The information contained in the following pages is intended as a guideline for general RTD sensor useage. Specific applications and environmental conditions may require that other sensor element types, element materials, or construction styles be used to provide optimum temperature measurement results. The dimensions, temperature ratings, accuracies, and other specifications may vary to satisfy a particular application requirement. For further information and recommendations on specific applications, please consult with the factory.

RTD ELEMENTS

Elements of several different materials, base resistances, temperature coefficients, accuracies, and construction styles are available for installation into final RTD temperature sensor assemblies to meet customer specifications. The most commonly used element throughout the USA and Europe is a wire-wound or thin film platinum with a base resistance of 100 Ω at 0 °C [32 ºF] and with a 0.003 85 $ºC^{-1}$ temperature coefficient.

A few USA companies, and most Japanese companies, use a similar 100 Ω platinum element, but with a 0.003 92 $ºC^{-1}$ temperature coefficient.

Pyromation's standard element for either of these specified assemblies is a wire-wound type, in which the platinum winding is supported inside a ceramic body, although other process considerations may sometimes require the use of a thin film or "glassed-in" type of element. Elements of materials other than platinum are typically wire-wound on a core and covered with an insulating material such as Kapton®.

The platinum elements used in Pyromation RTD assemblies are in accordance with the specifications set forth in the following standards:

STANDARDS for 0.003 85 $ºC^{-1}$ TEMPERATURE COEFFICIENT ELEMENTS

1. American Society For Testing and Materials. (ASTM) E 1157 - 97
2. International Electrotechnical Commission. IEC 60751 - 1995

STANDARDS for 0.003 92 $ºC^{-1}$ TEMPERATURE COEFFICIENT ELEMENTS

1. American Scientific Apparatus Manuf. Association: SAMA RC 21.4 - 1966
2. Japanese Standard: JIS C 1604 - 1997

RTD ELEMENT TERMINOLOGY and SPECIFICATIONS

Temperature Coefficient: Known as the "Alpha" value, and it is the average fractional change of element resistance per a 1 °C change in the element temperature over the range of (0 to 100) °C [32 to 212] ºF. The temperature coefficient of resistance is expressed as ohms/ohm/°C or $°C^{-1}$.

Accuracy: A statement of the initial element accuracy when its base resistance value is measured at **one point only**, usually 0 °C.

Repeatability-Stability: The ability of an element to reproduce the same resistance or temperature reading each time it is at equilibrium at a given repeated temperature. Expressed as a ± resistance or temperature value over a given temperature range. May also be expressed as the stability of its resistance. Typically platinum elements will not change more than 0.04% at 0 °C [32 ºF] after receiving ten consecutive shocks from (-200 to 600) °C [-328 to 1112] ºF.

Self-Heating: RTD elements are not self-powered and require a small current be passed through the device to provide a voltage that can be measured. Self-heating is the rise of temperature within the element itself, caused by the current flowing through the element. This self-heating appears as a measurement error and is affected by the thermal conductivity and velocity of the process being measured; it is negligible for most applications. Typical platinum resistance elements would require 60 mV of power dissipation to cause a 1 °C [1.8 °F] temperature measurement error when tested in water flowing at 3 ft/s.

Time Constant: The time required to sense 63% of a step temperature change from (25 to 80) °C [77 to 176] ºF in water flowing at 3 ft/s.

Interchangeability: The amount of allowable difference in readings between two RTD's when placed side by side in a process at the same temperature. Determined by the allowable RTD tolerance at that particular temperature.

Tolerance: The amount of resistance error tolerated when the elements are measured at various temperature points. Pyromation 100 and 200 ohm platinum elements are offered in three base resistance tolerance bands as follows:

Band 1: ± 0.1% @ 0 ºC (Actual Elements Used Exceed DIN Class B Tolerances)
Band 3: ± 0.03% @ 0 ºC (Actual Elements Used Exceed DIN Class A Tolerances)
Band 5: ± 0.01% @ 0 ºC (Actual Elements Used Exceed DIN Class A Tolerances)

Elements of other values and of other materials are offered in the following base resistance tolerance bands:

DIN Class A	± 0.06%	@ 0 °C
DIN Class B	± 0.12%	@ 0 °C
Class C	± 0.2%	@ 0 °C
Class D	± 0.5%	@ 0 °C

Vibration: Pyromation's fully assembled sheathed RTD sensors are designed to withstand an average vibration level of 30 G's using random vibrating frequencies from (20 to 2,000) HZ at ambient temperature. Supporting test results indicate that initial RTD tolerances remain as specified when tested at these vibration levels.

Humidity Limits: Sheaths, transition fittings, and lead seals capable of withstanding 100% humidity at normal atmospheric pressure, and at normal ambient temperatures.