

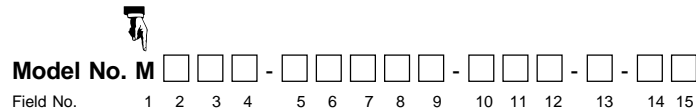
Model Number Breakdown

Explanation of MgO Thermocouple Model Number

Introduction

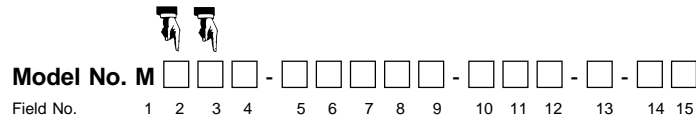
Each model number is made up of codes in 15 fields. Each code, or string of codes, represents a feature of the product. The illustrations below show options available for each field.

Model Number Breakdown



Field 1

Code “M” always occupies field 1. This identifies the sensor as an MgO insulated thermocouple with the BARCOPAC® trade name.



Field 2

Thermocouple Type

Codes J, K, E, T indicate thermocouple wire Types J, K, E, T with special limits; codes 1, 2, 3, 4 indicate thermocouple wire Types J, K, E, T with standard limits.

Field 3

Sheath Material

Inconel 600 and three grades of stainless steel are available.

Field 4

Sheath Diameter

Diameters range from 0.040” to 0.250”.

Field 5

Junction Style

This code indicates whether the element is grounded or ungrounded; it also indicates if dual element junctions are isolated or common.

Field 6

Transition, and Flexible Lead

This code indicates whether or not the thermocouple has a flexible lead. If it does, it indicates the lead protection (fiberglass, armor, SS overbraided) as well as the type of transition between the rigid probe and the flexible lead – molded plastic or potted metal casing.

Fields 7, 8, 9

Rigid Length

The code in this field specifies the rigid length in whole inches.

Fields 10, 11, 12

Flexible Length

If the thermocouple has a flexible lead, this field specifies the length in whole inches.

Field 13

Mounting Fitting

Indicates the attaching device that mounts the sensor to the workpiece.

Fields 14, 15

Cold End Termination

Indicates how cold end leads are terminated – stripped, lugs, plugs or head.

MgO Thermocouples

Magnesium Oxide Insulated Thermocouples (BARCOPAC®)

(Also see pad style thermocouples.)

Introduction

Thermocouples with magnesium oxide insulation are recommended where the thermocouple is immersed in liquids, high moisture, corrosive gases, or high pressures. The thermocouple can be formed to reach otherwise inaccessible areas. The magnesium oxide has a high dielectric strength, responds quickly to temperature changes, and is very durable.

MgO insulated thermocouple wire is manufactured from premium quality wire encased in pure magnesium oxide, and processed into a chemically clean outer metal sheath. The wires are individually selected and matched, and are of uniform cross section with smooth surfaces. Finished stock is warranted to meet ANSI standard limits of error set forth in MC96.1. The unique preparation of MgO insulated thermocouple wire produces a uniform thickness of insulation with high density. The result is a product that is mechanically strong and resistant to penetration of corrosive gases and moisture. The diameters of 0.040" and 1/16" are useful for applications requiring fast response.

Junction Construction

Ungrounded (insulated): Thermocouple insulated from sheath with MgO. Stray EMF is prevented from affecting the reading. Response from rapid or frequent temperature cycling is slower than for grounded style.

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

Time Constants

The time constant is the amount of time required for a thermocouple to indicated 63.2% of step change in temperature of a surrounding media. Some of the factors influencing the measured time constant are sheath wall thickness, degree of insulation compaction, and distance of junction from the welded cap on an ungrounded thermocouple. In addition, the velocity of a gas past the thermocouple probe greatly influences the time constant measurement.

In general, time constants for measurement of gas can be estimated to be ten times as long as those for measurement of liquid. The time constant also varies inversely proportional to the square root of the velocity of the media.

Approximate time constants for different sheath diameters in water are shown below for a step change from 0 to 100°C:

<u>Sheath Diameter</u>	<u>Grounded Junction</u>	<u>Ungrounded Junction</u>	<u>Exposed Junction</u>
0.040"	0.2 second	0.7 second	0.1 second
0.063"	0.3 second	0.8 second	0.2 second
0.125"	0.5 second	1.3 seconds	0.3 second
0.188"	1.0 second	2.5 seconds	0.5 second
0.250"	2.3 seconds	4.3 seconds	0.6 second

Specifications

Insulation Purity

MgO densely packed. High purity 99.4% MgO is used only with types K and S, Inconel sheathing. All others are standard purity 96% MgO.

