

OPTIFLUX 5000 Handbook

Electromagnetic flowmeter in flanged version

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

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

The OPTIFLUX 5000 flowmeter measures the volumetric flow rate of electrically conductive liquids, acids, alkaline solutions, pastes and slurries, also with very high solid contents.

1.2 Certification

Product marking

CE

Figure 1-1: Example of marking logo

The manufacturer certifies successful testing of the product by applying the conformity mark on the device.

This device fulfils the statutory requirements of the relevant directives.

For more information on the directives, standards and the approved certifications, please refer to the declaration of conformity supplied with the device or downloadable from the manufacturer's website.

Other approvals and standards

- Measuring Instruments Directive 2014/32/EU, Annex III (MI-001), Annex VII (MI-005).

For more information, please refer to the dedicated documentation.

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

CAUTION!
For devices used in SIL applications, additional safety notes apply. For detailed information refer to the "OPTIFLUX x400 Safety manual".

1.3 Safety instructions from the manufacturer

1.3.1 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.

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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.

1.3.2 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.

1.3.3 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.

1.3.4 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.

1.3.5 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.

1.4 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

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

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!
The remote version will arrive in two cartons. One carton contains the signal converter and one carton contains the flow sensor.

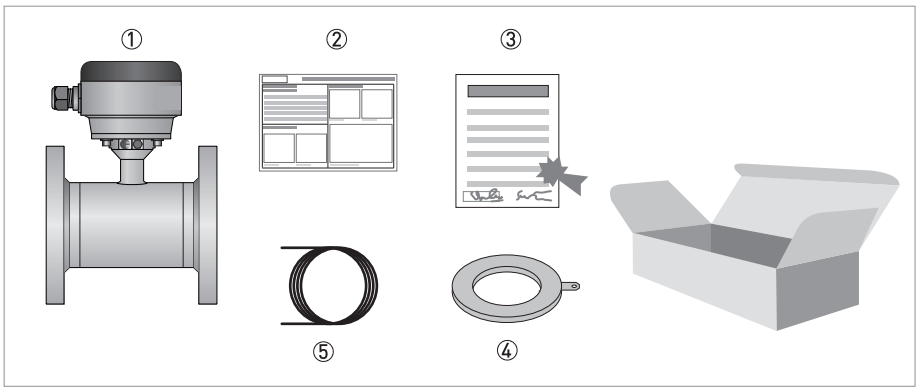


Figure 2-1: Scope of delivery

① Ordered flowmeter
② Product documentation
③ Factory calibration report
④ Grounding rings (optional)
⑤ Signal cable (remote versions only)

INFORMATION!
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

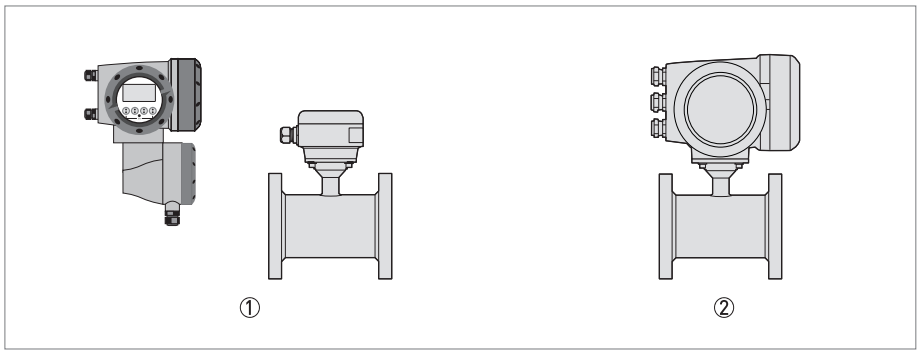
2.2 Device description

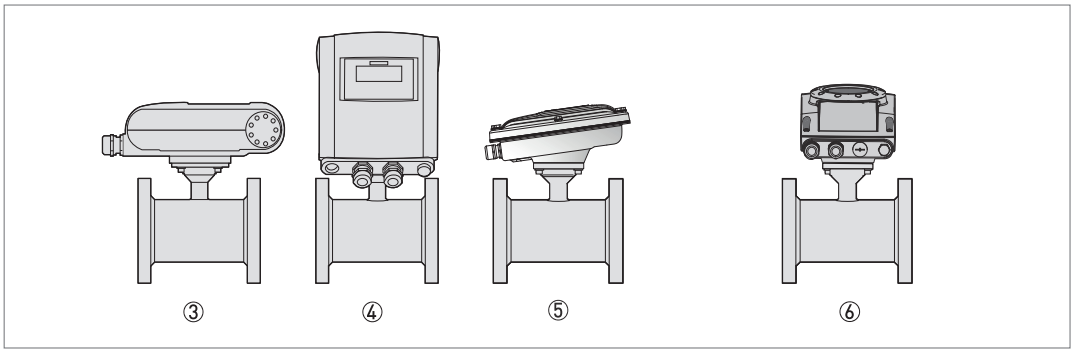
Electromagnetic flowmeters are designed exclusively to measure the flow and conductivity of electrically conductive, liquid media.

Your measuring device is supplied ready for operation. The factory settings for the operating data have been made in accordance with your order specifications.

The following versions are available:

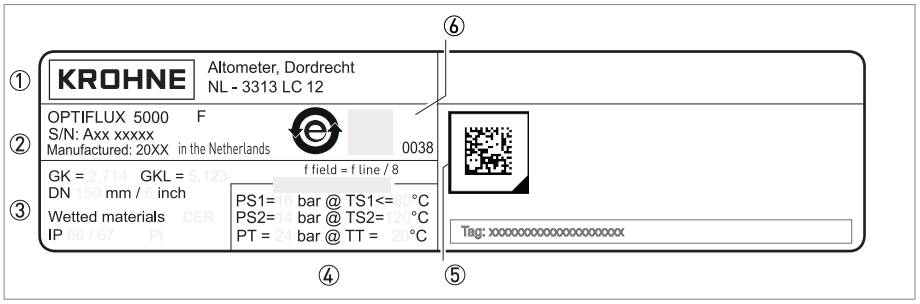
- Compact version (the signal converter is mounted directly on the flow sensor)
- Remote version (a flow sensor with a connection box and a separate signal converter, connected via field current- and signal cable)





① Remote version
② Compact version with IFC 300/ IFC 400 signal converter
③ Compact version with IFC 100 (0°) signal converter
④ Compact version with IFC 100 (45°) signal converter
⑤ Compact version with stainless steel IFC 100 (10°) signal converter
⑥ Compact version with IFC 050 (10°) signal converter

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.



① Name and address of the manufacturer
② Type designation of the flowmeter
③ Calibration data
④ PED data
⑤ Data Matrix
⑥ Disposal logo and CE sign with number(s) of notified body/bodies

Auto ID according to DIN specifications

The auto ID code (data matrix) guides you directly to the PICK server (Product Information Center KROHNE).
Scan the auto ID code on the device nameplate to download all product specific information.

- Handbooks, Quick Starts and Supplementary instructions
- Calibration certificates
- Factory settings as .bin file
- Parameter data sheets
- Digital nameplates

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 lasting direct exposure to the sun.
- Store the device in its original packaging.
- Storage temperature: -50...+70°C / -58...+158°F

3.3 Transport

Signal converter

- No special requirements.

Compact version

- Do not lift the device by the signal converter housing.
- Do not use lifting chains.
- To transport flange devices, use lifting straps. Wrap these around both process connections.

