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.

KROHNE

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1.1 Intended use

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

1.2 Safety instructions from the manufacturer

1.2.1 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.

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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.

1.2.2 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.

1.2.3 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.

1.2.4 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.

1.2.5 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.

1.3 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!
Check the packing list to check if you received completely all that you ordered.

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!
The device will arrive in two cartons. One carton contains the converter and one carton contains the sensor.

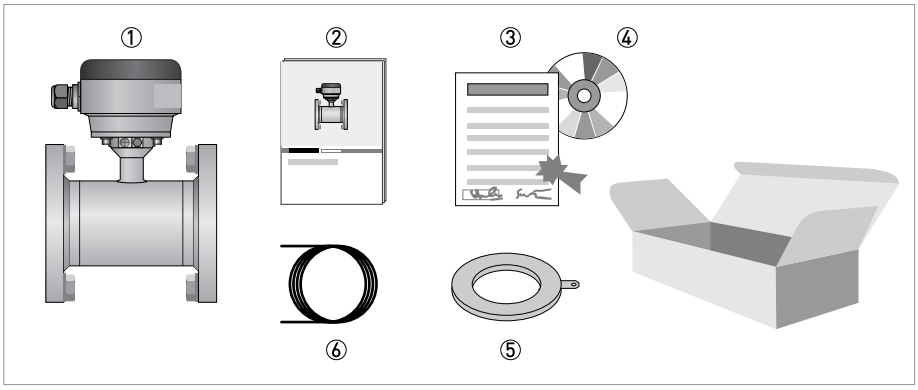


Figure 2-1: Scope of delivery

① Ordered flowmeter
② Product documentation
③ Factory calibration report
④ CD-ROM with product documentation
⑤ Grounding rings (optionally)
⑥ Cable (remote versions only)

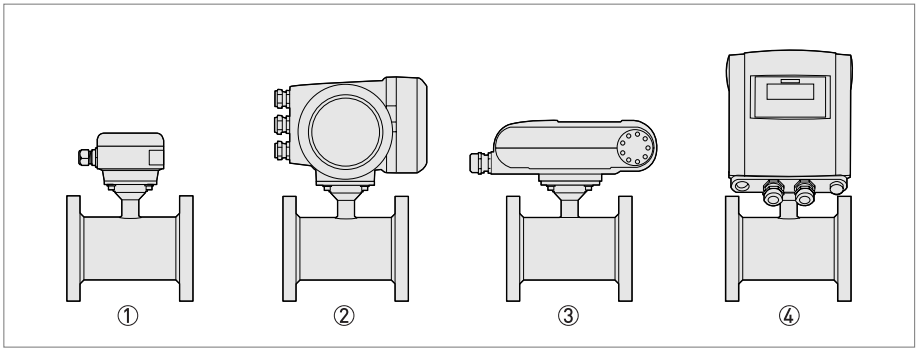
INFORMATION!
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

2.2 Device description

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:

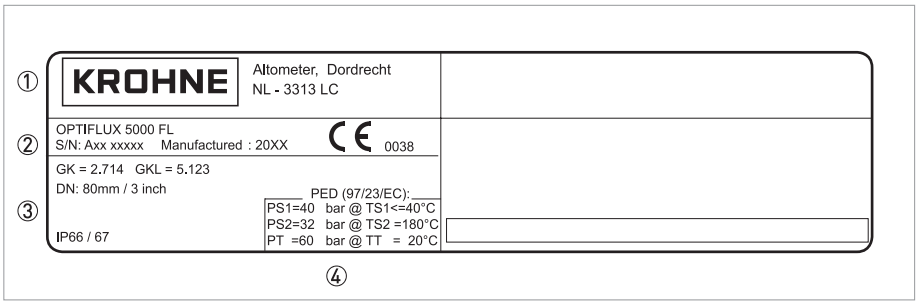
- Compact version (the signal converter is mounted directly on the measuring sensor)
- Remote version (electrical connection to the measuring sensor via field current and signal cable)



① Remote version
② Compact version with IFC 300 signal converter
③ Compact version with IFC 100 (0°) signal converter
④ Compact version with IFC 100 (45°) signal converter

2.3 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.



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

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 lasting direct exposure to the sun.
- Store the device in its original packing.

