



## OPTIMASS 6000 Handbook

Sensor for mass flow

The documentation is only complete when used in combination with the relevant documentation for the signal converter.

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## 1.1 Intended use

This mass flowmeter is designed for the direct measurement of mass flow rate, product density and product temperature. Indirectly, it also enables the measurement of parameters like total mass, concentration of dissolved substances and the volume flow. For use in hazardous areas, special codes and regulations are also applicable and these are specified in a separate documentation.

## 1.2 CE certification

CE marking



This device conforms with the following EC directives:

- EMC Directive 2004/108/EC
- ATEX Directive 94/9/EC
- Low Voltage Directive 2006/95/EC
- Pressure Equipment Directive 97/23/EC

The manufacturer declares conformity and the device carries the CE mark.

### 1.3 Associated documents

This handbook should be read in conjunction with relevant documents in relation to:

- hazardous areas
- communications
- concentration
- corrosion

## 1.4 Insulation case

On meters fitted with an insulation jacket, the jacket will be filled with Microtherm®. The material is an opacified blend of filament reinforced silica, suited to temperatures up to 1000°C / 1832°F. Microtherm® is classified as non-combustible by tests to BS 476 Part 4: 1970, Fire Tests on Building Materials and Structures: Non-combustibility test for materials [equivalent to ISO/R 1182]

Do not open the insulation case. Microtherm® can cause:

- skin irritation
- throat and lung irritation
- eye irritation

The dust produced by Microtherm® can also aggravate pre-existing upper respiratory conditions and lung disease.

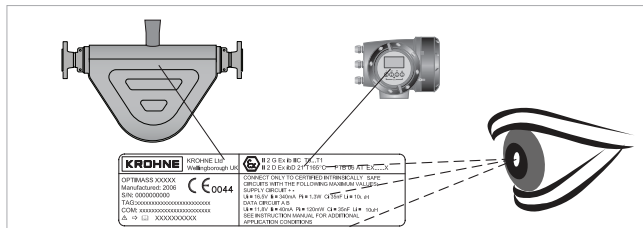
Install the meter so that water cannot get into the insulation case. Water will damage the Microtherm® and reduce insulation performance.

## 1.5 Pressure Equipment Directive (PED)



### LEGAL NOTICE!

*The Pressure Equipment Directive places legal requirements on both the manufacturer and the end user. Please read this section carefully!*



To ensure the PED integrity of the meter, you **MUST** check that the serial numbers on the converter nameplate and the sensor nameplate are the same.

To comply with the requirements of the Pressure Equipment Directive (PED) the manufacturer provides all the relevant technical data in the technical data section of this handbook. Secondary pressure containment is **NOT** supplied on this meter.

### Tube failure

Where the meter is being used to measure high pressure gasses and / or gasses kept as liquids by high pressure and / or where there is a risk of tube failure because of the use of corrosive or erosive fluids, frequent pressure and / or thermal cycling, seismic or other shock loading, the burst disc option **MUST** be purchased. For more information, please contact your nearest representative.



### DANGER!

*If it is suspected that the primary measuring tube has failed, de-pressurise the meter and remove it from service as soon as it is safe to do so.*

## **1.6 Safety instructions from the manufacturer**

### **1.6.1 Copyright and data protection**

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

### **1.6.2 Disclaimer**

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.



### 1.6.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation and operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

### 1.6.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of underneath icons.

### 1.6.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.



**DANGER!**

*This information refers to the immediate danger when working with electricity.*



**DANGER!**

*This warning refers to the immediate danger of burns caused by heat or hot surfaces.*



**DANGER!**

*This warning refers to the immediate danger when using this device in a hazardous atmosphere.*



**DANGER!**

*These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.*



**WARNING!**

*Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.*



**CAUTION!**

*Disregarding these instructions can result in damage to the device or to parts of the operator's plant.*



**INFORMATION!**

*These instructions contain important information for the handling of the device.*



**LEGAL NOTICE!**

*This note contains information on statutory directives and standards.*



• **HANDLING**

This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➡ **RESULT**

This symbol refers to all important consequences of the previous actions.

## 1.7 Safety instructions for the operator



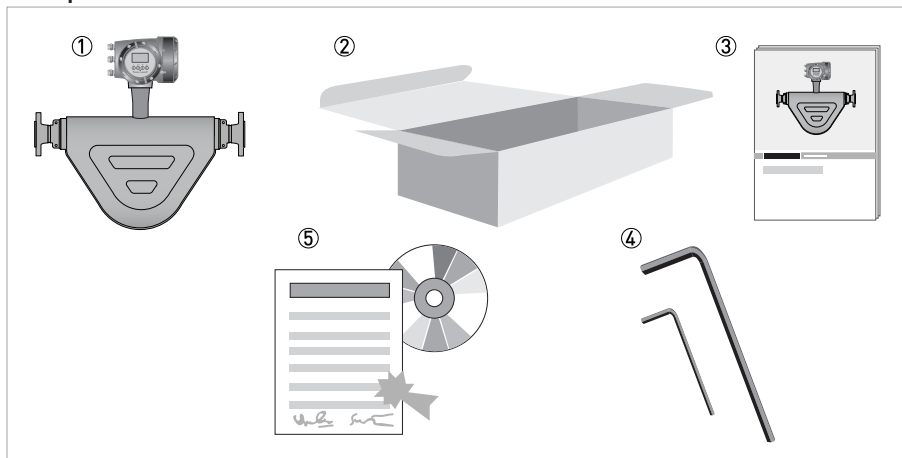
**WARNING!**

*In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.*

*This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.*

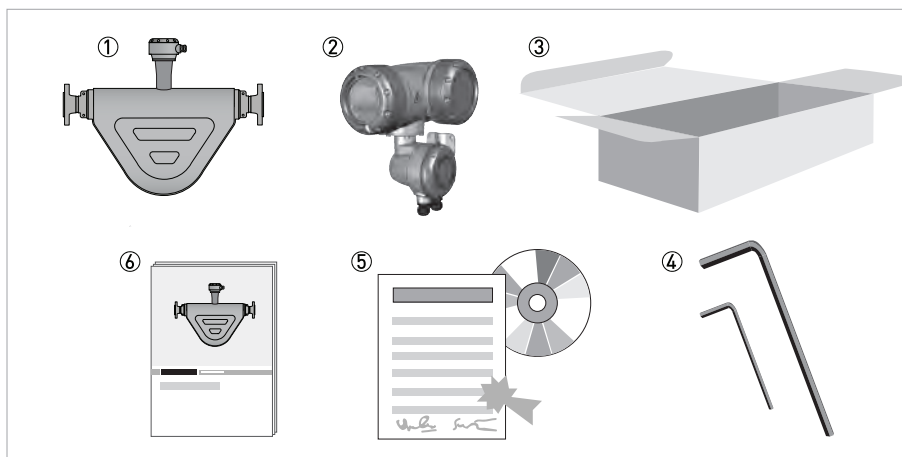
## 2.1 Scope of delivery

### Compact version



- ① Mass flowmeter.
- ② Carton.
- ③ Documentation.
- ④ 2.5 mm and 5 mm hex head tools.
- ⑤ CD-ROM and calibration certificate.

### Remote version

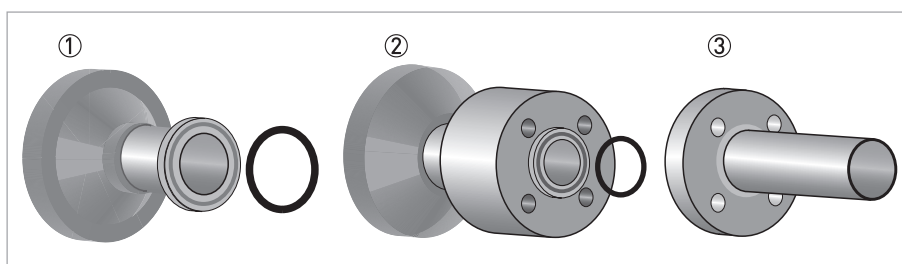


- ① Mass flowmeter.
- ② Converter. This will be either: field (as shown), wall or rack.
- ③ Carton.
- ④ 2.5 mm and 5 mm hex head tools.
- ⑤ CD-ROM and calibration certificate.
- ⑥ Documentation.

If any items are missing, please contact the manufacturer.

If your meter has flange connections, the flange specification is stamped on the outer edge of the flange. Check that the specification on the flange is the same as your order.

### 2.1.1 Meters with hygienic connections



- ① Fully welded - the O-rings between the meter and the process pipework are not supplied as standard but can be ordered.
- ② DIN 11864-2 Form A - the O-rings between the Form A and Form B parts of the connection are not supplied as standard but can be ordered.
- ③ The 11864-2 Form B is not supplied as part of this connection but it can be ordered.

## 2.2 Nameplates



### INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order.  
Check for the correct supply voltage printed on the nameplate.

## 2.3 Dual Seal

To comply with the requirements of ANSI/ISA -12.27.01-2011 "Requirements for process Sealing Between electrical systems and Flammable or Combustible process Fluids" a secondary seal is incorporated into all OPTIMASS / GAS products. If the primary seal fails, the secondary seal will prevent escaping fluid reaching the electronic compartment.

Pressures and / or temperatures are limited by tube, temperature, connection and Ex limits. Check the meter nameplates and relevant documentation for full details. On all meters operating on gas measurement, the casing of the meter is fitted with a burst disc. If the primary seal (tube) fails leakage will occur from the burst disc. Install the meter so that the burst disc is pointing away from personnel.

**Liquids** (Example model code: OPTIMASS 6000F S50 - LIQUID)

### Pressure and temperature data:

OPTIMASS 6000 / 6000F / 6400C -200°C...+230°C and 100...10000 kPa (Stainless Steel)  
 OPTIMASS 6000 / 6000F / 6400C -50°C...+230°C and 100...20000 kPa (Hastelloy® / duplex)  
 OPTIMASS 6000 / 6000F - HT -50°C...+400°C and 100...10000 kPa

If the primary seal fails, the casing of the meter will fill with liquid and the meter will stop working. The meter will notify the operator by displaying the status message "Sensor: Sensor signal low" on the converter or PLC display. This is an indication that the primary seal (tube) has failed and the status of the meter should be checked.

process line should be de-pressurised and the meter removed as soon as it is safe to do so.  
Please contact customer service for servicing or replacement of the meter.

**INFORMATION!**

*At high pressures, process fluid may also leak from the meter casing. This is also an indication that the primary seal has failed.*

**Meter status:**

The meter will also display the message "Sensor: Sensor signal low" if the measuring tubes are not completely filled with fluid. For example, if the meter is drained or re/filled.

To check the status of the meter, drain and re/fill with fluid and note the converter or PLC display. See the relevant section of the converter handbook for a list of status messages and diagnostics information.

If the meter continues to display the message: "Sensor: Sensor signal low" you **MUST** assume that the primary seal (tubes) has failed and the appropriate action **MUST** be taken.

**Gases** (Example model code: OPTIMASS 6000F S50 - GAS)

**Pressure / temperature data:**

OPTIMASS 6000 / 6000F / 6400C -200°C...+230°C and 500... 10000 kPa (Stainless Steel)  
 OPTIMASS 6000 / 6000F / 6400C -50°C...+230°C and 500...20000 kPa (Hastelloy® / duplex)  
 OPTIMASS 6000F - HT -50°C...+400°C and 500...10000 kPa

Pressures and/or temperatures may be further limited by tube, temperature, connection and Ex limits. Consult the meter nameplate and relevant documentation for full details.

On all meters operating on gas measurement the casing of the meter is fitted with a burst disc. If the primary seal (tube/s) fails leakage will occur from the burst disc. Install the meter so that the burst disc is pointing away from personnel.

**Regular maintenance of the burst disc:**

Carry out regular maintenance checks on burst discs for leakage and/or blockages. On all OPTIMASS meters, the primary seal is considered to be the measuring tube of the meter. The materials of construction of the measuring tube/s are described within the relevant sections of this handbook and the customer's product and any other fluid flowing through the tube must be compatible with the material of construction. If failure of the primary seal is suspected then the process line should be de-pressurised and the meter removed as soon as it is safe to do so. Please contact customer service for servicing or replacement of the meter.

## 2.4 Temperature differential and thermal shock

**Temperature differential**

The maximum difference between ambient temperature and process (operating) temperatures are:

Meter temperature range	Maximum temperature differential
-200°C...+40°C / -328°F...+104°F	210°C / 410°F
-70°C...+230°C / -94°F...+446°F	
-50°C...+400°C / -58°F...+752°F	380°C / 716°F

### Thermal shock

Thermal shock occurs when there is a sudden and extreme change (shift) in process temperature. To prevent thermal shock on this meter, the manufacturer recommends that you avoid a temperature shift greater than 100°C / 212°F, at a maximum of 40% of the nominal flow rate.

These limits will give a minimum calculated life span for the meter of 3500 cycles. Thermal shocking below this temperature will increase the life span of the meter. For more information, please contact your nearest representative.

### Maximum temperature rate rise

If the change in temperature (rate rise) is greater than 100°C / 212°F, the temperature rise must be over a period of time. Calculate the time required for the whole temperature rise using the table below.

Meter size	Temp. rate rise	Example
DN 08...50	6°C / 10.8°F per minute	20°C...230°C / 68°F...446°F = 35 minutes
		20°C...400°C / 68°F...752°F = 80 minutes
DN 80...100	3°C / 5.4°F per minute	20°C...230°C / 68°F...446°F = 70 minutes
		20°C...400°C / 68°F...752°F = 140 minutes

These limits will provide a minimum calculated life span for the meter of 2000 cycles. Temperature rises below 100°C / 212°F, or temperature rises over a longer period of time, will increase the life span of the meter.



