OPTIFLUX 2000 Handbook

Electromagnetic flow sensor

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 2000 electromagnetic flowmeter is designed exclusively to measure the flow of electrically conductive, liquid media.

WARNING!
If the device is not used according to the operating conditions (refer to chapter Technical data), the intended protection could be affected.

1.2 Certification

CE marking

The manufacturer certifies successful testing of the product by applying the CE marking.

This device fulfils the statutory requirements of the relevant EU directives.

For full information of the EU directives and standards and the approved certifications, please refer to the EU Declaration of Conformity or the website of the manufacturer.

Other approvals and standards

- Measuring Instruments Directive 2014/32/EU - Annex III (MI-001)

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.

1.3 Safety instructions from the manufacturer

1.3.1 Copyright and data protection

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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 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 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 converter and one carton contains the sensor.

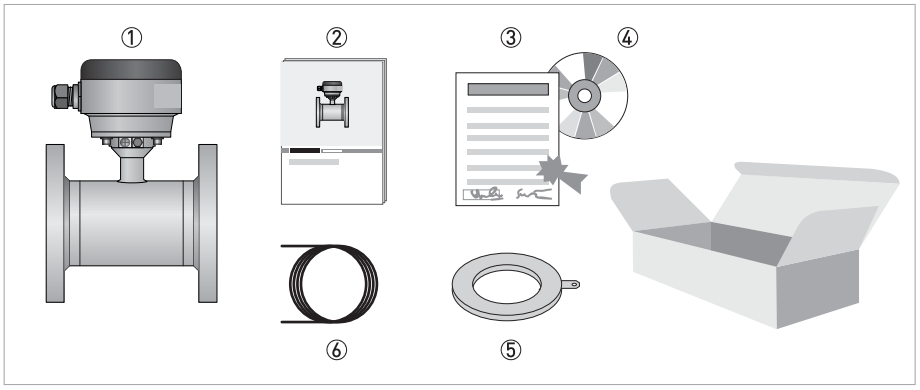


Figure 2-1: Scope of delivery

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

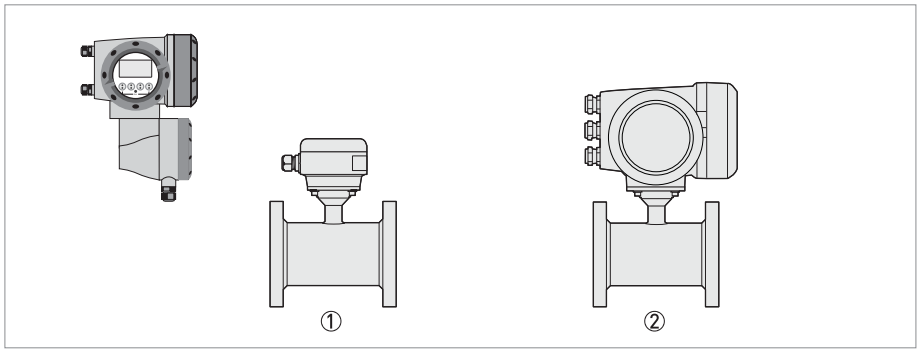
Your measuring device is supplied ready for operation. The factory settings for the operating data have been made in accordance with your order specifications.

INFORMATION!
Product specific information and extensive product specification is available using PICK, the Product Information Center KROHNE web-tool.
PICK can be found via the service menu button on the KROHNE.com website.

PICK up your information

The following versions are available:

- Compact version (the signal converter is mounted directly on the flow sensor)
- Remote version (a measuring sensor with connection box and a separate signal converter)



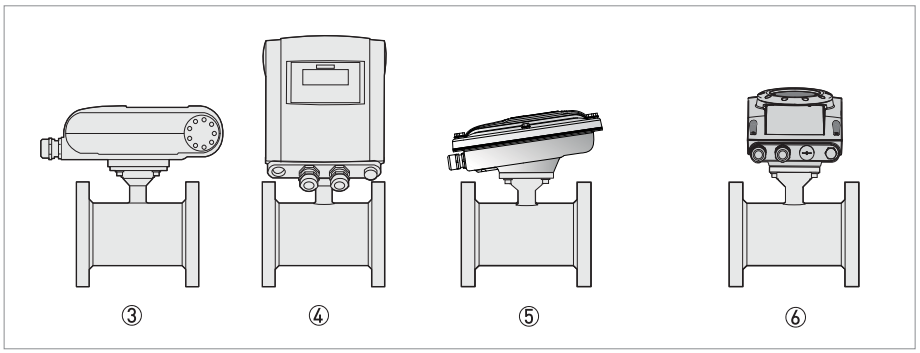


Figure 2-2: Device versions

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

2.3 Nameplate

INFORMATION!
Check the device nameplate to ensure that the device is delivered according to your order. Additional information (e.g. correct supply voltage), can be found in the documentation of the signal converter.

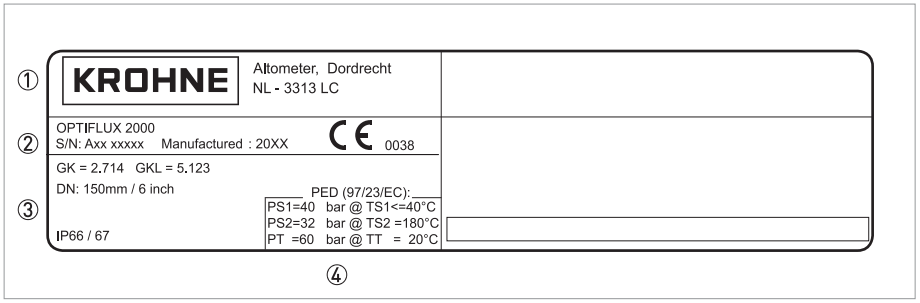


Figure 2-3: Example of nameplate

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 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.

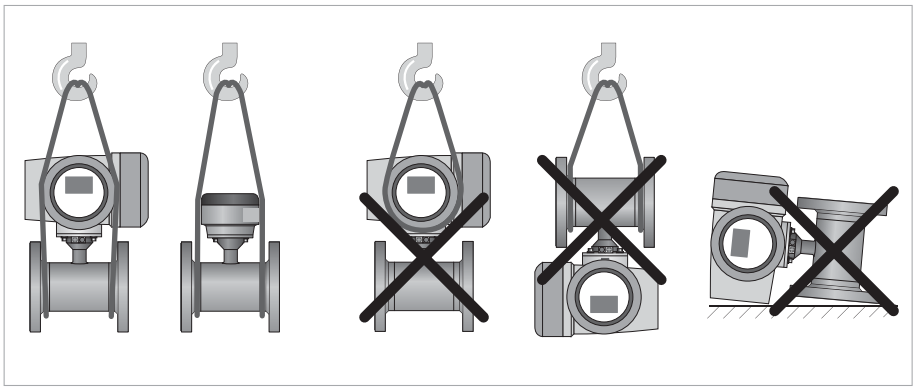


Figure 3-1: Transport

3.4 Pre-installation requirements

Make sure that you have all necessary tools available:

- Allen key (4 mm)
- Small screwdriver
- Wrench for cable glands
- Wrench for wall mounting bracket (remote version only)
- Torque wrench for installing flowmeter in pipeline

3.5 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 vibration. The flowmeters are tested for a vibration level in accordance with IEC 68-2-64.*

