



## OPTIMASS 3400 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.

**CAUTION!**

*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.*

**INFORMATION!**

*This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.*

**INFORMATION!**

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

## 1.2 CE certification

CE marking



This device conforms with the most recent and up to date versions of the following:

- EMC Directive
- ATEX Directive
- Low Voltage Directive
- Pressure Equipment Directive

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

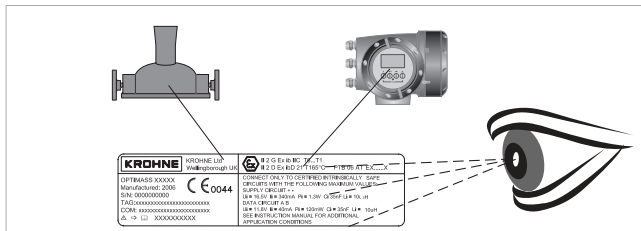
## 1.4 Pressure Equipment Directive (PED)



### LEGAL NOTICE!

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

### Visual check



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. In addition to which, the following should also be noted:

- Secondary pressure containment is supplied as standard.
- The PED / CRN approved secondary containment pressure is 30 barg / 435 psig at 20°C / 68°F.
- The wiring feedthrough is made of Epoxy, PPS or PEEK with two O-rings made from FPM / FKM & Hydrogenated Nitrile.
- If the measuring tube/s fails, the O-ring will be in contact with the process product.
- You **MUST** make sure that the O-ring material is suitable for the application.
- Alternative O-ring materials are available on request.

### Secondary pressure containment

Secondary pressure containment is subject to de-rating according to temperature. Refer to the de-rating graphs shown in the relevant section.

If a heating jacket is fitted, secondary pressure containment is limited to 10 barg / 145 psig at 20°C / 68°F

Where the meter is being used to measure high pressure gases and / or gases 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 shock, seismic or other shock loading, a secondary containment option **MUST** be purchased

Where the above situation applies and the process pressure exceeds the secondary pressure containment (please refer to technical data) or where secondary pressure containment is not available, the burst disc option **MUST** also be purchased. For more information, please contact your nearest representative.

The burst disc option is not available if the heating jacket option has been ordered.



**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.*

## 1.5 Dirty gas

Dirty gas is gas that carries sand or other solid particles. Dirty gas causes excessive wear to the primary measuring tube that can eventually result in complete tube failure. In some situations tube failure where gas is being measured, can be very dangerous.



**DANGER!**

*If the meter is being used to measure gas and there is a risk that the gas might be dirty, you must fit a filter upstream of the meter to catch solid particles.*

## 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 or 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 icons as shown below.



### 1.6.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.



**DANGER!**

*This warning 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

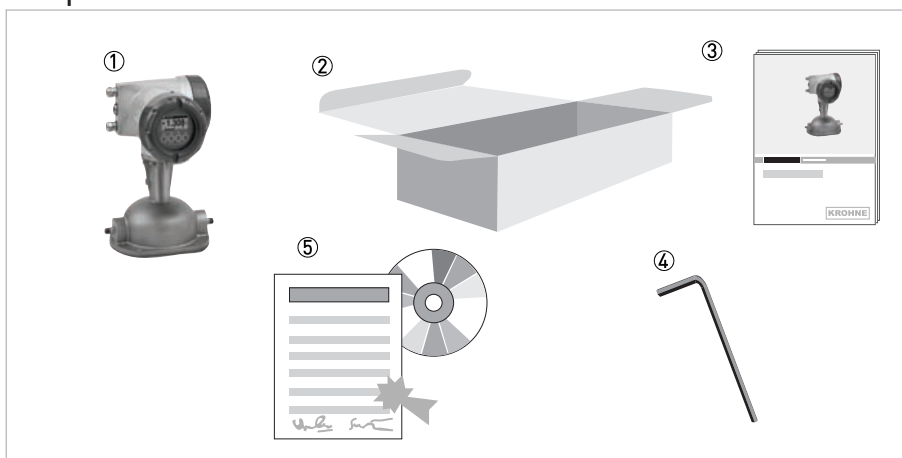


**WARNING!**

*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.*

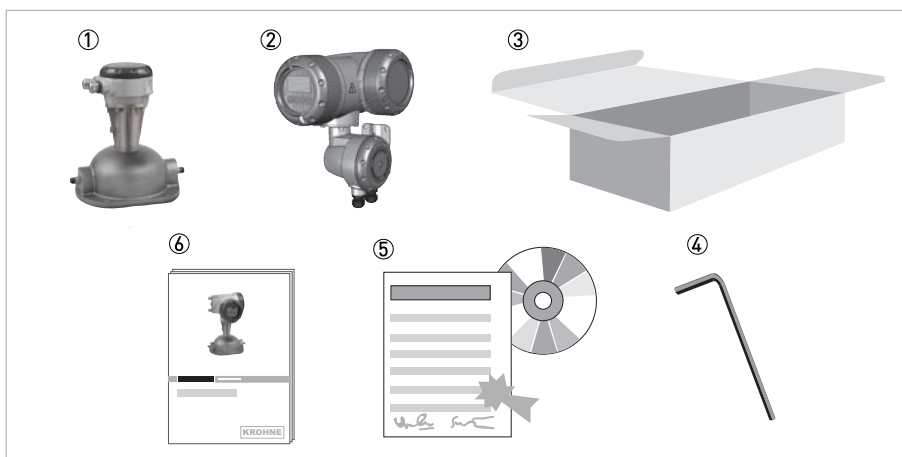
## 2.1 Scope of delivery

### Compact version



- ① Mass flowmeter.
- ② Carton.
- ③ Documentation.
- ④ 2.5 mm hex head tool.
- 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 hex head tool.
- 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.

## 2.2 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 CSA Dual Seal

To comply with the requirements of ANSI/ISA -12.27.01-2003 "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 3400C S04 - LIQUID)

**Pressure and temperature data:**

OPTIMASS 3000 / 3000F / 3400C -40°C...+150°C and 100...14000 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.

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 going into <Startup> mode and a diagnostic error will be shown 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.

**Meter status:**

The meter will also go into <Startup> mode if the primary seal (tube) fails, or if they 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 remains in <Startup> mode you **MUST** assume that the primary seal (tube) has failed and the appropriate action **MUST** be taken.

**Gases** (Example model code: OPTIMASS 3400C S04 - GAS)

**Pressure / temperature data:**

OPTIMASS 3000 / 3000F / 3400C -40°C...+150°C and 500...14000 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) temperature is 110°C / 230°F.

**Thermal shock**

Thermal shock occurs when there is a sudden and extreme change (shift) in process temperature. To avoid thermal shock, refer to the following table for the maximum temperature shift.

