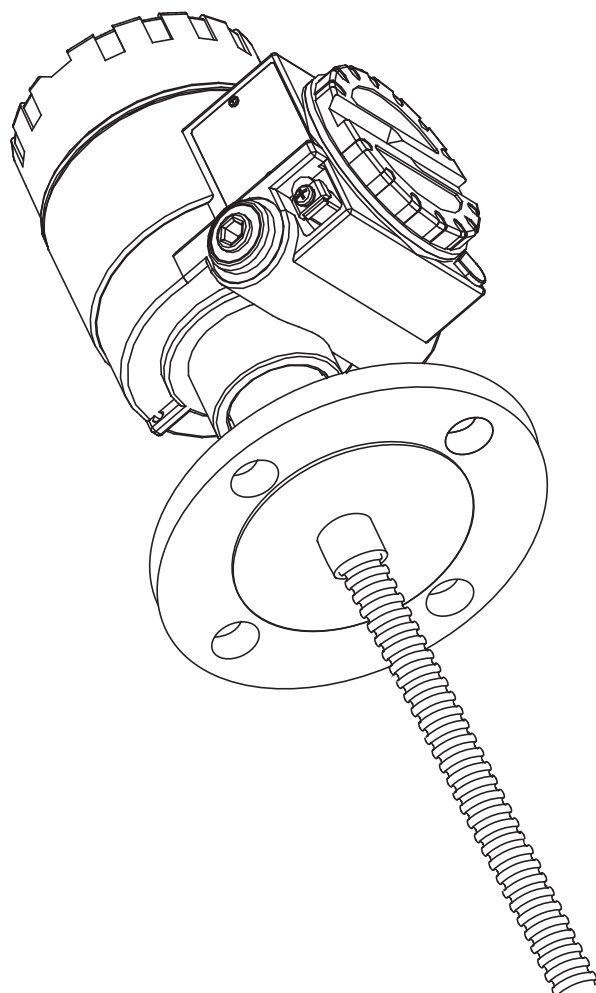


Operating Instruction

Prothermo NMT532

Temperature



Basic Device Layout of Prothermo NMT532

Connection with Micropilot FMR S-series

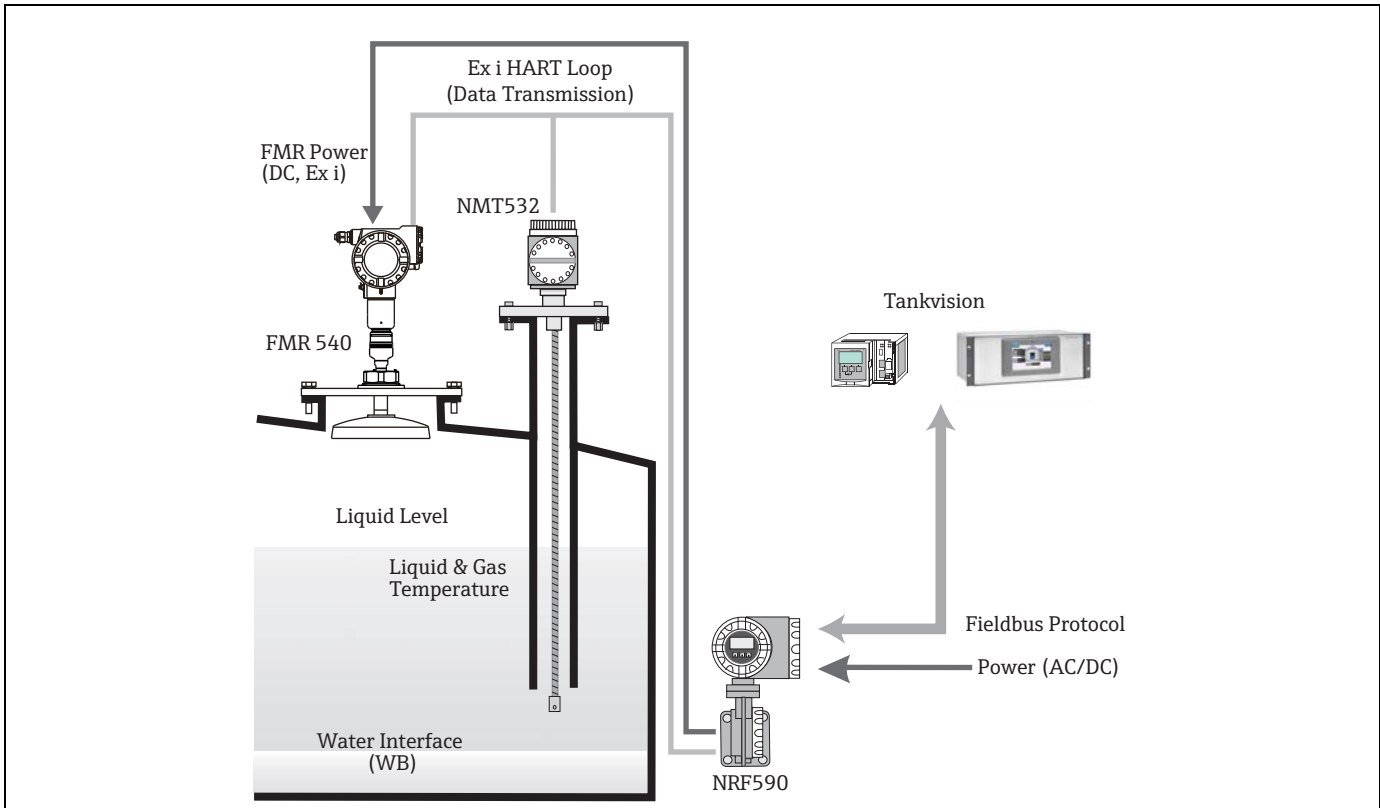


Figure 1: System Layout 1

Connection with Proservo NMS5

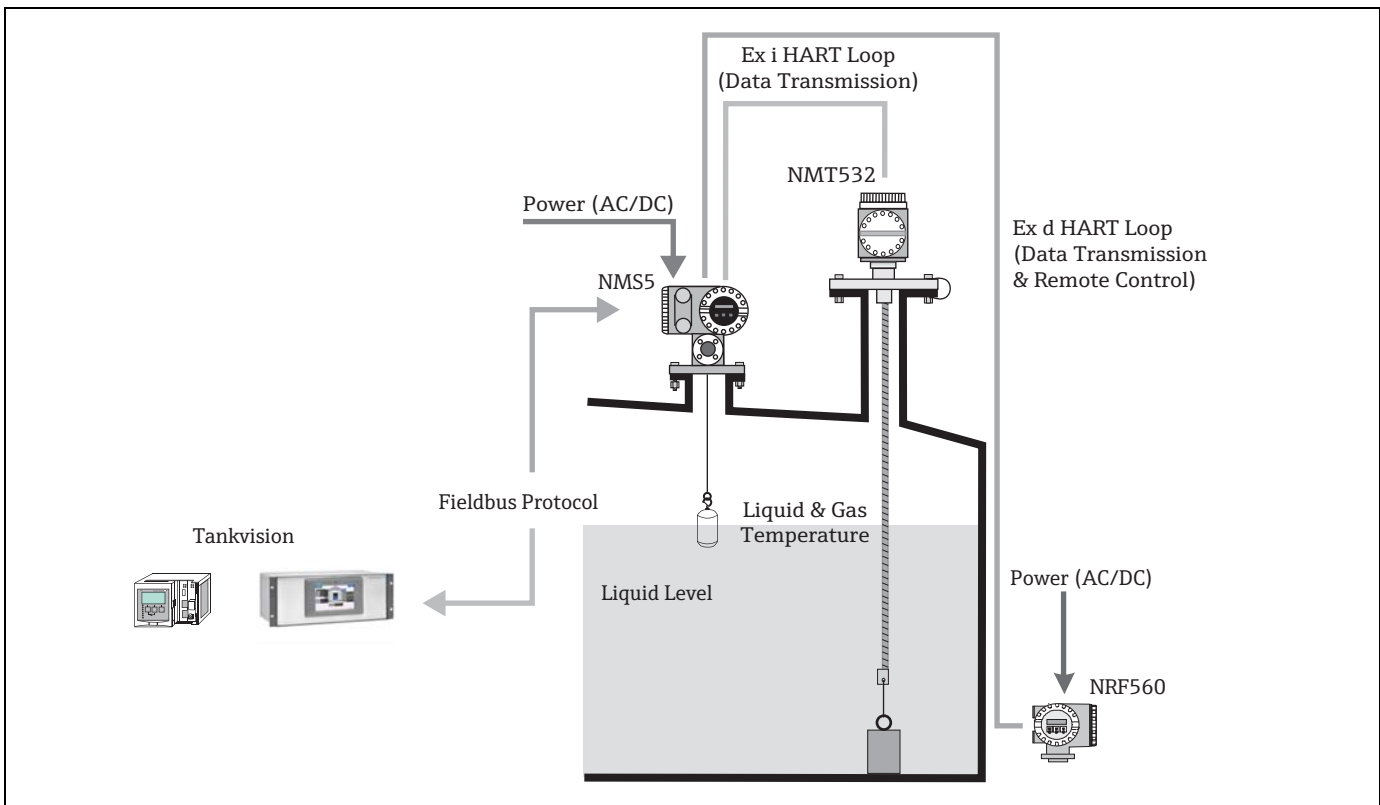


Figure 2: System Layout 2

Table of Contents

1	Safety Instructions	4	5	Operating	24
1.1	Designated Use	4	5.1	Local HART Connection	24
1.2	Installation, Commissioning, and Operation	4	5.2	Device Setup: NRF590	24
1.3	Operational Safety	4	5.3	Device Setup: NMS5	25
1.4	Notes on Safety Conventions and Symbols	5	6	Operation and Description of Instrument Function	27
1.5	Symbols for Certain Types of Information	5	6.1	Local HART Device Designation	27
2	Identification	6	6.2	Temperature Measurement	27
2.1	Device Designation	6	7	Maintenance	38
2.2	Order Information	8	7.1	Periodic Inspection	38
2.3	Scope of Delivery	9	7.2	Repairs	38
2.4	Certificates and Approvals	9	7.3	Repairs to Ex-approved Devices	38
2.5	Registered Trademarks	9	7.4	Replacement	38
3	Installation	10	8	Accessories	39
3.1	Incoming Acceptance, Transport, Storage	10	9	Troubleshooting	41
3.2	Installation Condition	11	9.1	System Error Messages	41
3.3	Installation Instructions	14	9.2	Return	42
4	Wiring	22	9.3	Disposal	42
4.1	Terminal Connection	22	9.4	Software History	42
4.2	Grounding	23	10	Technical Data	43

1 Safety Instructions

1.1 Designated Use

Prothermo NMT532 is a multi-spot Pt100 average thermometer combined with a local HART signal converter to meet the demand of temperature measurement for inventory control applications. NMT532 consists of Max. 6 temperature elements which have different length with fixed (2m or 3m) interval. It is best suited connected to Proservo NMS5, or Endress+Hauser Micropilot S-series radars and the Tank Side Monitor NRF590. Mounted on the tank top, NMT532 provides temperature information on the two wire, intrinsically safe (i.s.) powered local HART loop.

1.2 Installation, Commissioning, and Operation

- Mounting, electrical installation, start-up, and maintenance of the instrument may only be performed by trained personnel authorized by the operator of the facility.
- Personnel must read and understand these installation instructions before performing the procedures.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual must be observed.
- The installer must make sure that the measuring system is correctly wired according to the wiring diagrams. The measuring system must be grounded.
- Observe all law and regulations applicable and valid for your country and pertaining to the opening and repairing of electrical devices.

1.3 Operational Safety

Hazardous Area





- Use the explosion proof type for measurement in areas where explosion hazards are present.
- Devices installed in areas having explosion hazards must not be opened when the power is on.
- Strict compliance with installation instructions and - ratings, as directed in this supplementary documentation, is mandatory.
- Device maintenance and repair is restricted to meet explosion proof regulations.
- Tighten the cable gland firmly.
- Devices employed in areas having explosion hazards should be installed and wired in keeping with explosion proof regulations.
- Ensure that all personnel are properly qualified.
- Observe the certification requirements as well as national and local regulations.

WARNING





Changes or modifications other than those expressly approved by Endress+Hauser are strictly prohibited. Unauthorized modifications can cause malfunction or damage, resulting in serious injury or death.

1.4 Notes on Safety Conventions and Symbols

To highlight safety-relevant or alternative operating procedures in this manual, the following conventions have been used, each indicated by a corresponding symbol on the left.

Symbol	Meaning
 <small>A0011189-EN</small>	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 <small>A0011190-EN</small>	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 <small>A0011191-EN</small>	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 <small>A0011192-EN</small>	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.

1.5 Symbols for Certain Types of Information

Symbol	Meaning
 <small>A0011182</small>	Allowed Indicates procedures, processes or actions that are allowed.
 <small>A0011183</small>	Recommendation Indicates procedures, processes or actions that are recommended.
 <small>A0011184</small>	Forbidden Indicates procedures, processes or actions that are forbidden.
 <small>A0011193</small>	Tip Indicates additional information.

2 Identification

2.1 Device Designation

2.1.1 Nameplate

The following technical data are given on the instrument nameplate:

1	Order code
2	Serial number
3	Flexible tube length
4	Measuring temperature range
5	Date of manufacture

Figure 1: NMT532 Model Nameplate

1	Temperature class
2	Ambient temperature

Figure 2: ATEX Approval Ex ia Nameplate

1	Temperature class
2	Ambient temperature
3	Drawing revision

Figure 3: FM Approval Nameplate

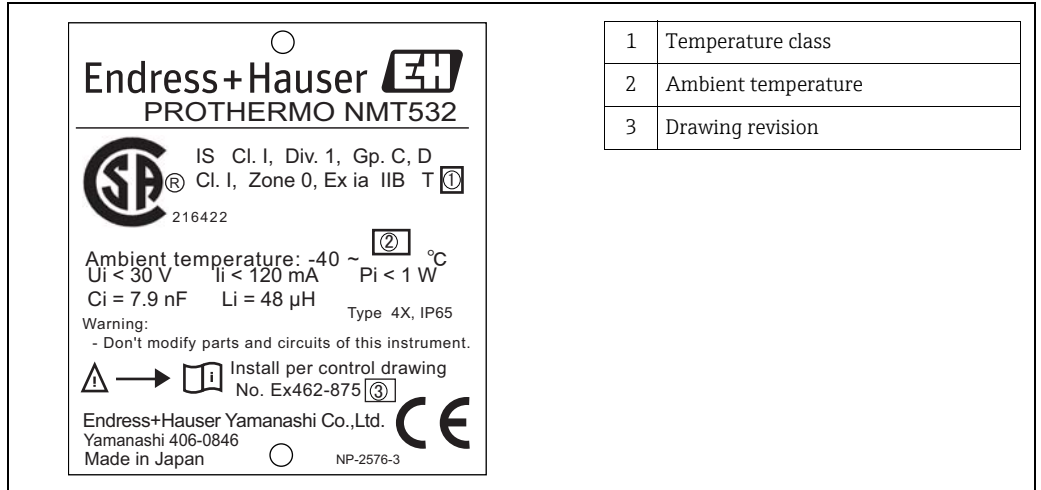


Figure 4: CSA Approval Nameplate

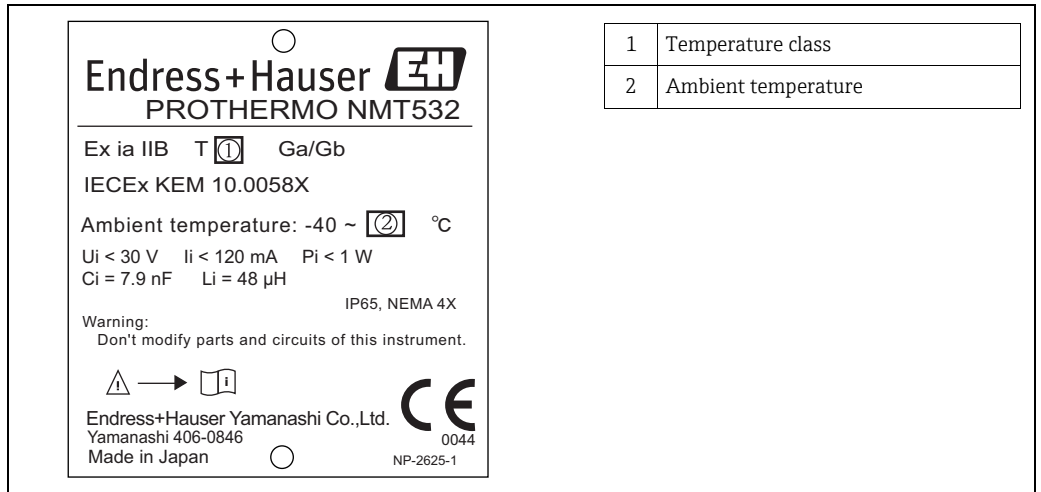


Figure 5: IEC Approval Nameplate

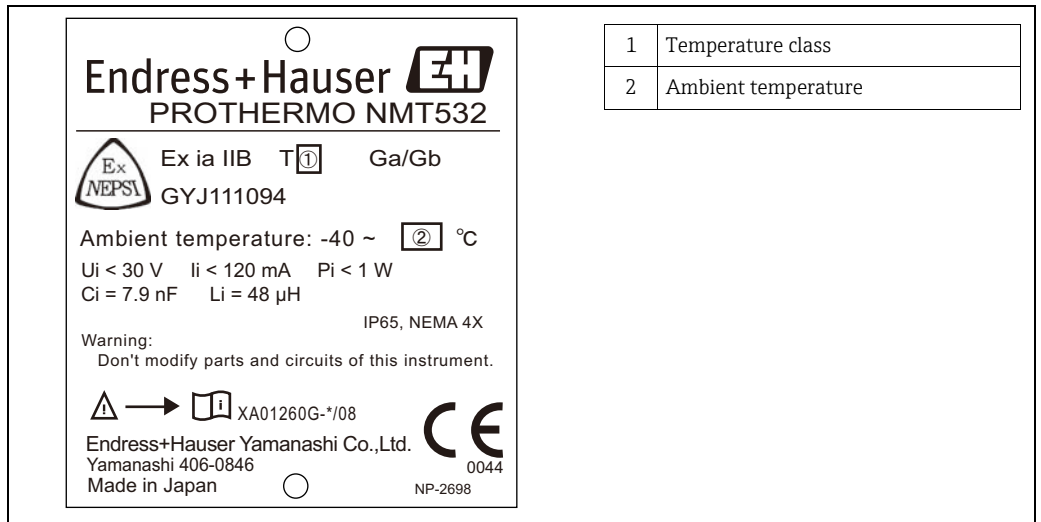


Figure 6: NEPSI Approval Nameplate

2.2 Order Information

010	Approval:		
	7	FM IS Cl.I Div.1 Gr. C-D	
	8	CSA IS Cl.I Div.1 Gr. C-D	
	B	ATEX Ex ia IIB T4 - T6	
	F	IEC Ex ia IIB T4 - T6	
	G	NEPSI Ex ia IIB T2-T6	
020	Cable Entry:		
	B	Thread NPT1/2	
	D	Thread M20	
030	Process Connection:		
	1	NPS 2" Cl.150 RF, 304 flange ASME B16.5	
	2	DN50 PN10 B1, 304 flange EN1092-1 (DIN2527 C)	
	9	Special version, TSP-no. to be spec.	
040	Probe Length; Element; Interval:		
	022	...mm; 2x Pt100; 2 m	
	032	...mm; 3x Pt100; 2 m	
	042	...mm; 4x Pt100; 2 m	
	052	...mm; 5x Pt100; 2 m	
	062	...mm; 6x Pt100; 2 m	
	023	...mm; 2x Pt100; 3 m	
	033	...mm; 3x Pt100; 3 m	
	043	...mm; 4x Pt100; 3 m	
	053	...mm; 5x Pt100; 3 m	
	063	...mm; 6x Pt100; 3 m	
050	Additional Option:		
	A	Not selected	
	B	Anchor weight, High profile	
	C	Anchor weight, low profile	
	D	Tensioning wire, wire hook, NPT1 top anchor	
	F	Tensioning wire, wire hook, R1 top anchor	
NMT532	Complete product designation		

2.3 Scope of Delivery

WARNING

It is extremely important to follow the instructions concerning the unpacking, transportation and storage of measuring instruments provided in the chapter "Incoming Acceptance, Transportation, Storage". The scope of delivery consists of:

- Assembled Instrument

NOTICE

Delivered Items vary depending on the product specifications (refer to "3.9 General View of Standard Drawings and Order Codes").

Accompanying documentation:

- Operating Instructions (this manual)
- Safety Instructions

2.4 Certificates and Approvals

CE Marks, Declaration of Conformity

The device is designed 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. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

2.5 Registered Trademarks

HART

Registered trademark of HART Communication Foundation, Austin, USA

FieldCare

Registered trademark of the company Endress+Hauser Flowtec AG, Rheinach, CH

3 Installation

3.1 Incoming Acceptance, Transport, Storage

3.1.1 Incoming Acceptance

Check the packing and contents for any signs of damage.

Check the shipment, and make sure that nothing is missing and that the items match your order.

3.1.2 Transportation

 **WARNING**

- Follow the safety instructions and conditions of transportation for instruments in excess of 18kg (40 lbs.).
- Do not lift the measuring instrument by its head during unpacking.

3.1.3 Storage

Pack the measuring instrument so that it is protected against impacts during storage and transportation.

The original packing material provides the optimum protection for this.

The allowed storage temperature is -40°C to +85°C (-40°F to +185°F).

3.2 Installation Condition

3.2.1 Dimensions

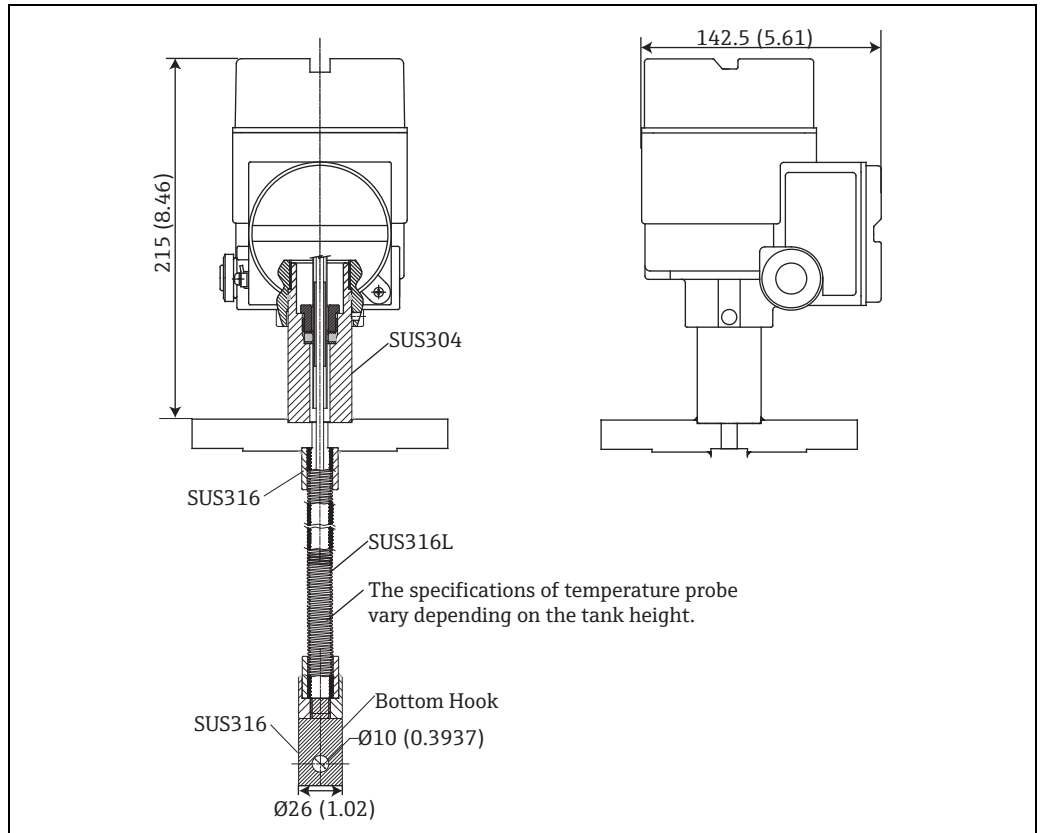


Figure 7: Dimensions, Unit of Measurement: mm (in)

3.2.2 Unpacking Procedure

CAUTION

When unpacking, be careful not to bend, fold or twist the flexible tube. Refer to the recommended procedure below.

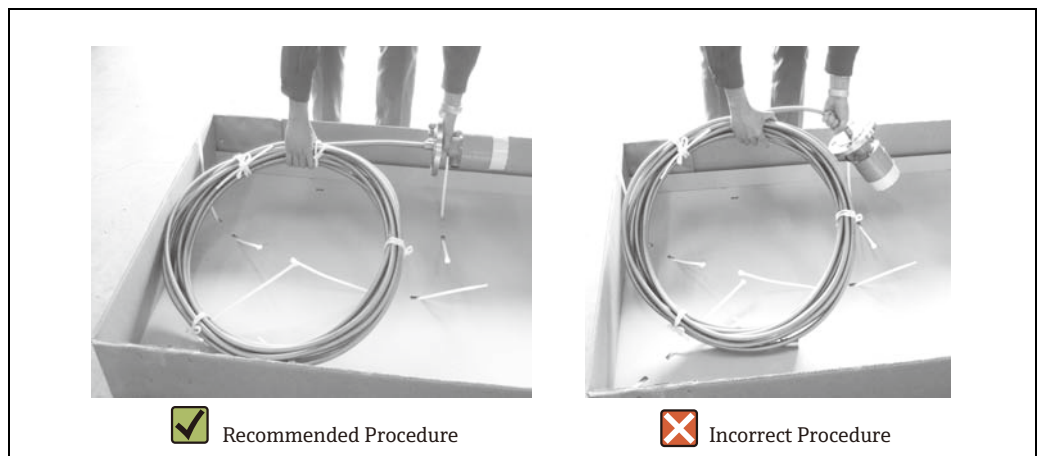


Figure 8: Unpacking Procedure

3.2.3 Flexible Tube Handling Procedure

⚠ CAUTION

Do not hold the flexible tube at a single point and lift the sensor. This may cause damage to the tube.

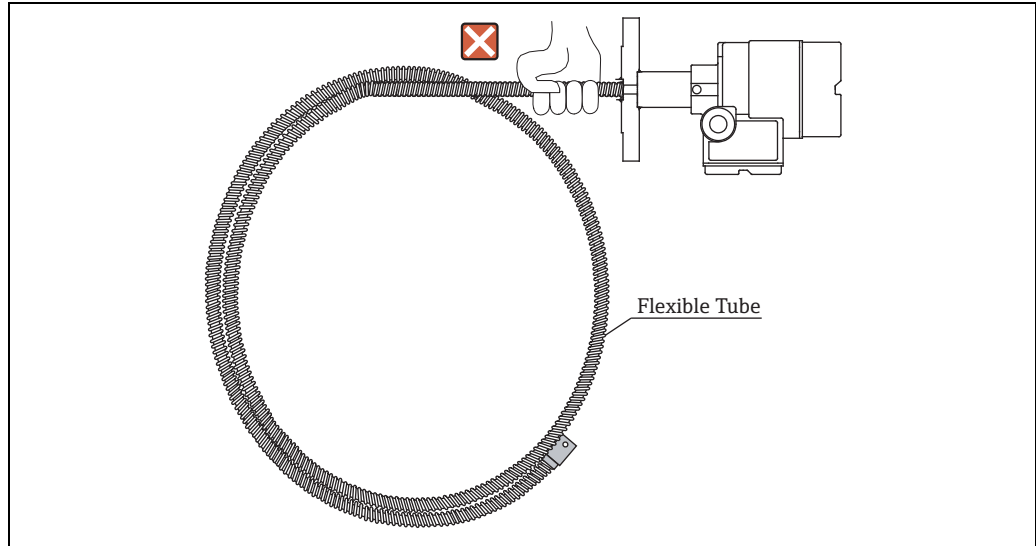


Figure 9: Flexible Tube

⚠ CAUTION

- When winding the flexible tube, keep the diameter of the tube at a minimum of 0.6m (23.62") or more.
- When bending the flexible tube to attach to a tank, the radius of the curved area must be 300mm (11.8") or more.

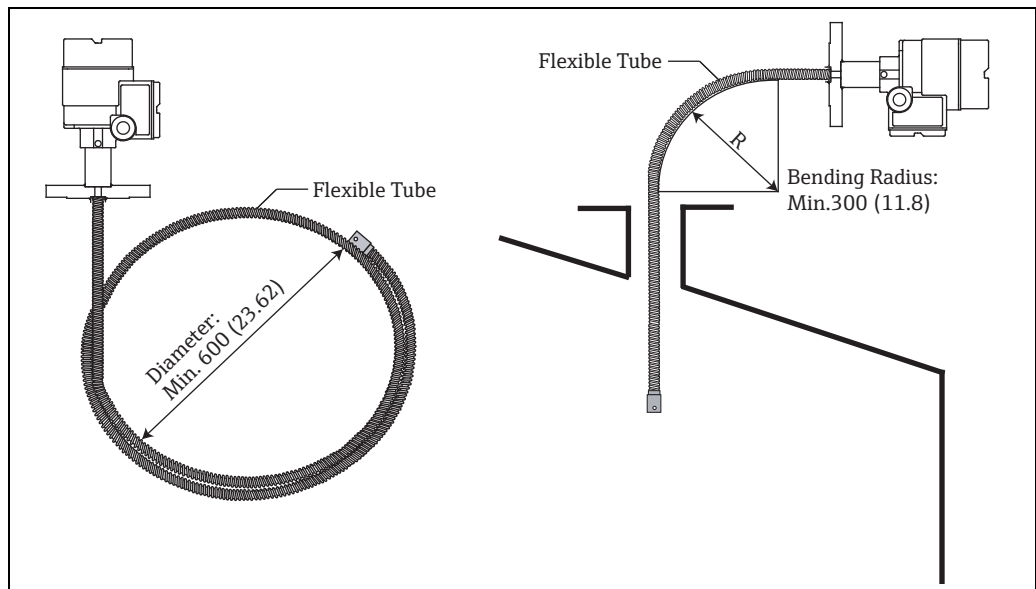


Figure 10: Flexible Tube Handling, Unit of Measurement: mm (in)

⚠ WARNING

If the radius of the curved area must be shown above becomes smaller than 300mm (11.8"), the flexible tube or the measuring element may be seriously damaged or broken.

3.2.4 NMT532 Mounting Procedure

NOTICE

1. The length of the flexible tube of NMT532 is determined based on specifications provided by customers. Check the following prior to mounting of NMT532:
 - Tag Number (if any) on Body of NMT532
 - Length of Flexible Tube
 - Number of Measuring Points
 - Intervals between Measuring Points
2. Mount NMT532 at a place that is a minimum of 500mm (19.67") away from exterior surface of tanks.
 - This will ensure that the measurement is not influenced by the temperature of tanks or surrounding environment.
3. The procedure for mounting NMT532 on a tank depends on the type of tank. Procedures for a fixed roof tank and for a floating roof tank are shown in this section as examples.
 - In any types of tanks, procedures for mounting of flexible tube head are same (mounted on the top of the tank).
 - Recommended diameter of nozzle is 50mm (2") as standard.

CAUTION

Ensure to keep the tension of 16kg or less during setting and after setting. Exceeding the limit may cause breakage in the flexible tube.