3.3 Transport

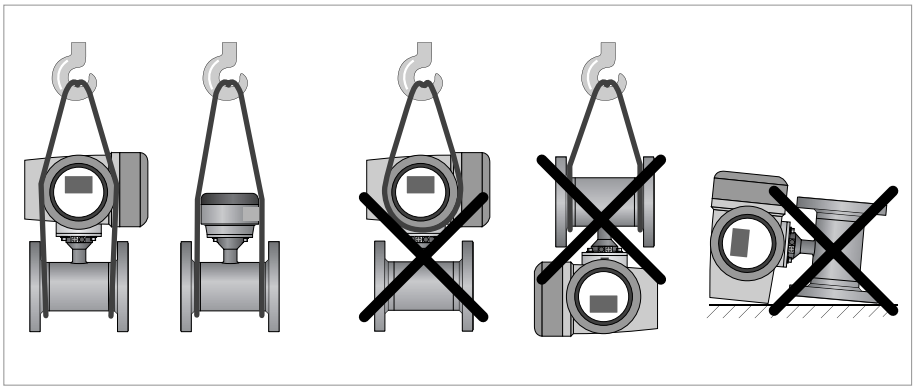


Figure 3-1: Transport

3.4 Installation conditions

3.4.1 Inlet and outlet

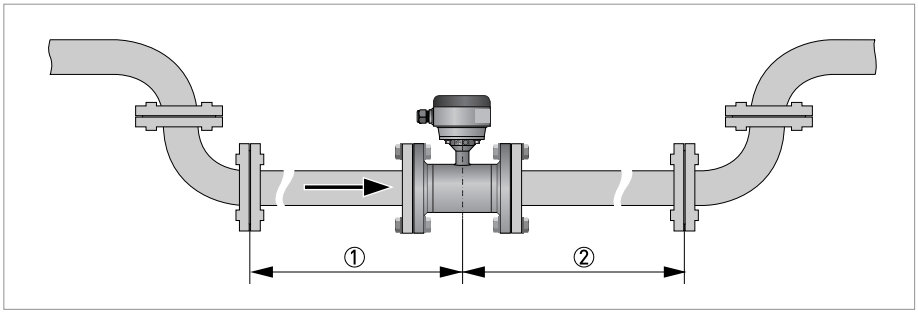


Figure 3-2: Recommended inlet and outlet sections

① ≥ 5 DN
② ≥ 2 DN

3.4.2 Mounting position

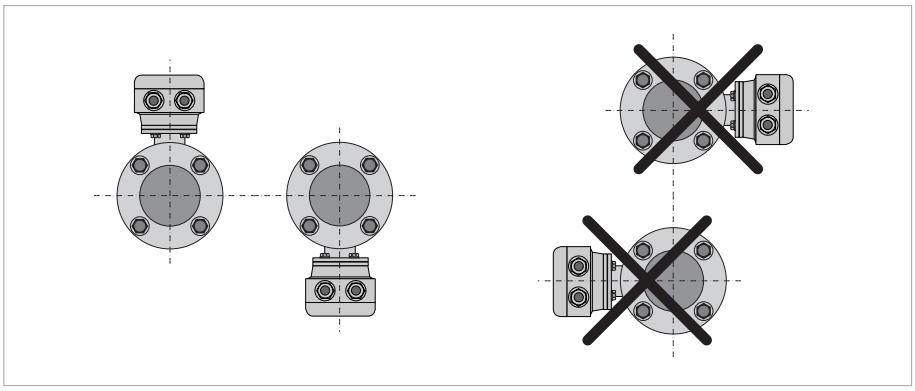


Figure 3-3: Mounting position

3.4.3 Flange deviation

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

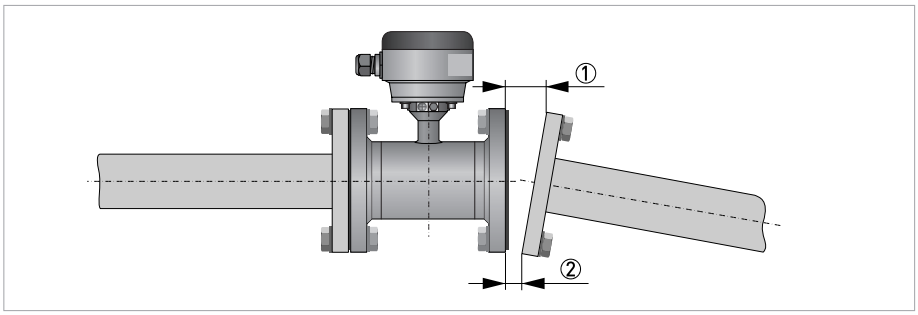


Figure 3-4: Flange deviation

① L_{max}
② L_{min}

3.4.4 T-section

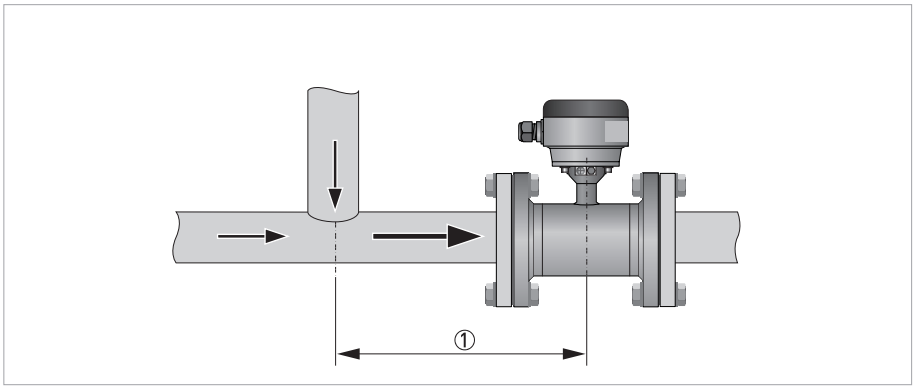


Figure 3-5: Distance after T-sections

