



# L.H. MARSHALL THERMOCOUPLES™



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**100% WARRANTY**

L.H. Marshall Company backs its products against defects and will repair or replace defective products returned to us freight prepaid. Excluded from this Warranty is equipment deterioration resulting from normal use, defects due to negligence, misuse, improper installation, accident or unauthorized alteration or repair by the purchaser. Full or partial credits for defective materials will be issued only after our inspection and evaluation. Credit for all shipping charges as a result of defective materials will be given.

# FAX REQUEST FORM



QUANTITY

DESCRIPTION OR PART NUMBER

_____	_____
_____	_____
_____	_____
_____	_____

## SENSOR SKETCH

COMPANY NAME

YOUR NAME

STREET ADDRESS

POSITION

PHONE

CITY

STATE

ZIP

FAX

EMAIL ADDRESS

## COMMENTS

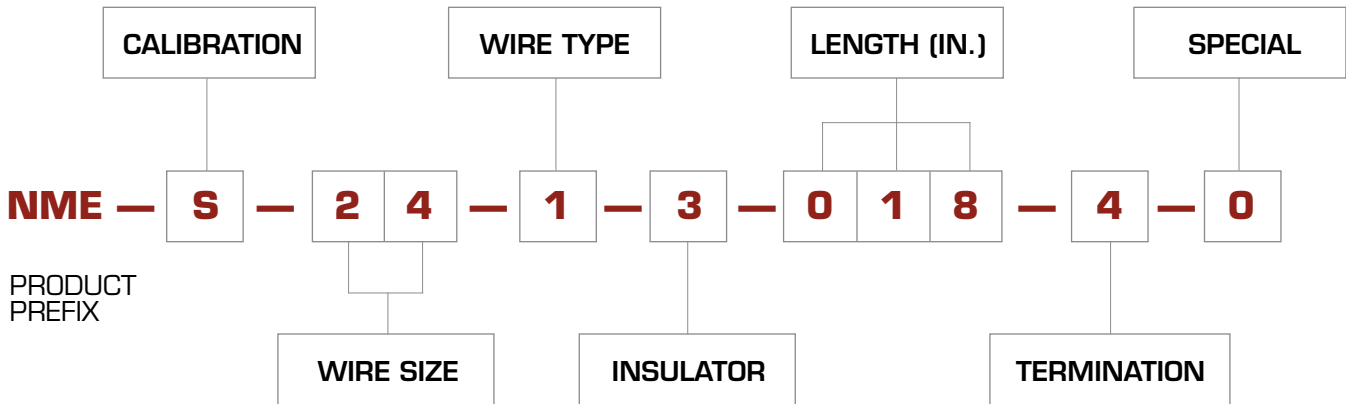
# ORDERING INFORMATION



Each product section in this catalog contains a table that lists the specifications for each component of the featured product. Every specification has a code that is used in a “box” format to create an Ordering Number. To order, fill in each Ordering Number box with the appropriate specification code. This series of numbers and letters will form the final Ordering Number.

## TYPICAL ORDERING NUMBER

A typical Ordering Number for a Noble Metal Element (NME) Thermocouple is shown below as an example.



## THE ABOVE ORDERING NUMBER SPECIFIES A NOBLE METAL ELEMENT (NME):

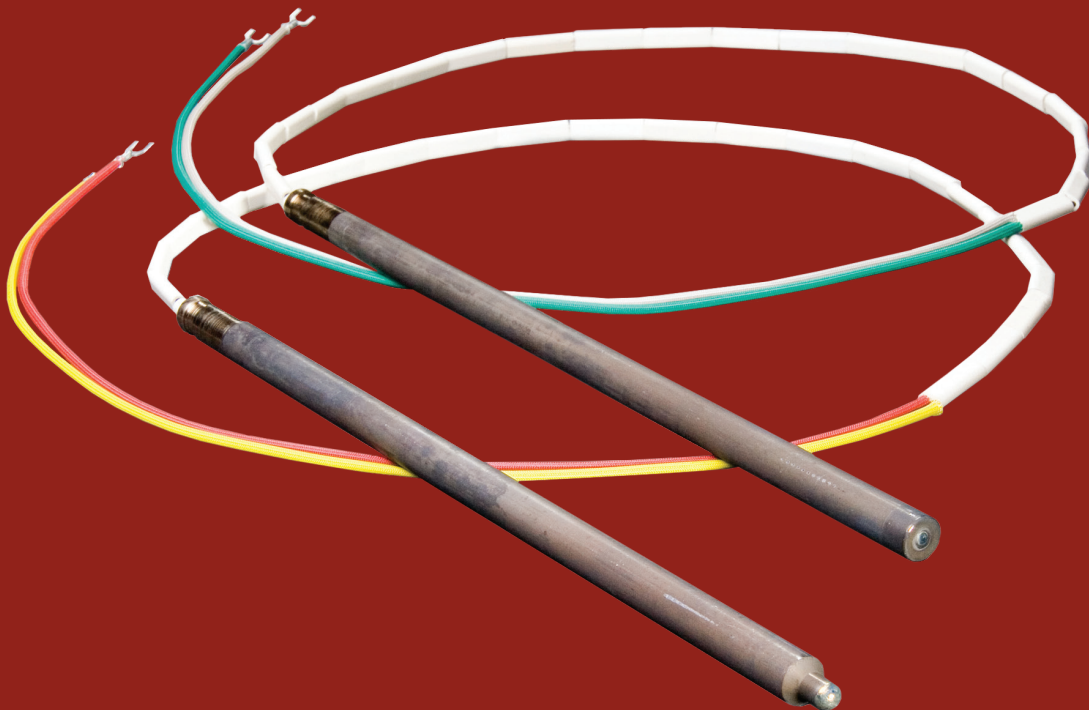
Plt.-Plt. 10% Rh. Type “S” Noble Element, .020” diameter wire size, Standard Grade Thermocouple wire type, in a 0.125” diameter Alumina insulator, 18” long, with fish spine beads and copper tips, no special specification.

S	Plt.-Plt. 10% Rh. Calibration Type
24	.020” Diameter Wire Size
1	Standard Grade Thermocouple Wire Type
3	0.125” OD Alumina Insulator
018	18” Length
4	Fish Spine Beads/Copper Tip Termination
0	No Special Specification

## HOW TO ORDER USING A SYSTEM OTHER THAN OURS

This catalog is designed to assist you in ordering the appropriate thermocouple, thermocouple components or accessories to meet your exact needs. However, if you are more comfortable with another vendor’s ordering number system or with using a generic description, contact us with that information and we will help you identify your product requirements. We have a fax order form (pg. 4) available for this purpose.

# MARSHALL THERMOCOUPLES™



## MARSHALL THERMOCOUPLE™

The L.H. Marshall Company invented and patented the enclosed tip Thermocouple™ over 80 years ago. Over 10 million Marshall Thermocouples have been sold worldwide for precision temperature measurement. Marshall Thermocouples are reusable, durable, accurate and are a quality product engineered to meet the industry standards for temperature measurement of molten metals.

Scientific research and development at one of America's leading research facilities has led to innovations in steel composition of the Marshall protection tubes resulting in the longest lasting, multiuse thermocouple in the industry.

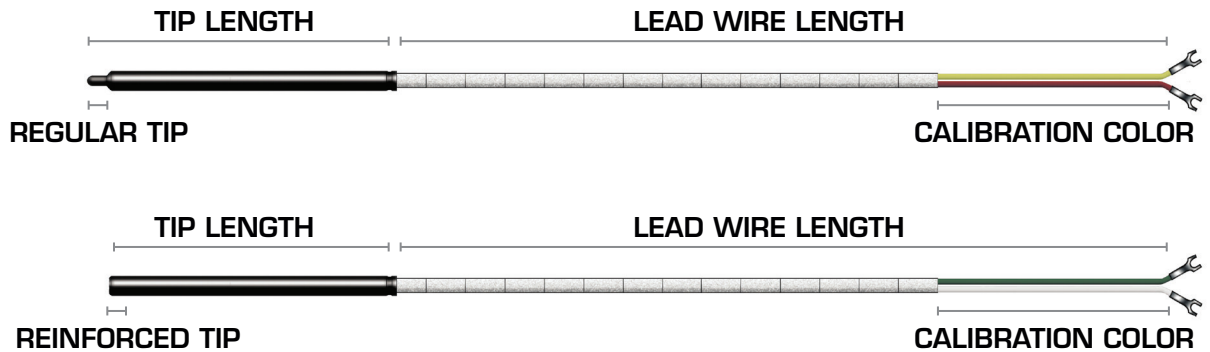
All Marshall Thermocouples are manufactured with Class 1, Special Limits wire which meet and exceed international quality standards of ANSI MC96.1 and IEC 584. Custom Marshall Thermocouples can be made to accommodate any range of industrial need while maintaining superior quality. Calibration certificates are available on Marshall Thermocouples and all products produced by the L.H. Marshall Company are 100% guaranteed.

# MARSHALL THERMOCOUPLE™

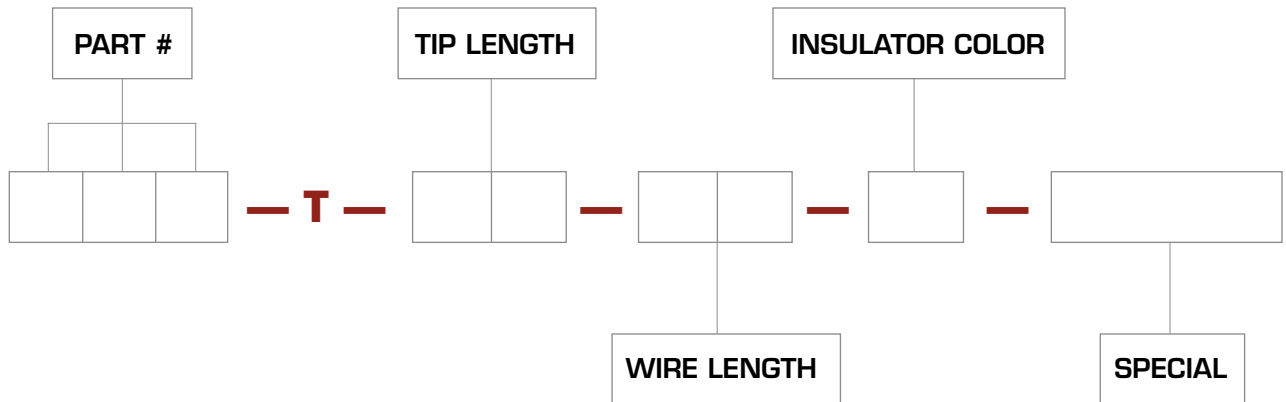


## ORDERING INFORMATION

Fill in each Ordering Number box with the appropriate specification code. This series of numbers and letters will form the final Ordering Number.



\*All thermocouples are lot calibrated at no charge. Individual calibration is available per the customer requirements.



PART #	TIP LENGTH	LEAD WIRE LENGTH	CALIBRATION COLOR	SPECIAL
501 - 8" or less	8" - 8" / 203 mm	31" - 31" / 787 mm	RY - Red (-) Yellow (+) Type K	R - Reinforced
701 - 9" or more	12" - 12" / 304 mm	43" - 43" / 1092 mm	GW - Green (+) White (-) Type K	U - Ungrounded
	15" - 15" / 381 mm	55" - 55" / 1397 mm	RW - Red (-) White (+) Type J	Plug - Plug
	18" - 18" / 457 mm	72" - 72" / 1829 mm	OR - Orange (+) Red (-) Type N	Jack - Jack
	20" - 20" / 508 mm	96" - 96" / 2438 mm	PW - Pink (+) White (-) Type N	Plug & Jack - Plug attached, Jack supplied
	24" - 24" / 610 mm	120" - 120" / 3048 mm		Jack & Plug - Jack attached, Plug supplied
	30" - 30" / 762 mm			

## EXAMPLE PART NUMBER

A 12" Marshall thermocouple with 43" lead wires, Calibration Type K



# THERMOCOUPLE TIPS RED & YELLOW LEAD WIRES



8" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
501-T-8-31-RY	31"	27 lbs / 12 kg
501-T-8-43-RY	43"	30 lbs / 14 kg
501-T-8-55-RY	55"	34 lbs / 16 kg
501-T-8-72-RY	72"	36 lbs / 17 kg
501-T-8-96-RY	96"	40 lbs / 18 kg
501-T-8-120-RY	120"	44 lbs / 20 kg

12" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-12-31-RY	31"	35 lbs / 16 kg
701-T-12-43-RY	43"	39 lbs / 18 kg
701-T-12-55-RY	55"	42 lbs / 19 kg
701-T-12-72-RY	72"	45 lbs / 21 kg
701-T-12-96-RY	96"	50 lbs / 23 kg
701-T-12-120-RY	120"	56 lbs / 26 kg

15" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-15-31-RY	31"	45 lbs / 21 kg
701-T-15-43-RY	43"	48 lbs / 22 kg
701-T-15-55-RY	55"	51 lbs / 24 kg
701-T-15-72-RY	72"	55 lbs / 25 kg
701-T-15-96-RY	96"	59 lbs / 27 kg
701-T-15-120-RY	120"	63 lbs / 29 kg

18" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-18-31-RY	31"	52 lbs / 24 kg
701-T-18-43-RY	43"	55 lbs / 25 kg
701-T-18-55-RY	55"	58 lbs / 27 kg
701-T-18-72-RY	72"	61 lbs / 28 kg
701-T-18-96-RY	96"	65 lbs / 30 kg
701-T-18-120-RY	120"	69 lbs / 32 kg

\* Lead wires can be color coded Red/Yellow or Green/White  
 \*\* See lance price page for part numbers  
 \*\*\* Per 50 pieces in lbs/kg



# THERMOCOUPLE TIPS RED & YELLOW LEAD WIRES

CONTINUED



20" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-20-31-RY	31"	54 lbs / 25 kg
701-T-20-43-RY	43"	57 lbs / 26 kg
701-T-20-55-RY	55"	60 lbs / 28 kg
701-T-20-72-RY	72"	63 lbs / 29 kg
701-T-20-96-RY	96"	67 lbs / 31 kg
701-T-20-120-RY	120"	71 lbs / 33 kg

24" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-24-31-RY	31"	62 lbs / 29 kg
701-T-24-43-RY	43"	65 lbs / 30 kg
701-T-24-55-RY	55"	68 lbs / 31 kg
701-T-24-72-RY	72"	71 lbs / 33 kg
701-T-24-96-RY	96"	75 lbs / 34 kg
701-T-24-120-RY	120"	79 lbs / 36 kg

30" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-30-31-RY	31"	72 lbs / 33 kg
701-T-30-43-RY	43"	75 lbs / 34 kg
701-T-30-55-RY	55"	78 lbs / 36 kg
701-T-30-72-RY	72"	81 lbs / 37 kg
701-T-30-96-RY	96"	85 lbs / 39 kg
701-T-30-120-RY	120"	89 lbs / 41 kg

**NOTES:** Longer length tips and wire lengths are available.

\* Lead wires can be color coded Red/Yellow or Green/White

\*\* See lance price page for part numbers

\*\*\* Per 50 pieces in lbs/kg

# THERMOCOUPLE TIPS GREEN & WHITE LEAD WIRES



8" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
501-T-8-31-GW	31"	27 lbs / 12 kg
501-T-8-43-GW	43"	30 lbs / 14 kg
501-T-8-55-GW	55"	34 lbs / 16 kg
501-T-8-72-GW	72"	36 lbs / 17 kg
501-T-8-96-GW	96"	40 lbs / 18 kg
501-T-8-120-GW	120"	44 lbs / 20 kg

12" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-12-31-GW	31"	35 lbs / 16 kg
701-T-12-43-GW	43"	39 lbs / 18 kg
701-T-12-55-GW	55"	42 lbs / 19 kg
701-T-12-72-GW	72"	45 lbs / 21 kg
701-T-12-96-GW	96"	50 lbs / 23 kg
701-T-12-120-GW	120"	56 lbs / 26 kg

15" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-15-31-GW	31"	45 lbs / 21 kg
701-T-15-43-GW	43"	48 lbs / 22 kg
701-T-15-55-GW	55"	51 lbs / 24 kg
701-T-15-72-GW	72"	55 lbs / 25 kg
701-T-15-96-GW	96"	59 lbs / 27 kg
701-T-15-120-GW	120"	63 lbs / 29 kg

18" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-18-31-GW	31"	52 lbs / 24 kg
701-T-18-43-GW	43"	55 lbs / 25 kg
701-T-18-55-GW	55"	58 lbs / 27 kg
701-T-18-72-GW	72"	61 lbs / 28 kg
701-T-18-96-GW	96"	65 lbs / 30 kg
701-T-18-120-GW	120"	69 lbs / 32 kg

\* Lead wires can be color coded Red/Yellow or Green/White  
 \*\* See lance price page for part numbers  
 \*\*\* Per 50 pieces in lbs/kg

# THERMOCOUPLE TIPS GREEN & WHITE LEAD WIRES

CONTINUED



20" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-20-31-GW	31"	54 lbs / 25 kg
701-T-20-43-GW	43"	57 lbs / 26 kg
701-T-20-55-GW	55"	60 lbs / 28 kg
701-T-20-72-GW	72"	63 lbs / 29 kg
701-T-20-96-GW	96"	67 lbs / 31 kg
701-T-20-120-GW	120"	71 lbs / 33 kg

24" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-24-31-GW	31"	62 lbs / 29 kg
701-T-24-43-GW	43"	65 lbs / 30 kg
701-T-24-55-GW	55"	68 lbs / 31 kg
701-T-24-72-GW	72"	71 lbs / 33 kg
701-T-24-96-GW	96"	75 lbs / 34 kg
701-T-24-120-GW	120"	79 lbs / 36 kg

30" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-30-31-GW	31"	72 lbs / 33 kg
701-T-30-43-GW	43"	75 lbs / 34 kg
701-T-30-55-GW	55"	78 lbs / 36 kg
701-T-30-72-GW	72"	81 lbs / 37 kg
701-T-30-96-GW	96"	85 lbs / 39 kg
701-T-30-120-GW	120"	89 lbs / 41 kg

**NOTES:** Longer length tips and wire lengths are available.

\* Lead wires can be color coded Red/Yellow or Green/White

\*\* See lance price page for part numbers

\*\*\* Per 50 pieces in lbs/kg

# THERMOCOUPLE TIPS RED & YELLOW LEAD WIRES REINFORCED TIP



8" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
501-T-8-31-RY-R	31"	27 lbs / 12 kg
501-T-8-43-RY-R	43"	30 lbs / 14 kg
501-T-8-55-RY-R	55"	34 lbs / 16 kg
501-T-8-72-RY-R	72"	36 lbs / 17 kg
501-T-8-96-RY-R	96"	40 lbs / 18 kg
501-T-8-120-RY-R	120"	44 lbs / 20 kg

12" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-12-31-RY-R	31"	35 lbs / 16 kg
701-T-12-43-RY-R	43"	39 lbs / 18 kg
701-T-12-55-RY-R	55"	42 lbs / 19 kg
701-T-12-72-RY-R	72"	45 lbs / 21 kg
701-T-12-96-RY-R	96"	50 lbs / 23 kg
701-T-12-120-RY-R	120"	56 lbs / 26 kg

15" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-15-31-RY-R	31"	45 lbs / 21 kg
701-T-15-43-RY-R	43"	48 lbs / 22 kg
701-T-15-55-RY-R	55"	51 lbs / 24 kg
701-T-15-72-RY-R	72"	55 lbs / 25 kg
701-T-15-96-RY-R	96"	59 lbs / 27 kg
701-T-15-120-RY-R	120"	63 lbs / 29 kg

18" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-18-31-RY-R	31"	52 lbs / 24 kg
701-T-18-43-RY-R	43"	55 lbs / 25 kg
701-T-18-55-RY-R	55"	58 lbs / 27 kg
701-T-18-72-RY-R	72"	61 lbs / 28 kg
701-T-18-96-RY-R	96"	65 lbs / 30 kg
701-T-18-120-RY-R	120"	69 lbs / 32 kg

\* Lead wires can be color coded Red/Yellow or Green/White  
 \*\* See lance price page for part numbers  
 \*\*\* Per 50 pieces in lbs/kg

# THERMOCOUPLE TIPS RED & YELLOW LEAD WIRES REINFORCED TIP CONTINUED



20" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-20-31-RY-R	31"	54 lbs / 25 kg
701-T-20-43-RY-R	43"	57 lbs / 26 kg
701-T-20-55-RY-R	55"	60 lbs / 28 kg
701-T-20-72-RY-R	72"	63 lbs / 29 kg
701-T-20-96-RY-R	96"	67 lbs / 31 kg
701-T-20-120-RY-R	120"	71 lbs / 33 kg

24" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-24-31-RY-R	31"	62 lbs / 29 kg
701-T-24-43-RY-R	43"	65 lbs / 30 kg
701-T-24-55-RY-R	55"	68 lbs / 31 kg
701-T-24-72-RY-R	72"	71 lbs / 33 kg
701-T-24-96-RY-R	96"	75 lbs / 34 kg
701-T-24-120-RY-R	120"	79 lbs / 36 kg

30" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-30-31-RY-R	31"	72 lbs / 33 kg
701-T-30-43-RY-R	43"	75 lbs / 34 kg
701-T-30-55-RY-R	55"	78 lbs / 36 kg
701-T-30-72-RY-R	72"	81 lbs / 37 kg
701-T-30-96-RY-R	96"	85 lbs / 39 kg
701-T-30-120-RY-R	120"	89 lbs / 41 kg

**NOTES:** Longer length tips and wire lengths are available.

- \* Lead wires can be color coded Red/Yellow or Green/White
- \*\* See lance price page for part numbers
- \*\*\* Per 50 pieces in lbs/kg

# THERMOCOUPLE TIPS GREEN & WHITE LEAD WIRES REINFORCED TIP



8" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
501-T-8-31-GW-R	31"	27 lbs / 12 kg
501-T-8-43-GW-R	43"	30 lbs / 14 kg
501-T-8-55-GW-R	55"	34 lbs / 16 kg
501-T-8-72-GW-R	72"	36 lbs / 17 kg
501-T-8-96-GW-R	96"	40 lbs / 18 kg
501-T-8-120-GW-R	120"	44 lbs / 20 kg

12" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-12-31-GW-R	31"	35 lbs / 16 kg
701-T-12-43-GW-R	43"	39 lbs / 18 kg
701-T-12-55-GW-R	55"	42 lbs / 19 kg
701-T-12-72-GW-R	72"	45 lbs / 21 kg
701-T-12-96-GW-R	96"	50 lbs / 23 kg
701-T-12-120-GW-R	120"	56 lbs / 26 kg

15" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-15-31-GW-R	31"	45 lbs / 21 kg
701-T-15-43-GW-R	43"	48 lbs / 22 kg
701-T-15-55-GW-R	55"	51 lbs / 24 kg
701-T-15-72-GW-R	72"	55 lbs / 25 kg
701-T-15-96-GW-R	96"	59 lbs / 27 kg
701-T-15-120-GW-R	120"	63 lbs / 29 kg

18" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-18-31-GW-R	31"	52 lbs / 24 kg
701-T-18-43-GW-R	43"	55 lbs / 25 kg
701-T-18-55-GW-R	55"	58 lbs / 27 kg
701-T-18-72-GW-R	72"	61 lbs / 28 kg
701-T-18-96-GW-R	96"	65 lbs / 30 kg
701-T-18-120-GW-R	120"	69 lbs / 32 kg

\* Lead wires can be color coded Red/Yellow or Green/White  
 \*\* See lance price page for part numbers  
 \*\*\* Per 50 pieces in lbs/kg

# THERMOCOUPLE TIPS GREEN & WHITE LEAD WIRES REINFORCED TIP CONTINUED



20" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-20-31-GW-R	31"	54 lbs / 25 kg
701-T-20-43-GW-R	43"	57 lbs / 26 kg
701-T-20-55-GW-R	55"	60 lbs / 28 kg
701-T-20-72-GW-R	72"	63 lbs / 29 kg
701-T-20-96-GW-R	96"	67 lbs / 31 kg
701-T-20-120-GW-R	120"	71 lbs / 33 kg

24" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-24-31-GW-R	31"	62 lbs / 29 kg
701-T-24-43-GW-R	43"	65 lbs / 30 kg
701-T-24-55-GW-R	55"	68 lbs / 31 kg
701-T-24-72-GW-R	72"	71 lbs / 33 kg
701-T-24-96-GW-R	96"	75 lbs / 34 kg
701-T-24-120-GW-R	120"	79 lbs / 36 kg

30" THERMOCOUPLE TIPS*	FOR USE WITH LANCE LENGTH**	SHIPPING WEIGHT***
701-T-30-31-GW-R	31"	72 lbs / 33 kg
701-T-30-43-GW-R	43"	75 lbs / 34 kg
701-T-30-55-GW-R	55"	78 lbs / 36 kg
701-T-30-72-GW-R	72"	81 lbs / 37 kg
701-T-30-96-GW-R	96"	85 lbs / 39 kg
701-T-30-120-GW-R	120"	89 lbs / 41 kg

**NOTES:** Longer length tips and wire lengths are available.

- \* Lead wires can be color coded Red/Yellow or Green/White
- \*\* See lance price page for part numbers
- \*\*\* Per 50 pieces in lbs/kg

# MARSHALL THERMOCOUPLES™ MT



## MARSHALL THERMOCOUPLE™

The L.H. Marshall Company invented and patented the enclosed tip Thermocouple™ over 80 years ago. Over 10 million Marshall Thermocouples have been sold worldwide for precision temperature measurement. Marshall Thermocouples are reusable, durable, accurate and are a quality product engineered to meet the industry standards for temperature measurement of molten metals.

