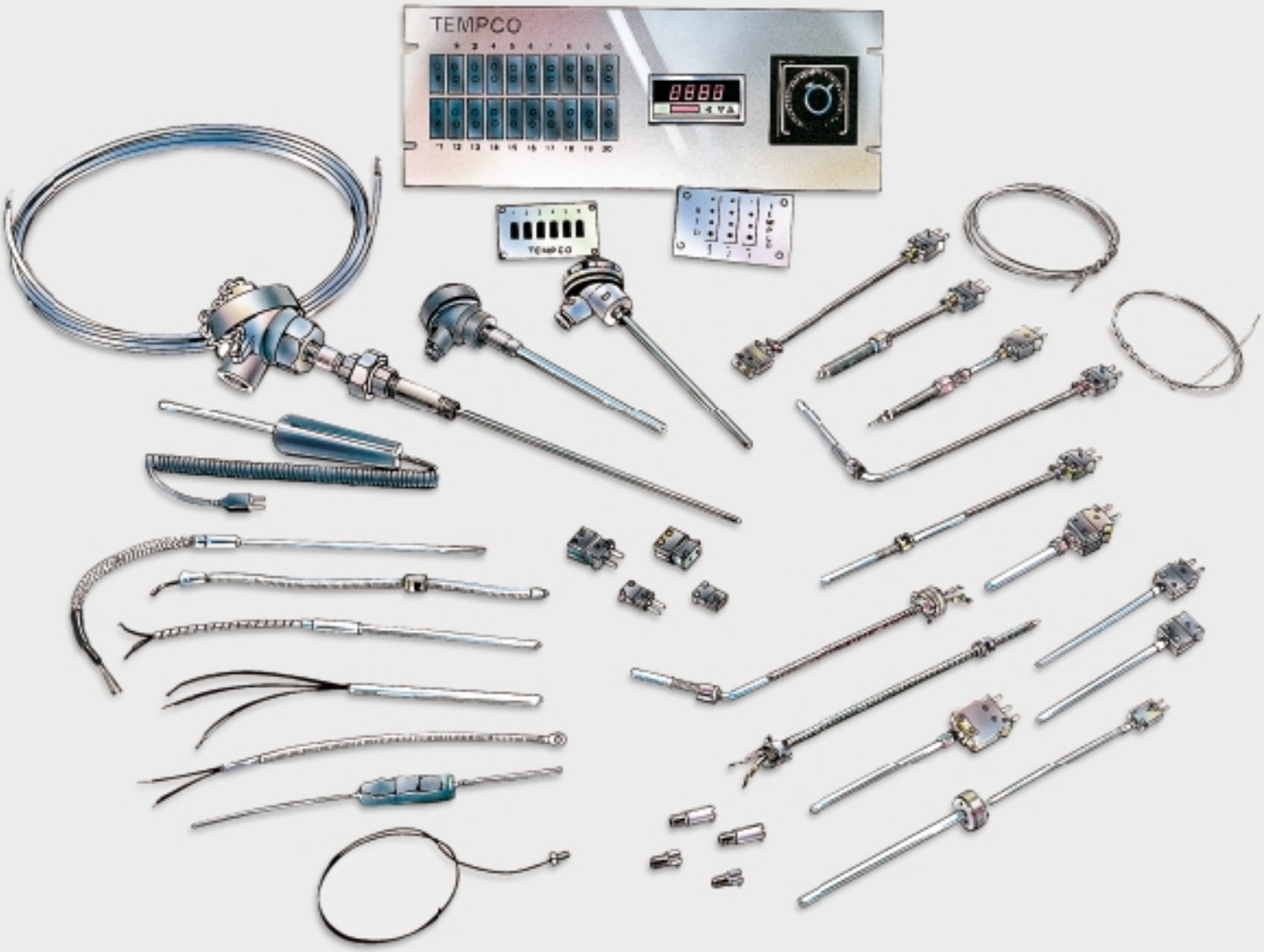

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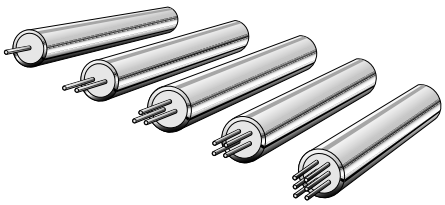
14 SECTION

TEMPERATURE SENSING

Make Tempco your "One Stop Shopping Source For Temperature Sensors"

Tempco offers one of the most complete quality engineered and manufactured Thermocouple and RTD selections in the industry, along with a wide array of related sensor accessories such as Metal Sheathed Mineral Insulated Thermocouple Cable (MI), Thermowells, Jack Panels and Insulated Thermocouple and Extension Wires.



Metal Sheathed Mineral Insulated Thermocouple Cable (MI T/C Cable)

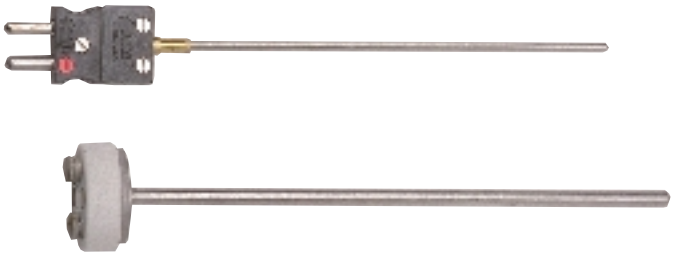
See Pages 14-4 through 14-15

Tempco offers a wide variety of sheathed, mineral insulated, thermocouple cable. We stock many varieties of sheath diameters and materials in ANSI recognized thermocouple types and can manufacture a multitude of non-stock combinations of sheath materials, O.D.'s, insulations, wire types and wire configurations on special request, consult Tempco with your specific requirements.

Thermocouple Assemblies

See Pages 14-16 through 14-31

Mineral Insulated, Industrial Process, Base Metal and Noble Metal Thermocouple Assemblies. Tempco manufacturers a wide variety of standard and custom designs for many diverse industries and applications including food processing, petrochemical, research laboratories, and semi conductors in temperature ranges from cryogenic –200°C (–328°F) to 2315°C (4200°F). When you have a special requirement or a difficult application, consult Tempco. Our team of professionals, with vast engineering and application knowledge, can assist you with specific solutions to your problem.



Thermowells, Ceramic and Metal Protection Tubes

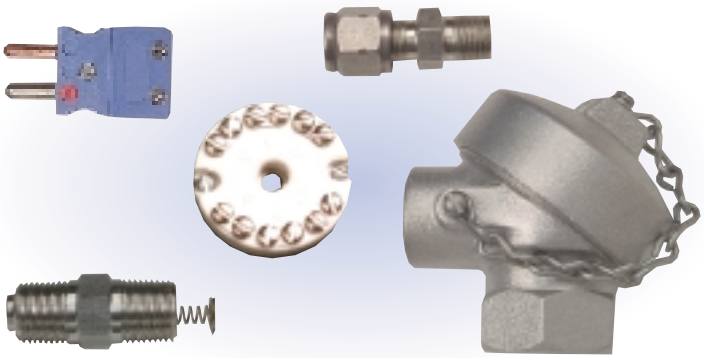
See Pages 14-32 through 14-42

Tempco offers standard and custom manufactured Thermowells and Protection Tubes which afford you an excellent variety of ways to protect your temperature sensor from high velocity, high pressure and corrosive and harsh environments.

Hardware and Accessories

See Pages 14-43 through 14-53

The hardware and accessory section features many items which will allow you to customize your sensor design, replace lost or worn out hardware and connectors or simply up-date your existing system with the latest in sensor accessories.



Insulated Thermocouple and Extension Wire

See Pages 14-54 through 14-60

This section presents the most commonly used insulated thermocouple and thermocouple extension wire available from stock in all the ANSI recognized calibrations. All thermocouple and thermocouple extension wires are supplied to meet Standard Tolerances of ANSI Circular MC96.1-1982. Special tolerances to ANSI MC96.1 are available at an extra charge.

Thermocouples for the Plastics Industry

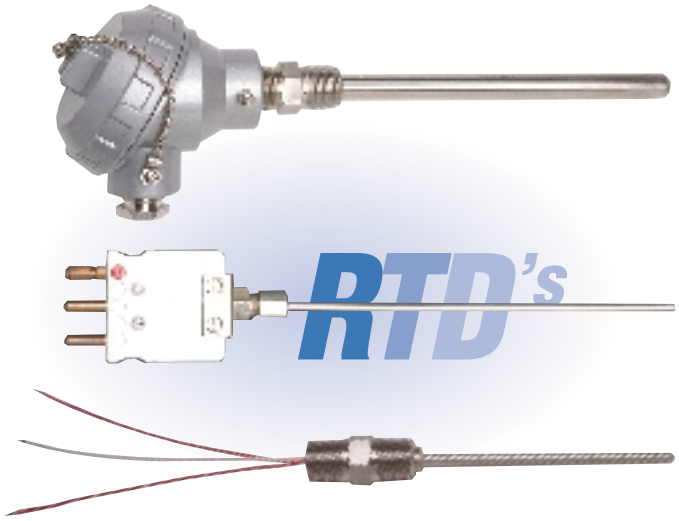
See Pages 14-61 through 14-70

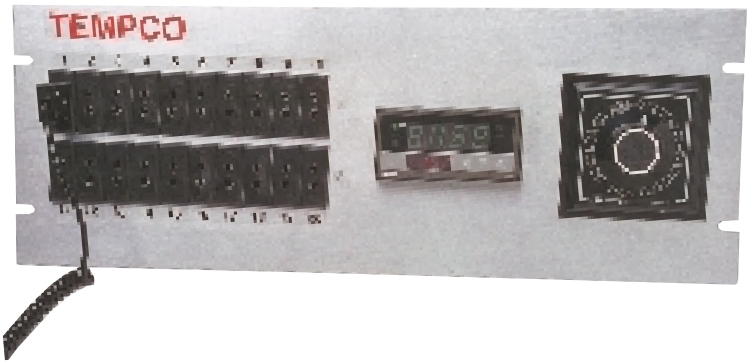
Tempco has a wide variety of standard designs and a large stock of thermocouples specifically manufactured for the plastics and commercial industry as well as the light to medium duty applications where more costly types of thermocouples are not necessary. All thermocouples are available in ANSI Type “J” (Standard), K, T and E calibrations.

Accu-Ohm RTD’s for Industrial, Plastics and Medium and Light Duty Applications

See Pages 14-71 through 14-87

Tempco’s RTD’s *(Resistance Temperature Detectors)* are designed to meet IEC Publication 751, DIN43760, JIS1604-1989 and BS1904-1984. They are normally supplied to Class B, but can be manufactured to Class A as an option. RTD’s offer greater repeatability and interchangeability than thermocouples or thermistors over the standard temperature scale from –260°C to 630°C (–436 to 1166°F).





Jack Panels and Accessories

See Pages 14-88 through 14-94

Tempco’s Jack Panels are made from rugged, .090" thick aluminum and allow for easy installation of multi-circuit thermocouple or RTD Quick Disconnect Jacks in your panel or housing. Panels can be manufactured with either a single calibration type or a mixed variety.

Tempco's Metal Sheathed, Mineral Insulated Thermocouple Cable

Tempco-Pak Thermocouples and cable are manufactured using premium quality materials along with rigid quality control standards to insure a reliable product that is state-of-the-art. The metal outer sheath protects the thermocouple wires and insulation from contamination and mechanical damage, hostile and oxidizing environments, while allowing it to be moisture proof, formable, weldable, compact and have fast response. The mineral insulation isolates the conductors from the sheath and each other while providing excellent high temperature insulation resistance.

Tempco offers a wide variety of sheath materials to choose from as there is no single sheath material that is suitable for all conditions. The most commonly stocked sheath materials are 304 S.S., 316 S.S. and alloy 600. These are offered in all ANSI recognized thermocouple calibrations.

As a standard, Tempco-Pak Thermocouple cable is made with high purity 94% minimum MgO insulation. Other types and purities are available; however, when selecting a mineral insulation, the environment, temperature rating and cost must be taken into consideration.

Quality Assurance

All Tempco-Pak Thermocouple cable is inspected for appearance, physical and electrical characteristics, as well as conformance to calibration.

Each coil or batch of Tempco-Pak is made from the same production lot of raw materials and processed together. This eliminates the need to calibrate each length cut from the same coil. Samples from each coil are calibrated as shown in the chart.

Tempco-Pak Thermocouple Calibration Temperatures

ANSI Calibration	Standard Calibration Points	Optional Points
T	200°F (93°C), 400°F (204°C)	—
J	200°F (93°C), 500°F (260°C), 1000°F (537°C), 1500°F (815°C)	—
E	300°F (149°C), 500°F (260°C), 1000°F (537°C), 1600°F (871°C)	—
K	300°F (149°C), 500°F (260°C), 1000°F (537°C), 1600°F (871°C), 2000°F (1093°C)✻	2200°F (1204°C)
R	1000°F (537°C), 1600°F (871°C), 2000°F (1093°C)✻	2600°F (1426°C)
S	1000°F (537°C), 1600°F (871°C), 2000°F (1093°C)✻	2600°F (1426°C)
B	1600°F (871°C), 2000°F (1093°C)✻, 2600°F (1426°C)✻	2600°F (1426°C)
N	300°F (149°C), 500°F (260°C), 1000°F (537°C), 1600°F (871°C), 2000°F (1093°C)✻	2200°F (1204°C)

✻These calibration points will be checked if the sheath and insulation are rated to this temperature.

Tempco-Pak

Thermocouple Data, Care and Handling

Calibration

Tempco-Pak Thermocouple Cable is normally supplied to ANSI standard limits (tolerances) of error as set forth in ANSI circular MC96.1–1982 and duplicated in ASTM E230. Special limits (tolerances) per ANSI MC96.1 are available at extra cost. (See Table 1 on 14-6)

Annealing

Unless otherwise specified all Tempco-Pak will be furnished in a fully annealed condition.

Formability

Because Tempco-Pak is fully annealed it can normally be formed around a mandrel 4 times the sheath diameter without loss of insulation resistance or the sheath's integrity.

Weldability

Tempco-Pak can be brazed, soldered or welded upon its sheath. However, because of the delicate nature of the fabricating of hot junctions, it is recommended they be done at the factory. Brazing or soldering material should not come in contact with the mineral insulation as the flux or resin will contaminate the insulation.

Insulation Resistance

Tempco-Pak should have a minimum insulation resistance wire to wire and wire to sheath at room temperature of 100 megohms at 50 VDC for 0.093" O.D. and smaller and 100 megohms at 100 VDC for .100" O.D. and larger.

Shipping and Packaging

Tempco-Pak is stocked in random lengths with the maximum stock lengths listed in the tables showing the varieties of commonly available material. Tempco reserves the right to supply random lengths of our choice unless specific lengths are specified on your order. Tempco-Pak can be furnished in coil form or in straight lengths. Normally .375" diameter and .312" diameter are shipped in straight lengths. Longer lengths are available on special order.

Handling and Storage

To prevent moisture from being absorbed by the hydroscopic insulation, both ends of the lengths of Tempco-Pak are sealed at the factory with a suitable sealer. Under some conditions, moisture absorption could take place which would lower the insulation resistance and may prove to be troublesome in subsequent assembly and welding, so it is advisable to store Tempco-Pak in a dry place. Slight moisture penetration can be remedied by removing approximately 3 inches from each end. Apply heat (approx 300°F) 6 to 7 inches from the open end and slowly work heat toward and over the open end. Allow end to cool to approximately 180°F and reseal end. When pieces are cut from stock lengths, the exposed ends should be squared and resealed immediately to prevent contamination or moisture absorption. For deeper moisture penetration, bake entire length of material with both ends open for 24 hours at 250°F to 300°F to remove moisture and bring up insulation resistance. If baking does not bring the insulation resistance to acceptable levels, discard the material. As an option Tempco can provide Tempco-Pak with the ends seal welded .

Selecting the M.I. Thermocouple Cable suited to your requirement

Tempco offers a wide variety of sheathed, mineral insulated, thermocouple cable. We stock many varieties of sheath diameters and materials in ANSI recognized thermocouple types and can manufacture a multitude of non-stock combinations of sheath materials, O.D.'s, insulations, wire types and wire configurations on special request. Consult Tempco with your specific requirements.

When selecting a cable for an application there are four things that must be considered:

Sheath Material

The outer sheath protects the insulation and wires from physical damage, contamination and the environment, all of which affect the service life and cost. As there isn't any one particular sheath material that is appropriate for all conditions, Tempco offers you a choice.

1

Insulation Material

The insulation material isolates the wires from each other and the sheath. Because the wires are used as conductors the insulating material becomes important in preventing electrical shorts and dielectric breakdown particularly at elevated temperatures.

2

Wire Types *(Calibration)*

Selecting the proper conductors can be crucial to the function the MI cable is to perform. Where thermocouple cable is concerned, selecting the appropriate calibration for the temperature to be measured, the instrumentation available, and the environment will be a significant factor in the accuracy, life and cost.

3

Physical Parameters

The four main physical characteristics of the MI cable that should be taken into account are:

a. Sheath Diameter

b. Sheath Wall Thickness

c. Conductor Size

d. Conductor Location (4 and 6 wires)

These will directly affect service life, flexibility, time response, weldability, strength and cost.

The following pages will serve as a guide for sheath materials, insulation materials and the various ANSI thermocouple calibrations.

4

CAUTION

The following information is designed to be used as a guide and may not be correct in every application. If in doubt, consult with your Tempco sales engineer or the factory. Temperatures shown are maximum recommended operating temperatures.

Sheath Material

Note: Letters in parenthesis following the sheath material are used with the Ordering Worksheet on Page 14-10.

Alloy 600 (A)

Maximum temperature: 1177°C (2150°F). Most widely used thermocouple sheath material. Good high temperature strength, corrosion resistance, resistance to chloride-ion stress corrosion cracking and oxidation resistance to high temperatures. Do not use in sulfur bearing environments. Good in nitriding environments.

304 SS (B)

Maximum temperature: 900°C (1650°F). Most widely used low temperature sheath material. Extensively used in food, beverage, chemical and other industries where corrosion resistance is required. Subject to damaging carbide precipitation in 482° to 871°C (900° to 1600°F) range. Lowest cost corrosion resistant sheath material available.

316 SS (C)

Maximum temperature: 900°C (1650°F). Best corrosion resistance of the austenitic stainless steel grades. Good corrosion resistance in H_2S. Widely used in the food and chemical industry. Subject to damaging carbide precipitation in 482° to 871°C (900° to 1600°F) range.

304L (D)

Maximum temperature: 900°C (1650°F). Low carbon version of 304 SS (B). Low carbon content allows this material to be welded and heated in the 482° to 871°C (900° to 1600°F) range without damage to corrosion resistance.

316L (E)

Maximum temperature: 900°C (1650°F). Same as 316 SS (C) except low carbon version allows for better welding and fabrication.

Continued next page…

Table 1 Tolerances on Initial Values of Emf vs. Temperature

NOTE 1 Tolerances in this table apply to new essentially homogeneous thermocouple wire, normally in the size range 0.25 mm to 3 mm in diameter (No. 30 to No. 8 Awg) and used at temperatures not exceeding the recommended limits of Table 1. If used at higher temperatures these tolerances may not apply.

NOTE 2 The Fahrenheit tolerance is 1.8 times larger than the °C tolerance at the equivalent °C temperature. Note particularly that percentage tolerances apply only to temperatures that are expressed in °C.

NOTE 3 *Caution:* Users should be aware that certain characteristics of thermocouple materials, including the emf versus temperature relationship may change with time in use; consequently, test results and performance obtained at time of manufacture may not necessarily apply throughout an extended period of use. Tolerances given in this table apply only to new wire or MI cable or thermocouples as delivered to the user and *do not allow for changes in characteristics with use.* The magnitude of such changes will depend on such factors as wire size, temperature, time of exposure, and environment. It should be further noted that due to possible changes in homogeneity, attempting to recalibrate *used* thermocouples is likely to yield irrelevant results, and is not recommended. However, it may be appropriate to compare used thermocouples *in-situ* with new or known good ones to ascertain their suitability for further service under the conditions of the comparison.

			Tolerances—Reference Junction 0°C (32°F)			
	Temperature Range		Standard Tolerances		Special Tolerances	
Thermocouple Type	°C	°F	°C (whichever is greater)	°F	°C (whichever is greater)	°F
T	0 to 370	32 to 700	±1 or ±0.75%	Note 2	±0.5 or 0.4%	Note 2
J	0 to 760	32 to 1400	±2.2 or ±0.75%		±1.1 or 0.4%	
E	0 to 870	32 to 1600	±1.7 or ±0.5%		±1 or ±0.4%	
K or N	0 to 1260	32 to 2300	±2.2 or ±0.75%		±1.1 or ±0.4%	
R or S	0 to 1480	32 to 2700	±1.5 or ±0.25%		±0.6 or ±0.1%	
B	870 to 1700	1600 to 3100	±0.5%			
T[A]	–200 to 0	–328 to 32	±1 or ±1.5%		[B]	
E[A]	–200 to 0	–328 to 32	±1.7 or ±1%		[B]	
K[A]	–200 to 0	–328 to 32	±2.2 or ±2%		[B]	

[A] Thermocouples and thermocouple materials are normally supplied to meet the tolerances specified in the table for temperatures above 0°C. The same materials, however, may not fall within the tolerances given for temperatures below 0°C in the second section of the table. If materials are required to meet the tolerances stated for temperatures below 0°C the purchase order must so state. Selection of materials usually will be required.

[B] Special tolerances for temperatures below 0°C are difficult to justify due to limited available information. However, the following values for Types E and T thermocouples are suggested as a guide for discussion between purchaser and supplier:

Type E –200 to 0°C ±1°C or ±0.5% (whichever is greater)

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

Initial values of tolerance for Type J thermocouples at temperatures below 0°C and special tolerances for Type K thermocouples below 0°C are not given due to the characteristics of the materials.

Sheath Material *continued*

310 SS (F)

Maximum temperature: 1150°C (2100°F). Mechanical and corrosion resistance, similar to but better than 304 SS. Very good heat resistance. This alloy contains 25% Cr, 20% Ni. Not as ductile as 304 SS.

321 SS (G)

Maximum temperature: 871°C (1600°F). Similar to 304 SS except titanium stabilized for intergranular corrosion. This alloy is designed to overcome susceptibility to carbide precipitation in the 482° to 871°C (900° to 1600°F) range. Used in aerospace and chemical applications.

347 SS (H)

Maximum temperature: 871°C (1600°F). Similar to 304 SS except nickel columbium stabilized. This alloy is designed to overcome susceptibility to carbide precipitation in the 482° to 871°C (900° to 1600°F) range. Used in aerospace and chemical applications.

Nickel 200 (J)

Maximum temperature: 315°C (600°F). Commercially pure wrought Nickel with good resistance to a wide range of corrosive materials. For temperatures above 600°F use Nickel 201 to prevent embrittlement by intergranular corrosion.

Nickel 201 (K)

Maximum temperature: 1093°C (2000°F). Commercially pure wrought nickel with low carbon. Used in molten salt bath furnaces. Offers good resistance to caustic alkalines and fluorine.

ASTM E230

TOLERANCES & TEMPERATURES

Table 2 Suggested Upper Temperature Limits for Protected Thermocouples

NOTE 1 This table gives the recommended upper temperature limits for the various thermocouples and wire sizes. These limits apply to protected thermocouples; that is, thermocouples in conventional closed-end protecting tubes. They do not apply to sheathed thermocouples having compacted mineral oxide insulation.

NOTE 2 The temperature limits given here are intended only as a guide to the user and should not be taken as absolute values nor as guarantees of satisfactory life or performance. These types and sizes are sometimes used at temperatures above the given limits, but usually at the expense of stability or life or both. In other instances, it may be necessary to reduce the given limits in order to achieve adequate service. ASTM MNL-12[5] and other literature sources should be consulted for additional applications information.

	Upper Temperature limit for Various Wire Sizes (Awg), °C (°F)					
Thermocouple Type	No. 8 Gage 3.25 mm (0.128 in)	No. 14 Gage 1.63 mm (0.064 in)	No. 20 Gage 0.81 mm (0.032 in)	No. 24 Gage 0.51 mm (0.020 in)	No. 28 Gage 0.33 mm (0.013 in)	No. 30 Gage 0.25 mm (0.010 in)
T		370 (700)	260 (500)	200 (400)	200 (400)	150 (300)
J	760 (1400)	590 (1100)	480 (900)	370 (700)	370 (700)	320 (600)
E	870 (1600)	650 (1200)	540 (1000)	430 (800)	430 (800)	370 (700)
K and N	1260 (2300)	1090 (2000)	980 (1800)	870 (1600)	870 (1600)	760 (1400)
R and S				1480 (2700)		
B				1700 (3100)		

[5] "Manual on the Use of Thermocouples in Temperature Measurement," ASTM MNL-12, 1993.

Tables courtesy ASTM

SHEATH MATERIAL *continued*

446 SS (L)

Maximum temperature: 1150°C (2100°F). Ferritic stainless steel, which has good resistance to sulfurous atmospheres at high temperatures. Good corrosion resistance to nitric acid, sulfuric acid and most alkalies. 27% chromium content gives this alloy the highest heat resistance of any ferritic stainless steel.

Pure Platinum (M)

Maximum temperature: 1482°C (2700°F). Platinum is the only metallic material capable of operating in an oxidizing atmosphere above 1260°C (2300°F) for extended periods of time. Normally used with type R, S or B conductors. Used in glass manufacturing, high temperature furnaces and as control standards.

Platinum 10% Rhodium (N)

Maximum temperature: 1552°C (2825°F). Excellent oxidation resistance. Same type of uses as platinum 20% rhodium except lower cost and reduced operating range.

Platinum 20% Rhodium (P)

Maximum temperature: 1649°C (3000°F). Excellent oxidation resistance. Very expensive oxidation resistant alloy used in glass manufacturing and in research applications. Also used for gas turbine test thermocouples.

Hastelloy X® (Q)

Maximum temperature: 1204°C (2200°F). Widely used in aerospace applications. Resistant to oxidizing, reducing and neutral atmospheric conditions. Excellent high temperature strength along with superior oxidation resistance. Resistant to stress corrosion cracking in petrochemical applications.

Continued next page…

Sheath Material *continued*

Inconel® 601 (R)

Maximum temperature: 1177°C (2150°F) Continuous; 1260°C (2300°F) Intermittent. Similar to Alloy 600 with the addition of aluminum for outstanding oxidation resistance. Designed for high temperature corrosion resistance. This material is good in carburizing environments, and has good creep rupture strength. Do not use in vacuum furnaces! Susceptible to intergranular attack by prolonged heating in 538° to 760°C (1000° to 1400°F) temperature range.

Incoloy® 800 (S)

Maximum temperature: 1093°C (2000°F). Widely used as heater sheath material. Minimal use in thermocouples. Superior to Alloy 600 in sulfur, cyanide salts and fused neutral salts. Susceptible to intergranular attack in some applications by exposure to the temperature range of 538 to 760°C (1000° to 1400°F).

Incoloy® 800HT (T)

Maximum temperature: 1093°C (2000°F). Same as Incoloy 800® (S) except carbon content is limited to upper end of range. This provides significantly higher creep and rupture strength. Used in the chemical and petrochemical industry for long term exposure to high temperatures.

Tantalum (U)

Maximum temperature in air: 482°C (900°F). Melting point: 2996°C (5425°F). Refractory metal. Very ductile. Use only in inert or very good vacuums—10-3 torr or better. Most commonly used with BeO and Tungsten Rhenium conductors. Do not use in environments containing nitrogen above 371°C (700°F).

Molybdenum (V)

Maximum temperature in air: 399°C (750°F). Melting point: 2610°C (4730°F). Refractory metal. Brittle; cannot be bent. Use only in inert, vacuum or reducing atmospheres. Most commonly used with BeO insulation and Tungsten Rhenium conductors. Uncompacted assemblies only.

Insulation

Note: Letters in parenthesis following the insulation material are used with the Ordering Worksheet on Page 14-10.

Magnesium Oxide—MgO 94% Typical **(M)**

This insulation is widely used in thermocouple and heater applications below 2000°F. SiO_2 is the major impurity which provides excellent insulation resistance. Do not use with platinum or in nuclear application.

High Purity Magnesium Oxide—MgO 99.4% Minimum Purity **(H)**

Low impurity levels make this insulation very useful for all thermocouple calibrations up to 2500°F. Above 2500°F we recommend using Beryllium Oxide insulation because of MgO's low resistivity. This material meets the requirements established in ASTM E-235-82.

Alumina Oxide—Al_2O_3 99.6% Minimum Purity **(A)**

Although this material is comparable to MgO in its electrical properties and cost, it does not compact as well and tends to "powder out." This undesirable characteristic has made this insulation unpopular in industry so cable with this type of insulation is available only as a "special."

Beryllium Oxide—BeO 99.7% Minimum Purity **(B)**

This excellent high temperature insulation is used primarily with tungsten rhenium conductors and either a molybdenum or tantalum sheath. Beryllia is the only material other than diamond which combines excellent electrical insulating properties along with high thermal conductivity. The two disadvantages of this material are cost, (approximately 10× greater than MgO), and the toxicity of BeO. Beryllia dust can cause potential health problems if it is inhaled. We highly recommend that assemblies containing Beryllium insulation be made at Tempco where our work stations are designed for handling this material. Maximum recommended temperature is 1900°C (3452°F).

Calibration

***Note:* Standard and Special Tolerance Calibration information to be used with the Ordering Worksheet on Page 14-10.**

ANSI Type (J) Standard; Special Tolerance **(3)**

Type J is composed of a positive leg (JP) which is iron and a negative leg (JN) which is approximately 45% nickel, 55% copper. When protected by the compacted mineral insulation and appropriate outer sheath, Type J is usable from 32° to 1500°F. Type J is not susceptible to short range ordering in the 700 to 1000°F temperature range, (+2°F to +4°F drift) which occurs with ANSI Type E and K. This low-cost, stable thermocouple calibration is primarily used with 94% minimum purity MgO insulation and a stainless steel sheath.

ANSI Type (K) Standard; Special Tolerance **(4)**

Type K is composed of a positive leg (KP) which is approximately 90% nickel, 10% chromium and a negative leg (KN) which is approximately 95% nickel, 2% aluminum, 2% manganese and 1% silicon. When protected by the compacted mineral insulation and appropriate outer sheath, Type K is usable from 32°F to 2300°F and is one of Tempco's most popular calibration types. If the application temperature is between 600 and 1100°F, we recommend using Type J or Type N because of short range ordering which can cause drift of +2°F to +4°F in a few hours' time. Type K is relatively stable to radiation transmutation and is used in nuclear environments. For applications below 32°F, special alloy selections are usually required.

ANSI Type (E) Standard; Special Tolerance **(5)**

Type E is composed of a positive leg (EP) which is approximately 90% nickel, 10% chromium and a negative leg (EN) which is approximately 45% nickel, 55% copper. When protected by the compacted mineral insulation and appropriate outer sheath, Type E is usable from 32°F to 1650°F. This thermocouple has the highest EMF output per degree of all ANSI recognized thermocouples. If the application temperature is between 600 and 1100°F, we recommend using Type J or Type N because of short range ordering which can cause drift of +2°F to +4°F in a few hours' time. For applications below 32°F, special alloy selections may be required.

ANSI Type (T) Standard; Special Tolerance **(6)**

Type T is composed of a positive leg (TP) which is pure copper and a negative leg (TN) which is approximately 45% nickel, 55% copper. When protected by the compacted mineral insulation and appropriate outer sheath, Type T is usable from 32°F to 662°F. Type T is very stable and is used in a wide variety of cryogenic and low temperature applications. For applications below 32°F special alloy selections may be required.

ANSI Type (N) Standard; Special Tolerance **(7)**

Type N is composed of a positive leg (Nicrosil) which is approximately 14% chromium, 1.4% silicon, 84.6% nickel and a negative leg (Nisil) which is approximately 4.4% silicon, 95.6% nickel. When protected by compacted mineral insulation and appropriate outer sheath, Type N is usable from 32°F to 2300°F. Type N was designed to overcome several problems inherent in Type K thermocouples. Short range ordering (+2 to +4°F drift) in the 600°F to 1100°F temperature range is greatly reduced, and the drift rate at high temperatures is considerably less. Type N has also been found to be more stable than Type K in nuclear environments.

ANSI Type (R) Standard Tolerance

Type R is composed of a positive leg (RP) which is 87% platinum, 13% rhodium and a negative leg (RN) which is 100% platinum. When protected by compacted mineral insulation and appropriate outer sheath, Type R is usable from 32°F to 2700°F. Type R is available as standard limits only, ITS90.

ANSI Type (S) Standard Tolerance

Type S is composed of a positive leg (SP) which is 90% platinum 10% rhodium and a negative leg (SN) which is 100% platinum. When protected by compacted mineral insulation and appropriate outer sheath, Type S is usable from 32°F to 2700°F. Type S has a lower EMF output than Type R and is available as standard limits only, ITS90.

ANSI Type (B) Standard Tolerance

Type B is composed of a positive leg (BP) which is approximately 70% platinum, 30% rhodium and a negative leg (BN) which is approximately 94% platinum, 6% rhodium. When protected by compacted mineral insulation and appropriate outer sheath, Type B is usable from 1600°F to 3100°F. Type B is available as standard limits only, IPTS 1968 scale.

Tungsten—5% Re/Tungsten, 26% Re **(W)**

This calibration has not been given a letter designation by ANSI. When this calibration is protected by mineral insulation and appropriate outer sheath, it is usable from 32°F to 4200°F. This calibration is used most often with Beryllium Oxide insulation and either molybdenum or tantalum sheath. These combinations can only be used in an inert or vacuum environment.

Miscellaneous

Consult Tempco with your requirements.

Ordering Worksheet

M	T	1	2	3	4	5

Designates **TEMPCO-PAK** Sheathed Mineral Insulated Thermocouple Cable

For a complete description of Worksheet options see pages 14-5 through 14-9.

Calibration Code — See Page 14-9.

ANSI Standard Tolerances	Special Tolerances
J = (I/C)	**3**
K = (C/A)	**4**
E = (CHROMEL®/Const.)	**5**
T = (Cu/C)	**6**
N = (Nicrosil/Nisil)	**7**
R = (Pt/Pt-13% Rh) PER ITS-90	
S = (Pt/Pt-10% Rh) PER ITS-90	
B = (Plat-6% Rh/Plat-30% Rh)	
W = (W-5% Re/W-26% Re)	
O = Miscellaneous (Consult Factory)	

Number of Conductors

2 = Standard for MI cable with a single thermocouple
4 = 4 wire construction (Duplex Element)

Insulation — See Page 14-8

M = 94% min. MgO
H = 99.4% min. MgO
A = 99.6% Alumina
B = 99.7% min. BeO

Sheath O.D.

