



RTD Temperature Sensor

Data Sheet DS33-200-6



The temperature of very low liquid levels can be measured accurately with a flush valve mounted RTD Temperature Sensor.

Description

The RTD Temperature Sensor is the latest development for measuring the temperature of materials processed in glassed-steel reactors. It is a three-wire, 100 ohm platinum Resistance Temperature Detector permanently encased in a corrosion resistant tantalum housing.

The RTD operates on the principle that the electrical resistance of a platinum wire increases with its temperature in a precise and repeatable manner. The relationship between the temperature and the resistance of a known purity of platinum is defined by a specific equation.

Features

Fast Response

An important characteristic of the RTD is its immediate response to rapid temperature changes throughout its entire operating range. This characteristic is maximized by the design of the sensor in the reactor vessel. The accompanying time-temperature graph illustrates the response of the RTD in a step temperature

change test. As shown, the first time constant of an RTD installed on a Glasteel® accessory is 7.5 seconds.

Accuracy

Accuracy is of significance in the measurement of temperature within reaction vessels, particularly when the measurement is the basis for control action. The nominal accuracy of the RTD is $\pm 0.28^{\circ}\text{C}$ ($\pm 0.5^{\circ}\text{F}$) or $\pm 0.5\%$ of the temperature being measured, whichever is greater.

See Table 1. The use of three wires permits compensation for lead wire resistance.

Therefore, the length of the lead wires between the RTD and the instrument does not affect the accuracy.

High Sensitivity

The RTD has a high sensitivity to small temperature changes which is vital to precise temperature measurement and control within very narrow limits. The output sensitivity is approximately ten times greater than thermocouples used in the same type of applications. The RTD eliminates the need for high-gain amplifiers and reduces susceptibility to electronic noise characteristic of systems which depend on low-magnitude sensor outputs.

Stable Output Signal

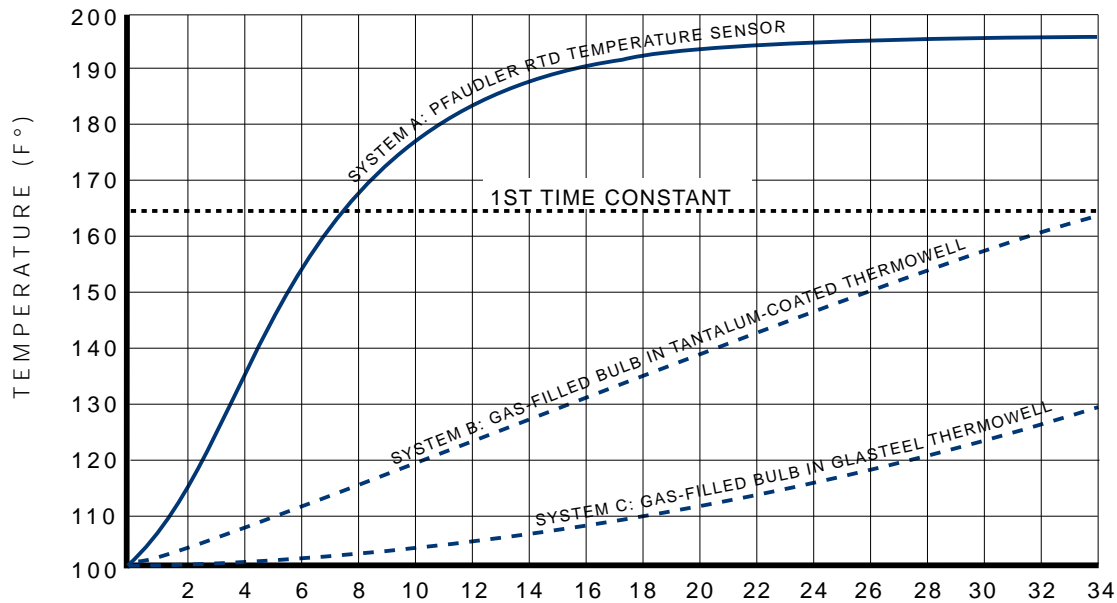
For reliable control applications, sensors must be free of drift. Measurements indicate the RTDs have a drift no greater than $\pm 0.056^{\circ}\text{C}$ ($\pm 0.1^{\circ}\text{F}$) in one year.

Nominal Resistance-Temperature Values RTD Temperature Sensor Basis: 100.00 ohms at 0°C (32°F)		
Resistance of RTD (ohms)	Temperature °C	Temperature °F
88.50	-28.9 (± 0.28)	-20 (± 0.50)
97.36	-6.7	20
100.00	0.0 (± 0.28)	32 (± 0.50)
106.15	15.6	60
114.88	37.8 (± 0.28)	100 (± 0.50)
123.56	60.0	140
132.17	82.2	180
139.02	100.0 (± 0.59)	212 (± 1.06)
140.73	104.4	220
149.22	126.7	260
157.66	148.9 (± 0.42)	300 (± 1.50)
166.04	171.1	340
174.37	193.3	380
182.63	215.6	420
188.79	232.2 (± 1.24)	450 (± 2.25)

Table 1

Speed of Response

100°F - 200°F TRUE LIQUID STEP TEMPERATURE CHANGE



Control reliability is further assured by the conformance of each RTD to a repeatability specification of $\pm 0.056^{\circ}\text{C}$ ($\pm 0.1^{\circ}\text{F}$) over the -29°C to $+232^{\circ}\text{C}$ (-20°F to $+450^{\circ}\text{F}$) operating range.

