

## Temperature Sensors



# glass industry

- Thermocouples for
  - Furnace Crown
  - Furnace Bottom
  - Forehearth
  - Distributor
  - Refiner / Throat
  - Spout Bowl
  - Lehr / Stack / Flue Gas
  - Tin Bath
- Glass Level Probe
- Blank Mould Thermocouples
- Accessories
  - Ceramic Tubes
  - Compensating Cables
  - Connector
- Calibration Services



**TEMPSENS**  
INSTRUMENTS

[www.tempsensindia.com](http://www.tempsensindia.com)  
[www.glassthermocouples.com](http://www.glassthermocouples.com)

## TEMPESENS IN GLASS INDUSTRY

**Tempsens** is a leading manufacturer of temperature sensors in India, having specialization to manufacture all critical Thermocouples for different applications with more than 35 years of experience. We at Tempsens specialize in design and manufacture of high precision temperature sensors for Glass Industries.

For more than 12 years we served major project re-builds with total Temperature Sensor Solutions which includes **Spout bowl** to **Stack Thermocouples**. Our customers have long experience of service life with our Thermocouples. We use special hardened platinum sheathing in our thimbles / claddings and all thermocouple elements used are Class 1, duly calibrated in our in house NABL accredited laboratory, which is traceable to international standards upto 1500°C.

### Type of Glass Industries Served

- Container / Bottle Glass
- TV-Panel Glass
- Tubing / Lighting Glass
- Optical & Special Glass
- Float Glass
- Tableware Glass
- Fiber Glass

### Products Produced for Important Locations

- Fore-hearth Thermocouples
- Furnace Bottom Thermocouples
- Refiner Thermocouples
- Annealing Lehr Thermocouples
- Tin Bath Thermocouples
- Compensating Cables
- Pressure Probes
- Distributor Thermocouples
- Furnace Crown Thermocouples
- Spout Bowl Thermocouples
- Stack / Flue Gas Thermocouples
- Glass Level Probes
- Quick Disconnecting Connectors

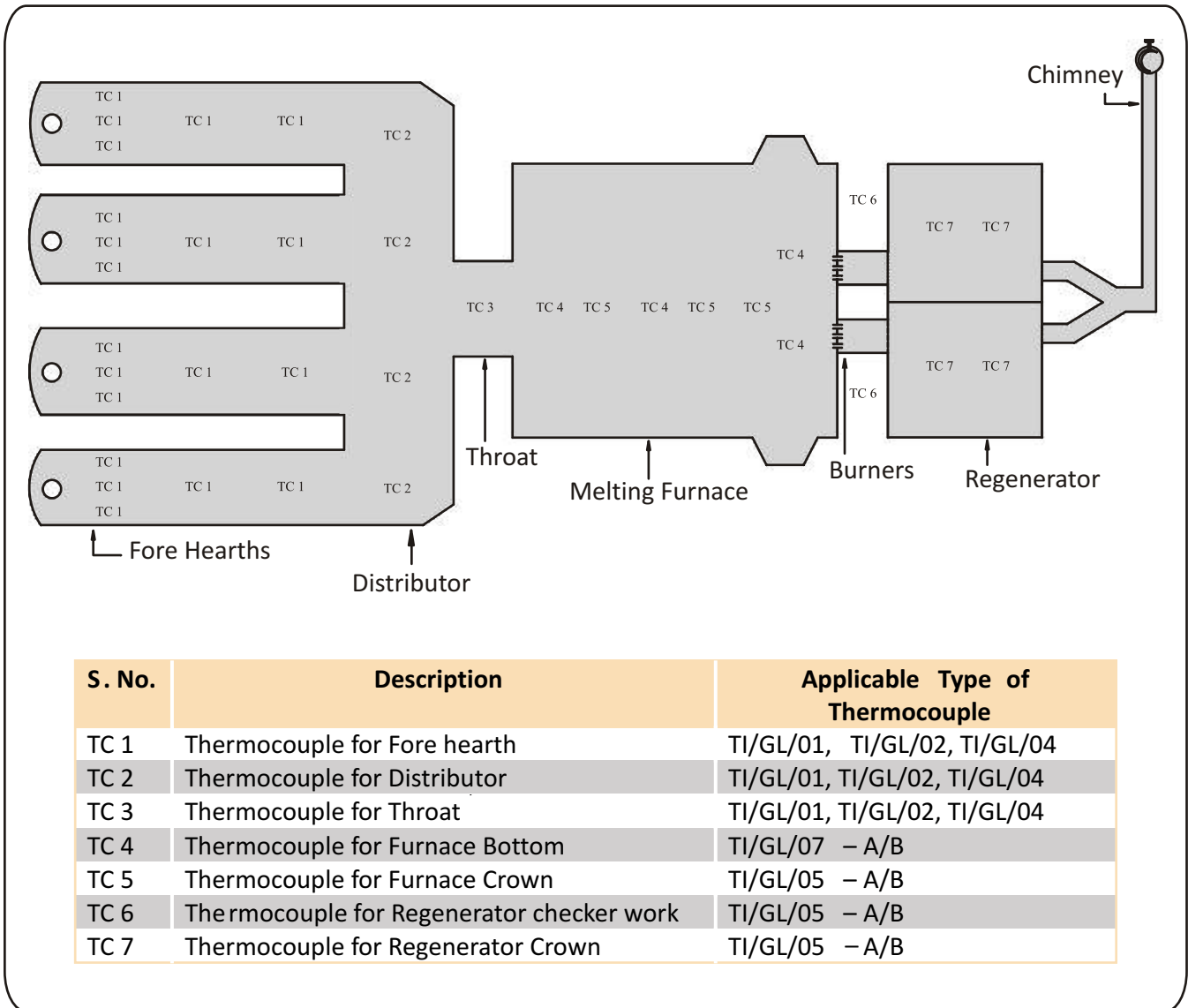


**Tempsens Unit-I**

**Tempsens Unit-II**



## LAYOUT PLAN OF TYPICAL GLASS FURNACE



Temperature is most important parameter to measure and control in all type of glass Industries.

Above diagram shows the typical applications for glass melting furnace. This is a typical diagram of an “End-fired furnace”. In some other furnaces (mainly in Float Glass) regenerators are at sides, called as “Side-fired furnace”.

Some important locations for temperature measurements in a glass furnace are shown in the above diagram.



