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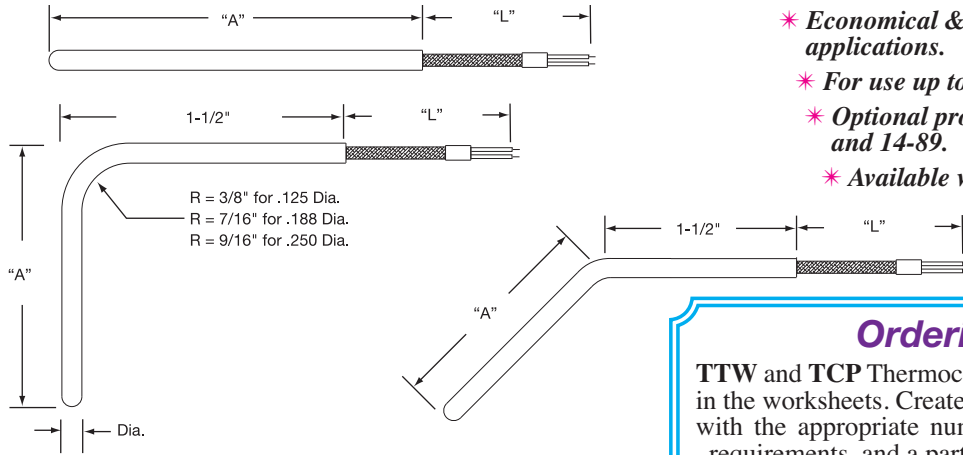
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Temperature Sensing

14
section



Tube and Wire Thermocouples



Design Features

- * Economical & versatile for a variety of applications.
- * For use up to 900°F (482°C).
- * Optional process fittings available. See pages 14-88 and 14-89.
- * Available with single or dual element.

Ordering Information

TTW and TCP Thermocouples are offered with the options listed in the worksheets. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code:

TTW -

Style BOX 1

- 1 = Straight
- 2 = 45° Bend
- 3 = 90° Bend
- X = Other (Specify)

Calibration Code BOX 2

ANSI Standard Tolerances **J K E T N**

Junction BOX 7

	Grounded	Ungrounded
Single Element	G	U
Dual Element	4	5

Sheath Material BOX 3

- B = 304 SS
- C = 316 SS

Lead Wire Length "L" BOX 8

In inches **000** to **999**
Example 048 for 48"

Sheath O.D. BOX 4

- F = .125" ±.002
- G = .188" ±.002
- H = .250" ±.002
- X = Other (Specify)

Lead Wire Construction BOX 9

		w/ SS Overbraid	w/ SS Armor Cable
Fiberglass 900°F (482°C)	S	B	A
Teflon® 400°F (204°C)	T	D	F

Depending on availability, sheath OD of .125" uses 24 gauge lead wire. Larger than .125" thermocouples use 20 gauge lead wire depending on availability and insulation type.

Sheath Length "A" BOX 5

Whole inches
00 to **99**
For lengths over 99 in. consult TEMPCO.

Sheath Length "A" BOX 6

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Lead Wire Termination BOX 10 †

- | | |
|-------------------------------------------------------------------|--------------------------------------------|
| B = 2-1/2 in. Split Leads | J = Standard Female Jack |
| S = 2-1/2 in. Split Leads with Spade Lugs | K = Std. Plug with Mating Jack |
| C = 2-1/2 in. Split Leads with BX connector and Spade Lugs | D = Miniature Male Plug |
| P = Standard Male Plug | E = Miniature Female Jack |
| | F = Miniature Plug with Mating Jack |
| | X = Other (Specify) |

Special Requirements BOX 11

- X = Specify
- 0 = None

† See page 14-9 for Termination Style descriptions



Note: Metric sizes available. Consult TEMPCO

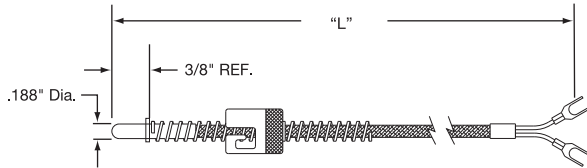


Stock Bayonet Style Thermocouples — Type J

Design Features

- * **Standard—ANSI Type J Grounded Junction**
- * **Standard Probe Material—304 Stainless Steel**
- * **Standard Probe Diameter 3/16" (1/8" optional)**
- * **For use up to 900°F (482°C)**

Style 1—Spring Adjustable Bayonet Thermocouple



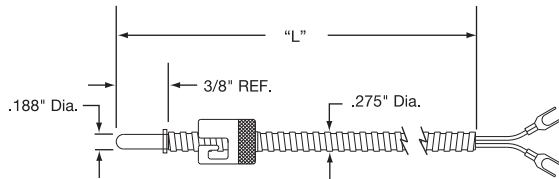
Design Features

- * **Insertion length adjustable from 1" to 10".**
- * **Forms easily to any angle.**
- * **One style can replace several fixed length thermocouples.**
- * **Use with bayonet adapters on page 14-87.**

All Items Available from Stock

Termination	36"	48"	60"	72"	96"	120"	144"
Spade Lugs	TCP10131	TCP10001	TCP10140	TCP10079	TCP10086	TCP10095	TCP10096
Std. Plug	TCP10153	TCP10003	TCP10145	TCP10060	TCP10071	TCP10058	TCP10108
2½" Split Leads	TCP10156	TCP10005	TCP10141	TCP10012	TCP10011	TCP10020	TCP10059

Style 2—Armor Cable Adjustable Bayonet Thermocouple



Design Features

- * **Insertion length adjustable over length of armor cable.**
- * **Forms easily to any angle.**
- * **One style can replace several fixed length thermocouples.**
- * **Use with bayonet adapters on page 14-87.**

All Items Available from Stock

Termination	36"	48"	60"	72"	96"	120"	144"
Spade Lugs	TCP20084	TCP20001	TCP20041	TCP20040	TCP20031	TCP20053	TCP20085
Std. Plug	TCP20086	TCP20003	TCP20011	TCP20006	TCP20008	TCP20018	TCP20010
2½" Split Leads	TCP20025	TCP20005	TCP20050	TCP20026	TCP20060	TCP20007	TCP20093

Custom Made TCP Thermocouples (Adjustable Bayonet Style)

Ordering Code: TCP - 1 2 3 4 5 6 7 8

Style BOX 1
 1 = Spring Adjustable
 2 = Armor Cable Adjustable

Lead Insulation BOX 5

	w/ SS Overbraid (Style 1 only)	w/ SS Armor Cable (Style 1 only)	w/ SS Armor Cable (Style 2 only)
Fiberglass 900°F (482°C)	S	B	A
Teflon® 400°F (204°C)	T	D	F

Calibration BOX 2
 ANSI Standard Tolerances **J K E T N**

Termination BOX 6 †

B = 2-1/2 in. Split Leads	K = Standard Plug and Jack
S = Spade Lugs	D = Miniature Plug
C = Spade Lugs with BX Conn.	E = Miniature Jack
P = Standard Plug	F = Mini. Plug and Jack
J = Standard Jack	X = Other (Specify)

† See page 14-9 for Termination Style descriptions

Junction BOX 3

	Grounded	Ungrounded
Single Element	G	U
Dual Element	4	5

Tip Style BOX 7

R = Round
F = Flat
D = Drill Point

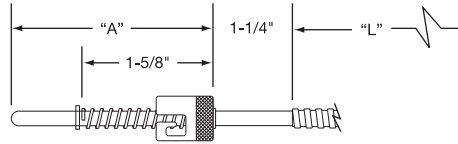
Special Requirements BOX 8

A = .125 dia. Tip
X = Other (Specify)
0 = None



Bayonet Styles

Style 3—Rigid Straight Bayonet Thermocouple



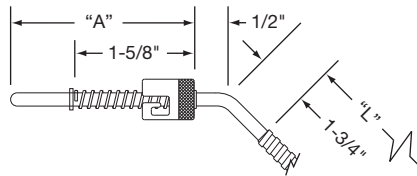
Stock Items Are Shown In **RED**

Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
TCP30001	S	4	48
TCP30002	C	4	48
TCP30003	P	4	48
TCP30004	J	4	48
TCP30005	B	4	48

Design Features

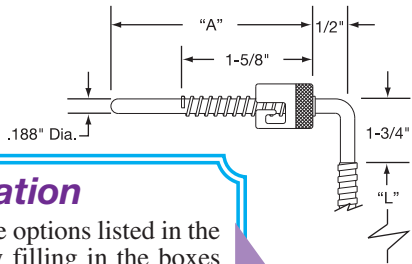
- * **Standard—ANSI Type J Grounded Junction**
- * **Standard Probe Material—304 Stainless Steel**
- * **Standard Probe Diameter—3/16" (1/8" optional)**
- * **For use up to 900°F (482°C)**
- * **See Page 14-87 for bayonet adapters and installation**

Style 4—Rigid 45° Bend Bayonet Thermocouple



Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
TCP40001	S	4	48
TCP40002	C	4	48
TCP40003	P	4	48
TCP40004	J	4	48
TCP40005	B	4	48

Style 5—Rigid 90° Bend Bayonet Thermocouple



Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
TCP50001	S	4	48
TCP50002	C	4	48
TCP50003	P	4	48
TCP50004	J	4	48
TCP50005	B	4	48

Ordering Information

TCP Thermocouples are offered with the options listed in the worksheets. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

† See page 14-9 for Termination Style descriptions

Custom Made TCP Thermocouples (Bayonet Style)

Ordering Code:

TCP -

Style BOX 1

- 3 = Straight
- 4 = 45° Bend
- 5 = 90° Bend

Calibration BOX 2

ANSI Standard Tolerances **J K E T N**

Junction BOX 6

Grounded Ungrounded
Single Element **G U**
Dual Element **4 5**

"L" Dimension BOX 7

Whole inches
000 to 999

Sheath Diameter BOX 3

- F = .125" ±.002
- G = .188" ±.002 (Standard)

Lead Insulation BOX 8

Fiberglass 900°F (482°C) **S B** w/ SS Overbraid w/ SS Armor Cable
Teflon® 400°F (204°C) **T D A F**

"A" Dimension BOX 4

Whole inches
01 to 99 (1-3/4" min.)

Termination BOX 9

(See page 14-9 for Termination Style Descriptions)
B = 2-1/2 in. Split Leads **P** = Standard Plug **D** = Miniature Plug
S = Spade Lugs **J** = Standard Jack **E** = Miniature Jack
C = Spade Lugs with BX Conn. **K** = Standard Plug and Jack **F** = Mini. Plug and Jack
X = Other (Specify)

"A" Dimension BOX 5

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Tip Style BOX 10

R = Round **F** = Flat **D** = Drill Point

Special Requirements BOX 11

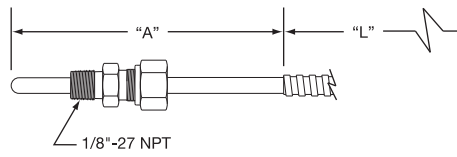
X = Specify
0 = None



Compression Fitting Styles

Style 6—Rigid Straight Compression Fitting Thermocouple

Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
TCP60001	S	4	48
TCP60002	C	4	48
TCP60003	P	4	48
TCP60004	J	4	48
TCP60005	B	4	48

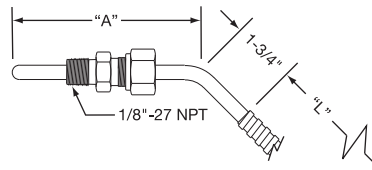


Design Features

- * Standard Calibration — ANSI Type J Grounded Junction
- * Standard Probe Material 304 Stainless Steel
- * Standard Probe Diameter—3/16"
- * For use up to 900°F (482°C)
- * One-Time Adjustable 1/8"-27 NPT Brass Compression Fitting

Style 7—Rigid 45° Bend Compression Fitting Thermocouple

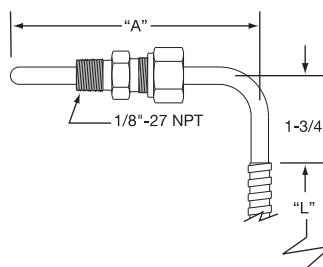
Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
TCP70001	S	4	48
TCP70002	C	4	48
TCP70003	P	4	48
TCP70004	J	4	48
TCP70005	B	4	48



All Items Available from Stock

Style 8—Rigid 90° Bend Compression Fitting Thermocouple

Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
TCP80001	S	4	48
TCP80002	C	4	48
TCP80003	P	4	48
TCP80004	J	4	48
TCP80005	B	4	48



† See Page 14-9 for Termination Style descriptions.

Custom Made TCP Thermocouples (Compression Fitting Style)

Ordering Code:

TCP -

Style BOX 1

6 = Straight
7 = 45° Bend
8 = 90° Bend

Calibration BOX 2

ANSI Standard Tolerances **J K E T N**

Junction BOX 6

	Grounded	Ungrounded
Single Element	G	U
Dual Element	4	5

"L" Dimension BOX 7

Whole inches
000 to 999

Sheath Diameter BOX 3

F = .125
G = .188 (Standard)
H = .250
X = Other (Specify)

Lead Insulation BOX 8

	w/ SS Overbraid	w/ SS Armor Cable
Fiberglass 900°F (482°C)	S	B
Teflon® 400°F (204°C)	T	D
		A
		F

"A" Dimension BOX 4

Whole inches
01 to 99 (1-3/4" min.)

Termination BOX 9

(See page 14-9 for Termination Style Descriptions)

B = 2-1/2 in. Split Leads	P = Standard Plug	D = Miniature Plug
S = Spade Lugs	J = Standard Jack	E = Miniature Jack
C = Spade Lugs with BX Conn.	K = Standard Plug and Jack	F = Mini. Plug and Jack
		X = Other (Specify)

"A" Dimension BOX 5

Fractional inches
0 = 0" 3 = 3/8" 6 = 3/4"
1 = 1/8" 4 = 1/2" 7 = 7/8"
2 = 1/4" 5 = 5/8"

Tip Style BOX 10

R = Round **F** = Flat **D** = Drill Point

Special Requirements BOX 11

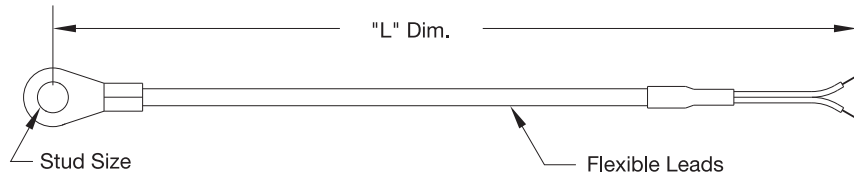
X = Specify
0 = None



Surface Thermocouples

Ring Lug Thermocouples

* Ring thermocouples mount on a surface using an existing screw or bolt to measure surface temperature. The T/C wire junction is crimped to the ring lug.



Ordering Code: **TRW** -

Stud Size BOX 1

- 1 = No. 6 (0.148)
- 2 = No. 8 (0.175)
- 3 = No. 10 (0.198)
- 4 = 1/4 (0.266)
- 5 = 3/8 (0.390)

Calibration BOX 2

ANSI Standard Tolerances **J K E T**

"L" Dimension BOX 3

Whole inches
Example: Enter **048** for 48 inches

Lead Insulation BOX 4 w/ SS Overbraid

- Fiberglass 900°F (482°C) **S** **B**
- Teflon® 400°F (204°C) **T** **D**

Termination BOX 5 †

- B = 2-1/2 in. Split Leads
- P = Standard Plug
- D = Miniature Plug
- S = Spade Lugs
- J = Standard Jack
- E = Miniature Jack
- C = Spade Lugs with BX Conn.
- K = Standard Plug and Jack
- F = Mini. Plug and Jack
- X = Other (Specify)

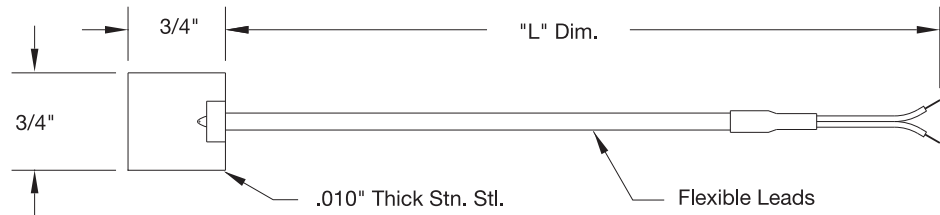
† See page 14-9 for Termination Style descriptions

Special Requirements BOX 6

- X = Specify
- 0 = None

Shim Stock Thermocouples

* A low-profile sensor that can be placed between two surfaces



Ordering Code: **TSW** -

Calibration BOX 1

ANSI Standard Tolerances **J K E T N**

"L" Dimension BOX 2

Whole inches
Example: Enter **048** for 48 inches

Lead Insulation BOX 3 w/ SS Overbraid

- Fiberglass 900°F (482°C) **S** **B**
- Teflon® 400°F (204°C) **T** **D**

Termination BOX 4 †

- B = 2-1/2 in. Split Leads
- P = Standard Plug
- D = Miniature Plug
- S = Spade Lugs
- J = Standard Jack
- E = Miniature Jack
- C = Spade Lugs with BX Conn.
- K = Standard Plug and Jack
- F = Mini. Plug and Jack
- X = Other (Specify)

† See page 14-9 for Termination Style descriptions

Special Requirements BOX 5

- X = Specify
- 0 = None



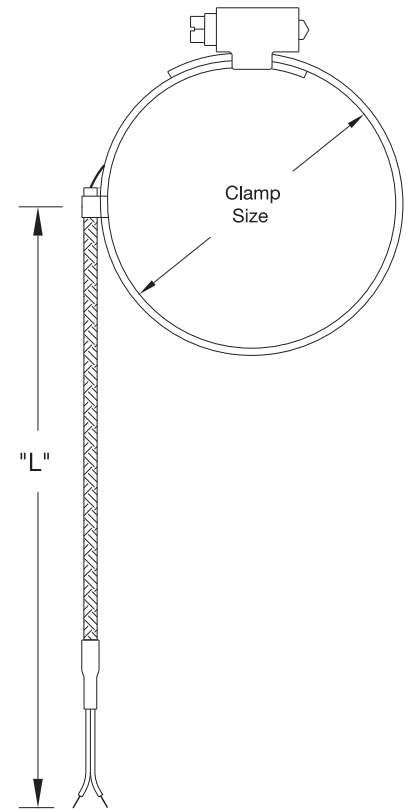
Pipe Clamp Thermocouples

Design Features

* **Stainless Steel Worm Drive Clamp 1/2" wide**

* **Ideal for Measuring Pipe Temperatures**

* **Thermocouple Junction Grounded to Clamp**



Ordering Code: **TPW** - [1] [2] [3] [4] [5] [6]

Clamp Size BOX 1

- 1 = 1/2" to 7/8"
- 2 = 7/8" to 1-1/2"
- 3 = 1-5/16" to 2-1/4"
- 4 = 2-1/4" to 3-5/16"
- 5 = 3-5/16" to 4-1/4"
- 6 = 4-5/16" to 5-1/4"
- 7 = 5-5/8" to 8-1/2" (9/16" Wide)
- X = Other (Specify)

Lead Insulation BOX 4

- Fiberglass 900°F (482°C) **S** w/ SS Overbraid
- Teflon 400°F (204°C) **T** **B**
- D**

Termination BOX 5 †

- B** = 2-1/2 in. Split Leads
- S** = Spade Lugs
- C** = Spade Lugs with BX Conn.
- P** = Standard Plug
- J** = Standard Jack
- K** = Standard Plug and Jack
- D** = Miniature Plug
- E** = Miniature Jack
- F** = Mini. Plug and Jack
- X** = Other (Specify)

Calibration BOX 2

- ANSI Standard Tolerances **J K E T**

"L" Dimension BOX 3

Whole inches
Example: Enter **048** for 48 inches

† See page 14-9 for Termination Style descriptions

Special Requirements BOX 6

- X** = Specify
- 0** = None

Ordering Information

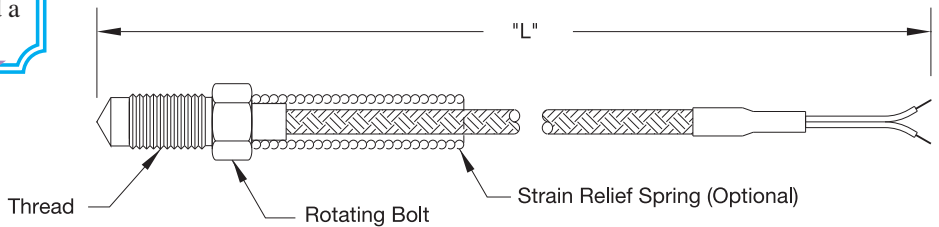
TRW, TSW, TPW and TNW Thermocouples are offered with the options listed in the worksheets. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Design Features

* **Mounted in a shallow threaded hole on the nozzle surface (there is no direct contact with material flow)**

* **Grounded junction**

Nozzle Thermocouples



Ordering Code: **TNW** - [1] [2] [3] [4] [5] [6] [7]

Thread Size BOX 1

- 1 = 1/4-28 UNF
- 2 = 1/4-20 UNC
- 3 = M6 x 1
- 4 = M8 x 1.25
- X = Other (Specify)

Lead Insulation BOX 4

- Fiberglass 900°F (482°C) **S** w/ SS Overbraid
- Teflon 400°F (204°C) **T** **B**
- D**

Termination BOX 5 †

- B** = 2-1/2 in. Split Leads
- S** = Spade Lugs
- C** = Spade Lugs with BX Conn.
- P** = Standard Plug
- J** = Standard Jack
- K** = Standard Plug and Jack
- D** = Miniature Plug
- E** = Miniature Jack
- F** = Mini. Plug and Jack
- X** = Other (Specify)

Calibration BOX 2

- ANSI Standard Tolerances **J K E T N**

"L" Dimension BOX 3

Whole inches
Example: Enter **048** for 48 inches

Strain Relief Spring BOX 6

- 0** = Not Required
- Y** = Required

† See page 14-9 for Termination Style descriptions

Special Requirements BOX 7

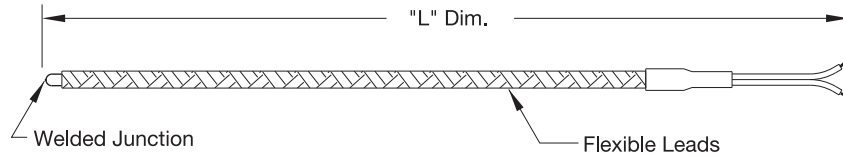
- X** = Specify
- 0** = None



Surface Thermocouples

Wire Thermocouples

* An economical insulated wire thermocouple with exposed junction



Ordering Code: **TWW** -

Wire Size BOX 1

- 1** = 30 ga. Solid
- 2** = 24 ga. Solid
- 3** = 24 ga. Stranded
- 4** = 20 ga. Solid
- 5** = 20 ga. Stranded
- X** = Other (Specify)

Calibration BOX 2

ANSI Standard Tolerances **J K E T**

"L" Dimension BOX 3

Whole inches
Example: Enter **048** for 48 inches

Lead Insulation BOX 4

Fiberglass 900°F (482°C) **S** **B**
Teflon® 400°F (204°C) **T** **D**

w/ SS Overbraid

Termination BOX 5 †

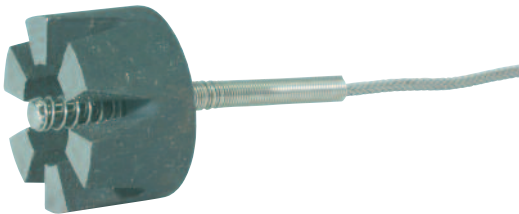
B = 2-1/2 in. Split Leads **P** = Standard Plug **D** = Miniature Plug
S = Spade Lugs **J** = Standard Jack **E** = Miniature Jack
C = Spade Lugs with BX Conn. **K** = Standard Plug and Jack **F** = Mini. Plug and Jack
X = Other (Specify)

Special Requirements BOX 6

X = Specify
0 = None

† See page 14-9 for Termination Style descriptions

Magnet Thermocouples



* This 1-1/4" dia. 6-pole magnet thermocouple can be attached to magnetic surfaces and walls with a holding force of 25 lbs. Magnet may lose some of the holding force above 750°F (400°C).

Ordering Code: **TMW** -

Calibration BOX 1

ANSI Standard Tolerances **J K E T N**

Lead Wire Length BOX 2

Whole inches
Example: Enter **048** for 48 inches

Lead Insulation BOX 3

Fiberglass 900°F (482°C) **S** **B**
Teflon® 400°F (204°C) **T** **D**

w/ SS Overbraid

Termination BOX 4 †

B = 2-1/2 in. Split Leads **P** = Standard Plug **D** = Miniature Plug
S = Spade Lugs **J** = Standard Jack **E** = Miniature Jack
C = Spade Lugs with BX Conn. **K** = Standard Plug and Jack **F** = Mini. Plug and Jack
X = Other (Specify)

Special Requirements BOX 5

X = Specify
0 = None

† See page 14-9 for Termination Style descriptions



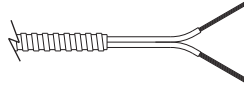
Optional Thermocouple Termination Styles

Optional Termination Styles

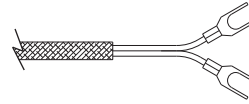
Available for the following thermocouples:

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TSW	14-6
TPW	14-7
TNW	14-7
TWW	14-8
TMW	14-8
MTA1	14-15

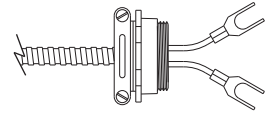
Style B—Plain Ends



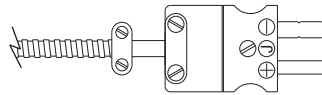
Style S—Spade Lugs



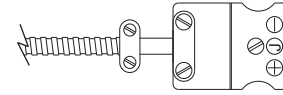
Style C—Spade Lugs with BX connector



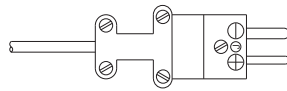
Style P—Standard Plug



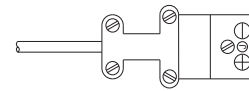
Style J—Standard Jack



Style D—Miniature Plug



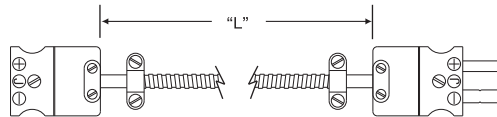
Style E—Miniature Jack



Thermocouple Extension Assemblies

Termination 1

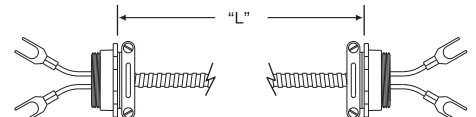
Termination 2



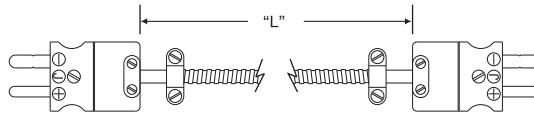
Jack to Plug

Termination 1

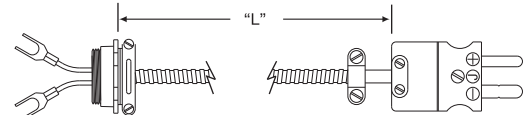
Termination 2



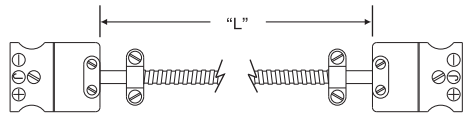
BX Connector to BX Connector



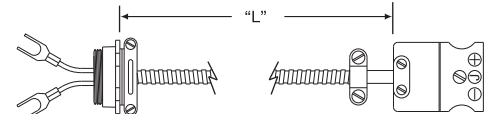
Plug to Plug



BX Connector to Plug



Jack to Jack



BX Connector to Jack

Ordering Information

ECA Thermocouple Extension Assemblies are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **ECA** -

Termination 1 & 2 BOX 1 & 2 †

S = Spade Lugs **B** = 2-1/2 in. Split Leads
C = Spade Lugs with BX Conn. **D** = Miniature Plug
P = Standard Plug **E** = Miniature Jack
J = Standard Jack **X** = Other (Specify)

Calibration BOX 3

ANSI Standard Tolerances **J K E T N**

† See above for Termination Style descriptions

"L" Dimension BOX 4

Whole inches **006** to **999**

Lead Insulation BOX 5

	Standard	w/ SS Overbraid	w/ SS Armor Cable
Fiberglass 900°F (482°C)	S	B	A
Teflon® 400°F (204°C)	T	D	F

Special Requirements BOX 6

X = Specify
0 = None



Melt Bolt Thermocouples

Melt Bolt Thermocouples for Plastic Extruders or Injection Molding Machines

Design Features

* **Bolt Material**

Stainless Steel
1/2-20 UNF Thread

* **Probe Material**

Stainless Steel

* **Probe Diameters**

Standard 1/8"

* **Calibration**

ANSI Type J
(Iron-Constantan)

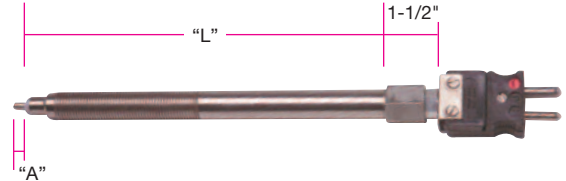
* **Junction Style**

Closed End Grounded

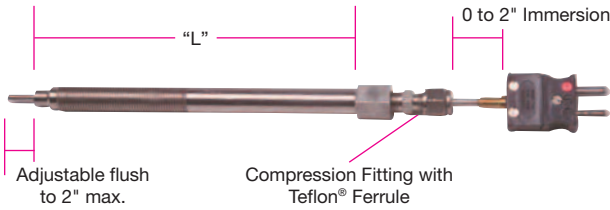
Style A—Adjustable Tip

- * Eliminates excess inventory.
- * Tip can be field adjusted from flush to 2 inches.
- * MgO insulated.
- * Can be installed wherever standard melt thermocouples are in use.
- * Bolt with Teflon® insert at tip has a maximum operating temperature of 500°F (260°C). Without insert 1400°F (760°C).

Style R—Rigid Plug



Insulation—MgO or Fiberglass

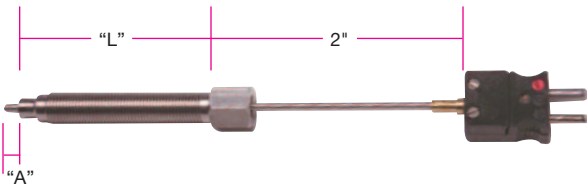


Thermocouple Diameter	Part Number			
	Without Teflon® Insert		With Teflon® Insert	
	L = 3"	L = 6"	L = 3"	L = 6"
1/8"†	TMB00001	TMB00002	TMB00003	TMB00004
3/16"	TMB00005	TMB00006	N/A	N/A

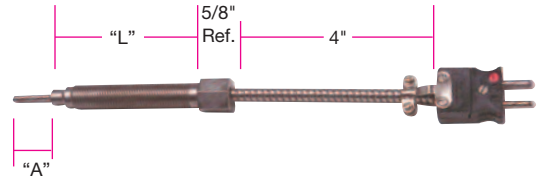
Part Number MgO Insulation	"A" (in)	"L" (in)	Part Number Fiberglass Insulation
TMB00027	Flush	3	TMB00037
TMB00028	1/4	3	TMB00038
TMB00029	1/2	3	TMB00039
TMB00030	3/4	3	TMB00040
TMB00031	1	3	TMB00041
TMB00032	Flush	6	TMB00042
TMB00033	1/4	6	TMB00043
TMB00034	1/2	6	TMB00044
TMB00035	3/4	6	TMB00045
TMB00036	1	6	TMB00046

†For 1/8" diameter, it is not recommended to immerse tip more than 1" due to bending and breakage in melt flow.

Style E—Extension Mounted Plug



Style F—Flexible Mount Plug



Insulation—MgO or Fiberglass

Part Number MgO Insulation	"A" (in)	"L" (in)	Part Number Fiberglass Insulation
TMB00007	Flush	3	TMB00017
TMB00008	1/4	3	TMB00018
TMB00009	1/2	3	TMB00019
TMB00010	3/4	3	TMB00020
TMB00011	1	3	TMB00021
TMB00012	Flush	6	TMB00022
TMB00013	1/4	6	TMB00023
TMB00014	1/2	6	TMB00024
TMB00015	3/4	6	TMB00025
TMB00016	1	6	TMB00026

Insulation—Fiberglass only

Stock Items Are Shown In RED

"A" (in)	"L" (in)	Part Number Fiberglass Insulation
Flush	3	TMB00047
1/4	3	TMB00048
1/2	3	TMB00049
3/4	3	TMB00050
1	3	TMB00051
Flush	6	TMB00052
1/4	6	TMB00053
1/2	6	TMB00054
3/4	6	TMB00055
1	6	TMB00056



See page 14-101 for Blank Melt Bolts



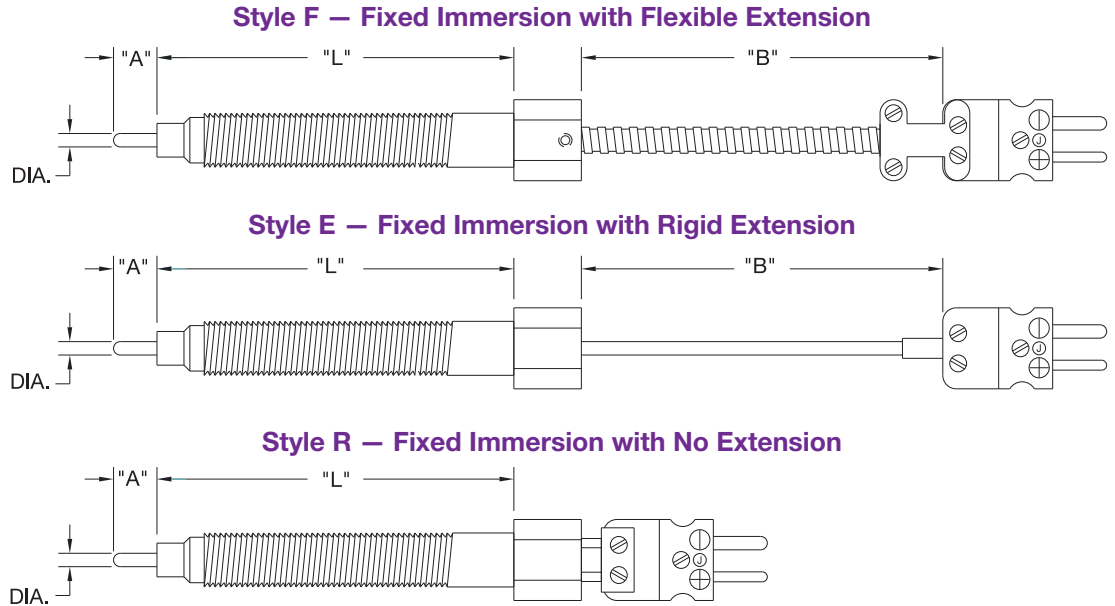
Melt Bolt Thermocouples (Custom Engineered/Manufactured)

Design Features

- * Designed to Measure the Temperature of Plastic Stream of an Extruder or Injection Molding Machine
- * 304 Stainless Steel Construction
- * 900°F (482°C) Operating Temperature
- * 1/2-20 UNF Thread

Ordering Information

TMB Melt Bolt Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.



Ordering Code: TMB - 1 2 3 4 5 6 7 8 9 10

Style BOX 1
F = w/ Flexible Extension
E = w/ Rigid Extension
R = w/ No Extension

Tip Diameter BOX 2
F = 0.125 (Standard)
G = 0.188
X = Other (Specify)

Melt Bolt Length BOX 3
 "L" Dim.
03 = 3" **09** = 9"
04 = 4" **10** = 10"
06 = 6" **12** = 12"

Calibration BOX 4
 ANSI Standard Tolerances **J** **K** **E** **T** **N**

"A" Dimension BOX 5
 Whole inches
0 to **9** (Enter 0 if less than 1)

Junction BOX 7
G = Grounded
U = Ungrounded

"B" Dimension BOX 8
 Whole inches
 Example: Enter **006** for 6 inches
 Enter **000** for Style R

"A" Dimension BOX 6
 Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Termination BOX 9 †
B = 2-1/2 in. Split Leads (Style F only) **P** = Standard Plug
S = Spade Lugs (Style F only) **J** = Standard Jack
C = Spade Lugs with BX Conn. (Style F only) **K** = Standard Plug and Jack
X = Other (Specify)

Special Requirements BOX 10
X = Specify
0 = None

† See page 14-9 for Termination Style descriptions



MI Cable Thermocouple Assemblies

Mineral Insulated Metal-Sheathed Cable

Thermocouple Assemblies are made from TEMPCO's high quality Tempco-Pak and will incorporate all the same outstanding features.

Important Features:

- * *Accurate*
- * *High Temperature Rating*
- * *Fast Response*
- * *Moisture Proof*
- * *Thermal Shock Resistant*
- * *Can Be Formed*
- * *Weldable*
- * *High Pressure Rated*
- * *Compact*
- * *Durable*

Typical Applications

- ↔ *Bearing Temperature*
- ↔ *Diesel Engines*
- ↔ *Food Processing*
- ↔ *Furnaces*
- ↔ *Glass Manufacturing*
- ↔ *Heat Treating*
- ↔ *Kilns*
- ↔ *Metal Processing*
- ↔ *Oil Processing*
- ↔ *Ovens*
- ↔ *Petrochemicals*
- ↔ *Power Stations*
- ↔ *Refineries*
- ↔ *Research Laboratories*
- ↔ *Steam Generators*
- ↔ *Turbines*

Hot Junctions

(Hot or Measuring Junctions available on single or dual element cable)

Choose the measuring junction that best suits your particular needs:



Exposed Junction (E)

Thermocouple wires are butt-welded. Insulation is sealed against liquid or gas penetration prior to use.

This junction style provides the fastest possible response time but leaves the thermocouple wires unprotected against corrosive or mechanical damage.



Grounded Junction (G)

The sheath and thermocouple wires are welded together, forming a completely sealed integral junction. Recommended in presence of liquids, moisture, gas or high pressure. The wire is protected from corrosive or erosive conditions. In the Grounded Junction, response time approaches that of the Exposed Junction.



Ungrounded Junction (U)

Thermocouple junction is fully insulated from welded sheath end. Excellent for applications where stray emf's would affect the reading and for frequent or rapid temperature cycling. With the Ungrounded Junction, response time is slightly longer than for the Grounded Junction.



Selecting the Correct Tempco-Pak Thermocouple Assembly

Thermocouples must be selected to meet the conditions of each particular application. The environment, operating temperature and atmosphere, response time and length of service must be considered when selecting the sheath, insulation, calibration, junction and termination of the thermocouple assembly.

Refer to the Mineral Insulated Thermocouples and Cable section regarding sheath, insulation and calibration (pages 14-114 through 14-118).

TEMPCO's engineering staff will be happy to assist you with the design and selection of your thermocouple requirements.

Sheath Materials

The most commonly used sheath materials and their maximum continuous operating temperatures in an oxidizing atmosphere are as follows:

Sheath Material	Max. Operating Temperature
Alloy 600	2150°F (1177°C)
304 Stainless Steel	1650°F (899°C)
316 Stainless Steel	1650°F (899°C)
310 Stainless Steel	2100°F (1150°C)



Note: For temperatures exceeding 2200°F (1204°C), Noble or Refractory metal sheaths are normally used.

Formability

Because Tempco-Pak is fully annealed it can normally be formed around a mandrel 4 times the sheath diameter. Consult TEMPCO if special forming is required.

Weldability

The thermocouple sheath can be brazed, soldered or welded. Welding the thermocouple sheath in the field is not recommended on diameters less than .093 in. All welding should be done in an inert atmosphere.

Calibrations

The table shows the standard temperature ranges for the various ANSI thermocouple calibrations:

ANSI Letter	Thermocouple Type	Temperature Range	
		°F	(°C)
J	Iron-Constantan	32-1400	(0-760)
K	CHROMEL P®-ALUMEL®	32-2300	(0-1260)
N	Nicrosil-Nisil	32-2300	(0-1260)
T	Copper-Constantan	32-660	(0-350)
E	CHROMEL P®-Constantan	32-1600	(0-871)
R	Pt 13% Rhodium-Platinum	32-2700	(0-1482)
S	Pt 10% Rhodium-Platinum	32-2700	(0-1482)
B	Pt 30% Rh-Pt 6% Rh	1600-3100	(871-1704)

Assembly Tolerances: Sheath Length Dimensions

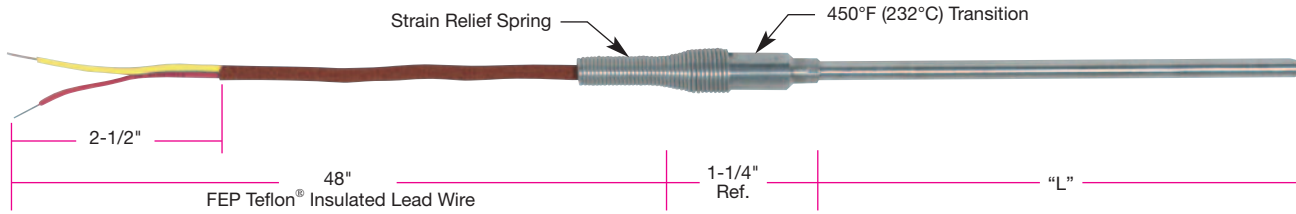
Sheath O.D.	"L" Tolerance Up to 24"	"L" Tolerance Over 24"
Up to .038"	±½"	±2%
.038" to .065"	±¾"	±1½%
Larger than .065"	±¼"	±1%

Flexible Lead Dimensions

Lead Length (ft.)	Tolerance
Up to 5	+6", -1"
5 to 10	+6", -2"
over 10	+5%, -2%



Style MTA1 — Transition to Lead Wire (Stock)



Ordering a Stock MTA1 Thermocouple

(Thermocouples not available from stock can be custom manufactured—see page 14-15)

TEMPCO stocks **MTA1 style Thermocouples** in type J and K in the standard lengths listed in the following two tables. These thermocouples have Teflon® insulated leads with a 2-1/2" split lead termination.

Order a stock unit from the tables after completing the ordering code with the Junction Type Code from Box 5 and Optional Compression Fitting Code from Box 6 below.

Type J — 316 SS Sheath

Diameter	"L" Dimension			
	6"	12"	18"	24"
0.063"	ST1-JD06B <input type="checkbox"/>	ST1-JD12B <input type="checkbox"/>	ST1-JD18B <input type="checkbox"/>	ST1-JD24B <input type="checkbox"/>
0.125"	ST1-JF06B <input type="checkbox"/>	ST1-JF12B <input type="checkbox"/>	ST1-JF18B <input type="checkbox"/>	ST1-JF24B <input type="checkbox"/>
0.250"	ST1-JH06B <input type="checkbox"/>	ST1-JH12B <input type="checkbox"/>	ST1-JH18B <input type="checkbox"/>	ST1-JH24B <input type="checkbox"/>

Type K — Alloy 600 Sheath

Diameter	"L" Dimension			
	6"	12"	18"	24"
0.063"	ST1-KD06B <input type="checkbox"/>	ST1-KD12B <input type="checkbox"/>	ST1-KD18B <input type="checkbox"/>	ST1-KD24B <input type="checkbox"/>
0.125"	ST1-KF06B <input type="checkbox"/>	ST1-KF12B <input type="checkbox"/>	ST1-KF18B <input type="checkbox"/>	ST1-KF24B <input type="checkbox"/>
0.250"	ST1-KH06B <input type="checkbox"/>	ST1-KH12B <input type="checkbox"/>	ST1-KH18B <input type="checkbox"/>	ST1-KH24B <input type="checkbox"/>

Stock Modification for Fast Delivery

Above stocked items can be cut to desired length and terminated with any standard termination for fast delivery. To order a probe length not listed in the tables above, complete the Code Number below.

Ordering Code: **ST1** -

Calibration BOX 1
ANSI Standard Tolerances **J K**

Diameter BOX 2
D = .063"
F = .125"
H = .250"

"L" Dimension BOX 3
06", 12", 18", 24" Stock Lengths
For other lengths, specify in inches.

Termination BOX 4
B = 2-1/2 in. Split Leads
S = Spade Lugs
C = Spade Lugs with BX Conn.
P = Standard Plug
J = Standard Jack
K = Standard Plug and Jack
D = Miniature Plug
E = Miniature Jack
F = Mini. Plug and Jack
See page 14-9 for Termination Style descriptions

Junction BOX 5
G = Grounded
U = Ungrounded
E = Exposed

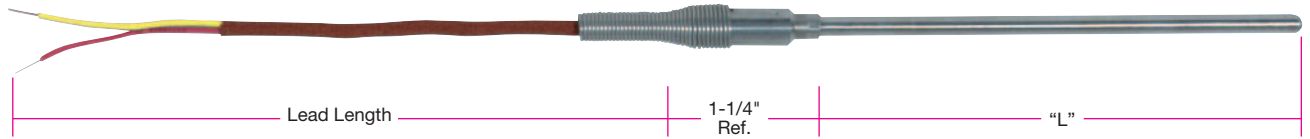
Optional Compression Fitting BOX 6
1 = 1/8" NPT SS
2 = 1/4" NPT SS
3 = 1/2" NPT SS
0 = None Required
4 = 1/8" NPT Brass
5 = 1/4" NPT Brass
6 = 1/2" NPT Brass



Optional Installation Compression Fitting
See Box 6



Style MTA1 — Transition to Lead Wire (Custom Manufactured)



Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.



Optional Installation
Compression Fitting
See Box 13

Design Features

- * Mineral insulated sheath provides flexibility to form and bend the thermocouple to meet design requirements.
- * Stainless steel transition with optional Strain Relief Spring
- * Standard epoxy potting transition provides greater moisture resistance rated to 450°F (232°C). Optional ceramic based potting rated to 1000°F (538°C). Ceramic potting not recommended with Teflon® leads, nor for high humidity applications.

Ordering Code:

MTA1 -

Calibration Code BOX 1

ANSI Standard Tolerances	J	K	E	T	N	R	S	B
Special Tolerances	3	4	5	6	7			

Junction BOX 8

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Lead Wire Length BOX 9

In inches 001 to 999
12" (012) Standard

Number of Conductors BOX 2

2 = Single (Standard)
4 = Duplex

Insulation BOX 3

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

Sheath Material BOX 4

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. BOX 5

A = .020" ±.001	K = .375" +.003/-.002
B = .032" ±.001	L = 1.0mm ±.03
C = .040" ±.001	N = 1.5mm ±.03
D = .063" ±.001	P = 2.0 mm ±.03
E = .093" ±.002	Q = 3.0 mm ±.03
F = .125" ±.002	R = 4.5 mm ±.05
G = .188" ±.002	S = 6.0 mm +.07/-.05
H = .250" +.003/-.002	T = 8.0 mm +.07/-.05
J = .313" +.003/-.002	V = 9.0 mm +.07/-.05

Sheath Length "L" BOX 6

Whole inches
01 to 99
For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches		
0 = 0"	3 = 3/8"	6 = 3/4"
1 = 1/8"	4 = 1/2"	7 = 7/8"
2 = 1/4"	5 = 5/8"	

Lead Wire Construction BOX 10

		w/ SS Overbraid	w/ SS Flex Armor
Fiberglass 900°F (482°C)	S	B	A
Teflon 400°F (204°C)	T	D	F

Depending on availability .040" to .125" uses 24 gauge lead wire. Larger than .125" thermocouples use 20 gauge lead wire depending on availability and insulation type.

Lead Wire Termination BOX 11

P = Standard Male Plug	F = Miniature Plug with Mating Jack
J = Standard Female Jack	B = Standard—2-1/2 in. Split Leads
K = Std. Plug with Mating Conn.	S = 2-1/2 in. Split Leads with Spade Lugs
D = Miniature Male Plug	C = 2-1/2 in. Split Leads with BX connector and Spade Lugs
E = Miniature Female Jack	X = Other (Specify)

See page 14-9 for Termination Style descriptions

Strain Relief Spring BOX 12

O = Not Required
Y = Required

Optional Compression Fitting BOX 13

1 = 1/8" NPT SS	4 = 1/8" NPT Brass
2 = 1/4" NPT SS	5 = 1/4" NPT Brass
3 = 1/2" NPT SS	6 = 1/2" NPT Brass
0 = None Required	

Special Requirements BOX 14

H = High temp potting 1000°F (538°C)
O = Standard Epoxy Potting 450°F (232°C)
X = Other (Specify)



Style MTA2 Plug Termination (Stock)



Ordering a Stock MTA2 Thermocouple

(Thermocouples not available from stock can be custom manufactured—see page 14-17)

TEMPCO stocks **MTA2 style Thermocouples** in type J and K in the standard lengths listed in the following two tables. These thermocouples have a standard Male Plug Termination.

Order a stock unit from the tables after completing the ordering code with the Junction Type Code from Box 4 and Optional Compression Fitting Code from Box 5 below.

Type J — 316 SS Sheath

Diameter	"L" Dimension			
	6"	12"	18"	24"
0.063"	ST2-JD06 <input type="checkbox"/>	ST2-JD12 <input type="checkbox"/>	ST2-JD18 <input type="checkbox"/>	ST2-JD24 <input type="checkbox"/>
0.125"	ST2-JF06 <input type="checkbox"/>	ST2-JF12 <input type="checkbox"/>	ST2-JF18 <input type="checkbox"/>	ST2-JF24 <input type="checkbox"/>

Type K — Alloy 600 Sheath

Diameter	"L" Dimension			
	6"	12"	18"	24"
0.063"	ST2-KD06 <input type="checkbox"/>	ST2-KD12 <input type="checkbox"/>	ST2-KD18 <input type="checkbox"/>	ST2-KD24 <input type="checkbox"/>
0.125"	ST2-KF06 <input type="checkbox"/>	ST2-KF12 <input type="checkbox"/>	ST2-KF18 <input type="checkbox"/>	ST2-KF24 <input type="checkbox"/>

Stock Modification for Fast Delivery

Above stocked items can be cut to desired length and junctioned for fast delivery. To order a probe length not listed in the tables above, complete the Code Number below.

Ordering Code: **ST2** -

Calibration BOX 1
ANSI Standard Tolerances **J K**

"L" Dimension BOX 3
06", 12", 18", 24" Stock Lengths
For other lengths specify in inches.

Optional Compression Fitting BOX 5
1 = 1/8" NPT SS **4** = 1/8" NPT Brass
2 = 1/4" NPT SS **5** = 1/4" NPT Brass
3 = 1/2" NPT SS **6** = 1/2" NPT Brass
0 = None Required

Diameter BOX 2
D = .063"
F = .125"

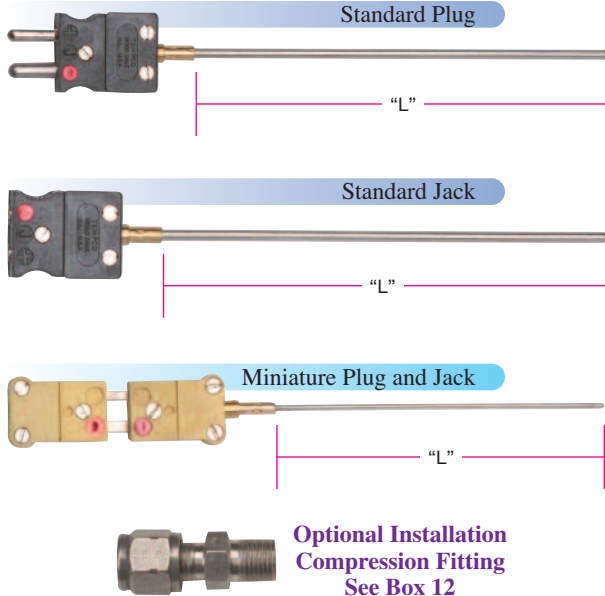
Junction BOX 4
G = Grounded
U = Ungrounded
E = Exposed



Optional Installation Compression Fitting
See Box 5



Style MTA2 Plug or Jack Termination (Custom Manufactured)



Design Features

- * Pins are made with matching thermocouple alloys.
- * Standard plugs come with hollow pins as standard and solid pins as an option.
- * Standard size and miniature plugs and jacks have a 350°F (177°C) continuous and 400°F (204°C) intermittent temperature rating.
- * High temperature plugs and jacks are rated for 500°F (260°C) continuous operation and 550°F (288°C) intermittent (brown only).
- * Ultra high temperature plugs and jacks are rated for 800°F (427°C) continuous operation and 1000°F (538°C) intermittent (all are reddish-brown in color).
- * Dual element available for sheath O.D. of 0.063" to 0.375".
- * 0.020" to 0.250" use crimp insert—0.313" and 0.375" use tube adapters.
- * Miniature plugs have solid flat pins.

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code:

MTA2 - 1 2 3 4 5 6 7 8 9 10 11 12 13

Calibration Code BOX 1

ANSI Standard Tolerances **J K E T N R S B**
 Special Tolerances **3 4 5 6 7**

Number of Conductors BOX 2

2 = Single (Standard)
 4 = Duplex

Connector Type BOX 9

Standard Plugs and Jacks
P = Standard Plug
J = Standard Jack
K = Standard Plug w/Mating Jack
Miniature Plugs and Jacks (.188" max O.D.)
D = Miniature Plug
E = Miniature Jack
F = Miniature Plug w/Mating Jack

Insulation BOX 3

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

Sheath Material BOX 4

A = Alloy 600 **B** = 304 SS **C** = 316 SS

Sheath O.D. BOX 5

A = .020" ±.001 **G** = .188" ±.002 **P** = 2.0mm ±.03
B = .032" ±.001 **H** = .250" +.003/-0.002 **Q** = 3.0mm ±.03
C = .040" ±.001 **J** = .313" +.003/-0.002 **R** = 4.5mm ±.05
D = .063" ±.001 **K** = .375" +.003/-0.002 **S** = 6.0mm +.07/-0.05
E = .092" ±.001 **L** = 1.0mm ±.03 **T** = 8.0mm +.07/-0.05
F = .125" ±.002 **N** = 1.5mm ±.03 **V** = 9.0mm +.07/-0.05

Connector Temp Rating BOX 10

S = Standard 350°F (177°C)
H = High Temperature 500°F (260°C)
U = Ultra-High Temperature 800°F (427°C)
 (Miniature not available)

Pin Option BOX 11

H = Hollow pins—std. **S** = Solid pins **O** = For Jack Termination

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Optional Compression Fitting BOX 12

1 = 1/8" NPT SS **4** = 1/8" NPT Brass
2 = 1/4" NPT SS **5** = 1/4" NPT Brass
3 = 1/2" NPT SS **6** = 1/2" NPT Brass
0 = None Required

Junction BOX 8

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Special Requirements BOX 13

X = Specify
0 = None



Style MTA4 Stripped Cold End (Stock)



Design Features

- * Standard strip length is 1/2 inch.
- * Stripped end sealed with resin to inhibit moisture penetration.

