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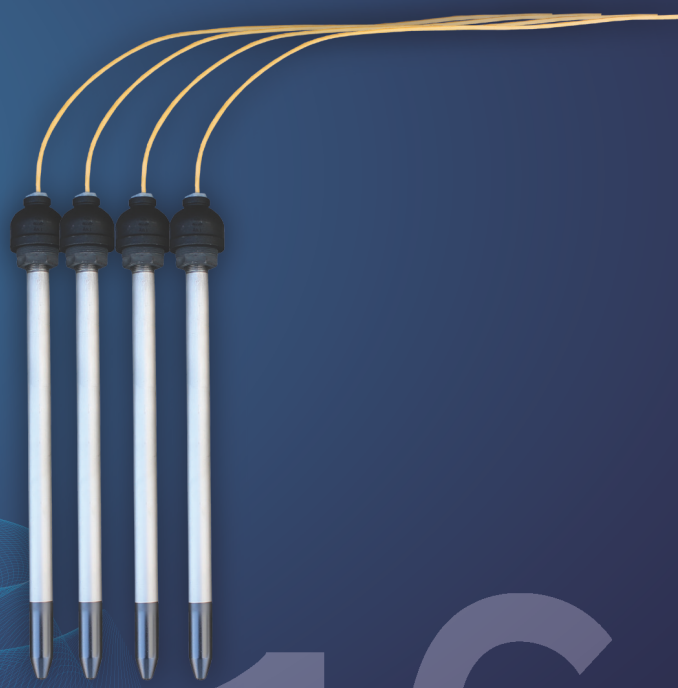

16

Thermocouple and Temperature Sensor Catalog

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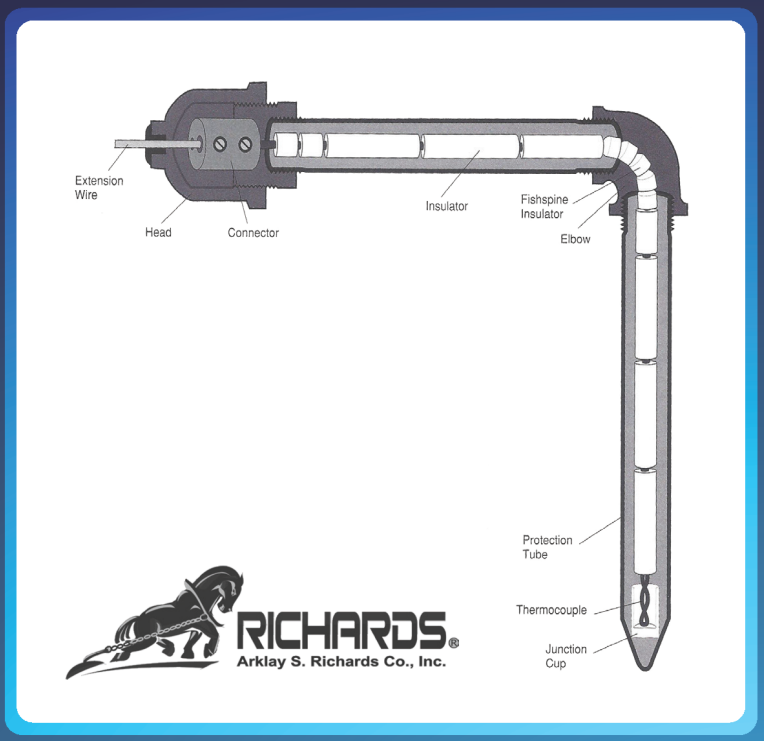
Thermocouples and Temperature Sensors

for Temperature Control and Process Monitoring



The Arklay S. Richards Co., Inc. has been manufacturing thermocouples and related temperature supplies for industrial high temperature monitoring and control since 1938. We have steadily grown into the oldest continuously family owned and operated thermocouple manufacturer in the country. We have accomplished this through continuously crafting superior products and providing excellent customer service all with comprehensive engineering support.

Our thermocouples can range from extremely small wire probes to very large industrial pipe and thermowell style assemblies. Thermocouples can be custom fabricated in all calibrations and protected with tubes in all high temperature metals, ceramics, composites, and a variety of other exotic materials. Our comprehensive product line now includes Thermocouples, RTD's, Thermocouple wire, Molten Metal Tips, Connectors, Insulators, Transmitters, Temperature Instruments, Thermometers, Protection Tubes, Connection Heads, Nichrome Heater Wire, Anemometers, Wind Vanes, Wind Speed Alarms and Displays, Quartz Tubes, Quartz Tubing, Pressure Gauges, and many more industrial process instruments.

High Performance Anemometers and Wind Vanes for Industrial Wind Monitoring

The Arklay S. Richards Co., Inc. also manufactures the finest high performance mechanical wind sensors available today. Richards wind sensors and wind alarm systems are used to monitor extremely high wind speeds in industrial applications and in locations with severe weather conditions. More information is available on our website at **www.asrichards.com** or in the Richards High Performance Industrial Wind Sensors and Systems Catalog.

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RICHARDS®
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Common Thermocouple Types - Types B, C, E, J, K, N, R, S, T, PK (Platinel II)

Type - B

The Type B thermocouple is composed of Platinum-30% Rhodium (+) wire verses a Platinum-6% (-) wire. This type of thermocouple can be used in oxidizing or inert atmospheres with a service temperature range between 870 and 1700°C (1000 to 3100°F). They should never be used in reducing atmospheres. Vacuum applications are possible for short periods of time. As with all Platinum type thermocouple they should always be protected with a ceramic protection tube. Alumina insulators and protection tubes are preferred to prevent silica contamination from Mullite ceramics. In most situations Platinum thermocouples should not be placed in any type of metal tube. In high temperature applications Type B thermocouples se less susceptible to grain growth and calibration drifts then R and S type thermocouples.

