



Thermocouples

A thermocouple is a temperature sensing element that operates on the principle that when two dissimilar metals are junctioned and the junction is heated, they produce a low voltage (millivoltage) which is proportional to the temperature. Thermocouples have a predictable and repeatable relationship between temperature and voltage. They are used widely in higher temperature applications because they can withstand greater temperatures than resistance temperature detectors (RTDs), and are less expensive in most cases.

The practical life of a thermocouple is limited by the environment it is exposed to and also by aging. The thermoelectric coefficients of the wires in a thermocouple change with time and the measurement voltage accordingly drops. As thermocouples age within a process, their conductors can also lose homogeneity due to chemical and metallurgical changes caused by extreme or prolonged exposure to high temperatures. One of the disadvantages of using thermocouples is the loss of accuracy when the thermocouple is cycled. For example, when the temperature is raised and lowered significantly over a period of time, this will cause the thermocouple to “drift”, thus creating errors in the reading.

Overview of the features and benefits of our thermocouples

T-PAK® thermocouples are mineral insulated, metal sheathed probes that can be exposed to most environments without further protection as they are very accurate and sensitive to changes in temperature. The outer sheath of stainless steel or other alloys, coupled with tightly compacted magnesia (MgO), ensures relatively long life by protecting the thermocouple from oxidizing, reducing, or other corrosive atmospheres.

At Thermo-Kinetics, we standardize on special limit grade wire in many instances to ensure that our thermocouples are the most reliable and accurate they can be.

We also custom make base metal and noble metal elements as well as high temperature Platinum (noble metal) elements to our customers' specifications. These come in many different configurations including metal protection tubes, ceramic protection tubes to name a few, but can be tailored to suit the customers' application.

We can also provide thermocouples that are CSA approved for hazardous locations in Class 1, Div. 1, Groups B, C and D environments.

Our in-house calibration service is ISO 17025 accredited and we are able to calibrate temperature sensors from -196° C to 1250° C.

Below is a table of different thermocouple types:

THERMOCOUPLE CHARACTERISTICS TABLE

ANSI/ASTM	Symbol Single	Generic Names	Individual Conductor	Overall Jacket Extension Grade Wire	Magnetic?	Environment (Bare Wire)
T	TP	Copper	Blue	Blue	No	Mild Oxidizing, Reducing, Vacuum or Inert. Good where moisture is present.
	TN	Constantan, Nominal Composition: 55% Cu, 45% Ni	Red			
J	JP	Iron	White	Black	Yes	Reducing Vacuum, Inert. Limited use in oxidizing at High Temperatures. Not recommended for low temperatures.
	JN	Constantan, Nominal Composition: 55% Cu, 45% Ni	Red			
E	EP	Chromel, Nominal Composition: 90%Ni, 10% Cr	Purple	Purple	No	Oxidizing or Inert. Limited use in Vacuum or Reducing.
	EN	Constantan, Nominal Composition: 55% Cu, 45% Ni	Red			
K	KP	Chromel, Nominal Composition: 90% Ni, 10% Cr	Yellow	Yellow	No	Clean Oxidizing and Inert. Limited use in Vacuum or Reducing.
	KN	Alumel, Nominal Composition: 95% Ni, 2% Mn, 2% Al	Red			
N	NP	Nicrosil, Nominal Composition: 84.6% Ni, 14.2% Cr, 1.4% Si	Orange	Orange	No	Clean Oxidizing and Inert. Limited use in Vacuum or Reducing.
	NN	Nisil, Nominal Composition: 95.5% Ni, 4.4% Si, 1% Mg	Red			
S	SP	Platinum 10% Rhodium	Black	Green	No	Oxidizing or Inert Atmospheres. Do not insert in metal tubes. Beware of contamination.
	SN	Pure Platinum	Red			
R	RP	Platinum 13% Rhodium	Black	Green	No	Oxidizing or Inert Atmospheres. Do not insert in metal tubes. Beware of contamination.
	RN	Pure Platinum	Red			
B	BP	Platinum 30% Rhodium	Gray	Gray	No	Oxidizing or Inert Atmospheres. Do not insert in metal tubes. Beware of contamination.
	BN	Platinum 6% Rhodium	Red			
C	P	Tungsten 5% Rhenium	Green	Red	No	Vacuum, Inert, Hydrogen Atmospheres. Beware of Embrittlement.
	N	Tungsten 26% Rhenium	Red			

