Duro-Sense Corporation

THERMOCOUPLE AND RTD TEMPERATURE SENSORS, THERMOWELLS WIRE, HARDWARE & ACCESSORIES

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869 Sandhill Avenue Carson, California 90746 | 310-533-6877

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BASE METAL & INDUSTRIAL THERMOCOUPLES

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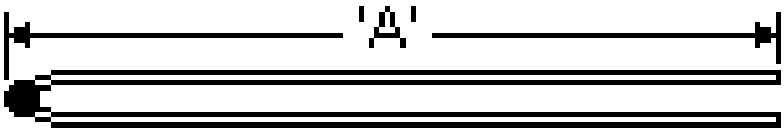
BASE METAL THERMOCOUPLES

Thermocouple Ordering Information

Bare Element



Part #: **BE-□□□-□□□-□□-□**

Calibration (Table 1)	Wire Gauge (Table 2)	Length (inches)	SP*	Cold End Termination (Table 3)

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Calibration

P/N	Description
J	Type 'J'
K	Type 'K'
T	Type 'T'
E	Type 'E'
N	Type 'N'
X	Special

Table 2
Wire Gauge

P/N	Description
8	8 Gauge
14	14 Gauge
16	16 Gauge
18	18 Gauge
20	20 Gauge
X	Special

Table 3
Cold End Termination

P/N	Description
A	Stripped Leads Only
B	Ceramic Terminal Block
C	Standard Plug *
D	Jab-In Plug*
E	Hi-Temp Plug *
F	Hi-Temp Jab-In Plug*
G	Ceramic Plug*
H	Ceramic Jab-In Plug*
J	Standard Jack *
K	Jab-In Jack*
L	Hi-Temp Jack *
M	Hi-Temp Jab-In Jack*
N	Ceramic Jack*
P	Ceramic Jab-In Jack*
Q	Spade Lug †
R	Ring Lug †
X	Special

* = Not available on 8 gauge
† = Not available on 8 or 14 gauge

Example: **BE-K14-12-SP-C**

Bare Element Style, Type 'K', 14 Gauge, 12" active length, special limits of error, standard male connector.

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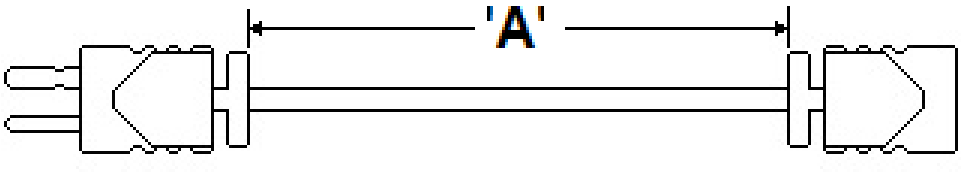
BASE METAL THERMOCOUPLES

Thermocouple Ordering Information

Flexible Extension



Part #: FE-□-□□-□-□□□-□-□

Calibration (Table 1)	Wire Gauge (Table 2)	Wire Insulation (Table 3)	Length (inches)	Termination 'A' (Table 4)	Termination 'B' (Table 5)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Calibration

P/N	Description
J	Type 'J'
K	Type 'K'
T	Type 'T'
E	Type 'E'
N	Type 'N'
X	Special

Table 2
Wire Gauge

P/N	Description
14	14 Gauge
16	16 Gauge
20	20 Gauge
24	24 Gauge
28	28 Gauge
30	30 Gauge
X	Special

Table 3
Wire Insulation

P/N	Description
A	P/P
B	TEX/TEX
C	TEX/TEX-SS
D	KFT/KFT
E	GB/GB
F	GB/GB-SS
G	HTGB/HTGB
H	HTGB/HTGB-SS
X	SPECIAL

Table 4
Termination 'A'

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Miniature Plug
D	Standard Jack
E	Hi-Temp Jack
F	Miniature Jack
G	Spade Lug
H	Ring Lug
J	Stripped Leads Only
X	Special

Table 5
Termination 'B'

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Miniature Plug
D	Standard Jack
E	Hi-Temp Jack
F	Miniature Jack
G	Spade Lug
H	Ring Lug
J	Stripped Leads Only
X	Special

Example: **FE-J-20-E-300-A-D**

Flexible Extension Style. Type 'J', 20 Gauge, Fiberglass insulation, 300" active length, Standard male plug termination at one end, Standard female jack termination at other end.

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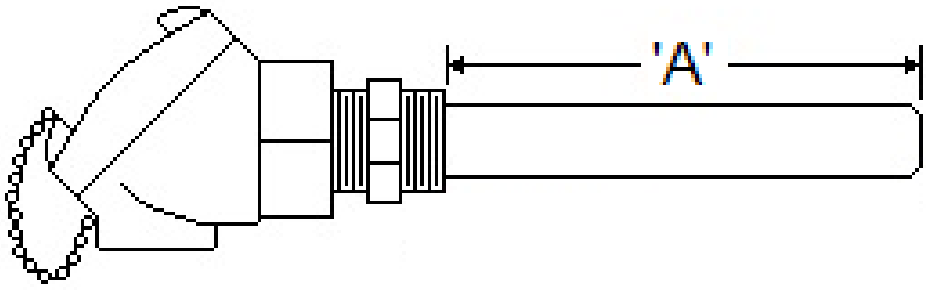
BASE METAL THERMOCOUPLES

Thermocouple Ordering Information

Industrial Assembly



Part #: **IA-□□□-PT-□-□-□□□□-□-□-□**

- Calibration (Table 1)
- Wire Gauge (Table 2)
- Material (Table 3)
- Diameter (Table 4)
- Length (inches)
- SP*
- Process Fitting (Table 5)
- Cold End Termination (Table 6)

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Calibration

P/N	Description
J	Type 'J'
K	Type 'K'
T	Type 'T'
E	Type 'E'
N	Type 'N'
X	Special

Table 2
Wire Gauge

P/N	Description
8	8 Gauge
14	14 Gauge
16	16 Gauge
18	18 Gauge
20	20 Gauge
X	Special

Table 3
Material

P/N	Description
1	Silicon Carbide
2	Mullite
3	Alumina
4	Inconel
5	304 SS
6	316 SS
7	310 SS
8	321 SS
9	446 SS
X	Special

Table 4
Diameter

P/N	Description
1	1/4" †
2	1/4" IPS †
3	3/8" *
4	3/8" IPS
5	1/2"
6	1/2" IPS
7	3/4"
8	3/4" IPS
9	1" IPS
X	Special

Table 5
Mounting Fitting

P/N	Description
A	1/4" NPT †
B	3/8" NPT †
C	1/2" NPT
D	3/4" NPT
E	1" NPT
F	1 ¼" NPT
G	1 ½" NPT
H	None
X	Special

Table 6
Cold End Termination

P/N	Description
A	Cast Aluminum Head
B	Miniature Aluminum Head
C	Cast Iron Head
D	Polypropylene Head
E	Miniature Plastic Head
F	Explosion Proof Head
G	Canister Style Head
H	Terminal Block
X	Special

† = Not available on 8 or 14 gauge
*** = Not available on 8 gauge**

Example:

Single Element: **IA-K14-PT-2-5-12-C-A**

Industrial Assembly Style, Type 'K', 14 gauge, ½" OD Mullite Protection Tube, 12" active length, ½" NPT Process Fitting, Cast Aluminum Head.

Dual Element: **IA-2K14-PT-2-5-12-C-A**

Industrial Assembly Style, Type 'K', 14 gauge, ½" OD Mullite Protection Tube, 12" active length, ½" NPT Process Fitting, Cast Aluminum Head.

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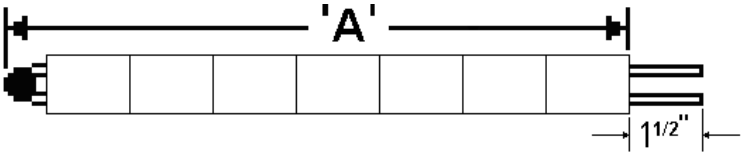
BASE METAL THERMOCOUPLES

Thermocouple Ordering Information

Insulated Element



Part #: IE-□□□-□□-□□□-□□-□

Calibration (Table 1)	Wire Gauge (Table 2)	Insulator Shape (Table 3)	Length (inches)	SP*	Cold End Termination (Table 4)

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Calibration

P/N	Description
J	Type 'J'
K	Type 'K'
T	Type 'T'
E	Type 'E'
N	Type 'N'
X	Special

Table 2
Wire Gauge

P/N	Description
8	8 Gauge
14	14 Gauge
16	16 Gauge
18	18 Gauge
20	20 Gauge
X	Special

Table 3
Insulator Shape

P/N	Description
OV	Oval
RO	Round

Table 4
Cold End Termination

P/N	Description
A	Standard Plug *
B	Jab-In Plug*
C	Hi-Temp Plug*
D	Hi-Temp Jab-In Plug*
E	Ceramic Plug*
F	Ceramic Jab-In Plug*
G	Miniature Plug†
H	Miniature Hi-Temp Plug†
J	Miniature Ceramic Plug†
K	Standard Jack *
L	Jab-In Jack*
M	Hi-Temp Jack *
N	Hi-Temp Jab-In Jack*
P	Ceramic Jack*
Q	Ceramic Jab-In Jack*
R	Miniature Jack†
S	Miniature Hi-Temp Jack†
T	Miniature Ceramic Jack†
U	Ceramic Terminal Block
V	Spade Lug †
W	Ring Lug †
Y	Stripped Leads Only
X	Special

* = Not available on 8 gauge
† = Not available on 8 or 14 gauge

Example:

Single Element: **IE-K14-OV-12-SP-C**

Insulated Element Style, Type 'K', 14 gauge, oval insulators,
12" active length, special limits of error. Standard male connector.

Dual Element: **IE-2K14-RO-12-SP-CC**

Insulated Element Style, Type 'K', 14 gauge, round insulators,
12" active length, special limits of error. Standard male connectors.

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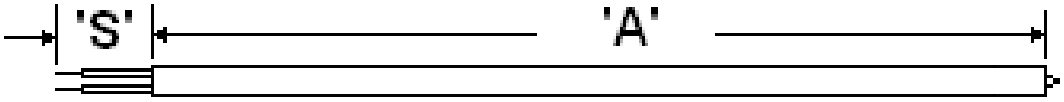
BASE METAL THERMOCOUPLES

Thermocouple Ordering Information

Loadcouple



Part #:LC-□□□-□-□□□/□□□-□□□-□□□-□

Wire Gauge	S*	Calibration** (Table 1)	Wire Insulation (Table 2)	Active Length (inches)	Strip Length (inches)	Cold End Termination (Table 3)

* = If wire is stranded, enter the letter 'S' in this field.

****** = If Special Limits of Error wire is required, enter the calibration letter twice in this field. (Example: "JJ" or "KK")

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 2
Leadwire Type

P/N	Description
TEX/TEX	FEP Teflon
TEX/TEX-SS	FEP w/ SS Overbraid
PFA/PFA	PFA Teflon
PFA/PFA-SS	PFA w/ SS Overbraid
KFT/KFT	Kapton Fused Tape
KFT/KFT-SS	Kapton w/ SS Overbraid
GB/GB	Fiberglass
GB/GB-SS	Fiberglass w/ SS Overbraid
HTGB/HTGB	Hi-Temp Fiberglass
HTGB/HTGB-SS	Hi-Temp Fiberglass w/ SS Overbraid
VSF/VSF	Vitreous Silica Fiber
VSF/VSF-SS	Vitreous Silica Fiber w/ SS Overbraid
CF/CF	Ceramic Fiber
CF/CF-SS	Ceramic Fiber w/ SS Overbraid
CF/CF-IB	Ceramic Fiber w/ Inconel Overbraid
XXX/XXX	Special

Table 3
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Ceramic Plug
D	Miniature Plug
E	Miniature Hi-Temp Plug
F	Miniature Ceramic Plug
G	Standard Jack
H	Hi-Temp Jack
J	Ceramic Jack
K	Miniature Jack
L	Miniature Hi-Temp Jack
M	Miniature Ceramic Jack
N	Spade Lug
P	Ring Lug
R	Stripped Leads Only
X	Special

Example: **LC-20-JJ-GB/GB-SS-12-1-R**

20 Gauge, Type 'J', Special Limits of Error, Fiberglass Insulation w/ SS Overbraid
12" Active Length, 1" Strip Length, Stripped leads Only.

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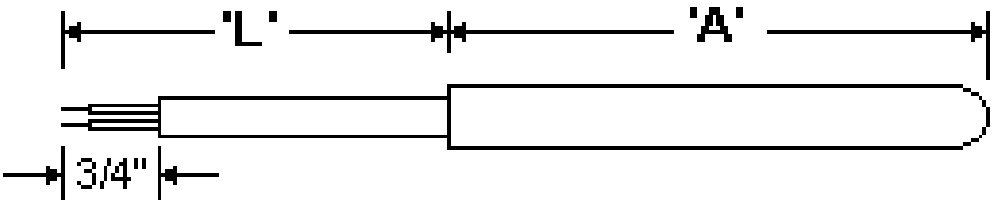
BASE METAL THERMOCOUPLES

Thermocouple Ordering Information

Wire & Tube Assembly



Part #:WT-□-□□-□□□-□□□-□-□□□□-□□-□□

Calibration (Table 1)	Junction (Table 2)	Sheath Diameter (Table 3)	Length (inches)	Sheath Material (Table 4)	Lead Length (inches)	Wire Type (Table 5)	SP*	Cold End Termination (Table 6)

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1 Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
8	Type 'N'
X	Special

Table 2 Junction

P/N	Description
E	Exposed
G	Grounded
U	Ungrounded
EE	Dual Exposed
GG	Dual Grounded
UU	Uncommon-Ungrounded
CU	Common-Ungrounded

Table 3 Sheath Diameter

P/N	Description
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
500	.500 inches
XXX	Special

Table 4 Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
X	Special

Table 5 Leadwire Type

P/N	Description
A	GB/GB
B	GB/GB-SS
C	TEX/TEX
D	TEX/TEX-SS
E	TEX/TW/ALM/TEX
F	KFT/KFT
G	HTGB/HTGB
X	Special

For a physical description of wire construction, refer to thermocouple wire page in catalog.

Lead wire is solid conductor on all assemblies unless otherwise specified.

Table 6 Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Ceramic Plug
D	Miniature Plug
E	Miniature Hi-Temp Plug
F	Miniature Ceramic Plug
G	Standard Jack
H	Hi-Temp Jack
J	Ceramic Jack
K	Miniature Jack
L	Miniature Hi-Temp Jack
M	Miniature Ceramic Jack
N	Spade Lug
P	Ring Lug
R	Stripped Leads Only
X	Special

Example:

Single Element WT-J-G-250-12-2-48A-D

.250" ϕ, Type 'J', 304 SS sheath, grounded junction,12" active length, 48" lead length, 20S-J-GB/GB-SS wire type, miniature male connector.

Dual Element: WT-2J-GG-250-12-2-48A-DD

.250" ϕ, Type 'J', 304 SS sheath, dual grounded junctions,12" active length, 48" lead length, 20S-J-GB/GB-SS wire type, dual miniature male connectors.

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PROTECTION TUBES

Both ceramic and metal protection tubes are used to protect the temperature sensor from harsh and/or caustic environments. Unlike thermowells, protection tubes are not primarily designed for pressure-tight applications. Protection tube construction styles are more limited than thermowells, but they tend to be more economical. They can also offer the advantages of corrosion resistance and, in some cases, higher temperature capabilities.

Protection Tube material selected for installation is governed primarily by temperature, corrosion resistance to gas or liquid and mechanical strength.

MATERIAL SELECTION GUIDE

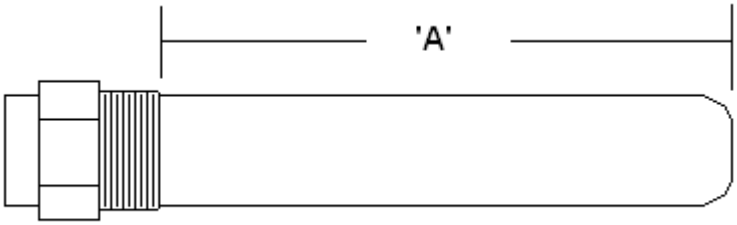
Material	Composition	Temperature Rating	Remarks
Alumina	99.8% Recrystalized Alumina Oxide	3450°F (1899°C)	Excellent electrical insulation properties. Fair resistance to thermal & mechanical shock. Impervious to gases at high temperature. Creeps (sags) at 3452°F (1900°C).
Hexoloy SA	Sintered Alpha Silicon Carbide	3000°F (1650°C)	Excellent corrosion resistance. High thermal conductivity. High thermal shock resistance. Good mechanical strength. Does not creep (sag). Attacked by halides, fused caustics & ferrous metals.
Mullite	63% Alumina	3100°F (1700°C)	Excellent electrical insulation properties. Impervious to gases at high temperatures. Poor thermal & mechanical shock resistance. Attacked by halides. Contains silica. Creeps (sags) at 3092°F (1700°C)..
Silicon Carbide	90% Silicon Carbide, 9% Silicon Dioxide, 1% Alumina Oxide	3000°F, (1650°C)	Can withstand direct flame impingement. Good thermal shock resistance. Permeable. Because of it's permeability, an inner tube of Alumina or Mullite is recommended when used in atmosphere.
Aluminum	Various Grades	1000°F (538°C)	Good thermal conductivity. Good mechanical strength. Oxidation can arise when not anodized or protected.
Brass	Various Grades	1000°F (538°C)	Good thermal conductivity. Good mechanical strength.
Carbon Steel	99% Iron, 0.8% Manganese, 0.2% Carbon, Trace amounts of Phosphorus & Sulfur	1000°F (538°C)	Temperature rating based on use in non-oxidizing environments. Areas of usage include molten metals and petroleum refinery applications.
Cast Iron		1300°F (708°C)	Temperature rating based on use in oxidizing environments. Can be used up to 1600°F (871°C) under reducing conditions.
Copper	Various Grades	500°F (260°C)	Excellent thermal conductivity. Poor mechanical strength.
Hastelloy B	67% Nickel, 28% Molybdenum, 10% Silicon, 2% Iron, 1% Cobalt, 1% Chromium, 1% Manganese, 0.02% Carbon	1500°F (815°C) In inert or vacuum atmospheres 1000°F (538°C) - In air	Excellent resistance to pitting & stress-corrosion cracking, Suitable for most chemical applications. Excellent in Hydrochloric Acid
Hastelloy C	62.5% Nickel, 16% Chromium, 15.5% Molybdenum, 3% Iron, 2% Cobalt, 1% Manganese, .08% Silicon, .015Carbon	1900°F (1038°C)	Temperature rating based on use in oxidizing environments. Exceptional resistance to a wide variety of chemical environments.

MATERIAL SELECTION GUIDE (continued)

Inconel 600	76% Nickel, 16% Chromium, 8% Iron	2100°F (1149°C) under oxidizing conditions 1900°F, (1038°C) under reducing conditions	Excellent corrosion & oxidation resistance. Must not be placed in Sulfurous environments above 1000°F (538°C)
Inconel 601	61% Nickel, 23% Chromium, 14% Iron,1.35% Aluminum	2100°F (1149°C) under oxidizing conditions 1900°F, (1038°C) under reducing conditions	Similar properties to Inconel 600, but with superior resistance to Sulphur. Also has a higher temperature oxidation resistance to 2300°F (1260°C).
Incoloy 800	46% Iron, 32.5% Nickel, 21% Chromium, .75% Manganese, .5% Silicon, .38% Aluminum, .38% Copper, .38% Titanium, .15% Carbon	1500°F (816°C)	Strong resistance to oxidation & carburization at high temperatures. Resists Sulfur attack, internal oxidation & scaling in a wide variety of atmospheres.
Molybdenum	99.95% Molybdenum, .03% Tungsten	3500°F (1926°C) in inert atmospheres 3400°F (1871°C) in vacuum at 10-4 torr.	Oxidizes in air above 800°F (426°C). Poor mechanical shock resistance after being heated to 1900°F (1038°C).
Monel	66.5% Nickel, 31.5% Copper, 1.25% Iron, 1% Manganese, .25% Silicon, .15% Carbon	1000°F (538°C)	Temperature rating based on use in a Sulfur-free environment. Excellent resistance to corrosion.
Platinum		2500°F (1374°C)	Temperature rating based on use in continuous oxidizing conditions. Good thermal conductivity. Used in applications where high temperature but no vacuum or inert atmosphere is available.
304 SS	19% Chromium, 10% Nickel, 2% Manganese, 1% Silicon, .08% Carbon, Trace amounts of Phosphorus & Sulfur. Balance Iron.	1650°F (899°C)	Temperature rating based on use in oxidizing environments. Has good oxidation & corrosion resistance in a wide range of industrial environments. Subject to carbide precipitation, which can reduce corrosion resistance between 800°F-1000°F (427°C-538°C). Good mechanical properties from -300°F-1450°F (-184°C-788°C).
310 SS	25% Chromium, 21% Nickel, 2% Manganese, 1.5% Silicon	2100°F (1149°C)	Mechanical & corrosion resistance similar to and better than 304 stainless steel.
316 SS	17% Chromium, 12% Nickel, 2.5% Molybdenum, 2% Manganese, 1% Silicon, .08% Carbon, Trace amounts of Phosphorus & Sulfur. Balance Iron.	1700°F (927°C)	Temperature rating based on use in oxidizing environments. Similar properties as 304 stainless steel, but with improved resistance to mild acid and pitting corrosion.
321 SS	18% Chromium, 10% Nickel, 2% Manganese, 1% Silicon, .4% Titanium, .04% Phosphorus, .03% Sulphur	1600°F (871°C)	Good corrosion resistance, Used where conditions are too severe for low Carbon stainless steel.
446 SS	27% Chromium, 1.5% Manganese, 1% Silicon, .25% Nitrogen, . 2% Carbon, Trace amounts of Phosphorus & Sulfur. Balance Iron.	2000°F (1093°C)	Temperature rating based on use in oxidizing environments. Excellent high temperature corrosion & oxidizing resistance. Not for use in carburizing environments.
Tantalum		4350°F (2349°C)	Good resistance to corrosion. Quick heat conductivity. Good mechanical strength.
Titanium		2300°F (1260°C)	Temperature rating based on use in inert or vacuum environments. Acid and chemical resistant. Oxidation resistance to 1000°F (538°C).

PROTECTION TUBES

Ordering Information



Part #: **PT-□-□-□□□-□**

Material (Table 1)	Diameter (Table 2)	Length (inches)	Cold End Termination (Table 3)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Material

P/N	Description
1	Silicon Carbide
2	Mullite
3	Alumina
4	Inconel
5	304 S.S.
6	316 S.S.
7	310 S.S.
8	321 S.S.
9	446 S.S.
X	Special

Table 2
Diameter

P/N	Description
1	1/4"
2	1/4" IPS
3	3/8"
4	3/8" IPS
5	1/2"
6	1/2" IPS
7	3/4"
8	3/4" IPS
9	1" IPS
X	Special

Table 3
Cold End Termination

P/N	Description
A	Plain
B	Threaded End
C	1/4" NPT Fitting
D	3/8" NPT Fitting
E	1/2" NPT fitting
F	½" x ¾" NPT Fitting
G	3/4" NPT Fitting
H	1" NPT Fitting
J	1 ¼" NPT Fitting
K	1 ½" NPT Fitting
X	Special

Example: **PT – 2 – 7 – 36 – F**

Protection Tube. Mullite. 3/4" OD x 36" long. ½"x ¾" NPT mounting fitting at cold end.

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PLASTICS INDUSTRY THERMOCOUPLES

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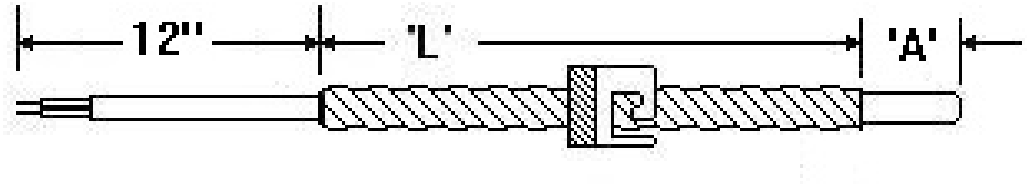
PLASTICS INDUSTRY THERMOCOUPLES

Thermocouple Ordering Information

Armor Adjustable Design (AA)



Part #: AA-□-□-□-□-□□□-□□□-□

Sheath Diameter (Table 1)	Calibration (Table 2)	Lead Protection (Table 3)	Junction (Table 4)	'A' Length (inches)	'L' Length (inches)	Cold End Termination (Table 5)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Sheath Diameter

P/N	Description
1	.125 inches
2	.188 inches
X	Special

Table 2
Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 3
Lead Protection

P/N	Description
A	Fiberglass
B	Fiberglass w/ SS Overbraid
C	Teflon
D	Teflon w/ SS Overbraid
X	Special

Table 4
Junction

P/N	Description
G	Grounded
U	Ungrounded
E	Exposed
X	Special

Table 5
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Standard Jack
D	Hi-Temp Jack
E	Miniature Plug
F	Miniature Hi-Temp Plug
G	Miniature Jack
H	Miniature Hi-Temp Jack
J	Spade Lugs
K	Ring Lugs
L	Stripped Leads
X	Special

Example: **AA-2-1-B-G-1-12-L**

Armor Adjustable Design, .188" ϕ, Type 'J', Fiberglass Leads w/ SS Overbraid, Grounded junction, 1" active length, 12" Lead length, standard stripped leads

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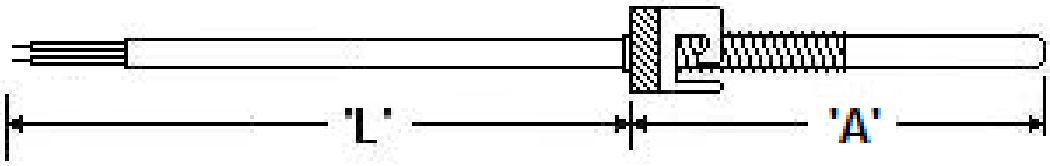
PLASTICS INDUSTRY THERMOCOUPLES

Thermocouple Ordering Information

Bayonet Straight Design (BS)



Part #: BS-□-□-□-□-□□□-□□□-□

Sheath Diameter (Table 1)	Calibration (Table 2)	Lead Protection (Table 3)	Junction (Table 4)	'A' Length (inches)	'L' Length (inches)	Cold End Termination (Table 5)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Sheath Diameter

P/N	Description
1	.125 inches
2	.188 inches
X	Special

Table 2
Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 3
Lead Protection

P/N	Description
A	Fiberglass
B	Fiberglass w/ SS Overbraid
C	Fiberglass w/ SS Flex Armor
D	Teflon
E	Teflon w/ SS Overbraid
F	Teflon w/ SS Flex Armor
X	Special

Table 4
Junction

P/N	Description
G	Grounded
U	Ungrounded
E	Exposed
X	Special

Table 5
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Standard Jack
D	Hi-Temp Jack
E	Miniature Plug
F	Miniature Hi-Temp Plug
G	Miniature Jack
H	Miniature Hi-Temp Jack
J	Spade Lugs
K	Ring Lugs
L	Stripped Leads
X	Special

Example: **BS-2-1-B-G-6-12-L**

Bayonet Straight Design, .188" ϕ, Type 'J', Fiberglass Leads w/ SS Overbraid, Grounded junction, 6" active length, 12" Lead length, standard stripped leads

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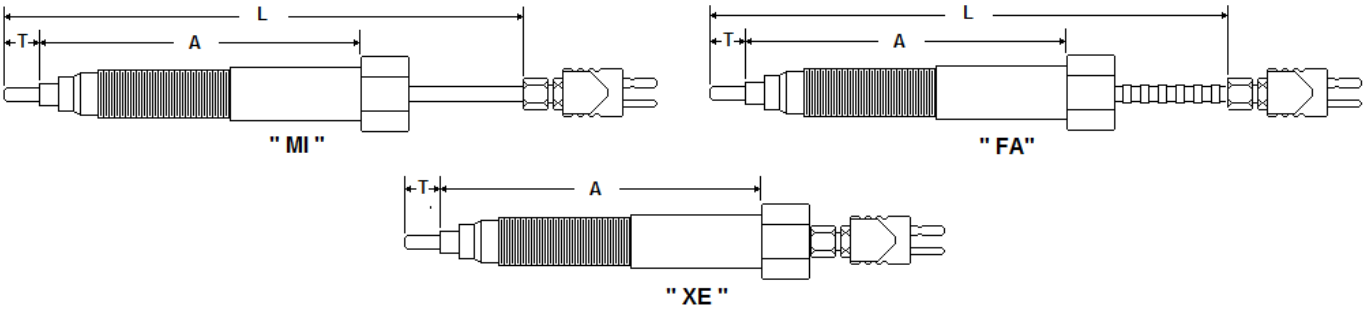
PLASTICS INDUSTRY THERMOCOUPLES

Thermocouple Ordering Information

Melt Bolt Assembly



Part #: PIT-MB-□□-□□□-□□□-□□□-□□□-□

Calibration (Table 1)	Design (Table 2)	'A' (inches)	'L' (inches)	'T' (inches)	Cold End Termination (Table 3)

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Calibration

P/N	Description
J	Type 'J'
K	Type 'K'
T	Type 'T'
E	Type 'E'
N	Type 'N'
X	Special

Table 2
Design

P/N	Description
FA	Flex Armor Extension
MI	M.I. Cable Extension
XE	No Extension

Table 3
Cold End Termination

P/N	Description
A	Stripped Leads Only
B	Ceramic Terminal Block
C	Standard Plug
D	Hi-Temp Plug
E	Ceramic Plug
F	Standard Jack
G	Hi-Temp Jack
H	Ceramic Jack
J	Spade Lug
K	Ring Lug
X	Special

Example: **BMT-MB-K-MI-6-6-F-C**

Melt Bolt Style, Type 'K', M.I. cable extension, A = 6, L = 6", T = flush, standard male connector.

