

Instruction

MI 021-533 en

AUG 2017

Foxboro® Model 9700A Magnetic Flow Sensor

Master Instruction

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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.

**NOTICE!**

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The 9700A 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.

**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

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

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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! <i>This warning refers to the immediate danger when working with electricity.</i>
	DANGER! <i>This warning refers to the immediate danger of burns caused by heat or hot surfaces.</i>
	DANGER! <i>This warning refers to the immediate danger when using this device in a hazardous atmosphere.</i>
	DANGER! <i>These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death.</i>
	WARNING! <i>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.</i>
	CAUTION! <i>Disregarding these instructions can result in damage to the device or to parts of the operator's plant.</i>
	NOTICE! <i>These instructions contain important information for the handling of the device.</i>
	LEGAL NOTICE! <i>This note contains information on statutory directives and standards.</i>



- **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


NOTICE!

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


NOTICE!

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


NOTICE!

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)


NOTICE!

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

2.2 Device description

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

The following versions are available:

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

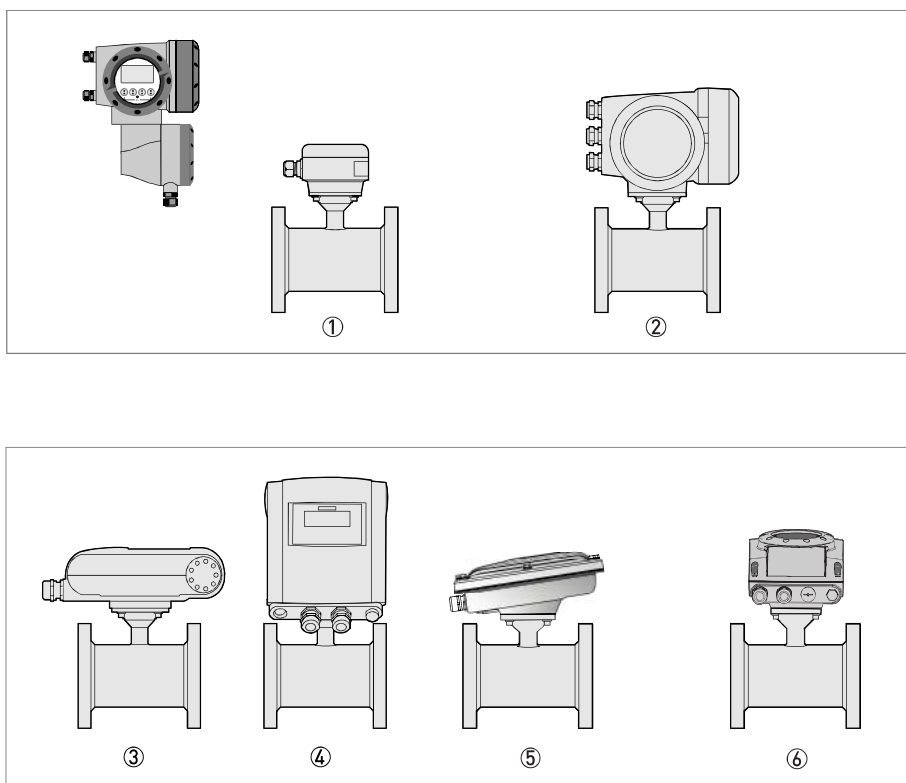


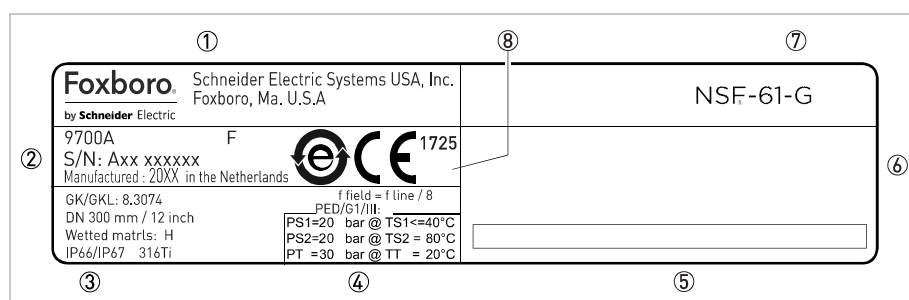
Figure 2-2: Device versions

- ① Remote version
- ② Compact version with signal converter IMT33A
- ③ Compact version with signal converter IMT31A (0°)
- ④ Compact version with signal converter IMT31A (45°)
- ⑤ Compact version with signal converter IMT31A (10°) Stainless steel
- ⑥ Compact version with signal converter IMT30A (10°)

2.3 Nameplate


NOTICE!

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.



- ① Name and address of the manufacturer
- ② Type designation of the flowmeter, serial number and manufacturing date
- ③ Calibration data
- ④ PED data
- ⑤ Tag number
- ⑥ Additional information
- ⑦ NSF product certification marking
- ⑧ Chinese recycling symbol and CE sign with number(s) of notified body / bodies

3.1 General notes on installation


NOTICE!

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


NOTICE!

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


NOTICE!

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.

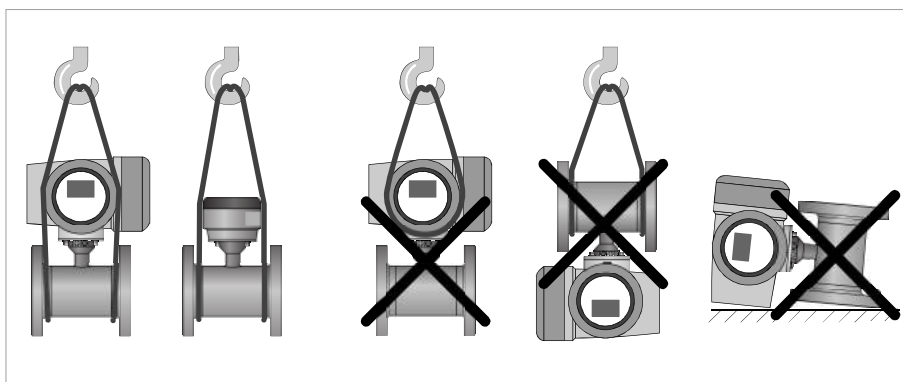


Figure 3-1: Transport

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



NOTICE!

