

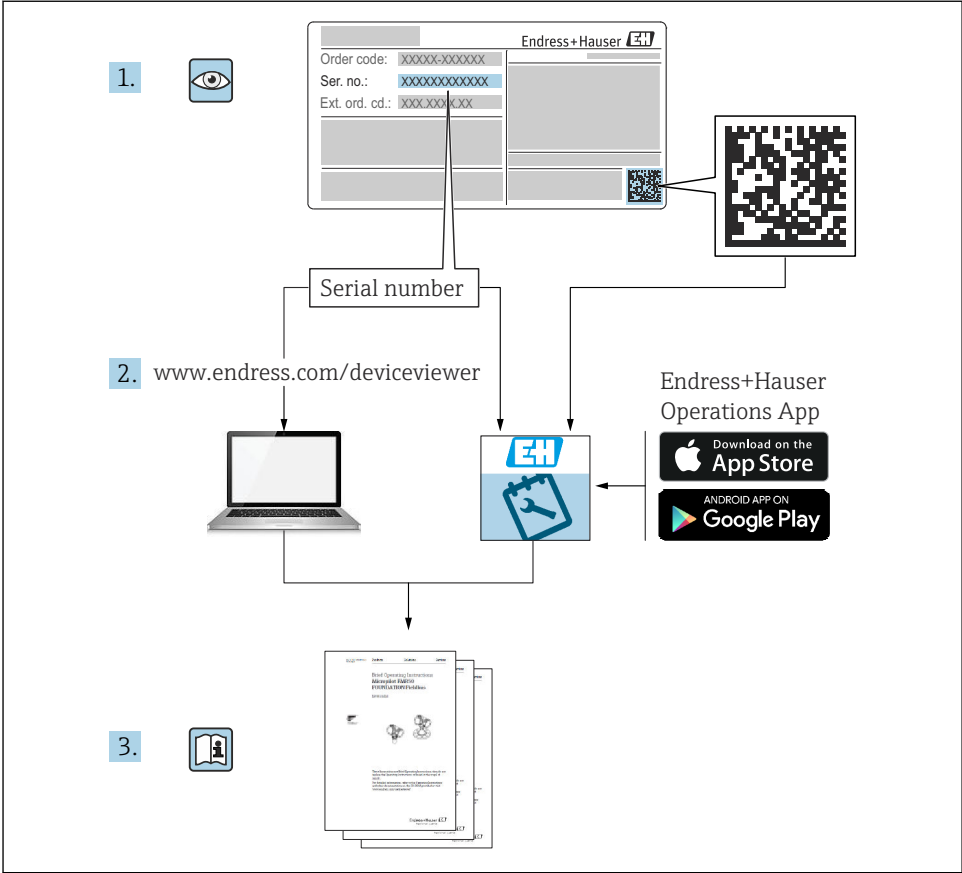
# Brief Operating Instructions

## **Solicap S FTI77**

Capacitance point level switch



# 1 Related documents



A0023555

## 2 About this document

### 2.1 Document conventions

#### 2.1.1 Safety symbols

##### **⚠ DANGER**

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

**⚠ WARNING**

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

**⚠ CAUTION**

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

**NOTICE**

This symbol contains information on procedures and other facts which do not result in personal injury.

### 2.1.2 Electrical symbols

#### ⊕ Protective earth (PE)

Ground terminals that must be connected to ground prior to establishing any other connections.

The ground terminals are located on the interior and exterior of the device:

- Interior ground terminal: protective earth is connected to the mains supply.
- Exterior ground terminal: device is connected to the plant grounding system.

### 2.1.3 Tool symbols



Flat blade screwdriver



Allen key



Open-ended wrench

### 2.1.4 Symbols for certain types of information and graphics

**✓ Permitted**

Procedures, processes or actions that are permitted

**✓✓ Preferred**

Procedures, processes or actions that are preferred

**✗ Forbidden**

Procedures, processes or actions that are forbidden

**i Tip**

Indicates additional information



Reference to documentation



Reference to page

**1., 2., 3.**

Series of steps



Visual inspection

**1, 2, 3, ...**

Item numbers

**A, B, C, ...**

Views

## 2.2 Documentation

### 2.2.1 Technical Information



**EMC test procedures**

TI00241F



**Nivotester FTL325N**

TI00353F



**Nivotester FTL375N**

TI00361F

## 2.3 Certificates

### **ATEX safety instructions**

Solicap S FTI77

- II 1 D Ex tD A20 IP65 T 90 °C
- II 1/2 D Ex tD A20/A21 IP65 T 100 °C

### **Functional safety (SIL2/SIL3)**

Solicap S FT77

SD00278F

### **Control Drawings (CSA and FM)**

- Solicap S FTI77

FM

ZD00243F

- Solicap S FTI77

CSA IS

ZD00225F

### **CRN registration**

CRN OF1988.75

### **Other**

AD2000: the wetted material (316L) corresponds to AD2000 – W0/W2

## 2.4 Patents

This product is protected by at least one of the patents:

- DE 103 22 279
- WO 2004 102 133
- US 2005 003 9528
- DE 203 13 695
- WO 2005 025 015

Further patents are under development.

## 3 Basic safety instructions

### 3.1 Requirements for the personnel

The personnel must fulfill the following requirements to carry out the necessary tasks:

- ▶ Are trained, qualified to perform specific functions and tasks.
- ▶ Are authorized by the plant owner or operator to perform specific tasks.
- ▶ Are familiar with federal or national regulations.
- ▶ Have read and understood the instructions in the manual and supplementary documentation.
- ▶ They follow instructions and comply with conditions.

### 3.2 Workplace safety

For work on and with the device:

- ▶ Wear the required protective equipment according to federal or national regulations.

### 3.3 Operational safety

When performing configuration, testing, and maintenance work on the device, alternative supervisory measures must be taken to guarantee the operational safety and process safety.

#### 3.3.1 Ex-area

When using the measuring system in Ex-areas, the appropriate national standards and regulations must be observed. Separate Ex-documentation, which constitutes an integral part of this documentation, is supplied with the device. The installation procedures, connection data and safety instructions it contains must be observed.

- Make sure that the technical staff has adequate training.
- The special measuring and safety-related requirements for the measuring points must be observed.

### 3.4 Product safety

This measuring device is designed following good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It is compliant with the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

## 4 Incoming acceptance and product identification

### 4.1 Incoming acceptance

Check whether the packaging or content is damaged. Check that the goods delivered are complete and compare the scope of delivery with the information in your order.

### 4.2 Product identification

Check nameplate data.



