



## OPTIFLUX 4000 **Technical Datasheet**

### Electromagnetic flow sensor

- Robust, fully welded construction
- Standard solutions for the widest range of industrial applications
- Engineered solutions for very demanding applications



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

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>Product features</b>                                 | <b>3</b>  |
| <hr/>    |   |           |
| 1.1      | The all-round solution for process industries.....      | 3         |
| 1.2      | Options.....  | 5         |
| 1.3      | Measuring principle.....                                | 7         |
| <b>2</b> | <b>Technical data</b>                                   | <b>8</b>  |
| <hr/>    |   |           |
| 2.1      | Technical data.....                                     | 8         |
| 2.2      | Legal metrology.....                                    | 15        |
| 2.2.1    | OIML R49.....   | 15        |
| 2.2.2    | MID Annex MI-001.....                                   | 17        |
| 2.2.3    | Verification to MI-001 & OIML 49.....                   | 19        |
| 2.2.4    | OIML R117.....  | 20        |
| 2.2.5    | MI-005.....   | 20        |
| 2.3      | Measurement accuracy.....                               | 21        |
| 2.4      | Vacuum load.....  | 23        |
| 2.5      | Dimensions and weights.....                             | 24        |
| <b>3</b> | <b>Installation</b>                                     | <b>28</b> |
| <hr/>    |   |           |
| 3.1      | Intended use.....                                       | 28        |
| 3.2      | General notes on installation.....                      | 28        |
| 3.2.1    | Vibration.....  | 28        |
| 3.2.2    | Magnetic field.....                                     | 28        |
| 3.3      | Installation conditions.....                            | 29        |
| 3.3.1    | Inlet and outlet.....                                   | 29        |
| 3.3.2    | Bends in 2 or 3 dimensions.....                         | 29        |
| 3.3.3    | T-section.....  | 29        |
| 3.3.4    | Bends.....  | 30        |
| 3.3.5    | Open feed or discharge.....                             | 30        |
| 3.3.6    | Flange deviation.....                                   | 31        |
| 3.3.7    | Pump.....   | 31        |
| 3.3.8    | Control valve.....                                      | 31        |
| 3.3.9    | Air venting and vacuum forces.....                      | 32        |
| 3.3.10   | Mounting position.....                                  | 33        |
| 3.4      | Mounting.....   | 33        |
| 3.4.1    | Torques and pressures.....                              | 33        |
| <b>4</b> | <b>Electrical connections</b>                           | <b>36</b> |
| <hr/>    |   |           |
| 4.1      | Safety instructions.....                                | 36        |
| 4.2      | Grounding.....  | 36        |
| 4.3      | Virtual reference for IFC 300 (C, W and F version)..... | 38        |
| <b>5</b> | <b>Notes</b>  | <b>39</b> |
| <hr/>    |   |           |

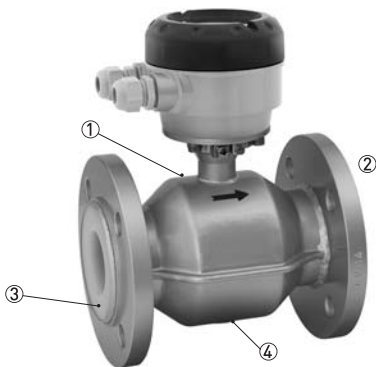
## 1.1 The all-round solution for process industries

The **OPTIFLUX 4000** design meets the demands of a very wide range of applications in industries including the chemical, pulp & paper, water and wastewater, minerals and mining, iron, steel and metals, pharmaceuticals and oil & gas industry.

The OPTIFLUX 4000 has a field proven and unsurpassed lifetime. This is assured by the fully welded construction, full bore pipe construction, absence of moving parts and wear resistant liner materials. Even for demanding applications in harsh environments or with aggressive and abrasive media KROHNE's OPTIFLUX 4000 can offer a solution.

Examples include water injection under high pressures (2500lbs), subsea installations, slurries with very high solids contents, alkaline solutions and acids, up to chemical dosing, bleaching, coloring, and black liquor in the paper industry. If required, a solution beyond our standard scope can be engineered. KROHNE has in house specialized know how on constructions, welding and exotic materials.

For custody transfer applications, where the highest accuracy is crucial, OPTIFLUX 4000 has a wide range of certifications including OIML R49 & R117, MI-001 & MI-005.



- ① Robust fully welded construction
- ② Diameter range: DN2.5...DN3000
- ③ PFA, PTFE, ETFE, PU and hard rubber liners
- ④ Hastelloy, titanium, tantalum, stainless steel, platinum and low noise electrodes

### Highlights

- Trusted and accepted flow sensor for all process applications
- Proven in use and unsurpassed lifetime
- Large installed base – more than 300.000 units - in virtually any industry
- All welded rugged construction, to extend lifetime of equipment
- Good corrosion, erosion / abrasion resistance
- Wide choice of materials for housing & flanges including SS, Duplex, 6mo
- Flexibility in sizes including sizes, special constructions, special inner diameters and thicknesses
- Corrosion resistant and leak tight electrodes. Specials (materials, retractable or pointed) on demand
- External coatings for offshore or subsoil installation. Optional paint specifications acc. to ISO 12944 – protective coating
- Reliably measurement under very demanding conditions: including high temperatures up to 180°C / 356°F, pressures up to 2500 bar, high solids contents (up to 70%)
- Bi-directional flow metering
- Wide range of approvals for hazardous areas
- Compliant with requirements for custody transfer OIML R49 & R117, MI-001 & MI-005
- No grounding rings with virtual reference option on IFC 300
- Extensive diagnostic capabilities
- Every meter leaving the factory is wet calibrated on our calibration rigs which are traceable

### Industries

- Chemicals
- Pulp & Paper
- Water
- Wastewater
- Minerals & Mining
- Iron, Steel & Metals
- Pharmaceuticals
- Oil & gas

### Applications

- For clean liquids
- For slurries and pastes with high solids content
- For abrasive and aggressive products

## 1.2 Options

The solution for any industry



### From standard to customized

For easy ordering the standard range of the OPTIFLUX 4000F covers all popular sizes, materials and coatings. Process connections are available in EN (up to PN40), ASME (up to 2500 lbs), and JIS (20K).

But KROHNE does not stop here. Our extensive engineering department is dedicated to provide solutions for all specifications not covered by our standard range. Requests for special sizes, flange connections, pressure ratings, building lengths, and materials, will always get a serious review. Whenever possible we will engineer a flow meter that fits your application.



### Easy installation

Fitting the OPTIFLUX 4000 is easy with the flanged design and standard ISO insertion lengths. To further ease the operation, the OPTIFLUX 4000 can be installed without filters and straighteners. Even grounding rings are not required with the patented "Virtual Reference" option on the IFC 300 converter.



### IP68

Installation in measurement chambers subject to (constant) flooding is possible with the IP68 rated version. The chambers can even be completely surpassed if the IP68 version is combined with our special subsoil coating, allowing the OPTIFLUX 4000 to be installed directly in the ground.



**Custody transfer**

In combination with the IFC 300 converter the OPTIFLUX 4000 is suitable for custody transfer applications. It meets the requirements of OIML R49 and can be verified according to Annex MI-001 of the Measuring Instruments Directive (MID) for cold water and to OIML R117 and MID Annex MI-005 for liquids other than water.

All water meters for legal metrology purposes in Europe require certification under the MID. The EC type examination certificate for the OPTIFLUX 2300 is valid for the compact and the remote version and applies for forward and reverse flow.

**Explosion safety**

In combination with the IFC 100 or IFC 300 signal converter, the OPTIFLUX 4000 has received a wide range of approvals for hazardous areas, including ATEX, CSA, FM, IEC and Nepsi.

### 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 flow meter

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

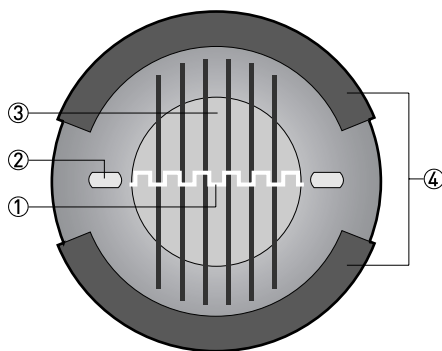


Figure 1-1: Measuring principle

- ① 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 sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Download Center).*

### Measuring system

|                          |                                |
|--------------------------|--------------------------------|
| Measuring principle      | Faraday's law                  |
| Application range        | Electrically conductive fluids |
| <b>Measured value</b>    |                                |
| Primary measured value   | Flow velocity                  |
| Secondary measured value | Volume flow                    |

### Design

|                      |  |
|----------------------|--|
| Features             | Fully welded maintenance-free sensor.  |
|                      | Flange version with full bore flow tube.   |
|                      | Standard as well as higher pressure ratings.   |
|                      | Broad range of nominal sizes.  |
|                      | Industry specific insertion lengths.   |
| Modular construction | The measurement system consists of a flow sensor and a signal converter. It is available as compact and as separate version. |
| Compact version      | With IFC 040 converter: OPTIFLUX 4040 C  |
|                      | With IFC 100 converter: OPTIFLUX 4100 C  |
|                      | With IFC 300 converter: OPTIFLUX 4300 C  |
| Remote version       | In wall (W) mount version with IFC 100 converter: OPTIFLUX 4100 W  |
|                      | In field (F), wall (W) or rack (R) mount version with IFC 300 converter: OPTIFLUX 4300 F, W or R                             |
| Nominal diameter     | With IFC 040 converter: DN10... 150 / 3/8... 6"  |
|                      | With IFC 100 converter: DN2.5...1200 / 1/10...48"  |
|                      | With IFC 300 converter: DN2.5...3000 / 1/10...120"   |

|                      |                                       |
|----------------------|---------------------------------------|
| Measuring accuracy   |                                       |
| Reference conditions | Medium: water                         |
|                      | Temperature: 10...30°C / 50...86°F    |
|                      | Operating pressure: 1 bar / 14.5 psig |
|                      | Inlet section: ≥ 5 DN                 |
|                      | Electrical conductivity: ≥ 300 µS/cm  |
|                      | Flow conditions similar to EN 29104   |