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

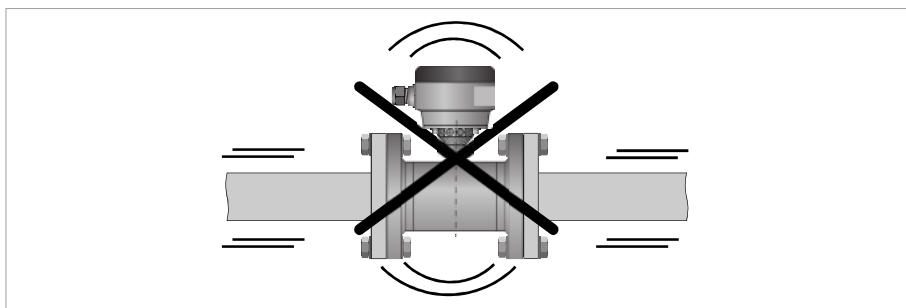


Figure 3-2: Avoid vibrations

3.5.2 Magnetic field

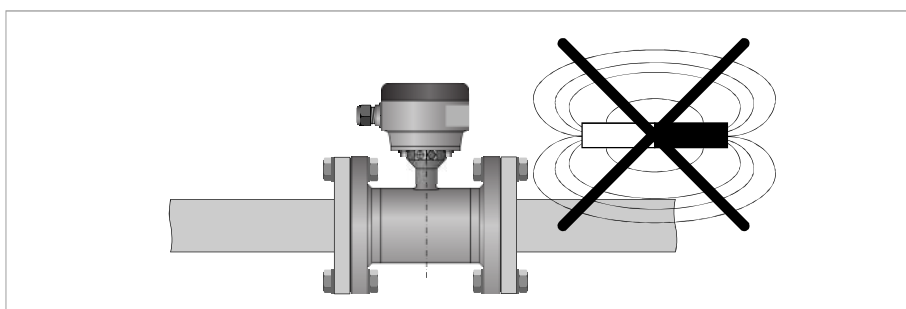


Figure 3-3: Avoid magnetic fields

3.6 Installation conditions

3.6.1 Inlet and outlet

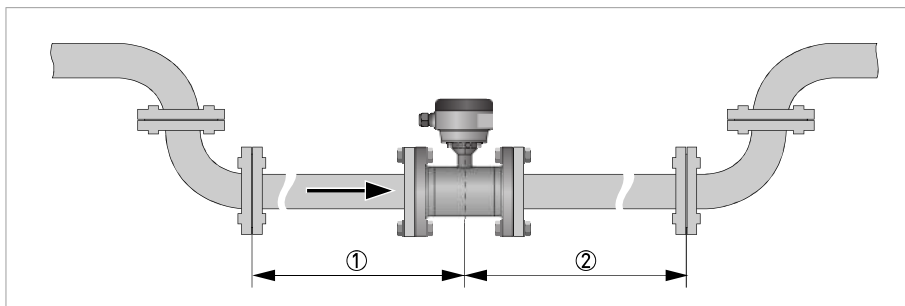


Figure 3-4: Recommended inlet and outlet

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



NOTICE!

9700A flowtube up to DN10 - 3/8": The inlet and outlet sections are enclosed inside the sensor.

3.6.2 Bends in 2 or 3 dimensions

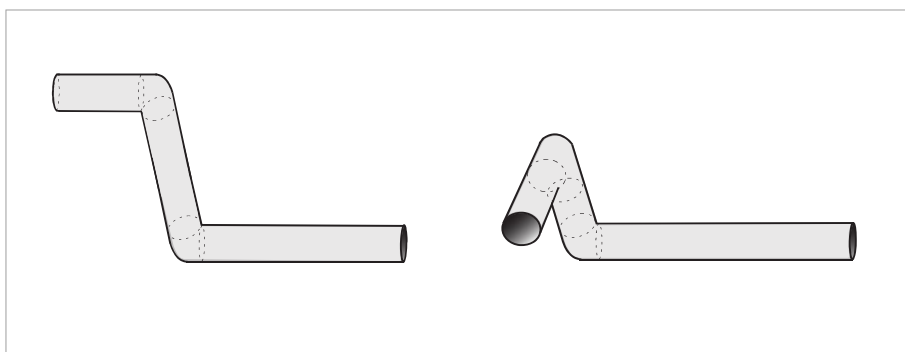


Figure 3-5: Inlet when using 2 and/or 3 dimensional bends upstream of the flowmeter

Inlet length: using bends in 2 dimensions: ≥ 5 DN; when having bends in 3 dimensions: ≥ 10 DN



NOTICE!

