OPTIFLUX 5000 Technical Datasheet

Electromagnetic flowmeter in flanged version

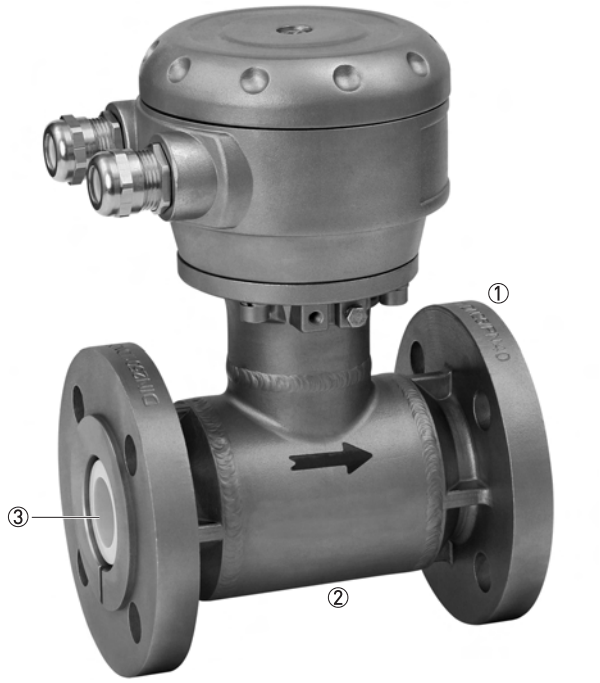
- Exceptional long-term stability and accuracy
- For highly aggressive and abrasive fluids
- Fully vacuum-resistant with high-tech ceramics liner

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

KROHNE

1.1 Solution with high-tech ceramics

The **OPTIFLUX 5000** is one of the most accurate flowmeters available in the market today. This is the result of a special tube design with conical parts, optimizing the flow profile. Leading metrological institutes use the **OPTIFLUX 5000** as their master meter.



① Flange design
② Ceramic liner
③ Cermet electrodes

Highlights

- Exceptional long-term stability and accuracy
- Unique flow tube
- Fused in-place Cermet or platinum electrodes
- For highly aggressive and abrasive fluids
- Fully vacuum-resistant
- High-tech ceramics liner
- Insensitive against temperature shocks

Industries

- Chemical
- Paper & pulp
- (Waste) water
- Minerals & mining
- Food & beverage
- Machinery

Applications

- Master transfer meter
- Precise volumetric dosing of additives
- Chemical injection
- For acids, alkaline, paste, slurries and many other aggressive media even with high solid contents

1.2 Options and variants

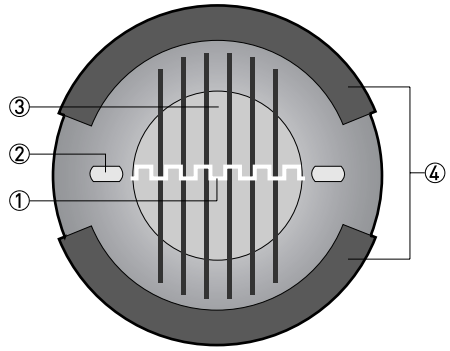
- Nominal diameter range DN15...300
- Several pressure ratings
- Configurable with IFC 100 and IFC 300 converter
- Hazardous areas
- Groundings rings available in high grade alloy's
- Virtual reference
- Stainless steel versions

1.3 Measuring principle

An electrically conductive fluid flows inside an electrically insulating 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. The signal voltage is quite small (typically 1 mV at v = 3 m/s / 10 ft/s and field coil power of 1 W). Finally, a signal converter is used to amplify the signal voltage, filter it (separate from noise) and convert it into signals for totalising, recording and output processing.



