

Mineral Insulated Thermocouples

- Wide choice of Sheaths, Cold and Hot Ends and Conductor Types
- Approval to Power Station Standards
- Standard and Customised Designs
- Computerised Calibration Available
- Special Tolerances to order

General Description

Our minerally insulated thermocouples are manufactured from superior grade materials. We are approved to manufacture thermocouples to BS EN 61515. We provide technical expertise, advice, design and a manufacturing facility second to none.

Thermocouple Types

Type	Conductor materials	Standard Tolerances
K	Nickel-Chromium/ Nickel-Aluminium	40°C to 333°C : ± 2.5°C 333°C to 1200°C : ± 0.75%
J	Iron/ Copper-Nickel	-40°C to 333°C : ± 2.5°C 333°C to 750°C : ± 0.75%
T	Copper/ Copper-Nickel	-40°C to 133°C : ± 1°C 133°C to 350°C : 0.75%
E	Nickel-Chromium/ Copper-Nickel	-40°C to 333°C : ± 2.5°C 333°C to 900°C : ± 0.75%
N	Nickel-Chromium/Si Nickel-Silicon	40°C to 333°C : ± 2.5°C 333°C to 1200°C : ± 0.75%
B	Platinum-30%Rhodium/ Platinum-6%Rhodium	0 to 600°C : ± 1.5°C 600°C to 1700°C : ±0.25%
R	Platinum-13%Rhodium/ Platinum	0 to 600°C : ± 1.5°C 600°C to 1600°C : ±0.25%
S	Platinum-10%Rhodium/ Platinum	0 to 600°C : ± 1.5°C 600°C to 1600°C : ±0.25%

Class 1 tolerances available to order

Applicable Standards

EMF Values

BS EN 60584-1: 1996, IEC 60854:1195,
Tables of EMF values are available on request.

Manufacture

BS EN 61515:1996

Colour Codes

IEC 60584-3:1989, BS 4937-30:1993

Tolerances

BS EN 60584-2:1193, IEC 60584-2:1982

Hot End Junctions

Insulated Junctions



Insulated hot end junctions are suitable for most applications, especially where low EMF pick-up is essential. High insulation resistance is enhanced due to extreme compaction of the high purity MgO powder insulation.

Bonded Junction



Bonded or grounded junctions offer a slightly faster temperature response than the insulated junction type. Not recommended for multi-point instrumentation.

Exposed Junction



Bare or exposed junction thermocouples provide extremely fast temperature response. Although the exposed MgO is completely moisture sealed, it is not recommended for corrosive environments or temperatures in excess of 300°C.

Extended Tip Junction



Extended tip junctions can also be provided to special order. Their solid end makes this type of construction ideal for spot welding or peening to the contact surface. The standard version has a pointed tip 15 mm long. Other shapes can be provided.

Reduced Tip Junction



Reduced tip junctions are ideal for applications where low mass and extremely fast response times are required, together with good mechanical strength. Reduced tip can be provided on 1.0 to 6.0 mm diameter thermocouples.

Sheaths and Conductors

A wide range of standard sheath materials are available, including 310 Stainless Steel, 321 Stainless Steel, Inconel® 600 and Cupro/Nickel. Thermocouple types J,T,K,E and N can be supplied as standard, in simplex, duplex, and in most cases triplex configurations

Thick Wall Thermocouples

Inconel® 600 and 310 Stainless Steel sheaths are available in thick wall construction for both 5.5 mm and 10.8 mm outside diameters. Nominal wall thickness for 5.5 mm is 1.23 mm and for 10.8 mm is 2.51 mm. Thick wall thermocouples are intended for applications where improved mechanical or corrosion resistance is required.

Special Sheaths

Special sheaths are available including 446 Stainless Steel, 347 Stainless Steel, Nicrosil, Hastelloy® and Nuclear Grade 20/25 Cr/Ni Stainless Steel Grade AESS 10102.

Special Conductors

A wide range of special conductors are available including Platinum-Rhodium/Platinum, Platinel and Tungsten/Rhenium.

Special Coatings

A wide variety of fluoroplastic coatings can be provided to meet corrosive environments. Standard coatings include PPS, PVDF or PFA. Fluoroshield®, a fluorocarbon polymer, can also be provided.

Other Facilities

Pre-ageing for improved stability can be provided in accordance with Power Station standards. Radiographic inspection can also be provided on request.