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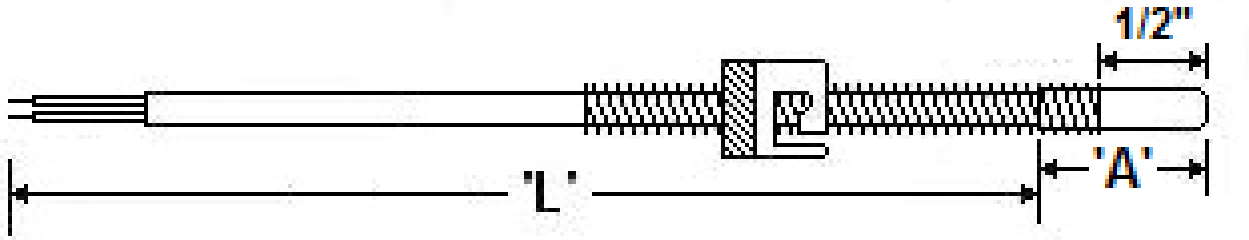
PLASTICS INDUSTRY THERMOCOUPLES

Thermocouple Ordering Information

Spring Adjustable Design (SA)



Part #: SA-□-□-□-□-□□□-□□□-□

Sheath Diameter (Table 1)	Calibration (Table 2)	Lead Protection (Table 3)	Junction (Table 4)	'A' Length (inches)	'L' Length (inches)	Cold End Termination (Table 5)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Sheath Diameter

P/N	Description
1	.125 inches
2	.188 inches
X	Special

Table 2
Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 3
Lead Protection

P/N	Description
A	Fiberglass
B	Fiberglass w/ SS Overbraid
C	Teflon
D	Teflon w/ SS Overbraid
X	Special

Table 4
Junction

P/N	Description
G	Grounded
U	Ungrounded
E	Exposed
X	Special

Table 5
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Standard Jack
D	Hi-Temp Jack
E	Miniature Plug
F	Miniature Hi-Temp Plug
G	Miniature Jack
H	Miniature Hi-Temp Jack
J	Spade Lugs
K	Ring Lugs
L	Stripped Leads
X	Special

Example: **SA-2-1-B-G-1-12-L**

Spring Adjustable Design, .188" ϕ, Type 'J', Fiberglass Leads w/ SS Overbraid, Grounded junction, 1" active length, 12" Lead length, standard stripped leads

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ENGINE COMPRESSOR THERMOCOUPLES

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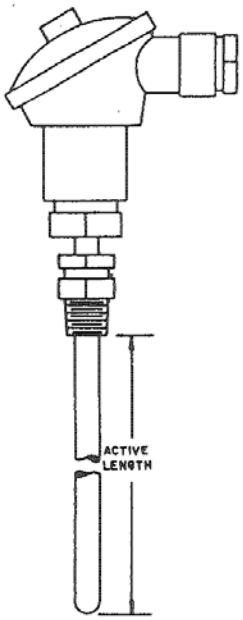
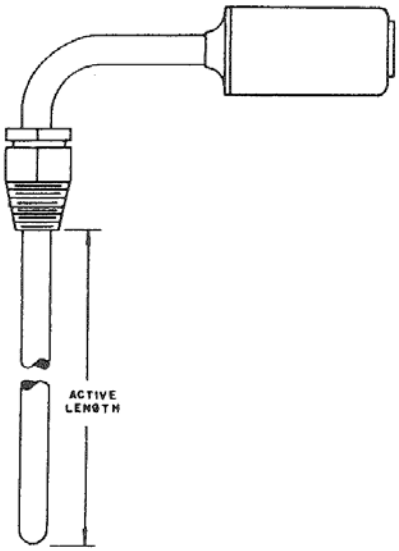
ENGINE-COMPRESSOR THERMOCOUPLES

Duro-Sense Engine-Compressor Thermocouples (ECT) are designed and manufactured to provide the finest quality available to insure maximum reliability. The unique preparation of premium grade conductors, MgO insulation and stainless steel tubing through reduction swaging and drawing produces a uniform thickness of sheath and high density of insulation. The result is a product that is mechanically strong and impervious to penetration of corrosive gases and moisture. This material has the advantage of high dielectric strength plus the ability to withstand severe physical abuse. It can be formed in a radius equal to its own diameter without damage and can be brazed without loss of dielectric integrity. They are available in a variety of configurations to satisfy numerous applications.

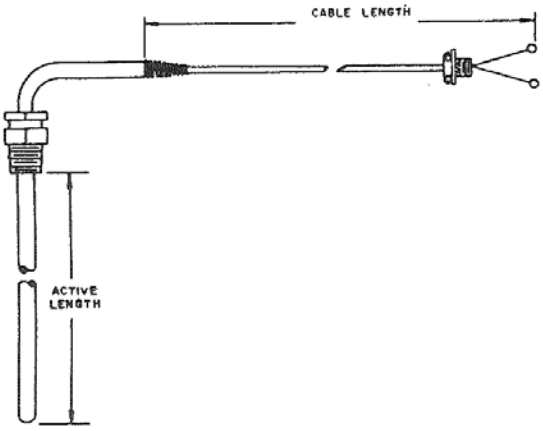
ECT-102



ECT-104



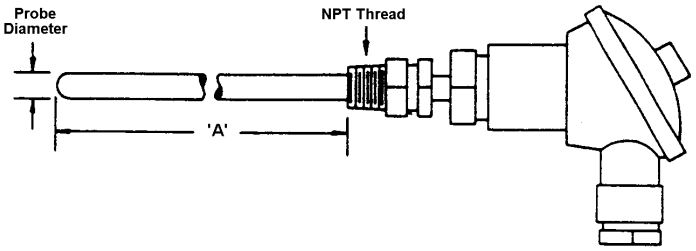
ECT-106



ENGINE-COMPRESSOR THERMOCOUPLES

Thermocouple Ordering Information

"102" Style



Part #: ECT-102-□-□-□-□-□

Junction (Table 1) | Calibration (Table 2) | Diameter (Table 3) | 'A' Length inches | Mounting Ftg. (Table 4)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Junction

P/N	Description
U	Ungrounded
G	Grounded
E	Exposed
UU	Uncommon-Ungrounded
GG	Dual Grounded
EE	Dual Exposed
X	Special

Table 2
Calibration

P/N	Description
J	Type 'J'
K	Type 'K'
E	Type 'E'
N	Type 'N'
X	Special

Table 3
Diameter

P/N	Description
1/8	1/8" O.D.
3/16	3/16" O.D.
1/4	1/4" O.D.
3/8	3/8" O.D.
X	Special

Table 4
Mounting Fitting

P/N	Description
A	1/8" NPT Adjustable
B	1/4" NPT Adjustable
C	1/2" NPT Adjustable
D	1/2" NPT Fixed †
E	3/8" NPT Adjustable
F	3/4" NPT Adjustable
X	Special

† - Only Available in 3/8" diameter

Example: **ECT-102-U-J-1/4-4.5-48-C**

102 Style, Type 'J', ¼" diameter sheath, 4.5" active length, ½" NPT adjustable mounting fitting

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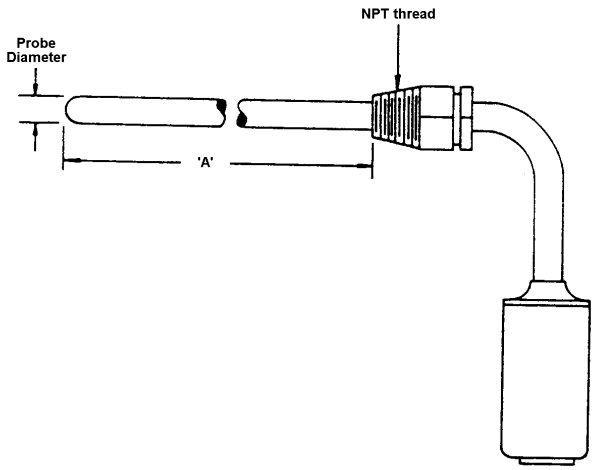
ENGINE-COMPRESSOR THERMOCOUPLES

Thermocouple Ordering Information

"104" Style



Part #: ECT-104-□-□-□-□-□-□

Junction (Table 1)	Calibration (Table 2)	Diameter (Table 3)	'A' Length inches	Mounting Ftg. (Table 4)	**

**** = If the assembly is to be straight, rather than 90° bend, add "S" as the last digit in the part number.**

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1 Junction

P/N	Description
U	Ungrounded
G	Grounded
E	Exposed
UU	Uncommon-Ungrounded
GG	Dual Grounded
EE	Dual Exposed
X	Special

Table 2 Calibration

P/N	Description
J	Type 'J'
K	Type 'K'
E	Type 'E'
N	Type 'N'
X	Special

Table 3 Diameter

P/N	Description
1/8	1/8" O.D.
3/16	3/16" O.D.
1/4	1/4" O.D.
3/8	3/8" O.D.
X	Special

Table 4 Mounting Fitting

P/N	Description
A	1/8" NPT Adjustable
B	1/4" NPT Adjustable
C	1/2" NPT Adjustable
D	1/2" NPT Fixed †
E	3/8" NPT Adjustable
F	3/4" NPT Adjustable
X	Special

† - Only Available in 3/8" diameter

Example: **ECT-104-U-J-1/4-4.5-48-C**

104 Style, Type 'J', ¼" diameter sheath, 4.5" active length, ½" NPT adjustable mounting fitting

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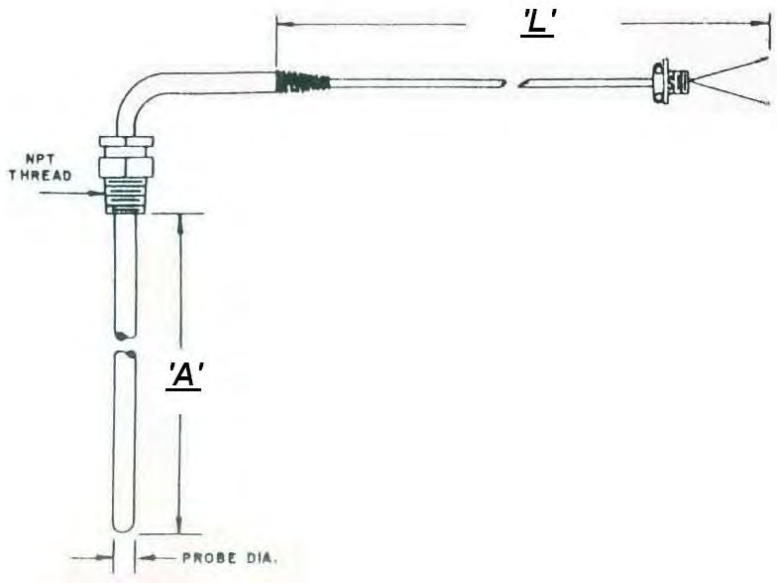
ENGINE-COMPRESSOR THERMOCOUPLES

Thermocouple Ordering Information

"106" Style



Part #: ECT-106-□-□-□-□-□□-□-□-□

Junction (Table 1)	Calibration (Table 2)	Diameter (Table 3)	'A' Length inches	'L' Length inches	*	Mounting Ftg. (Table 4)	Cable Ftg. (Table 5)	**

*** = If SS flex armor is required, add an 'F' in this field. If it is not required, omit this field.**

**** = If the assembly is to be straight, rather than 90° bend, add "S" as the last digit in the part number.**

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1 Junction

P/N	Description
U	Ungrounded
G	Grounded
E	Exposed
UU	Uncommon-Ungrounded
GG	Dual Grounded
EE	Dual Exposed
X	Special

Table 2 Calibration

P/N	Description
J	Type 'J'
K	Type 'K'
E	Type 'E'
N	Type 'N'
X	Special

Table 3 Diameter

P/N	Description
1/8	1/8" O.D.
3/16	3/16" O.D.
1/4	1/4" O.D.
3/8	3/8" O.D.
X	Special

Table 4 Mounting Fitting

P/N	Description
A	1/8" NPT Adjustable
B	1/4" NPT Adjustable
C	1/2" NPT Adjustable
D	1/2" NPT Fixed †
E	3/8" NPT Adjustable
F	3/4" NPT Adjustable
X	Special

† - Only Available in 3/8" diameter

Table 5 Cable Fitting

P/N	Description
B	BX Connector
C	Cord Grip
X	Special

Example: **ECT-106-U-J-1/4-4.5-48-C-B**

106 Style, Type 'J', ¼" diameter sheath, 4.5" active length, 48" lead length, ½" NPT adjustable mounting fitting, BX connector cable fitting.

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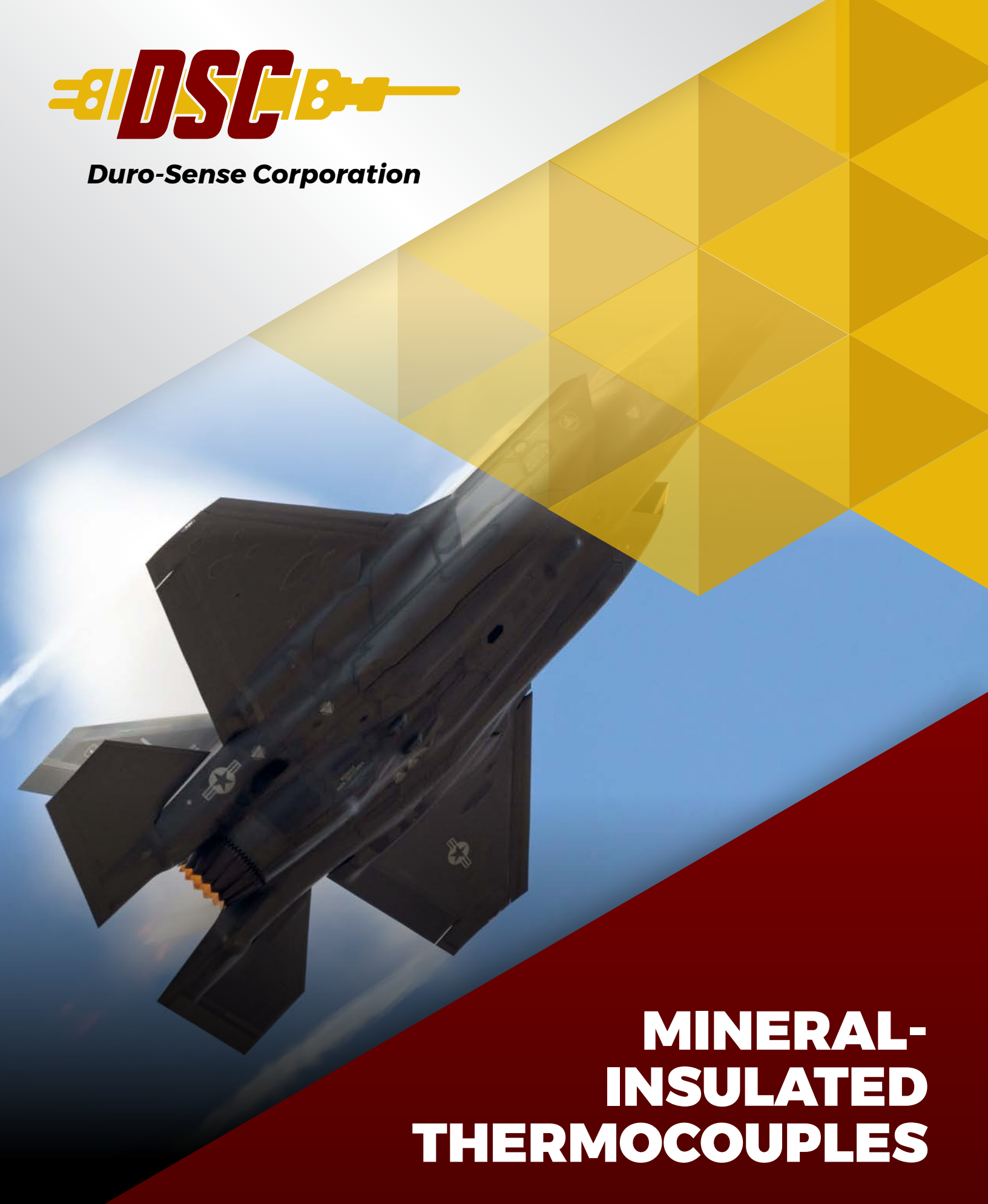

MINERAL-INSULATED THERMOCOUPLES

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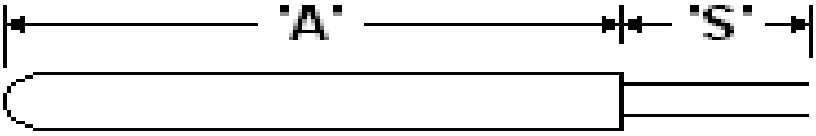
MINERAL INSULATED THERMOCOUPLES

Thermocouple Ordering Information

Style 'A'



Part #: MTC-A-□□□□□-□□-□□□-□□□-□□

Sheath Diameter (Table 1)	Calibration (Table 2)	Sheath Material (Table 3)	Junction (Table 4)	'A' Length (inches)	'S' Strip (inches)	SP*

***SP =** Special Limits of Error

If standard limits of error Is desired, omit this field.

NOTE: Dual Element Style is notated as 'AA'

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Sheath Diameter

P/N	Description
020	.020 inches
032	.032 inches
040	.040 inches
063	.063 inches
090	.090 inches
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
XXX	Special

Table 2
Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
7	MI2300
X	Special

Table 4
Junction

P/N	Description
E	Exposed
EE	Dual Exposed
E/HS	Exposed-Half Shield
E/AT	Exposed-Aspirated Tip
G	Grounded
GG	Dual Grounded
U	Ungrounded
UU	Uncommon-Ungrounded
CU	Common-Ungrounded

Example:

Single Element MTC-A-06321-U-12-0.75-SP

Style A, .063" ϕ, Type 'K', Alloy 600 sheath, ungrounded junction, 12" active length, ¾" strip length, special limits of error.

Dual Element: MTC-AA-06321-UU-12-0.75-SP

Style A, .063" ϕ, Type 'K', Alloy 600 sheath, uncommon-ungrounded junction, 12" active length, ¾" strip length, special limits of error.

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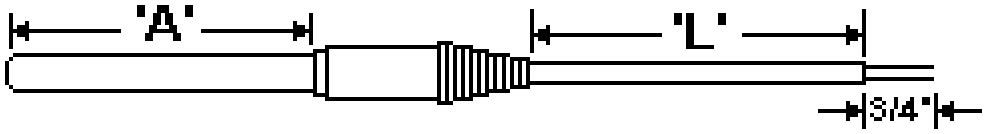
MINERAL INSULATED THERMOCOUPLES

Thermocouple Ordering Information

Style 'B'



Part #:MTC-B-□□□□□-□□-□□□-□□□□□-□□-□

Sheath Diameter (Table 1)	Calibration (Table 2)	Sheath Material (Table 3)	Junction (Table 4)	Sheath Length (inches)	Lead Length (inches)	Wire Type (Table 5)	SP*	Cold End Termination (Table 6)

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: Dual Element Style is notated as 'BB'

NOTE: *For any additional modifications to this assembly, add "**-MOD**" to the end of the part number and provide a physical description of the modification.*

Table 1 — Sheath Diameter

P/N	Description
020	.020 inches
032	.032 inches
040	.040 inches
063	.063 inches
090	.090 inches
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
XXX	Special

Table 2 — Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 3 — Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
7	MI2300
X	Special

Table 4 — Junction

P/N	Description
E	Exposed
EE	Dual Exposed
E/HS	Exposed-Half Shield
E/AT	Exposed-Aspirated Tip
G	Grounded
GG	Dual Grounded
U	Ungrounded
UU	Uncommon-Ungrounded
CU	Common-Ungrounded

Table 5 — Leadwire Type

P/N	Description
A	GB/GB
B	GB/GB-SS
C	TEX/TEX
D	TEX/TEX-SS
E	TEX/TW/ALM/TEX
F	P/P
G	P/TW/ALM/P
X	Special

For a physical description of wire construction, refer to thermocouple wire page in catalog.

Table 6 — Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Ceramic Plug
D	Miniature Plug
E	Miniature Hi-Temp Plug
F	Miniature Ceramic Plug
G	Standard Jack
H	Hi-Temp Jack
J	Ceramic Jack
K	Miniature Jack
L	Miniature Hi-Temp Jack
M	Miniature Ceramic Jack
N	Spade Lug
P	Ring Lug
R	Stripped Leads
X	Special

Example: **Single Element** **MTC-B-06321-U-12-48A-SP-A**

Style B, .063" ϕ, Type 'K', Alloy 600 sheath, ungrounded junction,12" active length, 48" lead length, lead wire with fiberglass insulation, special limits of error, standard male connector.

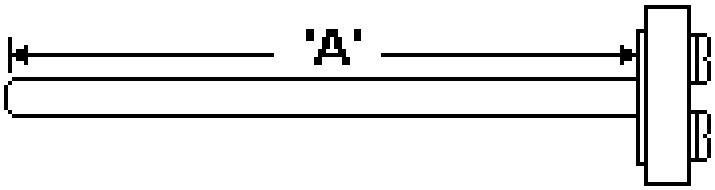
Dual Element: **MTC-BB-06321-UU-12-48A-SP-AA**

Style B, .063" ϕ, Type 'K', Alloy 600 sheath, uncommon-ungrounded junction, 12" active length, 48" lead length, lead wire with fiberglass insulation, special limits of error, dual standard male connectors.

MINERAL INSULATED THERMOCOUPLES

Thermocouple Ordering Information

Style 'C'



Part #: MTC-C-□□□□□-□□-□□□-□□-□

Sheath Diameter (Table 1)	Calibration (Table 2)	Sheath Material (Table 3)	Junction (Table 4)	Length (inches)	SP*	Cold End Termination (Table 5)

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: Dual Element Style is notated as 'CC'

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Sheath Diameter

P/N	Description
020	.020 inches
032	.032 inches
040	.040 inches
063	.063 inches
090	.090 inches
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches

Table 2
Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
7	MI2300
X	Special

Table 4
Junction

P/N	Description
E	Exposed
EE	Dual Exposed
E/HS	Exposed-Half Shield
E/AT	Exposed-Aspirated Tip
G	Grounded
GG	Dual Grounded
U	Ungrounded
UU	Uncommon-Ungrounded
CU	Common-Ungrounded

Table 5
Cold End Termination

P/N	Description
1	Glass-Filled Polymer
2	Ceramic

Example:

Single Element MTC-C-06321-U-12-SP-1

Style C, .063" ϕ, Type 'K', Alloy 600 sheath, ungrounded junction, 12" active length, special limits of error. Glass-filled Nylon block.

Dual Element: MTC-CC-06321-UU-12-SP-1

Style C, .063" ϕ, Type 'K', Alloy 600 sheath, uncommon-ungrounded junction, 12" active length, special limits of error. Glass-filled Nylon block.

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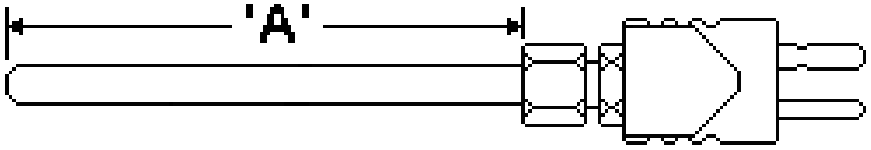
MINERAL INSULATED THERMOCOUPLES

Thermocouple Ordering Information

Style 'D'



Part #: MTC-D-□□□□□-□□-□□□-□□-□

Sheath Diameter (Table 1)	Calibration (Table 2)	Sheath Material (Table 3)	Junction (Table 4)	Length (inches)	SP*	Cold End Termination

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: Dual Element Style is notated as 'DD'

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Sheath Diameter

P/N	Description
020	.020 inches
032	.032 inches
040	.040 inches
063	.063 inches
090	.090 inches
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
XXX	Special

Table 2
Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
7	MI2300
X	Special

Table 4
Junction

P/N	Description
E	Exposed
EE	Dual Exposed
E/HS	Exposed-Half Shield
E/AT	Exposed-Aspirated Tip
G	Grounded
GG	Dual Grounded
U	Ungrounded
UU	Uncommon-Ungrounded
CU	Common-Ungrounded

Table 5
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Ceramic Plug
D	Miniature Plug
E	Miniature Hi-Temp Plug
F	Miniature Ceramic Plug
X	Special

Example:

Single Element MTC-D-06321-U-12-SP-B

Style D, .063" ϕ, Type 'K', Alloy 600 sheath, ungrounded junction, 12" active length, special limits of error, hi-temp male connector.

Dual Element: MTC-DD-06321-UU-12-SP-B

Style D, .063" ϕ, Type 'K', Alloy 600 sheath, uncommon-ungrounded junction, 12" active length, special limits of error, hi-temp male connectors.

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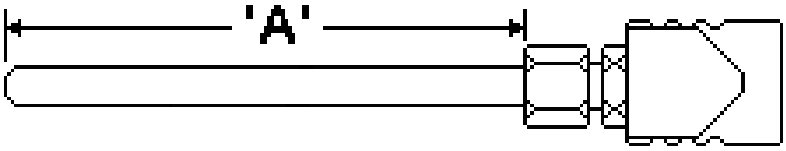
MINERAL INSULATED THERMOCOUPLES

Thermocouple Ordering Information

Style 'G'



Part #: MTC-G-□□□□□-□□-□□□-□□-□

Sheath Diameter (Table 1)	Calibration (Table 2)	Sheath Material (Table 3)	Junction (Table 4)	Length (inches)	SP*	Cold End Termination

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: Dual Element Style is notated as 'GG'

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Sheath Diameter

P/N	Description
020	.020 inches
032	.032 inches
040	.040 inches
063	.063 inches
090	.090 inches
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
XXX	Special

Table 2
Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
7	MI2300
X	Special

Table 4
Junction

P/N	Description
E	Exposed
EE	Dual Exposed
E/HS	Exposed-Half Shield
E/AT	Exposed-Aspirated Tip
G	Grounded
GG	Dual Grounded
U	Ungrounded
UU	Uncommon-Ungrounded
CU	Common-Ungrounded

Table 5
Cold End Termination

P/N	Description
A	Standard Jack
B	Hi-Temp Jack
C	Ceramic Jack
D	Miniature Jack
E	Miniature Hi-Temp Jack
F	Miniature Ceramic Jack

Example: **Single Element** **MTC-G-06321-U-12-SP-B**

Style G, .063" ϕ, Type 'K', Alloy 600 sheath, ungrounded junction, 12" active length, special limits of error, hi-temp female connector.

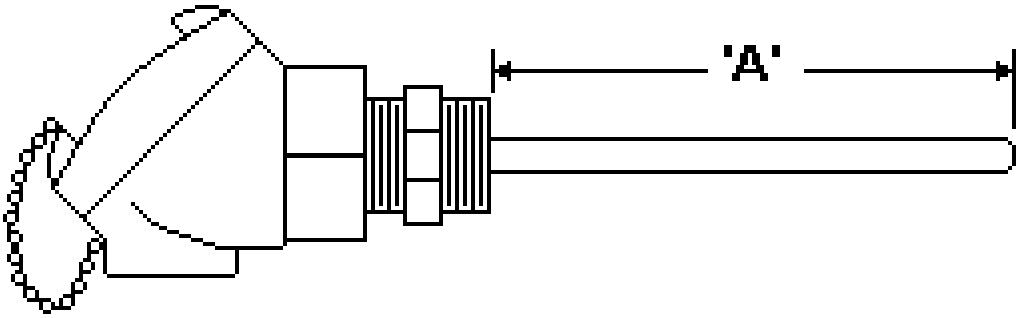
Dual Element: **MTC-GG-06321-UU-12-SP-B**

Style G, .063" ϕ, Type 'K', Alloy 600 sheath, uncommon-ungrounded junction, 12" active length, special limits of error, hi-temp female connectors.

MINERAL INSULATED THERMOCOUPLES

Thermocouple Ordering Information

Style 'H'



Part #:MTC-H-□□□□□-□□-□□□-□□-□-□

Sheath Diameter (Table 1)	Calibration (Table 2)	Sheath Material (Table 3)	Junction (Table 4)	Sheath Length (inches)	SP*	Process Fitting (Table 5)	Head Style (Table 6)

***SP =** Special Limits of Error

If standard limits of error is desired, omit this field.

NOTE: Dual Element Style is notated as 'HH'

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Sheath Diameter

P/N	Description
020	.020 inches
032	.032 inches
040	.040 inches
063	.063 inches
090	.090 inches
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
XXX	Special

Table 2
Calibration

P/N	Description
1	Type 'J'
2	Type 'K'
3	Type 'T'
4	Type 'E'
5	Type 'N'
X	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
7	MI2300
X	Special

Table 4
Junction

P/N	Description
E	Exposed
EE	Dual Exposed
E/HS	Exposed-Half Shield
E/AT	Exposed-Aspirated Tip
G	Grounded
GG	Dual Grounded
U	Ungrounded
UU	Uncommon-Ungrounded
CU	Common-Ungrounded

Table 5
Process Fitting

P/N	Description
A	1/4" NPT
B	3/8" NPT
C	1/2" NPT
D	3/4" NPT
E	1" NPT
F	1 ¼" NPT
G	1 ½" NPT
H	None
X	Special

Table 6
Connection Head

P/N	Description
A	Cast Aluminum
B	Miniature Aluminum
C	Cast Iron
D	Polypropylene
E	Miniature Plastic
F	Explosion Proof
G	Canister Style
X	Special

Example: **Single Element** **MTC-H-06321-U-12-SP-C-A**

Style H, .063" ϕ, Type 'K', Alloy 600 sheath, ungrounded junction, 12" active length, special limits of error, ½" NPT process threads, cast aluminum head.

Dual Element: **MTC-HH-06321-UU-12-SP-C-A**

Style H, .063" ϕ, Type 'K', Alloy 600 sheath, uncommon-ungrounded junction, 12" active length, special limits of error, ½" NPT process threads, cast aluminum head.

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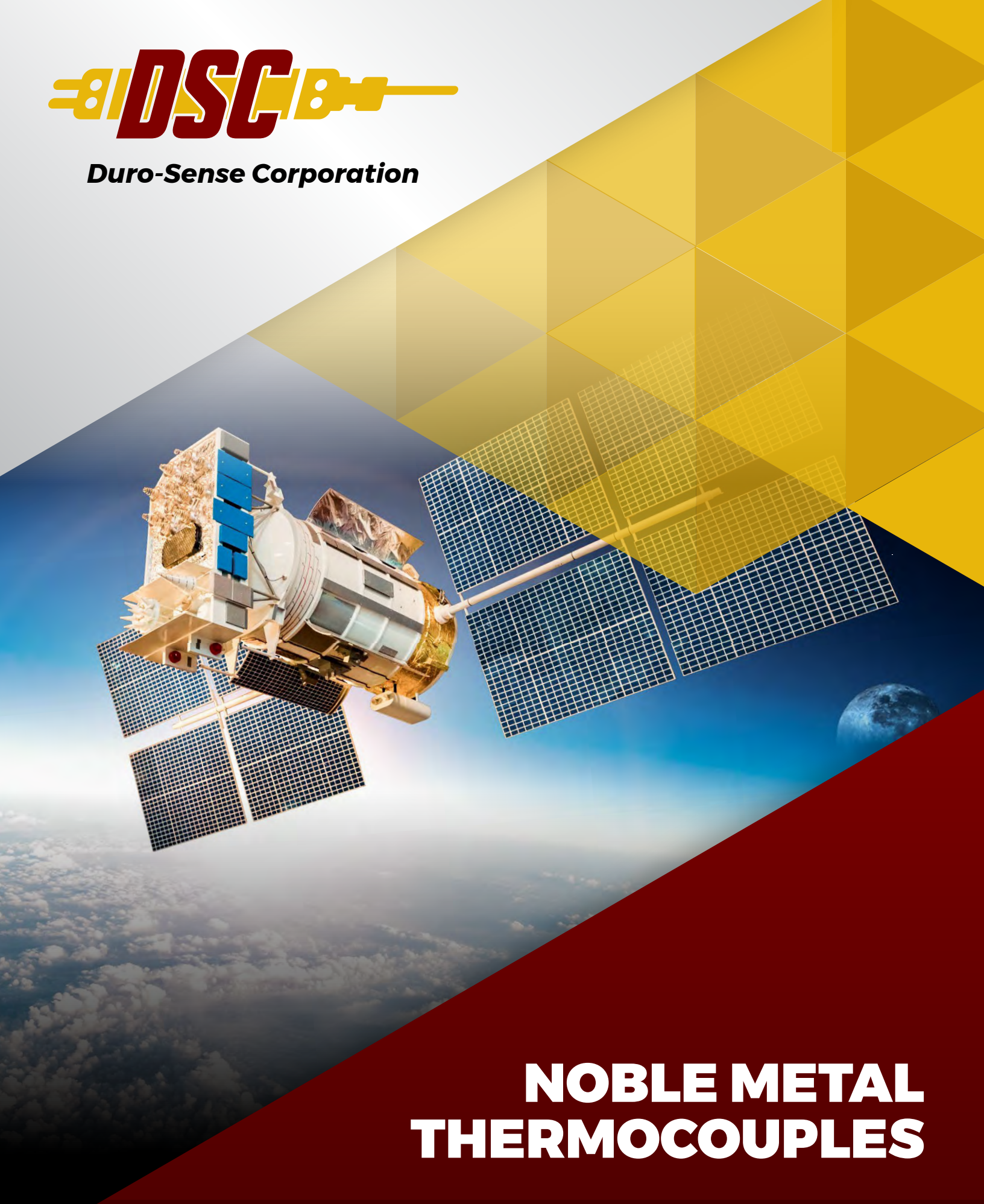

NOBLE METAL THERMOCOUPLES

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GENERAL NOTES

There are many arrangements of Noble Metal thermocouple assemblies that utilize combinations of protecting tubes, thermocouple elements, terminals and mounting options. They are categorized into High Temperature Metal Sheath (HTM), High Temperature Industrial (HTI), and Platinum Insulated Element (PIE) assemblies (See Below). Noble metal thermocouples are relatively expensive units that are easily contaminated so proper protection from harmful atmospheres is required in order to get suitable service life from the assembly.

