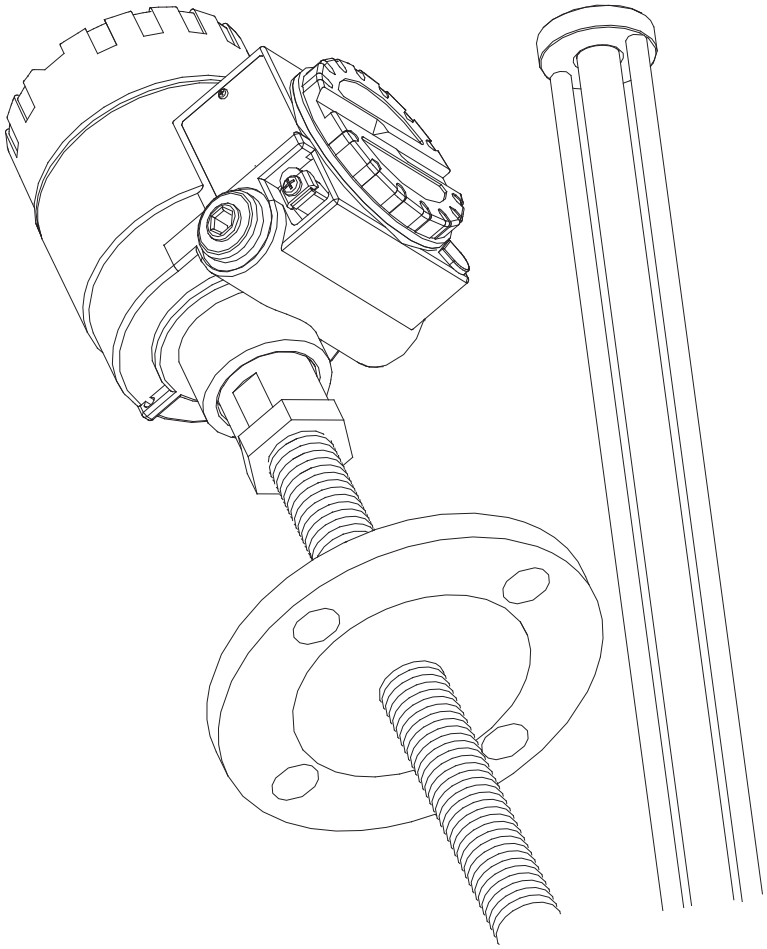
BA01025G/00/EN/23.19
71435461
2019-04-26

Operating Instructions
Prothermo NMT539

Average temperature device



Endress+Hauser
People for Process Automation

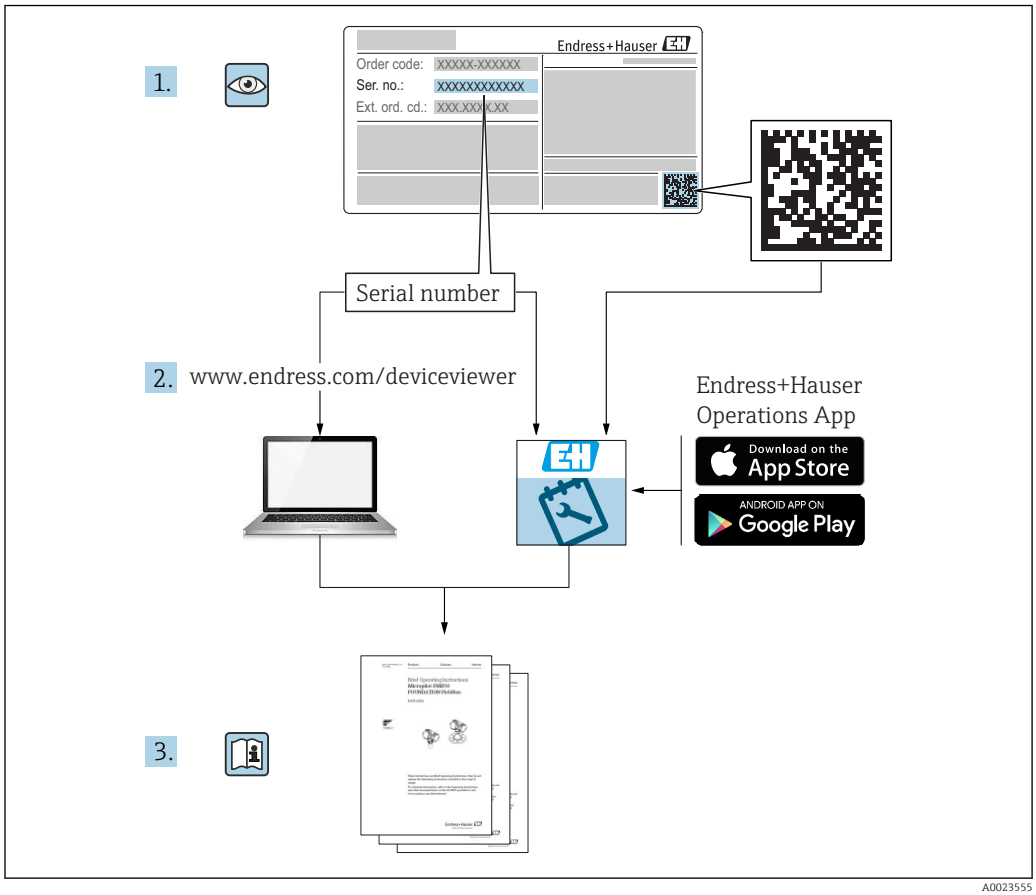

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX XXX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
A0023555

Table of contents

1 About this document

1.1 Document function

These Operating Instructions contain all the information that is required during various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbol

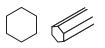
1.2.1 Safety symbols

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury, as well as a risk of fire or explosion.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in a risk of serious or fatal injury, fire or explosion.
CAUTION	**Note** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in a risk of minor or moderate injury and damages to properties.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts that do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	**Ground connection** A grounded terminal that, as far as the operator is concerned, is grounded via a grounding system.
	**Protective ground connection** A terminal that must be connected to the ground prior to establishing any other connections.
	**Equipotential connection** This connects with the grounding system at the plant. It includes equipotential line and single point ground systems, depending on the norms of each country or company.

1.2.3 Tool symbols

Symbol	Meaning
 A0013442	Torx screwdriver
 A0011220	Flat blade screwdriver
 A0011219	Phillips screwdriver
 A0011221	Allen key
 A0011222	Open-ended wrench

1.2.4 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted
	**Preferred** Procedures, processes or actions that are preferred
	**Forbidden** Procedures, processes or actions that are forbidden
	**Tip** Indicates additional information
	Reference to documentation
	Reference to page
	Reference to graphic
▶	Notice or individual step to be observed
1., 2., 3. ...	Series of steps
	Result of an operation or commissioning
	Help in the event of a problem
	Visual inspection
	Operation via the local display
	Operation via operating tool
	Write-protected parameter

1.2.5 Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1., 2., 3. ...	Series of steps
A, B, C, ...	Graphics
A-A, B-B, C-C, ...	Cross-sections
	**Hazardous area** Indicates the hazardous area
	**Safe area (non-hazardous area)** Indicates the non-hazardous area

1.2.6 Device symbol

Symbol	Meaning
	**Safety instructions** Observe the safety instructions contained in the associated Operating Instructions.
	**Temperature resistance of the connection cables** Specifies the minimum value of the temperature resistance of the connection cables.

1.3 Documentation

For an overview of the scope of the relevant Technical Documentation included with the product, refer to the following:
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer).
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

1.3.1 Technical information

The Technical Information contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

Device	Technical Information
Prothermo NMT539	TI01005G

1.3.2 Operating instructions (BA)

The Operating Instructions contain all the information that is required during various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

The Operating Instructions also contain detailed descriptions of each parameter in the operation menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Device	Operating Instructions
Prothermo NMT539	BA01025G BA01026G

1.3.3 Safety instructions (XA)

Feature 010 ("Approval")	Meaning	Ex / XA
A	Ex ia IIB T4	Ex463-820XJ Ex1060-953XJ Ex496-826XJ
B	ATEX Ex ia IIB T2-T6	XA00585G
C	Ex ia IIB T2	Ex495-823XJ
E	Ex d[ia] IIB T4	Ex1061-986XJ
F	IEC Ex ia IIB T2-T6	XA01790G
G	NEPSI Ex ia IIB T2-T6	XA01259G
7	FM C/US IS Ci. I Div.1 Gr. C-D	Ex461-851-1 Ex461-850-1

1.4 Registered trademarks

FieldCare®
Registered trademark of the Endress+Hauser Process Solutions AG, Reinach, Switzerland.

HART®
Registered trademark of the FieldComm Group, Austin, USA.

2 Basic safety instructions

2.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Be specialists who are trained and have a relevant qualification for this specific function and task.
- Be authorized by the plant owner-operator.
- Be familiar with local/national regulations.
- Before starting work, read and understand the instructions in the Operating Instructions and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:
- Be instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Designated use

Application and measured materials
Depending on the version ordered, the device can also be used with potentially explosive, flammable, poisonous or oxidizing materials.

Devices that are used in hazardous areas have corresponding labels on their nameplates.

To ensure that the device remains in proper condition for the operation time:
- Only use the device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Check the nameplate to verify if the device can be put to its intended use in hazardous areas.
- If the device is not operated at an atmospheric temperature, compliance with the relevant basic conditions specified in the relevant device documentation is absolutely essential.
- Protect the device permanently against corrosion from environmental influences.
- Observe the limit values in the "Technical Information".

The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to local/national regulations.

2.4 Operational safety

Risk of injury!
- ▶ Operate the device in proper technical conditions and fail-safe conditions only.
- ▶ The plant owner-operator is responsible for interference-free operation of the device.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:
- ▶ If modifications are nevertheless required, contact your Endress+Hauser Sales Center.

Repair

To ensure continued operational safety and reliability:
- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe local/national regulations pertaining to repair of an electrical device.
- ▶ Use only original spare parts and accessories from Endress+Hauser.

Ex-area

Observe the following notes to eliminate the risk of danger to persons or the facility when the device is used in Ex-areas (e.g. explosion protection, pressure equipment safety):
- ▶ Check the model nameplate to ensure that the ordered device is explosion proof.
- ▶ Observe the specifications in the separate supplementary documentation attached to these Instructions.

2.5 Product safety

This device was designed in accordance with GEP (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 the general safety standards and legal requirements.

3 Product description

3.1 Product design

NMT539 performs precise liquid and gas phase average temperature measurement, which makes it ideal for inventory management of large-scale tanks.

It is equipped with a capacitance WB device in crude oil and two-phase liquids, and it performs accurate average temperature and WB measurements.

The position of the flange cannot be adjusted in a welding flange type.

3.2 Technical data

Item	Details
Application	▪ Flange installation: Standard 50.8 mm (2 in) ▪ Temperature measuring range: Maximum length 99.999 m (3.94 in) (ATEX, IECEx, NEPSI, FM C/US), maximum length 40.000 m (1.57 in) (TIIS) ▪ WB measuring range: 1 m (3.28 ft) or 2 m (6.56 ft)
Measuring principle	▪ Temperature measurement NMT539 consists of up to 16 platinum resistance elements (Pt100) in a SUS316 protection tube. Pt100 has a unique characteristic of linear resistance change with respect to the surrounding ambient temperature change. A module in the NMT539 converter receives this resistance signal change as an input variable and converts it to temperature data. The converted and calculated data are then transmitted to the host device as a local HART signal. ▪ Water bottom (water interface level) measurement An attached capacitance level measurement probe detects the presence of water.The WB is converted into a given frequency variable (default setting) and its data is transmitted via local HART converter to the connected host device.
Minimum element interval (distance)	▪ Standard specifications: 150 mm (5.9 in) (Order Code: 030 Option 1, 4, 5) ▪ High temperature / Low temperature: 400 mm (15.75 in) (Order Code: 030 Option 2, 3, 6) If NMT539 comes with a WB (water bottom) probe option, the maximum number of WB internal elements is two, because of the restriction posed by the internal diameter.
Device structure	RTD average temperature signal for local HART conversion RTD average temperature measurement + local HART converter Average temperature + WB measurement + local HART converter
Measuring range	▪ Temperature measurement ▪ Temperature conversion: −200 to 235 °C (−328 to 455 °F) (−170 to 235 °C (−274 to 455 °F) TIIS) ▪ Standard: −40 to 100 °C (−40 to 212 °F) (−20 to 100 °C (−4 to 212 °F) TIIS) ▪ Wide range: −55 to 235 °C (−67 to 435 °F) (−20 to 235 °C (−4 to 455 °F) TIIS) ▪ Cryogenic: −170 to 60 °C (−274 to 140 °F) ▪ Probe length: Maximum length 99.999 m (328.08 ft) (ATEX, IECEx, NEPSI, INMETRO, FM C/US) Maximum length 40.000 m (131.23 ft) (TIIS) ▪ WB measurement Standard probe range: 1 m (3.28 ft) or 2 m (6.56 ft) −200 to 100 °C (−328 to 212 °F), which is below cryogenic temperature, can be accommodated upon request.
Output signal	Local HART protocol, exclusively for the local host device
Alarm signal	Error information can be accessed via the following interfaces and transmitted digital protocol (refer to "Prothermo NMT539 Operating Instructions and Description of Instrument Function" for the following instruments): ▪ NRF590 (BA00256F, BA00257F) ▪ NMS5 (BA00401G) ▪ NMS8x (BA1456G, BA1459G, BA1462G) ▪ NMR8x (BA01450G, BA01453G) ▪ NRF81 (BA01465G)
Local HART load	Minimum loading for local HART circuit: 250 Ω
Cable glands	Thread G1/2, Thread NPT1/2, Thread M20
Supply voltage	▪ DC 16 to 30 V: Ex ia ▪ DC 20 to 24 V: Ex d [ia]

Item	Details		
Power consumption	Ex ia: 6 mA (temperature measurement), 12 mA (WB measurement), Ex d [ia]: 8 mA (temperature measurement), 14 mA (WB measurement)		
Reference operating conditions	▪ Temperature: 25 °C (77 °F) ± 5 °C (9 °F) ▪ Pressure: 1 013 mbar abs. ± 20 mbar abs. (1 013 hPa abs. ± 20 hPa abs. , 14.7 psi abs. ± 0.3 psi abs.) ▪ Relative humidity (air): 65 % ± 20 % (linearity) ▪ Converter and precision resistor combination or converter and probe combination ▪ WB measurement range: 80 % (100 to 900 mm (3.94 to 35.43 in)) ▪ The factory default is adjusted based on DC (er) = 2.1. Adjustment should be made on-site when necessary		
Measured value resolution	▪ Temperature: ≤ 0.1 °C (0.18 °F) ▪ WB: ≤ 0.1 mm (0.004 in)		
Maximum measurement error	The values below represent performances under the reference conditions (including linearity, repeatability, hysteresis). **Conversion accuracy**		
	Temperature	Standard /PTB spec.	± 0.1 °C (0.18 °F)
	WB	1 m (3.28 ft) spec.	± 2 mm (0.08 in)
		2 m (6.56 ft) spec.	± 4 mm (0.16 in)
	Probe system		
	Temperature	Standard spec.	± 0.15 °C + 0.002 °C x |t| (0.27 °F + 0.0036 °F |t|) IEC 60751 / DIN EN 60751 / JIS C1604 Class A temperature element
		PTB spec.	± (0.3 °C + 0.005 °C x |t|) / 10 ((0.54 °F + 0.009 °F x |t|) / 10) Class 1/10B temperature element
	WB	1 m (3.28 ft) spec.	± 2 mm (0.08 in)
		2 m (6.56 ft) spec.	± 5 mm (0.2 in)
	Overall accuracy		
	Temperature	Standard spec.	Conversion accuracy ± 0.1 °C (0.18 °F) + Environmental effect ± 0.05 °C (0.09 °F) + Class A temperature element ± 0.15 °C + 0.002 °C x |t| (0.27 °F + 0.0036 °F x |t|)
		PTB spec.	Conversion accuracy ± 0.1 °C (0.18 °F) + Environmental effect ± 0.05 °C (0.09 °F) + Class 1/10B temperature element ± (0.3 °C + 0.005 °C x |t|) / 10 (0.54 °F + 0.009 °F x |t| / 10)
	WB	1 m (3.28 ft) spec.	Conversion accuracy ± 2 mm (0.08 in) + Probe accuracy ± 2 mm (0.08 in)
		2 m (6.56 ft) spec.	Conversion accuracy ± 5 mm (0.2 in) + Probe accuracy ± 5 mm (0.2 in)
	▪ Accuracy can be improved for each application by making adjustments on-site, such as adjusting the offset. ▪ |t| represents the temperature of the measured item.		
Ambient temperature	▪ –40 to 85 (–40 to 185) ▪ –20 to 60 °C (–4 to 140 °F): TIIS		
Storage temperature	–40 to 85 (–40 to 185)		
Climate class	DIN EN 60068-2-38 (test Z/AD)		
Protection class	▪ IP66/68 NEMA4X/6P: Converter set equipped with a temperature device or a WB device ▪ IP65 NEMA4X: Converter only (open housing: IP20)		
Electromagnetic compatibility	When installing the probes to metal or concrete tanks and when using a coax probe: ▪ Interference emission according to EN 61326, Electrical Equipment Class B ▪ Interference immunity according to EN 61326, Annex A (Industrial)		
Process temperature range	Temperature probe: –175 to 235 °C (–274 to 455 °F) WB probe: –0 to 100 °C (32 to 212 °F)		
Process pressure	Atmospheric pressure (absolute pressure 1 bar, 100 kPa, 14.5 psi) ▪ Pressure tank: If the pressure inside the tank exceeds the process pressure shown above, install a stilling well (protective tube) without holes or slits in the NMT539 to protect the probe from the pressure. ▪ Static pressure: Because NMT539 has undergone an airtightness test at an absolute pressure of 7 bar, it can withstand static pressure head in the 50 m (164 ft) range in petroleum/chemical product applications.		
Data transmission	▪ Minimum cable diameter: #24 AWG ▪ Cable type: Twist pair with a shield		

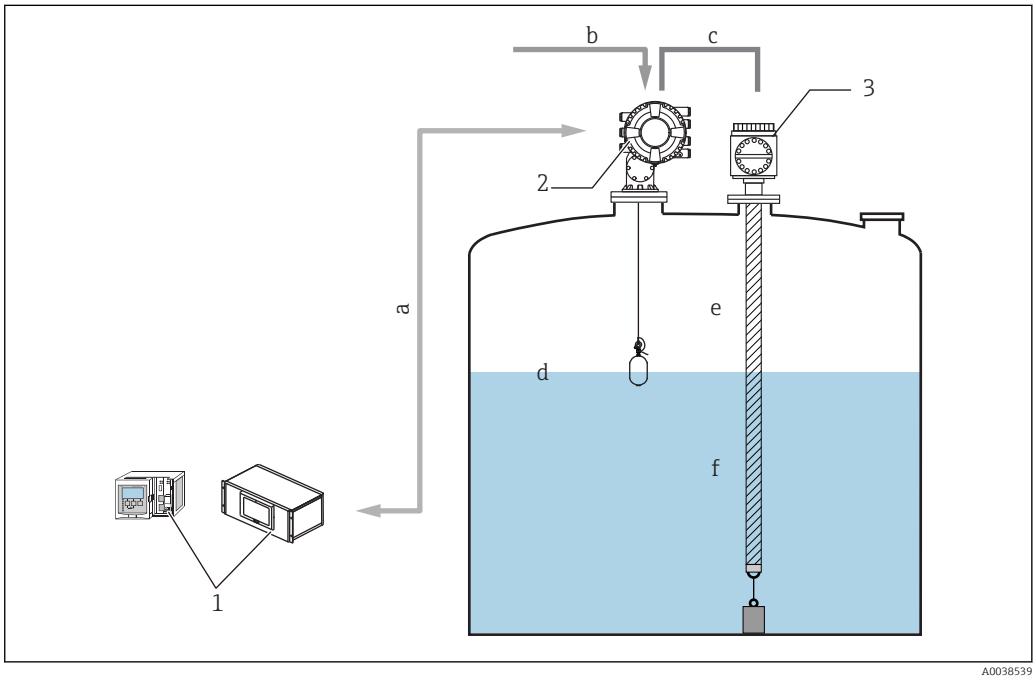
Item	Details
Weight	Approx. 13 kg Conditions ▪ Number of elements: 16 points ▪ Temperature probe: 10 m (32.8 ft) ▪ WB probe: 1 m (3.28 ft) ▪ Flange: 2" 150 lbs RF, SUS316
Material	▪ Temperature measurement elements: Class A Pt100, IEC60751/DIN EN60751/JISC1604 ▪ Housing: Aluminum die cast ▪ Temperature probe: SUS316, SUS316L (refer to the "Dimension") ▪ WB probe: SUS316 (center rod SUS 304 / PFA protected)
Flange specifications	▪ 10K 50A RF, SUS316, flange JIS B2220 ▪ NPS 2" Cl.150 RF, SUS316 flange ASME B16.5 ▪ DN50 PN10 B1, SUS316, flange EN1092-1 (DIN2527 B) ▪ 50A 150 lbs RF, SUS316, flange JPI 7S-15 ▪ Universal coupling, G3/4, (converter only) ▪ M20 threaded (converter only)
CE approval	By attaching the CE mark, Endress+Hauser confirms that the instruments have passed the required tests.
External standards and guidelines	▪ EN 60529 ▪ Protection class of housing (IP-code) ▪ EN 61326 ▪ Emissions (equipment class B), compatibility (appendix A – industrial area)
Ex approvals	**ATEX** ▪ II 1/2 G Ex ia IIB T2-T6 Ga/Gb (converter with temperature device and/or WB device) ▪ II 2G Ex ia IIB T2-T6 Gb (converter only)
	IEC ▪ Ex ia IIB T2-T6 Ga/Gb (converter with temperature device and/or WB device) ▪ Ex ia IIB T2-T6 Ga (converter only)
	FM C/US Converter with temperature device and/or WB device ▪ IS Cl. I, Div. 1, Gr. C, D T2-T6 ▪ IS Cl. I, Zone 0, AEx ia IIB Ga T2-T6 ▪ NI Cl. I, Div. 2, Gr. C, D T2-T6 Converter only ▪ IS Cl. I, Div. 1, Gr. C, D T4 ▪ IS Cl. I, Zone 0, AEx ia IIB Ga T4 ▪ NI Cl. I, Div. 2, Gr. C, D T4
	TIIS ▪ Ex ia IIB T4 (converter with temperature device and/or WB device) (converter only) ▪ Ex ia IIB T2 (converter with temperature device) ▪ Ex d[ia] IIB T4 (converter with temperature device and/or WB device)
	NEPSI ▪ Ex ia IIB T2-T6 (converter with temperature device and/or WB device) ▪ Ex ia IIB T2-T6 Ga (converter only)

3.3 Description of functions

Detailed descriptions of the function groups, functions and parameters are given in "NMT539 Operating Instructions and Description of Instrument Functions. "When NMT539 with WB probe and NRF590 are used together, confirm that the supply voltage to TMD1/NMS/TGM/NRF590 is stable at a voltage of 100 VAC or higher.