A = .020" ±.001	**L** = 1.0 mm ±.03
B = .032" ±.001	**N** = 1.5 mm ±.03
C = .040" ±.001	**P** = 2.0 mm ±.03
D = .063" ±.001	**Q** = 3.0 mm ±.05
E = .093" ±.002	**R** = 4.5 mm ±.05
F = .125" ±.002	**S** = 6.0 mm +.07/–.05
G = .188" ±.002	**T** = 8.0 mm +.07/–.05
H = .250" +.003/–.002	**V** = 9.0 mm +.07/–.05
J = .313" +.003/–.002	
K = .375" +.003/–.002	

Sheath Material — See Page 14-5 through 14-8

A = Alloy 600	**L** = 446 S.S.
B = 304 SS	**M** = Pure platinum
C = 316 SS	**N** = Platinum 10% rhodium
D = 304L SS	**P** = Platinum 20% rhodium
E = 316L SS	**Q** = Hastelloy X®
F = 310 SS	**R** = Inconel 601®
G = 321 SS	**S** = Incoloy 800®
H = 347 SS	**T** = Incoloy 800HT®
J = Nickel 200	**U** = Tantalum
K = Nickel 201	**V** = Molybdenum

How To Order
See page 14-14

Single Element Standard Size List

O.D. (in.)	Part Number	ANSI Calibration	Insulation (Min. Purity)	Sheath Material	Nom. Wall Thickness (in.)	Nom. B&S Wire Ga.	Max. Operating Temp. (°F)	Max. Stock Length (ft.)
.020 ±.001	MTC00001	J	99.4% MgO	Alloy 600	.003	39	1500	50
	MTC00002	K	99.4% MgO	Alloy 600	.003	39	1650	50
	MTC00003	J	99.4% MgO	304	.003	39	1500	50
	MTC00004	K	99.4% MgO	304	.003	39	1650	50
.032 ±.001	MTC00005	J	99.4% MgO	Alloy 600	.005	36	1500	150
	MTC00006	K	99.4% MgO	Alloy 600	.005	36	1800	150
	MTC00007	J	99.4% MgO	304	.005	36	1500	150
	MTC00008	K	99.4% MgO	304	.005	36	1650	150
.040 ±.001	MTC00009	J	99.4% MgO	Alloy 600	.006	33	1500	175
	*MTC00010	K	99.4% MgO	Alloy 600	.006	33	2000	175
	*MTC00011	J	99.4% MgO	304	.006	33	1500	175
	*MTC00012	K	99.4% MgO	304	.006	33	1650	175
	MTC00013	E	99.4% MgO	304	.006	33	1600	175
	MTC00014	T	99.4% MgO	304	.006	33	650	175
	MTC00015	J	99.4% MgO	316	.006	33	1500	175
	MTC00016	K	99.4% MgO	316	.006	33	1650	175
.062 ±.001	*MTC00017	J	94.0% MgO	Alloy 600	.008	30	1500	500
	MTC00018	J	99.4% MgO	Alloy 600	.008	30	1500	500
	*MTC00019	K	94.0% MgO	Alloy 600	.008	30	2000	500
	*MTC00020	K	99.4% MgO	Alloy 600	.008	30	2000	500
	*MTC00021	J	94.0% MgO	304	.008	30	1500	500
	MTC00022	J	99.4% MgO	304	.008	30	1500	500
	*MTC00023	K	94.0% MgO	304	.008	30	1650	500
	*MTC00024	K	99.4% MgO	304	.008	30	1650	500
	MTC00025	E	94.0% MgO	304	.008	30	1600	500
	MTC00026	T	99.4% MgO	304	.008	30	650	500
	MTC00027	J	94.0% MgO	316	.008	30	1500	500
	MTC00028	J	99.4% MgO	316	.008	30	1500	500
	MTC00029	K	94.0% MgO	316	.008	30	1650	500
	MTC00030	K	99.4% MgO	316	.008	30	1650	500
.093 ±.002	MTC00031	J	94.0% MgO	Alloy 600	.010	27	1500	450
	MTC00032	J	99.4% MgO	Alloy 600	.010	27	1500	450
	MTC00033	K	94.0% MgO	Alloy 600	.010	27	2000	450
	MTC00034	K	99.4% MgO	Alloy 600	.010	27	2150	450
	MTC00035	J	94.0% MgO	304	.010	27	1500	450
	MTC00036	J	99.4% MgO	304	.010	27	1500	450
	MTC00037	K	94.0% MgO	304	.010	27	1650	450
	MTC00038	K	99.4% MgO	304	.010	27	1650	450
.125 ±.002	MTC00039	J	94.0% MgO	Alloy 600	.014	24	1500	250
	MTC00040	J	99.4% MgO	Alloy 600	.014	24	1500	250
	*MTC00041	K	94.0% MgO	Alloy 600	.014	24	2000	250
	*MTC00042	K	99.4% MgO	Alloy 600	.014	24	2150	250
	*MTC00043	J	94.0% MgO	304	.014	24	1500	250
	MTC00044	J	99.4% MgO	304	.014	24	1500	250
	*MTC00045	K	94.0% MgO	304	.014	24	1650	250
	*MTC00046	K	99.4% MgO	304	.014	24	1650	250
	MTC00047	E	94.0% MgO	304	.014	24	1600	250
	MTC00048	T	94.0% MgO	304	.014	24	650	250
	MTC00049	J	94.0% MgO	316	.014	24	1500	250
	MTC00050	J	99.4% MgO	316	.014	24	1500	250
	MTC00051	K	94.0% MgO	316	.014	24	1650	250
	MTC00052	K	99.4% MgO	316	.014	24	1650	250
	MTC00053	E	94.0% MgO	316	.014	24	1600	250
	MTC00054	T	94.0% MgO	316	.014	24	650	250
	MTC00055	J	94.0% MgO	310	.014	24	1500	250
	MTC00056	K	94.0% MgO	310	.014	24	2000	250
	MTC00057	R	99.4% MgO	Alloy 600	.020	24	2150	25
	MTC00058	S	99.4% MgO	Alloy 600	.020	24	2150	25

Continued next page…

STOCK ITEMS ORDER NOW! ®

an asterisk next to the Part Number guarantees in-stock availability for same day shipping when ORDERED BY 2 PM CST

Single Element Standard Size List

Continued from previous page…

O.D. (in.)	Part Number	ANSI Calibration	Insulation (Min. Purity)	Sheath Material	Nom. Wall Thickness (in.)	Nom. B&S Wire Ga.	Max. Operating Temp. (°F)	Max. Stock Length (ft.)
.188 ±.002	MTC00059	J	94.0% MgO	Alloy 600	.022	21	1500	120
	MTC00060	J	99.4% MgO	Alloy 600	.022	21	1500	120
	*MTC00061	K	94.0% MgO	Alloy 600	.022	21	2000	120
	*MTC00062	K	99.4% MgO	Alloy 600	.022	21	2150	120
	*MTC00063	J	94.0% MgO	304	.022	21	1500	120
	MTC00064	J	99.4% MgO	304	.022	21	1500	120
	*MTC00065	K	94.0% MgO	304	.022	21	1650	120
	*MTC00066	K	99.4% MgO	304	.022	21	1650	120
	MTC00067	E	94.0% MgO	304	.022	21	1600	120
	MTC00068	T	94.0% MgO	304	.022	21	650	120
	MTC00069	J	94.0% MgO	316	.022	21	1500	120
	MTC00070	J	99.4% MgO	316	.022	21	1500	120
	MTC00071	K	94.0% MgO	316	.022	21	1650	120
	MTC00072	K	99.4% MgO	316	.022	21	1650	120
	MTC00073	E	94.0% MgO	316	.022	21	1600	120
	MTC00074	T	94.0% MgO	316	.022	21	650	120
	MTC00075	J	94.0% MgO	310	.022	21	1500	120
	MTC00076	K	94.0% MgO	310	.022	21	2000	120
.250 +.003 −.002	*MTC00077	J	94.0% MgO	Alloy 600	.029	18	1500	70
	MTC00078	J	99.4% MgO	Alloy 600	.029	18	1500	70
	*MTC00079	K	94.0% MgO	Alloy 600	.029	18	2000	70
	*MTC00080	K	99.4% MgO	Alloy 600	.029	18	2150	70
	*MTC00081	J	94.0% MgO	304	.029	18	1500	70
	MTC00082	J	99.4% MgO	304	.029	18	1500	70
	*MTC00083	K	94.0% MgO	304	.029	18	1650	70
	*MTC00084	K	99.4% MgO	304	.029	18	1650	70
	MTC00085	E	94.0% MgO	304	.029	18	1600	70
	MTC00086	T	94.0% MgO	304	.029	18	650	70
	MTC00087	J	94.0% MgO	316	.029	18	1500	70
	MTC00088	J	99.4% MgO	316	.029	18	1500	70
	MTC00089	K	94.0% MgO	316	.029	18	1650	70
	MTC00090	K	99.4% MgO	316	.029	18	1650	70
	MTC00091	E	94.0% MgO	316	.029	18	1600	70
	MTC00092	T	94.0% MgO	316	.029	18	650	70
	MTC00093	J	94.0% MgO	310	.029	18	1500	70
	MTC00094	K	94.0% MgO	310	.029	18	2000	70
.313 +.003 −.002	MTC00095	J	94.0% MgO	Alloy 600	.036	17	1500	40
	MTC00096	J	94.0% MgO	304	.036	17	1500	40
	MTC00097	K	94.0% MgO	Alloy 600	.036	17	2000	40
	MTC00098	K	94.0% MgO	304	.036	17	1650	40
	MTC00099	E	94.0% MgO	304	.036	17	1600	40
	MTC00100	E	94.0% MgO	316	.036	17	1600	40
	MTC00101	J	94.0% MgO	316	.036	17	1500	40
	MTC00102	K	94.0% MgO	316	.036	17	1650	40
.375 +.003 −.002	MTC00103	J	94.0% MgO	Alloy 600	.045	15	1500	30
	*MTC00104	J	94.0% MgO	304	.045	15	1500	30
	*MTC00105	K	94.0% MgO	Alloy 600	.045	15	2000	30
	*MTC00106	K	94.0% MgO	304	.045	15	1650	30
	MTC00107	J	94.0% MgO	316	.045	15	1500	30
	MTC00108	K	94.0% MgO	316	.045	15	1650	30

How To Order

See page 14-14

Duplex Element — Diagonal Standard Size List

O.D. (in.)	Part Number	ANSI Calibration	Insulation (Min. Purity)	Sheath Material	Nom. Wall Thickness (in.)	Nom. B&S Wire Ga.	Max. Operating Temp. (°F)	Max. Stock Length (ft.)
.063 ±.001	MTC00109	J	99.4% MgO	Alloy 600	.009	30	1500	500
	MTC00110	K	99.4% MgO	Alloy 600	.009	30	2000	500
	MTC00111	J	99.4% MgO	304	.009	30	1500	500
	MTC00112	K	99.4% MgO	304	.009	30	1650	500
.125 ±.002	MTC00113	J	94.0% MgO	Alloy 600	.016	24	1500	250
	*MTC00114	K	94.0% MgO	Alloy 600	.016	24	2000	250
	*MTC00115	J	94.0% MgO	304	.016	24	1500	250
	*MTC00116	K	94.0% MgO	304	.016	24	1650	250
	MTC00117	E	94.0% MgO	304	.016	24	1600	250
	MTC00118	J	94.0% MgO	316	.016	24	1500	250
	MTC00119	K	94.0% MgO	316	.016	24	1650	250
.188 ±.002	MTC00120	J	94.0% MgO	Alloy 600	.024	21	1500	120
	*MTC00121	K	94.0% MgO	Alloy 600	.024	21	2000	120
	*MTC00122	J	94.0% MgO	304	.024	21	1500	120
	*MTC00123	K	94.0% MgO	304	.024	21	1650	120
	MTC00124	E	94.0% MgO	304	.024	21	1600	120
	MTC00125	T	94.0% MgO	304	.024	21	650	120
	MTC00126	J	94.0% MgO	316	.024	21	1500	120
	MTC00127	K	94.0% MgO	316	.024	21	1650	120
.250 +.003 −.002	MTC00128	J	94.0% MgO	Alloy 600	.031	19	1500	70
	*MTC00129	K	94.0% MgO	Alloy 600	.031	19	2000	70
	*MTC00130	J	94.0% MgO	304	.031	19	1500	70
	*MTC00131	K	94.0% MgO	304	.031	19	1650	70
	MTC00132	E	94.0% MgO	304	.031	19	1600	70
	MTC00133	T	94.0% MgO	304	.031	19	650	70
	MTC00134	J	94.0% MgO	316	.031	19	1500	70
	MTC00135	K	94.0% MgO	316	.031	19	1650	70
.313 +.003 −.002	MTC00136	J	94.0% MgO	Alloy 600	.039	17	1500	40
	MTC00137	K	94.0% MgO	Alloy 600	.039	17	2000	40
	MTC00138	J	94.0% MgO	304	.039	17	1500	40
	MTC00139	K	94.0% MgO	304	.039	17	1650	40
	MTC00140	E	94.0% MgO	304	.039	17	1600	40
	MTC00141	T	94.0% MgO	304	.039	17	650	40
.375 +.003 −.002	MTC00142	J	94.0% MgO	Alloy 600	.047	15	1500	30
	*MTC00143	K	94.0% MgO	Alloy 600	.047	15	2000	30
	*MTC00144	J	94.0% MgO	304	.047	15	1500	30
	*MTC00145	K	94.0% MgO	304	.047	15	1650	30
	MTC00146	E	94.0% MgO	304	.047	15	1600	30
	MTC00147	T	94.0% MgO	304	.047	15	650	30

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an asterisk next to the Part Number guarantees in-stock availability for same day shipping when ORDERED BY 2 PM CST

Metric — Single Element Standard Size List

O.D. (mm)	Part Number	ANSI Calibration	Insulation (Min. Purity)	Sheath Material	Nom. Wall Thickness (mm)	Nom. Wire Dia. (mm)	Max. Operating Temp. (°C)	Max. Stock Length (M)
1.5 ±.03	MTC00148	J	99.4% MgO	Alloy 600	0.20	0.28	815	167
	MTC00149	K	99.4% MgO	Alloy 600	0.20	0.28	1093	167
	MTC00150	J	99.4% MgO	304	0.20	0.28	815	167
	MTC00151	K	99.4% MgO	304	0.20	0.28	898	167
2.0 ±.03	MTC00152	J	94.0% MgO	Alloy 600	0.25	0.36	815	93
	MTC00153	K	94.0% MgO	Alloy 600	0.25	0.36	1093	93
	MTC00154	J	94.0% MgO	304	0.25	0.36	815	93
	MTC00155	K	94.0% MgO	304	0.25	0.36	898	93
	MTC00156	J	94.0% MgO	316	0.25	0.36	815	93
	MTC00157	K	94.0% MgO	316	0.25	0.36	898	93
3.0 ±.05	MTC00158	J	94.0% MgO	Alloy 600	0.33	0.46	815	84
	MTC00159	K	94.0% MgO	Alloy 600	0.33	0.46	1093	84
	MTC00160	J	94.0% MgO	304	0.33	0.46	815	84
	MTC00161	K	94.0% MgO	304	0.33	0.46	898	84
	MTC00162	E	94.0% MgO	304	0.33	0.46	871	84
	MTC00163	T	94.0% MgO	304	0.33	0.46	343	84
	MTC00164	J	94.0% MgO	316	0.33	0.46	815	84
	MTC00165	K	94.0% MgO	316	0.33	0.46	898	84
4.5 ±.05	MTC00166	J	94.0% MgO	Alloy 600	0.53	0.69	815	37
	MTC00167	K	94.0% MgO	Alloy 600	0.53	0.69	1093	37
	MTC00168	J	94.0% MgO	304	0.53	0.69	815	37
	MTC00169	K	94.0% MgO	304	0.53	0.69	898	37
6.0 +.07 −.05	MTC00170	J	94.0% MgO	Alloy 600	0.69	0.94	815	21
	MTC00171	K	94.0% MgO	Alloy 600	0.69	0.94	1093	21
	MTC00172	J	94.0% MgO	304	0.69	0.94	815	21
	MTC00173	K	94.0% MgO	304	0.69	0.94	898	21
8.0 +.07 −.05	MTC00174	J	94.0% MgO	Alloy 600	0.91	1.22	815	12
	MTC00175	K	94.0% MgO	Alloy 600	0.91	1.22	1093	12
	MTC00176	J	94.0% MgO	304	0.91	1.22	815	12
	MTC00177	K	94.0% MgO	304	0.91	1.22	898	12

How to Order

Stock Thermocouple Cable

Order by Part Number from the Stock Lists on Pages 14-11 through 14-14.

Thermocouple wire is sold by the foot and subject to minimum billing.

Tempco-Pak is stocked in random lengths with the maximum stock lengths listed in the tables showing the varieties of commonly available material. Tempco reserves the right to supply random lengths of our choice unless specific lengths are specified on your order. Tempco-Pak can be furnished in coil form or in straight lengths. Normally .375" diameter and .312" diameter are shipped in straight lengths. Longer lengths are available on special order.

Custom Manufactured Thermocouple Cables

For Sizes and Specifications not listed, Tempco will design and manufacture a Mineral Insulated Thermocouple Cable to meet your requirements. Please refer to the ordering worksheet on page 14-10 and follow the model as diagrammed to specify your requirements with the Tempco code number.

In addition, refer to page 14-15 and ***specify the following***:

- ❑ Configuration type
- ❑ Conductor Configuration and Size
- ❑ Sheath wall thickness
- ❑ Minimum acceptable lengths and total length required

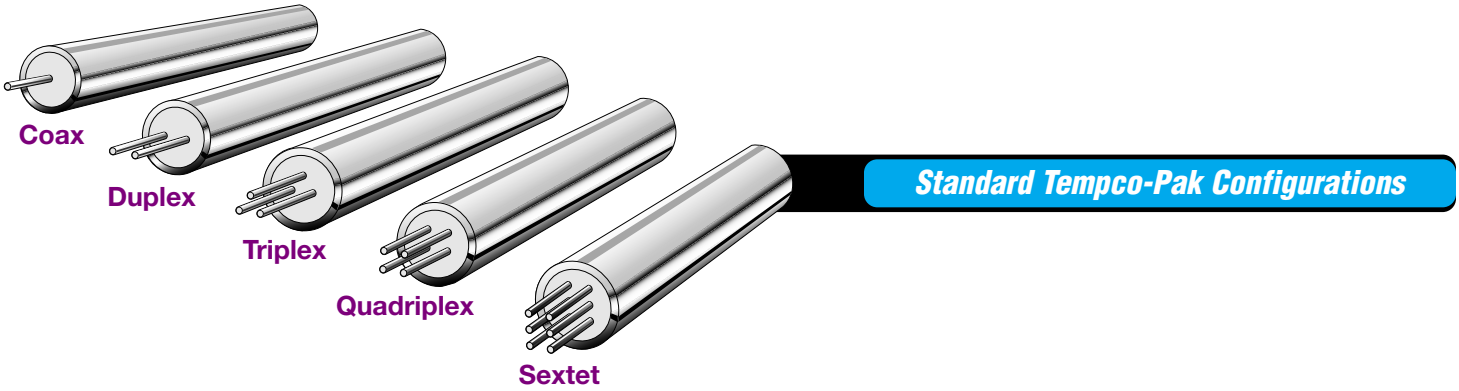
Made-To-Order Mineral-Insulated Cable

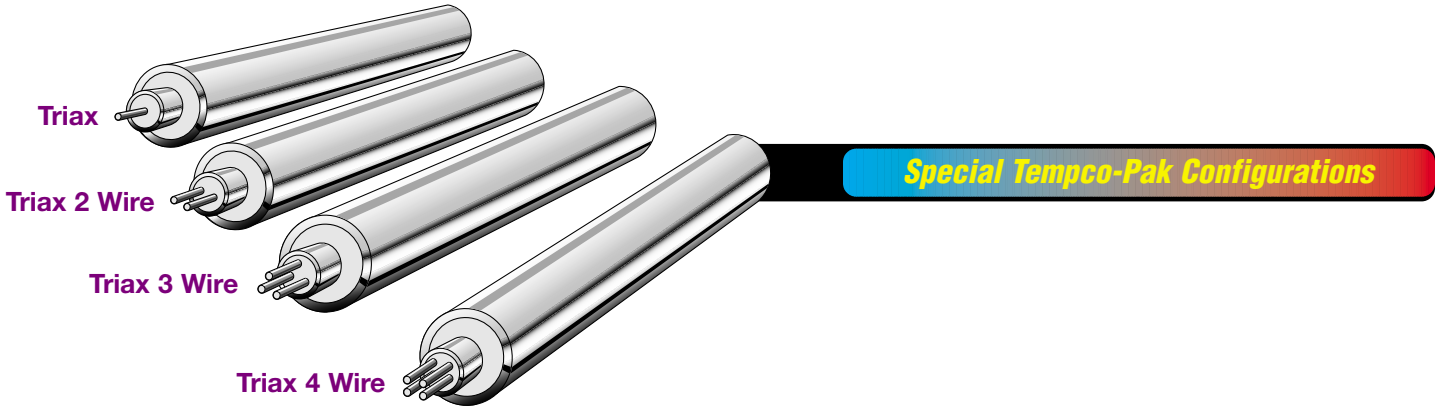
In addition to the standard line of Tempco-Pak Thermocouple Cables, we can also manufacture metal sheathed, mineral insulated cable in special configurations using a wide variety of sheath materials and conductor alloys such as copper, nickel, alloy 600, CHROMEL-A®, nickel clad copper, 304 SS and virtually any other malleable metal.

Properly selected combinations of materials (sheath, insulation and wire) will exhibit the same outstanding qualities and performance as our standard Tempco-Pak.

Shown below are standard and special Tempco-Pak configurations.

Consult Tempco with your specific requirements.





How to Order

Made-To-Order Mineral-Insulated Cable

Custom Manufactured Mineral-Insulated Cable

Supply the following information when requesting a quotation on made-to-order mineral-insulated cable:

- ❑ Configuration type
- ❑ Sheath material
- ❑ Insulation type and purity
- ❑ Calibration type or conductor material
- ❑ Conductor configuration and size
- ❑ Sheath wall thickness
- ❑ Minimum acceptable lengths and total length required

MI Cable Thermocouple Assemblies

All Tempco-Pak Thermocouple Assemblies are made from TEMPCO's high quality Tempco-Pak and will incorporate all the same outstanding features.

Important Features:

- Accurate
- High Temperature Rating
- Fast Response
- Moisture Proof
- Thermal Shock Resistant
- Can Be Formed
- Weldable
- High Pressure Rated
- Compact
- Durable

Typical Applications

- Heat Treating
- Furnaces
- Ovens
- Kilns
- Metal Processing
- Glass Manufacturing
- Food Processing
- Steam Generators
- Petrochemical
- Turbines
- Power Stations
- Diesel Engines
- Research Laboratories
- Refineries
- Oil Processing
- Bearing Temperature

Selecting the Correct Tempco-Pak Thermocouple Assembly

Thermocouples must be selected to meet the conditions of each particular application. The environment, operating temperature and atmosphere, response time and length of service must be considered when selecting the sheath, insulation, calibration, junction and termination of the thermocouple assembly. Refer to the Mineral Insulated Thermocouples and Cable section regarding sheath, insulation and calibration (pages 14-5 through 14-9). TEMPCO's engineering staff will be happy to assist you with the design and selection of your thermocouple requirements.

Sheath Materials

The most commonly used sheath materials and their maximum continuous operating temperatures in an oxidizing atmosphere are as follows:

Sheath Material	Max. Operating Temperature
Alloy 600	2150°F (1177°C)
304 Stainless Steel	1650°F (899°C)
316 Stainless Steel	1650°F (899°C)
310 Stainless Steel	2100°F (1150°C)

For temperatures exceeding 2200°F (1204°C), Noble or Refractory metal sheaths are normally used.

Calibrations

The table shows the standard temperature ranges for the various ANSI thermocouple calibrations:

ANSI Letter	Thermocouple Type	Temperature Range °F	(°C)
J	Iron-Constantan	32-1400	(0-760)
K	CHROMEL P®-ALUMEL®	32-2300	(0-1260)
N	Nicrosil-Nisil	32-2300	(0-1260)
T	Copper-Constantan	32-700	(0-371)
E	CHROMEL P®-Constantan	32-1600	(0-871)
R	Pt 13% Rhodium-Platinum	32-2700	(0-1482)
S	Pt 10% Rhodium-Platinum	32-2700	(0-1482)
B	Pt 30% Rh-Pt 6% Rh	1472-3100	(800-1704)

Formability

Because Tempco-Pak is fully annealed it can normally be formed around a mandrel 4 times the sheath diameter. Consult TEMPCO if special forming is required.

Weldability

The thermocouple sheath can be brazed, soldered or welded. It is not recommended on diameters less than .093 in. All welding should be done in an inert atmosphere.

Assembly Tolerances: Sheath Length Dimensions

Sheath O.D.	"L" Tolerance Up to 24"	"L" Tolerance Over 24"
.020 to .038	±½	±2%
.038 to .065	±⅜	±1½%
.065 and up	±¼	±1%

Flexible Lead Dimensions

Lead Length (ft.)	Tolerance
1 to 5	+6", –1"
5 to 10	+6", –2"
10 and over	+5%, –2%

Hot Junctions

(Hot or Measuring Junctions available on single or dual element cable.)

Choose the measuring junction that best suits your particular needs:

Exposed Junction (E)

Thermocouple wires are butt welded. Insulation is sealed against liquid or gas penetration prior to use.

This junction style provides the fastest possible response time but leaves the thermocouple wires unprotected against corrosive or mechanical damage.

Grounded Junction (G)

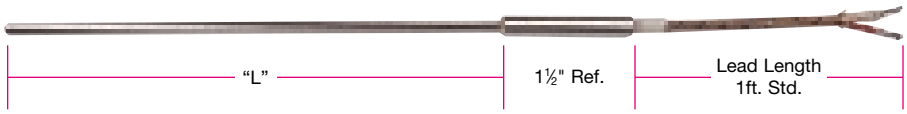
The sheath and thermocouple wires are welded together forming a completely sealed integral junction. Recommended in presence of liquids, moisture, gas or high pressure. The wire is protected from corrosive or erosive conditions. In the Grounded Junction, response time approaches that of the Exposed Junction.

Ungrounded Junction (U)

Thermocouple junction is fully insulated from welded sheath end. Excellent for applications where stray emf's would affect the reading and for frequent or rapid temperature cycling. With the Ungrounded Junction, response time is slightly longer than for the Grounded Junction.

Mineral Insulated T/C Assembly

Style T1 Transition to Lead wire



Design Features

- Stainless steel transition is brazed to thermocouple sheath.
- Maximum continuous operating temperature for the standard transition is 300°F (149°C). A high temperature transition 1000°F (538°C) maximum can be provided by ordering Special Requirement Option H in Box 11.
- Standard lead wire termination is 1" split leads.
- TEMPCO offers an optional Strain Relief Spring—Please Specify.
- Transition Diameters are 3/16" for .020" to .032" diameter sheath, ¼" O.D. for .040" to.188" diameter sheath and ½" O.D. for all sheath diameters above .190".

How To Order

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Design Style		1	2	3	4	5	6	7	8	9	10	11
T	1											

Calibration Code *BOX 1*

ANSI Standard Tolerances	J	K	E	T	N	R	S	B
Special Tolerances	3	4	5	6	7			

Number of Conductors *BOX 2*

2 = Standard for Single Thermocouple
4 = Duplex T/C

Insulation *BOX 3*

M = 94% Min. MgO
H = 99.4% Min. MgO
A = 99.6% Alumina

Sheath Material *BOX 4*

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. *BOX 5*

A = .020" ±.001	**G** = .188" ±.002	**P** = 2.0 mm ±.03
B = .032" ±.001	**H** = .250" +.003/–.002	**Q** = 3.0 mm ±.03
C = .040" ±.001	**J** = .313" +.003/–.002	**R** = 4.5 mm ±.05
D = .063" ±.001	**K** = .375" +.003/–.002	**S** = 6.0 mm +.07/–.05
E = .093" ±.002	**L** = 1.0mm ±.03	**T** = 8.0 mm +.07/–.05
F = .125" ±.002	**N** = 1.5mm ±.03	**V** = 9.0 mm +.07/–.05

Sheath Length "L" *BOX 6*

Whole inches **01** to **99**
Lengths over 99 in. consult TEMPCO

Junction *BOX 7*

	Grounded	Ungrounded	Exposed
Single	**G**	**U**	**E**
Dual, common	**4**	**5**	**6**
Dual, isolated	**—**	**7**	**8**

Lead Wire Length *BOX 8*

In inches **001** to **999**
12" (012) Standard

Lead Wire Construction *BOX 9*

	Standard	Overbraid	Flex Armor
Fiberglass Solid	**S**	**B**	**A**

Depending on availability .040" to .188" uses 24 gauge lead wire. .188" to .375" O.D. thermocouples use 20 gauge lead wire depending on availability and insulation type.

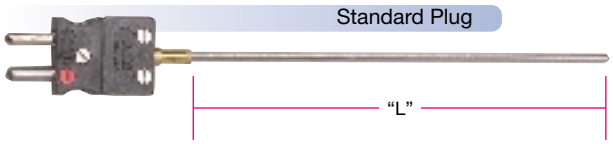
Lead Wire Termination *BOX 10*

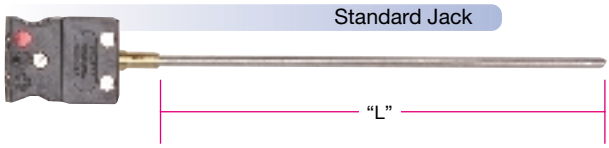
A = Standard Male Plug
B = Standard Female Jack
C = Std. Plug with Mating Conn.
D = Miniature Male Plug
E = Miniature Female Jack
F = Miniature Plug with Mating Jack
G = Standard—1.0 in. Split Leads
H = 1.0 in. Split Leads with Spade Lugs
J = 1.0 in. Split Leads with BX connector and Spade Lugs

Special Requirements *BOX 11*

H = High temp potting. If none, enter "**0**"
If others required, consult TEMPCO

Style T2 Plug or Jack Termination





Design Features

- Pins are made with matching thermocouple alloys.
- Standard Plugs come with hollow pins as a standard and with solid pins as an option. Solid pins are standard with high temperature plugs.
- Standard and miniature plugs and jacks have a 400°F max. temperature rating.
- High temperature plugs and jacks are rated for 800°F continuous operation and 1000°F intermittent (all are reddish-brown in color).
- Dual element available for sheath O.D. of 0.063" to 0.375".
- 0.020" to 0.250" uses braze insert—0.313" and 0.375" use spool-type brazing adaptors.

How To Order

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8	9	10
T	2										

Design Style

Calibration Code *BOX 1*

ANSI Standard Tolerances	J	K	E	T	N	R	S	B
Special Tolerances	3	4	5	6	7			

Number of Conductors *BOX 2*

2 = Standard for Single Thermocouple
4 = Duplex T/C

Insulation *BOX 3*

M = 94% Min. MgO
H = 99.4% Min. MgO
A = 99.6% Alumina

Sheath Material *BOX 4*

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. *BOX 5*

A = .020 ±.001	**G** = .188 ±.002	**P** = 2.0mm ±.03
B = .032 ±.001	**H** = .250 +.003/–.002	**Q** = 3.0mm ±.03
C = .040 ±.001	**J** = .313 +.003/–.002	**R** = 4.5mm ±.05
D = .063 ±.001	**K** = .375 +.003/–.002	**S** = 6.0mm +.07/–.05
E = .092 ±.001	**L** = 1.0mm ±.03	**T** = 8.0mm +.07/–.05
F = .125 ±.002	**N** = 1.5mm ±.03	**V** = 9.0mm +.07/–.05

Sheath Length "L" *BOX 6*

Whole inches **01** to **99**
Lengths over 99 in. consult TEMPCO

Junction *BOX 7*

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Connector type *BOX 8*

Standard Plugs and Jacks 400°F (.375" max O.D.)
A = Standard Plug
B = Standard Jack
C = Standard Plug w/Mating Jack
Miniature Plugs and Jacks 400°F (1.188" max O.D.)
D = Miniature Plug
E = Miniature Jack
F = Miniature Plug w/Mating Jack
Standard High Temperature Plugs and Jacks 800°F (.375" max O.D.)
G = High Temperature Plug
H = High Temperature Jack
J = High Temperature Plug w/Mating Jack

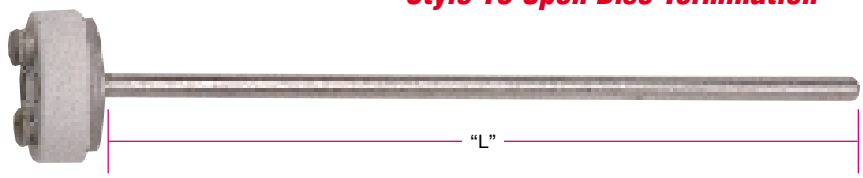
BOX 9

H = Hollow pins—std.
S = Solid pins

Special Requirements *BOX 10*

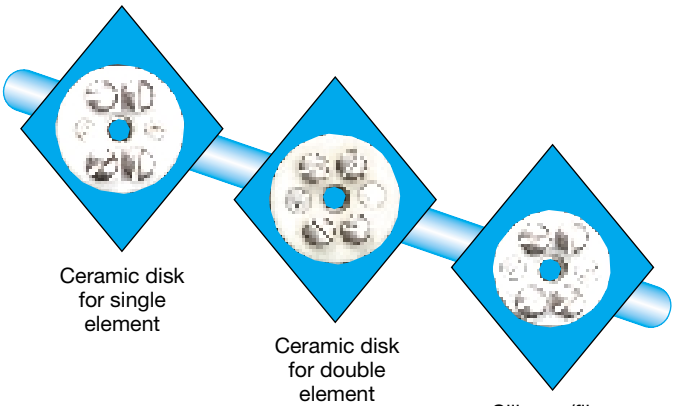
If none, enter "**0**"
If others required, consult TEMPCO

Style T3 Open Disc Termination



Design Features

- Economical termination with nickel plated brass inserts.
- Mounting plates are brass, stainless steel is optional.
- Available in sheath diameters ranging from 0.063" to 0.250", single and duplex construction.



Ceramic disk for single element

Ceramic disk for double element

Silicone/fiber disk for single element

How To Order

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8	9
T	3									

Design Style

Calibration Code *BOX 1*

ANSI Standard Tolerances	J	K	E	T	N	R	S	B
Special Tolerances	3	4	5	6	7			

Number of Conductors *BOX 2*

2 = Standard for Single Thermocouple
4 = Duplex T/C

Insulation *BOX 3*

M = 94% Min. MgO
H = 99.4% Min. MgO
A = 99.6% Alumina

Sheath Material *BOX 4*

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. *BOX 5*

D = .063" ±.001
E = .092" ±.001
F = .125" ±.002
G = .188" ±.002
H = .250" +.003/–.002
P = 2.0 mm ±.03
Q = 3.0 mm ±.03
R = 4.5 mm ±.05
S = 6.0 mm +.07/–.05

Sheath Length "L" *BOX 6*

Whole inches 01 to 99
Lengths over 99 in. consult TEMPCO

Junction *BOX 7*

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

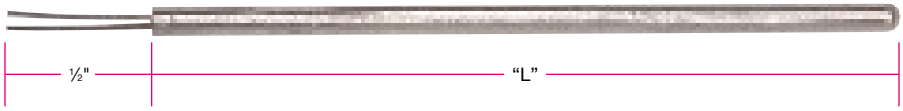
Termination *BOX 8*

1* = Silicone/glass cloth to 350°F (177°C) 1" O.D.
2 = Ceramic to 1000°F (538°C) 1⅛" O.D. Single and dual element
* Single element only

Special Requirements *BOX 9*

If none, enter "0"
If others required, consult TEMPCO

Style T4 Stripped Cold End



Design Features

- Standard strip length is ½ inch.
- Stripped end sealed with resin to inhibit moisture penetration.
- Duplex available from 0.063" diameter to 0.375" diameter.

How To Order

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8	9
T	4									

Design Style

Calibration Code *BOX 1*

ANSI Standard Tolerances	J	K	E	T	N	R	S	B
Special Tolerances	3	4	5	6	7			

Number of Conductors *BOX 2*

2 = Standard for Single Thermocouple
4 = Duplex T/C

Insulation *BOX 3*

M = 94% Min. MgO
H = 99.4% Min. MgO
A = 99.6% Alumina

Sheath Material *BOX 4*

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. *BOX 5*

B = .032 ±.001	**H** = .250 +.003/–.002	**Q** = 3.0mm ±.03
C = .040 ±.001	**J** = .313 +.003/–.002	**R** = 4.5mm ±.05
D = .063 ±.001	**K** = .375 +.003/–.002	**S** = 6.0mm +.07/–.05
E = .092 ±.001	**L** = 1.0mm ±.03	**T** = 8.0mm +.07/–.05
F = .125 ±.002	**N** = 1.5mm ±.03	**V** = 9.0mm +.07/–.05
G = .188 ±.002	**P** = 2.0mm ±.03	

Sheath Length "L" *BOX 6*

Whole inches **01** to **99**
Lengths over 99 in. consult TEMPCO

Junction *BOX 7*

	Grounded	Ungrounded	Exposed
Single	**G**	**U**	**E**
Dual, common	**4**	**5**	**6**
Dual, isolated	**—**	**7**	**8**

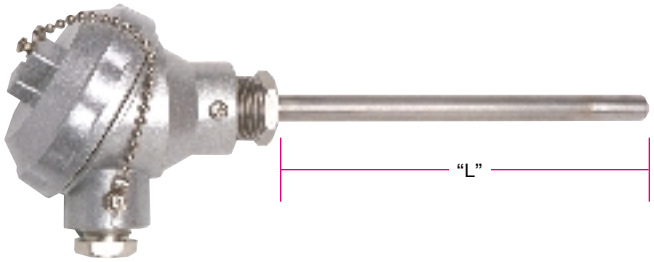
Strip Length *BOX 8*

0" to **3"**
Whole inches. ½" standard

Special Requirements *BOX 9*

If none, enter "**0**"
If others required, consult TEMPCO

Style T5 Connection Head



Design Features

- Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- Screw covers are attached to body with a plated chain.
- Covers have lugs for tightening or loosening with a screwdriver or wrench.
- Available in single (2 wire) or duplex (4 wire)
- Tempco's connection heads are available in die cast aluminum, bakelite and cast iron in a variety of sizes from miniature for confined areas to the large universal head designed for heavy process and industrial applications. See "Sensor Accessories" pages 14-46 and 14-47 for complete information.

How To Order

Thermocouples are offered with the options listed in the work-sheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Design Style		1	2	3	4	5	6	7	8	9
T	5									

Calibration Code *BOX 1*

ANSI Standard Tolerances	J	K	E	T	N	R	S	B
Special Tolerances	3	4	5	6	7			

Number of Conductors *BOX 2*

2 = Standard for Single Thermocouple
4 = Duplex T/C

Insulation *BOX 3*

M = 94% Min. MgO
H = 99.4% Min. MgO
A = 99.6% Alumina

Sheath Material *BOX 4*

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. *BOX 5*

D = .063" ±.001
F = .125" ±.002
G = .188" ±.002
H = .250" +.003/–.002
J = .313" +.003/–.002
K = .375" +.003/–.002
P = 2.0 mm ±.03
Q = 3.0 mm ±.03
R = 4.5 mm ±.05
S = 6.0 mm +.07/–.05

Sheath Length "L" *BOX 6*

Whole inches **01** to **99**
Lengths over 99 in. consult TEMPCO

Junction *BOX 7*

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

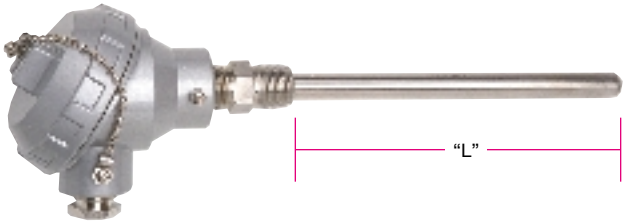
Connection Head *BOX 8*

Select style from connection head selection on pages 14-46 and 14-47 and enter code number here.

Special Requirements *BOX 9*

If none, enter "**0**"
If others required, consult TEMPCO

Style T6 Connection Head with ½" NPT Hex Nipple



Design Features

- Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- Screw covers are attached to body with a plated chain.
- Covers have lugs for tightening or loosening with a screwdriver or wrench.
- Available in single (2 wire) or duplex (4 wire)
- Tempco's connection heads are available in die cast aluminum, bakelite and cast iron in a variety of sizes from miniature for confined areas to the large universal head designed for heavy process and industrial applications. See "Sensor Accessories" pages 14-46 and 14-47 for complete information.

How To Order

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Design Style		1	2	3	4	5	6	7	8	9	10
T	6										

Calibration Code *BOX 1*

ANSI Standard Tolerances	J	K	E	T	N	R	S	B
Special Tolerances	3	4	5	6	7			

Number of Conductors *BOX 2*

2 = Standard for Single Thermocouple
4 = Duplex T/C

Insulation *BOX 3*

M = 94% Min. MgO
H = 99.4% Min. MgO
A = 99.6% Alumina

Sheath Material *BOX 4*

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. *BOX 5*

D = .063" ±.001
F = .125" ±.002
G = .188" ±.002
H = .250" +.003/–.002
J = .313" +.003/–.002
K = .375" +.003/–.002
P = 2.0 mm ±.03
Q = 3.0 mm ±.03
R = 4.5 mm ±.05
S = 6.0 mm +.07/–.05

Sheath Length "L" *BOX 6*

Whole inches **01** to **99**
Lengths over 99 in. consult TEMPCO

Junction *BOX 7*

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Connection Head *BOX 8*

Select style from connection head selection on pages 14-46 and 14-47 and enter code number here.

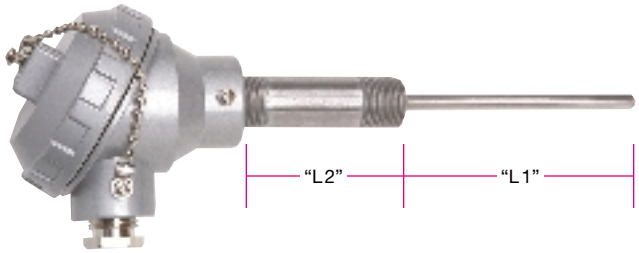
Spring Loaded Terminal Block *BOX 9*

"**O**" if not required
"**Y**" if required

Special Requirements *BOX 10*

If none, enter "**0**"
If others required, consult TEMPCO

Style T7 Connection Head with ½" NPT Pipe Nipple



Design Features

- Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- Screw covers are attached to body with a plated chain.
- Covers have lugs for tightening or loosening with a screwdriver or wrench.
- Available in single (2 wire) or duplex (4 wire)
- Tempco's connection heads are available in die cast aluminum, bakelite and cast iron in a variety of sizes from miniature for confined areas to the large universal head designed for heavy process and industrial applications. See "Sensor Accessories" pages 14-46 and 14-47 for complete information.

How To Order

Thermocouples are offered with the options listed in the work-sheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Design Style		1	2	3	4	5	6	7	8	9	10	11
T	7											

Calibration Code *BOX 1*

ANSI Standard Tolerances	J	K	E	T	N	R	S	B
Special Tolerances	3	4	5	6	7	8 per IPTS-68	9 per IPTS-68	

Number of Conductors *BOX 2*

2 = Standard for Single Thermocouple
4 = Duplex T/C

Insulation *BOX 3*

M = 94% Min. MgO
H = 99.4% Min. MgO
A = 99.6% Alumina

Sheath Material *BOX 4*

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. *BOX 5*

D = .063" ±.001
F = .125" ±.002
G = .188" ±.002
H = .250" +.003/–.002
J = .313" +.003/–.002
K = .375" +.003/–.002
P = 2.0 mm ±.03
Q = 3.0 mm ±.03
R = 4.5 mm ±.05
S = 6.0 mm +.07/–.05

Sheath Length "L1" *BOX 6*

Whole inches **01** to **99**
Lengths over 99 in. consult TEMPCO

Junction *BOX 7*

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Connection Head *BOX 8*

Select style from connection head selection on pages 14-46 and 14-47 and enter code number here.

"L2" ½" NPT Nipple Length *BOX 9*

Whole inches **03** to **18**
Lengths over 18 in. consult TEMPCO

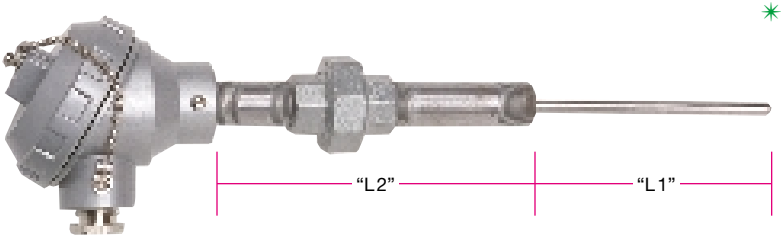
Spring Loaded Terminal Block *BOX 10*

"**O**" if not required
"**Y**" if required

Special Requirements *BOX 11*

If none, enter "**0**"
If others required, consult TEMPCO

Style T8 Connection Head with ½" NPT Nipple, Union, Nipple



Design Features

- Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- Screw covers are attached to body with a plated chain.
- Covers have lugs for tightening or loosening with a screwdriver or wrench.
- Available in single (2 wire) or duplex (4 wire)
- Tempco's connection heads are available in die cast aluminum, bakelite and cast iron in a variety of sizes from miniature for confined areas to the large universal head designed for heavy process and industrial applications. See "Sensor Accessories" pages 14-46 and 14-47 for complete information.