Scientific research and development at one of America's leading research facilities has led to innovations in steel composition of the Marshall protection tubes resulting in the longest lasting, multiuse thermocouple in the industry.

All Marshall Thermocouples are manufactured with Class 1, Special Limits wire which meet and exceed international quality standards of ANSI MC96.1 and IEC 584. Custom Marshall Thermocouples can be made to accommodate any range of industrial need while maintaining superior quality. Calibration certificates are available on Marshall Thermocouples and all products produced by the L.H. Marshall Company are 100% guaranteed.

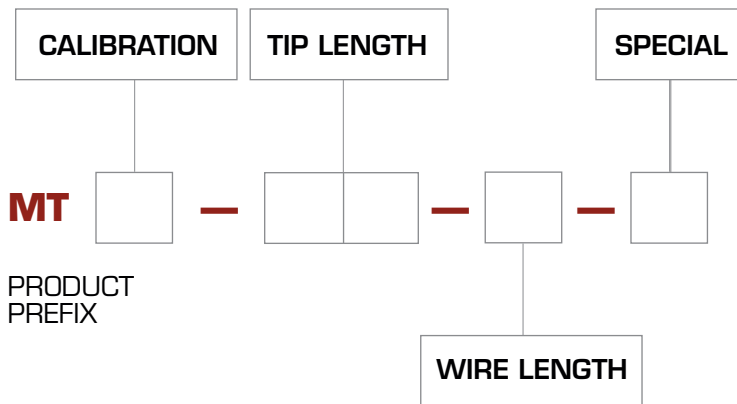
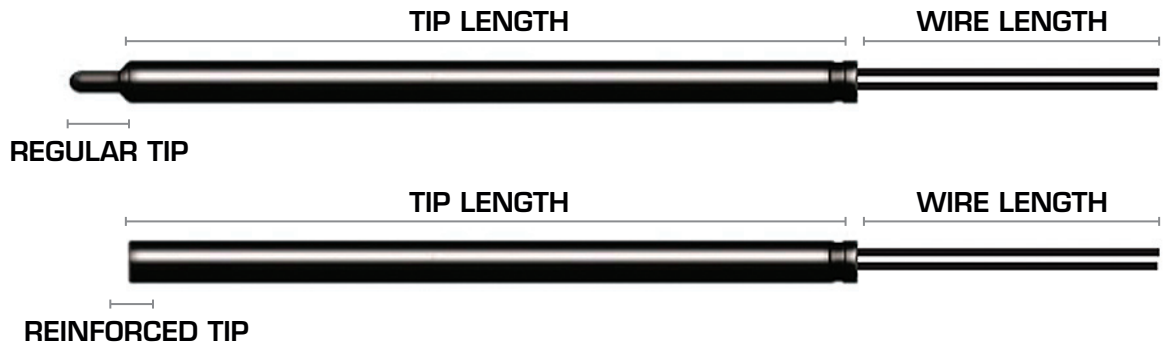


# MARSHALL THERMOCOUPLE™—MT



## ORDERING INFORMATION

Fill in each Ordering Number box with the appropriate specification code. This series of numbers and letters will form the final Ordering Number.



CALIBRATION	TIP LENGTH	WIRE LENGTH	SPECIAL
K - Type K	8 - 8" / 203 mm	6 - 6" / 152 mm - Standard	R - Reinforced
J - Type J	12 - 12" / 304 mm	" " - Other in Inches	Blank - Regular Tip
N - Type N	15 - 15" / 381 mm		U - Ungrounded
KK - Type K Dual Element	18 - 18" / 457 mm		Plug - Plug
JJ - Type J Dual Element	20 - 20" / 508 mm		Jack - Jack
NN - Type N Dual Element	24 - 24" / 610 mm		Plug & Jack - Plug attached, Jack supplied
	30 - 30" / 762 mm		Jack & Plug - Jack attached, Plug supplied

## EXAMPLE PART NUMBER

Marshall MT thermocouple that is 15" long with the standard 6" of bare lead wires

**MT** **K** - **15** - **6** -

# MARSHALL THERMOCOUPLE™—MT



## MT TYPE K

PART #, 6" BARE LEAD	TIP LENGTH	WIRE LENGTH
MTK-8-6	8 inches	6 inches
MTK-12-6	12 inches	6 inches
MTK-15-6	15 inches	6 inches
MTK-18-6	18 inches	6 inches
MTK-20-6	20 inches	6 inches
MTK-24-6	24 inches	6 inches
MTK-30-6	30 inches	6 inches
MTK-36-6	36 inches	6 inches

## MT TYPE J

PART #, 6" BARE LEAD	TIP LENGTH	WIRE LENGTH
MTJ-8-6	8 inches	6 inches
MTJ-12-6	12 inches	6 inches
MTJ-15-6	15 inches	6 inches
MTJ-18-6	18 inches	6 inches
MTJ-20-6	20 inches	6 inches
MTJ-24-6	24 inches	6 inches
MTJ-30-6	30 inches	6 inches
MTJ-36-6	36 inches	6 inches

## MT TYPE K DUAL ELEMENT

PART #, 6" BARE LEAD	TIP LENGTH	WIRE LENGTH
MTKK-8-6	8 inches	6 inches
MTKK-12-6	12 inches	6 inches
MTKK-J15-6	15 inches	6 inches
MTKK-18-6	18 inches	6 inches
MTKK-20-6	20 inches	6 inches
MTKK-24-6	24 inches	6 inches
MTKK-30-6	30 inches	6 inches
MTKK-36-6	36 inches	6 inches

## MT TYPE J DUAL ELEMENT

PART #, 6" BARE LEAD	TIP LENGTH	WIRE LENGTH
MTJJ-8-6	8 inches	6 inches
MTJJ-12-6	12 inches	6 inches
MTJJ-15-6	15 inches	6 inches
MTJJ-18-6	18 inches	6 inches
MTJJ-20-6	20 inches	6 inches
MTJJ-24-6	24 inches	6 inches
MTJJ-30-6	30 inches	6 inches
MTJJ-36-6	36 inches	6 inches

# MARSHALL THERMOCOUPLE™—MT REINFORCED TIP



## MT TYPE K

PART #, 6" BARE LEAD	TIP LENGTH	WIRE LENGTH
MTK-8-6-R	8 inches	6 inches
MTK-12-6-R	12 inches	6 inches
MTK-15-6-R	15 inches	6 inches
MTK-18-6-R	18 inches	6 inches
MTK-20-6-R	20 inches	6 inches
MTK-24-6-R	24 inches	6 inches
MTK-30-6-R	30 inches	6 inches
MTK-36-6-R	36 inches	6 inches

## MT TYPE J

PART #, 6" BARE LEAD	TIP LENGTH	WIRE LENGTH
MTJ-8-6-R	8 inches	6 inches
MTJ-12-6-R	12 inches	6 inches
MTJ-15-6-R	15 inches	6 inches
MTJ-18-6-R	18 inches	6 inches
MTJ-20-6-R	20 inches	6 inches
MTJ-24-6-R	24 inches	6 inches
MTJ-30-6-R	30 inches	6 inches
MTJ-36-6-R	36 inches	6 inches

## MT TYPE K DUAL ELEMENT

PART #, 6" BARE LEAD	TIP LENGTH	WIRE LENGTH
MTKK-8-6-R	8 inches	6 inches
MTKK-12-6-R	12 inches	6 inches
MTKK-J15-6-R	15 inches	6 inches
MTKK-18-6-R	18 inches	6 inches
MTKK-20-6-R	20 inches	6 inches
MTKK-24-6-R	24 inches	6 inches
MTKK-30-6-R	30 inches	6 inches
MTKK-36-6-R	36 inches	6 inches

## MT TYPE J DUAL ELEMENT

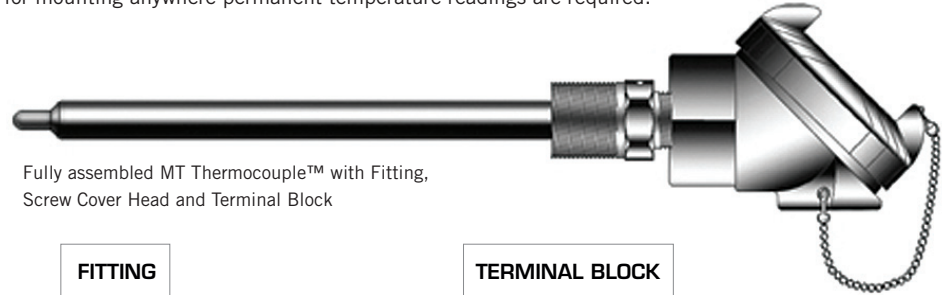
PART #, 6" BARE LEAD	TIP LENGTH	WIRE LENGTH
MTJJ-8-6-R	8 inches	6 inches
MTJJ-12-6-R	12 inches	6 inches
MTJJ-15-6-R	15 inches	6 inches
MTJJ-18-6-R	18 inches	6 inches
MTJJ-20-6-R	20 inches	6 inches
MTJJ-24-6-R	24 inches	6 inches
MTJJ-30-6-R	30 inches	6 inches
MTJJ-36-6-R	36 inches	6 inches

# MARSHALL MT THERMOCOUPLE™ ASSEMBLIES

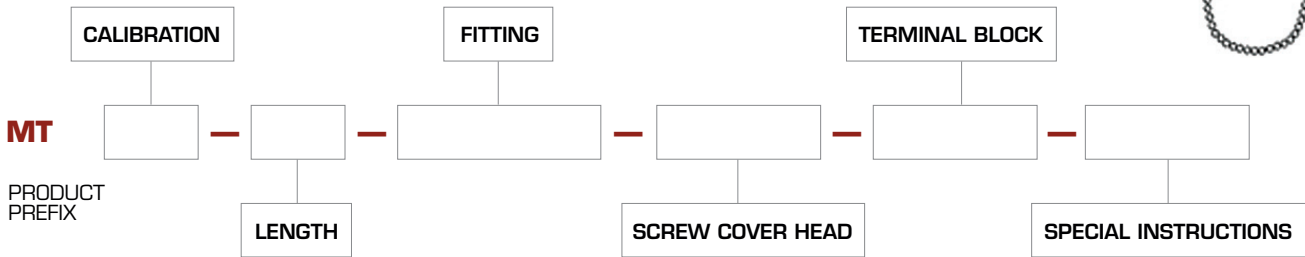


## ORDERING INFORMATION

L.H. Marshall Company manufactures the MT™ thermocouple which can be assembled with a threaded fitting, head and terminal block. These MT™ thermocouples are excellent for mounting anywhere permanent temperature readings are required.



Fully assembled MT Thermocouple™ with Fitting, Screw Cover Head and Terminal Block



CALIBRATION	LENGTH	FITTING	GENERAL PURPOSE & SCREW COVER HEADS	TERMINAL BLOCK	SPECIAL
<b>K</b> - Type K <b>J</b> - Type J <b>N</b> - Type N <b>KK</b> - Type K Dual Element <b>JJ</b> - Type J Dual Element <b>NN</b> - Type N0 Dual Element	<b>8 inches</b> <b>12 inches</b> <b>15 inches</b> <b>18 inches</b> <b>20 inches</b> <b>24 inches</b> <b>30 inches</b> <b>36 inches</b>	<b>1212</b> - 0.50" x 0.50" <b>3434</b> - 0.75" x 0.75" <b>1234</b> - 0.50" x 0.70"	<b>GENERAL PURPOSE HEADS</b> <b>GPH1</b> (0.50" NPT) <b>GPH2</b> (0.75" NPT) <b>GPH3</b> (1.00" NPT)  <b>SCREW COVER HEADS</b> <b>SCH1</b> (0.50" NPT) <b>SCH2</b> (0.75" NPT) <b>SCH3</b> (1.00" NPT)	<b>GTB</b> - Terminal Block for General Purpose Head <b>STB</b> - Terminal Block for Screw Cover Head  <b>DUAL ELEMENT</b> <b>GTBB</b> <b>STBB</b>	<b>Blank</b> - None

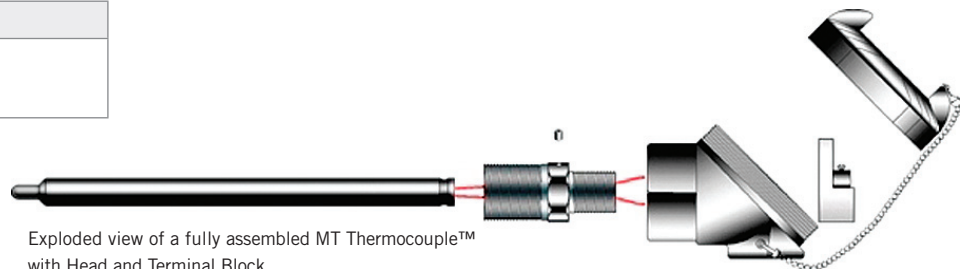
## TERMINAL BLOCKS AND HEADS

TERMINAL BLOCKS
<b>GTB</b> - Terminal Block for General Purpose Head
<b>STB</b> - Terminal Block for Screw Cover Head
<b>GTBB</b> - Dual Element Terminal Block for General Purpose Head
<b>STBB</b> - Dual Element Terminal Block for Screw Cover Head

FITTINGS
<b>1212</b> - Hex Pipe Nipple 0.50" x 0.50" CAT
<b>3434</b> - Hex Pipe Nipple 0.75" x 0.75" CAT
<b>1234</b> - Hex Pipe Nipple 0.50" x 0.75" CAT

GENERAL PURPOSE HEADS
<b>GPH1</b> (0.50" NPT)
<b>GPH2</b> (0.75" NPT)
<b>GPH3</b> (1.00" NPT)

SCREW COVER HEADS
<b>SCH1</b> (0.50" NPT)
<b>SCH2</b> (0.75" NPT)
<b>SCH3</b> (1.00" NPT)



Exploded view of a fully assembled MT Thermocouple™ with Head and Terminal Block

# MARSHALL LANCE



## **MARSHALL THERMOCOUPLE™**

The L.H. Marshall Company invented and patented the enclosed tip Thermocouple™ over 80 years ago. Over 10 million Marshall Thermocouples have been sold worldwide for precision temperature measurement. Marshall Thermocouples are reusable, durable, accurate and are a quality product engineered to meet the industry standards for temperature measurement of molten metals.

Scientific research and development at one of America's leading research facilities has led to innovations in steel composition of the Marshall protection tubes resulting in the longest lasting, multiuse thermocouple in the industry.

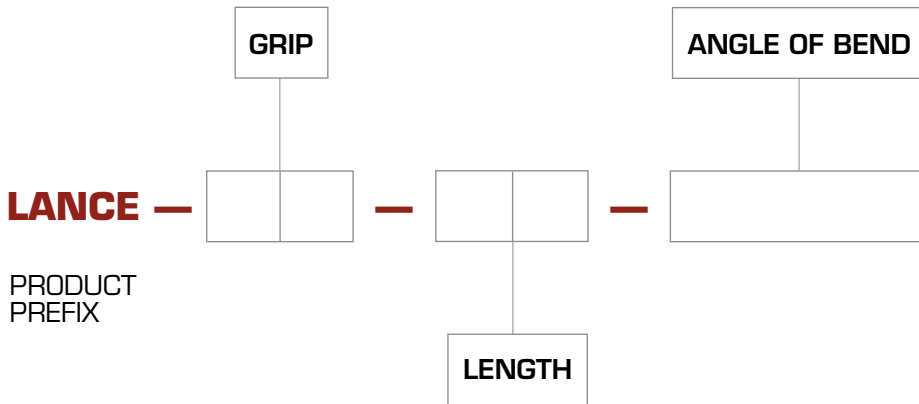
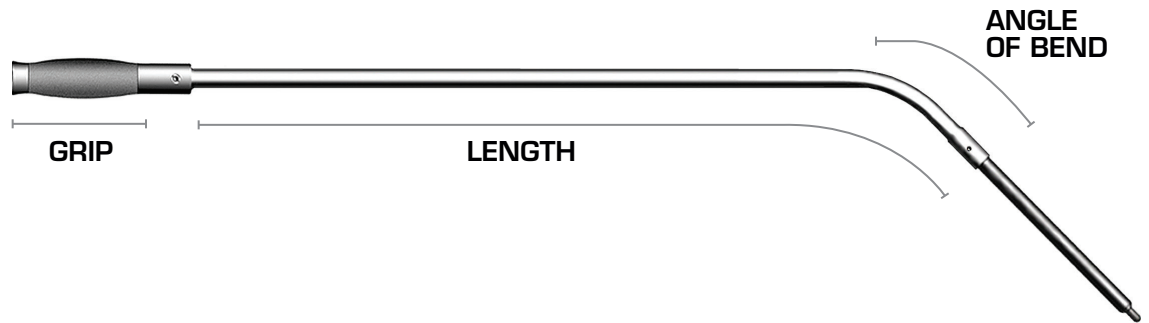
All Marshall Thermocouples are manufactured with Class 1, Special Limits wire which meet and exceed international quality standards of ANSI MC96.1 and IEC 584. Custom Marshall Thermocouples can be made to accommodate any range of industrial need while maintaining superior quality. Calibration certificates are available on Marshall Thermocouples and all products produced by the L.H. Marshall Company are 100% guaranteed.

# MARSHALL LANCE



## ORDERING INFORMATION

Fill in each Ordering Number box with the appropriate specification code. This series of numbers and letters will form the final Ordering Number.



GRIP	LENGTH	ANGLE OF BEND
NG - No Grip	31" - 31" / 787 mm	90 - 90°
AG - Aluminum	43" - 43" / 1092 mm	45 - 45°
PG - Plastic	55" - 55" / 1397 mm	Straight - No Bend
	72" - 72" / 1829 mm	* Custom Bend Available
	96" - 96" / 2438 mm	
	120" - 120" / 3048 mm	
	* Custom Length Available	

## EXAMPLE PART NUMBER

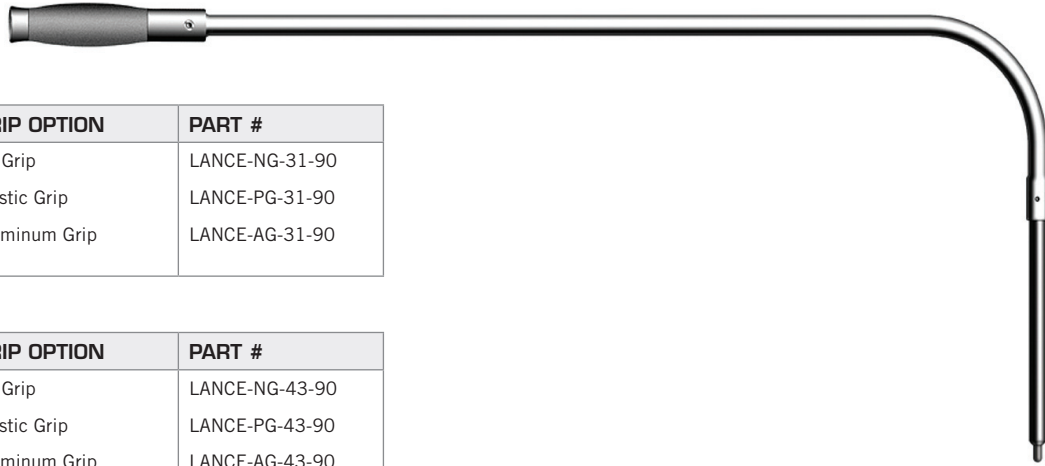
Lance with aluminum grip, 43" long and 90° bend

**LANCE** — **A** **X** — **4** **3** — **90**

# CURVED LANCE—90° BEND



BELOW: This picture shows the Marshall Lance with a plastic grip and a Marshall Thermocouple™. Parts below do not include the Marshall Thermocouple™ and have various grip options.



SIZE/WEIGHT	GRIP OPTION	PART #
<b>31" / 787 mm</b> Inches/Millimeters	No Grip	LANCE-NG-31-90
<b>1.5 lbs / 0.7 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-31-90
	Aluminum Grip	LANCE-AG-31-90

SIZE/WEIGHT	GRIP OPTION	PART #
<b>43" / 1092 mm</b> Inches/Millimeters	No Grip	LANCE-NG-43-90
<b>2.0 lbs / 0.9 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-43-90
	Aluminum Grip	LANCE-AG-43-90

SIZE/WEIGHT	GRIP OPTION	PART #
<b>55" / 1397 mm</b> Inches/Millimeters	No Grip	LANCE-NG-55-90
<b>2.5 lbs / 1.1 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-55-90
	Aluminum Grip	LANCE-AG-55-90

SIZE/WEIGHT	GRIP OPTION	PART #
<b>72" / 1829 mm</b> Inches/Millimeters	No Grip	LANCE-NG-72-90
<b>3.0 lbs / 1.4 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-72-90
	Aluminum Grip	LANCE-AG-72-90

SIZE/WEIGHT	GRIP OPTION	PART #
<b>96" / 2438 mm</b> Inches/Millimeters	No Grip	LANCE-NG-96-90
<b>4.0 lbs / 1.8 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-96-90
	Aluminum Grip	LANCE-AG-96-90

SIZE/WEIGHT	GRIP OPTION	PART #
<b>120" / 3048 mm</b> Inches/Millimeters	No Grip	LANCE-NG-120-90
<b>4.5 lbs / 2.0 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-120-90
	Aluminum Grip	LANCE-AG-120-90

# STRAIGHT LANCE



BELOW: This picture shows the Marshall Lance with a plastic grip and a Marshall Thermocouple™. Parts below do not include the Marshall Thermocouple™ and have various grip options.



