Temperature measurement
Thermometers and transmitters for the process industry

Temperature measurement

Endress+Hauser **EH**

People for Process Automation

Endress+Hauser — Your partner

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Endress+Hauser is a global leader in measurement instrumentation, services and solutions for industrial process engineering

With dedicated sales centers and a strong network of partners, Endress+Hauser guarantees competent worldwide support. Our production centers in twelve countries meet your needs and requirements quickly and effectively. The Group is managed and coordinated by a holding company in Reinach, Switzerland. As a successful family-owned business, Endress+Hauser is set to remain independent and self-reliant.

Endress+Hauser provides sensors, instruments, systems and services for level, flow, pressure and temperature measurement as well as analytics and data acquisition. The company supports you with automation engineering, logistics and IT services and solutions. Our products set standards in quality and technology.

We work closely with the Chemical, Petrochemical, Food & Beverage, Oil & Gas, Water & Wastewater, Power & Energy, Life Science, Mining, Minerals and Metals, Renewable Energy, Pulp & Paper and Shipbuilding industries. Endress+Hauser helps customers to optimize their processes in terms of reliability, safety, economic efficiency and environmental impact.

To learn more about Endress+Hauser, visit: www.endress.com

Information on the ISO certification: Cybersecurity certification for Endress+Hauser

Temperature measurement by Endress+Hauser — Because we understand

Its expansive, globally available portfolio of standard thermometers, temperature transmitters and engineered solutions makes Endress+Hauser one of the leading international complete providers of temperature measuring technology for process automation. The large vertical range of production and the high degree of in-house development, ranging from primary sensors and electronics to customized special solutions, make a crucial difference here. As a reliable and close partner for our customers, we utilize our wealth of product and solution expertise to develop innovative products that produce excellent customer benefits. These products include the world's first self-calibrating thermometer iTHERM TrustSens and unique inserts such as the iTHERM QuickSens and iTHERM StrongSens, excellent temperature transmitters like the iTEMP TMT162 — with SIL 2 or SIL 3 and even multipoint solutions for 2D/3D measurements in digesters. As your expert partner in all issues related to temperature measuring technology, we make a crucial contribution to making your processes more reliable and efficient and increasing the quality of the end products.

Competence center for temperature measurement, Temperature Engineered Solutions and system products

Endress+Hauser Temperature+System Products is one of the leading producers of temperature measurement, Temperature Engineered Solutions and system products worldwide.

The company employs more than 700 associates worldwide. 400 of which are working in our headquarters Nesselwang (Germany), where our products are developed and produced.

Associated Product Centers in Pessano (Italy), Greenwood (USA), Suzhou (China) and Chhatrapati Sambhajinagar (India) guarantee customer proximity with products and services.
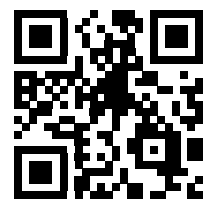
Oil & Gas

Fuel for thought

We reduce complexities to help you perform, comply and thrive in the Oil & Gas sector

Maximizing plant availability, safety and the efficiency of operations are the key challenges for today's Oil & Gas industry. Complexity increases in the face of volatile market forces, strict international regulations and your ever-tightening resources. Close, accurate monitoring of key process parameters is critical. Our broad, reliable portfolio of instrumentation, deep industry experience, and our services and solutions make Endress+Hauser the ideal partner for optimal plant performance.

Oil & Gas

Product highlights

iTHERM ProfileSens
- World's most robust insert for multipoint measurements
- Robust design for harsh process environments

More information: Page 20

iTHERM ModuLine
- Streamlined and innovative portfolio of modular thermometers
- With international approvals for hazardous areas, in compliance with international pressure regulations

More information: Page 32

iTEMP TMT142B
- Smart 4-20 mA and HART transmitter
- With Bluetooth and integrated overvol-tage protection

More information: Page 24

iTHERM MultiSens Slim TMS21
- Linear or flexible assembly without containment chamber
- Accurate temperature profiling, very low invasiveness, high density of measurement points

More information: Page 40

iTHERM SurfaceLine TM611
- Non invasive temperature measurement
- No risk of leakages
- Simple installation and maintenance

More information: Page 38

Temperature Engineered Solutions
- Fully customized surface thermometers
- High-precision multipoint thermometers

More information: Page 41

Advantages at a glance

- Mitigating risks by using state of the art technology – meeting highest demands with regard to Functional Safety (IEC 61508) and mechanical integrity (e.g. ASME BPV Codes, EN 13445, PED)
- Minimizing operational costs through efficient proof testing concepts, predictive maintenance and innovative data management
- Meeting internationally recognized standards and recommendations such as: API, OIML, ASME, NOR-SOK, NACE etc.
- Increasing plant availability with innovative technologies e.g. Dual Seal technology, iTHERM StrongSens sensor, iTHERM ProfileSens sensor
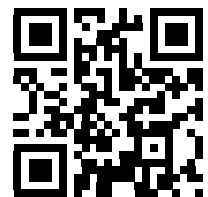
Chemicals

Competitive and safe

We help you boost your plant's safety and performance

Chemicals

Maximizing productivity and profitability whilst meeting toughening safety and sustainability standards is the greatest challenge facing the chemical industry today. Technological innovation brings opportunity, but reliability is vital. Plant modernization is expedient, yet project delivery complex. Our innovatory instrumentation with safety built-in, allied to expert safety and project consulting, enables Endress+Hauser to deliver solutions to safely and reliably attain peak plant performance.

Find a visual overview of the most relevant processes in the chemical industry and the suitable instruments in our portfolio brochure: SO01101

Product highlights

iTHERM ModuLine
- Suitable solutions from basic applications up to safety critical processes
- Including unique innovations like Dual Seal, iTHERM StrongSens, NAMUR thermowell and iTHERM TwistWell

More information:

iTHERM MultiSens Slim TMS21
- Right choice for chemical processes that require accurate temperature profiling
- Very low invasiveness, high density of measurement points and intrinsically safe versions

More information:

iTHERM TrustSens TM371/TM372
- Intrinsically safe device with functions like self-calibration and self-diagnostics
- Heartbeat technology and Netilion allow continuous diagnostics, verification and data access from anywhere

More information:

iTEMP TMT86
- Dual-channel Ethernet-APL head transmitter
- With FDI package for device integration, plug-on display support and integrated web server

More information:

iTHERM SurfaceLine TM611
- Non invasive temperature measurement
- No risk of leakages
- Simple installation and maintenance

More information:

iTEMP temperature transmitter
- Broad portfolio with head, field or DIN-rail and various field housing options.
- Explosion protection, SIL, 1 or 2-channel, HART, PROFIBUS PA, PROFINET over Ethernet-APL, FOUNDATION Fieldbus, Bluetooth® technology

More information:

Advantages at a glance

- Meeting internationally recognized standards/recommendations: NAMUR, ASME, NACE, IEC 17025, MID, OIML
- Internationally accepted hazardous area approvals: ATEX, IECEx, FM/CSA, NEPSI, TIIS, INMETRO, KOSHA, EAC etc.
- Use of state of the art technology – functional safety according to IEC 61508 (up to SIL 3)
- Uniform operating safety by design concepts for simple and safe operations
- Optimized material availability and minimized stocks through inventory management solutions
- Time savings for downtimes due to advanced diagnostic functions
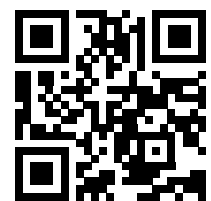
Mining, Minerals & Metals

Extracting more from less

In a world of lower ore grades, skill gaps and excavation challenges we can help you hit your target

Never more so than today has the Mining, Minerals & Metals industry had to manage such tension between soaring demand, increased scarcity, lower ore grades, fluctuating prices, and toughening safety and sustainability criteria. Combining our innovative product portfolio with our deep application and industry knowledge enables Endress+Hauser customers to optimize processes, boost productivity and ensure safety and environmental compliance.

Mining, Minerals
& Metals

Product highlights

iTHERM FlameLine
- Modular high-temperature thermo-meters made from exclusive materials
- Applicable for ceramic baking ovens, brickworks, steel treatment, cement production etc.

More information: Page 36

iTHERM ModuLine TM131
- Intrinsically safe temperature sensor (RTD or TC)
- Configurable for a wide range of applications

More information: Page 33

iTHERM CableLine TST310/TSC310
- Cost efficient temperature cable probe for direct installation
- Designed for use in many process and laboratory applications

More information: Page 30

iTEMP TMT86
- Dual-channel Ethernet-APL head transmitter
- With FDI package for device integration, plug-on display support and integrated web server

More information: Page 24

iTHERM SurfaceLine TM611
- Non invasive temperature measurement
- No risk of leakages
- Simple installation and maintenance

More information: Page 38

iTEMP temperature transmitter
- Broad portfolio with head, field or DIN-rail and various field housing options.
- Explosion protection, SIL, 1 or 2-channel, HART, PROFIBUS PA, PROFI-NET over Ethernet-APL, FOUNDATION Fieldbus, Bluetooth® technology

More information: Page 24

Advantages at a glance

- Complete product basket for all applications, specifically in harsh environments
- Advanced diagnostic functionalities to make the process more safe and reliable
- Savings in raw material, water, energy and labor through accurate data of critical and quality relevant points in your process
- High-temperature sensors with extended lifetime can help reduce costs significantly
- Vibration resistant, fast response time sensors and special materials result in increased process efficiency and product quality

Food & Beverages

Trust in quality

We help you to improve quality while reducing operational costs

Constant demand for consistency in product quality and taste makes Food & Beverage a demanding industry. Complexity increases as ever more stringent hygiene regulations for food safety add cost pressures. Endress+Hauser's industry leading portfolio of reliable instrumentation, expert global consulting and accredited calibration services all combine to enable greater plant availability, resource conservation and high repeatability in processing with traceable compliance.

Food & Beverages

➡ Find a visual overview of the most relevant processes in Food & Beverage production and the suitable instruments in our portfolio brochure: SO01090

Product highlights

iTHERM TrustSens TM371/TM372
- World's first self-calibrating thermo-meter
- Optimized elbow thermowells for clean operations

More information: Page 31

iTHERM ModuLine TM131
- From basic applications up to explosion-proof environments
- Including unique innovations like iTHERM QuickNeck and iTHERM QuickSens

More information: Page 33

iTHERM ModuLine TM401/TM402
- Sanitary modular thermometer with basic technology
- Developed specifically for use in hygienic/aseptic applications

More information: Page 35

iTEMP TMT31/TMT36
- 4-20 mA (TMT31) or IO-Link (TMT36) communication
- Simple products for basic processes
- Easy to configure and quick to install

More information: Page 24

iTHERM CompactLine TM311
- Hygienic compact thermometers, with extremely quick response time
- Ideal for short immersion depths in areas with small nominal pipe diameters
- 4-20 mA, IO-link or switch output

More information: Page 31

iTEMP TMT71/TMT72
- 4-20 mA and HART temperature transmitters
- World's first Bluetooth® technology transmitters for operation in Ex environment

More information: Page 24

Advantages at a glance

- The world's first self-calibrating thermometer reduces process risks and costs
- Best-in-class hygienic design
- Innovative thermowells with optimum hygienic properties

Life Sciences

The pulse of Life Sciences

Trust a reliable partner who helps you achieve operational excellence
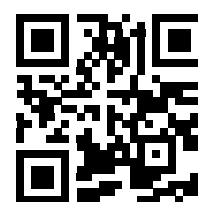
Today's thriving biopharmaceutical industry demands high productivity and efficiency balanced with meticulous alignment to GMP standards. From our innovatory ASME BPE compliant product portfolio enabling standardized production automation, reliable monitoring and predictive maintenance, to our expert consulting in process scale-up and operations optimization, Endress+Hauser offers the full solution. We speed time to market, sustain operational excellence, enhance productivity, and reduce risk.

Life Sciences

→ Find a visual overview of the most relevant processes in Life Sciences and the suitable instruments in our portfolio brochure: SO01099

Product highlights

iTHERM TrustSens TM371/TM372
- World's first self-calibrating thermometer
- Optimized elbow thermowells for clean operations

More information:

iTHERM ModuLine TM411/TM412
- Modular thermometer with or without thermowell
- Including iTHERM QuickNeck/QuickSens
- Developed specifically for use in hygienic/aseptic applications
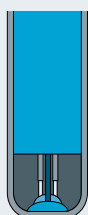
More information:

iTHERM QuickSens
- RTD insert with shortest response times worldwide
- High-precision, fast response times even in combination with thermowells

More information:

iTEMP TMT86
- Dual-channel Ethernet-APL head transmitter
- With FDI package for device integration, plug-on display support and integrated web server

More information:

iTHERM CompactLine TM311
- Compact thermometer with extremely quick response time and 4-20 mA, IO-Link or switch output
- Ideal for short immersion depths in areas with small nominal pipe diameters

More information:

iTEMP TMT31
- 4-20 mA basic head / DIN rail transmitter with RTD input and 4-20 mA output signal
- Easy to configure and and quick to install thanks to push-in terminal

More information:

Advantages at a glance

- The world's first self-calibrating thermometer reduces process risks and costs
- Quick and easy recalibration thanks to iTHERM QuickNeck technology
- Best-in-class hygienic design with full compliance to ASME BPE 2024
- Innovative thermowells with optimum hygienic properties

Water & Wastewater

Water is our life

Increase your efficiency and ensure compliance with an experienced and trusted partner

Today more than ever the Water & Wastewater industry must balance the opposing pressures of improving water safety and shrinking budgets. Whether treating for consumption or discharge, process complexity is rising. Endress+Hauser combines a wide portfolio of smart measuring instruments with industry-experienced consulting and expert services to flexibly and efficiently ensure water safety with verifiable regulatory compliance.
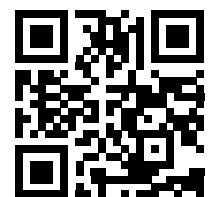
Water & Wastewater

→ Find a visual overview of the most relevant processes in the water/wastewater industry and the suitable instruments in our portfolio brochure: SO01094

Product highlights

iTEMP TMT36
- IO-Link technology to digitize the last mile of your plant
- Suitable for all temperature assemblies

More information: Page 24

iTEMP TMT31
- 4-20 mA basic head transmitter with RTD/TC input and 4-20 mA output signal
- Easy to configure and and quick to install thanks to push-in terminal

More information: Page 24

iTHERM CompactLine TM311
- Compact, accurate and fast RTD sensor
- With 4-20 mA, IO-Link (auto-detect) or switch output

More information: Page 31

iTEMP TMT71/TMT72
- 4-20 mA and HART temperature transmitter
- World's first Bluetooth® technology transmitter for operation in Ex environment

More information: Page 24

iTHERM ModuLine
- Streamlined and innovative portfolio of modular thermometers
- With international approvals for hazardous areas, in compliance with international pressure regulations
- Available as imperial versions (TM152/112)