3.3.1 NMT539 Ex ia and NMS8x Exd [ia] combination

he connection of NMT539 shown below is only available for connection with NMS5 or NMS8x.



1 *NMS8x and NMS539 system design*

a Fieldbus protocol
b Power supply
c Local HART (Ex i) loop (data transmission)
d Level
e Gas temperature
f Liquid temperature
1 Tankvision
2 NMS8x
3 NMT539

Typical application of NMT539 converter + temperature probe version

NMT539 is the successor of the former NMT535. For proper migration, NMT539 has inherited all the functionality and specifications of NMT535, including connection flange specifications, cable entries and wiring method. Since NMS5 or NMS8x is provided with WB measurement function, they can be combined with the converter + average temperature probe version of NMT539. When the converter + average temperature probe + WB probe version is combined with NMS5 or NMS8, the product in the tank will simultaneously be managed with level, continuous temperature and WB measurements. Most changes and parameter settings for NMT539 can be performed by NMS5 or NMS8x. NMT539 receives liquid level data from NMS5 or NMS8x and then calculates the average temperature of the liquid and gas phases. The calculated average temperature data of the

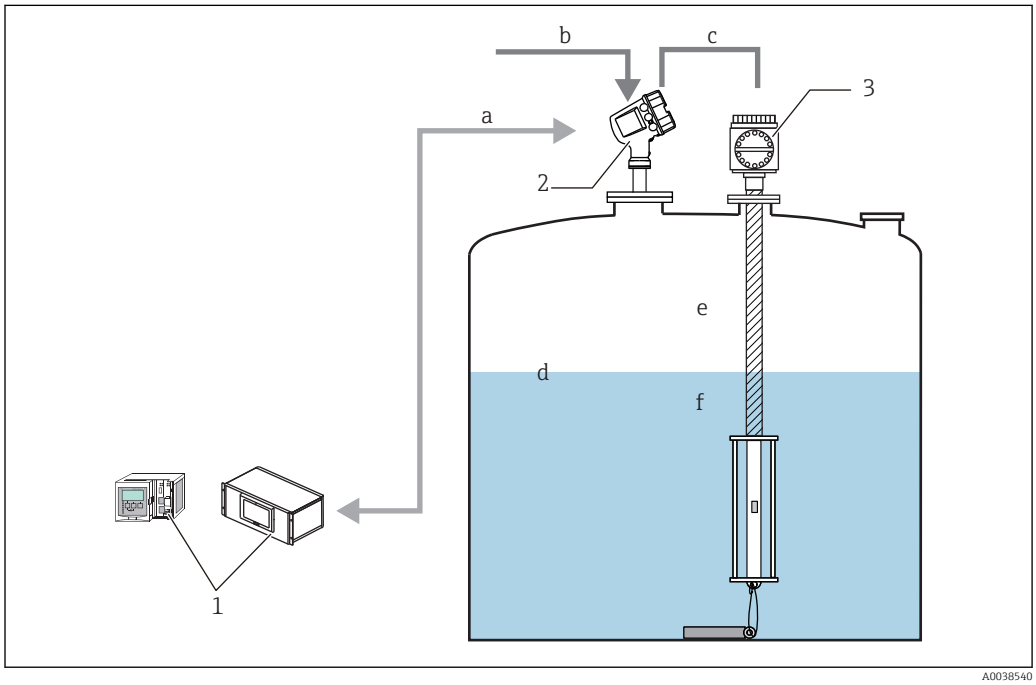
liquid and gas phases are transmitted to NMS8x or NMS5 along with the measured temperature of each element and the NMT539 device status.

All gathered data in the field interface unit are sent to inventory management software (Tankvision) or to NMS8x, NMS5x, NMS7, NMR8x, NRF8x or NRF590.

3.3.2 NMT539 Ex ia and NMR8x Ex d [ia] combination

The connection of NMT539 shown below is only available for connection with NMR8x Ex d [ia].

NRF81 is required as a gateway for FMR5xx and NMT539 Tankvision when using FMR5xx Ex ia radar.



2 *NMT539 Ex ia and NMR8x combination*

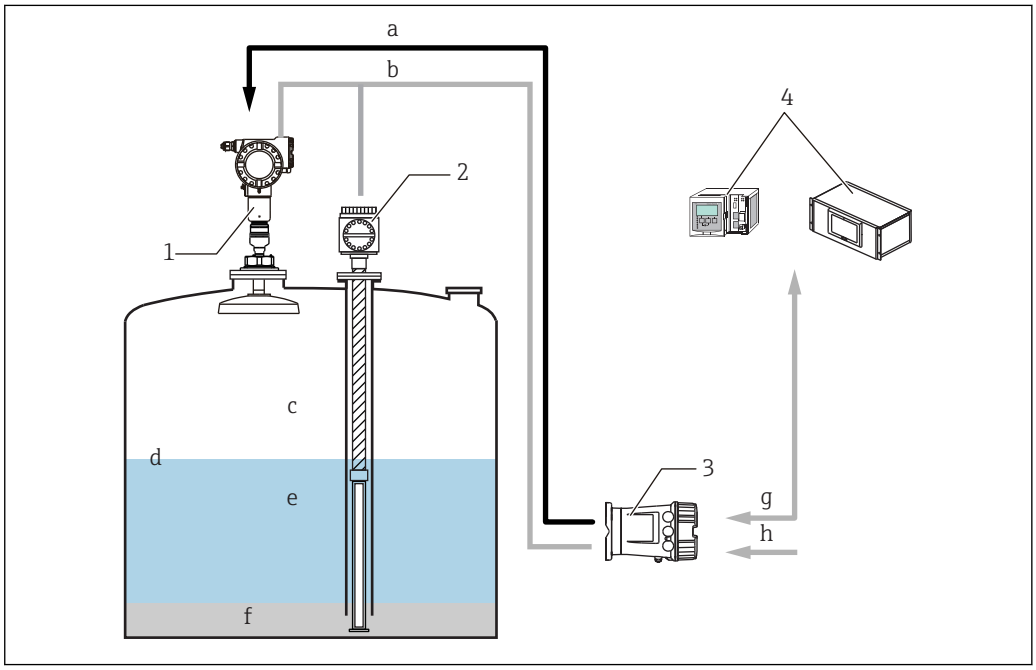
a Fieldbus protocol
b Power supply
c Local HART (Ex i) loop (data transmission)
d Level
e Gas temperature
f Liquid temperature
1 Tankvision
2 NMR8x
3 NMT539

3.3.3 NMT539 Ex ia and NRF590 Ex d [ia] combination

Typical application of NMT539 converter + temperature probe + WB probe version

The NMT539 converter + temperature probe + WB probe version is utilized most effectively in combination with radar level gauging. Water interface, temperature and liquid level measurement, with data collection and calculations via the NRF590 or NRF81, allow for optimal inventory control.Details on NMT539 functions and data can be accessed from NRF81 or NRF590. NMT539 receives radar level data from NRF590 or NRF81 and then calculates the average temperature of the liquid and gas phases. The calculated average temperature data of the liquid and gas phases are transmitted to NRF81 or NRF590 along with the measured temperature of each element and the NMT539 device status.

All gathered data in the field interface unit are sent to inventory management software (Tankvision) or to NMS8x, NMS5x, NMS7, NMR8x, NRF8x or NRF590.

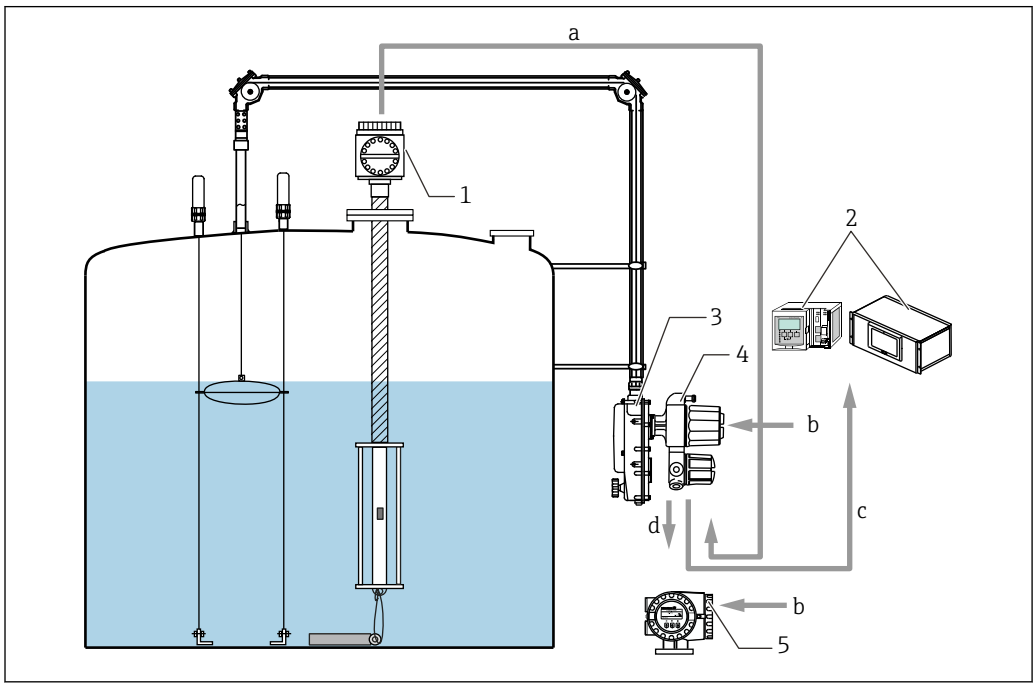


3 *NMT539 Ex ia and NRF590 Ex d [ia] combination*

a FMR power supply (DC/Ex i)
b Local HART (Ex i) loop (data transmission)
c Gas temperature
d Level
e Liquid level temperature
f Water
g Fieldbus protocol
h Power supply
1 FMR540
2 NMT539
3 NRF81/NRF590
4 Tankvision

3.3.4 NMT539 Ex d [ia] and TMD1 Ex d combination

Average temperature device NMT539 can be connected to Transmitter TMD1 or Servo Level Gauge TGM5 via local HART (Ex d) communication. Because local HART communication is digital, it is able to send a larger volume of information compared to the conventional RTD method. This means that NMT539 can work with not just DRM9700 but also with NRF560. If NMT539 WB probe and NRF560 are used together, confirm that the supply voltage to TMD1 is stable at 100 VAC or higher.

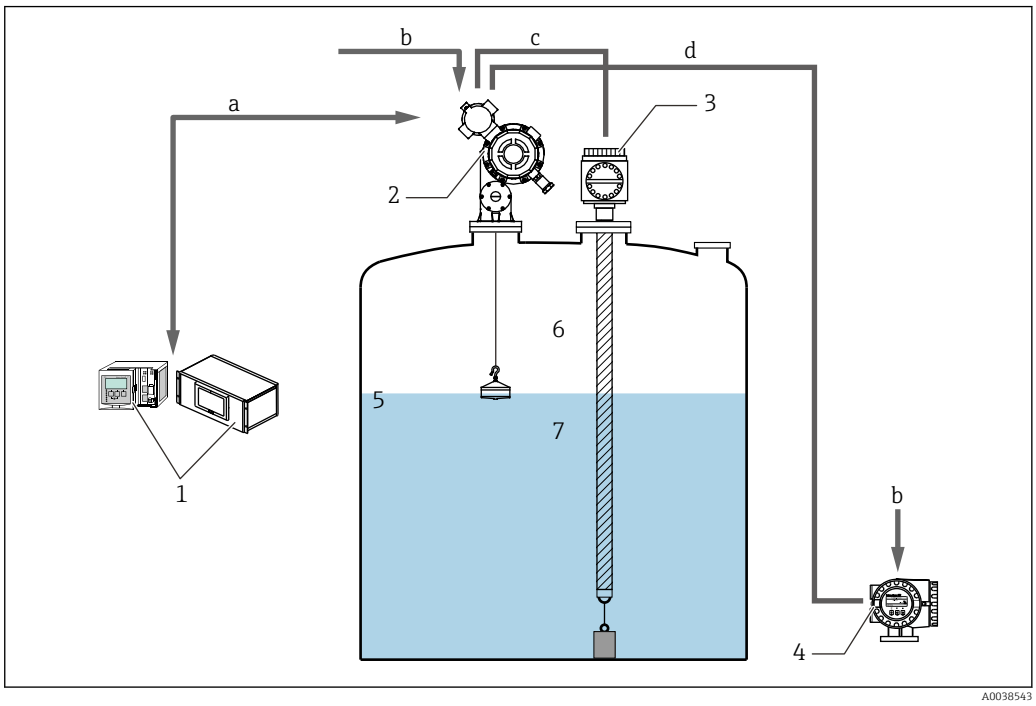


4 *NMT539 Ex d [ia] and TMD1 combination*

a Local HART (Ex d) loop (data transmission)
b Power supply
c Fieldbus protocol
d HART (Ex d) loop (data transmission)
1 NMT539
2 Tankvision
3 LT5
4 TMD1
5 NRF560

3.3.5 NMT539 Ex d [ia] and TGM5 combination

When NMT539 with WB probe and NRF560 are used together, confirm that the supply voltage to TGM5 is stable at 100 VAC or higher.



5 *NMT539 Ex d [ia] and TGM5 combination*

a Fieldbus protocol
b Power supply
c Local HART (Ex d) loop (NMT539 and TGM5)
d Local HART (Ex d) loop (TGM5 and NRF560)
1 Tankvision
2 TGM5
3 NMT539
4 NRF560
5 Level
6 Gas temperature
7 Liquid temperature

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Upon receipt of the goods check the following:
- Are the order codes on the delivery note and the product label identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) enclosed?

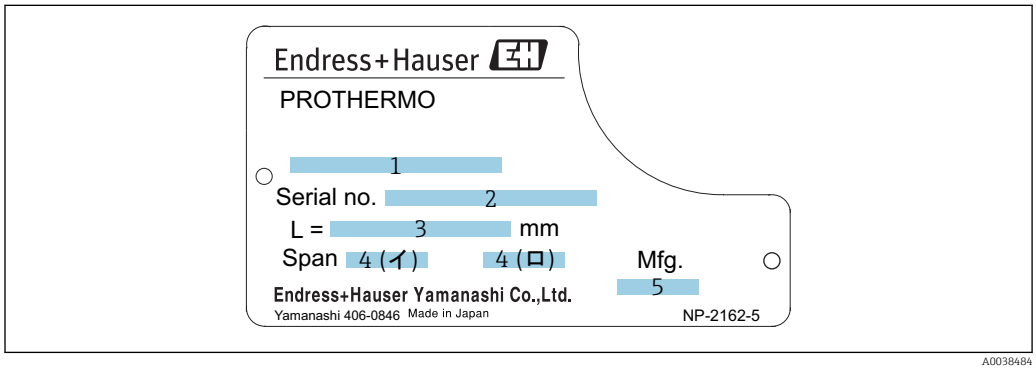
If any one of these conditions is not met, contact your Endress+Hauser Sales Center.

4.2 Product identification

The following options are available for the identification of the device:
- Nameplate
- Extended order code with a breakdown of the device features on the delivery note
- Enter serial numbers from nameplates into the *W@M Device Viewer* (www.endress.com/deviceviewer); all information on the device will be displayed.
- Enter serial numbers from nameplates into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*; all the information on the device will be displayed.

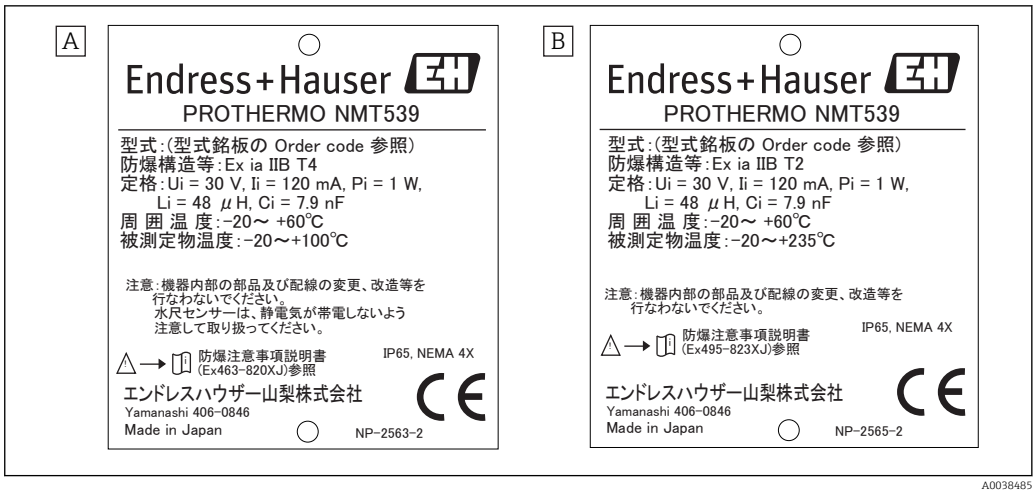
For an overview of the scope of the relevant Technical Documentation included with the product, refer to the following:
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer).
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

4.2.1 Nameplate



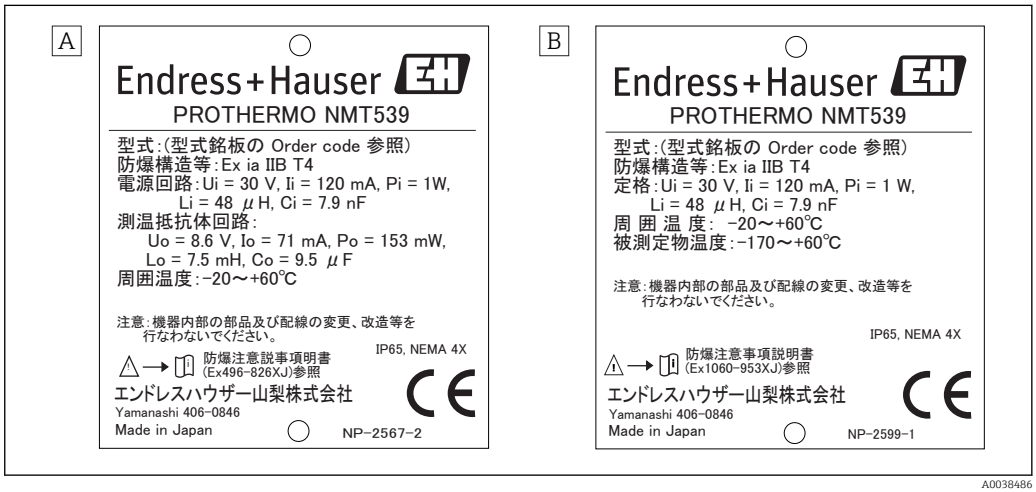
6 *NMT539 Nameplate*

1 *Order code*
2 *Serial number*
3 *Temperature probe length*
4 *Temperature measurement range*
5 *Manufacturing date*



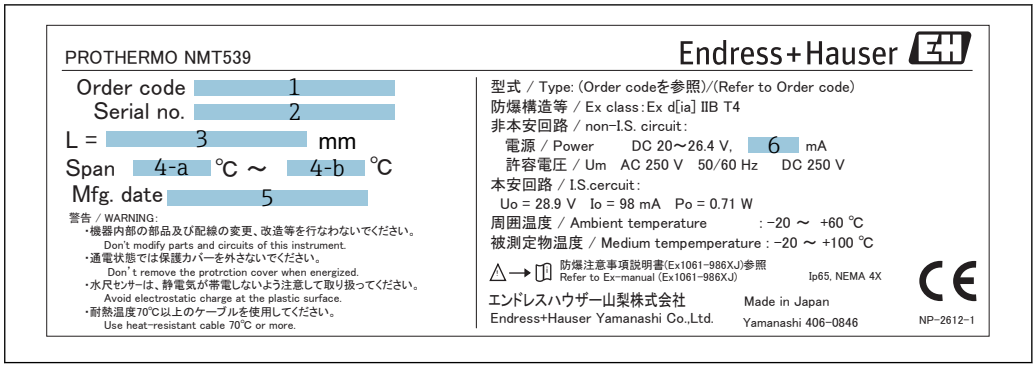
7 NMT539 TIIS Ex ia approval nameplate-1

