

Glossary

absolute zero - the lowest possible theoretical temperature. Defined as -273.15°C (0 K).

accuracy - the degree of agreement between a reference value and a measured value.

adiabatic - without loss or gain of heat within a process.

adjusting device (liquid-in-glass thermometer) - a device to adjust the liquid in the bulb and main capillary to that needed for the intended temperature interval.

alpha - (1) the temperature coefficient of resistance of a material. (2) a parameter for a resistance temperature detector.

ambient temperature - the temperature of the surrounding air which is in contact with the measuring devices.

boiling point - the equilibrium temperature is the temperature at which a liquid becomes a vapor. For water this is 100°C (212°F) at standard atmospheric pressure.

bulb (liquid-in-glass thermometer) - the reservoir for the thermometer liquid.

bulb length (liquid-in-glass thermometer) - the distance from the bottom of the bulb to the point where the internal bulb diameter begins to decrease as the bulb merges into the stem.

BTU (British thermal unit) - Defined as the quantity of heat necessary to raise the temperature of one pound of water from 32°F to 33°F (at standard atmospheric pressure).

calibrate - to determine the indication or output of a measuring device with respect to that of a standard.

calibration drift - a change in thermoelectric output due to unwanted environmental stress.

calibration point - a specific value, established by a standard, at which the indication or output of a measuring device is determined.

"Callendar Van Dusen Equation" - a function of temperature which provides resistance values as an interpolation equation for RTD's.

Celsius - the designation of the degree ($^{\circ}\text{C}$) - on the International Temperature Scale of 1990 (ITS-90). Formerly (prior to 1948) called "centigrade".

certification - to state that a test result is valid and/or a product that is as specified.

color code - the arrangement of standard colors for identifying thermocouple wires.

compensating alloys - a metal alloy which has the same or similar Seebeck coefficient as an actual thermocouple alloy.

connection head - a protective housing enclosing a terminal block for an electrical temperature-sensing device. Usually provided with threaded openings for attachment to a protecting tube and for attachment of conduit.

creep strength - the rate of continuous deformation under stress at a specified temperature. Generally expressed as PSI to produce a 1% elongation in 10,000 hours at the temperature indicated.

corrosion - a variety of environmental conditions which causes deterioration of a metal.

cryogenic - a term that relates to temperatures well below the ice point.

curie point - magnetic transformation point, or the temperature at which a normally magnetic material becomes substantially non-magnetic.

defining fixed points - the reproducible temperatures upon which the International Temperature Scale is based.

degree - the unit of measure on a temperature scale.

deviation - the departure from a standard or known value. Often referred to as "Delta".

DIN 43760 - the standard (obsolete) that defines the characteristics of a 100-ohm platinum resistance temperature detector; established by the European Industrial complex that formulates engineering standards.

drift - the change over a period of time of a set-point value.

ductility - The property of a material which permits deformation without rupture.

duplex - (1) a sensor with two separate elements. (2) A pair of wires made with the conductors insulated from each other.

elastic limit - the maximum stress a material will stand without permanent deformation.

electromotive force (emf) - the electrical potential difference which produces or tends to produce an electric current.

elongation - the amount of permanent stretch after fracture in tension.

endothermic - the absorption of heat.

error - the variant between the value being measured and the correct value.

exothermic - the loss of heat.

exposed junction - a construction in which the measuring function of the sensor protrudes beyond the sheath or a similar tube protecting it.

extension wire - a pair of wires having such temperature-emf characteristics relative to the thermocouple with which the wires are intended to be used that, when properly connected to the thermocouple, the reference junction is transferred to the opposite of the wires.

Fahrenheit - the designation of the degree ($^{\circ}\text{F}$) and the temperature scale used commonly in public life and engineering circles in English-speaking countries.

fixed point - a reproducible temperature of equilibrium between different phases of a material.

freezing point - the fixed point between the solid and liquid phases of material when approached from the liquid phase under a pressure of one standard atmosphere. For a pure material this is also the melting point.

grounded junction - a construction in which the measuring junction and the sheath material are in electrical contact with each other.

hardness - a resistance of a material to indentation, penetration, scratching or bending.

heat - thermal energy expressed in British thermal units (Btu's).

heater (metal sheathed, electrical resistance) - one consisting of resistance wire or wires, with or without connecting wires, embedded in ceramic insulation compacted within a metal protecting tube.

heat sink - a body where thermal energy is absorbed.

heat transfer - thermal energy is transferred from a body of high energy to a body of low energy.



