



OPTIFLUX 5000 Technical Datasheet

Electromagnetic flowmeter in sandwich version

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

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

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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 in combination with the high-end signal converter IFC 300.



- ① Sandwich design
- ② Ceramic liner
- ③ Cermet or Platinum electrodes



Ceramic durability

By implementing oxide ceramic sensors into OPTIFLUX and BATCHFLUX electromagnetic flowmeters as well as ceramic diaphragms into OPTIBAR pressure devices, KROHNE is using a superior material that is permanently resistant to corrosive and abrasive media and also immune to temperature shocks.

Highlights

- Excellent long-term stability and accuracy
- Unique flow tube
- Fused in-place Cermet or Platinum electrodes
- Custody transfer standard of international metrological authorities
- For highly aggressive and abrasive fluids
- Resistant to a full vacuum
- High-tech ceramic liners
- Insensitive against temperature shocks

Industries

- Chemical
- Paper & Pulp
- Water and wastewater
- Minerals & Mining
- Food & beverage
- Machinery

Applications

- Master transfer meter
- Precise volumetric dosing of additives
- Chemical injection
- For acids, alkaline, abrasive slurries and many other aggressive media

1.2 Options and variants



The OPTIFLUX 5000 sandwich version is available in a diameter range of DN2.5 up to DN100 - 1/10" up to 4".

The flow sensor is offered in a large range of pressure ratings and is configurable with the IFC 050, IFC 100 and the IFC 300 signal converter.

Can be ordered in stainless steel version and is also optionally suitable in hazardous areas. Grounding rings are available in high grade alloys.

The installation of the OPTIFLUX 5000 can be simplified by choosing the virtual reference option. Grounding rings can then be omitted. This option can only be combined with the IFC 300 signal converter.

1.3 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.

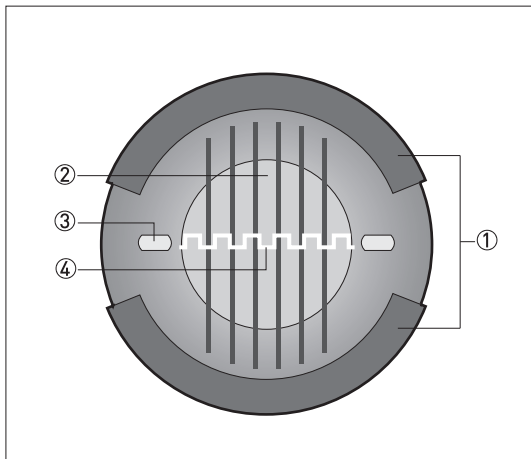


Figure 1-1: Measuring principle

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

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 sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Measuring principle	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	Sandwich version with optimized flow sensor
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 050 signal converter: OPTIFLUX 5050 C
	With IFC 100 signal converter: OPTIFLUX 5100 C
	With IFC 300 signal converter: OPTIFLUX 5300 C DN2.5...15 / 1/10...½" is only available with aluminum signal converter housing
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
Nominal diameter	DN2.5...100 / 1/10...4"

Measuring accuracy

Maximum measuring error	IFC 050: down to 0.5% of the measured value ± 1 mm/s
	IFC 100: down to 0.3% of the measured value ± 1 mm/s
	IFC 300: down to 0.15% of the measured value ± 1 mm/s
	The maximum measuring error depends on the installation conditions.
	For detailed information refer to <i>Measuring accuracy</i> on page 12.
Repeatability	$\pm 0.1\%$ of MV, minimum 1 mm/s
Calibration	Standard: 2 point calibration by direct volume comparison. Optional: special calibration on request.

Operating conditions

Temperature	
Process temperature	Compact version: -40...+140°C / -40... +284°F Size DN 2.5...15 / 1/10...1/2": -20...+120°C / -4... +248°F
	Remote version: -40...+180°C / -40...+356°F Size DN 2.5...15 / 1/10...1/2": -20...+180°C / -4... +356°F
	For Ex versions different temperature ranges are applicable. Please see the relevant Ex documentation for details.
Maximum temperature change (shock)	DN2.5...25 / 1/10...1": < 3 K/s DN40...100 / 1/2...4": < 0.2 K/s
Ambient temperature	-40...+65°C / -40...+149°F For IFC 100 stainless steel: -40...+60°C / -40...+140°F
	For Ex versions different temperature ranges are applicable. Please see the relevant Ex documentation for details.
Storage temperature	-50...+70°C / -58...+158°F
Measurement range	-12...+12 m/s / -40...+40 ft/s
Pressure	
Ambient	Atmospheric
Nominal flange pressure	
EN 1092-1	Standard:
	DN100: PN 16
	DN2.5...80: PN 40
	Option:
DN100: PN 25	
ASME B16.5	Standard:
	1/10...4": 150 lb
	Option:
	1/10...4": 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 ± 160 bar / 2320 psi
Chemical properties	
Physical condition	Liquids
Electrical conductivity	Non water:
	DN25...100 / 1...4": ≥ 1 μS/cm
	DN4...15 / 3/8...1/2": ≥ 5 μS/cm
	DN2.5 / 1/10": ≥ 10 μS/cm
	Demineralised cold water:
DN2.5...100 / 1/10...4": ≥ 20 μS/cm	
Permissible gas content (volume)	≤ 5%
Permissible solid content (volume)	IFC 050: ≤ 10%
	IFC 100: ≤ 10%
	IFC 300: ≤ 70%

Installation conditions

Installation	Take care that the flow sensor is always fully filled.
	For detailed information refer to <i>Installation</i> on page 18.
Flow direction	Forward and reverse.
	Arrow on the 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 <i>Dimensions and weights</i> on page 14.