|  |   |   |
|--|---|---|
| Maximum measuring error  | These values are related to the pulse / frequency output.   |   |
|  | Related to volume flow (MV = Measured Value)  |   |
|  | With IFC 040 converter:   |   |
|  | $v < 1 \text{ m/s} / 3.3 \text{ ft/s}: \pm 5 \text{ mm/s}$  |   |
|  | $v > 1 \text{ m/s} / 3.3 \text{ ft/s}: \pm 0.5 \% \text{ of MV}$  |   |
|  | With IFC 100 converter:   |   |
|  | DN2.5...6: $\pm 0.4\% \text{ of MV} + 1 \text{ mm/s}$   |   |
|  | DN10...1200: $\pm 0.3\% \text{ of MV} + 1 \text{ mm/s}$   |   |
|  | With IFC 300 converter:   |   |
|  | DN2.5...6: $\pm 0.3\% \text{ of MV} + 2 \text{ mm/s}$   |   |
|  | DN10...1600: $\pm 0.2\% \text{ of MV} + 1 \text{ mm/s}$   |   |
|  | DN1800...3000: $\pm 0.3\% \text{ of MV} + 2 \text{ mm/s}$   |   |
|  | The additional typical measuring deviation for the current output is $\pm 10 \mu\text{A}$ .   |   |
| The maximum measuring error depends on the installation conditions.      |   |   |
| For detailed information refer to <i>Measurement accuracy</i> on page 21 |   |   |
| Repeatability  | $\pm 0.1\% \text{ of MV}$ , minimum 1 mm/s  |   |
| Calibration / Verification   | <b>Standard:</b>  |   |
|  | Wet calibrated on EN 17025 accredited calibration rig by direct volume comparison.  |   |
|  | <b>Optional:</b>  |   |
|  | Verification to Measurement Instrument Directive (MID), Annex MI-001.<br>Standard: Verification at Ratio (Q3/Q1) = 80, Q3 $\geq 2 \text{ m/s}$<br>Optional: Verification at Ratio (Q3/Q1) > 80 on request |   |
|  | (Only in combination with IFC 300)  |   |
| Long term stability  | $\pm 0.1\% \text{ of MV}$   |   |
| Special calibration  | On request.   |   |
| MID Annex MI-001<br>(Directive 2004/22/EC)                               | <b>EC-Type examination certificate to MID Annex MI-001</b>  |   |
|  | (Only in combination with IFC 300)  |   |
|  | Diameter range: DN25...500  |   |
|  | Forward and reverse (bi-directional) flow   |   |
|  | Liquid temperature range: $+0.1^\circ\text{C} / 50^\circ\text{C}$   |   |
| For detailed information refer to <i>Legal metrology</i> on page 15      |   |   |
| OIML R49   | <b>Certificate of conformity to OIML R49</b>  |   |
|  | (Only in combination with IFC 300)  |   |
|  | Diameter range  | Class 1: DN80...500<br>Class 2: DN25...50 |
|  | Forward and reverse (bi-directional) flow   |   |
|  | Liquid temperature range: $+0.1^\circ\text{C} / 50^\circ\text{C}$   |   |
|  | For detailed information refer to <i>Legal metrology</i> on page 15   |   |

## Operating conditions

| <b>Temperature</b>  |  |
|---|--|
| For Ex versions different temperatures are valid. Please check the relevant Ex documentation for details. |  |
| Process temperature   | PTFE / PFA: -40...+180°C / -40...+356°F for remote versions                              |
|   | PTFE / PFA: -40...+140°C / -40...+284°F for IFC 300 compact versions                     |
|   | PTFE / PFA: -40...+120°C / -40...+248°F for IFC 100 compact versions                     |
|   | ETFE: -40...+120°C / -40...+248°F  |
|   | Hard rubber: -5...+80°C / 23...+176°F  |
|   | PU: -5...+65°C / 23...+149°F   |
|   | For more information about temperatures see the temperature table in the manual          |
| Ambient temperature   | <b>Standard</b> (with aluminium converter housing):<br>-40...+65°C / -40...+149°F        |
|   | Protect electronics against self-heating with ambient temperatures above +55°C / +131°F. |
|   | <b>Option</b> (with stainless steel converter housing):<br>-40...+55°C / -40...+130°F    |
|   |  |
| Storage temperature   | -50...+70°C / -58...+158°F   |
| Measurement range   | -12...+12 m/s / -40...+40 ft/s   |
| <b>Pressure</b>   |  |
| EN 1092-1   | DN2200...3000: PN 2.5  |
|   | DN1200...2000: PN 6  |
|   | DN200...1000: PN 10  |
|   | DN65 and DN100...150: PN 16  |
|   | DN2.5...50 and DN80: PN 40   |
|   | Other pressures on request.  |
| ISO insertion length  | Optional for DN15...600  |
| ASME B16.5  | 1/10...24": 150 lb RF  |
|   | Other pressures on request.  |
| JIS   | DN50...1000: 10 K  |
|   | DN2.5...40: 20 K   |
|   | Other pressures on request.  |
| Vacuum load   | For detailed information refer to <i>Vacuum load</i> on page 23                          |
| Pressure ranges for secondary containment   | For DN25...150:  |
|   | Pressure resistant up to 40 bar / 580 psi  |
|   | Burst pressure up to approx. 160 bar / 2320 psi  |
| Pressure loss   | Negligible   |

| <b>Chemical properties</b>         |                                   |
|------------------------------------|-----------------------------------|
| Physical condition                 | Electrically conductive liquids   |
| Electrical conductivity            | Water: $\geq 20 \mu\text{S/cm}$   |
|                                    | Standard: $\geq 1 \mu\text{S/cm}$ |
| Permissible gas content (volume)   | IFC 040: $\leq 3\%$               |
|                                    | IFC 100: $\leq 5\%$               |
|                                    | IFC 300: $\leq 5\%$               |
| Permissible solid content (volume) | IFC 040: $\leq 10\%$              |
|                                    | IFC 100: $\leq 10\%$              |
|                                    | IFC 300: $\leq 70\%$              |

### Installation conditions

|                        |  |
|------------------------|--|
| Installation           | Assure that the flow sensor is always fully filled.                        |
|                        | For detailed information refer to <i>Installation</i> on page 28           |
| Flow direction         | Forward and reverse.   |
|                        | Arrow on flow sensor indicates positive flow direction.                    |
| Inlet run              | $\geq 5 \text{ DN}$  |
| Outlet run             | $\geq 2 \text{ DN}$  |
| Dimensions and weights | For detailed information refer to <i>Dimensions and weights</i> on page 24 |

## Materials

|                                |  |
|--------------------------------|--|
| Sensor housing                 | DN2.5...15: Stainless steel 1.4408   |
|                                | DN20: GTW-S 30   |
|                                | DN25...3000: Sheet steel   |
|                                | Other materials on request.  |
| Measuring tube                 | Austenitic stainless steel   |
| Flanges                        | Standard: Carbon steel   |
|                                | Other materials on request.  |
| Liner                          | <b>Standard</b>  |
|                                | DN2.5...15: PFA  |
|                                | DN20: PTFE   |
|                                | DN25...150: PFA  |
|                                | DN200...1800: ETFE   |
|                                | <b>Option</b>  |
|                                | DN200...600: PTFE  |
|                                | DN200...1800: PU   |
|                                | DN200...3000: Hard rubber (Ex only)  |
| Other materials on request.    |  |
| Protective coating             | On exterior of the meter: flanges, housing, signal converter (compact version) and / or connection box (field version) |
|                                | Standard: polyurethane coating   |
| Connection box                 | Only for remote versions   |
|                                | Standard: die-cast aluminium   |
|                                | Option: Stainless steel  |
| Measuring electrodes           | Standard: Hastelloy® C   |
|                                | Option: Platinum, stainless steel, titanium, tantalum, low noise   |
|                                | Other materials on request.  |
| Grounding rings                | <b>Standard</b> : Stainless steel  |
|                                | <b>Option</b> : Hastelloy® C, titanium, tantalum   |
|                                | Grounding rings can be omitted with virtual reference option for the IFC 300 converter.                                |
| Reference electrode (optional) | Standard: Hastelloy® C   |
|                                | Option: Platinum, stainless steel, titanium, tantalum, low noise   |
|                                | Other materials on request.  |

### Process connections

|                          |   |
|--------------------------|---|
| <b>Flange</b>            |   |
| EN 1092-1                | DN2.5...3000 in PN 2.5...40                 |
| ASME                     | 1/10...120" in 150...2500 lb RF             |
| JIS                      | DN2.5...1000 in JIS 10...20 K               |
| Design of gasket surface | RF  |
|                          | Other sizes or pressure ratings on request. |

### Electrical connections

|   |  |
|---|--|
| For full detail; see the relevant documentation of the signal converter |  |
| <b>Signal cable</b> (remote versions only)                              |  |
| Type A (DS)   | <b>In combination with the IFC 040, IFC 100 and IFC 300 signal converter</b><br>Standard cable, double shielded.<br>Max. length: 600 m / 1950 ft (dep. on electrical conductivity and measuring sensor). |
| Type B (BTS)  | <b>Only in combination with the IFC 300 signal converter</b><br>Optional cable, triple shielded.<br>Max. length: 600 m / 1950 ft (dep. on electrical conductivity and measuring 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  |  |
| <b>CE</b>   |  |
| This device fulfills the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE mark. |  |
| Electromagnetic compatibility   | Directive: 2004/108/EC, NAMUR NE21/04  |
|   | Harmonized standard: EN 61326-1 : 2006 |
| Low voltage directive   | Directive: 2006/95/EC                  |
|   | Harmonized standard: EN 61010 : 2010   |
| Pressure equipment directive  | Directive: 97/23/EC                    |
|   | Category I, II or III                  |
|   | Fluid group 1                          |
|   | Production module H                    |

| Hazardous areas |  |
|-----------------|--|
| ATEX            | Please check the relevant Ex documentation for details.                |
|                 | <b>Compact version with IFC 040 C converter:</b> II 2 GD               |
|                 | <b>Compact version with IFC 100 C converter:</b> II 2 GD               |
|                 | <b>Compact version with IFC 300 C converter:</b> II 2 GD or II 2(1) GD |
|                 | <b>Remote version:</b> II 2 GD   |
| FM              | <b>In combination with IFC 300 converter:</b>                          |
|                 | 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             | <b>In combination with IFC 300 converter:</b>                          |
|                 | Class I, Div 2, groups A, B, C and D                                   |
|                 | Class II, Div 2, groups F and G  |
| IEC-Ex          | <b>Compact version with IFC 100 converter:</b>                         |
|                 | IIC T4   |
| NEPSI           | GYJ05234 / GYJ05237  |
|                 | Ex me ia IIC T6...T3   |
|                 | Ex de ia IIC T6...T3   |
|                 | Ex qe ia IIC T6...T3   |
|                 | Ex e ia IIC T6...T3  |

| Other approvals and standards                  |   |
|--|---|
| Custody transfer                               | Standard: without verification  |
|  | Only in combination with IFC 300 converter.   |
|  | For diameters: DN25...500 (other diameters on request)  |
|  | <b>Cold water</b>   |
|  | MI-001 type examination certificate   |
|  | OIML R49 certificate of conformity  |
|  | Conformity with ISO 4064 and EN 14154   |
|  | <b>Liquids other than water</b>   |
|  | MI-005 type examination certificate   |
|  | OIML R117 certificate of conformity   |
| Hygiene  | PFA liner is FDA approved.  |
| Protection category acc. to IEC 529 / EN 60529 | <b>Standard:</b>  |
|  | IP 66/67 (NEMA 4/4X/6)  |
|  | <b>Option:</b>  |
|  | IP 68 (NEMA 6P)<br>IP 68 is only available for separate design and with a stainless steel connection box. |
| Vibration resistance                           | IEC 68-2-64   |
| Random vibration test                          | IEC 68-2-34   |
| Shock test                                     | IEC 68-2-27   |

