A Novel Method to Determine the Effects of Stem Conduction in Resistive Thermometers

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Abstract

One of the large problems in measuring temperature using a platinum resistance thermometer or a thermistor is the effect of stem conduction or lack of immersion. This stem effect causes these thermometers to read closer to ambient temperature than the media they are being used to measure. A user of one of these devices may apply a correction to the readings of the instrument to account for stem conduction. However, such a correction comes with large uncertainty. If the stem effect is not accounted for by a measurement correction or measurement uncertainty, a measurement error results. This error may be rather large.

The effects of stem conduction may be determined by measuring the thermometer in a media of uniform temperature such as a stirred liquid bath. This type of measurement is done by taking temperature readings at several immersion depths. This method may show inaccuracies due to temperature non- uniformity. This type of data only applies to the particular medium used, as other media have different heat transfer properties. This method is cumbersome, and personnel outside calibration laboratories may not have the equipment to perform such tests. It also reveals nothing about the sensor length of the thermometer.

This paper speaks to a method to investigate the effects of stem conduction and the sensor length of a thermometer using a simple small wattage heater. This method is simple to do. The paper goes into testing done to investigate the effect of thermal transfer on the probes' readout resistance. It compares these results to stem conduction testing using thermally uniform heat sources.