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

2.1 Technical data

- *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 (Downloadcenter).*

Measuring system

Measuring principle	Faraday's law
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 documentation of the signal converter.
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"
	½" not available in 150 lbs version.
Measurement range	-12...12 m/s / -40...40 ft/s

Measuring accuracy

Reference conditions	Medium: water
	Temperature: 20°C / 68°F
	Inlet section: 10 DN
	Outlet section: 5 DN
	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
	With IFC 100 converter:
	DN15...300: ± 0.3% of MV + 1 mm/s
	With IFC 300 converter:
	DN15...100: ± 0.15% of MV + 1 mm/s
	DN150..300: ± 0.2% of MV + 1 mm/s
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 versions: -40...+180°C / -40...+356°F
	Remote versions: - 40...+140°C / -40...+284°F
	For Ex versions different temperatures count. Please see the relevant Ex documentation for details.
Maximum temperature change (shock)	120°C / 248°F
Ambient temperature	Non-Ex: -40…+65°C / -40…+149°F
	Ex: -40…+60°C / -40…+140°F
Storage temperature	-50…+70°C / -58…+158°F

Pressure	
Ambient	Atmospheric
Nominal flange pressure	**Standard:**
DIN (EN 1092-1)	PN10 for DN200...300
	PN16 for DN100...150
	PN40 for DN15...80
ASME B16.5	**Standard:**
	150 lbs for ASME1...12"
	Option:
	300 lbs RF for ASME½...3"
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	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)	≤ 70%
Recommended flow velocity	-12...12 m/s / -40...40 ft/s
Other conditions	
Protection category acc. to IEC 529 / EN 60529	Standard: IP 66/67 (NEMA 4/4X/6)
	Optional: IP 68 (NEMA 6P)
Vibration resistance	IEC 68-2-6

Installation condtitions

Inlet run	≥ 5DN (without disturbing flow, after a single 90° bend)
	≥ 10DN (after a double bend 2x 90°)
	≥ 10DN (behind a control valve)
Outlet run	≥ 2DN
Dimensions and weights	For detailed information see chapter "Dimensions and weights".

Materials

Sensor housing	DN15...100: Stainless steel AISI 316 (1.4408)
	DN150...300: Sheet steel (carbon steel)
Measuring tube	Ceramic
Grounding rings	**Standard:**
	DN15...100: Not included
	DN150...300: Stainless steel AISI 316L (1.4404)
	Option:
	DN150...300: Hastelloy® C
	Also available as alternative for grounding rings (IFC 300 only): Virtual Reference.
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

DIN	DN15..300 in PN 16...40
ASME	1...12" in 150 lbs
	½...3" in 300 lbs

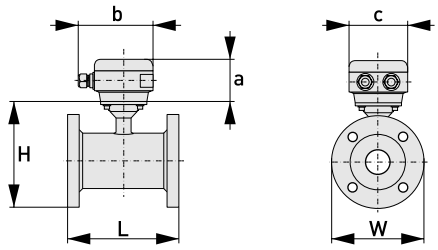
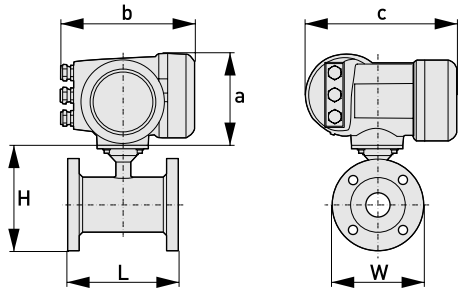
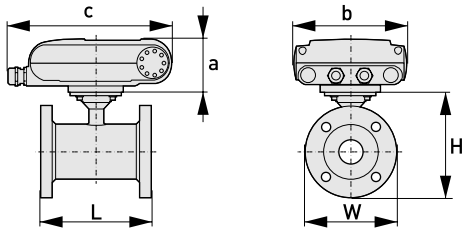
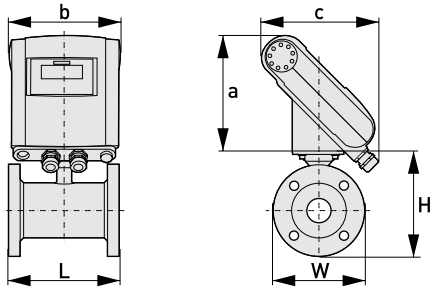
Electrical connections

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.
Hazardous areas	
ATEX	DN15...100 only
	KEMA 04 ATEX 2125 X
	ATEX II 2 GD EEx me ia IIC
	ATEX II 2 GD EEx de ia IIC
	T6...T3
	For more details, see Ex documentation of sensor and converter.
FM	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
CSA	Class I, Div 2, groups A, B, C and D
	Class II, Div 2, groups F and G
IEC-Ex	pending
NEPSI	GYJ05240
	Ex me ia IIC T6...T3
	Ex de ia IIC T6...T3
Other approvals and standards	
Electromagnetic compatibility	Directive: 89/336/EEC, 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
Custody transfer	Standard: without
	Option: MI-005, OIML R-117
Hygiene	Ceramic measuring tube is FDA approved.