Type - C

The Type C thermocouple is composed of a Tungsten-5% Rhenium (+) wire verses Tungsten-26% Rhenium (-) wire. This type of thermocouple can be used in high temperature vacuum or inert atmospheres with a service range up to 2316°C (4200°F). It has very poor oxidation resistance, which must be taken into consideration. The Type C thermocouple is the most common Tungsten-Rhenium form of thermocouple due to the conductors being the least brittle at room temperature. This characteristic is very important since brittle conductors create inferior thermocouples. The Type C thermocouple is composed of a Tungsten-5% Rhenium (+) wire verses Tungsten-26% Rhenium (-) wire. This type of thermocouple can be used in high temperature vacuum or inert atmospheres with a service range up to 2316°C (4200°F). It has very poor oxidation resistance, which must be taken into consideration. The Type C thermocouple is the most common Tungsten-Rhenium form of thermocouple due to the conductors being the least brittle at room temperature. This characteristic is very important since brittle conductors create inferior thermocouples.

Type - E

The Type E thermocouple is composed of a Nickel-10% Chromium (+) verses a Nickel-45% Copper (-) wire. This type of thermocouple can be used in oxidizing or inert atmospheres with a service temperature range of –200 to 900° C (-330 to 1600°F). The Type E thermocouple can be successfully in subzero applications due to high corrosion resistance to high moisture environments. Out of all the different types of thermocouples, the Type E has the highest EMF out put per degree.

Type - J

The Type J thermocouple is composed of an Iron (+) wire verses a Nickel-45% Copper wire. This type of thermocouple should be use in oxidizing, reducing, vacuum, or inert atmospheres with a service temperature range between 0 and 760°C (32 to 1400°F). If the thermocouple is being used over 540°C (1000°F) an 8 gauge wire should be used due to rapid oxidation of the iron (+) wire. Type J thermocouples should not be used in Sulfurous applications above 540°C (1000°F). The negative leg or JN, of a Type J thermocouple can be described by any of the following names: Constantan, ThermoKanthal-JN [5], HAI-JN [1], Cupron [4], or Advanced [3]. The positive leg, or JP, of a Type J thermocouple can be described by any of the following names: ThermoKanthal –JP [5], Iron, HAL-JP [1].

Type - K

The Type K thermocouple is composed of a Nickel-10% Chromium (+) wire verses a Nickel-5% Aluminum and silicon (-) wire. This type of thermocouple should only be use in oxidizing, or inert atmospheres with a service temperature range between –200 and 1260°C (-330 to 2300°F). They are most widely used at temperatures above 540°C (1000°F) due to superior oxidation resistance in comparison to Types E, J, or T. There are some conditions which should be avoided when using Type K thermocouples. Vacuum applications should not use Type K due to vaporization of Chromium in the positive leg. Type K thermocouples should not be used in Sulfurous environments since both legs will rapidly corrode and the negative leg will fail mechanically due to becoming brittle. Reducing atmospheres should also be avoided.

Low oxygen levels can cause the Green-Rot phenomenon in which the Chromium in the elements start to oxidize causing large negative drifts in calibration. Green-Rot is most pronounced when the thermocouples are used between 815 to 1040°C (1500 to 1900°F). In order to avoid this problem, large ID protection tubes should be used to maximize internal air circulation or the installation of an oxygen getter in the bottom of the protection tube. If Green-Rot is a serious problem, MgO sheathed elements, or Type N thermocouples could be installed.

The negative leg or KN, of a Type K thermocouple can be described by any of the following names: Alumel [2], HAI-KN [1], ThermoKanthal-KN [5], T-2 [3], Nickel-silicon, or Nial [4]. The positive leg, or KP, of a Type K thermocouple can be described by the following names: Chromel [2], Tophel [4], ThermoKanthal –KP [5], Nickel-chrome, T-1 [3], HAL-KP [1].

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Type - N

The Type N thermocouple is composed of a Nickel -14% Chromium - 1 1/2% Silicon (+) wire verses a Nickel – 4 1/2% Silicon - 1/10% Magnesium (-) wire. The Type N thermocouple is the newest addition to the ISA family. This type of thermocouple was developed to be used under the same conditions as a Type K. It should be used in oxidizing or inert atmospheres with a service temperature range between -200 and 1260°C (-330 to 2300°F). The addition of Silicon and Chromium makes this type of thermocouple more resistant to Green-Rot and less drifting when compared to a Type K. The negative leg, or NN, of a Type N thermocouple can be described by any of the following names: Nisil, Nickel - Silicon, or HAI-NN[1]. The positive leg, or NP, of a Type N thermocouple can be described by any of the following names: Nicrosil, Nickel - Chromium - Silicon, or HAI-NP[1].

Type - R

The Type R thermocouple is composed of Platinum-13% Rhodium (+) wire verses a Platinum (-) wire. This type of thermocouple can be used in oxidizing or inert atmospheres with a service temperature range between 0 and 1480°C (32 to 2700°F). They should never be used in reducing atmospheres. As with all platinum type thermocouples, they should always be protected with a ceramic protection tube. Alumina insulators and protection tubes are preferred to prevent silica contamination from Mullite ceramics. When Type R thermocouples are continuously used at higher temperatures, the elements can develop excessive grain growth in time causing mechanical breakage to the thermocouple. In most situations platinum thermocouples should not be placed in any type of metal tube or in applications where metallic vapors are present.

Type - S

The Type S thermocouple is composed of Platinum-10% Rhodium (+) wire verses a Platinum (-) wire. This type of thermocouple can be used in oxidizing or inert atmospheres with a service temperature range between 0 and 1480°C (32 to 2700°F). They should never be used in reducing atmospheres. As with all platinum type thermocouples, they should always be protected with a ceramic protection tube. Alumina insulators and protection tubes are preferred to prevent silica contamination from Mullite ceramics. When Type S thermocouples are continuously used at higher temperatures, the elements can develop excessive grain growth in time causing mechanical breakage to the thermocouple. In most situations platinum thermocouples should not be placed in any type of metal tube or in applications where metallic vapors are present.