Industrial Thermocouples

PRODUCT FEATURES

- 🔥 Base Metal and Noble Metal Elements and Assemblies
- 🔥 J, K, T, N, E, R, S and B Calibrations
- 🔥 Pipe & Angle Assemblies
- 🔥 Ceramic and Metal Protection Tube Configurations
- 🔥 Custom Configurations
- 🔥 Application information included
- 🔥 In-house calibration available



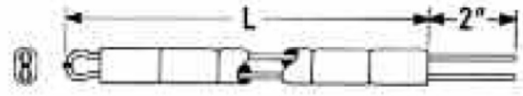
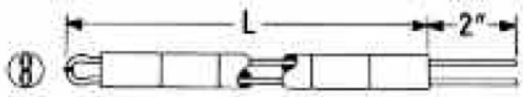
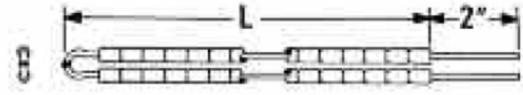

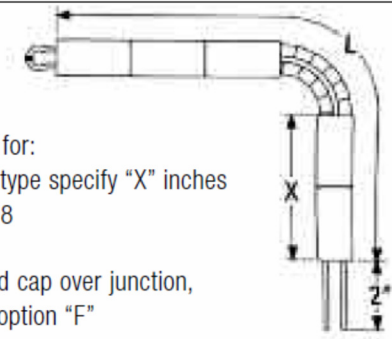
BASE METAL ELEMENTS

(Sample Configuration) CATALOG NUMBER: TK - K 14

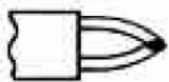
Calibration (K, J, T, E, N)
Wire Gauge (8, 14, 20)

B - 12.0 - X18

Options*
Length "L" (inches)
Construction Code
(see table below)

CONSTRUCTION CODE		DESCRIPTION	ILLUSTRATION
PARALLEL-WELD	TWIST-WELD		
B	J	Oval, Double-Bore 3" long insulators	
C	K	Round, Double-Bore 3" long insulators	
E	M	Fish Spine Insulators	
F	N	Round, Four-Bore (Duplex) 3" long insulators	
G	P	Angle type, 3" long oval double bore with fish spine at bend	 <p>* Options for: - angle-type specify "X" inches eg: X18 - insulated cap over junction, specify option "F"</p>
S	S	Special (describe in detail)	

Standard construction is: Parallel-weld with oval insulators (type B)



Parallel-weld

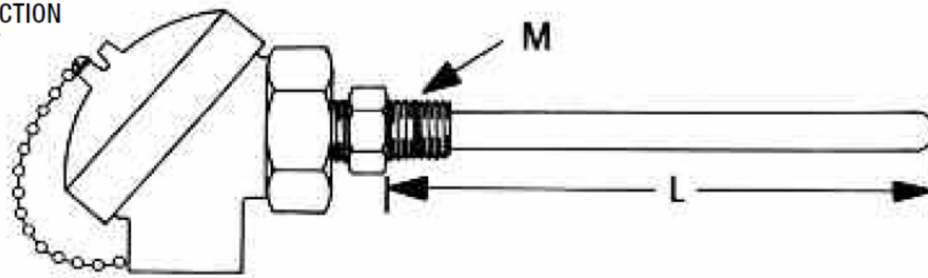


Twist-weld

Be sure to order these other free Literature Guides from Thermo-Kinetics:

- 1) T-PAK® Thermocouples
- 2) Thermowells
- 3) RTDs
- 4) Protection Tubes
- 5) Calibration Services

**CERAMIC PROTECTION
TUBE ASSEMBLY**



(Sample Configuration) CATALOG NUMBER: TA - A 5240 - J20B - 18.0 - 000



1A HEAD	
CODE	DESCRIPTION
A	Aluminum – General Purpose
B	Aluminum – Heavy Duty
C	Cast Iron – General Purpose
D	Cast Iron – Heavy Duty
G	GRLB
S	Special

2 ELEMENT
See details on page 2

3 LENGTH
Specify length "L" in inches

Standard lengths: 12" - 48" in 6" increment

4A OPTIONS	
CODE	DESCRIPTION
000	None
FLG	Adjustable flange*
WPC	Weatherproof cover*
Mxx	Mounting sleeve (ref. 4B)**
XSP	Special

* for Silicon Carbide tube only

** for all except Silicon Carbide

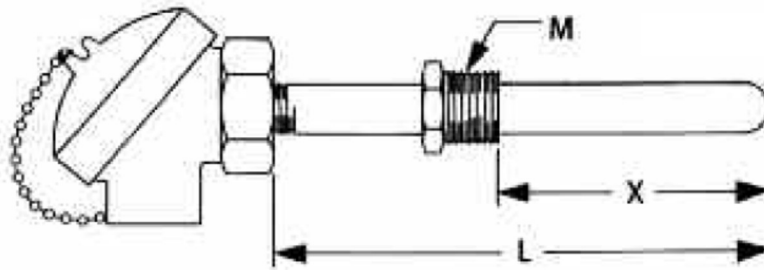
Hexoloy is a trademark of the Carborundum Co.