① ≥ 10 DN

3.4.5 Vibration

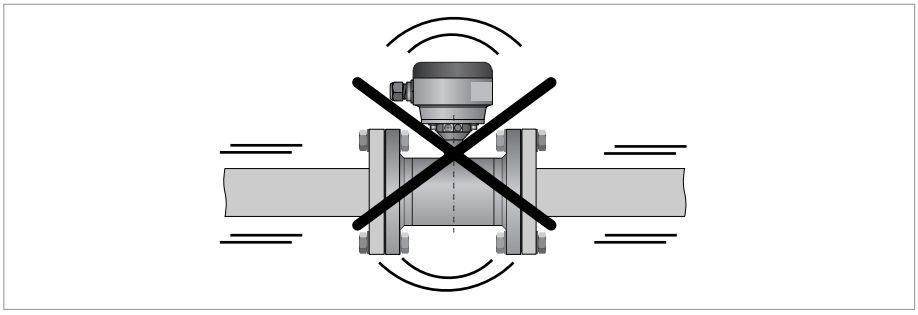


Figure 3-6: Avoid vibrations

3.4.6 Magnetic field

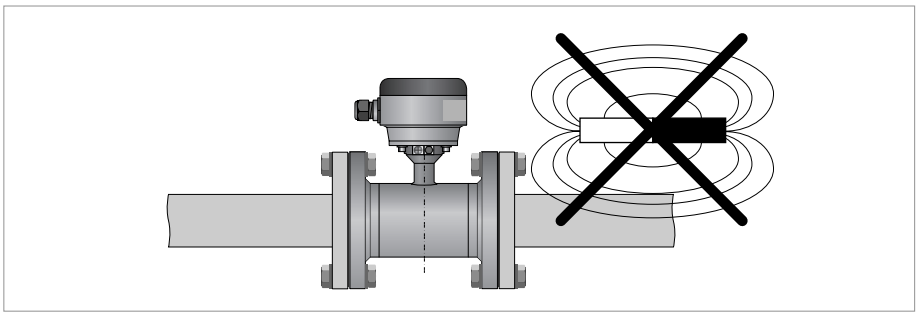


Figure 3-7: Avoid magnetic fields

3.4.7 Bends

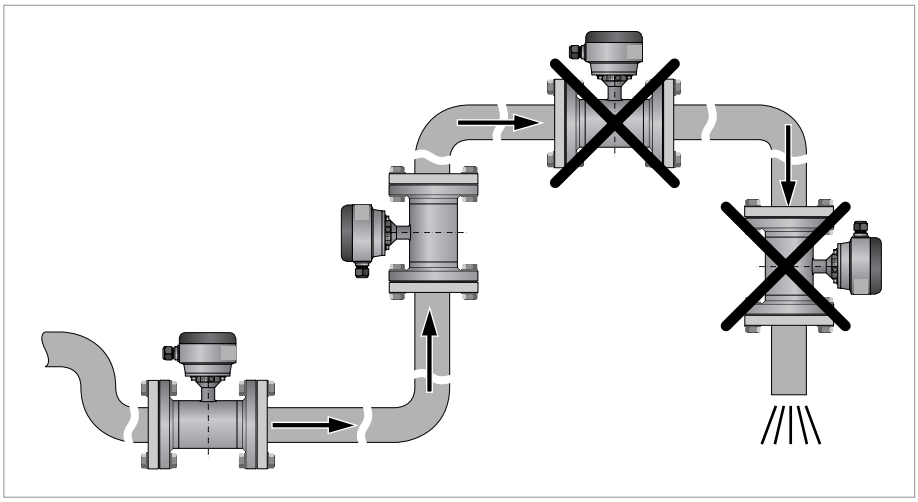


Figure 3-8: Installation in bending pipes

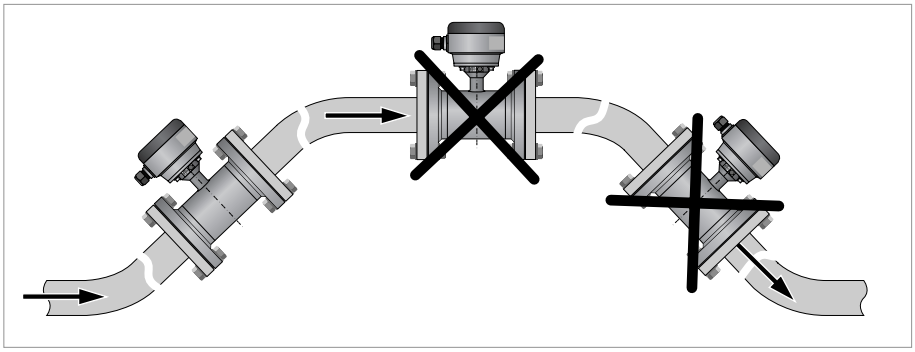


Figure 3-9: Installation in bending pipes

3.4.8 Open discharge

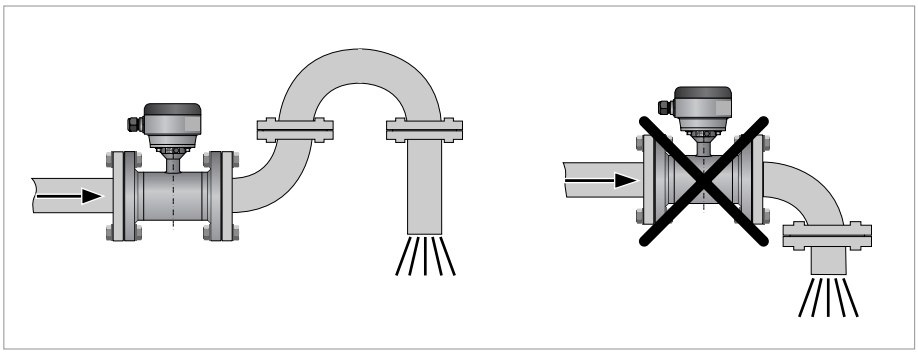


Figure 3-10: Installation before an open discharge

3.4.9 Control valve

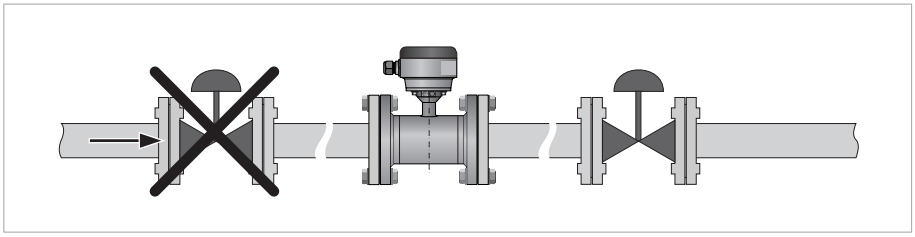


Figure 3-11: Installation before control valve