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

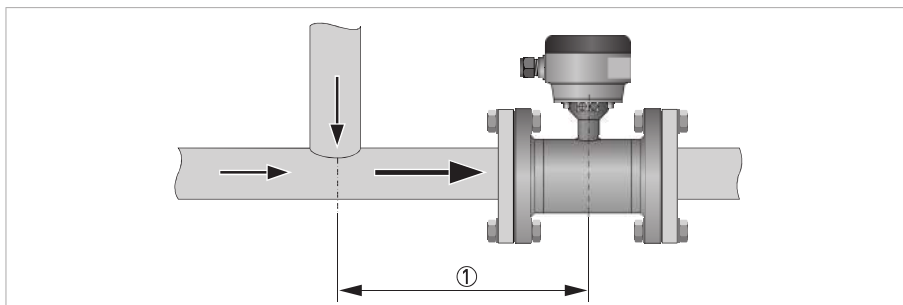


Figure 3-6: Distance behind a T-section

① ≥ 10 DN

3.6.4 Bends

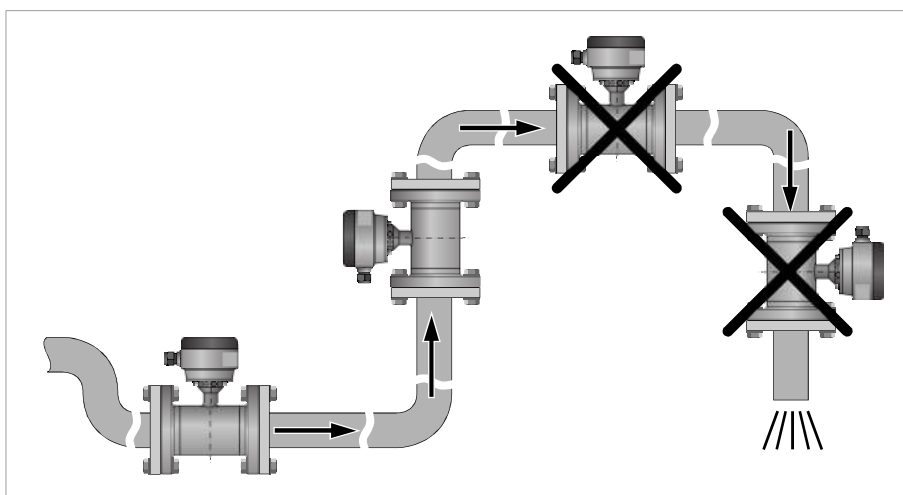


Figure 3-7: Installation in bending pipes

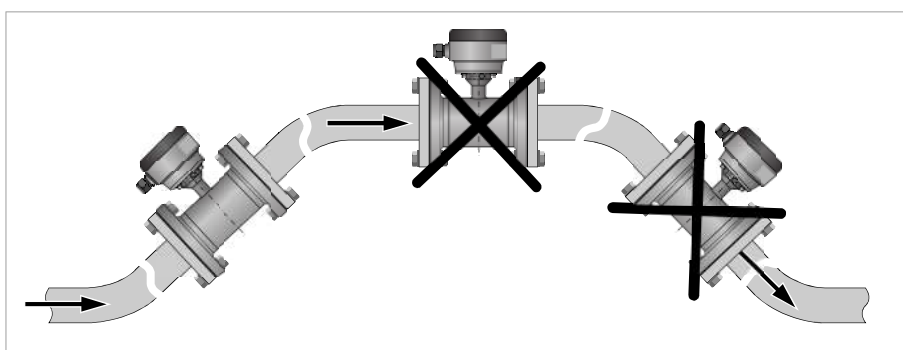


Figure 3-8: Installation in bending pipes



CAUTION!

Avoid draining or partial filling of the flow sensor

3.6.5 Open feed or discharge

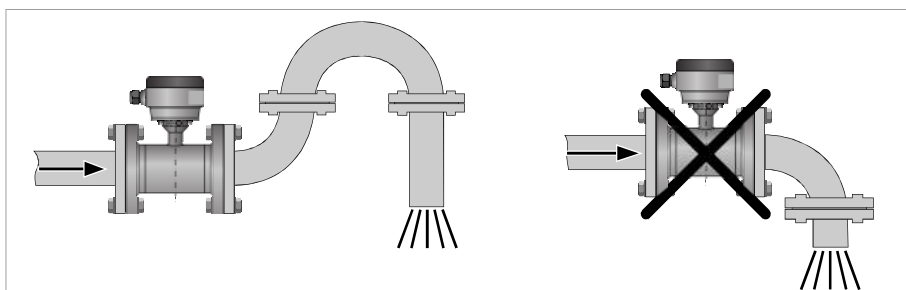


Figure 3-9: Installation in front of an open discharge

3.6.6 Flange deviation



CAUTION!

Max. permissible deviation of pipe flange faces:

