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Technical Information
Prothermo NMT81

Tank Gauging

Application

Prothermo NMT81 is designed for high accuracy temperature measurement in custody transfer and inventory control applications. It reliably meets demands in loss control, overall cost saving, and safe operation.

Specification, industry, and variety of application

- Precise temperature profile and average temperature measurement for tank gauging custody transfer and inventory control applications
- Typically measured fluids include white oil, refined oil (gasoline, naphtha, diesel, kerosene, light oil, jet fuels, etc.), black oil (crude oil, heavy oil, asphalt, bitumen), liquefied gas (LNG/LPG, ethylene, propane, butane, butadiene, ammonia), lubricants, additives, aromatics, vegetable oil, palm oil, alcohol.

Features

- The precise temperature conversion accuracy: ±0.025 °C (0.045 °F)
- Up to 24 four-wire RTD sensor elements selectable from Class 1/10B or Class A
- Up to 12 redundant RTD sensor pairs with enhanced software algorithm
- Up to 5 point temperature calibration exceeding API Chapter 7 standard
- Material of transmitter housing: aluminum or 316L (selectable)
- Material of wetted parts: 316L
- Flange nozzle size: tank top mounting from 1-1/4” flange nozzle
- Robust IP66/68, Type 4x/6P enclosure
- Airtight and pressure resistant to 6 bar (g) of vapor phase
- Optional display for local data confirmation at a glance
- Water bottom measurement with advanced 3 layer (air, product, water) compensation.

Endress+Hauser
People for Process Automation

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About this document

Document conventions

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.

Electrical symbols


Alternating current


Direct current and alternating current


Direct current


Ground connection

A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

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.

Tool symbols


Phillips head screwdriver


Flat blade screwdriver


Torx screwdriver


Allen key


Open-ended wrench

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

Tip
Indicates additional information

Reference to documentation

Reference to graphic

Notice or individual step to be observed

1., 2., 3.
Series of steps

Result of a step

Operation via operating tool

Write-protected parameter

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

Safety instructions
Observe the safety instructions contained in the associated Operating Instructions

Documentation

The following documentation types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads):

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

Technical Information (TI)

Planning aid
The document 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.

Brief Operating Instructions (KA)

Guide that takes you quickly to the 1st measured value
The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

Operating Instructions (BA)

The Operating Instructions contain all the information that is required in 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.

Description of Device Parameters (GP)

The Description of Device Parameters provides a detailed explanation of each individual parameter in the operating menu (except the Expert menu). The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

Installation instructions (EA)

Installation Instruction are used to replace a faulty unit with a functioning unit of the same type.

Registered trademarks

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

Function and system design

Measurement principle

NMT81 is available in three different versions:

- Converter + Average temperature probe
- Converter + Average temperature probe + WB probe
- Converter version

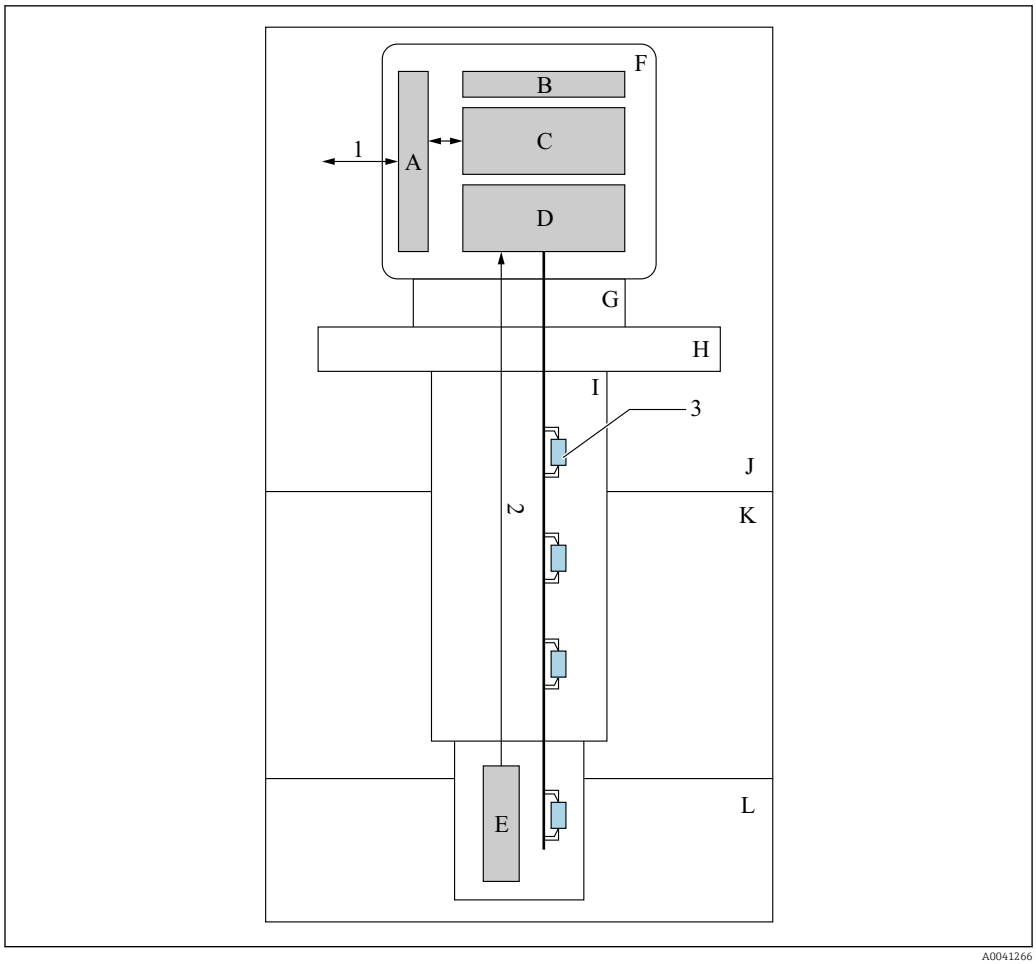
WB stands for “water bottom” and is used to denote the water bottom sensor, probe, or level. Throughout the following texts, the expression WB means water bottom sensor, probe, or level.

The NMT81 converter + average temperature probe version can be equipped with class A IEC 60751/DIN EN 60751 or class 1/10B Pt100 four-wire RTD sensor elements in its protective probe for up to 24 elements. It is able to accurately measure the temperature of each element by measuring the temperature dependent resistance. It can calculate average liquid temperatures, i.e. vapor, liquid, product and water, from a temperature profile. For the average temperature calculation, in case of a device with WB, the elements in the water can be excluded from the calculation based on the data that is directly measured by the WB. In case of the device without WB, after WB level (also called interface) data is received from the external devices such as NMS8x, the elements in the water can be excluded from the calculation. Also, weight factors can be set if necessary, typically for spherical tank applications. The NMT81 converter + temperature probe version conforms to intrinsic safety standards, and because NMT81 consumes very little power, it guarantees superior safety as an electrical device installed in tanks in hazardous locations and is environmentally friendly as well.

The converter + average temperature probe version is a combination of a local HART communication converter and a probe for establishing a temperature measurement function. The converter + average temperature probe + WB probe version is a multi-functional sensor that sends the temperature and WB data to a tank gauging HART master on the host side via two-wire local HART communication.

Each type of NMT81, including converter only or converter + average temperature, is a simplified version of a combination of converter + average temperature probe + WB probe. Up to two platinum resistance elements can be fitted inside the WB probe. For the setting of the elements, for a single setting, two elements can be set each in different positions. For a redundant setting, two elements can be set in the same position.

Tank gauging HART master includes the devices of NMS5, NMS7, NMS8x, NMR8x, NRF81, and NRF590.



1 *NMT81 operation principle*

A *Terminal unit*
B *Display (option)*
C *Main unit*
D *Sensor electronic unit*
E *Capacitive water bottom probe*
F *Converter housing*
G *Optional height adjuster*
H *Flange*
I *Protective flexible tube*
J *Vapor phase*
K *Liquid phase*
L *Water phase*
1 *HART compatible communication*
2 *Digital communication*
3 *Element*

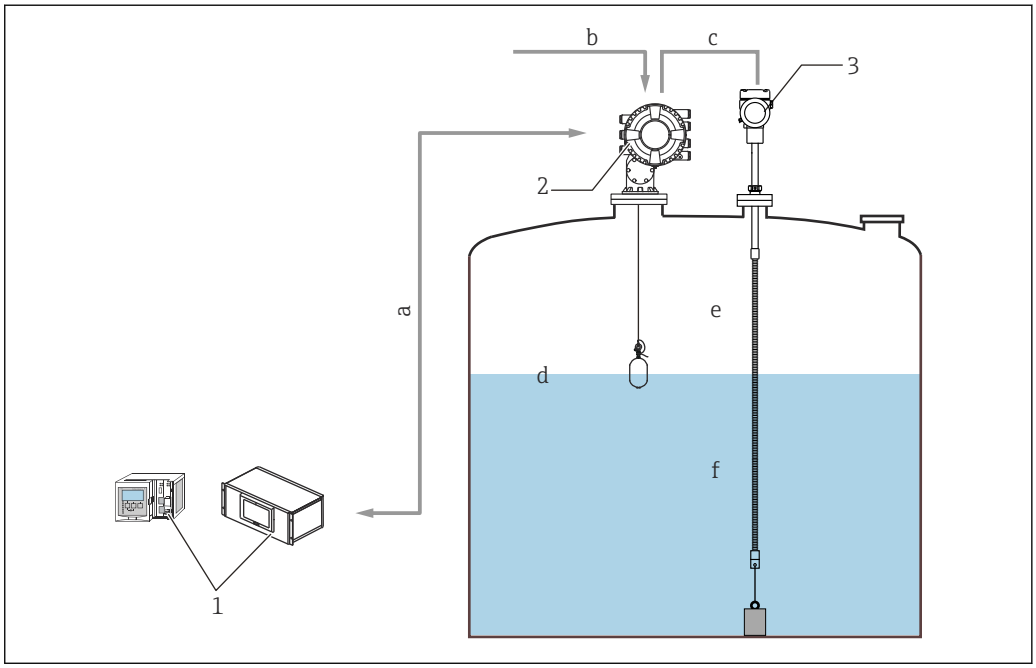
The elements in the figure above show RTD elements (maximum 24 elements). The elements up to two can be installed in the water bottom.

System design

Endress+Hauser offers a wide range of tank gauge system solutions, including field equipment. The following combinations describe typical solutions based on Ex (Explosion protection) concepts. For your application-based requests, contact your Endress+Hauser Sales Center.

NMT81 Ex ia and NMS8x Ex d [ia] combination

The connection of NMT81 shown below is available for connection with NMS8x or NMS Ex d [ia].



2 *NMS8x and NMT81 system design*

a *Fieldbus protocol*
b *Power supply*
c *Local HART (Ex i) loop (data transmission)*
d *Liquid level*
e *Vapor temperature*
f *Liquid temperature*
1 *Tankvision*
2 *NMS8x*
3 *NMT81*

NMT81 converter + temp. version typical installation diagram

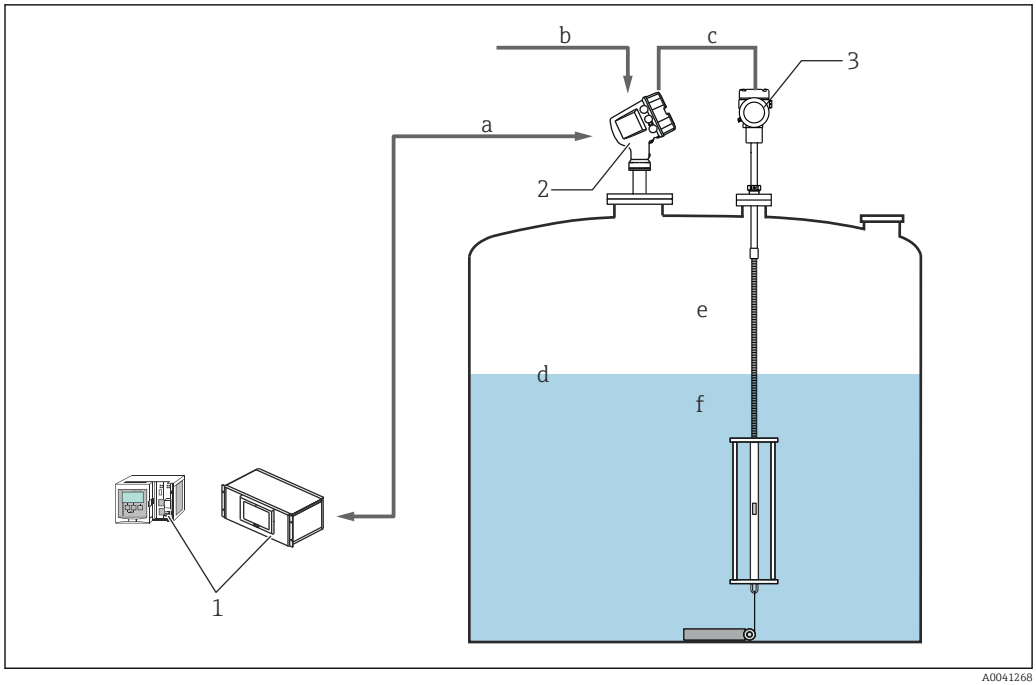
Since NMS5 and NMS8x are provided with the interface measurement function of NMS, they can be combined with the converter + average temperature probe version of NMT81. When using NMT81 with WB (water bottom), both NMS8x and NMT81 can respectively perform efficiently and reliably by focusing on liquid level measurement without requiring the master device such as NMS8x to measure the interface (water level) measurement. Most changes and parameter settings for NMT81 can be performed by the tank gauging HART master device. Also, NMT81 receives liquid level data from the tank gauging HART master device and then calculates the average temperature of the liquid and vapor phases. The calculated average temperature data of the liquid and vapor phases are transmitted to the tank gauging HART master device along with the measured temperature of each element and the NMT81 device status.

All gathered data or measured values in the field interface unit from the tank gauging HART master are sent to the inventory management software, Tankvision.

Tank gauging HART master includes the devices of NMS5, NMS7, NMS8x, NMR8x, NRF81, and NRF590.

NMT81 Ex ia and NMR8x Ex d [ia] combination

The connection of NMT81 shown below is only available for connection with NMR8x Ex d [ia]. The combination of the NMT81 converter + temperature probe + WB 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 NMR8x allow for optimal inventory control. Details on NMT81 functions and data can be accessed from NMR8x. NMT81 receives radar level data from NMR8x and then calculates the average temperature of the liquid and vapor phases. The calculated average temperature data of the liquid and vapor phases are transmitted via NMR8x to Tankvision. All gathered data or measured values in the field interface unit from the tank gauging HART master are sent to Tankvision.



3 NMT81 Ex ia and NMR8x combination

a Fieldbus protocol
b Power supply
c Local HART (Ex i) loop (data transmission)
d Liquid level
e Vapor temperature
f Liquid temperature
1 Tankvision
2 NMR8x
3 NMT81

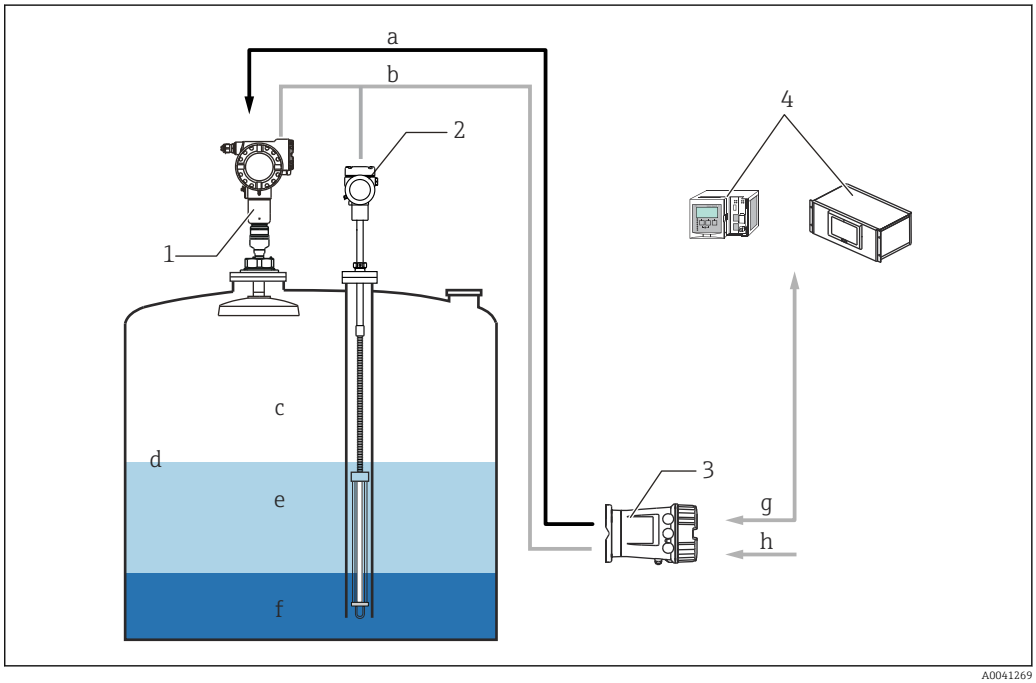
NMT81 Ex ia and NRF81/590 Ex d [ia] combination

Typical application of NMT81 converter + temperature probe + WB version

The NMT81 converter + temperature probe + WB 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 (hereinafter referred to as NRF), allow for optimal inventory control. Details on NMT81 functions and data can be accessed from NRF. NMT81 receives radar level data from NRF and then calculates the average temperature of the liquid and vapor phases. The calculated average temperature data of the liquid and vapor phases are transmitted to NRF along with the measured temperature of each element and the NMT81 device status.

NRF81 is required as a gateway for FMR5xx and NMT81 Tankvision when using FMR5xx Ex ia radar.

All gathered data or measured values in the field interface unit from the tank gauging HART master are sent to the inventory management software, Tankvision.



4 *NMT81 Ex ia and NRF Ex d [ia] combination*

a *FMR power supply (DC/Ex i)*
b *Local HART (Ex i) loop (data transmission)*
c *Vapor temperature*
d *Liquid level*
e *Liquid temperature*
f *Water*
g *Fieldbus protocol*
h *Power supply*
1 *FMR5xx*
2 *NMT81*
3 *NRF*
4 *Tankvision*

Input/output

Measured variable

The measured variable is resistance of up to 24 points exerted by Pt100 four-wire RTD sensor elements according to class A IEC 60751/DIN EN 60751 or class 1/10B. The variables are converted to temperature data. Optionally, the measured capacitance can be also converted to the water bottom (also called water level).

