High Temperature Metal Sheathed Thermocouples - Type 27

High temperature thermocouple sensors with a variety of specialist conductor, insulation and sheath materials.

For use in extreme service temperatures (up to 2300°C) and harsh environmental conditions.

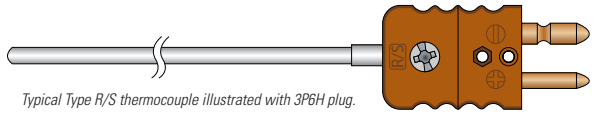
TC Ltd for Temperature Sensing, Measurement and Control

Type 27 High Temperature Metal Sheathed Thermocouples

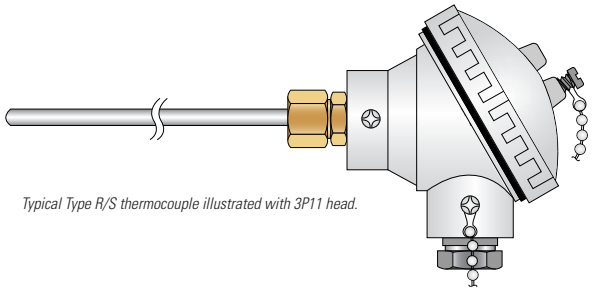
High Temperature Thermocouples for Applications up to 2300°C

These high temperature thermocouples are used in applications where other thermocouples would fail due to excessive heat or severe environments. Utilising specialist exotic sheath materials such as Platinum 10% Rhodium, Molybdenum and Tantalum they can be used in service temperatures up to 2300°C. The combination of conductor, insulation material and sheath must be carefully selected to suit your process environment, service temperature and installation requirements (i.e. whether the probe is flexible or not). Our experienced sales team are on hand to assist where needed, so please contact us if help is required.

- **Typically used with high temperature thermocouple types R, S, B, C and D**
- **Temperatures up to 2200°C (continuous) or 2300°C (short term)**
- **Semi-Rigid (mineral insulated) and Rigid (tube) styles available**
- **Wide range of end seals, terminations and cables available**
- **Calibration service for oxidizing and inert environments up to 1600°C**



Typical Type R/S thermocouple illustrated with 3P6H plug.



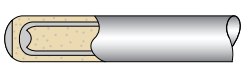
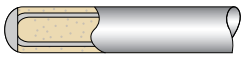
Typical Type R/S thermocouple illustrated with 3P11 head.

SECTION 1	Thermocouple Type	Temperature Range (continuous)	Temperature Range (short term)
R	Platinum - 13% Rhodium vs Platinum	0 to +1600°C	-50 to +1750°C
S	Platinum - 10% Rhodium vs Platinum	0 to +1550°C	-50 to +1700°C
B	Platinum - 30% Rhodium vs Platinum - 6% Rhodium	+100 to +1600°C	+100 to +1820°C
C	Tungsten - 5% Rhenium vs Tungsten - 26% Rhenium	0 to +2200°C	0 to +2300°C
D	Tungsten - 3% Rhenium vs Tungsten - 25% Rhenium	0 to +2200°C	0 to +2300°C

SECTION 2	Insulation Material	Comments	Maximum Temperature
MGO	**Magnesium Oxide** (MgO)	Very hygroscopic. Used mostly in compacted sheaths.	1700°C
ALO	**Aluminium Oxide** (Al_2O_3)	Excellent with Platinum alloys.	1550°C
HFO	**Hafnium Oxide** (HfO_2)	Comparable to Beryllium Oxide and safe to handle.	2200°C

