



## OPTIMASS 2400 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 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. 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 (PED)
- RoHS
- Measuring Instrument Directive
- Radio Equipment Directive (RED)

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

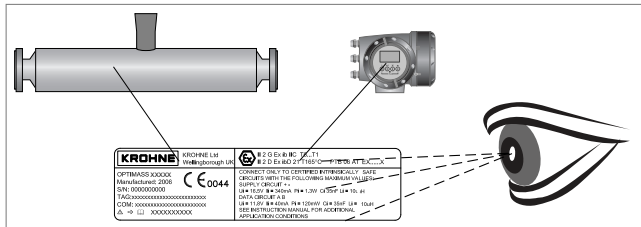
## 1.4 Pressure Equipment Directive (PED)



### 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 NOT supplied as standard.
- The non PED / CRN approved outer cylinder has a typical burst pressure greater than 100 barg / 1450 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 and feedthrough will be in contact with the process product.
- You **MUST** make sure that the O-ring and feedthrough material is suitable for the application.
- Alternative O-ring materials are available on request.
- If there is a risk that the meter will be operating with process conditions that are outside the limits shown on the nameplate, the manufacturer recommends that a suitable safety device is installed.
- The manufacturer has not tested the risk to the meter in the event of exposure to fire. If there is a risk of fire, it is recommended that a protective device is also installed.

### Secondary pressure containment

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 cycling, seismic or other shock loading, or other environmental conditions (for example: wind; traffic and / or transport) secondary containment option **MUST** be purchased. Where the process pressure is higher than the secondary containment, the burst disc option **MUST** also be purchased.



### 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.

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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 cannot 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

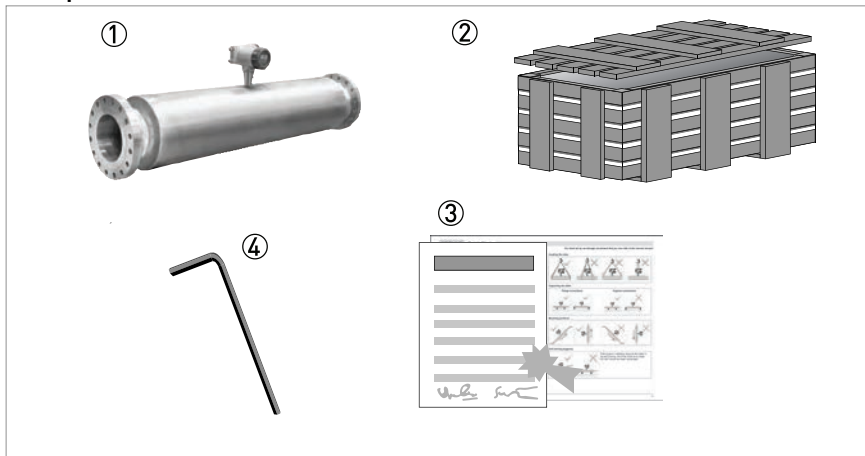


**WARNING!**

*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.*

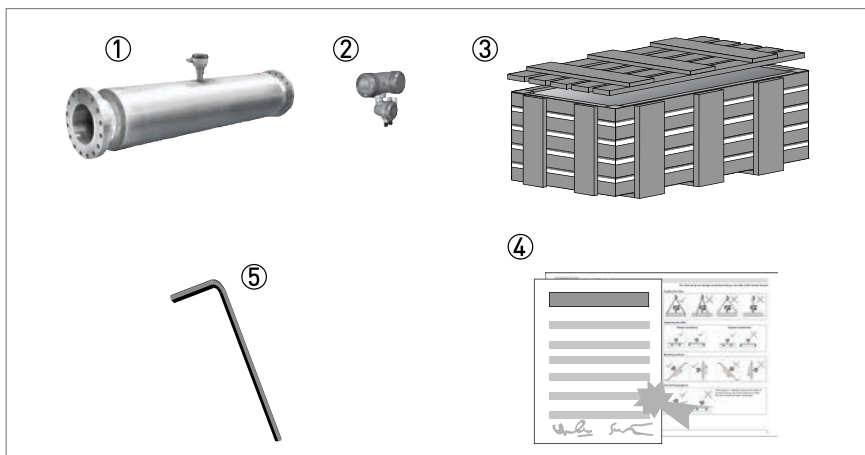
## 2.1 Scope of delivery

### Compact version



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

### Remote version



- ① Mass flowmeter.
- ② Converter. This will be either: field (as shown) or wall.
- ③ Crate.
- ④ Documentation.
- ⑤ 2.5 mm hex head tool.

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 -12.27.01-2011 "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 2400C S250 - LIQUID)

### Pressure and temperature data:

OPTIMASS 2400C -45°C...+130°C and 100...14000 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.

### 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 2400C S250 - GAS)

### Pressure / temperature data:

OPTIMASS 2400 -45°C...+130°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 100°C / 212°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.

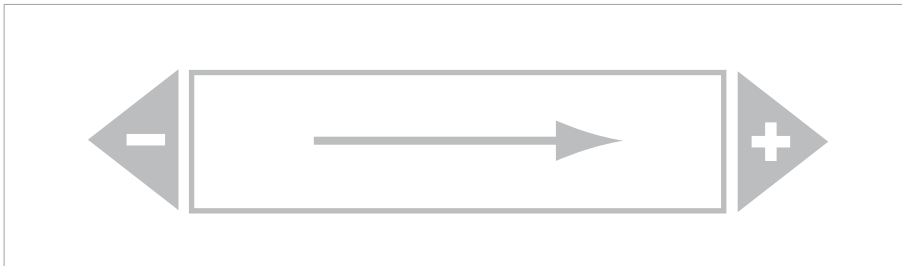
| Meter | Maximum temperature shift  |
|-------|--|
| S100  | +90°C / +194°F (+110°C / +230°F with a maximum operating pressure of 40 barg / 580 psig) |
| S150  | +80°C / +176°F   |
| S250  | +50°C / +122°F   |
| S400  | +50°C / +122°F   |



#### **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.*

## 2.5 Flow direction



The flow direction label on the sensor shows the default flow direction of the meter (left to right) as indicated by the arrow. If the flow direction is reversed (right to left) the converter or PLC display will show a negative value. The flow direction can be changed in the converter. For more information, see the relevant section of the converter handbook.

### 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!**

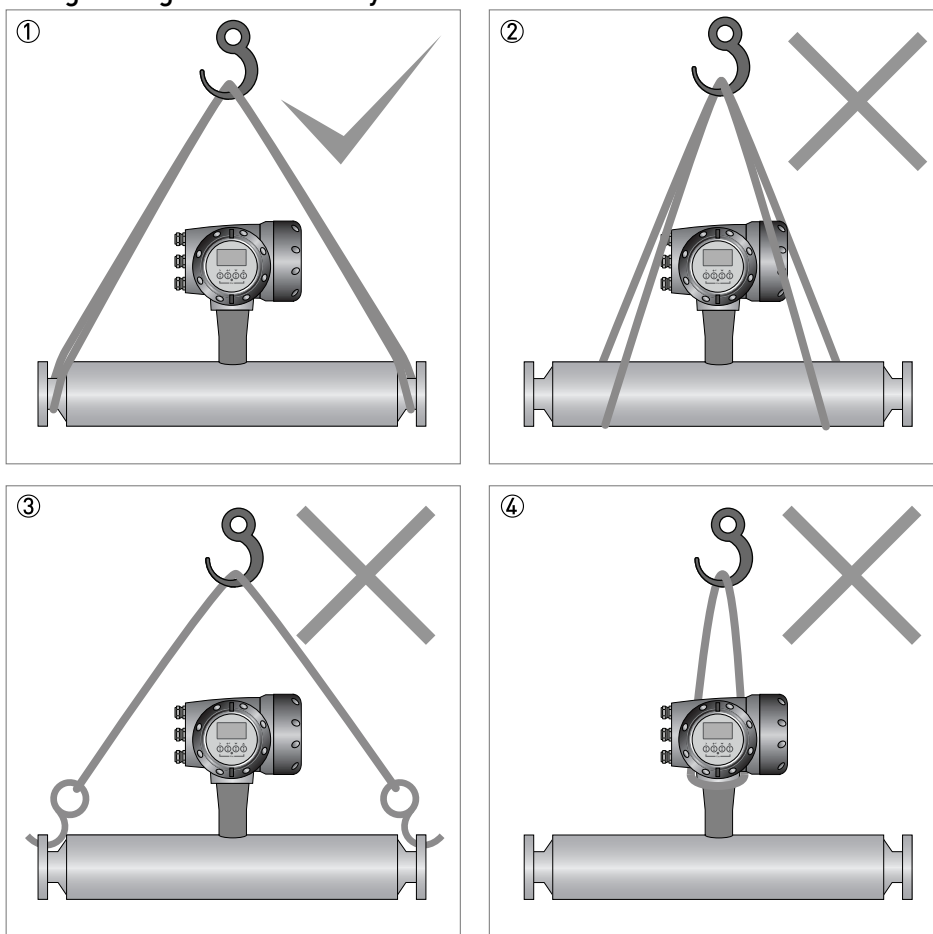
*Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.*

### 3.2 Storage

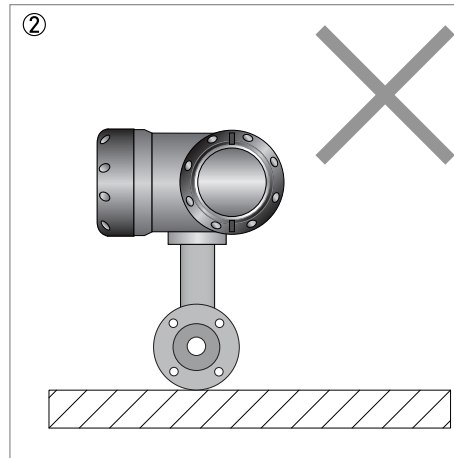
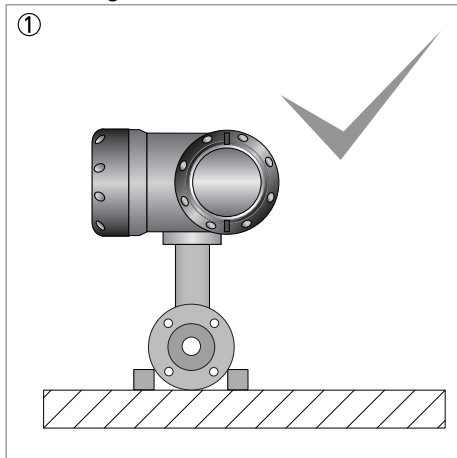
- Store the device in a dry and dust-free location.
- Avoid direct exposure to the sun.
- Store the device in its original packing.
- Do not allow the ambient temperature to fall below -50°C / -58°F or rise above +85°C / +185°F. (-40°C / -40°F and +70°C / +158°F. where a SIL capable Converter has been supplied)

## 3.3 Handling

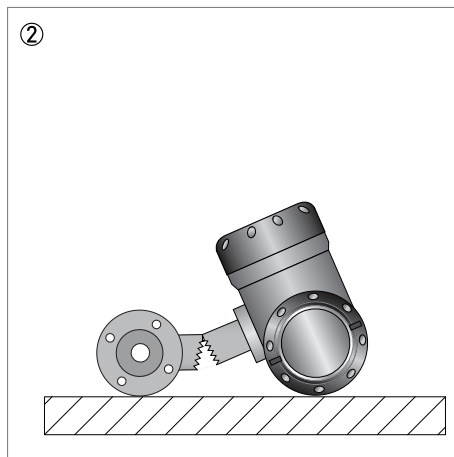
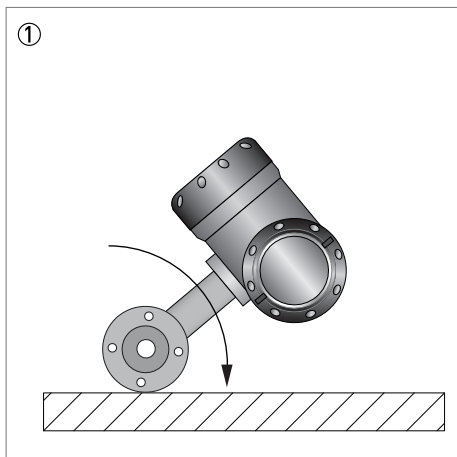
Using a sling to lift and carry the meter



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

**Standing the meter before installation**

- ① When standing the meter prior to installation, use blocks or similar to keep the meter upright.  
② NEVER stand the meter upright without blocks (or similar) .