A A Average temperature / WB (TIIS certification number: TC18319)
B B For high temperature (TIIS certification number: TC18320)



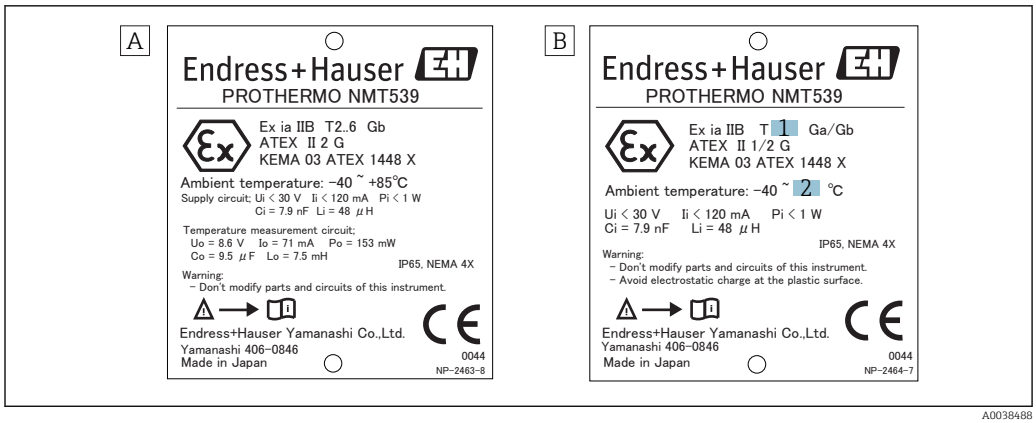
8 NMT539 TIIS Ex ia approval nameplate-2

A For converter only (TIIS certification number: TC18321)
B For low temperature (TIIS certification number: TC18604)



9 NMT539 TIIS Ex d [ia] approval nameplate (TIIS certification code: TC18884)

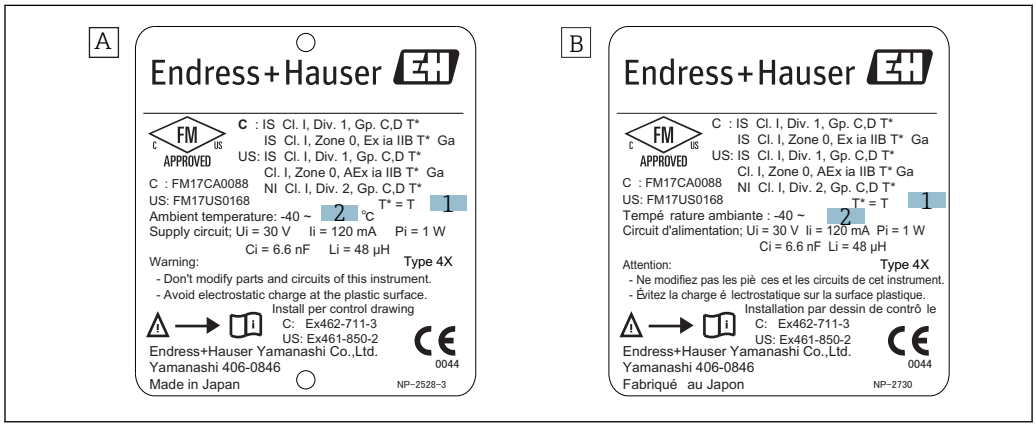
1 Order code
2 Serial number
3 Temperature probe length
4 Temperature measurement range
5 Manufacturing date
6 Consumption current



A0038488

10 NMT539 ATEX approval nameplate Ex ia

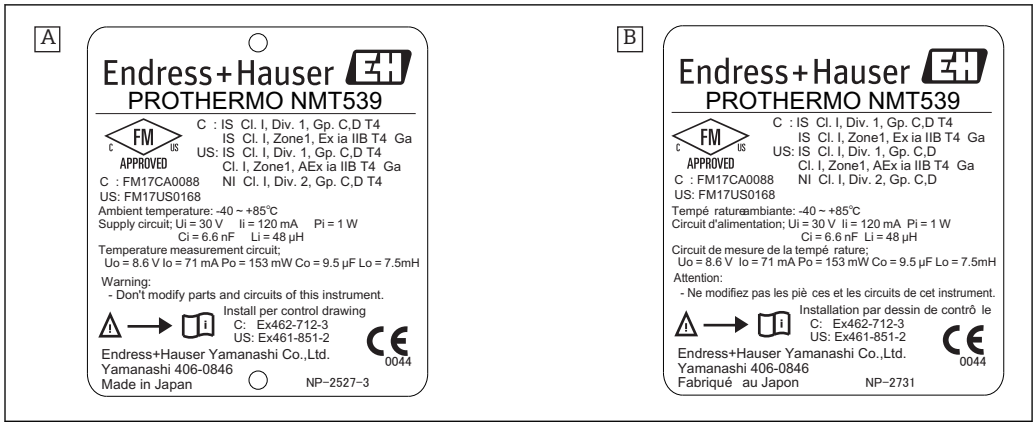
A Converter
B Average temperature / Level
1 Temperature class
2 Max. ambient temperature



A0038489

11 FM C/US approval nameplate (Converter + Average temperature + WB)

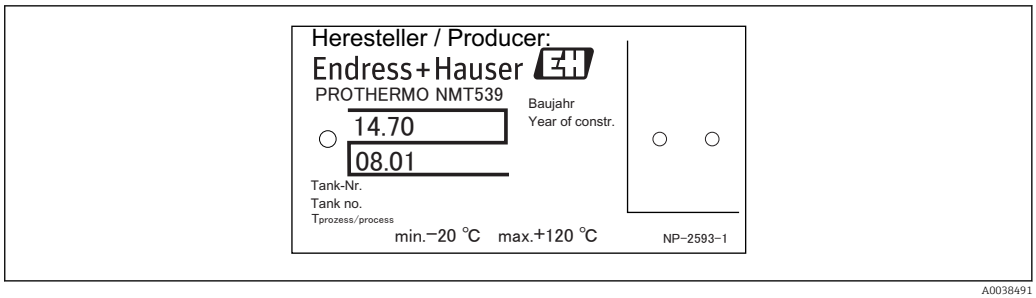
A A FM C/US approval nameplate (English)
B B FM C/US approval nameplate (French)
1 Temperature measurement range
2 Max. ambient temperature



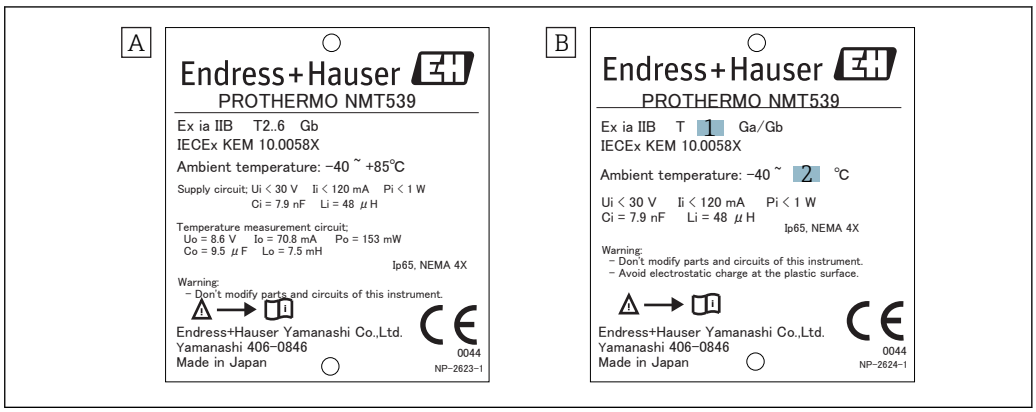
A0038490

12 FM C/US approval nameplate (for converter only)

A FM C/US approval nameplate (English)
B FM C/US approval nameplate (French)

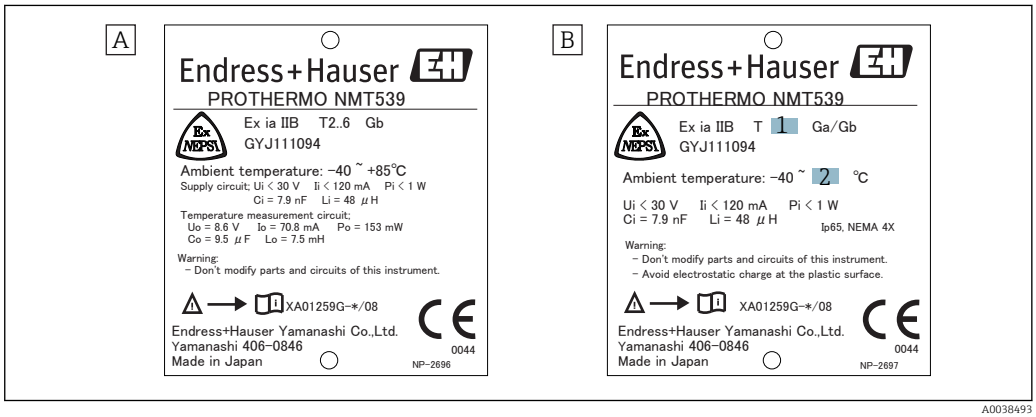


13 *NMT539 PTB W&M approval nameplate*



14 *NMT539 IEC approval nameplate*

A Converter
B Average temperature / Level
1 Temperature class
2 Max. ambient temperature



15 *NMT539 NPESI approval nameplate*

A Converter
B Average temperature / Level
1 Temperature class
2 Max. ambient temperature

16 *NMT539 EAC approval nameplate*

4.3 Manufacturer contact address

Endress+Hauser Yamanashi Co., Ltd.
862-1
Mitsukunugi, Sakaigawa, Fuefuki, Yamanashi, Japan
Address of the manufacturing plant: See nameplate.

4.4 Storage and transport

4.4.1 Storage conditions

- Storage temperature: −40 to +85 °C (−40 to 185 °F)
- Store the device in its original packaging.

4.4.2 Transport

NOTICE

The housing may become damaged or dislodged.

Risk of injury

- ▶ Transport the device to the measuring point in its original packaging or hold by the process connection.
- ▶ Do not fasten lifting devices (hoisting slings, lifting eyes etc.) at the housing; instead, secure it to the process connection. Take into account the center of gravity of the device in order to avoid unintended tilting.
- ▶ Comply with the safety instructions, transport conditions for devices over 18 kg (39.6 lbs) (IEC61010).

NOTICE

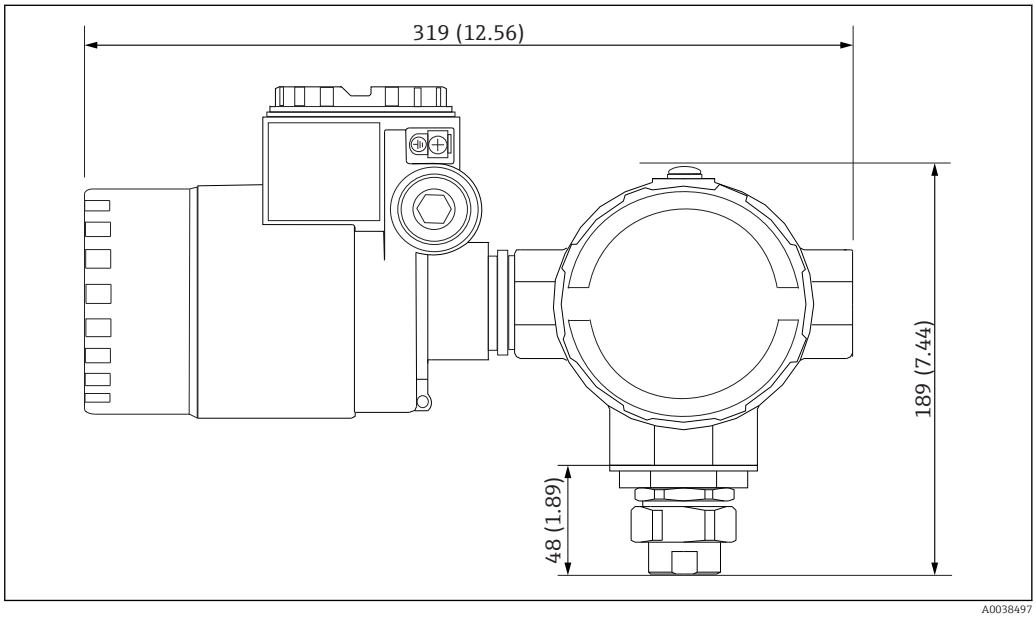
Risk of injury

- ▶ Transport the measuring device to the measuring point in its original packaging.
- ▶ Take into account the center of gravity of the device in order to avoid unintended tilting.
- ▶ Comply with the safety instructions, transport conditions for devices over 18 kg (39.6 lbs) (IEC61010).

5 Installation

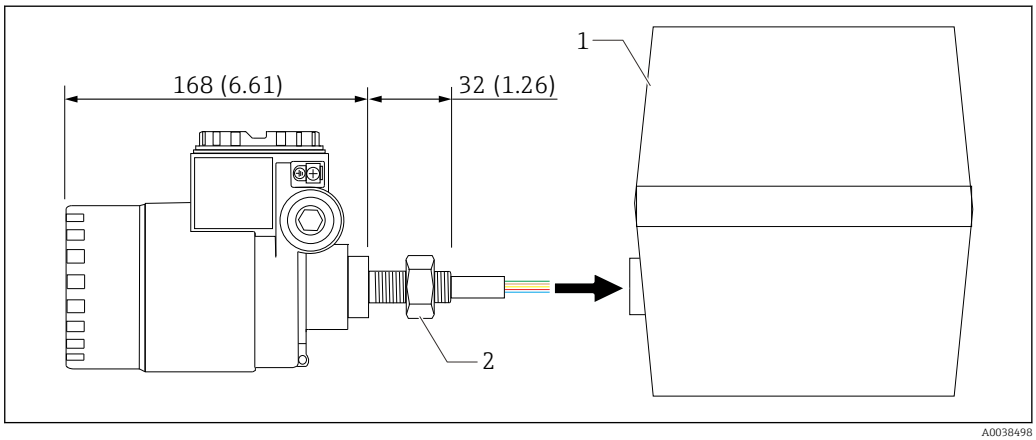
5.1 Dimensions of NMT539

5.1.1 Type 1: converter



17 *Type 1: converter (standard G3/4 (NPS 3/4) universal coupling connection). Unit of measurement mm (in)*

5.1.2 Type 2: converter



18 *Type 2: converter (Varec 1700, M20 threaded connection). Unit of measurement mm (in)*

1 Lock nut
2 1700 series RT probe terminal box

The UK model is designed specifically to connect with a Whessoe Varec 1700 series average temperature probe. WB data is not available for the UK model.

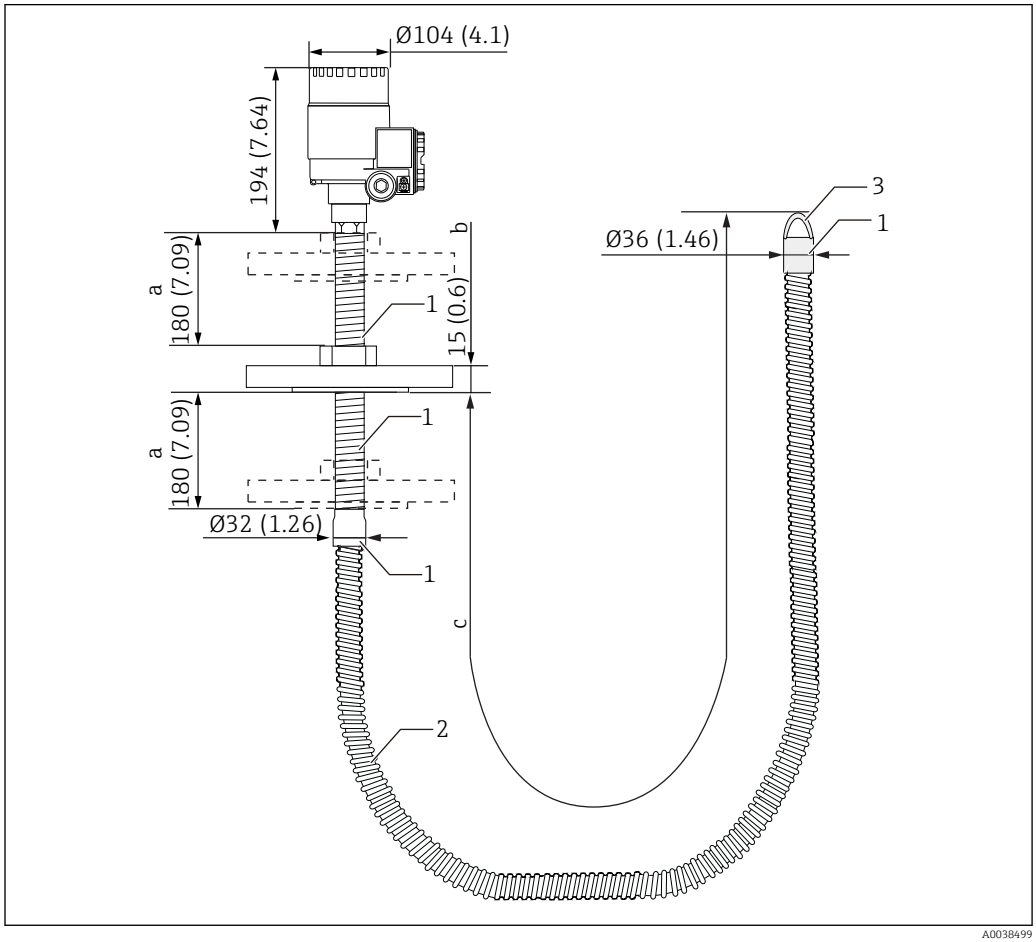
UK model M20 threaded type and Varec 1700 terminal housing connection procedure

1. Use sealing tape to protect the threaded connection opening, and insert the cable bundle (RTD signal entry cable) in the female threaded connection opening on the terminal box.

2. Screw on the NMT539 gauge head by rotating it at least 10 times clockwise, and secure it with a lock nut.
   ↳ A loose connection between NMT539 and Varec1700 terminal housings will lead to malfunction due to flooding and other factors.

This completes the procedure.

5.1.3 Converter + average temperature probe version



19 *Converter + average temperature probe. Unit of measurement mm (in)*

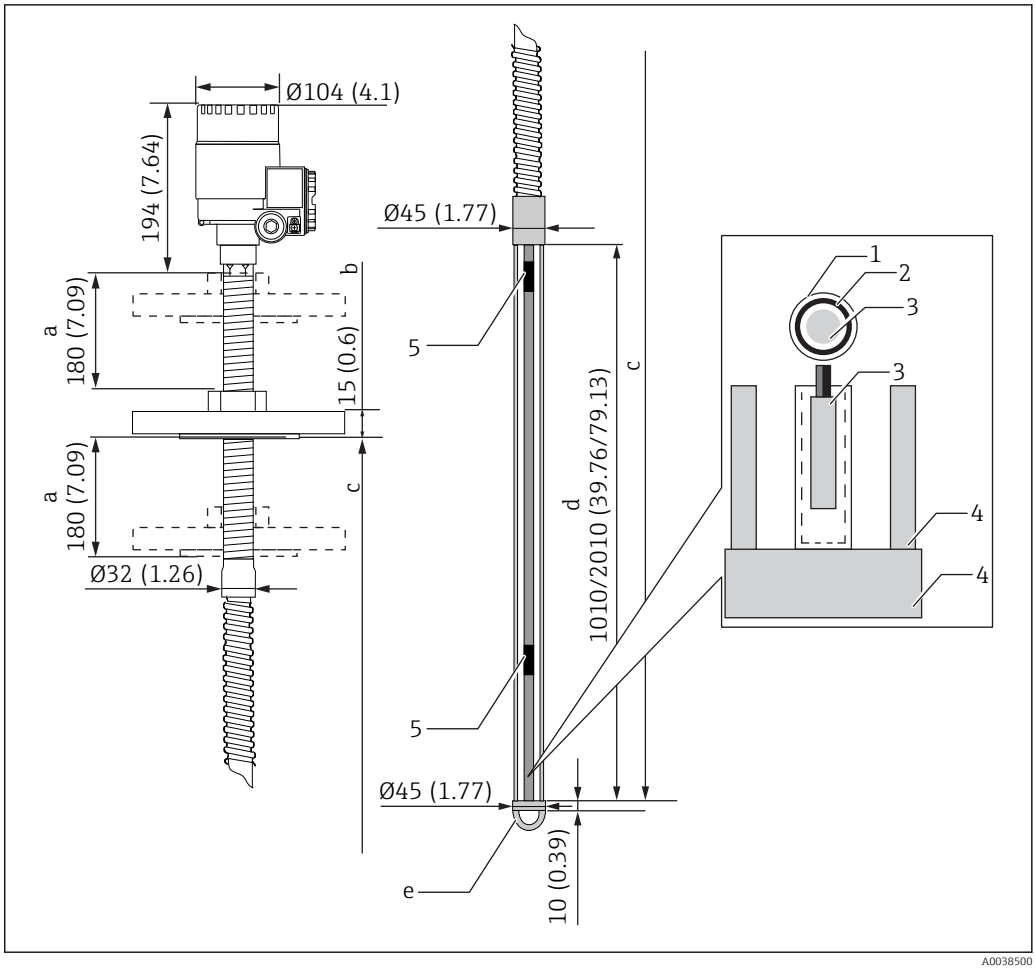
a Adjustable installation height
b Based on flange standards
c Temperature probe length (see below)
1 SUS316
2 SUS316L
3 SUS316

The following tolerances are applied regardless of whether or not there is an optional WB probe.