### CAUTION!

*Operation outside these limits may result in shifts in density and mass flow calibration. Repeated shocking and / or rapid heating, may also result in premature failure of the meter. However, higher thermal shocks and / or an increased number of cycles are possible at lower working pressures. For more information, please contact your nearest representative.*

### 3.1 Notes on installation

**INFORMATION!**

*Inspect the cartons carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.*

**INFORMATION!**

*Do a check of the packing list to make sure that you have all the elements given in the order.*

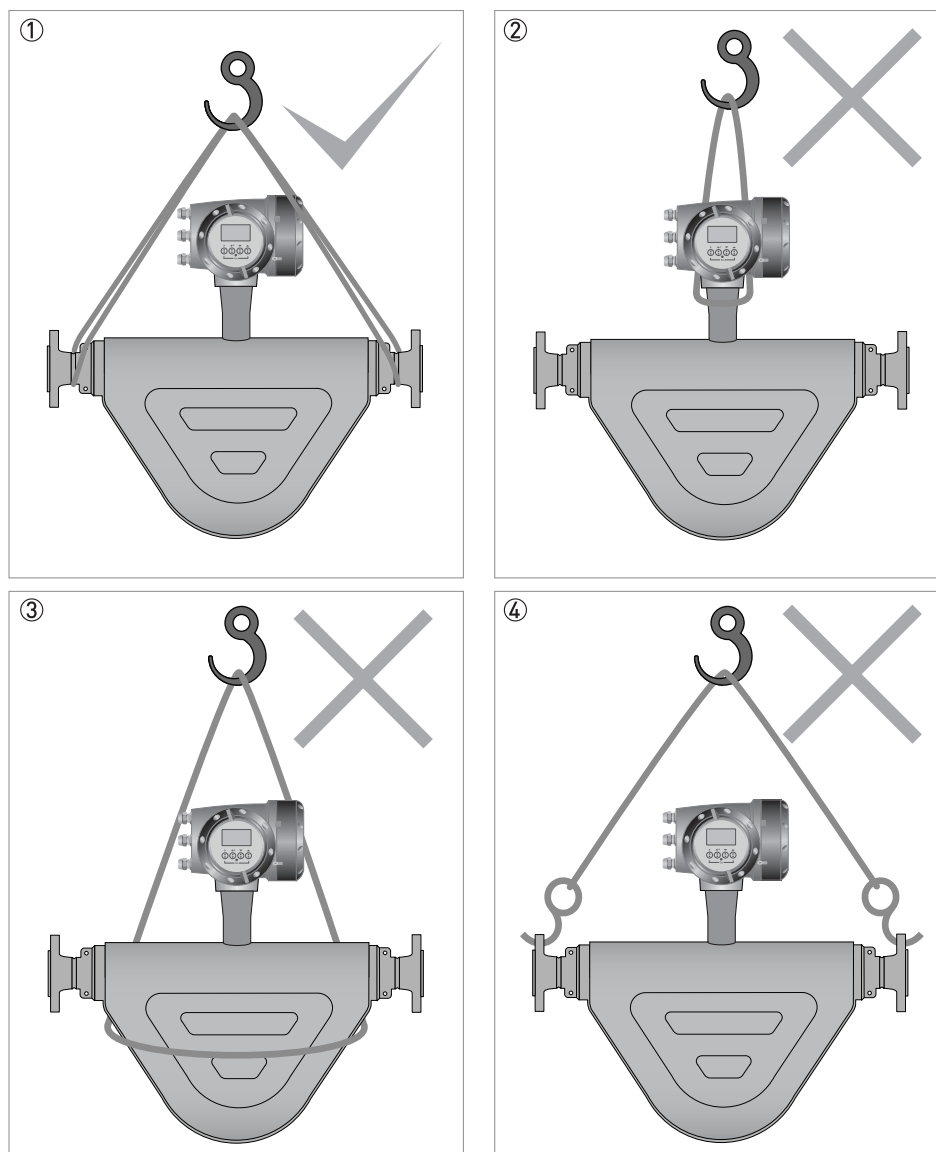
**INFORMATION!**

*Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.*

### 3.2 Storage

- Store the device in a dry and dust-free location.
- Avoid direct exposure to the sun.
- Store the device in its original packing.
- Do not allow the ambient temperature to fall below -50°C / -58°F or rise above +85°C / +185°F.

### 3.3 Handling

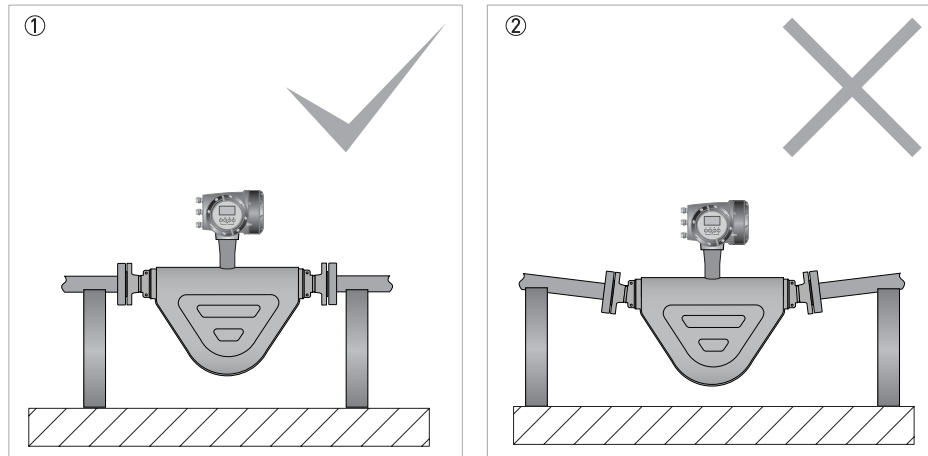


- ① Use a well maintained sling to lift the meter by the spigots.
- ② DO NOT lift the meter by the converter housing or the electronics stem.
- ③ DO NOT lift the meter by the meter body.
- ④ DO NOT lift the meter using the flange bolt holes.



### 3.4 Installation conditions

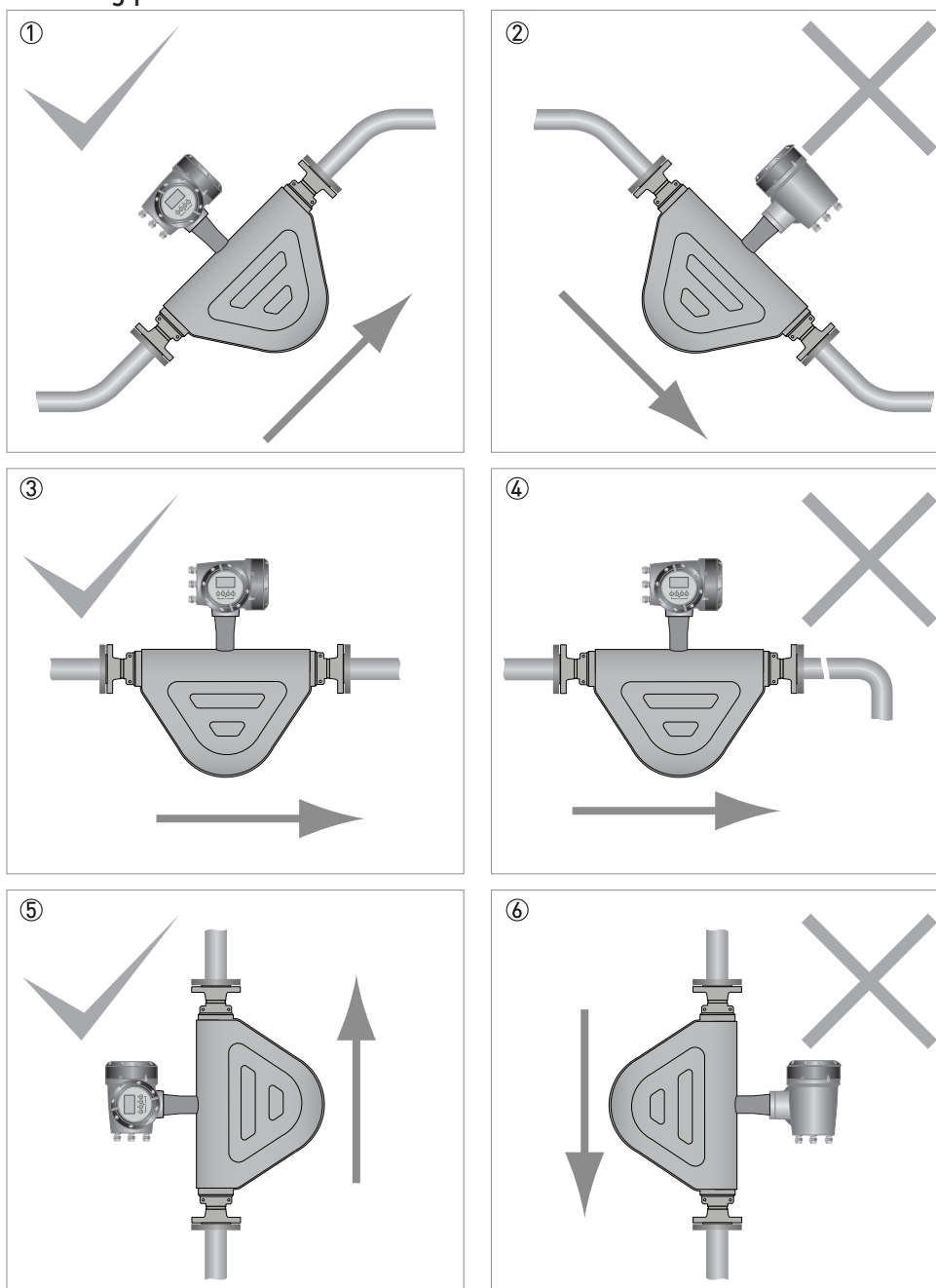
#### 3.4.1 Supporting the meter



- ① Support the weight of the meter on the process pipework.
- ② DO NOT leave a long pipe run between the meter and the support. This can cause damage to the meter, especially on larger meter sizes.

## 3.4.2 Mounting the meter

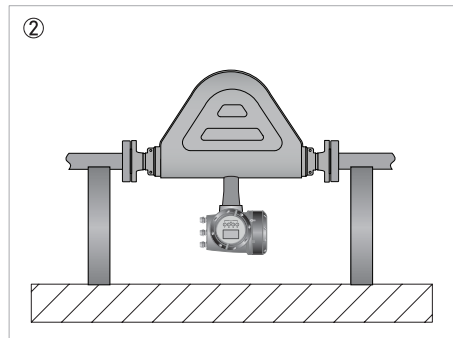
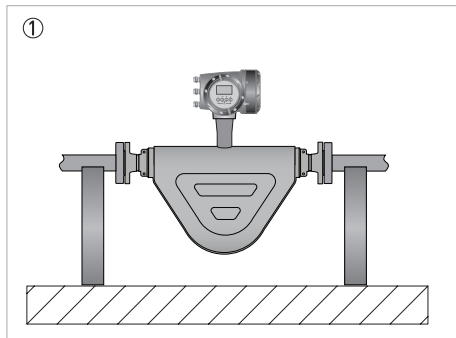
## Mounting positions



- ① The meter can be mounted at an angle but it is recommended that the flow is uphill.
- ② Avoid mounting the meter with the flow running downhill because it can cause siphoning. If the meter has to be mounted with the flow running downhill, install an orifice plate or control valve downstream of the meter to maintain backpressure.
- ③ Horizontal mounting with flow running left to right.
- ④ Avoid mounting meter with long vertical runs after the meter as it can cause cavitation. Where the installation includes a vertical run after the meter, install an orifice plate or control valve downstream to maintain backpressure.
- ⑤ The meter can be mounted vertically but it is recommended that the flow is uphill.
- ⑥ Avoid mounting the meter vertically with the flow running downhill. This can cause siphoning. If the meter has to be installed this way, install an orifice plate or control valve downstream to maintain backpressure.

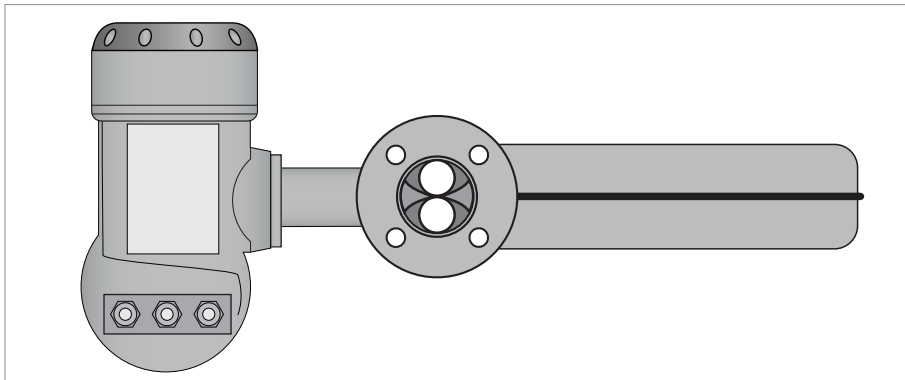
### 3.4.3 Gas / liquid build up

In certain applications, the design of the meter can cause either gas or liquid to build up in the measuring tube.



- ① Where liquids are being measured, mount the meter as shown. This will prevent gas building up in the measuring tube, when there is no flow.
- ② Where gases are being measured, mount the meter as shown. This will prevent liquids building up in the measuring tube, when there is no flow.

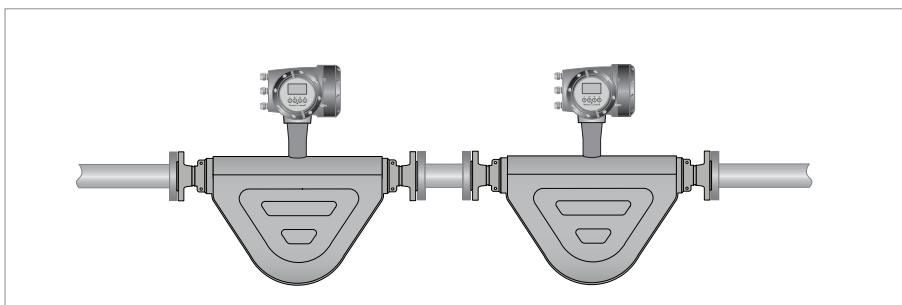
### 3.4.4 Side mounting



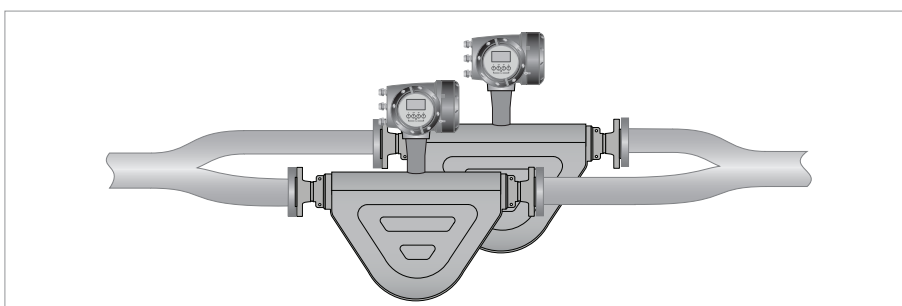
The meter can be installed with the converter (or remote junction box) on the side of the meter so that the measuring tubes are sitting one above the other. Avoid this method of installation where there is a two phase process flow, or where the process fluid contains gas. If this situation cannot be avoided, please contact the manufacturer for advice.

### 3.4.5 Cross talk

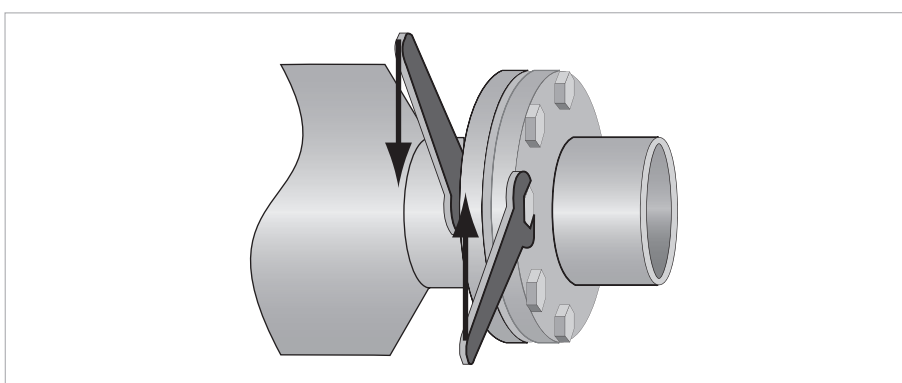
Where more than one meter is being installed, a very high level of immunity to cross talk means that the meters can be mounted within close proximity to each other. The meters can be mounted either in series or parallel, as shown.