$$L_{\max} - L_{\min} \leq 0.5 \text{ mm} / 0.02''$$

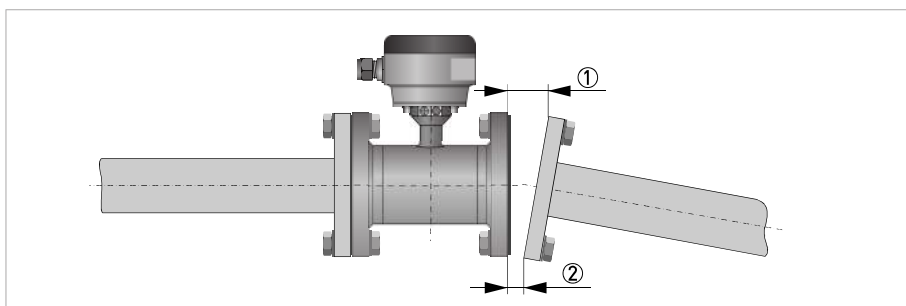


Figure 3-10: Flange deviation

- ① L_{\max}
- ② L_{\min}

3.6.7 Control valve

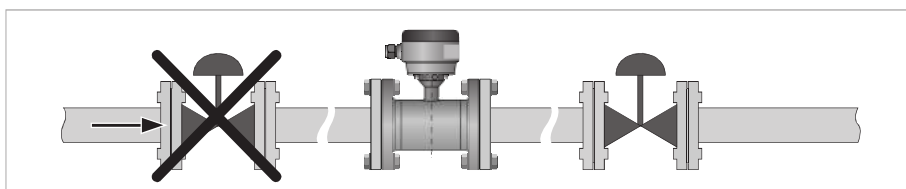


Figure 3-11: Installation in front of a control valve

3.6.8 Pump

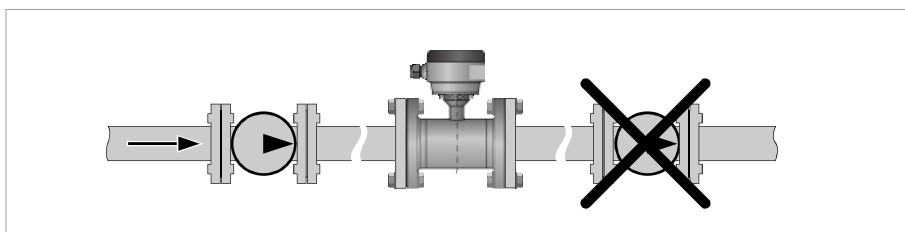


Figure 3-12: Installation behind a pump

3.6.9 Air venting and vacuum forces

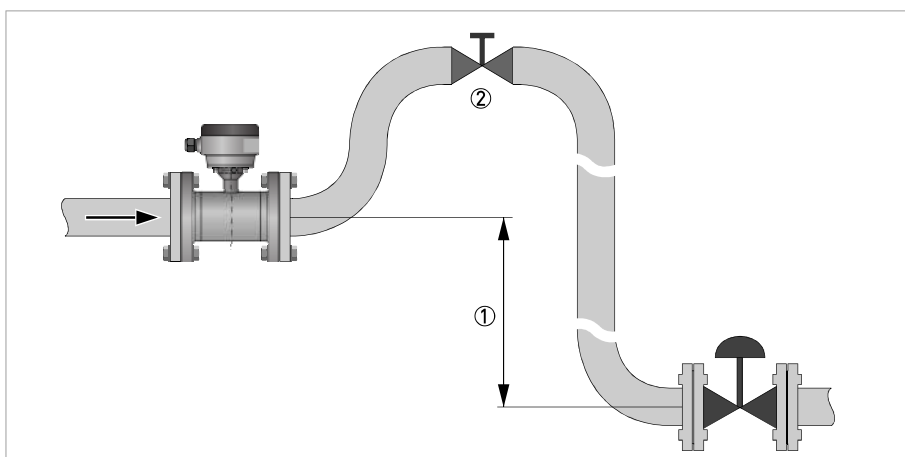


Figure 3-13: Air venting

① ≥ 5 m / 17 ft

② Air ventilation point

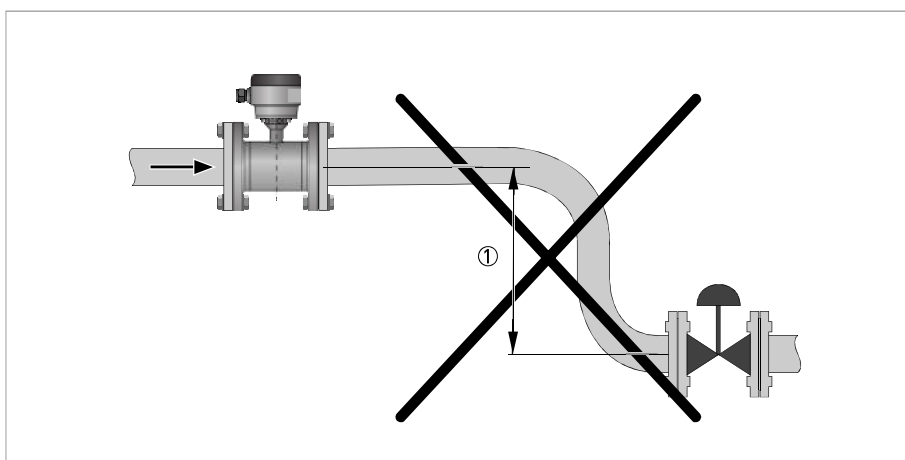


Figure 3-14: Vacuum

① ≥ 5 m / 17 ft

3.6.10 Mounting position

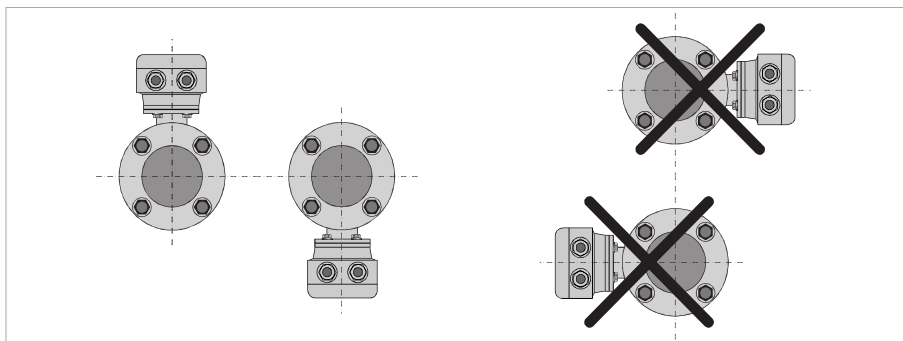


Figure 3-15: Mounting position

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

3.7 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.

3.7.1 Torques and pressures

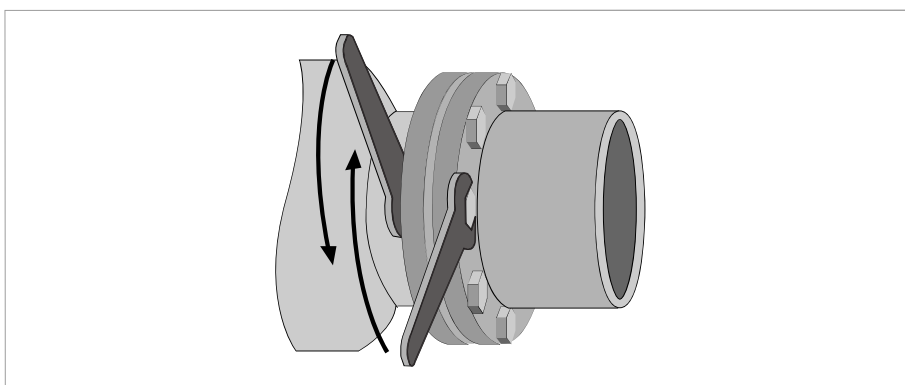


Figure 3-16: Tightening of bolts

**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.

**NOTICE!**

Other sizes / pressure ratings on request.

Nominal size DN [mm]	Pressure rating	Bolts ②	Max. torque [Nm] ①					
			PFA	PTFE	ETFE	PU	Hard rubber	Soft rubber
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	-	36
65	PN 16	4 x M 16	51	51	51	42	-	18
65	PN 40	8 x M 16	38	38	38	21	-	-
80	PN 40	8 x M 16	47	47	47	25	-	33
100	PN 16	8 x M 16	39	39	39	30	-	30
125	PN 16	8 x M 16	53	53	53	40	-	43
150	PN 16	8 x M 20	68	68	68	47	-	68
200	PN 10	8 x M 20	84	84	84	68	68	50
200	PN 16	12 x M 20	68	68	68	45	45	-
250	PN 10	12 x M 20	78	78	78	65	65	48
250	PN 16	12 x M 24	116	116	116	78	78	-
300	PN 10	12 x M 20	88	88	88	76	76	59
300	PN 16	12 x M 24	144	144	144	105	105	-
350	PN 10	16 x M 20	97	97	97	75	75	67
400	PN 10	16 x M 24	139	139	139	104	104	97
450	PN 10	20 x M 24	-	127	127	93	93	89
500	PN 10	20 x M 24	-	149	149	107	107	103
600	PN 10	20 x M 27	-	205	205	138	138	144
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	-
③ *								

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 factory

Nominal size [inch]	Flange class [lb]	Bolts ②	Max. torque [in-lb] ①					
			PFA	PTFE	ETFE	PU	Hard rubber	Soft rubber
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	-	-	158
3	150	4 x 5/8"	380	380	380	-	-	283
4	150	8 x 5/8"	300	300	300	-	-	207
6	150	8 x 3/4"	540	540	540	-	-	328
8	150	8 x 3/4"	979	979	979	818	818	418
10	150	12 x 7/8"	1104	1104	1104	923	923	601
12	150	12 x 7/8"	1478	1478	1478	1237	1237	676
14	150	12 x 1"	1835	1835	1835	1538	1538	909
16	150	16 x 1"	1767	1767	1767	1481	1481	1141
18	150	16 x 1 1/8"	-	2605	2605	2183	2183	1100
20	150	20 x 1 1/8"	-	2365	2365	1984	1984	1618
24	150	20 x 1 1/4"	-	3419	3419	2873	2873	1479
28	150	28 x 1 1/4"	-	2904	2904	-	③ *	2155
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 factory



NOTICE!

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.

3.8 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.

