Thermocouple general information

What is Thermocouple Wire?

Wire that is used in a thermocouple from the point of sensing to the point of cold junction compensation (cjc end) where the signal is measured. A thermocouple is a sensor for measuring temperature, that consists of two dissimilar metals that are joined together at the sensing end. Different thermocouple types (e.g. J, K, T, E, etc) use different mixtures of metals in the wire. At the cjc end, the millivolt value provided by the thermocouple represents the difference in temperature of the sensing end as compared to the cjc end (also called the reference end).

How are insulated thermocouple wires identified?

The insulation on thermocouple wire is color coded for identification. Common guidelines include that the negative lead in insulated thermocouple wire is red. The positive lead has the color of the thermocouple as well as the overall color of insulated extension grade wire. The outer jacket of thermocouple grade wire is typically brown. For high temperature wire, it is common to have a color coded tracer thread in the white material. For information on usable temperature ranges for the insulation see the "Wire Insulation Identification" table. Other tables at this link are also available for information on the metals used in the thermocouple wire, insulation color codes, and more.

What is the difference between Standard and Special Limits of Error (SLE) wire?

Standard vs SLE (special limits of error) wire has to do with accuracy of the wire. SLE wire is the same as standard wire with the added feature of having a little better accuracy spec. Accuracy of thermocouples vary with thermocouple types. e.g. For the lower temperature ranges type T, composed of copper wire in the positive lead and constantan (copper-nickel mixture) for the negative, has good accuracy specifications. Additional information on accuracy.

What is the difference between Thermocouple grade and Extension grade wire?

Thermocouple grade wire is wire that is used to make the sensing point (or probe part) of the thermocouple. Extension grade wire is only used to extend a thermocouple signal from a probe back to the instrument reading the signal. The extension grade wire typically will have a lower ambient temperature limit in which the wire may be used. Namely, it may pass a signal representing a higher temperature as received from the probe, but the wire physically may not be exposed to higher temperatures. Thermocouple wire may be used as extension wire, but extension grade wire may not be used in the sensing point (or probe part) of the thermocouple. Part numbers for extension wire typically begin with an "X" suffix.

Thermocouple Type Information

A thermocouple is a temperature measuring device consisting of two conductors of dissimilar metals or alloys that are connected only at the ends. When the ends are at different temperatures a small voltage is produced in the wire that can be related directly to the temperature difference between the ends. If the temperature at one end is known, the temperature at the other end can be determined. Thermocouple wire or extension grade wire is recommended to be used to connect thermocouples to the sensing or control instrumentation. The conditions of measurement determine the type of thermocouple wire and insulation to be used. Temperature range, environment, insulation requirements, response, and service life should be considered.

Calibration Type Characteristics

TYPE J (Iron vs Constantan) is used in vacuum, oxidizing, inert or reducing atmospheres. Iron element oxidizes rapidly at temperatures exceeding 538'C, and therefore heavier gauge wire is recommended for longer life at these temperatures.

TYPE K (CHROMEL vs ALUMEL) is used in oxidizing, inert or dry reducing atmospheres. Exposure to vacuum limited to short time periods. Must be protected from sulfurous and marginally oxidizing atmospheres. Reliable and accurate at high temperatures.

TYPE T (Copper vs Constantan) is used or service in oxidizing, inert or reducing atmospheres or in vacuum. It is highly resistant to corrosion from atmospheric moisture and condensation and exhibits high stability at low temperatures. It is the only type with limits of error guaranteed for cryogenic temperatures.

TYPE E (CHROMEL vs Constantan) may be used in oxidizing, inert or dry reducing atmospheres, or for short periods of time under vacuum. Must be protected from sulfurous and marginally oxidizingatmospheres. Produces the highest EMF per degree o any standardized thermocouple.