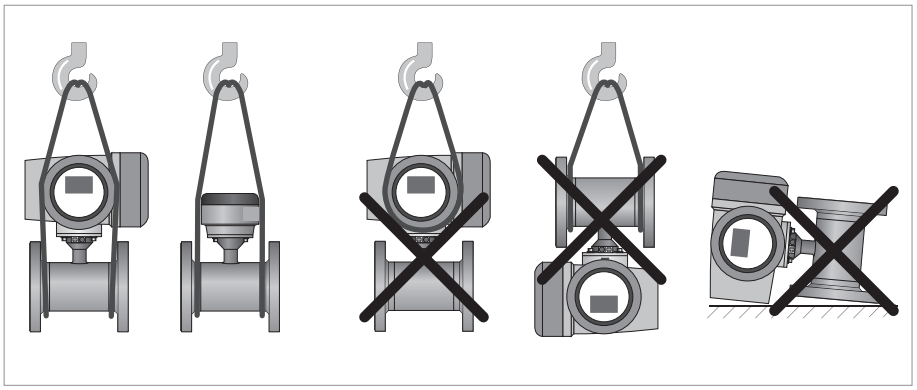


Figure 3-1: Transport

3.4 General requirements

INFORMATION!
The following precautions must be taken to ensure reliable installation.

- *Make sure that there is adequate space to the sides.*
- *Protect the signal converter from direct sunlight and install a sun shade if necessary.*
- *Signal converters installed in control cabinets require adequate cooling, e.g. by fan or heat exchanger.*
- *Do not expose the signal converter to intense vibrations and mechanical shocks. The measuring devices are tested for a vibration/shock level as described in the chapter "Technical data".*
- *Avoid magnetic field! Keep at least 5 DN distance between electromagnetic flow sensors.*

3.4.1 Vibrations

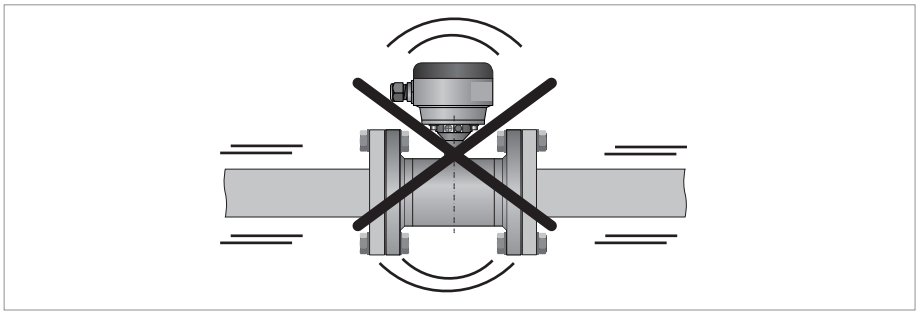


Figure 3-2: Avoid vibrations

3.4.2 Magnetic field

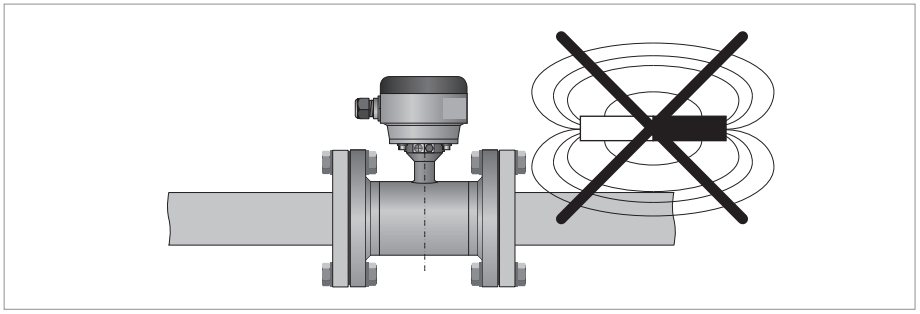


Figure 3-3: Avoid magnetic field

3.5 Installation conditions

For the highest measuring accuracy, respect the recommended inlet and outlet lengths in the following paragraphs. The flow sensor in combination with the IFC 300 signal converter, can be installed in a 0D/0D configuration (no inlet and no outlet length).

3.5.1 Inlet and outlet

Use straight inlet and outlet pipe sections to prevent flow distortion or swirl, caused by bends and T-sections.

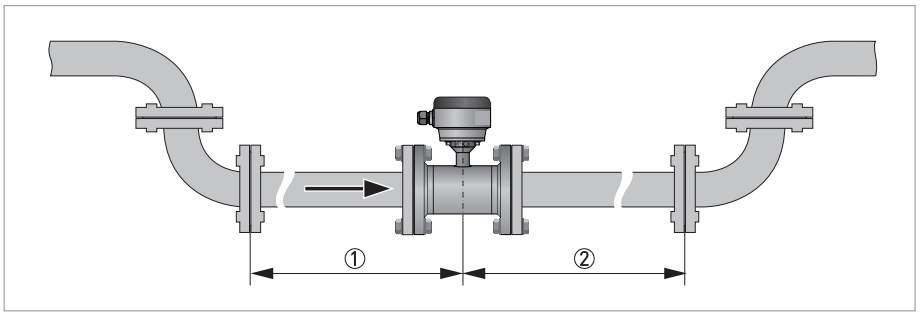


Figure 3-4: Recommended inlet and outlet section

① Refer to chapter "Bends in 2 or 3 dimensions"
② ≥ 2 DN

3.5.2 Bends in 2 or 3 dimensions

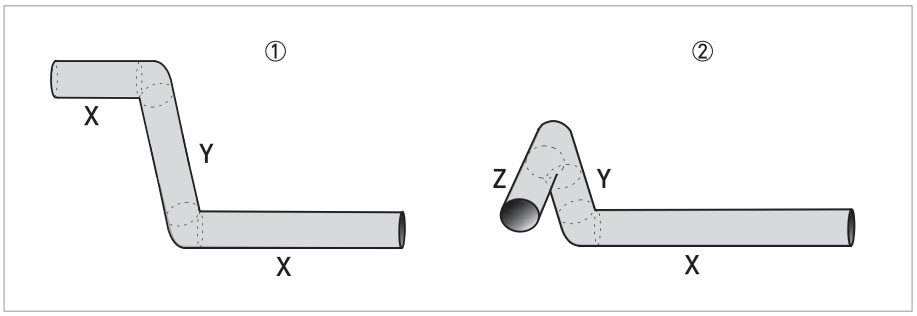


Figure 3-5: 2 and/or 3 dimensional bends upstream of the flowmeter

① 2 dimensions = X/Y
② 3 dimensions = X/Y/Z
Inlet length: using bends in 2 dimensions: ≥ 5 DN; when having bends in 3 dimensions: ≥ 10 DN

INFORMATION!
*2 dimensional bends occur in a vertical **or** horizontal plane (X/Y) only, while 3 dimensional bends occur in both vertical **and** horizontal plane (X/Y/Z).*

3.5.3 Bends

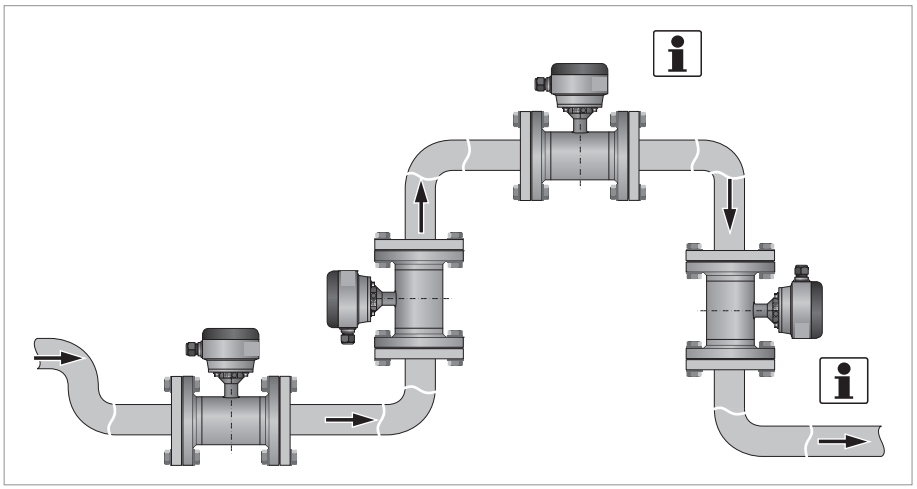


Figure 3-6: Installation in bending pipes (90°)

INFORMATION!
Recommended installation positions are at a lowered or ascending section of the pipeline installation. Installation at the highest point will enlarge the risk of flowmeter malfunction, because of air/gas bubbles.
Vertical installation in combination with an open discharge has to be avoided.
Vertical installation with a controlled back-pressure is possible.