3.5.1 Vibration

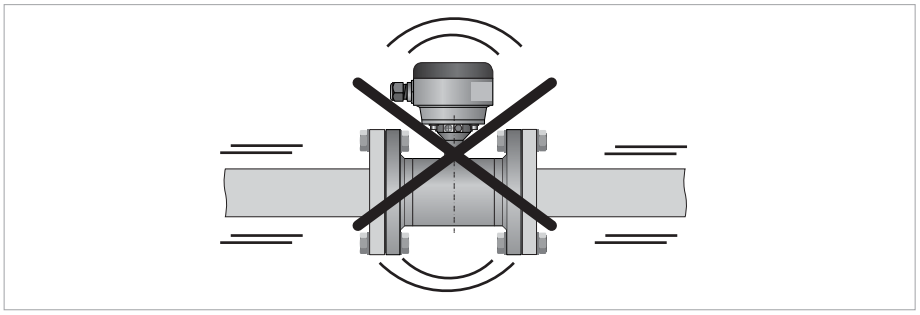


Figure 3-2: Avoid vibrations

3.5.2 Magnetic field

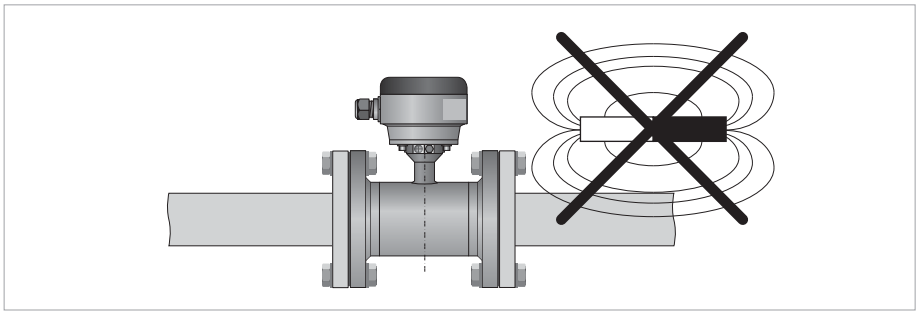


Figure 3-3: Avoid magnetic fields

3.6 Installation conditions

3.6.1 Inlet and outlet

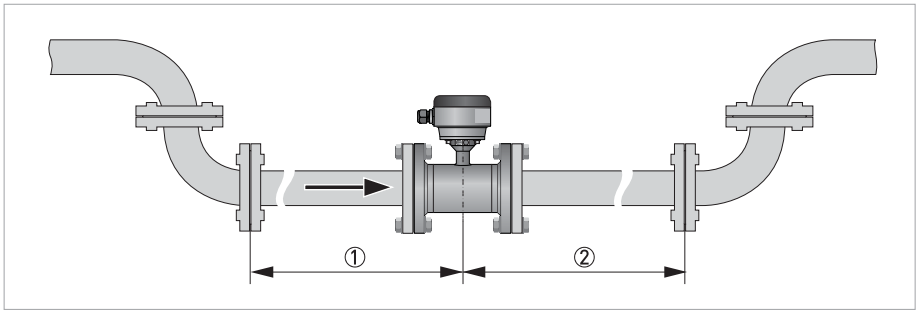


Figure 3-4: Recommended inlet and outlet

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

INFORMATION!
Sensors of type VN02 up to DN10:
The inlet and outlet sections are enclosed inside the sensor.

3.6.2 Bends in 2 or 3 dimensions

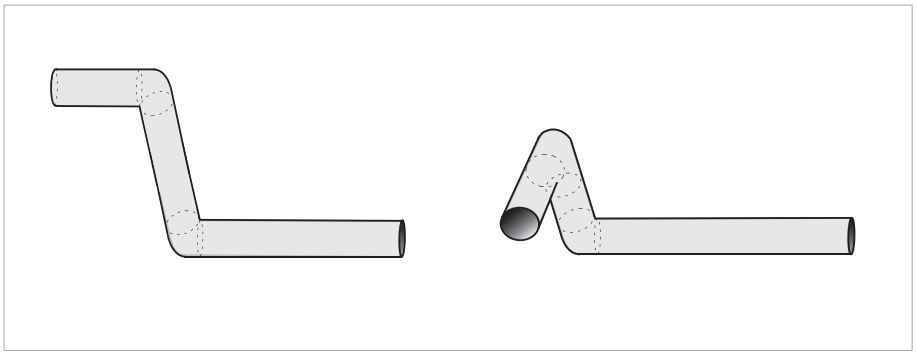


Figure 3-5: Inlet when using 2 and/or 3 dimensional bends upstream of the flowmeter

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 plane only, while 3 Dimensional bends occur in both vertical **and** horizontal plane.*

