



VF7 Quick Start

2-wire / Guided Radar (TDR) Level Meter

for distance, level, volume and mass measurement of liquids, liquid interface, pastes and solids

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Warnings and symbols used



DANGER!

This information refers to the immediate danger when working with electricity.



DANGER!

These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.



WARNING!

Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.



CAUTION!

Disregarding these instructions can result in damage to the device or to parts of the operator's plant.



INFORMATION!

These instructions contain important information for the handling of the device.



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.

Safety instructions for the operator



CAUTION!

Installation, assembly, start-up and maintenance may only be performed by appropriately trained personnel. The regional occupational health and safety directives must always be observed.



LEGAL NOTICE!

The responsibility as to the suitability and intended use of this device rests solely with the user. The supplier assumes no responsibility in the event of improper use by the customer. Improper installation and operation may lead to loss of warranty. In addition, the "Terms and Conditions of Sale" apply which form the basis of the purchase contract.



INFORMATION!

- Further information can be found on the supplied CD-ROM in the manual, on the data sheet, in special manuals, certificates and on the manufacturer's website.
- If you need to return the device to the manufacturer or supplier, please fill out the form contained on the CD-ROM and send it with the device. Unfortunately, the manufacturer cannot repair or inspect the device without the completed form.

2.1 Intended use



CAUTION!

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.



INFORMATION!

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

It can be installed on tanks, silos and open pits.

2.2 Scope of delivery



INFORMATION!

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

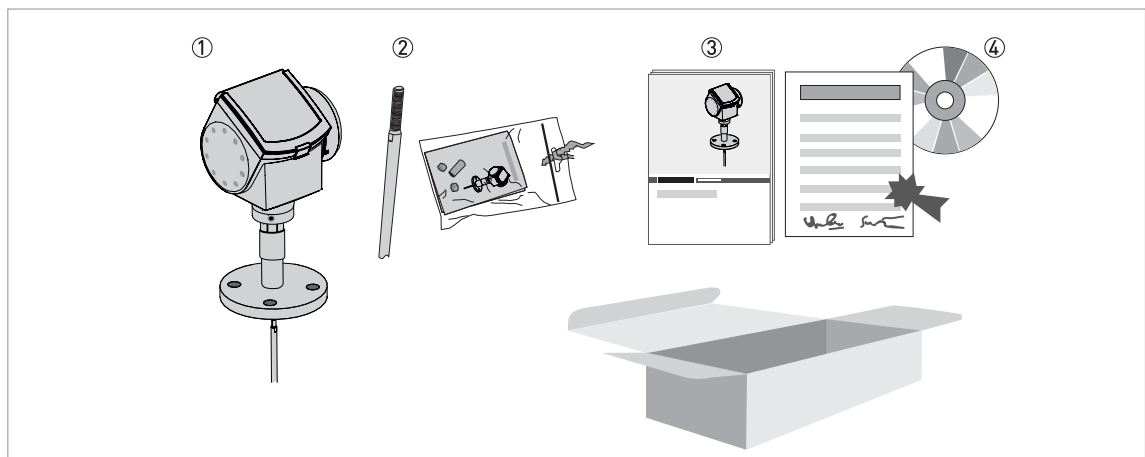


Figure 2-1: Scope of delivery for compact version

- ① Signal converter and probe – compact version.
- ② Probe segments. For the assembly procedure of the single rod probe, refer to the instructions that are supplied with the device. If a single rod or coaxial probe is attached and you ordered the "segmented probe" option, only part of the probe is attached to the device. For the assembly procedure of the segmented single rod probe, refer to the instructions that are supplied with the device. For the assembly procedure of the segmented coaxial probe, refer to the instructions that are supplied with the device.
The assembly instructions and small parts are in a bag attached to the signal converter.
- ③ Quick Start
- ④ CD-ROM. This contains the Handbook, the Quick Start, the Technical Datasheet and related software.

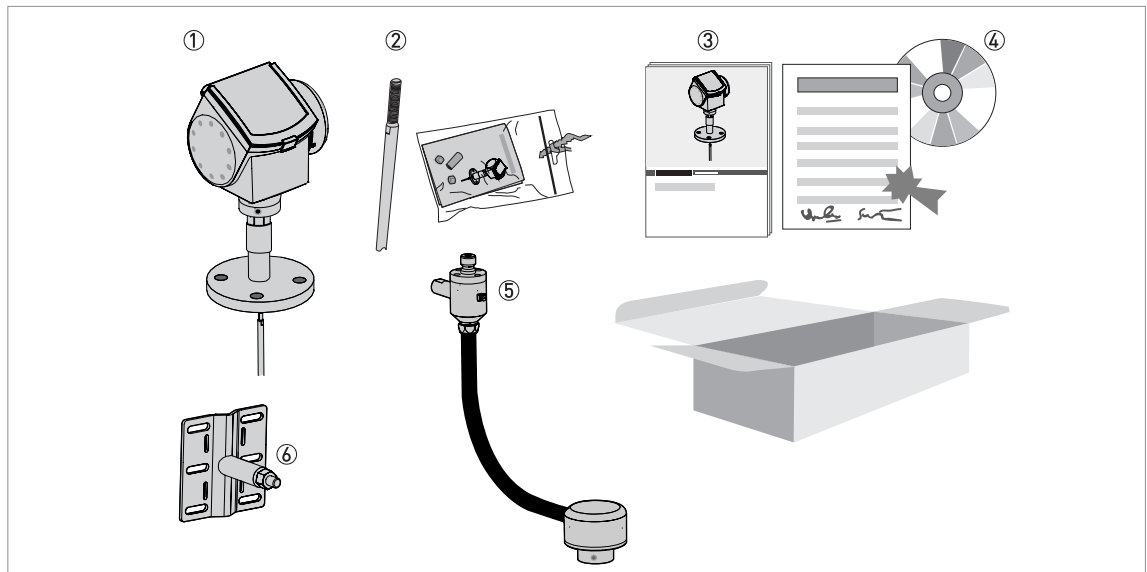


Figure 2-2: Scope of delivery for the remote version

- ① Signal converter and probe
- ② Probe segments. For the assembly procedure of the single rod probe, refer to the instructions that are supplied with the device. If a single rod or coaxial probe is attached and you ordered the "segmented probe" option, only part of the probe is attached to the device. For the assembly procedure of the segmented single rod, refer to the instructions that are supplied with the device. For the assembly procedure of the segmented coaxial probe, refer to the instructions that are supplied with the device.
The assembly instructions and small parts are in a bag attached to the signal converter.
- ③ Quick Start
- ④ CD-ROM. This contains the Handbook, the Quick Start, the Technical Datasheet and related software.
- ⑤ Flexible conduit. For the assembly procedure, refer to *How to assemble the remote version* on page 32.
- ⑥ Wall bracket (also for installation on pipes)



INFORMATION!

No special tools, no training required!

2.3 Visual Check



INFORMATION!

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

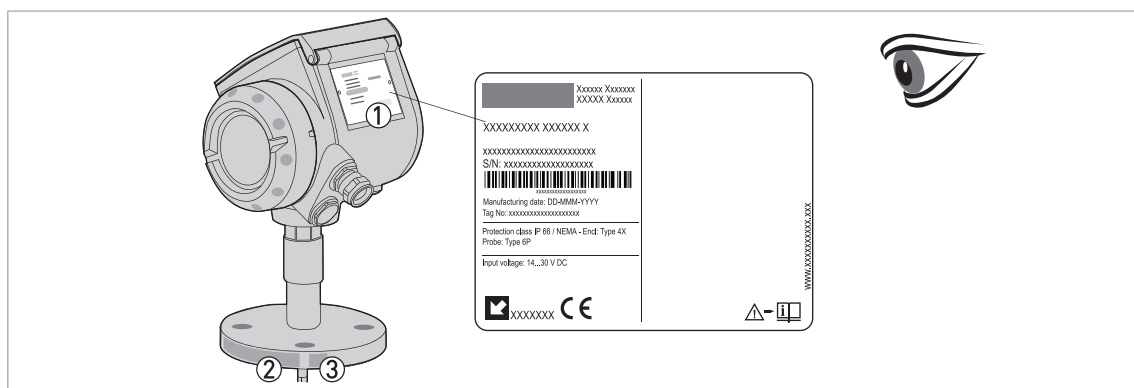


Figure 2-3: Visual check

- ① Device nameplate (for more data, refer to the handbook)
- ② Process connection data (size and pressure rating, material reference and heat number)
- ③ Gasket material data - refer to the illustration that follows



Figure 2-4: Symbols for the supplied gasket material (on the side of the process connection)

- ① EPDM
- ② Kalrez® 6375

If the device is supplied with an FKM/FPM gasket, there is no symbol on the side of the process connection.



INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.



WARNING!

- If the display screen glass is broken, do not touch.
- If the device has to measure the level of dangerous products (ammonia etc.), we recommend that the device has the Metaglas® option.
- If the device has to measure the level of products where there is a risk of electrostatic discharge, we recommend that the device has the ESD (electrostatic discharge) protection option.

2.4 Storage

**WARNING!**

Do not keep the device in a vertical position. This will damage the probe and the device will not measure correctly.

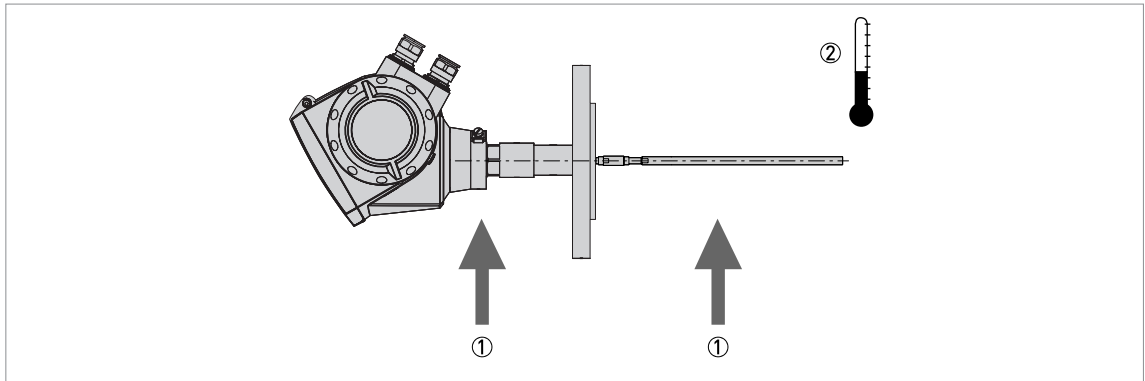


Figure 2-5: Storage conditions

- ① Do not bend rod and coaxial probes – support here
- ② Storage temperature range: -50...+85°C / -60...+185°F (min. -40°C / -40°F for devices with the integrated LCD display option)

- Store the device in a dry and dust-free location.
- Store the device in its original packing.

2.5 Transport

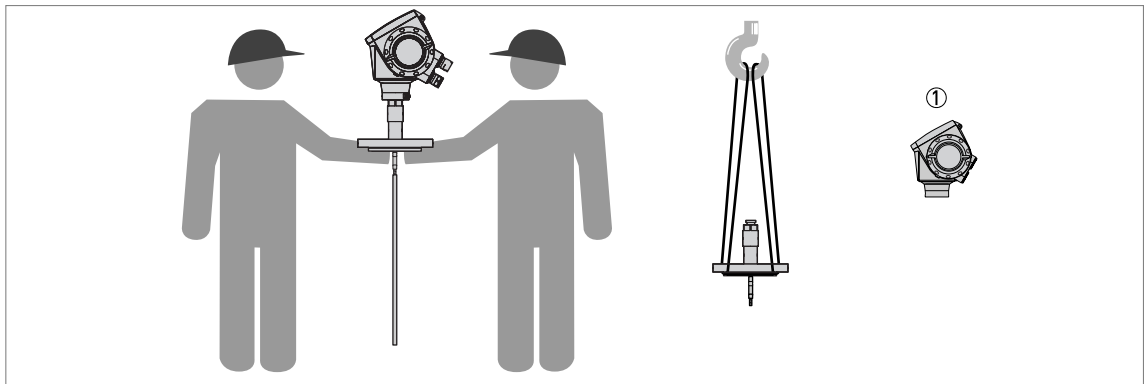


Figure 2-6: How to hold the device

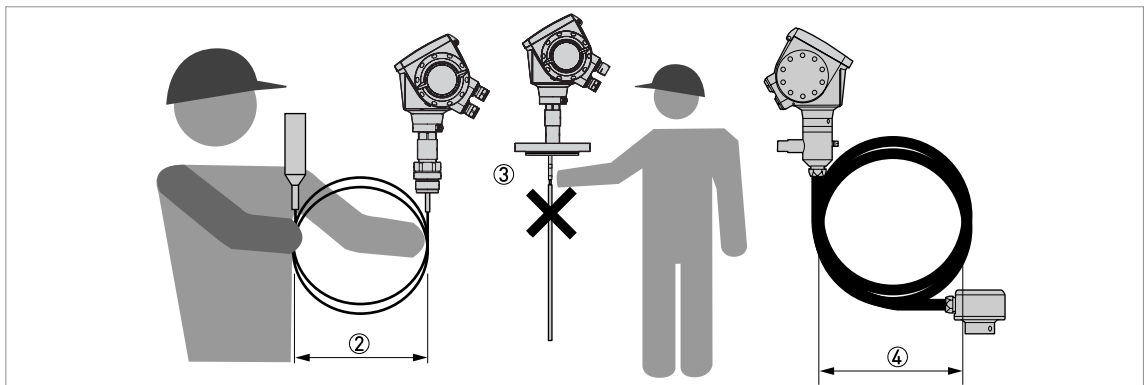


Figure 2-7: How to hold the device

- ① Remove the converter before you lift the device with a hoist.
- ② Wind cable probes greater than 400 mm / 16" in diameter.
- ③ Do not hold the probe when you lift the device.
- ④ Do not wind the flexible conduit less than 330 mm / 13" in diameter.



WARNING!

If you do not lift the device carefully, you can cause damage to the probe.

2.6 Pre-installation requirements



INFORMATION!

Obey the precautions that follow to make sure that the device is correctly installed.

- Make sure that there is sufficient space on all sides.
- Protect the signal converter from direct sunlight. If necessary, install the weather protection accessory.
- Do not subject the signal converter to heavy vibrations. The devices are tested for vibration and agree with EN 50178 and IEC 60068-2-6.

2.7 How to prepare the tank before you install the device



CAUTION!

To avoid measuring errors and device malfunction, obey these precautions.

