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From: PHMC_Lessons_Learned@rl.gov
Subject: Blue Alert: Problems Detected in Thermocouples

Title: Blue Alert: Problems Detected in Thermocouples

Date: September 5, 2001 Identifier: 2001-NV-NLVBN-035

Lessons Learned Statement: Measuring devices should be adequately inspected and tested prior to installation to ensure good data.

Discussion: A laboratory received a large quantity of new type T thermocouples from a customer to test prior to installation in a complex temperature measuring system. Two problems were quickly discovered during the inspection and testing process:

1. At the output, the two leads had been separated by shrink tubing. During this process the insulation on both leads had been cut back leaving bare wires. This made it possible for the wires to short together creating a "pseudo" thermocouple junction which would indicate the equivalent temperature at that "junction" rather than the temperature at the tip. This occurred intermittently depending on the positioning of the two wires. The suggested correction was to strip back the two leads, confirm mutual insulation, and reapply the shrink tubing if required.
2. The second problem was in some cases shrouded by the first. A thermocouple opens presumably at or near the tip. Some of the thermocouples being inspected/tested were found to be permanently open and others by a very minor movement of the sheet metal mounting assembly would open and/or unite to give an indication. Visual inspection revealed no identifiable differences between the good and the bad thermocouples. There was no suggested correction for this problem since it appeared that the actual annealing of the thermocouple junction was faulty.

Analysis: There is always a risk in assuming that any product purchased, whether in bulk or in limited quantities, will perform as advertised or desired. The purchaser must evaluate the application or use of the product and determine if a simple inspection is sufficient to identify a product deficiency or if testing or calibration by a qualified calibration laboratory prior to use is required. In the case of the approximately 680 thermocouples which were slated to be installed in a complex temperature measuring system, the defective items would have given false indications and probably impacted the project's technical objectives. If the defective thermocouples had been installed without testing, they would have to have been diagnosed and repaired on an individual basis resulting in excessive costs to the project. The principles of quality control dictate that large batches of items be statistically sampled and tested to either accept or reject the entire lot. Purchasers should remember the axiom, "Bad data can look just as believable as good data." The lesson to be learned is to know the risks you are taking by not adequately testing or inspecting measuring devices of any type prior to use and/or installation. Often onsite laboratories can assist purchasers in the inspection, testing, and calibration of a wide range of measuring and testing devices and/or equipment.

Recommended Actions: The laboratory notified the customer of the faulty thermocouples and the entire batch was returned to the vendor (Omega). After evaluating the thermocouples, the vendor determined that a complete step in one of their processes had been omitted. They have agreed to supply the customer with new thermocouples.

Priority Descriptor: Blue

Work Function: Inspection and Testing

Hazard: Other - Inadequate Testing Equipment

ISM Core Function: Develop and Implement Controls

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References: N/A