Materials

Flow sensor housing	DN2.5...15 / 1/10...1/2": stainless steel 1.4408 / 316
	DN25...100 / 1...4": stainless steel 1.4301 / 304
Flow sensor	Ceramic
Connection box (remote versions only)	Standard: Polyurethane coated die-cast aluminum
	Option: Stainless steel
Grounding rings	Standard: Stainless steel
	Option: Hastelloy® C, titanium, tantalum
	Other materials on request.
	Grounding rings can be omitted with virtual reference option for the IFC 300 signal converter.
Mounting materials	Standard: rubber centering sleeves
	Option: stud bolts and nuts in stainless steel or galvanized steel
Gaskets	DN2.5...15 / 1/10...1/2"; O-rings: FKM, EPDM, FFKM DN25...100 / 1...4"; flat gaskets: filled PTFE, Graphite. PTFE envelope: only in combination with tantalum grounding rings.
	Other materials on request.
Measuring electrodes	DN2.5...25 / 1/10...1": Cermet
	DN40...100 / 1 1/2...4": Platinum

Process connections

EN 1092-1	Standard:
	DN100: PN 16
	DN2.5...80: PN 40
	Option:
	DN100: PN 25
ASME	Standard:
	1/10...4": 150 lb
	Option:
	1/10...4": 300 lb
JIS	DN2.5...100: 10...20 K

Electrical connections

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

Approvals and certifications

CE	
This device fulfills the statutory requirements of the EU directives. The manufacturer certifies successful testing of the product by applying the CE mark.	
	For full information of the EU directives & standards and the approved certifications, please refer to the EU Declaration of Conformity or the manufacturer website.
Hazardous areas	
Non-Ex	Standard
ATEX	KEMA 04 ATEX 2126 X
	ATEX II 2 GD EEx me ia IIC T6...T3
	ATEX II 2 GD EEx de ia IIC T6...T3
	For more details, see Ex documentation of the flow sensor and signal 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
IECEX	Pending
NEPSI	GYJ15.1313X
	Ex e ia mb IIC T6...T3 and Ex d e ia IIC T6...T3
Protection category acc. to IEC 60529	Standard:
	IP66/67, NEMA 4/4X/6
	Option:
	IP68, NEMA 6P
	IP68 is only available for remote designs and with a stainless steel connection box.
	IP67/69 with IFC 100 stainless steel signal converter
Hygiene	FDA approved materials.
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.

2.2 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

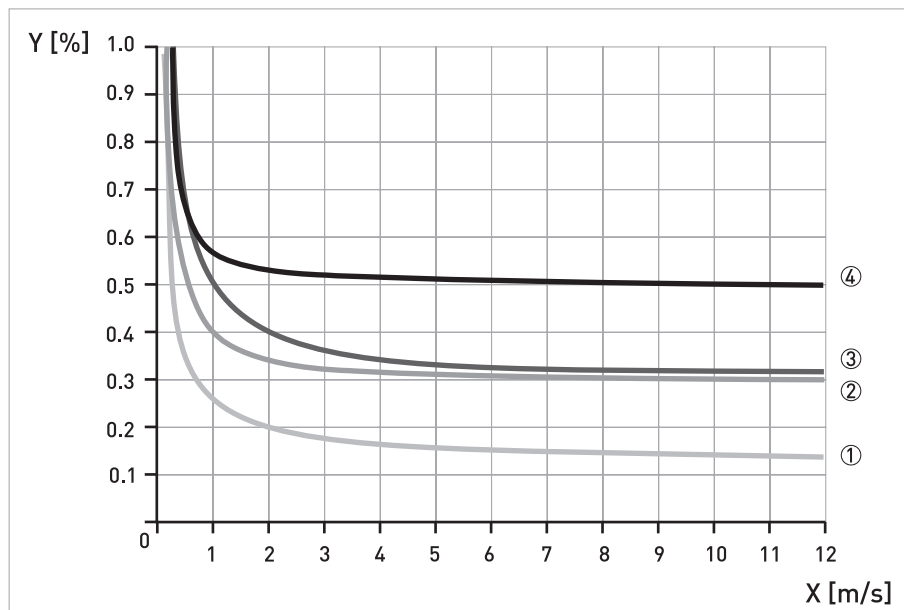


Figure 2-1:
X [m/s]: flow velocity
Y [%]: deviation from the actual measured value (mv)

In combination with the IFC 300

	Accuracy	Curve
DN2.5...6 / 1/10...1/4"	0.3% of mv + 2 mm/s	③
DN10...100 / 3/8... 4"	0.15% of mv + 1 mm/s	①