Meter	Maximum temperature shift
Stainless Steel	+80°C / +176°F
Hastelloy®	+80°C / +176°F

**CAUTION!**

*Operation outside these limits may result in shifts in density and mass flow calibration. Repeated shocking may also lead to premature failure of the meter! However, higher thermal shocks are possible at lower working pressures. For more information, please contact your nearest representative.*

### 3.1 General notes on installation

**INFORMATION!**

*Inspect the packaging 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.*

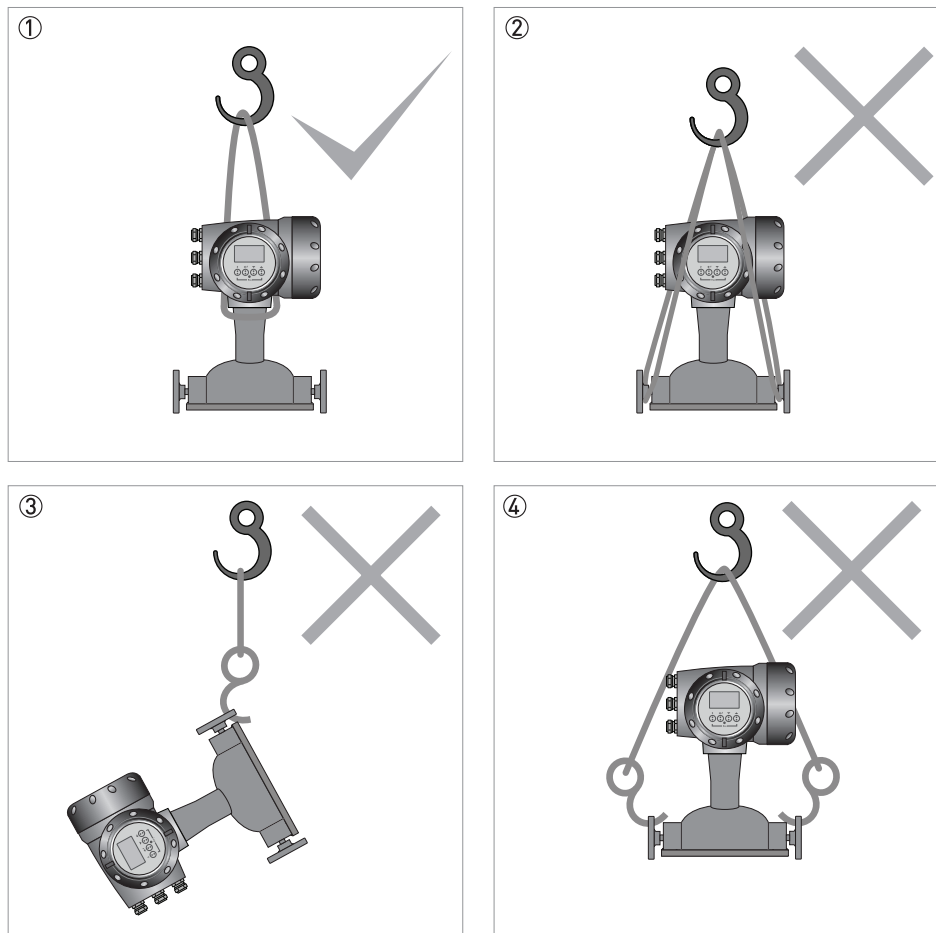
**INFORMATION!**

*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. [-40°C / -40°F and +70°C / +158°F. where a SIL capable converter has been supplied]

## 3.3 Handling



- ① Lift the meter by the converter or remote connection box
- ② DO NOT lift the meter where the measuring tube exits the meter body.
- ③ DO NOT lift the meter using a single flange or process connector.
- ④ DO NOT lift the meter using both flanges or process connectors.

## 3.4 Installation conditions

### 3.4.1 Plastic Inserts

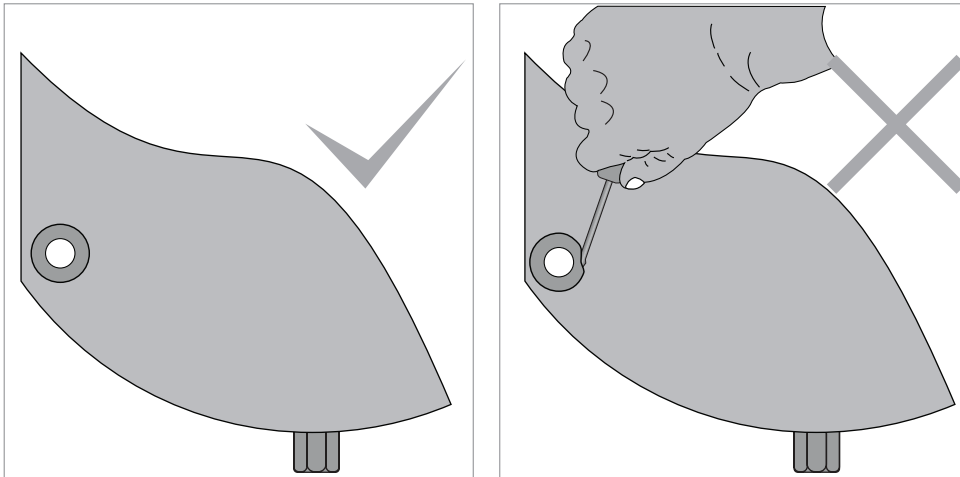


Figure 3-1: Base plate plastic inserts



**CAUTION!**

The four mounting holes in the meter base plate are fitted with plastic inserts. Do not remove the inserts prior to installation.

### 3.4.2 Two hole mounting

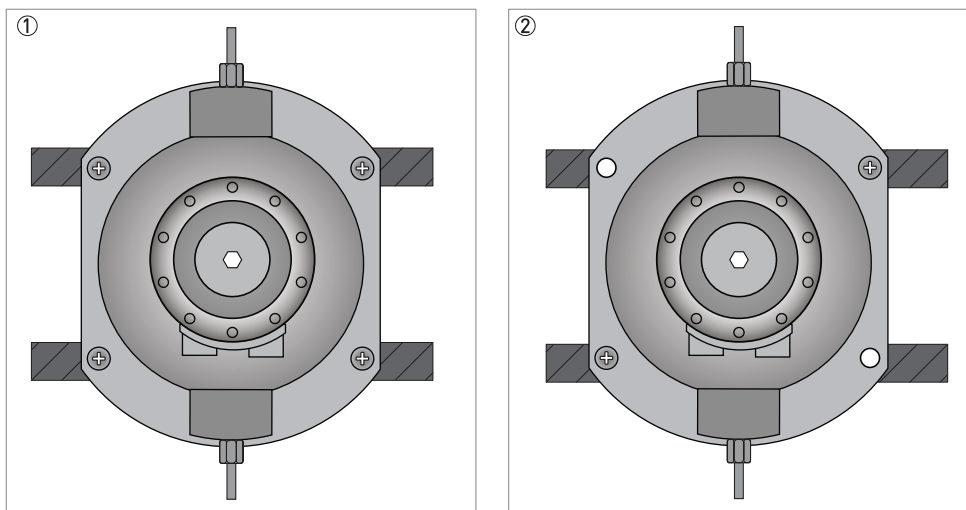


Figure 3-2: Using two holes to mount the meter

- ① It is recommended that ALL four mounting holes are used to secure the meter.
- ② It is possible to secure the meter using only two of the mounting holes.

### 3.4.3 Self draining

#### Verticle mounting angles for self draining

If the meter is mounted vertically and the installation requires the meter to be self draining, mount the meter at the angle shown in the table. The angles are marked on the meter base plate.

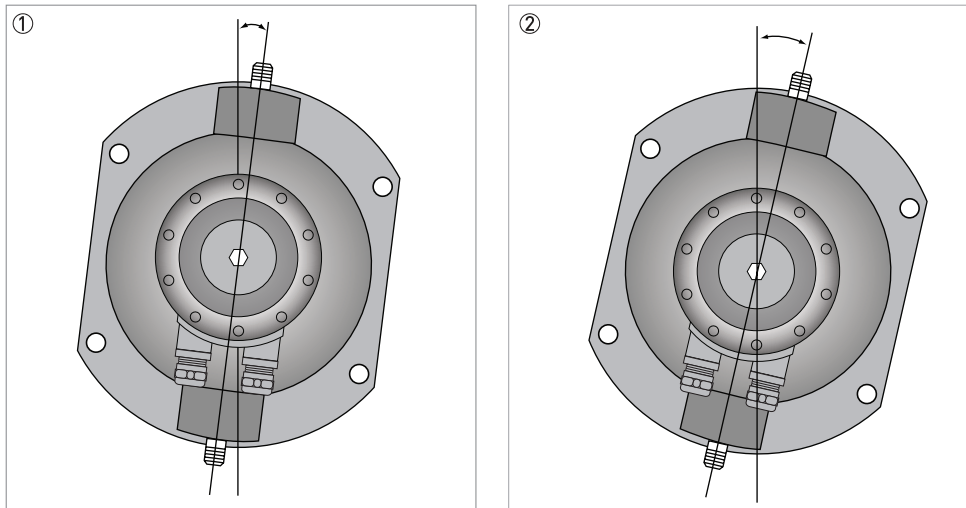


Figure 3-3: Angle of rotation for self draining

- ① 7° of clockwise rotation from the vertical for self draining. [See table for applicable meter sizes].
- ② 13° of clockwise rotation from the vertical for self draining. [See table for applicable meter sizes].