## 2.2 Legal metrology

OIML R49- R117 and MID Annex MI-001 is **only** available in combination with the IFC 300 signal converter!

### 2.2.1 OIML R49

The OPTIFLUX 4300 has a certificate of conformity with the international recommendation OIML R49. 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 is determined by Q3 (nominal flow rate) and R (ratio).

$$Q_1 = Q_3 / R$$

$$Q_2 = Q_1 * 1.6$$

$$Q_3 = Q_1 * R$$

$$Q_4 = Q_3 * 1.25$$

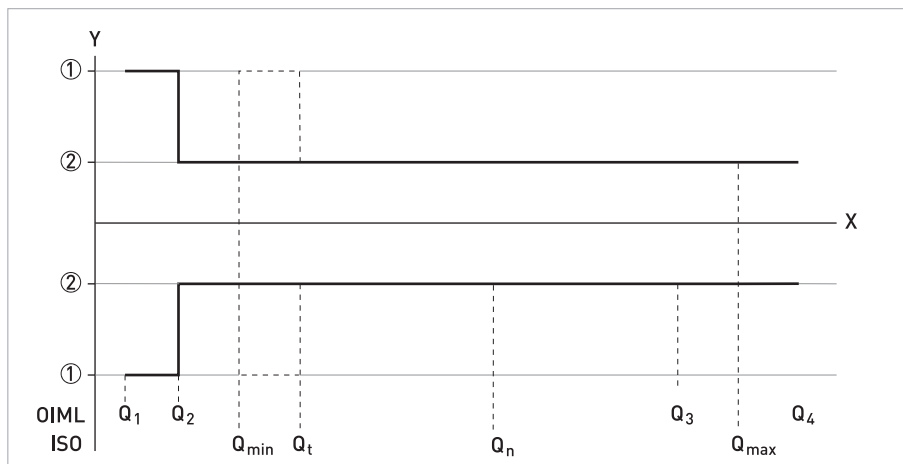


Figure 2-1: ISO flow rates added to figure as comparison towards OIML

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 <sup>3</sup> /h] |                 |              |             |
|------|----------|-------------------------------|-----------------|--------------|-------------|
|      |          | Minimum Q1                    | Transitional Q2 | Permanent Q3 | Overload Q4 |
| 65   | 630      | 0.1587                        | 0.25            | 100          | 125         |
| 80   | 630      | 0.254                         | 0.40            | 160          | 200         |
| 100  | 630      | 0.3968                        | 0.6             | 250          | 312.5       |
| 125  | 630      | 0.6349                        | 1.0             | 400          | 500         |
| 150  | 630      | 0.6349                        | 1.0             | 400          | 500         |
| 200  | 1000     | 1.0                           | 1.6             | 1000         | 1250        |
| 250  | 1000     | 1.6                           | 2.6             | 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                          | 20.2            | 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       |
| 1200 | 80       | 200                           | 320             | 16000        | 20000       |
| 1600 | 80       | 312.5                         | 500             | 25000        | 31250       |

## OIML R49 Class 2

| DN | Span (R) | Flow rate [m <sup>3</sup> /h] |                 |              |             |
|----|----------|-------------------------------|-----------------|--------------|-------------|
|    |          | Minimum Q1                    | Transitional Q2 | Permanent Q3 | Overload Q4 |
| 25 | 400      | 0.040                         | 0.064           | 16           | 20          |
| 32 | 400      | 0.0625                        | 0.10            | 25           | 31.3        |
| 40 | 400      | 0.0625                        | 0.10            | 25           | 31.3        |
| 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.



## 2.2.2 MID Annex MI-001

All new designs of flow meters that are to be used for legal purposes in Europe require certification under the Measurement Instrument Directive (MID) 2004/22/EC. 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 4300 has an EC-type examination certificate and can be verified to the MID Annex MI-001 for water meters with diameter DN25...DN1600. The conformity assessment procedure followed for OPTIFLUX 4300 is Module B (Type Examination) and Module D (Quality Assurance of the Production Process).

The maximum permissible error on volumes delivered between Q2 (transitional) flow rate and Q4 (overload) flow rate is  $\pm 2\%$ .

The maximum permissible error on volumes delivered between Q1 (minimum) flow rate and Q2 (transitional) flow rate is  $\pm 5\%$ .

$$Q1 = Q3 / R$$

$$Q2 = Q1 * 1.6$$

$$Q3 = Q1 * R$$

$$Q4 = Q3 * 1.25$$

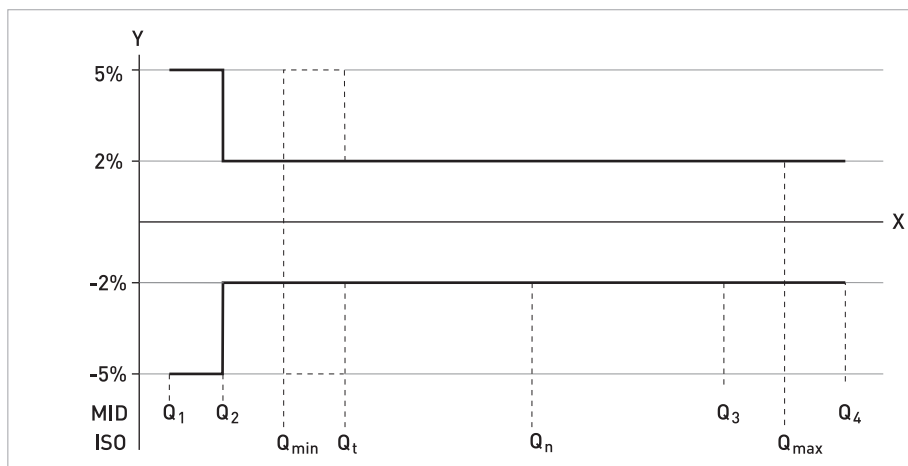


Figure 2-2: ISO flow rates added to figure as comparison towards MID

X: Flow rate

Y [%]: Maximum measuring error

## MI-001 certified flow characteristics

| DN   | Span (R)<br>Q3 / Q1 | Flow rate [m <sup>3</sup> /h] |                 |              |             |
|------|---------------------|-------------------------------|-----------------|--------------|-------------|
|      |                     | Minimum Q1                    | Transitional Q2 | Permanent Q3 | Overload Q4 |
| 25   | 400                 | 0.040                         | 0.064           | 16           | 20          |
| 32   | 400                 | 0.0625                        | 0.10            | 25           | 31.3        |
| 40   | 400                 | 0.0625                        | 0.10            | 25           | 31.3        |
| 50   | 400                 | 0.10                          | 0.16            | 40           | 50          |
| 65   | 625                 | 0.1587                        | 0.25            | 100          | 125         |
| 80   | 640                 | 0.254                         | 0.40            | 160          | 200         |
| 100  | 625                 | 0.3968                        | 0.6             | 250          | 312.5       |
| 125  | 667                 | 0.6349                        | 1.0             | 400          | 500         |
| 150  | 667                 | 0.6349                        | 1.0             | 400          | 500         |
| 200  | 1000                | 1.0                           | 1.6             | 1000         | 1250        |
| 250  | 1000                | 1.6                           | 2.6             | 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                          | 20.2            | 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       |
| 1200 | 80                  | 200                           | 320             | 16000        | 20000       |
| 1600 | 80                  | 312.5                         | 500             | 25000        | 31250       |

### 2.2.3 Verification to MI-001 & OIML 49

Verification to MI-001 and to OIML R49 class 2 is carried out at the following values for R, Q1, Q2 and Q3. Verification to OIML R49 class 1 and at other values for R and Q3 available on request.