2.2 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" ① c = 257 mm / 10.1" 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" Total height = H + a

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

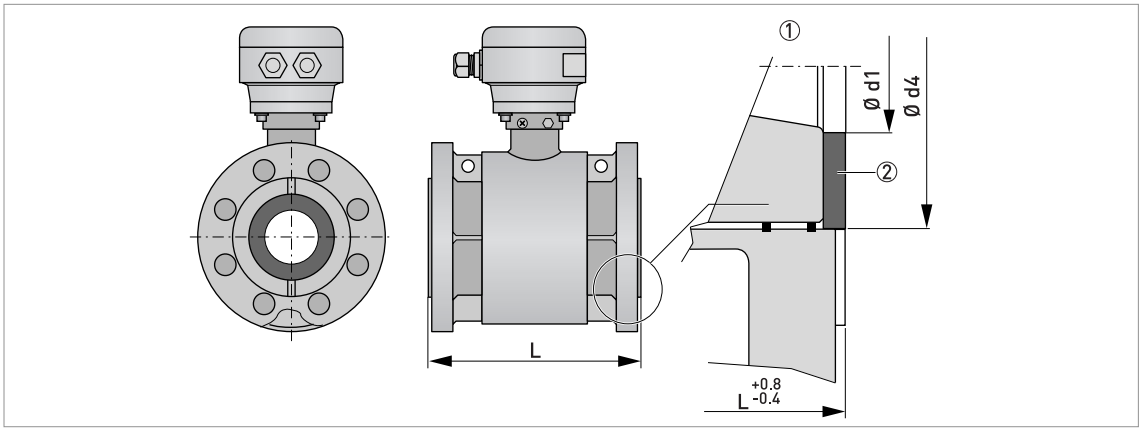


Figure 2-1: Construction details DN15...100

① Detail ceramics / flange / gaskets
② Gasket

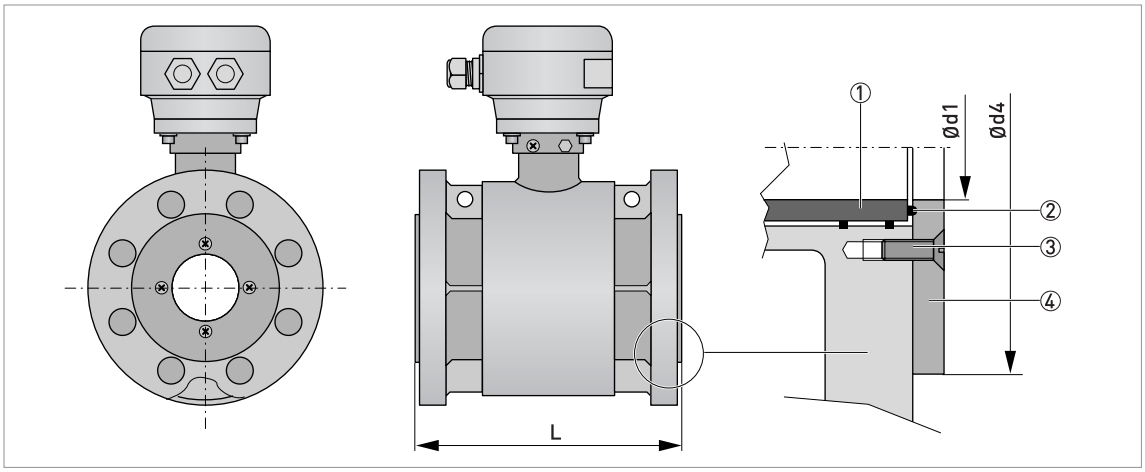


Figure 2-2: Construction details DN150...300

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

- *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.*

Nominal size		Dimensions [mm]					Approx. weight [kg]
DN	PN [bar]	L	H	W	Ød1	Ød4	
15	40	150	127	95	15	44	3
25	40	150	143	115	26	46	4
40	40	150	168	150	39	62	6
50	40	200	184	165	51	74	9
80	40	200	217	200	80	106	15
100	16	250	248	235	101	133	21
150	16	265	355	283	150	215	37
200	10	315	396	342	198	270	53
250	10	365	458	395	250	322	87
300	10	500	493	445	300	375	145

