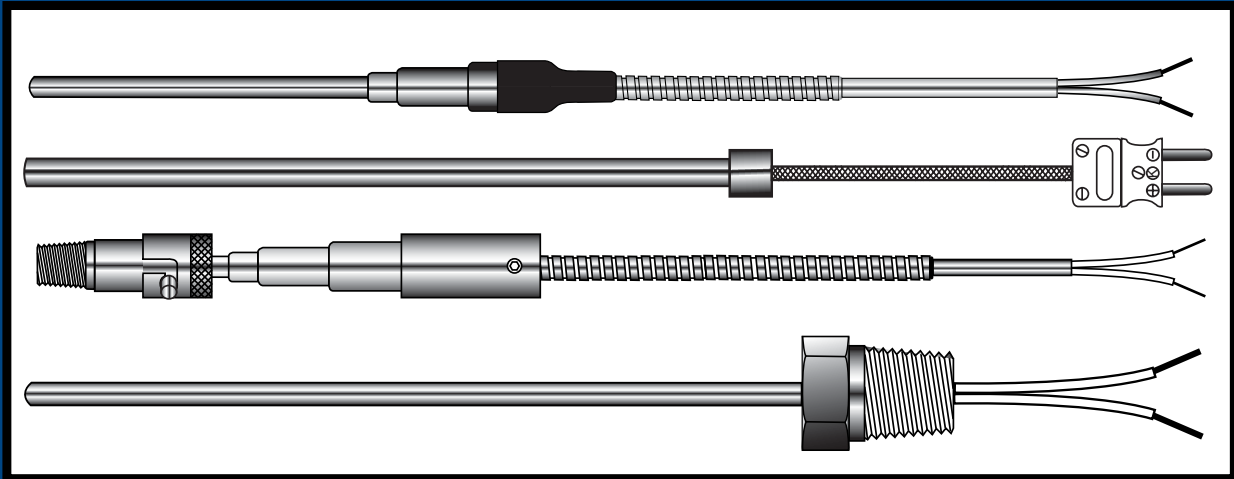


SECTION 1

THERMOCOUPLES



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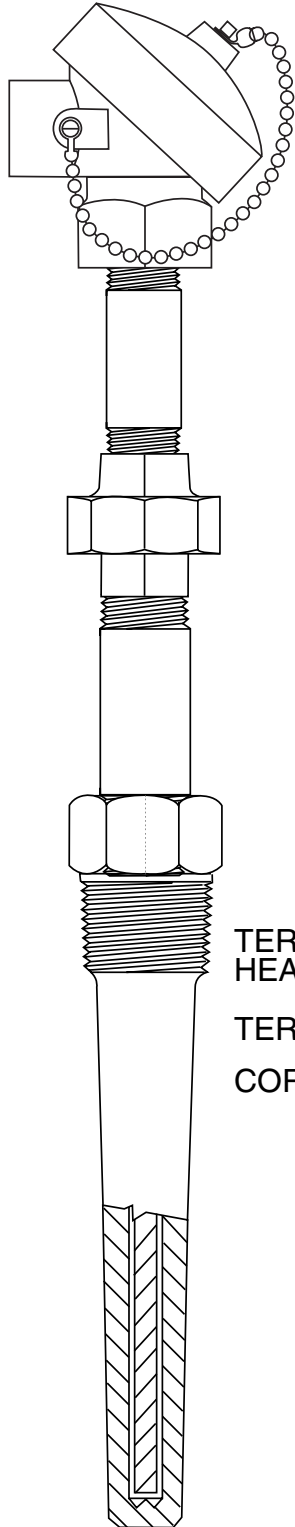
Technical Data.....20-22

THERMOCOUPLE



Thermocouple Assemblies

ORDERING INFORMATION

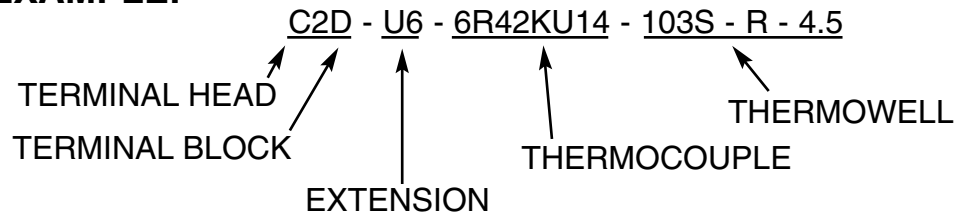


To specify thermocouple assembly, follow the steps shown below:

For Types 1, 4, S4, 6, and 10:

- Step 1 - Specify Terminal Head from pages 3 and 4.
- Step 2 - Specify Terminal Block from page 5.
- Step 3 - Specify Extension Type (if required) from page 6.
- Step 4 - Specify Thermocouple Element from pages 7-17.
- Step 5 - Specify Thermowell or Protection Tube from Section 3.

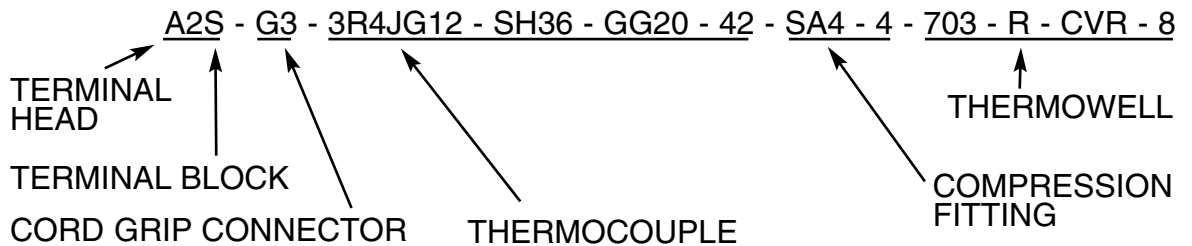
EXAMPLE:



For Types 2, and 3:

- Step 1 - Specify Terminal Head from pages 3 and 4.
- Step 2 - Specify Terminal Block from page 5.
- Step 3 - Specify Cord Grip Connector (if required) from page 71.
- Step 4 - Specify Thermocouple Element from pages 8 and 9.
- Step 5 - Specify Compression Fitting (if required) from page 71.
- Step 6 - Specify Thermowell or Protection Tube (if required) from Section 3.

EXAMPLE:



Junction Types

E - Exposed -Welded



G - Grounded



U - Ungrounded



P - Welding Pad



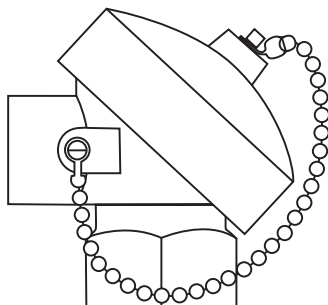
THERMOCOUPLE



TERMINAL HEADS

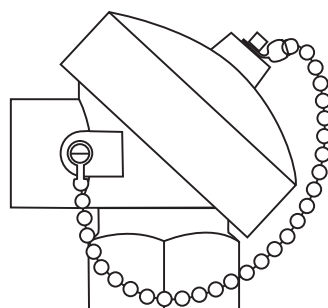
General Purpose - Weather- Proof

CAST IRON



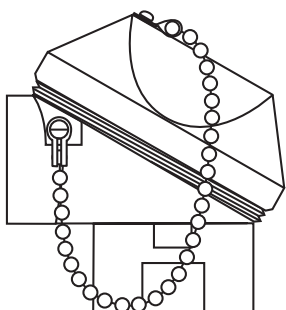
PART NO.	CONDUIT CONNECTION	INSTRUMENT CONNECTION
C1	1/2" NPT	1/2" NPT
C2	3/4" NPT	1/2" NPT
C3	3/4" NPT	3/4" NPT
C4	3/4" NPT	1" NPT

