

# **THERMO-KINETICS**

**INDUSTRIAL THERMOCOUPLES**

**SENSIBLE SOLUTIONS TO TEMPERATURE MEASUREMENT**



**THERMO-KINETICS** COMPANY LIMITED

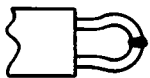
# THERMOCOUPLE ELEMENTS (Base Metal)

(Sample Configuration) **CATALOG NUMBER:** TK - K 14 B - 12.0 - X18

Calibration (K, J, T, E, N) | Wire Gauge (8, 14, 20) | Construction Code (see table below) | Length "L" (inches) | Options\*

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

Standard construction is:  
 8ga: Butt-weld with oval insulators (type B)  
 14ga and 20ga: Parallel-weld with oval insulators (type U)



Butt-weld



Parallel-weld



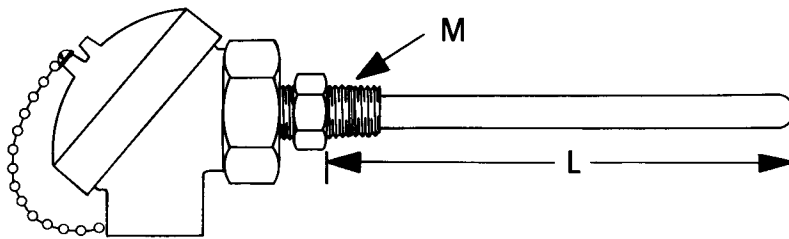
Twist-weld

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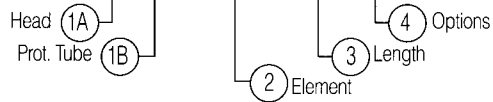
- ① T-Pak® Thermocouples    ③ Thermowells
- ② RTDs    ④ Protection Tubes

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# CERAMIC PROTECTION TUBES (Base Metal Thermocouples)



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



1 A 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" increments

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

\*for Silicon Carbide tube only  
\*\*for all except Silicon Carbide

1 B PROTECTION TUBE			
CODE	MATERIAL (O.D. X I.D.)	"M"	REPLACEMENT P/N
5130	Mullite (3/8"x1/4")	3/4" NPT	CP-0604-32-"L"
5230	Mullite (11/16"x7/16")*	3/4" NPT	CP-1107-32-"L"
5240	Mullite (11/16"x7/16")*	1" NPT	CP-1107-42-"L"
5350	Mullite (1"x3/4")	1-1/4" NPT	CP-1612-53-"L"
6130	Alumina (3/8"x1/4")	3/4" NPT	AP-0604-32-"L"
6230	Alumina (11/16"x7/16")*	3/4" NPT	AP-1107-32-"L"
6240	Alumina (11/16"x7/16")*	1" NPT	AP-1107-42-"L"
6350	Alumina (1"x3/4")	1-1/4" NPT	AP-1612-53-"L"
7400	Silicon Carbide (1-3/4"x1")	---	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"	SA-1208-42-"L"
9350	Hexoloy (1" x 1/2")	1-1/4"	SA-1608-53-"L"

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

### 4B MOUNTING SLEEVE DETAILS (opt. "M" only)

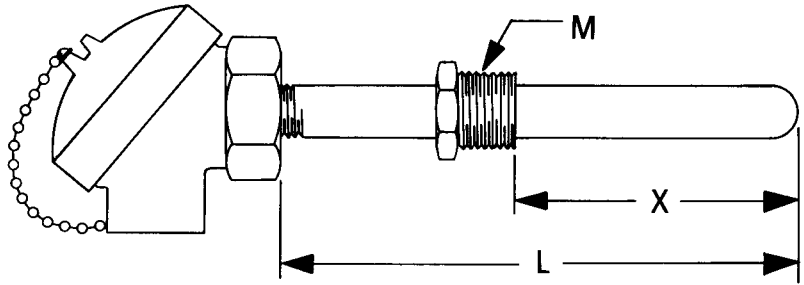
**M S F 4**

- Sleeve length (X) in inches
- Options: X = None, F = Adjustable Flange
- Material: C = Carbon Steel, S = Stainless Steel