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hot junction - the thermocouple measuring junction.

hysteresis - a metallurgical instability or in-homogeneities caused by temperature cycling of elevated temperatures.

ice point - the fixed point between ice and air-saturated water under a pressure of one standard atmosphere. This temperature is 0°C (273.15 K) on the International Temperature Scale of 1990 (ITS-90).

IEC-751 - the current standard that defines the characteristics of a 100-ohm platinum resistance temperature detector; established by the International Electrotechnical Commission (IEC).

International (Practical) Temperature Scales - temperature scales adopted by various conferences on weights and measures are defined in terms of fixed and reproducible equilibrium temperatures. (1) IPTS-48 standard established in the year 1948 (2) IPTS-68 supersedes above scale in 1968 (3) ITS-90 the current reference standard

immersion depth - the length of the sensor which is exposed to the temperature being measured.

impedance - the resistance to electrical flow in alternating current circuits.

insulation resistance - the electrical resistance between isolated conducting materials in a circuit consisting of both conducting and insulating materials.

intrinsically safe - a system or device which inherently poses no risk of causing a spark that could cause ignition of flammable gases.

isothermal - a constant temperature area.

junction - the point at which two dissimilar metals are joined to become the measuring point of a thermocouple.

Kelvin - designates the thermodynamic temperature scale named after Lord Kelvin. Degrees (K) on this scale are of the same magnitude as the Celsius scale.

lag - (1) a delay of time of the signal between the output of the sensor and the measuring device. (2) the "T" dimension of a thermowell which has an extension above the mounting threads.

limits of error - a tolerance for thermoelectric devices as set forth by ANSI specifications.

linearity - the extent to which an instrument or transducer's relative response varies with respect to its input.

loop resistance - the total electrical resistance of a thermocouple circuit expressed in Ohms.

lower range value - the lowest quantity that an instrument is adjusted to measure.

measuring junction - that junction of a thermocouple which is subjected to the temperature to be measured.

melting point - the fixed point between the solid and liquid phases of a material when approached from the solid phase under a pressure of one standard atmosphere. For a pure material this is also the freezing point.

negative temperature coefficient - a decrease in resistance when the temperature is increased.

noise - an undesirable electrical interface.

NPT - abbreviation for American National Standard taper pipe thread.

parallax - an incorrect reading of a measuring device caused by the viewing edge not being perpendicular to same, causing an optical illusion.

Peltier coefficient - the reversible heat flow, which is absorbed or evolved at a thermocouple junction when unit current passes in unit time.

Peltier emf - synonymous with Peltier coefficient.

platinum 27 - the platinum standard to which the National Bureau of Standards referenced thermoelectric measurements prior to 1972.

platinum 67 - the platinum standard used by the National Bureau of Standards after 1972 as the reference to which thermoelectric measurements are referred.

polarity - an electrical characteristic of a charged current determining a positive and negative flow.

positive temperature coefficient - the increase in resistance with an increase in temperature.

power supply - a device that furnishes separate power to a circuit.

primary standard resistance thermometer - a resistance thermometer that has had its temperature-resistance relationship determined in accordance with methods described in the text establishing the International Temperature Scale.

primary standard thermocouple - a thermocouple that has had its temperature-emf relationship determined in accordance with methods described in the text establishing the International Temperature Scale.

probe - a term used to describe thermocouples and other temperature measuring devices.

PSI - the usual unit of stress in pounds per square inch.

protecting tube - a tube designed to enclose a temperature-sensing device and protect it from the deleterious effects of the environment. It may provide for attachment to a connection head but is not primarily designed for pressure-tight attachment to a vessel.

range - the region between the limits within which a quantity is measured. It is expressed by stating the lower and upper range-values.

reference junction - that junction of a thermocouple which is at a known temperature.

refractory metal thermocouple - a thermocouple whose thermoelements have melting points above that of 60 percent platinum, 40 percent rhodium, 1935°C (3515°F).

repeatability - the action of a sensor to indicate the same reading or output under repeated identical conditions.

resistance - the opposition to the flow of an electrical current.

resistance, insulation (sheathed thermocouple wire) - the measured resistance between wires or between wires and sheath multiplied by the length of the wire expressed in Meg Ohms per foot of length.

response time - the time required for a sensor to reach 63.2% of a step change in temperature.