CAST ALUMINUM



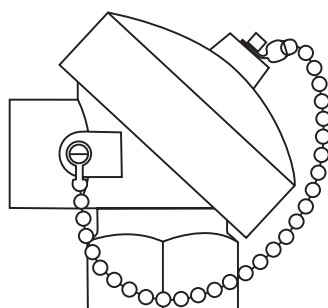
PART NO.	CONDUIT CONNECTION	INSTRUMENT CONNECTION
A1	1/2" NPT	1/2" NPT
A2	3/4" NPT	1/2" NPT
A3	3/4" NPT	3/4" NPT
A4	3/4" NPT	1" NPT

SMALL CAST ALUMINUM



PART NO.	CONDUIT CONNECTION	INSTRUMENT CONNECTION
A5	1/2" NPT	1/2" NPT
A6	3/4" NPT	1/2" NPT
A7	3/4" NPT	3/4" NPT
A8	3/4" NPT	1" NPT

STAINLESS STEEL



PART NO.	CONDUIT CONNECTION	INSTRUMENT CONNECTION
S1	1/2" NPT	1/2" NPT
S2	3/4" NPT	1/2" NPT
S3	3/4" NPT	3/4" NPT
S4	3/4" NPT	1" NPT

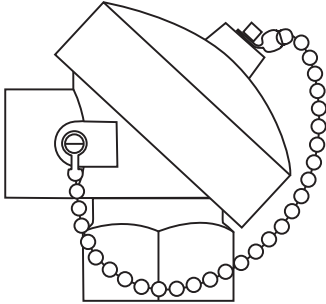
THERMOCOUPLE



TERMINAL HEADS

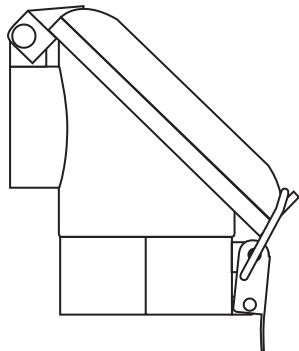
General Purpose - Weather- Proof

SCREW COVER - POLYPROPYLENE



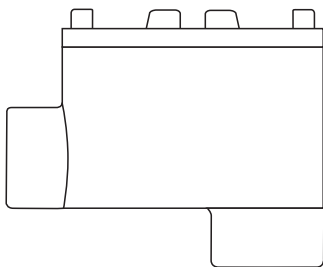
PART NO.	CONDUIT CONNECTION	INSTRUMENT CONNECTION	COLOR
P2	1/2" NPT	1/2" NPT	BLACK
P3	3/4" NPT	1/2" NPT	FDA APPROVED WHITE

HINGED COVER - FLIP TOP TERMINAL HEADS



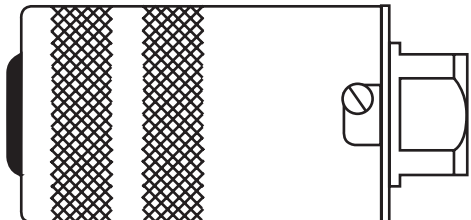
PART NO.	MATERIAL AND COLOR	CONDUIT CONNECTION	INSTRUMENT CONNECTION
H1	FDA APPROVED WHITE POLYPROPYLENE	3/4" NPT	1/2" NPT
H2	FDA APPROVED WHITE POLYPROPYLENE	3/4" NPT	3/4" NPT
H3	BLACK POLYPROPYLENE	3/4" NPT	1/2" NPT
H4	BLACK POLYPROPYLENE	3/4" NPT	3/4" NPT
H5	ALUMINUM	1/2" NPT	1/2" NPT
H6	ALUMINUM	3/4" NPT	1/2" NPT
H7	ALUMINUM	3/4" NPT	3/4" NPT
H8	ALUMINUM	3/4" NPT	1" NPT

EXPLOSION PROOF



PART NO.	CONDUIT CONNECTION	INSTRUMENT CONNECTION
EB1	1/2" NPT	1/2" NPT
EB2	3/4" NPT	1/2" NPT
EB3	3/4" NPT	3/4" NPT
EB4	3/4" NPT	1" NPT

CANISTER TYPE MINIATURE ALUMINUM TERMINAL HEADS WITH CERAMIC TERMINAL BLOCKS



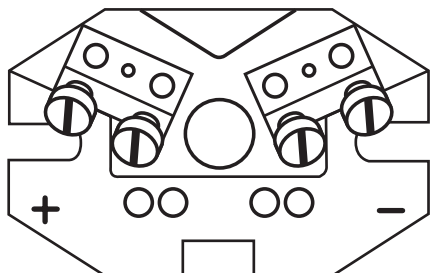
PART NO.	CONDUIT CONNECTION	NUMBER OF TERMINALS
M1	1/4" NPT	2
M2	1/8" NPT	2
M3	1/4" NPT	3
M4	1/8" NPT	3
M5	1/4" NPT	4
M6	1/8" NPT	4

THERMOCOUPLE

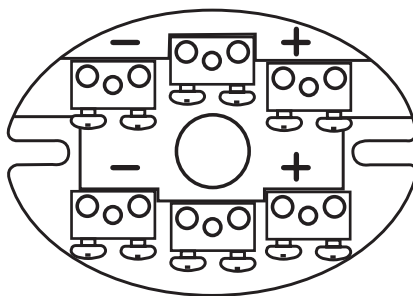
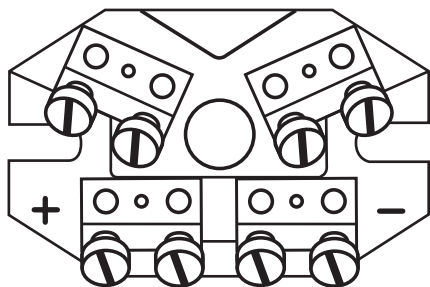


TERMINAL AND BARRIER BLOCKS

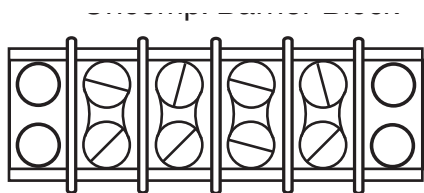
CERAMIC TERMINAL BLOCKS



CODE	PART NUMBER & DESCRIPTION
S	TB2 - Single Terminal Block
D	TB4 - Dual Terminal Block
T	TB6 - Triplex Terminal Block