In combination with the IFC 100

	Accuracy	Curve
DN2.5...6 / 1/10...1/4"	0.4% of mv + 1 mm/s	As ② + 0.1%
DN10...100 / 3/8...4"	0.3% of mv + 1 mm/s	②

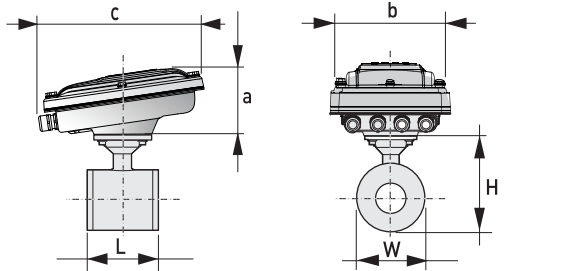
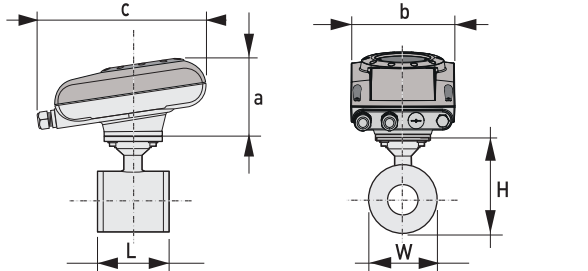
In combination with the IFC 050

	Accuracy	Curve
DN2.5...6 / 1/10...1/4"	0.5% of mv + 1 mm/s	④
DN10...100 / 3/8...4"	0.5% of mv + 1 mm/s	

*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.*

2.3 Dimensions and weights

<p>Remote version: DN2.5...15 / 1/10...1/2"</p>		<p>a = 88 mm / 3.5" b = 139 mm / 5.5" ① c = 106 mm / 4.2" Total height = H + a</p>
<p>Remote version: DN25...100 / 1...4"</p>		<p>a = 88 mm / 3.5" b = 139 mm / 5.5" ① c = 106 mm / 4.2" Total height = H + a</p>
<p>Compact version with IFC 300</p>		<p>a = 155 mm / 6.1" b = 230 mm / 9.1" ① c = 260 mm / 10.2" Total height = H + a</p>
<p>Compact version with IFC 100 (0°)</p>		<p>a = 82 mm / 3.2" b = 161 mm / 6.3" c = 257 mm / 10.1" ① Total height = H + a</p>
<p>Compact version with IFC 100 (45°)</p>		<p>a = 186 mm / 7.3" b = 161 mm / 6.3" c = 184 mm / 7.3" ① Total height = H + a</p>

Compact stainless steel version with 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 = 100 mm / 4" b = 157 mm / 6.18" ① c = 260 mm / 10.24"

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

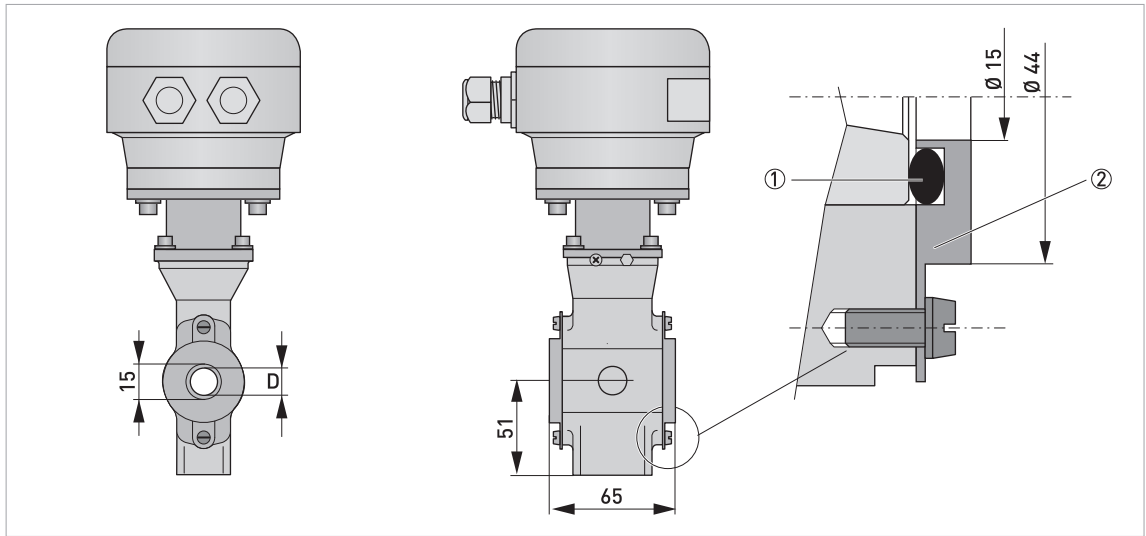


Figure 2-2: Construction details DN2.5...15 / 1/10...1/2"