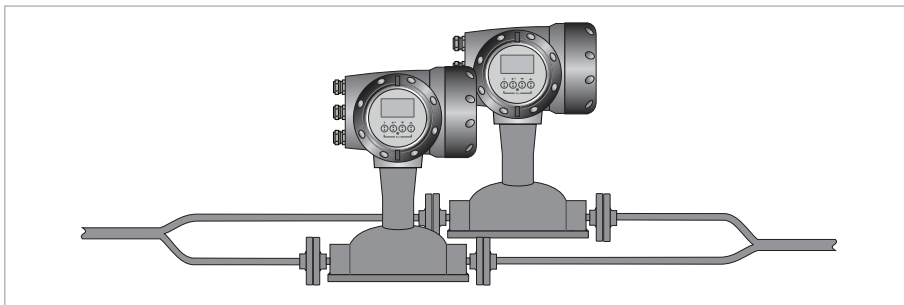
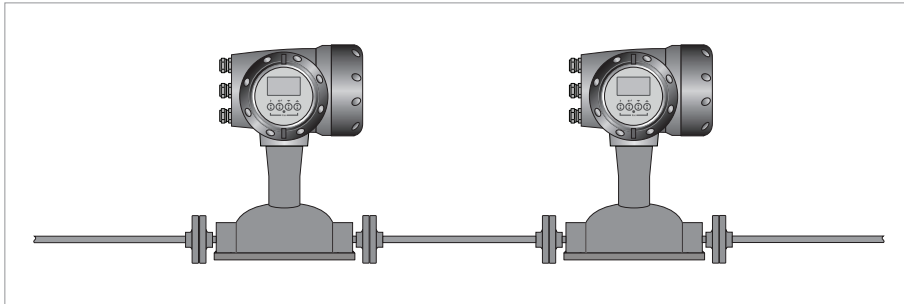
#### Set angles

Meter size	Angle of rotation (clockwise)
01	7°
03	13°
04	13°



### 3.4.4 Cross talk

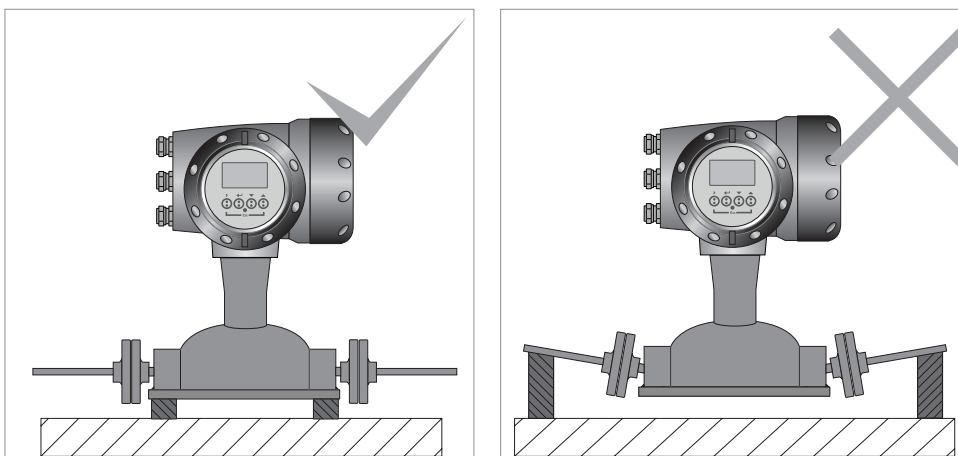
Where more than one meter is being installed, a very high level of immunity to cross talk means that the meters can be mounted within close proximity to each other. The meters can be mounted either in series or parallel, as shown.



#### **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.

### 3.4.5 Meter support



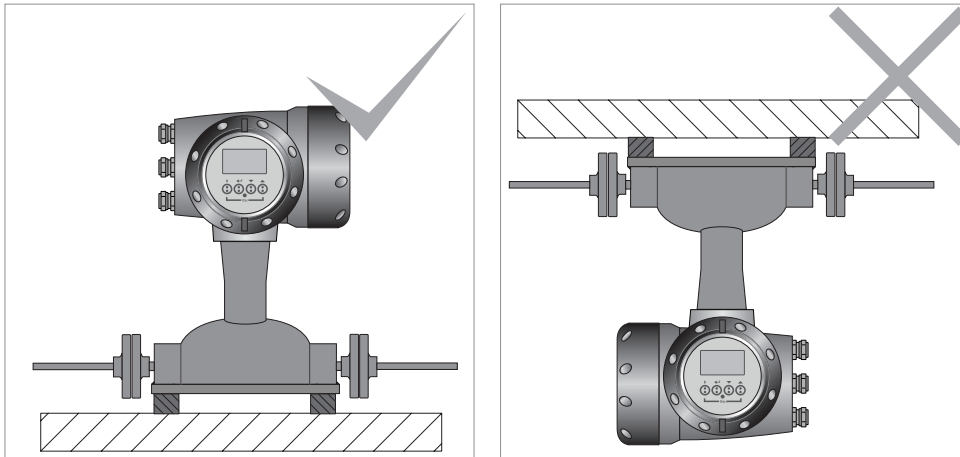
Use the base plate to mount and fully support the weight of the meter.



#### **CAUTION!**

**DO NOT** use the process pipework to support the weight of the meter. This will cause severe damage.

## 3.4.6 Horizontal mounting

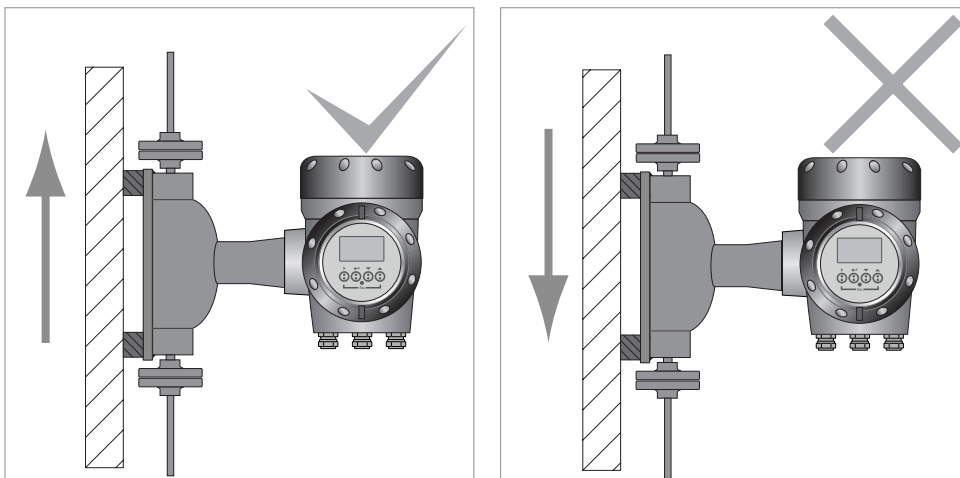


Mount the meter on a firm, rigid base.



**CAUTION!**  
*DO NOT mount the meter upside down.*

## 3.4.7 Vertical mounting



If the meter is mounted vertically, the process flow **MUST** be upwards.