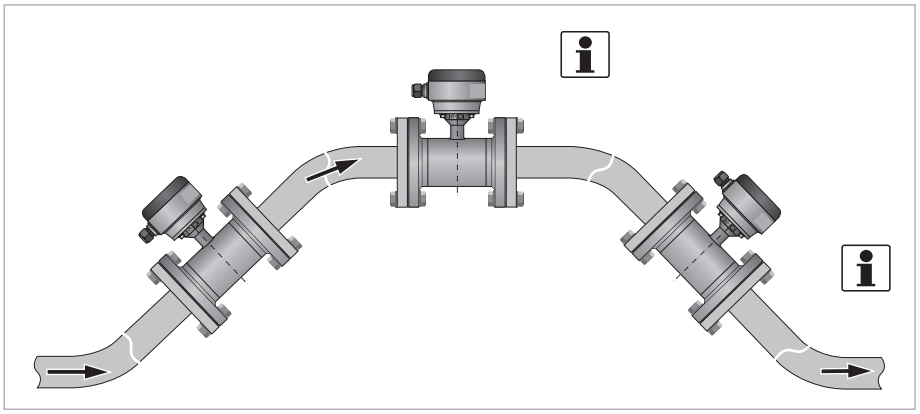


Figure 3-7: Installation in bending pipes (45°)

CAUTION!
Avoid draining or partial filling of the flow sensor.

INFORMATION!
Vertical installation on a descending slope in the pipeline is only recommended when the back-pressure is controlled.

3.6 T-section

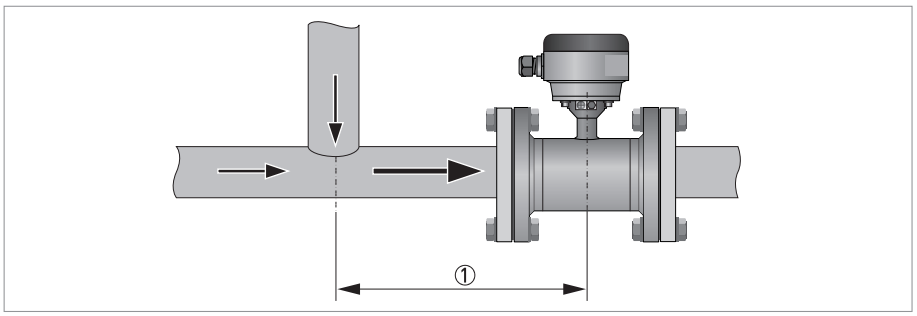


Figure 3-8: Distance behind a T-section

① ≥ 10 DN

3.7 Open discharge

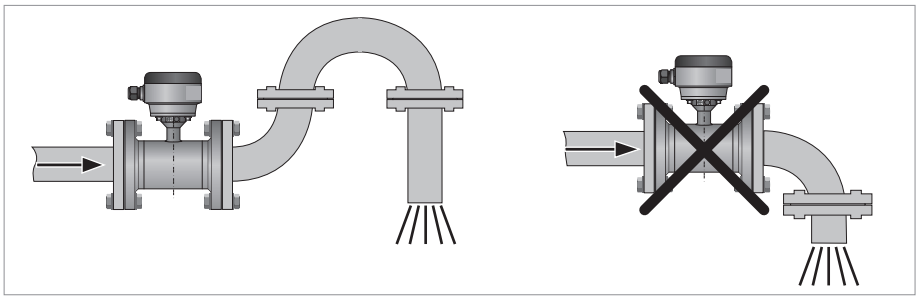


Figure 3-9: Installation in front of an open discharge

3.8 Control valve

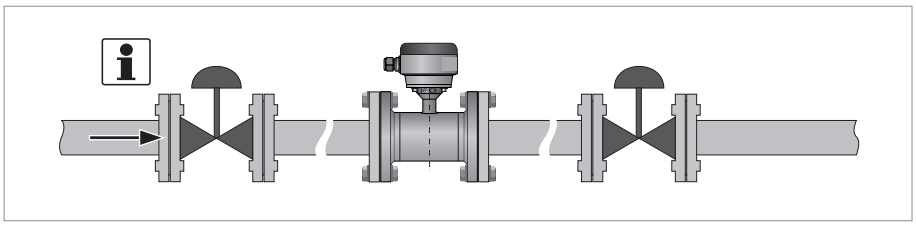


Figure 3-10: Installation in front of a control valve

INFORMATION!
Recommended position to install a flowmeter is upstream a control valve.
An electromagnetic flowmeter can be installed downstream of the control valve if there is no cavitation in the pipeline system (e.g. flow profile disturbances are resolved).

3.9 Pump

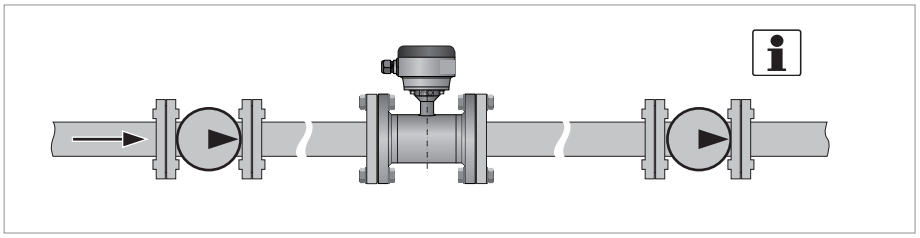


Figure 3-11: Installation behind a pump

INFORMATION!
Recommended position to install a flowmeter is downstream a pump (on a position where the flow disturbances of the pump are resolved).
An electromagnetic flowmeter can be installed in the suction line of a pump if there is no cavitation in the pipeline system.