- ① O-ring
- ② Grounding ring

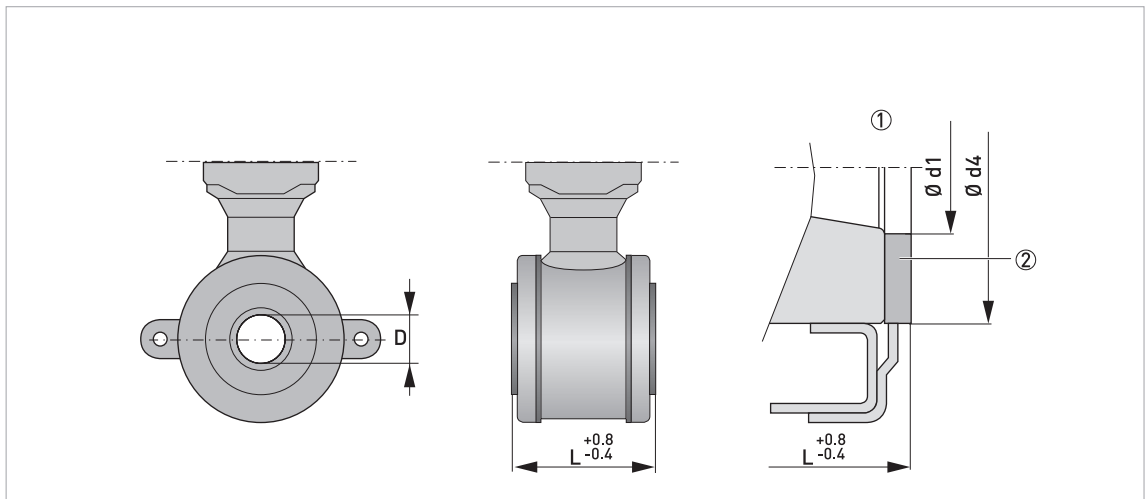


Figure 2-3: Construction details DN25...100 / 1...4"

- ① Situation without grounding rings
- ② Gasket

- 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.

Nominal size	Dimensions [mm]						Approx. weight [kg]	
	DN	L	H	W	D	Ød1		Ød4
2.5	65 ①	123	44			-	-	1.6
4	65 ①	123	44			-	-	1.6
6	65 ①	123	44			-	-	1.6
10	65 ①	123	44			-	-	1.6
15	65 ①	123	44			-	-	1.6
25	58 ②	116	68	20	26	46		1.6
40	83 ②	131	83	30	39	62		2.4
50	103 ②	149	101	40	51	74		2.9
80	153 ②	181	133	60	80	106		6.4
100	203 ②	206	158	80	101	133		8.8

① Total fitting length of flowmeter with integrated rings: dimension L + 2 x gasket thickness.

② Total fitting length of flowmeter without rings: dimension L only.

Nominal size	Dimensions [inches]						Approx. weight [lb]	
	ASME	L	H	W	D	Ød1		Ød4
1/10"	2.56 ①	4.84	1.73			-	-	3.53
1/6"	2.56 ①	4.84	1.73			-	-	3.53
¼"	2.56 ①	4.84	1.73			-	-	3.53
3/8"	2.56 ①	4.84	1.73			-	-	3.53
½"	2.56 ①	4.84	1.73			-	-	3.53
1"	2.28 ②	4.57	2.68	0.79	1.02	1.81		3.53
1½"	3.27 ②	5.16	3.27	1.18	1.54	2.44		5.29
2"	4.06 ②	5.87	3.98	1.57	2.01	2.91		6.39
3"	6.02 ②	7.13	5.24	2.36	3.15	4.17		14.11
4"	7.99 ②	8.11	6.22	3.15	3.98	5.24		19.40

① Total fitting length of flowmeter with integrated rings: dimension L + 2 x gasket thickness.

② Total fitting length of flowmeter without rings: dimension L only.

3.1 Intended use

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.

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.

3.2 General notes on installation

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

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

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.