3.4.10 Air venting

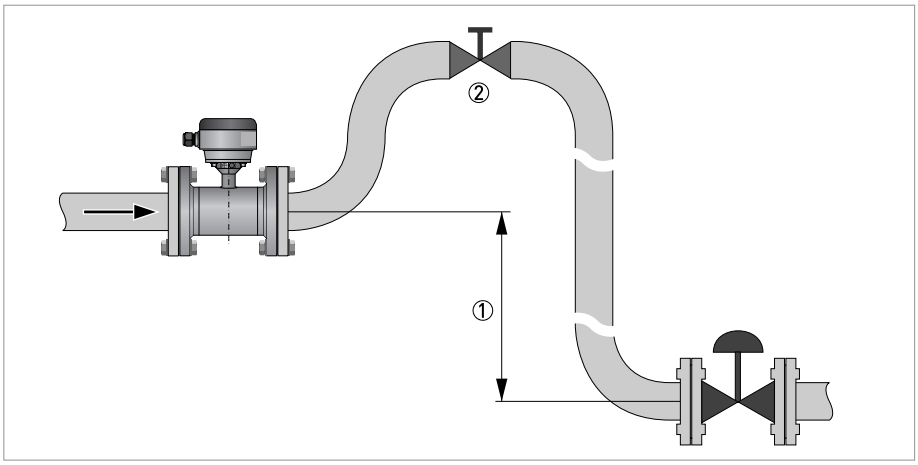


Figure 3-12: Air venting

① ≥ 5 m
② Air ventilation point

3.4.11 Pump

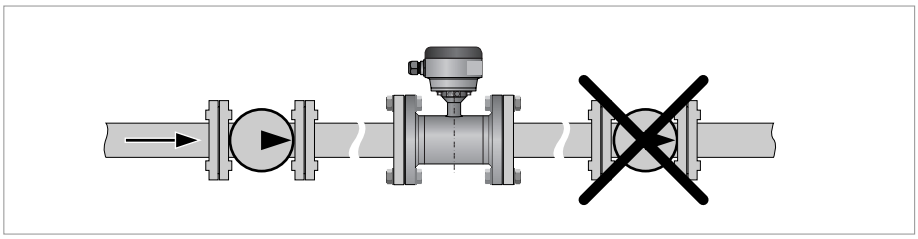


Figure 3-13: Installation after pump

3.5 Mounting

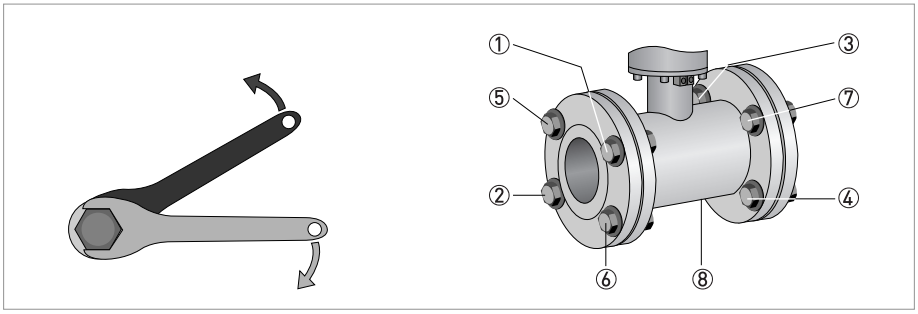
3.5.1 Torques and pressures

WARNING!
Please use "not lubricated" Stainless steel A2 / 6.9 class bolts.

DN15...100

Tighten the bolts in fixed order, see picture:

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



INFORMATION!
Diameters DN80 and DN100 have 8 holes per flange, please continue in the same way to tighten the other bolts.