3.10 Air venting and vacuum forces

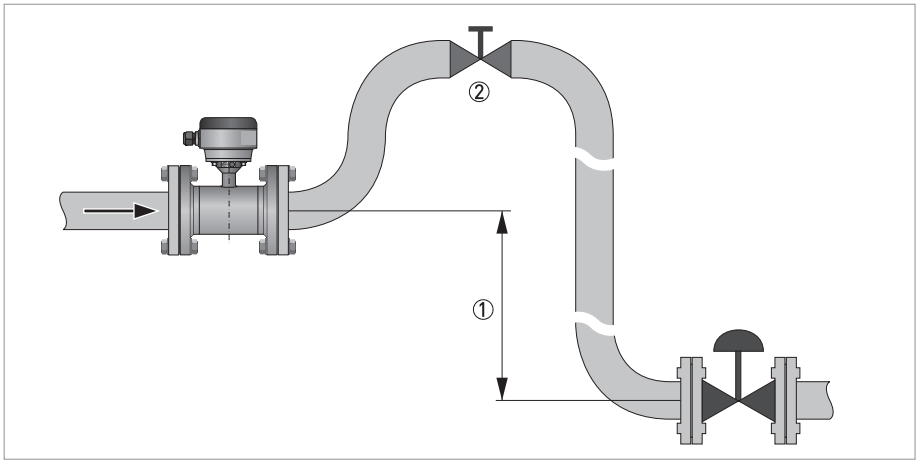


Figure 3-12: Air venting

① ≥ 5 m / 17 ft
② Air ventilation point

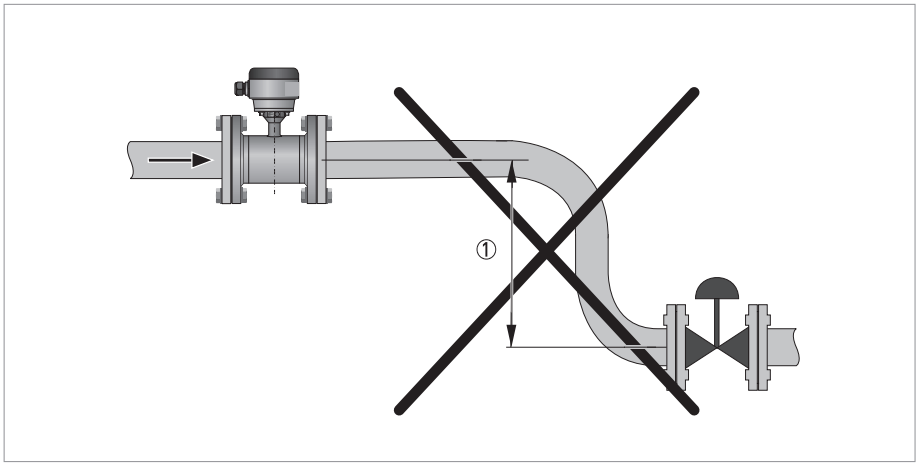


Figure 3-13: Vacuum

① ≥ 5 m / 17 ft

3.11 Flange deviation

CAUTION!
Max. permissible deviation of pipe flange faces:
L_{max} - L_{min} ≤ *0.5 mm / 0.02"*

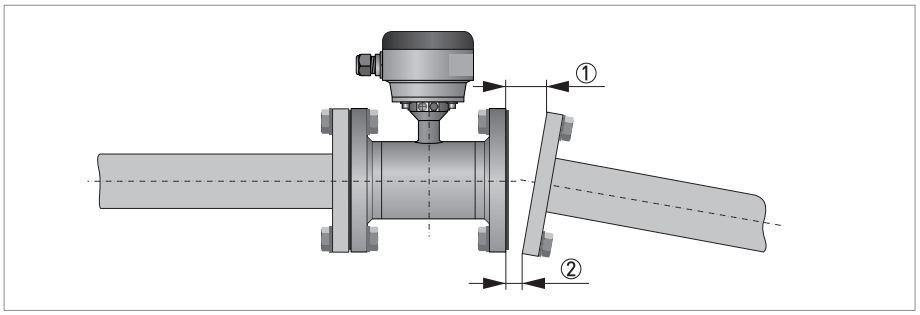


Figure 3-14: Flange deviation

① L_{max}
② L_{min}

3.12 Mounting position

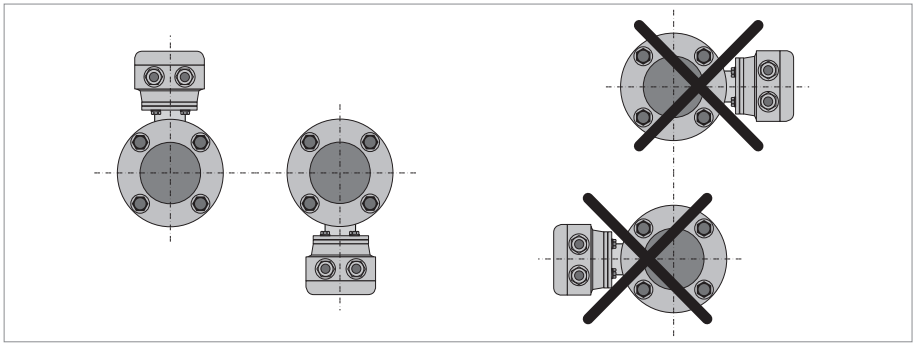


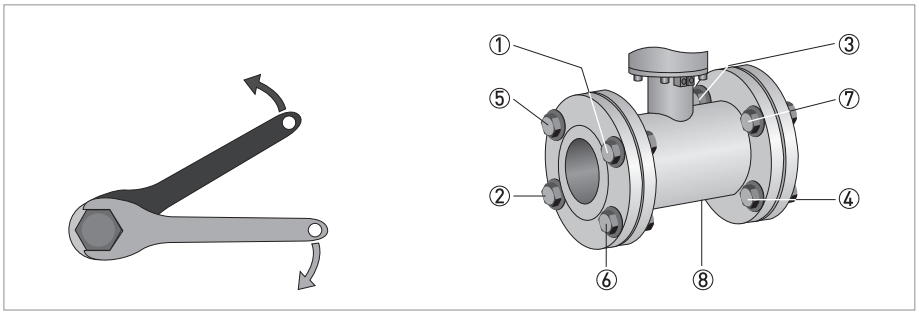
Figure 3-15: Mounting position

3.13 Mounting

3.13.1 Torques and pressures

Tighten the bolts in fixed order, see picture:

- Step 1: by hand
- Step 2: approx. 10% of max. torque
- Step 3: approx. 25% of max. torque
- Step 4: approx. 50% of max. torque
- Step 5: approx. 80% of max. torque
- Step 6: 100% of max. torque given in table



INFORMATION!
Diameters DN80 to DN300 have more bolts than the drawing in the picture above shows. Please continue in the same sequence to tighten the other bolts.

CAUTION!
With the instrument, 4 PTFE gaskets are delivered (2 gaskets to be used with installation, 2 as spare). There are no other gaskets required.

The specified torque values are dependent on variables (temperature, bolt material, gasket material, lubricants, etc.) which are not within the control of the manufacturer. Therefore the values should be regarded as indicative only.
The torque values in the following tables are based 8.8 bolts and a friction coefficient 0.14.

EN 1092-1

Nominal size DN [mm]	Pressure rating	Bolts	Recommended torque [Nm]	
			Min.	Max.
15	PN 40	4 x M 12	50	70
25	PN 40	4 x M 12	50	70
40	PN 40	4 x M 16	100	175
50	PN 40	4 x M 16	100	175
80	PN 40	8 x M 16	100	175
100	PN 16	8 x M 16	100	175
150	PN 16	8 x M 20	200	340
200	PN 10	8 x M 20	200	340
250	PN 10	12 x M 20	250	340
300	PN 10	12 x M 20	250	340

ASME B 16.5

Nominal size [inch]	Flange class [lb]	Bolts	Recommended torque [ftlb]	
			Min.	Max.
1/2	300	4 x 1/2"	40	80
1	150 / 300	4 x 1/2"	40	80
1 1/2	150 / 300	4 x 1/2"	60	80
2	150 / 300	4 x 5/8"	80	160
3	150 / 300	4 x 5/8"	100	160
4	150	8 x 5/8"	100	160
6	150	8 x 3/4"	150	280
8	150	8 x 3/4"	200	280
10	150	12 x 7/8"	250	450
12	150	12 x 7/8"	300	450

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 Grounding

DANGER!
The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

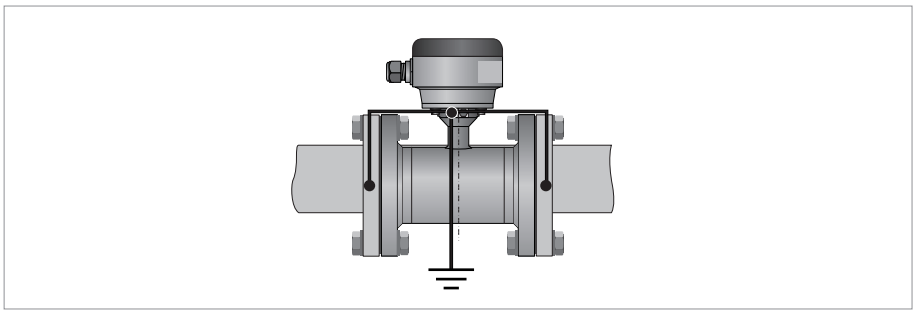


Figure 4-1: Grounding

Metal pipelines, not internally coated. Grounding without grounding rings.