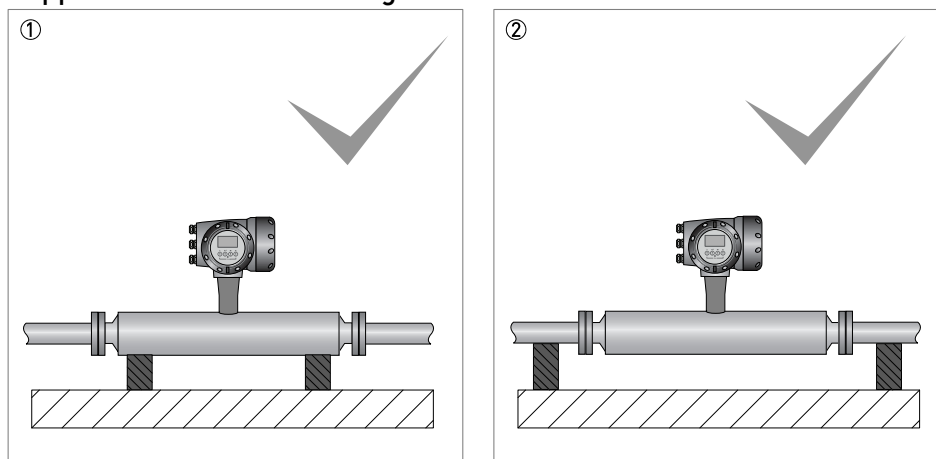


- ① If the meter is not blocked it can roll over  
② This can cause severe damage to the meter, or injury to personnel

## 3.4 Installation conditions

### 3.4.1 Supporting the meter

#### Support for meters with flange connections

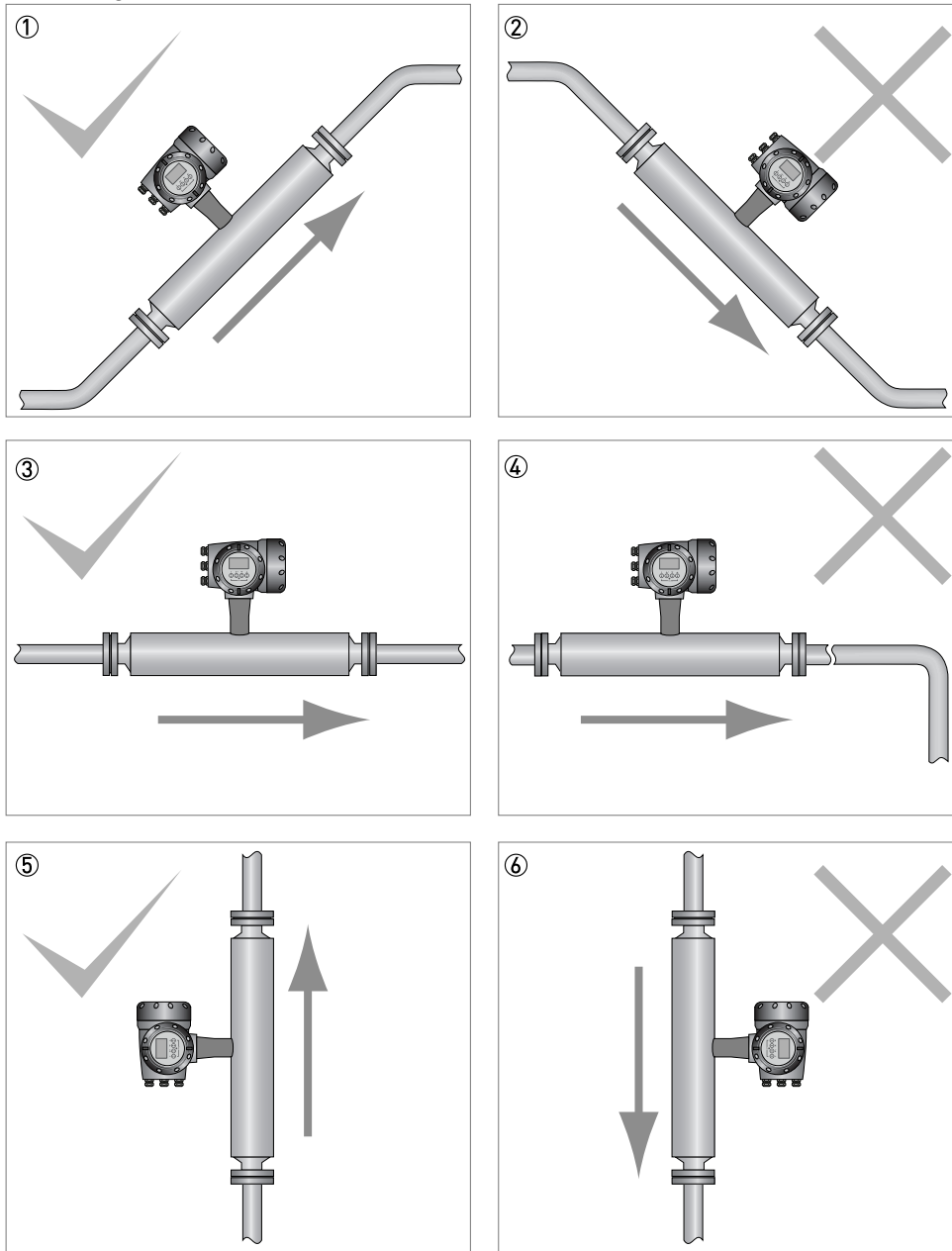


- ① The meter can be supported directly by its body
- ② The meter can also be supported by the process pipework



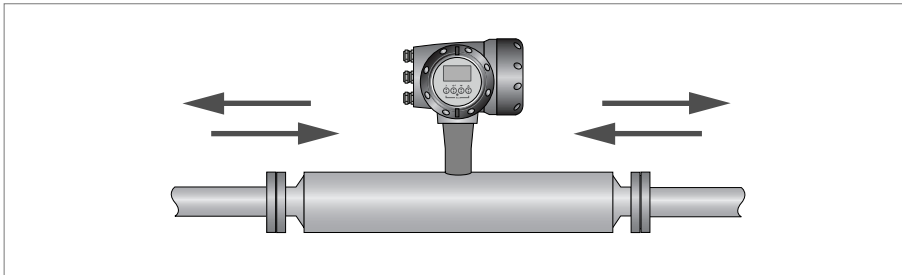
### 3.4.2 Mounting the meter

#### Mounting positions



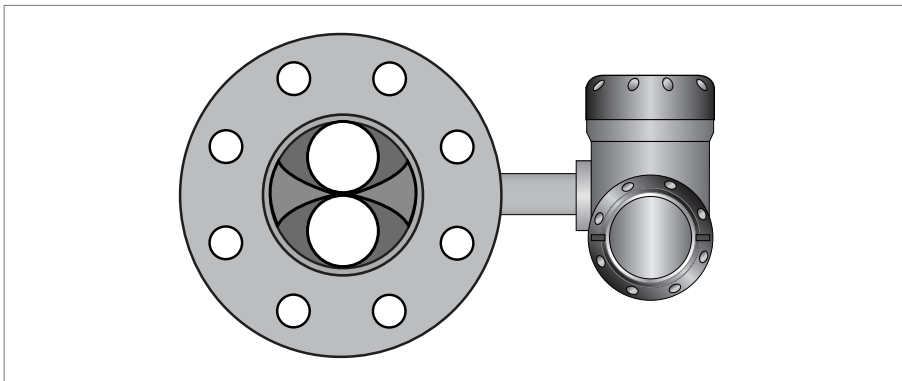
- ① The meter can be mounted at an angle but it is recommended that the flow is uphill.
- ② Avoid mounting the meter with the flow running downhill because it can cause siphoning. If the meter has to be mounted with the flow running downhill, install an orifice plate or control valve downstream of the 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 Maximum pipework forces



Avoid external forces that apply pressure (negative, positive or rotational) to the ends of the meter. If it is not possible to avoid such forces you **MUST** contact the manufacturer.

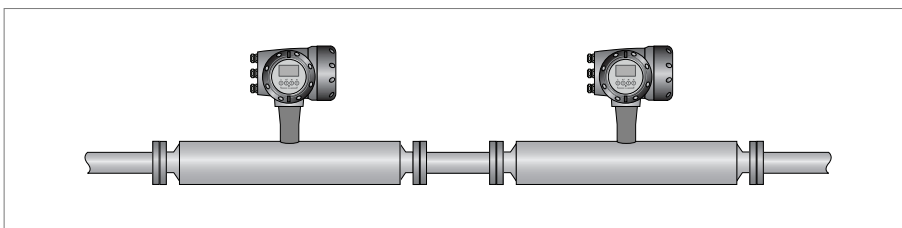
### 3.4.4 Side mounting



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.