3.6.3 T-section

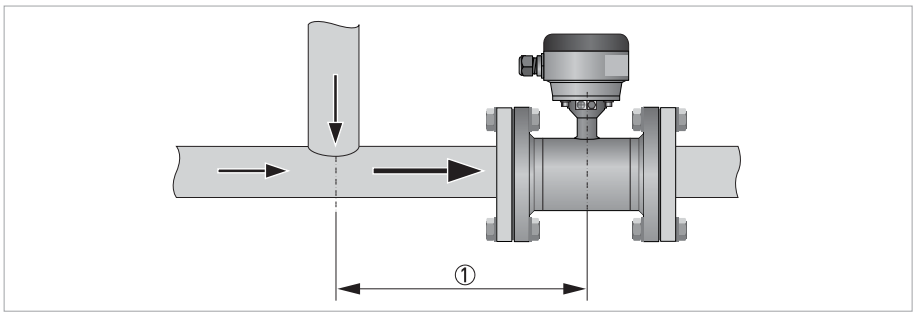


Figure 3-6: Distance behind a T-section

① ≥ 10 DN

3.6.4 Bends

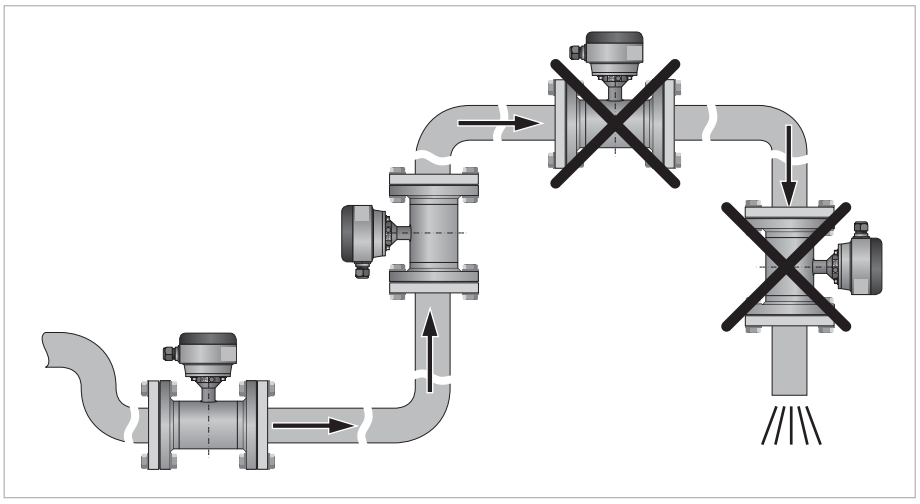


Figure 3-7: Installation in bending pipes

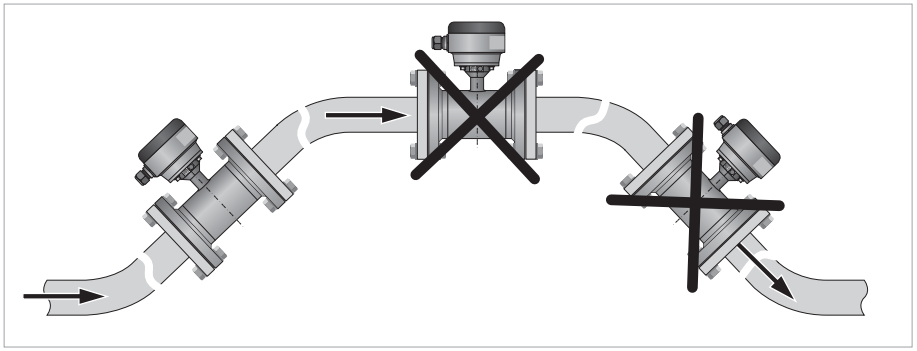


Figure 3-8: Installation in bending pipes

CAUTION!
Avoid draining or partial filling of the flow sensor

3.6.5 Open feed or discharge

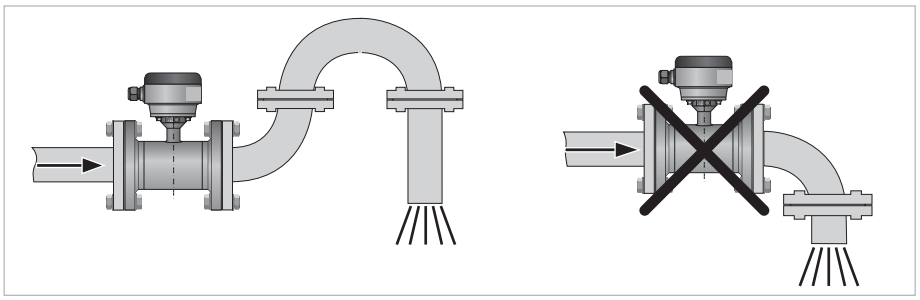


Figure 3-9: Installation in front of an open discharge

3.6.6 Flange deviation

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

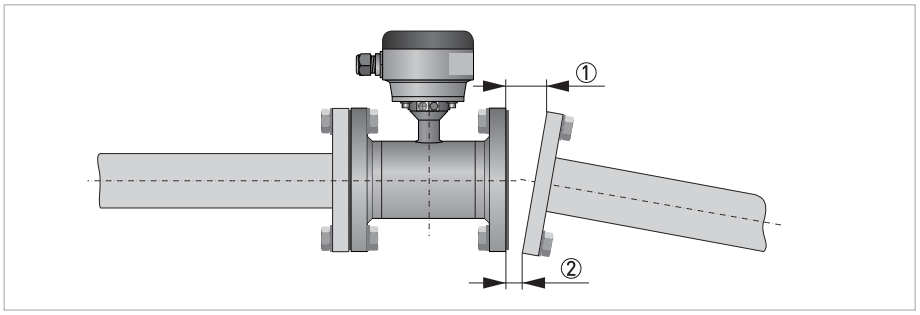


Figure 3-10: Flange deviation

① L_{max}
② L_{min}

3.6.7 Control valve

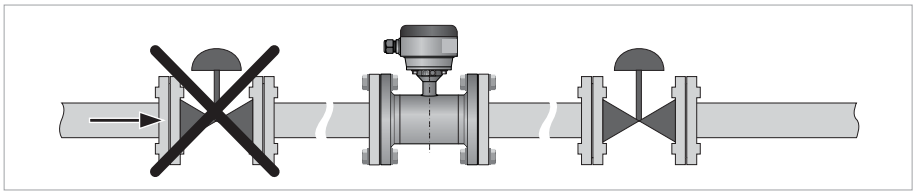


Figure 3-11: Installation in front of a control valve

3.6.8 Pump

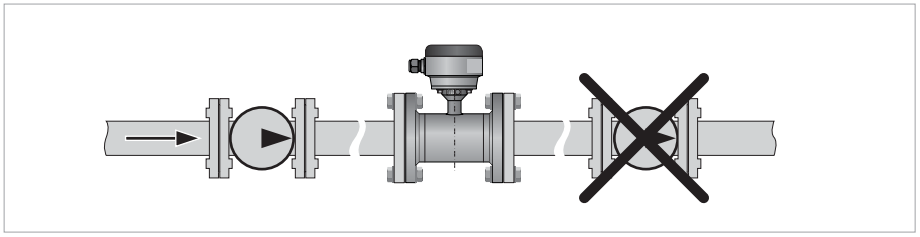


Figure 3-12: Installation behind a pump

3.6.9 Air venting and vacuum forces

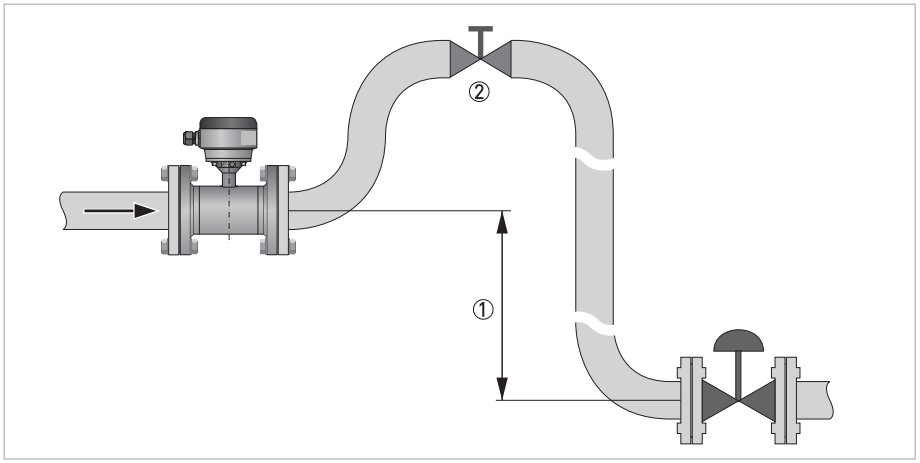


Figure 3-13: Air venting

① ≥ 5 m / 17 ft
② Air ventilation point

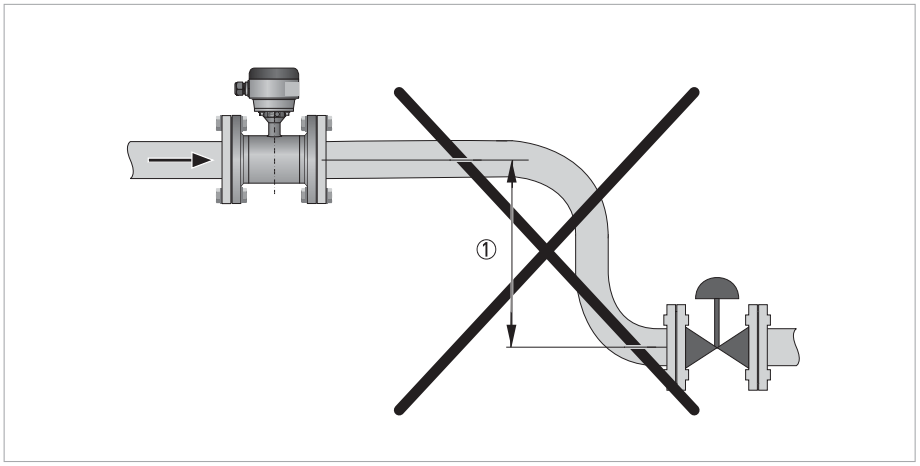


Figure 3-14: Vacuum

① ≥ 5 m / 17 ft

3.6.10 Mounting position

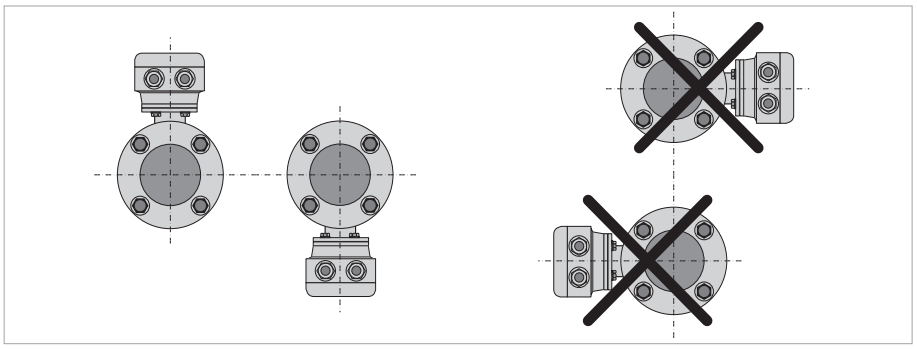


Figure 3-15: Mounting position

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

3.6.11 Mounting

CAUTION!
Please take care to use the proper gasket to prevent damaging the liner of the flowmeter. In general, the use of spiral wound gaskets is not advised, as it could severely damage the liner of the flowmeter.