Type - T

The Type T thermocouple is composed of a Copper (+) wire verses a Nickel– 45% Copper (-) wire. The Type T thermocouple is frequently referred to as Copper-Constantan. This type of thermocouple can be used in oxidizing, reducing, or inert atmospheres with a service temperature range between -200 and 370°C (-330 to 700°F). The Type T thermocouple is one of the few thermocouples which have established limits of error for use in subzero and cryogenic applications. This is possible due to the Type T's superior corrosion resistance in moist environments.

Type - PK

The Type PK thermocouple (Platinel II[6]) is composed of a Palladium– 55%, Platinum– 31%, and Gold- 14% (+) wire verses a Palladium– 35%, and Gold- 65% (-) wire. The Type PK thermocouple is a noble-metal form and should be protected in the same manner as a Type B, R, or S. This type of thermocouple was developed to approximate the Type K Curve at higher temperatures. It can be used in oxidizing or inert atmospheres with a service temperature range up to 1260°C (2300°F). When using Type PK thermocouples, Type KX extension wire should be used.

! Note: The Thermocouple types we describe in this Richards Catalog are the letter designations assigned by the Instrument Society of America (ISA) and adopted in ANSI MC 96.1 and ASTM E 230 with the exception of "PK". The Type PK is a designation used by us to describe Platinel II[6]. There are other more exotic types of thermocouples, which have been developed, but since they are rarely used we decided not to list them in this catalog. If you have any questions regarding any of these less common types of thermocouples, contact one of our sales engineers and we will be glad to assist you.

[1] Trademark of Harrison Alloys. Incorporated
[2] Trademark of The Hoskins Manufacturing Company
[3] Trademark of Driver Harris Company
[4] Trademark of Carpenter Technology Corporation
[5] Trademark of Kanthal Corporation
[6] Trademark of Engelhard Industries

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Straight Assemblies - Metal Tubes -Types E, J, K & N - Screw Cover Head

Easy to Order -
1 - State quantity
2 - Specify the part number
(ours or competitive)
3 - Specify the length * Multiples of 6" (152.4 mm)
starting at 12" are stocked.
4 - Add letters for mounting attachments

Example: The part number describes the thermocouple giving the gauge, type of wire, construction, tube length and mounting device, if any. The part number **8K4-1012XH-24-AF** signifies an 8 gauge, Type K complete assembly, 1/2" NPT extra heavy 24" long #10 alloy (32% nickel - 215 chromium) tube, a 1/2" Adjustable Flange and a screw cover head. Other combinations of thermocouples and tubes can be specified depending on your application.

! **Note:** If you would like to order a Type E, J, or N assembly, just substitute the "**J**" with an E, J, or N in the part numbers listed on this page.

Typical Application	Protection Tube	Wire Gauge	Pipe Size	Outside Diameter Inches	Outside Diameter mm	Type J	Type K
601 Maximum service temperature 2300°F (1260°C) in oxidizing atmospheres. good resistance to sulfidizing atmospheres.	**#6 Seamless Nickel Alloy (601)** Nickel 60.5%, Chromium 23% Iron 14%, Aluminum 1.4% Copper .5%, Manganese .5% Silicon .2%, Carbon .05%	8	1" Std	1.32	33.4	8J4-601-*	8K4-601-*
		8	3/4" Std	1.05	26.7	8J4-634-*	8K4-634-*
		8	3/4" NPT	1.25	31.8	8J4-634SP-*	8K4-634SP-*
		8	1/2" Std	.84	21.4	8J4-622-*	8K4-622-*
		11	3/8" Std	.68	17.2		11K4-638-*
		14	3/8" Std	.68	17.2	14J4-638-*	14K4-638-*
446SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Excellent resistance to sulfidizing atmospheres , corrosion, scaling, and abrasion.	**#7 Seamless Stainless Steel (446)** Chromium 23-27% Manganese 1.5% Silicon 1%, Nitrogen .25% Carbon .20%, Sulphur .030% Phosphorous .040% Iron (Balance)	8	1" Std	1.32	33.4	8J4-701-*	8K4-701-*
		8	3/4" XH	1.05	26.7	8J4-734XH-*	8K4-734XH-*
		8	3/4" NPT	1.25	31.8	8J4-734SP-*	8K4-734SP-*
		8	1/2" Std	.84	21.4	8J4-722-*	8K4-722-*
		14	1/2" XH	.84	21.4	8J4-712XH-*	8K4-712HX-*
		11	3/8" Std	.54	13.7		11K4-738-*
		14	3/8" Std	.68	17.2	14J4-738-*	14K4-738-*
		14	1/4" Std	.54	13.7	14J4-714XH-*	14K4-714XH-*
304SS Maximum service temperature 1600°F (871°C) in oxidizing atmospheres.	**#8 Seamless Stainless Steel (304)** Chromium 19% Nickel 10%, Manganese 2% Silicon 1%, Carbon .08% Phosphorous .045% Sulphur .030% Iron (Balance)	8	3/4" Std	1.05	26.7	8J4-834-*	8K4-834-*
		8	3/4" XH	1.05	26.7	8J4-834XH-*	8K4-834XH-*
		8	3/4" NPT	1.25	31.8	8J4-834SP-*	8K4-834SP-*
		8	1/2" XH	.84	21.4	8J4-812XH-*	8K4-812XH-*
		11	3/8" Std	.68	17.2		11K4-838-*
		14	3/8" Std	.68	17.2	14J4-838-*	14K4-838-*
		11	1/4" Std	.54	13.7		11K4-814-*
		14	1/4" Std	.54	13.7	14J4-814-*	14K4-814-*
		14	1/8" Std	.41	10.3	14J4-818-*	14K4-818-*
600 Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Avoid sulfidizing atmospheres.	**#9 Seamless Nickel Alloy (600)** Nickel 76% Chromium 15.5% Iron 8% Manganese .5% Silicon .2%, Copper .2% Carbon .08%	8	1" Std	1.32	33.4	8J4-901-*	8K4-901-*
		8	3/4" Std	1.05	26.7	8J4-934-*	8K4-934-*
		8	3/4" XH	1.05	26.7	8J4-934XH-*	8K4-934XH-*
		8	3/4" NPT	1.25	31.8	8J4-934SP-*	8K4-934SP-*
		8	1/2" Std	.84	21.4	8J4-922-*	8K4-922-*
		8	1/2" XH	.84	21.4	8J4-912XH-*	8K4-912XH-*
		11	3/8" Std	.68	17.2		11K4-938-*
		14	3/8" Std	.68	17.2	14J4-938-*	14K4-938-*
		11	1/4" Std	.54	13.7		11K4-914-*
		14	1/4" Std	.54	13.7	14J4-914-*	14K4-914-*
		14	1/8" Std	.41	10.3	14J4-918-*	14K4-918-*
800 Maximum service temperature 2100°F (1150°C) in oxidizing or reducing atmospheres. Good resistance to sulfidizing atmospheres.	**#10 Seamless Nickel Alloy (800)** Nickel 35%, Chromium 23% Iron 39.5%, Manganese 1.5% Silicon 1%, Copper .75% Aluminum & Titanium .6% Carbon .1%	8	1" Std	1.32	33.4	8J4-1001-*	8K4-1001-*
		8	3/4" Std	1.05	26.7	8J4-1034-*	8K4-1034-*
		8	1/2" XH	.84	21.4	8J4-1012XH-*	8K4-1012XH-*

