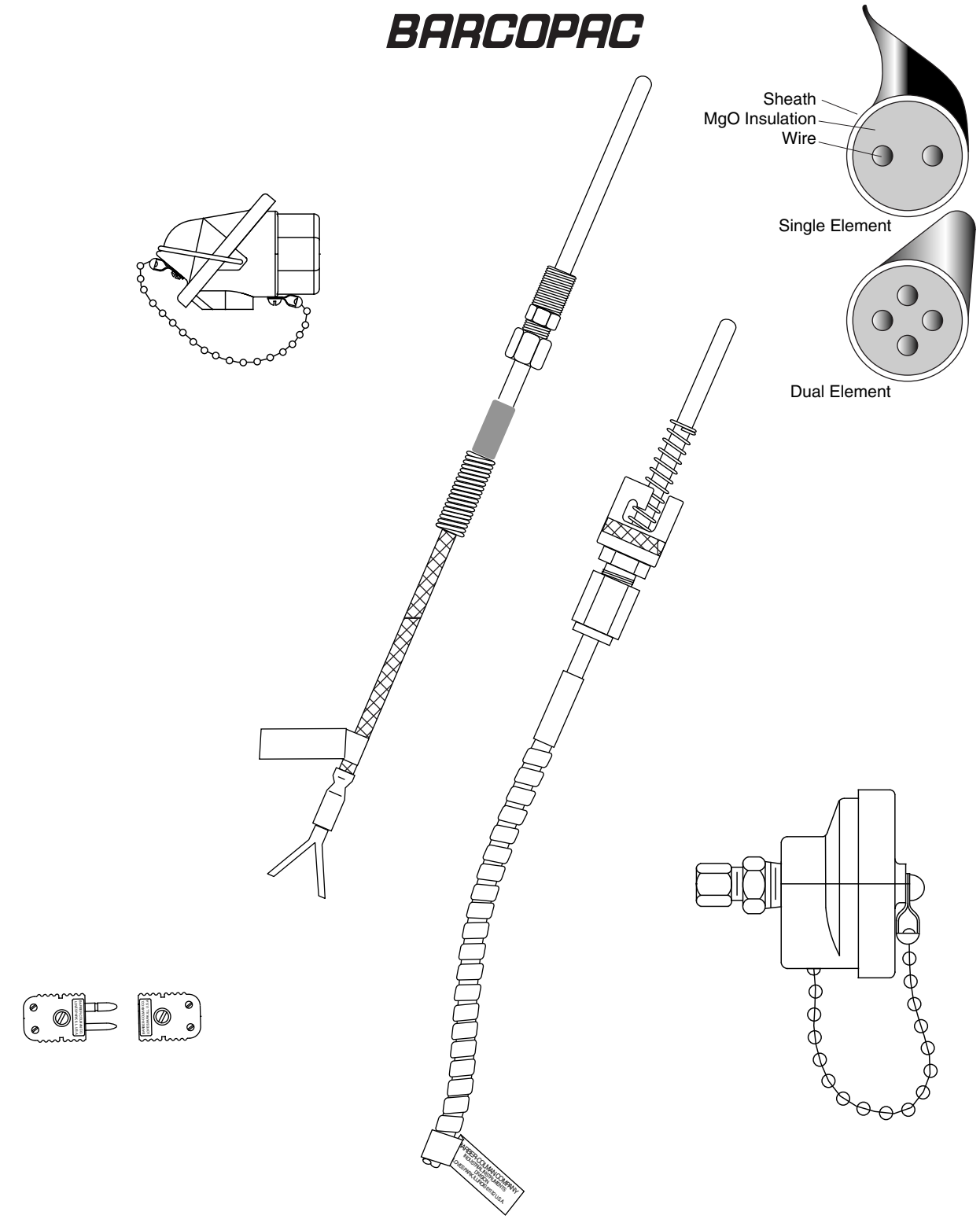
# BARCOPAC® MgO Insulated Thermocouples






## MGO INSULATED THERMOCOUPLES

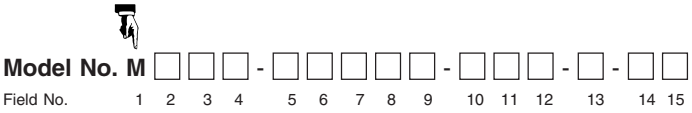
# Model Number Breakdown

## Explanation of MgO Thermocouple Model Number

### Introduction

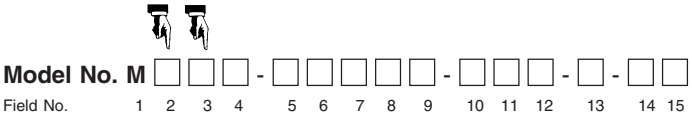
Each model number is made up of codes in 15 fields. Each code, or string of codes, represents a feature of the product. The illustrations below show options available for each field.

### 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 overbraid) 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.

# 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:

| Sheath Diameter | Grounded Junction | Ungrounded Junction | Exposed Junction |
|---|---|---|---|
| 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.

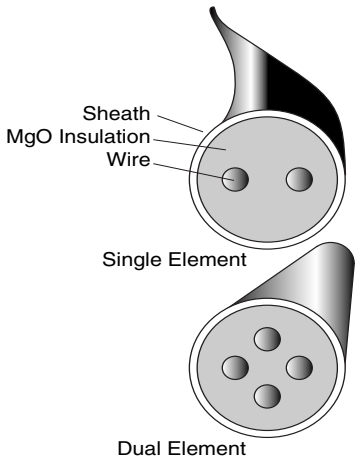
**Temperature Ratings**

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

## 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” | |
| MJ15 - J | single | 1150°F | 304 SS | 0.187” | |