All Items Available from Stock

Ordering a Stock MTA4 Thermocouple

(Thermocouples not available from stock can be custom manufactured—see page 14-19)

TEMPCO stocks **MTA4 style Thermocouples** in type J and K in the standard lengths listed in the following two tables. These thermocouples have a 1/2-inch strip length.

Order a stock unit from the tables after completing the ordering code with the Junction Type Code from Box 4 and Optional Compression Fitting Code from Box 5 below.

Stock Type J — 316 SS Sheath

Diameter	"L" Dimension			
	7"	13"	19"	25"
0.063"	ST4JD07 <input type="checkbox"/>	ST4JD13 <input type="checkbox"/>	ST4JD19 <input type="checkbox"/>	ST4JD25 <input type="checkbox"/>
0.125"	ST4JF07 <input type="checkbox"/>	ST4JF13 <input type="checkbox"/>	ST4JF19 <input type="checkbox"/>	ST4JF25 <input type="checkbox"/>
0.188"	ST4JG07 <input type="checkbox"/>	ST4JG13 <input type="checkbox"/>	ST4JG19 <input type="checkbox"/>	ST4JG25 <input type="checkbox"/>
0.250"	ST4JH07 <input type="checkbox"/>	ST4JH13 <input type="checkbox"/>	ST4JH19 <input type="checkbox"/>	ST4JH25 <input type="checkbox"/>

Stock Type K — Alloy 600 Sheath

Diameter	"L" Dimension			
	7"	13"	19"	25"
0.063"	ST4KD07 <input type="checkbox"/>	ST4KD13 <input type="checkbox"/>	ST4KD19 <input type="checkbox"/>	ST4KD25 <input type="checkbox"/>
0.125"	ST4KF07 <input type="checkbox"/>	ST4KF13 <input type="checkbox"/>	ST4KF19 <input type="checkbox"/>	ST4KF25 <input type="checkbox"/>
0.188"	ST4KG07 <input type="checkbox"/>	ST4KG13 <input type="checkbox"/>	ST4KG19 <input type="checkbox"/>	ST4KG25 <input type="checkbox"/>
0.250"	ST4KH07 <input type="checkbox"/>	ST4KH13 <input type="checkbox"/>	ST4KH19 <input type="checkbox"/>	ST4KH25 <input type="checkbox"/>

Stock Modification for Fast Delivery

Above stocked items can be cut to desired length and stripped as required for fast delivery. To order a probe length not listed in the tables above, complete the Code Number below.

Ordering Code: **ST4** - ¹ ² ³ ⁴ ⁵

Calibration BOX 1
ANSI Standard Tolerances **J K**

Diameter BOX 2
D = .063"
F = .125"
G = .188"
H = .250"

"L" Dimension BOX 3
07", 13", 19", 25" Stock Lengths
For other lengths specify in inches.

Junction BOX 4
G = Grounded
U = Ungrounded
E = Exposed

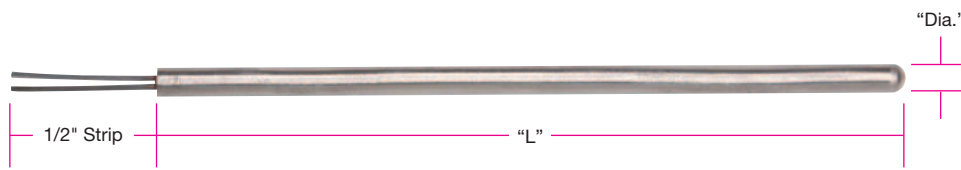
Optional Compression Fitting BOX 5
1 = 1/8" NPT SS **4** = 1/8" NPT Brass
2 = 1/4" NPT SS **5** = 1/4" NPT Brass
3 = 1/2" NPT SS **6** = 1/2" NPT Brass
0 = None Required



Optional Installation Compression Fitting
See Box 5



Style MTA4 Stripped Cold End (Custom Manufactured)



Design Features

- * Standard strip length is 1/2 inch.
- * Stripped end sealed with resin to inhibit moisture penetration.
- * Duplex available from 0.063" to 0.375" diameter.

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.



**Optional Installation
Compression Fitting**
See Box 10

Ordering Code: **MTA4** -

Calibration Code BOX 1

ANSI Standard Tolerances **J K E T N R S B**

Special Tolerances **3 4 5 6 7**

Sheath Length "L" BOX 6

Whole inches
01 to 99
For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" 3 = 3/8" 6 = 3/4"
1 = 1/8" 4 = 1/2" 7 = 7/8"
2 = 1/4" 5 = 5/8"

Number of Conductors BOX 2

2 = Single (Standard)
4 = Duplex

Junction BOX 8

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Insulation BOX 3

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

Strip Length BOX 9

S = 1/2" standard
1 = 1"
2 = 2"
3 = 3"
1" maximum on .040" and smaller

Sheath Material BOX 4

A = Alloy 600
B = 304 SS
C = 316 SS

Optional Compression Fitting BOX 10

1 = 1/8" NPT SS **4** = 1/8" NPT Brass
2 = 1/4" NPT SS **5** = 1/4" NPT Brass
3 = 1/2" NPT SS **6** = 1/2" NPT Brass
0 = None Required

Sheath O.D. BOX 5

B = .032" ±.001	H = .250" +.003/-.002	Q = 3.0mm ±.03
C = .040" ±.001	J = .313" +.003/-.002	R = 4.5mm ±.05
D = .063" ±.001	K = .375" +.003/-.002	S = 6.0mm +.07/-.05
E = .092" ±.001	L = 1.0mm ±.03	T = 8.0mm +.07/-.05
F = .125" ±.002	N = 1.5mm ±.03	V = 9.0mm +.07/-.05
G = .188" ±.002	P = 2.0mm ±.03	

Special Requirements BOX 11

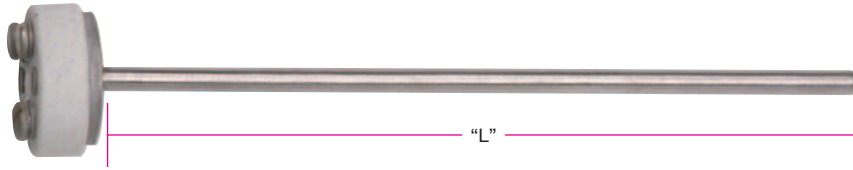
X = Specify
0 = None

Temperature Sensing



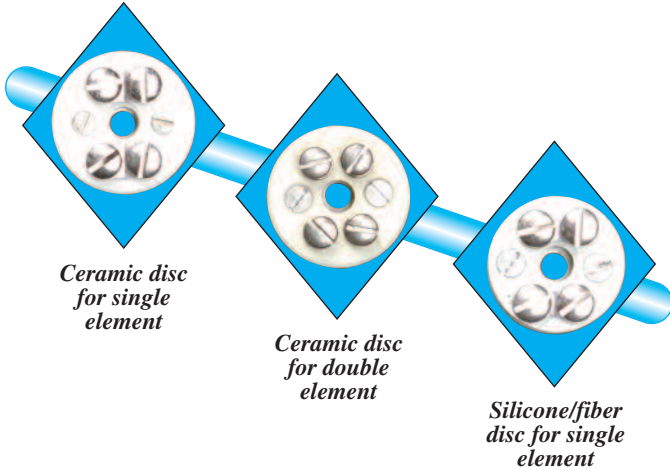
MI Cable Thermocouple Assemblies

Style MTA3 — Open Disc Termination



Design Features

- * Economical termination with nickel plated brass inserts.
- * Available in sheath diameters ranging from 0.063" to 0.250", single and duplex construction.



Optional Installation
Compression Fitting
See Box 10

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **MTA3** -

Calibration Code BOX 1

ANSI Standard **J K E T N R S B**
Tolerances
Special Tolerances **3 4 5 6 7**

Sheath Length "L" BOX 6

Whole inches
01 to 99
For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Number of Conductors BOX 2

2 = Single (Standard)
4 = Duplex

Junction BOX 8

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Insulation BOX 3

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

Termination BOX 9

1* = Silicone/glass cloth to 350°F (177°C) 1" O.D. with Brass mounting plate
2 = Ceramic to 1000°F (538°C) 1-1/8" O.D. Single and Dual element with SS mounting plate
* Single element only

Sheath Material BOX 4

A = Alloy 600
B = 304 SS
C = 316 SS

Optional Compression Fitting BOX 10

1 = 1/8" NPT SS **4** = 1/8" NPT Brass
2 = 1/4" NPT SS **5** = 1/4" NPT Brass
3 = 1/2" NPT SS **6** = 1/2" NPT Brass
0 = None Required

Sheath O.D. BOX 5

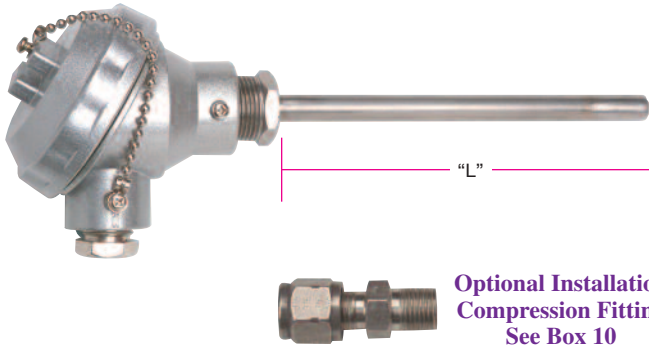
D = .063" ±.001 **G** = .188" ±.002 **Q** = 3.0 mm ±.03
E = .092" ±.001 **H** = .250" +.003/-0.002 **R** = 4.5 mm ±.05
F = .125" ±.002 **P** = 2.0 mm ±.03 **S** = 6.0 mm +.07/-0.05

Special Requirements BOX 11

X = Specify
0 = None



Style MTA5 — Connection Head



Design Features

- * Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- * Screw covers are attached to body with a plated chain.
- * Covers have lugs for tightening or loosening with a screwdriver or wrench.
- * Available in single (2-wire) or duplex (4-wire).
- * Tempco's connection heads are available in die cast aluminum, Bakelite and cast iron in a variety of sizes from miniature for confined areas to the large universal head designed for heavy process and industrial applications. See sensor accessories pages 14-98 through 14-100 for complete information.

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **MTA5** -

Calibration Code BOX 1

ANSI Standard Tolerances **J K E T N R S B**
 Special Tolerances **3 4 5 6 7**

Number of Conductors BOX 2

2 = Single (Standard)
4 = Duplex

Insulation BOX 3

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

Sheath Material BOX 4

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. BOX 5

D = .063" ±.001 **P** = 2.0 mm ±.03
F = .125" ±.002 **Q** = 3.0 mm ±.03
G = .188" ±.002 **R** = 4.5 mm ±.05
H = .250" +.003/-.002 **S** = 6.0 mm +.07/-.05
J = .313" +.003/-.002
K = .375" +.003/-.002

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Junction BOX 8

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Connection Head BOX 9

A = Standard Size Aluminum **F** = Standard Bakelite
B = Medium Size Aluminum **P** = Polypropylene
C = Miniature Aluminum **N** = Miniature Nickel Plated Steel
H = Standard Cast Iron **S** = Stainless Steel
Note: Conduit connection for A, F, H & S is 1/2" (3/4" is available); for B & C is 3/8"; and for P is 3/4" NPT.
 For overall dimensions see pages 14-98 through 14-100.

Optional Compression Fitting BOX 10

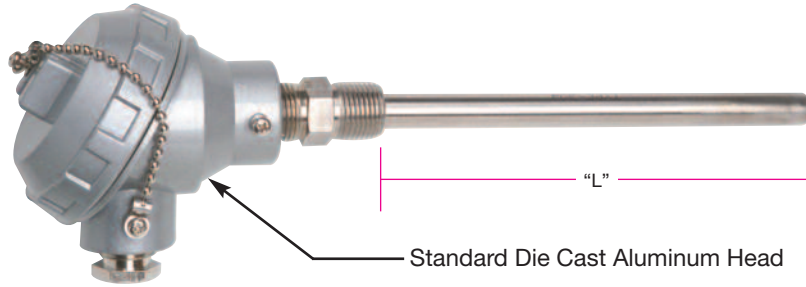
1 = 1/8" NPT SS **4** = 1/8" NPT Brass
2 = 1/4" NPT SS **5** = 1/4" NPT Brass
3 = 1/2" NPT SS **6** = 1/2" NPT Brass
0 = None Required

Special Requirements BOX 11

X = Specify
0 = None



Style MTA6 Connection Head with 1/2" NPT Hex Nipple (Stock)



Ordering a Stock MTA6 Thermocouple

(Thermocouples not available from stock can be custom manufactured—see page 14-23)

TEMPCO stocks **MTA6 style Thermocouples** in type J and K in the standard lengths listed in the following two tables. These thermocouples have a 1/2" NPT SS process connection with a standard die cast aluminum head (Type A)

Order a stock unit from the tables after completing the ordering code with the Junction Type Code from Box 4 below.

Stock Type J – 316 SS Sheath

Diameter	"L" Dimension			
	6"	12"	18"	24"
0.125"	ST6JF06 <input type="checkbox"/>	ST6JF12 <input type="checkbox"/>	ST6JF18 <input type="checkbox"/>	ST6JF24 <input type="checkbox"/>
0.188"	ST6JG06 <input type="checkbox"/>	ST6JG12 <input type="checkbox"/>	ST6JG18 <input type="checkbox"/>	ST6JG24 <input type="checkbox"/>
0.250"	ST6JH06 <input type="checkbox"/>	ST6JH12 <input type="checkbox"/>	ST6JH18 <input type="checkbox"/>	ST6JH24 <input type="checkbox"/>

Stock Type K – Alloy 600 Sheath

Diameter	"L" Dimension			
	6"	12"	18"	24"
0.125"	ST6KF06 <input type="checkbox"/>	ST6KF12 <input type="checkbox"/>	ST6KF18 <input type="checkbox"/>	ST6KF24 <input type="checkbox"/>
0.188"	ST6KG06 <input type="checkbox"/>	ST6KG12 <input type="checkbox"/>	ST6KG18 <input type="checkbox"/>	ST6KG24 <input type="checkbox"/>
0.250"	ST6KH06 <input type="checkbox"/>	ST6KH12 <input type="checkbox"/>	ST6KH18 <input type="checkbox"/>	ST6KH24 <input type="checkbox"/>

Stock Modification

Above stocked items can be cut to desired length and junctioned for fast delivery. For lengths other than listed in table above, complete the Code Number below.

Ordering Code: **ST6** - ¹ ² ³ ⁴

Calibration BOX 1
ANSI Standard Tolerances **J K**

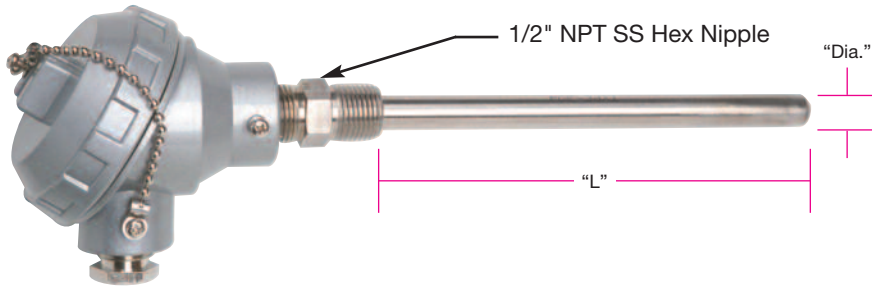
Diameter BOX 2
F = .125"
G = .188"
H = .250"

"L" Dimension BOX 3
06", 12", 18", 24" Stock Lengths
For other lengths specify in inches.

Junction BOX 4
G = Grounded
U = Ungrounded
E = Exposed



Style MTA6 (Custom Engineered/Manufactured)



Design Features

- * 1/2" NPT Stainless Steel Process Connection.
- * Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- * Screw covers are attached to body with a plated chain.
- * Covers have lugs for tightening or loosening with a screwdriver or wrench.
- * Available in single (2-wire) or duplex (4-wire).
- * Tempco's connection heads are available in die cast aluminum, Bakelite and cast iron in a variety of sizes from miniature for confined areas to the large universal head designed for heavy process and industrial applications. See sensor accessories on pages 14-98 through 14-100 for complete information.

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **MTA6** -

Calibration Code BOX 1

ANSI Standard **J K E T N R S B**
 Tolerances
 Special Tolerances **3 4 5 6 7**

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Number of Conductors BOX 2

2 = Single (Standard)
4 = Duplex

Junction BOX 8

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Insulation BOX 3

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

Connection Head BOX 9

A = Standard Size Aluminum **S** = Stainless Steel
B = Medium Size Aluminum **F** = Standard Bakelite
C = Miniature Aluminum **P** = Polypropylene (FDA Approved)
H = Standard Cast Iron

Note: Conduit connection for A, F, H & S is 1/2" (3/4" is available); for B & C is 3/8"; and for P is 3/4" NPT. For overall dimensions see pages 14-98 through 14-100.

Sheath Material BOX 4

A = Alloy 600
B = 304 SS
C = 316 SS

Spring-Loaded Terminal Block BOX 10

O = Not required
Y = Required

Sheath O.D. BOX 5

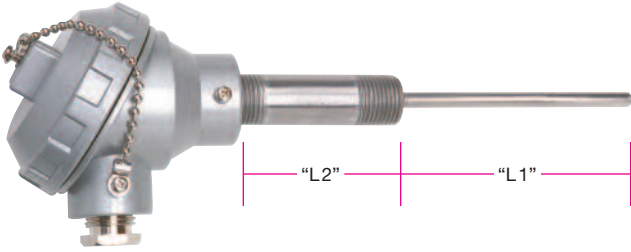
D = .063" ±.001	P = 2.0 mm ±.03
F = .125" ±.002	Q = 3.0 mm ±.03
G = .188" ±.002	R = 4.5 mm ±.05
H = .250" +.003/- .002	S = 6.0 mm +.07/- .05
J = .313" +.003/- .002	
K = .375" +.003/- .002	

Special Requirements BOX 11

X = Specify
0 = None



Style MTA7 Connection Head with 1/2" NPT Pipe Nipple



Design Features

- * Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- * Screw covers are attached to body with a plated chain.
- * Covers have lugs for tightening or loosening with a screwdriver or wrench.
- * Available in single (2-wire) or duplex (4-wire).
- * Tempco's connection heads are available in die cast aluminum, Bakelite and cast iron in a variety of sizes from miniature for confined areas to the large universal head designed for heavy process and industrial applications. See sensor accessories on pages 14-98 through 14-100 for complete information.
- * Pipe nipple is galvanized steel.

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code:

MTA7 -

Calibration Code BOX 1

ANSI Standard Tolerances **J K E T N R S B**
 Special Tolerances **3 4 5 6 7**

Junction BOX 8

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Number of Conductors BOX 2

2 = Single (Standard)
4 = Duplex

Connection Head BOX 9

A = Standard Size Aluminum **S** = Stainless Steel
B = Medium Size Aluminum **F** = Standard Bakelite
C = Miniature Aluminum **P** = Polypropylene (FDA Approved)
H = Standard Cast Iron

Note: Conduit connection for A, F, H & S is 1/2" (3/4" is available); for B & C is 3/8"; and for P is 3/4" NPT.
 For overall dimensions see pages 14-98 through 14-100.

Insulation BOX 3

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

Sheath Material BOX 4

A = Alloy 600
B = 304 SS
C = 316 SS

"L2" 1/2" NPT Nipple Length BOX 10

Whole inches **00** to **99**
 For lengths over 99 in. consult TEMPCO.
 Standard Lengths **S1** = 1", **S2** = 2-1/2", **S3** = 5-1/2"

Sheath O.D. BOX 5

F = .125" ±.002	Q = 3.0 mm ±.03
G = .188" ±.002	R = 4.5 mm ±.05
H = .250" +.003/- .002	S = 6.0 mm +.07/- .05
J = .313" +.003/- .002	
K = .375" +.003/- .002	

Spring-Loaded Terminal Block BOX 11

O = Not required
Y = Required

Sheath Length "L1" BOX 6

Whole inches
01 to **99**
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L1" BOX 7

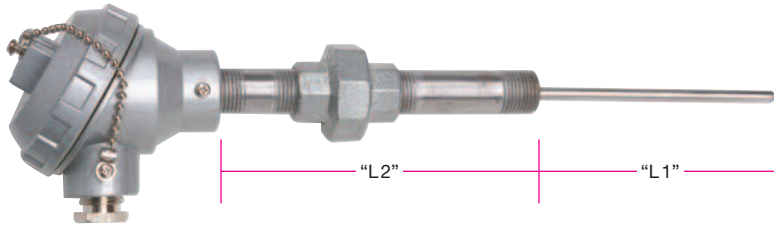
Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Special Requirements BOX 12

X = Specify
0 = None



Style MTA8 Connection Head with 1/2" NPT Nipple, Union, Nipple



Design Features

- * Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- * Screw covers are attached to body with a plated chain.
- * Covers have lugs for tightening or loosening with a screwdriver or wrench.
- * Available in single (2-wire) or duplex (4-wire).
- * Tempco's connection heads are available in die cast aluminum, Bakelite and cast iron in a variety of sizes from miniature for confined areas to the large universal head designed for heavy process and industrial applications. See sensor accessories on pages 14-98 through 14-100 for complete information.
- * Nipple-Union-Nipple is galvanized steel.

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code:

MTA8 -

Calibration Code BOX 1

ANSI Standard Tolerances **J K E T N R S B**
 Special Tolerances **3 4 5 6 7**

Junction BOX 8

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Number of Conductors BOX 2

2 = Single (Standard)
4 = Duplex

Connection Head BOX 9

A = Standard Size Aluminum **S** = Stainless Steel
B = Medium Size Aluminum **F** = Standard Bakelite
C = Miniature Aluminum **P** = Polypropylene (FDA Approved)
H = Standard Cast Iron

Note: Conduit connection for A, F, H & S is 1/2" (3/4" is available); for B & C is 3/8"; and for P is 3/4" NPT. For overall dimensions see pages 14-98 through 14-100.

Insulation BOX 3

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

"L2" Dimension (in.) BOX 10

Nipple, Union, Nipple
 Whole inches **03** to **99**
 Standard Lengths **S1** = 3-1/2", **S2** = 6-1/2", **S3** = 12-1/2"

Sheath Material BOX 4

A = Alloy 600
B = 304 SS
C = 316 SS

Spring-Loaded Terminal Block BOX 11

O = Not required
Y = Required

Sheath O.D. BOX 5

F = .125" ±.002 **Q** = 3.0 mm ±.03
G = .188" ±.002 **R** = 4.5 mm ±.05
H = .250" +.003/- .002 **S** = 6.0 mm +.07/- .05
J = .313" +.003/- .002
K = .375" +.003/- .002

Special Requirements BOX 12

X = Specify
0 = None

Sheath Length "L1" BOX 6

Whole inches
01 to **99**
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L1" BOX 7

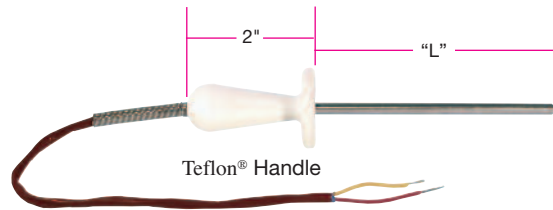
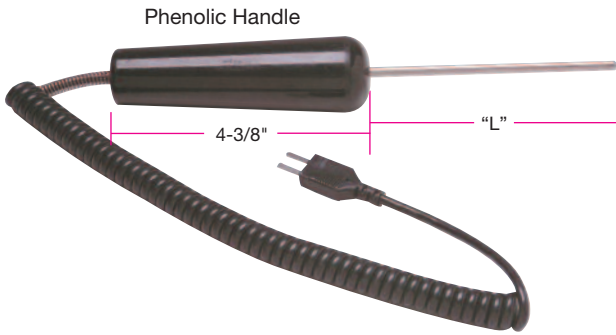
Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Temperature Sensing



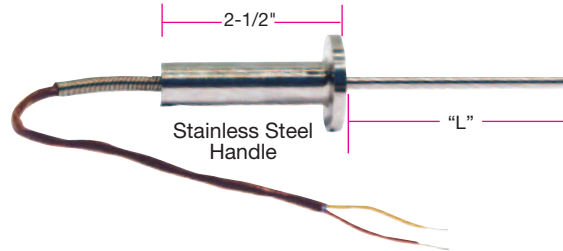
MI Cable Thermocouple Assemblies

Style MTA9 Handheld Probe



Design Features

- * Coil cord lengths are available only in 1 ft. (5 ft. extended) and 2 ft. (10 ft. extended).
- * Coil cord construction is good to 221°F (105°C).
- * Fiberglass lead construction is good to 900°F (482°C).
- * Teflon® insulated lead construction is good to 392°F (200°C).



Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code:

MTA9 -

Calibration Code BOX 1

ANSI Standard Tolerances **J K E T N**
 Special Tolerances **3 4 5 6 7**

Number of Conductors BOX 2

2 = Single
4 = Duplex

Insulation BOX 3

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

Sheath Material BOX 4

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. BOX 5

F = .125" ±.002
G = .188" ±.002
H = .250" +.003/- .002

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Junction BOX 8

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Tip BOX 9

R = Round Tip
D = Drill Point
F = Flat Tip
O = Exposed Junction

Lead Wire Length BOX 10

In inches **012 to 999**
 For Coil Cords Enter **060** or **120**

Lead Wire Construction BOX 11

	Coil Cord	Fiberglass	Teflon®	Overbraided	Flex Armor
	C	S	T	B	A
				D	F

Note: Coil cord insulation is PVC/Polyurethane with a temperature rating of 221°F (105°C).

Lead Wire Termination BOX 12

P = Standard Male Plug
J = Standard Female Jack
K = Std. Plug with Mating Jack
D = Mini Male Plug
E = Mini Female Jack
F = Mini Plug with Mating Jack
B = Std.— 2-1/2" Split Leads
S = Leads with Spade Lugs
C = 2-1/2" Split with BX connector and Spade Lugs

Handle Type BOX 13

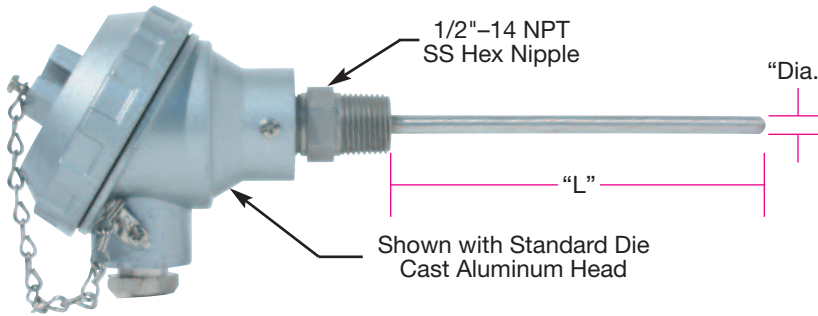
1 = Stainless Steel
2 = Teflon® 500°F (260°C)
3 = Phenolic 383°F (195°C)

Special Requirements BOX 14

X = Specify
0 = None

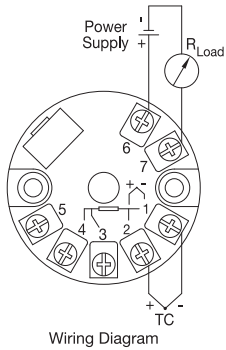


Thermocouples with Transmitter and Connection Head



Design Features

- * 4-20mA Programmable Linear Output Transmitter
- * Available with Spring-Loaded Sheath
- * For field programming of the temperature transmitter see Part Number ETM90006 on page 12-45
- * Transmitter Accuracy of +/-0.2% of temperature span
- * 1/2" NPT Process Connection



Transmitter Ambient Temperature Range:
-40° to +185°F (-40° to +85°C)
Refer to page 12-44 for complete details.



EMT10001



EMT20001

See Connection Head Box 9 below.

Refer to page 12-50 for complete Indicator specifications.

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code:

TTM -

Calibration Code BOX 1

ANSI Standard Tolerances **J K E T**
Special Tolerances **3 4 5 6**

Junction Type BOX 7

Grounded **G** Ungrounded **U** Exposed **E**

Insulation BOX 2

M = 96% min. MgO (Standard)
H = 99.4% min. MgO

Transmitter Type BOX 8 (Enter Code Below)

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
		Temperature low range		Temperature high range		Unit °F °C	
		1 = Non-isolated (Standard)		2 = Isolated			

Sheath Material BOX 3

A = Alloy 600 **C** = 316 SS
B = 304 SS

Sheath O.D. BOX 4

F = .125" **H** = .250"
G = .188"

Sheath Length "L" BOX 5

Whole inches
01 to 99
For lengths over 99 in. consult TEMPCO.

Connection Head BOX 9

A = Standard Aluminum **S** = Stainless Steel
B = Medium Size Aluminum **L** = Aluminum Head with LCD Indicator (EMT10001)
H = Standard Cast Iron
P = Polypropylene Head **M** = Heavy Duty Aluminum Head with LCD Indicator (EMT20001) (FDA Approved)

Note: Conduit connection for A, H & S is 1/2", for B is 3/8" NPT, for P is 3/4" NPT. For overall dimensions see pages 14-98 through 14-100.

Sheath Length "L" BOX 6

Fractional inches
0 = 0" **2** = 1/4" **4** = 1/2" **6** = 3/4"
1 = 1/8" **3** = 3/8" **5** = 5/8" **7** = 7/8"

Spring-Loaded BOX 10

Y = Spring-Loaded
0 = Not Required

Special Requirements BOX 11

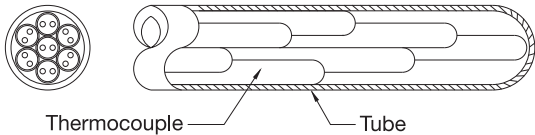
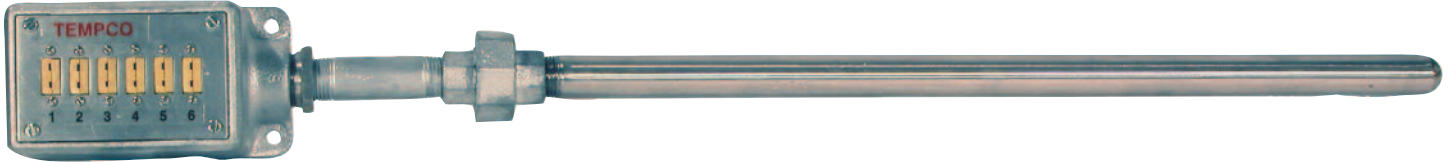
X = Specify
0 = None



Series TCM Multipoint Thermocouple Assemblies

Multipoint Thermocouples are used in a broad range of processes and installations to monitor the temperature in multiple positions or elevations. These sensors are used in a variety of applications such as Petroleum, Chemical Processing, Furnaces, Storage Tanks and Air Flow Ducts.

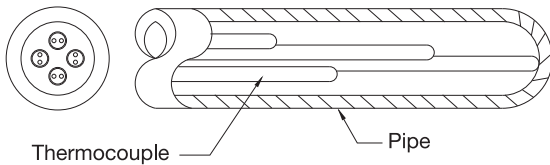
These sensors are made-to-order to meet the requirements of the specific application. The styles depicted below are the most common constructions. Consult Tempco for other sizes and construction methods. To order, simply fill out the specification sheet on page 14-31.



Style 1 – Standard Miniature Style Assembly

This Multipoint Assembly uses numerous individual mineral insulated thermocouple elements contained in a tube. Individual thermocouples are made with the largest possible Mineral Insulated Cable in order to maximize contact with Protection Tube.

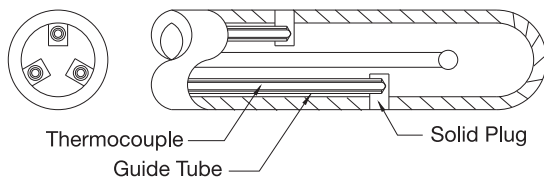
Tube OD	Maximum Number of Points
.125"	13
.188"	20
.250"	20
.312"	20
.375"	20
.500"	20



Style 2 – Free-Hanging Assembly In A Pipe

This Heavy Duty Multipoint Assembly uses several individual Mineral Insulated Thermocouple Elements contained in a Standard Protection Pipe. Thermocouple bundles are replaceable.

Pipe Size	Maximum Number of Points
1/2" NPT SCH. 40	12
3/4" NPT SCH. 40	20
1" NPT SCH. 40	20



Style 3 – Protection Pipe With Guide Tubes

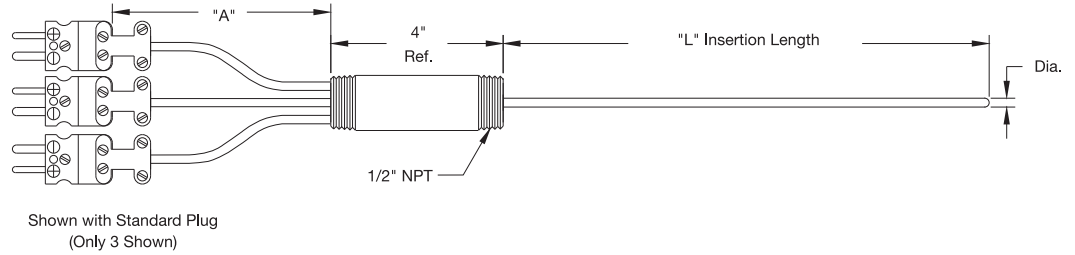
This Multipoint Assembly is mostly used in the Petrochemical Industry. Guide Tubes are positioned at specific locations and enable the replacement of individual sensors in the field. This Multipoint Style is ideal in high temperature and pressure applications and provides a quick thermal response.

Pipe Size	Maximum Number of Points
1/2" NPT SCH. 40	10
3/4" NPT SCH. 40	20
1" NPT SCH. 40	20

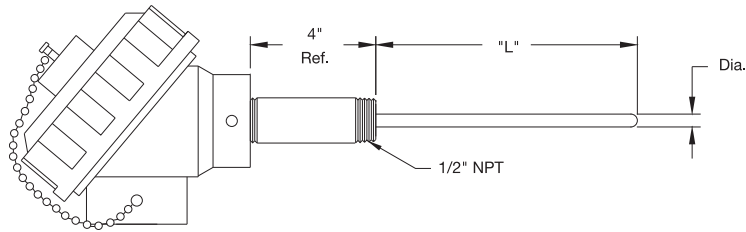


Multipoint Assemblies with Protection Tube

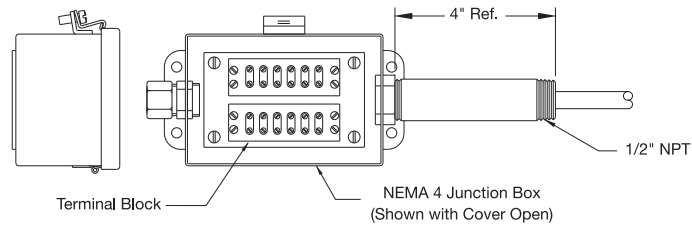
Style 1 Shown with Lead Wire Extension



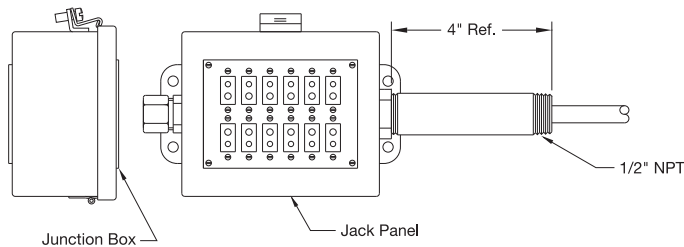
Style 1 Shown with Standard Die Cast T/C Head
(3 Points Maximum)



Style 1 Shown with Nema 4 Junction Box



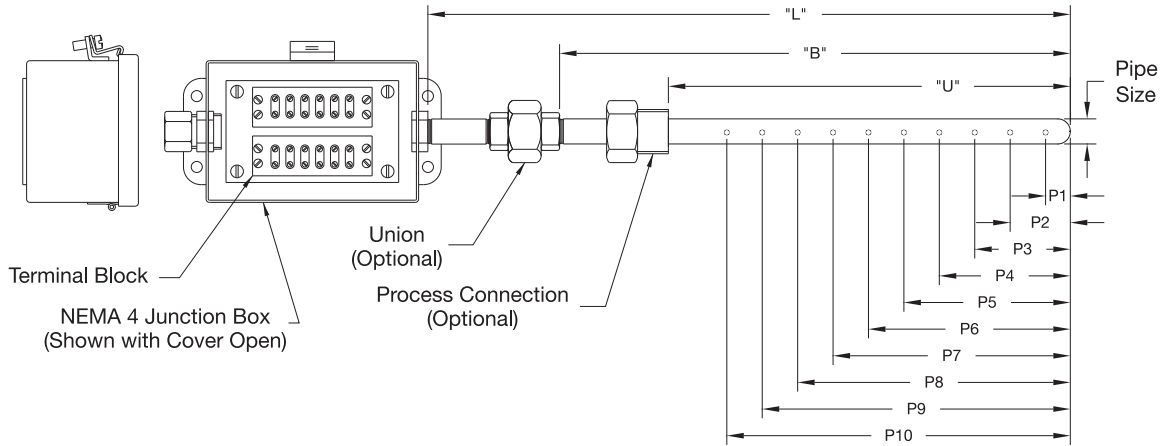
Style 1 Shown with Jack Panel Junction Box



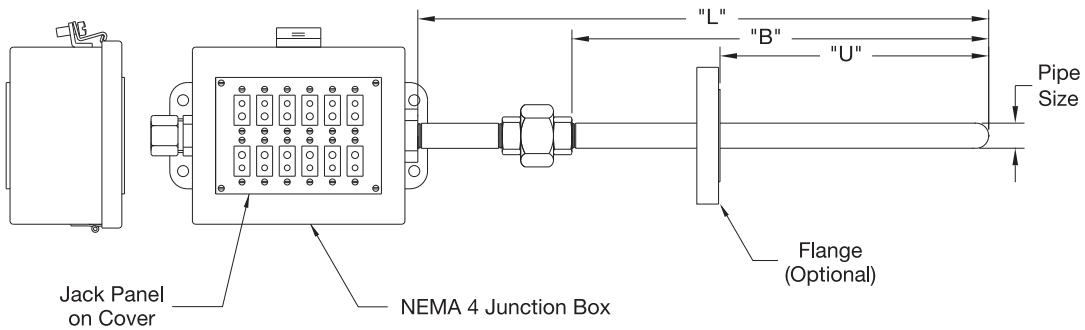
CONTINUED

Heavy Duty Multipoint Assemblies with Pipe as Protection Tube

Style 2 Shown with Union, Threaded Process Connection and Nema 4 Junction Box



Style 2 Shown with Union, Flange and Jack Panel Junction Box





Ordering Information for Multipoint Assemblies

Please supply the following information by filling in the boxes as required.

Calibration = _____
J, K, E, T, N
 Other (Specify)

Junction = _____
 Grounded Or Ungrounded

Protection Tube Dia.= _____
 Tube Sizes: .125", .188", .25", .312", .375", .500"
 PIPE Sizes (SCH. 40): 1/2" NPT, 3/4" NPT, 1" NPT
 Other (specify)
 Are Guide Tubes Required? _____ (Style 3) See Page 14-28

Protection Tube Length = _____
 "L" Dimension (in inches)

Protection Tube Material = _____
 Tube Materials: 304SS, 316SS, Inconel 600
 Pipe Materials: 304/304L SS, 316/316L SS, 446SS, Inconel 600
 Other (specify)

Point Locations (in inches) See Page 14-30
 List As Many As Needed
 P1=____ P11=____
 P2=____ P12=____
 P3=____ P13=____
 P4=____ P14=____
 P5=____ P15=____
 P6=____ P16=____
 P7=____ P17=____
 P8=____ P18=____
 P9=____ P19=____
 P10=____ P20=____

Union (option)
 If Required, Specify "B" Dim. = _____
 "B" Dim. is the length below the union
 (Enter 0 if not required)
 Material: _____
 Rating: _____
 (150 lbs. Galvanized Steel is standard)

Flange or Threaded Process Connection (option)
 If Required, Specify "U" Dim. = _____
 "U" Dim. is the length below flange or thread
 Flange or Process Thread: _____
 (Enter 0 if not required)
 Size: _____
 Material: _____
 Rating: _____
 Face Type (Flange): _____

Termination = _____
 NEMA 4 Junction Box With Terminal Block
 Jack Panel Junction Box
 Std. Aluminum T/C Head (3 Points Max.)
 Other (specify)

Lead Wire Extension (if Required)
 Length ("A" Dim.) = _____ (in Inches)
 (Enter 0 If Not Required)
 Insulation = _____
 Fiberglass
 Fiberglass w/ SS Overbraid
 Teflon® (400°F Max.)
 Termination = _____
 Standard Plug or Jack
 Mini Plug or Jack
 Spade Lugs or with BX Connector
 2-1/2" Stripped Ends
 Other (specify)

Describe any Pertinent Information or Special Requirements:



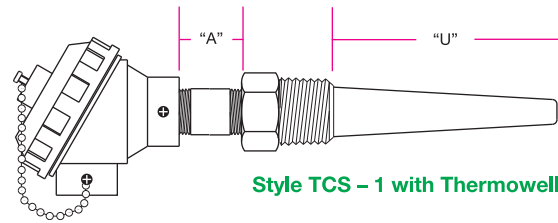
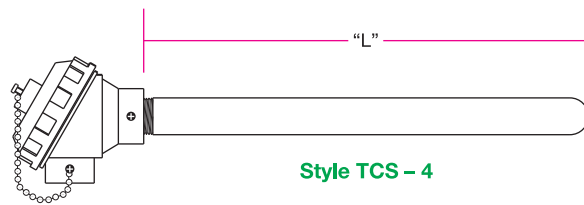
Industrial Process Thermocouples



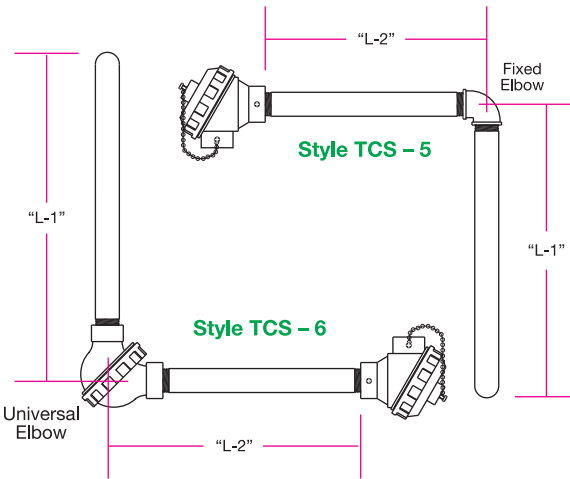
Tempco manufactures many styles of industrial thermocouple assemblies for a wide range of industries, from petrochemical to textile applications, where one or more protection tubes may be necessary to protect the thermocouple.

Metal Protecting Tube Assemblies

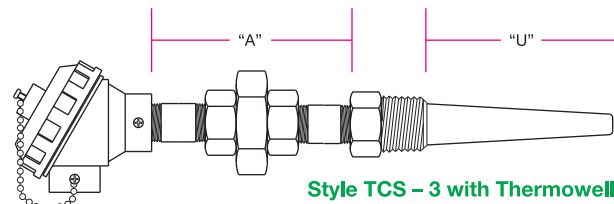
Thermowell Assemblies



Thermocouple Head, Nipple, Thermowell

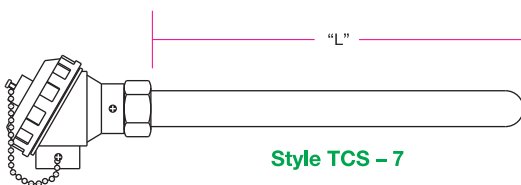


Thermocouple Head, Metal Protecting Tube

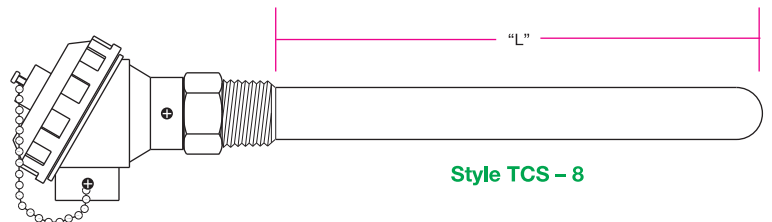


Thermocouple Head, Nipple, Union, Nipple, Thermowell

Ceramic Tube Assemblies



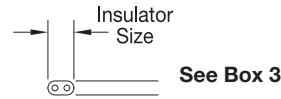
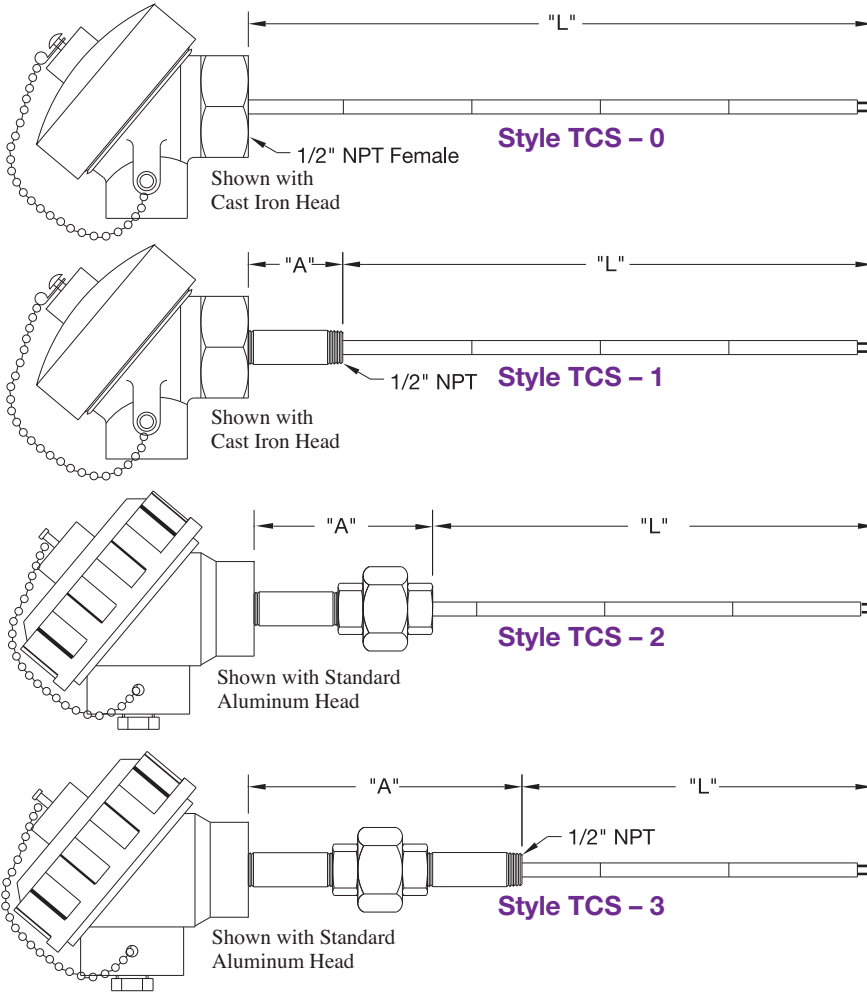
Thermocouple Head, Fixed Bushing, Ceramic Tube



Thermocouple Head, Ceramic Tube



Thermocouples for Thermowells and Protection Tubes



Design Features

- * Ceramic Insulator to Insulate Wires
- * Galvanized 1/2" Pipe Nipple & Union
- * Cast Iron or Aluminum Head
- * Used with protection tubes and thermowells shown on pages 14-76 through 14-86

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **TCS** -

Style BOX 1
0 = Plain
1 = with Nipple
2 = with Nipple and Union
3 = with Nipple, Union and Nipple

Calibration Code BOX 2
J = Type J
K = Type K
X = Other (Specify)

Wire Gauge and Insulator Size BOX 3
B = 20 ga. (.172" x .118" insulator)
C = 14 ga. (.375" x .217" insulator)
D = 8 ga. (.437" x .250" insulator)
X = Other (Specify)

"L" Dimension BOX 4
 Whole inches
00 to 99

"A" Dimension (TCS -1, TCS -2 & TCS -3 only) BOX 5
01 to 99 inches or use Codes below for standard length
Enter 00 for TCS - 0 Style

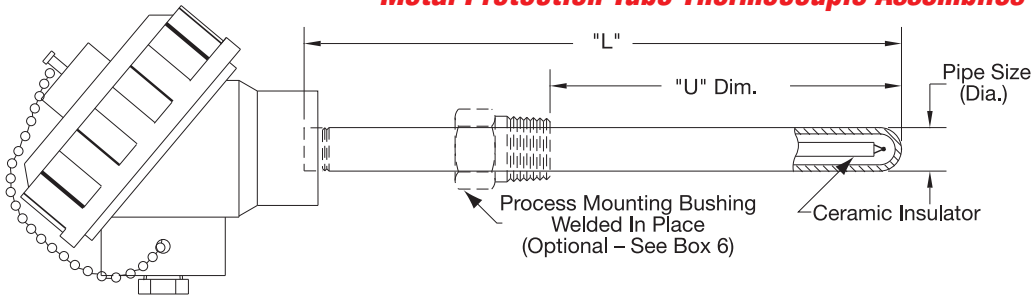
TCS1	TCS2	TCS3
S1 = 1"	S1 = 2-1/2"	S1 = 3-1/2"
S2 = 2-1/2"	S2 = 4"	S2 = 6-1/2"
S3 = 5-1/2"	S3 = 7"	S3 = 12-1/2"

Connection Head BOX 6
A = Standard Size Aluminum
H = Standard Cast Iron
S = Stainless Steel
Note: All have 1/2" conduit connection (3/4" available).
 For overall dimensions see pages 14-98 through 14-100.

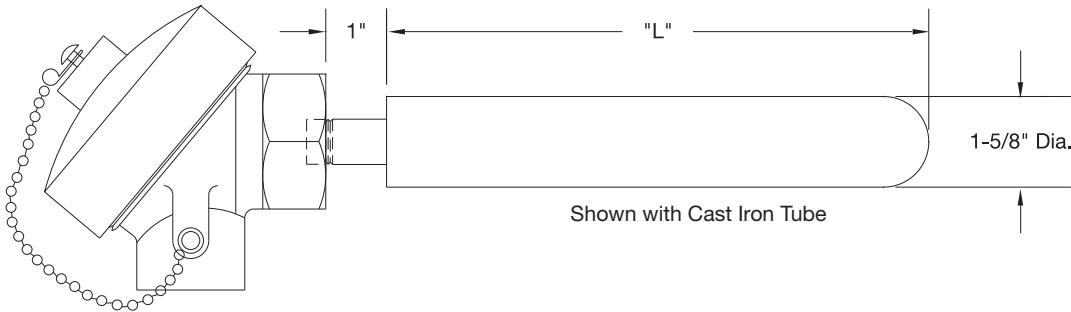
Special Requirements BOX 7
X = Specify
0 = None



Metal Protection Tube Thermocouple Assemblies



Shown with Standard Die Cast Aluminum Head



Shown with Cast Iron Head

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: TCS4 -

Pipe Size Sch. 40 BOX 1
H = 1/2" Pipe (.84" OD x .62" ID)
M = 3/4" Pipe (1.05" OD x .82" ID)
N = 1" Pipe (1.31" OD x 1.05" ID)
R = 1-5/8" OD x 7/8" ID (Cast Iron Only)
X = Other (Specify)

"L" Dimension BOX 5
Whole inches 12 to 96
 (in 6-inch increments)
 Cast Iron is available in limited lengths.

Sheath Material BOX 2
1 = Carbon Steel (Black Pipe)
2 = 304 SS
3 = 316 SS
4 = 446 SS
5 = Cast Iron (1-5/8" OD x 7/8" ID Only)
6 = Alloy 601
X = Other (Specify)

Process Mounting Bushing BOX 6
0 = No Bushing Required
 Enter 0 for Cast Iron Tube
M = 3/4" NPT (For 1/2" pipe only)
N = 1" NPT (For 1/2 and 3/4" pipe only)
P = 1-1/4" NPT
X = Other (Specify)

Calibration Code BOX 3
J = Type J
K = Type K
X = Other (Specify)

"U" Dimension BOX 7
Whole inches 01 to 99
 Enter 00 for cast iron tube or if no bushing required

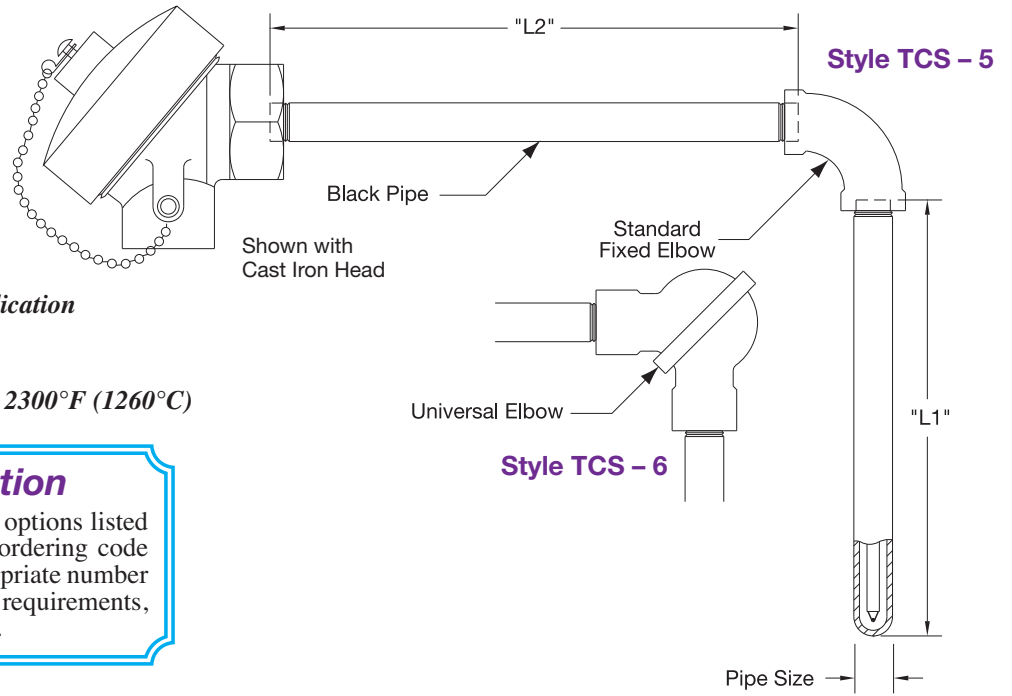
Wire Gauge BOX 4
B = 20 ga.
C = 14 ga.
D = 8 ga.
X = Other (Specify)

Connection Head BOX 8
A = Standard Size Aluminum
H = Standard Cast Iron
S = Stainless Steel
Note: All have 1/2" conduit connection (3/4" available).
 For overall dimensions see pages 14-98 through 14-100.