Nominal size		Dimensions [inches]					Approx. weight [lbs]
DN	PN [psi]	L	H	W	Ød1	Ød4	
1"	580	5.91	5.63	4.25	1.02	1.81	8.8
1½"	580	5.91	6.61	5	1.54	2.44	13.2
2"	580	7.87	7.24	6	2.01	2.91	19.8
3"	580	7.87	8.54	7.5	3.15	4.17	33.1
4"	232	9.84	9.76	9	3.98	5.24	46.3
6"	232	10.43	13.98	11	5.91	8.46	81.6
8"	145	12.4	15.59	13.5	7.80	10.63	116.8
10"	145	14.37	18.03	16	9.84	12.68	191.8
12"	145	19.69	19.41	19	11.81	14.76	366

3.1 Notes on installation

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

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

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 Intended use

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.

3.3 Installation conditions

3.3.1 Inlet and outlet

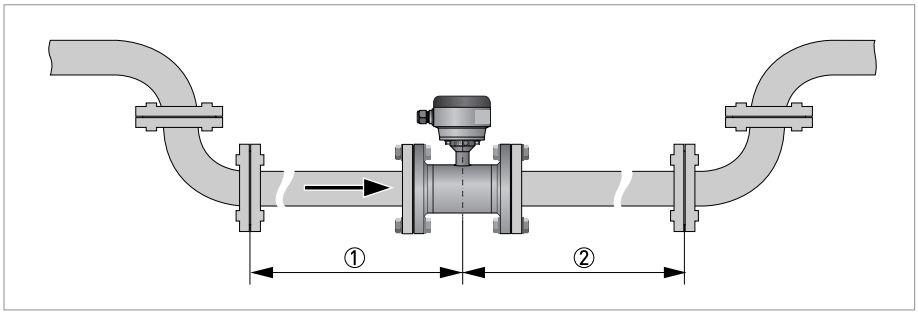


Figure 3-1: Recommended inlet and outlet

① ≥ 5DN
② ≥ 2DN

3.3.2 Mounting position

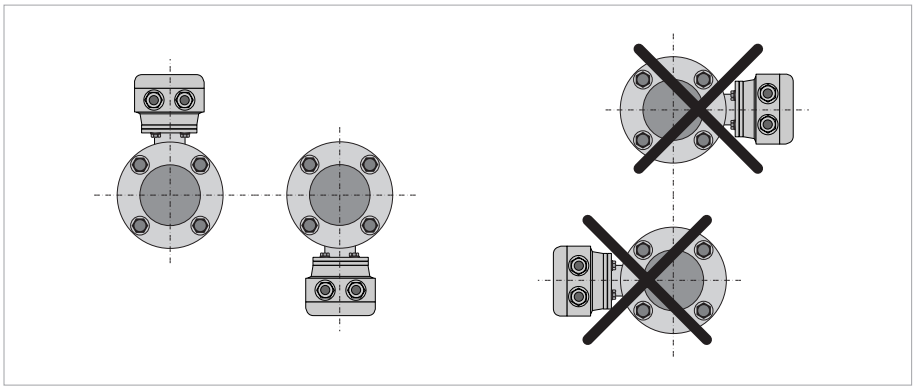


Figure 3-2: Mounting position

3.3.3 Flange deviation

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

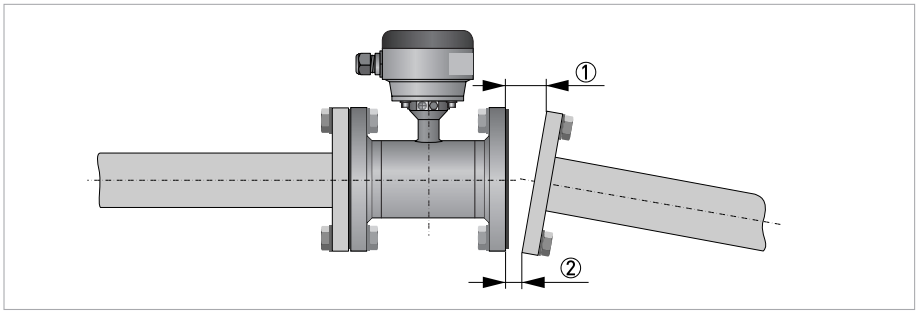


Figure 3-3: Flange deviation

① L_{max}
② L_{min}

3.3.4 T-section

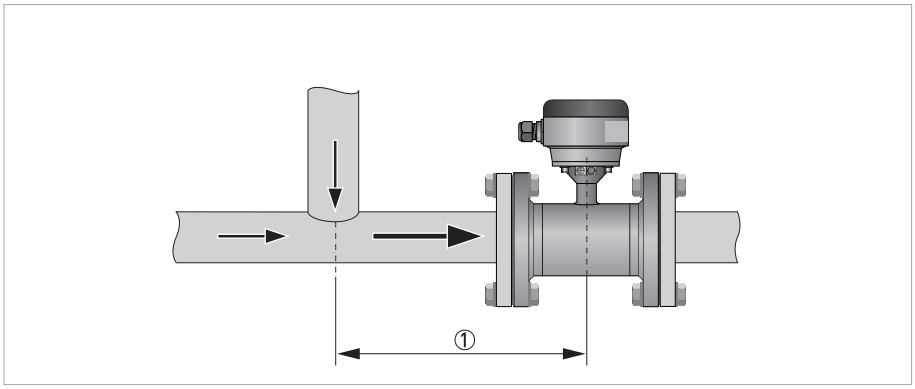


Figure 3-4: Distance after T-sections

① ≥ 10DN

3.3.5 Vibration

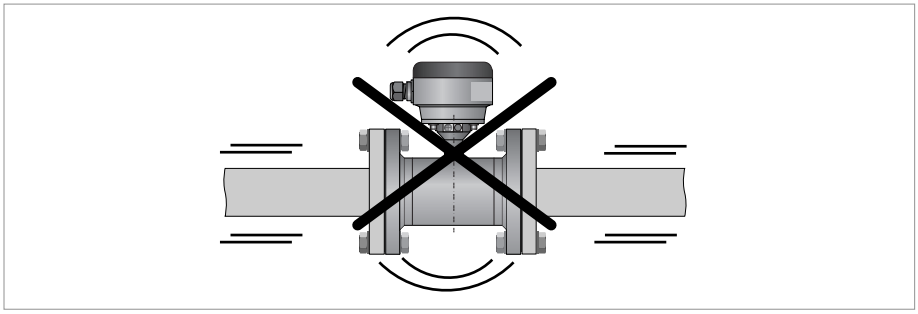


Figure 3-5: Avoid vibrations

3.3.6 Magnetic field

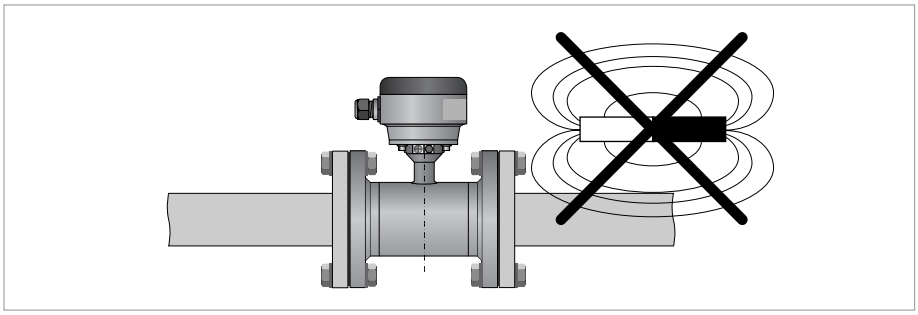