| 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” | |
| 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” | |
| 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” | |
| 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” | |
| 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” | |

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

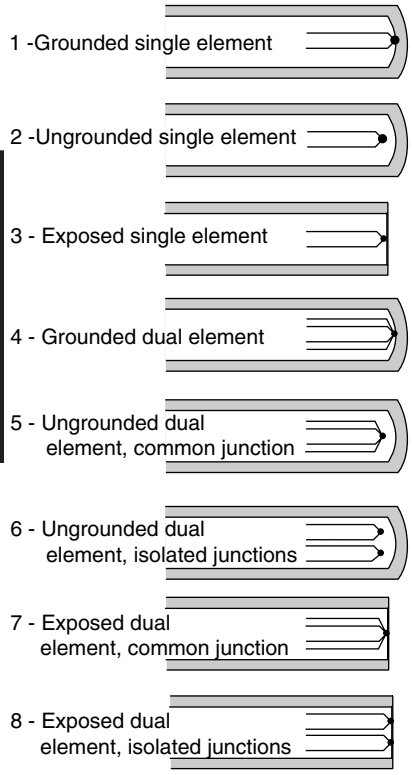
## Ordering Information (continued)

**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” |
| M144 - | J | single | 970°F | 310 SS | 0.125” |
| M213 - | K | single | 1600°F | 304 SS | 0.063” |
| 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” |
| M245 - | K | single | 2100°F | 310 SS | 0.188” |
| M246 - | K | single | 2100°F | 310 SS | 0.188” |
| M246 - | K | dual | 2100°F | 310 SS | 0.250” |
| 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” |

## Ordering Information (continued)

Junction Styles
Field 5 codes




**Field 5. JUNCTION STYLE**

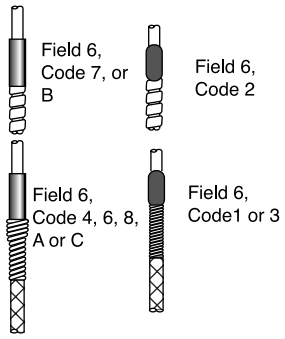
Note: Thermocouple will not function without a junction