INFORMATION!
Grounding can be omitted with Virtual reference (option on IFC 300 and IFC 400 converter). For detailed information refer to Virtual reference Option on page 23.

4.3 Virtual reference Option

CAUTION!
Only in combination with the IFC 300 and IFC 400 signal converter (C, W and F version)

Benefits of virtual reference:

- Grounding rings or grounding electrodes can be omitted.
- Safety increases by reducing the number of potential leakage points.
- The installation of the flowmeters is much easier.
- Compliant with OIML-R49 and MID MI-001 certification (IFC 300).

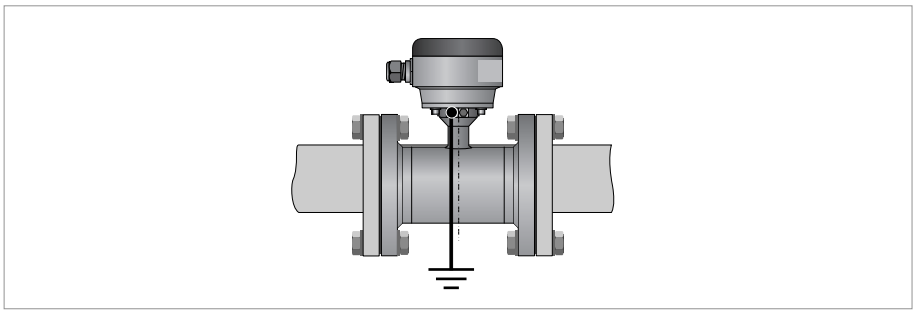


Figure 4-3: Virtual reference

Minimum requirements:

- Electrical conductivity: ≥ 200 µS/cm
- Signal cable: max. 50 m / 164 ft, type DS

INFORMATION!
Virtual reference cannot be activated when the IFC 400 is in the SIL mode.

4.4 Connection diagrams

INFORMATION!
For the connection diagrams, please refer to the documentation of the applicable 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 Repairs

Repairs must be carried out exclusively by the manufacturer or the manufacturer authorised specialist companies.

5.4 Returning the device to the manufacturer

5.4.1 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.*

5.4.2 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: Fax number:		Email address:
Manufacturer order number or serial number:		
The device has been operated with the following medium:		
This medium is:		radioactive
		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 caused by any residual media contained in this device when it is returned.		
Date:		Signature:
Stamp:		

5.5 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.

5.5.1 Disassembling and recycling



INFORMATION!
For information about disassembling and recycling, refer to the applicable documentation of the signal converter or consult product support.

6.1 Measuring principle

An electrically conductive fluid flows inside an electrically insulated pipe through a magnetic field. This magnetic field is generated by a current, flowing through a pair of field coils. Inside of the fluid, a voltage U is generated:
U = v * k * B * D

in which:
v = mean flow velocity
k = factor correcting for geometry
B = magnetic field strength
D = inner diameter of flowmeter

The signal voltage U is picked off by electrodes and is proportional to the mean flow velocity v and thus the flow rate Q. A signal converter is used to amplify the signal voltage, filter it and convert it into signals for totalizing, recording and output processing.

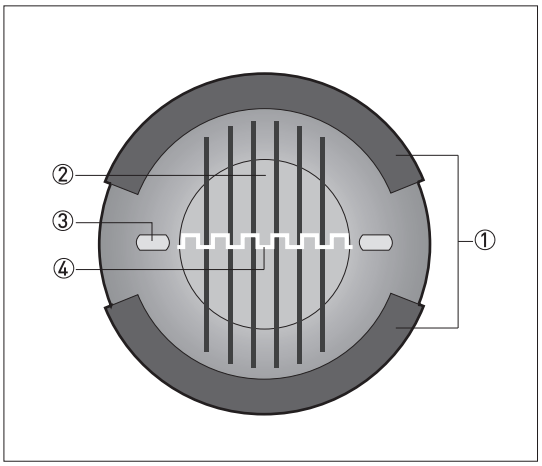


Figure 6-1: Measuring principle

① Field coils
② Magnetic field
③ Electrodes
④ Induced voltage (proportional to flow velocity)

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 (Download Center).*

Measuring system

Measuring principle	Faraday's law of induction
Application range	This electromagnetic flowmeter is designed exclusively to measure the flow and conductivity of electrically conductive, liquid media.
Measured value	
Primary measured value	Flow velocity
Secondary measured value	Volume flow, mass flow, electrical conductivity, coil temperature

Design

Features	Flanged version with optimized flow tube
Modular construction	The measurement system consists of a flow sensor and a signal converter. It is available as compact and as separate version. More information about the signal converter can be found in the relevant documentation.
Compact version	With IFC 050 signal converter : OPTIFLUX 5050 C
	With IFC 100 signal converter: OPTIFLUX 5100 C
	With IFC 300 signal converter : OPTIFLUX 5300 C
	With IFC 400 signal converter : OPTIFLUX 5400 C
Remote version	In wall (W) mount version with IFC 050 signal converter: OPTIFLUX 5050 W
	In wall (W) mount version with IFC 100 signal converter: OPTIFLUX 5100 W
	In field (F), wall (W) or rack (R) mount version with IFC 300 signal converter: OPTIFLUX 5300 F, W or R
	In field (F), wall (W) or rack (R) mount version with IFC 400 signal converter: OPTIFLUX 5400 F, W or R
Nominal diameter	DN15...300 / 1/2...12"

Measuring accuracy

Maximum measuring error	
	IFC 100: down to 0.3% of the measured value ± 1 mm/s
	IFC 300 and IFC 400: down to 0.15% of the measured value ± 1 mm/s
	Optionally: optimised accuracy for IFC 050 and IFC 100. For more details on optimised accuracy, seethe concerning signal converter documentation.
	The maximum measuring error depends on the installation conditions
	For detailed information refer to *Measuring accuracy* on page 42.
Repeatability	± 0.1% of MV, minimum 1 mm/s
Long term stability	± 0.1% of MV
Special calibration	On request

Operating conditions

Temperature	
Process temperature	Compact version: -40...+140°C / -40...+284°F
	Remote version: -40...+180°C / -40...+356°F
	For Ex versions different temperatures are valid. Please check the relevant Ex documentation for details.
Maximum temperature change (shock)	DN2.5...25 / 1/10...1": < 3 K/s
Ambient temperature	**Standard:** -40...+65°C / -40...+149°F
	Option: stainless steel version: -40...+55°C / -40...+130°F
	For Ex versions different temperatures are valid. Please check the relevant Ex documentation for details.
Protect electronics against self-heating at ambient temperatures above +55°C / +131°F.	
Storage temperature	-50...+70°C / -58...+158°F
Measurement range	-12...+12 m/s / -40...+40 ft/s
Pressure	
Ambient	Atmospheric
Nominal flange pressure	**Standard:**
EN 1092-1	DN200...300: PN 10
	DN100...150: PN 16
	DN15...80: PN 40
ASME B16.5	**Standard:**
	1...12": 150 lb
	1/2": 300 lb
	Option:
	1", 2", 3": 300 lb
Vacuum load	0 mbar / 0 psi
Pressure ranges for secondary containment	Pressure resistant up to 40 bar / 580 psi
	Burst pressure up to approximately 160 bar / 2320 psi
Chemical properties	
Physical condition	Conductive liquids
Electrical conductivity	Standard measurement
	For detailed information refer to the relevant signal converter document.
Permissible gas content (volume)	IFC 100, IFC 300 and IFC 400: ≤ 5%
Permissible solid content (volume)	IFC 050 and IFC 100: ≤ 10%
	IFC 300 and IFC 400: ≤ 70%

Installation conditions

Installation	Assure that the flow sensor is always fully filled
	For detailed information refer to *Installation* on page 12.
Flow direction	Forward and reverse
	Arrow on flow sensor indicates positive flow direction
Inlet run	≥ 5 DN (without disturbing flow, after a single 90° bend)
	≥ 10 DN (after a double bend = 2 x 90°)
Outlet run	≥ 2 DN
Dimensions and weights	For detailed information refer to *Dimensions and weights* on page 37.