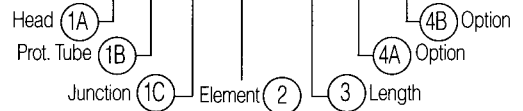
# METAL PROTECTION TUBES (Base Metal Thermocouples)

## 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



(Sample Configuration) **CATALOG NUMBER:** TA - A 423 A - K14B - 24.0 - B S416



## 1C JUNCTION

CODE	DESCRIPTION
A	Grounded
B	Insulated
C	Exposed (open ended tube)

## 2 ELEMENT

See details on page 2

## 3 LENGTH

Specify length "L" in inches.

## 4A OPTIONS

CODE	DESCRIPTION
O	None
A	Angle Type (ref. Page 5)
B	Welded Bushing
FLG	Adjustable Flange
P	Pipe Extension (ref. Page 5)
XSP	Special

## 1B PROTECTION TUBE

CODE	MATERIAL	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" 316 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"
42H	1/2" HR160, Sch 40	MP-16040-08-"L"
110	Cast Iron	MP-11097-"L"
210	LT-1 Metal Ceramic	MP-21075-12-"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.	

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.

## 4B WELDED BUSHING DETAILS (opt. "B" only)

**B S 4 16**

"X" length in inches

THREAD SIZE: 2: 1/2" NPT 4: 1" NPT

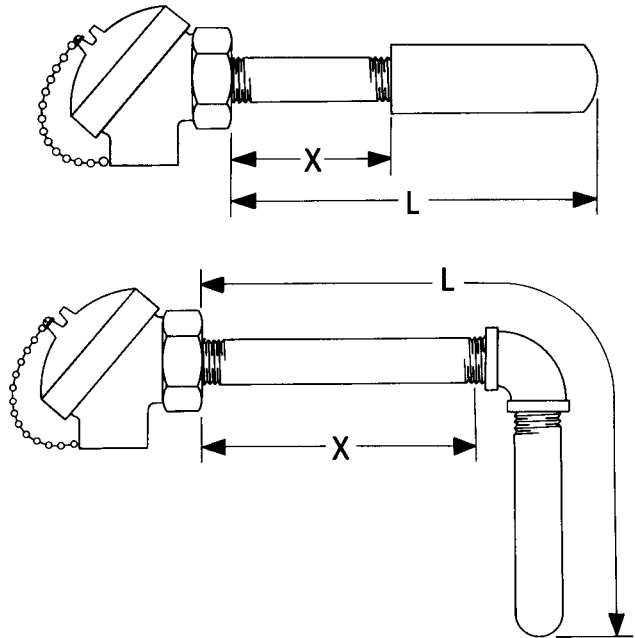
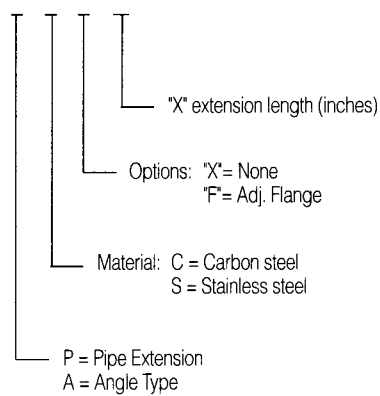
"M" 3: 3/4" NPT 5: 1-1/4" NPT

MATERIAL: C= Carbon Steel

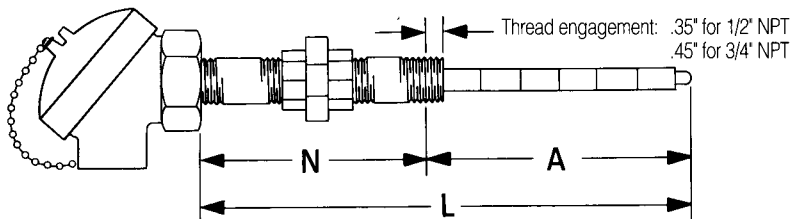
S= Stainless Steel

# PIPE & ANGLE EXTENSION ASSEMBLIES

P C X 12



# N & NUN ASSEMBLIES



(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: Nipple, S.S.