*** Add the required thermocouple length "P" at the end of the part number. Multiples of 6" (152.4 mm) starting at 12" (304.8) are stocked.**

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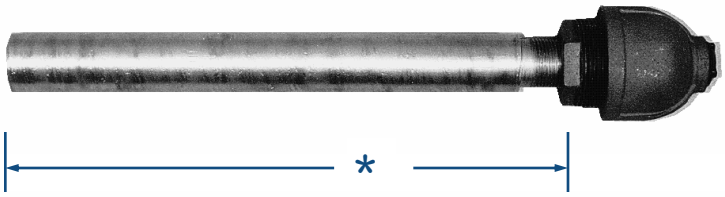
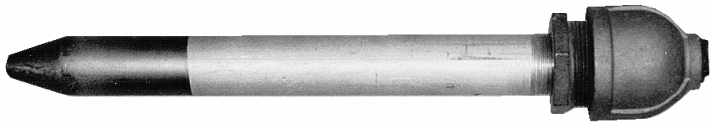
Straight Assemblies - Metal Tubes -Types E, J, K & N - Screw Cover Heads

The Richards Screw Cover Head makes inspection of the thermocouple easy. Unscrew the cover without disconnecting the leads. The single element can now be pulled out for inspection. The element is installed into the connector without bending, which prevents the insulators from cracking. If the element needs to be replaced, simply unscrew the two terminals and install a new one. The cover will never get dropped or lost since the extension wires pass through the center. The cover and bushing are cast iron, which have been coated and then waxed to help prevent rust and corrosion.

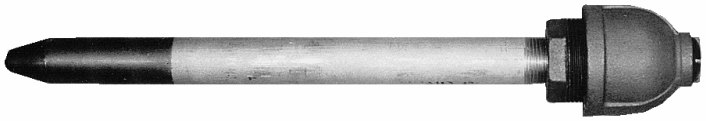
Straight Assemblies Configuration 4

1 

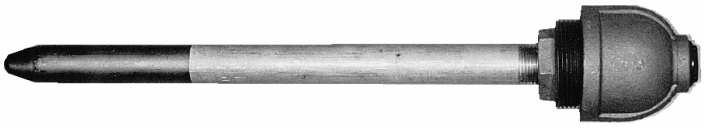
SP
Size

2 

1”
Pipe Size

3 

3/4”
Pipe Size

4 

1/2”
Pipe Size

5 

3/8”
Pipe Size

6 

1/4”
Pipe Size

7 

1/8”
Pipe Size

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Example: The part number describes the thermocouple giving the gauge, type of wire, construction, tube length and mounting device, if any. The part number **8K4-1012XH-24-AF** signifies an 8 gauge, Type K complete assembly, 1/2" NPT extra heavy 24" long, #10 alloy (32% nickel - 215 chromium) tube, a 1/2" Adjustable Flange and a screw cover head. Other combinations of thermocouples and tubes can be specified depending on your application.

! **Note:** If you would like to order a Type E, J, or N assembly, just substitute the "**J**" with an E, or N in the part numbers listed on this page.

