OPTIMASS 8000K Handbook

Sensor for mass flow

Software revision:
V2.2.xx

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

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1.1 Software History

Release date	Software version	Documentation
Aug 2008	V2.2.xx	MA MFC 300 R02
		MA OPTIMASS 8000k R01

1.2 Intended use

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

1.3 CE certification

CE marking

This device conforms with the following EC directives:

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

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

1.4 Associated documents

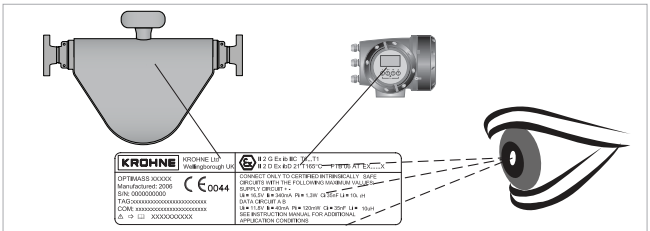
This handbook should be read in conjunction with relevant documents in relation to:

- hazardous areas
- communications
- concentration
- corrosion

1.5 Pressure Equipment Directive (PED)

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

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. Secondary pressure containment is NOT supplied on this meter.

Tube failure

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

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

1.6 Safety instructions from the manufacturer

1.6.1 Copyright and data protection

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

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

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

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

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

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

1.6.2 Disclaimer

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

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

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

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

1.6.3 Product liability and warranty

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

1.6.4 Information concerning the documentation

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

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

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

1.6.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

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

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

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

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

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

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

INFORMATION!
These instructions contain important information for the handling of the device.

LEGAL NOTICE!
This note contains information on statutory directives and standards.

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

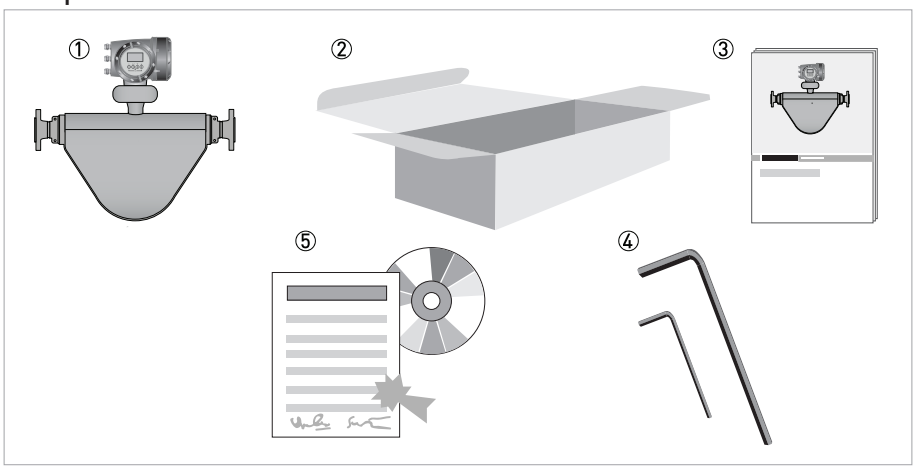
➲ RESULT
This symbol refers to all important consequences of the previous actions.

1.7 Safety instructions for the operator

WARNING!
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

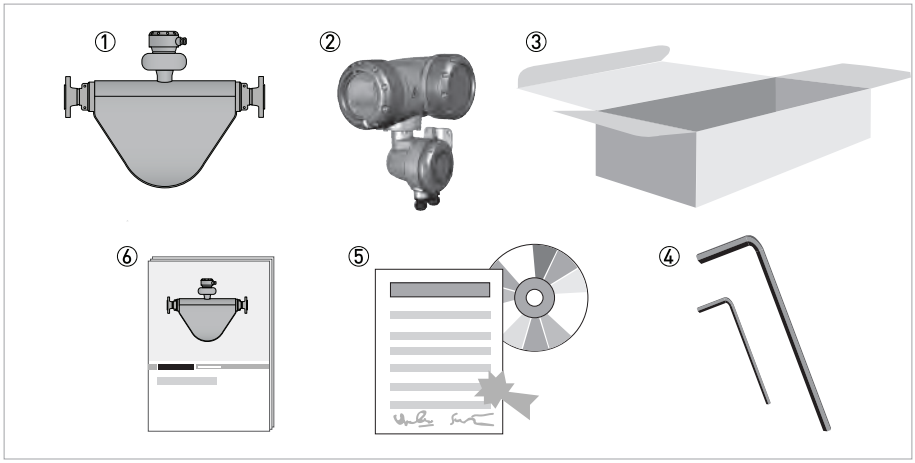
2.1 Scope of delivery

Compact version



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

Remote version

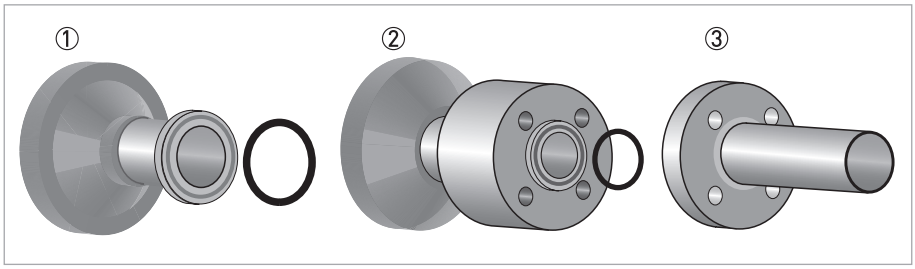


① Mass flowmeter.
② Converter. This will be either: field (as shown), wall or rack.
③ Carton.
④ 2.5 mm and 5 mm hex head tools.
⑤ CD-ROM and calibration certificate.
⑥ Documentation.

If any items are missing, please contact the manufacturer.

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

2.1.1 Meters with hygienic connections



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

2.2 Nameplates

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

2.3 Temperature differential and thermal shock

Temperature differential

The maximum difference between ambient temperature and process (operating) temperature is 210°C / 410°F.

Thermal shock

Thermal shock occurs when there is a sudden and extreme change (shift) in process temperature. To prevent thermal shock on this meter, the manufacturer recommends that you avoid a temperature shift greater than 120°C / 248°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 Notes on installation

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

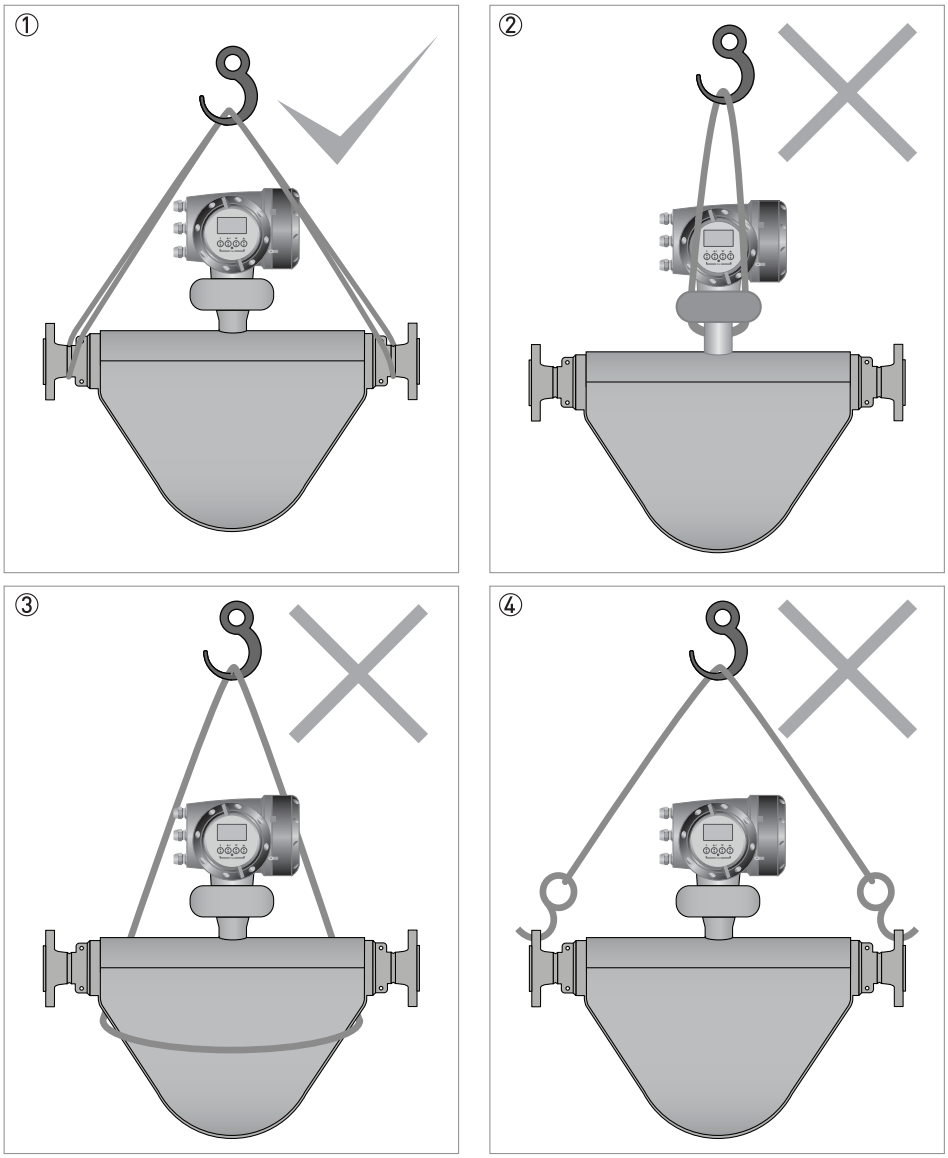
INFORMATION!
Check the packing list to check if you received completely all that you ordered.