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

EN 1092-1

Nominal size DN [mm]	Pressure rating	Bolts	Max. torque [Nm]
15	PN 40	4 × M 12	73.5
25	PN 40	4 × M 12	73.5
40	PN 40	4 × M 16	178
50	PN 40	4 × M 16	178
80	PN 40	8 × M 16	178
100	PN 16	8 × M 16	178

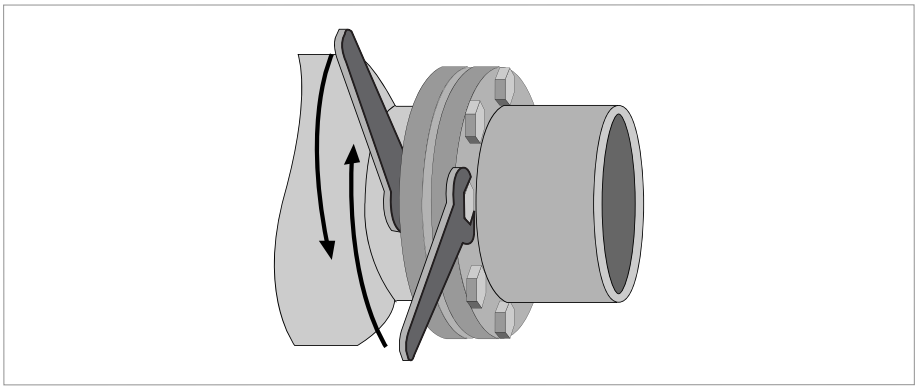
ASME B 16.5

Nominal size [inch]	Flange class [lb]	Bolts	Max. torque [ftlb]
1/2	300	4 × 1/2"	40
1	150 / 300	4 × 1/2"	40
1 1/2	150 / 300	4 × 1/2"	40
2	150 / 300	4 × 5/8"	97
3	150 / 300	4 × 5/8"	97
4	150	8 × 5/8"	97

DN150...300

Tighten the bolts:

- Step 1: approx. 50% of max. torque
- Step 2: approx. 80% of max. torque
- Step 3: 100% of max. torque given in table



EN 1092-1

Nominal size DN [mm]	Pressure rating	Bolts	Max. torque [Nm]
150	PN 16	8 × M 20	①
200	PN 10	8 × M 20	①
250	PN 10	12 × M 20	①
300	PN 10	12 x M 20	①

① Max. torque depends on the gaskets used by the end-user.

ASME B 16.5

Nominal size [inch]	Flange class [lb]	Bolts	Max. torque [ftlb]
6	150	8 × 3/4"	①
8	150	8 × 3/4"	①
10	150	12 × 7/8"	①
12	150	12 x 7/8"	①

① Max. torque depends on the gaskets used by the end-user.

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.

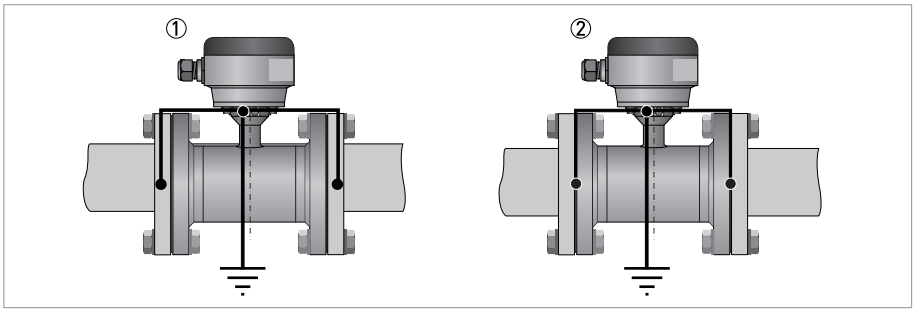


Figure 4-1: Grounding

① Metal pipelines, not internally coated. Grounding without grounding rings.
② Metal pipelines with internal coating and non-conductive pipelines. Grounding with grounding rings.

Figure 4-2: Grounding ring number 1

Grounding ring number 1 (for type VN20):

- 3 mm / 0.1" thick (tantalum: 0.5 mm / 0.1")

4.3 Virtual reference for IFC 300 (C, W and F version)

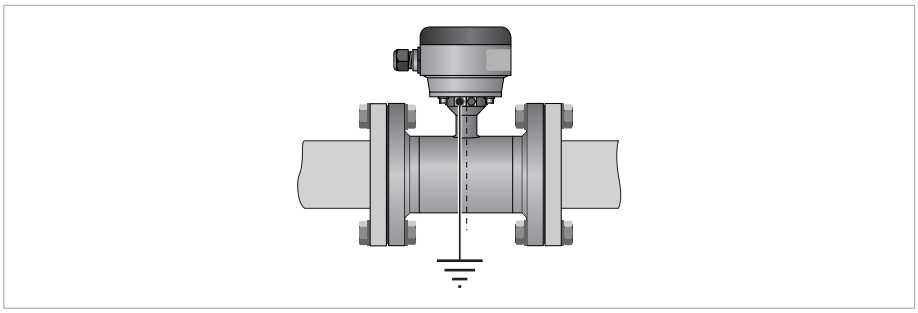


Figure 4-3: Virtual reference

Possible if:

- ≥ DN10
- Electrical conductivity ≥ 200 µS/cm
- Electrode cable max. 50m., type DS

4.4 Connection diagrams

INFORMATION!
For the connection diagrams please refer to the documentation of the applicable converter.