3.2.1 Vibrations

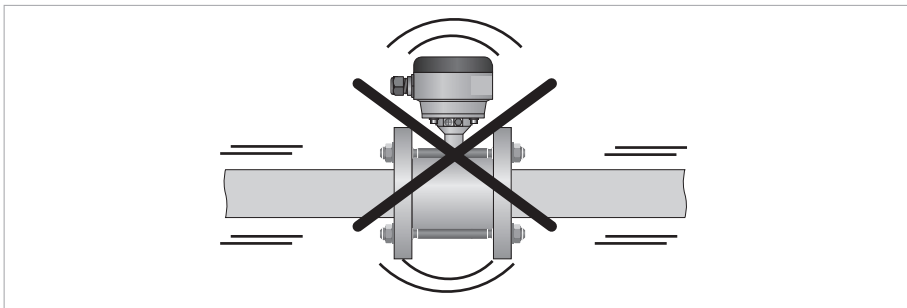


Figure 3-1: Avoid vibrations

3.2.2 Magnetic field

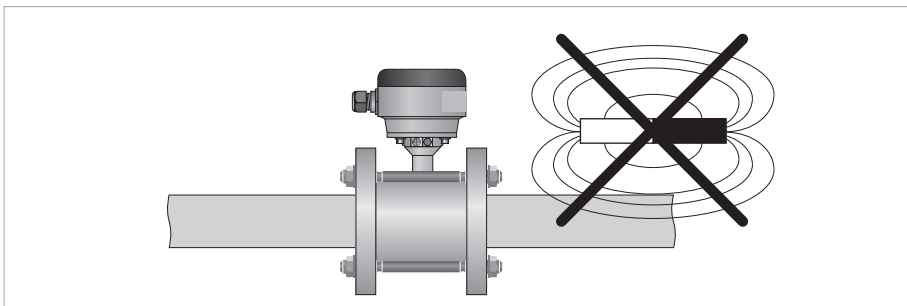


Figure 3-2: Avoid magnetic fields

3.3 Installation conditions

3.3.1 Inlet and outlet

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

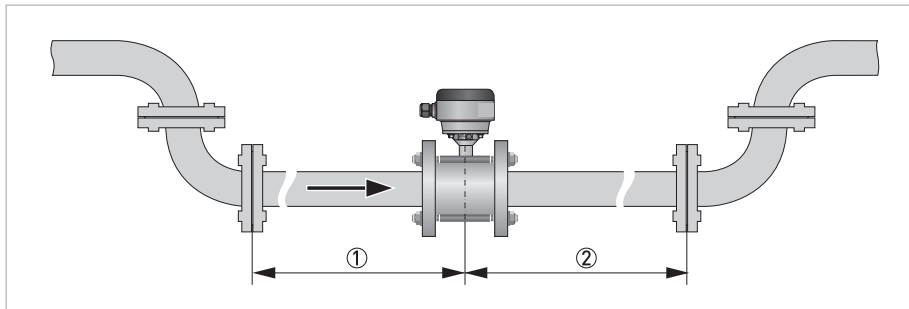


Figure 3-3: Recommended inlet and outlet section

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

3.3.2 Bends in 2 or 3 dimensions

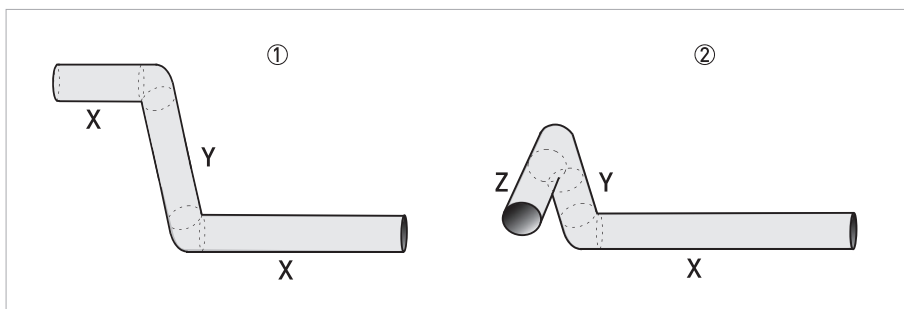


Figure 3-4: 2 and/or 3 dimensional bends upstream of the flowmeter

- 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

*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).*

3.3.3 T-section

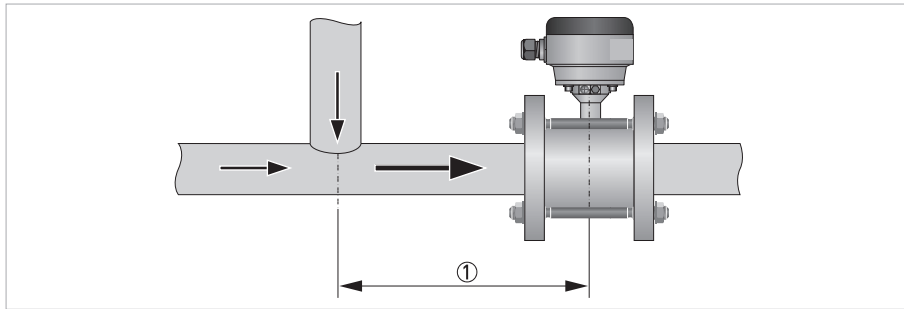


Figure 3-5: Distance behind a T-section

① ≥ 10 DN

3.3.4 Bends

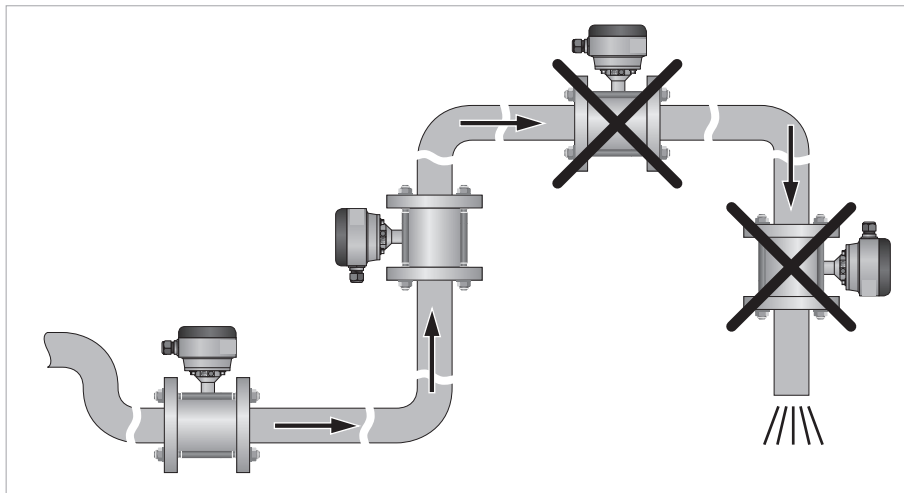


Figure 3-6: Installation in bending pipes (90°)