The measured variables of the device are:

- The resistance of each of up to 24 single elements, which is converted to temperature
- The average temperature of the elements immersed in liquid
- The average temperature of the elements immersed in product (except elements in water)
- The average temperature of the elements immersed in water
- The average temperature of the elements in vapor
- Optionally, the measured capacitance of the probe, which is converted to water level

Measuring range

Temperature probe

Standard temperature	−40 to 100 °C (−40 to 212 °F)
Standard temperature with water bottom	−40 to 75 °C (−40 to 167 °F)
High temperature	−55 to 235 °C (−67 to 455 °F)
Low temperature	−196 to 100 °C (−320 to 212 °F)
Probe length	Maximum 100 m (328.08 ft)

The range of −200 to 100 °C (−328 to 212 °F) can be accommodated upon request.

Water bottom sensor

Standard length	500 mm (19.69 in), 1 000 mm (39.37 in), or 2 000 mm (78.74 in)
Water bottom range	−40 to 75 °C (−40 to 167 °F)

- For longer measurements, contact your Endress+Hauser Sales Center.
- For the water bottom option, the active measuring range depends on the freezing point of the liquid.

Follow the range of the temperature according to the table described in the Safety Instruction when using a device in the hazardous area.

Compatible elements (Converter-only version)

The NMT81 converter + temperature probe version only has Pt100 elements installed. However, since the software in the converter is equipped with a function that converts elements with different characteristics, it can be used with temperature probes of other manufacturers.

Elements	Standard	Temperature coefficient
Pt100	IEC60751, EN60751, JIS1604	α=0.00385
Pt100	GOST6651-2009	α=0.00391
Cu100	GOST6651-2009	α=0.00428
Ni100	GOST6651-2009	α=0.00617

- For element types not listed above, contact your Endress+Hauser Sales Center.
- Because the converter of NMT81 uses a four-wire system in its communication, if any other wires are connected to the device, the measurement accuracy varies according to the wires.

Number of elements

1 to 24 points

Minimum element interval (Distance)

300 mm (11.8 in)

If NMT81 comes with a WB (water bottom) probe option, the maximum number of WB internal elements is two due restrictions imposed by the internal diameter.

Communication

Output signal

Two-wire loop powered Ex ia local HART protocol (exclusively for local host/HART master device). Fixed current is used for communication between the NMT81 and a compatible HART Master.

Compatible HART master

Compatible HART master devices fully supported:

- Proservo NMS8x
- Micropilot NMR8x
- Tankside monitor NRF81

Compatible HART master devices supported in the NMT539 compatibility mode (limited to 16 single element temperatures)

- Proservo NMS5/NMS7
- Tankside monitor NRF590
- Digital transmitter TMD1

Alarm signal

Errors occurring during commissioning or operation are signaled in the following way:

- Error symbol and error code on the optional local display module.
- Error symbol and error code on the display module of the connected HART master
- Transmission via the local HART protocol and via the Fieldbus of the connected HART master

Refer to operating instructions for details on each device.

NMS5	BA00401G
NMS7	BA01001G
NMS8x	BA1456G, BA1459G, BA1462G
NMR8x	BA01450G, BA01453G
NRF590	BA00256F, BA00257F
NRF81	BA01465G

Power supply

Load of local HART

Max. load for HART communication	500 Ω
Min. load for HART communication	250 Ω

Overvoltage protection

- Spark-over voltage: min. 400 V_{DC}
- Tested according to IEC/DIN EN60079-14 sub chapter 12.3 (IEC/DIN EN 60060-1 chapter 7)
- Nominal discharge current: 10 kA

Overvoltage category

Overvoltage category II

Pollution degree

Pollution degree 2

Supply voltage

14-30 V_{DC}	Ex ia
14-35 V_{DC}	Non Ex

Power consumption

Ex ia

Current consumption	Temperature measurement / Water bottom measurement	4 mA

Cable entries

The following cable entries are available:

- Thread G1/2
- Thread NPT1/2
- Thread M20

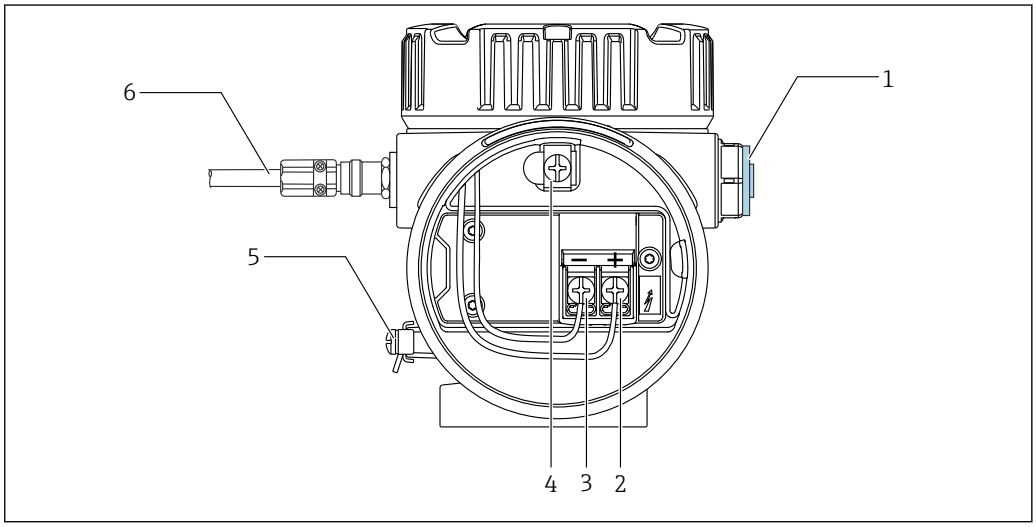
Cable specifications

Cable diameter	#20 AWG to #13 AWG (The range of 0.5 to 2.5 mm^2 is available.)
Cable types	Twist pair with a shield

Electrical connection

NMT81 (Ex ia) intrinsically safe connection

NMT81, which uses intrinsically safe HART communication, must be connected to the device's intrinsically safe terminal. Refer to the intrinsic safety regulations for establishing wiring and field device layout.



5 *NMT81 terminal (ATEX・Ex ia)*

1 Stopping plug (Non-Ex)
2 + terminal (see Information)
3 - terminal (see Information)
4 Internal ground terminal for the cable shield
5 External ground terminal
6 Shielded twisted pair wire or steel-armored wire

- Only a metal cable gland may be used. The shielded wire on the HART communication line must be grounded.
- The plug is also mounted at the side of |6| in the figure above prior to shipping. The material of plug (aluminum or 316L) varies depending on the type of the transmitter housing material.

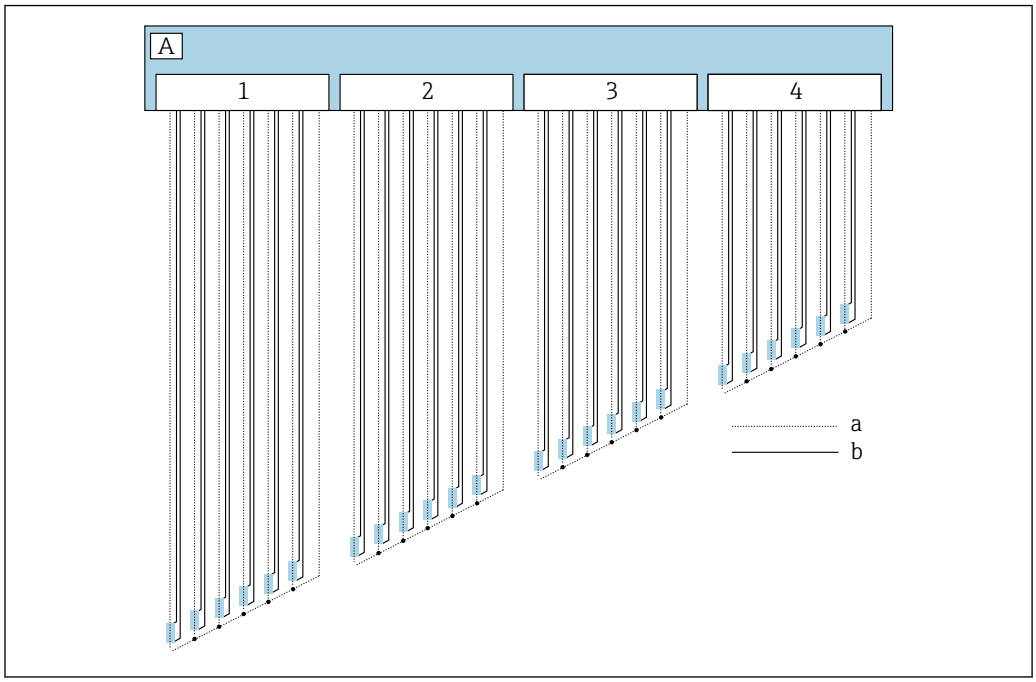
Connection table

Connection to NRF590		Connection to NMS5		Connection to NMS8x/NMR8x/NRF81 [1)]	
+ Terminal	24, 26, 28	+ Terminal	24	+ Terminal	E1
- Terminal	25, 27, 29	- Terminal	25	- Terminal	E2

1) If an analog Ex i/IS 4 to 20 mA HART module is installed, NMT81 can be connected to slot B2, B3 or C2, C3.

NMT81 transmitter and element connection

Four-wire common return enables the highest accuracy in the narrowest probe in a limited tank nozzle opening. The wiring diagram shows the configuration as follows.

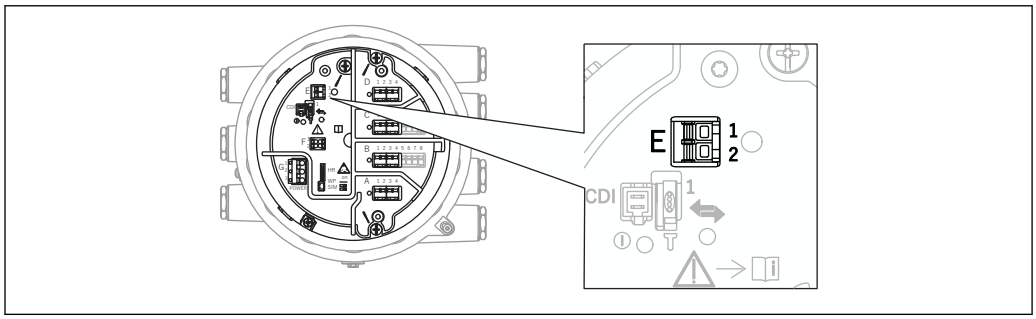


6 *Four-wire connection diagram*

A Sensor unit
a Current flow
b Voltage measurement
1 Connector 1
2 Connector 2
3 Connector 3
4 Connector 4

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

To connect an intrinsically safe NMT81, E1 and E2 are used to connect with NMS8x, NMR8x and NRF81.

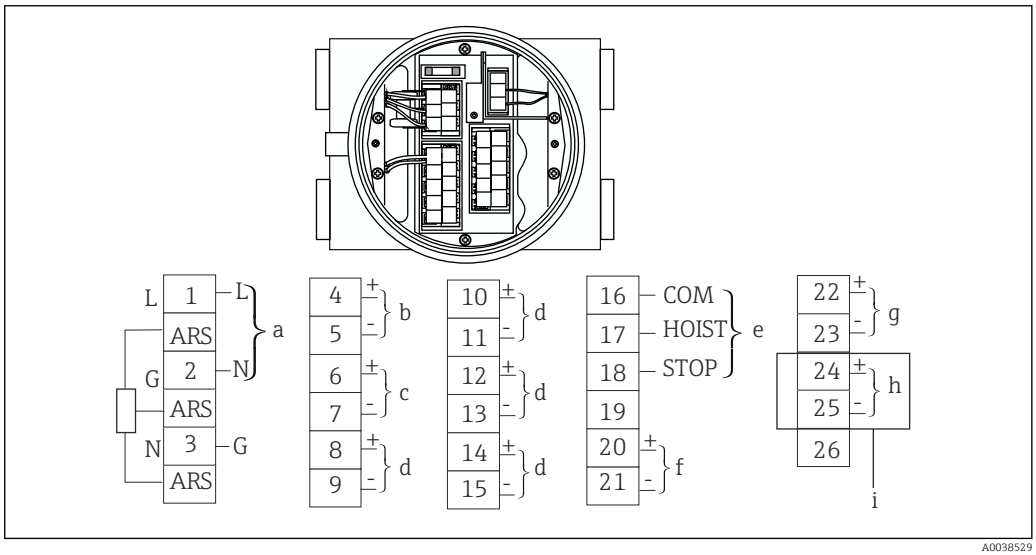


7 *NMS8x terminal for NMT81*

E1 + terminal
E2 - terminal

NMS5 (Ex d [ia]) intrinsically safe connection

The intrinsically safe NMT81 must be connected to the intrinsically safe HART terminal on NMS5.



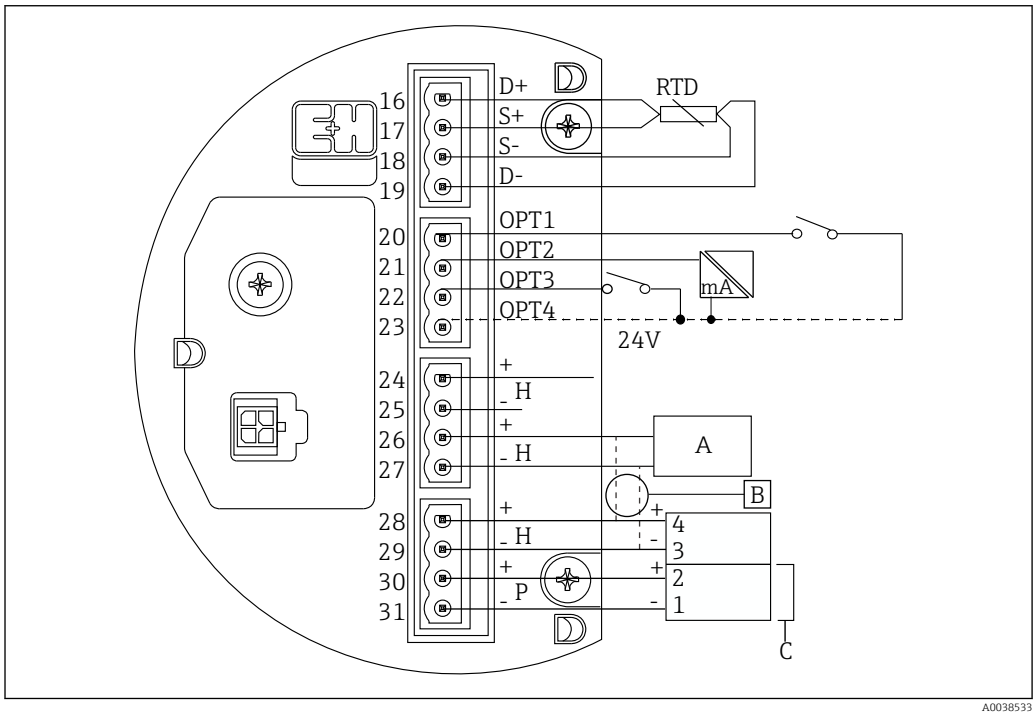
8 *NMS5 terminal*

a *Power supply*
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 NMT81 Ex ia*

Do not connect NMT81 HART communication cable to terminals 4 and 5 on NMS5/NMS7. These terminals are designed to connect to Ex d HART communication.

NRF590 terminals

NRF590 has three sets of intrinsically safe local HART terminals.



9 *NRF590 (intrinsically safe) terminals*

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 HART line cannot be connected from NMT81 to terminals 30 and 31. These terminals are an intrinsically safe 24 V_{DC} power supply for the Micropilot S Series (FMR53x, FMR540).

Performance characteristics

Reference operating conditions

- Ambient temperature Ta = 20 °C (68 °F)
- Ambient pressure = atm. (1 bar (abs.))
- Measured temperature = different temperature by calibration bath at Endress+Hauser production facility as per order.

Converter

This is the case when a Pt100 sensor based on IEC60751/DIN EN60751/JIS C1604 is used.

The converter is under the reference condition.

No.	Name	Value	Condition
1	Resolution	0.0002 °C (0.00036 °F)	/
2	Conversion accuracy	± 0.025 °C (0.045 °F)	Range: −196 to 235 °C (−320.8 to 455 °F)

Converter + Temperature probe

Temperature sensor element characteristics

No.	Sensor type	Accuracy	Standard
1	Class A	± (0.15 + 0.002 x |t|) °c ± (0.27+0.004 x |t - 32|) °F	IEC60751 DIN EN60751 JIS C1604
2	Class 1/10B	± (0.030 + 0.0005 x |t|) °c ± (0.054+0.0009 x |t - 32|) °F	/

- \|t\| represents the temperature of the measured item.
- Class 1/10B is only available at the range of the standard temperature.

Accuracy for the standard temperature range −40 to 75 °C (−40 to 167 °F) [1)]

No.	Name	Sensor type	Sensor accuracy [2)]	Converter accuracy [3)]	Total system accuracy [4)]
1	Five points temperature calibration	1/10B, A	± 0.020 °C (0.036 °F)	± 0.025 °C (0.045 °F)	± 0.032 °C (0.058 °F)
2	Three points temperature calibration	1/10B, A	± 0.048 °C (0.086 °F)		± 0.054 °C (0.097 °F)
3	One point temperature verification	1/10B	± 0.068 °C (0.122 °F)		± 0.072 °C (0.130 °F)
4		A	± 0.300 °C (0.540 °F)		± 0.301 °C (0.542 °F)
5	No temperature calibration	1/10B	± 0.068 °C (0.122 °F)		± 0.072 °C (0.130 °F)
6		A	± 0.300 °C (0.540 °F)		± 0.301 °C (0.542 °F)

1) The range of the temperature accuracy verified in the temperature calibration is −30 to 70 °C (−22 to 158 °F). If calibration of each single element (component calibration) to get the highest accuracy at the range of −196 to 235 °C (−320.8 to 455 °F) is required, contact your E+H Sales Center for further assistance.
2) The sensor accuracy is improved by five or three point calibration.
3) The converter is under the reference condition.
4) Total system accuracy is root-mean-square of sensor accuracy and converter accuracy. Linearity, repeatability, sensitivity, and hysteresis are included in the total system accuracy.