See Operation Instructions → 2

### 4.3 Storage and transport

For storage and transportation, pack the device to protect it against impact. The original packing offers the best protection for this. The permitted storage temperature is -50 to +85 °C (-58 to +185 °F).

## 5 Mounting requirements

### 5.1 General notes and precautions

#### NOTICE

**Filling the silo.**

- ▶ The filling stream must not be directed onto the probe.

#### NOTICE

**Angle of material flow.**

- ▶ Take care to the expected angle of the material flow and the outlet funnel when determining the mounting location or probe rod length.

#### NOTICE

**Distance between probes.**

- ▶ The minimum distance of 500 mm (19.7 in) between the probes must be observed.

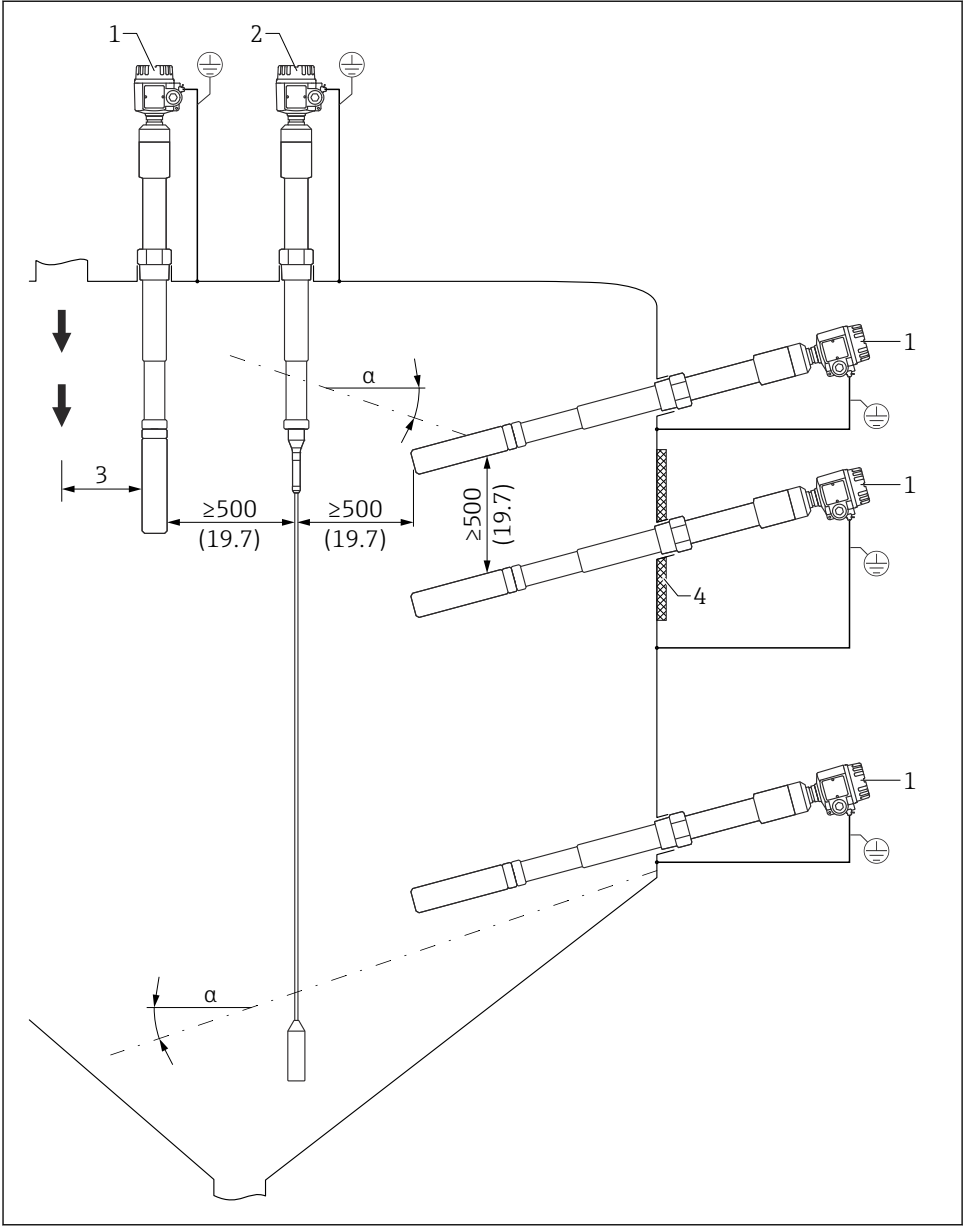
#### NOTICE

**Threaded coupling for mounting.**

- ▶ The threaded coupling should be as short as possible. Condensation or product residue may occur in a long threaded coupling and interfere with the correct operation of the probe.

**NOTICE****Heat insulation**

- ▶ To avoid exceeding the permitted temperature of the Solicap S housing insulate the external silo wall.
- ▶ To prevent the condensation and reduce buildup in the threaded coupling area insulate the silo wall.



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- a* Angle of the slope
- 1* FTI77 sword probe
- 2* FTI77 rope probe
- 3* Distance from the loading point
- 4* Heat insulation

## 5.2 Mounting the sensor

The Solicap S FTI77 with the sword probe can be installed in vertical or horizontal position.

The Solicap S FTI77 with rope probe can be installed only in vertical position.

### NOTICE

**Mounting the probe in the loading curtain area can cause an incorrect device operation!**

- ▶ Mount the probe away from the loading curtain.

### NOTICE

**Mounting the sword probe in parallel position can cause a incorrect device operation!**

- ▶ Mount the sword probe with the narrow edge position upwards.

