



Level



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Technical Information

Thermocouple T53, T54 and T55

Explosion proof Thermocouple assemblies in Thermowells with spring loaded insert and enclosure for process industry



Areas of application

The T53, T54 and T55 temperature sensors are Thermocouple assemblies installed in Thermowells and designed for use in harsh environments and explosive areas, due to their FM and CSA approvals.

The sensor is made up of a Magnesium Oxide insulated thermocouple as a measurement probe and a thermowell made of bar-stock material.

The sensor assemblies can be used in process industries such as:

- Chemicals
- Petrochemicals
- Refineries
- Offshore Platforms

Head transmitters

Instead of directly wiring your temperature sensors to your control system, use transmitters to reduce wiring and maintenance costs while increasing measurement accuracy.

Field transmitters

Temperature field transmitters with HART® or FOUNDATION Fieldbus™ protocol for highest reliability in harsh industrial environments. Blue backlit display with large measured value, bargraph and fault condition indication for ease of reading.

Your benefits

- FM/CSA XP Class I, Div. 1 approved temperature assemblies for maximum safety
- One source shopping for temperature measurement solutions. World class transmitter with integrated sensor offering for heavy process industry applications
- Remove and install straight out of the box!
- Improved galvanic isolation on most devices (2 kV)
- Simplified model structure: Competitively priced, offers great value. Easy to order and reorder. A single model number includes sensor, thermowell and transmitter assembly for a complete point solution
- All iTEMP® transmitters provide long term stability ≤ 0.05% per year



Function and system design

Measuring principle

The thermocouple sensing element consists of two metal wires that are homogeneous but different from each other and insulated along their entire length. The two wires are welded together at one end, known as the "hot junction". The other end, where the wires are free, is known as the "cold junction" and is connected to an electromotive force measurement circuit where the force is generated by the different thermoelectric power of each of the thermocouple wires if there is a temperature difference between the hot junction and the cold junction (Seebeck effect). The function that links the electromotive force to the temperature differences is a curve whose characteristics depend on the materials used in the construction of the thermocouple. The thermocouples comply with the temperature-electromotive force (EMF) tables of ASTM E-230 and IEC60584 standards.

Equipment architecture

MgO thermocouple assemblies consists of a thermocouple element swaged in hard-packed standard purity (96%) Magnesium Oxide mineral insulation and encased in a metal sheath. Thermocouple sheaths have been fully annealed; the hot junction of the thermocouple types according to ASTM E-230 specification are welded to form a pure joint to ensure highest accuracy and long term stability. The thermocouple assemblies with ¼" sheaths and 0.26" ID drilled bar stock thermowells are an installation ready solution providing reliable temperature measurement for all applications in the process industry. Thermowells are used to provide an isolation between a temperature sensor and the environment, either liquid, gas or slurry. A thermowell allows the temperature sensor to be removed and replaced without compromising either the ambient region or the process.

Measurement range

Upper Temperature limits for various thermocouple types in °F (°C)					
Sheath OD	Type T	Type J	Type E	Type K	Type N
Ø ¼"	700 °F (370 °C)	1330 °F (720 °C)	1510 °F (820 °C)	2100 °F (1150 °C)	
Maximum Element Temperature Range Limits	-454 to 752 °F (-270 to +400 °C)	-346 to 2192 °F (-210 to +1200 °C)	-454 to 1832 °F (-270 to +1000 °C)	-454 to 2500 °F (-270 to +1372 °C)	-454 to 2372 °F (-270 to +1300 °C)



Note!

These values are valid for single and duplex thermocouples. The temperature limits given are intended only as a guide to the user and should not be taken as absolute values or as guarantees of satisfactory life or performance. These types are sometimes used at temperatures above the given limits, but usually at the expense of stability or life or both. In other instances, it may be necessary to reduce the above limits in order to achieve adequate service.



Note!

Thermocouples with 316 SS sheath and assemblies with 316 SS thermowells are rated for a maximum temperature of 1700 °F (927 °C).

Calibration specifications**3 point sensor calibration**

-40 to 0 °C	0 to 100 °C	+40 to 215 °C
-40 to 32 °F	32 to 212 °F	104 to 420 °F
Minimum length requirements for calibrated sensors = 6"		

**Note!**

Use option code 'B' (Block: Test; calibration) for calibration, the three temperature points need to be specified in 5 °C (9 °F) increments.

The manufacturer provides comparison temperature calibrations from -40 to +215 °C (-40 to +420 °F) on the International Temperature Scale (ITS) of 1990. Calibrations are traceable to standards maintained by the National Institute of Standards and Technology (NIST). Calibration services are in conformance with ASTM E220, IEC 17025 and ANSI/NCCL Z540-1-1994. The report of calibration is referenced to the serial number of the assembly.

Three point calibrations are provided, given that the specified temperatures are within the recommended range and the minimum length requirements are met as specified. The minimum length is based on overall length 'x' of the spring loaded insert.

Electronics

Family of temperature transmitters

Measurement assemblies with iTEMP® transmitters are an installation ready solution to improve the functionality of temperature measurement by increasing accuracy and reliability when compared to direct wired sensors. Overall installation costs are lower than with direct wired sensors, since an inexpensive pair of signal (4 to 20 mA) wires can be run over long distances.

PC programmable device TMT181

PC programmable head transmitter offers you extreme flexibility and help control costs with the ability to stock one device and program it for your needs. Regardless of your choice of output, all iTEMP® transmitters can be configured quickly and easily with a PC. To help you with this task, Endress+Hauser offers free software ReadWin® 2000 which can be downloaded from our website. Go to **www.readwin2000.com** to download ReadWin® 2000 today. For details see Technical Information.

HART® TMT182 head transmitter

HART® communication is all about easy, reliable data access and getting better information more inexpensively. iTEMP® transmitters integrate seamlessly into your existing control system and provide painless access to preventative diagnostic information. Configuration with a DXR275 or 375 hand-held or a PC with configuration program (FieldCare, ReadWin® 2000) or configure with AMS or PDM. For details, see Technical Information.

Field transmitter TMT162 - Dual compartment housing

Field transmitter with HART® communication, FOUNDATION Fieldbus™ protocol and blue backlit display. Can be read easily from a distance, in sunlight and at night. Large measurement value, bargraph and fault indication display. Benefits are: dual sensor input, highest reliability in harsh industrial environments, mathematic functions, thermometer drift monitoring, sensor back-up functionality, corrosion detection and sensor transmitter matching by accepting Callendar Van Dusen constants. For details, see Technical Information.

Field transmitter TMT142 - Single compartment housing

Field transmitter with HART® communication. The one channel TMT142 allows for cost effective replacement of smaller transmitters with tiny display and old style analog transmitters. Large and brilliant blue backlit display. Regardless of whether you install the transmitter in a dark location or in direct sunlight, you still get a clear temperature reading. Reliable temperature measurement through advanced diagnostics. For details, see Technical Information.

PROFIBUS® PA TMT184 head transmitter

Universally programmable head transmitter with PROFIBUS®-PA fieldbus communication. Converting various input signals into a digital output signal. High accuracy in the total ambient temperature range. Swift and easy operation, visualization and maintenance using a PC direct from the control panel, e. g. using operating software such as FieldCare, Simatic PDM or AMS. DIP switch for address setting, makes start up and maintenance safe and reliable. For details, see Technical Information.