Accuracy for the extended temperature range −196 to 235 °C (−320.8 to 455 °F) [1)]

No.	Name	Sensor type	Sensor accuracy [2)]	Converter accuracy [3)]	Total system accuracy [4)]
1	Five points temperature calibration	A	± 0.020 °C (0.036 °F)	± 0.025 °C (0.045 °F)	± 0.032 °C (0.058 °F)
2	Three points temperature calibration	A	± 0.048 °C (0.086 °F)		± 0.054 °C (0.097 °F)
3	One point temperature verification	A	± 0.620 °C (1.116 °F)		± 0.621 °C (1.118 °F)
4	No temperature calibration	A	± 0.620 °C (1.116 °F)		± 0.621 °C (1.118 °F)

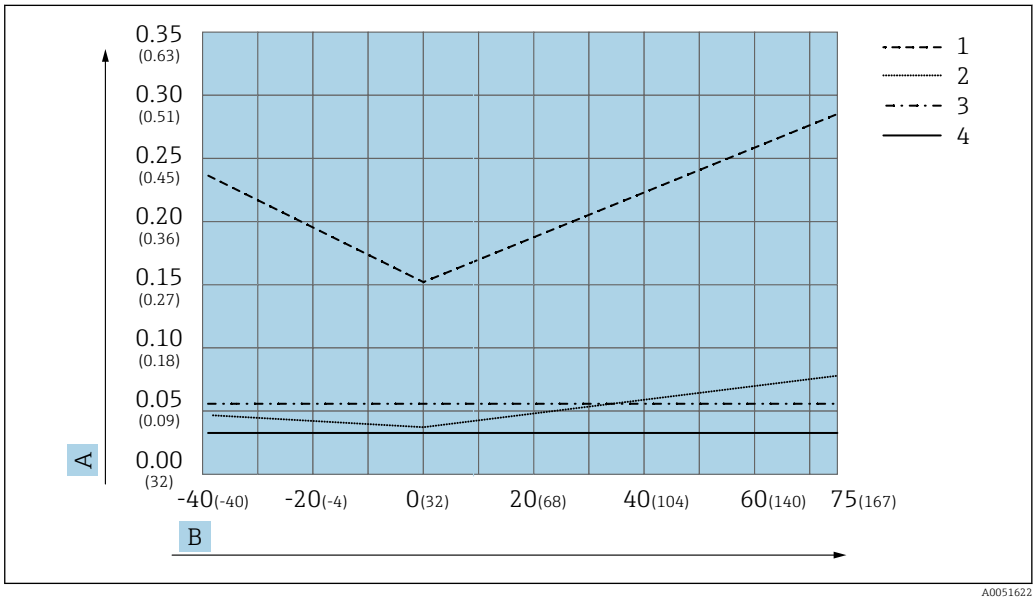
1) The range of the temperature accuracy verified in the temperature calibration is −30 to 70 °C (−22 to 158 °F). If calibration of each single element (component calibration) to get the highest accuracy at the range of −196 to 235 °C (−320.8 to 455 °F) is required, contact your E+H Sales Center for further assistance.
2) The sensor accuracy is improved by five or three point calibration.
3) The converter is under the reference condition.
4) Total system accuracy is root-mean-square of sensor accuracy and converter accuracy. Linearity, repeatability, sensitivity, and hysteresis are included in the total system accuracy.

Calibration temperature

No.	Name	Calibration temperature	Note
1	Five points temperature calibration	−30 °C (−22 °F), 0 °C (32 °F), 20 °C (68 °F), 40 °C (104 °F), 70 °C (158 °F)	System calibration, standard order option
2	Three points temperature calibration	−30 °C (−22 °F), 20 °C (68 °F), 70 °C (158 °F)	System calibration, standard order option
3	One point temperature verification	20 °C (68 °F)	System verification, standard order option

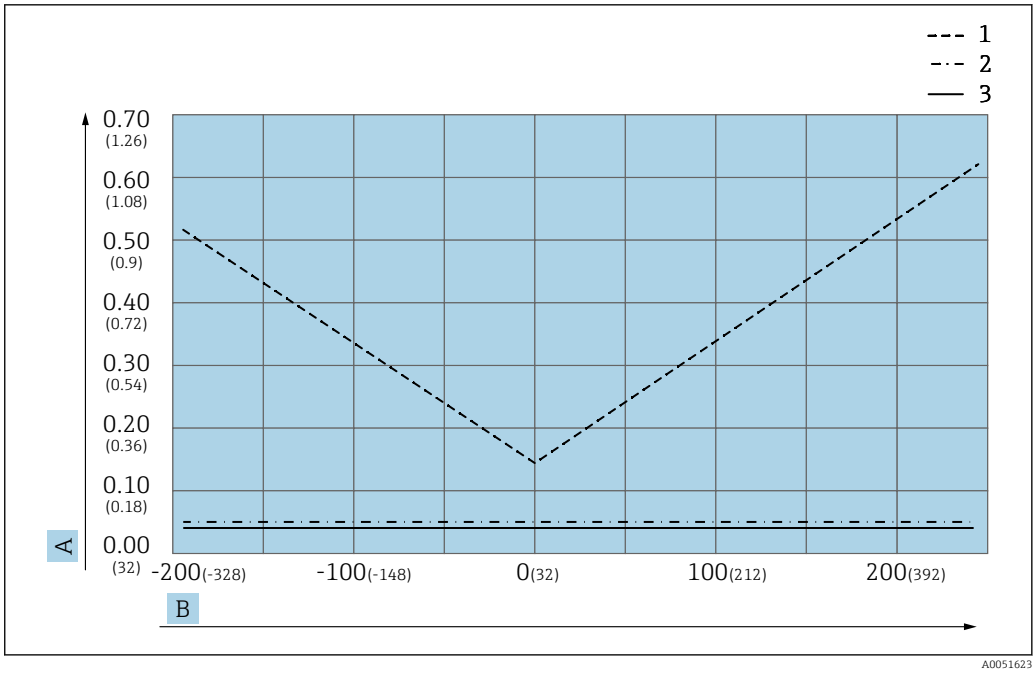
Effect of the temperature calibration

The two graphs show the total accuracy of device.



10 *Total accuracy, standard temperature ranges, Unit of temperature in degree °C (°F)*

A Accuracy in degree
B Temperature in degree
1 Class A, One point temperature verification
2 Class 1/10B, One point temperature verification
3 Three points calibration
4 Five points calibration



11 *Total accuracy, high and low temperature ranges, Unit of temperature in degree °C (°F)*

A Accuracy in degree
B Temperature in degree
1 Class A, One point temperature verification
2 Three points calibration
3 Five points calibration

Water bottom probe

No.	Name	Probe length	Value
1	Resolution	/	0.02 mm (0.0008 in)
2	Level accuracy	500 mm (19.69 in)	± 1.5 mm (0.06 in)
3		1000 mm (39.37 in)	± 2.0 mm (0.08 in)
4		2000 mm (78.74 in)	± 5.0 mm (0.2 in)

Linearity, repeatability, sensitivity, and hysteresis are included in the above described total accuracy.

The values shown above are the result of calibration using air and water when the converter is under the reference condition Ta = 20 ℃ (68 ℉).

Installation

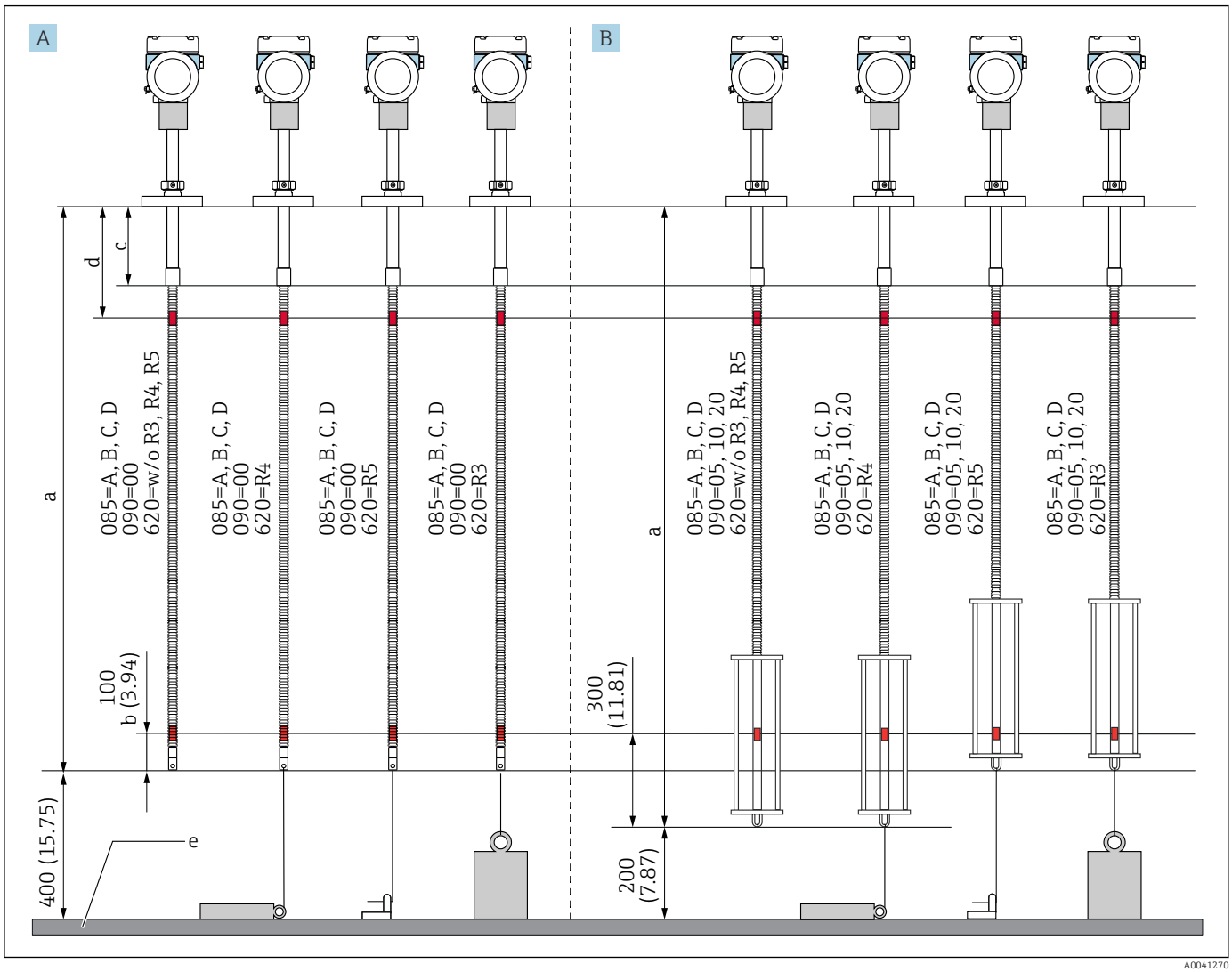
Element No. 1 position

Element No. 1 is mounted inside the probe according to the combinations of order specifications as described in the figure below. The element No. 1 is usually the element mounted in the lowest position in the tank.

When selecting 085 = E (customized positioning) the element No. 1 can be positioned in a range from: 100 mm (3.94 in) (d) measured from end of the probe up to probe length -315 mm (12.40 in) (d)

When selecting 085 = F, the element No. 1 is mounted at the position of 100 mm (3.94 in) from the bottom of the probe (b in the figure), and the element at the highest point is mounted at a position 315 mm (12.40 in) (d in the figure) from the bottom of the flange. All other elements are mounted at a spacing determined by following formula.

Element spacing = (a - b - d) / (number of measuring points - 1)

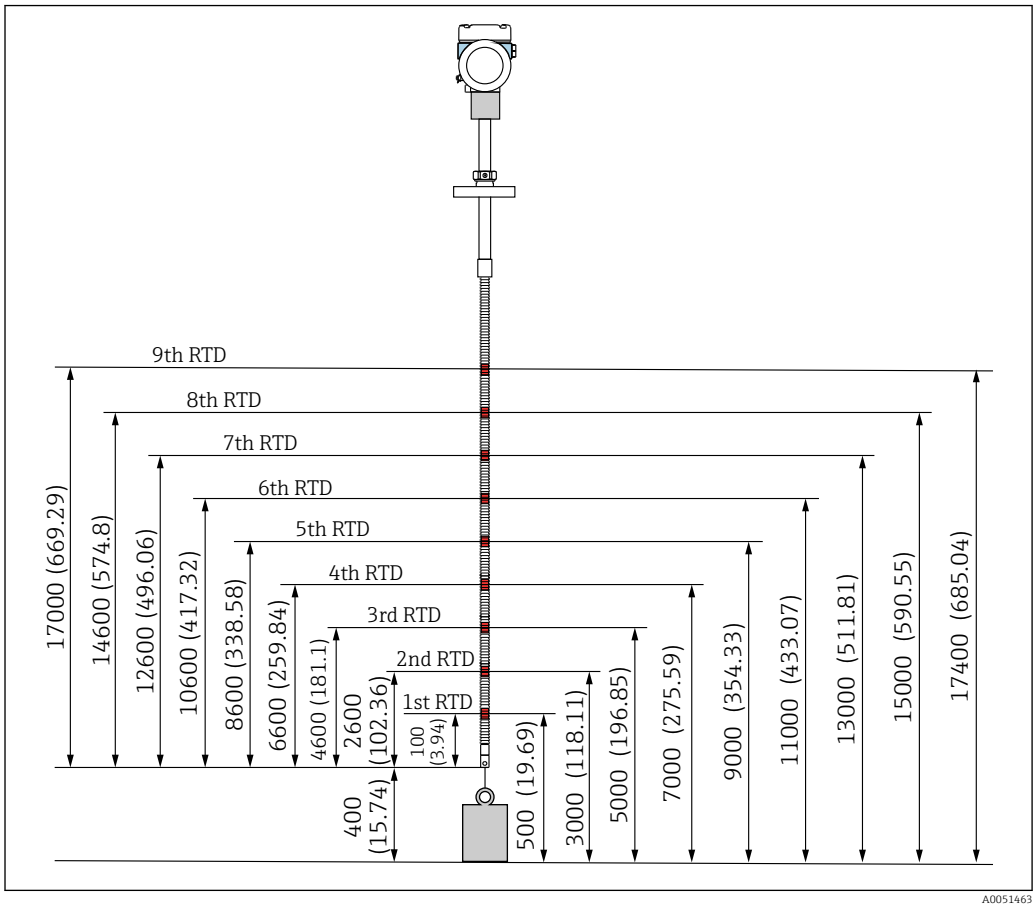


12 *Position of NMT81 element No. 1 based on the installation method. Unit of measurement mm (in)*

A Converter + temperature probe
B Converter + temperature probe + WB probe
a Recommended installation (Probe length)
b Element No.1
c Factory default setting distance from flange bottom to flexible probe: 215 mm (8.46 in)
d Minimum distance from flange bottom to upper element: 315 mm (12.40 in)
e Tank bottom/Datum plate

Element positions

The order specification of 085 E shows element positions from the probe end. FC data shows element positions from the tank bottom/datum plate.



13 *Element position. Unit of measurement mm (in)*

Installation height adjustment

A unique feature of NMT81 is its ability to adjust its height by approx. ±180 mm (7.09 in) from the original position.

The height adjustment can be ordered optionally.

Process connection

Converter-only version

The converter of NMT81 can be used with the temperature probes of other manufacturers with the following mechanical connection sizes and types:

- G 3/4" (NPT 3/4" or equivalent product) universal coupling
- M20 threaded

Refer to the NMT81 Operating Instructions (BA02094G) for detailed installation procedures.

"Converter + temperature probe" and "Converter + temperature probe + WB probe" versions

These two versions can be fitted to a tank nozzle.

The following flange standards are available:

Feature 105: Process Connection, Sealing Surface	
Code	**Descriptions**
AA	Flange ASME B16.5, RF
A1	Thread ASME B1.20.3, NPT
EB	Flange EN1092-1, B1
I1	Thread ISO228, G, universal coupling, converter
JA	Flange JIS B2220, RF

Feature 105: Process Connection, Sealing Surface	
Code	**Descriptions**
JB	Flange JPI 7S-15, RF
X1	Thread DIN13, M, converter

Feature 110: Process Connection	
Code	**Descriptions**
ABJ	NPS 1-1/4" Cl.150, 316/316L
ACJ	NPS 1-1/2" Cl. 150, 316/316L
ADJ	NPS 2" Cl.150, 316/316L
AFJ	NPS 3" Cl.150, 316/316L
AGJ	NPS 4" Cl.150, 316/316L
AQJ	NPS 2" Cl.300, 316/316L
ASJ	NPS 3" Cl.300, 316/316L
EQJ	DN50 PN10/16, 316L
ESJ	DN80 PN10/16, 316L
PDJ	10K 50A, 316L
QDJ	50A 150lbs, 316L
VBJ	3/4", 316L, converter
VLJ	MNPT1-1/2, 316L
VMJ	MNPT2, 316L
XZJ	M20, 316L, converter

1-1/4" and 1-1/2" flange nozzles are only available for temperature measurement without a water bottom due to the size of the nozzle.

WB blocking distance

The WB probe bottom clearance can be adjusted in small increments using the installation height adjustment function. The capacitance WB device in NMT81 has a unique structure in which the ground reference is established with the main unit alone, so it is barely affected by the bottom and the wall of the tank. As a result, measurements can be taken very closely to the bottom of the tank. Due to the mechanical design of the WB probe, the bottom plate including the hook (see the following figure) is approximately 36 mm (1.42 in) in thickness. This becomes the blocking distance (ineffective measuring range).

NOTICE

Setting the WB probe bottom clearance

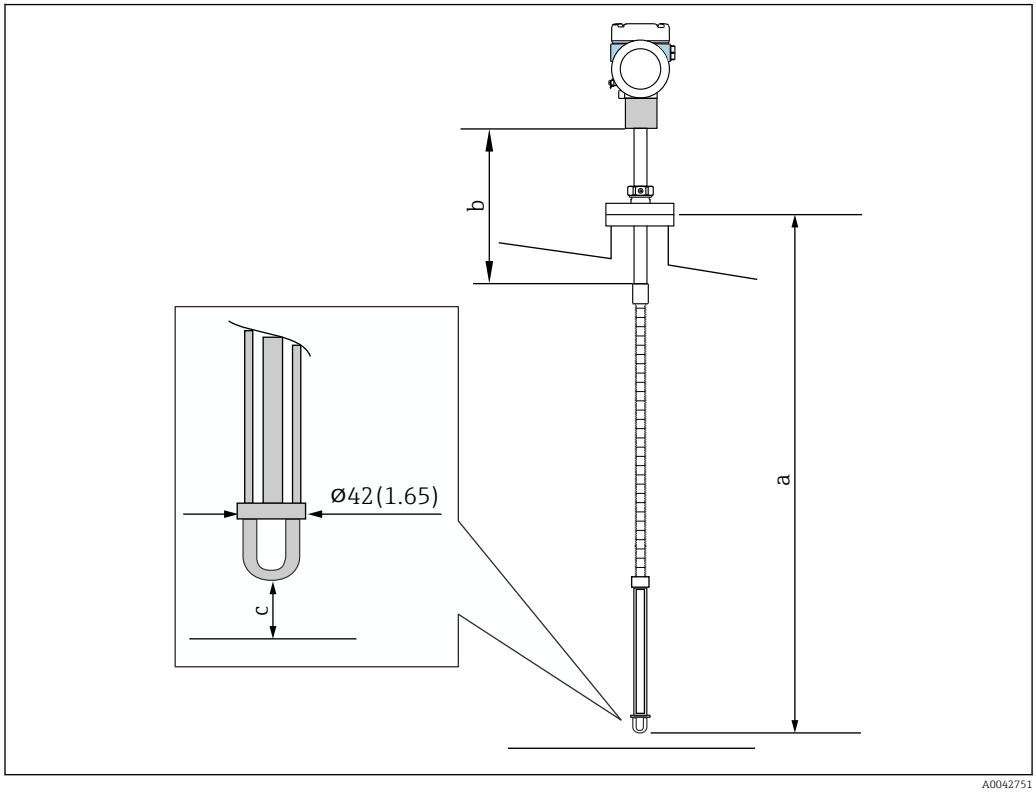
If the WB probe touches the bottom of the tank, the entire weight of the NMT81 flexible probe is applied to the WB probe, which may prevent accurate and stable WB measurement.