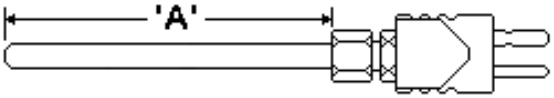
Platinum & Tungsten-Rhenium 24 ga. (.020) and 30 ga. (.010) thermocouple elements have welded junctions. Insulators are round double bore alumina. Thermocouple protection tubes are available in Alumina, Stainless Steel, Inconel, Molybdenum, Platinum, Platinum-Rhodium, Tantalum, and Titanium. All sheath assemblies are evacuated and back filled with inert gas to hinder contamination.

Noble Metal thermocouples tolerate higher temperatures and provide greater accuracy than base metal thermocouples. Typical application would include: jet engines, rocket engines, turbines, exhaust gas sensing, glass manufacturing, heat treating, laboratory research, nuclear environments, power stations, vacuum furnaces, and more.

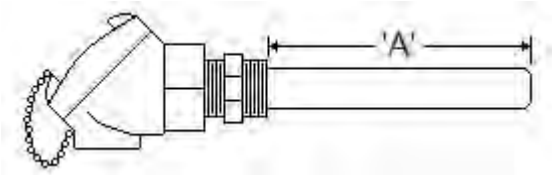
SPECIFICATIONS

CALIBRATION	APPROXIMATE UPPER USEFUL TEMPERATURE	APPROXIMATE MELTING POINT	RECOMMENDED ENVIRONMENT	NOTES
Pt-10% Pt/Rh ANSI Type 'S'	2700°F (1480°C)	3200°F (1760°C)	Oxidizing, Inert	Composed of a positive leg (SP) that is 90% platinum & 10% rhodium, and a negative leg (SN) that is 100% platinum. Type 'S' has a lower EMF output than Type 'R' & is available in standard grade and reference grade.
Pt-13% Pt/Rh ANSI Type 'R'	2700°F (1480°C)	3200°F (1760°C)	Oxidizing, Inert	Composed of a positive leg (RP) that is 87% platinum & 13% rhodium, and a negative leg (RN) that is 100% platinum. Type 'R' is available in standard grade & reference grade.
Pt-30% Pt-6%/Rh ANSI Type 'B'	3100°F (1700°C)	3250°F (1790°C)	Oxidizing, Inert	Composed of a positive leg (BP) that is 70% platinum & 30% rhodium, and a negative leg (SN) that is 94% platinum & 6% rhodium. Type 'B' is available in standard grade & reference grade.
W-5% Re/W-26% Re Type 'C' (Non-ANSI)	4200°F (2320°C)	5600°F (3094°C)	Vacuum, High Purity Hydrogen, Inert	Composed of a positive leg (CP) that is tungsten & 5% Rhenium, and a negative leg (CN) that is tungsten & 26% rhenium. Conductors are brittle and can only be used in vacuum or inert environments.

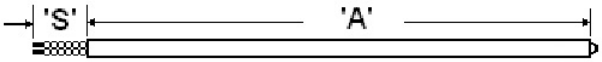
High Temperature – Metal Sheathed (HTM)



High Temperature – Industrial (HTI)

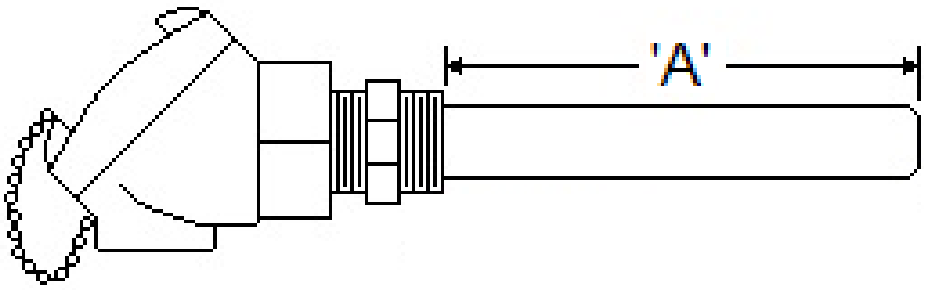


Platinum Insulated Element



NOBLE METAL THERMOCOUPLES

Thermocouple Ordering Information



Part #: HTI-□-□□-□□□-□□□-□-□-□

Calibration (Table 1)	Junction (Table 2)	Sheath Diameter (Table 3)	'A' Length (inches)	Sheath Material (Table 4)	Process Fitting (Table 5)	Connection Head (Table 6)

Note:

All Noble Metal Assemblies are provided with Reference-Grade conductors.

NOTE: Dual Element Style is notated as with a '2' Prefix

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Calibration

P/N	Description
B	Type 'B'
C	Type 'C'
R	Type 'R'
S	Type 'S'

Table 2
Junction

P/N	Description
E	Exposed
EE	Dual Exposed
G	Grounded
GG	Dual Grounded
U	Ungrounded
UU	Uncommon-Ungrounded

Table 3
Sheath Diameter

P/N	Description
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
500	.500 inches
XXX	Special

Table 4
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316S.S.
4	310S.S.
5	321 S.S.
6	446 S.S.
7	Molybdenum
8	Alumina
X	Special

Table 5
Process Fitting

P/N	Description
A	1/4" NPT
B	3/8" NPT
C	1/2" NPT
D	3/4" NPT
E	1" NPT
F	1 ¼" NPT
G	1 ½" NPT
H	None
X	Special

Table 6
Connection Head

P/N	Description
A	Cast Aluminum
B	Miniature Aluminum
C	Cast Iron
D	Stainless Steel
E	Polypropylene
F	Miniature Plastic
G	Explosion-proof
H	Canister Style
X	Special

Example:

Single Element HTI-S-U-250-24-1-C-A

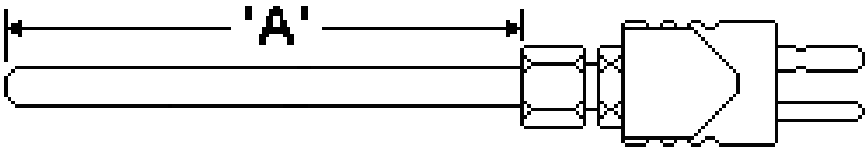
Noble Metal Assy. Type 'S', ungrounded junction,.250" OD, Inconel sheath, 24" active length, 1/2" NPT process threads, cast aluminum head.

Dual Element: 2HTI-S-UU-250-24-1-C-A

Noble Metal Assy. Type 'S', uncommon-grounded junctions,.250" OD, Inconel sheath, 24" active length, 1/2" NPT process threads, cast aluminum head.

NOBLE METAL THERMOCOUPLES

Thermocouple Ordering Information



Part #:HTM-□-□□-□□□-□□□-□-□

Calibration (Table 1)	Junction (Table 2)	Sheath Diameter (Table 3)	'A' Length (inches)	Sheath Material (Table 4)	Cold End Termination (Table 5)

Note:

All Noble Metal Assemblies are provided with Reference-Grade conductors.

NOTE: Dual Element Style is notated as with a '2' Prefix

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Calibration

P/N	Description
B	Type 'B'
C	Type 'C'
R	Type 'R'
S	Type 'S'

Table 2
Junction

P/N	Description
E	Exposed
EE	Dual Exposed
E/HS	Exposed-Half Shield
E/AT	Exposed-Aspirated Tip
G	Grounded
GG	Dual Grounded
U	Ungrounded
UU	Uncommon-Ungrounded

Table 3
Sheath Diameter

P/N	Description
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
XXX	Special

Table 4
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316S.S.
4	310S.S.
5	321 S.S.
6	446 S.S.
7	Molybdenum
8	Alumina
X	Special

Table 5
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Ceramic Plug
D	Standard Jack
E	Hi-Temp Jack
F	Ceramic Jack
X	Special

Example: **Single Element HTM-S-U-188-24-1-A**

Noble Metal Assy. Type 'S', ungrounded junction,.188" OD, Inconel sheath, 24" active length, standard male connector.

Dual Element: 2HTM-S-UU-188-24-1-A

Noble Metal Assy. Type 'S', uncommon-grounded junctions,.188" OD, Inconel sheath, 24" active length, standard male connectors.

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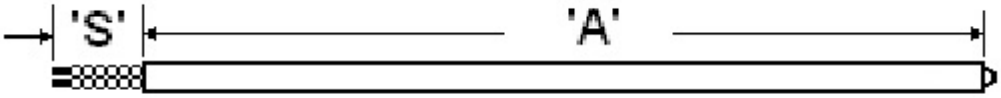
NOBLE METAL THERMOCOUPLES

Thermocouple Ordering Information



Part #:PIE-□-□□□-□□□-□□□

Calibration (Table 1)	Sheath Diameter (Table 2)	'A' Length (inches)	'S' Length (inches)

Note:

All Noble Metal Assemblies are provided with Reference-Grade conductors.

NOTE: Dual Element Style is notated as with a '2' Prefix

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Calibration

P/N	Description
B	Type 'B'
C	Type 'C'
R	Type 'R'
S	Type 'S'

Table 2
Sheath Diameter

P/N	Description
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
XXX	Special

Example:

Single Element PIE-S-188-24-1

Noble Metal Assy. Type 'S', .188" OD, 24" active length, 1" Strip length.

Dual Element: 2PIE-S-188-24-1

Noble Metal Assy. Type 'S', .188" OD, 24" active length, 1" Strip length.

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Duro-Sense Corporation

RESISTANCE TEMPERATURE DETECTORS (RTD)

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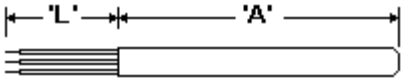
RESISTANCE TEMPERATURE DETECTORS

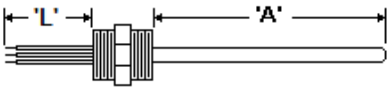
Resistance Temperature Detectors (RTD's) operate under the principle that the electrical resistance of certain metals increases or decreases in a repeatable and predictable manner with a temperature change. RTD's may have a lower temperature range than some thermocouples and a slower response time, however, they are more stable and repeatable over long periods of time. RTD's higher signal output makes them easier to interface with computers and data loggers and reduces the effects of radio frequency interference. RTD's are used in the plastic processing industry, environmental test chambers, motor windings, pumps and bearings, ovens, kilns, waste treatment and the pulp and paper industry, as well as many other applications.

Fundamental Interval R_{100} / R_0 = 1.385	IEC Specification 751Temperature BS Specification 1904 Coefficient .00385 / / °C 99.99% Platinum	
°C	°F	Ohms
-100	-148	60.20
0	32	100.00
100	212	138.50
200	392	175.86
300	572	212.08
400	752	247.07
500	932	280.94

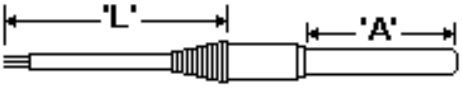
Fundamental Interval R_{100} / R_0 = 1.3916	SAMA Specification Temperature Coefficient .003916 / / °C 99.99% Platinum	
°C	°F	Ohms
-100	-148	59.79
0	32	100.00
100	212	139.16
200	392	177.14
300	572	213.95
400	752	249.59
500	932	284.04



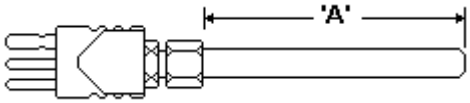
RA Design



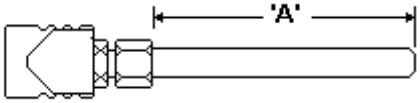
RHN Design



RPL Design



RQP Design



RQJ Design

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RESISTANCE TEMPERATURE DETECTORS

RTD Ordering Information

"RA" DESIGN

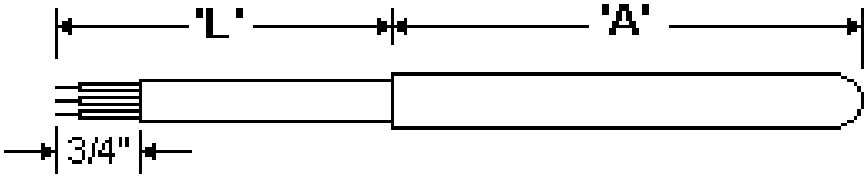

Table 1
Sheath Diameter

P/N	Description
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
500	.500 inches
XXX	Special

Table 2
Calibration

P/N	Description
PD	100Ω Platinum (.00385)
PS	100Ω Platinum (.00392)
PF	500Ω Platinum (.00385)
PT	1000Ω Platinum (.00385)
CU	10Ω Copper (.00427)
NI	120Ω Nickel (.00672)
XX	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
X	Special

Table 4
Temp. Range

P/N	Description
1	0°F-450°F
2	0°F-900°F
X	Special

Table 5
Wire Construction

P/N	Description
A	GB/GB
B	GB/GB-SS
C	TEX/TEX
D	TEX/TEX-SS
E	TEX/TW/ALM/TEX
F	TEX/GB/TEX
X	Special

Table 6
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Ceramic Plug
D	Miniature Plug
E	Miniature Hi-Temp Plug
F	Miniature Ceramic Plug
G	Standard Jack
H	Hi-Temp Jack
J	Ceramic Jack
K	Miniature Jack
L	Miniature Hi-Temp Jack
M	Miniature Ceramic Jack
N	Spade Lug
P	Ring Lug
R	Stripped Leads Only
X	Special

RA ------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐

Design	Number Of Elements	Sheath Diameter (Table 1)	Element Calibration (Table 2)	Sheath Material (Table 3)	Temp. Range (Table 4)	"A" Dimension (In Inches)	Number of Conductors	"L" Dimension (In Inches)	Leadwire Construction (Table 5)	Cold End Termination (Table 6)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Example:

Single Element: RA-1-250-PD-2-2-12-3-48C-P

RA Design, single element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 0°F-500°F temperature range, 12" active length, 3 conductors, 48" long Teflon-insulated leads, Ring Lugs.

Dual Element: RA-2-250-PD-2-2-012-3-48C-P

RA Design, dual element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 0°F-500°F temperature range, 12" active length, 3 conductors, 48" long Teflon-insulated leads, Ring Lugs.

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RESISTANCE TEMPERATURE DETECTORS

RTD Ordering Information

"RHN" DESIGN

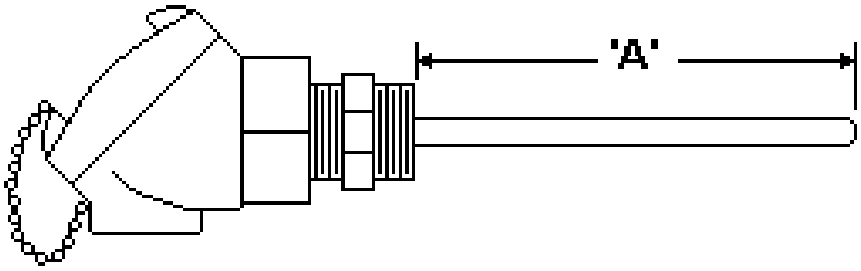

Table 1
Sheath Diameter

P/N	Description
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
500	.500 inches
XXX	Special

Table 2
Calibration

P/N	Description
PD	100Ω Platinum (.00385)
PS	100Ω Platinum (.00392)
PF	500Ω Platinum (.00385)
PT	1000Ω Platinum (.00385)
CU	10Ω Copper (.00427)
NI	120Ω Nickel (.00672)
XX	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
X	Special

Table 4
Temp. Range

P/N	Description
1	0°F-450°F
2	0°F-900°F
X	Special

Table 5
Process Fitting

P/N	Description
A	1/4" NPT
B	3/8" NPT
C	1/2" NPT
D	3/4" NPT
E	1" NPT
F	1 ¼" NPT
G	1 ½" NPT
H	None
X	Special

Table 6
Cold End Termination

P/N	Description
A	Cast Aluminum Head
B	Miniature Aluminum Head
C	Cast Iron Head
D	Polypropylene Head
E	Miniature Plastic Head
F	Explosion Proof Head
G	Stainless Steel Head
H	Canister Style Head
J	Stripped Leads
K	Spade Lugs
L	Ring Lugs
X	Special

RHN-------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ----------☐ ----------☐

Design	Number Of Elements	Sheath Diameter (Table 1)	Element Calibration (Table 2)	Sheath Material (Table 3)	Temp. Range (Table 4)	"A" Dimension (In Inches)	Number of Conductors	"L" Dimension (In Inches)	Process Fitting (Table 5)	Cold End Termination (Table 6)

*** If cold end termination eliminates leads, omit this field.*

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Example: **Single Element: RHN-1-250-PD-2-2-12-3-C-A**

RHN Design, single element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 250°F-500°F temperature range, 12" active length, 3 conductors, 1/2" NPT process threads, cast aluminum head.

Dual Element: RHN-2-250-PD-2-2-12-3-C-A

RHN Design, dual element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 250°F-500°F temperature range, 12" active length, 3 conductors, 1/2" NPT process threads, cast aluminum head.

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RESISTANCE TEMPERATURE DETECTORS

RTD Ordering Information

"RPF" DESIGN

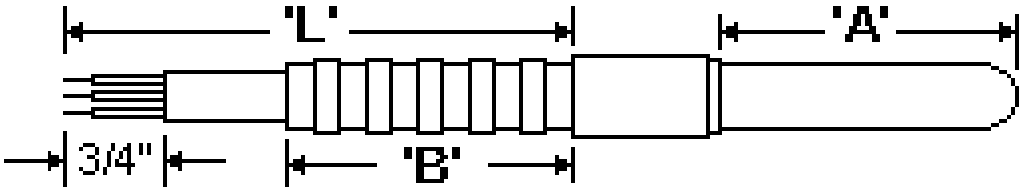

Table 1
Sheath Diameter

P/N	Description
125	.125 inches
4mm	.157 inches
188	.188 inches
6mm	.236 inches
250	.250 inches
313	.313 inches
375	.375 inches
500	.500 inches
XXX	Special

Table 2
Calibration

P/N	Description
PD	100Ω Platinum (.00385)
PS	100Ω Platinum (.00392)
PF	500Ω Platinum (.00385)
PT	1000Ω Platinum (.00385)
CU	10Ω Copper (.00427)
NI	120Ω Nickel (.00672)
XX	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
X	Special

Table 4
Temp. Range

P/N	Description
1	0°F-250°F
2	250°F-500°F
3	500°F-900°F
X	Special

Table 5
Wire Construction

P/N	Description
A	GB/GB
B	GB/GB-SS
C	TEX/TEX
D	TEX/TEX-SS
E	TEX/TW/ALM/TEX
F	TEX/GB/TEX
X	Special

Table 6
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Ceramic Plug
D	Miniature Plug
E	Miniature Hi-Temp Plug
F	Miniature Ceramic Plug
G	Standard Jack
H	Hi-Temp Jack
J	Ceramic Jack
K	Miniature Jack
L	Miniature Hi-Temp Jack
M	Miniature Ceramic Jack
N	Spade Lug
P	Ring Lug
R	Stripped Leads Only
X	Special

RPF-------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ----------☐ ----------☐

Design	Number Of Elements	Sheath Diameter (Table 1)	Element Calibration (Table 2)	Sheath Material (Table 3)	Temp. Range (Table 4)	"A" Dimension (In Inches)	Number of Conductors	"L" Dimension (In Inches)	Wire Construction (Table 5)	Cold End Termination (Table 6)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Example:

Single Element: RPF-1-250-PD-2-2-012-3-A-R

RPF Design, single element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 250°F-500°F temperature range, 12" active length, 3 conductors, fiberglass insulated leads, stainless steel flex armor, stripped leads.

Dual Element: RPF-2-250-PD-2-2-012-3-A-R

RPF Design, dual element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 250°F-500°F temperature range, 12" active length, 3 conductors, fiberglass insulated leads, stainless steel flex armor, stripped leads.

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RESISTANCE TEMPERATURE DETECTORS

RTD Ordering Information

"RPL" DESIGN

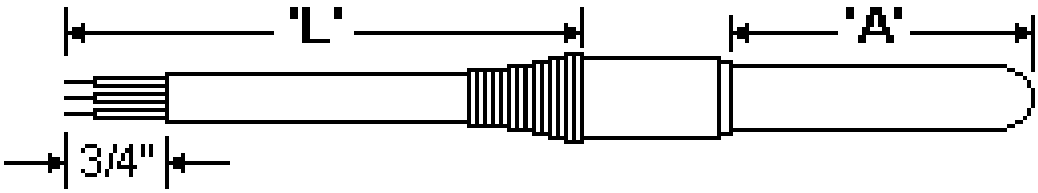

Table 1
Sheath Diameter

P/N	Description
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
500	.500 inches
XXX	Special

Table 2
Calibration

P/N	Description
PD	100Ω Platinum (.00385)
PS	100Ω Platinum (.00392)
PF	500Ω Platinum (.00385)
PT	1000Ω Platinum (.00385)
CU	10Ω Copper (.00427)
NI	120Ω Nickel (.00672)
XX	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
X	Special

Table 4
Temp. Range

P/N	Description
1	0°F-450°F
2	0°F-900°F
X	Special

Table 5
Wire Construction

P/N	Description
A	GB/GB
B	GB/GB-SS
C	TEX/TEX
D	TEX/TEX-SS
E	TEX/TW/ALM/TEX
F	TEX/GB/TEX
X	Special

Table 6
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Ceramic Plug
D	Miniature Plug
E	Miniature Hi-Temp Plug
F	Miniature Ceramic Plug
G	Standard Jack
H	Hi-Temp Jack
J	Ceramic Jack
K	Miniature Jack
L	Miniature Hi-Temp Jack
M	Miniature Ceramic Jack
N	Spade Lug
P	Ring Lug
R	Stripped Leads Only
X	Special

RPL-------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ----------☐ ----------☐ ----------☐

Design	Number Of Elements	Sheath Diameter (Table 1)	Element Calibration (Table 2)	Sheath Material (Table 3)	Temp. Range (Table 4)	"A" Dimension (In Inches)	Number of Conductors	"L" Dimension (In Inches)	Wire Construction (Table 5)	Cold End Termination (Table 6)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Example: **Single Element: RPL-1-250-PD-2-2-12-3-48A-P**

RPL Design, single element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 0°F-500°F temperature range, 12" active length, 3 conductors, 48" long fiberglass-insulated leads, ring lugs.

Dual Element: RPL-2-250-PD-2-2-12-3-48A-P

RPL Design, dual element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 0°F-500°F temperature range, 12" active length, 3 conductors, 48" long fiberglass-insulated leads, ring lugs.

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RESISTANCE TEMPERATURE DETECTORS

RTD Ordering Information

"RQJ" DESIGN

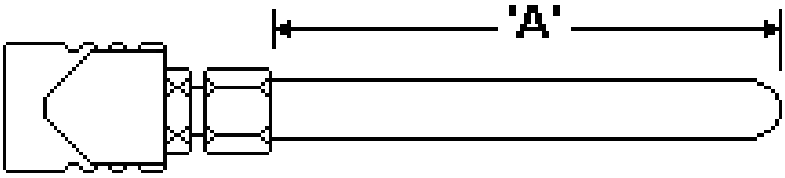

Table 1
Sheath Diameter

P/N	Description
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
500	.500 inches
XXX	Special

Table 2
Calibration

P/N	Description
PD	100Ω Platinum (.00385)
PS	100Ω Platinum (.00392)
PF	500Ω Platinum (.00385)
PT	1000Ω Platinum (.00385)
CU	10Ω Copper (.00427)
NI	120Ω Nickel (.00672)
XX	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
X	Special

Table 4
Temp. Range

P/N	Description
1	0°F-450°F
2	0°F-900°F
X	Special

Table 5
Cold End Termination

P/N	Description
A	Standard Jack
B	Hi-Temp Jack
C	Ceramic Jack
D	Miniature Jack
E	Miniature Hi-Temp Jack
F	Miniature Ceramic Jack
X	Special

RQJ--------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐

Design	Number Of Elements	Sheath Diameter (Table 1)	Element Calibration (Table 2)	Sheath Material (Table 3)	Temp. Range (Table 4)	"A" Dimension (In Inches)	Number of Conductors	Cold End Termination (Table 5)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Example:

Single Element: RQJ-1-250-PD-2-2-12-3-A

RQJ Design, single element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 0°F-500°F temperature range, 12" active length, 3 conductors, standard jack.

Dual Element: RQJ-2-250-PD-2-2-12-3-A

RQJ Design, dual element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 0°F-500°F temperature range, 12" active length, 3 conductors, standard jack.

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RESISTANCE TEMPERATURE DETECTORS

RTD Ordering Information

"RQP" DESIGN

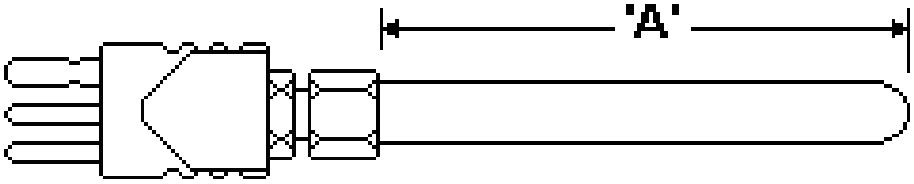

Table 1
Sheath Diameter

P/N	Description
125	.125 inches
188	.188 inches
250	.250 inches
313	.313 inches
375	.375 inches
500	.500 inches
XXX	Special

Table 2
Calibration

P/N	Description
PD	100Ω Platinum (.00385)
PS	100Ω Platinum (.00392)
PF	500Ω Platinum (.00385)
PT	1000Ω Platinum (.00385)
CU	10Ω Copper (.00427)
NI	120Ω Nickel (.00672)
XX	Special

Table 3
Sheath Material

P/N	Description
1	Alloy 600
2	304 S.S.
3	316 S.S.
4	310 S.S.
5	321 S.S.
6	446 S.S.
X	Special

Table 4
Temp. Range

P/N	Description
1	0°F-450°F
2	0°F-900°F
X	Special

Table 5
Cold End Termination

P/N	Description
A	Standard Plug
B	Hi-Temp Plug
C	Ceramic Plug
D	Miniature Plug
E	Miniature Hi-Temp Plug
F	Miniature Ceramic Plug
X	Special

RQP--------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐ ---------- ☐

Design	Number Of Elements	Sheath Diameter (Table 1)	Element Calibration (Table 2)	Sheath Material (Table 3)	Temp. Range (Table 4)	"A" Dimension (In Inches)	Number of Conductors	Cold End Termination (Table 5)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Example:

Single Element: RQP-1-250-PD-2-2-12-3-A

RQP Design, single element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 0°F-500°F temperature range, 12" active length, 3 conductors, standard plug.

Dual Element: RQP-2-250-PD-2-2-12-3-A

RQP Design, dual element, .250"ϕ, 100Ω Platinum (.00385), 304 SS sheath, 0°F-500°F temperature range, 12" active length, 3 conductors, standard plug.

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HARDWARE & ACCESSORIES

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COMPRESSION STYLE & FIXED FITTINGS

Duro-Sense compression fittings allow the thermocouple immersion depth to be set in the field. They are available in both adjustable and non-adjustable/fixed styles. They are available in both stainless steel and brass. The internal ferrule or sealant glands are available in a variety of materials depending on the application. Compression fittings are rated up to 3000psi depending on temperature and sheath diameter.

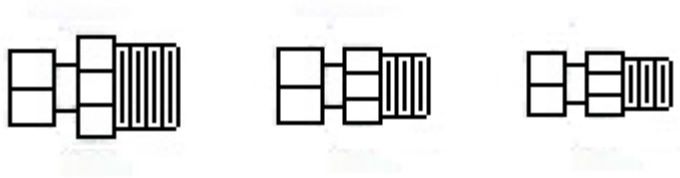
Duro-Sense adjustable compression fittings can be relocated at different positions along the thermocouple sheath whenever changes in the immersion depth are necessary. To relocate an adjustable compression fitting, simply loosen the cap, slide the fitting into the new position and retighten the cap. Adjustable compression fittings have a stainless steel body and an internal ferrule or sealant gland of Tetrafluorethylene (TFE) Teflon. Additional ferrule materials are available for specialty fittings only. TFE ferrules are rated at -300ºF to 500ºF (-184ºC to 260ºC). TFE ferrules should withstand several relocations before replacement is necessary.

Duro-Sense non-adjustable compression fittings cannot be relocated once they are tightened. Since the ferrule or sealant gland is made from stainless steel, once it is tightened the ferrule and the thermocouple sheath are deformed and do not allow for relocation. When ordered as a part of a thermocouple assembly, all compression fittings are shipped loose or finger-tight on the thermocouple sheath.

Duro-Sense fixed fittings are either brazed or welded to the thermocouple sheath and are permanent. They are available with threads on one or two sides. The two-sided fitting is also available in a spring-loaded version.

THERMOCOUPLE HARDWARE

Compression Fitting Ordering Information



Non-Adjustable Fitting (Metal Ferrule/Single Use)

Part #: D□F- □□ □

Fitting Material (Table 1) | Bore Size (Table 2) | Thread Size(NPT) (Table 3)

Adjustable Fitting (Non-SS Ferrule/Multi-Use)

Part #: DACF- □□ □ - □

Bore Size (Table 1) | Thread Size(NPT) (Table 2) | Ferrule Material (Table 4)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Fitting Material

P/N	Description
B	Brass
C	SS

Table 2
Bore Size

P/N	Description
06	1/16
12	1/8
18	3/16
25	1/4
50	1/2

Table 3
Thread Size

P/N	Description
Leave Blank	1/8" NPT
1	1/4" NPT
2	1/2" NPT
3	3/8" NPT
4	3/4" NPT

Table 4
Ferrule Material

P/N	Description
T	Teflon
L	Lava*
G	Grafoil*
N	Neoprene*
V	Viton*

NOTE: Not all combinations are available. Consult Factory.