How To Order

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8	9	10	11
T	8											

Design Style

Calibration Code *BOX 1*

ANSI Standard Tolerances	J	K	E	T	N	R	S	B
Special Tolerances	3	4	5	6	7	8 per IPTS-68	9 per IPTS-68	

Number of Conductors *BOX 2*

2 = Standard for Single Thermocouple
4 = Duplex T/C

Insulation *BOX 3*

M = 94% Min. MgO
H = 99.4% Min. MgO
A = 99.6% Alumina

Sheath Material *BOX 4*

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. *BOX 5*

D = .063" ±.001
F = .125" ±.002
G = .188" ±.002
H = .250" +.003/–.002
J = .313" +.003/–.002
K = .375" +.003/–.002
P = 2.0 mm ±.03
Q = 3.0 mm ±.03
R = 4.5 mm ±.05
S = 6.0 mm +.07/–.05

Sheath Length "L1" *BOX 6*

Whole inches **01** to **99**
Lengths over 99 in. consult TEMPCO

Junction *BOX 7*

	Grounded	Ungrounded	Exposed
Single	G	U	E
Dual, common	4	5	6
Dual, isolated	—	7	8

Connection Head *BOX 8*

Select style from connection head selection on pages 14-46 and 14-47 and enter code number here.

"L2" Dimension (in.) *BOX 9*

Nipple, Union, Nipple in whole inches

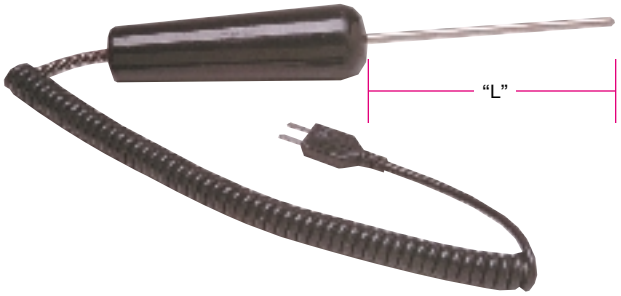
Spring Loaded Terminal Block *BOX 10*

"**O**" if not required
"**Y**" if required

Special Requirements *BOX 11*

If none, enter "**0**"
If others required, consult TEMPCO

Style T9 Hand Held Probe



Design Features

- Grounded hot junction with round tip is standard— conical pointed tip or flat tip is available upon request.
- Coil cord lengths are available only 1 ft. [5 ft. extended (060)] and 2 ft. [10 ft. extended (120)].
- Coiled cord construction is good to 221°F (105°C).
- Fiber glass lead construction is good to 900°F (482°C).
- Teflon insulated lead construction is good to 392°F(200°C).

How To Order

Thermocouples are offered with the options listed in the worksheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8	9	10	11
T	9											

Design Style

Calibration Code *BOX 1*

ANSI Standard Tolerances	J	K	E	T	N
Special Tolerances	3	4	5	6	7

Number of Conductors *BOX 2*

2 = Single Thermocouple only

Insulation *BOX 3*

M = 94% Min. MgO
H = 99.4% Min. MgO
A = 99.6% Alumina

Sheath Material *BOX 4*

A = Alloy 600
B = 304 SS
C = 316 SS

Sheath O.D. *BOX 5*

F = .125" ±.002
G = .188" ±.002
H = .250" +.003/–.002

Sheath Length "L" *BOX 6*

Whole inches **01** to **99**
Lengths over 99 in. consult TEMPCO

Junction *BOX 7*

	Grounded	Ungrounded	Exposed
Single	G	U	E

Lead Wire Length *BOX 8*

In inches **012** to **999**
60" (060) Standard

Lead Wire Construction *BOX 9*

		Standard	Overbraid	Flex Armor
2 Wire	Coil Cord	A	—	—
Fiberglass	Stranded	—	C	E
Teflon	Stranded	B	D	F

Lead Wire Termination *BOX 10*

A = Standard Male Plug 350°F
B = Standard Female Jack
C = Std. Plug with Mating Jack
D = Mini Male Plug 350°F
E = Mini Female Jack
F = Mini Plug with Mating Jack
G = Std.—1.0 in. Split Leads
H = Leads with Spade Lugs
J = 1½" Split with BX connector and Spade Lugs

Special Requirements *BOX 11*

If none, enter "**0**"
If others required, consult TEMPCO

Industrial Process Thermocouples

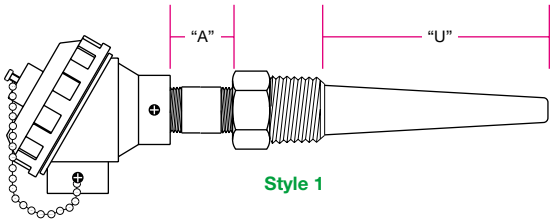
Tempco manufactures many styles of industrial thermocouple assemblies for a wide range of industries, from petrochemical to textile applications, where one or more protection tubes may be necessary to protect the thermocouple. The following offers typical assembly selections with IPT (Industrial Process Thermocouple) assembly design numbers, replacement elements, thermowells and protection tubes.

How To Order *Please Specify the following:*

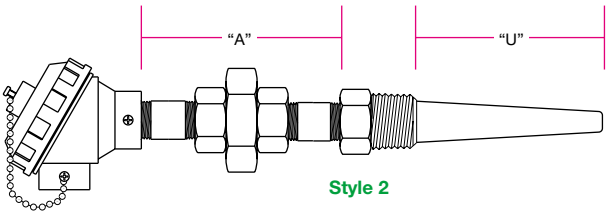
These are custom made thermocouple assemblies and require a selection of materials as shown below:

- ❑ Style Number
- ❑ Thermowell or protection tube part number. See pages 14-32 through 14-42
- ❑ "U", "A", and "L" where applicable
- ❑ ANSI Calibration type
- ❑ Select T/C element style from pages 14-28 through 14-30.
- ❑ Hot Junction Type; grounded junction is standard
- ❑ Spring loaded assembly is optional on styles 1, 2 and 5 only
- ❑ Thermocouple head size and material. See pages 14-46 and 14-47.
- ❑ Quantity

Thermowell Assemblies

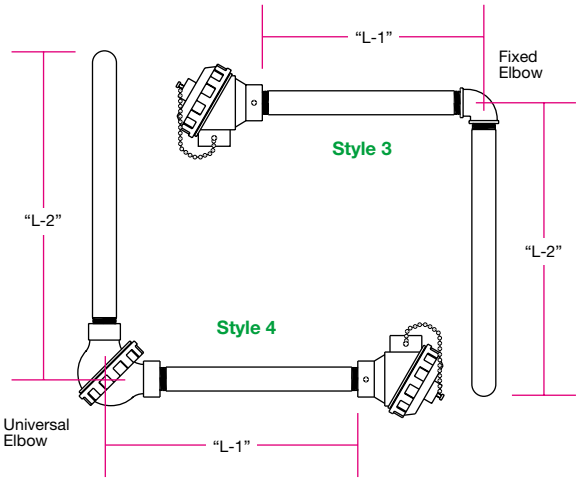


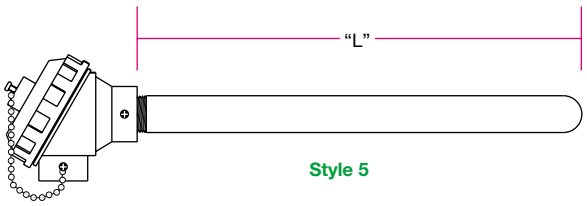
Thermocouple Head, Nipple, Thermowell



Thermocouple Head, Nipple, Union, Nipple, Thermowell

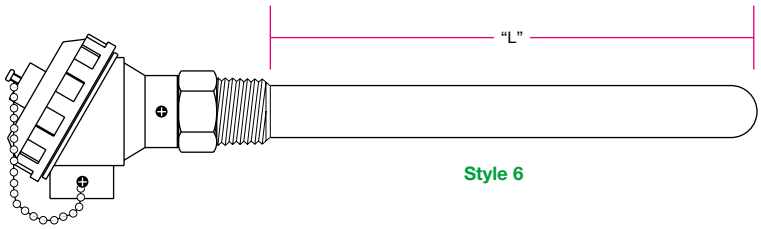
Metal Protecting Tube Assemblies



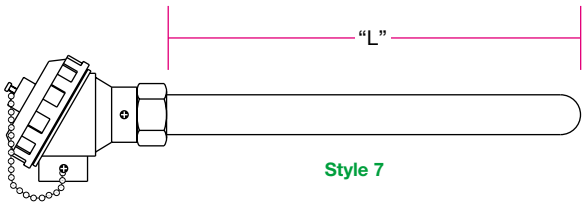


Thermocouple Head, Metal Protecting tube

Ceramic Tube Assemblies



Thermocouple Head, Fixed Bushing, Ceramic Tube



Thermocouple Head, Ceramic tube

Base Metal Thermocouples

Tempco offers general purpose thermocouple elements in ANSI Type “J” and “K”. The general purpose elements are available with a twisted and welded or butt welded junction. Available in 8 ga. (08), 14 ga. and 20 ga. with standard calibration tolerances.

Style B — Bare Wire

Twisted and Welded Junction

Butt Welded Junction

Style F — Thermocouple with fiberglass sleeving

Twisted and Welded Junction

Butt Welded Junction

Style O — 2 Hole Oval Insulator

Twisted and Welded Junction

Butt Welded Junction

- 8 ga. insulator P/N COR-122-101
- 14 ga. insulator P/N COR-122-102
- 20 ga. insulator P/N COR-122-103

* *See Page 14-31 for Insulator Dimensions.* *

Style R — 2 Hole Round Insulator

Twisted and Welded Junction

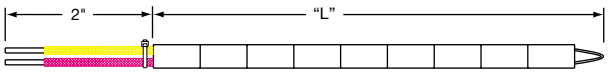
Butt Welded Junction

- 8 ga. insulator P/N COR-127-102
- 14 ga. insulator P/N COR-126-102
- 20 ga. insulator P/N COR-125-102

* *See Page 14-31 for Insulator Dimensions.* *

How To Order

Base Metal Thermocouple Elements Styles B, F, O and R are offered with the options listed below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.



Design Style B, F, O or R

Calibration ANSI Type K or J

Wire Gauge Size 8 ga. (08), 14 or 20

Junction W = Twisted and Welded
B = Butt Welded

Length “L” in whole inches— 06-99"

Style D — Dual Element *(Available in 14 ga. and 20 ga. only)*

- 14 ga. insulator P/N COR-128-102
- 20 ga. insulator P/N COR-128-101

* See Page 14-31 for Insulator Dimensions. *

How To Order

Base Metal Thermocouple Element Style D is offered with the options listed below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Thermocouples are offered with the options listed in the work-sheet below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

D [ ] [ ] [ ] [ ] [ ] [ ]

Design Style

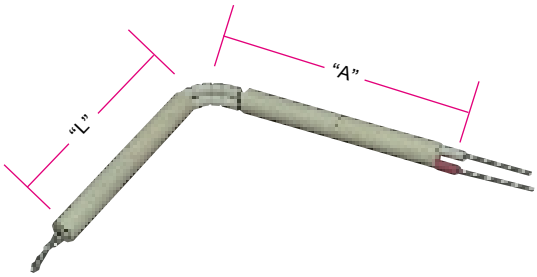
Calibration ANSI Type K, or J

Wire Gauge Size 8 ga. (08), 14 or 20

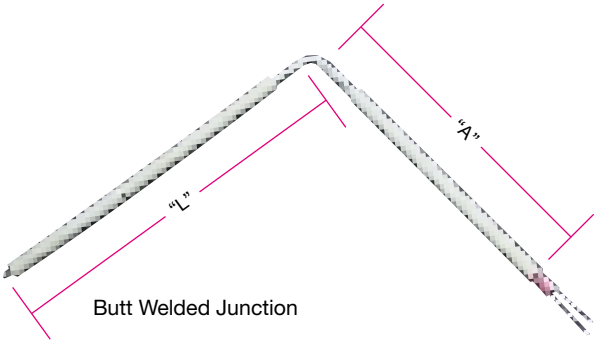
Butt-Welded Junction
1 = Common
2 = 2 separate junctions

Length "L" in whole inches— 06-99"

Style A — Angle Element



Twisted and Welded Junction



Butt Welded Junction

- 8 ga. insulator P/N COR-122-101
- 14 ga. insulator P/N COR-122-102
- 20 ga. insulator P/N COR-122-103

* See Page 14-31 for Insulator Dimensions. *

How To Order

Base Metal Thermocouple Element Style A is offered with the options listed below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

A [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Design Style

Calibration ANSI Type K, or J

Wire Gauge Size 8 ga. (08), 14 or 20

Length "L" in whole inches— 03" min.

Junction W = Twisted and Welded
B = Butt Welded

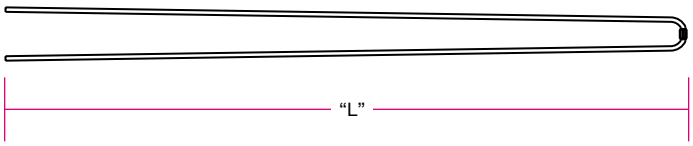
Length "A" in whole inches— 03" min.

Noble Metal Thermocouple Elements

Noble Metal Thermocouple Elements ANSI Type R and S are provided in accordance with ITS90, and ANSI Type B is provided in accordance with IPTS-68.

Alumina insulators are recommended with noble metal thermocouples. All noble metal elements have a butt welded junction and are available in 20 ga. (.032"), 24 ga. (.020") and 30 ga. (.010").

Style NB — Bare Wire



How To Order

Noble Metal Thermocouple Element Style NB is offered with the options listed below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

N B

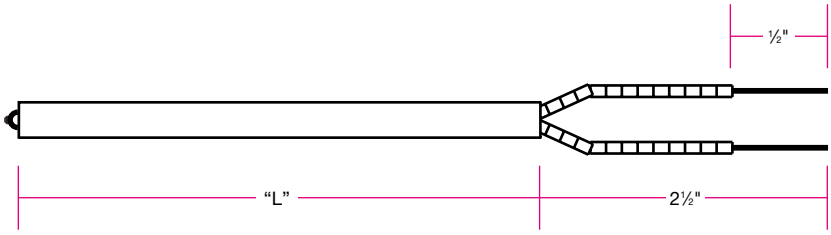
Design Style

Calibration ANSI Type R, S or B

Length "L" in whole inches— 06" min.

Wire Gauge Size 20, 24 or 30 gauge

Style NZ — 2 Hole Alumina Insulator



How To Order

Noble Metal Thermocouple Element with 2 hole Alumina insulator Style NZ is offered with the options listed below. Create an ordering code by filing in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

N Z

Design Style

Calibration ANSI Type R, S or B

Length "L" in whole inches— 06" min.

Wire Gauge Size 20, 24 or 30 gauge

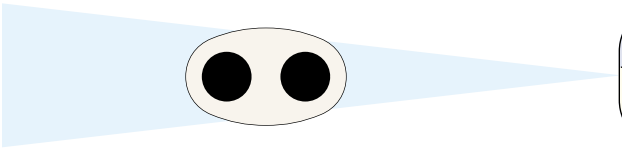
- 30 ga. Insulator P/N COR-124-105 and P/N CER-103-101
- 24 ga. Insulator P/N COR-124-104 and P/N CER-103-101
- 20 ga. Insulator P/N COR-124-106 and P/N CER-103-101

See Page 14-31 for insulator dimensions

Thermowells, Metal and Ceramic Protection Tubes for Base Metal and Noble Thermocouples see pages 14-27, 14-41 and 14-42.

Oval—Double Hole Cordierite

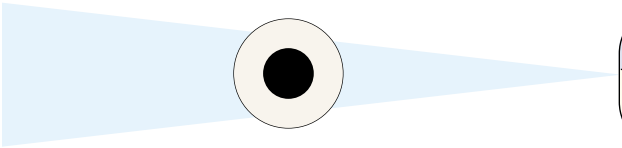
Maximum Temperature 2282°F (1250°C)



Part Number	Width (in)	Thickness (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-120-105	.437	.250	.156	7	1
COR-120-104	.375	.217	.110	10	1
COR-120-106	.172	.118	.042	19	1

Round—Single Hole Mullite

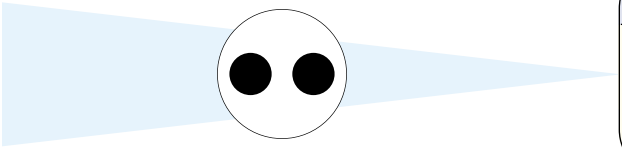
Maximum Temperature 2900°F (1593°C)



Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-123-101	.062	.031	22	12
COR-123-102	.125	.062	16	12
COR-123-103	.187	.094	12	12

Round—Double Hole Alumina

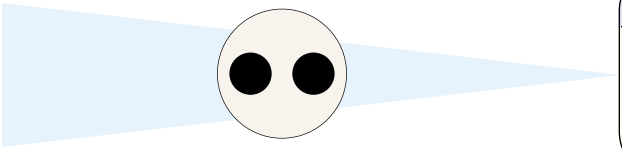
Maximum Temperature 3300°F (1815°C)



Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-124-101	.125	.031	22	1
COR-124-102	.125	.031	22	2
COR-124-103	.125	.031	22	3
COR-124-104	.125	.031	22	12
COR-124-105	.062	.016	28	12
COR-124-106	.187	.040	20	12

Round—Double Hole Steatite

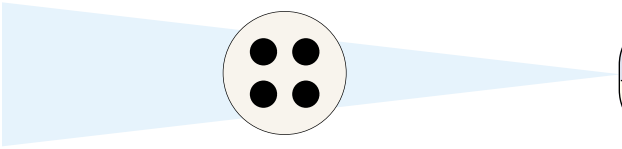
Maximum Temperature 2400°F (1315°C)



Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-125-101	.156	.046	18	1
COR-125-102	.156	.046	18	3
COR-126-101	.250	.085	13	1
COR-126-102	.250	.085	13	3
COR-127-101	.437	.156	7	1
COR-127-102	.437	.156	7	3

Round—Four Hole Alumina

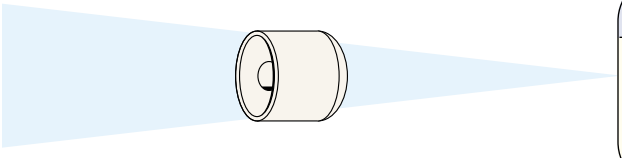
Maximum Temperature 3300°F (1815°C)



Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)
COR-128-101	.187	.047	18	1
COR-128-102	.312	.078	13	1

Fish Spine—Ball and Socket Insulators—Steatite

Maximum Temperature 2400°F (1315°C)



Part Number	Diameter (in)	Bore (in)	Max. B & S Gauge Size	Length (in)	Number of Pcs. per Sleeve
CER-103-101	.110	.056	16	.110	67 pcs/6"
CER-103-102	.170	.068	14	.170	86 pcs/12"
CER-103-104	.200	.092	12	.200	Bulk Loose
CER-103-105	.330	.124	9	.330	Bulk Loose
CER-103-106	.400	.156	7	.400	Bulk Loose
CER-103-109	.260	.156	7	.26	Bulk Loose

Standard Thermowells for Industrial Applications

Velocity Ratings of Wells

Well failures, in most cases, are not due to the effect of pressure and temperature. The calculations necessary to provide adequate strength, under given conditions, are familiar enough to permit proper choice of wall thickness and material.

Less familiar, and more dangerous, are the vibrational effects to which wells are subjected. Fluid, flowing by the well, forms a turbulent wake (called the Von Karman Trail) which has a definite frequency based on the diameter of the well and the velocity of the fluid. It is important that the well has sufficient stiffness so that the wake frequency will never equal the natural frequency of the well itself. If the natural frequency of the well were to coincide with the wake frequency, the well would vibrate to destruction and break off in the piping.

On the following pages, a recommended velocity rating can be found for every standard well length and material cataloged. To reduce the complexity of presenting this information, the ratings are based on operating temperatures of 1000°F for wells made of Carbon Steel (C-1018), ANSI 304 ANSI 316. Values for brass wells are based on 350°F operation. Limits for Monel are based on 900°F service. Slightly higher velocity is possible at lower temperatures.

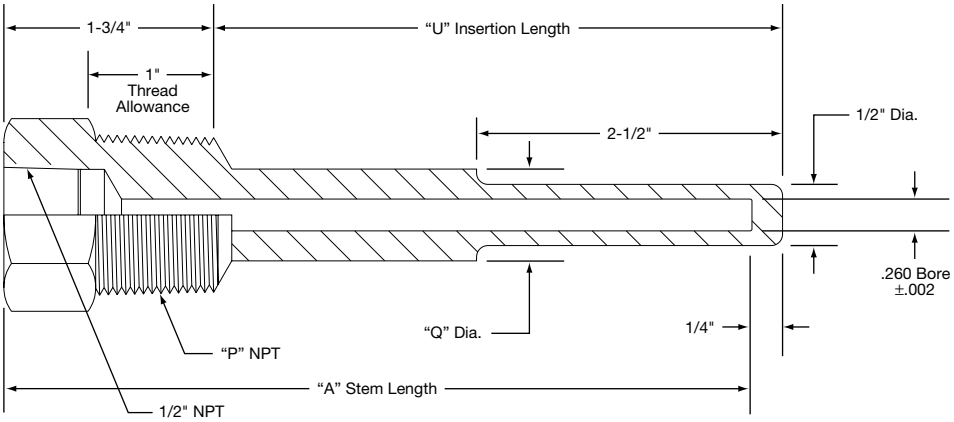
Where single values appear in the velocity tables, these may be considered safe for water, steam, air or gas. In the shorter insertion lengths, consideration is given to the velocity pressure effect of water flowing at higher velocities. The values in parenthesis, therefore, represent safe values for water flow while the unbracketed value may be used for steam, air, gas and similar density fluids.

It should be pointed out that the values given are extremely conservative, and intended primarily as a guide. Wells are also safe if the resonant frequency is well below the wake frequency or if the fluid velocity is constantly fluctuating through the critical velocity point. Nevertheless, if the installation is not hampered by the use of a sufficiently stiff well, we recommend the values should not be exceeded.

If you have operating conditions requiring special well designs, our Engineering staff is available to assist you. Consult Tempco with your requirements.

Series 10 Straight Shank with .260 Bore for ¼" Diameter Elements

Standard Duty Threaded



How To Order

Complete the Part Number by filling in the box with the number designating the material.

- 1 = **Steel**
- 2 = **Brass**
- 3 = **316 Stainless Steel**
- 4 = **304 Stainless Steel**
- 5 = **Monel**

Standard Sizes

Part Number	External Thread "P"	Stem Length "A" (in)	Insertion Length "U" (in)	Shank Diameter "Q" (in)
TWL1011☐	½" NPT	4	2½	–
TWL1012☐		6	4½	⅝
TWL1013☐		9	7½	⅝
TWL1014☐		12	10½	⅝
TWL1015☐		15	13½	⅝
TWL1016☐		18	16½	⅝
TWL1018☐		24	22½	⅝
TWL1021☐	¾" NPT	4	2½	—
TWL1022☐		6	4½	¾
TWL1023☐		9	7½	¾
TWL1024☐		12	10½	¾
TWL1025☐		15	13½	¾
TWL1026☐		18	16½	¾
TWL1028☐		24	22½	¾
TWL1031☐	1" NPT	4	2½	—
TWL1032☐		6	4½	⅞
TWL1033☐		9	7½	⅞
TWL1034☐		12	10½	⅞
TWL1035☐		15	13½	⅞
TWL1036☐		18	16½	⅞
TWL1038☐		24	22½	⅞

Maximum Fluid Velocity Feet Per Second

(See Velocity Ratings on page 14-32)

Well Type	Material	Insertion Length — "U" (in) 2½	4½	7½	10½	13½	16½	19½	22½
½" Series 10 and 15	Brass	207 (59.3)	75.5 (32.2)	27.3 (19.7)	13.9	8.4	5.6	4.1	3.0
	Carbon Steel	290 (106)	105 (59)	38.2 (36.3)	19.4	11.8	7.8	5.7	4.2
	A.I.S.I. 304 & 316	300 (148)	109 (82.2)	39.5	20.1	12.2	8.1	5.9	4.4
	Monel	261 (118)	95 (65.5)	34.4	17.5	10.5	7.1	5.2	3.8
¾" Series 10 and 15	Brass	207 (59.3)	89.1 (39.8)	32.2 (23.9)	16.4	9.9	6.6	4.8	3.6
	Carbon Steel	290 (106)	123 (71.2)	44.9 (42.7)	22.8	13.8	9.3	6.7	4.9
	A.I.S.I. 304 & 316	300 (148)	128 (99.3)	46.4	23.6	14.3	9.6	6.9	5.1
	Monel	261 (118)	112 (79.8)	40.6	20.7	12.4	8.3	6.1	4.5
1" Series 10 and 15	Brass	207 (59.3)	102 (47.6)	37.0 (28)	18.8	11.4	7.6	5.5	4.1
	Carbon Steel	290 (106)	143 (84.3)	51.6 (50.6)	26.2	15.9	10.6	7.6	5.7
	A.I.S.I. 304 & 316	300 (148)	148 (117)	53.5	27.2	16.5	11.0	7.9	5.9
	Monel	261 (118)	128 (93.3)	46.7	23.7	14.4	9.5	6.9	5.1

SEE NOTE FOR TABLE USE ⇨

Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parenthesis in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.

* *See Page 14-34 for Maximum Pressure—Temperature Ratings* *

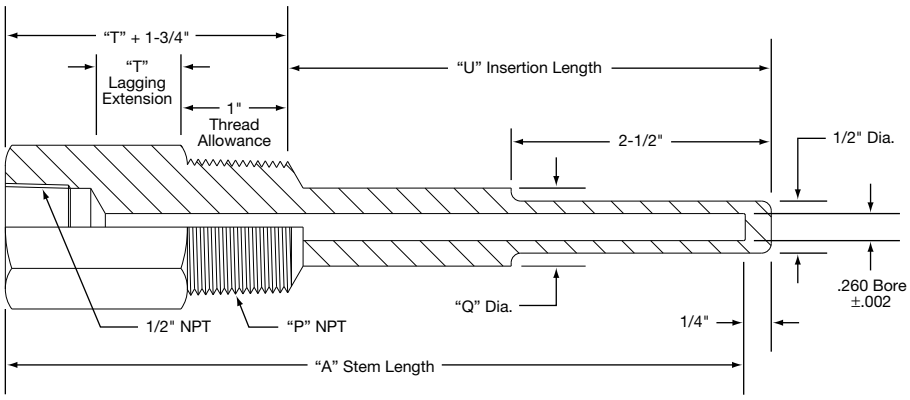
Series 15 Straight Shank — Lagging Extension Type with .260" Bore for ¼" Diameter Elements

Standard Duty Threaded

How To Order

Complete the Part Number by filling in the box with the number designating the material.

- 1 = **Steel**
- 2 = **Brass**
- 3 = **316 Stainless Steel**
- 4 = **304 Stainless Steel**
- 5 = **Monel**



Standard Sizes

Part Number	External Thread "P"	Stem Length "A" (in)	Insertion Length "U" (in)	Lag Extension "T" (in)	Shank Diameter "Q" (in)
TWL1511☐	½" NPT	6	2½	2	—
TWL1512☐		9	4½	3	⅝
TWL1513☐		12	7½	3	⅝
TWL1514☐		15	10½	3	⅝
TWL1515☐		18	13½	3	⅝
TWL1517☐		24	19½	3	⅝
TWL1521☐	¾" NPT	6	2½	2	—
TWL1522☐		9	4½	3	¾
TWL1523☐		12	7½	3	¾
TWL1524☐		15	10½	3	¾
TWL1525☐		18	13½	3	¾
TWL1527☐		24	19½	3	¾
TWL1531☐	1" NPT	6	2½	3	—
TWL1532☐		9	4½	3	⅞
TWL1533☐		12	7½	3	⅞
TWL1534☐		15	10½	3	⅞
TWL1535☐		18	13½	3	⅞
TWL1537☐		24	19½	3	⅞

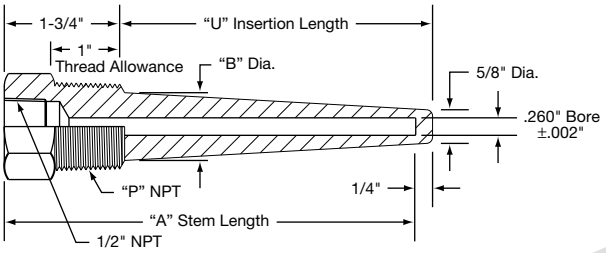
Pressure — Temperature Rating *(lbs per square inch)*

Material	Temperature 70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
Brass	5000	4222	1000	—	—	—	—
Carbon Steel	5200	5000	4800	4600	3500	1500	—
A.I.S.I. 304	7000	6200	5600	5400	5200	4500	1650
A.I.S.I. 316	7000	7000	6400	6200	6100	5100	2500
Monel	6500	6000	5400	5300	5200	1500	—

See Page 14-33 for Maximum Fluid Velocity Feet per Second

Series 20 Tapered Shank with .260" Bore for ¼" Diameter Elements

Heavy Duty Threaded



Series 20 Standard Sizes

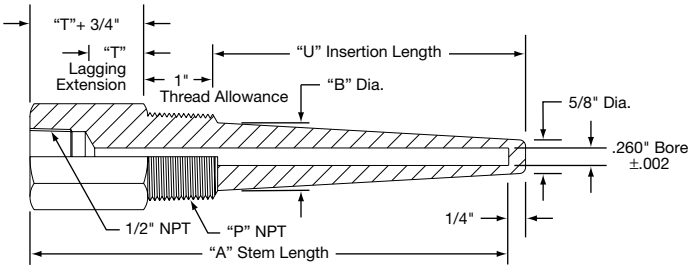
Part Number	External Thread "P"	Element Length "A" (in)	Insertion Length "U" (in)	Shank Diameter "B" (in)
TWL2021☐	¾" NPT	4	2½	—
TWL2022☐		6	4½	⅞
TWL2023☐		9	7½	⅞
TWL2024☐		12	10½	⅞
TWL2025☐		15	13½	⅞
TWL2026☐		18	16½	⅞
TWL2028☐		24	22½	⅞
TWL2031☐	1" NPT	4	2½	—
TWL2032☐		6	4½	1 1/16
TWL2033☐		9	7½	1 1/16
TWL2034☐		12	10½	1 1/16
TWL2035☐		15	13½	1 1/16
TWL2036☐		18	16½	1 1/16
TWL2038☐		24	22½	1 1/16

***Thermowells** are available in the following materials: Steel, Brass, 316 Stainless Steel, 304 Stainless Steel and Monel.*

For How to Order See Page 14-34

Series 25 Tapered Shank-Lagging Extension Type with .260" Bore for ¼" Diameter Elements

Heavy Duty Threaded



Series 25 Standard Sizes

Part Number	External Thread "P"	Lag Extension "T" (in)	Stem Length "A" (in)	Insert Length "U" (in)	Shank Diameter "B" (in)
TWL2521☐	¾" NPT	2	6	2½	—
TWL2522☐		3	9	4½	⅞
TWL2523☐		3	12	7½	⅞
TWL2524☐		3	15	10½	⅞
TWL2525☐		3	18	13½	⅞
TWL2527☐		3	24	19½	⅞
TWL2531☐	1" NPT	2	6	2½	—
TWL2532☐		3	9	4½	1 1/16
TWL2533☐		3	12	7½	1 1/16
TWL2534☐		3	15	10½	1 1/16
TWL2535☐		3	18	13½	1 1/16
TWL2537☐		3	24	19½	1 1/16

Maximum Fluid Velocity Feet per Second

(See Velocity Ratings on page 14-33)

Well Type	Material	Insertion Length — "U" (in) 2½	4½	7½	10½	13½	16½	19½	22½
¾" Series 20 and 25	Brass	305 (97.5)	93.8 (54.1)	33.9	17.1	10.5	7.0	5.0	3.7
	Carbon Steel	386 (175)	180 (97.2)	65.3 (58.3)	33.0	20.1	13.4	9.6	7.1
	A.I.S.I. 304 &316	440 (243)	197 (135)	71.2	36.0	22.0	14.7	10.5	7.8
	Monel	354 (195)	155 (108)	56.1	28.4	17.3	11.6	7.5	5.6
1" Series 20 and 25	Brass	354 (161)	108 (89.5)	39.4	19.8	12.2	8.1	5.8	4.3
	Carbon Steel	448 (289)	209 (161)	75.7	38.4	23.3	15.5	11.1	8.2
	A.I.S.I. 304 &316	490 (403)	228 (225)	82.5	41.8	25.5	17.1	12.2	9.1
	Monel	410 (322)	179 (178)	65.1	33.0	20.1	13.5	8.7	6.5

Pressure — Temperature Rating

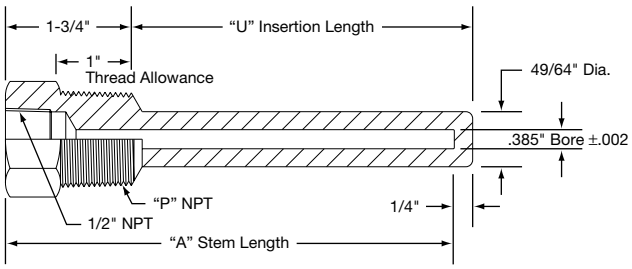
(lbs per square inch)

Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parenthesis in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.

Material	Temperature 70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
Brass	5300	4750	1100	—	—	—	—
Carbon Steel	5950	5750	5450	5250	4000	1750	—
A.I.S.I. 304	7800	7050	6400	6150	6000	5190	1875
A.I.S.I. 316	7800	7800	7250	7100	6950	5800	2720
Monel	7450	6850	6150	6100	5940	1750	—

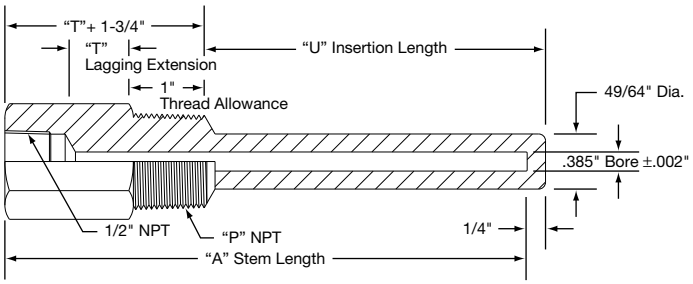
Series 30 Straight Shank with .385" Bore for ⅜" Diameter Elements

Standard Duty Threaded



Series 35 Straight Shank — Lagging Extension Type with .385" Bore for ⅜" Diameter Elements

Standard Duty Threaded



Series 30 Standard Sizes

Part Number	External Thread "P"	Stem Length "A" (in)	Insertion Length "U" (in)
TWL3021☐	¾" NPT	4	2½
TWL3022☐		6	4½
TWL3023☐		9	7½
TWL3024☐		12	10½
TWL3025☐		15	13½
TWL3026☐		18	16½
TWL3028☐		24	22½
TWL3031☐	1" NPT	4	2½
TWL3032☐		6	4½
TWL3033☐		9	7½
TWL3034☐		12	10½
TWL3035☐		15	13½
TWL3036☐		18	16½
TWL3038☐		24	22½

Series 35 Standard Sizes

Part Number	External Thread "P"	Lag. Exten. "T" (in)	Stem Length "A" (in)	Insert Length "U" (in)
TWL3521☐	¾" NPT	2	6	2½
TWL3522☐		3	9	4½
TWL3523☐		3	12	7½
TWL3524☐		3	15	10½
TWL3525☐		3	18	13½
TWL3527☐		3	24	19½
TWL3531☐	1" NPT	2	6	2½
TWL3532☐		3	9	4½
TWL3533☐		3	12	7½
TWL3534☐		3	15	10½
TWL3535☐		3	18	13½
TWL3537☐		3	24	19½

Thermowells are available in the following materials: Steel, Brass, 316 Stainless Steel, 304 Stainless Steel and Monel.

For How to Order See Page 14-34

Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parenthesis in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.

Pressure — Temperature Rating

(lbs per square inch)

Material	Temperature 70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
Brass	5000	4222	1000	—	—	—	—
Carbon Steel	5200	5000	4800	4600	3500	1500	—
A.I.S.I. 304	7000	6200	5600	5400	5200	4500	1650
A.I.S.I. 316	7000	7000	6400	6200	6100	5100	2500
Monel	6500	6000	5400	5300	5200	1500	—

Maximum Fluid Velocity Feet per Second

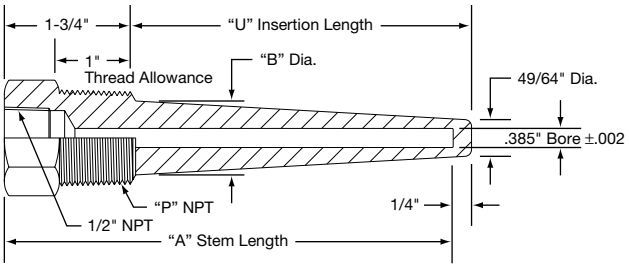
(See Velocity Ratings on page 14-33)

Material	Insertion Length — "U" (in) 2½	4½	7½	10½	13½	16½	19½	22½
Brass	290 (145)	150 (80)	54.1 (48)	27.6	16.7	11.1	8.0	6.0
Carbon Steel	326 (260)	192 (144)	69.5	35.4	20.5	14.3	10.3	7.7
A.I.S.I. 304 & 316	349 (360)	199	71.9	36.6	21.2	14.8	10.7	8.0
Monel	316 (320)	189 (178)	68.1	34.8	20.8	14.0	10.0	7.5

SEE NOTE FOR TABLE USE

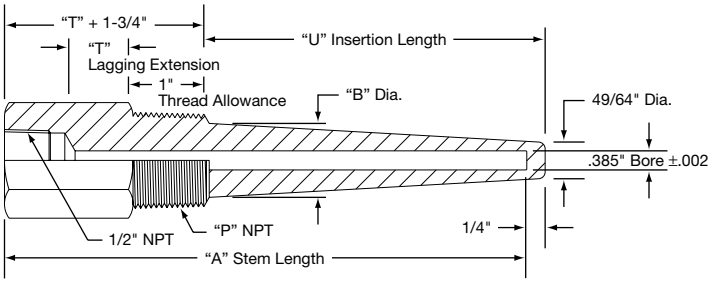
Series 40 Tapered Shank with .385" Bore for ⅜" Diameter Elements

Heavy Duty Threaded



Series 45 Tapered Shank — Lagging Extension Type with .385" Bore for a ⅜" Diameter Element

Heavy Duty Threaded



Series 40 Standard Sizes

Part Number	External Thread "P"	Stem Length "A" (in)	Insertion Length "U" (in)	Shank Diameter "B" (in)
TWL4021☐	¾" NPT	4	2½	⅞
TWL4022☐		6	4½	⅞
TWL4023☐		9	7½	⅞
TWL4024☐		12	10½	⅞
TWL4025☐		15	13½	⅞
TWL4026☐		18	16½	⅞
TWL4028☐		24	22½	⅞
TWL4031☐	1" NPT	4	2½	1 1/16
TWL4032☐		6	4½	1 1/16
TWL4033☐		9	7½	1 1/16
TWL4034☐		12	10½	1 1/16
TWL4035☐		15	13½	1 1/16
TWL4036☐		18	16½	1 1/16
TWL4038☐		24	22½	1 1/16

Series 45 Standard Sizes

Part Number	External Thread "P"	Lag. Exten. "T" (in)	Stem Length "A" (in)	Insert Length "U" (in)	Shank Diameter "B" (in)
TWL4521☐	¾" NPT	2	6	2½	⅞
TWL4522☐		3	9	4½	⅞
TWL4523☐		3	12	7½	⅞
TWL4524☐		3	15	10½	⅞
TWL4525☐		3	18	13½	⅞
TWL4527☐		3	24	19½	⅞
TWL4531☐	1" NPT	2	6	2½	1 1/16
TWL4532☐		3	9	4½	1 1/16
TWL4533☐		3	12	7½	1 1/16
TWL4534☐		3	15	10½	1 1/16
TWL4555☐		3	18	13½	1 1/16
TWL4537☐		3	24	19½	1 1/16

Thermowells are available in the following materials: Steel, Brass, 316 Stainless, 304 Stainless Steel and Monel.

For How to Order See Page 14-34

Pressure — Temperature Rating

(lbs per square inch)

Material	Temperature 70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
Brass	5000	4222	1000	—	—	—	—
Carbon Steel	5200	5000	4800	4600	3500	1500	—
A.I.S.I. 304	7000	6200	5600	5400	5200	4500	1650
A.I.S.I. 316	7000	7000	6400	6200	6100	5100	2500
Monel	6500	6000	5400	5300	5200	1500	—

Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parenthesis in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.