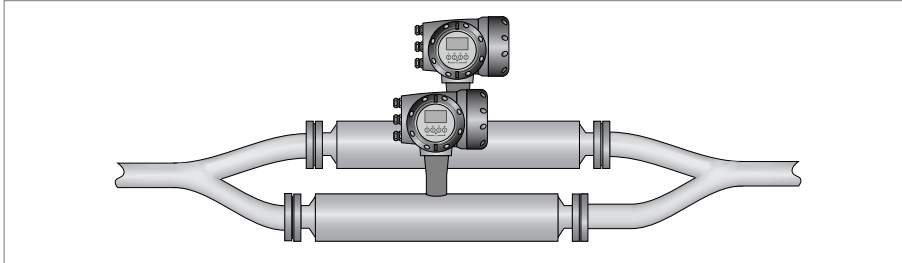
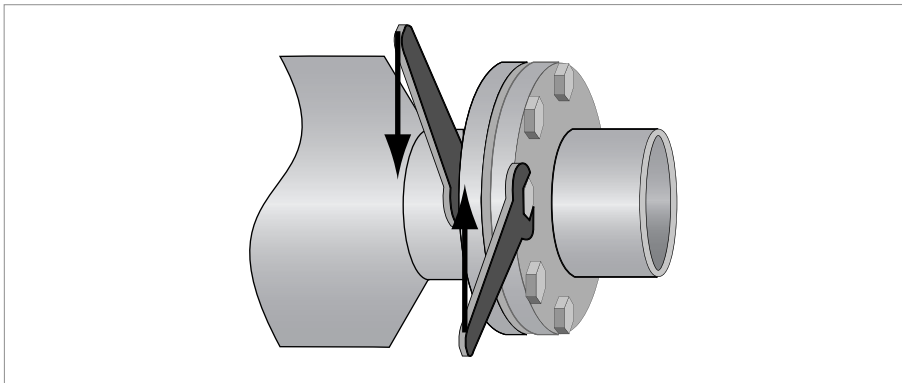
### 3.4.5 Cross talk

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.

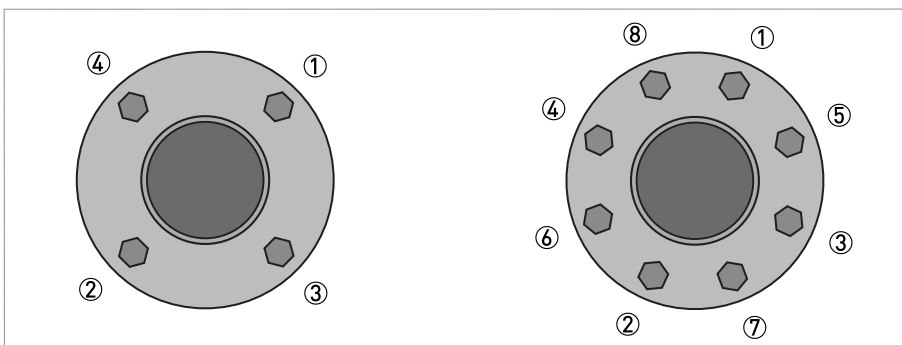


**INFORMATION!**

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**

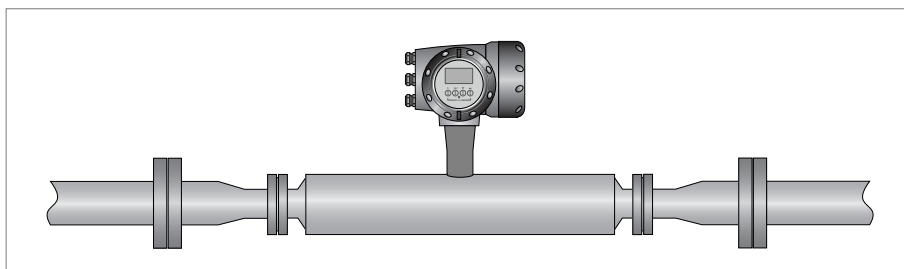
Tighten the flange bolts evenly and in turn.



Use a regular pattern to tighten the bolts evenly

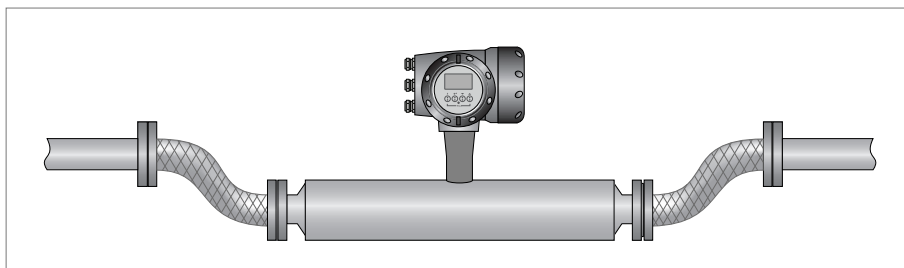
DO NOT use the meter to align the process pipework. Using the meter to align or straighten the pipework can cause stress on the meter that could affect performance.

### 3.4.7 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.

### 3.4.8 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.

### 3.4.9 Heating and insulation

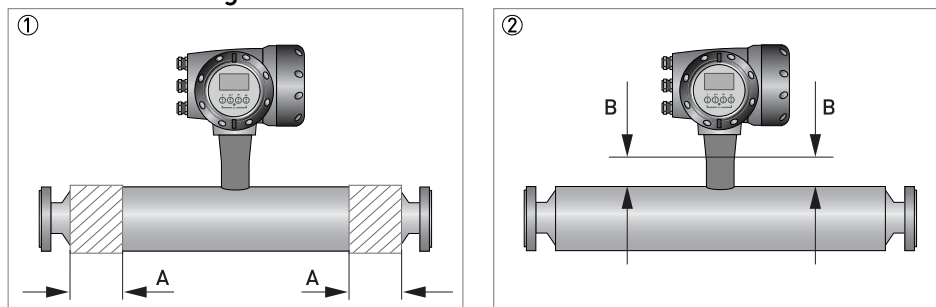
#### Heating

The meter can be heated by electrical tape (or similar) as shown. ONLY heat the meter in the area marked A.

#### Insulation

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

#### Electrical heating and insulation



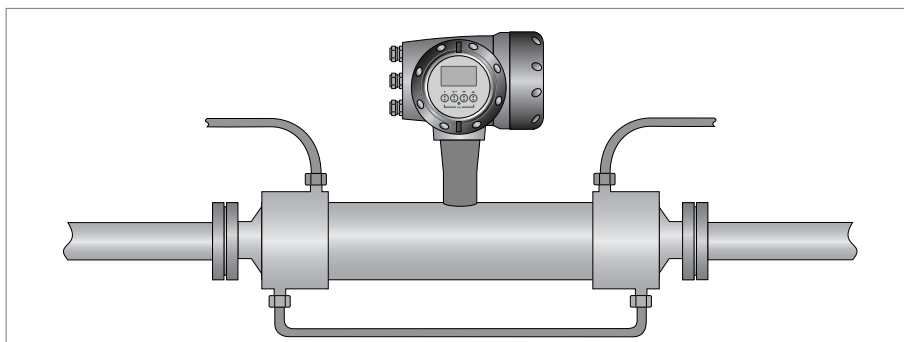
- ① Area that can be heated (A). Refer to the table for the maximum sizes.
- ② Maximum depth of insulation (B). Refer to the table.

#### Heated area

|                |        | S100 | S150 | S250 | S400 |
|----------------|--------|------|------|------|------|
| Dimension of A | mm     | 200  | 250  | 250  | 290  |
|                | Inches | 7.9  | 9.8  | 9.8  | 11.4 |
| Dimension of B | mm     | 50   |      |      |      |
|                | Inches | 2.0  |      |      |      |

#### Factory fitted heating jacket

If the meter has been ordered with a heating jacket, it will be supplied with NPT, Ermeto or flange connections.



### Connecting / using the heating jacket

- Use reinforced flexible hoses to connect the heating jacket to the heat source.
- The heating jacket material is 316L but the heating medium is also in contact with the outer cylinder, which might be a lower grade stainless steel.
- 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.
- Heat the jacket to working temperature before flowing the process fluid through the meter.



#### CAUTION!

*The maximum heating pressure and temperature for heating jackets is 10 barg at 130°C / 145 psig at 266°F*

### Heating times

| Temperature [°C / °F] ① | Time [minutes] |      |      |      |
|-------------------------|----------------|------|------|------|
|                         | S100           | S150 | S250 | S400 |
| 40 / 104                | 7              | 7    | 10   | 12   |
| 60 / 140                | 10             | 10   | 17   | 20   |
| 80 / 176                | 15             | 15   | 30   | 35   |
| 100 / 212               | 20             | 20   | 60   | 65   |
| 110 / 230               | 30             | 50   | 90   | 100  |
| 120 / 248               | 75             | 200  | 270  | 280  |

① Measured at the spigot end of the measuring tube.

### Reference conditions

|                            |                 |
|----------------------------|-----------------|
| Ambient temperature        | +25°C / +77°F   |
| Heating medium             | Hot liquid      |
| Heating medium temperature | +130°C / +266°F |

#### 3.4.10 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.*

### 3.4.11 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 20 barg at +20°C / 290 psig at +68°F.

#### Automatic fitment

If the connection rating of the meter is greater than 100 barg / 1450 psig but the 150 barg / 2175 psig secondary containment option has not been purchased, the meter will be supplied with a burst disc fitted as a safety feature.



#### CAUTION!

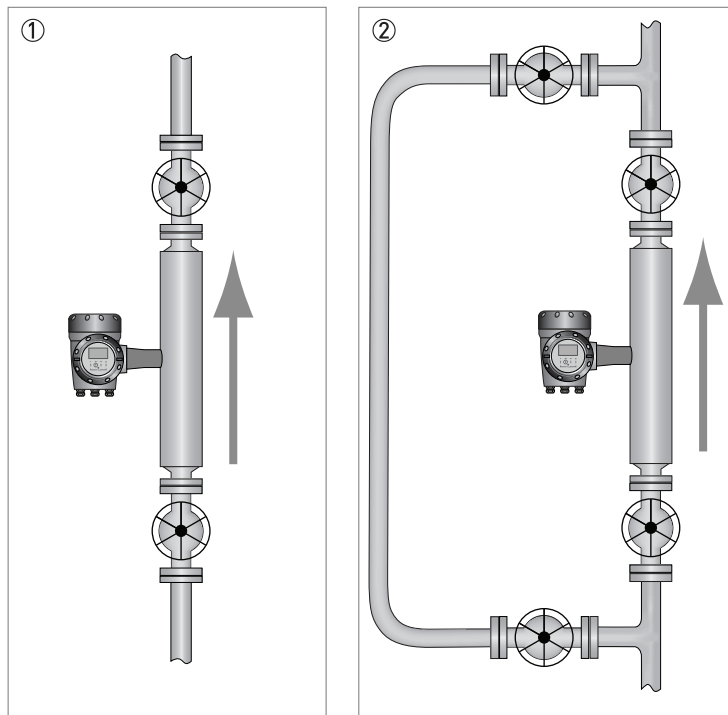
*The fitted burst disc will be suitable for the flow rates and process conditions specified on the original order. If the process conditions alter in any way, it is recommended that you contact the manufacturer for advice regarding suitability.*

*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.*

### 3.4.12 Zero calibration

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

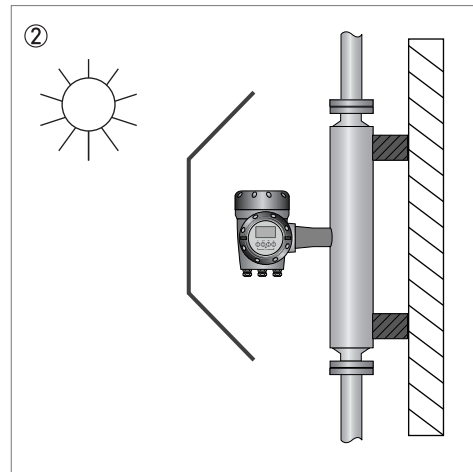
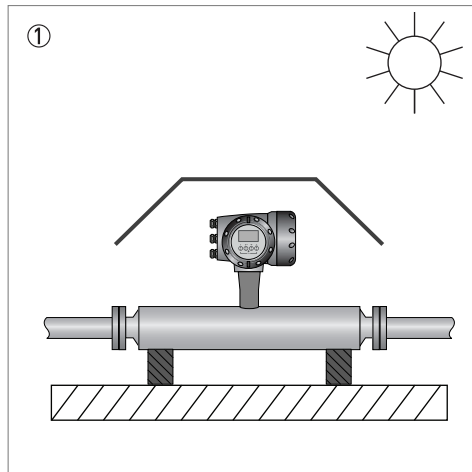
#### Zero calibration



- 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.