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

3.2 Storage

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

3.3 Handling

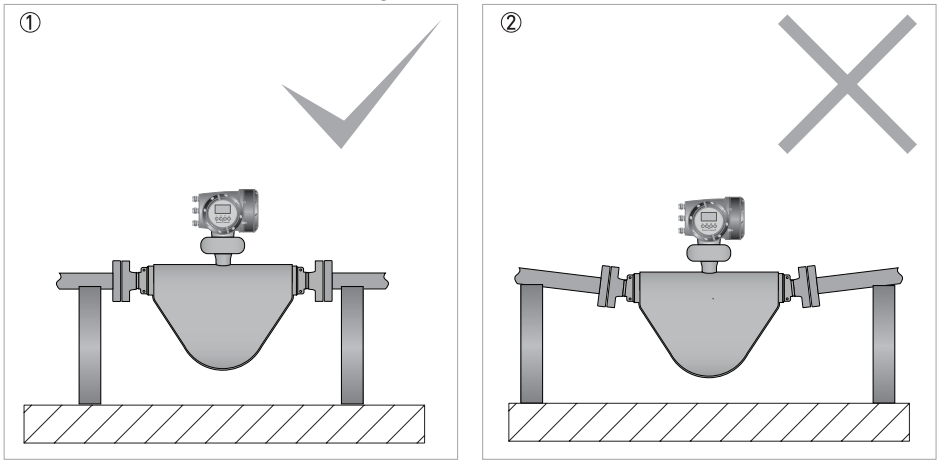


① Use a well maintained sling to lift the meter by the spigots.
② DO NOT lift the meter by the converter housing or the electronics stem.
③ DO NOT lift the meter by the meter body.
④ DO NOT lift the meter using the flange bolt holes.

3.4 Installation conditions

3.4.1 Supporting the meter

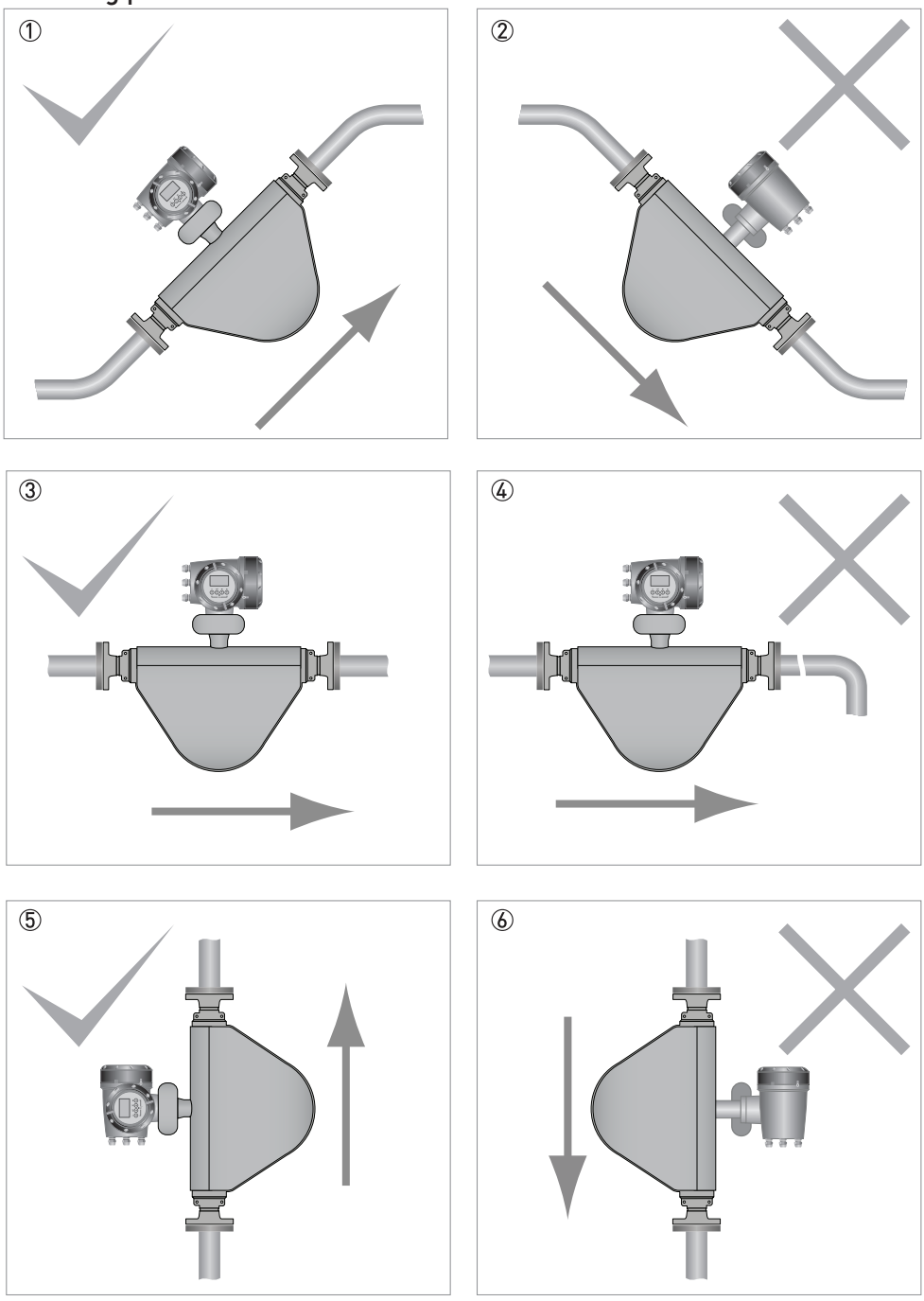
Support for meters with flange connections



① Support the meter as close as possible to the meter body
② DO NOT leave a long pipe run between the meter and the support. This can cause damage to the meter, especially on larger meter sizes.

3.4.2 Mounting the meter

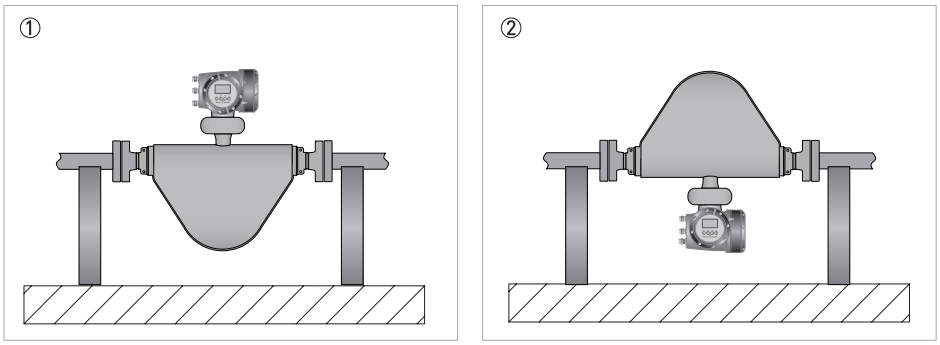
Mounting positions



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

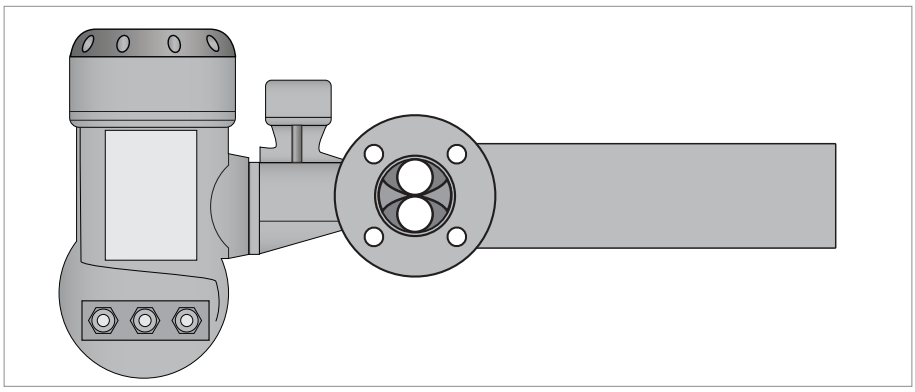
3.4.3 Gas / liquid build up

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



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

3.4.4 Side mounting

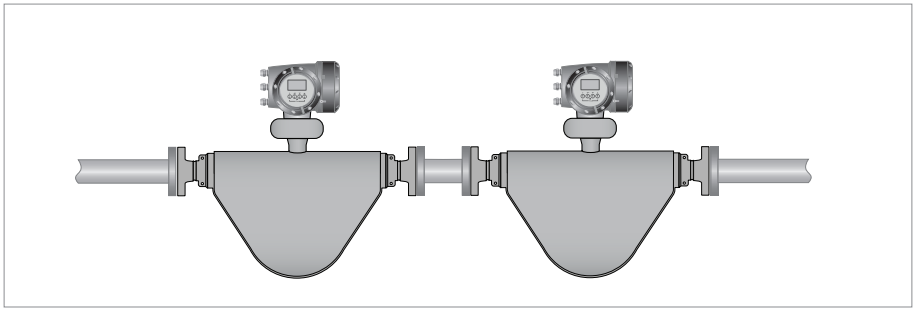


The meter can be installed with the converter (or remote junction box) on the side of the meter so that the measuring tubes are sitting one above the other. Avoid this method of installation where there is a two phase process flow, or where the process fluid contains gas. If this situation cannot be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

3.4.5 Cross talk

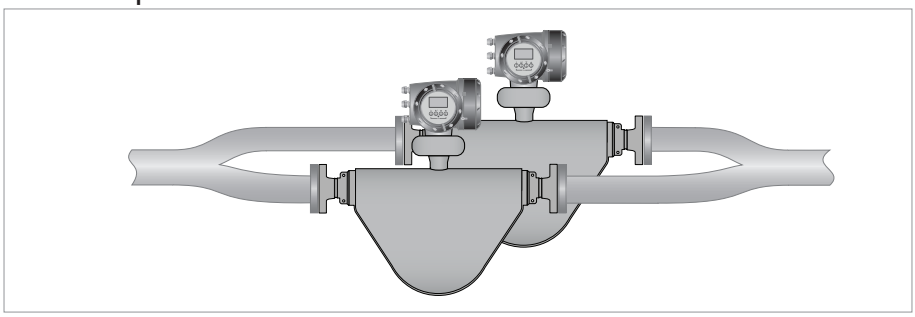
Where more than one meter is being installed, a very high level of immunity to cross talk means that the meters can be mounted within close proximity to each other. The meters can be mounted either in series or parallel, as shown.