Typical Application	Protection Tube	Wire Gauge	Pipe Size	Outside Diameter Inches	Outside Diameter mm	Type J	Type K
316SS Maximum service temperature 1600°F (780°C) in oxidizing atmospheres. Considered better than 304SS on corrosion.	**#16 Seamless Stainless Steel (316)** Nickel 10-14%, Chromium 16-18% Molybdenum 2-3%, Manganese 2% Silicon 1%, Phosphorous .045% Carbon .08%, Sulfur .03%	8	1" Std	1.32	33.4	8J4-1601-*	8K4-1601-*
		8	3/4" Std	1.05	26.7	8J4-1634-*	8K4-1634-*
		8	3/4" XH	1.05	26.7	8J4-1634XH-*	8K4-1634XH-*
		8	3/4" NPT	1.25	31.8	8J4-1634SP-*	8K4-1634SP-*
		8	1/2" XH	.84	21.3	8J4-1612XH-*	8K4-1612XH-*
		11	3/8" Std	.68	17.2		11K4-1638-*
		14	3/8" Std	.68	17.2	14J4-1638-*	14K4-1638-*
		11	1/4" Std	.54	13.7		11K4-1614-*
		14	1/4" Std	.54	13.7	14J4-1614-*	14K4-1614-*
		14	1/8" Std	.41	10.3	14J4-1618-*	14K4-1618-*
310SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Resists heat scaling	**#20 Seamless Stainless Steel (310)** Chromium 24-26%, Nickel 19-22% Silicon 1.5%, Manganese 2% Carbon .25%, Phosphorous .045% Sulphur .03%, Iron (Balance)	8	1" Std	1.32	33.4	8J4-2001-*	8K4-2001-*
		8	3/4" Std	1.05	26.7	8J4-2034-*	8K4-2034-*
		8	1/2" Std	.84	21.3	8J4-2022-*	8K4-2022-*
		11	1/4" Std	.54	13.7		11K4-2014-*
		14	1/4" Std	.54	13.7	14J4-2014-*	14K4-2014-*
		14	3/8" Std	.41	10.3	14J4-2018-*	14K4-2018-*
Carbon Steel Maximum service temperature 1000°F (540°C) in non-oxidizing applications. Typically used in galvanizing, tin, molten babbit, molten magnesium, petroleum applications and water lines.	**#SS Seamless Carbon Steel** Extra Heavy wall (**XH**) Double Extra Heavy wall (**DXH**)	8	1" DXH	1.32	33.4	8J4-SS01DXH-*	8K4-SS01DXH*
		8	1" XH	1.32	33.4	8J4-SS01XH-*	8K4-SS01XH-*
		8	3/4" XH	1.05	26.7	8J4-SS34XH-*	8K4-SS34XH-*
		8	1/2" XH	.84	21.3	8J4-SS12XH-*	8K4-SS12XH-*
HR-160 Maximum service temperature 2200°F (1204°C) in oxidizing and reducing atmospheres. Excellent resistance to sulfur, chlorides, and hot corrosion. Typically used in waste incineration.	**#160HR Seamless Nickel Alloy (HR-160)** Nickel 37%, Cobalt 30%, Chromium 28%, Iron 3.5% Silicon 2.75%, Molybdenum 1% Tungsten 1%, Manganese .5% Titanium .5%, Carbon .05%	8	3/4" Std	1.05	26.7		8K4-160HR34-*
		8	3/4" XH	1.05	26.7		8K4-160HR34XH-*
		8	1/2" Std	.84	21.3		8K4-160HR22-*
Cast Iron Maximum service temperature 1300°F (700°C) in oxidizing atmospheres. Typically used in	**#CI Cast Iron Extra Heavy (CIXH)** Extra Heavy wall. Cast Iron Protection Tube. Tube I.D. = .88" (22.4 mm). 3/4" NPT female thread.	8	3/4" FNPT	1.63	41.4	8J4-CIXH-*	8K4-CIXH-*
Coated Cast Iron Maximum service temperature 1300°F (700°C) in oxidizing atmospheres. Typically used in molten metal applications	**#CICG Cast Iron Ceramic Grazed Extra Heavy** Extra Heavy wall. Cast Iron Protection Tube. Tube I.D. = .88" (22.4 mm). 3/4" NPT female thread.	8	3/4" FNPT	1.63	41.4	8J4-CIXHCG-*	8K4-CIXHCG-*

*** Add the required thermocouple length "P" at the end of the part number. Multiples of 6" (152.4 mm) starting at 12" (304.8) are stocked.**

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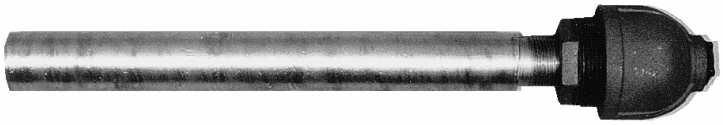
Straight Assemblies - Metal Protection Tubes -Types E, J, K & N - Screw Cover Head

Straight Assemblies
Configuration 4

1 
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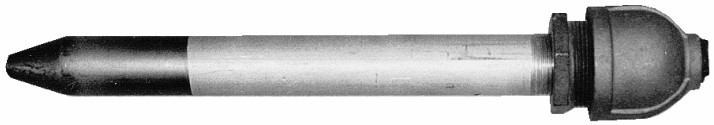
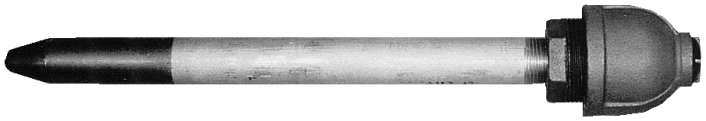
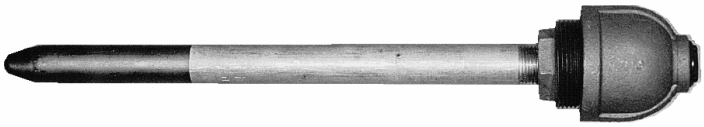
2 
1”
Pipe Size

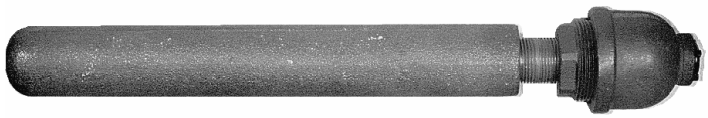
3 
3/4”
Pipe Size

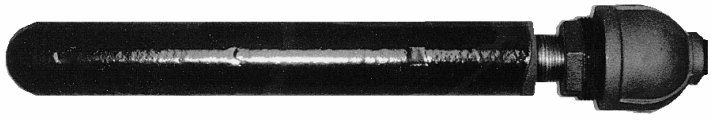
4 
1/2”
Pipe Size

5 
3/8”
Pipe Size

6 
1/4”
Pipe Size

7 
1/8”
Pipe Size

8 
CIXH
3/4” FNPT

9 
CIXHCG
3/4” FNPT

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Straight Assemblies, Metal Tubes -Types E, J, K & N - Standard Head, Aluminum