PTFE & PFA

Separate flow sensor	-40	180	-40	65	-40	356	-40	149
Compact with IMT33A	-40	140	-40	65	-40	284	-40	149
Compact with IMT31A	-40	120	-40	65	-40	248	-40	149
Compact with IMT30A	-40	120	-40 ①	65 ①	-40	248	-40 ①	149 ①

ETFE

Separate flow sensor	-40	120	-40	65	-40	248	-40	149
Compact with IMT33A	-40	120	-40	65	-40	248	-40	149
Compact with IMT31A	-40	120	-40	65	-40	248	-40	149
Compact with IMT30A	-40	120	-40	65	-40	248	-40	149

Hard rubber

Separate flow sensor ②	-5	80	-40	65	23	176	-40	149
Compact with IMT33A ②	-5	80	-40	65	23	176	-40	149
Compact with IMT31A ②	-5	80	-40	65	23	176	-40	149
Compact with IMT30A	-5	80	-40	65	23	176	-40	149

PU

Separate flow sensor	-5	65	-40	65	23	149	-40	149
Compact with IMT33A	-5	65	-40	65	23	149	-40	149
Compact with IMT31A	-5	65	-40	65	23	149	-40	149
Compact with IMT30A	-5	65	-40	65	23	149	-40	149

① Max. ambient temperature is 60°C / 140°F, but process temperature is then limited to 60°C / 140°F.

② Hard rubber liner is available for Ex-versions only.


NOTICE!

Ambient temperatures below -25°C / -13°F may affect the readability of the display

4.1 Safety instructions

**DANGER!**

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

**DANGER!**

Observe the national regulations for electrical installations!

**DANGER!**

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

**WARNING!**

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

**NOTICE!**

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.

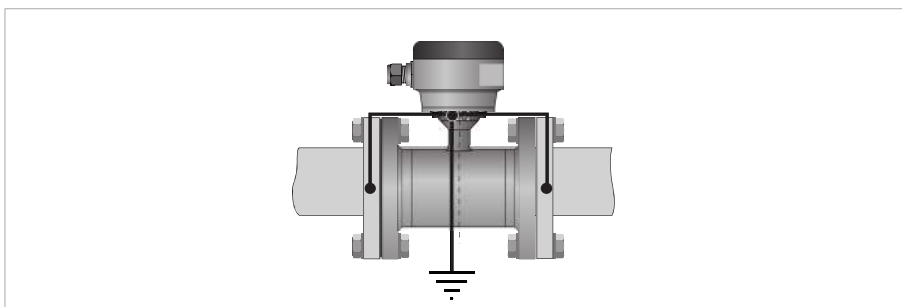


Figure 4-1: Grounding

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

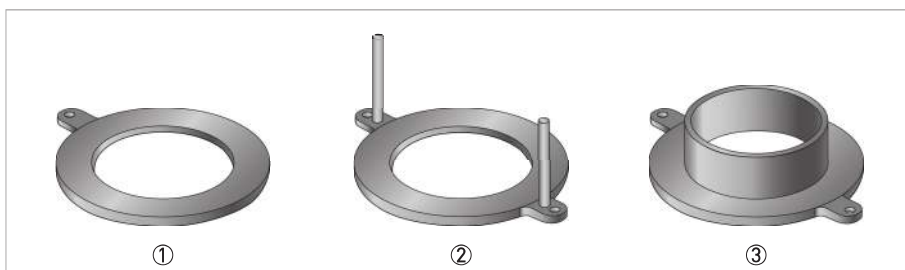


Figure 4-2: Different types of grounding rings

- 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 IMT33A (4, N and H version)

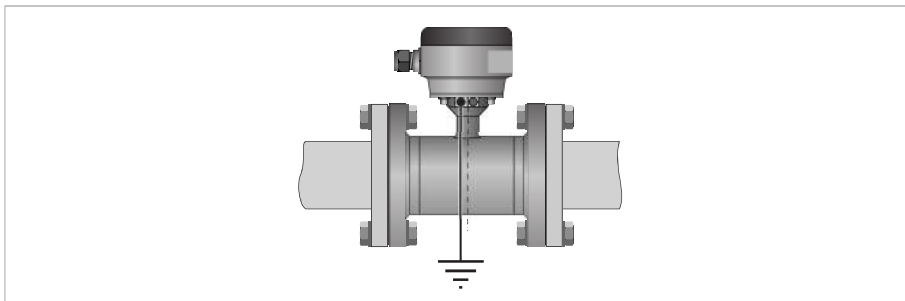


Figure 4-3: Virtual reference

Minimum requirements:

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

4.4 Connection diagrams



NOTICE!

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.



NOTICE!

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 Preapproval form - Customer returned process-wetted products

**LEGAL NOTICE!**

In compliance with U.S. Federal OSHA Standard 29CFR1910.1200 process information must be reviewed previous to receiving authorization to return material to Schneider Electric Systems USA, Inc.

NO PRODUCT EXPOSED TO HYDROFLUORIC ACID OR MERCURY WILL BE ACCEPTED!

Date: _____

Customer information

Customer's name:

Address:

Phone no:

Fax no.:

Contact's name:

Rep information

Rep's name:

Address:

Phone no:

Fax no.:

Contacts' name:

Product being returned:

Model No.:

Serial no.:

Under warranty?

YES

NO

Copies of MSDS sheets for all processes including cleaning solutions may be required.

Type of process (what chemicals/materials were processed through the unit):

Explain what steps were taken to decontaminate the unit: (was unit steam cleaned, rinsed out with water, chemically cleaned etc.)

Form completed by:

Print name

Signature

Date: _____

CLEANING STATEMENT

(Note: Your item will not be serviced unless the following cleaning statement has been signed):

I certify that the above referenced item has been properly purged and cleaned, complies with U.S. Department of Transportation shipping requirements and DOES NOT present a health and/or safety hazard (as defined by OSHA) to our Customer Repair personnel.

Print name: _____

Signature: _____

Print title: _____

Date: _____

Please fax the completed form to the Customer Satisfaction Center +1-508-549-4999

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.

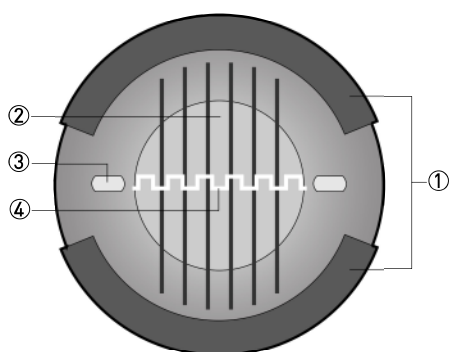


Figure 6-1: Measuring principle

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

6.2 Technical data



NOTICE!

- 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.