#### Verification to MI-001

| DN   | Span (R)<br>Q3 / Q1 | Flow rate [m <sup>3</sup> /h] |      |       |
|------|---------------------|-------------------------------|------|-------|
|      |                     | Q1                            | Q2   | Q3    |
| 25   | 80                  | 0.05                          | 0.08 | 4     |
| 32   | 80                  | 0.125                         | 0.20 | 10    |
| 40   | 80                  | 0.125                         | 0.20 | 10    |
| 50   | 80                  | 0.2                           | 0.32 | 16    |
| 65   | 80                  | 0.3125                        | 0.50 | 25    |
| 80   | 80                  | 0.5                           | 0.80 | 40    |
| 100  | 80                  | 0.7875                        | 1.26 | 63    |
| 125  | 80                  | 1.250                         | 2.00 | 100   |
| 150  | 80                  | 2.0                           | 3.2  | 160   |
| 200  | 80                  | 3.125                         | 5.0  | 250   |
| 250  | 80                  | 5.0                           | 8.0  | 400   |
| 350  | 80                  | 5.0                           | 8.0  | 400   |
| 300  | 80                  | 7.875                         | 12.6 | 630   |
| 350  | 80                  | 12.5                          | 20.0 | 1000  |
| 400  | 80                  | 12.5                          | 20.0 | 1000  |
| 450  | 80                  | 12.5                          | 20   | 1000  |
| 500  | 80                  | 20.0                          | 32   | 1600  |
| 600  | 80                  | 50.0                          | 80   | 4000  |
| 700  | 80                  | 125                           | 200  | 10000 |
| 800  | 80                  | 125                           | 200  | 10000 |
| 900  | 80                  | 200                           | 320  | 16000 |
| 1000 | 80                  | 200                           | 320  | 16000 |
| 1200 | 80                  | 200                           | 320  | 16000 |
| 1600 | 80                  | 312.5                         | 500  | 25000 |

## 2.2.4 OIML R117

## OIML R117

| DN  | Qmax [m <sup>3</sup> /h] | Qmin [m <sup>3</sup> /h] | MMQ[m <sup>3</sup> ] | MPA Class | Accuracy [%] |
|-----|--------------------------|--------------------------|----------------------|-----------|--------------|
| 15  | 5.4                      | 0.27                     | 0.002                | 0.5       | 0.3          |
| 25  | 20                       | 1                        | 0.2                  | 0.3       | 0.2          |
| 50  | 50                       | 2.5                      | 0.5                  | 0.3       | 0.2          |
| 80  | 200                      | 10                       | 2                    | 0.3       | 0.2          |
| 100 | 312.5                    | 15.6                     | 2                    | 0.3       | 0.2          |
| 150 | 500                      | 25                       | 5                    | 0.3       | 0.2          |
| 250 | 2000                     | 100                      | 20                   | 0.3       | 0.2          |
| 500 | 7875                     | 787.5                    | 100                  | 0.3       | 0.2          |

## 2.2.5 MI-005

## MI-005

| DN  | Qmax [m <sup>3</sup> /h] | Qmin [m <sup>3</sup> /h] | MMQ[m <sup>3</sup> ] | Accuracy Class |
|-----|--------------------------|--------------------------|----------------------|----------------|
| 15  | 5.4                      | 0.27                     | 0.002                | 0.5            |
| 25  | 20                       | 1.0                      | 0.01                 | 0.3            |
| 32  | 31.3                     | 1.6                      | 0.5                  | 0.3            |
| 40  | 31.3                     | 1.6                      | 0.5                  | 0.3            |
| 50  | 50                       | 2.5                      | 0.5                  | 0.3            |
| 65  | 125                      | 6.3                      | 2                    | 0.3            |
| 80  | 200                      | 10                       | 2                    | 0.3            |
| 100 | 312.5                    | 15.6                     | 2                    | 0.3            |
| 125 | 500                      | 25                       | 5                    | 0.3            |
| 150 | 500                      | 25                       | 5                    | 0.3            |
| 200 | 1250                     | 62.5                     | 10                   | 0.3            |
| 250 | 2000                     | 100                      | 20                   | 0.3            |
| 300 | 3125                     | 156                      | 50                   | 0.3            |
| 350 | 3125                     | 156                      | 50                   | 0.3            |
| 400 | 5000                     | 250                      | 50                   | 0.3            |
| 450 | 5000                     | 250                      | 50                   | 0.3            |
| 500 | 7875                     | 787.5                    | 100                  | 0.3            |

## 2.3 Measurement accuracy

Each flowmeter is standard wet calibrated under reference conditions by direct volume comparison. The performance of the flowmeter is defined and documented in an individual calibration certificate.

### Reference conditions

- Medium: water
- Temperature: +10...30°C / +50...86°F
- Operating pressure: 1 bar / 14.5 psig
- Inlet section:  $\geq 5$  DN
- Electrical conductivity:  $\geq 300 \mu$

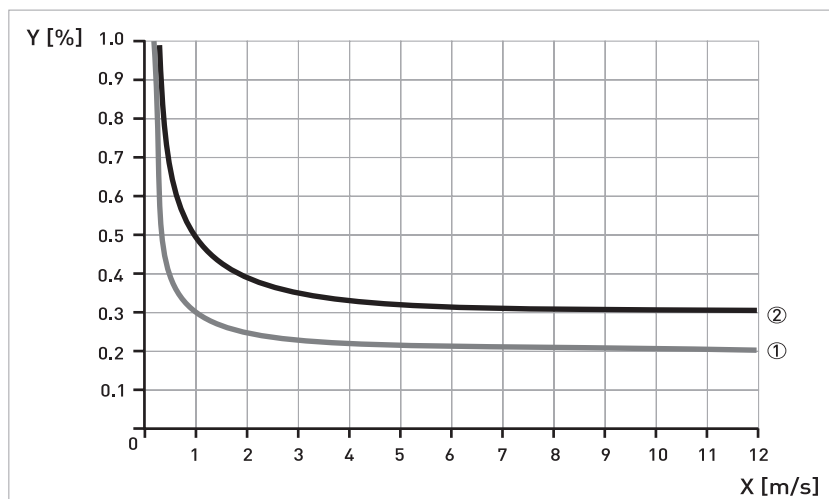


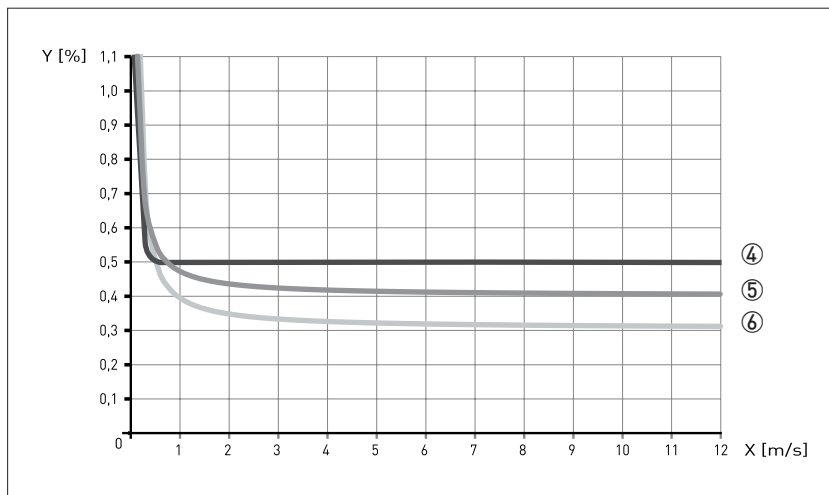
Figure 2-3: Flow velocity vs. accuracy

X [m/s] : flow velocity

Y [%]: deviation from the actual measured value (mv)

### Accuracy

| Sensor diameter                | Converter type | Accuracy                   | Curve |
|--------------------------------|----------------|----------------------------|-------|
| DN2.5...6 / $1/10$ ... $1/4$ " | IFC 300        | $\pm 0.3\%$ of mv + 2 mm/s | ②     |
| DN10...1600 / $3/8$ ...64"     | IFC 300        | $\pm 0.2\%$ of mv + 1 mm/s | ①     |
| DN1800...3000 / > 64"          | IFC 300        | $\pm 0.3\%$ of mv + 2 mm/s | ②     |



**Accuracy**

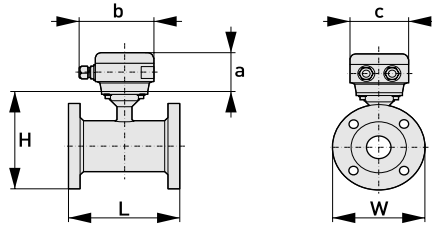
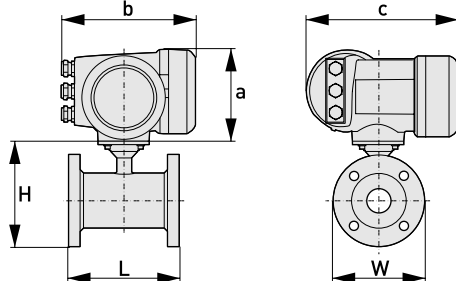
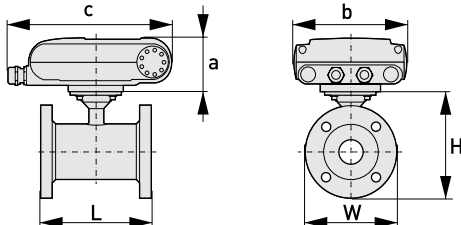
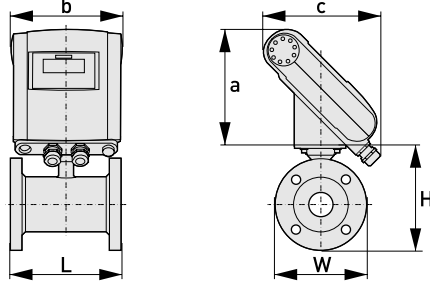
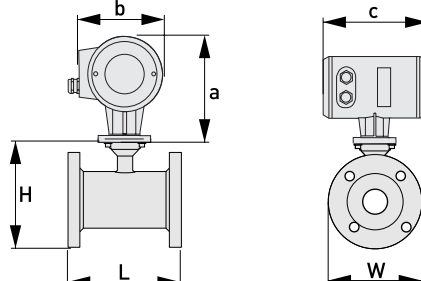
| Sensor diameter             | Converter type | Accuracy   | Curve |
|-----------------------------|----------------|--|-------|
| DN2.5...3000 / 1/10 ...120" | IFC 040        | ±0.5% of mv above 1 m/s.<br>below 1 m/s ± 5 mm/s | ④     |
| DN2.5...6 / 1/10 ...1/4"    | IFC 100        | ±0.4% of mv + 1 mm/s                             | ⑤     |
| DN10...1200 / 3/8...48"     | IFC 100        | ±0.3% of mv + 1 mm/s                             | ⑥     |