Special Requirements BOX 9
X = Specify
0 = None



Metal and Silicon Carbide Protection Tube Thermocouple Assemblies



Design Features

- * Right Angle for Over-the-Side Application
- * Cast Iron or Aluminum Head
- * Available with Metal Pipe or Silicon Carbide (Carbon Bonded) 2300°F (1260°C)

Ordering Information

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **TCS** -

Elbow Type BOX 1

- 5 = Standard Fixed Elbow
- 6 = Universal Elbow

Wire Gauge BOX 5

- B = 20 ga.
- C = 14 ga.
- D = 8 ga.

Pipe and Tube Size BOX 2

- H = 1/2" Pipe (.84" OD x .62" ID)
- M = 3/4" Pipe (1.05" OD x .82" ID)
- N = 1" Pipe (1.31" OD x 1.05" ID)
- R = 1-5/8" OD x 7/8" ID (Cast Iron Only)
- S = 2-1/16" OD (Silicon Carbide Only)
- X = Other (Specify)

"L1" Dimension BOX 6

Whole inches **12 to 96**
(in 6-inch increments)
Silicone Carbide and Cast Iron are available in limited lengths.

Sheath Material BOX 3

- 1 = Carbon Steel (Black Pipe)
- 2 = 304 SS
- 3 = 316 SS
- 4 = 446 SS
- 5 = Cast Iron (1-5/8" OD x 7/8" ID Only)
- 6 = Alloy 601
- 7 = Silicone Carbide (2-1/16" OD Only)
- X = Other (Specify)

"L2" Dimension BOX 7

Whole inches **12 to 96** (in 6-inch increments)

Connection Head BOX 8

- A = Standard Size Aluminum
- H = Standard Cast Iron
- S = Stainless Steel

Note: All have 1/2" conduit connection (3/4" available).
For overall dimensions see pages 14-98 through 14-100.

Calibration Code BOX 4

- J = Type J
- K = Type K
- X = Other (Specify)

Special Requirements BOX 9

- X = Specify
- 0 = None



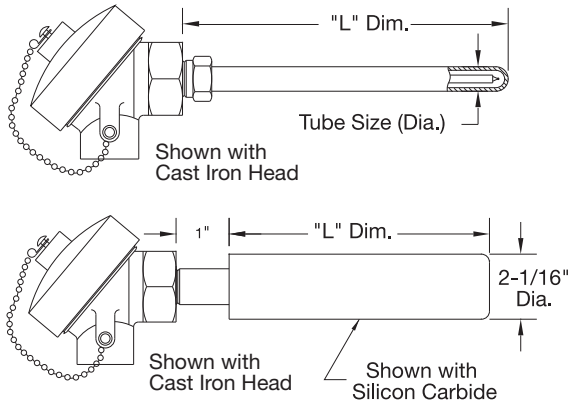
Ceramic and Silicon Carbide Protection Tube Thermocouple Assemblies

Design Features

- * Ceramic Insulator to Insulate Wires
- * Choice of Alumina 3450°F (1900°C), Mullite 3100°F (1700°C), Hexoloy SA (sintered silicon carbide) 3000°F (1650°C) or Silicon Carbide (carbon bonded) 2300°F (1260°C)
- * With or Without Threaded Process Mounting Bushing
- * Available with Double Protection Tube

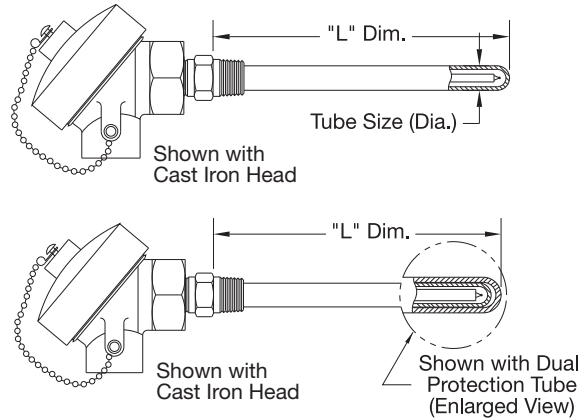
Style TCS - 7

Without Threaded Process Connection



Style TCS - 8

With Threaded Process Connection



Ordering Code: TCS -

Style BOX 1

- 7 = Plain
- 8 = w/Pipe Thread Process Connection

Sheath Material BOX 2

- A = Alumina
- H = Hexoloy SA (sintered silicone carbide)
- M = Mullite
- S = Silicon Carbide (carbon bonded)
- X = Other (Specify)

Tube & Fitting Size BOX 3

(Style TCS - 7 has no process pipe thread)

- 1 = 3/8" OD (1/4" ID) — 1/2" NPT Thread for Style TCS-8 (available in Alumina, Mullite or Hexoloy SA only)
- 2 = 5/8" OD (3/8" ID) — 1/2" NPT Thread for Style TCS-8 (available in Hexoloy SA only)
- 3 = 11/16" OD (7/16" ID) — 3/4" NPT Thread for Style TCS-8 (available in Alumina or Mullite only)
- 4 = 3/4" OD (1/2" ID) — 3/4" NPT Thread for Style TCS-8 (available in Hexoloy SA only)
- 5 = 2-1/16" OD (Style TCS-7) (available in carbon bonded silicone carbide only)
- X = Other (Specify)

Calibration Code BOX 4

- J = Type J R = Type R
- K = Type K B = Type B
- S = Type S

Wire Gauge BOX 5

- A = 24 ga. (Type S, R and B) D = 8 ga.
- B = 20 ga. X = Other (Specify)
- C = 14 ga.

"L" Dimension BOX 6

Whole inches 12 to 48
in 6-inch increments
For lengths over 48 in. consult TEMPACO.

Threaded Bushing Material

- BOX 7
- S = Stainless Steel
 - B = Brass
 - Enter 0 for TCS-7

Protection Tube BOX 8

- 1 = Single Protection Tube (Std.)
- 2 = Double Protection Tube

Connection Head BOX 9

- A = Standard Size Aluminum
- H = Standard Cast Iron
- S = Stainless Steel
- Note: All have 1/2" conduit connection (3/4" available).
- For overall dimensions see pages 14-98 through 14-100.

Special Requirements BOX 10

- 0 = None
- X = Specify

Ordering Information

Thermocouples are offered with the options listed in the worksheet. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.



Base Metal — Bare and Fiberglass or Ceramic Insulated Thermocouple Wire

Tempco offers general purpose thermocouple elements in ANSI Type J and K. The general purpose elements are available with

a twisted and welded or butt-welded junction. Available in 8 ga., 14 ga. and 20 ga. with standard calibration tolerances.

Style B — Bare Thermocouple Wire



Twisted and Welded Junction



Butt-Welded Junction

Style F — Thermocouple Wire with Fiberglass Sleaving



Twisted and Welded Junction



Butt-Welded Junction

Style O — Thermocouple Wire with 2-Hole Oval Insulator



Twisted and Welded Junction



Butt-Welded Junction

• 8 ga. insulator P/N COR-120-105

• 14 ga. insulator P/N COR-120-104

• 20 ga. insulator P/N COR-120-106

* See Page 14-96 for Insulator Dimensions. *

Style R — Thermocouple Wire with 2-Hole Round Insulator



Twisted and Welded Junction



Butt-Welded Junction

• 8 ga. insulator P/N COR-127-102

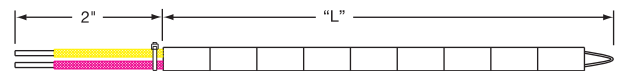
• 14 ga. insulator P/N COR-126-102

• 20 ga. insulator P/N COR-125-102

* See Page 14-96 for Insulator Dimensions. *

Ordering Information

Base Metal Thermocouple Element Styles B, F, O and R are offered with the options listed below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.



Ordering Code: **TCB** -

Design Style B, F, O or R

Calibration ANSI Type K or J

Wire Gauge Size 8 ga. (08), 14 or 20

Junction **W** = Twisted and Welded
B = Butt-Welded

Length "L" in whole inches — 06-99

(800) 323-6859 • Email: sales@tempco.com



Industrial Thermocouples

Base Metal Thermocouples

Style D – Dual Element *(Available in 14 ga. and 20 ga. only)*

Dual set of thermocouple wires with 4-hole round alumina insulators



• 14 ga. insulator P/N COR-128-102

• 20 ga. insulator P/N COR-128-101

** See Page 14-96 for Insulator Dimensions. **

Ordering Information

Base Metal Thermocouple Element Style D is offered with the options listed below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **TCB** - **D**

Design Style

Calibration ANSI Type K or J

Wire Gauge Size 14 or 20

Butt-Welded Junction

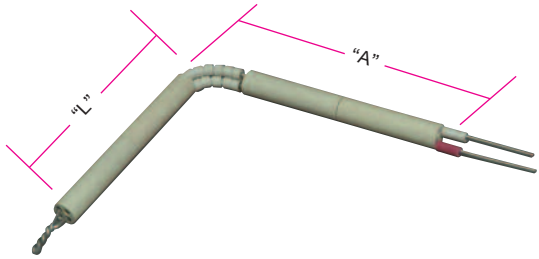
1 = Common

2 = 2 separate junctions

Length "L" in whole inches — 06-99"

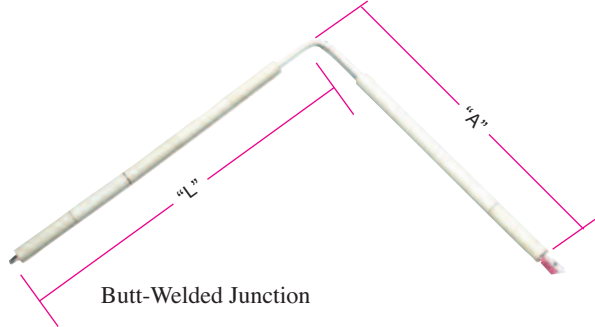
Style A – Angle Element

Angle thermocouple wires with 2-hole round ceramic insulators.



Twisted and Welded Junction

• 8 ga. insulator P/N COR-120-105



Butt-Welded Junction

• 14 ga. insulator P/N COR-120-104

• 20 ga. insulator P/N COR-120-106

** See Page 14-96 for Insulator Dimensions. **

Ordering Information

Base Metal Thermocouple Element Style A is offered with the options listed below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **TCB** - **A**

Design Style

Calibration ANSI Type K or J

Wire Gauge Size 8 ga. (08), 14 or 20

Length "L" in whole inches — 3" min.

Junction **W** = Twisted and Welded
Junction **B** = Butt-Welded

Length "A" in whole inches — 3" min.



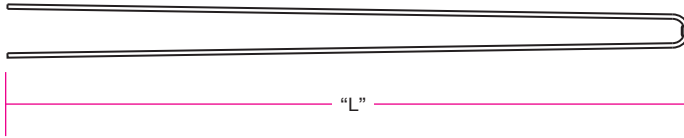
Noble Metal Thermocouples

Design Features

* Noble Metal Thermocouple Elements ANSI Type R and S are provided in accordance with ITS90, and ANSI Type B is provided in accordance with IPTS-68.

* Alumina insulators are recommended with noble metal thermocouples. All noble metal elements have a butt-welded junction & are available in 20 ga. (.032"), 24 ga. (.020") and 30 ga. (.010").

Style NB – Noble Bare Thermocouple Wire



Ordering Information

Noble Metal Thermocouple Element Style NB is offered with the options listed below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: -

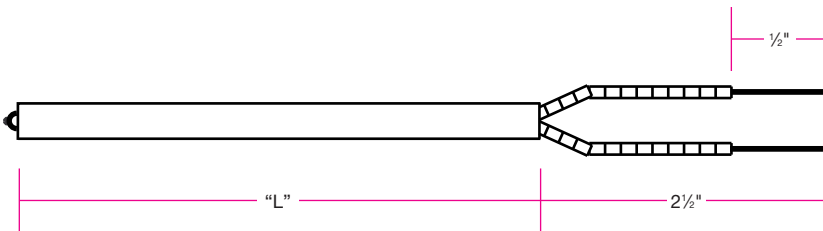
Design Style

Calibration ANSI Type R, S or B

Length "L" in whole inches — 6" min.

Wire Gauge Size 20, 24 or 30 gauge

Style NZ – Noble Thermocouple Wire with 2-Hole Round Alumina Insulator



Ordering Information

Noble Metal Thermocouple Element with 2-hole Alumina insulator Style NZ is offered with the options listed below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: -

Design Style

Calibration ANSI Type R, S or B

Length "L" in whole inches — 6" min.

Wire Gauge Size 20, 24 or 30 gauge

- 30 ga. Insulator P/N COR-124-105 and P/N CER-103-101 Ceramic Beads
- 24 ga. Insulator P/N COR-124-104 and P/N CER-103-101 Ceramic Beads
- 20 ga. Insulator P/N COR-124-106 and P/N CER-103-101 Ceramic Beads

* See Page 14-96 for Insulator Dimensions *

For Metal and Ceramic Protection Tubes
see pages 14-85 and 14-86.

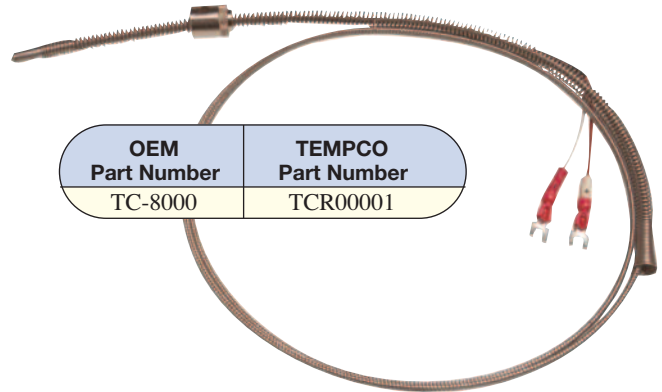
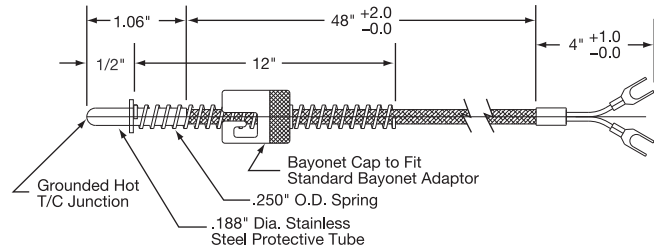


Industrial Thermocouples

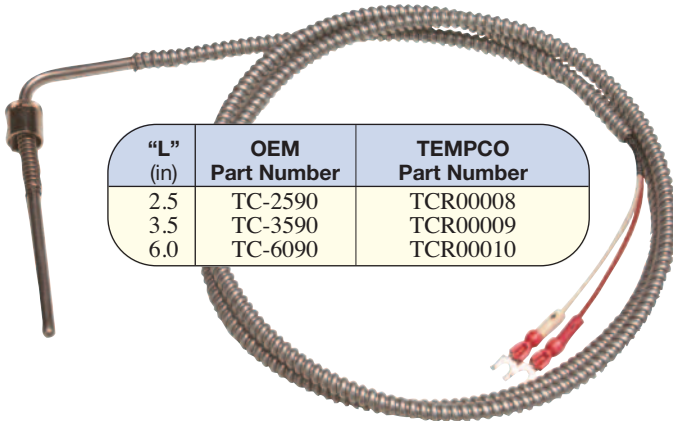
OEM Replacement Thermocouples

Direct Replacement Thermocouples

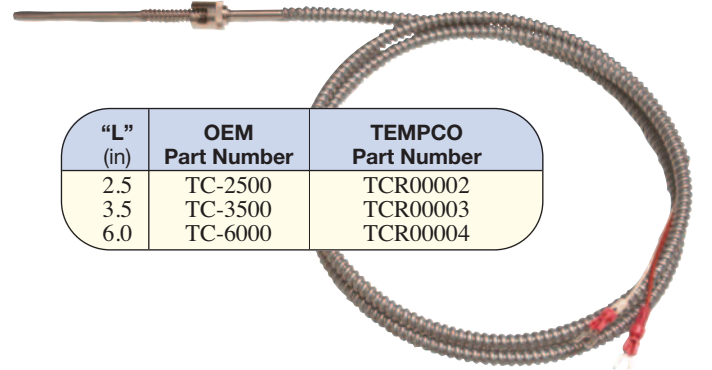
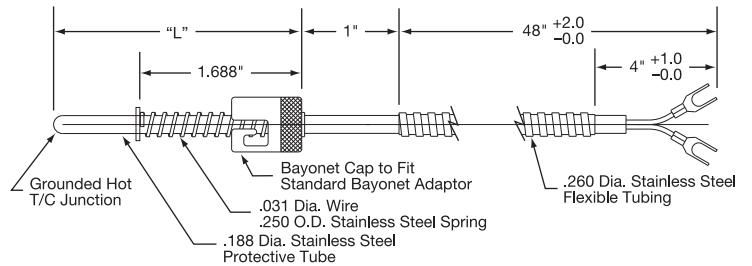
- * All the following thermocouples are manufactured with the highest quality materials and workmanship.
- * The thermocouple wire is stranded (for flexibility) ANSI Type J thermocouple grade, with ANSI color-coded fiberglass insulation (White=Positive, Red=Negative).
- * All hot junctions are grounded. Spade lugs where required are insulated and accept a No. 6 stud.



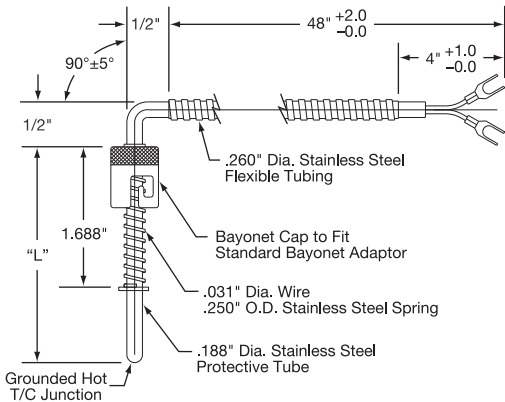
OEM Part Number	TEMPCO Part Number
TC-8000	TCR00001



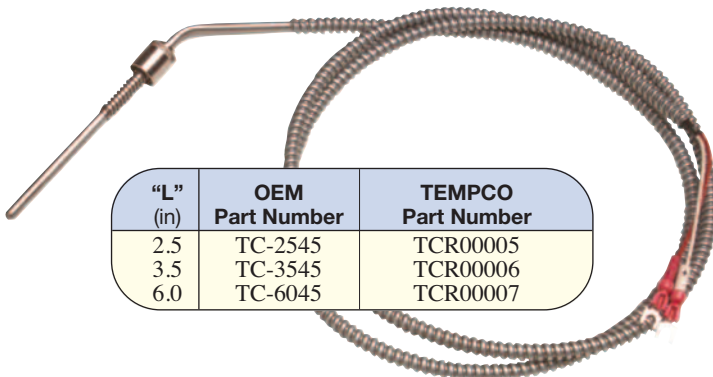
"L" (in)	OEM Part Number	TEMPCO Part Number
2.5	TC-2590	TCR00008
3.5	TC-3590	TCR00009
6.0	TC-6090	TCR00010



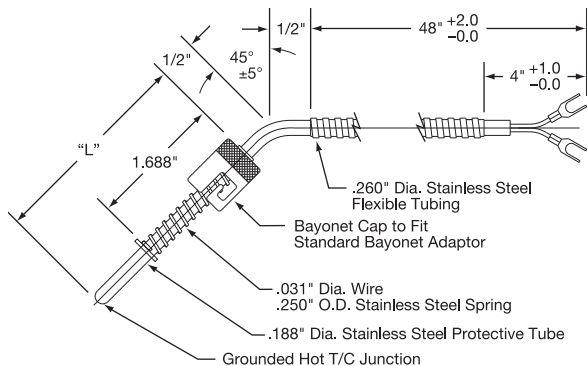
"L" (in)	OEM Part Number	TEMPCO Part Number
2.5	TC-2500	TCR00002
3.5	TC-3500	TCR00003
6.0	TC-6000	TCR00004



All Items Available from Stock



"L" (in)	OEM Part Number	TEMPCO Part Number
2.5	TC-2545	TCR00005
3.5	TC-3545	TCR00006
6.0	TC-6045	TCR00007

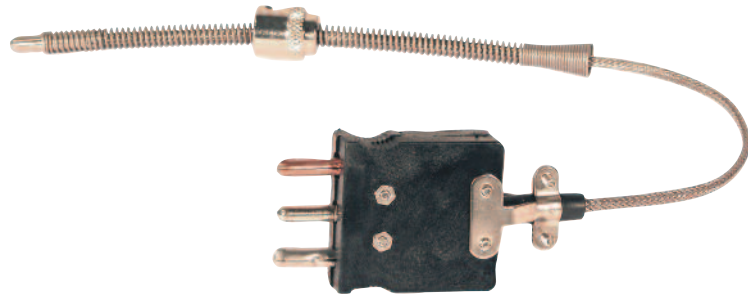




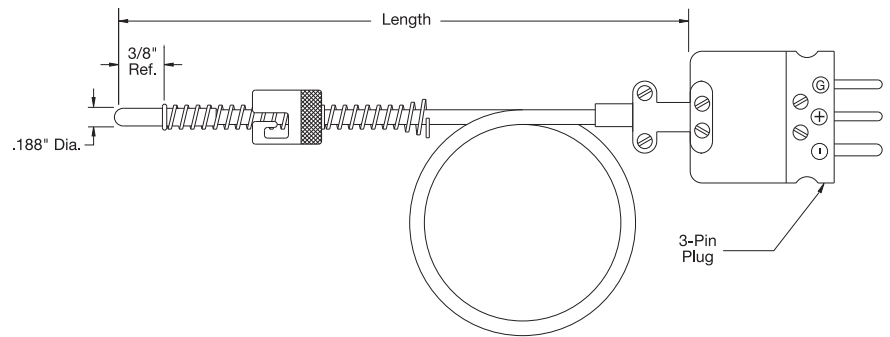
OEM Replacement Thermocouples

Spring Adjustable Thermocouples with 3-pin Male Plug

- * *Ungrounded Type J Thermocouple*
- * *12" Long Compression Spring*
- * *Grounded Stainless Steel Braided Shield*
- * *900°F (482°C) Max. Operation*
- * *Used with the Bayonet Adapters on page 14-87*



Part Number	Length (inches)
TCP18001	24
TCP18002	36
TCP18003	48
TCP18004	60
TCP18005	72
TCP18006	84
TCP18007	96
TCP18008	108
TCP18009	120
TCP18010	132
TCP18011	144

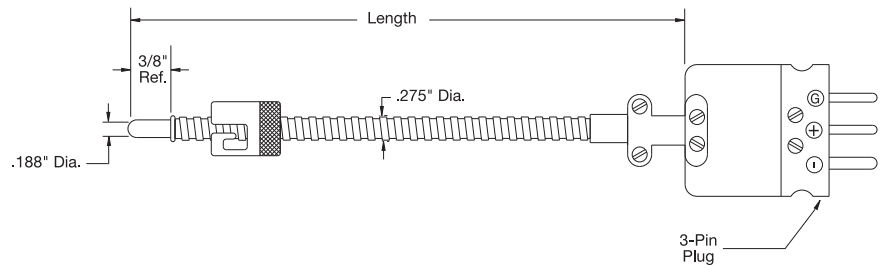


Armor Cable Adjustable Thermocouples with 3-pin Male Plug

- * *Ungrounded Type J Thermocouple*
- * *Grounded Stainless Steel Armor Cable*
- * *900°F (482°C) Max. Operation*
- * *Used with the Bayonet Adapters on page 14-87*



Part Number	Length (inches)
TCP28001	12
TCP28002	24
TCP28003	36
TCP28004	48
TCP28005	60
TCP28006	72
TCP28007	84
TCP28008	96
TCP28009	108
TCP28010	120
TCP28011	132
TCP28012	144





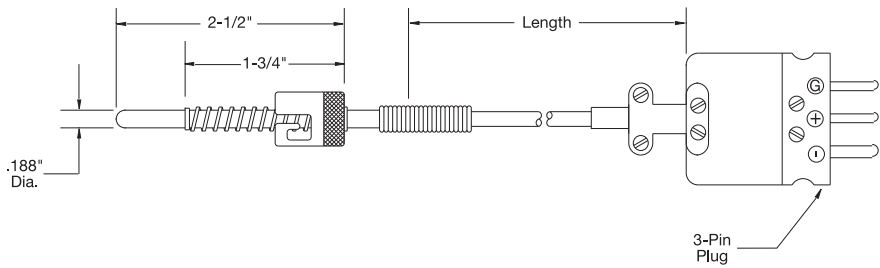
OEM Replacement Thermocouples (Type J)

Spring-Loaded Bayonet Style Thermocouples with 3-pin Male Plug

- * Ungrounded Type J Thermocouple
- * Grounded Stainless Steel Braided Shield
- * 900°F (482°C) Max. Operation
- * Used with the Bayonet Adapters on page 14-87



Part Number	Length (inches)
TCP38101	12
TCP38102	24
TCP38103	36
TCP38104	48
TCP38105	60
TCP38106	72
TCP38107	84
TCP38108	96
TCP38109	108
TCP38110	120

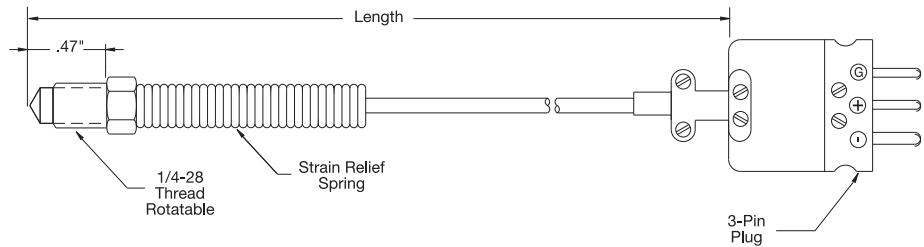


Nozzle Style Thermocouples with 3-pin Male Plug

- * Ungrounded Type J Thermocouple
- * Rotatable 1/4-28 UNF Threaded Tip with Strain Relief Spring
- * Grounded Stainless Steel Braided Shield
- * 900°F (482°C) Max. Operation

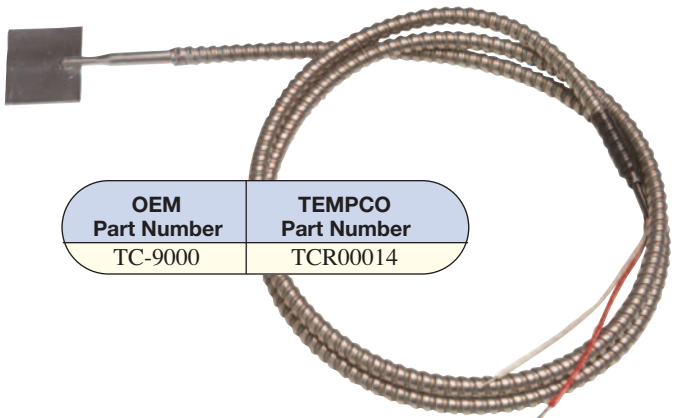
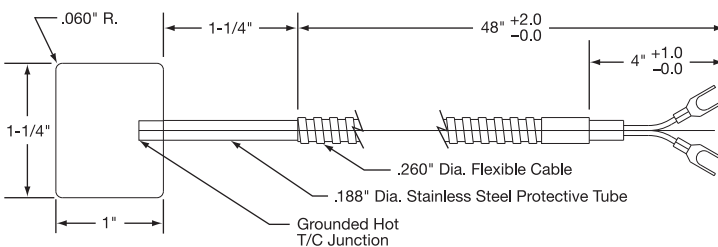
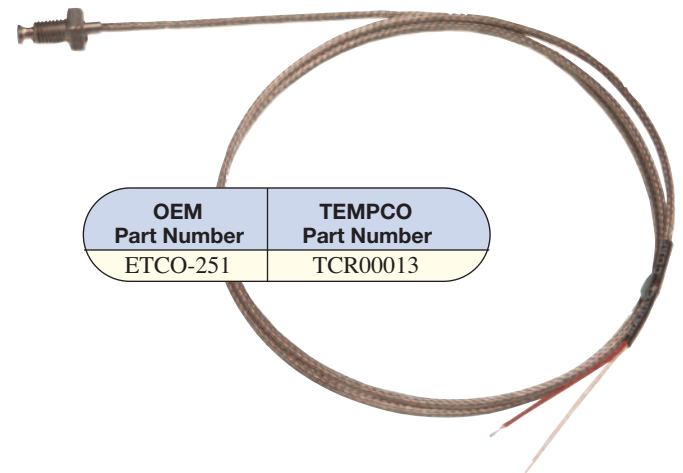
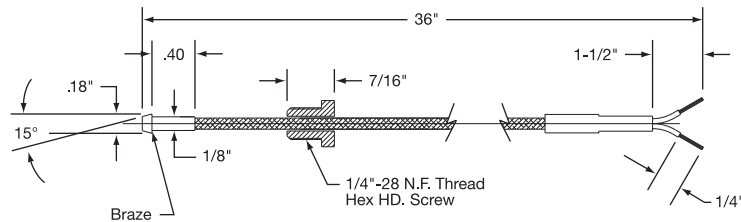
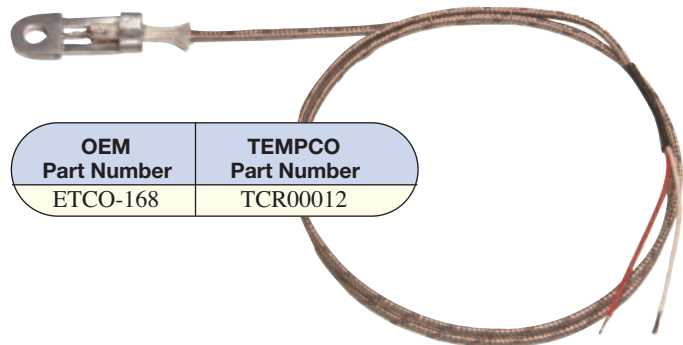
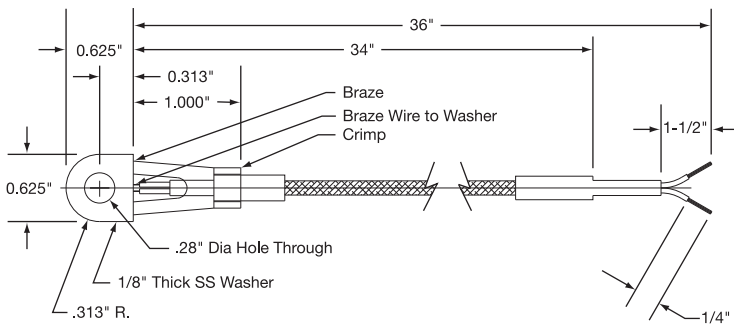
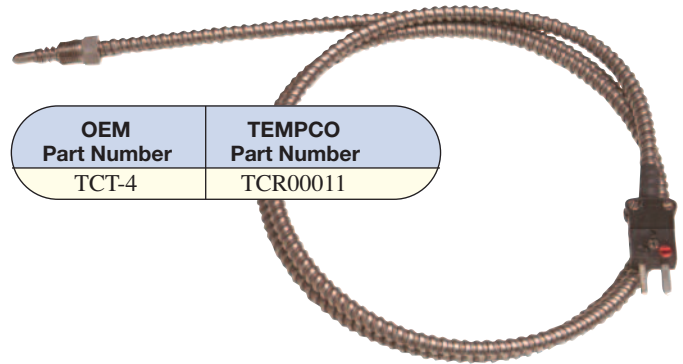
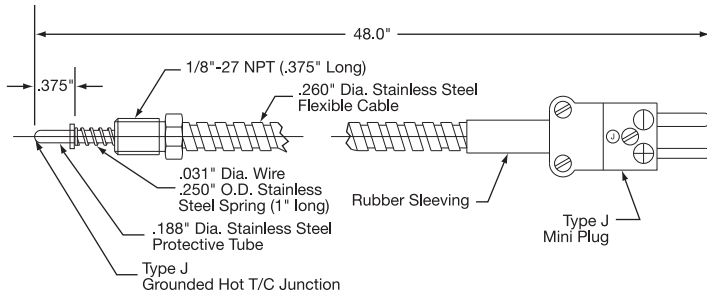


Part Number	Length (inches)
TNW81001	12
TNW81002	24
TNW81003	36
TNW81004	48
TNW81005	60
TNW81006	72
TNW81007	84
TNW81008	96
TNW81009	108
TNW81010	120
TNW81011	132
TNW81012	144
TNW81013	156
TNW81014	168
TNW81015	180
TNW81016	192





OEM Replacement Thermocouples (Type J)



All Items Available from Stock



OEM Replacement Thermocouples (Type J)

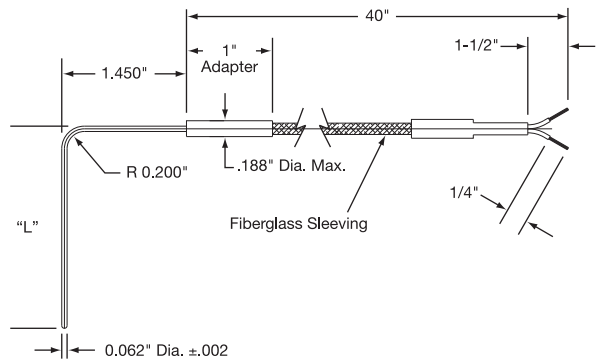
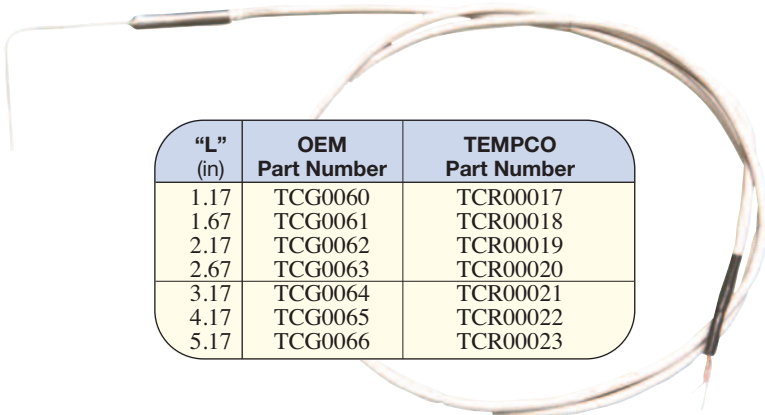
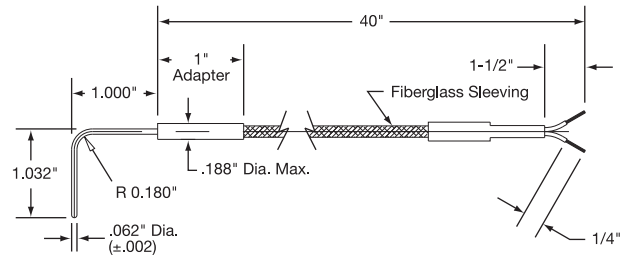
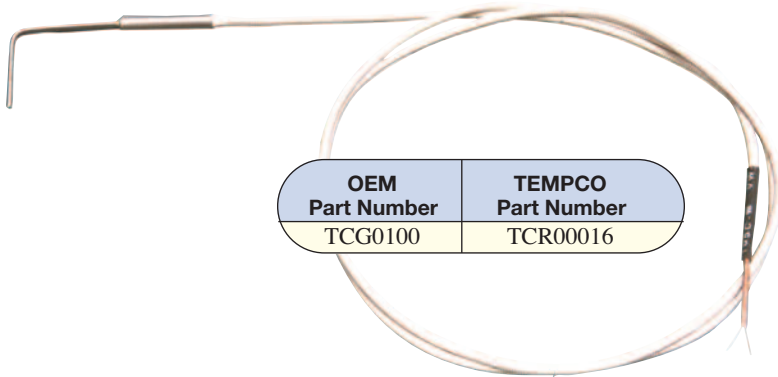
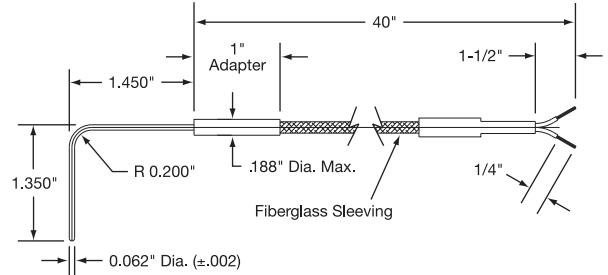
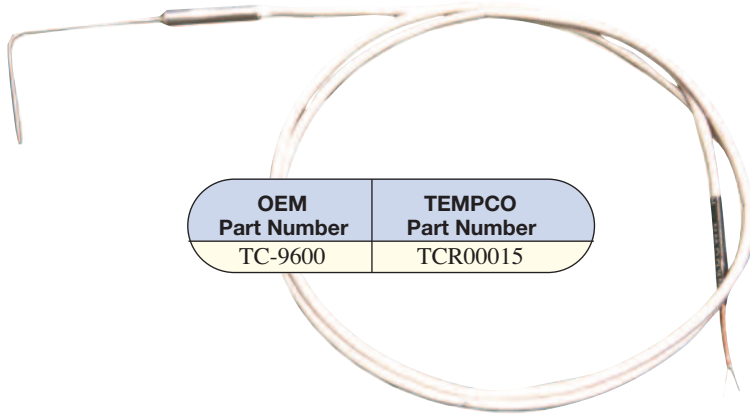
Specialty Application

The following **Runnerless Mold Thermocouples** are manufactured using Tempco's high quality, mineral insulated thermocouple wire "Tempco-Pak." The Tempco-Pak is .062" diameter 304 stainless steel sheathed, MgO insulated, ANSI Type J thermocouple wire.



Notes: All hot junctions are grounded.

The lead wire is ANSI Type "J" thermocouple grade with ANSI color-coded fiberglass insulation and an additional high temperature outer fiberglass sleeve. The transition area (potting adapter) between the Tempco-Pak and lead wire is potted with high temperature cement rated to 900°F (482°C).



All Items Available from Stock



Comparing Three Types Of Temperature Sensors

RTDs VS. THERMOCOUPLES VS. THERMISTORS

RTDs

Resistance Temperature Detectors (RTDs) are temperature sensing devices consisting of a wire coil or deposited film of pure metal, usually platinum. The element's resistance increases with temperature in a known and repeatable manner. RTDs exhibit excellent accuracy over a wide temperature range, -200 to 650°C (-328 to 1202°F).

RTDs offer

Stability and repeatability: The platinum RTD is the primary interpolation instrument used by the National Institute of Standards and Technology from -260 degrees Celsius to 630 degrees Celsius. Precision RTDs can be manufactured with a stability of 0.0025 degrees Celsius per year. However, most industrial models drift less than 0.1 degrees Celsius per year.

Linearity: The platinum RTD produces a more linear curve than thermocouples or thermistors. The RTD's non-linearities can be corrected through proper design of resistive bridge networks.

Sensitivity: The voltage drop across an RTD provides a much larger output than a thermocouple. Since thermistors have a higher resistance than RTDs, the measuring current through them may be so low as to limit self-heating, making their voltage drop less than that of an RTD.

Standardization: RTDs are manufactured to industry standard curves, usually 100 ohm platinum to IEC 751, which makes them very interchangeable.

System Cost: RTDs usually offer a lower system cost than do thermocouples as they use ordinary copper extension leads and require no cold junction compensation.

Thermocouples

A thermocouple consists of two wires of dissimilar metals welded together into a junction. At the other end of the signal wires, usually as part of the input instrument, is another junction called the reference junction. Heating the sensing junction generates a thermoelectric potential (emf) proportional to the temperature difference between the two junctions. This millivolt-level emf, when compensated for the known temperature of the reference junction, indicates the temperature at the sensing tip. Published millivolt tables assume the reference junction is at 0 degrees Celsius.

Thermocouples are simple and familiar. Designing them into systems, however, is complicated by the need for special extension wires and reference junction compensation.

Thermocouple advantages include

Extremely high temperature capability: Thermocouples with a noble metal junction may be rated as high as 1700°C (3100°F).

Ruggedness: The inherent simplicity of thermocouples makes them resistant to shock and vibration.

Small size/fast response: A fine-wire thermocouple junction takes up little space and has low mass, making it suitable for point sensing and fast response.

Thermistors

Thermistors are resistive devices usually made of metal oxides formed into a bead and encapsulated in epoxy or glass. Thermistors show a large negative temperature coefficient. Their resistance drops dramatically and non-linearly with a temperature increase. A thermistor's sensitivity is many times that of an RTD, but its useful temperature range is limited.

Because of wide variations of performance and cost among thermistors, generalized advantages and disadvantages may not always apply.

Typical benefits are

Lower Sensor Cost: Basic thermistors are less costly than RTDs and thermocouples, but when assembled in protective sheaths or wells the price difference narrows. Thermistors with tighter interchangeability or extended temperature ranges often cost more than RTDs.

High Sensitivity: Resistance may be several thousand ohms, which provides a larger output than RTDs with the same measuring current, offsetting lead wire resistance problems. Caution must be taken to limit measuring current because thermistors are more susceptible to self-heating than are RTDs.

Point Sensing: A thermistor bead may be the size of a pinhead, allowing for small area sensing.



TEMPCO'S ACCU-OHM™ RTD

All of Tempco's Accu-Ohm RTDs comply with the following specifications:

IEC publication 751 issued by the International Electrotechnical Commission (dated 1983).

This is the widest international scope of any RTD standard. This publication sets the tolerance for platinum RTDs with a value of 100 ohms at 0°C with a temperature coefficient of resistance (TCR) of 0.00385 ohms/ohm/°C in one of two classes:

Class A: Plus or minus 0.06% at 0°C

Class B: Plus or minus 0.12% at 0°C

All Tempco RTDs meet class B; class A is optional.

DIN 43760 issued by Deutsches Institute für Normung (Germany), dated 1987. The platinum resistance curves are now covered under DIN IEC 751.

JIS 1604-1989 issued by the Japanese Standards Association (dated 1989).

The Platinum resistance curves are in accordance with IEC 751 but there is also a provision for TCR 0.003916 ohms/ohm/°C which can be supplied in most of Tempco's standard designs on special request.

BS 1904-1984 issued by the British Standard Institute (dated 1984). This specification is identical to IEC 751.

What is Temperature Coefficient of Resistance (TCR)?

Temperature coefficient differentiates between resistance/temperature curves of RTDs. It is also called ALPHA and may be specified in various ways by different manufacturers. Here TCR is the RTDs resistance change from 0 to 100°C, divided by the resistance at 0°C, divided by 100°C:

$$TCR (\Omega/\Omega/^\circ C) = \frac{R_{100^\circ C} - R_{0^\circ C}}{R_{0^\circ C} \times 100^\circ C}$$

Example: A platinum RTD measuring 100 Ω's at 0°C and 138.5 Ω's at 100°C has TCR 0.00385 Ω/Ω/°C

$$TCR = \frac{138.5 \Omega - 100 \Omega}{100 \Omega \times 100^\circ C} = 0.00385 \Omega/\Omega/^\circ C$$

Stated another way, TCR is the average resistance increase per degree of a hypothetical RTD measuring 1 ohm at 0°C.

The most common use of TCR is to distinguish between curves for platinum, which is available with TCRs ranging from 0.00375 to 0.003927. The highest TCR indicates the highest purity platinum, and is mandated by ITS-90 for standard platinum thermometers.

There are no technical advantages of one TCR versus another in practical industrial applications. 0.00385 platinum is the most popular worldwide standard and is available in both wire-wound and thin-film elements.

In most cases, all you need to know about TCR is that it must be properly matched when replacing RTDs or connecting them to instruments.

Interchangeability and Repeatability

Interchangeability and accuracy are commonly cited as the RTDs most distinguishing attributes. Because of the tight tolerances of the Class A and Class B, RTDs are quite interchangeable. Their accuracy is also very good because of the RTD's repeatability over the standard temperature scale from -260°C to 630°C. Ordinary industrial RTDs tend to show a drift of less than 0.1°C per year in normal use.

Because RTDs are exactly what the name implies (Resistance Temperature Detectors), a resistance type sensor, any resistance introduced by the addition of extension wires between the RTD and the control or measuring instrument will add to the readings. This added resistance is not constant since the extension wires, usually copper, change their resistance values with changing ambient temperature. Extension wire errors can be significant, particularly with small gauge wires or elements with low sensitivity. Fortunately most of these errors may be nearly canceled by using a three wire system.

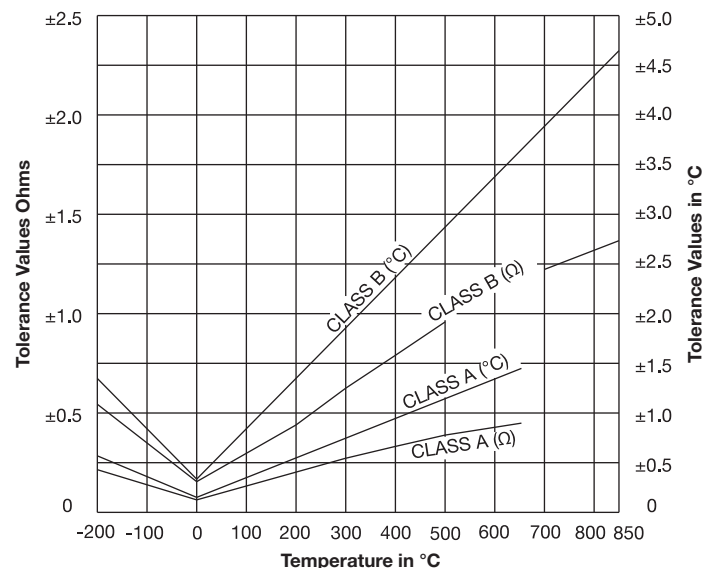
The majority of RTDs in today's industry are 3- or 4-wire systems; the 2-wire lead system is the least efficient unless the leads are heavy gauge, very short, or both.

In 3- or 4-wire circuits, common leads, connected to the same end of the RTD element, are the same color.

Tolerances for 100Ω RTDs

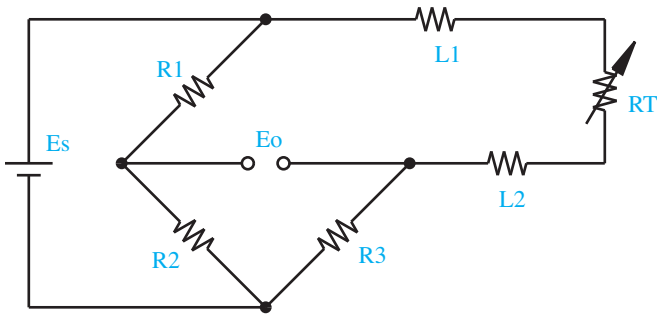
Temperature (°C)	Tolerance			
	Class A		Class B	
	(± °C)	(± Ω)	(± °C)	(± Ω)
-200	0.55	0.24	1.3	0.56
-100	0.35	0.14	0.8	0.32
0	0.15	0.06	0.3	0.12
100	0.35	0.13	0.8	0.30
200	0.55	0.20	1.3	0.48
300	0.75	0.27	1.8	0.64
400	0.95	0.33	2.3	0.79
500	1.15	0.38	2.8	0.93
600	1.35	0.43	3.3	1.06
650	1.45	0.46	3.6	1.13
700	—	—	3.8	1.17
800	—	—	4.3	1.28
850	—	—	4.6	1.34

Tolerance Values as a Function of Temperature for 100Ω RTDs



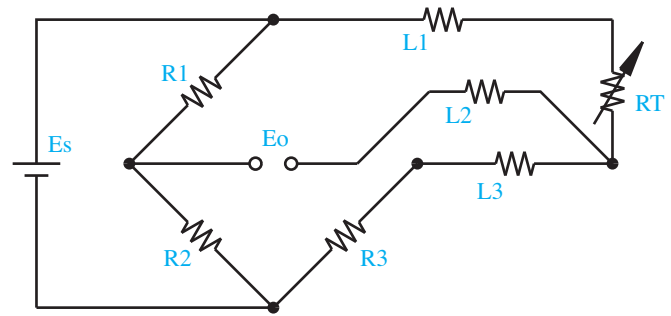


Wiring Diagrams



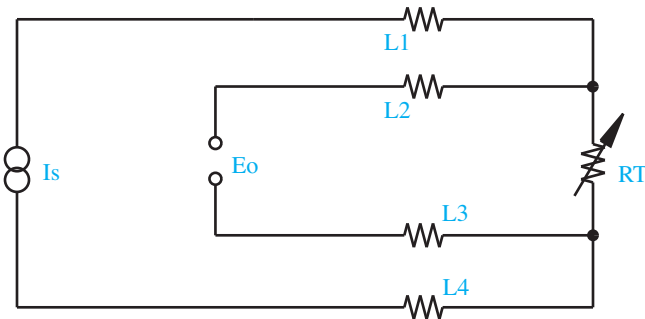
2-wire circuit

Shown is a 2-wire RTD connected to a typical Wheatstone bridge circuit. E_s is the supply voltage; E_o is the output voltage; R_1 , R_2 , and R_3 are fixed resistors; and RT is the RTD. In this uncompensated circuit, lead resistance L_1 and L_2 add directly to RT .



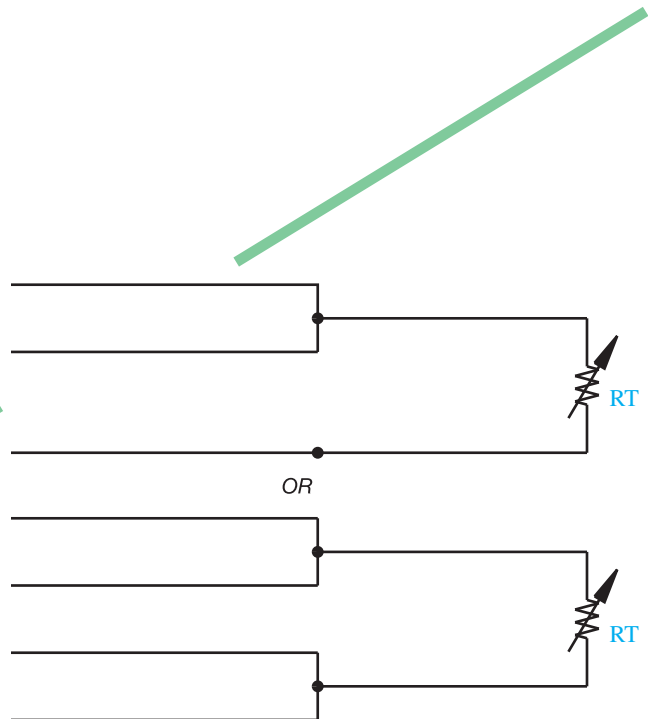
3-wire circuit

In this circuit there are three leads coming from the RTD instead of two. L_1 and L_3 carry the measuring current while L_2 acts only as a potential lead. No current flows through it while the bridge is in balance. Since L_1 and L_3 are in separate arms of the bridge, resistance is canceled. This circuit assumes high impedance at E_o and close matching of resistance between wires L_2 and L_3 . TEMPACO matches RTD leads within 5%. As a rule of thumb, 3-wire circuits can handle wire runs up to 100 feet.



4-wire circuit

4-wire RTD circuits not only cancel lead wires but remove the effects of mismatched resistances such as contact points. A common version is the constant current circuit shown here. I_s drives a precise measuring current through L_1 and L_4 ; L_2 and L_3 measure the voltage drop across the RTD element. E_o must have high impedance to prevent current flow in the potential leads. 4-wire circuits may be usable over a longer distance than 3-wire, but you should consider using a transmitter in electrically noisy environments.



If necessary you can connect a 2-wire RTD to a 3-wire circuit or 4-wire circuit, as shown. As long as the junctions are near the RTD, as in a connection head, errors are negligible.