Maximum Fluid Velocity Feet per Second

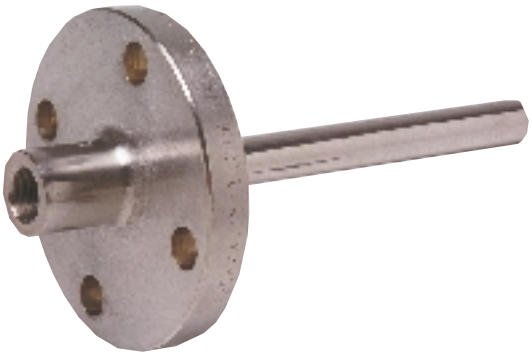
(See Velocity Ratings on page 14-33)

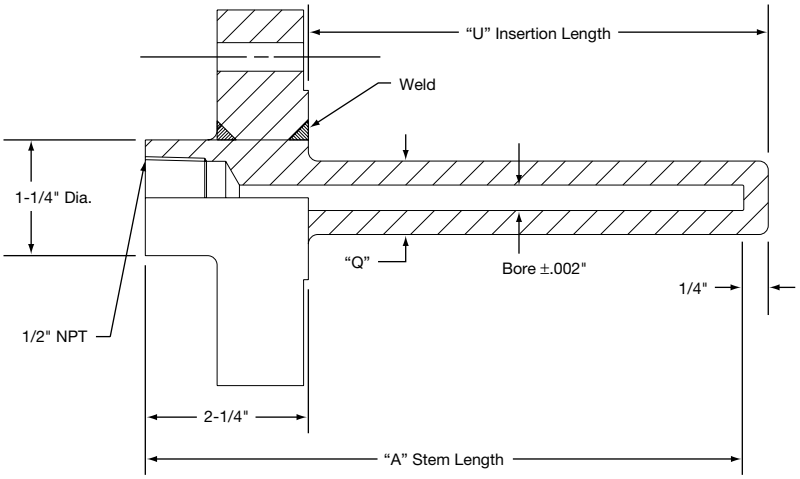
Well Type	Material	Insertion Length — "U" (in) 2½	4½	7½	10½	13½	16½	19½	22½
¾" Series 40 and 45	Brass	276 (127)	124 (79)	44.0	22.0	13.0	8.0	6.0	4.0
	Carbon Steel	352 (228)	191 (114)	68.9	35.0	21.0	14.0	10.0	7.5
	A.I.S.I. 304 & 316	415 (299)	203 (154)	73.2	37.3	22.5	15.0	11.0	8.0
	Monel	340 (255)	172 (134)	62.0	31.0	19.0	12.8	8.0	6.0
1" Series 40 and 45	Brass	321 (150)	129 (83.5)	46.8	23.6	14.5	9.6	6.9	5.1
	Carbon Steel	410 (270)	249 (150)	90.3	45.6	27.8	18.5	13.2	9.8
	A.I.S.I. 304 & 316	483 (350)	272 (208)	97.3	49.7	30.4	20.3	14.5	10.7
	Monel	396 (306)	214 (167)	77.5	39.2	23.8	16.0	10.3	7.7

SEE NOTE FOR TABLE USE (above)

Series 50 (.260" Bore) and Series 55 (.385" Bore) for ¼" and ⅜" Diameter Elements

Flanged





Standard Sizes

"U" (in)	"A" (in)	Part Number 1" Flange .260 Bore Q = ¾"	1" Flange .385 Bore Q = ⅞"	1½" Flange .260 Bore Q = ¾"	1½" Flange .385 Bore Q = ⅞"
2	4	TWL50001	TWL55001	TWL50008	TWL55008
4	6	TWL50002	TWL55002	TWL50009	TWL55009
7	9	TWL50003	TWL55003	TWL50010	TWL55010
10	12	TWL50004	TWL55004	TWL50011	TWL55011
13	15	TWL50005	TWL55005	TWL50012	TWL55012
16	18	TWL50006	TWL55006	TWL50013	TWL55013
22	24	TWL50007	TWL55007	TWL50014	TWL55014

- Catalog Part Numbers have carbon steel (C-1018) 150-lb Raised Face Flanges. Other Facings and Pressure Ranges are available.
- Additional available materials are A.I.S.I. 304, A.I.S.I. 316 and Monel.

Maximum Fluid Velocity Feet per Second

(See Velocity Ratings on page 14-33)

Well Type	Material	Insertion Length — "U" (in) 2	4	7	10	13	16	22
Series 50 and 60	Carbon Steel	404 (129)	184 (71.2)	67.0 (42.7)	34.0	20.6	13.7	7.4
	A.I.S.I. 304 & 316	430 (179)	192 (99.3)	69.7 (59.6)	35.4	21.5	14.3	7.7
	Monel	350 (143)	168 (79.8)	61 (47.7)	31.0	18.8	12.5	6.7
Series 55 and 65	Carbon Steel	410 (152)	248 (84.3)	91.3 (50.6)	45.7	27.6	18.5	10.0
	A.I.S.I. 304 & 316	444 (211)	258 (117)	95.2 (70.3)	47.6	28.8	19.3	10.4
	Monel	338 (168)	226 (93.3)	83.3 (56.0)	41.6	25.2	16.9	9.1

SEE NOTE FOR TABLE USE

Where single values appear in table, thermowell may be considered safe for water, steam, air or gas. The values in parenthesis in the shorter insertion lengths represent safe values for water flow, taking into consideration the velocity pressure effect of water flowing at higher velocities.

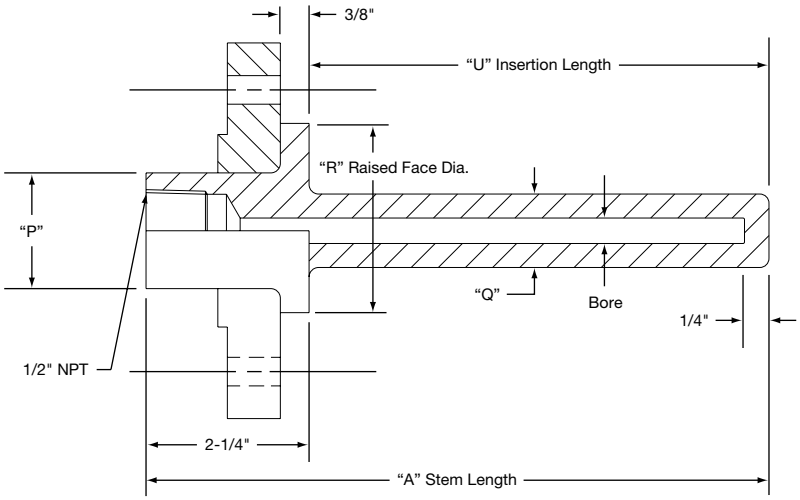
Maximum Flange Pressure — Temperature Rating

(lbs per square inch)

Material	Temperature °F 0°	800°	1000°	1125°
Carbon Steel	2500	2500	—	—
A.I.S.I. 304	2500	2500	2500	—
A.I.S.I. 316	2500	2500	2500	2500
Monel	2500	2500	—	—

Series 60 (.260" Bore) and 65 (.385" Bore) for ¼" and ⅜" Elements

Van Stone



Lap Joint Flange supplied by customer

Standard Sizes

"U" (in)	"A" (in)	Part Number 1" Flange R = 2", P = 1.315" .260 Bore Q = ¾"	1" Flange .385 Bore Q = ⅞"	1½" Flange R = 2⅞, P = 1.900" .260 Bore Q = ¾"	1½" Flange .385 Bore Q = ⅞"
2	4	TWL60001	TWL65001	TWL60008	TWL65008
4	6	TWL60002	TWL65002	TWL60009	TWL65009
7	9	TWL60003	TWL65003	TWL60010	TWL65010
10	12	TWL60004	TWL65004	TWL60011	TWL65011
13	15	TWL60005	TWL65005	TWL60012	TWL65012
16	18	TWL60006	TWL65006	TWL60013	TWL65013
22	24	TWL60007	TWL65007	TWL60014	TWL65014

- Catalog Part Numbers are carbon steel (C-1018) and fit 1" and 1½" Lap Joint Flanges
- Additional available materials are A.I.S.I. 304, A.I.S.I. 316 and Monel

Thermowell Corrosive Service Guide

Corrodent	Temp. °F	Conc. %	Recommended Material
Acetic Acid	212	All	Monel
Acetic Anhydride	300		Nickel
Acetone	212	All	304 SS
Acetylene	400		304 SS
Alcohols	212	All	304 SS
Alum (Potassium or Sodium)	300	All	Hast. C
Aluminum Chloride	212	All	Hast. B
Aluminum Sulfate	212	All	316 SS
Ammonia, Dry	212	All	304 SS, 316 SS
Ammonium Hydroxide (Ammonia, Aqua)	212	All	304 SS, 316 SS
Ammonium Chloride	300	50%	Monel
Ammonium Nitrate	300	All	304 SS
Ammonium Sulfate	212	All	316 SS
Amyl Acetate	300	All	304 SS
Aniline	75		Monel
Asphalt	250		304 SS
Atmosphere, (Industrial and Marine)			304 SS
Barium Compounds	*See Calcium*		
Beer	70		304 SS
Benzene (Benzol)	212		Steel
Benzoic Acid	212	All	316 SS
Bleaching Powder	70	15%	Monel
Borax	212	All	Brass
Bordeaux Mixture	200		304 SS
Boric Acid	400	All	316 SS
Bromine	125	Dry	Monel
Butane	400	All	Steel
Butyl Alcohol	*See Alcohols*		
Butyric Acid	212		Hast. C
Calcium Bisulphite	75	All	Hast. C
Calcium Chloride	212	All	Hast. C
Calcium Hydroxide	300	20%	Hast. C
Calcium Hypochlorite	*See Bleaching Powder*		
Carbolic Acid	*See Pheno*		
Carbon Dioxide, Dry	800	All	Brass
Carbon Disulfide	200		304 SS
Carbon Tetrachloride	125	All	Monel
Carbonated Beverages	212		304 SS
Carbonated Water	212	All	304 SS
Chloracetic Acid	212	All	Monel
Chlorine, Dry	100		Monel
Chlorine, Moist	100	All	Monel
Chloroform, Dry	212		Monel
Chromic Acid	300	All	Hast. C
Cider	300	All	304 SS
Citric Acid	212	All	Hast. C
Copper (10) Chloride	212	All	Hast. C
Copper (10) Nitrate	300	All	316 SS
Copper (10) Sulfate	300	All	316 SS
Copper Plating Solution (Acid)	75		304 SS
Copper Plating Solution (Cyanide)	180		304 SS
Corn Oil	200		304 SS
Creosote	200	All	304 SS
Crude Oil	300		Monel
Ethanol	*See Alcohols*		
Ethyl Acetate	*See Lacquer Thinner*		
Ethyl Chloride, Dry	500		Steel
Ethylene Glycol (Uninhibited)	212	All	304 SS
Ethylene Oxide	75		Steel
Fatty Acids	500	All	316 SS
Ferric Chloride	75	All	Hast. C
Ferric Sulfate	300	All	304 SS
Formaldehyde	212	40%	316 SS
Formic Acid	300	All	316 SS
Fluorine, Anhydrous	100		304 SS
Freon	300		Steel
Furfural	450		316 SS
Gasoline	300		Steel
Glucose	300		304 SS
Glue ph 6-8	300	All	304 SS
Glycerine	212	All	Brass
Hydrobromic Acid	212	All	Hast. C

Corrodent	Temp. °F	Conc. %	Recommended Material
Hydrochloric Acid (37-38%)	225	All	Hast. B
Hydrocyanic Acid	212	All	304 SS
Hydrofluogilicic Acid	212	40%	Monel
Hydrofluoric Acid	212	60%	Monel
Hydrogen Chloride, Dry	500		304 SS
Hydrogen Fluoride, Dry	175		Steel
Hydrogen Peroxide	125	10-100%	304 SS
Kerosene	300	All	Steel
Lacquers & Thinners	300	All	304 SS
Lactic Acid	300	All	316 SS
Lime	212	All	316 SS
Linseed Oil	75		Steel
Magnesium Chloride	212	50%	Nickel
Magnesium Hydroxide (or Oxide)	75	All	304 SS
Magnesium Sulfate	212	40%	304 SS
Mercuric Chloride	75	10%	Hast. C
Mercury	700	100%	Steel
Methyl Chloride, Dry	75		Steel
Methylene Chloride	212	All	304 SS
Milk, fresh or sour	180		304 SS
Molasses	*See Glucose*		
Natural Gas	70		304 SS
Nitric Acid	75	All	304 SS
Nitric Acid	110	All	316 SS
Oxygen	75	All	Steel
Oleic Acid	*See Fatty Acids*		
Oxalic Acid	212	All	Monel
Palmitic Acid	*See Fatty Acids*		
Phosphoric Acid	212	All	316 SS
Phenol	212	All	316 SS
Photographic Bleaching	100	All	304 SS
Potassium Compounds	*See Sodium Compounds*		
Propane	300		Steel
Rosin	700	100%	316 SS
Salt or Brine	*See Sodium Chloride*		
Sea Water	75		Monel
Soap & Detergents	212	All	304 SS
Sodium Bicarbonate	212	20%	316 SS
Sodium Bisulfate	212	20%	304 SS
Sodium Bisulfite	212	20%	304 SS
Sodium Carbinate	212	40%	316 SS
Sodium Chloride	300	30%	Monel
Sodium Chromate	212	All	316 SS
Sodium Cyanide	212	All	304 SS
Sodium Hydroxide	212	30%	316 SS
Sodium Hypochlorite	75	10%	Hast. C
Sodium Nitrate	212	40%	304 SS
Sodium Nitrite	75	20%	316 SS
Sodium Phosphate	212	10%	Steel
Sodium Silicate	212	10%	Steel
Sodium Sulfate	212	30%	316 SS
Sodium Sulfide	212	10%	316 SS
Sodium Sulfite	212	30%	304 SS
Sodium Thiosulfate	212	All	304 SS
Steam			304 SS
Stearic Acid	*See Fatty Acids*		
Sugar Solutions	*See Glucose*		
Sulfur	500		304 SS
Sulfur Chloride	75	Dry	316 SS
Sulfur Dioxide	500	Dry	316 SS
Sulfur Trioxide	500	Dry	316 SS
Sulfuric Acid	212	10%	316 SS
Sulfuric Acid	212	10-90%	Hast. B
Sulfuric Acid	212	90-100%	Hast. B
Sulfuric Acid, Fuming	175		Carp. 20
Sulfurous Acid	75	20%	316 SS
Titanium Tetrachloride	75	All	316 SS
Tannic Acid	75	40%	Hast. B
Toluene	75		Steel
Trichloracetic Acid	75	All	Hast. B
Trichlorethylene	300	Dry	Monel
Turpentine	75		316 SS
Varnish	150		Steel
Zinc Chloride	212	All	Hast. B
Zinc Sulfate	212	All	316 SS

CAUTION This information is given as a guide only. Final material selection should be made by the user based on their knowledge of the application.

Ceramic Protection Tubes Application Data

Ceramic Protection Tubes are used in applications where contamination from hostile environments or the cutting action of concentrated and direct flame impingement are factors. Such conditions usually require a noble metal thermocouple such as platinum and platinum alloys.

When selecting assemblies using ceramic components, the expected maximum temperatures must be considered. At elevated temperatures, some ceramic materials go through a glass phase. As silica is a prime contaminant of platinum, alumina protecting tubes and insulators are recommended for temperatures exceeding 2000°F (1093°C).

Material	Maximum Operating Temperature	Thermal Shock Characteristics	Maximum Available Length (in)	Typical Applications	Remarks
Alumina (99.5%)	3350°F (1843°C)	Fair (preheating to 900°F (482°C) recommended	84	Iron, Barium, crown glass: Non-ferrous metals; gas-tight protection for noble metal thermocouples in excess of 2400°F (1316°C)	Sags at 2900°F (1593°C) Prevents dry hydrogen penetration
Porcelain (Mullite)	2900°F (1593°C)	Poor (preheating to 900°F (482°C) recommended	84	Non-ferrous metals; gas-tight protection for noble metal thermocouples to 2400°F (1316°C)	Sags at 2900°F (1593°C) Prone to attack by halogen gases; Some penetration of dry hydrogen. Contains silica.

Alumina
(99% Min. Purity)

Protecting Tubes

Protecting Tubes with 3/4 x 1/2 NPT Brass Hex Fitting

Porcelain

Protecting Tubes

Protecting Tubes with Collar

Part Number	I.D. × O.D.†	Construction	Length
APT-101- ☐	¼" × ⅜"	Plain End	12" thru 48" in 6" increments
*APT-102- ☐	7/16" × 11/16"	Plain End	12" thru 60" in 6" increments
APT-103- ☐	¾" × 1"	Plain End	12" thru 72" in 6" increments
APT-104- ☐	1" × 1¼"	Plain End	12" thru 72" in 6" increments
APT-105- ☐	¼" × ⅜"	With Ferrule ⅞-27 Threads	12" thru 48" in 6" increments
APT-106- ☐	7/16" × 11/16"	With Ferrule ⅞-27 Threads	12" thru 60" in 6" increments

Part Number	I.D. x O.D.†	Construction	Length
PPT-101- ☐	¼" × ⅜"	Plain End	12" thru 84" in 6" increments
*PPT-102- ☐	7/16" × 11/16"	Plain End	
PPT-103- ☐	¾" × 1"	Plain End	
PPT-104- ☐	1" × 1¼"	Plain End	
PPT-105- ☐	¼" × ⅜"	w/Collar Approx. 5/16" × ¾"	
PPT-106- ☐	7/16" × 11/16"	w/Collar Approx. 5/16" × 1 1/16"	
PPT-107- ☐	¾" × 1"	w/Collar Approx. 5/16" × 1⅜"	
PPT-108- ☐	1" × 1¼"	w/Collar Approx. 5/16" × 1⅝"	
PPT-109- ☐	¼" × ⅜"	w/Ferrule ⅞-27 Threads	
PPT-110- ☐	7/16" × 11/16"	w/Ferrule ⅞-27 Threads	

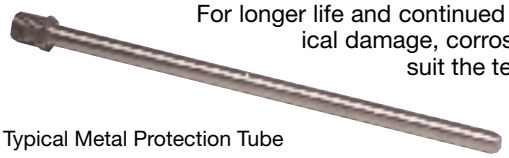
Complete the Part Number with 3 digits indicating length in whole inches. Example: = APT-105-[012] is 12" long and PPT-107-[048] is 48" long.

*Available with brass or steel reducing fitting – ¾" NPT × ½ NPT

†Dimensional tolerance: Up to 1" ±5% or .025", whichever is greater
Over 1" ±4% or .050", whichever is greater

Metal Protection Tubes

For longer life and continued accuracy, most thermocouples in industrial applications should be protected from physical damage, corrosion, and contamination by some type of protecting tube or well. Metal tubes selected to suit the temperature, pressure and atmosphere are generally used with base metal thermocouples.



Typical Metal Protection Tube

Typical Cast Iron Protection Tube

Material	Maximum Operating Temperature	Typical Applications	Remarks
304 Stainless	1800°F (982°C)	Food and Dairy Products, Petroleum Products, Mild Acids, Alkalies,	Embrittles in 800°F (427°C) to 1400°F (760°C) range
Cast Iron	1300°F (704°C)	Molten Aluminum, Gas Ducts	Withstands sulphur and caustic solutions
316 Stainless	1800°F (982°C)	Food and Dairy Products, Petroleum Products, Mild Acids, Alkalies	Greater corrosion resistance than 304 Stainless.
446 Stainless	2000°F (1093°C)	Sulphurous Atmospheres such as Hydrogen Sulphide, Neutral Salt Baths	Excellent resistance to corrosion and oxidation at high temperatures. Do not use in carburizing atmospheres.
Inconel 601®	2200°F (1204°C)	Neutral Salt Baths, Carburizing and Nitriding Atmospheres	Good resistance to corrosion at high temperatures; excellent resistance to oxidation at high temperatures. Do not use in carburizing atmospheres above 1000°F (538°C).
Black Steel Pipe per ASTM A120	1200°F (649°C)	Molten Babbitt, Tin, Lead, and Magnesium	Low Cost

304 Stainless Steel *(8% Nickel-18% Chrome)*

Part Number	I.D. × O.D.	NPT Thread	Const.	Length
*MPT-101-___	.622" × .840"	½"	Welded	12" and over in 6" increments
*MPT-102-___	.824" × 1.050"	¾"	Welded	
*MPT-103-___	1.049" × 1.315"	1"	Welded	

*If extra heavy wall is desired, Specify.

446 Stainless Steel *(28% Chrome Iron)*

Part Number	I.D. × O.D.	NPT Thread	Const.	Length
MPT-109-___	.622" × .840"	½"	Seamless	12" and over in 6" increments
MPT-110-___	.824" × 1.050"	¾"	Seamless	
MPT-111-___	1.049" × 1.315"	1"	Seamless	

Cast Iron

Part Number	I.D. × O.D.	NPT Thread	Const.	Length
MPT-104-___	⅞" × 1⅝"	¾" Int.*	Cast	12" thru 72" in 6" increments
MPT-105-___	⅞" × 1⅜"	1" Ext.	Cast	12" thru 48" in 6" increments

*1" NPT External thread available on special request.

Inconel Alloy 601® *(60% Nickel-23% Chrome-14% Iron)*

Part Number	I.D. × O.D.	NPT Thread	Const.	Length
MPT-112-___	.622" × .840"	½"	Seamless	12" and over in 6" increments
MPT-113-___	.824" × 1.050"	¾"	Seamless	
MPT-114-___	1.049" × 1.315"	1"	Seamless	

316 Stainless Steel

Part Number	I.D. × O.D.	NPT Thread	Const.	Length
MPT-106-___	.622" × .840"	½"	Welded	12" and over in 6" increments
MPT-107-___	.824" × 1.050"	¾"	Welded	
MPT-108-___	1.049" × 1.315"	1"	Welded	

Black Steel Pipe *(Per ASTM A120)*

Part Number	I.D. × O.D.	NPT Thread	Const.	Length
MPT-115-___	.364" × .540"	¼"	Welded	12" and over in 6" increments
MPT-116-___	.302" × .540"	¼"	Welded	
MPT-117-___	.546" × .840"	½"	Welded	
MPT-118-___	.742" × 1.050"	¾"	Welded	
MPT-119-___	.957" × 1.315"	1"	Welded	

Complete the Part Number with 3 digits indicating length in whole inches. Example 12": MPT-105- 012 is 12" long and MPT-107- 048 is 48" long.

Protection Tube Mounting Parts

For Ceramic Tubes

Part Number	Description
TCA-122-101	⅞-27 Threaded Ferrule for PPT-101-☐ Porcelain or APT-101-☐ Alumina tube
TCA-122-102	⅞-27 Threaded Ferrule for PPT-102-☐ Porcelain or APT-102-☐ Alumina tube
FTG-148-101	¾" NPT × ½" NPT Brass reducing hex nipple for PPT-102-☐ or APT-102-☐ tube
FTG-148-102	¾" NPT × ½" NPT Steel reducing hex nipple for PPT-102-☐ or APT-102-☐ tube

TCA-122-101
TCA-122-102

FTG-148-101
FTG-148-102

FLG-122-101
FLG-122-102
FLG-122-103

For Metal Tubes

Part Number	Description
FLG-122-101	15/16" I.D. × 3½" Cast Iron Flange for ½" IPS
FLG-122-102	1¼" I.D. × 3 9/16" Cast Iron Flange for ¾" IPS
FLG-122-103	1 7/16" I.D. × 3 11/16" Cast Iron Flange for 1" IPS
FTG-149-101	½" NPT × ½" NPT Malleable 90° Elbow
FTG-149-102	¾" NPT × ¾" NPT Malleable 90° Elbow
FTG-149-103	1" NPT × 1" NPT Malleable 90° Elbow
FTG-150-101	½" NPT × ½" NPT Universal Elbow
FTG-150-102	¾" NPT × ¾" NPT Universal Elbow
FTG-150-103	1" NPT × 1" NPT Universal Elbow

FTG-149-101
FTG-149-102
FTG-149-103

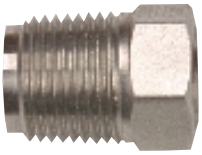
FTG-150-101
FTG-150-102
FTG-150-103

Sensor Mounting Fixed Fittings

Sheath Diameter (in)	Male NPT	Over-All Length (in)	Hex Across Flats (in)	Part Number Brass	Part Number Stainless Steel
1/16	⅛	¾	7/16	FTG-159-101	FTG-162-101
	¼	1	9/16	FTG-159-102	FTG-162-102
	½	1¼	⅞	FTG-159-103	FTG-162-103
1/8	⅛	¾	7/16	FTG-159-104	FTG-162-104
	¼	1	9/16	FTG-159-105	FTG-162-105
	½	1¼	⅞	FTG-159-106	FTG-162-106
3/16	⅛	¾	7/16	FTG-159-107	FTG-162-107
	¼	1	9/16	FTG-159-108	FTG-162-108
	½	1¼	⅞	FTG-159-109	FTG-162-109
1/4	⅛	¾	7/16	FTG-159-110	FTG-162-110
	¼	1	9/16	FTG-159-111	FTG-162-111
	½	1¼	⅞	FTG-159-112	FTG-162-112
5/16	¼	1	9/16	FTG-159-113	FTG-162-113
	½	1¼	⅞	FTG-159-114	FTG-162-114
3/8	¼	1	9/16	FTG-159-115	FTG-162-115
	½	1¼	⅞	FTG-159-116	FTG-162-116

Mounting fittings are sometimes necessary for the installation of thermocouple and RTD probes. The two basic types of fixed fittings are the Hex Bushing and the Hex Nipple, most commonly made of either Brass or Stainless Steel.

Fixed fittings are brazed to the sheath of the probe; therefore the immersion length "U" must be specified in inches or mm. The immersion length is from the probe tip to the beginning of the thread on the fitting.



Hex Bushing

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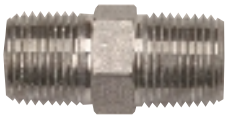
Sensor Mounting Fixed Fittings

Hex Nipple



Sheath Diameter (in)	Male NPT	Over-All Length (in)	Hex Across Flats (in)	Part Number Brass	Part Number Stainless Steel
1/16	1/4	1 13/32	9/16	FTG-152-101	FTG-153-101
	1/2	1 27/32	7/8	FTG-152-102	FTG-153-102
1/8	1/4	1 13/32	9/16	FTG-152-103	FTG-153-103
	1/2	1 27/32	7/8	FTG-152-104	FTG-153-104
3/16	1/4	1 13/32	9/16	FTG-152-105	FTG-153-105
	1/2	1 27/32	7/8	FTG-152-106	FTG-153-106
1/4	1/4	1 13/32	9/16	FTG-152-107	FTG-153-107
	1/2	1 27/32	7/8	FTG-152-108	FTG-153-108
5/16	1/4	1 13/32	9/16	FTG-152-109	FTG-153-109
	1/2	1 27/32	7/8	FTG-152-110	FTG-153-110
3/8	1/4	1 13/32	9/16	FTG-152-111	FTG-153-111
	1/2	1 27/32	7/8	FTG-152-112	FTG-153-112

Compression Fittings

There are non-adjustable and adjustable compression fittings. Non-adjustable compression fittings have a metal ferrule which is compressed onto the sheath and deformed permanently in the application; the fitting cannot be relocated along the sheath after tightening. Adjustable compression fittings have a Teflon® ferrule and the fitting can be relocated several times if immersion length is changed.

MNPT	Sheath O.D. (in)	Part Number Non-Adjustable Brass	Part Number Non-Adjustable Stainless Steel	Part Number Adjustable Brass	Part Number Adjustable Stainless Steel
1/16	1/16	FTG-154-101	FTG-155-101	FTG-156-101	FTG-157-101
	1/8	FTG-154-102	FTG-155-102	FTG-156-102	FTG-157-102
	1/4	FTG-154-103	FTG-155-103	FTG-156-103	FTG-157-103
1/8	1/16	FTG-154-104	FTG-155-104	FTG-156-104	FTG-157-104
	1/8	FTG-154-105	FTG-155-105	FTG-156-105	FTG-157-105
	3/16	FTG-154-106	FTG-155-106	FTG-156-106	FTG-157-106
	1/4	FTG-154-107	FTG-155-107	FTG-156-107	FTG-157-107
	5/16	FTG-154-108	FTG-155-108	FTG-156-108	FTG-157-108
	3/8	FTG-154-109	FTG-155-109	FTG-156-109	FTG-157-109
1/4	1/16	FTG-154-110	FTG-155-110	FTG-156-110	FTG-157-110
	1/8	FTG-154-111	FTG-155-111	FTG-156-111	FTG-157-111
	3/16	FTG-154-112	FTG-155-112	FTG-156-112	FTG-157-112
	1/4	FTG-154-113	FTG-155-113	FTG-156-113	FTG-157-113
	5/16	FTG-154-114	FTG-155-114	FTG-156-114	FTG-157-114
	3/8	FTG-154-115	FTG-155-115	FTG-156-115	FTG-157-115
1/2	1/8	FTG-154-116	FTG-155-116	FTG-156-116	FTG-157-116
	1/4	FTG-154-117	FTG-155-117	FTG-156-117	FTG-157-117
	3/8	FTG-154-118	FTG-155-118	FTG-156-118	FTG-157-118

Spring Loaded Hex Nipple

Sheath Diameter (in)	Part Number
1/8	FTG-158-101
3/16	FTG-158-102
1/4	FTG-158-103

Stainless steel ½" NPT × ½" NPT

Open Disc Terminal Blocks

The open disc terminal blocks are available for both single and dual element thermocouples or single-element RTD assemblies. They are available in two different materials. Ceramic discs are rated for 1000°F (530°C) and silicone/glass fiber discs are rated for 350°F (117°C). Silicone glass/fiber has a higher resistance to vibration and thermal shock than do the ceramic discs.

Each disc is assembled to a 1" O.D. × ⅛" thick Brass (standard) or optional stainless steel back-up plate by two screws, and the plate is directly brazed to the sensor sheath.

Ceramic Open Disc with Brass Back-Up Plate and Mounting Screws

Sheath O.D. (in)	Approximate Dimensions (in)	Part Number			Six wire Approximate Dimensions (in)
		Single Element	Dual Element	Six wire Element	
⅛	1⅛ O.D. × 9/16 H	TCH10045	TCH10048	TCH10051	2 1/32 O.D. × 9/16 H
3/16	1⅛ O.D. × 9/16 H	TCH10046	TCH10049	TCH10052	2 1/32 O.D. × 9/16 H
¼	1⅛ O.D. × 9/16 H	TCH10047	TCH10050	TCH10053	2 1/32 O.D. × 9/16 H

Ceramic Open Disc with Stainless Steel Back-Up Plate and Mounting Screws

Sheath O.D. (in)	Approximate Dimensions (in)	Part Number			Six wire Approximate Dimensions (in)
		Single Element	Dual Element	Six wire Element	
⅛	1⅛ O.D. × 9/16 H	TCH10054	TCH10057	TCH10060	2 1/32 O.D. × 9/16 H
3/16	1⅛ O.D. × 9/16 H	TCH10055	TCH10058	TCH10061	2 1/32 O.D. × 9/16 H
¼	1⅛ O.D. × 9/16 H	TCH10056	TCH10059	TCH10062	2 1/32 O.D. × 9/16 H

Silicone/Glass Fiber Open Disc with Brass Back-Up Plate and Mounting Screws

Sheath O.D. (in)	Approximate Dimensions (in)	Part Number	
		Single Element	Dual Element
⅛	1" O.D. × 9/16 H	TCH10063	N/A
3/16	1" O.D. × 9/16 H	TCH10064	N/A
¼	1" O.D. × 9/16 H	TCH10065	N/A

Silicone/Glass Fiber Open Disc with Stainless Steel Back-Up Plate and Mounting Screws

Sheath O.D. (in)	Approximate Dimensions (in)	Part Number	
		Single Element	Dual Element
⅛	1" O.D. × 9/16 H	TCH10066	N/A
3/16	1" O.D. × 9/16 H	TCH10067	N/A
¼	1" O.D. × 9/16 H	TCH10068	N/A

Ceramic Disc for Single Element

TCA-110-126

Ceramic Disc for Dual Elements

TCA-110-127

Silicone/Glass Fiber for Single Element Only

TCA-110-128

Ceramic Disc for Six Wire

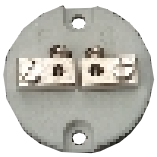
TCA-110-129

Die Cast Aluminum Heads

- Plated chain attaches cover to body
- Body is "O" Ring gasketed
- Available in Single (2 wire) or Duplex (4 wire)
- Comes in three sizes—Standard, Medium and Miniature to allow for design flexibility
- Has grommeted conduit entry for lead wire or flexible cable

Standard Size Head

3½"H × 4"L × 3¼"W



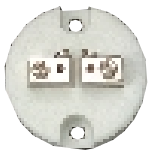
Single Terminal Block
P/N: TCA-116-101

Duplex Terminal Block
P/N: TCA-116-102

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number				
		Head Only	Head with Single	*CODE	Head with Duplex	*CODE
¾"	½"	TCA-110-104	TCH10001	01	TCH10003	03
½"	½"	TCA-110-105	TCH10002	02	TCH10004	04

Medium Die Cast Aluminum Head

3½"H × 3¾"L × 2⅝"W



Single Terminal Block
P/N: TCA-116-103

Duplex Terminal Block
P/N: TCA-116-104

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number				
		Head Only	Head with Single	*CODE	Head with Duplex	*CODE
½"	⅜"	TCA-110-106	TCH10005	05	TCH10008	08
⅜"	⅜"	TCA-110-107	TCH10006	06	TCH10009	09
¼"	⅜"	TCA-110-108	TCH10007	07	TCH10010	10

Miniature Die Cast Aluminum Head

2⅝"H × 3"L × 2⁵⁄₁₆"W

Single Terminal Block
P/N TCA-116-105

Duplex Terminal Block
P/N TCA-116-106

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number				
		Head Only	Head with Single	*CODE	Head with Duplex	*CODE
½"	⅜"	TCA-110-109	TCH10011	11	TCH10014	14
⅜"	⅜"	TCA-110-110	TCH10012	12	TCH10015	15
¼"	⅜"	TCA-110-111	TCH10013	13	TCH10016	16

***CODE** Number indicates Head Style to be inserted in Part Number for thermocouple and RTD Assemblies

Universal Series

- Designed for heavy process and industrial applications
- Available in Cast Iron or Cast Aluminum
- Single or Duplex, high temperature terminal blocks will accept up to 8 gauge wire
- Terminal blocks are provided with a 3/32" diameter access hole to allow checking of the working thermocouple with an external 1/16" diameter thermocouple

Single Terminal Block
P/N TCA-116-109

Duplex Terminal Block
P/N TCA-116-110

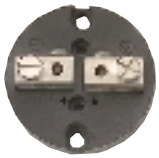
Material	Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number: Head Only	Head with Single	*CODE	Head with Duplex	*CODE
Cast Iron	1"	3/4"	TCA-110-112	TCH10017	17	TCH10020	20
	3/4"	3/4"	TCA-110-113	TCH10018	18	TCH10021	21
	1/2"	3/4"	TCA-110-114	TCH10019	19	TCH10022	22
	1"	1/2"	TCA-110-115	TCH10023	23	TCH10026	26
	3/4"	1/2"	TCA-110-116	TCH10024	24	TCH10027	27
	1/2"	1/2"	TCA-110-117	TCH10025	25	TCH10028	28
Cast Aluminum	1"	3/4"	TCA-110-118	TCH10029	29	TCH10032	32
	3/4"	3/4"	TCA-110-119	TCH10030	30	TCH10033	33
	1/2"	3/4"	TCA-110-120	TCH10031	31	TCH10034	34
	1"	1/2"	TCA-110-121	TCH10035	35	TCH10038	38
	3/4"	1/2"	TCA-110-122	TCH10036	36	TCH10039	39
	1/2"	1/2"	TCA-110-123	TCH10037	37	TCH10040	40

Approximate Assembled Dimensions
4"H × 4" × 3½"W

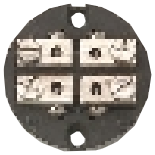
Bakelite Series

- Lightweight
- Non-combustible, Acid and Alkali resistant body
- Maximum service temperature of 662°F (350°C)
- Plated chain attaches cover to body
- Body is "O" Ring gasketed
- Available in Single (2 wire) or Duplex (4 wire)
- Has grommeted conduit entry for lead wire or flexible cable
- Available in two sizes: Standard and Small

Standard Size Bakelite Head



Bakelite
Single Terminal Block
P/N TCA-116-111



Bakelite
Duplex Terminal Block
P/N TCA-116-112

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number: Head Only	Head with Single	*CODE	Head with Duplex	*CODE
1/2"	1/2"	TCA-110-124	TCH10041	41	TCH10042	42

Approximate Size:
3⅞"H × 4⅛"L × 3 3/16"W

Miniature Size Bakelite Head

Bakelite
Single Terminal Block
P/N TCA-116-113

Bakelite
Duplex Terminal Block
P/N TCA-116-114

Sensor Opening (FNPT)	Conduit Opening (FNPT)	Part Number: Head Only	Head with Single	*CODE	Head with Duplex	*CODE
1/4"	3/8"	TCA-110-125	TCH10043	43	TCH10044	44

Approximate Size:
2⅝"H × 3"L × 2 5/16"W

***CODE** Number indicates Head Style to be inserted in Part Number for thermocouple and RTD Assemblies

Standard Quick Disconnect Plugs and Jacks

Hollow Pin Plug

- Quick, positive connections
- Bodies are ANSI color coded, glass filled nylon with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent
- Pins are made from matching thermocouple material except R and S which are compensated
- Plugs available in hollow or solid pins
- Plugs and Jacks are interchangeable with other thermocouple connectors with standard 7/16-inch spacing
- Can be imprinted with customer's own name (minimum order and tooling charge applies).