1B PROTECTION TUBE			
CODE	MATERIAL (O.D. X I.D.)	M	REPLACEMENT P/N
5130	Mullite (3/8"x 1/4")	3/4" NPT	CP-0604-32-"L"
5230	Mullite (1 1/16"x 7/16")	3/4" NPT	CP-1107-32-"L"
5240	Mullite (1 1/16"x 7/16")	1" NPT	CP-1107-43-"L"
5350	Mullite (1"x 3/4")	1 1/4" NPT	CP-1612-53-"L"
6130	Alumina (3/8"x 1/4")	3/4" NPT	AP-0604-32-"L"
6230	Alumina (1 1/16"x 7/16")	3/4" NPT	AP-1107-32-"L"
6240	Alumina (1 1/16"x 7/16")	1" NPT	AP-1107-43-"L"
6350	Alumina (1"x 3/4")	1 1/4" NPT	AP-1612-53-"L"
7400	Silicon Carbide (1 3/4"x 1")	—	SP-2816-SC-"L"
9130	Hexoloy (3/8"x 1/4")	3/4" NPT	SA-0604-32-"L"
9240	Hexoloy (3/4"x 1/2")	1" NPT	SA-1208-43-"L"
9350	Hexoloy (1"x 1/2")	1 1/4" NPT	SA-1608-53-"L"

* For 8ga element, use construction code C or K only

4B MOUNTING SLEEVE DETAILS (opt. "M" only)	
	<p>M S F 04</p> <p>Sleeve length (X) in inches</p> <p>Options: X = None F = Adjustable Flange</p> <p>Material: C = Carbon Steel S = Stainless Steel</p> <p>For weld bushing on sleeve, use option "XSP"</p>

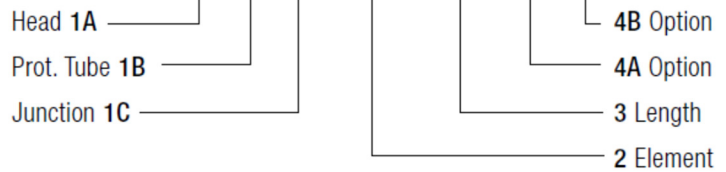
METAL PROTECTION TUBE ASSEMBLY



1A HEAD	
CODE	DESCRIPTION
A	Aluminum – General Purpose
B	Aluminum – Heavy Duty
C	Cast Iron – General Purpose
D	Cast Iron – Heavy Duty
G	GRLB
S	Special

CATALOG NUMBER: TA - A 423 A - K14B - 24.0 - B S416

(Sample Configuration)



1C JUNCTION	
CODE	DESCRIPTION
A	Grounded
B	Insulated
C	Exposed (open ended tube)
O	N/A (use for 1xx, 2xx, 3xx)

1B PROTECTION TUBE		
CODE	MATERIAL (O.D. X I.D)	REPLACEMENT P/N
421	1/2" C. Stl. Sch 40	MP-10040-08-"L"
422	1/2" 304 SS, Sch 40	MP-30440-08-"L"
423	1/2" 310 SS, Sch 40	MP-31040-08-"L"
424	1/2" 316 SS, Sch 40	MP-31640-08-"L"
426	1/2" 446 SS, Sch 40	MP-44640-08-"L"
427	1/2" INC 601, Sch 40	MP-60140-08-"L"
42A	1/2" Pyrosil D, Sch 40	MP-PYA40-08-"L"
42B	1/2" Hastelloy B3, Sch 40	MP-HSB40-08-"L"
42C	1/2" Hastelloy C-22, Sch 40	MP-HSC40-08-"L"
42X	1/2" Hastelloy X, Sch 40	MP-HSX40-08-"L"
110	Cast Iron (3/4" IPS)	MP-11097-"L"
224	LT-1 Metal Ceramic	MP-21075-43-"L"
320	Lava Coated Pipe (1/2")	LP-3210-08-"L"
330	Lava Coated Pipe (3/4")	LP-3210-12-"L"
999	Unlisted – specify part, material, size, etc.	

2 ELEMENT
See details on page 2

3 LENGTH
Specify length "L" in inches

For Sch 80 pipe, change 1st digit from 4 to 8 (eg. 822 for Sch 80 304 SS)

Also, change 40 to 80 in replacement part number.

