

GP 15-02-01	Temperature Instruments	October 2008
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Temperature Instruments

GP 15-02-01

Scope

- 1) **[I]** This Global Practice (GP) covers the design and selection of temperature instruments and sensors.
- 2) **[I]** Additional temperature measurement requirements for specific process and equipment items, such as rotating equipment, fired heaters, motors, and storage tanks, may also be covered by the equipment-specific Practices.

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1. Required References

This Section lists the Practices, codes, standards, specifications, and publications that shall be used with this document. Unless otherwise specified herein, use the latest edition.

1.1. Global Practices–ExxonMobil Engineering Practices

GP 18-12-01	Positive Material Identification
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1.2. API–American Petroleum Institute

API RP 551	Process Measurement Instrumentation
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1.3. ASME–American Society of Mechanical Engineers

ASME B1.20.1	Pipe Threads, General Purpose (Inch)
ASME B16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B31.3	Process Piping
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME PTC 19.3	Part 3: Temperature Measurement Instruments and Apparatus (Performance Test Codes)

1.4. ASTM–American Society for Testing and Materials

ASTM A 249/A 249M	Standard Specification for Welded Austenitic Steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes
ASTM A 268/A 268M	Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service
ASTM A 276	Standard Specification for Stainless Steel Bars and Shapes
ASTM A 479/A 479M	Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels

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2. Additional Requirements

[*] This Section lists the additional Practices, codes, standards, specifications, and publications that shall be used with this document only where specified. Unless otherwise specified herein, use the latest edition.

2.1. Global Practices–ExxonMobil Engineering Practices

GP 15-07-02	Protective Systems
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2.2. API–American Petroleum Institute

API MPMS 7	Manual of Petroleum Measurement Standards - Chapter 7: Temperature Determination
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2.3. ASTM–American Society for Testing and Materials

ASTM E 230	Standard Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples
ASTM E 235	Standard Specification for Thermocouples, Sheathed, Type K and Type N, for Nuclear or for Other High-Reliability Applications
ASTM E 1137/E 1137M	Standard Specification for Industrial Platinum Resistance Thermometers

2.4. IEC–International Electrotechnical Commission

IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)
IEC 60751	Industrial Platinum Resistance Thermometer Sensors

2.5. NEMA–National Electrical Manufacturers Association

NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
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3. Basic Design

- 1) [S] [M] Thermowells are required for all temperature measuring devices used in flammable, toxic, or otherwise hazardous pressurized or vacuum systems. Thermowells are not required for temperature measurement of equipment, such as reactor shell skin, machinery bearings, or motor windings, where there is no risk to personnel from the process fluid during removal of the measuring element, or where radial thermocouples are used. Where a thermowell is not used, a permanent label shall be affixed to the primary element, indicating that there is no thermowell.
- 2) [O] Tip-sensitive elements shall be provided with a mechanical means of ensuring a solid thermal connection with the thermowell tip (spring loaded, compression fitting, etc.).
- 3) [A] [C] [O] For general temperature measurement and control, thermocouples shall be the preferred choice for the primary sensing elements. Alternatively, resistance temperature devices (RTDs) may be used, subject to approval by the Owner's Engineer. The choice would be based on temperature range span and/or accuracy.
- 4) [O] [R] Where specified by the Owner's Engineer, critical temperature control loops that use a thermocouple for the sensing element may be furnished with a second thermocouple as a check sensor. A comparison of measured values can be used as a diagnostic tool to determine possible drift and/or abnormal operations (e.g., start-up, shutdowns, etc.).
- 5) Use of a dual thermocouple in a single thermowell is the preferred method of supplying the check measurement. However, where issues such as intrinsic safety exist, the check thermocouple shall be installed in a separate thermowell within 18 in. (0.46 m) of the control thermocouple. Current applied technology (sheathing and transmitters) essentially eliminates the need for separate thermowells.
- 6) [O] [R] Temperature control loops and other critical loops (Safety Instrument Systems [SIS], etc.) shall use a field-mounted transmitter.
- 7) [R] A single thermocouple shall not be connected to more than one device. A single thermocouple signal needed at more than one receiver device shall first be converted to a standard current or voltage signal.
- 8) [A] [M] [R] The use of filled-system or bi-metallic temperature switches requires approval by the Owner's Engineer. Temperature switches shall be snap-acting type. Other temperature measuring elements may be used subject to approval by the Owner's Engineer.
- 9) [A] [O] [R] Thermocouple/thermowell installations, especially where the measured temperature is higher than 212°F (100°C), shall be designed to reduce the probability for water (condensation or rain) accumulation in the tip of the thermowell. Considerations shall include keeping the tip of the thermowell at or above the horizontal and providing a drain path for condensed water. Designs require approval by the Owner's Engineer.

4. Thermocouples

- 1) [R] Thermocouples for general service shall be mineral-insulated, metal-sheathed with the following construction:

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