**INFORMATION!**

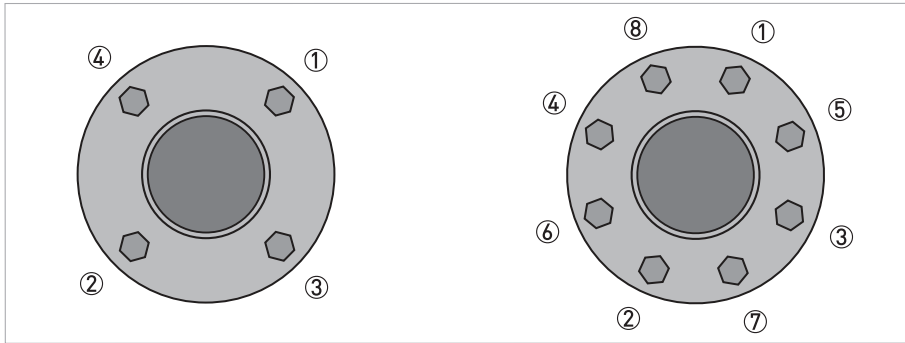
*Where the meters are installed in series, it is strongly recommended that the process pipe diameter remains constant. For more information, please contact the manufacturer.*



### 3.4.6 Flange connections

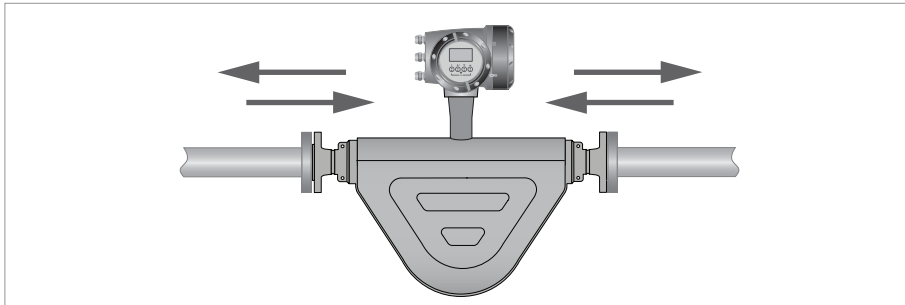


Tighten the flange bolts evenly and in turn.



Use a regular pattern to tighten the bolts evenly

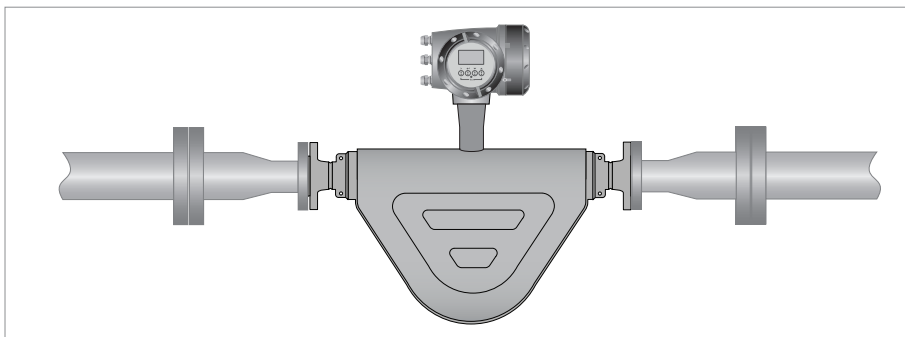
### 3.4.7 Maximum pipework forces (end loadings)



Mass flowmeters have a maximum level of force (negative or positive) that can be applied to the ends of the meter. Refer to the table below for permitted forces.

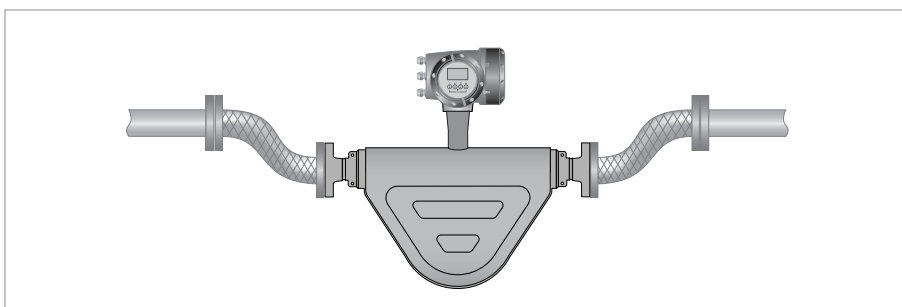
Please refer to the table in the technical data section of this Handbook for the maximum end loadings.

### 3.4.8 Pipework reducers



Always avoid extreme step changes in pipe size. Use pipework reducers, where there is a large difference between pipework size and meter flanges.

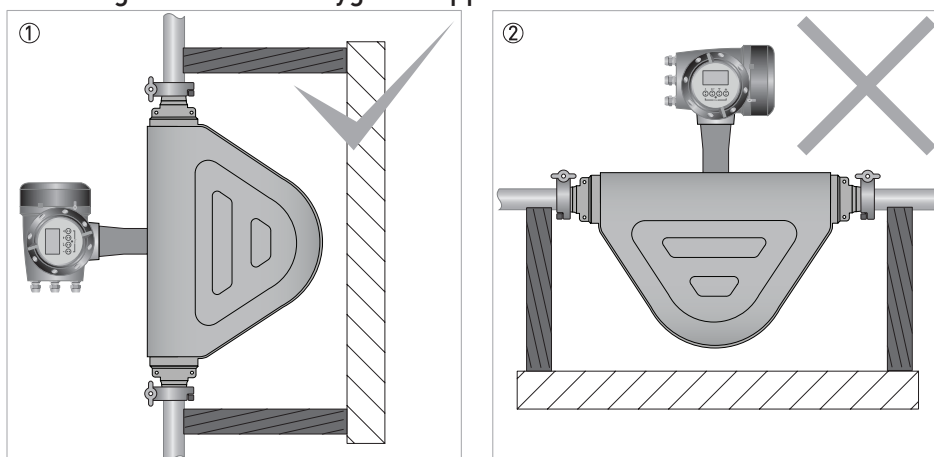
### 3.4.9 Flexible connections



Flexible connections can be used but because of the high flow rates associated with large diameter meters, it is recommended that flexible connections are not used on meters larger than size 80.

### 3.4.10 Hygienic installations

#### Mounting the meter for hygienic applications



- ① Install the meter vertically to allow self draining.
- ② DO NOT install the meter horizontally.

Where the meter has been approved by the sanitary requirements of the European Hygienic Engineering and Design Group, you **MUST** give consideration to:

- Installation - install the meter at an angle to allow self-draining (see illustration).
- Cleaning fluids - cleaning fluids should flow uphill with a velocity rate greater than 1.5 m/s / 5ft/s. If the process flow is downhill, install a flow restrictor downstream of the meter. This will make sure that the meter is completely filled with the cleaning fluid.
- Process connections and seals **MUST** be in accordance with EHEDG documentation.

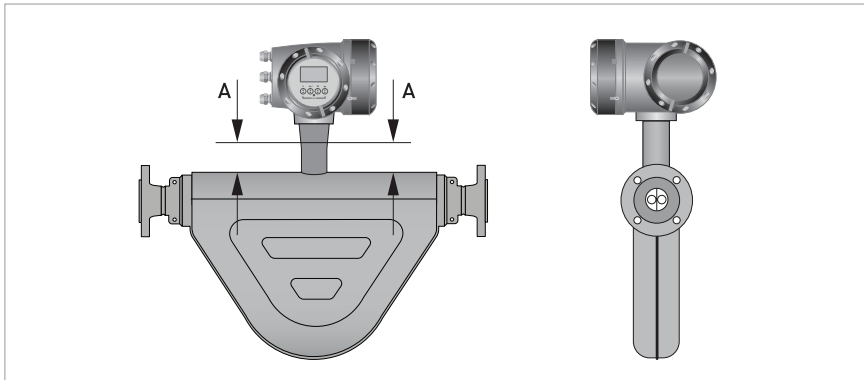
The manufacturer also recommends that you refer to EHEDG ([www.ehedg.org](http://www.ehedg.org)) document number 8 "HYGIENIC EQUIPMENT DESIGN CRITERIA".

### 3.4.11 Heating and insulation

#### Insulation

The meter can be insulated to a maximum depth as shown (A). Do not insulate above this depth as this will cause the electronics to overheat.

#### Insulation



	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
Dimension A [mm]	100	100	100	100	100	100	100	100	100	100
Dimension A [inches]	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9

#### Factory fitted heating jacket

If the meter has been ordered with a heating jacket, it will be supplied with DN15 PN40 to EN 1092-1 or 1/2" ASME150 flange connections.

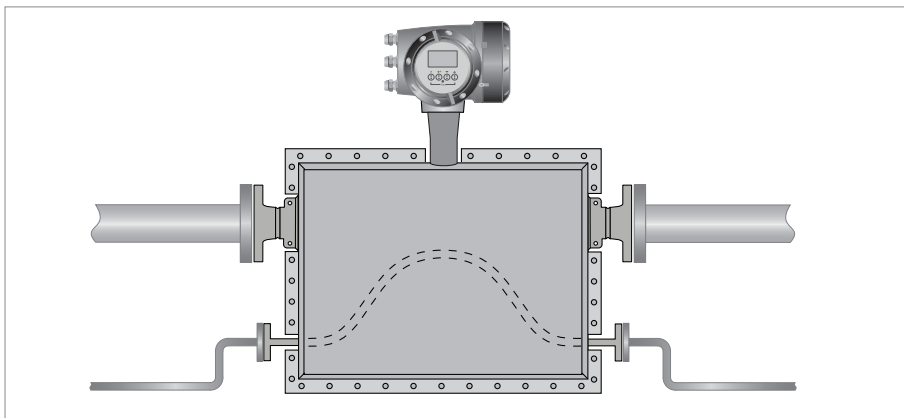


Figure 3-1: The loop inside the heating jacket, carries the heating medium.

#### Connecting / using the heating jacket

- Use rigid or reinforced flexible hoses to connect the heating jacket to the heat source.
- The heating jacket / loop material is SS316.
- Suitable heating mediums are steam or hot oil. Avoid the use of heating mediums that can cause crevice corrosion in Stainless Steel.

- Where liquid is being used, set up the pipe configuration so that air can be vented from the system.
- Where steam is being used, set up the pipe configuration so that condensation can be drained off.
- Gradually heat the jacket to working temperature before flowing the process fluid through the meter.

**CAUTION!**

*The design of the heating jacket is such that NO end load pressure (negative or positive) can be applied. The manufacturer recommends that (where possible) flexible hoses are used to connect to the heat source.*

**CAUTION!**

*The maximum heating pressure and temperature for heating jackets is 10 barg at 230°C / 145 psig at 446°F or 5 barg at 400°C / 72.5 psig at 752°F*

### 3.4.12 Purge ports

If the meter has been ordered with a purge port, it will be supplied with NPT female connections which are clearly marked. The connections are sealed with NPT plugs and PTFE tape.

**CAUTION!**

*DO NOT remove these plugs.*

*The meter is factory sealed with a dry nitrogen gas fill and if moisture is allowed to enter the meter casing it will cause damage. The plugs should only be removed to purge the meter casing in the event that the primary measuring tube fails.*

*If it is suspected that the primary measuring tube has failed, de-pressurise the meter and remove it from service, as soon as it is safe to do so.*

### 3.4.13 Burst discs

If the meter has been ordered with a burst disc, it will be supplied with the disc fitted. The failure pressure of the disc is 10 barg at +20°C / 145 psig at +68°F.

**CAUTION!**

*The fitted burst disc will be suitable for the flow rates and process conditions specified on the original order. If the process conditions alter in any way, it is recommended that you contact the manufacturer for advice regarding suitability.*

*If the process product is hazardous (in any way) it is recommended that an exhaust tube is connected to the NPT male thread of the burst disc and the pipe routed so that the process product can be discharged to a safe area. Use a tube with a diameter large enough AND routed in such a way, so that pressure cannot build up in the meter case.*

**INFORMATION!**

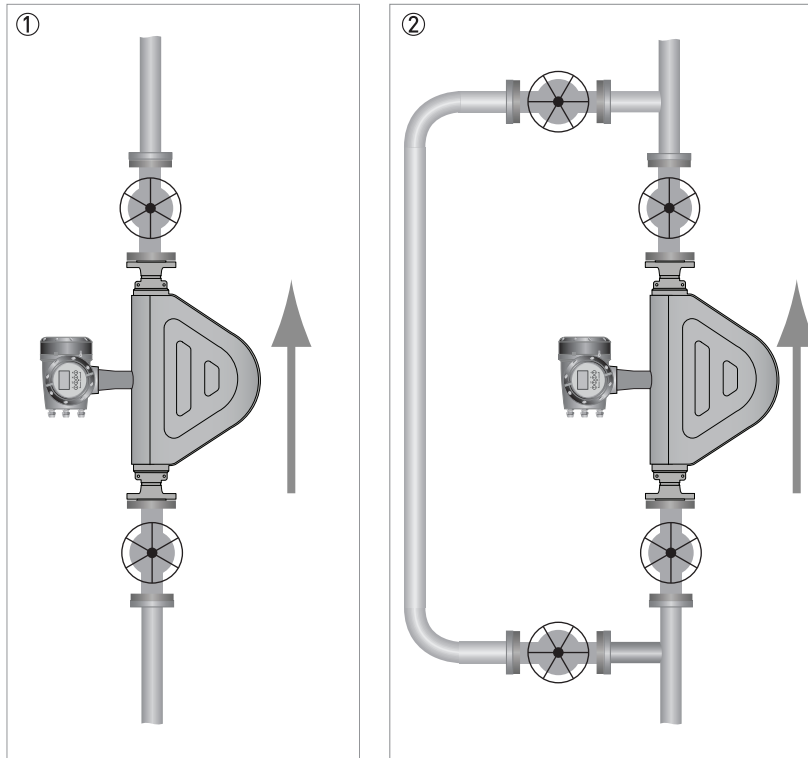
*For gas applications, the burst disc must be specified at the time of ordering.*



### 3.4.14 Zero calibration

The procedure for zero calibration is contained in the converter handbook. However, the following information should be considered when installing the meter.