Minimum Bend Diameter

Two times the outside diameter of the sheath.

Temperature Ratings

Oxidizing atmospheres: temperature ratings vary depending on sheath diameter, sheath material, and type calibration. Sheath wall thickness, contaminants, abrasion, and erosion must be considered.

MqO Thermocouples

Ordering Information

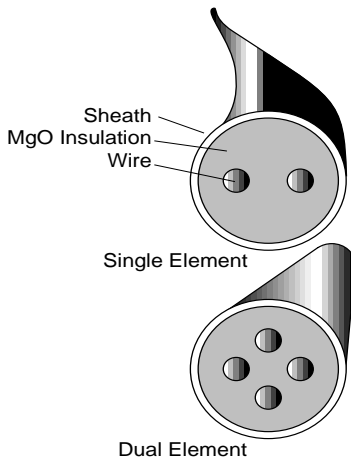
Model No. M - - - -
 Field No. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Fields 1, 2, 3, 4 BASE MODEL

☞ Determine length by completing Fields 7, 8, 9

Type	Elements	Max. Sugg	Sheath	Diameter
Special Limits				
MJ14 - J	single	970°F	304 SS	0.125"
MJ14 - J	dual	970°F	304 SS	0.125" (Obsolete)
MJ15 - J	single	1150°F	304 SS	0.187" (Obsolete)
MJ15 - J	dual	1150°F	304 SS	0.187"
MJ16 - J	single	1330°F	304 SS	0.250"
MJ16 - J	dual	1330°F	304 SS	0.250"
MJ24 - J	single	970°F	Inconel 600	0.125"
MJ26 - J	single	1330°F	Inconel 600	0.250"
MK12 - K	single	1290°F	304 SS	0.040" (Obsolete)
MK13 - K	single	1600°F	304 SS	0.063"
MK16 - K	single	1600°F	304 SS	0.250"
MK16 - K	dual	1600°F	304 SS	0.250"
MK22 - K	single	1290°F	Inconel 600	0.040" (Obsolete)
MK23 - K	single	1690°F	Inconel 600	0.063"
MK24 - K	single	1960°F	Inconel 600	0.125"
MK24 - K	dual	1960°F	Inconel 600	0.125"
MK25 - K	single	2100°F	Inconel 600	0.188"
MK26 - K	single	2100°F	Inconel 600	0.250"
MK26 - K	dual	2100°F	Inconel 600	0.250"
MK64 - K	single	2300°F	Hoskins 2300	0.125" Note 1
MK66 - K	single	2300°F	Hoskins 2300	0.250" Note 1
ME16 - E	single	1510°F	304 SS	0.250"
ME16 - E	dual	1510°F	304 SS	0.250"
MT16 - T	single	700°F	304 SS	0.250"
MT16 - T	dual	700°F	304 SS	0.250"
Standard Limits				
M112 - J	single	500°F	304 SS	0.040" (Obsolete)
M113 - J	single	825°F	304 SS	0.063"
M113 - J	dual	825°F	304 SS	0.063"
M114 - J	single	970°F	304 SS	0.125"
M114 - J	dual	970°F	304 SS	0.125"
M115 - J	single	1150°F	304 SS	0.188"
M115 - J	dual	1150°F	304 SS	0.188"
M116 - J	single	1330°F	304 SS	0.250"
M116 - J	dual	1330°F	304 SS	0.250"
M117 - J	single	1500°F	304 SS	0.375"
M123 - J	single	825°F	Inconel 600	0.063" (Obsolete)
M124 - J	single	970°F	Inconel 600	0.125"
M125 - J	single	1150°F	Inconel 600	0.188"
M126 - J	single	1330°F	Inconel 600	0.250"
M133 - J	single	825°F	316 SS	0.063"
M133 - J	dual	825°F	316 SS	0.063"
M134 - J	single	970°F	316 SS	0.125"
M134 - J	dual	970°F	316 SS	0.125"
M135 - J	single	1150°F	316 SS	0.188"
M135 - J	dual	1150°F	316 SS	0.188"

MgO Insulated T/C



Note 1: Hoskins 2300 is no longer manufactured. We will continue to supply this product until existing inventories are exhausted.