- If the probe length is 50 000 mm (1 968.5 in) or less, tolerance is ± 50 mm (1.97 in).
- If the probe length is 50 001 to 99 999 mm (1 968.54 to 3 936.97 in), tolerance is ± 100 mm (3.94 in).

The position of the flange cannot be adjusted in a welding flange type.

5.1.4 Converter + average temperature probe + water bottom probe



20 *Converter + temperature probe + WB probe. Unit of measurement mm (in)*

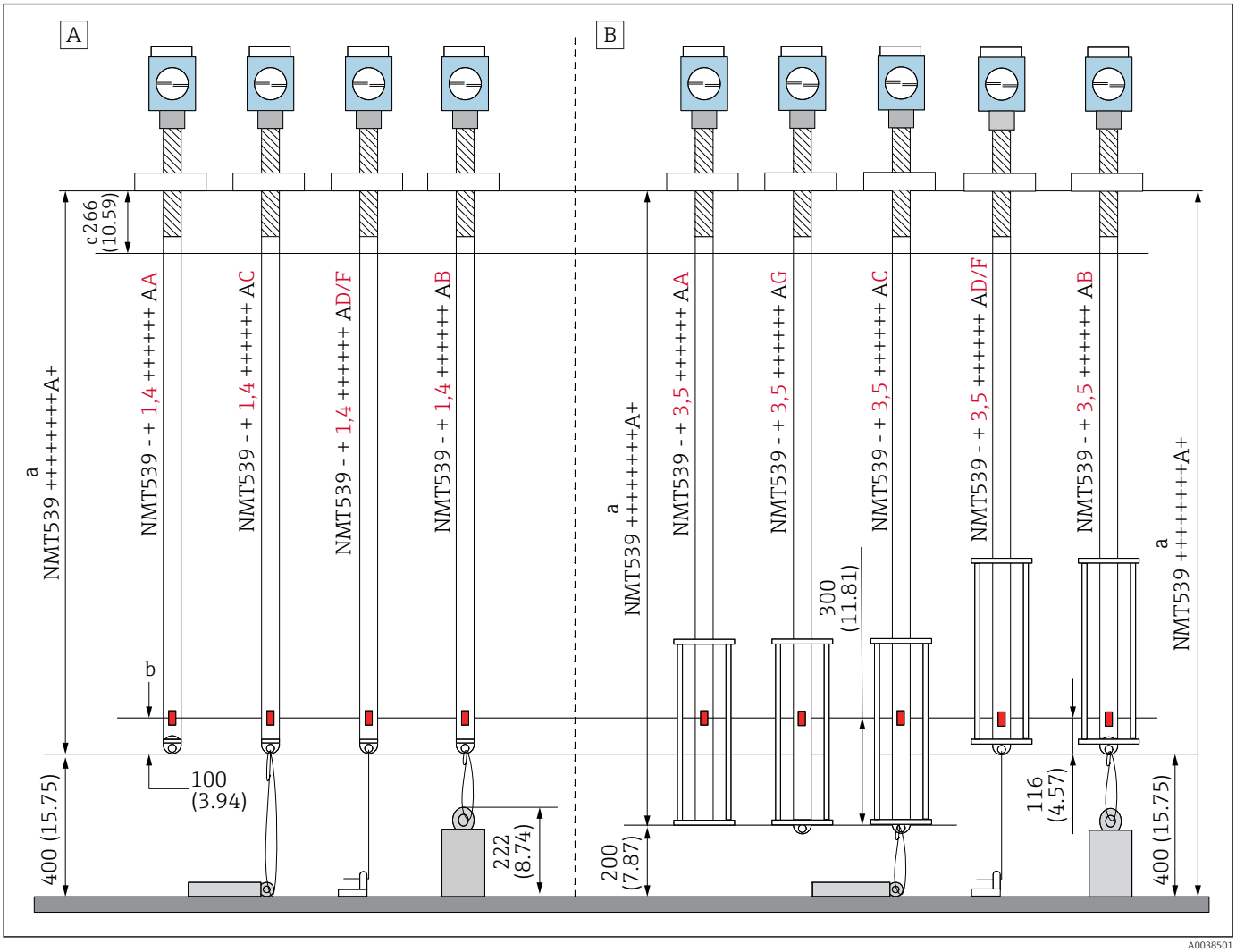
a Adjustable installation height
b Based on flange standards
c Probe length (from flange bottom to the tip of WB probe) (see below)
d Capacitance WB probe
e Anchor weight hook (optional) (SUS316)
1 PFA protection tube (SUS316: thickness 1 mm (0.04 in))
2 Intermediate rod (SUS304)
3 Pt100 element
4 Base plate / side rod (SUS316)
5 Element (Pt100 element can be installed up to 2 points)

The following tolerances are applied regardless of whether or not there is an optional WB probe.

- If the probe length is 50 000 mm (1 968.5 in) or less, tolerance is ± 50 mm (1.97 in).
- If the probe length is 50 001 to 99 999 mm (1 968.54 to 3 936.97 in), tolerance is ± 100 mm (3.94 in).

The position of the flange cannot be adjusted in a welding flange type.

5.2 Position of element No. 1

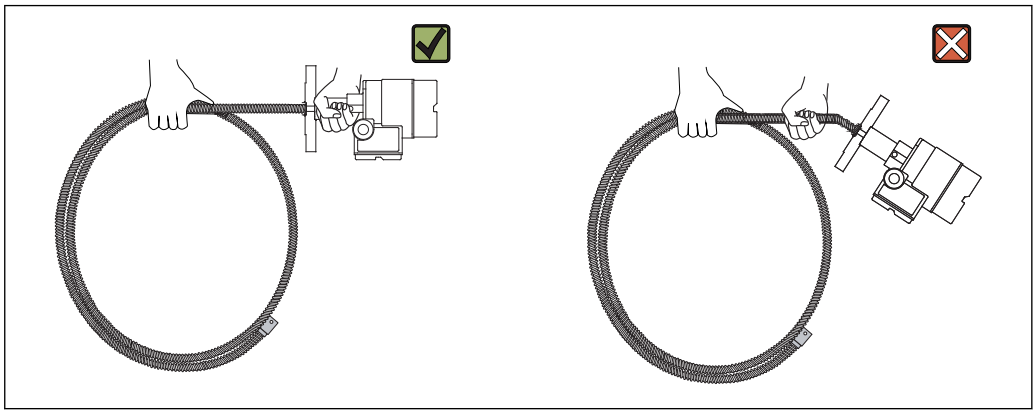


21 *Element No. 1 position. Unit of measurement mm (in)*

A Converter + temperature probe
B Converter + temperature probe + WB probe
a Below the flange
b Element No.1
c Distance from the flange bottom to flexible probe

5.3 Unpacking

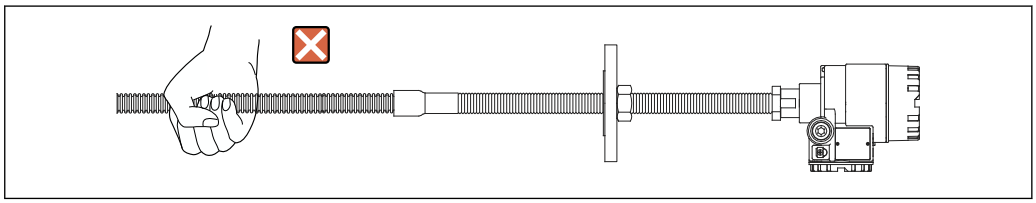
Unpack NMT539 with multiple people. If one person unpacks NMT539, the temperature probe may become bent or twisted.



22 *Unpacking NMT539*

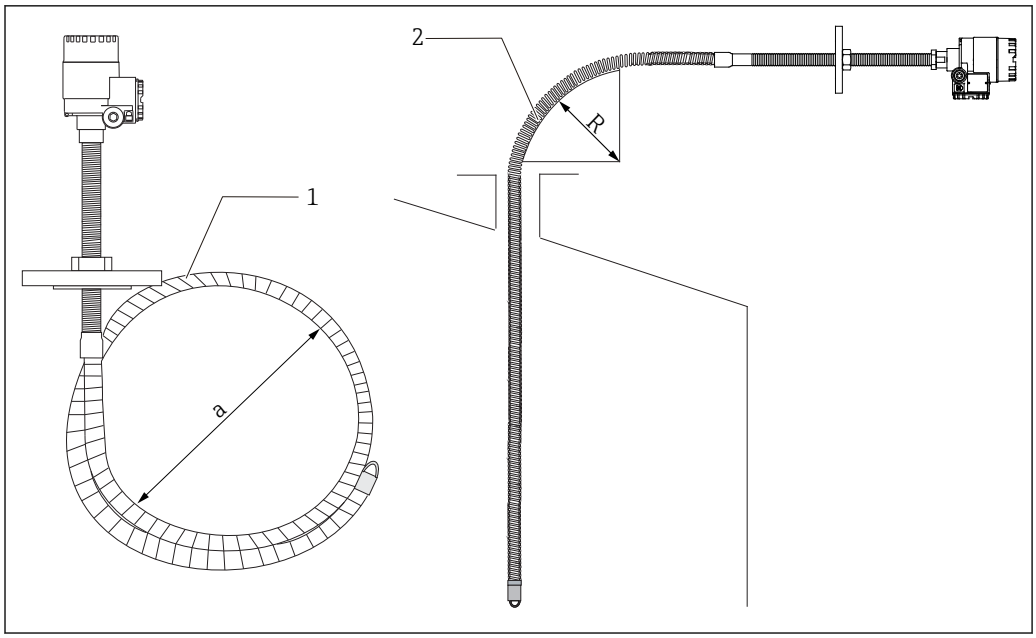
5.4 Temperature probe handling

Do not pull the gauge head while holding onto the temperature probe. This may cause the system to malfunction.



23 *Temperature probe handling*

When winding the temperature probe, keep the diameter of the coil at a minimum of 1 000 mm (39.4 in).When installing the temperature probe onto a tank or if it is necessary to bend the temperature probe, ensure that the bent portion is at least R = 500 mm (19.7 in).



24 Installation and winding of a temperature probe

a 1 000 mm (39.4 in) or more
R 500 mm (19.7 in) or more
1 Temperature probe
2 Element protection pipe

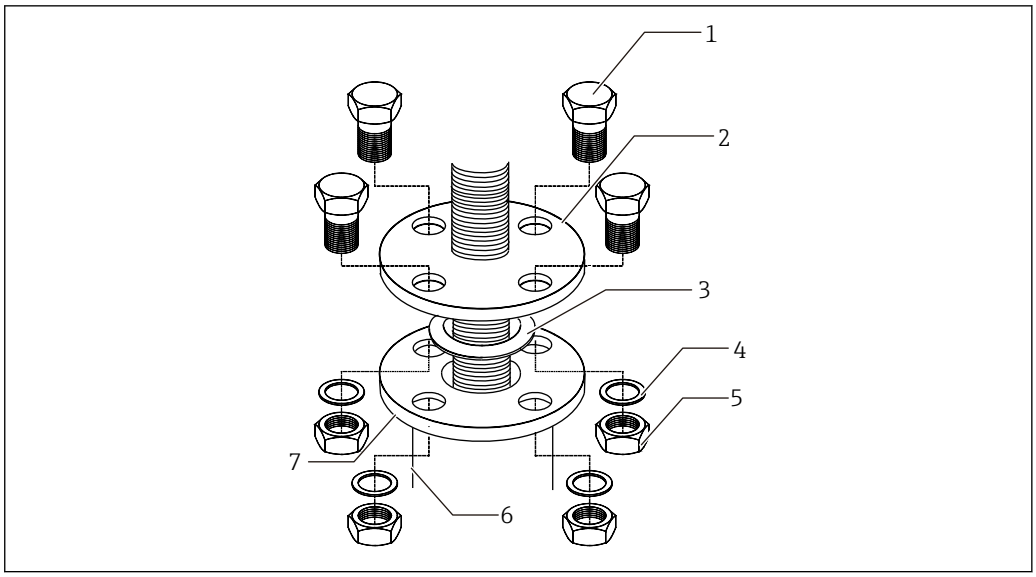
If the bend in the temperature probe is made with R = 500 mm (19.7 in) or smaller, it may damage the probe and elements.

5.5 Installation procedure

The length of the NMT539 probe is predetermined by the customer. Check the following items before installing.

- Tag number on the NMT539 main unit
- Length of the temperature probe
- Number of elements
- Element intervals

- Install NMT539 at least 500 mm (19.7 in) away from the wall. This will ensure that the temperature measurement is not affected by the tank's ambient or wall temperatures.
- The procedure for installing NMT539 will vary depending on the tank's shape and type. A cone roof tank and a floating roof tank are used for the following examples. The procedure for installing a flange for a temperature probe is the same regardless of what type of tank is being used.
- The recommended standard diameter of an installation nozzle is 50A (2").



25 *NMT539 installation*

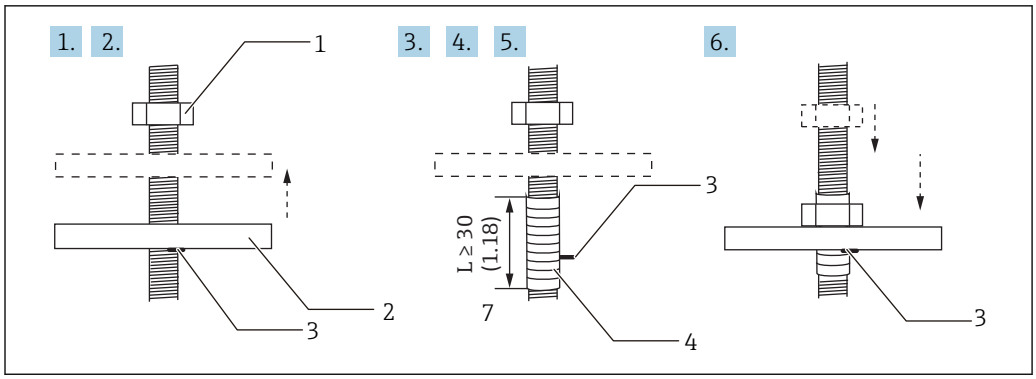
1 *Hexagonal bolt*
2 *Temperature probe tip*
3 *Gasket*
4 *Washer*
5 *Bolt*
6 *Installation nozzle*
7 *Tank top flange*

Procedure for wrapping sealing tape

In order to improve the airtightness in flange connection, wrap the screwing side with sealing tape that is at least 30 mm (1.18 in) wide.

1. Once the installation height of the probe has been determined, lift the probe and mark the position of the bottom of the flange.
2. Rotate the flange and move it towards the converter by approximately 30 mm (1.18 in).
3. Wrap sealing tape (example: PTFE or other suitable materials) around the adjustment pipe located below the bottom of the flange (see figure below).
4. Rotate the flange and return it to the (marked) installation height.
5. Wrap sealing tape around the adjustment pipe above the flange.
6. Lower the lock nut and secure it in place until the flange is airtight.

This completes the procedure for wrapping sealing tape.



26 Wrapping with sealing tape. Unit of measurement mm (in)

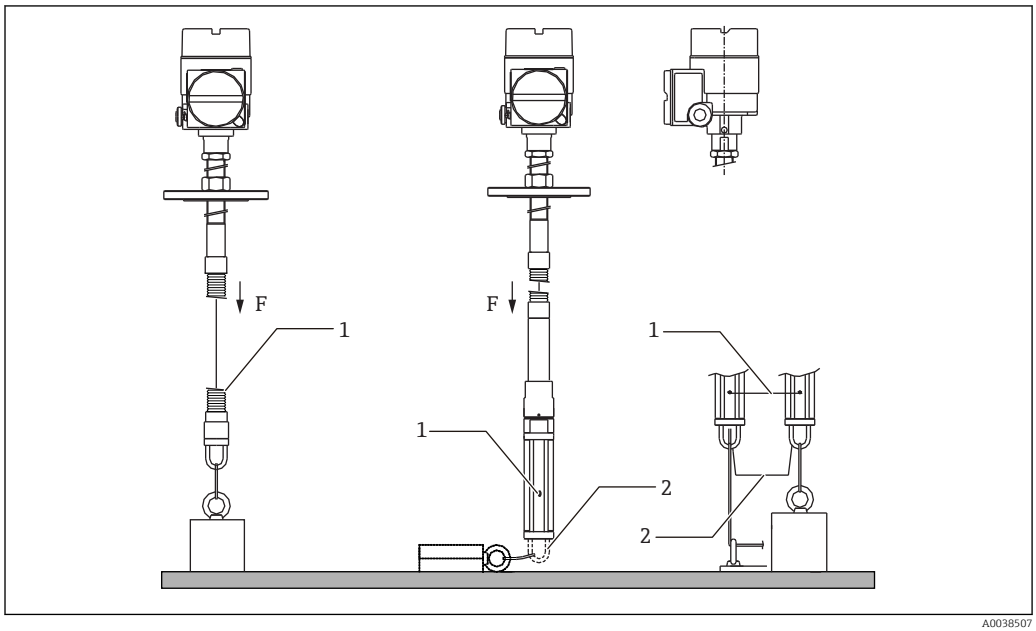
1 Nut
2 Flange
3 Mark
4 Sealing tape

CAUTION

Precautions regarding tension on anchor weight and top anchor

Applying tension of 16 kg or more will cause internal damage in the temperature probe.

► Ensure that the tension during and after installation is no more than 16 kg.



27 Installation of anchor weight / top anchor

F During/after installation: F ≤ 16 kg (35.3 lb)
1 Lowest temperature element position
2 Hook

5.6 Precautions for NMT539: −170 °C (−274 °F) specifications

When NMT539 is installed in cryogenic tanks, air pressure in the protection pipe and electrical housing may decrease drastically due to the rapid cooling of the temperature probe. During this process, leave the terminal cover open until the air pressure inside the temperature probe and electrical housing is stable. When removing NMT539 from a cryogenic tank, the air pressure inside the temperature probe and electrical housing may increase drastically due to sudden warming. In such conditions, external impact may cause the temperature probe to crack or create a hole. This results in a dangerous situation, as compressed air escapes and explodes the protection pipe.

To prevent this when removing NMT539 from a cryogenic tank, turn off the power until the air pressure of the protection pipe and electrical housing is stable, and leave the terminal cover open.

28 −170 °C (−274 °F) caution plate

5.7 Mounting NMT539 on a cone roof tank

When installing a WB probe, check "point zero" (reference position) on the WB probe by comparing it to a manual dipping reference.

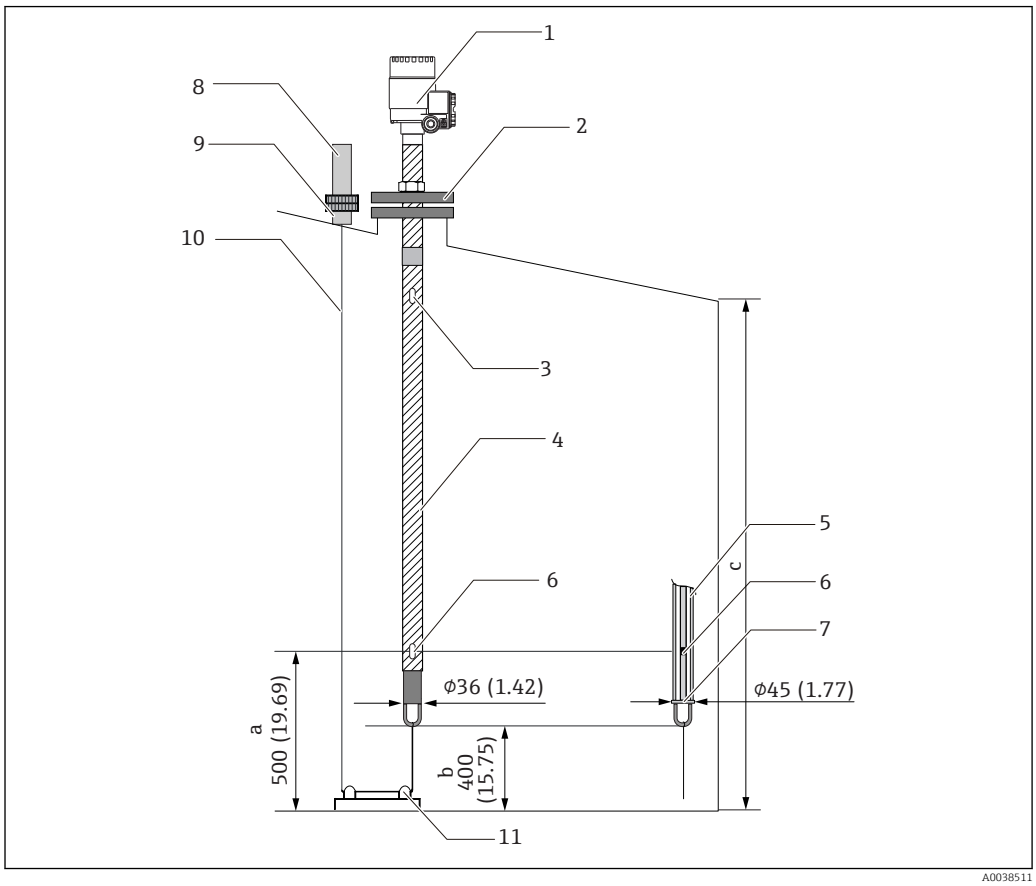
There are three ways to install NMT539 onto a cone roof tank:

- Top anchor method
- Thermo well method
- Anchor weight method

If a heating coil is attached to the bottom of the tank, install NMT539 so that the bottom of the temperature probe or WB probe is not too close to the heating coil (distance varies depending on the type of heating coil).