### 3.4.13 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.



### **WARNING!**

*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.*



### **WARNING!**

*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:   |  |
| Telephone number:  |                          | Email address:  |  |
| Fax number:  |                          |   |  |
| Manufacturer order number or serial number:  |                          |   |  |
| 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 caused by any residual media contained in this device when it is returned. |                          |   |  |
| Date:  |                          | Signature:  |  |
| Stamp:   |                          |   |  |

### 5.4 Disposal



**LEGAL NOTICE!**

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

**Separate collection of WEEE (Waste Electrical and Electronic Equipment):**

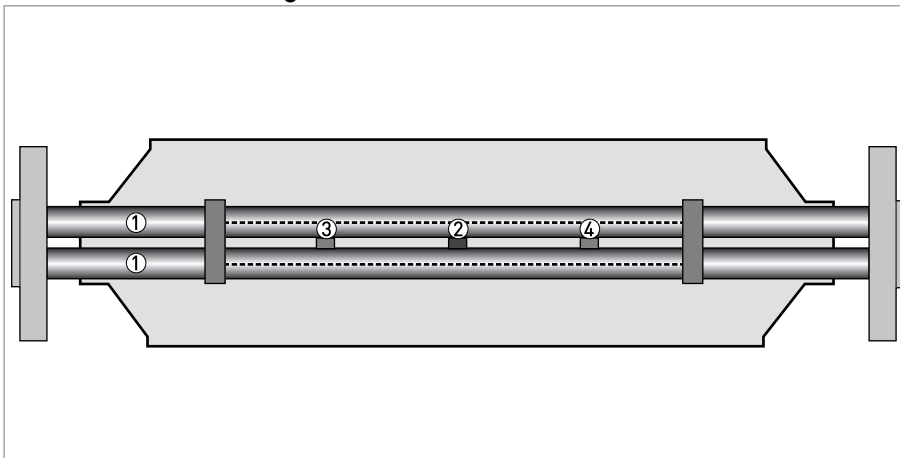


According to the directive 2012/19/EU or UK Regulation 2013 No. 3113, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste.**

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 (multiple tube)

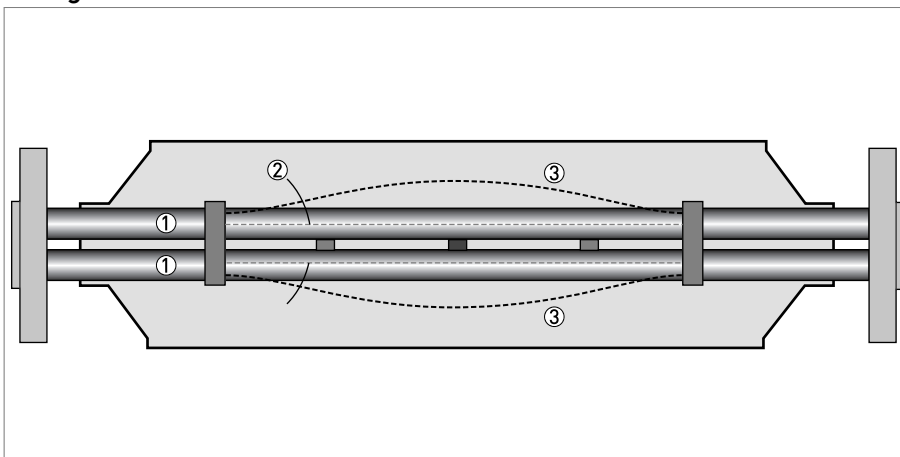
Static meter not energised and with no flow



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

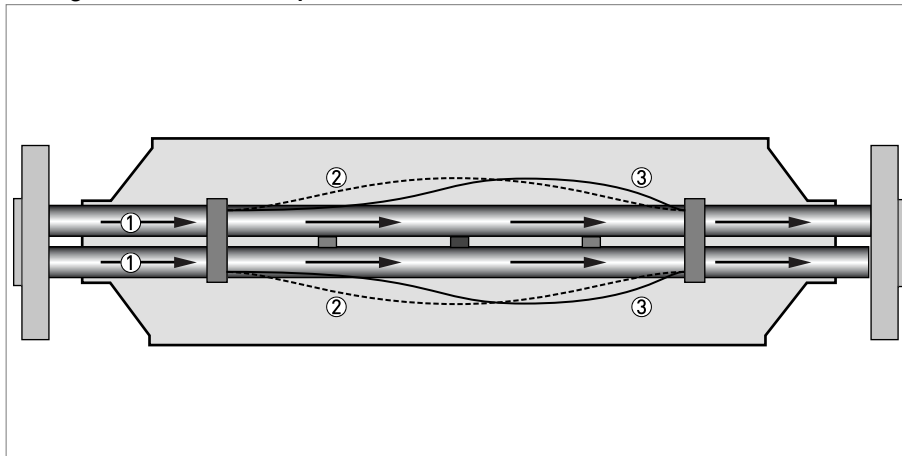
A Coriolis multiple tube mass flowmeter consists of either two or four measuring tubes ① one or two drive coils ② and two or four sensors ( ③ and ④ ). The sensors are positioned either side of the drive coil / s.

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 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 and solids |
| 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 multiple straight measuring tubes        |
| <b>Variants</b> |  |
| Compact version | Integral converter   |
| Remote version  | Available with field mount versions of the converter                               |

### Performance specification

|  |  |
|--|--|
| <b>Reference conditions</b>                              |  |
| Calibration fluid  | Water  |
| Calibration temperature                                  | +20°C / +68°F (± 5°C)  |
| Calibration pressure                                     | 1...6 barg / 14.5...87 psig  |
| Calibration rig  | Accreditation satisfies the requirements of BS EN ISO / IEC 17025  |
| <b>Mass flow (standard)</b>                              |  |
| Liquid   |  |
| Maximum permissible error ( ≥ 20:1 of nominal flow rate) | ±0.1% of actual measured flow rate   |
| Maximum permissible error (< 20:1 of nominal flow rate)  | ± zero stability (see zero stability below)  |
| Repeatability  |  |
| ≥ 20:1 of nominal flow rate                              | Better than ±0.05% of actual measured flow rate  |
| < 20:1 of nominal flow rate                              | Better than ±zero stability x 0.5 of actual measured flow rate   |
| Gas  |  |
| Maximum permissible error                                | ±0.35% of actual measured flow rate + zero stability   |
| Repeatability  | Better than 0.2% of actual measured flow rate plus zero stability (includes the combined effects of repeatability, linearity and hysteresis) |

|  |  |
|--|--|
| <b>Mass flow (optional)</b>  |  |
| Liquid   |  |
| Maximum permissible error ( $\geq 10:1$ of nominal flow rate)  | $\pm 0.05\%$ of actual measured flow rate  |
| Maximum permissible error ( $< 10:1$ of nominal flow rate)   | $\pm$ zero stability (see zero stability below)  |
| Repeatability  |  |
| $\geq 10:1$ of nominal flow rate   | Better than $\pm 0.025\%$ of actual measured flow rate   |
| $< 10:1$ of nominal flow rate  | Better than $\pm$ zero stability x 0.5 of actual measured flow rate  |
| <b>Zero stability</b>  |  |
| S100   | $< 11$ kg/h  |
| S150   | $< 25$ kg/h  |
| S250   | $< 60$ kg/h  |
| S400   | $< 120$ kg/h   |
| <b>Maximum permissible error on sensor zero point caused by deviation in process temperature from zero calibration temperature</b> |  |
| Stainless Steel  | $\pm 0.0008\%$ of nominal flow rate per $1^\circ\text{C}$ / $0.00044\%$ of nominal flow rate per $1^\circ\text{F}$ |
| <b>Maximum permissible error on sensor zero point caused by deviation in process pressure from zero calibration pressure</b>       |  |
| Stainless Steel  | $\pm 0.0002\%$ of the nominal flow rate per 1 barg / $0.000014\%$ of the nominal flow rate per 1 psig              |
| <b>Pressure effect on mass flow rate</b>   |  |
| Size 100   | $+0.006\%$ of reading per barg / $+0.00041\%$ of reading per psig  |
| Size 150   | $+0.0042\%$ of reading per barg / $+0.00029\%$ of reading per psig   |
| Sizes 250...400  | $+0.0037\%$ of reading per barg / $+0.00026\%$ of reading per psig   |
| <b>Density</b>   |  |
| Measuring range  | 400...3000 kg/m <sup>3</sup> / 25...187 lb/ft <sup>3</sup>   |
| Maximum permissible error  | $\pm 1.0$ kg/m <sup>3</sup> / $\pm 0.06$ lb/ft <sup>3</sup>  |
| Repeatability / on site calibration  | Better than $\pm 0.2$ kg/m <sup>3</sup> / $\pm 0.012$ lb/ft <sup>3</sup>   |
| <b>Volume flow</b>   |  |
| Measurement error and repeatability calculations satisfy the requirements of BS ISO 10790 (most recent and up to date version)     |  |
| <b>Temperature</b>   |  |
| Maximum permissible error  | $\pm 1^\circ\text{C}$ / $\pm 1.8^\circ\text{F}$ of reading   |