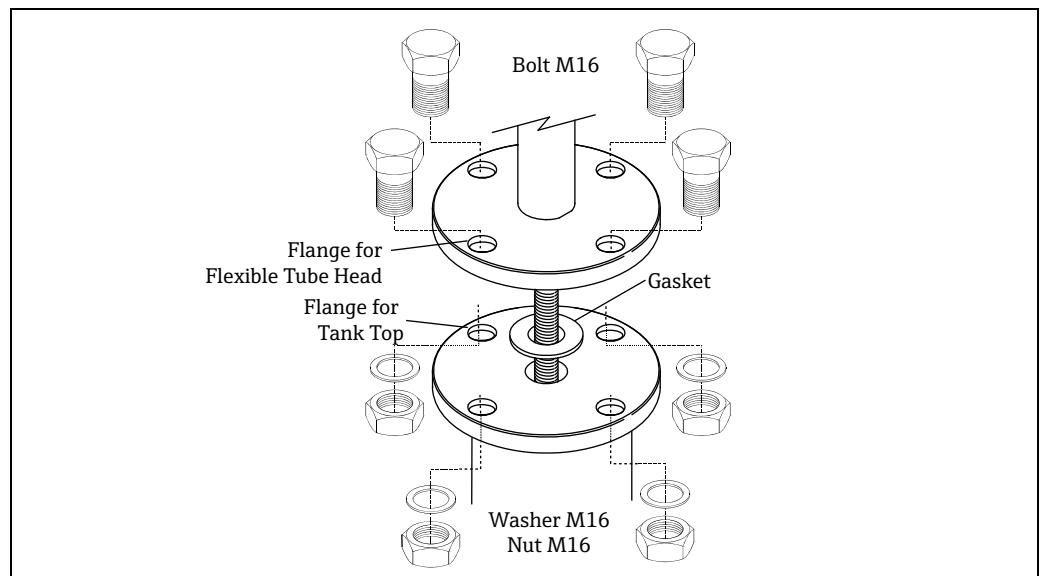


Figure 11: NMT532 Flange Bolts and Nuts

3.3 Installation Instructions

NOTICE

When installing water bottom, check "Zero" reference position of water bottom compared with manual dipping reference.

3.3.1 Mounting NMT532 on Fixed Roof Tank

There are three methods for mounting NMT532 on a fixed roof tank:

1. Top Anchor Method
2. Stilling Well Method
3. Anchor Weight Method

NOTICE

If a heating coil is attached to the bottom of the tank, the clearance between the bottom hook of the flexible tube and the bottom of the tank may vary depending on the type of heating coil.

Top Anchor Method

The flexible tube is fixed with a wire hook and a top anchor.

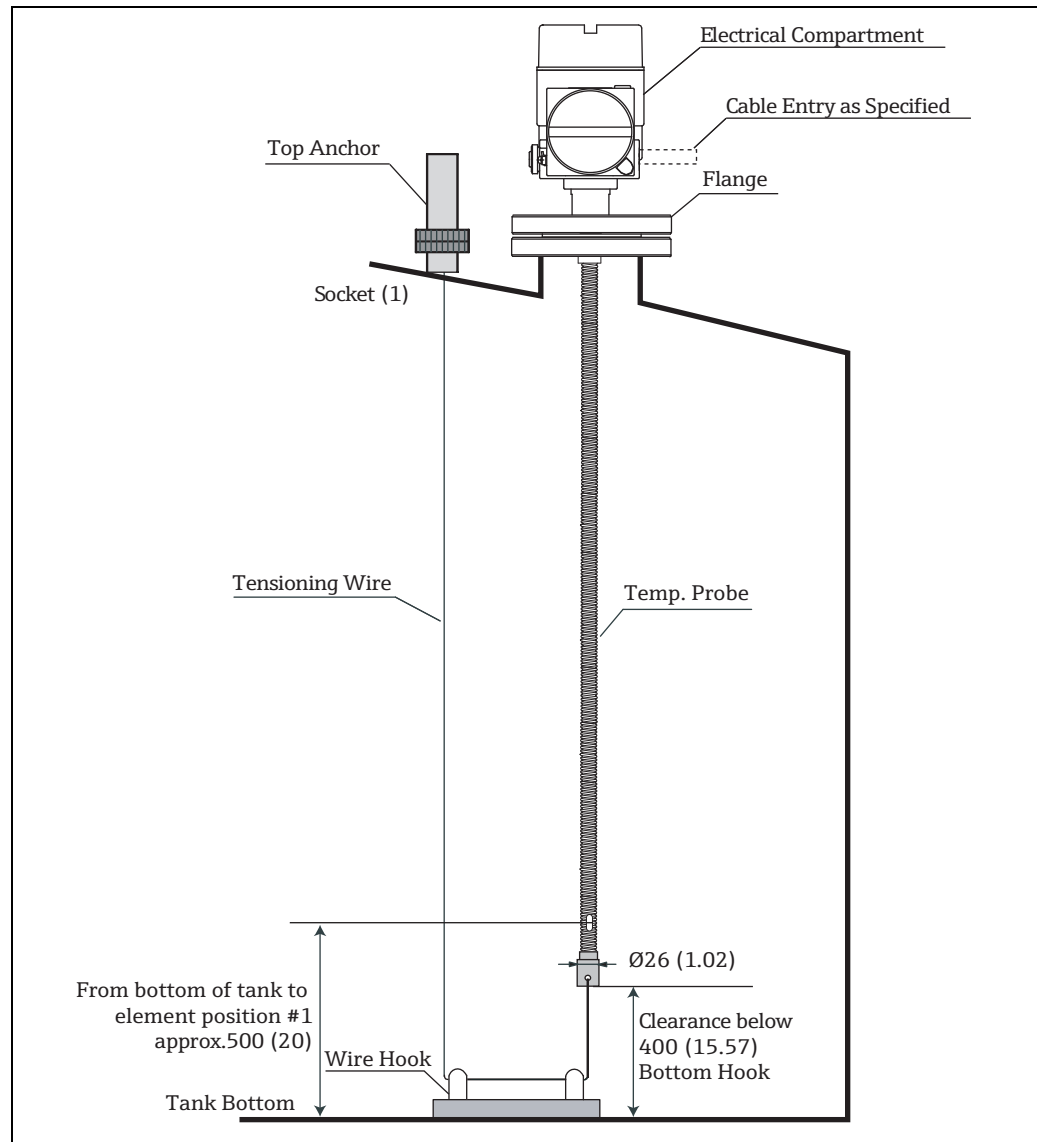


Figure 12: Fixed Roof Tank, Unit of Measurement: mm (in)

Top Anchor Attachment Procedure

1. Insert the flexible tube into a gasket and lower the flexible tube from the nozzle at the top of the tank.

⚠ CAUTION

The flexible tube must be lowered carefully without overbending and scratching the inner edge of the nozzle hole.

2. Rotate NMT532 for cabling in the most convenient way.
3. Straighten the tensioning wire, temporarily fix the end of the wire to the top anchor and lower the wire.
4. Put the tensioning wire into the wire hook at the bottom of the tank.
5. Secure the tensioning wire twice through the hole at the bottom hook
6. Tighten the tensioning wire.
7. Wind the provided wire around the tensioning wire to secure the tensioning wire.

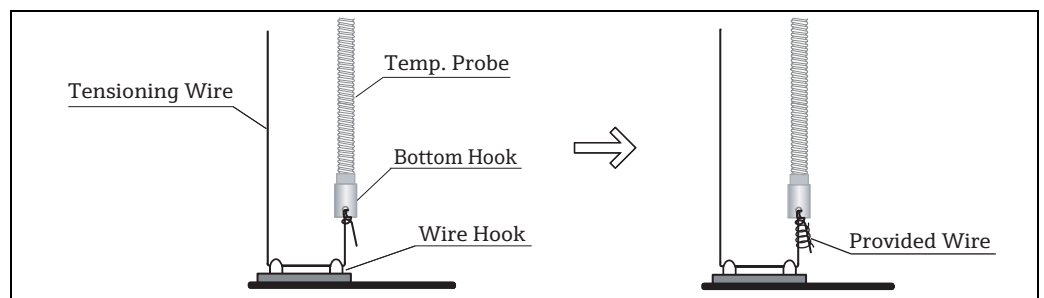


Figure 13: Top Anchor Attachment 1

8. Using bolts, fix the mounting flange of NMT532 to the nozzle at the top of the tank.

⚠ CAUTION

- Keep the compression of the spring of 35 to 37mm (1.38 to 1.47 inch).
 - Compression exceeding the spring of 35 to 37mm may damage the sensor.
9. Draw the end of the tensioning wire as much as possible by hand and foot.
 10. Bend the wire and fix it using the nut.
 11. Cut the excess wire.
 12. Screw the nut to compress down the spring of the top anchor from 35 to 37mm.
 13. Cover the top anchor.

This completes the top anchor attachment procedure.

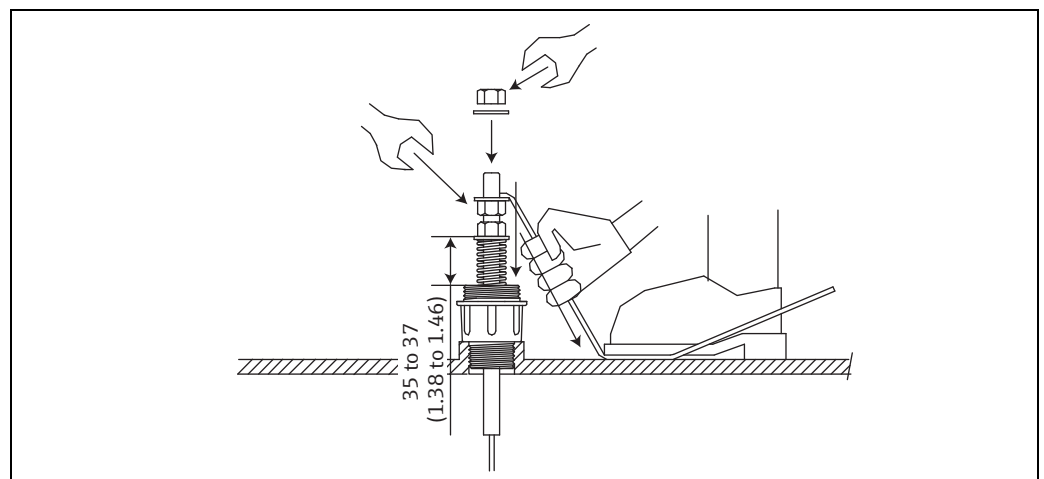


Figure 14: Top Anchor Attachment 2

Stilling Well Method

The flexible tube is inserted into a stilling well with a diameter of 2" or more.

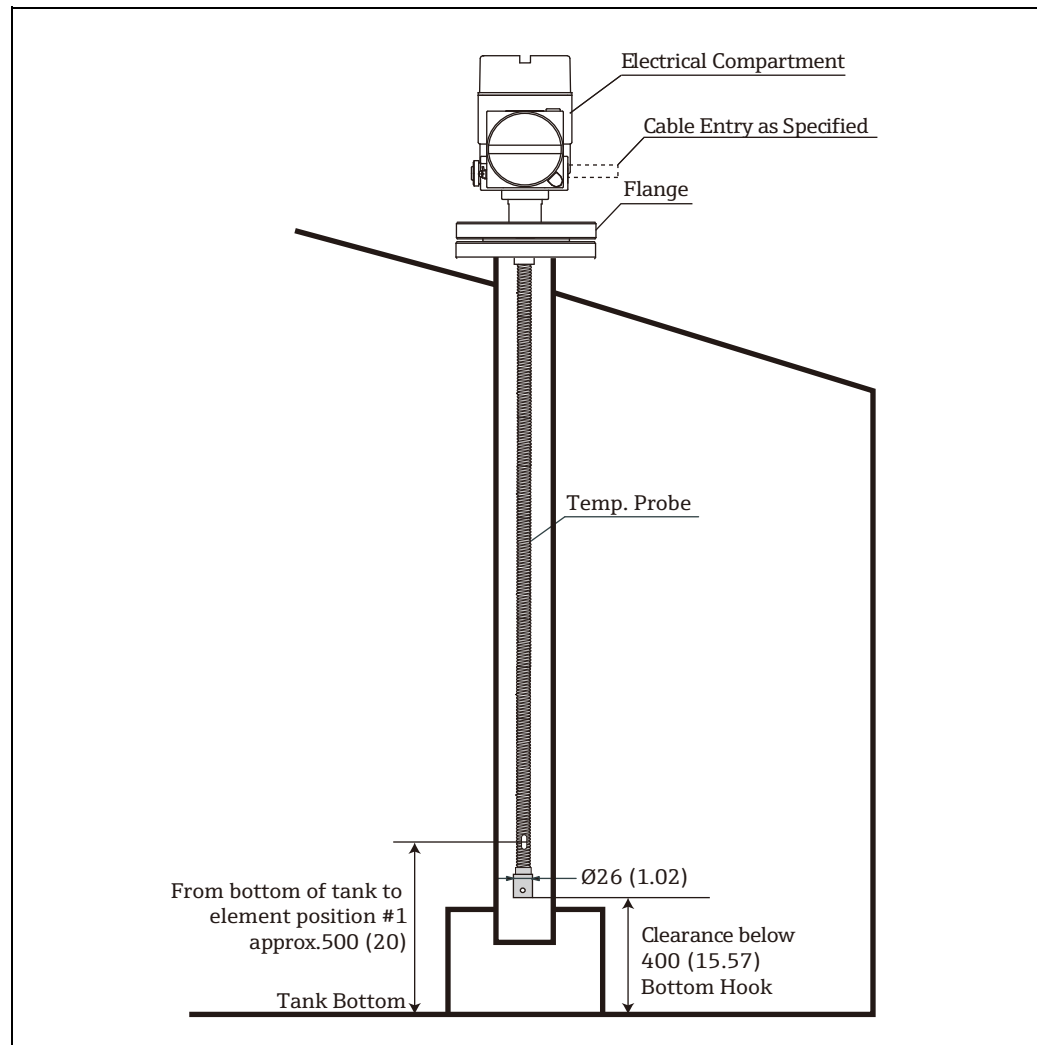


Figure 15: Stilling Well, Unit of Measurement: mm (in)

Stilling Well Attachment Procedure

CAUTION

The flexible tube must be lowered carefully without overbending and scratching the inner edge of the nozzle hole.

1. Insert a flexible tube into a gasket and lower the flexible tube into the inlet of the stilling well.
2. Rotate NMT532 for cabling in the most convenient way.
3. Using bolts, fix the mounting flange of NMT532 to the nozzle at the top of the tank.

This completes the stilling well attachment procedure.

Anchor Weight Method

The flexible tube is fixed with an anchor weight.

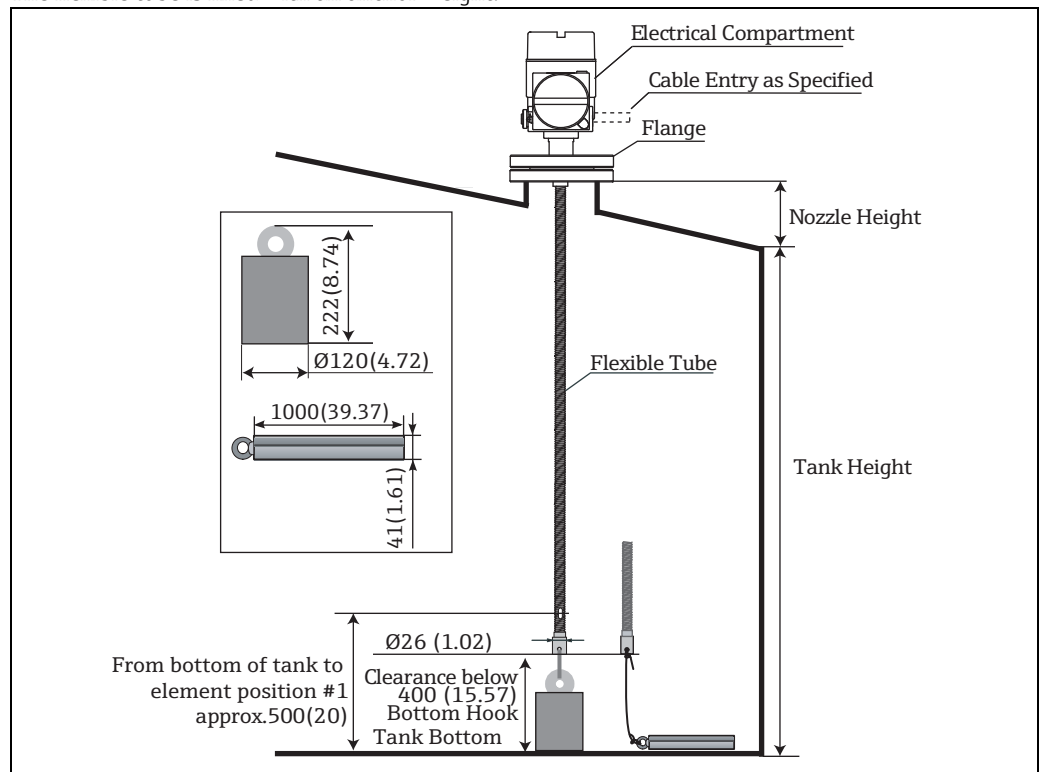


Figure 16: Anchor Weight, Unit of Measurement: mm (in)

CAUTION

Ensure to put the anchor weight at the bottom of the tank. When installing with the suspended anchor weight, use the anchor weight of 16kg or less. Exceeding the limit may cause internal breakage in the flexible tube.