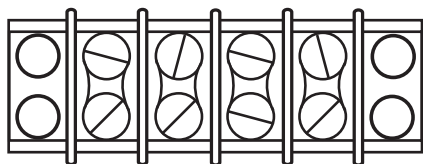


UNCOMPENSATED BARRIER BLOCKS



PART NO.	NO. OF TERMINALS
BB2	2
BB4	4
BB6	6
BB8	8
BB10	10
BB12	12
BB14	14

COMPENSATED BARRIER BLOCKS



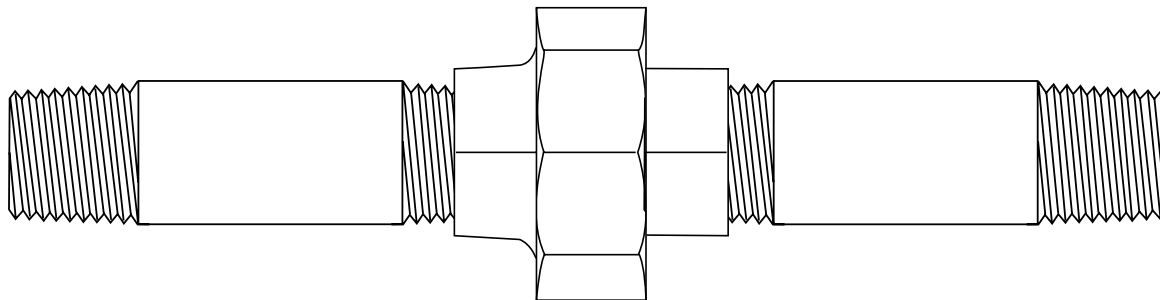
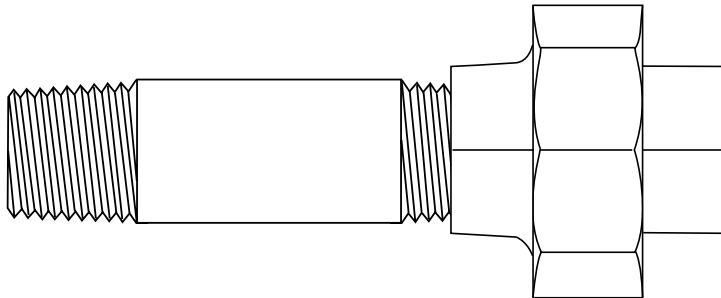
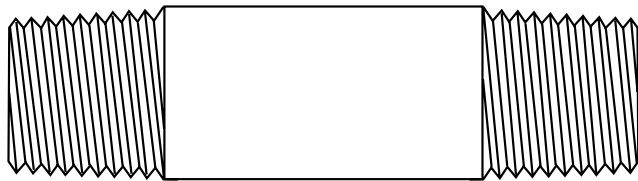
PART NO.	NO. OF TERMINALS	CALIBRATION
CBB2	2	J,K,T,E
CBB4	4	J,K,T,E
CBB6	6	J,K,T,E
CBB8	8	J,K,T,E
CBB10	10	J,K,T,E
CBB12	12	J,K,T,E
CBB14	14	J,K,T,E

To Order, Specify Part Number And Calibration

THERMOCOUPLE



EXTENSIONS



EXTENSION CODE	CONSTRUCTION
N	NIPPLE ONLY
U	NIPPLE-UNION-NIPPLE
UN	UNION-NIPPLE
CN	COUPLING-NIPPLE

MATERIAL CODE	MATERIAL
NO CODE	GALVANIZED STEEL
B	BLACK IRON
SS	304SS
R	316SS
X	OTHER

Specify extension code, extension length and material. Extension thread size is determined by the terminal head and thermowell connections.

Example: U4SS (Nipple-Union-Nipple, 4", 304SS Material)

If ordering extension only, specify code, extension length, material and thread size.

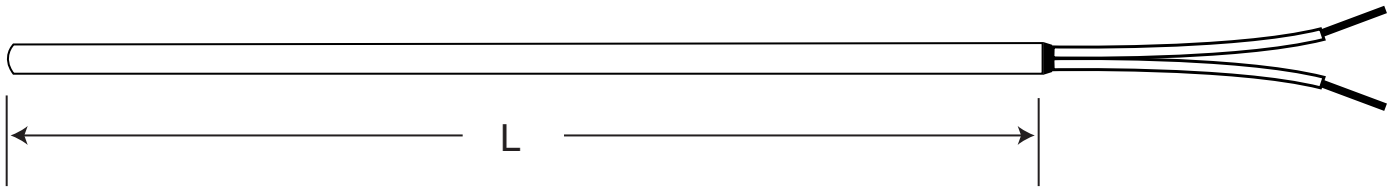
Example: U4SS-1/2" NPT (Nipple-Union-Nipple 4", 304SS Material, 1/2" NPT)

THERMOCOUPLE



Thermocouple Type 1

**** Bare Lead MgO Insulated Thermocouple**



ORDERING INFORMATION:----- 1 - R - 6 - 2K - U - 24

DESIGN TYPE ←

SHEATH MATERIAL ←

- P - 304SS Q - 310SS
- R - 316SS X - OTHER(SPECIFY)
- J - INCONEL 600

SHEATH DIA. ←

- 1 - .062 (1/16") 4 - .250 (1/4")
- 2 - .125 (1/8") 5 - .313 (5/16")
- 3 - .188 (3/16") 6 - .375 (3/8")

THERMOCOUPLE CALIBRATION TYPE ←

- | | |
|-------------------------------|--|
| J - Single Iron/Constantan | R - Single Platinum/Platinum 13% Rhodium |
| 2J - Dual Iron/Constantan | 2R - Dual Platinum/Platinum 13% Rhodium |
| K - Single Chromel/Alumel | S - Single Platinum/Platinum 10% Rhodium |
| 2K - Dual Chromel/Alumel | 2S - Dual Platinum/Platinum 10% Rhodium |
| E - Single Chromel/Constantan | B - Single Platinum 30% Rhodium/Platinum 6% Rhodium |
| 2E - Dual Chromel/Constantan | C - Single (W5Re) Tungsten 5% Rhenium/(W26Re) Tungsten 26% Rhenium |
| T - Single Copper/Constantan | |
| 2T - Dual Copper/Constantan | |

HOT JUNCTION ←

- | | |
|---------------------------------|-------------------------------|
| G - Grounded | E - Exposed |
| U - Ungrounded | GP - Grounded With Weld Pad |
| UI - Ungrounded Isolated (Dual) | UP - Ungrounded With Weld Pad |

SHEATH "L" LENGTH (SPECIFY) ←

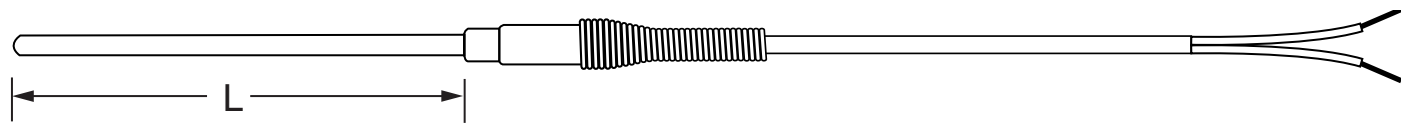
**Bare Color Coded Leads.

THERMOCOUPLE



Thermocouple Type 2

MgO Insulated Thermocouples With 20 AWG Extension Lead



ORDERING INFORMATION:----- 2 - R - 2 - 2E - U - 12 - PP - 20 - 24

DESIGN TYPE ←

SHEATH MATERIAL ←

- P - 304SS
- R - 316SS
- J - INCONEL 600
- Q - 310SS
- X - OTHER(SPECIFY)

SHEATH DIA. ←

- 1 - .062 (1/16")
- 2 - .125 (1/8")
- 3 - .188 (3/16")
- 4 - .250 (1/4")
- 5 - .313 (5/16")
- 6 - .375 (3/8")

THERMOCOUPLE CALIBRATION TYPE ←

- J - Single Iron/Constantan
- 2J - Dual Iron/Constantan
- K - Single Chromel/Alumel
- 2K - Dual Chromel/Alumel
- E - Single Chromel/Constantan
- 2E - Dual Chromel/Constantan
- T - Single Copper/Constantan
- 2 - Dual Copper/Constantan
- R - Single Platinum/Platinum 13% Rhodium
- 2R - Dual Platinum/Platinum 13% Rhodium
- S - Single Platinum/Platinum 10% Rhodium
- 2S - Dual Platinum/Platinum 10% Rhodium
- B - Single Platinum 30% Rhodium/Platinum 6% Rhodium
- C - Single (W5Re) Tungsten 5% Rhenium/(W26Re) Tungsten 26% Rhenium

HOT JUNCTION ←

- G - Grounded
- U - Ungrounded
- UI -Ungrounded Isolated (Dual)
- E - Exposed
- GP - Grounded With Weld Pad
- UP - Ungrounded With Weld Pad

