CLEVELAND ELECTRIC LABORATORIES
Thermocouples & Sensing Solutions since 1920

Magnesium Oxide (MgO) Insulated Thermocouples

- MgO thermocouples are versatile sensors for use in process temperatures up to 2400°F and are also recommended in high moisture, liquid, high pressure, and corrosive environments
- Attributes are high dielectric strength, durability, malleability and quick response to temperature fluctuations
- The uniform thickness of wires and magnesium oxide insulation provides mechanical strength, plus corrosion and moisture resistance
- Densely- packed, high- purity MgO insulation is used in all calibrations and sheath materials
- Minimum Bend Diameter is equal to two times the outside diameter

Sheath Ratings

Continuous maximum temperature ratings of sheath in oxidizing atmospheres

304SS:	Up to1650ºF	good corrosion characteristics and resistance to oxidation, generally regarded as a standard sheath material.
Inconel 600:	Up to 2100ºF	good high temperature resistance to corrosion, not suitable for use in presence of sulfur above 1000ºF.
316SS:	Up to1700ºF	has excellent acid corrosion resistance; highly resistant to pitting type corrosion.
310SS:	Up to 2100ºF	good resistance to oxidation and corrosion at high temperatures.

Time Constants

The time required for a thermocouple to indicate 63.2% of a step change in temperature in a surrounding media is The time constant. Several factors influence the measured time constant, such as the degree of insulation compaction, sheath wall thickness and distance of junction from the welded cap on the ungrounded style. These factors, as well as the velocity of liquid or mass past the thermocouple probe, affect the time constant.

TIME CONSTANTS/SECOND

SHEATH DIAMETER (In inches)	GROUNDED JUNCTION	UNGROUNDED JUNCTION	EXPOSED JUNCTION
0.040	0.2	0.7	0.1
0.063	0.3	0.8	0.2
0.125	0.5	1.3	0.3
0.188	1.0	2.5	0.5
0.250	2.3	4.3	0.6

Junction Construction

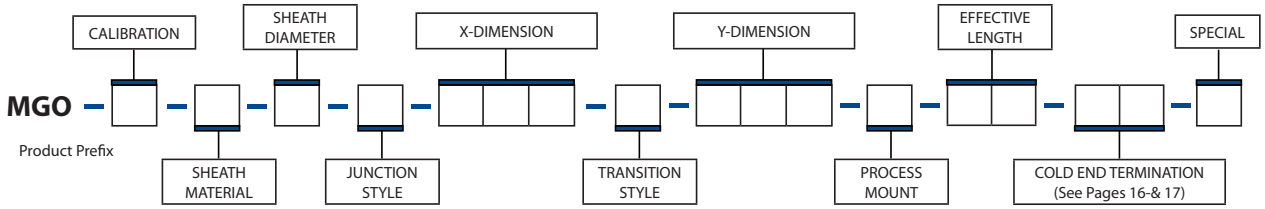
Grounded • Thermocouple welded to the sheath. Fast response with thermocouple protected.

Ungrounded (Isolated) • Thermocouple insulated from sheath with magnesium oxide. Stray EMF's are prevented from affecting the reading. Response from rapid or frequent temperature cycling is slower than grounded style.

Exposed • Thermocouple junction is not protected by welded cap. Used for quick response, but is susceptible to early corrosive failure.

Dual Element Common • Two thermocouples with junctions welded together.

Dual Element Isolated (Standard) • Two thermocouples electrically separate in the same sheath, provides isolation where instrumentation necessitates.

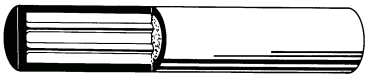


• X-Dimension is the measurement from the tip of the thermocouple to beginning of termination (length of metal sheath).
•• Y-Dimension is the measurement from the beginning of the transition fitting to the end of the wire (transition style only).