MqO Thermocouples

Ordering Information (continued)

Fields 1, 2, 3, 4 BASE MODEL (continued)

	Type	Elements	Max. Sugg	Sheath	Diameter
M136 - J	single		1330°F	316 SS	0.250"
M136 - J	dual		1330°F	316 SS	0.250"
M143 - J	single		825°F	310 SS	0.063" (Obsolete)
M144 - J	single		970°F	310 SS	0.125" (Obsolete)
M213 - K	single		1600°F	304 SS	0.063" (Obsolete) Replace w/ M223
M214 - K	single		1600°F	304 SS	0.125"
M215 - K	single		1600°F	304 SS	0.188"
M216 - K	single		1600°F	304 SS	0.250"
M216 - K	dual		1600°F	304 SS	0.250"
M222 - K	single		1290°F	Inconel 600	0.040"
M223 - K	single		1690°F	Inconel 600	0.063"
M223 - K	dual		1690°F	Inconel 600	0.073"
M224 - K	single		1960°F	Inconel 600	0.125"
M224 - K	dual		1960°F	Inconel 600	0.125"
M225 - K	single		2100°F	Inconel 600	0.188"
M225 - K	dual		2100°F	Inconel 600	0.188"
M226 - K	single		2100°F	Inconel 600	0.250"
M226 - K	dual		2100°F	Inconel 600	0.250"
M227 - K	single		2100°F	Inconel 600	0.375"
M233 - K	single		1690°F	316 SS	0.063"
M234 - K	single		1700°F	316 SS	0.125"
M235 - K	single		1700°F	316 SS	0.188"
M236 - K	single		1700°F	316 SS	0.250"
M236 - K	dual		1700°F	316 SS	0.250"
M244 - K	single		1960°F	310 SS	0.125" (Obsolete)
M245 - K	single		2100°F	310 SS	0.188" (Obsolete)
M246 - K	single		2100°F	310 SS	0.188" (Obsolete)
M246 - K	dual		2100°F	310 SS	0.250" (Obsolete)
M314 - E	single		1200°F	304 SS	0.125"
M314 - E	dual		1200°F	304 SS	0.125"
M315 - E	single		1350°F	304 SS	0.188"
M334 - E	single		1200°F	316 SS	0.125"
M336 - E	single		1600°F	316 SS	0.250"
M336 - E	dual		1600°F	316 SS	0.250"
M413 - T	single		500°F	304 SS	0.063"
M414 - T	single		600°F	304 SS	0.125"
M415 - T	single		700°F	304 SS	0.188"
M416 - T	single		700°F	304 SS	0.250"
M436 - T	single		660°F	316 SS	0.250"
M436 - T	dual		660°F	316 SS	0.250"
M726 - N	single		2150°F	Inconel 600	0.250"

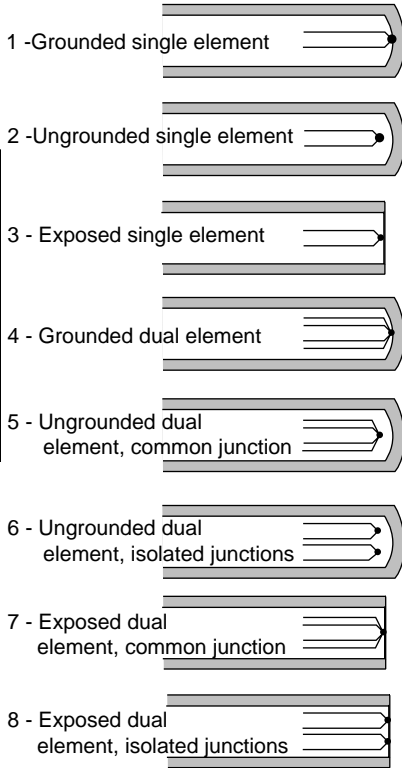
MgO Insulated T/C

MqO Thermocouples

Ordering Information (continued)

MgO Insulated T/C

Junction Styles
Field 5 codes



Field 5. JUNCTION STYLE

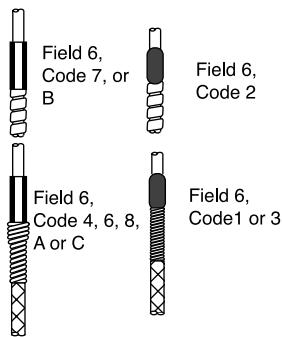
Note: Thermocouple will not function without a junction

Single Element Assemblies

- 0 - None, end sealed (bulk material only)
- 1 - Grounded (not available with platinum element)
- 2 - Ungrounded
- 3 - Exposed (not available with platinum element)

Dual Element Assemblies

- 4 - Grounded (not available with platinum element)
- 5 - Ungrounded, common junction
- 6 - Ungrounded, isolated junctions (not with 0.040" or 0.063" sheath)
- 7 - Exposed, common junction (not available with platinum element)
- 8 - Exposed, isolated junctions (not with 0.040" or 0.063" sheath)
- 9 - None, end sealed (bulk material only)



Field 6. TRANSITION; FLEXIBLE LEAD (DIMENSION "Y")

All extension wire is solid AWG 20, except Type E is 16 gauge polyvinyl plastic.