► Calculate the vertical movement for the NMT81 installation height prior to setting the WB probe bottom clearance. Approx. 20 to 30 mm (0.79 to 1.18 in) of vertical movement should be allowed for due to external deformation (warping) of a typical tank.

Recommended installation height

The required bottom clearances of both a temperature probe and a WB probe vary depending on the installation method (see the figure of the element No. 1 position). Consider the required bottom clearance when ordering NMT81. Use the recommended clearance in the figure above as a reference or contact your Endress+Hauser Sales Center.

- The standard position of the lowest temperature element should be set at 500 mm (19.69 in) from the bottom of the tank regardless of the probe type, except for element spacing by requested customized spacing or equal distribution.
- The installation height of "a" in the figure is the probe length from the bottom of the flange to the bottom of the temperature probe or bottom of the WB probe.



14 *Recommended installation. Unit of measurement mm (in)*

a Recommended installation
b Approx. ± 180 mm (7.09 in) Total 360 mm (14.17 in) (adjustable range)
c Varies depending on the specifications

Recommended stilling well installation

When installing a base plate at the bottom of a tank, a clearance of at least 300 mm (11.81 in) from the bottom of a stilling well (perforated protective pipe) is required.

If an anchor weight is not being used in the stilling well method, install the WB probe so that its end is below the bottom of the stilling well. This will allow the pipe to be filled with liquid.

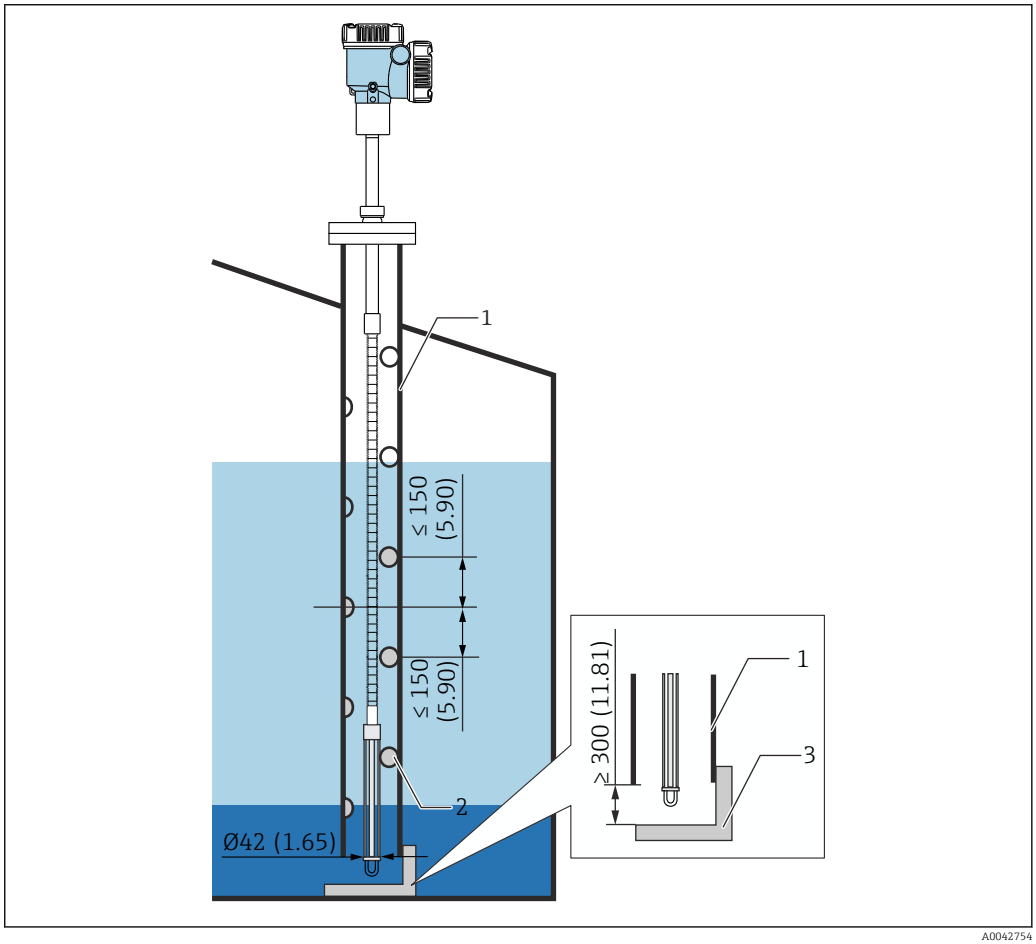
Recommended pipe size for stilling wells is 50A or larger.

NOTICE

Using a stilling well and an anchor weight

The device may receive impacts when liquid is flowed in or out, or when moving a WB probe sideways or swinging. Such impacts may damage the WB probe.

- Use stilling well to protect the device from impact and use a pipe that is at least 100A (4") (JIS, ASME) when using an anchor weight.



15 *Stilling well. Unit of measurement mm (in)*

1 *Stilling well*
2 *Hole (Ø 25 mm (0.98 in))*
3 *Base plate/datum plate*

Installation attachments

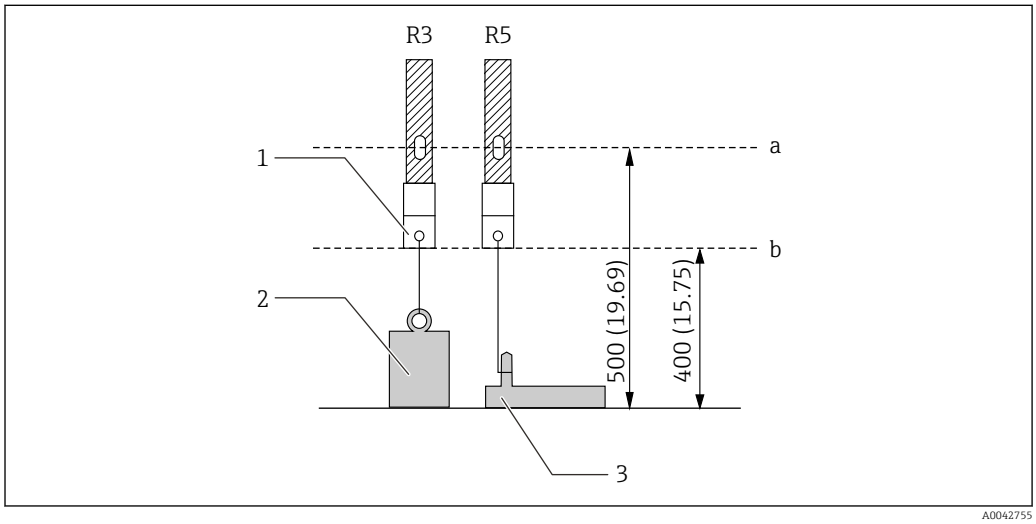
Details of fixture products, ordering information 620: standard contents of installation attachments

620		R3: Anchor weight (High profile, D100)	R4: Anchor weight (Low profile, hexagon H38)	R5: Stranded wire + wire hook + R1 top anchor
94 + 95	0 Converter version	Not selected	Not selected	Not selected
	1, 4 Temperature probe + converter version	Bottom hook Anchor weight Sling wire	Bottom hook Anchor weight Sling wire	Bottom hook Base plate Wire hook R1 top anchor Stranded wire
	3, 5 Temperature probe + WB probe + converter version			

Installation attachment (Converter + temperature probe)

R3	Anchor weight: high profile (D100)
R5	Stranded wire + wire hook + R1 top anchor

A high profile anchor weight is the anchoring method recommended for the converter + temperature probe versions. Both high profile anchor weight and stranded wire anchor methods have a recommended clearance of approx. 400 mm (15.75 in) between the bottom hook and the tank bottom. This clearance can be adjusted easily using the height adjuster at the top of the tank.



16 *Installation attachment 1 (Converter + temperature probe). Unit of measurement mm (in)*

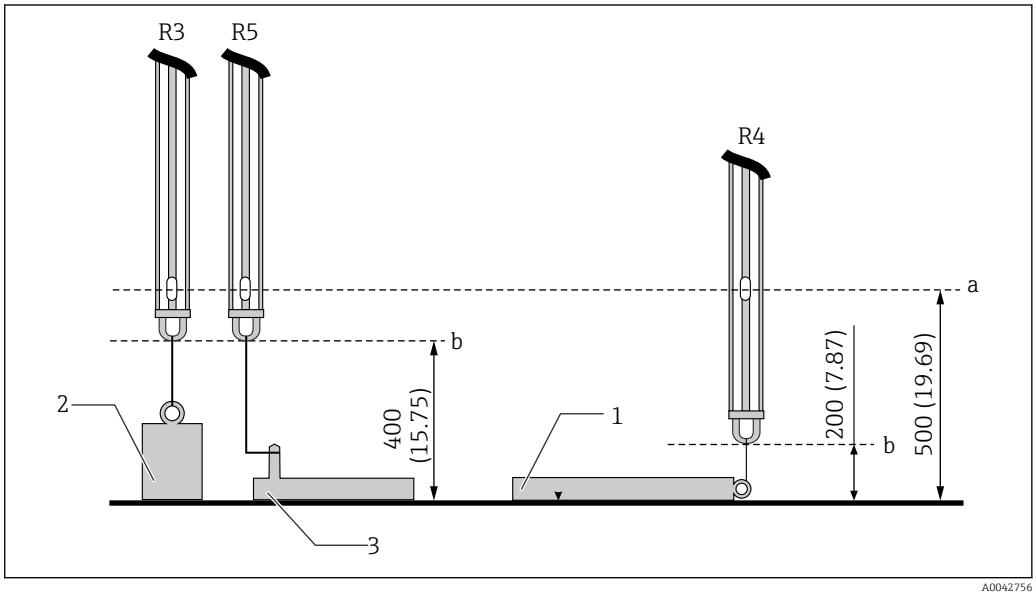
a Lowest element position
b Clearance from bottom of tank to bottom hook
1 Bottom hook
2 Anchor weight (high profile)
3 Wire hook

When ordering NMT81, refer to "Ordering information: item 85 (temperature element interval).

Installation attachment 2 (Converter + temperature probe + WB probe)

R3	Anchor weight: high profile (D100)
R4	Anchor weight: low profile (hexagon H38)
R5	Stranded wire + wire hook + R1 top anchor

A low profile anchor weight is mainly designed to secure a WB probe and it makes NMT81 possible to install in the lower position for measuring the WB measurement range more accurately compared to a high profile anchor. It is also possible to install from a tank top nozzle exceeding the diameter. For a temperature probe and WB probe with a low profile anchor weight, a clearance of 200 mm (7.87 in) from the WB probe bottom is recommended.



17 *Installation attachment 2. Unit of measurement mm (in)*

a Lowest element position
b Clearance from WB probe
1 Anchor weight (low profile)
2 Anchor weight (high profile)
3 Wire hook

The lowest possible WB measuring point is approximately 36 mm (1.42 in) from the bottom of the tank. Use the height adjuster to set it to the desired installation height if necessary.

Mounting NMT81 on a cone roof tank

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

There are three ways to install NMT81 onto a cone roof tank:

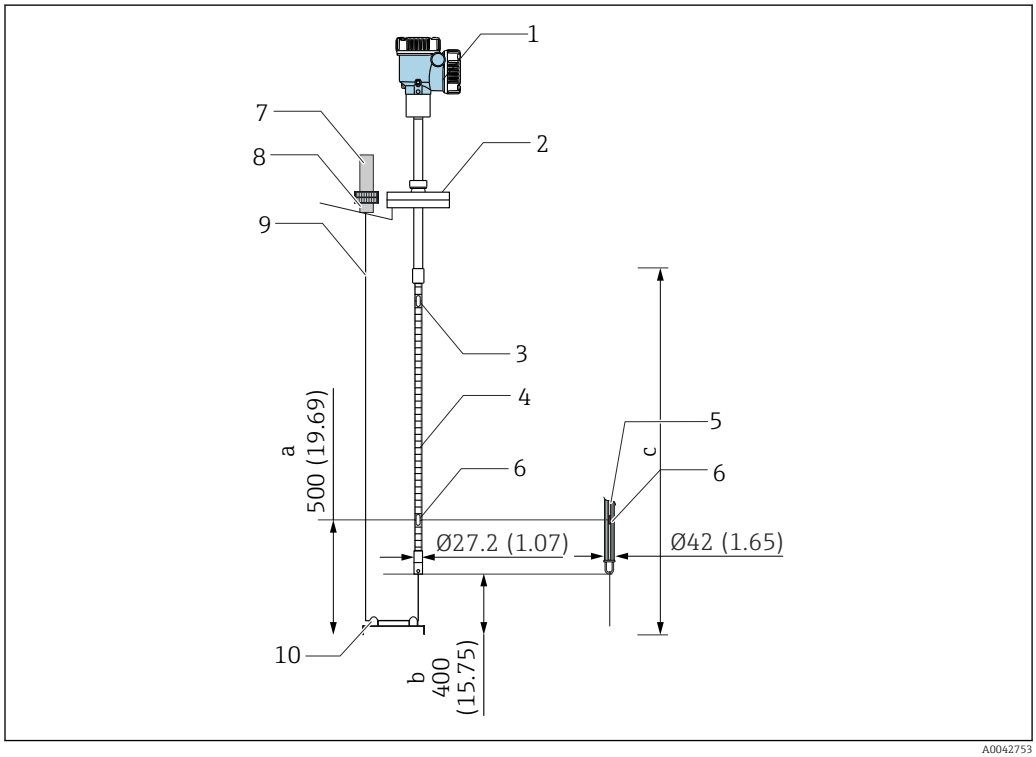
- Top anchor method
- Stilling well method
- Anchor weight method

If a heating coil is attached to the bottom of the tank, install NMT81 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).

Top anchor method

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

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



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

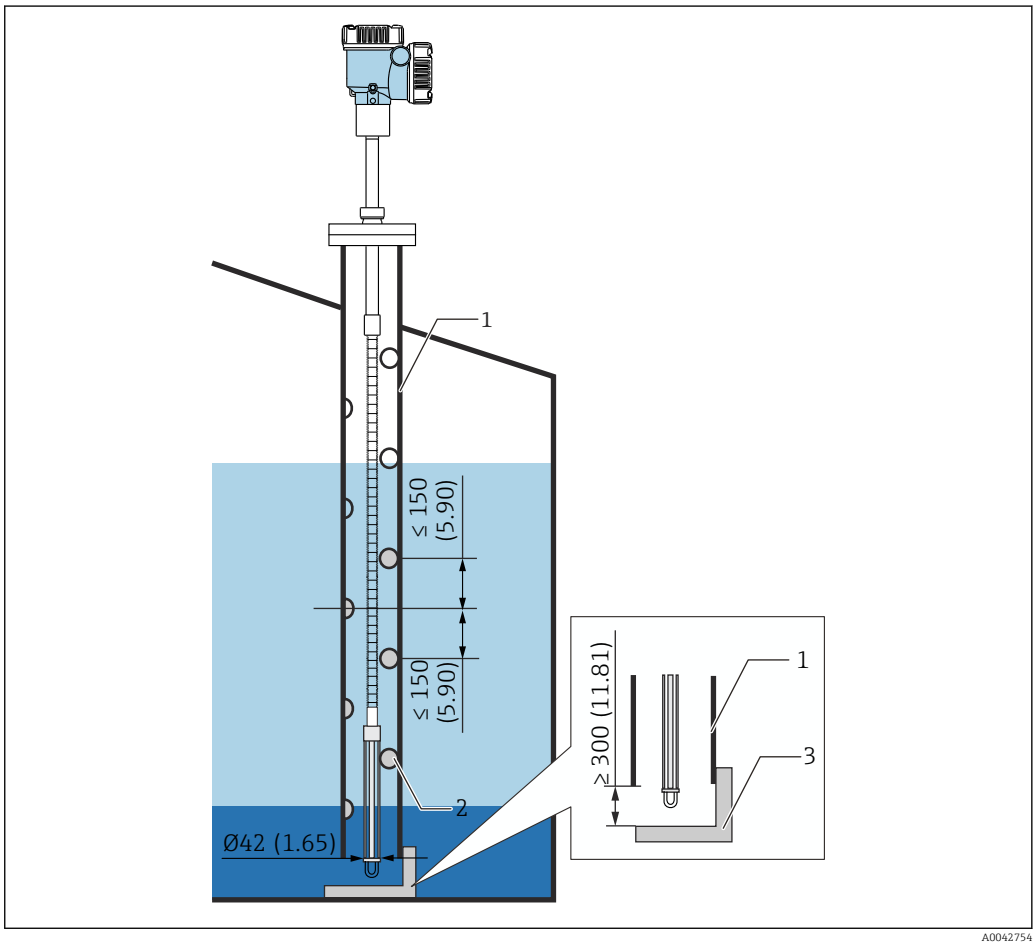
a From the tank bottom to the lowest element
b From the tank bottom to the probe bottom
c Tank height
1 Converter (electrical compartment)
2 Flange
3 Highest temperature element
4 Temperature probe
5 WB probe
6 Element position No.1 (lowest element)
7 Top anchor
8 Socket
9 Stranded wire
10 Wire hook

Stilling well method

Prepare the stilling well that is larger than the diameter of the measuring probe when installing it.