Meters in series

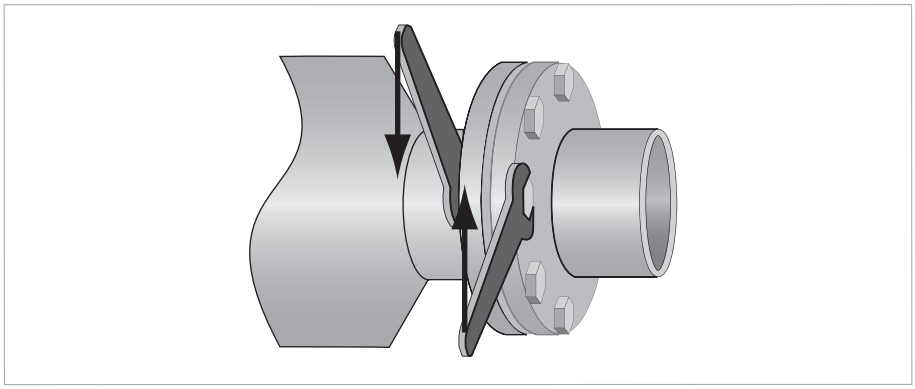


INFORMATION!
Where the meters are installed in series, it is strongly recommended that the process pipe diameter remains constant. For more information, please contact the manufacturer.

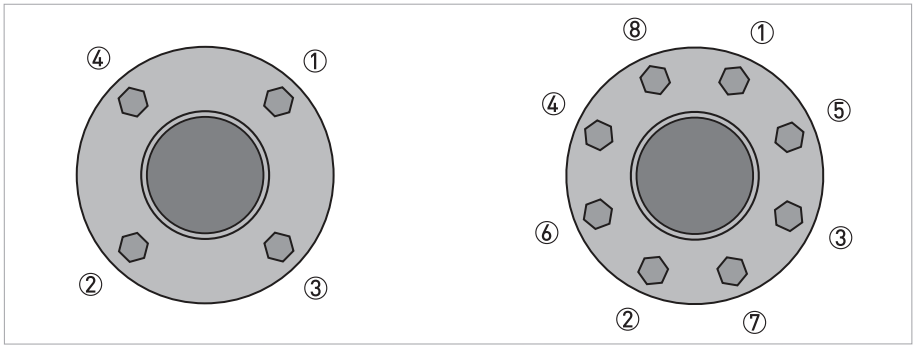
Meters in parallel



3.4.6 Flange connections

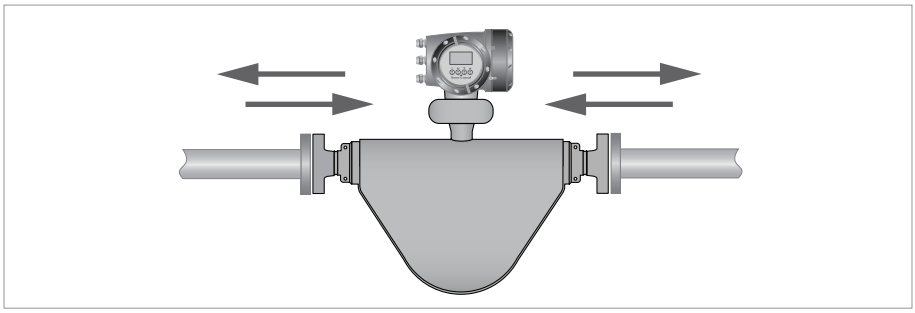


Tighten the flange bolts evenly and in turn.



Use a regular pattern to tighten the bolts evenly

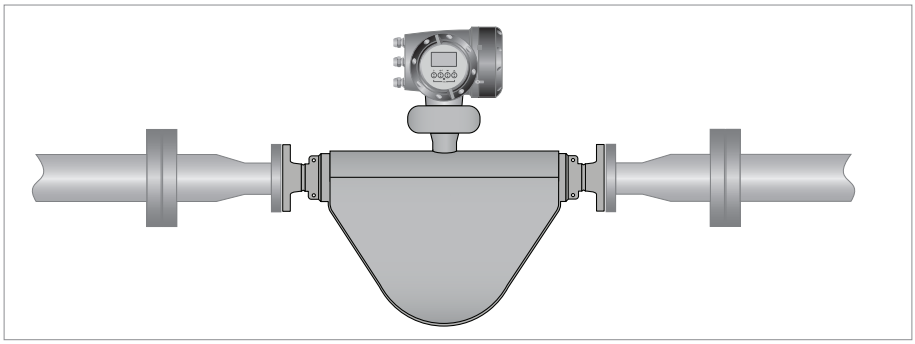
3.4.7 Maximum pipework forces (end loadings)



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

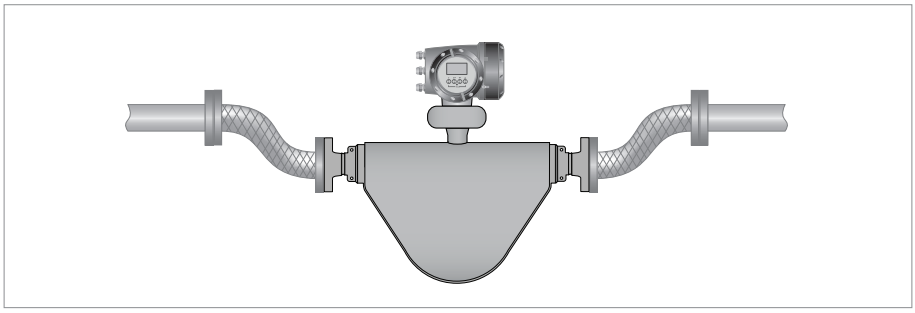
Please refer to the table in the technical data section of this Handbook for the maximum end loadings.

3.4.8 Pipework reducers



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

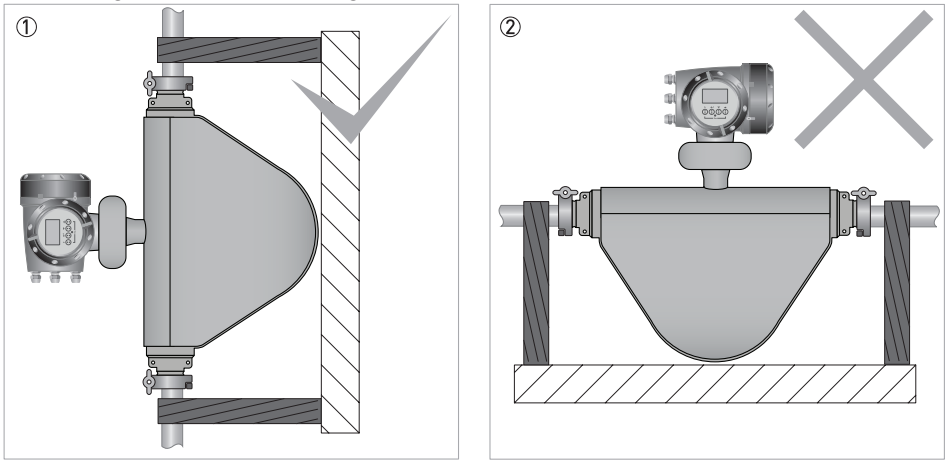
3.4.9 Flexible connections



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

3.4.10 Hygienic installations

Mounting the meter for hygienic applications



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

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

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

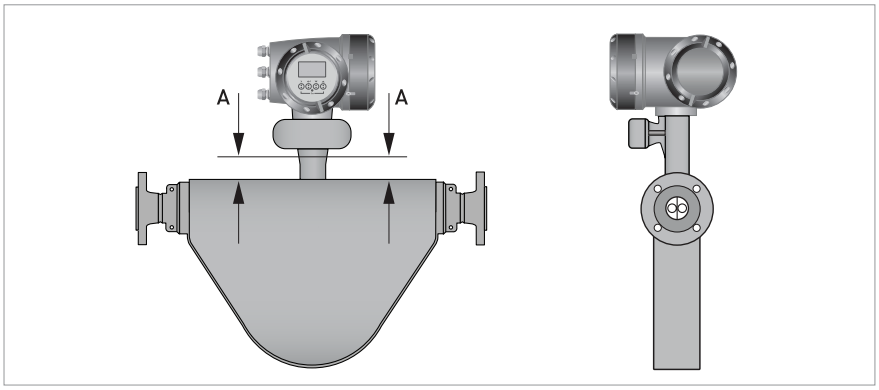
The manufacturer also recommends that you refer to EHEDG (www.ehedg.org) document number 8 "HYGIENIC EQUIPMENT DESIGN CRITERIA".

