BURNS ENGINEERING

Averaging Resistance Thermometer Element Assemblies Instruction Manual

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PRINCIPLE OF OPERATION

The sensing element is composed of a length of precision grade wire. The resistance of this wire changes with temperature in a highly reproducible manner (see Resistance Temperature Tables alpha = .00385).

HIGH ACCURACY

Burns Resistance Thermometer Element Assemblies provide one of the most accurate methods of temperature measurement.

SENSITIVE PORTION

The temperature sensitive length of the sensor is dependent on which part number is ordered. This sensitive length gives an output proportional to the average temperature over the element length.

LINEARITY

Burns resistance thermometer elements have a nearly linear output, well known for stability and dependability.

LEAD WIRES

No special alloy lead wires are required. Regular copper conductors may be used from remotely located elements to the control room. Lead wire resistance is compensated for within the instrument to which the element is connected. Consult the instrument specifications for proper lead wire selection. Shielded 18 GA lead wires are generally used. Extra long lead wire lengths may require special attention.

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NO REFERENCE JUNCTION REQUIRED

Resistance thermometers do not use reference junctions which are required on thermocouple systems. All connections are made without regard to polarity.

MATERIALS

Type 316 stainless steel and aluminum are standard sheath materials. Typically a 1/2 NPT mounting fitting is used.

CONSTRUCTION

A stainless steel sheath provides improved protection over the sensitive position of the element. The element and lead wires are enclosed in the sheath in a special way to insure years of dependable service.

INSPECTION

Each element assembly is carefully inspected prior to shipment. A thorough visual inspection should be made upon receipt to determine if damage occurred during shipment. Look for bends in the sheath or broken lead wires. A serial number is impression stamped or etched on each element assembly as well as tag numbers when specified. These identifying numbers should be used in any future correspondence or reorder.

TESTING

To determine that the resistance element is operational, the following tests may be run:

Continuity -

With a standard multimeter, check the resistance of the element at room temperature. Check the appropriate circuit diagram and then connect one lead to one side of the element, and the other lead to the other side. The resistance reading should correspond to the values shown on the resistance temperature table. The current through the element should not exceed 10 mA.

Insulation Resistance -

With dry external surfaces, the insulation resistance between any lead wire and the metal sheath should be greater than 200 megohms. If insulation resistance appears to be low, or the element has become wet, place it in an oven at approximately 250 °F for three hours or until dry, and repeat the test.

CALIBRATION

Averaging Sensor Resistance Elements -

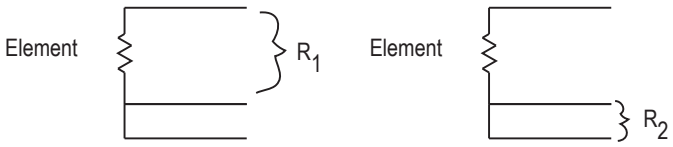
The resistance - temperature table for Burns Engineering Elements was determined over a period of several years by means of many precision resistance measurements. These measurements were made with high accuracy calibration standards traceable to the National Institute of Standards and Technology. Elements made by various manufacturers do not follow the same table even though they may all use the same wire. Strain and contamination in various degrees and combinations can raise or lower the temperature coefficient of resistance.

Laboratory Calibration -

Special equipment and measuring techniques are required, and this is usually best performed at the factory.

Field Calibration -

If a continuity check shows the element to be operational and reasonably within tolerance, a further check of accuracy may be made in the field. A trough or pipe of water can serve as a calibration bath if the water temperature can be determined. Immerse the sensor over the entire sensitive length. Allow about 15 minutes for the sensor output to stabilize. Measure the resistance of the sensor with a wheatstone bridge. Use 2 mA of current or less through the element, or a self-heating error may result. If the bridge does not automatically compensate for the lead wire resistance, take one reading with the element in the circuit, and subtract from it the resistance of the two common lead wires.



R Element = R_1 - R_2

Compare this reading with the nominal resistance value at the known temperature from the resistance temperature table.

MOUNTING INSTRUCTIONS

The sensor must be supported so it will have virtually no vibration in service. When forming the sensor, care must be used to avoid kinks or sharp bends that may damage the element. Do not allow the sheath to flatten during bending. Start at the leadwire end of the sensor and form to the desired shape by working toward the closed end. The minimum bend radius is 2.0 inches

RESISTANCE VS. TEMPERATURE TABLE

alpha = 0.00385 ohms/ohms/°C

T (°C)	ohms	T (°F)	ohms
0	100.00	20	97.39
10	103.90	40	101.74
20	107.79	60	106.07
30	111.67	80	110.38
40	115.54	100	114.68
50	119.40	120	118.97
60	123.24	140	123.24
70	127.08	160	127.50
80	130.90	180	131.74
90	134.71	200	135.97
100	138.51	220	140.19
110	142.29	240	144.39
120	146.07	260	148.58
130	149.83	280	152.75
140	153.58	300	156.91
150	157.33		

Notes:

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