SHEATH "L" LENGTH (SPECIFY) ←

LEAD INSULATION & LENGTH (INCHES) ←

- PP - PVC-Solid
- GG - Fiberglass-Solid
- TT - Teflon-Solid
- PPST - PVC-Stranded
- TTST - Teflon-Stranded
- GGST - Fiberglass Stranded
- PPSHD - PVC Shielded
- PPSB - PVC W/SS Overbraid
- GGSB - Fiberglass W/SS Overbraid
- X - Other-Specify

LEAD WIRE GAUGE - 20 AWG STANDARD ←

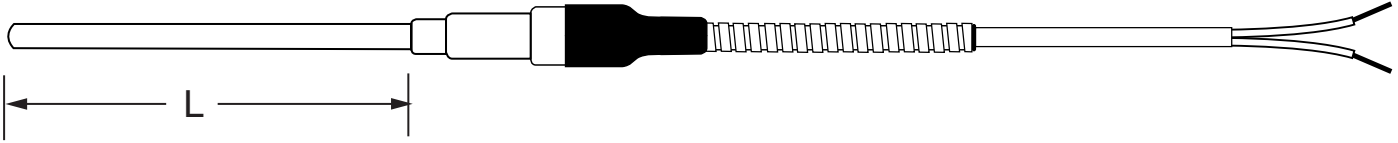
LEAD LENGTH IN INCHES ←

THERMOCOUPLE



Thermocouple Type 3

MgO Insulated Thermocouples With 20 AWG Armored Lead



ORDERING INFORMATION:----- 3 - J - 4 - K - U - 24 - TH - 36 - GG - 20 - 42

DESIGN TYPE ←

SHEATH MATERIAL ←

- P - 304SS Q - 310SS
- R - 316SS X - OTHER(SPECIFY)
- J - INCONEL 600

SHEATH DIA. ←

- 1 - .062 (1/16") 4 - .250 (1/4")
- 2 - .125 (1/8") 5 - .313 (5/16")
- 3 - .188 (3/16") 6 - .375 (3/8")

THERMOCOUPLE CALIBRATION TYPE ←

- J - Single Iron/Constantan R - Single Platinum/Platinum 13% Rhodium
- 2J - Dual Iron/Constantan 2R - Dual Platinum/Platinum 13% Rhodium
- K - Single Chromel/Alumel S - Single Platinum/Platinum 10% Rhodium
- 2K - Dual Chromel/Alumel 2S - Dual Platinum/Platinum 10% Rhodium
- E - Single Chromel/Constantan B - Single Platinum 30% Rhodium/Platinum 6% Rhodium
- 2E - Dual Chromel/Constantan C - Single (W5Re) Tungsten 5% Rhenium/(W26Re) Tungsten 26% Rhenium
- T - Single Copper/Constantan
- 2 - Dual Copper/Constantan

HOT JUNCTION ←

- G - Grounded E - Exposed
- U - Ungrounded GP - Grounded With Weld Pad
- UI - Ungrounded Isolated (Dual) UP - Ungrounded With Weld Pad

SHEATH "L" LENGTH (SPECIFY) ←

ARMOR ←

- SH - Stainless Steel
- PH - PVC Coated Galvanized
- PSH - PVC Coated Stainless Steel
- TH - Teflon Coated Stainless Steel

ARMOR LENGTH IN INCHES ←

LEAD INSULATION & LENGTH (INCHES) ←

- PP - PVC-Solid TTST - Teflon-Stranded
- GG - Fiberglass-Solid GGST - Fiberglass Stranded
- TT - Teflon-Solid PPSHD - PVC Shielded
- PPST - PVC-Stranded X - Other-Specify

LEAD WIRE GAUGE - 20 AWG STANDARD ←

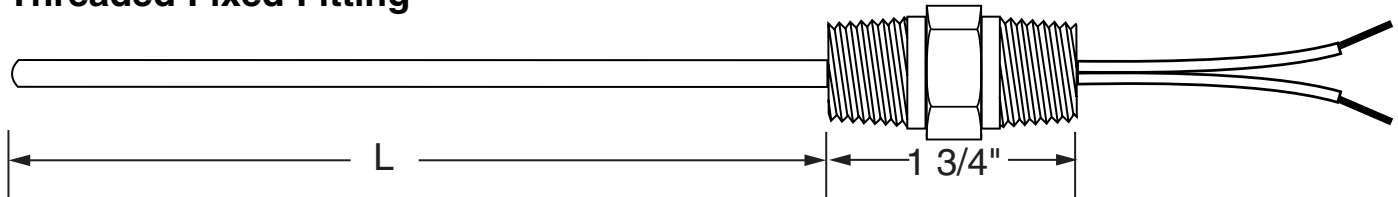
LEAD LENGTH IN INCHES ←

THERMOCOUPLE



Thermocouple Type 4

MgO Insulated Thermocouple With Double Threaded Fixed Fitting



ORDERING INFORMATION:----- 4 - R - 6 - 2K - U - 24

DESIGN TYPE ←

SHEATH MATERIAL ←

- P - 304SS Q - 310SS
- R - 316SS X - OTHER(SPECIFY)
- J - INCONEL 600

SHEATH DIA. ←

- 1 - .062 (1/16") 4 - .250 (1/4")
- 2 - .125 (1/8") 5 - .313 (5/16")
- 3 - .188 (3/16") 6 - .375 (3/8")

THERMOCOUPLE CALIBRATION TYPE ←

- J - Single Iron/Constantan R - Single Platinum/Platinum 13% Rhodium
- 2J - Dual Iron/Constantan 2R - Dual Platinum/Platinum 13% Rhodium
- K - Single Chromel/Alumel S - Single Platinum/Platinum 10% Rhodium
- 2K - Dual Chromel/Alumel 2S - Dual Platinum/Platinum 10% Rhodium
- E - Single Chromel/Constantan B - Single Platinum 30% Rhodium/Platinum 6% Rhodium
- 2E - Dual Chromel/Constantan C - Single (W5Re) Tungsten 5% Rhenium/(W26Re) Tungsten 26% Rhenium
- T - Single Copper/Constantan
- 2T - Dual Copper/Constantan

HOT JUNCTION ←

- G - Grounded E - Exposed
- U - Ungrounded GP - Grounded With Weld Pad
- UI - Ungrounded Isolated (Dual) UP - Ungrounded With Weld Pad

SHEATH "L" LENGTH (SPECIFY) ←

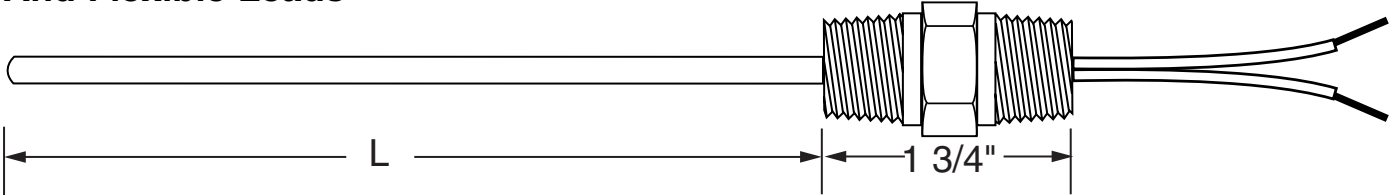
**Bare Color Coded Leads Standard. 1/2" NPT Standard.
Fittings Are Available In Other Sizes - Consult TMS.