When using an anchor weight, use a pipe that is 100A (4") (JIS, ASME) or larger. If an anchor weight is not being used in the stilling well method, install the WB probe so that its end is below the bottom of the stilling well. This will allow the pipe to be filled with liquid.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



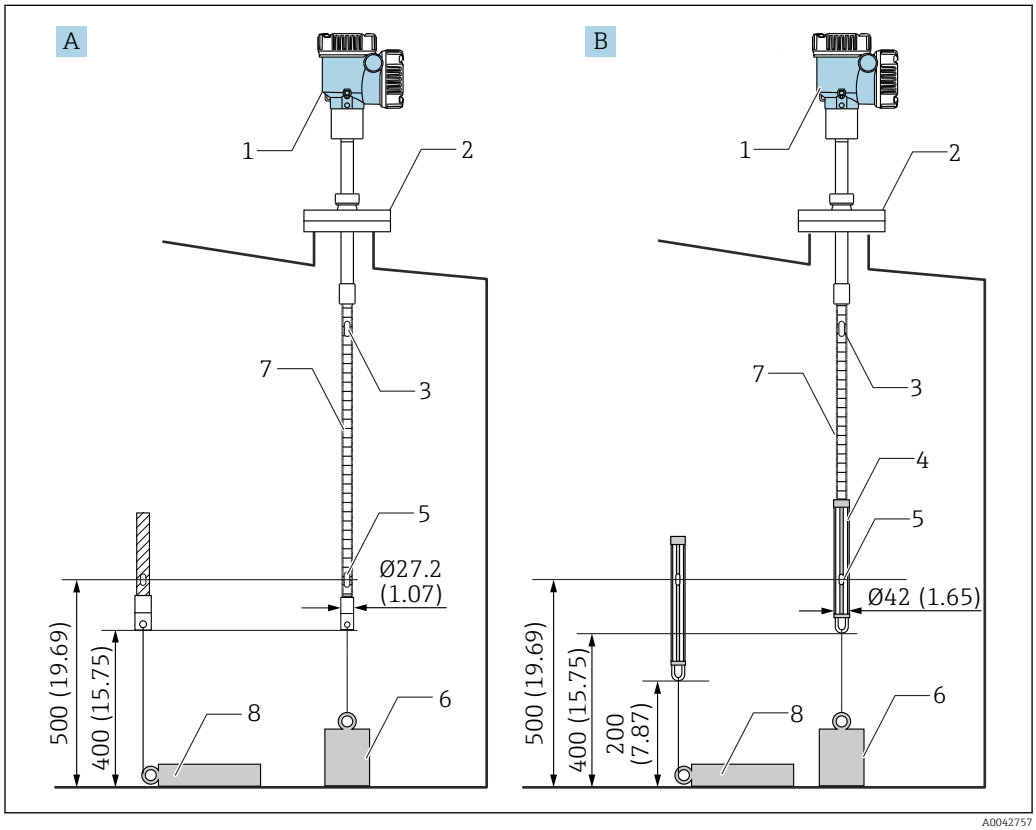
19 *Stilling well. Unit of measurement mm (in)*

1 *Stilling well*
2 *Hole (φ 25 mm (0.98 in))*
3 *Base plate/datum plate*

Anchor weight method

This method secures a temperature probe using an anchor weight.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



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

A Without WB probe
B With WB probe
1 Converter (electrical compartment)
2 Flange
3 Top element
4 WB probe
5 Element No.1 (lowest element)
6 Anchor weight (high profile)
7 Temperature probe
8 Anchor weight (low profile)

CAUTION

Installation of an anchor weight

Using an anchor weight that is heavier than 6 kg (13.23 lb) may cause internal damage to the temperature probe.

- ▶ Ensure that the anchor weight is stable at the bottom of the tank. When installing NMT81 with a suspended anchor weight, use an anchor weight that weighs 6 kg (13.23 lb) or less.

Mounting NMT81 on a floating roof tank

There are three ways to mount NMT81 on to a floating roof tank.

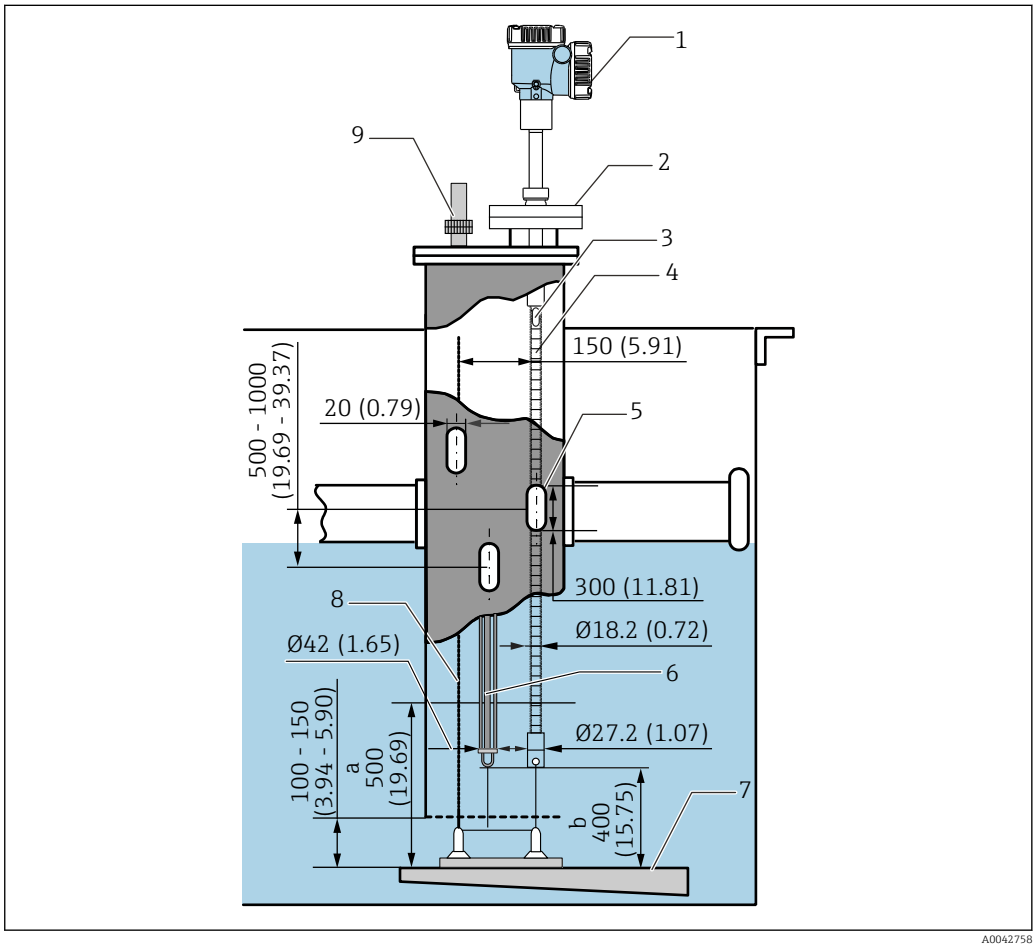
- Top anchor method
- Stilling well method
- Guide ring and anchor weight method

If a heating coil is attached to the bottom of the tank, install NMT81 so that the bottom hook of a temperature probe or a WB probe is not too close to the heating coil.

Top anchor method

Insert a temperature probe or a WB probe into a fixed pipe and secure it with a top anchor.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



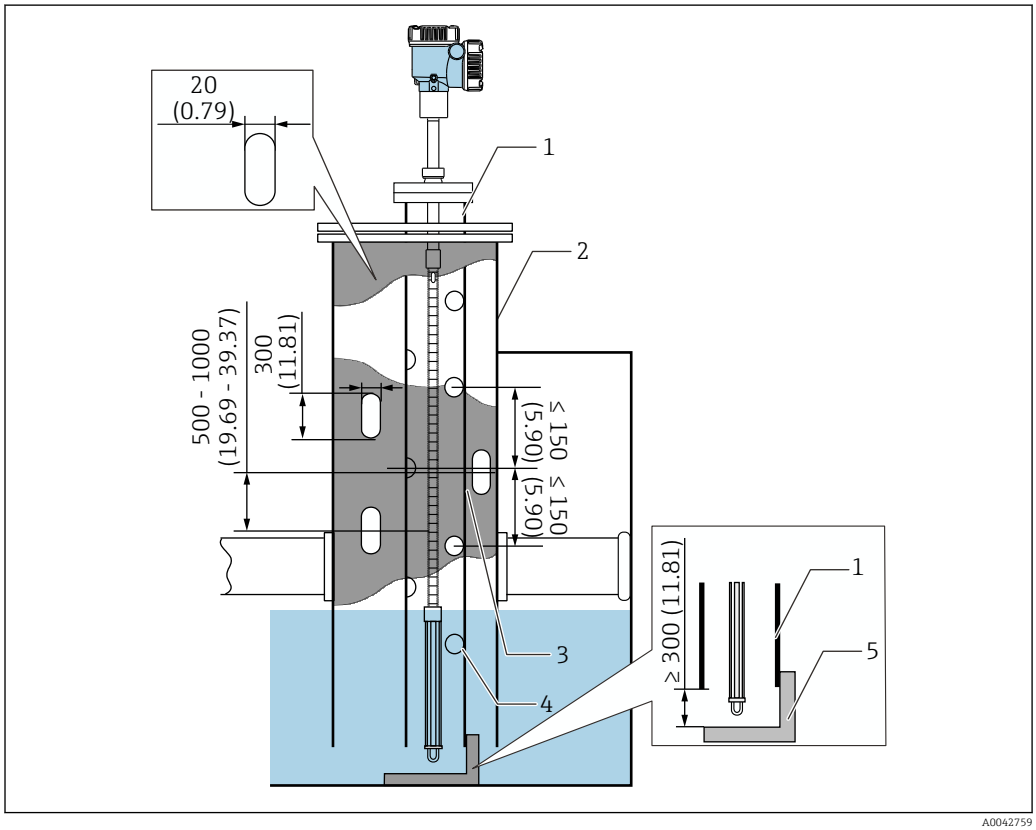
21 *Top anchor method. Unit of measurement mm (in)*

a Distance between the base plate and the temperature probe
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 Stilling well hole
6 Temperature probe (with WB probe)
7 Base plate/datum plate
8 Stranded wire
9 Top anchor

Stilling well method

Insert a temperature probe and a WB probe into a stilling well that is 50A (2") or larger. The installation procedure is same for only temperature version.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



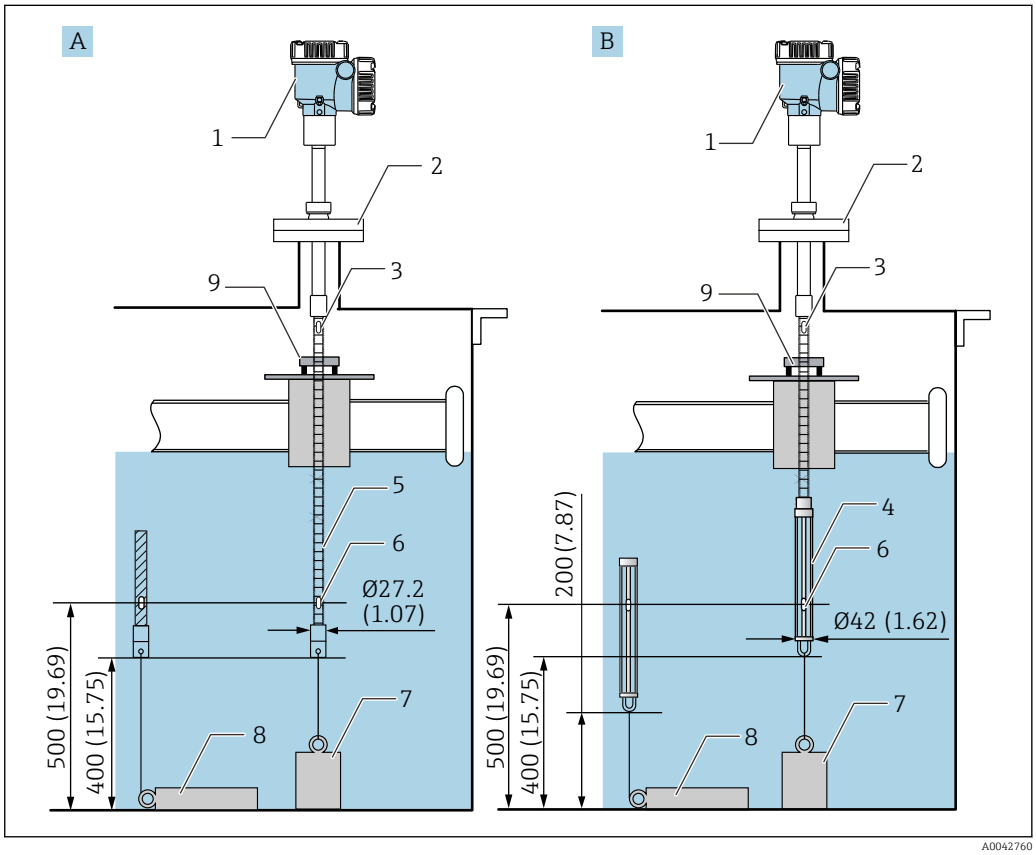
22 *Stilling well method. Unit of measurement mm (in)*

1 *Stilling well*
2 *Fixed pipe*
3 *Fixed pipe hole*
4 *Stilling well hole (φ 25 mm (0.98 in))*
5 *Base plate/datum plate*

Guide ring and anchor weight method

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

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



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

A Without WB probe
B With WB probe
1 Converter (electrical compartment)
2 Flange
3 Top element
4 WB probe
5 Temperature probe
6 Element No.1 (lowest element)
7 Anchor weight (high profile)
8 Anchor weight (low profile)
9 Guide ring (not supplied, see NOTE.)

Guide ring must be prepared by a customer or contact your Endress +Hauser Sales Center for further information.

CAUTION

Installation of an anchor weight

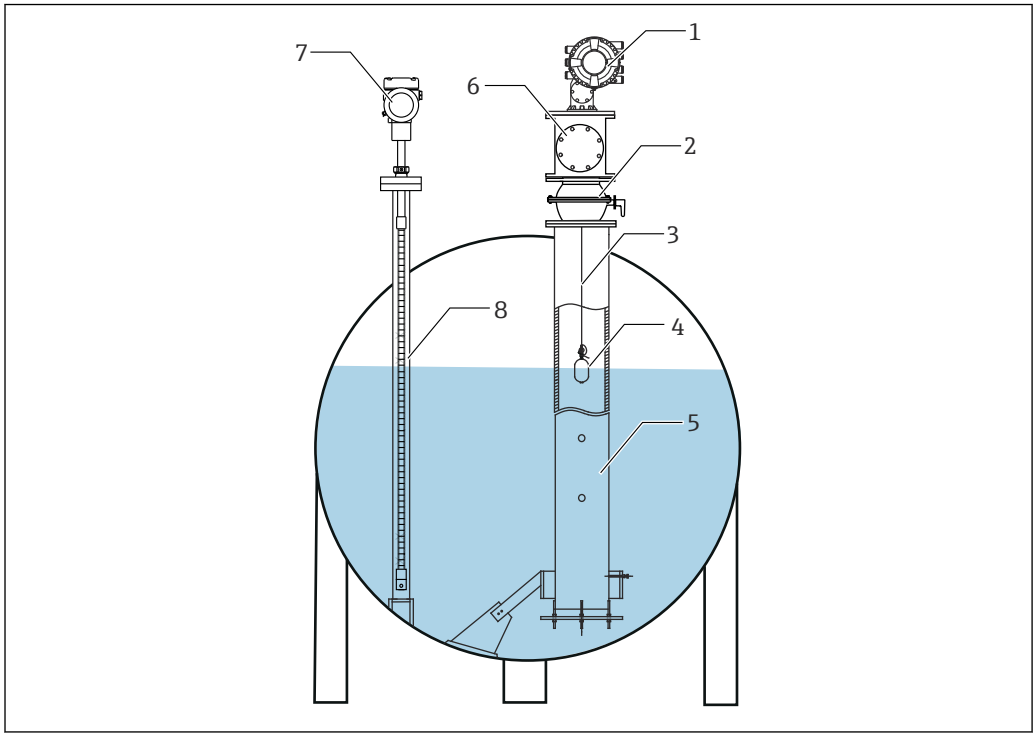
Using an anchor weight that is heavier than 6 kg (13.23 lb) may cause internal damage to the temperature probe.

- Ensure that the anchor weight is stable at the bottom of the tank. When installing NMT81 with a suspended anchor weight, use an anchor weight that weighs 6 kg (13.23 lb) or less.

Mounting NMT81 on a pressurized tank

In a pressurized tank, a protective pipe or a thermowell without any holes, slits, nor an open end must be installed in order to protect the probes from pressure.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



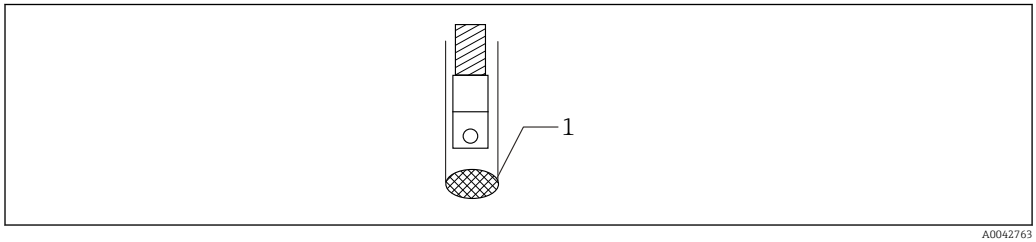
A0042762

24 Thermowell for a pressurized tank

1 NMS8x/NMS5
2 Ball valve
3 Measuring wire
4 Displacer
5 Stilling well
6 Maintenance chamber
7 NMT81
8 Thermowell

If the pressure inside a tank exceeds the pressure limit, install a thermowell with no holes or slits surrounding NMT81 to protect NMT81 from the application (process) pressure. However, NMS8x requires a stilling well with holes and slits.

The thermowell is installed from the top of the tank nozzle. Cover the bottom of the thermowell and weld it to protect the probe from the pressure.



A0042763

25 Thermowell welding

1 Welding point

Process

Process temperature range

Temperature probe	−196 to 235 °C (−320.8 to 455 °F)
WB probe	0 to 70 °C (32 to 158 °F) (T6), 0 to 75 °C (32 to 167 °F) (T4 to T2)

Follow the range of the temperature according to the table described in the Safety Instruction when using a device in the hazardous area.

Process pressure limits

The device can withstand the head water pressure at the position of 100 m (328.08 ft) in a pressure tank with 1.2 bar absolute (gauge pressure 0.2 bar).

The device can withstand the head water pressure at 40 m (131.23 ft) in a pressure tank with 7 bar absolute (gauge pressure 6 bar). This is for the device version without a height adjuster.

For a pressure tank, when using a tank that exceeds the process pressure, install a thermowell with no holes or slits onto NMT81 to protect the probes from the pressure inside the tank.

Feature: 61 Application Pressure		**Feature: 65 Sensor Height Adjustment**		**Probe length**
A	0.2 bar / 20 kPa / 2.9 psi (gauge)	0	Not selected	Up to 100 m (328.08 ft)
		1	Selected	
B	6 bar / 600 kPa / 87 psi (gauge)	0	Not selected	Up to 40 m (131.23 ft)
		1	Selected	N/A [1)]

1) The combination of B and 1 cannot be selected.

Environment

Ambient temperature

T-Class	Ambient temperature
T6	−40 °C (−40 °F) ≤ Ta ≤ 60 °C (140 °F)
T4 to T2 **Non hazardous**	−40 °C (−40 °F) ≤ Ta ≤ 70 °C (158 °F)

Measure of low or high temperature liquid

- The process temperature shall not bring the enclosure of the electronics compartment beyond the specified ambient temperature range limits.
- When installing high or low temperature storage tank, heat or cold from the liquid, the vapor or tank wall should not be conducted to the NMT81 directly.
- Cover the tank with a thermal isolated material and/or install an ambient temperature adjustment pipe between NMT81 and nozzle of the tank.