## 2.4 Vacuum load

| Diameter                    | Max. pressure | Vacuum load in mbar abs. at a process temperature of |      |      |      |      |       |       |       |       |
|-----------------------------|---------------|--|------|------|------|------|-------|-------|-------|-------|
| [mm]                        | [bar]         | 40°C   | 60°C | 70°C | 80°C | 90°C | 100°C | 120°C | 140°C | 180°C |
| <b>Liner in PTFE</b>        |               |  |      |      |      |      |       |       |       |       |
| DN10...20                   | 50            | 0  | 0    | 0    | 0    | 0    | 0     | 500   | 750   | 1000  |
| DN200...300                 | 50            | 500  | 750  | 1000 | 1000 | 1000 | 1000  | 1000  | 1000  | 1000  |
| DN350...600                 | 50            | 800  | 1000 | 1000 | 1000 | 1000 | 1000  | 1000  | 1000  | 1000  |
| <b>Liner in PFA</b>         |               |  |      |      |      |      |       |       |       |       |
| DN2.5...150                 | 50            | 0  | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0     |
| <b>Liner in ETFE</b>        |               |  |      |      |      |      |       |       |       |       |
| DN200...2000                | 150           | 100  | 100  | 100  | 100  | 100  | 100   | 100   | -     | -     |
| <b>Liner in Hard rubber</b> |               |  |      |      |      |      |       |       |       |       |
| DN200...300                 | 150           | 250  | 400  | 400  | 400  | -    | -     | -     | -     | -     |
| DN350...3000                | 150           | 500  | 600  | 600  | 600  | -    | -     | -     | -     | -     |
| <b>Liner in PU</b>          |               |  |      |      |      |      |       |       |       |       |
| DN200...1800                | 1500          | 500  | 600  | -    | -    | -    | -     | -     | -     | -     |

| Diameter                    | Max. pressure | Vacuum load in psia at a process temperature of |       |       |       |       |       |       |       |       |
|-----------------------------|---------------|---|-------|-------|-------|-------|-------|-------|-------|-------|
| [inch]                      | [psi]         | 104°F   | 140°F | 158°F | 176°F | 194°F | 212°F | 248°F | 284°F | 356°F |
| <b>Liner in PTFE</b>        |               |   |       |       |       |       |       |       |       |       |
| 3/8...3/4"                  | 725           | 0   | 0     | 0     | 0     | 0     | 0     | 7.3   | 10.9  | 14.5  |
| 8...12"                     | 725           | 7.3   | 10.9  | 14.5  | 14.5  | 14.5  | 14.5  | 14.5  | 14.5  | 14.5  |
| 14...24"                    | 725           | 11.6  | 14.5  | 14.5  | 14.5  | 14.5  | 14.5  | 14.5  | 14.5  | 14.5  |
| <b>Liner in PFA</b>         |               |   |       |       |       |       |       |       |       |       |
| 1/10...6"                   | 725           | 0   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| <b>Liner in ETFE</b>        |               |   |       |       |       |       |       |       |       |       |
| 8...72"                     | 2176          | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | 1.5   | -     | -     |
| <b>Liner in Hard rubber</b> |               |   |       |       |       |       |       |       |       |       |
| 8...12"                     | 2176          | 3.6   | 5.8   | 5.8   | 5.8   | -     | -     | -     | -     | -     |
| 14...120"                   | 2176          | 7.3   | 8.7   | 8.7   | 8.7   | -     | -     | -     | -     | -     |
| <b>Liner in PU</b>          |               |   |       |       |       |       |       |       |       |       |
| 8...72"                     | 21756         | 7.3   | 8.7   | -     | -     | -     | -     | -     | -     | -     |

2.5 Dimensions and weights

|   |  |   |
|---|--|---|
| <p>Remote version</p>                     |    | <p>a = 88 mm / 3.5"<br/>                     b = 139 mm / 5.5" ①<br/>                     c = 106 mm / 4.2"<br/>                     Total height = H + a</p>   |
| <p>Compact version with IFC 300</p>       |    | <p>a = 155 mm / 6.1"<br/>                     b = 230 mm / 9.1" ①<br/>                     c = 260 mm / 10.2"<br/>                     Total height = H + a</p> |
| <p>Compact version with IFC 100 (0°)</p>  |  | <p>a = 82 mm / 3.2"<br/>                     b = 161 mm / 6.3"<br/>                     c = 257 mm / 10.1" ①<br/>                     Total height = H + a</p>  |
| <p>Compact version with IFC 100 (45°)</p> |  | <p>a = 186 mm / 7.3"<br/>                     b = 161 mm / 6.3"<br/>                     c = 184 mm / 7.3" ①<br/>                     Total height = H + a</p>  |
| <p>Compact version with IFC 040</p>       |  | <p>a = 165 mm / 6.5"<br/>                     b = 136 mm / 5.3" ①<br/>                     c = 208 mm / 8.2"<br/>                     Total height = H + a</p>  |

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



- 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 |          | Dimensions [mm] |     |      |      | Approx. weight [kg] |
|--------------|----------|-----------------|-----|------|------|---------------------|
| DN           | PN [bar] | L               |     | H    | W    |                     |
|              |          | DIN             | ISO |      |      |                     |
| 2.5...6      | 40       | 130             | -   | 142  | 90   | 3                   |
| 10           | 40       | 130 ①           | -   | 106  | 90   | 6                   |
| 15           | 40       | 130 ①           | 200 | 106  | 95   | 6                   |
| 20           | 40       | 150             | 200 | 158  | 105  | 7                   |
| 25           | 40       | 150             | 200 | 140  | 115  | 4                   |
| 32           | 40       | 150             | 200 | 157  | 140  | 5                   |
| 40           | 40       | 150             | 200 | 166  | 150  | 5                   |
| 50           | 40       | 200             | 200 | 186  | 165  | 9                   |
| 65           | 16       | 200             | 200 | 200  | 185  | 9                   |
| 80           | 40       | 200             | 200 | 209  | 200  | 12                  |
| 100          | 16       | 250             | 250 | 237  | 220  | 15                  |
| 125          | 16       | 250             | 250 | 266  | 250  | 19                  |
| 150          | 16       | 300             | 300 | 300  | 285  | 27                  |
| 200          | 10       | 350             | 350 | 361  | 340  | 34                  |
| 250          | 10       | 400             | 450 | 408  | 395  | 48                  |
| 300          | 10       | 500             | 500 | 458  | 445  | 58                  |
| 350          | 10       | 500             | 550 | 510  | 505  | 78                  |
| 400          | 10       | 600             | 600 | 568  | 565  | 101                 |
| 450          | 10       | 600             | -   | 618  | 615  | 111                 |
| 500          | 10       | 600             | -   | 671  | 670  | 130                 |
| 600          | 10       | 600             | -   | 781  | 780  | 165                 |
| 700          | 10       | 700             | -   | 898  | 895  | 248                 |
| 800          | 10       | 800             | -   | 1012 | 1015 | 331                 |
| 900          | 10       | 900             | -   | 1114 | 1115 | 430                 |
| 1000         | 10       | 1000            | -   | 1225 | 1230 | 507                 |
| 1200         | 6        | 1200            | -   | 1417 | 1405 | 555                 |
| 1400         | 6        | 1400            | -   | 1619 | 1630 | 765                 |
| 1600         | 6        | 1600            | -   | 1819 | 1830 | 1035                |
| 1800         | 6        | 1800            | -   | 2027 | 2045 | 1470                |
| 2000         | 6        | 2000            | -   | 2259 | 2265 | 1860                |

① 150 mm for construction according to order code VN03(contact sales).

## 150 lb flanges

| Nominal size |          | Dimensions [inches] |       |      | Approx. weight [lb] |
|--------------|----------|---------------------|-------|------|---------------------|
| ASME         | PN [psi] | L                   | H     | W    |                     |
| 1/10"        | 284      | 5.12                | 5.59  | 3.50 | 6                   |
| 1/8"         | 284      | 5.12                | 5.59  | 3.50 | 6                   |
| 1/4"         | 284      | 5.12                | 5.59  | 3.50 | 6                   |
| 3/8"         | 284      | 5.12 ①              | 5.08  | 3.50 | 12                  |
| 1/2"         | 284      | 5.12 ①              | 5.08  | 3.50 | 12                  |
| 3/4"         | 284      | 5.91                | 5.28  | 3.88 | 18                  |
| 1"           | 284      | 5.91                | 5.39  | 4.25 | 7                   |
| 1 1/4"       | 284      | 5.91                | 5.98  | 4.62 | 7                   |
| 1 1/2"       | 284      | 5.91                | 6.10  | 5.00 | 11                  |
| 2"           | 284      | 7.87                | 7.05  | 5.98 | 18                  |
| 2 1/2"       | 284      | 7.87                | 7.72  | 7.00 | 24                  |
| 3"           | 284      | 7.87                | 8.03  | 7.50 | 26                  |
| 4"           | 284      | 9.84                | 9.49  | 9.00 | 40                  |
| 5"           | 284      | 9.84                | 10.55 | 10.0 | 49                  |
| 6"           | 284      | 11.81               | 11.69 | 11.0 | 64                  |
| 8"           | 284      | 13.78               | 14.25 | 13.5 | 95                  |
| 10"          | 284      | 15.75               | 16.3  | 16.0 | 143                 |
| 12"          | 284      | 19.69               | 18.78 | 19.0 | 207                 |
| 14"          | 284      | 27.56               | 20.67 | 21.0 | 284                 |
| 16"          | 284      | 31.50               | 22.95 | 23.5 | 364                 |
| 18"          | 284      | 31.50               | 24.72 | 25.0 | 410                 |
| 20"          | 284      | 31.50               | 26.97 | 27.5 | 492                 |
| 24"          | 284      | 31.50               | 31.38 | 32.0 | 675                 |

① 5.91" for construction according to order code VN03(contact sales).

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

## 300 lb flanges

| Nominal size |          | Dimensions [inches] |       |      | Approx. weight [lb] |
|--------------|----------|---------------------|-------|------|---------------------|
| ASME         | PN [psi] | L                   | H     | W    |                     |
| 1/10"        | 741      | 5.12                | 5.59  | 3.75 | 6                   |
| 1/8"         | 741      | 5.12                | 5.59  | 3.75 | 6                   |
| 1/4"         | 741      | 5.12                | 5.59  | 3.75 | 6                   |
| 3/8"         | 741      | 5.12 ①              | 5.24  | 3.75 | 15                  |
| 1/2"         | 741      | 5.12 ①              | 5.24  | 3.75 | 15                  |
| 3/4"         | 741      | 5.91                | 5.67  | 4.62 | 20                  |
| 1"           | 741      | 5.91                | 5.71  | 4.87 | 11                  |
| 1 1/2"       | 741      | 7.87                | 6.65  | 6.13 | 13                  |
| 2"           | 741      | 9.84                | 7.32  | 6.50 | 22                  |
| 3"           | 741      | 9.84                | 8.43  | 8.25 | 31                  |
| 4"           | 741      | 11.81               | 10.00 | 10.0 | 44                  |
| 6"           | 741      | 13.78               | 12.44 | 12.5 | 73                  |
| 8"           | 741      | 15.75               | 15.04 | 15.0 | 157                 |
| 10"          | 741      | 19.69               | 17.05 | 17.5 | 247                 |
| 12"          | 741      | 23.62               | 20.00 | 20.5 | 375                 |
| 14"          | 741      | 27.56               | 21.65 | 23.0 | 474                 |
| 16"          | 741      | 31.50               | 23.98 | 25.5 | 639                 |
| 20"          | 741      | 31.50               | 28.46 | 30.5 | 937                 |
| 24"          | 741      | 31.50               | 33.39 | 36.0 | 1345                |

① 5.91" for construction according to order code VN03(contact sales).