SECTION 3	Sheath Material	Operational Properties	MI (Semi-Rigid) Tube (Rigid)	Insulation Material	Thermocouple Types	Available Sheath Diameters (mm)	Max. Continuous Temperature*
600	**Inconel 600®**	Suitable for use in inert, vacuum and oxidizing environments. **Minimum bend radius: 5 x sheath diameter**. Not recommended for use above 800°C in oxidising atmospheres. Do not use in sulphur bearing atmospheres above 550°C.	Semi-Rigid	MgO	**R, S and B**	1.0mm, 1.5mm, 3.0mm, 3.2mm, 4.8mm, 6.0mm and 6.4mm	1175°C
600T	**Inconel 600®**	As above. **Do not bend.**	Rigid	Al_2O_3	**R, S and B**	3.0mm, 3.2mm, 4.8mm, 6.0mm and 6.4mm	1175°C
P10R	**Platinum 10% Rhodium**	Suitable for use in inert and oxidizing environments. **Minimum bend radius: 10 x sheath diameter**.	Semi-Rigid	MgO	**R, S and B**	1.0mm, 1.5mm and 1.6mm	1550°C
TAN	**Tantalum**	Suitable for use in inert and vacuum environments. **Minimum bend radius: 5 x sheath diameter**.	Semi-Rigid	MgO, Al_2O_3, HfO_2	**R, S, B, C and D**	1.0mm, 1.5mm, 1.6mm, 3.0mm and 3.2mm	2200°C
NIO	**Niobium 1% Zirconium**	Suitable for use in inert and vacuum environments. **Minimum bend radius: 10 x sheath diameter.**	Semi-Rigid	MgO, Al_2O_3, HfO_2	**R, S, B, C and D**	1.6mm and 3.2mm	2200°C
MOL	**Molybdenum**	Suitable for use in inert, vacuum and reducing environments. **Do not bend**.	Rigid	MgO, Al_2O_3, HfO_2	**R, S, B, C and D**	1.5mm, 1.6mm, 3.0mm, 3.2mm, 4.8mm, 6.0mm and 6.4mm	2000°C
CMOL	**Coated Molybdenum**	Suitable for use in inert and oxidizing environments. **Do not bend**.	Rigid	MgO, Al_2O_3, HfO_2	**C and D**	1.5mm, 1.6mm, 3.0mm, 3.2mm and 6.4mm	1600°C

** Maximum temperature range of sensor is limited by the choice of insulation material.*

SECTION 4	Types of Sensing Junction	
2I		**Insulated** The hot (measuring) junction is insulated from the sheath and this gives a floating output with a typical insulation resistance in excess of 100 megohms. Enter **2I** for simplex or **2ID** for duplex.
2G		**Grounded** Hot junction welded to sheath tip giving earthed output and faster response to temperature changes. Enter **2G** for simplex or **2GD** for duplex.

Thermocouple Type		Thermocouple Output Tolerances (IEC 60584.1) Type	Class 1	Class 2	Class 3
R	Platinum - 13% Rhodium vs Platinum	Range Tolerance Range Tolerance	0°C to +1100°C ±1.0°C 1100°C to 1600°C ±(1 +0.003 (t · 1100)°C	0°C to +600°C ±1.5°C 600°C to 1600°C ±0.0025 · [t]	– – – –
S	Platinum - 10% Rhodium vs Platinum	Range Tolerance Range Tolerance	0°C to +1100°C ±1.0°C 1100°C to 1600°C ±(1 +0.003 (t · 1100)°C	0°C to +600°C ±1.5°C 600°C to 1600°C ±0.0025 · [t]	– – – –
B	Platinum - 30% Rhodium vs Platinum - 6% Rhodium	Range Tolerance Range Tolerance	– – – –	– – 600°C to 1700°C ±0.0025 · [t]	600°C to +800°C ±4.0°C 800°C to 1700°C ±0.005 · [t]
C	Tungsten - 5% Rhenium vs Tungsten - 26% Rhenium	Range Tolerance Range Tolerance	– – – –	0°C to +425°C ±4.4°C 425°C to 2320°C ±1.0%	– – – –
D	Tungsten - 3% Rhenium vs Tungsten - 25% Rhenium	Range Tolerance Range Tolerance	– – – –	0°C to +400°C ±4.5°C 400°C to 2320°C ±1.0%	– – – –

