

# T/C, Straight Metal or Ceramic

## Thermocouple, Metal or Ceramic Tube, Straight

### Introduction

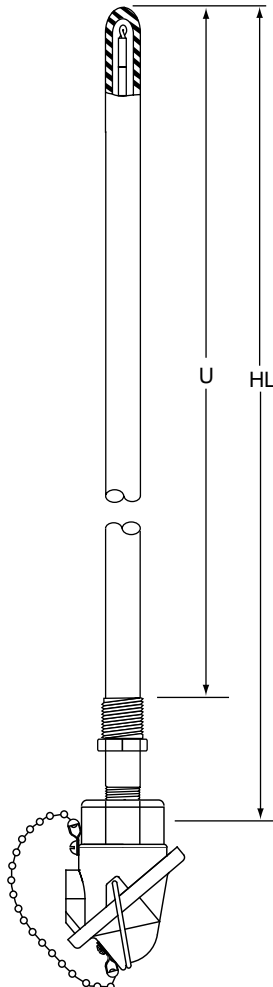
Base metal thermocouple assemblies are designed to be used in the most severe and demanding environments. The choice of a specific style is to a large degree determined by the temperature working range, ambient atmospheric or media conditions, as well as the size and shape required for the application. Control requirements such as accuracy and speed of response may also be considerations.

When speed of response is critical, specify the open end construction. An exposed element is directly subject to corrosion and physical damage; therefore, this style should be used only after consideration of the relative need for fast response versus thermocouple life.

Another feature for improving response time is the butt welded junction. This design has less mass and therefore faster response than the twist, which is normally supplied by the factory. The twist weld offers greater mechanical strength and longer life.

When possible, the sensor should be installed in a vertical plane rather than horizontal to prevent sagging.

### Ordering Information



**Model No.**     -       -  **0**   -

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

#### Fields 1, 2, 3. THERMOCOUPLE TYPE; WIRE GAUGE

Determine length by completing Fields 8, 9

	Type	Wire	Gauge	Limits
J08 -	J	Iron-Constantan	8	standard
J09 -	J	Iron-Constantan	8	special
J14 -	J	Iron-Constantan	14	standard
J15 -	J	Iron-Constantan	14	special
J20 -	J	Iron-Constantan	20	standard
J21 -	J	Iron-Constantan	20	special
K08 -	K	Chromel-Alumel	8	standard
K09 -	K	Chromel-Alumel	8	special
K14 -	K	Chromel-Alumel	14	standard
K15 -	K	Chromel-Alumel	14	special
K20 -	K	Chromel-Alumel	20	standard
K21 -	K	Chromel-Alumel	20	special
E08 -	E	Chromel-Constantan	8	standard
E09 -	E	Chromel-Constantan	8	special
E14 -	E	Chromel-Constantan	14	standard
E15 -	E	Chromel-Constantan	14	special
E20 -	E	Chromel-Constantan	20	standard
E21 -	E	Chromel-Constantan	20	special
T14 -	T	Copper-Constantan	14	standard
T15 -	T	Copper-Constantan	14	special
T20 -	T	Copper-Constantan	20	standard
T21 -	T	Copper-Constantan	20	special

\*Ni 0.8% Co - Ni 18% Mo14    standard    Special order, consult factory

# T/C, Straight Metal or Ceramic


## Ordering Information (continued)

Note: this is the letter "I,"  
not the numeral "1."

### Field 4. NUMBER OF ELEMENTS AND JUNCTION STYLE

- 1 - Single, twisted, grounded
- 2 - Single, twisted, ungrounded
- 3 - Single, butt welded, grounded
- 4 - Single, butt welded, ungrounded
- H - Dual, twisted, grounded
- 5 - Dual common, butt welded, ungrounded
- 6 - Dual isolated, butt welded, ungrounded

### Fields 5, 6. PROTECTION TUBE

 Use length determined in Fields 8, 9. See compatibility table on page 3-3.