More information: Page 32

iTHERM CableLine TST310
- High flexibility through user-specific insertion lengths and variable process connections
- Fast response time

More information: Page 30

Advantages at a glance

- Cost-effective product portfolio for any applications, e.g. for drinking water, wastewater
- Meeting internationally recognized standards/recommendations for drinking water applications
- Highest efficiency by easy commissioning, operation and maintenance of instruments
- Worldwide accepted Ex approvals
- Unique technologies like Dual Seal and iTHERM StrongSens

Power & Energy

Power up your plant

Power plants play a vital role, we help maximize uptime while delivering safety and productivity

Today's Power & Energy industry must strike a complex balance: meeting spiraling demand for affordable and reliable energy while increasing cleaner and renewable sources in the energy mix. As cost and regulatory pressures grow, modernization is essential for efficient, safe resource use. As renewables advance, so does the need for energy storage. With best-fit instrumentation, deep power application expertise, services and solutions, Endress+Hauser brings efficient, reliable productivity.
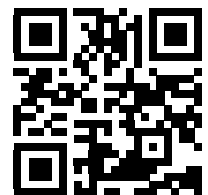
Power & Energy

Product highlights

iTHERM FlameLine
- Modular high-temperature thermo-meters in robust design
- Selection of durable thermowell materials

More information:

iTEMP TMT71/TMT72
- 4-20 mA and HART temperature transmitters
- World's first Bluetooth® technology transmitters for operation in Ex environment

More information:

iTHERM ModuLine
- Assorted RTD/TC thermometers
- Flexible configuration for e.g. straight-forward monitoring tasks or complex, safety-related measuring points
- Available as imperial versions (TM152/112)

More information:

iTEMP TMT82
- Dual channel, SIL compliant, incl. HART
- Field mount housing with separate termi-nal compartment for comfortable wiring

More information:
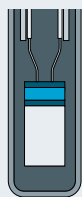
iTHERM StrongSens
- Highly robust and vibration-resistant RTD insert
- Also suitable for applications in hazardous areas

More information:

iTHERM Surface Line TM611
- Non invasive temperature measurement
- No risk of leakages
- Simple installation and maintenance

More information:

Advantages at a glance

- Intelligent instruments with continuous self-monitoring
- Minimized downtime and highest safety through modern instrumentation
- Worldwide accepted Ex approvals and SIL certified transmitters and assemblies (IEC 61508 SIL 2/3)
- Unique technologies like Dual Seal and iTHERM StrongSens
- Optimizing high temperature applications

Thermometer design
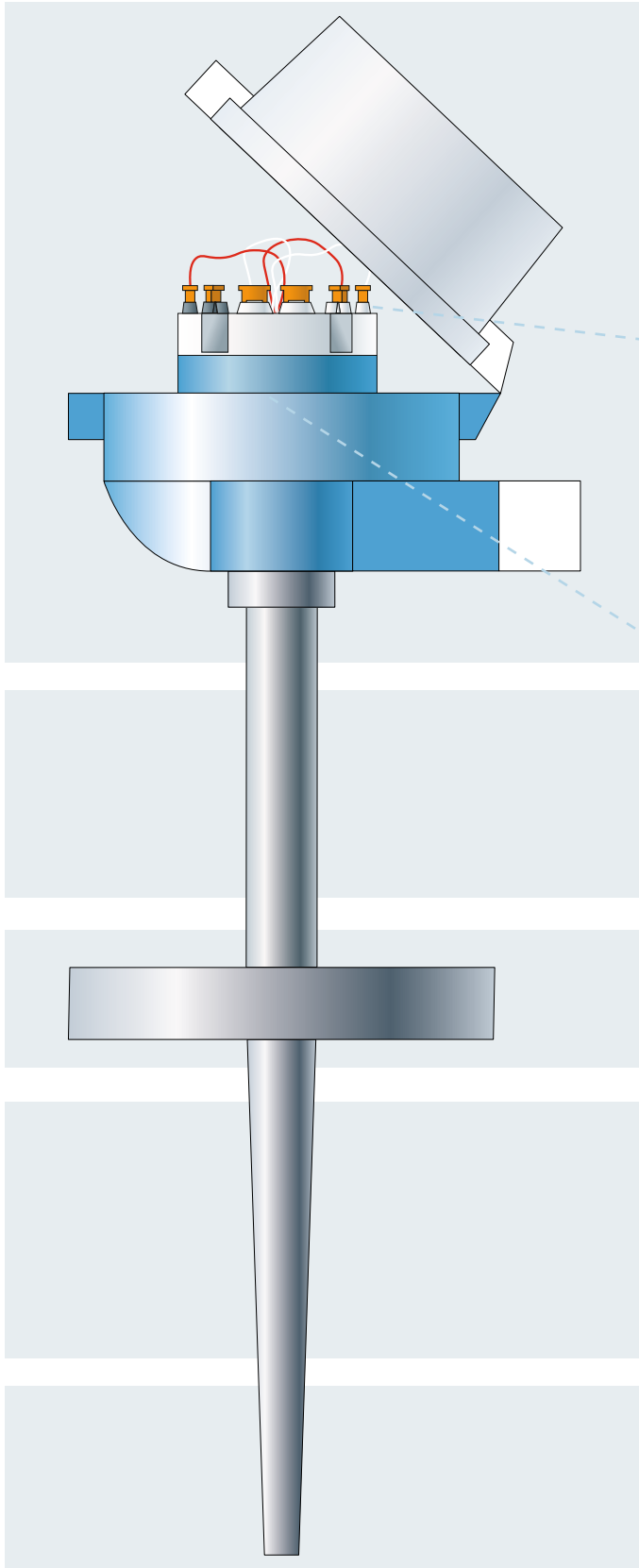
Terminal head

... is fitted to the thermowell or the neck of the thermometer.

Head transmitter

... transfers the sensor signal into a stable and standardized output signal.

Extension neck

... is the connection between terminal head and process connection/thermowell.

Process connection

... is the connection between the process and the thermometer.

Thermowell

... is the process wetted component of the thermometer.

Insert

... is located in the thermowell. The tip of the measurement insert contains the temperature sensor element itself.

Benefits:
- Protection and installation for terminal block or transmitter
- Cable entry and wiring
- Display (as option)

Benefits:
- Enhanced accuracy and stability
- Reduced wiring costs
- Lower maintenance time and expense
- Advanced diagnostics

Learn more on pages 22-25

Benefits:
- Protection of the head transmitter from overheating
- Guarantees access to the terminal head in the case of pipe insulation

Benefits:
- Increases the life cycle of the measurement insert through protection against process influence
- Possible measurement insert exchange under process conditions
- Mechanical stability against pressure and flow
- Ensures long-term stable temperature measurements

Benefits:
Enables electrical connection of the sensor element to the terminal block/transmitter

Learn more on pages 20-21

Visit our Youtube playlist on temperature know-how series to learn more about:

- Measurement inserts (RTD Resistance sensors/TC Thermocouples)
- Golden rules of temperature measurements
- Technical insights on thermometers
  Link to YouTube Playlist

Endress+Hauser offers a complete assortment of thermometers and their components such as thermowells, terminal heads, temperature transmitters, process connections, neck/lagging, measurement inserts and further accessories for all types of process industries.

Using the configurator on **endress.com** helps you create a thermometer suitable for your process, deciding on the version of every single component. Of course it is possible to order these different components separately, e.g. as spare parts.