2.7.1 Pressure and temperature ranges

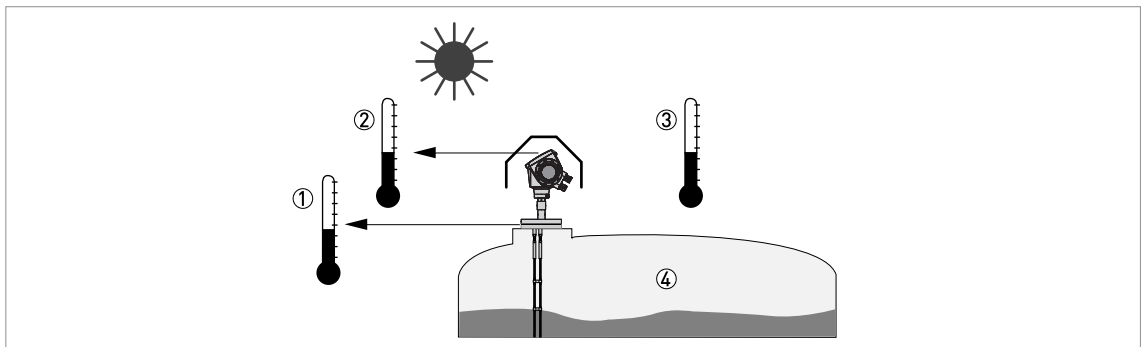


Figure 2-8: Pressure and temperature ranges

① Process connection temperature

The process connection temperature must stay in the temperature range of the gasket material unless the device is a High-Temperature version. Refer to the table "Temperature ranges for gaskets" that follows and to "Technical data" on page 42.

Ex devices: see supplementary operating instructions

② Ambient temperature for operation of the display

-20...+60°C / -5...+140°F

If the ambient temperature is not between these limits, the display screen switches off automatically

③ Ambient temperature

Non-Ex devices: -40...+80°C / -40...+176°F

Ex devices: see supplementary operating instructions

④ Process pressure

Refer to the table "Process pressure limits" that follows and "Pressure/temperature table for probe selection" in the handbook.



WARNING!

The process connection temperature range must agree with the temperature limits of the gasket material. The operating pressure range is subject to the process connection used and the flange temperature.

Temperature ranges for gaskets

Gasket material	Process connection temperature					
	Standard version		High-Pressure version		High-Temperature and High-Temperature / High-Pressure versions	
	[°C]	[°F]	[°C]	[°F]	[°C]	[°F]
FKM/FPM	-40...+200	-40...+392	-40...+150	-40...+302	-40...+300	-40...+572
Kalrez® 6375	-20...+200	-4...+392	-20...+150	-4...+302	-20...+300	-4...+572
EPDM	-50...+150	-58...+302	-50...+150	-58...+302	-50...+250	-58...+482

**INFORMATION!**

Ø4 mm / 0.16" single cable probe with FEP coating option only: The process connection temperature range is -20...+150°C / -4...+302°F

**INFORMATION!**

Single rod probes with protective sheath option only: The process connection temperature range depends on the protective sheath material selected.

PP: -40...+90°C / -40...+194°F; PVDF: -40...+150°C / -40...+302°F; PVC: -15...+80°C / +5...+176°F

Process pressure limits

Device version	Maximum process pressure	
	[barg]	[psig]
Ø8 mm / 0.32" single cable	40 ①	580 ①
High-Pressure (HP) version	300 ①	4350 ①
All other probe types and device versions	100 ①	1450 ①

① Refer also to "Pressure / temperature table for probe selection" in the handbook

2.7.2 General information for nozzles



CAUTION!

Follow these recommendations to make sure that the device measures correctly.

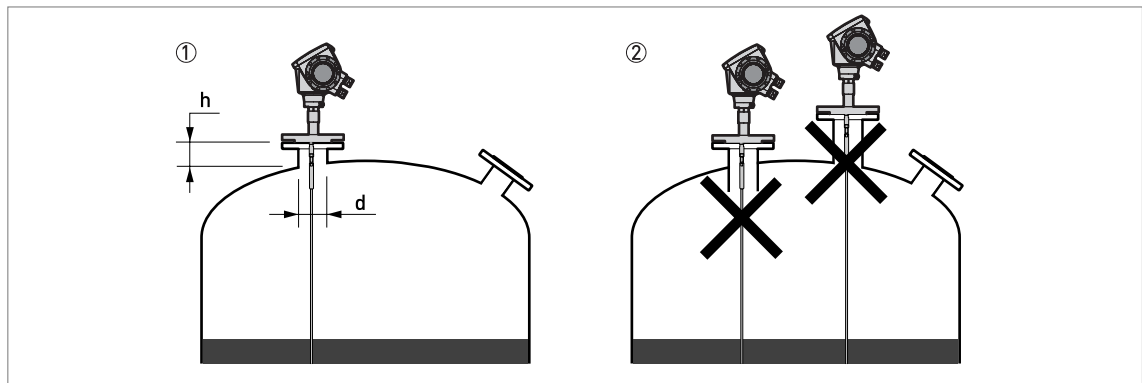


Figure 2-9: Recommended nozzle dimensions for single rod and single cable probes

- ① Recommended conditions: $h \leq d$, where h is the height of the tank nozzle and d is the diameter of the tank nozzle.
- ② The end of the nozzle must not have an extension into the tank. Do not install the device on a high nozzle.



CAUTION!

If the device is installed on a high nozzle, make sure that the probe does not touch the side of the nozzle (attach the probe end, ...). We recommend that you use a coaxial probe (this solution is applicable only to liquids).



INFORMATION!

It is possible to measure in these conditions with a minimum top dead zone. Use the snapshot function to filter the parasite signals from long nozzles. For more data, refer to the Handbook.

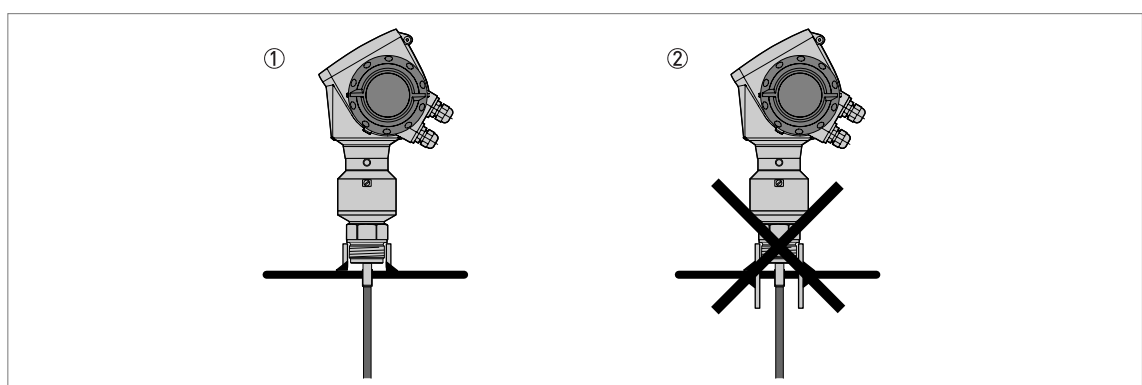


Figure 2-10: Sockets for threaded process connections

- ① Recommended installation
- ② The end of the socket must not have an extension into the tank

**CAUTION!**

Do not put the process connection near to the product inlet. If the product that enters the tank touches the probe, the device will measure incorrectly.

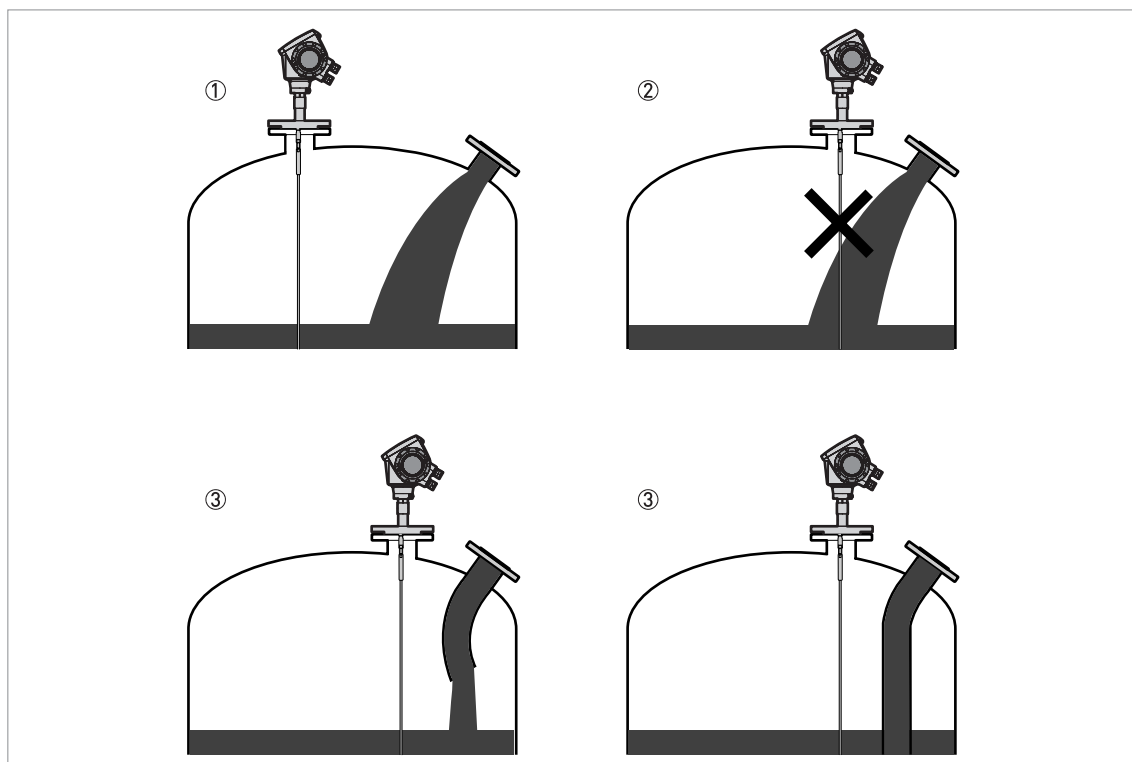


Figure 2-11: Do not put the device near to a product inlet

- ① The device is in the correct position.
- ② The device is too near to the product inlet.
- ③ If it is not possible to put the device in the recommended position, install a deflector pipe.

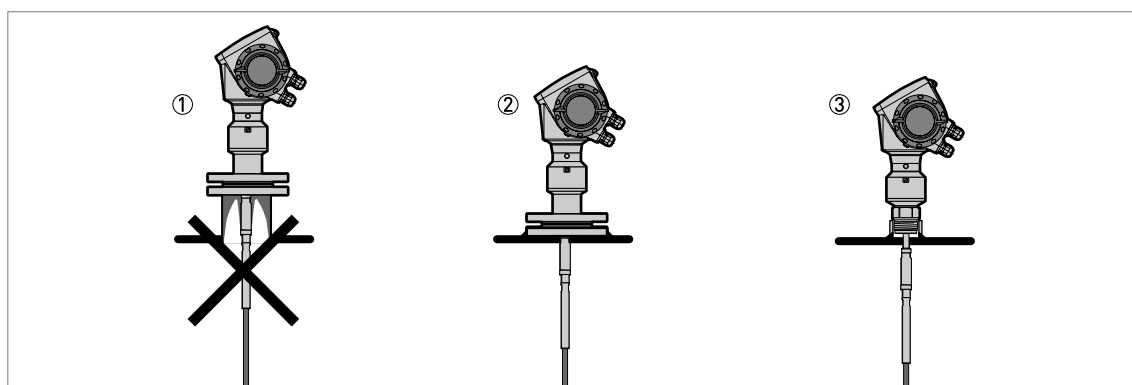


Figure 2-12: How to prevent build-up of product around the process connection

- ① If product particles are likely to collect in holes, a nozzle is not recommended.
- ② Attach the flange directly to the tank.
- ③ Use a threaded connection to attach the device directly to the tank.

**INFORMATION!**

If your device has a coaxial probe, you can ignore these installation recommendations.

**CAUTION!**

Install coaxial probes in clean liquids that are not too viscous.

2.7.3 Installation requirements for concrete roofs

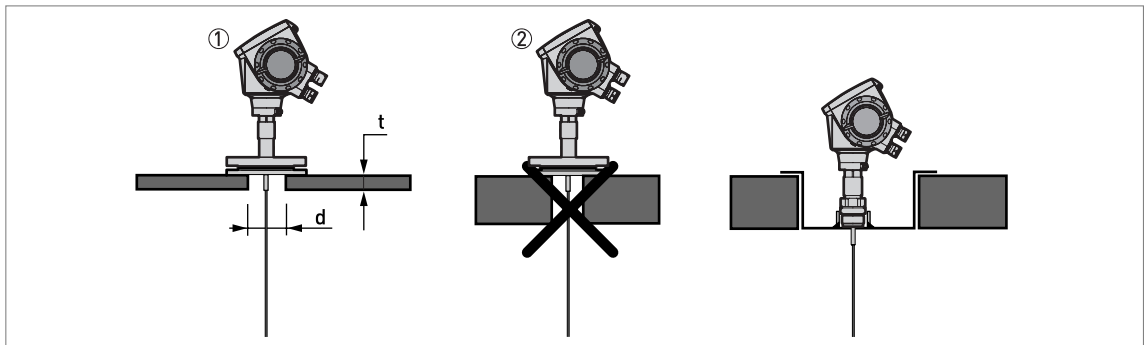


Figure 2-13: Installation on a concrete roof

- ① The diameter, d , of the hole must be greater than the thickness, t , of the concrete.
- ② If the thickness, t , of the concrete is greater than the diameter, d , of the hole, install the device in a recess.

2.8 Installation recommendations for liquids

2.8.1 General requirements

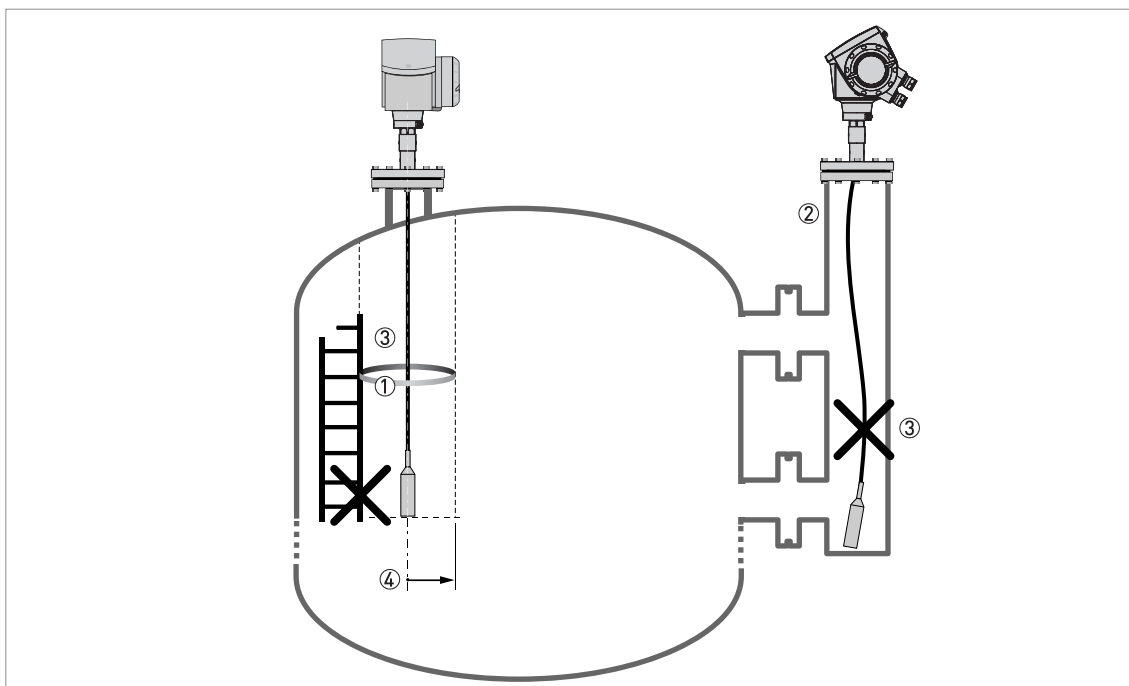


Figure 2-14: Installation recommendations for liquids

- ① The electromagnetic (EM) field generated by the device. It has a radius of R_{min} . Make sure that the EM field is clear of objects and product flow. Refer to the table that follows.
- ② If there are too many objects in the tank, install a bypass chamber or stilling well.
- ③ Keep the probe straight. If the probe is too long, shorten the probe length. Make sure that the device is configured with the new probe length. For more data on the procedure, refer to the handbook.
- ④ Empty space. Refer to the table that follows.