☞ Determine length by completing Fields 10, 11, 12

- 0 - None

Molded (220°F) Not applicable on 0.040" o.d. or 0.375" o.d.

- 1 - Fiberglass insulation
- 2 - Fiberglass with armor
- 3 - Fiberglass with SS overbraid

Metal Potting Adapter

- 4 - PVC (220°F)
- 6 - High temperature (1000°F); fiberglass insulation
- 7 - High temperature (1000°F); fiberglass with armor
- 8 - FEP Teflon® (Types J, K, T only)

(Specify one of the following lead (500°F) codes on order)

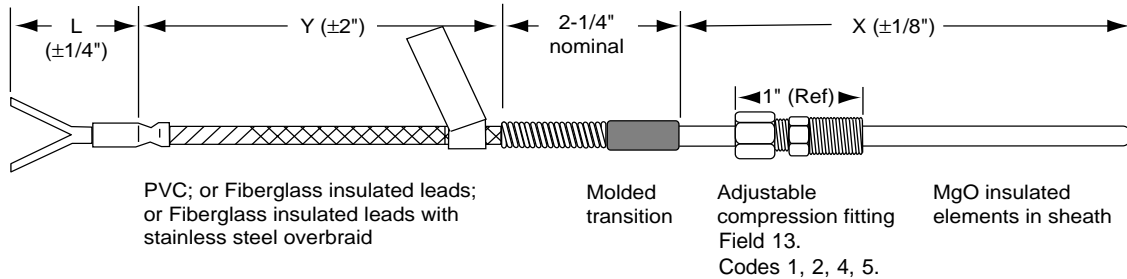
- A - Fiberglass insulation*
- B - Fiberglass with armor**
- C - Fiberglass with SS overbraid*

*Nickel plated brass adapter **Stainless steel adapter

MgO Thermocouples

Ordering Information (continued)

Fields 14, 15.
Cold End Termination



Fields 7, 8, 9. RIGID LENGTH (DIMENSION X)

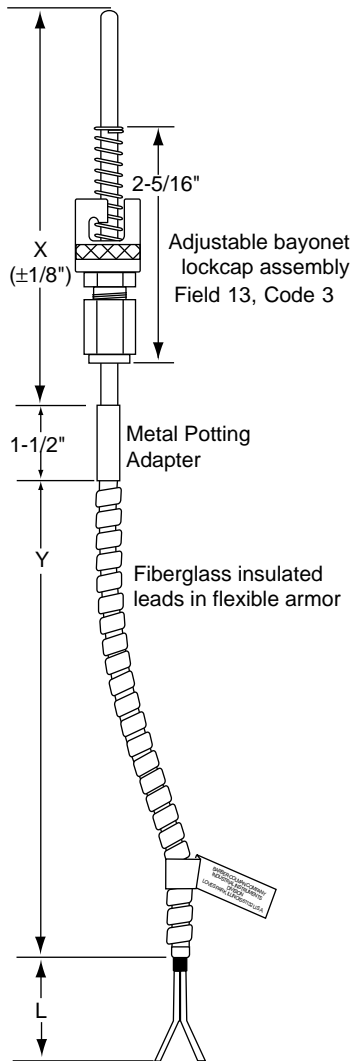
☞ Complete these Fields to determine length for Fields 1, 2, 3, 4

XXX - Actual length up to 998" in whole inches

999 - Longer than 998". Specify details on order. Consult factory

Note: Maximum allowable hot length for ungrounded junction assemblies:

Sheath o.d.	J (single)	J (dual)	K (single)	K (dual)	T (single)	T (dual)	E	S
0.063"	180"	140"	100"	82"	200"	162"	90"	227"
0.125"	700"	479"	430"	282"	555"	555"	330"	921"
0.188"	1600"	1206"	877"	729"	1750"	1491"	722"	2692"
0.250"	3181"	1944"	1934"	1129"	3885"	2333"	1521"	7000"
0.375"	2340"	n/a	2087"	n/a	n/a	n/a	n/a	n/a



Fields 10, 11, 12. FLEXIBLE LENGTH (DIMENSION "Y")