Measuring system

Measuring principle	Faraday's law
Application range	Electrically conductive fluids
Measured value	
Primary measured value	Flow velocity
Secondary measured value	Volume flow

Design

Features	Fully welded maintenance-free flow 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 signal converter IMT30A: 9700A + IMT30A 4
	With signal converter IMT31A: 9700A + IMT31A 4
	With signal converter IMT33A: 9700A + IMT33A 4
Remote version	In wall (W) mount version with signal converter IMT30A: 9700A + IMT30A N
	In wall (W) mount version with signal converter IMT31A: 9700A + IMT31A N
	In field (F) or wall (W) mount version with signal converter IMT33A: 9700A + IMT33A H or N
Nominal diameter	With signal converter IMT30A: DN10... 1200 / 3/8...48"
	With signal converter IMT31A: DN10... 1200 / 3/8...48"
	With signal converter IMT33A: DN10... 2000 / 3/8...80"

Measuring accuracy

Maximum measuring error	Depending on signal converter and DN size.
	IMT30A: down to 0.5% of the measured value ± 1 mm/s
	IMT31A: down to 0.3% of the measured value ± 1 mm/s
	IMT33A: down to 0.2% of the measured value ± 1 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 38.
Repeatability	$\pm 0.1\%$ of MV, minimum 1 mm/s
Calibration / Verification	Standard:
	2 point calibration by direct volume comparison.
	Optional:
	Verification to Measurement Instrument Directive (MID), Annex III (MI-001). Check BuyAutomation for availability
	[Only in combination with signal converter IMT33A]
Long term stability	$\pm 0.1\%$ of MV

Operating conditions

Temperature	
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 IMT33A compact versions
	PTFE / PFA: -40...+120°C / -40...+248°F for IMT30A and IMT31A compact versions
	ETFE: -40...+120°C / -40...+248°F
	Hard rubber: -5...+80°C / 23...+176°F
	Soft rubber: -5...+60°C / 23...+140°F
	PU: -5...+65°C / 23...+149°F
	For more information about temperatures see the temperature table in the manual.
Ambient temperature	Standard (with aluminum signal converter housing):
	-40...+65°C / -40...+149°F
	Protect electronics against self-heating with ambient temperatures above +55°C / +131°F.
	Option (with stainless steel signal converter housing): Check BuyAutomation for availability.
	-40...+55°C / -40...+130°F
Storage temperature	-50...+70°C / -58...+158°F
Measuring range	-12...+12 m/s / -40...+40 ft/s
Pressure	
EN 1092-1	DN1200...2000: PN6
	DN200...1000: PN10
	DN65 and DN100...150: PN16
	DN10...50 and DN80: PN40
	Other pressures on request.
ASME B16.5	3/8...40": 150 lb RF
	Other pressures on request.
JIS	DN50...1000 / 2..40": 10 K
	DN10...40 / 3/8...1½" : 20 K
	Other pressures on request.
Vacuum load	For detailed information refer to <i>Vacuum load</i> on page 46.
Pressure loss	Negligible

Chemical properties	
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)	IMT30A: $\leq 3\%$
	IMT31A: $\leq 5\%$
	IMT33A: $\leq 5\%$
Permissible solid content (volume)	IMT30A: $\leq 10\%$
	IMT31A: $\leq 10\%$
	IMT33A: $\leq 70\%$

Installation conditions

Installation	Assure that the flow sensor is always fully filled.
	For detailed information refer to <i>Installation</i> on page 13.
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 39.

Materials

Flow sensor housing	DN10...15 / 3/8...1/2": stainless steel 1.4408
	DN20 / 3/4": GTW-S 30
	DN25...2000 / 1...80": sheet steel
Measuring tube	Austenitic stainless steel
Flanges	Standard: carbon steel
Liner	Standard
	DN10...15 / 3/8...1/2": PFA
	DN20 3/4": PTFE
	DN25...150 / 1...6": PFA
	DN200...1800 / 8...72": ETFE
	Option
	DN25...600 / 1...24": PTFE
	DN200...1800 / 8...72": PU
	DN200...2000 / 8...80": Hard rubber (Ex only)
Protective coating	On exterior of the meter: flanges, housing, signal converter (compact version) and / or connection box (field version)
	Standard coating
Connection box	Only for remote versions
	Standard: die-cast aluminum
	Option: stainless steel
Measuring electrodes	Standard: Hastelloy® C
	Option: platinum, stainless steel, titanium, tantalum, low noise
	Option: conductive rubber (only in combination with soft rubber liner)
Grounding rings	Standard : stainless steel
	Option: Hastelloy® C, titanium, tantalum
	Grounding rings can be omitted with virtual reference option for the signal converter IMT33A.
Reference electrode (optional)	Standard: Hastelloy® C
	Option: platinum, stainless steel, titanium, tantalum, low noise

Process connections

Flange	
EN 1092-1	DN10...2000 in PN6...40
ASME	3/8...80" in 150...300 lb RF
JIS	DN10...1000 in JIS 10...20 K
Design of gasket surface	EN 1092-1, ASME, JIS; RF

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 IMT30A, IMT31A and IMT33A
	Standard cable, double shielded. Max. length: 600 m / 1968 ft (dep. on electrical conductivity and flow sensor).
Type B (BTS)	Only in combination with the signal converter IMT33A
	Optional cable, triple shielded. Max. length: 600 m / 1968 ft (dep. 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 CE declaration or the website of the manufacturer.
Hazardous areas	
ATEX	Please check the relevant Ex documentation for details.
	Compact version with signal converter IMT30A 4 : II 2 GD
	Compact version with signal converter IMT31A 4: II 2 GD
	Compact version with signal converter IMT33A 4: II 2 GD or II 2(1) GD
	Remote version: II 2 GD
FM	In combination with signal converter IMT33A 4:
	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 IMT33A:
	Class I, Div 2, groups A, B, C and D
	Class II, Div 2, groups F and G
IECEx	Compact version with signal converter
	IIC T4
	Compact version with signal converter
	IIC T6...T3
NEPSI	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	
Hygiene	PFA liner is FDA compliant.
Protection category acc. to IEC 60529 / 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.
Protective coating	Standard; ISO 12944-2: C3 medium / C4 high
Vibration resistance	IEC 68-2-64
Random vibration test	IEC 68-2-34
Shock test	IEC 68-2-27