SIZE/WEIGHT	GRIP OPTION	PART #
<b>31" / 787 mm</b> Inches/Millimeters	No Grip	LANCE-NG-31-STRAIGHT
<b>1.5 lbs / 0.7 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-31-STRAIGHT
	Aluminum Grip	LANCE-AG-31-STRAIGHT

SIZE/WEIGHT	GRIP OPTION	PART #
<b>43" / 1092 mm</b> Inches/Millimeters	No Grip	LANCE-NG-43-STRAIGHT
<b>2.0 lbs / 0.9 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-43-STRAIGHT
	Aluminum Grip	LANCE-AG-43-STRAIGHT

SIZE/WEIGHT	GRIP OPTION	PART #
<b>55" / 1397 mm</b> Inches/Millimeters	No Grip	LANCE-NG-55-STRAIGHT
<b>2.5 lbs / 1.1 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-55-STRAIGHT
	Aluminum Grip	LANCE-AG-55-STRAIGHT

SIZE/WEIGHT	GRIP OPTION	PART #
<b>72" / 1829 mm</b> Inches/Millimeters	No Grip	LANCE-NG-72-STRAIGHT
<b>3.0 lbs / 1.4 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-72-STRAIGHT
	Aluminum Grip	LANCE-AG-72-STRAIGHT

SIZE/WEIGHT	GRIP OPTION	PART #
<b>96" / 2438 mm</b> Inches/Millimeters	No Grip	LANCE-NG-96-STRAIGHT
<b>4.0 lbs / 1.8 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-96-STRAIGHT
	Aluminum Grip	LANCE-AG-96-STRAIGHT

SIZE/WEIGHT	GRIP OPTION	PART #
<b>120" / 3048 mm</b> Inches/Millimeters	No Grip	LANCE-NG-120-STRAIGHT
<b>4.5 lbs / 2.0 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-120-STRAIGHT
	Aluminum Grip	LANCE-AG-120-STRAIGHT



# CURVED LANCE—45° BEND



BELOW: This picture shows the Marshall Lance with a plastic grip and a Marshall Thermocouple™. Parts below do not include the Marshall Thermocouple™ and have various grip options.



SIZE/WEIGHT	GRIP OPTION	PART #
<b>31" / 787 mm</b> Inches/Millimeters	No Grip	LANCE-NG-31-45
<b>1.5 lbs / 0.7 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-31-45
	Aluminum Grip	LANCE-AG-31-45

SIZE/WEIGHT	GRIP OPTION	PART #
<b>43" / 1092 mm</b> Inches/Millimeters	No Grip	LANCE-NG-43-45
<b>2.0 lbs / 0.9 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-43-45
	Aluminum Grip	LANCE-AG-43-45

SIZE/WEIGHT	GRIP OPTION	PART #
<b>55" / 1397 mm</b> Inches/Millimeters	No Grip	LANCE-NG-55-45
<b>2.5 lbs / 1.1 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-55-45
	Aluminum Grip	LANCE-AG-55-45

SIZE/WEIGHT	GRIP OPTION	PART #
<b>72" / 1829 mm</b> Inches/Millimeters	No Grip	LANCE-NG-72-45
<b>3.0 lbs / 1.4 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-72-45
	Aluminum Grip	LANCE-AG-72-45

SIZE/WEIGHT	GRIP OPTION	PART #
<b>96" / 2438 mm</b> Inches/Millimeters	No Grip	LANCE-NG-96-45
<b>4.0 lbs / 1.8 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-96-45
	Aluminum Grip	LANCE-AG-96-45

SIZE/WEIGHT	GRIP OPTION	PART #
<b>120" / 3048 mm</b> Inches/Millimeters	No Grip	LANCE-NG-120-45
<b>4.5 lbs / 2.0 kg</b> Pounds/Kilograms (Approx. Shipping Weight)	Plastic Grip	LANCE-PG-120-45
	Aluminum Grip	LANCE-AG-120-45

# MARSHALL PORTA-PROBE™



## MARSHALL THERMOCOUPLE™

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Scientific research and development at one of America's leading research facilities has led to innovations in steel composition of the Marshall protection tubes resulting in the longest lasting, multiuse thermocouple in the industry.

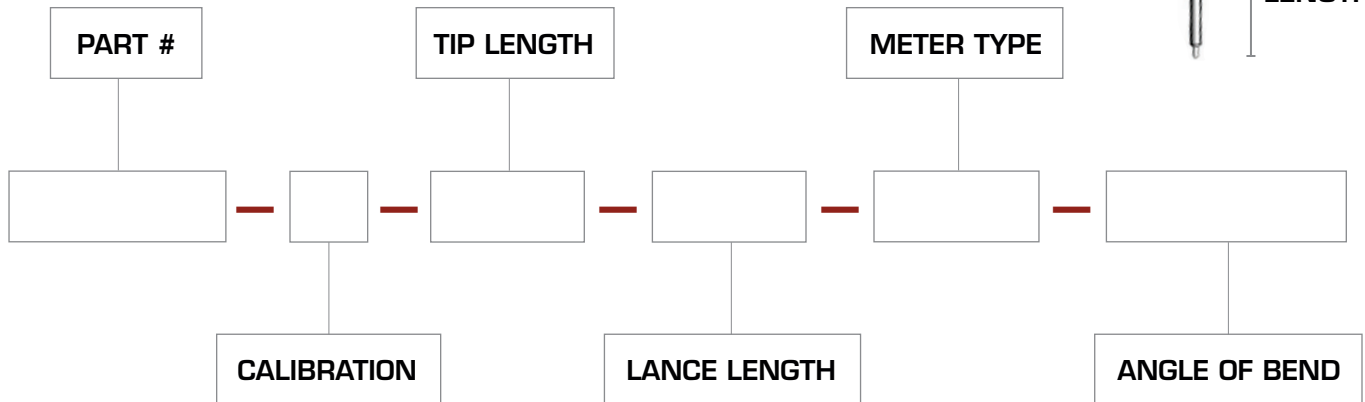
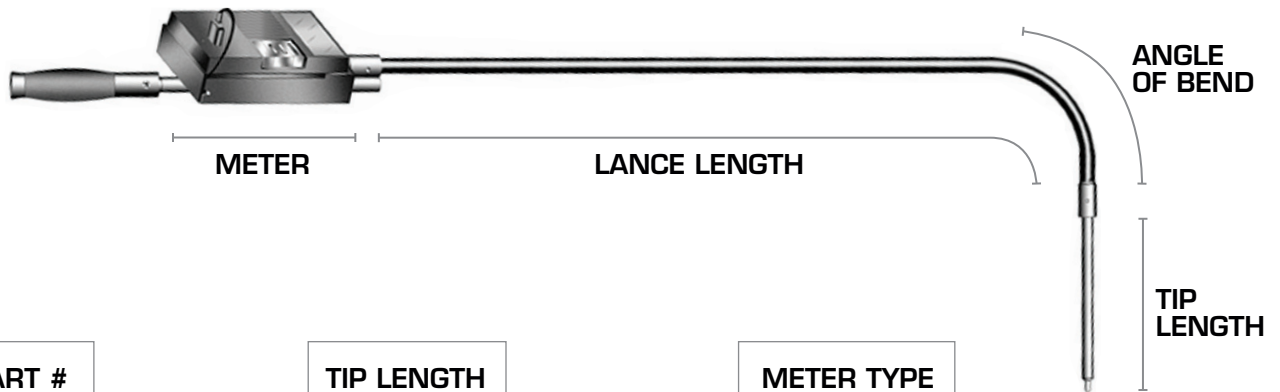
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# MARSHALL PORTA-PROBE™



## ORDERING INFORMATION

Fill in each Ordering Number box with the appropriate specification code. This series of numbers and letters will form the final Ordering Number.



PART #	CALIBRATION	TIP LENGTH	LANCE LENGTH	METER TYPE	ANGLE OF BEND
PORTA - Standard	K - TYPE K	8 - 8" / 203 mm	31 - 31" / 787 mm	F51II	90 - 90°
PORTA-Q - Quick Change	J - TYPE J	12 - 12" / 304 mm	43 - 43" / 1092 mm	F53II	45 - 45°
	N - TYPE N	15 - 15" / 381 mm	55 - 55" / 1397 mm	00 = No Meter	Straight - No Bend
	0 - NO TIP	18 - 18" / 457 mm	72 - 72" / 1829 mm	* Meters manufactured by FLUKE Corporation www.fluke.com	* Custom Bend Available
		20 - 20" / 508 mm	96 - 96" / 2438 mm		
		24 - 24" / 610 mm	120 - 120" / 3048 mm		
		30 - 30" / 762 mm	• Custom Length Available		
	00 - NO TIP				

## EXAMPLE PART NUMBER

Marshall Porta-Probe quick change model with a 12" tip, 55" long lance, a Fluke F51II meter and a 90° bend

**PORTA-Q** - **1** **2** - **5** **5** - **F5311** - **90**

# MARSHALL PORTA-PROBE™



## PORTABLE FAST AND ACCURATE TEMPERATURE READINGS

- Highly Accurate Marshall Thermocouple
- Highly Accurate Fluke Meter
- Instant Conversion from °F to °C
- Data Logging Available
- Computer Downloadable



### FLUKE METER 51 II

CANNOT DOWNLOAD TO COMPUTER

METER / ADAPTER BOX	PART #
Fluke Meter 51 II	Fluke51-II
Adapter Box Fluke 51 II	Adapter-Fluke-II
Adapter Box Fluke 51	Adapter-Fluke-51
Adapter Box Quick Change	Adapter-Q



### FLUKE METER 53 II

COMPUTER DATA LOGGING, CAN DOWNLOAD TO COMPUTER

METER / ADAPTER BOX	PART #
Fluke Meter 53 II	Fluke53-II
Adapter Box Fluke 53 II	Adapter-Fluke-II

\* F53 is for single input and F54 is for dual input

# MARSHALL PORTA-PROBE Q™



## PORTABLE FAST AND ACCURATE TEMPERATURE READINGS

- Highly Accurate Marshall Thermocouple
- Highly Accurate Fluke Meter
- Instant Conversion from °F to °C
- Data Logging Available
- Computer Downloadable
- Angled Viewing of Meter
- Fast Change of Thermocouple



### FLUKE METER 51 II

CANNOT DOWNLOAD TO COMPUTER

METER / ADAPTER BOX	PART #
Fluke Meter 51 II	Fluke51-II
Adapter Box Fluke 51 II	Adapter-Fluke-II
Adapter Box Fluke 51	Adapter-Fluke-51
Adapter Box Quick Change	Adapter-Q



### FLUKE METER 53 II

COMPUTER DATA LOGGING, CAN DOWNLOAD TO COMPUTER

METER / ADAPTER BOX	PART #
Fluke Meter 53 II	Fluke53-II
Adapter Box Fluke 53 II	Adapter-Fluke-II

\* F53 is for single input and F54 is for dual input

# FLUKE 51 II THERMOMETER



## FLUKE 51 SERIES II PRODUCT FEATURES

- Relative time clock on MIN, MAX and AVG provides a time reference for major events
- Electronic Offset function allows compensation of thermocouple errors to maximize overall accuracy
- Measures J, K, T, E thermocouples
- Readout in °C, °F or Kelvin (K)
- Splash and dust resistant case protected by impact absorbing holster
- User-friendly front panel is easy to set up and operate
- Sleep mode increases battery life; typical 1000-hour battery life
- Battery door allows easy battery replacement without breaking the calibration seal
- 3-year warranty

SPECIFICATIONS	
Temperature Accuracy	<p><b>Above - 100 °C:</b> J, K, T, E: <math>\pm(0.05\% + 0.3^{\circ}\text{C})</math> R and S-types: <math>\pm(0.05\% + 0.4^{\circ}\text{C})</math></p> <p><b>Below - 100 °C:</b> J, K, T, E: <math>\pm(0.20\% + 0.3^{\circ}\text{C})</math> T-type: <math>\pm(0.50\% + 0.3^{\circ}\text{C})</math></p>
Temperature	<p><b>J-type:</b> -210°C to 1200°C</p> <p><b>K-type:</b> -200°C to 1372°C</p> <p><b>T-type:</b> -250°C to 400°C</p> <p><b>E-type:</b> -150°C to 1000°C</p>



# FLUKE 53 II THERMOMETER



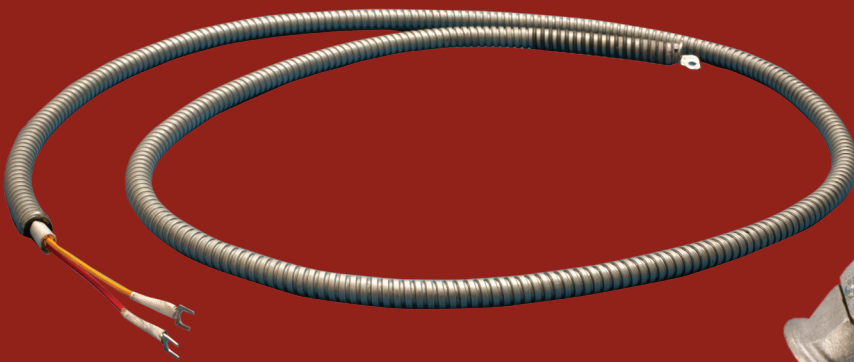
## FLUKE 53 SERIES II PRODUCT FEATURES

- Relative time clock on MIN, MAX and AVG provides a time reference for major events
- Electronic Offset function allows compensation of thermocouple errors to maximize overall accuracy
- Measures J, K, T, E, R, S and N (for a total of 7 different types) thermocouples
- Readout in °C, °F or Kelvin (K)
- Splash and dust resistant case protected by impact absorbing holster
- User-friendly front panel is easy to set up and operate
- Sleep mode increases battery life; typical 1000-hour battery life
- Battery door allows easy battery replacement without breaking the calibration seal
- 3-year warranty
- Large backlit display
- Recall function allows logged data to be easily reviewed on the meter display
- IR communication port allows data to be exported to optional FlukeView Forms® Temperature PC software for further analysis and graphing
- Data Logging up to 500 points of data with user adjustable recording interval

SPECIFICATIONS	
Temperature Accuracy	<p><b>Above - 100 °C:</b> J, K, T, E and N-types: <math>\pm(0.05\% + 0.3^{\circ}\text{C})</math> R and S-types: <math>\pm(0.05\% + 0.4^{\circ}\text{C})</math></p> <p><b>Below - 100 °C:</b> J, K, T, E and N-types: <math>\pm(0.20\% + 0.3^{\circ}\text{C})</math> T-type: <math>\pm(0.50\% + 0.3^{\circ}\text{C})</math></p>
Temperature	<p><b>J-type:</b> -210°C to 1200°C</p> <p><b>K-type:</b> -200°C to 1372°C</p> <p><b>T-type:</b> -250°C to 400°C</p> <p><b>E-type:</b> -150°C to 1000°C</p> <p><b>N-type:</b> -200°C to 1300°C</p> <p><b>R and S-types:</b> 0°C to 1767°C</p>
Temperature Scale	ITS - 90
Applicable Standards	NIST - 175



# MARSHALL THERMOCOUPLE ACCESSORIES



EXTENSION WIRE



GRIPS

## MARSHALL THERMOCOUPLE™

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# -GRIPS FOR LANCE -THERMOCOUPLE REPLACEMENT PARTS



## GRIPS FOR LANCE

DESCRIPTION	PART #
Plastic Handle Grip (Below, left)	PGX
Aluminum Handle Grip (Below, right)	AGX

## THERMOCOUPLE REPLACEMENT PARTS

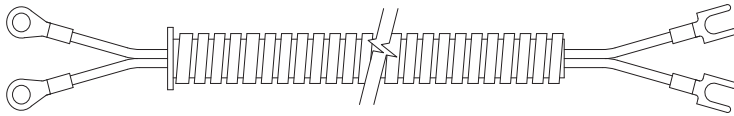
DESCRIPTION	PART #
Terminal Block, 501-AG OR 101-AG	103-TB
Alloy Screws for holding tip, pair	101-EX-2S
Lead wire spring	R-762-S
Lugs for lead wire ends, pair	R-762-LS-2
Lugs for extension wire ends, pair	R-762-LB-2
Anchor ferrule for plastic grip	PG-762-AF
Anchor ferrule for aluminum grip	R-762-AF
Lead wire small ferrules for plastic grip	PG-762-F
Flexible conduit, per foot	T-762-FC

# EXTENSION WIRES

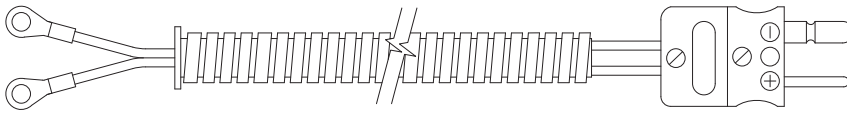


## ORDERING INFORMATION

L.H. Marshall Company manufactures extension wire assemblies that attach to our lances with aluminum or plastic grips. The connections to the aluminum and plastic grip are different so they must be ordered for the type of grip you will be using it with. The termination is available with different options.



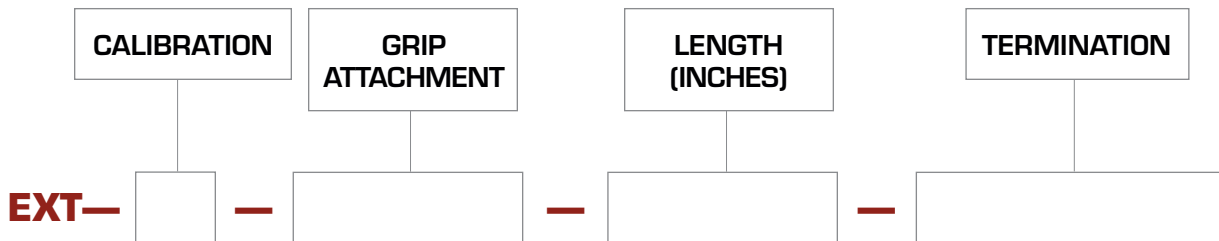
### EXTENSION FOR PLASTIC GRIP WITH SPADE TERMINATION



### EXTENSION FOR PLASTIC GRIP WITH PLUG TERMINATION



### EXTENSION FOR ALUMINUM GRIP WITH SPADE TERMINATION



CALIBRATION	GRIP ATTACHMENT	LENGTH (INCHES)	TERMINATION
J - Type J	PG - Plastic Grip	40 - 40 inches	Blank - Spade
K - Type K	AG - Aluminum Grip	60 - 5 feet	Plug - Plug
N - Type N		96 - 8 feet	Mini Plug - Mini Plug
		120 - 10 feet	
		180 - 15 feet	
		240 - 20 feet	
		300 - 25 feet	
		360 - 30 feet	
		" " - Custom	

## EXAMPLE PART NUMBER

Type K extension wire for attachment to a Marshall plastic grip that is 60" (5 feet) long

**EXT** — **K** — **P G** — **6 0** —

# THERMOCOUPLES



## **MARSHALL THERMOCOUPLE™**

The L.H. Marshall Company invented and patented the enclosed tip Thermocouple™ over 80 years ago. Over 10 million Marshall Thermocouples have been sold worldwide for precision temperature measurement. Marshall Thermocouples are reusable, durable, accurate and are a quality product engineered to meet the industry standards for temperature measurement of molten metals.

Scientific research and development at one of America's leading research facilities has led to innovations in steel composition of the Marshall protection tubes resulting in the longest lasting, multiuse thermocouple in the industry.

All Marshall Thermocouples are manufactured with Class 1, Special Limits wire which meet and exceed international quality standards of ANSI MC96.1 and IEC 584. Custom Marshall Thermocouples can be made to accommodate any range of industrial need while maintaining superior quality. Calibration certificates are available on Marshall Thermocouples and all products produced by the L.H. Marshall Company are 100% guaranteed.

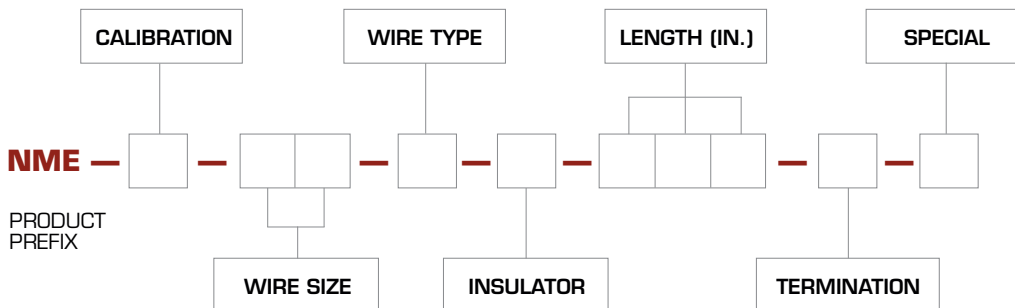
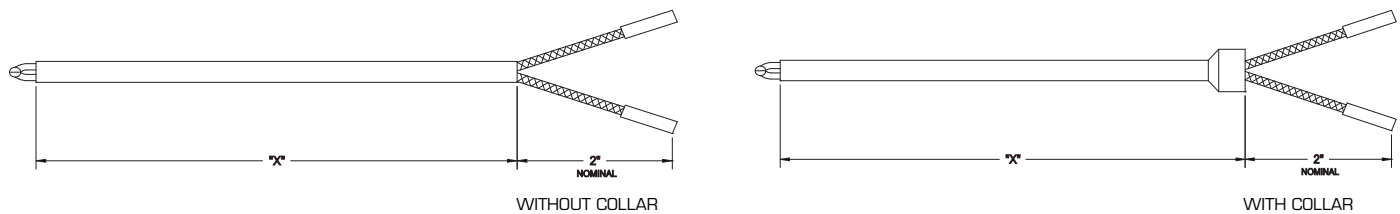
# NOBLE METAL THERMOCOUPLES/ NOBLE METAL ELEMENTS



## ORDERING INFORMATION

Noble Metal Thermocouples are available in a wide variety of configurations. Once a specific application is identified, the thermocouple can be built to order for peak performance. Available in single- or multi-point assemblies, this series of products will perform well in applications of extreme temperatures, as high as 4200°F. For information on material selection parameters for Protection Tubes and other components, please refer to the appropriate pages.

L.H. Marshall Company offers individual platinum elements in Standard, Reference, Fibro and Certified materials, as well as all components for full assemblies. Types S and R are suitable for high temperatures of up to 3000°F for short periods, or 2700°F continuously. Type B is recommended for use in temperatures as high as 3100°F, while a Tungsten-5% Rhenium-Tungsten-26% Rhenium thermocouple is capable of up to 4200°F operating temperature. Platinel II is suitable to 2300°F. Use Specification Codes below to assemble a complete Ordering Number.



CALIBRATION	WIRE SIZE	WIRE TYPE	INSULATOR	LENGTH	TERMINATION	SPECIAL
<b>S</b> - Plt-Plt 10% Rh	30 - .010 28 - .013	1 - Standard	1 - Bare	Specify from 000" to 999"	1 - Copper Tips	0 - None
<b>R</b> - Plt-Plt 13% Rh	27 - .014	2 - Reference Grade	2 - .125 OD Mullite		2 - Knife Clips/Glass Sleeving	C - Lot Certification
<b>B</b> - Plt 6% Rh-Plt 30% Rh	26 - .016 24 - .020	3 - Fibro Grade	4 - .187 OD Mullite	3 - Fish Spine Beads Only	D - Dual Element	
<b>C</b> - W 5% Re-W 26% Re	27 - .014		A - .187 OD Mullite w/Collar	4 - Fish Spine Beads/CU Tips	E - Individual Certification	
<b>F</b> - Platinel	22 - .025 21 - .028		E - .200 OD Mullite	5 - Fiber Glass Sleeve Only	X - Special (Consult Factory)	
<b>G</b> - Gold	20 - .032		G - .200 OD Mullite w/Collar	6 - Bare Ends Only		
<b>L</b> - Silver	18 - .040 15 - .060 14 - .064 XX - Other		6 - .250 OD Mullite	7 - Mini Plug w/Tube Adapter		
			C - .250 OD Mullite w/Collar	8 - Mini Plug w/Cable Clamps		
			3 - .125 OD Alumina	A - SHX Alumina Plug		
			5 - .187 OD Alumina	B - NHX Alumina Plug		
			B - .187 OD Alumina w/Collar	H - Hi-Temp. Mini Plug		
			F - .200 OD Alumina	P - Hi-Temp. Plug w/Tube Adapter		
			H - .200 OD Alumina w/Collar	G - Male Plug (400 deg) Tube Adapter		
			7 - .250 OD Alumina	J - Hi-Temp Jack/Tube Adapter		
			D - .250 OD Alumina w/Collar			
			S - 1/16" OD Spaghetti			
			9 - 1/16" OD Alumina Ins.			
			8 - .150 OD x 1" Alumina			
			M - .156 Alumina w/Collar			
			T - Ceramic Braid-Twist			
			U - Special Insulator			

## EXAMPLE PART NUMBER

Type S, .020" dia. wire size, standard grade thermocouple wire type, in a 3/16" mullite with collar, fish spine beads with copper tips, 18" length.