CAUTION

The flexible tube must be lowered carefully without overbending and scratching the inner edge of the nozzle hole.

Anchor Weight Attachment Procedure

1. Insert a gasket and lower the flexible tube from the nozzle at the top of the tank.
2. Rotate NMT532 for cabling in the most convenient way.
3. Put the tensioning wire through the anchor weight hook twice and also tie the other end to the bottom hook.
4. Wind the provided wire around both ties of the hooks to secure the tensioning wire.
5. Using the bolts, fix the mounting flange of NMT532 to the nozzle at the top of the tank.

This completes the mounting anchor weight procedure.

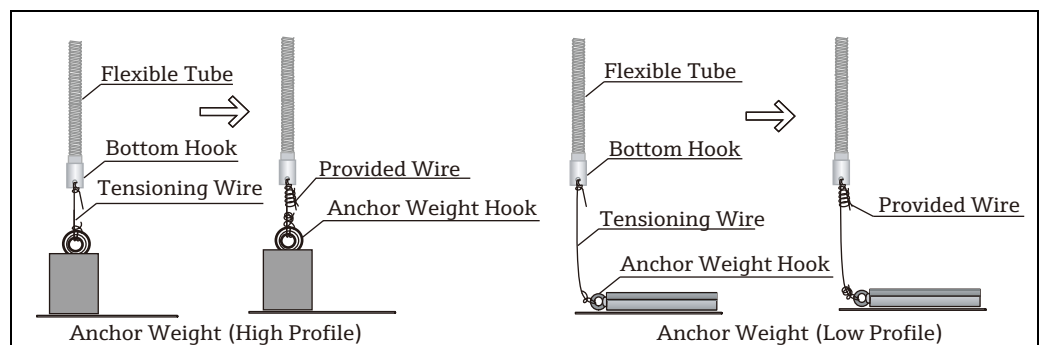


Figure 17: Anchor Weight Attachment

3.3.2 Mounting on Floating Roof Tank

There are three methods of mounting NMT532 on a floating roof tank:

1. Top Anchor Method
2. Stilling Well Method
3. Guide Wire Ring Method

NOTICE

If a heating coil is attached to the bottom of the tank, the clearance between the bottom hook of the flexible tube and the bottom of the tank may vary depending on the type of heating coil.

Top Anchor Method

The flexible tube is installed in a fixed pipe and fixed with the top anchor. NMS5 and NMT532 can be mounted in the same fixed pipe.

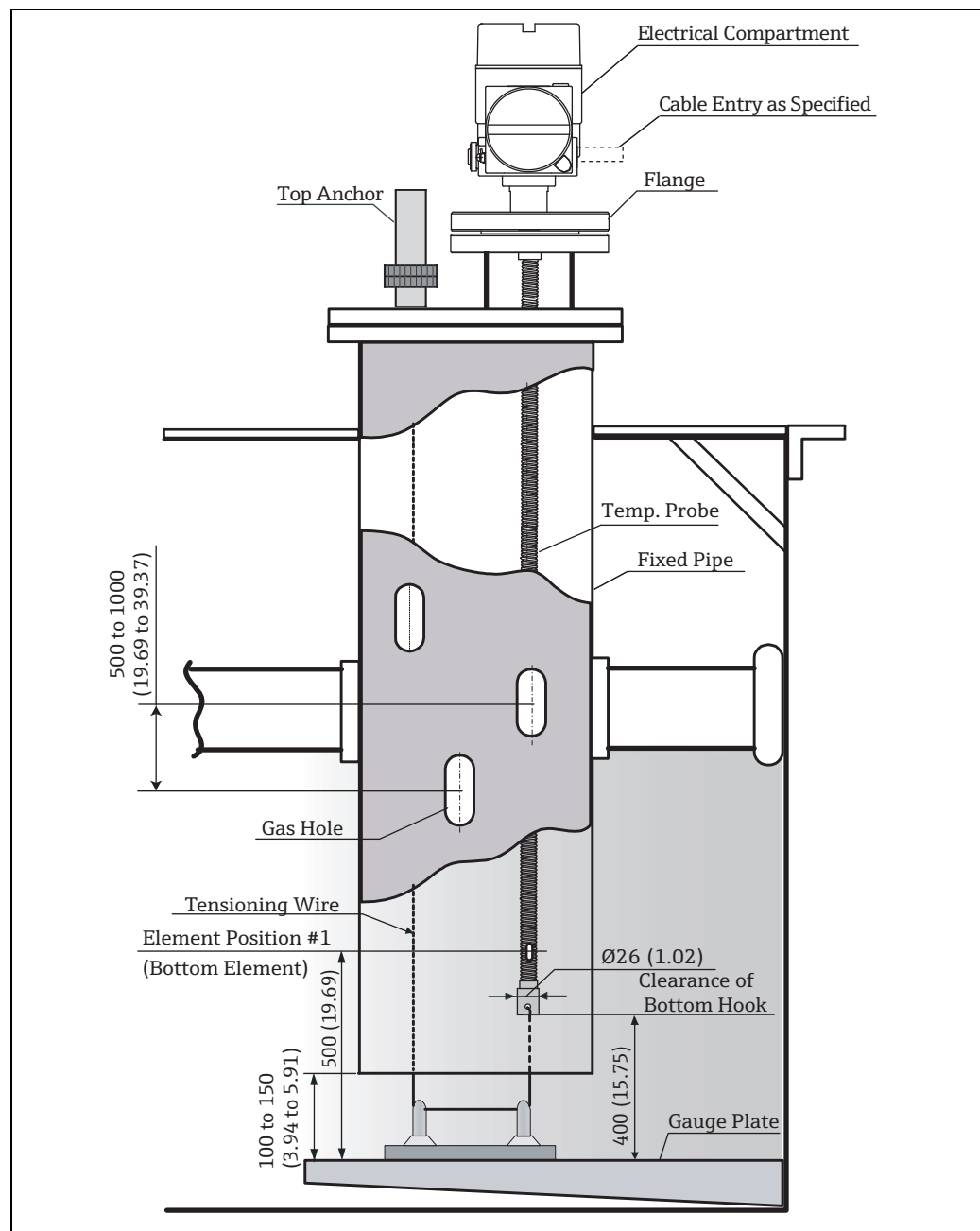


Figure 18: Floating Roof Tank, Unit of Measurement: mm (in)

The installation procedure is the same as in the mounting on fixed roof tanks using the top anchor.

Stilling Well Method

The flexible tube is inserted into a stilling well in the fixed pipe.

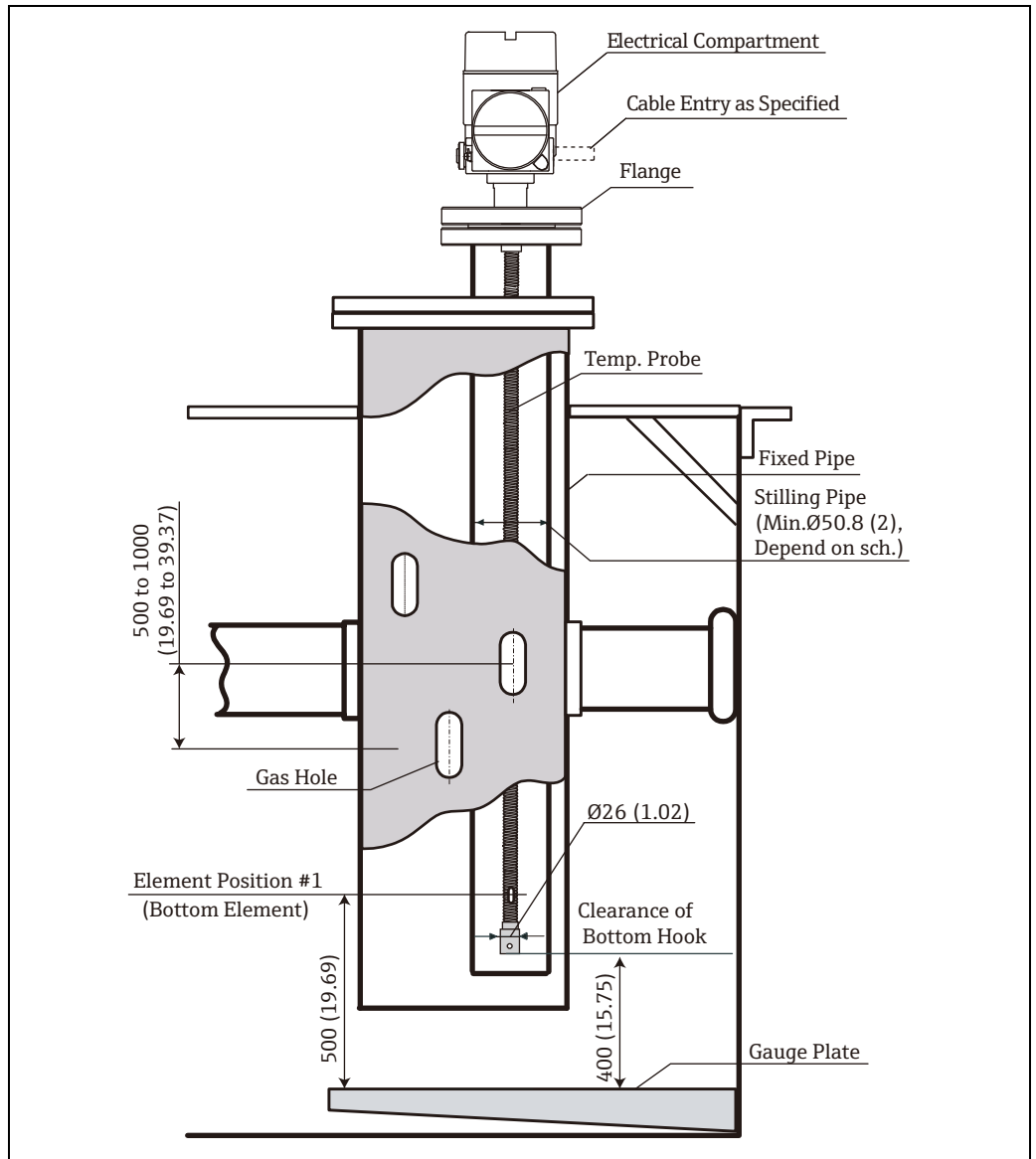


Figure 19: Stilling Well Method, Unit of Measurement: mm (in)

The installation procedure is the same as in the mounting on fixed roof tanks using the stilling well.

Guide Ring and Anchor Weight Method

The flexible tube is fixed with a guide ring and an anchor weight.

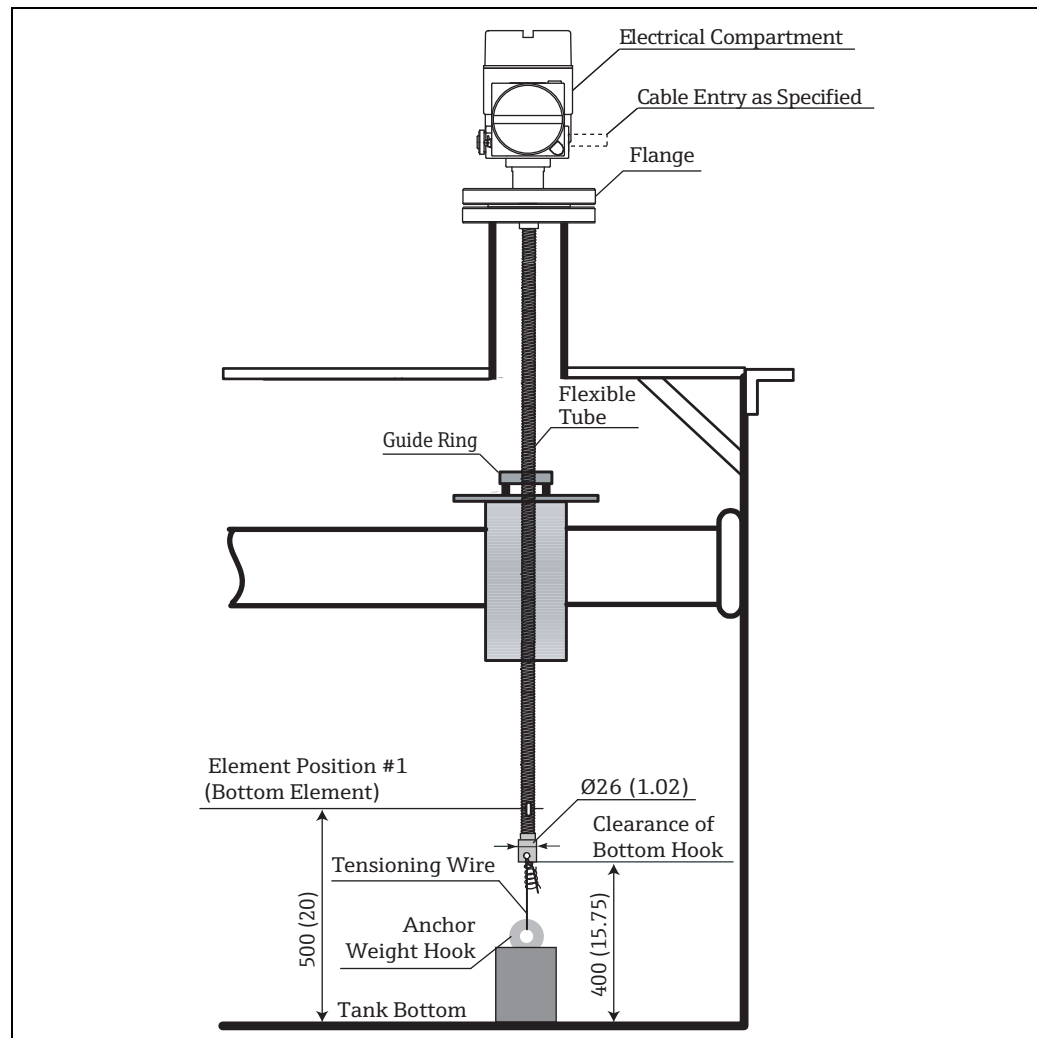


Figure 20: Guide Ring and Anchor Weight, Unit of Measurement: mm (in)

⚠ CAUTION

- Ensure to put the anchor weight at the bottom of the tank. When installing with the suspended anchor weight, use the anchor weight of 16kg or less. Exceeding the limit may cause internal breakage in the flexible tube.
- The flexible tube must be lowered carefully without overbending and scratching the inner edge of the nozzle hole.

Guide Ring and Anchor Weight Attachment Procedure

1. Set the guide ring to the floating roof.
2. Insert the flexible tube into a gasket and lower the flexible tube from the nozzle at the top of the tank.
3. Rotate NMT532 for cabling in the most convenient way.
4. Put the tensioning wire through the anchor weight hook twice and also tie the other end to the bottom hook.
5. Wind the provided wire around both ties of the hooks to secure the tensioning wire.
6. Using the bolts, fix the mounting flange of NMT532 to the nozzle at the top of the tank.

This completes the mounting guide ring and anchor weight procedure.

3.3.3 Mounting on Pressurized Tank

Pressurized tank is required to install a thermo well to protect the probe from the pressure.