Performance characteristics

Response time

63% response time per ASTM E839

Thermocouple assembly T55 without thermowell

Construction	Thermocouple insert $\varnothing$ 1/4"
Grounded thermocouples	1.3 s
Ungrounded thermocouples	2.9 s



Note!

Response time for the sensor assembly without transmitter.

Response time examples for thermocouples assemblies with thermowell T53 and T54

Construction	Stepped thermowell	Tapered thermowell	3/4" straight thermowell
Time	15 s	20 s	25 s



Note!

Response times for thermocouples assemblies with thermowell are provided for general design guidance without transmitter.

When the temperature of a process media changes, the output signal of a Thermocouple assembly follows this change after a certain time delay. The physical cause is the time related to heat transfer from the process media through the thermowell and the insert to the sensor element (thermocouple). The manner in which the reading follows the change in temperature of the assembly over time is referred to as the response time. Variables that influence or impact the response time are:

- Wall thickness of thermowell
- Spacing between thermocouple insert and thermowell
- Sensor packaging
- Process parameters such as media, flow velocity, etc.

Maximum measured error

Thermocouples corresponding to ASTM E-230.

	Temperature Range		Standard Tolerance (IEC Class 2)	Special Tolerance (IEC Class 1)
Type	[°C]	[°F]	[°C] (whichever is greater)	[°C] (whichever is greater)
E	0 to 870	32 to 1600	±1.7 or ±0.5%	±1 or ±0.4%
J	0 to 760	32 to 1400	±2.2 or ±0.75%	±1.1 or ±0.4%
K	0 to 1260	32 to 2300	±2.2 or ±0.75%	±1.1 or ±0.4%
T	0 to 370	32 to 700	±1 or ±0.75%	±0.5 or ±0.4%
N	0 to 1260	32 to 2300	±2.2 or ±0.75%	±1.1 or ±0.4%



Note!

For measurement errors in °F, calculate using equation above in °C, then multiply the outcome by 1.8.

Measurement accuracy transmitter

Thermocouple type	TMT181 multifunctional PCP	TMT182 HART®	TMT184 PROFIBUS® PA	TMT162 FF Field transmitter	TMT162 and TMT142 HART® Field transmitter	
					Accuracy	
					Digital	D/A ¹
K, J, T, E	typ. 0.9 °F (0.5 °C) or 0.08% ²	typ. 0.9 °F (0.5 °C) or 0.08% ²	typ. 0.9 °F (0.5 °C)	typ. 0.45 °F (0.25 °C)	0.45 °F (0.25 °C) ³	0.02%
N	typ. 1.8 °F (1.0 °C) or 0.08% ²	typ. 1.8 °F (1.0 °C) or 0.08% ²	typ. 1.8 °F (0.9 °C)	typ. 0.9 °F (0.5 °C)	0.9 °F (0.5 °C) ³	0.02%

- 1) % relates to the set span. Accuracy = Digital + D/A accuracy
- 2) % is related to the adjusted measurement range. The value to be applied is the greater.
- 3) for TMT142 only with the option 'advanced electronics'

Transmitter long-term stability

≤ 0.18 °F / year (≤ 0.1 °C/year) or ≤ 0.05% / year
Data under reference conditions; % relates to the set span. The larger value applies.

Insulation resistance

Insulation resistance for MgO insulated thermocouples with ungrounded hot junction between terminals and probe sheath, test voltage 500 V DC.

- 1,000 MΩ at 77 °F (25 °C)

These values for insulation resistance apply also between each thermocouple wire at single and duplex constructions with ungrounded hot junction.

Galvanic isolation

Galvanic isolation of Endress+Hauser iTEMP® transmitters (input/output)

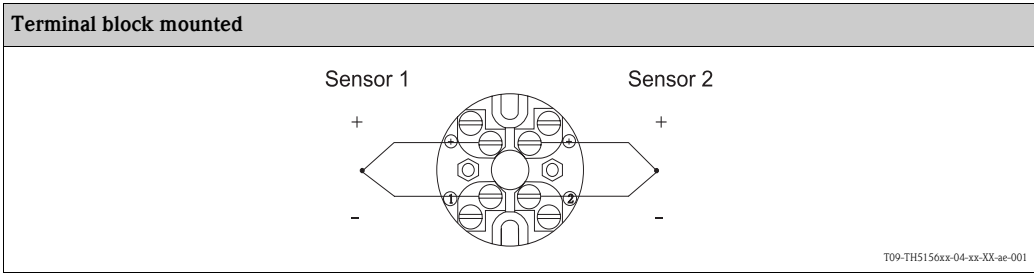
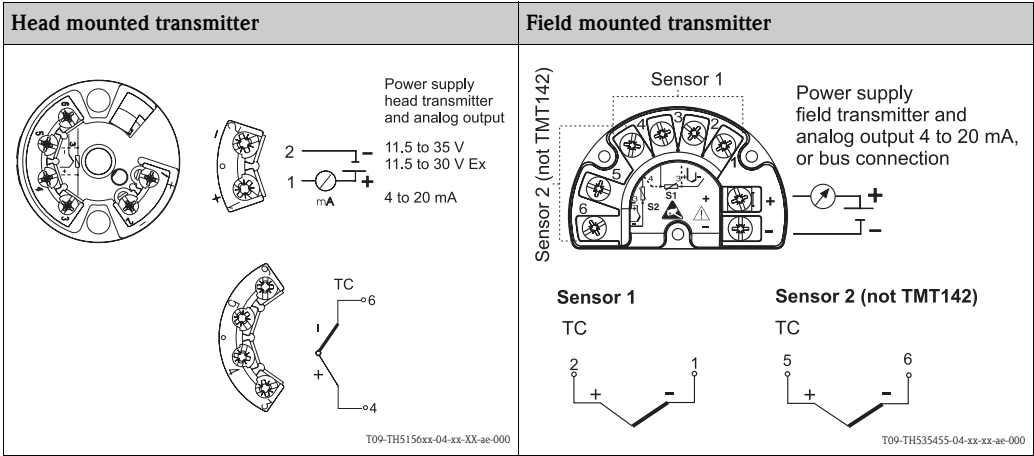
Transmitter type	Galvanic isolation
TMT181 PCP	Û = 3.75 kV AC
TMT182 HART®	U = 2 kV AC
TMT184 PROFIBUS®-PA	
TMT162 HART®, FF Field transmitter	
TMT142 HART® Field transmitter	

In applications where fast response time is needed, grounded thermocouples are recommended. This thermocouple design may cause a ground loop. This can be avoided by using iTEMP transmitters with high galvanic isolation.