Find all products on endress.com:
Products for temperature measurement
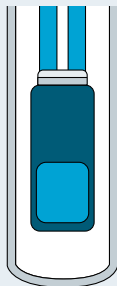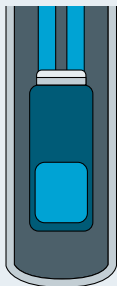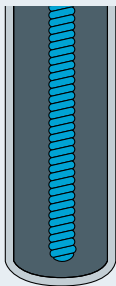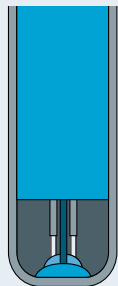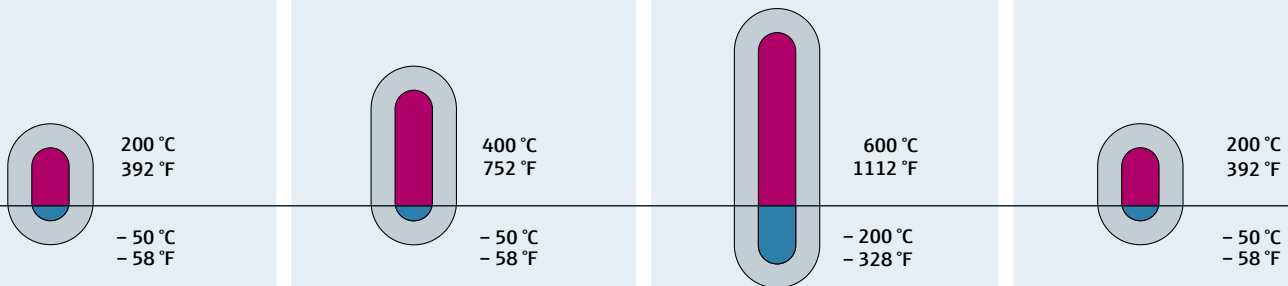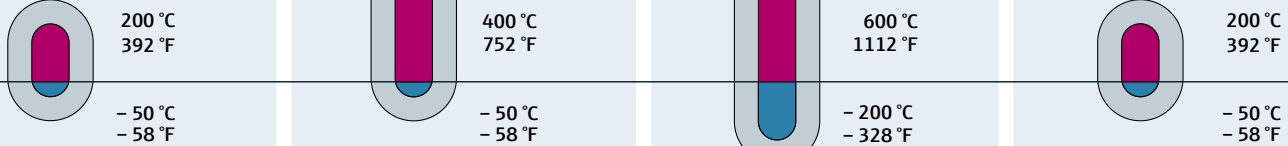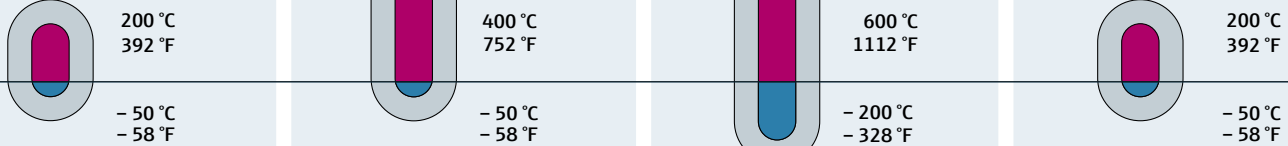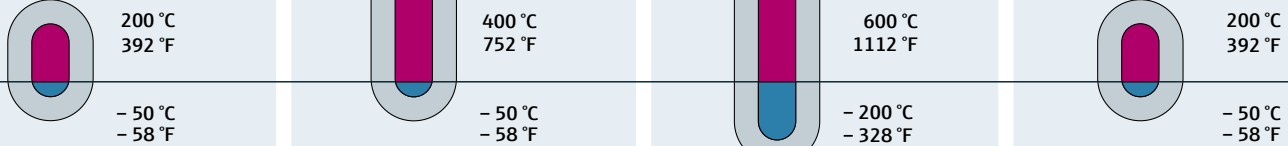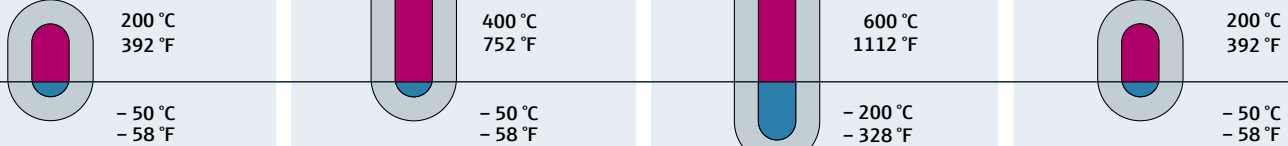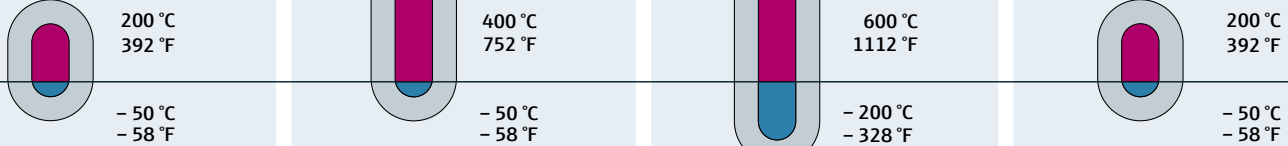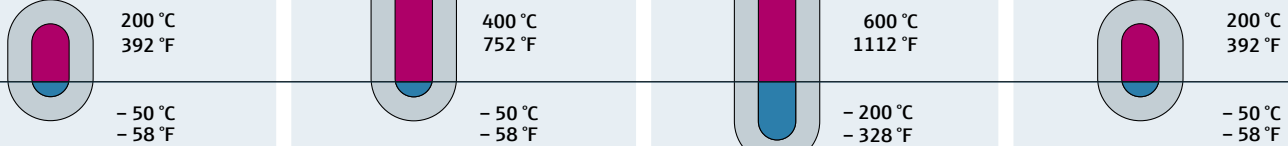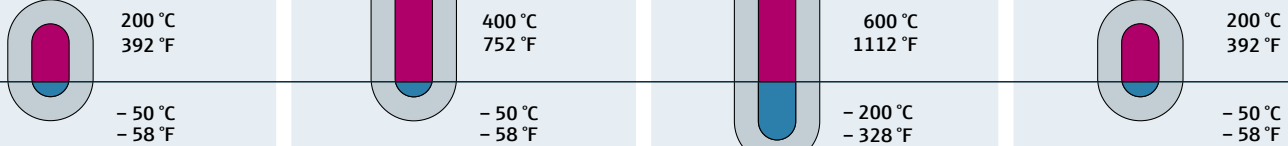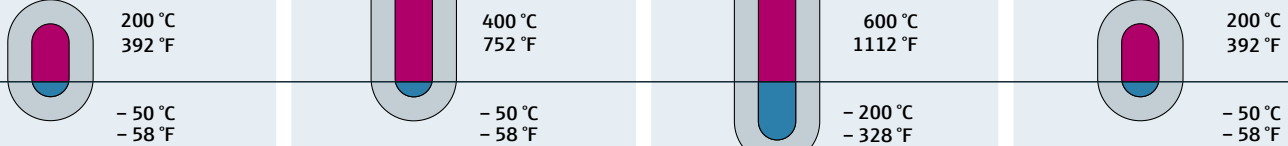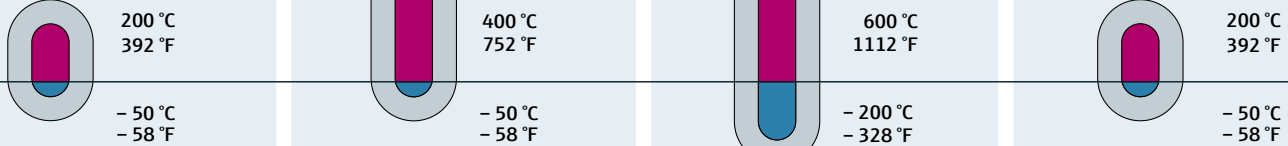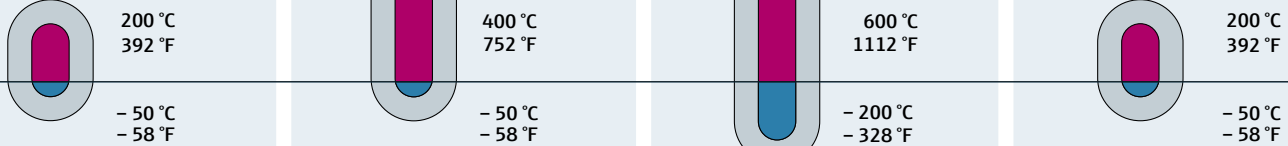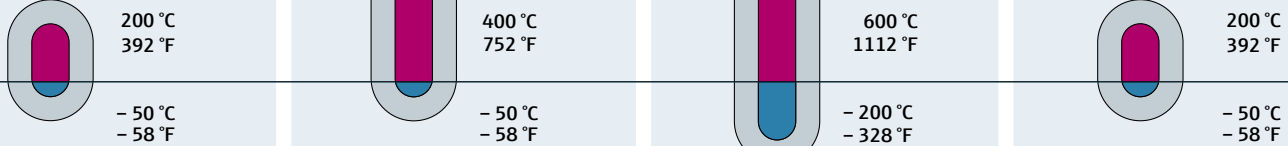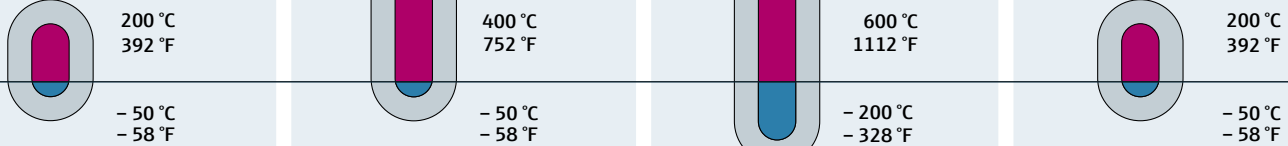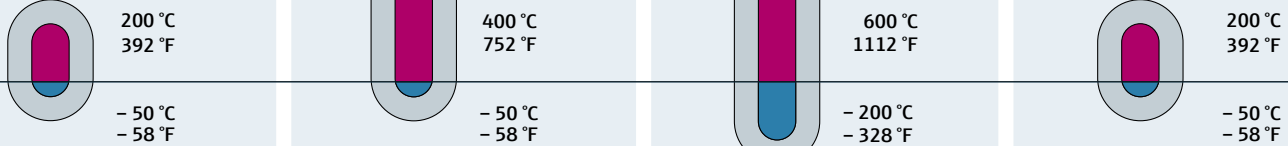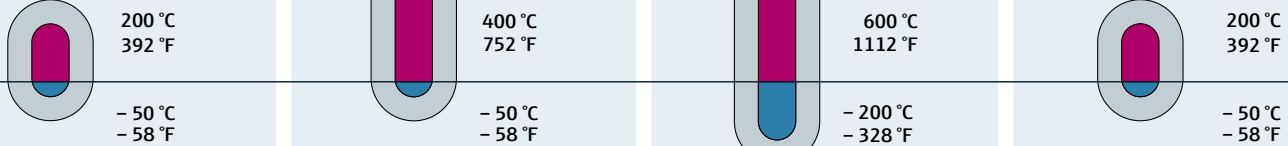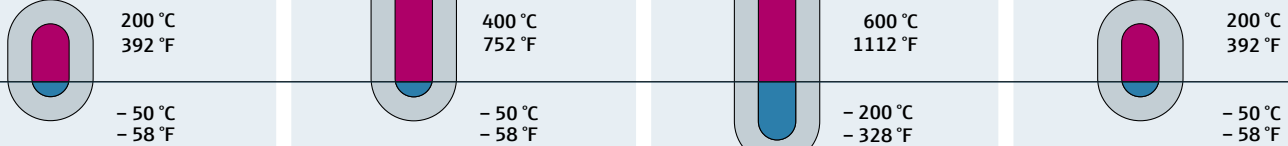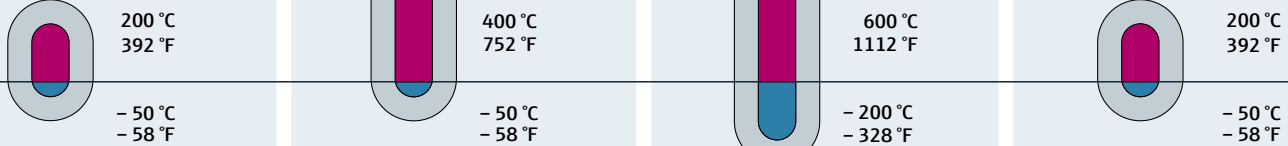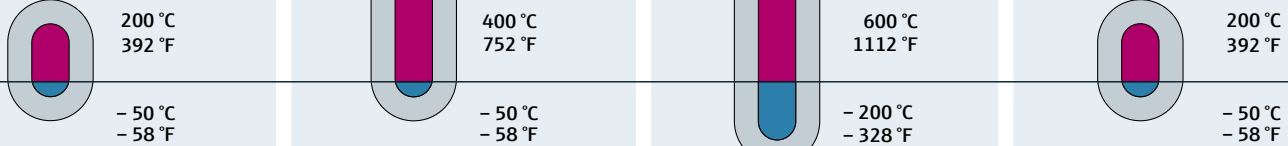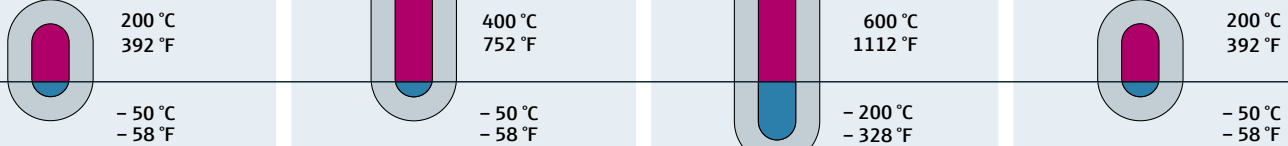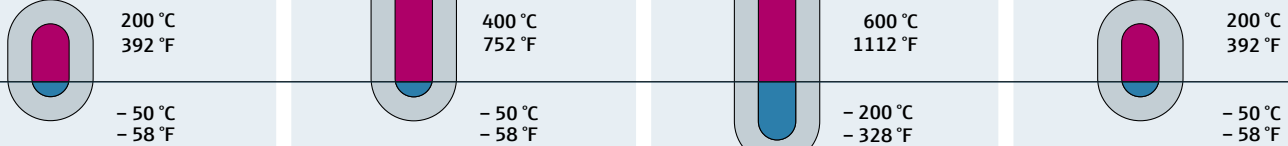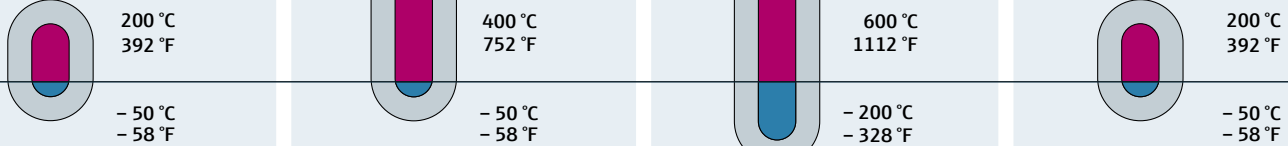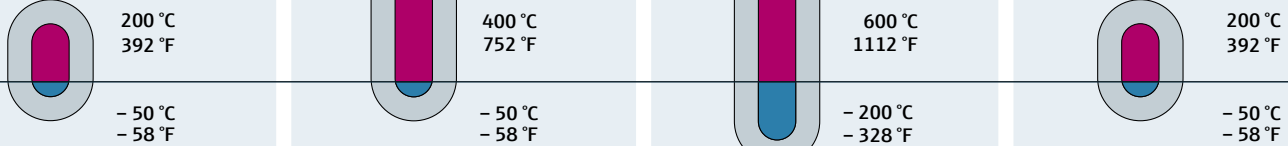