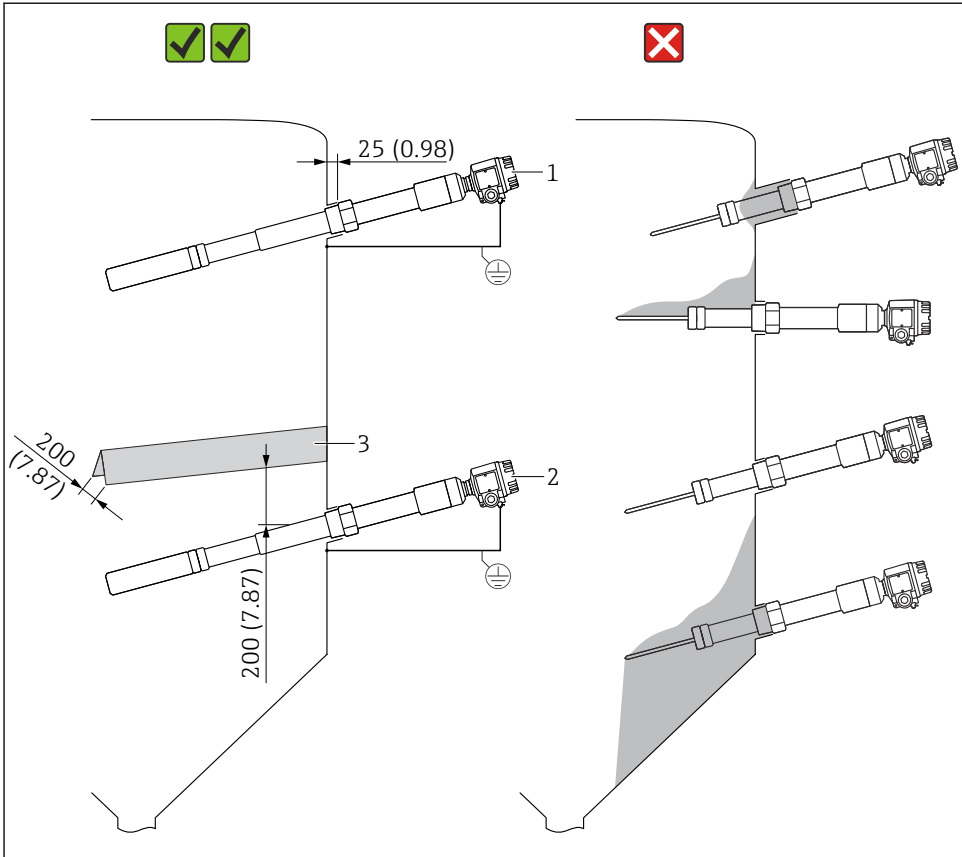
### NOTICE

**The probe cannot touch the metal container wall!**

- ▶ Make sure that the probe is insulated from the metal container wall.



- To determine the mounting location and the probe length, observe the expected angle of the material flow or of the outlet funnel.
- The threaded coupling should be as short as possible. Condensation or product residue may occur in a long threaded coupling and interfere with the correct operation of the probe.
- In the case of high temperatures in the silo, insulate the silo wall to avoid exceeding the temperature the probe housing. The heat insulation also prevents condensation and reduces buildup from forming near the threaded boss in the silo.



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1 Mounting examples. Unit of measurement mm (in)

- 1 For maximum level limit detection
- 2 For minimum point level detection
- 3 The protective cover protects the probe sword from collapsing mounds or mechanical strain at the outflow.

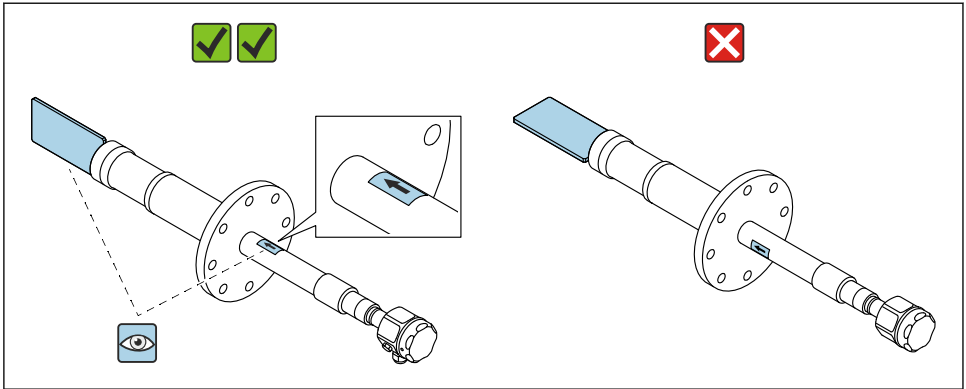
## 5.3 Mounting the sword probe FTI77

### 5.3.1 Aligning the sword probe in horizontal position

#### NOTICE

Mounting the probe in the wrong position of the sword can cause an incorrect device operation or probe damage!

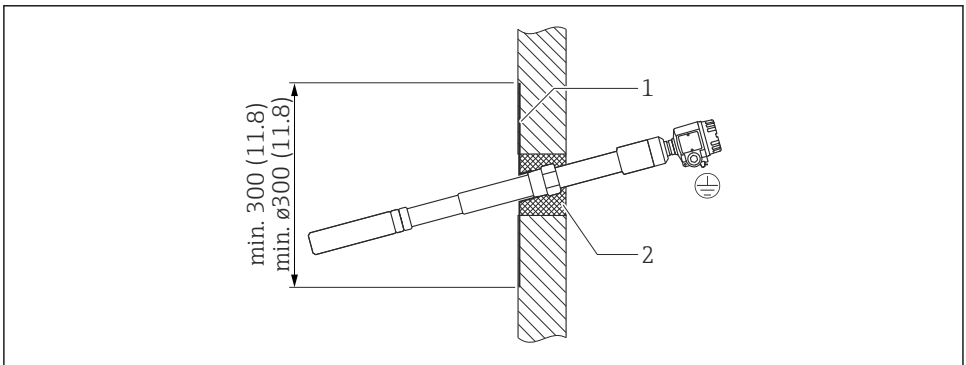
- Mount the probe so that the markup label is upwards. The markup shows the position of the narrow edge of the sword.



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### 5.3.2 Mounting the probe in a silo with concrete walls

The grounded steel plate forms the counter electrode. The heat insulation prevents condensation and therefore buildup on the steel plate.



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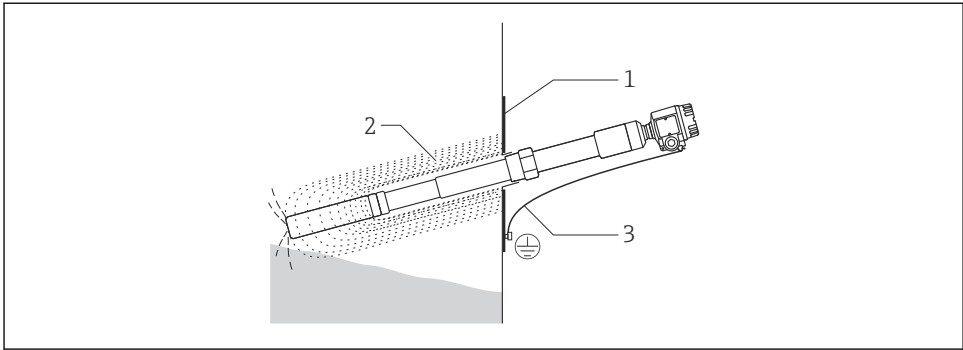
- 1 Sheet metal plate with threaded socket
- 2 Heat insulation

### 5.3.3 Installing the probe in a silo with plastic walls

When the probe is installed in the silo with plastic walls, a sheet metal plate must be attached to the exterior of the silo as a counter electrode. The plate can be in square or round shape.