Wiring

Wiring diagrams

Type of sensor connection

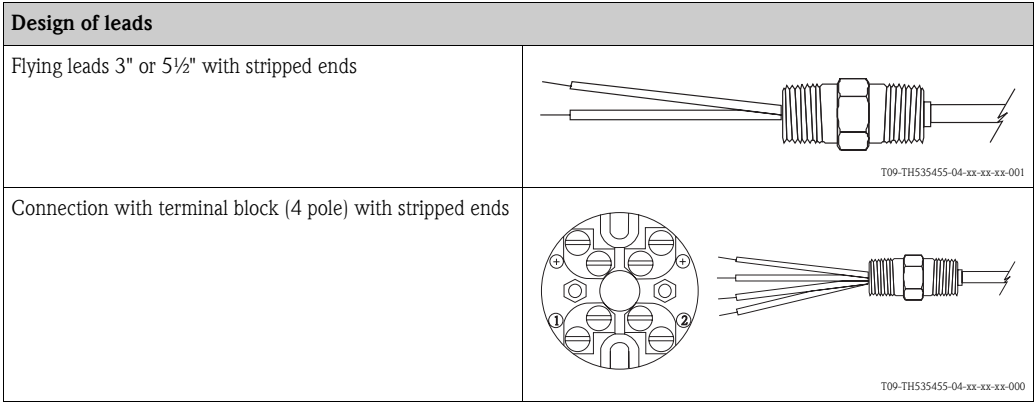


Note!
The blocks and transmitters are shown as they sit inside the heads in reference to the conduit opening.

Wire specifications

Thermocouple grade, TFE insulated 20AWG, 7 strands with stripped ends

Electrical connection
Flying leads, standard 3" for wiring in connection head, head mounted transmitter or terminal block mounted
Flying leads, 5½" for wiring with TMT162 or TMT142 assemblies



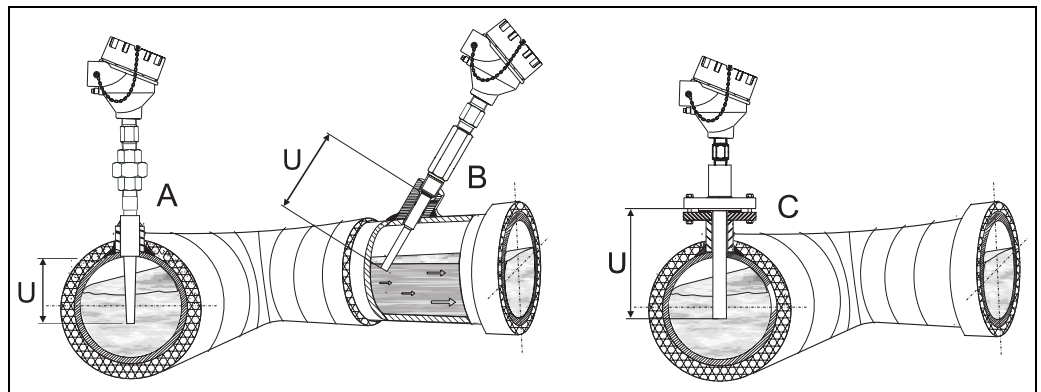
Thermocouple color codes per ASTM E-230

T.C. Type	POS NEG	Material	MAGNETIC		Insulation	
			YES	NO	Single Conductor	Overall T.C. wire
E	EP (+)	Nickel - 10% chromium		X	Purple	Brown
	EN (-)	Copper - 45% nickel (constantan)		X	Red	
J	JP (+)	Iron	X		White	Brown
	JN (-)	Copper - 45% nickel (constantan)		X	Red	
K	KP (+)	Nickel - 10% chromium		X	Yellow	Brown
	KN (-)	Nickel - 5% (aluminum, silicon) ¹	X		Red	
T	TP (+)	Copper		X	Blue	Brown
	TN (-)	Copper - 45% nickel (constantan)		X	Red	
N	NP (+)	Nickel - 14% chromium - 1.5% silicon		X	Orange	Brown
	NN (-)	Nickel - 4.5% silicon - 0.1% magnesium		X	Red	

1) Silicon, or aluminum and silicon, may be present in combination with other elements.

Installation conditions**Orientation**

No restrictions for installation orientation.

Installation instructions

Examples for pipe installation - In pipes with a small cross section the sensor tip should reach or extend slightly past the center line of the pipe (=U).

A: T53 assembly socket weld installation

B: Threaded, tilted installation of T53 assembly

C: Flange installation of T54 assembly

Immersion

Minimum immersion length T55 without thermowell should be 2.5 inches for the ¼" OD thermocouple sheath, nominal.

For temperature assemblies with thermowell (T53 and T54) the minimum immersion is the depth to which the thermowell is immersed in the medium, measured from the tip. To minimize errors from ambient temperature the following minimum immersion lengths are recommended:

Construction	Minimum Immersion (Inch)
Stepped thermowell	2½"
Tapered thermowell	4½"
¾" straight thermowell	4"
Weld in thermowell	4½"

Environmental conditions

Ambient temperature

Housing without head-mounted transmitter

- Aluminum pressure die-cast housing -58 to 212 °F (-50 to 100 °C)
- SS housing -58 to 212 °F (-50 to 100 °C)

Housing with head-mounted transmitter

- -40 to 185 °F (-40 to 85 °C)

Field transmitter

- -40 to 185 °F (-40 to 85 °C) without display
- -40 to 158 °F (-40 to 70 °C) with display



Note!

For detailed information follow the control drawings, which are an integral part of the product documentation.