Size	Material
<b>Metal</b>	
02 - 1/4" NPT	Low carbon black steel
03 - 1/2" NPT	Low carbon black steel
04 - 3/4" NPT	Low carbon black steel
05 - 1" XH NPT	Low carbon black steel, extra heavy wall, schedule 80 pipe
06 - 1/8" NPT	SAE 1020 steel
07 - 1/4" NPT	SAE 1026 steel
08 - 1" XH NPT	SAE 1025 steel, extra heavy wall, schedule 80 pipe
11 - 3/4" NPT	446 stainless steel
12 - 1/2" NPT	446 stainless steel
13 - 1" NPT	446 stainless steel
14 - 1/2" NPT	Nickel
16 - 1/2" NPT	Inconel 601
17 - 3/4" NPT	Inconel 601
18 - 1/4" NPT	304 stainless steel
19 - 1/2" NPT	304 stainless steel
26 - 1/2" NPT	Incoloy 800
27 - 3/4" NPT	Incoloy 800
44 - 1/2" NPT	316 stainless steel
47 - 3/4" NPT	316 stainless steel
<b>Ceramic Tube</b>	
21 - 1-3/4" o.d.	Silicon carbide (note 3)
22 - 1-3/4" o.d.	Silicon carbide with collar (note 3)
23 - 3/8" o.d.	High temperature Mullite
24 - 11/16" o.d.	High temperature Mullite
25 - 1" o.d.	High temperature Mullite
28 - 7/8" o.d.	Metal ceramic (note 3)
29 - 3/8" o.d.	Aluminum oxide
30 - 11/16" o.d.	Aluminum oxide
31 - 1" o.d.	Aluminum oxide
34 - 7 mm o.d.	Aluminum oxide
<b>Other</b>	
09 - 1-5/8" o.d.	Cast iron
41 - 1-1/4" o.d.	Steel, ceramic coated (notes 1 & 3)
42 - 1-1/4" o.d.	Steel, ceramic coated, with spring (notes 2 & 3)

#### Notes:

- 1) Immersion depth is 2" less than hot length. Replacement element is A-11711.
- 2) Immersion depth is 8" less than hot length. Minimum length is 18". Replacement element is A-11888.
- 3) Available only in increments of 6".

### Field 7. COLD END TERMINATION


- 1 - General purpose, cast iron
- 2 - Weatherproof, cast iron
- 3 - General purpose, aluminum
- A - Weatherproof, aluminum
- B - Explosionproof (n/a with ceramic tube)
- D - Aluminum, DIN size
- E - Aluminum, explosionproof (extended lead timen/a with ceramic tube)

See page 3-30 for protection tube/cold end termination compatibility table.

# T/C, Straight Metal or Ceramic

## Ordering Information (continued)

### Fields 8, 9. HOT LENGTH (DIMENSION "HL")

-  Complete these Fields to determine length for Fields 1, 2, 3, and Fields 5, 6  
HL - Enter actual inches in 6" increments. Minimum 12", maximum 48"  
(except if Fields 5, 6 is code 42, 18" minimum)  
HL - Over 48" consult factory for availability.  
99 - Metric. Specify dimension on order.

### Field 10. HOT END

- 0 - Closed end  
8 - Open end

### Fields 11, 12. RESERVED

### Field 13. MOUNTING FITTING

#### Either Metal Pipe or Ceramic Tube

- 0 - None (Required when Fields 5, 6 is code 01, 09, 41 or 42)  
2 - Adjustable flange

#### Metal Pipe (must specify at least 1 size larger than Pipe - Fields 5, 6)

- 8 - Welded bushing, black steel, one size larger than pipe (standard)  
A - 1/2" welded bushing, black steel  
B - 3/4" welded bushing, black steel  
C - 1" welded bushing, black steel  
D - 1-1/2" welded bushing, black steel  
M - 1-1/4" welded bushing, black steel  
E - 1/2" welded bushing, 316 stainless steel  
F - 3/4" welded bushing, 316 stainless steel  
G - 1" welded bushing, 316 stainless steel  
N - 1-1/4" welded bushing, 316 stainless steel  
H - 1-1/2" welded bushing, 316 stainless steel

