Thermocouple Installation & Operating Instruction Manual

Contents

Introduction

This manual covers Burns Engineering Thermocouple products, Following the guidelines in this Manual will help ensure that you get the most accurate measurement and longest service life from your Burns Thermocouple.

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Inspection - Mechanical

Examine the sheath and mounting surfaces for signs of shipping damage. Whenever "C", "E" or "K" style Thermocouples are ordered with a thermowell, they may be shipped unassembled (depending on the overall length) to prevent damage during shipment. Install the thermowell, extension, and connection head prior to installing the Sensor to prevent lead wire damage. For Ex approved assemblies, (Certified as Explosion Proof or Flame Proof) specific assembly details must be followed. See the "Safety" paragraph on page 3 for required installation and assembly instructions and manuals.

Inspection - Electrical

Insulation Resistance (IR):

For Ungrounded thermocouples only, using a meter capable of measuring resistance in the range of 5 to 500 megohms (10^6 ohms), measure the insulation resistance between the lead wires and the sheath when the sensor is at room temperature. The insulation resistance should be greater than the value stated on the specific sensors specification drawing. As an alternative, the IR test criteria per ASTM is:

IR > 100 megohms when tested at approximately 50 vdc.

Note: Ex Installation Manual is available on the Burns Web Site at:
http://www.burnsengineering.com/local/uploads/files/EX_Assembly-Installation_Manual.pdf
Burns EX Configuration Control drawing is available on the Burns Web Site at:
http://www.burnsengineering.com/local/uploads/content/files/18938_Dwg.pdf

Installation & Field Wiring:

Mechanical-
'A' style thermocouple assemblies may be threaded directly into the well or process. If it is necessary to turn the connection head in relation to the enclosed thermocouple assembly, disconnect the wires from the terminal block to prevent twisting and shorting.

'B' style thermocouples are normally installed with a compression fitting for variable insertion. Install the compression fitting in the process, insert the thermocouple assembly to the desired depth and tighten the compression fitting.

'C', 'E', and 'K' style thermocouples are designed such that the sensor can be removed from the assembly without removing the conduit connection or connection head. To install these style thermocouples, remove the terminal block or transmitter and then remove the sensor. Thread (or weld) the thermowell firmly into the process making sure the head and nipple are aligned to facilitate the conduit connection. Replace the sensor and the terminal block or transmitter to spring load the sensor into the thermowell.

Electrical-
The sensor and any extension wires should be clean and in good condition to ensure an effective electrical connection to the terminal block, transmitter or other device. Connect the positive extension wire to the positive thermocouple wire. Dual thermocouples use 'lettered' terminal blocks with A and B for one thermocouple and C and D for the other. Wires are color coded for identification. See the table for standard Insulation colors.

Thermocouple Type	Wire Insulation Color	
Lead Polarity	+	-
E	Purple	Red
J	White	Red
K	Yellow	Red
T	Blue	Red
N	Orange	Red

Occasionally it is necessary to identify a thermocouple that has been damaged or discolored or to determine the thermocouple polarity. The following characteristics can be helpful.

Type E – the negative lead is silver in appearance. It has lower resistance in ohms per foot than the positive lead for the same size wire.
Type J – The positive lead is frequently rusty and is magnetic. It has a lower resistance in ohms per foot than the negative lead for the same size wire.
Type K – The negative lead is slightly magnetic. It has a lower resistance in ohms per foot than the positive lead for the same size wire.
Type N – Both leads are non-magnetic. The positive leg has higher resistance per foot than the negative lead.
Type T – The positive lead is red and the negative lead is silver in appearance. The positive lead has a lower resistance in ohms per foot than the negative lead for the same size wire.

<u>Thermocouple Wire Configurations:</u>
Single Grounded
Single Ungrounded
Dual grounded
Dual ungrounded Isolated

It is important to know what wiring configuration to ensure proper wire connections.

Installation in Hazardous Locations- Hazardous environments require specific installation methods based on the type of approval. See the "Safety" section for installation information.

Operation

The temperature of the connection head should be kept as near room ambient as possible to avoid errors due to the extension wires. The maximum recommended temperature is 400°F at the terminal block. If the sensor is used in an **Explosive environment**, the ambient temperature range and enclosure maximum surface temperature is based on the approval certificate for the enclosure incorporated in the assembly. See the Ex Installation Manual. (Link Pg. 1)

Vibration at elevated temperatures will decrease the life of the thermocouple and should be avoided.

Maintenance

Frequency of calibration checks must be determined for each individual application by noting the de-calibration rate at each installation. Calibration is usually made by comparison with a working standard. The thermocouple may be removed from its installation and checked in an electric furnace with a working standard. However, after a thermocouple has been used for some time at high temperatures, it is difficult, if not impossible, to determine how much of the calibration is in error by removing it from the installation and testing is a laboratory furnace. The thermocouple is usually in homogeneous after such use so the electromotive force (emf) developed by the thermocouple depends upon the temperature distribution along the wire. Such thermocouples should be tested in the same installation in which the are used, the working standard may be inserted in a test well of hole near the thermocouple to make the calibration checks. Another method is to wait until the process has reached a constant temperature and make observations with the thermocouple being tested, then remove the thermocouple and insert the working standard. Although it is not usually possible to obtain as high a precision by testing thermocouples in place as in laboratory tests, the results are far more accurate by being representative of the thermocouple behavior in actual use. Three standard thermocouples should be maintained. One is used as the working standard. The second is used for laboratory checks of the working standard. The third is used as a "referee" if the first two disagree.