Shock and vibration resistance 4g / 2 to 150 Hz as per IEC 60 068-2-6

Process conditions

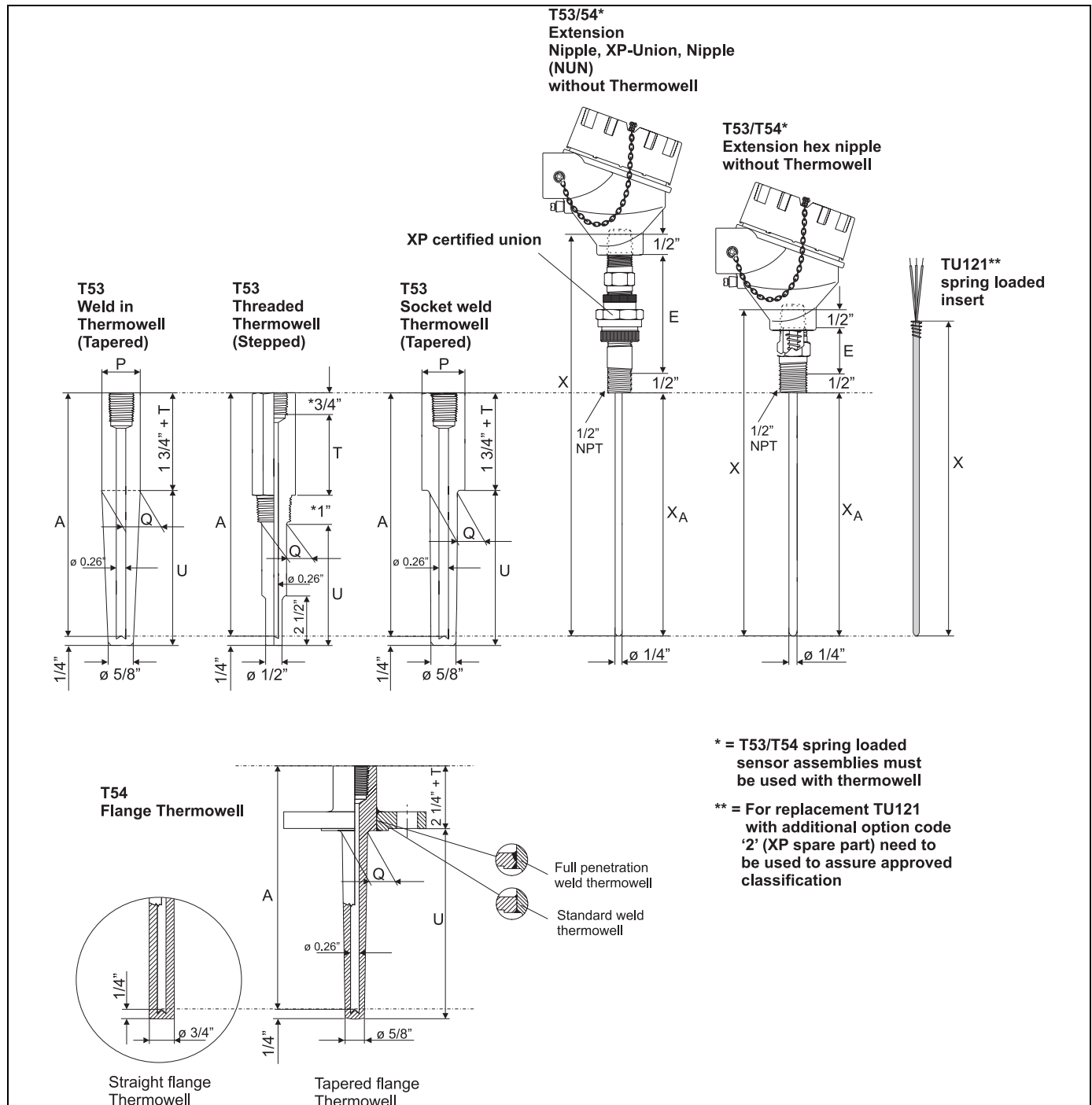
Thermowells are used in measuring the temperature of a moving fluid in a conduit, where the stream exerts an appreciable force. The limiting value for the thermowells is governed by the temperature, the pressure and the speed of the medium, the immersion length, the materials of the thermowells and the medium, etc.

Calculations for stress and vibration of thermowells can be done according to ASME PTC 19.3-1974 standard, please consult Endress+Hauser.

Mechanical construction

Design, dimensions

All dimensions are in inches. For the values related to this graphic please refer to the tables and equations below.



*For T53 thermowells with 1/2" NPT - 1" Process thread length and 3/4" Hex length dimensions are reversed.

Pos. E: Extension length ('nom.' dimension)

Pos. P: Pipe size

Pos. Q: Thermowell diameter

Pos. T: Lag dimension (see product structure)

Pos. U: Thermowell immersion length

Pos. X_A, A: Immersion length thermocouple sensor; Thermowell drilled length

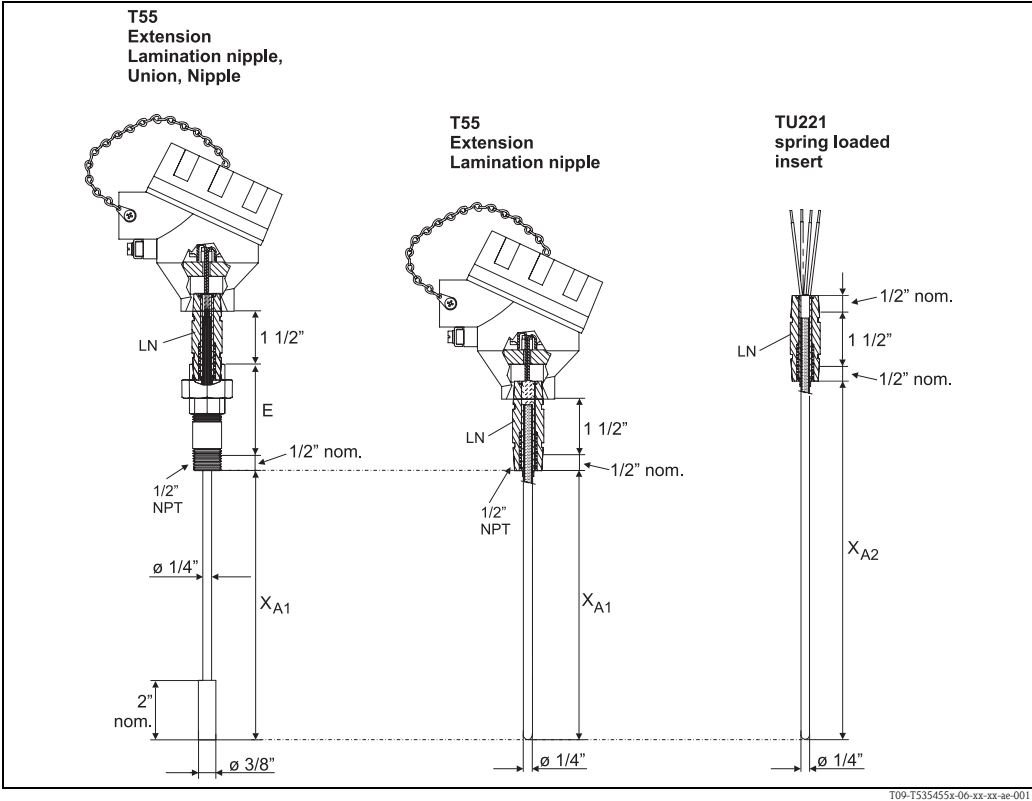
Pos. X: Insert overall length

All thermowells are marked with:

- Material I.D.
- CRN# (Canadian Registration Number)
- Heat No.

Dimensions of T53					
U	E	T	Process connection	Shape of Thermowell	ø Q
2½", 4½", 7½", 10½" specified length 2" to 18" in ½" increments	Hex nipple = 1" or Nipple Union Nipple (NUN) = 4" or 7" Material: Steel or 316SS	3" or specified length 1" to 6" in ½" increments	½" NPT	Stepped (Standard duty) Tapered (Heavy duty)	5/8" 1 11/16"
			¾" NPT	Stepped (Standard duty) Tapered (Heavy duty)	¾" 7/8"
			1" NPT	Stepped (Standard duty) Tapered (Heavy duty)	7/8" 1 1/16"
			¾" Socket weld	Stepped (Standard duty) Tapered (Heavy duty)	¾" ¾"
			1" Socket weld	Stepped (Standard duty) Tapered (Heavy duty)	7/8" 1"
			¾" weld in	Tapered (Heavy duty)	1.050"
			1" weld in	Tapered (Heavy duty)	1.315"
Immersion length thermocouple sensor = Thermowell drilled length $X_A = A = U + 1\frac{1}{2}" + T$ Insert overall length $X = A + E + 1"$					
P = Pipe size Nom. ¾"; Dia. = 1.050" Nom. 1"; Dia. = 1.315"					

Dimensions of T54 Flange rating: ASME B16.5				
U	E	T	Flange size	ø Q, Tapered version
2", 4", 7", 10" specified length 2" to 18" in ½" increments	Hex nipple = 1" or Nipple Union Nipple (NUN) = 4" or 7" Material: Steel or 316SS	specified length 1" to 10" in ½" increments	1"	7/8"
			1½"	1 1/16"
			2"	1 1/16"
Immersion length thermocouple sensor - Thermowell drilled length $X_A = A = U + 2" + T$ Insert overall length $X = A + E + 1"$				