5.7.1 Top anchor method

In this method, the temperature probe or the WB probe is secured using a wire hook and a top anchor.



29 *Top anchor method . Unit of measurement mm (in)*

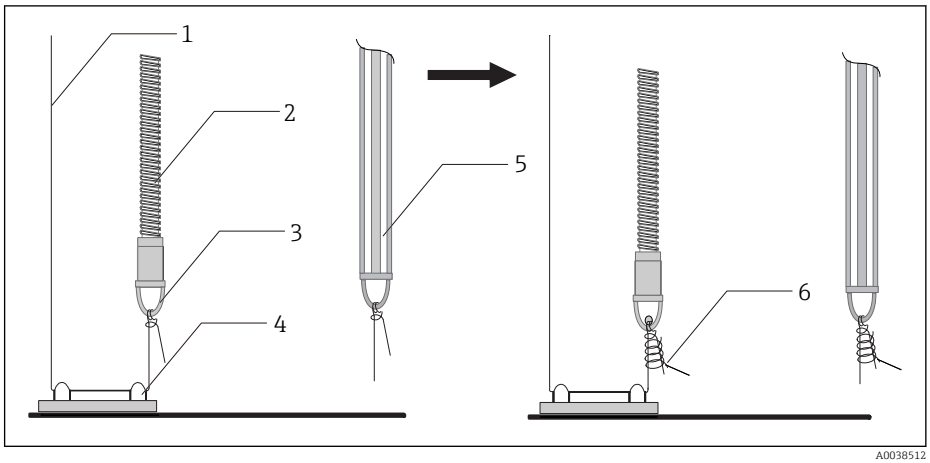
a From the tank bottom to the lowest element
b From the tank bottom
c Tank height
1 Electrical compartment
2 Flange
3 Highest temperature element
4 Temperature probe
5 WB probe
6 Element position #1 (lowest element)
7 Zero point
8 Top anchor
9 Socket
10 Tension wire
11 Wire hook

Top anchor installation procedure

The temperature probe and WB probe can be easily damaged. Ensure that they do not hit a corner when they are being inserted from the installation nozzle.

1. Pass the temperature probe and the WB probe through a gasket and insert them from the installation nozzle at the top of the tank.
2. Rotate the main unit based on the wiring layout and obstacles in order to position the cable gland in an optimal direction.
3. Suspend the tension wire from the top anchor at the top of the tank and temporarily secure its end to the top anchor.
4. Pass the tension wire through the wire hook at the bottom of the tank.

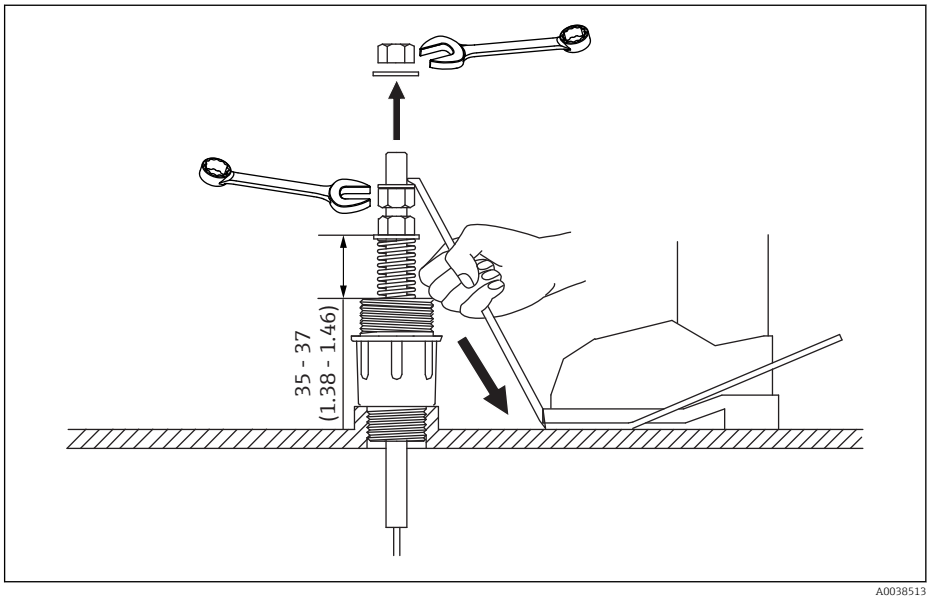
5. Wrap the tension wire around the hook twice.
6. Tie the tension wire, and then bundle the knot with the provided securing wire.



30 *Top anchor installation 1*

1 *Tension wire*
2 *Temperature probe*
3 *Hook (wire suspension)*
4 *Wire hook*
5 *WB probe*
6 *Provided securing wire*

7. Use bolts to secure the flange of NMT539 to the installation nozzle on top of the tank.
   Compress the anchor spring until it is 35 to 37 mm (1.38 to 1.46 in).
8. Secure the tension wire to the top anchor while drawing it by holding it down with a foot or a hand.
9. Wrap the end of the tension wire once around the top anchor's axis, and tighten it using two nuts.
10. Cut the excess tension wire.
11. Rotate the nuts clockwise until the top anchor's spring is 35 to 37 mm (1.38 to 1.46 in).



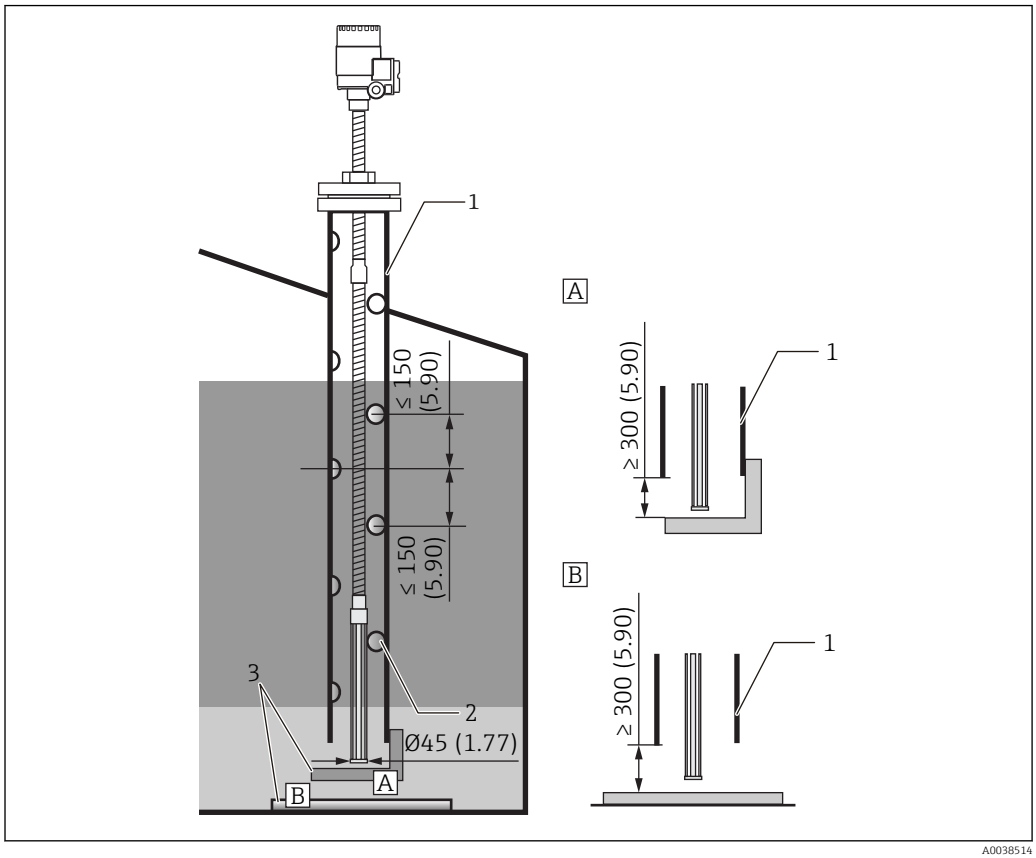
31 *Top anchor installation 2. Unit of measurement mm (in)*

12. Cover the top anchor.

This completes the procedure for installing a top anchor.

5.7.2 Thermo well method

Insert a temperature probe and a WB probe into a thermo well that is 50A (2") or larger.



32 *Thermo well. Unit of measurement mm (in)*

A Base plate case 1
B Base plate case 2
1 Thermo well
2 Hole (Ø 25 mm (0.98 in))
3 Base plate

Thermo well installation procedure

1. Pass the temperature probe and the WB probe through a gasket and insert them from the installation nozzle at the top of the tank.
2. Rotate the main unit based on the wiring layout and obstacles in order to position the cable gland in an optimal direction.
3. Use bolts to secure the flange of NMT539 to the installation nozzle on top of the tank.

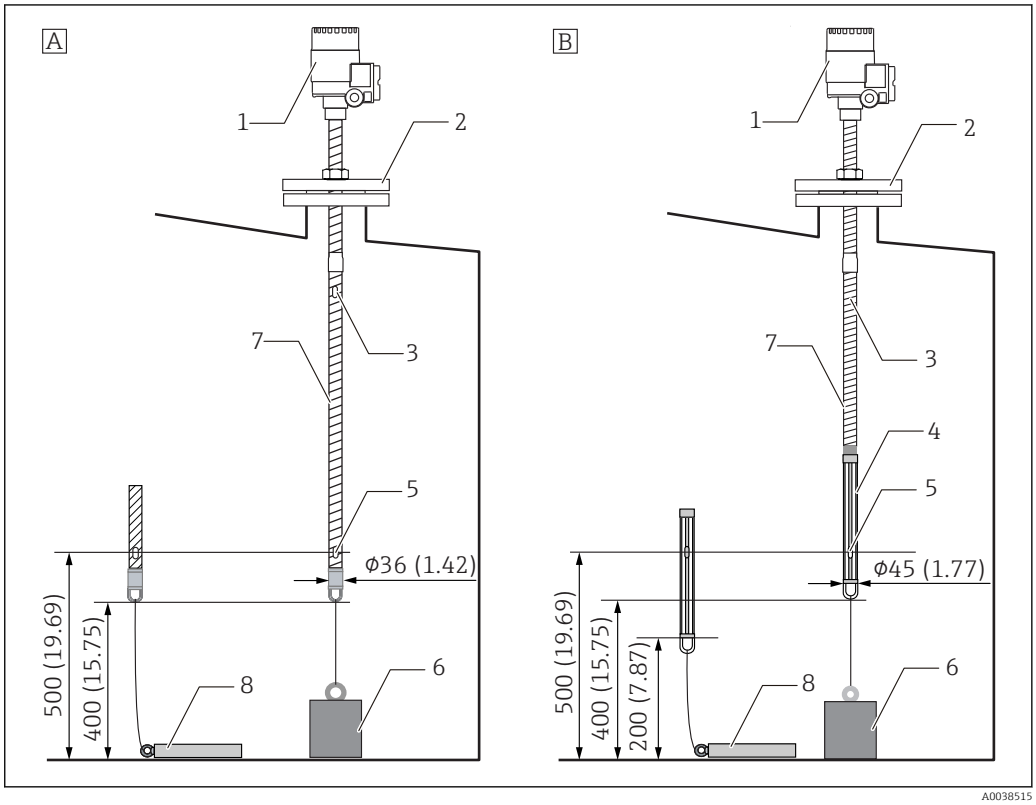
This completes the procedure for installing a stilling well.

- If an anchor weight is not being used in the thermo well method, install the WB probe so that its end is below the bottom of the thermo well. This will allow the pipe to be filled with liquid.
- A thermo well is available from a 50A (2") (JIS, ANSI) pipe.
- When using an anchor weight, use a pipe that is 100A (4") (JIS, ASME) or larger.
- Do not move the WB probe horizontally or swing it. This will cause turbulence, which could damage the WB probe.
- The temperature probe and WB probe can be easily damaged. Ensure that they do not hit a corner when they are being inserted from the installation nozzle.

5.7.3 Anchor weight method

This method secures a temperature probe using an anchor weight.

The temperature probe can be easily damaged. Ensure that it does not hit a corner if it is being inserted from the installation nozzle.



33 *Anchor weight method. Unit of measurement mm (in)*

A Without WB probe
B With WB probe
1 Electrical compartment
2 Flange
3 Top terminal
4 WB probe
5 Bottom terminal
6 High-profile weight
7 Temperature probe
8 Low-profile weight

⚠ CAUTION

Installation of an anchor weight

Using an anchor weight that is heavier than 16 kg may cause internal damages to the temperature probe.

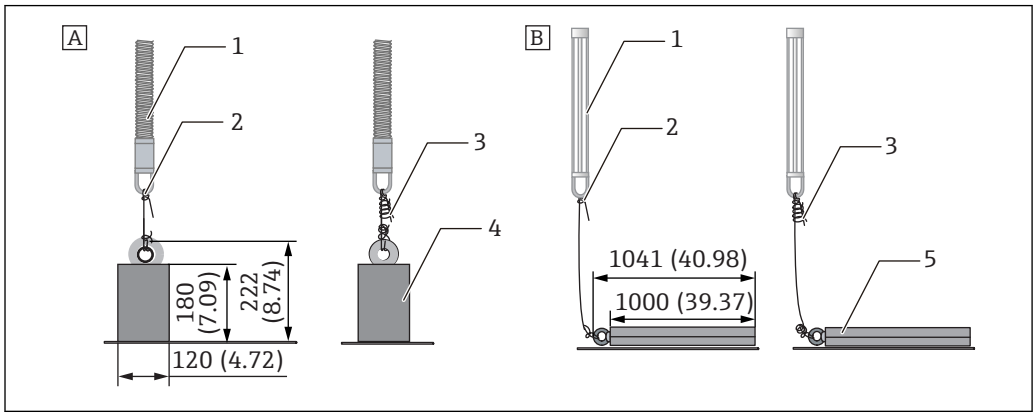
- ▶ Ensure that the anchor weight is stable at the bottom of the tank. When installing NMT539 with a suspended anchor weight, use an anchor weight that weighs 16 kg or less.

Anchor weight installation procedure

1. Pass the temperature probe and the WB probe through a gasket and insert them from the installation nozzle.
2. Rotate the main unit based on the wiring layout and obstacles in order to position the cable gland in an optimal direction.
3. Tie the bottom hook of the temperature probe or the WB probe to the anchor weight's ring using a tension wire.

4. Wrap the tension wire twice around the bottom hook. Pull it downwards and tie it down, and then bundle it with the provided securing wire.
5. Using bolts, secure the flange of NMT539 to the nozzle at the top of the tank.

This completes the procedure for installing an anchor weight.



34 *Anchor weight installation. Unit of measurement mm (in)*

A High-pressure weight
B Low-pressure weight
1 Temperature probe
2 Bottom hook
3 Provided securing wire
4 High-profile weight
5 Low-profile weight

5.8 Mounting NMT539 on a floating roof tank

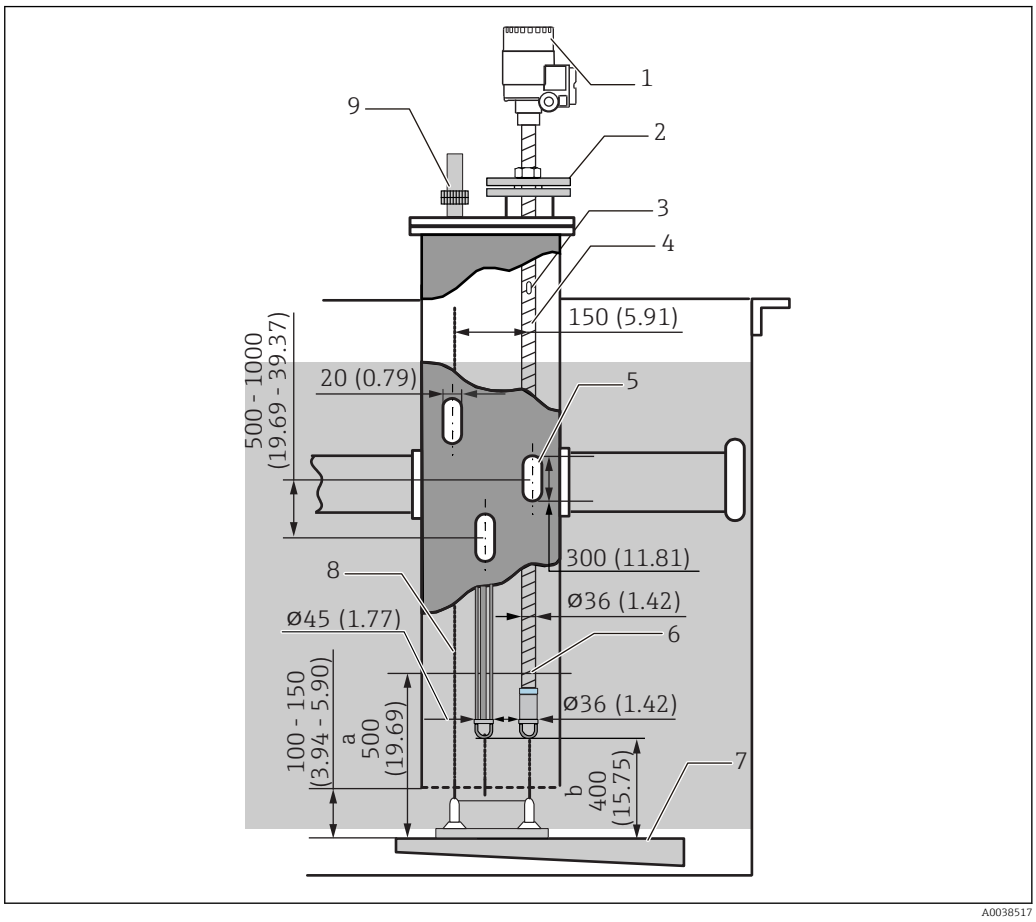
There are three ways to mount NMT539 on to a floating roof tank.

- Top anchor method
- Thermo well method
- Guide ring and anchor weight method

If a heating coil is attached to the bottom of the tank, install NMT539 such that the bottom hook of a temperature probe or a WB probe is not too close to the heating coil.

5.8.1 Top anchor method

Insert a temperature probe or a WB probe into a fixed pipe, and secure it with a top anchor. In NMS5, NMS7, NMS8x and NMT539, both can be installed in one fixed pipe.



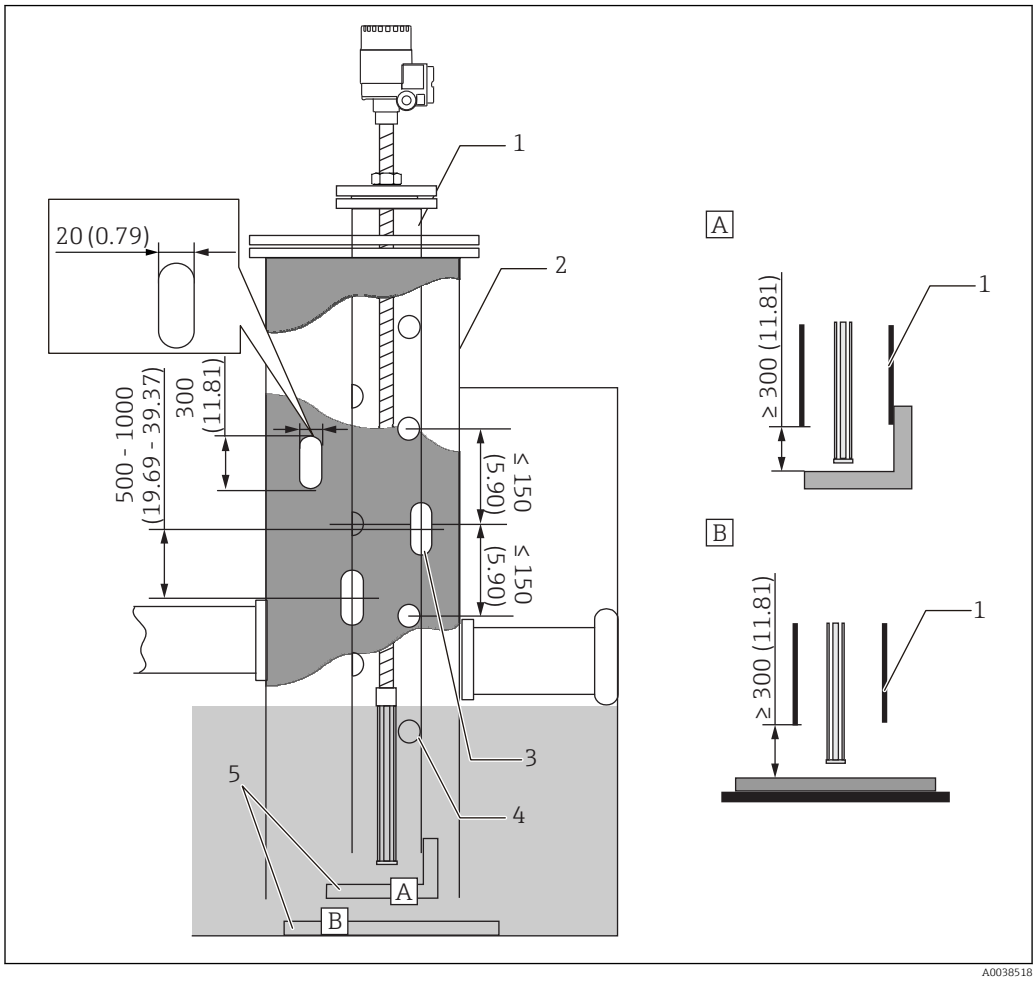
35 *Top anchor method. Unit of measurement mm (in)*

a Distance between the base plate and the bottom element
b Distance between the base plate and the WB probe
1 Converter (electrical compartment)
2 Flange
3 Top element
4 Temperature probe (without WB probe)
5 Thermo well hole
6 Temperature probe (with WB probe)
7 Element position #1 (lowest element)
8 Base plate
9 Tension wire
10 Top anchor

The installation procedure is the same as the installation procedure for a cone-roof tank. → 31

5.8.2 Thermo well method

Insert a temperature probe and a WB probe into a thermo well that is 50A (2") or larger.



