Thermocouple/ rtd measurement calibration lab report

Thermocouple calibration formula. How to check rtd and thermocouple. Thermocouple calibration method. How to calibrate rtd and thermocouple. Thermocouple/rtd measurement & calibration lab report.

OSTI.GOV Technical Report: THERMOCOUPLE RESEARCH REPORT FOR THE PERIOD NOVEMBER 1, 1956 TO OCTOBER 31, 1957. Progress Report No. 1 The general characteristics of thermocouples are reviewed, and particular reference is made to available information on the chromel-alumel type alloys. A description of the experimental equipment constructed and operated for thermocouple calibration, time-at-temperature studies of changes in thermal emf, and heat treating of wires is presented. (W.L.H.) Authors: McElroy, D. L. Publication Date: Sat Mar 01 00:00:00 EST 1958 Research Org.: Tennessee. Univ., Knoxville OSTI Identifier: 4335020 Report Number(s): ORNL-2467 NSA Number: NSA-12-006643 DOE Contract Number: W-7405-ENG-26; SUBCONTRACT 1072 Resource Type: Technical Report Resource Relation: Other Information: for Oak Ridge National Lab. Orig. 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L.}, abstractNote = {The general characteristics of thermocouples are reviewed, and particular reference is made to available information on the chromel-alumel type alloys. A description of the experimental equipment constructed and operated for thermocouple calibration, time-at-temperature studies of changes in thermal emf, and heat treating of wires is presented. (W.L.H.)}, doi = {10.2172/4335020}, url = { , journal = {},number = , volume = , place = {United States}, year = {Sat Mar 01 00:00:00 EST 1958}, month = {Sat Mar 01 00:00:00 EST 1958} } Similar records in OSTI.GOV collections: R.T.D. Accuracy checks for a resistance temperature detector/device (RTD) is often necessary to validate the accuracy of a new RTD.Calibrating and testing RTD sensors : Typically RTDs are checked while calibrating the connected device, such as a panel meter You're Reading a Free Preview Pages 4 to 5 are not shown in this preview. You're Reading a Free Preview Pages 6 to 10 are not shown in this preview. Full PDF PackageDownload Full PDF PackageThis PaperA short summary of this paper30 Full PDFs related to this paperDownloadPDF Pack 1. Jordan University of Science and Technology Faculty of Engineering Department of Mechanical Engineering Instrumentation and Dynamic Systems Lab Experiment #8: Thermocouples Introduction: 2. External circuit Material 2 Material 1 Junction A B I Since many of the matter features are related to the temperature, such as the pressure, electrical resistance, expansion coefficient, etc …, and they change with it, they can be used to measure the change in the temperature of bodies The electrical resistance is used widely, because of the high accuracy and ease to use. The temperature change tends to change the resistance of the material being used for this purpose, so the material draw a voltage signal, can be amplified and measured as an indication to the temperature change. Figure 1: typical representation for a thermocouple connected to an external circuit. When the thermocouple junction receives a temperature change, an emf is existed between the two points "A" and "B", this phenomenon is called the See-beck effect Thermocouple connection depends on two terminals, so if the temperature of one terminal is known, it's easy to find the other terminal temperature using the thermoelectric properties of the materials, which are listed in standard tables. The known temperature of the first terminal is called the reference temperature, and it's commonly used to be "zero ºC", established in an ice bath. Standard tables are prepared on this basis, which relates the generated emf with the temperature, and are based on a third order polynomial regression: E=AT+BT2/2+CT3/3 Where the constants A, B and C depend on the material type of the thermocouple used. The thermocouples are widely used in several applications, such as measuring the internal temperature of furnaces, especially in heat treatment operations, also in measuring body's temperature when it's difficult to be measured using the traditional thermometer, also thermocouples can be used as a control system, when the temperature is the affecting parameter, for example, the fire safety systems, the furnaces shut down system and many other applications. To attain higher accuracy, multi-thermocouples are connected in series, this configuration is called a thermopile. When connecting multi-thermocouples in parallel with each thermocouple- end at a different temperature (but having the same reference), the average value of theses temperatures are given. Equipments and instrumentations: Chromel-Alumel thermocouple. Thermometer: Mercury thermometer is used to read the actual temperature of the water. Vessel: Glass vessel or cup is used to melt the ice with water. 3. Voltmeter with precision at least of 10-3: electrical device used for measuring the induced voltage or emf. Chart Recorder: Mechanical, second order system, used for plotting the response of other systems directly on a paper, it transforms the input voltage to a move the plotter head on the plotting paper. Ice (reference) and hot water. Procedure: The thermocouple should be prepared for measuring the temperature, this is done by joining the ends of both wires, either by mechanical means, or by welding them electrically, and electrical welding is used in this experiment. Connect the thermocouple free ends to the voltmeter, and set a scale of 10-3, i.e. m-volt. Put ice in the vessel, and contact the welded end to it, and read the voltage induced. Use the thermometer to measure the temperature, and convert it into an emf using the standard tables of Chromel-Alumel thermocouple (table "1"), call it V (Thermometer). Read the voltage from the voltmeter, and convert the induced voltage (emf) into a temperature, using the standard table, call it T (Voltmeter). Add some water to the vessel, and repeat the readings. Repeat the process 6 or 8 times, by adding a little amount of water, in order to change the solution temperature. Results: 4. Figure 2: Experiment Results Sample of Calculation: The See-beck coefficient for the chromel-alumel thermocouple is: K= 41µV/Kelvin. Assuming linear relation: $Th = Tc + V/K$ At iteration # 2: $Th = 4.5 + 3.2 * 10-3 41 * 10-6 = 67.9$ Or $Vh = Vc + V = 0.139 + 3.2 = 3.34$ Referring to the Table of the chromel-alumel thermocouple, then Th = 67.9 degrees Celsius. Discussion of Results: The experiment shows how a thermocouple is used to measure unknown temperature with respect to a known reference temperature, assuming linearity between voltage change and temperature difference for the thermocouple. This assumption is correct to large extent as long as the temperature differences aren’t so large (many hundreds). The Table in Figure 2 shows the results of the experiment. Sources of error aren’t identified clearly, although a large error value is recorded. 5. Percentage Error(iteration #2) = 67.9−45 45 * 100% = 29% Conclusions: Thermocouples are widely used devices due to its simplicity and linearity for a wide range of temperature differences. The arrangement of many thermocouples determines whether the device is used for more sensitive measurements or for multi-temperature points .

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