Solid Pin Plug

Jack

ANSI Calibration	Body Color	Part Number Hollow Pin Plug	Solid Pin Plug	Jack
J	Black	TCA-101-101	TCA-101-111	TCA-102-101
K	Yellow	TCA-101-102	TCA-101-112	TCA-102-102
T	Blue	TCA-101-103	TCA-101-113	TCA-102-103
E	Purple	TCA-101-107	TCA-101-114	TCA-102-107
N	Orange	TCA-101-108	TCA-101-115	TCA-102-108
R/S	Green	TCA-101-109	TCA-101-116	TCA-102-109
Cu	White	TCA-101-110	TCA-101-117	TCA-102-110

High Temperature Standard Quick Disconnect Plugs and Jacks

- All of the same features as the standard Plugs and Jacks except body color comes in "Brown" only
- Temperature rating of 500°F (260°C) continuous and 550°F (288°C) intermittent

ANSI Calibration	Body Color	Part Number Hollow Pin Plug	Solid Pin Plug	Jack
J	Brown	TCA-101-118	TCA-101-125	TCA-102-111
K	Brown	TCA-101-119	TCA-101-126	TCA-102-112
T	Brown	TCA-101-120	TCA-101-127	TCA-102-113
E	Brown	TCA-101-121	TCA-101-128	TCA-102-114
N	Brown	TCA-101-122	TCA-101-129	TCA-102-115
R/S	Brown	TCA-101-123	TCA-101-130	TCA-102-116
Cu	Brown	TCA-101-124	TCA-101-131	TCA-102-117

Miniature Quick Disconnect Plugs and Jacks

- Designed for light weight and to be space-saving
- Bodies are ANSI color coded, glass filled nylon with a temperature rating of 350°F (177°C) continuous and 400°F (204°C) intermittent
- Pins are made from matching thermocouple material except R and S which are compensated
- Plugs and Jacks are interchangeable with other miniature connectors
- Will accept wire from .001" to .032" and sheath diameters from .010" to .188"
- Negative pin marked with red disc
- Complements modern miniature instrumentation

Plug—Male

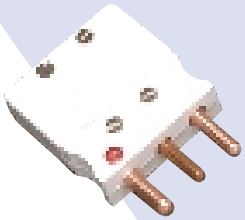
Jack—Female

ANSI Calibration	Body Color	Part Number Plug	Part Number Jack
J	Black	TCA-101-105	TCA-102-118
K	Yellow	TCA-101-104	TCA-102-119
T	Blue	TCA-101-132	TCA-102-120
E	Purple	TCA-101-133	TCA-102-121
N	Orange	TCA-101-134	TCA-102-122
R/S	Green	TCA-101-135	TCA-102-123
Cu	White	TCA-101-136	TCA-102-124

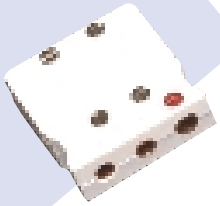
3-Pin Quick Disconnect Plugs and Jacks

Standard

- Standard 3-Pin Plugs and Jacks accept all accessories of the standard 2-Pin Plug and Jack except the spool type brazing adaptor and neoprene boot
- 3-Pin Plug is available with all three pins being solid or with the two thermocouple pins being hollow
- Has all the same features as the standard 2-Pin Plug and Jack



Plug—Male

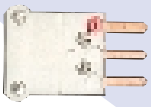


Jack—Female

ANSI Calibration	Body Color	Part Number Hollow Pin Plug	Part Number Solid Pin Plug	Part Number Jack
J	Black	TCA-101-137	TCA-101-143	TCA-102-125
K	Yellow	TCA-101-138	TCA-101-144	TCA-102-126
T	Blue	TCA-101-139	TCA-101-145	TCA-102-127
E	Purple	TCA-101-140	TCA-101-146	TCA-102-128
R/S	Green	TCA-101-141	TCA-101-147	TCA-102-129
Cu	White	TCA-101-142	TCA-101-148	TCA-102-130

Miniature

- Has all the same standard features as the 2-Pin miniature Plug and Jack
- The miniature 3-Pin Plugs and Jacks will accept all accessories of the 2-Pin Plugs and Jacks except the cable clamp and neoprene boot



Plug—Male

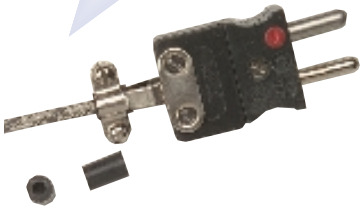
Jack—Female

ANSI Calibration	Body Color	Part Number Plug	Part Number Jack
J	Black	TCA-101-149	TCA-102-131
K	Yellow	TCA-101-150	TCA-102-132
T	Blue	TCA-101-151	TCA-102-133
E	Purple	TCA-101-152	TCA-102-134
R/S	Green	TCA-101-153	TCA-102-135
Cu	White	TCA-101-154	TCA-102-136

Accessories for Standard Plugs and Jacks

Cable Clamps

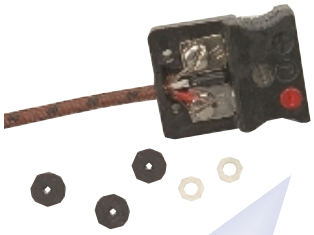
For ⅜" Diameter sheath or ¼" armor cable
Cable Clamp
(Part Number TCA-107-102)



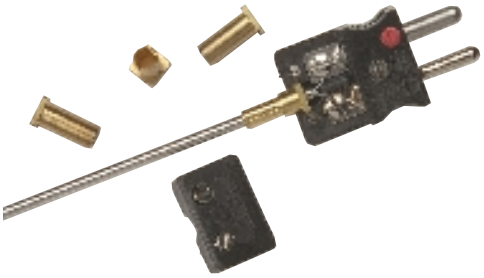
For Lead wire with or without Braid
Cable Clamp
(Part Number TCA-107-106)
Neoprene Grommet
(Part Number TCA-109-102)

Neoprene Wire Entrance Grommets

Nylon Wire Protection Washers



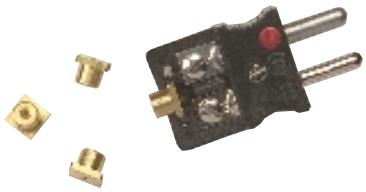
Grommets used in place of Cable Clamp.
(Part Number TCA-109-103)
Washer protects fine wire from breakage.
(Part Number TCA-120-101)



Brass Crimping Inserts

Used Primarily with TEMPCO-PAK

Sheath Diameter	Part Number
Undrilled	TCA-112-101
.020" (0.5 mm)	TCA-112-102
.040" (1.0 mm)	TCA-112-103
.063" (1.6 mm)	TCA-112-104
.125" (3.17 mm)	TCA-112-105
.188" (4.77 mm)	TCA-112-106
.250" (6.35 mm)	TCA-112-107
.118" (3.0 mm)	TCA-112-108
.177" (4.5 mm)	TCA-112-109
.236" (6.0 mm)	TCA-112-110



Brass Brazing Inserts

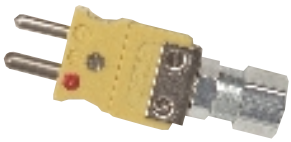
Can be used with Tubing or TEMPCO-PAK

Sheath Diameter	Part Number
Undrilled	TCA-113-101
.020" (0.5 mm)	TCA-113-102
.040" (1.0 mm)	TCA-113-103
.063" (1.6 mm)	TCA-113-104
.125" (3.17 mm)	TCA-113-105
.188" (4.77 mm)	TCA-113-106
.250" (6.35 mm)	TCA-113-107
.236" (6.0 mm)	TCA-113-108

Accessories for Standard Plugs and Jacks

Compression Type Tube Adaptors

- Can be used with TEMPCO-PAK or Tubing
- Both types have Brass Ferrules



Standard Tube Adaptors

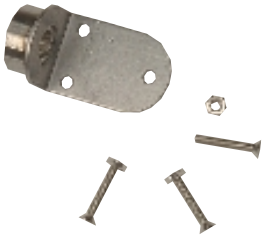
Affords higher degree of stability to Plug or Jack

Sheath Diameter	Part Number
.040"	TCA-103-106
.063"	TCA-103-102
.125"	TCA-103-101
.188"	TCA-103-103
.250"	TCA-103-104
.313"	TCA-103-107
.375"	TCA-103-108

Insert Tube Adaptor

Secured by slots in body of the Plug or Jack (2-Pin or 3-Pin)

Sheath Diameter	Part Number
.040"	TCA-103-109
.063"	TCA-103-110
.125"	TCA-103-111



Stainless Steel Spool-Type Brazing Adaptors

- Provides maximum rigidity to Plug or Jack
- For 2-Pin connectors only

Sheath Diameter	Part Number
Undrilled	TCA-113-109
.063"	TCA-113-110
.125"	TCA-113-111
.188"	TCA-113-112
.250"	TCA-113-113
.313"	TCA-113-114
.375"	TCA-113-115

Neoprene Boots for Standard Plug and Jack

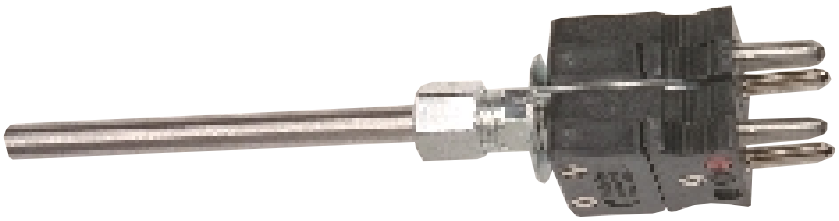
- Made of Flexible Neoprene
- Sized to cover standard connectors even with accessories (such as Cable Clamps and Tube Adaptors)
- 3/32" Wire Entrance
- Order 2 per Assembly
- For 2-Pin Connections only

Part Number TCA-121-101

Dual Tube Adaptors

- Assemble Standard Connectors into Dual Connectors
- For adjacent TEMPCO-PAK
- Has Brass Ferrule
- Use 2-Pin Connectors only

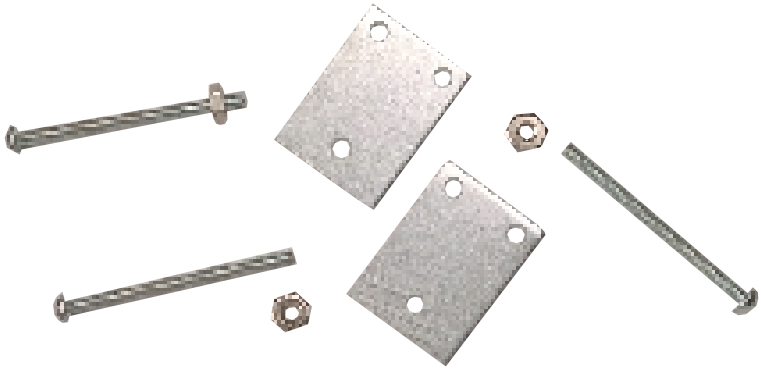
Sheath Diameter	Part Number
.063"	TCA-103-112
.125"	TCA-103-113
.188"	TCA-103-114
.250"	TCA-103-115
.313"	TCA-103-116
.375"	TCA-103-117



Dual Cable Clamps

- Assemble Standard Connectors into Dual Connectors
- Accommodate either One or Two Lead-In Cables
- Use 2-Pin Connectors only

Part Number: TCA-107-103

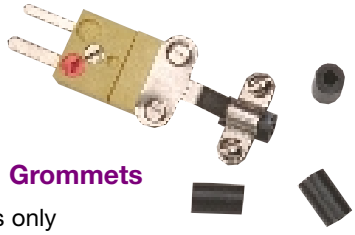


Filler Plate Set

- When combined with Dual Tube Adaptor or Dual Cable Clamp, the Filler Plate Set provides the ¾" pin spacing of a single Duplex Connector

Part Number: TCA-107-104

Accessories for Miniature Plugs and Jacks

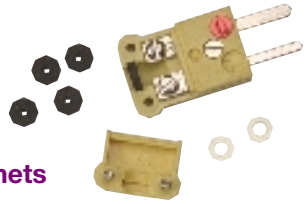


Cable Clamps and Grommets

- For 2-Pin Miniatures only

Cable Clamp
(Part Number TCA-107-105)

Neoprene Grommet
(Part Number TCA-109-102)

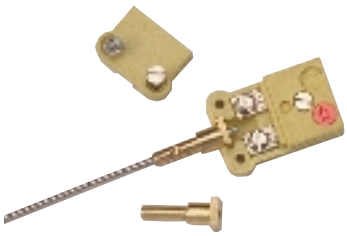


Neoprene Wire Entrance Grommets
Nylon Wire Protection Washers

- For all Miniature Connectors
- Grommet is used in place of cable clamp
- Washer protects fine wire from breakage

Grommet
(Part Number TCA-109-104)

Washer
(Part Number TCA-120-102)



Crimping Inserts

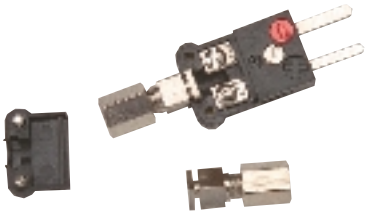
- For all Miniature Connectors
- Used primarily with TEMPCO-PAK

Sheath Diameter (in)	(mm)	Part Number
Undrilled		TCA-112-111
.020	.50	TCA-112-112
.040	1.00	TCA-112-113
.063	1.60	TCA-112-114
.125	3.17	TCA-112-115
.188	4.77	TCA-112-116

Brazing Inserts

- For all Miniature Connectors
- Can be used with Tubing or TEMPCO-PAK

Sheath Diameter (in)	(mm)	Part Number
Undrilled		TCA-113-116
.020	.50	TCA-113-117
.040	1.00	TCA-113-118
.063	1.60	TCA-113-119
.125	3.17	TCA-113-120
.188	4.77	TCA-113-121



Mini Insert Tube Adaptor

- Secured by slots in body of the Plug or Jack (2-pin or 3-Pin)
- Compression Fitting has Brass Ferrules
- Can be used with TEMPCO-PAK or Tubing
- For all Miniature Connectors only

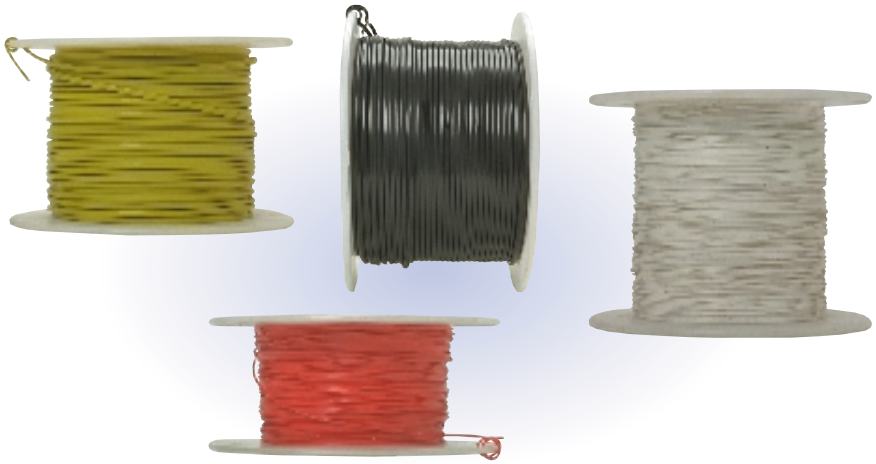
Sheath Diameter (in)	(mm)	Part Number
.040	1.00	TCA-103-118
.063	1.60	TCA-103-119
.125	3.17	TCA-103-120

Neoprene Boot for Miniature Plug and Jack

- Made of Flexible Neoprene
- Sized to cover miniature connectors even with accessories (such as Cable Clamps and Tube Adaptors)
- 3/32" Wire Entrance
- Order 2 per Assembly
- For 2-Pin Connections only

Part Number: TCA-121-102

Insulated Thermocouple and Extension Wire



● Glass Braided

● Double Glass Wrap

● High Temperature Glass Braid

● Polyvinyl (PVC)

● FEP Extr.

● Kapton*

● Polyvinyl (PVC) with Drain Wire & Aluminum/Mylar Shield

● Vitreous Silica Fiber

● Ceramic Fiber

● Stainless Steel or Tinned Copper Overbraid

● Stainless Steel Wrap

Color-Coding

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

ANSI Type		Magnetic		ANSI Color-Code		
T/C	Single	YES	NO	Single	Overall Extension Wire	Overall T/C Wire
B	BP BN		X X	Grey Red	Grey	—
E	EP EN		X X	Purple Red	Purple	Brown
J	JP JN	X	 X	White Red	Black	Brown
K	KP KN	X	X	Yellow Red	Yellow	Brown
N	NP NN		X X	Orange Red	Orange	Brown
R, S	RP, SP RN, SN		X X	Black Red	Green	—
T	TP TN		X X	Blue Red	Blue	Brown

Construction and Characteristics

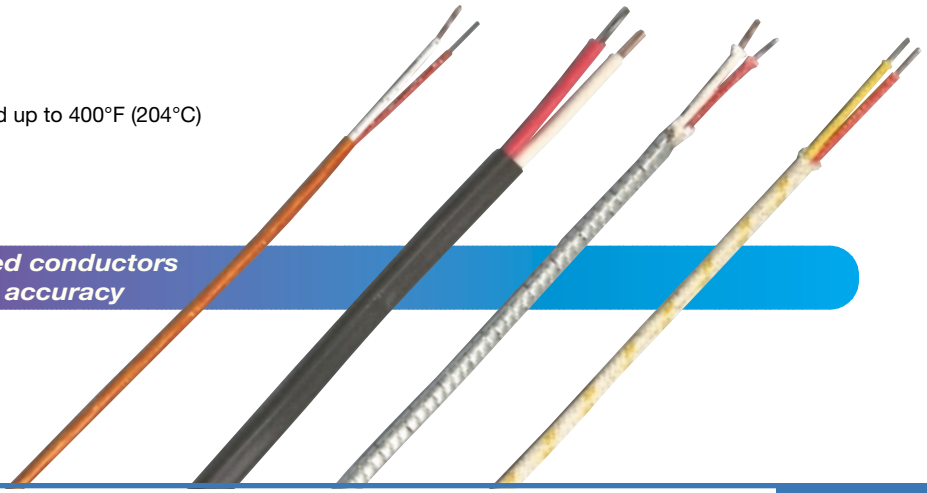
Single Conductor		Duplex Conductors		Temperature Rating†		ANSI Color Coded	Physical Properties			Notes
Insulation	Impregnation	Insulation	Impregnation	Continuous	Single Reading		Abrasion Resist.	Moisture Resist.	Chemical Resist.	
Glass Braid	Silicone Modified Resin	Glass Braid	Silicone Modified Resin	900°F (482°C)	1000°F (538°C)	Yes	Fair	Good	Good	Impregnation retained to 400°F (204°C)
Double Glass Wrap	Silicone Modified Resin	Glass Braid	Silicone Modified Resin	900°F (482°C)	1000°F (538°C)	Yes	Fair	Good	Good	Impregnation retained to 400°F (204°C)
High Temp Glass Braid	High Temp Varnish	High Temp Glass Braid	—	1300°F (704°C)	1600°F (871°C)	Yes	Good	Good	Good	Impregnation retained to 400°F (204°C)
Polyvinyl (PVC)	—	Polyvinyl (PVC)	—	-20 to +221°F (-29 to105°C)	—	Yes	Good	Excellent	Good	—
FEP Extr.	—	FEP Extr.	—	400°F (204°C)	500°F (260°C)	Yes	Excellent	Excellent	Excellent	—
Kapton*	—	Kapton*	—	500°F (260°C)	—	Yes Indiv. only	Excellent	Excellent	Excellent	—
Polyvinyl (PVC)	—	Polyvinyl (PVC) Twisted	—	-20 to +221°F (-29 to +105°C)	—	Yes	Good	Excellent	Good	Aluminum/Mylar shield with Drain Wire
Vitreous Silica Fiber	—	Vitreous Silica Fiber	—	1600°F (871°C)	2000°F (1093°C)	No	Fair	Fair	Good	—
Ceramic Fiber	—	Ceramic Fiber	—	2200°F (1204°C)	2600°F (1427°C)	No	Good	Fair	Good	—

Stainless Steel or Tinned Copper Overbraid

Stainless Steel Wrap

* Trade name of E.I. DuPont de Nemours & Co.

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



High quality insulated conductors for long life and accuracy

T/C Wire Specifications

ANSI Letter designations

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

ANSI Letter	Description	Popular Generic and Trade Names†
B	BP BN	Platinum 30% Rhodium Platinum 6% Rhodium
E	EP EN	Chromel, Tophel, HAI-KP Constantan, Cupron, Advance
J	JP JN	Iron Constantan, Cupron, Advance
K	KP KN	Chromel, Tophel, HAI-KP Alumel, Nial, HAI-KN
N	NP NN	Nicrosil Nisil
R	RP RN	Platinum 13% Rhodium Pure Platinum
S	SP SN	Platinum 10% Rhodium Pure Platinum
T	TP TN	Copper Constantan, Cupron, Advance

†Trade names: Cupron, Nial and Tophel–Carpenter Technology • Advance, HAI-KP, and HAI-KN-Harrison alloys Co.• Chromel and Alumel-Hoskins Mfg. Co.

Initial Calibration Tolerances For Thermocouple Extension Wires

Reference Junction 0°C (32°F)				
Extension Wire Type	Temperature Range (°C)	Temperature Range (°F)	Tolerances Standard (°C)	Tolerances Special (°C)
EX	0-200	32-392	±1.7	±1.0
JX	0-200	32-392	±2.2	±1.1
KX	0-200	32-392	±2.2	±1.1
NX	0-200	32-392	±2.2	±1.1
TX	0-100	32-212	±1.0	±0.5

Initial Calibration Tolerances For Thermocouple Extension Wires

Reference Junction 0°C (32°F)					
Thermo-couple Type	Compen-sating Wire Type	Temperature Range (°C)	Temperature Range (°F)	Tolerances† (°C)	Tolerances† (°F)
R, S	SX*	0-200	32-392	±7	±12
B	BX#	0-100	32-212	+0,–3.7	+32,–6

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

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

*Copper (+) versus copper nickel alloy (–).

#Copper versus copper compensating extension wire, usable to 100°C (212°F) with maximum deviations as indicated, but with no significant deviation over 0°C to 50°C (32°F to 122°F) range.

ANSI Tolerances

All thermocouple wire and extension wire is supplied to meet Standard Tolerances of ANSI Circular MC96.1–1982. Special tolerances are also available per ANSI MC96.1 at an extra charge. The standard and special tolerances for thermocouple and extension wires are given in the accompanying tables. Where tolerances are given in percent, the percentage applies to the temperature being measured.

Initial Calibration Tolerances for Thermocouples

Reference Junction 0°C (32°F)				
Thermocouple Type	Temperature Range (°C)	Temperature Range (°F)	Tolerances† (whichever is greater) Standard	Tolerances† (whichever is greater) Special
B	870-1700	1598-3092	± 0.5%	—
E	0-900	32-1652	±1.7°C *OR* ± 0.5%	±1.1°C *OR* ± 0.4%
J	0-750	32-1382	±2.2°C *OR* ± 0.75%	±1.1°C *OR* ± 0.4%
K	0-1250	32-2282	±2.2°C *OR* ± 0.75%	±1.1°C *OR* ± 0.4%
N	0-1250	32-2282	±2.2°C *OR* ± 0.75%	±1.1°C *OR* ± 0.4%
R or S	0-1450	32-2642	±1.5°C *OR* ± 0.25%	±0.6°C *OR* ± 0.1%
T	0-350	32-662	±1.0°C *OR* ± 0.75%	±0.5°C *OR* ± 0.4%

†Where tolerances are given in percent, the percentage applies to the temperature being measured in degrees Celsius. For example, the standard tolerance of Type J over the temperature range 277°C to 750°C is ±0.75 percent. If the temperature being measured is 538°C, the tolerance is ±0.75 percent of 538, or ±4.0°C. To determine the tolerance in °F: Multiply the tolerance in °C by 9 and divide by 5.

Calibration and Certification

Thermocouple wire and elements can be factory calibrated and certified at an extra charge. Each thermocouple, coil, reel, or spool of wire is then tagged to show the individual departure from curve.

The normal calibrating temperature range is 32°F–2000°F (0°C–1093°C), depending on wire type, gauge size and insulation type.

A certificate of calibration is furnished for all calibrated items upon request. Each item calibrated is also tagged with the results.

Many of the insulated thermocouple and extension wire constructions listed on the following pages are available with Stainless Steel or Tinned Copper overbraid or Stainless Steel wrap as an option.

ANSI Type "J" Duplex

ANSI color code—White positive/Red negative—Overall Brown (fiberglass and SS Braid w/black tracer)

B & S GA	ANSI Type	Nominal Overall Dimensions	Wire Type	Maximum Temp. °F	°C	Insulation Each Conductor	Insulation Overall	Part Number	Category See Pg. 14-59
20	J	.066 × .118	Stranded (7/28)	900	482	Glass Braid	Glass Braid	TCW-101-109	A
20	J	.088 × .140	Stranded (7/28)	900	482	Glass Braid	Glass Braid w/ S.S. Braid O/A	TCW-101-106	A
20	J	.060 × .106	Solid	900	482	Glass Braid	Glass Braid	TCW-101-110	A
20	J	.068 × .116	Solid	400	204	Extruded (FEP) teflon	Extruded (FEP) teflon	TCW-101-111	A
20	J	.055 × .099	Solid	500	260	Color coded Kapton tape	Amber colored Kapton tape	TCW-101-112	A
24	J	.043 × .074	Solid	900	482	Double Glass wrap	Glass Braid	TCW-101-113	A
30	J	.033 × .054	Solid	900	482	Double Glass wrap	Glass Braid	TCW-101-114	C
20	J	.086 × .136	Solid	1300	704	Hi-temp Glass Braid	Hi-temp Glass Braid	TCW-101-115	B
24	J	.046 × .092	Solid	221	105	PVC (extruded)	non-rip-cord construct.	TCW-101-116	C

ANSI Type "JX" Thermocouple Extension Wire

Duplex construction—ANSI color code—White positive/Red negative—overall Black

B & S GA	ANSI Type	Nominal Overall Dimensions	Wire Type	Maximum Temp. °F	°C	Insulation Each Conductor	Insulation Overall	Part Number	Category See Pg. 14-59
20	JX	.092 × .154	Solid	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-102-102	A
20	JX	.098 × .166	Stranded (7/28)	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-102-103	A
20	JX	.169 round	Solid	221	105	PVC/twisted w/alum mylar tape shield & bare drain wire	Polyvinyl (PVC)	TCW-102-104	A
16	JX	.111 × .192	Solid	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-102-105	A
16	JX	.207 × round	Solid	221	105	PVC/twisted w/alum mylar tape shield & bare drain wire	Polyvinyl (PVC)	TCW-102-106	A

ANSI Type "J" Single Conductor Construction

Individual wires color code—Negative (JN) wire Red—Positive (JP) wire White

B & S GA	Conductor Type	Nominal O.D.	Wire Type	Max. Temp. °F	°C	Insulation Each Conductor	ANSI Color Code	Part Number	Category See Pg. 14-59
20	Iron (JP)	.050"	Stranded	900	482	Glass Braid	White	TCW-104-105	C
20	Constantan (JN)	.050"	Stranded	900	482	Glass Braid	Red	TCW-105-105	C
24	Iron (JP)	.036"	Stranded	900	482	Glass Braid	White	TCW-104-106	C
24	Constantan (JN)	.036"	Stranded	900	482	Glass Braid	Red	TCW-105-106	C

How To Order

See "How To Order" Box on Page 14-59.

ANSI Type "K" Duplex

Color code Yellow positive/Red negative—Overall Brown (fiberglass and SS braid w/Yellow tracer)

B & S GA	ANSI Type	Nominal Overall Dimensions	Wire Type	Maximum Temp. °F	°C	Insulation Each Conductor	Insulation Overall	Part Number	Category See Pg. 14-59
20	K	.060 × .116	Solid	900	482	Glass Braid	Glass Braid	TCW-103-104	A
20	K	.066 x .118	Stranded (7/28)	900	482	Glass Braid	Glass Braid	TCW-103-101	A
20	K	.088 × .140	Stranded (7/28)	900	482	Glass Braid	Glass Braid w/SS Braid O.A.	TCW-103-107	A
20	K	.068 × .116	Solid	400	204	Extruded (FEP) teflon	Extruded (FEP) teflon	TCW-103-109	A
20	K	.055 × .099	Solid	500	260	Color coded Kapton tape	Amber colored Kapton tape	TCW-103-110	A
24	K	.043 × .074	Solid	900	482	Double Glass wrap	Glass Braid	TCW-103-111	A
30	K	.033 × .054	Solid	900	482	Double Glass wrap	Glass Braid	TCW-103-112	C
20	K	.086 × .136	Solid	1300	704	Hi-temp Glass Braid	Hi-temp Glass Braid	TCW-103-113	A
20	Special Limits	.092 × .154	Solid	1600-2300	871-1260	Vitreous Silica braid "not color coded"	Vitreous Silica braid "not color coded"	TCW-103-114	A
20	K Special Limits	.092 × .154	Solid	2200-2600	1204-1426	Ceramic Fiber braid "not color coded"	Ceramic Fiber braid "not color coded"	TCW-103-115	A
24	K	.0436 × .092	Solid	221	105	PVC (extruded)	non-rip-cord construct.	TCW-103-116	C

ANSI Type "KX" Duplex Construction Insulated Thermocouple Wire

ANSI color code—Yellow positive/Red negative—Overall Yellow

B & S GA	ANSI Type	Nominal Overall Dimensions	Wire Type	Maximum Temp. °F	°C	Insulation Each Conductor	Insulation Overall	Part Number	Category See Pg. 14-59
20	KX	.092 × .154	Solid	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-117-101	A
20	KX	.098 × .166	Stranded (7/28)	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-117-102	A
20	KX	.169 round	Solid	221	105	PVC/twisted w/alum mylar tape shield & bare drain wire	Polyvinyl (PVC)	TCW-117-103	A

ANSI Type "N" and "NX" Duplex Constructions Insulated Thermocouple and Extension Wire

ANSI color code—Orange positive/Red negative—Overall Brown (fiberglass w/Orange tracer)

B & S GA	ANSI Type	Nominal Overall Dimensions	Wire Type	Maximum Temp. °F	°C	Insulation Each Conductor	Insulation Overall	Part Number	Category See Pg. 14-59
20	N	.066 × .118	Solid	900	482	Glass Braid	Glass Braid	TCW-118-101	B
20	N	.092 × .154	Solid	1600-2300	871-1260	Vitreous Silica Braid	Vitreous Silica Braid	TCW-118-102	A
24	N	.043 × .074	Solid	900	482	Glass Braid	Glass Braid	TCW-118-103	B
20	NX	.092 × .154	Solid	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-119-101	C
20	NX	.098 × .166	Solid	221	105	PVC/twisted w/alum mylar tape shield & bare drain wire	Polyvinyl (PVC)	TCW-119-102	C

ANSI Type "T" and "TX" Duplex construction Insulated Thermocouple and Extension Wire

ANSI Type "T" color code—Blue positive/Red negative—Overall Brown (fiberglass w/Blue tracer)
ANSI Type "TX" color code—Blue positive/Red negative—Overall Blue

B & S GA	ANSI Type	Nominal Overall Dimensions	Wire Type	Maximum Temp. °F	°C	Insulation Each Conductor	Insulation Over-All	Part Number	Category See Pg. 14-59
20	T	.060 × .106	Solid	900	482	Glass Braid	Glass Braid	TCW-113-101	B
20	T	.068 × .116	Solid	400	204	Extruded (FEP) teflon	Extruded (FEP) teflon	TCW-113-102	A
24	T	.046 × .092	Solid	221	105	Polyvinyl (PVC)	non-rip-cord construction	TCW-113-103	C
24	T	.056 × .092	Solid	400	204	Extruded (FEP) teflon	Extruded (FEP) teflon	TCW-113-104	C
20	TX	.092 × .154	Solid	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-120-101	A
20	TX	.098 × .166	Stranded (7-28)	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-120-102	C
20	TX	.169 round	Solid	221	105	PVC/twisted w/alum mylar tape shield & bare drain wire	Polyvinyl (PVC)	TCW-120-103	A

ANSI Type "E" and "EX" Chromel/Constantan Duplex Construction Thermocouple and Extension Wire

ANSI color code—Purple positive/Red negative—Overall "E" Brown (fiberglass w/Purple tracer), "EX"—Purple

B & S GA	ANSI Type	Nominal Overall Dimensions	Wire Type	Maximum Temp. °F	°C	Insulation Each Conductor	Insulation Over-All	Part Number	Category See Pg. 14-59
20	E	.060 × .106	Solid	900	482	Glass Braid	Glass Braid	TCW-121-101	B
20	E	.060 × .104	Solid	500	260	TFE teflon tape	TFE teflon tape	TCW-121-102	B
20	EX	.092 × .154	Solid	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-122-101	C
20	EX	.169 round	Solid	221	105	PVC/twisted w/alum mylar tape shield & bare drain wire	Polyvinyl (PVC)	TCW-122-102	C

ANSI Type "R/SX" Copper/#11 Alloy Duplex Construction Insulated Extension Wire

ANSI color code—Black positive/Red negative—Overall Green (Compensating alloys for Type "S" and Type "R" thermocouples)

B & S GA	ANSI Type	Nominal Overall Dimensions	Wire Type	Maximum Temp. °F	°C	Insulation Each Conductor	Insulation Over-All	Part Number	Category See Pg. 14-59
20	RSX	.169 round	Solid	221	105	PVC/twisted w/alum mylar tape shield & bare drain wire	Polyvinyl (PVC)	TCW-123-101	C
20	RSX	.092 × .154	Solid	221	105	Polyvinyl (PVC)	Polyvinyl (PVC)	TCW-123-102	A
20	RSX	.068 × .116	Solid	400	204	Extruded (FEP) teflon	Extruded (FEP) teflon	TCW-123-103	C
20	RSX	.060 × .106	Solid	900	482	Glass Braid	Glass Braid	TCW-123-104	B

How To Order

Enter your order simply by stating the *Part Number* and *Length* in feet required.

Note: The wire is separated into three different categories with different minimum length per order requirements.

Category A
Wire is available on 1,000 foot spools. It can be "re-spooled" on 100 foot spools for a nominal charge.

Category B
Wire is available on 500 and 1,000 foot spools.

Category C
Wire is available only on 1,000 foot spools.

Please note: Tempco reserves the right to alter the category designations as needed.

Coil Cord Thermocouple Wire

Design/Special Features

- Complements modern instrumentation
- Designed to be space saving and convenient with excellent retractability
- Rated for 221°F (105°C) upper limit (above 104°F [40°C], coil form may change if stretched)
- ANSI Color Coded Outer Jacket
- Wire is 26 gauge stranded with PVC insulation and the outer jacket is polyurethane
- Available with mini plug molded on one end only for thermocouples and has open ends only for 3 wire RTD's
- Can be used with all available thermocouple or RTD plugs, jacks and cable clamps standard or miniature
- Open ends have approximately 4 inches straight

Calibration	Outer Jacket Color	Coil Length (in)	Extended Length Maximum (in)	Part Number †With Molded on Miniature Plug One End	Part Number †Both Ends Open
J	Black	12	60	TCW-124-101	TCW-125-101
J	Black	24	120	TCW-124-102	TCW-125-102
K	Yellow	12	60	TCW-124-103	TCW-125-103
K	Yellow	24	120	TCW-124-104	TCW-125-104
E	Purple	12	60	TCW-124-105	TCW-125-105
T	Blue	12	60	TCW-124-106	TCW-125-106
T	Blue	24	120	TCW-124-107	TCW-125-107
R/S	Green	12	60	TCW-124-108	TCW-125-108
R/S	Green	32	180	—	TCW-125-109
U(2 Wire uncompensated)	White	12	60	TCW-124-109	TCW-125-110
3 Wire RTD	White	12	60	—	TCW-125-111
3 Wire RTD	White	36	180	—	TCW-125-112

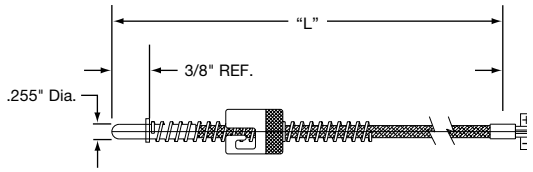
†Other configurations and lengths are available on special request. Minimum order may apply. Consult Tempco with your requirements.

Thermocouples for the Plastics Industry — Bayonet Styles

- Standard—ANSI Type "J"
- Standard Probe Material—304 Stainless Steel
- Standard Probe Diameter—3/16" (1/8" optional)
- For use up to 900°F (482°C)

Style 1—Spring Adjustable Bayonet Thermocouple

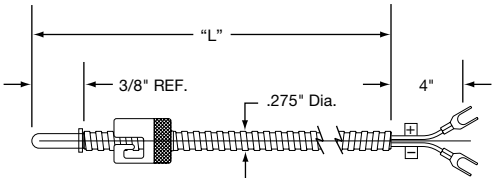
- Insertion length adjustable from 1" to 10"
- Forms easily to any angle
- One style can replace several fixed length thermocouples



Part Number	Termination Style†	"L" Dim. (in)
*TCP10001	S	48
*TCP10002	C	48
*TCP10003	P	48
*TCP10004	J	48
*TCP10005	B	48

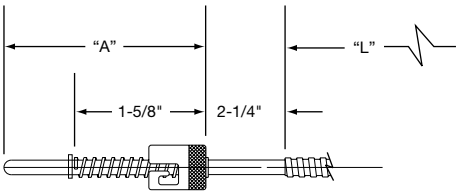
Style 2—Armor Cable Adjustable Bayonet Thermocouple

- Insertion length adjustable over length of armor cable
- Forms easily to any angle
- One style can replace several fixed length thermocouples



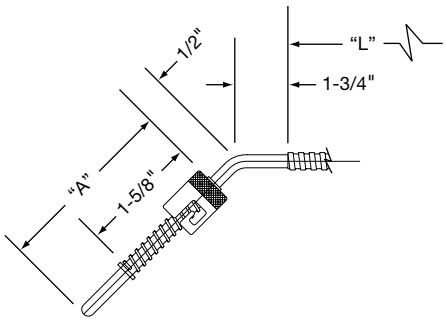
Part Number	Termination Style†	"L" Dim. (in)
*TCP20001	S	48
*TCP20002	C	48
*TCP20003	P	48
*TCP20004	J	48
*TCP20005	B	48

Style 3—Rigid Straight Bayonet Thermocouple



Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
*TCP30001	S	4	48
*TCP30002	C	4	48
*TCP30003	P	4	48
*TCP30004	J	4	48
*TCP30005	B	4	48

Style 4—Rigid 45° Bend Bayonet Thermocouple



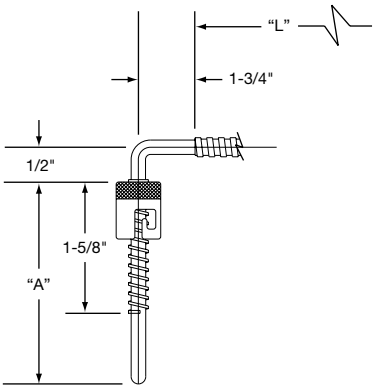
Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
*TCP40001	S	4	48
*TCP40002	C	4	48
*TCP40003	P	4	48
*TCP40004	J	4	48
*TCP40005	B	4	48

† See Page 14-63 for Termination Style descriptions.

STOCK ITEMS ORDER NOW! *

an asterisk next to the Part Number guarantees in-stock availability for same day shipping when ORDERED BY 2 PM CST

Style 5—Rigid 90° Bend Bayonet Thermocouple for use to 900°F (482°C)

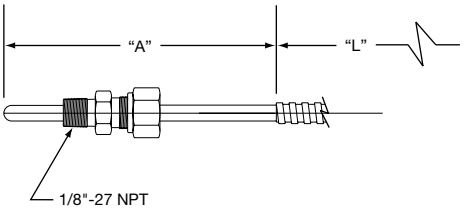


Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
*TCP50001	S	4	48
*TCP50002	C	4	48
*TCP50003	P	4	48
*TCP50004	J	4	48
*TCP50005	B	4	48

Thermocouples for the Plastics Industry — Compression Fitting Styles

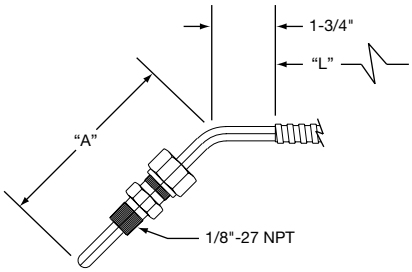
- Standard Calibration—ANSI Type "J"
- Standard Probe Material 304 Stainless Steel
- Standard Probe Diameter—3/16"
- For use up to 900°F (482°C)
- One Time Adjustable, 1/8"-27 NPT Brass Compression Fitting

Style 6—Rigid Straight Compression Fitting Thermocouple



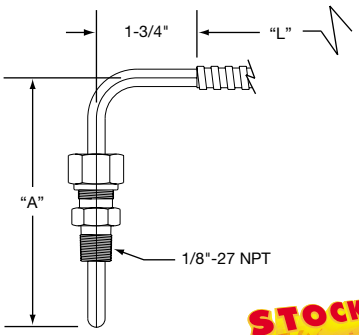
Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
*TCP60001	S	4	48
*TCP60002	C	4	48
*TCP60003	P	4	48
*TCP60004	J	4	48
*TCP60005	B	4	48

Style 7—Rigid 45° Bend Compression Fitting Thermocouple



Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
*TCP70001	S	4	48
*TCP70002	C	4	48
*TCP70003	P	4	48
*TCP70004	J	4	48
*TCP70005	B	4	48

Style 8—Rigid 90° Bend Compression Fitting Thermocouple



Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
*TCP80001	S	4	48
*TCP80002	C	4	48
*TCP80003	P	4	48
*TCP80004	J	4	48
*TCP80005	B	4	48

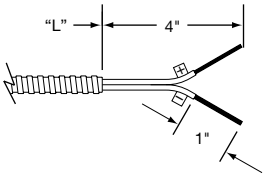
†See Page 14-63 for Termination Style descriptions.

STOCK ITEMS ORDER NOW! ®

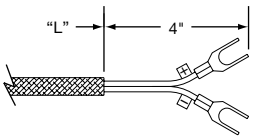
an asterisk next to the Part Number guarantees in-stock availability for same day shipping when ORDERED BY 2 PM CST

Termination Styles

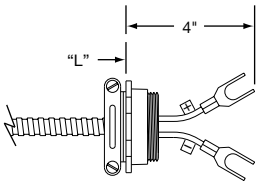
Style B—Plain Ends



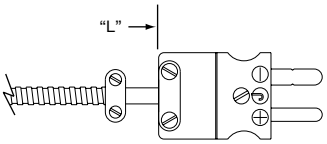
Style S—Spade Lugs



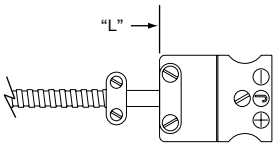
Style C—Spade Lugs with BX connector



Style P—Standard Plug



Style J—Standard Jack



How to Order

Catalog Thermocouples

Order by Part number for stock Thermocouples.