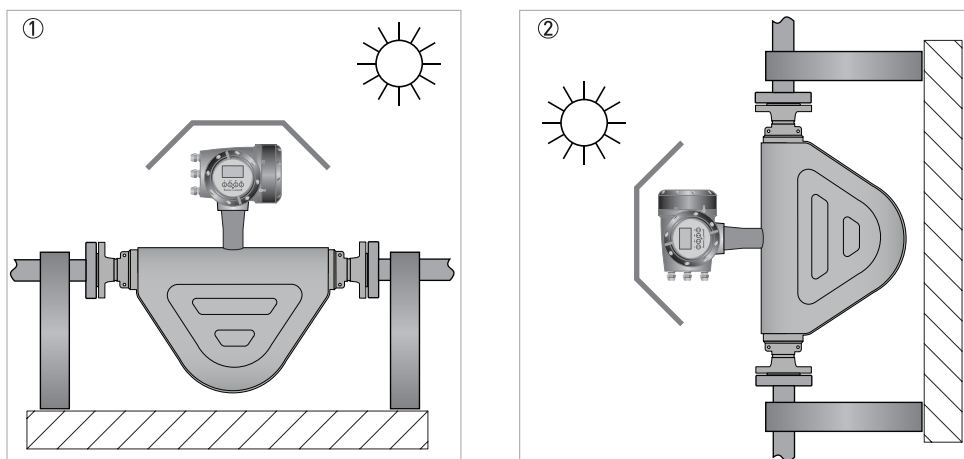
#### Zero calibration



- 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 flow cannot be stopped, install a bypass section for zero calibration.

### 3.4.15 Sunshades

The meter **MUST** be protected from strong sunlight.



- ① Horizontal installation
- ② Vertical installation

## 4.1 Safety instructions

**DANGER!**

*All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!*

**DANGER!**

*Observe the national regulations for electrical installations!*

**DANGER!**

*For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.*

**WARNING!**

*Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.*

**INFORMATION!**

*Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.*

## 4.2 Electrical and I/O connections

For information regarding electrical and I/O connections, please refer to the handbook for the relevant signal converter.

## 5.1 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

## 5.2 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.



### **INFORMATION!**

*For more precise information, please contact your local representative.*

## 5.3 Returning the device to the manufacturer

### 5.3.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.



### **CAUTION!**

*Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:*

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*



### **CAUTION!**

*If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:*

- *to check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that is safe to handle and stating the product used.*

## 5.3.2 Form (for copying) to accompany a returned device

Company:		Address:	
Department:		Name:	
Tel. no.:		Fax no.:	
Manufacturer's order no. or serial no.:			
The device has been operated with the following medium:			
This medium is:	water-hazardous		
	toxic		
	caustic		
	flammable		
	We checked that all cavities in the device are free from such substances.		
	We have flushed out and neutralized all cavities in the device.		
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.			
Date:		Signature:	
Stamp:			

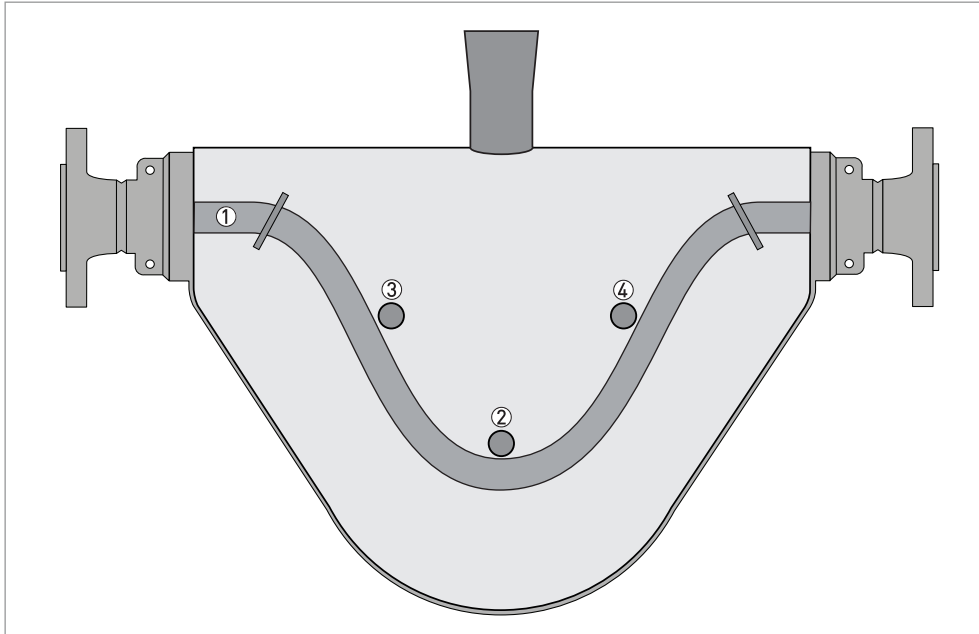
## 5.4 Disposal

**CAUTION!**

*Disposal must be carried out in accordance with legislation applicable in your country.*

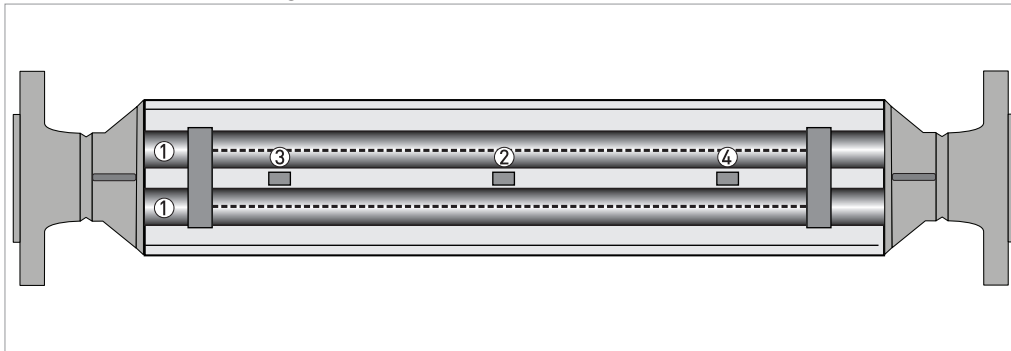
## 6.1 Measuring principle (twin tube)

Meter from the side, showing tube layout



- ① Measuring tubes
- ② Drive coil
- ③ Sensor 1
- ④ Sensor 2

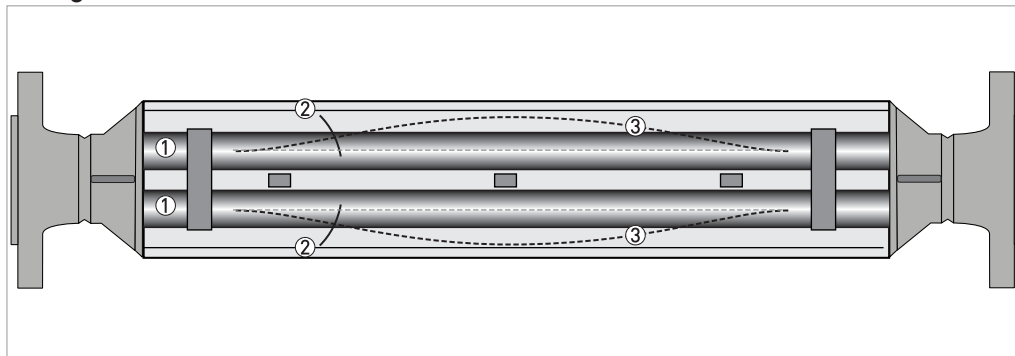
Static meter not energised and with no flow



- ① Measuring tubes
- ② Drive coil
- ③ Sensor 1
- ④ Sensor 2

A Coriolis twin tube mass flowmeter consists of two measuring tubes ① a drive coil ② and two sensors (③ and ④) that are positioned either side of the drive coil.

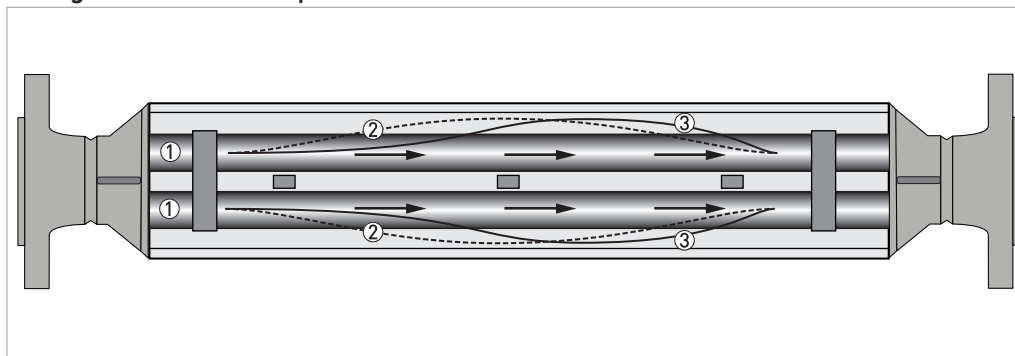
## Energised meter



- ① Measuring tubes
- ② Direction of oscillation
- ③ Sine wave

When the meter is energised, the drive coil vibrates the measuring tubes causing them to oscillate and produce a sine wave ③. The sine wave is monitored by the two sensors.

## Energised meter with process flow



- ① Process flow
- ② Sine wave
- ③ Phase shift

When a fluid or gas passes through the tubes, the coriolis effect causes a phase shift in the sine wave that is detected by the two sensors. This phase shift is directly proportional to the mass flow.

Density measurement is made by evaluation of the frequency of vibration and temperature measurement is made using a Pt500 sensor.

## 6.2 Technical data



### INFORMATION!

- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local representative.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Download Center).

### Measuring system

Measuring principle	Coriolis mass flow
Application range	Mass flow and density measurement of fluids, gases and solids

Measured values	Mass, density, temperature
Calculated values	Volume, referred density, concentration, velocity
<b>Sensor model range</b>	
Stainless Steel 316L 08...250	Compact / remote 100 barg @ 20°C / 1450 psig @ 68°F, temp. range -70°C...+230°C / -94°F...+446°F
	Remote only 100 barg @ 20°C / 1450 psig @ 68°F, temp. range -50°C...+400°C / -58°F...+752°F
	Remote only 100 barg @ 20°C / 1450 psig @ 68°F, temp. range -200°C...+40°C / -364°F...+104°F
Hastelloy® 08...50	Compact / remote 200 barg @ 20°C / 2900 psig @ 68°F, temp. range -70°C...+230°C / -58°F...+446°F
Duplex Stainless Steel 80...150	Compact / remote 200 barg @ 20°C / 2900 psig @ 68°F, temp. range -50°C...+230°C / -58°F...+446°F

## Design

Basic	System consists of a measuring sensor and a converter to process the output signal
Features	Fully welded maintenance free sensor with twin V-shaped measuring tube
<b>Variants</b>	
Compact version	Integral converter
Remote version	Available with field or wall versions of the converter
Modbus version	Sensor with integral electronics. Modbus output for connection to a PLC

## Measuring accuracy

<b>Mass (standard)</b>	
Liquid (≥ 20:1 of nominal flow rate)	±0.1% of actual measured flow rate
Liquid (< 20:1 of nominal flow rate)	± zero stability (see zero stability below)
Gas	±0.35% of actual measured flow rate + zero stability
<b>Mass (optional)</b>	
Liquid (≥ 10:1 of nominal flow rate)	±0.05% of actual measured flow rate
Liquid (< 10:1 of nominal flow rate)	± zero stability (see zero stability below)
<b>Repeatability</b>	
Liquid	Better than 0.05% plus zero stability (includes the combined effects of repeatability, linearity and hysteresis)
Gas	Better than 0.2% plus zero stability (includes the combined effects of repeatability, linearity and hysteresis)
<b>Zero stability</b>	
08	< 0.03 kg/h
10	< 0.06 kg/h
15	< 0.19 kg/h
25	< 0.95 kg/h
50	< 1.8 kg/h
80	< 3.9 kg/h
100	< 8.8 kg/h
150	< 16 kg/h
200	< 30 kg/h
250	< 50 kg/h

<b>Reference conditions</b>	
Product	Water
Temperature	+20°C / +68°F
Operating pressure	1 barg / 14.5 psig
<b>Effect on sensor zero point caused by a shift in process temperature</b>	
All materials	0.00075% of nominal flow per 1°C / 0.00042% of nominal flow per 1°F
<b>Pressure effect on mass flow rate</b>	
All materials sizes 08...50	0.005% per 1 barg / 0.00034 % per 1 psig
All materials sizes 80...100	0.0055% per 1 barg / 0.00038 % per 1 psig
All materials sizes 150...250	0.008% per 1 barg / 0.00055 % per 1 psig
<b>Density</b>	
Measuring range	100...3000 kg/m <sup>3</sup> / 6...187 lbs/ft <sup>3</sup>
Accuracy	±1 kg/m <sup>3</sup> / ±0.06 lbs/ft <sup>3</sup>
On site calibration	±0.2 kg/m <sup>3</sup> / ±0.012 lbs/ft <sup>3</sup>
<b>Temperature</b>	
Accuracy	± 0.5°C / ±0.9°F (± 0.5% of reading)

### Operating conditions

<b>Nominal flow rates</b> (1 barg / 14.5 psig pressure drop)	
08	600 kg/h / 22 lbs/min
10	1200 kg/h / 44 lbs/min
15	3800 kg/h / 139 lbs/min
25	19000 kg/h / 698 lbs/min
50	35000 kg/h / 1286 lbs/min
80	78000 kg/h / 2866 lbs/min
100	175000 kg/h / 6430 lbs/min
150	320000 kg/h / 11758 lbs/min
200	550000 kg/h / 20209 lbs/min
250	1000000 kg/h / 36743 lbs/min
	Assumes operating density 1000 kg/m <sup>3</sup> / 62.4 lb/ft <sup>3</sup>
	For Hastelloy® meters, assume a pressure drop of 1.15 barg
<b>Maximum flow rates</b>	
All meters	150% of nominal flow rate
<b>Ambient temperature</b>	
Compact version with Aluminium converter	Standard temperature range: -40...+65°C / -40...+149°F
	Cryogenic temperature range: -25...+40°C / -13...+104°F
Compact version with Stainless Steel converter	Standard temperature range: -40...+55°C / -40...+131°F
	Cryogenic temperature range: -25...+40°C / -13...+104°F
Remote versions	Standard temperature range: -40...+65°C / -40...+149°F
	Cryogenic temperature range: -20...+65°C / -4...+149°F
Hazardous Area versions	Refer to temperature limits