Thermocouples can still be produced which comply with the obsolete CEBG standards GDCG16, GDCD 244 and GOM 101.

The table below shows the sheath/conductor combinations which are the most common, and are readily available from Thermocouple Instruments.

Type K - Nickel Chromium/Nickel Aluminium									
Sheath Material	Outside Diameter (mm)								
	10.8	8.0	6.0	5.5	4.5	3.0	2.0	1.5	1.0
310 Stainless Steel	① ②	① ②	① ②	① ②	① ②	① ②	① ②	①	①
Inconel® 600	① ②	① ②	① ②	①	①	① ②	①	①	①
321 Stainless Steel			① ②		① ②	① ②	①	①	①
Hastelloy® X		①	①						

Type J - Iron/Copper-Nickel									
Sheath Material	Outside Diameter (mm)								
	10.8	8.0	6.0	5.5	4.5	3.0	2.0	1.5	1.0
321 Stainless Steel			① ②		①	①			

Type T - Copper/Copper-Nickel									
Sheath Material	Outside Diameter (mm)								
	10.8	8.0	6.0	5.5	4.5	3.0	2.0	1.5	1.0
321 Stainless Steel			① ②		①	① ②		①	
Cupro-Nickel								①	

Type E - Nickel - Chromium/Copper-Nickel									
Sheath Material	Outside Diameter (mm)								
	10.8	8.0	6.0	5.5	4.5	3.0	2.0	1.5	1.0
321 Stainless Steel			① ②						

Type N - Nickel-Chromium-Silicon/Nickel-Silicon									
Sheath Material	Outside Diameter (mm)								
	10.8	8.0	6.0	5.5	4.5	3.0	2.0	1.5	1.0
Nicrobell® C			① ②			①		①	

① = Simplex

② = Duplex

Fittings

A wide range of termination glands and adjustable compression fittings are available to suit thermocouples of all diameters.

Cold End Terminations

Springloaded Terminal Blocks

Available as a high grade ATEX approved moulded Ryton block, or as general purpose ceramic version. Both terminal blocks can accommodate sheath sizes from 1.5 mm to 8.0 mm diameter, and can be fitted with up to eight terminals. The Ryton block is suitable for temperatures up to 260°C, and when used in conjunction with an appropriate Thermocouple Instruments connection head, provides a complete assembly approved to ATEX EExde IIC. Both terminal blocks are fitted with 2 x M4 screws mounted on 33 mm centres.

Transmitter Baseplates

Thermocouples can be manufactured with DIN mounting plates to suit temperature transmitters. We can offer a full range of ATEX approved transmitters, from fixed range devices to HART® smart devices.

Moulded Plugs

The P4 plug is a standard round 2 pin moulded plug suitable for 1.0 mm, 1.5 mm, 2.0 mm, 3.0 mm, 4.5 mm and 6.0 mm diameter thermocouples. Maximum ambient temperature is 270°C. A duplex version is also available.

The P3 plug is a miniature flat 2 pin moulded plug which can be fitted to 1.0 mm, 1.5 mm, 2.0 mm and 3.0 mm diameter thermocouples.

Both P3 and P4 can be supplied in socket end versions. An alternative range of high temperature plug and socket combinations is available with ceramic bodies.

Standard Seals

A wide variety of standard and custom designed seals can be manufactured to suit specific applications.

The C Pot is a stainless steel crimped-on epoxy resin seal, suitable for 2.0 mm, 3.0 mm, 4.5 mm, 5.5 mm, 6.0 mm and 8.0 mm diameter thermocouples. Maximum ambient temperature is 105°C when fitted with PVC tail wires and 180°C when fitted with PTFE tail wires and high temperature epoxy. A high temperature glazed seal version is available, with ceramic beaded tail wires, suitable for temperatures up to 350°C.

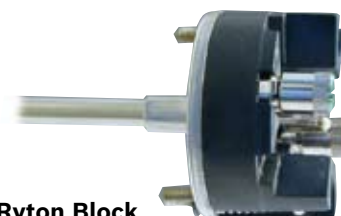
The PS1 Pot is a standard crimped-on stainless steel seal for 0.5 mm, 1.0 mm, 1.5 mm, 2.0 mm and 3.0 mm diameter thermocouples.

Thread Seals

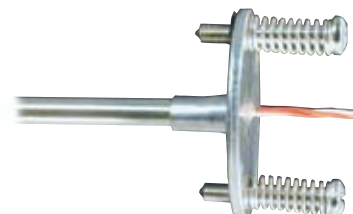
The A Pot is an M8 threaded epoxy resin seal for 0.5 mm, 1.0 mm, 1.5 mm, 2.0 mm, 3.0 mm and 4.5 mm thermocouples.