Custom Manufactured Thermocouples

For other sizes, ratings and accuracy, **TEMPCO** will design and manufacture a Thermocouple to meet your requirements.

Please Specify the following:

- ❑ Model Prefix (TCP)
- ❑ Length of "L" in inches
- ❑ Length of "A" in inches
- ❑ Style Number 1 through 8 (See Pages 14-61 and 14-62)
- ❑ Calibration: J, T, K or E
- ❑ Termination Style Code (B, S, C, P or J)
- ❑ Probe Diameter (3/16" Standard, 1/8" optional)

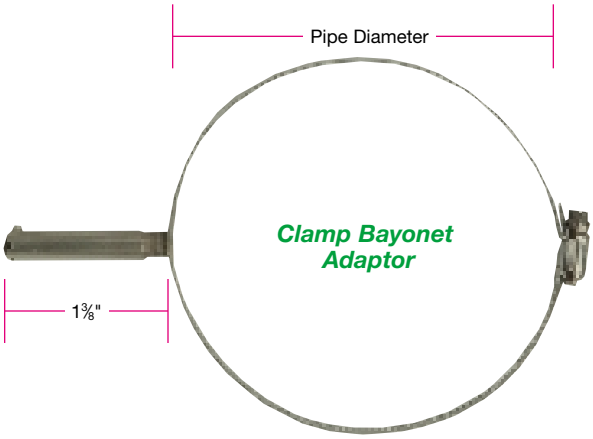
Pipe Clamp Adaptors for Bayonet Type Thermocouples

Spring loaded bayonet cap type thermocouples are used in conjunction with bayonet adaptors. After inserting the thermocouple sheath through the adaptor the spring is compressed and locked by the cap pushing the sensing junction tight against the surface being measured for increased accuracy and faster response time.

Pipe Clamp adaptors permit thermocouple placement without the drilling and tapping of holes to attach the adaptor.

Threaded adaptors are on the next page.

Part Number	Pipe Diameter (in) Min.	Max.
TCH00001	1/2	7/8
TCH00002	7/8	1 1/2
TCH00003	1 5/16	2 1/4
TCH00004	2 1/4	3 5/16
TCH00005	3 5/16	4 1/4
TCH00006	4 5/16	5 1/4



Bayonet Adaptors

Spring-Loaded Bayonet Cap Type Thermocouples are used in conjunction with bayonet adaptors. After inserting the thermocouple sheath through the adaptor the spring is compressed and locked by the cap pushing the sensing junction tight against the surface being measured for increased accuracy and faster response time.

Adaptor Selection and Installation

1. Select an adaptor length by comparing the hole depth and thermocouple probe length in Table 1A.
2. Select from Table 1B a thread type for the adaptor length you determined in Table 1A.

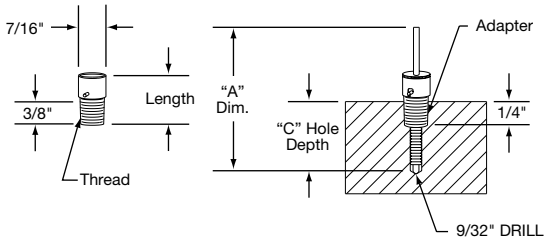


Table 1A—Adaptor Length for Bayonet Type Thermocouples

Hole "C" (in)	Probe Length A (in) 7/8" Long Adaptor	1 3/8" Long Adaptor	2 1/2" Long Adaptor
1/4 to 1/2	1 5/8	2	3 1/8
1/2 to 1	2	2 1/2	3 5/8
1 to 1 1/2	2 1/2	3	4 1/8
2 to 2 1/2	3 1/2	4	5 1/8
2 1/2 to 3	4	4 1/2	5 5/8
3 to 3 1/2	4 1/2	5	6 1/8
3 1/2 to 4	5	5 1/2	6 5/8
4 to 4 1/2	5 1/2	6	7 1/8
4 1/2 to 5	6	6 1/2	7 5/8
5 to 5 1/2	6 1/2	7	8 1/8
5 1/2 to 6	7	7 1/2	8 5/8
6 to 6 1/2	7 1/2	8	9 1/8

Table 1B—Bayonet Adaptor for Threaded Type Thermocouples

Part Number	Length (in)	Thread
TCA-104-101	7/8	1/8-27 NPT
TCA-104-102	7/8	3/8-24 UNF
TCA-104-103	1 3/8	1/8-27 NPT
TCA-104-104	1 3/8	3/8-24 UNF
TCA-104-105	2 1/2	1/8-27 NPT
TCA-104-106	2 1/2	3/8-24 UNF
TCA-104-107	2 3/8	14 ×1.5mm
TCA-104-108	2 1/2	10 ×1.5mm

How to Order

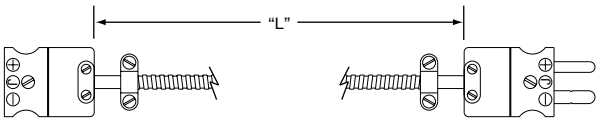
Extension Cable Assemblies

Please Specify Style and "L" Dimension

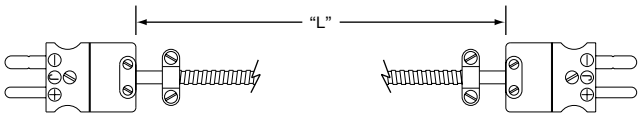
Calibration— All styles are available in ANSI Type J, K, T, E, R/S, N and are made with 3/16" flexible armor cable.

Standard Lead Time:

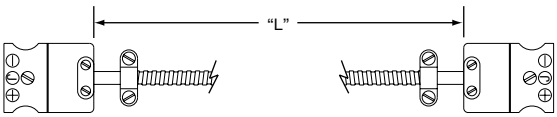
ANSI type J and K— **2 weeks**
ANSI type T, E, R/S, and N— **4 weeks**



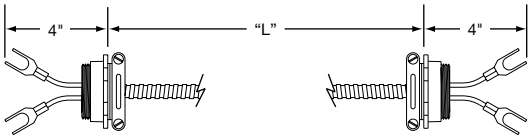
Style JP—Jack to Plug



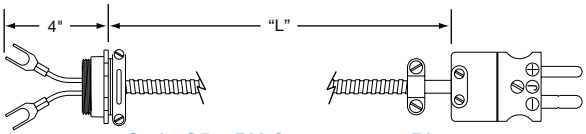
Style PP—Plug to Plug



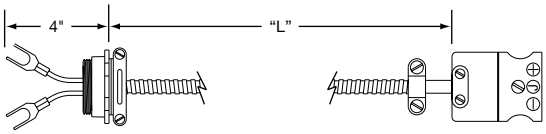
Style JJ—Jack to Jack



Style CC—BX Connector to BX Connector



Style CP—BX Connector to Plug



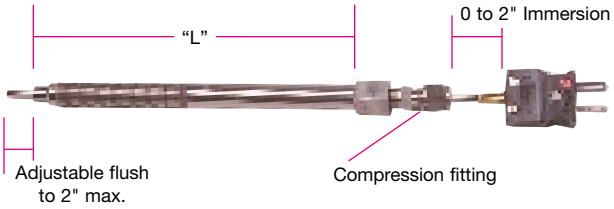
Style CJ—BX Connector to Jack

Plastic Extruder Melt Bolt Thermocouples

Bolt Material	Probe Material	Probe Diameters	Calibration	Junction Styles
Stainless Steel	Stainless Steel	Standard ⅛"	ANSI Type "J" (Iron-Constantan)	Closed end grounded

Style A—Adjustable Tip

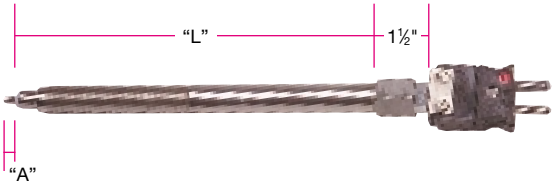
- Eliminates excess inventory
- Tip can be field adjusted from flush to 2 inches
- Mgo insulated
- Can be installed wherever standard melt thermocouples are in use
- Bolt with Teflon® insert at tip has a maximum operating temperature of 500°F (260°C). Without insert 1400°F (760°C).



Thermocouple Diameter	Part Number Without Teflon Insert L = 3"	Part Number Without Teflon Insert L = 6"	Part Number With Teflon Insert L = 3"	Part Number With Teflon Insert L = 6"
⅛"†	TCP00001	TCP00002	TCP00003	TCP00004
3⁄16"	TCP00005	TCP00006	N/A	N/A

†For ⅛" Diameter, it is not recommended to immerse tip more than 1" due to bending and breakage in melt flow.

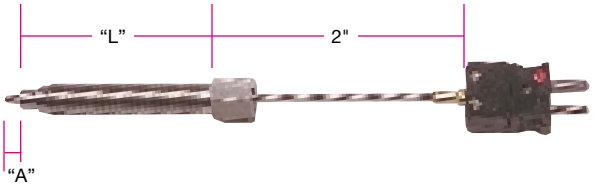
Style R—Rigid Plug



Insulation—MgO or Fiberglass

Part Number MgO Insulation	"A" (in)	"L" (in)	Part Number Fiberglass Insulation
TCP00027	Flush	3	TCP00037
TCP00028	¼	3	TCP00038
TCP00029	½	3	TCP00039
TCP00030	¾	3	TCP00040
TCP00031	1	3	TCP00041
TCP00032	Flush	6	TCP00042
TCP00033	¼	6	TCP00043
TCP00034	½	6	TCP00044
TCP00035	¾	6	TCP00045
TCP00036	1	6	TCP00046

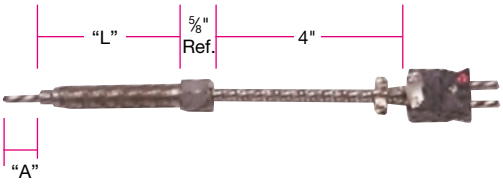
Style E—Extension Mounted Plug



Insulation—MgO or Fiberglass

Part Number MgO Insulation	"A" (in)	"L" (in)	Part Number Fiberglass Insulation
TCP00007	Flush	3	TCP00017
TCP00008	¼	3	TCP00018
TCP00009	½	3	TCP00019
TCP00010	¾	3	TCP00020
TCP00011	1	3	TCP00021
TCP00012	Flush	6	TCP00022
TCP00013	¼	6	TCP00023
TCP00014	½	6	TCP00024
TCP00015	¾	6	TCP00025
TCP00016	1	6	TCP00026

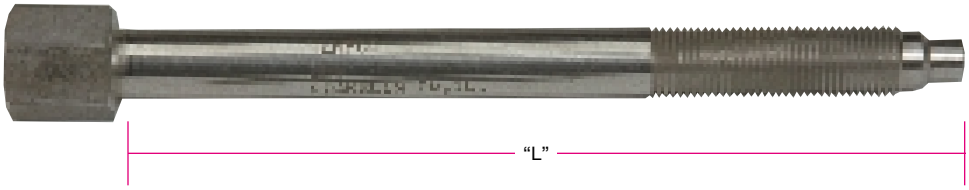
Style F—Flexible Mount Plug



Insulation—Fiberglass only

"A" (in)	"L" (in)	Part Number Fiberglass Insulation
Flush	3	TCP00047
¼	3	TCP00048
½	3	TCP00049
¾	3	TCP00050
1	3	TCP00051
Flush	6	TCP00052
¼	6	TCP00053
½	6	TCP00054
¾	6	TCP00055
1	6	TCP00056

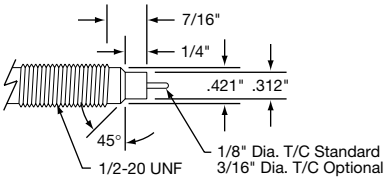
Plastic Melt Bolts



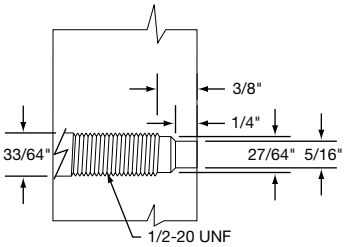
The Blank Bolt is used to seal hole if thermocouple is removed from extruder.

Note: All bolts except Blank Bolts are drilled to accept ⅛" diameter thermocouple

Detailed Dimensions for Plastic Melt Bolts



Bolt-Tip Dimensions



Recommended drilling dimensions for proper mounting in extruder.

Length "L"	Blank	With ⅛" Diameter Hole	with Teflon Insert	To make Style "R" *	To make Style "R" w/teflon insert *	To make Style "F"	To make Style "F" w/Teflon Insert
3"**	FAS-116-101	FAS-116-103	FAS-116-105	FAS-116-107	FAS-116-109	FAS-116-111	FAS-116-113
6"**	FAS-116-102	FAS-116-104	FAS-116-106	FAS-116-108	FAS-116-110	FAS-116-112	FAS-116-114

* Includes hardware to mount plug ** 300 series stainless steel

How to Order

Catalog Extruder Melt Bolt Thermocouples and Plastic Melt Bolts

Order by Part Number

Custom Engineered/Manufactured Extruder Melt Bolt Thermocouples

Bolt Material: Stainless Steel
Probe Material: Stainless Steel
Probe Diameters: ⅛"— Standard
3⁄16"— *Specify*
Calibrations: Type J Iron-Constantan—Standard.
Type T Copper-Constantan—*Specify*
Type K Chromel-Alumel—*Specify*
Insulation: Fiberglass—Standard (MgO *Specify*)
Junction Styles: Closed end grounded—Standard
† Closed end ungrounded—*Specify*
† Exposed end—*Specify*

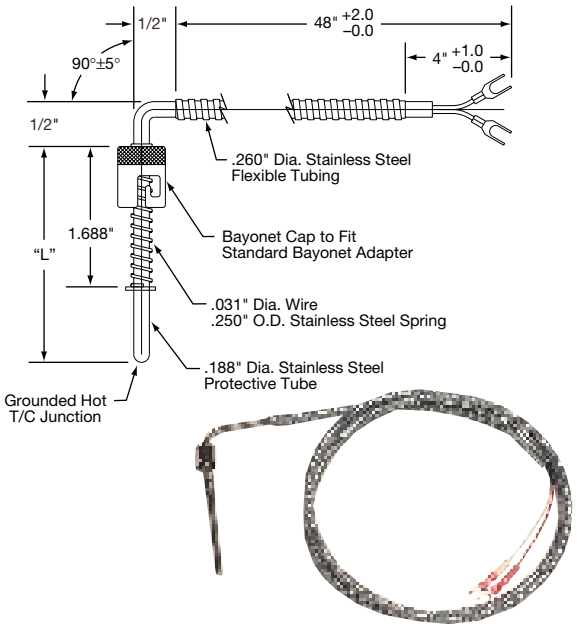
† For MgO insulated thermocouples only

OEM Replacement Thermocouples

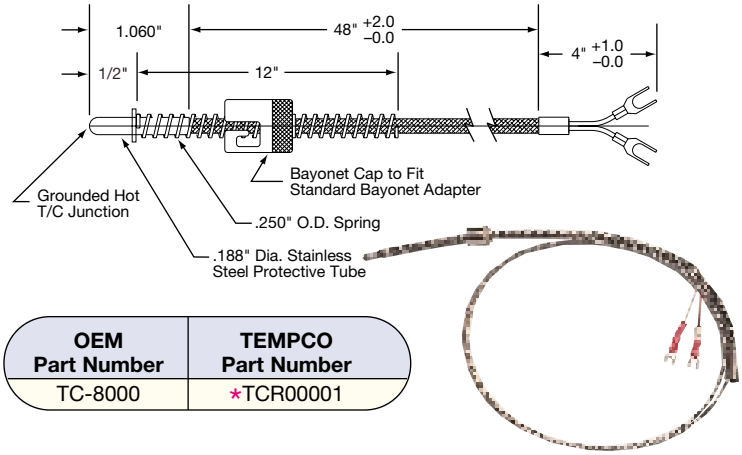
All the following thermocouples are manufactured with the highest quality materials and workmanship.

The thermocouple wire is stranded (for flexibility) ANSI Type J thermocouple grade, with ANSI color coded fiberglass insulation (White-Positive, Red-Negative).

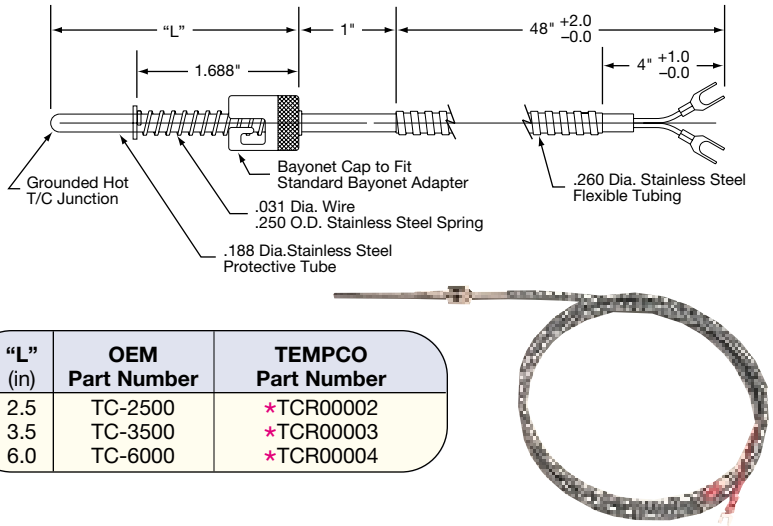
All hot junctions are grounded. Spade lugs where required are insulated and accept a No. 6 stud.



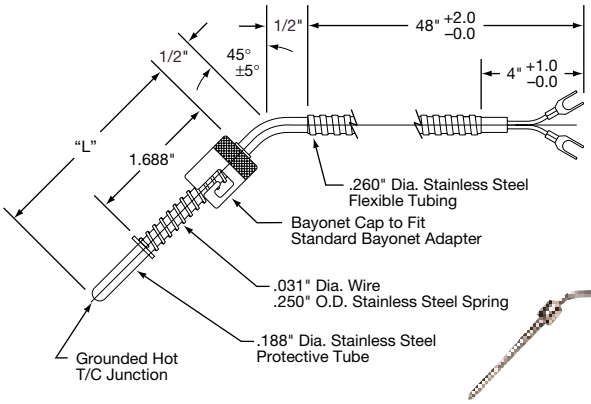
"L" (in)	OEM Part Number	TEMPCO Part Number
2.5	TC-2590	*TCR00008
3.5	TC-3590	*TCR00009
6.0	TC-6090	*TCR00010



OEM Part Number	TEMPCO Part Number
TC-8000	*TCR00001



"L" (in)	OEM Part Number	TEMPCO Part Number
2.5	TC-2500	*TCR00002
3.5	TC-3500	*TCR00003
6.0	TC-6000	*TCR00004



"L" (in)	OEM Part Number	TEMPCO Part Number
2.5	TC-2545	*TCR00005
3.5	TC-3545	*TCR00006
6.0	TC-6045	*TCR00007

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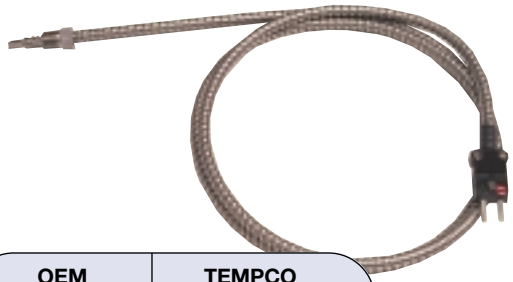
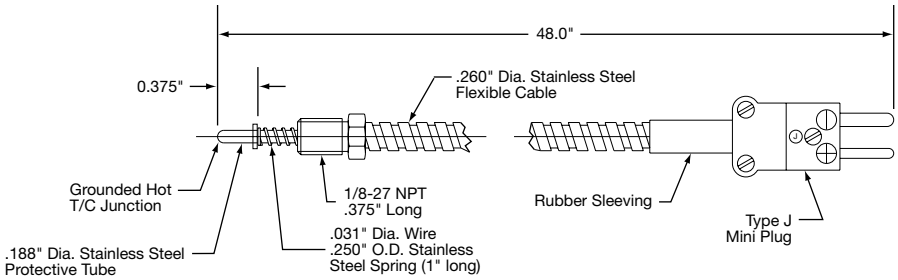
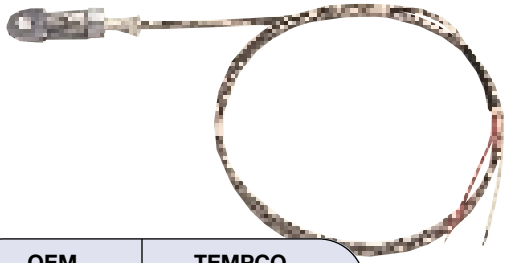
an asterisk next to the Part Number guarantees in-stock availability for same day shipping when ORDERED BY 2 PM CST

OEM Replacement Thermocouples

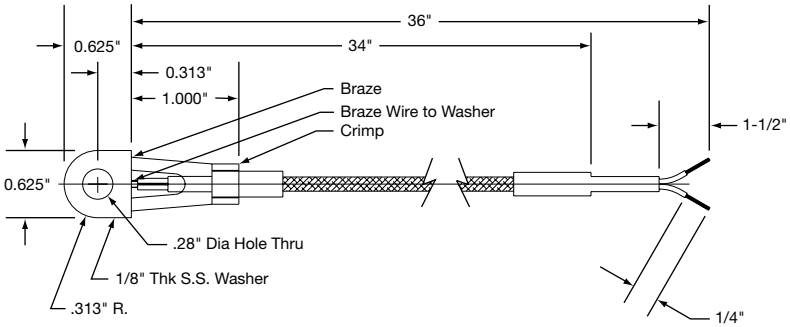


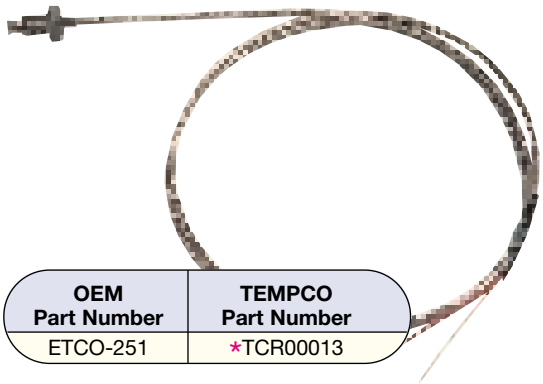
OEM Part Number	TEMPCO Part Number
TCT-4	*TCR00011



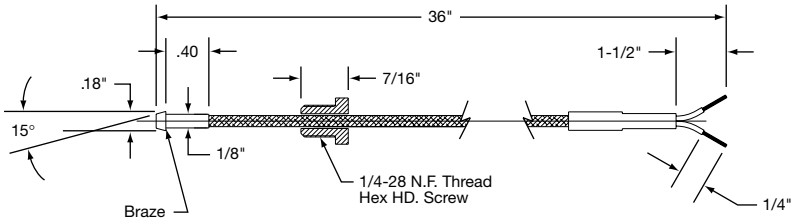


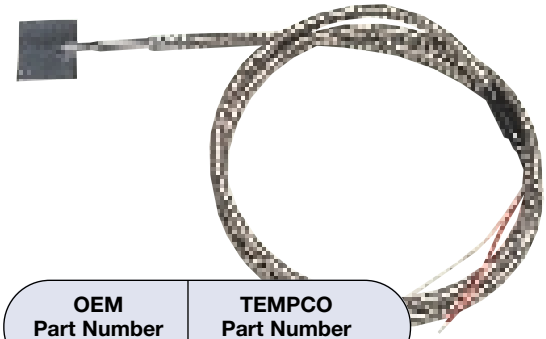
OEM Part Number	TEMPCO Part Number
ETCO-168	TCR00012



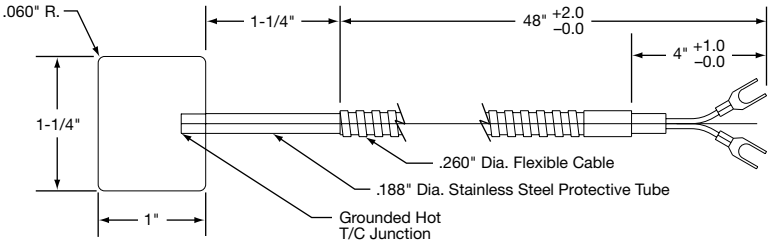


OEM Part Number	TEMPCO Part Number
ETCO-251	*TCR00013





OEM Part Number	TEMPCO Part Number
TC-9000	*TCR00014



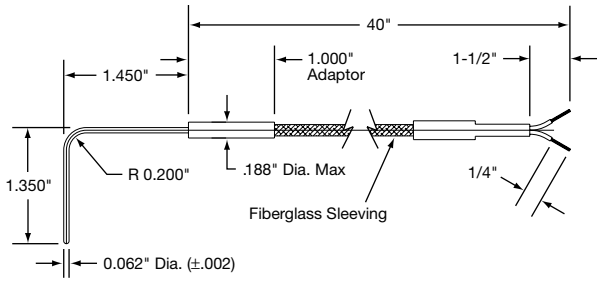
OEM Replacement Thermocouples

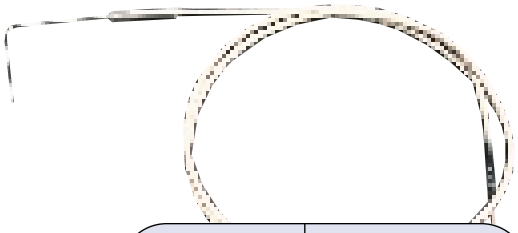
All hot junctions are grounded.

The lead wire is ANSI Type "J" thermocouple grade with ANSI color coded fiberglass insulation and an additional high temperature outer fiberglass sleeve. The transition area (potting adaptor) between the Tempco-Pak and lead wire is potted with high temperature cement rated to 900°F.

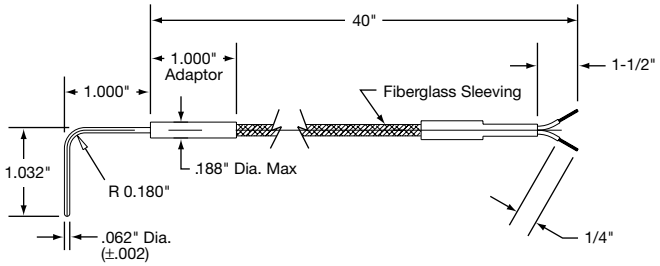
Specialty Application

The following **Runnerless Mold Thermocouples** are manufactured using Tempco's high quality, mineral insulated, thermocouple wire "Tempco-Pak." The Tempco Pak is .062" diameter 304 stainless steel sheathed, MgO insulated, ANSI Type "J" thermocouple wire.

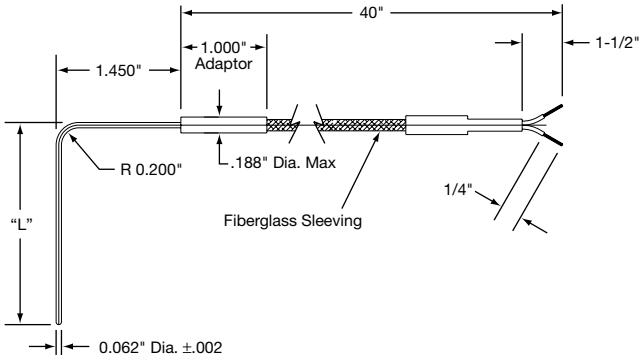


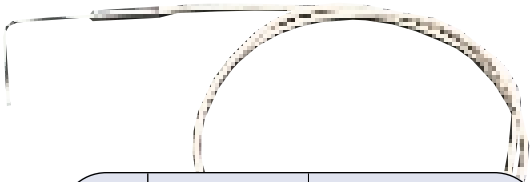


OEM Part Number	TEMPCO Part Number
TC-9600	*TCR00015



OEM Part Number	TEMPCO Part Number
TCG0100	*TCR00016





"L" (in)	OEM Part Number	TEMPCO Part Number
1.17	TCG0060	*TCR00017
1.67	TCG0061	*TCR00018
2.17	TCG0062	*TCR00019
2.67	TCG0063	*TCR00020
3.17	TCG0064	*TCR00021
4.17	TCG0065	*TCR00022
5.17	TCG0066	*TCR00023

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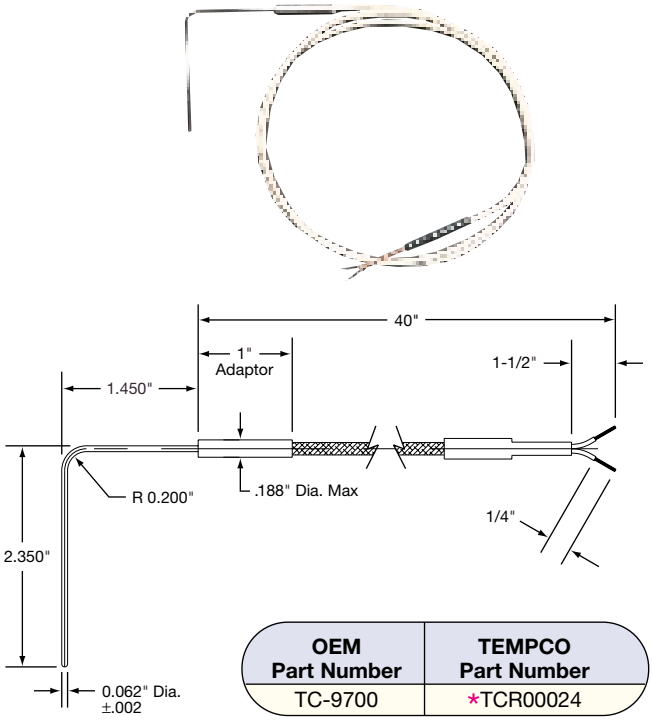
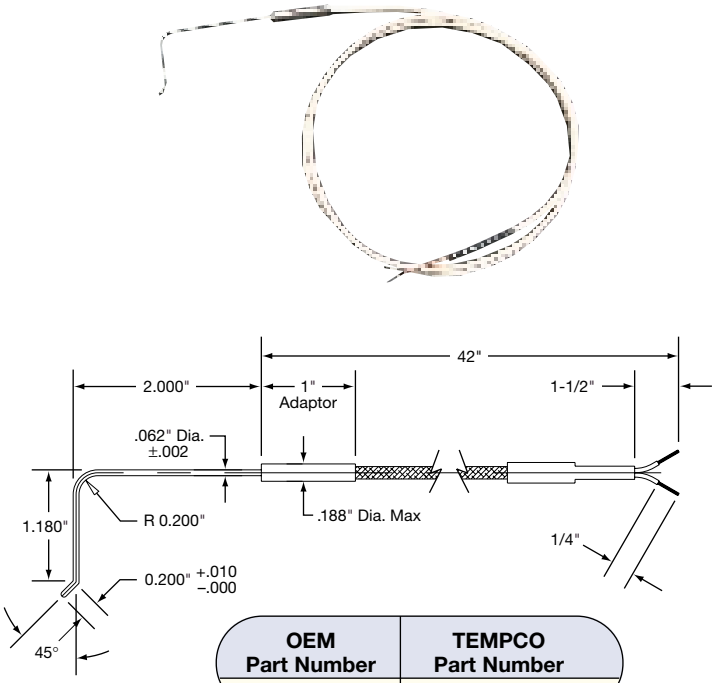
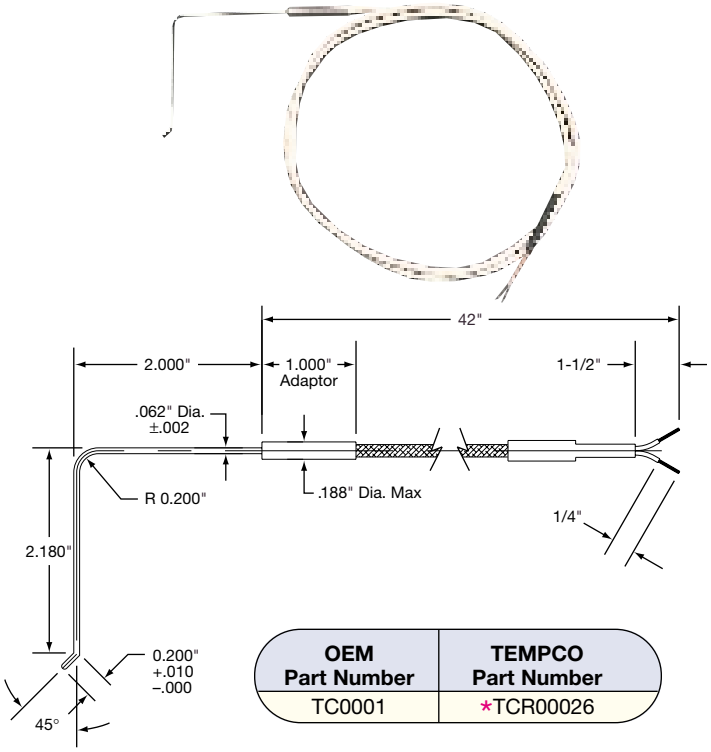
OEM Replacement Thermocouples



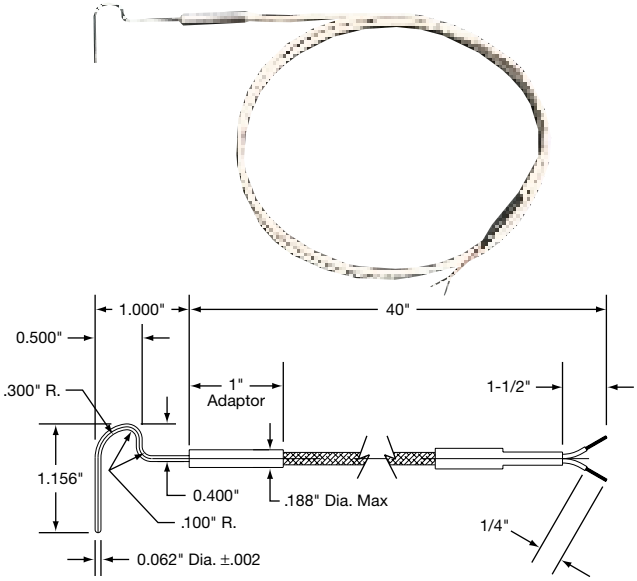
OEM Part Number	TEMPCO Part Number
TC-9700	*TCR00024



OEM Part Number	TEMPCO Part Number
TC0002	*TCR00025



OEM Part Number	TEMPCO Part Number
TC0001	*TCR00026



OEM Part Number	TEMPCO Part Number
TC0003	*TCR00027

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RTD's vs. THERMOCOUPLES vs. THERMISTORS

RTD's

Resistance Temperature Detectors (RTD'S) are temperature sensing devices consisting of a wire coil or deposited film of pure metal, usually platinum. The element's resistance increases with temperature in a known and repeatable manner. They exhibit excellent accuracy over a wide temperature range, –200 to 650°C (–328 to 1200°F).

RTD'S offer

Stability and repeatability: The platinum RTD is the primary interpolation instrument used by the National Institute of Standards and Technology from –260 degrees Celsius to 630 degrees Celsius. Precision RTD's can be manufactured with a stability of 0.0025 degrees Celsius per year. However, most industrial models drift less than 0.1 degrees Celsius per year.

Linearity: The platinum RTD produces a more linear curve than thermocouples or thermistors. The RTD's non-linearities can be corrected through proper design of resistive bridge networks.

Sensitivity: The voltage drop across an RTD provides a much larger output than a thermocouple. Thermistors have a higher resistance than RTD's but the measuring current through them may be so low to limit self-heating, making the voltage drop less than an RTD.

Standardization: RTD's are manufactured to industry standard curves, usually 100 ohm platinum to IEC 751 which makes them very interchangeable.

System Cost: RTD's usually offer a lower system cost than do thermocouples as they use ordinary copper extension leads and require no cold junction compensation.

Thermocouples

A thermocouple consists of two wires of dissimilar metals welded together into a junction. At the other end of the signal wires, usually as part of the input instrument, is another junction called the reference junction. Heating the sensing junction generates a thermoelectric potential (emf) proportional to the temperature difference between the two junctions. This millivolt-level emf, when compensated for the known temperature of the reference junction, indicates the temperature at the sensing tip. Published millivolt tables assume the reference junction is at 0 degrees Celsius.

Thermocouples are simple and familiar. Designing them into systems, however, is complicated by the need for special extension wires and reference junction compensation.

—Thermocouple advantages include—

Extremely high temperature capability: Thermocouples with noble metal junction may be rated as high as 1700°C (3100°F).

Ruggedness: The inherent simplicity of thermocouples makes them resistant to shock and vibration.

Small size/fast response: A fine-wire thermocouple junction takes up little space and has low mass, making it suitable for point sensing and fast response.

Thermistors

Thermistors are resistive devices usually made of metal oxides formed into a bead and encapsulated in epoxy or glass. Thermistors show a large negative temperature coefficient. Their resistance drops dramatically and non-linearly with a temperature increase. A thermistor's sensitivity is many times that of an RTD, but its useful temperature range is limited.

Because of wide variations of performance and cost among thermistors, generalized advantages and disadvantages may not always apply.

Typical benefits are

Lower Sensor Cost: Basic thermistors are less costly than RTD's and thermocouples, but when assembled in protective sheaths or wells the price difference narrows. Thermistors with tighter interchangeability or extended temperature ranges often cost more than RTD's.

High Sensitivity: Resistances may be several thousand ohms, which provides a larger output than RTD's with the same measuring current, offsetting lead wire resistance problems. Caution must be taken to limit measuring current because thermistors are more susceptible to self-heating than are RTD's

Point Sensing: A thermistor bead may be the size of a pinhead, allowing for small area sensing.

TEMPCO'S ACCU-OHM™ RTD

All of Tempco's Accu-Ohm RTD's comply with the follow specifications:

IEC publication 751 issued by the International Electrotechnical Commission (dated 1983).

This is the widest international scope of any RTD standard. This publication sets the tolerance for platinum RTD's with a value of 100 ohms at 0°C with a temperature coefficient of resistance (TCR) of 0.00385 ohms/ohm/°C in one of two classes:

Class A: Plus or minus 0.06% at 0°C

Class B: Plus or minus 0.12% at 0°C

All Tempco RTD's meet class B; class A is optional.

DIN 43760 issued by Deutsches Institute fur Normung (Germany), dated 1987. The platinum resistance curves are now covered under DIN IEC 751.

JIS 1604-1989 issued by the Japanese Standards Association (dated 1989).

The Platinum resistance curves are in accordance with IEC 751 but there is also a provision for TCR 0.003916 ohms/ohm/°C which can be supplied in most of Tempco's standard designs on special request.

BS 1904-1984 issued by the British Standard Institute (dated 1984). This specification is identical to IEC 751.

What is Temperature Coefficient of Resistance (TCR)?

Temperature coefficient differentiates between resistance/temperature curves of RTD's. It is also called ALPHA and may be specified in various ways by different manufacturers. Here TCR is the RTD's resistance change from 0 to 100°C, divided by the resistance at 0°C, divided by 100°C:

$$\text{TCR } (\Omega/\Omega/°\text{C}) = \frac{\text{R } 100°\text{C} - \text{R } 0°\text{C}}{\text{R } 0°\text{C} \times 100°\text{C}}$$

Example: A platinum RTD measuring 100 Ω's at 0°C and 138.5 Ω's at 100°C has TCR 0.00385 Ω/Ω/°C

$$\text{TCR} = \frac{138.5\,\Omega - 100\,\Omega}{100\,\Omega \times 100°\text{C}} = 0.00385\ \Omega/\Omega/°\text{C}$$

Stated another way, TCR is the average resistance increase per degree of a hypothetical RTD measuring 1 ohm at 0°C.

The most common use of TCR is to distinguish between curves for platinum, which is available with TCR's ranging from 0.00375 to 0.003927. The highest TCR indicates the highest purity platinum, and is mandated by ITS-90 for standard platinum thermometers.

There are no technical advantages of one TCR versus another in practical industrial applications. 0.00385 platinum is the most popular worldwide standard and is available in both wire-wound and thin-film elements.

In most cases, all you need to know about TCR is that it must be properly matched when replacing RTD's or connecting them to instruments.