THERMOCOUPLE



Thermocouple Type S4

MgO Insulated Thermocouple With Double Threaded Spring Load Bushing And Flexible Leads**



ORDERING INFORMATION:-----S4 - R - 6 - 2K - U - 24

DESIGN TYPE ←

SHEATH MATERIAL ←

- P - 304SS Q - 310SS
- R - 316SS X - OTHER(SPECIFY)
- J - INCONEL 600

SHEATH DIA. ←

- 1 - .062 (1/16") 4 - .250 (1/4")
- 2 - .125 (1/8") 5 - .313 (5/16")
- 3 - .188 (3/16") 6 - .375 (3/8")

THERMOCOUPLE CALIBRATION TYPE ←

- J - Single Iron/Constantan R - Single Platinum/Platinum 13% Rhodium
- 2J - Dual Iron/Constantan 2R - Dual Platinum/Platinum 13% Rhodium
- K - Single Chromel/Alumel S - Single Platinum/Platinum 10% Rhodium
- 2K - Dual Chromel/Alumel 2S - Dual Platinum/Platinum 10% Rhodium
- E - Single Chromel/Constantan B - Single Platinum 30% Rhodium/Platinum 6% Rhodium
- 2E - Dual Chromel/Constantan C - Single (W5Re) Tungsten 5% Rhenium/(W26Re)
- T - Single Copper/Constantan

HOT JUNCTION ←

- G - Grounded E - Exposed
- U - Ungrounded GP - Grounded With Weld Pad

SHEATH "L" LENGTH (SPECIFY) ←

**1/2" NPT Standard

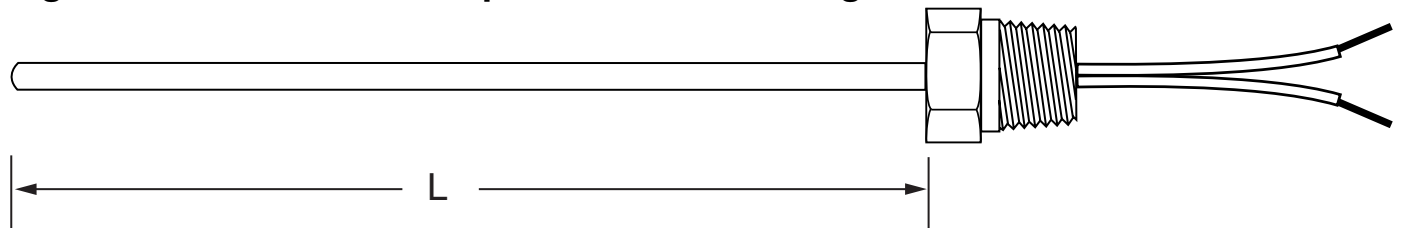
Fittings Are Available In Other Sizes - Consult TMS.

THERMOCOUPLE



Thermocouple Type 5

MgO Insulated Thermocouple With Fixed Fitting.



ORDERING INFORMATION:----- 5 - R - 4 - 2K - U - 24

DESIGN TYPE

SHEATH MATERIAL

- P - 304SS Q - 310SS
- R - 316SS X - OTHER(SPECIFY)
- J - INCONEL 600

SHEATH DIA.

- 1 - .062 (1/16") 4 - .250 (1/4")
- 2 - .125 (1/8") 5 - .313 (5/16")
- 3 - .188 (3/16") 6 - .375 (3/8")

THERMOCOUPLE CALIBRATION TYPE

- J - Single Iron/Constantan R - Single Platinum/Platinum 13% Rhodium
- 2J - Dual Iron/Constantan 2R - Dual Platinum/Platinum 13% Rhodium
- K - Single Chromel/Alumel S - Single Platinum/Platinum 10% Rhodium
- 2K - Dual Chromel/Alumel 2S - Dual Platinum/Platinum 10% Rhodium
- E - Single Chromel/Constantan B - Single Platinum 30% Rhodium/Platinum 6% Rhodium
- 2E - Dual Chromel/Constantan C - Single (W5Re) Tungsten 5% Rhenium/(W26Re) Tungsten 26% Rhenium
- T - Single Copper/Constantan
- 2T - Dual Copper/Constantan

HOT JUNCTION

- G - Grounded E - Exposed
- U - Ungrounded GP - Grounded With Weld Pad
- UI - Ungrounded Isolated (Dual) UP - Ungrounded With Weld Pad

SHEATH "L" LENGTH (SPECIFY)

1/2" NPT Standard.

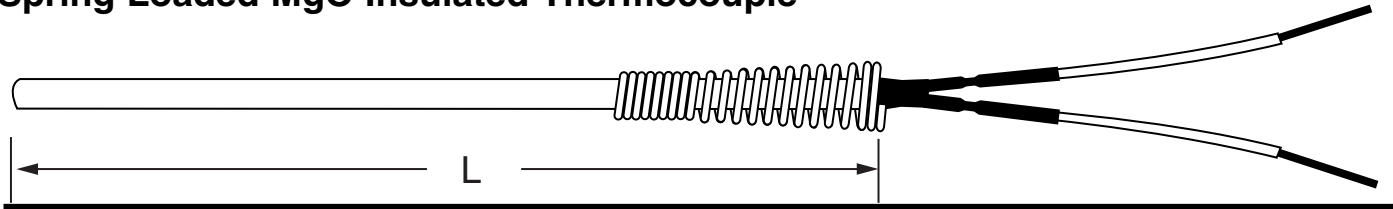
Fittings Are Available In Other Sizes - Consult TMS.

THERMOCOUPLE



Thermocouple Type 6

****Spring Loaded MgO Insulated Thermocouple**



ORDERING INFORMATION:----- 6 - R - 4 - 2J - U - 18

DESIGN TYPE ←

SHEATH MATERIAL ←

- P - 304SS Q - 310SS
- R - 316SS X - OTHER(SPECIFY)
- J - INCONEL 600

SHEATH DIA. ←

- 1 - .062 (1/16") 4 - .250 (1/4")
- 2 - .125 (1/8") 5 - .313 (5/16")
- 3 - .188 (3/16") 6 - .375 (3/8")

THERMOCOUPLE CALIBRATION TYPE ←

- | | |
|-------------------------------|--|
| J - Single Iron/Constantan | R - Single Platinum/Platinum 13% Rhodium |
| 2J - Dual Iron/Constantan | 2R - Dual Platinum/Platinum 13% Rhodium |
| K - Single Chromel/Alumel | S - Single Platinum/Platinum 10% Rhodium |
| 2K - Dual Chromel/Alumel | 2S - Dual Platinum/Platinum 10% Rhodium |
| E - Single Chromel/Constantan | B - Single Platinum 30% Rhodium/Platinum 6% Rhodium |
| 2E - Dual Chromel/Constantan | C - Single (W5Re) Tungsten 5% Rhenium/(W26Re) Tungsten 26% Rhenium |
| T - Single Copper/Constantan | |
| 2T - Dual Copper/Constantan | |

HOT JUNCTION ←

- | | |
|---------------------------------|-------------------------------|
| G - Grounded | E - Exposed |
| U - Ungrounded | GP - Grounded With Weld Pad |
| UI - Ungrounded Isolated (Dual) | UP - Ungrounded With Weld Pad |

SHEATH "L" LENGTH (SPECIFY) ←

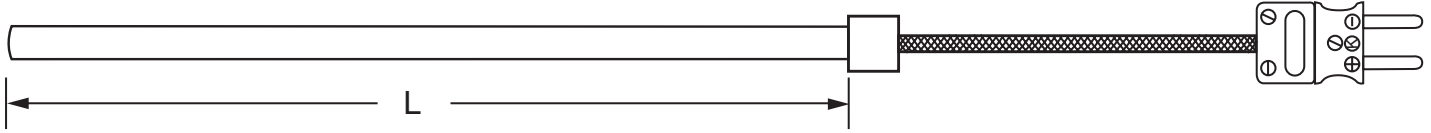
**3" Flexible Leads Standard.