## Operating conditions

|                           |                              |
|---------------------------|------------------------------|
| <b>Nominal flow rates</b> |                              |
| S100                      | 220000 kg/h / 8084 lb/min    |
| S150                      | 500000 kg/h / 18372 lb/min   |
| S250                      | 1200000 kg/h / 44092 lb/min  |
| S400                      | 2400000 kg/h / 88185 lb/min  |
| <b>Maximum flow rates</b> |                              |
| S100                      | 420000 kg/h / 15432 lb/min   |
| S150                      | 900000 kg/h / 33069 lb/min   |
| S250                      | 2300000 kg/h / 84510 lb/min  |
| S400                      | 4600000 kg/h / 169021 lb/min |

|   |   |
|---|---|
| <b>Ambient temperature</b>                      |   |
| Compact version with Aluminium converter        | -40...+60°C / -40...+140°F<br>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>                      |   |
| Flanged connection                              | -45...+130°C / -49...+266°F   |
| <b>Nominal pressure at 20°C / 68°F</b>          |   |
| <b>Measuring tube (Duplex UNS S31803)</b>       |   |
| PED   | -1...150 barg / -14.5...2175 psig   |
| cFMus (S100...250)                              | -1...140 barg / -14.5...2030 psig   |
| cFMus (S400)                                    | -1...110 barg / -14.5...1595 psig   |
| CRN / ASME B31.3                                | -1...100 barg / -14.5...1450 psig   |
| <b>Measuring tube (Super Duplex UNS S32760)</b> |   |
| PED   | -1...180 barg / -14.5...2610 psig   |
| cFMus   | -1...152 barg / -14.5...2205 psig   |
| CRN / ASME B31.3                                | -1...120 barg / -14.5...1740 psig   |
| <b>Outer cylinder</b>                           |   |
| Non PED / CRN approved                          | Typical burst pressure > 100 barg / 1450 psig   |
| PED approved secondary containment              | -1...40 barg / -14.5...580 psig (S100...250 only)   |
|   | -1...150 barg / -14.5...2175 psig (Duplex option)   |
| <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                             |   |
| EN 60529  | IP66 / 67   |
| NEMA 250  | NEMA 4X   |
| <b>Installation conditions</b>                  |   |
| Inlet runs                                      | None required   |
| Outlet runs                                     | None required   |

## Materials

|                             |   |
|-----------------------------|---|
| Measuring tube              | Stainless Steel UNS S31803 (1.4462)                                       |
|                             | Optional UNS S32760 (1.4501)  |
| Spigot                      | Stainless Steel UNS J92205 (1.4470)                                       |
|                             | Optional UNS J93404 (1.4469)  |
|                             | Optional UNS S32760 (1.4501) (NACE approved)                              |
| Flanges                     | Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified          |
|                             | Optional Stainless Steel UNS S31803 (1.4462) (NACE approved)              |
|                             | Optional UNS S32760 (1.4501) (NACE approved)                              |
| Outer cylinder (S100...250) | Stainless Steel AISI 304 / 304L (1.4301 / 1.4307) dual certified          |
|                             | Optional Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified |
|                             | Optional Stainless Steel UNS S31803 (1.4462) ①                            |



|                               |   |
|-------------------------------|---|
| Outer cylinder (S400)         | Standard 9mm wall: Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified |
|                               | Optional 15mm wall: Stainless Steel UNS S31803 (1.4462) (NACE approved)             |
| <b>Heating jacket version</b> |   |
| Heating jacket                | Stainless Steel 316L (1.4404)   |
|                               | Note: the outer cylinder is in contact with the heating medium                      |
| <b>Remote versions</b>        |   |
| Junction box                  | Die cast Aluminium (polyurethane coating)   |

### Process connections

|               |                           |
|---------------|---------------------------|
| <b>Flange</b> |                           |
| DIN           | DN100...400 / PN16...160  |
| ASME          | 4...16" / ASME 150...1500 |
| JIS           | 100A / 10...20K           |

### 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 / UKCA                        | The device fulfils the statutory requirements of the relevant CE directives and UK designated standards. The manufacturer certifies that these requirements have been met by applying the CE and UKCA marks. |
| cFMus                            | 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  |
|                                  | Class III, Div 2 hazardous areas   |
| ANSI / CSA (Dual Seal)           | 12.27.01-2011  |
| Custody Transfer                 | Measuring Instruments Directive (MID) MI 002 and MI 005 (most recent and up to date version)   |
|                                  | OIML R117-1  |
|                                  | OIML R137 (pending)  |
|                                  | Compliant with API and AGA   |
| Ingress protection               | EN 60529 (most recent and up to date version)  |
|                                  | NEMA 250 (most recent and up to date version)  |
| <b>Hazardous area markings</b>   |  |
| <b>OPTIMASS 2400C</b>            |  |
| Gas, Ex e connection compartment |  |
| II 1/2 G                         | Ex db eb ia IIc T6 - T1 Ga/Gb  |
| Gas, Ex d connection compartment |  |
| II 1/2 G                         | Ex db ia IIc T6 - T1 Ga/Gb   |
| Dust                             |  |
| II 2D/1G                         | Ex tb ia IIIC T160°C Db/Ga   |

|                |                         |
|----------------|-------------------------|
| OPTIMASS 2000F |                         |
| Gas            |                         |
| II 1 G         | Ex ia IIC T6-T1 Ga      |
| Dust           |                         |
| II 2D/1G       | Ex ia IIIC T160°C Db/Ga |

① Where this option is ordered, the electronics stem material is UNS J92205 (1.4470)

### 6.3 Hazardous areas temperature limits

#### OPTIMASS 2000F

| Ambient temp. $T_{amb}$ °C  | Max. process temp. $T_m$ °C | Temp. class | Max. surface temp. °C |
|---|-----------------------------|-------------|-----------------------|
| -40...+65   | 65                          | T6 - T1     | T80                   |
|   | 80                          | T5 - T1     | T95                   |
|   | 115                         | T4 - T1     | T130                  |
|   | 130                         | T3 - T1     | T160                  |
| Minimum process temperature: $T_{amb} \geq -35^\circ\text{C}$ $T_m = -50^\circ\text{C}$ , $T_{amb} < -35^\circ\text{C}$ $T_m = -40^\circ\text{C}$ |                             |             |                       |

#### OPTIMASS 2400C with aluminium converter housing

| Ambient temp. $T_{amb}$ °C  | Max. process temp. $T_m$ °C | Temp. class | Max. surface temp. °C |
|---|-----------------------------|-------------|-----------------------|
| -40...+50   | 50                          | T6 - T1     | T80                   |
|   | 130                         | T3 - T1     | T160                  |
| -40...+55   | 100                         | T4 - T1     | T130                  |
|   | 120                         | T3 - T1     | T150                  |
| -40...+60   | 90                          | T4 - T1     | T120                  |
| -40...+65   | 65                          | T5 - T1     | T95                   |
| Minimum process temperature: $T_{amb} \geq -35^\circ\text{C}$ $T_m = -50^\circ\text{C}$ , $T_{amb} < -35^\circ\text{C}$ $T_m = -40^\circ\text{C}$ |                             |             |                       |

#### OPTIMASS 2400C with Stainless Steel converter housing

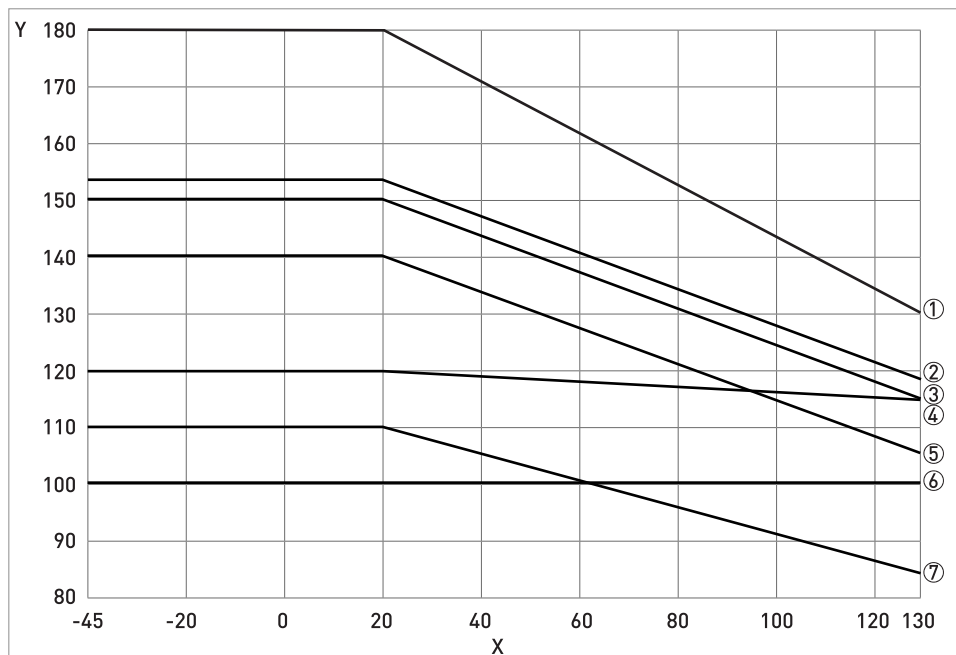
| Ambient temp. $T_{amb}$ °C  | Max. process temp. $T_m$ °C | Temp. class | Max. surface temp. °C |
|---|-----------------------------|-------------|-----------------------|
| -40...+40   | 130                         | T3 - T1     | T160                  |
| -40...+45   | 100                         | T4 - T1     | T130                  |
|   | 110                         | T3 - T1     | T140                  |
| -40...+50   | 50                          | T6 - T1     | T80                   |
|   | 90                          | T4 - T1     | T120                  |
| -40...+55   | 65                          | T5 - T1     | T95                   |
|   | 75                          | T4 - T1     | T105                  |
| -40...+60   | 60                          | T5 - T1     | T90                   |
| Minimum process temperature: $T_{amb} \geq -35^\circ\text{C}$ $T_m = -50^\circ\text{C}$ , $T_{amb} < -35^\circ\text{C}$ $T_m = -40^\circ\text{C}$ |                             |             |                       |

## 6.4 Guidelines for maximum operating pressure

### Notes:

- Ensure that the meter is used within its operating limits
- The maximum operating pressure will be either the flange rating or the measuring tube rating, **WHICHEVER IS THE LOWER!**

### Pressure / temperature de-rating, all meter sizes in metric (flanged connections as per EN 1092-1:2007)



X temperature [°C]

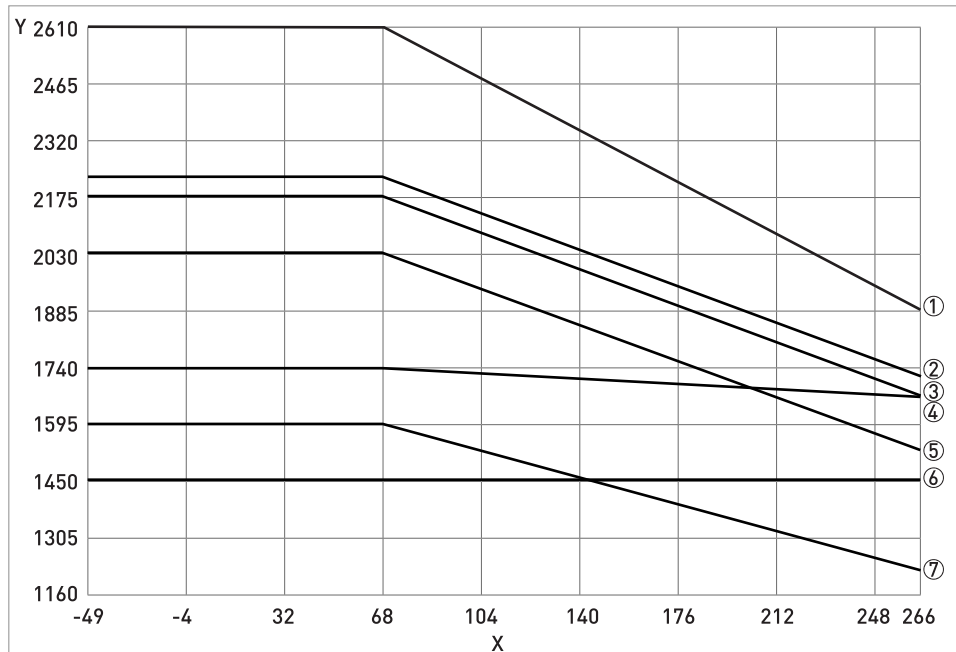
Y pressure [barg]