### 3.4.8 Purge ports

#### Purge ports

- Meters ordered with purge port option, will be fitted with ¼" NPT female connections
- The NPT connections are sealed with NPT plugs and PTFE tape



#### **CAUTION!**

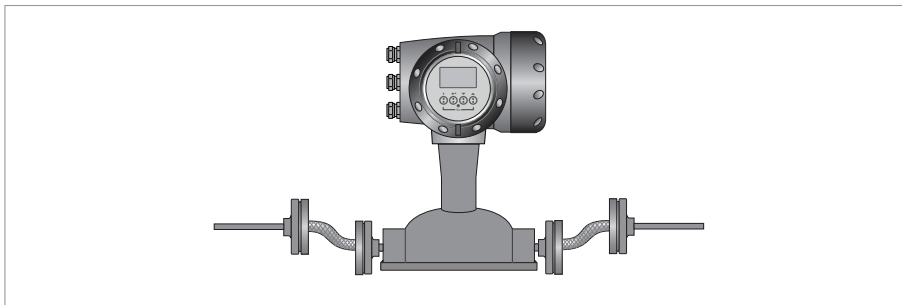
*DO NOT REMOVE THE NPT plugs!*

*The meter is factory sealed and filled with dry nitrogen gas. If you remove the plugs and allow moisture to get into the meter it will cause damage. If you think that the measuring tube has failed, depressurise the meter (when it is safe to do so) and remove the plugs. Purge the meter case to remove the process product.*

#### Burst discs

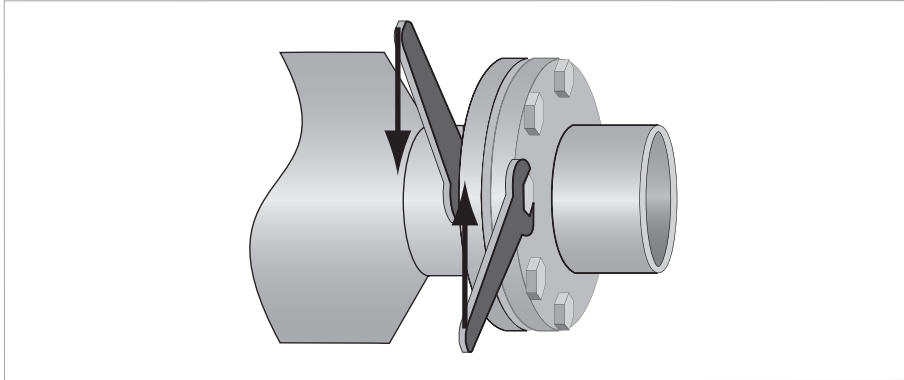
- If the operating pressure is higher than the design pressure of the secondary containment you **MUST** order the burst disc option.
- The disc failure pressure is 20 barg at 20°C / 290 psig at 68°F.
- If process conditions change from the original order, you **MUST** contact the manufacturer for advice regarding the suitability of the fitted disc.
- If the process product is hazardous, it is recommended that an exhaust tube is fitted to the NPT male thread so that the discharge can be piped to a safe area.
- Make sure that the arrow on the burst disc is pointing away from the meter.

### 3.4.9 Flexible connections

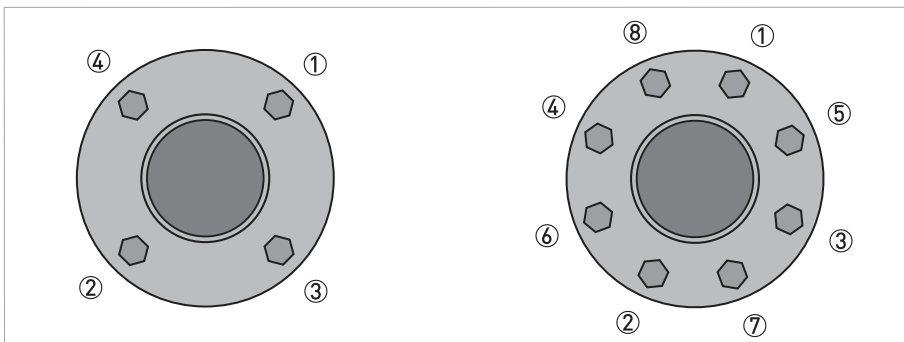


Flexible connections can be used to connect the meter to the process pipework.

## 3.4.10 Flange connections



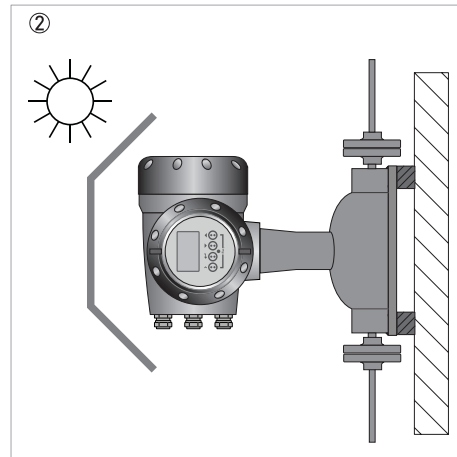
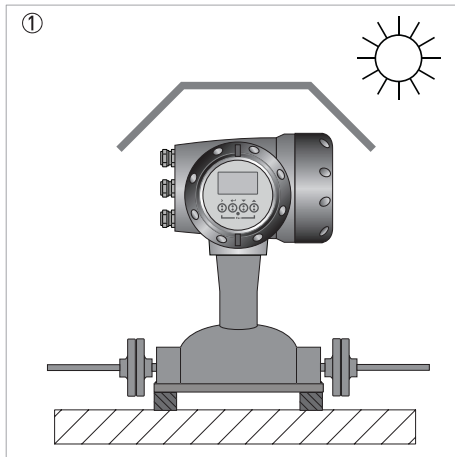
Tighten the flange bolts evenly and in turn.



Use a regular pattern to tighten the bolts evenly

### 3.4.11 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 sales office.*

## 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 the personnel, the 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, radioactive, flammable or water-endangering products, you are kindly requested:*

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

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



**CAUTION!**

*To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.*

Company:		Address:	
Department:		Name:	
Tel. no.:		Fax no. and/or Email address:	
Manufacturer's order no. or serial no.:			
The device has been operated with the following medium:			
This medium is:	<input type="checkbox"/>	radioactive	
	<input type="checkbox"/>	water-hazardous	
	<input type="checkbox"/>	toxic	
	<input type="checkbox"/>	caustic	
	<input type="checkbox"/>	flammable	
	<input type="checkbox"/>	We checked that all cavities in the device are free from such substances.	
	<input type="checkbox"/>	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.*

**Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:**



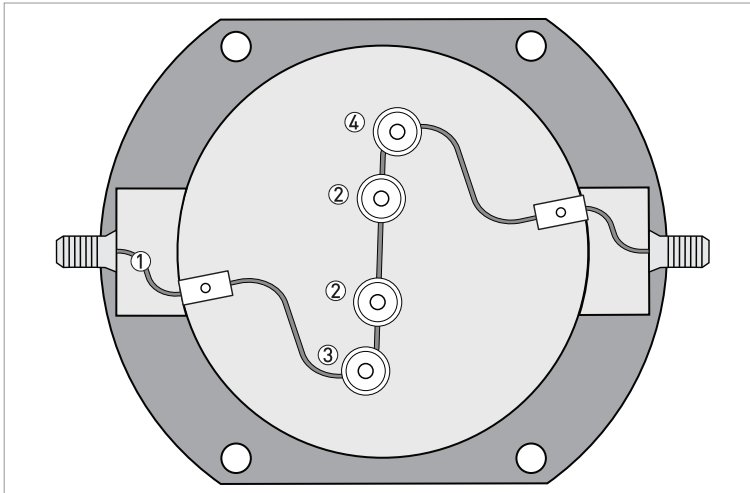
According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.