Interchangeability and Repeatability

Interchangeability and its accuracy are commonly cited as the RTD's most distinguishing attributes. Because of the tight tolerances of the class "A" and class "B", RTD's are quite interchangeable. Their accuracy is also very good because of the RTD's repeatability over the standard temperature scale from –260°C to 630°C. Ordinary industrial RTD's tend to show a drift of less than 0.1°C per year in normal use.

Because RTD's are exactly what the name implies (Resistance Temperature Detector), a resistance type sensor, any resistance introduced by the addition of extension wires between the RTD and the control or measuring instrument will add to the readings. This added resistance is not constant since the extension wires, usually copper, change their resistance values with changing ambient temperature. Extension wire errors can be significant, particularly with small gauge wires or elements with low sensitivity. Fortunately most of these errors may be nearly canceled by using a three wire system.

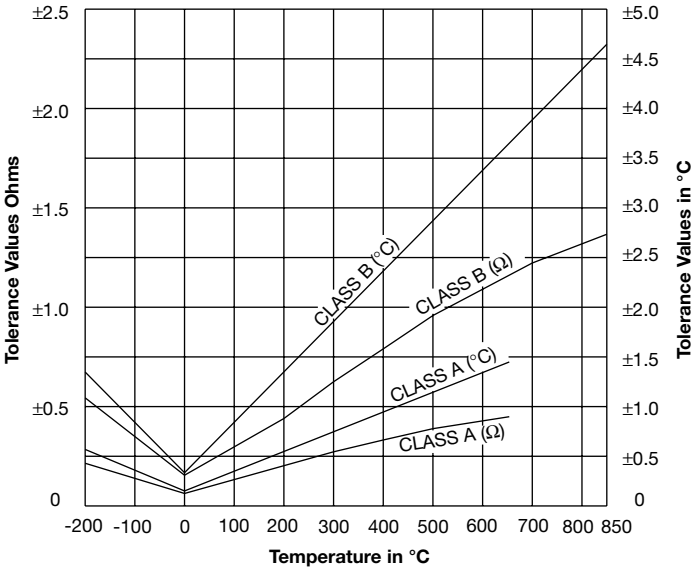
The majority of RTD's in today's industry are 3- or 4-wire systems, the two wire lead system is the least efficient unless the leads are heavy gauge, very short, or both.

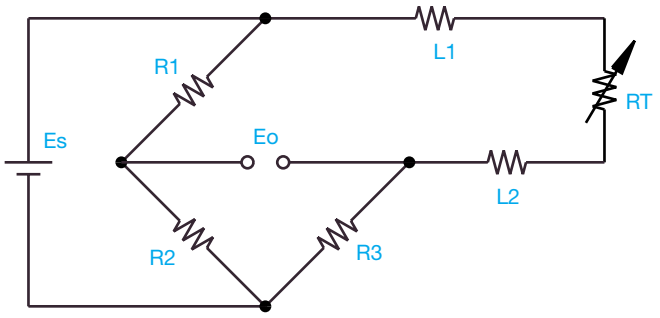
In 3- or 4-wire circuits, common leads, connected to the same end of the RTD element, are the same color.

Tolerances for 100Ω RTD's

Temperature (°C)	Tolerance Class A (± °C)	Class A (± Ω)	Class B (± °C)	Class B (± Ω)
–200	0.55	0.24	1.3	0.56
–100	0.35	0.14	0.8	0.32
0	0.15	0.06	0.3	0.12
100	0.35	0.13	0.8	0.30
200	0.55	0.20	1.3	0.48
300	0.75	0.27	1.8	0.64
400	0.95	0.33	2.3	0.79
500	1.15	0.38	2.8	0.93
600	1.35	0.43	3.3	1.06
650	1.45	0.46	3.6	1.13
700	—	—	3.8	1.17
800	—	—	4.3	1.28
850	—	—	4.6	1.34

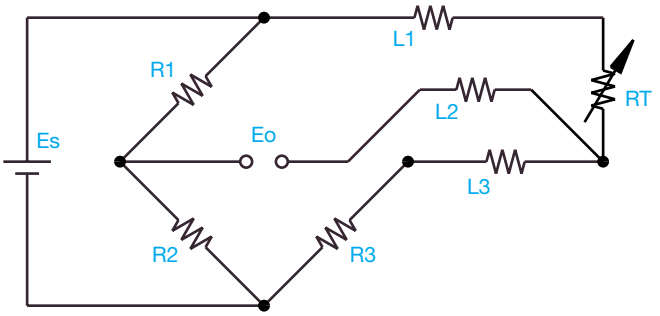
Tolerance values as a function of temperature for 100Ω RTD's.





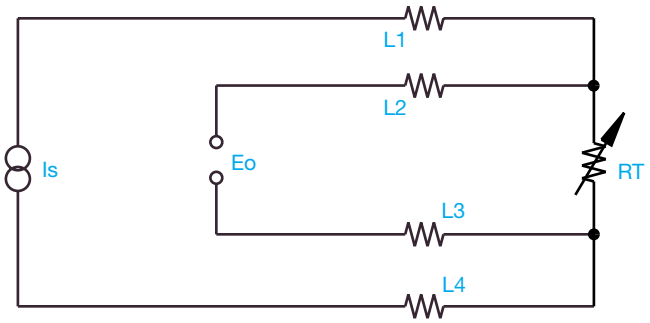
2-wire circuit

Shown is a 2-wire RTD connected to a typical Wheatstone bridge circuit. Es is the supply voltage; Eo is the output voltage; R1, R2, and R3 are fixed resistors; and RT is the RTD. In this uncompensated circuit, lead resistance L1 and L2 add directly to RT.



3-wire circuit

In this circuit there are three leads coming from the RTD instead of two. L1 and L2 carry the measuring current while L3 acts only as a potential lead. No current flows through it while the bridge is in balance. Since L1 and L2 are in separate arms of the bridge, resistance is canceled. This circuit assumes high impedance at Eo and close matching of resistance between wires L1 and L2. TEMPCO matches RTD leads within 5%. As a rule of thumb, 3 wire circuits can handle wire runs up to 100 feet.



4-wire circuit

4-wire RTD circuits not only cancel lead wires but remove the effects of mismatched resistances such as contact points. A common version is the constant current circuit shown here. Is drives a precise measuring current through L1 and L4; L2 and L3 measure the voltage drop across the RTD element. Eo must have high impedance to prevent current flow in the potential leads. 4-wire circuits may be usable over a longer distance than 3-wire, but you should consider using a transmitter in electrically noisy environments.

If necessary you can connect a 2-wire RTD to a 3-wire circuit or 4-wire circuit, as shown. As long as the junctions are near the RTD, as in a connection head, errors are negligible.

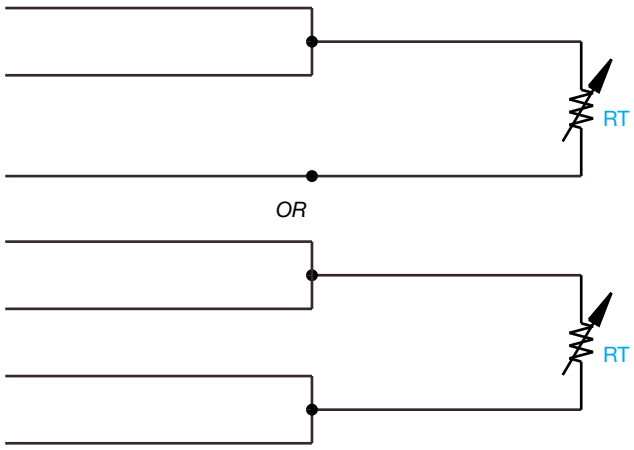


Table 1 Temperature/Resistance Relationship Class B

Resistance at 0°C = 100.00 Ω Alpha = 0.003850

°C	0	–10	–20	–30	–40	–50	–60	–70	–80	–90	–100
0	100.00	96.09	92.16	88.22	84.27	80.31	76.33	72.33	68.33	64.30	60.25
°C	**0**	**+10**	**+20**	**+30**	**+40**	**+50**	**+60**	**+70**	**–80**	**+90**	**+100**
0	100.00	103.90	107.79	111.67	115.54	119.40	123.24	127.07	130.89	134.70	138.50
+100	138.50	142.29	146.06	149.82	153.58	157.31	161.04	164.76	168.46	172.16	175.84
+200	175.84	175.91	183.17	186.82	190.45	194.07	197.69	201.29	204.88	208.45	212.02
+300	212.02	215.57	219.12	222.65	226.17	229.67	233.17	236.65	240.13	243.59	247.04
+400	247.04	250.48	253.90	257.32	260.72	264.11	267.49	270.86	274.22	277.56	280.90
+500	280.90	284.22	287.53	290.83	294.11	297.39	300.65	303.91	307.15	310.38	315.59
+600	315.59	316.80	319.99	323.18	326.35	329.51	332.66				

°F	0	–20	–40	–60	–80	–100	–120	–140	–160	–180	–200
0	93.03	88.65	84.21	79.85	75.42	70.98	66.52	62.04	57.52		
°F	**0**	**+20**	**+40**	**+60**	**+80**	**+100**	**+120**	**+140**	**–160**	**+180**	**+200**
0	90.03	97.39	101.74	106.07	110.38	114.68	118.97	123.24	127.50	131.74	135.97
+ 200	135.97	140.18	144.38	148.57	152.74	159.90	161.04	165.17	169.29	173.39	177.47
+ 400	177.47	181.54	185.60	189.64	193.67	197.69	201.69	205.67	209.64	213.60	217.54
+ 600	217.54	221.47	225.38	229.28	233.17	237.04	240.90	244.74	248.57	252.38	256.18
+ 800	256.18	259.97	263.74	267.49	271.23	274.96	278.68	282.37	282.37	289.73	293.39
+1000	293.39	297.03	300.65	304.27	307.87	311.45	315.02	318.58	318.58	325.64	329.16
+1200	329.16	332.66									

Table 2 Temperature/Resistance Relationship Class A

Resistance at 0°C = 100.00 Ω Alpha = 0.003902

°C	0	–10	–20	–30	–40	–50	–60	–70	–80	–90	–100
0	100.00	96.03	92.05	88.06	84.05	80.04	76.00	71.96	67.91	63.84	59.76
°C	**0**	**+10**	**+20**	**+30**	**+40**	**+50**	**+60**	**+70**	**–80**	**+90**	**+100**
0	100.00	103.96	107.90	111.83	115.75	119.66	123.55	127.44	131.31	135.17	139.02
100	138.50	142.86	146.88	150.49	154.30	158.09	161.86	165.63	169.38	173.13	176.86
200	176.86	180.58	184.29	184.29	191.67	195.34	199.00	202.65	206.29	213.53	213.53
300	213.53	217.14	220.73	200.73	227.88	231.44	234.99	238.52	242.04	249.05	249.05
400	249.05	252.54	256.02	256.02	262.94	266.38	269.81	273.22	276.63	283.41	283.41
500	283.41	286.78	290.14	290.14	296.82	300.14	303.45	306.75	310.03	316.57	316.57
600	316.57	319.82	323.06	323.06	329.50	332.70					

°F	0	–20	–40	–60	–80	–100	–120	–140	–160	–180	–200
0	92.94	88.50	84.05	79.59	75.11	70.61	66.10	61.57	57.03	52.47	47.90
°F	**0**	**+20**	**+40**	**+60**	**+80**	**+100**	**+120**	**+140**	**–160**	**+180**	**+200**
0	92.84	97.36	101.76	106.15	110.52	114.88	119.23	123.56	127.87	132.17	136.46
200	136.46	140.73	144.98	149.22	153.45	157.66	161.86	166.05	170.22	174.37	178.51
400	178.51	182.64	185.75	190.85	194.93	199.00	203.06	207.10	211.13	215.14	219.14
600	219.14	223.12	227.09	231.04	234.99	238.91	242.82	246.72	250.61	254.47	258.33
800	258.33	262.17	266.00	269.81	273.60	277.39	281.15	284.91	288.64	292.37	296.08
1000	296.08	299.77	303.45	307.11	310.76	314.40	318.02	321.62	325.21	328.78	332.34
1200	332.34	332.66									

Style R1

Design Features

- Standard industrial type with insulated leads.
- Not available in mineral insulated construction.
- Fiberglass lead wire construction good to 1200°F (650°C) at hot end.
- Teflon® leadwire construction good to 392°F (200°C) at hot end.

How To Order

RTD's are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Design Style		1	2	3	4	5	6	7	8	9	10
R	1										

Element *BOX 1*

S = 100Ω Single
D = 100Ω Dual
TCR = .00385 ohm/ohm/°C

Element Class *BOX 2*

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads *BOX 3*

2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125 O.D. 3-wire circuit consult TEMPCO
0.125 O.D. 4-wire circuit not available

Sheath O.D. *BOX 4*

F = 0.125 in.
G = 0.188 in.
H = 0.250 in.

Sheath Material *BOX 5*

B = 304 SS
C = 316 SS

Sheath Length "L" *BOX 6*

Whole inches **01** to **99** — Metric sizes and lengths over 99 in. consult TEMPCO

Lead Wire Length *BOX 7*

In inches **001** to **999**
12" (012) Standard

Lead Wire Construction *BOX 8*

	Standard	Overbraid*	Flex Armor*
Fiberglass Stranded	A	C	E
Teflon® Stranded	B	D	F

** Flex Armor options, overbraid options and .125 O.D. and dual constructions require transitions.*

Lead Wire Termination *BOX 9*

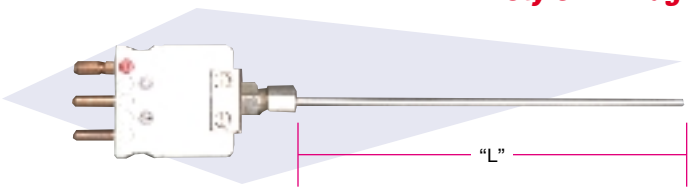
A* = Standard Male Plug 350°F
B* = Standard Female Jack
C* = Std. Plug with Mating Jack
D* = Mini Male Plug 350°F
G = Std.—1.0 in. Split Leads
H = Leads with Spade Lugs
J = 1.5 in. Split Leads with BX Connector and Spade Lugs

** 2- or 3-wire single element only.*

Special Requirements *BOX 10*

If none, enter "**0**"
If others required, consult TEMPCO

Style R2 Plug or Jack Termination



Design Features

- Available with standard or mini, 2- or 3-prong plug or jack.
- Standard industrial construction with hot end good to 1200°F (650°C) with fiberglass leads; 392°F (200°C) with Teflon® leads.

How To Order

RTD's are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6		7	8
R	2									

Design Style

Element *BOX 1*
S = 100Ω Single only
TCR = .00385 ohm/ohm/°C

Element Class *BOX 2*
A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads *BOX 3*
2 = 2-wire circuit
3 = 3-wire circuit
0.125 O.D. 3-wire circuit consult TEMPCO

Sheath O.D. *BOX 4*
F = 0.125 in.
G = 0.188 in.
H = 0.250 in.

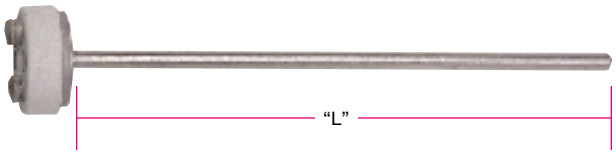
Sheath Material *BOX 5*
B = 304 SS
C = 316 SS

Sheath Length "L" *BOX 6*
Whole inches **01** to **99** — Metric sizes and lengths over 99 in. consult TEMPCO

Lead Wire Termination *BOX 7*
A* = Standard Male Plug 350°F
B* = Standard Female Jack
C* = Std. Plug with Mating Jack
D* = Mini Male Plug 350°F
E* = Mini Female Jack
F* = Mini Plug with Mating Jack
** 2- or 3-wire single element only.*

Special Requirements *BOX 8*
If none, enter "**0**"
If others required, consult TEMPCO

Style R3 Open Disc Termination



Design Features

- Standard industrial construction with hot end good to 1200°F (650°C) with fiberglass leads; 392°F (200°C) with Teflon® leads.
  - Ceramic disc 1⅛" O.D. for 2-, 3- and 4-wire designs, 2 1/32" O.D. for dual 6 wire design (.188" and .250" O.D. sheath) consult factory for ⅛" sheath O.D.

How To Order

RTD's are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6		7
R	3								

Design Style

Element *BOX 1*
S = 100Ω Single
D = 100Ω Dual
TCR = .00385 ohm/ohm/°C

Element Class *BOX 2*
A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads *BOX 3*
2 = 2 wire circuit
3 = 3 wire circuit
4 = 4 wire circuit
6 = 6 wire dual circuit
0.125 O.D. 3-wire circuit consult TEMPCO
0.125 O.D. 4- or 6-wire circuit not available

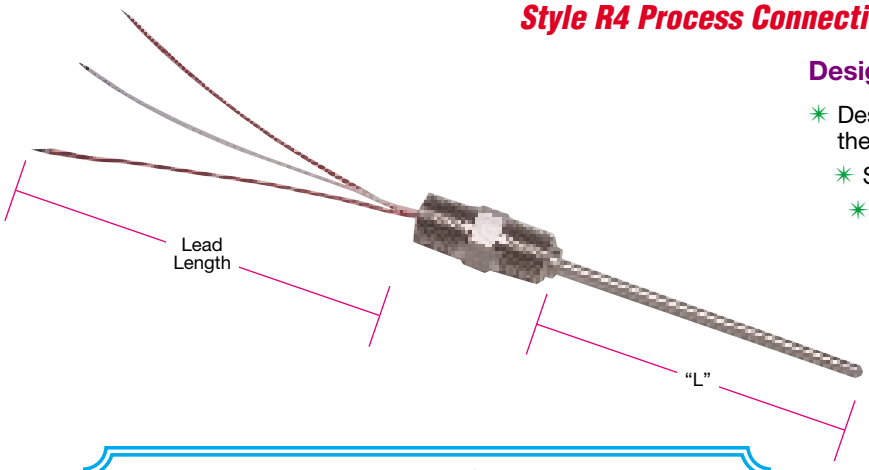
Sheath O.D. *BOX 4*
F = 0.125 in.
G = 0.188 in.
H = 0.250 in.

Sheath Material *BOX 5*
B = 304 SS
C = 316 SS

Sheath Length "L" *BOX 6*
Whole inches **01** to **99** — Metric sizes and lengths over 99 in. consult TEMPCO

Special Requirements *BOX 7*
If none, enter "**0**"
If others required, consult TEMPCO

Style R4 Process Connection



Design Features

- Designed for mounting to connection head and thermowells.
- Standard industrial construction.
- Fiberglass lead wire construction good to 1200°F (650°C) at hot end.
- Teflon lead wire construction good to 392°F (200°C) at hot end.
- Optional spring loading on ½"NPT only.
- Stainless Steel fittings with ¼" and ½" NPT thread.

How To Order

RTD's are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8	9	10	11
R	4											

Design Style

Element *BOX 1*
S = 100Ω Single
D = 100Ω Dual
TCR = .00385 ohm/ohm/°C

Element Class *BOX 2*
A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads *BOX 3*
2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125 O.D. 3-wire circuit consult TEMPCO
0.125 O.D. 4-wire circuit not available

Sheath O.D. *BOX 4*
F = 0.125 in.
G = 0.188 in.
H = 0.250 in.

Sheath Material *BOX 5*
B = 304 SS
C = 316 SS

Sheath Length "L" *BOX 6*
Whole inches **01** to **99**
Lengths over 99 in. consult TEMPCO

Lead Wire Length *BOX 7*
In inches **001** to **999**
12" (012) Standard

Thread *BOX 8*
4 = ¼" NPT
2 = ½" NPT

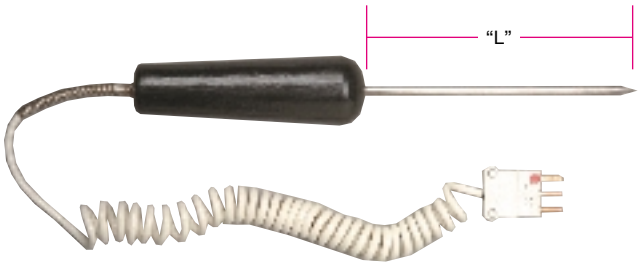
Spring Loaded *BOX 9*
O = Not required
Y = Yes, ½"NPT only

Lead Wire Construction *BOX 10*

	Standard
Fiberglass Stranded	**A**
Teflon Stranded	**B**

Special Requirements *BOX 11*
If none, enter "**0**"
If others required, consult TEMPCO

Style R5 Hand Held Probe



Design Features

- Ground conical point for easy meat penetration.
- Large handle makes penetration and removal easy.
- Teflon insulated lead wire construction good to 392°F (200°C).
- Fiberglass lead wire construction good to 900°F (482°C).
- 3-wire coil cord construction good to 221°F (105°C). Not available with overbraid or flex armor. 5 ft. extended length. (Standard)

How To Order

RTD's are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8	9	10
R	5										

Design Style

Element *BOX 1*

S = 100Ω Single
D = 100Ω Dual
TCR = .00385 ohm/ohm/°C

Element Class *BOX 2*

A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads *BOX 3*

2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125 O.D. 3-wire circuit consult TEMPCO
0.125 O.D. 4-wire circuit not available

Sheath O.D. *BOX 4*

F = 0.125 in.
G = 0.188 in.
H = 0.250 in.

Sheath Material *BOX 5*

B = 304 SS
C = 316 SS

Sheath Length "L" *BOX 6*

Whole inches **01** to **99** — Metric sizes and lengths over 99 in. consult TEMPCO

Lead Wire Length *BOX 7*

In inches **012** to **999**
60" (060) Standard

Lead Wire Construction *BOX 8*

	Standard	Overbraid	Flex Armor
3-Wire Coil Cord	A		
Fiberglass Stranded		C	E
Teflon Stranded	B	D	F

Lead Wire Termination *BOX 9*

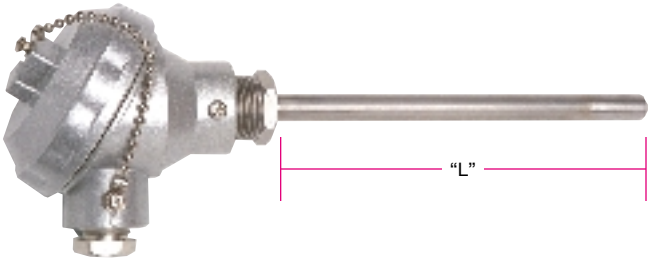
A* = Standard Male Plug 350°F
B* = Standard Female Jack
C* = Std. Plug with Mating Jack
D* = Mini Male Plug 350°F
E* = Mini Female Jack
F* = Mini Plug with Mating Jack
G = Std.—1.0 in. Split Leads
H = Leads with Spade Lugs
J = 1.5 in. with BX Connector and Spade Lugs

** 2- or 3-wire single element only.*

Special Requirements *BOX 10*

If none, enter "**0**"
If others required, consult TEMPCO

Style R6 Connection Head



Design Features

- Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
  - Screw covers are attached to body with a plated chain.
    - Covers have lugs for tightening or loosening with a screwdriver or wrench.
      - Available in single (2-wire) or duplex (4-wire).
        - Tempco's connection heads are available in die cast aluminum, bakelite and cast iron in a variety of sizes from miniature for confined areas, to the large universal head designed for heavy process and industrial applications. See "Sensor Accessories" pages 14-46 and 14-47 for complete information.

How To Order

RTD's are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8
R	6								

Design Style

Element *BOX 1*
S = 100Ω Single
D = 100Ω Dual
TCR = .00385 ohm/ohm/°C

Element Class *BOX 2*
A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads *BOX 3*
2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125 O.D. 3-wire circuit consult TEMPCO
0.125 O.D. 4-wire circuit not available

Sheath O.D. *BOX 4*
F = 0.125 in.
G = 0.188 in.
H = 0.250 in.

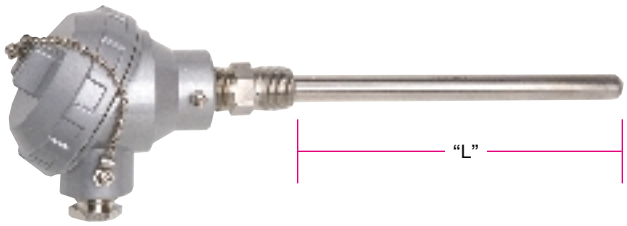
Sheath Material *BOX 5*
B = 304 SS
C = 316 SS

Sheath Length "L" *BOX 6*
Whole inches **01** to **99** — Metric sizes and lengths over 99 in. consult TEMPCO

Connection Head *BOX 7*
Select style from connection head selection on pages 14-46 and 14-47 and enter code number here.

Special Requirements *BOX 8*
If none, enter "**0**"
If others required, consult TEMPCO

Style R7 Connection Head with ½" NPT Hex Nipple



Design Features

- Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- Screw covers are attached to body with a plated chain.
- Covers have lugs for tightening or loosening with a screwdriver or wrench.
- Available in single (2-wire) or duplex (4-wire).
- Tempco's connection heads are available in die cast aluminum, bakelite and cast iron in a variety of sizes from miniature for confined areas, to the large universal head designed for heavy process and industrial applications. See "Sensor Accessories" pages 14-46 and 14-47 for complete information.

How To Order

RTD's are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

Design Style		1	2	3	4	5	6	7	8	9
R	7									

Element *BOX 1*
S = 100Ω Single
D = 100Ω Dual
TCR = .00385 ohm/ohm/°C

Element Class *BOX 2*
A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads *BOX 3*
2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125 O.D. 3-wire circuit consult TEMPCO
0.125 O.D. 4-wire circuit not available

Sheath O.D. *BOX 4*
F = 0.125 in.
G = 0.188 in.
H = 0.250 in.

Sheath Material *BOX 5*
B = 304 SS
C = 316 SS

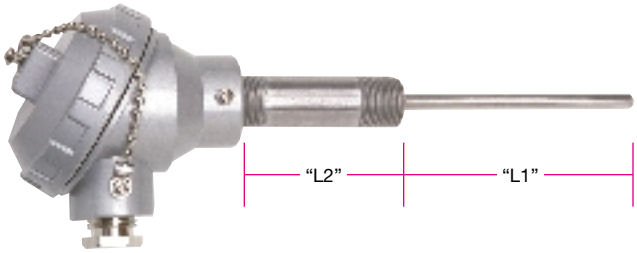
Sheath Length "L" *BOX 6*
Whole inches **01** to **99** — Metric sizes and lengths over 99 in. consult TEMPCO

Connection Head *BOX 7*
Select style from connection head selection on pages 14-46 and 14-47 and enter code number here.

Spring Loaded Terminal Block *BOX 8*
O = If not required
Y = If required, ½"NPT only

Special Requirements *BOX 9*
If none, enter "**0**"
If others required, consult TEMPCO

Style R8 Connection Head with ½" NPT Pipe Nipple



Design Features

- Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- Screw covers are attached to body with a plated chain.
- Covers have lugs for tightening or loosening with a screwdriver or wrench.
- Available in single (2-wire) or duplex (4-wire).
- Tempco's connection heads are available in die cast aluminum, bakelite and cast iron in a variety of sizes from miniature for confined areas, to the large universal head designed for heavy process and industrial applications. See "Sensor Accessories" pages 14-46 and 14-47 for complete information.

How To Order

RTD's are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8	9	10
R	8										

Design Style

Element *BOX 1*
S = 100Ω Single
D = 100Ω Dual
TCR = .00385 ohm/ohm/°C

Element Class *BOX 2*
A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads *BOX 3*
2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125 O.D. 3-wire circuit consult TEMPCO
0.125 O.D. 4-wire circuit not available

Sheath O.D. *BOX 4*
F = 0.125 in.
G = 0.188 in.
H = 0.250 in.

Sheath Material *BOX 5*
B = 304 SS
C = 316 SS

Sheath Length "L1" *BOX 6*
Whole inches **01** to **99** — Metric sizes and lengths over 99 in. consult TEMPCO

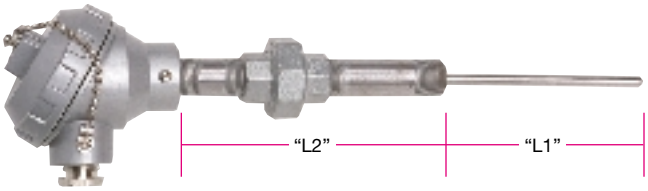
"L2" ½" NPT Nipple Length *BOX 7*
Whole inches **03** to **18**
Lengths over 18 in. consult TEMPCO

Connection Head *BOX 8*
Select style from connection head selection on pages 14-46 and 14-47 and enter code number here.

Spring Loaded Terminal Block *BOX 9*
O = If not required
Y = If required, ½" NPT only

Special Requirements *BOX 10*
If none, enter "**0**"
If others required, consult TEMPCO

Style R9 Connection Head with ½" NPT Nipple, Union, Nipple



Design Features

- Tempco's connection heads are gasketed to seal against moisture, dust and corrosive or hostile atmospheres.
- Screw covers are attached to body with a plated chain.
- Covers have lugs for tightening or loosening with a screwdriver or wrench.
- Available in single (2-wire) or duplex (4-wire).
- Tempco's connection heads are available in die cast aluminum, bakelite and cast iron in a variety of sizes from miniature for confined areas, to the large universal head designed for heavy process and industrial applications. See "Sensor Accessories" pages 14-46 and 14-47 for complete information.

How To Order

RTD's are offered with the options listed in the worksheet below. Create an ordering code by filling in the boxes with the appropriate number and/or letter designation for your requirements, and a part number will be assigned.

		1	2	3	4	5	6	7	8	9	10
R	9										

Design Style

Element *BOX 1*
S = 100Ω Single
D = 100Ω Dual
TCR = .00385 ohm/ohm/°C

Element Class *BOX 2*
A = ±0.06% at 0°C, Optional
B = ±0.12% at 0°C, Standard

Number of Leads *BOX 3*
2 = 2-wire circuit
3 = 3-wire circuit
4 = 4-wire circuit
0.125 O.D. 3-wire circuit consult TEMPCO
0.125 O.D. 4-wire circuit not available

Sheath O.D. *BOX 4*
F = 0.125 in.
G = 0.188 in.
H = 0.250 in.

Sheath Material *BOX 5*
B = 304 SS
C = 316 SS

Sheath Length "L1" *BOX 6*
Whole inches **01** to **99** — Metric sizes and lengths over 99 in. consult TEMPCO

"L2" Nipple, Union, Nipple Length *BOX 7*
Whole inches **06** to **18**
Lengths over 18 in. consult TEMPCO

Connection Head *BOX 8*
Select style from connection head selection on pages 14-46 and 14-47 and enter code number here.

Spring Loaded Terminal Block *BOX 9*
O = If not required
Y = If required, ½" NPT only

Special Requirements *BOX 10*
If none, enter "**0**"
If others required, consult TEMPCO

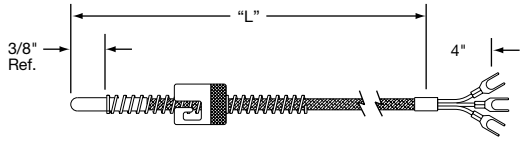
Bayonet Style RTD's for the Plastics Industry

Why RTD's? They are becoming the State-of-the-Art in many industries of which plastics is one. As processing temperatures become more and more critical the accuracy and repeatability of the temperature sensor also becomes more critical.

- 3⁄16" diameter stainless steel probe
- Operating temp. up to 900°F (482°C)
- 3-wire circuit
- 100 ohms Class B element per IEC 751
- Can be installed wherever existing thermocouples of similar design are used

Style 1—Adjustable Spring Bayonet RTD

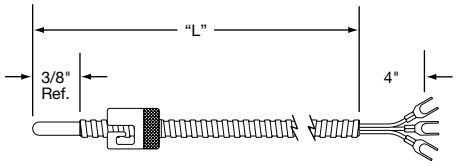
- Insertion length adjustable from 1" to 10"
- One can replace several fixed length thermocouples
- Forms easily to any angle



Part Number	Termination Style†	"L" Dim. (in)
RTP10001	S	48
RTP10002	C	48
RTP10003	P	48
RTP10004	J	48
*RTP10005	B	48

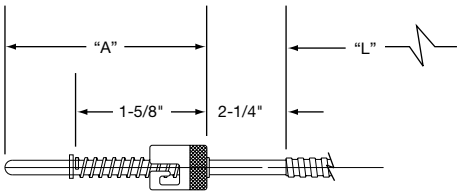
Style 2—Adjustable Armor Cable Bayonet RTD

- Insertion length adjustable over length of armor cable
- One can replace several fixed length thermocouples or RTD's
- Forms easily to any angle



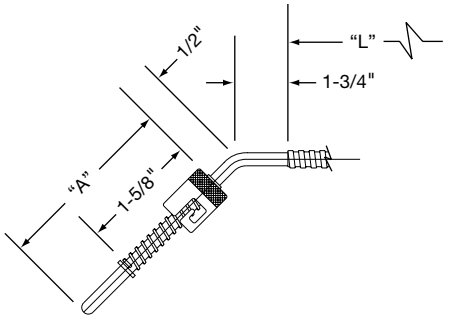
Part Number	Termination Style†	"L" Dim. (in)
RTP20001	S	48
RTP20002	C	48
RTP20003	P	48
RTP20004	J	48
*RTP20005	B	48

Style 3—Rigid Straight Bayonet RTD



Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP30001	S	4	48
RTP30002	C	4	48
RTP30003	P	4	48
RTP30004	J	4	48
RTP30005	B	4	48

Style 4—Rigid 45° Bend Bayonet RTD



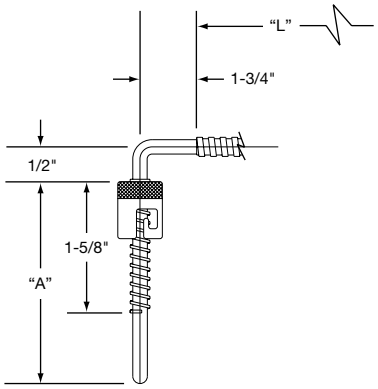
Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP40001	S	4	48
RTP40002	C	4	48
RTP40003	P	4	48
RTP40004	J	4	48
RTP40005	B	4	48

†See Page 14-86 for Termination Style descriptions.

STOCK ITEMS ORDER NOW! *

an asterisk next to the Part Number guarantees in-stock availability for same day shipping when ORDERED BY 2 PM CST

Style 5—Rigid 90° Bend Bayonet RTD for use to 900°F (482°C)



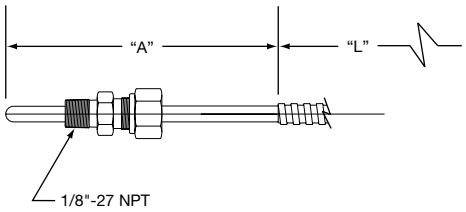
Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP50001	S	4	48
RTP50002	C	4	48
RTP50003	P	4	48
RTP50004	J	4	48
RTP50005	B	4	48

See page 14-64 for bayonet adapters and adapter installation

Compression Fitting Style RTD's for the Plastics Industry

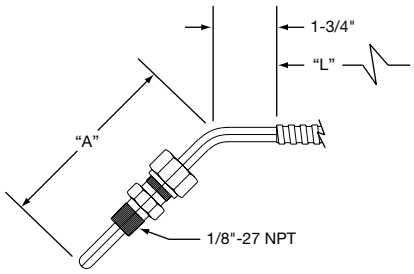
Style 6—Rigid Straight Compression Fitting RTD

- 3/16" diameter stainless steel probe
- Operating temp. up to 900°F (482°C)
- One Time Adjustable, 1/8-27 NPT Brass Compression Fitting
- 3-wire circuit
- 100 ohms Class B element per IEC 751
- Can be installed wherever existing thermocouples of similar design are used



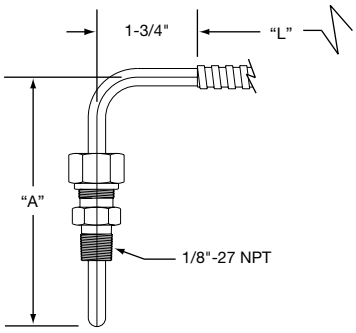
Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP60001	S	4	48
RTP60002	C	4	48
RTP60003	P	4	48
RTP60004	J	4	48
RTP60005	B	4	48

Style 7—Rigid 45° Bend Compression Fitting RTD



Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP70001	S	4	48
RTP70002	C	4	48
RTP70003	P	4	48
RTP70004	J	4	48
RTP70005	B	4	48

Style 8—Rigid 90° Bend Compression Fitting RTD

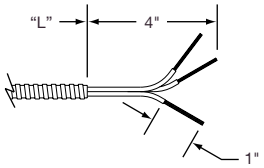


Part Number	Termination Style†	"A" Dim. (in)	"L" Dim. (in)
RTP80001	S	4	48
RTP80002	C	4	48
RTP80003	P	4	48
RTP80004	J	4	48
RTP80005	B	4	48

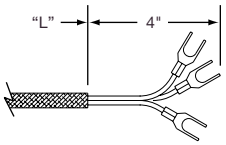
†See Page 14-86 for Termination Style descriptions.

Termination Styles

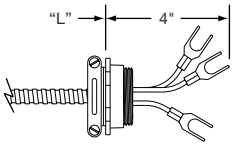
Style B—Plain Ends



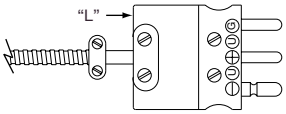
Style S—Spade Lugs



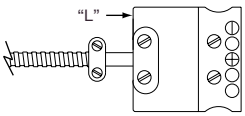
Style C—Spade Lugs with BX Connector



Style P—Plug



Style J—Jack



How to Order

Catalog RTD's

Order by Part number for stock RTD's.

Custom Manufactured RTD's

For other sizes, ratings and accuracy, **TEMPCO** will design and manufacture an RTD to meet your requirements.

Please Specify the following:

- ❑ Model Prefix (RTP)
- ❑ Style Number 1 through 8 (See Pages 14-84 through 14-85)
- ❑ Length to "L" in inches
- ❑ Length to "A" in inches
- ❑ Class A or B (See Page 14-72)
- ❑ Termination Style Code (B, S, C, P or J)
- ❑ Probe Diameter (3⁄16" Standard, 1⁄8" optional)

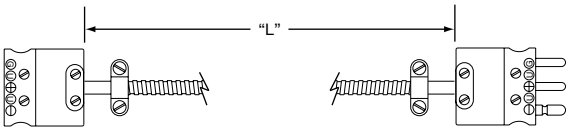
How to Order

Extension Cable Assemblies

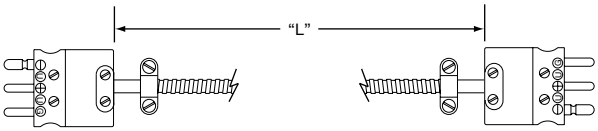
Standard lead time is 2 weeks

Please Specify Style and "L" Dimension

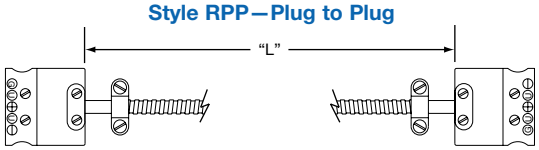
Calibration— All styles are made with 3⁄16" flexible armor cable.