<b>Process temperatures</b>		
Standard temperature range (flange connections)		
Safe area	-70...+230°C / -94...+446°F	
Hazardous area	-50...+230°C / -58...+446°F	
High temperature range	-50...+400°C / -58...+752°F	
Cryogenic temperature range	-200...+40°C / -328...+104°F	
Standard temperature range (hygienic connections)		
Safe area	-70...+150°C / -94...+302°F	
Hazardous area	-50...+150°C / -58...+302°F	
<b>Nominal pressure at 20°C / 68°F</b>		
<b>Measuring tube</b>	SS 316 / 316L	Hastelloy® C22 / S31803
FM / PED 97/23/EC	-1...100 barg / -14.5...1450 psig	-1...200 barg / -14.5...2900 psig
CRN / ASME B31.3	-1...100 barg / -14.5...1450 psig	Pending
<b>Fluid properties</b>		
Permissible physical condition	Liquids, gases, slurries	
Permissible gas content (volume)	Contact manufacturer for information.	
Permissible solid content (volume)	Contact manufacturer for information.	
Protection category (acc. to EN 60529)	IP 67, NEMA 4X	
<b>Installation conditions</b>		
Inlet / outlet runs	None required	

## Materials

<b>Stainless Steel (316 / 316L) meter</b>	
Measuring tubes / spigots	Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified
Flanges	Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified
Bridge	Stainless Steel AISI 304 / 304L (1.4301 / 1.4307) dual certified or AISI 316 / 316L (1.4401 / 1.4404) dual certified
Outer casing	Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified
<b>Stainless Steel (S31803) meter</b>	
Measuring tubes / spigots	Stainless Steel UNS 31803 (1.4462)
Flanges	Stainless Steel UNS 31803 (1.4462)
Bridge	Stainless Steel AISI 304 / 304L (1.4301 / 1.4307) dual certified or AISI 316 / 316L (1.4401 / 1.4404) dual certified
Outer casing	Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified
<b>Hastelloy® C22 meter</b>	
Measuring tubes / raised face	Hastelloy® C22
(Backing) flanges	Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified
Bridge	Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified
Outer Casing	Stainless Steel AISI 316L (1.4404) dual certified
<b>Heating jacket version</b>	
Heating loop and insulation jacket	Stainless Steel AISI 316 (1.4401)
<b>All versions</b>	
Junction box (remote version)	Die cast Aluminium (polyurethane coating)
	Optional Stainless Steel 316 (1.4401)

### Process connections

<b>Flange</b>	
DIN (EN 1092-1 2007)	DN10...300 / PN16...160
ASME (B616.5)	½...12" / ASME 150...1500
JIS (2220 2001)	10A...300A / 10...20K (10K maximum allowable temperature 300°C / 572°F)
<b>Hygienic (08...50 only)</b>	
Tri-clover	¾...3"
Tri-clamp DIN 32676	DN15..80
Tri-clamp ISO 2852	1...3"
DIN 11864-2 Form A	DN15...80
Male thread DIN 11851	DN15...80
Male thread SMS	1...3"

### Electrical connections

Electrical connections	For full details, including: power supply, power consumption etc., see technical data for the relevant converter.
I/O	For full details of I/O options, including data streams and protocols, see technical data for the relevant converter.

### Approvals

<b>Mechanical</b>	
Electromagnetic compatibility (EMC) acc. to CE	Namur NE 21/5.95
	2004/108/EC (EMC)
	2006/95/EC (Low Voltage Directive)
European Pressure Equipment Directive	PED 97-23 EC (acc. to EN13445-3)
CRN	acc. to ASME B31.3 (pending)
<b>ATEX (acc. 94/9/EC)</b>	
<b>OPTIMASS 6400C non Ex i signal outputs</b>	
Ex d connection compartment	II 1/2 G Ex d ia IIC T6....T1 Ga/Gb
	II 2 D Ex tb IIIC T270°C Db
Ex e connection compartment	II 1/2 G Ex de ia IIC T6....T1 Ga/Gb
	II 2 D Ex tb IIIC T270°C Db
<b>OPTIMASS 6400C Ex i signal outputs</b>	
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 T270°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 T270°C Db
<b>OPTIMASS 6000 / 6000F</b>	II 1 G Ex ia IIC T6...T1 Ga
	II 1 D Ex ia IIIC T270°C Da
	II 1 D Ex ia IIIC T440°C Da

**ATEX (acc. 94/9/EC) temperature limits**

OPTIMASS 6000 / 6000F with or without heating jacket / insulation.			
Ambient temp. $T_{amb}$ °C	Medium temp. $T_m$ °C	Temp. class	Max. Surface temp. °C
-40...40	-50...40	T6	T80
	-50...150	T3	T190
	-50...230	T2-T1	T270
-40...55	-50...40	T6	T80
	-50...150	T3	T190
	-50...230	T2-T1	T270
-40...65	-50...40	T6	T80
	-50...150	T3	T190
	-50...230	T2-T1	T270
<b>Cryogenic version</b>			
-20...65	-200...40	T6-T1	T80
OPTIMASS 6400C with aluminium converter housing, with or without heating jacket / insulation			
-40...40	-50...40	T6	T80
	-50...150	T3	T190
	-50...230	T2-T1	T270
-40...50	-50...40	T6	T80
	-50...150	T3	T190
	-50...230	T2-T1	T270
-40...65	-50...65	T4-T1	T105
<b>Cryogenic version</b>			
-40...65	-200...40	T6-T1	T80
OPTIMASS 6400C with SS converter housing, with or without heating jacket / insulation.			
-40...40	-50...40	T6	T80
	-50...150	T3	T190
	-50...230	T2-T1	T270
-40...50	-50...40	T6	T80
	-50...150	T3	T190
	-50...230	T2-T1	T270
-40...60	-50...60	T4-T1	T100
<b>Cryogenic version</b>			
-25...+60	-200...40	T6-T1	T80
<b>High temperature versions</b>			
OPTIMASS 6000F - HT with aluminium junction box, heating jacket and insulation			
-40...40	-50...40	T6	T80
	-50...230	T2	T270
	-50...400	T1	T440
-40...55	-50...40	T6	T80
	-50...230	T2	T270
	-50...400	T1	T440

-40...60	-50...40	T6	T80
	-50...230	T2	T270
	-50...400	T1	T440
-40...65	-50...350	T1	T390
OPTIMASS 6000F - HT with SS junction box, heating jacket and insulation			
-40...40	-50...40	T6	T80
	-50...230	T2	T270
	-50...400	T1	T440
-40...50	-50...40	T6	T80
	-50...230	T2	T270
	-50...400	T1	T440
-40...55	-50...40	T6	T80
	-50...230	T2	T270
	-50...400	T1	T440
-40...60	-50...350	T1	T390
OPTIMASS 6000F - HT with aluminium or SS junction box, insulation but no heating jacket			
-40...40	-50...40	T6	T80
	-50...230	T2	T270
	-50...400	T1	T440
-40...55	-50...40	T6	T80
	-50...230	T2	T270
	-50...400	T1	T440
-40...65	-50...40	T6	T80
	-50...230	T2	T270
	-50...400	T1	T440

### Maximum end loadings (Stainless Steel 316 / 316L)

		S08 / S10	S15	S25	S50	S80	S100	S150	S200	S250
<b>Flanges</b>										
20°C	40 barg	15 kN	25 kN	38 kN	48 kN	99 kN	130 kN	250 kN	300 kN	350 kN
	100 barg	12 kN	17 kN	19 kN	15 kN	20 kN	100 kN	150 kN	150 kN	200 kN
230°C	32 barg	7 kN	12 kN	18 kN	25 kN	45 kN	60 kN	150 kN	200 kN	250 kN
	60 barg	5 kN					20 kN			
400°C	27.4 barg	5 kN	6 kN	10 kN	12 kN	20 kN	50 kN	80 kN	100 kN	150 kN
	40 barg	4 kN	5 kN				20 kN			
<b>Hygienic (all connections)</b>										
150°C	10 barg	5 kN	9 kN	12 kN	12 kN	18 kN	N/A	N/A	N/A	N/A

### Maximum end loadings (Hastelloy® and Stainless Steel UNS S31803)

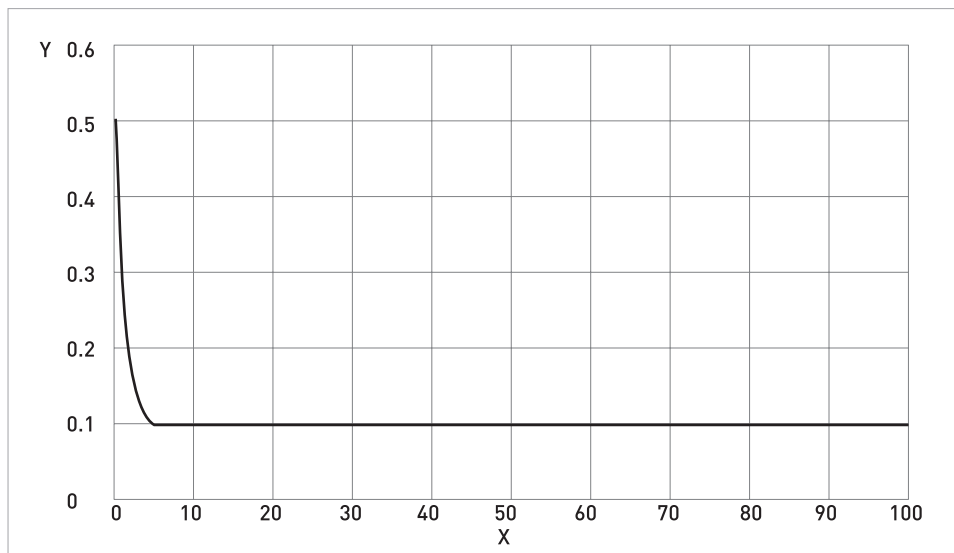
		H08 / H10	H15	H25	H50	H80	D100	D150	D200
Flanges (not including CRN)									
20°C	200 barg	12 kN	17 kN	19 kN	15 kN	20 kN	100 kN	150 kN	
230°C	145 barg	5 kN				20 kN			
Flanges (CRN regions)									
20°C	200 barg ①	12 kN	17 kN	19 kN	15 kN	20 kN	60 kN	30 kN	10 kN
230°C	145 barg ②	5 kN				20 kN			

① D200 limited to 180 barg at 20°C

② D100 and D150 limited to 120 barg at 230°C. D200 limited to 110 barg at 230°C

- DN08...50 (axial) loads have been calculated, based on 316L schedule 40 process pipework, where un-radiographed butt welds have been used in pipe joints.
- DN80...250 (axial) loads have been calculated, based on 316L schedule 80 process pipework, where un-radiographed butt welds have been used in pipe joints.
- The loads shown are the maximum permitted static load. If loads are cycling (between tension and compression) these loads should be reduced. For advice, consult the manufacturer.

## 6.3 Measuring accuracy



X nominal flow rate [%]

Y measuring error [%]

### Measuring error

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

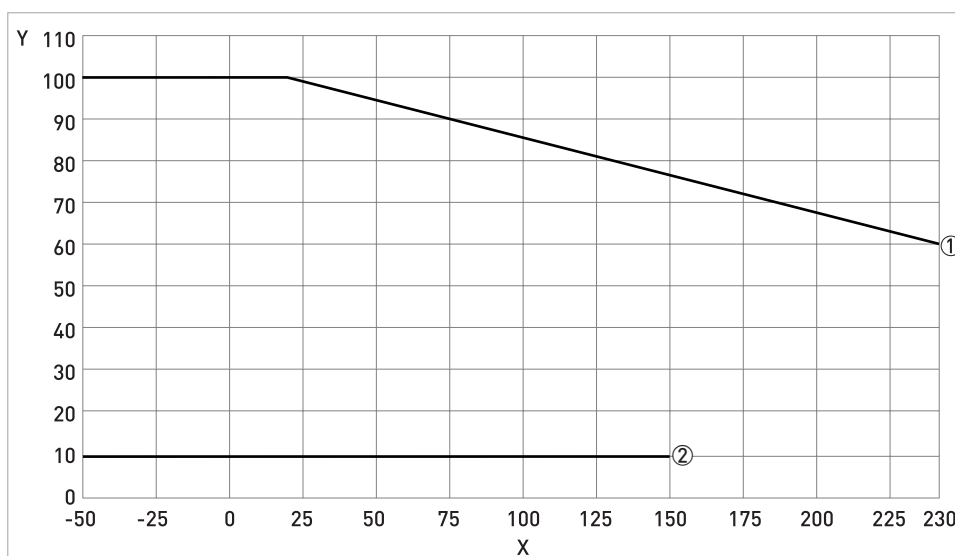
**Reference conditions**

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

**6.4 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 (metric) for meters with SS 316 measuring tubes.  
Standard temperature range.**

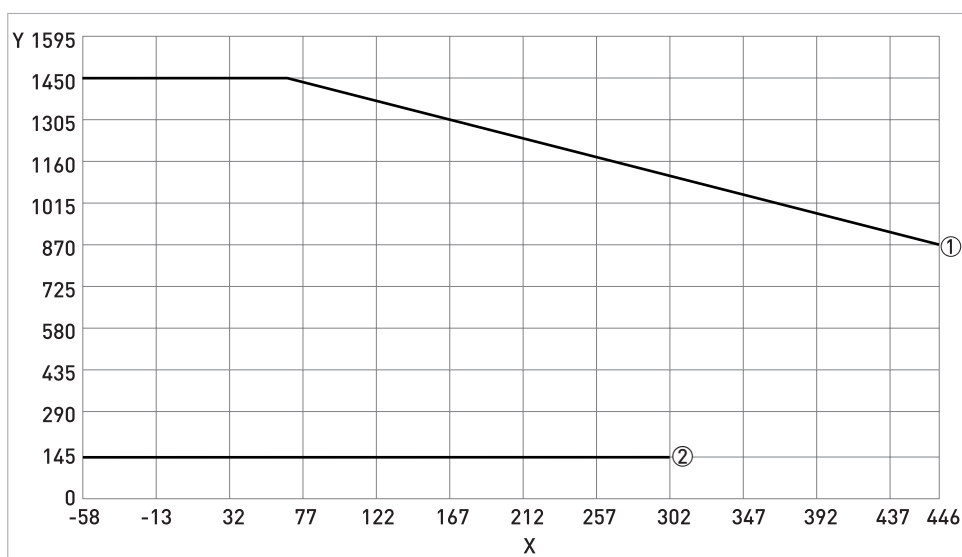


X temperature [°C]

Y pressure [barg]

- ① Measuring tube PED certification
- ② Hygienic connection

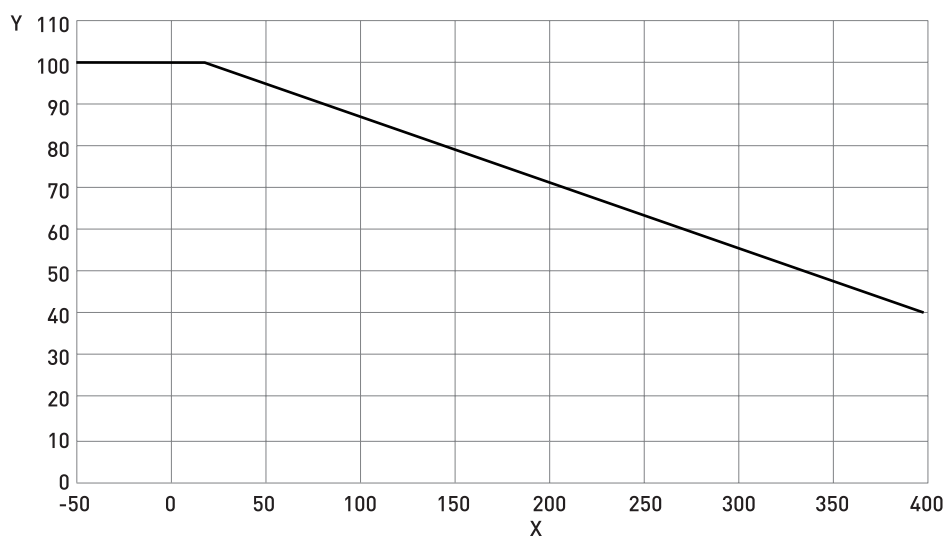
**Pressure / temperature de-rating (imperial) for meters with SS 316 measuring tubes.  
Standard temperature range.**