High Temperature Metal Sheathed Thermocouples Type 27

SECTION 5

Types of End Seal Configuration

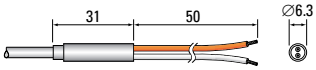
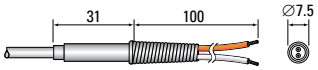
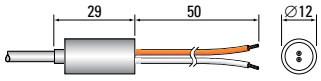
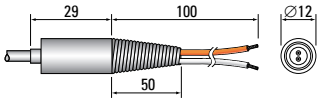
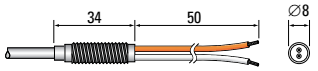
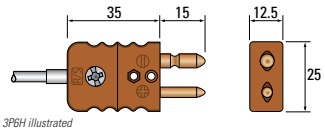
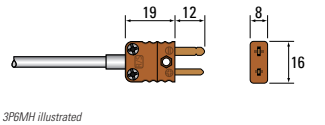
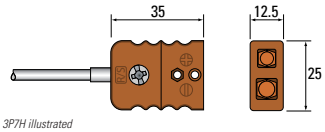
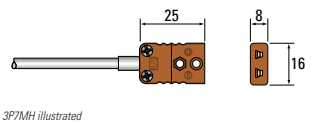
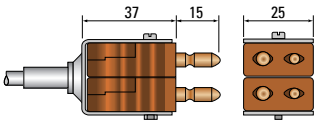
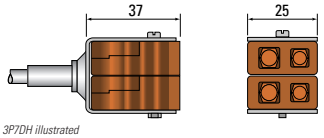
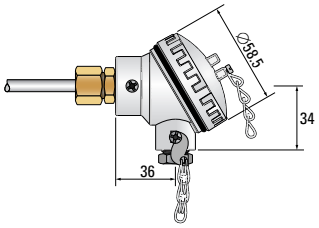
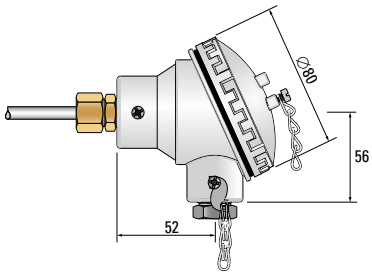
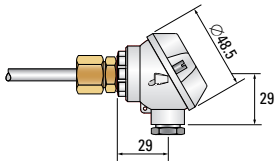
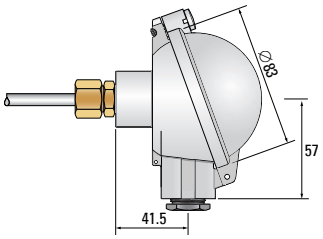
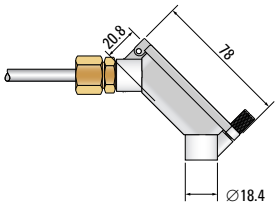
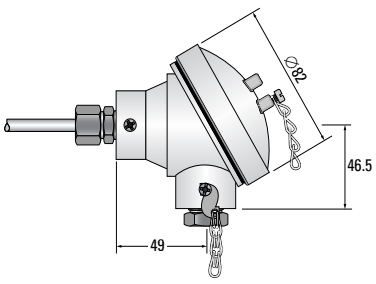
	Diagram	Specification
3P1		**Internal Seal with Bare Conductors** for all sheath diameters 3P1 Maximum end seal temperature **135**°C 3P1B Maximum end seal temperature **300**°C
3P2L		**Crimp on Stainless Steel Pot Seal** for sheath diameters up to 3.0mm 3P2L Pot Seal rated to **135**°C 3P2LA Pot Seal rated to **235**°C 3P2LB Pot Seal rated to **300**°C *see section 9 if extension leads are required*
3P2 TRL	 ** It is unlikely that any benefit would be derived from specifying this type of pot seal with the standard 100mm tails.*	**Stainless Steel Pot Seal with Anti Chafe Spring** for sheath diameters up to 3.0mm 3P2TRL Pot Seal rated to **135**°C 3P2TRLA Pot Seal rated to **235**°C 3P2TRLB Pot Seal rated to **300**°C *see section 9 if extension leads are required*
3P4CL		**Crimp on Stainless Steel Pot Seal** for sheath diameters between 3.0mm & 6.4mm 3P4CLA Pot Seal rated to **235**°C 3P4CLB Pot Seal rated to **300**°C *see section 9 if extension leads are required*