3.4.11 Heating and insulation

Insulation

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

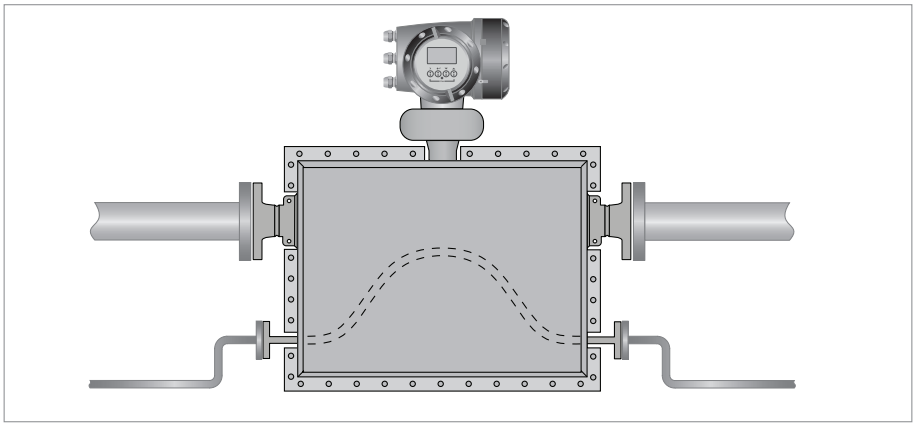
Insulation



	S15	S25	S40	S80	S100
Dimension A [mm]	75	75	75	75	75
Dimension A [inches]	2.9	2.9	2.9	2.9	2.9

Factory fitted heating jacket

If the meter has been ordered with a heating jacket, it will be supplied with DN15 PN40 to DIN 2501 or 1/2¨ ASME150 flange connections.



Connecting / using the heating jacket

- Use rigid or reinforced flexible hoses to connect the heating jacket to the heat source.
- The heating jacket material is 304.
- 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 design of the heating jacket is such that NO end load pressure (negative or positive) can be applied. The manufacturer recommends that (where possible) flexible hoses are used to connect to the heat source.

CAUTION!
The maximum heating pressure and temperature for heating jackets is 10 barg at 230° C / 145 psig at 446° F

3.4.12 Purge ports

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

CAUTION!
DO NOT remove these plugs.

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

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

3.4.13 Burst dics

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 4 barg at +20°C / 58 psig at +68°F.

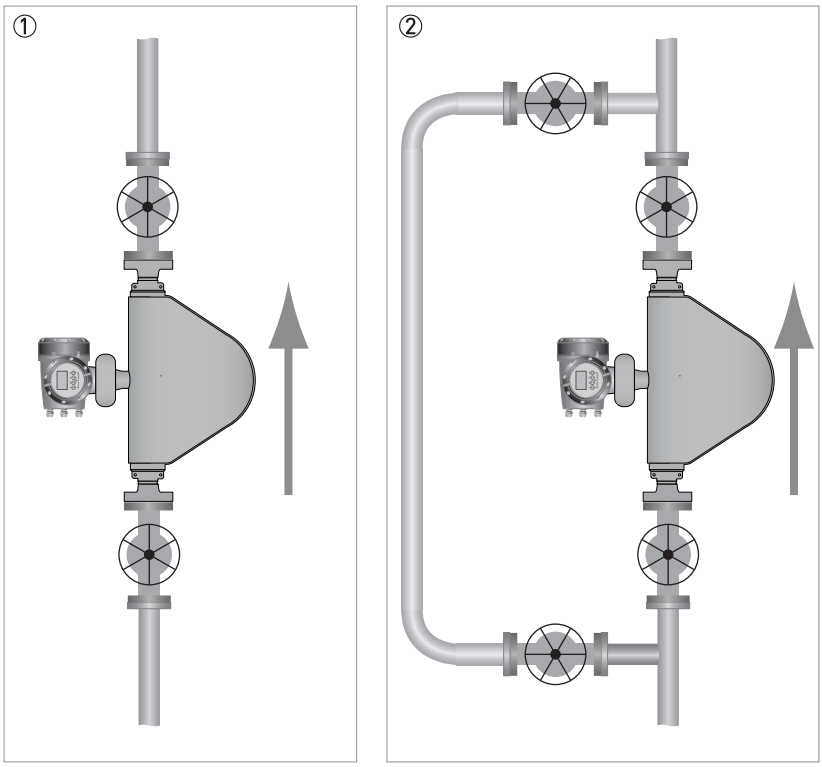
CAUTION!
The fitted burst disc will be suitable for the flow rates and process conditions specified on the original order. If the process conditions alter in any way, it is recommended that you contact the manufacturer for advice regarding suitability.

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

3.4.14 Zero calibration

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

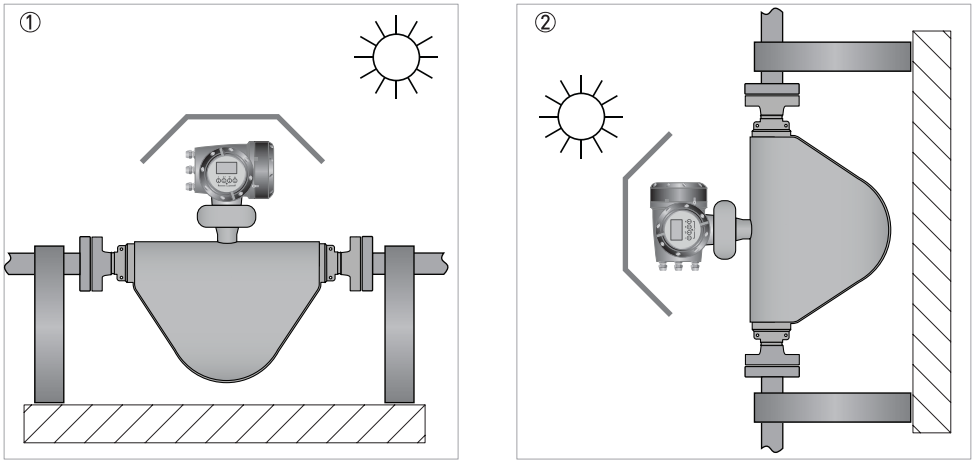
Zero calibration



① Where the meter has been installed vertically, install shut-off valves either side of the meter to assist with zero calibration.
② If the process flow cannot be stopped, install a bypass section for zero calibration.

3.4.15 Sunshades

The meter MUST be protected from strong sunlight.



① Horizontal installation
② Vertical installation

4.1 Safety instructions

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

DANGER!
Observe the national regulations for electrical installations!

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

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

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

4.2 Electrical and I/O connections

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

5.1 Spare parts availability

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

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

5.2 Availability of services

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

INFORMATION!
For more precise information, please contact your local representative.

5.3 Returning the device to the manufacturer

5.3.1 General information

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

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

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

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

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

5.3.2 Form (for copying) to accompany a returned device

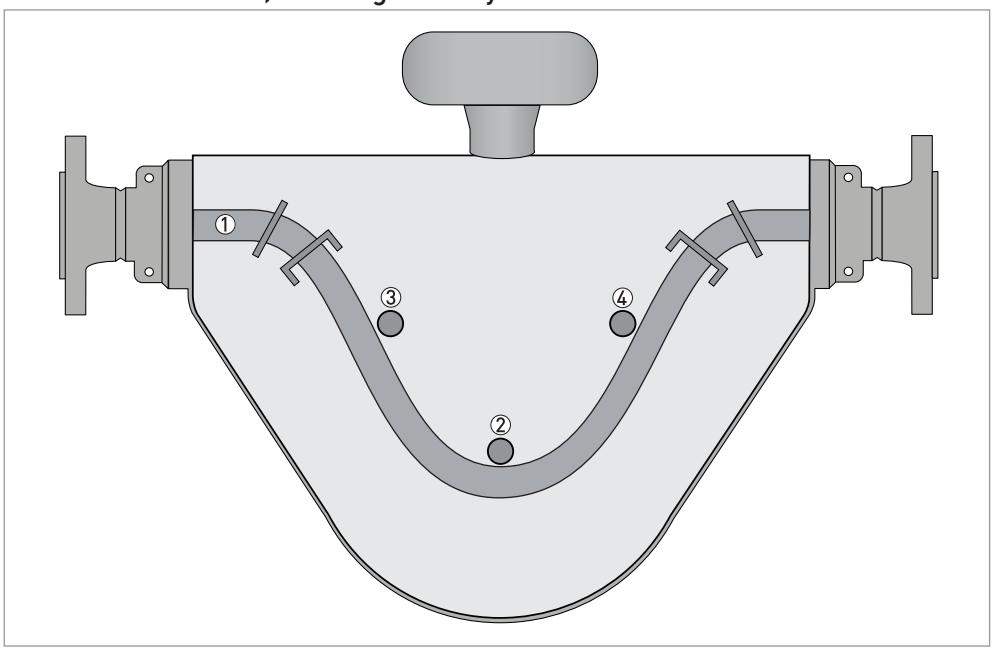
Company:		Address:
Department:		Name:
Tel. no.:		Fax no.:
Manufacturer's order no. or serial no.:		
The device has been operated with the following medium:		
This medium is:	☐	water-hazardous
	☐	toxic
	☐	caustic
	☐	flammable
	☐	We checked that all cavities in the device are free from such substances.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