X temperature [°F]

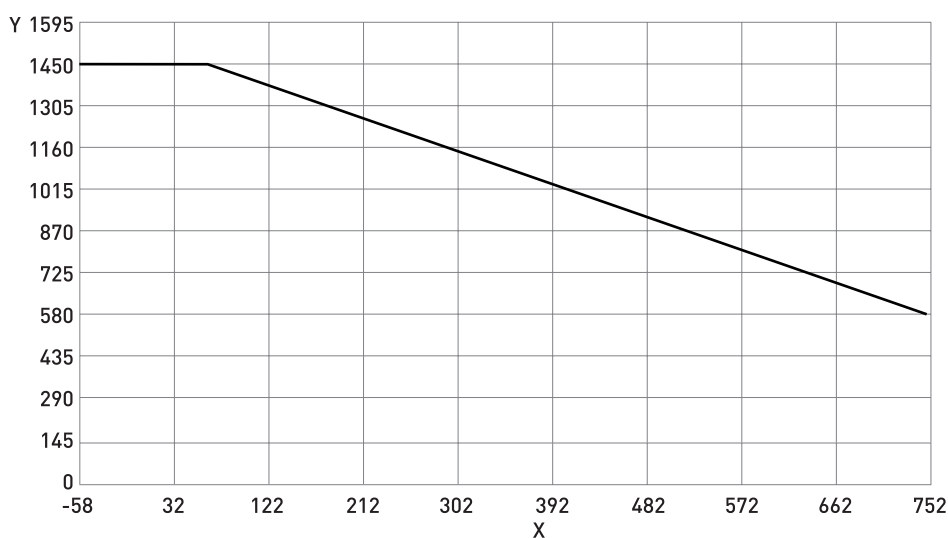
Y pressure [psig]

- ① Measuring Tube PED certification
- ② Hygienic connection

**Pressure / temperature de-rating (metric) for meters with SS 316, PED certified measuring tubes. High temperature range.**

X temperature [°C]

Y pressure [barg]

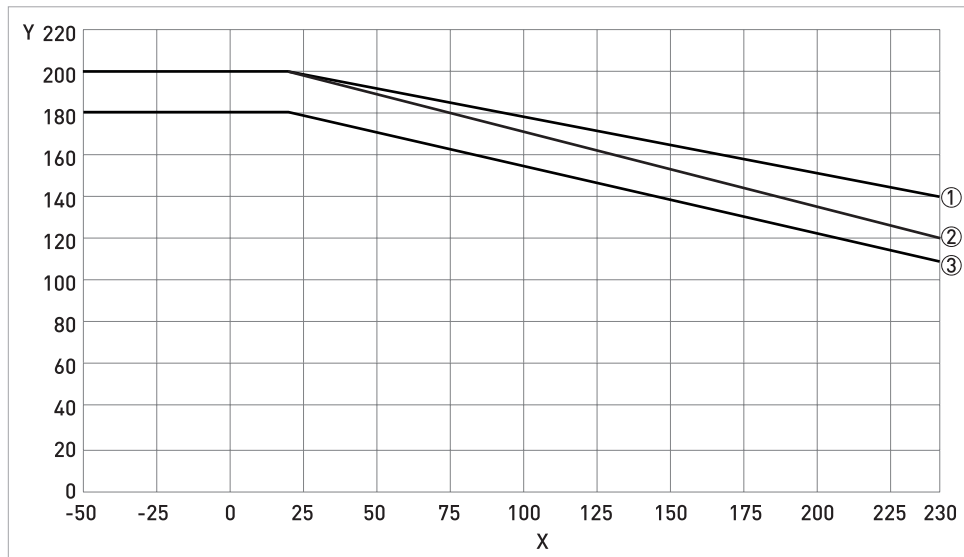
**Pressure / temperature de-rating (imperial) for meters with SS 316, PED certified measuring tubes. High temperature range.**

X temperature [°F]

Y pressure [psig]



**Pressure / temperature de-rating (metric) for meters with SS 31803 and Hastelloy® C22, PED certified measuring tubes. Standard temperature range**

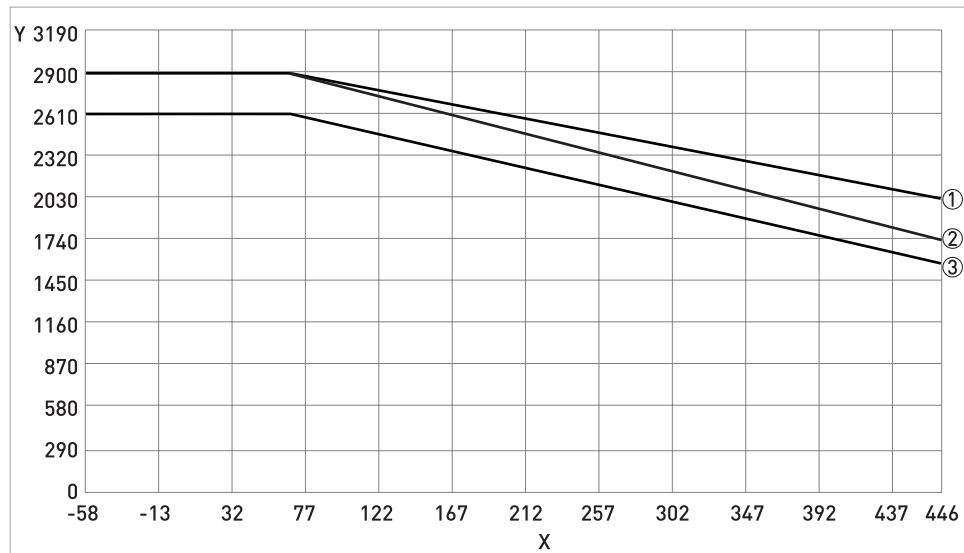


X temperature [°C]

Y pressure [barg]

- ① PED / CRN H08...80
- ② CRN D100...150
- ③ CRN D200

**Pressure / temperature de-rating (imperial) for meters with SS 31803 and Hastelloy® C22, PED certified measuring tubes. Standard temperature range.**

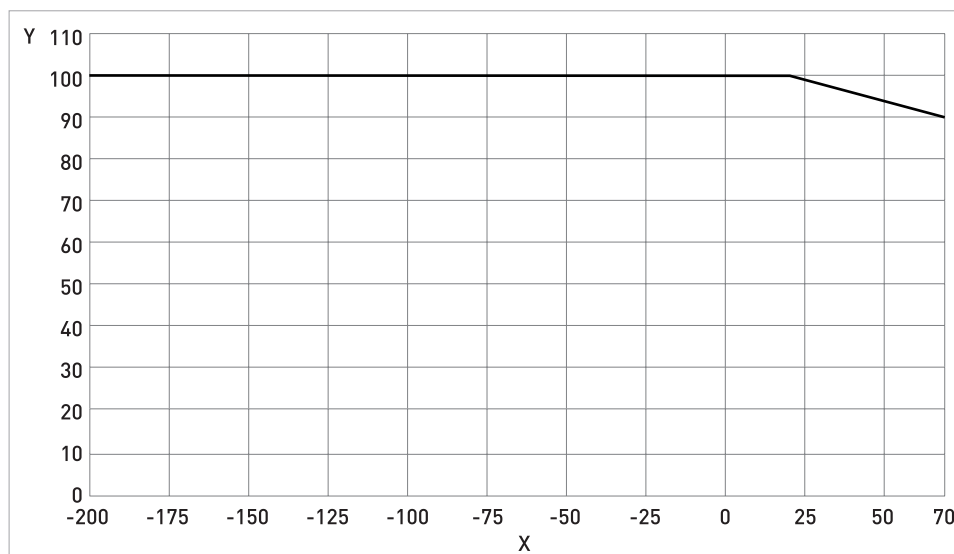


X temperature [°F]

Y pressure [psig]

- ① PED / CRN H08...80
- ② CRN D100...150
- ③ CRN D200

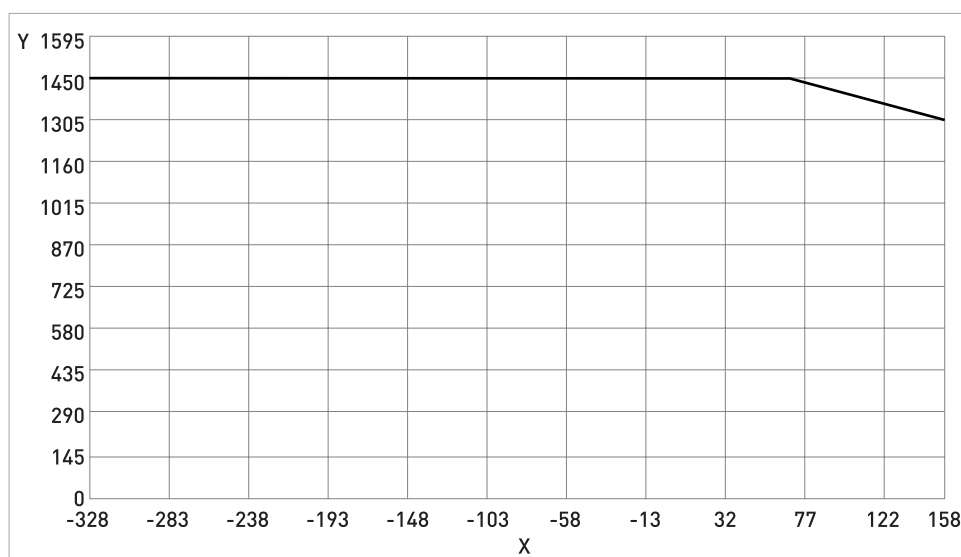
**Pressure / temperature de-rating (metric) for meters with SS 316, PED certified measuring tubes. Cryogenic temperature range.**



X temperature [°C]

Y pressure [barg]

**Pressure / temperature de-rating (imperial) for meters with SS 316 measuring tubes PED certified. Cryogenic temperature range.**



X temperature [°F]

Y pressure [psig]

### Flanges

- DIN flange ratings are based on EN 1092-1 2007 table G.4.1 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: 2001 table 1 division 1 material group 022a
- JIS 10K flanges are limited to a maximum temperature of 300°C / 572°F

### 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.

## 6.5 Dimensions and weights

### 6.5.1 Flanged versions

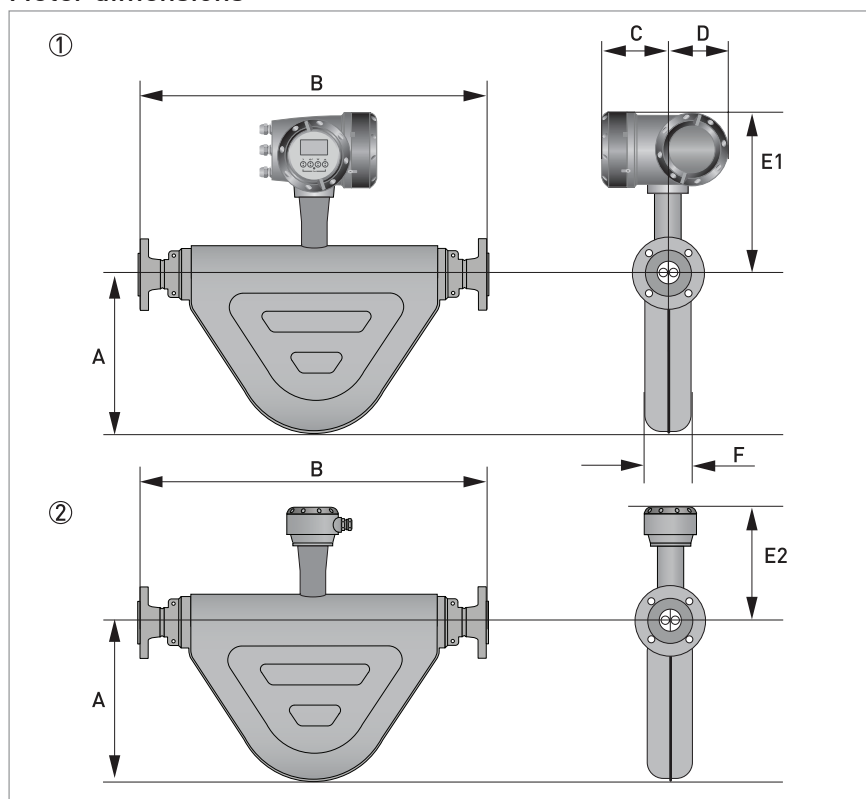
#### Meter weights

	kg									
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
Aluminium (compact)	9.3	10.1	12.9	23.5	29.4	58.9	94.3	193.6	443.6	911.2
Stainless Steel (compact)	15.2	16	18.8	29.4	35.3	64.8	100.2	199.5	449.5	461.3
Aluminium (remote)	5.8	6.6	9.4	19.9	25.9	55.4	90.8	190.1	440	907.6
Stainless Steel (remote)	6.5	7.35	10.1	20.65	26.6	56.1	57.6	190.8	440.7	908.3
Heating jacket add	3.1		4.5	7	7.9	12.7	15.7	27.6	N/A	

	lbs									
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
Aluminium (compact)	20.5	22.3	28.4	51.8	64.8	129.8	207.9	426.8	978	2008.8
Stainless Steel (compact)	33.5	35.3	41.4	64.8	77.8	142.9	220.9	440.7	991	1017
Aluminium (remote)	12.8	14.5	20.7	43.9	57.1	122.1	200.2	419.1	970	2001
Stainless Steel (remote)	14.3	16.2	22.3	45.5	58.6	123.7	127	420.6	971.6	2002.5
Heating jacket add	6.8		9.9	15.4	17.4	28	34.6	60.8	N/A	

The weights shown are for meters fitted with PN40 flanges. Smaller or larger flange sizes will affect the overall weight. For further information, please contact the manufacturer.