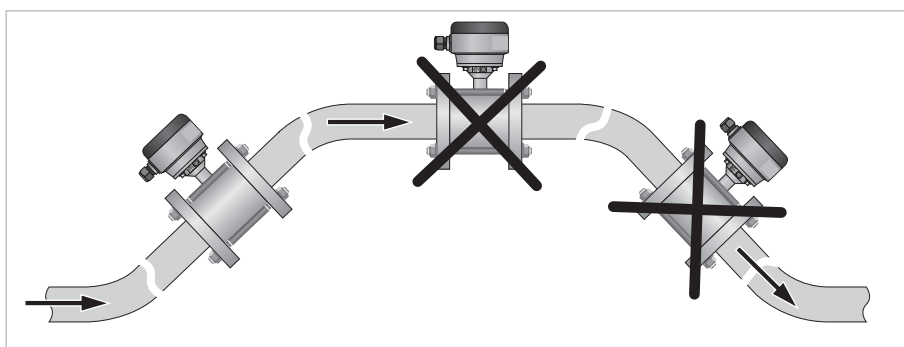


Figure 3-7: Installation in bending pipes (45°)

Avoid draining or partial filling of the flow sensor

3.4 Open discharge

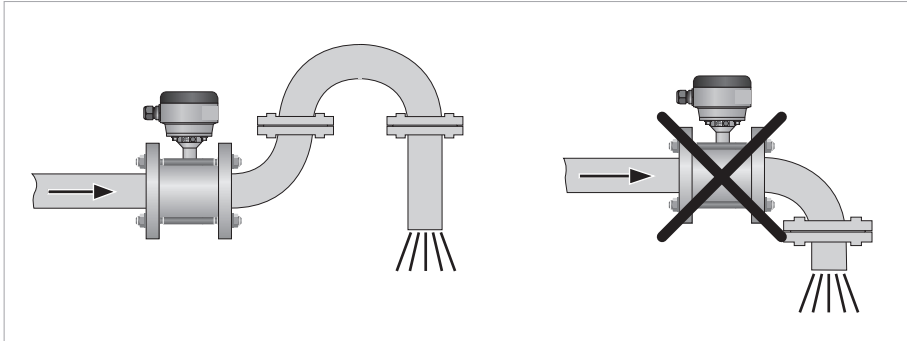


Figure 3-8: Installation in front of an open discharge

3.5 Flange deviation

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

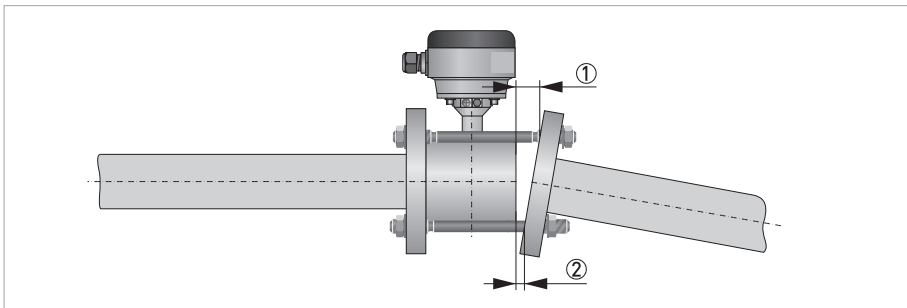


Figure 3-9: Flange deviation

- ① L_{max}
- ② L_{min}

3.6 Pump

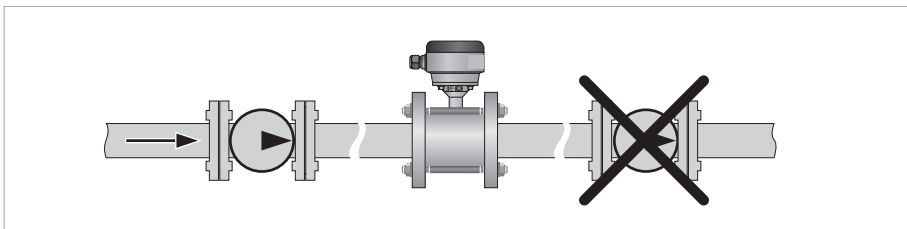


Figure 3-10: Installation behind a pump

3.7 Control valve

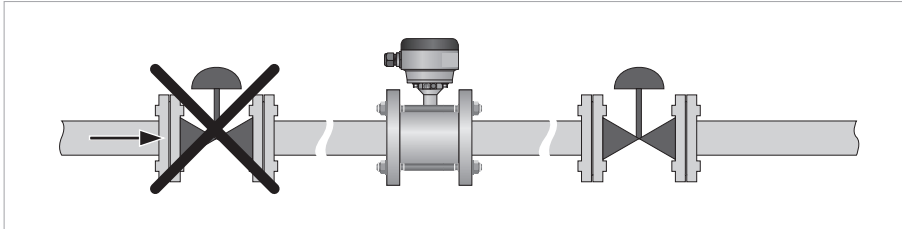


Figure 3-11: Installation in front of a control valve

3.8 Air venting and vacuum forces