6.3 Measurement 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

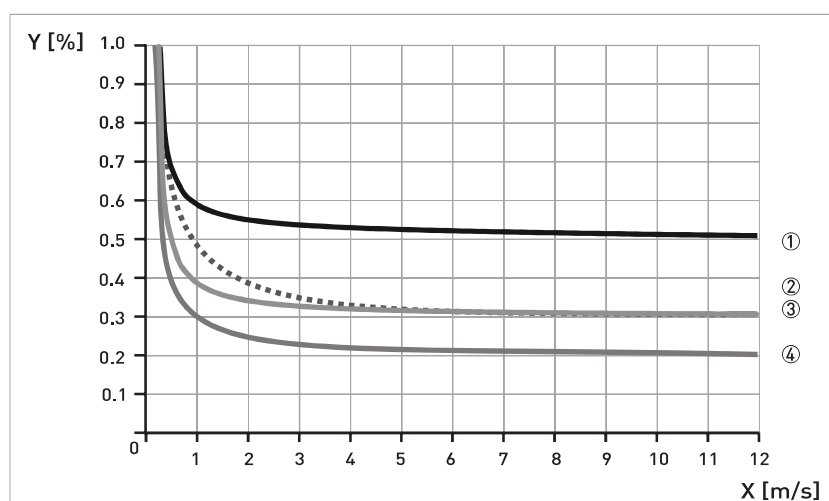


Figure 6-2: Flow velocity vs. accuracy

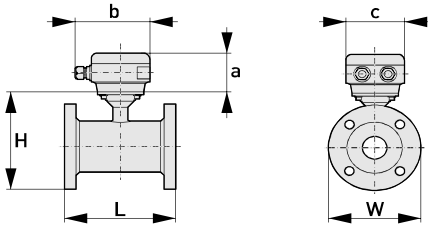
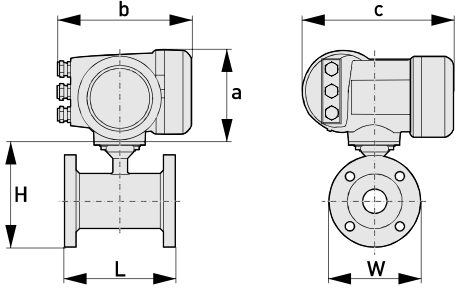
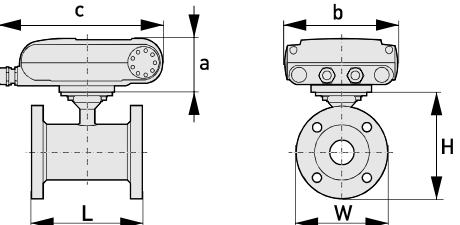
X [m/s] : flow velocity

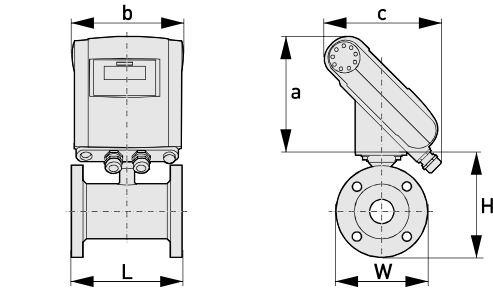
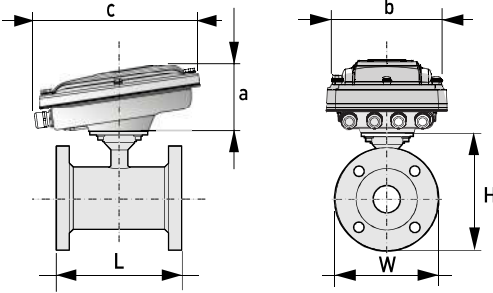
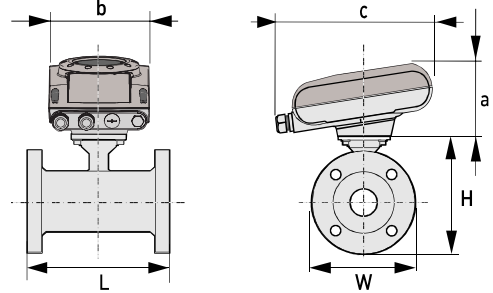
Y [%]: deviation from the actual measured value (mv)

Accuracy

Flow sensor diameter	Signal converter type	Accuracy	Curve
DN10...1600 / $\frac{3}{8}$...64"	IMT33A	$\pm 0.2\%$ of mv + 1 mm/s	④
DN1800...2000 / > 64"	IMT33A	$\pm 0.3\%$ of mv + 2 mm/s	③
DN10...1200 / $\frac{3}{8}$...48"	IMT31A	$\pm 0.3\%$ of mv + 1 mm/s	②
DN10...1200 / $\frac{1}{10}$...48"	IMT30A	$\pm 0.5\%$ of mv + 1 mm/s	①

6.4 Dimensions and weights

Remote version		<p>a = 88 mm / 3.5"</p> <p>b = 139 mm / 5.5" ①</p> <p>c = 106 mm / 4.2"</p> <p>Total height = H + a</p>
Compact version with : IMT33A		<p>a = 155 mm / 6.1"</p> <p>b = 230 mm / 9.1" ①</p> <p>c = 260 mm / 10.2"</p> <p>Total height = H + a</p>
Compact version with : IMT31A [0°]		<p>a = 82 mm / 3.2"</p> <p>b = 161 mm / 6.3"</p> <p>c = 257 mm / 10.1" ①</p> <p>Total height = H + a</p>

Compact version with : IMT31A (45°)		$a = 186 \text{ mm} / 7.3''$ $b = 161 \text{ mm} / 6.3''$ $c = 184 \text{ mm} / 2.7''$ ① Total height = $H + a$
Compact version with stainless steel IMT31A (10°)		$a = 100 \text{ mm} / 4''$ $b = 187 \text{ mm} / 7.36''$ ① $c = 270 \text{ mm} / 10.63''$ Total height = $H + a$
Compact version with : IMT30A (10°)		$a = 100 \text{ mm} / 4''$ $b = 157 \text{ mm} / 6.18''$ ① $c = 260 \text{ mm} / 10.24''$ Total height = $H + a$

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



NOTICE!

- 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]				Approximately weight [kg]
DN	PN [bar]	L		H	W	
		DIN	ISO 13359			
10	40	150	-	106	90	6
15	40	150	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

150 lb flanges

Nominal size		Dimensions [inch]				Approximately weight [lb]
ASME	PN [psi]	L		H	W	
		DIN	ISO 13359			
3/8"	284	5.91	-	5.08	3.50	12
1/2"	284	5.91	7.87	5.08	3.50	12
3/4"	284	5.91	7.87	5.28	3.88	18
1"	284	5.91	7.87	5.39	4.25	7
1 1/4"	284	5.91	7.87	5.98	4.62	7
1 1/2"	284	5.91	7.87	6.10	5.00	11
2"	284	7.87	7.87	7.05	5.98	18
2 1/2"	284	7.87	7.87	7.72	7.00	24
3"	284	7.87	7.87	8.03	7.50	26
4"	284	9.84	9.84	9.49	9.00	40
5"	284	9.84	9.84	10.55	10.0	49
6"	284	11.81	11.81	11.69	11.0	64
8"	284	13.78	13.78	14.25	13.5	95
10"	284	15.75	17.71	16.3	16.0	143
12"	284	19.69	19.69	18.78	19.0	207
14"	284	27.56	21.65	20.67	21.0	284
16"	284	31.50	23.62	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