## Meter dimensions



- ① Compact version  
② Remote version

## General dimensions

	mm									
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
A $\pm 3$	156		186	282	326	411	547	555	675	805
C	123.5									
D	137									
E1 $\pm 3$ (compact)	375		376	393		428	455	480	522	598
E2 $\pm 3$ (remote 250°C)	295		296	316		348	375	400	442	518
E2 $\pm 3$ (remote 400°C)	335		336	353		388	415	440	482	558
F $\pm 2$	81			118	130	188	243	275	355	508

	inches									
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
A $\pm 0.11$	6.14		7.3	11.1	326	12.8	21.5	21.8	26.6	31.7
C	4.9									
D	5.4									
E1 $\pm 0.12$ (compact)	14.8		14.8	15.5		16.8	17.9	18.9	20.5	23.5
E2 $\pm 0.12$ (remote 482°F)	11.6		11.6	12.4		13.7	14.8	15.7	17.4	20.4
E2 $\pm 0.12$ (remote 752°F)	13.2		13.2	13.9		15.3	16.3	17.3	19	22
F $\pm 0.08$	3.2			4.6	5.1	7.4	9.6	10.8	14	20

## Dimension B for meters with Stainless Steel measuring tubes

mm (±5)										
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
<b>PN16</b>										
DN80	-	-	-	-	-	-	970	-	-	-
DN100	-	-	-	-	-	-	1000	1154	-	-
DN150	-	-	-	-	-	-	-	1200	1572	-
DN200	-	-	-	-	-	-	-	-	1586	-
DN250	-	-	-	-	-	-	-	-	-	2100
DN300	-	-	-	-	-	-	-	-	-	2026
<b>PN40</b>										
DN10	335	347	-	-	-	-	-	-	-	-
DN15	341	353	510	-	-	-	-	-	-	-
DN25	-	-	514	600	-	-	-	-	-	-
DN40	-	-	-	610	709	-	-	-	-	-
DN50	-	-	-	-	715	895	-	-	-	-
DN80	-	-	-	-	-	915	986	-	-	-
DN100	-	-	-	-	-	-	1000	1180	-	-
DN150	-	-	-	-	-	-	-	1200	1612	-
DN200	-	-	-	-	-	-	-	-	1638	-
DN250	-	-	-	-	-	-	-	-	-	2080
DN300	-	-	-	-	-	-	-	-	-	2100
<b>PN63</b>										
DN50	-	-	-	-	743	923	-	-	-	-
DN80	-	-	-	-	-	943	1014	-	-	-
DN100	-	-	-	-	-	-	1026	1206	-	-
DN150	-	-	-	-	-	-	-	1240	1652	-
DN200	-	-	-	-	-	-	-	-	1682	-
DN250	-	-	-	-	-	-	-	-	-	2120
DN300	-	-	-	-	-	-	-	-	-	2150
<b>PN100</b>										
DN10	355	367	-	-	-	-	-	-	-	-
DN15	355	367	524	-	-	-	-	-	-	-
DN25	-	-	550	636	-	-	-	-	-	-
DN40	-	-	-	644	743	-	-	-	-	-
DN50	-	-	-	-	755	935	-	-	-	-
DN80	-	-	-	-	-	955	1026	-	-	-
DN100	-	-	-	-	-	-	1050	1230	-	-
DN150	-	-	-	-	-	-	-	1280	1692	-
DN200	-	-	-	-	-	-	-	-	1722	-
DN250	-	-	-	-	-	-	-	-	-	2184
DN300	-	-	-	-	-	-	-	-	-	2210

mm (±5)										
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
<b>ASME 150</b>										
½"	361	373	530	-	-	-	-	-	-	-
¾"	-	-	540	-	-	-	-	-	-	-
1"	-	-	546	632	-	-	-	-	-	-
1½"	-	-	-	644	743	-	-	-	-	-
2"	-	-	-	-	747	926	-	-	-	-
3"	-	-	-	-	-	939	1010	-	-	-
4"	-	-	-	-	-	-	1022	1202	-	-
6"	-	-	-	-	-	-	-	1228	1640	-
8"	-	-	-	-	-	-	-	-	1666	-
10"	-	-	-	-	-	-	-	-	-	2074
12"	-	-	-	-	-	-	-	-	-	2100
<b>ASME 300</b>										
½"	371	383	540	-	-	-	-	-	-	-
¾"	-	-	550	-	-	-	-	-	-	-
1"	-	-	558	644	-	-	-	-	-	-
1½"	-	-	-	658	757	-	-	-	-	-
2"	-	-	-	-	759	939	-	-	-	-
3"	-	-	-	-	-	957	1028	-	-	-
4"	-	-	-	-	-	-	1042	1222	-	-
6"	-	-	-	-	-	-	-	1246	1658	-
8"	-	-	-	-	-	-	-	-	1686	-
10"	-	-	-	-	-	-	-	-	-	2106
12"	-	-	-	-	-	-	-	-	-	2132
<b>ASME 600</b>										
½"	383	395	552	-	-	-	-	-	-	-
¾"	-	-	562	-	-	-	-	-	-	-
1"	-	-	572	658	-	-	-	-	-	-
1½"	-	-	-	674	773	-	-	-	-	-
2"	-	-	-	-	779	959	-	-	-	-
3"	-	-	-	-	-	977	1048	-	-	-
4"	-	-	-	-	-	-	1086	1266	-	-
6"	-	-	-	-	-	-	-	1298	1710	-
8"	-	-	-	-	-	-	-	-	1742	-
10"	-	-	-	-	-	-	-	-	-	2186
12"	-	-	-	-	-	-	-	-	-	2194
<b>JIS 10K</b>										
50A	-	-	-	-	715	895	-	-	-	-
80A	-	-	-	-	-	915	986	-	-	-
100A	-	-	-	-	-	-	1022	1202	-	-
150A	-	-	-	-	-	-	-	1202	1652	-

mm (±5)										
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
200A	-	-	-	-	-	-	-	-	1666	-
250A	-	-	-	-	-	-	-	-	-	2106
300A	-	-	-	-	-	-	-	-	-	2124
<b>JIS 20K</b>										
10A	341	353	-	-	-	-	-	-	-	-
15A	341	353	510	-	-	-	-	-	-	-
25A	-	-	514	600	-	-	-	-	-	-
40A	-	-	-	610	709	-	-	-	-	-
50A	-	-	-	-	715	895	-	-	-	-
80A	-	-	-	-	-	915	986	-	-	-
100A	-	-	-	-	-	-	1022	1240	-	-
150A	-	-	-	-	-	-	-	1240	1652	-
200A	-	-	-	-	-	-	-	-	1666	-
250A	-	-	-	-	-	-	-	-	-	2106
300A	-	-	-	-	-	-	-	-	-	2124

inches (±0.2)										
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
<b>PN16</b>										
DN80	-	-	-	-	-	-	38.2	-	-	-
DN100	-	-	-	-	-	-	39.3	45.4	-	-
DN150	-	-	-	-	-	-	-	47.2	61.9	-
DN200	-	-	-	-	-	-	-	-	62.4	-
DN250	-	-	-	-	-	-	-	-	-	82.7
DN300	-	-	-	-	-	-	-	-	-	79.8
<b>PN40</b>										
DN10	13.2	13.7	-	-	-	-	-	-	-	-
DN15	13.4	13.9	20.1	-	-	-	-	-	-	-
DN25	-	-	20.2	23.6	-	-	-	-	-	-
DN40	-	-	-	24	27.9	-	-	-	-	-
DN50	-	-	-	-	28.1	35.2	-	-	-	-
DN80	-	-	-	-	-	36	38.8	-	-	-
DN100	-	-	-	-	-	-	39.4	46.4	-	-
DN150	-	-	-	-	-	-	-	47.2	63.5	-
DN200	-	-	-	-	-	-	-	-	64.5	-
DN250	-	-	-	-	-	-	-	-	-	81.9
DN300	-	-	-	-	-	-	-	-	-	82.7
<b>PN63</b>										
DN50	-	-	-	-	29.2	36.3	-	-	-	-
DN80	-	-	-	-	-	37.1	39.9	-	-	-

inches (±0.2)										
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
DN100	-	-	-	-	-	-	40.4	47.5	-	-
DN150	-	-	-	-	-	-	-	48.8	65	-
DN200	-	-	-	-	-	-	-	-	66.2	-
DN250	-	-	-	-	-	-	-	-	-	83.5
DN300	-	-	-	-	-	-	-	-	-	84.6
<b>PN100</b>										
DN10	14	14.4	-	-	-	-	-	-	-	-
DN15	14	14.4	20.6	-	-	-	-	-	-	-
DN25	-	-	21.6	25	-	-	-	-	-	-
DN40	-	-	-	25.3	29.2	-	-	-	-	-
DN50	-	-	-	-	29.7	36.8	-	-	-	-
DN80	-	-	-	-	-	37.6	40.4	-	-	-
DN100	-	-	-	-	-	-	41.3	48.4	-	-
DN150	-	-	-	-	-	-	-	50.4	66.6	-
DN200	-	-	-	-	-	-	-	-	67.8	-
DN250	-	-	-	-	-	-	-	-	-	85.9
DN300	-	-	-	-	-	-	-	-	-	87
<b>ASME 150</b>										
½"	14.2	14.7	20.9	-	-	-	-	-	-	-
¾"	-	-	21.2	-	-	-	-	-	-	-
1"	-	-	21.5	24.9	-	-	-	-	-	-
1½"	-	-	-	25.3	29.2	-	-	-	-	-
2"	-	-	-	-	29.4	36.5	-	-	-	-
3"	-	-	-	-	-	37	39.8	-	-	-
4"	-	-	-	-	-	-	40.2	47.3	-	-
6"	-	-	-	-	-	-	-	48.3	64.6	-
8"	-	-	-	-	-	-	-	-	65.6	-
10"	-	-	-	-	-	-	-	-	-	81.6
12"	-	-	-	-	-	-	-	-	-	82.7
<b>ASME 300</b>										
½"	14.6	15.1	21.2	-	-	-	-	-	-	-
¾"	-	-	21.6	-	-	-	-	-	-	-
1"	-	-	22	25.3	-	-	-	-	-	-
1½"	-	-	-	25.9	29.8	-	-	-	-	-
2"	-	-	-	-	30	37	-	-	-	-
3"	-	-	-	-	-	37.7	40.5	-	-	-
4"	-	-	-	-	-	-	41	48.1	-	-
6"	-	-	-	-	-	-	-	49	65.3	-
8"	-	-	-	-	-	-	-	-	66.4	-
10"	-	-	-	-	-	-	-	-	-	82.9
12"	-	-	-	-	-	-	-	-	-	83.9



inches (±0.2)										
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
<b>ASME 600</b>										
½"	15.1	15.5	21.7	-	-	-	-	-	-	-
¾"	-	-	22.1	-	-	-	-	-	-	-
1"	-	-	22.5	25.9	-	-	-	-	-	-
1½"	-	-	-	26.5	30.4	-	-	-	-	-
2"	-	-	-	-	30.7	37.7	-	-	-	-
3"	-	-	-	-	-	38.5	41.2	-	-	-
4"	-	-	-	-	-	-	42.8	49.8	-	-
6"	-	-	-	-	-	-	-	51.1	67.3	-
8"	-	-	-	-	-	-	-	-	68.6	-
10"	-	-	-	-	-	-	-	-	-	86
12"	-	-	-	-	-	-	-	-	-	86.4
<b>JIS 10K</b>										
50A	-	-	-	-	28.2	35.2	-	-	-	-
80A	-	-	-	-	-	36	38.8	-	-	-
100A	-	-	-	-	-	-	40.2	47.3	-	-
150A	-	-	-	-	-	-	-	47.3	65	-
200A	-	-	-	-	-	-	-	-	65.5	-
250A	-	-	-	-	-	-	-	-	-	82.9
300A	-	-	-	-	-	-	-	-	-	83.6
<b>JIS 20K</b>										
10A	13.4	13.9	-	-	-	-	-	-	-	-
15A	13.4	13.9	20	-	-	-	-	-	-	-
25A	-	-	20.2	23.6	-	-	-	-	-	-
40A	-	-	-	24	27.9	-	-	-	-	-
50A	-	-	-	-	28.2	35.2	-	-	-	-
80A	-	-	-	-	-	36	38.8	-	-	-
100A	-	-	-	-	-	-	40.2	48.8	-	-
150A	-	-	-	-	-	-	-	48.8	65	-
200A	-	-	-	-	-	-	-	-	62.6	-
250A	-	-	-	-	-	-	-	-	-	82.9
300A	-	-	-	-	-	-	-	-	-	83.6

#### Dimension B for meters with Hastelloy® and Stainless Steel (UNS S31803) measuring tubes

mm									
	H08	H10	H15	H25	H50	H80	D100	D150	D200
<b>PN40</b>									
DN15	328	353	-	-	-	-	-	-	-
DN25	-	-	510	-	-	-	-	-	-
DN40	-	-	-	600	-	-	-	-	-
DN50	-	-	-	-	715	-	-	-	-

mm									
	H08	H10	H15	H25	H50	H80	D100	D150	D200
DN80	-	-	-	-	-	915	-	-	-
<b>PN63</b>									
DN50	-	-	-	-	715	-	-	-	-
DN80	-	-	-	-	-	915	-	-	-
<b>PN100</b>									
DN15	328	353	-	-	-	-	-	-	-
DN25	-	-	510	-	-	-	-	-	-
DN40	-	-	-	600	-	-	-	-	-
DN50	-	-	-	-	715	-	-	-	-
DN80	-	-	-	-	-	915	-	-	-
<b>PN160</b>									
DN15	328	353	-	-	-	-	-	-	-
DN25	-	-	510	-	-	-	-	-	-
DN40	-	-	-	600	-	-	-	-	-
DN50	-	-	-	-	715	-	-	-	-
DN80	-	-	-	-	-	915	1042	-	-
DN100	-	-	-	-	-	-	1070	1250	-
DN150	-	-	-	-	-	-	-	1306	1718
DN200	-	-	-	-	-	-	-	-	1742
<b>ASME 150</b>									
½"	328	353	-	-	-	-	-	-	-
1"	-	-	510	-	-	-	-	-	-
1½"	-	-	-	600	-	-	-	-	-
2"	-	-	-	-	715	-	-	-	-
3"	-	-	-	-	-	915	-	-	-
<b>ASME 300</b>									
½"	328	353	-	-	-	-	-	-	-
1"	-	-	510	-	-	-	-	-	-
1½"	-	-	-	600	-	-	-	-	-
2"	-	-	-	-	715	-	-	-	-
3"	-	-	-	-	-	915	-	-	-
<b>ASME 600</b>									
½"	328	353	-	-	-	-	-	-	-
1"	-	-	510	-	-	-	-	-	-
1½"	-	-	-	600	-	-	-	-	-
2"	-	-	-	-	715	-	-	-	-
3"	-	-	-	-	-	915	-	-	-
<b>ASME 900</b>									
1½"	-	-	-	600	-	-	-	-	-
2"	-	-	-	-	715	-	-	-	-
3"	-	-	-	-	-	915	1086	-	-