CALIBRATION	SHEATH MATERIAL	SHEATH DIAMETER	JUNCTION CONSTRUCTION	X-DIMENSION (IN.)	TRANSITION STYLE
J - Iron-Constantan **K** - Chromel-Alumel **E** - Chromel-Constantan **T** - Copper-Constantan **N** - Nicrosil-Nisil **S** - Plt - Plt 10% Rh **R** - Plt - Plt 13% Rh **B** - Plt 6% Rh - Plt 30% Rh **C** - W 5% Re - W 26% Re **D** - W 3% Re - W 25% Re **P** - Plt 40% Rh- Plt 20% Rh **W** - W-W/26% re **M** - NI/NI Moly	**1** - 304SS **2** - Inconel 600 **3** - 316SS **4** - 310SS **5** - 446SS **6** - Tantalum **7** - Molybdenum **8** - Inconel 601 **9** - Pyrosil **C** - 276 **X** - Hastalloy X **P** - Plt 10% Rh **T** - Plt 20% Rh **G** - 347SS **Q** - Pure Platinum **E** - Super O-C	**1** - .032 **2** - .040 **3** - .063 (1/16") **4** - .125 (1/8") **5** - .188 (3/16") **6** - .250 (1/4") **7** - .315 (5/16") **8** - .375 (3/8") **9** - .500 (1/2") **M** - .090 **F** - .020 **E** - .010 **L** - .750 (3/4") **C** - .013 **H** - .025	**G** - Grounded Junction **U** - Ungrounded Junction **E** - Exposed Junction **H** - Spcl Half Exposed Junction **S** - Squared Tip-Grounded Junction **A** - 45 Deg Angle Tip-Grounded Junction	Specify from 000" to 999"	**0** - No Trans Flex Lead Wire **1** - Fiberglass Covered Std Temp Trans (400 deg F) **2** - Fiberglass w/Flex ArmCov Std Temp Trans (400 deg F) **3** - Fiberglass w/SS Ovrbrd Std Temp Trans (400 deg F) **4** - Polyvinyl Plastic Std Temp Trans (400 deg F) **5** - Teflon Insulation Std Temp Trans (400 deg F) **6** - Teflon w/SS Ovrbrd Std Temp Trans (400 deg F) **7** - Hitemp Glass w/SS Ovrbrd Std Temp Trans (400 deg F) **8** - Teflon Insul/No Trans Body **9** - Teflon w/Flex Armor Std Temp Trans (400 deg F) **M** - Hitemp Glass insulation Std Temp Trans (400 deg F) **C** - PVC Coil Cord Std Temp Trans (400 deg F) **F** - PVC Insulation w/Flex Armor Std Temp Trans (400degF) **K** - Kapton Insulation Std Temp Trans (400 deg F) **A** - Fibre-Glass Insulation Hi Temp Trans (1000 F) **B** - Fibre-Glass w/Flex Armor Hi Temp Trans (1000F) **D** - Fibre-Glass w/SSOB Hi Temp Trans (1000 F) **E** - Hi Temp Glass w/SSOB Hi Temp Trans (1000F) **G** - HI Temp Glass w/Flex Armor Hi Temp Trans (1000F) **H** - Butt-welded Leads-Varflex-No Trans Ftg. **L** - Hi Temp Glass-Hi Temp Trans (1000 F)

Y-DIMENSION (IN.)	PROCESS MOUNTING DEVICE			EFFECTIVE LENGTH (IN.)	SPECIAL
Specify from 000" to 999"	**0** - None **1** - SS 1/2-Hex-1/2" NPT Bushing **2** - SS 3/4-Hex-3/4" NPT Bushing **3** - CS 1/2-Hex-1/2" NPT Bushing **4** - CS 3/4-Hex-3/4"NPT Bushing **5** - Hex Proc Mtg Ftg-1/8" NPT **6** - Hex Proc Mtg Ftg-1/4" NPT **7** - Hex Proc Mtg Ftg-3/8" NPT **8** - Hex Proc Mtg Ftg-1/2" NPT **9** - Hex Proc Mtg Ftg-3/4" NPT **A** - BR Adj Comp Ftg-1/8" NPT **B** - BR Adj Comp Ftg-1/4" NPT **C** - BR Adj Comp Ftg-3/8" NPT **D** - BR Adj Comp Ftg-1/2" NPT	**E** - SS Adj Comp Ftg-1/8" NPT **F** - SS Adj Comp Ftg-1/4" NPT **G** - SS Adj Comp Ftg-3/8" NPT **H** - SS Adj Comp Ftg-1/2" NPT **I** - CS Adj Comp Ftg-1/8" NPT **J** - CS Adj Comp Ftg-1/4" NPT **K** - CS Adj Comp Ftg-3/8" NPT **L** - CS Adj Comp Ftg-1/2" NPT **M** - BR Re-Adj Comp Ftg-1/8" NPT **N** - BR Re-Adj Comp Ftg-1/4" NPT **P** - BR Re-Adj Comp Ftg-3/8" NPT **Q** - BR Re-Adj Comp Ftg-1/2" NPT **R** - SS Re-Adj Comp Ftg-1/8" NPT	**S** - SS Re-Adj Comp Ftg-1/4" NPT **T** - SS Re-Adj Comp Ftg-3/8" NPT **U** - SS Re-Adj Comp Ftg-1/2" NPT **V** - CS Re-Adj Comp Ftg-1/8" NPT **W** - CS Re-Adj Comp Ftg-1/4" NPT **X** - Re-Adj Comp Ftg-3/8" NPT **Y** - CS Re-Adj Comp Ftg-1/2" NPT **Z** - 1/2-Hex-1/2 S.L. Bushing **BR** - Brass **CS** - Carbon Steel **SS** - Stainless Steel Comp - Compression Fitting Mtg - Fixed Mounting Fitting	Specify from 000" to 999"	**0** - None **C** - Lot Certification **D** - Dual Element **E** - Individual Cert **F** - Evac & Backfill **L** - Low Drift / Lot Certified **W** - Weld Pad **X** - Special (Consult Factory) **2** - Dual Element Lot Certified

(G) Grounded Junction
Welded to form a completely sealed integral junction, the G junction component is recommended in presence of liquids, moisture, gas, or high pressure.