** = Only available in specialty fittings.*

Example:

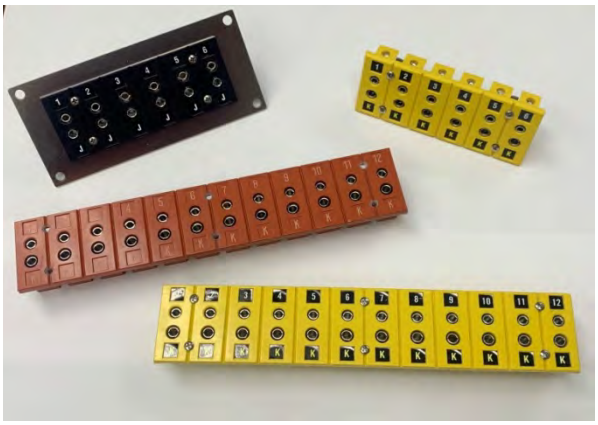
Non-Adjustable: DCF-252

1/4" Bore x 1/2" NPT Compression Fitting w/ SS Ferrule

Adjustable: DACF-252-T

1/4" Bore x 1/2" NPT Compression Fitting w/ Teflon Ferrule

JACK PANELS



Duro-Sense jack panels are molded out of glass-filled thermoset compounds (will not melt) for high strength and dependability. The color-coded panels will withstand ambient temperatures up to 400ºF (205ºC) continuous and 500ºF (260ºF) intermittent. Hi-Temperature panels are also available. All Hi-Temp panels are color-coded maroon and will withstand ambient temperatures up to 800ºF (425ºC) continuous and 1000ºF (540ºC) intermittent.

Duro-Sense jack panels are available in two(2) to twelve(12) circuits; with and without frames. Panels with mounting frames can accommodate virtually any number of circuits. One-piece mounting frames are made from 3/32" thick rigid steel. Horizontal rows are assumed unless specified as vertical. Horizontal panels are numbered left to right. Vertical panels are numbered top to bottom. All panels are numbered starting with one(1) unless otherwise noted.

Duro-Sense jack panels can be wired and installed completely from the front. The patented self-contained fastening device, "T-NUT", is permanently attached, holds tight, and simplifies mounting. Thermocouple type and circuit numbers are marked on the face of the panel with corresponding circuit numbers and polarity identification on the back.

Duro-Sense jack panel inserts are spring-loaded collet type to ensure positive full contact. The negative insert is larger, making it virtually impossible to reverse polarity. They are also available with gold-plated contacts for corrosive applications. Caution – system errors can result from use of plated contacts if significant thermal gradients exist.

TYPE CODE	INSERT MATERIAL ALLOY		COLOR CODE
	POSITIVE	NEGATIVE	
J	IRON	CONSTANTAN	BLACK
K	CHROMEL	ALUMEL	YELLOW
T	COPPER	CONSTANTAN	BLUE
E	CHROMEL	CONSTANTAN	PURPLE
N	NICROSIL	NISIL	ORANGE
R	COPPER	#11 ALLOY	GREEN
S	COPPER	#11 ALLOY	GREEN
U	COPPER	COPPER	WHITE
C	#405 ALLOY	#426 ALLOY	BROWN
ALL HI-TEMP JACK PANELS			MAROON

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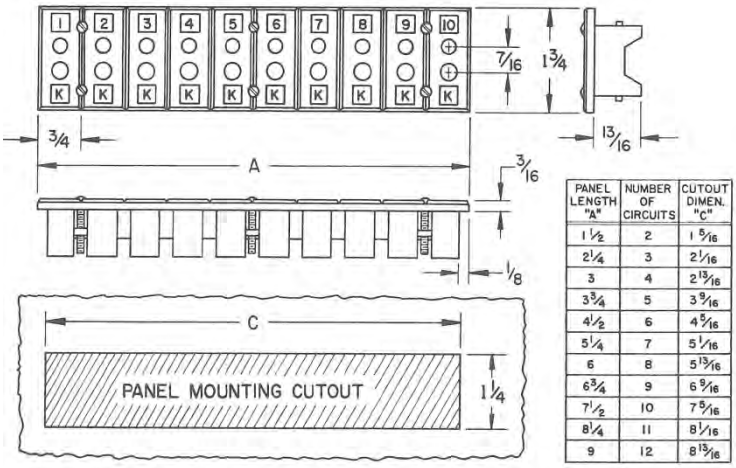
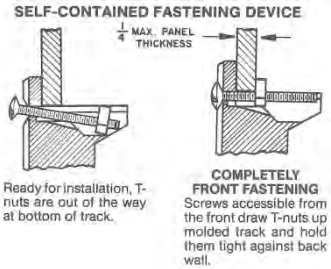
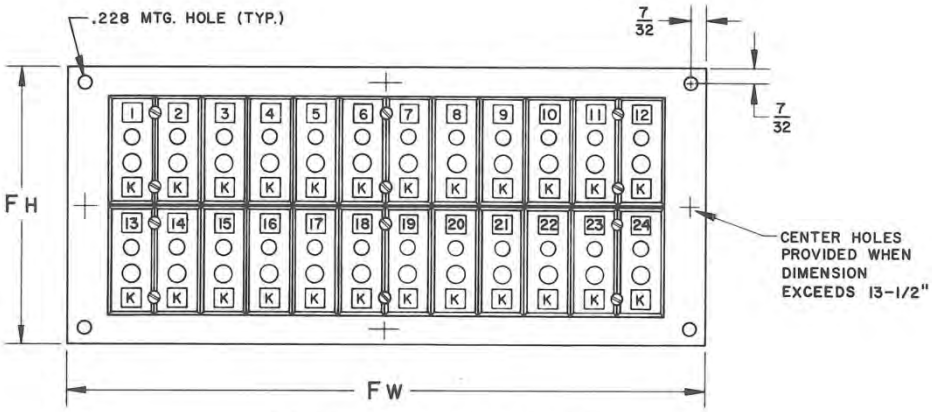
Phone: (310) 533-6877 -- Fax: (310) 533-0330 – E-mail: sales@duro-sense.com -- Website: www.duro-sense.com

JACK PANELS



PANEL LENGTH "A"	NUMBER OF CIRCUITS	CUTOUT DIMEN. "C"
1 1/2	2	1 5/16
2 1/4	3	2 1/16
3	4	2 13/16
3 3/4	5	3 9/16
4 1/2	6	4 5/16
5 1/4	7	5 1/16
6	8	5 13/16
6 3/4	9	6 9/16
7 1/2	10	7 5/16
8 1/4	11	8 1/16
9	12	8 13/16





Dimension for Panel Assembly

C_H AND C_W ARE MOUNTING CUTOUT DIMENSIONS

NUMBER OF ROWS	F_H / C_H	CIRCUITS PER ROW 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		F_W = 2 3/4" C_W = 1 1/2"	F_W = 3 1/2" C_W = 2 1/4"	F_W = 4 1/4" C_W = 3"	F_W = 5" C_W = 3 3/4"	F_W = 5 3/4" C_W = 4 1/2"	F_W = 6 1/2" C_W = 5 1/4"	F_W = 7 1/4" C_W = 6"	F_W = 8" C_W = 6 3/4"	F_W = 8 3/4" C_W = 7 1/2"	F_W = 9 1/2" C_W = 8 1/4"	F_W = 10 1/4" C_W = 9"	F_W = 11" C_W = 9 3/4"	F_W = 11 3/4" C_W = 10 1/2"	F_W = 12 1/2" C_W = 11 1/4"	F_W = 13 1/4" C_W = 12"	F_W = 14" C_W = 12 3/4"	F_W = 14 3/4" C_W = 13 1/2"	F_W = 15 1/2" C_W = 14 1/4"	F_W = 16 1/4" C_W = 15"	F_W = 17" C_W = 15 3/4"	F_W = 17 3/4" C_W = 16 1/2"	F_W = 18 1/2" C_W = 17 1/4"	F_W = 19 1/4" C_W = 18"
1	F_H = 2 5/8" C_H = 1 1/2"	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2	F_H = 4 3/8" C_H = 3 1/4"	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48
3	F_H = 6 1/8" C_H = 5"	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72
4	F_H = 7 7/8" C_H = 6 3/4"	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96
5	F_H = 9 5/8" C_H = 8 1/2"	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
6	F_H = 11 3/8" C_H = 10 1/4"	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144
7	F_H = 13 1/8" C_H = 12"	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147	154	161	168
8	F_H = 14 7/8" C_H = 13 3/4"	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192
9	F_H = 16 5/8" C_H = 15 1/2"	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180	189	198	207	216
10	F_H = 18 3/8" C_H = 17 1/4"	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240

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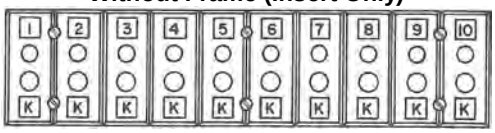
THERMOCOUPLE HARDWARE

Jack Panels

Without Frame (Insert Only)



Part #: DJP- □□ - □ - □

- Number of Circuits (Table 1)
- Calibration (Table 2)
- *

* If a Hi-Temp panel is required, add "HT" after the designated calibration.

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Number of Circuits

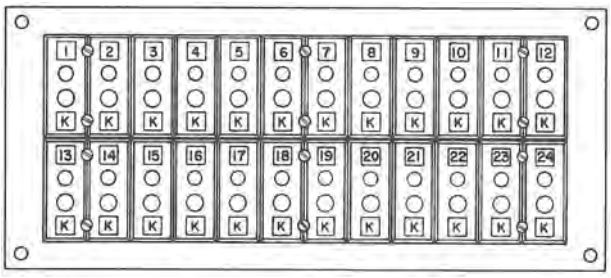
2 - 12

Table 2
Calibration

J	R
K	S
T	U
E	C
N	

♦ ♦ ♦

With Frame



Part #: DJP- □□ x □□ - □□ - □ - □

- # of Rows (Table 1)
- # of Circuits Per row (Table 2)
- Total # of Circuits
- Calibration (Table 3)
- *

* If a Hi-Temp panel is required, add "HT" after the designated calibration.

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
# of Rows

1 - 12

Table 2
# of Circuits

1 – 12

Table 3
Calibration

J	R
K	S
T	U
E	C
N	

Example:

DJP-6-K
6-Circuit, Type 'K' Jack Panel without Frame
DJP-1x6-6-K
6-Circuit, Type 'K' Jack Panel with Frame

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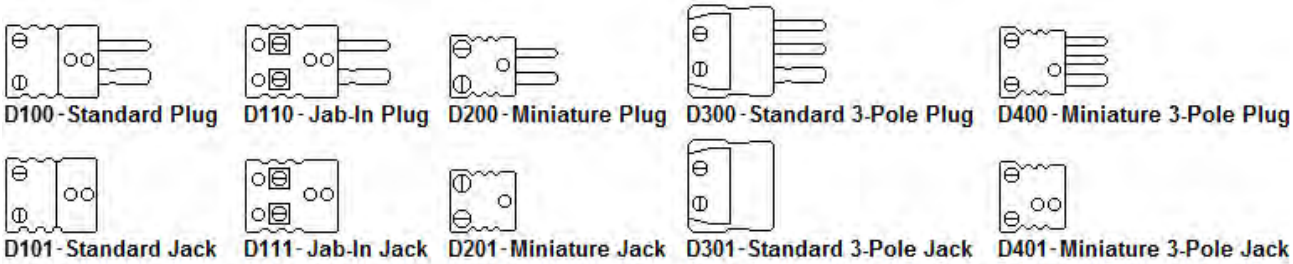
THERMOCOUPLE CONNECTORS

Connector Ordering Information



Part #: D□□□-□-□□□-□-□

Connector Style (See Above) | **Calibration** (Table 1) | * | ** | † | ††

Table 1
Calibration

P/N	Description
J	Type 'J'
K	Type 'K'
T	Type 'T'
E	Type 'E'
N	Type 'N'
R	Type 'R'
S	Type 'S'
C	Type 'C'
U	Uncompensated
X	Special

*	**	†	††
If a high-temp connector is required, add "HT" after the designated calibration.	If a ceramic connector is required, add "C" after the "HT" designation.	If solid pins are required, add an "S" suffix to the part number.	If gold-plated pins are required, add a "G" suffix to the part number.[1]

[1] Solid pins required for gold plating.

Note: Not all configurations will work together. Consult factory with questions.

Example: **D100-K-HTC**

Standard male plug. Type 'K'. High-temp ceramic.

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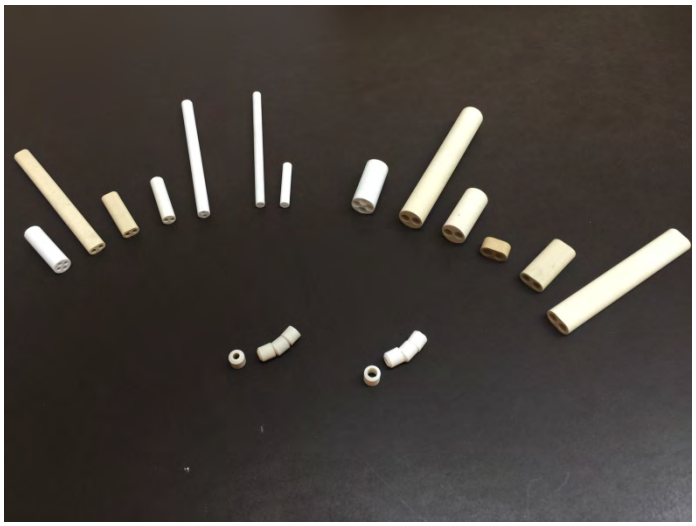
INSULATORS



Duro-Sense selects our insulators based on their ability to withstand elevated temperatures or to resist thermal shock. Our catalog listing, groups our insulators in these classifications for convenient selection. Some sizes and lengths are available in more than one classification. The thermocouple insulators listed on the following page are generally carried in stock for quick delivery. Other sizes can be made to suit individual requirements.

Mullite Insulators

- High Temperature
- Low Thermal Expansion
- Good Mechanical Strength
- Maximum Continuous Temperature 2640ºF (1450ºC)
- Maximum Intermittent Temperature 3000ºF (1650ºC)

Cordierite Insulators

- Excellent Thermal Shock Resistance
- Fair Physical Strength & Electrical Properties
- Maximum Continuous Temperature 2280ºF (1250ºC)
- Maximum Intermittent Temperature 2370ºF (1300ºC)

Alumina Insulators

- Excellent High Temperature Insulation
- Good Electrical & Mechanical Properties
- Maximum Continuous Temperature 3000ºF (1650ºC)
- Maximum Intermittent Temperature 3300ºF (1815ºC)

THERMOCOUPLE HARDWARE

Insulator Ordering Information

Part #: D □ □ □□ - □

# Holes (Table 1)	Shape (Table 2)	Gauge (Table 3)	Length (Table 4)

NOTE: For any additional modifications to this item, add "-MOD" to the end of the part number and provide a physical description of the modification.

Not all configurations work together. Consult Factory with questions.

Table 1
 # Holes

P/N	Description
1	One
2	Two
4	Four
X	Special

Table 2
Shape

P/N	Description
O	Oval
R	Round

Table 3
Gauge

P/N	Description
8	8 AWG
14	14 AWG
20	20 AWG
X	Special

Table 4
Length

P/N	Description
1	1 Inch
3	3 Inches
X	Special

Example: **D2O14-1**

2-Bore, Oval, 14 Gauge Insulator x 1" Long

Fish Spine Ordering Information

Part #: DFS - □□

Gauge (Table 3)

NOTE: For any additional modifications to this item, add "-MOD" to the end of the part number and provide a physical description of the modification.

Example: **DFS-14**

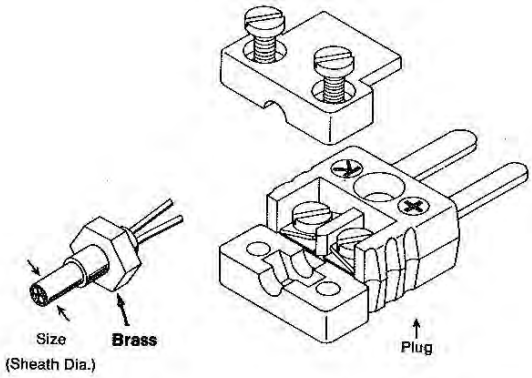
14 Gauge Fish Spine

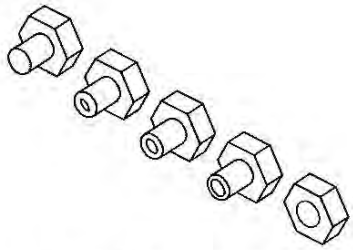
Dimensional Information(Nominal)

Description	Gauge	OD	Hole Size	Length
Round Single Bore	8	.250"	.156"	Various (Specify)
	14	.187"	.094"	Various (Specify)
Round Two Bore	8	.468"	.156"	1" or 3"
	14	.250"	.080"	1" or 3"
	20	.156"	.045"	1" or 3"
Round Four Bore	8	.461"	.156"	1" or 3"
	14	.313"	.078"	1" or 3"
	20	.187"	.047"	1" or 3"
Oval Two Bore	8	.485" x .281"	.156"	1" or 3"
	14	.313" x .188"	.085"	1" or 3"
	20	.172" x .118"	.045"	1" or 3"
Fish Spine	8	.250"	.156"	¼"
	14	.220"	.100"	¼"

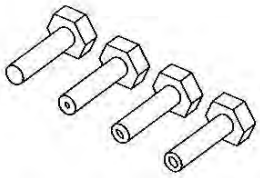
THERMOCOUPLE CONNECTOR HARDWARE

Miniature Connector Hardware Ordering Information

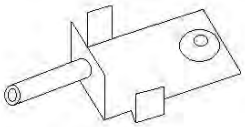




Braze-On Adapter



Hex Crimp-On Adapter



Crimp-On Tube Adapter

Part #: DBOA-□□□-Mini
Diameter of Sheath
(Table 1)

Part #: DCOA-□□□-Mini
Diameter of Sheath
(Table 2)

Part #: DPJA-□□□-Mini
Diameter of Sheath
(Table 3)

Table 1

P/N	Description
040	.040”
063	.063”
090	.090”
125	.125”

Table 2

P/N	Description
020	.020”
032	.032”
040	.040”
063	.063”

Table 3

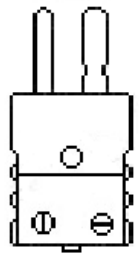
P/N	Description
040	.040”
063	.063”
125	.125”

Example: **DCOA-040-Mini**

Miniature Crimp-On Adapter for .040” Diameter Sheath.

THERMOCOUPLE CONNECTOR HARDWARE

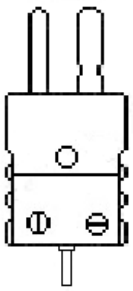
Standard Connector Hardware Ordering Information



Braze Adapter

Part #: DBOA-□□□

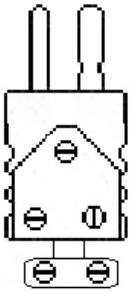
Diameter of Sheath (Table 1)



Crimp Adapter

Part #: DCOA-□□□

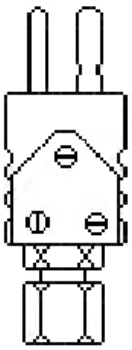
Diameter of Sheath (Table 2)



Cable/Wire Clamp

Part #: DCC (Cable Clamp)

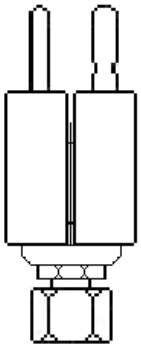
Part #: DWC (Wire Clamp)



Tube Adapter

Part #: DPJA-□□□

Diameter of Sheath (Table 3)



Dual Tube Adapter

Part #: DPJA-□□□-D

Diameter of Sheath (Table 3)

Table 1
Diameter of Sheath

P/N	Description
040	.040”
063	.063”
090	.090”
125	.125”
188	.188”
250	.250”

Table 2
Diameter of Sheath

P/N	Description
040	.040”
063	.063”
125	.125”
188	.188”

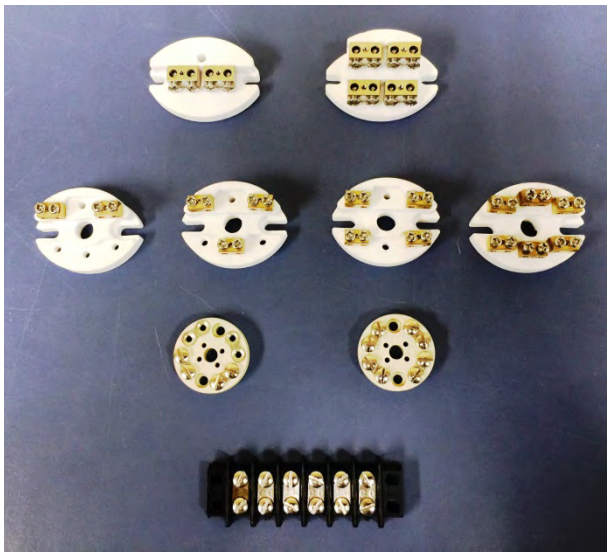
Table 3
Diameter of Sheath

P/N	Description
040	.040”
063	.063”
125	.125”
188	.188”
250	.250”
313	.313”
375	.375”

Example: **DPJA-250-D**

Dual Tube Adapter for .250” Diameter Sheath.

THERMOCOUPLE / RTD TERMINAL BLOCKS



Duro-Sense thermocouple/RTD terminal blocks are available in a wide variety of configurations. The following page illustrates the most popular styles and configurations. Should your requirements call for a style or configuration that is not listed, contact the factory to discuss how we can best meet your need.

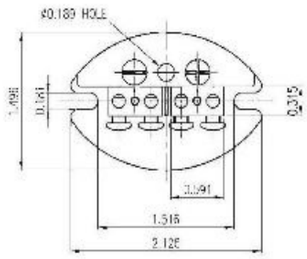
Duro-Sense standard terminal block material is Al2O3 95%. This is stronger than ceramic and resistant to cracking and flaking. Al2O3 has a high melting point, high mechanical strength and due to the relatively large coefficient of thermal expansion, thermal shock resistance is reduced. They fit most styles of heads. The D-341 & D-342 series of terminal blocks are suitable for 8 AWG to 24 AWG wires. The D-343 series of blocks are suitable for 14 AWG to 24 AWG wires.

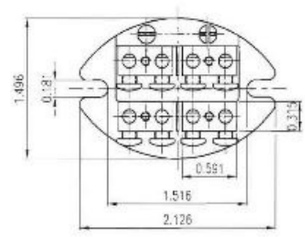
Duro-Sense mini terminal block material is Steatite. Steatite has high electrical resistance at elevated temperatures, good mechanical strength and a very low dielectric loss factor. Such properties make it ideal for high frequency, low loss, and high voltage insulation. They are designed specifically for use with the mini cast aluminum head. The mini terminal block is suitable for 20 AWG to 30AWG wires.

Duro-Sense terminal barrier strip material is glass-filled Nylon. These terminal strips are not rated for high temperature use, like the standard and mini blocks. They are rated at 350°F-400°F max. The unique aspect of the terminal barrier strips is that the terminals are compensated thermocouple alloy. They are available in Type J, K, T, E, N and uncompensated copper. The terminal barrier strips are suitable for 14 AWG to 24 AWG wires.

THERMOCOUPLE HARDWARE

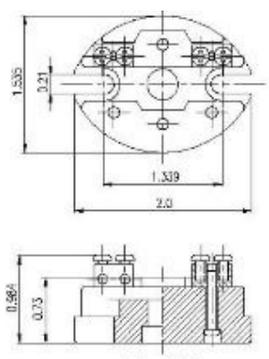
Standard Terminal Block Ordering Information

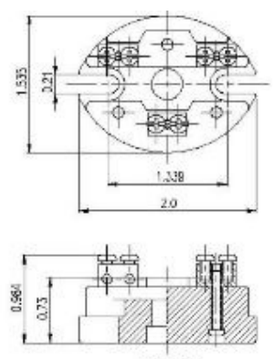


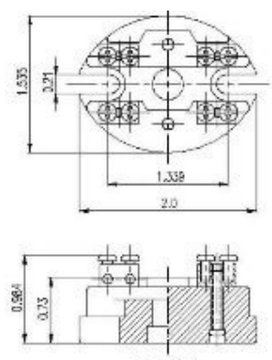


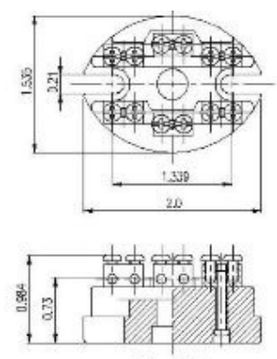
D-341 ♦ Single Block **D-342 ♦ Duplex Block**

Standard Terminal Block with Center Hole Ordering Information



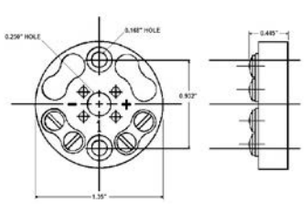


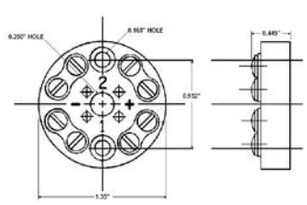




D-343-2 ♦ 2-Pole **D-343-3 ♦ 3-Pole** **D-343-4 ♦ 4-Pole** **D-343-6 ♦ 6-Pole**

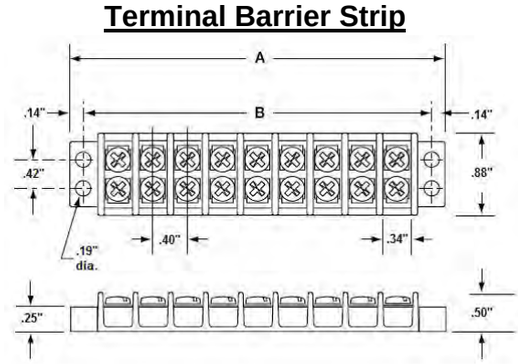
Miniature Terminal Block Ordering Information





MTB-1 ♦ Single Block **MTB-2 ♦ Duplex Block**

Terminal Barrier Strip



TBS- ** - †

** = # of Terminals ♦ † = Calibration

# of Terminals	Length 'A'	Mounting Centers 'B'
2	1-5/8	1-5/16
3	2-1/8	1-3/4
4	2-1/2	2-3/16
6	3-3/8	3-1/16
8	4-1/4	3-15/16
10	5-1/8	4-13/16
12	6	5-11/16
14	6-7/8	6-9/16
16	7-3/4	7-7/16
20	9-1/2	9-3/16

THERMOCOUPLE / RTD CONNECTION HEADS

Duro-Sense thermocouple/RTD connection heads are available in a wide variety of configurations. The following pages illustrate the most popular styles and configurations. Should your requirements call for a style or configuration that is not listed, contact the factory to discuss how we can best meet your need.

Duro-Sense cast aluminum, cast iron, and stainless steel connection heads meet NEMA 4X rating for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); that provides an additional level of protection against corrosion; and that will be undamaged by the external formation of ice on the enclosure. These connection heads are suitable for DIN size transmitters and most terminal blocks.

Duro-Sense polypropylene connection heads carry an FDA approval for use in sanitary and food applications. These connection heads are suitable for DIN size transmitters and most terminal blocks.

Duro-Sense mini cast aluminum heads meet NEMA 4 rating for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water) These connection heads are suitable for the miniature terminal block.

Duro-Sense explosion proof connection heads carry various rating as noted below.

Aluminum: **FM** - Explosion proof for Class 1, Division 1, Groups A, B, C and D; and dust-ignition proof for Class II, III Division 1, Groups E, F and G hazardous (classified) locations; indoor/outdoor. NEMA 4, **FMC** (Canada) - Explosion proof for Class 1, Division 1, Groups A, B, C and D; and suitable for Class II, III Division 1, Groups E, F and G hazardous (classified) locations; indoor/outdoor. NEMA 4, **ATEX** - Directive Code: II 2 G D, Standards Code: Ex d IIC T6, Ex tD A21 T100°C IP68.

316SS: **FM** - Explosion proof for Class 1, Division 1, Groups A, B, C and D; and dust-ignition proof for Class II, III Division 1, Groups E, F and G hazardous (classified) locations; indoor/outdoor. NEMA 4, **FMC** (Canada) - Explosion proof for Class 1, Division 1, Groups A, B, C and D; and suitable for Class II, III Division 1, Groups E, F and G hazardous (classified) locations; indoor/outdoor. NEMA 4, **ATEX** - Directive Code: II 2 G D, Standards Code: Ex d IIC T6, Ex tD A21 T100°C IP68.

These connection heads are suitable for 40mm and DIN size terminal blocks and transmitters.

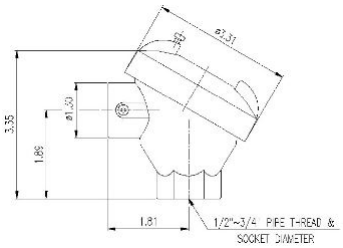
Iron: Explosion proof for Class I, Division 1 and 2 Groups B, C and D, Class II, Division 1 and 2, Groups E, F and G, Class III. NEMA 3 and 4.

These connection heads are not suitable for standard terminal blocks and transmitters. This style connection head requires the use of a terminal barrier strip. (see accessories page for details).

THERMOCOUPLE HARDWARE

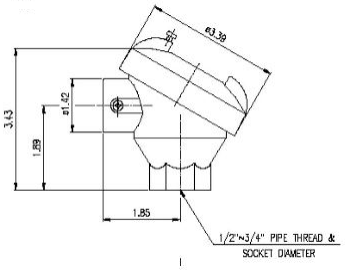
Standard Thermocouple Head Ordering Information

CAST ALUMINUM



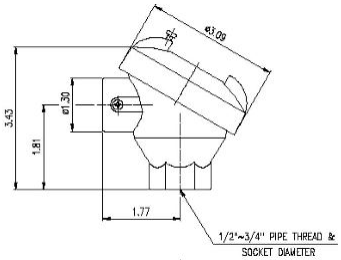
D-304 ♦ ½" x ½" NPT
D-305 ♦ ½" x ¾" NPT
D-306 ♦ ¾" x ¾" NPT

CAST IRON



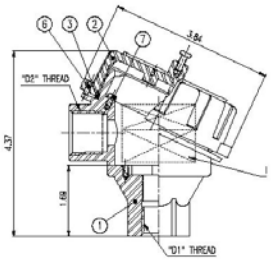
D-307 ♦ ½" x ½" NPT
D-308 ♦ ½" x ¾" NPT
D-309 ♦ ¾" x ¾" NPT

STAINLESS STEEL



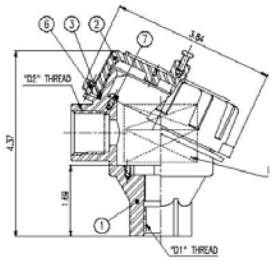
D-404 ♦ ½" x ½" NPT
D-405 ♦ ½" x ¾" NPT
D-406 ♦ ¾" x ¾" NPT

EXPLOSION PROOF ALUMINUM



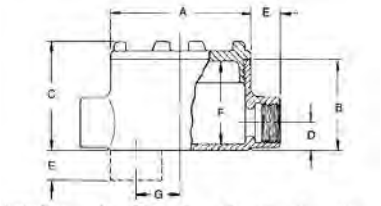
D-234 ♦ ½" x ½" NPT
D-235 ♦ ½" x ¾" NPT
D-236 ♦ ¾" x ¾" NPT

EXPLOSION PROOF 316SS



D-237 ♦ ½" x ½" NPT
D-238 ♦ ½" x ¾" NPT
D-239 ♦ ¾" x ¾" NPT

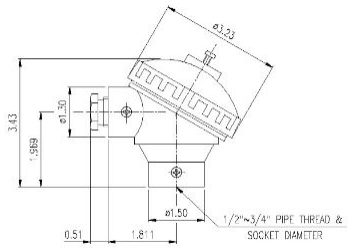
EXPLOSION PROOF MALEABLE IRON



Hub Size	A	B	C	D	E	F	G
1/2"	3.75"	2.44"	2.88"	.75"	.81"	2.25"	1.25"
3/4"	3.75"	2.44"	2.88"	.75"	.81"	2.25"	1.25"
1"	3.75"	2.44"	2.88"	.94"	.94"	2.25"	1.06"

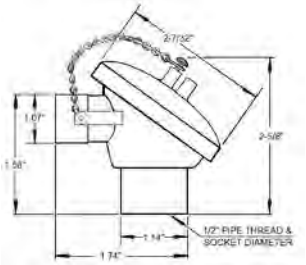
D-244 ♦ ½" x ½" NPT
D-245 ♦ ¾" x ¾" NPT
D-246 ♦ 1" x 1" NPT

POLYPROPYLENE



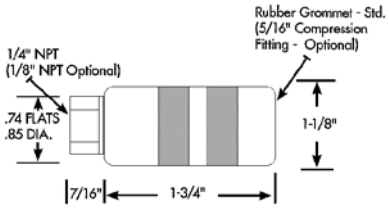
D-397 ♦ ½" x ¾" NPT

MINI CAST ALUMINUM



D-104 ♦ ½" x ½" NPT

CANNISTER STYLE



D-791 ♦ ¼" NPT
D-792 ♦ 1/8" NPT

DURO-SENSE CORPORATION 869 Sandhill Ave., Carson, CA 90746
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TEMPERATURE TRANSMITTERS

A temperature transmitter is generally described as a device, which on the input side is connected to some sort of temperature sensor and on the output side generates a signal that is amplified and modified in different ways. Normally the output signal is directly proportional to the measured temperature within a defined measurement range. Many additional features can be added depending on the type of transmitter being used. The features of the temperature transmitter are often described by using different terms with respect to technology, mounting method, functions, etc. The following list is a brief summary of these terms.