Materials

Flow sensor housing	DN15...100 / 1/2...4": stainless steel AISI 316 / 1.4408
	DN150...300 / 6...12": sheet steel (carbon steel)
Flow sensor	Ceramic
Connection box (only remote versions)	Standard: die-cast aluminium
	Option: stainless steel
	Standard coating
Grounding rings	**Standard:**
	Not included
	Option:
	Virtual reference: only with IFC 300/ IFC 400 signal converter
Gaskets	PTFE, white
	Option: filled PTFE, blue (L-type) 25% carbon graphite filled PTFE, grey; Gylon 3504, blue
Measuring electrodes	**Standard:**
	Cermet

Process connections

EN 1092-1	DN200...300: PN 10
	DN100..150: PN 16
	DN15...80: PN 40
ASME	**Standard:**
	1...12": 150 lb
	1/2": 300 lb
	Option:
	1", 2", 3": 300 lb

Electrical connections

For full detail, see the relevant documentation of the signal converter.	
Signal cable for remote systems only.	
Type A (DS)	**In combination with the IFC 050, IFC 100, IFC 300 and IFC 400 signal converter.**
	Standard cable, double shielded. Max. length: 600 meter / 1950 feet (depends on the electrical conductivity and flow sensor).
Type B (BTS)	**Only in combination with the IFC 300 and IFC 400 signal converter**
	Optional cable, triple shielded. Max. length: 600 meter / 1950 feet (depends on electrical conductivity and flow sensor).
I/O	For more details of the I/O options, including data streams and protocols, see technical data of the relevant signal converter.

Approvals and certifications

CE mark	
This device fulfils the statutory requirements of the relevant directives. The manufacturer certifies successful testing of the product by applying the conformity mark on the device.	
	For more information on the directives, standards and the approved certifications, please refer to the declaration of conformity supplied with the device or downloadable from the manufacturer's website.
Hazardous areas	
ATEX	Please check the relevant Ex documentation for details.
	In combination with IFC 050 and IFC 100 signal converter: II 2 GD
	In combination with IFC 300 signal converter: II 2 GD or II 2 (1) GD
	Remote version: II 2 GD
	Consult IFC 300 manual for EEx i and non-EEx i I/O modules
FM	Only for diameters DN15...100 / 1/2...4" **In combination with IFC 300 C or F signal converter**
	Class I, Div. 2, groups A, B, C and D
	Class II, Div. 2, groups F and G
	Class III, Div. 2
CSA	Only for diameters DN15...100 / 1/2...4" **In combination with IFC 300 C or F signal converter**
	Class I, Div. 2; groups A, B, C and D
	Class II, Div. 2; groups F and G
IEC-Ex	pending
Other approvals and standards	
Custody transfer	**Standard:** without verification
	Option: MI-001, MI-005 type examination certificate
	MID Annex III (MI-001) according Directive 2014/32/EU
	Option: cold water: MI-001 type examination for DN25...100 / 1...4"
	Liquids other than water: MI-005 type examination for DN25...100 / 1...4"
	OIML R49 - R117 certificate of conformity
	Conformity with ISO4064 and EN14154
	Only in combination with IFC 300 signal converter.
Protection category acc. to IEC 60529	Standard: IP 66 / 67, NEMA 4 / 4X / 6 IFC 100 stainless steel: IP 67 / 69
	Option: IP 68, NEMA 6P
Hygiene	Ceramic tube: FDA approved material
Shock test	IEC 60068-2-27
	30 g for 18 ms
Vibration test	IEC 60068-2-64
	f = 20...2000 Hz, rms = 4.5 g, t = 30 min

6.3 Legal metrology

INFORMATION!
*OIML R49 and MID Annex MI-001 and MI-005 version is **only** available in combination with the IFC 300 signal converter!*

6.3.1 OIML R49

The OPTIFLUX 5300 has a certificate of conformity with the international recommendation OIML R49-1. The certificate has been issued by NMi (Dutch board of weight and measures).

The OIML R49 -1 concerns water meters intended for the metering of cold potable and hot water. The measuring range of the flowmeter is determined by Q3 (nominal flow rate) and R (ratio).

The OPTIFLUX 5300 meets the requirements for water meters of accuracy class 1 and 2.

The following accuracy can be met in all installation orientations (horizontal, vertical or diagonal) and with flow profile sensitivity class 0DN / 0DN (0 x DN upstream and 0 x DN downstream).

- For accuracy class 1, the maximum permissible error for water meters is ± 1% for the upper flow rate zone and ± 3% for the lower flow rate zones.
- For accuracy class 2, the maximum permissible error for water meters is ± 2% for the upper flow rate zone and ± 5% for the lower flow rate zones.

Q1 = Q3 / R

Q2 = Q1 * 1.6

Q3 = Q1 * R

Q4 = Q3 * 1.25



Figure 6-2: ISO flow rates added to figure as comparison towards OIML
X: Flow rate
Y [%]: Maximum measuring error

① ± 3% for class 1, ± 5% for class 2 devices
② ± 1% for class 1, ± 2% for class 2 devices

OIML R49 Class 1

DN	Span (R)	Flow rate [m^3/h]			
		Minimum Q1	Transitional Q2	Permanent Q3	Overload Q4
50	400	0.10	0.16	40	50
65	630	0.1587	0.254	100	125
80	630	0.2540	0.4063	160	200
100	630	0.3968	0.6349	250	312.5

OIML R49 Class 2

DN	Span (R)	Flow rate [m^3/h]			
		Minimum Q1	Transitional Q2	Permanent Q3	Overload Q4
25	400	0.04	0.064	16	20
32	400	0.0625	0.1	25	31.25
40	400	0.0625	0.1	25	31.25

6.3.2 MID Annex III (MI-001)

All new designs of flow meters that are to be used for legal purposes in Europe require certification under the Measurement Instrument Directive (MID) 2014/32/EU, Annex III (MI-001). Annex MI-001 of the MID applies to water meters intended for the measurement of volume of clean, cold or heated water in residential, commercial and light industrial use. An EC-type examination certificate is valid in all countries of the European Union.

The OPTIFLUX 5300 has a type examination certificate and can be verified to the MID Annex III (MI-001) for water meters with diameter DN25...100.
The conformity assessment procedure followed for OPTIFLUX 5300 is Module B (Type Examination) and Module D (Quality Assurance of the Production Process).

The following accuracy can be met in all installation orientations (horizontal, vertical or diagonal) and with flow profile sensitivity class 0DN / 0DN (0 x DN upstream and 0 x DN downstream).

- The maximum permissible error on volumes delivered between Q2 (transitional) flow rate and Q4 (overload) flow rate is ± 2%.
- The maximum permissible error on volumes delivered between Q1 (minimum) flow rate and Q2 (transitional) flow rate is ± 5%.