## THERMOCOUPLES FOR FURNACE AND REGENERATOR CROWN

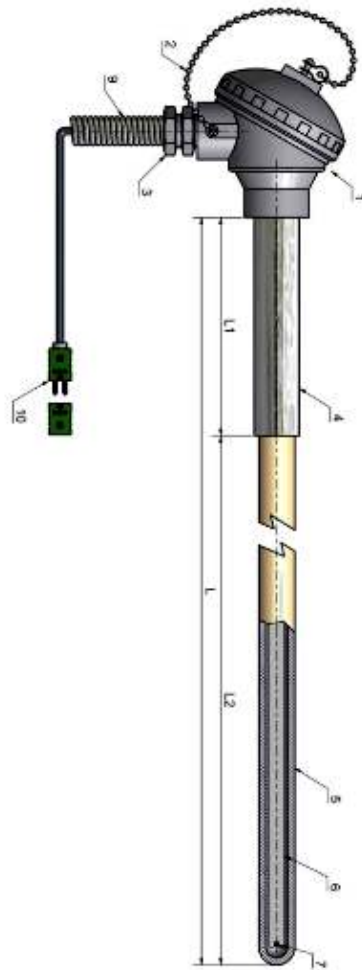
THERMOCOUPLES FOR FURNACE CROWN



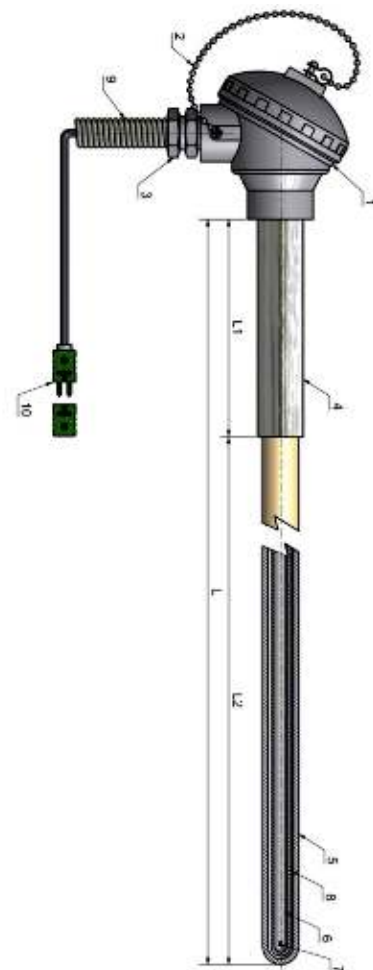
Glass Melting Furnace includes a melting chamber in which solid batch materials are heated to produce molten glass. The arch of this melting chamber is known as crown. To measure and control the temperature of furnace crown is important, because with the correct temperatures one can improve the service life of crown, as the overheating of the crown may cause of early erosion of crown refractory and on the other side if the temperatures are low, it can affect the melting efficiency and will increase the fuel consumption. The highest temperature in melting furnace is at crown. To select the right materials and assembly is quit important as the temperature at crown is even more than 1600°C. The design we recommend is with dual protection HWT (Heavy Wall Thickness) ceramic sheaths. In most of the furnaces, thermocouples are placed in block pockets, but over a period of service it may get through hole. At crown there are number of points to measure in center, right and left, the same kind of assemblies can be used for regenerator crown as well.

Type	TI/GL/05 - A/B
Measuring Range	100 To 1600°C
Sensor Type	"R"/"S"/"B"
Protection Sheathing	Recrystallised Alumina KER-710 (C-799) Tube
Application	Furnace Crown , T/C Pockets, Regenerators Crown.

S.No.	Description
1.	SS/Aluminium Connection Head IP-67.
2.	SS Chain.
3.	½" NPT(M) Cable Gland.
4.	Holding Tube : (Inconel - 600/SS310).
5.	Recry. Alumina Outer Tube :- OD X ID to be specified.
6.	2/4 Bore Recry. Alumina Insulating Tube.
7.	PTRH-PT Thermocouple Element R/S/B type
8.	Inner Tube suitable to outer tube.
9.	Ceramic Fibre Insulated Compensating Cable
10.	M/F Connector



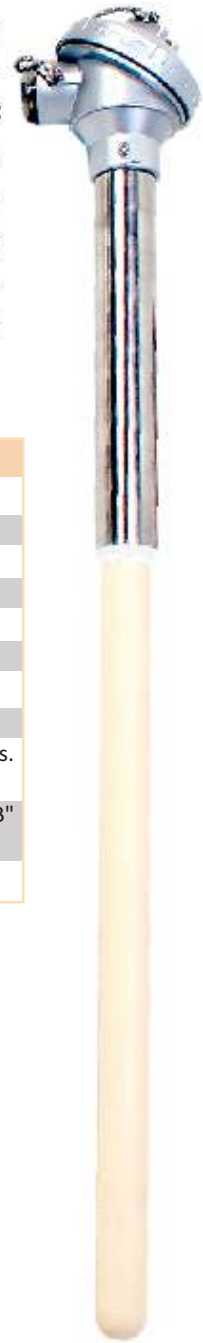
TI / GL / 05 - A  
(Single Protection)



TI / GL / 05 - B  
(Double Protection)

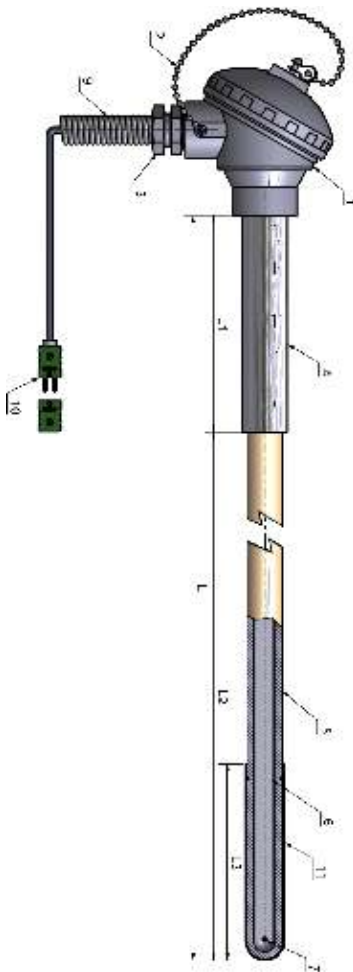
## THERMOCOUPLES FOR FURNACE BOTTOM

Same as crown, to measure the correct temperatures at furnace bottom results in higher service life of bottom blocks. Bottom blocks are the costliest part of a melting tank. Bottom thermocouples are used to get efficient operation of Glass Furnace. Even 2 - 3 Degrees higher or lower temperature can affect the fuel consumption of furnace. **Tempens** Thermocouples proved the "whole campaign life" goal on many projects. On this application hole can be through to immerse a glass immersion thermocouple, which will be with hardened platinum / platinum alloy thimbles over ceramic protection tubes. If the hole is blind or provided with thermocouple pocket, the protection will be with recrystallised alumina protection sheaths.

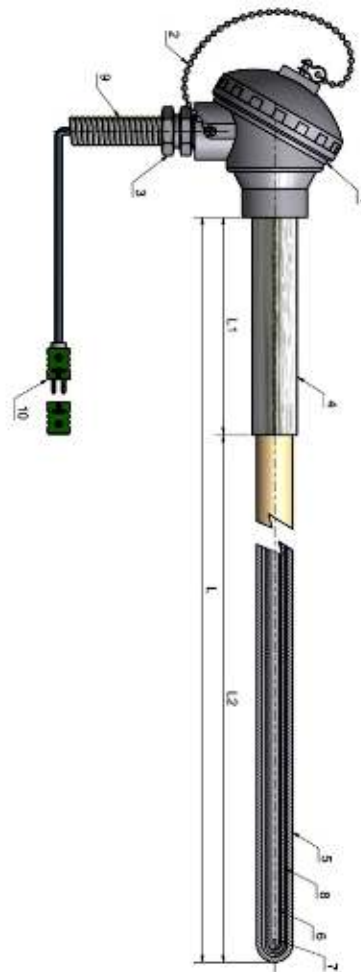


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Type	TI/GL/07 - A/B	S.No.	Description
Measuring Range	100 To 1600°C	1.	SS/Aluminium Connection Head IP-67.
Sensor Type	"R" / "S" / "B"	2.	SS Chain.
Protection Sheathing	Recrystallised Alumina KER-710 (C-799) Tube	3.	½" NPT(M) Cable Gland.
Application	Furnace Bottom, T/C Pockets, Regenerators.	4.	Holding Tube : (Inconel - 600/SS310).
		5.	Recry. Alumina Outer Tube :- OD X ID to be specified.
		6.	2/4 Bore Recry. Alumina Insulating Tube.
		7.	PTRH-PT Thermocouple Element R/S/B type.
		8.	Inner Tube suitable to outer tube.
		9.	Ceramic Fibre Insulated Compensating Cable 3/6 Mtrs. long with overall ceramic fiber sleeve.
		10.	Quick Release Compensated Connectors "R" / "S" / "B" Type.
		11.	Pt. Alloy thimble (in case of glass immersion)