RTD Temperature vs. Resistance Table

100 Ohm RTD

DIN 43760 with Temperature Coefficient of .00385
JIS 1604-1989 with Temperature Coefficient of .00392

°C	DIN	JIS	°C	DIN	JIS	°F	DIN	JIS	°F	DIN	JIS
-100	60.26	59.54	290	208.48	210.45	-200	48.46	47.54	580	213.63	215.69
-90	64.30	63.66	300	212.05	214.08	-180	53.02	52.18	600	217.58	219.71
-80	68.33	67.76	310	215.61	217.70	-160	57.55	56.79	620	221.51	223.71
-70	72.33	71.84	320	219.15	221.31	-140	62.06	61.37	640	225.42	227.70
-60	76.33	75.90	330	222.68	224.91	-120	66.54	65.94	660	229.32	231.67
-50	80.31	79.95	340	226.20	228.49	-100	71.00	70.48	680	233.21	235.63
-40	84.27	83.99	350	229.71	232.06	-80	75.44	75.00	700	237.09	239.57
-30	88.22	88.01	360	233.21	235.63	-60	79.87	79.50	720	240.94	243.50
-20	92.16	92.02	370	236.70	239.18	-40	84.27	83.99	740	244.79	247.42
-10	96.09	96.02	380	240.17	242.72	-20	88.66	88.46	760	248.62	251.32
0	100.00	100.00	390	243.64	246.24	0	93.03	92.91	780	252.44	255.20
10	103.90	103.97	400	247.09	249.76	20	97.39	97.34	800	256.24	259.07
20	107.79	107.93	410	250.53	253.26	40	101.74	101.77	820	260.03	262.93
30	111.67	111.88	420	253.96	256.75	60	106.07	106.17	840	263.80	266.77
40	115.54	115.82	430	257.38	260.23	80	110.38	110.57	860	267.56	270.60
50	119.40	119.75	440	260.78	263.70	100	114.68	114.95	880	271.30	274.42
60	123.24	123.66	450	264.18	267.16	120	118.97	119.31	900	275.03	278.21
70	127.07	127.56	460	267.56	270.60	140	123.24	123.66	920	278.75	282.00
80	130.90	131.45	470	270.93	274.03	160	127.50	128.00	940	282.45	285.77
90	134.71	135.33	480	274.29	277.46	180	131.74	132.32	960	286.14	289.52
100	138.51	139.20	490	277.64	280.87	200	135.97	136.62	980	289.82	293.27
110	142.29	143.06	500	280.97	284.26	220	140.19	140.91	1000	293.47	296.99
120	146.07	146.90	510	284.30	287.65	240	144.39	145.19	1020	297.12	300.70
130	149.83	150.73	520	287.61	291.02	260	148.58	149.46	1040	300.75	304.40
140	153.58	154.55	530	290.91	294.39	280	152.75	153.70	1060	304.37	308.09
150	157.32	158.36	540	294.20	297.74	300	156.91	157.94	1080	307.97	311.75
160	161.05	162.16	550	297.48	301.08	320	161.05	162.16	1100	311.56	315.41
170	164.77	165.94	560	300.75	304.40	340	165.18	166.36	1120	315.13	319.05
180	168.48	169.71	570	304.01	307.72	360	169.30	170.55	1140	318.69	322.67
190	172.17	173.48	580	307.25	311.02	380	173.40	174.73	1160	322.24	326.28
200	175.85	177.23	590	310.48	314.31	400	177.49	178.89	1180	325.77	329.88
210	179.53	180.96	600	313.70	317.59	420	181.56	183.04	1200	329.28	333.46
220	183.19	184.69	610	316.91	320.86	440	185.62	187.17	1220	332.79	337.03
230	186.83	188.41	620	320.11	324.12	460	189.66	191.29	1240	336.28	340.58
240	190.47	192.11	630	323.30	327.36	480	193.69	195.39	1260	339.75	344.12
250	194.10	195.80	640	326.47	330.60	500	197.71	199.48	1280	343.21	347.64
260	197.71	199.48	650	329.64	333.82	520	201.71	203.55	1300	346.65	351.15
270	201.31	203.15	660	332.79	337.03	540	205.70	207.61	1320	350.09	354.65
280	204.90	206.80	670	335.93	340.23	560	209.67	211.66	1340	353.50	358.13

Tolerance °C

Class A: $\pm(0.15+0.002T)^\circ\text{C}$

Class B: $\pm(0.30+0.005T)^\circ\text{C}$

NOTE: "T" is the actual temperature, in °C of the platinum element.



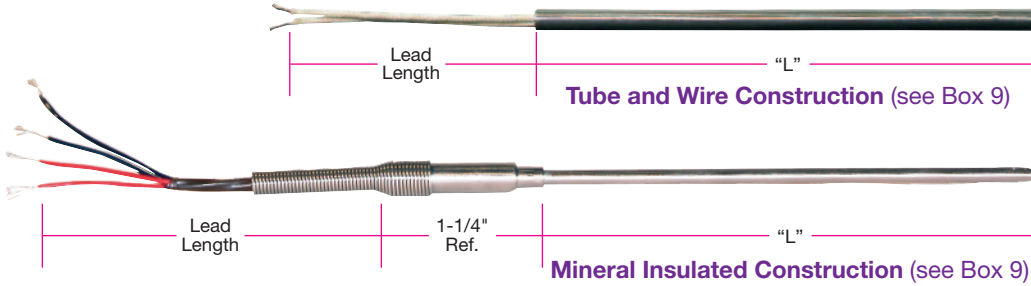
Note: For 1000 ohm RTDs multiply resistance shown in table by 10.

Temperature Sensing



Resistance Temperature Sensing

Style RTD1 — Straight Probes



Design Features

* *Platinum Resistance Element*



**Optional Installation
Compression Fitting**
See Box 12

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Two Construction Styles to Suit Any Application

(See Ordering Code Box 9)

* *Standard Industry Tube and Wire construction with fiberglass 900°F (482°C) or Teflon® 392°F (200°C) lead wires*

* *Mineral Insulated construction rated up to 1200°F (650°C). This construction type allows forming and bending the sheath to meet design requirements.*

Ordering Code:

RTD1 -

Element BOX 1

S = 100Ω Single **K** = 1000Ω Single
D = 100Ω Dual **L** = 1000Ω Dual
TCR = .00385 ohm/ohm/°C

Lead Wire Length BOX 8

In inches **001** to **999**
 12" (012) Standard

RTD Construction Type BOX 9

T = Tube and Wire Construction
M = MgO Insulated Construction with strain relief spring (Type "M" not available for "K" or "L" from Element Box 1)

Element Class BOX 2

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Lead Wire Construction BOX 10

Fiberglass 900°F (482°C)	S	w/ SS Overbraid*	B	w/SS Flex Armor*	A
Teflon® 392°F (200°C)	T		D		F

* *Flex Armor options, overbraid options and .125" O.D. and dual constructions may require transitions.*

Number of Leads BOX 3

2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125 O.D. 4-wire circuit not available

Lead Wire Termination BOX 11

P = Standard Male Plug 350°F (177°C)	F = Mini Plug & Mating Jack
J = Standard Female Jack	B = Std. — 2-1/2 in. Split Leads
K = Std. Plug with Mating Jack	S = Leads with Spade Lugs
D = Mini Male Plug 350°F (177°C)	C = 2-1/2 in. Split Leads with BX Connector and Spade Lugs
E = Mini Female Jack	
X = Other (Specify)	

Plugs and Jacks for 2- and 3-Wire Only

Sheath O.D. BOX 4

F = 0.125" (Single Element Only)
G = 0.188"
H = 0.250"
X = Other (Specify)

Optional Compression Fitting BOX 12

1 = 1/8" NPT SS	4 = 1/8" NPT Brass
2 = 1/4" NPT SS	5 = 1/4" NPT Brass
3 = 1/2" NPT SS	6 = 1/2" NPT Brass
0 = None Required	

Sheath Material BOX 5

B = 304 SS
C = 316 SS
A = Alloy 600
 (Type "M" only; See Box 9)

Sheath Length "L" BOX 6

Whole inches
01 to **99**
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

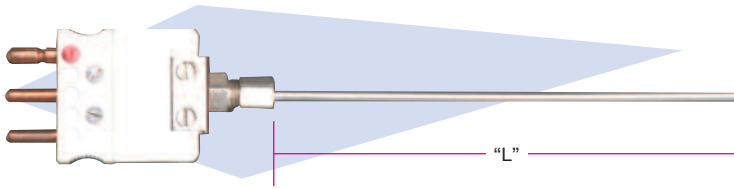
Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Special Requirements BOX 13

X = Specify
0 = None



Style RTD2 — Plug or Jack Termination



**Optional Installation
Compression Fitting**
See Box 10

Design Features

- * *Platinum Resistance Element*
- * *Available with standard or mini, 2- or 3-prong plug or jack*

Two Construction Styles to Suit Any Application

(See Ordering Code Box 9)

- * *Standard Industry Tube and Wire construction with fiberglass 900°F (482°C) or Teflon® 392°F (200°C) lead wires*
- * *Mineral Insulated construction rated up to 1200°F (650°C). This construction type allows forming and bending the sheath to meet design requirements.*

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **RTD2** -

Element BOX 1

S = 100Ω Single **K** = 1000Ω Single
D = 100Ω Dual **L** = 1000Ω Dual
TCR = .00385 ohm/ohm/°C

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Element Class BOX 2

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Termination BOX 8

P = Standard Male Plug 350°F (177°C) **D** = Mini Male Plug 350°F (177°C)
J = Standard Female Jack **E** = Mini Female Jack
K = Std. Plug with Mating Jack **F** = Mini Plug with Mating Jack

Number of Leads BOX 3

2 = 2-wire circuit
3 = 3-wire circuit (Dual circuit not available)

RTD Construction Type BOX 9

Standard Industry Construction
S = Fiberglass insulated 900°F (450°C)
T = Teflon® Insulated 392°F (200°C)
Mineral Insulated Construction
M = MgO Insulated 1200°F (650°C)
 (Type "M" not available for "K" or "L" from Element Box 1)

Sheath O.D. BOX 4

F = 0.125" (Single Element Only)
G = 0.188"
H = 0.250"

Optional Compression Fitting BOX 10

1 = 1/8" NPT SS **4** = 1/8" NPT Brass
2 = 1/4" NPT SS **5** = 1/4" NPT Brass
3 = 1/2" NPT SS **6** = 1/2" NPT Brass
0 = None Required

Sheath Material BOX 5

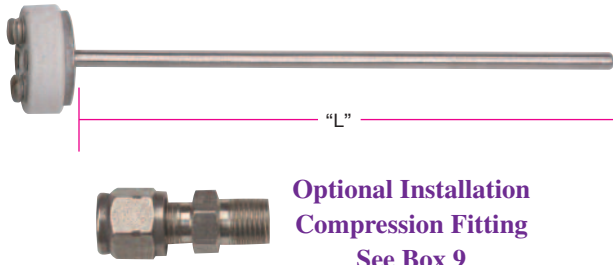
B = 304 SS
C = 316 SS
A = Alloy 600
 (Style M only; See Box 9)

Special Requirements BOX 11

X = Specify
0 = None



Style RTD3 — Open Disc Termination



Design Features

- * *Platinum Resistance Element*
- * *Ceramic disc 1-1/8" O.D. for 2-, 3- and 4-wire designs, 2-1/32" O.D. for dual 6-wire design (.188" and .250" O.D. sheath); consult factory for 1/8" sheath O.D.*

Two Construction Styles to Suit Any Application

(See Ordering Code Box 8)

- * *Standard Industry Tube and Wire construction with fiberglass 900°F (482°C) or Teflon® 392°F (200°C) lead wires*
- * *Mineral Insulated construction rated up to 1200°F (650°C). This construction type allows forming and bending the sheath to meet design requirements.*

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **RTD3** -

Element BOX 1

S = 100Ω Single **K** = 1000Ω Single
D = 100Ω Dual **L** = 1000Ω Dual
 TCR = .00385 ohm/ohm/°C

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Element Class BOX 2

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Number of Leads BOX 3

2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
 0.125" O.D. (Dual circuit not available)

RTD Construction Type BOX 8

Standard Industry Construction
S = Fiberglass insulated 900°F (450°C)
T = Teflon® Insulated 392°F (200°C)
Mineral Insulated Construction
M = MgO Insulated 1200°F (650°C)
 (Type "M" not available for "K" or "L" from Element Box 1)

Sheath O.D. BOX 4

F = 0.125"
G = 0.188"
H = 0.250"

Optional Compression Fitting BOX 9

1 = 1/8" NPT SS **4** = 1/8" NPT Brass
2 = 1/4" NPT SS **5** = 1/4" NPT Brass
3 = 1/2" NPT SS **6** = 1/2" NPT Brass
0 = None Required

Sheath Material BOX 5

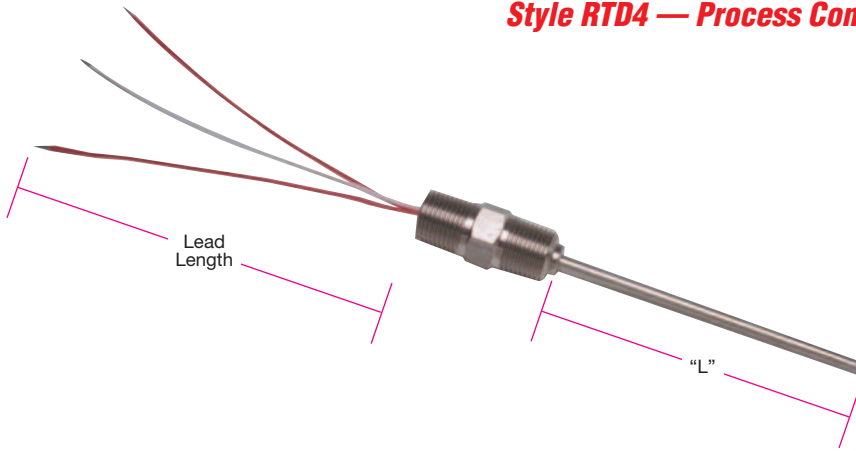
B = 304 SS
C = 316 SS
A = Alloy 600
 (Type "M" Only; See Box 8)

Special Requirements BOX 10

X = Specify
0 = None



Style RTD4 — Process Connection



Design Features

- * Platinum Resistance Element
- * Designed for mounting to connection head and thermowells
- * Optional spring loading on 1/2" NPT only
- * Stainless Steel fittings with 1/4" or 1/2" NPT thread

Two Construction Styles to Suit any Application (See Ordering Code Box 11)

- * Standard Industry Tube and Wire construction with fiberglass 900°F (482°C) or Teflon® 392°F (200°C) lead wires.
- * Mineral Insulated construction rated up to 1200°F (650°C). This construction type allows forming and bending the sheath to meet design requirements.

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code:

RTD4 -

Element BOX 1

S = 100Ω Single **K** = 1000Ω Single
D = 100Ω Dual **L** = 1000Ω Dual
TCR = .00385 ohm/ohm/°C

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Element Class BOX 2

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Lead Wire Length BOX 8

In inches **001 to 999**
 12" (012) Standard

Number of Leads BOX 3

2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125" O.D. (Dual circuit not available)

Thread BOX 9

4 = 1/4" NPT
2 = 1/2" NPT

RTD Construction Type BOX 11

T = Tube and Wire Construction
M = MgO Insulated Construction
 (Type "M" not available for "K" or "L" from Element Box 1)

Sheath O.D. BOX 4

F = 0.125"
G = 0.188"
H = 0.250"
X = Other (Specify)

Spring-Loaded BOX 10

O = Not Required
Y = Yes, 1/2" NPT only

Lead Wire Construction BOX 12

Fiberglass Stranded 900° (482°C)	S	w/ SS Braid	w/ SS Armor
Teflon® Stranded 392°F (200°C)	T	B	A
		D	F

Sheath Material BOX 5

B = 304 SS
C = 316 SS
A = Alloy 600
 (Type M Only; See Box 11)

Special Requirements BOX 13

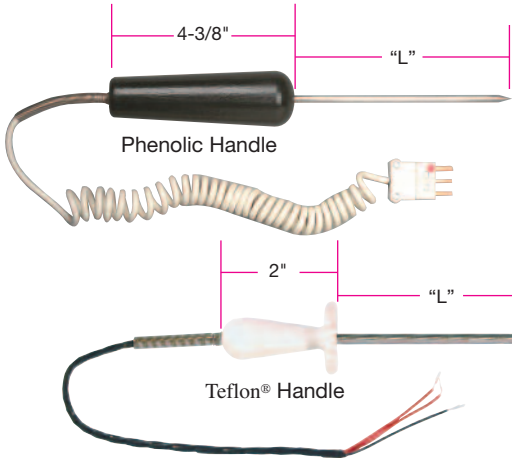
X = Specify
0 = None

Temperature Sensing



Resistance Temperature Sensing

Style RTD5 — Handheld Probe

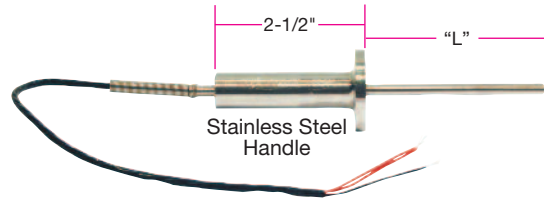


Design Features

- * **Platinum Resistance Element**
- * **Ground conical point for easy meat penetration**
- * **Large handle makes penetration and removal easy**
- * **Teflon® insulated lead wire construction good to 392°F (200°C)**
- * **Fiberglass lead wire construction good to 900°F (482°C)**
- * **3-wire coil cord construction good to 221°F (105°C). Not available with overbraid or flex armor. Extended length 5 or 15 ft. (standard).**

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.



Ordering Code:

RTD5 - ¹ ² ³ ⁴ ⁵ ⁶ ⁷ ⁸ ⁹ ¹⁰ ¹¹ ¹²

Element BOX 1

S = 100Ω Single **K** = 1000Ω Single
D = 100Ω Dual **L** = 1000Ω Dual
TCR = .00385 ohm/ohm/°C

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Element Class BOX 2

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Lead Wire Length BOX 8

In inches **012 to 999**
 60" (060) Standard
For Coil Cords Enter 060 or 180

Number of Leads BOX 3

2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125" O.D. (Dual circuit not available)

Lead Wire Construction BOX 9

	Standard	w/ SS Overbraid	w/ Flex Armor
Coil Cord 221°F (105°C)	C	—	—
Fiberglass Stranded 900°F (482°C)	S	B	A
Teflon® Stranded 392°F (200°C)	T	D	F

Sheath O.D. BOX 4

F = 0.125"
G = 0.188"
H = 0.250"
X = Other (Specify)

Lead Wire Termination BOX 10

P = Standard Male Plug 350°F (177°C) **F** = Mini Plug with Mating Jack
J = Standard Female Jack **B** = Split Leads
K = Std. Plug with Mating Jack **S** = Leads with Spade Lugs
D = Mini Male Plug 350°F (177°C) **C** = 2.5 in. with BX Connector and Spade Lugs
E = Mini Female Jack

Plugs and Jacks for 2- and 3-Wire Only

Sheath Material BOX 5

B = 304 SS
C = 316 SS

Handle Type BOX 11

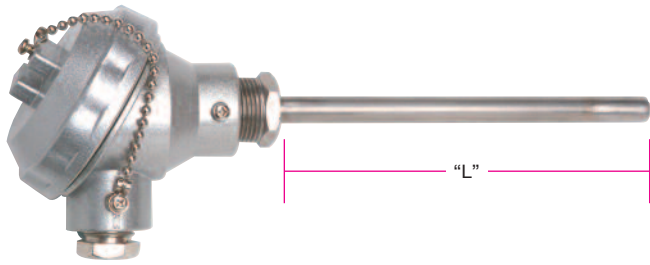
1 = Stainless Steel
2 = Teflon® 500°F (260°C)
3 = Phenolic 383°F (195°C)

Special Requirements BOX 12

X = Specify
0 = None



Style RTD6 — Connection Head



**Optional Installation
Compression Fitting**
See Box 10

Design Features

- * *Platinum Resistance Element.*
- * *Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.*
- * *Screw covers are attached to body with a plated chain.*
- * *Covers have lugs for tightening or loosening with a screwdriver or wrench.*
- * *Available in single or duplex.*
- * *Tempco's connection heads are available in die cast aluminum, Bakelite and cast iron in a variety of sizes from miniature for confined areas, to the large universal head designed for heavy process and industrial applications. See sensor accessories on pages 14-98 through 14-100 for complete information.*

Two Construction Styles to Suit Any Application

(See Ordering Code Box 9)

- * *Standard Industry Tube and Wire construction with fiberglass 900°F (482°C) or Teflon® 392°F (200°C) lead wires*
- * *Mineral Insulated construction rated up to 1200°F (650°C). This construction type allows forming and bending the sheath to meet design requirements.*

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **RTD6** -

Element BOX 1

S = 100Ω Single **K** = 1000Ω Single
D = 100Ω Dual **L** = 1000Ω Dual
TCR = .00385 ohm/ohm/°C

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Element Class BOX 2

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Connection Head BOX 8

A = Standard Size Aluminum **F** = Standard Bakelite
B = Medium Size Aluminum **P** = Polypropylene
C = Miniature Aluminum **N** = Miniature Nickel-Plated Steel
H = Standard Cast Iron **S** = Stainless Steel

Note: Conduit connection for A, F, H & S is 1/2" (3/4" available);
 for B & C is 3/8"; and for P is 3/4" NPT.
 For overall dimensions see pages 14-98 through 14-100.
 Type "N" not available with Dual 3-Wire

Number of Leads BOX 3

2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit (Dual circuit not available)
0.125" O.D. (Dual circuit not available)

RTD Construction Type BOX 9

Standard Industry Construction
S = Fiberglass insulated 900°F (450°C)
T = Teflon® Insulated 392°F (200°C)
Mineral Insulated Construction
M = MgO Insulated 1200°F (650°C)
 (Type "M" not available for "K"
 or "L" from Element Box 1)

Sheath O.D. BOX 4

F = 0.125"
G = 0.188"
H = 0.250"

Sheath Material BOX 5

B = 304 SS
C = 316 SS
A = Alloy 600
 (Type "M" Only; See Box 9)

Optional Compression Fitting BOX 10

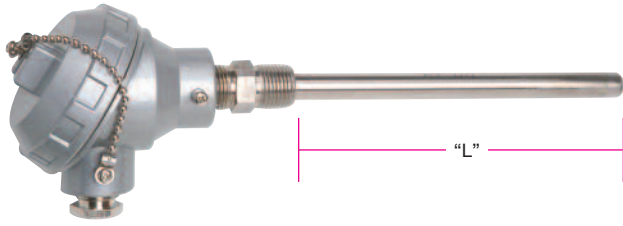
1 = 1/8" NPT SS **4** = 1/8" NPT Brass
2 = 1/4" NPT SS **5** = 1/4" NPT Brass
3 = 1/2" NPT SS **6** = 1/2" NPT Brass
0 = None Required

Special Requirements BOX 11

X = Specify
0 = None



Style RTD7 — Connection Head with 1/2" NPT Hex Nipple



Design Features

- * **Platinum Resistance Element.**
- * **Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.**
- * **Screw covers are attached to body with a plated chain.**
- * **Covers have lugs for tightening or loosening with a screwdriver or wrench.**
- * **Available in single or duplex.**
- * **Tempco's connection heads are available in die cast aluminum, Bakelite and cast iron in a variety of sizes from miniature for confined areas, to the large universal head designed for heavy process and industrial applications. See sensor accessories on pages 14-98 through 14-100 for complete information.**

Two Construction Styles to suit any application

(See Ordering Code Box 10)

- * **Standard Industry Tube and Wire construction with fiberglass 900°F (482°C) or Teflon® 392°F (200°C) lead wires.**
- * **Mineral Insulated construction rated up to 1200°F (650°C). This construction type allows forming and bending the sheath to meet design requirements.**

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **RTD7** -

Element BOX 1

S = 100Ω Single **K** = 1000Ω Single
D = 100Ω Dual **L** = 1000Ω Dual
TCR = .00385 ohm/ohm/°C

Sheath Length "L" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Element Class BOX 2

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Connection Head BOX 8

A = Standard Size Aluminum **S** = Stainless Steel
B = Medium Size Aluminum **F** = Standard Bakelite
C = Miniature Aluminum **P** = Polypropylene
H = Standard Cast Iron
Note: Conduit connection for A, F, H & S is 1/2" (3/4" available); for B & C is 3/8"; and for P is 3/4" NPT.
 For overall dimensions see pages 14-98 through 14-100.

Number of Leads BOX 3

2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit (Dual circuit not available)
0.125" O.D. (Dual circuit not available)

Spring-Loaded Terminal Block BOX 9

O = Not Required
Y = Required

Sheath O.D. BOX 4

F = 0.125"
G = 0.188"
H = 0.250"

RTD Construction Type BOX 10

Standard Industry Construction
S = Fiberglass insulated 900°F (450°C)
T = Teflon® Insulated 392°F (200°C)
Mineral Insulated Construction
M = MgO Insulated 1200°F (650°C)
 (Type "M" not available for "K" or "L" from Element Box 1)

Sheath Material BOX 5

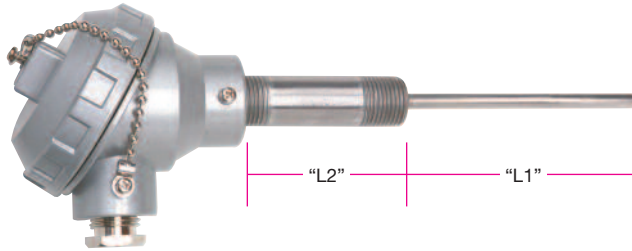
B = 304 SS
C = 316 SS
A = Alloy 600
 (Type "M" Only; See Box 10)

Special Requirements BOX 11

X = Specify
0 = None



Style RTD8 — Connection Head with 1/2" NPT Pipe Nipple



Two Construction Styles to Suit Any Application

(See Ordering Code Box 11)

- * **Standard Industry Tube and Wire construction with fiberglass 900°F (482°C) or Teflon® 392°F (200°C) lead wires.**
- * **Mineral Insulated construction rated up to 1200°F (650°C). This construction type allows forming and bending the sheath to meet design requirements.**

Design Features

- * **Platinum Resistance Element.**
- * **Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.**
- * **Screw covers are attached to body with a plated chain.**
- * **Covers have lugs for tightening or loosening with a screwdriver or wrench.**
- * **Available in single or duplex.**
- * **Tempco's connection heads are available in die cast aluminum, Bakelite and cast iron in a variety of sizes from miniature for confined areas, to the large universal head designed for heavy process and industrial applications. See sensor accessories on pages 14-98 through 14-100 for complete information.**
- * **Pipe Nipple is galvanized.**

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code:

RTD8 -

Element BOX 1

S = 100Ω Single **K** = 1000Ω Single
D = 100Ω Dual **L** = 1000Ω Dual
TCR = .00385 ohm/ohm/°C

Sheath Length "L1" BOX 6

Whole inches
01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L1" BOX 7

Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Element Class BOX 2

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

"L2" 1/2" NPT Nipple Length BOX 8

Whole inches **03 to 18**
 For lengths over 18 in. consult TEMPCO.
 Standard Lengths **S1** = 1", **S2** = 2-1/2", **S3** = 5-1/2"

Number of Leads BOX 3

2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit (Dual circuit not available)
0.125" O.D. (Dual circuit not available)

Connection Head BOX 9

A = Standard Size Aluminum **S** = Stainless Steel
B = Medium Size Aluminum **F** = Standard Bakelite
C = Miniature Aluminum **P** = Polypropylene
H = Standard Cast Iron
Note: Conduit connection for A, F, H & S is 1/2" (3/4" available);
 for B & C is 3/8"; and for P is 3/4" NPT.
 For overall dimensions see pages 14-98 through 14-100.

Sheath O.D. BOX 4

F = 0.125"
G = 0.188"
H = 0.250"

Spring-Loaded Terminal Block BOX 10

O = Not Required
Y = Required

Sheath Material BOX 5

B = 304 SS
C = 316 SS
A = Alloy 600
 (Type "M" Only; See Box 11)

RTD Construction Type BOX 11

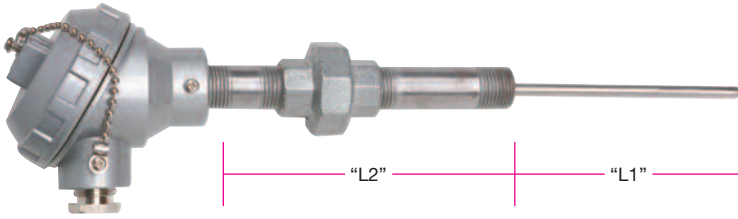
Standard Industry Construction
S = Fiberglass insulated 900°F (450°C)
T = Teflon® Insulated 392°F (200°C)
Mineral Insulated Construction
M = MgO Insulated 1200°F (650°C)
 (Type "M" not available for "K"
 or "L" from Element Box 1)

Special Requirements BOX 12

X = Specify
0 = None



Style RTD9 — Connection Head with 1/2" NPT Nipple, Union, Nipple



Design Features

- * Platinum Resistance Element.
- * Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- * Screw covers are attached to body with a plated chain.
- * Covers have lugs for tightening or loosening with a screwdriver or wrench.
- * Available in single or duplex.
- * Tempco's connection heads are available in die cast aluminum, bakelite and cast iron in a variety of sizes from miniature for confined areas, to the large universal head designed for heavy process and industrial applications. See sensor accessories on pages 14-98 through 14-100 for complete information.
- * Nipple-Union-Nipple is galvanized.

Two Construction Styles to Suit Any Application

(See Ordering Code Box 11)

- * Standard Industry Tube and Wire construction with fiberglass 900°F (482°C) or Teflon® 392°F (200°C) lead wires
- * Mineral Insulated construction rated up to 1200°F (650°C). This construction type allows forming and bending the sheath to meet design requirements.

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code:

RTD9 -

Element BOX 1

S = 100Ω Single K = 1000Ω Single
 D = 100Ω Dual L = 1000Ω Dual
 TCR = .00385 ohm/ohm/°C

Sheath Length "L1" BOX 6

Whole inches
 01 to 99
 For lengths over 99 in. consult TEMPCO.

Sheath Length "L1" BOX 7

Fractional inches
 0 = 0" 3 = 3/8" 6 = 3/4"
 1 = 1/8" 4 = 1/2" 7 = 7/8"
 2 = 1/4" 5 = 5/8"

Element Class BOX 2

A = ±0.06% at 0°C, Optional
 B = ±0.12% at 0°C, Standard

"L2" Dimension (in.) BOX 8

Nipple, Union, Nipple in whole inches
 Standard Lengths S1 = 3-1/2", S2 = 6-1/2", S3 = 12-1/2"

Number of Leads BOX 3

2 = 2-wire circuit
 3 = 3-wire circuit
 4 = 4-wire circuit (Dual circuit not available)
 0.125" O.D. (Dual circuit not available)

Connection Head BOX 9

A = Standard Size Aluminum S = Stainless Steel
 B = Medium Size Aluminum F = Standard Bakelite
 C = Miniature Aluminum P = Polypropylene
 H = Standard Cast Iron
 Note: Conduit connection for A, F, H & S is 1/2" (3/4" available);
 for B & C is 3/8"; and for P is 3/4" NPT.
 For overall dimensions see pages 14-98 through 14-100.

Sheath O.D. BOX 4

F = 0.125"
 G = 0.188"
 H = 0.250"

Spring-Loaded Terminal Block BOX 10

O = Not Required
 Y = Required

Sheath Material BOX 5

B = 304 SS
 C = 316 SS
 A = Alloy 600
 (Type "M" Only; See Box 11)

RTD Construction Type BOX 11

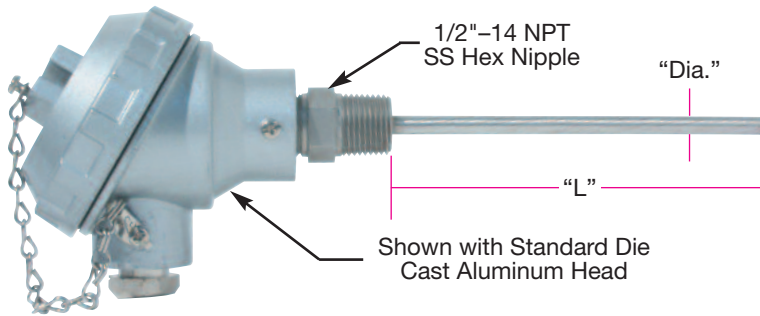
Standard Industry Construction
 S = Fiberglass insulated 900°F (450°C)
 T = Teflon® Insulated 392°F (200°C)
 Mineral Insulated Construction
 M = MgO Insulated 1200°F (650°C)
 (Type "M" not available for "K"
 or "L" from Element Box 1)

Special Requirements BOX 12

X = Specify
 0 = None

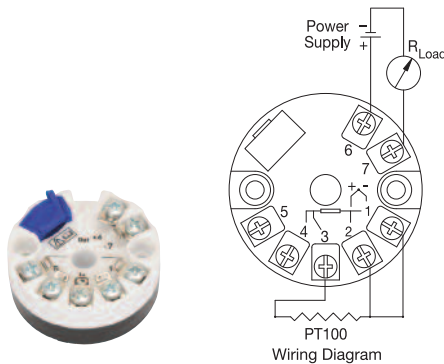


RTDs with Transmitter and Connection Head



Design Features

- * 100 ohm RTD
- * 4-20mA Programmable Linear Output Transmitter
- * Available with Spring-Loaded Sheath
- * Temperature Range of -58°F to 500°F (-50° to 260°C)
- * Transmitter Accuracy of +/-0.2% of temperature span
- * For field programming of the temperature transmitter see Part Number ETM90006 on page 12-45
- * Available in Single 3-wire Circuit only
- * 1/2" NPT process connection



Transmitter Ambient Temperature Range:
-40° to +185°F (-40° to +85°C)
Refer to page 12-44 for complete details.



EMT10001



EMT20001

See Connection Head Box 7 below.

Refer to page 12-50 for complete Indicator specifications.

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Ordering Code: **RTM** -

Element Class BOX 1

- A** = +/-0.06% At 0°C (Optional)
- B** = +/-0.12% At 0°C (Standard)

Sheath O.D. BOX 2

- F** = .125"
- G** = .188"
- H** = .250"

Sheath Material BOX 3

- B** = 304 SS
- C** = 316 SS

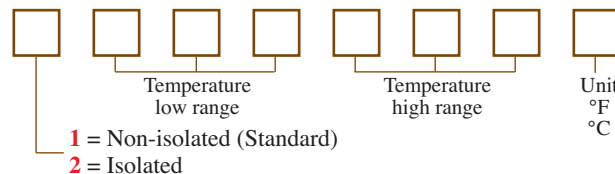
Sheath Length "L" BOX 4

- Whole inches
- 01** to **99**

Sheath Length "L" BOX 5

- Fractional inches
- 0** = 0" **3** = 3/8" **6** = 3/4"
- 1** = 1/8" **4** = 1/2" **7** = 7/8"
- 2** = 1/4" **5** = 5/8"

Transmitter Type BOX 6 (Enter Code Below)



Connection Head BOX 7

- A** = Standard Aluminum **H** = Standard Cast Iron
- B** = Medium Size Aluminum **L** = Aluminum Head with LCD Indicator (EMT10001)
- S** = Stainless Steel
- P** = Polypropylene Head (FDA Approved) **M** = Heavy Duty Aluminum Head with LCD Indicator (EMT20001)

Note: Conduit connection for A, H & S is 1/2", for B is 3/8" NPT, for P is 3/4" NPT. For overall dimensions see pages 14-98 through 14-100.

Spring-Loaded Probe BOX 8

- 0** = Not Required
- Y** = Required

Special Requirements BOX 9

- X** = Specify
- 0** = None

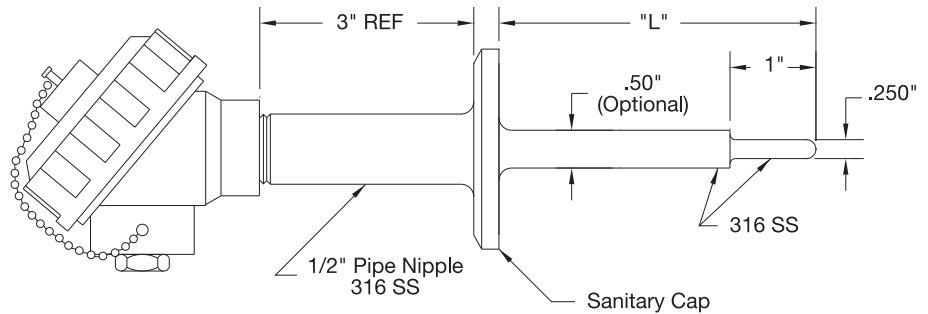


Sanitary RTDs



Design Features

- * **Platinum Resistance Element**
- * **Ideal for Food and Dairy Applications**
- * **316 SS Construction**
- * **Available in Standard .250 dia. Tip or Optional .500 dia. Reduced to .250 dia.**
- * **Improved Response Time**
- * **Welded and Highly Polished Components**
- * **Operating Temperature Range of -58° to 500°F (-50° to 260°C)**



Ordering Code: **RTS** -

Diameter BOX 1
1 = 0.250"
2 = 0.500" with .250" tip

Element BOX 2
S = 100Ω Single **K** = 1000Ω Single
D = 100Ω Dual **L** = 1000Ω Dual
TCR = .00385 ohm/ohm/°C

Element Class BOX 3
A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads BOX 4
2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit (*Dual Circuit not available*)

Sanitary Cap Type BOX 5
 (Standard Finish)
A = 16 AMP Tri-Clover
X = Other (Specify)

Sanitary Cap Size BOX 6
A = 1-1/2"
B = 2"
C = 2-1/2"
D = 3"
X = Other (Specify)

Sheath Length "L" BOX 7
 Whole inches
01 to 99

Sheath Length "L" BOX 8
 Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

Connection Head BOX 9
P = Polypropylene Head (FDA Approved)
A = Standard Die Cast Aluminum Head
 For overall dimensions see pages 14-98 to 14-100.
 (Note: Conduit connection for A is 1/2", and for B is 3/4".)

Special Requirements BOX 10
X = Specify
0 = None



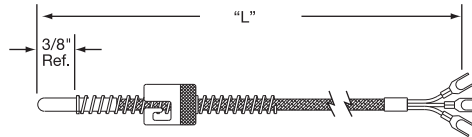
Bayonet Style RTDs for the Plastics Industry

Design Features

- * 3/16" diameter stainless steel probe
- * Operating temp. 392°F (200°C); 900°F (482°C) available
- * 3-wire circuit
- * 100 ohms Class B element per IEC 751
- * Can be installed wherever existing thermocouples of similar design are used

Style 1 – Adjustable Spring Bayonet RTD

- * Insertion length adjustable from 1" to 10"
- * One can replace several fixed-length thermocouples
- * Forms easily to any angle



See Page 14-87 for Bayonet Adapters.

Stock Items Are Shown In **RED**

Part Number	Termination Style [†]	"L" Dim. (in)
RTP10001	S	48
RTP10002	C	48
RTP10003	P	48
RTP10004	J	48
RTP10005	B	48

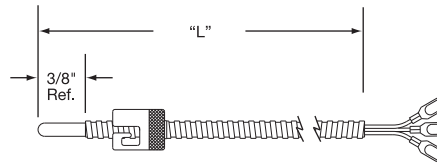
[†] See page 14-64 for Termination Style descriptions.

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Style 2 – Adjustable Armor Cable Bayonet RTD

- * Insertion length adjustable over length of armor cable
- * One can replace several fixed-length thermocouples or RTDs
- * Forms easily to any angle



Stock Items Are Shown In **RED**

Part Number	Termination Style [†]	"L" Dim. (in)
RTP20001	S	48
RTP20002	C	48
RTP20003	P	48
RTP20004	J	48
RTP20005	B	48

[†] See page 14-64 for Termination Style descriptions.

Ordering Code: **RTP** - 1 2 3 4 5 6 7 8

Style BOX 1

- 1 = Spring Adjustable
- 2 = Armor Cable Adjustable

"L" Dimension BOX 5

Whole inches
012 to 999

Element BOX 2

- S = 100Ω Single
- D = 100Ω Dual

Lead Insulation BOX 6

Fiberglass 900°F (482°C)	(Style 1 only)	w/ SS Overbraided (Style 1 only)	w/ SS Armor Cable (Style 2 only)
Teflon® 392°F (200°C)	S T	B D	A F

Element Class BOX 3

- A = ±0.06% at 0°C, Optional
- B = ±0.12% at 0°C, Standard

Termination BOX 7[†]

- | | |
|-------------------------------------|-----------------------------------|
| B = 2-1/2 in. Split Leads | K = Standard Plug and Jack |
| S = Spade Lugs | D = Miniature Plug |
| C = Spade Lugs with BX Conn. | E = Miniature Jack |
| P = Standard Plug | F = Mini. Plug and Jack |
| J = Standard Jack | X = Other (Specify) |

Plugs and Jacks for 2- and 3-Wire Only

[†] See page 14-64 for Termination Style descriptions.

Number of Leads BOX 4

- 2 = 2-wire circuit
- 3 = 3-wire circuit
- 4 = 4-wire circuit*
- *Not available with dual element

Special Requirements BOX 8

- X = Specify
- 0 = None

CONTINUED →



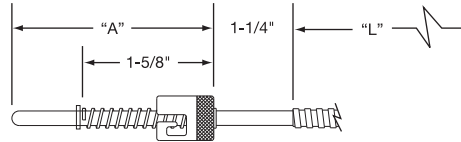
Resistance Temperature Sensing

Bayonet Style RTDs for the Plastics Industry

Design Features

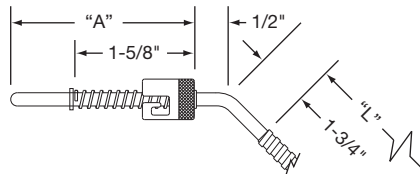
- * 3/16" diameter stainless steel probe
- * Operating temp. 392°F (200°C); 900°F (482°C) available
- * 3-wire circuit
- * 100 ohms Class B element per IEC 751
- * Can be installed wherever existing thermocouples of similar design are used

Style 3—Rigid Straight Bayonet RTD



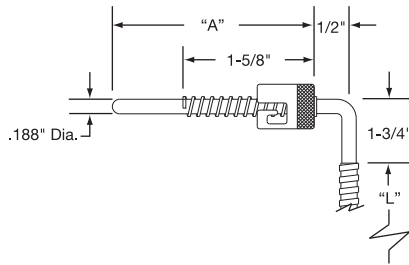
Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP30001	S	4	48
RTP30002	C	4	48
RTP30003	P	4	48
RTP30004	J	4	48
RTP30005	B	4	48

Style 4—Rigid 45° Bend Bayonet RTD



Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP40001	S	4	48
RTP40002	C	4	48
RTP40003	P	4	48
RTP40004	J	4	48
RTP40005	B	4	48

Style 5—Rigid 90° Bend Bayonet RTD



Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP50001	S	4	48
RTP50002	C	4	48
RTP50003	P	4	48
RTP50004	J	4	48
RTP50005	B	4	48

†See Page 14-64 for Termination Style descriptions.

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Custom Made Bayonet Style RTDs

Ordering Code: RTP -

Style BOX 1

- 3 = Straight
- 4 = 45° Bend
- 5 = 90° Bend

Element BOX 2

- S = 100Ω Single
- D = 100Ω Dual

Element Class BOX 3

- A = ±0.06% at 0°C, Optional
- B = ±0.12% at 0°C, Standard

Number of Leads BOX 4

- 2 = 2-wire circuit
- 3 = 3-wire circuit
- 4 = 4-wire circuit*
- *Not available with dual element

"A" Dimension BOX 5

- Whole inches
- 01 to 99 (1-3/4 in. min.)

"A" Dimension BOX 6

- Fractional inches
- 0 = 0" 3 = 3/8" 6 = 3/4"
- 1 = 1/8" 4 = 1/2" 7 = 7/8"
- 2 = 1/4" 5 = 5/8"

"L" Dimension BOX 7

- Whole inches
- 000 to 999

Termination BOX 9 †

- B = 2-1/2 in. Split Leads
- S = Spade Lugs
- C = Spade Lugs with BX Conn.
- P = Standard Plug
- J = Standard Jack
- K = Standard Plug and Jack
- D = Miniature Plug
- E = Miniature Jack
- F = Mini. Plug and Jack
- X = Other (Specify)

†See Page 14-64 for Termination Style descriptions.

Plugs and Jacks for 2- and 3-Wire Only

Special Requirements BOX 10

- X = Specify
- 0 = None

Lead Insulation BOX 8

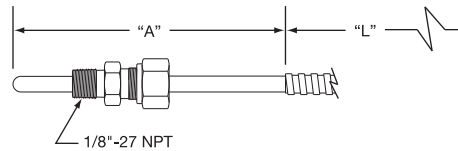
- | | | | |
|--------------------------|----------|-----------------|-------------------|
| Fiberglass 900°F (482°C) | Standard | w/ SS Overbraid | w/ SS Armor Cable |
| Teflon® 392°F (200°C) | S | B | A |
| | T | D | F |



Compression Fitting Style RTDs for the Plastics Industry

Style 6—Rigid Straight Compression Fitting RTD

Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP60001	S	4	48
RTP60002	C	4	48
RTP60003	P	4	48
RTP60004	J	4	48
RTP60005	B	4	48

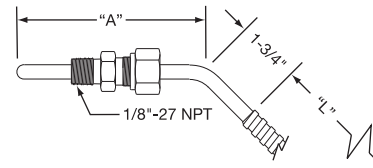


Design Features

- * 3/16" diameter stainless steel probe
- * Operating temp. 392°F (200°C); 900°F (482°C) available
- * One-time adjustable 1/8"-27 NPT brass compression fitting
- * 3-wire circuit
- * 100 ohms Class B element per IEC 751
- * Can be installed wherever existing thermocouples of similar design are used

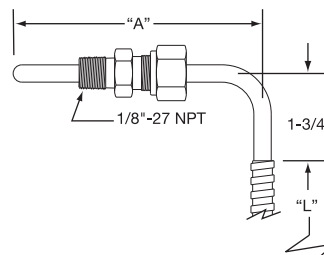
Style 7—Rigid 45° Bend Compression Fitting RTD

Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP70001	S	4	48
RTP70002	C	4	48
RTP70003	P	4	48
RTP70004	J	4	48
RTP70005	B	4	48



Style 8—Rigid 90° Bend Compression Fitting RTD

Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP80001	S	4	48
RTP80002	C	4	48
RTP80003	P	4	48
RTP80004	J	4	48
RTP80005	B	4	48



†See Page 14-64 for Termination Style descriptions.

Ordering Information

RTDs are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Custom Made Compression Fitting Style RTDs

Ordering Code: **RTP** - 1 2 3 4 5 6 7 8 9 10

Style BOX 1
6 = Straight
7 = 45° Bend
8 = 90° Bend

Element BOX 2
S = 100Ω Single
D = 100Ω Dual

Element Class BOX 3
A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads BOX 4
2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit*
 *Not available with dual element

"A" Dimension BOX 5
 Whole inches
01 to 99 (1-3/4 in. min.)

"A" Dimension BOX 6
 Fractional inches
0 = 0" **3** = 3/8" **6** = 3/4"
1 = 1/8" **4** = 1/2" **7** = 7/8"
2 = 1/4" **5** = 5/8"

"L" Dimension BOX 7
 Whole inches
000 to 999

Termination BOX 9 †
B = 2-1/2 in. Split Leads
S = Spade Lugs
C = Spade Lugs with BX Conn.
P = Standard Plug
J = Standard Jack
K = Standard Plug and Jack
D = Miniature Plug
E = Miniature Jack
F = Mini. Plug and Jack
X = Other (Specify)

†See Page 14-64 for Termination Style descriptions.

Plugs and Jacks for 2- and 3-Wire Only

Special Requirements BOX 10
X = Specify
0 = None

Lead Insulation BOX 8

	Standard	w/ SS Overbraid	w/ SS Armor Cable
Fiberglass 900°F (482°C)	S	B	A
Teflon® 392°F (200°C)	T	D	F



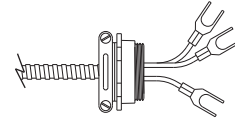
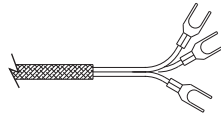
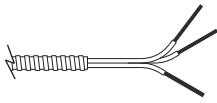
RTD Termination Styles

RTD Termination Styles

Style B—Plain Ends

Style S—Spade Lugs

Style C—Spade Lugs with BX connector



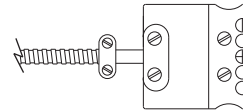
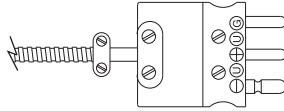
Optional Termination Styles

Available for the following RTDs:

Style	Page
RTD1	14-50
RTD4	14-53
RTD5	14-54
RTP	14-61 through 14-63

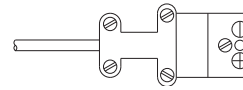
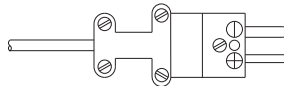
Style P—Standard Plug
(3-wire shown)

Style J—Standard Jack
(3-wire shown)



Style D—Miniature Plug
(2-wire shown)

Style E—Miniature Jack
(2-wire shown)



ECR Style RTD Extension Assemblies

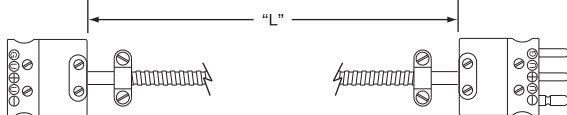
(3-wire circuits shown, 2-wire circuits also available)

Termination 1

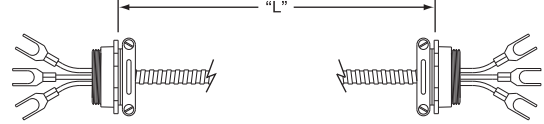
Termination 2

Termination 1

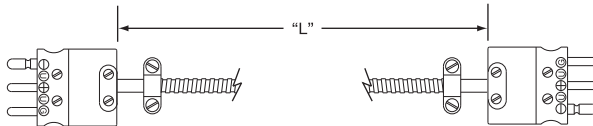
Termination 2



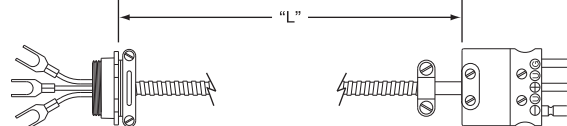
Style RJP—Jack to Plug



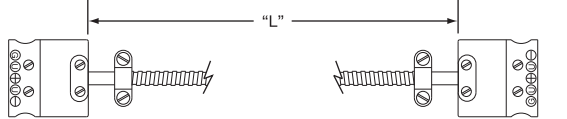
Style RCC—BX Connector to BX Connector



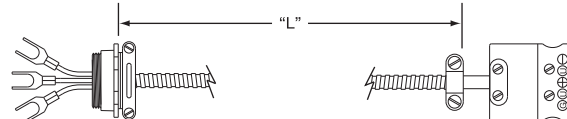
Style RPP—Plug to Plug



Style RCP—BX Connector to Plug



Style RJJ—Jack to Jack



Style RCJ—BX Connector to Jack

Ordering Code: **ECR** -

Number of Leads BOX 1

- 2 = 2-wire circuit
- 3 = 3-wire circuit
- 4 = 4-wire circuit*

*Plugs and Jacks not available

"L" Dimension BOX 4

Whole inches
001 to 999

Lead Insulation BOX 5

	Standard	w/ SS Overbraid	w/ SS Armor Cable
Fiberglass 900°F (482°C)	S	B	A
Teflon® 392°F (200°C)	T	D	F

Termination (Specify for Both Ends) BOXES 2 & 3

- B** = 2-1/2 in. Split Leads
- S** = Spade Lugs
- C** = Spade Lugs with BX Conn.
- P*** = Standard Plug
- J*** = Standard Jack
- D*** = Miniature Plug
- E*** = Miniature Jack
- X** = Other (Specify)

*Plugs and Jacks for 2- and 3-Wire Only

Special Requirements BOX 6

- X** = Specify
- 0** = None



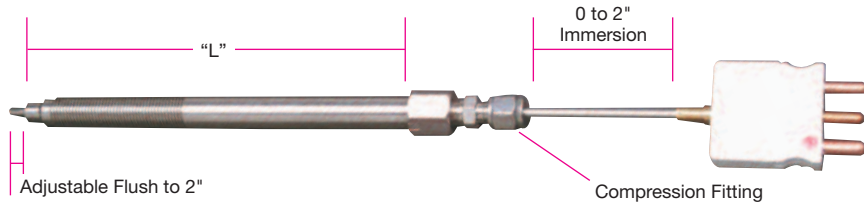
Melt Bolt RTDs for Plastics Extruders or Injection Molding Machines

Design Features

- * 3/16" diameter Probe
- * 100 ohm Class B element per IEC 751
- * 3-wire circuit
- * Can be installed wherever standard melt thermocouples are used
- * Operating temp. 392°F (200°C), 900°F (482°C) available
- * Available in 3" and 6" bolt designs
- * Bolts and Probes are 300 series stainless steel

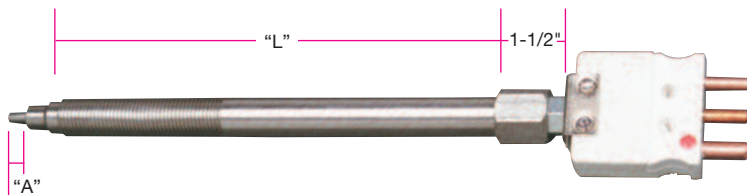
Style RT1—Adjustable Tip

- Thermocouple tip immersion length can be field adjusted from flush to 2"
- Eliminates excess inventory



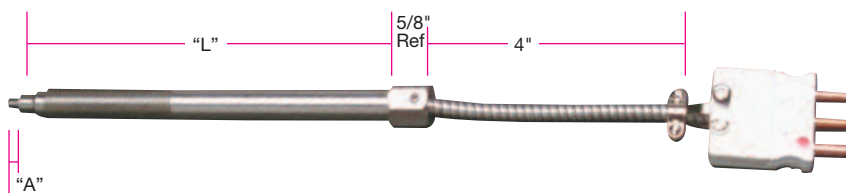
Part Number	
L = 3"	L = 6"
RTP00001	RTP00002

Style RT2—Rigid Plug Mount Fixed Tip



Part Number	"A" (in)	"L" (in)
RTP00003	Flush	3
RTP00004	1/4	3
RTP00005	1/2	3
RTP00006	3/4	3
RTP00007	1	3
RTP00008	Flush	6
RTP00009	1/4	6
RTP00010	1/2	6
RTP00011	3/4	6
RTP00012	1	6

Style RT3—Flexible Mounted Plug



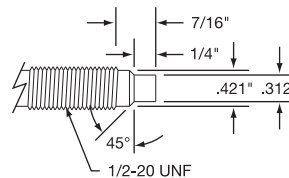
Part Number	"A" (in)	"L" (in)
RTP00013	Flush	3
RTP00014	1/4	3
RTP00015	1/2	3
RTP00016	3/4	3
RTP00017	1	3
RTP00018	Flush	6
RTP00019	1/4	6
RTP00020	1/2	6
RTP00021	3/4	6
RTP00022	1	6

Blank Melt Bolts

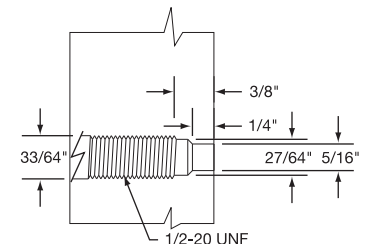
(See page 14-101)



Detailed Dimensions for Plastic Melt Bolts



Bolt-Tip Dimensions



Recommended drilling dimensions for proper mounting in extruder barrel.