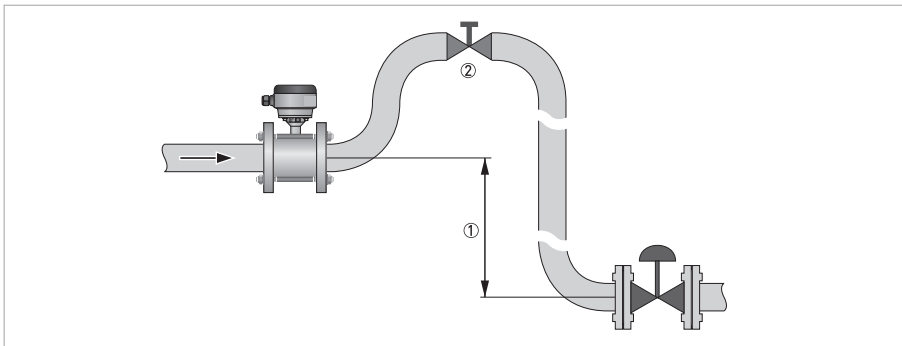


Figure 3-12: Air venting

- ① $\geq 5 \text{ m} / 17 \text{ ft}$
- ② Air ventilation point

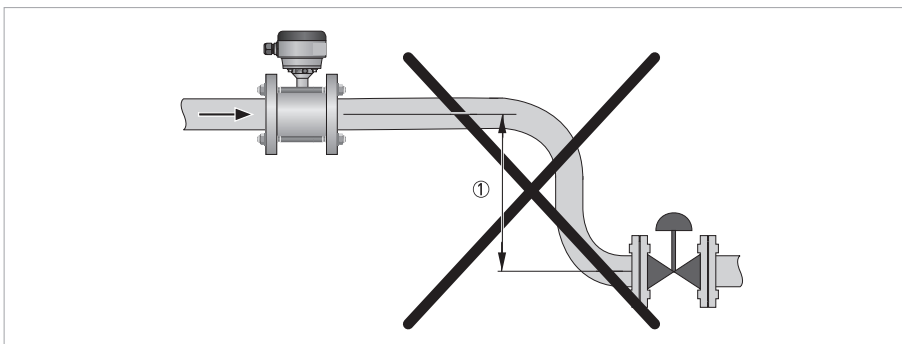


Figure 3-13: Vacuum

- ① $\geq 5 \text{ m} / 17 \text{ ft}$

3.9 Mounting position

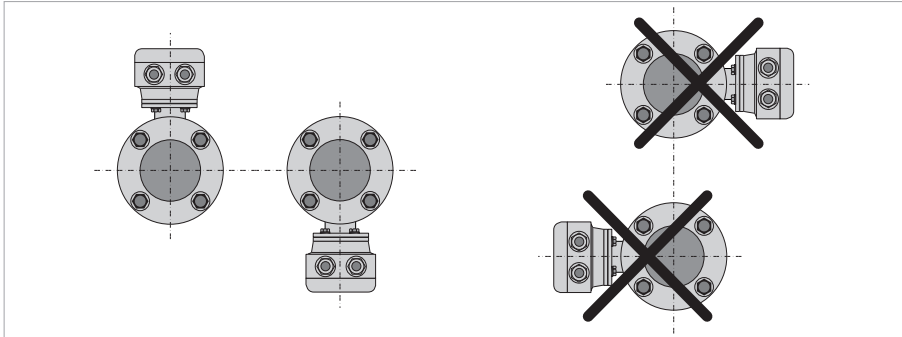


Figure 3-14: Mounting position

- Install the flow sensor in line with the pipe axis.
- Pipe flange faces must be parallel to each other.

3.10 Mounting

3.10.1 Torques and pressure

- Please use stainless steel A2 / 6.9 class bolts.
- Make sure the connecting flanges are of type raised face (RF).

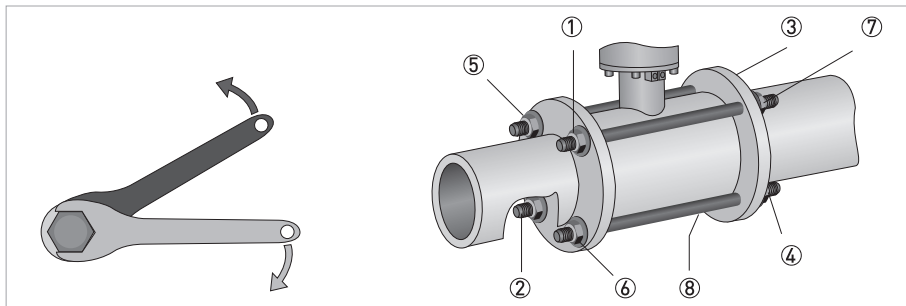


Figure 3-15: Tighten the bolts in fixed order, see picture.