- ① Measuring tube (UNS S32760) PED certification
- ② Measuring tube (UNS S32760) FM certification
- ③ Measuring tube (UNS S31803) PED certification
- ④ Measuring tube (UNS S32760) CRN certification
- ⑤ Measuring tube (UNS S31803) FM certification (S100...250)
- ⑥ Measuring tube (UNS S31803) CRN certification
- ⑦ Measuring tube (UNS S31803) FM certification (S400)

### Linear de-rating of PED certified secondary containment

| Outer cylinder material         | -45°C    | 20°C     | 130°C    |
|---------------------------------|----------|----------|----------|
| 304 / L or 316 / L (S100...250) | 40 barg  | 40 barg  | 32 barg  |
| UNS S31803 (S100...400)         | 150 barg | 150 barg | 100 barg |

**Pressure / temperature de-rating, all meter sizes, in imperial (flanged connections as per ASME B16.5)**



X temperature [°F]  
Y pressure [psig]

- ① Measuring tube (UNS S32760) PED certification
- ② Measuring tube (UNS S32760) FM certification
- ③ Measuring tube (UNS S31803) PED certification
- ④ Measuring tube (UNS S32760) CRN certification
- ⑤ Measuring tube (UNS S31803) FM certification (S100...250)
- ⑥ Measuring tube (UNS S31803 ) CRN certification
- ⑦ Measuring tube (UNS S31803 ) FM certification (S400)

**Linear de-rating of PED certified secondary containment**

| Outer cylinder material         | -49°F     | 68°F      | 266°F     |
|---------------------------------|-----------|-----------|-----------|
| 304 / L or 316 / L (S100...250) | 580 psig  | 580 psig  | 464 psig  |
| UNS S31803 (S100...400)         | 2175 psig | 2175 psig | 1450 barg |

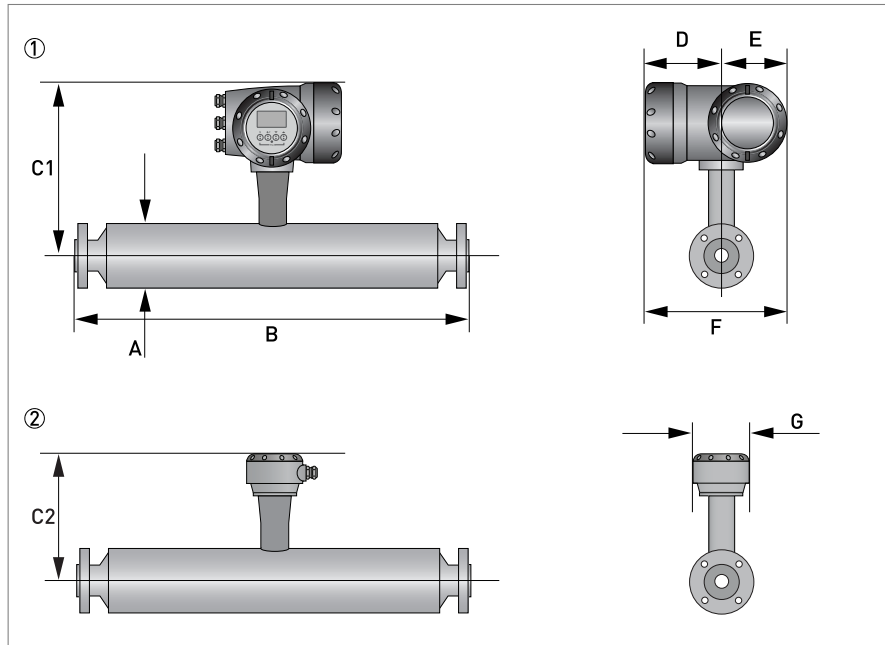
**Flanges**

- DIN flange ratings are based on EN 1092-1 2007 table G.4.1 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

## 6.5 Dimensions and weights

### 6.5.1 Flanged versions

#### Meter dimensions



- ① Compact version  
② Remote version

#### Meter weights (PN40 flanges).

|        | Weight | Compact   |                 | Remote    |                 |
|--------|--------|-----------|-----------------|-----------|-----------------|
|        |        | Aluminium | Stainless Steel | Aluminium | Stainless Steel |
| S100   | kg     | 84.8      | 90.1            | 80.8      | 81.7            |
|        | lb     | 187.0     | 198.0           | 178.0     | 180.0           |
| S150   | kg     | 211.5     | 216.8           | 207.5     | 208.4           |
|        | lb     | 466.0     | 478.0           | 457.0     | 459.0           |
| S250   | kg     | 444.5     | 449.8           | 440.5     | 441.4           |
|        | lb     | 980.0     | 991.0           | 971.0     | 973.0           |
| S400 ① | kg     | 940.0     | 945.3           | 936.0     | 936.9           |
|        | lb     | 2072.3    | 2083.4          | 2063.5    | 2065.5          |
| S400 ② | kg     | 1045.0    | 1050.3          | 1041.0    | 1041.9          |
|        | lb     | 2303.8    | 2315.5          | 2295.0    | 2297.0          |

- ① 9mm outer cylinder wall thickness  
② 15mm outer cylinder wall thickness

For meter weights with different flange ratings, please contact the manufacturer.

## Measuring tube in Stainless Steel

|              | Dimensions [mm] |        |        |        |
|--------------|-----------------|--------|--------|--------|
|              | S100            | S150   | S250   | S400   |
| A            | 219 ±5          | 324 ±5 | 406 ±5 | 508 ±5 |
| C1 (compact) | 370 ±5          | 422 ±5 | 463 ±5 | 515 ±5 |
| C2 (remote)  | 307 ±5          | 359 ±5 | 400 ±5 | 453 ±5 |
| D            | 137             |        |        |        |
| E            | 123.5           |        |        |        |
| F            | 260.5           |        |        |        |
| G            | 118             |        |        |        |

|              | Dimensions [inches] |           |           |           |
|--------------|---------------------|-----------|-----------|-----------|
|              | S100                | S150      | S250      | S400      |
| A            | 8.6 ±0.2            | 12.7 ±0.2 | 16 ±0.2   | 20 ±0.2   |
| C1 (compact) | 14.6 ±0.2           | 16.6 ±0.2 | 18.2 ±0.2 | 20.3 ±0.2 |
| C2 (remote)  | 12.1 ±0.2           | 14.1 ±0.2 | 15.7 ±0.2 | 17.8 ±0.2 |
| D            | 5.4                 |           |           |           |
| E            | 4.9                 |           |           |           |
| F            | 10.2                |           |           |           |
| G            | 4.6                 |           |           |           |

## Dimension B

|             | mm (±5) |      |      |      |
|-------------|---------|------|------|------|
|             | S100    | S150 | S250 | S400 |
| <b>PN16</b> |         |      |      |      |
| DN100       | 1284    | -    | -    | -    |
| DN150       | 1290    | 1584 | -    | -    |
| DN200       | -       | 1598 | -    | -    |
| DN250       | -       | -    | 1953 | -    |
| DN300       | -       | -    | 1969 | 2277 |
| DN350       | -       | -    | -    | 2285 |
| DN400       | -       | -    | -    | 2291 |
| <b>PN40</b> |         |      |      |      |
| DN100       | 1310    | -    | -    | -    |
| DN150       | 1330    | 1624 | -    | -    |
| DN200       | -       | 1650 | -    | -    |
| DN250       | -       | -    | 2023 | -    |
| DN300       | -       | -    | 2043 | 2351 |
| DN350       | -       | -    | -    | 2371 |
| DN400       | -       | -    | -    | 2391 |
| <b>PN63</b> |         |      |      |      |
| DN100       | 1336    | -    | -    | -    |

|                 | mm (±5) |      |      |      |
|-----------------|---------|------|------|------|
|                 | S100    | S150 | S250 | S400 |
| DN150           | 1370    | 1664 | -    | -    |
| DN200           | -       | 1694 | -    | -    |
| DN250           | -       | -    | 2063 | -    |
| DN300           | -       | -    | 2093 | 2401 |
| DN350           | -       | -    | -    | 2421 |
| DN400           | -       | -    | -    | 2441 |
| <b>PN100</b>    |         |      |      |      |
| DN100           | 1360    | -    | -    | -    |
| DN150           | 1410    | 1704 | -    | -    |
| DN200           | -       | 1734 | -    | -    |
| DN250           | -       | -    | 1970 | -    |
| DN300           | -       | -    | 2153 | 2471 |
| DN350           | -       | -    | -    | 2499 |
| DN400           | -       | -    | -    | -    |
| <b>PN160</b>    |         |      |      |      |
| DN100           | 1380    | -    | -    | -    |
| DN150           | 1436    | 1730 | -    | -    |
| DN200           | -       | 1754 | -    | -    |
| DN250           | -       | -    | 2123 | -    |
| DN300           | -       | -    | 2163 | 2471 |
| DN350           | -       | -    | -    | -    |
| DN400           | -       | -    | -    | -    |
| <b>ASME 150</b> |         |      |      |      |
| 4"              | 1334    | -    | -    | -    |
| 6"              | 1358    | 1652 | -    | -    |
| 8"              | -       | 1678 | 2018 | -    |
| 10"             | -       | -    | 2017 | -    |
| 12"             | -       | -    | 2043 | 2351 |
| 14"             | -       | -    | -    | 2375 |
| 16"             | -       | -    | -    | 2375 |
| <b>ASME 300</b> |         |      |      |      |
| 4"              | 1352    | -    | -    | -    |
| 6"              | 1378    | 1672 | -    | -    |
| 8"              | -       | 1698 | 2038 | -    |
| 10"             | -       | -    | 2049 | -    |
| 12"             | -       | -    | 2075 | 2383 |
| 14"             | -       | -    | -    | 2407 |
| 16"             | -       | -    | -    | 2413 |
| <b>ASME 600</b> |         |      |      |      |
| 4"              | 1398    | -    | -    | -    |
| 6"              | 1428    | 1722 | -    | -    |

|                  | mm (±5) |      |      |      |
|------------------|---------|------|------|------|
|                  | S100    | S150 | S250 | S400 |
| 8"               | -       | 1754 | 2094 | -    |
| 10"              | -       | -    | 2131 | -    |
| 12"              | -       | -    | 2139 | 2448 |
| 14"              | -       | -    | -    | 2465 |
| 16"              | -       | -    | -    | 2491 |
| <b>ASME 900</b>  |         |      |      |      |
| 4"               | 1422    | -    | -    | -    |
| 6"               | 1474    | 1768 | -    | -    |
| 8"               | -       | 1812 | -    | -    |
| 10"              | -       | -    | 2195 | -    |
| 12"              | -       | -    | 2227 | 2535 |
| 14"              | -       | -    | -    | 2561 |
| 16"              | -       | -    | -    | 2567 |
| <b>ASME 1500</b> |         |      |      |      |
| 4"               | 1442    | -    | -    | -    |
| 6"               | 1554    | -    | -    | -    |
| 8"               | -       | 1914 | -    | -    |
| 10"              | -       | -    | 2335 | -    |
| 12"              | -       | -    | 2393 | 2701 |
| 14"              | -       | -    | -    | 2731 |
| 16"              | -       | -    | -    | 2757 |
| <b>JIS 10K</b>   |         |      |      |      |
| 100A             | 1270    | -    | -    | -    |
| 350A             | -       | -    | -    | -    |
| <b>JIS 20K</b>   |         |      |      |      |
| 100A             | 1296    | -    | -    | -    |
| 350A             | -       | -    | -    | -    |