**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)

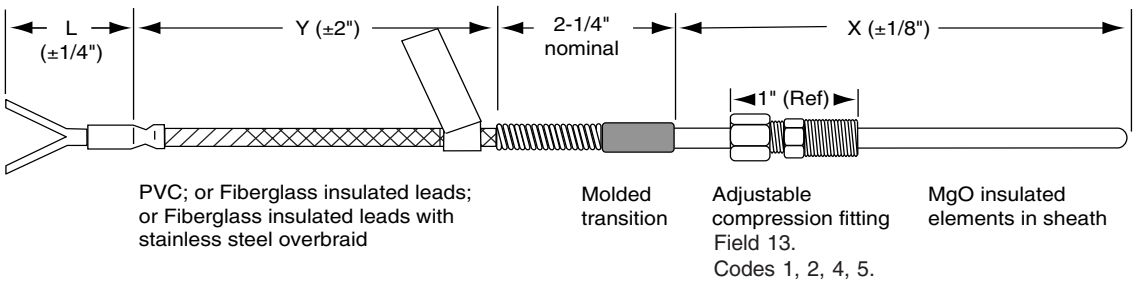
(Specify one of the following lead (500°F) codes on order)

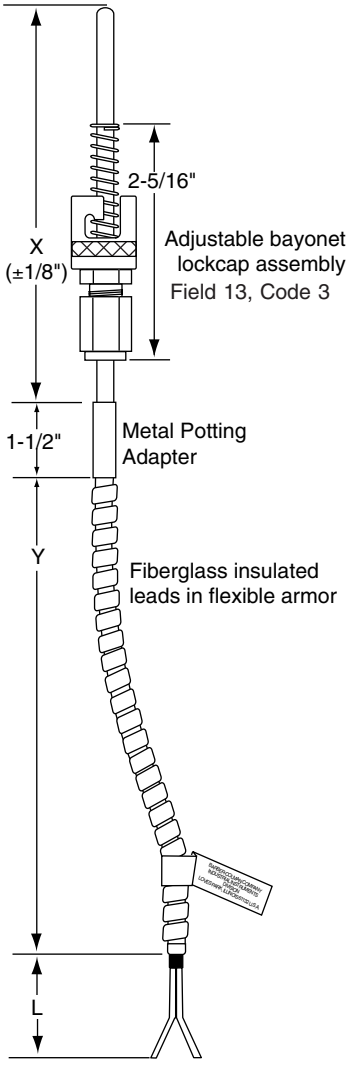
A - Fiberglass insulation*
B - Fiberglass with armor**
C - Fiberglass with SS overbraid*

*Nickel plated brass adapter **Stainless steel adapter

## 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:

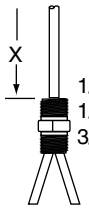
| Sheath o.d. | J (single) | J (dual) | K (single) | K (dual) | T (single) | T (dual) | E | S |
|---|---|---|---|---|---|---|---|---|
| 0.063" | 180" | 140" | 100" | 82" | 200" | 162" | 90" | 227" |
| 0.125" | 700" | 479" | 430" | 282" | 555" | 555" | 330" | 921" |
| 0.188" | 1600" | 1206" | 877" | 729" | 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)




Field 13, Code 7 or 8
Double Ended Bushing

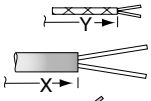
1/4" NPT: 1.500" Long
1/2" NPT: 1.750" Long
3/4" NPT: 1.837" Long
1" NPT: 2.219" Long

Field 13, Code 6

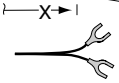

1/8" stainless steel
brazed bushing

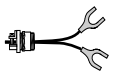
## Ordering Information (continued)

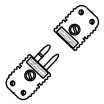
Fields 14, 15



Code 00

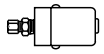

Code 01


Code 02


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

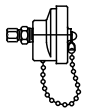

Codes 18, 19, 20

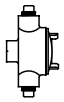

Code 05

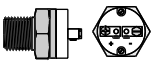

Code 06


Codes 08, 09

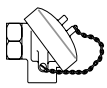

Codes 10, 27


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)
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.