Extension Size  
2: 1/2" NPT  
3: 3/4" NPT

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

0: None  
THW: Assembled with T/W  
(ordered separately)  
CSA: CSA Approved \*\*

Total length "L" (inches)

Ref. page 2

\*\* CSA Approved for Class 1, Groups B,C, D  
Hazardous locations (for selected models) Consult Factory

# THERMOCOUPLE ELEMENTS (Noble Metal)

(Sample Configuration) **CATALOG NUMBER:** TK - S 24 X - 24.0 - O

Calibration (S,R,B)

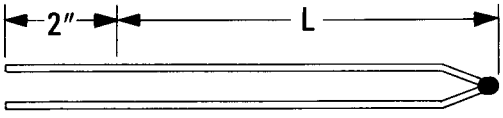
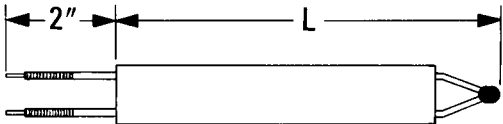
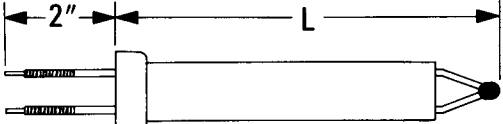
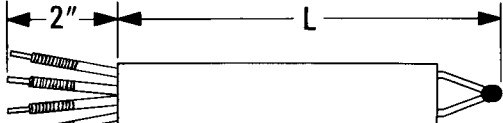
Wire Gauge (20,24)

Option

Length "L" (inches)

Construction Code (see table below)

## CONSTRUCTION CODE

CODE	DESCRIPTION	ILLUSTRATION
T	Bare element	
U	Mullite, double bore full length insulator	
V	Alumina, double bore full length insulator	
W	Mullite, double bore full length insulate 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	
S	Special (describe in detail)	

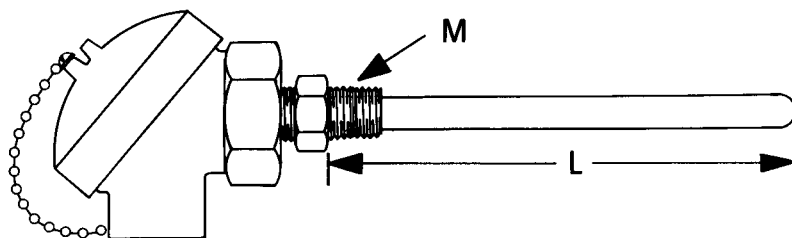
Codes U to Z include Copper sleeves attached to end of each lead.

Alumina insulators should be used for platinum T/C's above 1200°C (2200°F)

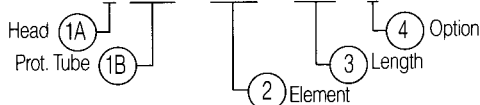
## OPTIONS

O	None
C	Delete copper sleeves (not required for type 'E' head)

# SINGLE PROTECTION TUBE (Noble Metal Thermocouples)



(Sample Configuration) **CATALOG NUMBER:** TA - A 5230 - R24X - 18.0 - 0



## 1 A 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" increments

## 4A OPTIONS

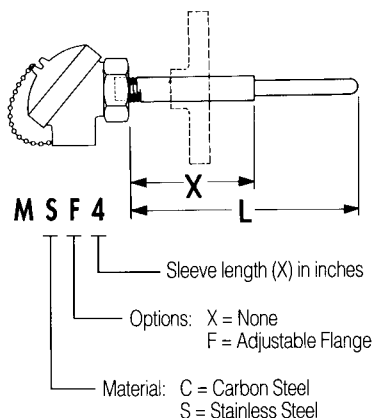
CODE	DESCRIPTION
O	None
M	Mounting Sleeve (ref. 4B)
XSP	Special