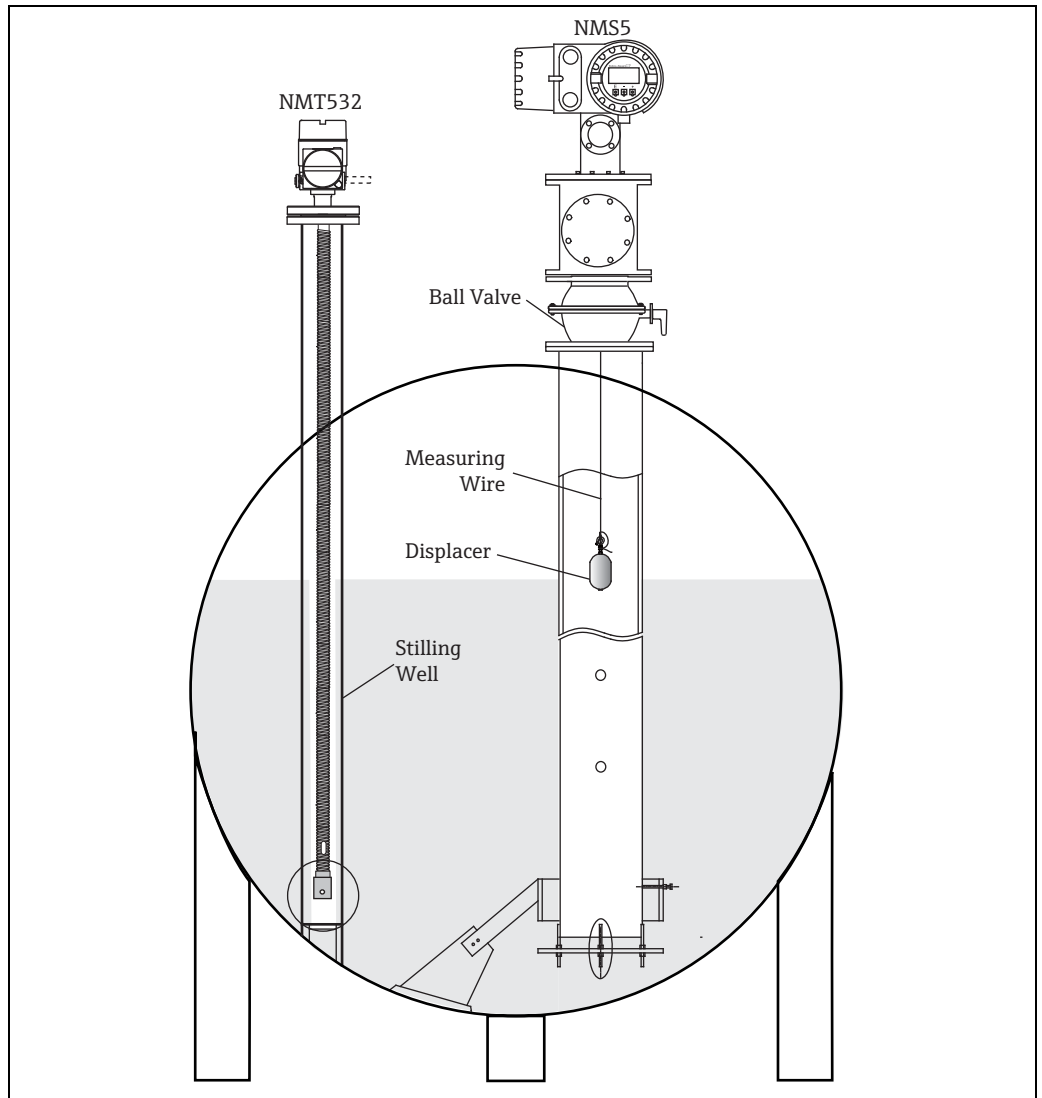


Figure 21: Pressurized Tank

CAUTION

- When the pressure inside the tank exceeds 1 bar (100KPa, 14.5psi), stilling well which does not have any holes or slits must be installed.
- NMT532 is installed in the thermo well from the top of the tank nozzle.
- Cover the bottom of the thermo well and weld it to protect the probe from the pressure.

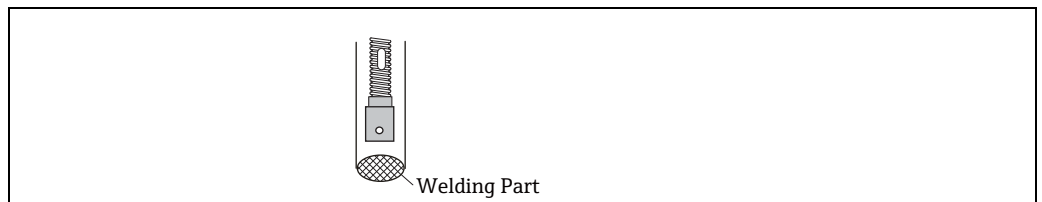


Figure 22: Welding Part of Stilling Well

4 Wiring

4.1 Terminal Connection

4.1.1 NMT532 Terminal (Ex ia)

NOTICE

NMT532 (Ex ia) allows an intrinsically safe local HART connection only. Refer to the i.s. regulation for establishing wiring and field device layout.

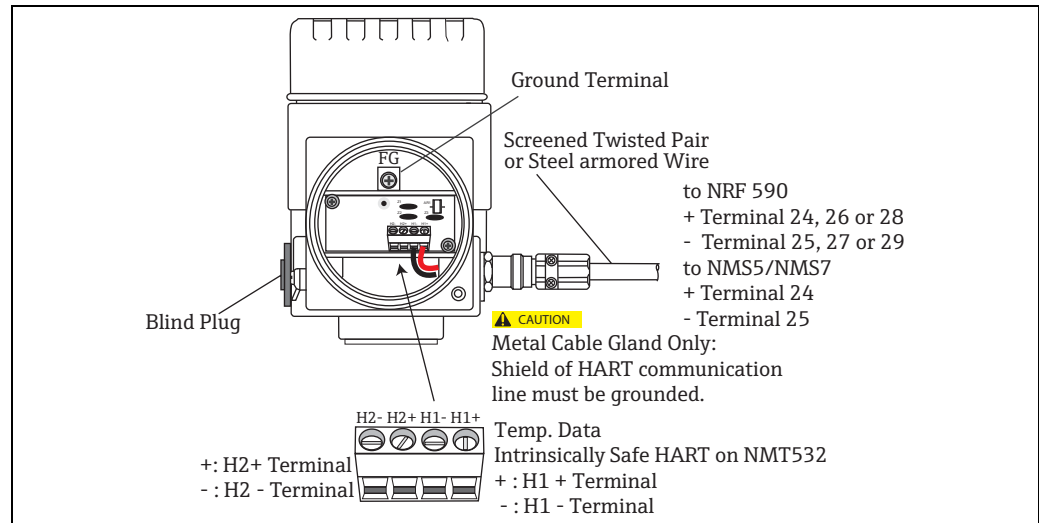


Figure 23: NMT532 Terminal

4.1.2 NMS5 Terminal (Ex d [ia])

Since NMT532 is an intrinsically safe instrument, the terminal connection to the Ex i side on local HART connection is allowed on NMS5 terminal housing.

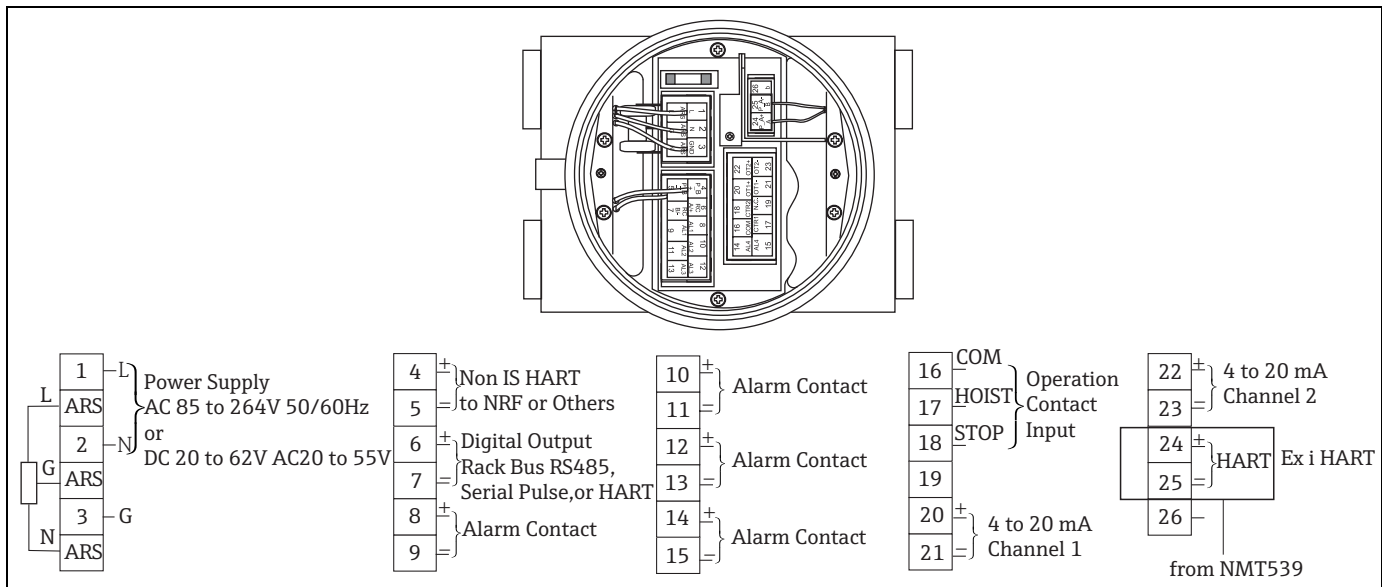


Figure 24: NMS5 Terminal

CAUTION

Do not connect NMT532 local HART communication to terminals 4 and 5 of NMS5. These terminals are designed to connect Ex d local HART communication.

4.1.3 NRF590 Intrinsically Safe Terminal

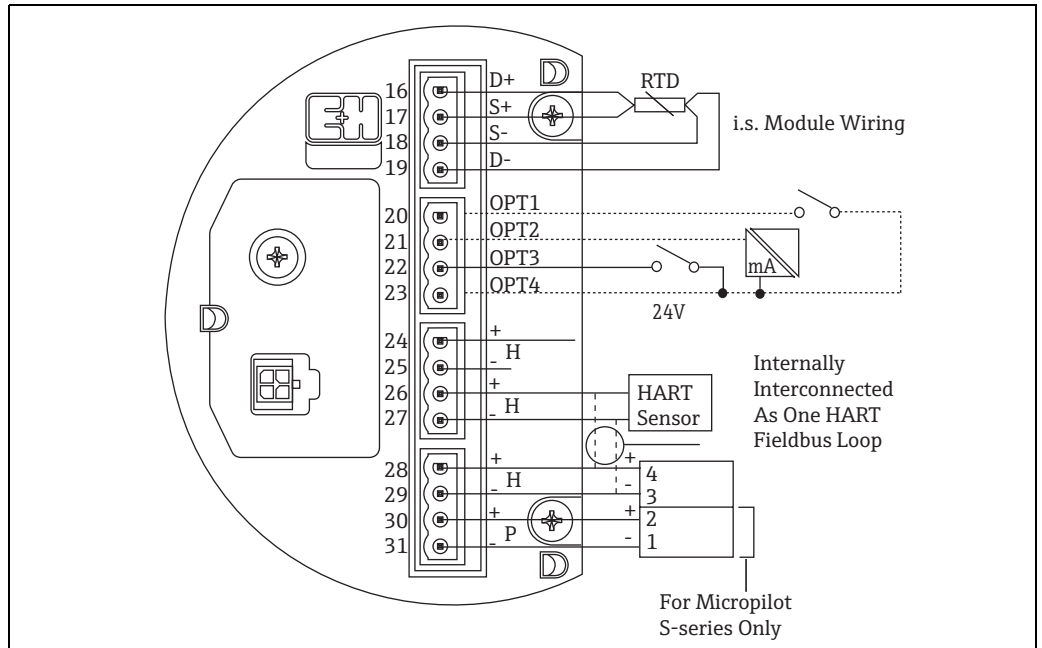


Figure 25: NRF590 Terminal

NOTICE

NRF590 has three sets of i.s. local HART terminals. These three pairs are looped internally.

CAUTION

Do not connect signal local HART lines from NMT532 to terminals 30 and 31. These terminals are designed to supply drive power for FMR 53x series only.

4.2 Grounding

NMT532 must be grounded to the tank potential before communication and power connections are made. The connections from ground terminal of NMT532 to the tank ground must be made before any other wiring connections are made. All grounding must comply with local and company regulations and must be checked before the equipment is commissioned.

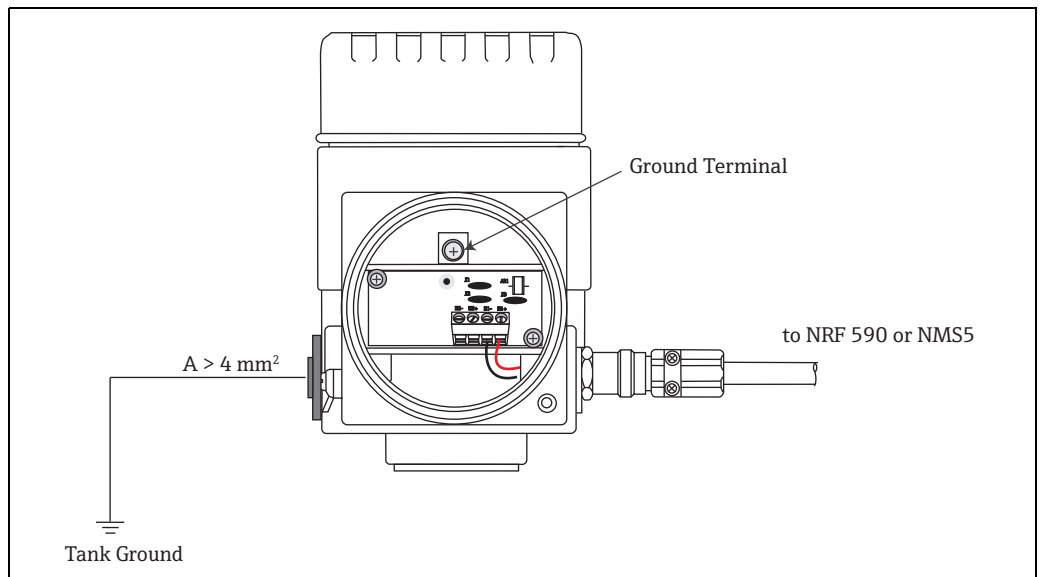


Figure 26: Grounding

5 Operating

5.1 Local HART Connection

5.1.1 Endress+Hauser Tank Gauging Instrument

NMT532 is developed and designated primarily to work with Endress+Hauser tank gauging host instruments NRF590 or NMS5.

Temperature information is transmitted on a two wire intrinsically safe local HART loop to the host instrument.

Since both NRF590 and NMS5 have a pre-configured menu for NMT series functionality as default, simple wiring to NMT532 will complete the initial setup for NMT532.

Measurement function

0: Converter Only

1: Temperature + Converter

These four basic data are available as standard.

1. Average Liquid Temperature
2. Average Gas Phase Temperature
3. Level (entered liquid level at "VH02 measured distance")
4. Device Status

5.2 Device Setup: NRF590

Connect the loop powered local HART communication cable from NRF590 (intrinsically safe side compartment) to NMT532.

Since NRF590 is designed to recognize NMT532 as a specific Endress+Hauser local HART instrument, set up is easy.

5.2.1 HART Scanner

After the physical cabling between NMT532 and NRF590 is complete, scan all connected loop powered local HART devices by activating "HART SCAN" on Tank Side Monitor.

CAUTION

Not all of NRF590 are equipped with fully accessible compatibility to recognize NMT532. Consult Endress+Hauser representatives to cross check the software and hardware version of NRF590. Specific parameters of NMT532 is set to NRF590

5.2.2 Specific Parameters of NMT 532 for Setup to NRF590

Configuration of NMT532 parameters on the display of NRF590 is dependent on the installed software and hardware version of NRF590. Refer to the operating manual of NRF590 to determine accessible parameters.

All required initial setup and configuration can be performed by FieldCare. Detailed information will be described in the following chapters relating to operation.

5.3 Device Setup: NMS5

NMS5 is also specifically designed to recognize NMT532.
Terminals 24 and 25 of NMT532 and NMS5 are connected by using local HART.

5.3.1 Preparation of NMS5

NMS5 must be pre-configured to accept NMT532 connection via the multi drop local HART loop.

GVH362: NMT Connection

"Average Temp." must be selected in order to configure NMT532.

NOTICE

To change this parameter, an access code is required.
Refer to NMS5 operation manual (BA00401G) for further information.

5.3.2 NMT532 Configuration on NMS5

Most required NMT532 parameters can be configured on G4 "Temperature" matrix as it is on the display of NMS5.

