

## Tri-Level Thermocouples

### Introduction:

Tri-Level thermocouples are triplex thermocouples with three sensors positioned at different lengths for measurement of vertical temperature profile. These three sensors are named as Top, Middle and Bottom sensors according to their respective positions. These type of sensors are basically used in Glass Furnaces/ Fore-hearths. It is used there to monitor the state of molten glass before it is further processed. The sensors act as a feedback channel for the furnace heaters so as to sustain thermal homogeneity of the glass exiting the fore-hearth for forming.

As the thermocouple is inserted into molten glass, it is subjected to erosion. To withstand this Platinum / Platinum alloy thimbles are used to sheath the thermocouple. These thimbles are resistant to wear and can be inserted and removed several times without damaging the sensor. These thimbles are either brazed to the shank or are cemented with the Alumina protection tube.

But introducing raw thimbles into the molten glass has an adverse effect, molten glass consists of strong reducing agents which react with Platinum to form oxides. These oxides break the grain structure of the thimble and weakens it. Also the sulphur content in the glass reacts with Platinum alloy which in turn destroys the thimble.

To counter this problem Dispersion Hardening technique is used for hardening Platinum and its alloys, this increases the mechanical strength and also strengthens the grain structure.

### Properties of Dispersion Hardened Thimble:

- High Mechanical Strength.
- Higher Creep even at high temperatures.
- Strong grain structure.
- Increased formability.

### Materials used for Thimble:

- DPH Platinum
  - DPH Platinum 10% Rhodium
  - DPH Platinum 20% Rhodium
- \*DPH: Dispersion Hardened



### Specifications:

- Temperature Range: 100 – 1600 °C.
- Element : R / S / B (At 3 levels top, middle and bottom)
- Protection Sheath: Al<sub>2</sub>O<sub>3</sub> Ceramic tube / Platinum or Platinum alloy Thimble.
- Thimble Wall Thickness: 0.2 to 0.5 mm.
- Sheath Length: As per requirement.
- Process Connection: As per application.
- Holding Tube: Inconel™600 / SS310.
- Connection Cable: Ceramic Fiber Insulated compensating cable.
- Position of element: Adjustable acc. to application.

### Features:

- 3 point temperature measurement using only a single entry and process connection.
- Accurate Temperature profiling for achieving thermal homogeneity.
- Customizable sensor positions for different applications.
- High temperature resistant sheath allows measurement at higher temperatures without sensor failure.
- Top quality Ceramics and rare metals used for accuracy and precision.



### Applications:

- Fore-Hearth and distributor glass immersion.
- Any other application where vertical temperature profiling is required.