Analog Transmitters: These transmitters are designed on analog circuit technology. They normally offer basic functions such as temperature linearization and sensor break technology. Sometimes they are adjustable for different measuring ranges, often with a fast response time.

Digital Transmitters: This transmitter type is mainly based on a microprocessor. They are often called intelligent transmitters, because they normally offer many extra features, which are not possible to realize in analog transmitters.

In-Head Transmitters: These transmitters are designed for mounting in the connection heads of temperature sensors. All Duro-Sense in-head transmitters fit into DIN B heads or larger. Special care has to be devoted to the ruggedness because of the harsh conditions that sometimes exist.

DIN Rail Transmitters: DIN rail transmitters are designed to be snapped onto a DIN rail. Duro-Sense DIN rail transmitters fit on a 35mm rail according to DIN EN 50022.

RTD Transmitters: RTD transmitters are used only for RTD sensors. (Pt100, Pt1000, Ni100, etc.). Normally they can handle only one RTD type. Most Duro-Sense transmitters can handle more than one type of RTD and are either fix-ranged or adjustable. They all have linear output.

Thermocouple Transmitters: Thermocouple transmitters measure a MV signal from the thermocouple and compensates for the temperature of the cold junction. The cold junction compensation is normally made by measuring the terminal temperature. Alternatively, some transmitters can be adjusted to compensate for an external fixed cold junction temperature. Pure thermocouple transmitters are often not temperature linearized due to the complicated unlinearity of the thermocouples.

Analog Output: The output signal is a current (4-20mA). Some transmitters are available with 0-20mA or 0-10mA output. The signal is normally proportional to the measured value within a defined measurement range.

Digital Output: The measured value (temperature) is presented as a binary coded message. So called Fieldbus transmitters use this technique. The Fieldbus transmitters on the market today use different standards for the communication thus creating some problems when integrating them with other instrumentation. Examples of standard available are: Profibus, Interbus, Foundation Fieldbus, LonWorks and CAN-bus.

Analog and Digital Output: The HART transmitters have an analog output with a superimposed digital signal on the same wires. Typically, the analog signal is used for normal measurements and the digital signal only for temporary measurements, because of the low communication speed. The digital signal is mainly used for configuration and status information.

Isolated Transmitters: Isolated transmitters have no leading connections between circuits that are isolated from each other. The isolation effectively eliminates the risk for circulating currents and facilitates the connection of transmitters to control systems with grounded inputs.

Non-Isolated Transmitters: These transmitters have leading connections between, for instance, input and output circuits. They should be used with care.

Temperature Transmitter Ordering Information

Part #: **TT- □ - □ - □ □**

Model (Table 1) | Calibration (Table 2) | Temperature Range | Unit of Measure (Table 3)

*** For RTD configuration, specify the resistance. (ie: 100Ω Platinum, 1000Ω Platinum, 10Ω Copper, etc.)*

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Model

P/N	Description
Minipaq	Minipaq
Ipaq-H	Ipaq-H
Ipaq C202	Ipaq C202
Ipaq R202	Ipaq R202
Ipaq C330	Ipaq C330
Ipaq R330	Ipaq R330
Ipaq C530	Ipaq C530
Ipaq R530	Ipaq R530
X	Special

Table 2
Calibration

P/N	Description
J	Type 'J' T/C
K	Type 'K' T/C
T	Type 'T' T/C
E	Type 'E' T/C
N	Type 'N' T/C
R	Type 'R' T/C
S	Type 'S' T/C
B	Type 'B' T/C
RTD**	RTD

Table 3
Unit of Measure

P/N	Description
C	°C
F	°F

Example: **TT-Minipaq-K-0-400F**

Minipaq Style Transmitter for use with Type 'K' T/C, Temperature Range = 0-400°F

♦ ♦ ♦

Configuration Kit Ordering Information

Part #: **CK- □**

Model (Table 1)

- *EX-approved*
- *HART modem not included*

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Model

P/N	Description
X	ICON-X
L	ICON Lite

Example: **CK-X**

ICON-X Configuration Kit

Temperature Transmitter Ordering Information

MINIPAQ-HLP/L

This is a cost-competitive, non-isolated Temperature transmitter that will accept RTD & thermocouple inputs. This Transmitter is programmable via a PC.
Input: RTD, T/C
Accuracy: ± 0.15% of span
Sensor & system error correction capability

IPAQ C/R 202

This low-cost, 3-wire Pt100 RTD input with programmable output transmitter is an excellent value. Digital design provides Long-term stability & excellent accuracy. Excellent alternative to analog transmitters.
Input: Pt100 RTD
Accuracy: ± 0.10% of span
Approvals: ATEX & IECEx (C202X)
Sensor & system error correction capability

IPAQ C/R 330

This universal input, isolated, PC-programmable transmitter offers superior accuracy & lifetime performance.
Input: RTD, T/C, Ω, mV
Accuracy: ± 0.08% of span
Approvals: ATEX & IECEx (C330X)
FM & CSA (Pending)
Sensor & system error correction capability & 50-point custom linearization

IPAQ C/R 530

This transmitter was developed to meet the Highest standards of accuracy & reliability. The 530 offers NFC & Bluetooth® wireless Configuration capabilities.
Input: RTD, T/C, Ω, mV
Accuracy: ± 0.08% of span
Approvals: ATEX & IECEx (C330x)
FM & CSA (Pending)
Sensor & system error correction capability & 50-point custom linearization

ICON-X Kit

This is a complete kit for PC configuration of all transmitters in the product line, except for the MESO transmitters. This kit contains the USB interface, transmitter cables, software and carrying case. Communication with the transmitter is established automatically. without any problems to match the PC communication port to the software.

ICON Lite Kit

This configuration kit is for Mini USB port transmitters. MiniPAQ, C/R 202, C/R 330, C/R 520, C/R 530.
It includes the USB interface, PC to USB cable, mini USB to mini USB cable to connect to transmitters. Complete with storage bag.

Duro-Sense Corporation

THERMOWELLS

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869 Sandhill Avenue Carson, California 90746 | 310-533-6877

THERMOWELLS

Duro-Sense thermowells are drilled and machined from selected bar stock. The exterior of the thermowell is provided with a polished finish below the threads for minimum resistance to flow lines.

The bore size of thermowells shown in this catalog cover the most commonly used temperature sensing elements. Thermowells with a bore size of 0.260” are recommended for (but not limited to) ¼” stem bi-metal thermometers, ¼” diameter mineral insulated thermocouples and RTD’s, and 20 gauge insulated thermocouples. Thermowells with a bore size of 0.385” are recommended for (but not limited to) 3/8” diameter mineral insulated thermocouples and RTD’s and 14 gauge insulated thermocouples.

When ordering flanged thermowells, please include the type of flange, pressure rating, size and material.

Any thermowell that is not listed can be quoted upon receipt of full specifications.

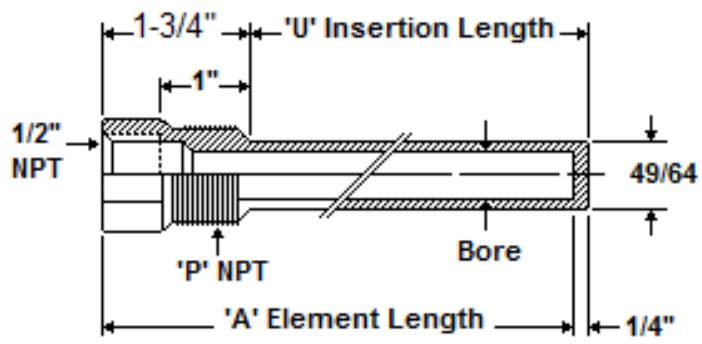
Thermowell material selected for installation is governed primarily by temperature, corrosion resistance to gas or liquid and mechanical strength.

MATERIAL SELECTION GUIDE

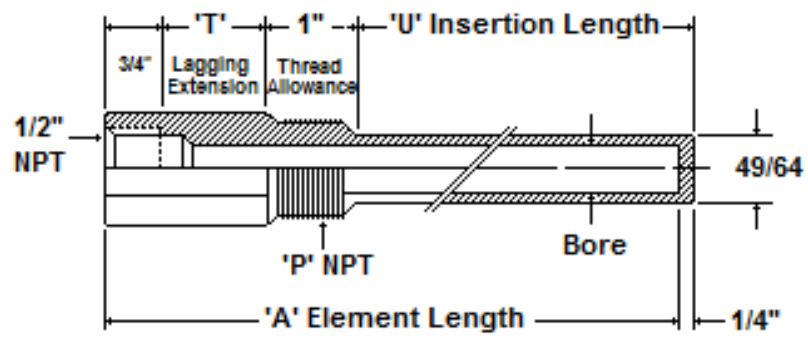
SUBSTANCE	CONDITIONS	RECOMMENDED MATERIAL	SUBSTANCE	CONDITIONS	RECOMMENDED MATERIAL
Acetic Acid	10%-50%, 70°F	304SS, Hastelloy C, Monel	Cyanogen Gas		304SS
Acetic Acid	50%, 212°F	316SS, Hastelloy C, Monel	Dow therm		Low Carbon Steel
Acetic Acid	99%, 212°F	430SS, Hastelloy C, Monel	Epsom Salt	Hot and cold	304SS
Acetic Anhydride		Monel	Ether	70°F	304SS
Acetone	212°F	304SS	Ethyl Acetate		Monel, 304SS
Acetylene		304SS, Monel	Ethyl Chloride	70°F	304SS
Alcohol, ethyl, methyl	70°F-212°F	304SS	Ethyl Sulfate	70°F	Monel
Aluminum	Molten	Cast Iron	Ethylene Glycol		Low Carbon Steel
Ammonia	All concentrations, 70°F	304SS, 316SS	Ferric Chloride	5%, 70°F to boiling	Tantalum, Hastelloy C
Ammonium Chloride	All concentrations, 212°F	316SS, Monel	Ferric Sulfate	5%, 70°F	304SS
Ammonium Nitrate	All concentrations, 212°F	316SS	Ferrous Sulphate	Dilute, 70°F	304SS
Ammonium Sulphate	10% to saturated, 212°F	316SS	Formaldehyde		304SS, 316SS
Barium Carbonate	70°F (21°C)	304SS	Formic Acid	5%, 70°F-150°F	316SS
Barium Chloride	All concentrations, 70°F	Monel, Hastelloy C	Freon		Monel
Barium Hydroxide	All concentrations, 70°F	Low Carbon Steel	Gallic Acid	5%, 70°F-150°F	Monel
Barium Sulphite		Nichrome, Hastelloy C	Gasoline	70°F	304SS
Bromine	70°F (21°C)	Tantalum, Monel	Glucose	70°F	304SS
Butadiene		304SS	Glycerine	70°F	304SS
Butane	70°F (21°C)	304SS	Glycerol		304SS
Butylacetate		Monel	Hydrobromic Acid	98%, 212°F	Hastelloy B
Butyl Alcohol		304SS	Hydrochloric Acid	1%, 5%, 70°F	Hastelloy C
Calcium Bisulfite	70°F (21°C)	316SS	Hydrochloric Acid	1%, 5%, 212°F	Hastelloy B
Calcium Chlorate	Dilute, 70°F-150°F	304SS	Hydrochloric Acid	25%, 70°F-212°F	Hastelloy B
Calcium Hydroxide	10%-20%, 212°F	304SS, Hastelloy C	Hydrocyanic Acid		316SS
Calcium Hydroxide	50%, 212°F	316SS, Hastelloy C	Hydrofluoric Acid	60%, 212°F	Hastelloy C, Monel
Carbonic Acid	All, 212°F	316SS	Hydrogen Peroxide	70°F-212°F	316SS, 304SS
Carbon Dioxide	Wet or dry	2017-T4 Aluminum, Monel, Nickel	Hydrogen Sulfide	Wet or dry	316SS
Chlorine Gas	Dry, 70°F, (21°C)	316SS, Monel	Iodine	70°F	Tantalum
Chlorine Gas	Moist, 20°F-212°F	Hastelloy C	Kerosene	70°F	304SS
Chromic Acid	10%-50%, 212°F	316SS, Hastelloy C	Lactic Acid	5%, 70°F	304SS, 316SS
Citric Acid	15%, 70°F (21°C)	304SS, Hastelloy C	Lactic Acid	5%, 150°F	316SS
Citric Acid	15%, 212°F (100°C)	316SS, Hastelloy C	Lactic Acid	10%, 212°F	Tantalum
Citric Acid	Concentrated, 212°F	316SS, Hastelloy C	Lacquer	70°F	316SS
Copper Nitrate		304SS, 316SS	Latex		Low Carbon Steel
Copper Sulfate		304SS, 316SS	Lime Sulphur		Low Carbon Steel
Cresols		304SS	Linseed oil	70°F	304SS
SUBSTANCE	CONDITIONS	RECOMMENDED MATERIAL	SUBSTANCE	CONDITIONS	RECOMMENDED MATERIAL
Magnesium Chloride	5%, 70°F	Monel. Nickel	Resin		304SS
Magnesium Chloride	5%, 212°F	Nickel	Rosin	Molten	304SS
Magnesium Sulphate	Cold and hot	Monel	Sea Water		Monel, Hastelloy C
Malic Acid	Cold and hot	316SS	Salammoniac		Monel
Mercury		304SS, Monel	Salicylic Acid		Nickel
Methane	70°F	Low Carbon Steel	Saline		Aluminum, Brass, Monel
Milk		304SS, 316SS, Nickel	Shellac		304SS
Molasses		Monel, Nickel	Soap	70°F	304SS
Muriatic Acid	70°F	Tantalum	Sodium Bicarbonate	All concentrations, 70°F	304SS
Naptha	70°F	304SS	Sodium Bicarbonate	5%, 150°F	304SS, 316SS
Natural Gas	70°F	304SS, 316SS, 317SS	Sodium Bisulphate		Monel
Neon	70°F	304SS	Sodium Carbonate	5%, 70°F	304SS, 316SS
Nickel Chloride	70°F	304SS	Sodium Carbonate	5%, 150°F	304SS, 316SS
Nickel Sulphate	Cold and hot	304SS	Sodium Chloride	5%, 70°F	316SS
Nitric Acid	5%, 70°F	304SS, 316SS	Sodium Chloride	5%, 150°F	316SS
Nitric Acid	20%, 70°F	304SS, 316SS	Sodium Chloride	Saturated, 70°F	316SS, Monel
Nitric Acid	50%, 70°F	304SS, 316SS	Sodium Chloride	Saturated, 212°F	316SS, Monel
Nitric Acid	50%, 212°F	304SS, 316SS	Sodium Fluoride	5%, 70°F	Monel
Nitric Acid	65%, 212°F	316SS	Sodium Hydroxide		304SS, 316SS, Hastelloy C
Nitric Acid	Concentrated, 70°F	304SS, 316SS	Sodium Hypochlorite	5%, still	316SS, Hastelloy C
Nitric Acid	Concentrated, 212°F	Tantalum	Sodium Nitrate	Fused	316SS
Nitrobenzene	70°F	304SS	Sodium Peroxide		304SS
Nitrous Acid		304SS	Sodium Phosphate		Steel
Oleic Acid	70°F	316SS	Sodium Silicate		Steel
Oleum	70°F	316SS	Sodium Sulphate	70°F	304SS, 316SS
Oxalic Acid	5%, cold and hot	304SS	Sodium Sulphide	70°F	316SS
Oxalic Acid	10%, 212°F	Monel	Sodium Sulphite	30%, 150°F	304SS
Oxygen	70°F	Steel	Steam		304SS
Oxygen	Liquid	304SS, 316SS	Stearic Acid		304SS
Palmitic Acid		316SS	Sulphur	Dry, molten	304SS
Pentane		304SS	Sulphur	Wet	316SS
Petroleum Ether		304SS	Sulphur Dioxide	Moist gas, 70°F	316SS
Phenol		304SS	Sulphur Dioxide	Gas, 575°F	304SS, 316SS
Phosphoric Acid	1%, 5%, 70°F	304SS	Sulphuric Acid	5%, 70°F-212°F	Hastelloy B, 316SS
Phosphoric Acid	10%, 70°F	316SS	Sulphuric Acid	10%, 70°F-212°F	Hastelloy B
Phosphoric Acid	10%, 212°F	Hastelloy C	Sulphuric Acid	50%, 70°F-212°F	Hastelloy B
Phosphoric Acid	30%, 70°F-212°F	Hastelloy B	Sulphuric Acid	90%, 70°F	Hastelloy B
Phosphoric Acid	85%, 70°F-212°F	Hastelloy B	Sulphuric Acid	90%, 212°F	Hastelloy D
Picric Acid	70°F	304SS	Tannic Acid	70°F	304SS, Hastelloy B
Potassium Bromide	70°F	316SS	Tar		304SS, Monel, Nickel
Potassium Carbonate	1%, 70°F	304SS, 316SS	Tartaric Acid	70°F	304SS
Potassium Chlorate	70°F	304SS	Tartaric Acid	150°F	316SS
Potassium Chloride	5%, 70°F	304SS	Tin	Molten	Cast Iron
Potassium Chloride	5%, 212°F	304SS	Toluene		2017-T4 Aluminum, Monel
Potassium Hydroxide	5%, 70°F	304SS	Trichlord Ethylene		Steel
Potassium Hydroxide	25%, 212°F	304SS	Turpentine		304SS
Potassium Hydroxide	50%, 212°F	316SS	Varnish		304SS
Potassium Nitrate	5%, 70°F	304SS	Vegetable Oils		304SS, Monel
Potassium Nitrate	5%, 212°F	304SS	Vinegar		304SS
Potassium Permanganate	5%, 70°F	304SS	Whiskey		304SS, Nickel
Potassium Sulphate	5%, 70°F	304SS, 316SS	Wine		304SS, Nickel
Potassium Sulphate	5%, 212°F	304SS, 316SS	Xylene		Copper
Potassium Sulfide	70°F	304SS, 316SS	Zinc	Molten	Cast Iron
Propane		304SS	Zinc Chloride		Monel
Pyrogallic Acid		304SS	Zinc Sulphate	5%, 70°F	304SS, 316SS
Quinine Bisulphate	Dry	316SS	Zinc Sulphate	Saturated, 70°F	304SS, 316SS
Quinine Sulphate	Dry	304SS	Zinc Sulphate	25%, 212°F	304SS, 316SS

THERMOWELLS

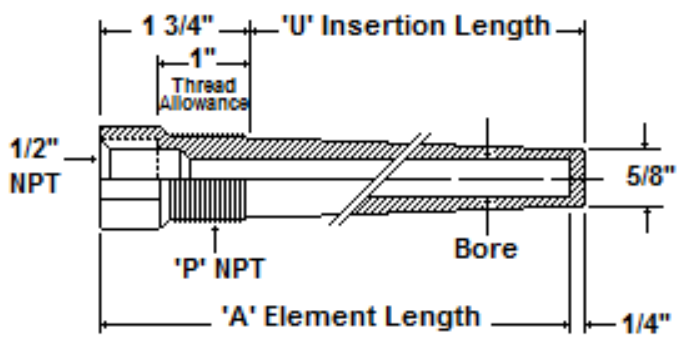
STRAIGHT



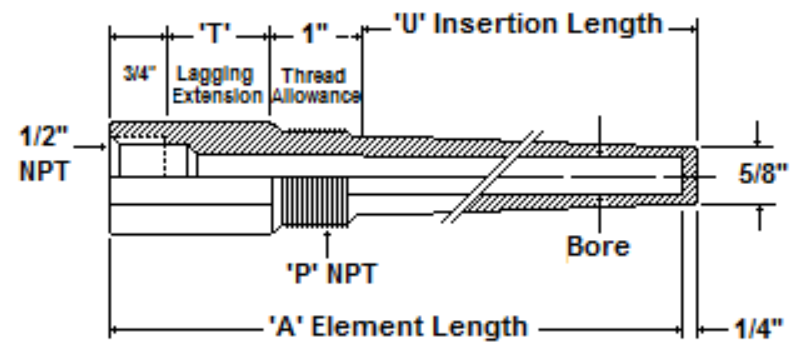
STRAIGHT W/ LAGGING EXTENSION



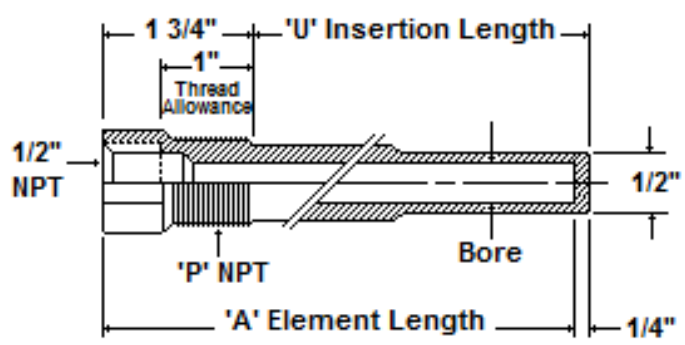
TAPERED



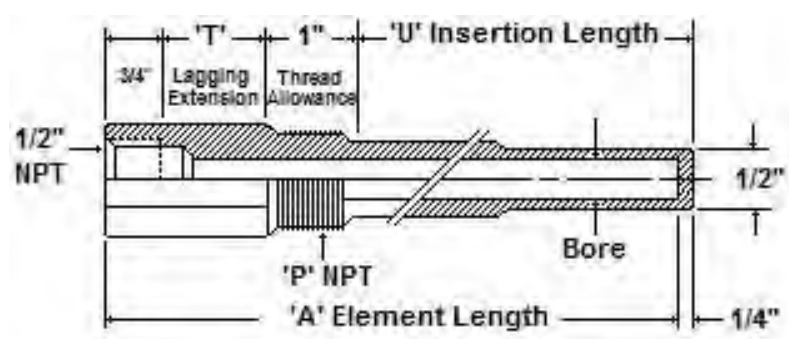
TAPERED WITH LAGGING EXTENSION



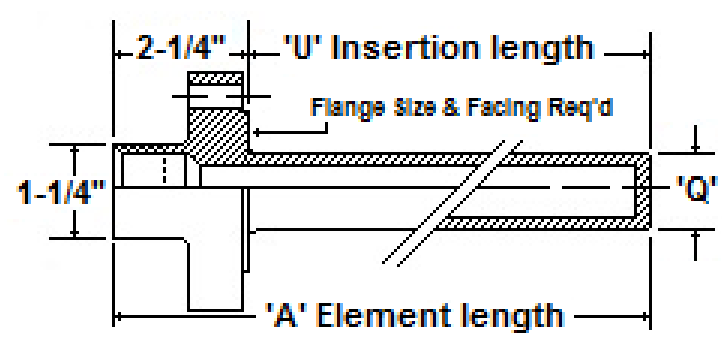
STEPPED(BI-MET)



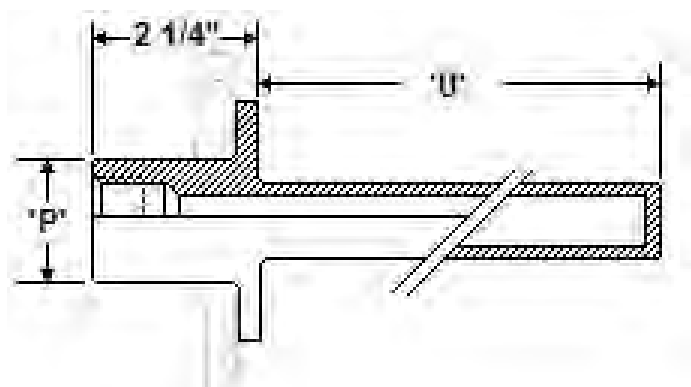
STEPPED(BI-MET) WITH LAGGING EXTENSION



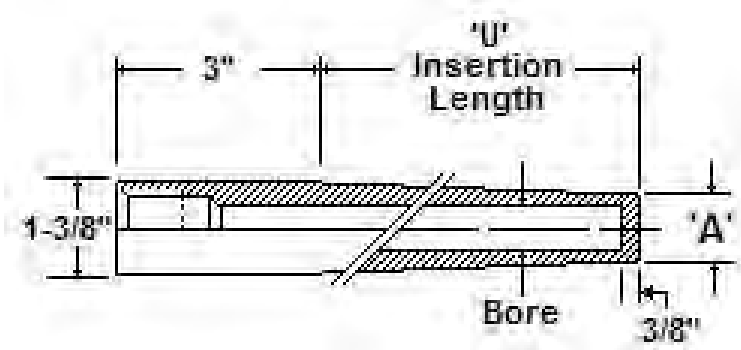
FLANGED



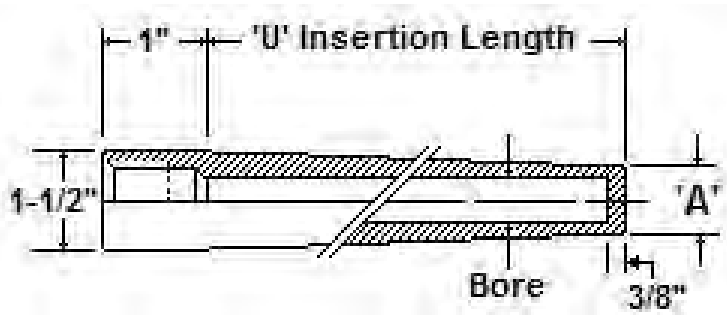
VAN STONE



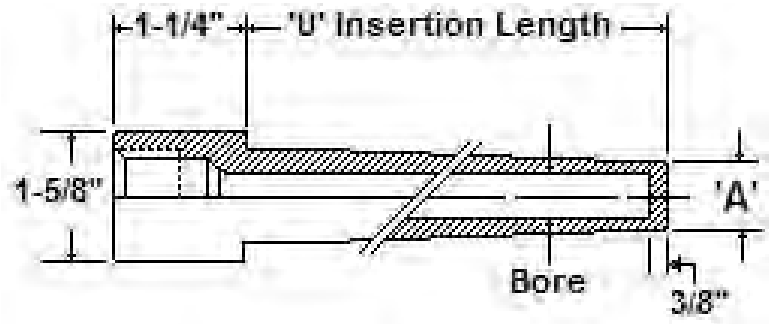
SOCKET-WELD(STRAIGHT HOLE)



SOCKET-WELD(TAPERED HOLE)



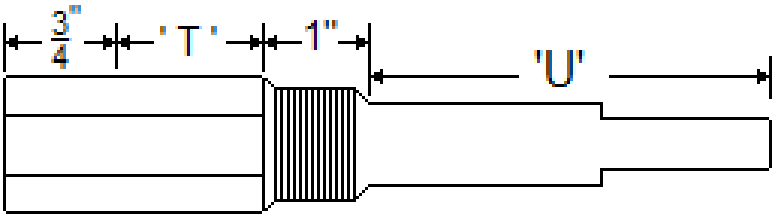
SOCKET-WELD(1-1/4" SOCKET-WELD FITTING)



THERMOWELLS

Ordering Information

Stepped (Bi-Met) Well with Lagging Extension



Part #: □-BL-□□□-□□□-□□□-□

Process Thread (Table 1)	'T' Length (Lag) (inches)	Bore (Table 2)	'U' Length (inches)	Material (Table 3)

NOTE 1: Standard step length is 2.5" (for wells longer than 2.5"). For thermowells shorter than 2.5", stepped option is not available. Well would be provided straight.

NOTE 2: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Process Thread

P/N	Description
1/2	1/2"
3/4	1/4"
1	1"
1-1/2	1-1/2"
X	Special

Table 2
Bore

P/N	Description
260	.260"
385	.385"
X	Special

Table 3
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

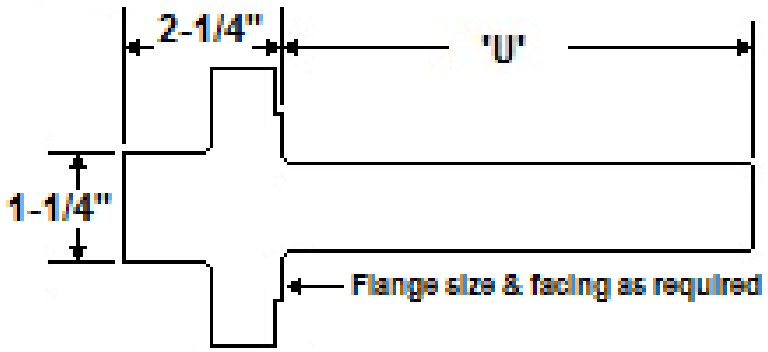
Example: **1/2-BL-2-260-6-B**

Stepped (Bi-Met) Thermowell. 1/2" NPT Process Thread. 2" Lagging Extension .260" Bore. U=6". 304 S.S.

THERMOWELLS

Ordering Information

Flanged Well



Part #: **FS-□□□-□□□-□-□**

Bore (Table 1)	'U' Length (inches)	Material (Table 2)	Flange Size & Facing

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Bore

P/N	Description
260	.260"
385	.385"
X	Special

Table 2
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

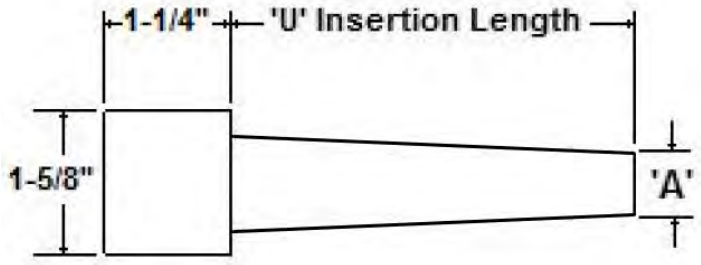
Example: **FS-260-6-B-150# RF**

Flanged Thermowell. .260" Bore. U=6". 304 S.S. with 150# Raised Face Flange

THERMOWELLS

Ordering Information

Socket-Weld Well (For Welding in 1-1/4" Socket-Weld Fitting)



Part #: **SW-158-□□□-□□□-□**

Bore (Table 1) — 'U' Length (inches) — Material (Table 2)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Bore

P/N	Description
260	.260"
385	.385"
500	.500"
X	Special

Table 2
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

Example: **SW-158-260-6-B**

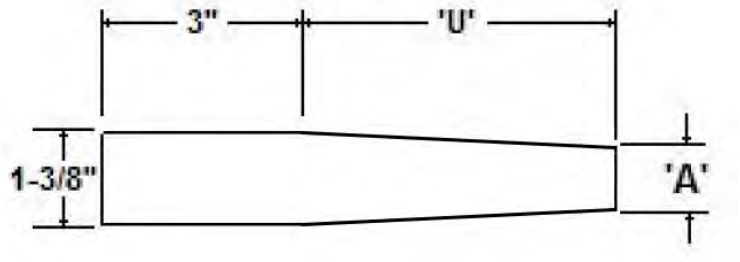
Socket-Weld Thermowell. .260" Bore. U=6". 304 S.S.