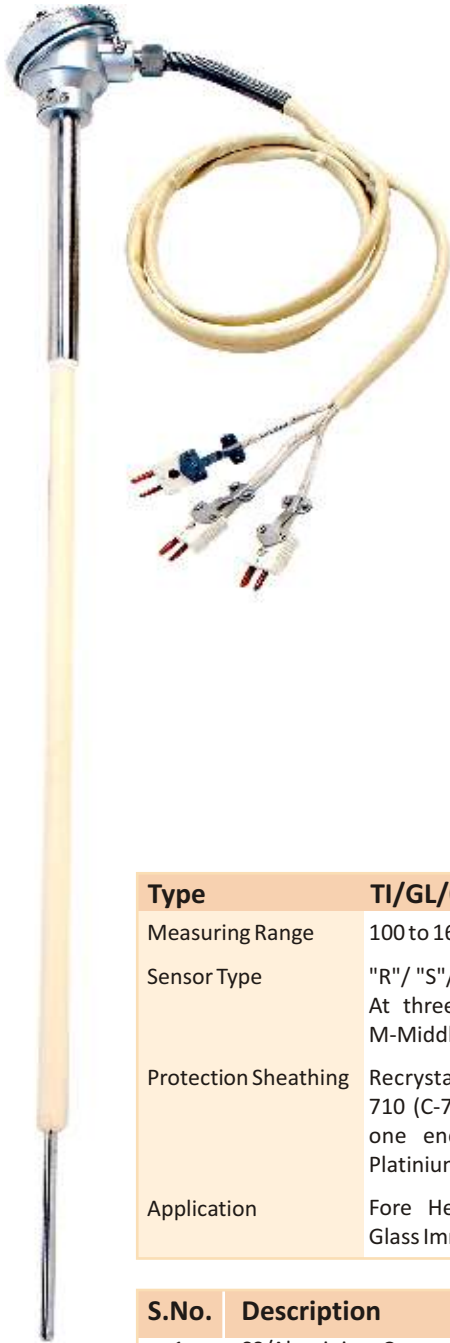


TI / GL / 07 - A  
(Pt. Thimbled)



TI / GL / 07 - B  
(Double Protection)

## THERMOCOUPLES FOR DISTRIBUTOR AND FORE HEARTH



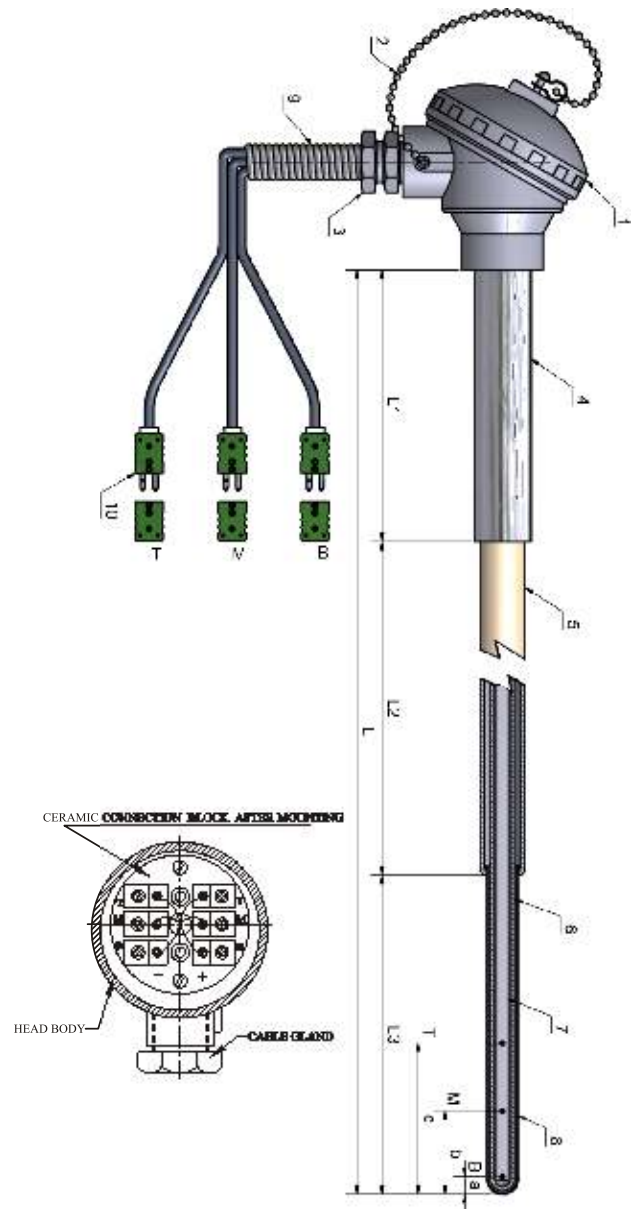
In distributor and fore hearths temperature measurement and control is most important. The glass fore-hearth control system includes a temperature sensing system and control system. The temperature sensing system includes an arrangement of pre-positioned temperature sensors. Simplex thimble thermocouples and tri-level / triplex thermocouples consist of an assembly of a bottom, middle and top thermocouples for sensing the vertical temperature profile of the molten glass at a fixed location. The output signals from these temperature sensors are received by controllers of the control system which then provide control signals and regulate the operation of the heat input devices and the cooling input devices. Thermocouple output and controller's calibration must be accurate, reliable and repeatable.

The Tri-Level Thermocouples designed to achieve thermal homogeneity of the glass exiting from the fore-hearth for forming, as the homogeneity will help to get the proper distribution of Gob in moulds.

<b>Type</b>	<b>TI/GL/01</b>
Measuring Range	100 to 1600°C.
Sensor Type	"R"/ "S"/ "B". At three levels at B-Bottom, M-Middle, T-Top.
Protection Sheathing	Recrystallised Alumina KER-710 (C-799) Tube with hole at one end. Special Hardened Platinum /PT Alloy Thimble.
Application	Fore Hearth and Distributor Glass Immersion.

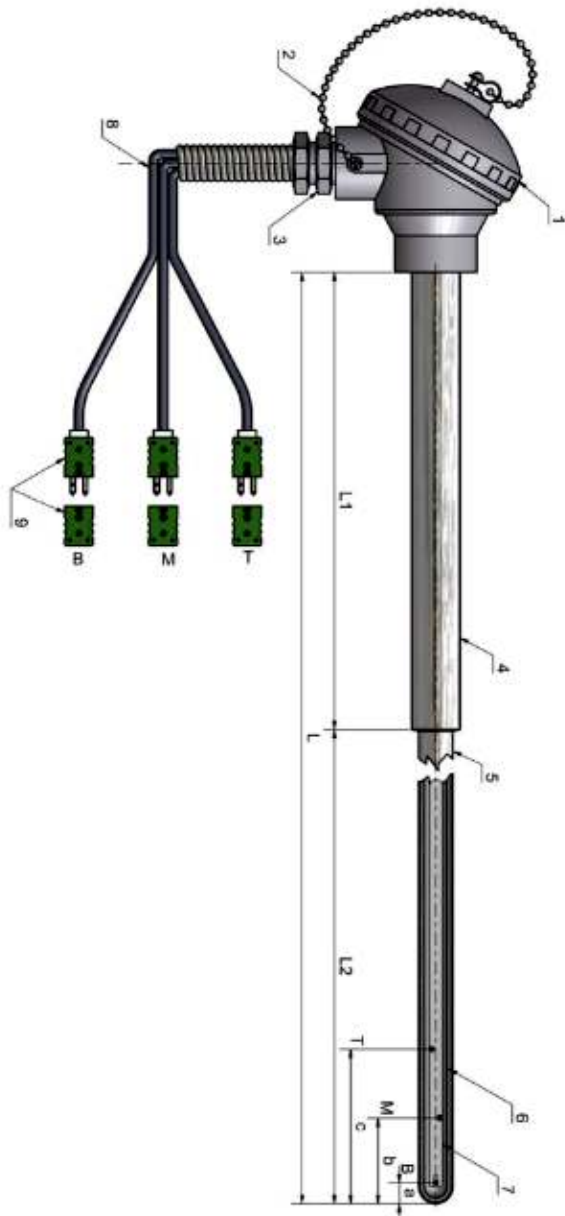
S.No.	Description
1.	SS/Aluminium Connection Head IP-67.
2.	SS Chain.
3.	½" NPT(M) Cable Gland.
4.	Holding Tube : (Inconel - 600/SS310).
5.	Recry. Alumina Tube :- OD X ID to be specified.
6.	Inner Tube suitable to Outer Tube.
7.	6 Bore Recry. Alumina Insulating Tube.
8.	Hardened PT/PT Alloy Thimble :- OD X THK. suitable to Outer Dimension.
9.	Ceramic Fibre Insulated Compensating Cable 3/6 Mtrs. long with overall ceramic fiber sleeve.
10.	Quick Release Compensated Connectors "R"/ "S"/ "B" Type.