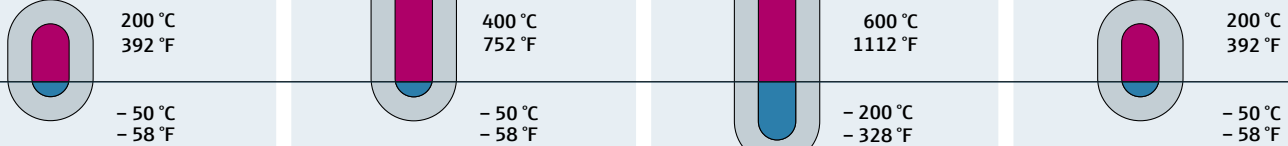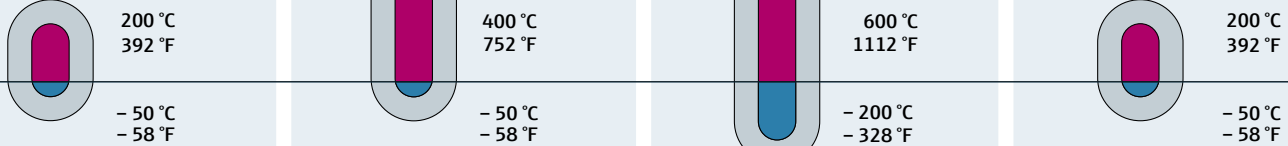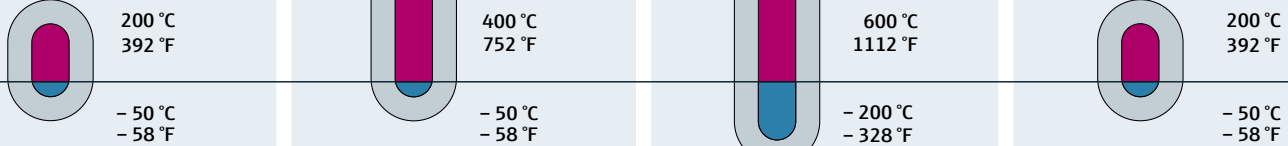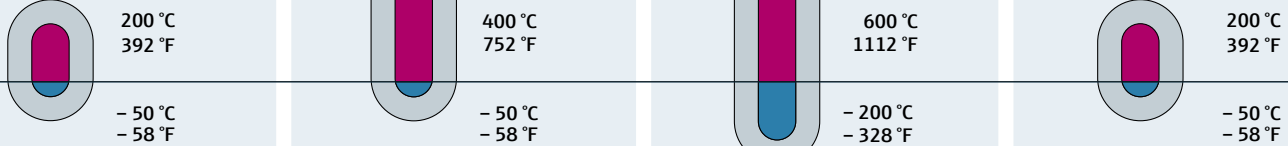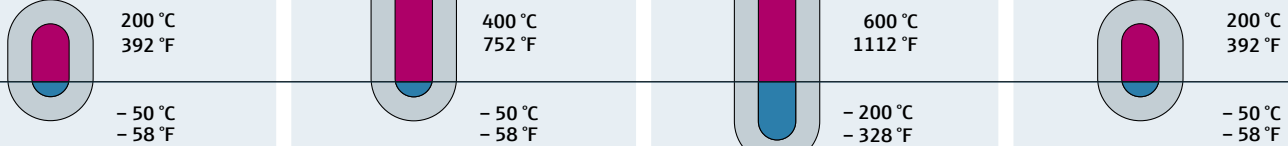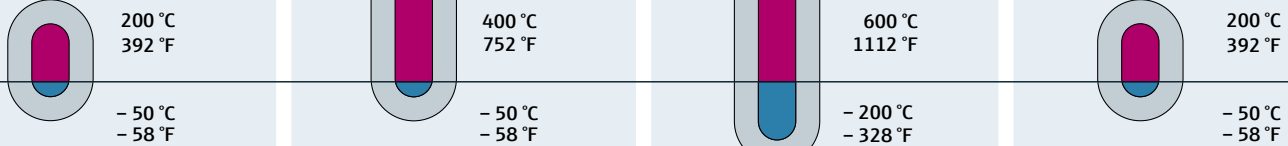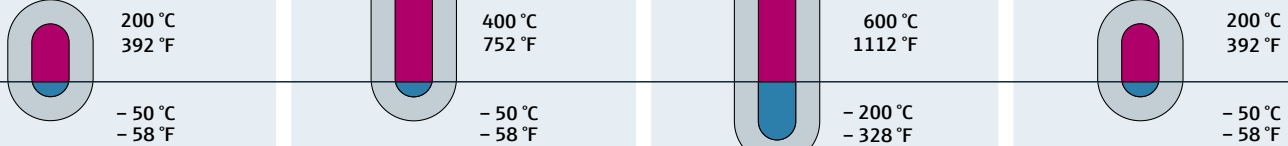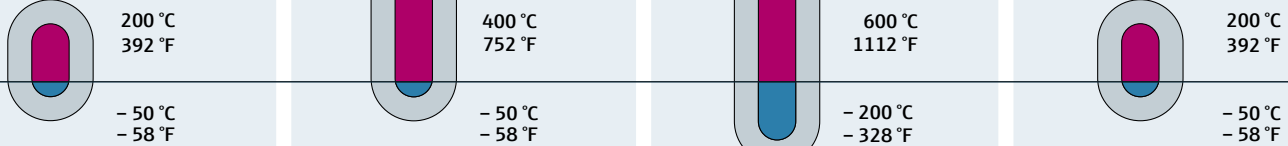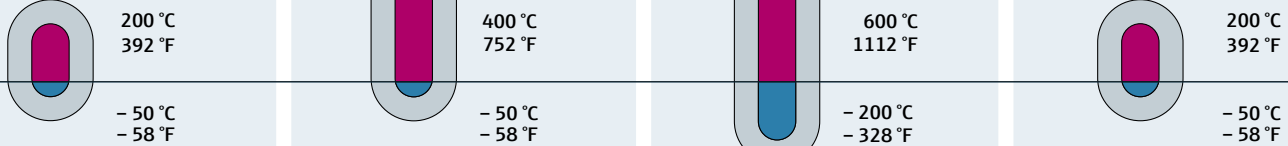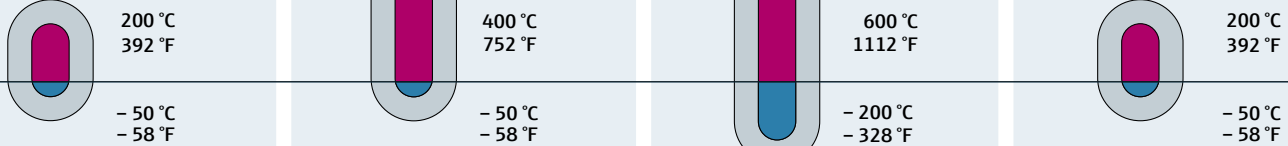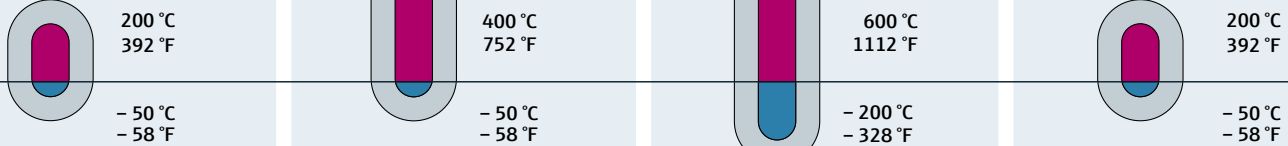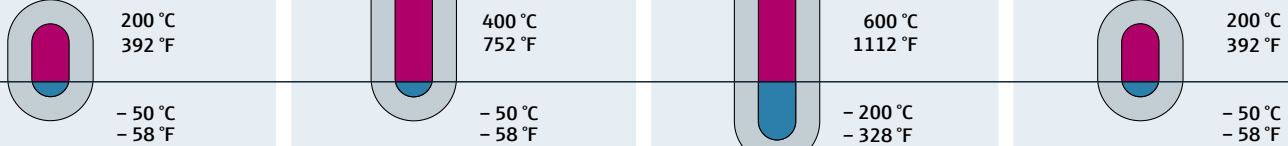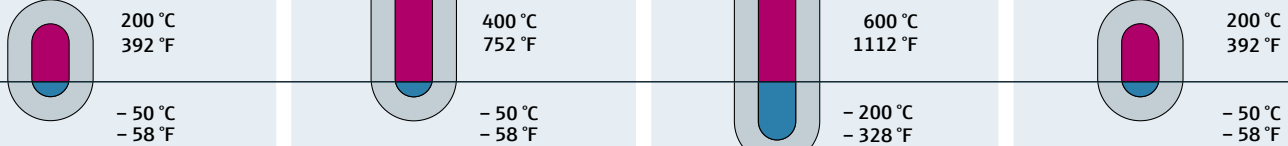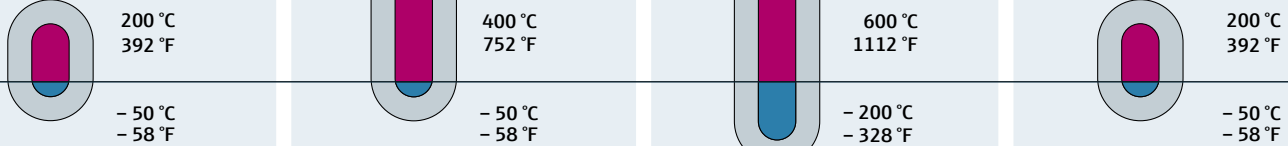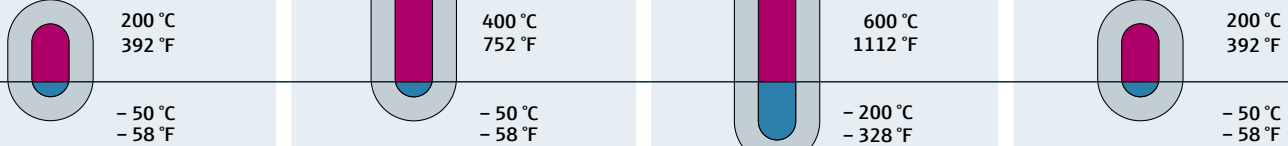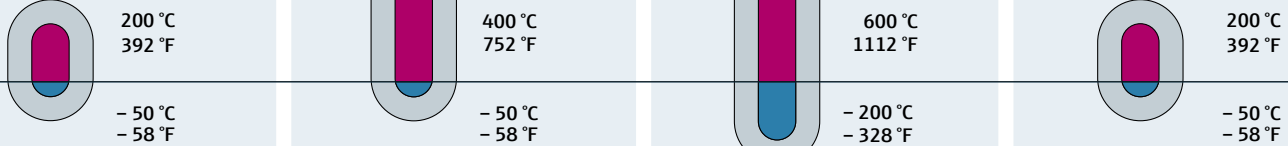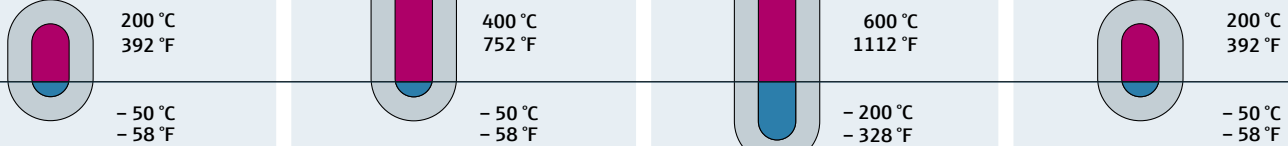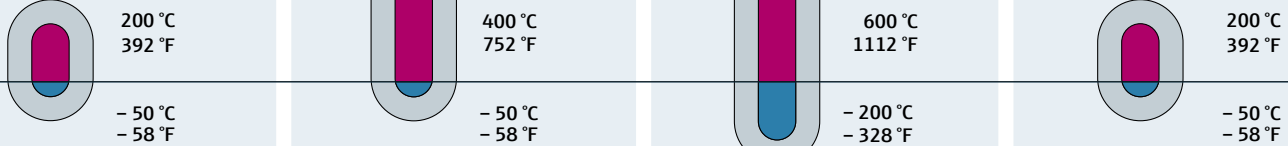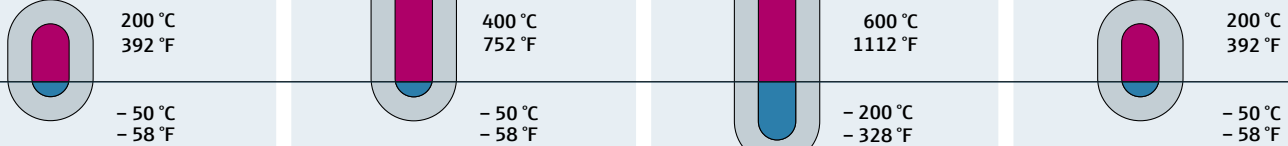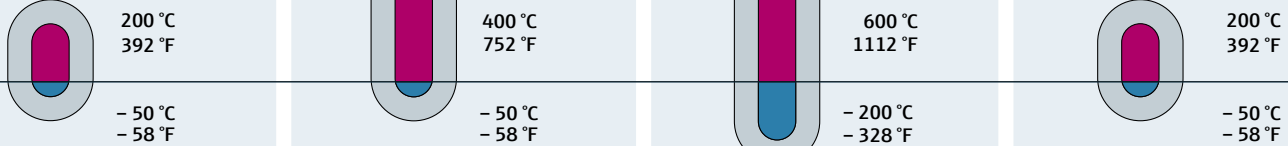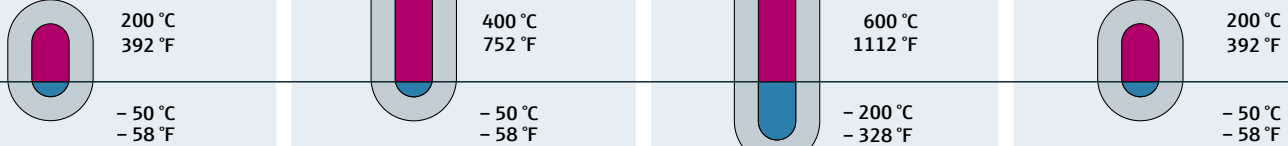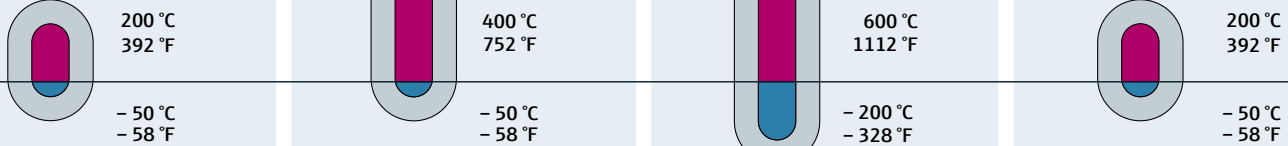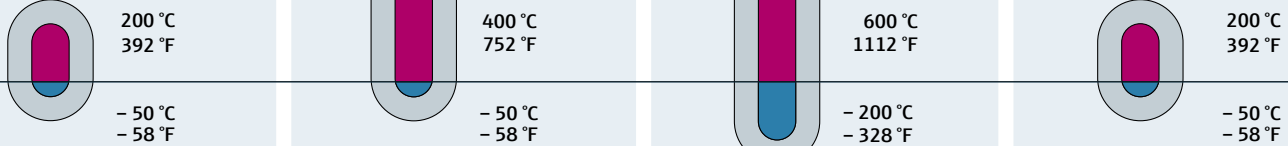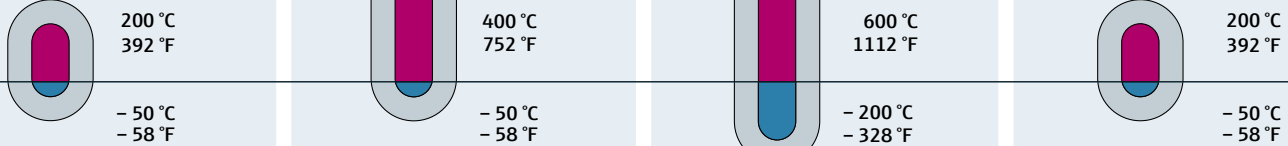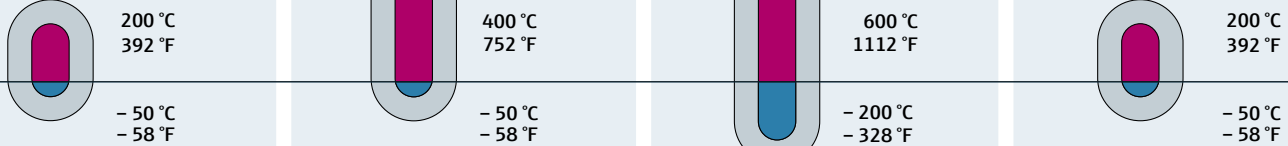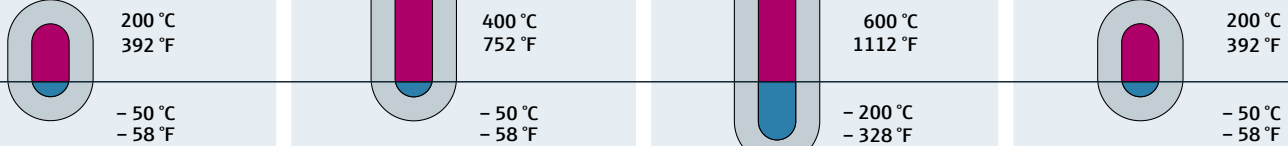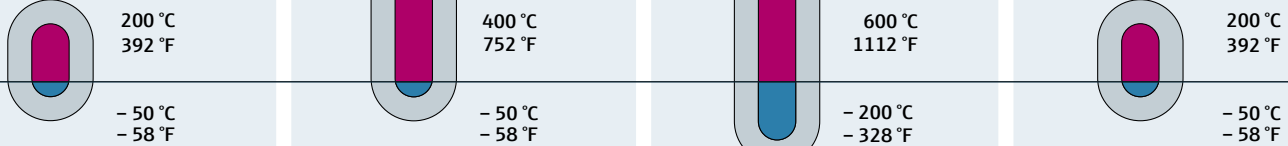