3P4 CTRL	 ** It is unlikely that any benefit would be derived from specifying this type of pot seal with the standard 100mm tails.*	**Stainless Steel Pot Seal with Anti Chafe Spring** for sheath diameters between 3.0mm & 6.4mm 3P4CTRL Pot Seal rated to **135**°C 3P4CTRLA Pot Seal rated to **235**°C 3P4CTRLB Pot Seal rated to **300**°C *see section 9 if extension leads are required*
3P3L	 *Lock nuts are available in stainless steel to suit the 3P3L series and should be ordered separately as LN08S.*	**8mm ISO x 1mm Threaded Stainless Steel Pot Seal** for sheath diameters up to 3.0mm 3P3L Pot Seal rated to **135**°C 3P3LA Pot Seal rated to **235**°C 3P3LB Pot Seal rated to **300**°C *see section 9 if extension leads are required*
3P6	 *3P6H illustrated*	**Standard 2-pin (round) Plug** for sheath diameters between 1.0mm & 6.4mm 3P6 Plug rated to **220**°C 3P6H Plug rated to **300**°C 3P6UH Plug rated to **425**°C 3P6C Plug rated to **600**°C
3P6M	 *3P6MH illustrated*	**Miniature 2-pin (flat) Plug** for sheath diameters between 1.0mm & 3.2mm 3P6M Plug rated to **220**°C 3P6MH Plug rated to **300**°C 3P6MUH Plug rated to **425**°C 3P6MC Plug rated to **600**°C
3P7	 *3P7H illustrated*	**Standard 2-pin (round) Socket** for sheath diameters between 1.0mm & 6.4mm 3P7 Socket rated to **220**°C 3P7H Socket rated to **300**°C 3P7UH Socket rated to **425**°C 3P7C Socket rated to **600**°C
3P7M	 *3P7MH illustrated*	**Miniature 2-pin (flat) Socket** for sheath diameters between 1.0mm & 3.2mm 3P7M Socket rated to **220**°C 3P7MH Socket rated to **300**°C 3P7MUH Socket rated to **425**°C 3P7MC Socket rated to **600**°C
3P6D	 *3P6DH illustrated*	**Standard DUPLEX 2-pin (round) Plug** for sheath diameters 6.0mm & 6.4mm 3P6D Plug rated to **220**°C 3P6DH Plug rated to **300**°C 3P6DUH Plug rated to **425**°C 3P6DC Plug rated to **600**°C
3P7D	 *3P7DH illustrated*	**Standard DUPLEX 2-pin (round) Socket** for sheath diameters 6.0mm & 6.4mm 3P7D Plug rated to **220**°C 3P7DH Plug rated to **300**°C 3P7DUH Plug rated to **425**°C 3P7DC Plug rated to **600**°C