36 Thermo well method. Unit of measurement mm (in)

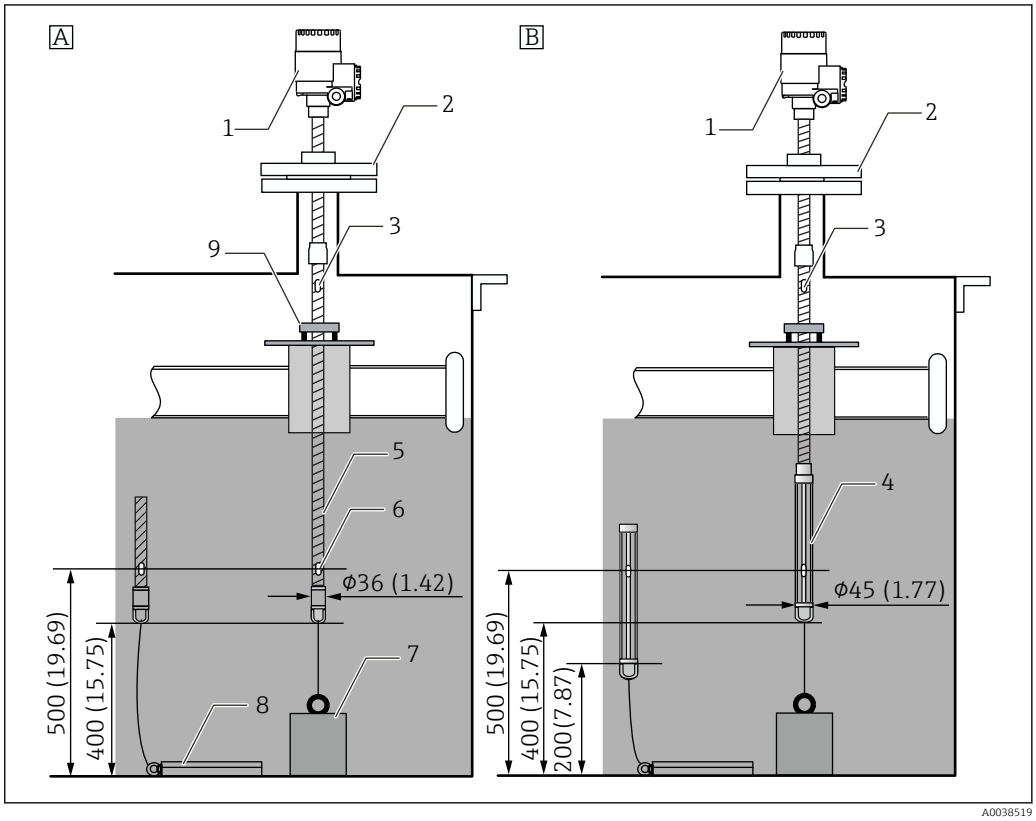
A Base plate case 1
B Base plate case 2
1 Thermo well
2 Fixed pipe
3 Thermo well hole
4 Hole (Ø 25 mm (0.98 in))
5 Base plate

The installation procedure is the same as the installation procedure for a cone-roof tank. → 31

5.8.3 Guide ring and anchor weight method

Secure a temperature probe and/or a WB probe using a guide ring and an anchor weight.

The temperature probe and WB probe can be easily damaged. Ensure that they do not hit a corner when they are being inserted from the installation nozzle.



37 *Guide ring and anchor weight method. Unit of measurement mm (in)*

A Without WB probe
B With WB probe
1 Electrical compartment
2 Flange
3 Top element
4 WB probe
5 Temperature probe
6 Bottom element
7 High-profile weight
8 Low-profile weight
9 Guide ring

⚠ CAUTION

Installation of an anchor weight

Using an anchor weight that is heavier than 16 kg may cause internal damages to the temperature probe.

- Ensure that the anchor weight is stable at the bottom of the tank. When installing NMT539 with a suspended anchor weight, use an anchor weight that weighs 16 kg or less.

Anchor weight installation procedure

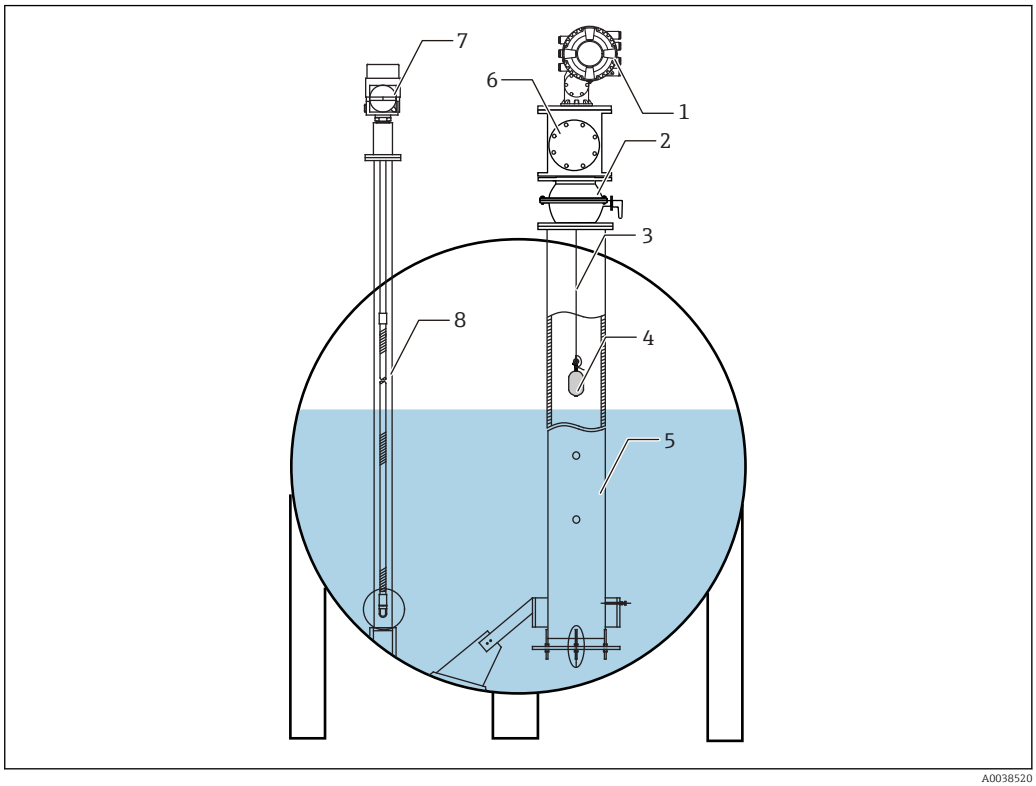
1. Pass a temperature probe and a WB probe through a gasket, and lower them from the installation nozzle at the top of the tank.
2. Rotate the main unit based on the wiring layout and obstacles in order to position the cable gland in an optimal direction.

3. Tie the bottom hook of the temperature probe and the anchor weight's ring using a tension wire.
4. Wrap the tension wire twice around the bottom hook. Pull it downwards to tie it, and reinforce the knot using the provided securing wire.
5. Use bolts to secure the flange of NMT539 to the nozzle on top of the tank.

This completes the procedure for installing an anchor weight.

5.9 Mounting NMT539 on a pressurized tank

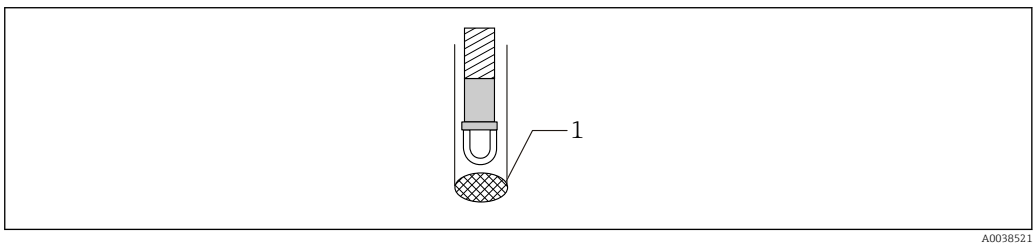
With pressurized tanks, a thermo well (protective pipe) must be installed in order to protect the probes from pressure.



38 *Thermo well for a pressurized tank*

1 *NMS8x / NMS5*
2 *Ball valve*
3 *Measuring wire*
4 *Displacer*
5 *Stilling well*
6 *Calibration / maintenance chamber*
7 *NMT539*
8 *Thermo well*

- If the pressure inside a tank exceeds the atmospheric pressure (absolute pressure 1 bar, 100 kPa, 14.5 psi), install a thermo well (protective pipe) with no holes or slits onto NMT539. However, NMS8x requires a stilling well with holes and slits.
- NMT539 is installed in the thermo well (protective pipe) from the top of the tank nozzle.
- Cover the bottom of the thermo well for NMT539 and weld it to protect the probe from the pressure.

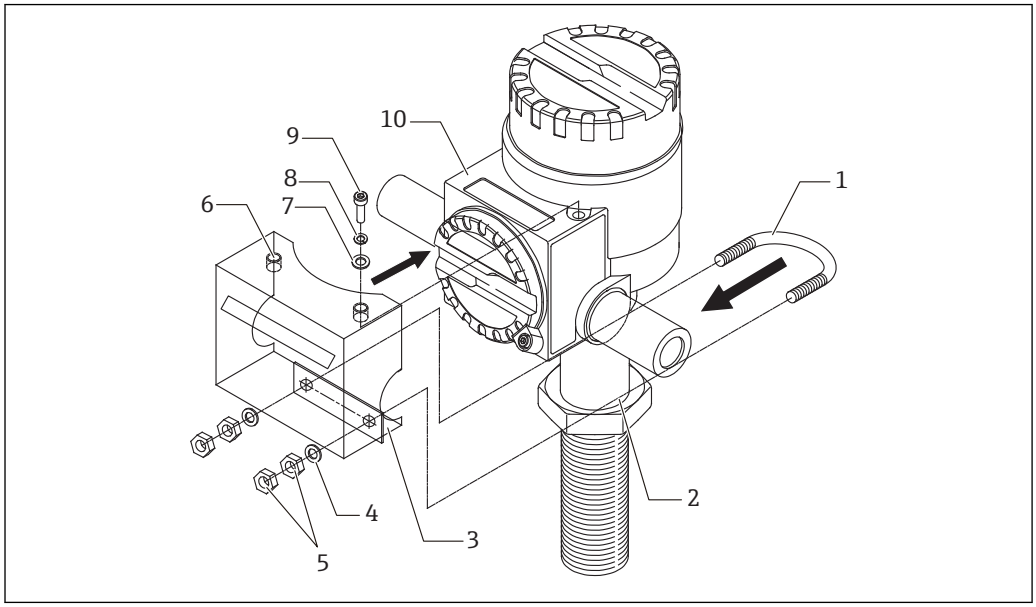


39 *Thermo well welding*

1 *Welding point*

5.10 Protective cover

NMT539 TIIS Exd [ia] requires a protective cover to be installed.



40 *Protective cover installation*

1 *U bolt*
2 *WB adapter*
3 *Protective cover*
4 *Washer*
5 *Double nut*
6 *Boss*
7 *Washer*
8 *Spring washer*
9 *Bolt with hole*
10 *Housing*

Protective cover installation procedure

1. Place a protective cover over the housing from the terminal cover side.
2. Secure it with bolts with holes, spring washers and washers from the top of the protective cover.
3. Insert the U bolt into the protective cover installation hole from the WB adapter side.
4. Secure it from the protective cover side with washers and double nuts.

This completes the procedure for installing a protective cover.

- Over-tightening the nuts may deform the protective cover.
- TIIS Ex d [ia] comes with two SXC-16B cable glands. Always use the cable glands that are provided with NMT539.

6 Electrical connection

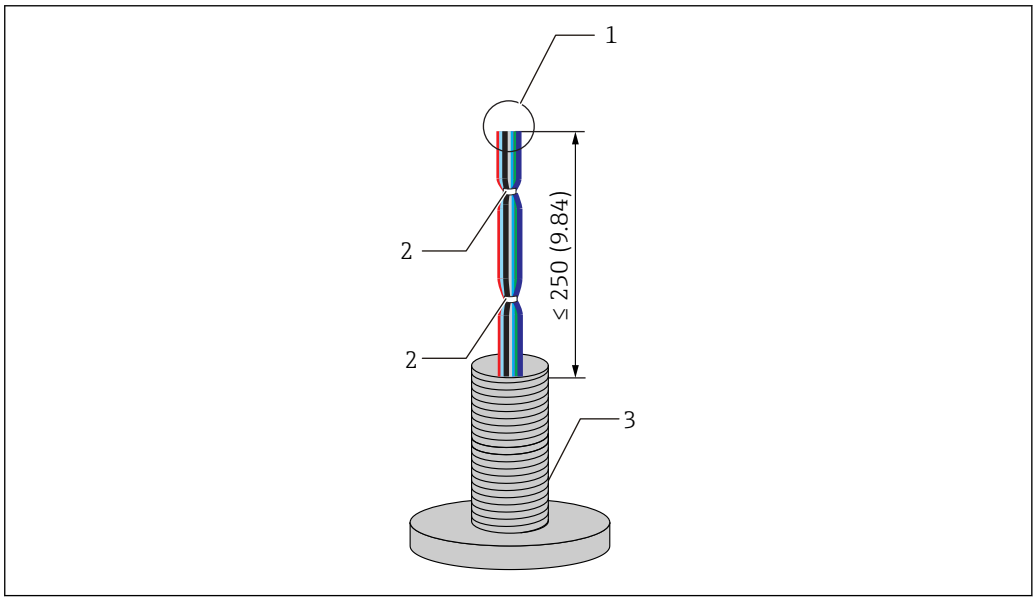
6.1 Mechanical connection for converter-only version

Preparation of mechanical connection

Check the following items before replacing an existing RTD temperature converter. They are required for the installation of the NMT539 converter-only type *8702. Element type:

- Number of elements
- Presence/absence of additional tank bottom and gas phase spot temperature elements other than average temperature elements
- Lowest element position
- Element interval
- Cable color for each element

Before installing NMT539, bundle all RTD cables (including coaxial cable for temperature sensor and WB probe) temporarily using a zip tie or a short string so that the cables do not become damaged during the mechanical connection process.



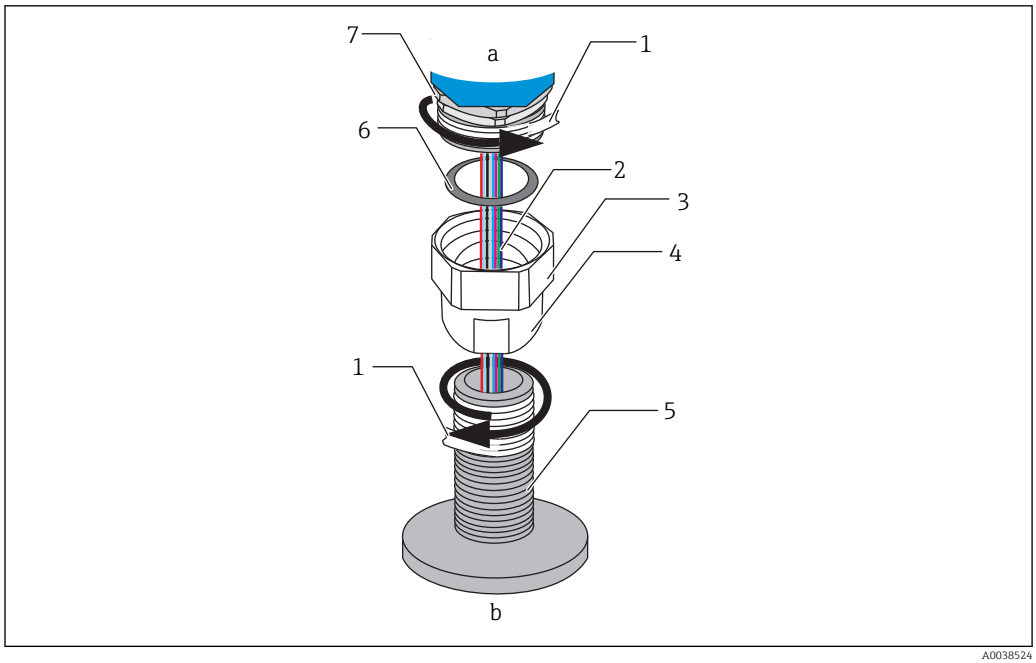
41 Cable handling

1 Cable end
2 Cable ties

Cable handling procedure

1. Cut the ends of the cables so that they are the same length for connecting to NMT539.
2. Temporarily tie all the cables together to protect them against damages during the mechanical connection process.
3. Maintain at least 250 mm (9.84 in) between the edge of the NPS 3/4 connector and the cable ends.

This completes the cable handling procedure.



42 *Threaded connection*

a NMT539 connection side
b RTD probe connection side (to average temperature elements)
1 Sealing tape (not included)
2 Cables (for RTD signals, coaxial cable and probe)
3 NPS female thread connector
4 Union
5 NPT3/4 tread connection (RTD probe side)
6 Packing
7 Male thread connector

- Check the safety precautions before installing NMT539 on to an RTD probe.
- Loosen the NPS female thread connector, and place it on the RTD probe and align them to ensure that each thread can be connected smoothly.

Threaded connection procedure

1. Wrap the NPT3/4 thread connection with sealing tape.
2. Screw on the union and the NPS female thread connector to the NPT3/4 thread connection part and make sure that it is secure.
3. Wrap the male thread connector with sealing tape.
4. Insert the packing in the union, and install NMT539.
5. Tighten the union by hand until it is fully screwed in.
6. Remove the cover and confirm that both sides of the cables have enough length to be connected.
7. After connecting the cables and adjusting the position of NMT539, tighten the union by hand and then make a 1/8 rotation with a wrench to secure it in place.

This completes the threaded connection procedure.

⚠ CAUTION

Cable handling

This may cause the inside of the cable, where temperature cannot be measured, to malfunction or to become damaged.

► Do not pull the sides of cables or subject them to over-tension during this process.

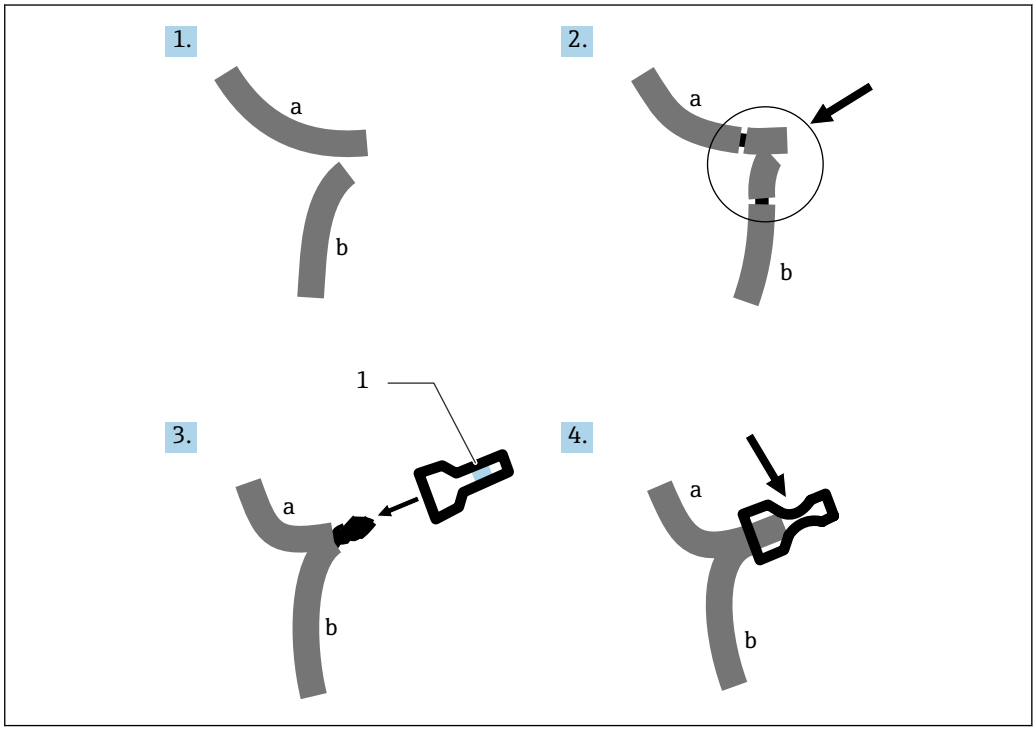
6.2 Wiring connection for converter-only version

Procedure for connecting temperature signal cable

A temperature signal cable is connected to the NMT539 input cable with the provided terminal connector.

