

## **Temperature Element Instrument**

There are several temperature element instrument types widely used to measure temperature of a process substance . These types are categorized into mechanical temperature element and electronic temperature element. Mechanical temperature element uses the principle of thermal expansion i.e. the element expands if the temperature rise and vice versa. Electronic temperature element use the principle of electrical properties change following of temperature variation.

### **Mechanical Based Temperature Element**

#### **Solidelement**

Bimetallic is temperature element instrument formed from two types of metal which have different thermal expansion properties. These two metal are bonded together become one strips. The metal strips will bend if temperature changes. At free end of bimetal, the pointer is attached to indicate the result of temperature measurement.

#### **Gaselement**

Gas filled system is temperature element instrument based on principle of the ideal gas law. It consist of bulb/stem, capillary and bourdon tube. The sensing element is a rigid bulb or stem containing a gas. If the temperature rises, the volume remain constant since the bulb is rigid, while the gas pressure increase proportionally. The change in gas pressure is measured by a pressure element such as bourdon tube. The bulb and the bourdon tube is connected by a capillary tube allowing the temperature indacator to be located not directly attached to the piping/vessel being measured. This advantages allows the temperature gauge indicator being mounted on the convenient location whereas the tapping point of process fluid to be measured is not permanently inaccessible.

However the capillary might lose heat therefore the addition of compensation is required to eliminate the error.  
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## Liquid element

Liquid temperature element utilizes mercury constrained within a bulb/stem. Mercury is no longer preferred in most process application although it provides fast response and good accuracy. Mercury mostly used in glass stem thermometer for non-process industry such as body temperature measurement.

## **Electronic based Temperature Instrument**

The most two commonly used electronic temperature element are Resistance Temperature Detector (RTD) and Thermocouple. To indicate the temperature measurement, these elements need to be connected to control system by wired directly or [using temperature transmitter](#).

### Resistance Temperature Detector

Resistance Temperature Detector (RTD) works based on principle that resistance of a metal varies with its temperature. RTD is the most commonly used type in process measurement due to its good stability, accuracy, repeatability.

### Thermocouple

Thermocouple consist of two dissimilar metals of which the junction generates a voltage proportional to the junction temperature. The Thermocouple is selected for service which requires wide range (very high – low temperature). The other advantages of thermocouple over RTD are it has more rugged design and also provide faster response.

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