INFORMATION!

If the device has to measure the level of dangerous products (ammonia etc.), we recommend that you use a device with the Metaglas® option.

Clearance between the probe and other objects in the tank

Probe type	Empty space (radius, R_{min}), around the probe	
	[mm]	[inches]
Coaxial	0	0
Double rod / cable	100	4
Single rod / cable	300	12

2.8.2 How to attach probes to the bottom of the tank

If the liquid is agitated or turbulent, you can attach the probe to the bottom of the tank. The procedure to attach the probe depends on the type of probe used.

For more data, refer to the Handbook.

2.8.3 Standpipes

Use a standpipe if:

- There is highly conductive foam in the tank.
- The liquid is very turbulent or agitated.
- There are too many other objects in the tank.
- The device is measuring a liquid (petro-chemicals) in a tank with a floating roof.

For more data, refer to the Handbook.

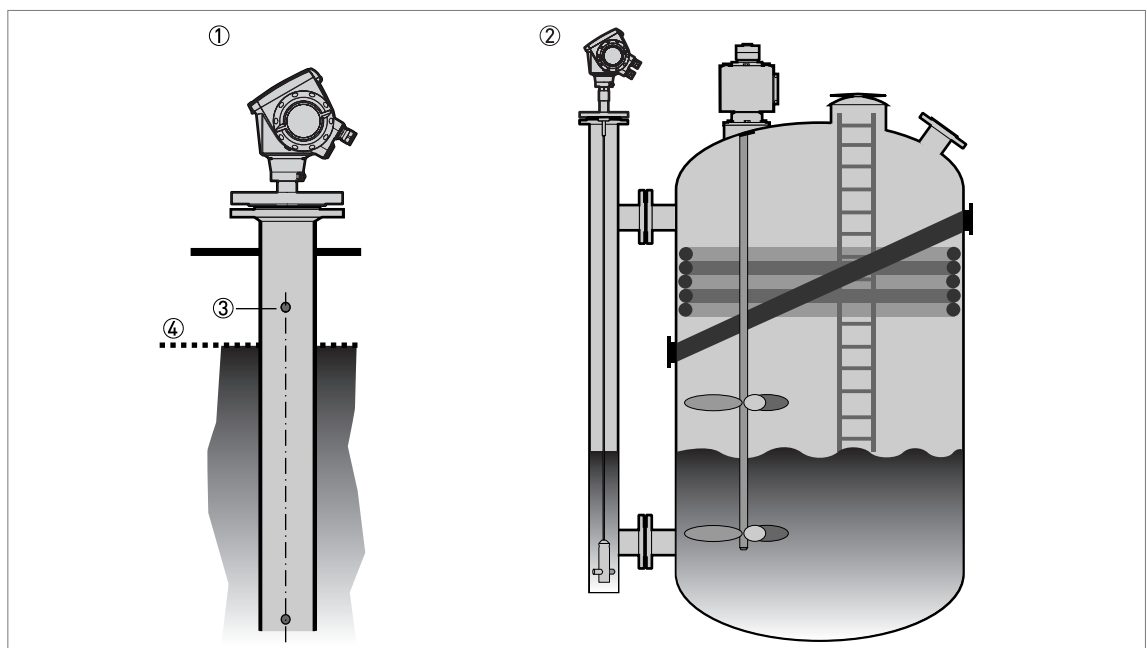


Figure 2-15: Basic installation recommendations for standpipes (stilling wells and bypass chambers)

- ① Stilling well
- ② Bypass chamber
- ③ Air circulation hole
- ④ Level of the liquid



INFORMATION!

Standpipes are not necessary for devices with coaxial probes. But if there is a sudden change in diameter in the standpipe, we recommend that you install a device with a coaxial probe.

2.9 Installation recommendations for solids

2.9.1 Nozzles on conical silos

We recommend that you prepare the installation when the silo is empty.

**DANGER!**

Risk of electrostatic discharge (ESD): The device is resistant to electrostatic discharges of up to 15 kV (30 kV with the ESD protection option – recommended for solid applications), but it is the responsibility of the fitter and the user to prevent ESD.

**CAUTION!**

Install the device at the correct location to measure level correctly and prevent too much bending and traction. If necessary, attach the probe to the bottom of the tank.

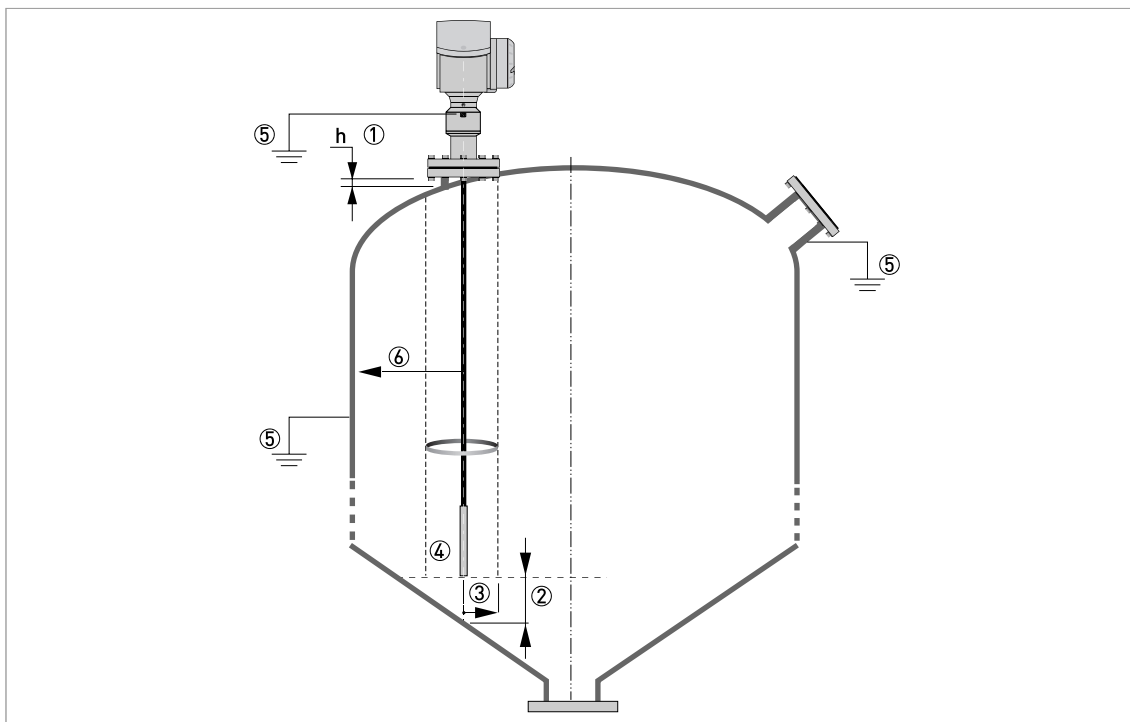


Figure 2-16: Installation recommendations for solids

- ① We recommend installation without a nozzle. If not, $h \leq 50 \text{ mm} / 2''$.
- ② The end of the probe must be more than 300 mm / 12" above the tank bottom.
- ③ Empty space (radius, R_{\min}) around the probe.
- ④ The electromagnetic (EM) field generated by the device. It is also the measurement zone of the probe. Make sure that the EM field is clear of objects and product flow.
- ⑤ Ground the tank, the product and the probe (if attached).
- ⑥ If possible, put the process fitting $\geq 300 \text{ mm} / 12''$ from the tank wall

Clearance between the probe and other objects in the tank

Probe type	Empty space (radius, R_{\min}) around the probe	
	[mm]	[inches]
Single cable $\varnothing 4 \text{ mm} / 0.16''$ ④	300	12
Single cable $\varnothing 8 \text{ mm} / 0.32''$ ④	300	12

**INFORMATION!**

If the probe is longer than 10 m / 33 ft, we recommend that you do not attach the end of the probe.

2.9.2 Traction loads on the probe

Traction load depends on:

- The height and shape of the tank.
- The particle size and density.
- The rate at which the tank is emptied.



CAUTION!

Risk of damage to the cable probe. High loads can break the cable.

If the load on the Ø8 mm / 0.32" single cable probe is more than 3500 kg / 7700 lb, contact your supplier.



CAUTION!

Make sure that the tank roof is resistant to deformation at high loads.

Estimated traction load on the probe in kg

Material	Probe length, 10 m	Probe length, 20 m	Probe length, 30 m
	[kg]		
Cement	1000	2000	3000
Fly ash	500	1000	1500
Wheat	300	500	1200

Estimated traction load on the probe in lb

Material	Probe length, 33 ft	Probe length, 65 ft	Probe length, 98 ft
	[lb]		
Cement	2200	4410	6520
Fly ash	1100	2200	3300
Wheat	660	1100	2650

2.10 How to install the device on the tank

2.10.1 How to assemble the single rod probe (single-piece probe)

**INFORMATION!**

This procedure is for devices with single rod probes that are not segmented (single-piece probes).

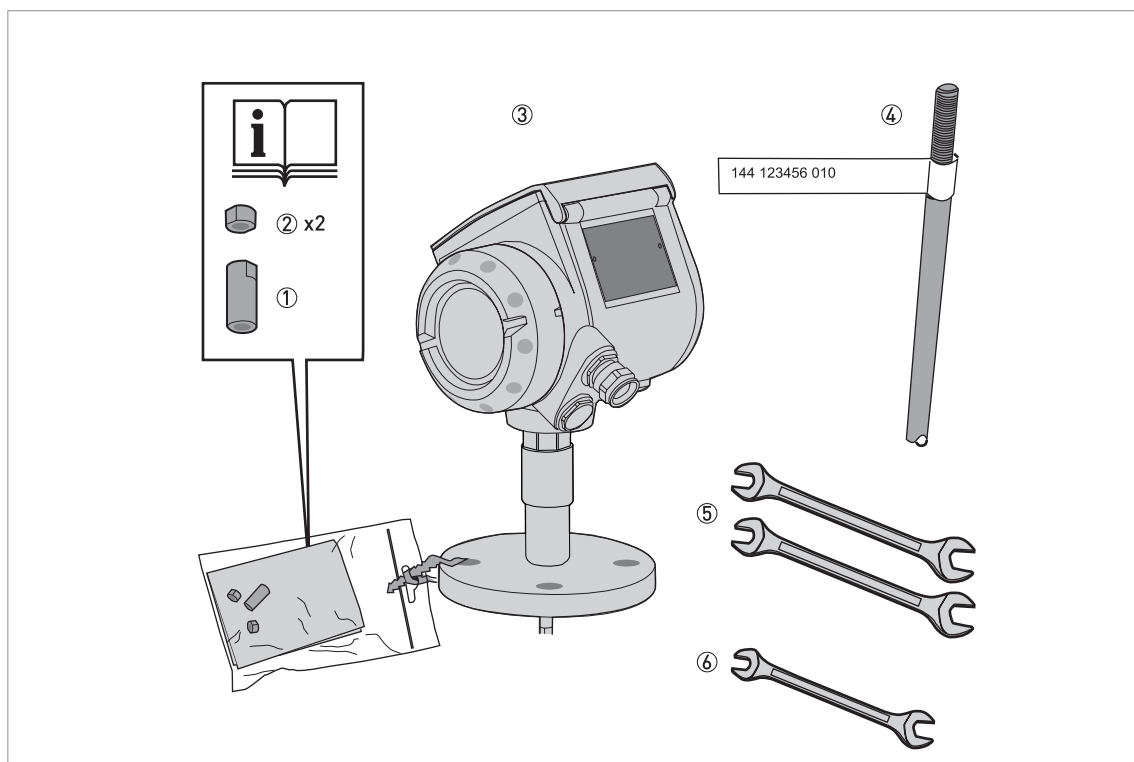
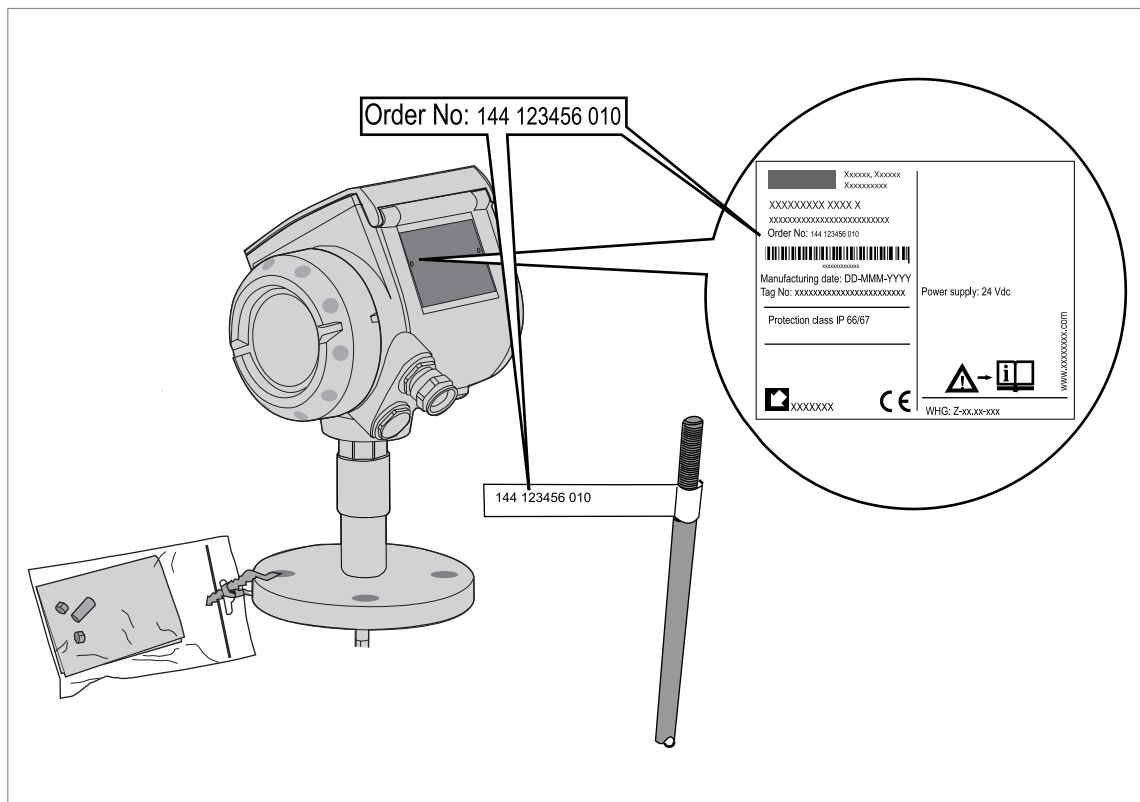