## 1 B PROTECTION TUBE+

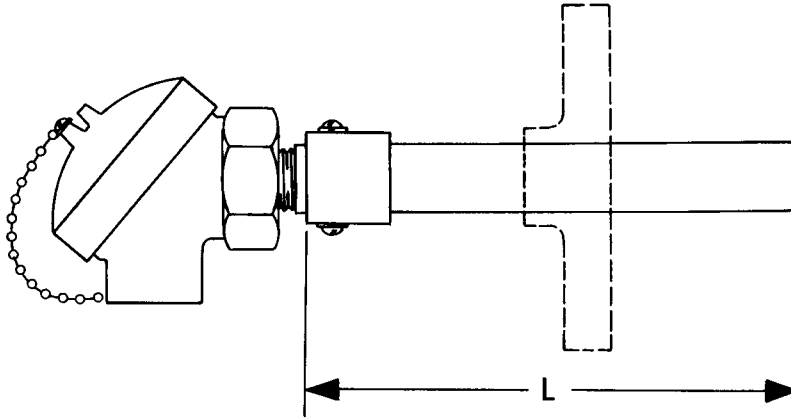
CODE	MATERIAL (O.D. X I.D.)	"M"	REPLACEMENT P/N
5130	Mullite (3/8" X 1/4")	3/4" NPT	CP-0604-32-"L"
5230	Mullite (11/16" x 7/16")	3/4" NPT	CP-1107-32-"L"
5240	Mullite (11/16" x 7/16")	1" NPT	CP-1107-42-"L"
5350	Mullite (1" x 3/4")	1-1/4" NPT	CP-1612-53-"L"
6130	Alumina (3/8" x 1/4")	3/4" NPT	AP-0604-32-"L"
6230	Alumina (11/16" x 7/16")	3/4" NPT	AP-1107-32-"L"
6240	Alumina (11/16" x 7/16")	1" NPT	AP-1107-42-"L"
6350	Alumina (1" x 3/4")	1-1/4" NPT	AP-1612-53-"L"
9130	Hexoloy (3/8" x 1/4")	3/4" NPT	SA-0604-32-"L"
9240	Hexoloy (3/4" x 1/2")	1"	SA-1208-42-"L"
9350	Hexoloy (1" x 1/2")	1-1/4"	SA-1608-53-"L"

+ use Alumina protection tube above 1300°C (2400°F)

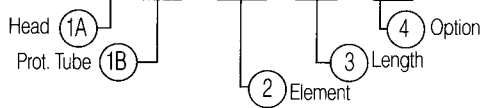
## 4B MOUNTING SLEEVE DETAILS (opt. "M" only)



# DOUBLE PROTECTION TUBE (Noble Metal Thermocouples)



(Sample Configuration) **CATALOG NUMBER:** TA - A 525R - R24X - 24.0 - 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.

Standard lengths: 12 - 48" in 6" increments

## 4 OPTIONS

CODE	DESCRIPTION
O	None
*B	Weld bushing <small>(ref. Table 4B, pg.4)</small>
**FLG	Adjustable flange
**WPC	Weatherproof cover

\*for Inconel outer tube only

\*\*for Silicon Carbide outer tube only

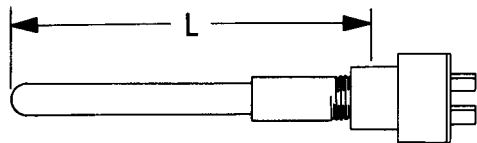
## 1B DOUBLE PROTECTION TUBE

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"	**	CP-1107-00/SP-2816-SC-"L"
520I			Inconel	3/4" Pipe	*	CP-1107-00/MP-60140-12-"L"
613R	Alumina	1/4"	Alumina	11/16"	3/4" NPT	AP-0604-00/AP-1107-32-"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"	**	AP-1107-00/SP-2816-SC-"L"
620I			Inconel	3/4" Pipe	*	AP-1107-00/MP-60140-12-"L"

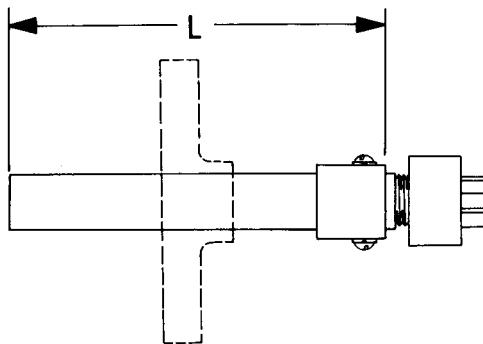
Note: Silicon Carbide tubes cannot be cut. Available in 6" increments. \*for Inconel outer tube only \*\* for Silicon Carbide outer tube only