The B Pot is an M10 threaded epoxy resin seal for 3.0 mm, 4.5 mm, 5.5 mm, 6.0 mm, or 8.0 mm thermocouples.

Locknuts can be supplied. Maximum ambient temperature is 105°C when fitted with PVC tail wires and 180°C when fitted with PTFE tail wires and high temperature epoxy.



Ryton Block



Transmitter Baseplate



P4 Plug



P3 Plug



C Pot



PS1 Pot



A Pot



B Pot

Thermocouple Material Selection Chart

T/C Type	Sheath Material	Maximum Operating Temperature	Typical Applications	Remarks
K	310 Stainless Steel	1100°C	Blast Furnace Gases, Open Hearth Furnace Flues, Re-Heat and Annealing Furnaces, Brick Kilns, Power Station Boilers, High Temperature Superheater Tubes, Vitreous enamelling.	Good oxidation resistance properties but should not be subjected to subsequent manipulation. Satisfactory in sulphur-bearing atmospheres.
K	Inconel® 600	1100°C	Heat Treatment Processes, Chemical Reactors, Annealing Furnaces – Trailing Thermocouples, Soaking Pits, Glass Tank Flues, Cement Kilns, Incinerators and Aircraft Engines.	Excellent high temperature strength and resistance to oxidation but should not be used in sulphur-bearing atmospheres above 550°C. Very good chemical resistance, almost immune to chloride-ion stress cracking
K	321 Stainless Steel	800°C	Nuclear Energy 'In-Pile' Instrumentation, Annealing Furnaces, Chemical Acid Production (Acetic, Nitric etc), Boiler Steam and Feed Water, Turbo-Alternator Steam Measurement, Heat Exchangers. Food and Beverage Processing.	Excellent resistance to corrosion in a wide range of industrial applications, retaining good ductility properties. This grade is titanium stabilized for improved welding characteristics.
K	316 Stainless Steel	900°C	Applications as 321SS, but with improved resistance to a wide range of more aggressive chemicals. Widely used in Paper Digesters.	Best corrosion resistance of the austenitic stainless steels, widely used in chemical processing, offers useful resistance to H ₂ S, dry chlorine gas and sodium chloride.
E	321 Stainless Steel	800°C	Annealing Furnaces, Chemical Acid Production (Acetic, Nitric etc), High EMF output ideal for low temperature sensitivity.	Excellent resistance to corrosion in a wide range of industrial applications, retaining good ductility properties. This grade is titanium stabilized for improved welding characteristics.
J	Inconel® 600	800°C	Polyethylene Manufacture, Tar Stills, Paper Manufacturing Plant.	Excellent oxidation resistance, but should not be used in sulphur-bearing atmospheres at temperatures above 550°C. Very good chemical resistance, almost immune to chloride-ion stress cracking
J	321 Stainless Steel	750°C	Re-heat and Annealing Furnaces, Aluminium Heat Treatment, Chemical Reactors, Plastic Injection Moulding Machines.	Excellent resistance to corrosion in a wide range of industrial applications, retaining good ductility properties. This grade is titanium stabilized for improved welding characteristics.
T	321 Stainless Steel	400°C	Producer Gas Plant, Oil Lubricant Temperature Measurement, widely used in Cryogenic applications. Type T thermocouples are more accurate than other base metal types.	Excellent resistance to corrosion in a wide range of industrial applications, retaining good ductility properties. This grade is titanium stabilized for improved welding characteristics.
T	Cupro-Nickel	400°C	Chemical Acid Production (Sulphuric), Food Processing (Bread Ovens etc), Boiler Flue Gas at Stack, Turbo-Alternator-Condensers, Gearbox Bearings, Plastic Moulding, Sub-zero Temperatures.	Excellent resistance to corrosive environments, particularly under wet conditions.
N	Nicrobell®	1300°C	Blast Furnace Gases, Heat Treatment, Brick Kilns, Power Station Boilers, Nuclear 'In-Pile' Instrumentation, Semiconductor Manufacturing.	Lowest drift of the base metal thermocouple group, particularly good at extreme temperatures and nuclear applications. Can replace expensive platinum types in Some applications.

Other combinations are available - please consult the Sales Office for further details



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