Figure 2-17: Equipment needed to assemble the device

- ① Union nut
- ② 2 locking nuts
- ③ Housing assembly
- ④ Single rod probe
- ⑤ Tools: two 8 mm open-ended wrenches (not supplied)
- ⑥ Tools: one 7 mm open-ended wrench (not supplied)



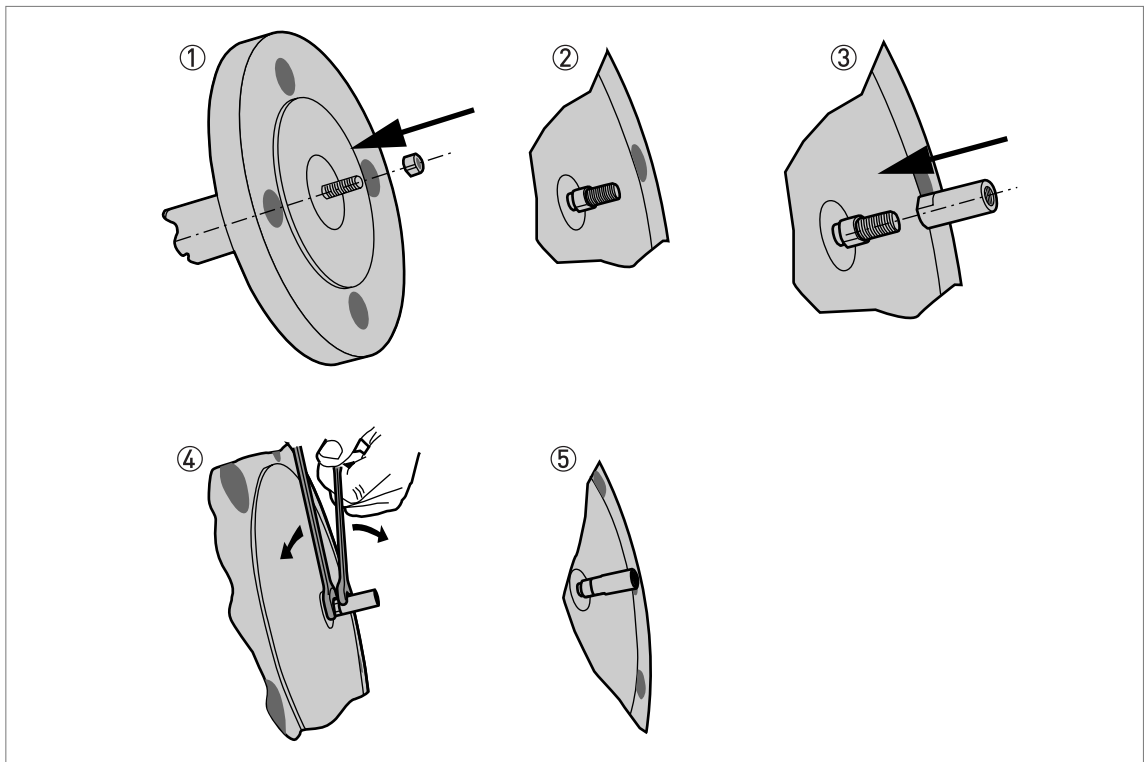


Figure 2-19: How to attach the locking nut and union nut



- Attach a locking nut to the housing assembly.
- Make sure that the nut is fully engaged on the thread.
- Attach the union nut to the housing assembly.
- Tighten these nuts with the two 8 mm open-ended wrenches.
- Continue the assembly procedure on the page that follows.

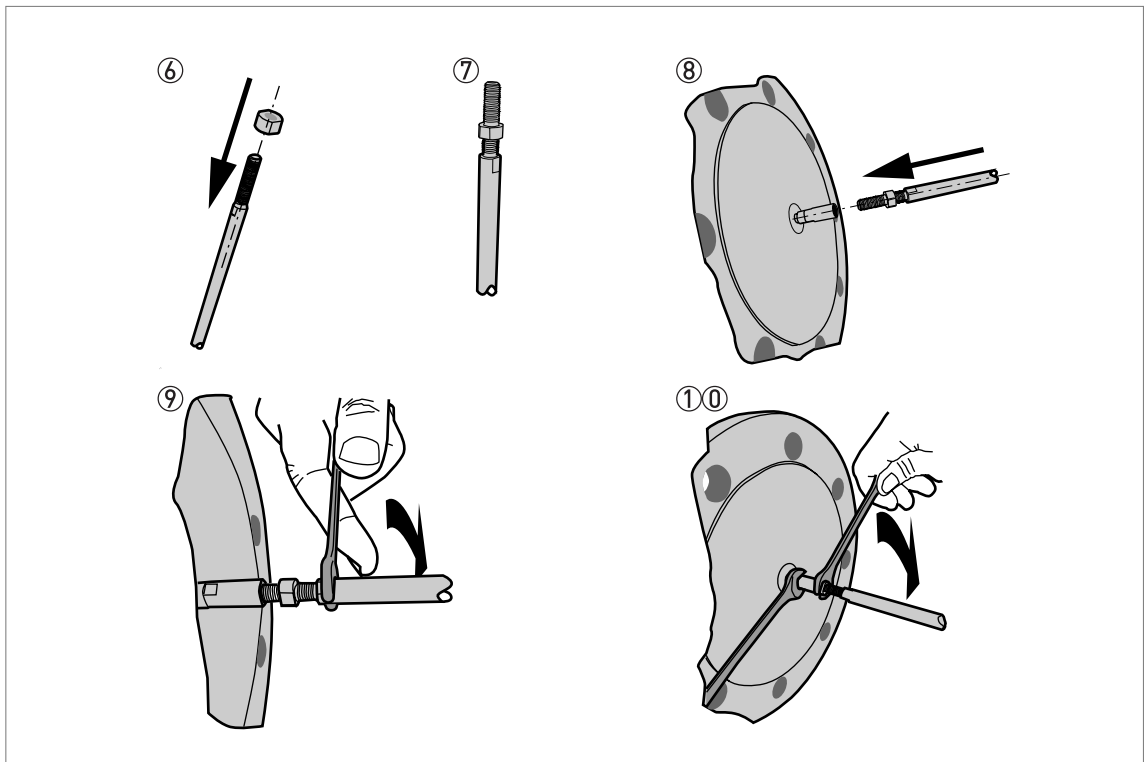


Figure 2-20: How to attach the single rod probe to the flange assembly



CAUTION!

Support the probe.



- Attach a locking nut to the single rod.
- Make sure that the locking nut is engaged $\frac{3}{4}$ along the length of the thread.
- Attach the single rod to the union nut. Make sure the probe touches the housing assembly.
- Tighten the single probe with a 7 mm open-ended wrench (step 9).
- Tighten the locking nut against the union nut with two 8 mm open-ended wrenches (step 10).

2.10.2 How to assemble the single rod probe (segmented probe)

**INFORMATION!**

This procedure is for devices with single rod probes that are segmented.

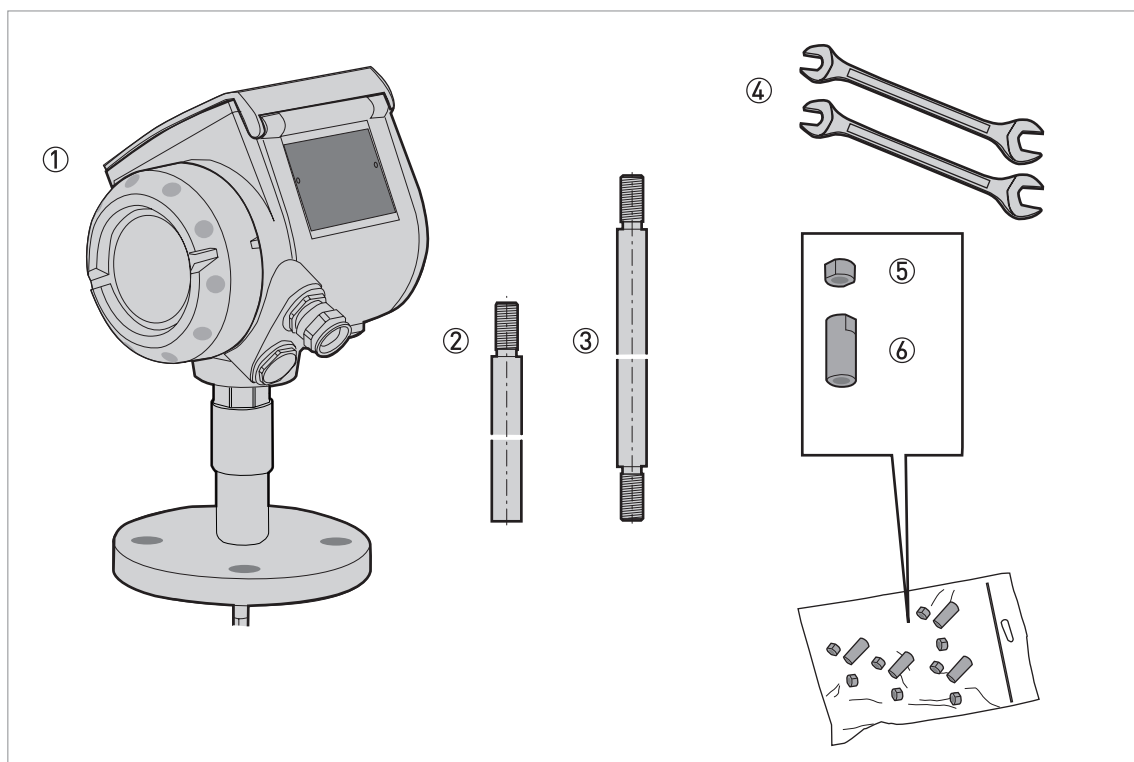


Figure 2-21: Equipment needed to assemble the single rod probe (segmented)

- ① Converter and process connection
- ② Bottom (quantity: 1) segment of the rod probe
- ③ Top and middle (if more than one) segments of the rod probe
- ④ Tools: two 8 mm open-end wrenches (not supplied)
- ⑤ Lock nuts (2 lock nuts per segment)
- ⑥ Union nut (1 union nut per segment)

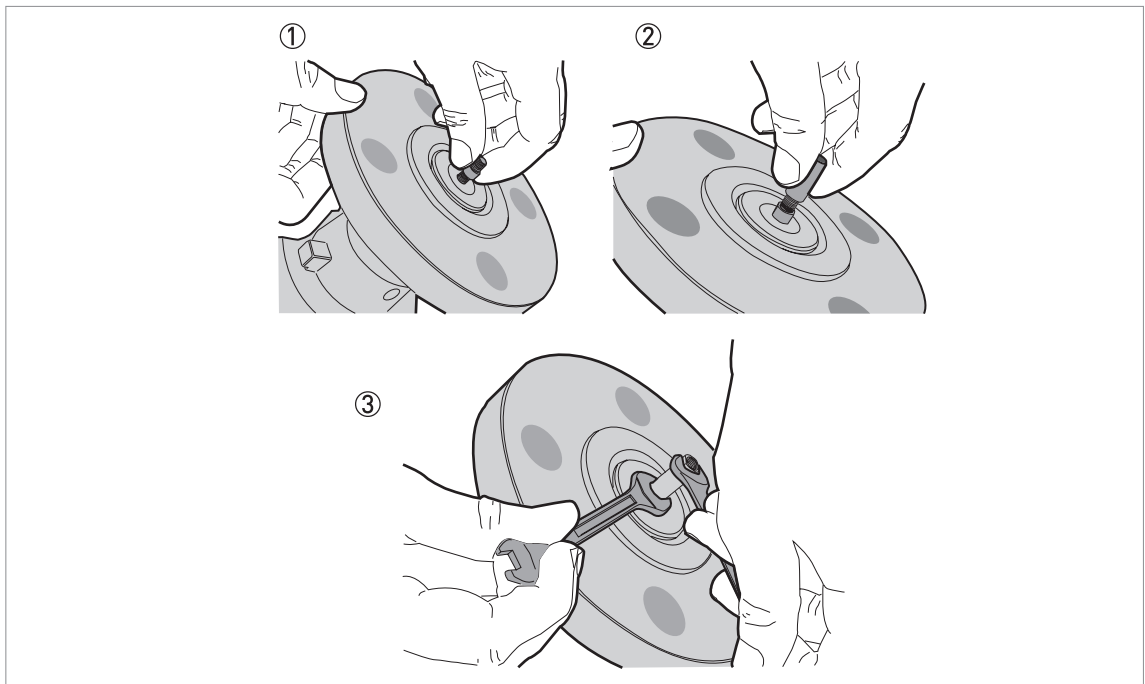


Figure 2-22: How to assemble the segmented single rod probe: part 1



CAUTION!

Make sure that the nuts are tight and the rod probe cannot loosen.



- Attach a lock nut to the threaded rod below the process connection. Turn the nut until it is $\frac{3}{4}$ along the length of the rod.
- Attach a union nut to the threaded rod below the process connection.
- Use two 8 mm open-end wrenches to tighten the union nut against the lock nut.

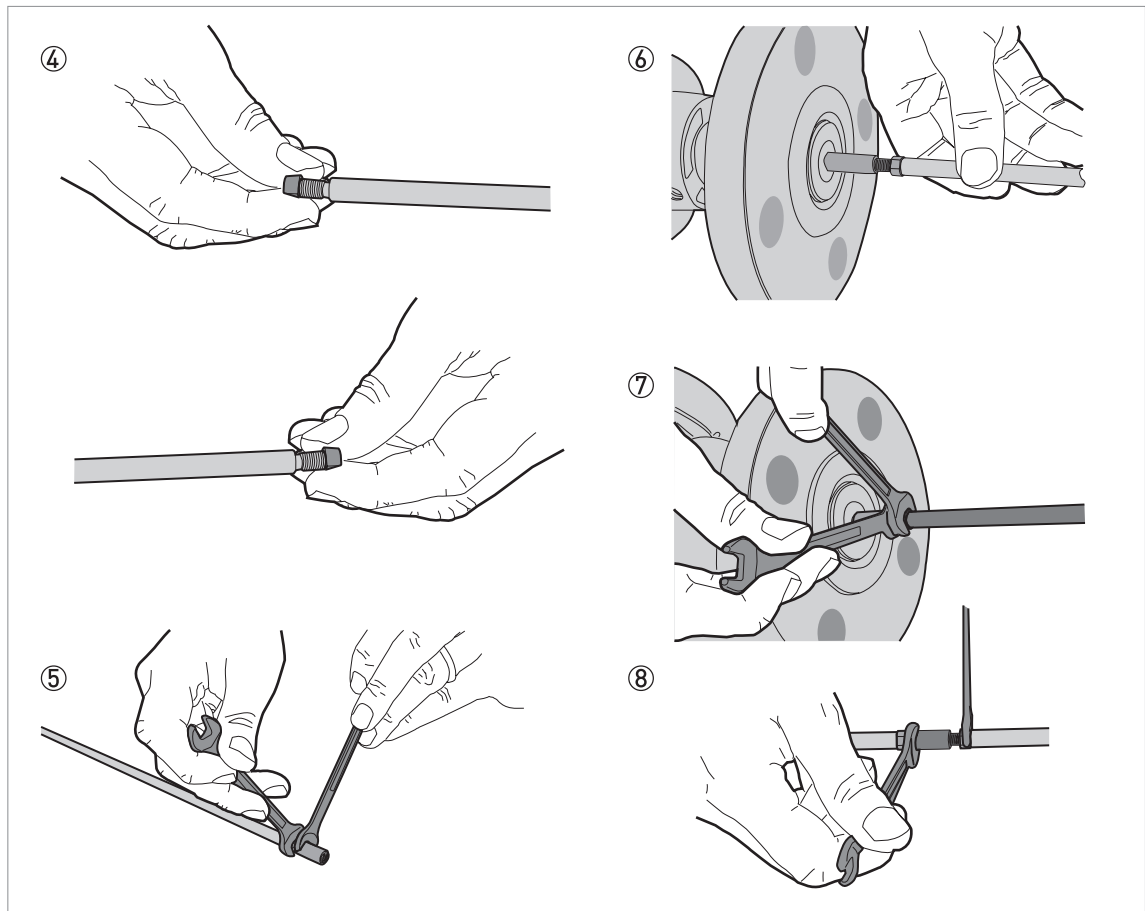


Figure 2-23: How to assemble the segmented single rod probe: part 2



WARNING!