5.1 Spare parts availability

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

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

5.2 Availability of services

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

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

5.3 Returning the device to the manufacturer

5.3.1 General information

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

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

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

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

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

5.3.2 Form (for copying) to accompany a returned device

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

5.4 Disposal

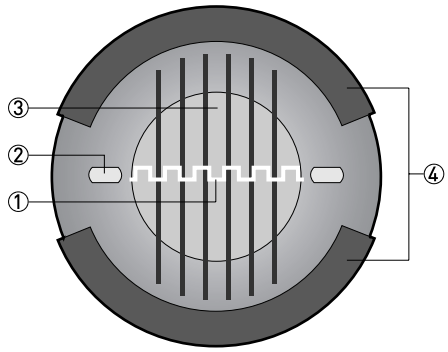
CAUTION!
Disposal must be carried out in accordance with legislation applicable in your country.

6.1 Measuring principle

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 flow meter

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 totalising, recording and output processing.



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

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	Faraday's law of induction
Application range	Electrically conductive fluids
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 100 converter: OPTIFLUX 5100 C
	With IFC 300 converter: OPTIFLUX 5300 C
Remote version	In wall (W) mount version with IFC 100 converter: OPTIFLUX 5100 W
	In field (F), wall (W) or rack (R) mount version with IFC 300 converter: OPTIFLUX 5300 F, W or R
Nominal diameter	DN15...300 / ½...12"
Measurement range	-12...+12 m/s / -40...+40 ft/s

Measuring accuracy

Reference conditions	Medium: water
	Temperature: 20°C / 68°F
	Flow velocity: > 1 m/s / > 3 ft/s
	Operating pressure: 1 bar / 14.5 psig
	Valve closing time variation: < 1 ms
	Wet calibrated on EN 17025 accredited calibration rig by direct volume comparison.
Maximum measuring error	Related to volume flow (MV = measured value).
	These values are related to the pulse / frequency output.
	The additional typical measuring deviation for the current output is ±10 µA.
	For information refer to *Measuring accuracy* on page 31.
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)	120°C / 248°F
Ambient temperature	-40…+65°C / -40…+149°F
	For Ex versions different temperatures are valid. Please check the relevant Ex documentation for details.
Storage temperature	-50…+70°C / -58…+158°F
Pressure	
Ambient	Atmospheric
Nominal flange pressure	**Standard:**
EN 1092-1	DN200...300: PN10
	DN100...150: PN16
	DN15...80: PN40
ASME B16.5	**Standard:**
	1...12": 150 lb
	½": 300 lb
	Option:
	1...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 approx. 160 bar / 2320 psi
Chemical properties	
Physical condition	Conductive liquids
Electrical conductivity	**Non water:**
	DN25...300: ≥ 1 µS/cm
	DN15: ≥ 5 µS/cm
	Demineralised cold water:
	DN15...300: ≥ 20 µS/cm
Permissible gas content (volume)	≤ 5%
Permissible solid content (volume)	IFC 100: ≤ 10%
	IFC 300: ≤ 70%
Recommended flow velocity	-12...+12 m/s / -40...+40 ft/s

Installation conditions

Installation	Take care that the flow sensor is always fully filled.
	For detailed information refer to *Installation* on page 10.
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 2x 90°)
	≥ 10 DN (behind a control valve)
Outlet run	≥ 2 DN
Dimensions and weights	For detailed information refer to *Dimensions and weights* on page 27.

Materials

Sensor housing	DN15...100: stainless steel AISI 316 (1.4408)
	DN150...300: sheet steel (carbon steel)
Measuring tube	ceramic
Connection box (only remote versions)	Standard: polyurethane coated die-cast aluminium
	Option: stainless steel
Grounding rings	**Standard:**
	DN15...100: not included
	DN150...300: integrated, stainless steel AISI 316L (1.4404)
	Option:
	DN15...100: virtual reference (only with IFC 300 converter)
	DN150...300: Hastelloy® C
Gaskets	DN15...100: PTFE
	DN150...300: FPM / FKM O-ring
Measuring electrodes	**Standard:**
	DN15...100: cermet
	DN150...300: stainless steel AISI 316 Ti (1.4571)
	Option:
	DN150...300: platinum, Hastelloy® C, low noise (basis Hastelloy C4, tantalum, titanium)

Process connections

EN 1092-1	DN200...300: PN10
	DN100..150: PN16
	DN15...80: PN40
ASME	**Standard:**
	1...12": 150 lb
	½": 300 lb
	Option:
	1...3": 300 lb

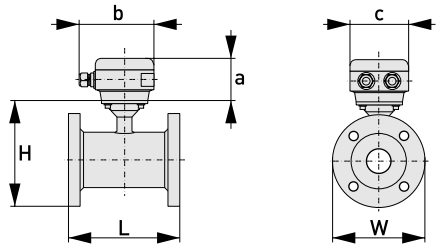
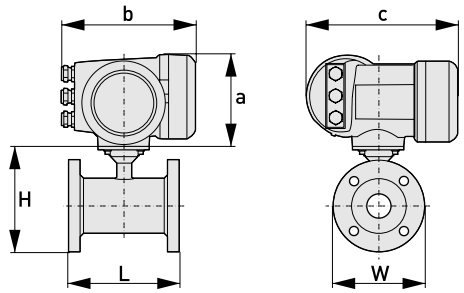
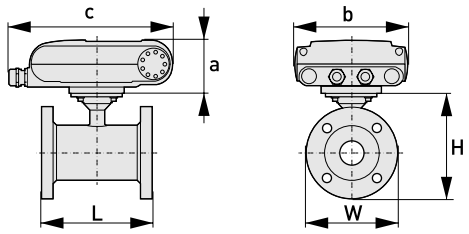
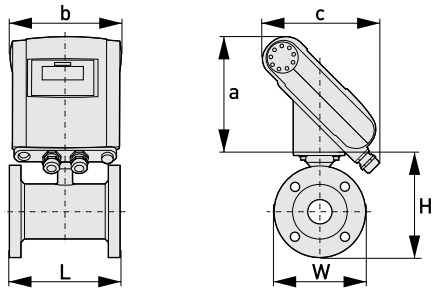
Electrical connections