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

### 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 measurement of volumetric flowrate of electrically conductive fluids. Basic measurement is the flow velocity upon which all other measurements are based.

### 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 Vibration

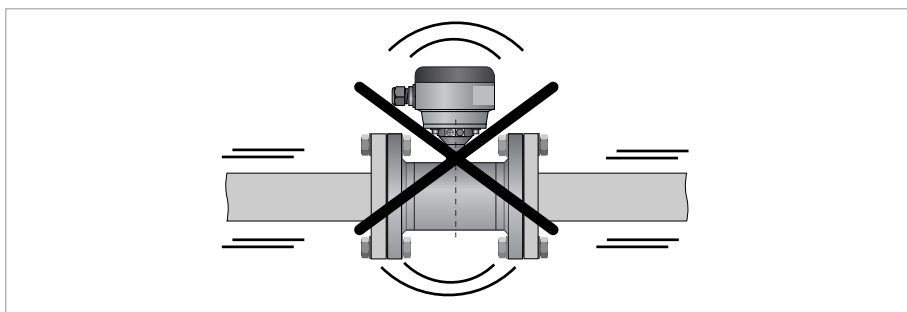


Figure 3-1: Avoid vibrations

#### 3.2.2 Magnetic field

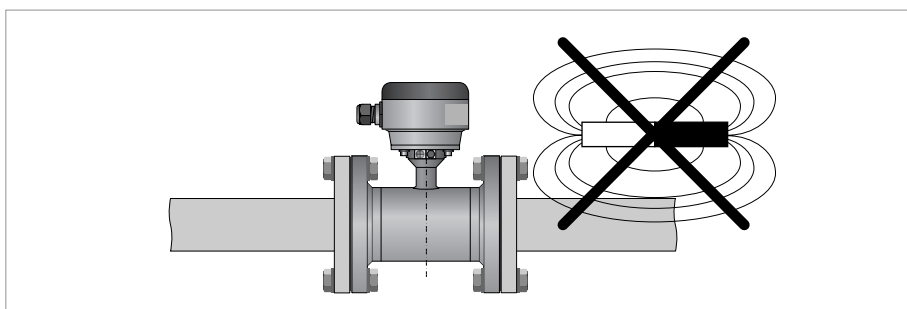


Figure 3-2: Avoid magnetic fields

### 3.3 Installation conditions

#### 3.3.1 Inlet and outlet

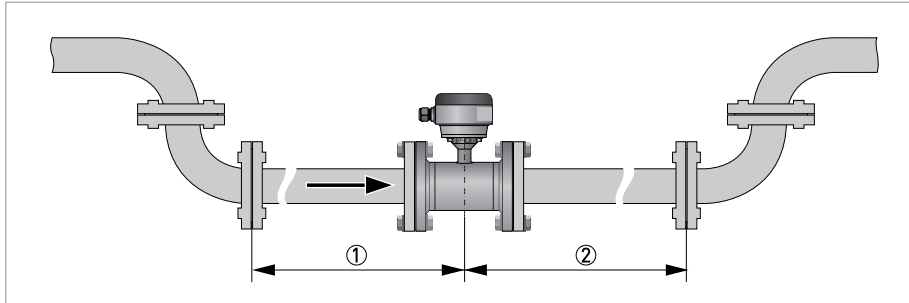


Figure 3-3: Recommended inlet and outlet

- ① Refer to chapter "Bends in 2 or 3 dimensions"
- ②  $\geq 2$  DN

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

#### 3.3.2 Bends in 2 or 3 dimensions

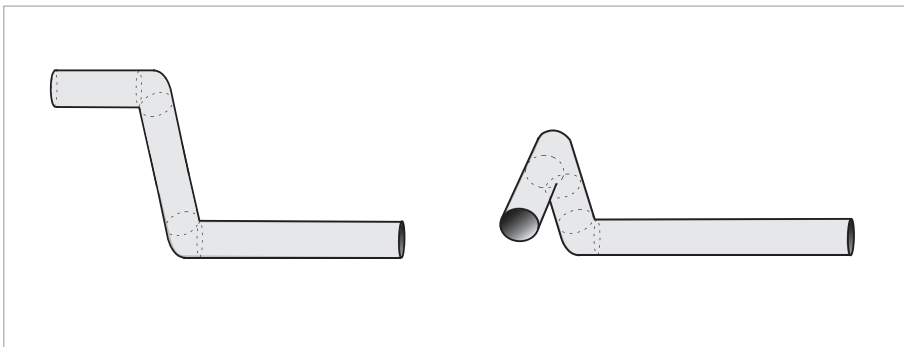


Figure 3-4: 2 and 3 dimensional bends, in front of flowmeter

- ① Bends in 2 dimensions:  $\geq 5$  DN; bends in 3 dimensions:  $\geq 10$  DN

#### 3.3.3 T-section

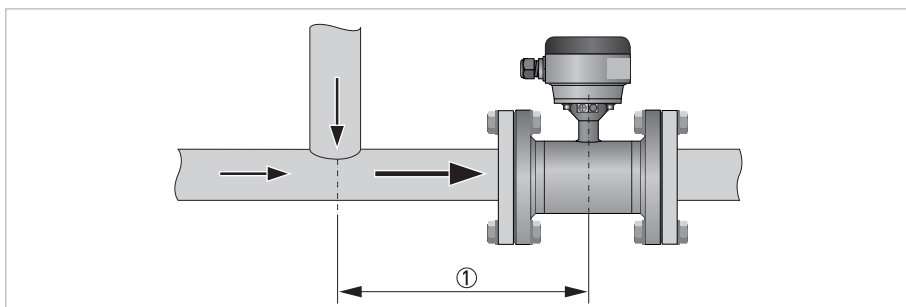


Figure 3-5: Distance behind a T-section

- ①  $\geq 10$  DN

3.3.4 Bends

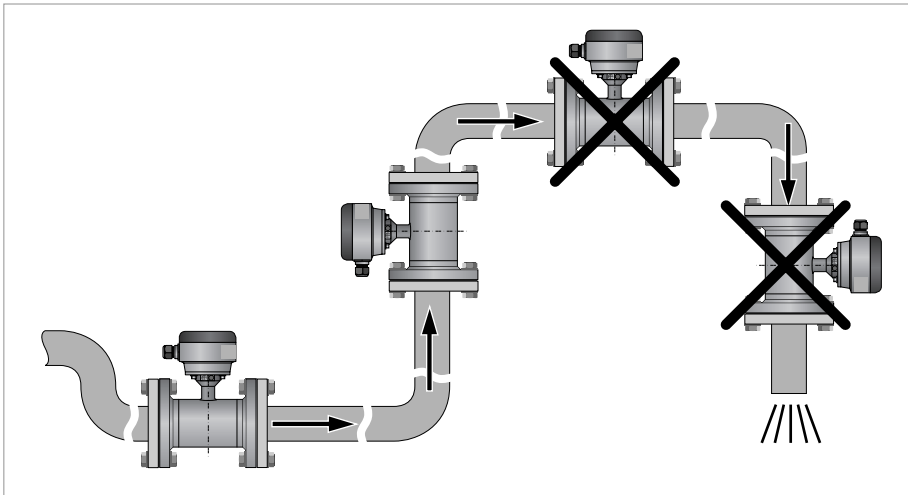


Figure 3-6: Installation in bending pipes

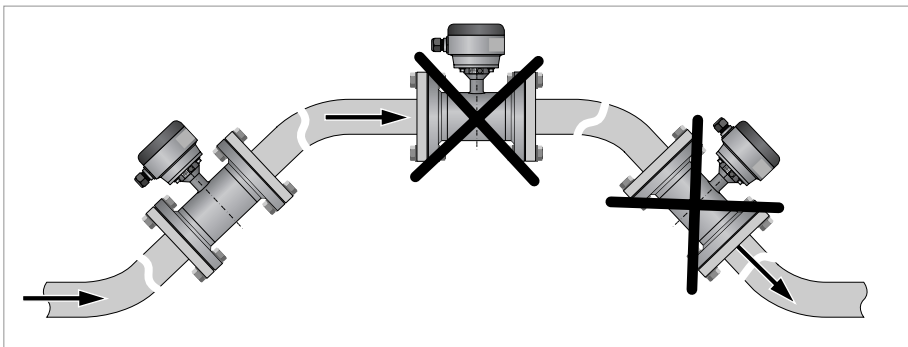


Figure 3-7: Installation in bending pipes

*Avoid draining or partial filling of the flow sensor*

3.3.5 Open feed or discharge

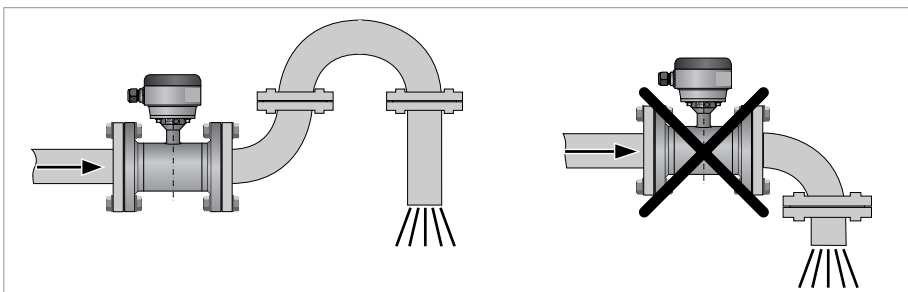


Figure 3-8: Installation in front of an open discharge

### 3.3.6 Flange deviation

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

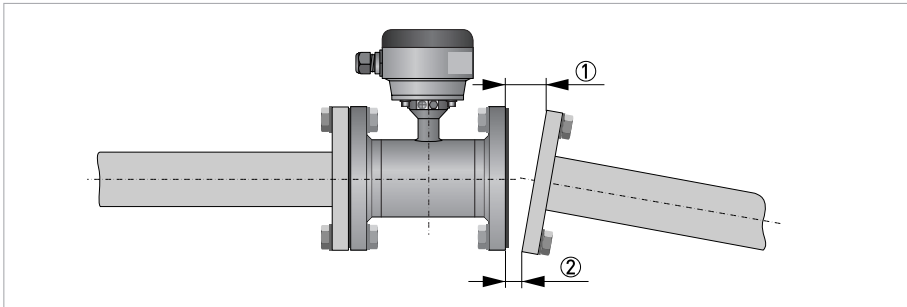


Figure 3-9: Flange deviation

- ①  $L_{max}$
- ②  $L_{min}$

### 3.3.7 Pump

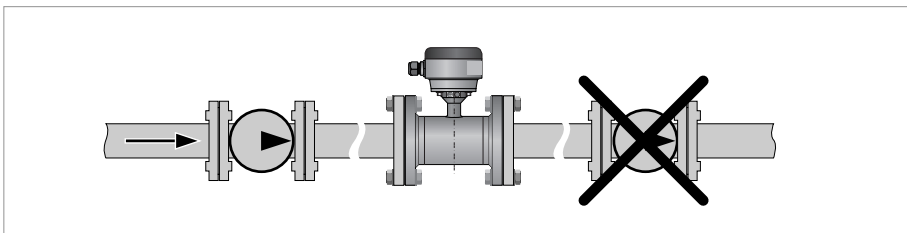


Figure 3-10: Installation behind a pump

### 3.3.8 Control valve

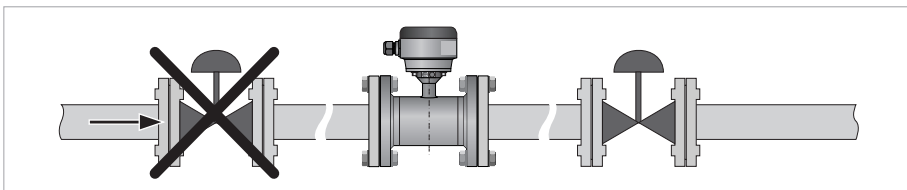


Figure 3-11: Installation in front of a control valve

## 3.3.9 Air venting and vacuum forces

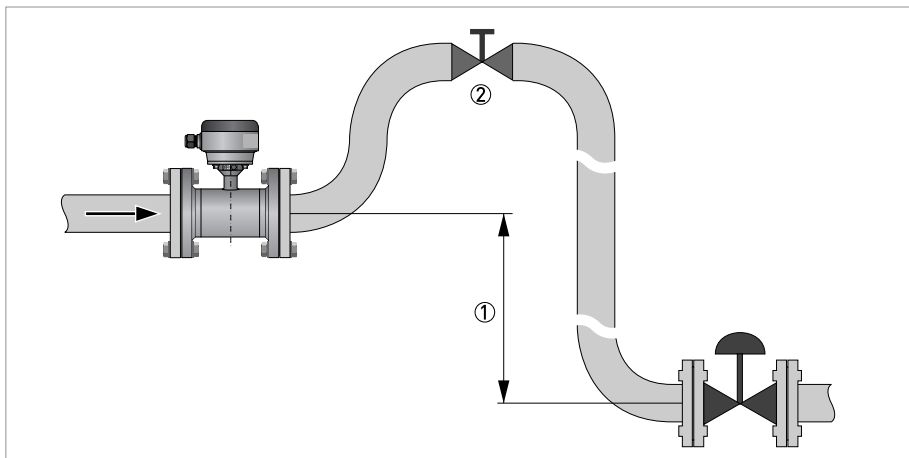


Figure 3-12: Air venting

- ①  $\geq 5$  m
- ② Air ventilation point

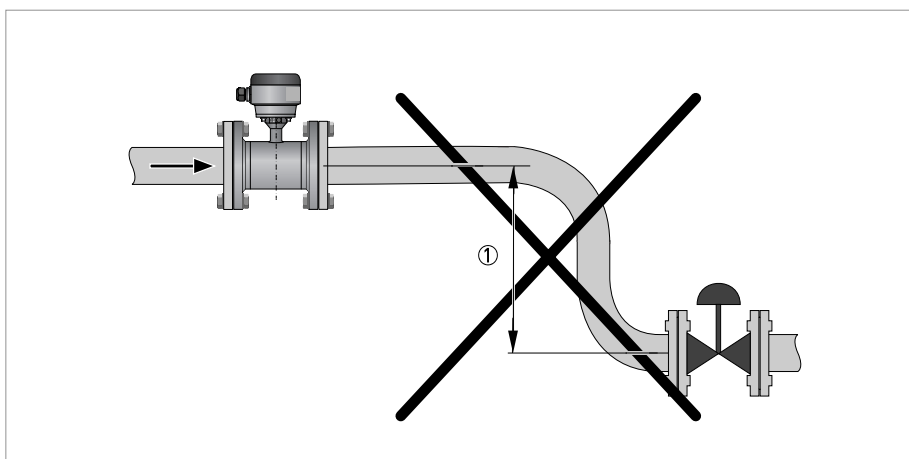


Figure 3-13: Vacuum

- ①  $\geq 5$  m



### 3.3.10 Mounting position

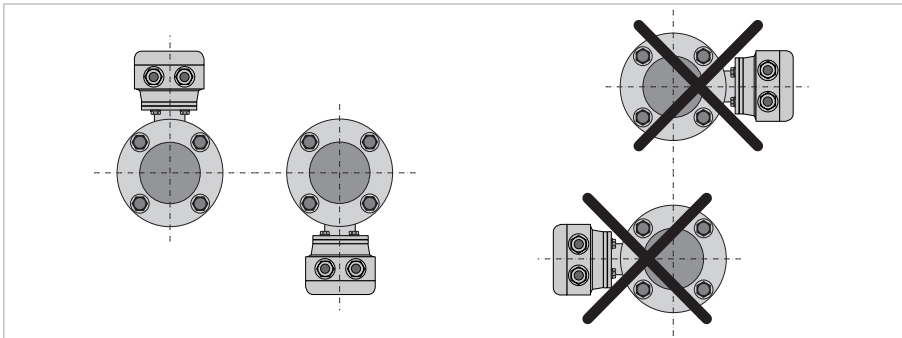


Figure 3-14: Mounting position

## 3.4 Mounting

### 3.4.1 Torques and pressures

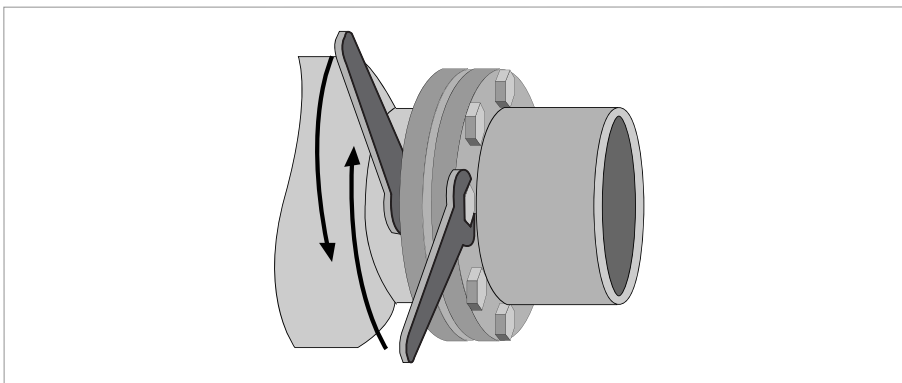


Figure 3-15: Tightening of bolts

#### 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.

*Other sizes / pressure ratings on request.*

| Nominal size DN [mm] | Pressure rating | Bolts ②   | Max. torque [Nm] ① |      |      |     |             |
|----------------------|-----------------|-----------|--------------------|------|------|-----|-------------|
|                      |                 |           | PFA                | PTFE | ETFE | PU  | Hard rubber |
| 2.5                  | PN 40           | 4 x M 12  | 32                 | 32   | -    | -   | -           |
| 4                    | PN 40           | 4 x M 12  | 32                 | 32   | -    | -   | -           |
| 6                    | PN 40           | 4 x M 12  | 32                 | 32   | -    | -   | -           |
| 10                   | PN 40           | 4 x M 12  | 7.6                | 7.6  | -    | 4.6 | -           |
| 15                   | PN 40           | 4 x M 12  | 9.3                | 9.3  | -    | 5.7 | -           |