The dimensions of the plate are:

- approximately square of 500 mm (19.7 in) each side or round  $\varnothing 500$  mm (19.7 in) for thin wall with low dielectric constant
- approximately square of 700 mm (27.6 in) each side or round  $\varnothing 700$  mm (27.6 in) for thick wall with high dielectric constant

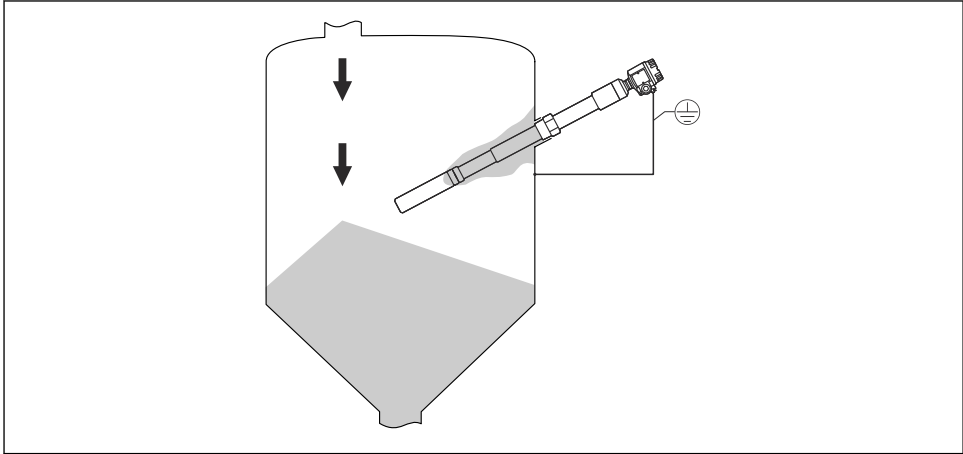


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- 1 Electrical HF field
- 2 Sheet metal plate
- 3 Ground connection

### 5.3.4 Active buildup compensation

To prevent the measurement distortions coming from the material buildup on the sword probe, use the active buildup compensation function. The cleaning of the sword is not necessary anymore.



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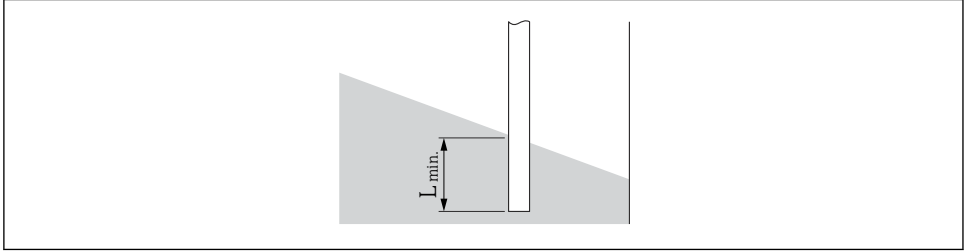
## 5.4 Probe length and minimum coverage



For probe length tolerances, see TI01561F.



- To ensure problem-free operation, it is important that the difference in capacitance between the covered and uncovered parts of the probe is at least 5 pF.
- If you do not know the dielectric constant of the material, contact the E+H service.



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$L_{min}$  Minimum coverage

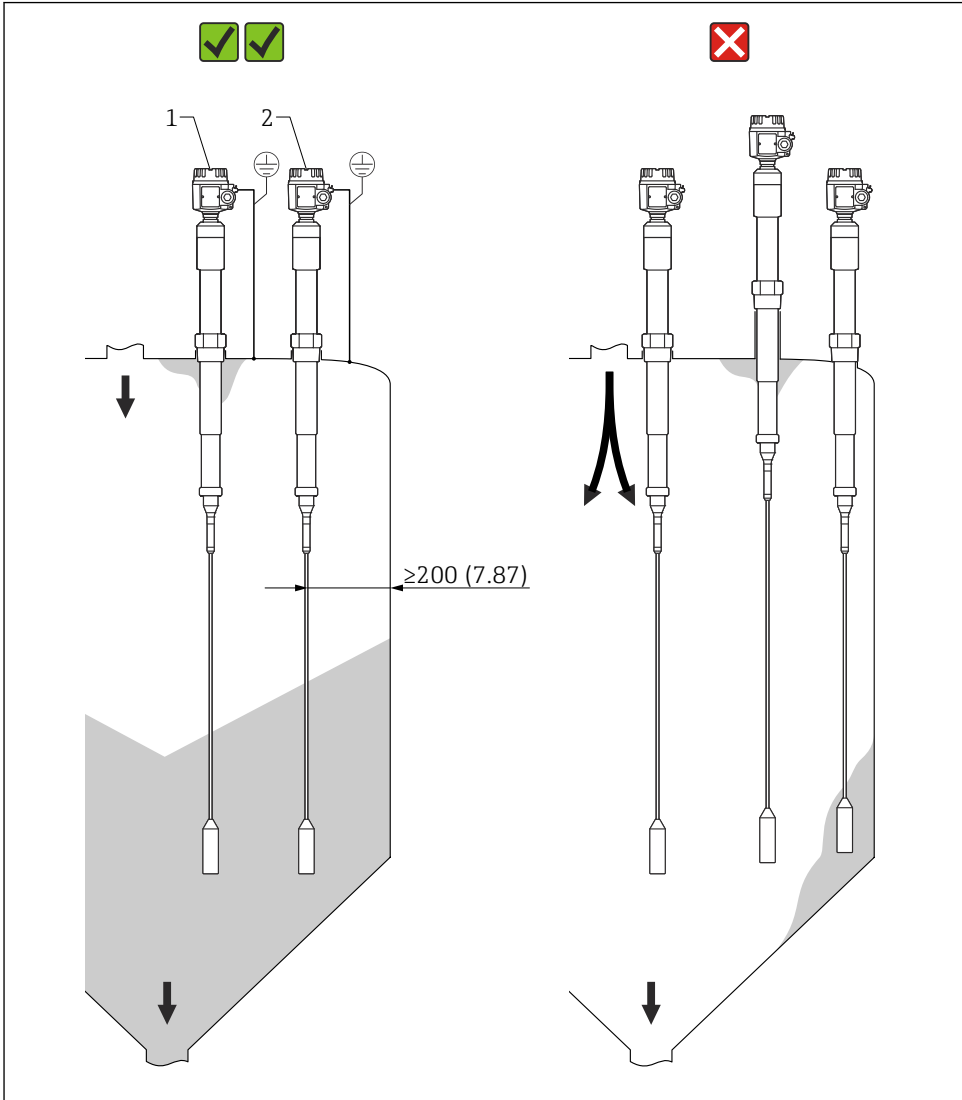


Pay attention to the dependency between the relative dielectric constant  $\epsilon_r$  and the minimum amount the probe rod that needs to be covered.