For 3/4" or 1" pipe, change 2nd digit from 2 to 3 or 4 (eg. 442 for 1" 304 SS)

Also, change 08 to 12 or 16 in replacement part number.

4A OPTIONS	
CODE	DESCRIPTION
000	None
Axx	Angle type (ref. Page 5)
Bxx	Welded Bushing (ref. 4B)
FLG	Adjustable Flange*
Pxx	Pipe Extension (ref. Page 5)
XSP	Special

* for 4xx & 8xx metal tubes

4B WELDED BUSHING DETAILS (opt. "B" only)			
B	S	4	16
Thread Size: 2: 1/2" NPT 4: 1" NPT "M" 3: 3/4" NPT 5: 1 1/4" NPT			
Material: C = Carbon Steel S = Stainless Steel			
LT-1 is a trademark of Union Carbide INCONEL is a trademark of Inco Hastelloy is a trademark of Haynes International			

OPTIONS

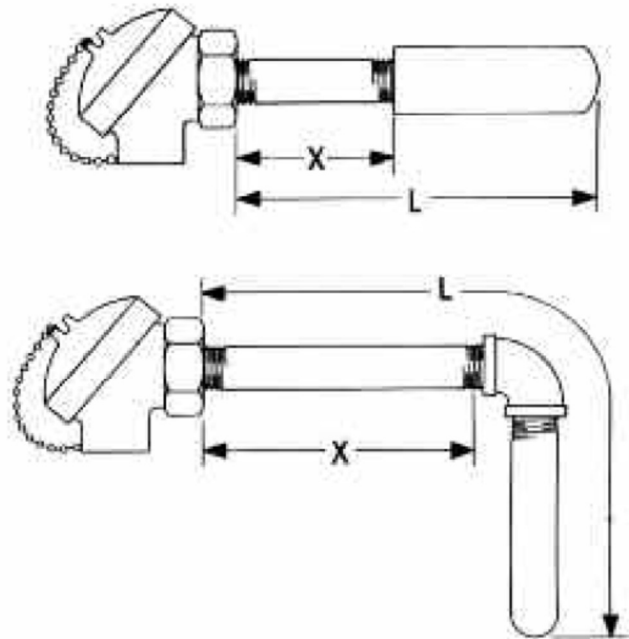
P C X 12

— "X" extension length (inches)

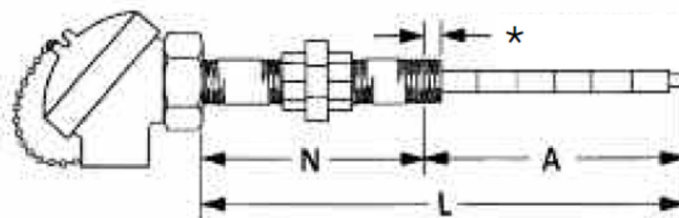
Options: "X" = None
"F" = Adj. Flange

Material: C = Carbon Steel
S = Stainless Steel

P = Pipe Extension
A = Angle Type



N & NUN ASSEMBLIES



* Thread engagement: 35° for 1/2" NPT
45° for 3/4" NPT

(Sample Configuration) **CATALOG NUMBER: TA - A N 2 30 - Element - Length - Option**

Head (ref. Table 1A page 4)

Extension Type

N: Nipple, Galv

U: N-U-N, Galv

W: N-U, Galv

M: Nipple, S.S.

V: N-U-N, S.S.

Y: N-U, S.S

Extension Size

2: 1/2" NPT

3: 3/4" NPT

000: None

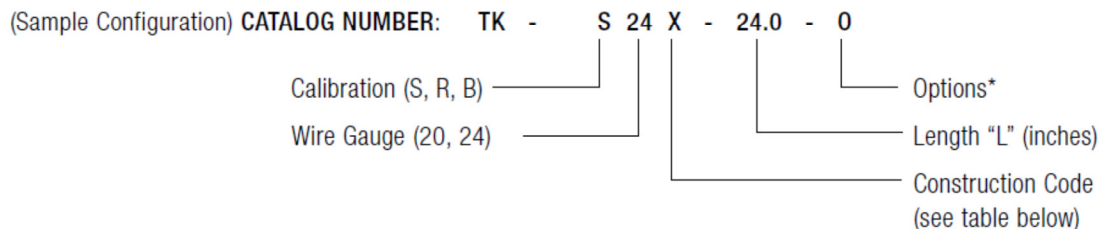
THW: Assembled with T/W
(ordered separately)