5.4 Disposal

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

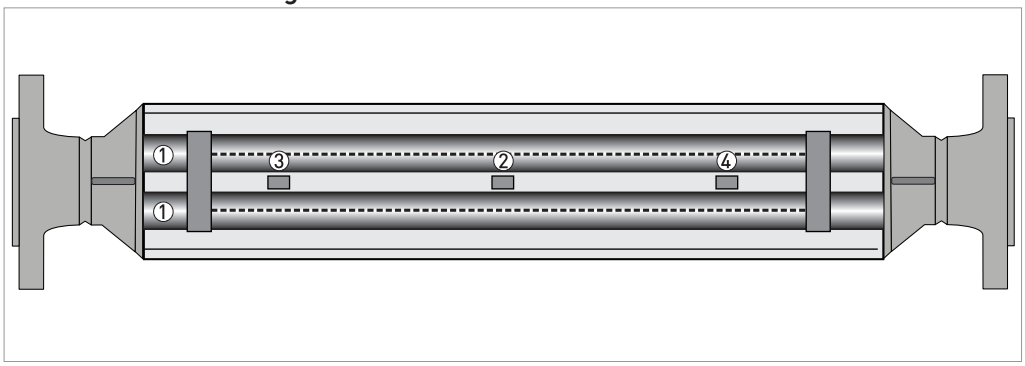
6.1 Measuring principle (twin tube)

Meter from the side, showing tube layout



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

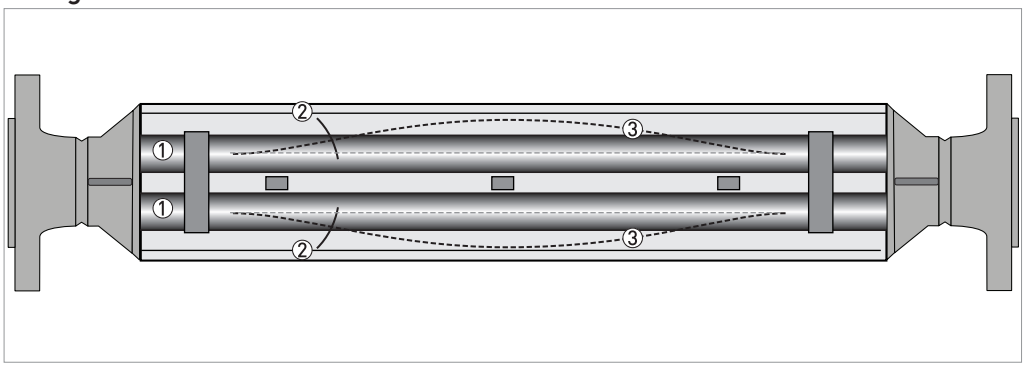
Static meter not energised and with no flow



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

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

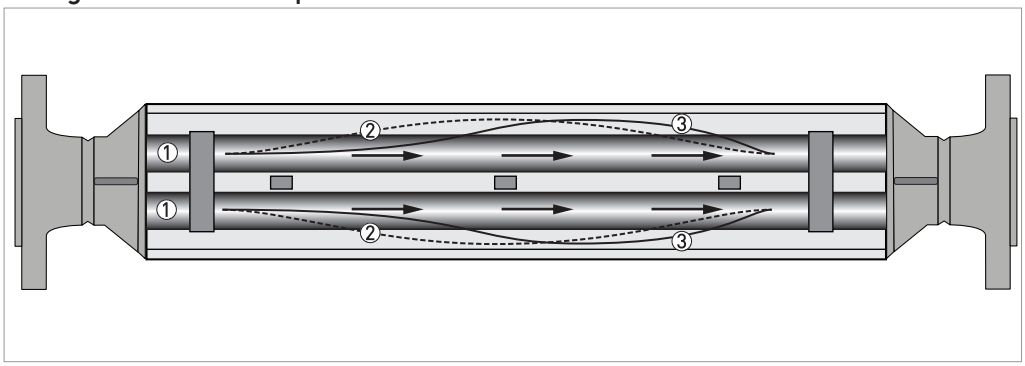
Energised meter



① Measuring tubes
② Direction of oscilation
③ Sine wave

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

Energised meter with process flow



① Process flow
② Sine wave
③ Phase shift

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

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

6.2 Technical data

INFORMATION!

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

Measuring system

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

Design

Basic	System consists of a measuring sensor and a converter to process the output signal
Features	Fully welded maintenance free sensor with twin U-shaped measuring tube
Variants	
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

Mass	
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)
Zero stability	
Stainless Steel	±0.004% of maximum flow rate with respective sensor size
Reference conditions	
Product	Water
Temperature	+20°C / +68°F
Operating pressure	1 barg / 14.5 psig
Effect on sensor zero point caused by a shift in process temperature	
Stainless Steel	0.001% of max flow per 1°C / 0.0005% per 1°F
Pressure effect on mass flow rate	
Stainless Steel	-0.015% per 1 barg / 0.001% per 1 psig
Density	
Measuring range	400...3000 kg/m^3 / 25...187 lbs/ft^3
Accuracy	±2 kg/m^3 / ±0.13 lbs/ft^3
On site calibration	±0.5 kg/m^3 / ±0.033 lbs/ft^3
Temperature	
Accuracy	±1°C / ±1.8°F

Operating conditions

Maximum flow rates	
S15	3510 kg/h / 128.7 lbs/min
S25	11700 kg/h / 429 lbs/min
S40	41600 kg/h / 1525.3 lbs/min
S80	110500 kg/h / 4051.6 lbs/min
S100	325000 kg/h / 11916.6 lbs/min
	Assumes operating density 1000 kg/m^3 / 62.4 lb/ft^3
Ambient temperature	
Compact version with Aluminium converter	Standard temperature range: -40...+60°C / -40...+140°F
	Cryogenic temperature range: -25...+40°C / -13...+104°F
Compact version with Stainless Steel converter	Standard temperature range: -40...+55°C / -40...+131°F
	Cryogenic temperature range: -25...+40°C / -13...+104°F
Remote versions	Standard temperature range: -40...+65°C / -40...+149°F
	Cryogenic temperature range: -20...+65°C / -4...+149°F
Hazardous Area versions	Refer to temperature limits
Process temperature	
Standard temperature range	
Safe area (compact and remote version)	-70...+230°C / -94...+440°F
Hazardous area (standard temperature, compact version only)	-40...+190°C / -40...+370°F
Hazardous area (standard temperature, remote version only)	-40...+230°C / -40...+440°F
Hygienic connections	-70...+150°C / -94...+302°F
Cryogenic temperature range	
Safe area	-195...+40°C / -310...+104°F
Hazardous area	-195...+40°C / -310...+104°F
Nominal pressure at 20°C / 68°F	
Measuring tube	
PED 97/23/EC	-1...100 barg / -14.5...1450 psig
FM	Pending
CRN / ASME B31.3	Pending
Fluid properties	
Permissible physical condition	Liquids, gases, slurries
Permissible gas content (volume)	Contact manufacturer for information.
Permissible solid content (volume)	Contact manufacturer for information.
Protection category (acc. to EN 60529)	IP 67, NEMA 4X
Installation conditions	
Inlet runs	None required
Outlet runs	None required

Materials

Measuring tube	Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified
Spigot	Stainless Steel AISI 316 / 316L (CF3M / 1.4409) dual certified
Flanges	Stainless Steel AISI 316 / 316L (1.4401 / 1.4404) dual certified
Outer casing	Stainless Steel AISI 304 (1.4301)
Heating jacket version	
Heating tubes and insulation jacket	Stainless Steel AISI 304 (1.4301)
All versions	
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

Flange	
DIN	DN15…150 / PN40…100
ASME	½...6" / ASME 150…600
JIS	15A...100A / 10...20K
Hygienic (S100 only)	
Tri-clover	1...4"
Tri-clamp DIN 32676	DN25..100
Tri-clamp ISO 2852	1...4"
DIN 11864-2 Form A	DN25...100
Male thread DIN 11851	DN25...100
Male thread SMS	1...4"
Male thread IDF / ISS	1...4"
Male thread RJT	1...4"

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

Mechanical	
Electromagnetic compatibility (EMC) acc. to CE	Namur NE 21/5.95
	2004/108/EC (EMC)
	2006/95/EC (Low Voltage Directive)
European Pressure Equipment Directive	PED 97-23 EC (acc. to EN13445-3)
ASME	B31.3
ATEX (acc. 94/9/EC)	
OPTIMASS 8300k C non Ex i Signal outputs	
Ex d connection compartment	II 1/2 G - Ex d [ib] IIC T4....T1 Ga/Gb
	II 2 D - Ex t IIIC Txx°C Db

Ex e connection compartment	II 1/2 G - Ex de [ib] IIC T4....T1 Ga/Gb
	II 2 D - Ex t IIIC Txx°C Db
OPTIMASS 8300k C Ex i signal outputs	
Ex d connection compartment	II 1/2 (1) G - Ex d [ia/ib] IIC T4....T1 Ga/Gb
	II 2 (1) D - Ex t [ia Da] IIIC Txx°C Db
Ex e connection compartment	II 1/2 (1) G - Ex de [ia/ib] IIC T4....T1 Ga/Gb
	II 2 (1) D - Ex t [ia Da] IIIC Txx°C Db
OPTIMASS 8000k / 8010k C	II 1/2 G - Ex ib IIC T4...T1 Ga/Gb
	II 2 D - Ex t IIIC Txx°C Db