#### Fittings for Metal Pipe Protection Tubes

<u>Pipe Size</u>	<u>Available Fitting Codes</u>
1/8" NPT	0, 2, 8, A, B, C, E, F, & G
1/4" NPT	0, 2, 8, A, B, C, E, F, & G
1/2" NPT	0, 2, 8, B, C, D, F, G, H, M & N
3/4" NPT	0, 2, 8, D, G, H, M & N
1" NPT	0, 2, 8, D, H, M & N

#### Ceramic Tube

- 1 - 4" Black steel sleeve\*  
3 - 4" Stainless steel sleeve\*  
4 - 4" Stainless steel sleeve and flange\*  
5 - 4" Black steel sleeve and flange\*  
7 - Double ended bushing\*  
P - Double ended bushing, 1/2" x 3/4" (Fields 5, 6, codes 24 and 30 only)  
R - Black steel sleeve longer than 4". Specify length in order.\*  
T - Stainless steel sleeve longer than 4". Specify length in order.\*  
V - Stainless steel sleeve and flange longer than 4". Specify length in order.\*  
W - Black steel sleeve and flange longer than 4". Specify length in order.\*  
\*Cannot be used with Fields 5, 6, code 21.

### Fields 14, 15. MOUNTING FITTING LOCATION ("U" DIMENSION)

- Applicable only for welded bushing fitting in Field 13  
UU - Whole inches  
99 - Fractional inches or metric; specify details on order.  
The maximum "U" dimension is the Hot Length minus two inches.

# Protection Tube/Head Compatibility

This table shows which heads are compatible with each protection tube for industrial sensors. Blank cell = compatible; filled cell = not compatible.

See Section 6 for head descriptions.

Head Model Number:		HD01	HD03	HD04	HD05	HD06	HD08	HD09	HD11	HD12	HD14	HD15	HD16	HD17
Fields 5, 6. Protection Tube		Field 7. Cold End Termination Codes												
Code / Description		1	3	4	5	6	8	8	B	A	9	C	E	D
01	Cast iron coated													
02	Black steel, 1/4" NPS													
03	Black steel, 1/2" NPS													
04	Black steel, 3/4" NPS													
05	Black steel, 1" NPS													
06	Welded steel, 1/8" NPS													
07	Welded steel, 1/4" NPS													
08	Welded steel, 1" NPS													
09	Cast iron													
11	446 SS, 3/4" NPS													
12	446 SS, 1/2" NPS													
13	446 SS, 1" NPS													
14	Pure nickel, 1/2" NPS													
16	Inconel 601, 1/2" NPS													
17	Inconel 601, 3/4" NPS													
18	304 SS, 1/4" NPS													
19	304 SS, 1/2" NPS													
21	Silicon carbide, 1-3/4" o.d.													
22	Silicon carbide w/collar													
23	H.T. Mullite, 3/8" o.d.													
24	H.T. Mullite, 11/16" o.d.													
25	H.T. Mullite, 1" o.d.													
26	Incoloy 800, 1/2" NPS													
27	Incoloy 800, 3/4" NPS													
28	Metal ceramic, 7/8" o.d.													
29	Aluminum oxide, 3/8" o.d.													
30	Aluminum oxide, 11/16" o.d.													
31	Aluminum oxide, 1" o.d.													
41	Ceramic clad													
42	Ceramic clad w/spring													
44	316 SS, 1/2" NPS													
46	Silicon carbide pipe, reinforced													
47	316 SS, 3/4" NPS													
65	304 SS, 0.160" x 0.185"													
66	304 SS, 0.194" x 0.250"													
67	304 SS, 0.305" x 0.375"													
68	316 SS, 0.160" x 0.185"													
69	316 SS, 0.194" x 0.250"													
70	316 SS, 0.305" x 0.375"													
72	Inconel 601, 0.194" x 0.250"													
73	Inconel 601, 0.305" x 0.375"													

# Industrial Sensors

## Element Compatibility

The element you select from Field 4 of the tables on the following pages must be compatible with the protection tube selected from Fields 5, 6 and the wire gauge selected from Fields 2, 3. The following table shows the element codes (Field 4) that are compatible with each protection tube/wire gauge combination. Note: "I" is the letter "I," not the numeral "1."