☞ Complete these Fields to determine length for Field 6

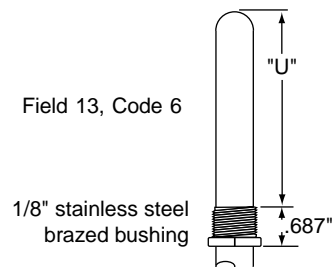
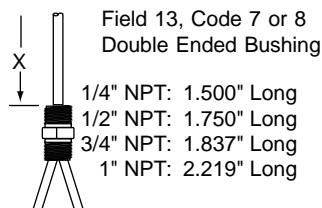
000 - None - no flexible lead (no transition)

YYY - Actual length up to 998" in whole inches

999 - Longer than 998". Specify details on order

Field 13. MOUNTING FITTING (DIMENSION "U")

- 0 - None
- 1 - 1/8" nickel plated brass compression fitting
- 2 - 1/8" stainless steel compression fitting
- 3 - Adjustable bayonet lockcap assembly (1/8" diameter only)
- 4 - 1/4" nickel plated brass compression fitting
- 5 - 1/4" stainless steel compression fitting
- 6 - 1/8" stainless steel brazed bushing (specify "U" dimension on order)
- 7 - Silver soldered SS double ended bushing (specify size on order)
- 8 - Spring loaded stainless steel double ended bushing (1/2" NPT only, for .188 or .250 sheath diameter)



MgO Insulated T/C

MgO Thermocouples

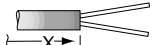
Ordering Information (continued)

MgO Insulated T/C

Fields 14, 15



Code 00



Code 01



Code 02



Codes 03, 04, 07,
14, 15, 16, 23, 24



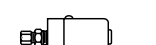
Codes 18, 19, 20



Code 05



Code 06



Codes 08, 09



Codes 10, 27



Codes 12, 17



Code 22



Code 11 and
Code 31 (illustrated)



Code 32



Code 33



Fields 14, 15. COLD END TERMINATION (DIMENSION "L")

- 00 - Stripped leads (Note 6)
- 01 - 2-1/2" split leads, spade lugs (Note 3)
- 02 - 2-1/2" split leads, spade lugs, 1/2" NPS box connector with lock nut (Note 3)
- 03 - Solid pin quick disconnect plug
- 04 - Solid pin quick disconnect plug with mating jack
- 05 - Ceramic wafer open head (dual; 0.250" sheath only)
- 06 - Miniature head and cover (Notes 1, 2)
- 07 - Standard quick disconnect jack
- 08 - General purpose, cast iron head (Notes 1, 2)
- 09 - General purpose, aluminum head (Notes 1, 2) (Obsolete) replace w/code 27
- 10 - Weatherproof, cast iron head (Notes 1, 2)
- 11 - Brass, open terminal, no external mounting threads (Notes 1, 2)
- 12 - Weatherproof, plastic head (Notes 2, 7)
- 13 - 1-1/2" split leads, sleeve & butt connectors (Note 5)
- 14 - High temperature quick disconnect plug
- 15 - High temperature quick disconnect plug and jack
- 16 - High temperature quick disconnect jack
- 17 - High temp. plastic weatherproof head (Notes 2, 7)
- 18 - Miniature quick disconnect plug (Notes 3, 4)
- 19 - Miniature quick disconnect plug and jack (Note 4)
- 20 - Miniature quick disconnect jack (Note 4)
- 22 - Explosionproof head
- 23 - Hollow pin quick disconnect plug(s) (Type J only)
- 24 - Hollow pin quick disconnect plug(s) with mating jack(s) (Type J only)
- 27 - Weatherproof, aluminum head (Notes 1, 2)
- 31 - Brass, open terminal, w/external process mounting threads (Notes 1, 2)
- 32 - Aluminum, DIN size (Notes 1, 2)
- 33 - Aluminum, explosionproof (extended lead time) (Notes 1, 2)
- 99 - Extended lead. Specify length "L" (up to 36") on order, and specify termination code (from above list).
Assembly with flexible armor.
Assembly with double ended bushing.

Notes:

- Note 1: Limited to 1/8" MgO or larger.
- Note 2: Not available with assemblies using lead wire between MgO and connector.
- Note 3: Available with Field 6, codes 1, 3, 4 and 6.
- Note 4: Maximum sheath o.d. is 1/8" for Field 6, code 0. Single element only.
- Note 5: Available with Field 6, code 0 only. Not available with 0.040" diameter.
- Note 6: 1/4" stripped unless there is no transition (Field 6, code 0); then 1-1/4" stripped.
- Note 7: Weatherproof plastic head accepts 1/4" bushing only (Field 13, code 7).
- Note 8: Available with Field 6, codes 1, 2, 3, 4, 5, 6, 7, 8 and 9.