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

	Ambient temp. T_{amb} °C	Max. medium temp. T_m °C	Temp. class	Max. surface temp. °C
OPTIMASS 8000k / 8010k C with or without heating jacket / insulation. Minimum process temperature T_m -40ºC ①	-40...+65	80	T4	T130
		140	T3	T195
		230	T2-T1	T280
OPTIMASS 8000k / 8010k C with or without heating jacket / insulation, Cryogenic Applications ①	-20...+65	-195...80	T4-T1	T130
OPTIMASS 8300k C Aluminium converter housing - with or without heating jacket / insulation. Minimum process temperature T_m -40ºC ①	-40...+40	60	T4	T125
		120	T3	T190
		190	T2-T1	T265
	-40...+50	120	T3	T190
		190	T2-T1	T260
	-40...+55	55	T4-T1	T125
	-40...+60 ②	60	T4-T1	T130
OPTIMASS 8300k C Stainless Steel converter housing - with or without heating jacket / insulation. Minimum process temperature T_m -40ºC ①	-40...+40	60	T4	T125
		120	T3	T195
		190	T2-T1	T265
	-40...+45	55	T4	T125
		190	T2-T1	T260
	-40...+50 ②	50	T4-T1	T120
OPTIMASS 8300k C Aluminium or Stainless Steel converter housing with or without heating jacket / insulation, Cryogenic Applications ①	-25...+40	-195...60	T4-T1	T125

① For sensors with additional paint coating, please refer to manufacturer

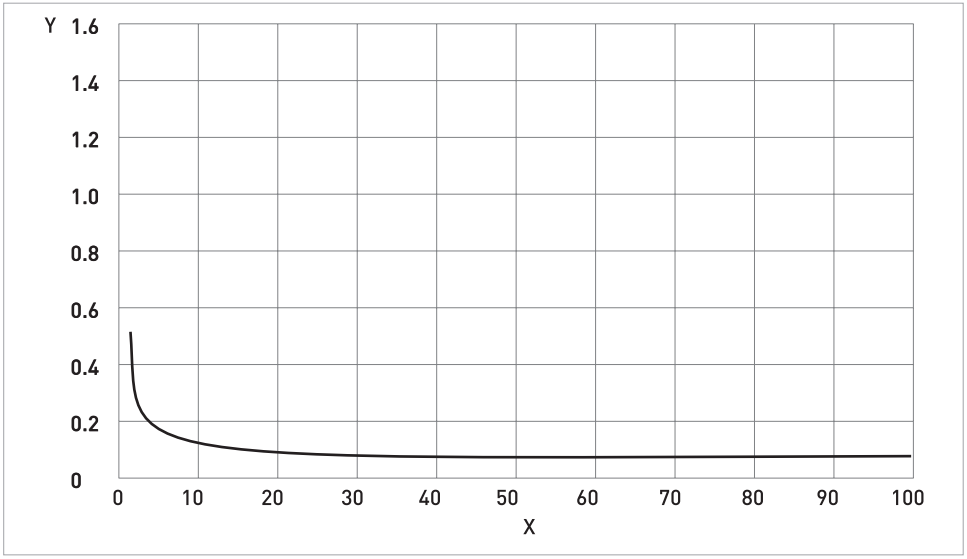
② depending on I/O option. Please call for more information.

Maximum end loadings

		S15	S25	S40	S80	S100
Flanges						
20°C	40 barg	25 kN	38 kN	48 kN	99 kN	150 kN
	100 barg	17 kN	19 kN	15 kN	20 kN	100 kN
230°C	32 barg	12 kN	18 kN	23 kN	45 kN	100 kN
	52 barg	10 kN			15 kN	60 kN
Hygienic (all connections)						
130°C	10 barg	5 kN	9 kN	12 kN	12 kN	18 kN

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

6.3 Measuring accuracy



Measuring error

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

Reference conditions

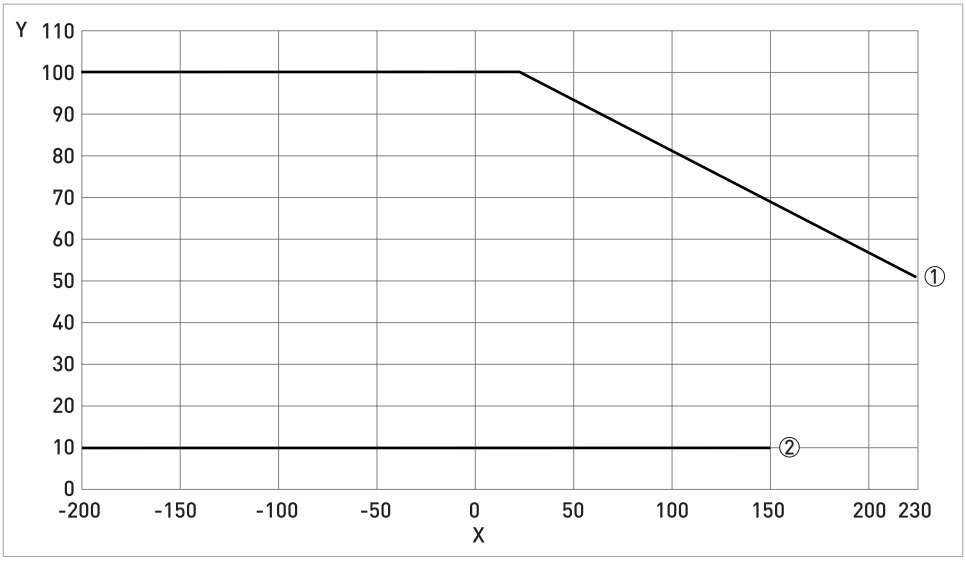
Product	Water
Temperature	+20°C / +68°F
Operating pressure	1 barg / 14.5 psig

6.4 Guidelines for maximum operating pressure

Notes:

- Ensure that the meter is used within its operating limits
- All hygienic process connections have a maximum operating rating of 10 barg at 130°C / 145 psig at 266°F

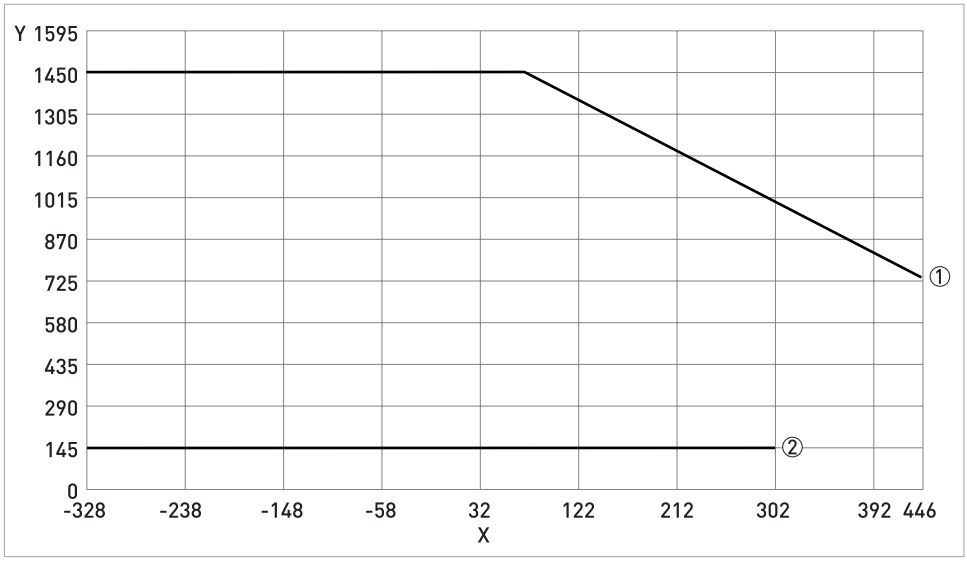
Pressure / temperature de-rating, all meter sizes in metric (flanged connections as per EN 1092-1)



X temperature [°C]
Y pressure [barg]

① Measuring tube PED certification
② Hygienic connection

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 PED certification
② Hygienic connection

Flanges

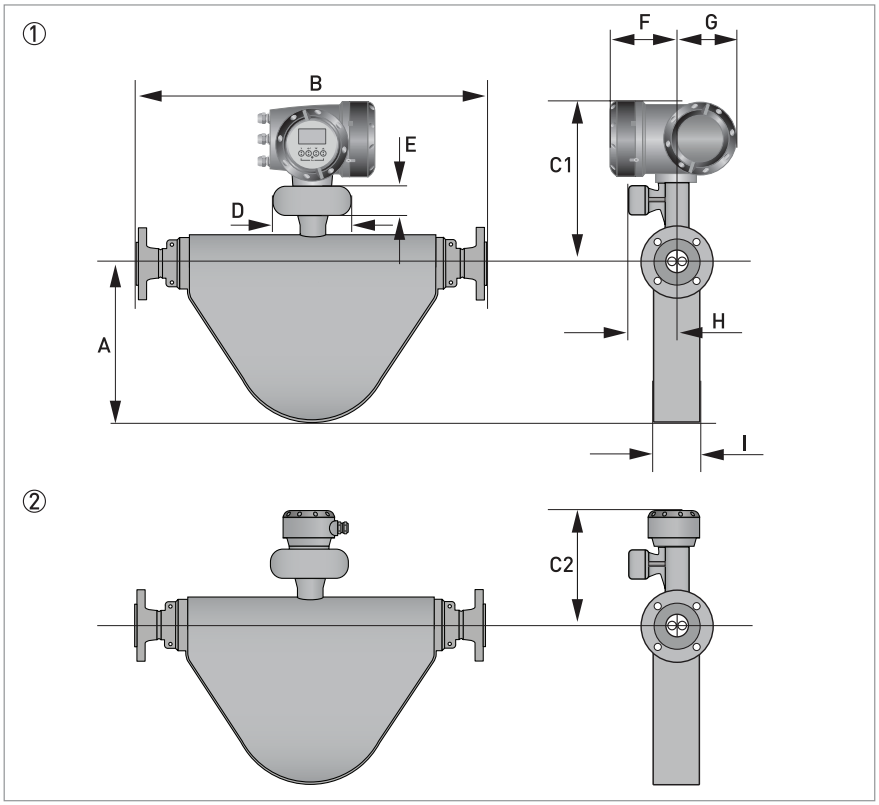
- DIN flange ratings are based on EN 1092-1 2007 table G.4.1 material group 14EO
- ASME flange ratings are based on ASME B16.5 2003 table 2 material group 2.2
- JIS flange ratings are based on JIS 2220: 2001 table 1 division 1 material group 022a