■ a,b,c are distances from tip to bottom, middle & top sensor elements depending on the design.



## THERMOCOUPLES FOR DISTRIBUTOR AND FORE HEARTH

In TI/GL/01 uses small thimble length. That model is economic and commonly used worldwide, normally it gives very good service life but the only disadvantage is recovery of platinum as the ceramic tube is in flame contact and if it breaks, one can lose the whole thimble. In TI/GL/02 thimble length is long, it is from glass immersion to roofing block and thimble shall be in flame, there is no joint of ceramic tube & PT thimble in fore hearth atmosphere. It is quite popular design in heavy draw fore hearths. Where glass draw is high, customer can choose as per their requirement. All thermocouples are custom built.



TI / GL / 02

Type	TI/GL/02
Measuring Range	100 to 1600°C.
Sensor Type	"R" / "S" / "B". At three levels at B-Bottom, M-Middle, T-Top.
Protection Sheathing	Special Hardened Platinum / PT Alloy Thimble.
Application	Fore Hearth and Distributor Glass Immersion.

S.No.	Description
1.	SS/Aluminium Connection Head IP-67.
2.	SS Chain.
3.	½" NPT(M) Cable Gland.
4.	Holding Tube : (Inconel - 600/SS310).
5.	Hardened PT/PT Alloy Thimble :- OD X THK. suitable to Inner Dimension.
6.	Recry. Alumina Tube :- OD X ID to be specified.
7.	6 Bore Recry. Alumina Insulating Tube.
8.	Ceramic Fibre Insulated Compensating Cable 3/6 Mtrs. long with overall Ceramic Fiber Sleeve.
9.	Quick Release compensated Connectors "R"/"S"/"B" Type.
■	a,b,c are distances from tip to bottom, middle & top sensor elements depending on the design.

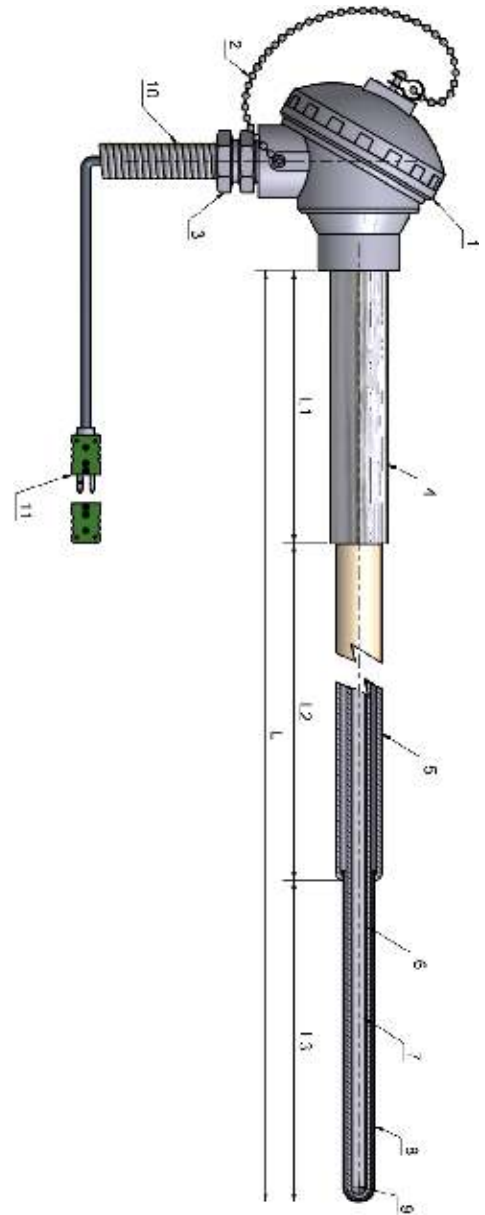
## THERMOCOUPLES FOR DISTRIBUTOR AND FORE HEARTH



In distributor and fore hearths rear and middle zone most of the glass companies use this simplex small thimble thermocouple. This is the substitute of fibre optic pyrometer. With Pyrometer customer can get only glass surface temperature but using this thermocouple, customer can get glass immersion temperatures. It is commonly used in all container glass industries. We manufacture conditioning zone trilevels and rear /middle zone simplex thermocouples from same batch element with same accuracy, our customer can get relative temperatures with high accuracy.

Type	TI/GL/04
Measuring Range	100 to 1600°c.
Sensor Type	"R"/"S"/"B". At three levels at B-Bottom, M-Middle, T-Top.
Protection Sheathing	Recrystallised Alumina KER-710 (C-799) Tube with hole at one end. Special Hardened Platinum /PT Alloy Thimble.
Application	Fore Hearth and Distributor Glass Immersion.

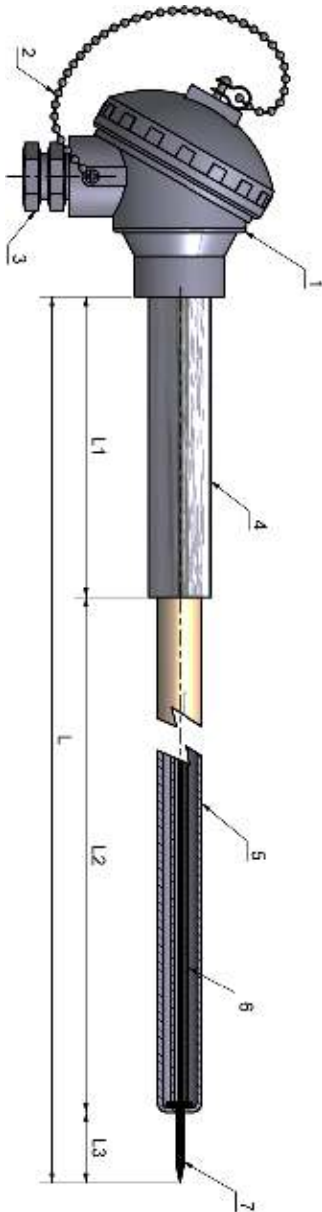
S.No.	Description
1.	SS/Aluminium Connection Head IP-67.
2.	SS Chain.
3.	½" NPT(M) Cable Gland
4.	Holding Tube : (Inconel - 600/SS310)
5.	Recry. Alumina Tube :- OD X ID to be specified.
6.	Inner Tube suitable to Outer Tube.
7.	2 Bore Recry. Alumina Insulating Tube.
8.	Hardened PT/PT Alloy Thimble :- OD X THK. suitable to Inner Tube.
9.	PT-RHPT Thermocouple Element R/S/B type
10.	Ceramic Fibre Insulated Compensating Cable 3/6 Mtrs. long with overall Ceramic Fiber Sleeve.
11.	Quick release compensated connectors "R"/"S"/"B" Type.



TI / GL / 04

## GLASS LEVEL PROBES FOR LEVEL CONTROL

Glass level probe for glass level control is made with Pt alloy probe. Inside and outside protection is with recrystallised alumina tubes, with this customer can replace old fashioned water cooled level probes. These probes are available in different type of hangers as per customer requirement. Service life is very good. All lengths & dia are available as per site needs.

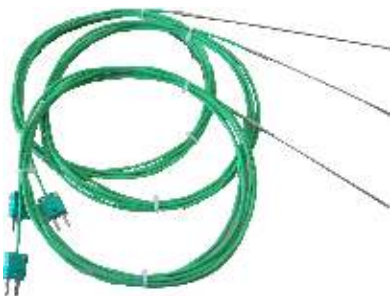


TI / GL / 03

Type	TI/GL/03
Measuring Range	Glass Contact.
Sensor Type	Pt. or Pt. Rh alloy Electrode.
Protection Sheathing	Recrystallised Alumina KER-710 (C-799) Tube with hole at one end. With PT Alloy Tip for Glass Level Sensing.
Application	Fore Hearth & Distributor.