| 20                   | PN 40           | 4 x M 12  | 16                 | 16   | -    | 9.6 | -           |
| 25                   | PN 40           | 4 x M 12  | 22                 | 22   | 22   | 11  | -           |
| 32                   | PN 40           | 4 x M 16  | 37                 | 37   | 37   | 19  | -           |
| 40                   | PN 40           | 4 x M 16  | 43                 | 43   | 43   | 25  | -           |
| 50                   | PN 40           | 4 x M 16  | 55                 | 55   | 55   | 31  | -           |
| 65                   | PN 16           | 4 x M 16  | 51                 | 51   | 51   | 42  | -           |
| 65                   | PN 40           | 8 x M 16  | 38                 | 38   | 38   | 21  | -           |
| 80                   | PN 40           | 8 x M 16  | 47                 | 47   | 47   | 25  | -           |
| 100                  | PN 16           | 8 x M 16  | 39                 | 39   | 39   | 30  | -           |
| 125                  | PN 16           | 8 x M 16  | 53                 | 53   | 53   | 40  | -           |
| 150                  | PN 16           | 8 x M 20  | 68                 | 68   | 68   | 47  | -           |
| 200                  | PN 10           | 8 x M 20  | 84                 | 84   | 84   | 68  | 68          |
| 200                  | PN 16           | 12 x M 20 | 68                 | 68   | 68   | 45  | 45          |
| 250                  | PN 10           | 12 x M 20 | 78                 | 78   | 78   | 65  | 65          |
| 250                  | PN 16           | 12 x M 24 | 116                | 116  | 116  | 78  | 78          |
| 300                  | PN 10           | 12 x M 20 | 88                 | 88   | 88   | 76  | 76          |
| 300                  | PN 16           | 12 x M 24 | 144                | 144  | 144  | 105 | 105         |
| 350                  | PN 10           | 16 x M 20 | 97                 | 97   | 97   | 75  | 75          |
| 400                  | PN 10           | 16 x M 24 | 139                | 139  | 139  | 104 | 104         |
| 450                  | PN 10           | 20 x M 24 | -                  | 127  | 127  | 93  | 93          |
| 500                  | PN 10           | 20 x M 24 | -                  | 149  | 149  | 107 | 107         |
| 600                  | PN 10           | 20 x M 27 | -                  | 205  | 205  | 138 | 138         |
| 700                  | PN 10           | 20 x M 27 | -                  | 238  | 238  | 163 | 163         |
| 800                  | PN 10           | 24 x M 30 | -                  | 328  | 328  | 219 | 219         |
| 900                  | PN 10           | 28 x M 30 | -                  | 308  | 308  | 205 | 205         |
| 1000                 | PN 10           | 28 x M 35 | -                  | 392  | 392  | 261 | 261         |
| 1200                 | PN 10           | ③ *       |                    |      |      |     |             |
| 1400                 | PN 10           |           |                    |      |      |     |             |
| 1600                 | PN 10           |           |                    |      |      |     |             |
| 1800                 | PN 10           |           |                    |      |      |     |             |
| 2000                 | PN 10           |           |                    |      |      |     |             |