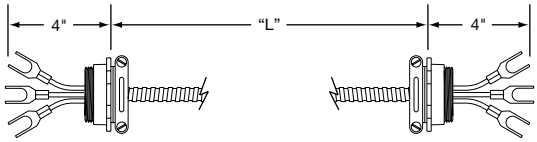
Style RJP—Jack to Plug



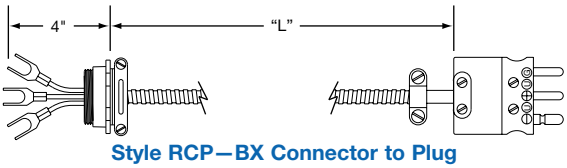
Style RPP—Plug to Plug



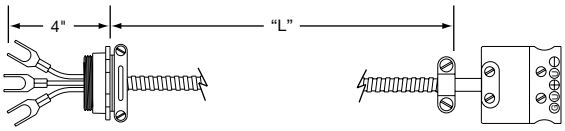
Style RJJ—Jack to Jack



Style RCC—BX Connector to BX Connector



Style RCP—BX Connector to Plug



Style RCJ—BX Connector to Jack

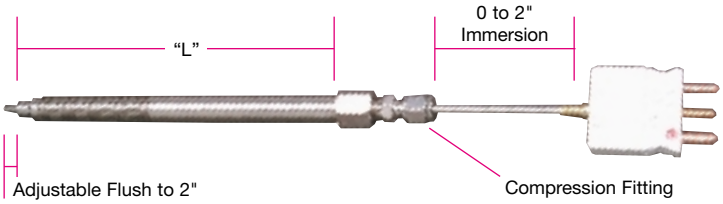
Plastic Melt Bolt RTD'S

- 3/16" diameter Probe
- 100 ohm Class B element per IEC 751
- 3-wire circuit
- Can be installed wherever standard melt thermocouples are used
- Operating temperature up to 1200°F (650°C)
- Available in 3" and 6" bolt designs
- Bolts and Probes are 300 series stainless steel

- Tip immersion length can be field adjusted from flush to 1 inch
- Eliminates excess inventory

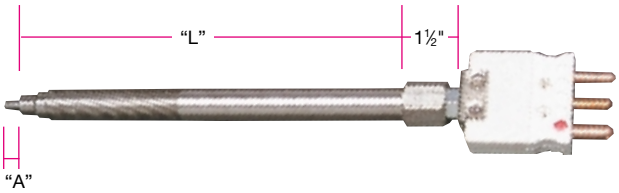
Part Number L = 3"	Part Number L = 6"
RTP00001	RTP00002

Style RT1—Adjustable Tip



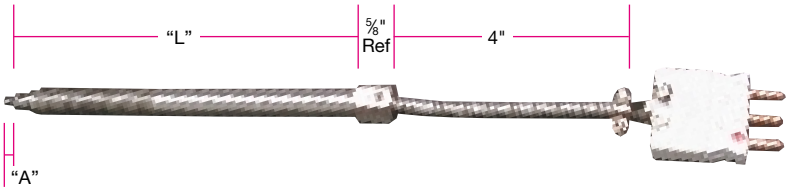
Part Number	"A" (in)	"L" (in)
RTP00003	Flush	3
RTP00004	1/4	3
RTP00005	1/2	3
RTP00006	3/4	3
RTP00007	1	3
RTP00008	Flush	6
RTP00009	1/4	6
RTP00010	1/2	6
RTP00011	3/4	6
RTP00012	1	6

Style RT2—Rigid Plug Mount Fixed Tip

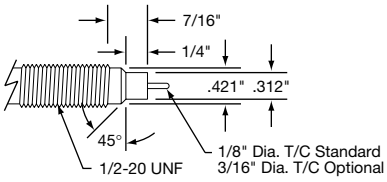


Part Number	"A" (in)	"L" (in)
RTP00013	Flush	3
RTP00014	1/4	3
RTP00015	1/2	3
RTP00016	3/4	3
RTP00017	1	3
RTP00018	Flush	6
RTP00019	1/4	6
RTP00020	1/2	6
RTP00021	3/4	6
RTP00022	1	6

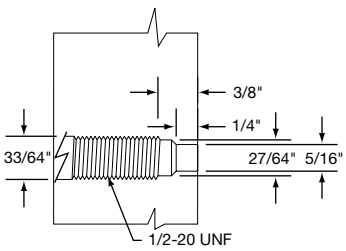
Style RT3—Flexible Mounted Plug



Detailed Dimensions for for Plastic Melt Bolts



Bolt-Tip Dimensions



Recommended drilling dimensions for proper mounting in extruder.

10" Bezel Jack Panel for Standard Thermocouple Connectors

- Accepts standard plugs.
- Jacks are ANSI color coded, glass filled nylon with a maximum service temperature of 400°F (204°C).
- Panels are manufactured from rugged, .090" thick aluminum.
- Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- Panels are normally supplied unassembled with all necessary hardware to assemble and install included. Can be furnished assembled at an additional cost.

Standard Sizes

Part Number	Number of Rows	Panel Height H × L (in)	Number of Jacks	Cutout Size H × L (in)
JP(✣)00001	1	3½ × 10	12	1⅞ × 9¼
JP(✣)00002	2	5 3/16 × 10	24	3 9/16 × 9¼
JP(✣)00003	3	8⅛ × 10	36	6½ × 9¼
JP(✣)00004	4	9⅞ × 10	48	8¼ × 9¼
JP(✣)00005	5	12¾ × 10	60	11⅛ × 9¼
JP(✣)00006	6	14 9/16 × 10	72	12 15/16 × 9¼

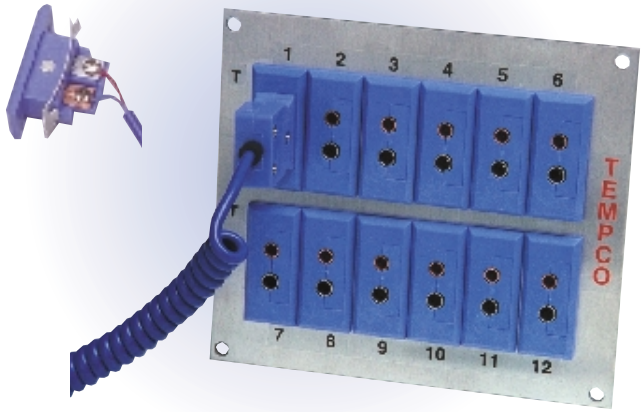
✣ Insert calibration code in Part Number (J, K, T, E, R, S, U, N)

Mounting Hole Spacing: 3/16" in from each side to center of 13/64" hole (for #10 screw).

Bezel Panel Jacks are retained by a spring clip which is installed from the rear of the panel.

Wire may be attached after Jacks are installed in panel.

5" Bezel Jack Panel for Standard Thermocouple Connectors



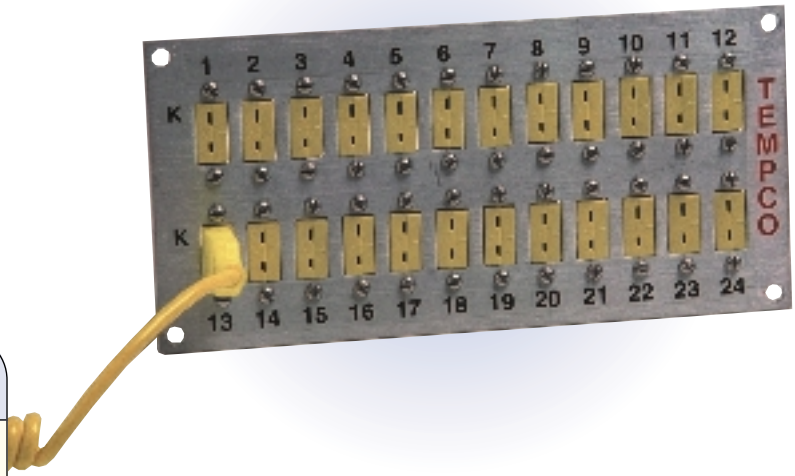
Standard Sizes

Part Number	Number of Rows	Panel Height H × L (in)	Number of Jacks	Cutout Size H × L (in)
JP(✣)00007	1	3½ × 5½	6	1⅞ × 4 21/32
JP(✣)00008	2	5 3/16 × 5½	12	3 9/16 × 4 21/32
JP(✣)00009	3	8⅛ × 5½	18	6½ × 4 21/32
JP(✣)00010	4	9⅞ × 5½	24	8¼ × 4 21/32
JP(✣)00011	5	12¾ × 5½	30	11⅛ × 4 21/32
JP(✣)00012	6	14 9/16 × 5½	36	12 15/16 × 4 21/32

✣ Insert calibration code in Part Number (J, K, T, E, R, S, U, N)

For Miniature Thermocouple Connectors

- Designed to be space saving.
- Complements modern miniature instrumentation.
- Jack bodies are ANSI color coded, glass filled nylon with a maximum service temperature of 400°F (204°C).
- Panels are manufactured of rugged .090" thick aluminum.
- Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- Panels are supplied unassembled for ease of wiring—all hardware to assemble is included.



Standard Sizes

Part Number	Number of Rows	Panel Height H × L (in)	Number of Jacks	Cutout Size H × L (in)
JP(✣)00013	1	$2\frac{21}{32} \times 3\frac{5}{8}$	6	$1\frac{9}{32} \times 3\frac{3}{32}$
JP(✣)00014	2	$4\frac{5}{16} \times 3\frac{5}{8}$	12	$2\frac{15}{16} \times 3\frac{3}{32}$
JP(✣)00015	3	$5\frac{31}{32} \times 3\frac{5}{8}$	18	$4\frac{19}{32} \times 3\frac{3}{32}$
JP(✣)00016	4	$7\frac{5}{8} \times 3\frac{5}{8}$	24	$6\frac{1}{4} \times 3\frac{3}{32}$
JP(✣)00017	1	$2\frac{21}{32} \times 6\frac{5}{8}$	12	$1\frac{9}{32} \times 6\frac{1}{16}$
JP(✣)00018	2	$4\frac{5}{16} \times 6\frac{5}{8}$	24	$2\frac{15}{16} \times 6\frac{1}{16}$
JP(✣)00019	3	$5\frac{31}{32} \times 6\frac{5}{8}$	36	$4\frac{19}{32} \times 6\frac{1}{16}$
JP(✣)00020	4	$7\frac{5}{8} \times 6\frac{5}{8}$	48	$6\frac{1}{4} \times 6\frac{1}{16}$

✣ Insert calibration code in Part Number (J, K, T, E, R, S, U)

Mounting Hole Spacing: $\frac{3}{16}$" in from each side to center of $\frac{13}{64}$" hole (for #10 screw).

How to Order

Catalog Jack Panels

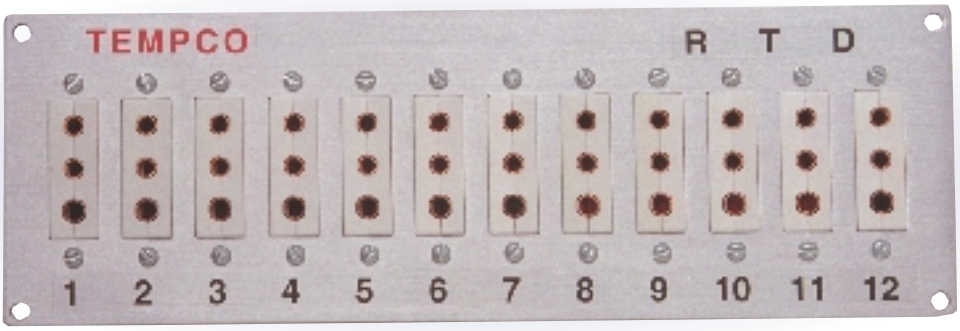
Order by Part number.

Custom Engineered/Manufactured Jack Panels

For sizes and styles not listed, **TEMPCO** will design and manufacture a Jack Panel to meet your specifications. ***Standard lead time is 2 weeks.***

Please Specify the following:

- ❑ Overall Dimensions
- ❑ Type of Jack (Standard or Miniature)
- ❑ Number of Jacks (Circuits)
- ❑ Number of Rows
- ❑ Calibration



For Standard 3-pin Connectors

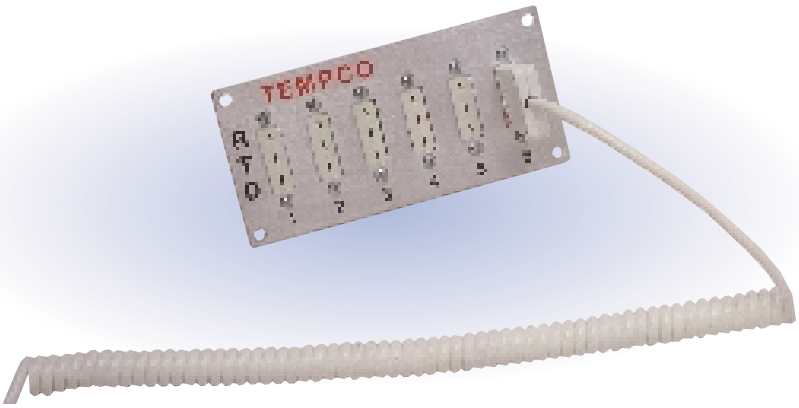
- For use with RTD's and shielded thermocouples requiring 3 wires.
- Will accept standard 3-Pin connectors.
- Jack bodies are ANSI color coded, glass filled nylon with a maximum service temperature of 400°F (204°C).
- Panels are manufactured of rugged .090" thick aluminum.
- Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- Panels are supplied unassembled for ease of wiring—all hardware to assemble is included.

Standard Sizes

Part Number	Number of Rows	Panel Height H × L (in)	Number of Jacks	Cutout Size H × L (in)
JP(✣)00021	1	3½ × 5¼	6	2 3/32 × 4 15/32
JP(✣)00022	2	6 1/32 × 5¼	12	4 21/32 × 4 15/32
JP(✣)00023	3	8 19/32 × 5¼	18	7 9/32 × 4 15/32
JP(✣)00024	4	11 5/32 × 5¼	24	9 25/32 × 4 15/32
JP(✣)00025	1	3½ × 9¾	12	2 3/32 × 8 31/32
JP(✣)00026	2	6 1/32 × 9¾	24	4 21/32 × 8 31/32
JP(✣)00027	3	8 19/32 × 9¾	36	7 9/32 × 8 31/32
JP(✣)00028	4	11 5/32 × 9¾	48	9 25/32 × 8 31/32

✣ Insert calibration code in Part Number (J, K, T, E, R, S, U)

Mounting Hole Spacing: 3/16" in from each side to center of 13/64" hole (for #10 screw).



For Miniature 3-Pin Connectors

- For use with RTD's and shielded thermocouples requiring 3 wires.
- Complements modern miniature instrumentation.
- Jack bodies are ANSI color coded, glass filled nylon with a maximum service temperature of 400°F (204°C).
- Panels are manufactured of rugged .090" thick aluminum.
- Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- Panels are supplied unassembled for ease of wiring—all hardware to assemble is included.

Standard Sizes

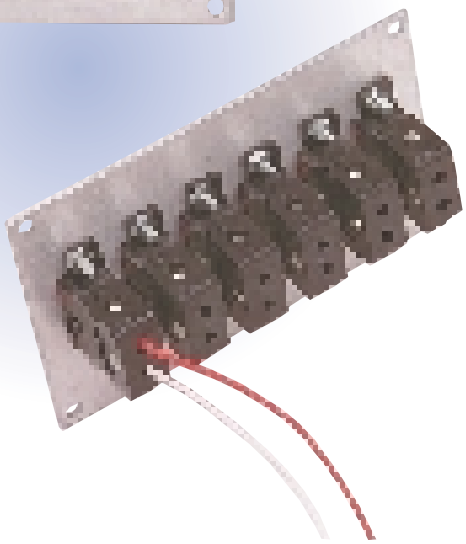
Part Number	Number of Rows	Panel Height H × L (in)	Number of Jacks	Cutout Size H × L (in)
JP(✣)00029	1	2 15/16 × 4¾	6	1 9/16 × 4 5/32
JP(✣)00030	2	4 15/16 × 4¾	12	3 9/16 × 4 5/32
JP(✣)00031	3	6 15/16 × 4¾	18	5 9/16 × 4 5/32
JP(✣)00032	4	8 15/16 × 4¾	24	7 9/16 × 4 5/32
JP(✣)00033	1	2 15/16 × 9	12	1 9/16 × 8 15/32
JP(✣)00034	2	4 15/16 × 9	24	3 9/16 × 8 15/32
JP(✣)00035	3	6 15/16 × 9	36	5 9/16 × 8 15/32
JP(✣)00036	4	8 15/16 × 9	48	7 9/16 × 8 15/32

✣ Insert calibration code in Part Number (J, K, T, E, R, S, U)

Mounting Hole Spacing: 3/16" in from each side to center of 13/64" hole (for #10 screw).

Jab-In Style Termination

- Accepts Standard Plugs.
- Jacks will accept up to 14 gauge wire.
- Jack bodies are ANSI color coded, glass filled nylon with a maximum service temperature of 400°F (204°C).
- Panels are manufactured of rugged .090" thick aluminum.
- Brushed and anodized finishes are available at an additional cost. Consult TEMPCO with your requirements.
- Jack rows are placed further apart than standard Jack Panels for ease of termination.
- Panels are supplied unassembled for ease of wiring—all hardware to assemble is included.



Standard Sizes

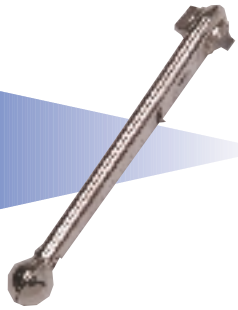
Part Number	Number of Rows	Panel Height H × L (in)	Number of Jacks	Cutout Size H × L (in)
JP(✣)00037	1	3½ × 5½	6	1⅞ × 4 21/32
JP(✣)00038	2	5 3/16 × 5½	12	3 9/16 × 4 21/32
JP(✣)00039	3	8⅛ × 5½	18	6½ × 4 21/32
JP(✣)00040	1	3½ × 10	12	1⅞ × 9¼
JP(✣)00041	2	5 3/16 × 10	24	3 9/16 × 9¼
JP(✣)00042	3	8⅛ × 10	36	6½ × 9¼

✣ Insert calibration code in Part Number (J, K, T, E, R, S, U)

Mounting Hole Spacing: 3/16" in from each side to center of 13/64" hole (for #10 screw).

To help ease installation Optional Ratchet Screwdriver

Part Number:
TUL-101-101



How to Order

Catalog Jack Panels

Order by Part number.

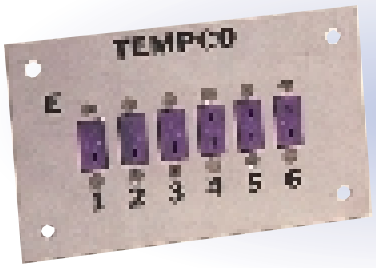
Custom Engineered/Manufactured Jack Panels

For sizes and styles not listed, **TEMPCO** will design and manufacture a Jack Panel to meet your specifications. ***Standard lead time is 2 weeks.***

Please Specify the following:

- ❑ Overall Dimensions
- ❑ Type of Jack (Standard or Miniature)
- ❑ Number of Jacks (Circuits)
- ❑ Number of Rows
- ❑ Calibration

Panel Only



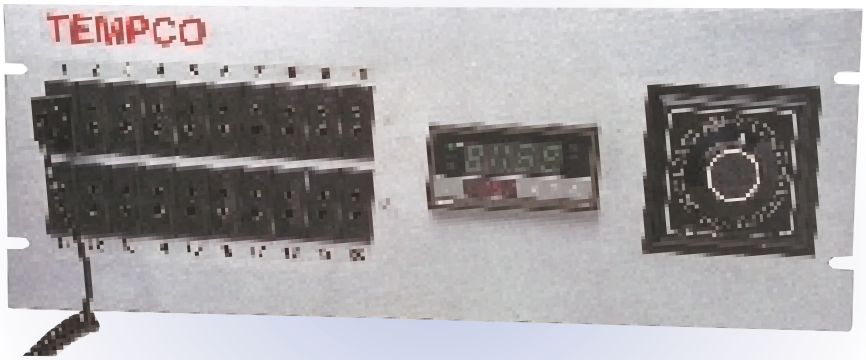
Panel and Box Assembly

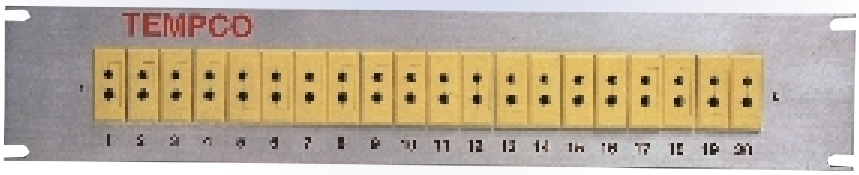
For FS Box

- Jack Panels are designed to be used with standard FS Style boxes.
- Panels are manufactured of rugged .090" thick aluminum.
- Panels are designed to accept the safest maximum number of Jacks—see table.
- Available for Standard and Miniature Jacks, 2-pin or 3-pin.
- Rated for a maximum of 400°F (204°C).
- Panels measure 2 13/16" high × 4½" long.

Jack Style	Part Number	Number of Jacks
Standard 2 Pin Bezel Mount	JP(✣)00043	4
Standard 2 Pin Jab-In Mount	JP(✣)00044	4
Standard 3 Pin	JP(✣)00045	4
Miniature 2 Pin	JP(✣)00046	6
Miniature 3 Pin	JP(✣)00047	4

✣ Insert calibration code in Part Number (J, K, T, E, R, S, U)





Custom Made 19" Rack Panels

Standard Features

- Panels are made of .090" thick aluminum with a smooth mill finish.
- All panels have slotted holes positioned at E.I.A. standard spacing.
- Panels are available with any of the standard or miniature Panel Jacks shown in this section.
- Rack Panels come in standard heights of 3½", 5¼", 7", and 8¼".
- Panels are supplied unassembled for ease of wiring—all hardware to assemble is included.

How to Order

Rack Panels

Custom Engineered/Manufactured Rack Panels

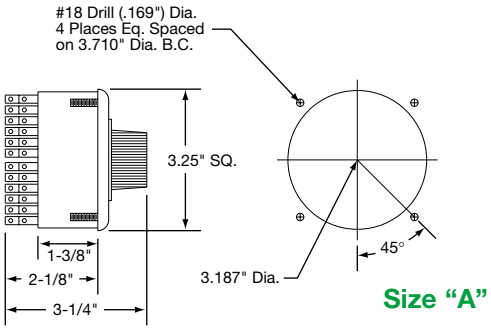
TEMPCO can manufacture a Rack Panel to meet your specifications. ***Standard lead time is 2 weeks.***

Please Specify the following:

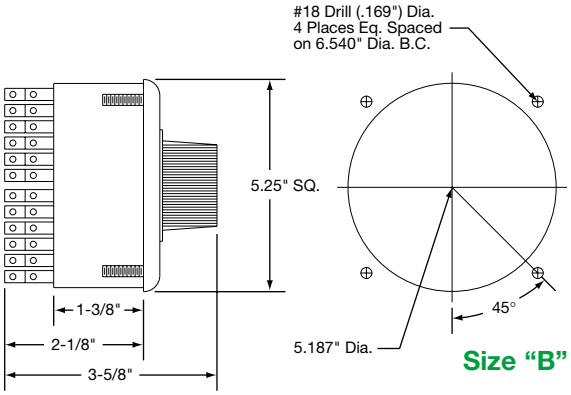
- ❑ Panel Size
- ❑ Type of Jack (Standard or Miniature)
- ❑ Number of Jacks (circuits)
- ❑ Number of Rows
- ❑ Calibration(s)
- ❑ Panel Meter Style
- ❑ Switch—if required

Selector Switches

- Available in 6 to 36 positions
- 2-Pole and 3-Pole circuits with "OFF" position
- Silver plated blades and contacts with self-cleaning wiper action and low contact resistance
- Terminals are silver plated brass with numbered circuits and polarity identification
- "OFF" position has terminals available for shorting input circuit when using it with a digital meter (Not available on 3-Pole)
- High impact GE noryl™ case



Size "A"



Size "B"

Number of Positions	Circuit Type	Part Number	
6	2-Pole	TCA-124-101	Size "A"
10	Break Before Make	TCA-124-102	
12	2-Pole	TCA-124-103	
18	Make Before Break	TCA-124-104	
20		TCA-124-105	
24	2-Pole	TCA-124-106	Size "B"
36	Make Before Break	TCA-124-107	
6		TCA-124-108	
12	3-Pole	TCA-124-109	
18	Make Before Break	TCA-124-110	
24		TCA-124-111	

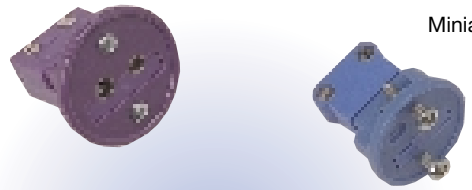
Circular Panel Jacks

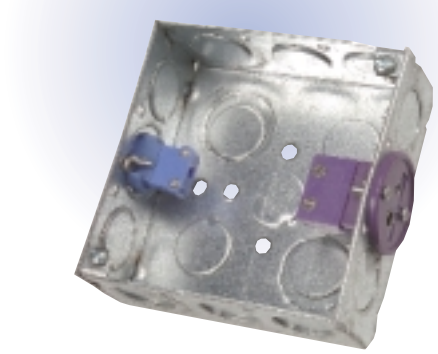
- Available in standard and miniature sizes (2-pin only).
- Used where individual Jacks are required to fit in standard electrical knockouts.
- Standard Jack fits in ¾" (1⅛" dia.) electrical knockout.
- Miniature Jack fits in ½" (⅞" dia.) electrical knockout.
- Jacks are ANSI color coded with a maximum service temperature of 400°F (204°C).
- Both the standard and miniature Jacks install from the front of the panel with no additional hardware required.

ANSI Calibration	Body Color	Part Number Standard	Part Number Miniature
J	Black	TCA-102-167	TCA-102-174
K	Yellow	TCA-102-168	TCA-102-175
T	Blue	TCA-102-169	TCA-102-176
E	Purple	TCA-102-170	TCA-102-177
R/S	Green	TCA-102-171	TCA-102-178
Cu	White	TCA-102-172	TCA-102-179
N	Orange	TCA-102-173	—

Standard Jack

Miniature Jack

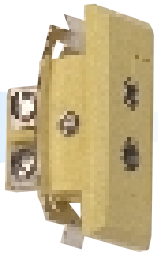


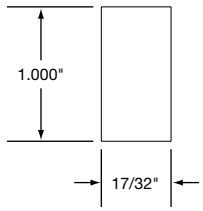


Example of Electrical Box Mount

Panel Jacks

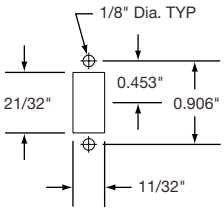
Bezel Mount Standard Jack





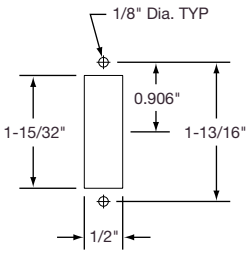
ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-137
K	Yellow	TCA-102-138
T	Blue	TCA-102-139
E	Purple	TCA-102-140
R/S	Green	TCA-102-141
Cu	White	TCA-102-142
N	Orange	TCA-102-180

Miniature Panel Jack — 2-Pin



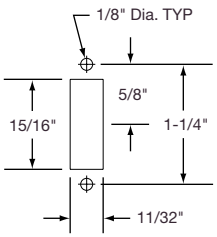
ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-143
K	Yellow	TCA-102-144
T	Blue	TCA-102-145
E	Purple	TCA-102-146
R/S	Green	TCA-102-147
Cu	White	TCA-102-148

Standard 3-Pin Panel Jack



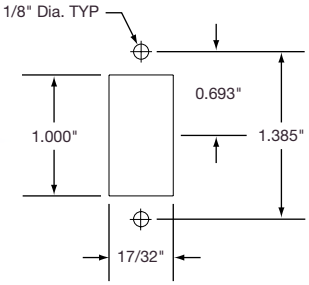
ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-149
K	Yellow	TCA-102-150
T	Blue	TCA-102-151
E	Purple	TCA-102-152
R/S	Green	TCA-102-153
Cu	White	TCA-102-154

Miniature Panel Jack — 3-Pin



ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-155
K	Yellow	TCA-102-156
T	Blue	TCA-102-157
E	Purple	TCA-102-158
R/S	Green	TCA-102-159
Cu	White	TCA-102-160

Panel Mount Standard Jab-In Jack



ANSI Calibration	Body Color	Part Number
J	Black	TCA-102-161
K	Yellow	TCA-102-162
T	Blue	TCA-102-163
E	Purple	TCA-102-164
R/S	Green	TCA-102-165
Cu	White	TCA-102-166

All Panel Jacks have the same high quality features as their non-panel counterparts and include hardware for mounting.

Glossary

Absolute Zero — Theoretically, the lowest possible temperature. A body at absolute zero would have no molecular motion or heat energy. It is the zero point on the Kelvin and Rankine scales, and is estimated to be -273.15°C or -459.67°F.

Accuracy — A statement that is used to define the largest allowable error in a device or system. It is an indication of how close measured values are to true values. It can be expressed in both measured units and in percentages.

Alloy #11 — A Harrison Alloys trademark for a low-cost negative thermoelement used with copper for a compensating extension wire used with thermocouple types R and S. The EMF characteristics are similar to R and S up to approximately 204°C.

Alpha (-) — The temperature coefficient of resistance of a material, derived from measurements at 0°C and at 100°C: {R sub{100} – R sub{0}} over {100 times R sub{0}}. It indicates the basic change in resistance in a material for each °C change in temperature. It is a defining parameter for resistance temperature detectors (RTD's).

ANSI — An abbreviation for American National Standards Institute.

ASTM — An abbreviation for American Society for Testing and Materials.

AWG — An abbreviation for American Wire Gauge.

Boiling Point — The equilibrium temperature between a liquid and its vapor. It is commonly associated with water at 100°C, and 1 standard atmosphere.

Callendar - van Dusen Equation — An interpolation equation which provides resistance values as a function of temperature for RTD's.

Celsius Temperature Scale — A temperature scale with the ice point at 0 and the boiling point of water at 100. The formula for conversion to the Fahrenheit scale is F = 1.8C + 32. Formerly referred to as "Centigrade".

Ceramic Insulation — Crystalline compounds of both metallic and nonmetallic elements which serve as dielectric insulators. Two of the most common single oxide ceramics are alumina (Al_2O_3) and magnesium oxide (MgO). Ceramics are the primary insulation used to isolate sheathed thermocouple alloys.

Compensating Alloy — An alloy that has similar EMF characteristics to an actual thermocouple alloy. It is usually a low-cost alternative for some types of thermocouple alloy extension lead wires. An example would be the use of Alloy #11 as compensating lead wire for platinum thermocouple sensors.

Compensated Connectors — A thermocouple connector that utilizes either actual thermocouple material contacts or compensating alloy contacts. By maintaining uniform circuit properties throughout the connection systems, errors due to mismatched materials are reduced.

Compensating Loop — Utilized in RTD's, a compensating loop is an extra pair of lead wires that have the same resistance as the actual lead wires, but which are not connected to the RTD element. Its purpose is to correct for lead wire resistance errors when making temperature measurement.

Connection Head — A housing on a sensor assembly that provides a terminal block for electrical connections and allows the attachment of protection tubes and cable or conduit hookups.

Constantan — The negative leg of types E, J and T thermocouples. Constantan is 55% copper and 45% nickel. The emf values can be significantly different for this material depending upon with which type of thermocouple alloy it is intended to be matched.

Copper — The positive leg of type T thermocouple.

Cryogenic — A term that usually refers to temperatures in the range of -183°C or lower.

Dielectric Strength — A measure of the voltage that an insulating material can withstand before an electrical breakdown occurs. It is sometimes referred to as breakdown potential.

DIN 43760 — German Institute for Standards document that covers nickel and platinum resistance elements. This is the most popular specification for 100 ohm platinum RTD's with a resistance vs. temperature curve specified by 0.00385 ohms/ohm/C.

Drain Wire — An uninsulated wire used in a cable construction as a ground connection.

Duplex Construction — A cable or wire constructed with two insulated conductors running parallel or twisted together.

Exposed Junction — A specific type of thermocouple junction where the measuring junction is exposed to the environment without any protecting sheath or outer tube. An exposed junction offers the fastest response time.

Extension Wire — A pair of wires connecting a thermocouple sensor to its reference junction or instrumentation. The emf characteristics of the extension wire must be similar to the thermocouple emf characteristics.

Fahrenheit Temperature Scale — A temperature scale with the ice point at 32 and the boiling point of water at 212. The formula for conversion to the Celsius scale is: C = 5/9 (F – 32).

Fixed Point — A very reproducible temperature at the equilibrium point between phase changes in a material. The triple point of water (0.01°C) is an example of a fixed point.

Freezing Point — The fixed temperature point of a material that occurs during the transition from a liquid to a solid state. This is also known as the melting point for pure materials.

FEP — An abbreviation for Fluorinated Ethylene Propylene. This component is commonly referred to as "Teflon®".

GIGA — A prefix meaning billion or 10^9. The symbol is G.

Ground — A conducting connection to earth or to some other large conducting object. Its purpose is to maintain an earth potential on the conductors connected to it, and to conduct the ground current to and from the earth.

Grounded Junction — A specific type of thermocouple junction in which the sheath and conductors are welded together forming a completely sealed integral junction. A grounded junction is recommended for use in liquids, gas, and high pressure environments.

Hi-Pot Test — A test that determines the largest potential that can be applied to a conductor without breaking down the insulation (see Dielectric Strength).

Ice Point — The melting (and freezing) point of ice, 0°C. The ice point is frequently used as a calibration check point on resistance temperature detectors and as the reference junction for thermocouples.

Initial Calibration Tolerances — The allowable deviation from the theoretical emf value generated by any particular calibration thermocouple at a given temperature (previously referred to as limits of error).

Insulation Resistance — A ratio of the applied voltage to the total current flow between two conductors separated by insulation or any conductor and the sheath.

Interchangeability — A statement that describes how closely a sensor adheres to its defining equation, and the maximum variation that would exist in the readings of identical sensors mounted side-by-side under identical conditions.

IPTS- 68, 48 — Abbreviations for the International Practical Temperature Scales of 1968 and 1948. IPTS-68 is the most recent revision of the temperature scale, which is a standard scale made up of fixed points that closely approximate thermodynamic temperatures. All temperatures between the fixed points are derived by interpolation using the assigned interpolation instrument.

Iron — The positive leg of a type J thermocouple.

ISA — An abbreviation for the Instrument Society of America.

Junction (thermocouple) — The point at which two thermocouple alloys are joined. In a typical thermocouple circuit there is a measuring junction and a reference junction.

Kelvin Temperature Scale — Also known as the thermodynamic temperature scale, the Kelvin Scale is an absolute temperature scale in which temperature differences are proportional to the amount of heat energy converted to mechanical work by a Carnot engine. The ice point on the Kelvin Scale is 273.15K. A useful approximation for conversion of the Kelvin Scale to the Celsius scale is: T(K) = T(C) + 273.15.

KN — The negative leg of a type K thermocouple. It is predominantly nickel with small added amounts of aluminum, manganese, and silicon. Company trade names are Alumel, Nial, and HAI-KN.

KP — The positive leg of a type K thermocouple. It is predominantly nickel with added chromium. Company trade names are chromel, Tophel, and HAI-KP.

Limit of Error — The allowable error in a thermocouple, expressed as a percentage or a specific degree value throughout defined temperature ranges. See Initial Calibration Tolerances.

Glossary

Linearity — An instrument or transducer's deviation in response from straight line values.

Loop Resistance — The total resistance of the thermocouple materials in a thermocouple circuit or heater in a heater circuit.

Measuring Junction — The junction in a thermocouple circuit that senses the temperature of the unknown object. It is commonly referred to as the hot junction.

Mega — A prefix meaning million or 10^6. The symbol is M.

Mica — A silicate mineral used mainly as an electrical and heat insulator.

Microvolt (µV) — One millionth of a volt (10^{-6} volt). In thermocouple measurements, a microvolt is the smallest common increment of output.

Millivolt (mV) — One thousandth of a volt.

Mineral-Insulated Thermocouple — A thermocouple that is manufactured by loading a metal sheath with conductors and insulators, and then compacting the entire assembly.

Negative Temperature Coefficient — A characteristic of a material in which a decrease in resistance accompanies an exposure to increased temperatures.

NEMA — An abbreviation for the National Electrical Manufacturers Association.

Nicrosil — The positive leg of a type N thermocouple. It is predominantly nickel with added chromium and silicon.

NISIL — The negative leg of a type N thermocouple. It is predominantly nickel with added silicon and magnesium.

Noise — Unwanted electrical interference picked up on a signal cable.

NPT — An abbreviation for American National Standard taper pipe thread.

OFHC — An abbreviation for oxygen free high conductivity copper.

Parallel Pair — A wire construction where two single conductors are laid parallel.

Platinel — An Englehard Industries trade name for a platinum thermocouple alloy with thermoelectric characteristics that closely match type K thermocouples at temperatures above 800°C.

Platinum — The negative leg in types R and S thermocouples. A noble metal, symbol Pt with excellent chemical and heat resistance. It is more ductile than silver, gold, or copper.

Platinum 67 — The platinum standard used by the NIST. Platinum 67 is used to interpolate the temperature scale between 630.74 and 1064.43°C. Previously called Platinum 27, Platinum 67 (IPTS-68) is 9 microvolts negative to Platinum 27 (IPTS-48) at 1200°C.

Platinum 6% Rhodium — The platinum-rhodium alloy that forms the negative leg on type B thermocouple.

Platinum 10% Rhodium — The platinum-rhodium alloy that forms the positive leg on a type S thermocouple.

Platinum 13% Rhodium — The platinum-rhodium alloy that forms the positive leg on a type R thermocouple.

Platinum 30% Rhodium — The platinum-rhodium alloy that forms the positive leg on a type B thermocouple.

Positive Temperature Coefficient — A characteristic of a material in which an increase in resistance accompanies exposure to an increase in temperature.

Primary Standard — A term that applies to an instrument that meets conditions required for establishing the International Practical Temperature Scale.

Protection Tube — A tube that is designed to protect a sensor from any harsh environment or process conditions.

PTFE — An abbreviation for polytetrafluoroethylene. One of the most chemically resistant carbon based insulations.

PVC — An abbreviation for polyvinyl chloride, a thermoplastic with excellent dielectric strength and flexibility.

Rankine Temperature Scale — A temperature scale with its 0 at the absolute zero of temperature. Its degree is equal to a Fahrenheit degree, thus: T(R) = T(F) + 459.67.

Reference Junction — The junction in a thermocouple circuit that is maintained at a constant, known temperature. It is also referred to as the cold junction and as a standard it is usually maintained at 0°C; however, any temperature can be used.

Refractory Metal Thermocouple — A thermocouple made from materials that melt above 1935°C.

R0 — The resistance measurement taken on an RTD at 0°C.

Repeatability — The ability of a sensor or system to indicate the same reading under repeated identical conditions.

Resistance — A property of conductors that determines the current produced by a given difference of potential. Dimensions, material and temperature all influence resistance.

Response Time — The time required for a sensor to reach 63.2% of the step change in temperature for a particular set of test conditions.

Rhenium — An elementary metal that when added to tungsten, forms an alloy with better ductility and improved high temperature strength over tungsten alone.

Rhodium — A platinum group metal added to pure platinum as a mild hardware and to increase high-temperature strength.

RTD — An abbreviation for resistance temperature detector. It is a circuit element whose resistance increases with increasing temperature in a predictable manner. Platinum is the most popular material used in RTD's.

Secondary Standard — A measurement device that has been referenced to a primary standard.

Seebeck Coefficient — The rate of change of thermal emf with temperature at a given temperature.

Seebeck emf — The net thermal emf in a thermocouple under zero current conditions.

Shield — A metallic foil or braided wire layer surrounding a conductor or a group of conductors to prevent electrostatic or electromagnetic interferences from external sources.

Stability — The ability of an instrument or a sensor to maintain a consistent output with the application of a constant input.

TERA — A prefix meaning trillion or 10^{12}. The symbol is T.

Temperature Calibration Point — A temperature at which the output of a sensor is compared or determined by comparison against a standard.

Thermal Gradient — The distribution of differential temperatures in and across an object.

Thermistor — A contraction for thermally sensitive resistor. A thermistor is a semiconducting circuit element that typically exhibits a high negative coefficient of resistance.

Thermocouple — A temperature sensor formed by joining two dissimilar metals and applying a temperature differential between the measuring junction and the reference junction.

Thermopile — Multiple thermocouples connected in series so that alternate junctions are at the reference and measuring points. The result of this type of arrangement is an increased output for a given temperature differential.

Thermowell — A closed-end tube that will accept a temperature sensor and provide a pressure-tight connection at the well's point of installation.

Transducer — A device that receives and transmits energy. In many instances, the energy that is received is transmitted in a different form.

Transmitter — An externally powered device that transmits a signal from a thermocouple or an RTD via a two-wire current loop.

Triple Point of Water — A thermodynamic state (of water) in which the gas, liquid, and solid phases all occur in equilibrium. For water, the triple point is 0.01°C.

Twisted Pair — Two insulated conductors twisted together. Twisted wires in thermocouple circuits minimize magnetic noise produced from current carrying conductors.

Ungrounded Junction — A thermocouple junction that is fully insulated from the capped sheath end. An ungrounded junction is often specified for applications involving frequent or rapid temperature cycling, and for protection against stray emf signals.

Working Standard — A measurement device that has been referenced to a secondary standard.