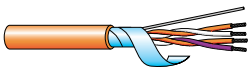
	Diagram	Specification
3P10		Weatherproof die cast alloy, epoxy coated, screw top terminal head with the tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 3mm to 8mm diameter.
3P11		Weatherproof die cast alloy, epoxy coated, screw top terminal head with the tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 20mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 6mm to 14mm diameter.
3P8J		Weatherproof die cast alloy, epoxy coated, screw down terminal head with tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 6mm to 14mm diameter.
3P13A		Weatherproof die cast alloy, epoxy coated, flip-top terminal head with the tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 20mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 6mm to 14mm diameter.
3P9		Weatherproof die cast alloy, epoxy coated, angled terminal head with the tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies.
3P19		Weatherproof Stainless Steel screw top terminal head with the tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex & duplex assemblies. Supplied with a 20mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 6mm to 14mm diameter.

continued

Type 27 High Temperature Metal Sheathed Thermocouples

SECTION 6

Extension Cables

	Diagram	Specification		Diagram	Specification
A27		**HR PVC Twisted Pair with Screen (105°C)** One pair of 7/0.2mm stranded conductors HR PVC insulated. Pair twisted, screened with Mylar® aluminium tape and drain wire. HR PVC sheathed overall.	C40		**Fibreglass Flat Twin (480°C)** One pair of 7/0.2mm stranded conductors double glass fibre lapped, braided and varnished. Pair laid flat, glass fibre braided and varnished.
B20		**PFA Flat Twin (250°C)** One pair of 1/0.5mm solid conductors PFA insulated. Pair laid flat. PFA sheathed overall.	C60		**Fibreglass Flat Twin with Steel Braid (480°C)** One pair of 7/0.2mm stranded conductors double glass fibre lapped, braided and varnished. Pair laid flat, glass fibre braided and varnished. Stainless steel wire braided overall.
B50		**PFA Flat Twin (250°C)** One pair of 7/0.2mm stranded conductors PFA insulated. Pair laid flat. PFA sheathed overall.	C80		**HT Fibreglass Flat Twin with Steel Braid (800°C)** One pair of 13/0.2mm conductors, double HT glass fibre lapped, braided & silicone varnished. Pair laid flat, HT glass fibre braided & silicone varnished. Stainless steel wire braided overall.
B80		**PFA Twisted Pair with Screen (250°C)** One pair of 7/0.2mm stranded conductors PFA insulated. Pair twisted, screened with Mylar® aluminium tape and drain wire with a PFA sheath overall.	M 1702		**PVC 2-Pair - for Duplex Sensors (105°C)** Two pairs of 7/0.2mm stranded conductors FR PVC insulated. Pairs twisted and individually screened with Mylar® aluminium tape with a drainwire. Pairs laid up and screened overall with Mylar® aluminium tape with a drainwire. FR PVC sheathed.
C20		**Fibreglass Flat Twin (480°C)** One pair of 1/0.5mm solid conductors double glass fibre lapped, braided and varnished. Pair laid flat, glass fibre braided and varnished.	BM 0702		**PFA 2-Pair - for Duplex Sensors (250°C)** Two pairs of 7/0.2mm dia stranded conductors PFA insulated. Pairs twisted and bunched and screened with Mylar® aluminium tape with a drainwire. PFA sheathed.

Order Code - Example

Style No.	Thermocouple Type (see section 1)	Sheath Material (see section 3)	Insulation Material (see section 2)	Sheath Diameter (see section 3)	Sensing Junction (see section 4)	Sheath Length (in mm)	End Seal Termination (see section 5)	Extension Cable (see section 6)
27 -	R -	P10R -	ALO -	3.2 -	2I -	500 -	3P4CLB -	2 MTRS C60RCA

If no cable is required, leave this section of the order code blank and the sensor will be supplied with PFA tails. Other cables are available on request.

'HR' = Heat Resistant, 'FR' = Flame Retardant

Calibration

TC Ltd can perform calibration in both inert and oxidising environments. We offer calibration to internationally recognised and approved standards for sensors and instrumentation. Units can be calibrated prior to despatch, or units purchased previously or elsewhere can be sent to our manufacturing facility at a later date. 'System' calibration can be performed to ensure that instrumentation and sensors are reading correctly and what errors you can expect in your application. Please contact us for a full list of calibration services we offer.

Additional Services

X-Ray
Radiographic inspection (X-Ray) is a method of non-destructive testing, a service offered by TC Ltd. This is a method for exposing flaws or faults within cold ends of sheaths, sensing sections of sensors or component products. Radiography can determine where a fault has occurred within a faulty sensor, such as a broken connection between an element and extension cables.

Positive Material Identification (XRF, Chemical Analysis)
Using an XRF tester, we are able to determine the exact chemical composition of any metal tube to determine which sheath material sensors have been manufactured from. This is a form of non-destructive testing and does not impair or affect the sensor.

Helium Leak Testing
Due to Helium being non-toxic, inert, non-flammable and non-condensable, it is the ideal choice for a tracer gas to find leaks within sheaths. Due to a small atomic mass, helium passes easily through leaks and imperfections.

Tagging/Lasermarking/Etching
TC Ltd are able to provide a service for easy identification and to help customers keep track of sensors once they have arrived on site. This includes various tagging options such as metal or plastic 'keyfob' type tags, printing directly onto a sheath or connector with a laser, or etching details onto connectors or pot seals. All options are relatively inexpensive and are quick to do.

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