Storage temperature

−40 to 85 °C (−40 to 185 °F)

Protection class

IP66/68, Type 4X / 6P	Converter set with a temperature device or a WB device
IP20	Converter only

Shock resistance

- 10 g (11 ms) according to IEC 60721-3-4 (1995)
- Classification according to IEC 60721-3-4: 4M4 (1995)

Vibration resistance

- 5 to 9 Hz Displacement vibration (single amplitude) 3.0 mm (0.12 in)
- 9 to 200 Hz Acceleration amplitude 10 m (32.8 ft)/s2

Electromagnetic compatibility (EMC)

When installing the probes to metal or concrete tanks:

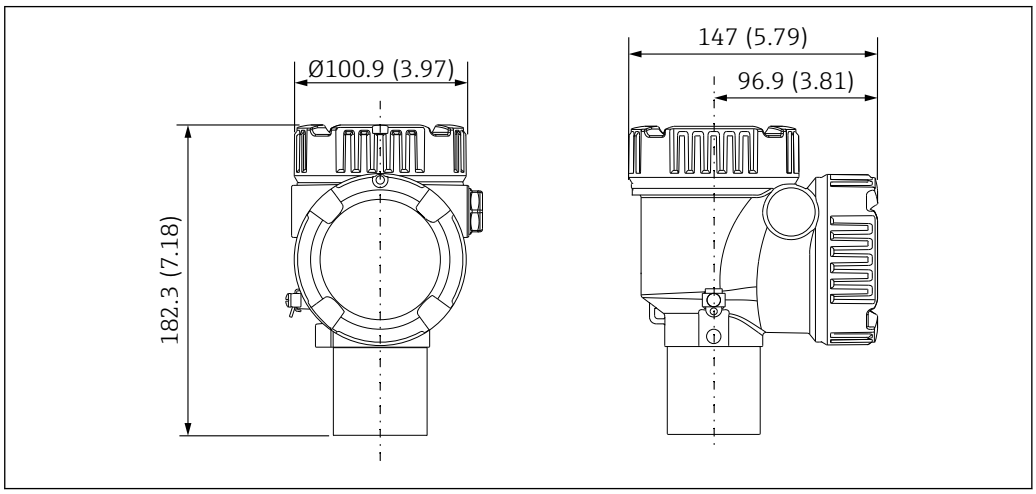
Emission	Conforms to Class A EN 61326-1, electrical device class 1/10B
Immunity	Conforms to Class A EN 61326-1

Maximum use altitude

2 000 m (6 561.68 ft) above sea level

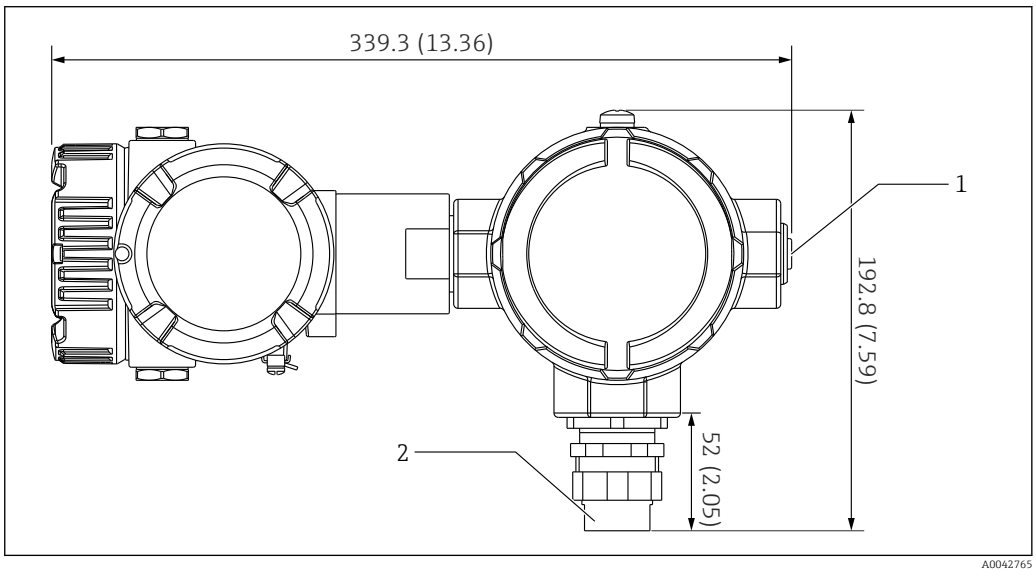
Mechanical construction

Converter



26 Standard converter. Unit of measurement mm (in)

Option 1: Converter with universal coupling



27 Option 1: converter (Standard G3/4 (NPT 3/4) universal coupling connection). Unit of measurement mm (in)

1 G 1/2 Stopping plug
2 G 3/4 thread

Option 1: Measurement functions

Because the software in the converter is equipped with a function that converts elements with different characteristics, it is possible to use other brand's temperature probes.

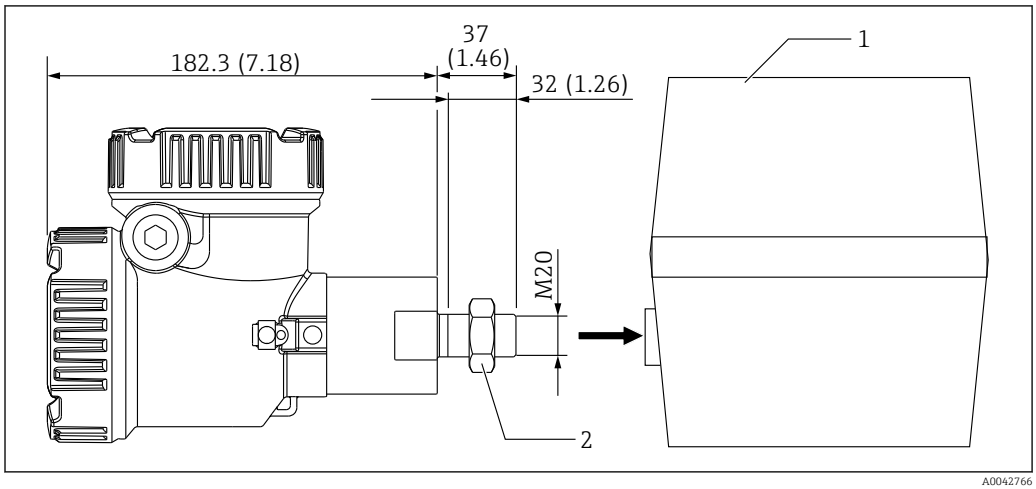
The NMT81 converter only version supports the following element types:

Elements	Standard	Temperature coefficient
Pt100	IEC60751	α=0.00385
Pt100	GOST	α=0.00391
Cu100	GOST	α=0.00428
Ni100	GOST	α=0.00617

- If elements other than the items above are required, contact your Endress+Hauser Sales Center.
- NMT81 is four-wire only with MSTs (Multi-spot thermometers), but it is not compatible with a thermocouple temperature device.
- The physical connection between a probe and NMT81 is completed by a zinc-plated carbon steel G 3/4" (NPT 3/4") universal threaded coupling. If a different thread size is required, Endress+Hauser can provide a solution by adapting a variety of coupling sizes and materials based on existing temperature probe specifications. Contact your Endress+Hauser Sales Center.
- Power supply and data transmission lines are both provided from the host gauge of NMS5, NMS8x, NMR8x, NRF81 or NRF590 through a two-wire local HART loop connection. NMT81 can be configured and operated using FieldCare.

Option 2: Converter with M20 mounting thread

This option model is designed specifically to connect with a Whessoe Varec 1700 series average temperature probe. WB data is not available because the 1700 series does not have WB.



28 Option 2: converter (Varec 1700, M20 threaded connection). Unit of measurement mm (in)

1 Existing 1700 series RT probe terminal box on-site
2 Lock nut

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

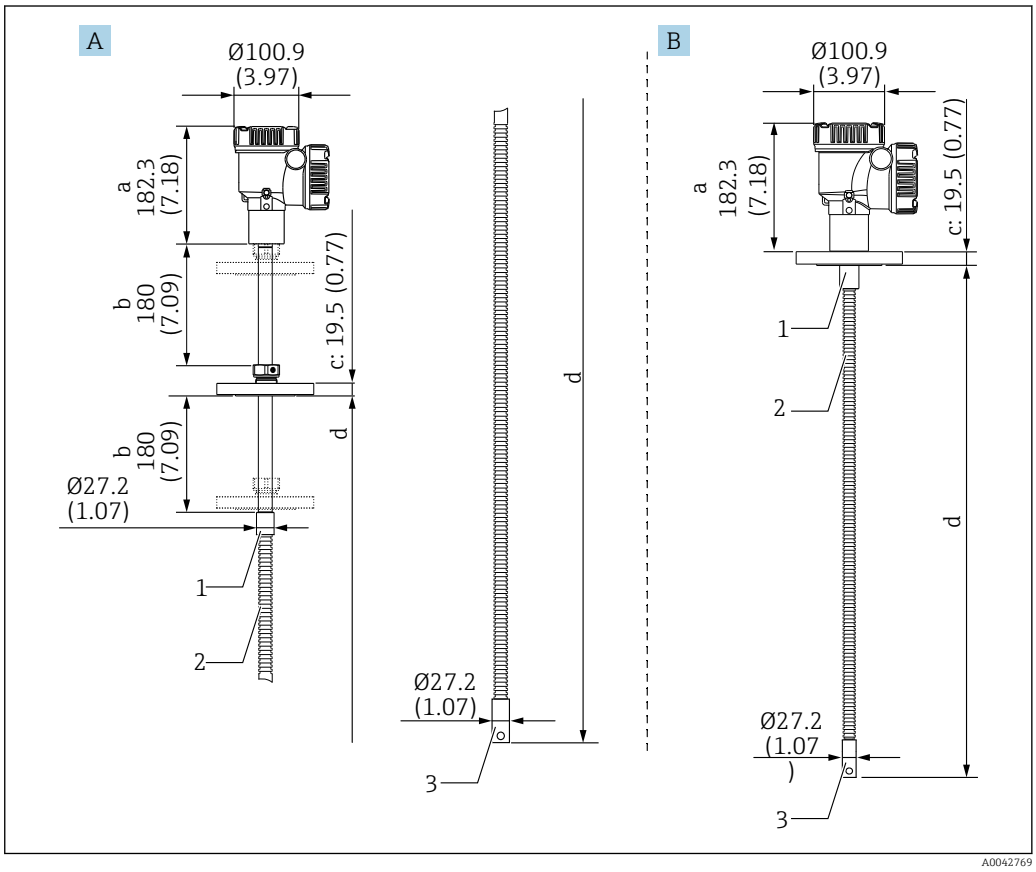
1. Use sealing tape to protect the threaded connection opening, and insert the cable bundle (RTD signal entry cable) into the female threaded connection opening on the terminal box.
2. Screw on the NMT81 converter by rotating it at least 10 times clockwise, and secure it with a lock nut.
   ↳ A loose connection between NMT81 and Varec1700 terminal housings will lead to malfunction due to ingress of flood and other factors.

This completes the procedure.

Option 2: Measurement functions

Option 2 has the same functions as option 1; however, option 2 is designed so that a special M20 threaded connection opening fits directly in the existing terminal housing of a Varec 1700. The wiring of RTD signals from the probe to NMT81 is done in the terminal box of the Varec 1700 and not on the NMT81 side. For this reason, there is no additional housing provided to NMT81 as in option 1.

Converter + average temperature probe version



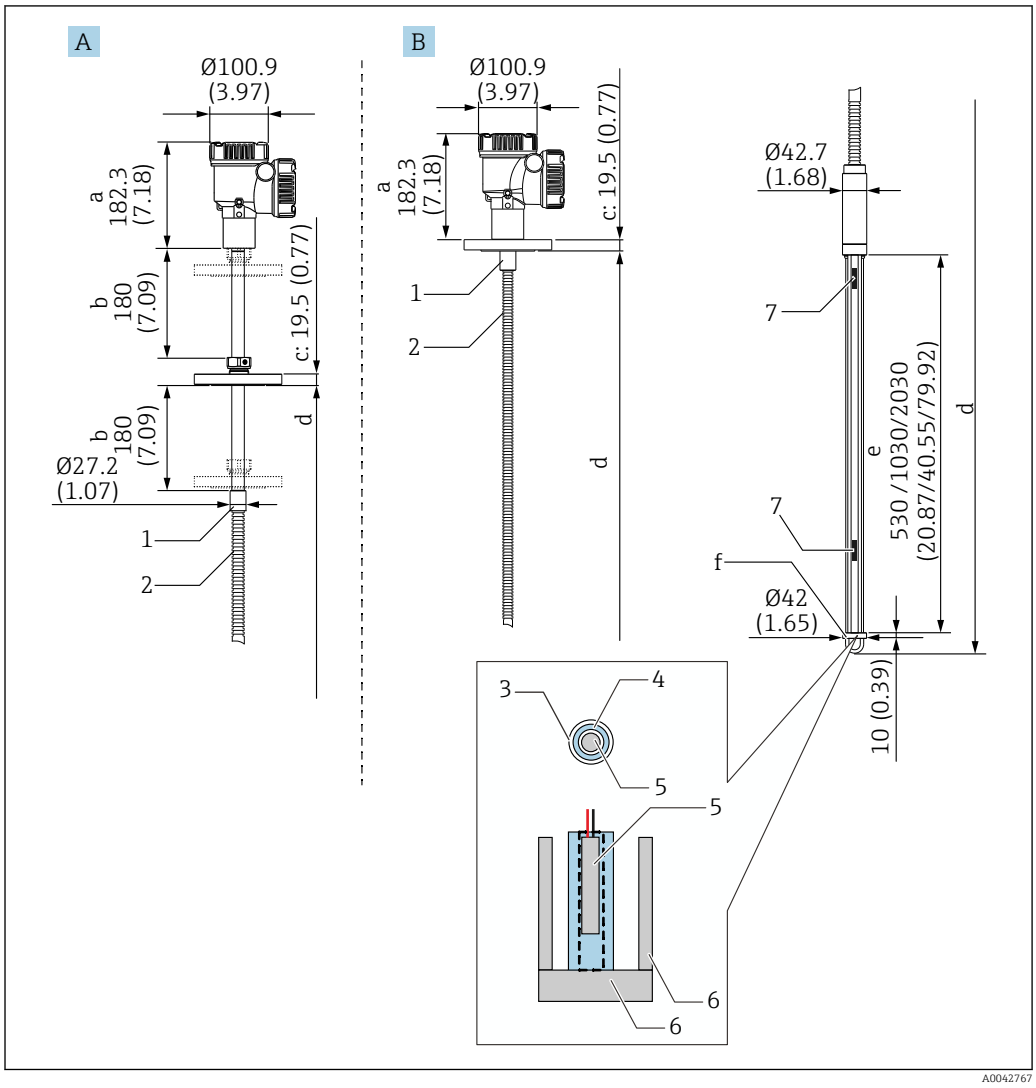
29 Converter + average temperature probe. Unit of measurement mm (in)

A Adjustable flange
B Welded flange
a Converter height
b Adjustable installation height
c Based on flange standards
d Temperature probe length (see below)
1 316L
2 316L
3 316L

The following tolerances are applied regardless of an optional WB probe. However, the position of the flange cannot be adjusted in a welded flange type.

Probe length	Tolerance of probe and element positions
1000 to 25000 mm (39.37 to 984.25 in)	± 50 mm (1.97 in)
25001 to 40000 mm (984.29 to 1574.80 in)	± 50 mm (1.97 in)
40001 to 60000 mm (1574.84 to 2362.21 in)	± 100 mm (3.94 in)
60001 to 100000 mm (2362.24 to 3937.01 in)	± 300 mm (11.81 in)

Converter + average temperature probe + water bottom probe



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

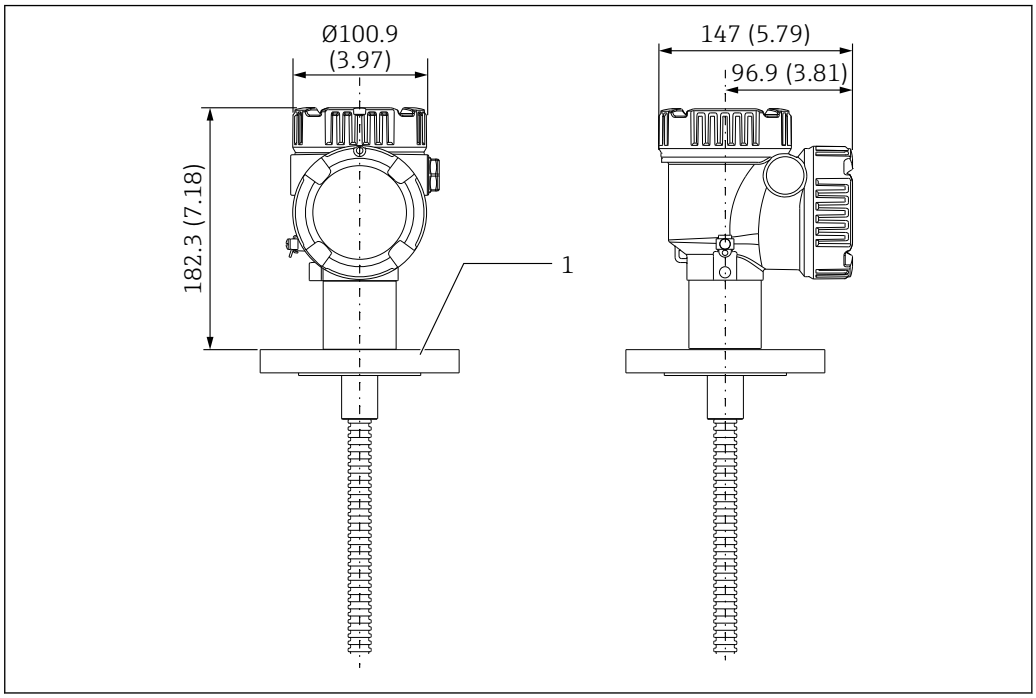
A Adjustable flange
B Welded flange
a Converter height
b Adjustable installation height
c Based on flange standards
d Probe length (from flange bottom to the tip of WB probe) (see below)
e Capacitance WB probe
f Anchor weight hook (316L)
1 316L
2 316L
3 PFA protection tube (thickness 1 mm (0.04 in))
4 Sensor pipe (304)
5 Pt100 element
6 Base plate/side rod (316L)
7 Element

The following tolerances are applied regardless of an optional WB probe. The position of the flange cannot be adjusted in a welding flange type.