Catalog #	Bore	Stock Size	'A'	'T'
SW-158-260-'U'-(*)	.260"	1-5/8"	7/8"	1-1/4"
SW-158-375-'U'-(*)	.375"	1-5/8"	3/4"	1-1/4"
SW-158-500-'U'-(*)	.500"	1-5/8"	9/16"	1-1/4"

THERMOWELLS

Ordering Information

Socket-Weld Well (For Welding in Straight Hole)



Part #: SW-138-□□□-□□□-□

- Bore (Table 1)
- 'U' Length (inches)
- Material (Table 2)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Bore

P/N	Description
260	.260"
385	.385"
500	.500"
X	Special

Table 2
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

Example: **SW-138-260-6-B**

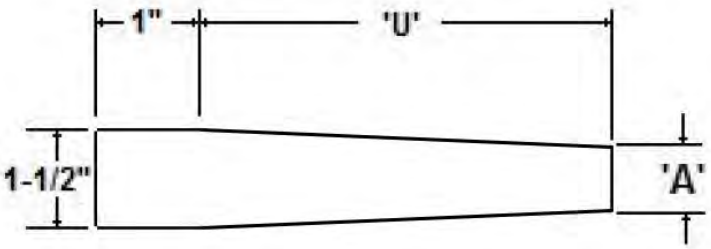
Socket-Weld Thermowell. .260" Bore. U=6". 304 S.S.

Catalog #	Bore	Stock Size	'A'	'T'
SW-138-260-'U'-(*)	.260"	1-3/8"	7/8"	3"
SW-138-375-'U'-(*)	.375"	1-3/8"	3/4"	3"
SW-138-500-'U'-(*)	.500"	1-3/8"	9/16"	3"

THERMOWELLS

Ordering Information

Socket-Weld Well (For Welding in Tapered Hole)



Part #: **SW-150-□□□-□□□-□**

- Bore (Table 1)
- 'U' Length (inches)
- Material (Table 2)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Bore

P/N	Description
260	.260"
385	.385"
500	.500"
X	Special

Table 2
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

Example: **SW-150-260-6-B**

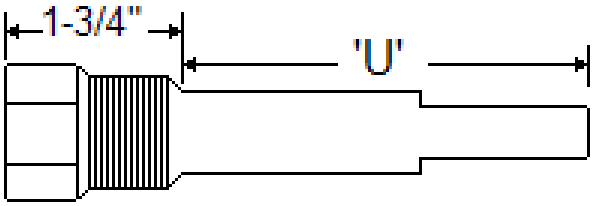
Socket-Weld Thermowell. .260" Bore. U=6". 304 S.S.

Catalog #	Bore	Stock Size	'A'	'T'
SW-150-260-'U'-(*)	.260"	1-1/2"	7/8"	1"
SW-150-375-'U'-(*)	.375"	1-1/2"	3/4"	1"
SW-150-500-'U'-(*)	.500"	1-1/2"	9/16"	1"

THERMOWELLS

Ordering Information

Stepped (Bi-Met) Well



Part #: □-BM-□□□-□□□-□

Process Thread (Table 1)	Bore (Table 2)	'U' Length (inches)	Material (Table 3)

NOTE 1: Standard step length is 2.5" (for wells longer than 2.5"). For thermowells shorter than 2.5", stepped option is not available. Well would be provided straight.

NOTE 2: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Process Thread

P/N	Description
1/2	1/2"
3/4	1/4"
1	1"
1-1/2	1-1/2"
X	Special

Table 2
Bore

P/N	Description
260	.260"
385	.385"
X	Special

Table 3
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

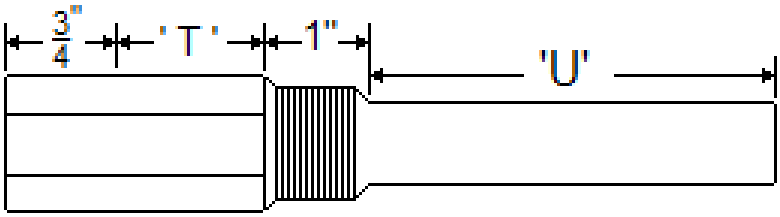
Example: **1/2-BM-260-6-B**

Stepped (Bi-Met) Thermowell. 1/2" NPT Process Thread. .260" Bore. U=6". 304 S.S.

THERMOWELLS

Ordering Information

Straight Well with Lagging Extension



Part #: □-SL-□□□-□□□-□□□-□

Process Thread (Table 1)	'T' Length (Lag) (inches)	Bore (Table 2)	'U' Length (inches)	Material (Table 3)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Process Thread

P/N	Description
1/2	1/2"
3/4	1/4"
1	1"
1-1/2	1-1/2"
X	Special

Table 2
Bore

P/N	Description
260	.260"
385	.385"
X	Special

Table 3
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

Example: **1/2-SL-2-260-6-B**

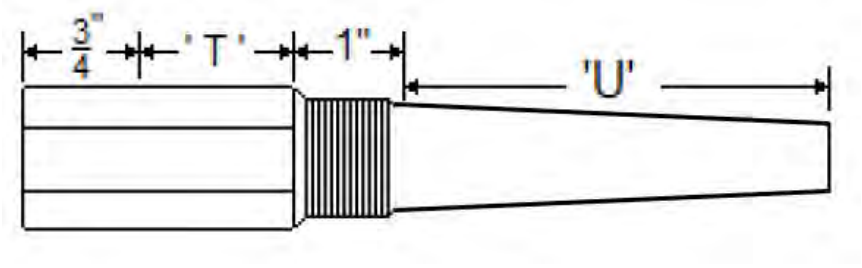
Straight Thermowell. 1/2" NPT Process Thread. 2" Lagging Extension .260" Bore. U=6". 304 S.S.

DURO-SENSE CORPORATION 869 Sandhill Ave., Carson, CA 90746
Phone: (310) 533-6877 -- Fax: (310) 533-0330 – E-mail: sales@duro-sense.com -- Website: www.duro-sense.com

THERMOWELLS

Ordering Information

Tapered Well with Lagging Extension



Part #: □-TL-□□□-□□□-□□□-□

Process Thread (Table 1)	'T' Length (Lag) (inches)	Bore (Table 2)	'U' Length (inches)	Material (Table 3)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Process Thread

P/N	Description
1/2	1/2"
3/4	1/4"
1	1"
1-1/2	1-1/2"
X	Special

Table 2
Bore

P/N	Description
260	.260"
385	.385"
X	Special

Table 3
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

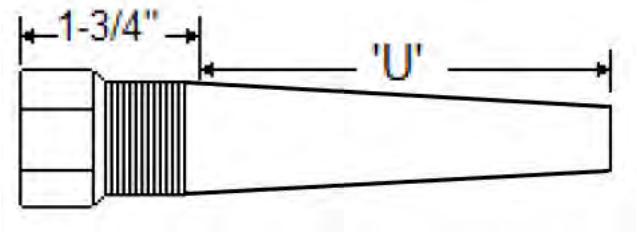
Example: **1/2-TL-2-260-6-B**

Tapered Thermowell. 1/2" NPT Process Thread. 2" Lagging Extension .260" Bore. U=6". 304 S.S.

THERMOWELLS

Ordering Information

Tapered Well



Part #: □-TS-□□□-□□□-□

- Process Thread (Table 1)
- Bore (Table 2)
- 'U' Length (inches)
- Material (Table 3)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Process Thread

P/N	Description
1/2	1/2"
3/4	1/4"
1	1"
1-1/2	1-1/2"
X	Special

Table 2
Bore

P/N	Description
260	.260"
385	.385"
X	Special

Table 3
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

Example: **1/2-TS-260-6-B**

Tapered Thermowell. 1/2" NPT Process Thread. .260" Bore. U=6". 304 S.S.

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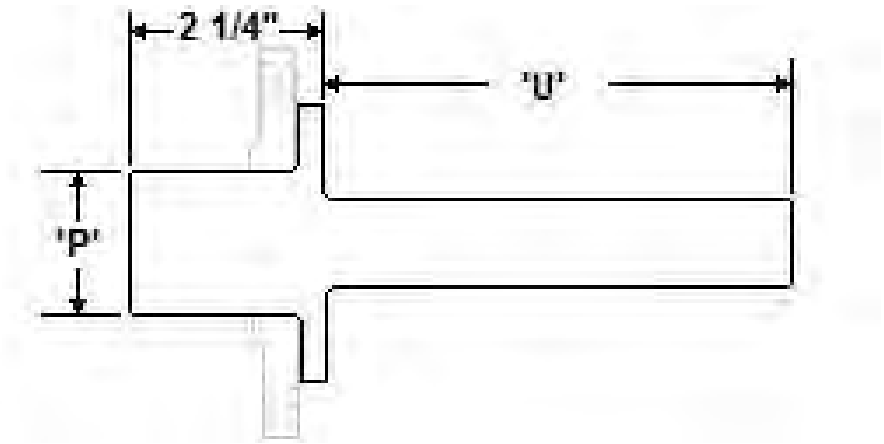
THERMOWELLS

Ordering Information

Van Stone Well



Part #: □-VS-□□□-□□□-□

- Pipe Size ('P') (Table 1)
- Bore (Table 2)
- 'U' Length (inches)
- Material (Table 3)

NOTE: For any additional modifications to this assembly, add "-MOD" to the end of the part number and provide a physical description of the modification.

Table 1
Pipe Size (Nominal)

P/N	Description
1	1"
1-1/2	1-1/2"
X	Special

Table 2
Bore

P/N	Description
260	.260"
385	.385"
X	Special

Table 3
Material

P/N	Description
A	Inconel
B	304 S.S.
C	316 S.S.
D	310 S.S.
E	321 S.S.
F	446 S.S.
G	Brass
X	Special

Example: **1-VS-260-6-B**

Van Stone Thermowell. 1" Pipe Size. .260" Bore. U=6". 304 S.S.

DURO-SENSE CORPORATION 869 Sandhill Ave., Carson, CA 90746
Phone: (310) 533-6877 -- Fax: (310) 533-0330 – E-mail: sales@duro-sense.com -- Website: www.duro-sense.com

Duro-Sense Corporation

THERMOCOUPLE & RTD WIRE

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THERMOCOUPLE EXTENSION WIRE

Polyvinyl Chloride (PVC) Suggested operating range: -15°F to 221°F (-26°C to 105°C) Also available: ♦ **Shielded PVC**	Flame retardant PVC insulation provides excellent chemical and abrasion resistance. PVC also has high dielectric strength as well as outstanding insulation resistance to ozone, acid, alkalis, alcohol, oil, gasoline, grease, wax, moisture and most solvents. The individual conductors and outer jacket are extruded.
Nylon Suggested operating range: -85°F to 250°F (-65°C to 121°C)	Nylon provides high tensile, impact and flexural resistance. It has excellent resistance to abrasion and is unaffected by most alkalis, oil, grease, dilute mineral acids and most organic acids. It is inert to most organic solvents including hydraulic fluid and aviation oil. The individual conductors and outer jacket are extruded.
Fluorinated Ethylene Propylene (FEP) Suggested operating range: -90°F to 400°F (-67°C to 204°C)	FEP retains useful strength and flexibility over broad ranges of environmental temperature or thermal aging. FEP is flame retardant and non-propagating in fire conditions. It is moisture and chemical resistant and accepted for use around food and pharmaceuticals. The individual conductors and outer jacket are extruded.
Perfluoroalkoxy (PFA) Suggested operating range: -328°F to 500°F (-200°C to 260°C)	Flame retardant PFA provides flexibility and toughness with stress crack resistance, resistance to weather, non-aging characteristics and a low coefficient of friction. PFA also provides outstanding electrical characteristics, as well as resistance to virtually all chemicals. The individual conductors and outer jacket are extruded.
Tetrafluoroethylene (TFE) Suggested operating range: -328°F to 500°F (-200°C to 260°C)	TFE is flame retardant (passes IEEE 383 & VW-1 flame tests) and has excellent solvent and abrasion resistance. TFE is unaffected by long term exposure to virtually all chemicals and solder iron temperatures. The individual conductors and outer jacket are insulated with TFE Tape.
Polymide Tape (Kapton) Suggested operating range: -400°F to 600°F (-240°C to 315°C)	Kapton is extremely tough. It has excellent abrasion, impact and cut through resistance, very high resistance to oxidative degradation, weathering, and all chemicals except strong bases. Kapton also offers high dielectric strength and insulation resistance. Kapton does not support combustion; even at extremely high temperatures, it decomposes slowly without visible burning. It is also resistant to radiation. The individual conductors and outer jacket are insulated with Kapton Tape.

THERMOCOUPLE WIRE

Nylon Suggested operating range: -85°F to 250°F (-65°C to 121°C)	Nylon provides high tensile, impact and flexural resistance. It has excellent resistance to abrasion and is unaffected by most alkalis, oil, grease, dilute mineral acids and most organic acids. It is inert to most organic solvents including hydraulic fluid and aviation oil. The individual conductors and outer jacket are extruded.
Fluorinated Ethylene Propylene (FEP) Suggested operating range: -90°F to 400°F (-67°C to 204°C) Also available: ♦ **FEP Twisted Singles (No Outer Jacket)** ♦ **Shielded FEP**	FEP retains useful strength and flexibility over broad ranges of environmental temperature or thermal aging. FEP is flame retardant and non-propagating in fire conditions. It is moisture and chemical resistant and accepted for use around food and pharmaceuticals. The individual conductors and outer jacket are extruded.
Perfluoroalkoxy (PFA) Suggested operating range: -328°F to 500°F (-200°C to 260°C)	Flame retardant PFA provides flexibility and toughness with stress crack resistance, resistance to weather, non-aging characteristics and a low coefficient of friction. PFA also provides outstanding electrical characteristics, as well as resistance to virtually all chemicals. The individual conductors and outer jacket are extruded.
Tetrafluoroethylene (TFE) Suggested operating range: -328°F to 500°F (-200°C to 260°C)	TFE is flame retardant (passes IEEE 383 & VW-1 flame tests) and has excellent solvent and abrasion resistance. TFE is unaffected by long term exposure to virtually all chemicals and solder iron temperatures. The individual conductors and outer jacket are insulated with TFE Tape.
Polymide Tape (Kapton) Suggested operating range: -400°F to 600°F (-240°C to 315°C)	Kapton is extremely tough. It has excellent abrasion, impact and cut through resistance, very high resistance to oxidative degradation, weathering, and all chemicals except strong bases. Kapton also offers high dielectric strength and insulation resistance. Kapton does not support combustion; even at extremely high temperatures, it decomposes slowly without visible burning. It is also resistant to radiation. The individual conductors and outer jacket are insulated with Kapton Tape.

THERMOCOUPLE WIRE

Fiberglass Suggested maximum operating temperature: 900°F (482°C) continuous 1000°F (538°C) single exposure {Impregnation maintained to 400°F (200°C)}	Fiberglass insulation, with the special binder impregnation, offers good moisture and chemical resistance, as well as good abrasion resistance. Typical applications include aerospace, foundries, heat treating, plastics industry and a wide variety of other uses.
Hi-Temp Fiberglass Suggested maximum operating temperature: 1300°F (704°C) continuous 1600°F (871°C) single exposure {Impregnation maintained to 400°F (200°C)} Also available: ♦ **Twisted Singles (No Outer Jacket)**	Hi-Temp fiberglass is used in applications where standard fiberglass won't stand up. With the special binder impregnation, Hi-Temp fiberglass offers good moisture and chemical resistance, as well as good abrasion resistance.
Vitreous Silica Fiber (Refrasil) Suggested maximum operating temperature: 1600°F (871°C) continuous 2000°F (1093°C) single exposure	Vitreous Silica Fiber is designed to be used at very high temperature. However, since no saturant is used, it is not recommended for use in abrasive applications without an additional metal covering. Vitreous Silica Fiber is typically used under conditions where beaded ceramic or sheathed thermocouples were previously necessary.
Ceramic Fiber Suggested maximum operating temperature: 2200°F (1204°C) continuous 2400°F (1316°C) single exposure	Ceramic Fiber is flexible and offers good abrasion and chemical resistance. It is supplied white, without saturant or colored tracers. Because the insulation retains its overall product integrity at elevated temperatures, serviceability is increased while reducing maintenance and replacement costs.

MULTIPAIR EXTENSION WIRE CONSTRUCTION

Polyvinyl Chloride (PVC) ***Overall Shield Only*** Suggested operating range: -15°F to 221°F (-26°C to 105°C)	Flame retardant PVC insulation provides excellent chemical and abrasion resistance. PVC also has high dielectric strength as well as outstanding insulation resistance to ozone, acid, alkalis, alcohol, oil, gasoline, grease, wax, moisture and most solvents. The individual conductors and outer jacket are extruded.
Polyvinyl Chloride (PVC) ***Individual & Overall Shield*** Suggested operating range: -15°F to 221°F (-26°C to 105°C)	Flame retardant PVC insulation provides excellent chemical and abrasion resistance. PVC also has high dielectric strength as well as outstanding insulation resistance to ozone, acid, alkalis, alcohol, oil, gasoline, grease, wax, moisture and most solvents. The individual conductors and outer jacket are extruded.

THERMOCOUPLE WIRE

PVC INSULATION 221°F(105°C)

Ordering Information:

□□□ - □X- P/P - □

- Wire Gauge (Table 1)
- "S" Denotes Stranded Conductors
- Calibration (Table 2)
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

14
16
20
24

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Flame Retardant PVC Insulation

Product Characteristics
- Excellent Moisture Resistance
- Good Abrasion Resistance
- Good Chemical Resistance

Applications
- Laboratories
- Industrial Equipment Testing
- Automotive

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
14	0.064	(1.628)	0.015	(0.381)	0.020	(0.508)	0.134 x 0.233	(3.404 x 5.918)	38	(57)
14S*	0.076	(1.865)	0.015	(0.381)	0.020	(0.508)	0.149 x 0.258	(3.785 x 6.553)	44	(66)
16	0.051	(1.290)	0.015	(0.381)	0.020	(0.508)	0.121 x 0.207	(3.073 X 5.258)	26	(39)
16S*	0.048	(1.495)	0.015	(0.381)	0.020	(0.508)	0.129 x 0.223	(3.277 x 5.664)	28	(42)
20	0.032	(0.813)	0.015	(0.381)	0.015	(0.381)	0.092 x 0.154	(2.337 x 3.912)	14	(21)
20S*	0.038	(0.965)	0.015	(0.381)	0.015	(0.381)	0.097 x 0.164	(2.464 x 4.166)	16	(24)
24	0.020	(0.508)	0.015	(0.381)	0.015	(0.381)	0.080 x 0.130	(2.032 x 3.302)	9	(14)
24S*	0.024	(0.610)	0.015	(0.381)	0.015	(0.381)	0.084 x 0.138	(2.134 x 3.505)	10	(15)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

SHIELDED PVC INSULATION 221°F(105°C)

Ordering Information: ☐☐☐ - ☐X- P/TW/ALM/P - ☐

- Wire Gauge (Table 1)
- "S" Denotes Stranded Conductors
- Calibration (Table 2)
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

14
16
20
24

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Single Twisted Pair w/ Aluminum Mylar Shield & Copper Drain Wire & Flame Retardant PVC Insulation

Product Characteristics
- Excellent Moisture Resistance
- Good Abrasion Resistance
- Good Chemical Resistance

Applications
- Signal transmission applications which are susceptible to electrostatic noise or interference
- Laboratories
- General Industry

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
14	0.064	(1.628)	0.015	(0.381)	0.020	(0.508)	0.274	(7.0)	54	(80)
14S*	0.076	(1.865)	0.015	(0.381)	0.020	(0.508)	0.290	(7.4)	60	(89)
16	0.051	(1.290)	0.015	(0.381)	0.020	(0.508)	0.213	(5.4)	34	(51)
16S*	0.048	(1.495)	0.015	(0.381)	0.020	(0.508)	0.223	(5.7)	37	(56)
20	0.032	(0.813)	0.015	(0.381)	0.020	(0.508)	0.175	(4.5)	18	(27)
20S*	0.038	(0.965)	0.015	(0.381)	0.020	(0.508)	0.185	(4.7)	20	(30)
24	0.020	(0.508)	0.015	(0.381)	0.020	(0.508)	0.156	(4.0)	12	(18)
24S*	0.024	(0.610)	0.015	(0.381)	0.020	(0.508)	0.164	(4.1)	13	(19)

** "S" denotes stranded (7-strand) wire.*

Tolerances
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THERMOCOUPLE WIRE

MULTI-PAIR SHIELDED PVC INSULATION 221°F(105°C)

Ordering Information: ☐☐ - ☐ - ☐X- P/TW/ALM/P - ☐

Wire Gauge (Table 1)	Number of Conductors (2,4,8,12,16,24)	Calibration (Table 2)	Metallic Overbraid (Table 3)

Table 1
Wire Gauge

20

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Twisted Pairs w/ Aluminum Mylar Shield Overall & Copper Drain Wire & Flame Retardant PVC Insulation
- 300 V UL® Listed

Product Characteristics
- Excellent Moisture Resistance
- Good Abrasion Resistance
- Good Chemical Resistance

Applications
- Signal transmission applications which are susceptible to electrostatic noise or interference
- General Use Extension Wire
- General Industry

Wire Specifications

# of Pairs	Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
2	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.290	(7.37)	72	(107)
4	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.350	(8.89)	94	(140)
8	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.440	(11.18)	140	(209)
12	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.535	(13.59)	188	(280)
16	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.610	(15.49)	240	(358)
24	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.710	(18.03)	344	(513)

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

MULTI-PAIR SHIELDED PVC INSULATION 221°F(105°C)

Ordering Information: ☐☐ - ☐ - ☐X- P/ALM/TW/ALM/P - ☐

- Wire Gauge (Table 1)
- Number of Conductors (2,4,8,12,16,24)
- Calibration (Table 2)
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

20

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction

- Twisted Pairs w/ **Individual & Overall** Aluminum Mylar Shield & Copper Drain Wire & Flame Retardant PVC Insulation
- 300 V UL® Listed

Product Characteristics

- Excellent Moisture Resistance
- Good Abrasion Resistance
- Good Chemical Resistance

Applications

- Signal transmission applications which are susceptible to electrostatic noise or interference
- General Use Extension Wire
- General Industry

Wire Specifications

# of Pairs	Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
2	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.305	(7.75)	77	(115)
4	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.385	(9.78)	104	(155)
8	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.490	(12.45)	160	(238)
12	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.610	(15.49)	218	(325)
16	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.640	(16.26)	280	(417)
24	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.805	(20.45)	404	(602)

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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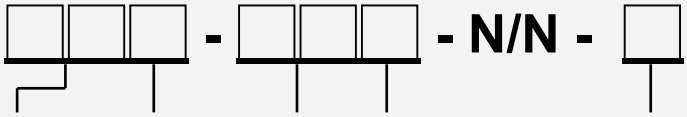
THERMOCOUPLE WIRE

NYLON INSULATION 248°F(120°C)

Ordering Information:



Wire Gauge (Table 1) | **"S" Denotes Stranded Conductors** | **Calibration (Table 2)** | **"X" Denotes Extension Grade** | **Metallic Overbraid (Table 3)**

Table 1
Wire Gauge

20
24
30

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Nylon Polymide Resin Insulation

Product Characteristics
- Excellent Abrasion Resistance
- Good Chemical and Solvent Resistance
- Fair Moisture Resistance

Applications
- Laboratories
- Test Stands
- Food Processing

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
20	0.032	(0.813)	0.006	(0.150)	0.008	(0.200)	0.058 x 0.100	(2.337 x 3.912)	8	(12)
20S*	0.038	(0.965)	0.006	(0.150)	0.008	(0.200)	0.062 x 0.108	(2.464 x 4.166)	9	(13)
24	0.020	(0.508)	0.006	(0.150)	0.006	(0.150)	0.042 x 0.072	(2.032 x 3.302)	3	(5)
24S*	0.024	(0.610)	0.006	(0.150)	0.006	(0.150)	0.046 x 0.080	(2.134 x 3.505)	4	(6)
30	0.010	(0.254)	0.005	(0.130)	0.005	(0.130)	0.030 x 0.050	(0.762 x 1.270)	3	(5)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

FEP INSULATION 400°F(204°C)

Ordering Information: ☐☐☐ - ☐☐☐ - TEX/TEX - ☐

Wire Gauge (Table 1)	"S" Denotes Stranded Conductors	Calibration (Table 2)	"X" Denotes Extension Grade	Metallic Overbraid (Table 3)

Table 1
Wire Gauge

16
20
24
30

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Flame Retardant Extruded FEP Insulation

Product Characteristics
- Excellent Abrasion Resistance
- Excellent Chemical and Solvent Resistance
- Excellent Moisture Resistance

Applications
- Aerospace
- Industrial Equipment Testing
- Petrochemical Plants

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
16	0.051	(1.290)	0.009	(0.230)	0.012	(0.305)	0.095 x 0.166	(2.410 x 4.220)	28	(42)
16S*	0.060	(1.520)	0.009	(0.230)	0.012	(0.305)	0.104 x 0.190	(2.640 x 4.830)	30	(45)
20	0.032	(0.813)	0.009	(0.230)	0.010	(0.254)	0.072 x 0.124	(2.337 x 3.912)	12	(18)
20S*	0.038	(0.965)	0.009	(0.230)	0.010	(0.254)	0.078 x 0.136	(2.464 x 4.166)	14	(21)
24	0.020	(0.508)	0.008	(0.200)	0.010	(0.254)	0.060 x 0.100	(2.032 x 3.302)	8	(12)
24S*	0.024	(0.610)	0.008	(0.200)	0.010	(0.254)	0.064 x 0.108	(2.134 x 3.505)	9	(13)
30	0.010	(0.254)	0.005	(0.130)	0.005	(0.130)	0.046 x 0.072	(1.200 x 1.800)	3	(5)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

SHIELDED FEP INSULATION 400°F(204°C)

Ordering Information: ☐☐☐ - ☐☐☐-TEX/TW/ALM/TEX- ☐

- Wire Gauge (Table 1)
- "S" Denotes Stranded Conductors
- Calibration (Table 2)
- "X" Denotes Extension Grade
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

16
20
24
30

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Single Twisted Pair w/ Aluminum Mylar Shield & Copper Drain Wire & Flame Retardant FEP Insulation

Product Characteristics
- Excellent Abrasion Resistance
- Excellent Chemical and Solvent Resistance
- Excellent Moisture Resistance

Applications
- Aerospace
- Industrial Equipment Testing
- Signal transmission applications which are susceptible to electrostatic noise or interference

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
16	0.051	(1.290)	0.009	(0.230)	0.015	(0.305)	0.180	(4.57)	38	(57)
16S*	0.060	(1.520)	0.009	(0.230)	0.015	(0.305)	0.198	(5.03)	41	(61)
20	0.032	(0.813)	0.008	(0.200)	0.012	(0.254)	0.142	(3.61)	22	(33)
20S*	0.038	(0.965)	0.008	(0.200)	0.012	(0.254)	0.158	(3.91)	24	(36)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

TWISTED FEP INSULATION 400°F(204°C)

Ordering Information:

□□□ - □□□ - TEX/TW - □

- Wire Gauge (Table 1)
- "S" Denotes Stranded Conductors
- Calibration (Table 2)
- "X" Denotes Extension Grade
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

16
20
24
30

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Twisted Conductors with Flame Retardant Extruded FEP Insulation & No Outer Jacket

Product Characteristics
- Excellent Abrasion Resistance
- Excellent Chemical and Solvent Resistance
- Excellent Moisture Resistance

Applications
- Aerospace
- Food Processing
- Cryogenic Applications

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
16	0.051	(1.290)	0.008	(0.200)	n/a	n/a	0.134	(3.400)	18	(27)
16S*	0.060	(1.520)	0.008	(0.200)	n/a	n/a	0.148	(3.800)	20	(30)
20	0.032	(0.813)	0.008	(0.200)	n/a	n/a	0.096	(2.400)	8	(11)
20S*	0.038	(0.965)	0.008	(0.200)	n/a	n/a	0.104	(2.600)	8	(12)
24	0.020	(0.508)	0.008	(0.200)	n/a	n/a	0.072	(1.800)	4	(6)
24S*	0.024	(0.610)	0.008	(0.200)	n/a	n/a	0.080	(2.000)	4	(6)
30	0.010	(0.254)	0.006	(0.152)	n/a	n/a	0.052	(1.300)	2	(3)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

PFA INSULATION 500°F(260°C)

Ordering Information:

□□□ - □□□ - PFA/PFA - □

- Wire Gauge (Table 1)
- "S" Denotes Stranded Conductors
- Calibration (Table 2)
- "X" Denotes Extension Grade
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

16
20
24
30

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Flame Retardant Extruded PFA Insulation

Product Characteristics
- Good Abrasion Resistance
- Excellent Chemical and Solvent Resistance
- Excellent Moisture Resistance

Applications
- Aerospace
- Food Processing
- Petrochemical Plants

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
16	0.051	(1.290)	0.009	(0.230)	0.012	(0.305)	0.095 x 0.166	(2.410 x 4.220)	27	(40)
16S*	0.060	(1.520)	0.009	(0.230)	0.012	(0.305)	0.104 x 0.184	(2.640 x 4.670)	29	(43)
20	0.032	(0.813)	0.008	(0.200)	0.010	(0.254)	0.068 x 0.116	(1.730 x 2.950)	12	(18)
20S*	0.038	(0.965)	0.008	(0.200)	0.010	(0.254)	0.074 x 0.128	(1.880 x 3.250)	14	(21)
24	0.020	(0.508)	0.008	(0.200)	0.010	(0.254)	0.056 x 0.092	(1.420 x 2.340)	8	(12)
24S*	0.024	(0.610)	0.008	(0.200)	0.010	(0.254)	0.060 x 0.100	(1.520 x 2.540)	9	(13)
30	0.010	(0.254)	0.005	(0.130)	0.005	(0.130)	0.022 x 0.038	(0.559 x 0.965)	3	(5)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

TFE INSULATION 500°F(260°C)

Ordering Information:

□□□ - □□□ - TFE/TFE - □

- Wire Gauge (Table 1)
- "S" Denotes Stranded Conductors
- Calibration (Table 2)
- "X" Denotes Extension Grade
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

16
20
24
30

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Two Layers of Fused TFE Tape Insulation

Product Characteristics
- Good Abrasion Resistance
- Excellent Chemical and Solvent Resistance
- Excellent Moisture Resistance