Easy to Order -
1 - State quantity
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(ours or competitive)
3 - Specify the length * Multiples of 6" (152.4 mm)
starting at 12" are stocked.
4 - Add letters for mounting attachments

Example: The part number describes the thermocouple giving the gauge, type of wire, construction, tube length and mounting device, if any. The part number **8K4-1012XH-24-SH-AF** signifies an 8 gauge, Type K complete assembly, 1/2" NPT extra heavy 24" long #10 alloy (32% nickel - 215 chromium) tube, a Standard Head and an 1/2" Adjustable Flange. Other combinations of thermocouples and tubes can be specified depending on your application.

! Note: If you would like to order a Type E, J, or N assembly, just substitute the "J" with an E, J, or N in the part numbers listed on this page.

Typical Application	Protection Tube	Wire Gauge	Pipe Size	Outside Diameter Inches	mm	Type J	Type K
601 Maximum service temperature 2300°F (1260°C) in oxidizing atmospheres. good resistance to sulfidizing atmospheres.	**#6 Seamless Nickel Alloy (601)** Nickel 60.5%, Chromium 23% Iron 14%, Aluminum 1.4% Copper .5%, Manganese .5% Silicon .2%, Carbon .05%	8	1" Std	1.32	33.4	8J4-601-*- SH	8K4-601-*- SH
		8	3/4" Std	1.05	26.7	8J4-634-*- SH	8K4-634-*- SH
		8	1/2" Std	.84	21.3	8J4-622-*- SH	8K4-622-*- SH
		11	3/8" Std	.68	17.2		11K4-638-*- SH
		14	3/8" Std	.68	17.2	14J4-638-*- SH	14J4-638-*- SH
446SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Excellent resistance to sulfidizing atmospheres , corrosion, scaling, and abrasion.	**#7 Seamless Stainless Steel (446)** Chromium 23-27% Manganese 1.5% Silicon 1%, Nitrogen .25% Carbon .20%, Sulphur .030% Phosphorous .040% Iron (Balance)	8	1" Std	1.32	33.4	8J4-701-*- SH	8K4-701-*- SH
		8	3/4" XH	1.05	26.7	8J4-734XH-*- SH	8K4-734XH-*- SH
		8	3/4" NPT	1.25	31.8	8J4-734SP-*- SH	8K4-734SP-*- SH
		8	1/2" Std	.84	21.3	8J4-722-*- SH	8K4-722-*- SH
		14	1/2" NPT	1.00	25.4	14J4-712SP-*- SH	14K4-712SP-*- SH
		11	3/8" Std	.54	13.7		11K4-738-*- SH
		14	3/8" Std	.68	17.2	14J4-738-*	14K4-738-*- SH
		14	1/4" Std	.54	13.7	14J4-714XH-*	14K4-714XH-*
304SS Maximum service temperature 1600°F (871°C) in oxidizing atmospheres.	**#8 Seamless Stainless Steel (304)** Chromium 19% Nickel 10%, Manganese 2% Silicon 1%, Carbon .20% Phosphorous .045% Sulphur .030% Iron (Balance)	8	3/4" Std	1.05	26.7	8J4-834-*- SH	8K4-834-*- SH
		8	3/4" XH	1.05	26.7	8J4-834XH-*- SH	8K4-834XH-*- SH
		8	3/4" NPT	1.25	31.8	8J4-834SP-*- SH	8K4-834SP-*- SH
		8	1/2" XH	.84	21.2	8J4-812XH-*- SH	8K4-812XH-*- SH
		11	3/8" Std	.68	17.2		11K4-838-*- SH
		14	3/8" Std	.68	17.2	14J4-838-*- SH	14K4-838-*- SH
		11	1/4" Std	.54	13.7		11K4-814-*- SH
		14	1/4" Std	.54	13.7	14J4-814-*- SH	14K4-814-*- SH
		14	1/8" Std	.41	10.3	14J4-818-*- SH	14K4-818-*- SH
600 Maximum service temperature 2100° F (1150°C) in oxidizing atmospheres. Avoid sulfidizing atmospheres.	**#9 Seamless Nickel Alloy (600)** Nickel 76% Chromium 15.5% Iron 8% Manganese .5% Silicon .2%, Copper .2% Carbon .08%	8	1" Std	1.32	33.4	8J4-901-*- SH	8K4-901-*- SH
		8	3/4" Std	1.05	26.7	8J4-934-*- SH	8K4-934-*- SH
		8	3/4" XH	1.05	26.7	8J4-934XH-*- SH	8K4-934XH-*- SH
		8	3/4" NPT	1.25	31.8	8J4-934SP-*- SH	8K4-934SP-*- SH
		8	1/2" Std	.84	21.3	8J4-922-*- SH	8K4-922-*- SH
		8	1/2" XH	.84	21.3	8J4-912XH-*- SH	8K4-912XH-*- SH
		11	3/8" Std	.68	17.2		11K4-938-*- SH
		14	3/8" Std	.68	17.2	14J4-938-*- SH	14K4-938-*- SH
		11	1/4" Std	.54	13.7		11K4-914-*- SH
		14	1/4" Std	.54	13.7	14J4-914-*- SH	14K4-914-*- SH
		14	1/8" Std	.41	10.3	14J4-918-*- SH	14K4-918-*- SH
800 Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Avoid sulfidizing atmospheres.	**#10 Seamless Nickel Alloy (800)** Nickel 35%, Chromium 23% Iron 39.5%, Manganese 1.5% Silicon 1%, Copper .75% Aluminum & Titanium .6% Carbon .1%	8	1" Std	1.32	33.4	8J4-1001-*- SH	8K4-1001-*- SH
		8	3/4" Std	1.05	26.7	8J4-1034-*- SH	8K4-1034-*- SH
		8	1/2" XH	.84	21.3	8J4-1012XH-*- SH	8K4-1012XH-*- SH