Total length "L" (inches)

Ref. page 2

"N" length in 0.1 inches
(eg. 30 = 3", 35 = 3.5")

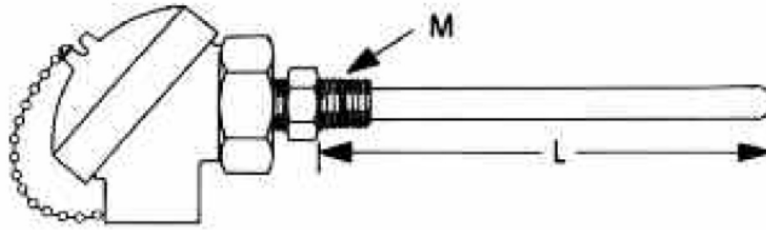
NOBLE METAL ELEMENTS



CODE	DESCRIPTION	ILLUSTRATION
U	Mullite, double bore full length insulator	
V	Alumina, double bore full length insulator	
W	Mullite, double bore full length insulator with collar	
X	Alumina, double bore full length insulator with collar	
Y	Mullite 4 bore full length insulator	
Z	Alumina 4 bore full length insulator	
Q	Mullite 4 bore full length insulator with collar	
R	Alumina 4 bore full length insulator with collar	
S	Special (describe in detail)	

Codes U to Z include Copper sleeves attached to end of each lead.
Alumina insulators should be used for platinum T/C's above 1200°C (2200°F)

OPTIONS	
0	None
C	Delete copper sleeves (not required for type 'F' head)



(Sample Configuration) CATALOG NUMBER: TA - A 5230 - R24X - 18.0 - 000



1A HEAD	
CODE	DESCRIPTION
A	Aluminum – General Purpose
B	Aluminum – Heavy Duty
C	Cast Iron – General Purpose
D	Cast Iron – Heavy Duty
G	GRLB
S	Special

2 ELEMENT
See details on page 6

3 LENGTH
Specify length "L" in inches

Standard lengths: 12" - 48" in 6" increment

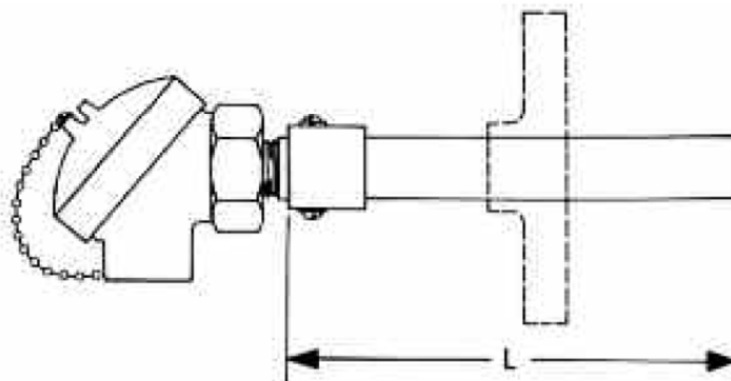
4A OPTIONS	
CODE	DESCRIPTION
000	None
Mxx	Mounting sleeve (ref. 4B)
XSP	Special

1B PROTECTION TUBE +			
CODE	MATERIAL (O.D. X I.D.)	M*	REPLACEMENT P/N
5130	Mullite (3/8" x 1/4")	3/4" NPT	CP-0604-32-"L"
5230	Mullite (1 1/16" x 7/16")	3/4" NPT	CP-1107-32-"L"
5240	Mullite (1 1/16" x 7/16")	1" NPT	CP-1107-43-"L"
5350	Mullite (1" x 3/4")	1 1/4" NPT	CP-1612-53-"L"
6130	Alumina (3/8" x 1/4")	3/4" NPT	AP-0604-32-"L"
6230	Alumina (1 1/16" x 7/16")	3/4" NPT	AP-1107-32-"L"
6240	Alumina (1 1/16" x 7/16")	1" NPT	AP-1107-43-"L"
6350	Alumina (1" x 3/4")	1 1/4" NPT	AP-1612-53-"L"

+ use Alumina protection tube above 1200°C (2200°F)

* M size will change when sleeve is used.