### Minimum length of the probe rod ( $L_{min}$ ) that needs to be covered

- 25 mm (0.98 in) for electrically conductive product
- 100 mm (3.94 in) for nonconductive product  $\epsilon_r > 10$  nF/m
- 200 mm (7.87 in) for nonconductive product  $\epsilon_r > 5$  to 10 nF/m
- 500 mm (19.7 in) for nonconductive product  $\epsilon_r > 2$  to 5 nF/m

## 5.5 Mounting the rope probe FTI77



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### 5.5.1 Mounting of the probe in the silo roof

Ensure that the silo roof is of a sufficiently stable construction. High tensile forces may occur when material is being extracted, particularly in the case of heavy and powdery bulk solids which have a tendency to form buildup.

### 5.5.2 Abrasive bulk solids

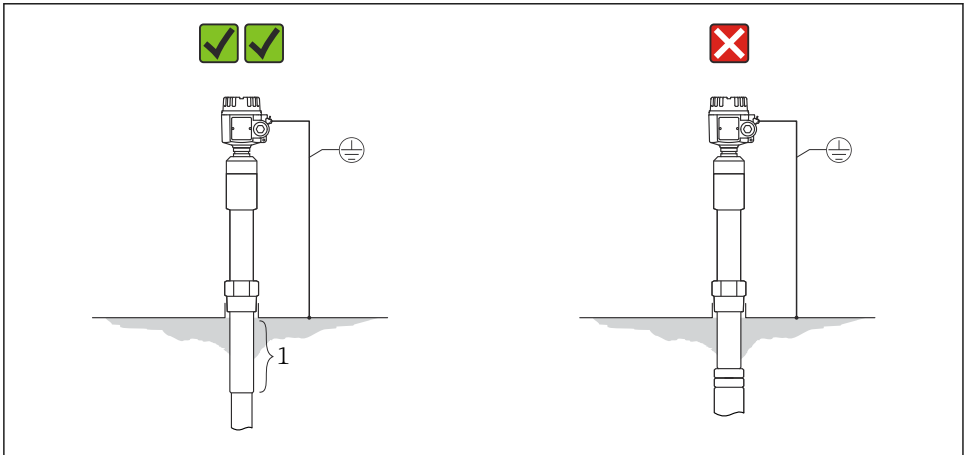
In silos with extremely abrasive bulk solids, use Solicap S FTI77 only for maximum detection.

### 5.5.3 Distance between the rope probes

The minimum distance between the rope probes is 500 mm (19.7 in). This also applies when installing several Solicap S units in adjacent silos with nonconductive walls.

### 5.5.4 Mounting probe in the event of condensation

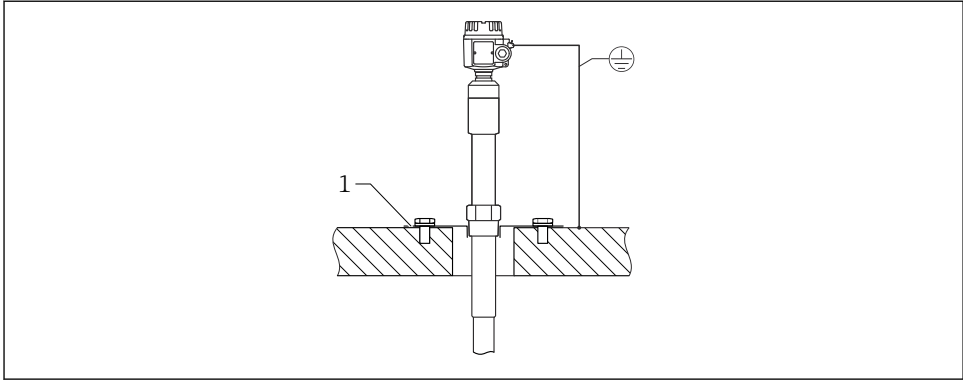
In the event of condensation use only probes with inactive length. The inactive length prevents moisture and buildup forming between the active part of the probe and the silo roof.



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2 Silo with conducting walls

To reduce the effects of condensation and buildup, the threaded coupling must project into the silo. Maximum length of the threaded coupling is 25 mm (0.98 in).

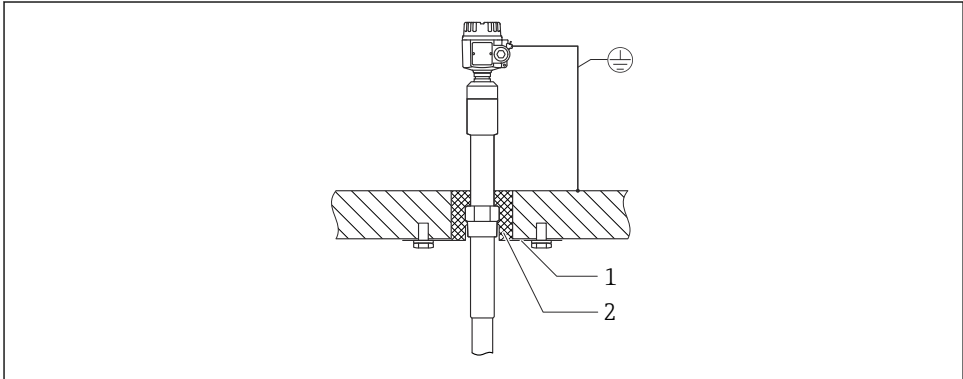


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3 Silo with concrete walls

1 Steel plate connected to the reinforcing steel

Heat insulation reduces condensation and therefore buildup on the steel plate.