1. Select a pair of cables.
2. Strip off 10 mm (0.39 in) from the cable end.
3. Twist both cable ends together and insert them into the terminal connector [1].
4. Crimp the connected terminal with a pair of pliers or any connector tool.

This completes the procedure for connecting temperature signal cables.



43 *Connecting the cables*

a *Cable from NMT539*
b *Cable from RTD probe*
1 *Terminal connector*

The cable color codes are listed below.

NMT539 cable colors: 3-wire spot RTD wiring method using A, B and b.

Position	Wire colors	Position	Wire colors
No.1	Brown	No.9	White
No.2	Red	No.10	Black
No.3	Orange	No.11	Brown & white
No.4	Yellow	No.12	Red & white
No.5	Green	No.13	Orange & white
No.6	Blue	No.14	Yellow & white
No.7	Blue	No.15	Yellow & white
No.8	Violet	No.16	Green & white

Common wire	Wire colors	Common wire	Wire colors
B	Violet & white	b	Black & white

6.3 Terminal wiring (TIIS, Ex d [ia])

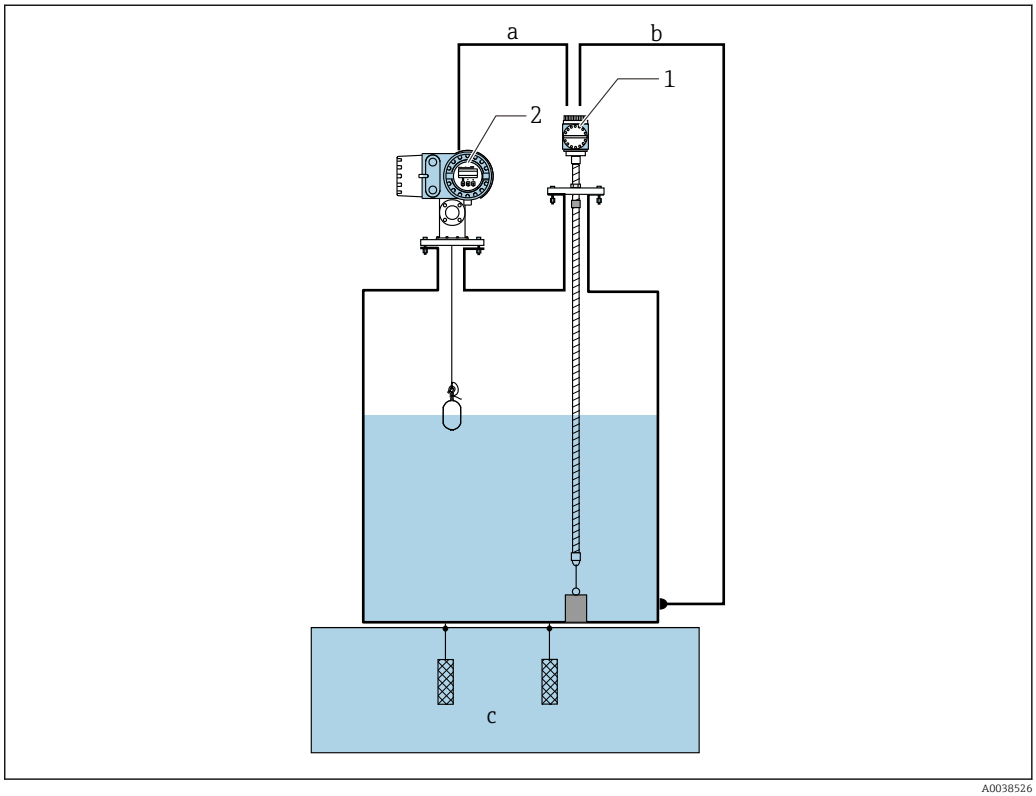
When NMT539 has a flameproof and intrinsically-safe structure (Ex d[ia]), class A grounding is required as shown below.

- The zener barrier that is built into NMT539 (PE) should be grounded to a grounding point in a non-hazardous location, independent of any other types of grounding wires (arresters), as per class A grounding standards.
- The cross-sectional area of the core of the grounding cable must be at least 2 to 2.6 mm^2. In an instrumentation room, a field device with class A grounding may be connected in common to the communication cable shield.

Overview of class A grounding

Ground resistance value	10 Ω or less
Grounding cable	▪ Tensile strength: metal wire with tensile strength of at least 1.04 kN ▪ Cable core cross-sectional area: annealed copper wire with a core cross-sectional area of at least 2 to 2.6 mm^2 ▪ External diameter of the finished cable: minimum φ 8 mm (0.31 in)

Example of grounding procedure



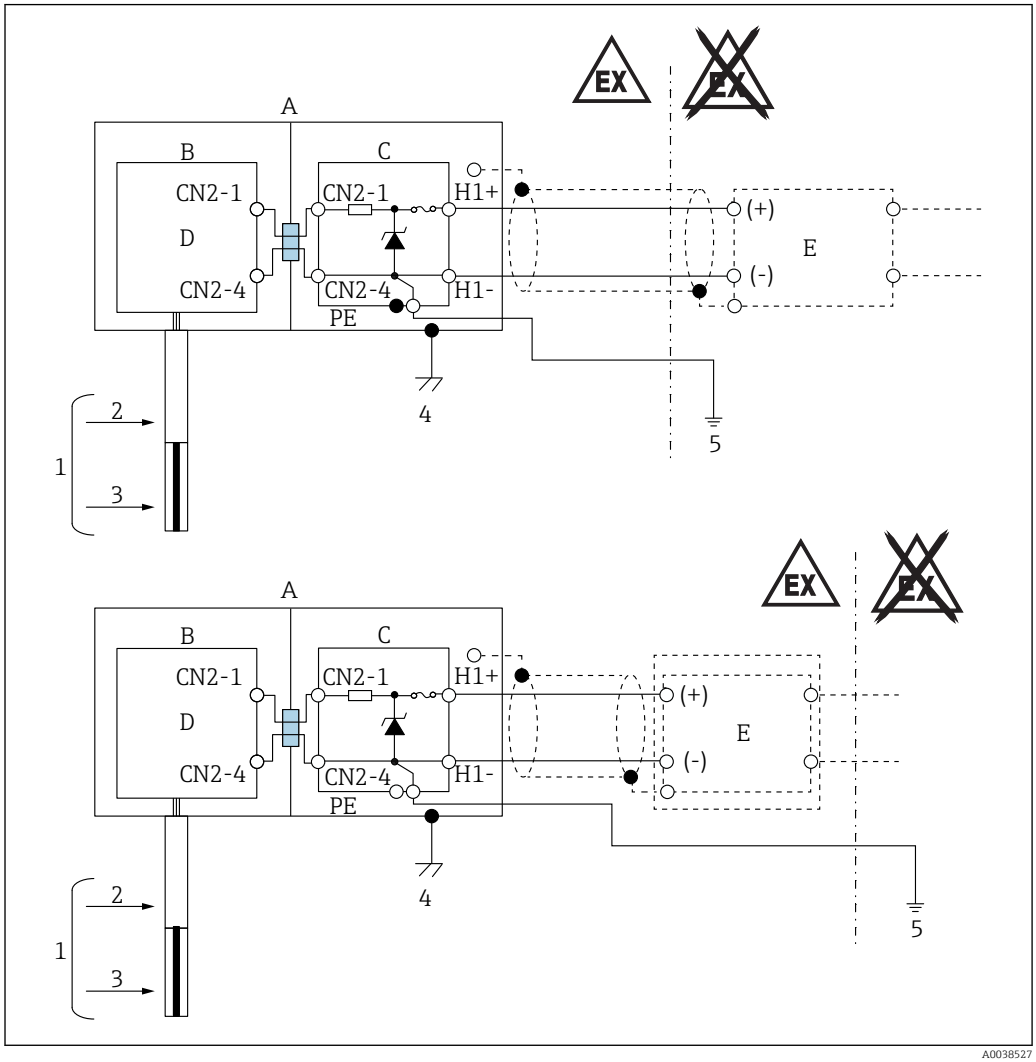
44 *Grounding procedure*

a Local HART (Ex d) communication
b Ground wire (see Note)
c Non-hazardous/class A grounding work/underground
1 NMT539
2 NMS5

When grounding a zener barrier (PE), the external diameter of the cable to be attached to a tank must be Ø 8 mm (0.31 in) or larger.

6.3.1 Wiring diagram

When wiring an intrinsically safe device, ensure that a current or voltage that can compromise the intrinsic safety feature of the intrinsically safe circuit is not generated on the intrinsically safe circuit due to electromagnetic or static induction.



45 *Wiring diagram*

A Meter in tank
B Flameproof enclosure (terminal compartment)
C Intrinsically safe circuit
D Generic device (DC 20 to 26.4 V)
1 Measured site (see Note)
2 Temperature measurement probe
3 WB probe
4 External grounding terminal
5 Class A grounding (see Note)

A WB probe is not included when the only measurement function is average temperature measurement.

NOTICE

Common grounding wire with an arrester

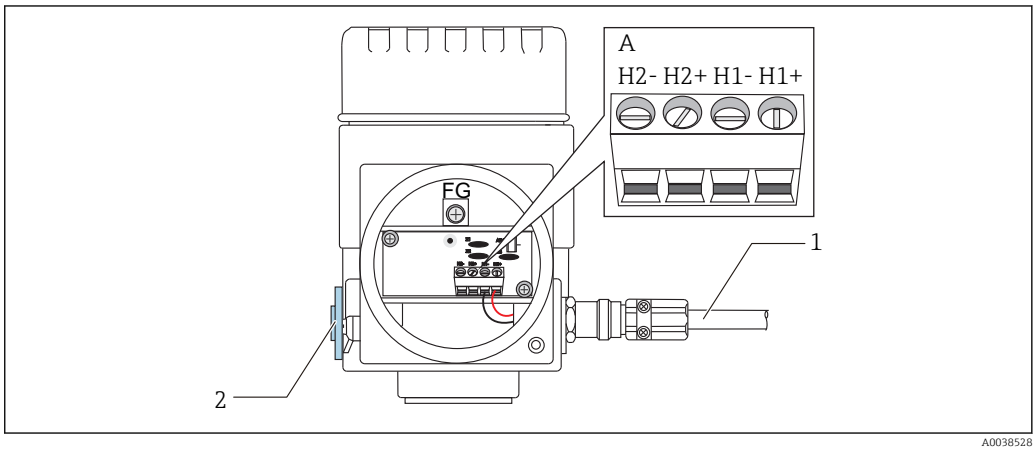
Flow of significant current due to a lightning strike will cause the NMT539 to malfunction.

- ► Although grounding wire A can be used with the grounding wires of other safety barriers, do not use it with the grounding wire of an arrester.

6.4 Terminal connection

6.4.1 NMT539 (Ex ia) intrinsically safe connection

NMT539, which uses intrinsically safe local HART communication, must be connected to the device's intrinsically safe terminal to be connected. Refer to the intrinsic safety regulations for establishing wiring and field device layout.



46 *NMT539 terminal (ATEX・Ex ia)*

A Temperature (WB) data / NMT539 intrinsically safe 2-wire HART communication (see Information)
1 Shielded twisted pair wire or steel-armored wire
2 Standard aluminum (die-cast plug)

Only a metal cable gland may be used. The shielded wire on the HART communication line must be grounded.

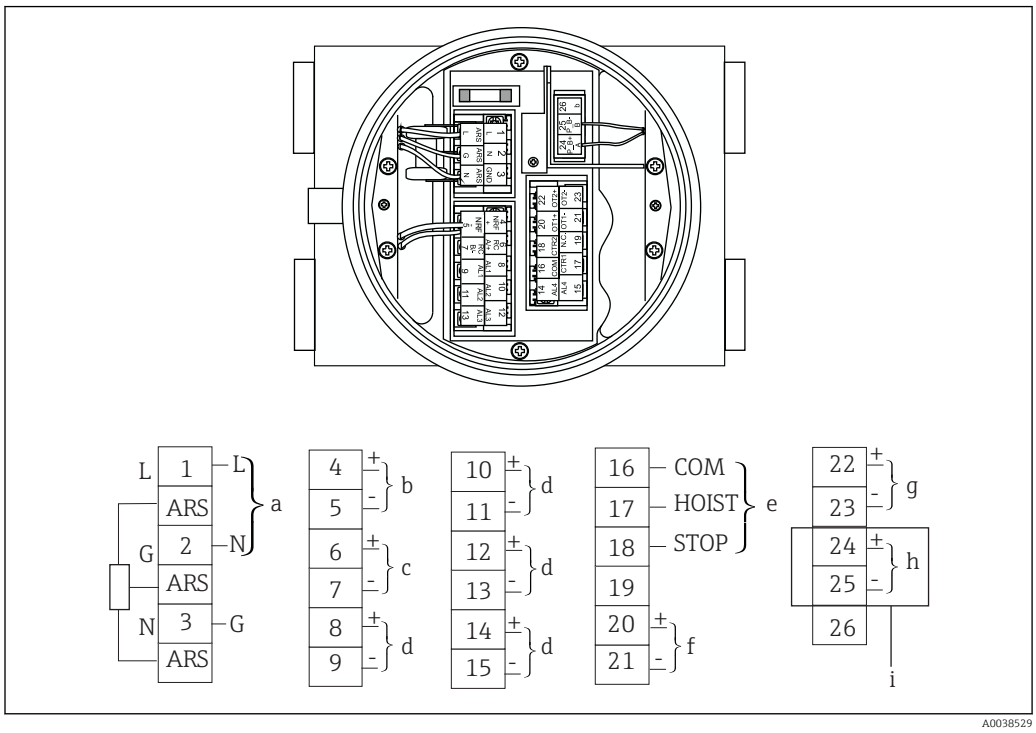
Connection table

Connection to NRF590		Connection to NMS5		Connection to NMS8x/NMR8x/NRF81	
+ Terminal	24, 26, 28	+ Terminal	24	+ Terminal	E1
- Terminal	25, 27, 29	- Terminal	25	- Terminal	E2

+H1 and +H2 are + terminals, and -H1 and -H2 are - terminals.

6.4.2 NMS5 (Ex d [ia]) intrinsically safe connection

The intrinsically safe NMT539 must be connected to the intrinsically safe local HART terminal on NMS5.



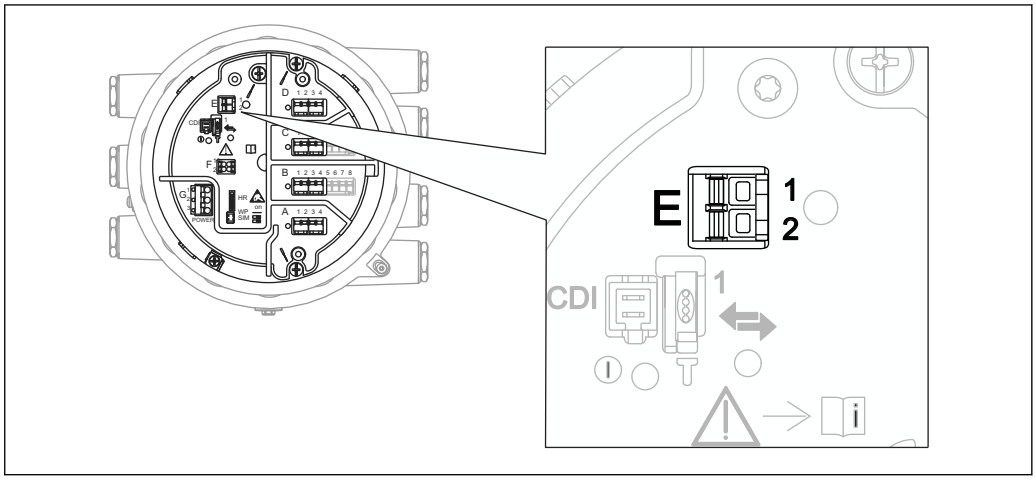
47 *NMS5 terminal*

a *Power supply AC85: 264V 50/60 Hz or DC20: 62V AC20: 55V*
b *Non-intrinsically safe HART communication: NRF, etc.*
c *Digital output Modbus, RS485 serial pulse or HART*
d *Alarm contact point*
e *Operation contact point input*
f *4 to 20 mA channel 1*
g *4 to 20 mA channel 2*
h *Intrinsically safe HART*
i *From NMT539 Ex ia*

Do not connect NMT539 local HART communication cable to terminals 4 and 5 on NMS5/NMS7. These terminals are designed to connect to Ex d local HART communication.

6.4.3 NMS8x/NMR8x/NRF81 (Ex d [ia]) intrinsically safe connection

To connect an intrinsically safe NMT539, E1 and E2 are used to connect with NMS8x, NMR8x and NRF81.



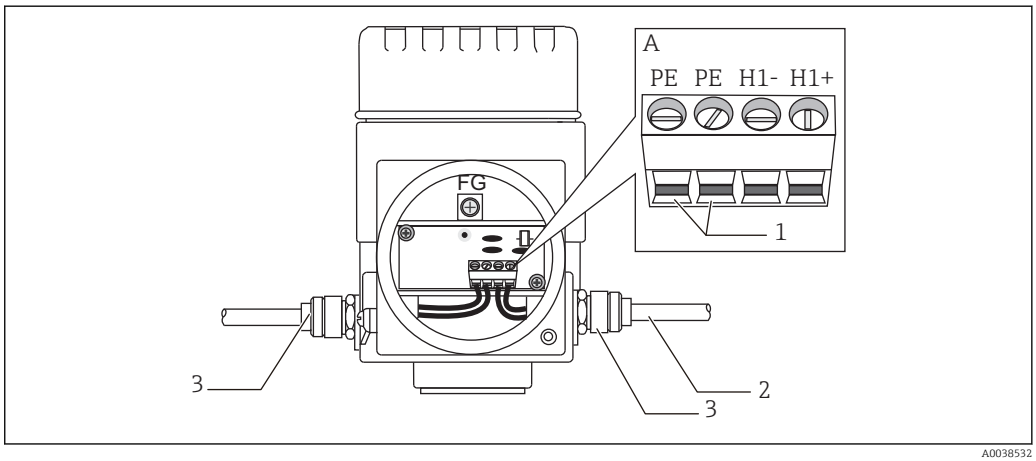
A0038531

48 *NMS8x terminal for NMT539*

E1 H+ terminal
E2 H- terminal

6.4.4 NMT539 (TIIS, Ex d [ia]) terminal

Connect a flameproof local HART communication NMT539 to the flameproof terminal of the device to be connected. Wiring and on-site equipment layout must be in accordance with the Safety Guide for Electric Equipment.



A0038532

49 *NMT539 terminal (TIIS ・Ex d [ia])*

A Temperature (WB) data / NMT539 flameproof 2-wire HART communication (see Information)
1 Class A grounding work at a non-hazardous location (1 to 1.5 mm^2: 1 wire)
2 Shielded twisted pair wire or steel-armored wire
3 Cable gland (SXC-16B)

The shielded wire on the HART communication line must be grounded.

NOTICE

Common grounding wire with an arrester

Flow of significant current due to a lightning strike will cause the NMT539 to malfunction.

- ▶ Although grounding wire A can be used with the grounding wires of other safety barriers, do not use it with the grounding wire of an arrester.

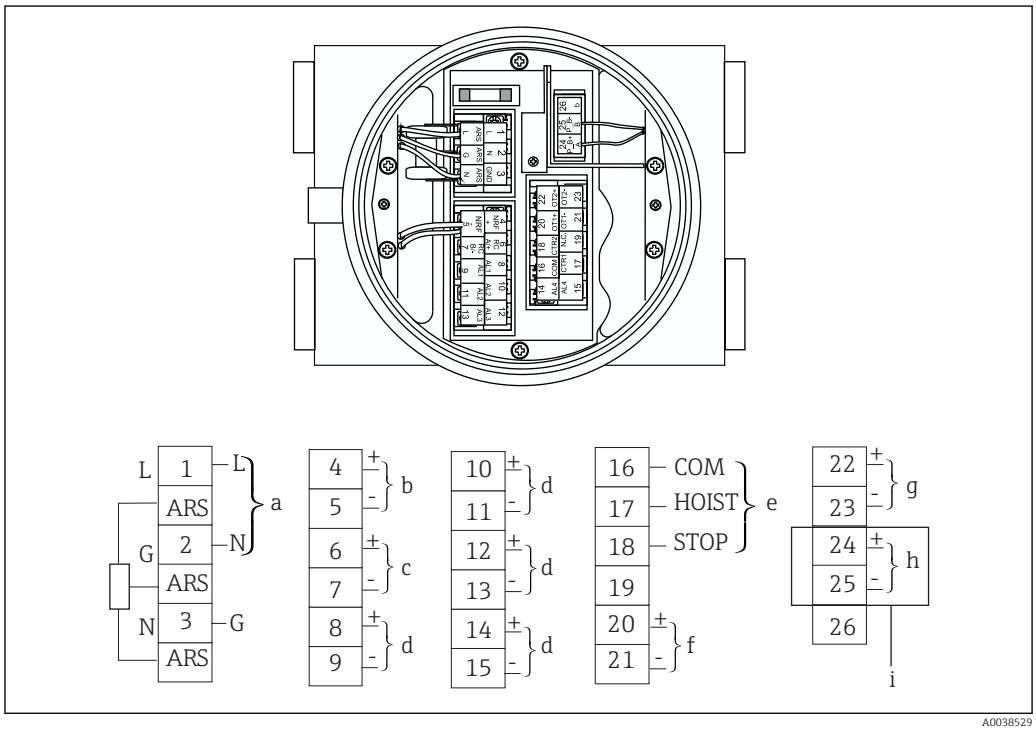
Connection table

Connection to NRF590		Connection to NMS5	
+ Terminal	13	+ Terminal	24
- Terminal	12	- Terminal	25

+H1 and +H2 are + terminals, and -H1 and -H2 are - terminals.