Signal cable	Only for remote systems.
Type A	Standard cable, double shielded. Max. length: 600 m / 1950 ft (dep. on electrical conductivity and measuring sensor). See documentation of the converter for more information.
Type B	Optional cable, triple shielded. Max. length: 600 m / 1950 ft (dep. on electrical conductivity and measuring sensor). See documentation of the converter for more information.

Approvals and certifications

CE Sign	
	This device fulfills the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE mark.
Electromagnetic compatibility	Directive: 2004/108/EC, NAMUR NE21/04
	Harmonized standard: EN 61326-1 : 2006
Low Voltage Directive	Directive: 2006/95/EC
	Harmonized standard: EN 61010 : 2001
Pressure Equipment Directive	Directive: 97/23/EC
	Category I, II or SEP
	Fluid group 1
	Production module H
Other approvals and standards	
Non-Ex	Standard
Hazardous areas	
ATEX	Please check the relevant Ex documentation for details.
	In combination with IFC 100 W converter
	II 2 G or II 2 D
	In combination with IFC 300 C or F converter
	II 2 GD or II 2 (1) GD
	Remote version
	II 2 GD
FM	**In combination with IFC 300 C or F converter**
	Class I, Div. 2, groups A, B, C and D
	Class II, Div. 2, groups F and G
	Class III, Div. 2, groups F and G
	Only for diameters DN15...100
CSA	**In combination with IFC 300 C or F converter**
	Class I, Div. 2, groups A, B, C and D
	Class II, Div. 2, groups F and G
	Only for diameters DN15...100
IEC-Ex	pending
NEPSI	GYJ101206 / GYJ101207
	Ex me ia IIC T6...T3
	Ex de ia IIC T6...T3
Custody transfer	Standard: without verification
	Only in combination with IFC 300 converter.
	Option: MI-001, MI-005 type examination certificate
Protection category acc. to IEC 529 / EN 60529	Standard: IP 66/67 (NEMA 4/4X/6)
	Option: IP 68 (NEMA 6P)
Hygiene	Ceramic measuring tube is FDA approved.
Vibration resistance	IEC 68-2-6

6.3 Dimensions and weights

Remote version		a = 77 mm / 3.1" 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 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