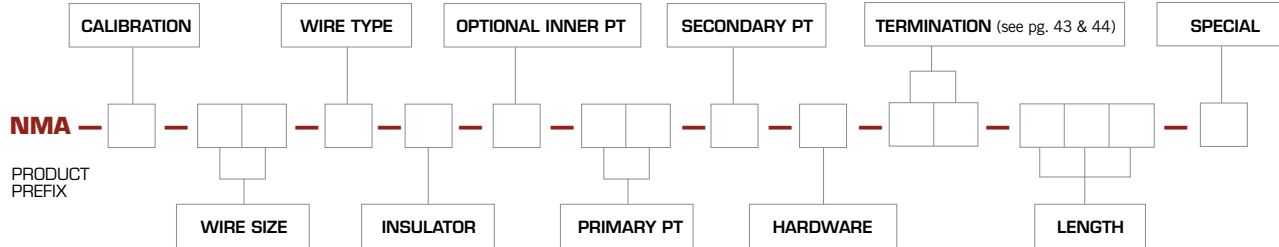
**NME** — **S** — **24** — **1** — **A** — **018** — **4** — **0**

# NOBLE METAL THERMOCOUPLES/ NOBLE METAL ASSEMBLIES



## ORDERING INFORMATION

L.H. Marshall Company manufactures a complete line of standard, high temperature thermocouples. A variety of configurations are available to meet rigorous, high temperature applications. Wire calibration and gauge, as well as all components, should be carefully chosen to provide optimum performance in every application. Use the Specification Codes below to assemble a complete Ordering Number, or consult L.H. Marshall for assistance.



## SPECIFICATIONS / CODES

CALIBRATION	WIRE SIZE	WIRE TYPE	INSULATOR	OPTIONAL INNER P/T	PRIMARY P/T
<b>S</b> - Pt-Pt 10% Rh <b>R</b> - Pt-Pt 13% Rh <b>B</b> - Pt 6% Rh-Pt 30% Rh <b>C</b> - W 5% Re-W 26% Re <b>F</b> - PlatineL <b>G</b> - Gold <b>L</b> - Silver	<b>30</b> - .010 <b>28</b> - .013 <b>27</b> - .014 <b>26</b> - .016 <b>24</b> - .020 <b>27</b> - .014 <b>22</b> - .025 <b>21</b> - .028 <b>20</b> - .032 <b>18</b> - .040 <b>15</b> - .060 <b>14</b> - .064 <b>XX</b> - Other	<b>1</b> - Standard <b>2</b> - Reference Grade <b>3</b> - Fibro Grade	<b>2</b> - .125 OD Mullite <b>4</b> - .187 OD Mullite <b>A</b> - .187 OD Mullite w/Collar <b>6</b> - .250 OD Mullite <b>C</b> - .250 OD Mullite w/Collar <b>3</b> - .125 OD Alumina <b>5</b> - .187 OD Alumina <b>B</b> - .187 OD Alumina w/Collar <b>7</b> - .250 OD Alumina <b>D</b> - .250 OD Alumina w/Collar <b>E</b> - 1/16" OD Spaghetti <b>U</b> - Special Insulator <b>M</b> - .156 Alumina w/Collar <b>N</b> - .200 Alumina	<b>0</b> - No Inner Tube <b>3</b> - 5mm x 7mm Mullite <b>M5</b> - 5mm x 7mm Mullite <b>1</b> - 1/4" x 3/8" Mullite <b>4</b> - 5mm x 7mm Alumina <b>2</b> - 1/4" x 3/8" Alumina <b>5</b> - 5mm x 8mm Alumina <b>6</b> - 3/16" x 1/4" Alumina	<b>M9</b> - 1/8" x 3/16" OD Mullite <b>M2</b> - 3/16" x 1/4" OD Mullite <b>M5</b> - 5mm x 7mm Mullite <b>M8</b> - 1/4" x 3/8" OD Mullite <b>M3</b> - 3/8" x 1/2" OD Mullite <b>M6</b> - 7/16" x 11/16" OD Mullite <b>MF</b> - 11/16" Mullite 3/4 Hex 3/4 SS <b>MH</b> - 11/16" Mullite w/1/2 x 3/4 Ftg. <b>MN</b> - 11/16" Mullite w/3/4 Nipple <b>MS</b> - 11/16" Mullite w/356 Slv. <b>M4</b> - 1/2" x 3/4" OD Mullite <b>M1</b> - 3/4" x 1" OD Mullite <b>M7</b> - 1" x 1-1/4" Mullite <b>A9</b> - 1/8" x 3/16" OD Alumina <b>A2</b> - 3/16" x 1/4" OD Alumina <b>A0</b> - 3/16" x 5/16" OD Alumina <b>A5</b> - 5mm x 7mm Alumina <b>A8</b> - 1/4" x 3/8" OD Alumina <b>AA</b> - 5/16" x 7/16" Alumina <b>A3</b> - 3/8" x 1/2" OD Alumina <b>A6</b> - 7/16" x 11/16" OD Alumina <b>AF</b> - 11/16" Alumina 3/4 Hex 3/4 SS <b>AH</b> - 11/16" Alumina w/1/2 x 3/4 Ftg. <b>AN</b> - 11/16" Alumina w/3/4 Nipple <b>AS</b> - 11/16" Alumina w/356 Slv. <b>A4</b> - 1/2" x 3/4" OD Alumina <b>A1</b> - 3/4" x 1" OD Alumina <b>A7</b> - 1" x 1-1/4" Alumina <b>I4</b> - 1/4" OD Inconel Tubing <b>I5</b> - 3/16" OD Inconel Tubing <b>H3</b> - Hexaloy <b>HM</b> - 3/8" x 11/16" Halcis "R" <b>HL</b> - 5/16" x 5/8" Halcis "R"
SECONDARY P/T	HARDWARE	LENGTH (INCHES)	SPECIAL		
<b>0</b> - No Secondary <b>2</b> - Silicon Carbide w/o Collar <b>3</b> - 1/2" NPT Inconel <b>4</b> - 3/4" NPT Inconel <b>5</b> - 1" NPT Inconel <b>6</b> - 1/4" x 3/8" Mullite <b>7</b> - 7/16" x 11/16" Mullite <b>8</b> - 1/2" x 3/4" Mullite <b>9</b> - 3/4" x 1" Mullite <b>A</b> - 1" x 1-1/4" Mullite <b>B</b> - 1/4" x 3/8" Alumina <b>C</b> - 7/16" x 11/16" Alumina <b>D</b> - 1/2" x 3/4" Alumina <b>E</b> - 3/4" x 1" Alumina <b>F</b> - 1" x 1-1/4" Alumina <b>G</b> - LT-1 Metal Ceramic <b>H</b> - 1/4" NPT Inconel <b>J</b> - 1/2" 446SS <b>K</b> - 3/4" 309 <b>L</b> - 3/4" NPT 310SS <b>S</b> - Silicon Carbide w/Collar <b>T</b> - 3/4" 253 Alloy <b>U</b> - 3/8" NPT Inconel <b>W</b> - 1/2" 253 Alloy <b>X</b> - 3/4" NPT 304	<b>0</b> - No Hardware <b>1</b> - Support Casting Assembly <b>2</b> - Weatherproof Cover <b>3</b> - 1" Coupling <b>4</b> - Adjustable Flange <b>5</b> - Split Flange <b>6</b> - St. Hex Bush/Alloy Sleeve <b>7</b> - Hex Bushing 1" NPT <b>8</b> - 3/4" Hex 3/4" Fitting <b>9</b> - 3/4" x 1" St. Hex Fitting <b>A</b> - Alloy Sleeve <b>B</b> - 1/2" X Close Nipple <b>C</b> - Close Nipple <b>E</b> - Hex Bushing, 3/4" NPT <b>F</b> - W/P Cover w/Flange <b>H</b> - 1/2" Hex 1/2" Fitting <b>P</b> - 3/4" x 1-1/4" Hex Bushing <b>Q</b> - 1" x 1-1/2" Hex Bushing <b>R</b> - 1/2" x 3/4" St. Hex Fitting <b>T</b> - Tapered Plug <b>W</b> - 1-1/2" Hex Bushing <b>X</b> - 1/2" NPT Hex Bushing	Specify from 000" to 999"	<b>0</b> - None <b>C</b> - Lot Certification (Std.) <b>D</b> - Dual Element <b>E</b> - Individual Certification <b>F</b> - Evacuate & Backfill <b>H</b> - Effective Length <b>X</b> - Special (Consult Factory)		

## EXAMPLE PART NUMBERS

Type S, .020" dia. assembly 7/16" x 11/16" Alumina tube, 356 brass sleeve, open terminal head, 18" long

**NMA** — **S** — **24** — **1** — **2** — **0** — **AS** — **0** — **0** — **B1** — **018** — **0**

Type R, .020" dia. assembly 7/16" x 11/16" Alumina primary tube with 1/2 x 3/4 steel fitting inside a silicon carbide tube with a weatherproof cover and cast iron head, 24" long

**NMA** — **S** — **24** — **1** — **2** — **0** — **AS** — **0** — **0** — **B1** — **018** — **0**

# BASE METAL ELEMENTS



## ORDERING INFORMATION

L.H. Marshall Company offers individual elements in standard and special limits material, as well as components or full assemblies.

**Type K** - Due to its reliability and accuracy, Type K is used extensively at temperatures of up to 2300°F. It is good practice to always protect this type of thermocouple with a suitable metal or ceramic protection tube, especially in reducing atmospheres. In oxidizing atmospheres and when other conditions are suitable, tube protection is not always necessary; however, protection is recommended for cleanliness and general mechanical protection. Recommended temperature range is 32°F to 2300°F.

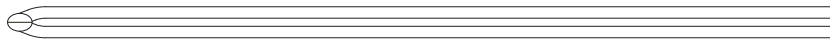
**Type J** - This element may be used, protected or unprotected, where there is a deficiency of free oxygen. To maintain cleanliness and generally longer life, a protection tube is recommended. Because Type J wire will oxidize rapidly at temperatures over 1000°F, it is recommended that larger gauge wire be used to compensate. Recommended temperature range is 32°F to 1400°F.

**Type T** - Useable in oxidizing, reducing or inert atmospheres, as well as vacuum applications. Not subject to corrosion in moist atmospheres. Recommended temperature is 328°F to 662°F, but can be used to -425°F.

**Type E** - This thermocouple is suitable for use in temperatures up to 1652°F in a vacuum, inert, mildly oxidizing or reducing atmosphere. Recommended temperature range is 32°F to 1600°F.

**Type N** - This thermocouple is used primarily at high temperatures of up to 2300°F.

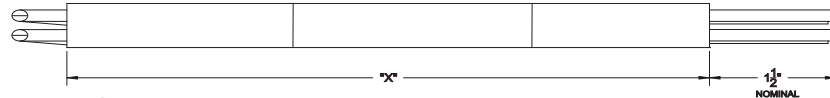
To order an element, use Specification Codes below to assemble a complete Ordering Number.



BARE ELEMENT




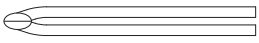
INSULATED ELEMENT

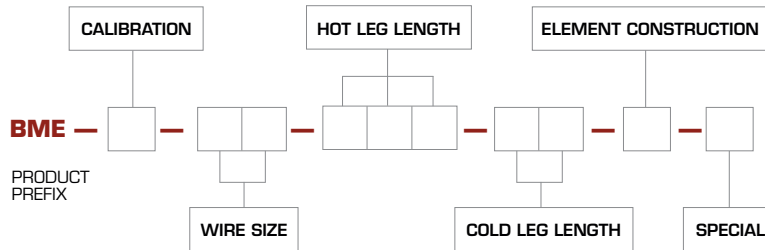


DUPLEX INSULATED

**TWO BASIC HOT JUNCTION STYLES**

**TWIST WELD STANDARD** 

**BUTT WELD OPTIONAL** 



CALIBRATION	WIRE SIZE	HOT LEG LENGTH	COLD LEG LENGTH	ELEMENT CONSTRUCTION	SPECIAL
<b>K</b> - Chromel-Alumel	8 - 8 AWG	Specify from 000" to 999"	Specify from 00" to 99"	<b>A</b> - Straight SGL Element Insul.	<b>0</b> - None
<b>J</b> - Iron-Constantan	11 - 11 AWG			<b>C</b> - 90° Angle Element w/Insul.	<b>B</b> - Butt Weld
<b>T</b> - Copper-Constantan	14 - 14 AWG			<b>D</b> - Bare Wire Element	<b>C</b> - Lot Certification
<b>E</b> - Chromel-Constantan	16 - 16 AWG			<b>F</b> - Straight Dual Element w/Insul.	<b>D</b> - Dual Element
<b>N</b> - Nicrosil-Nisil	18 - 18 AWG			<b>G</b> - Angle Dual Element w/Insul.	<b>E</b> - Individual Certification
<b>M</b> - Ni-Ni Moly	20 - 20 AWG			<b>H</b> - SGL One-Hole Ins Per Wire	<b>X</b> - Special
	22 - 22 AWG			<b>S</b> - E-808-1 Ins	(Consult Factory)
	24 - 24 AWG				
	24 - 24 AWG				
	30 - 30 AWG				

## EXAMPLE PART NUMBERS

Base Metal Element Type K standard 8 ga. 24"L straight, single element, two-hole oval insulators

**BME - K - 08 - 024 - 00 - A - 0**

Base Metal Element Type K standard 8 ga. 12"L hot leg, 18"L cold leg, 90° angle single element, two-hole oval insulators

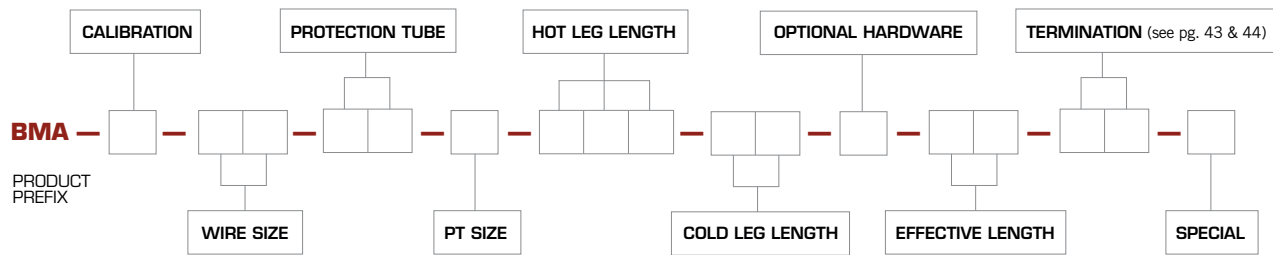
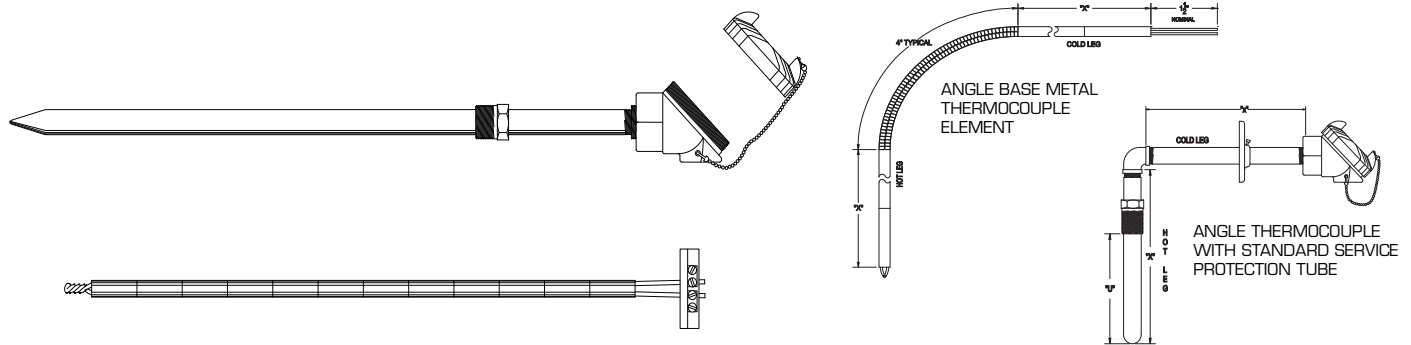
**BME - K - 08 - 012 - 18 - C - 0**

# BASE METAL ASSEMBLIES



## ORDERING INFORMATION

Industrial 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 and the size and shape required for the application. Control requirements such as accuracy and speed of response may also be considerations.



CALIBRATION	WIRE SIZE	PROTECTION TUBE	P/T SIZE	HOT LEG LENGTH	COLD LEG LENGTH	OPTIONAL HARDWARE	IMMERSION LENGTH	SPECIAL
J - Iron-Constantan K - Chromel-Alumel T - Copper-Constantan E - Chromel-Constantan N - Nicrosil-Nisil M - Ni-Ni Moly**	08 - 8 AWG 11 - 11 AWG 14 - 14 AWG 16 - 16 AWG 18 - 18 AWG 20 - 20 AWG 22 - 22 AWG 24 - 24 AWG 30 - 30 AWG	15 - 446 SS 16 - Pure Nickel 17 - Inconel 18 - 304 SS 19 - 310 SS 20 - 316 SS 21 - Silicon Carbide 22 - Mullite 23 - Alumina 24 - Metal Ceramic 25 - Carbon Steel 26 - Tercod 27 - Cast Alloy 28 - Cast-Iron w/Tap 29 - 330 SS 30 - Hexaloy 31 - Cast-T 32 - Refractory Coated 33 - Incoloy 800 34 - Hastelloy C 276	A - 1/4" NPT B - 1/2" NPT C - 3/4" NPT D - 1" NPT E - 1-3/4" OD F - 3/8" OD G - 11/16" OD H - 3/4" OD I - 7/8" OD J - 1" OD K - 1/8" NPT L - 3/8" NPT M - 1/2" OD N - 7mm P - 1/4" OD	Specify from 00" to 99"	Specify from 00" to 99"	0 - None A - Adjustable Flange B - 1/4" NPT Fix Hex St.Mt.Bush C - 1/2" NPT Fix Hex St.Mt.Bush D - 3/4" NPT Fix Hex St.Mt.Bush E - 1" NPT Fix Hex St.Mt.Bush F - 1-1/4" NPT Fix Hex St.Mt.Bush G - 1-1/2" NPT Fix Hex St.Mt.Bush H - 1/4" NPT Fix Hex St.St. J - 1/2" NPT Fix Hex St.St. K - 3/4" NPT Fix Hex St.St. L - 1" NPT Fix Hex St.St. M - 1-1/4" NPT Fix Hex St.St. N - 1-1/2" NPT Fix Hex St.St. P - Hot Junction Cup Q - Tapered Plug R - 1/2" x 3/4" St. Hex Fitting S - 3/4" x 1" St. Hex Fitting T - 6" Alloy Sleeve U - 6" Carbon Steel Sleeve W - 1/2" -Hex-1/2" Y - 3/4" -Hex-3/4" Z - 3/4" x 1-1/4" Hex Fitting 3 - 3/4" x 1-1/2" Hex Fitting 2 - 3/4" x Close Nipple	Specify from 00" to 99"	0 - None B - Open Both Ends C - Lot Certification D - Dual Element E - Individual Certification H - SCH 80 X - Special (Consult Factory)

## EXAMPLE PART NUMBERS

Base Metal Assembly, Type K standard 8 ga., Inconel PT 3/4" NPT, 24"L w/1" NPT bushing for 18" immersion, 3/4" snap cover head

**BMA - K - 08 - 17 - C - 024 - 00 - E - 18 - S4 - 0**

Base Metal Assembly, Type K standard 8 ga., pure nickel protection tube, 3/4" NPT, hot leg 12"L cold leg 24"L w/ 3/4" cast iron head

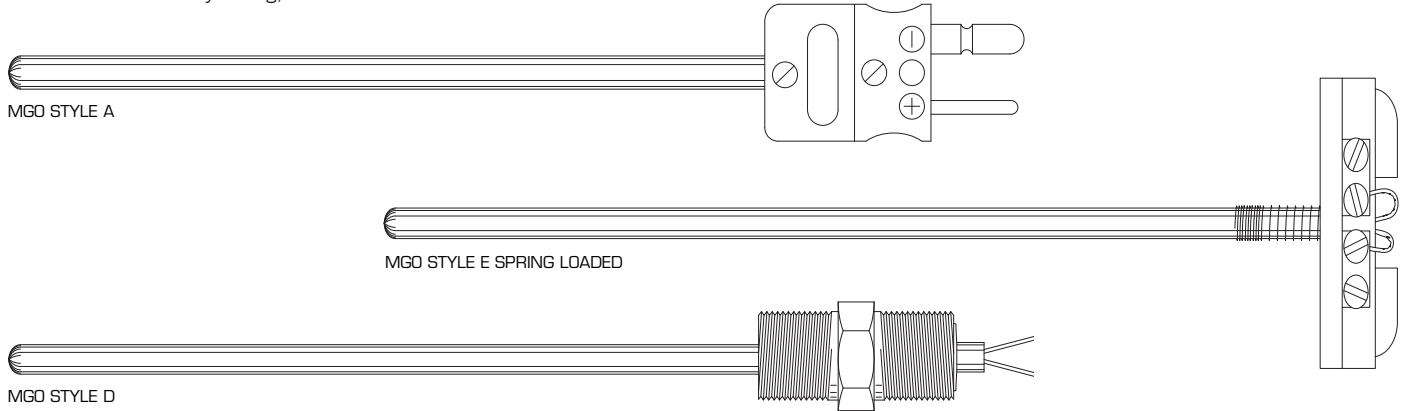
**BMA - K - 08 - 16 - C - 012 - 24 - 0 - 00 - C4 - 0**

# MAGNESIUM OXIDE INSULATED THERMOCOUPLES



## ORDERING INFORMATION

An MgO Thermocouple is recommended for high moisture, liquid, high pressure and corrosive environments. This style offers high dielectric strength, durability, quick response to temperature fluctuations, and malleability. The uniform thickness of thermocouple wires insulated with magnesium oxide creates a mechanically strong, corrosion and moisture resistant sensor.



## SPECIFICATIONS

**Insulation Purity** - MgO (magnesium oxide) densely packed High Purity 99.4% MgO is used with Types K, R and S, Inconel Sheathing. All others are Standard Purity 96% MgO.

**Minimum Bend Diameter** - Two times the outside diameter of the sheath.

## CONTINUOUS MAXIMUM TEMPERATURE RATINGS OF SHEATH IN OXIDIZING ATMOSPHERES\*

**304SS:** Up to 1650°F - good corrosion characteristics and resistance to oxidation, generally regarded as a standard sheath material.

**Inconel 600:** Up to 1650°F - good high temperature resistance to corrosion, not suitable for use in presence of sulfur above 1000°F.

**316SS:** Up to 1700°F - has excellent acid corrosion resistance; highly resistant to pitting type corrosion.

**310SS:** Up to 2100°F - good resistance to oxidation and corrosion at high temperatures.

\*Not necessarily a recommended temperature. Sheath wall thickness, contaminants, abrasion and erosion must be considered.

## TIME CONSTANTS

The time required for a thermocouple to indicate 63.2% of a step change in temperature in a surrounding media is the time constant. Several factors influence the measured time constant, such as the degree of insulation compaction, sheath wall thickness and distance of junction from the welded cap on the ungrounded style. These factors, as well as the velocity of liquid or mass past the thermocouple probe, affect the time constant.