The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.



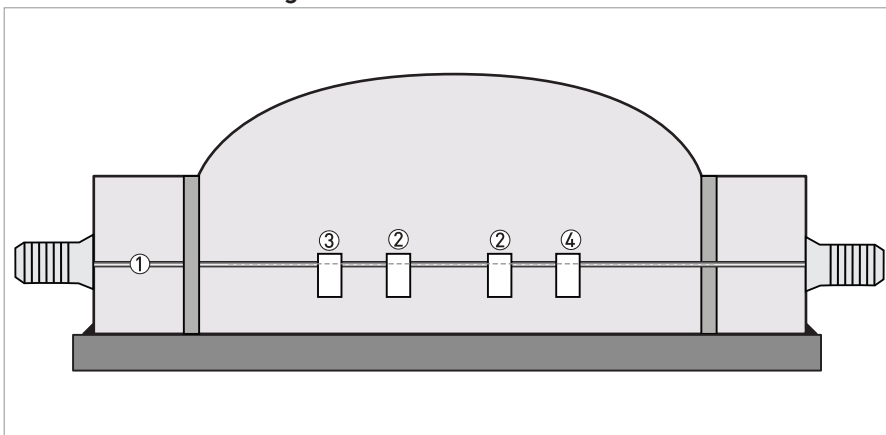
## 6.1 Measuring principle (single Z tube)

Meter tube layout, shown from above



- ① Measuring tube
- ② Drive coils
- ③ Sensor 1
- ④ Sensor 2

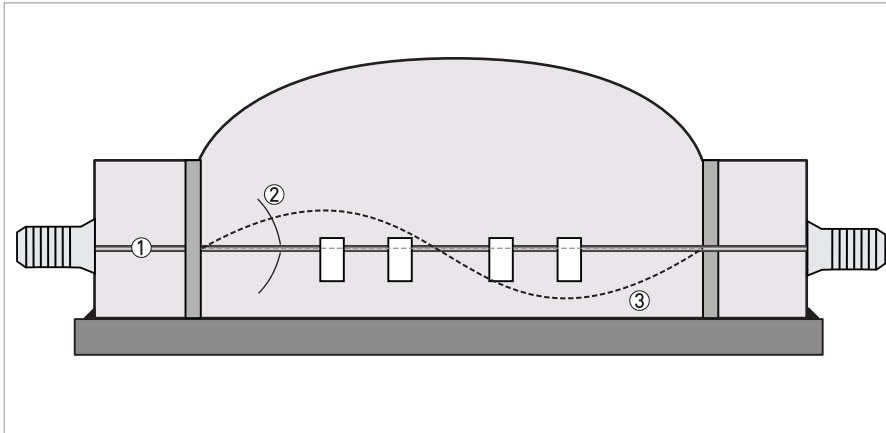
Static meter not energised and with no flow



- ① Measuring tube
- ② Drive coils
- ③ Sensor 1
- ④ Sensor 2

A Coriolis single Z tube mass flowmeter consists of a single Z shaped measuring tube (①) two drive coils (②) and two sensors (③ and ④) that are positioned either side of the drive coils.

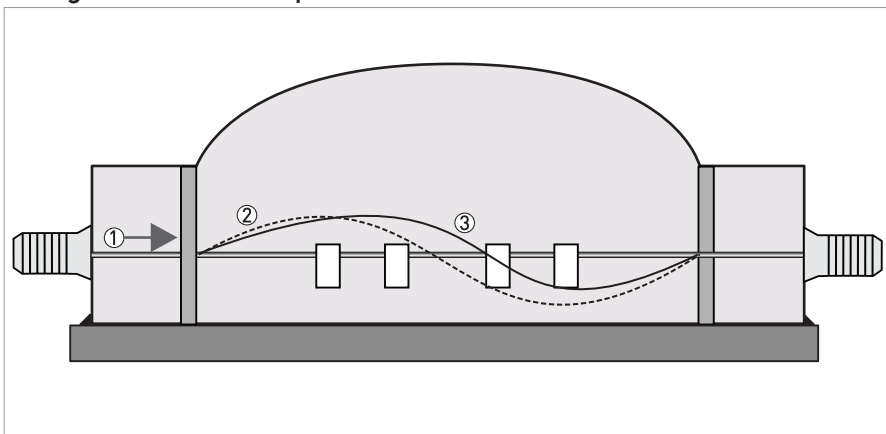
### Energised meter



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

When the meter is energised, the drive coils vibrate the measuring tube causing it 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 tube, 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 sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

### Measuring system

Measuring principle	Coriolis mass flow
Application range	Mass flow and density measurement of fluids, gases
Measured values	Mass, density, temperature
Calculated values	Volume, referred density, concentration, velocity

### Design

Basic	System consists of a measuring sensor and a converter to process the output signal
Features	Fully welded maintenance free sensor with single Z-shaped measuring tube
<b>Variants</b>	
Compact version	Integral converter
Remote version	Available with field, wall or 19" rack mount versions of the converter
Modbus version	Sensor with integral electronics providing Modbus output for connection to a PLC

### Measuring accuracy

<b>Mass</b>	
Liquid	±0.1% of actual measured flow rate + zero stability
Gas	±0.5% of actual measured flow rate + zero stability
Repeatability	Better than 0.05% plus zero stability (includes the combined effects of repeatability, linearity and hysteresis)
<b>Zero stability</b>	
Stainless Steel / Hastelloy®	0.0057% of maximum flow rate with respective sensor size
<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>	
Stainless Steel / Hastelloy®	0.0056% per 1°C / 0.0031% per 1°F
<b>Effect on sensor zero point caused by a shift in process pressure</b>	
Stainless Steel / Hastelloy®	0.013% of the max flow rate per 1 barg / 0.0009% of the max flow rate per 1 psig
<b>Density</b>	
Measuring range	400...3000 kg/m <sup>3</sup> / 25...187 lbs/ft <sup>3</sup>
Accuracy	±2 kg/m <sup>3</sup> / ±0.13 lbs/ft <sup>3</sup>
On site calibration	±0.5 kg/m <sup>3</sup> / ±0.033 lbs/ft <sup>3</sup>
<b>Temperature</b>	
Accuracy	±1°C / ±1.8°F

### Operating conditions

<b>Maximum flow rates</b>	
01	20 kg/h / 0.733 lbs/min
03	130 kg/h / 4.766 lbs/min
04	450 kg/h / 16.5 lbs/min
<b>Ambient temperature</b>	
Compact version with Aluminium converter	-40...+60°C / -40...+140°F Extended temperature range: 65°C / 149°F for some I/O options. For more information contact manufacturer.
Compact version with Stainless Steel converter	-40...+55°C / -40...+130°F
Remote versions	-40...+65°C / -40...+149°F
<b>Process temperature</b>	
Stainless Steel / Hastelloy®	-40...+150°C / -40...+302°F
<b>Nominal pressure at 20°C / 68°F</b>	
<b>Measuring tube</b>	
Stainless Steel	-1...150 barg / -14.5...2175 psig
Hastelloy®	-1...300 barg / -14.5...4351 psig
<b>Outer casing</b>	
PED / CRN approved	-1...30 barg / -14.5...435 psig For operating pressures >30barg / 435psig, a burst disc is mandatory
<b>Fluid properties</b>	
Permissible physical condition	Liquids, gases
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

### Installation conditions

Inlet runs	None required
Outlet runs	None required

### Materials

<b>Stainless Steel meter</b>	
Measuring tube	Stainless Steel 316L [1.4435]
Process connections	Stainless Steel 316L [1.4435]
Baseplate	Stainless Steel 316L [1.4435]
Outer casing	Stainless Steel 316L [1.4435]
<b>Hastelloy® meter</b>	
Measuring tube	Hastelloy® C-22
Process connections	Hastelloy® C-22
Baseplate	Stainless Steel 316L [1.4435]
Outer casing	Stainless Steel 316L [1.4435]
<b>Heating jacket version</b>	
Heating jacket	Stainless Steel 316L [1.4435]