6.4.5 NMS5 (Ex d [ia]) intrinsically safe connection

The intrinsically safe NMT539 must be connected to the intrinsically safe local HART terminal on NMS5.



50 *NMS5 terminal*

a *Power supply AC85: 264V 50/60 Hz or DC20: 62V AC20: 55V*
b *Non-intrinsically safe HART communication: NRF, etc.*
c *Digital output Modbus, RS485 serial pulse or HART*
d *Alarm contact point*
e *Operation contact point input*
f *4 to 20 mA channel 1*
g *4 to 20 mA channel 2*
h *Intrinsically safe HART*
i *From NMT539 Ex ia*

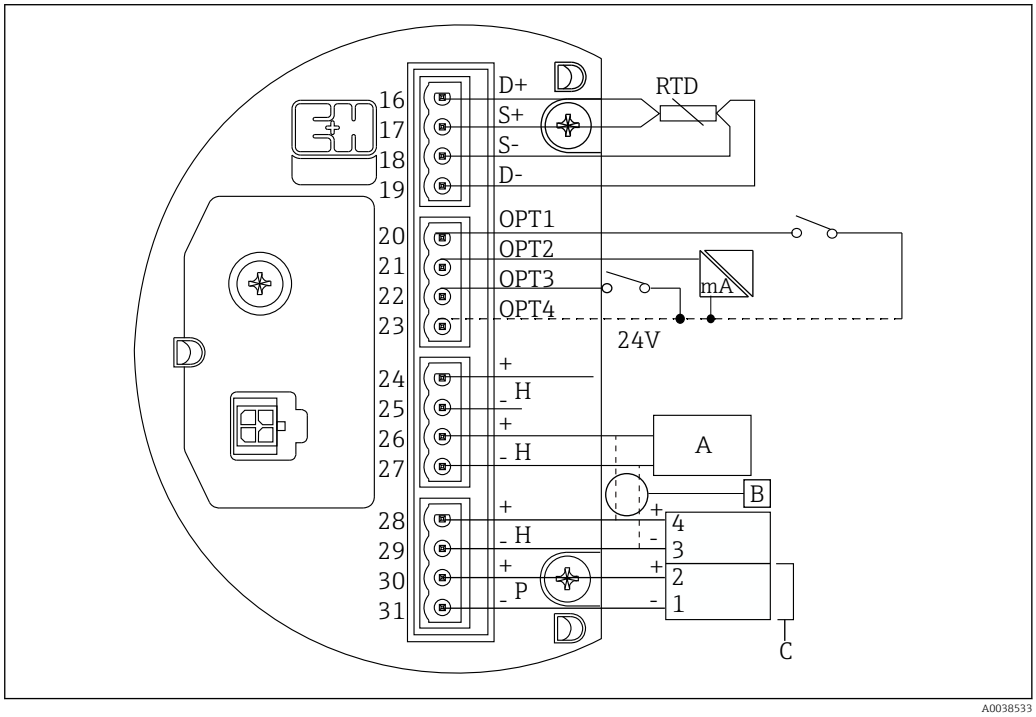
6.4.6 TGM5 and TMD1 terminals

TGM5 is equipped with local HART communication function except for when "Sakura code (collector common), BCD (emitter common), BCD (collector common)" has been selected in "Output 1. "Although connection with an Ex d [ia] device is possible, the terminal numbers are different depending on the specifications. To connect, see the TGM5 terminal table.

In the case of TMD1-xBxxxxxxxxx (with local HART input), it is possible to connect Ex d [ia] devices; however, terminal numbers are different depending the specifications. To connect, see the TMD1 terminal table.

6.4.7 NRF590 terminals

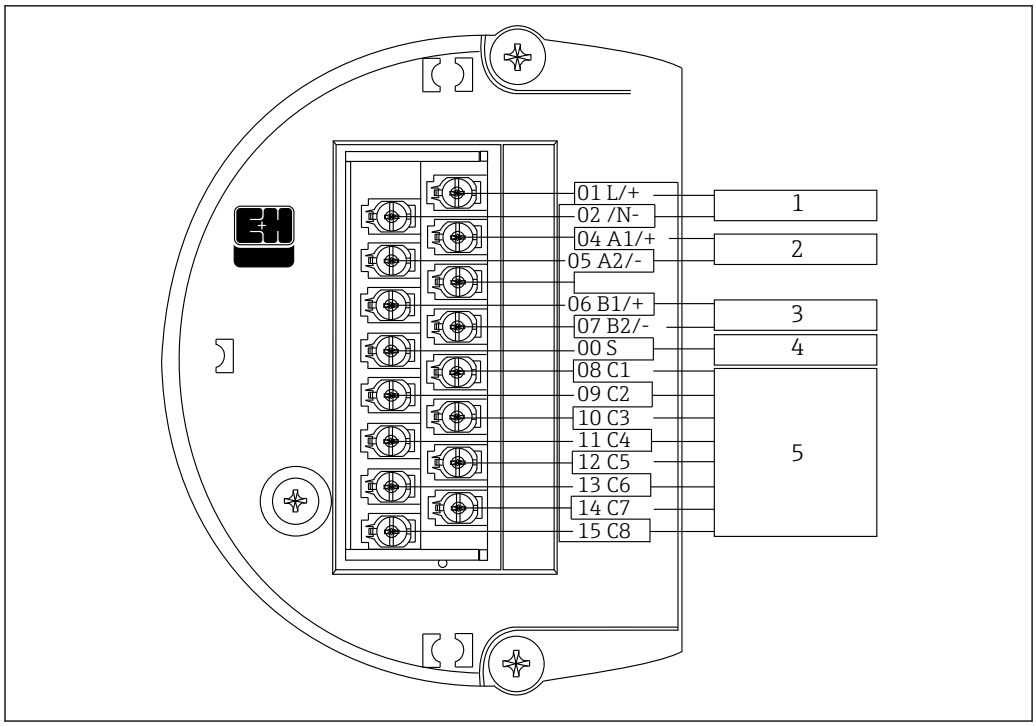
NRF590 has three sets of intrinsically safe local HART terminals.



51 *NRF590 (intrinsically safe) terminals*

A A HART sensor (mutually connected as a single HART fieldbus loop on the inside)
B Fieldbus loop
C Only in Micropilot S series

A signal local HART line cannot be connected from NMT539 to terminals 30 and 31. These terminals are an intrinsically safe DC 24V power supply for the Micropilot S Series (FMR53x, FMR540).



52 *NRF590 (TIIS flameproof) terminal*

1 *Power supply*
2 *Digital I/O A*
3 *Digital I/O B*
4 *Cable shield*
5 *Field protocol and analog I/O*

7 Diagnostics and troubleshooting

7.1 System error messages

Code	Text	Description	Remedy
0	No Error presence	There is no error.	No action is required.
1	Common line open	The common line is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #1 temperature element (brown).
3	#1 element open	The cable for a temperature element (#1) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #1 temperature element (brown).
4	#1 element short	The cable for a temperature element (#1) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #1 temperature element (brown).
5	#2 element open	The cable for a temperature element (#2) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #2 temperature element (red).
6	#2 element short	The cable for a temperature element (#2) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #2 temperature element (red).
7	#3 element open	The cable for a temperature element (#3) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #3 temperature element (orange).
8	#3 element short	The cable for a temperature element (#3) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #3 temperature element (orange).
9	#4 element open	The cable for a temperature element (#4) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #4 temperature element (yellow).
10	#4 element short	The cable for a temperature element (#4) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #4 temperature element (yellow).
11	#5 element open	The cable for a temperature element (#5) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #5 temperature element (green).
12	#5 element short	The cable for a temperature element (#5) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #5 temperature element (green).
13	#6 element open	The cable for a temperature element (#6) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #6 temperature element (blue).
14	#6 element short	The cable for a temperature element (#6) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #6 temperature element (blue).
15	#7 element open	The cable for a temperature element (#7) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #7 temperature element (purple).
16	#7 element short	The cable for a temperature element (#7) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #7 temperature element (purple).
17	#8 element open	The cable for a temperature element (#8) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #8 temperature element (gray).

Code	Text	Description	Remedy
18	#8 element short	The cable for a temperature element (#8) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #8 temperature element (gray).
19	#9 element open	The cable for a temperature element (#9) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #9 temperature element (white).
20	#9 element short	The cable for a temperature element (#9) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #9 temperature element (white).
21	#10 element open	The cable for a temperature element (#10) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #10 temperature element (black).
22	#10 element short	The cable for a temperature element (#10) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #10 temperature element (black).
23	#0 element over range	Reference temperature element #0 in the module is damaged.	Replace the module.
24	Memory defect (ROM)	Program memory is defective.	Replace the module.
25	#11 element open	The cable for a temperature element (#11) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #11 temperature element (white/brown).
26	#11 element short	The cable for a temperature element (#11) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #11 temperature element (white/brown).
27	#12 element open	The cable for a temperature element (#12) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #12 temperature element (white/red).
28	#12 element short	The cable for a temperature element (#12) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #12 temperature element (white/red).
29	Element exposed	The level is below temperature element #1.	Liquid temperature cannot be measured. The error will disappear when the level rises above temperature element #1.
32	Low power supply	The power supply from the host device through the Multidrop HART loop is below Prothermo's specifications.	Check the power supply from the host device and the connected HART device's power consumption.
33	#13 element open	The cable for a temperature element (#13) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #13 temperature element (white/orange).
34	#13 element short	The cable for a temperature element (#13) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #13 temperature element (white/orange).
35	#14 element open	The cable for a temperature element (#14) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #14 temperature element (white/yellow).
36	#14 element short	The cable for a temperature element (#14) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #14 temperature element (white/yellow).
37	#15 element open	The cable for a temperature element (#15) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #15 temperature element (white/green).
38	#15 element short	The cable for a temperature element (#15) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #15 temperature element (white/green).
39	#16 element open	The cable for a temperature element (#16) is open.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #16 temperature element (white/blue).

Code	Text	Description	Remedy
40	#16 element short	The cable for a temperature element (#16) is short-circuited.	Check the module's connections, and check the impedance between the common cable (white/black or white/purple) and the cable for the #16 temperature element (white/blue).
41	Memory defect (RAM)	Data memory is defective.	Replace the module.
42	Memory defect (EEROM)	Non-volatile data memory is defective.	Replace the module.
43	WB line open	The WB cable is open.	Replace the module. If replacing the module does not resolve the problem, replace the entire system.
44	WB line short	The WB cable is short-circuited.	Replace the module .If replacing the module does not resolve the problem, replace the entire system.

Error codes appear on the screen when FieldCare is properly connected. For methods and descriptions of error display on a host device, see documents for NRF590, MS5, NMS7 or NMS8x.

8 Maintenance

8.1 Maintenance work

No special maintenance work is required.

8.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

8.2 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

9 Repair

9.1 General information on repairs

9.1.1 Repair concept

The Endress+Hauser repair concept assumes that the devices have a modular design and that repairs can be done by the Endress+Hauser Service Department or specially trained customers.

Spare parts are included in appropriate kits. They contain the related replacement instructions.

For more information on service and spare parts, contact the Endress+Hauser Service Department.

9.1.2 Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel or by the Endress+Hauser Service Department.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- When ordering a spare part, note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, perform the specified routine test on the device.
- Only the Endress+Hauser Service Department may convert a certified device into a different certified variant.
- Document all repair work and conversions.

9.2 Spare parts

Some interchangeable device components are listed on an overview label on the connection compartment cover.

The spare part overview label contains the following information:
- A list of the most important spare parts for the device, including their ordering information
- The URL for the *W@M Device Viewer* (www.endress.com/deviceviewer):
  All the spare parts for the device, along with the order code, are listed here so that they can be ordered. If available, users can also download the associated Installation Instructions.

9.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

Your Endress+Hauser Sales Center can provide detailed information on the services.

9.4 Return

The device must be returned if it is in need of repair or a factory calibration, or if the wrong device has been delivered or ordered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that have come into contact with measured materials.

To ensure safe, swift and professional device returns, refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at http://www.endress.com/support/return-material.

9.5 Disposal

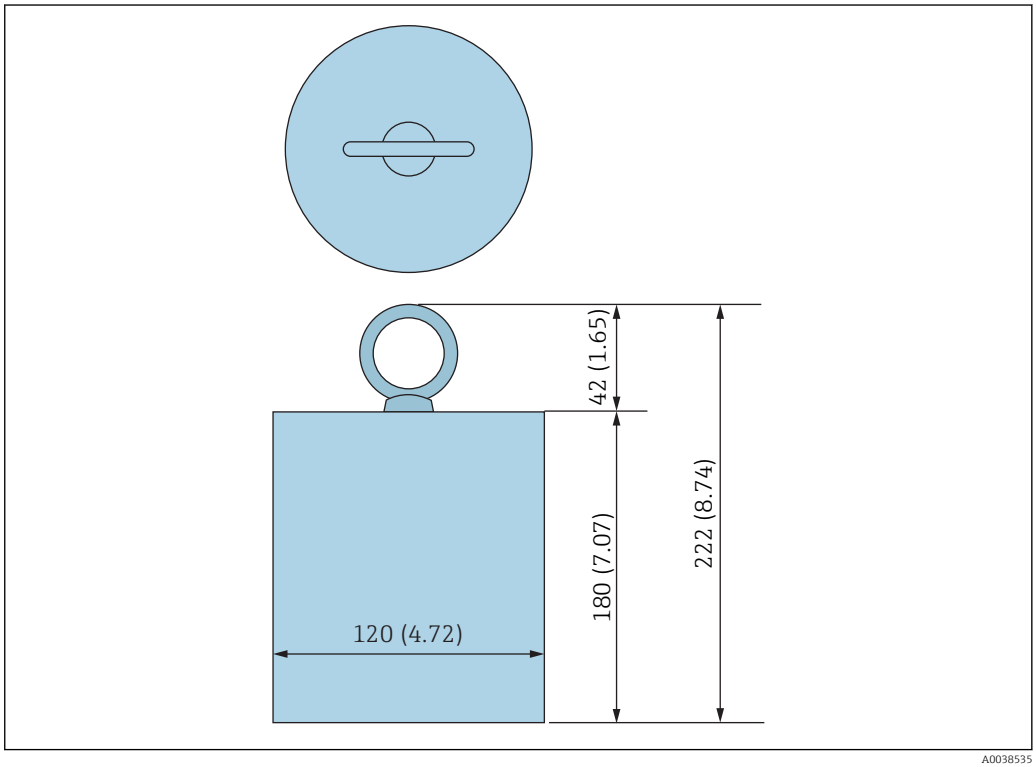
Observe the following notes during disposal:
- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

10 Accessories

10.1 Device-specific accessories

10.1.1 Anchor weight (high profile)

This anchor weight was designed for the converter + temperature probe version. Even when an anchor weight is used for the installation, the bottom element (bottom point temperature measurement position) will be set at approx. 500 mm above the tank bottom. When installing a high-profile anchor weight from a nozzle at the top of the tank, ensure that the nozzle opening is at least 150A (6").



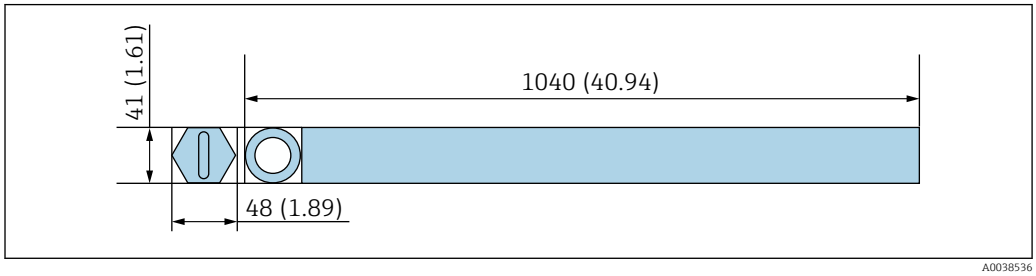
53 *Installation attachment / Option B . Unit of measurement mm (in)*

The anchor weight comes in different dimensions, weight and materials.

Description	Details
Weight	JIS SS400 mild carbon steel
Eye-bolt	JIS SS400 mild carbon steel
Mass	16 kg (35.3 lb)

10.1.2 Anchor weight (low profile)

The low-profile anchor weight is mainly designed to secure a WB probe for measuring the WB measurement range accurately. It can also be used as an installation attachment for the converter + temperature probe version when trying to install a small tank nozzle (50A (2") or smaller) that is in use.

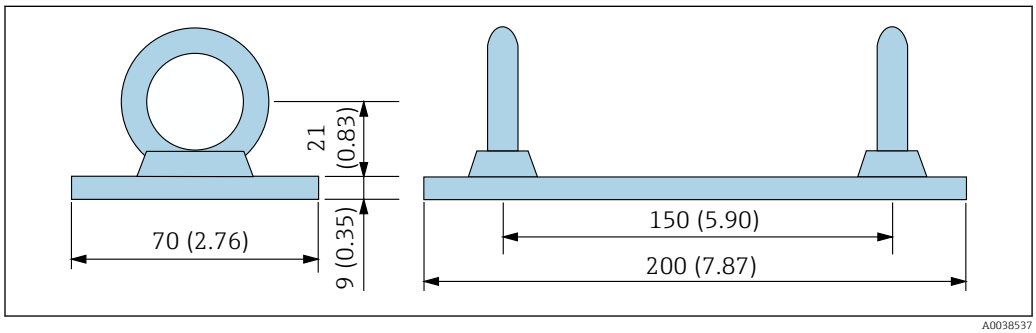


54 *Installation attachment / option C/G. Unit of measurement mm (in)*

Description	Details
Weight	JIS SS400 mild carbon steel
Eye-bolt	JIS SS400 mild carbon steel
Mass	12 kg (26.46 lb)

10.1.3 Wire hook

Wire hooks come in a variety of wire types, sizes, materials, and special coatings to suit installations for a wide range of applications. The actual tension is created by the securing wire between the wire hook and the top anchor (SUS316, stranded wire with a diameter of 3 mm (0.12 in)).

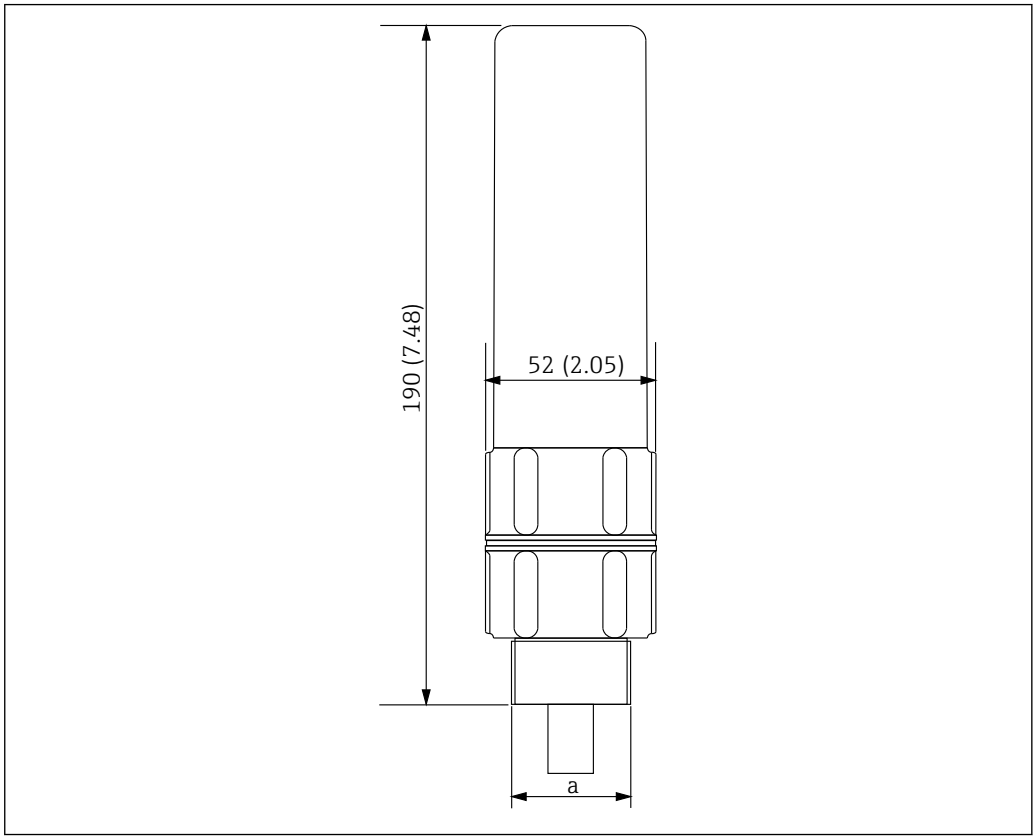


55 *Wire hook / option D/F. Unit of measurement mm (in)*

Description	Details
Weight	JIS SS400 mild carbon steel
Eye-bolt	JIS SS400 mild carbon steel
Mass	1.5 kg (3.31 lb)

10.1.4 Top anchor

The standard threaded connection for a top anchor is an NPT1 or R1 threaded connection. It can accommodate different thread sizes, materials and special specifications. A joint flange is also possible.



56 Top anchor dimensions. Unit of measurement mm (in)

a R1 or NPT1 (specified by the order code)

Description	Details
Exterior	ADC (aluminum)
Interior	SUS316
Mass	1.2 kg (2.65 lb)

Index

Symbols

C

D

E

P

R

W

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