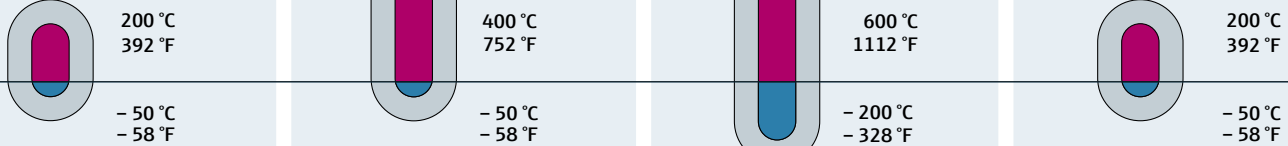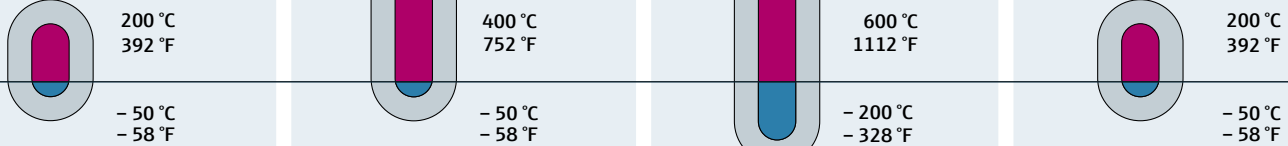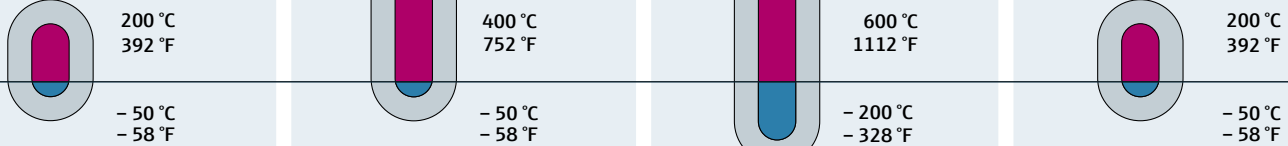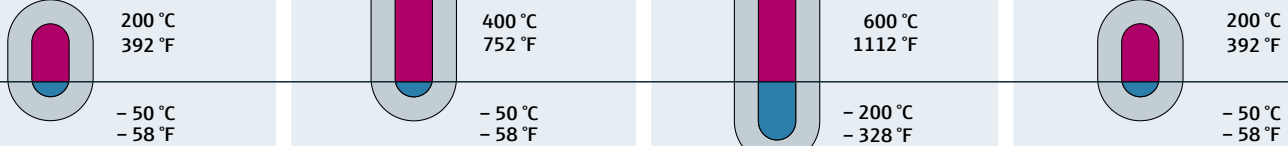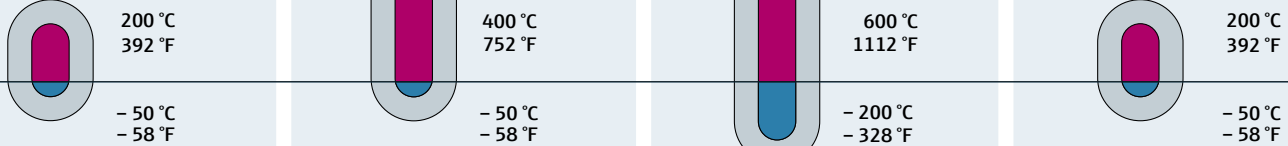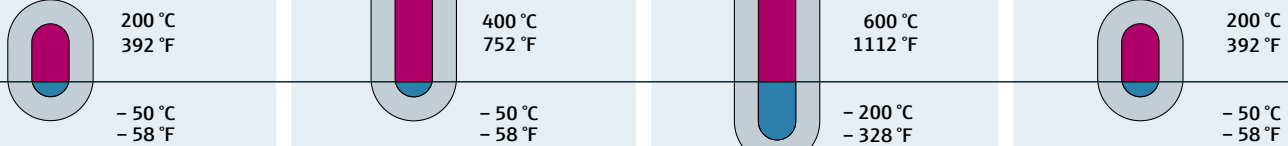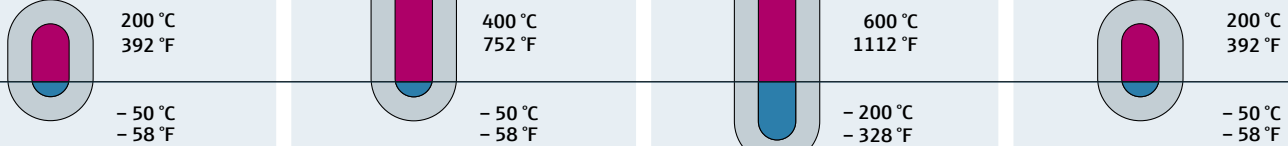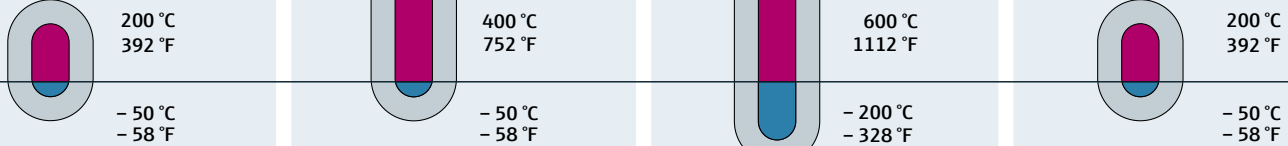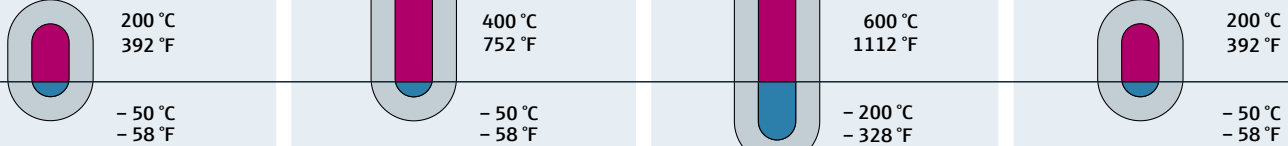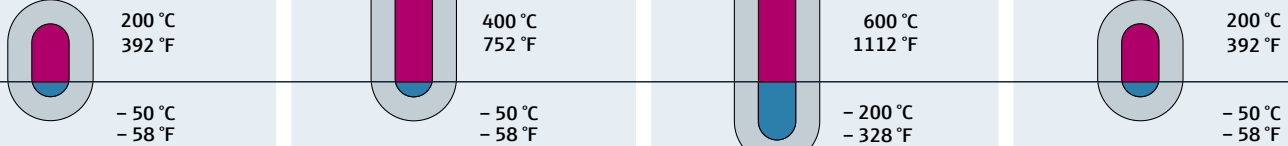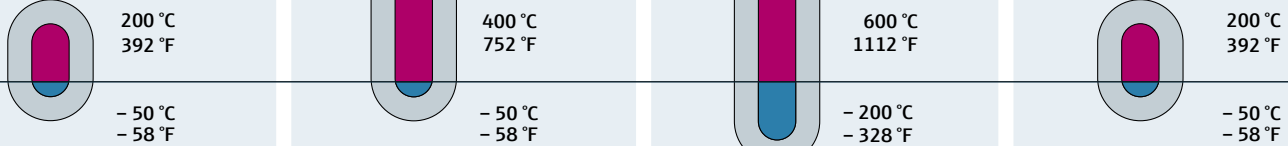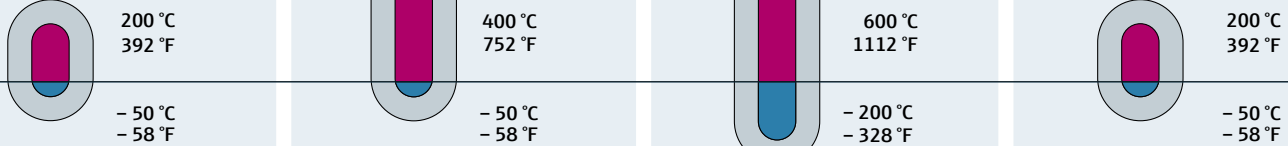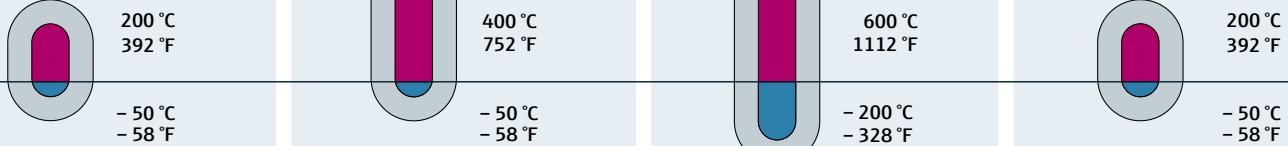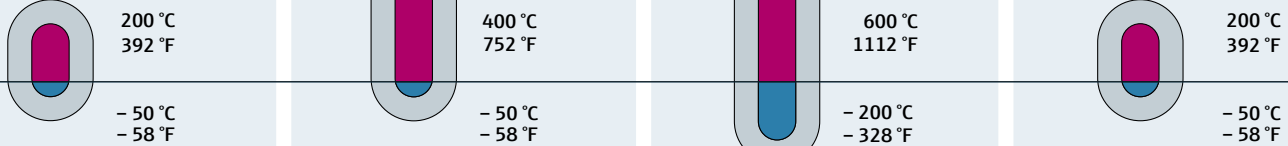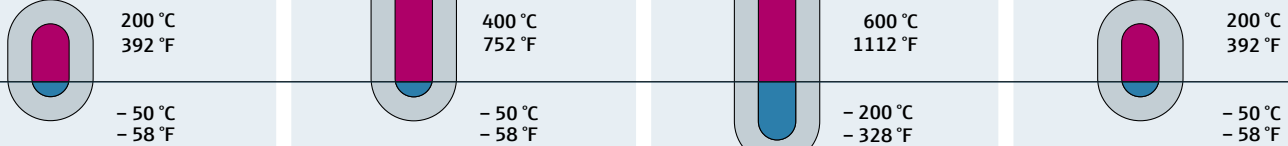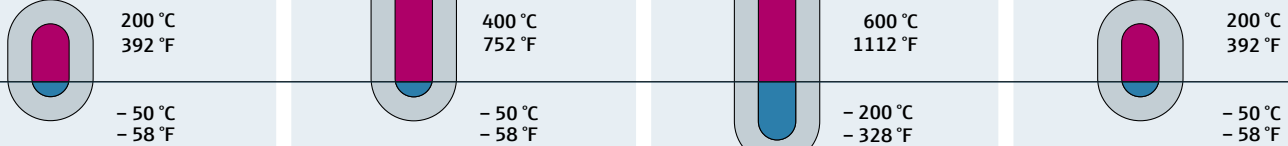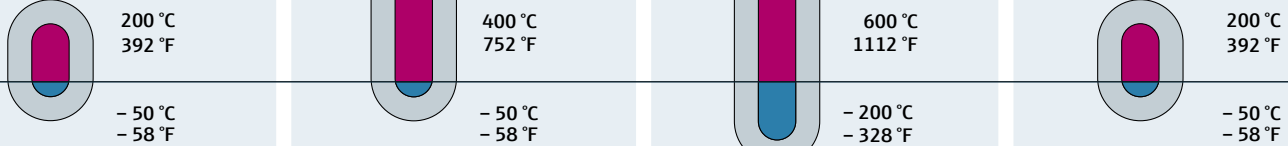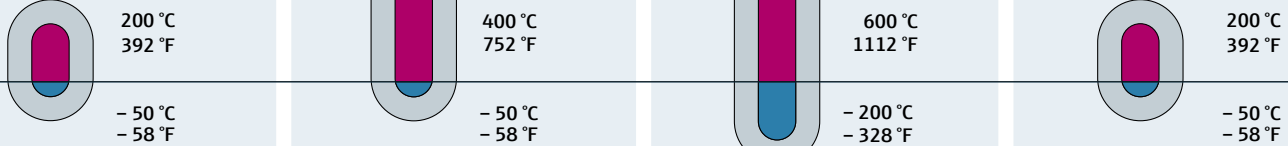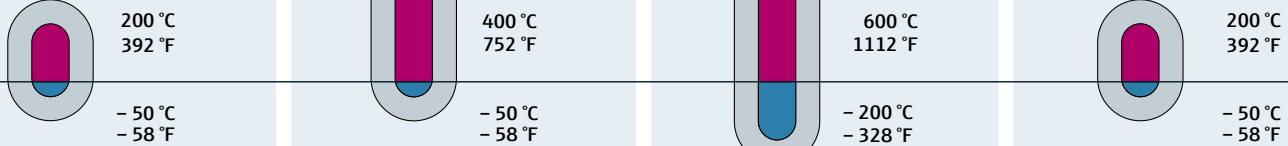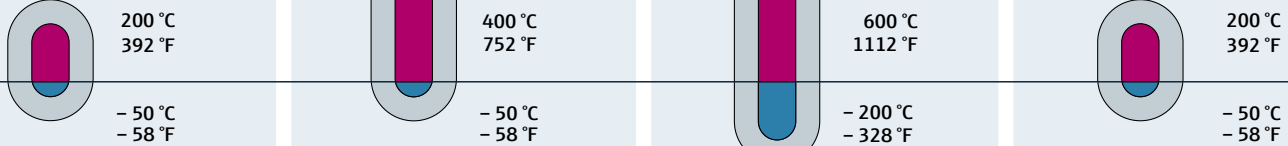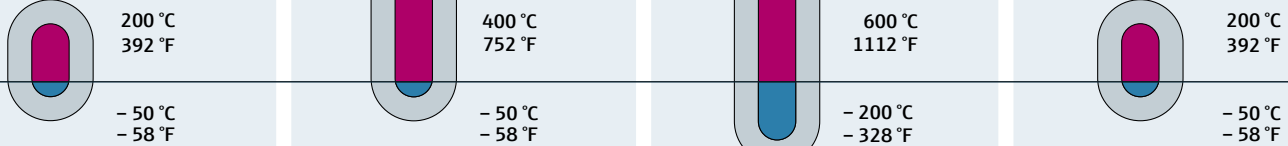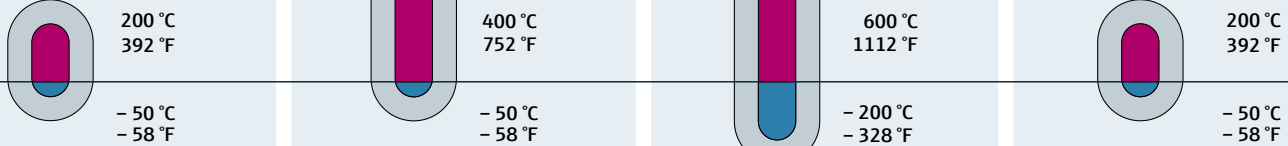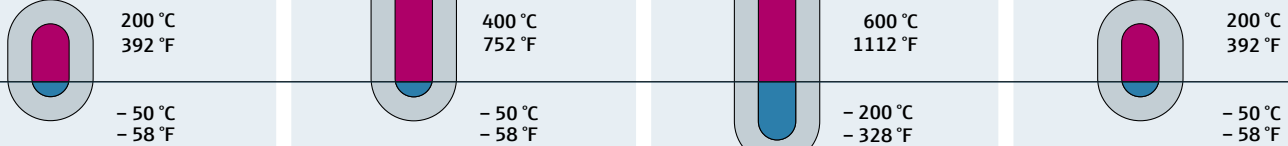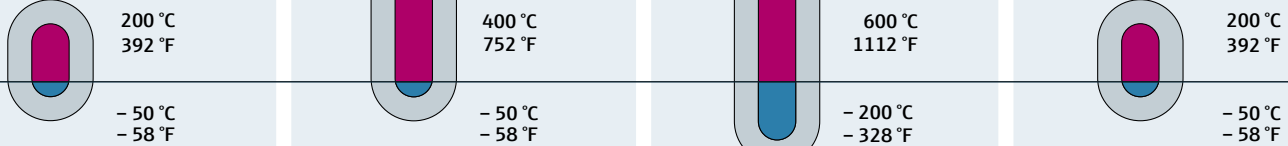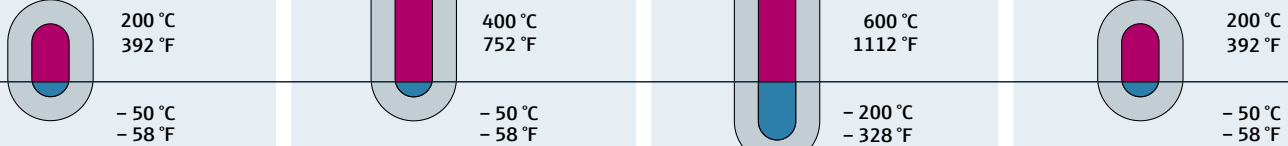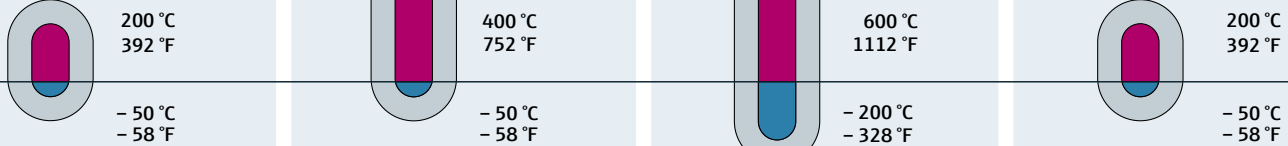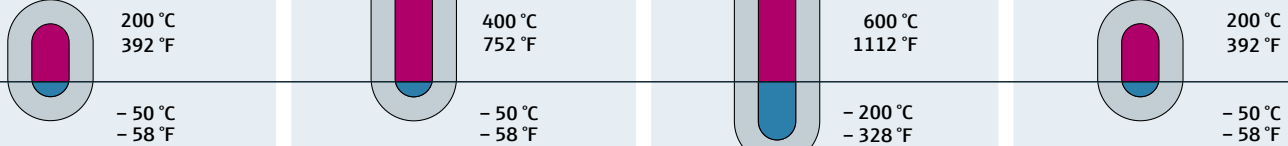
Sensor technology