Figure 3-6: Avoid magnetic fields

3.3.7 Bends

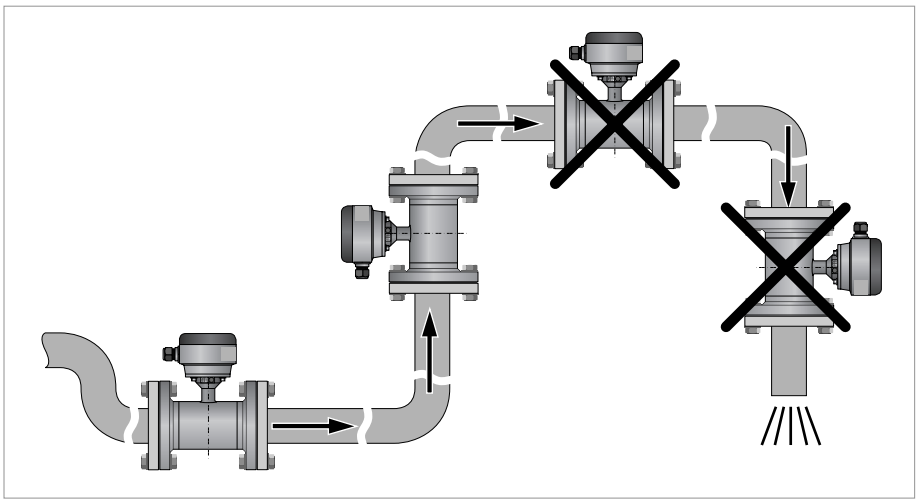


Figure 3-7: Installation in bending pipes

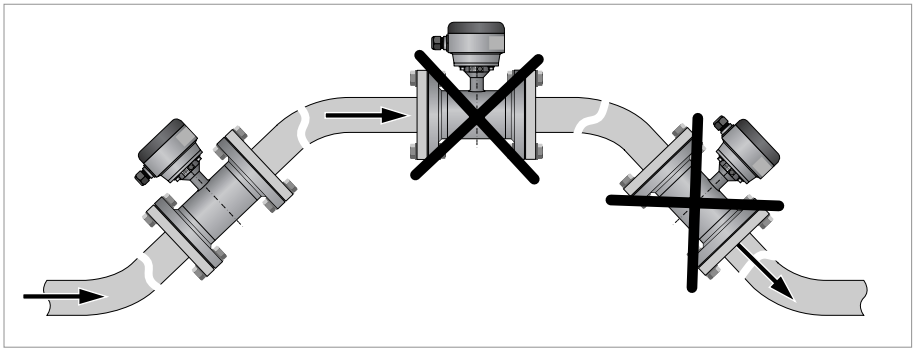


Figure 3-8: Installation in bending pipes

3.3.8 Open discharge

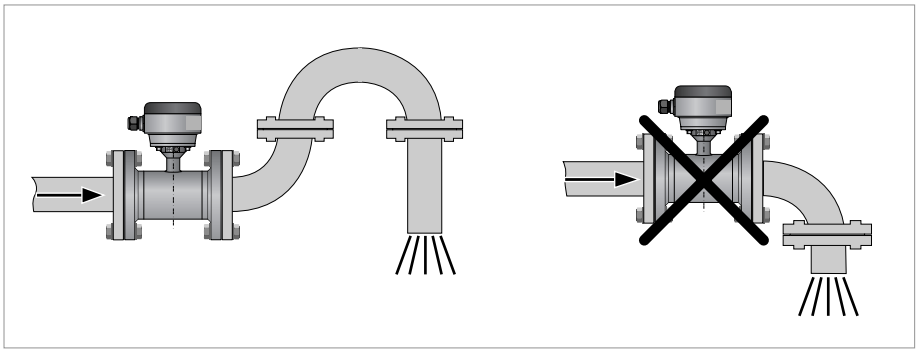


Figure 3-9: Installation before an open discharge

3.3.9 Control valve

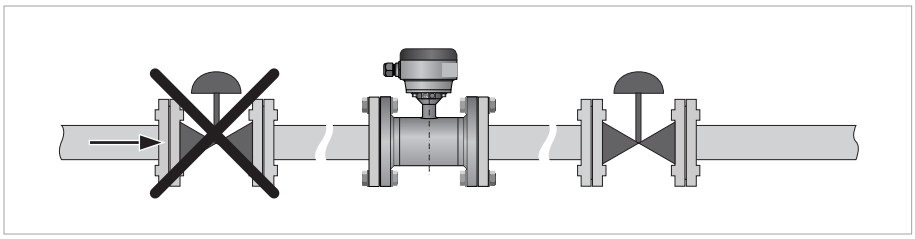


Figure 3-10: Installation before control valve

3.3.10 Air venting

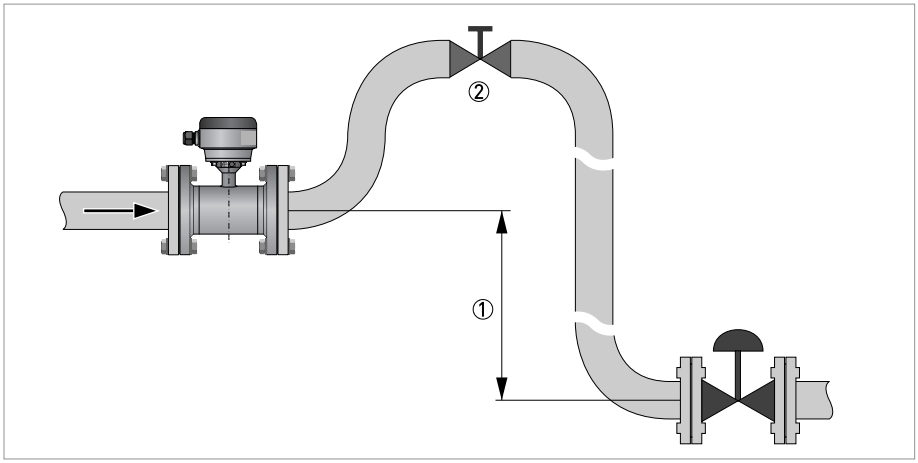


Figure 3-11: Air venting

① ≥ 5 m
② Air ventilation point

3.3.11 Pump

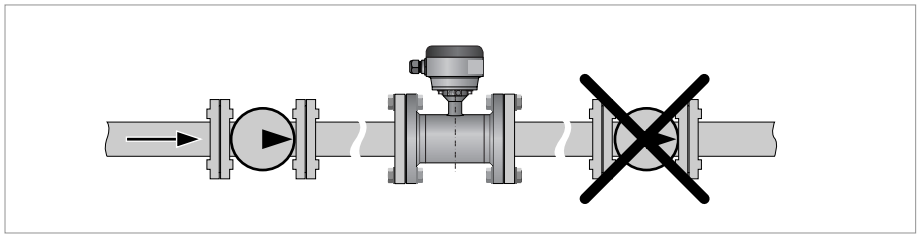


Figure 3-12: Installation after pump