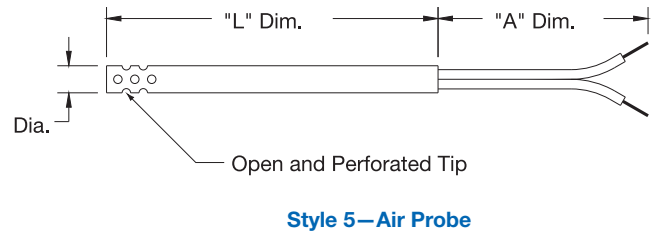
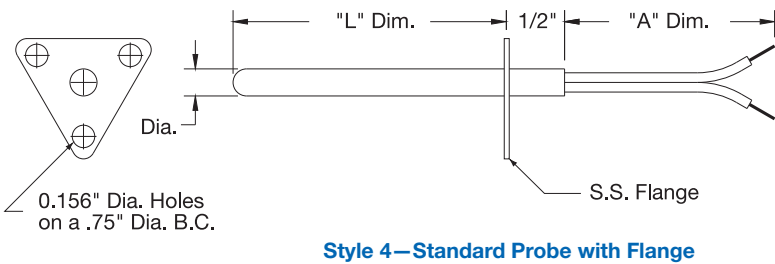
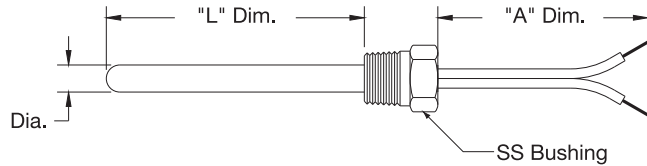
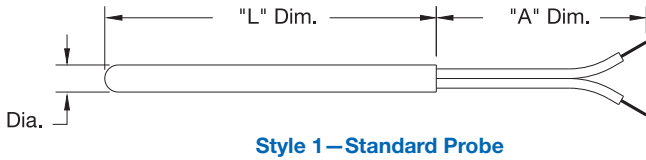


Thermistors

General Purpose NTC Thermistors

Design Features

- * 316 Stainless Steel Sheath
- * Glass Encapsulated Thermistor Element
- * Fast Response Time
- * Up to 572°F (300°C) Operating Temperature (Limited to Wire Insulation Material; See Box 8)



Ordering Code: TTR -

Style BOX 1
 1 = Standard Probe
 2 = Standard Probe with 1/8" NPT SS Bushing
 3 = Standard Probe with 1/4" NPT SS Bushing
 4 = Standard Probe with Flange
 5 = Open Air
 6 = Open Air with Flange

Diameter BOX 2
 G = 0.188" Dia.
 H = 0.250" Dia.
 X = Other (Specify)

Element Resistance BOX 3
 K = 10KΩ
 L = 20KΩ
 N = 50KΩ
 P = 100KΩ
 X = Other (Specify)

Resistance Tolerance BOX 4
 (At 25°C/77°F)
 D = +/-10% (Standard)
 C = +/-5%
 B = +/-2%
 A = +/-1%

"L" Dimension BOX 5
 Whole inches
 01 to 99

"L" Dimension BOX 6
 Fractional inches
 0 = 0" 3 = 3/8" 6 = 3/4"
 1 = 1/8" 4 = 1/2" 7 = 7/8"
 2 = 1/4" 5 = 5/8"

"A" Dimension BOX 7
 Whole inches
 001 to 999

Lead Insulation BOX 8

Fiberglass 900°F (482°C)	S	w/ SS Overbraid	B	w/ SS Armor Cable	A
Teflon® 392°F (200°C)	T		D		F

Termination BOX 9
 B = No Termination C = Spade Lugs with BX Conn.
 S = Spade Lugs X = Other (Specify)

Special Requirements BOX 10
 X = Specify
 0 = None



Precision Centigrade Temperature Sensor

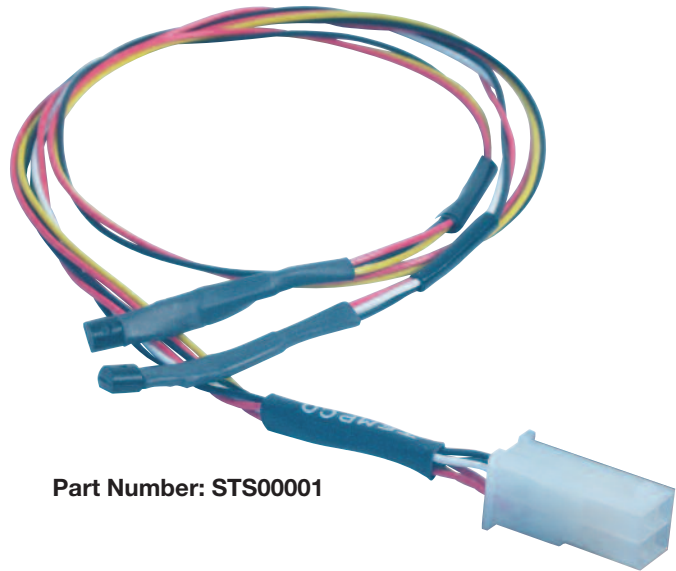
This sensor probe utilizes a dual precision integrated-circuit temperature sensor, whose output voltage is linearly proportional to the Celsius temperature.

This sensor does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4^\circ\text{C}$ at room temperature or $\pm 3/4^\circ\text{C}$ over a full -55°C to 150°C temperature range. This sensor includes a Molex 4-pin connector.

Design Features:

- * Calibrated directly in $^\circ\text{C}$
- * Linear $+10.0\text{mv}/^\circ\text{C}$ scale factor
- * $\pm 1/4^\circ\text{C}$ accuracy (at 25°C)
- * Rated to full -55°C to 150°C range
- * Suitable for remote applications
- * Operates from 4 to 30 volts
- * Less than $60\mu\text{A}$ current drain
- * Low self-heating, 0.08°C in still air
- * Nonlinearity only $\pm 1/4^\circ\text{C}$ typical
- * Low impedance output, 0.1Ω for 1mA load

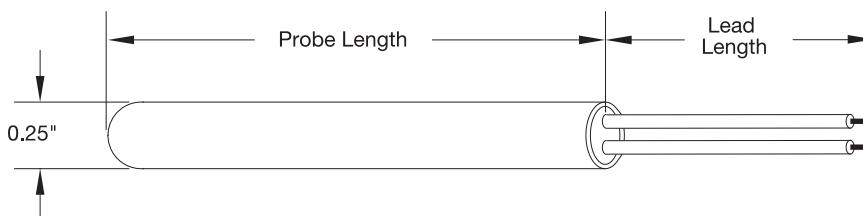
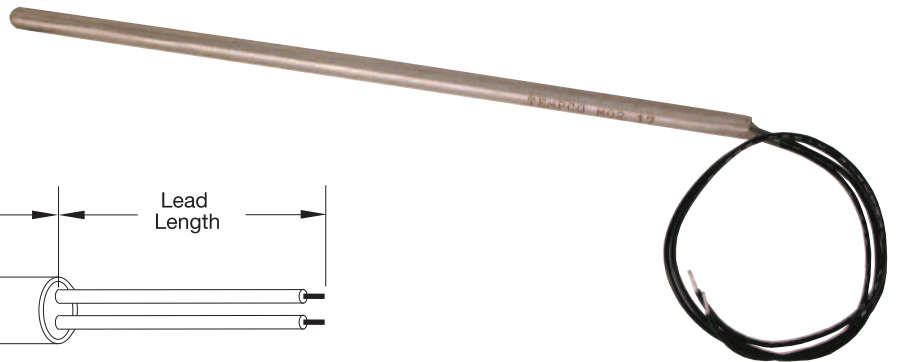
This Sensor is available in other designs and configurations. Consult Tempco with your requirements.



Part Number: STS00001

2000 Ohm RTD Sensor

This sensor probe is a fast responding 2000 ohm RTD sensor used widely in the HVAC, appliance and automotive industries. Sensor is protected in a 316 SS housing and supplied with 22 ga. Teflon® leads.



Design Features:

- * 2000 ohm nominal resistance at 20°C
- * Accurate to $\pm 0.7^\circ\text{C}$ at 20°C
- * Near linear temperature sensitivity; provides $8\Omega/^\circ\text{C}$ sensitivity
- * $\pm 3\%$ max. linearity (can be linearized to $\pm 0.2\%$)
- * Long term stability
- * Interchangeable without sensor-to-sensor recalibration
- * Operating temperature range of -40°C to $+150^\circ\text{C}$

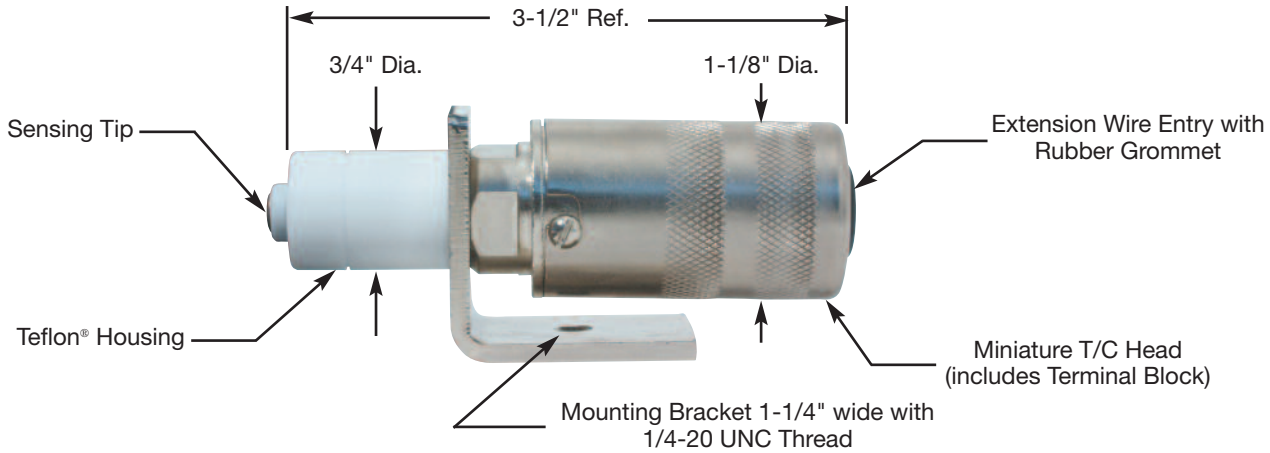
Part Number	Probe Length	Lead Length
STS00002	8"	10-1/2"
STS00003	4"	13"

This type of sensor is also available in other designs and configurations. Consult Tempco with your requirements.

Special Application Thermocouples

Spring-Loaded Surface Contact Thermocouple

This Type J thermocouple is used to sense the temperature of moving drums or rollers. Spring-loaded tip provides free movement and proper contact of the sensing tip. The sensing tip is made of copper for fast response time. Thermocouple wires are terminated in a miniature connection head and connected to a terminal block. This thermocouple can be operated up to 500°F (260°C).



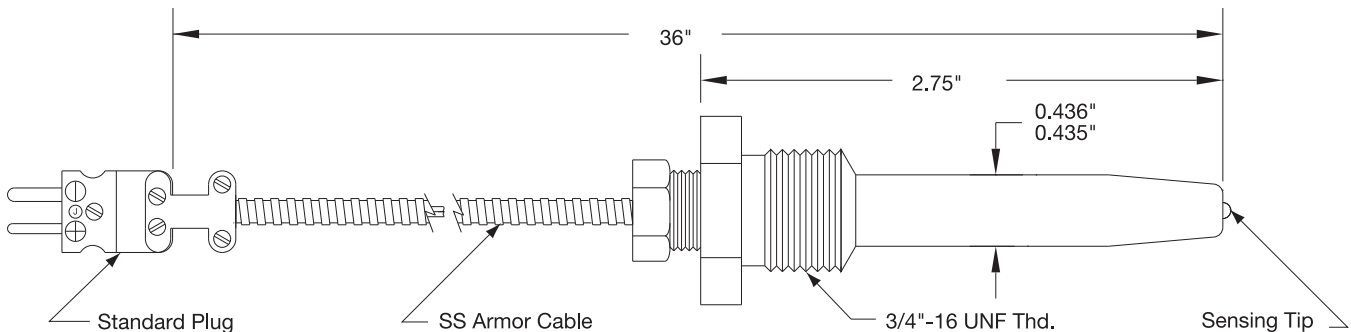
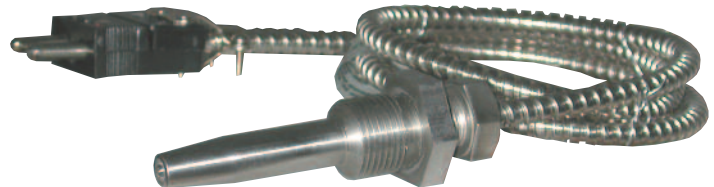
Part Number: TCP90185

Type J calibration; consult Tempco for other calibrations.

Compound Mixer Thermocouple

This Type J thermocouple is used in mixers and pelletizers. The body is made of 416 SS. The ungrounded junction, and sensing tip, is isolated from the body with a high temperature thermal barrier to ensure accuracy.

Maximum Operating Temperature: 750°F (400°C).



Part Number: TCP90231



10" Long Bezel Jack Panel for Standard Thermocouple Connectors



Design Features:

- * Accepts standard plugs.
- * Jacks are ANSI color coded, glass-filled nylon with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent.
- * Panels are manufactured from rugged, .090" thick aluminum.
- * Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- * Panels are normally supplied unassembled with all necessary hardware to assemble and install included. Can be furnished assembled at an additional cost.

Standard Sizes

Part Number	Number of Rows	Panel Height H x L (in)	Number of Jacks	Cutout Size H x L (in)
JP(⊕)00001	1	3½ × 10	12	1⅞ × 9¼
JP(⊕)00002	2	5⅜ × 10	24	3⅜ × 9¼
JP(⊕)00003	3	8⅞ × 10	36	6½ × 9¼
JP(⊕)00004	4	9⅞ × 10	48	8¼ × 9¼
JP(⊕)00005	5	12¾ × 10	60	11⅞ × 9¼
JP(⊕)00006	6	14⅞ × 10	72	12⅞ × 9¼

⊕ Insert calibration code (J, K, T, E, R, S, U) in Part Number, "U" is designated for RTDs and type B thermocouples

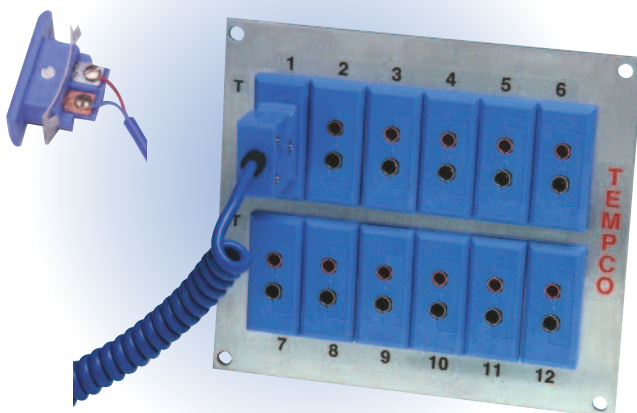


Notes: Mounting Hole Spacing: 3/16" in from each side to center of 13/64" hole (for #10 screw)

Bezel Panel Jacks are retained by a spring clip, which is installed from the rear of the panel.

Wire may be attached after jacks are installed in panel.

5-1/2" Long Bezel Jack Panel for Standard Thermocouple Connectors



Standard Sizes

Part Number	Number of Rows	Panel Height H x L (in)	Number of Jacks	Cutout Size H x L (in)
JP(⊕)00007	1	3½ × 5½	6	1⅞ × 4 ²¹ / ₃₂
JP(⊕)00008	2	5⅜ × 5½	12	3⅜ × 4 ²¹ / ₃₂
JP(⊕)00009	3	8⅞ × 5½	18	6½ × 4 ²¹ / ₃₂
JP(⊕)00010	4	9⅞ × 5½	24	8¼ × 4 ²¹ / ₃₂
JP(⊕)00011	5	12¾ × 5½	30	11⅞ × 4 ²¹ / ₃₂
JP(⊕)00012	6	14⅞ × 5½	36	12⅞ × 4 ²¹ / ₃₂

⊕ Insert calibration code (J, K, T, E, R, S, U) in Part Number, "U" is designated for RTDs and type B thermocouples



Jack Panels

Jack Panels for Miniature Thermocouple Connectors

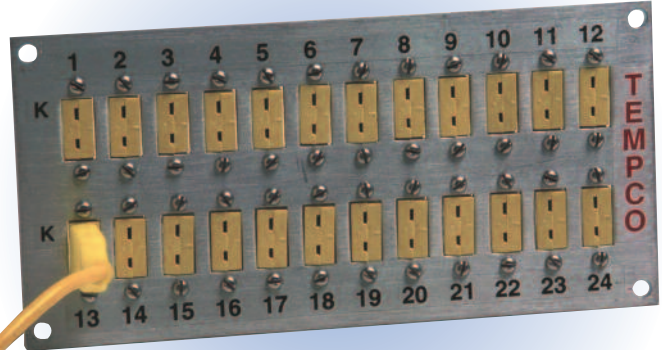
Design Features:

- * Designed to be space saving.
- * Complements modern miniature instrumentation.
- * Jack bodies are ANSI color coded, glass-filled nylon with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent.
- * Panels are manufactured of rugged .090" thick aluminum.
- * Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- * Panels are supplied unassembled for ease of wiring—all hardware necessary to assemble is included.

Standard Sizes

Part Number	Number of Rows	Panel Height H x L (in)	Number of Jacks	Cutout Size H x L (in)
JP(+)00013	1	2 ²¹ / ₃₂ x 3 ⁵ / ₈	6	1 ⁹ / ₃₂ x 3 ³ / ₃₂
JP(+)00014	2	4 ³ / ₁₆ x 3 ⁵ / ₈	12	2 ¹⁵ / ₁₆ x 3 ³ / ₃₂
JP(+)00015	3	5 ³¹ / ₃₂ x 3 ⁵ / ₈	18	4 ¹⁹ / ₃₂ x 3 ³ / ₃₂
JP(+)00016	4	7 ⁷ / ₈ x 3 ⁵ / ₈	24	6 ¹ / ₄ x 3 ³ / ₃₂
JP(+)00017	1	2 ²¹ / ₃₂ x 6 ⁵ / ₈	12	1 ⁹ / ₃₂ x 6 ¹ / ₁₆
JP(+)00018	2	4 ³ / ₁₆ x 6 ⁵ / ₈	24	2 ¹⁵ / ₁₆ x 6 ¹ / ₁₆
JP(+)00019	3	5 ³¹ / ₃₂ x 6 ⁵ / ₈	36	4 ¹⁹ / ₃₂ x 6 ¹ / ₁₆
JP(+)00020	4	7 ⁷ / ₈ x 6 ⁵ / ₈	48	6 ¹ / ₄ x 6 ¹ / ₁₆

- + Insert calibration code (J, K, T, E, R, S, U) in Part Number, "U" is designated for RTDs and type B thermocouples



Note: Mounting Hole Spacing: 3/16" in from each side to center of 13/64" hole (for #10 screw)

Ordering Information

Catalog Jack Panels

Order by Part Number

Custom Engineered/Manufactured Jack Panels

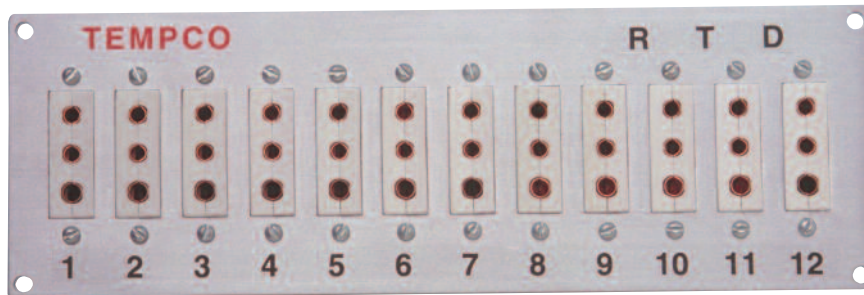
For sizes and styles not listed, TEMPCO will design and manufacture a Jack Panel to meet your specifications. **Standard lead time is 2 weeks.**

Please Specify the following:

- Overall Dimensions
- Type of Jack (Standard or Miniature)
- Number of Jacks (Circuits)
- Number of Rows
- Calibration



Jack Panels for Standard 3-pin Connectors



Standard Sizes

Part Number	Number of Rows	Panel Height H x L (in)	Number of Jacks	Cutout Size H x L (in)
JP(✚)00021	1	3 $\frac{1}{2}$ x 5 $\frac{1}{4}$	6	2 $\frac{3}{32}$ x 4 $\frac{15}{32}$
JP(✚)00022	2	6 $\frac{1}{32}$ x 5 $\frac{1}{4}$	12	4 $\frac{21}{32}$ x 4 $\frac{15}{32}$
JP(✚)00023	3	8 $\frac{1}{32}$ x 5 $\frac{1}{4}$	18	7 $\frac{7}{32}$ x 4 $\frac{15}{32}$
JP(✚)00024	4	11 $\frac{5}{32}$ x 5 $\frac{1}{4}$	24	9 $\frac{25}{32}$ x 4 $\frac{15}{32}$
JP(✚)00025	1	3 $\frac{1}{2}$ x 9 $\frac{3}{4}$	12	2 $\frac{7}{32}$ x 8 $\frac{31}{32}$
JP(✚)00026	2	6 $\frac{1}{32}$ x 9 $\frac{3}{4}$	24	4 $\frac{21}{32}$ x 8 $\frac{31}{32}$
JP(✚)00027	3	8 $\frac{1}{32}$ x 9 $\frac{3}{4}$	36	7 $\frac{9}{32}$ x 8 $\frac{31}{32}$
JP(✚)00028	4	11 $\frac{5}{32}$ x 9 $\frac{3}{4}$	48	9 $\frac{25}{32}$ x 8 $\frac{31}{32}$

✚ Insert calibration code (J, K, T, E, R, S, U) in Part Number, "U" is designated for RTDs and type B thermocouples.

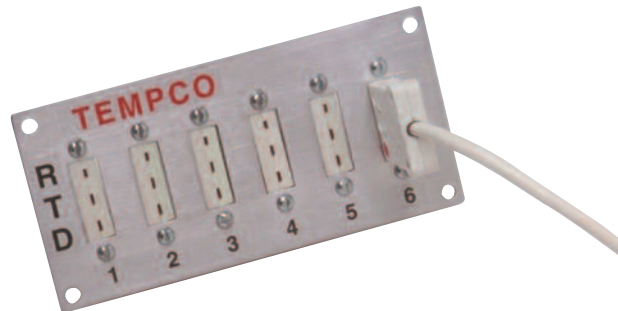
Design Features:

- * For use with RTDs and shielded thermocouples requiring 3 wires.
- * Will accept standard 3-Pin connectors.
- * Jack bodies are ANSI color coded, glass-filled nylon with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent.
- * Panels are manufactured of rugged .090" thick aluminum.
- * Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- * Panels are supplied unassembled for ease of wiring — all hardware necessary to assemble is included.



Note: Mounting Hole Spacing: 3/16" in from each side to center of 13/64" hole (for #10 screw)

Jack Panels for Miniature 3-Pin Connectors



Standard Sizes

Part Number	Number of Rows	Panel Height H x L (in)	Number of Jacks	Cutout Size H x L (in)
JP(✚)00029	1	2 $\frac{15}{16}$ x 4 $\frac{3}{4}$	6	1 $\frac{1}{16}$ x 4 $\frac{3}{32}$
JP(✚)00030	2	4 $\frac{1}{16}$ x 4 $\frac{3}{4}$	12	3 $\frac{1}{16}$ x 4 $\frac{3}{32}$
JP(✚)00031	3	6 $\frac{1}{16}$ x 4 $\frac{3}{4}$	18	5 $\frac{1}{16}$ x 4 $\frac{3}{32}$
JP(✚)00032	4	8 $\frac{1}{16}$ x 4 $\frac{3}{4}$	24	7 $\frac{1}{16}$ x 4 $\frac{3}{32}$
JP(✚)00033	1	2 $\frac{15}{16}$ x 9	12	1 $\frac{1}{16}$ x 8 $\frac{15}{32}$
JP(✚)00034	2	4 $\frac{1}{16}$ x 9	24	3 $\frac{1}{16}$ x 8 $\frac{15}{32}$
JP(✚)00035	3	6 $\frac{1}{16}$ x 9	36	5 $\frac{1}{16}$ x 8 $\frac{15}{32}$
JP(✚)00036	4	8 $\frac{1}{16}$ x 9	48	7 $\frac{1}{16}$ x 8 $\frac{15}{32}$

✚ Insert calibration code (J, K, T, E, R, S, U) in Part Number, "U" is designated for RTDs and type B thermocouples

Design Features:

- * For use with RTDs and shielded thermocouples requiring 3 wires.
- * Complements modern miniature instrumentation.
- * Jack bodies are ANSI color coded, glass-filled nylon with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent.
- * Panels are manufactured of rugged .090" thick aluminum.
- * Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- * Panels are supplied unassembled for ease of wiring—all hardware necessary to assemble is included.



Note: Mounting Hole Spacing: 3/16" in from each side to center of 13/64" hole (for #10 screw)

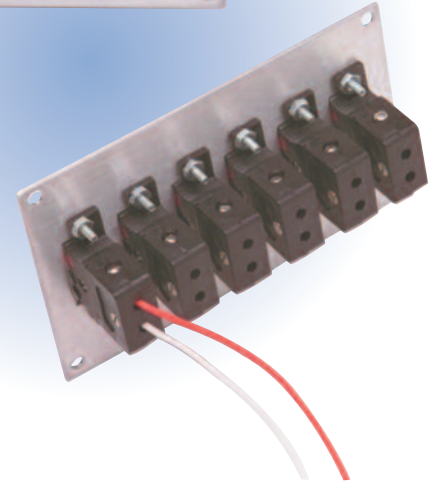
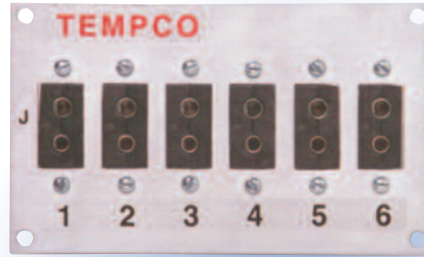


Jack Panels

Jack Panels — Jab-In Style Termination

Design Features:

- * Accepts Standard Plugs.
- * Jacks will accept up to 14-gauge wire.
- * Jack bodies are ANSI color coded, glass-filled nylon with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent.
- * Panels are manufactured of rugged .090" thick aluminum.
- * Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- * Jack rows are placed further apart than standard Jack Panels for ease of termination.
- * Panels are supplied unassembled for ease of wiring — all hardware necessary to assemble is included.



Standard Sizes

Part Number	Number of Rows	Panel Height H x L (in)	Number of Jacks	Cutout Size H x L (in)
JP(+)00037	1	3½ x 5½	6	1¾ x 4 ² / ₃₂
JP(+)00038	2	5 ³ / ₁₆ x 5½	12	3 ³ / ₁₆ x 4 ² / ₃₂
JP(+)00039	3	8 ¹ / ₈ x 5½	18	6 ¹ / ₂ x 4 ² / ₃₂
JP(+)00040	1	3½ x 10	12	1¾ x 9¼
JP(+)00041	2	5 ³ / ₁₆ x 10	24	3 ³ / ₁₆ x 9¼
JP(+)00042	3	8 ¹ / ₈ x 10	36	6 ¹ / ₂ x 9¼

- * Insert calibration code (J, K, T, E, R, S, U) in Part Number, "U" is designated for RTDs and type B thermocouples



Note: Mounting Hole Spacing: 3/16" in from each side to center of 13/64" hole (for #10 screw).

To help ease installation:
Optional Ratchet Screwdriver

Part Number:
TUL-101-101



Ordering Information

Catalog Jack Panels
Order by Part Number

Custom Engineered/Manufactured Jack Panels

For sizes and styles not listed, TEMPCO will design and manufacture a Jack Panel to meet your specifications. **Standard lead time is 2 weeks.**

Please Specify the following:

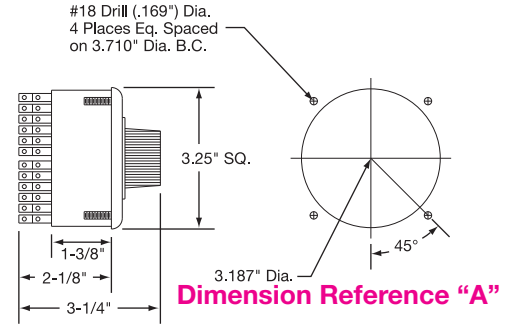
- Overall Dimensions
- Type of Jack (Standard or Miniature)
- Number of Jacks (Circuits)
- Number of Rows
- Calibration



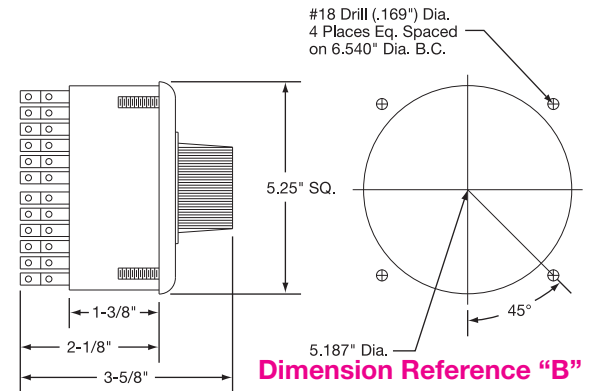
Thermocouple and RTD Selector Switch

Design Features:

- * Available in 6 to 36 positions.
- * 2-pole and 3-pole circuits with "OFF" position.
- * Silver-plated blades and contacts with self-cleaning wiper action and low contact resistance.
- * Terminals are silver-plated brass with numbered circuits and polarity identification.
- * "OFF" position has terminals available for shorting input circuit when using it with a digital meter (not available on 3-pole).
- * High-impact GE Noryl™ case.



Number of Positions	Circuit Type	Dimensions Reference	Part Number
6	2-Pole	A	TCA-124-101
10	Break Before Make	A	TCA-124-102
12	2-Pole	A	TCA-124-103
18	Make Before Break	A	TCA-124-104
20	Make Before Break	A	TCA-124-105
24	2-Pole	B	TCA-124-106
36	Make Before Break	B	TCA-124-107
6	3-Pole	B	TCA-124-108
12	Make Before Break	B	TCA-124-109
18	Make Before Break	B	TCA-124-110
24	Make Before Break	B	TCA-124-111



Circular Panel Jacks

Design Features:

- * Available in standard and miniature sizes (2-pin only).
- * Used where individual jacks are required to fit in standard electrical knockouts.
- * Standard jack fits in 3/4" (1-1/8" dia.) electrical knockout.
- * Miniature jack fits in 1/2" (7/8" dia.) electrical knockout.
- * Jacks are ANSI color coded with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent.
- * Both the standard and miniature jacks install from the front of the panel with no additional hardware required.

Standard Jack

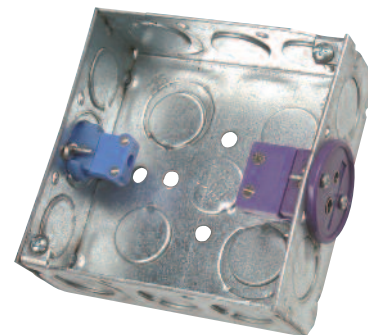


Miniature Jack



ANSI Calibration	Body Color	Part Number	
		Standard	Miniature
J	Black	TCA-102-167	TCA-102-174
K	Yellow	TCA-102-168	TCA-102-175
T	Blue	TCA-102-169	TCA-102-176
E	Purple	TCA-102-170	TCA-102-177
R/S	Green	TCA-102-171	TCA-102-178
U*	White	TCA-102-172	TCA-102-179
N	Orange	TCA-102-173	—

* "U" is designated for RTDs and type B thermocouples



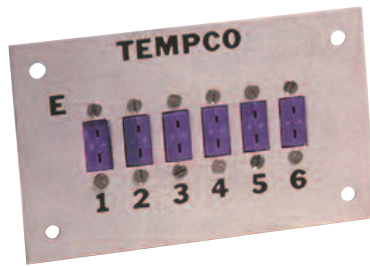
Example of Electrical Box Mount



Jack Panels

Jack Panels

Panel Only



For FS Box



Panel and Box Assembly

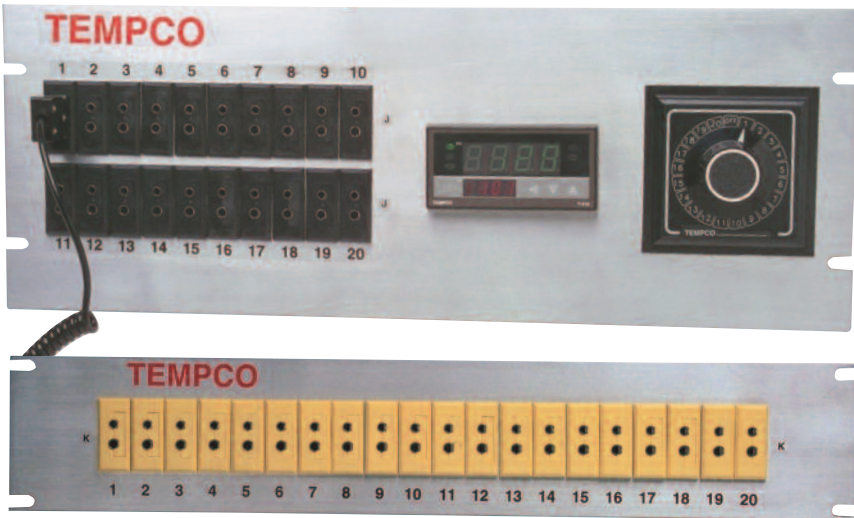
Design Features:

- * Jack Panels are designed to be used with standard FS Style boxes.
- * Panels are manufactured of rugged .090" thick aluminum.
- * Panels are designed to accept the safest maximum number of Jacks.
- * Available for Standard and Miniature Jacks, 2-pin or 3-pin.
- * Rated for 350°F (177°C) continuous and 400°F (204°C) intermittent.
- * Panels measure 2-13/16" high × 4-1/2" long.

Jack Style	Number of Jacks	Part Number	
		Panel Only	Panel and Box Assembly
Standard 2-Pin Bezel Mount	4	JP(+)00043	JP(+)00060
Standard 2-Pin Jab-In Mount	4	JP(+)00044	JP(+)00062
Standard 3-Pin	4	JP(+)00045	JP(+)00063
Miniature 2-Pin	6	JP(+)00046	JP(+)00059
Miniature 3-Pin	4	JP(+)00047	JP(+)00064

+ Insert calibration code (J, K, T, E, R, S, U) in Part Number, "U" is designated for RTDs and type B thermocouples

Custom-Made 19" Rack Panels



Design Features:

- * Panels are made of .090" thick aluminum with a smooth mill finish.
- * All panels have slotted holes positioned at E.I.A. standard spacing.
- * Panels are available with any of the standard or miniature Panel Jacks shown in this section.
- * Rack Panels come in standard heights of 3-1/2", 5-1/4", 7", and 8-1/4".
- * Panels are supplied unassembled for ease of wiring—all hardware to assemble is included.

Ordering Information

Rack Panels are custom made.

Custom Engineered/Manufactured Rack Panels

TEMPCO can manufacture a Rack Panel to meet your specifications. **Standard lead time is 2 weeks.**

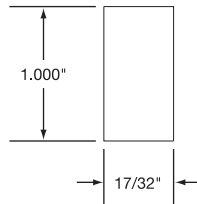
Please Specify the following:

- | | |
|---------------------------------------------------------------|---------------------------------------------|
| <input type="checkbox"/> Panel Size | <input type="checkbox"/> Calibration(s) |
| <input type="checkbox"/> Type of Jack (Standard or Miniature) | <input type="checkbox"/> Panel Meter Style |
| <input type="checkbox"/> Number of Jacks (circuits) | <input type="checkbox"/> Switch—if required |
| <input type="checkbox"/> Number of Rows | |



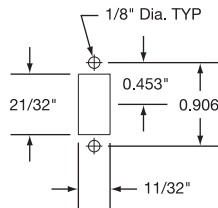
Panel Jacks — Standard and Miniature

Bezel Mount Standard Jack



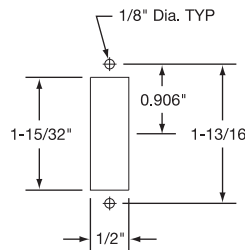
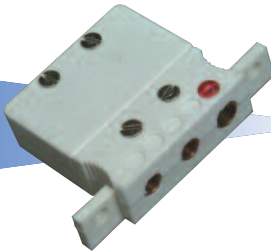
ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-137
K	Yellow	TCA-102-138
T	Blue	TCA-102-139
E	Purple	TCA-102-140
R/S	Green	TCA-102-141
U*	White	TCA-102-142
N	Orange	TCA-102-180

Miniature 2-Pin Panel Jack



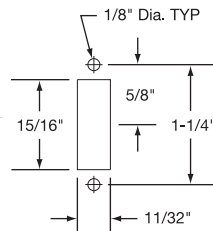
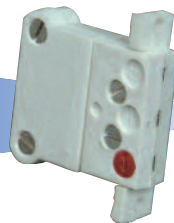
ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-143
K	Yellow	TCA-102-144
T	Blue	TCA-102-145
E	Purple	TCA-102-146
R/S	Green	TCA-102-147
U*	White	TCA-102-148

Standard 3-Pin Panel Jack



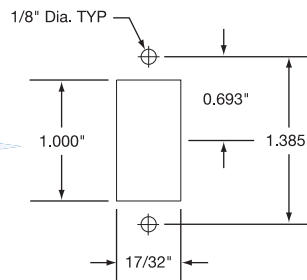
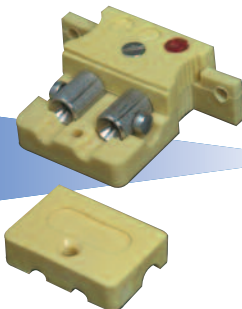
ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-149
K	Yellow	TCA-102-150
T	Blue	TCA-102-151
E	Purple	TCA-102-152
R/S	Green	TCA-102-153
U*	White	TCA-102-154

Miniature 3-Pin Panel Jack



ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-155
K	Yellow	TCA-102-156
T	Blue	TCA-102-157
E	Purple	TCA-102-158
R/S	Green	TCA-102-159
U*	White	TCA-102-160

Panel Mount Standard Jab-In Jack



ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-161
K	Yellow	TCA-102-162
T	Blue	TCA-102-163
E	Purple	TCA-102-164
R/S	Green	TCA-102-165
U*	White	TCA-102-166



Note: All panel jacks have the same high quality features as their non-panel counterparts and include hardware for mounting.

* "U" is designated for RTDs and type B thermocouples

Panel Jacks are rated for 350°F (177°C) continuous and 400°F (204°C) intermittent.



Standard Thermowells for Industrial Applications



Velocity Ratings of Wells

Well failures, in most cases, are not due to the effects of pressure and temperature. The calculations necessary to provide adequate strength under given conditions are familiar enough to permit proper choice of wall thickness and material.

Less familiar, and more dangerous, are the vibrational effects to which wells are subjected. Fluid, flowing by the well, forms a turbulent wake (called the Von Karman Trail) which has a definite frequency based on the diameter of the well and the velocity of the fluid. It is important that the well has sufficient stiffness so that the wake frequency will never equal the natural frequency of the well itself. If the natural frequency of the well were to coincide with the wake frequency, the well would vibrate to destruction and break off in the piping.

On the following pages, a recommended velocity rating can be found for every standard well length and material cataloged. To reduce the complexity of presenting this information, the ratings are based on operating temperatures of 1000°F for wells made of Carbon Steel (C-1018), ANSI 304, and ANSI 316. Values for Brass wells are based on 350°F operation. Limits for Monel are based on 900°F service. Slightly higher velocity is possible at lower temperatures.

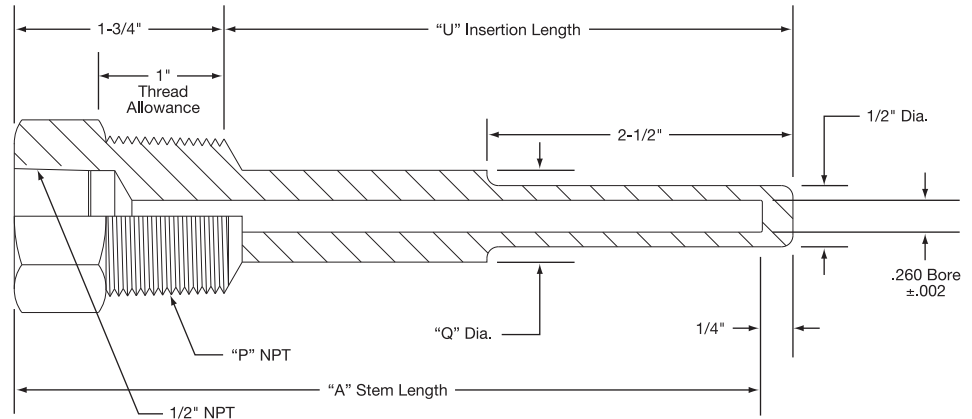
Where single values appear in the velocity tables, these may be considered safe for water, steam, air or gas. In the shorter insertion lengths, consideration is given to the velocity pressure effect of water flowing at higher velocities. The values in parentheses, therefore, represent safe values for water flow, while the unbracketed value may be used for steam, air, gas and fluids of similar density.

It should be pointed out that the values given are extremely conservative, and intended primarily as a guide. Wells are also safe if the resonant frequency is well below the wake frequency or if the fluid velocity is constantly fluctuating through the critical velocity point. Nevertheless, if the installation is not hampered by the use of a sufficiently stiff well, we recommend the values should not be exceeded.

If you have operating conditions requiring special well designs, our engineering staff is available to assist you. Consult Tempco with your requirements.



Series 10 Straight Shank with .260 Bore for 1/4" Diameter Elements Standard Duty Threaded



Ordering Information

Complete the Part Number by filling in the box with the number designating the material.

- 1 = Steel
- 2 = Brass
- 3 = 316 Stainless Steel
- 4 = 304 Stainless Steel
- 5 = Monel

Standard Sizes

Part Number	External Thread "P"	Stem Length "A" (in)	Insertion Length "U" (in)	Shank Diameter "Q" (in)
TWL1011	1/2" NPT	4	2 1/2	—
TWL1012		6	4 1/2	3/8
TWL1013		9	7 1/2	5/8
TWL1014		12	10 1/2	3/4
TWL1015		15	13 1/2	5/8
TWL1016		18	16 1/2	3/4
TWL1018		24	22 1/2	5/8
TWL1021		3/4" NPT	4	2 1/2
TWL1022	6		4 1/2	3/4
TWL1023	9		7 1/2	3/4
TWL1024	12		10 1/2	3/4
TWL1025	15		13 1/2	3/4
TWL1026	18		16 1/2	3/4
TWL1028	24		22 1/2	3/4
TWL1031	1" NPT	4	2 1/2	—
TWL1032		6	4 1/2	7/8
TWL1033		9	7 1/2	7/8
TWL1034		12	10 1/2	7/8
TWL1035		15	13 1/2	7/8
TWL1036		18	16 1/2	7/8
TWL1038		24	22 1/2	7/8

Maximum Fluid Velocity, Feet Per Second (See Velocity Ratings on page 14-76)

Well Type	Material	Insertion Length — "U" (in)							
		2 1/2	4 1/2	7 1/2	10 1/2	13 1/2	16 1/2	19 1/2	22 1/2
1/2" Series 10 and 15	Brass	207 (59.3)	75.5 (32.2)	27.3 (19.7)	13.9	8.4	5.6	4.1	3.0
	Carbon Steel	290 (106)	105 (59)	38.2 (36.3)	19.4	11.8	7.8	5.7	4.2
	A.I.S.I. 304 & 316	300 (148)	109 (82.2)	39.5	20.1	12.2	8.1	5.9	4.4
	Monel	261 (118)	95 (65.5)	34.4	17.5	10.5	7.1	5.2	3.8
3/4" Series 10 and 15	Brass	207 (59.3)	89.1 (39.8)	32.2 (23.9)	16.4	9.9	6.6	4.8	3.6
	Carbon Steel	290 (106)	123 (71.2)	44.9 (42.7)	22.8	13.8	9.3	6.7	4.9
	A.I.S.I. 304 & 316	300 (148)	128 (99.3)	46.4	23.6	14.3	9.6	6.9	5.1
	Monel	261 (118)	112 (79.8)	40.6	20.7	12.4	8.3	6.1	4.5
1" Series 10 and 15	Brass	207 (59.3)	102 (47.6)	37.0 (28)	18.8	11.4	7.6	5.5	4.1
	Carbon Steel	290 (106)	143 (84.3)	51.6 (50.6)	26.2	15.9	10.6	7.6	5.7
	A.I.S.I. 304 & 316	300 (148)	148 (117)	53.5	27.2	16.5	11.0	7.9	5.9
	Monel	261 (118)	128 (93.3)	46.7	23.7	14.4	9.5	6.9	5.1



Note: Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parentheses in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.

* See Page 14-78 for Maximum Pressure — Temperature Ratings *



Thermowells

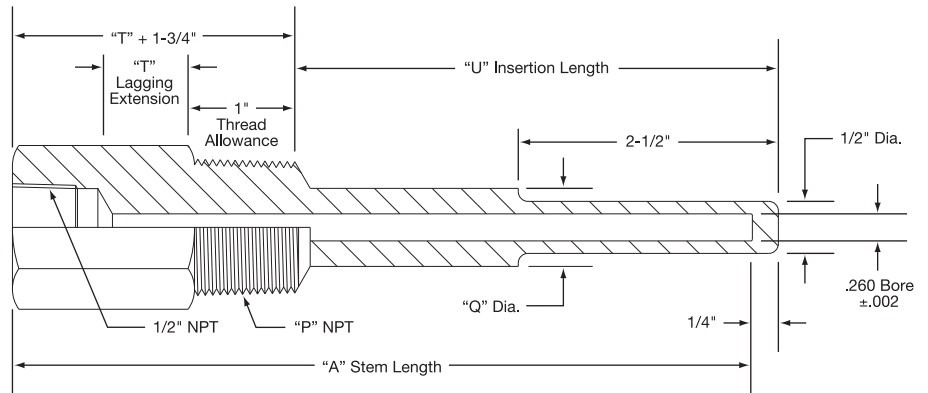
Series 15 Straight Shank — Lagging Extension Type with .260" Bore for 1/4" Diameter Elements Standard Duty Threaded



Ordering Information

Complete the Part Number by filling in the box with the number designating the material.

- 1 = Steel**
- 2 = Brass**
- 3 = 316 Stainless Steel**
- 4 = 304 Stainless Steel**
- 5 = Monel**



Standard Sizes

Part Number	External Thread "P"	Stem Length "A" (in)	Insertion Length "U" (in)	Lag Extension "T" (in)	Shank Diameter "Q" (in)
TWL1511 <input type="checkbox"/>	1/2" NPT	6	2 1/2	2	—
TWL1512 <input type="checkbox"/>		9	4 1/2	3	5/8
TWL1513 <input type="checkbox"/>		12	7 1/2	3	5/8
TWL1514 <input type="checkbox"/>		15	10 1/2	3	5/8
TWL1515 <input type="checkbox"/>		18	13 1/2	3	5/8
TWL1517 <input type="checkbox"/>		24	19 1/2	3	5/8
TWL1521 <input type="checkbox"/>	3/4" NPT	6	2 1/2	2	—
TWL1522 <input type="checkbox"/>		9	4 1/2	3	3/4
TWL1523 <input type="checkbox"/>		12	7 1/2	3	3/4
TWL1524 <input type="checkbox"/>		15	10 1/2	3	3/4
TWL1525 <input type="checkbox"/>		18	13 1/2	3	3/4
TWL1527 <input type="checkbox"/>		24	19 1/2	3	3/4
TWL1531 <input type="checkbox"/>	1" NPT	6	2 1/2	3	—
TWL1532 <input type="checkbox"/>		9	4 1/2	3	7/8
TWL1533 <input type="checkbox"/>		12	7 1/2	3	7/8
TWL1534 <input type="checkbox"/>		15	10 1/2	3	7/8
TWL1535 <input type="checkbox"/>		18	13 1/2	3	7/8
TWL1536 <input type="checkbox"/>		24	19 1/2	3	7/8
TWL1537 <input type="checkbox"/>		24	19 1/2	3	7/8

Pressure — Temperature Rating (lbs. per square inch)

Material	Temperature						
	70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
Brass	5000	4222	1000	—	—	—	—
Carbon Steel	5200	5000	4800	4600	3500	1500	—
A.I.S.I. 304	7000	6200	5600	5400	5200	4500	1650
A.I.S.I. 316	7000	7000	6400	6200	6100	5100	2500
Monel	6500	6000	5400	5300	5200	1500	—

See Page 14-77 for Maximum Fluid Velocity, Feet Per Second

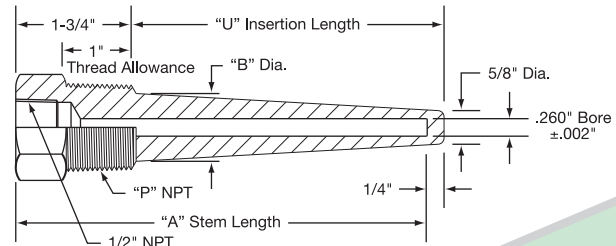


Series 20 Tapered Shank with .260" Bore for 1/4" Diameter Elements

Heavy Duty Threaded

Series 20 Standard Sizes

Part Number	External Thread "P"	Element Length "A" (in)	Insertion Length "U" (in)	Shank Diameter "B" (in)
TWL2021	3/4" NPT	4	2 1/2	—
TWL2022		6	4 1/2	7/8
TWL2023		9	7 1/2	7/8
TWL2024		12	10 1/2	7/8
TWL2025		15	13 1/2	7/8
TWL2026		18	16 1/2	7/8
TWL2028	24	22 1/2	7/8	
TWL2031	1" NPT	4	2 1/2	—
TWL2032		6	4 1/2	1 1/16
TWL2033		9	7 1/2	1 1/16
TWL2034		12	10 1/2	1 1/16
TWL2035		15	13 1/2	1 1/16
TWL2036		18	16 1/2	1 1/16
TWL2038		24	22 1/2	1 1/16



Thermowells are available in the following materials: Steel, Brass, 316 Stainless Steel, 304 Stainless Steel and Monel.

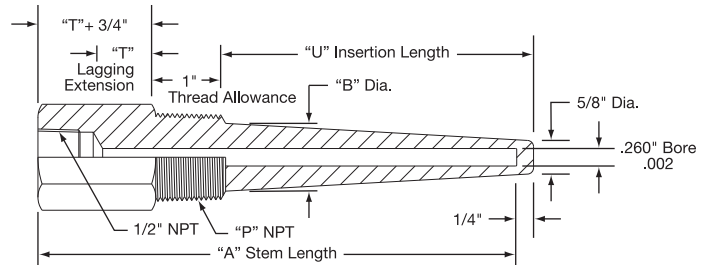
For Ordering Information See Page 14-78

Series 25 Tapered Shank-Lagging Extension Type with .260" Bore for 1/4" Diameter Elements

Heavy Duty Threaded

Series 25 Standard Sizes

Part Number	External Thread "P"	Lagging Extension "T" (in)	Stem Length "A" (in)	Insert Length "U" (in)	Shank Diameter "B" (in)
TWL2521	3/4" NPT	2	6	2 1/2	—
TWL2522		3	9	4 1/2	7/8
TWL2523		3	12	7 1/2	7/8
TWL2524		3	15	10 1/2	7/8
TWL2525		3	18	13 1/2	7/8
TWL2527		3	24	19 1/2	7/8
TWL2531	1" NPT	2	6	2 1/2	—
TWL2532		3	9	4 1/2	1 1/16
TWL2533		3	12	7 1/2	1 1/16
TWL2534		3	15	10 1/2	1 1/16
TWL2535		3	18	13 1/2	1 1/16
TWL2537		3	24	19 1/2	1 1/16



Maximum Fluid Velocity Feet Per Second (See Velocity Ratings on page 14-76)

Well Type	Material	Insertion Length — "U" (in)							
		2 1/2	4 1/2	7 1/2	10 1/2	13 1/2	16 1/2	19 1/2	22 1/2
3/4" Series 20 and 25	Brass	305 (97.5)	93.8 (54.1)	33.9	17.1	10.5	7.0	5.0	3.7
	Carbon Steel	386 (175)	180 (97.2)	65.3 (58.3)	33.0	20.1	13.4	9.6	7.1
	A.I.S.I. 304 & 316	440 (243)	197 (135)	71.2	36.0	22.0	14.7	10.5	7.8
	Monel	354 (195)	155 (108)	56.1	28.4	17.3	11.6	7.5	5.6
1" Series 20 and 25	Brass	354 (161)	108 (89.5)	39.4	19.8	12.2	8.1	5.8	4.3
	Carbon Steel	448 (289)	209 (161)	75.7	38.4	23.3	15.5	11.1	8.2
	A.I.S.I. 304 & 316	490 (403)	228 (225)	82.5	41.8	25.5	17.1	12.2	9.1
	Monel	410 (322)	179 (178)	65.1	33.0	20.1	13.5	8.7	6.5



Note: Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parentheses in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.