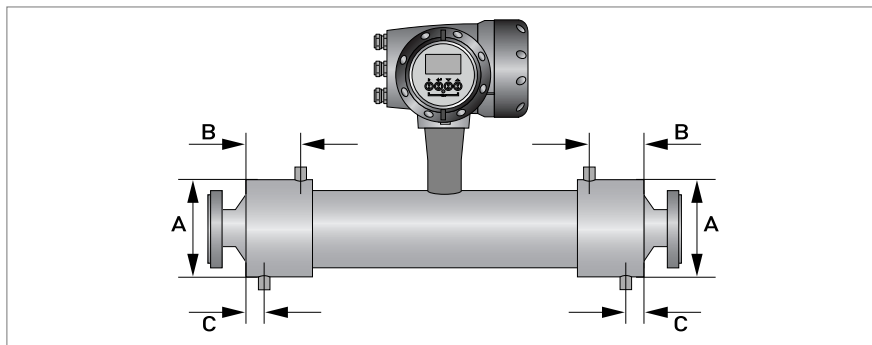
|             | Inches Dimension (±0.2) |      |      |      |
|-------------|-------------------------|------|------|------|
|             | S100                    | S150 | S250 | S400 |
| <b>PN16</b> |                         |      |      |      |
| DN100       | 50.5                    | -    | -    | -    |
| DN150       | 50.8                    | 62.4 | -    | -    |
| DN200       | -                       | 62.9 | -    | -    |
| DN250       | -                       | -    | 77.0 | -    |
| DN300       | -                       | -    | 77.5 | 89.6 |
| DN350       | -                       | -    | -    | 90.0 |
| DN400       | -                       | -    | -    | 90.2 |
| <b>PN40</b> |                         |      |      |      |
| DN100       | 51.5                    | -    | -    | -    |



|                 | Inches Dimension ( $\pm 0.2$ ) |      |      |      |
|-----------------|--------------------------------|------|------|------|
|                 | S100                           | S150 | S250 | S400 |
| DN150           | 52.4                           | 63.9 | -    | -    |
| DN200           | -                              | 65.0 | -    | -    |
| DN250           | -                              | -    | 79.6 | -    |
| DN300           | -                              | -    | 80.4 | 92.5 |
| DN350           | -                              | -    | -    | 93.3 |
| DN400           | -                              | -    | -    | 94.1 |
| <b>PN63</b>     |                                |      |      |      |
| DN100           | 52.6                           | -    | -    | -    |
| DN150           | 53.9                           | 65.5 | -    | -    |
| DN200           | -                              | 66.7 | -    | -    |
| DN250           | -                              | -    | 81.2 | -    |
| DN300           | -                              | -    | 82.4 | 94.5 |
| DN350           | -                              | -    | -    | 95.3 |
| DN400           | -                              | -    | -    | 96.1 |
| <b>PN100</b>    |                                |      |      |      |
| DN100           | 53.9                           | -    | -    | -    |
| DN150           | 55.5                           | 67.1 | -    | -    |
| DN200           | -                              | 68.3 | -    | -    |
| DN250           | -                              | -    | 77.6 | -    |
| DN300           | -                              | -    | 84.8 | 96.9 |
| DN350           | -                              | -    | -    | 98.4 |
| DN400           | -                              | -    | -    | -    |
| <b>PN160</b>    |                                |      |      |      |
| DN100           | 54.3                           | -    | -    | -    |
| DN150           | 56.5                           | 68.1 | -    | -    |
| DN200           | -                              | 69.0 | -    | -    |
| DN250           | -                              | -    | 83.6 | -    |
| DN300           | -                              | -    | 85.1 | 97.3 |
| DN350           | -                              | -    | -    | -    |
| DN400           | -                              | -    | -    | -    |
| <b>ASME 150</b> |                                |      |      |      |
| 4"              | 52.5                           | -    | -    | -    |
| 6"              | 53.4                           | 65.0 | -    | -    |
| 8"              | -                              | 66.1 | 79.7 | -    |
| 10"             | -                              | -    | 79.4 | -    |
| 12"             | -                              | -    | 80.4 | 92.6 |
| 14"             | -                              | -    | -    | 93.5 |
| 16"             | -                              | -    | -    | 93.5 |
| <b>ASME 300</b> |                                |      |      |      |
| 4"              | 53.2                           | -    | -    | -    |
| 6"              | 54.2                           | 65.8 | -    | -    |

|                  | Inches Dimension ( $\pm 0.2$ ) |      |      |       |
|------------------|--------------------------------|------|------|-------|
|                  | S100                           | S150 | S250 | S400  |
| 8"               | -                              | 66.8 | 80.2 | -     |
| 10"              | -                              | -    | 80.7 | -     |
| 12"              | -                              | -    | 81.7 | 93.8  |
| 14"              | -                              | -    | -    | 94.8  |
| 16"              | -                              | -    | -    | 95.0  |
| <b>ASME 600</b>  |                                |      |      |       |
| 4"               | 55.0                           | -    | -    | -     |
| 6"               | 56.2                           | 67.8 | -    | -     |
| 8"               | -                              | 69.0 | 82.4 | -     |
| 10"              | -                              | -    | 83.9 | -     |
| 12"              | -                              | -    | 84.2 | 96.4  |
| 14"              | -                              | -    | -    | 97.0  |
| 16"              | -                              | -    | -    | 98.1  |
| <b>ASME 900</b>  |                                |      |      |       |
| 4"               | 56.0                           | -    | -    | -     |
| 6"               | 58.0                           | 69.6 | -    | -     |
| 8"               | -                              | 71.3 | -    | -     |
| 10"              | -                              | -    | 86.4 | -     |
| 12"              | -                              | -    | 87.7 | 99.8  |
| 14"              | -                              | -    | -    | 100.8 |
| 16"              | -                              | -    | -    | 101.1 |
| <b>ASME 1500</b> |                                |      |      |       |
| 4"               | 56.8                           | -    | -    | -     |
| 6"               | 61.2                           | -    | -    | -     |
| 8"               | -                              | 75.3 | -    | -     |
| 10"              | -                              | -    | 91.9 | -     |
| 12"              | -                              | -    | 94.2 | 106.3 |
| 14"              | -                              | -    | -    | 107.5 |
| 16"              | -                              | -    | -    | 108.5 |
| <b>JIS 10K</b>   |                                |      |      |       |
| 100A             | 50.0                           | -    | -    | -     |
| 350A             | -                              | -    | -    | -     |
| <b>JIS 20K</b>   |                                |      |      |       |
| 100A             | 51.0                           | -    | -    | -     |
| 350A             | -                              | -    | -    | -     |

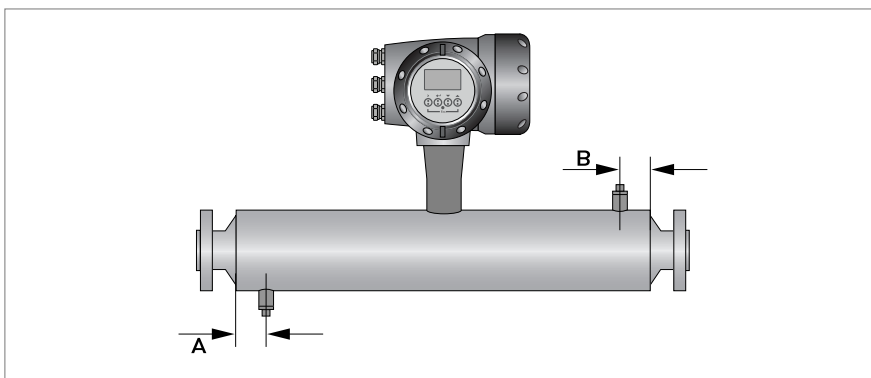
## 6.5.2 Heating jacket version



|                         | Dimensions [mm] |          |
|-------------------------|-----------------|----------|
|                         | S100            | S150     |
| Heating connection size | 25 mm (ERMETO)  |          |
| A                       | 254 ±2.5        | 355 ±2.5 |
| B                       | 178 ±2.0        | 228 ±2.0 |
| C                       | 28 ±2.0         | 28 ±2.0  |