THERMOCOUPLE



Thermocouple Type 7

****MgO Insulated Thermocouples W/20 Gauge Extension Lead And Male Plug**



ORDERING INFORMATION:----- 7 - R - 4 - J - U - 12 - PP20-36

DESIGN TYPE ←

SHEATH MATERIAL ←

- P - 304SS Q - 310SS
- R - 316SS X - OTHER(SPECIFY)
- J - INCONEL 600

SHEATH DIA. ←

- 1 - .062 (1/16") 4 - .250 (1/4")
- 2 - .125 (1/8") 5 - .313 (5/16")
- 3 - .188 (3/16") 6 - .375 (3/8")

THERMOCOUPLE CALIBRATION TYPE ←

- J - Single Iron/Constantan R - Single Platinum/Platinum 13% Rhodium
- 2J - Dual Iron/Constantan 2R - Dual Platinum/Platinum 13% Rhodium
- K - Single Chromel/Alumel S - Single Platinum/Platinum 10% Rhodium
- 2K - Dual Chromel/Alumel 2S - Dual Platinum/Platinum 10% Rhodium
- E - Single Chromel/Constantan B - Single Platinum 30% Rhodium/Platinum 6% Rhodium
- 2E - Dual Chromel/Constantan
- T - Single Copper/Constantan

HOT JUNCTION ←

- G - Grounded E - Exposed
- U - Ungrounded GP - Grounded With Weld Pad
- UI -Ungrounded Isolated (Dual) UP - Ungrounded With Weld Pad

SHEATH "L" LENGTH (SPECIFY) ←

LEAD INSULATION & LENGTH (INCHES) ←

- PP - PVC-Solid GGST - Fiberglass Stranded
- GG - Fiberglass-Solid PPSHD - PVC Shielded
- TT - Teflon-Solid PPSB - PVC W/SS Overbraid
- PPST - PVC-Stranded GGSB - Fiberglass W/SS Overbraid
- TTST - Teflon-Stranded X - Other-Specify

**Provided With Standard Size Connectors Unless Otherwise Specified.

***If Mating Female Jack Is Required, Add "FJ" After Complete Part Number.

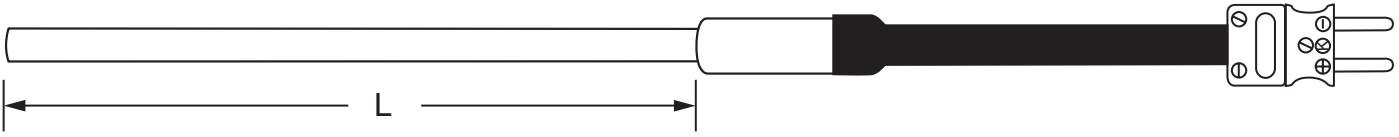
EX: 7R42KU12-PP20-36-FJ.

THERMOCOUPLE



Thermocouple Type 8

****MgO Insulated Thermocouples With Armored 20 Gauge Extension Lead And Male Plug**



ORDERING INFORMATION:----- 8 - R - 4 - 2K - U - 18 - SH36 - PP20-36

DESIGN TYPE ←

SHEATH MATERIAL ←

- P - 304SS Q - 310SS
- R - 316SS X - OTHER(SPECIFY)
- J - INCONEL 600

SHEATH DIA. ←

- 1 - .062 (1/16") 4 - .250 (1/4")
- 2 - .125 (1/8") 5 - .313 (5/16")
- 3 - .188 (3/16") 6 - .375 (3/8")

THERMOCOUPLE CALIBRATION TYPE ←

- J - Single Iron/Constantan R - Single Platinum/Platinum 13% Rhodium
- 2J - Dual Iron/Constantan 2R - Dual Platinum/Platinum 13% Rhodium
- K - Single Chromel/Alumel S - Single Platinum/Platinum 10% Rhodium
- 2K - Dual Chromel/Alumel 2S - Dual Platinum/Platinum 10% Rhodium
- E - Single Chromel/Constantan B - Single Platinum 30% Rhodium/Platinum 6% Rhodium
- 2E - Dual Chromel/Constantan C - Single (W5Re) Tungsten 5% Rhenium/(W26Re)
- T - Single Copper/Constantan Tungsten 26% Rhenium
- 2T - Dual Copper/Constantan

HOT JUNCTION ←

- G - Grounded E - Exposed
- U - Ungrounded GP - Grounded With Weld Pad
- UI - Ungrounded Isolated (Dual) UP - Ungrounded With Weld Pad

SHEATH "L" LENGTH (SPECIFY) ←

ARMOR MATERIAL ←

- SH - Stainless THS - Teflon Coated Stainless
- PH - PVC Coated Galvanized X - Other-Specify
- PHS - PVC Coated Stainless

LEAD INSULATION & LENGTH (INCHES) ←

- PP - PVC-Solid GGST - Fiberglass Stranded
- GG - Fiberglass-Solid PPSHD - PVC Shielded
- TT - Teflon-Solid X - Other-Specify
- PPST - PVC-Stranded
- TTST - Teflon-Stranded

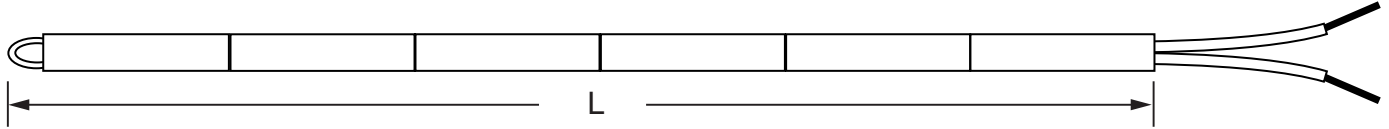
**Provided With Standard Size Connectors Unless Otherwise Specified.
 ***If Mating Female Jack Is Required, Add "FJ" After Complete Part Number.
EX: 7SR42KU12-PP20-36-FJ.

THERMOCOUPLE



Thermocouple Type 10

**Beaded Thermocouples



ORDERING INFORMATION:----- 10 - K - 14 - 24

DESIGN TYPE ←

THERMOCOUPLE CALIBRATION TYPE ←

- | | |
|----------------------------|-------------------------------|
| J - Single Iron/Constantan | E - Single Chromel/Constantan |
| JJ - Dual Iron/Constantan | EE - Dual Chromel/Constantan |
| K - Single Chromel/Alumel | T - Single Copper/Constantan |
| KK - Dual Chromel/Alumel | TT - Dual Copper/Constantan |

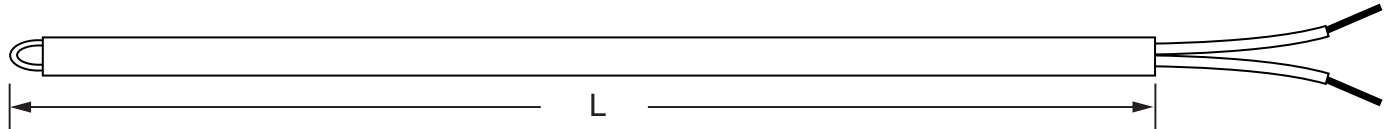
STANDARD WIRE SIZES (AWG) ←

8, 14, 20, 24 Other Sizes Available

CERAMIC INSULATOR LENGTH ←

***Insulator Material Unless Otherwise Specified Are Mullite for J, K, E And T Thermocouples.
Other Materials Are Available. Consult TMS.