NOTICE

Typical NMT532 parameters are displayed on the matrix of NMS5.

G0 Static Matrix

GVH010: Liquid Temp

Display average liquid temperature.

GVH013: Gas Temperature

Display average gas temperature.

G4 Dynamic Matrix: Temperature

GVH440: Liquid Temp

Display the same value indicated on GVH010 Liquid Temp

GVH441: Gas Temperature

Display the same value indicated on GVH013 Gas Temperature

GVH442: Measured Level

Display liquid level value established in NMS5

NMT532 must have liquid level data in order to calculate both liquid and gas phase average temperature.

GVH447: Reference Zero

Check that temperature transforming of measuring temperature resistor is performed correctly.
Allowable Range: $\pm 1.0^{\circ}\text{C}$ ($\pm 33.8^{\circ}\text{F}$)

GVH450 - 459; Temp No.1-10 (No.1 - 6 for NMT532)

Display measuring values of temperature from each inserted element in the probe.

GVH460 - 49; Element Position No.11 - 16 (not available with NMT532)

GVH470: Select Point

A matrix to select the desired element data on GVH471 "Zero Adjust", GVH473 "Element Temp" and GVH474 "Element Position."

GVH480: Diagnostic

Display error code message

Refer to the error code chart in a later chapter of this manual (refer to Page 40).

GVH482: Total No. Element

Enter the number of installed temperature elements in the average temperature probe.

GVH485: Type of Interval

Select type of element interval

Even: Element spacing will be equally spaced by providing the distance at GVH487 "Element Interval", and the lowest element position can be set at GVH486 "Bottom Point".

GVH486: Bottom Point

The lowest inserted element position in the average temperature probe

NOTICE

This parameter setting is only used to change the theoretical element position within NMT532's software for purposes of average calculation. The physical location of the temperature element position does not change.

6 Operation and Description of Instrument Function

Description for FieldCare from this chapter

6.1 Local HART Device Designation

Local HART Device Code "184":

Device code for temperature measurement function in NMT532 only

6.1.1 Device Data

Tag Number: read and write

Default: Local HART

A customer specific device identification and control number (or name)

Tank name, site number, or any other ID can be entered.

Assembly Number: read and write

Default: 0

Manufacture control number based on production process

6.2 Temperature Measurement

6.2.1 Primary Values: VH00 - VH09

VH00 Liquid Temp

Item type: read only

Range: -200°C to +240°C

NOTICE

- Display measured liquid phase average temperature.
- Liquid level input must be provided by Micropilot radar level gauge (via Tank Side Monitor) or NMS5 series servo level gauge in order to calculate true liquid average temperature.

VH01 Gas Temp

Item Type: read only

Range: -200°C to +240°C

Display measured gas (vapor) phase average temperature.

NOTICE

- Display measured gas (vapor) phase average temperature.
- Liquid level input must be provided by Micropilot radar level gauge (via Tank Side Monitor) or NMS5 series servo level gauge in order to calculate true gas average temperature.

VH02 Measured Distance

Item Type: read and write

Range: 0mm - 99999mm

Display provided liquid level by connected level gauge.

When level gauge is not connected, inputting liquid level is also available for the device test purpose.

VH07 Temperature 0

Item Type: read only

Check that temperature transforming of measuring temperature resistor is performed correctly.

Allowable Range: $\pm 1.0^{\circ}\text{C}$ ($\pm 33.8^{\circ}\text{F}$)

VH09 Temperature 17

Item Type: read only

This temperature is used to check at the factory.

6.2.2 Element Temperature 1: VH10 - VH15 (VH16-19 is used only in NMT 532)**VH10 - 19 Temperature 1 - 10**

Item Type: read only

Range: -200°C to +240°C

Display individual measured element temperature

6.2.3 Element Temperature 2: VH20 - VH29 (not available in NMT532)**VH26 Selec. Ave Method**

Item Type: select

Selection: standard, advanced

Select average calculation method

Standard:**Conventional Calculation Method**

Regardless of tank shape, average temperature calculation will be performed based on the following example (ex.: liquid temperatures).

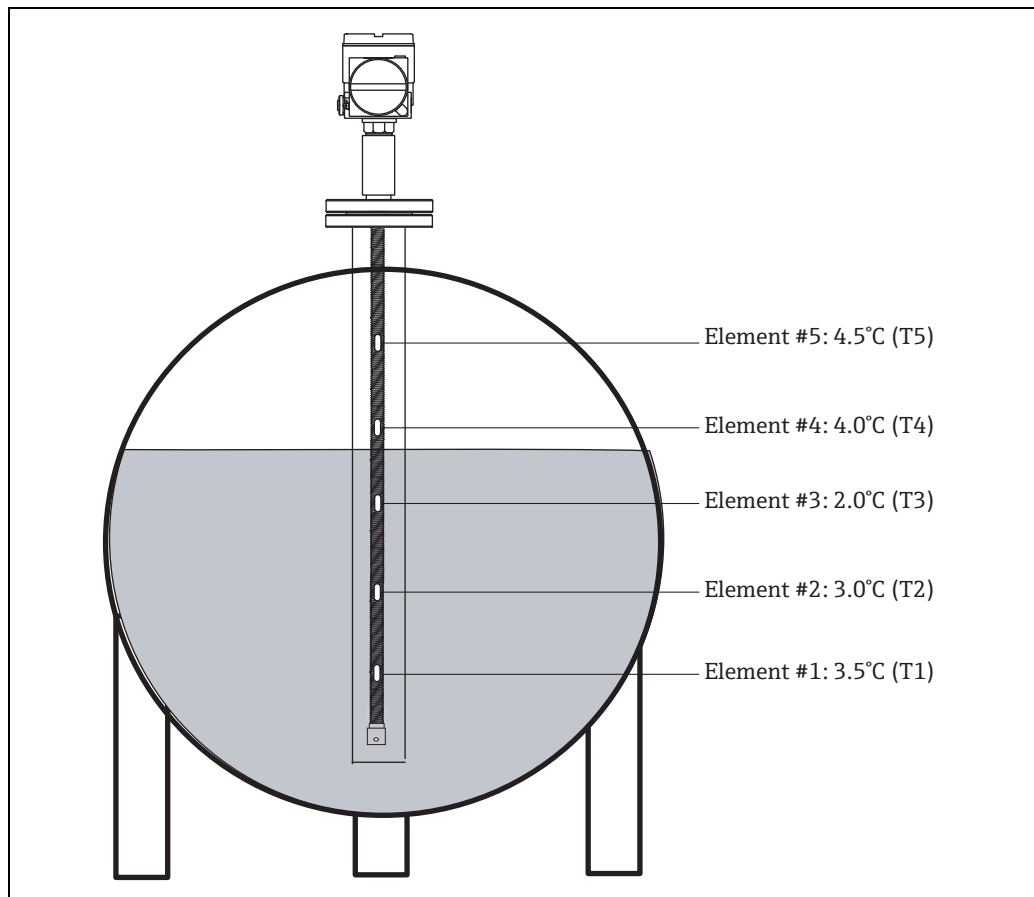


Figure 27: Conventional Calculation for Standard

Formula: $(T1 + T2 + T3) / \# \text{ of element in liquid phase}$
= Average temperature $(3.5^\circ\text{C} + 3.0^\circ\text{C} + 2.0^\circ\text{C}) / 3 = 2.83^\circ\text{C}$

Advanced:

Average temperature calculation can be performed adding correction factor to compensate unequal volume distribution (example: liquid temperatures).

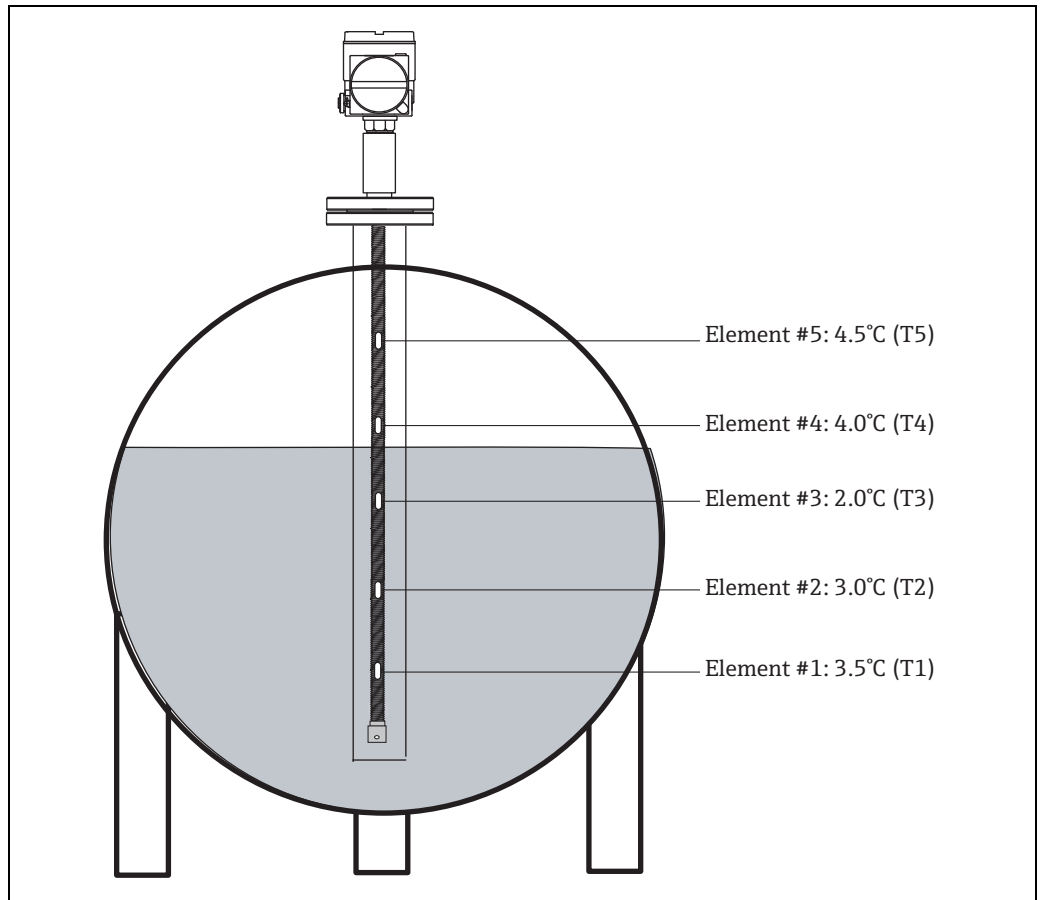


Figure 28: Conventional Calculation for Advanced 1

Formula: $(T1 \cdot V1 + T2 \cdot V2 + T3 \cdot V3) / (V1 + V2 + V3) = \text{Average temperature}$

NOTICE

V = # of additional volume factor and related parameters are determined at VH53, 54 and 55.

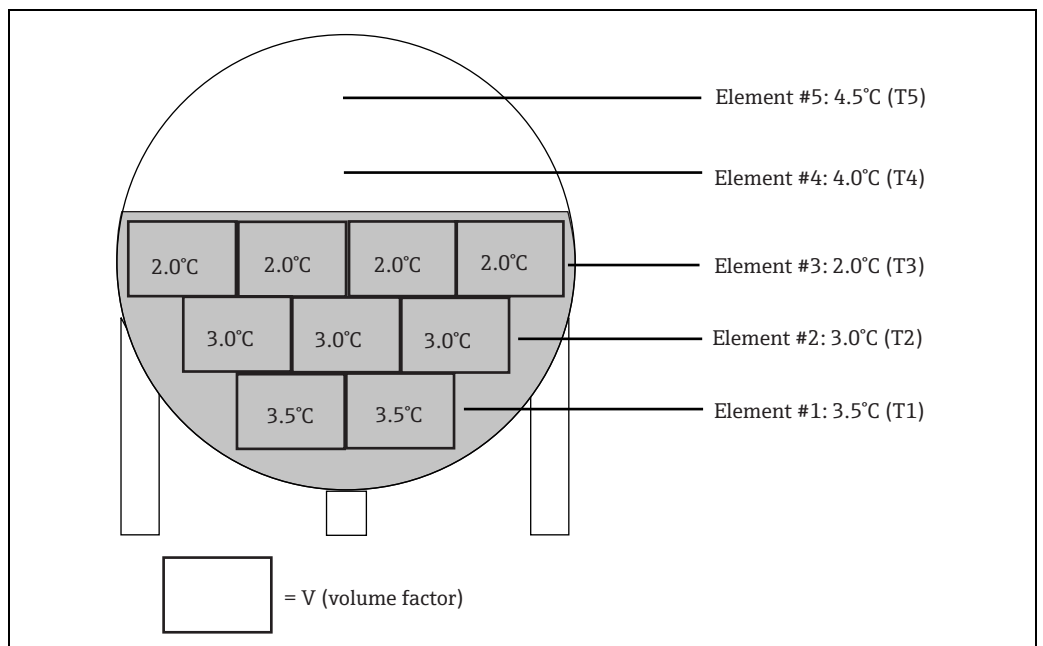


Figure 29: Conventional Calculation for Advanced 2

Spot:

When some elements (resistance and material) are located in each input cable in the probe; average calculation is performed based on sum of submerged element temperature value/total number of element submerged.

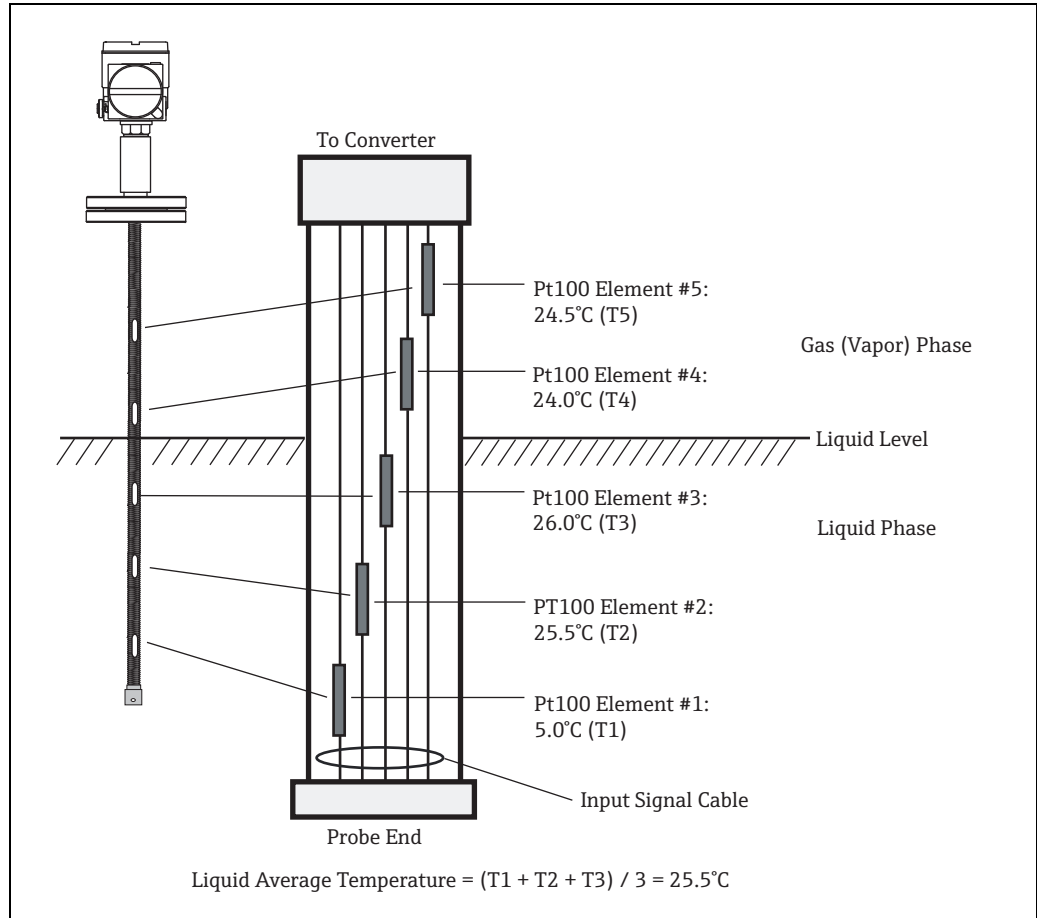


Figure 30: Spot Type

VH28 Lower Limit

Item Type: read and write

Default Value: -20.5°C

Range: -999.9°C to +999.9°C

Display low limit temperature. This is used for reference of element shortage.