Q1 = Q3 / R

Q2 = Q1 * 1.6

Q3 = Q1 * R

Q4 = Q3 * 1.25

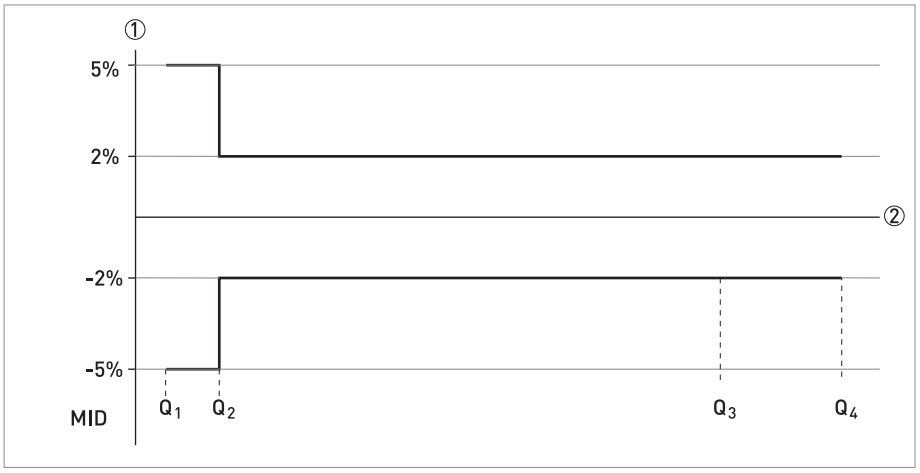
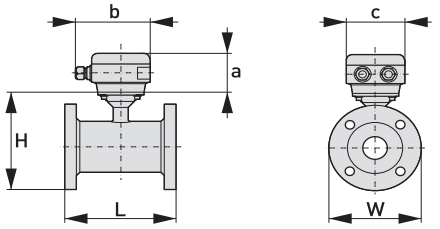
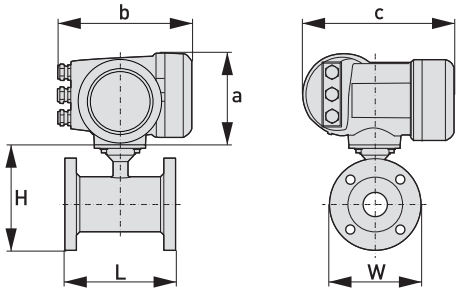
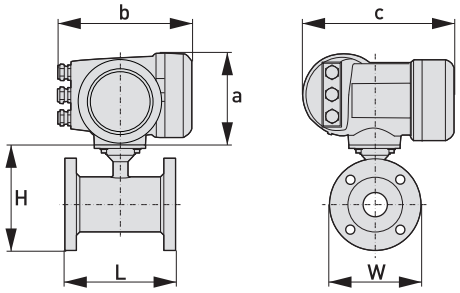
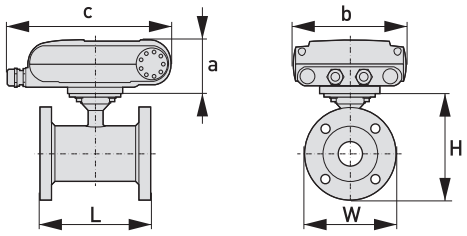


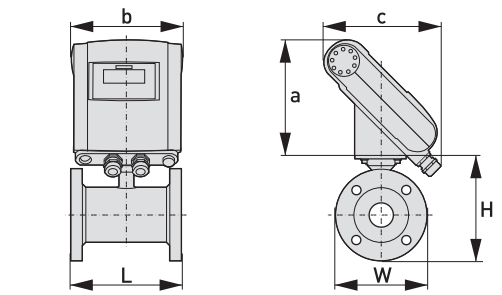
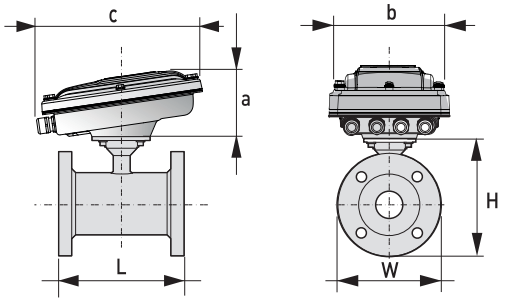
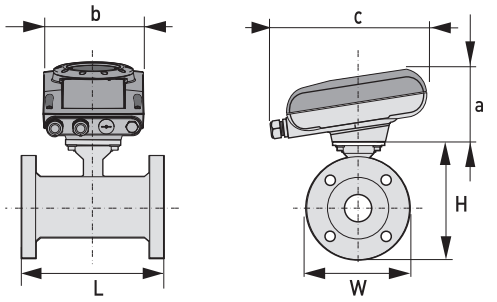
Figure 6-3: ISO flow rates added to figure as comparison towards MID
X: Flow rate
Y [%]: Maximum measuring error

MI-001 certified flow characteristics

DN	Span (R) Q3 / Q1	Flow rate [m^3/h]			
		Minimum Q1	Transitional Q2	Permanent Q3	Overload Q4
25	400	0.04	0.064	16	20
32	400	0.0625	0.10	25	31.25
40	400	0.0625	0.10	25	31.25
50	400	0.10	0.16	40	50
65	625	0.1587	0.254	100	125
80	640	0.254	0.4063	160	200
100	625	0.3968	0.6349	250	312.5

6.4 Dimensions and weights

Remote version		a = 88 mm / 3.5" b = 139 mm / 5.5" ① c = 106 mm / 4.2" Total height = H + a
Compact version with: **IFC 300**		a = 155 mm / 6.1" b = 230 mm / 9.1" ① c = 260 mm / 10.2" Total height = H + a
Compact version with: **IFC 400**		a = 160 mm / 6.3" b = 240 mm / 9.5" ① c = 260 mm / 10.2" Total height = H + a
Compact version with: **IFC 100 (0°)**		a = 82 mm / 3.2" b = 161 mm / 6.3" c = 257 mm / 10.1" ① Total height = H + a

Compact version with: **IFC 100 (45°)**		a = 186 mm / 7.3" b = 161 mm / 6.3" c = 184 mm / 2.7" ① Total height = H + a
Compact version **with stainless steel** **IFC 100 (10°)**		a = 100 mm / 4" b = 187 mm / 7.36" ① c = 270 mm / 10.63" Total height = H + a
Compact version with: **IFC 050 (10°)**		a = 100mm / 4" b = 157 mm / 6.18" ① c = 260 mm / 10.24" Total height = H + a

① The value may vary depending on the used cable glands.

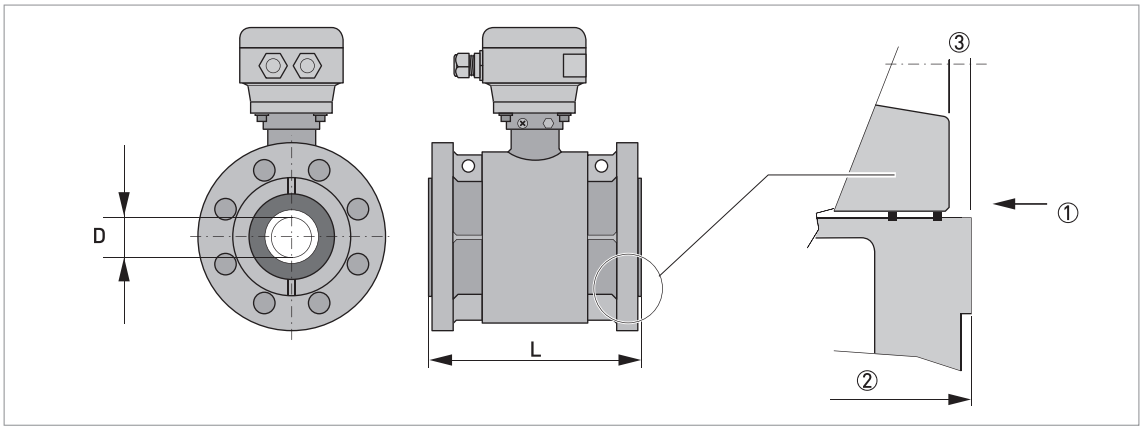


Figure 6-4: Construction details DN25...300 / 1...12"

① Detail ceramics, flange and gaskets, see options in following illustration
② Length tolerances (see table on following pages)
③ Gasket area