**Noble Metal Thermocouples



ORDERING INFORMATION:----- 10 - R - 24 - 36

DESIGN TYPE ←

THERMOCOUPLE CALIBRATION TYPE ←

- | | |
|-----------------------------------|--|
| R - Platinum/Platinum 13% Rhodium | B - Platinum 30% Rhodium/Platinum 6% Rhodium |
| S - Platinum/Platinum 10% Rhodium | C - Tungsten 5% Rhenium/Tungsten 26% Rhenium |

WIRE AWG (24 GAUGE STANDARD) ←

CERAMIC INSULATOR LENGTH ←

***Other Wire Gauges Available. Consult TMS.

**Insulators Are Alumina Unless Otherwise Specified.

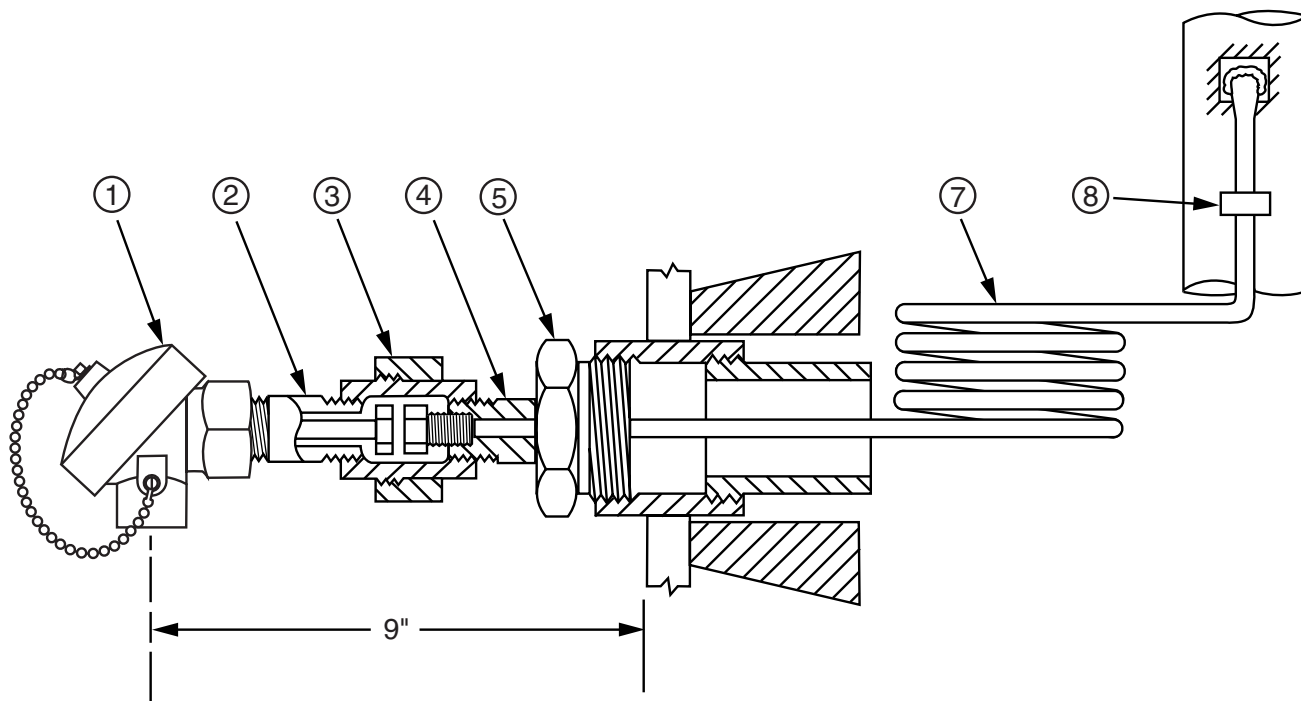
THERMOCOUPLE



Tube Skin Thermocouple Assemblies

Tube skin thermocouple assemblies are used to provide an efficient means of measuring the temperature of vessel walls. Unless otherwise specified, grounded hot junctions are provided to insure quick response. The thermocouples can be designed with an expansion loop to provide flexibility. Weld pads are provided and can be curved to the radius of the vessel to be welded to.

Tube skin thermocouples can be manufactured as shown in the following information or can be manufactured to your specifications. Please consult TMS with any changes to the following design(s) or with your individual specifications.

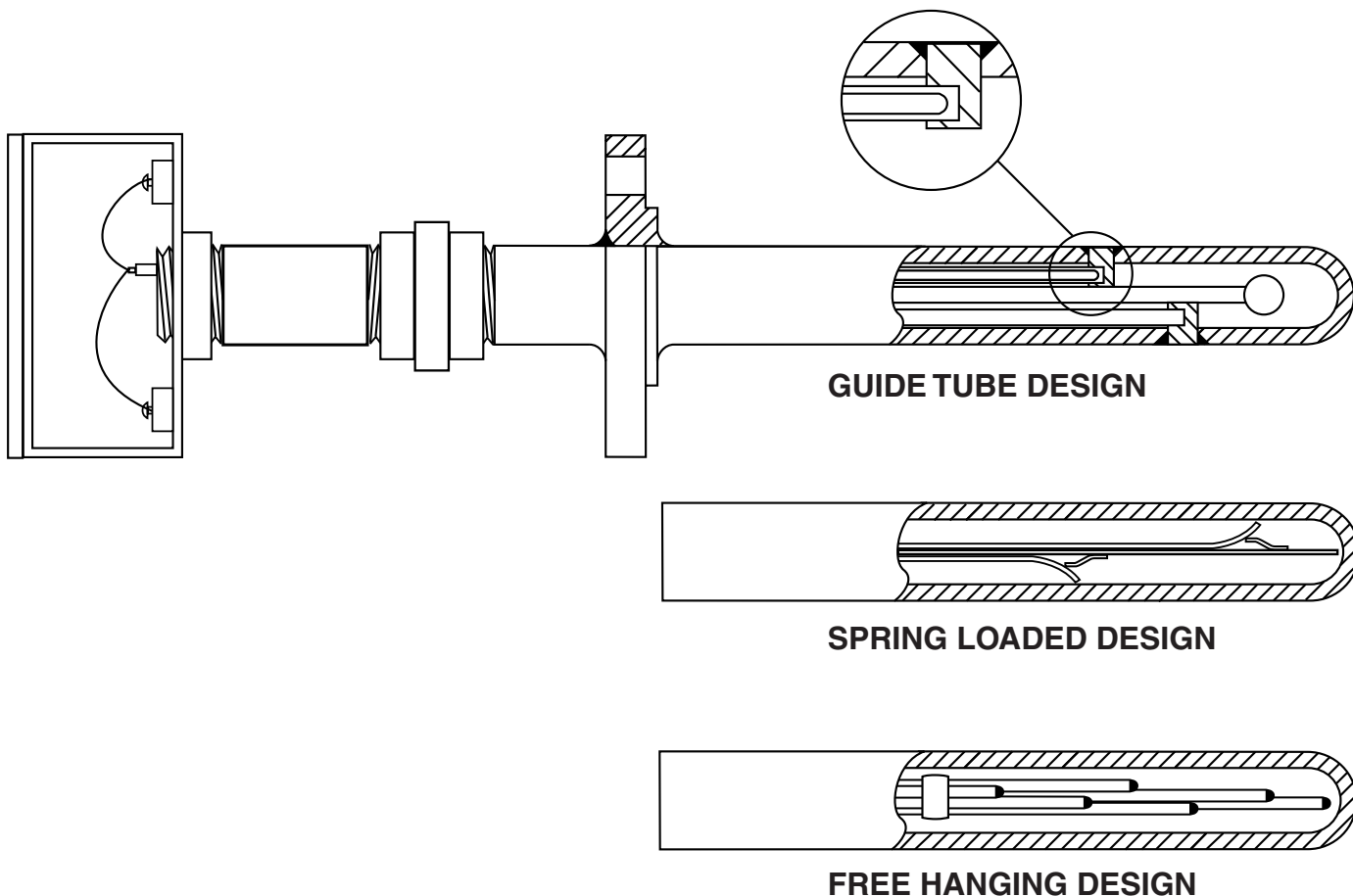


DETAIL NO.	DESCRIPTION
1.	Terminal Head Assembly
2. 3. 4.	Nipple-Union-Nipple 3/4"
5.	Reducing Bushing 1 1/2" X 3/4"
7.	Thermocouple Assembly
8.	Welding Clips (2)

ORDERING INFORMATION

PART NO.	T/C DIAMETER	T/C CALIBRATION	LENGTH	SHEATH MATERIAL
TS - 100	.188 - 3/16"	Chromel/Alumel	Specify	Specify
TS - 101	.188 - 3/16"	Iron/Constantan	Specify	Specify
TS - 102	.250 - 1/4"	Iron/Constantan	Specify	Specify
TS - 103	.250 - 1/4"	Chromel/Alumel	Specify	Specify

Multipoint Thermocouple Assemblies



Multipoint Assemblies are manufactured in three basic designs. Due to the many variations that are possible with these designs no ordering information is provided within this literature. Please consult TMS with your individual specifications for these items.