4.1 Safety instructions

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

Observe the national regulations for electrical installations!

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

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.

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

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

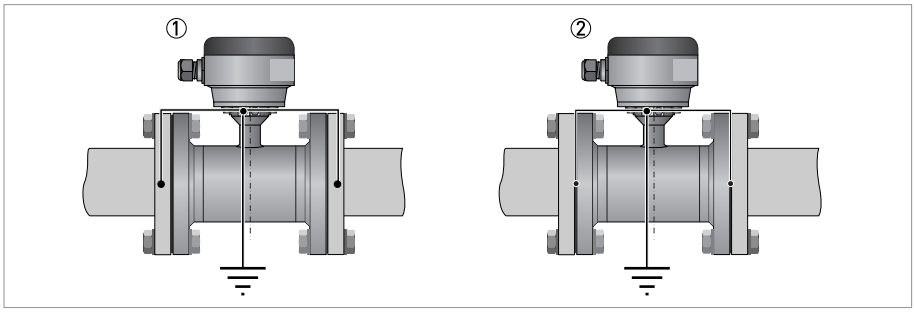


Figure 4-1: Grounding

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

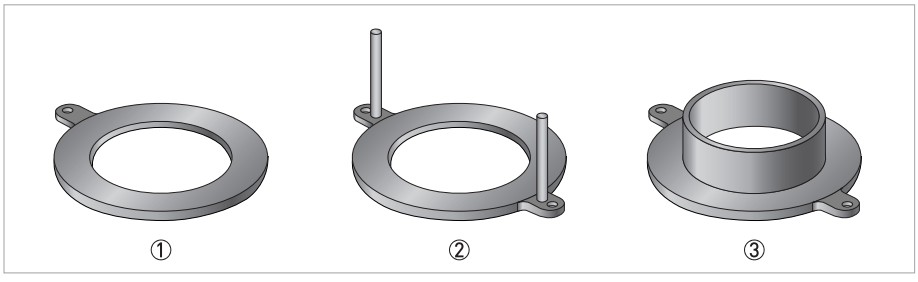


Figure 4-2: Different types of grounding rings

① Grounding ring number 1
② Grounding ring number 2
③ Grounding ring number 3

Grounding ring number 1:

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

Grounding ring number 2:

- 3 mm / 0.1" thick
- prevents damage to the flanges during transport and installation
- Especially for flow sensors with PTFE liner

Grounding ring number 3:

- 3 mm / 0.1" thick (tantalum: 0.5 mm / 0.1")
- with cylindrical neck (length 30 mm / 1.25" for DN10...150 / 3/8...6")
- prevents damage to the liner when abrasive liquids are concerned

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

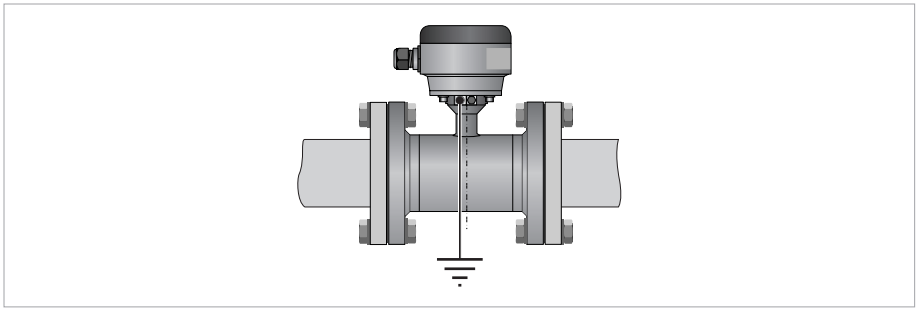
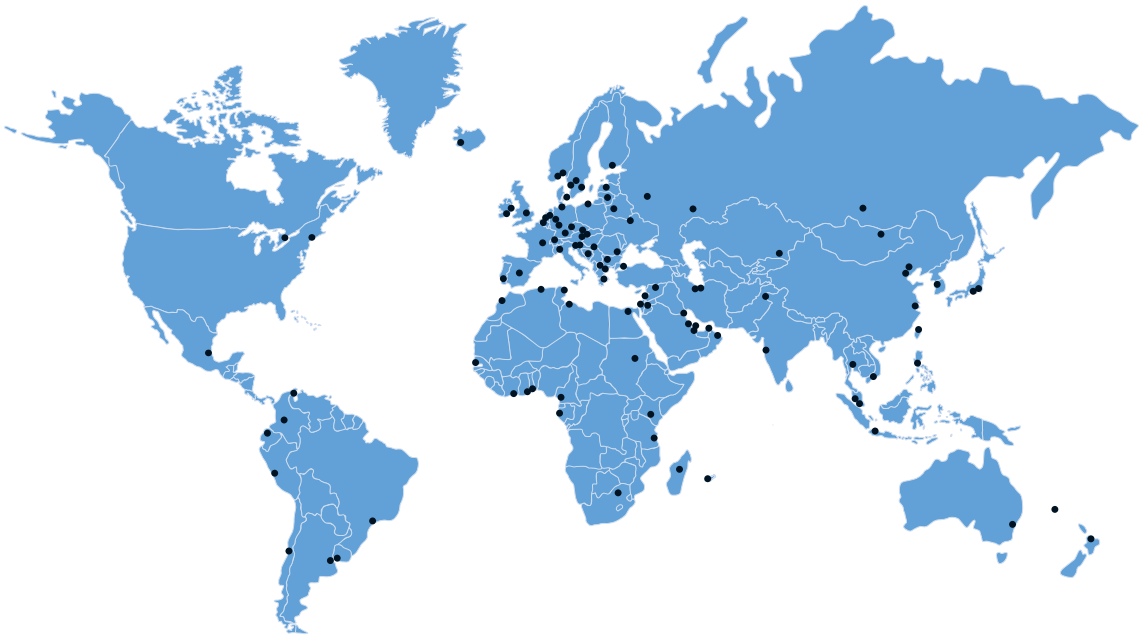


Figure 4-3: Virtual reference

Possible if:
≥ DN10
Electrical conductivity ≥ 200 µS/cm



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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