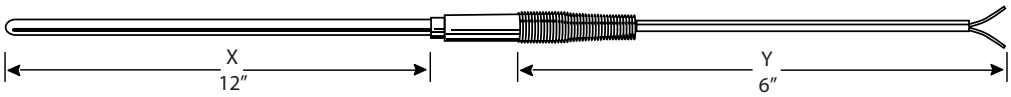
(U) Ungrounded Junction
Fully insulated from the welded sheath end, this junction is excellent for applications where stray EMF's would affect the reading and for rapid or frequent temperature cycling.

E) Exposed Junction
Exposed Junction thermocouple wires are butt welded with insulation sealed against liquid or gas penetration. This component provides the fastest response time, but is unprotected against corrosive or mechanical damage.

Example Ordering Numbers

MGO – K – 2 – 4 – U – 0 2 4 – 0 – 0 0 0 – 0 – 0 0 – 0 4 – 0

This is a Type K Inconel sheath, 1/8" diameter, unground junction, 24" long, with tube adapter and plug.



MGO – K – 3 – 5 – U – 0 1 2 – 1 – 0 0 6 – 0 – 0 0 – 1 S – 0

This is a Type K 316 stainless steel sheath, 3/16" diameter, ungrounded junction, 12" long/transition fitting to 6" glass/glass extension wire-1" strip.

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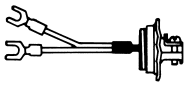
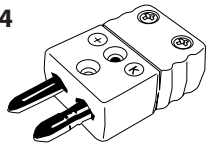
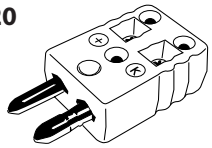
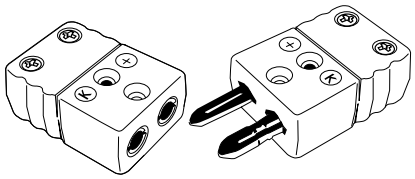
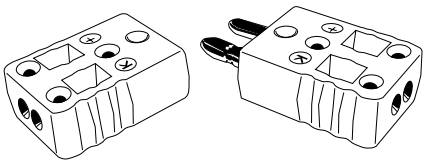
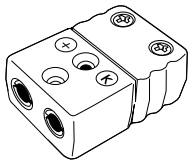
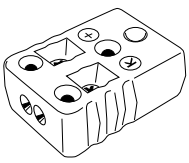
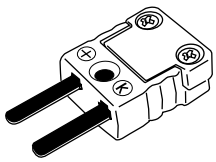
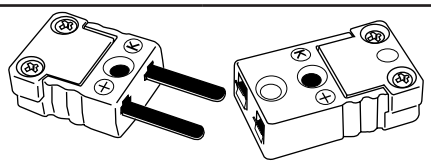
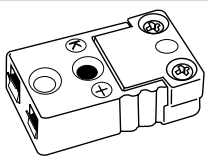
The Termination Specifications listed may be used in assembly Ordering Numbers for Noble, Base and MgO Thermocouples. Most may be ordered separately. Listed are the most common types. Consult the factory for other requirements you may have.

__S 	**Strip*** CODE: ___"S" (Insert desired length in inches)
02 	**2-1/2" Strip with Spade Lugs*** CODE: 02
03 	**2-1/2" Strip with Spade Lugs* BX Connect and Locknut** CODE: 03
04  20 	**Male Plug (400°F)** CODE: 04 Standard Connect CODE: 20 Jab-in Style
05 	**Male Plug and Female Jack (400°F)** CODE: 05 Standard Connect
21 	**Male Plug and Female Jack (400°F)** CODE: 21 Jab-in Style
06  22 	**Female Jack (400°F)** CODE: 06 Standard Connect CODE: 22 Jab-in Style
10 	**Male Mini Plug (400°F)** CODE: 10
11 	**Male Mini Plug and Female Mini Jack (400°F)** CODE: 11
12 	Female Mini Jack (400°F) CODE: 12

High Temperature Male Plug (800°F)
CODE: 07 Standard Connect
CODE: 23 Jab-in Style

High Temperature Female Jack (800°F)
CODE: 09 Standard Connect
CODE: 25 Jab-in Style

High Temperature Male Plug and High Temperature Female Jack (800°F)
CODE: 08 Standard Connect
CODE: 24 Mini Alumina Plug & Jack

