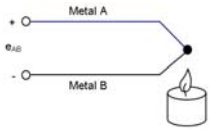
Selecting and Using Thermocouples

What are thermocouples (TC)?

When two wires composed of dissimilar materials are joined at one end and the end is heated, a open circuit voltage (Seebeck voltage, e_{AB}) is a function of the junction temperature and the composition of the two metals. By measuring this voltage temperature can be measured indirectly.



Why is proper use of TC important?

If thermocouples are not selected, installed and used properly wrong temperature readings are recorded.

Choosing the TC

Choose the thermocouple type according to the application:

Temp. Range	Environment	TC Type
-10 to 40ºC	RH up to 100%, humid, condensation might occur	K, T
30 to 120 ºC	relatively dry	K, T
ambient to >500 ºC	dry, oxidizing flue gasses	J, K,

Unfortunately there are many different national standards for color coding of Thermocouples (Table 1). When trying to determine the type of an unknown thermocouple it therefore helps to know where it came from.

Using Thermocouples

To have the best possible results:

- Use largest possible wire but consider that it should not transfer heat away from the measuring location
- If a small wire is needed use only a short length close to the measurement location and use extension wire to connect to the instrumentation
- For long thermocouple wires consider twisted pair extension wire and shielded wires with the shield connected to the ground of the terminal
- Avoid steep temperature gradients in the wire
- Avoid mechanical stress and vibrations
- Choose the TC type according to the Table on the left
- Use extension wire only at low temperatures and in regions of small temperature gradients
- Keep an event log and continuous record of thermocouple resistance
- If available use a data logger with integrated temperature compensation

Table 1: National and international color coding of thermcouple and extension grade wires

ANSI Code	Thermocuple grade	Extension grade					International	International *Intrinsi-cally Safe*
Standard			DIN 43710	JIS C 1610-1981	NFC 42-324	BS 1843	IIEC 584-3	IEC 584-3
J								
K								
T								

Further Readings

Thermocouple Table downloads:
http://www.temperatures.com/tctables.html
Thermocouple Color Codes:
http://www.omega.com/techref/thermcolorcodes.html
Practical Temperature Measurements.
In The Temperature Handbook, Omega

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