SHEATH DIAMETER (INCHES)	TIME CONSTANTS/SECOND		
	GROUNDING JUNCTION	UNGROUNDING JUNCTION	EXPOSED JUNCTION
0.040	0.2	0.7	0.1
0.063	0.3	0.8	0.2
0.125	0.5	1.3	0.3
0.188	1.0	2.5	0.5
0.250	2.3	4.3	0.6

## JUNCTION CONSTRUCTION

**Grounded** - Thermocouple welded to the sheath. Fast response with thermocouple protected.

**Ungrounded (Insulated)** - Thermocouple insulated from sheath with magnesium oxide. Stray EMF's are prevented from affecting the reading. Response from rapid or frequent temperature cycling is slower than for grounded style.

**Exposed** - Thermocouple junction is not protected by welded cap. Used for quick response, but is susceptible to early corrosive failure.

**Dual Element Common** - Two thermocouples with junctions welded together.

**Dual Element Isolated (Standard)** - Two thermocouples electrically separate in the same sheath, provides isolation where instrumentation necessitates.

## EXAMPLE PART NUMBERS

Type K Inconel sheath, 1/8" diameter, ungrounded junction, 24" long, with tube adapter and plug. 1/4" NPT stainless steel adjustable compression fitting

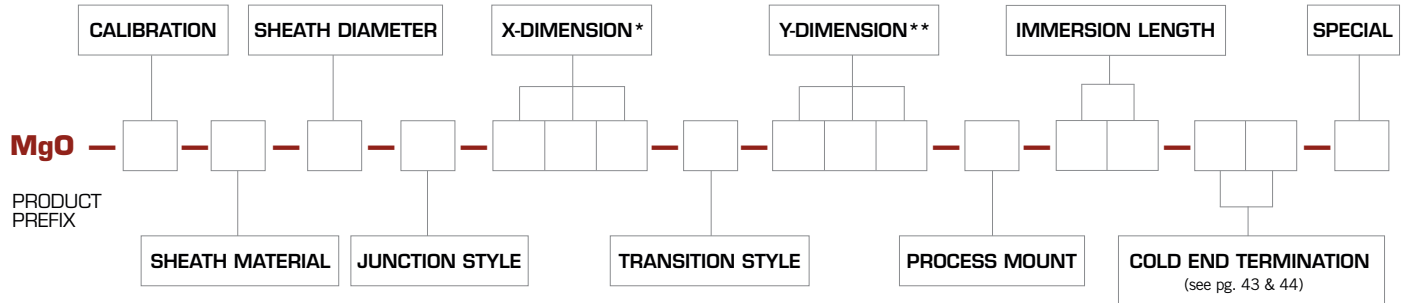
MGO - K - 2 - 4 - U - 0 2 4 - 0 - 0 0 0 - F - 0 0 - 0 4 - 0

Type K 316 stainless steel sheath, 3/16" diameter, ungrounded junction, 12" long transition fitting to 6" glass/glass extension wire with 1" strip 1/8" stainless steel adjustable compression fitting

MGO - K - 3 - 5 - U - 0 1 2 - 1 - 0 0 6 - E - 0 0 - 1 S - 0



# MAGNESIUM OXIDE INSULATED THERMOCOUPLES



\*X-Dimension is the measurement from the tip of the thermocouple to beginning of termination (length of metal sheath).  
 \*\* Y-Dimension is the measurement from the beginning of the transition fitting to the end of the wire (transition style only).

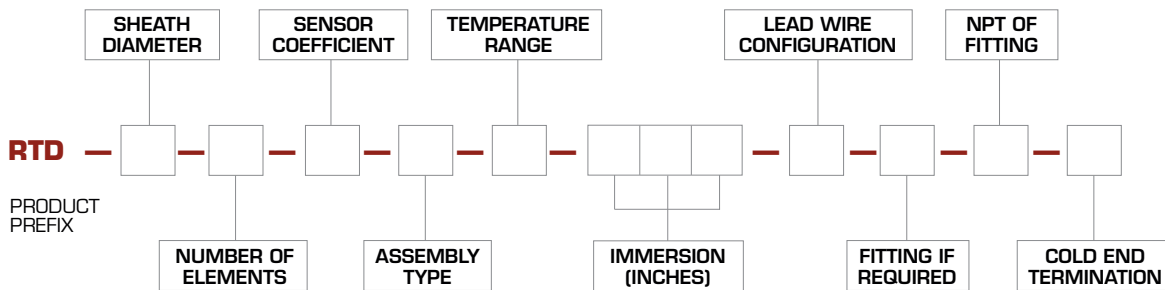
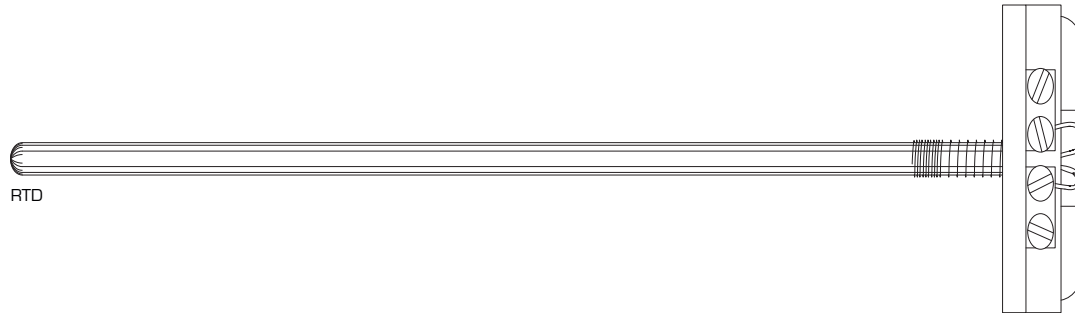
CALIBRATION	SHEATH MATERIAL	SHEATH DIAMETER	JUNCTION CONSTRUCTION	X-DIMENSION (INCHES)	TRANSITION STYLE	
<b>J</b> - Iron-Constantan <b>K</b> - Chromel-Alumel <b>E</b> - Chromel-Constantan <b>T</b> - Copper-Constantan <b>N</b> - Nicrosil-Nisil <b>S</b> - Plt - Plt 10% Rh <b>B</b> - Plt 6% Rh- Plt 30% Rh <b>C</b> - W 5% Re- W 26% Re <b>G</b> - W 3% Re- W 25% Re <b>P</b> - Plt 40% Rh- Plt 20% Rh <b>W</b> - W - W/26% Re <b>M</b> - Ni/Ni Moly	<b>1</b> - 304SS <b>2</b> - Inconel 600 <b>3</b> - 316SS <b>4</b> - 310SS <b>5</b> - 446SS <b>6</b> - Tantalum <b>7</b> - Molybdenum <b>8</b> - Inconel 601 <b>9</b> - Niobell <b>A</b> - Hast C-22 <b>H</b> - 2300 <b>P</b> - Plt 10% Rh <b>T</b> - Plt 20% Rh <b>G</b> - 347SS <b>Q</b> - Pure Platinum <b>E</b> - Super Omega Clad	<b>1</b> - .032 <b>2</b> - .040 <b>3</b> - .063 (1/16") <b>4</b> - .125 (1/8") <b>5</b> - .188 (3/16") <b>6</b> - .250 (1/4") <b>7</b> - .315 (5/16") <b>8</b> - .375 (3/8") <b>9</b> - .500 (1/2") <b>M</b> - .090 <b>F</b> - .020 <b>E</b> - .010 <b>L</b> - .750 (3/4") <b>C</b> - .013 <b>H</b> - .025	<b>G</b> - Grounded Junction <b>U</b> - Ungrounded Junction <b>E</b> - Exposed Junction <b>H</b> - Spcl Half Exposed Junction <b>S</b> - Squared Tip-Grounded Junction <b>A</b> - 45 Deg Angle Tip-Grounded Junction	Specify from 000" to 999"	<b>0</b> - No Trans Flex Lead Wire <b>1</b> - Fiberglass Covered <b>2</b> - Fiberglass w/Flex ArmCov <b>3</b> - Fiberglass w/SS Ovrbrd <b>4</b> - Polyvinyl Plastic <b>5</b> - Teflon Insulation <b>6</b> - Teflon w/SS Ovrbrd <b>7</b> - Hitemp Glass w/SS Ovrbrd <b>8</b> - Teflon Insul/No Trans Body <b>9</b> - Teflon w/Flex Armor <b>M</b> - Hitemp Glass Insulation Std Temp Trans (400°F) <b>C</b> - PVC Coil Cord <b>F</b> - PVC Insulation w/Flex Armor Std Temp Trans (400°F) <b>K</b> - Kapton Insulation Std Temp Trans (400°F) <b>A</b> - Fibre-Glass Insulation Hi Temp Trans (1000°F) <b>B</b> - Fibre-Glass w/Flex Armor Hi Temp Trans (1000°F) <b>D</b> - Fibre-Glass w/SSOB Hi Temp Trans (1000°F) <b>E</b> - Hi Temp Glass w/SSOB Hi Temp Trans (1000°F) <b>G</b> - Hi Temp Glass w/Flex Armor Hi Temp Trans (1000°F) <b>H</b> - Butt-Welded Leads-Varflex-No Trans Ftg. <b>L</b> - Hi Temp Glass Hi Temp Trans (1000°F)	
Y-DIMENSION (INCHES)	PROCESS MOUNTING DEVICE			IMMERSION LENGTH (INCHES)	SPECIAL	
Specify from 000" to 999"	<b>0</b> - None <b>1</b> - SS 1/2-Hex-1/2" NPT Bushing <b>2</b> - SS 3/4-Hex-3/4" NPT Bushing <b>3</b> - CS 1/2-Hex-1/2" NPT Bushing <b>4</b> - CS 3/4-Hex-3/4" NPT Bushing <b>5</b> - Hex Proc Mtg Ftg-1/8" NPT <b>6</b> - Hex Proc Mtg Ftg-1/4" NPT <b>7</b> - Hex Proc Mtg Ftg-3/8" NPT <b>8</b> - Hex Proc Mtg Ftg-1/2" NPT <b>9</b> - Hex Proc Mtg Ftg-3/4" NPT <b>A</b> - BR Adj Comp Ftg-1/8" NPT <b>B</b> - BR Adj Comp Ftg-1/4" NPT <b>C</b> - BR Adj Comp Ftg-3/8" NPT <b>D</b> - BR Adj Comp Ftg-1/2" NPT <b>E</b> - SS Adj Comp Ftg-1/8" NPT <b>F</b> - SS Adj Comp Ftg-1/4" NPT <b>G</b> - SS Adj Comp Ftg-3/8" NPT <b>H</b> - SS Adj Comp Ftg-1/2" NPT <b>I</b> - CS Adj Comp Ftg-1/8" NPT <b>J</b> - CS Adj Comp Ftg-1/4" NPT <b>K</b> - CS Adj Comp Ftg-3/8" NPT <b>L</b> - CS Adj Comp Ftg-1/2" NPT <b>M</b> - BR Re-Adj Comp Ftg-1/8" NPT <b>N</b> - BR Re-Adj Comp Ftg-1/4" NPT <b>P</b> - BR Re-Adj Comp Ftg-3/8" NPT <b>Q</b> - BR Re-Adj Comp Ftg-1/2" NPT <b>R</b> - SS Re-Adj Comp Ftg-1/8" NPT <b>S</b> - SS Re-Adj Comp Ftg-1/4" NPT <b>T</b> - SS Re-Adj Comp Ftg-3/8" NPT <b>U</b> - SS Re-Adj Comp Ftg-1/2" NPT <b>V</b> - CS Re-Adj Comp Ftg-1/8" NPT <b>W</b> - CS Re-Adj Comp Ftg-1/4" NPT <b>X</b> - CS Re-Adj Comp Ftg-3/8" NPT <b>Y</b> - CS Re-Adj Comp Ftg-1/2" NPT <b>Z</b> - 1/2-Hex-1/2 S.L. Bushing			<b>BR</b> - Brass <b>CS</b> - Carbon Steel <b>SS</b> - Stainless Steel <b>Comp</b> - Compression Fitting <b>Mtg</b> - Fixed Mounting Fitting	Specify from 00" to 99"	<b>0</b> - None <b>C</b> - Lot Certification <b>D</b> - Dual Element <b>E</b> - Individual Cert <b>F</b> - Evac & Backfill <b>L</b> - Low Drift / Lot Certified <b>W</b> - Weld Pad <b>X</b> - Special (Consult Factory)
					<b>HOT/MEASURING JUNCTION TYPES</b> <b>(G) GROUNDED JUNCTION</b> Welded to form a completely sealed integral junction, the G junction component is recommended in presence of liquids, moisture, gas, or high pressure.	
					<b>(U) UNGROUNDED JUNCTION</b> Fully insulated from the welded sheath end, this junction is excellent for applications where stray EMF's would affect the reading and for rapid or frequent temperature cycling.	
					<b>(E) EXPOSED JUNCTION</b> Exposed Junction thermocouple wires are butt welded with insulation sealed against liquid or gas penetration. This component provides the fastest response time, but is unprotected against corrosive or mechanical damage.	

# RESISTANCE TEMPERATURE DETECTORS



## ORDERING INFORMATION

100 Ohm Platinum Temperature Detectors are temperature sensing devices used to measure resistance changes. The resistance properties of these metals increase with temperature in a known and repeatable manner. RTD sensing elements are also available in copper, nickel and nickel-iron wire.



SHEATH DIAMETER (OD)	NUMBER OF ELEMENTS	SENSOR COEFFICIENT		ASSEMBLY TYPE	
1 - .125" 2 - .188" 3 - .250" 4 - .313" 5 - .375"	D - Dual S - Single	D - .00385 OHMS/OHM/Deg C A - .00392 OHMS/OHM/Deg C B - .00385 Degussa		G - General Purpose Stem Sensitive S - Spring Loaded for Standard Head E - Spring Loaded for Explosion Proof X - Exp Tip Resp Dry Air/Gas	
TEMPERATURE RANGE	IMMERSION (INCHES)	LEAD WIRE CONFIGURATION	FITTING IF REQUIRED	NPT OF FITTING	COLD END TERMINATION
S - 350 to +500°F H - 320 to +1700°F	Specify from 00" to 99"	2 - 2 Wire 3 - 3 Wire 4 - 4 Wire 6 - 6 Dual 3 Wire 8 - 8 Dual 4 Wire	0 - None 1 - Hex Nipple 2 - Hex Bushing (Proc Connect) 3 - Hex Bushing (Head Connect) 4 - Adj Stainless 5 - Hex Nipple Oil Seal 6 - Hex Nipple Spring Loaded 7 - Bayonet Spring Loaded 8 - With Spring 9 - 1/2" x 5" Galvanized Nipple	0 - None A - 1/8" B - 1/4" C - 1/2" D - 3/4" E - 1/4" x 1/2" F - 3/4" x 1/2" G - 1" x 1/2"	0 - 6" Leads w/Strip A - Std Cast Iron Head B - Std Cast Aluminum Head C - Explosion Proof Head D - Miniature Polypropylene E - Assy. w/Flex Armor Lead F - Assy. w/SS Overbraided Leads G - 3 Pin Plug H - Epoxy Coated Aluminum X - Special P - Std Polypropylene Head

## EXAMPLE PART NUMBER

3/16" OD x 24" length 100 ohm Pt RTD sensor, .00392 ohms/ohm deg. C. Coefficient, 1/2" NPT hex spring loaded nipple, 6" leads.

**RTD - 2 - S - A - S - H - 0 2 4 - 3 - 6 - C - 0**

# THERMOCOUPLE TERMINATIONS



The Termination Specifications listed may be used in assembly Ordering Numbers for Noble, Base and MgO Thermocouples. Most may be ordered separately. Listed are the most common types. Consult the factory for other requirements you may have.

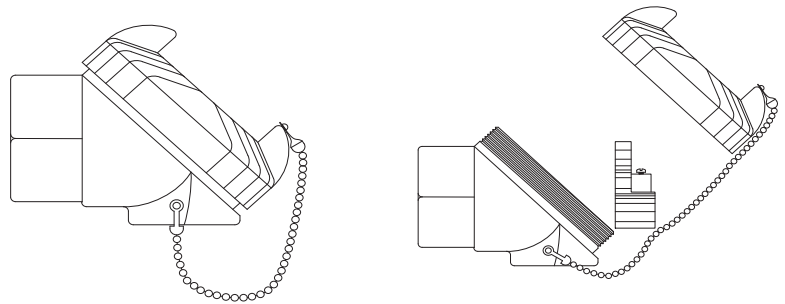
	<p><b>Strip*</b> CODE: _____ "S" (Insert desired length in inches)</p>	<p><b>High Temperature Male Plug (800°F)</b> CODE: <b>07</b> Standard Connect CODE: <b>23</b> Jab-in Style</p>
	<p><b>2-1/2" Strip with Spade Lugs*</b> CODE: <b>02</b></p>	<p><b>High Temperature Male Plug and High Temperature Female Jack (800°F)</b> CODE: <b>08</b> Standard Connect CODE: <b>24</b> Jab-in Style</p>
	<p><b>Male Plug (400°F)</b> CODE: <b>04</b> Standard Connect CODE: <b>20</b> Jab-in Style</p>	<p><b>High Temperature Female Jack (800°F)</b> CODE: <b>09</b> Standard Connect CODE: <b>25</b> Jab-in Style</p>
	<p><b>Male Plug and Female Jack (400°F)</b> CODE: <b>05</b> Standard Connect CODE: <b>21</b> Jab-in Style</p>	<p><b>High Temperature Male Mini Plug (800°F)</b> CODE: <b>HM</b> <b>Male Plug with Crimp Fitting (400°F)*</b> CODE: <b>CP</b></p>
	<p><b>Female Jack (400°F)</b> CODE: <b>06</b> Standard Connect CODE: <b>22</b> Jab-in Style</p>	<p><b>High Temperature Male Plug with Crimp Fitting (800°F)*</b> CODE: <b>CH</b></p>
	<p><b>Male Plug (400°F)</b> CODE: <b>05</b> Standard Connect CODE: <b>21</b> Jab-in Style</p>	<p><b>Solid Pin Male Plug (400°F)</b> CODE: <b>SP</b></p>
	<p><b>Female Jack (400°F)</b> CODE: <b>06</b> Standard Connect CODE: <b>22</b> Jab-in Style</p>	<p><b>3-Pin Male Plug (400°F)</b> CODE: <b>3P</b></p>
	<p><b>Male Mini Plug (400°F)</b> CODE: <b>10</b></p>	<p><b>Alumina Male Plug (1200°F)</b> CODE: <b>18</b></p>
	<p><b>Male Mini Plug and Female Mini Jack (400°F)</b> CODE: <b>11</b></p>	<p><b>Alumina Female Jack (1200°F)</b> CODE: <b>19</b></p>
	<p><b>Female Mini Jack (400°F)</b> CODE: <b>12</b></p>	<p><b>No Termination*</b> CODE: <b>00</b></p>
		<p><b>Water Type Open Head</b> CODE: <b>13</b></p> <p><b>Cannister Head</b> CODE: <b>14</b></p> <p><b>Plastic Weatherproof Head (400°F)</b> CODE: <b>15</b></p> <p><b>High Temperature Plastic Weatherproof Head (800°F)</b> CODE: <b>16</b></p> <p><b>Explosion-Proof Head</b> CODE: <b>17</b></p> <p><b>1/2" Polypropylene Head</b> CODE: <b>P2</b></p> <p>* Not available as separate item.</p>

# THERMOCOUPLE TERMINATIONS

CONTINUED

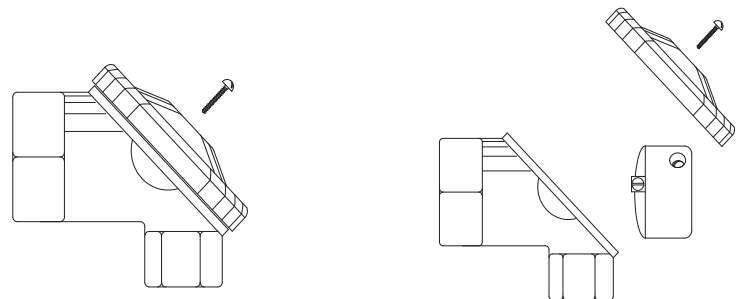


SCREW COVER HEADS WITH TERMINAL BLOCK	
CODE	DESCRIPTION
A1	1" NPT Aluminum
A2	1/2" NPT Aluminum
A4	3/4" NPT Aluminum
C1	1" NPT Cast Iron
C2	1/2" NPT Cast Iron
C4	3/4" NPT Cast Iron
E2	1/2" NPT Epoxy Coated Aluminum
SA	Mini Aluminum (Single)
SD	Mini Aluminum (Double)

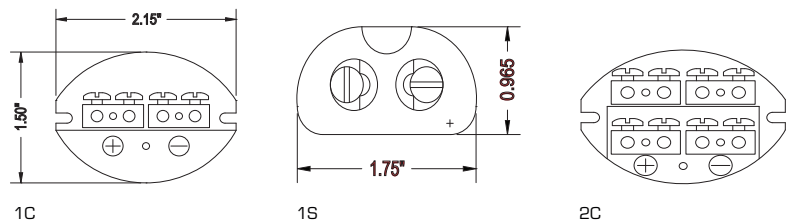


SNAP COVER HEADS WITH TERMINAL BLOCK	
CODE	DESCRIPTION
S1	1" NPT Aluminum
S2	1/2" NPT Aluminum
S4	3/4" NPT Aluminum

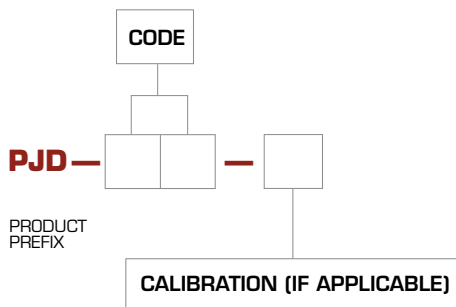
GENERAL PURPOSE HEADS	
CODE	DESCRIPTION
GPH1	1/2" NPT Cast Iron
GPH2	3/4" NPT Cast Iron
GPH3	1" NPT Cast Iron



TERMINAL BLOCKS	
CODE	DESCRIPTION
1C	Universal Screw Cover - Single
2C	Universal Screw Cover - Dual
1S	Snap Cover - Single
2S	Snap Cover - Dual



TO ORDER A THERMOCOUPLE TERMINATION AS A SEPARATE ITEM, FOLLOW THE ORDERING INFORMATION BELOW.



EXAMPLE PART NUMBER

PJD - 0 7 - K



# THERMOCOUPLE WIRE

## **MARSHALL THERMOCOUPLE™**

The L.H. Marshall Company invented and patented the enclosed tip Thermocouple™ over 80 years ago. Over 10 million Marshall Thermocouples have been sold worldwide for precision temperature measurement. Marshall Thermocouples are reusable, durable, accurate and are a quality product engineered to meet the industry standards for temperature measurement of molten metals.

Scientific research and development at one of America's leading research facilities has led to innovations in steel composition of the Marshall protection tubes resulting in the longest lasting, multiuse thermocouple in the industry.

All Marshall Thermocouples are manufactured with Class 1, Special Limits wire which meet and exceed international quality standards of ANSI MC96.1 and IEC 584. Custom Marshall Thermocouples can be made to accommodate any range of industrial need while maintaining superior quality. Calibration certificates are available on Marshall Thermocouples and all products produced by the L.H. Marshall Company are 100% guaranteed.