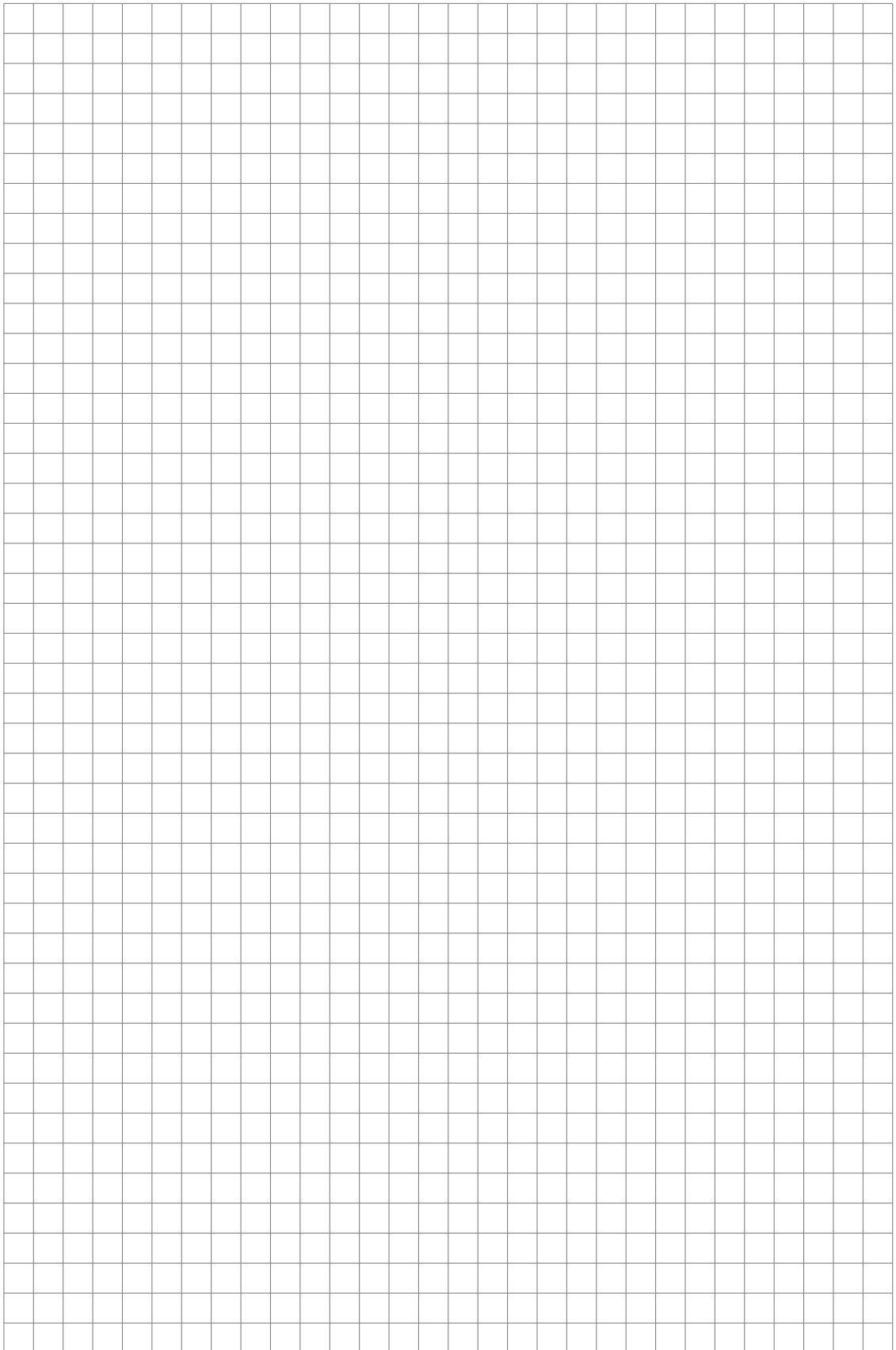
|                         | Dimensions [inches] |           |
|-------------------------|---------------------|-----------|
|                         | S100                | S150      |
| Heating connection size | 1" (NPTF)           |           |
| A                       | 10 ±0.1             | 14 ±0.1   |
| B                       | 7 ±0.08             | 9 ±0.08   |
| C                       | 1.1 ±0.08           | 1.1 ±0.08 |

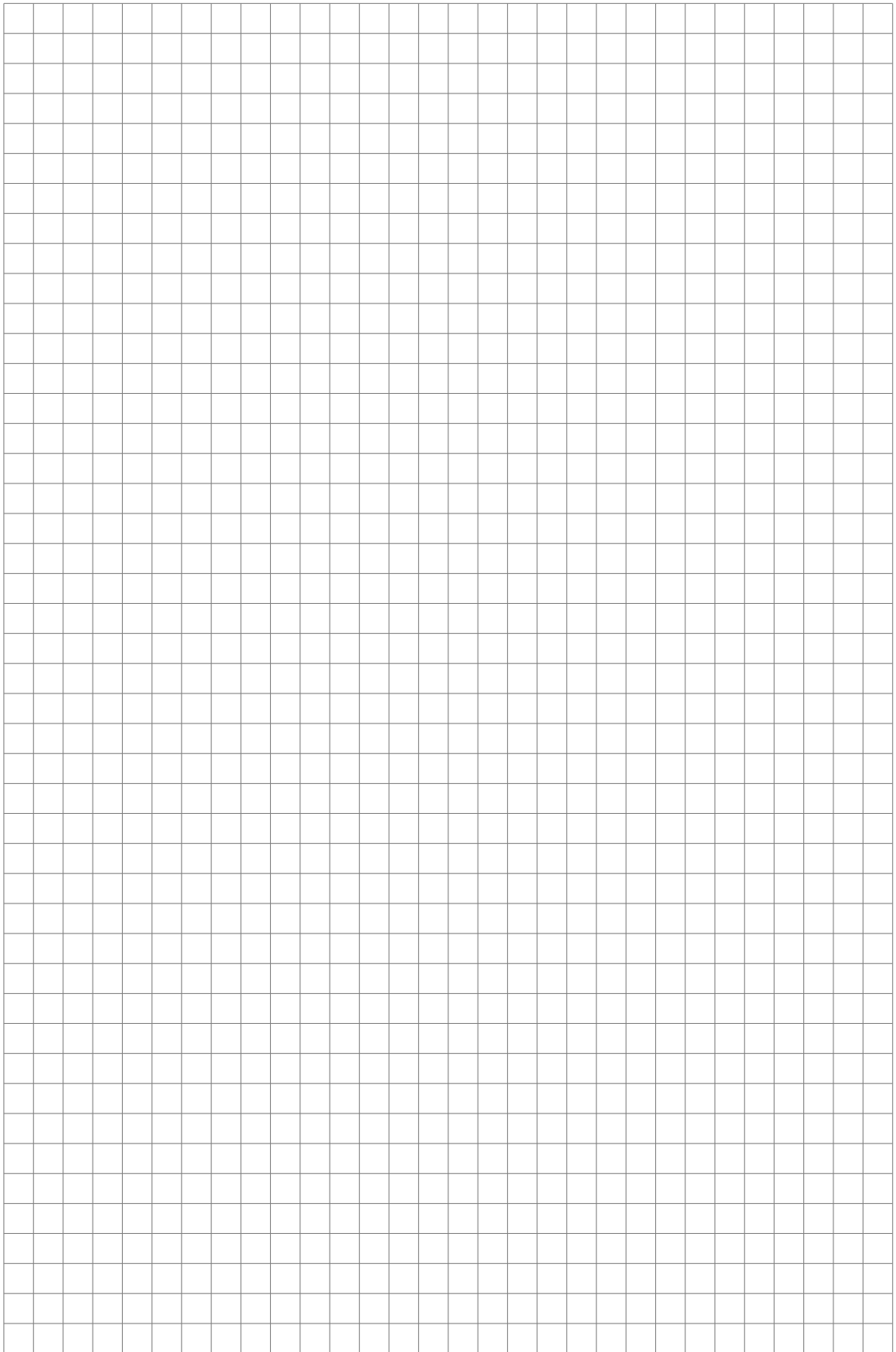
6.5.3 Purge port option

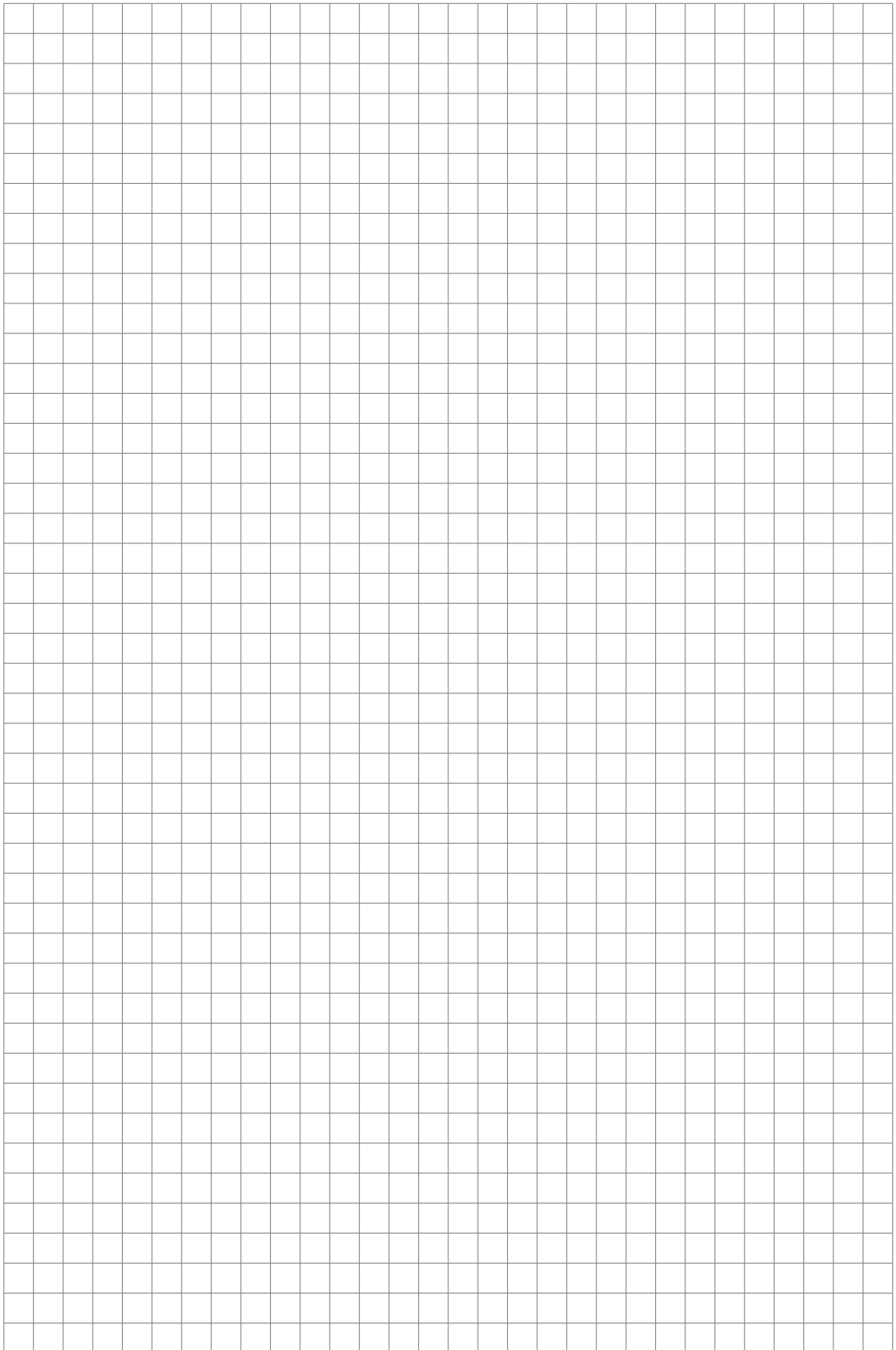


|   | Dimensions [mm] |          |      |      |
|---|-----------------|----------|------|------|
|   | S100            | S150     | S250 | S400 |
| A | 70 ±1.0         | 100 ±1.0 |      |      |
| B | 70 ±1.0         | 100 ±1.0 |      |      |

|   | Dimensions [inches] |           |      |      |
|---|---------------------|-----------|------|------|
|   | S100                | S150      | S250 | S400 |
| A | 2.75 ±0.04          | 4.0 ±0.04 |      |      |
| B | 2.75 ±0.04          | 4.0 ±0.04 |      |      |







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