High Temperature Mini Male Plug (800°F)
CODE: HM Hi-Temp Mini Male Plug

High Temperature Mini Female Jack (800°F)
CODE: 26 Hi-Temp Mini Female Jack

Male Plug with Crimp Fitting (400°F)*
CODE: CP

High Temperature Male Plug with Crimp Fitting (800°F)*
CODE: CH

Solid Pin Male Plug (400°F)
CODE: SP

3-Pin Male Plug (400°F)
CODE: 3P

Alumina Male Plug (1200°F)
CODE: 18

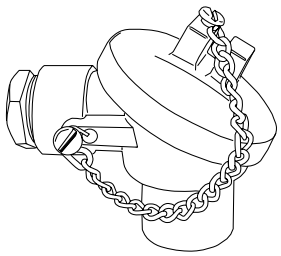
Alumina Female Jack (1200°F)
CODE: 19

No Termination*
CODE: 00

* Not available as separate item.

Screw Cover Heads with Terminal Block

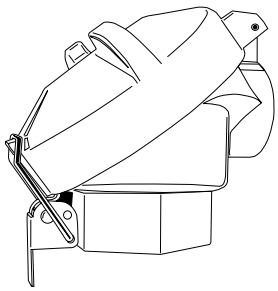
CODE	DESCRIPTION
A1	1″ NPT Aluminum
A2	½″ NPT Aluminum
A4	¾″ NPT Aluminum
C1	1″ NPT Cast Iron
C2	½″ NPT Cast Iron
C4	¾″ NPT Cast Iron
E2	½″ NPT Epoxy Coated Aluminum
SA	Mini Aluminum (Single)
SD	Mini Aluminum (Double)
E1	1″ NPT Stainless Steel
E5	½″ NPT Stainless Steel
E4	¾″ NPT Stainless Steel



SA
SD

Snap Cover Heads with Terminal Block

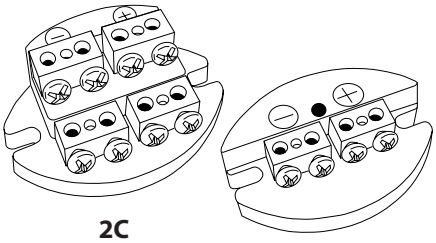
CODE	DESCRIPTION
S1	1″ NPT Aluminum
S2	½″ NPT Aluminum
S4	¾″ NPT Aluminum



S1
S2
S4

Terminal Blocks

CODE	DESCRIPTION
1C	Universal Screw Cover – Single
2C	Universal Screw Cover – Dual
1S	Snap Cover – Single
2S	Snap Cover – Dual

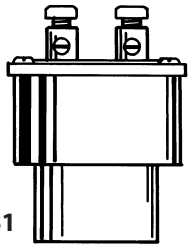


2C
2S

1C
1S

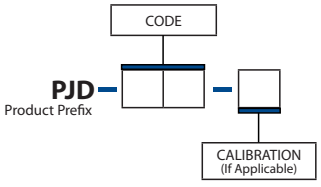
Open Terminal Heads

CODE	DESCRIPTION
B1	Open Terminal Head (Noble Metal Only) Specify Calibration
B2	External Thread Head (Noble Metal Only) Specify Calibration
B3	Open Terminal Head (Base Metal Only)



B1

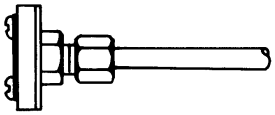
To order a thermocouple termination as a separate item, Follow the ordering information below.



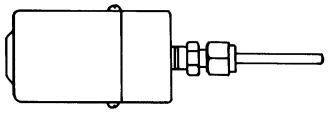
Example Ordering Number

PJD – 0 7 – K
Product Prefix

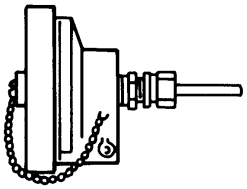
This is a High Temperature Male Plug (800°F) Termination, Type K.



Wafer Type Open Head
Code: 13

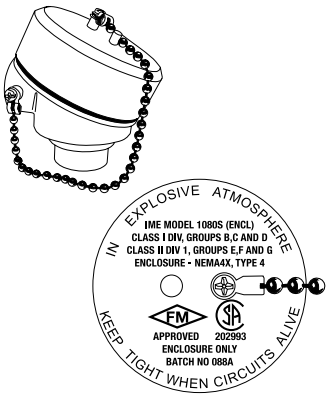


Cannister Head
CODE: 14



Plastic Weatherproof Head (400ºF)
CODE: 15

High Temperature Plastic Weatherproof Head (800ºF)
CODE: 16



Explosion-Proof Head
CODE: 17

1/2″ Polypropylene Head
CODE: P2