



# PRINCIPLES OF THERMOCOUPLES & RTD'S

## — THERMOCOUPLES —



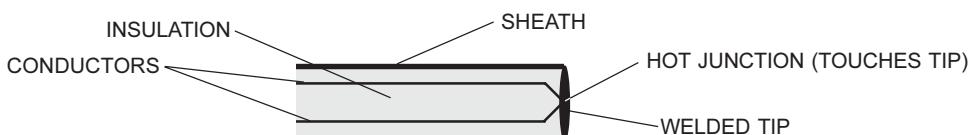
### GENERAL INFORMATION

Thermocouples are the most widely used devices to measure temperature. In their simplest form they consist of a welded junction, called the hot junction, between two dissimilar metals (e.g. - iron & constantan, Type J) and a reference junction at the other end of the lead wires. The hot junction will create an EMF, which can be measured at the reference junction, that corresponds to a specific temperature. Advantages of using a thermocouple include a wide temperature range, ruggedness, fast response time, and low cost. **PPE Thermocouples are ROHS Compliant.**

### JUNCTIONS

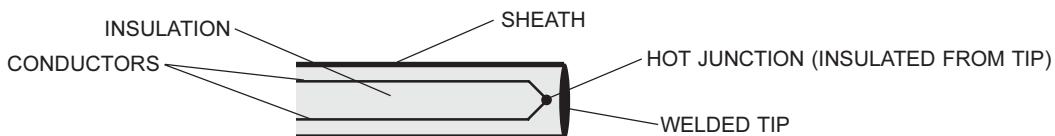
Grounded - In grounded thermocouples, the conductors are contained in a sheath with mineral insulation, but the actual hot junction is welded to the end of the sheath (see figure #1). This provides a great deal of ruggedness and environmental protection without sacrificing too much response time. The disadvantage of this construction is that there is no protection if stray voltages come in contact with the sheath. Grounded construction is the most commonly used construction in the Plastics Industry. Unless otherwise specified all PPE thermocouples are grounded.

FIGURE #1



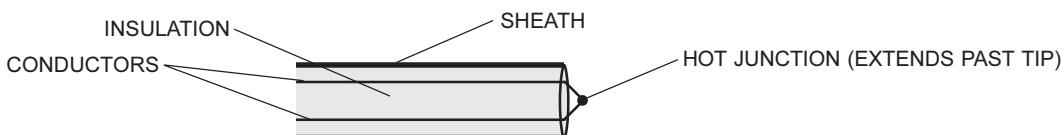
Ungrounded (Insulated) - The ungrounded construction is similar to the grounded construction except the hot junction is totally contained within the sheath (see figure #2). This provides complete isolation from any foreign voltage that may be present in the application. The drawback with this construction is response time, as it takes more time for the heat to penetrate the insulation and reach the hot junction.

FIGURE #2



Exposed - In this construction, the conductors actually extend beyond the sheath or there is no sheath at all (see figure #3). This provides excellent response time, but no protection from the environment or stray voltages. Exposed thermocouples are relatively fragile.

FIGURE #3



### CALIBRATION (TYPE)

As mentioned earlier, thermocouples are made of two dissimilar metals. The specific metals used determine the type of thermocouple. Over 90% of thermocouples used in the Plastics Industry are Type J (Iron/Constantan). The remaining are usually Type K (Chromel/Alumel). Check your machine or temperature control to determine which type you need.

## — THERMOCOUPLE vs. RTD —

FACTOR	THERMOCOUPLE	RTD
COST	LOWER	HIGHER
ACCURACY	GOOD	BETTER
RESPONSE TIME	FASTER	SLOWER
TEMPERATURE RANGE	-450°F TO 4000°F	-400°F TO 1500°F
DURABILITY	GOOD	FRAGILE
MEASURING AREA	TIP SENSITIVE	STEM SENSITIVE



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