<b>All versions</b>	
Sensor electronics housing	Stainless Steel 316L (1.4409)
Junction box (remote version)	Die cast Aluminium (polyurethane coating)
	Optional Stainless Steel 316 (1.4401)

### Process connections

<b>Threaded</b>	
NPT-M	¼"
<b>Flange</b>	
DIN	DN15 / PN40
ASME	½" / ASME 150...300
JIS	15A / 20K
<b>Hygienic</b>	
Tri-clover	½"
Tri-clamp DIN 32676	DN10

### 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

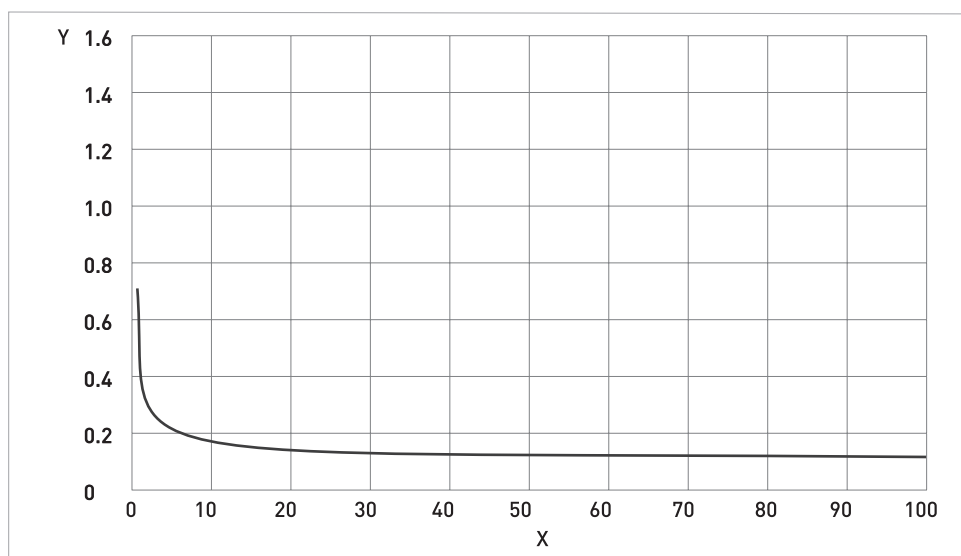
CE	The device fulfils the statutory requirements of the CE directive. The manufacturer certifies that these requirements have been met by applying the CE mark.
Factory Mutual / CSA	Class I, Div 1 groups A, B, C, D
	Class II, Div 1 groups E, F, G
	Class III, Div 1 hazardous areas
	Class I, Div 2 groups A, B, C, D
	Class II, Div 2 groups F, G
ANSI / CSA (Dual Seal)	12.27.901-2003
<b>ATEX (most recent and up to date version)</b>	
<b>OPTIMASS 3000 / 3000F (with or without heating jacket / insulation)</b>	
	II 1 G Ex ia IIC T6...T1 Ga
	II 1 D Ex ia IIIC T165°C Da
<b>OPTIMASS 3400C Non Ex i signal outputs (with or without heating jacket / insulation)</b>	
Ex d connection compartment	II 2 G Ex d ia IIC T6...T1 Gb
	II 2 D Ex tb IIIC T165°C Db
Ex e connection compartment	II 2 G Ex de ia IIC T6...T1 Gb
	II 2 D Ex tb IIIC T165°C Db

OPTIMASS 3400C Ex i signal outputs (with or without heating jacket / insulation)	
Ex d connection compartment	II 2(1) G Ex d ia [ia Ga] IIC T6...T1 Gb
	II 2(1) D Ex tb [ia Da] IIIC T165°C Db
Ex e connection compartment	II 2(1) G Ex de ia [ia Ga] IIC T6...T1 Gb
	II 2(1) D Ex tb [ia Da] IIIC T165°C Db

### 6.3 ATEX temperature limits

	Ambient Temp. $T_{amb}$ °C	Max medium Temp. $T_m$ °C	Temp. Class	Max. Surface Temp. °C	
Optimass 3000 / 3000F with or without heating jacket / insulation	-40...+40	40	T6	T55	
		70	T5	T85	
		90	T4	T105	
		150	T3 – T1	T165	
	-40...+50	70	T5	T85	
		90	T4	T105	
		150	T3-T1	T165	
	-40...+65	90	T4	T105	
		130	T3-T1	T145	
	Minimum medium temp: -50°C				
	Optimass 3400C Aluminium converter housing, with or without heating jacket / insulation	-40...+40	40	T6	T55
			70	T5	T85
90			T4	T105	
150			T3 – T1	T165	
-40...+50		90	T4	T105	
		145	T3-T1	T160	
-40...+65		65	T6-T1	T80	
Minimum medium temp: -45°C					
Optimass 3400C - Stainless Steel converter housing, with or without heating jacket / insulation		-40...+40	40	T6	T55
			70	T5	T85
	90		T4	T105	
	130		T3 - T1	T145	
	-40...+50	70	T5	T85	
		90	T4 - T1	T105	
	-40...+60	60	T6 - T1	T75	
	Minimum medium temp: -45°C				

## 6.4 Measuring accuracy



X Flow rate [%]

Y Measuring error [%]

### Measuring error

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

### Reference conditions

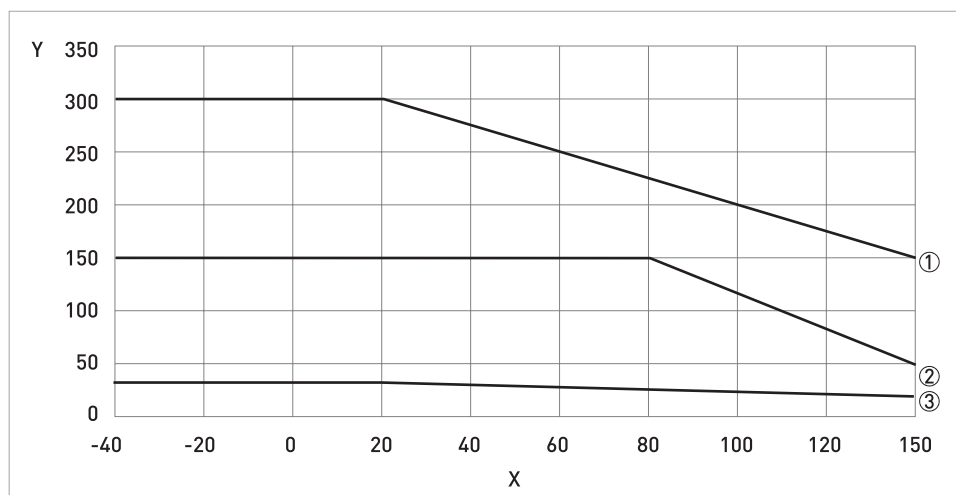
Product	Water
Temperature	+20°C / +68°F
Operating pressure	1 barg / 14.5 psig