*** Add the required thermocouple length "P" at the end of the part number. Multiples of 6" (152.4 mm) starting at 12" (304.8) are stocked.**

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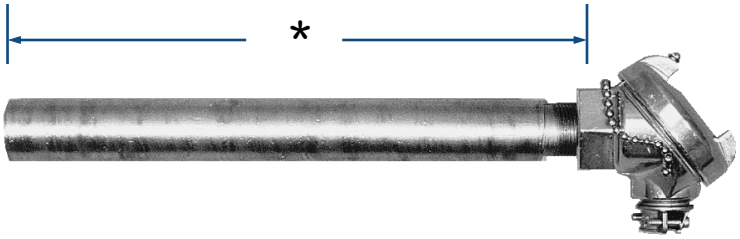
Straight Assemblies, Metal Tubes -Types E, J, K & N - Standard Head, Aluminum

The Richards Standard Head (**SH**) style die cats aluminum weatherproof head is the most versatile head we offer. This head has a NEMA 4 rating for indoor or outdoor use in non-hazardous locations. The cover and body have been polished to help prevent corrosion. The cover has a special silicon gasket, which helps protect the from wind-blown rain and dust. This gasket is also press fit into a groove to keep it from falling out when the cover is removed for inspection. A stainless steel chain is attached to the cover and body to prevent it from getting misplaced. One of the most beneficial advantages to this type of head is the variety of connector blocks which can be used. The Standard Head can also be fitted with our in-head style Transmitters (**TS**).

Straight Assemblies
Configuration 4



1	**SP** Size	
2	**1”** Pipe Size	
3	**3/4”** Pipe Size	
4	**1/2”** Pipe Size	
5	**3/8”** Pipe Size	
6	**1/4”** Pipe Size	
7	**1/8”** Pipe Size	

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Straight Assemblies, Metal Tubes -Types E, J, K & N - Standard Head, Aluminum

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Example: The part number describes the thermocouple giving the gauge, type of wire, construction, tube length and mounting device, if any. The part number **8K4-1012XH-24-SH-AF** signifies an 8 gauge, Type K complete assembly, 1/2" NPT extra heavy 24" long, #10 alloy (32% nickel - 215 chromium) tube, Standard Head an 1/2" Adjustable Flange. Other combinations of thermocouples and tubes can be specified depending on your application.

! **Note:** If you would like to order a Type E, J, or N assembly, just substitute the "**J**" with an E, or N in the part numbers listed on this page.

Typical Application	Protection Tube	Wire Gauge	Pipe Size	Outside Dia. Inches	Outside Dia. mm	Type J	Type K
316SS Maximum service temperature 1600°F (780°C) in oxidizing atmospheres. Considered better than 304SS on corrosion.	**#16 Seamless Stainless Steel (316)** Nickel 10-14%, Chromium 16-18% Molybdenum 2-3%, Manganese 2% Silicon 1%, Phosphorous .045% Carbon .08%, Sulfur .03%	8	1" Std	1.32	33.4	8J4-1601-*-SH	8K4-1601-*-SH
		8	3/4" Std	1.05	26.7	8J4-1634-*-SH	8K4-1634-*-SH
		8	3/4" XH	1.05	26.7	8J4-1634XH-*-SH	8K4-1634XH-*-SH
		8	3/4" NPT	1.25	31.8	8J4-1634SP-*-SH	8K4-1634SP-*-SH
		8	1/2" XH	.84	21.3	8J4-1612XH-*-SH	8K4-1612XH-*-SH
		11	3/8" Std	.68	17.2		11K4-1638-*-SH
		14	3/8" Std	.68	17.2	14J4-1638-*-SH	14K4-1638-*-SH
		11	1/4" Std	.54	13.7		11K4-1614-*-SH
		14	1/4" Std	.54	13.7	14J4-1614-*-SH	14K4-1614-*-SH
		14	1/8" Std	.41	10.3	14J4-1618-*-SH	14K4-1618-*-SH
310SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Resists heat scaling	**#20 Seamless Stainless Steel (310)** Chromium 24-26%, Nickel 19-22% Silicon 1.5%, Manganese 2% Carbon .25%, Phosphorous .045% Sulphur .03%, Iron (Balance)	8	1" Std	1.32	33.4	8J4-2001-*-SH	8K4-2001-*-SH
		8	3/4" Std	1.05	26.7	8J4-2034-*-SH	8K4-2034-*-SH
		8	1/2" Std	.84	21.3	8J4-2022-*-SH	8K4-2022-*-SH
		11	1/4" Std	.54	13.7		11K4-2014-*-SH
		14	1/4" Std	.54	13.7	14J4-2014-*-SH	14K4-2014-*-SH
		14	3/8" Std	.41	10.3	14J4-2018-*-SH	14K4-2018-*-SH
Carbon Steel Maximum service temperature 1000°F (540°C) in non-oxidizing applications. Typically used in galvanizing, tin, molten Babbitt, molten magnesium, petroleum applications and water lines.	**#SS Seamless Carbon Steel** Extra Heavy wall (**XH**) Double Extra Heavy wall (**DXH**)	8	1" DXH	1.32	33.4	8J4-SS01DXH-*-SH	8K4-SS01DXH*-SH
		8	1" XH	1.32	33.4	8J4-SS01XH-*-SH	8K4-SS01XH-*-SH
		8	3/4" XH	1.05	26.7	8J4-SS34XH-*-SH	8K4-SS34XH-*-SH
		8	1/2" XH	.84	21.3	8J4-SS12XH-*-SH	8K4-SS12XH-*-SH
		14	1/4" Std	.41	10.3	8J4-SS14-*-SH	8K4-SS14-*-SH
HR-160 Maximum service temperature 2200°F (1204°C) in oxidizing and reducing atmospheres. Excellent resistance to sulfur, chlorides, and hot corrosion. Typically used in waste incineration.	**#160HR Seamless Nickel Alloy** Nickel 37%, Cobalt 30%, Chromium 28%, Iron 3.5% Silicon 2.75%, Molybdenum 1% Tungsten 1%, Manganese .5% Titanium .5%, Carbon .05%	8	3/4" Std	1.05	26.7		8K4-160HR34-*-SH
		8	3/4" XH	1.05	26.7		8K4-160HR34XH-*-SH
		8	1/2" Std	.84	21.3		8K4-160HR22-*-SH
Cast Iron Maximum service temperature 1300°F (700°C) in oxidizing atmospheres. Typically used in molten metal applications.	**#CI Cast Iron** Extra Heavy wall **(CIXH)**. Cast Iron Protection Tube. Tube I.D. = .88" (22.4 mm). 3/4" NPT female thread.	8	3/4" FNPT	1.63	41.4	8J4-CIXH-*-SH	8K4-CIXH-*-SH
Coated Cast Iron Maximum service temperature 1300°F (700°C) in oxidizing atmospheres. Typically used in molten metal applications.	**#CICG Cast Iron Ceramic Grazed Extra Heavy (CICGXH)** Extra Heavy wall. Cast Iron Protection Tube. Tube I.D. = .88" (22.4 mm). 3/4" NPT female thread.	8	3/4" FNPT	1.63	41.4	8J4-CICGXH-*-SH	8K4-CICGXH-*-SH