RFI - the abbreviation for Radio Frequency Interference.

RTD - the abbreviation for a Resistance Temperature Detector.

secondary reference point - reproducible temperatures other than the fixed points; Defined in the ITS, as being useful for calibration purposes.

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secondary standard thermocouple - a thermocouple that has had its temperature-emf relationship determined by comparison to a primary standard of temperature.

Seebeck coefficient - the rate of change of thermal emf with temperature at a given temperature. Normally expressed as emf per unit of temperature. Synonymous with thermoelectric power.

Seebeck emf - the net emf set up in a thermocouple under open circuit conditions. It represents the algebraic sum of the Peltier and Thomson emf. Synonymous with thermal emf.

sheathed thermocouple - a thermocouple having its thermoelements, and sometimes its measuring junction, embedded in ceramic insulation compacted within a metal protecting tube.

signal - information from a transducer, normally carried electrically. This information can be of either digital or analog form.

span - the algebraic difference between the upper and lower range values.

spark test - a test to detect insulation requirements.

specific gravity - the ratio of the weight of a solid or liquid to the weight of an equal volume of water.

specific heat - the amount of heat necessary to raise the temperature of a substance by 1°F. Expressed as BTU per pound per °F.

specific resistance - the resistance of a material, usually a metal or alloy, to the passage of an electric current.

stability - a sensor's ability to maintain a consistent output when a consistent input is applied.

standard thermoelement - a thermoelement that has been calibrated with reference to pre-determined international standards.

tensile strength - the stress required to rupture in tension (pull). Expressed in PSI.

test thermocouple - a thermoelement that is to be calibrated by comparing its thermal emf with that of a standard thermoelement.

thermal conductivity - the measure of heat a substance will conduct through itself.

thermal electromotive force - the net emf set up in a thermocouple under conditions of zero current. Synonymous with Seebeck emf.

thermal expansion - the increase in length caused by heating. Expressed in inches of increase, per inch of original length, per degrees of temperature.

thermocouple - a device for measuring temperatures by the use of two dissimilar metals in contact; the junction of these metals gives rise to a measurable electrical potential that changes with temperature.

thermocouple assembly - an assembly consisting of a thermocouple element and one or more associated parts such as terminal block, connection head, and protecting tube.

thermocouple element - a pair of bare or insulated thermoelements joined as one end to form a measuring junction and intended for use as a thermocouple or as part of a thermocouple assembly.

thermocouple (letter designated types B, E, J, K, N, R, S, or T) - a thermocouple having an emf-temperature relationship corresponding to the appropriate letter-designated table in ASTM E-230 standard "Temperature Electromotive Force Tables for Thermocouples", within the limits of error specified in that standard.

thermoelectric power - the rate of change of thermal emf with temperature at a given temperature. Synonymous with Seebeck coefficient. Normally expressed as emf per unit of temperature.

thermoelectric pyrometer - an instrument that senses the output of a thermocouple and converts it to equivalent temperature units.

thermoelement - one of the two dissimilar electrical conductors comprising a thermocouple.

thermopile - a number of thermocouples connected in series, arranged so that alternate junctions are at the reference temperature and at the measured temperature. This arrangement serves to increase the output for a given temperature difference between reference and measuring junctions.

thermowell - a tube designed for the insertion of a temperature-sensing element(s), and provided with means for pressure-tight attachment to a vessel.

Thomson coefficient - the rate at which heat is absorbed or evolved reversibly in a thermoelement.

Thomson emf - the product of the Thomson coefficient and the temperature difference across a thermoelement.

transducer - a device which receives and converts energy into another parameter.

transmitter - an externally powered variable resistor which transmits a signal from a transducer via a two wire current loop.

triple point (of water, TPW) - the temperature of equilibrium between ice, water and water vapor. This temperature is to 0.01°C (273.16 K) on the International Temperature Scale of 1990.

ungrounded hot junction - the construction of the measuring junction of a thermocouple which is fully insulated from the enclosing protective material.

upper range value - the highest quantity that an instrument is adjusted to measure.

working standard thermocouple - a thermocouple that has had its temperature - emf relationship determined by reference to a secondary standard of temperature.

yield strength - the stress at which a material exhibits a specified limit. Expressed as PSI.