Probe length	Tolerance of probe and element positions
1 000 to 25 000 mm (39.37 to 984.25 in)	± 50 mm (1.97 in)
25 001 to 40 000 mm (984.29 to 1 574.80 in)	± 50 mm (1.97 in)
40 001 to 60 000 mm (1 574.84 to 2 362.21 in)	± 100 mm (3.94 in)
60 001 to 100 000 mm (2 362.24 to 3 937.01 in)	± 300 mm (11.81 in)

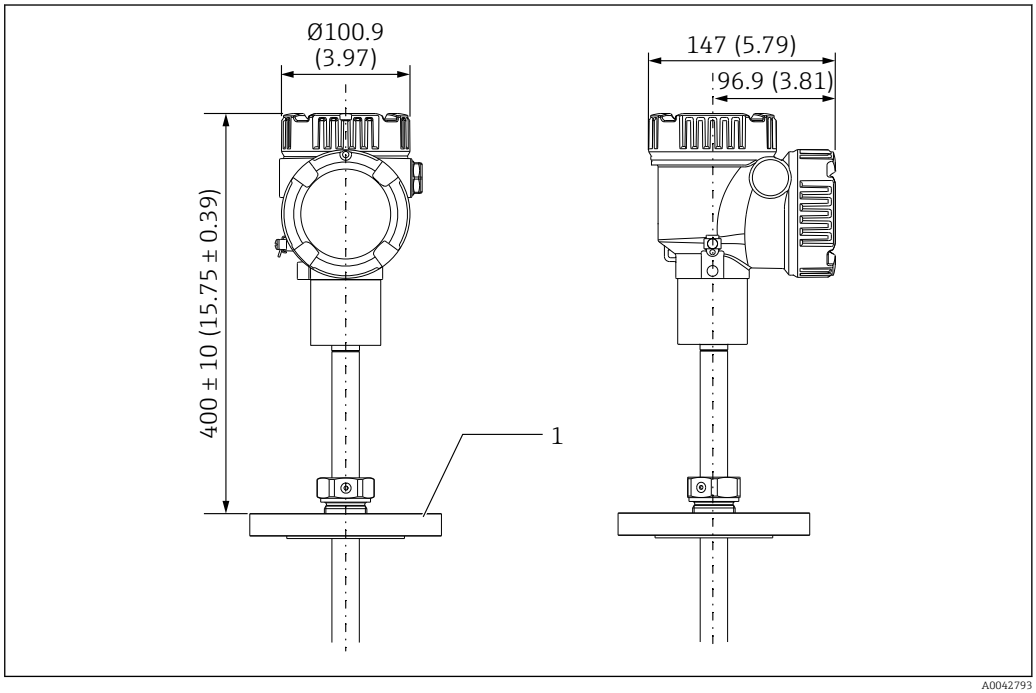
Flange

Welded flanges are more watertight because the joint is completely welded together. However, the position of welded flanges cannot be adjusted.



31 *Welded flange. Unit of measurement mm (in)*

1 Flange (JIS, ASME, JPI, DIN)



32 *Adjustable flange. Unit of measurement mm (in)*

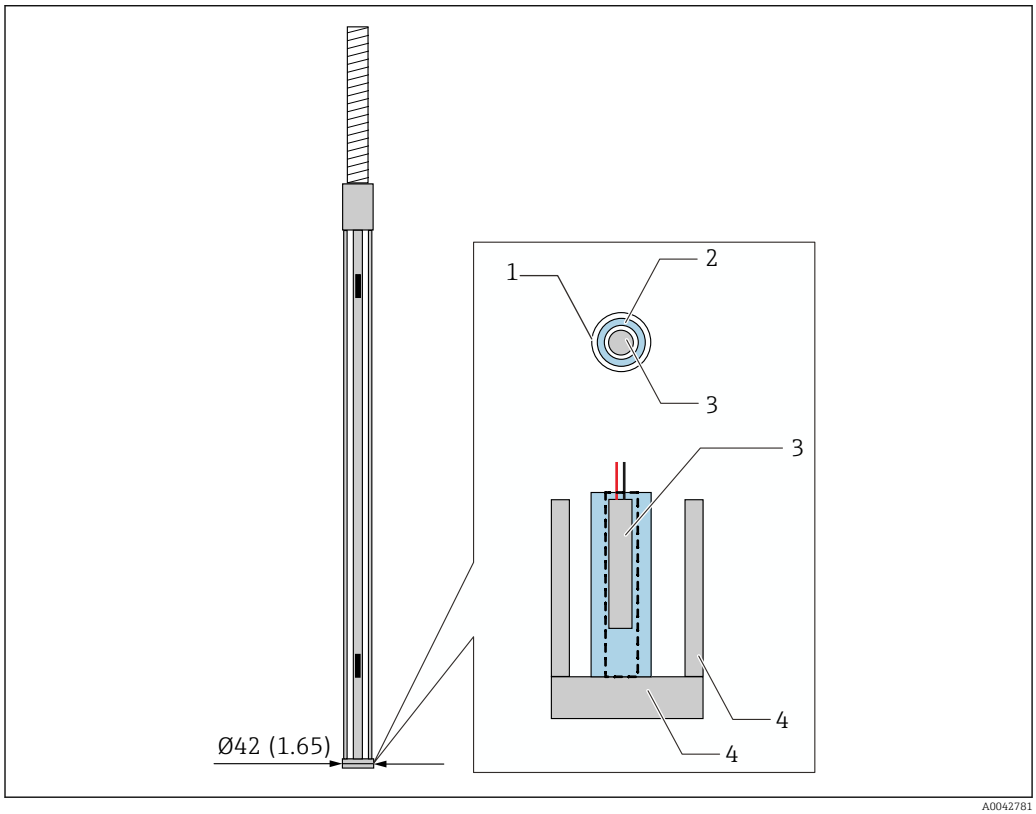
1 Flange (JIS, ASME, JPI, DIN)

WB probe design

The integrated WB sensor (capacitance water interface measurement) is set at the bottom of an average temperature probe. The standard water interface measurement ranges are 500 mm (19.69 in), 1 000 mm (39.37 in), and 2 000 mm (78.74 in). The WB probe is made of 304 stainless pipe protected by 1 mm (0.04 in) thickness PFA tube and a 316L base plate and side rods.

Up to two Pt100 temperature elements can be set in the tube. This allows constant temperature measurement near the tank bottom.

- Precise initial calibration of NMT81 is performed in accordance with your options prior to shipping.
- NMT81 cannot measure the water interface if the water inside the tank is frozen. Ensure that the water in the tank does not freeze.



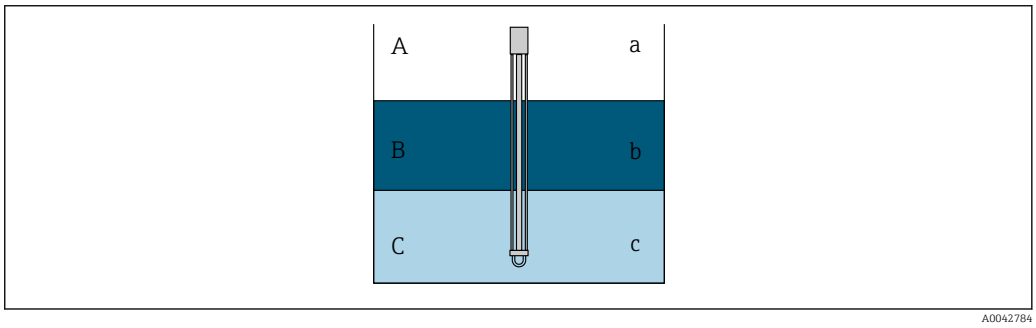
33 *WB probe design. Unit of measurement mm (in)*

1 *PFA protective tube (thickness: 1 mm)*
2 *Sensor pipe (304)*
3 *Pt100 element*
4 *Base plate/side rod (316L)*

Water level measurement in the three layers condition

When measuring the water level with three layers (air, product, and water) present in the range of the water bottom (WB), the accuracy of the water level measurement is negatively influenced by the dielectric difference between air, product, and water.

NMT81 compensates for this influence by comparing the product level from NMS8x or NMR8x. NMT81 also eliminates the influenced dielectric difference with this compensation result so that the water bottom (WB) maintains high probe accuracy and stable measurement.



34 *Water level measurement in three layers*

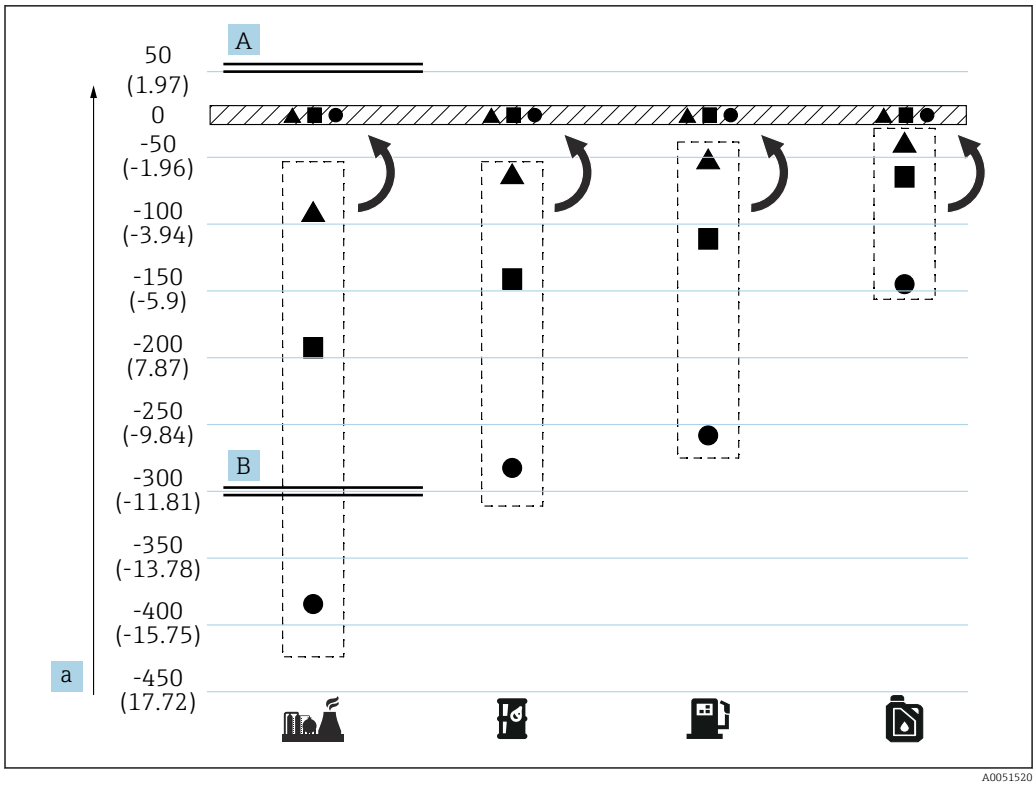
A Air
B Product
C Water
a Low dielectric
b Dielectric
c Conductivity

The relationship between the assumed relative permittivity and the application are as follows.

No	Relative permittivity	Application
1	3.0	Fuel
2	2.5	Crude
3	2.2	Gasoline
4	1.8	Diesel oil, Kerosene
5	1.0	Air

Fuel refers to biodiesel, soybean oil, and such like. By selecting an item that best represents your application from the table above, the measurement error can be approximated to 0 mm (0 in).

If the function of the three-layer compensation is not enabled (no compensation), the error appears on the minus side on the table below. However, three-layer compensation will be available only if the relative permittivity of the application is approximately 3 (fuel) or less.



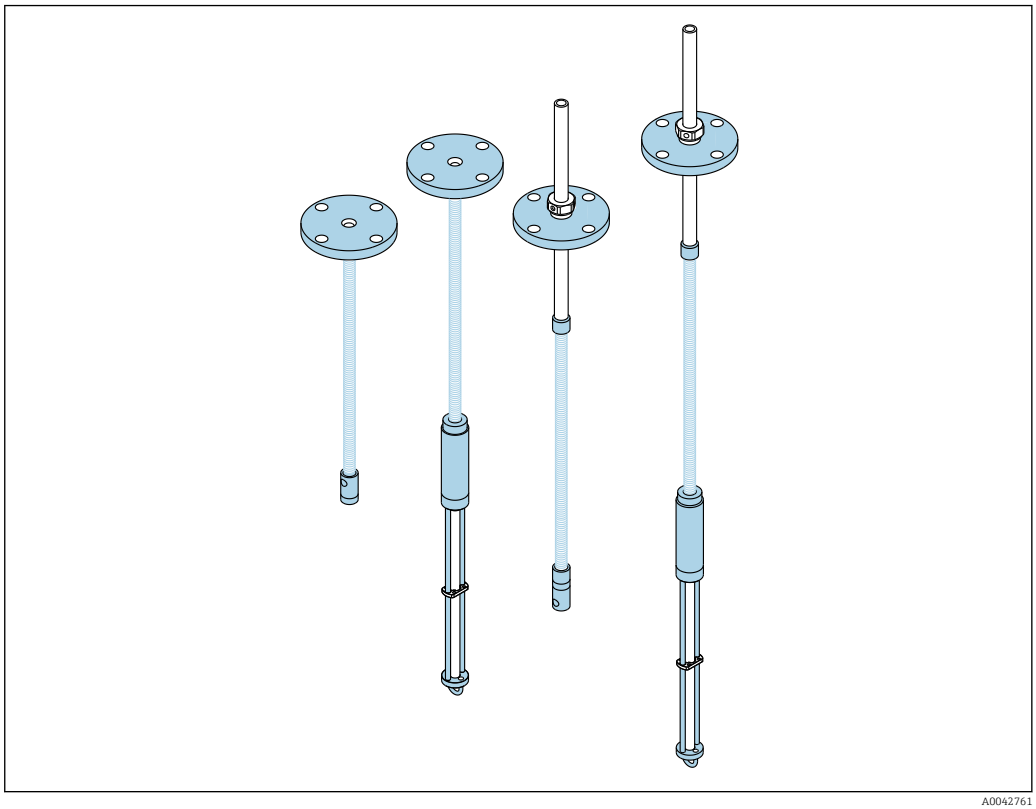
35 *Effect of the three layers compensation*

A With compensation
B Without compensation
a Maximum error of water level mm (in)

	Fuel	●	Probe length = 2.0 m (6.56 ft)
	Crude	■	Probe length = 1.0 m (3.28 ft)
	Gasoline	▲	Probe length = 0.5 m (1.64 ft)
	Diesel heating oil, Kerosene		

Parts according to NACE standard

In accordance with NACE MR 0175 and NACE MR 0103, the following parts highlighted in blue are available as NACE standard materials. For further information of standards, → 51



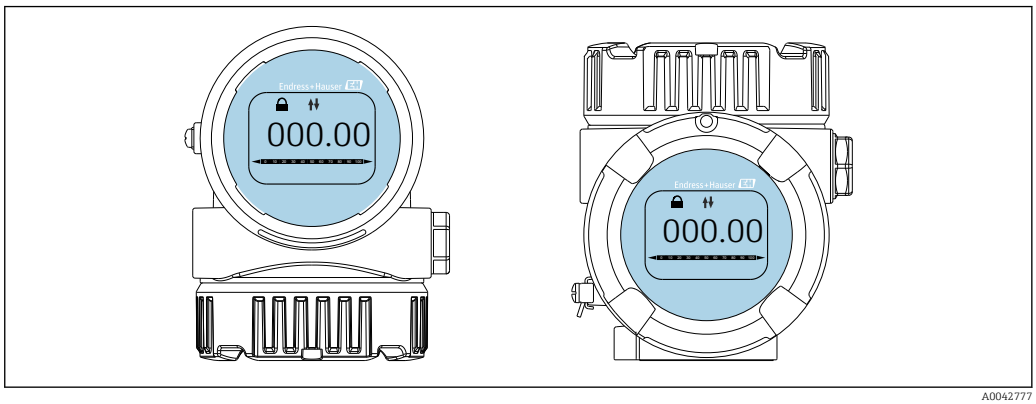
A0042761

36 *Parts according to NACE standard*

Display

The device has an illuminated liquid crystal display (LCD) that shows measured values as well as the device status in the standard view. An optional display can be provided, mounted on the top or the side of the NMT81.

Specification of converter	Position of display
Aluminum	Top or side
Stainless steel	Top or side



A0042777

37 *Display position: Top (left) side (right)*

The NMT81 allows only one display to be mounted on either the top or the side of the converter.

Weight and other specifications

Weight	11 kg (24.26 lb)
Number of elements	24 elements
Temperature probe	10 m (32.8 ft)
WB probe	1 m (3.28 ft)
Flange	ASME B16.5, NPS 2" Cl.150 RF
Display	N/A

Material

Temperature measurement element	Class A or Class 1/10B, Pt100, IEC60751/DIN EN60751/JIS C1604
Housing	Aluminum die cast/stainless steel
Cover	Aluminum die cast/stainless steel
Temperature probe	316L
WB probe	316L (Intermediate rod 304/PFA cover)

Sealing

Sealing	Material	Shape
Flange adapter	FKM	C-ring
Housing cover	FVMQ	O-ring

Operability

Operation using FieldCare

NMT81 can be operated with FieldCare. This program supports commissioning, securing of data, signal analysis and documentation of the instruments.

FieldCare supports the following functions:

- Online configuration of transmitters
- Loading and saving of instrument data (upload/download)
- Measurement position confirmation

Certificates and approvals

Custody mode

The parameters of the NMT81 can be locked by a hardware switch in the main unit compartment. In locking state W&M related parameters are read only. The device can be sealed from unauthorized access.

CE mark

By attaching the CE mark, Endress+Hauser confirms that the instruments have passed the required tests.

RoHS

In compliance with RoHS directive 2011/65/EU (RoHS 2).

Approvals

Standard	Class	Type
ATEX/ IECEx/ UKEx	II 1/2G Ex ia IIC T6 Ga/Gb	converter with a temperature device
	II 1/2G Ex ia IIB T6 Ga/Gb	converter + temperature device + WB device
	II 2G Ex ia IIC T6 Gb	converter only
CSA C/US	IS Cl.I Div.1 Gr.A-D, Cl.I zone 0, AEx/Ex ia IIC T6	converter with a temperature device
	IS Cl.I Div.1 Gr.C/D, Cl.I zone 0, AEx/Ex ia IIB T6	converter + temperature device + WB device
	IS Cl.I Div.1 Gr.A-D, Cl.I zone 1, AEx/Ex ia IIC T6	converter only
EAC	Ex ia IIC T6 Ga/Gb	converter with a temperature device
	Ex ia IIB T6 Ga/Gb	converter + temperature device + WB device
	Ex ia IIC T6 Gb	converter only
JPN Ex	Ex ia IIC T6 Ga/Gb	converter with a temperature device
	Ex ia IIB T6 Ga/Gb	converter + temperature device + WB device
	Ex ia IIC T6 Gb	converter only
	Ex ia IIC T2 Ga/Gb	converter with a temperature device (high temperature)
KC	Ex ia IIC T6 Ga/Gb	converter with a temperature device
	Ex ia IIB T6 Ga/Gb	converter + temperature device + WB device
	Ex ia IIC T6 Gb	converter only
INMETRO	Ex ia IIC T6 Ga/Gb	converter with a temperature device
	Ex ia IIB T6 Ga/Gb	converter + temperature device + WB device
	Ex ia IIC T6 Gb	converter only
NEPSI	Ex ia IIC T6 Ga/Gb	converter with a temperature device
	Ex ia IIB T6 Ga/Gb	converter + temperature device + WB device
	Ex ia IIC T6 Gb	converter only

Weight and measure approvals

PTB: DE-22-M-PTB-0048

The device has a sealable locking switch according to the Weight & Measure requirements. This switch locks all software parameters related to the measurement. The switching status is indicated on the display and via the communication protocol.