Notes

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

6.5 Dimensions and weights

6.5.1 Flanged versions



① Compact version
② Remote version

Meter weights (all flanges)

	Weight [kg]				
	S15	S25	S40	S80	S100
Aluminium (compact)	13.8	22.3	30.8	62.3	103.8
Stainless Steel (compact)	19.2	28.4	36.9	68.4	109.9
Aluminium (remote)	11	19.5	28	59.5	101
Stainless Steel (remote)	11.8	20.3	28.8	60.3	101.8
Heating jacket add	7.5	10	11.5	16	20

	Weight [lb]				
	S15	S25	S40	S80	S100
Aluminium (compact)	30.4	49	67.8	137	228.4
Stainless Steel (compact)	42.2	62.5	81.2	150.5	241.8
Aluminium (remote)	24.2	42.9	61.6	130.9	222.2
Stainless Steel (remote)	26	44.7	63.4	132.7	224
Heating jacket add	16.5	22	25.3	35.2	44

Measuring tube in Stainless Steel

	Dimensions [mm]				
	S15	S25	S40	S80	S100
A	185	280	320	415	450
C1 (compact)	359	374	380	407	433
C2 (remote)	282	297	303	330	356
D	160				
E	60				
F	137				
G	123.5				
H	98.5				
I	73	102	114	168	220

	Dimensions [inches]				
	S15	S25	S40	S80	S100
A	7.3	11	12.6	16.3	17.7
C1 (compact)	14.1	14.7	15	16	17
C2 (remote)	11.1	11.7	11.9	13	14
D	6.3				
E	2.4				
F	5.4				
G	4.9				
H	3.9				
I	2.9	4	4.5	6.6	8.7

Flange connections

	Dimension B [mm]				
	S15	S25	S40	S80	S100
PN40					
DN15	510	-	-	-	-
DN25	512	600	-	-	-
DN40	-	608	700	-	
DN50	-	-	715	893	-
DN80	-	-	-	915	984
DN100	-	-	-	-	998
DN150	-	-	-	-	1018
PN63					
DN50	-	-	741	921	-
DN80	-	-	-	943	1012
DN100	-	-	-	-	1024
DN150	-	-	-	-	1058
PN100					

	Dimension B [mm]				
	S15	S25	S40	S80	S100
DN15	522	-	-	-	-
DN25	548	634	-	-	-
DN40	-	642	741	-	-
DN50	-	-	753	933	-
DN80	-	-	-	953	1024
DN100	-	-	-	-	1048
DN150	-	-	-	-	1098
ASME 150					
½¨	528	-	-	-	-
¾¨	538	-	-	-	-
1¨	544	518	-	-	-
1½¨	-	642	741	-	-
2¨	-	-	745	925	-
3¨	-	-	-	937	1008
4¨	-	-	-	-	1022
6¨	-	-	-	-	1046
ASME 300					
½¨	538	-	-	-	-
¾¨	548	-	-	-	-
1¨	556	642	--	-	-
1½¨	-	656	755	-	-
2¨	-	-	757	937	-
3¨	-	-	-	957	1028
4¨	-	-	-	-	1040
6¨	-	-	-	-	1066
ASME 600					
½¨	550				
¾¨	560	-	-	-	-
1¨	568	656	-	-	-
1½¨	-	670	771	-	-
2¨	-	-	775	957	-
3¨	-	-	-	975	1046
4¨	-	-	-	-	1086
6¨	-	-	-	-	1116
JIS 10K					
50A	-	-	706	893	-
80A	-	-	-	913	-
JIS 20K					
15A	508	-	-	-	-
25A	512	598	-	-	-
40A	-	608	707	-	-

	Dimension B [mm]				
	S15	S25	S40	S80	S100
50A	-	-	713	893	-
80A	-	-	-	913	-
100A	-	-	-	-	1020

	Dimension B [inches]				
	S15	S25	S40	S80	S100
PN40					
DN15	20	-	-	-	-
DN25	20.2	23.5	-	-	-
DN40	-	24	27.8	-	
DN50	-	-	28	35.2	-
DN80	-	-	-	36	38.7
DN100	-	-	-	-	39.3
DN150	-	-	-	-	40.2
PN63					
DN50	-	-	29		-
DN80	-	-	-	37	39.8
DN100	-	-	-	-	40.3
DN150	-	-	-	-	41.6
PN100					
DN15	20.5	-	-	-	-
DN25	21.6	25	-	-	-
DN40	-	25.3	28.9	-	-
DN50	-	-	29.4	36.7	-
DN80	-	-	-	37.5	40.3
DN100	-	-	-	-	41.3
DN150	-	-	-	-	43.2
ASME 150					
½¨	20.8	-	-	-	-
¾¨	21.2	-	-	-	-
1¨	21.4	20.4	-	-	-
1½¨	-	25.3	29.2	-	-
2¨	-	-	29.3	36.4	-
3¨	-	-	-	36.9	39.7
4¨	-	-	-	-	40.2
6¨	-	-	-	-	41.3
ASME 300					
½¨	21.2	-	-	-	-
¾¨	21.6	-	-	-	-
1¨	21.9	25.3	--	-	-

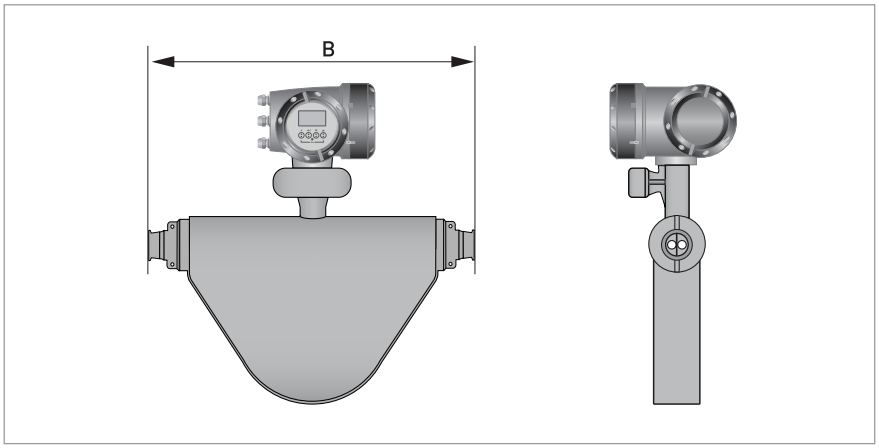
	Dimension B [inches]				
	S15	S25	S40	S80	S100
1½"	-	25.8	29.7	-	-
2"	-	-	29.8	36.9	-
3"	-	-	-	37.7	40.5
4"	-	-	-	-	41
6"	-	-	-	-	42
ASME 600					
½	21.6	-	-	-	-
¾"	22	-	-	-	-
1"	22.4	25.8	-	-	-
1½"	-	26.4	30.4	-	-
2"	-	-	30.5	37.7	-
3"	-	-	-	38.4	41.2
4"	-	-	-	-	42.8
6"	-	-	-	-	44
JIS 10K					
50A	-	-	28	35.2	-
80A	-	-	-	35.9	-
JIS 20K					
15A	20	-	-	-	-
25A	20.2	23.5	-	-	-
40A	-	23.9	27.8	-	-
50A	-	-	28	35.1	-
80A	-	-	-	35.9	-
100A	-	-	-	-	40.2

6.5.2 NAMUR dimensions

The following face to face dimensions comply with NAMUR NE132

PN40	Dimensions [mm +0.0 / -5.0]				
	S15	S25	S40	S80	S100
DN 15	510	-	-	-	-
DN 25	-	600	-	-	-
DN 50	-	-	715	-	-
DN 80	-	-	-	915	-
	Dimensions [inches +0.0 / -0.12]				
DN 15	20.1	-	-	-	-
DN 25	-	23.6	-	-	-
DN 50	-	-	28.1	-	-
DN 80	-	-	-	36	-