Design and dimensions of T55 (without Thermowell)

Pos. LN: Lamination nipple (flamepath nipple)

Pos. E: Extension length ('nom.' dimension)

Pos. X_{A1} : Insert immersion length

Pos. X_{A2} : Insert immersion length TU221

Dimensions of T55 (without Thermowell)	
Immersion length thermocouple sensor X_{A1}	Extension E
4", 6", 9", 12", 14" specified length 4" to 100" in 1/2" increments	Lamination Nipple Union Nipple (LUN) = 3" or 6"
Immersion length thermocouple sensor X_{A2} for spring loaded insert TU221 as spare part insert for Lamination nipple Union Nipple (LUN) version ¹	Extension E
Calculate X_{A2} as follows: $X_{A2} = X_{A1} + E$	Lamination Nipple Union Nipple (LUN) = 3" or 6"

1) Order code for spring loaded insert TU221 (TU221-__ 5 __ __ __)

Hot or measuring junction**Grounded junction***Grounded junction*

The thermocouple junction is welded securely into the closure end of the sheath, becoming an integral part of the weld. This is a good general purpose, low cost junction providing faster response times than an ungrounded junction of similar sheath diameter. Grounded junctions should not be used with Type T thermocouples, due to the copper wire. For a reliable temperature reading of grounded thermocouples Transmitters with galvanic isolation are strongly recommended. iTEMP transmitters have galvanic isolation of min. 2kV (from the sensor input to the output and the housing).

Ungrounded junction*Ungrounded junction*

The welded thermocouple junction is fully isolated from the welded closed end sheath. This junction provides electrical isolation to reduce problems associated with electrical interference. Ungrounded junctions are also recommended for use in extreme positive or negative temperatures, rapid thermal cycling and for ultimate corrosion resistance of the sheath alloy. iTEMP transmitters have an excellent noise immunity (EMC) meeting all requirements listed under IEC61326 for use in noisy environments.

**Note!**

Dual ungrounded elements supplied with individually isolated junctions, except Ø 1/16" which are supplied with common junctions.

Weight

From 1 to 10 lbs

Material

Sheath materials		
Material	Max. temp. rating	Application notice
316SS	1700 °F (927 °C)	Superior corrosion resistance
Inconel 600 ^{1 2 3}	2100 °F (1149 °C)	Excellent oxidation and corrosion resistance at high temperature. Not to be used in sulphur atmosphere ³ .

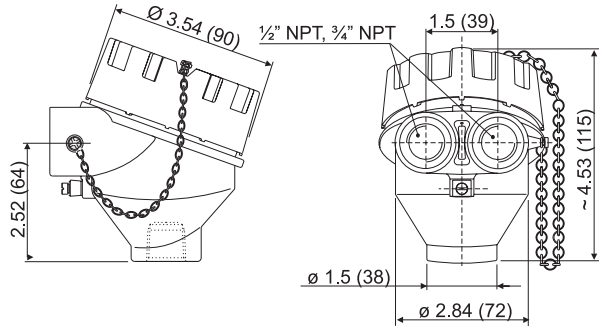
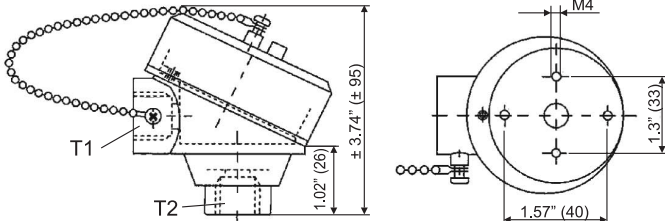
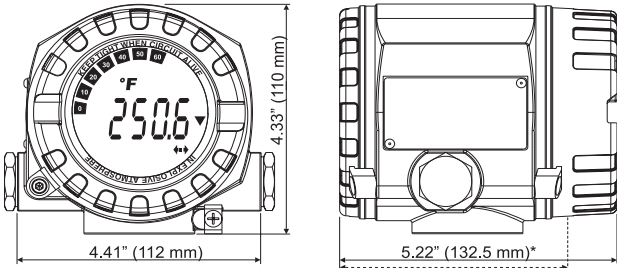
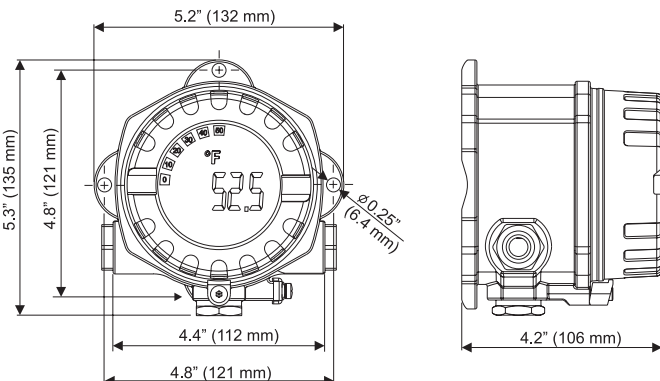
- 1) Type T & J thermocouples are not available with Inconel 600 sheaths.
- 2) Type N thermocouples are not available with 316SS sheaths.
- 3) Inconel 600 maximum working temperature is 2100 °F (1149 °C) under oxidizing conditions: Reducing conditions reduce maximum temperature to 1900 °F (1038 °C). Must not be placed in sulfurous atmospheres over 1000 °F (538 °C).

Thermowell material

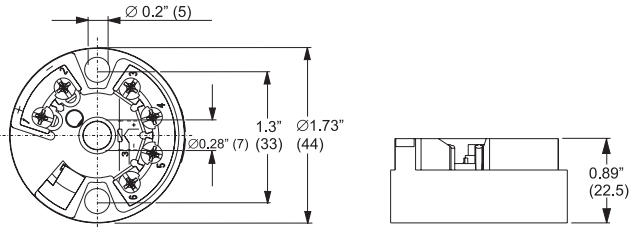
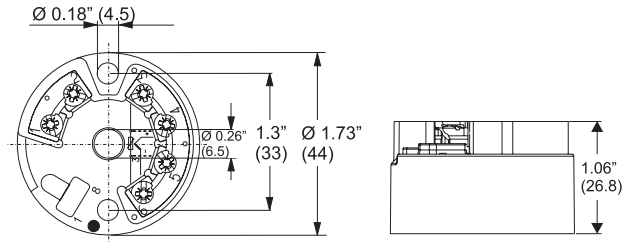
Wetted parts 316SS for usage up to 1700 °F (927 °C). 316SS has good oxidation and corrosion resistance in a wide range of industrial environments with improved resistance to mild acid and pitting corrosion. Exposure to carbide precipitation, reduces corrosion resistance in the 800 to 1000 °F (427 to 538 °C) temperature range. Good mechanical properties for -300 to 1450 °F (-184 to 788 °C) temperature range. Generally regarded as standard protection tube material, other materials are available upon request.