## 6.5 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 130°C / 145 psig at 266°F

### Pressure / temperature de-rating for all meter sizes / materials, in metric



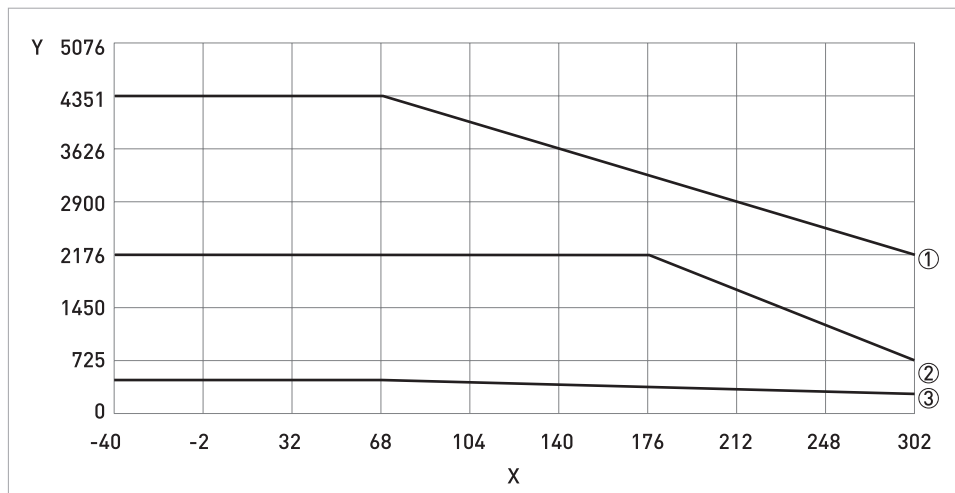
X Temperature [°C]

Y Pressure [barg]

- ① Hastelloy® C22 measuring tube
- ② Stainless Steel 316L measuring tube
- ③ Outer casing



### Pressure / temperature de-rating for all meter sizes / materials, in imperial



X Temperature [°F]

Y Pressure [psig]

- ① Hastelloy® HC22 measuring tube
- ② Stainless Steel 316L measuring tube
- ③ Outer casing

### Flanges

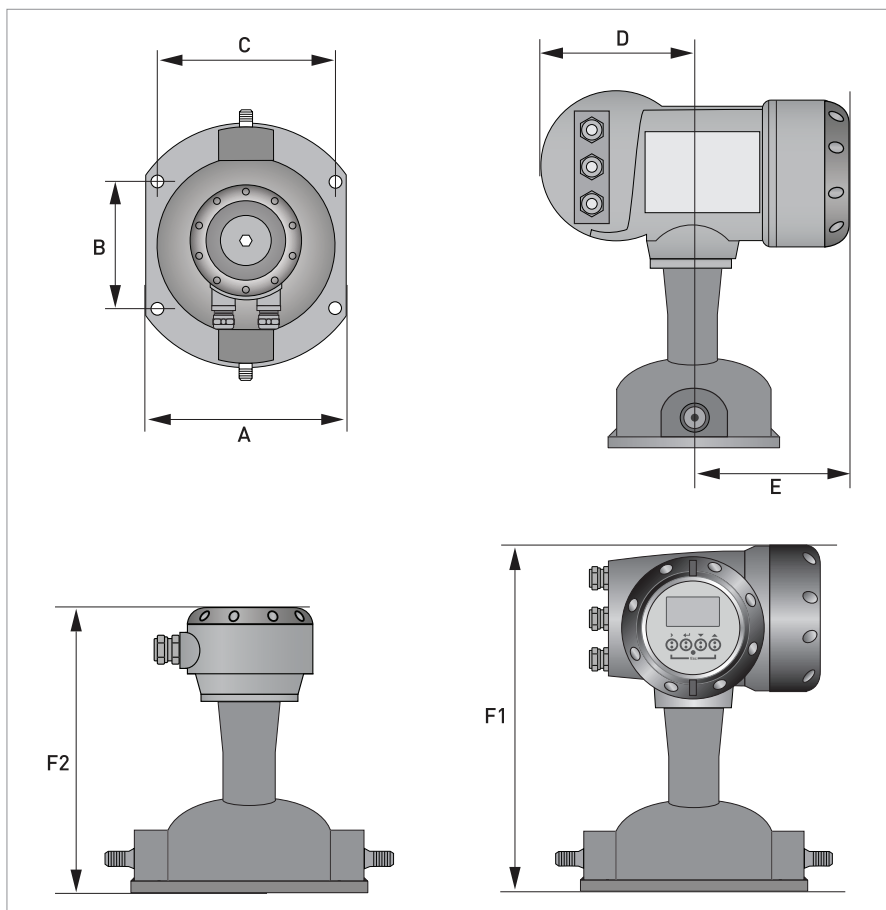
- DIN flange ratings are based on EN 1092-1 2001 table 18, 1% proof stress material group 14E0
- ASME flange ratings are based on ASME B16.5 2003 table 2 material group 2.2
- JIS flange ratings are based on JIS 2220: 2001 table 1 division 1 material group 022a

### 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.

## 6.6 Dimensions and weights

### 6.6.1 General dimensions



### Meter weights for Hastelloy® (H) and Stainless Steel (S)

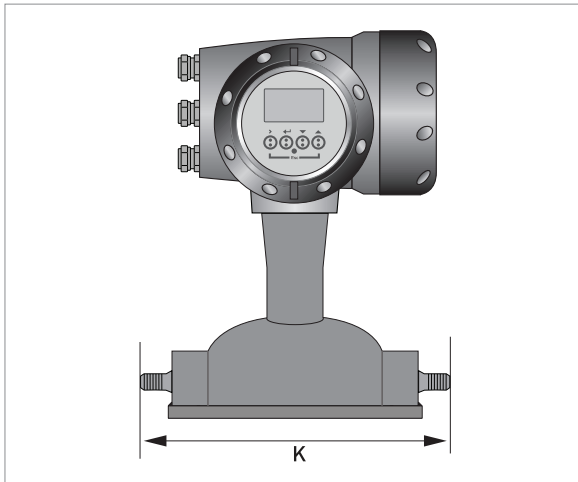
	Weight [kg]		
	H/S 01	H/S 03	H/S 04
Aluminium (compact)	16	16	16
Stainless Steel (compact)	22.1	22.1	22.1
Aluminium (remote)	13.2	13.2	13.2
Stainless Steel (remote)	14	14	14

	Weight [lbs]		
	H/S 01	H/S 03	H/S 04
Aluminium (compact)	35.2	35.2	35.2
Stainless Steel (compact)	48.62	48.62	48.62
Aluminium (remote)	29.04	29.04	29.04
Stainless Steel (remote)	30.8	30.8	30.8

## Dimensions

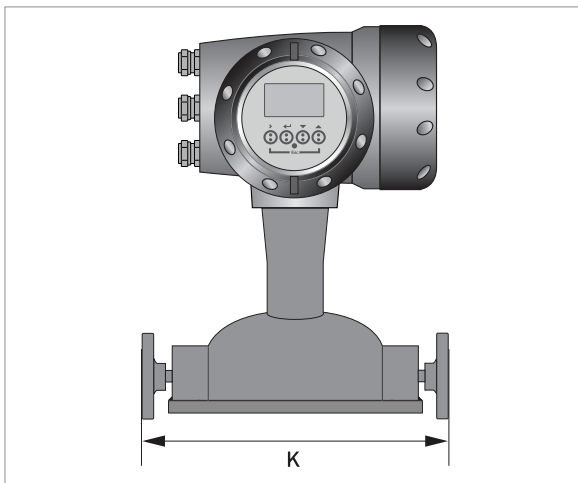
	Size [mm] / [inches]		
	S/H 01	S/H 03	S/H 04
A	180 / 7.1		
B	132 / 5.2		
C	156 / 6.1		
D	123.5 / 4.9		
E	98.5 / 3.9		
F	137 / 5.4		
G	60 / 2.4		
H	160 / 6.3		
J1	348 / 13.7		
J2	269 / 10.6		
Measuring tube inner diameter [mm]	1.2	2.6	4.0