Put a support below the probe to prevent deformation.



CAUTION!

Make sure that the nuts are tight and the rod probe cannot loosen.



- Attach a lock nut to each end of the rod probe segments.
- Attach a union nut to the bottom end of each rod probe segment, but not to the bottom segment. Use two 8 mm open-end wrenches to tighten the union nut against the lock nut.
- Attach the top segment of the rod probe to the union nut below the process connection. Use two 8 mm open-end wrenches to tighten the union nut against the lock nut on the rod probe.
- Attach the middle segment of the rod probe to the union nut on the top segment (if there are middle segments). Use two 8 mm open-end wrenches to tighten the union nut against the lock nut. Repeat this step for the other segments.
- Attach the bottom segment of the rod probe to the union nut on the top segment. Use two 8 mm open-end wrenches to tighten the union nut against the lock nut.

**CAUTION!**

Make sure that the length of the probe is correct. If the probe is too long, refer to "How to decrease the length of probes" in the handbook.

2.10.3 How to assemble the segmented coaxial probe

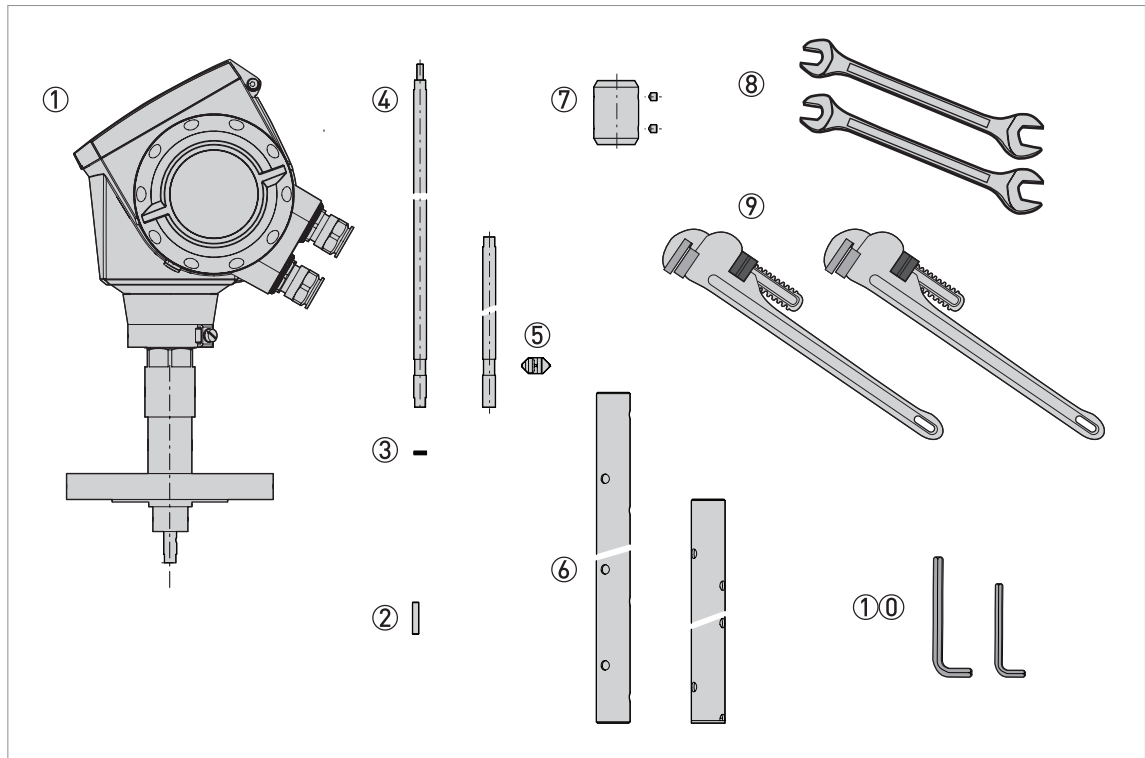


Figure 2-24: Equipment needed to assemble the coaxial probe

- ① Converter and process connection
- ② HC M4×20 screws (1 screw per probe segment)
- ③ Lock washers (1 pair of washers per probe segment)
- ④ Top (quantity: 1), middle (quantity: 1 or more) and bottom (quantity: 1) segments of the signal rod
- ⑤ PTFE spacer (1 spacer per probe segment)
- ⑥ Middle (quantity: 1 or more) and bottom (quantity: 1) segments of the coaxial tube
- ⑦ Union nut with 2 socket set screws M5×5 (1 union nut per segment of the coaxial tube)
- ⑧ Tools: two 7 mm open-end wrenches (not supplied)
- ⑨ Tools: two pipe (Stillson) wrenches (not supplied)
- ⑩ Tools: one 2.5 mm Allen wrench and one 2 mm Allen wrench (not supplied)

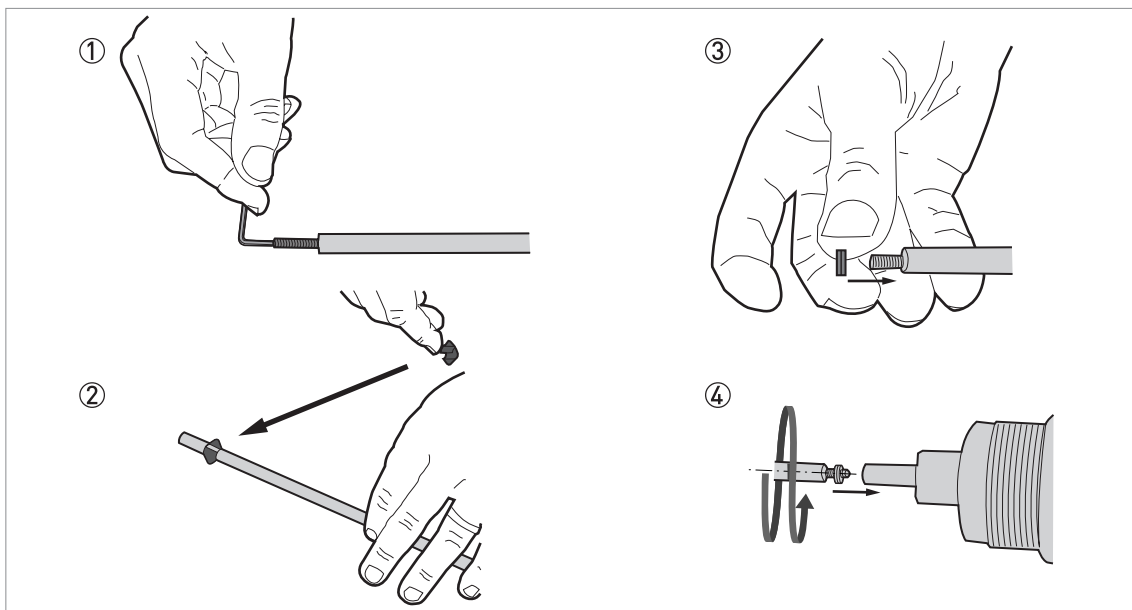


Figure 2-25: How to assemble the segmented coaxial probe: part 1



CAUTION!

Do not attach the screw to the end of the rod segment that has a groove for the attachment of a PTFE spacer.



- Use a 2 mm Allen wrench to attach and tighten a HC M4×20 screw at the top of each rod segment (intermediary and end rod segments)
- Attach a PTFE spacer to the end of each rod segment that has a groove.
- Attach a pair of lock washers at the top of each rod segment (intermediary and end rod segments)
- Assemble one of the middle rod segments (with a pair of lock washers on the attached screw) and the signal rod below. Use two 7 mm open-ended wrenches to tighten the assembled parts to a torque of 2...3 Nm.

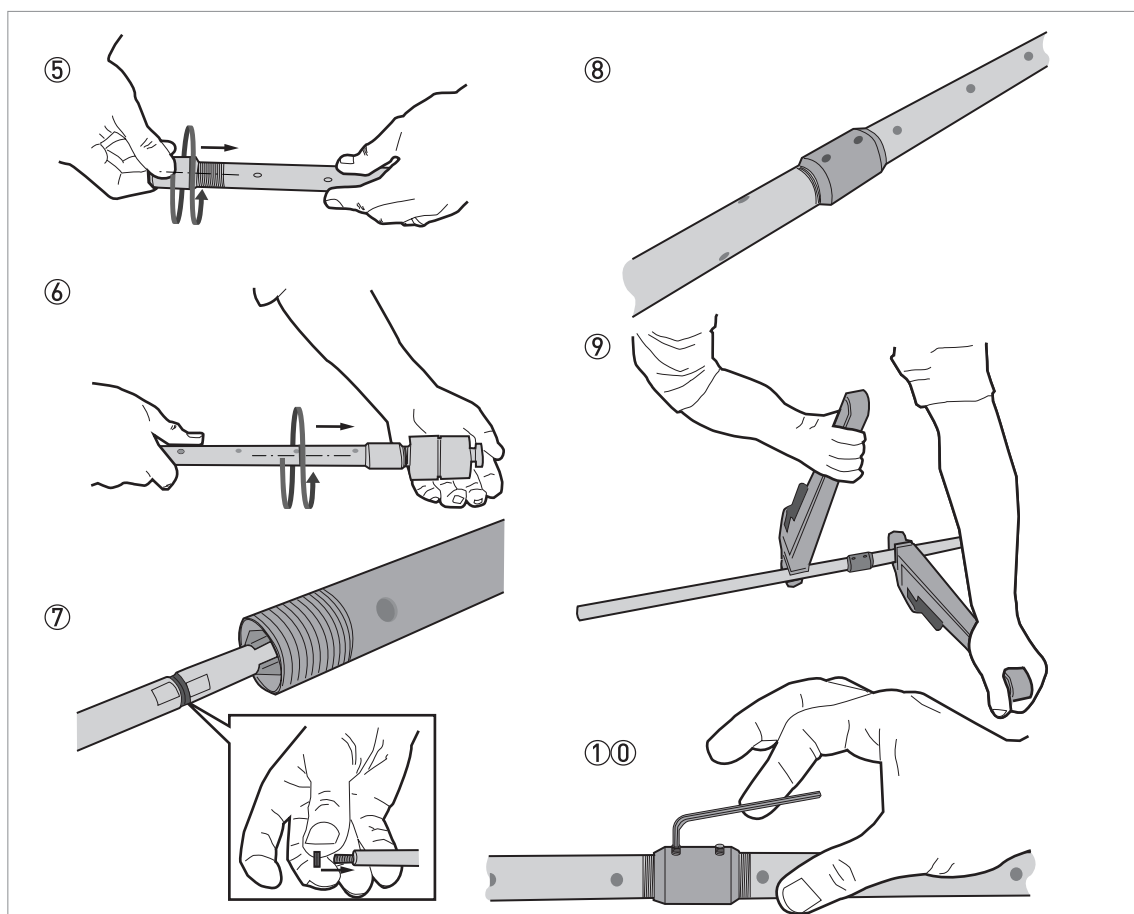


Figure 2-26: How to assemble the segmented coaxial probe: part 2



WARNING!

Be careful when you use the pipe wrenches. Make sure that the measuring tubes have no deformation.



CAUTION!

- *Make sure that the screws are tight and the measuring tube cannot loosen.*
- *Make sure that the fitting for the lock screw is not aligned with a hole in the coaxial tube.*



- Attach a union nut to each coaxial tube (middle and end tubes)
- Attach a middle tube segment to the coaxial probe stem. Do not use tools to tighten the assembled parts.
- Assemble the next middle rod segment (with a pair of lock washers on the attached screw) and the top rod segment. Use two 7 mm open-ended wrenches to tighten the assembled parts to a torque of 2...3 Nm.
- Assemble the next coaxial tube segment and the top coaxial tube segment. Do not use tools to tighten the assembled parts. Do steps (9) thru (10) again until the end rod segment and end coaxial tube are attached.
- Use the 2 pipe wrenches to tighten the coaxial tubes in the lock nuts.
- Use a 2.5 mm Allen wrench to attach and tighten the two HC M5×5 screws (lock screws) to the union nut.

2.10.4 How to install a device with a flange connection

Equipment needed:

- Device
- Gasket (not supplied)
- Wrench (not supplied)

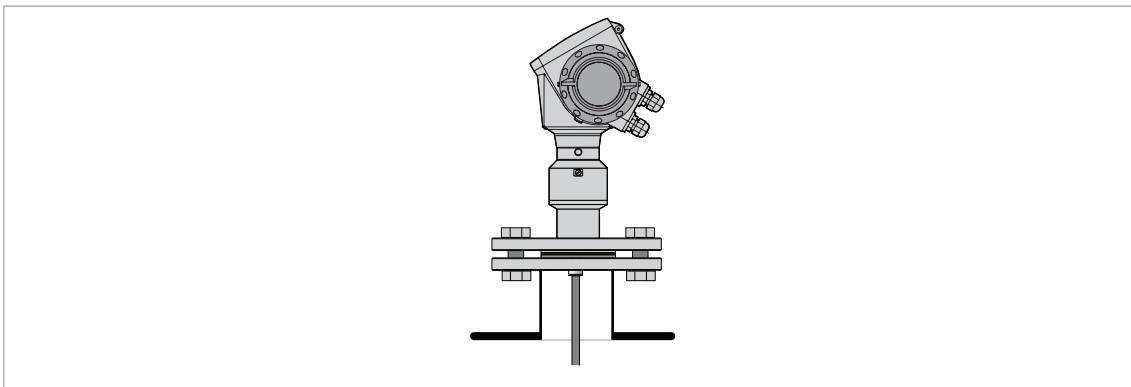


Figure 2-27: Flange connection



- Make sure that the flange on the nozzle is level.
- Make sure that you use the applicable gasket for the flange and the process.
- Align the gasket correctly on the flange facing of the nozzle.
- Lower the probe carefully into the tank.
- ➡ For more data on cable probes, refer to *How to install a cable probe in the tank* on page 30.
- Tighten the flange bolts.
- ➡ Refer to local rules and regulations for the correct torque to apply to the bolts.