Applications
- Aerospace
- Petrochemical Plants
- Power Generation

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
16	0.051	(1.290)	0.010	(0.254)	0.008	(0.203)	0.087 x 0.158	(2.210 x 4.010)	25	(37)
16S*	0.060	(1.520)	0.010	(0.254)	0.008	(0.203)	0.096 x 0.176	(2.440 x 4.470)	27	(40)
20	0.032	(0.813)	0.006	(0.152)	0.008	(0.203)	0.060 x 0.104	(1.520 x 2.640)	11	(18)
20S*	0.038	(0.965)	0.006	(0.152)	0.008	(0.203)	0.066 x 0.116	(1.680 x 2.950)	12	(18)
24	0.020	(0.508)	0.006	(0.152)	0.008	(0.203)	0.048 x 0.080	(1.220 x 2.030)	5	(8)
24S*	0.024	(0.610)	0.006	(0.152)	0.008	(0.203)	0.052 x 0.088	(1.320 x 2.230)	6	(9)
30	0.010	(0.254)	0.006	(0.152)	0.008	(0.203)	0.050 x 0.076	(1.300 x 1.900)	3	(4)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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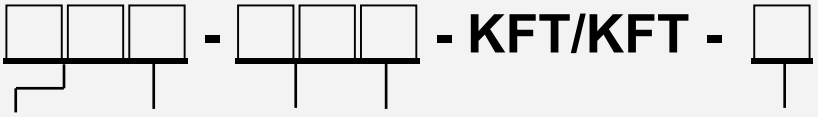
THERMOCOUPLE WIRE

KAPTON INSULATION 600°F(315°C)

Ordering Information:



Wire Gauge (Table 1) | **"S" Denotes Stranded Conductors** | **Calibration (Table 2)** | **"X" Denotes Extension Grade** | **Metallic Overbraid (Table 3)**

Table 1
Wire Gauge

20
24
30

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Two Layers of Fused Polymide Tape Insulation

Product Characteristics
- Excellent Abrasion Resistance
- Excellent Chemical and Solvent Resistance
- Excellent Moisture Resistance

Applications
- Aerospace
- Power Generation
- Pharmaceutical

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
20	0.032	(0.813)	0.006	(0.152)	0.006	(0.152)	0.064 x 0.100	(1.630 x 2.540)	10	(15)
20S*	0.038	(0.965)	0.006	(0.152)	0.006	(0.152)	0.070 x 0.112	(1.780 x 2.840)	11	(16)
24	0.020	(0.508)	0.006	(0.152)	0.006	(0.152)	0.054 x 0.076	(1.370 x 1.930)	5	(8)
24S*	0.024	(0.610)	0.006	(0.152)	0.006	(0.152)	0.056 x 0.084	(1.420 x 2.130)	6	(9)
30	0.010	(0.254)	0.006	(0.152)	0.006	(0.152)	0.044 x 0.056	(1.120 x 1.420)	3	(5)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

FIBERGLASS INSULATION 900°F(480°C)

Ordering Information: ☐☐☐ - ☐☐☐ - GB/GB - ☐

- Wire Gauge (Table 1)
- "S" Denotes Stranded Conductors
- Calibration (Table 2)
- "X" Denotes Extension Grade
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

20
24
30

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Impregnated, Braided Fiberglass Insulation

Product Characteristics
- Fair Abrasion Resistance
- Good Chemical and Solvent Resistance
- Good Moisture Resistance

Applications
- Heat Treating
- Steel & Aluminum Industry
- Plastics Industry

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
20	0.032	(0.813)	0.005	(0.127)	0.006	(0.152)	0.056 x 0.096	(1.420 x 2.440)	9	(13)
20S*	0.038	(0.965)	0.006	(0.152)	0.006	(0.152)	0.064 x 0.112	(1.630 x 2.840)	10	(15)
24	0.020	(0.508)	0.005	(0.127)	0.006	(0.152)	0.045 x 0.072	(1.140 x 1.830)	7	(10)
24S*	0.024	(0.610)	0.005	(0.127)	0.006	(0.152)	0.046 x 0.080	(1.220 x 2.030)	8	(12)
30	0.010	(0.254)	0.007	(0.178)	0.008	(0.203)	0.043 x 0.064	(1.090 x 1.630)	3	(5)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

HI-TEMP FIBERGLASS INSULATION 1300°F(705°C)

Ordering Information: ☐☐☐ - ☐☐☐ - HTGB/HTGB - ☐

- Wire Gauge (Table 1)
- "S" Denotes Stranded Conductors
- Calibration (Table 2)
- "X" Denotes Extension Grade
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

14
16
20
24

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Hi-Temp Impregnant and Hi-Temp Braided Fiberglass Insulation

Product Characteristics
- Good Abrasion Resistance
- Good Chemical Resistance
- Good Moisture Resistance

Applications
- Heat Treating
- Furnace Surveys
- Steel & Aluminum Industry

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
14	0.064	(1.630)	0.015	(0.381)	0.010	(0.254)	0.114 x 0.200	(2.900 x 5.080)	34	(51)
16	0.051	(1.290)	0.015	(0.381)	0.010	(0.254)	0.100 x 0.174	(2.540 x 4.420)	25	(37)
20	0.032	(0.813)	0.015	(0.381)	0.010	(0.254)	0.082 x 0.140	(2.080 x 3.560)	13	(19)
24	0.020	(0.508)	0.015	(0.381)	0.010	(0.254)	0.072 x 0.120	(1.830 x 3.050)	10	(15)

Tolerances
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THERMOCOUPLE WIRE

TWISTED HI-TEMP FIBERGLASS INSULATION 1300°F(705°C)

Ordering Information: ☐☐☐ - ☐☐☐ - HTGB/TW - ☐

- Wire Gauge (Table 1)
- "S" Denotes Stranded Conductors
- Calibration (Table 2)
- "X" Denotes Extension Grade
- Metallic Overbraid (Table 3)

Table 1
Wire Gauge

14
16
20
24

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
R	n/a
S	n/a
B	n/a
C	n/a

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Twisted Conductors with Hi-Temp Fiberglass Insulation & No Outer Jacket

Product Characteristics
- Good Abrasion Resistance
- Good Chemical Resistance
- Good Moisture Resistance

Applications
- Heat Treating
- Furnace Surveys
- Steel & Aluminum Industry

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
14	0.064	(1.630)	0.015	(0.381)	n/a	n/a	0.200	(5.080)	32	(48)
16	0.051	(1.290)	0.015	(0.381)	n/a	n/a	0.174	(4.420)	21	(31)
20	0.032	(0.813)	0.015	(0.381)	n/a	n/a	0.124	(3.150)	10	(15)
24	0.020	(0.508)	0.015	(0.381)	n/a	n/a	0.100	(2.540)	6	(9)

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

VITREOUS SILICA FIBER INSULATION 1800°F(980°C)

Ordering Information: □□ - □□ - VSF/VSF - □

Wire Gauge (Table 1) — Calibration (Table 2) — Metallic Overbraid (Table 3)

Table 1
Wire Gauge

14
16
20
24

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
E	EE
N	NN

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Hi-Temp Impregnant and Braided Vitreous Silica Yarn Insulation

Product Characteristics
- Fair Abrasion Resistance
- Good Chemical and Solvent Resistance
- Fair Moisture Resistance

Applications
- Heat Treating
- Furnace Surveys
- Steel & Aluminum Industry

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
14	0.064	(1.630)	0.016	(0.406)	0.015	(0.381)	0.132 x 0.230	(3.400 x 5.800)	33	(49)
16	0.051	(1.290)	0.016	(0.406)	0.015	(0.381)	0.118 x 0.198	(3.000 x 5.030)	25	(37)
20	0.032	(0.813)	0.018	(0.457)	0.015	(0.381)	0.098 x 0.154	(2.490 x 3.910)	15	(22)
24	0.020	(0.508)	0.018	(0.457)	0.015	(0.381)	0.088 x 0.142	(2.200 x 3.600)	10	(14)

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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THERMOCOUPLE WIRE

CERAMIC FIBER INSULATION 2200°F(1205°C)

Ordering Information: □□ - □□ - CF/CF - SF90 - □

Wire Gauge (Table 1)	Calibration (Table 2)	Metallic Overbraid (Table 3)

Table 1
Wire Gauge

14
16
20
24

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
E	EE
N	NN

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Braided Ceramic Fiber Insulation*
  (*Light Build version of CF/CF)

Product Characteristics
- Good Abrasion Resistance
- Good Chemical and Solvent Resistance
- Fair Moisture Resistance

Applications
- Heat Treating
- Furnace Surveys
- Steel & Aluminum Industry

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
14	0.064	(1.630)	0.014	(0.360)	0.018	(0.460)	0.128 x 0.220	(3.300 x 5.600)	33	(49)
16	0.051	(1.290)	0.014	(0.360)	0.018	(0.460)	0.115 x 0.194	(2.900 x 4.900)	24	(36)
20	0.032	(0.813)	0.014	(0.360)	0.018	(0.460)	0.096 x 0.156	(2.400 x 4.000)	14	(21)
24	0.020	(0.508)	0.014	(0.360)	0.018	(0.460)	0.084 x 0.132	(2.100 x 3.400)	9.3	(14)

Tolerances
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THERMOCOUPLE WIRE

CERAMIC FIBER INSULATION 2200°F(1205°C)

Ordering Information:

□□ - □□ - CF/CF - □

Wire Gauge (Table 1)	Calibration (Table 2)	Metallic Overbraid (Table 3)

Table 1
Wire Gauge

14
16
20
24

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
E	EE
N	NN

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Parallel Conductors with Braided Ceramic Fiber Insulation

Product Characteristics
- Good Abrasion Resistance
- Good Chemical and Solvent Resistance
- Fair Moisture Resistance

Applications
- Heat Treating
- Furnace Surveys
- Steel & Aluminum Industry

Wire Specifications

Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
14	0.064	(1.630)	0.016	(0.406)	0.016	(0.406)	0.132 x 0.218	(3.350 x 5.540)	44	(66)
16	0.051	(1.290)	0.016	(0.406)	0.016	(0.406)	0.119 x 0.192	(3.020 x 4.880)	32	(48)
20	0.032	(0.813)	0.016	(0.406)	0.016	(0.406)	0.100 x 0.154	(2.540 x 3.910)	16	(24)
24	0.020	(0.508)	0.016	(0.406)	0.016	(0.406)	0.088 x 0.132	(2.240 x 3.350)	13	(19)

Tolerances
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BARE WIRE

Ordering Information: ☐☐ - BW- ☐☐☐

Wire Gauge (Table 1) — Calibration (Table 2) — Polarity (Table 3)

Table 1
Wire Gauge

8
14
20
24
30

Table 2
Calibration

Standard	*Special*
J	JJ
K	KK
T	TT
E	EE
N	NN
n/a	S**
n/a	R**
n/a	B**

Table 3
Metallic Overbraid

P/N	Description
P	Positive Leg
N	Negative Leg

NOTES:
The choices of gauge and calibration represent the most popular constructions of this product. However, additional wire gauges and alternate calibrations can be manufactured to meet specific applications. Consult factory for additional information.

** Type 'S', 'R' & 'B' wire is only available in 20 Ga., 24 Ga. & 30 Ga.

Product Characteristics

- Bare wire is sold in matched pairs. Equal amounts of each leg must be ordered.
- 8 Ga. wire is shipped in coils. 14 Ga. and smaller are shipped on spools.

Wire Specifications

Base Metal

Gauge	Feet per Lb.																			
8	JP	23	JN	20	KP	21	KN	21	TP	20	TN	20	EP	21	EN	20	NP	21	NN	21
14	JP	91	JN	80	KP	83	KN	83	TP	80	TN	80	EP	83	EN	80	NP	83	NN	83
20	JP	365	JN	332	KP	331	KN	331	TP	332	TN	332	EP	331	EN	332	NP	337	NN	330
24	JP	926	JN	818	KP	838	KN	838	TP	818	TN	818	EP	838	EN	818	NP	853	NN	836
30	JP	3740	JN	3290	KP	3370	KN	3370	TP	3290	TN	3290	EP	3370	EN	3290	NP	3370	NN	3370

Noble Metal

Gauge	Inches per TOz.											
20	SP	118	SN	110	RP	120	RN	110	BP	134	BN	114
24	SP	302	SN	282	RP	308	RN	282	BP	343	BN	294
30	SP	1206	SN	1127	RP	1230	RN	1127	BP	1105	BN	1079

Tolerances
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RTD WIRE

FEP INSULATION 400°F(204°C)

Ordering Information: ☐☐☐ - ☐☐☐☐ - TEX/TEX ☐

Wire Gauge (Table 1)	"S" Denotes Stranded Conductors	# of Wires (2,3,4)	Conductor (Table 2)	Metallic Overbraid (Table 3)

Table 1
Wire Gauge

20
22
24
26
28
30

Table 2
Conductor

NPC	Nickel-Plated Copper
SPC	Silver-plated Copper
TPC	Tin-plated Copper

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and conductor represent the most popular construction of this product. However, additional wire gauges and alternate constructions can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Twisted Conductors with Flame Retardant Extruded FEP Insulation

Product Characteristics
- Excellent Abrasion Resistance
- Excellent Chemical and Solvent Resistance
- Excellent Moisture Resistance

Applications
- Aerospace
- Industrial Equipment Testing
- Petrochemical Plants

Wire Specifications

# of Wires	Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
2	20S*	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.146	(3.71)	17	(25.3)
	22S*	0.030	(0.762)	0.008	(0.203)	0.012	(0.305)	0.130	(3.30)	14	(20.9)
	24S*	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.118	(3.00)	12	(17.9)
3	20S*	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.158	(4.01)	24	(35.8)
	22S*	0.030	(0.762)	0.008	(0.203)	0.012	(0.305)	0.140	(3.56)	20	(29.8)
	24S*	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.126	(3.20)	16	(23.8)
4	20S*	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.170	(4.32)	27	(40.2)
	22S*	0.030	(0.762)	0.008	(0.203)	0.012	(0.305)	0.150	(3.81)	23	(34.3)
	24S*	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.136	(3.46)	19	(28.3)

** "S" denotes stranded (7-strand) wire.*

Tolerances
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RTD WIRE

PFA INSULATION 500°F(260°C)

Ordering Information: ☐☐☐ - ☐☐☐☐ - PFA/PFA - ☐

Wire Gauge (Table 1)	"S" Denotes Stranded Conductors	# of Wires (2,3,4)	Conductor (Table 2)	Metallic Overbraid (Table 3)

Table 1
Wire Gauge

20
22
24
26
28
30

Table 2
Conductor

NPC	Nickel-Plated Copper
SPC	Silver-plated Copper
TPC	Tin-plated Copper

Table 3
Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:
The choices of gauge and conductor represent the most popular construction of this product. However, additional wire gauges and alternate constructions can be manufactured to meet specific applications. Consult factory for additional information.

Construction
- Twisted Conductors with Flame Retardant Extruded PFA Insulation

Product Characteristics
- Excellent Abrasion Resistance
- Excellent Chemical and Solvent Resistance
- Excellent Moisture Resistance

Applications
- Aerospace
- Food Processing
- Petrochemical Plants

Wire Specifications

# of Wires	Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
2	20S*	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.146	(3.71)	17	(25.3)
	22S*	0.030	(0.762)	0.008	(0.203)	0.012	(0.305)	0.130	(3.30)	14	(20.9)
	24S*	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.118	(3.00)	12	(17.9)
3	20S*	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.158	(4.01)	24	(35.8)
	22S*	0.030	(0.762)	0.008	(0.203)	0.012	(0.305)	0.140	(3.56)	20	(29.8)
	24S*	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.126	(3.20)	16	(23.8)
4	20S*	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.170	(4.32)	27	(40.2)
	22S*	0.030	(0.762)	0.008	(0.203)	0.012	(0.305)	0.150	(3.81)	23	(34.3)
	24S*	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.136	(3.46)	19	(28.3)

** "S" denotes stranded (7-strand) wire.*

Tolerances
Due to allowances in manufacturing processes, Duro-Sense Corporation reserves the right to ship a variation of ± 10% from the quantity of goods ordered. Physical specifications shown are nominal. Shipping weights are an average of all types of conductors and are listed for estimating purposes only. These weights can vary significantly due to different types of spools, reels and/or conductors.

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FIBERGLASS INSULATION 900 °F(480°C)

Ordering Information: ☐☐☐ - ☐☐☐☐ - GB/GB - ☐

Wire Gauge (Table 1)	"S" Denotes Stranded Conductors	# of Wires (2,3,4)	Conductor (Table 2)	Metallic Overbraid (Table 3)

Table 1 Wire Gauge

20
22
24
26
28
30

Table 2 Conductor

NPC	Nickel-Plated Copper
SPC	Silver-plated Copper
TPC	Tin-plated Copper

Table 3 Metallic Overbraid

SS	Stainless Steel
IB	Inconel
CB	Copper

NOTES:

The choices of gauge and conductor represent the most popular construction of this product. However, additional wire gauges and alternate constructions can be manufactured to meet specific applications. Consult factory for additional information.

Construction

- Twisted Conductors with Impregnated, Braided Fiberglass Insulation

Product Characteristics

- Fair Abrasion Resistance
- Good Chemical and Solvent Resistance
- Good Moisture Resistance

Applications

- Heat Treating
- Steel & Aluminum Industry
- Plastics Industry

Wire Specifications

# of Wires	Gauge	Nominal Conductor Size		Nominal Insulation Thickness Conductor		Nominal Insulation Thickness Overall		Nominal Overall Diameter		Approximate Shipping Weight	
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/mft	kg/km
	20S*	0.038	(0.965)	0.006	(0.152)	0.006	(0.152)	0.112	(2.84)	9	(13.4)
2	22S*	0.030	(0.762)	0.005	(0.127)	0.006	(0.152)	0.092	(2.34)	7	(10.4)
	24S*	0.024	(0.610)	0.005	(0.127)	0.006	(0.152)	0.080	(2.03)	9	(8.9)
	20S*	0.038	(0.965)	0.006	(0.152)	0.006	(0.152)	0.120	(3.05)	12	(17.9)
3	22S*	0.030	(0.762)	0.005	(0.127)	0.006	(0.152)	0.098	(2.49)	9	(13.4)
	24S*	0.024	(0.610)	0.005	(0.127)	0.006	(0.152)	0.086	(2.18)	8	(11.9)
	20S*	0.038	(0.965)	0.006	(0.152)	0.006	(0.152)	0.130	(3.30)	16	(23.8)
4	22S*	0.030	(0.762)	0.005	(0.127)	0.006	(0.152)	0.106	(2.69)	12	(17.9)
	24S*	0.024	(0.610)	0.005	(0.127)	0.006	(0.152)	0.092	(2.34)	10	(14.9)

** "S" denotes stranded (7-strand) wire.*

Tolerances

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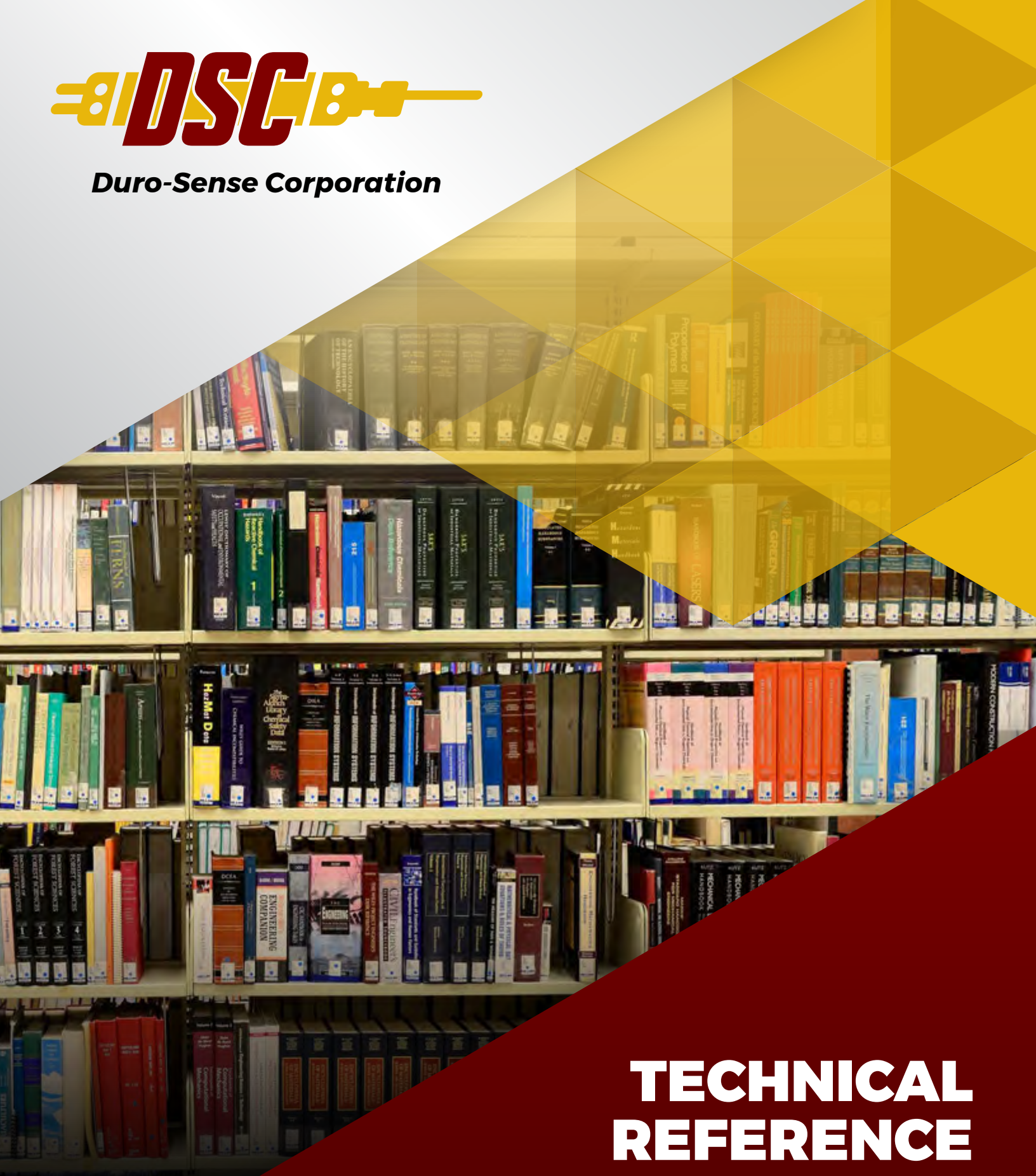
Duro-Sense Corporation



TECHNICAL REFERENCE GUIDE

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869 Sandhill Avenue Carson, California 90746 | 310-533-6877

THERMOCOUPLE TECHNICAL REFERENCE

Thermocouple Types

Thermocouple Type (ANSI Code)	Positive Leg	Negative Leg	Recommended/General Temperature Range	Notes
J	Iron	Constantan	32°F-1400°F (0°C-760°C)	Suitable for vacuum, reducing, or inert atmospheres and oxidizing atmospheres with reduced life. Since oxidation of the iron leg occurs rapidly at temperatures above 1000°F(538°C), heavier gauge wire should be used at those temperatures. Iron may be attacked by ammonia, hydrogen, and nitrogen if not protected. Bare elements should not be exposed to sulphurous atmospheres above 1000°F(538°C)
K	Chromel**	Alumel**	32°F-2300°F (0°C-1260°C)	Suitable for oxidizing or inert atmospheres. Recommended for use above 1000°F(538°C). Accuracy below 900°F(482°C) is greatly reduced after prolonged use above 1400°F(760°C). Should not be used in reducing atmosphere if unprotected.
T	Copper	Constantan	-300°F-700°F (-184°C-371°C)	Suitable for oxidizing, inert, or reducing atmospheres. Has a high corrosive resistance to moisture. Is excellent for very low temperature applications.
E	Chromel**	Constantan	32°F-1600°F (0°C-871°C)	Recommended for use in oxidizing or inert atmospheres. Exhibits good resistance to corrosion at low temperatures. Greatest EMF output of standard calibrations.
N	Nicrosil***	Nisil***	32°F-2300°F (0°C-1260°C)	Suitable for use in applications where Type 'K' elements have shorter life and stability problems due to oxidation.
R	Platinum/13% Rhodium	Platinum	1000°F-2700°F (538°C-1482°C)	Recommended for high temperature applications. Protection from all atmospheres must be provided, as it is subject to contamination and drift. Prolonged use at high temperature can cause grain growth which can lead to mechanical failure. Rhodium diffusion and volatilization can lead to calibration drift. Primarily used in industrial applications.
S	Platinum/10% Rhodium	Platinum	1000°F-2700°F (538°C-1482°C)	Recommended for high temperature applications. Protection from all atmospheres must be provided, as it is subject to contamination and drift. Prolonged use at high temperature can cause grain growth which can lead to mechanical failure. Rhodium diffusion and volatilization can lead to calibration drift. Primarily used in laboratory applications.
B	Platinum/30% Rhodium	Platinum	1600°F-3100°F (871°C-1705°C)	Similar applications as Type 'R' and type 'S', but with better stability and higher temperature range. It is also less susceptible to grain growth and drift.
C*	Tungsten/5% Rhenium	Tungsten/26% Rhenium	1000°F-4200°F (538°C-2315°C)	Recommended for very high temperature applications in vacuum or inert atmospheres. No oxidation resistance.

*Not an ANSI symbol

**Trademark of Hoskins Mfg. Co.

***Trademark of Amax Specialty Metals Corp.

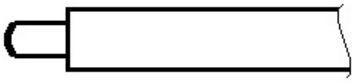
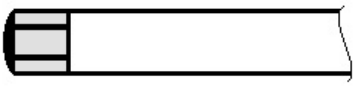
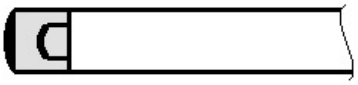
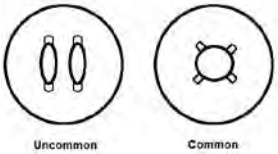
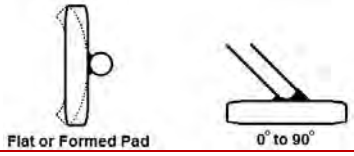
Initial Calibration Tolerances

Thermocouple Type	°C			°F		
ANSI Symbol	Temperature Range	Standard Limits	Special Limits	Temperature Range	Standard Limits	Special Limits
T	-200 to -65 -65 to 130 130 to 350	±1.5% ±1° ±0.75%	±0.8% ±0.5° ±0.4%	-330 to -85 -85 to 270 270 to 660	±1.5% ±1.8° ±0.75%	±0.8% ±0.9° ±0.4%
J	0 to 285 285 to 750	±2.2° ±0.75%	±1.1° ±0.4%	32 to 545 545 to 1400	±4° ±0.75%	±2° ±0.4%
E	-200 to -170 -170 to 250 250 to 340 340 to 900	±1% ±1.7° ±1.7° ±0.5%	±1° ±1° ±0.4% ±0.4%	-330 to -270 -270 to 480 480 to 640 640 to 1600	±1% ±3° ±3° ±0.5%	±1.8° ±1.8° ±0.4% ±0.4%
K	-200 to -110 -110 to 0 0 to 285 285 to 1250	±2% ±2.2° ±2.2° ±0.75%	-- -- ±1.1° ±0.4%	-330 to -165 -165 to 32 32 to 545 545 to 2300	±2% ±4° ±4° ±0.75%	-- -- ±2° ±0.4%
N	0 to 285 285 to 1250	±2.2° ±0.75%	±1.1° ±0.4%	32 to 545 545 to 2300	±4° ±0.75%	±2° ±0.4%
S	0 to 600 600 to 1450	±1.5° ±0.25%	±0.6° ±0.1%	32 to 1110 1110 to 2650	±2.7° ±0.25%	±1.1° ±0.1%
R	0 to 600 600 to 1450	±1.5° ±0.25%	±0.6° ±0.1%	32 to 1110 1110 to 2650	±2.7° ±0.25%	±1.1° ±0.1%
B	870 to 1700	±0.5%	±0.25%	1600 to 3100	±0.5%	±0.25%
C*	400 to 2300	±1%	--	800 to 4200	±1%	--

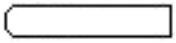
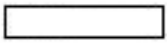
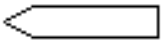
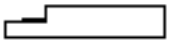
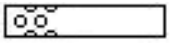
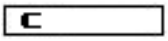
*Not an ANSI symbol

THERMOCOUPLE TECHNICAL REFERENCE

Hot Tip Junction Types

Description	Illustration
Exposed Junction: Thermocouple conductors are welded to form a junction that extends beyond the sheath for a distance equal to the diameter. This style is used where fast response is required and contamination is not a factor.	
Grounded Junction: Thermocouple conductors are welded directly to the sheath. Provides good protection against pressure, moisture and mechanical damage, yet retains good response characteristics.	
Ungrounded Junction: Thermocouple conductors are welded together but remain electrically and mechanically isolated from the sheath. This provides long life characteristics under maximum corrosion, thermal shock, and vibration conditions.	
Dual Element Junction: This version provides two circuits for simultaneous response from individual thermal points. Exposed, grounded or ungrounded junctions are available. Two versions of dual junctions are available; Uncommon and Common. In the Uncommon version, the junctions are isolated from the sheath *and* from each other. In the common version the junctions are isolated from the sheath but *not* from each other.	
Weld Pad Junction: This type of junction is used as a means of attaching thermocouples to surfaces such as boiler tubes and pipes to provide efficient surface temperature measurement. Standard weld pad design uses an alloy pad (1"x1"x1/8") of the same composition as the sheath. Tube skin perpendicular and parallel pad arrangements are available.	

Junction Tip Styles

Rounded	
Flat	
Pointed	
Half-Shield	
Aspirated	
Recessed Exposed	

THERMOCOUPLE TECHNICAL REFERENCE

Thermocouple Type Color Codes

Thermocouple Type (ANSI Code)	Symbol	Trade Name	Magnetic Yes	Magnetic No	Color Coding: Conductors	Color Coding: Overall T/C Wire	Color Coding: Overall Extension Wire	Color Coding: Connector
J	JP JN	Iron Constantan	X 	 X	White Red	Brown	Black	Black
K	KP KN	Chromel** Alumel**	 X	X 	Yellow Red	Brown	Yellow	Yellow
T	TP TN	Copper Constantan	 	X X	Blue Red	Brown	Blue	Blue
E	EP EN	Chromel** Constantan	 X	X 	Purple Red	Brown	Purple	Purple
N	NP NN	Nicrosil*** Nisil***	 	X X	Orange Red	Brown	Orange	Orange
R	RP RN	Platinum 13% Rhodium Pure Platinum	 	X X	Black Red	-----	Green	Green
S	SP SN	Platinum 10% Rhodium Pure Platinum	 	X X	Black Red	-----	Green	Green
B	BP BN	Platinum 30% Rhodium Platinum 6% Rhodium	 	X X	Gray Red	-----	Gray	White (Uncompensated)
C*	CP* CN*	Tungsten 5% Rhenium Tungsten 26% Rhenium	 	X X	White/Red Trace Red	-----	White/Red Trace	Brown

*Not an ANSI symbol
**Trademark of Hoskins Mfg. Co.
***Trademark of Amax Specialty Metals Corp.