System components

Housing

Type of housing	Specification
Connection head Aluminum  T09-T131415x-06-xx-xx-ae-001	- Material: Die-cast Aluminum head - Sensor connection: 1/2" NPT Female - Cable entry: 1/2" NPT or 3/4" NPT Female. 1/2" NPT has a Al reducer bushing - Body paint: Spray SPU, RAL5012 - Cover paint: Spray SPU, RAL7035 - Coating thread (body-cover), lubricant acc. E+H standard, MgO coating; benefits include ease of opening/closing cover and improved thread engagement. Improves lifetime of the connection head. - Degree of protection NEMA 4X (IP 66)
XP connection head SS/AL (FM/CSA certification only valid for Grp. B-G)  T09-T131415x-06-xx-xx-ae-000	- Material: Aluminum or 316SS - Degree of protection NEMA 4X (IP 67) - Cable entry: 1/2" NPT or 3/4" NPT Female (Pos. T1) - Sensor connection: 1/2" NPT Female (Pos. T2) - Stainless steel connection head only available with nipple union nipple (NUN) 316 SS - The aluminum, grey and 316SS connection heads with cover are not available with Hex nipple
Temperature field transmitter iTEMP® TMT162  T09-TMT162ZZ-06-00-xx-ae-001	- Material: Die-cast aluminum housing AlSi10Mg with powder coating on polyester base - Separate electronics compartment and connection compartment - Display rotatable in 90° increments - Cable entry: 2 x 1/2" NPT - Degree of protection NEMA 4X (IP 67) - Brilliant blue backlit display with ease of visibility in bright sunshine or pitch darkness - Gold plated terminals to avoid corrosion and additional measurement errors Details see Technical Information (see 'Documentation')
Temperature field transmitter iTEMP® HART® TMT142  T09-TMT142ZZ-06-00-06-ae-001	- Material: Die-cast aluminum housing AlSi10Mg with powder coating on polyester base - Display rotatable in 90° increments - Cable entry: 3 x 1/2" NPT - Degree of protection NEMA 4X (IP 67) - Brilliant blue backlit display with ease of visibility in bright sunshine or pitch darkness - Gold plated terminals to avoid corrosion and additional measurement errors Details see Technical Information (see 'Documentation')

Head transmitter

Type of transmitter)	Specification
iTEMP® TMT18x  Top view dimensions: $\varnothing 0.2''$ (5), $\varnothing 0.28''$ (7) (33), 1.3'' (33), $\varnothing 1.73''$ (44). Side view dimension: 0.89'' (22.5). Reference: R09-TMT182ZZ-06-06-xx-ae-001 iTEMP® PA TMT184  Top view dimensions: $\varnothing 0.18''$ (4.5), $\varnothing 0.26''$ (6.5), 1.3'' (33), $\varnothing 1.73''$ (44). Side view dimension: 1.06'' (26.8). Reference: T09-TMT184ZZ-06-06-xx-ae-001	■ Material Housing: PC Potting: PUR ■ Terminals: Cable up to max. 16 AWG (secure screws) or with wire end ferrules ■ Eyelets for easy connection of a HART®-handheld terminal with alligator clips ■ Degree of protection NEMA 4 (see also type of connection head) Details see Technical Information (see 'Documentation')

Certificates and approvals

CE Mark	The iTEMP® Series of temperature transmitters complies with the legal requirements laid out within the EU regulations.
Other standards and guidelines	■ IEC 60529: Degrees of protection by housing (IP-Code) ■ IEC 61010: Safety requirements for electrical measurement, control and laboratory instrumentation ■ IEC 60584 Thermocouples - Reference tables ■ ASTM E-230: Standard Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples ■ ASTM E839: American society for testing and materials, Standard test methods for sheathed thermocouples and sheathed thermocouple material ■ NEMA - ANSI / NEMA 250 Standardization association for the electrical industry ■ ASME PTC 19.3 - 1974 Performance test codes, Temperature Measurement ■ CSA Std. C22.2 (No. 25, No. 30, No. 157, No. 213, No. 1010.1) Requirements for hazardous locations & safety requirements for electrical equipment for measurement, control and laboratory use ■ FM Standards (Class No. 3600, 3610, 3615, 3810) Requirements for hazardous locations & electrical and electronic test, measuring and process control equipment
UL	Temperature transmitters are recognized components to UL 3111-1 (iTEMP® Series) except for TMT184 PROFIBUS®-PA.

CSA / FM

T53/54 with E+H blue head or Field Housing	
FM XP DIP IS NI Class I,II,III Div. 1+2, Grp. A-G	pending, please consult your local representative
CSA XP DIP IS NI Class I,II,III Div. 1+2, Grp. A-G	
FM XP DIP Class I,II,III Div. 1+2, Grp. A-G	
FM XP NI DIP Class I,II,III Div. 1+2, Grp. A-G	pending, please consult your local representative
CSA XP DIP Class I,II,III Div. 1+2, Grp. A-G	
CSA XP NI DIP Class I,II,III Div. 1+2, Grp. A-G	
FM/CSA XP DIP Class I,II,III Div. 1+2, Grp. A-G	
FM/CSA XP NI DIP Class I,II,III Div. 1+2, Grp. A-G	pending, please consult your local representative

T53/54 with Al grey and 316SS connection head	
FM XP DIP IS NI Class I,II,III Div. 1+2, IS Grp. A-D, XP DIP Grp. B-G	pending, please consult your local representative
CSA XP DIP IS NI Class I,II,III Div. 1+2, IS Grp. A-D, XP DIP Grp. B-G	
FM XP DIP Class I,II,III Div. 1+2, Grp. B-G	
FM XP NI DIP Class I,II,III Div. 1+2, Grp. B-G	pending, please consult your local representative
CSA XP DIP Class I,II,III Div. 1+2, Grp. B-G	
CSA XP NI DIP Class I,II,III Div. 1+2, Grp. B-G	
FM/CSA XP DIP Class I,II,III Div. 1+2, Grp. B-G	
FM/CSA XP NI DIP Class I,II,III Div. 1+2, Grp. B-G	pending, please consult your local representative

T55 with E+H blue head or Field Housing	
FM XP DIP IS NI Class I,II,III Div. 1+2, Grp. A-G	pending, please consult your local representative
CSA XP DIP IS NI Class I,II,III Div. 1+2, IS Grp. A-D, XP DIP Grp. B-G	
FM XP DIP Class I,II,III Div. 1+2, Grp. A-G	
FM XP NI DIP Class I,II,III Div. 1+2, Grp. A-G	pending, please consult your local representative
CSA XP DIP Class I,II,III Div. 1+2, Grp. B-G	
CSA XP NI DIP Class I,II,III Div. 1+2, Grp. B-G	
FM/CSA XP DIP Class I,II,III Div. 1+2, FM Grp. A-G, CSA Grp. B-G	
FM/CSA XP NI DIP Class I,II,III Div. 1+2, FM Grp. A-G, CSA Grp. B-G	pending, please consult your local representative

T55 with Al grey and 316SS connection head	
FM XP DIP IS NI Class I,II,III Div. 1+2, IS Grp. A-D, XP DIP Grp. B-G	pending, please consult your local representative
CSA XP DIP IS NI Class I,II,III Div. 1+2, IS Grp. A-D, XP DIP Grp. B-G	
FM XP DIP Class I,II,III Div. 1+2, Grp. B-G	
FM XP NI DIP Class I,II,III Div. 1+2, Grp. B-G	pending, please consult your local representative
CSA XP DIP Class I,II,III Div. 1+2, Grp. B-G	
CSA XP NI DIP Class I,II,III Div. 1+2, Grp. B-G	
FM/CSA XP DIP Class I,II,III Div. 1+2, Grp. B-G	
FM/CSA XP NI DIP Class I,II,III Div. 1+2, Grp. B-G	pending, please consult your local representative

FM/CSA certification for Al grey and 316SS connection head are only valid for Grp. B-G.