Fields 5, 6. Protection Tube		Fields 2, 3. Wire Gauge Codes		
Code / Description		08 or 09	14 or 15	20 or 21
01	Cast iron coated	I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M		I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M
02	Black steel, 1/4" NPS	n/a		
03	Black steel, 1/2" NPS	I, 2, 3, 4, L, C, E, F, A, R, S, T		
04	Black steel, 3/4" NPS	All except K, U, V		All
05	Black steel, 1" NPS			
06	Welded steel, 1/8" NPS	n/a	n/a	I, 2, 3, 4, H, 5, 6
07	Welded steel, 1/4" NPS	n/a		I, 2, 3, 4, H, 5, 6
08	Welded steel, 1" NPS	All except K, U, V		All
09	Cast iron	I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M		I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M
11	446 SS, 3/4" NPS	All except K, U, V		All except A, R, S, T
12	446 SS, 1/2" NPS	I, 2, 3, 4, L, C, E, F, A, R, S, T		
13	446 SS, 1" NPS	All except K, U, V		
14	Pure nickel, 1/2" NPS	I, 2, 3, 4, L, C, E, F		
15	Pure nickel, 3/4" NPS	I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M		
16	Inconel 601, 1/2" NPS	I, 2, 3, 4, L, C, E, F, A, R, S, T		
17	Inconel 601, 3/4" NPS	All except K, U, V		
18	304 SS, 1/4" NPS	n/a		I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M
19	304 SS, 1/2" NPS	I, 2, 3, 4, L, C, E, F, A, R, S, T		All
21	Silicon carbide, 1-3/4" o.d.	I, 2, 3, 4, H, 5, 6, L, C, E, F		I, 2, 3, 4, H, 5, 6
22	Silicon carbide w/collar	I, 2, 3, 4, H, 5, 6	n/a	I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M
23	H.T. Mullite, 3/8" o.d.	n/a	I, 4	I, 4, H, 5, 6
24	H.T. Mullite, 11/16" o.d.	I, 4, L, F		I, 4, H, 5, 6, L, F, J, G, M
25	H.T. Mullite, 1" o.d.	I, 4, H, 5, 6, L, F, J, G, M		
26	Incoloy 800, 1/2" NPS	I, 2, 3, 4, L, C, E, F, A, R, S, T		
27	Incoloy 800, 3/4" NPS	I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M		I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M
28	Metal ceramic, 7/8" o.d.	I, L, F		
29	Aluminum oxide, 3/8" o.d.	n/a	I, 4	I, 4, H, 5, 6
30	Aluminum oxide, 11/16" o.d.	I, 4, L, F		I, 4, H, 5, 6, L, F, J, G, M
31	Aluminum oxide, 1" o.d.	I, 4, H, 5, 6, L, F, J, G, M		
41	Ceramic clad	I, 2, 3, 4, L, C, E, F		I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M
42	Ceramic clad w/spring			
44	316 SS, 1/2" NPS	I, 2, 3, 4, L, C, E, F, A, R, S, T		All
46	Silicon carbide pipe, reinforced	I, 2, 3, 4, L, C, E, F		I, 2, 3, 4, H, 5, 6, L, C, E, F, J, G, M
47	316 SS, 3/4" NPS	All except K, U, V		All
65	304 SS, 0.160" x 0.185"	n/a	n/a	I
66	304 SS, 0.194" x 0.250"			
67	304 SS, 0.305" x 0.375"	n/a	I, 4	I, 2, 3, 4, H, 5, 6
68	316 SS, 0.160" x 0.185"	n/a	n/a	I, 4
69	316 SS, 0.194" x 0.250"			
70	316 SS, 0.305" x 0.375"	n/a	I	I, 2, 3, 4, H, 5, 6
72	Inconel 601, 0.194" x 0.250	n/a	n/a	I
73	Inconel 601, 0.305" x 0.375"	n/a	I	I, 2, 3, 4, H, 5, 6