# OPEN STYLE HEAD (Noble Metal Thermocouples)

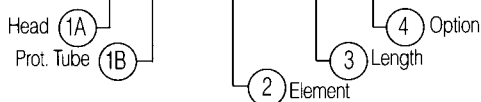


**SINGLE PROTECTION TUBE**



**DOUBLE PROTECTION TUBE**

(Sample Configuration) **CATALOG NUMBER:** TA - E 5210 - R24X - 36.0 - O



## 1A HEAD

CODE	DESCRIPTION
E	Open Style (Alum)
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
O	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	11/16" x 7/16"	CP-1107-27-"L"
6110	Alumina	3/8" x 1/4"	AP-0604-27-"L"
6210	Alumina	11/16" 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 cannot be cut. Available in 6" increments. \* Adjustable Flange available (Opt. "FLG" Table 4)

# REFERENCE DATA

## 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	1.488	.754	1.778	1.98	.449	.453	.550
28	2.297	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	22.8	20.2	21	21	19.8	20.2	21	20.2	21	20.9
14	91.2	80.9	83	83	80.5	80.9	83	80.9	84	83.6
16	144	127	130	130	128	127	130	127	132	131
18	233	207	212	212	203	207	212	207	215	214
20	365	324	331	331	324	324	331	324	336	334
24	925	821	838	838	820	821	838	821	861	847
28	2353	2089	2130	2130	2062	2089	2130	2089	2170	2156
30	3736	3316	3370	3370	3294	3316	3370	3316	3445	3423

## RESPONSE TIME (sec)

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

## 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

# APPLICATION DATA

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 1830°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 of 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 to 2900°F)	Recommended for high temperature. Must be protected with nonmetallic 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	TYPE	POSITIVE	NEGATIVE
J	Iron	Constantan (Cu-45%Ni)	E	Chromel	Constantan
K	Chromel (Ni-10%Cr)	Alumel (MnSiAl-95%Ni)	R	Pt-13% Rh	Platinum
T	Copper	Constantan	S	Pt-10% Rh	Platinum
N	Nicrosil (Ni-14%Cr)	Nisil (Ni-4%Si)	B	Pt-30% Rh	Pt-6% Rh

# TECHNICAL SPECIFICATIONS

## LIMITS OF ERROR

TC TYPE	TEMPERATURE RANGE		LIMITS OF ERRORS*	
	°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 -200 to 0°C	32 to 2300°F -330 to 32°F	±0.75% or 2.2°C(4°F) ±2% or 2.2°C(4°F)	± 0.4% or 1.1°C(2°F) —
T	0 to 370°C -200 to 0°C	32 to 700°F -330 to 32°F	±0.75% or 1°C(1.8°F) ±1.5% or 1°C(1.8°F)	±0.4% or .5°C(.9°F) ±0.8% or .5°C(.9°F)
E	0 to 870°C -200 to 0°C	32 to 1600°F -330 to 32°F	±0.5% or 1.7°C(3°F) ±1% or 1.7°C(3°F)	±0.4% or 1.1°C(2°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

## MAXIMUM TEMPERATURE LIMITS

TC TYPE	RECOMMENDED MAXIMUM TEMPERATURE LIMITS							
	8 GAUGE (.125")		14 GAUGE (.064")		20 GAUGE (.032")		24 GAUGE (.020")	
J	760°C	1400°F	600°C	1100°F	500°C	900°F	370°C	700°F
K	1260°C	2300°F	1100°C	2000°F	1000°C	1800°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	1100°C	2000°F	1000°C	1800°F	870°C	1600°F
R	—	—	—	—	—	—	1480°C	2700°F
S	—	—	—	—	—	—	1480°C	2700°F
B	—	—	—	—	—	—	1700°C	3100°F



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