Guide Tube Design - Thermocouple elements are bottomed into a block which is an integral part of the protection tube assembly. The blocks provide increased sensitivity to temperature change. Individual thermocouple elements are easily replaceable without the need to disassemble the entire thermocouple assembly.

Spring Loaded Design - Spring Loaded design forces thermocouple hot junction to come in contact with the inner wall of the thermocouple protection tube providing quick response to temperature change.

Free Hanging Design - Thermocouple elements are manufactured to specified lengths and are secured to a Stainless Steel strap by clamps. The Multipoint thermocouple bundle hangs freely inside the protection tube.

Other designs and configurations are available. Consult TMS.

PROTECT THERMOCOUPLES IN SERVICE - Evaporation, diffusion, oxidation, corrosion, and contamination induce EMF drift due to their effect on the composition of the thermocouple alloys. In as much as these environmental factors are destructive to all common thermocouple alloys, it is essential that proper protection be provided anytime adverse conditions are encountered. In many applications this can be done by using sheath style elements. If bare wire elements are used, the thermoelement must be properly installed in suitable protection tubes or thermowells. When the interior of the protection tube or thermowell is free of sulfur bearing medias and when they are of the proper diameter to length ratios to permit adequate ventilation, they serve very well in overcoming the harmful effects of a corrosive atmosphere.

WIRE SIZE - It is generally true that heavy gauge thermocouples are more stable at high temperatures than finer gauge thermocouples. In many applications, a heavy gauge thermocouple will not satisfy requirements for flexibility and response. A compromise must then be struck between long-term stability of heavier gauges and greater versatility of smaller gauges. Where high temperature stability is necessary, use the largest practical wire size consistent with the other requirements of the job.

LOCATION INSTALLATION - The location of installation of a thermocouple should insure that the temperatures being measured are representative of the equipment and/or media. Direct flame impingement on the thermocouple does not provide a representative temperature.

IMMERSION DEPTH - Since heat conducted away from the hot junction causes the thermocouple to indicate a lower temperature, provide for sufficient depth of immersion of the element into the media to minimize heat transfer along the protection tube. A minimum immersion of ten times the outside diameter of the protection tube should be used.

Under certain conditions, inhomogeneities may gradually develop in a pair of thermocouple wires due to oxidation, corrosion, evaporation, contamination or metallurgical changes. A change in depth of immersion, which shifts such inhomogeneous wire into a steep temperature gradient zone can alter the thermocouple output and produce incorrect readings. Avoid changing the immersion depth of a thermocouple after it has been in service.

EFFECT OF HEATING CYCLES - For maximum accuracy, a thermocouple should be used to control a single temperature or successively higher temperatures only. For various reasons, this procedure cannot always be followed. In many installations, thermocouples continually traverse a broad range of temperatures with adequate results. Errors that arise out of cyclic heating are analogous to those generated by changes in immersion and may range from two or three degrees F. for elements in good condition, to many degrees for thermocouples that are corroded. The type of heating cycle and condition of the thermocouple affects the accuracy obtainable in a specific location. Where cyclic heating cannot be avoided, use top condition thermocouples for maximum accuracy.

PREVENTIVE MAINTENANCE - Thermocouples, protection tubes, and extension wires should be checked periodically. Experience largely determines the frequency of inspection but once a month is normally sufficient.

Check out extension wire by making certain that it meets the established external resistance required.

THERMOCOUPLE



Damaged or burnt out protection tubes and thermowells should be replaced to prevent damage to the thermocouple.

Thermocouples should be checked in place if possible. If removing the element is necessary, it should be reinserted to the same depth or deeper to avoid errors arising from placing an inhomogeneous segment of wire in a steep temperature gradient.

TROUBLE SHOOTING

When a thermocouple is suspected of giving incorrect readings, the following steps may be taken to isolate the source of error.

1. Circuit - The first step is to check the polarity of the thermocouple circuit and all connections. The positive leg (wire) should be properly connected to the positive side of the instrument. The negative leg (wire) should be properly connected to the negative extension wire which should be connected to the negative side of the instrument. A check at these points will save delays in production. To identify the positive and negative wires follow the following table. Most thermocouples are color coded per ANSI standards. Use of a magnet can check thermocouple types J and K as one leg (wire) is magnetic.

ANSI TYPE	MAGNETIC	NEGATIVE/POSITIVE ANSI COLOR CODE	THERMOCOUPLE ALLOY
J	YES NO	JP - WHITE JN - RED	IRON CONSTANTAN
K	NO YES	KP - YELLOW KN - RED	CHROMEL ALUMEL
E	NO NO	EP - PURPLE EN - RED	CHROMEL CONSTANTAN
T	NO NO	TP - BLUE TN - RED	COPPER CONSTANTAN
R	NO NO	RP - BLACK RN - RED	PLATINUM 13% RHODIUM PURE PLATINUM
S	NO NO	SP - BLACK SN - RED	PLATINUM 10% RHODIUM PURE PLATINUM

INSTRUMENT - If the circuit checks out, the next step is to check the instrument. If a millivolt type meter is used, it should first be checked as to room temperature setting (cold junction compensation). This is done by removing one of the extension wires, either positive or negative, from the meter and observing the meter reading. It should coincide with the room temperature.

If further testing is required, or if the instrument in question is a potentiometer, the working pyrometer set up should be checked by comparing its readings against those obtained with a test thermocouple of known accuracy. In making checks this way, it is important that the test thermocouple be inserted along side the working thermocouple with the hot junction weld beads of both as close as possible. It is also essential that the temperature of both the working and the test meter be the same.

If the test meter reading agrees with that indicated by the working meter the source of trouble is not in the pyrometry circuit but is in the furnace itself. If the test meter reading does not agree with the working meter reading, the following checks should be made to isolate the trouble.

THERMOCOUPLE - Severely corroded or oxidized thermocouples are always a possibility of trouble. Changes in wire composition can result from corrosion and contamination by foreign elements. Impurities such as sulfur and iron plus other factors picked up from furnace refractories, oxide scale, brazing alloys and fluxes constitute possible sources of drift away from initial calibration.

To check the working thermocouple, hook it to the test meter of known accuracy and observe the reading. If the reading is the same as that previously obtained from the test thermocouple of known accuracy, then the working thermocouple is not the problem.

METER AND EXTENSION WIRES - To check the working meter and extension wires, connect the extension wires to the test thermocouple of known accuracy and observe the temperature reading. If the reading is different from that obtained with the test meter, the trouble is either in the extension wires or in the working meter.

EXTENSION WIRE RESISTANCE - If the working meter is the millivolt type, it will have been calibrated for a certain external resistance. Accordingly, the extension wire loop should be checked to make sure that it meets this established external resistance required.

The above checks are intended only as elementary guides in trying to pinpoint the possible cause of erroneous readings. If the cause of erroneous readings can be definitely localized in the thermocouple itself, it should be removed and inspected. A visual inspection, plus a few tests that can be made with hand instruments, will often reveal the condition which caused the thermocouple wires to be out of calibration. Severely corroded or oxidized thermocouples should be replaced. It is usually more economical to replace the thermocouple element than to risk loss of productivity, product or equipment through inaccurate temperature measurement.