2.10.5 How to install a device with a threaded connection

Equipment needed:

- Device
- Gasket (not supplied)
- 50 mm / 2" wrench (not supplied)

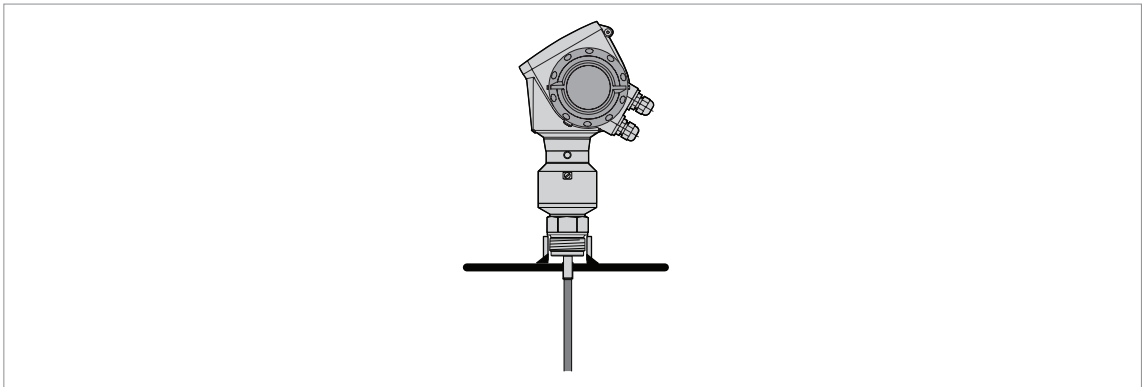


Figure 2-28: Threaded connection



- Make sure the tank connection is level.
- Make sure that you use the applicable gasket for the connection and the process.
- Align the gasket correctly.
- If the device is installed on a tank made of plastic or other non-conductive material, refer to *Recommendations for pits and tanks made of non-conductive materials* on page 31.
- Lower the probe carefully into the tank.
- ➡ For more data on cable probes, refer to *How to install a cable probe in the tank* on page 30.
- Use 50 mm / 2" wrench to attach the process connection to the tank.
- Tighten the nut.
- ➡ Refer to local rules and regulations for the correct torque to apply to the connection.

**INFORMATION!**

If there is not sufficient clearance to install the device, remove the housing. Install the probe and then put the housing back on the process connection. For more data, refer to How to turn or remove the signal converter on page 35.

2.10.6 How to install a cable probe in the tank

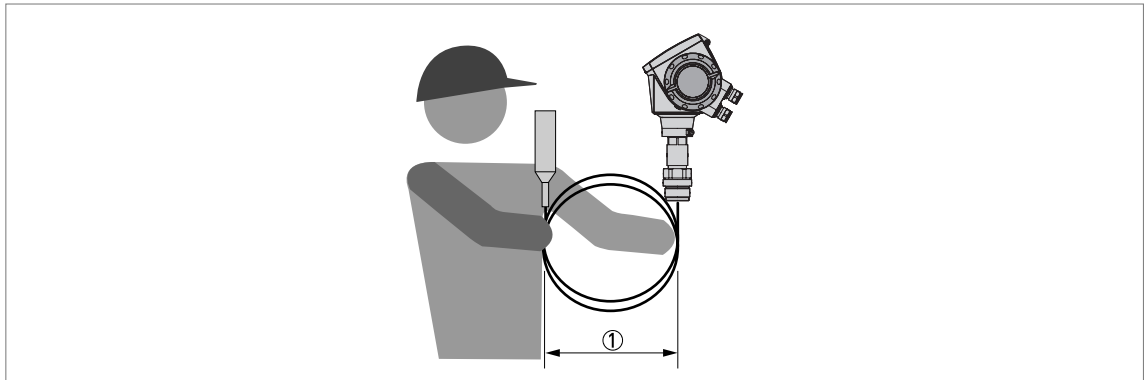


Figure 2-29: Wind cable probes carefully

① Do not wind cable probes less than 400 mm / 16" in diameter.

**WARNING!**

If you bend the probe too much, you will damage the device and it will not measure accurately.

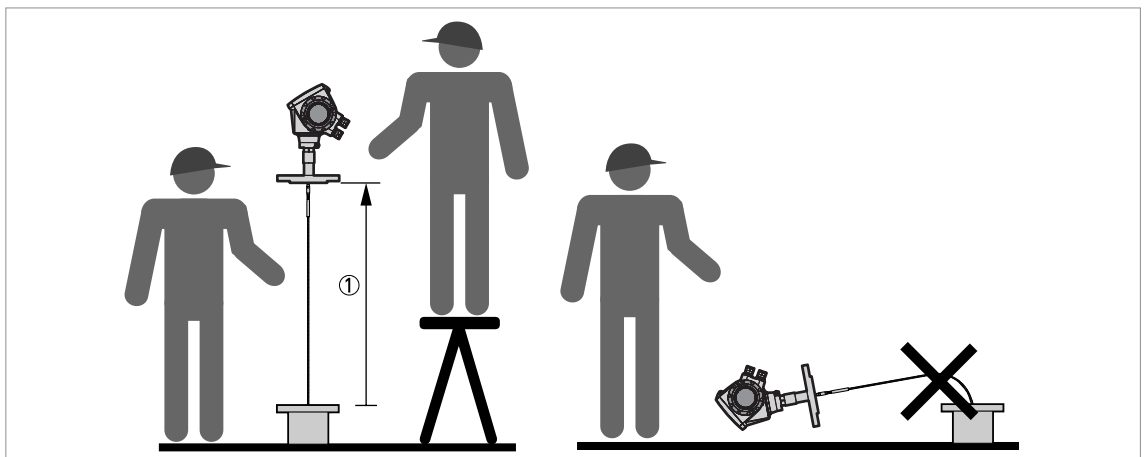


Figure 2-30: Installation of devices with cable probes

① >1 m / 3½ ft



- Use two persons to lift the housing and the probe above the process connection.
- Hold the device 1 m / 3½ ft above the tank.
- Unwind the probe carefully into the tank.

2.10.7 Recommendations for pits and tanks made of non-conductive materials



If you have a device with a single rod or a single cable probe and a thread connection, obey these instructions:

- Put a metal sheet between the device and the process connection.
- It must have a diameter greater than 200 mm / 8".
- Make sure that the metal sheet is in contact with the thread stop on the device.

We recommend that you use $DN \geq 200$ / $\geq 8''$ for flange connections.

If you have a device with a double rod, double cable or coaxial probe, you can ignore these instructions.

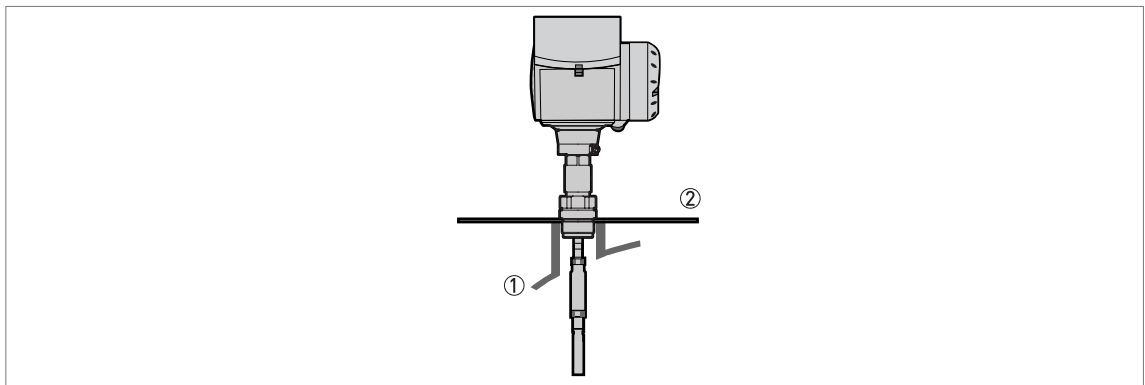


Figure 2-31: Installation in a non-metallic tank or pit with a thread connection

- ① Non-metallic (plastic...) tank or pit
- ② Metal sheet, $\varnothing \geq 200$ mm / 8"



CAUTION!

When the device is installed, make sure that the tank roof has no deformation.

2.10.8 How to assemble the remote version

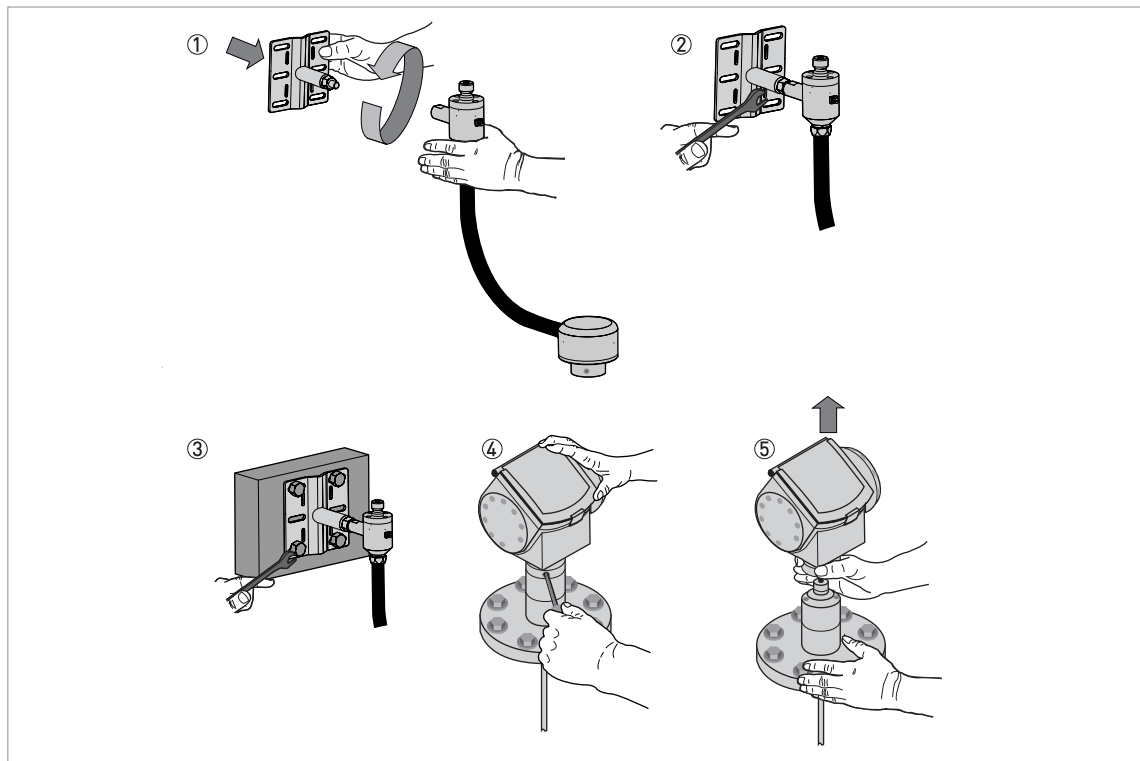


Figure 2-32: Part 1 of assembly procedure



- Attach the wall bracket ① to the flexible conduit.
- Tighten the locking nut ② with a 24 mm wrench.
- Attach the wall bracket to a wall or pipe (DN50...100 / 2"...4") ③.
- Loosen the housing locking screw ④ with a 5 mm Allen wrench.
- Remove the housing ⑤.

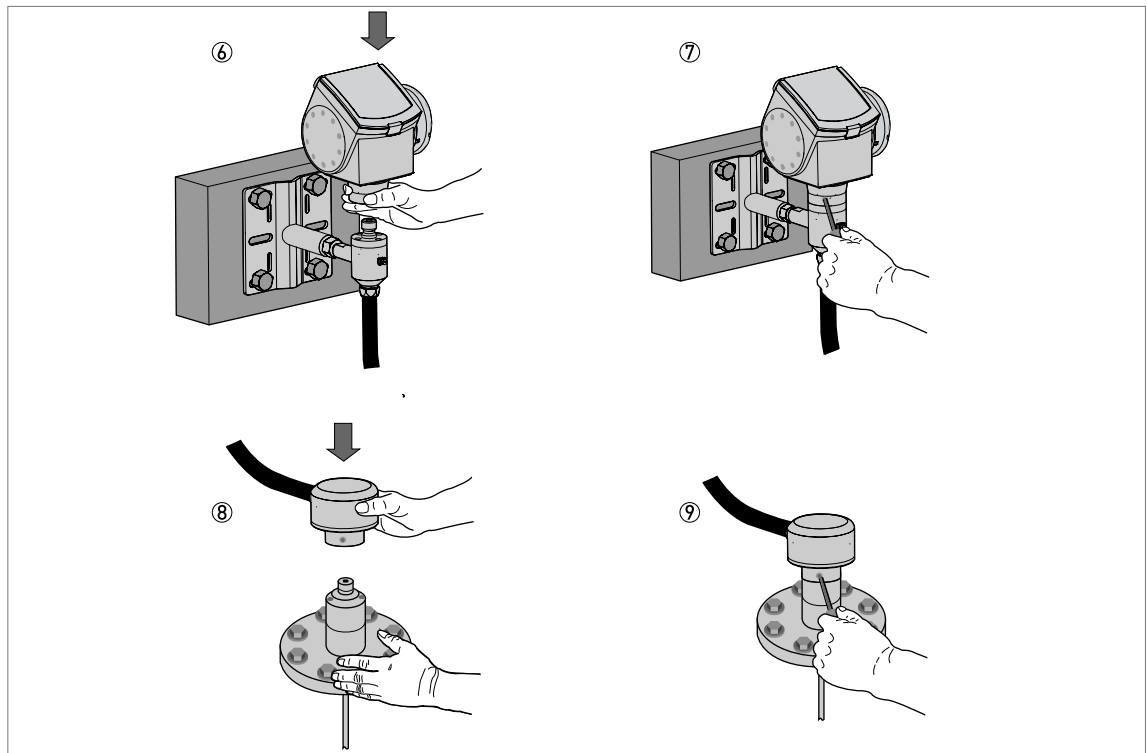


Figure 2-33: Part 2 of the assembly procedure



- Attach the housing to the flexible conduit ⑥.
- Tighten the housing locking screw ⑦.
- Attach the flexible conduit to the probe ⑧.
- Tighten the flexible conduit locking screw ⑨.