VH29 Upper Limit

Item Type: read and write

Default Value: 245°C

Range: -999.9°C to +999.9°C

Display high limit temperature. This is used for reference of element disconnection.

6.2.4 Element Position 1: VH30 - VH35 (VH36 - VH39 is used only in NMT 532)

VH30 - VH39 Position 1 - 6 (7-10 is used only in NMT 532)

Item Type: read and write

Range: 0mm - 99999mm

Individual element position from tank bottom

Calculation is automatically performed when element spacing "Even" is selected at VH85.

6.2.5 Element Position 2: VH46 - VH49 (VH40 - VH45 are not available in NMT532)

VH46 Hysteresis Width

Item Type: read and write

Default: 10mm

Range: 0mm - 99999mm

Element switching point hysteresis

Entered hysteresis as a offset value is added on the liquid level when the liquid level is raising, subtracted when lowering to prevent from hunching by unstable liquid surface condition.

VH47 Clear Memory

Item Type: select

Default: None (0)

Selection: None, Clear

Reset matrix parameter to default setting.

VH48 Gas Offset

Item Type: read and write

Default: 300mm

Range: 0mm - 99999mm

When a temperature element in the gas (vapor) phase is within the range of 300mm shown below, it is not used for the average temperature calculation of the gas temperature.

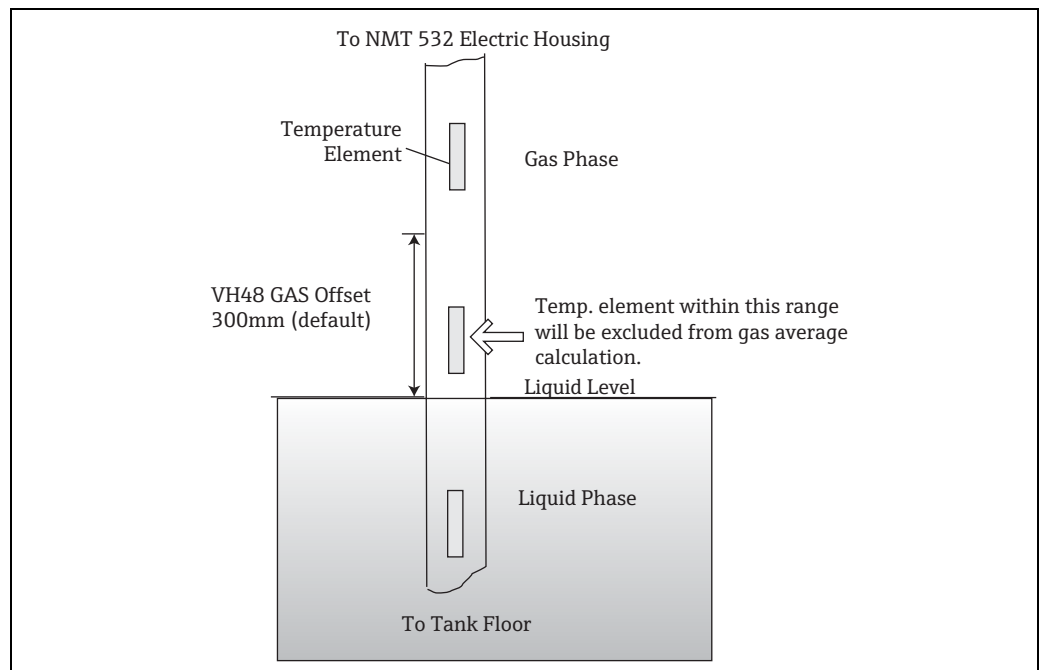


Figure 31: Gas Offset

VH49 Liquid Offset

Item Type: read and write

Default: 300mm

Range: 0mm - 99999mm

When a temperature element in the liquid phase is within the range of 300mm shown below, it is not used for the average temperature calculation of the gas temperature.

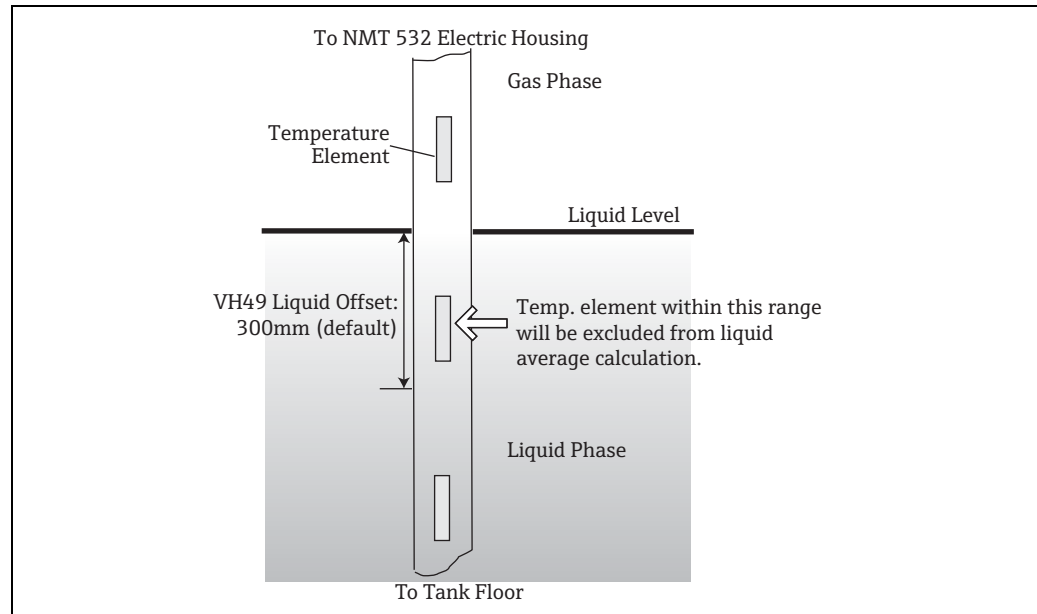


Figure 32: Liquid Offset

6.2.6 WB Primary and Advanced Temp: VH50 - VH59

VH53 Element Point

Item Type: select

Default: 0

Selection: 0 - 5 (element #1 = 0, element #6 = 5)

Select element number for "Advanced" average calculation at VH26. Selected element position will be displayed on VH54 "Element Position" and enable to change additional volume factor at VH55 "Element Volume."

VH54 Element Position

Item Type: read only

Range: 0m - 99999mm

Display the selected element position at VH53

VH55 Element Volume

Item Type: read and write

Range: 1 - 99999.9

Set additional factor on the selected element at VH53. Additional volume can be added to the individual element for advanced average temperature calculation (refer to "Select Average Method" for details on the description of VH26).

6.2.7 Operation Power Adjustment: VH60 - VH69

VH67 Common Voltage

Item Type: read only

Range: 0 - 255 (0 - 3V)

Display running voltage of the temperature element line (both signal and common).

Detected voltage across common line (shall be between 0 - 3V) is converted to the range of 0 - 255 count when it is displayed.

VH68 Output Current

Item Type: read only

Range: 0 - 65535

Output current is set according to customer specifications.

VH69 Ref Voltage

Item Type: read and write

Default: 200

Range: 0 - 255

A parameter to draw power supply failure alarm

NMT532 operates at minimum 16VDC of supply voltage via multi drop HART loop under normal operating condition. NMT532 transmits error message when supply voltage drops below 16VDC with default value setting 200.

6.2.8 Temperature Adjustment: VH70 - VH79

VH70 Element Select

Item Type: select

Range: 0 - 19

Select "need adjustment" temperature element (0 = #1 element, 5 = #6 element, 19 = reference 100 Ohm resistor)

Detailed value and parameter of the element selected in this matrix can be shown in,

VH71 "Zero Adjust"

VH73 "Temperature X"

VH74 "Position X"

VH75 "Resistance X"

VH76 "Resistance Adj"

VH71 Zero Adjust

Item Type: read and write

Default: 0

Range: -1000.0 - 1000.0

Zero adjustment of individual element selected at VH70

Comparing to precision reference thermometer, when measuring value shows minor offset value, the reading value can be adjusted.

NOTICE

Set "-0.2" in this matrix if 1) selected element #2 indicates 25.4°C and 2) reference thermometer indicates 25.2°C. After setting the value, the offset value which is based on the actual measuring value of the element #2 will be -0.2°C.

VH72 Adjust Span

Item type: read and write

Default: 1

Range: 0.8 - 1.2

The span adjustment can apply to all the installed temperature elements.

A linearized factor of given parameter is multiplied to raw element measurement for final calculation.

VH73 Temperature X

Item type: read only

Specified element temperature selected at VH70

Display the temperature of the element selected at VH70 and display the individual element temperature shown at VH10 - VH25.

The value is calculated based on the following formula.

$$\text{VH73: "Temperature X"} = \text{raw element temperature} \times \text{span (VH72)} + \text{zero offset (VH71)}$$

VH74 Position X

Item type: read and write

Range: 0mm - 99999mm

A position of specified element at VH70

Each element positions are also determined when "Not Even" element spacing is selected at VH85.

VH75 Resistance X

Item type: read only

Display the element resistance selected at VH70.

VH76 Resistance Adj.

Item type: read and write

Default: 0

Range: -1000.0 - 1000.0

Adjust the element resistance selected at VH70

Minor resistance adjustment can be set at the reading value.

NOTICE

Set "-0.3 Ohm" in this matrix if 1) selected element #5 indicates 100.3 Ohm and 2) reference precision resistor indicates 100.0 Ohm under the same environment condition. After setting the value, the offset value which is based on the actual measuring value of the element #5 will be -0.3°C.

VH77 Element Type

Item type: select

Selection: Pt100 (must be selected in NMT532)

NOTICE

NMT532 always consists "Pt100" element with "Spot" element layout.

Do not change these parameters.

VH78 Average Number

Item type: read and write

Default: 1

Range: 1 - 10

Number of sampling for average calculation prior to determine final display value

Increasing number of sampling may prevent from faulty display.

CAUTION

Additional sampling # will cause slower reaction time on value switch over. Maximum 1 sampling sequence will take approximately 2 sec {total 11 elements (6 temp elements and 5 times for 3 reference resistors)}.

NH79 Protect Code

Item type: read and write

Default: 0

Range: 0 - 999

Access code 530 to enable select and write command available

6.2.9 Device setting 1: VH80 - VH89

VH80: Present Error

Item type: read only

Display the error message.

The following codes will be indicated.

For detailed description, refer to "Troubleshooting".

Error Code	Description
0	No error presence
1	Common line open
3	#1 element open
4	#1 element short
5	#2 element open
6	#2 element short
7	#3 element open
8	#3 element short
9	#4 element open
10	#4 element short
11	#5 element open
12	#5 element short
13	#6 element open
14	#6 element short
23	#0 element over range
24	Memory defect (ROM)
29	Element exposed (liquid level below #1 element position)
41	Memory defect (RAM)
42	Memory defect (EEROM)

VH81 Temperature Unit

Item Type: select

Default: °C

Selection: C, F, K

Select the unit of the temperature display

Based on universal local HART setting, °C(HART code: 32), °F(HART code: 33) and °K(HART code: 35) are available.

NOTICE

Selection of temperature display unit only applies to reply data from NMT532. Data transmission from host gauge (NRF590 or NMS5) to NMT532 is performed by °C unit only.

VH82 Element Number

Item Type: read and write

Default: 2

Range: 1 - 6

Entering # of available temperature element

CAUTION

Do not change the default parameter on NMT532. # of element on this version is pre-determined by customer's choice. It may cause faulty calculation or unnecessary error display.

VH83 No. of Preambles

Item Type: read and write

Default: 5

Range: 2 - 20

Set # of preamble for local HART communication

⚠ CAUTION

Do not change default value. Changing value may cause communication error.

VH84 Distance Unit

Item Type: select

Default: mm

Selection: ft., m, inch, mm

Select the unit of the level display

The unit applies to liquid level display on VH02 "Liquid Level". "Level units are coded based on the universal local HART setting, ft. (HART code: 44), m (HART code: 45), inch (HART code: 47), mm (HART code: 49).

VH85 Kind of Interval

Item Type: select

Default: Even Interval

Selection: Even Interval (always "Even" for NMT532)

Select the interval of the elements depending on spacing layout.

⚠ CAUTION

Do not change its parameter on NMT 532 Converter + Temperature version excluding repair. Kind of Interval and individual element positions are physically determined at factory.

VH86 Bottom Point

Item Type: read and write

Default: 500mm

Range: 0mm - 99999mm

Position of #1 element that is also called "Bottom Point"

#1 element position becomes critically important when "Even Interval" is selected at VH85 because remaining element positions rely on this location of Bottom Point.

VH87 Element Interval

Item Type: read and write

Default: 1000mm

Range: 0mm - 99999mm

Designate Even Interval spacing.

⚠ CAUTION

Changing element interval and setting element position are only applied to reconfigure switching points for average temperature calculation. The physical element position will never be changed.

VH88 Short Error

Item Type: read and write

Default: -49.5

Range: -49.5 - 359.5

A type of error message when any of element has short circuit

Method of display can be configured at VH92 "Error Display Select."

VH89 Open Error

Item Type: read write

Default: 359.0

Range: -49.5 - 359.5

A type of error message when any of element has open circuit

Method of display can be configured at VH92 "Error Display Select".

6.2.10 Device setting 2: VH90 - VH99

VH90 Device ID Number

Item Type: read and write

Default: 0

Range: 0 - 16777214

In order to distinguish own device ID when NMT532 is connected in multi drop local HART loop.

CAUTION

Changing device ID may lead to communication error because of mismatched pre-registered device ID and local HART address.

VH91 Previous Error

Item Type: read only

Display of error history

Coded error message will be the same contents as VH80.

VH92 Error Dis. Sel.

Item Type: select

Default: 0_OFF

Selection: 0_OFF, 1_ON

Select the type of the display of VH88 "Short Error Value" and VH89 "Open Error Value".

0_OFF: These 2 error messages will not be transmitted to the connected host gauge. This function automatically excludes defect element in average temperature calculation.

1_ON: Error message will be transmitted to the host gauge. As a result, VH88 and 89's numeric error code will be displayed on host gauge default screen and may transmit to upper receiver as well.

VH94 Polling Address

Item Type: read and write

Default: 2

Range: 1 - 15

Polling address for local HART communication

VH95 Manufacture ID

Item Type: read only

Default: 17

A manufacture ID within E+H instrumentation

VH96 Software Version

Item Type: read only

A display of installed software version

VH97 Hardware Version

Item type: read only

A display of installed hardware version

VH98 Below Bottom

Item type: select

Default: 0_OFF

Selection: 0_OFF, 1_ON

A type of error display when liquid level drops below #1 element (Bottom Point)

Error code "29" is displayed on VH80 and VH91 when 0_ON is selected.

VH99 Device Type Code

Item Type: read only

Device type will be displayed.

190: Temperature measurement function only

7 Maintenance

7.1 Periodic Inspection

NMT532 requires no special maintenance. Conduct all-round periodic inspection of equipment wiring etc. once a year as much as possible.

Periodic Inspection Item

- Check terminal parts and body cover loose
- Check damage or deterioration of cable and O-rings
- Check screw of adjustment parts

7.2 Repairs

The Endress+Hauser repair policy is based on the fact that the measuring devices have a modular design and that customers are able to undertake repairs themselves. Contact Endress+Hauser service representatives for further assistance regarding service and spare parts.

7.3 Repairs to Ex-approved Devices

When performing repairs on Ex-approved devices, note the following:

- Repairs of Ex-approved devices may only be performed by trained personnel or by Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and other relevant rules.
- Only use original spare parts provided by Endress+Hauser.
- When ordering spare parts, note the device information on the nameplate. Replace parts only with parts that have the same device information.
- Perform repairs according to the instructions. When completing repairs, perform the specified routine test on the device.
- Only Endress+Hauser service representatives may convert a certified device into a different certified variant.
- Document all repair work and conversions.

7.4 Replacement

After NMT532 electronic module has been replaced completely, the parameters must be manually re-entered to the replaced new module in order to maintain the proper operation. Measurement can continue without having to perform a new setup.

The following matrix parameters should be confirmed after replacement of the electronics.