Max. torque:

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

EN 1092-1

Nominal size DN [mm]	Pressure rating	Max. allowable operating pressure [bar]
2.5...80	PN 40	40
100	PN 16	16
100	PN 25	25

ASME B 16.5

Nominal size [inch]	Pressure rating	Max. allowable operating pressure [psig]
1/10...4"	150 lb	230
1/10...3"	300 lb	580

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

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.

EN 1092-1

Nominal size DN [mm]	Counter flanges & bolts		Max. allowable torque					
			Gasket: Filled PTFE / PTFE / PF29		Gasket: Graphite		O-ring	
	Rating	Size	Nm	ft-lb	Nm	ft-lb	Nm	ft-lb
2.5...10	PN 40	M12 x 141	-	-	-	-	32	24
15	PN 40	M12 x 141	-	-	-	-	36	27
25	PN 40	M12 x 141	22	16	32	24	-	-
40	PN 40	M16 x 176	47	35	66	49	-	-
50	PN 40	M16 x 203	58	43	82	60	-	-
80	PN 40	M16 x 261	48	35	69	51	-	-
100	PN 16	M16 x 303	75	55	106	78	-	-
100	PN 25	M20 x 176	94	69	133	98	-	-

ASME B 16.5

Nominal size [inch]	Counter flanges & bolts		Max. allowable torque					
			Gasket: Filled PTFE / PTFE / PF29		Gasket: Graphite		O-ring	
	Rating	Size	Nm	ft-lb	Nm	ft-lb	Nm	ft-lb
1/10...3/8"	150 lb	1/2"UNC x 142	-	-	-	-	35	26
1/2"	150 lb	1/2"UNC x 142	-	-	-	-	35	26
1"	150 lb	1/2"UNC x 142	24	18	33	24	-	-
1 1/2"	150 lb	1/2"UNC x 174	38	28	54	40	-	-
2"	150 lb	5/8"UNC x 215	58	43	83	61	-	-
3"	150 lb	5/8"UNC x 268	98	72	138	102	-	-
4"	150 lb	5/8"UNC x 318	75	55	108	80	-	-

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.

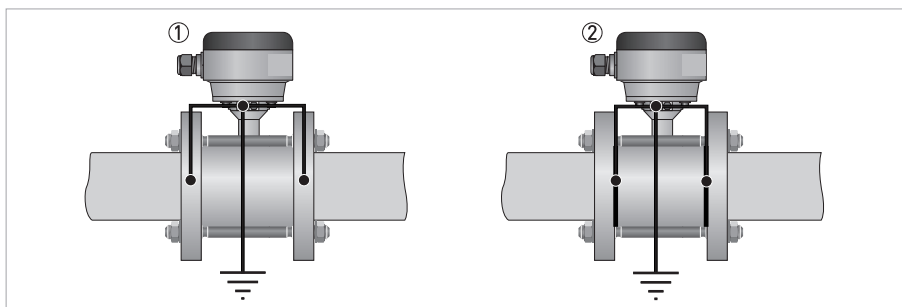


Figure 4-1: Grounding

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

For diameter DN10 / 3/8" and DN15 / 1/2", grounding rings are integrated as standard in the flow sensor construction.

Grounding rings

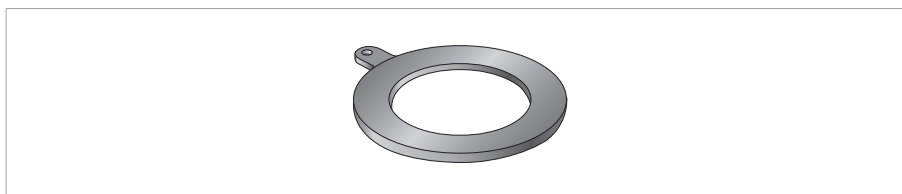


Figure 4-2: Grounding ring number 1

Grounding ring number 1 (optional for DN25...150 / 1...6"): Thickness: 3 mm / 0.1"
(tantalum: 0.5 mm / 0.02")

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

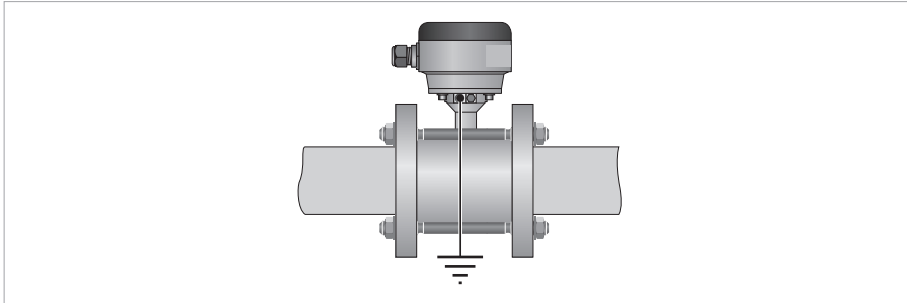


Figure 4-3: Virtual reference

Minimum requirements:

- Size: \geq DN10 / 3/8"
- Electrical conductivity: \geq 200 μ S/cm
- Signal cable: max. 50 m / 164 ft, type DS

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