S.No.	Description
1.	SS/Aluminium Connection Head IP-67.
2.	SS Chain.
3.	½" NPT(M) Cable Gland.
4.	Holding Tube : (Inconel - 600 / SS310).
5.	Recry. Alumina Outer Tube hole at Close End :- OD X ID to be specified.
6.	Inner Tube suitable to Outer Tube.
7.	Pt. Alloy Electrode.

## BLANK MOULD THERMOCOUPLES



To measure the temperature at Blank Mould is important, to achieve proper gob distribution & product quality. Most of the container glass industries are using Blank Mould 'K' Type / J type Thermocouple with mineral insulating flexible high temperature cable. These thermocouples are lower in dia i.e. 1.5mm / 3 mm, and as it is flexible. It can be used for different size of moulds. These thermocouples will help to get continuous monitoring of mould temperature.

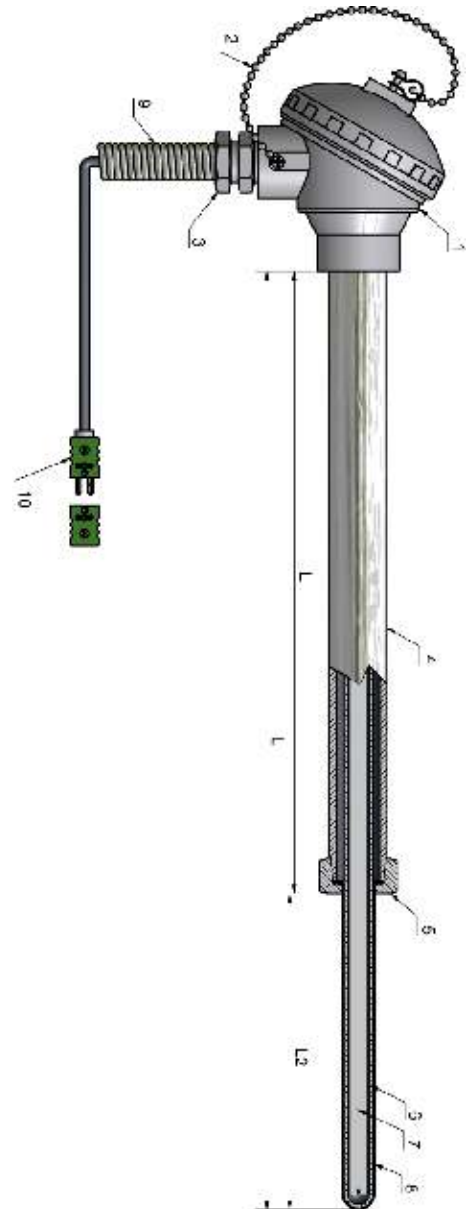
## SPOUT THERMOCOUPLES

In container glass industries Spout Bowl glass temperature is very important. To measure it, we designed Spout Bowl Thermocouples in noble metal with platinum thimble. It is immersed through side and user can get correct temperature of molten glass just before glass cutting. Length as per application need.



<b>Type</b>	<b>TI/GL/06</b>
Measuring Range	100 to 1600°C.
Sensor Type	"R"/ "S"/ "B".
Protection Sheathing	Recrystallised Alumina KER-710 (C-799) Tube with hole at one end. Special Hardened Platinum/ PT Alloy Thimble.
Application	Spout Bowl.

S.No.	Description
1.	SS/Aluminium Connection Head IP-67.
2.	SS Chain.
3.	½" NPT(M) Cable Gland.
4.	Holding Tube : (Inconel - 600/SS310).
5.	Process Connection.
6.	Recry. Alumina Outer Tube :- OD X ID to be specified.
7.	Recry. Alumina Insulating Tube.
8.	Hardened PT/PT Alloy Thimble :- OD X THK. suitable to Inner Dimension.
9.	Ceramic Fibre Insulated Compensating Cable 3/6 Mtrs. long with overall Ceramic Fiber Sleeve.
10.	Quick Release Connector "R"/ "S"/ "B" Type.



TI / GL / 06

## ACCESSORIES

### Ceramic Tubes



Open Ended



Close Ended



Insulators

- Material** : Ceramic -Alumina Tubes, Type DIN C-799, Type 610, K 80 etc.  
**Type** : One End Closed / Open Both End.  
**Standard Length** : 350, 530, 600, 650, 740, 900, 1030, 1200, 1430, 2000, 2300mm. etc.  
**OD** : 5mm to 24 mm, other diameters also available on request.

**CeramTec**  
Germany

### Ceramic Protection Sheaths & Insulating Tubes

All thermocouple assemblies produced at Tempsens are with high purity alumina protection sheaths and insulating tubes. These tubes called as sintered recrystallised alumina tube with alumina content 99.7%. Excellent stability under very high temperature is an essential and a prominent property of ceramic materials. These tubes have definite advantages in comparison to other various metals. The maximum application temperature depends on the material. The application temperature is also influenced by the tube geometry, the diameter, the wall thickness and the method of application. Alumina tubes have high mechanical wear resistance. This is specially important for the long term stability of products. Technical parameters of recrystallised alumina tubes are as under :-

Properties	Recrsytallised Alumina Tube (DIN C-799)
Al <sub>2</sub> O <sub>3</sub> -content	99.7%
Color	Yellow/ivory
Specific gravity	3.85
Water absorption	0
Flexural strength	360
Max. temp. use	1.700°C
Thermal conductivity	28
Thermal expansion linear coefficient	
20-100 °C	5.4
20-200 °C	6.5
20-600 °C	7.7
20-1.000 °C	8.5
Volume resistivity	
200 °C	10 <sup>15</sup>
400 °C	10 <sup>13</sup>
600 °C	10 <sup>11</sup>
Temperature stability	good/satis.
Chemical resistivity	very good
Te value	1.000

## High Temperature Cables

Compensating and Extension cables for thermocouples J,K,T,E,N,R,S,B Types.

- Wire Gauge** : 14 to 36 gauge (AWG/SWG)
- Conductor** : Solid / Multistrand
- Insulation** : Single and Double Fibre Glass, Teflon, Silicon, Ceramic Fibre(Nextel), Silica Fibre, SS Braided, PVC etc.
- Protection** : Armoured / Unarmoured.



Other Cables for Signal, Control and Instrumentation are available with variety of insulation and various configurations

### WIRE INSULATION IDENTIFICATION AND APPLICATION GUIDE

INSULATION CODE	INSULATION		APPEARANCE OF THERMOCOUPLE GRADE WIRE	TEMP. RANGE INSULATION	ABRASION RESISTANCE	FLEXIBILITY	WATER SUBMERSION	RESISTANCE TO:	
	OVERALL	CONDUCTORS						FLAME	HUMIDITY
<b>P</b>	Polyvinyl Chloride (PVC)	Polyvinyl Chloride (PVC)		40 to 105°C	GOOD	EXCELLENT	GOOD	GOOD	GOOD
<b>T</b>	PTFE or PFA/FEP	PTFE or PFA/FEP		267 to 260°C	EXCELLENT	GOOD	EXCELLENT	EXCELLENT	EXCELLENT
<b>K</b>	Kapton	Kapton		267 to 316°C	EXCELLENT	GOOD	EXCELLENT	EXCELLENT	EXCELLENT
<b>S</b>	Silicon	Silicon		40 to 200°C	GOOD	GOOD	EXCELLENT	GOOD	EXCELLENT
<b>F</b>	Fiber Glass Braid	FTFE/PFA or Fiber Glass		73 to 260°C	GOOD	GOOD	EXCELLENT	EXCELLENT	EXCELLENT
<b>CF</b>	Ceramic Fiber	Ceramic Fiber		73 to 871°C	POOR	GOOD	POOR	EXCELLENT	EXCELLENT
<b>SF</b>	Silica	Silica		73 to 1038°C	POOR	GOOD	POOR	EXCELLENT	FAIR

## Connectors

Plug and Jack compensated connectors for thermocouples.