Ordering information

Product structure, thermocouple assembly T53

T53-	Thermocouple assembly, T53, U. S. Style				
					Certification:
				B	FM XP DIP IS NI, Class I, II, III Div. 1+2
				C	CSA XP DIP IS NI, Class I, II, III Div. 1+2
				D	FM XP DIP Class I, II, III Div. 1+2
				E	FM XP NI DIP Class I, II, III Div. 1+2
				F	CSA XP DIP Class I, II, III Div. 1+2
				G	CSA XP NI DIP Class I, II, III Div. 1+2
				J	FM/CSA XP DIP Class I, II, III Div. 1+2
				K	FM/CSA XP NI DIP Class I, II, III Div. 1+2
					Shape of TW:
				2	Stepped, Standard Duty
				3	Tapered, Heavy Duty
				9	Special
					Process connection, TW Material:
				A1	½" NPT 316SS
				A2	¾" NPT 316SS
				A3	1" NPT 316SS
				B1	Socket weld ¾" 316SS
				B2	Socket weld 1" inch 316SS
				C1	Weld in ¾" 316SS
				C2	Weld in 1" inch 316SS
				YY	Special
					TW Immersion length U:
				1	2½ inch
				2	4½ inch
				3	7½ inch
				4	10½ inch
				8	 inch (0.5" increments)
				Y	special
					Lag of TW T:
				A	None
				E	3 inch
				X	... inch (0.5" increments)
				Y	Special
					Extension:
				1	Hex nipple steel, E=1"
				2	Hex nipple 316SS, E=1"
				3	Nipple Union Nipple, steel, E=4"
				4	Nipple Union Nipple, 316SS, E=4"
				5	Nipple Union Nipple, steel, E=7"
				6	Nipple Union Nipple, 316SS, E=7"
				9	Special
T53-					← Order code (Part 1)

										Type Sensor; Class:	
										A	1 Type J class 2 (Insert 316SS)
										B	2 Type J class 2 (Insert 316SS)
										C	1 Type J class 1 (Insert 316SS)
										D	2 Type J class 1 (Insert 316SS)
										E	1 Type K class 2 (Insert Inconel 600)
										F	2 Type K class 2 (Insert Inconel 600)
										G	1 Type K class 1 (Insert Inconel 600)
										H	2 Type K class 1 (Insert Inconel 600)
										J	1 Type E class 2 (Insert Inconel 600)
										K	2 Type E class 2 (Insert Inconel 600)
										L	1 Type E class 1 (Insert Inconel 600)
										M	2 Type E class 1 (Insert Inconel 600)
										N	1 Type N class 2 (Insert Inconel 600)
										O	2 Type N class 2 (Insert Inconel 600)
										P	1 Type N class 1 (Insert Inconel 600)
										Q	2 Type N class 1 (Insert Inconel 600)
										R	1 Type T class 2 (Insert 316SS)
										S	2 Type T class 2 (Insert 316SS)
										T	1 Type T class 1 (Insert 316SS)
										U	2 Type T class 1 (Insert 316SS)
										Y	Special
										Enclosure:	
										A	E+H blue Al + cover, 1/2" NPT, Group A-G
										B	E+H blue Al + cover, 3/4" NPT, Group A-G
										C	Al, grey + cover, 1/2" NPT, Group B-G
										D	Al, grey + cover, 3/4" NPT, Group B-G
										E	316SS + cover, 1/2" NPT, Group B-G
										F	316SS + cover, 3/4" NPT, Group B-G
										G	AL Field Housing, 1/2" NPT, Group A-G
										H	AL Field Housing, Display, 1/2" NPT, Group A-G
										I	316L Field Housing, 1/2" NPT, Group A-G
										J	316L Field Housing, Display, 1/2" NPT, Group A-G
										Y	Special
										Electrical connection:	
										B	Programmable TMT181
										C	HART TMT182
										D	HART TMT182 Advanced Electronic
										E	Profibus PA TMT184
										F	HART TMT162, 1 Input, Dual Compartment
										G	HART TMT162, 2 Input, Dual Compartment
										H	FF TMT162, 2 Input, Dual Compartment
										I	HART TMT142, 1 Input, Single Compartment
										Y	Special
										2	Flying Leads
										3	Terminal block
										Model:	
										K	Standard model, North American region
										Y	special version
										Test; Calibration:	
										A	None
										B	Sensor calibration certificate
										C	Material traceability certificate
										Y	Special version
T53-										← Order code (complete)	

**Product structure,
thermocouple assembly in
flanged thermowell T54**

T54-	Thermocouple assembly, T54, U. S. style									
Certification:										
	B	FM XP DIP IS NI, Class I, II, III Div. 1+2								
	C	CSA XP DIP IS NI, Class I, II, III Div. 1+2								
	D	FM XP DIP Class I, II, III Div. 1+2								
	E	FM XP NI DIP Class I, II, III Div. 1+2								
	F	CSA XP DIP Class I, II, III Div. 1+2								
	G	CSA XP NI DIP Class I, II, III Div. 1+2								
	J	FM/CSA XP DIP Class I, II, III Div. 1+2								
	K	FM/CSA XP NI DIP Class I, II, III Div. 1+2								
Shape of TW; Welding:										
	1	Straight; standard weld								
	2	Tapered; standard weld								
	3	Straight; full penetration weld								
	4	Tapered; full penetration weld								
	9	Special								
Flange size; TW Material:										
	A	1 inch 316SS								
	B	1½ inch 316SS								
	C	2 inch 316SS								
	Y	Special								
Rating; Type:										
	1	150 psi; RF								
	2	300 psi; RF								
	3	600 psi; RF								
	9	Special								
TW Immersion length U										
	1	2 inch								
	2	4 inch								
	3	7 inch								
	4	10 inch								
	8	 inch (0.5" increments)								
	9	Special version								
Lag of TW, T:										
	A	None								
	X	 inch (0.5" increments)								
	Y	Special								
Extension:										
	1	Hex nipple steel, E=1"								
	2	Hex nipple 316SS, E=1"								
	3	Nipple Union Nipple, steel, E=4"								
	4	Nipple Union Nipple, 316SS, E=4"								
	5	Nipple Union Nipple, steel, E=7"								
	6	Nipple Union Nipple, 316SS, E=7"								
	9	Special								
T54-										← Order code (Part 1)