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4 Silo with concrete walls

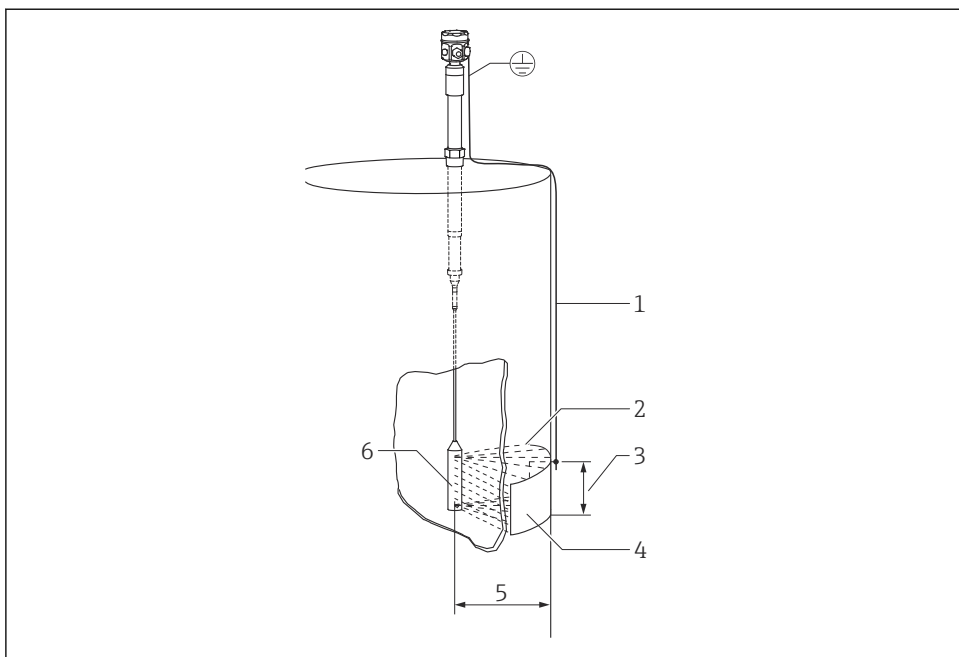
1 Steel plate

2 Heat insulation

### 5.5.5 Mounting the probe in a nonconductive tank

When installing in a silo made of concrete, a counter electrode must be mounted on the silo exterior at the same height as the tensioning weight. The length of the edge of the counter electrode should be approximately the same length as the distance between the tensioning weight and the silo wall.



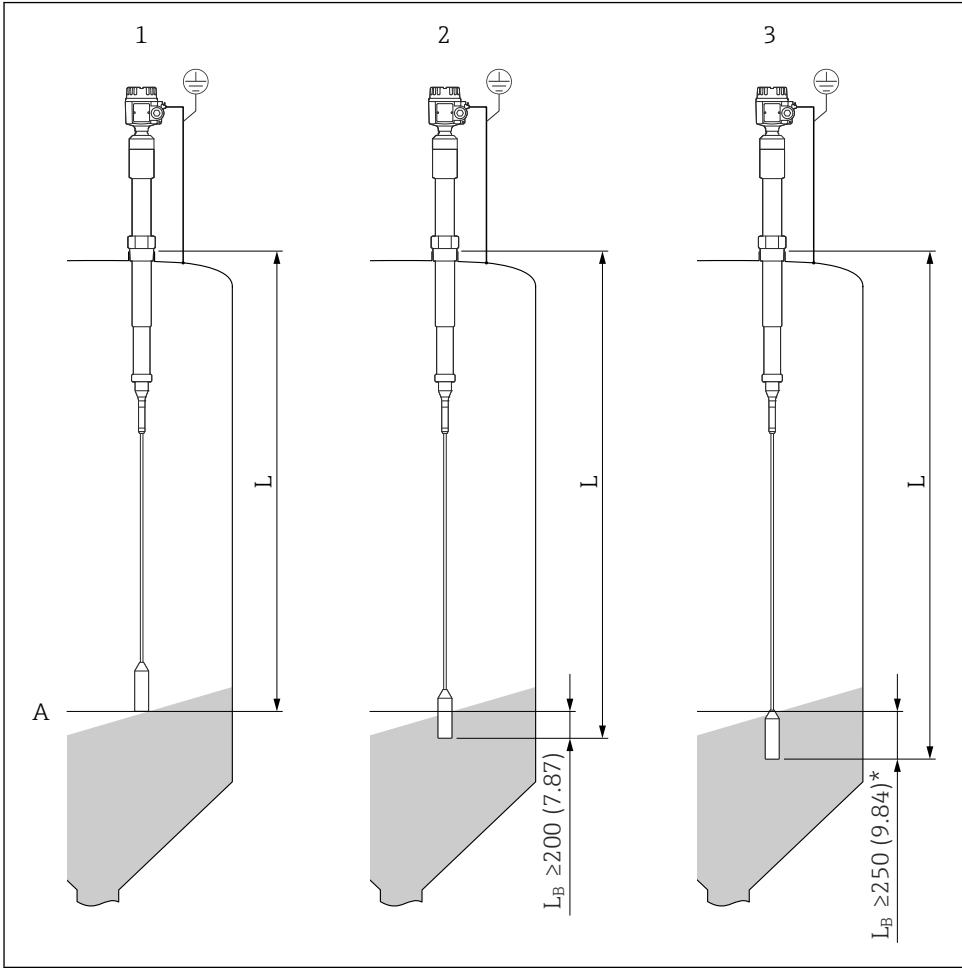


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#### 5 Mounting the probe in plastic tanks

- 1 Ground connection
- 2 Electrical HF field
- 3 Surface area e.g.  $1 \text{ m}^2$  ( $10.7 \text{ ft}^2$ )
- 4 Metal counter electrode
- 5 Distance of  $1 \text{ m}$  ( $3.3 \text{ ft}$ )

## 5.6 Range of sensor lengths



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Unit of measurement mm (in)

$L_B$  Covered length

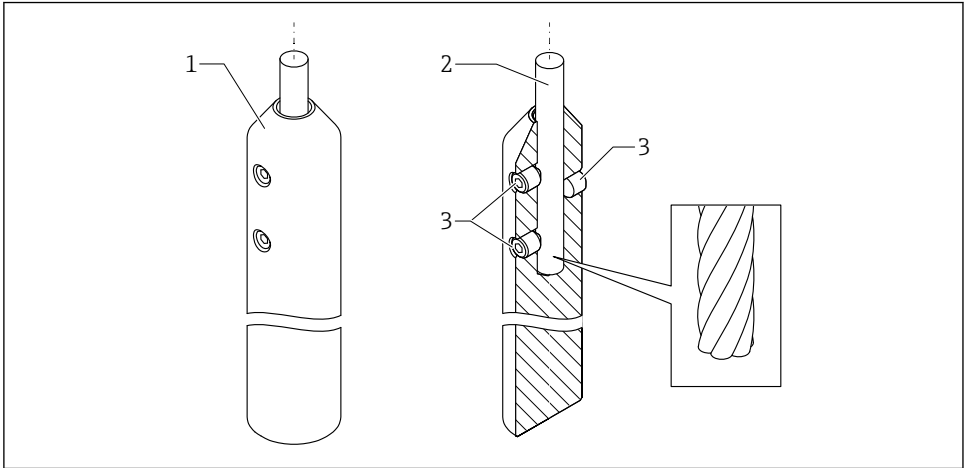
- 1 Rope length ( $L$ ) for electrically conductive bulk solids, e.g. coal
- 2 Rope length ( $L$ ) for bulk solids with high dielectric constant, e.g. rock salt
- 3 Rope length ( $L$ ) for bulk solids with low dielectric constant, e.g. dried grain