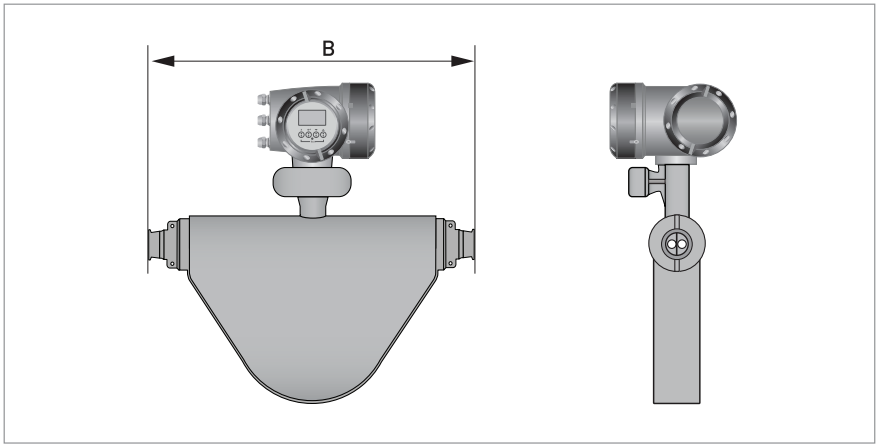
6.5.3 Hygienic versions



Hygienic connections: all welded versions

	Dimension B [mm]				
	S15	S25	S40	S80	S100
Tri-clover					
1¨	485	-	-	-	-
1½¨	-	580	-	-	-
2¨	-	-	675	-	-
3¨	-	-	-	850	-
4¨	-	-	-	-	911
Tri-clamp DIN 32676					
DN25	475	-	-	-	-
DN40	-	570	-	-	-
DN50	-	-	668	-	-
DN80	-	-	-	859	-
DN100	-	-	-	-	924
Tri-clamp ISO 2852					
1¨	481	-	-	-	-
1½¨	-	586	-	-	-
2¨	-	-	666	-	-
3¨	-	-	-	846	-
4¨	-	-	-	-	911
DIN 11864-2 Form A (Female)					
DN25	512	-	-	-	-
DN40	-	617	-	-	-
DN50	-	-	715	-	-
DN80	-	-	-	919	-
DN100	-	-	-	-	984

	Dimension B [inches]				
	S15	S25	S40	S80	S100
Tri-clover					
1¨	19	-	-	-	-
1½¨	-	23	-	-	-
2¨	-	-	26.6	-	-
3¨	-	-	-	33.5	-
4¨	-	-	-	-	36
Tri-clamp DIN 32676					
DN25	19	-	-	-	-
DN40	-	22.5	-	-	-
DN50	-	-	26.3	-	-
DN80	-	-	-	34	-
DN100	-	-	-	-	36.4
Tri-clamp ISO 2852					
1¨	19	-	-	-	-
1½¨	-	23	-	-	-
2¨	-	-	26.2	-	-
3¨	-	-	-	33.3	-
4¨					36
DIN 11864-2 Form A (Female)					
DN25	20	-	-	-	-
DN40	-	24.3	-	-	-
DN50	-	-	28.2	-	-
DN80	-	-	-	36	-
DN100	-	-	-	-	38.7

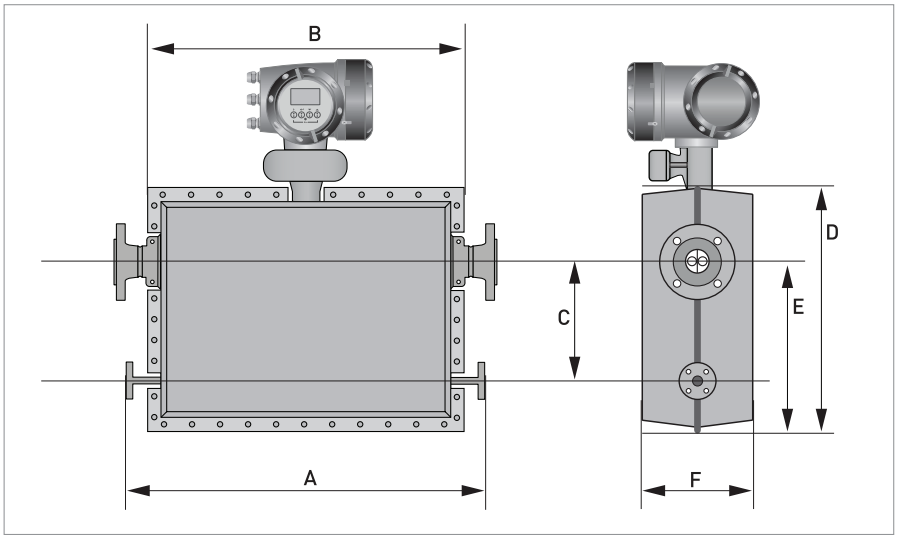


Hygienic connections: adapter versions (male thread)

	Dimension B [mm]				
	S15	S25	S40	S80	S100
Male thread DIN 11851					
DN25	490	-	-	-	-
DN40	-	593	-	-	-
DN50	-	-	695	-	-
DN80	-	-	-	893	-
DN100	-	-	-	-	976
Male thread SMS					
1¨	472	-	-	-	-
1½¨	-	583	-	-	-
2¨	-	-	678	-	-
3¨	-	-	-	855	-
4¨	-	-	-	-	924
Male thread IDF/ISS					
1¨	485	-	-	-	-
1½¨	-	580	-	-	-
2¨	-	-	675	-	-
3¨	-	-	-	850	-
4¨	-	-	-	-	911
Male thread RJT					
1¨	496	-	-	-	-
1½¨	-	591	-	-	-
2¨	-	-	686	-	-
3¨	-	-	-	861	-
4¨	-	-	-	-	922

	Dimension B [inches]				
	S15	S25	S40	S80	S100
Male thread DIN 11851					
DN25	19.3	-	-	-	-
DN40	-	23.3	-	-	-
DN50	-	-	27.4	-	-
DN80	-	-	-	35	-
DN100	-	-	-	-	38.4
Male thread SMS					
1¨	18.6	-	-	-	-
1½¨	-	23	-	-	-
2¨	-	-	26.7	-	-
3¨	-	-	-	33.7	-
4¨	-	-	-	-	36.4
Male thread IDF/ISS					
1¨	19	-	-	-	-
1½¨	-	22.8	-	-	-
2¨	-	-	26.6	-	-
3¨	-	-	-	33.5	-
4¨	-	-	-	-	35.9
Male thread RJT					
1¨	19.5	-	-	-	-
1½¨	-	23.3	-	-	-
2¨	-	-	27	-	-
3¨	-	-	-	33.4	-
4¨	-	-	-	-	36.3

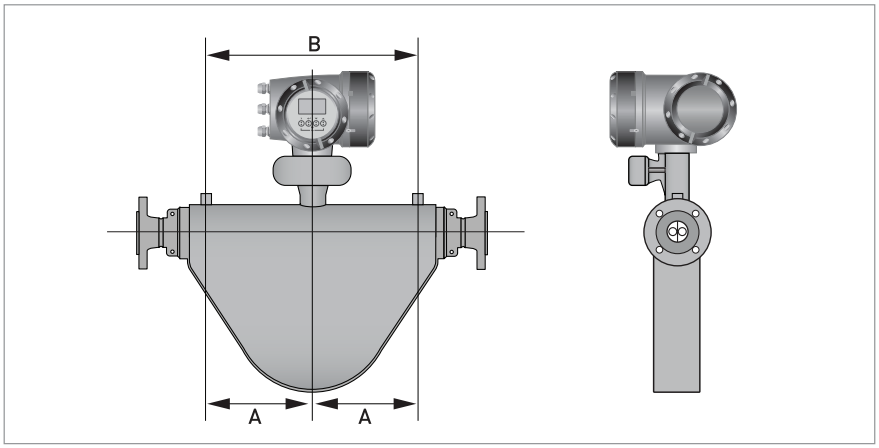
6.5.4 Heating jacket version



	Dimensions [mm]				
	S15	S25	S40	S80	S100
Heating connection size	PN40 DN25 or ASME 150 ½"				
A	590 ±5.0	692 ±5.0	715 ±5.0	891 ±5.0	956 ±5.0
B	440 ±3.0	542 ±3.0	565 ±3.0	741 ±3.0	806 ±3.0
C	130 ±3.0	210 ±3.0	230 ±3.0	320 ±3.0	340 ±3.0
D	344 ±3.0	453 ±3.0	499 ±3.0	622 ±3.0	682 ±3.0
E	221 ±3.0	316 ±3.0	356 ±3.0	451 ±3.0	486 ±3.0
F	226 ±3.0	254 ±3.0	266 ±3.0	322 ±3.0	372 ±3.0

	Dimensions [inches]				
	S15	S25	S40	S80	S100
Heating connection size	PN40 DN25 or ASME 150 ½"				
A	23.2±0.2	27.2 ±0.2	28 ±0.2	891 ±0.2	37.6 ±0.2
B	17.3 ±0.12	21.3 ±0.12	22.2 ±0.12	29 ±0.12	31.7 ±.012
C	5 ±0.12	8.7 ±0.12	9 ±0.12	12.6 ±0.12	13.4 ±0.12
D	13.5 ±0.12	17.8 ±0.12	19.6 ±0.12	24.5 ±0.12	26.9 ±0.12
E	8.7 ±0.12	12.4 ±0.12	14 ±0.12	17.7 ±0.12	19.1 ±0.12
F	8.9 ±0.12	10 ±0.12	10.5 ±0.12	12.7 ±0.12	14.6 ±0.12

6.5.5 Purge port option



	Dimensions [mm]				
	S15	S25	S40	S80	S100
A	150	200	215	300	305
B	300	400	430	600	610

	Dimensions [inches]				
	S15	S25	S40	S80	S100
A	5.9	7.9	8.5	11.8	12
B	11.8	15.7	17	23.6	24

KROHNE product overview

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

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
D-47058 Duisburg (Germany)
Tel.:+49 (0)203 301 0
Fax:+49 (0)203 301 10389
info@krohne.de

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com

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