All of our solutions at a glance

Basic thinfilm Pt100 (RTD)	Standard thinfilm Pt100 (RTD)	Wirewound Pt100 (RTD)	iTHERM QuickSens Pt100 (RTD)
Thinfilm sensor consisting of ceramic substrate with vapor-deposited platinum	Small sensor consisting of ceramic substrate with vapor-deposited platinum	Ultrapure platinum wire wound around a ceramic core	Thinfilm sensor with unmatched response time
Sensing element and wiring in stainless steel sheath	Embedded in mineral isolated stainless steel sheath	Embedded in mineral isolated stainless steel sheath	Sensor-on-tip technology for short immersion length
➕ Measurement performance sufficient for most support processes	➕ Long-term stability	➕ Long-term stability	➕ World's fastest response time
➖ Limited measurement range	➕ Vibration resistance	➕ High measurement repeatability	➕ Maximum process safety
	➖ Limited measurement range	➖ Relative cost	➖ Limited measurement range
		➖ Susceptible to mechanical stress	
			✓ Exclusive Endress+Hauser technology

200 °C / 392 °F ... –50 °C / –58 °F	400 °C / 752 °F ... –50 °C / –58 °F	600 °C / 1112 °F ... –200 °C / –328 °F	200 °C / 392 °F ... –50 °C / –58 °F

iTHERM StrongSens Pt100 (RTD)

Ceramic-encapsulated thinfilm with unmatched robustness

Vibration resistance up to 60g (2,116 oz) for lower life cycle cost

➕ World's highest vibration resistance

➕ Robust

➕ Long lifetime and plant availability

➖ Limited measurement range

✓ Exclusive Endress+Hauser technology
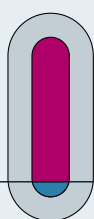
500 °C
932 °F

– 50 °C
– 58 °F
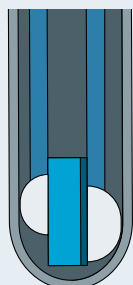
iTHERM TrustSens Pt100 (RTD)

Self-calibrating sensor unit

Pt100 sensor and integrated fixed point reference, making use of the Curie effect

➕ Self-calibrating

➕ High degree of automation

➕ Risk reduction

➖ Limited measurement range

✓ Exclusive Endress+Hauser technology
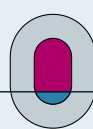
190 °C
374 °F

– 40 °C
– 40 °F
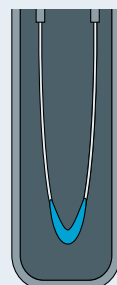
Thermocouple (TC)

Two dissimilar metals spot welded (hot junction)

Ideal for high temperatures

➕ Measurement range

➕ Ideal for high temperatures

➖ Long-term stability

➖ Limited accuracy
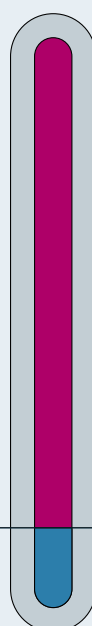
up to 1800 °C
up to 3272 °F

– 270 °C
– 454 °F

iTHERM ProfileSens Thermocouple (TC)

Up to six individual sensors

MI cable mineral insulated (MgO powder)

Double metal sheathing technology

➕ Robust and reliable

➕ For high temperatures, pressure, agressive media

➕ Increased plant safety

➖ Limited accuracy (compared to RTD)

✓ Exclusive Endress+Hauser technology
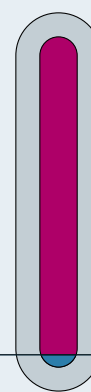
1100 °C
2012 °F

– 40 °C
– 40 °F

Temperature transmitters

The task of a temperature transmitter is the transformation of the sensor signal into a stable and standardized signal. To interpret this signal correctly, an exact configuration with respect to sensor and process conditions is required. Different technologies can be used to adapt this configuration and display the process value and further information.

Benefits at a glance

Increased accuracy, enhanced safety, optimized usability and a high degree of standardization and digitalization! What makes our temperature transmitters the perfect solution for your measuring point?

Watch our YouTube videos to learn more about our transmitters:

"Perfect fit"

Our Endress+Hauser temperature transmitters are the perfect fit for all industries and a wide range of applications.

- Different housing types make the transmitters suitable for a wide range of systems and applications available
- Various digital and analog output signals ensure an optimal selection of the transmitter according to the existing or desired system environment
- Several features and approvals guarantee perfect alignment of the measuring point to the respective industry requirements

Housing types

DIN rail
Installation in control cabinets

Head transmitter
Installation in thermometer terminal heads

Field transmitter
Remote installation in process area

Digital and analog output signals

The Endress+Hauser portfolio includes basic temperature transmitters that communicate with analog signals as well as advanced devices that use digital communication technologies. They ensure high accuracy as well as flexibility and provide additional information from the measuring point, like extended diagnostics.

Digital

IO-Link
PROFINET ®
FOUNDATION
HART COMMUNICATION PROTOCOL
ethernet-apl™ advanced physical layer
PROFIBUS ®

Analog   4-20 mA

ethernet-apl™ advanced physical layer

NEW

IO-Link

The 2-wire data highway for endless possibilities
Ethernet-APL combines the benefits of simple and robust 2-wire technology with the benefits of Ethernet, enabling top-performance and seamless data access in the field of process plants. This technology is based on established industrial Ethernet protocols such as PROFINET.

2-wire cable with 10 Mbit/s full duplex communication

Explosion protection for all zones and divisions

Power supply via APL switches

Benefits
- High plant availability and increased production output with less plant shutdowns
- Increased efficiency in maintenance
- Plant downtimes can be minimized

Digitize the last mile of your plant
Smart Ethernet devices like valve islands, remote IOs, recorders, liquid analyzers or flow measurement devices are digitalized with Industrial Ethernet. Basic devices also become digitally accessible with IO-Link: This makes offline parametrization, data transparency and plug-and-produce device exchange available for all devices.

Benefits
Shorten commissioning time
- Use of unshielded standard cables and standard connection plugs
- Offline engineering

Speed up MRO
- Time-saving parameterization via the engineering system without the need for additional software
- Comprehensive access to device, diagnostic and process information as well as fast data upload and download for maintenance and service

Increase productivity
- Automatic device identification and multivariable devices

Temperature transmitters

Communication standard	4-20 mA	IO-Link	4-20 mA	HART
Housing types and models	TMT31	TMT36	TMT71	TMT72 TMT142B
Type of input	RTD or TC	RTD	Universal	
Sensor inputs(s)	1			
Additional information	Programmable or fixed configuration	Plug-in display	Plug-in display (head) Bluetooth® technology	Plug-in display (head) Bluetooth® technology Backlit display (TMT142B) Integrated over-voltage protection (TMT142B)
Approvals/ certificates	Ex ec: ATEX, CSA C/US; DNV		Ex ia, Ex d: ATEX, IECEx, INMETRO, NEPSI, UK Ex; IS, XP: CSA C/US; DNV	Ex ia, Ex d: ATEX, IECEx, INMETRO, NEPSI, UK Ex; IS,XP: CSA C/US; DNV (TMT72)
Diagnostics	Sensor break, open-circuit or short-cut detection		Sensor break, open-circuit or short-cut detection Corrosion monitoring	
Segment	**F** L E X		F **L** E X	

	FOUNDATION Fieldbus	PROFIBUS PA	PROFINET over Ethernet-APL
TMT82	TMT85	TMT84	
TMT162	TMT162	TMT162	TMT86
Universal			
2			
Plug-in display (head) Backlit display (TMT162) Dual compartment housing (TMT162) Integrated overvoltage protection (TMT162)			Plug-in display 2-wire Ethernet IEEE 802.3cg 10BASE-T1L
Ex ia, Ex d: ATEX, IECEx, INMETRO, NEPSI, UK Ex; IS, XP, NI: FM, CSA; SIL 2/SC 3; DNV, ABS, LR, BV (TMT82)	Ex ia, Ex d: ATEX, IECEx, INMETRO, NEPSI, UK Ex; IS, XP, NI: FM, CSA	Ex ia, Ex d: ATEX, IECEx, INMETRO, NEPSI, UK Ex; IS, XP,NI: FM, CSA	Ex ia, Ex d: ATEX, IECEx, NEPSI; IS, XP, NI: CSA C/US
Sensor break, open-circuit or short-cut detection Corrosion monitoring Sensor drift detection or sensor back up function			

F L E X

Highlight: iTEMP TMT31

Where simplicity meets reliablity

Our iTEMP TMT31 temperature transmitter combines simplified selection, ordering, installation and operation with the highest reliability and long-term stability in one product.

With our updated iTEMP TMT31, we are simplifying our transmitter portfolio. The new F-segment transmitter replaces several previous products and combines their features into just one product structure. No matter which sensor input, which housing type and if pre-configuration is required - the starting point is always the iTEMP TMT31. This simplifies product selection and the ordering process while reducing the error rate during product configuration.

NEW RTD or TC input

NEW Fixed or programmable

NEW Head or DIN rail

Benefits

Save time and effort on commissioning, configuration and maintenance

- Push-in terminals for fast, tool-free wiring during installation or maintenance

- Simple parametrization via free software tools

Long-term stability, accurate and precise temperature measurements

Categorized and uniform diagnostic information according to NAMUR

Form B head or DIN rail temperature transmitter

4 to 20 mA output

1 x RTD or TC input

Zone 2 ⬡Ex

NEW

Power & status LED

Push-in terminals

Updated screw terminals

Only 12.5 mm (0.49 ") width

Our F-segment transmitters

- Simple products for basic processes

- Up-to-date technology

- Best price-performance ratio

- Simple product selection, ordering, installation and operation

- Focus on current trends in the industry

- Simplicity combined with renowned Endress+Hauser quality and technical know-how

TMT31   TMT36

Thermowells

Type	Barstock thermowell			Welded industrial thermowell	Welded hygienic thermowell	
Model	**TT151**	**TT152**	**TT511**	**TT131**	**TT411**	**TT412**
Design	Metric	Imperial	Metric			Imperial
Segment			F L E X			
Thermowell design	DIN, ASME	ASME	Van Stone	DIN	Hygienic	
Process connection	Flange, weld-in, threaded		Lap-joint flange	Flange, weld-in, threaded	Hygienic	
Material	316, 316L, 316Ti, 347, 310 Alloys 600, C276, 10CrMo9-10, 13CrMo4-5, 16Mo3 A105, C22.8 Duplex S32205, Titan Gr.2		1.4401, 1.4571	Stainless steel: 316, 316L, 316Ti, 321, Alloy446 nickel-based materials: AlloyC276, Alloy600, jackets in Tantalum and PTFE	316L	
Approvals/ certificates	CRN					
Innovations	iTHERM TwistWell		-	QuickLink iTHERM QuickNeck	Tee and elbow thermowells	
Suitable for	TM131, TM151	TM152	TM131, TM151	TM131	TM411	TM412

Product overview thermometers

Our expansive portfolio offers globally available, standardized thermometers for industrial and hygienic applications across all industries. As a full-range supplier for temperature measurement, we unite all competencies under one roof – from sensors and electronics to complete assemblies and customized solutions.

With outstanding customer-centric innovations, we help to increase plant availability, efficiency and safety. Our internationally tested and certified products ensure seamless integration, ease of use and long-term reliable performance.

i This brochure presents our current core portfolio, highlighting our future-proof products.

For a complete overview, including discontinued products and their successors or spare parts (e.g. terminal heads, inserts), please visit: www.endress.com

Cable probes
iTHERM CableLine
Power & Energy, Oil & Gas
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Compact thermometers
iTHERM CompactLine
Food & Beverages, Life Sciences
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Industrial modular thermometers
iTHERM ModuLine
Chemical, Oil & Gas, Power & Energy
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Hygienic modular thermometers
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High temperature thermometers
iTHERM FlameLine
Mining, Minerals, Metals, Oil & Gas, Power & Energy
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Surface thermometers
iTHERM SurfaceLine
Power & Energy, Chemical, Oil & Gas
Page 37

Multipoint thermometers
iTHERM MultiSens
Oil & Gas, Chemical, Food & Beverages
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Cable probes

Model	TST310	TSC310	TH12	TH52	TH56
Design	Metric		Imperial		
Segment			F L E X		
Description	With permanently affixed connecting cable or plug connector (TH56)				
Approvals/ certificates	ATEX Ex ia, Ex nA; NEPSI Ex ia; IECEx Ex ia; UK Ex ia, Ex nA		-		
Temperature range	RTD: -200 to +600 °C (-328 to +1112 °F)	TC: -270 to +1100 °C (-454 to +2012 °F)	RTD: -200 to +200 °C (-328 to +392 °F)	TC: -270 to +1372 °C (-454 to +2500 °F)	

Compact thermometers

Type	Thermometers					Temperature switches	
Model	**TMR31**	**TMR35**	**TM311**	**TM371**	**TM372**	**TTR31**	**TTR35**
Design	Metric		Metric/ imperial	Metric	Imperial	Metric	
Segment		F L E X		F L E X		F L E X	
Application	Industrial	Hygienic	Industrial/ hygienic	Hygienic		Industrial	Hygienic
Features	With thread or compression fitting	Hygienic process connections	iTHERM TipSens	iTHERM TrustSens		With thread or compression fitting	Hygienic process connections
			Hygienic tee and elbow thermowells				
Description	With integrated transmitter			Reduces risks and costs by a fully automated, traceable inline self-calibration		Temperature switch with 1/2 PNP switch outputs	
Communication standards	4-20 mA		4-20 mA, IO-Link	4-20 mA, HART		4-20 mA	
Approvals/ certificates	UL		EHEDG; ASME; FDA; 3-A; CSA C/US; DNV	EHEDG; ASME; FDA; 3-A; CSA C/US; Ex; UK Ex ia; ATEX IECEx Ex ia		UL; CSA C/US	UL; CSA C/US; 3-A; EHEDG
Temperature range	RTD: -50 to +200 °C (-58 to +392 °F)			RTD: -40 to +190 °C (-40 to +374 °F)		RTD: -50 to +150 °C (-58 to +302 °F)	

Industrial modular thermometers

Thermowell	Direct contact – without thermowell		
Model	**TM101**	**TM111**	**TM112**
Design	Metric		Imperial
Segment	F L E X	F L E X	
Communication standards	4-20 mA, HART, IO-Link	4-20 mA, HART, PROFINET over Ethernet-APL, FOUNDATION Fieldbus, IO-Link, PROFIBUS PA	
Features	Best price/performance ratio	iTHERM StrongSens iTHERM QuickSens	
Approvals/ certificates	-	ATEX/IECEx Ex ia, Ex nA, Ex ec, Ex tc, Ex ta/tb, Ex db; CSA C/US IS, NI, XP, DIP; INMETRO Ex ia, Ex d; NEPSI Ex ia, Ex d, Ex tD; UK Ex ia, Ex nA	
Temperature range	TC: -40 to +650 ℃ (-40 to +1202 ℉) RTD: -50 to +200 ℃ (-58 to +392 ℉)	TC: -40 to +1100 ℃ (-40 to +2012 ℉) RTD: -200 to +600 ℃ (-328 to +1112 ℉)	

Welded thermowell		Barstock thermowell	
TM121	**TM131**	**TM151**	**TM152**
Metric			Imperial
F L E X	F L E X		
4-20 mA, HART, IO-Link	4-20 mA, HART, PROFINET over Ethernet-APL, FOUNDATION Fieldbus, IO-Link, PROFIBUS PA		
Best price/performance ratio	iTHERM StrongSens iTHERM QuickSens iTHERM QuickNeck QuickLink Dual Seal Dual compartment housing	iTHERM StrongSens iTHERM QuickSens iTHERM QuickNeck iTHERM TwistWell QuickSleeve Dual Seal Dual compartment housing	
-	ATEX/IECEx Ex ia, Ex nA, Ex ec, Ex tc, Ex ta/tb, Ex db; CSA C/US IS, NI, XP, DIP; INMETRO Ex ia, Ex d; NEPSI Ex ia, Ex d, Ex tD; UK Ex ia, Ex nA; SIL 2/SC 3; DNV		
TC: -40 to +650 °C (-40 to +1202 °F) RTD: -50 to +200 °C (-58 to +392 °F)	TC: -40 to +1100 °C (-40 to +2012 °F) RTD: -200 to +600 °C (-328 to +1112 °F)		

Industrial modular thermometers

RTD thermometer for outdoor and indoor ambient temperature measurement

Just like temperature, flow or pressure instruments, you can connect ambient temperature measurement to the control room via a standard communication protocol.

