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**EMISSION MEASUREMENT CENTER**  
**APPROVED ALTERNATIVE METHOD (ALT-011)**

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**ALTERNATIVE METHOD 2**  
**THERMOCOUPLE CALIBRATION PROCEDURE**

**INTRODUCTION**

In EPA Method 2, EPA recommended the use of an extrapolation technique for a simplified, post-test, thermocouple calibration procedure using a two point calibration: (1) ice bath and (2) boiling water. Because of the inherent accuracy and precision of the thermocouple within  $\pm 1.3^{\circ}\text{F}$  in the range of  $-32^{\circ}\text{F}$  to  $2500^{\circ}\text{F}$ , the two-point post-test calibration procedure may be replaced with a single-point check.

A single-point calibration procedure that checks the operation of a thermocouple system within  $\pm 1.0$  percent of the absolute measured temperature is all that is necessary to check the system for the presence of disconnected wire junctions, other loose connections, or a potential miscalibrated emf readout. A system that performs accurately at one temperature is expected to behave similarly at other temperatures.

Therefore, an alternative to the Method 2, two-point, thermocouple calibration can be used and the procedure is as follows:

**ALTERNATIVE POST-TEST AND RECOMMENDED PRETEST CALIBRATION PROCEDURE**

After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacture, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall agree to within  $\pm 2^{\circ}\text{F}$ .

A crimp in the connecting wires or crossed lines that change the location of the reference junction will affect readings. Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

To ensure linearity of the measurements, it is recommended that the emf meter be originally calibrated against a NIST traceable or a comparable voltage source at several points covering the range of intended use, e.g., 0, 500, 1000, and  $2000^{\circ}\text{F}$ .

**REFERENCE**

1. Shigehara, R.T., E.W. Stewart, Kenneth Alexander, "Simplified Thermocouple Calibration Procedure", Entropy, Incorporated, contained in the EMTIC TSAR Library.