GVH	Contents
443	Level Data Selection
460-469	Element Position No. 1-9
470	(to select elements 10-15)
474	(to adjust position of element selected at GVH=470)
482	Total No. Elements
485	Kind of Interval
486	Bottom Point
487	Element Interval (If GVH=485 is "Equal")

8 Accessories

Anchor Weight (High Profile)

CAUTION

Installation of anchor weight will cause element position #1 (the lowest temperature measurement position) to be raised approximately 500mm (20") from the tank floor.
 For installing the high profile anchor from a top of the tank nozzle, the nozzle opening has to be 150mm (6") or more.

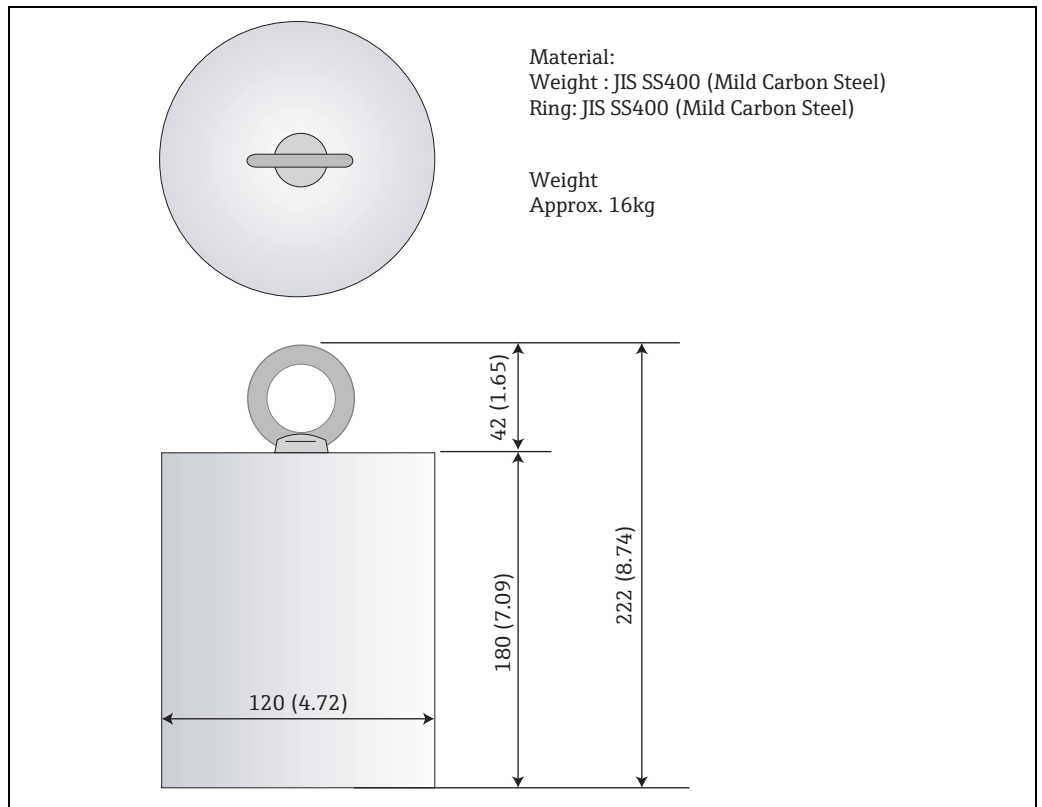


Figure 33: Anchor Weight for High Profile, Unit of Measurement: mm (in)

Different dimension, weight, and material anchor are also available. Consult Endress+Hauser representatives for further details.

Anchor Weight (Low Profile)

The low profile anchor weight is a version for an existing tank installation with a small nozzle opening for converter and temperature version.

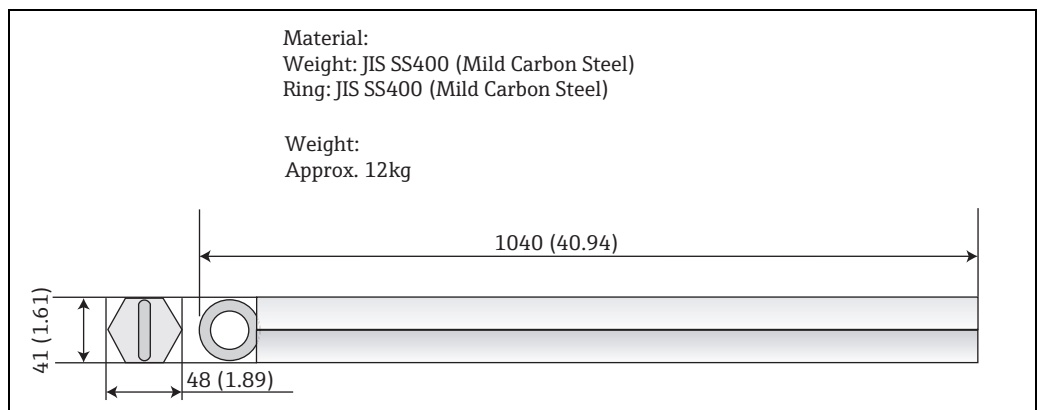


Figure 34: Anchor Weight for Low Profile, Unit of Measurement: mm (in)

Wire Hook and Top Anchor Mounting Attachment Option: D

Anchor weights are supplied with SUS316 standard 3mm diameter tension wire for attaching anchor weight to temperature probe.

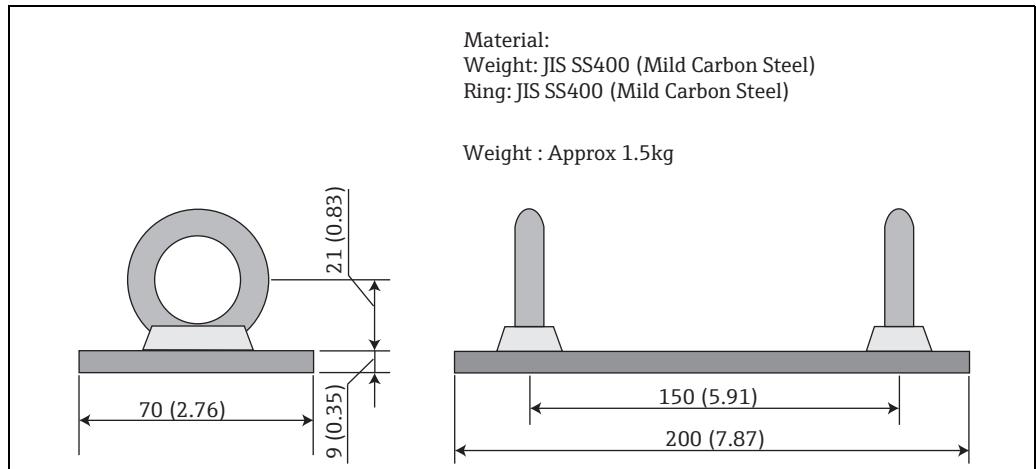


Figure 35: Wire Hook, Unit of Measurement: mm (in)

Actual tensioning can be completed with SUS316 stranded 3mm diameter tension wire between the wire hook and the top anchor. Based on the application and installation variable, type of wire & size, material, and special coatings are available. Consult Endress+Hauser representatives for further details.

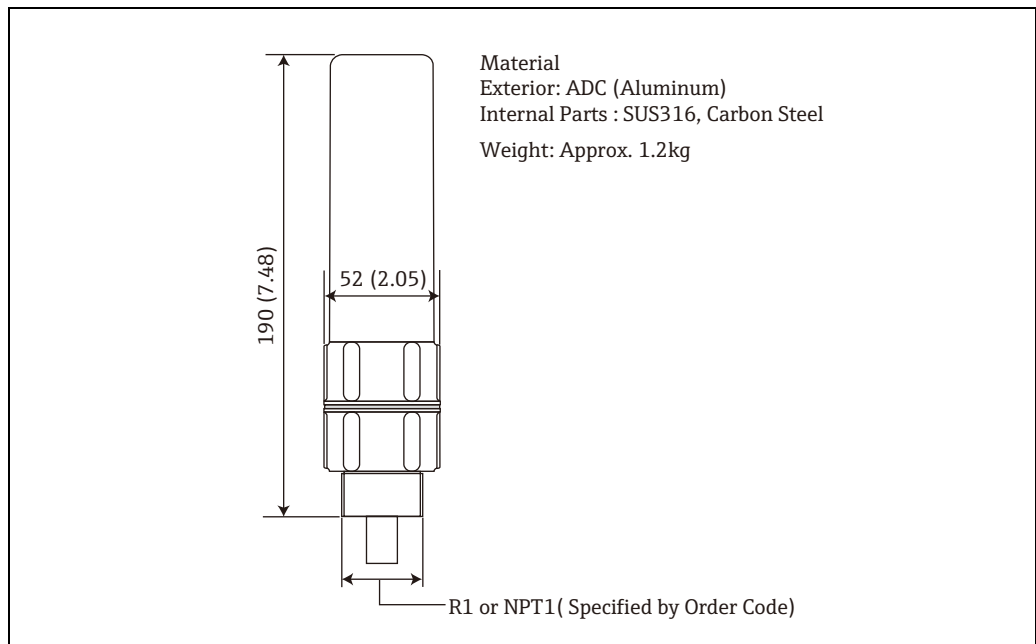


Figure 36: Top Anchor Dimension

NOTICE

The standard process connection of the top anchor is R1 or NPT1" threaded connection. Different thread size, material, and specification are available. Flange type connection is also available.

9 Troubleshooting

9.1 System Error Messages

Code	Text	Description	Action
0	No Error presence	No error arise	Not necessary.
1	Common line open	Common line is open.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #1 element line (brown).
3	#1 element open	Temperature element signal cable (#1) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #1 element line (brown).
4	#1 element short	Temperature element signal cable (#1) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #1 element line (brown).
5	#2 element open	Temperature element signal cable (#2) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #2 element line (red).
6	#2 element short	Temperature element signal cable (#2) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #2 element line (red).
7	#3 element open	Temperature element signal cable (#3) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #3 element line (orange).
8	#3 element short	Temperature element signal cable (#3) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #3 element line (orange).
9	#4 element open	Temperature element signal cable (#4) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #4 element line (yellow).
10	#4 element short	Temperature element signal cable (#4) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #4 element line (yellow).
11	#5 element open	Temperature element signal cable (#5) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #5 element line (green).
12	#5 element short	Temperature element signal cable (#5) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #5 element line (green).
13	#6 element open	Temperature element signal cable (#6) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #6 element line (blue).
14	#6 element short	Temperature element signal cable (#6) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #6 element line (blue).
23	#0 element over range	The reference #0 element on the electronic module has malfunction.	Replace the electronic module.
24	Memory defect (ROM)	Program memory malfunction.	Replace the electronic module.
29	Element exposed	Liquid level is below #1 element position.	No liquid temperature measurement is available. When liquid level goes over #1 element position, the error disappears.
32	Low power supply	Supply voltage on multi drop HART loop to Prothermo is below specification from a connected host instrument.	Check power supply on the host instrument and consumption of connected loop powered HART devices.
41	Memory defect (RAM)	Data memory malfunction.	Replace the electronic module with new one.

Code	Text	Description	Action
42	Memory defect (EEROM)	Non-volatile data memory malfunction.	Replace the electronic module with new one.

NOTICE

These error code will be mainly displayed on FieldCare display when the tool is properly connected. Method and description of error display on host instrument, refer to the documentation of NRF590 or NMS5.

9.2 Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong measuring device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium. To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material

9.3 Disposal

Observe the following notes during disposal:


- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

9.4 Software History

Software version / Date	Software changes	Documentation changes
V1.45/04.2006	Original software	BA1039N (Operating Instructions)
V01.51.00 / 2011.1	HART ID configuration, FieldCare support updated	BA01039G (Operating Instructions)

10 Technical Data

Application	
Application	NMT532 performs precise liquid and gas phase average temperature measurement in bulk storage tank applications. <ul style="list-style-type: none"> ▪ Standard 2" flange installation ▪ Overall 18,5m temperature measurement range
Function and System Design	
Measuring Principle	Temperature measurement <ul style="list-style-type: none"> ▪ Up to 6 elements spaced evenly over the length of the flexible tube. ▪ Pt100, IEC 60751/DIN EN 60751 Class A elements
Input	
Measured Variable	Temperature measurement Temperature conversion range: -20 to +100°C
Measuring Range	-20 to +100°C (-4 to 212°F)
Output	
Output Signal	<ul style="list-style-type: none"> ▪ Local HART protocol (multi drop local HART loop connection)
Signal on Alarm	Error information can be accessed via the following interfaces and transmitted digital protocol (refer to the operation manuals on following instruments). <ul style="list-style-type: none"> ▪ NRF590 ▪ NMS5
Auxiliary Energy	
Load HART	Minimum load for local HART communication: 250 Ω
Cable Entry	Thread NPT1/2 Thread M20
Supply Voltage	16 to 30VDC (on HART loop)
Current Consumption	6mA
Performance Characteristics	
Reference Operating Conditions	<ul style="list-style-type: none"> ▪ Temperature = +25°C(77°F) ±5 (9°F) ▪ Pressure = 1013 mbar abs. ±20 mbar abs. (1013 hPa abs. ±20 hPa abs., 14.7 psi abs. ±0.3 psi abs.) ▪ Relative humidity (air) = 65% ±20%
Maximum Measured Error	Typical statements for reference conditions, include linearity, repeatability, and hysteresis: <ul style="list-style-type: none"> ▪ Linearity: <ul style="list-style-type: none"> - Temperature: ±0.15°C (0.27°F) + element deviation (based on IEC 60751/DIN EN 60751 class A standard)

Operating Conditions	
Environment	
Ambient Temperature	-40 °C to +85°C (-40°F to +185°F)
Storage Temperature	-40 °C to +85°C (-40°F to +185°F)
Climate Class	DIN EN 60068-2-38 (test Z/AD)
Degree of Protection	<ul style="list-style-type: none"> ▪ Housing: IP65, NEMA 4X (Converter only, open housing: IP20) ▪ Probe: IP68
Electromagnetic Compatibility	<p>When installing the probes in metal and concrete tanks and when using a coax probe:</p> <ul style="list-style-type: none"> ▪ Interference Emission to EN 61326, Electrical Equipment Class B ▪ Interference Immunity to EN 61326, Annex A (Industrial)
Process Condition	
Temperature Range	Temperature probe: -20 to +100 °C (-4 to +212°F)
Pressure Limit	<p>1 bar (100 kPa, 14.5 psi)</p> <p> WARNING</p> <p>When the pressure inside the tank exceeds 1 bar (100KPa, 14.5psi), stilling well which does not have any holes or slits must be installed.</p>
Data Transmission	2.5mm coaxial cable & common ground
Mechanical Construction	
Weight	<p>Approx. 8kg</p> <p>Condition: 6 elements Temp. probe: 11.5m Flange: NPS 2" Cl.150 RF, 304 flange ASME B16.5</p>
Material	<p>Elements: Class A Pt100, IEC 60751/DIN EN 60751/ JIS C1604</p> <p>Housing: Aluminum die-casting</p> <p>Temp. probe: SUS316, SUS316L flexible tube (refer to "Dimension")</p>
Process Connection	<p>NPS 2" Cl.150 RF, 304 flange ASME B16.5</p> <p>DN50 PN10 B1, 304 flange EN1092-1 (DIN2527 C)</p>
Certificates and Approvals	
CE Mark	The measuring system meets the legal requirements of the EC-guidelines. Endress+Hauser confirms the instrument passing the required tests by attaching the CE-mark.
External Standards and Guidelines	<p>EN 60529 Protection class of housing (IP-code)</p> <p>EN 61326 Emissions (equipment class B), compatibility (appendix A – industrial area)</p>
Ex Approval	<p>ATEX: II 1/2 G Ex ia IIB T4-T6 Ga/Gb</p> <p>IEC: Ex ia IIB T4- T6 Ga/Gb</p> <p>FM: IS Class I, Div. 1, Gp. C, D, T6, T4, Class I, Zone 0, AEx ia IIB, T6, T4</p> <p>CSA: Ex ia Class I, Div.1, Gp. C, D, T6, T5, T4, Ex ia IIB, T6, T5, T4</p> <p>NEPSI: Ex ia IIB T4- T6 Ga/Gb</p>

www.addresses.endress.com