This cross-industry device is ideal for general applications:

- around piping and machinery
- factory and production halls
- control cabinet
- server rooms
- aboratories, greenhouses
- drying and cooling rooms

Model	TST434B
Segment	F L E X
Communication standards	4-20 mA, HART, PROFIBUS PA, FOUNDATION Fieldbus, IO-Link, PROFINET over Ethernet-APL
Features	Robust terminal heads according to DIN EN 50446 or stable plastic housings, simple and fast wall mounting
Temperature range	RTD: -50 to +150 °C (-58 to +302 °F)

Paired set of RTD thermometers for thermal energy measurements

To achieve the smallest possible deviation between two thermometers, paired RTD primary sensors with almost identical characteristics can be installed. These sensors are the right choice for energy consumption measurements.

Model	TST90
Design	Metric
Segment	F L E X
Description	Design as per DIN 43772 form 2G
Features	Paired in the range: 0 to +120 °C (+32 to +248 °F); Deviation of the sensors: ± 0.05 K Paired in the range: -40 to 0 °C (-40 to +32 °F); Deviation of the sensors: ± 0.1 K
Temperature range	RTD: -50 to +400 °C (-58 to +752 °F)

Hygienic modular thermometers

Thermowell	Direct contact - without thermowell		With or without thermowell	
Model	**TM401**	**TM402**	**TM411**	**TM412**
Design	Metric	Imperial	Metric	Imperial
Segment	F L E X		F L E X	
Communication standards	4-20 mA, HART , IO-Link		4-20 mA, HART, FOUNDATION Fieldbus, PROFIBUS PA, PROFINET over Ethernet-APL, IO-Link	
Highlights	-		iTHERM QuickNeck iTHERM QuickSens iTHERM StrongSens	
Approvals/ Certificates	EHEDG; ASME; 3-A; FDA	EHEDG; ASME; 3-A; FDA; PMO	EHEDG; ASME; 3-A; FDA; ATEX Ex ia, Ex nA; CSA C/US IS, NI; FM IS, NI; JPN Ex ia; NEPSI Ex ia; UK Ex ia, Ex nA	EHEDG; ASME; 3-A; FDA; ATEX Ex nA; CSA C/US IS, NI; FM IS, NI; ATEX/IECEx Ex tb, Ex ia
Temperature range	RTD: -50 to +200 ℃ (-58 to +392 ℉)		RTD: -200 to +600 ℃ (-328 to +1112 ℉)	
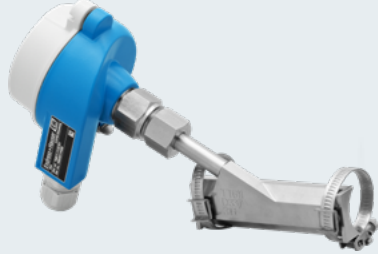
High temperature thermometers

Model	TAF11	TAF12S	TAF12D	TAF12T	TAF16
Design	Metric				
Segment			F L E X		
Thermowell	Single/dual thermowell	Single thermowell	Dual thermowell	Triple thermowell	Single/dual thermowell
Material thermowell	Ceramic C610, sinterized silicon carbide (SiC), special silicon nitride ceramic (SiN)	Ceramic C610, C799		Ceramic C530, C610, C799	AISI: 316L, 310, 304, 446, Alloy 600, Alloy 601; Alloy 800HT, Alloy C276, Kanthal AF and Kanthal Super, special nickel/cobalt alloy (NiCo), special silicon nitride ceramic (SiN) Optional ceramic inner sheat
Temperature range	TC: Up to +1820 °C (+3308 °F)				TC: Up to +1768 °C (+3214,4 °F)

Surface thermometers

Model	TST602	TM611
Design	Metric	Metric
Segment	F **L** E X	F L **E** X
Description	For basic monitoring applications	Accurate and fast temperature measurement for process control and safety functions
Communication standards	-	4-20 mA, HART, FOUNDATION Fieldbus, PROFIBUS PA, IO-Link, PROFINET over Ethernet-APL
Type	Cable probe	Cable probe or industrial thermometer
Approvals/Certificates	-	ATEX/IECEx Ex ia, Ex nA Ex ec, Ex tc, Ex ta/tb, Ex db; CSA C/US IS, NI, XP, DIP
Measuring range	RTD: -20 to +200 °C (-4 to +392 °F)	RTD: -200 to + 400 °C (-328 to + 752 °F) TC: -40 to +400 °C (-40 to +752 °F)

Highlight: iTHERM SurfaceLine TM611

Non-invasive thermometer

No process opening, **no risk of leakage**

Simplicity: installation, maintenance, product selection

Increased safety: for personnel, system, environment

Measuring accuracy & response time
comparable to invasive measurements

Significant cost savings:
- Reduced development & project planning times
- Reduced expenses: installation, certification,inspections
- No expenses for: thermowells, nozzles, flanges, weld seam tests, pipe extensions

For a wide range of demanding industrial applications

High flow velocities / process pressures, highly viscous / corrosive media, abrasion, pigging, small pipe diameters

Retrofitting, temporary / additional measurements, greenfield projects, energy monitoring

Measuring range
-200 ... +400 ℃
-328 ... +752 ℉

Ex

Safety Integrity Level
SIL
Endress+Hauser

iTEMP temperature transmitters
- All common communication protocols
- Bluetooth® connectivity
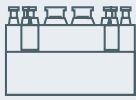
Thermal coupling element
- Extra wide contact surface
- No air gap between coupling element and sensor
- Geometry adapted to the pipe diameter

Heat transfer material
- Compensates for imperfections of the pipe
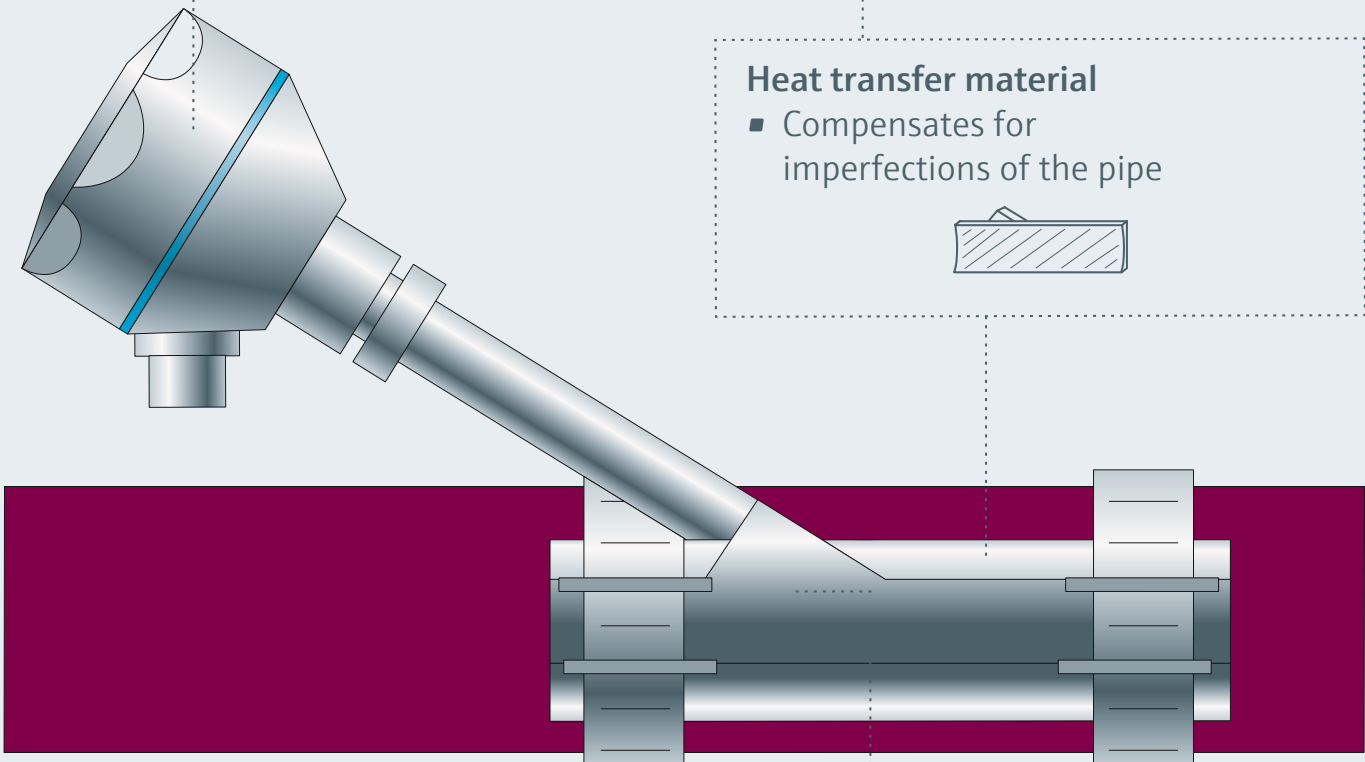
Stainless steel screw clamps
- Easy, convenient, safe installation
- No drilling, welding, additional tools

Measurement insert
- Precisely fitted into the thermal coupling element
- Standard RTD / TC sensor with low thermal mass

Multipoint thermometers

Pre-engineered multipoint temperature assemblies

Model	Flex TMS01		Flex TMS02		Linear TMS11	Linear TMS12	Slim TMS21		Bundle TMS31
Design	Metric/imperial		–		Metric/imperial				
Segment					F L E X				
Type	Direct contact	Individual thermo-wells	Direct contact	Individual thermo-wells	Multiple, primary thermowell		Annealed tube	Annealed tube with flexible part	Stainless steel flexible rope
Response time	●●●●●	●●●··	●●●●●	●●●··	●●···		●●●●·		●●●●●
Layout/ bendability	●●●●●	●●···	●●●●●	●●···	–		●●●··	●●●●●	●●···
Diagnostic capabilities	–		Advanced		Basic	Advanced	–		
Individually replaceable sensors			✔				–		
Max. number of points	48 (linear or 3D) 80 (Profile-Sens)	48 (linear or 3D)	48 (linear or 3D) 80 (Profile-Sens)	48 (linear or 3D)	16 (linear)	12 (linear)	59 (linear)		20 (linear)
Max. pressure in bar (psi)	100 (1 450)		200 (2 900)		240 (3 481)		90 (1 305)		40 (580.1)
Measuring technology	RTD/TC						TC		RTD/TC

✅ **Benefits at a glance**

- Measurement and recording of a temperature profile for control of the process in the reactor or storage conditions in tanks and silos
- Shortest response time enabled by state-of-the-art sensor technology
- Easily configurable and globally available
- Coverage of all key applications in the oil & gas, chemical, food & beverage, petrochemical industries
- Increased safety thanks to a diagnostic chamber able to contain the process in the event of leakages through the primary seals

Temperature Engineered Solutions – TES

Fully customized temperature measurement solutions

Customized engineered temperature solutions — excellence in instrumentation, services and project support

Our solutions including tests, accessories and services are planned and executed specifically with the aim of satisfying challenging customer requirements. Engineering, selected materials and highest production standards guarantee instrument longetivity in all types of process media, pressure and temperature ranges.

✅ **Expertise from project start to finish**

- Active support during turn-around planning
- Design studies
- Installation and supervision
- Field tests, complete in-house validation test packages
- Immediate on-site or remote service and consultation
- Maintenance, training
- Comprehensive documentation package

Customized SkinPoint thermometers — for surface temperature measurement

✅ **Benefits at a glance**

- Continuous heat exchange monitoring
- No affection of the stream's steadiness or invasion into the pipe
- Engineered for maximum reliability — wide range of high-grade materials
- Compensation for thermal distortion with optimized expansion coils
- Quick & easy commissioning
- Compatibility with existing process connections
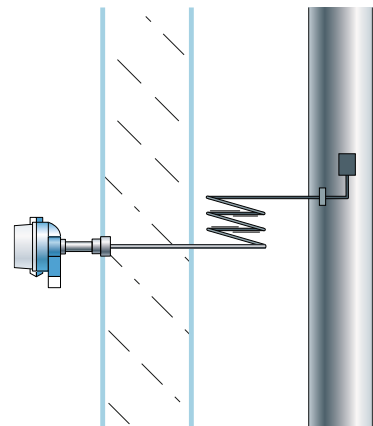
❗ For support during configuration or to order a customized Temperature Engineered Solution, please contact your Endress+Hauser sales representative.