The covered length ( $L_B$ ) must be 5 % longer than the distance between the tank roof and the limit level, and no shorter than 250 mm (9.84 in) for non-conductive bulk solids with a low dielectric constant ( $\epsilon_r$ ).

## 5.7 Rope shortening

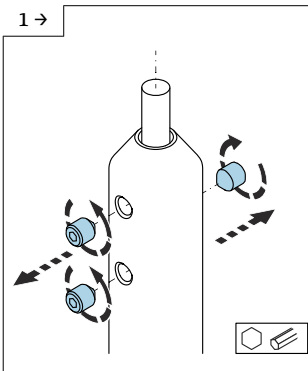
Both versions of the rope probes can be shortened. The tension weight must be removed from the rope first.



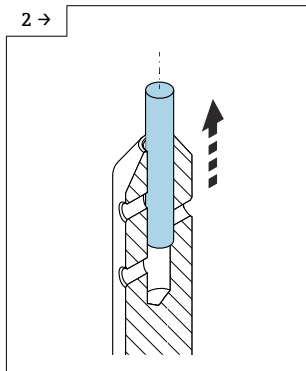
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- 1 The tension weight
- 2 The rope
- 3 The locking screws

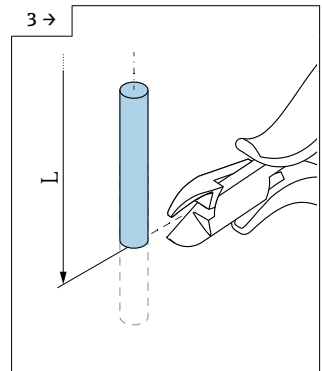
### The rope shortening procedure



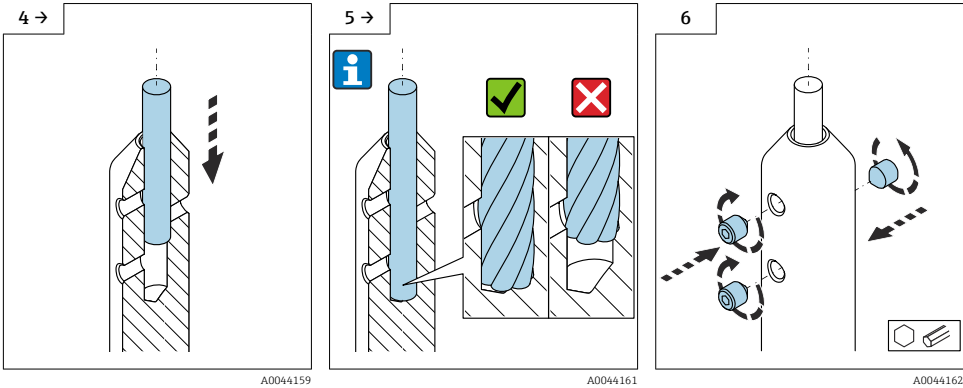
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A0044157



A0044158



## 6 Electrical connection

- i Before connecting the power supply, note the following:**
- the supply voltage must match the data specified on the nameplate
  - switch off the supply voltage before connecting the device
  - connect the potential equalization to the ground terminal on the sensor

- i When using the probe in hazardous areas, the relevant national standards and the information in the safety instructions (XA) must be observed.**

Use the specified cable gland only.

### 6.1 Connecting requirements

#### 6.1.1 Potential equalization



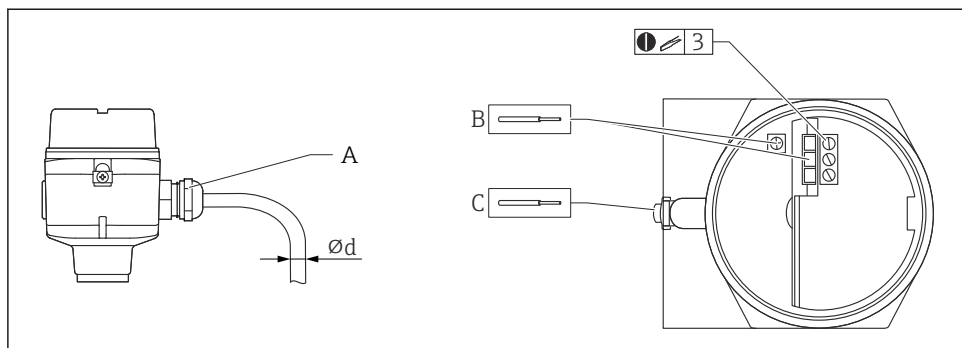
##### **Risk of explosion!**

- Connect the cable screen on the sensor side only if installing the probe in Ex-areas!

Connect the potential equalization to the outer ground terminal of the housing (T13, F13, F16, F17, F27). In the case of the stainless steel housing F15, the ground terminal can also be located in the housing. For further safety instructions, please refer to the separate documentation for applications in hazardous areas.

#### 6.1.2 Cable specification

Connect the electronic inserts by using commercially available instrument cables. If a potential equalization is present, and the shielded instrument cables are used, connect the shielding on both sides to optimize the shielding effect.