# THERMOCOUPLE WIRE DATA



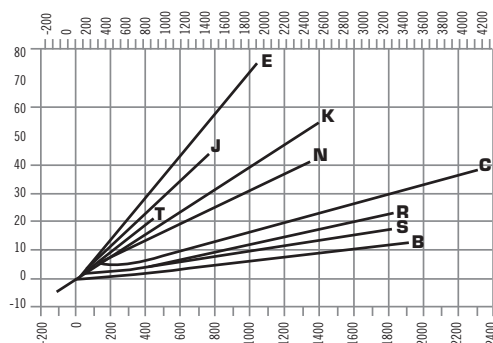
## THERMOCOUPLE CODES: CONDUCTOR COMBINATIONS AND CHARACTERISTICS

ANSI CODE	CONDUCTOR COMBINATIONS		TEMP. RANGE	LIMITS OF ERROR			APPLICATION INFORMATION
	POSITIVE + LEG	NEGATIVE - LEG		RANGE (°F)	STANDARD	SPECIAL	
TYPE <b>J</b>	IRON (magnetic) WHITE + BLACK	CONSTANTAN RED - WHITE	32 to 1400°F (0 to 760°C)	32 to 530 530 to 1400	±4°F ±0.75%	+2°F ±0.4%	Suitable for vacuum, reducing, or inert atmospheres. Reduced life in oxidizing atmosphere. Iron oxidizes rapidly above 1000°F (538°C) so only heavy gauge wire is recommended for high temperature. Bare elements should not be exposed to sulfurous atmospheres above 1000°F (538°C).
TYPE <b>K</b>	CHROMEL YELLOW + GREEN	ALUMEL (magnetic) RED - WHITE	2 to 2300°F (0 to 1260°C)	32 to 530 530 to 2300	±4°F ±0.75%	±2°F ±0.4%	Recommended for continuous oxidizing or neutral atmospheres. Mostly used above 1000°F (530°C). Subject to failure if exposed to sulfur. Preferential oxidation of chromium in positive leg at certain low oxygen concentrations causes "green rot" and large negative calibration drifts most serious in the 1500-1900°F range.
TYPE <b>T</b>	COPPER BLUE + BROWN	CONSTANTAN RED - WHITE	32 to 700°F (0 to +370°C)	32 to 200 200 to 700	±2°F ±0.75%	±1°F ±0.4%	Useable in oxidizing, reducing, or inert atmospheres, as well as vacuum. Not subject to corrosion in moist atmospheres.
TYPE <b>E</b>	CHROMEL PURPLE + PURPLE	CONSTANTAN RED - WHITE	32 to 1600°F (0 to 871°C)	32 to 600 600 to 1600	±3°F ±0.5%	±2°F ±0.4%	Recommended for continuously oxidizing or inert atmospheres. Highest thermoelectric output of common calibration.
TYPE <b>S</b>	PLATINUM-10% Rhodium	PLATINUM	32 to 2700°F (0 to 1480°C)	32 to 1000 1000 to 2700	±3°F ±0.25%	±1°F ±0.1%	Recommended for high temperature. Must be protected with non-metallic protection tube and ceramic insulators. Continued high temperature useage 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.
TYPE <b>R</b>	PLATINUM-13% Rhodium +	PLATINUM -					
TYPE <b>B</b>	PLATINUM-30% Rhodium +	PLATINUM 6% Rhodium -	1600 to 3100°F (871 to 1705°C)	1600 to 3100	±0.5%	±0.25%	Same as S & R but output is lower. Also less susceptible to grain growth and drift.
TYPE <b>N</b>	NICROSIL ORANGE + PINK	NISIL (magnetic) RED - WHITE	32 to 2300°F (0 to 1260°C)	32 to 530 530 to 2300	±4°F ±0.75%	±2°F ±0.4%	Nicrosil/Nisil nickel-based thermocouple alloy used primarily at high temperature (up to 2300°F). While not a direct replacement for Type K, Type N provides better resistance to oxidation at high temperature and longer life in applications where sulfur is present.
TYPE <b>C</b>	TUNGSTEN 5% Rhenium +	TUNGSTEN 26% Rhenium -	32 to 4200°F (0 to 2330°C)	32 to 800 800 to 4200	±8°F ±1.0%	N/A	This refractory metal thermocouple may be used at temperatures up to 4200°F (2315°C). As it has no oxidation resistance its use is restricted to vacuum, hydrogen or inert atmospheres.

TEMPERATURE IN °F

THERMOCOUPLE TEMPERATURE EMF GRAPH

TEMPERATURE IN °C



### ANSI SYMBOL

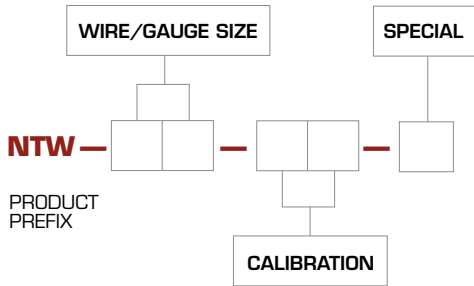
- T COPPER VS. CONSTANTAN
- E CHROMEL VS. CONSTANTAN
- J IRON VS. CONSTANTAN
- K CHROMEL VS. ALUMEL
- S PLATINUM 10% RHODIUM VS. PLATINUM
- R PLATINUM 13% RHODIUM VS. PLATINUM
- B PLATINUM 30% RHODIUM VS. PLATINUM 6% RHODIUM
- N NICROSIL VS. NISIL
- C TUNGSTEN 5% RHENIUM VS. TUNGSTEN 26% RHENIUM

# THERMOCOUPLE WIRE



Noble Metal and Base Metal Thermocouple Wire is available in bulk form for customers who fabricate elements or assemblies. Below are Specification Codes with Ordering Number format for each of these items.

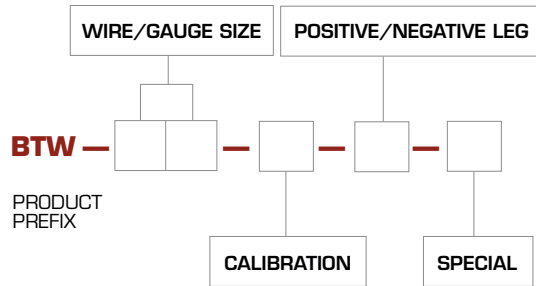
## NOBLE THERMOCOUPLE WIRE (NTW)



WIRE/GAUGE SIZE	CALIBRATION	SPECIAL
32 - 32 AWG (.008)	0P - Pure Platinum Wire	0 - None
30 - 30 AWG (.010)	06 - Platinum-6% Rhodium Wire	F - Fibro
28 - 28 AWG (.013)	10 - Platinum-10% Rhodium Wire	S - Special Limits
27 - 27 AWG (.014)	13 - Platinum-13% Rhodium Wire	C - Certified
26 - 26 AWG (.016)	30 - Platinum-30% Rhodium Wire	
24 - 24 AWG (.020)		
23 - 23 AWG (.023)		
22 - 22 AWG (.025)		
21 - 21 AWG (.028)		
20 - 20 AWG (.032)		
18 - 18 AWG (.040)		
17 - 17 AWG (.045)		
15 - 15 AWG (.060)		
08 - 8 AWG (.125)		

\* Typically sold in inch Quantities

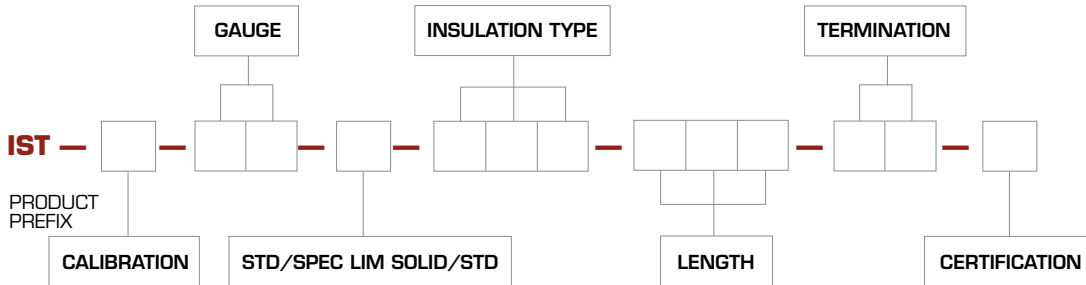
## BARE THERMOCOUPLE WIRE (BTW)



WIRE/GAUGE SIZE	CALIBRATION	POSITIVE/NEGATIVE LEG	SPECIAL
32 - 32 AWG	N - Nicrosil-Nisil	P - Positive Leg	0 - None
30 - 30 AWG	J - Iron-Constantan	N - Negative Leg	S - Special Limits
28 - 28 AWG	K - Chromel-Alumel		C - Certified
27 - 27 AWG	T - Copper-Constantan		
26 - 26 AWG	E - Chromel-Constantan		
24 - 24 AWG	W - 5% Re-W 26% Re		
23 - 23 AWG	M** - Ni/Ni Moly		
22 - 22 AWG			
20 - 20 AWG			
18 - 18 AWG			
17 - 17 AWG			
16 - 16 AWG			
14 - 14 AWG			
11 - 11 AWG			
09 - 9 AWG			
08 - 8 AWG			
02 - 2 AWG			

\* Typically sold in pound Quantities

## INSULATED SURVEY THERMOCOUPLE (IST)



CALIBRATION	GAUGE	STD/SPEC LIM SOLID/STD	INSULATION TYPE	LENGTH	TERMINATION	CERTIFICATION
J - Iron-Constantan	14 - 14 AWG	1 - Solid STD Limits	232 - HiTemp GL BR/HiTemp GL BR	000 - 999	01 - 1" Strip	0 - None
K - Chromel-Alumel	16 - 16 AWG	2 - Solid Special Limits	301 - VIT SIL FIB/VIT SIL FIB		02 - Std. Male Plug	C - Std. Points
N - Nicrosil-Nisil	20 - 20 AWG	5 - Solid Ext Grade	304 - Glass Braid/Glass Braid		03 - Hi-Temp Male Plug	X - Special Points
T - Copper-Constantan	24 - 24 AWG	7 - Stranded Ext Grade	305 - Glass Wrap/Glass Braid		04 - Mini Plug	
	28 - 28 AWG	8 - Stranded STD Limits	309 - HiTemp GL BR/HiTemp GL BRD		05 - Std. Jack	
	30 - 30 AWG	9 - Stranded Special Limits	332 - HiTemp GL BR/HiTemp GL BRD		06 - Hi-Temp Jack	
		3 - Stranded STD Limits	350 - Ceramic Fibr/Ceramic Fibr		XX - Special	
			502 - PVC/PVC			
			507 - FEP Extruded/FEP Extruded			
			513 - Fuse KAP Tape/Fuse KAP Tape			
			508 - TFE Tape/TFE Tape			
			505 - PVC Ripcord			

# INSULATED THERMOCOUPLE WIRE / INSULATED EXTENSION WIRE



## HOW TO READ THE CATALOG NUMBER CHART

L.H. Marshall Company offers a complete line of insulated thermocouple and extension grade wires in single, duplex and multipair constructions. Ordering with another manufacturer's part number is an acceptable option, or construct an L.H. Marshall part number using the box format explained below.

By filling in the boxes in the natural order of progression, construction of a part number for a thermocouple or extension grade wire is a simple seven-step process.

**Step 1:** Insert the "ITW" insulated thermocouple wire or "IEW" insulated extension wire prefix into the designated space.

**Step 2:** Insert the desired calibration K, J, T etc. into the corresponding box.

**Step 3:** Insert desired wire gauge.

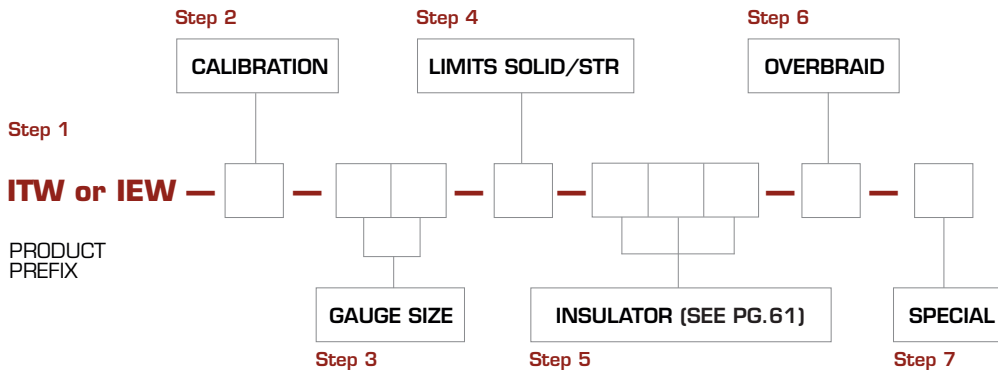
**Step 4:** The "limits/solid/stranded" box consists of a single digit. The #1 indicates solid conductors standard limits or error, while the #3 indicates stranded conductors standard limits of error for thermocouple grade wire. When constructing an extension cable, insert the #5 for solid conductors standard limits of error or the #7 for stranded conductors standard limits of error. NOTE: When special limits of error material is required, these digits must be changed to the next higher even digit, i.e., from ITW-K-20-1-304-0-0.

**Step 5:** Select desired insulation type.

**Step 6:** Select overbraid material. If none, insert "0".

**Step 7:** This box is reserved for certified and custom constructions. If certified (see below) or a custom built wire is required, please consult factory for further instructions. If none, please insert "0" in this box.

**CERTIFICATION:** L.H. Marshall Company can certify bulk thermocouple wire or individual elements traceable to N.I.S.T. Each thermocouple element, coil or spool of wire is tagged with the individual temperature departure from the corresponding calibration curve. Special temperature points as well as notarized results are available. Please consult factory for additional information.



## ANSI TOLERANCES:

Unless specified, our thermocouple and extension wires are supplied to meet Standard Tolerances of ANSI circular MC96. 1-1982. Special Tolerances are also available per ANSI MC96.1. Tolerances for thermocouple and extension wires are given in the accompanying tables. Where tolerances are given in percent, the percentage applies to the temperature being measured.

## INITIAL CALIBRATION TOLERANCES FOR THERMOCOUPLES

Reference Junction 0°C (32°F)

THERMO-COUPLE TYPE	TEMPERATURE RANGE		TOLERANCES †	
	°C	°F	STANDARD	SPECIAL
B	870 to 1700	1598 to 3092	±0.5%	—
E	0 to 900	32 to 1652	±1.7°C or ±0.5%	±1.1°C or ±0.4%
J	0 to 750	32 to 1382	±2.2°C or ±0.75%	±1.1°C or ±0.4%
K	0 to 1250	32 to 2282	±2.2°C or ±0.75%	±1.1°C or ±0.4%
R or S	0 to 1450	32 to 662	±1.0°C or ±0.75%	±0.6°C or ±0.1%
T	0 to 350 Cryogenic Ranges	32 to 662	±1.0°C or ±0.75%	±0.5°C or ±0.4%
E*	-200 to 0	-328 to 32	±1.7°C or ±1%	**
K*	-200 to 0	-328 to 32	±2.2°C or ±2%	**
T*	-200 to 0	-328 to 32	±1.0°C or ±1.5%	**

\*Thermocouples and thermocouple material are normally supplied to meet the tolerances specified in the table for the normal specified range. The same materials, however, may not fall within the cryogenic tolerances in the second section of the table. If materials are required to meet the cryogenic tolerances, the purchase order must so state. Selection of materials usually will be required. Tolerances indicated in this table are not necessarily an indication of the accuracy of temperature measurements in use after initial heating of the materials.

\*\*Little information is available to justify establishing special tolerances for cryogenic temperatures. Limited experience suggests the following tolerances for types E and T thermocouples:

-Type E-200 to 0°C ± 1.0°C or ±0.5% (whichever is greater)

-Type T-200 to 0°C ± 0.5°C or ±0.8% (whichever is greater)

These tolerances are given only as a guide for discussion between purchaser and supplier. Due to the characteristics of the materials, cryogenic tolerances for Type J thermocouples and special cryogenic tolerances for Type K thermocouples are not listed.

† Where tolerances are given in percent, the percentage applies to the temperature being measured in degrees Celsius. For example, the standard tolerance of Type J over the temperature range of 227°C to 750°C is ±0.75 percent. If the temperature being measured is 538°C, the tolerance is ±0.75 percent of 538, or ±4.0°C. To determine the tolerance in degrees Fahrenheit, multiply the tolerance in degrees Celsius times 1.8.



# INSULATED THERMOCOUPLE WIRE / INSULATED EXTENSION WIRE



## INITIAL CALIBRATION TOLERANCES FOR THERMOCOUPLE EXTENSION WIRES

Reference Junction 0°C (32°F)

EXTENSION WIRE TYPE	TEMPERATURE RANGE		TOLERANCES	
	°C	°F	STANDARD	SPECIAL
EX	0 to 200	32 to 392	±1.7°C	—
JX	0 to 200	32 to 392	±2.2°C	±1.1°C
KX	0 to 200	32 to 392	±2.2°C	—
TX	0 to 200	32 to 212	±1.0°C	±0.5°C
SX	0 to 200	32 to 392	±5°F	—
BX	0 to 200	32 to 212	-3.7°C (-6°F)	—
NX				

†Due to the non-linearity of the types S, R, and B temperature-EMF curves, the error introduced into a thermocouple system by the compensating wire will be variable when expressed in degrees. The °F tolerances given in parentheses are based on the following measuring junction temperatures:

Type Wire Measuring Junction Temperature  
 SX Greater than 870°C (1598°F)  
 BX Greater than 1000°C (1832°F)

Copper (+) versus copper nickel alloy (-).

#Copper versus compensating extension wire, useable to 100°C (212°F) with maximum deviations as indicated, but with no significant deviation over 0 to 50°C (32 to 122°F) range. Matched proprietary alloy compensating wire is available for use over the range 0 to 200°C (32 to 392°F) with claimed tolerances of (0.033 mV (±3.7°C).

## ANSI LETTER DESIGNATIONS

Thermocouple and extension wires are now generally ordered and specified by ANSI letter designations for wire type. Positive and negative legs are identified by the appropriate letter suffixes P and N, respectively.

## ANSI LETTER DESIGNATIONS

ANSI LETTER	DESCRIPTION	POPULAR GENERIC & TRADE NAMES*
T	TP TN	Copper Constantan, Cupron, Advance
J	JP JN	Iron Constantan, Cupron, Advance
E	EP EN	Chromel, Tophel, T1 Constantan, Cupron, Advance
K	KP KN	Chromel, Tophel, T1 Alumel, Nial, T2
S	SP SN	Platinum 10% Rhodium Pure Platinum
R	RP RN	Platinum 13% Rhodium Pure Platinum
B	BP BN	Platinum 30% Rhodium Platinum 6% Rhodium

\*Trade names Cupron, Nial and Tophel 3/4 AMAX, Advance, T1 and T2 3/4 Driver/Harris Co. Chromel and Alumel 3/4 Hoskins Mfg. Co.

## SOLID AND STRANDED CONDUCTORS

Thermocouple and extension wires are usually solid conductors, but both are available in stranded construction if greater flexibility is required.

CONDUCTOR		STRANDING	
GAUGE	ANSI TYPE	NO. OF STRANDS	GAUGE
14	All	7	22
16	All	7	24
18	All	7	26
20	All	7	28
22	All	7	30
24	All	7	32

## COLOR CODING

Standard ANSI color coding is used on all insulated thermocouple wire and extension wire when the type of insulation permits. In color coding, the right is reserved to include a tracer to identify the ANSI type.

## ANSI COLOR CODING

ANSI TYPE	MAGNETIC	SINGLE	ANSI COLOR CODE		
			OVERALL EXTENSION WIRE	OVERALL T/C WIRE	
T/C	YES	NO			
T		•	Blue	Blue	Brown
			Red		
J	•	•	White	Black	Brown
			Red		
E	•	•	Purple	Purple	Brown
			Red		
K	•	•	Yellow	Yellow	Brown
			Red		
S, R	•	•	Black	Green	
			Red		
B	•	•	Grey	Grey	
			Red		
N	•	•	Red		
			Orange		

# INSULATED THERMOCOUPLE WIRE / INSULATED EXTENSION WIRE



## THEMOCOUPLE WIRE, INSULATION, CONSTRUCTION AND CHARACTERISTICS

INSULATION CODE	SINGLE CONDUCTOR		—DUPLEX CONDUCTOR		TEMP. RATING* *		ANSI COLOR CODED	PHYSICAL PROPERTIES		NOTES
	Insulation	Impregna-tion	Insulation	Impregnation	Continuous	Single Reading		Abrasion Resistance	Moisture Resistance	
200	High Temp. Glass Braid	High Temp. Varnish	None Twisted	—	704°C 1300°F	871°F 1600°F	Yes	Good	Good	Impregnation retained to 204°C (400°F)
232	High Temp. Glass Braid	High Temp. Varnish	High Temp. Glass Braid	High Temp. Varnish	704°C 1300°F	871°F 1600°F	Yes	Good	Good	Impregnation retained to 204°C (400°F)
301	Vitreous Silica Fiber	None	Vitreous Silica Fiber	None	871°F 1600°F	1092°F 2000°F	No	Fair	Fair	—
302	Double Glass Braid	Silicone Modified Resin	Glass Braid	Silicone Modified Resin	482°F 900°F	538°F 1000°F	Yes	Good	Good	Impregnation retained to 204°C (400°F)
304	Glass Braid	Silicone Modified Resin	Glass Braid	Silicone Modified Resin	482°F 900°F	538°F 1000°F	Yes	Fair	Good	Impregnation retained to 204°C (400°F)
305	Double Glass Wrap	High Temp. Varnish	Glass Braid	Silicone Modified Resin	482°F 900°F	538°F 1000°F	Yes	Fair	Good	Impregnation retained to 204°C (400°F)
307	TFE Tape (not fused) TFE Coated Glass	—	TFE Coated Glass Braid	—	482°F 900°F	538°F 1000°F	Yes	Good	Excellent	Teflon good to 260°C (500°F)
350	Ceramic Fiber	—	Ceramic Fiber	—	1204°F 2200°F	1427°F 2600°F	No	Good	Fair	—
505	Polyvinyl	—	Ripcord	—	-29 to +150°C -20 to +221°C	—	Yes	Good	Excellent	—
507	FEP Extr.	—	FEP Extr.	—	204°F 400°F	316°F 600°F	Yes	Very Good	Excellent	—
508	TFE Tape Fused	—	TFE Tape Fused	—	260°F 500°F	316°F 600°F	Yes	Good	Excellent	—
509	FEP Extr.	—	FEP Extr. Twisted	—	204°F 400°F	316°F 600°F	Yes	Very Good	Excellent	Aluminum/Mylar® shield with drain wire
511	Fused Kapton Tape	—	None Twisted	—	316°F 600°F	427°F 800°F	Yes	Excellent	Excellent	FEP binder melts at approx. 260°C (500°F)
513	Fused Kapton Tape Polyimide	—	Fused Kapton Tape	—	316°F 600°F	427°F 800°F	Yes	Excellent	Excellent	FEP binder melts at approx. 260°C (500°F)
514	Tefzel®	—	Tefzel	—	150°F 302°F	200°F 392°F	Yes	Excellent	Excellent	—

\*Trade names of E I duPont de Nemours & Co.

\*\*Thermocouple extension grade wire is only calibrated up to 204°C (400°F).

Note: ServTex synthetic fibers are organic compounds. Good ventilation is recommended in areas where this product may be subjected to elevated temperatures.

