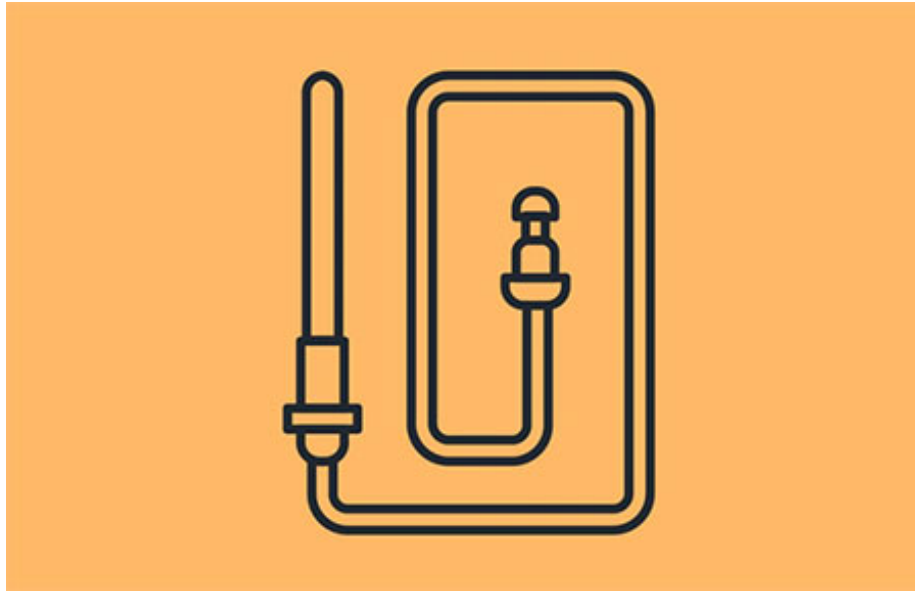


Rules of Good Thermocouple Practice

By: - August 13, 2020



(abcimg://icon%20of%20a%20thermocouple)

With proper installation and normal conditions, [thermocouples](/en/products/sensors/thermocouples) can be depended upon to give trouble-free service and long life. Occasionally though, difficulties may be encountered resulting from improper application or operation. This short guide serves to help thermocouple users obtain the accuracy and economy for which the thermocouple alloys are produced.

Protect thermocouples in service

Evaporation, diffusion, oxidation, corrosion and contamination induce electromotive force (EMF) drift due to their effect on the composition of thermocouple alloys. As much as these environmental factors are destructive to all common thermocouple materials, it is essential that proper protection be provided whenever adverse conditions are encountered. In many applications, this requirement can be met using sheathed unit construction.

If bare wire thermocouples are used, the thermoelements must be properly installed in suitable protection tubes. When the interiors of such tubes are clean and free of sulphur-bearing oils, refractories, etc.—and when they are of the proper diameter-to-length ratios to permit adequate ventilation inside — they serve admirably in overcoming the harmful effects of a corrosive atmosphere.

Use the largest practical wire size

It is generally true that heavy gauge thermocouples are more stable at high temperatures than their finer gauge counterparts. In many applications, however, a heavy gauge thermocouple will not satisfy the requirements for flexibility, rapid response, equipment geometry and the like. A compromise must

then be struck between long-term stability of heavy sizes and greater versatility of smaller thermocouples. Where high temperature stability is a substantial consideration, use the largest practical wire size consistent with the other requirements of the job.

Install the thermocouple in a proper location

The location selected for the installation of the thermocouple should ensure that the temperatures being measured are representative of the equipment or medium. Direct flame impingement on the thermocouple, for example, does not provide a representative temperature.

Provide for a sufficient immersion depth

Since heat conducted away from the “hot” junction causes the thermocouple to indicate a lower temperature, provide for sufficient depth of immersion of the thermocouple into the medium being measured to minimize heat transfer along the protection tube. As a rule, a minimum immersion of 10 times the outside diameter of the protection tube should be used.

Avoid changing the depth of immersion

Under certain conditions, inhomogeneities may gradually develop in a pair of thermocouple wires due to oxidation, corrosion, evaporation, contamination or metallurgical changes. A change in depth of immersion, which shifts such inhomogeneous wire into a steep temperature gradient zone, can alter the thermocouple output and produce erroneous readings. Therefore, avoid changing the depth of immersion of a thermocouple after it has been in service.

Recognize the effect of heating cycles

For maximum accuracy, a thermocouple should be used to control a single temperature, or successively higher temperatures only. For various reasons, however, this procedure cannot always be followed. In many installations, thermocouples continually traverse a broad range of temperatures, with wholly adequate results.

Errors which arise out of cyclic heating are analogous to those generated by changes in immersion and may range from two- or three-degrees Fahrenheit for thermocouples in good condition, to many degrees for badly corroded couples. Therefore, the type of heating cycle and condition of the thermocouple mutually impact the accuracy obtainable in a specific location. Where cyclic heating cannot be avoided, use top condition thermocouples for maximum accuracy.

Establish a preventive maintenance program

Thermocouples, protection tubes and extension wire circuits should be checked regularly. Experience largely determines the frequency of inspection, but once a month is usually sufficient.

Check extension wire circuits by making certain that they meet the established external resistance requirement. Damaged or burned out protection tubes should be replaced to prevent damage to the thermocouple.

Thermocouples should be checked in place, if possible. If it is necessary to remove the thermocouple, it should be reinserted to the same depth or deeper to avoid errors arising from placing an inhomogeneous segment of wire in a steep temperature gradient.