6.6.2 NPT connections



Connection type	Dimension K	
	[mm]	[inches]
1/4" NPT(M)	256±3	10.1 ±0.1

6.6.3 Flange connections

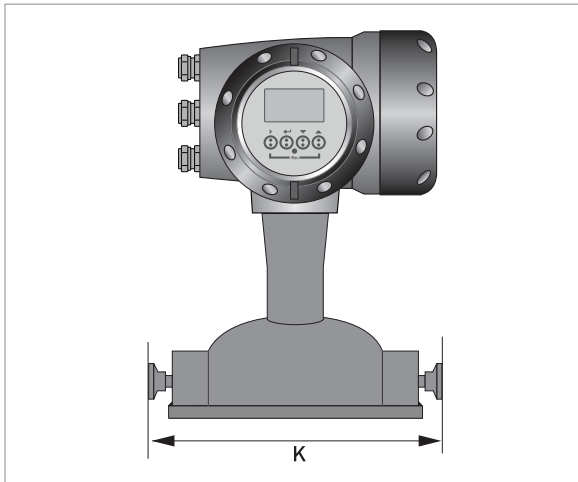


Connection type	Dimension K	
	[mm]	[inches]
ASME150	286±3	11.3 ±0.1
ASME300 ①	286±3	11.3 ±0.1
DN15 PN40 ②	286±3	11.3 ±0.1
15A JIS 20K	286±3	11.3 ±0.1

① For RJT raised faces add 8mm / 0.31 inches

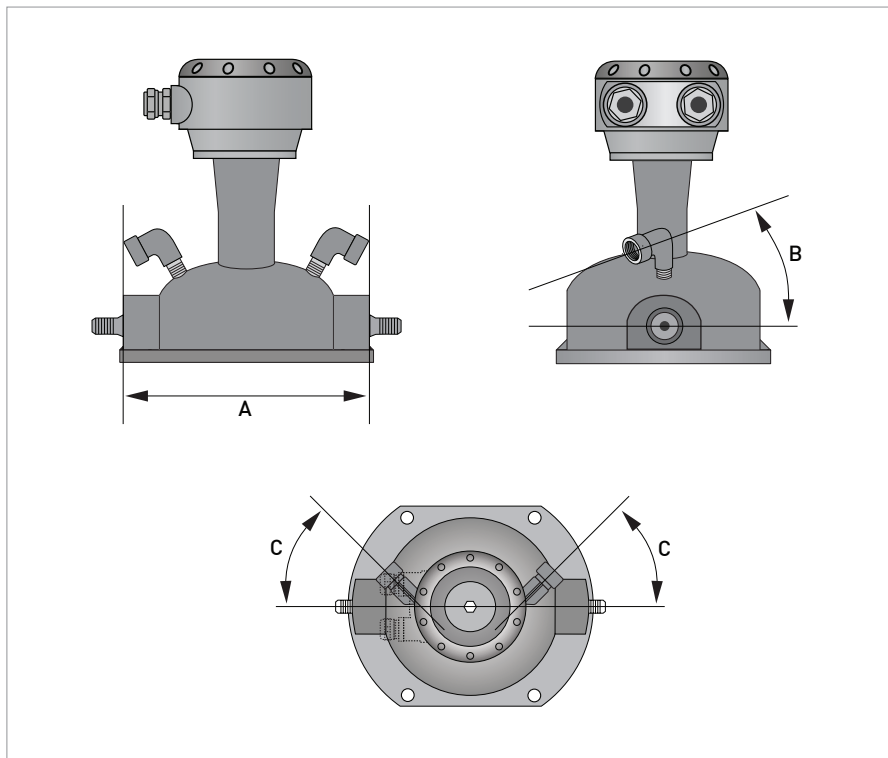
② Type C, D, E & F

### 6.6.4 Hygienic connections

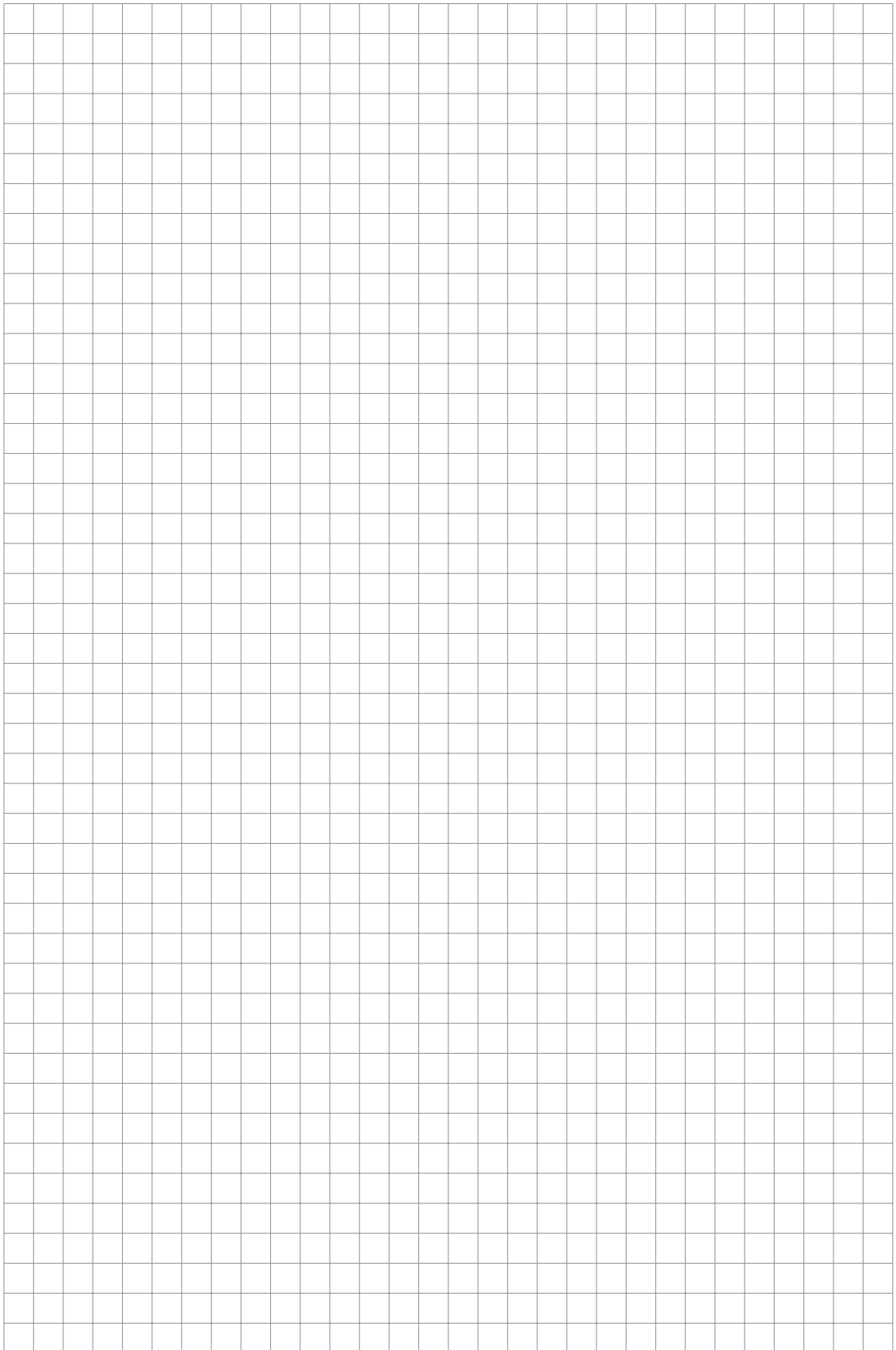


Connection type	Dimension K	
	[mm]	[inches]
DN10 DIN32676	260±3	10.2 ±0.1
½" Tri-Clover	262±3	10.3 ±0.1

6.6.5 Heating jacket version



Meter size	01	03	04
A [mm] / [inches]	129 ±5.0 / 5.01 ±0.2		
B	45° (approximately)		
C	45° ±6°		





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