- Types** : J, K, R, S, B, T, E  
Standard, Miniature
- Material** : Glass filled engineering plastic suitable up to 150 °C

## NABL CALIBRATION SERVICE

Calibration of contact and non contact type sensors in temperature range -38°C to 1500°C

- Onsite Calibration services at Customer place
- Fixed point calibration - TPW, Ga, Sn, Zn and Al
- NABL certified calibration services In house/ Onsite
- Well experienced engineers



## COMPONENT SELECTION

### Thermocouple Elements

Elements used in all Tempens assemblies are made from using high precision calibrated thermocouple wires with class 1 accuracy. Tempens ensures all thermocouples supplied in a single project with the same batch of element and with the same accuracy to avoid any temperature deviation. Measuring Junctions are made with highly skilled workmanship and each measuring junction is traceable in form of photograph in computer memory which can be retrieved even after long time in case of need. In high temperature applications, noble metal thermocouples R, S & B are the most used element world wide. Below are the technical specifications of these elements :

#### Type S : Pt vs. Pt 10 Rh

This combination is one of the most common and widely used noble metal thermocouple. The accuracy of S type element is excellent through out the range, this element has excellent mechanical and chemical properties. This combination is suitable for oxidizing atmosphere, but not suitable for reducing atmosphere.

**Recommended temperature range**

400°C to 1650°C continuously

**Accuracy Level**

Standard :  $\pm 1.5^\circ\text{C}$  or  $\pm 0.25\%$

Special :  $\pm 0.6^\circ\text{C}$  or  $\pm 0.1\%$

**Size available:** 0.30mm to 1mm diameter.

#### Type R : Pt vs. Pt 13 Rh

This combination is very similar to S type element with slight higher thermoelectric output (mV), all other properties and recommendations are same for S type.

**Recommended temperature range**

400°C to 1650°C continuously

**Accuracy Level**

Standard :  $\pm 1.5^\circ\text{C}$  or  $\pm 0.25\%$

Special :  $\pm 0.6^\circ\text{C}$  or  $\pm 0.1\%$

**Size available:** 0.30mm to 1mm diameter.

#### Type B : Pt 6 Rh vs. Pt 30 Rh

This combination is used for higher temperature application where S & R type elements are showing accelerated drift or physical degradation. Thermoelectric output of B type is lower than other two combinations.

**Recommended temperature range**

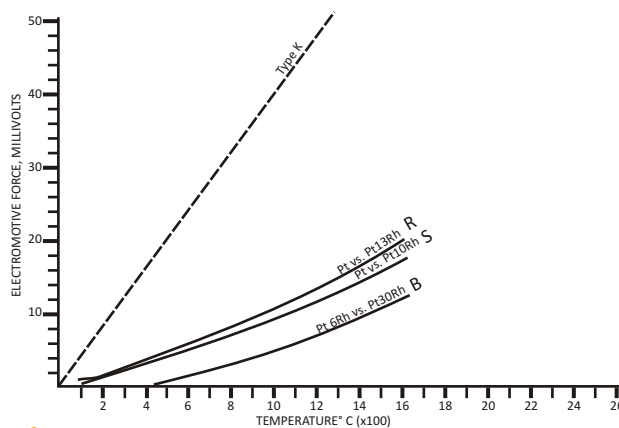
400°C to 1750°C continuously

**Accuracy Level**

Standard :  $\pm 0.5\%$

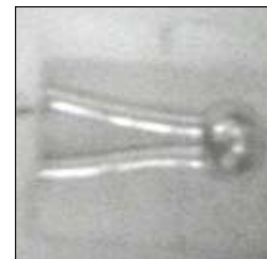
Special : though special class is not available but higher accuracy are available on request.

**Size available:** 0.30mm to 1mm diameter.



### Thermocouples Junction

The photograph shown is right kind of measuring junction. The melting of both legs to be proper and equal to avoid premature opening of junction. During production, the photograph of each Thermocouple is kept as record for future reference.



## Precious Metal Thimbles / Cladding

In all Glass Immersion Thermocouples we use special hardened platinum alloys. The stress rupture strength of these hardened material is even better than Pt-10%Rh alloy, this can be checked with below table :-

	Density g/cm <sup>3</sup>	Melting Point or solidus Temperature °C	Vickers hardness	Stress repture strength (100 h / 1400°C) N/mm <sup>2</sup>	(100h / 1600°C) N/mm <sup>2</sup>
Pt	21.4	1772	45	< 1	-
Pt-10Rh	19.9	1840	95	5	2.8
Pt (Hardened)	21.3	1772	72	25	-
Pt-5Au (Hardened)	21.3	1675	115	5	-
Pt-10Rh (Hardened)	19.9	1840	150	40	17.0

With Hardened Platinum we have succeeded in supplying a new class of materials with greatly improved high temperature properties and corrosion resistance compared with pure platinum and platinum alloys.

The dispersoids not only cause a considerable alternation in the crystallization properties, but also at high temperatures prevent the loss of the additional hardness which is achieved when forming the material to finished product state. In this way, equipment which is made of Hardened Platinum can be produced from less material and can be employed at temperatures approaching the melting point of platinum without the need for supporting components.

Due to modified grain structure, Hardened Platinum materials are considerably more resistant to grain boundary corrosion than traditional materials.

In Glass industry, equipment is normally exposed simultaneously to several forms of loading ,e.g. high temperature exposure, mechanical stress, corrosive attack etc. Problems which have previously arisen in the choice of equipment can be now solved by the use of dispersion strengthened materials.

### Holding Tubes

We have selection of holding tubes in different metals and sizes depending on application and temperatures, Most used material in holding tubes are Inconel-600 / 800, SS310 & SS316. Diameter of holding tube will depend on the size of outer protection tube.

Looking to the importance of all above critical components we are extremely careful for the quality of all components as it is really important to ensure stable & repeatable results for our supplied thermocouples.

### Scrap metal recovery

Precious metal thermocouples always have value - even when they have completed their service life and are no longer usable. The metal content of precious metal thermocouples can be recycled into new replacements; or monetary credit can be given for their current value; or provide the user with book credit for use at a later date. All reclamations are made on a weight basis. For the most accurate and beneficial credit, used thermocouples should be returned intact for recovery of precious metal in full.

# NON CONTACT RADIATION PYROMETERS

## Fibre Optics Pyrometers

**Tempsens** Fibre Optics Pyrometers are specially designed digital pyrometer for glass industry application which provide high performance with low maintenance. Especially designed for Glass furnace, fore hearth, Feeder and working end. The rugged fibre optic cable is designed to withstand high ambient temperature without water cooling. The supplied software allows remote communication and data logging through RS 232. Emissivity, sub range or response time and peak picker can be preset ex works or adjusted through software. The pyrometers have solid body in Stainless Steel housing which provide high operation safety even in rough industrial environment.



Type	Fibre Optics Pyrometers
Temperature Range	600 ..... 1800°C (User Programmable)
Sensor Type	Si
Features	High Accuracy Fast Response Time Air Purge with quick release Bayonet Connectors Suitable for High ambient Temperature upto 250°C Rugged Stainless Steel Housing
Application	Furnace Crown, Forehearth /Feeder, Furnace Side wall, Working End, Molten Glass Temperature Measurement.

Specification	
Emissivity	0.1 .... 1.0 Adjustable
Spectral	1 $\mu$ m
Field of View	100 : 1 (Approx.) Min. Spot 13mm
Response	2ms Adjustable upto 10s
Analog Output	4.....20mA
Digital	RS 232 or RS 485 /422
Sighting	Without Laser
Power	24VDC
Accuracy	0.3%

# PORTABLE PYROMETERS

## General Application Pyrometers

Tempsens provides Fast & accurate handheld pyrometers for temperature measurement of almost all applications such as Non-Metallic surfaces, Refractory, Ceramic, Coated, Painted or Anodized metals. Integrated laser pilot lights to aim the measuring spot. Optional add-on optical systems can be fitted to the handheld instruments for flexibility in adapting to the respective measuring situation.