# INSULATED THERMOCOUPLE WIRE / INSULATED EXTENSION WIRE



## EXTENSION WIRE, INSULATION, CONSTRUCTION AND CHARACTERISTICS, CONT.

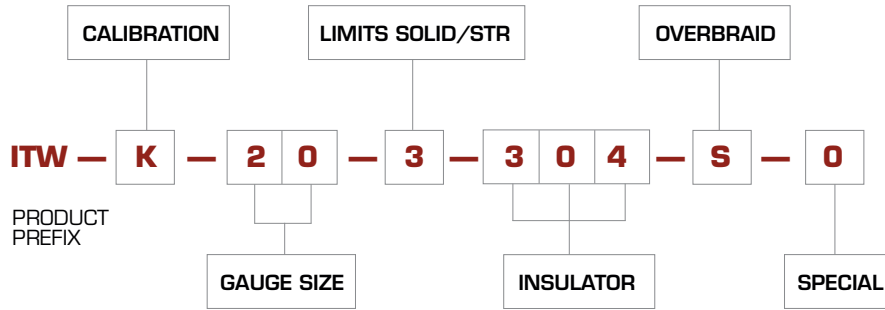
INSULATION CODE	SINGLE CONDUCTOR		—DUPLEX CONDUCTOR		TEMP. RATING**		ANSI COLOR CODED	PHYSICAL PROPERTIES		NOTES
	Insulation	Impregnation	Insulation	Impregnation	Continuous	Single Reading		Abrasion Resistance	Moisture Resistance	
155	Glass Braid	Silicone Modified Resin	ServTex Braid	Moisture Resistant	288°C 550°F	343°C 650°F	Yes	Good	Fair	Impregnation retained to 149°C (300°F)
157	TFE Tape (not fused) Glass Braid	Silicone Modified Resin	ServTex Braid	Compound	288°C 550°F	343°C 650°F	Yes	Good	Good	Impregnation retained to 204°C (400°F) Teflon good to 260°C (500°F)
232	High Temp Glass Braid	High Temp. Varnish	High Temp Glass Braid	Moisture Resistant Compound	704°C 1300°F	871°C 1600°F	Yes	Good	Good	Impregnation retained to 204°C (400°F)
303	Enamel/ Glass Braid	Silicone Modified Resin	Glass Braid	High Temp. Varnish	482°C 900°F	538°C 1000°F	Yes	Fair	Good	Impregnation retained to 204°C (400°F)
502	Polyvinyl	—	Polyvinyl	—	-29 to +105°C -20 to +221°F	—	Yes	Good	Excellent	—
507	FEP Extr.	—	FEP Teflon Extr.	—	204°C 400°F	316°C 600°F	Yes	Very Good	Excellent	—
509	FEP Extr.	—	FEP Teflon Extr.	—	204°C 400°F	316°C 600°F	Yes	Very Good	Excellent	Aluminum/Mylar* shield with Drain Wire
510	Polyvinyl	—	Polyvinyl Twisted	—	-29 to +105°C -20 to +221°F	—	No	Good	Excellent	Aluminum/Mylar* shield with Drain Wire
514	Tefzel®	—	Tefzel	—	150°C 302°F	200°C 392°F	Yes	Excellent	Excellent	—
515	Tefzel	—	Tefzel Twisted	—	150°C 302°F	200°C 392°F	Yes	Excellent	Excellent	Aluminum/Mylar* shield with Drain Wire

\*Trade names of E I duPont de Nemours & Co.

\*\*Thermocouple extension grade wire is only calibrated up to 204°C (400°F).

Note: ServTex synthetic fibers are organic compounds. Good ventilation is recommended in areas where this product may be subjected to elevated temperatures.

# INSULATED THERMOCOUPLE WIRE / INSULATED EXTENSION WIRE



OVERBRAID SELECTION CODE	
Stainless Steel Wire Braid	<b>S</b>
Tinned Copper Wire Braid	<b>C</b>
Flat Stainless Steel Ribbon Braid	<b>F</b>
Flat Stainless Steel Spiral Wrap	<b>W</b>
Half Oval Galvanized Steel Spiral Wrap	<b>G</b>
Inconel	<b>I</b>

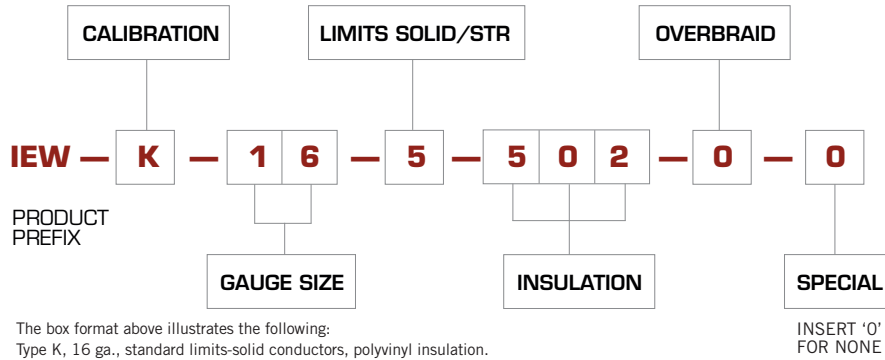
To order standard catalog material with overbraid, do so by catalog number as follows. Desired: ITW-J-20-1-305 with stainless steel wire braid. Specify: Catalog Number ITW-J-20-1-305-S-0.

The box format above illustrates the following:  
Type K, 20 ga., standard limits-stranded conductors, glass braid insulation, stainless steel overbraid.

CALIBRATION	B & S GAUGE SIZE	CONDUCTOR CODE	INSULATION CODE	EACH CONDUCTOR	OVERALL
J, K	14	1	232	High Temperature Glass Braid	High Temperature Glass Braid
K	16	1	350	Ceramic Fiber	Ceramic Fiber
J, K	16	1	232	High Temperature Glass Braid	High Temperature Glass Braid
K	20	2	301	Vitreous Silica Fiber	Vitreous Silica Fiber
J, K, T, E	20	1, 2, 3	304	Glass Braid	Glass Braid
J, K, T	20	1, 2	305	Double Glass Wrap	Double Glass Wrap
J, K	20	2	232	High Temperature Glass Braid	High Temperature Glass Braid
K	20	2	350	Ceramic Fiber	Ceramic Fiber
J, K, T	20	1, 2	507	FEP Extruded	FEP Extruded
J, K, T	20	1, 2	508	Fused TFE Tape	Fused TFE Tape
J, K, T	20	1, 2, 3	509	FEP Extruded	FEP Extruded
J, K	20	1, 2	511	Fused Kapton Tape	Fused Kapton Tape
J, K, T	20	1, 2	513	Fused Kapton Tape	Fused Kapton Tape
J	20	1, 2	307	TFE Tape/TFE Imp Glass	TFE Tape/TFE Imp Glass
J	20	9	P04	JP Single Conductor	JP Single Conductor
J	20	9	N04	JN Single Conductor	JN Single Conductor
J, K, T	24	1, 2	304	Glass Braid	Glass Braid
J, K, T	24	1, 2	305	Glass Wrap	Glass Wrap
J, K	24	1, 2	232	High Temperature Glass Braid	High Temperature Glass Braid
J, K, T	24	1, 2	508	Fused TFE Tape	Fused TFE Tape
J, K, T	24	1, 2	505	Polyvinyl	Polyvinyl
J, K, T	24	1, 2	513	Fused Kapton Tape	Fused Kapton Tape
T	24	1, 2	514	Tefzel	Tefzel
K	26	1, 2	305	Glass Wrap	Glass Wrap
J, K	28	1, 2	305	Glass Wrap	Glass Wrap
K, T	30	1, 2	305	Glass Wrap	Glass Wrap
K, T	30	1, 2	507	FEP Extruded	FEP Extruded
J, K, T	30	1, 2	513	Fused Kapton Tape	Fused Kapton Tape

\*Multi Pair Thermocouple Wire Available. Consult Factory.

# INSULATED THERMOCOUPLE WIRE / INSULATED EXTENSION WIRE



OVERBRAID SELECTION CODE	
Stainless Steel Wire Braid	<b>S</b>
Tinned Copper Wire Braid	<b>C</b>
Flat Stainless Steel Ribbon Braid	<b>F</b>
Flat Stainless Steel Spiral Wrap	<b>W</b>
Half Oval Galvanized Steel Spiral Wrap	<b>G</b>

To order standard catalog material with overbraid, do so by catalog number as follows. Desired: IEW-K-20-5-502 with stainless steel wire braid. Specify: Catalog Number IEW-K-20-5-502-S.

CALIBRATION	B & S GAUGE SIZE	CONDUCTOR CODE	INSULATION CODE	EACH CONDUCTOR	OVERALL
J, K	14	5	155	Felted ServTex	ServTex Braid
J, K	14	5	502	Polyvinyl	Polyvinyl
J, K	14	5	303	Enamel Glass Braid	Glass Braid
J, K	14	5	232	High Temperature Glass Braid	High Temperature Glass Braid
J, K	14	5	507	FEP Extruded	FEP Extruded
J, K, S	16	5, 7	155	Felted ServTex	ServTex Braid
J, K, S	16	5, 7	157	TFE/Felted ServTex	ServTex Braid
J, K, S	16	5	303	Enamel Glass Braid	Glass Braid
J, K	16	5	232	High Temperature Glass Braid	High Temperature Glass Braid
J, K, E, T, S	16	5, 7	502	Polyvinyl	Polyvinyl
J, K, E, T, S	16	5, 7	510	Polyvinyl	Twisted Aluminum Mylar/PVC
J, K, E, T	16	7	515	Tefzel	Tefzel Twisted
J, K, S	16	5, 7	507	FEP Extruded	FEP Extruded
J, K, S	16	5, 7	509	FEP Extruded	Twisted Aluminum Mylar/PVC
J, K, E, T, S	20	5, 7	502	Polyvinyl	Polyvinyl
J, K, S	20	5	232	High Temperature Glass Braid	High Temperature Glass Braid
J, K, E, T, S	20	5, 7	510	Polyvinyl	Twisted Aluminum Mylar/PVC
J, K, E, T	20	5	514	Tefzel	Tefzel
J, K, S	20	5	507	FEP Extruded	FEP Extruded
J, K, S	20	5, 7	509	FEP Extruded	Twisted Aluminum Mylar/PVC
S	20	5	304	Glass Braid	Glass Braid
S	24	5	304	Glass Braid	Glass Braid
R	22	3	701	PVC	PVC (3-wire) Stranded
R	22	4	701	PVC	PVC (3-wire) Stranded
R	24	3	705	Glass Braid	Glass Braid (3-wire) Stranded
R	24	4	705	Glass Braid	Glass Braid (3-wire) Stranded

# INSULATED THERMOCOUPLE WIRE / INSULATED EXTENSION WIRE



## MULTIPAIR THERMOCOUPLE EXTENSION CABLE

**Special Orders** - Thermocouple extension wire can be made to your specific order as multipair cable with individual and over-all insulations to suit installation conditions. Such cables greatly reduce cost of installation compared to pulling separate pairs of wires through conduit. Minimum quantity of any cable manufactured to order is 1000 feet. Complete specifications must accompany request for quotation.

**Standard Multipair Extension Cable** - The more common extension wire types are made up into standard multipair cables which are usually available for immediate delivery.

**Twisted Pair Cable** - Each conductor is covered with polyvinyl, nominal .015 inch thick, with each pair twisted to reduce magnetic interference. The twisted pairs are cabled and then shielded with a .0015 inch thick aluminum backed Mylar tape and a 20 gauge stranded copper drain wire. The drain wire, in contact with the aluminum, provides a simple mechanical connection for the shield, thus minimizing the effects of electromagnetic interference. The cable is then covered with an outer layer of polyvinyl, nominal .045 inch thick. A heavy Easy-Strip nylon thread is included. This cable is particularly adapted to those installations demanding maximum reduction in magnetic and electrostatic interference.

**Signal Wire and Coding** - As an added convenience, each standard cable contains an extra polyvinyl-clad 20-gauge solid copper wire for use as a signal connection for completing a communications of signal circuit.

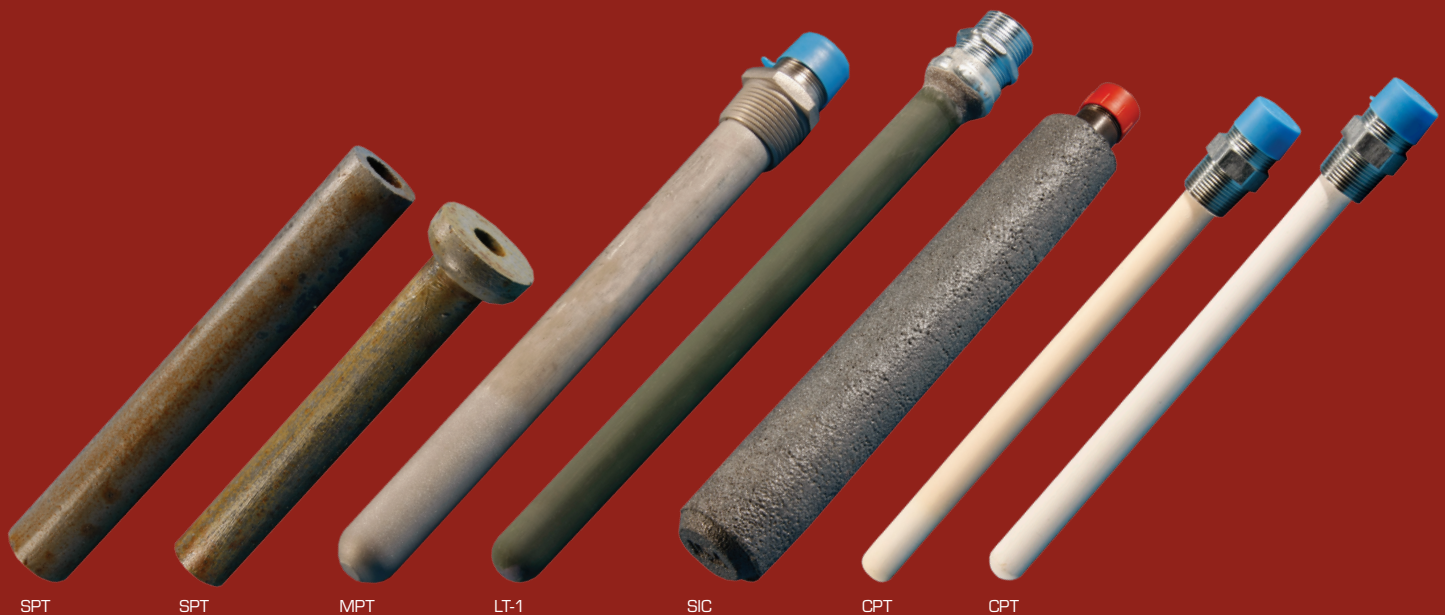
These standard cables are color coded on the individual conductors and over-all. The positive leg only on Series 900 is marked 1, 2, etc. Primary insulation will withstand ambient temperatures up to 105°C (221°F) and resists atmosphere and moisture.

**Wire Overbraid** - Any of the standard cables listed in the accompanying tables can be supplied with a braid of stainless steel wire.

CALIBRATION	B & S GAUGE SIZE	CONDUCTOR CODE	INSULATION CODE	EACH CONDUCTOR	OVERALL
J, K, T	20	5	904	Polyvinyl Twisted	Twisted Aluminum Mylar/PVC
J, K, T	20	5	908	Polyvinyl Twisted	Twisted Aluminum Mylar/PVC
J, K, T	20	5	912	Polyvinyl Twisted	Twisted Aluminum Mylar/PVC
J, K	20	5	916	Polyvinyl Twisted	Twisted Aluminum Mylar/PVC
J, K	20	5	920	Polyvinyl Twisted	Twisted Aluminum Mylar/PVC
J, K, T	20	5	924	Polyvinyl Twisted	Twisted Aluminum Mylar/PVC

NOTE: Multi Pair Extension Cable Available in Teflon Insulation, Consult Factory.

# PROTECTION TUBES



## MARSHALL THERMOCOUPLE™

The L.H. Marshall Company invented and patented the enclosed tip Thermocouple™ over 80 years ago. Over 10 million Marshall Thermocouples have been sold worldwide for precision temperature measurement. Marshall Thermocouples are reusable, durable, accurate and are a quality product engineered to meet the industry standards for temperature measurement of molten metals.

Scientific research and development at one of America's leading research facilities has led to innovations in steel composition of the Marshall protection tubes resulting in the longest lasting, multiuse thermocouple in the industry.

All Marshall Thermocouples are manufactured with Class 1, Special Limits wire which meet and exceed international quality standards of ANSI MC96.1 and IEC 584. Custom Marshall Thermocouples can be made to accommodate any range of industrial need while maintaining superior quality. Calibration certificates are available on Marshall Thermocouples and all products produced by the L.H. Marshall Company are 100% guaranteed.

# PROTECTION TUBE COMPARISON TABLE



## SPECIFICATIONS / CODES

PROTECTION TUBE CODE	TYPICAL APPLICATIONS	TUBE DESCRIPTION	COMPOSITION OF FORM	MAX. TEMP.	GENERAL COMMENTS
304	Food Preparation Petroleum Industry Chemical Processes Mixed Acids Lactic Acid Dyeing Tanks	304 Stainless Steel	Controlled amounts of Nickel, Chromium, Carbon, Manganese, Silicon, traces of Phosphorous & Sulfur, balance iron	1600°F Oxidizing, 2300°F Non-Oxidizing	Good resistance to corrosion. For wet process applications such as steam, oil, and many chemical solutions.
316	Petroleum Industry Chemical Processes	316 Stainless Steel	12% Nickel, 17% Chromium, 2-1/2% Molybdenum, 2% Manganese max., 0.08% Carbon max., 1% Silicon max., traces of Phosphorous & Sulfur, balance iron	1600°F Oxidizing	Good resistance to corrosion. Resists pitting corrosion. More resistant to acids than 304 SS.
446	High Temperature Hardening Nitriding Salt Baths Vitreous Enameling Non-ferrous Metals such as Tin, Lead, Zinc or Babbit Metal Smelting Low Temperature Blast Furnaces	446 Stainless Steel	27% Chromium, 0.25% Nitrogen max., 0.20% Carbon max., 1.50% Manganese max., 1.00% Silicon max., traces of Phosphorous & Sulfur, balance iron	2000°F Oxidizing, 2300°F Non-Oxidizing	Good resistance to corrosion at high temperatures. Impervious to sulfurous atmospheres, salt bath or low temperature molten metals.
601	High Temperature Heat Treating Carburizing Nitriding Salt Baths Blast Furnace Operations Gas Generators Ceramic Kilns	Inconel 601	61% Nickel, 23% Chromium, 14% Iron, 1.35% Aluminum	2200°F Oxidizing	Excellent resistance to corrosion and oxidation at high temperature. Good mechanical strength. More resistant to sulfur than Inconel 600. Hydrogen causes embrittlement.
200	Potassium Cyanide Salt Baths 2000°F Caustics and Brines High Temperature Chemical Applications 1200°F	Pure Nickel	Drawn or Drilled, 99.5% Nickel	2200°F Oxidizing, 1000°F Reducing, 2400°F Neutral	For high temperature applications. Will withstand many chemical actions, but must not be placed in the presence of sulfur. Frequently placed in caustic and molten salt baths. Drilled tube recommended for hydrogen atmospheres.
CSP	Annealing Drawing Tempering Glass Lehrs Power Plant Preheaters Food Baking Ovens Asphalt Mixers	Low Carbon Black Steel Pipe	Controlled amounts of Carbon Manganese, Silicon and Copper, traces of Phosphorous & Sulfur, balance Iron	1250°F	For non-corrosive atmospheres and in low temperature molten metals.
CIT	Chemical Industry: • Molten Aluminum • Die Cast Metals	Cast Iron	Cast	1300°F Oxidizing, 2000°F Non-Oxidizing	To 1600°F in reducing atmospheres. Will withstand sulfuric acid and caustic solutions. For extra long life, process coated tubes are available. Cast iron tubes should be painted daily with whitening when measuring aluminum or die cast metal temperatures.
LT-1	High Temperature Heat Treating: • Molten Copper Base Alloys to 2100°F • Blast Furnace and Stack Gases to 2400°F • Sulfur Burners to 2000°F • Cement Kilns to 2200°F • Chemical Process Reactors to 2500°F	Metal-Ceramic Tubes	(Slip cast composite of Chromium and Aluminum Oxide) 77% Chromium 23% Aluminum Oxide	2500°F	Superior oxidation resistance to 2500°F. Thermal conductivity equal to that of stainless steel. Good resistance to most molten metals to 2100°F. Not useable in molten aluminum. With noble metal element, a ceramic primary tube is required.
CPT	Ceramics Industry: • Bright Annealing • Forging Furnaces • Glass Making • High Speed Salt Baths	Mullite	Al2O3 63.5% SiO2 34.2% Fe2O3 0.6% TiO2 0.6% CaO 0.1% MgO 0.4% Na2O 0.6%	2800°F	Impervious to gases at high temperature. Possesses good thermal shock but poor mechanical shock. Often necessary to provide secondary tube protection. Should be mounted vertically. Useable in Barium Chloride salt baths to 2350°F.
CPT	Induction Melting up to 3200°F Applications for metal and ceramic industry requiring extreme temperatures.	Alumina	Al2O3 99.7% SiO2 0.1% MgO 0.1% Na2O 0.1%	3400°F	Fair resistance to thermal and mechanical shock. For very high temperature processes. Impervious to gases up to 3200°F.
SPT	Brick and Ceramic Kilns Steel Soaking Pits Applications requiring resistance to cutting action of flames and gases	Silicon Carbide	90% Silicon Carbide, 9% Silicon Dioxide, balance Aluminum Oxide & Ferric Oxide	3000°F	For molten non-ferrous metals. Also is a secondary protection tube for resistance to thermal shock.



# CERAMIC PROTECTION TUBES



## ORDERING INFORMATION

Protection tubes are used to help shield sensors, generally thermocouples, from contamination and/or mechanical damage. These tubes usually incorporate some manner by which the tube, sensor, and terminal are assembled and mounted into the process.

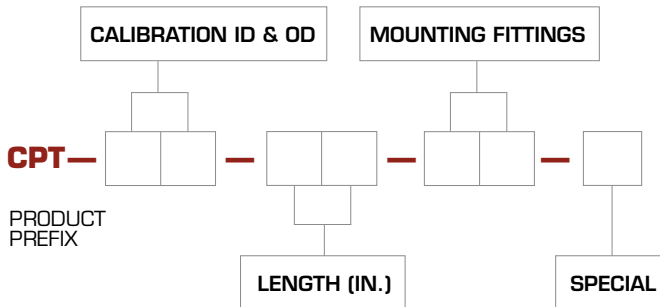
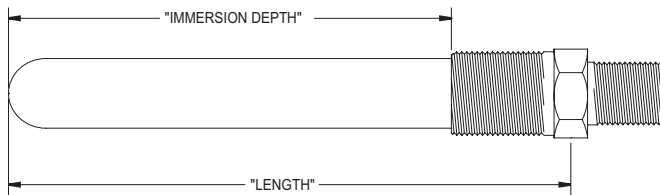
A fine grained, nonporous material, ceramic tubing is gas tight and is used at high temperatures to protect either platinum or base metal thermocouples. Ceramic tubes should either be preheated or slowly heated from 400°F to 800°F to dissipate any moisture that might be collected while at room temperature. Moisture that remains trapped in the tube may affect its performance.

Mullite protection tubes are impervious to gases at high temperatures. This type of tube possesses good thermal shock resistance, having a maximum temperature range of 2800°F.

Alumina protection tubes have a fair resistance to thermal and mechanical shock. Designed for very high temperature processes, these tubes are impervious to gases up to 3200°F.

Both Mullite and Alumina tubes are available in many sizes.

To order, use Specification Codes shown to assemble a complete Ordering Number.