4B MOUNTING SLEEVE DETAILS (opt. "M" only)	
<p>M S F 04</p>	<p>Sleeve length (X) in inches</p> <p>Options: X = None F = Adjustable Flange</p> <p>Material: C = Carbon Steel S = Stainless Steel</p>
<p>For weld bushing on sleeve, use option "XSP"</p>	



(Sample Configuration) CATALOG NUMBER: TA - A 523R - R24X - 18.0 - FLG



1A HEAD	
CODE	DESCRIPTION
A	Aluminum – General Purpose
B	Aluminum – Heavy Duty
C	Cast Iron – General Purpose
D	Cast Iron – Heavy Duty
G	GRLB
S	Special

2 ELEMENT
See details on page 6

3 LENGTH
Specify length "L" in inches*1

4 OPTIONS	
CODE	DESCRIPTION
000	None
Bxx	Weld bushing (Table 4B Page 4)*2
FLG	Adjustable flange*3
WPC	Weatherproof cover*4

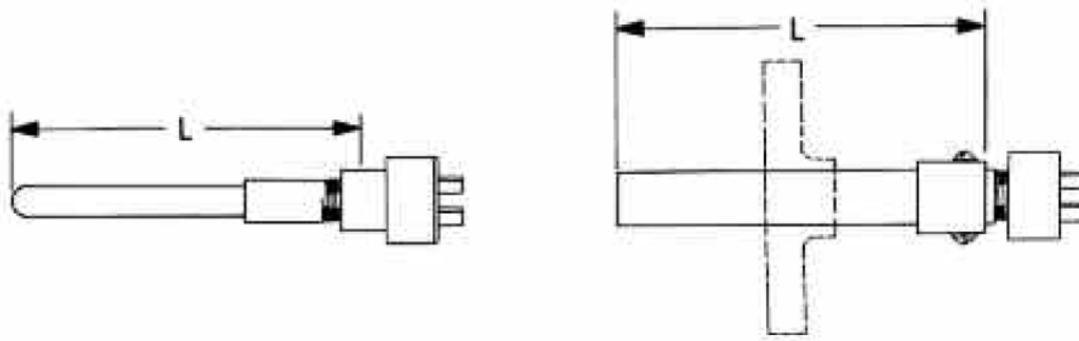
1B DOUBLE PROTECTION TUBE							
CODE	INNER TUBE		OUTER TUBE			REPLACEMENT PART NUMBER	
	MATERIAL	I.D.	MATERIAL	O.D.	MTG		
513M	Mullite	1/4"	Mullite	11/16"	3/4" NPT	CP-0604-00/CP-1107-32-"L"	
513R			Alumina	11/16"	3/4" NPT	CP-0604-00/AP-1107-32-"L"	
510I			Inconel	1/2" Pipe	*		CP-0604-00/MP-60140-08-"L"
525M	Mullite	7/16"	Mullite	1"	1 1/4" NPT	CP-1107-00/CP-1612-53-"L"	
525R			Alumina	1"	1 1/4" NPT	CP-1107-00/AP-1612-53-"L"	
520S			Silicon Carbide	1 3/4"	*3 *4		CP-1107-32/SP-2816-SC-"L"
520I			Inconel	3/4" Pipe	*2 *3		CP-1107-00/MP-60140-12-"L"
613R	Alumina	1/4"	Alumina	11/16"	3/4" NPT	AP-0604-00/AP-1107-32-"L"	
614H			Hexoloy	3/4"	1" NPT	AP-0604-00/SA-1208-43-"L"	
610I			Inconel	1/2" Pipe	*		AP-0604-00/MP-60140-08-"L"
625R	Alumina	7/16"	Alumina	1"	1 1/4" NPT	AP-1107-00/AP-1612-53-"L"	
620S			Silicon Carbide	1 3/4"	*3 *4		AP-1107-32/SP-2816-SC-"L"
620I			Inconel	3/4" Pipe	*2 *3		AP-1107-00/MP-60140-12-"L"

*1 Silicon Carbide tubes are available in 6" increments only and cannot be cut.

*2 For Inconel tubes only.

*3 For Inconel and Silicon Carbide tubes only.

*4 For Silicon Carbide tubes only.



(Sample Configuration) CATALOG NUMBER: TA - F 5210 - R24X - 36.0 - 000



1A HEAD	
CODE	DESCRIPTION
F	Open Style (Brass)

2 ELEMENT
See details on page 6

3 LENGTH
Specify length "L" in inches

Standard lengths: 12" - 48" in 6" increments

4 OPTIONS	
CODE	DESCRIPTION
000	None
FLG	Adjustable flange**

**for Silicon Carbide outer tube only

1B PROTECTION TUBE (single)			
CODE	MATERIAL	(O.D. X I.D.)	REPLACEMENT P/N
5110	Mullite	3/8" x 1/4"	CP-0604-27-"L"
5210	Mullite	1 1/16" x 7/16"	CP-1107-27-"L"
6110	Alumina	3/8" x 1/4"	AP-0604-27-"L"
6210	Alumina	1 1/16" x 7/16"	AP-1107-27-"L"

1B PROTECTION TUBE (double)						
CODE	INNER TUBE		OUTER TUBE			REPLACEMENT PART NUMBER
	MATERIAL	I.D.	MATERIAL	O.D.	MTG	
521S	Mullite	7/16"	Silicon Carbide	1 3/4"	*	CP-1107-27/SP-2816-SC-"L"
621S	Alumina	7/16"	Silicon Carbide	1 3/4"	*	AP-1107-27/SP-2816-SC-"L"

Note: Silicon Carbide tubes are available in 6" increments only and cannot be cut.