Type	General Application
Temperature Range	-32 ..... 900°C
Sensor Type	Thermopile
Features	Laser Targeting Light Min./Max./Avg. Data storage
Application	General applications / Surface Temperature

Specification	
Emissivity	0.2 .... 1.0 Adjustable
Spectral Range	8....14 µm
Field of View	50 : 1 (Min 2.2)
Response Time	150ms
Output	RS 232 and Analog output
Sighting	Laser Targeting

## Glass Surface Temperature Measurement Pyrometers

Fast and Accurate Portable pyrometers are available for Glass Surface temperature measurement. These are useful for float Glass, Bulb Shell temperature measurement, Bottle Temperature, Sheet Glass Etc.



Type	Glass Surface
Temperature Range	150...1800°C
Sensor Type	Special Thermopile
Features	Laser Targeting Light Spectral range 5.14 µm Small spot sizes
Application	Temperature Measurement of Glass Surface

Specification	
Emissivity	0.2 .... 1.0 Adjustable
Spectral Range	5.14 µm
Field of View	50 : 1
Response Time	150ms
Output	RS 232 and Analog output
Sighting	Laser Targeting Light

## Optical Pyrometers

Optical Pyrometers are available in wide temperature range and very robust aluminum die-cast housing for use in rough environments. Focusable precision optics for adjusting smallest spot sizes. Temperature displays on the housing, in the view finder and on the multi functional display sideways. These are useful for Inside Furnace Temperature Measurement, Molten Glass, Gob Temperature etc.



Type	Optical Pyrometer
Temperature Range	250...1600°C
Sensor Type	InGaAs
Features	Very Fast Very small Spot size Maximum value storage Temperature indicator inside the view finder
Application	Temperature Measurement of Molten Glass, Glass Gob & Glass Moulds

Specification	
Emissivity	0.1 .... 1.0
Spectral Range	1.45....1.8 µm
Field of View	Min 230 : 1
Response Time	1ms
Output	USB/RS 232
Sighting	View Finder

## ONLINE PYROMETERS

### Glass Surface Pyrometer

The measurement of the surface temperature of glass is very important in many production processes connected with the heating or cooling of glass such as In Toughening of glass, test of thermal resistance of glassware, monitoring the temperature of strip drawn from the furnace, Float Glass Production, Bottle Temperature, Bulb Shell and Tube temperature.

Online pyrometer in two wire design is available for temperature measurement of Glass surface . It is simple to use and it provides highly accurate digital signal .It is equipped with a digital interface, enabling temperature indication and storage on a PC. The temperature sub range can be configured and the instrument parameters can be adjusted remotely.



Type	Ratio Pyrometer
Temperature Range	100...2500°C
Sensor Type	Special Thermopile
Features	Two-wire design High accuracy due to digital linearisation of the output Adjustable exposure time Compact housing
Application	Temperature Measurement of Glass Surfaces in Float Glass

Specification	
Emissivity	0.2 .... 1.0
Spectral Range	5.14 µm
Field of View	3 Fixed Optics 50:1 (Min 2.5)
Response Time	80ms adjustable upto 30ms
Output	4.....20 mA
Sighting	Laser Targeting Light

### Glass Gob Pyrometer

Tempsens provides special two colour Pyrometer for Gob Temperature Measurements. These pyrometers are equipped with a built-in lens contamination control system. Short response time facilitates the measurement of fast heating processes. Emissivity slope, exposure time and analog output can be set directly in the instrument. Thus, pyrometers ensure the desired container wall thickness through the core temperature of the gob.



Type	Glass Surface
Temperature Range	700...2500°C
Sensor Type	Silicon Sandwich
Features	Two Colour Design (Switchable to mono mode) High accuracy Adjustable Measuring ranges Max. Value Storage Very small spot sizes Laser targeting light or View Finder or Integrated TV Camera Analog output and Digital interface
Application	Temperature Measurement of Glass Gob

Specification	
Emissivity	0.2 .... 1.0
Spectral Range	Channel 1: 0.9 µm Channel 2: 1.05 µm
Field of View	Min 200 : 1 (Min 01.5)
Response Time	10 ms adjustable upto 10s
Output	0/4.....20mA RS 232 or RS 485
Sighting	Laser Targeting Light or View Finder or Integrated TV Camera

## INSTALLATION RECOMMENDATIONS

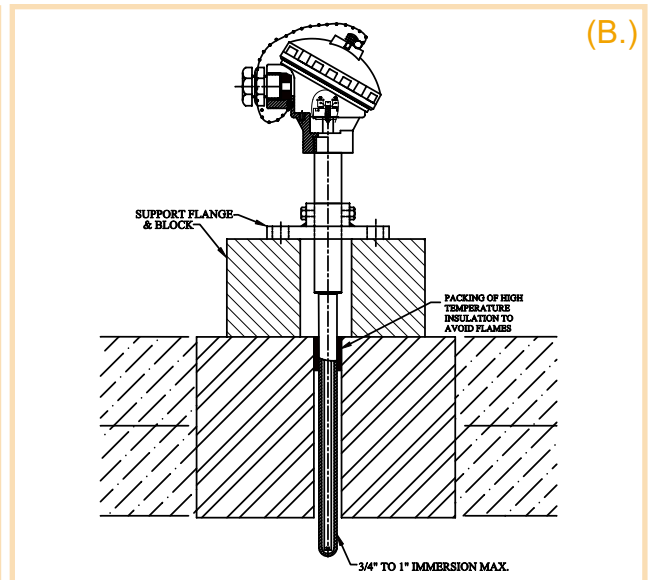
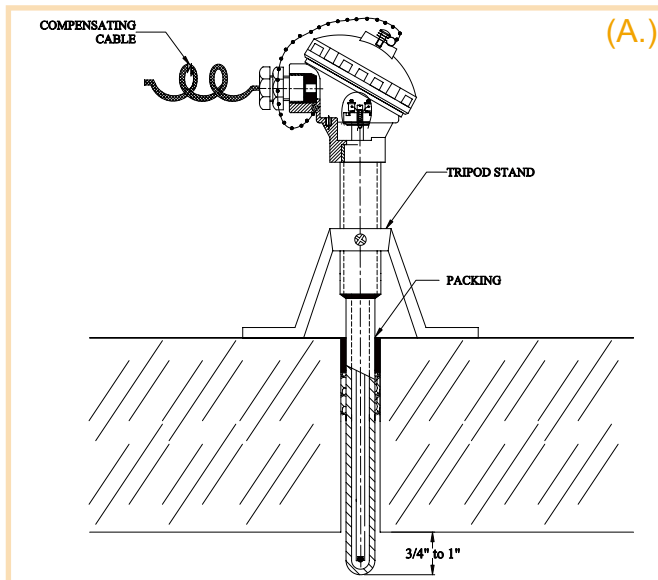
The following installation recommendations are based on the long experience available with Tempens. However, each furnace must be considered independently and selectively to determine if these recommendations are appropriate. Tempens is always pleased to provide technical support to its customers about the installation and thermocouple design .

### Method of Good Installation :

Connection Head should be 6" to 12" above roofing, protection sheath should be properly packed with high temperature insulation to avoid heat.

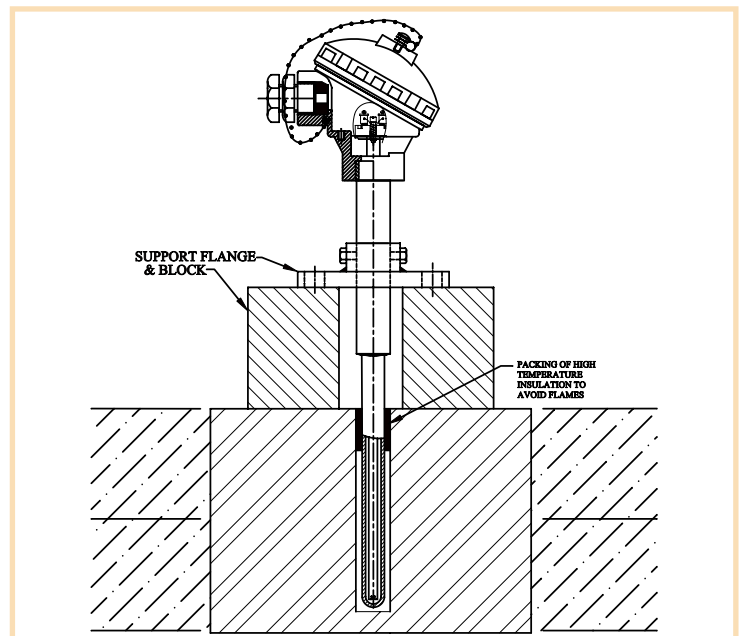
**Preheating :** Tempens recommend a preheating of thermocouple at a temperature of 200°C - 300°C for atleast 12 hrs & then gradual immersion of thermocouple can be done.