3.6.12 Torques and pressures

The maximum pressure and torques values for the flowmeter are theoretical and calculated for optimum conditions and use with carbon steel flanges.

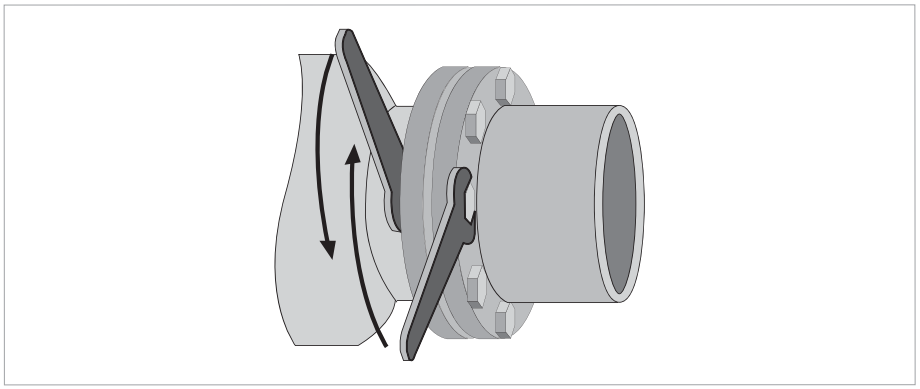


Figure 3-16: Tightening of bolts

Tightening of bolts

- Always tighten the bolts uniformly and in diagonally opposite sequence.
- Do not exceed the maximum torque value.
- Step 1: Apply approx. 50% of max. torque given in table.
- Step 2: Apply approx. 80% of max. torque given in table.
- Step 3: Apply 100% of max. torque given in table.

Nominal size DN [mm]	Pressure rating	Bolts	Max. torque [Nm] ①		
			Polyolefin	Polypropylene	Hard rubber
25	PN 40	4 x M 12	-	22	11
32	PN 40	4 x M 16	-	37	19
40	PN 40	4 x M 16	-	43	25
50	PN 40	4 x M 16	-	55	31
65	PN 16	② x M 16	-	51	42
65	PN 40	8 x M 16	-	38	21
80	PN 40	8 x M 16	-	47	25
100	PN 16	8 x M 16	-	39	30
125	PN 16	8 x M 16	-	53	40
150	PN 16	8 x M 20	-	68	47
200	PN 10	8 x M 20	68	-	68
200	PN 16	12 x M 20	45	-	45
250	PN 10	12 x M 20	65	-	65
250	PN 16	12 x M 24	78	-	78
300	PN 10	12 x M 20	76	-	76
300	PN 16	12 x M 24	105	-	105
350	PN 10	16 x M 20	75	-	75
400	PN 10	16 x M 24	104	-	104
450	PN 10	20 x M 24	93	-	93
500	PN 10	20 x M 24	107	-	107
600	PN 10	20 x M 27	138	-	138
700	PN 10	24 x M 27	163	-	163
800	PN 10	24 x M 30	219	-	219
900	PN 10	28 x M 30	205	-	205
1000	PN 10	28 x M 33	261	-	261

① 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.

② DN65 / PN16 is available with standard 8 bolt holes. On request 4 bolt holes is optional.

INFORMATION!

Other sizes / pressure ratings on request.

Nominal size [inch]	Flange class [lb]	Bolts	Max. torque [lbf.ft] ①		
			Polyolefin	Polypropylene	Hard rubber
1	150	4 x 1/2"	-	6.7	3.2
1 1/2	150	4 x 1/2"	-	13	9
2	150	4 x 5/8"	-	24	17
3	150	4 x 5/8"	-	43	29
4	150	8 x 5/8"	-	34	23
6	150	8 x 3/4"	-	61	38
8	150	8 x 3/4"	51	-	51
10	150	12 x 7/8"	58	-	58
12	150	12 x 7/8"	77	-	77
14	150	12 x 1"	69	-	69
16	150	16 x 1"	67	-	67
18	150	16 x 1 1/8"	105	-	105
20	150	20 x 1 1/8"	94	-	94
24	150	20 x 1 1/4"	133	-	133
28	150	28 x 1 1/4"	119	-	119
32	150	28 x 1 1/2"	191	-	191
36	150	32 x 1 1/2"	198	-	198
40	150	36 x 1 1/2"	198	-	198

① 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.

INFORMATION!
Other sizes / pressure ratings on request.

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

3.6.13 Temperatures

CAUTION!
Protect the device from direct sunlight.

Temperature range	Process [°C]		Ambient [°C]		Process [°F]		Ambient [°F]	
	min.	max.	min.	max.	min.	max.	min.	max.
Hard rubber / Polyolefin ①								
Separate flow sensor	-5	80	-40	65	23	176	-40	149
Compact with IFC 300	-5	80	-40	65	23	176	-40	149
Compact with IFC 100	-5	80	-40	65	23	176	-40	149
Compact with IFC 100 Stainless steel	5	80	-40	60	23	176	-40	140
Compact with IFC 050	-5	80	-40	65	23	176	-40	149
Polypropylene ②								
Separate flow sensor	-5	90	-40	65	23	194	-40	149
Compact with IFC 300	-5	90	-40	65	23	194	-40	149
Compact with IFC 100	-5	90	-40	65	23	194	-40	149
Compact with IFC 100 Stainless steel	-5	90	40	60	23	194	-40	140
Compact with IFC 050	-5	90	-40	65	23	194	-40	149

① Polyolefin is only available for DN200...1000
② Polypropylene is only available for DN25...150

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!

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.

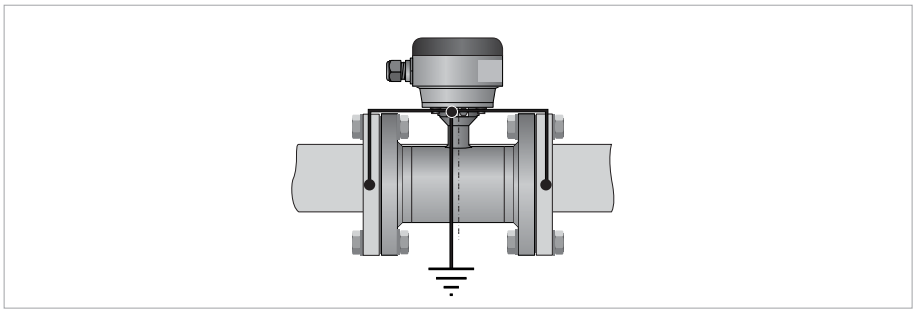


Figure 4-1: Grounding

① Metal pipelines, not internally coated. Grounding without grounding rings.