Pressure — Temperature Rating (lbs. per square inch)

Material	Temperature						
	70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
Brass	5300	4750	1100	—	—	—	—
Carbon Steel	5950	5750	5450	5250	4000	1750	—
A.I.S.I. 304	7800	7050	6400	6150	6000	5190	1875
A.I.S.I. 316	7800	7800	7250	7100	6950	5800	2720
Monel	7450	6850	6150	6100	5940	1750	—

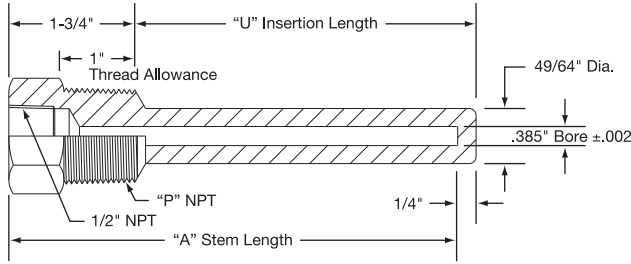
Temperature Sensing



Thermowells

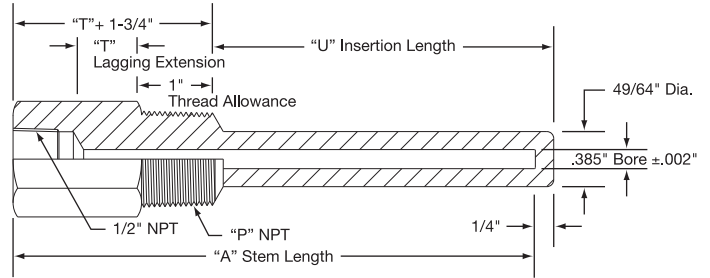
Series 30 Straight Shank with .385" Bore for 3/8" Diameter Elements

Standard Duty Threaded



Series 35 Straight Shank — Lagging Extension Type with .385" Bore for 3/8" Diameter Elements

Standard Duty Threaded



Series 30 Standard Sizes

Part Number	External Thread "P"	Stem Length "A" (in)	Insertion Length "U" (in)
TWL3021	3/4" NPT	4	2 1/2
TWL3022		6	4 1/2
TWL3023		9	7 1/2
TWL3024		12	10 1/2
TWL3025		15	13 1/2
TWL3026		18	16 1/2
TWL3028		24	22 1/2
TWL3031	1" NPT	4	2 1/2
TWL3032		6	4 1/2
TWL3033		9	7 1/2
TWL3034		12	10 1/2
TWL3035		15	13 1/2
TWL3036		18	16 1/2
TWL3038		24	22 1/2

Series 35 Standard Sizes

Part Number	External Thread "P"	Lagging Extension "T" (in)	Stem Length "A" (in)	Insert Length "U" (in)
TWL3521	3/4" NPT	2	6	2 1/2
TWL3522		3	9	4 1/2
TWL3523		3	12	7 1/2
TWL3524		3	15	10 1/2
TWL3525		3	18	13 1/2
TWL3527		3	24	19 1/2
TWL3531	1" NPT	2	6	2 1/2
TWL3532		3	9	4 1/2
TWL3533		3	12	7 1/2
TWL3534		3	15	10 1/2
TWL3535		3	18	13 1/2
TWL3537		3	24	19 1/2

Thermowells are available in the following materials: Steel, Brass, 316 Stainless Steel, 304 Stainless Steel and Monel.

For Ordering Information See Page 14-78

Pressure — Temperature Rating (lbs. per square inch)

Material	Temperature						
	70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
Brass	5000	4222	1000	—	—	—	—
Carbon Steel	5200	5000	4800	4600	3500	1500	—
A.I.S.I. 304	7000	6200	5600	5400	5200	4500	1650
A.I.S.I. 316	7000	7000	6400	6200	6100	5100	2500
Monel	6500	6000	5400	5300	5200	1500	—

Maximum Fluid Velocity Feet Per Second

(See Velocity Ratings on page 14-76)

Material	Insertion Length — "U" (in)							
	2 1/2	4 1/2	7 1/2	10 1/2	13 1/2	16 1/2	19 1/2	22 1/2
Brass	290 (145)	150 (80)	54.1 (48)	27.6	16.7	11.1	8.0	6.0
Carbon Steel	326 (260)	192 (144)	69.5	35.4	20.5	14.3	10.3	7.7
A.I.S.I. 304 & 316	349 (360)	199	71.9	36.6	21.2	14.8	10.7	8.0
Monel	316 (320)	189 (178)	68.1	34.8	20.8	14.0	10.0	7.5

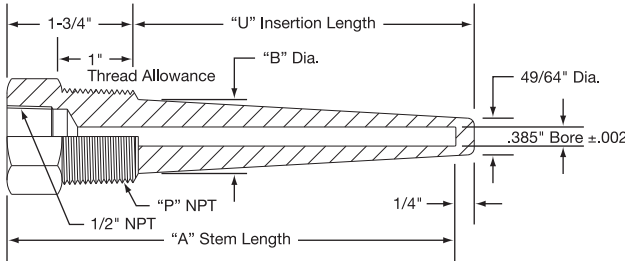


Note: Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parentheses in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.



Series 40 Tapered Shank with .385" Bore for 3/8" Diameter Elements

Heavy Duty Threaded

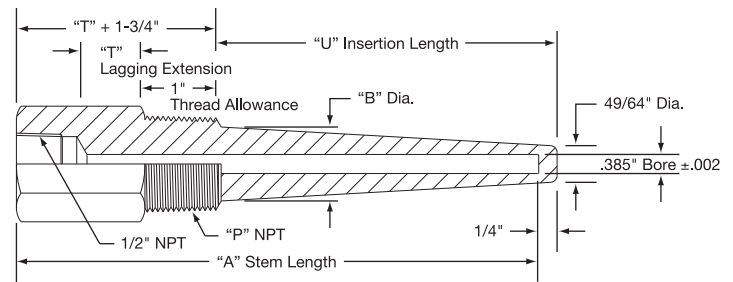


Series 40 Standard Sizes

Part Number	External Thread "P"	Stem Length "A" (in)	Insertion Length "U" (in)	Shank Diameter "B" (in)
TWL4021	3/8" NPT	4	2 1/2	7/8
TWL4022		6	4 1/2	7/8
TWL4023		9	7 1/2	7/8
TWL4024		12	10 1/2	7/8
TWL4025		15	13 1/2	7/8
TWL4026		18	16 1/2	7/8
TWL4028		24	22 1/2	7/8
TWL4031	1" NPT	4	2 1/2	1 1/16
TWL4032		6	4 1/2	1 1/16
TWL4033		9	7 1/2	1 1/16
TWL4034		12	10 1/2	1 1/16
TWL4035		15	13 1/2	1 1/16
TWL4036		18	16 1/2	1 1/16
TWL4038		24	22 1/2	1 1/16

Series 45 Tapered Shank — Lagging Extension Type with .385" Bore for a 3/8" Diameter Element

Heavy Duty Threaded



Series 45 Standard Sizes

Part Number	External Thread "P"	Lag. Exten. "T" (in)	Stem Length "A" (in)	Insert Length "U" (in)	Shank Diameter "B" (in)
TWL4521	3/8" NPT	2	6	2 1/2	7/8
TWL4522		3	9	4 1/2	7/8
TWL4523		3	12	7 1/2	7/8
TWL4524		3	15	10 1/2	7/8
TWL4525		3	18	13 1/2	7/8
TWL4527		3	24	19 1/2	7/8
TWL4531		1" NPT	2	6	2 1/2
TWL4532	3		9	4 1/2	1 1/16
TWL4533	3		12	7 1/2	1 1/16
TWL4534	3		15	10 1/2	1 1/16
TWL4535	3		18	13 1/2	1 1/16
TWL4537	3		24	19 1/2	1 1/16

Thermowells are available in the following materials: Steel, Brass, 316 Stainless Steel, 304 Stainless Steel and Monel.

For Ordering Information See Page 14-78

Pressure — Temperature Rating (lbs. per square inch)

Material	Temperature						
	70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
Brass	5000	4222	1000	—	—	—	—
Carbon Steel	5200	5000	4800	4600	3500	1500	—
A.I.S.I. 304	7000	6200	5600	5400	5200	4500	1650
A.I.S.I. 316	7000	7000	6400	6200	6100	5100	2500
Monel	6500	6000	5400	5300	5200	1500	—

Maximum Fluid Velocity Feet Per Second

(See Velocity Ratings on page 14-76)

Well Type	Material	Insertion Length — "U" (in)							
		2 1/2	4 1/2	7 1/2	10 1/2	13 1/2	16 1/2	19 1/2	22 1/2
3/8" Series 40 and 45	Brass	276 (127)	124 (79)	44.0	22.0	13.0	8.0	6.0	4.0
	Carbon Steel	352 (228)	191 (114)	68.9	35.0	21.0	14.0	10.0	7.5
	A.I.S.I. 304 & 316	415 (299)	203 (154)	73.2	37.3	22.5	15.0	11.0	8.0
	Monel	340 (255)	172 (134)	62.0	31.0	19.0	12.8	8.0	6.0
1" Series 40 and 45	Brass	321 (150)	129 (83.5)	46.8	23.6	14.5	9.6	6.9	5.1
	Carbon Steel	410 (270)	249 (150)	90.3	45.6	27.8	18.5	13.2	9.8
	A.I.S.I. 304 & 316	483 (350)	272 (208)	97.3	49.7	30.4	20.3	14.5	10.7
	Monel	396 (306)	214 (167)	77.5	39.2	23.8	16.0	10.3	7.7



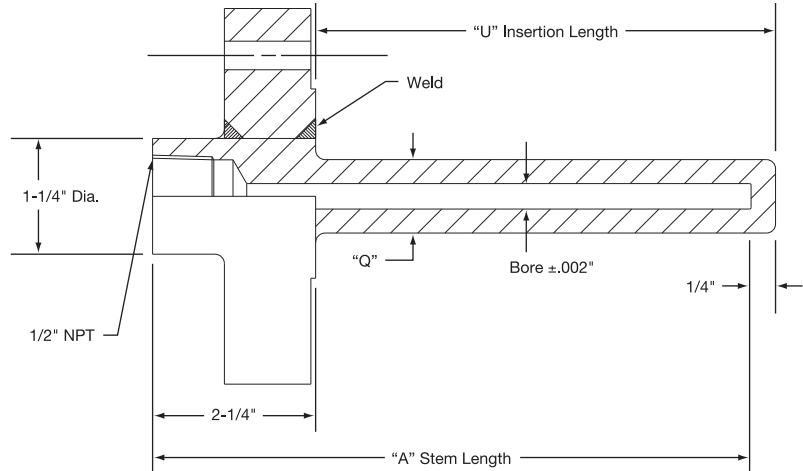
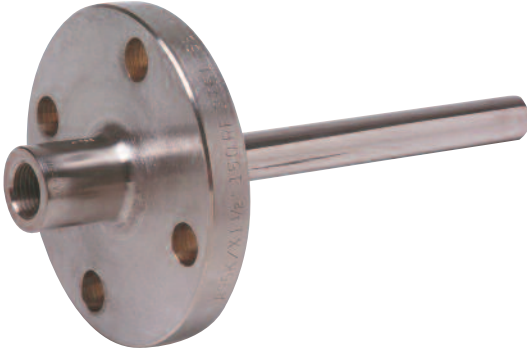
Note: Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parentheses in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.



Thermowells

Series 50 (.260" Bore) & Series 55 (.385" Bore) for 1/4" and 3/8" Diameter Elements

Flanged



Standard Sizes

"U" (in)	"A" (in)	Part Number			
		1" Flange .260 Bore Q = 3/4"		1 1/2" Flange .385 Bore Q = 7/8"	
2	4	TWL5021	TWL5521	TWL5028	TWL5528
4	6	TWL5022	TWL5522	TWL5029	TWL5529
7	9	TWL5023	TWL5523	TWL5030	TWL5530
10	12	TWL5024	TWL5524	TWL5031	TWL5531
13	15	TWL5025	TWL5525	TWL5032	TWL5532
16	18	TWL5026	TWL5526	TWL5033	TWL5533
22	24	TWL5027	TWL5527	TWL5034	TWL5534

• Flanges are 150-lb. Raised Face. Other Facings and Pressure Ranges are available.

Ordering Information

Complete the Part Number by filling in the box with the number designating the material.

- 1 = Steel**
- 2 = Brass**
- 3 = 316 Stainless Steel**
- 4 = 304 Stainless Steel**
- 5 = Monel**

Maximum Fluid Velocity Feet Per Second

(See Velocity Ratings on page 14-76)

Well Type	Material	Insertion Length – "U" (in)						
		2	4	7	10	13	16	22
Series 50 and 60	Carbon Steel	404 (129)	184 (71.2)	67.0 (42.7)	34.0	20.6	13.7	7.4
	A.I.S.I. 304 & 316	430 (179)	192 (99.3)	69.7 (59.6)	35.4	21.5	14.3	7.7
	Monel	350 (143)	168 (79.8)	61 (47.7)	31.0	18.8	12.5	6.7
Series 55 and 65	Carbon Steel	410 (152)	248 (84.3)	91.3 (50.6)	45.7	27.6	18.5	10.0
	A.I.S.I. 304 & 316	444 (211)	258 (117)	95.2 (70.3)	47.6	28.8	19.3	10.4
	Monel	338 (168)	226 (93.3)	83.3 (56.0)	41.6	25.2	16.9	9.1



Note: Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parentheses in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.

Maximum Flange Pressure – Temperature Rating

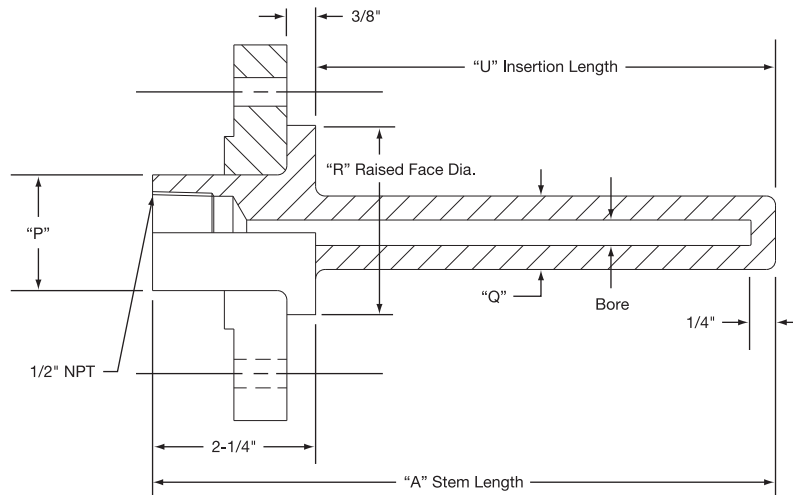
(lbs. per square inch)

Material	Temperature °F			
	0°	800°	1000°	1125°
Carbon Steel	2500	2500	—	—
A.I.S.I. 304	2500	2500	2500	—
A.I.S.I. 316	2500	2500	2500	2500
Monel	2500	2500	—	—



Series 60 (.260" Bore) & Series 65 (.385" Bore) for 1/4" and 3/8" Elements

Van Stone



Standard Sizes

"U" (in)	"A" (in)	Part Number			
		1" Flange R = 2", P = 1.315"		1 1/2" Flange R = 2 7/8", P = 1.900"	
		.260 Bore Q = 3/4"	.385 Bore Q = 7/8"	.260 Bore Q = 3/4"	.385 Bore Q = 7/8"
2	4	TWL6021 <input type="checkbox"/>	TWL6521 <input type="checkbox"/>	TWL6028 <input type="checkbox"/>	TWL6528 <input type="checkbox"/>
4	6	TWL6022 <input type="checkbox"/>	TWL6522 <input type="checkbox"/>	TWL6029 <input type="checkbox"/>	TWL6529 <input type="checkbox"/>
7	9	TWL6023 <input type="checkbox"/>	TWL6523 <input type="checkbox"/>	TWL6030 <input type="checkbox"/>	TWL6530 <input type="checkbox"/>
10	12	TWL6024 <input type="checkbox"/>	TWL6524 <input type="checkbox"/>	TWL6031 <input type="checkbox"/>	TWL6531 <input type="checkbox"/>
13	15	TWL6025 <input type="checkbox"/>	TWL6525 <input type="checkbox"/>	TWL6032 <input type="checkbox"/>	TWL6532 <input type="checkbox"/>
16	18	TWL6026 <input type="checkbox"/>	TWL6526 <input type="checkbox"/>	TWL6033 <input type="checkbox"/>	TWL6533 <input type="checkbox"/>
22	24	TWL6027 <input type="checkbox"/>	TWL6527 <input type="checkbox"/>	TWL6034 <input type="checkbox"/>	TWL6534 <input type="checkbox"/>

• Catalog Part Numbers fit 1" and 1-1/2" Lap Joint Flanges

Ordering Information

Complete the Part Number by filling in the box with the number designating the material.

- 1** = Steel
- 2** = Brass
- 3** = 316 Stainless Steel
- 4** = 304 Stainless Steel
- 5** = Monel



Thermowell Corrosive Service Guide

Thermowell Corrosive Service Guide

Corrodent	Temp. °F	Conc. %	Recommended Material
Acetic Acid	212	All	Monel
Acetic Anhydride	300		Nickel
Acetone	212	All	304 SS
Acetylene	400		304 SS
Alcohols	212	All	304 SS
Alum (Potassium or Sodium)	300	All	Hast. C
Aluminum Chloride	212	All	Hast. B
Aluminum Sulfate	212	All	316 SS
Ammonia, Dry	212	All	304 SS, 316 SS
Ammonium Chloride	300	50%	Monel
Ammonium Hydroxide (Ammonia, Aqua)	212	All	304 SS, 316 SS
Ammonium Nitrate	300	All	304 SS
Ammonium Sulfate	212	All	316 SS
Amyl Acetate	300	All	304 SS
Aniline	75		Monel
Asphalt	250		304 SS
Atmosphere, (Industrial and Marine)			304 SS
Barium Compounds	See Calcium		
Beer	70		304 SS
Benzene (Benzol)	212		Steel
Benzoic Acid	212	All	316 SS
Bleaching Powder	70	15%	Monel
Borax	212	All	Brass
Bordeaux Mixture	200		304 SS
Boric Acid	400	All	316 SS
Bromine	125	Dry	Monel
Butane	400	All	Steel
Butyl Alcohol	See Alcohols		
Butyric Acid	212		Hast. C
Calcium Bisulphite	75	All	Hast. C
Calcium Chloride	212	All	Hast. C
Calcium Hydroxide	300	20%	Hast. C
Calcium Hypochlorite	See Bleaching Powder		
Carbolic Acid	See Phenol		
Carbon Dioxide, Dry	800	All	Brass
Carbon Disulfide	200		304 SS
Carbon Tetrachloride	125	All	Monel
Carbonated Beverages	212		304 SS
Carbonated Water	212	All	304 SS
Chloracetic Acid	212	All	Monel
Chlorine, Dry	100		Monel
Chlorine, Moist	100	All	Monel
Chloroform, Dry	212		Monel
Chromic Acid	300	All	Hast. C
Cider	300	All	304 SS
Citric Acid	212	All	Hast. C
Copper (10) Chloride	212	All	Hast. C
Copper (10) Nitrate	300	All	316 SS
Copper (10) Sulfate	300	All	316 SS
Copper Plating Solution (Acid)	75		304 SS
Copper Plating Solution (Cyanide)	180		304 SS
Corn Oil	200		304 SS
Creosote	200	All	304 SS
Crude Oil	300		Monel
Ethanol	See Alcohols		
Ethyl Acetate	See Lacquer Thinner		
Ethyl Chloride, Dry	500		Steel
Ethylene Glycol (Uninhibited)	212	All	304 SS
Ethylene Oxide	75		Steel
Fatty Acids	500	All	316 SS
Ferric Chloride	75	All	Hast. C
Ferric Sulfate	300	All	304 SS
Formaldehyde	212	40%	316 SS
Formic Acid	300	All	316 SS
Fluorine, Anhydrous	100		304 SS
Freon	300		Steel
Furfural	450		316 SS
Gasoline	300		Steel
Glucose	300		304 SS
Glue ph 6-8	300	All	304 SS
Glycerine	212	All	Brass
Hydrobromic Acid	212	All	Hast. C

Corrodent	Temp. °F	Conc. %	Recommended Material
Hydrochloric Acid (37-38%)	225	All	Hast. B
Hydrocyanic Acid	212	All	304 SS
Hydrofluogilicic Acid	212	40%	Monel
Hydrofluoric Acid	212	60%	Monel
Hydrogen Chloride, Dry	500		304 SS
Hydrogen Fluoride, Dry	175		Steel
Hydrogen Peroxide	125	10-100%	304 SS
Kerosene	300	All	Steel
Lacquers & Thinners	300	All	304 SS
Lactic Acid	300	All	316 SS
Lime	212	All	316 SS
Linseed Oil	75		Steel
Magnesium Chloride	212	50%	Nickel
Magnesium Hydroxide (or Oxide)	75	All	304 SS
Magnesium Sulfate	212	40%	304 SS
Mercuric Chloride	75	10%	Hast. C
Mercury	700	100%	Steel
Methyl Chloride, Dry	75		Steel
Methylene Chloride	212	All	304 SS
Milk, fresh or sour	180		304 SS
Molasses	See Glucose		
Natural Gas	70		304 SS
Nitric Acid	75	All	304 SS
Nitric Acid	110	All	316 SS
Oleic Acid	See Fatty Acids		
Oxalic Acid	212	All	Monel
Oxygen	75	All	Steel
Palmitic Acid	See Fatty Acids		
Phenol	212	All	316 SS
Phosphoric Acid	212	All	316 SS
Photographic Bleaching	100	All	304 SS
Potassium Compounds	See Sodium Compounds		
Propane	300		Steel
Rosin	700	100%	316 SS
Salt or Brine	See Sodium Chloride		
Sea Water	75		Monel
Soap & Detergents	212	All	304 SS
Sodium Bicarbonate	212	20%	316 SS
Sodium Bisulfate	212	20%	304 SS
Sodium Bisulfite	212	20%	304 SS
Sodium Carbonate	212	40%	316 SS
Sodium Chloride	300	30%	Monel
Sodium Chromate	212	All	316 SS
Sodium Cyanide	212	All	304 SS
Sodium Hydroxide	212	30%	316 SS
Sodium Hypochlorite	75	10%	Hast. C
Sodium Nitrate	212	40%	304 SS
Sodium Nitrite	75	20%	316 SS
Sodium Phosphate	212	10%	Steel
Sodium Silicate	212	10%	Steel
Sodium Sulfate	212	30%	316 SS
Sodium Sulfide	212	10%	316 SS
Sodium Sulfite	212	30%	304 SS
Sodium Thiosulfate	212	All	304 SS
Steam			304 SS
Stearic Acid	See Fatty Acids		
Sugar Solutions	See Glucose		
Sulfur	500		304 SS
Sulfur Chloride	75	Dry	316 SS
Sulfur Dioxide	500	Dry	316 SS
Sulfur Trioxide	500	Dry	316 SS
Sulfuric Acid	212	10%	316 SS
Sulfuric Acid	212	10-90%	Hast. B
Sulfuric Acid	212	90-100%	Hast. B
Sulfuric Acid, Fuming	175		Carp. 20
Sulfurous Acid	75	20%	316 SS
Tannic Acid	75	40%	Hast. B
Titanium Tetrachloride	75	All	316 SS
Toluene	75		Steel
Trichloroacetic Acid	75	All	Hast. B
Trichlorethylene	300	Dry	Monel
Turpentine	75		316 SS
Varnish	150		Steel
Zinc Chloride	212	All	Hast. B
Zinc Sulfate	212	All	316 SS

CAUTION This information is given as a guide only. Final material selection should be made by the user based on their knowledge of the application.

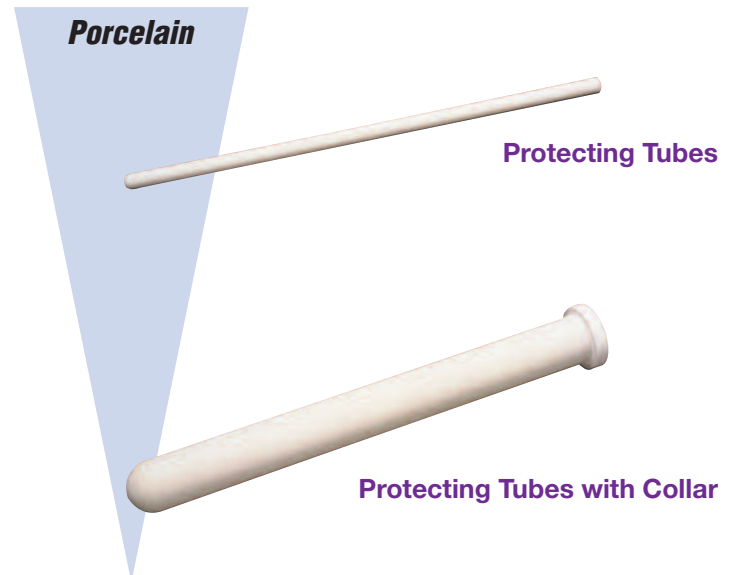


Ceramic Protection Tubes Application Data

Ceramic Protection Tubes are used in applications where contamination from hostile environments or the cutting action of concentrated and direct flame impingement are factors. Such conditions usually require a noble metal thermocouple such as platinum and platinum alloys.

When selecting assemblies using ceramic components, the expected maximum temperatures must be considered. At elevated temperatures, some ceramic materials go through a glass phase. As silica is a prime contaminant of platinum, alumina protecting tubes and insulators are recommended for temperatures exceeding 2000°F (1093°C).

Material	Maximum Operating Temperature	Thermal Shock Characteristics	Maximum Available Length (in)	Typical Applications	Remarks
Alumina (99.7%)	3100°F (1700°C)	Fair (preheating to 900°F [482°C] recommended)	84	Iron, Barium, crown glass; non-ferrous metals; gas-tight protection for noble metal thermocouples in excess of 2400°F (1316°C)	Sags at 2900°F (1593°C) Prevents dry hydrogen penetration
Porcelain (Mullite)	2550°F (1400°C)	Poor (preheating to 900°F [482°C] recommended)	84	Non-ferrous metals; gas-tight protection for noble metal thermocouples to 2400°F (1316°C)	Sags at 2550°F (1400°C) Prone to attack by halogen gases; some penetration of dry hydrogen. Contains silica.



Part Number	I.D. x O.D. †	Construction	Length
APT-101- <input type="text"/>	¼" x ⅜"	Plain End	12" thru 48" in 6" increments
APT-102- <input type="text"/>	⅞" x 1⅞"	Plain End	12" thru 60" in 6" increments
APT-103- <input type="text"/>	¾" x 1"	Plain End	12" thru 72" in 6" increments
APT-104- <input type="text"/>	1" x 1¼"	Plain End	12" thru 72" in 6" increments
APT-105- <input type="text"/>	¼" x ⅜"	With Hex Fitting	12" thru 48" in 6" increments
APT-106- <input type="text"/>	⅞" x 1⅞"	With Hex Fitting	12" thru 60" in 6" increments

Part Number	I.D. x O.D. †	Construction	Length
PPT-101- <input type="text"/>	¼" x ⅜"	Plain End	12" through 84" in 6" increments
PPT-102- <input type="text"/>	⅞" x 1⅞"	Plain End	
PPT-103- <input type="text"/>	¾" x 1"	Plain End	
PPT-104- <input type="text"/>	1" x 1¼"	Plain End	
PPT-105- <input type="text"/>	¼" x ⅜"	w/ Collar Approx. ⅝" x ¾"	
PPT-106- <input type="text"/>	⅞" x 1⅞"	w/ Collar Approx. ⅝" x 1⅞"	
PPT-107- <input type="text"/>	¾" x 1"	w/ Collar Approx. ⅝" x 1⅜"	
PPT-108- <input type="text"/>	1" x 1¼"	w/ Collar Approx. ⅝" x 1⅝"	
PPT-109- <input type="text"/>	¼" x ⅜"	w/Hex Fitting	
PPT-110- <input type="text"/>	⅞" x 1⅞"	w/Hex Fitting	

Ordering Information

Complete the Part Number with 3 digits indicating length in whole inches.

Example: = APT-105- is 12" long and PPT-107- is 48" long.

† Dimensional tolerance:
Up to 1" Dia. ±5% or .025", whichever is greater
Over 1" Dia. ±4% or .050", whichever is greater



Metal Protection Tubes

Metal Protection Tubes

For longer life and continued accuracy, most thermocouples in industrial applications should be protected from physical damage, corrosion, and contamination by some type of

protecting tube or well. Metal tubes selected to suit the temperature, pressure and atmosphere are generally used with base metal thermocouples.



Typical Metal Protection Tube



Typical Cast Iron Protection Tube

Material	Maximum Operating Temperature	Typical Applications	Remarks
304 Stainless	1800°F (982°C)	Food and Dairy Products, Petroleum Products, Mild Acids, Alkalies	Embrittles in 800°F (427°C) to 1400°F (760°C) range.
Cast Iron	1300°F (704°C)	Molten Aluminum, Gas Ducts	Withstands sulphur and caustic solutions.
316 Stainless	1800°F (982°C)	Food and Dairy Products, Petroleum Products, Mild Acids, Alkalies	Greater corrosion resistance than 304 Stainless.
446 Stainless	2000°F (1093°C)	Sulphurous Atmospheres such as Hydrogen Sulphide, Neutral Salt Baths	Excellent resistance to corrosion and oxidation at high temperatures. Do not use in carburizing atmospheres.
Inconel 601®	2200°F (1204°C)	Neutral Salt Baths, Carburizing and Nitriding Atmospheres	Good resistance to corrosion at high temperatures; excellent resistance to oxidation at high temperatures. Do not use in carburizing atmospheres above 1000°F (538°C).
Black Steel Pipe per ASTM A120	1200°F (649°C)	Molten Babbitt, Tin, Lead, and Magnesium	Low Cost

304 Stainless Steel (8% Nickel-18% Chrome)

Part Number	I.D. x O.D.	NPT Thread	Const.	Length
*MPT-101-___	.622" x .840"	½"	Welded	12" and over in 6" increments
*MPT-102-___	.824" x 1.050"	¾"	Welded	
*MPT-103-___	1.049" x 1.315"	1"	Welded	

*If extra heavy wall is desired, specify.

446 Stainless Steel (28% Chrome Iron)

Part Number	I.D. x O.D.	NPT Thread	Const.	Length
MPT-109-___	.622" x .840"	½"	Seamless	12" and over in 6" increments
MPT-110-___	.824" x 1.050"	¾"	Seamless	
MPT-111-___	1.049" x 1.315"	1"	Seamless	

Cast Iron

Part Number	I.D. x O.D.	NPT Thread	Const.	Length
MPT-104-___	¾" x 1½"	¾" Int.*	Cast	12" thru 72" in 6" increments
MPT-105-___	¾" x 1½"	1" Ext.	Cast	12" thru 48" in 6" increments

*1" NPT external thread available on special request.

Inconel Alloy 601® (60% Nickel-23% Chrome-14% Iron)

Part Number	I.D. x O.D.	NPT Thread	Const.	Length
MPT-112-___	.622" x .840"	½"	Seamless	12" and over in 6" increments
MPT-113-___	.824" x 1.050"	¾"	Seamless	
MPT-114-___	1.049" x 1.315"	1"	Seamless	

316 Stainless Steel

Part Number	I.D. x O.D.	NPT Thread	Const.	Length
MPT-106-___	.622" x .840"	½"	Welded	12" and over in 6" increments
MPT-107-___	.824" x 1.050"	¾"	Welded	
MPT-108-___	1.049" x 1.315"	1"	Welded	

Black Steel Pipe (Per ASTM A120)

Part Number	I.D. x O.D.	NPT Thread	Const.	Length
MPT-115-___	.364" x .540"	¼"	Welded	12" and over in 6" increments
MPT-116-___	.302" x .540"	¼"	Welded	
MPT-117-___	.546" x .840"	½"	Welded	
MPT-118-___	.742" x 1.050"	¾"	Welded	
MPT-119-___	.957" x 1.315"	1"	Welded	

Ordering Information

Complete the Part Number with 3 digits indicating length in whole inches.

Example: = MPT-105-**012** is 12" long and
MPT-107-**048** is 48" long.



Bayonet Type Adapters



Spring-Loaded Bayonet Cap Type Thermocouples are used in conjunction with bayonet adapters. After inserting the thermocouple sheath through the adapter the spring is compressed and locked by the cap, pushing the sensing junction tight against the surface being measured for increased accuracy and faster response time.

Adapter Selection and Installation

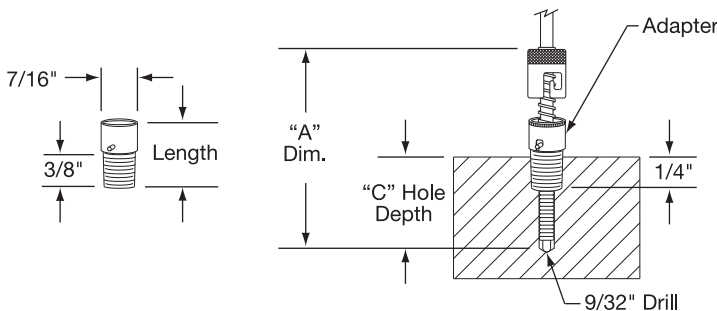
1. Select an adapter length by comparing the hole depth and thermocouple probe length in Table 1A.
2. Select from Table 1B a thread type for the adapter length determined in Table 1A.

Table 1A—Adapter Length for Bayonet Type Thermocouples (page 14-4) and RTDs (page 14-62)

Hole "C" (in)	Probe Length A (in)		
	7/8" Long Adapter	1-3/8" Long Adapter	2-1/2" Long Adapter
1/4 to 1/2	1 5/8	2	3 3/8
1/2 to 1	2	2 1/2	3 3/4
1 to 1 1/2	2 1/2	3	4 1/8
2 to 2 1/2	3 1/2	4	5 1/8
2 1/2 to 3	4	4 1/2	5 5/8
3 to 3 1/2	4 1/2	5	6 1/8
3 1/2 to 4	5	5 1/2	6 5/8
4 to 4 1/2	5 1/2	6	7 1/8
4 1/2 to 5	6	6 1/2	7 5/8
5 to 5 1/2	6 1/2	7	8 1/8
5 1/2 to 6	7	7 1/2	8 5/8
6 to 6 1/2	7 1/2	8	9 1/8

Table 1B—Bayonet Adapter for Threaded Type Thermocouples and RTDs

Part Number	Length (in)	Thread	Material
TCA-104-101	3/8	1/8"-27 NPT	Plated Steel
TCA-104-103	1 1/8	1/8"-27 NPT	Plated Steel
TCA-104-121	1 1/2	1/8"-27 NPT	Plated Steel
TCA-104-118	2	1/8"-27 NPT	Plated Steel
TCA-104-105	2 1/2	1/8"-27 NPT	Plated Steel
TCA-104-115	3 1/2	1/8"-27 NPT	Plated Steel
TCA-104-110	4	1/8"-27 NPT	Plated Steel
TCA-104-102	7/8	3/8"-24 UNF	Plated Steel
TCA-104-104	1 3/8	3/8"-24 UNF	Plated Steel
TCA-104-106	2 1/2	3/8"-24 UNF	Plated Steel
TCA-104-107	2 3/8	14 × 1.5mm	Stainless Steel
TCA-104-108	2 1/2	10 × 1.5mm	Plated Steel
TCA-104-111	2 1/2	12 × 1mm	Plated Steel
†TCA-104-116	2 1/2	12 × 1.5mm	Plated Steel
TCA-104-126	2	12 × 1mm	Plated Steel
†TCA-104-127	1	12 × 1mm	Plated Steel
TCA-104-128	1	12 × 1.75mm	Plated Steel
TCA-104-131	3	12 × 1mm	Plated Steel
TCA-104-132	5	12 × 1mm	Plated Steel



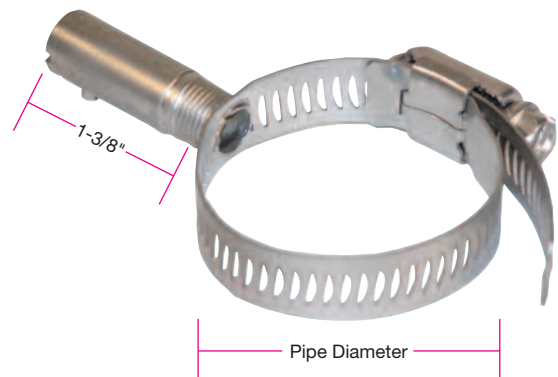
†Must be used with 12 mm ID bayonet caps

Pipe Clamp Adapters for Bayonet Type Thermocouples

Spring-loaded bayonet cap type thermocouples are used in conjunction with bayonet adapters. After inserting the thermocouple sheath through the adapter the spring is compressed and locked by the cap, pushing the sensing junction tight against the surface being measured for increased accuracy and faster response time.

Pipe Clamp adapters permit thermocouple placement without the drilling and tapping of holes to attach the adapter.

Part Number	Pipe Diameter (in)	
	Min.	Max.
TCH00001	1/2	7/8
TCH00002	7/8	1 1/2
TCH00003	1 3/16	2 1/4
TCH00004	2 1/4	3 3/16
TCH00005	3 3/16	4 1/4
TCH00006	4 3/16	5 1/4





Protection Tube Mounting Parts

For Ceramic Tubes



FTG-148-101
FTG-148-102

Part Number	Description
FTG-148-101	3/4" NPT x 1/2" NPT Brass reducing hex nipple for PPT-102-□ or APT-102-□ tube
FTG-148-102	3/4" NPT x 1/2" NPT Steel reducing hex nipple for PPT-102-□ or APT-102-□ tube



FLG-122-101
FLG-122-102
FLG-122-103



FTG-149-101
FTG-149-102
FTG-149-103



FTG-150-101
FTG-150-102
FTG-150-103

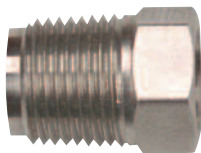
For Metal Tubes

Part Number	Description
FLG-122-101	1 5/16" I.D. x 3 1/2" Cast Iron Flange for 1/2" IPS
FLG-122-102	1 1/4" I.D. x 3 9/16" Cast Iron Flange for 3/4" IPS
FLG-122-103	1 7/16" I.D. x 3 11/16" Cast Iron Flange for 1" IPS
FTG-149-101	1/2" NPT x 1/2" NPT Malleable 90° Elbow
FTG-149-102	3/4" NPT x 3/4" NPT Malleable 90° Elbow
FTG-149-103	1" NPT x 1" NPT Malleable 90° Elbow
FTG-150-101	1/2" NPT x 1/2" NPT Universal Elbow
FTG-150-102	3/4" NPT x 3/4" NPT Universal Elbow
FTG-150-103	1" NPT x 1" NPT Universal Elbow

Sensor Mounting Fixed Fittings

Mounting fittings are sometimes necessary for the installation of thermocouple and RTD probes. The two basic types of fixed fittings are the Hex Bushing and the Hex Nipple, most commonly made of either Brass or Stainless Steel.

Fixed fittings are brazed to the sheath of the probe; therefore the immersion length "U" must be specified in inches or millimeters. The immersion length is from the probe tip to the beginning of the thread on the fitting.



Hex Bushing

Sheath Diameter (in)	Male NPT (in)	Overall Length (in)	Hex Across Flats (in)	Part Number	
				Brass	Stainless Steel
1/16	1/8	3/4	7/16	FTG-159-101	FTG-162-101
	1/4	1	9/16	FTG-159-102	FTG-162-102
	1/2	1 1/4	7/8	FTG-159-103	FTG-162-103
1/8	1/8	3/4	7/16	FTG-159-104	FTG-162-104
	1/4	1	9/16	FTG-159-105	FTG-162-105
	1/2	1 1/4	7/8	FTG-159-106	FTG-162-106
3/16	1/8	3/4	7/16	FTG-159-107	FTG-162-107
	1/4	1	9/16	FTG-159-108	FTG-162-108
	1/2	1 1/4	7/8	FTG-159-109	FTG-162-109
1/4	1/8	3/4	7/16	FTG-159-110	FTG-162-110
	1/4	1	9/16	FTG-159-111	FTG-162-111
	1/2	1 1/4	7/8	FTG-159-112	FTG-162-112
5/16	1/4	1	9/16	FTG-159-113	FTG-162-113
	1/2	1 1/4	7/8	FTG-159-114	FTG-162-114
3/8	1/4	1	9/16	FTG-159-115	FTG-162-115
	1/2	1 1/4	7/8	FTG-159-116	FTG-162-116



Sensor Mounting Fixed Fittings

Sheath Diameter (in)	Male NPT (in)	Overall Length (in)	Hex Across Flats (in)	Part Number	
				Brass	Stainless Steel
1/16	1/4	1 ¹³ / ₃₂	9/16	FTG-152-101	FTG-153-101
	1/2	1 ²⁷ / ₃₂	7/8	FTG-152-102	FTG-153-102
1/8	1/4	1 ¹³ / ₃₂	9/16	FTG-152-103	FTG-153-103
	1/2	1 ²⁷ / ₃₂	7/8	FTG-152-104	FTG-153-104
3/16	1/4	1 ¹³ / ₃₂	9/16	FTG-152-105	FTG-153-105
	1/2	1 ²⁷ / ₃₂	7/8	FTG-152-106	FTG-153-106
1/4	1/4	1 ¹³ / ₃₂	9/16	FTG-152-107	FTG-153-107
	1/2	1 ²⁷ / ₃₂	7/8	FTG-152-108	FTG-153-108
5/16	1/4	1 ¹³ / ₃₂	9/16	FTG-152-109	FTG-153-109
	1/2	1 ²⁷ / ₃₂	7/8	FTG-152-110	FTG-153-110
3/8	1/4	1 ¹³ / ₃₂	9/16	FTG-152-111	FTG-153-111
	1/2	1 ²⁷ / ₃₂	7/8	FTG-152-112	FTG-153-112

Hex Nipple



MNPT (in)	Sheath O.D. (in)	Part Number			
		Non-Adjustable Brass	Non-Adjustable Stainless Steel	Adjustable Brass	Adjustable Stainless Steel
1/16	1/16	FTG-154-101	FTG-155-101	FTG-156-101	FTG-157-101
	1/8	FTG-154-102	FTG-155-102	FTG-156-102	FTG-157-102
1/8	1/16	FTG-154-104	FTG-155-104	FTG-156-104	FTG-157-104
	1/8	FTG-154-105	FTG-155-105	FTG-156-105	FTG-157-105
	3/16	FTG-154-106	FTG-155-106	FTG-156-106	FTG-157-106
	1/4	FTG-154-107	FTG-155-107	FTG-156-107	FTG-157-107
1/4	1/16	FTG-154-110	FTG-155-110	FTG-156-110	FTG-157-110
	1/8	FTG-154-111	FTG-155-111	FTG-156-111	FTG-157-111
	3/16	FTG-154-112	FTG-155-112	FTG-156-112	FTG-157-112
	1/4	FTG-154-113	FTG-155-113	FTG-156-113	FTG-157-113
	3/8	FTG-154-114	FTG-155-114	FTG-156-114	FTG-157-114
	1/2	FTG-154-115	FTG-155-115	FTG-156-115	FTG-157-115
1/2	1/8	FTG-154-116	FTG-155-116	FTG-156-116	FTG-157-116
	1/4	FTG-154-117	FTG-155-117	FTG-156-117	FTG-157-117
	3/8	FTG-154-118	FTG-155-118	FTG-156-118	FTG-157-118

Compression Fittings

There are non-adjustable and adjustable compression fittings. Non-adjustable compression fittings have a metal ferrule which is compressed onto the sheath and deformed permanently in the application; the fitting cannot be relocated along the sheath after tightening. Adjustable compression fittings have a Teflon® ferrule and the fitting can be relocated several times if immersion length is changed.



Sheath Diameter (in)	Part Number
1/8	FTG-158-101
3/16	FTG-158-102
1/4	FTG-158-103

Stainless steel 1/2" NPT × 1/2" NPT

Spring-Loaded Hex Nipple



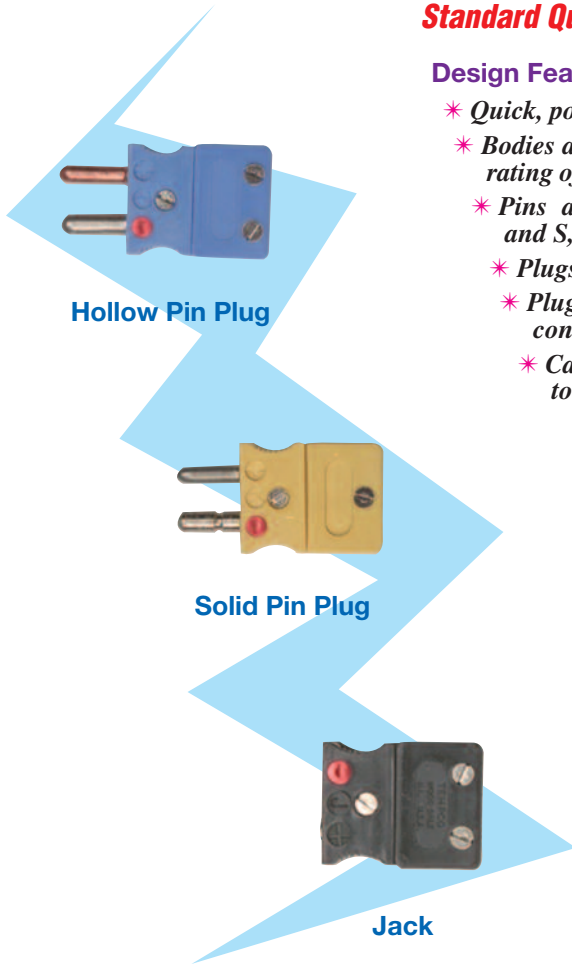


Quick Disconnect Plugs and Jacks

Standard Quick Disconnect Plugs and Jacks

Design Features:

- * Quick, positive connections.
- * Bodies are ANSI color coded, glass filled nylon with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent.
- * Pins are made from matching thermocouple material except R and S, which are compensated.
- * Plugs available in hollow or solid pins.
- * Plugs and Jacks are interchangeable with other thermocouple connectors with standard 7/16-inch spacing.
- * Can be imprinted with customer's own name (minimum order and tooling charge applies).



ANSI Calibration	Body Color	Part Number		
		Hollow Pin Plug	Solid Pin Plug	Jack
J	Black	TCA-101-101	TCA-101-111	TCA-102-101
K	Yellow	TCA-101-102	TCA-101-112	TCA-102-102
T	Blue	TCA-101-103	TCA-101-113	TCA-102-103
E	Purple	TCA-101-107	TCA-101-114	TCA-102-107
N	Orange	TCA-101-108	TCA-101-115	TCA-102-108
R/S	Green	TCA-101-109	TCA-101-116	TCA-102-109
U*	White	TCA-101-110	TCA-101-117	TCA-102-110

* "U" is designated for RTDs and type B thermocouples

High Temperature Standard Quick Disconnect Plugs and Jacks

- * All of the same features as the standard Plugs and Jacks except body color comes in "Brown" only
- * Temperature rating of 500°F (260°C) continuous and 550°F (288°C) intermittent

ANSI Calibration	Body Color	Part Number		
		Hollow Pin Plug	Solid Pin Plug	Jack
J	Brown	TCA-101-118	TCA-101-125	TCA-102-111
K	Brown	TCA-101-119	TCA-101-126	TCA-102-112
T	Brown	TCA-101-120	TCA-101-127	TCA-102-113
E	Brown	TCA-101-121	TCA-101-128	TCA-102-114
N	Brown	TCA-101-122	TCA-101-129	TCA-102-115
R/S	Brown	TCA-101-123	TCA-101-130	TCA-102-116
U*	Brown	TCA-101-124	TCA-101-131	TCA-102-117

* "U" is designated for RTDs and type B thermocouples

Ultra-High Temperature Quick Disconnect Plugs and Jacks

- * Temperature rating of 800°F (427°C) continuous and 1000°F (538°C) intermittent

ANSI Calibration	Body Color	Part Number		
		Hollow Pin Plug	Solid Pin Plug	Jack
J	Reddish-Brown	TCA-101-161	TCA-101-160	TCA-102-187
K	Reddish-Brown	TCA-101-163	TCA-101-159	TCA-102-189

Other calibrations available upon request.



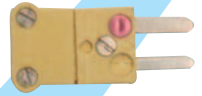
Miniature Quick Disconnect Plugs and Jacks

Design Features:

- * Designed to be lightweight and to be space-saving.
- * Bodies are ANSI color coded, glass filled nylon with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent.
- * Pins are solid flat with 5/16" spacing, made from matching thermocouple material except R and S, which are compensated.
- * Plugs and jacks are interchangeable with other miniature connectors.
- * Will accept wire from .001" to .032" and sheath diameters from .010" to .188".
- * Negative pin marked with red disc.
- * Complements modern miniature instrumentation.

ANSI Calibration	Body Color	Part Number	
		Plug	Jack
J	Black	TCA-101-105	TCA-102-118
K	Yellow	TCA-101-104	TCA-102-119
T	Blue	TCA-101-132	TCA-102-120
E	Purple	TCA-101-133	TCA-102-121
N	Orange	TCA-101-134	TCA-102-122
R/S	Green	TCA-101-135	TCA-102-123
U*	White	TCA-101-136	TCA-102-124

* "U" is designated for RTDs and type B thermocouples



Plug - Male



Jack - Female

Standard 3-Pin Quick Disconnect Plugs and Jacks

Design Features:

- * Standard 3-Pin Plugs and Jacks accept all accessories of the standard 2-pin plug and jack except the spool type brazing adaptor and neoprene boot.
- * 3-Pin Plug is available with all three pins being solid or with the two thermocouple pins being hollow.
- * Has all the same features as the standard 2-Pin Plug and Jack

ANSI Calibration	Body Color	Part Number		
		Hollow Pin Plug	Solid Pin Plug	Jack
J	Black	TCA-101-137	TCA-101-143	TCA-102-125
K	Yellow	TCA-101-138	TCA-101-144	TCA-102-126
T	Blue	TCA-101-139	TCA-101-145	TCA-102-127
E	Purple	TCA-101-140	TCA-101-146	TCA-102-128
R/S	Green	TCA-101-141	TCA-101-147	TCA-102-129
U*	White	TCA-101-142	TCA-101-148	TCA-102-130

* "U" is designated for RTDs and type B thermocouples



Plug - Male



Jack - Female

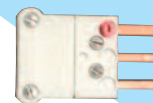
Miniature 3-Pin Quick Disconnect Plugs and Jacks

Design Features:

- * Has all the same standard features as the 2-Pin miniature Plug and Jack.
- * The miniature 3-pin plugs and jacks will accept all accessories of the 2-Pin Plugs and Jacks except the cable clamp and neoprene boot.

