

## Type “N” Thermocouples

Dr. Noel Burley of the Australian defense command developed the Type N Thermocouple in the 1970's. It is the most recent ISA Letter Designated thermocouple having obtained letter designation in 1983. It was designed to minimize some of the instabilities of the conventional Chromel-Alumel Type K combination. It differs from Type K in the addition of Silicon in both the NP and NN wires and an increase in the Chromium content of the NP wire. The NN wire also contains a small amount of Magnesium.

This thermocouple has an EMF output and Seebeck Coefficient similar to that of a Type K and covers an equivalent temperature range. It has lower drift rates at temperatures up to 1200 C., it does not exhibit the short range ordering problem of the Type K and it is less susceptible to “Green Rot” compared to a Type K. Type N Thermocouples can be used in the same environments as Type K. Error tolerances on the Type N are the same as the Type K and ASTM has published both thermocouple tables and polynomials describing the emf response of Type N just as it has for all other Letter Designated Thermocouples. It is somewhat surprising that the Type N has not seen greater use.

Data from the literature and experience in our laboratories confirm that the Type N thermocouple is more stable and drifts at a lower rate. The graph below from a publication by Dr. Richard Anderson of Oak Ridge National Laboratories helps illustrate this point. Small diameter Type K and Type N thermocouples in Inconel and Stainless Steel sheaths were tested for drift at 1200 C. Note that while all of the sensors began

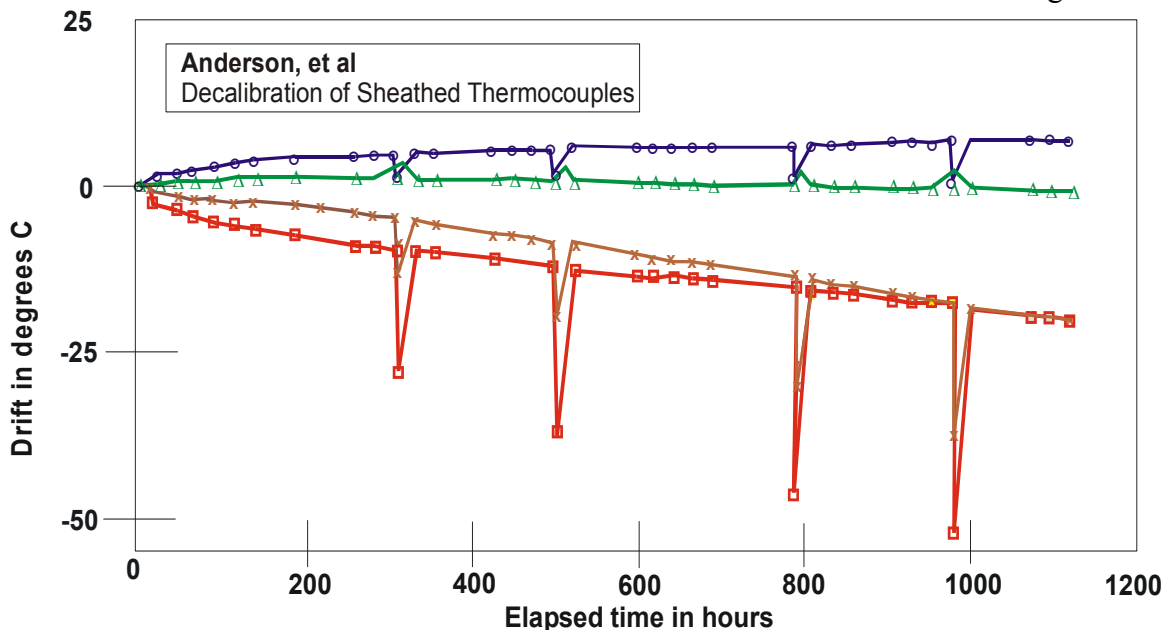


Fig. 30. Drift of 3-mm-diameter stainless steel-sheathed and Inconel 600-sheathed type K and Nicrosil versus Nisil thermocouples at 1200 C in vacuum. The dips in the drift curve are the result of the "in-place inhomogeneity test" where the samples were extracted from the furnace by 5 cm. The symbols used for the various samples are: type K in Inconel - circles; Nicrosil versus Nisil in Inconel - triangles; Nicrosil versus Nisil in stainless steel - crosses; and type K in stainless steel - squares.

drifting almost immediately at these severe conditions, the two Type N couples (triangles and crosses) show lower initial drift rates and hence greater stability than the two Type K's. We see similar results in our laboratories.

We believe that for most applications Type N is superior to Type K. We think that the reluctance to change to Type N is due to the very large installed base and experience with Type K. Many systems have been built around Type K over the years and some of them are not easily modified. With the advances in electronics most signal conditioning units and smart transmitters now come with multiple calibration options including the Type N. Process instrumentation systems are slowly being modernized and more capability is being demanded of instrumentation and control systems. This should lead to greater use of the Type N in the future because of its obvious benefits.

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Ref: Anderson, R.L., et.al., DECALIBRATION OF SHEATHED THERMOCOUPLES,  
Temperature, (1982) pp 997-1007