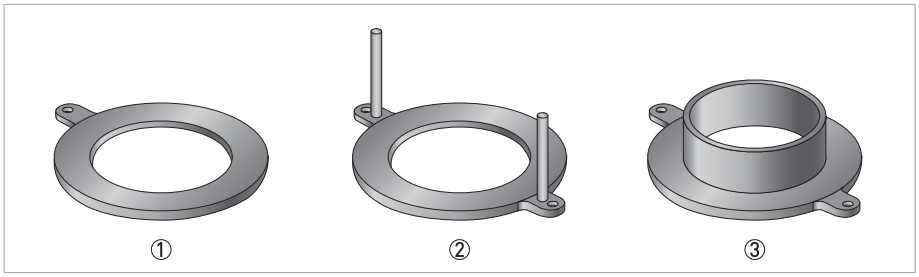


Figure 4-2: Different types of grounding rings

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

Grounding ring number 1:

- Thickness : 3 mm / 0.1" (tantalum: 0.5 mm / 0.02")

Grounding ring number 2:

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

Grounding ring number 3:

- Thickness : 3 mm / 0.1"
- With cylindrical neck (length 30 mm / 1.25" for DN10...150 / 3/8...6")
- Offers liner protection against abrasive fluids

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

The virtual reference option on the flow converter IFC 300 provides complete isolation of the measurement circuit.

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.

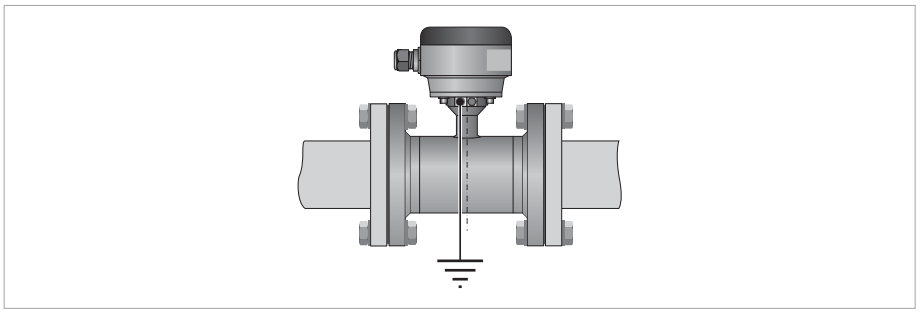


Figure 4-3: Virtual reference

Minimum requirements:

- Size: ≥ DN10 / 3/8"
- Electrical conductivity: ≥ 200 µS/cm
- Signal cable: max. 50 m / 164 ft, type DS

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 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.

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.*

5.3.2 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:
Tel. no.:		Fax no. and/or Email address:
Manufacturer's order no. or serial no.:		
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 through any residual media contained in the device when it is returned.		
Date:		Signature:
Stamp:		

5.4 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) in the European Union:

According to the directive 2012/19/EU, 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.

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.

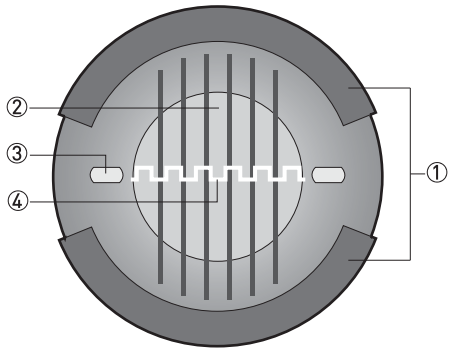


Figure 6-1: Measuring principle

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 (Downloadcenter).*

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

Design

Features	Fully welded maintenance-free sensor.
	Large diameter range DN25...3000
	Rugged liners approved for drinking water.
	Large standard range but also available in customer specific diameter, length and pressure rating.
Modular construction	The measurement system consists of a flow sensor and a signal converter. It is available as compact and as separate version. Additional information can be found in the documentation of the signal converter.
Compact version	With signal converter IFC 050: OPTIFLUX 2050 C
	With signal converter IFC 100: OPTIFLUX 2100 C
	With signal converter IFC 300: OPTIFLUX 2300 C
Remote version	In wall (W) mount version with signal converter IFC 050: OPTIFLUX 2050 W
	In wall (W) mount version with signal converter IFC 100: OPTIFLUX 2100 W
	In field (F), wall (W) or rack (R) mount version with signal converter IFC 300: OPTIFLUX 2300 F, W or R
Nominal diameter	With signal converter IFC 050: DN25...1200 / 1...48"
	With signal converter IFC 100: DN25...1200 / 1...48"
	With signal converter IFC 300: DN25...3000 / 1...120"

Measuring accuracy

Reference conditions	Medium: water	
	Temperature: +10...+30°C / +50...+86°F	
	Operating pressure: 1 bar / 14.5 psi	
	Inlet section ≥ 5 DN	
	Electrical conductivity: ≥ 300 µS/cm	
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 0.2% of the measured value ±1 mm/s	
	The maximum measuring error depends on the installation conditions.	
	For detailed information refer to *Measuring accuracy* on page 39.	
Repeatability	±0.1% of the measured value, minimum 1 mm/s	
Calibration / Verification	**Standard:**	
	2 point calibration by a direct volume comparison.	
	Optional:	
	Verification to Measurement Instrument Directive (MID), Annex MI-001. Standard: Verification at Ratio (Q3/Q1) = 80, Q3 ≥ 2 m/s Optional: Verification at Ratio (Q3/Q1) > 80 on request	
	Only in combination with the signal converter IFC 300.	
MID Annex MI-001 (Directive 2004/22/EC)	**EC-Type examination certificate to MID Annex MI-001**	
	Only in combination with the signal converter IFC 300.	
	Diameter range: DN25...1600	
	Forward and reverse (bi-directional) flow	
	Liquid temperature range: +0.1°C / +50°C	
	For detailed information refer to *Legal metrology* on page 35.	
OIML R49	**Certificate of conformity to OIML R49**	
	Only in combination with the signal converter IFC 300.	
	Diameter range	Class 1:DN65...1600
		Class 2: DN25...50
	Forward and reverse (bi-directional) flow	
	Liquid temperature range: +0.1°C / +50°C	
	For detailed information refer to *Legal metrology* on page 35.	

Operating conditions

Temperature	
For detailed information in pressure / temperature refer to *Pressure derating* on page 44.	
	For Ex versions different temperatures are valid. Please refer to the relevant Ex documentation for details.
Process temperature	Hard rubber liner: -5...+80°C / +23...+176°F
	Polypropylene liner: -5...+90°C / +23...+194°F
	Polyolefin liner: -5...+80°C / +23...+176°F
Ambient temperature	**Standard** (with aluminum signal converter housing): standard flanges
	-20…+65°C / -4…+149°F
	Option (with aluminum signal converter housing): low temperature carbon steel flanges or stainless steel flanges
	-40…+65°C / -40…+149°F
	Option (with stainless steel signal converter housing): low temperature carbon steel flanges or stainless steel flanges
	-40...+55°C / -40…+130°F
Protect electronics against self-heating at ambient temperatures above +55°C / +131°F.	
Storage temperature	-50...+70°C / -58...+158°F
Measuring range	-12...+12 m/s / -40...+40 ft/s

Pressure	
For detailed information in pressure / temperature refer to *Pressure derating* on page 44.	
EN 1092-1	DN2200...3000: PN2.5
	DN1200...2000: PN6
	DN200...1000: PN10
	DN65 and DN100...150: PN16
	DN25...50 and DN80: PN40
	Other pressures on request
ASME B16.5	1...24": 150 & 300 lb RF
	Other pressures on request
JIS	DN50...1000 / 2...40": 10 K
	DN25...40 / 1...1½": 20 K
	Other pressures on request
AWWA (class B or D FF)	**Option:**
	DN700...1000 / 28...40": ≤ 10 bar / 145 psi
	DN1200...2000 / 48...80": ≤ 6 bar / 87 psi
DIN	PN16 - 6 bar rated; DN700...2000
	PN10 - 6 bar rated; DN700...2000
	PN6 - 2 bar rated; DN700...2000
Vacuum load	For detailed information refer to *Vacuum load* on page 46.
Pressure loss	Negligible
Chemical properties	
Physical condition	Electrically conductive liquids
Electrical conductivity	Standard: ≥ 5 µS/cm
	Demineralised water: ≥ 20 µS/cm
Permissible gas content (volume)	IFC 050: ≤ 3%
	IFC 100: ≤ 3%
	IFC 300: ≤ 5%
Permissible solid content (volume)	IFC 050: ≤ 10%
	IFC 100: ≤ 10%
	IFC 300: ≤ 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 flow direction.
Inlet run	≥ 5 DN
Outlet run	≥ 2 DN
Dimensions and weights	For detailed information refer to *Dimensions and weights* on page 40.