RTDs provide a nearly linear output thus minimizing any loss of accuracy when the output passes through a transmitter. This linearity extends over the entire recommended temperature range.

Safety

Although it requires an external power source, the RTD is a non-inductive design which cannot store energy. When used with instrumentation systems approved by Factory Mutual Research Corporation as intrinsically safe, and with specified barriers, the RTD is considered intrinsically safe in hazardous areas.

Mounting Locations

The RTD is factory installed with wires and terminal head on such Glasteel® accessories as flush valves, baffles and thermowells. RTDs can be purchased separately for field installation on baffles and thermowells provided the accessory has a removable restricted tip and is drilled and tapped to the proper size.

Functional at Very Low Liquid Levels

The RTD mounted in a flush valve (as illustrated) solves the problem of measuring temperatures when the level of the process liquid in the reaction vessel is extremely low. When the liquid drops below the minimum level required by sensors mounted on the end of baffles or thermowells, the valve-mounted RTD continues to provide dependable temperature

measurements until the vessel is drained. There is virtually no liquid level at which temperature cannot be measured.

Options

The following options are available on a built-to-order basis:

- European Standard temperature coefficient per DIN 43760.
- Two independent RTD elements installed within the same enclosure.
- Enclosure material other than tantalum.
- Thermocouples Type J and K.

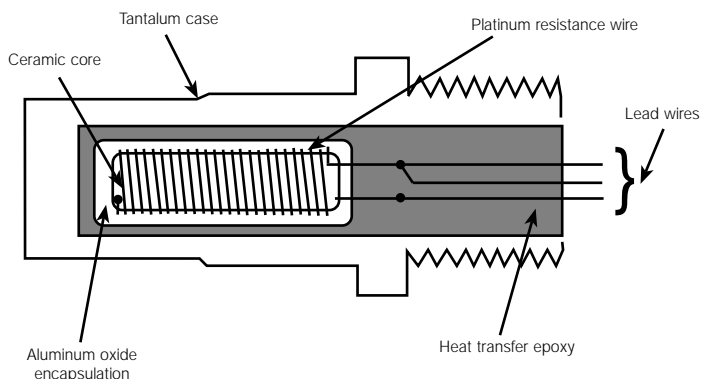
Comparative Response Time

System	% of True Liquid Temperature Change	
	63.2%	95.0%
A	7.5 sec.	27.2 sec.
B	33.0 sec.	115.0 sec.
C	65.0 sec.	150.0 sec.

NOTE: Data intended for comparison. Not for guarantee or warranty.

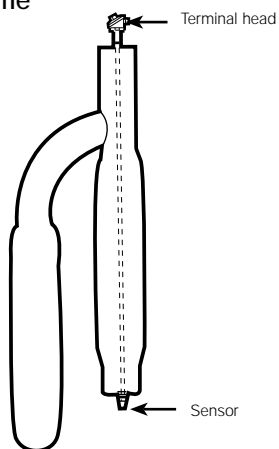


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In addition to flush valves, RTDs can also be supplied on baffles (as shown) and thermowells.

Baffle



Standard Design Specifications

Resistance at 0°C (32°F):
100.00 ohms.

Temperature Coefficient:
American Standard 0.003902 ohms/ohm/°C.

Temperature Range:
-29°C to +232°C
(-20°F to +450°F).

Lead Wires:
Two white and one red. PTFE coated, overwrapped with PTFE tape into a single cable.

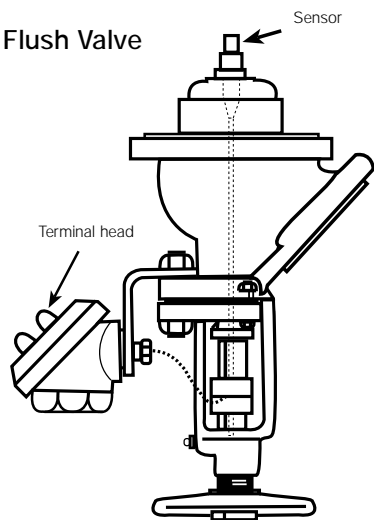
Thread Sizes:
5/16 - 24, for flush valves.

5/8 - 18, for flat surfaces (baffle or thermowell factory drilled and tapped).

1-1/8 - 12 for flat surfaces (baffle or thermowell factory drilled or tapped).

Enclosure Material:
Tantalum

Flush Valve



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