You can attach the wall bracket of the remote housing to a wall or pipe (DN50...100 / 2" ...4"). These are the dimensions:

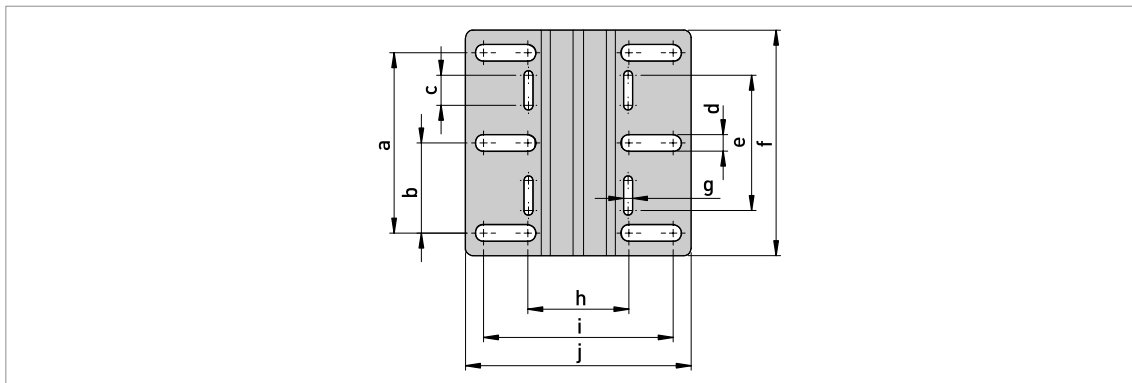


Figure 2-34: Dimensions of the wall bracket

Dimensions in mm

	Dimensions [mm]									
	a	b	c	d	e	f	g	h	i	j
Wall bracket	120	60	20	11	90	150	6	67.4	126.4	150.4

Dimensions in inches

	Dimensions [inches]									
	a	b	c	d	e	f	g	h	i	j
Wall bracket	4.7	2.4	0.8	0.4	3.5	5.9	0.2	2.65	4.98	5.92

2.10.9 How to turn or remove the signal converter

The converter turns 360°. The converter can be removed from the process connection assembly under process conditions.

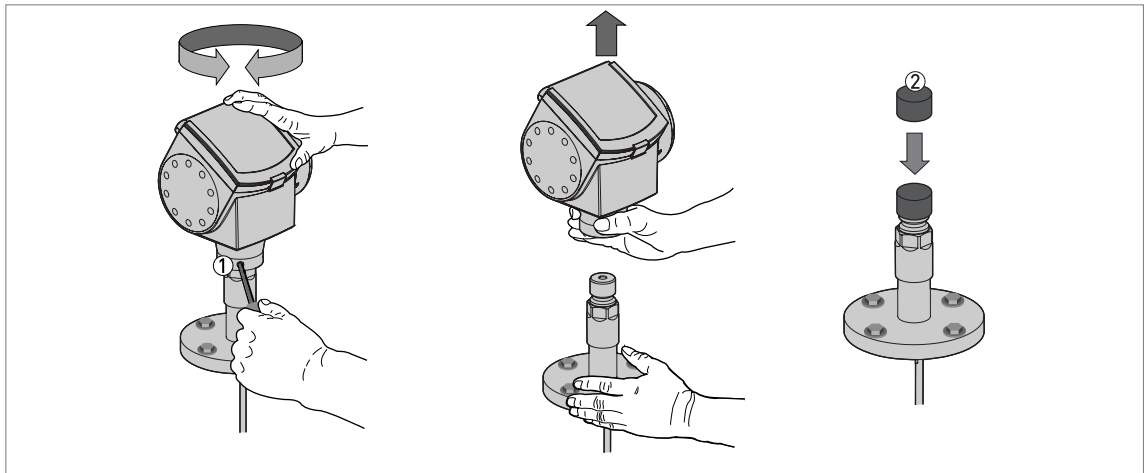


Figure 2-35: How to turn or remove the signal converter

- ① Tool: 5 mm Allen wrench (not supplied) for the lock screw on the signal converter
- ② Cover for the coaxial hole on top of the process connection assembly (not supplied)



CAUTION!

If you remove the housing, put a cover on the the coaxial hole on top of the process connection assembly.

When the housing is attached to the process connection assembly, tighten the lock screw with the 5 mm Allen wrench ①.

2.10.10 How to attach the weather protection to the device

Equipment needed:

- Device
- Weather protection (option)
- 10 mm wrench (not supplied)

Refer to "Technical data: Dimensions and weight", for the overall dimensions of the weather protection.

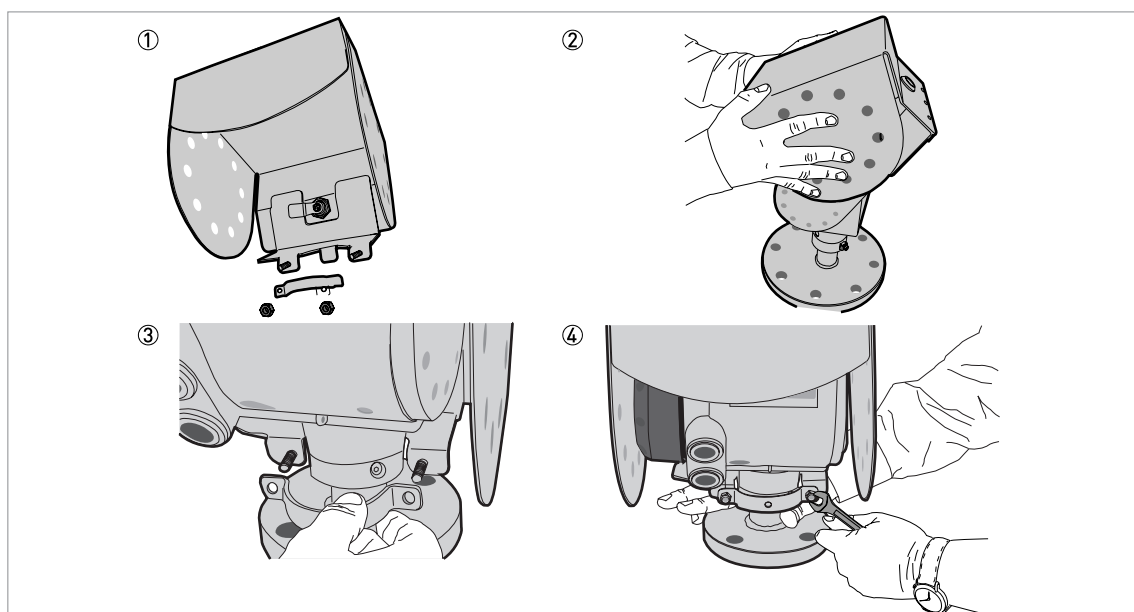


Figure 2-36: Installation of the weather protection



- Loosen the bracket nuts on the weather protection. Remove the bracket.
- Lower the weather protection onto the device. Turn the weather protection so that the keyhole points forward.
- Attach the bracket.
- Lift the weather protection to the top of the housing support pillar. Hold the weather protection in the correct position and tighten the bracket nuts.

2.10.11 How to open the weather protection

Equipment needed:

- Weather protection attached to the device.
- Large slotted tip screwdriver (not supplied).

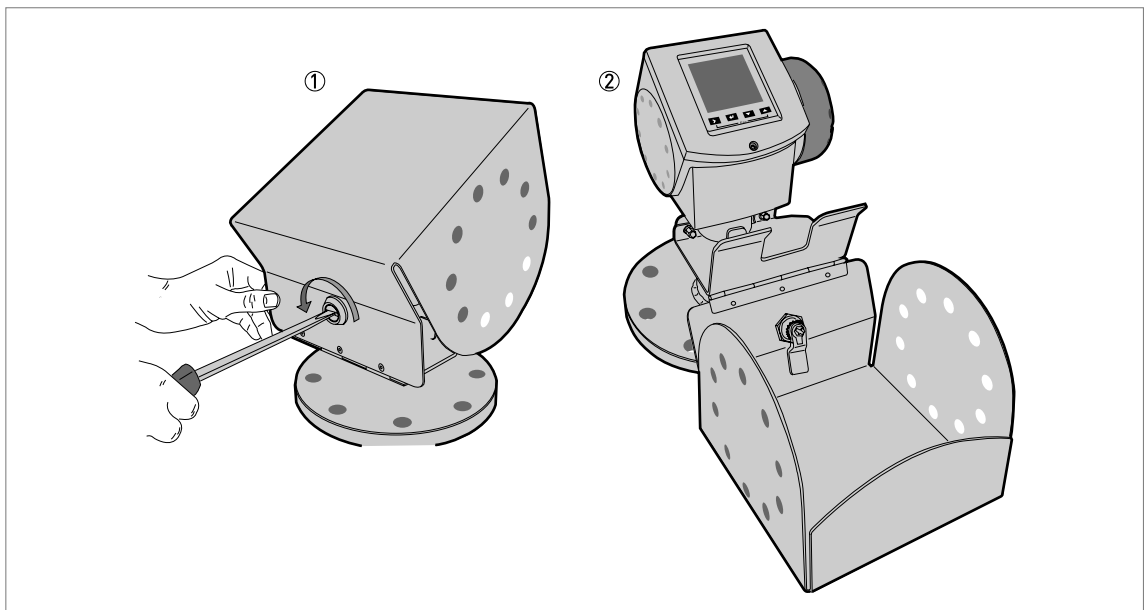


Figure 2-37: How to open the weather protection

- ① Weather protection in its closed position
- ② Weather protection in its open position. Minimum clearance in front of the device: 300 mm / 12".



- Put a large slotted tip screwdriver into the keyhole at the front of the weather protection. Turn the screwdriver counterclockwise.
- Pull the top of weather protection up and forward.
- ➡ This will open the weather protection.

2.11 Electromagnetic compatibility

The device design agrees with European Standard EN 61326-1 when installed in metallic tanks.

You can install the device on open-air tanks and tanks that are not made of metal. Refer also to the note that follows.

**CAUTION!**

If you install a device with a rod or cable probe in a non-metallic tank or open-air pit, a strong electromagnetic field near to the device can have an unwanted effect on the accuracy. Use a device with a coaxial probe for this type of installation.

**INFORMATION!**

Device operation agrees with residential-class (class B) emissions and industrial-class for immunity requirements if:

- *the device has a single or double probe (rod or cable probe) and is used in a closed tank made of metal or*
- *the device has a coaxial probe.*

3.1 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.



INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Electrical installation: outputs 1 and 2

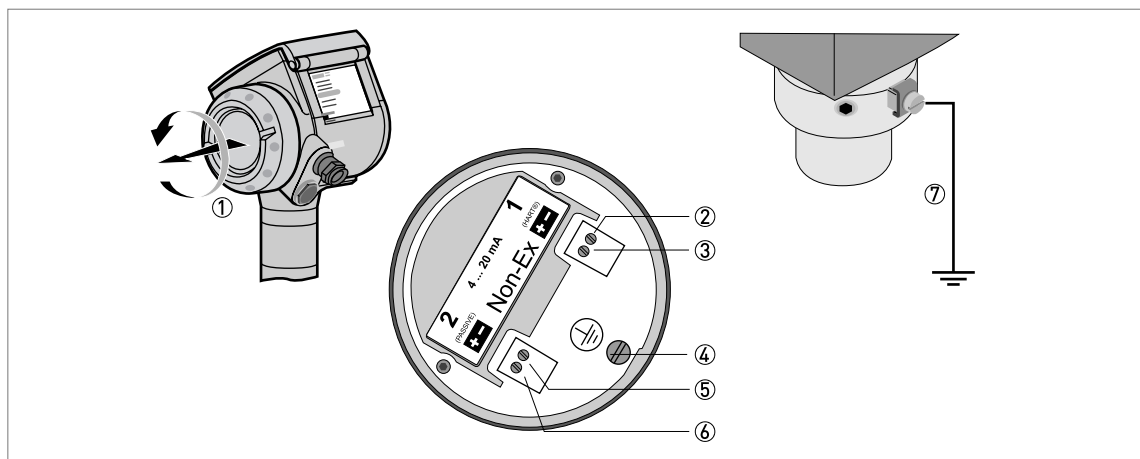


Figure 3-1: Electrical installation

- ① Terminal compartment cover
- ② Output 1: current output -
- ③ Output 1: current output +
- ④ Grounding terminal in the housing
- ⑤ Output 2: current output - (option)
- ⑥ Output 2: current output + (option)
- ⑦ Grounding terminal between the process connection and the converter

Output 1 energizes the device and is used for HART[®] communication. If the device has the second current output option, use a separate power supply to energize output 2.

**Procedure:**

- Remove the housing terminal compartment cover ①.
- Connect the wires to the device. Obey the national electrical codes.
- Make sure that the polarity of the wires is correct.
- Attach the ground to ④ or ⑦. Both terminals are technically equivalent.

**INFORMATION!**

If the polarity is not correct, this will not cause damage to the device. But the device will not operate and the output will be 0 mA.

3.3 Electrical connection for current output

3.3.1 Non-Ex devices

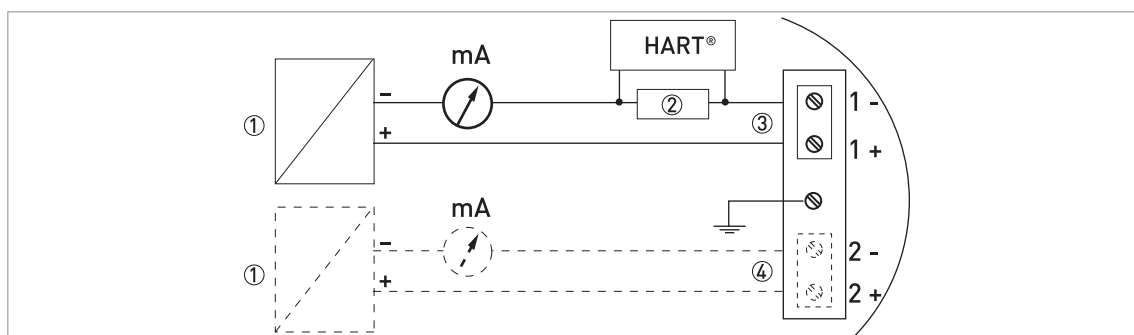


Figure 3-2: Electrical connections for non-Ex devices

- ① Power supply
- ② Resistor for HART® communication
- ③ Output 1: 14...30 VDC for an output of 22 mA at the terminal
- ④ Output 2: 10...30 VDC for an output of 22 mA at the terminal

3.3.2 Devices for hazardous locations

**DANGER!**

For electrical data for device operation in hazardous locations, refer to the related certificates of compliance and supplementary instructions (ATEX, IECEx, FM, CSA, ...). This documentation can be downloaded from our website.

3.4 Protection category

**INFORMATION!**

The device fulfils all requirements per protection category IP 66/67. It also fulfils all requirements per NEMA type 4X (housing) and type 6P (probe).

**DANGER!**

Make sure that the cable gland is watertight.

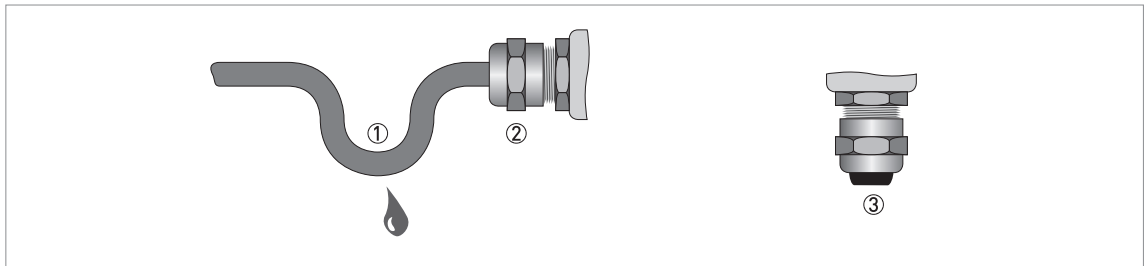


Figure 3-3: How to make the installation agree with protection category IP 67



- Make sure that the gaskets are not damaged.
- Make sure that the electrical cables are not damaged.
- Make sure that the electrical cables agree with the national electrical code.
- The cables are in a loop in front of the device ① so water does not go into the housing.
- Tighten the cable feedthroughs ②.
- Close unused cable feedthroughs with dummy plugs ③.