Materials

Flow sensor housing	Sheet steel
	Other materials on request
Measuring tube	Austenitic stainless steel
Flanges	Carbon steel
	Other materials on request
Liner	**Standard:**
	DN25...150 / 1...6": polypropylene
	DN200...3000 / 8...120": hard rubber
	Option:
	DN25...150 / 1...6": hard rubber
	DN200...1000 / 8...40": polyolefin
Protective coating	On exterior of the meter: flanges, housing, signal converter (compact version) and / or connection box (field version)
	Standard: polyurethane coating
	Option: subsoil coating, offshore coating
Connection box	Only for remote versions
	Standard: die-cast aluminum
	Option: stainless steel
Measuring electrodes	Standard: Hastelloy® C
	Option: stainless steel, titanium
	Other materials on request
Grounding rings	Standard: stainless steel
	Option: Hastelloy® C, titanium, tantalum
	Grounding rings can be omitted with virtual reference option for the signal converter IFC 300.
Reference electrode (optional)	Standard: Hastelloy® C
	Option: stainless steel, titanium
	Other materials on request

Process connections

Flange	
EN 1092-1	DN25...3000 in PN2.5...40
ASME	1...24" in 150 & 300 lb RF
JIS	DN25...1000 in 10...20 K
AWWA	DN700...2000 in 6...10 bar
Design of gasket surface	RF
	Other sizes or pressure ratings on request.

Electrical connections

	For full detail refer to the relevant documentation of the signal converter.
Signal cable (remote versions only)	
Type A (DS)	**In combination with the signal converter IFC 050, IFC 100 and IFC 300**
	Standard cable, double shielded. Max. length: 600 m / 1968 ft (depends on electrical conductivity and flow sensor)
Type B (BTS)	**Only in combination with the signal converter IFC 300**
	Optional cable, triple shielded. Max. length: 600 m / 1968 ft (depends on electrical conductivity and flow sensor)
I/O	For full details of I/O options, including data streams and protocols, see technical datasheet of the relevant signal converter.

Approvals and certificates

CE	
This device fulfils 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 directive & standards and the approved certifications; please refer to the EU Declaration of Conformity or the website of the manufacturer.
Hazardous area	
ATEX	Please check the relevant Ex documentation for details.
	Compact version with signal converter IFC 100
	II 2 GD
	Compact version with signal converter IFC 300
	II 2 GD or II 2(1) GD
	Remote version
	II 2 GD
FM	**In combination with signal converter IFC 300**
	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	**In combination with signal converter IFC 300**
	Class I, Div. 2, Groups A, B, C and D
	Class II, Div. 2, Groups F and G
NEPSI	GYJ05234 / GYJ05237
	Ex me ia IIC T6...T3
	Ex de ia II T6...T3
	Ex qe ia IIC T6...T3
	Ex e ia IIC T6...T3
Other approvals and standards	
Custody transfer	Only in combination with the signal converter IFC 300.
	MID Annex MI-001 type examination certificate
	OIML R49 certificate of conformity
	Conformity with ISO 4064 and EN 14154
Drinking water approvals	Hard rubber liner: NSF / ANSI standard 61 / ACS, KTW(<60°C), DVGW-W270, KIWA on request.
	Polypropylene liner: ACS, KIWA/ATA, KTW, NSF / ANSI standard 61, DVGW-W270, WRAS
	Polyolefin liner: ACS, KIWA/ATA, KTW, DVGW-W270, WRAS
Protection category acc. to IEC 529 / EN 60529	**Standard:**
	IP66 / 67 (NEMA 4/4X/6)
	Option:
	IP68 (NEMA 6P)
	IP68 is only available for separate design and with a stainless steel connection box.
Shock test	IEC 68-2-27
	30 g for 18 ms
Vibration test	IEC 68-2-64
	f = 20-2000 Hz, rms = 4.5 g, t = 30 min

6.3 Legal metrology

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

6.3.1 OIML R49

The OPTIFLUX 2300 has a certificate of conformity with the international recommendation OIML R49 (edition 2006). The certificate has been issued by NMi (Dutch board of weight and measures). The OIML R49 recommendation (2006) 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 2300 meets the requirements for water meters of accuracy class 1 and 2.

- 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.

According to OIML R49, accuracy class 1 designation shall be applied only to flowmeter with $Q3 \geq 100\ m^3/h$.

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
65	630	0.1587	0.254	100	125
80	630	0.254	0.4063	160	200
100	630	0.3968	0.6349	250	312.5
125	630	0.6349	1.0159	400	500
150	630	0.6349	1.0159	400	500
200	1000	1.0	1.6	1000	1250
250	1000	1.6	2.56	1600	2000
300	1000	2.5	4.0	2500	3125
350	500	5.0	8.0	2500	3125
400	500	8.0	12.8	4000	5000
450	500	8.0	12.8	4000	5000
500	500	12.6	20.16	6300	7875
600	160	39.375	63	6300	7875
700	80	125	200	10000	12500
800	80	125	200	10000	12500
900	80	200	320	16000	20000
1000	80	200	320	16000	20000
1100	80	200	320	16000	20000
1200	80	200	320	16000	20000
1300	80	312.5	500	25000	31250
1400	80	312.5	500	25000	31250
1500	80	312.5	500	25000	31250
1600	80	312.5	500	25000	31250
1800	50	500	800	25000	31250

OIML R49 Class 2

DN	Span (R)	Flow rate [m^3/h]			
		Minimum Q1	Transitional Q2	Permanent Q3	Overload Q4
25	400	0.040	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

For DN65 to DN1600; same values (DN, R, Q1, Q2, Q3, Q4) as for OIML R49 class 1 are applicable.

6.3.2 MID Annex III (MI-001)

All new designs of water 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 2300 has an EC-type examination certificate and can be verified to the MID Annex III (MI-001) for water meters with diameter DN25...DN1800. The conformity assessment procedure followed for OPTIFLUX 2300 is Module B (Type Examination) and Module D (Quality Assurance of the Production Process).