ANSI Calibration	Body Color	Part Number	
		Plug	Jack
J	Black	TCA-101-149	TCA-102-131
K	Yellow	TCA-101-150	TCA-102-132
T	Blue	TCA-101-151	TCA-102-133
E	Purple	TCA-101-152	TCA-102-134
R/S	Green	TCA-101-153	TCA-102-135
U*	White	TCA-101-154	TCA-102-136

* "U" is designated for RTDs and type B thermocouples



Plug - Male



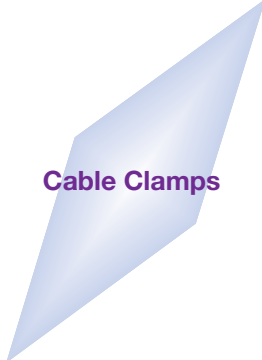
Jack - Female



Accessories for Standard Plugs and Jacks



For 3/8" Diameter sheath or 1/4" armor cable
Cable Clamp
 (Part Number TCA-107-102)



Cable Clamps



For Lead Wire with or without Braid
Cable Clamp
 (Part Number TCA-107-106)
Neoprene Grommet
 (Part Number TCA-109-102)

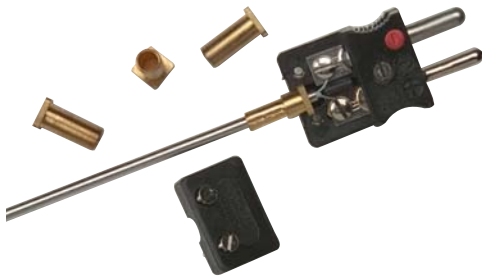


Grommets used in place of Cable Clamp
 (Part Number TCA-109-105)
Washer protects fine wire from breakage
 (Part Number TCA-120-101)



Neoprene Wire Entrance Grommets

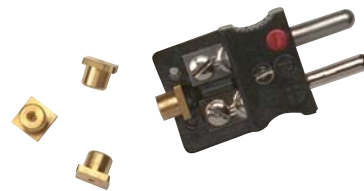
Nylon Wire Protection Washers



Brass Crimping Inserts

Used Primarily with TEMPCO-PAK

Sheath Diameter	Part Number
Undrilled	TCA-112-101
.020" (0.5 mm)	TCA-112-102
.040" (1.0 mm)	TCA-112-103
.063" (1.6 mm)	TCA-112-104
.125" (3.17 mm)	TCA-112-105
.188" (4.77 mm)	TCA-112-106
.250" (6.35 mm)	TCA-112-107
.118" (3.0 mm)	TCA-112-108
.177" (4.5 mm)	TCA-112-109
.236" (6.0 mm)	TCA-112-110



Brass Brazing Inserts

Can be used with Tubing or TEMPCO-PAK

Sheath Diameter	Part Number
Undrilled	TCA-113-101
.020" (0.5 mm)	TCA-113-102
.040" (1.0 mm)	TCA-113-103
.063" (1.6 mm)	TCA-113-104
.125" (3.17 mm)	TCA-113-105
.188" (4.77 mm)	TCA-113-106
.250" (6.35 mm)	TCA-113-107
.236" (6.0 mm)	TCA-113-108



Accessories for Standard Plugs and Jacks

Compression Type Tube Adapters

- * Can be used with TEMPCO-PAK or Tubing
- * Both types have Brass Ferrules



Standard Tube Adapters

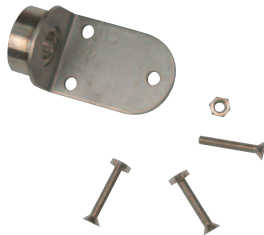
Affords higher degree of stability to Plug or Jack

Sheath Diameter	Part Number
.040"	TCA-103-106
.063"	TCA-103-102
.125"	TCA-103-101
.188"	TCA-103-103
.250"	TCA-103-104
.313"	TCA-103-107
.375"	TCA-103-108

Insert Tube Adapter

Secured by slots in body of the Plug or Jack (2-Pin or 3-Pin)

Sheath Diameter	Part Number
.040"	TCA-103-109
.063"	TCA-103-110
.125"	TCA-103-111



Stainless Steel Spool-Type Brazing Adapters

- * Provides maximum rigidity to Plug or Jack
- * For 2-Pin connectors only

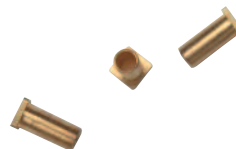
Sheath Diameter	Part Number
Undrilled	TCA-113-109
.063"	TCA-113-110
.125"	TCA-113-111
.188"	TCA-113-112
.250"	TCA-113-113
.313"	TCA-113-114
.375"	TCA-113-115

Neoprene Boots for Standard Plug and Jack

- * Made of Flexible Neoprene
- * Sized to cover standard connectors even with accessories (such as Cable Clamps and Tube adapters)
- * 3/32" Wire Entrance
- * Order 2 per Assembly
- * 3/32" Wire Entrance
- * For 2-Pin Connections only

Part Number TCA-121-101

Brass Crimping/Brazing Inserts for Ultra-Temp Plugs & Jacks



Sheath Diameter	Part Number
.040"	TCA-112-119
.062"	TCA-112-117
.125"	TCA-112-118
.188"	TCA-112-120
.250"	TCA-112-121

CONTINUED



Accessories for Standard Plugs and Jacks

Dual Tube Adaptors

- * Assemble Standard Connectors into Dual Connectors
- * For adjacent TEMPCO-PAK
- * Has Brass Ferrule
- * Use 2-Pin Connectors only

Sheath Diameter	Part Number
.063"	TCA-103-112
.125"	TCA-103-113
.188"	TCA-103-114
.250"	TCA-103-115
.313"	TCA-103-116
.375"	TCA-103-117



Dual Cable Clamps

- * Assemble Standard Connectors into Dual Connectors
- * Accommodate either One or Two Lead-In Cables
- * Use 2-Pin Connectors only

Part Number: TCA-107-103



Thermocouple Bracket

- * Used to mount T/C Probes on Panel or Oven Walls
- * Supplied with two #6 Self-Tapping Screws

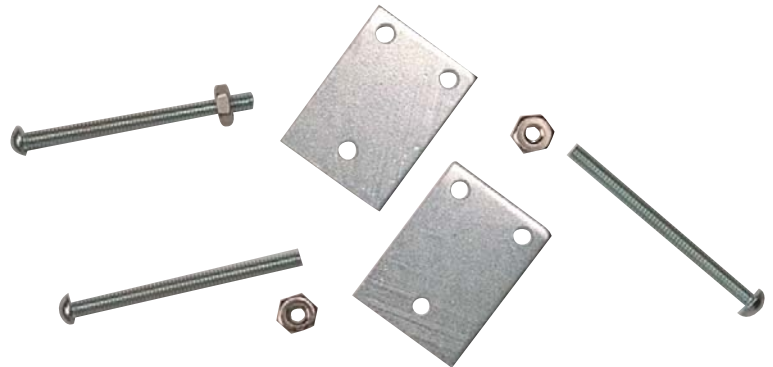
Part Number: SMPR-1062



Filler Plate Set

- * When combined with Dual Tube Adaptor or Dual Cable Clamp, the Filler Plate Set provides the 3/4" pin spacing of a single Duplex Connector.

Part Number: TCA-107-104





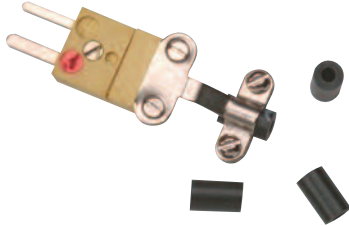
Accessories for Miniature Plugs and Jacks

Cable Clamps and Grommets

Cable Clamp (For 2-Pin Miniature)
Part Number: **TCA-107-105**

Cable Clamp (For 3-Pin Miniature)
Part Number: **TCA-107-109**

Neoprene Grommet
Part Number: **TCA-109-102**

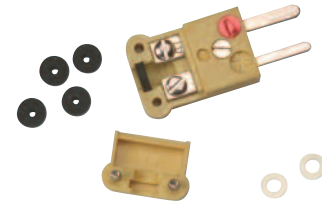


Neoprene Wire Entrance Grommets Nylon Wire Protection Washers

- * For all Miniature Connectors
- * Grommet is used in place of cable clamp
- * Washer protects fine wire from breakage

Grommet
Part Number: **TCA-109-104**

Washer
Part Number: **TCA-120-102**



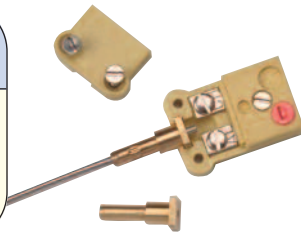
Crimping Inserts

- * For all Miniature Connectors
- * Used primarily with TEMPCO-PAK

Brazing Inserts

- * For all Miniature Connectors
- * Can be used with Tubing or TEMPCO-PAK

Sheath Diameter (in) (mm)	Part Number
Undrilled	TCA-112-111
.020 .50	TCA-112-112
.040 1.00	TCA-112-113
.063 1.60	TCA-112-114
.125 3.17	TCA-112-115
.188 4.77	TCA-112-116



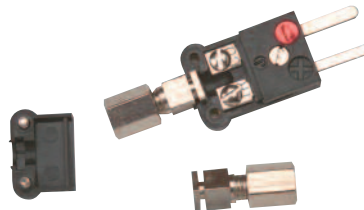
Sheath Diameter (in) (mm)	Part Number
Undrilled	TCA-113-116
.020 .50	TCA-113-117
.040 1.00	TCA-113-118
.063 1.60	TCA-113-119
.125 3.17	TCA-113-120
.188 4.77	TCA-113-121



Mini Insert Tube Adapter

- * Secured by slots in body of the Plug or Jack (2-pin or 3-Pin)
- * Compression Fitting has Brass Ferrules
- * Can be used with TEMPCO-PAK or Tubing
- * For all Miniature Connectors only

Sheath Diameter (in) (mm)	Part Number
.040 1.00	TCA-103-118
.063 1.60	TCA-103-119
.125 3.17	TCA-103-120



Neoprene Boot for Miniature Plug and Jack

- * Made of Flexible Neoprene
- * Sized to cover miniature connectors even with accessories (such as Cable Clamps and Tube Adapters)
- * 3/32" Wire Entrance
- * Order 2 per Assembly
- * For 2-Pin Connections only

Part Number: **TCA-121-102**



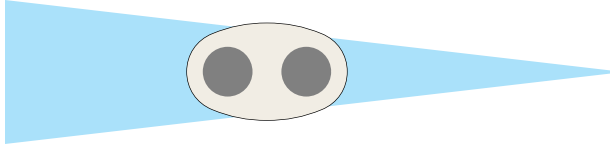


Thermocouple Insulators

Thermocouple Insulators

Oval—Double Hole Cordierite

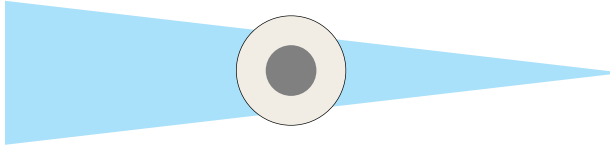
Maximum Temperature 2282°F (1250°C)



Part Number	Width (in)	Thickness (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-120-105	.437	.250	.156	7	1
COR-120-104	.375	.217	.110	10	1
COR-120-106	.172	.118	.042	19	1

Round—Single Hole Mullite

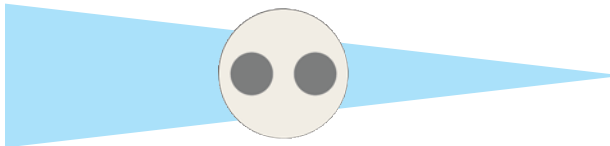
Maximum Temperature 2900°F (1593°C)



Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-123-101	.062	.031	22	12
COR-123-102	.125	.062	16	12
COR-123-103	.187	.094	12	12

Round—Double Hole Alumina

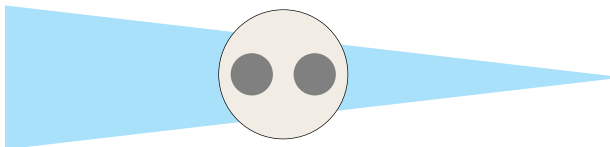
Maximum Temperature 3300°F (1815°C)



Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-124-101	.125	.031	22	1
COR-124-102	.125	.031	22	2
COR-124-103	.125	.031	22	3
COR-124-104	.125	.031	22	12
COR-124-105	.062	.016	28	12
COR-124-106	.187	.040	20	12

Round—Double Hole Mullite

Maximum Temperature 2400°F (1315°C)

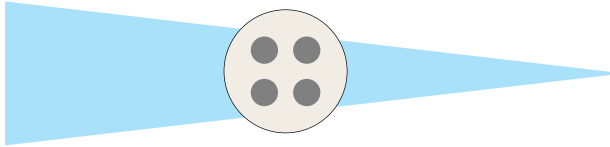


Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-125-101	.156	.046	18	1
COR-125-102	.156	.046	18	3
COR-126-101	.250	.085	13	1
COR-126-102	.250	.085	13	3
*COR-127-101	.437	.156	7	1
*COR-127-102	.437	.156	7	3

*Material is Cordierite

Round—Four Hole Alumina

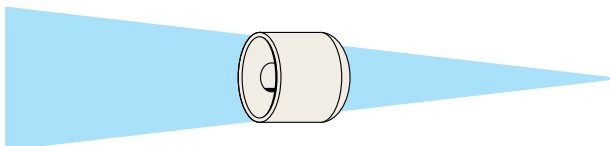
Maximum Temperature 3300°F (1815°C)



Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-128-101	.187	.047	18	1
COR-128-102	.312	.078	13	1

Fish Spine—Ball and Socket Insulators—Steatite

Maximum Temperature 2400°F (1315°C)



Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)	Number of Pcs. per Sleeve
CER-103-101	.110	.056	16	.110	67 pcs/6"
CER-103-102	.170	.068	14	.170	86 pcs/12"
CER-103-104	.200	.092	12	.200	Bulk Loose
CER-103-105	.330	.124	9	.330	Bulk Loose
CER-103-106	.400	.156	7	.400	Bulk Loose
CER-103-109	.260	.156	7	.260	Bulk Loose



Open Disc Terminal Blocks

The open disc terminal blocks are available for both single and dual element thermocouples or single-element RTD assemblies. They are available in two different materials. Ceramic discs are rated for 1000°F (530°C) and silicone/glass fiber discs are rated for 350°F (117°C). Silicone glass/fiber has a higher resistance to vibration and thermal shock than do the ceramic discs.

Each disc is assembled to a 1" O.D. × 1/8" thick brass (standard) or optional stainless steel back-up plate by two screws, and the plate is directly brazed to the sensor sheath.

Ceramic Open Disc with Brass Back-Up Plate and Mounting Screws

Sheath O.D. (in)	Approximate Dimensions (in)	Part Number			Six Wire Approximate Dimensions (in)
		Single Element	Dual Element	Six Wire Element	
1/8	1 1/8 O.D. × 1/16 H	TCH10045	TCH10048	TCH10051	2 1/2 O.D. × 1/16 H
3/16	1 1/8 O.D. × 1/16 H	TCH10046	TCH10049	TCH10052	2 1/2 O.D. × 1/16 H
1/4	1 1/8 O.D. × 1/16 H	TCH10047	TCH10050	TCH10053	2 1/2 O.D. × 1/16 H

Ceramic Disc for Single Element



P/N: TCA-110-126

Ceramic Disc for Dual Elements



P/N: TCA-110-127

Ceramic Open Disc with Stainless Steel Back-Up Plate and Mounting Screws

Sheath O.D. (in)	Approximate Dimensions (in)	Part Number			Six Wire Approximate Dimensions (in)
		Single Element	Dual Element	Six Wire Element	
1/8	1 1/8 O.D. × 1/16 H	TCH10054	TCH10057	TCH10060	2 1/2 O.D. × 1/16 H
3/16	1 1/8 O.D. × 1/16 H	TCH10055	TCH10058	TCH10061	2 1/2 O.D. × 1/16 H
1/4	1 1/8 O.D. × 1/16 H	TCH10056	TCH10059	TCH10062	2 1/2 O.D. × 1/16 H

Silicone/Glass Fiber for Single Element Only



P/N: TCA-110-128

Silicone/Glass Fiber Open Disc with Brass Back-Up Plate and Mounting Screws

Sheath O.D. (in)	Approximate Dimensions (in)	Part Number	
		Single Element	Dual Element
1/8	1" O.D. × 1/16 H	TCH10063	N/A
3/16	1" O.D. × 1/16 H	TCH10064	N/A
1/4	1" O.D. × 1/16 H	TCH10065	N/A

Ceramic Disc for Six Wire



P/N: TCA-110-129

Silicone/Glass Fiber Open Disc with Stainless Steel Back-Up Plate and Mounting Screws

Sheath O.D. (in)	Approximate Dimensions (in)	Part Number	
		Single Element	Dual Element
1/8	1" O.D. × 1/16 H	TCH10066	N/A
3/16	1" O.D. × 1/16 H	TCH10067	N/A
1/4	1" O.D. × 1/16 H	TCH10068	N/A



Die Cast Aluminum Heads

Die Cast Aluminum Heads

Design Features:

- * Plated chain attaches cover to body
- * Body is O-ring gasketed
- * Available in 2-terminal or 4-terminal
- * Comes in three sizes—Standard, Medium and Miniature—to allow for design flexibility
- * Has grommeted conduit entry for lead wire or flexible cable

Type "A" Standard Size Head



3-1/2"H x 4"L x 3-1/4"W



2-Terminal Ceramic Block
P/N: TCA-116-101



4-Terminal Ceramic Block
P/N: TCA-116-102

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number		
		Head Only	Head with 2-Terminal	Head with 4-Terminal
1/4"	1/2"	TCA-110-104	TCH10001	TCH10003
1/2"	1/2"	TCA-110-105	TCH10002	TCH10004

Type "B" Medium Die Cast Aluminum Head



3-1/2"H x 3-3/4"L x 2-5/8"W



2-Terminal Ceramic Block
P/N: TCA-116-103



4-Terminal Ceramic Block
P/N: TCA-116-104

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number		
		Head Only	Head with 2-Terminal	Head with 4-Terminal
1/2"	3/8"	TCA-110-106	TCH10005	TCH10008
3/8"	3/8"	TCA-110-107	TCH10006	TCH10009
1/4"	3/8"	TCA-110-108	TCH10007	TCH10010

Type "C" Miniature Die Cast Aluminum Head



2-5/8"H x 3"L x 2-5/16"W



2-Terminal Ceramic Block
P/N: TCA-116-105



4-Terminal Ceramic Block
P/N: TCA-116-106

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number		
		Head Only	Head with 2-Terminal	Head with 4-Terminal
1/2"	3/8"	TCA-110-109	TCH10011	TCH10014
3/8"	3/8"	TCA-110-110	TCH10012	TCH10015
1/4"	3/8"	TCA-110-111	TCH10013	TCH10016



Type "D" Heavy Duty Cast Iron Head and Type "E" Cast Aluminum Head

* Designed for heavy process and industrial applications



2-Terminal Ceramic Block
P/N: TCA-116-109



4-Terminal Ceramic Block
P/N: TCA-116-110



Approximate Size
4"H x 4"L x 3 1/2"W

Material	Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number		
			Head Only	Head with 2-Terminal	Head with 4-Terminal
Cast Iron Type "D"	1/2"	3/4"	TCA-110-114	TCH10019	TCH10022
	1/2"	1/2"	TCA-110-117	TCH10025	TCH10028
Cast Aluminum Type "E"	1/2"	3/4"	TCA-110-120	TCH10031	TCH10034
	1/2"	1/2"	TCA-110-123	TCH10037	TCH10040

Type "H" Standard Cast Iron Head

Design Features:

- * Stainless Steel chain and screws
- * High temperature painted finish
- * Neoprene rubber O-ring for weatherproof seal

Approximate Size
3-1/2"H x 3-1/2"L x 3-1/2"W



Terminal Blocks

Can use terminal blocks from Type A and Type B Head (page 14-98), and Spring-Loaded (page 14-100)

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number
1/2"	1/2"	TCA-110-152
1/2"	3/4"	TCA-110-153

Bakelite Series

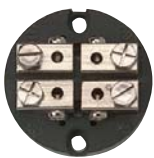
Design Features:

- * Lightweight
- * Non-combustible, Acid and Alkali resistant body
- * Maximum service temperature of 662°F (350°C)
- * Plated chain attaches cover to body
- * Body is O-ring gasketed
- * Available in 2-Terminal or 4-Terminal
- * Has grommeted conduit entry for lead wire or flexible cable
- * Available in two sizes: Standard and Small

Type "F" Standard Size Bakelite Head



Bakelite
2-Terminal Block
P/N: TCA-116-111



Bakelite
4-Terminal Block
P/N: TCA-116-112

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number		
		Head Only	Head with 2-Terminal	Head with 4-Terminal
1/2"	1/2"	TCA-110-124	TCH10041	TCH10042



Approximate Size:
3-7/8"H x 4-1/8"L x 3-3/16"W

Type "G" Miniature Size Bakelite Head



Bakelite
2-Terminal Block
P/N: TCA-116-113



Bakelite
4-Terminal Block
P/N: TCA-116-114

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number		
		Head Only	Head with 2-Terminal	Head with 4-Terminal
1/4"	3/8"	TCA-110-125	TCH10043	TCH10044



Approximate Size:
2-5/8"H x 3"L x 2-5/16"W



Thermocouple Accessories

Type P Polypropylene Head

Design Features:

- * FDA approved white polypropylene for food industry
- * Screw cover head with stainless steel chain and screws
- * 1/2" NPT process connection and 3/4" NPT conduit connection

P/N: TCA-110-147



Terminal Blocks

Can use terminal blocks from Type A and Type B Head (page 14-98), and Type F Head (page 14-99)

Approximate Size:
3-1/4"H x 3-1/2"L x 3-1/4"W

Type S Stainless Steel Head

Design Features:

- * 316 Stainless Steel body
- * Stainless Steel chain and screws
- * Neoprene rubber O-ring for weatherproof seal

Terminal Blocks

Can use terminal blocks from Type A and Type B Head (page 14-98), and Spring-Loaded (below)

Approximate Size:
3-1/2"H x 3-1/2"L x 3"W



Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number
1/2"	1/2"	TCA-110-154
1/2"	3/4"	TCA-110-155

Type N Miniature Nickel-Plated Steel Head



Approximate Size:
1-1/8" Dia. x 2-3/8"L

Design Features:

- * 2- or 4-terminal block included
- * 1/8" NPT or 1/4" NPT Process opening
- * Neoprene Cap Grommet for wire entry

Part Number	Thread Size	Number of Terminals
TCA-110-146	1/4 NPT	2
TCA-110-148	1/4 NPT	4
TCA-110-149	1/8 NPT	2
TCA-110-150	1/8 NPT	4

Spring-Loaded Terminal Blocks

- * Used on spring-loaded assemblies
- * Ceramic with nickel-plated brass terminals
- * Steel plate for mounting
- * Can be used with Type A, B, F, H, P and S Heads



2-Terminal Block

P/N: TCA-116-116



4-Terminal Block

P/N: TCA-116-119



3-Terminal Block

P/N: TCA-116-122



6-Terminal Block

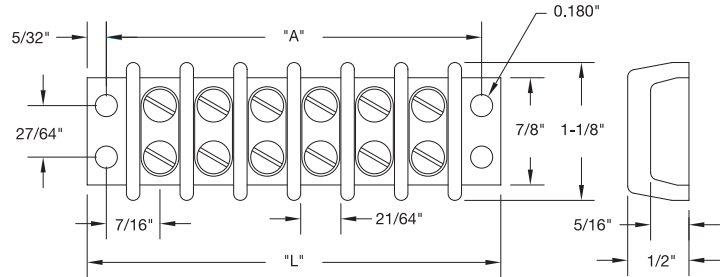
P/N: TCA-116-120



Screw Terminal Barrier Blocks for Thermocouples

Design Features:

- * Made of Glass-Filled Nylon, 350°F (177°C) max.
- * 250 VAC RMS max. Voltage Rating, 20 Amps max.
- * Supplied with 6-32 Terminal Screws
- * Available with Nickel-Plated Copper Lugs, Thermocouple Compensating Lugs or No Lugs



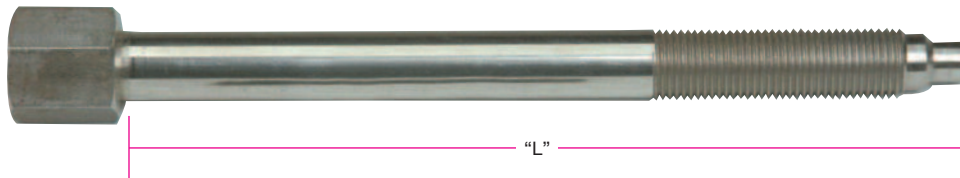
Ordering Code: **TBS** -

No. of Terminals BOX 1
Enter **02 to 20**
(See table for available Number of Terminals)

Type of Lugs BOX 2
00 = No Lugs, Screws Supplied
10 = Nickel-Plated Copper Lugs
1 = With Thermocouple Compensating Lugs
Enter Calibration

Number of Terminals	"A" Dim. (inches)	"L" Dim. (inches)
2	1.31	1.63
3	1.75	2.06
4	2.19	2.50
6	3.06	3.38
8	3.94	4.25
10	4.81	5.13
12	5.69	6.00
14	6.56	6.88
16	7.44	7.75
20	9.19	9.50

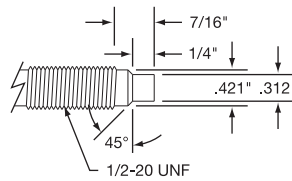
Plastic Melt Bolts



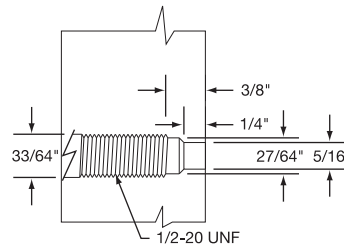
The Blank Bolt is used to seal hole if thermocouple is removed from extruder.

NOTE: All bolts except Blank Bolts are drilled to accept 1/8" diameter thermocouple.

Detailed Dimensions for Plastic Melt Bolts



Bolt-Tip Dimensions



Recommended drilling dimensions for proper mounting in extruder

Styles R & F are shown on Pages 14-10 and 14-11

Length "L"	Blank	With 1/8" Diameter Hole	With Teflon® Insert	To make Style "R" *	To make Style "R" w/Teflon® insert *	To make Style "F"	To make Style "F" w/Teflon® Insert
3"***	FAS-116-101	FAS-116-103	FAS-116-105	FAS-116-107	FAS-116-109	FAS-116-111	FAS-116-113
6"***	FAS-116-102	FAS-116-104	FAS-116-106	FAS-116-108	FAS-116-110	FAS-116-112	FAS-116-114

* Includes hardware to mount plug

** 300 series stainless steel

Thermocouple Wire and Thermocouple Extension Wire



- ◆ ***Insulated Thermocouple and Extension Wire Insulation Types*** — See Page 14-104
- ◆ ***Thermocouple Wire and Extension Grade Thermocouple Wire Color Codes*** — See Pages 14-105 and 14-106
- ◆ ***Thermocouple Grade Wire*** — See Pages 14-107 through 14-109
- ◆ ***Thermocouple Extension Grade Wire*** — See Pages 14-110 and 14-111
- ◆ ***Coil Cords and RTD Wires*** — See Page 14-112

Using Thermocouple Extension Wire

Thermocouple extension wire is often used to make the connection between the thermocouple and the measuring instrument, especially when long distances are involved, due to its cost advantage. Thermocouple extension wire has approximately the same characteristics as thermocouple wire but its accuracy is guaranteed over a more limited range of temperatures.

For base metal thermocouples, extension wire is of essentially the same composition as the corresponding thermocouple wire. Because of the high cost of noble metals, noble metal thermocouple extension wires are made from alloys that match the noble metal thermocouple characteristics.



Note: Thermocouple Extension Wire should never be used in place of thermocouple wire as the actual sensor because it will not generate accurate temperature information.

Protective Wraps for Thermocouple Wire and Thermocouple Extension Wire

Many of the insulated thermocouple wire and extension wire constructions listed on the following pages are available with the following two wraps as an option.



Stainless Steel or Tinned Copper Overbraid



Stainless Steel Wrap



Tolerances and Temperatures

Table 1 Tolerances on Initial Values of Emf vs. Temperature

- NOTE 1** Tolerances in this table apply to new essentially homogeneous thermocouple wire, normally in the size range 0.25 mm to 3 mm in diameter (No. 30 to No. 8 Awg) and used at temperatures not exceeding the recommended limits of Table 2. If used at higher temperatures these tolerances may not apply.
- NOTE 2** The Fahrenheit tolerance is 1.8 times larger than the °C tolerance at the equivalent °C temperature. Note particularly that percentage tolerances apply only to temperatures that are expressed in °C.
- NOTE 3** **Caution:** Users should be aware that certain characteristics of thermocouple materials, including the emf versus temperature relationship, may change with time in use; consequently, test results and performance obtained at time of manufacture may not necessarily apply throughout an extended period of use. Tolerances given in this table apply only to new wire or MI cable or thermocouples as delivered to the user and **do not allow for changes in characteristics with use**. The magnitude of such changes will depend on such factors as wire size, temperature, time of exposure, and environment. It should be further noted that due to possible changes in homogeneity, attempting to recalibrate **used** thermocouples is likely to yield irrelevant results, and is not recommended. However, it may be appropriate to compare used thermocouples *in-situ* with new or known good ones to ascertain their suitability for further service under the conditions of the comparison.

Thermocouple Type	Temperature Range		Tolerances—Reference Junction 0°C (32°F)			
			Standard Tolerances		Special Tolerances	
	°C	°F	°C (whichever is greater)		°C (whichever is greater)	
T	0 to 370	32 to 700	±1 or ±0.75%	Note 2	±0.5 or 0.4%	Note 2
J	0 to 760	32 to 1400	±2.2 or ±0.75%		±1.1 or 0.4%	
E	0 to 870	32 to 1600	±1.7 or ±0.5%		±1 or ±0.4%	
K or N	0 to 1260	32 to 2300	±2.2 or ±0.75%		±1.1 or ±0.4%	
R or S	0 to 1480	32 to 2700	±1.5 or ±0.25%		±0.6 or ±0.1%	
B	870 to 1700	1600 to 3100	±0.5%			
T ^A	-200 to 0	-328 to 32	±1 or ±1.5%		B	
E ^A	-200 to 0	-328 to 32	±1.7 or ±1%		B	
K ^A	-200 to 0	-328 to 32	±2.2 or ±2%		B	

^A Thermocouples and thermocouple materials are normally supplied to meet the tolerances specified in the table for temperatures above 0°C. The same materials, however, may not fall within the tolerances given for temperatures below 0°C in the second section of the table. If materials are required to meet the tolerances stated for temperatures below 0°C the purchase order must so state. Selection of materials usually will be required.

^B Special tolerances for temperatures below 0°C are difficult to justify due to limited available information. However, the following values for Types E and T thermocouples are suggested as a guide for discussion between purchaser and supplier:

Type E -200 to 0°C ±1°C or ±0.5% (whichever is greater) **Type T** -200 to 0°C ±0.5°C or ±0.8% (whichever is greater)

Initial values of tolerance for Type J thermocouples at temperatures below 0°C and special tolerances for Type K thermocouples below 0°C are not given due to the characteristics of the materials.

Table 2 Suggested Upper Temperature Limits for Protected Thermocouples

- NOTE 1** This table gives the recommended upper temperature limits for the various thermocouples and wire sizes. These limits apply to protected thermocouples: that is, thermocouples in conventional closed-end protection tubes. They do not apply to sheathed thermocouples having compacted mineral oxide insulation.
- NOTE 2** The temperature limits given here are intended only as a guide to the user and should not be taken as absolute values nor as guarantees of satisfactory life or performance. These types and sizes are sometimes used at temperatures above the given limits, but usually at the expense of stability or life or both. In other instances, it may be necessary to reduce the given limits in order to achieve adequate service. ASTM MNL-12^c and other literature sources should be consulted for additional application information.




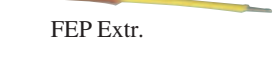
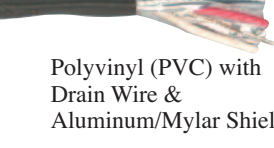


Thermocouple Type	Upper Temperature Limit for Various Wire Sizes (Awg), °C (°F)					
	No. 8 Gauge 3.25 mm (0.128 in)	No. 14 Gauge 1.63 mm (0.064 in)	No. 20 Gauge 0.81 mm (0.032 in)	No. 24 Gauge 0.51 mm (0.020 in)	No. 28 Gauge 0.33 mm (0.013 in)	No. 30 Gauge 0.25 mm (0.010 in)
T		370 (700)	260 (500)	200 (400)	200 (400)	150 (300)
J	760 (1400)	590 (1100)	480 (900)	370 (700)	370 (700)	320 (600)
E	870 (1600)	650 (1200)	540 (1000)	430 (800)	430 (800)	370 (700)
K and N	1260 (2300)	1090 (2000)	980 (1800)	870 (1600)	870 (1600)	760 (1400)
R and S				1480 (2700)		
B				1700 (3100)		

^c "Manual on the Use of Thermocouples in Temperature Measurement," ASTM MNL-12, 1993.

Tables courtesy ASTM



Insulated Thermocouple and Extension Wire Insulation Types

	Single Conductor		Duplex Conductors		Temperature Rating†		ANSI Color Coded	Physical Properties		
	Insulation	Impregnation	Insulation	Impregnation	Continuous	Single Reading		Abrasion Resist.	Moisture Resist.	Chemical Resist.
 Glass Braid	Glass Braid	Silicone Modified Resin (retained to 400°F [204°C])	Glass Braid	Silicone Modified Resin (retained to 400°F [204°C])	900°F (482°C)	1000°F (538°C)	Yes	Fair	Good	Good
 Double Glass Wrap	Double Glass Wrap	Silicone Modified Resin (retained to 400°F [204°C])	Glass Braid	Silicone Modified Resin (retained to 400°F [204°C])	900°F (482°C)	1000°F (538°C)	Yes	Fair	Good	Good
 High Temperature Glass Braid	High Temp Glass Braid	High Temp Varnish (retained to 400°F [204°C])	High Temp Glass Braid	High Temp Varnish	1300°F (704°C)	1600°F (871°C)	Yes	Good	Fair	Good
 Polyvinyl (PVC)	Polyvinyl (PVC)	—	Polyvinyl (PVC)	—	-20 to +221°F (-29 to 105°C)	221°F (105°C)	Yes	Good	Excellent	Good
 FEP Extr.	FEP Extr.	—	FEP Extr.	—	400°F (204°C)	500°F (260°C)	Yes	Excellent	Excellent	Excellent
 Kapton®	Kapton®	—	Kapton®	—	500°F (260°C)	800°F (427°C)	Yes (Indiv. only)	Excellent	Excellent	Excellent
 Polyvinyl (PVC) with Drain Wire & Aluminum/Mylar Shield	Polyvinyl (PVC)	—	Polyvinyl (PVC) Twisted	—	-20 to +221°F (-29 to +105°C)	221°F (105°C)	Yes	Good	Excellent	Good
 Vitreous Silica Fiber	Vitreous Silica Fiber	—	Vitreous Silica Fiber	—	1600°F (871°C)	2000°F (1093°C)	No	Fair	Fair	Good
 Ceramic Fiber	Ceramic Fiber	—	Ceramic Fiber	—	2200°F (1204°C)	2600°F (1427°C)	No	Good	Fair	Good

†Thermocouple extension grade wire is only calibrated up to 400°F (204°C).



Thermocouple Wire Color Code & Specifications (United States, Canada & Mexico)



ANSI Code	Color Code	Positive (+) Lead	Negative (-) Lead	Temperature Range	Initial Calibration Tolerances	
					Standard °C (whichever is greater)	Special °C (whichever is greater)
J		Iron	Constantan (45% Nickel, 55% Copper)	32-1382°F (0-750°C)	±2.2°C or ±0.75%	±1.1°C or ±0.4%
K		Chromel® (90% Nickel, 10% Chromium)	Alumel (95% Nickel, 2% Aluminum, 2% Manganese, 1% Silicon)	32-2282°F (0-1250°C)	±2.2°C or ±0.75%	±1.1°C or ±0.4%
E		Chromel® (90% Nickel, 10% Chromium)	Constantan (45% Nickel, 55% Copper)	32-1652°F (0-900°C)	±1.7°C or ±0.5%	±1.0°C or ±0.4%
T		Copper	Constantan (45% Nickel, 55% Copper)	32-662°F (0-350°C)	±1°C or ±0.75%	±.5°C or ±0.4%
N		Nicrosil (84.6% Nickel, 14% Chromium, 1.4% Silicon)	Nisil (95.6% Nickel, 4.4 % Silicon)	32-2282°F (0-1250°C)	±2.2°C or ±0.75%	±1.1°C or ±0.4%



Thermocouple Extension Wire Color Code & Specifications (United States, Canada & Mexico)

ANSI Code	ANSI Color Code	Positive (+) Lead	Negative (-) Lead	Temperature Range	Initial Calibration Tolerances	
					Standard	Special
JX		Iron	Constantan (45% Nickel, 55% Copper)	32-392°F (0-200°C)	±2.2°C	±1.1°C
KX		Chromel® (90% Nickel, 10% Chromium)	Alumel (95% Nickel, 2% Aluminum, 2% Manganese, 1% Silicon)	32-392°F (0-200°C)	±2.2°C	±1.1°C
EX		Chromel® (90% Nickel, 10% Chromium)	Constantan (45% Nickel, 55% Copper)	32-392°F (0-200°C)	±1.7°C	±1.1°C
TX		Copper	Constantan (45% Nickel, 55% Copper)	32 to 212°F (0-100°C)	±1.0°C	±0.5°C
NX		Nicrosil (84.6% Nickel, 4% Chromium, 1.4 % Silicon)	Nisil (95.6% Nickel, 4.4 % Silicon)	32-392°F (0-200°C)	±2.2°C	±1.1°C
Compensating Extension Wire Type						
RX*		Copper	Copper Alloy	32-392°F (0-200°C)	±9°F (±5°C)	N/A
SX*		Copper	Copper Alloy	32-392°F (0-200°C)	±9°F (±5°C)	N/A
BX†*		Copper	Copper	32 to 212°F (0-100°C)	+0°F -6.7°F (+0°C -3.7°C)	N/A

* Due to the non-linearity of the types R, S, and B temperature-emf curves, the error introduced into a thermocouple system by the compensating wire will be variable when expressed in degrees. The degree C tolerances are based on the following measuring junction temperatures.

†Copper versus copper compensating extension wire, usable to 100°C (212°F) with maximum deviations as indicated, but with no significant deviation over 0°C to 50°C (32°F to 122°F) range.

Type Wire	Measuring Junction Temperature
SX	Greater than 1598°F (870°C)
BX	Greater than 1832°F (1000°C)



Thermocouple Tolerances and Calibration

ANSI Tolerances

All thermocouple wire and extension wire is supplied to meet Standard Tolerances of ANSI Circular MC96.1–1982. Special tolerances are also available per ANSI MC96.1 at an extra charge. The standard and special tolerances for thermocouple and extension wires are given in the accompanying tables — see pages 14-103 and 14-105. Where tolerances are given in percent, the percentage applies to the temperature being measured.

Calibration and Certification

Thermocouple wire and elements can be factory calibrated and certified at an extra charge. Each thermocouple, coil, reel, or spool of wire is then tagged to show the individual departure from curve. The normal calibrating temperature range is 32°F–2000°F (0°C–1093°C), depending on wire type, gauge size and insulation type.

A certificate of calibration is furnished upon request for all calibrated items. Each item calibrated is also tagged with the results.

ANSI Type J Duplex Thermocouple Wire

ANSI color code— White positive/Red negative— Over All Brown

“J” Thermocouple Wire – Stocked on 100 and 250 Foot Spools



TC Type	Wire Type	Insulation	Insulation Temperature Limits (°F/°C)	Nominal Overall Dimensions (inches)	Part Number	
					100 Foot Spool	250 Foot Spool
J	20 Gauge Solid	Fiberglass	900/482	.060 × .106	TCWR-1028	TCWR-1032
J	20 Gauge Stranded	Fiberglass	900/482	.066 × .118	TCWR-1033	TCWR-1035
J	24 Gauge Solid	Fiberglass	900/482	.048 × .082	TCWR-1037	TCWR-1069
J	24 Gauge Stranded	Fiberglass	900/482	.048 × .082	TCWR-1038	TCWR-1070
J	20 Gauge Stranded	Fiberglass with SS overbraid	900/482	.088 × .140	TCWR-1047	TCWR-1051
J	20 Gauge Solid	FEP Teflon®	400/204	.068 × .116	TCWR-1060	TCWR-1062
J	24 Gauge Stranded	Fiberglass with SS overbraid	900/482	.074 × .100	TCWR-1048	TCWR-1052

“J” Thermocouple Wire – Order Length Required (50 Foot Minimum)

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp.		Nominal Overall Dimensions (inches)	Part Number
				°F	°C		
16	Solid	Glass Braid	Glass Braid	900	482	.080 × .144	TCW-101-123
18	Stranded (7/26)	Glass Braid w/ SS Braid O/A	Glass Braid	900	482	.122 × .175	TCW-101-130
20	Solid	Hi-temp Glass Braid	Hi-temp Glass Braid	1400	760	.086 × .136	TCW-101-115
20	Solid	Amber colored Kapton® tape	Color coded Kapton® tape	500	260	.055 × .099	TCW-101-112
20	Stranded (7/28)	Kapton®	Kapton®	500	260	.058 × .108	TCW-101-131
24	Solid	Glass Braid	Double Glass wrap	900	482	.043 × .074	TCW-101-113
24	Solid	Rip-cord construction	PVC (extruded)	221	105	.046 × .092	TCW-101-116
24	Solid	Glass Braid w/ SS Braid	Glass Braid	900	482	.074 × .100	TCW-101-119
30	Solid	Glass Braid	Double Glass wrap	900	482	.033 × .054	TCW-101-114



Insulated Thermocouple Wire

ANSI Type J Single Conductor Construction Thermocouple Wire

Individual wires ANSI color code—Negative (JN) wire Red—Positive (JP) wire White

B & S ga.	Conductor Type	Nominal O.D. (inches)	Wire Type	Insulation Each Conductor	Max. Temp		Part Number
					°F	°C	
20	Iron (JP)	.050"	Stranded	Glass Braid	900	482	TCW-104-105
20	Constantan (JN)	.050"	Stranded	Glass Braid	900	482	TCW-105-105
24	Iron (JP)	.036"	Stranded	Glass Braid	900	482	TCW-104-106
24	Constantan (JN)	.036"	Stranded	Glass Braid	900	482	TCW-105-106

ANSI Type K Duplex Insulated Thermocouple Wire

ANSI color code—Yellow positive/Red negative—Over All Brown

“K” Thermocouple Wire — Stocked on 100 and 250 Foot Spools



TC Type	Wire Type	Insulation	Insulation Temperature Limits (°F/°C)	Nominal Overall Dimensions (inches)	Part Number	
					100 Foot Spool	250 Foot Spool
K	20 Gauge Solid	Fiberglass	900/482	.060 × .116	TCWR-1025	TCWR-1029
K	20 Gauge Stranded	Fiberglass	900/482	.066 × .118	TCWR-1034	TCWR-1036
K	24 Gauge Solid	Fiberglass	900/482	.044 × .074	TCWR-1039	TCWR-1071
K	24 Gauge Stranded	Fiberglass	900/482	.050 × .082	TCWR-1040	TCWR-1072
K	20 Gauge Stranded	Fiberglass with SS overbraid	900/482	.088 × .140	TCWR-1049	TCWR-1053
K	20 Gauge Solid	FEP Teflon®	400/204	.068 × .116	TCWR-1061	TCWR-1063
K	24 Gauge Stranded	Fiberglass with SS overbraid	900/482	.074 × .100	TCWR-1050	TCWR-1054

“K” Thermocouple Wire — Order Length Required (50 Foot Minimum)

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp.		Nominal Overall Dimensions (inches)	Part Number
				°F	°C		
20	Solid	Hi-temp Glass Braid	Hi-temp Glass Braid	1400	760	.086 × .136	TCW-103-113
20	Solid	Amber colored Kapton® tape	Color coded Kapton® tape	500	260	.055 × .099	TCW-103-110
24	Solid	Glass Braid	Double Glass wrap	900	482	.043 × .074	TCW-103-111
24	Solid	Rip-cord construction	PVC (extruded)	221	105	.046 × .092	TCW-103-116
24	Solid	FEP Teflon®	FEP Teflon®	400	204	.056 × .092	TCW-103-123
24	Solid	Glass Braid w/ SS Braid	Glass Braid	900	482	.074 × .100	TCW-103-117
30	Solid	Glass Braid	Double Glass wrap	900	482	.033 × .054	TCW-103-112

ANSI Type K Special Limits Duplex Insulated Thermocouple Wire

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp.		Nominal Overall Dimensions (inches)	Part Number
				°F	°C		
20	Solid	<i>NOT COLOR CODED</i> Vitreous Silica Braid	<i>NOT COLOR CODED</i> Vitreous Silica Braid	1600-2300	871-1260	.092 × .154	TCW-103-114
20	Solid	<i>NOT COLOR CODED</i> Ceramic Fiber Braid	<i>NOT COLOR CODED</i> Ceramic Fiber Braid	2200-2600	1204-1427	.092 × .154	TCW-103-115



ANSI Type N Duplex Construction Insulated Thermocouple Wire

ANSI color code—Orange positive/Red negative—Brown Over All

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp.		Nominal Overall Dimensions (inches)	
				°F	°C		
20	Solid	Glass Braid	Glass Braid	900	482	.066 × .118	TCW-118-101
20	Solid	<small>NOT COLOR CODED</small> Vitreous Silica Braid	<small>NOT COLOR CODED</small> Vitreous Silica Braid	1600-2300	871-1260	.092 × .154	TCW-118-102
24	Solid	Glass Braid	Glass Braid	900	482	.043 × .074	TCW-118-103

ANSI Type T Duplex Construction Insulated Thermocouple Wire

ANSI color code—Blue positive/Red negative—Brown Over All

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp.		Nominal Overall Dimensions (inches)	Part Number
				°F	°C		
20	Stranded (7/28)	FEP Teflon®	FEP Teflon®	400	204	.074 × .128	TCW-113-105
20	Solid	Glass Braid	Glass Braid	900	482	.060 × .106	TCW-113-101
20	Solid	Extruded (FEP) Teflon®	Extruded (FEP) Teflon®	400	204	.068 × .116	TCW-113-102
24	Solid	Polyvinyl (PVC)	Polyvinyl (PVC)	221	105	.046 × .092	TCW-113-103
24	Solid	Extruded (FEP) Teflon®	Extruded (FEP) Teflon®	400	204	.056 × .092	TCW-113-104

ANSI Type E and Chromel/Constantan Duplex Construction Thermocouple Wire

ANSI color code—Purple positive/Red negative—Brown Over All

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp.		Nominal Overall Dimensions (inches)	Part Number
				°F	°C		
20	Solid	Glass Braid	Glass Braid	900	482	.060 × .106	TCW-121-101
20	Solid	TFE Teflon® tape	TFE Teflon® tape	500	260	.060 × .104	TCW-121-102
20	Stranded (7/28)	Glass Braid	Glass Braid	900	482	.066 × .118	TCW-121-103
20	Stranded (7/28)	Glass Braid	Double Glass wrap	900	482	.061 × .110	TCW-121-104

Ordering Information

Order by **Part Number** for wire stocked on standard 100 and 250 foot spools.
 Order by **Part Number** and **Length** in feet required (50 feet minimum) for wire not stocked on standard spools.

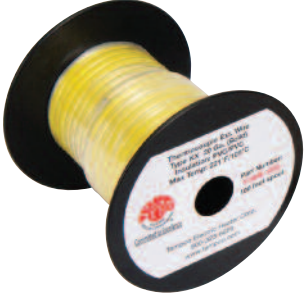


Insulated Thermocouple Extension Wire

ANSI Type JX Thermocouple Extension Wire

Duplex construction—ANSI color code—White positive/Red negative— Black Over All

“JX” Thermocouple Extension Wire — Stocked on 100 and 250 Foot Spools



TC Type	Wire Type	Insulation	Insulation Temperature Limits (°F/°C)	Nominal Overall Dimensions (inches)	Part Number	
					100 Foot Spool	250 Foot Spool
JX	20 Gauge Solid	PVC	221/105	.092 x .154	TCWR-1027	TCWR-1031
JX	20 Gauge Stranded	PVC	221/105	.098 x .166	TCWR-1041	TCWR-1073
JX	24 Gauge Solid	PVC	221/105	.080 x .130	TCWR-1042	TCWR-1074
JX	24 Gauge Stranded	PVC	221/105	.084 x .138	TCWR-1043	TCWR-1075
JX	20 Gauge Solid	PVC with Shield & Drain	221/105	.169 Diameter	TCWR-1055	TCWR-1057

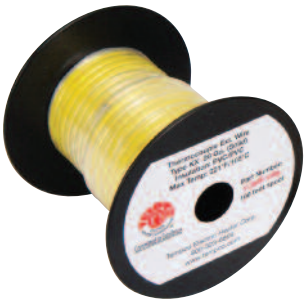
“JX” Thermocouple Extension Wire — Order Length Required (50 Foot Minimum)

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp.		Nominal Overall Dimensions (inches)	Part Number
				°F	°C		
16	Solid	Polyvinyl (PVC)	Polyvinyl (PVC)	221	105	.111 x .192	TCW-102-105
16	Solid	PVC/twisted w/ alum Mylar tape shield & bare drain wire	Polyvinyl (PVC)	221	105	.207 x round	TCW-102-106

ANSI Type KX Duplex Construction Insulated Thermocouple Extension Wire

ANSI color code—Yellow positive/Red negative— Yellow Over All

“KX” Thermocouple Extension Wire — Stocked on 100 and 250 Foot Spools



TC Type	Wire Type	Insulation	Insulation Temperature Limits (°F/°C)	Nominal Overall Dimensions (inches)	Part Number	
					100 Foot Spool	250 Foot Spool
KX	20 Gauge Solid	PVC	221/105	.092 x .154	TCWR-1026	TCWR-1030
KX	20 Gauge Stranded	PVC	221/105	.098 x .166	TCWR-1044	TCWR-1076
KX	24 Gauge Solid	PVC	221/105	.080 x .130	TCWR-1045	TCWR-1077
KX	24 Gauge Stranded	PVC	221/105	.084 x .138	TCWR-1046	TCWR-1078
KX	20 Gauge Solid	PVC with Shield & Drain	221/105	.169 Diameter	TCWR-1056	TCWR-1058

“KX” Thermocouple Extension Wire — Order Length Required (50 Foot Minimum)

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp.		Nominal Overall Dimensions (inches)	Part Number
				°F	°C		
20	Stranded (7/28)	PVC/twisted w/alum. mylar tape shield & bare drain wire	Polyvinyl (PVC)	221	105	.181 round	TCW-117-105



ANSI Type NX Duplex Construction Insulated Thermocouple Extension Wire

ANSI color code—Orange positive/Red negative—Orange Over All

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp. °F °C	Nominal Overall Dimensions (inches)	Part Number
20	Solid	Polyvinyl (PVC)	Polyvinyl (PVC)	221 105	.092 × .154	TCW-119-101
20	Solid	PVC/twisted w/ alum. mylar tape shield & bare drain wire	Polyvinyl (PVC)	221 105	.098 × .166	TCW-119-102

ANSI Type TX Duplex Construction Insulated Thermocouple Extension Wire

ANSI color code—Blue positive/Red negative—Blue Over All

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp. °F °C	Nominal Overall Dimensions (inches)	Part Number
20	Solid	Polyvinyl (PVC)	Polyvinyl (PVC)	221 105	.092 × .154	TCW-120-101
20	Stranded (7/28)	Polyvinyl (PVC)	Polyvinyl (PVC)	221 105	.098 × .166	TCW-120-102
20	Solid	PVC/twisted w/ alum. mylar tape shield & bare drain wire	Polyvinyl (PVC)	221 105	.169 round	TCW-120-103

ANSI Type EX Duplex Construction Thermocouple Extension Wire

ANSI color code—Purple positive/Red negative—Purple Over All

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp. °F °C	Nominal Overall Dimensions (inches)	Part Number
20	Solid	Polyvinyl (PVC)	Polyvinyl (PVC)	221 105	.092 × .154	TCW-122-101
20	Solid	PVC/twisted w/ alum. Mylar tape shield & bare drain wire	Polyvinyl (PVC)	221 105	.169 round	TCW-122-102

ANSI Type R/SX Copper/#11 Alloy Duplex Construction Insulated Extension Wire

ANSI color code—Black positive/Red negative—Green Over All (Compensating alloys for Type “S” and Type “R” thermocouples)

B & S ga.	Wire Type	Insulation Over All	Insulation Each Conductor	Maximum Temp. °F °C	Nominal Overall Dimensions (inches)	Part Number
20	Solid	PVC/twisted w/ alum. Mylar tape shield & bare drain wire	Polyvinyl (PVC)	221 105	.169 round	TCW-123-101
20	Solid	Polyvinyl (PVC)	Polyvinyl (PVC)	221 105	.092 × .154	TCW-123-102
20	Solid	Extruded (FEP) Teflon®	Extruded (FEP) Teflon®	400 204	.068 × .116	TCW-123-103
20	Solid	Glass Braid	Glass Braid	900 482	.060 × .106	TCW-123-104

Ordering Information

Order by **Part Number** for wire stocked on standard 100 and 250 foot spools.
 Order by **Part Number** and **Length** in feet required (50 feet minimum) for wire not stocked on standard spools.



Coil Cord for Thermocouples and RTDs

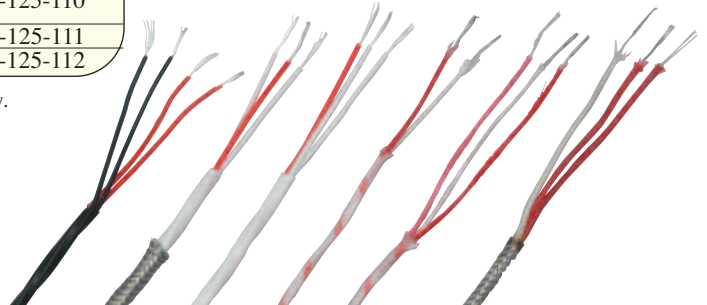
Design/Special Features

- * Complements modern instrumentation.
- * Designed to be space saving and convenient with excellent retractability.
- * Rated for 221°F (105°C) upper limit (above 104°F [40°C], coil form may change if stretched).
- * ANSI Color Coded Outer Jacket.
- * Wire is 26 gauge stranded with PVC insulation and the outer jacket is polyurethane.
- * Available with mini plug molded on one end only for thermocouples and has open ends only for 3-wire RTDs.
- * Can be used with all available thermocouple or RTD plugs, jacks and cable clamps, standard or miniature.
- * Open ends have approximately 4 inches straight.



Calibration	Outer Jacket Color	Coil Length (in)	Extended Length Maximum (in)	Part Number	
				† With Miniature Plug Molded on One End	† Both Ends Open
J	Black	12	60	TCW-124-101	TCW-125-101
J	Black	24	120	TCW-124-102	TCW-125-102
K	Yellow	12	60	TCW-124-103	TCW-125-103
K	Yellow	24	120	TCW-124-104	TCW-125-104
E	Purple	12	60	TCW-124-105	TCW-125-105
T	Blue	12	60	TCW-124-106	TCW-125-106
T	Blue	24	120	TCW-124-107	TCW-125-107
R/S	Green	12	60	TCW-124-108	TCW-125-108
R/S	Green	32	180	—	TCW-125-109
U (2-wire uncompensated)	White	12	60	TCW-124-109	TCW-125-110
3-wire RTD	White	12	60	—	TCW-125-111
3-wire RTD	White	36	180	—	TCW-125-112

† Other configurations and lengths are available on special request. Minimum order may apply. Consult Tempco with your requirements.



RTD Multiconductor Wire

Part Number	No. of Conductors	B & S Gauge	Inner Insulation	Outer Insulation	Max. Temp. °F	°C	Nom. Overall Size
LDW-126-101	2	24 Str. NPC*	Fiberglass 1xRed, 1xWhite	Fiberglass	900	480	.080"
LDW-120-101	3	24 Str. SPC**	TFE Teflon® 2xWhite, 1xRed	FEP Jacket White w/SS Overbraid	392	200	.140"
LDW-120-102	3	24 Str. SPC**	TFE Teflon® 2xWhite, 1xRed	FEP Jacket, White	392	200	.125"
LDW-120-103	3	24 Str. NPC*	Fiberglass 2xRed, 1xWhite	SS Overbraid	900	480	.115"
LDW-120-104	3	24 Str. NPC*	Fiberglass 2xRed, 1xWhite	Fiberglass	900	480	.086"
LDW-122-101	4	26 Str. SPC**	TFE Teflon® 2xRed, 2xBlack	FEP Jacket, Black	392	200	.125"

* NPC denotes nickel-plated copper

** SPC denotes silver-plated copper



International Color Codes for Thermocouple and Extension Grade Wires

	International IEC 584-3	International IEC 584-3 <i>(Intrinsically Safe)</i>	British BS1843	German DIN43710	Japanese JIS C1610-1981	French NFE-18001
J						
K						
E						
T						
N						
RX						
SX						
BX						



Tempco's Metal Sheathed, Mineral Insulated Thermocouple Cable

Tempco-Pak Thermocouples and cable are manufactured using premium quality materials along with rigid quality control standards to ensure a reliable product that is state of the art. The metal outer sheath protects the thermocouple wires and insulation from contamination and mechanical damage as well as hostile and oxidizing environments while allowing the cable to be moisture proof, formable, weldable, compact and have fast response. The mineral insulation isolates the conductors from the sheath and each other while providing excellent high temperature insulation resistance.