										Type Sensor; Class:	
										A	1 Type J class 2 (Insert 316SS)
										B	2 Type J class 2 (Insert 316SS)
										C	1 Type J class 1 (Insert 316SS)
										D	2 Type J class 1 (Insert 316SS)
										E	1 Type K class 2 (Insert Inconel 600)
										F	2 Type K class 2 (Insert Inconel 600)
										G	1 Type K class 1 (Insert Inconel 600)
										H	2 Type K class 1 (Insert Inconel 600)
										J	1 Type E class 2 (Insert Inconel 600)
										K	2 Type E class 2 (Insert Inconel 600)
										L	1 Type E class 1 (Insert Inconel 600)
										M	2 Type E class 1 (Insert Inconel 600)
										N	1 Type N class 2 (Insert Inconel 600)
										O	2 Type N class 2 (Insert Inconel 600)
										P	1 Type N class 1 (Insert Inconel 600)
										Q	2 Type N class 1 (Insert Inconel 600)
										R	1 Type T class 2 (Insert 316SS)
										S	2 Type T class 2 (Insert 316SS)
										T	1 Type T class 1 (Insert 316SS)
										U	2 Type T class 1 (Insert 316SS)
										Y	Special
										Enclosure:	
										A	E+H blue Al + cover, 1/2" NPT, Group A-G
										B	E+H blue Al + cover, 3/4" NPT, Group A-G
										C	Al, grey + cover, 1/2" NPT, Group B-G
										D	Al, grey + cover, 3/4" NPT, Group B-G
										E	316SS + cover, 1/2" NPT, Group B-G
										F	316SS + cover, 3/4" NPT, Group B-G
										G	AL Field Housing, 1/2" NPT, Group A-G
										H	AL Field Housing, Display, 1/2" NPT, Group A-G
										I	316L Field Housing, 1/2" NPT, Group A-G
										J	316L Field Housing, Display, 1/2" NPT, Group A-G
										Y	Special
										Electrical connection:	
										B	Programmable TMT181
										C	HART TMT182
										D	HART TMT182 Advanced Electronic
										E	Profibus PA TMT184
										F	HART TMT162, 1 Input, Dual Compartment
										G	HART TMT162, 2 Input, Dual Compartment
										H	FF TMT162, 2 Input, Dual Compartment
										I	HART TMT142, 1 Input, Single Compartment
										Y	Special
										2	Flying Leads
										3	Terminal block
										Model:	
										K	Standard model, North American region
										Y	special version
										Test; Calibration:	
										A	None
										B	Sensor calibration certificate
										C	Material traceability certificate
										Y	Special version
T54-										← Order code (complete)	

**Product structure,
thermocouple assembly T55**

T55-	Thermocouple assembly, T55			
	Certification:			
	B	FM XP DIP IS NI, Class I, II, III Div. 1+2, Grp. A-G		
	C	CSA XP DIP IS NI, Class I, II, III Div. 1+2, IS Grp. A-D, XP DIP Grp. B-G		
	D	FM XP DIP Class I, II, III Div. 1+2, Grp. A-G		
	E	FM XP NI DIP Class I, II, III Div. 1+2, Grp. A-G		
	F	CSA XP DIP Class I, II, III Div. 1+2, Grp. B-G		
	G	CSA XP NI DIP Class I, II, III Div. 1+2, Grp. B-G		
	J	FM/CSA XP DIP Class I, II, III Div. 1+2, FM Grp. A-G, CSA Grp. B-G		
	K	FM/CSA XP NI DIP Class I, II, III Div. 1+2, FM Grp. A-G, CSA Grp. B-G		
	Immersion length X_A			
	1	4 inch		
	2	6 inch		
	3	9 inch		
	4	12 inch		
	8	 inch (0.5" increments)		
	9	Special version		
	Sheath diameter:			
	A	¼ inch 316SS		
	B	¼ inch Inconel 600		
	C	3/8 inch 316SS		
	D	3/8 inch Inconel 600		
	Y	Special		
	Extension:			
	5	Lamination Nipple 316SS		
	6	Lam. Nipple Union Nipple, 316SS, E=3"		
	7	Lam. Nipple Union Nipple, 316SS, E=6"		
	9	Special		
	Type Sensor; Class:			
	A	1 Type J class 2 (Insert 316SS)		
	B	2 Type J class 2 (Insert 316SS)		
	C	1 Type J class 1 (Insert 316SS)		
	D	2 Type J class 1 (Insert 316SS)		
	E	1 Type K class 2 (Insert Inconel 600)		
	F	2 Type K class 2 (Insert Inconel 600)		
	G	1 Type K class 1 (Insert Inconel 600)		
	H	2 Type K class 1 (Insert Inconel 600)		
	J	1 Type E class 2 (Insert Inconel 600)		
	K	2 Type E class 2 (Insert Inconel 600)		
	L	1 Type E class 1 (Insert Inconel 600)		
	M	2 Type E class 1 (Insert Inconel 600)		
	N	1 Type N class 2 (Insert Inconel 600)		
	O	2 Type N class 2 (Insert Inconel 600)		
	P	1 Type N class 1 (Insert Inconel 600)		
	Q	2 Type N class 1 (Insert Inconel 600)		
	R	1 Type T class 2 (Insert 316SS)		
	S	2 Type T class 2 (Insert 316SS)		
	T	1 Type T class 1 (Insert 316SS)		
	U	2 Type T class 1 (Insert 316SS)		
	Y	Special		
T55-				← Order code (part 1)

										Enclosure:	
										A	E+H blue Al + cover, 1/2" NPT
										B	E+H blue Al + cover, 3/4" NPT
										C	Al, grey + cover, 1/2" NPT
										D	Al, grey + cover, 3/4" NPT
										E	SS316 + cover, 1/2" NPT
										F	SS316 + cover, 3/4" NPT
										G	AL Field Housing, 1/2" NPT
										H	AL Field Housing, Display, 1/2" NPT
										I	316L Field Housing, 1/2" NPT
										J	316L Field Housing, Display, 1/2" NPT
										Y	Special
										Electrical connection:	
										B	Programmable TMT181
										C	HART TMT182
										D	HART TMT182 Advanced Electronic
										E	Profibus PA TMT184
										F	HART TMT162, 1 Input, Dual Compartment
										G	HART TMT162, 2 Input, Dual Compartment
										H	FF TMT162, 2 Input, Dual Compartment
										I	HART TMT142, 1 Input, Single Compartment
										Y	Special
										2	Flying Leads
										3	Terminal block
										Model:	
										K	Standard model, North American region
										Y	Special
										Test; Calibration:	
										A	None
										B	Sensor calibration certificate
										Y	Special
T55-										← Order code (complete)	

Documentation

- Compact instructions T53 Explosion proof TC assembly in thermowell (KA243r/24/ae)
- Compact instructions T54 TC Explosion proof assembly in flanged thermowell (KA244r/24/ae)
- Compact instructions T55 TC Explosion proof assembly – spring loaded (KA245r/24/ae)
- Technical information Temperature field transmitter iTEMP® TMT162 (TI086r/24/ae)
- Technical information Temperature field transmitter iTEMP® HART® TMT142 (TI107r/24/ae)
- Technical information Temperature head transmitter iTEMP® PCP TMT181 (TI070r/24/ae)
- Technical information Temperature head transmitter iTEMP® HART® TMT182 (TI078r/24/ae)
- Technical information Temperature head transmitter iTEMP® PA® TMT184 (TI079r/24/ae)

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