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A Cable entry

B Electronic insert connections: cable size max.  $2.5 \text{ mm}^2$  (14 AWG)

C The ground connection outside the housing, cable size max.  $4 \text{ mm}^2$  (12 AWG)

$\varnothing d$  Cable diameter

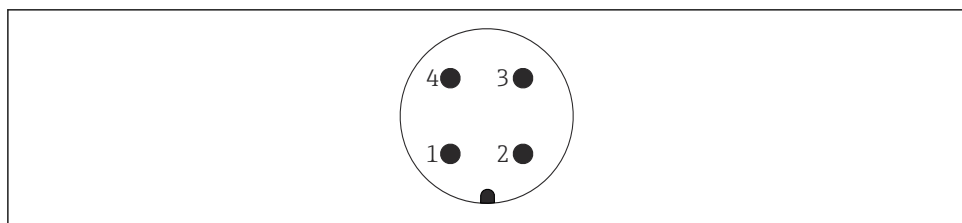
### Cable entries

- Nickel-plated brass:  $\varnothing d = 7$  to  $10.5 \text{ mm}$  (0.28 to 0.41 in)
- Synthetic material:  $\varnothing d = 5$  to  $10 \text{ mm}$  (0.2 to 0.38 in)
- Stainless steel:  $\varnothing d = 7$  to  $12 \text{ mm}$  (0.28 to 0.47 in)

### 6.1.3 Connector

For the version with a connector M12, the housing does not have to be opened for connecting the signal line.

### PIN assignment for M12 connector



A0011175

1 Positive potential

2 Not used

3 Negative potential

4 Ground

### 6.1.4 Cable entry

#### Cable gland

M20x1.5 for Ex d only cable entry M20

Two cable glands are included in scope of delivery.

#### Cable entry

- G $\frac{1}{2}$
- NPT $\frac{1}{2}$
- NPT $\frac{3}{4}$

## 6.2 Wiring and connecting

### 6.2.1 Connection compartment

Depending on explosion protection, the connection compartment is available in the following variants:

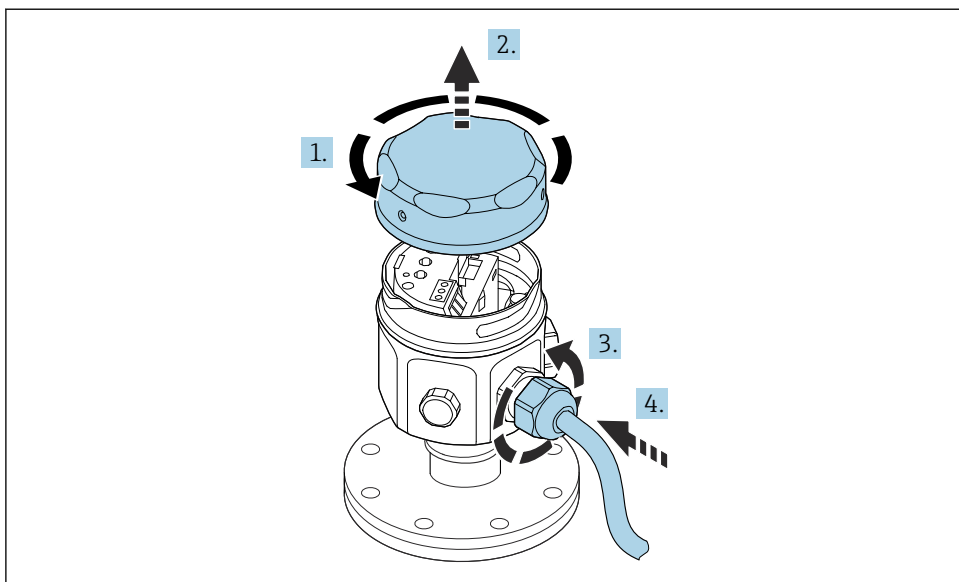
#### Standard protection, Ex ia protection

- polyester housing F16
- stainless steel housing F15
- aluminum housing F17
- aluminum housing F13 with gas-tight process seal
- aluminum housing T13, with the separate connection compartment

#### Ex d protection, Gas-tight process seal

- aluminum housing F13 with gas-tight process seal
- aluminum housing T13, with the separate connection compartment

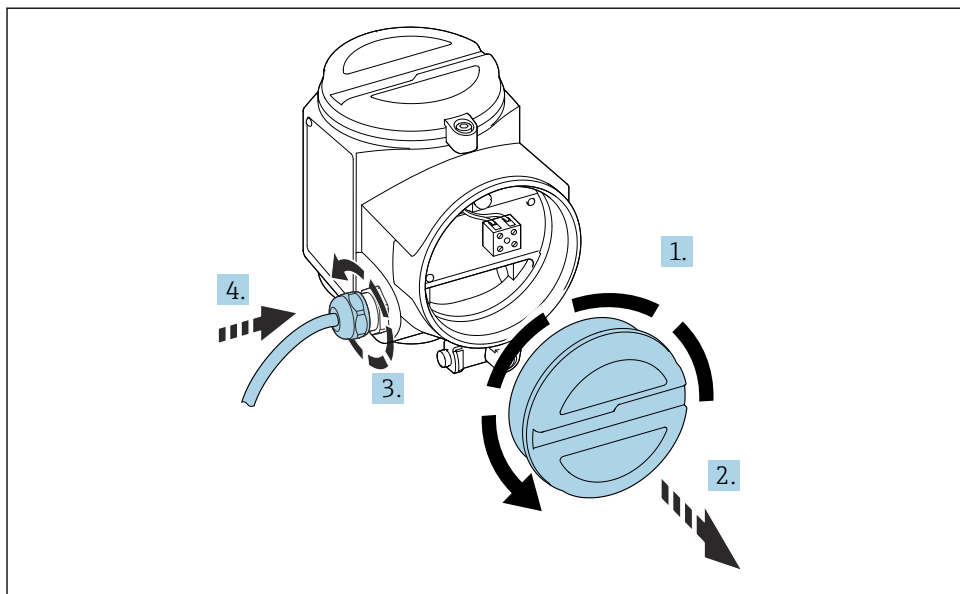
Connecting the electronic insert to the power supply:



A0040635

1. Unscrew the housing cover.
2. Remove the housing cover.
3. Release the cable gland.
4. Insert the cable.

Connecting the electronic insert to the power supply mounted in the housing T13:



A0040637

1. Unscrew the housing cover.
2. Remove the housing cover.
3. Release the cable gland.
4. Insert the cable.

### 6.3 Connecting the measuring device

Possible measuring devices:

- 2-wire AC electronic insert FEI51
- DC PNP electronic insert FEI52
- 3-wire electronic insert FEI53
- AC and DC with relay output electronic insert FEI54
- SIL2 / SIL3 electronic insert FEI55
- PFM electronic insert FEI57S
- NAMUR electronic insert FEI58



See Operating Instructions → 2



## 7 Commissioning

### 7.1 Installation and function check



See Operating Instructions →  2

### 7.2 Switching on the measuring device



To switch on the measuring device and set the electronic insert, see Operating Instructions →  2, chapter "Commissioning".

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