Tempco offers a wide variety of sheath materials to choose from as there is no single sheath material that is suitable for all conditions. The most commonly stocked sheath materials are 304 SS, 316 SS and alloy 600. These are offered in all ANSI recognized thermocouple calibrations.

As a standard, Tempco-Pak Thermocouple cable is made with high purity 94% minimum MgO insulation. Other types and purities are available; however, when selecting a mineral insulation, the environment, temperature rating and cost must be taken into consideration.



Quality Assurance

All Tempco-Pak Thermocouple cable is inspected for appearance, physical and electrical characteristics, as well as conformity to calibration.

Each coil or batch of Tempco-Pak is made from the same production lot of raw materials and processed together. This eliminates the need to calibrate each length cut from the same coil. Samples from each coil are calibrated as shown in the chart.

Tempco-Pak Thermocouple Calibration Temperatures

ANSI Calibration	Standard Calibration Points	Optional Points
T	200°F (93°C), 400°F (204°C)	—
J	200°F (93°C), 500°F (260°C), 1000°F (537°C), 1500°F (815°C)	—
E	300°F (149°C), 500°F (260°C), 1000°F (537°C), 1600°F (871°C)	—
K	300°F (149°C), 500°F (260°C), 1000°F (537°C), 1600°F (871°C), 2000°F (1093°C)*	2200°F (1204°C)*
R	1000°F (537°C), 1600°F (871°C), 2000°F (1093°C)*	2600°F (1426°C)*
S	1000°F (537°C), 1600°F (871°C), 2000°F (1093°C)*	2600°F (1426°C)*
B	1600°F (871°C), 2000°F (1093°C)*, 2600°F (1426°C)*	
N	300°F (149°C), 500°F (260°C), 1000°F (537°C), 1600°F (871°C), 2000°F (1093°C)*	2200°F (1204°C)*

* These calibration points will be checked if the sheath and insulation are rated to this temperature.

Tempco-Pak

Thermocouple Data, Care and Handling

Calibration

Tempco-Pak Thermocouple Cable is normally supplied to ANSI standard limits (tolerances) of error as set forth in ANSI circular MC96.1-1982 and duplicated in ASTM E230. Special limits (tolerances) per ANSI MC96.1 are available at extra cost (See Table 1 on page 14-103).

Annealing

Unless otherwise specified all Tempco-Pak will be furnished in a fully annealed condition.

Formability

Because Tempco-Pak is fully annealed it can normally be formed around a mandrel 4 times the sheath diameter without loss of insulation resistance or the sheath's integrity.

Weldability

Tempco-Pak can be brazed, soldered or welded upon its sheath. However, because of the delicate nature of the fabricating of hot junctions, it is recommended they be done at the factory. Brazing or soldering material should not come in contact with the mineral insulation as the flux or resin will contaminate the insulation.

Insulation Resistance

Tempco-Pak should have a minimum insulation resistance wire to wire and wire to sheath at room temperature of 100 megohms at 50 VDC for 0.093" O.D. and smaller and 100 megohms at 100 VDC for .100" O.D. and larger.

Shipping and Packaging

Tempco-Pak is stocked in random lengths with the maximum stock lengths listed in the tables showing the varieties of commonly available material. Tempco reserves the right to supply random lengths of our choice unless specific lengths are specified on your order. Tempco-Pak can be furnished in coil form or in straight lengths. Normally .375" diameter and .312" diameter are shipped in straight lengths. Longer lengths are available on special order.

Handling and Storage

To prevent moisture from being absorbed by the hygroscopic insulation, both ends of the lengths of Tempco-Pak are sealed at the factory with a suitable sealer. Under some conditions, moisture absorption could take place that would lower the insulation resistance and may prove to be troublesome in subsequent assembly and welding, so it is advisable to store Tempco-Pak in a dry place. Slight moisture penetration can be remedied by removing approximately 3 inches from each end. Apply heat (approx. 300°F) 6 to 7 inches from the open end and slowly work heat toward and over the open end. Allow end to cool to approximately 180°F and reseal end. When pieces are cut from stock lengths, the exposed ends should be squared and resealed immediately to prevent contamination or moisture absorption. For deeper moisture penetration, bake entire length of material with both ends open for 24 hours at 250°F to 300°F to remove moisture and bring up insulation resistance. If baking does not bring the insulation resistance to acceptable levels, discard the material. As an option Tempco can provide Tempco-Pak with the ends seal welded.



Selecting the Mineral Insulated Thermocouple Cable Suited to Your Requirement

Tempco offers a wide variety of sheathed, mineral insulated thermocouple cable. We stock many varieties of sheath diameters and materials in ANSI recognized thermocouple types and can manufacture a multitude of non-stock combinations of sheath materials, O.D.s, insulations, wire types and wire configurations on special request. Consult Tempco with your specific requirements.

When selecting a cable for an application there are four things that must be considered:

Sheath Material

The outer sheath protects the insulation and wires from physical damage, contamination and the environment, all of which affect the service life and cost. As there isn't any one particular sheath material that is appropriate for all conditions, Tempco offers you a choice.

Wire Types (Calibration)

Selecting the proper conductors can be crucial to the function the MI cable is to perform. Where thermocouple cable is concerned, selecting the appropriate calibration for the temperature to be measured, the instrumentation available, and the environment will be a significant factor in the accuracy, life and cost.

Insulation Material

The insulation material isolates the wires from each other and the sheath. Because the wires are used as conductors, the insulating material becomes important in preventing electrical shorts and dielectric breakdown, particularly at elevated temperatures.

Physical Parameters

The four main physical characteristics of the MI cable that should be taken into account are:

- a. Sheath Diameter
- b. Sheath Wall Thickness
- c. Conductor Size
- d. Conductor Location (4 and 6 wires)

These will directly affect service life, flexibility, time response, weldability, strength and cost.

The following pages will serve as a guide for sheath materials, insulation materials and the various ANSI thermocouple calibrations.



The following information is designed to be used as a guide and may not be correct in every application. If in doubt, consult with your Tempco sales engineer or the factory. Temperatures shown are maximum recommended operating temperatures.

Sheath Material

NOTE: Letters in parentheses following the sheath material are used with the Ordering Worksheet on page 14-119.

Alloy 600 (A)

Maximum temperature: 1177°C (2150°F). Most widely used thermocouple sheath material. Good high temperature strength, corrosion resistance, resistance to chloride-ion stress corrosion cracking and oxidation resistance to high temperatures. Do not use in sulfur-bearing environments. Good in nitriding environments.

316 SS (C)

Maximum temperature: 900°C (1650°F). Best corrosion resistance of the austenitic stainless steel grades. Good corrosion resistance in H₂S. Widely used in the food and chemical industry. Subject to damaging carbide precipitation in 482° to 871°C (900° to 1600°F) range.

304 SS (B)

Maximum temperature: 900°C (1650°F). Most widely used low temperature sheath material. Extensively used in food, beverage, chemical and other industries where corrosion resistance is required. Subject to damaging carbide precipitation in 482° to 871°C (900° to 1600°F) range. Lowest-cost corrosion resistant sheath material available.

304L (D)

Maximum temperature: 900°C (1650°F). Low-carbon version of 304 SS (B). Low carbon content allows this material to be welded and heated in the 482° to 871°C (900° to 1600°F) range without damage to corrosion resistance.

316L (E)

Maximum temperature: 900°C (1650°F). Same as 316 SS (C) except low-carbon version allows for better welding and fabrication.





Sheath Material (continued)

NOTE: Letters in parentheses following the sheath material are used with the Ordering Worksheet on page 14-119.

310 SS (F)

Maximum temperature: 1150°C (2100°F). Mechanical and corrosion resistance, similar to but better than 304 SS. Very good heat resistance. This alloy contains 25% Cr, 20% Ni. Not as ductile as 304 SS.

321 SS (G)

Maximum temperature: 871°C (1600°F). Similar to 304 SS except titanium stabilized for intergranular corrosion. This alloy is designed to overcome susceptibility to carbide precipitation in the 482°C to 871°C (900°F to 1600°F) range. Used in aerospace and chemical applications.

347 SS (H)

Maximum temperature: 871°C (1600°F). Similar to 304 SS except nickel columbium stabilized. This alloy is designed to overcome susceptibility to carbide precipitation in the 482°C to 871°C (900°F to 1600°F) range. Used in aerospace and chemical applications.

446 SS (L)

Maximum temperature: 1150°C (2100°F). Ferritic stainless steel, which has good resistance to sulfurous atmospheres at high temperatures. Good corrosion resistance to nitric acid, sulfuric acid and most alkalis. 27% chromium content gives this alloy the highest heat resistance of any ferritic stainless steel.

Hastelloy X® (Q)

Maximum temperature: 1204°C (2200°F). Widely used in aerospace applications. Resistant to oxidizing, reducing and neutral atmospheric conditions. Excellent high temperature strength along with superior oxidation resistance. Resistant to stress corrosion cracking in petrochemical applications.

Incoloy® 800 (S)

Maximum temperature: 1093°C (2000°F). Widely used as heater sheath material. Minimal use in thermocouples. Superior to Alloy 600 in sulfur, cyanide salts and fused neutral salts. Susceptible to intergranular attack in some applications by exposure to the temperature range of 538°C to 760°C (1000° to 1400°F).

Incoloy® 800HT (T)

Maximum temperature: 1093°C (2000°F). Same as Incoloy 800® (S) except carbon content is limited to upper end of range. This provides significantly higher creep and rupture strength. Used in the chemical and petrochemical industry for long-term exposure to high temperatures.

Inconel® 601 (R)

Maximum temperature: 1177°C (2150°F) Continuous; 1260°C (2300°F) Intermittent. Similar to Alloy 600 with the addition of aluminum for outstanding oxidation resistance. Designed for high temperature corrosion resistance. This material is good in carburizing environments, and has good creep rupture strength. Do not use in vacuum furnaces! Susceptible to intergranular attack by prolonged heating in 538°C to 760°C (1000°F to 1400°F) temperature range.

Molybdenum (V)

Maximum temperature in air: 399°C (750°F). Melting point: 2610°C (4730°F). Refractory metal. Brittle; cannot be bent. Use only in inert, vacuum or reducing atmospheres. Most commonly used with BeO insulation and Tungsten Rhenium conductors. Uncompacted assemblies only.

Nickel 200 (J)

Maximum temperature: 315°C (600°F). Commercially pure wrought Nickel with good resistance to a wide range of corrosive materials. For temperatures above 600°F use Nickel 201 to prevent embrittlement by intergranular corrosion.

Nickel 201 (K)

Maximum temperature: 1093°C (2000°F). Commercially pure wrought nickel with low carbon. Used in molten salt bath furnaces. Offers good resistance to caustic alkalines and fluorine.

Platinum 10% Rhodium (N)

Maximum temperature: 1552°C (2825°F). Excellent oxidation resistance. Same type of uses as platinum 20% rhodium except lower cost and reduced operating range.

Platinum 20% Rhodium (P)

Maximum temperature: 1649°C (3000°F). Excellent oxidation resistance. Very expensive oxidation resistant alloy used in glass manufacturing and in research applications. Also used for gas turbine test thermocouples.

Pure Platinum (M)

Maximum temperature: 1482°C (2700°F). Platinum is the only metallic material capable of operating in an oxidizing atmosphere above 1260°C (2300°F) for extended periods of time. Normally used with type R, S or B conductors. Used in glass manufacturing, high temperature furnaces and as control standards.

Tantalum (U)

Maximum temperature in air: 482°C (900°F). Melting point: 2996°C (5425°F). Refractory metal. Very ductile. Use only in inert or very good vacuums—10-3 torr or better. Most commonly used with BeO and Tungsten Rhenium conductors. Do not use in environments containing nitrogen above 371°C (700°F).



Mineral Insulated Cable Calibration

NOTE: Letters in parentheses following the sheath material are used with the Ordering Worksheet on page 14-119.

ANSI Type (J) Standard; Special Tolerance (3)

Type J is composed of a positive leg (JP) which is iron and a negative leg (JN) which is approximately 45% nickel, 55% copper. When protected by the compacted mineral insulation and appropriate outer sheath, Type J is usable from 32°F to 1500°F. Type J is not susceptible to short range ordering in the 700 to 1000°F temperature range (+2°F to +4°F drift), which occurs with ANSI Type E and K. This low-cost, stable thermocouple calibration is primarily used with 94% minimum purity MgO insulation and a stainless steel sheath.

ANSI Type (K) Standard; Special Tolerance (4)

Type K is composed of a positive leg (KP) which is approximately 90% nickel, 10% chromium and a negative leg (KN) which is approximately 95% nickel, 2% aluminum, 2% manganese and 1% silicon. When protected by the compacted mineral insulation and appropriate outer sheath, Type K is usable from 32°F to 2300°F and is one of Tempco's most popular calibration types. If the application temperature is between 600°F and 1100°F, we recommend using Type J or Type N because of short range ordering that can cause drift of +2°F to +4°F in a few hours' time. Type K is relatively stable to radiation transmutation and is used in nuclear environments. For applications below 32°F, special alloy selections are usually required.

ANSI Type (E) Standard; Special Tolerance (5)

Type E is composed of a positive leg (EP) which is approximately 90% nickel, 10% chromium and a negative leg (EN) which is approximately 45% nickel, 55% copper. When protected by the compacted mineral insulation and appropriate outer sheath, Type E is usable from 32°F to 1650°F. This thermocouple has the highest EMF output per degree of all ANSI recognized thermocouples. If the application temperature is between 600°F and 1100°F, we recommend using Type J or Type N because of short range ordering that can cause drift of +2°F to +4°F in a few hours' time. For applications below 32°F, special alloy selections may be required.

ANSI Type (T) Standard; Special Tolerance (6)

Type T is composed of a positive leg (TP) which is pure copper and a negative leg (TN) which is approximately 45% nickel, 55% copper. When protected by the compacted mineral insulation and appropriate outer sheath, Type T is usable from 32°F to 662°F. Type T is very stable and is used in a wide variety of cryogenic and low temperature applications. For applications below 32°F special alloy selections may be required.

ANSI Type (N) Standard; Special Tolerance (7)

Type N is composed of a positive leg (Nicrosil) which is approximately 14% chromium, 1.4% silicon, 84.6% nickel and a negative leg (Nisil) which is approximately 4.4% silicon, 95.6% nickel. When protected by compacted mineral insulation and appropriate outer sheath, Type N is usable from 32°F to 2300°F. Type N was designed to overcome several problems inherent in Type K thermocouples. Short range ordering (+2°F to +4°F drift) in the 600°F to 1100°F temperature range is greatly reduced, and the drift rate at high temperatures is considerably less. Type N has also been found to be more stable than Type K in nuclear environments.

ANSI Type (R) Standard Tolerance

Type R is composed of a positive leg (RP), which is 87% platinum, 13% rhodium and a negative leg (RN), which is 100% platinum. When protected by compacted mineral insulation and appropriate outer sheath, Type R is usable from 32°F to 2700°F. Type R is available as standard limits only, ITS90.

ANSI Type (S) Standard Tolerance

Type S is composed of a positive leg (SP), which is 90% platinum, 10% rhodium and a negative leg (SN), which is 100% platinum. When protected by compacted mineral insulation and appropriate outer sheath, Type S is usable from 32°F to 2700°F. Type S has a lower EMF output than Type R and is available as standard limits only, ITS90.

ANSI Type (B) Standard Tolerance

Type B is composed of a positive leg (BP) which is approximately 70% platinum, 30% rhodium and a negative leg (BN) which is approximately 94% platinum, 6% rhodium. When protected by compacted mineral insulation and appropriate outer sheath, Type B is usable from 1600°F to 3100°F. Type B is available as standard limits only, IPTS 1968 scale.

Tungsten—5% Re/Tungsten, 26% Re (C)

This calibration has not been given a letter designation by ANSI. When this calibration is protected by mineral insulation and appropriate outer sheath, it is usable from 32°F to 4200°F. Calibration is used most often with Beryllium Oxide insulation and either molybdenum or tantalum sheath. These combinations can only be used in an inert or vacuum environment.

Miscellaneous (O)

Consult Tempco with your requirements.



Mineral Insulated Thermocouple Cable

Insulation

NOTE: Letters in parentheses following the sheath material are used with the Ordering Worksheet on page 14-119.

Magnesium Oxide — MgO 96% Typical (M)

This insulation is widely used in thermocouple and heater applications below 2000°F. SiO₂ is the major impurity that provides excellent insulation resistance. Do not use with platinum or in nuclear application.

High Purity Magnesium Oxide — MgO 99.4% Minimum Purity (H)

Low impurity levels make this insulation very useful for all thermocouple calibrations up to 2500°F. Above 2500°F we recommend using Hafnia Oxide (HfO₂) insulation because of MgO's low resistivity. This material meets the requirements established in ASTM E-235-82.

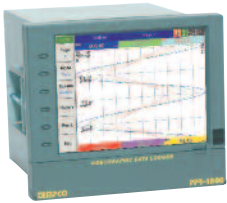
Alumina Oxide — Al₂O₃ 99.6% Minimum Purity (A)

Although this material is comparable to MgO in its electrical properties and cost, it does not compact as well and tends to "powder out." This undesirable characteristic has made this insulation unpopular in industry so cable with this type of insulation is available only as a "special."

Complete Your Thermal Loop System

Instrumentation

Videographic Data Loggers and Paper Chart Recorders



Complete details can be found in Section 12 of this catalog.



TEC Temperature Controllers



Complete details can be found in Section 13 of this catalog.





Mineral Insulated Thermocouple Cable Ordering Worksheet

Ordering Code: **MTC** - 1 2 3 4 5

Designates
TEMPCO-PAK Sheathed
Mineral Insulated
Thermocouple Cable

Calibration Code — See page 14-117

ANSI Standard Tolerances	Special Tolerances
J = (Iron/Constantan)	3
K = (Chromel®/Alumel)	4
E = (Chromel®/Constantan)	5
T = (Cu/Constantan)	6
N = (Nicrosil/Nisil)	7
R = (Pt/Pt-13% Rh) PER ITS-90	
S = (Pt/Pt-10% Rh) PER ITS-90	
B = (Plat-6% Rh/Plat-30% Rh)	
C = (W-5% Re/W-26% Re)	
O = Miscellaneous (Consult Factory)	

Number of Conductors

2 = 2-wire construction (Single Element)
4 = 4-wire construction (Duplex Element)

Insulation — See page 14-118

M = 96% min. MgO
H = 99.4% min. MgO
A = 99.6% Alumina

Ordering Worksheet



Note: For a complete description of Worksheet options see pages 14-115 through 14-118.

Sheath O.D.

A = .020" ±.001	L = 1.0 mm ±.03
B = .032" ±.001	N = 1.5 mm ±.03
C = .040" ±.001	P = 2.0 mm ±.03
D = .063" ±.001	Q = 3.0 mm ±.05
E = .093" ±.002	R = 4.5 mm ±.05
F = .125" ±.002	S = 6.0 mm +.07/-.05
G = .188" ±.002	T = 8.0 mm +.07/-.05
H = .250" +.003/-.002	V = 9.0 mm +.07/-.05
J = .313" +.003/-.002	
K = .375" +.003/-.002	

Sheath Material — See pages 14-115 and 14-116

A = Alloy 600	L = 446 SS
B = 304 SS	M = Pure platinum
C = 316 SS	N = Platinum 10% rhodium
D = 304L SS	P = Platinum 20% rhodium
E = 316L SS	Q = Hastelloy X®
F = 310 SS	R = Inconel® 601
G = 321 SS	S = Incoloy® 800
H = 347 SS	T = Incoloy® 800HT
J = Nickel 200	U = Tantalum
K = Nickel 201	V = Molybdenum



Single Element Standard Size List



O.D. (in.)	Part Number	ANSI Calibration	Insulation (Min. Purity)	Sheath Material	Nom. Wall Thickness (in.)	Nom. B&S Wire ga.	Max. Operating Temp. (°F)	Max. Stock Length (ft.)
.020 ±.001	MTC00001	J	99.4% MgO	Alloy 600	.003	39	1500	50
	MTC00002	K	99.4% MgO	Alloy 600	.003	39	1650	50
	MTC00003	J	99.4% MgO	304	.003	39	1500	50
	MTC00004	K	99.4% MgO	304	.003	39	1650	50
.032 ±.001	MTC00005	J	99.4% MgO	Alloy 600	.005	36	1500	150
	MTC00006	K	99.4% MgO	Alloy 600	.005	36	1800	150
	MTC00007	J	99.4% MgO	304	.005	36	1500	150
	MTC00008	K	99.4% MgO	304	.005	36	1650	150
.040 ±.001	MTC00009	J	99.4% MgO	Alloy 600	.006	33	1500	175
	MTC00010	K	99.4% MgO	Alloy 600	.006	33	2000	175
	MTC00011	J	99.4% MgO	304	.006	33	1500	175
	MTC00012	K	99.4% MgO	304	.006	33	1650	175
	MTC00013	E	99.4% MgO	304	.006	33	1600	175
	MTC00014	T	99.4% MgO	304	.006	33	650	175
	MTC00015	J	99.4% MgO	316	.006	33	1500	175
	MTC00016	K	99.4% MgO	316	.006	33	1650	175
.062 ±.001	MTC00017	J	96.0% MgO	Alloy 600	.008	30	1500	500
	MTC00018	J	99.4% MgO	Alloy 600	.008	30	1500	500
	MTC00019	K	96.0% MgO	Alloy 600	.008	30	2000	500
	MTC00020	K	99.4% MgO	Alloy 600	.008	30	2000	500
	MTC00021	J	96.0% MgO	304	.008	30	1500	500
	MTC00022	J	99.4% MgO	304	.008	30	1500	500
	MTC00023	K	96.0% MgO	304	.008	30	1650	500
	MTC00024	K	99.4% MgO	304	.008	30	1650	500
	MTC00025	E	96.0% MgO	304	.008	30	1600	500
	MTC00026	T	99.4% MgO	304	.008	30	650	500
	MTC00027	J	96.0% MgO	316	.008	30	1500	500
	MTC00028	J	99.4% MgO	316	.008	30	1500	500
MTC00029	K	96.0% MgO	316	.008	30	1650	500	
MTC00030	K	99.4% MgO	316	.008	30	1650	500	
.093 ±.002	MTC00031	J	96.0% MgO	Alloy 600	.010	27	1500	450
	MTC00032	J	99.4% MgO	Alloy 600	.010	27	1500	450
	MTC00033	K	96.0% MgO	Alloy 600	.010	27	2000	450
	MTC00034	K	99.4% MgO	Alloy 600	.010	27	2150	450
	MTC00035	J	96.0% MgO	304	.010	27	1500	450
	MTC00036	J	99.4% MgO	304	.010	27	1500	450
	MTC00037	K	96.0% MgO	304	.010	27	1650	450
	MTC00038	K	99.4% MgO	304	.010	27	1650	450
.125 ±.002	MTC00039	J	96.0% MgO	Alloy 600	.014	24	1500	250
	MTC00040	J	99.4% MgO	Alloy 600	.014	24	1500	250
	MTC00041	K	96.0% MgO	Alloy 600	.014	24	2000	250
	MTC00042	K	99.4% MgO	Alloy 600	.014	24	2150	250
	MTC00043	J	96.0% MgO	304	.014	24	1500	250
	MTC00044	J	99.4% MgO	304	.014	24	1500	250
	MTC00045	K	96.0% MgO	304	.014	24	1650	250
	MTC00046	K	99.4% MgO	304	.014	24	1650	250
	MTC00047	E	96.0% MgO	304	.014	24	1600	250
	MTC00048	T	96.0% MgO	304	.014	24	650	250
	MTC00049	J	96.0% MgO	316	.014	24	1500	250
	MTC00050	J	99.4% MgO	316	.014	24	1500	250
	MTC00051	K	96.0% MgO	316	.014	24	1650	250
	MTC00052	K	99.4% MgO	316	.014	24	1650	250
	MTC00053	E	96.0% MgO	316	.014	24	1600	250
	MTC00054	T	96.0% MgO	316	.014	24	650	250
	MTC00055	J	96.0% MgO	310	.014	24	1500	250
	MTC00056	K	96.0% MgO	310	.014	24	2000	250
MTC00057	R	99.4% MgO	Alloy 600	.020	24	2150	250	
MTC00058	S	99.4% MgO	Alloy 600	.020	24	2150	250	

CONTINUED



Single Element Standard Size List

Continued from previous page...

O.D. (in.)	Part Number	ANSI Calibration	Insulation (Min. Purity)	Sheath Material	Nom. Wall Thickness (in.)	Nom. B&S Wire ga.	Max. Operating Temp. (°F)	Max. Stock Length (ft.)
.188 ±.002	MTC00059	J	96.0% MgO	Alloy 600	.022	21	1500	120
	MTC00060	J	99.4% MgO	Alloy 600	.022	21	1500	120
	MTC00061	K	96.0% MgO	Alloy 600	.022	21	2000	120
	MTC00062	K	99.4% MgO	Alloy 600	.022	21	2150	120
	MTC00063	J	96.0% MgO	304	.022	21	1500	120
	MTC00064	J	99.4% MgO	304	.022	21	1500	120
	MTC00065	K	96.0% MgO	304	.022	21	1650	120
	MTC00066	K	99.4% MgO	304	.022	21	1650	120
	MTC00067	E	96.0% MgO	304	.022	21	1600	120
	MTC00068	T	96.0% MgO	304	.022	21	650	120
	MTC00069	J	96.0% MgO	316	.022	21	1500	120
	MTC00070	J	99.4% MgO	316	.022	21	1500	120
	MTC00071	K	96.0% MgO	316	.022	21	1650	120
	MTC00072	K	99.4% MgO	316	.022	21	1650	120
	MTC00073	E	96.0% MgO	316	.022	21	1600	120
	MTC00074	T	96.0% MgO	316	.022	21	650	120
	MTC00075	J	96.0% MgO	310	.022	21	1500	120
	MTC00076	K	96.0% MgO	310	.022	21	2000	120
.250 +.003 -.002	MTC00077	J	96.0% MgO	Alloy 600	.029	18	1500	70
	MTC00078	J	99.4% MgO	Alloy 600	.029	18	1500	70
	MTC00079	K	96.0% MgO	Alloy 600	.029	18	2000	70
	MTC00080	K	99.4% MgO	Alloy 600	.029	18	2150	70
	MTC00081	J	96.0% MgO	304	.029	18	1500	70
	MTC00082	J	99.4% MgO	304	.029	18	1500	70
	MTC00083	K	96.0% MgO	304	.029	18	1650	70
	MTC00084	K	99.4% MgO	304	.029	18	1650	70
	MTC00085	E	96.0% MgO	304	.029	18	1600	70
	MTC00086	T	96.0% MgO	304	.029	18	650	70
	MTC00087	J	96.0% MgO	316	.029	18	1500	70
	MTC00088	J	99.4% MgO	316	.029	18	1500	70
	MTC00089	K	96.0% MgO	316	.029	18	1650	70
	MTC00090	K	99.4% MgO	316	.029	18	1650	70
MTC00091	E	96.0% MgO	316	.029	18	1600	70	
MTC00092	T	96.0% MgO	316	.029	18	650	70	
MTC00093	J	96.0% MgO	310	.029	18	1500	70	
MTC00094	K	96.0% MgO	310	.029	18	2000	70	
.313 +.003 -.002	MTC00095	J	96.0% MgO	Alloy 600	.036	17	1500	40
	MTC00096	J	96.0% MgO	304	.036	17	1500	40
	MTC00097	K	96.0% MgO	Alloy 600	.036	17	2000	40
	MTC00098	K	96.0% MgO	304	.036	17	1650	40
	MTC00099	E	96.0% MgO	304	.036	17	1600	40
	MTC00100	E	96.0% MgO	316	.036	17	1600	40
	MTC00101	J	96.0% MgO	316	.036	17	1500	40
	MTC00102	K	96.0% MgO	316	.036	17	1650	40
.375 +.003 -.002	MTC00103	J	96.0% MgO	Alloy 600	.045	15	1500	30
	MTC00104	J	96.0% MgO	304	.045	15	1500	30
	MTC00105	K	96.0% MgO	Alloy 600	.045	15	2000	30
	MTC00106	K	96.0% MgO	304	.045	15	1650	30
	MTC00107	J	96.0% MgO	316	.045	15	1500	30
	MTC00108	K	96.0% MgO	316	.045	15	1650	30



Duplex Element — Diagonal Standard Size List



O.D. (in.)	Part Number	ANSI Calibration	Insulation (Min. Purity)	Sheath Material	Nom. Wall Thickness (in.)	Nom. B&S Wire Ga.	Max. Operating Temp. (°F)	Max. Stock Length (ft.)
.063 ±.001	MTC00109	J	99.4% MgO	Alloy 600	.009	30	1500	500
	MTC00110	K	99.4% MgO	Alloy 600	.009	30	2000	500
	MTC00111	J	99.4% MgO	304	.009	30	1500	500
	MTC00112	K	99.4% MgO	304	.009	30	1650	500
.125 ±.002	MTC00113	J	96.0% MgO	Alloy 600	.016	24	1500	250
	MTC00114	K	96.0% MgO	Alloy 600	.016	24	2000	250
	MTC00115	J	96.0% MgO	304	.016	24	1500	250
	MTC00116	K	96.0% MgO	304	.016	24	1650	250
	MTC00117	E	96.0% MgO	304	.016	24	1600	250
	MTC00118	J	96.0% MgO	316	.016	24	1500	250
	MTC00119	K	96.0% MgO	316	.016	24	1650	250
.188 ±.002	MTC00120	J	96.0% MgO	Alloy 600	.024	21	1500	120
	MTC00121	K	96.0% MgO	Alloy 600	.024	21	2000	120
	MTC00122	J	96.0% MgO	304	.024	21	1500	120
	MTC00123	K	96.0% MgO	304	.024	21	1650	120
	MTC00124	E	96.0% MgO	304	.024	21	1600	120
	MTC00125	T	96.0% MgO	304	.024	21	650	120
	MTC00126	J	96.0% MgO	316	.024	21	1500	120
	MTC00127	K	96.0% MgO	316	.024	21	1650	120
.250 +.003 -.002	MTC00128	J	96.0% MgO	Alloy 600	.031	19	1500	70
	MTC00129	K	96.0% MgO	Alloy 600	.031	19	2000	70
	MTC00130	J	96.0% MgO	304	.031	19	1500	70
	MTC00131	K	96.0% MgO	304	.031	19	1650	70
	MTC00132	E	96.0% MgO	304	.031	19	1600	70
	MTC00133	T	96.0% MgO	304	.031	19	650	70
	MTC00134	J	96.0% MgO	316	.031	19	1500	70
	MTC00135	K	96.0% MgO	316	.031	19	1650	70
.313 +.003 -.002	MTC00136	J	96.0% MgO	Alloy 600	.039	17	1500	40
	MTC00137	K	96.0% MgO	Alloy 600	.039	17	2000	40
	MTC00138	J	96.0% MgO	304	.039	17	1500	40
	MTC00139	K	96.0% MgO	304	.039	17	1650	40
	MTC00140	E	96.0% MgO	304	.039	17	1600	40
	MTC00141	T	96.0% MgO	304	.039	17	650	40
.375 +.003 -.002	MTC00142	J	96.0% MgO	Alloy 600	.047	15	1500	30
	MTC00143	K	96.0% MgO	Alloy 600	.047	15	2000	30
	MTC00144	J	96.0% MgO	304	.047	15	1500	30
	MTC00145	K	96.0% MgO	304	.047	15	1650	30
	MTC00146	E	96.0% MgO	304	.047	15	1600	30
	MTC00147	T	96.0% MgO	304	.047	15	650	30



Metric — Single Element Standard Size List



O.D. (mm.)	Part Number	ANSI Calibration	Insulation (Min. Purity)	Sheath Material	Nom. Wall Thickness (mm.)	Nom. Wire Dia. (mm)	Max. Operating Temp. (°C)	Max. Stock Length (m.)
1.5 ±.03	MTC00148	J	99.4% MgO	Alloy 600	0.20	0.28	815	167
	MTC00149	K	99.4% MgO	Alloy 600	0.20	0.28	1093	167
	MTC00150	J	99.4% MgO	304	0.20	0.28	815	167
	MTC00151	K	99.4% MgO	304	0.20	0.28	898	167
2.0 ±.03	MTC00152	J	96.0% MgO	Alloy 600	0.25	0.36	815	93
	MTC00153	K	96.0% MgO	Alloy 600	0.25	0.36	1093	93
	MTC00154	J	96.0% MgO	304	0.25	0.36	815	93
	MTC00155	K	96.0% MgO	304	0.25	0.36	898	93
	MTC00156	J	96.0% MgO	316	0.25	0.36	815	93
	MTC00157	K	96.0% MgO	316	0.25	0.36	898	93
3.0 ±.05	MTC00158	J	96.0% MgO	Alloy 600	0.33	0.46	815	84
	MTC00159	K	96.0% MgO	Alloy 600	0.33	0.46	1093	84
	MTC00160	J	96.0% MgO	304	0.33	0.46	815	84
	MTC00161	K	96.0% MgO	304	0.33	0.46	898	84
	MTC00162	E	96.0% MgO	304	0.33	0.46	871	84
	MTC00163	T	96.0% MgO	304	0.33	0.46	343	84
	MTC00164	J	96.0% MgO	316	0.33	0.46	815	84
	MTC00165	K	96.0% MgO	316	0.33	0.46	898	84
4.5 ±.05	MTC00166	J	96.0% MgO	Alloy 600	0.53	0.69	815	37
	MTC00167	K	96.0% MgO	Alloy 600	0.53	0.69	1093	37
	MTC00168	J	96.0% MgO	304	0.53	0.69	815	37
	MTC00169	K	96.0% MgO	304	0.53	0.69	898	37
6.0 +07 -05	MTC00170	J	96.0% MgO	Alloy 600	0.69	0.94	815	21
	MTC00171	K	96.0% MgO	Alloy 600	0.69	0.94	1093	21
	MTC00172	J	96.0% MgO	304	0.69	0.94	815	21
	MTC00173	K	96.0% MgO	304	0.69	0.94	898	21
8.0 +07 -05	MTC00174	J	96.0% MgO	Alloy 600	0.91	1.22	815	12
	MTC00175	K	96.0% MgO	Alloy 600	0.91	1.22	1093	12
	MTC00176	J	96.0% MgO	304	0.91	1.22	815	12
	MTC00177	K	96.0% MgO	304	0.91	1.22	898	12

Ordering Information

Standard Thermocouple Cable

Order by Part Number from the Lists on Pages 14-120 through 14-123.

Thermocouple wire is sold by the foot and is subject to minimum billing.

Tempco-Pak is stocked in random lengths with the maximum stock lengths listed in the tables showing the varieties of commonly available material. Tempco reserves the right to supply random lengths of our choice unless specific lengths are indicated on your order. Tempco-Pak can be furnished in coil form or in straight lengths. Normally .375" diameter and .312" diameter are shipped in straight lengths. Longer lengths are available on special order.

Custom Manufactured Thermocouple Cables

For sizes and specifications not listed, Tempco will design and manufacture a Mineral Insulated Thermocouple Cable to meet your requirements. Please refer to the ordering worksheet on page 14-119 and follow the model as diagrammed to specify your requirements with the Tempco code number.

In addition, refer to page 14-124 and **specify the following:**

- Configuration type
- Sheath wall thickness
- Conductor Configuration and Size
- Minimum acceptable lengths and total length required



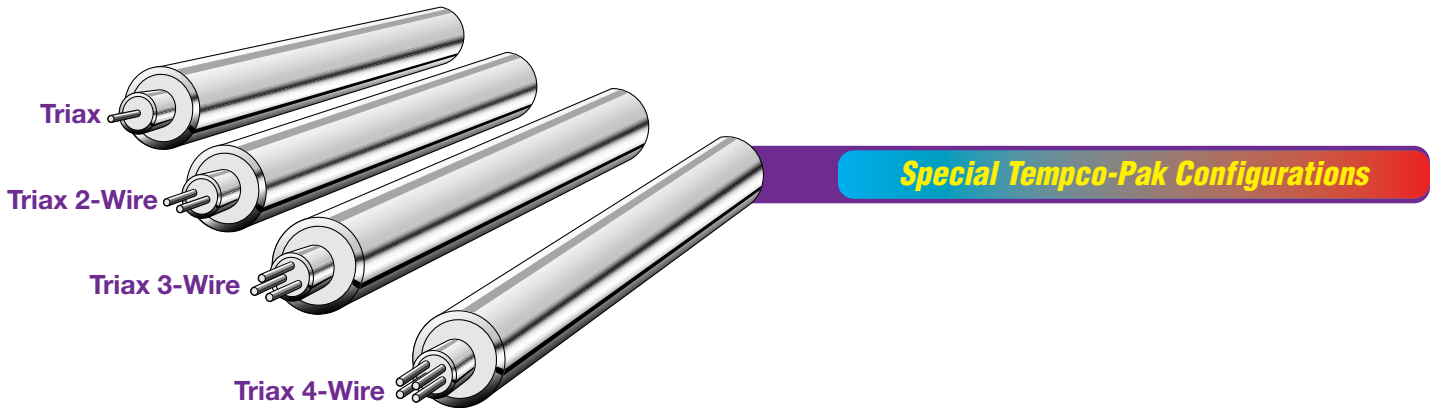
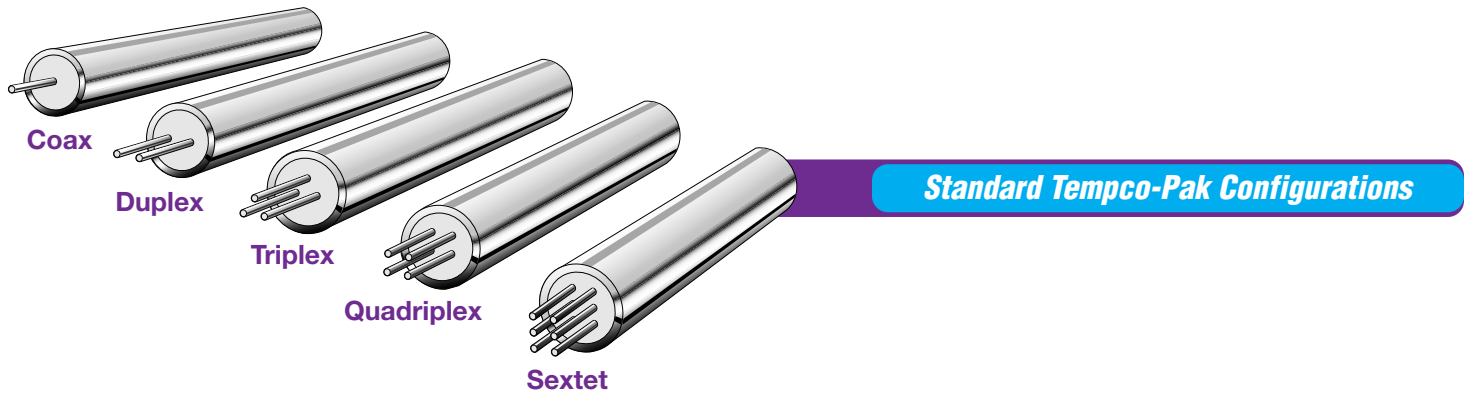
Mineral Insulated Thermocouple Cable

Made-To-Order Mineral-Insulated Cable

In addition to the standard line of Tempco-Pak Thermocouple Cables, we can also manufacture metal sheathed, mineral insulated cable in special configurations using a wide variety of sheath materials and conductor alloys such as copper, nickel, alloy 600, CHROMEL-A®, nickel clad copper, 304 SS and virtually any other malleable metal.

Properly selected combinations of materials (sheath, insulation and wire) will exhibit the same outstanding qualities and performance as our standard Tempco-Pak.

Shown below are standard and special Tempco-Pak configurations. *Consult Tempco with your specific requirements.*



Ordering Information

Made-To-Order Mineral-Insulated Cable

Custom Manufactured Mineral-Insulated Cable

Supply the following information when requesting a quotation on made-to-order mineral-insulated cable:

- Configuration type
- Sheath material
- Insulation type and purity
- Calibration type or conductor material
- Conductor configuration and size
- Sheath wall thickness
- Minimum acceptable lengths and total length required



Glossary of Temperature Sensing Terms

Absolute Zero — Theoretically, the lowest possible temperature. A body at absolute zero would have no molecular motion or heat energy. It is the zero point on the Kelvin and Rankine scales, and is estimated to be -273.15°C or -459.67°F .

Accuracy — A statement that is used to define the largest allowable error in a device or system. It is an indication of how close measured values are to true values. It can be expressed in both measured units and in percentages.

Alloy #11 — A Harrison Alloys trademark for a low-cost negative thermoelement used with copper for a compensating extension wire used with thermocouple types R and S. The EMF characteristics are similar to R and S up to approximately 204°C .

Alpha (α) — The temperature coefficient of resistance of a material, derived from measurements at 0°C and at 100°C : $\{R_{\text{sub}(100)} - R_{\text{sub}(0)}\}$ over $\{100 \text{ times } R_{\text{sub}(0)}\}$. It indicates the basic change in resistance in a material for each $^{\circ}\text{C}$ change in temperature. It is a defining parameter for resistance temperature detectors (RTDs).

ANSI — An abbreviation for American National Standards Institute.

ASTM — An abbreviation for American Society for Testing and Materials.

AWG — An abbreviation for American Wire Gauge.

Boiling Point — The equilibrium temperature between a liquid and its vapor. It is commonly associated with water at 100°C , and 1 standard atmosphere.

Callendar - van Dusen Equation — An interpolation equation that provides resistance values as a function of temperature for RTDs.

Celsius Temperature Scale — A temperature scale with the ice point at 0 and the boiling point of water at 100. The formula for conversion to the Fahrenheit scale is $F = 1.8C + 32$. Formerly referred to as "Centigrade."

Ceramic Insulation — Crystalline compounds of both metallic and nonmetallic elements that serve as dielectric insulators. Two of the most common single oxide ceramics are alumina (Al_2O_3) and magnesium oxide (MgO). Ceramics are the primary insulation used to isolate sheathed thermocouple alloys.

Compensated Connector — A thermocouple connector that utilizes either actual thermocouple material contacts or compensating alloy contacts. By maintaining uniform circuit properties throughout the connection systems, errors due to mismatched materials are reduced.

Compensating Alloy — An alloy that has similar EMF characteristics to an actual thermocouple alloy. It is usually a low-cost alternative for some types of thermocouple alloy extension lead wires. An example would be the use of Alloy #11 as compensating lead wire for platinum thermocouple sensors.

Compensating Loop — Utilized in RTDs, a compensating loop is an extra pair of lead wires that have the same resistance as the actual lead wires, but which are not connected to the RTD element. Its purpose is to correct for lead wire resistance errors when making temperature measurement.

Connection Head — A housing on a sensor assembly that provides a terminal block for electrical connections and allows the attachment of protection tubes and cable or conduit hookups.

Constantan — The negative leg of types E, J and T thermocouples. Constantan is 55% copper and 45% nickel. The emf values can be significantly different for this material depending upon with which type of thermocouple alloy it is intended to be matched.

Copper — The positive leg of type T thermocouple.

Cryogenic — A term that usually refers to temperatures in the range of -183°C or lower.

Dielectric Strength — A measure of the voltage that an insulating material can withstand before an electrical breakdown occurs. It is sometimes referred to as breakdown potential.

DIN 43760 — German Institute for Standards document that covers nickel and platinum resistance elements. This is the most popular specification for 100 ohm platinum RTDs with a resistance vs. temperature curve specified by 0.00385 ohms/ohm $^{\circ}\text{C}$.

Drain Wire — An uninsulated wire used in a cable construction as a ground connection.

Duplex Construction — A cable or wire constructed with two insulated conductors running parallel or twisted together.

Exposed Junction — A specific type of thermocouple junction where the measuring junction is exposed to the environment without any protecting sheath or outer tube. An exposed junction offers the fastest response time.

Extension Wire — A pair of wires connecting a thermocouple sensor to its reference junction or instrumentation. The emf characteristics of the extension wire must be similar to the thermocouple emf characteristics.

Fahrenheit Temperature Scale — A temperature scale with the ice point at 32 and the boiling point of water at 212. The formula for conversion to the Celsius scale is $C = 5/9 (F - 32)$.

FEP — An abbreviation for Fluorinated Ethylene Propylene. This component is commonly referred to as "Teflon $^{\circledR}$."

Fixed Point — A very reproducible temperature at the equilibrium point between phase changes in a material. The triple point of water (0.01°C) is an example of a fixed point.

Freezing Point — The fixed temperature point of a material that occurs during the transition from a liquid to a solid state. This is also known as the melting point for pure materials.

Giga- — A prefix meaning billion, or 10^9 . The symbol is G.

Ground — A conducting connection to earth or to some other large conducting object. Its purpose is to maintain an earth potential on the conductors connected to it, and to conduct the ground current to and from the earth.

Grounded Junction — A specific type of thermocouple junction in which the sheath and conductors are welded together, forming a completely sealed integral junction. A grounded junction is recommended for use in liquids, gas, and high pressure environments.

Hi-Pot Test — A test that determines the largest potential that can be applied to a conductor without breaking down the insulation (see Dielectric Strength).

Ice Point — The melting (and freezing) point of ice, 0°C . The ice point is frequently used as a calibration check point on resistance temperature detectors and as the reference junction for thermocouples.

Initial Calibration Tolerances — The allowable deviation from the theoretical emf value generated by any particular calibration thermocouple at a given temperature (previously referred to as limits of error).

Insulation Resistance — A ratio of the applied voltage to the total current flow between two conductors separated by insulation or any conductor and the sheath.

Interchangeability — A statement that describes how closely a sensor adheres to its defining equation, and the maximum variation that would exist in the readings of identical sensors mounted side-by-side under identical conditions.

IPTS- 68, 48 — Abbreviations for the International Practical Temperature Scales of 1968 and 1948. IPTS-68 is the most recent revision of the temperature scale, which is a standard scale made up of fixed points that closely approximate thermodynamic temperatures. All temperatures between the fixed points are derived by interpolation using the assigned interpolation instrument.

Iron — The positive leg of a type J thermocouple.

ISA — An abbreviation for the Instrument Society of America.

Junction (thermocouple) — The point at which two thermocouple alloys are joined. In a typical thermocouple circuit there is a measuring junction and a reference junction.

Kelvin Temperature Scale — Also known as the thermodynamic temperature scale, the Kelvin Scale is an absolute temperature scale in which temperature differences are proportional to the amount of heat energy converted to mechanical work by a Carnot engine. The ice point on the Kelvin Scale is 273.15K . A useful approximation for conversion of the Kelvin Scale to the Celsius scale is $T(\text{K}) = T(\text{C}) + 273.15$.

KN — The negative leg of a type K thermocouple. It is predominantly nickel with small added amounts of aluminum, manganese, and silicon. Company trade names are Alumel, Nial, and HAI-KN.

KP — The positive leg of a type K thermocouple. It is predominantly nickel with added chromium. Company trade names are Chromel, Tophel, and HAI-KP.

Limit of Error — The allowable error in a thermocouple, expressed as a percentage or a specific degree value throughout defined temperature ranges. See Initial Calibration Tolerances.





Glossary of Temperature Sensing Terms (continued)

Linearity — An instrument or transducer's deviation in response from straight line values.

Loop Resistance — The total resistance of the thermocouple materials in a thermocouple circuit or heater in a heater circuit.

Measuring Junction — The junction in a thermocouple circuit that senses the temperature of the unknown object. It is commonly referred to as the hot junction.

Mega- — A prefix meaning million, or 10^6 . The symbol is M.

Mica — A silicate mineral used mainly as an electrical and heat insulator.

Microvolt (μV) — One millionth of a volt (10^{-6} volt). In thermocouple measurements, a microvolt is the smallest common increment of output.

Millivolt (mV) — One thousandth of a volt.

Mineral-Insulated Thermocouple — A thermocouple that is manufactured by loading a metal sheath with conductors and insulators, and then compacting the entire assembly.

Negative Temperature Coefficient — A characteristic of a material in which a decrease in resistance accompanies an exposure to increased temperatures.

NEMA — An abbreviation for the National Electrical Manufacturers Association.

Nicrosil — The positive leg of a type N thermocouple. It is predominantly nickel with added chromium and silicon.

NISIL — The negative leg of a type N thermocouple. It is predominantly nickel with added silicon and magnesium.

NIST — National Institute of Standards and Technology.

Noise — Unwanted electrical interference picked up on a signal cable.

NPT — An abbreviation for American National Standard taper pipe thread.

OFHC — An abbreviation for oxygen free high conductivity copper.

Parallel Pair — A wire construction where two single conductors are laid parallel.

Platinel — An Englehard Industries trade name for a platinum thermocouple alloy with thermoelectric characteristics that closely match type K thermocouples at temperatures above 800°C .

Platinum — The negative leg in types R and S thermocouples. A noble metal, symbol Pt, with excellent chemical and heat resistance. It is more ductile than silver, gold, or copper.

Platinum 6% Rhodium — The platinum-rhodium alloy that forms the negative leg on type B thermocouple.

Platinum 10% Rhodium — The platinum-rhodium alloy that forms the positive leg on a type S thermocouple.

Platinum 13% Rhodium — The platinum-rhodium alloy that forms the positive leg on a type R thermocouple.

Platinum 30% Rhodium — The platinum-rhodium alloy that forms the positive leg on a type B thermocouple.

Platinum 67 — The platinum standard used by the NIST. Platinum 67 is used to interpolate the temperature scale between 630.74 and 1064.43°C . Previously called Platinum 27, Platinum 67 (IPTS-68) is 9 microvolts negative to Platinum 27 (IPTS-48) at 1200°C .

Positive Temperature Coefficient — A characteristic of a material in which an increase in resistance accompanies exposure to an increase in temperature.

Primary Standard — A term that applies to an instrument that meets conditions required for establishing the International Practical Temperature Scale.

Protection Tube — A tube that is designed to protect a sensor from any harsh environment or process conditions.

PTFE — An abbreviation for polytetrafluoroethylene. One of the most chemically resistant carbon based insulations.

PVC — An abbreviation for polyvinyl chloride, a thermoplastic with excellent dielectric strength and flexibility.

Rankine Temperature Scale — A temperature scale with its 0 at the absolute zero of temperature. Its degree is equal to a Fahrenheit degree, thus $T(\text{R}) = T(\text{F}) + 459.67$.

Reference Junction — The junction in a thermocouple circuit that is maintained at a constant, known temperature. It is also referred to as the cold junction and as a standard it is usually maintained at 0°C ; however, any temperature can be used.

Refractory Metal Thermocouple — A thermocouple made from materials that melt above 1935°C .

Repeatability — The ability of a sensor or system to indicate the same reading under repeated identical conditions.

Resistance — A property of conductors that determines the current produced by a given difference of potential. Dimensions, material and temperature all influence resistance.

Response Time — The time required for a sensor to reach 63.2% of the step change in temperature for a particular set of test conditions.

Rhenium — An elementary metal that when added to tungsten, forms an alloy with better ductility and improved high temperature strength over tungsten alone.

Rhodium — A platinum group metal added to pure platinum as a mild hardware and to increase high-temperature strength.

Ro — The resistance measurement taken on an RTD at 0°C .

RTD — An abbreviation for resistance temperature detector. It is a circuit element whose resistance increases with increasing temperature in a predictable manner. Platinum is the most popular material used in RTDs.

Secondary Standard — A measurement device that has been referenced to a primary standard.

Seebeck Coefficient — The rate of change of thermal emf with temperature at a given temperature.

Seebeck emf — The net thermal emf in a thermocouple under zero current conditions.

Shield — A metallic foil or braided wire layer surrounding a conductor or a group of conductors to prevent electrostatic or electromagnetic interferences from external sources.

Stability — The ability of an instrument or a sensor to maintain a consistent output with the application of a constant input.

Temperature Calibration Point — A temperature at which the output of a sensor is compared or determined by comparison against a standard.

Tera- — A prefix meaning trillion, or 10^{12} . The symbol is T.

Thermal Gradient — The distribution of differential temperatures in and across an object.

Thermistor — A contraction for thermally sensitive resistor. A thermistor is a semiconducting circuit element that typically exhibits a high negative coefficient of resistance.

Thermocouple — A temperature sensor formed by joining two dissimilar metals and applying a temperature differential between the measuring junction and the reference junction.

Thermopile — Multiple thermocouples connected in series so that alternate junctions are at the reference and measuring points. The result of this type of arrangement is an increased output for a given temperature differential.

Thermowell — A closed-end tube that will accept a temperature sensor and provide a pressure-tight connection at the well's point of installation.

Transducer — A device that receives and transmits energy. In many instances, the energy that is received is transmitted in a different form.

Transmitter — An externally powered device that transmits a signal from a thermocouple or an RTD via a two-wire current loop.

Triple Point of Water — A thermodynamic state (of water) in which the gas, liquid, and solid phases all occur in equilibrium. For water, the triple point is 0.01°C .

Twisted Pair — Two insulated conductors twisted together. Twisted wires in thermocouple circuits minimize magnetic noise produced from current carrying conductors.

Ungrounded Junction — A thermocouple junction that is fully insulated from the capped sheath end. An ungrounded junction is often specified for applications involving frequent or rapid temperature cycling, and for protection against stray emf signals.

Working Standard — A measurement device that has been referenced to a secondary standard.