NMi (in preparation)

External standards and guidelines

IEC 61326 Appendix: A, immunity according to table A-1

- EN 60529: Protection class of housing (IP-code)
- EN 61326: Emissions (equipment class 1/10B), compatibility (appendix A – industrial area) EN 61000-4-2 Immunity to electrostatic discharge

NACE MR 0175, NACE MR 0103: Sulfide stress cracking resistant metallic materials for oilfield equipment

Stainless steel conversion table

In this document, material designations are written based on U.S.A AISI standard, however corresponding materials in different country standards are also applied to actual products because of global sourcing.

Country	Standard	Expressions			
Japan	JIS	SUS304	SUS304L	SUS316	SUS316L
Germany	DIN 17006	X5 CrNi 18 10 X5 CrNi 18 12	X2 CrNi 18 11	X5 CrNiMo 17 12 2/1713 3	X2 CrNiMo 17 13 2
	W.N. 17007	1.4301 1.4303	1.4306	1.4401/1.4436	1.4404
France	AFNOR	Z 6 CN 18-09	Z 2CN 18-10	Z 6 CND 17-11/17 12	Z2 CND 17-12
Italy	UNI	X5 CrNi 1810	X2 CrNi 1911	X5 CrNiMo 1712/1713	X2 CrNiMo 1712
U.K.	BSI	304S15/304S16	304S11	316S31/316S33	316S11
U.S.A.	AISI	304	304L	316	316L
E.U.	EURONORM	X6 CrNi 1810	X3 CrNi 1810	X6 CrNiMo 17 12 2/17 13 3	X3 CrNiMo 17 12 2
Spain	UNE	X6 CrNi 19-10	X2 CrNi 19-10	X6 CrNiMo 17-12-03	X2 CrNiMo 17-12-03
Russia	GOST	08KH18N10 06KH18N11	03KH18N11	-	03KH17N14M2
-	ISO	11	10	20	19
-	ASME	S30400	S30403	S31600	S31603

The standards may not necessarily correspond exactly in different countries because they are defined by their respective mechanical and chemical criteria. However, the most properties are harmonized over different countries standards.

Pressure Equipment Directive 2014/68/EU (PED)

Temperature sensors with flange and threaded bosses that have no pressurized housing are not subject to the pressure equipment directive independent of the maximum allowable amount of pressure.

Reasons: According to Article 2, point 5 of EU Directive 2014/68/EU, pressure accessories are defined as “device with an operational function and having pressure-bearing housing”. If a pressure instrument does not have a pressure-bearing housing (no identifiable pressure chamber of its own), there is no pressure accessory present within the meaning of the Directive.

Calibration

Verification or calibrations with certificates are available by options.

Temperature options

- 1-point temperature verification by factory
- 3- or 5-point temperature calibration by factory traceable to an international reference standard (étalon)
- 3- or 5-point temperature calibration by laboratory traceable to an international reference standard (étalon) conformed to ISO/IEC 17025 accredited by JAB, Japan Accreditation Board, of ILAC MRA (Accredited measurement uncertainty, U = 0.070 °C, k= 2)

Water bottom option

5-point water separation calibration by factory traceable to an international reference standard (étalon)

Ordering information

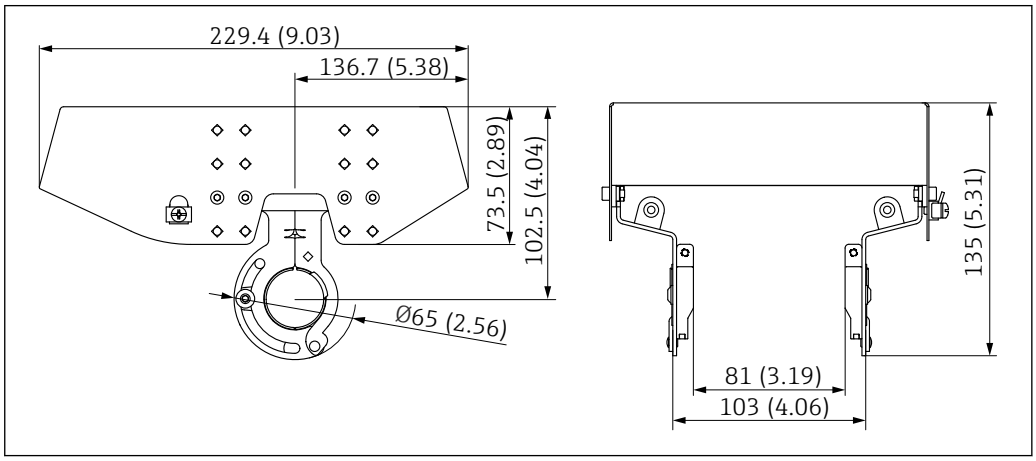
Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to open the Product Configurator.
- From your nearest Endress+Hauser sales organization: www.addresses.endress.com

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Device-specific accessories

Weather protection cover



38 *Weather protection cover. Unit of measurement mm (in)*

Materials

Part	Material
Protection cover and mounting brackets	stainless steel 316L

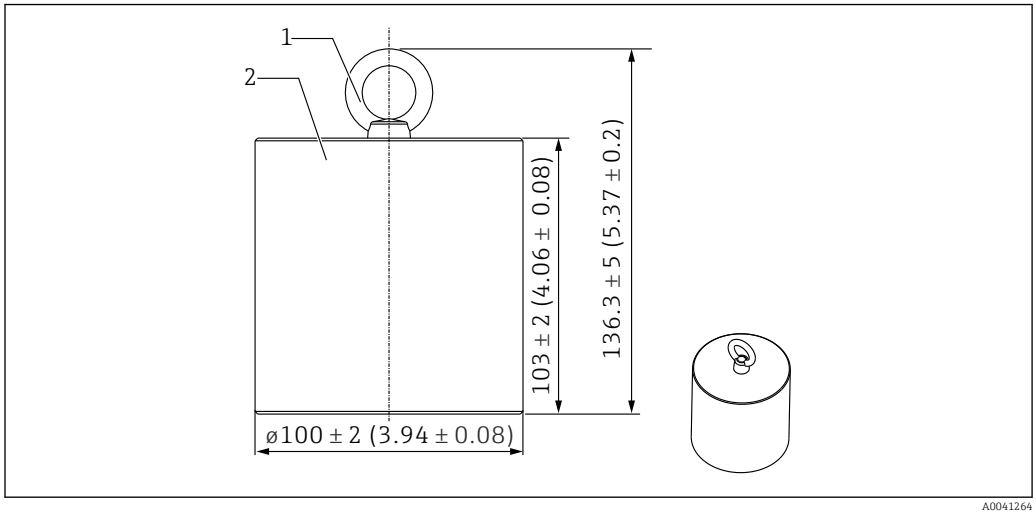
- The weather protection cover can be ordered together with the device:
  Ordering feature 620 "Accessory Enclosed", option PA "Weather Protection Cover")
- It can also be ordered as an accessory:
  Order code: 71438303
- For cover installation instructions, refer to the separate SD02424F

Anchor weight (High profile)

This anchor weight was mainly 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 (19.69 in) 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").

The following items are supplied when shipped.

- Stranded wire (1000 mm (39.37 in)/φ3 mm (0.12 in)) which connects between the anchor weight and the probe
- Wire (1300 mm (51.12 in)/φ0.5 mm (0.02 in)) for binding



39 Installation attachment. Unit of measurement mm (in)

1 Eyebolt
2 Weight

Because an anchor weight is made of mild carbon steel, exposure it to the air for over a long period may get rust during storage.

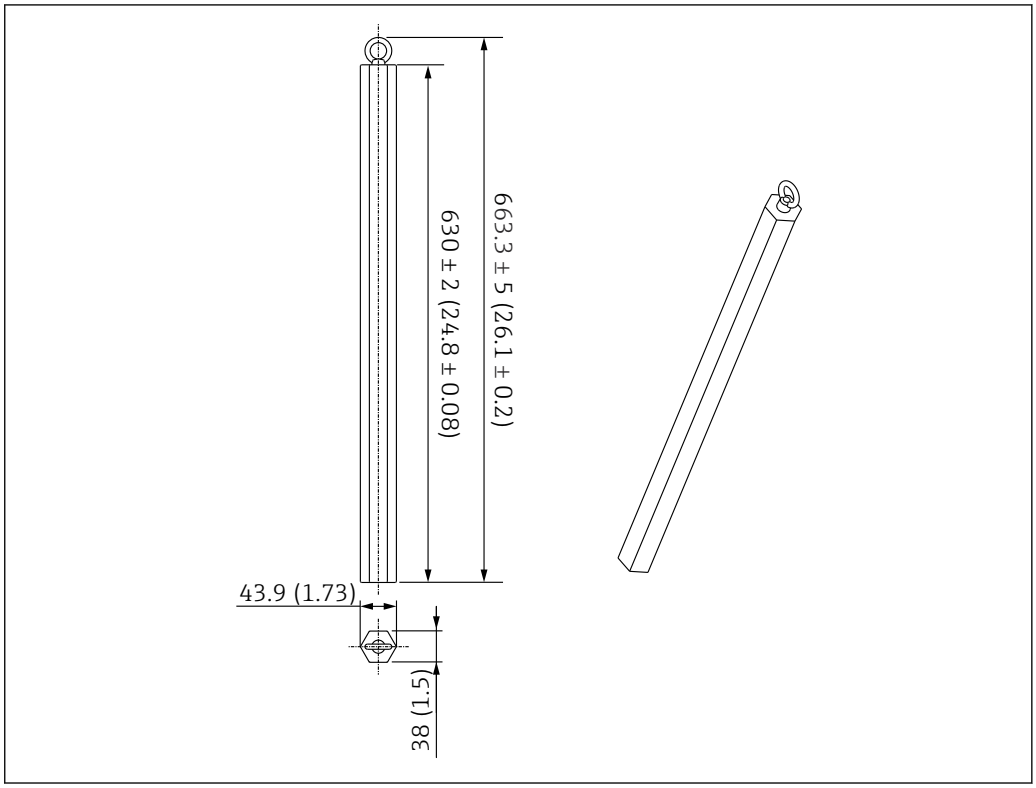
Description	Details
Anchor weight	JIS SS400 mild carbon steel
Eyebolt	JIS SS400 mild carbon steel
Weight	6 kg (13.23 lb)

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 be also used as an installation attachment for the converter + temperature probe version when trying to install it in a small tank nozzle (e.g., 50A (2")).

The following items are supplied when shipped.

- Stranded wire (1000 mm (39.37 in)/φ3 mm (0.12 in)) which connects between the anchor weight and the probe
- Wire (1300 mm (51.12 in)/φ0.5 mm (0.02 in)) for binding



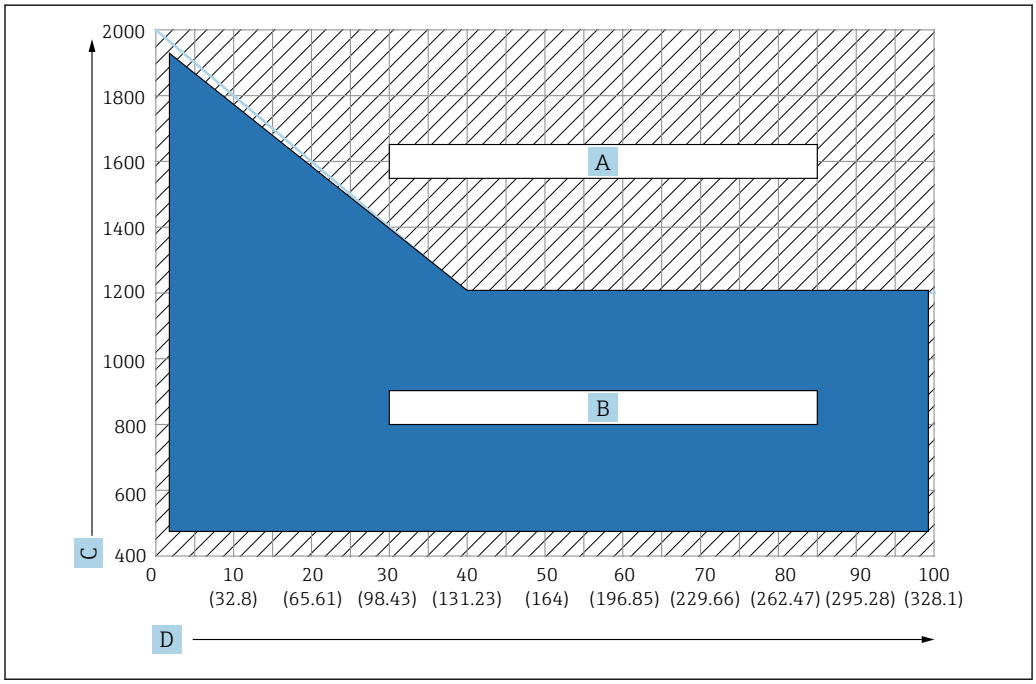
40 Installation attachment. Unit of measurement mm (in)

Because an anchor weight is made of mild carbon steel, exposure it to the air for over a long period may get rust during storage.

Description	Details
Anchor weight	JIS SS400 mild carbon steel
Eyebolt	JIS SS400 mild carbon steel
Weight	6 kg (13.23 lb)

Specification of anchor weight

The use of the available range for the anchor weight varies depending on the specification or application of the tank. See the following chart for selection of the appropriate anchor weight.



41 Anchor weight selection chart, C: Unit of density [kg/m3], D: Unit of length m/(ft)

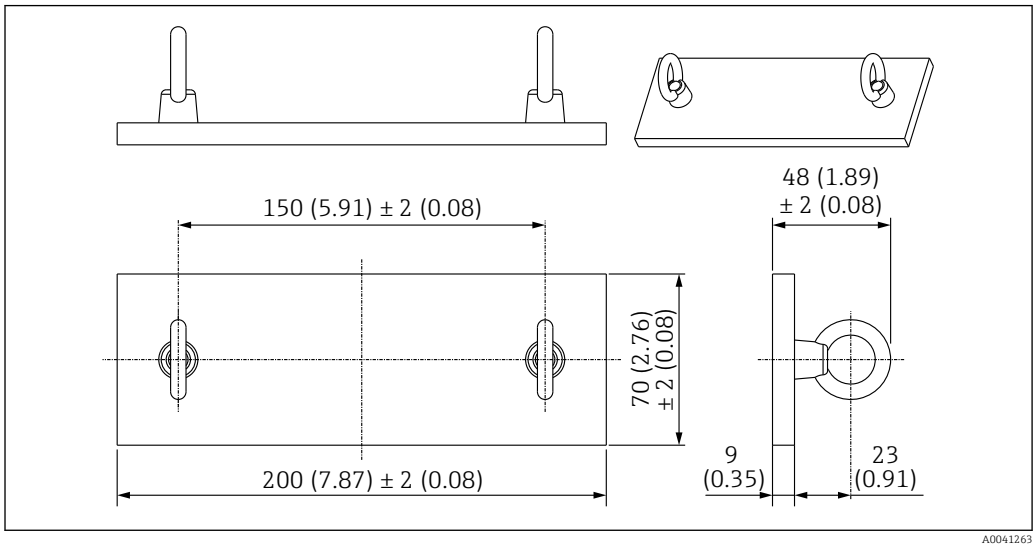
A Range for requirement of advance inquiry
B Range for standard use

Wire hook

The actual tension is created by the securing wire between the wire hook and the top anchor (316).

The following items are supplied when shipped.

- Stranded wire (Specified length of the probe + 2 000 mm (78.74 in)/φ3 mm (0.12 in))
- Wire (2 000 mm (78.74 in)/φ0.5 mm (0.02 in)) for binding



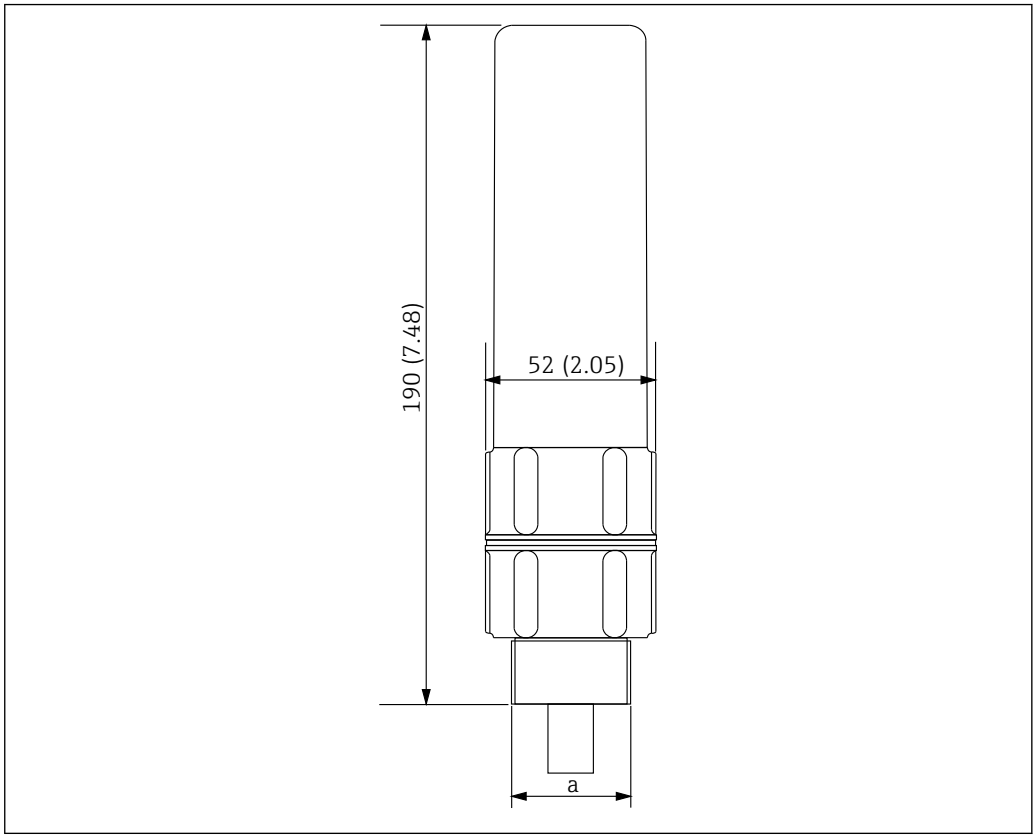
42 Wire hook. Unit of measurement mm (in)

Description	Details
Plate	JIS SS400 mild carbon steel
Eye nut	JIS SS400 mild carbon steel
Weight	1.5 kg (3.31 lb)

Because a wire hook is made of mild carbon steel, exposure it to the air for over a long period may get rust during storage.

Top anchor

The standard threaded connection for a top anchor is an R1 threaded connection.



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

a R1 thread

Description	Details
Exterior	ADC (aluminum)
Interior	316
Weight	1.2 kg (2.65 lb)

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