*Adjustable Flange available ("FLG" Table 4)

THERMOCOUPLE WIRE RESISTANCE								
WIRE GA	LOOP RESISTANCE (Ω /FT@20°C)							
	J	K	T	E	N	S	R	B
8	.022	.036	.019	.044				
14	.089	.147	.074	.176	.198	—	—	—
16	.141	.232	.117	.277	.308	—	—	—
18	.229	.377	.190	.450	.500	.112	.113	.139
20	.357	.588	.297	.702	.781	.175	.178	.218
24	.905	1.49	.754	1.18	1.98	.449	.453	.550
28	2.30	3.59	1.92	4.33	5.04	1.062	1.073	1.392
30	3.65	6.02	2.94	7.19	8.00	1.794	1.813	2.213

THERMOCOUPLE WIRE WEIGHT (ft/lb)										
WIRE GA	TYPE J		TYPE K		TYPE T		TYPE E		TYPE N	
	Iron + JP	Constantan - JN	Chromel + KP	Alumel - KN	Copper + TP	Constantan + TN	Chromel + EP	Constantan - EN	Nicrosil + NP	Nisil - NN
8	23	20	21	21	20	20	21	20	21	21
14	91	81	82	84	81	81	83	81	84	84
16	144	127	129	131	128	127	130	127	132	131
18	233	207	210	213	203	207	212	207	215	214
20	365	324	329	334	324	324	331	324	336	334
24	925	821	833	845	820	821	838	821	861	847
28	2353	2089	2121	2153	2062	2089	2130	2089	2170	2156
30	3736	3316	3366	3418	3294	3316	3370	3316	3445	3423

RESPONSE TIME (sec)	
WIRE GA	RESPONSE TIME
8	15
14	5
20	2
24	1

MELTING TEMP.		
METAL	TEMP.	
	°C	°F
Iron	1490	2715
Constantan	1220	2228
Copper	1083	1981
Chromel	1430	2605
Alumel	1400	2550
Nisil	1330	2425
Nicrosil	1420	2590
Platinum	1769	3215
Rhodium	1967	3573

T/C WIRE SIZE	
GAUGE	DIAMETER (in)
8	0.1285
14	0.0641
16	0.0508
18	0.0403
20	0.0320
22	0.0253
24	0.0201
28	0.0126
30	0.0100

CALIBRATION	RECOMMENDED TEMP. RANGE	APPLICATION INFORMATION
J	0 to 760°C (32 to 1400°F)	Suitable for vacuum, reducing or inert atmospheres; oxidizing atmospheres with reduced life. Iron oxidizes rapidly above 540°C (1000°F) so only heavy gauge wire is recommended for high temperature. Bare elements should not be exposed to sulphurous atmospheres above 540°C (1000°F). Unprotected iron wire may be attacked by ammonia, nitrogen or hydrogen atmospheres. When used above 760°C (1400°F), will lose accuracy when recycled to lower temperature. Unstable below 0°C (32°F).
K	0 to 1250°C (32 to 2280°F)	Recommended for continuous oxidizing or neutral atmospheres. Should not be used in reducing atmospheres or vacuum. Mostly used above 540°C (1000°F). Calibration shifts occur when operating in the range 370-540°C (700-1000°F). Subject to failure if exposed to sulphur. Must be protected from marginally oxidizing atmospheres. Preferential oxidation of chromium in positive leg at certain low oxygen concentrations causes "green rot" and large negative calibration drifts; most serious in the 820-1040°C (1500-1900°F) range. Ventilation or inert sealing of the protection tube can prevent this.
T	-185 to 400°C (-300 to 750°F)	Usable in oxidizing, reducing or inert atmospheres as well as vacuum. Not subject to corrosion in moist atmospheres. Limit of error published for sub-zero temperature ranges. Traditionally used for low temperature applications. Copper oxidizes above 370°C (700°F).
N	0 to 1260°C (32 to 2300°F)	Suitable for use in oxidizing, inert or dry reducing atmospheres. Can be used in applications where type K elements have shorter life and stability problems due to oxidation and the development of "green rot". Must be protected from sulphurous atmospheres. Provides higher stability than K above 1000°C (1800°F).
E	0 to 1000°C (32 to 2900°F)	Recommended for continuously oxidizing or inert atmospheres. Highest thermoelectric output of common calibrations. Not subject to corrosion at sub-zero temperatures. Can be used for short periods time in vacuum. Must be protected from sulphurous or marginally oxidizing atmospheres. Subject to "green rot". Extended usage at high temperatures causes chromium to vaporize altering calibration.
R S	0 to 1600°C (32 -2280°F)	Recommended for high temperature. Must be protected with non-metallic protection tube and ceramic insulators. Continued high temperature usages causes grain growth, which can lead to mechanical failure. Negative calibration drift caused by rhodium diffusion to pure leg as well as from rhodium volatilization. Must be protected from reducing atmospheres.
B	500 to 1700°C (930 to 3100°F)	Same as R & S but output is lower. Also less susceptible to grain growth and drift. Can be used at higher temperature.