## APPLICATION NOTES

### MULLITE CERAMIC PROTECTION TUBES

- Maximum temperature: 2800°F
- Good resistance to thermal shock and chemicals
- Good mechanical strength
- Can contaminate the platinum element above 2400°F
- Glazed tube-recommended for generator & atmosphere furnaces

### ALUMINA CERAMIC PROTECTION TUBES

- Maximum temperature: 3400°F
- Susceptible to thermal shock. Needs preheating
- Good mechanical strength
- Resists chemicals and will not contaminate platinum

MATERIAL ID & OD	LENGTH (INCHES)	MOUNTING FITTINGS	SPECIAL
M5 - 5mm x 7mm Mullite M8 - 1/4" x 3/8" Mullite M3 - 3/8" x 1/2" Mullite M6 - 7/16" x 11/16" Mullite M4 - 1/2" x 3/4" Mullite G0 - 1/2" x 3/4" Mullite G-0 G2 - 1/2" x 3/4" Mullite G-2 M1 - 3/4" x 1" Mullite M7 - 1" x 1-1/4" Mullite M9 - 1-1/4" x 1-1/2" Mullite A5 - 5mm x 7mm Alumina A8 - 1/4" x 3/8" Alumina A2 - 5/16" x 1/2" Alumina A3 - 3/8" x 1/2" Alumina A6 - 7/16" x 11/16" Alumina A4 - 1/2" x 3/4" Alumina A1 - 3/4" x 1" Alumina A7 - 1" x 1-1/4" Alumina A9 - 1-1/4" x 1-1/2" Alumina A0 - 5mm x 8mm Alumina	12 - 1-5/8" x 1-7/8" Mullite 11 - 5/8" x 7/8" Alumina 13 - 1" x 2" Mullite 14 - 3/4" x 1-1/4" Mullite 15 - 3/16" x 1/4" Mullite 16 - 5/16" x 7/16" Mullite 17 - 5/8" x 7/8" Mullite 18 - 1-5/8" x 1-7/8" Alumina 19 - 3/16" x 5/16" Alumina 20 - 15mm x 10mm Alumina 21 - 15mm x 11mm Mullite M2 - 3/16" x 1/4" Mullite 22 - 1/8" x 3/16" Alumina 23 - 9/16" x 3/4" Mullite 26 - 9/16" x 3/4" Alumina	Specify from 000" to 999"  00 - No Fitting B3 - Brass Sleeve B4 - 3/4" x 1" Brass Hex Ftg 24 - 1/2" x 3/4" Hex Ftg 05 - Pipe Nipple 06 - Ceramic Collar D2 - 1/2-Hex -1/2 Ftg D3 - 3/4-Hex -3/4 Ftg D1 - 1"-Hex -1" Ftg H2 - Hex-1/2 Ftg H3 - Hex-3/4 Ftg C1 - 1-1/4" Coupling C2 - 1" Coupling C3 - 1-1/2" Coupling H1 - Hex -1" Ftg 31 - 3/4" x 1" Hex Ftg 32 - 3/4" x 1-1/4" Hex Ftg 25 - 1" x 1-1/4" Hex Ftg AS - Alloy Sleeve 21 - 1/2" x 1" Hex Ftg	0 - None B - Open Both Ends E - Effective Length X - Special (Consult Factory)

## EXAMPLE PART NUMBER

7/16" x 11/16" Mullite Protection Tube with 1/2" x 3/4" NPT Hex Fitting (1/2" x 3/4" NPT Hex Fitting (1/2" fitting for use with connecting head), 16" long

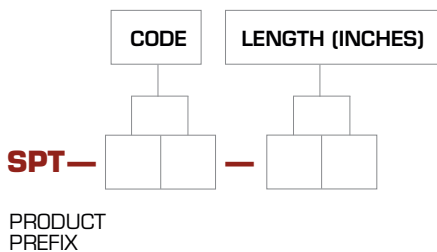
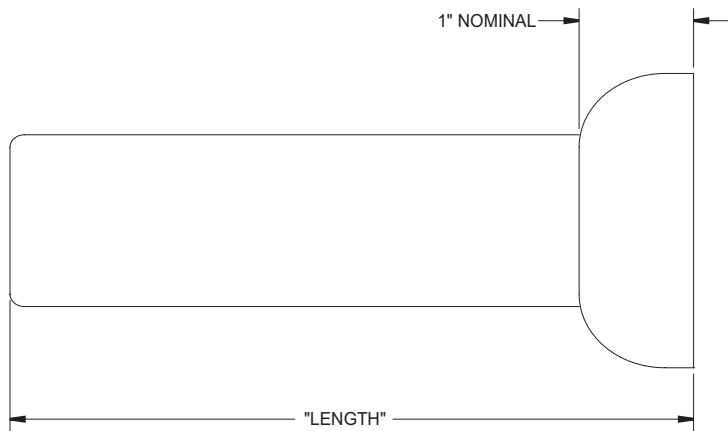
CPT - M 6 - 1 6 - 2 4 - 0

# SILICON CARBIDE PROTECTION TUBES/ SILICON CARBIDE WITH STEEL INNER TUBES



## SILICON CARBIDE PROTECTION TUBES (SPT)

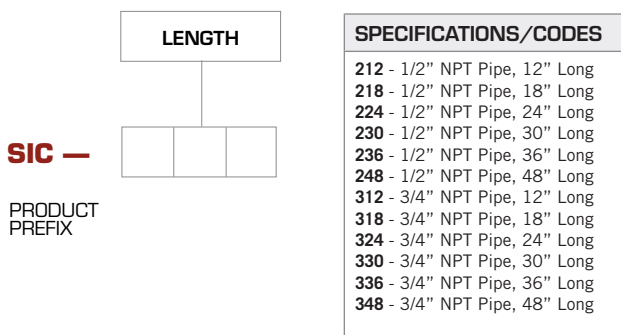
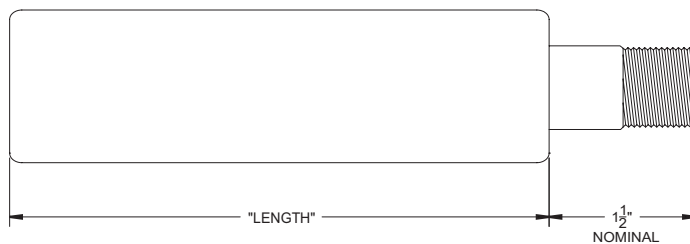
Silicon Carbide Tubes provide excellent thermal conductivity for quick response to temperature changes. They can be used as an alternative to Cast Iron Tubes, thus eliminating the possibility of iron pick-up. Special surface treatment assures maximum resistance to metal penetration for protection of the contained thermocouple. Protection tubes are available with or without collar in standard lengths from 12" to 48" in 6-inch increments.



SILICON CARBIDE PROTECTION TUBES		
CODE	SIDE ID x OD	LENGTH (INCHES)
<b>WC</b>	1" X 1-3/4" with Collar 3" Diameter	12 - 12"
		18 - 18"
		24 - 24"
		30 - 30"
<b>WO</b>	1" x 1-3/4" without Collar	36 - 36"
		42 - 42"
		48 - 48"

## SILICON CARBIDE WITH STEEL INNER TUBE (SIC)

Silicon Carbide Tubes are designed for monitoring, melting and holding temperatures of aluminum and other non-ferrous alloys up to 2300°F. They consist of silicon carbide/graphite isostatically formed around threaded pipe for easy installation. These are available in 1/2" and 3/4" NPT pipe in lengths of 12" to 48" in 6" increments.



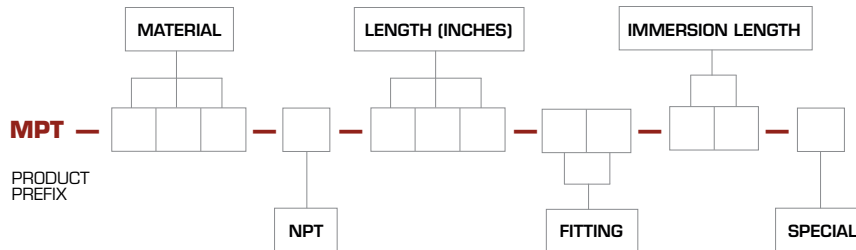
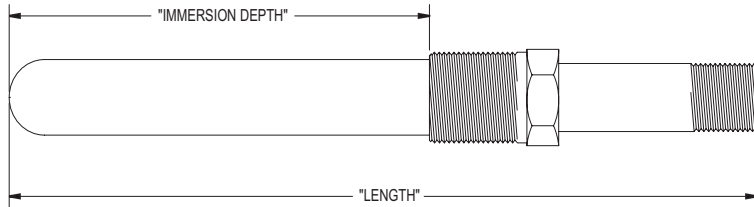
# METAL PROTECTION TUBES



## METAL PROTECTION TUBES (MPT)

To protect thermocouples from corrosion, physical damage and contamination, it is important to use some type of protection tube or well. Metal protection tubes are generally used with base metal thermocouples.

We stock the most widely used standard tubes and can provide other metal tubes on request. See page 54 for Tube Specifications and Applications.



\*Effective length is the length from the closed end of the tube to the bottom thread of the fitting.

MATERIAL	OPERATING TEMP	REMARKS	NPT	LENGTH	FITTING	IMMERSION LENGTH	SPECIAL
600 - 600 Inconel 601 - 601 Inconel	2220°F	Generally used for high temperature. Good corrosion-resistance.	<b>A</b> - 1/4" NPT <b>B</b> - 1/2" NPT <b>C</b> - 3/4" NPT <b>D</b> - 1" NPT <b>E</b> - 3/4" NPT Tap <b>F</b> - 1/8" NPT <b>H</b> - 3/8" NPT <b>J</b> - 3-1/2" NPT	Specify from 000" to 999"	<b>00</b> - None <b>AF</b> - Adjustable Flange <b>C3</b> - 3/8" Steel Hex Bushing <b>C2</b> - 1/2" Steel Hex Bushing <b>C4</b> - 3/4" Steel Hex Bushing <b>C1</b> - 1" Steel Hex Bushing <b>C5</b> - 1-1/4" Steel Hex Bushing <b>C6</b> - 1-1/2" Steel Hex Bushing <b>S3</b> - 3/8" St.St. Hex Bushing <b>S2</b> - 1/2" St.St. Hex Bushing <b>S4</b> - 3/4" St.St. Hex Bushing <b>S1</b> - 1" St.St. Hex Bushing <b>S5</b> - 1-1/4" St.St. Hex Bushing <b>S6</b> - 1-1/2" St.St. Hex Bushing <b>TP</b> - Tapered Plug <b>RF</b> - Raised Face Flange <b>S7</b> - 2" NPT SS Bushing <b>C7</b> - 2" NPT Steel Bushing <b>FF</b> - Flat Face Flange	Specify from 00" to 99"	<b>O</b> - None <b>B</b> - Open Both Ends <b>H</b> - SCH 80 <b>X</b> - Special (Consult Factory) <b>T</b> - No Threads
304 - 304 Stainless Steel 309 - 309 Stainless Steel	1800°F	Good corrosion-resistance. Embrittles in the 900°F to 1450°F range.					
310 - 310 Stainless Steel	2100°F	High mechanical and creep strength at elevated temperature. Very good corrosion resistance.					
316 - 316 Stainless Steel	1700°F	Higher corrosion resistance than 304SS. Resists pitting in sulfuric, phosphoric acids.					
330 - 330 Stainless Steel	2200°F	Good in oxidizing or reducing atmosphere.					
446 - 446 Stainless Steel	2000°F	Highly resistant to sulfur attack. General purpose alloy.					
200 - Pure Nickel	2000°F	Do not use in the presence of sulfur or reducing atmosphere.					
CIT - Cast Iron	1400°F	Withstands sulfuric and caustic solutions. Good mechanical strength.					
LT-1 - Metal Ceramic	2600°F	Good resistance to mechanical and thermal shock.					
CSP - Carbon Steel Pipe	1000°F	Non-corrosive gases and liquids. Scales quickly at higher temperatures.					

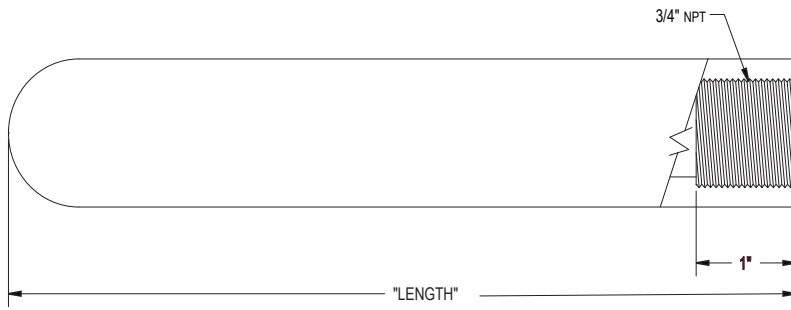
All pipe available in schedule 80. Consult factory for additional information.

# CAST IRON PROTECTION TUBES / METAL CERAMIC PROTECTION TUBES



## CAST IRON PROTECTION TUBES (CIPT)

Cast Iron Protection Tubes are typically used in molten aluminum and die cast metal application in reducing atmospheres to 1600°F and will withstand sulfuric and caustic solutions with a maximum temperature of 1300°F (oxidizing) and 2000°F (non-oxidizing). Tubes are 7/8" ID and 1-5/8" OD in lengths of 12" to 46" in 6" increments and are supplied with a 3/4" NPT internal thread.



**CIPT** — 

LENGTH

SPECIFICATIONS/CODES
12 - 12" Long
18 - 18" Long
24 - 24" Long
30 - 30" Long
36 - 36" Long
48 - 48" Long

PRODUCT PREFIX

### EXAMPLE PART NUMBER

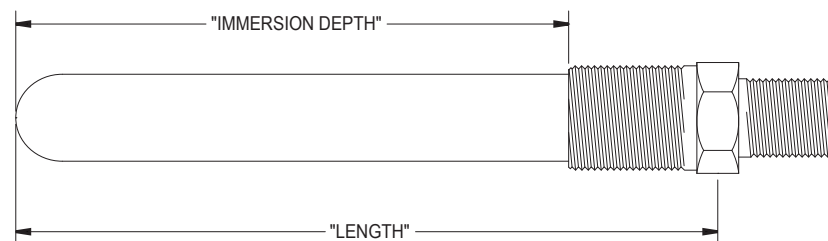
18" Cast Iron Protection Tube

**CIPT** — 

1	8
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## METAL CERAMIC PROTECTION TUBES (LT-1)

Metal Ceramic Protecting Tubes have excellent oxidation resistance and also resist wetting by many metals and alloys as well as basic furnace slags. The chromium metal phase takes on a very tightly bonded layer of chromium oxide which, together with the naturally inert nature of the Alumina, provides this material with its remarkable resistance to oxidizing atmospheres over 2200°F, good corrosion resistance, and the ability to resist wetting by molten metals. When used with platinum thermocouples, it is recommended that a primary Alumina tube be used with metal ceramic tubes. LT-1 tubes are available with a standard conduit connector in lengths from 12" to 48" in 6-inch increments.



**LT-1** — 

CODE

LENGTH (INCHES)
12"
18"
24"
30"
36"
42"
48"

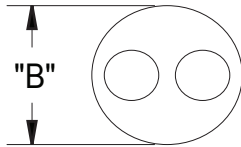
PRODUCT PREFIX

# CERAMIC INSULATOR

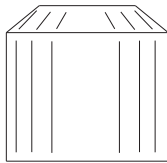


## CERAMIC INSULATOR (CBI)

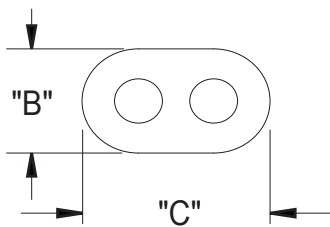
Thermocouple insulators are selected for specific applications to withstand elevated temperatures and to resist thermal shock. Mullite is available for excellent thermal shock resistance up to 2800°F. For applications up to 3400°F Alumina is recommended. Both Alumina and Mullite insulators are stocked in a variety of sizes and lengths for quick delivery.



DOUBLE HOLE ROUND (DH)					
INSULATOR MODEL NO.	PRICE	MATERIAL / MAX TEMP	USED WITH WIRE SIZE AWG / INCH	DIMENSION*	
				LENGTH MM (IN)	OD MM (IN)
DH-1-8-100	\$50	Mullite 1600° C (2910° F)	8 / 0.128	25 (1)	11.1 (7/16)
DH-1-14-100	\$45		14 / 0.064	25 (1)	7.0 (9/32)
DH-1-20-100	\$45		20 / 0.032	25 (1)	4.0 (5/32)
DH-1-24-100	\$45		24 / 0.020	25 (1)	3.0 (1/8)

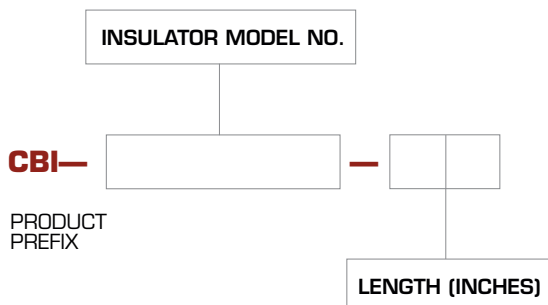


SINGLE HOLE FISH SPINE (FS)				
INSULATOR MODEL NO.	MATERIAL / MAX TEMP	USED WITH WIRE SIZE AWG / INCH	DIMENSION*	
			LENGTH MM (IN)	OD MM (IN)
FS-400-8	Steatite 1200° C (2190° F)	8 / 0.128	10.2 (0.40)	10.2 (0.40)
FS-330-10		10 / 0.102	8.38 (0.33)	8.38 (0.33)
FS-260-8		8 / 0.128	6.60 (0.26)	6.60 (0.26)
FS-260-12		12 / 0.081	6.60 (0.26)	6.60 (0.26)
FS-200-14		14 / 0.064	5.08 (0.20)	5.08 (0.20)
FS-170-18		18 / 0.040	4.32 (0.17)	4.32 (0.17)
FS-125-20		20 / 0.032	3.18 (0.13)	3.18 (0.13)
FS-110-20		20 / 0.032	2.79 (0.11)	2.79 (0.11)



DOUBLE HOLE OVAL (OV)						
INSULATOR MODEL NO.	PRICE	MATERIAL / MAX TEMP	USED WITH WIRE SIZE AWG / INCH	DIMENSION*		
				LENGTH MM (IN)	OD MM (IN)	THICKNESS MM (IN)
OV-1-8-100	\$50	Mullite 1600° C (2910° F)	8 / 0.128	25 (1)	11.1 (7/16)	6.99 (0.275)
OV-1-14-100	\$45		14 / 0.064	25 (1)	8.0 (5/16)	5.16 (0.203)
OV-1-20-100	\$45		20 / 0.032	25 (1)	4.4 (11/64)	3.0 (0.118)

\*All dimensions given are nominal figures only.  
†Specify quantity: 500 or 1000





# THERMOWELLS

## **MARSHALL THERMOCOUPLE™**

The L.H. Marshall Company invented and patented the enclosed tip Thermocouple™ over 80 years ago. Over 10 million Marshall Thermocouples have been sold worldwide for precision temperature measurement. Marshall Thermocouples are reusable, durable, accurate and are a quality product engineered to meet the industry standards for temperature measurement of molten metals.

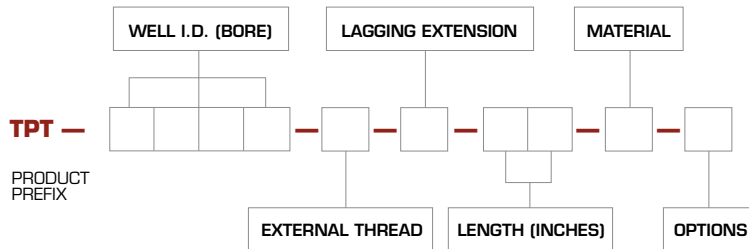
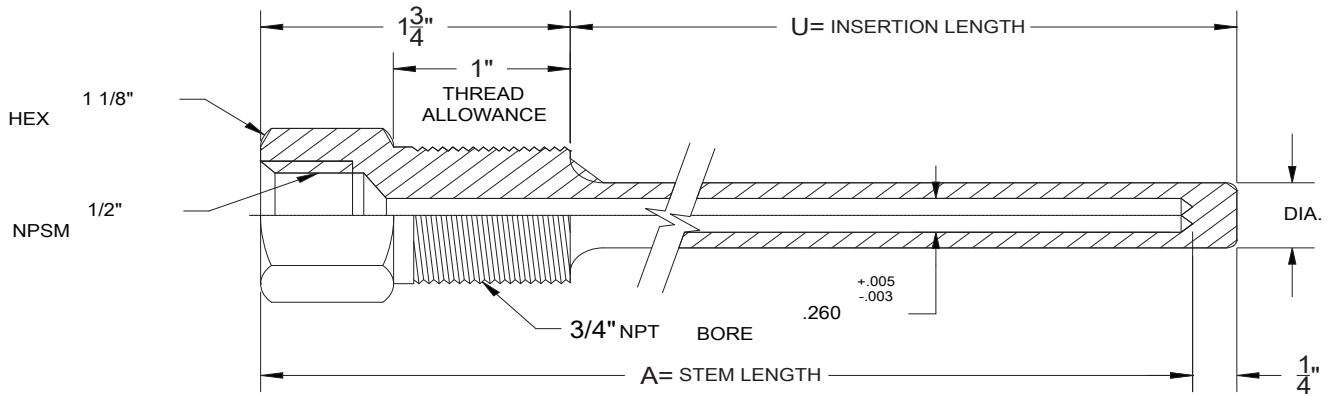
Scientific research and development at one of America's leading research facilities has led to innovations in steel composition of the Marshall protection tubes resulting in the longest lasting, multiuse thermocouple in the industry.

All Marshall Thermocouples are manufactured with Class 1, Special Limits wire which meet and exceed international quality standards of ANSI MC96.1 and IEC 584. Custom Marshall Thermocouples can be made to accommodate any range of industrial need while maintaining superior quality. Calibration certificates are available on Marshall Thermocouples and all products produced by the L.H. Marshall Company are 100% guaranteed.

### ORDERING INFORMATION

Alloy wells are generally categorized as metal protection tubes. But unlike the tubes we fabricate from standard schedule 40 or 80 pipe, alloy wells are drilled bar stock, precision machined, highly polished and designed for high pressure applications.

Thermocouple assemblies with alloy wells are recommended for used in high-pressure environments or where there is severe vibration. Typical applications include measuring temperatures in water, steam, and air lines in power plants or in chemical and petrochemical applications.



WELL I.D. (BORE)	EXTERNAL	LAGGING EXTENSION	LENGTH (INCHES)	MATERIAL	OPTIONS
<b>260S</b> - Std. Duty 1/4" Dia. Elements <b>385S</b> - Std. Duty 1/4" Dia. Elements <b>260H</b> - Heavy Duty 1/4" Dia. Elements <b>385H</b> - Heavy Duty 3/8" Dia. Elements <b>260W</b> - Weldin 1/4" Dia. Elements <b>385W</b> - Weldin 3/8" Dia. Elements <b>437S</b> - Std. Duty .437 Bore	<b>A</b> - 1/2" NPT <b>B</b> - 3/4" NPT <b>C</b> - 1" NPT	<b>0</b> - None <b>L</b> - Lagging Extension	<b>04</b> - U=2-1/2, T=0 <b>06</b> - U=4-1/2, T=0, U=2-1/2, T=2 <b>09</b> - U=7-1/2, T=0, U=4-1/2, T=3 <b>12</b> - U=10-1/2, T=0, U=7-1/2, T=3 <b>15</b> - U=13-1/2, T=0, U=10-1/2, T=3 <b>18</b> - U=16-1/2, T=0, U=13-1/2, T=3 <b>24</b> - U=22-1/2, T=0, U=19-1/2, T=3 <b>XX</b> - Other Than Above (Consult Factory) T - Lagging Dimension	<b>1</b> - Brass (ASTM B-16) <b>2</b> - Carbon Steel (C-1018) <b>3</b> - 304 Stainless Steel <b>4</b> - 316 Stainless Steel <b>5</b> - Monel <b>6</b> - Other Than Above (Consult Factory)	<b>0</b> - None <b>B</b> - For Brass Cap & Chain <b>S</b> - For SS Cap & Chain

### EXAMPLE PART NUMBER

Heavy-duty threaded thermowell for 1/4" dia. elements, 3/4" NPT process thread, 10-1/2" insertion, 304SS material, brass cap and chain

TPT — **2 6 0 H** — **B** — **0** — **1 2** — **3** — **B**