The maximim 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	0.040	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	0.2540	100	125
80	640	0.254	0.4063	160	200
100	625	0.3968	0.6349	250	312.5
125	667	0.6349	1.0159	400	500
150	667	0.6349	1.0159	400	500
200	1000	1.0	1.6	1000	1250
250	1000	1.6	2.56	1600	2000
300	1000	2.5	4.0	2500	3125
350	500	5.0	8.0	2500	3125
400	500	8.0	12.8	4000	5000
450	500	8.0	12.8	4000	5000
500	500	12.6	20.16	6300	7875
600	160	39.375	63	6300	7875
700	80	125	200	10000	12500
800	80	125	200	10000	12500
900	80	200	320	16000	20000
1000	80	200	320	16000	20000
1100	80	200	320	16000	20000
1200	80	200	320	16000	20000
1300	80	312.5	500	25000	31250
1400	80	312.5	500	25000	31250
1500	80	312.5	500	25000	31250
1600	80	312.5	500	25000	31250
1800	59	500	800	25000	31250

6.4 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

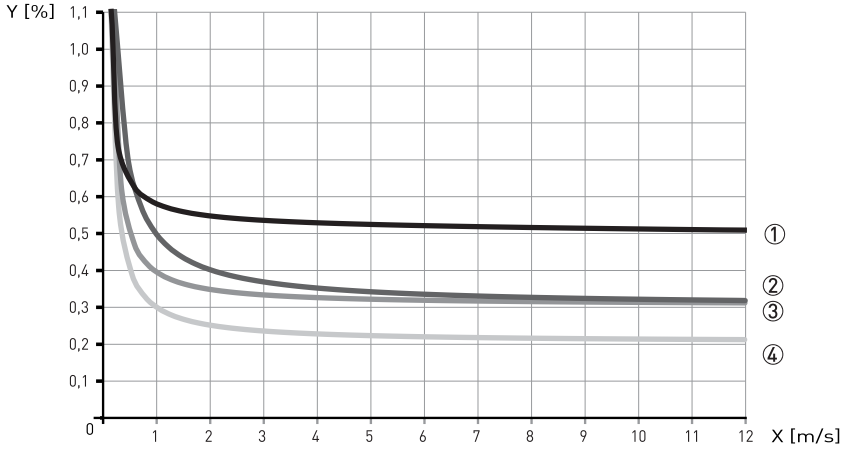


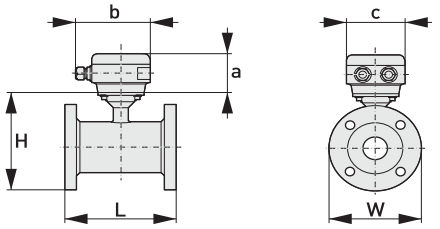
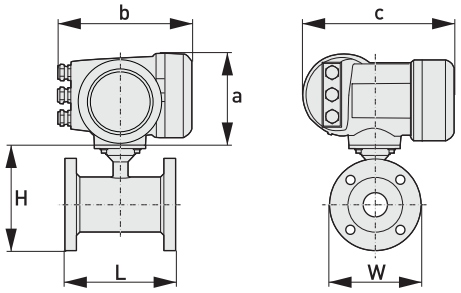
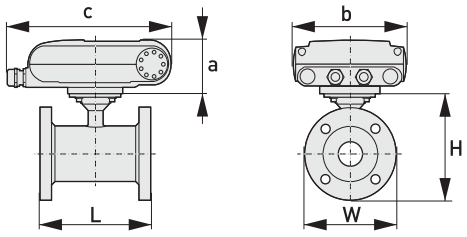
Figure 6-4: Flow velocity vs. accuracy
X [m/s] : flow velocity
Y [%]: deviation from the actual measured value (mv)

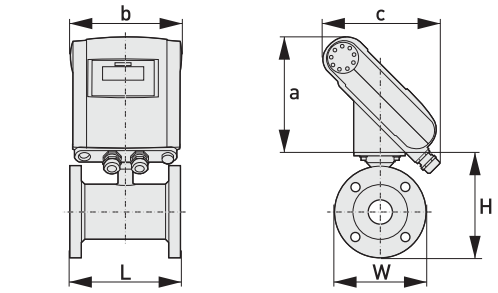
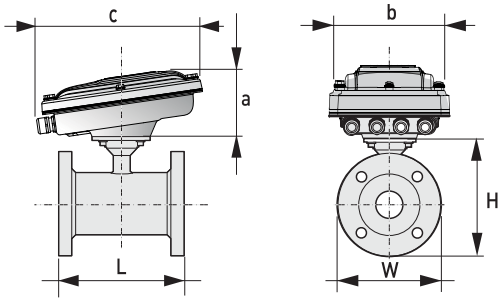
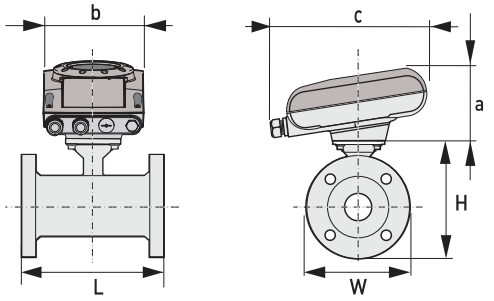
Accuracy

Flow sensor diameter	Signal converter type	Accuracy	Curve
DN25...1200 / 1...48"	IFC 050	0.5% of mv + 1 mm/s	①
DN25...1200 / 1...48"	IFC 100	0.3% of mv + 1 mm/s	③
DN25...1600 / 1...64"	IFC 300	0.2% of mv + 1 mm/s	④
DN1800...3000 / > 64"	IFC 300	0.3% of mv + 2 mm/s	②

INFORMATION!
Optionally for IFC050 and IFC 100; extended calibration at 2 points for optimised accuracy.
For more details on optimised accuracy, see the concerning signal converter documentation.

6.5 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 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 = 101 mm / 3.98" b = 157 mm / 6.18" c = 260 mm / 10.24" ① Total height = H + a

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

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

Nominal size DN [mm]	Dimensions [mm]				Approx. weight [kg]
	Standard length	ISO Insertion length	H	W	
25	150	200	140	115	5
32	150	200	157	140	6
40	150	200	166	150	7
50	200	200	186	165	11
65	200	200	200	185	9
80	200	200	209	200	14
100	250	250	237	220	15
125	250	250	266	250	19
150	300	300	300	285	27
200	350	350	361	340	34
250	400	450	408	395	48
300	500	500	458	445	58
350	500	550	510	505	78
400	600	600	568	565	101
450	600	-	618	615	111
500	600	-	671	670	130
600	600	-	781	780	165
700	700	-	898	895	248
800	800	-	1012	1015	331
900	900	-	1114	1115	430
1000	1000	-	1225	1230	507
1200	1200	-	1417	1405	555
1400	1400	-	1619	1630	765
1600	1600	-	1819	1830	1035
1800	1800	-	2027	2045	1470
2000	2000	-	2259	2265	1860

ASME B16.5 / 150 lb flanges

Nominal size [inch]	Dimensions [inch]			Approx. weight [lb]
	L	H	W	
1"	5.91	5.39	4.25	9
1¼"	5.91	5.75	4.63	13
1½"	5.91	6.10	5.00	15
2"	7.87	7.05	5.98	18
2½"	7.87	7.72	7	22
3"	7.87	8.03	7.50	26
4"	9.84	9.49	9.00	44
5"	9.84	10.55	10.00	49
6"	11.81	11.69	11.00	64
8"	13.78	14.25	13.50	95
10"	15.75	16.30	16.00	143
12"	19.69	18.78	19.00	207
14"	27.56	20.67	21.00	284
16"	31.50	22.95	23.50	364
18"	31.50	24.72	25.00	410
20"	31.50	26.97	27.50	492
24"	31.50	31.38	32.00	675

ASME B16.5 / 300 lb flanges

Nominal size [inch]	Dimensions [inch]			Approx. weight [lb]
	L	H	W	
1"	5.91	5.71	4.87	11
1¼"	7.87	6.30	5.25	17
1½"	7.87	6.65	6.13	20
2"	9.84	7.32	6.50	22
2½"	9.84	7.95	7.5	25
3"	9.84	8.43	8.25	31
4"	11.81	10.00	10.00	44
6"	12.60	12.44	12.50	73
8"	15.75	15.04	15.00	157
10"	19.69	17.05	17.50	247
12"	23.62	20.00	20.50	375
14"	27.56	21.65	23.00	474
16"	31.50	23.98	25.50	639
20"	31.50	28.46	30.50	937
24"	31.50	33.39	36.00	1345

6.6 Pressure derating

The graphs below refer to the maximum pressure as a function of the temperature for the flanges of the flowmeter (per specified flange material).