COMPOSITION		
TYPE	POSITIVE	NEGATIVE
J	Iron*	Constantan (Cu-45%Ni)
K	Chromel (Ni-10%Cr)	Alumel (MnSiAl-95%Ni)**
T	Copper	Constantan
N	Nicrosil (Ni-14%Cr)	Nisil (Ni-4%Si)**
E	Chromel	Constantan
R	Pt-13% Rh	Platinum
S	Pt-10% Rh	Platinum
B	Pt-30% Rh	Pt-6% Rh

* Magnetic ** Slightly magnetic

INITIAL CALIBRATION TOLERANCES				
TC TYPE	TEMPERATURE RANGE		TOLERANCE	
	°C	°F	STANDARD	SPECIAL
J	0 to 760°C	32 to 1400°F	±0.75% or 2.2°C(4°F)	±0.4% or 1.1°C(2°F)
K	0 to 1260°C	32 to 2300°F	±0.75% or 2.2°C(4°F)	±0.4% or 1.1°C(2°F)
	-200 to 0°C	-330 to 32°F	±2% or 2.2°C(4°F)	—
T	0 to 370°C	32 to 700°F	±0.75% or 1°C(1.8°F)	±0.4% or .5°C(2°F)
	-200 to 0°C	-330 to 32°F	±1.5% or 1°C(1.8°F)	±0.8% or .5°C(9°F)
E	0 to 870°C	32 to 1600°F	±0.5% or 1.7°C(3°F)	±0.4% or 1.1°C(2°F)
	-200 to 0°C	-330 to 32°F	±1% or 1.7°C(3°F)	—
N	0 to 1260°C	32 to 2300°F	±0.75% or 2.2°C(4°F)	±0.4% or 1.1°C(2°F)
R	0 to 1480°C	32 to 2700°F	±0.25% or 1.5°C(2.7°F)	±0.1% or .6°C(1.1°F)
S	0 to 1480°C	32 to 2700°F	±0.25% or 1.5°C(2.7°F)	±0.1% or .6°C(1.1°F)
B	870 to 1700°C	1600 to 3090°F	±0.5%	—

*%of reading or fixed error; whichever is greater. (%-based tolerances calculated in °C, then converted to °F).

Tolerances in the upper table apply to new homogenous thermocouple wire used at temperatures not exceeding the recommended maximum limits shown in the lower table.

Thermocouple wire is normally supplied to meet specified tolerances for temperatures above 0 °C. The same wire may not fall within these tolerances at temperatures below 0 °C. Wire required for use below 0 °C should be ordered specifically for this application.

TC TYPE	RECOMMENDED MAXIMUM TEMPERATURE LIMITS (FOR PROTECTED THERMOCOUPLES)							
	8 GAUGE (.129")		14 GAUGE (.064")		20 GAUGE (.032")		24 GAUGE (.020")	
J	760°C	1400°F	590°C	1095°F	480°C	895°F	370°C	700°F
K	1260°C	2300°F	1090°C	1995°F	980°C	1795°F	870°C	1600°F
T	—	—	370°C	700°F	260°C	500°F	200°C	400°F
E	870°C	1600°F	650°C	1200°F	550°C	1000°F	430°C	800°F
N	1200°C	2200°F	1090°C	1995°F	980°C	1795°F	870°C	1600°F
R	—	—	—	—	—	—	1480°C	2700°F
S	—	—	—	—	—	—	1480°C	2700°F
B	—	—	—	—	—	—	1700°C	3100°F



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