Upper Temperature Limits for Thermocouples

Thermocouple Type	ANSI Code	Wire Gauge (AWG): 8 gauge	14 gauge	20 gauge	24 gauge	30 gauge
Iron–Constantan	J	760ºC 1400ºF	600ºC 1100ºF	500ºC 900ºF	370ºC 700ºF	320ºC 600ºF
Chromel**–Alumel**	K	1260ºC 2300ºF	1100ºC 2000ºF	1000ºC 1800ºF	870ºC 1600ºF	760ºC 1400ºF
Copper–Constantan	T	-----	370ºC 700ºF	260ºC 500ºF	200ºC 400ºF	150ºC 300ºF
Chromel**-Constantan	E	870ºC 1600ºF	650ºC 1200ºF	550ºC 1000ºF	430ºC 800ºF	430ºC 800ºF
Nicrosil***-Nisil***	N	1260ºC 2300ºF	1100ºC 2000ºF	1000ºC 1800ºF	870ºC 1600ºF	760ºC 1400ºF
Platinum-10% Rhodium	R	-----	-----	-----	1480ºC 2700ºF	-----
Platinum-13% Rhodium	S	-----	-----	-----	1480ºC 2700ºF	-----
Platinum-30% vs 6% Rhodium	B	-----	-----	-----	1700ºC 3100ºF	-----
Tungsten-5% vs26% Rhenium	C*	-----	-----	-----	2300ºC 4200ºF	-----

*Not an ANSI symbol
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RTD TECHNICAL REFERENCE

The accuracy of a platinum resistance thermometer, also known as a resistance temperature detector (RTD), is contingent upon two factors. The first is the offset of its actual resistance from the nominal value (typically 100 ohms) at some reference temperature (usually 0ºC). The second factor is a variation from a nominal value of the effective resistance temperature coefficient over a given temperature interval, effecting an additional error component that is proportional to the temperature. Both of these factors are variable from sensor to sensor, but their magnitude limits are implicit for a given tolerance class.

The designation of an RTD tolerance class is based upon the percent allowable variation, in ohms, of the nominal resistance value at the reference temperature. This ohmic tolerance is often expressed as an equivalent temperature variation (in ºC). One must add the allowable proportional error for the class to this base uncertainty, which is stated as a percentage of measured temperature. This percentage applies when temperatures are expressed in degrees Celsius.

RTD Tolerance Chart

DIN/EC Class / Band	Accuracy (%)	Accuracy (Ω)	Accuracy (ºC)	Accuracy (ºF)
Class D	± 0.50%	± 0.500 Ω	± 1.30 ºC	± 2.30ºF
Class C	± 0.20%	± 0.200 Ω	± 0.52 ºC	± 0.94ºF
DIN/EC Class B	± 0.12%	± 0.120 Ω	± 0.30 ºC	± 0.54ºF
Band 1	± 0.10%	± 0.100 Ω	± 0.26 ºC	± 0.47ºF
1/2 DIN/EC Class A	± 0.06%	± 0.060 Ω	± 0.15 ºC	± 0.23ºF
Band 2	± 0.05%	± 0.050 Ω	± 0.13 ºC	± 0.23ºF
1/3 DIN/EC	± 0.04%	± 0.040 Ω	± 0.10 ºC	± 0.18ºF
Band 3	± 0.03%	± 0.030 Ω	± 0.08 ºC	± 0.14ºF
1/5 DIN/EC	± 0.02%	± 0.024 Ω	± 0.06 ºC	± 0.11ºF
Band 4	± 0.02%	± 0.020 Ω	± 0.05 ºC	± 0.09ºF
1/10 DIN/EC	± 0.01%	± 0.012 Ω	± 0.03 ºC	± 0.05ºF
Band 5	± 0.01%	± 0.010 Ω	± 0.03 ºC	± 0.05ºF

Standard RTD Material Specifications*

Element Material	Element Resistance @ 0ºC	Temperature Coefficient	Operating Range†	Available Accuracies @ 0ºC
Platinum	100 Ω	.00385	-150ºF to 900ºF (-101ºC to 760ºC)	± .12%, .06%, .03%, .01%
Platinum	100 Ω	.00392	-150ºF to 900ºF (-101ºC to 760ºC)	± .12%, .06%, .03%
Platinum	500 Ω	.00385	-150ºF to 400ºF (-101ºC to 204ºC)	± .12%
Platinum	1000 Ω	.00385	-150ºF to 400ºF (-101ºC to 204ºC)	± .12%
Copper	10 Ω	.00427	-150ºF to 400ºF (-101ºC to 204ºC)	± .2%
Nickel	120 Ω	.00672	-150ºF to 400ºF (-101ºC to 204ºC)	± .5%

* - Sensing elements of other materials, base values, and temperature coefficients may be available upon request.
† - Stated operating ranges are typical values and are dependent on several factors, including: sensing element, element substrate, and construction style of the assembly.

Standards for .00385 Temperature Coefficient Elements

German Standard	DIN 43760 - 1987
British Standard	BS 1904 - 1984
International Electrotechincal Commission Standard	IEC 751 - 1983

Standards for .00392 Temperature Coefficient Elements

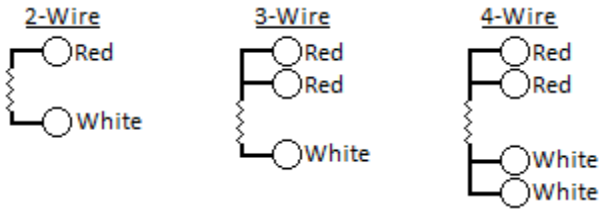
American Scientific Apparatus Manuf. Association	SAMA RC21 – 4 - 1966
Japanese Standard	JIS C1604 – 2013

RTD TECHNICAL REFERENCE

Resistance Temperature Detector(RTD) Terminology

Accuracy: A statement of the initial element accuracy as measured at one specific point, usually 0ºC.

Element Configuration: RTD sensor assemblies are available with 2, 3, 4, wire leads. Two wire connected elements do not provide lead resistance compensation for the measuring device. Three and four wire connected elements provide a means of compensating for lead resistance between the sensor and the measuring device.



Two-Wire: Provides one connection to each side of the element. This construction is suitable for applications where the resistance of the lead wire may be considered as an additive constant in the circuit and where changes in lead resistance, due to ambient temperature changes, may be disregarded.

Three-Wire: Provides one connection to one side of the element and two to the other side of the element. When connected to an instrument designed to accept three-wire input, sufficient compensation is typically achieved for lead-wire resistance and temperature change. This is the most commonly used configuration.

Four-Wire: Provides two connections to each side of the element, to completely compensate for lead wire resistance and temperature change. This configuration is used where highly accurate temperature measurement is crucial.

Interchangeability: The amount of allowable difference in readings between two RTD's when placed side by side in a process at the same temperature. This is determined by the allowable RTD tolerance at that particular temperature.

Lead Wire: All standard RTD lead wire is stranded, silver-plated copper with either FEP Teflon or fiberglass insulation. Teflon-insulated leads are rated at a maximum of 400ºF. Fiberglass-insulated leads are rated at a maximum of 900ºF.

Repeatability/Stability: The ability of an element to reproduce the same resistance or temperature reading each time it is at equilibrium at a given repeated temperature. It is expressed as a "±" resistance or temperature value over a given temperature range. It may also be expressed as the stability of its resistance. Typically, Platinum elements will not change more than 0.04% at 0ºC after receiving ten consecutive shocks form -200ºC to 600ºC.

Self-Heating: RTD elements are not self-powered. They require a small current to pass through the device to provide a voltage that can be measured. Self-heating is the rise of temperature within the element itself, caused by the current flowing through the element. This self-heating appears as a measurement error and is affected by the thermal conductivity and velocity of the process being measured. It is negligible in most applications. Typcial Platinum resistance elements would require 60mV of power dissipation to cause a 1.8ºF (1ºFC) temperature measurement error when tested in water flowing at 3 ft./sec.

Temperature Coefficient of Resistance: The fractional change in element resistance per change of 1ºC. It is expressed as Ohms/Ohms/ºC

Time Constant: The time required to sense 63% of a step temperature change from 25ºC to 80ºC in water flowing at 3 ft./second. The time constant for a 3/16" OD stainless steel sheath is typically 2.0 seconds.

GENERAL TECHNICAL REFERENCE

General Thermometry Reference Points

	Kelvins (K)	Degrees Celsius (ºC)	Degrees Fahrenheit (ºF)
Triple point of e-hydrogen	13.8033	-259.3467	-434.8241
Triple point of neon	24.5561	-248.5939	-415.4690
Triple point of oxygen	54.3584	-218.7916	-361.8249
Triple point of nitrogen	63.1504	-209.9996	-345.9993
Triple point of argon	83.8058	-189.3442	-308.8196
Triple point of krypton	115.776	-157.374	-251.273
Triple point of xenon	161.404	-111.746	-169.143
Sublimation of carbon dioxide	194.685	-78.465	-109.237
Triple point of carbon dioxide	216.589	-56.561	-69.810
Triple pint of mercury	234.3156	-38.8344	-37.9019
Freezing point of mercury	234.3216	-38.8284	-37.8911
Melting point of ice	273.15	0.0	32.0
Triple point of water	273.16	0.01	32.018
Melting point of gallium	302.9146	29.7646	85.5763
Triple point of gallium	302.9165	29.7665	85.5797
Freezing point of indium	429.7485	156.5985	313.8773
Freezing point of tin	505.078	231.928	449.472
Freezing point of cadmium	594.219	321.069	609.924
Freezing point of lead	600.612	327.462	621.432
Freezing point of zinc	692.677	419.527	787.149
Freezing point of antimony	903.78	630.63	1167.13
Freezing point of aluminum	933.473	660.323	1220.581
Freezing point of silver	1234.93	961.78	1763.20
Freezing point of gold	1337.33	1064.18	1947.52
Freezing point of copper	1357.77	1084.62	1984.32
Freezing point of palladium	1828.00	1554.8	2830.60
Freezing point of platinum	2041.30	1768.10	3214.60
Freezing point of rhodium	2235.50	1962.30	3564.10
Freezing point of iridium	2719.00	2446.00	4435.00
Freezing point of molybdenum	2896.00	2623.00	4753.00

Physical Properties of Materials

Material	Melting Point (ºF)	Recommended Operating Atmosphere	Maximum Operating Temp. in Atmosphere (ºF)
304 SS	2560	ORNV	1650
310 SS	2560	ORNV	2100
316 SS	2500	ORNV	1700
321 SS	2550	ORNV	1600
347 SS	2600	ORNV	1600
446 SS	2700	ORNV	2000
Carbon Steel	2500	ON	1300
Inconel	2550	ONV	2100
Inconel X	2620	ONV	2200
Incoloy	2500	ON	1600
Hastelloy X	2350	O	2200
Hastelloy C	2310	O	1800
Hastelloy B	2375	OR	1400
Monel	2460	OR	1000
Brass	1850	O	650
Aluminum	1220	O	700
Nickel	2647	O	1400
Tantalum	5425	V	5000
Titanium	3035	VN	2000

O = Oxidizing R = Reducing N = Neutral V = Vacuum

GENERAL TECHNICAL REFERENCE

Nominal Thermocouple Resistance – Ohms per Double Foot @ 68ºF (20ºC)

Wire Gauge	Wire Size Diameter	ANSI Types						
		J	K	T	E	S	R	B
6	.162	.014	.023	.012	.027	.007	.007	.008
8	.128	.022	.036	.019	.044	.010	.010	.013
14	.064	.089	.147	.074	.176	.044	.044	.054
16	.050	.141	.232	.117	.277	.069	.069	.086
18	.040	.229	.377	.190	.450	.112	.113	.139
20	.032	.357	.588	.297	.702	.175	.178	.218
24	.020	.905	1.488	.745	1.778	.449	.453	.550
26	.015	1.441	2.45	1.20	2.84	.701	.708	.875
28	.012	2.297	3.59	1.92	4.33	1.062	1.073	1.392
30	.010	3.65	6.02	2.94	7.19	1.794	1.813	2.213
36	.005	14.66	24.08	12.22	28.80	7.15	7.226	8.897

Bare Thermocouple Wire Approximate Weight Feet/Lb.

Wire Gauge	Wire Size Diameter	Type 'J'		Type 'K'		Type 'T'		Type 'E'	
		Iron + JP	Constantan – JN	Chromel + KP	Alumel – KN	Copper + TP	Constantan – TN	Chromel + EP	Constantan – EN
6	.162	14.2	12.6	13	13	12.6	12.6	13	12.6
8	.128	22.8	20.2	21	21	19.8	20.2	21	20.2
14	.064	91.2	80.9	83	83	80.5	80.9	83	80.9
16	.050	144	127	130	130	128	127	130	127
18	.040	233	207	212	212	203	207	212	207
20	.032	365	324	331	331	324	324	331	324
24	.020	925	821	838	838	820	821	838	821
26	.015	1478	1312	1340	1340	1299	1312	1340	1312
28	.012	2353	2089	2130	2130	2062	2089	2130	2089
30	.010	3736	3316	3370	3370	3294	3316	3370	3316
36	.005	14940	13260	13500	13500	13250	13260	13500	13260

Bare Wire Sizes

American Wire Gauge (AWG)	**Size (Diameter) inches**	**American Wire Gauge (AWG)**	**Size (Diameter) inches**
1	0.2893	21	0.0285
2	0.2576	22	0.0253
3	0.2294	23	0.0226
4	0.2043	24	0.0201
5	0.1819	25	0.0179
6	0.1620	26	0.0159
7	0.1443	27	0.0142
8	0.1285	28	0.0126
9	0.1144	29	0.0113
10	0.1019	30	0.0100
1	0.0907	31	0.00893
12	0.0808	32	0.00795
13	0.0720	33	0.00708
14	0.0641	34	0.00630
15	0.0571	35	0.00561
16	0.0508	36	0.00500
17	0.0453	37	0.00445
18	0.0403	38	0.00396
19	0.0359	39	0.00353
20	0.0320	40	0.00314

THERMOCOUPLE TECHNICAL REFERENCE

Thermocouple Science

It is commonly known that a thermocouple consists of a pair of dissimilar wires joined at one end. This connecting point is known as a measuring junction. However, the junction itself doesn't really "measure" anything. It simply joins the two wires at one place, and ensures that there can be no electrical potential difference between the wires at that point.

Therefore, the sole purpose of the "junction" is to establish a starting point from which a thermoelectric voltage can be developed. In this erroneous "model", it is imagined that the thermocouple's "hot" (measuring) junction somehow functions as an electrical source, and that the junction itself produces the thermocouple's small signal voltage. This concept is simply not true.

The actual thermoelectric effect is an extended and continuous one that is distributed along the entire length of the thermocouple conductors. The process is driven by the temperature differences, or gradients, through which these conductors pass. The key point here is that a thermocouple electromotive force (emf), or voltage, is developed from the measuring junction rather than by that junction. It follows that throughout the circuit beyond this starting point or junction, the thermocouple conductors must be electrically insulated from each other, and must remain so under all operating conditions, so that a useful output signal may be realized.

One helpful way of visualizing a thermocouple is to consider a hypothetical and greatly idealized application in which there are three temperature zones.

One zone, where the temperature is being measured, is uniformly hot. Another, containing the reference junction and instrument connections, is taken to be at a cooler, and likewise uniform, ambient temperature. And in between is a zone within which the temperature is assumed to vary in a linear manner with distance, decreasing smoothly from the hotter to the cooler temperature section.

Because of the connection at the measuring junction, there is no electrical potential difference between the wires at that point. In fact, no emf difference between the wires can exist anywhere within the uniform hot zone because, under the assumed temperature conditions, there is no thermal gradient there that could produce one. For the same reason, no additional change in emf difference between wires will occur within the uniformly cool, ambient temperature zone.

All thermoelectric activity therefore takes place in the center zone of decreasing temperature. The two thermocouple wires, or thermo elements, are dissimilar by design. That is to say, each conductor is made up of chemical elements that essentially differ from those of the other wire, and the presence of these dissimilarities will cause each element to respond to external stimuli (in this case, a temperature change) in a different way.

The electrical potential emf along any wire will change as the local temperature changes. Thus, a diminishing temperature will result in a reduced emf for both thermo elements, but the amount of this reduction in one wire will not be the same as for the other because of their different compositions. The small net difference in emf change between two dissimilar wires constitutes a thermocouple output signal. For an appropriately chosen thermocouple pair, this emf output can be a dependable and repeatable function of the temperature difference between the ends of the wires.

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THERMOCOUPLE TECHNICAL REFERENCE

Thermocouple Science cont'd.

Thus, we see that when subjected to a temperature gradient, selected wires with different known thermoelectric properties will produce a useful electrical signal that varies with the temperature difference in a predictable way. It should be apparent that if the temperature does not change along a particular length of a thermo element pair, then the emf will not change along that length. It also follows that a temperature difference of any magnitude cannot produce a thermal emf between two conductors traversing that difference, if the conductors are thermoelectrically identical.

Identification of noble metal thermocouple wires is made difficult by the fact that all alloys are nearly identical in color and all are non-magnetic. Sometimes it is possible to distinguish the positive wire from the negative one by observing the "limpness" of the wires. Pure platinum wires tend to be more soft, or limp, while the rhodium-alloyed conductors are a little stiffer, enough so to permit identification.

The difference, however, is subtle, and it is not possible to tell one rhodium alloy from another by these means . Proper connections for these thermocouples can be reliably determined by gently heating the junction and observing the resulting polarity on a sensitive indicator. In a related way, qualitative identification of rhodium alloys may be made by forming a junction between an unknown wire and another whose composition is known. If the wires are the same, no significant emf will result when their junction is heated o a considerable degree.

Accuracy

Thermocouple materials are produced, tested and sold in two tolerance grades, called standard and special. These tolerance classes are intended to ensure interchangeability of thermocouple sensors without special calibration testing reported to the user. Then, if necessary, corrections based on the test results may be made. A unique advantage of thermocouples is that "lot calibration tests" may be made of samples from a given spool (or lot) of wire, and those test results will apply to all sensors made from that same lot. In this way significantly closer control of tolerance variations may be gained without incurring the high cost of testing a large number of individual thermocouples.

Design Rationale

The choice of thermocouple type is dependent upon the temperatures and conditions of use. Whatever the choice, it is usually necessary to provide the thermo element with suitable protection from the often-harsh conditions in which temperature measurements must be made. Another important factor in selecting a design can be the ease with which a sensor may be serviced or replaced.

Materials Selection

One class of thermocouple material, referred to as "metal-sheathed", has an integral outer sheath, or tube, whose material is chosen to be compatible with the test and to resist deterioration by it. Inside this sealed tube, a compacted ceramic (metal oxide) powder supports and insulates the thermocouple wires. These sensors are rugged and may be bent. Materials inside the sheath are made pure and dry at time of manufacture and effective seals are formed at both ends. These seals must remain intact so that the ceramic powder inside remains completely dry, because moisture intrusion is apt to shorten service life .

(b)

THERMOCOUPLE TECHNICAL REFERENCE

Thermocouple Science cont'd.

In another frequently used construction, bare thermo elements are simply strung through holes in hard-fired ceramic beads. Under very favorable conditions, it may be possible to insert such a bare, insulated thermo element directly into a space to obtain temperature measurements. However, in most instances, isolation from the test medium is necessary. Therefore, bare-wire, insulated thermo elements are usually inserted into single, or multiple concentric, closed-end protecting tubes for isolation and protection from the measurement environment.

Metal-sheathed assemblies are often installed in such tubes, too. By such means, measurements in very hostile environments can be successfully taken. Where measurements are to be obtained in fluids under pressure, drilled thermowells , machined from solid metal, are sometimes required to obtain the necessary mechanical properties.

For moderate temperature applications, it may be possible to utilize soft insulated single or duplex thermo elements with a simple welded junction bead at the end. Depending on the type of insulation and conditions of use, these economical constructions may be directly inserted into the medium to be measured, or may be provided with some type of tube or other enclosure for isolation from potentially harmful test atmospheres.

Hardware Choices

Once the basic materials selections have been made, the mechanical details of the installation can be determined. Mounting may be accomplished by simply sliding the sensor into a hole, or it may be necessary to rigidly connect it to the process by means of threads or clamps. Pipe fittings are often used for this purpose. Note that the hardware associated with the complete design can often be as important to the success of an application as the choice of thermocouple type inside.

Connecting means for wiring to an instrument often occurs at the outer end of a sensor assembly. In some instances this may take the form of an open or enclosed connecting head, or a terminal block. At other times, a plug and jack type of quick disconnect may be used. It is important that all current carrying portions of the circuit that may be subjected to a temperature gradient should be made of matching thermocouple materials. This is because each incremental length in the circuit must make its contribution according to the temperature difference that it "sees".

As an exception to the matching materials rule, judicious use can sometimes be made of short, heavy splices containing non-matching materials as long as the connections are well protected and remain essentially isothermal. Where properly applied, such splices may be used without causing a significant error. Often it is desirable to select wiring used beyond a connecting head or plug that is different in some respects from the construction needed for the thermocouple itself.

Because the ambient temperatures in this "extension" part of the circuit are often less severe than those seen by the thermocouple itself. Economical extension grade wires are available that have the same nominal composition as costlier thermocouple grades, but are usually guaranteed over more limited temperature ranges and may also have moderately relaxed tolerance levels.

(c)

THERMOCOUPLE TECHNICAL REFERENCE

Thermocouple Science cont'd.

In those cases where thermocouple wires are made of noble metals or other costly alloys, the extension wires can be made of totally different material as an economy measure. Such specially produced extension alloys have thermoelectric properties that are closely matched to those of the particular thermocouple type with which they are to be used. These materials are called compensating thermocouple extension wires.

Selection Factors - Why chose one T/C over another?

The usual goals in choosing a thermocouple type are to provide an adequate measurement over the longest possible life, and at the lowest cost. It is prudent, for such comparisons, to consider the total cost over some suitable time period. It is easy to overlook such hidden costs as maintenance, testing, and replacement, or loss of production due to down time or as a result of inaccurate readings.

Other factors in making the best choice might be the availability of instrumentation, and sometimes a need to standardize on the thermocouple type or types to be used at a given site.

Service Life

Useful thermocouple life is a very difficult prediction to make, even when most of the details of an application are known. And unfortunately, such information is often very hard to determine. The very best test for any application is to actually install, use, and evaluate the in-use performance of a design that is thought likely to succeed . The recommendations, and non-recommendations, listed under the thermocouple type descriptions are a good starting place to pick a type to try.

Decalibration and Drift

All thermocouples are subject to calibration drift with use, it is just a matter of how much, and how fast this may happen. Thermocouple performance is critically dependent upon absolute uniformity of both physical and chemical properties along the entire length of the circuit. When thermo element materials are produced, careful steps are taken to assure that this uniformity (or homogeneity) is achieved. In use, different parts of the circuit experience different conditions of heat, chemical exposure etc., and as a result, such parts actually do grow to be "different" from each other physically.

Because the thermoelectric emf resulting from a given temperature difference is sensitive to changes in the chemical and metallurgical properties of the wire, the total emf produced by a used probe can be different from an otherwise identical new one under the same conditions. The changes are usually small (often negligibly small) over appreciable periods of time. But under adverse conditions, it is possible to realize large drifts at rapid rates.

To achieve long and reliable thermocouple life, the usual strategy is to operate the device comfortably under its maximum temperature, and provide it with the cleanest possible environment in which to work. Enclosures, such as sheaths, protecting tubes, and thermowells are the usual means of controlling the conditions that actually surround the thermo elements themselves.

(d)

THERMOCOUPLE TECHNICAL REFERENCE

Thermocouple Science cont'd.

What can go wrong

Protecting tubes, sheaths, and even thermowells can fail due to corrosion or mechanical damage. Processes can go over temperature and expose thermo elements to higher than anticipated temperatures. If a sensor controlling a process drifts low in its output, the process, in response to its controller, may as a result be forced to temperatures higher than intended.

Base metal assemblies are vulnerable to attack by a number of chemical agents. They can also be altered by unfavorable operating conditions.

As supplied, noble metal thermocouple wire of good quality has very low impurity levels. Consequently, it is quite susceptible to contamination that can affect its thermoelectric properties. Platinum is especially sensitive to the presence of free silicon, with which it can combine to form a eutectic alloy that will melt at, or below, normal service temperatures. High-purity insulators and protecting tubes for precious metal assemblies, as well as careful attention to cleanliness in handling, are therefore essential to help prevent this.

Human error can be a contributing factor, as well. Controls may be improperly set, connections may be improperly made, and inappropriate action in response to the operating conditions may be taken by mistake. Redundancy in instrumentation combined with training and responsibility are the usual means to combat these kinds of errors.

Troubleshooting - The Approach

There is no better way to go about finding troubles than to use plain common sense. One should ask if system performance seems to be reasonable for the conditions? Do changes in the controls produce a logical result? What about the product? Does its condition correspond with what the instruments are saying?

How to test a used T/C

First of all, one cannot ordinarily remove a suspect thermocouple from service and "test" it in another place. The very fact that the device is used means that it may no longer be homogeneous. Subjecting an inhomogeneous thermocouple to a different set of temperature gradients, even if only subtly different, can result in a different output and reading. So, "recalibrating" a used t/c will certainly yield a "number", but that number will probably be meaningless in the thermocouple's place of use.

Perhaps the best way to evaluate a used thermocouple is to "probe" the location by placing a new, or nearly new thermocouple that is known to be good alongside the suspect one in an operating process and compare the readings. If it is not practical to have two sensors in place at the same time, the next best thing is to remove the suspect probe and replace it with another one known to be good. Then, as long as the good probe is located in the same place as the removed one had been, and the process has not changed during the exchange, the readings from the two probes can be compared.

(e)

THERMOCOUPLE TECHNICAL REFERENCE

Thermocouple Science cont'd.

Note that it is not necessary to keep and use an unlimited supply of new probes for these tests. A few suitable replacement devices can be kept on hand and one of them selected for testing use. Under normal circumstances, thermocouple drift, or degradation, is a gradual, and very slow process. A single replacement probe can thus be used a number of times to probe a process before it accumulates very much time at operating temperature, and can usually be considered reliable for a number of such repeated tests.

And, when a drifted probe has been found, the test probe may simply be left in place as a working sensor, while the next replacement becomes the test device.

System tests

One very useful instrument for troubleshooting thermocouple systems is a portable temperature indicator. A number of these devices are capable of operating with two or more different thermocouple types, and some offer an "output" function that will produce an electrical output to simulate a thermocouple operating at any temperature of choice.

In use, the instrument is normally "clipped on" to the wires of a circuit being tested at some convenient access point, such as in a connecting head. There, the output of an operating sensor may be monitored and evaluated. Or, using and instrument's "output" function, a synthesized signal may be sent back to the circuit's permanent indicator or controller to verify proper operation of the rest of the circuit. When driving a signal back towards an instrument, it is usually necessary to break one side of the circuit to avoid "loading" the portable tester by the low resistance of the thermocouple itself.

Sections of extension wiring in thermocouple circuits may be checked for proper connections with a portable tester, as well. The section being tested should be electrically isolated from the rest of the loop, and one end of an extension wire pair should be shorted together. If a tester is connected to the opposite end of the shorted pair, the tester should indicate the approximate temperature of the shorted end.

Note that if both ends of the extension pair happen to be at the same temperature, it may be necessary to warm the shorted end a little and verify that the tester "sees" the temperature change correctly. Note that there is the possibility of an incorrect, reversed connection that is being checked in this test.

Summary

A key to the successful use of thermocouples is the understanding of how and why they operate. Once the basic principle – namely distributed generation of the thermocouple's emf, driven by the temperature gradients, or differences, through which the wires pass – is known and understood, applying thermocouples to most applications becomes straightforward and logical.

Commercially available thermocouples are standardized by letter-designated type and by tolerance levels of conformance to published tables or "curves" of emf versus temperature. Custom calibration of thermocouple materials is available to answer needs more critical than can be covered by the usual tolerance grades.

(f)

THERMOCOUPLE TECHNICAL REFERENCE

Thermocouple Science cont'd.

An important fact to be remembered is that laboratory calibration of thermo elements is predicated upon good uniformity or homogeneity of the thermo element being tested. New materials will possess this property, but used materials may not, so it is not normally advisable to recalibrate used thermocouples. This is particularly true for base metal types after use at high temperatures .

Thermocouples are available in an almost endless variety of constructions and configurations. It is possible and practical to connect them in special ways to sense either temperature differences or temperature averages over a number of sites. It is even possible to "gang" these devices together to boost the amount of electrical signal arising from small temperature differences. But applications like these are specialized.

The major use for thermocouples is to make reliable and direct measurements of temperature in many diverse applications. Thermocouples are fundamentally simple devices. They are extremely versatile and rugged, and are capable of operating over a very wide range or temperatures. Thermocouples can be made to very tiny dimensions and into many different forms for standard or special purposes, In addition, they are low in cost and are readily interchanged or replaced. But they do need to be understood, so that they will measure the quantity that is desired with the precision that is required.

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Duro-Sense Corporation

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TERMS AND CONDITIONS

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All orders are shipper F.O.B. Duro-Sense Corporation factory. All shipments are made prepaid and additional, unless otherwise negotiated in advance. Packing and handling charges are included in the shipping charges. Insurance charges are added only at the request of the purchaser.

Drop shipments will be made at the purchaser's request, providing that the invoice is issued to the "purchaser" and not to the "receiver".

Damage to shipments beyond the F.O.B. point is the responsibility of the carrier. Shipments should be opened promptly upon receipt and any claim for damage is to be initiated by the purchaser with the carrier. Replacement shipments will be made on a chargeable basis.

Each shipment should be examined by the purchaser promptly upon receipt. Any claims for shipment shortages must be made to Duro-Sense Corporation within 72 hours of receipt of shipment.

MATERIAL RETURNS:

Returns for credit, evaluation or repair will not be allowed without prior factory authorization. Purchaser must contact the factory for a "Return Merchandise Authorization" (RMA) number, and clearly describe the item, the reason for its return, the original purchase order number, order date, invoice number, and any other pertinent information germane to the item(s) in question.

RESTOCKING CHARGES:

Products and related parts that are returned to Duro-Sense Corporation in unused and like-new condition, that are returned for credit, will be subject to a minimum 20% restocking charge. The actual charges will be determined, by Duro-Sense Corporation, based on the type of material, its resale value and inspection and evaluation of the material in question.

CERTIFICATION:

N.I.S.T. traceable calibration and certification is available for thermocouples, RTD's and thermocouple wire. Certifications are limited to temperatures between -109°F and 2650°F (-78°C and 1454°C). Certifications are dependent upon calibration limitations of element materials and sheaths where applicable. The minimum sensor assembly length for certification is 18 inches of sheath length and the minimum length for certifying insulated thermocouple wire is 24 inches. Thermocouple wire is certified by making thermocouples from each end of the wire spool and evaluating them at specified temperatures. Lead-time for certification is dependent upon the quantity of items being certified as well as the capacity of the calibration laboratory at the time. Purchaser should contact Duro-Sense Corporation directly for current certification lead times.

COMPLIANCE:

Duro-Sense Corporation is dedicated to maintaining the highest level of quality in both manufacturing and testing. Duro-Sense Corporation operates under its own quality standard, DSQ-2000, which is compliant with the following quality and testing standards:

ISO-9001, AS-9100, MIL-I-45208, MIL-STD-45662A, ISO 10012-1:2003, ANSI/NCSL Z-540-3-2006, AMS2750E, ASTM E 220-7A, ASTM E 230-03, ASTM E 207-08, ANSI/ASQC Z1.4-1993.

Copies of the Duro-Sense Corporation quality manual and any existing certifications are available upon request.

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