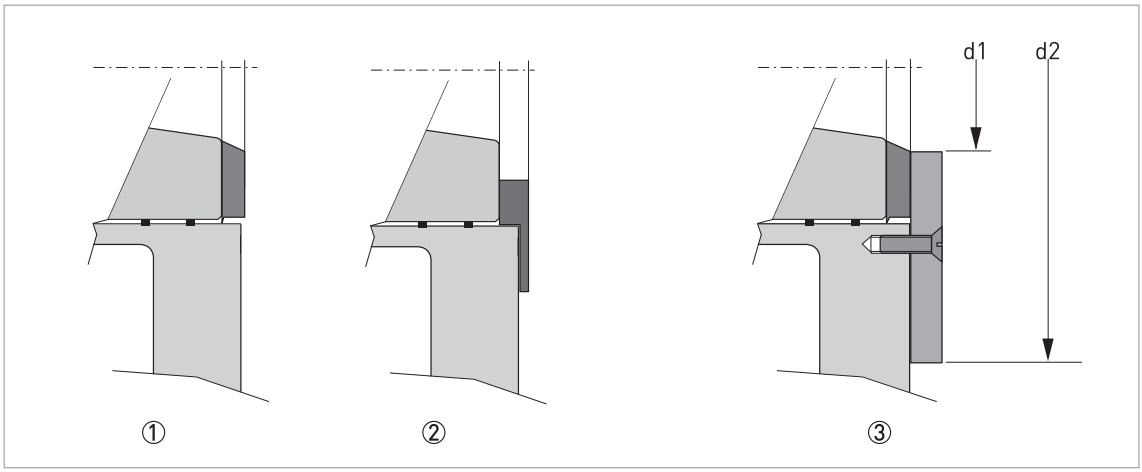


Figure 6-5: Details of gasket options

① Sealing ring: PTFE (white)
Optional: conductive PTFE (grey) / Gylon 3504 (blue)
② Sealing ring for rounded counter flanges: filled PTFE (blue)
③ DN150...300 / 6...12"; optional spacer ring with gasket

INFORMATION!

- *All data given in the following tables are based on standard versions of the flow sensor only.*
- *Especially for smaller nominal sizes of the flow sensor, the signal converter can be bigger than the flow sensor.*
- *Note that for other pressure ratings than mentioned, the dimensions may be different.*
- *For full information on signal converter dimensions see relevant documentation.*

EN 1092-1

Size	Dimensions [mm]							Approx. weight [kg]
DN	L + *	tolerance	H	W	D	Ød1	Ød2	
15	150	A	127	95	12	-	-	3
25	150	A	143	115	20	-	-	4
40	150	A	168	150	30	-	-	6
50	200	A	184	165	40	-	-	9
80	200	A	217	200	60	-	-	15
100	250	A	242	220	80	-	-	21
150	250	B	355	283	150	150	215	37
200	300	B	396	342	200	198	270	53
250	350	B	458	395	250	250	322	87
300	450	B	493	445	300	300	375	145

INFORMATION!

*L + **

- *Add approximately 2 x 7.5 mm to L when using spacer rings (option for DN150...300).*
- *Add approximately 2 x 1.45 mm to L when using filled blue PTFE gaskets (optional).*

INFORMATION!

Tolerances A & B

- *A = + 0.8 / - 0.4 mm; + 0.031 / - 0.016 inches*
- *B = + 0.5 / - 1.0 mm; + 0.02 / - 0.04 inches*

ASME B 16.5 150 lb

Size	Dimensions [inches]							Approx. weight [lb]
inch	L + *	tolerance	H	W	D	Ød1	Ød2	
1"	5.91	A	5.47	4.25	0.79	-	-	8.8
1 1/2"	5.91	A	6.18	5	1.18	-	-	13.2
2"	7.87	A	6.89	6	1.57	-	-	19.8
3"	7.87	A	8.39	7.5	2.36	-	-	33.1
4"	9.84	A	9.65	9	3.15	-	-	46.3
6"	9.84	B	13.98	11	5.91	6.06	8.46	81.6
8"	11.81	B	15.59	13.5	7.80	7.99	10.63	116.8
10"	13.78	B	18.03	16	9.84	10.08	12.68	191.8
12"	17.72	B	19.41	19	11.81	12.05	14.76	366

ASME B 16.5 300 lb

Nominal size	Dimensions [inches]					Approx. weight [lb]
inch	L	H	W	D	Ød1	
1"	5.91	5.91	4.92	0.79	1.02	8.8
2"	7.87	7.20	6.50	1.57	2.01	22.9
3"	7.87	8.86	8.27	2.36	3.15	40.6



CAUTION!

- *Pressures at 20°C / 68°F.*
- *For higher temperatures, the pressure and temperature ratings are as per ASME B16.5.*



INFORMATION!

*L + **

- *Add approximately 2 x 0.3" to L when using spacer rings (option for 6"...12").*
- *Add approximately 2 x 0.055" to L when using filled blue PTFE gaskets (optional).*



INFORMATION!

Tolerances A & B

- *A = + 0.8 / - 0.4 mm; + 0.031 / - 0.016 inches*
- *B = + 0.5 / - 1.0 mm; + 0.02 / - 0.04 inches*

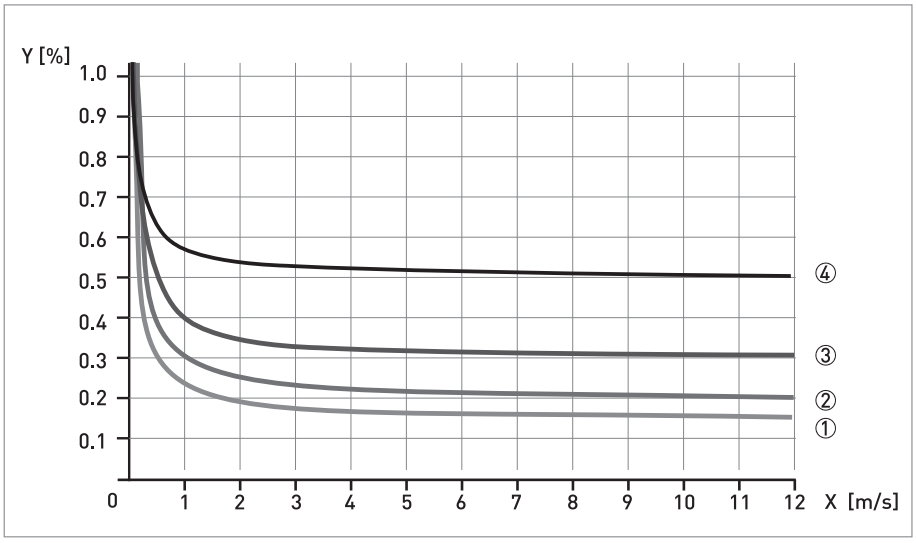
6.5 Measuring accuracy

Every electromagnetic flowmeter is calibrated by direct volume comparison. The wet calibration validates the performance of the flowmeter under reference conditions against accuracy limits.

The accuracy limits of electromagnetic flowmeters are typically the result of the combined effect of linearity, zero point stability and calibration uncertainty.

Reference conditions

- Medium: water
- Temperature: +5...+35°C / +41...+95°F
- Operating pressure: 0.1...5 barg / 1.5...72.5 psig
- Inlet section: ≥ 5 DN
- Outlet section: ≥ 2 DN



X [m/s]: flow velocity
Y [%]: deviation from the actual measured value (MV)

Accuracy

Compact with IFC 300/ IFC 400	Accuracy	Curve
DN15...100 / 1/2...4"	± 0.15% of MV + 1 mm/s	①
DN150...300 / 6...12"	± 0.2% of MV + 1 mm/s	②

Compact with IFC 100	Accuracy	Curve
DN15...300 / 1/2...12"	± 0.3% of MV + 1 mm/s	③

INFORMATION!
Optionally for IFC 050 and IFC 100; extended calibration at 2 points for optimised accuracy.
For more details on optimised accuracy, see the concerning signal converter documentation.

KROHNE – Products, Solutions and Services

- Process instrumentation for flow, level, temperature, pressure measurement and process analytics
- Flow metering, monitoring, wireless and remote metering solutions
- Engineering, commissioning, calibration, maintenance and training services

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