Exclusive Endress+Hauser technology

Trend-setting innovations, from individual components to products

iTHERM QuickNeck

Divisible extension neck with tool-free quick release for easy & fast recalibration

More than 50% cost + time savings

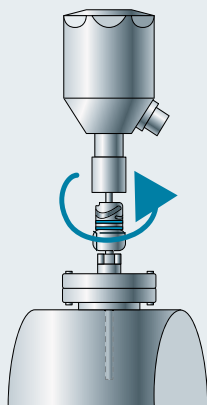- Removal of insert without any tools
- Terminal head can remain closed, connection cables remain connected
- No risk of water ingress, mechanical damage or wiring errors recalibration

Dual Seal

Pressure-triggered safety valve for critical applications
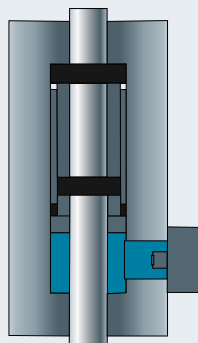
100% leakage detection

- Second process barrier for the case of thermowell failure/rupture
- Health monitoring & signal to PLC in case of activation
- Additional health information from measurement device
- Immediate sealing for containment of hazardous media

QuickLink

Thermowell with patented design to control the process at peak efficiency and performance
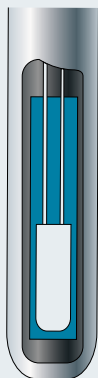
Up to 5x faster response times

- Optimized thermal coupling between insert and thermowell
- Applicable with replaceable standard inserts Ø 6 mm (0.25 inches)
- For temperatures up to +400 °C (+752 °F)

iTHERM TwistWell

Barstock thermowell with helix design for high velocity applications

> 90% reduction of vortex induced vibrations

- Static loads can be calculated acc. ASME PTC 19.3 TW
- Easy installation for all nozzle sizes starting from 1"/DN25
- Effectiveness of the design verified by an independent 3rd party agency

QuickSleeve

Insert for fast response times in combination with barstock thermowells

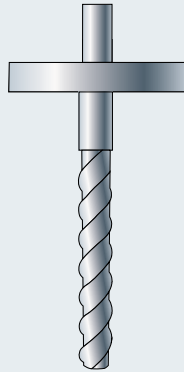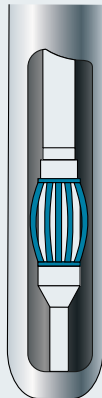Up to **2x** faster response times

- Bridging the usual airgap between insert & barstock thermowells for optimized thermal coupling
- Suitable for bore Ø 6,5 and 7 mm (0.26 inches)
- For temperatures up to +400 °C (+752 °F)

iTHERM TrustSens TM371/TM372

Thermometer with innovative self-calibration technology for hygienic applications
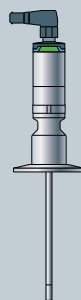
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iTHERM SurfaceLine TM611

Non-invasive thermometer with highest accuracy for demanding applications

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Sensor technologies

iTHERM QuickSens, ProfileSens, StrongSens

Quality assurance

Extensive range of measurement and test equipment

- Microscopy, UT, endoscopy and X-ray are used for **optical testing of the quality of welded and soldered joints.**
- **Material and manufacturing quality** is verified by means of dye penetration testing, ultrasonic testing, helium leak testing, pressure endurance testing, insulation and vibration testing, along with a range of material testing techniques that are also non-destructive.
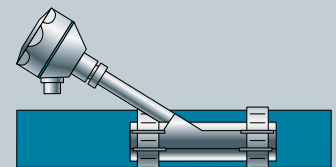- **Determination of response times** of the inserts with and without a thermowell in flowing water in an appropriate test facility in accordance with VDI/VDE 3522 or IEC EN 60751.
- Using high-precision **x-ray equipment**, the tiniest details can be detected in thermometers without having to open or destroy them.

Certificates

- **NACE (MR0175):** Suitability test of materials for acid gas surroundings by approval test NACE standard MR0175 listed in the EN 10204 - 3.1.
- **Penetrant testing:** according to the EN ISO 3452 as well as the ASME V and ASME VIII guidelines.
- **X-ray test certificate:** for thermowell welding seams in accordance with EN ISO 17636 or ASME V – ASME VIII.
- **Thermowell calculation:** according to DIN 43772 or ASME PTC 19.3 using customer specific pressure, temperature and flow rate values.
- **Helium leak test:** tracer gas method according to EN ISO 20485 or ASTM E499/ASTM E498 - sealing tightness test.
- **Pressure test:** Thermowell internal and external pressure test according to PED (Pressure Equipment Directive) in Europe or CRN (Canadian Registration Number) in North- and Central America.
- **Testimonials in accordance with paragraph 3.1 EN 10204** regarding material compositions (if necessary with smelt composition), surface roughness and ferrite content.
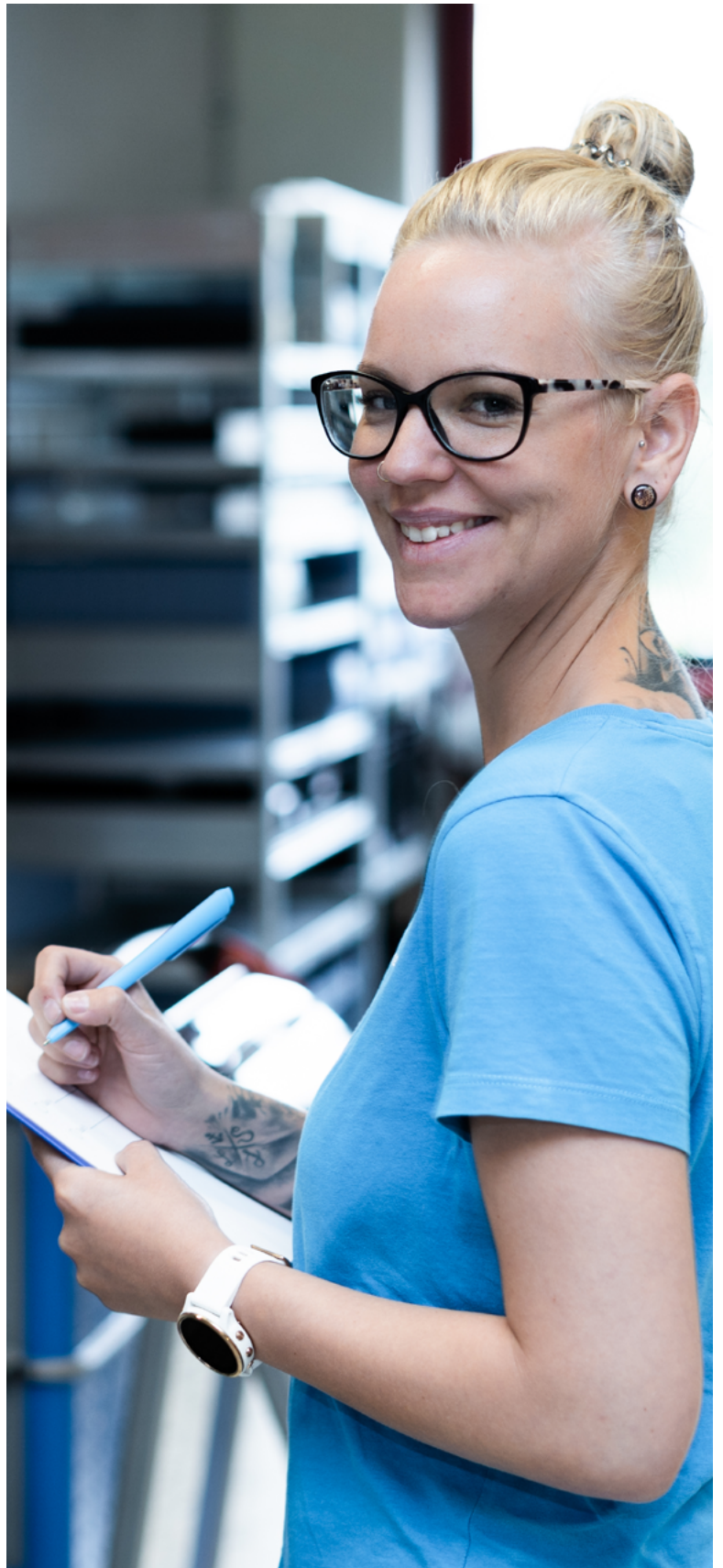
Calibration services
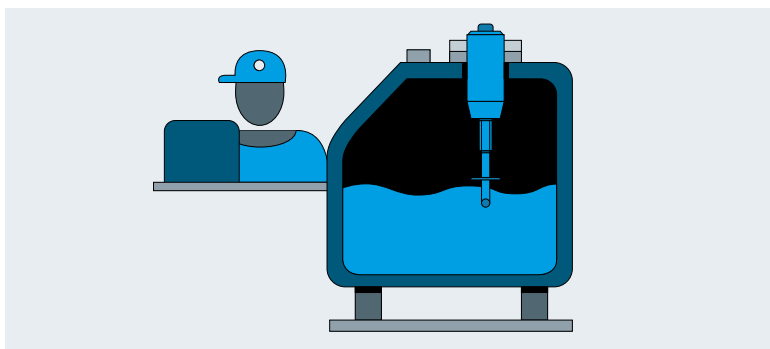
Calibration competence at a glance

- Worldwide calibration facilities, some of them accredited to ISO/IEC 17025
- Calibration of thermometers to the lowest possible measurement uncertainty and traceable to national standards and the ITS90 international temperature scale

Certificates

- **Detailed works calibration certificates** oriented to ISO 17025
- **Accredia-/DAkkS calibration certificates** with measurement results according to ISO 17025, calibrating uncertainties according to GUM or DIN V ENV 13005 and identification curve approximations like Callendar van Dusen coefficients

Calibration methods

- **Fixed point calibration** at the water triple point cell (0.01 °C) and the ice point (0.0 °C/32 °F) with a measurement uncertainty of < 5 mK and at the nitrogen fixed point of 196 °C (384.8 °F).
- **Comparison calibration** of resistance thermometers and thermocouples with precision thermometers from -80 to +300 °C (-112 to +572 °F) in very homogenous and stable calibration baths (measurement uncertainty 20 to 100 mK) and up to 1500 °C (2732 °F) in calibration furnaces with a measurement uncertainty as defined and approved by the accredition bodies.
- **High precision resistance measurements** (1 ppm accuracy) and thermo voltage measurements (sub-µV accuracy).
- **Sensor-transmitter matching** for additional reduction of the thermometer measurement uncertainty.

Netilion – the multi-brand ecosystem

Netilion is a cloud-based IIoT ecosystem, designed for industrial processes. It connects the physical and digital worlds to send valuable information from the field straight to your phone, tablet or other devices. Netilion empowers you to improve efficiency and drive innovation.

Multi-brand ecosystem

You have equipment from various vendors in your installation. An IIoT solution should provide data from as many assets as possible, and Netilion can do that. This multi-brand ecosystem brings transparency into a plant regardless of device type or manufacturer.

Security and privacy

Your facility's information is valuable and needs protection. Netilion allows users to access data digitally because it meets internationally recognized standards of cloud-platform security. It's a safe harbor for your data.

Decentralized processes monitored efficiently

- Reduction of routine checkup tours through comprehensive visualization of essential process variables, e.g. flow quantities, limit values, levels, temperature, pressure or physicochemical quality parameters
- Low operating costs through fast reaction in case of failure

Legal compliance thanks to automation

- Continuous measurement of quantitative and qualitative parameters
- Generation of legally compliant documentation thanks to integrated reporting systems

Data access around the clock

- Complete data access independent of time and place
- Numerous options to analyze and visualize ratios, amounts, thresholds, time series and trends, as well as balances
- Everything at a glance thanks to the web-based visualization of networks with optimized depiction for highly diverse terminal devices
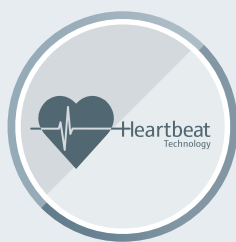
More about Netilion:
www.netilion.endress.com

5. Data fusion and analysis

Algorithms for leakage detection, verification, forecasts, etc.
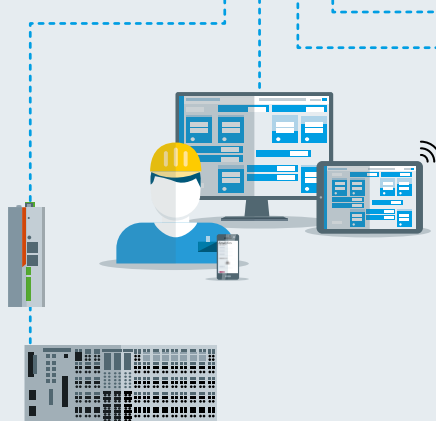
4. Data management and visualization

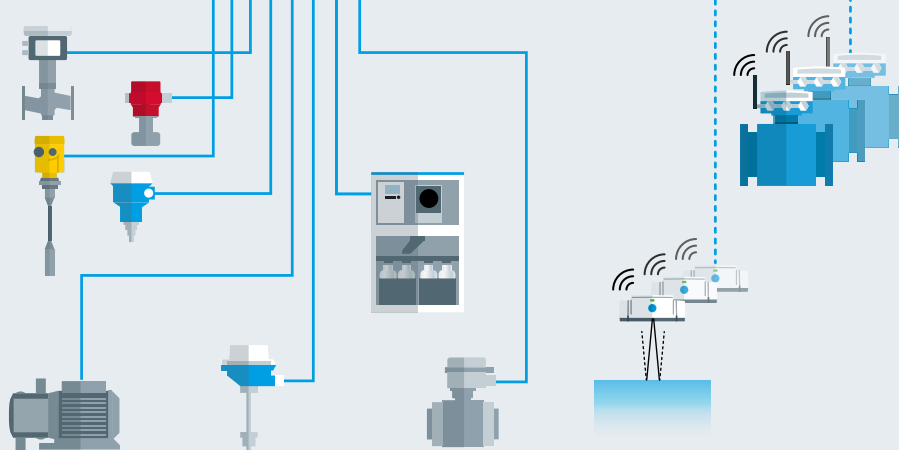Monitoring of networks and decentralized infrastructures

3. Data collection and transmission
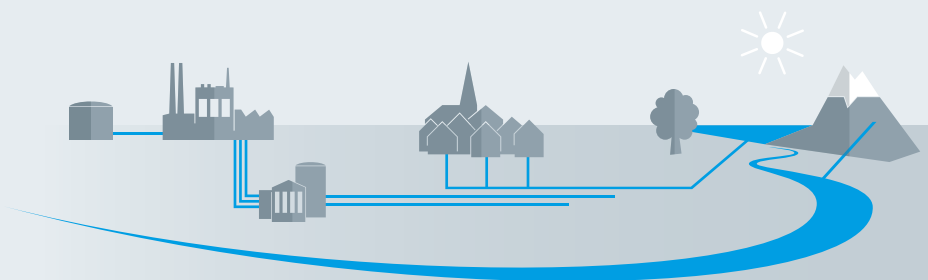
Flexible edge connectivity solutions

2. Data collection and control

Smart field devices and sensors (flow, analysis, pressure, level, temperature, etc.)

1. Physical world

Infrastructure (pipes, pumps, valves, etc.)

Netilion

Have you found "your" device? We would be pleased to send you further detailed technical information.

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People for Process Automation