BURNS ENGINEERING

Application Note

A180510

Waterproof RTD Finds Several Applications

APPLICATION

Freeze dryers, incubators, steam autoclaves, freezers and refrigerators are just a few of the applications where a waterproof RTD is necessary to ensure long term accurate temperature measurement. When liquid water is present or pressure changes occur standard RTDs just do not measure up. A probe used in a freezer will experience freeze thaw cycles when removed for calibration or defrosting and will be exposed to liquid water. Eventually water will leak inside and damage the sensing element. Other applications may require full immersion in a liquid such as insertion in a glycol filled thermowell or liquid filled tanks. Space becomes a limitation for some applications where the temperature probe needs to be placed in a machine or inserted into product. Small diameter and short length are required to snake around bends or fully fit into a product container.

A02

- 3/16" diameter, 1.25" long, with as-specified cable length

CHALLENGE

Typical epoxy seals are not capable of maintaining a dry environment inside the probe sheath if exposed to liquid water or pressure changes that can cause water vapor to be sucked into the probe. Moisture that seeps in will cause the probe to indicate a lower than actual temperature and the repeatability of the measurement may be affected. An example of the moisture induced error is:

IR acts as a shunt resistor to the measurement circuit the lower the IR the higher the effect on the accuracy of the probe. The equation for calculating theoretical effect of IR on the measurement is basically the equation for calculating the overall resistance of resistor in parallel, where one resistor is the PRT (R_{PRT}) and the other is the insulation resistance (R_{IR})

$$R_{Measured} = \frac{[R_{PRT} x R_{IR}]}{[R_{PRT} + R_{IR}]}$$

Where: $R_{Measured}$ = Resultant measured resistance
R_{PRT} = Resistance of PRT element
R_{IR} = Insulation resistance value

So for example: a probe that reads 100Ω at 0ºC that then degrades to IR of 0.1 MΩ the measured resistance will be 99.900 which equates to approximately -0.26ºC.

Accuracy and repeatability of the sensor are important features of any temperature measurement so the sensing element has to be designed with a nearly strain free configuration in addition to being durable.

SOLUTION

The Burns Model A02 incorporates a high accuracy platinum sensor molded to the cable jacket providing a 100% water and pressure proof package. A 316L stainless steel sheath adds mechanical protection and a means of mounting the probe to a variety of surfaces and objects. The sensor and cable can be fully immersed in liquids that are compatible with PFA and stainless steel without leakage or damage to the sensing element. Pressure cycling during the steam autoclave process has no affect on the sensor for the –1 to 3 bar pressures experienced during a typical sterilization cycle. With a temperature range of –196°C to 200°C the A02 can be used in a variety of environments from liquid nitrogen to steam sterilization temperatures and more. The small size allows mounting on wire racks, insertion into thermowells or buried in process product. Three other diameters are available, 1/4", 1/8" and .080" along with longer length SS tubes to adapt to your application.

For more info check our website or call to speak with an applications engineer at extension 6413 or 6422

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