Please note that the specified values only refer to the flanges. The maximum value for the flowmeter can further be limited by the maximum value for other materials (i.e. the liner)

For A = Carbon steel A 105 & B = Stainless steel 316L
X/Y axes in all graphs; X = Temperature in [°C] / Y = Pressure in [bar]
x/y axes in all graphs; x = Temperature in [°F] / y = Pressure in [psi]

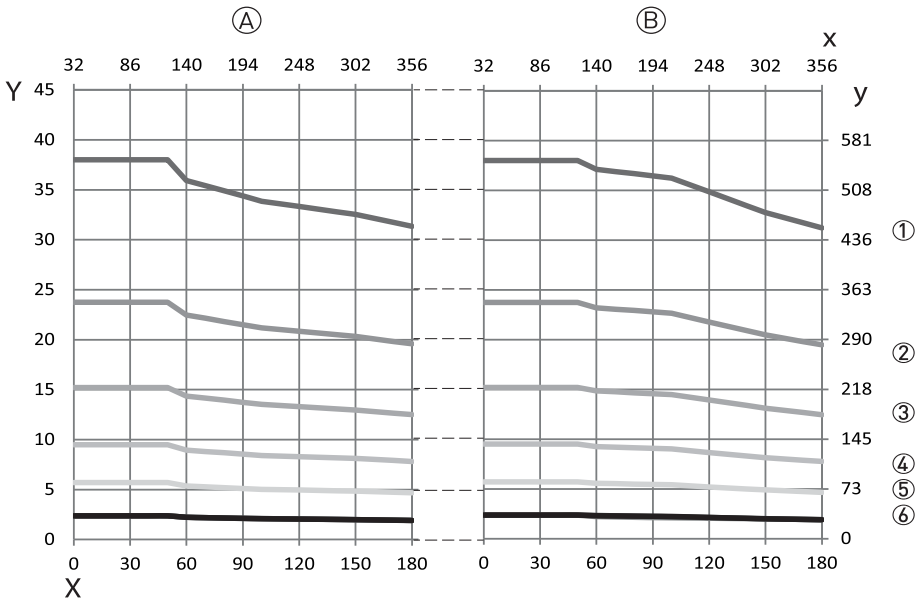


Figure 6-5: Pressure derating; EN 1092-1

① PN 40
② PN 25
③ PN 16
④ PN 10
⑤ PN 6
⑥ PN 2.5

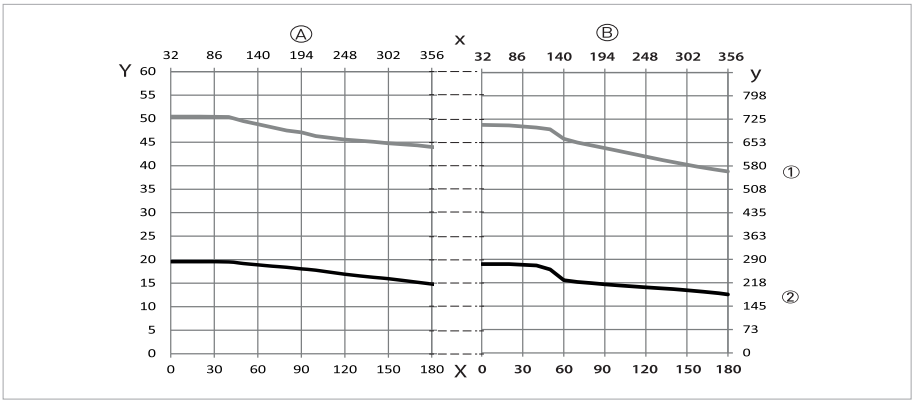


Figure 6-6: Pressure derating; ANSI B16.5

① 300 lbs
② 150 lbs

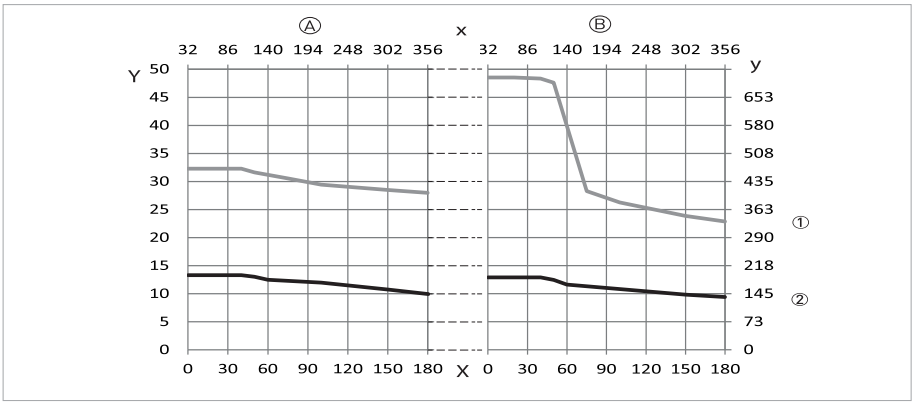


Figure 6-7: Pressure derating; JIS B2220

① 20K
② 10K

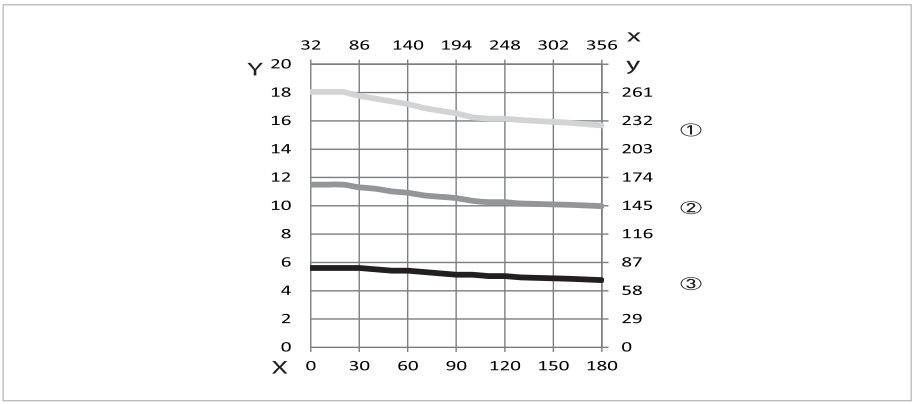


Figure 6-8: Pressure derating; AWWA C207

① Class D1 [4...12"]
② Class D2 [>12"]
③ Class B

6.7 Vacuum load

Diameter	Vacuum load in mbar abs. at a process temperature of			
[mm]	20°C	40°C	60°C	80°C
Hard rubber				
DN200...300	250	250	400	400
DN350...1000	500	500	600	600
DN1200...3000	600	600	750	750
Polypropylene				
DN25...150	250	250	400	400
Polyolefin				
DN200...1000	0	0	0	0

Diameter	Vacuum load in psia at process temperature of			
[inch]	68°F	104°F	140°F	176°F
Hard rubber				
8...12	3.6	3.6	5.8	5.8
14...40	7.3	7.3	8.7	8.7
48...120	8.7	8.7	10.9	10.9
Polypropylene				
1...6	3.6	3.6	5.8	5.8
Polyolefin				
8...40	0	0	0	0

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