**CAUTION!**

- 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 [inch]				Approximately weight [lb]
ASME	PN [psi]	L		H	W	
		DIN	ISO 13359			
3/8"	741	5.91	-	5.24	3.75	15
½"	741	5.91	7.87	5.24	3.75	15
¾"	741	5.91	7.87	5.67	4.62	20
1"	741	5.91	7.87	5.71	4.87	11
1 ½"	741	7.87	7.87	6.65	6.13	13
2"	741	9.84	7.87	7.32	6.50	22
3"	741	9.84	7.87	8.43	8.25	31
4"	741	11.81	9.84	10.00	10.0	44
6"	741	12.60	11.81	12.44	12.5	73
8"	741	15.75	13.78	15.04	15.0	157
10"	741	19.69	17.71	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

**CAUTION!**

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

6.5 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]

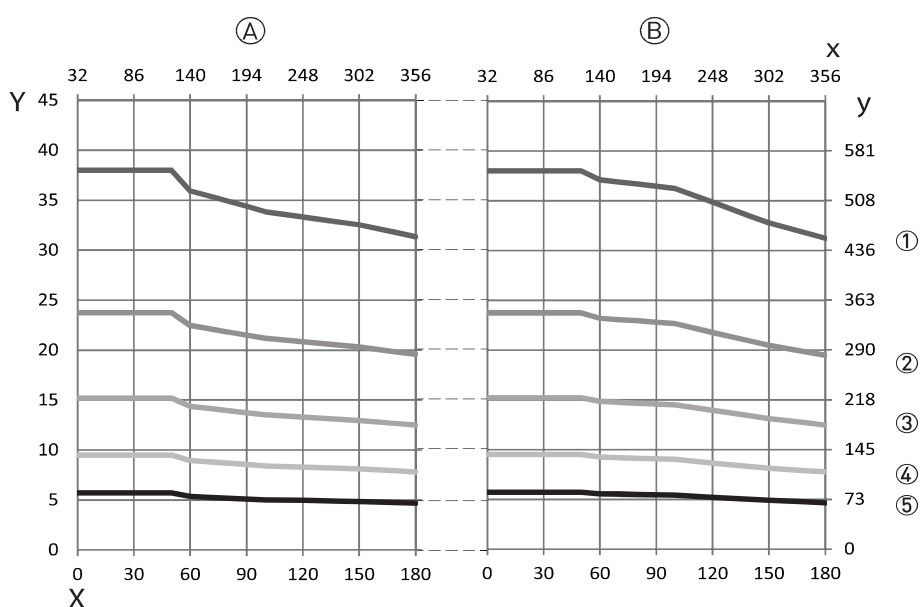


Figure 6-3: Pressure derating; EN 1092-1

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

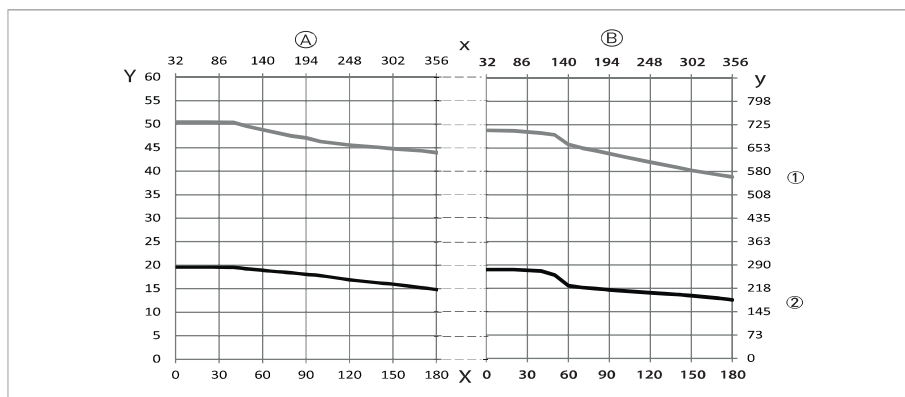


Figure 6-4: Pressure derating; ANSI B16.5

- ① 300 lbs
② 150 lbs

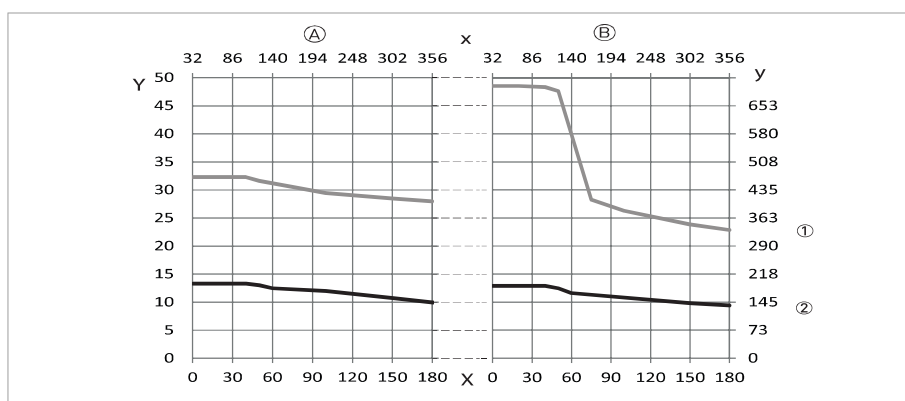


Figure 6-5: Pressure derating; JIS B2220

- ① 20K
② 10K

6.6 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
Liner in PTFE										
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
Liner in PFA										
DN25...150	50	0	0	0	0	0	0	0	0	0
Liner in ETFE										
DN200...2000	150	100	100	100	100	100	100	100	-	-
Liner in Hard rubber										
DN200...300	150	250	400	400	400	-	-	-	-	-
DN350...2000	150	500	600	600	600	-	-	-	-	-
Liner in PU										
DN200...1800	1500	500	600	-	-	-	-	-	-	-
Liner in Soft rubber										
DN50...600	40	1000	1000	-	-	-	-	-	-	-

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
Liner in PTFE										
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
Liner in PFA										
1...6"	725	0	0	0	0	0	0	0	0	0
Liner in ETFE										
8...72"	2176	1.5	1.5	1.5	1.5	1.5	1.5	1.5	-	-
Liner in Hard rubber										
8...12"	2176	3.6	5.8	5.8	5.8	-	-	-	-	-
14...80"	2176	7.3	8.7	8.7	8.7	-	-	-	-	-
Liner in PU										
8...72"	21756	7.3	8.7	-	-	-	-	-	-	-
Liner in Soft rubber										
2...24"	580	14.5	14.5	-	-	-	-	-	-	-



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