Output

Thermocouples are designed to provide the voltage signal (millivolts) necessary to indicate temperature. For complete Millivolts vs. Temperature tables for thermocouple types E, J, K, N, and T, visit the Burns website under "Technical Info/Technical Papers".

Safety and Warnings

When used in their intended applications Thermocouples are inherently safe passive devices that pose no significant safety risk. Follow the guidelines below to ensure safe operation.

- Never connect a Thermocouple to a high voltage electrical supply. Thermocouples are designed to provide the voltage signal necessary to indicate temperature – no power needs o be supplied to the thermocouple. Connecting to a high voltage electrical supply will damage the sensor and

could significantly increase the risk of electrocution.

- Explosive Environment use. Many sensors are not designed or approved for use in an explosive environment.

  For assemblies that are labeled and approved for use in hazardous environments, verify the installation requirements are in accordance to the type of approval.

  There are various Hazardous Locations approvals, certified by FM Approvals. The available certifications and their region of appropriate use include:

  Explosion Proof (Class/Div) in the USA;
  Code: "/AFM"
  Flameproof in the USA;
  Code: "/AFP"
  Flameproof in Canada;
  Code: "/FMC"
  ATEX in the EU & UK;
  Code: "/ATEX"
  IECEx in World Regions per IEC Standards;
  Code: "/IEC"

  For the details regarding these approvals and various combinations of these approvals, refer to the FM Approved assembly Definition and Installation Drawing #18938 and the Ex Installation Manual available on the Burns website.
  www.BurnsEngineering.com

- Warnings:

  The following warnings should be obeyed:

  - WARNING: DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT
  - WARNING: DO NOT OPEN WHEN ENERGIZED
  - WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD—SEE NOTE
    - To minimize an electrostatic charging hazard on the exterior of the enclosures both the main and remote (If ordered) enclosures should be connected to earth ground, see the Ex instruction manual for more details.
    - External surfaces sold be wiped down using a damp cloth.

- Earth Grounding: Most enclosures (connection heads) incorporate both an internal and external grounding point. All assemblies should be grounded to an effective earth ground. See the "Safety" paragraph for the instruction / installation manuals for all Explosive Environment applications.

- Handle with Care. Depending on the specific model the temperature range can be as wide as -40°C to 1180°C. When the sensor is being used at extreme temperatures (both high and low) the user should wear the appropriate personal protection equipment when handling the sensor. The sensor, after removal from the application, may remain at a dangerous temperature for a period of time.

- Supply Power: When the assembly incorporates a transmitter, the power to the transmitter should be shut off prior to removal of the enclosure cover or performing any maintenance.

Responsible Disposal

When the time comes to replace the sensor it should be taken to a collection point for the recycling of electronic and electrical equipment to ensure the product is recycled properly.

The Series 100 assemblies are intended for installation in large-scale stationary industrial tools and / or large-scale fixed

installations. According to the exemptions stated in the WEEE and RoHS2 Directives Burns Engineering is not responsible to manage the proper disposal of the product.

Approvals - ATEX

The Burns Engineering Series 100 Thermocouples have been certified by FM Approvals as complying with the European Parliament Directive 2014/34/EU (ATEX) regarding use in Hazardous Environments as Flame Proof. Consequently the CE mark has been applied to the Burns Engineering Series 100 Thermocouple assemblies for compliance to the ATEX directive 2014/34/EU.

The Series 100 products have been self certified for European Parliament Directive 2001/95/EC on General Product Safety.

The CE mark below applies to the following Burns Engineering part numbers when tagged with the ATEX approval information:

100A-***/ATEX/**, 100B-***/ATEX/**,
110A-***/ATEX/**, 110B-***/ATEX/**,
120A-***/ATEX/**, 100B-***/ATEX/**,
100C-***/ATEX/**, 120E-***/ATEX/**,
100K-***/ATEX/**, 100L-***/ATEX/**,

Where the '***' portions represent various other details of the model configuration such as accuracy, enclosure, wire style and length variables. See the Series 100 catalog for complete details.

(http://www.burnsengineering.com/local/uploads/files/series_100_thermocouples.pdf)

These parts are manufactured by

Burns Engineering, Inc.
10201 Bren Road East,
Minnetonka, MN 55343
UNITED STATES OF AMERICA

European Parliament Directive 2014/34/EU on use in Hazardous Environments as Flame Proof (ATEX).

Additional Information

Burns Engineering is available to answer your questions regarding Series 100 Thermocouple applications.
Call toll free 1-800-328-3871.
Email: info(at)burnsengineering.com