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

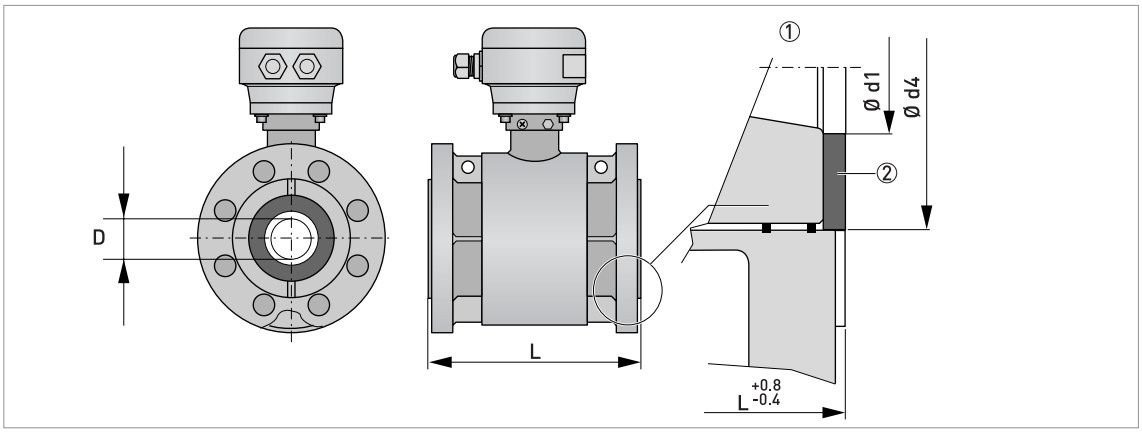


Figure 6-1: Construction details DN15...100

① Detail ceramics / flange / gaskets
② PTFE sealing ring

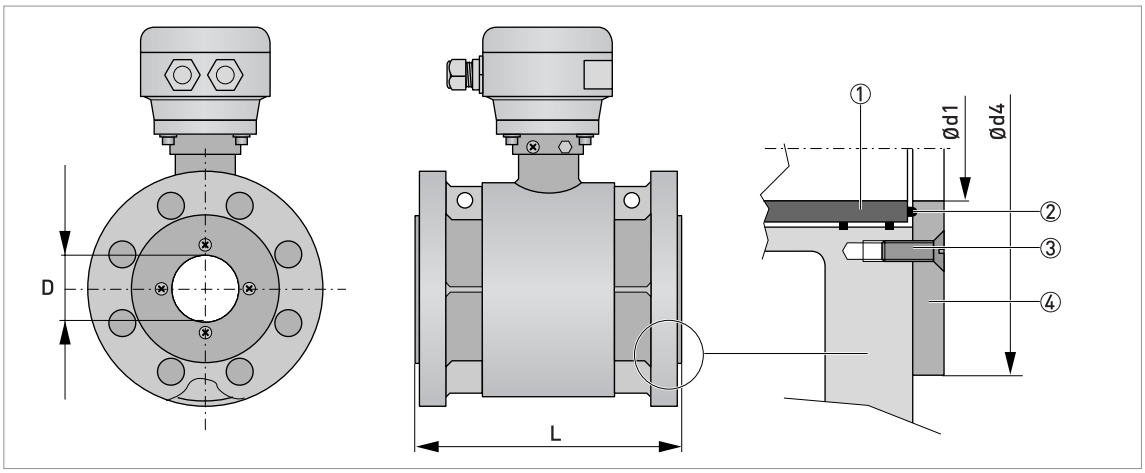


Figure 6-2: Construction details DN150...300

① Ceramic liner
② O-ring
③ Screw
④ Grounding ring

INFORMATION!

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

EN 1092-1

Nominal size	Dimensions [mm]						Approx. weight [kg]
DN	L	H	W	D	Ød1	Ød4	
15	150	127	95	12	15	44	3
25	150	143	115	20	26	46	4
40	150	168	150	30	39	62	6
50	200	184	165	40	51	74	9
80	200	217	200	60	80	106	15
100	250	242	220	80	101	133	21
150	265	355	283	150	150	215	37
200	315	396	342	200	198	270	53
250	365	458	395	250	250	322	87
300	500	493	445	300	300	375	145

ASME B 16.5 150 lb

Nominal size	Dimensions [inches]						Approx. weight [lb]
inch	L	H	W	D	Ød1	Ød4	
1"	5.91	5.47	4.25	0.79	1.02	1.81	8.8
1½"	5.91	6.18	5	1.18	1.54	2.44	13.2
2"	7.87	6.89	6	1.57	2.01	2.91	19.8
3"	7.87	8.39	7.5	2.36	3.15	4.17	33.1
4"	9.84	9.65	9	3.15	3.98	5.24	46.3
6"	10.43	13.98	11	5.91	5.91	8.46	81.6
8"	12.4	15.59	13.5	7.80	7.80	10.63	116.8
10"	14.37	18.03	16	9.84	9.84	12.68	191.8
12"	19.69	19.41	19	11.81	11.81	14.76	366

ASME B 16.5 300 lb

Nominal size	Dimensions [inches]						Approx. weight [lb]
inch	L	H	W	D	Ød1	Ød4	
½"	5.91	5.0	3.74	0.47	0.59	-	6.8
1"	5.91	5.91	4.92	0.79	1.02	1.81	8.8
2"	7.87	7.20	6.50	1.57	2.01	2.91	22.9
3"	7.87	8.86	8.27	2.36	3.15	4.17	40.6
1½": not possible because of ASTM-NUT							

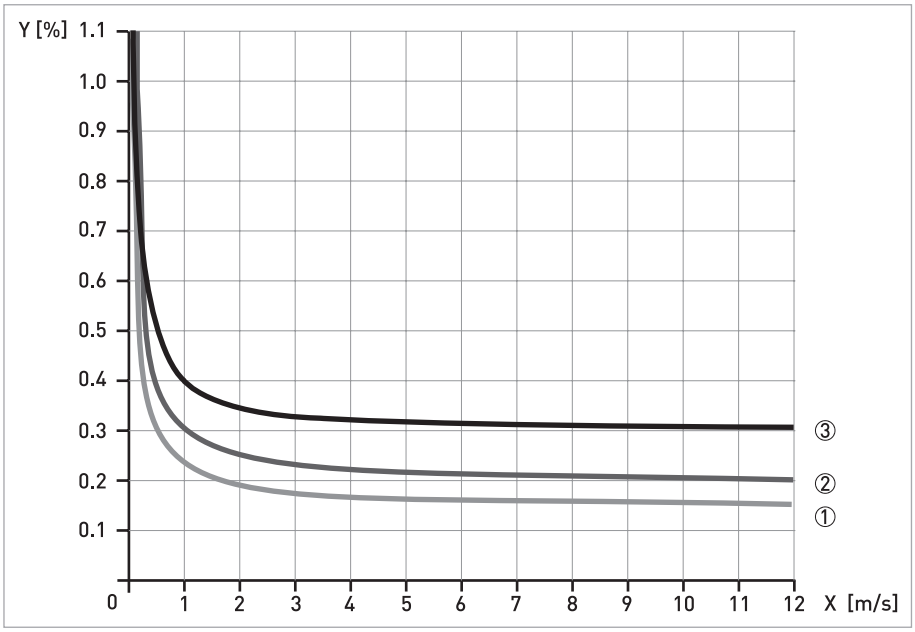
CAUTION!

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

6.4 Measuring accuracy

Reference conditions

- Medium: water
- Temperature: 20°C / 68°F
- Pressure: 1 bar / 14.5 psi



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

Compact with IFC 300	Accuracy	Curve
DN15...100 / ½...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 / ½...12"	±0.3% of MV + 1 mm/s	③

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

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