### Furnace crown immersion thermocouple

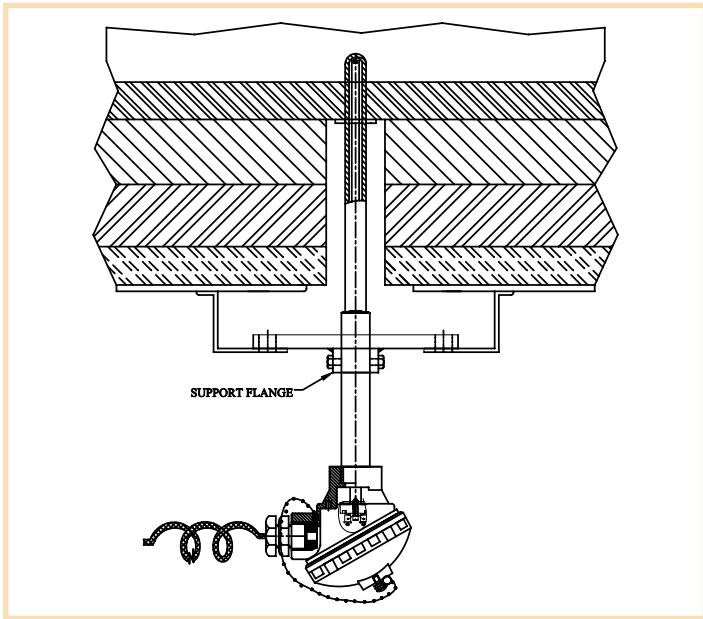


### Non Immersion or In Block (Blind) Installation

On Furnace Crown, Regenerator Crown & Many Glass Industries uses non immersion or Blind Thermocouples. This installation recommendation is ideal for all non immersion designs.



## INSTALLATION RECOMMENDATIONS

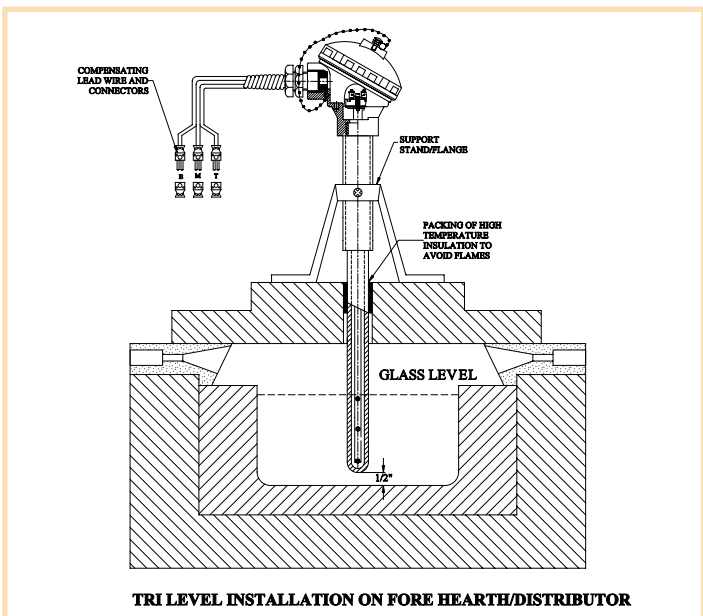
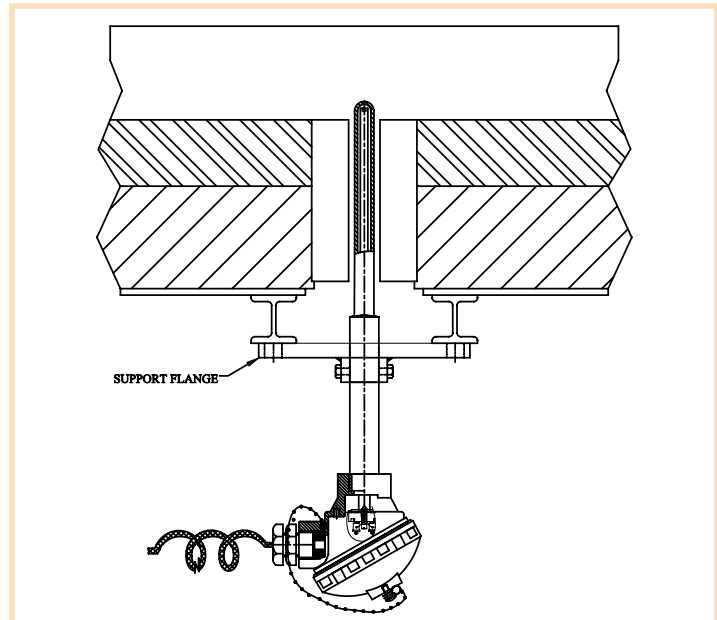


### Furnace Bottom Immersion Thermocouple

A common approach to immerse a thermocouple through a layered bottom. Shown is the partially thimbled thermocouple, with a flanged installation. Cooling air may be required to insure glass seal off.

### Direct Immersion

Full length thimble designs can extend up to 4 inches beyond the bottom of the block. The hole diameter should be kept to a minimum (15 mm) and counterbored only if shifting, tilting, or shear cracking are anticipated. By installing blocks with one or two additional blind holes in them, hot drilling and insertion of replacement thermocouples, bubbler tubes, etc., can be easily accommodated.



TRI LEVEL INSTALLATION ON FORE HEARTH/DISTRIBUTOR

### Method of Tri Level Installation on Fore Hearth / Distributor

Connection Head should be 6" to 12" above roofing, protection sheath should be properly packed with high temperature insulation to avoid heat.

Thermocouple should be 1/2" above bottom block as to avoid any breakage due to thermal expansion. All three points should be in the glass depth & difference in thermocouple points to be selected as per glass depth.

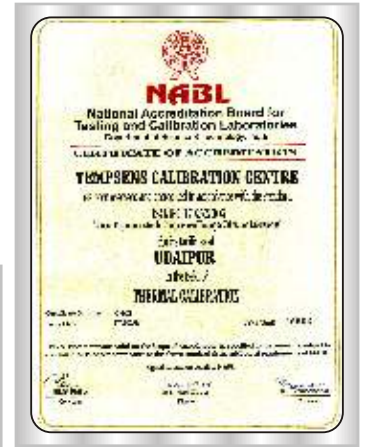
**Always one step ahead.....Committed to success**

TEMPSENS Instruments (I) Pvt. Ltd is a part of Pyrotech group which was established by four technocrats in 1976 at Udaipur, with our first product as Thermocouples and RTDs. To enhance our customer's success we provide high quality products and services for "Temperature solution", tailored to their needs, and delivered to meet their schedule.

We have tied up with world leaders in Temperature measuring technology for critical components, Non contact Temperature measurement and Thermal imaging solutions. We add value to these products and deliver complete engineered solutions, backed by efficient service and application support.

Today we have strong sales and service network operating from important locations of India and abroad. Continuing our constant endeavor of delivering solutions for temperature technology to our large base of over two thousand satisfied customers.

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**OTHER PRODUCTS**

- |                            |                                |
|----------------------------|--------------------------------|
| ➤ Thermocouples            | ➤ Non Contact Pyrometers       |
| ➤ RTDs                     | ➤ Thermal Imagers              |
| ➤ Thermowells              | ➤ Kiln Shell Scanners          |
| ➤ Thermocouple Accessories | ➤ Furnace Cameras              |
| ➤ Master Sensors           | ➤ Heaters                      |
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