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 F= ASTM gr B7 Studbolts - F=0.14 - Carbon steel flanges

③ \* Information DN > 1000; please contact the support service department

| Nominal size [inch] | Flange class [lb] | Bolts ②     | Max. torque [in-lb] ① |      |      |      |             |
|---------------------|-------------------|-------------|-----------------------|------|------|------|-------------|
|                     |                   |             | PFA                   | PTFE | ETFE | PU   | Hard rubber |
| 1/10                | 150               | 4 x 1/2"    | 39                    | 39   | -    | -    | -           |
| 1/6                 | 150               | 4 x 1/2"    | 39                    | 39   | -    | -    | -           |
| 1/4                 | 150               | 4 x 1/2"    | 39                    | 39   | -    | -    | -           |
| 3/8                 | 150               | 4 x 1/2"    | 39                    | 39   | -    | -    | -           |
| 1/2                 | 150               | 4 x 1/2"    | 34                    | 34   | -    | -    | -           |
| 3/4                 | 150               | 4 x 1/2"    | 50                    | 50   | -    | -    | -           |
| 1                   | 150               | 4 x 1/2"    | 67                    | 67   | 67   | -    | -           |
| 1 1/4               | 150               | 4 x 1/2"    | 97                    | 97   | 97   | -    | -           |
| 1 1/2               | 150               | 4 x 1/2"    | 138                   | 138  | 138  | -    | -           |
| 2                   | 150               | 4 x 5/8"    | 225                   | 225  | 225  | -    | -           |
| 3                   | 150               | 4 x 5/8"    | 43                    | 43   | 43   | -    | -           |
| 4                   | 150               | 8 x 5/8"    | 34                    | 34   | 34   | -    | -           |
| 6                   | 150               | 8 x 3/4"    | 61                    | 61   | 61   | -    | -           |
| 8                   | 150               | 8 x 3/4"    | 979                   | 979  | 979  | 818  | 818         |
| 10                  | 150               | 12 x 7/8"   | 1104                  | 1104 | 1104 | 923  | 923         |
| 12                  | 150               | 12 x 7/8"   | 1478                  | 1478 | 1478 | 1237 | 1237        |
| 14                  | 150               | 12 x 1"     | 1835                  | 1835 | 1835 | 1538 | 1538        |
| 16                  | 150               | 16 x 1"     | 1767                  | 1767 | 1767 | 1481 | 1481        |
| 18                  | 150               | 16 x 1 1/8" | -                     | 2605 | 2605 | 2183 | 2183        |
| 20                  | 150               | 20 x 1 1/8" | -                     | 2365 | 2365 | 1984 | 1984        |
| 24                  | 150               | 20 x 1 1/4" | -                     | 3419 | 3419 | 2873 | 2873        |
| 28                  | 150               | 28 x 1 1/4" | -                     | 2904 | 2904 | -    | *           |
| 32                  | 150               | 28 x 1 1/2" | -                     | 4560 | 4560 | -    | *           |
| 36                  | 150               | 32 x 1 1/2" | -                     | -    | ③ *  | -    | *           |
| 40                  | 150               | 36 x 1 1/2" | -                     | -    | *    | -    | *           |

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 F= ASTM gr B7 Studbolts - F=0.14 - Carbon steel flanges

③ Information \* ; please contact the support service department

*Other sizes / pressure ratings on request.*

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

## 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!*

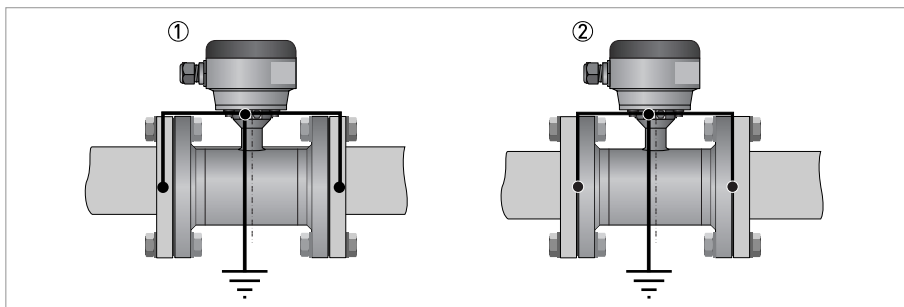
*Observe the national regulations for electrical installations!*

*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.

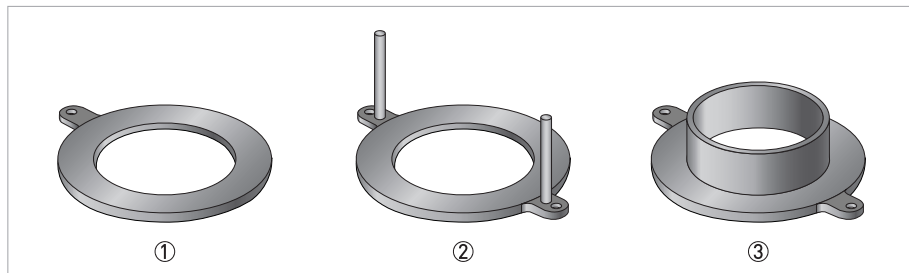


Figure 4-2: Different types of grounding rings

- 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 / 0.02")

#### 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
- With cylindrical neck (length 30 mm / 1.25" for DN10...150 / 3/8...6")
- Prevents damage to the liner when abrasive liquids are used

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

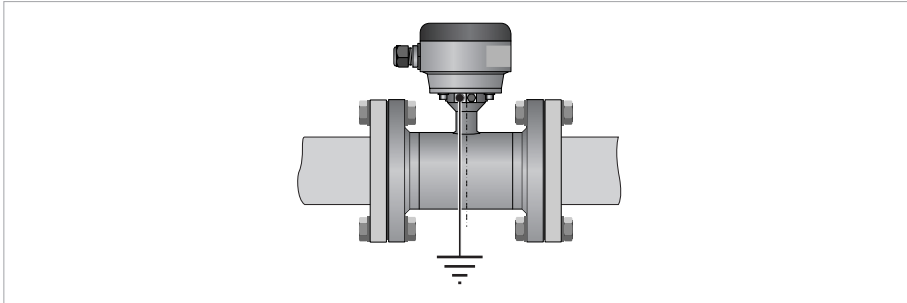
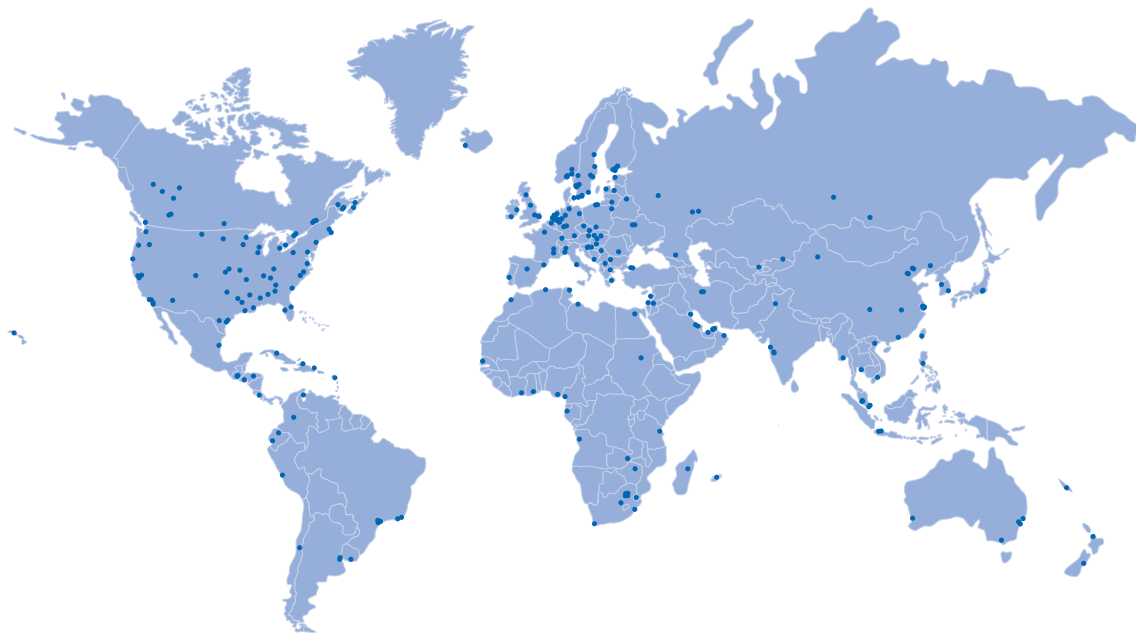


Figure 4-3: Virtual reference

**Minimum requirements:**

- Size:  $\geq$  DN10
- Electrical conductivity:  $\geq$  200  $\mu$ S/cm
- Electrode cable: max. 50 m / 164 ft, type DS





### KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature assemblies
- Pressure transmitters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry

Head Office KROHNE Messtechnik GmbH  
Ludwig-Krohne-Str. 5  
47058 Duisburg (Germany)  
Tel.: +49 203 301 0  
Fax: +49 203 301 103 89  
info@krohne.com

The current list of all KROHNE contacts and addresses can be found at:  
[www.krohne.com](http://www.krohne.com)

**KROHNE**