mm									
	H08	H10	H15	H25	H50	H80	D100	D150	D200
4"	-	-	-	-	-	-	1112	1292	-
6"	-	-	-	-	-	-	-	1342	1754
8"	-	-	-	-	-	-	-	-	1798
<b>ASME 1500</b>									
½"	328	353	-	-	-	-	-	-	-
1"	-	-	510	-	-	-	-	-	-
1½"	-	-	-	600	-	-	-	-	-
2"	-	-	-	-	715	-	-	-	-
3"	-	-	-	-	-	915	1118	-	-
4"	-	-	-	-	-	-	1130	1310	-
6"	-	-	-	-	-	-	-	1406	1818
8"	-	-	-	-	-	-	-	-	1900
<b>JIS 10K</b>									
50A	-	-	-	-	715	-	-	-	-
80A	-	-	-	-	-	915	-	-	-
<b>JIS 20K</b>									
15A	328	353	-	-	-	-	-	-	-
25A	-	-	510	-	-	-	-	-	-
40A	-	-	-	600	-	-	-	-	-
50A	-	-	-	-	715	-	-	-	-
80A	-	-	-	-	-	915	-	-	-

inches									
	H08	H10	H15	H25	H50	H80	D100	D150	D200
<b>PN40</b>									
DN15	12.9	13.9	-	-	-	-	-	-	-
DN25	-	-	20.1	-	-	-	-	-	-
DN40	-	-	-	23.6	-	-	-	-	-
DN50	-	-	-	-	28.1	-	-	-	-
DN80	-	-	-	-	-	36	-	-	-
<b>PN63</b>									
DN50	-	-	-	-	28.1	-	-	-	-
DN80	-	-	-	-	-	36	-	-	-
<b>PN100</b>									
DN15	12.9	13.9	-	-	-	-	-	-	-
DN25	-	-	20.1	-	-	-	-	-	-
DN40	-	-	-	23.6	-	-	-	-	-
DN50	-	-	-	-	28.1	-	-	-	-
DN80	-	-	-	-	-	36	-	-	-

inches									
	H08	H10	H15	H25	H50	H80	D100	D150	D200
<b>PN160</b>									
DN15	12.9	13.9	-	-	-	-	-	-	-
DN25	-	-	20.1	-	-	-	-	-	-
DN40	-	-	-	23.6	-	-	-	-	-
DN50	-	-	-	-	28.1	-	-	-	-
DN80	-	-	-	-	-	36	41	-	-
DN100	-	-	-	-	-	-	42.1	49.2	-
DN150	-	-	-	-	-	-	-	51.4	67.6
DN200	-	-	-	-	-	-	-	-	68.6
<b>ASME 150</b>									
½"	12.9	13.9	-	-	-	-	-	-	-
1"	-	-	20.1	-	-	-	-	-	-
1½"	-	-	-	23.6	-	-	-	-	-
2"	-	-	-	-	28.1	-	-	-	-
3"	-	-	-	-	-	36	-	-	-
<b>ASME 300</b>									
½"	12.9	13.9	-	-	-	-	-	-	-
1"	-	-	20.1	-	-	-	-	-	-
1½"	-	-	-	23.6	-	-	-	-	-
2"	-	-	-	-	28.1	-	-	-	-
3"	-	-	-	-	-	36	-	-	-
<b>ASME 600</b>									
½"	12.9	13.9	-	-	-	-	-	-	-
1"	-	-	20.1	-	-	-	-	-	-
1½"	-	-	-	23.6	-	-	-	-	-
2"	-	-	-	-	28.1	-	-	-	-
3"	-	-	-	-	-	36	-	-	-
<b>ASME 900</b>									
1½"	-	-	-	23.6	-	-	-	-	-
2"	-	-	-	-	28.1	-	-	-	-
3"	-	-	-	-	-	36	42.7	-	-
4"	-	-	-	-	-	-	43.7	50.9	-
6"	-	-	-	-	-	-	-	52.7	69
8"	-	-	-	-	-	-	-	-	70.8
<b>ASME 1500</b>									
½"	12.9	13.9	-	-	-	-	-	-	-
1"	-	-	20.1	-	-	-	-	-	-
1½"	-	-	-	23.6	-	-	-	-	-
2"	-	-	-	-	28.1	-	-	-	-
3"	-	-	-	-	-	36	44	-	-
4"	-	-	-	-	-	-	44.5	51.6	-

inches									
	H08	H10	H15	H25	H50	H80	D100	D150	D200
6"	-	-	-	-	-	-	-	55.3	71.6
8"	-	-	-	-	-	-	-	-	74.8
<b>JIS 10K</b>									
50A	-	-	-	-	28.1	-	-	-	-
80A	-	-	-	-	-	36	-	-	-
<b>JIS 20K</b>									
15A	12.9	13.9	-	-	-	-	-	-	-
25A	-	-	20.1	-	-	-	-	-	-
40A	-	-	-	23.6	-	-	-	-	-
50A	-	-	-	-	28.1	-	-	-	-
80A	-	-	-	-	-	36	-	-	-

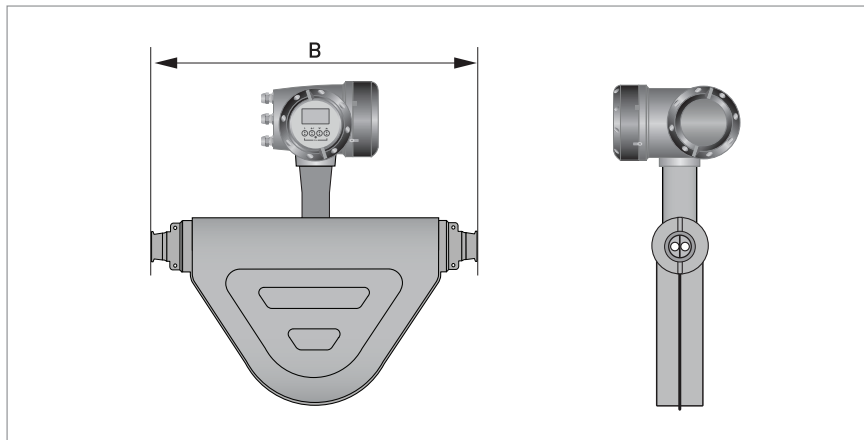
## 6.5.2 NAMUR dimensions

The following face to face dimensions comply with NAMUR NE132

mm (±3)							
	S15	S25	S50	S80	S100	S150	S250
<b>PN10</b>							
DN250	-	-	-	-	-	-	2100
<b>PN16</b>							
DN100	-	-	-	-	1000	-	-
DN150	-	-	-	-	-	1200	-
DN200	-	-	-	-	-	-	2100
<b>PN40</b>							
DN 15	510	-	-	-	-	-	-
DN 25	-	600	-	-	-	-	-
DN 50	-	-	715	-	-	-	-
DN 80	-	-	-	915	-	-	-

inches (±0.12)							
	S15	S25	S50	S80	S100	S150	S250
<b>PN10</b>							
DN250	-	-	-	-	-	-	82.7
<b>PN16</b>							
DN100	-	-	-	-	39.4	-	-
DN150	-	-	-	-	-	47.2	-
DN200	-	-	-	-	-	-	82.7
<b>PN40</b>							
DN 15	20.1	-	-	-	-	-	-
DN 25	-	23.6	-	-	-	-	-
DN 50	-	-	28.1	-	-	-	-
DN 80	-	-	-	36	-	-	-

### 6.5.3 Hygienic versions



Dimension B for meters with Stainless Steel measuring tubes

	mm (±5)					
	S08	S10	S15	S25	S50	S80
<b>Tri-clover</b>						
½"	308	320	-	-	-	-
1"	-	-	477	-	-	-
1½"	-	-	-	563	-	-
2"	-	-	-	-	662	-
3"	-	-	-	-	-	842
<b>Tri-clamp DIN 32676</b>						
DN15	301	313	-	-	-	-
DN25	-	-	477	-	-	-
DN40	-	-	-	563	-	-
DN50	-	-	-	-	662	-
DN80	-	-	-	-	-	855
<b>Tri-clamp ISO 2852</b>						
1"	-	-	483	-	-	-
1½"	-	-	-	569	-	-
2"	-	-	-	-	668	-
3"	-	-	-	-	-	848
<b>DIN 11864-2 Form A (female)</b>						
DN15	345	357	-	-	-	-
DN25	-	-	514	-	-	-
DN40	-	-	-	610	-	-
DN50	-	-	-	-	709	-
DN80	-	-	-	-	-	915
<b>Male thread DIN 11851</b>						
DN15	307	319	-	-	-	-
DN25	-	-	492	-	-	-

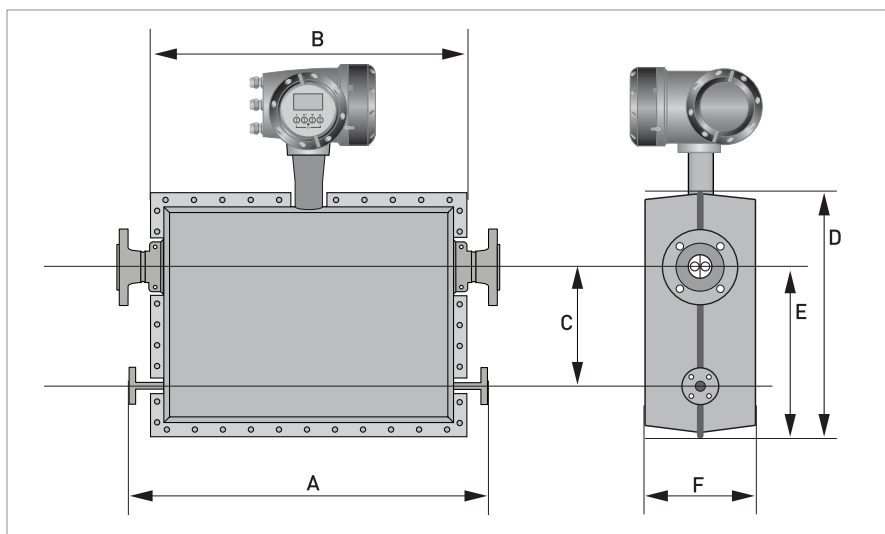
	mm (±5)					
	S08	S10	S15	S25	S50	S80
DN40	-	-	-	586	-	-
DN50	-	-	-	-	689	-
DN80	-	-	-	-	-	889
<b>Male thread SMS</b>						
1"	-	-	464	-	-	-
1½"	-	-	-	566	-	-
2"	-	-	-	-	665	-
3"	-	-	-	-	-	847

	inches (±0.2)					
	S08	S10	S15	S25	S50	S80
<b>Tri-clover</b>						
½"	12.1	12.6	-	-	-	-
1"	-	-	18.8	-	-	-
1½"	-	-	-	22.2	-	-
2"	-	-	-	-	26	-
3"	-	-	-	-	-	33.1
<b>Tri-clamp DIN 32676</b>						
DN15	11.8	12.3	-	-	-	-
DN25	-	-	18.8	-	-	-
DN40	-	-	-	22.2	-	-
DN50	-	-	-	-	26	-
DN80	-	-	-	-	-	33.7
<b>Tri-clamp ISO 2852</b>						
1"	-	-	19	-	-	-
1½"	-	-	-	22.4	-	-
2"	-	-	-	-	26.3	-
3"	-	-	-	-	-	33.4
<b>DIN 11864-2 Form A (female)</b>						
DN15	13.6	14	-	-	-	-
DN25	-	-	20.2	-	-	-
DN40	-	-	-	24	-	-
DN50	-	-	-	-	27.9	-
DN80	-	-	-	-	-	36
<b>Male thread DIN 11851</b>						
DN15	12	12.5	-	-	-	-
DN25	-	-	19.4	-	-	-
DN40	-	-	-	23	-	-
DN50	-	-	-	-	27.1	-
DN80	-	-	-	-	-	35



	inches ( $\pm 0.2$ )					
	S08	S10	S15	S25	S50	S80
<b>Male thread SMS</b>						
1"	-	-	18.3	-	-	-
1½"	-	-	-	22.3	-	-
2"	-	-	-	-	26.2	-
3"	-	-	-	-	-	33.3

## 6.5.4 Heating jacket version

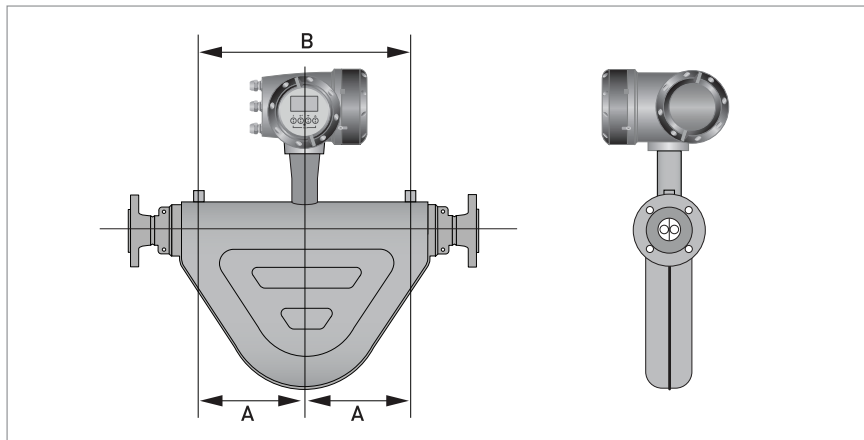


## General dimensions

	mm									
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
Heating connection size: PN40 DN15 or ASME 150 ½"										
A ±5.0	435		590	692	715	891	956	1139	TBA	TBA
B ±3.0	283		440	542	565	741	806	989	TBA	TBA
C ±3.0	100		130	210	230	320	340	450	TBA	TBA
D ±3.0	315		344	453	499	622	682	844	TBA	TBA
E ±3.0	198		221	316	356	451	486	617	TBA	TBA
F ±3.0	232		226	254	266	322	372	428	TBA	TBA

	inches									
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
Heating connection size: PN40 DN15 or ASME 150 ½"										
A ±0.2	17.1		23.2	27.2	28.1	35.1	37.6	44.8	TBA	TBA
B ±0.12	11.1		17.3	21.3	22.2	29.2	31.7	38.9	TBA	TBA
C ±0.12	3.9		5.1	8.3	9	12.6	13.4	17.7	TBA	TBA
D ±0.12	12.4		13.5	17.8	19.6	24.5	26.8	33.2	TBA	TBA
E ±0.12	7.8		8.7	12.4	14	17.7	19.1	24.3	TBA	TBA
F ±0.12	9.1		8.9	10	10.5	12.7	14.6	16.8	TBA	TBA

### 6.5.5 Purge port option



#### Dimensions

	mm									
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
A	80		150	200	215	300	305	380	600	800
B	160		300	400	430	600	610	720	1200	1600

	inches									
	S08	S10	S15	S25	S50	S80	S100	S150	S200	S250
A	3.1		5.9	7.9	8.5	11.8	12	15	23.6	31.5
B	6.3		11.8	15.7	16.9	23.6	24	28.3	47.2	63



### KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry

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[www.krohne.com](http://www.krohne.com)

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