4.1 Technical data



INFORMATION!

- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website.

Measuring system

Measuring principle	2-wire loop-powered level transmitter; Time Domain Reflectometry (TDR)
Application range	Level measurement of liquids, pastes, slurries, powders and granulates
Primary measured value	Time between the emitted and received signal
Secondary measured value	Distance, level, volume, mass and/or interface

Design

Construction	The measurement system consists of a measuring sensor (probe) and a signal converter which is available in a compact or remote version
Options	Integrated LCD display (-20...+60°C / -5...+140°F); if the ambient temperature is not in these limits, the display switches off
	2nd current output
	ESD protection (max. 30 kV)
	Metaglas® (dual process sealing system for dangerous products (ammonia, chlorine, ...)) ①
	Remote housing connected to the probe via a flexible conduit Standard lengths: 2 m / 6.6 ft, 4.5 m / 14.8 ft, 9.5 m / 31.2 ft and 14.5 m / 47.6 ft
	Probe end types (not for rod and coaxial probes) Standard: Counterweights (refer to counterweight dimensions in "Technical data: Dimensions and weights in the handbook") Options: Turnbuckle, chuck, threaded end, crimped end, open end
Accessories	Weather protection
Max. measuring range	Double rod Ø8 mm / 0.32": 4 m / 13 ft
	Single rod Ø8 mm / 0.32": 4 m / 13 ft
	Single rod Ø8 mm / 0.32" (segmented): 6 m / 20 ft
	Coaxial Ø22 mm / 0.87": 6 m / 20 ft
	Coaxial Ø22 mm / 0.87" (segmented): 6 m / 20 ft
	Double cable Ø4 mm / 0.16": 8 m / 26 ft
	Single cable Ø2 mm / 0.08": 35 m / 115 ft (for liquids only)
	Single cable Ø4 mm / 0.16": 35 m / 115 ft (For liquids only. An angled probe is available on request for installations with very low ceilings or objects in the tank that prevent installation on top of the tank.)
	Single cable Ø8 mm / 0.32": 35 m / 115 ft (for solids only)
Tolerance, probe length	±0.5%
Dead zone	This depends on the type of probe. For more data, refer to "Measurement limits" in the handbook.
Display and User interface	
Display	LCD display
	9 lines, 160×160 pixels in 8-step grayscale with 4-button keypad
Interface languages	English, German, French, Italian, Spanish, Portuguese, Japanese, Simplified Chinese and Russian

Accuracy

Resolution	1 mm / 0.04"
Repeatability	±1 mm / ±0.04"
Accuracy (in direct mode)	Liquids: ±3 mm / ±0.12", when distance < 10 m / 33 ft; ±0.03% of measured distance, when distance > 10 m / 33 ft Powders: ±20 mm / ±0.8" Interface: ±10 mm / ±0.4" (ϵ_r constant)
Accuracy (in TBF mode)	±20 mm / ±0.8" (ϵ_r constant)
Minimum layer (interface)	50 mm / 2"
Reference conditions acc. to EN 60770	
Temperature	+20°C ±5°C / +68°F ±10°F
Pressure	1013 mbara ±20 mbar / 14.69 psia ±0.29 psi
Relative air humidity	60% ±15%

Operating conditions

Temperature	
Ambient temperature	-40...+80°C / -40...+176°F Ex: see supplementary operating instructions or approval certificates
Storage temperature	-40...+85°C / -40...+185°F
Process connection temperature	Standard -50...+200°C / -58...+392°F (according to the temperature limits of the gasket material. Refer to "Material" in this table.) Ex: see supplementary operating instructions or approval certificates ② High-Temperature (HT) and High-Temperature / High-Pressure (HT/HP) versions with FKM/FPM and Kalrez® 6375 gaskets +300°C / +572°F (single cable Ø2 mm / 0.08" probe only) Ex: see supplementary operating instructions or approval certificates ② HT and HT/HP versions with EPDM gaskets +250°C / +482°F (single cable Ø2 mm / 0.08" probe only) Ex: see supplementary operating instructions or approval certificates ②
Pressure	
Operating pressure	Single cable Ø8 mm / 0.32" probe -1...40 barg / -14.5...580 psig subject to process connection temperature and probe type used ② High-Pressure (HP) version max. 300 barg / 4350 psig (single cable Ø2 mm / 0.08" probe only) subject to process connection temperature and probe type used ② All other probe types -1...100 barg / -14.5...1450 psig subject to process connection temperature and probe type used ②
Other conditions	
Dielectric constant (ϵ_r)	Level in direct mode: ≥1.4 for coaxial probe; ≥1.6 for single and double probes Interface in direct mode: $\epsilon_r(\text{interface}) \gg \epsilon_r(\text{level})^2$ Level in TBF mode: ≥1.1
Vibration resistance	IEC 60068-2-6 and EN 50178 (10...57 Hz: 0.075 mm / 57...150 Hz: 1g)
Protection category	IP 66/67 equivalent to NEMA 4X (housing) and 6P (probe)

Installation conditions

Process connection size	Refer to "Installation: How to prepare the tank before you install the device" and "Technical data: Measurement limits"
Process connection position	Make sure that there are not any obstructions directly below the process connection for the device.
Dimensions and weights	Refer to "Technical data: Dimensions and weights" in the Handbook

Material

Housing	Standard: Polyester-coated aluminium
	Option: Stainless steel (1.4404 / 316L) ③
Single rod (single-piece)	Standard: Stainless steel (1.4404 / 316L)
	Option: Stainless steel (1.4404 / 316L) in a PVDF protective sheath, Hastelloy® C-22 (2.4602) ④
	On request: Stainless steel (1.4404 / 316L) in a PVC or PP protective sheath
	On request: Monel; Tantalum; Titanium; Duplex
Single rod (segmented)	Standard: Stainless steel (1.4404 / 316L)
Double rod	Standard: Stainless steel (1.4404 / 316L)
	Option: Hastelloy® C-22 (2.4602)
	On request: Monel; Tantalum; Titanium; Duplex
Coaxial (single-piece)	Standard: Stainless steel (1.4404 / 316L)
	Option: Hastelloy® C-22 (2.4602)
Coaxial (segmented)	Standard: Stainless steel (1.4404 / 316L)
Single cable	Standard: Stainless steel (1.4401 / 316)
	Option: Hastelloy® C-22 (2.4602) – only for the Ø2 mm / 0.08" single cable probe
	On request: FEP-coated stainless steel (-20...+150°C / -4...+302°F) – only for the Ø4 mm / 0.16" single cable probe
Double cable	Stainless steel (1.4401 / 316)
Process fitting	Standard: Stainless steel (1.4404 / 316L)
	Option: Hastelloy® C-22 (2.4602)
	On request: Monel; Tantalum; Titanium; Duplex
Gaskets	FKM/FPM (-40...+200°C / -40...+392°F); Kalrez® 6375 (-20...+200°C / -5...+392°F); EPDM (-50...+150°C / -60...+302°F) – all probes except single cable Ø8 mm / 0.32" ⑤
Weather protection (Option)	Stainless steel (1.4301 / 304)
Protective sheath (On request for single rod only)	PP (-40...+90°C / -40...+194°F); PVC (-15...+80°C / +5...+176°F); PVDF (-40...+150°C / -40...+302°F)
Conduit for remote housing (Option)	Zinc-coated steel in a PVC sheath (-40...+105°C / -40...+221°F)

Process connections

Thread	
Single cable Ø2 mm / 0.08"	G ½ (ISO 228); ½ NPT (ASME B1.20.1); ½ NPTF (ASME B1.20.3 – for the HT/HP version)
Single cable Ø8 mm / 0.32" Double cable Ø4 mm / 0.16" Double rod Ø8 mm / 0.32"	G 1½ (ISO 228); 1½ NPT (ASME B1.20.1)
All other probes	G ¾...1½ (ISO 228); ¾...1½ NPT (ASME B1.20.1)

Flange versions for double rod and double cable probes	
EN 1092-1	DN50...80 in PN40 (Form B1), DN100...200 in PN16 or PN40 (Form B1), DN50...150 in PN63 or PN100 (Form B1); others on request Optional flange facing: Forms C, D, E and F
ASME B16.5	2"...8" in 150 lb, 2"...6" in 300 lb RF, 2"...4" in 600 lb RF, 3"...4" 900 lb RF, 2" in 900 lb or 1500 lb RJ; others on request Optional flange facing: RJ (Ring Joint)
JIS B2220	50...100A in 10K; others on request
Flange versions for single cable Ø8 mm / 0.32" cable probes	
EN 1092-1	DN40...80 in PN40 (Form B1), DN100...200 in PN16 or PN40 (Form B1), DN40...150 in PN63 or PN100 (Form B1); others on request Optional flange facing: Forms C, D, E and F
ASME B16.5	1½"...8" in 150 lb, 1½"...6" in 300 lb RF, 1½"...4" in 600 lb RF, 3"...4" 900 lb RF, 1½"...2" in 900 lb or 1500 lb RJ; others on request Optional flange facing: RJ (Ring Joint)
JIS B2220	40...100A in 10K; others on request
Flange versions for single cable Ø2 mm / 0.08" probe	
EN 1092-1	DN25...80 in PN40 (Form B1), DN100...200 in PN16 or PN40 (Form B1), DN40...150 in PN63 or PN100 (Form B1); others on request Optional flange facing: Forms C, D, E and F
ASME B16.5	1"...8" in 150 lb RF, 1½"...6" in 300 lb RF, 1"...4" in 600 lb RF, 3"...4" in 900 lb RF, 1"...2" in 900 lb or 1500 lb RJ; others on request Optional flange facing: RJ (Ring Joint)
JIS B2220	40...100A in 10K; others on request
Flange versions for other probes	
EN 1092-1	DN25...80 in PN40 (Form B1), DN100...200 in PN16 or PN40 (Form B1), DN25...150 in PN63 or PN100 (Form B1); others on request Optional flange facing: Forms C, D, E and F
ASME B16.5	1"...8" in 150 lb RF, 1½"...6" in 300 lb RF, 1"...4" in 600 lb RF, 3"...4" in 900 lb RF, 1"...2" in 900 lb or 1500 lb RJ; others on request Optional flange facing: RJ (Ring Joint)
JIS B2220	40...100A in 10K; others on request
Other options for single and double rod probes	
SMS	Available on request
Tri-clamp	Available on request
Others	Others on request

Electrical connections

Power supply	Terminals output 1 – Non-Ex / Ex i: 14...30 VDC; min./max. value for an output of 22 mA at the terminal
	Terminals output 1 – Ex d: 20...36 VDC; min./max. value for an output of 22 mA at the terminal
	Terminals output 2 – Non-Ex / Ex i / Ex d: 10...30 VDC; min./max. value for an output of 22 mA at the terminal (additional power supply needed – output only)
Cable entry	M20×1.5; ½ NPT
	G ½ (not for FM- and CSA-approved devices. Not for stainless steel housings.)
	M25×1.5 (for stainless steel housings only)
Cable gland	Standard: none
	Options: M20×1.5 (for non-Ex and Ex-approved devices with M20×1.5 and M25×1.5 cable entries); others are available on request
Cable entry capacity (terminal)	0.5...1.5 mm²

Input and output

Current output	
Output signal (Output 1)	4...20 mA HART® or 3.8...20.5 mA acc. to NAMUR NE 43 ⑥
Output signal (Output 2 – optional)	4...20 mA (no HART® signal) or 3.8...20.5 mA acc. to NAMUR NE 43 (optional)
Resolution	±3 µA
Temperature drift	Typically 50 ppm/K
Error signal	High: 22 mA; Low: 3.6 mA acc. to NAMUR NE 43

Approvals and certification

CE	This device fulfils the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE mark.
Explosion protection	
ATEX KEMA 05ATEX1118 X	II 1 G, 1/2 G, 2 G Ex ia IIC or Ex ia IIB or Ex ia IIA T6...T2;
	II 1 D, 1/2 D, 2 D Ex iaD 20 or Ex iaD 20/21 or Ex iaD 21 IP6X T70°C...T95°C;
	II 1/2 G, 2 G Ex d[ia] IIC or Ex d[ia] IIB or Ex d[ia] IIA T6...T2;
	II 1/2 D, 2 D Ex tD[iaD] A21/20 or Ex tD[iaD] A21 IP6X T70°C...T95°C;
	II 3 G Ex nA II T6...T2 X
FM – Dual Seal-approved	NEC 500
	XP-IS / Cl. I / Div. 1 / Gr. ABCD / T6-T1;
	DIP / Cl. II, III / Div. 1 / Gr. EFG / T6-T1;
	IS / Cl. I, II, III / Div. 1 / Gr. ABCDEFG / T6-T1;
	NI / Cl. I / Div. 2 / Gr. ABCD / T6-T1
	NEC 505
	Cl. I / Zone 0 / AEx d[ia] / IIC / T6-T1;
	Cl. I / Zone 0 / AEx ia / IIC / T6-T1;
	Cl. I / Zone 2 / AEx nA[ia] / IIC / T6-T1
	Hazardous (Classified) Locations, indoor/outdoor Type 4X and 6P, IP66, Dual Seal
CSA – Dual Seal-approved	CEC Section 18 (Zone ratings)
	Cl. I, Zone 1, Ex d, IIC (Probe: Zone 0) T6;
	Cl. I, Zone 0, Ex ia, IIC T6;
	Cl. I, Zone 2, Ex nA, IIC T6
	CEC Section 18 and Annex J (Division ratings)
	XP-IS, Cl. I, Div. 2, Gr. ABCD; Cl. II, Div. 2, Gr. FG; Cl. III, Div. 2 T6;
	IS, Cl. I, Div. 1, Gr. ABCD; Cl. II, Gr. FG; Cl. III T6

Other standards and approvals	
EMC	Electromagnetic Compatibility Directive 2004/108/EC in conjunction with EN 61326-1 (2013). The device agrees with this standard if: – the device has a coaxial probe or – the device has a single / double probe that is installed in a metallic tank. For more data, refer to <i>Electromagnetic compatibility</i> on page 38.
NAMUR	NAMUR NE 21 Electromagnetic Compatibility (EMC) of Industrial Process and Laboratory Control Equipment
	NAMUR NE 43 Standardization of the Signal Level for the Failure Information of Digital Transmitters
CRN	This certification is for all Canadian provinces and territories. For more data, refer to the website.
Construction code	On request: NACE MR0175 / ISO 15156; NACE MR0103

① Metaglas® is a registered trademark of Herberts Industrieglas, GMBH & Co., KG

② Refer to the Pressure/Temperature table for probe selection

③ This option is not available for FM- or CSA-approved devices

④ Hastelloy® is a registered trademark of Haynes International, Inc.

⑤ Kalrez® is a registered trademark of DuPont Performance Elastomers L.L.C.

⑥ HART® is a registered trademark of the HART Communication Foundation

4.2 Measurement limits

For more data, refer to "Measurement limits" in the handbook.

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