*** Add the required thermocouple length "P" at the end of the part number. Multiples of 6" (152.4 mm) starting at 12" (304.8) are stocked.**

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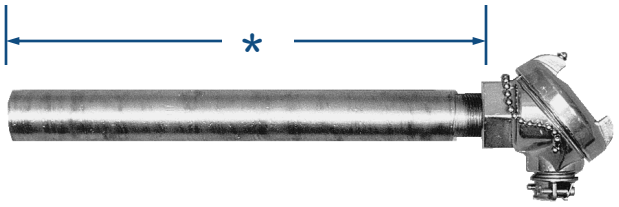
Straight Assemblies, Metal Tubes -Types E, J, K & N - Standard Head, Aluminum

Straight Assemblies
Configuration 4



1	**SP** Size	
2	**1”** Pipe Size	
3	**3/4”** Pipe Size	
4	**1/2”** Pipe Size	
5	**3/8”** Pipe Size	
6	**1/4”** Pipe Size	
7	**1/8”** Pipe Size	
8	**CIXH** 3/4” FNPT	
9	**CIXHCG** 3/4” FNPT	

Straight Assemblies - Ceramic Tubes - Types E, J, K & N - Screw Cover Heads

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starting at 12" are stocked.
4 - Add letters for mounting attachments
5 - For Double Element Assembly add "D" to the
part number (**14K4D-P11F-12**)

Example: The part number describes the thermocouple giving the gauge, type of wire, construction, tube length and mounting device, if any. The part number **8K4-P11F-24** signifies an 8 gauge, Type K complete assembly, 11/16" OD Mullite tube, 24" long, a 1/2" x 3/4" steel fitting, and a screw cover head. Other combinations of thermocouples and tubes can be specified depending on your application.

! Note: If you would like to order a Type E, J, or N assembly, just substitute the K with an E, J, or N in the part numbers listed on this page.

Typical Application	Protection Tube		Wire Gauge	Type K
Mullite **63.5% Aluminum Oxide, balance Silicon Dioxide** Mullite has a maximum service temperature of 2900°F (1590°C). It is considered to be better than Alumina for thermal shock resistance. Mullite tubes should be used with care, since they have poor mechanical shock resistance. Secondary metal tubes can be added for protection from mechanical damage. Mullite tubes are considered gas tight at high temperatures. All tubes which are used in horizontal installations and at elevated temperatures should be supported. Mullite tubes should not be used for primary protection tubes on noble metal (platinum based) thermocouples.	**Mullite Porcelain** Single tube, O.D. 3/8" (9.5 mm) 3/8" NPT steel hex nipple 1 1/2" long - Plug & Jack	**1**	14	**14K4-P06HXPJ-K3-***
	Mullite Porcelain Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting	**2**	8 14	**8K4-P11F-*** **14K4-P11F-****
	Mullite Porcelain Single tube, O.D. 11/16" (17.5 mm) 3/4" NPT steel nipple 2 1/2" long.	**3**	8 14	**8K4-P11N-*** **14K4-P11N-***
	Mullite Porcelain Single tube, O.D. 11/16" (17.5 mm), 3/4" NPT alloy 600 nipple sleeve Specify sleeve length (**Z**)	**4**	8 14	**8K4-P11N9-Z-*** **14K4-P11N9-Z-***
Silicon Carbide **90.0% Silicon Carbide, 9% Silicon Dioxide** Silicon Carbide has a maximum service temperature of 2730°F (1500°C). It has excellent resistance to thermal shock and the cutting action of flames. However, silicon carbide tubes are porous so they should not be used if a gas tight seal is required for protection of the thermocouple element. Because of their porosity, silicon carbide is usually used a the secondary thermocouple protection tube. The SCI type silicon carbide tubes are isopressed around a steel inner protection tube. This creates a gas tight unit, which is then considered a non-porous tube.	**Silicon carbide** Single tube, O.D. 1 3/4" (44.5 mm) 2.0" NPT Machined Steel Bushing	**5**	8 14	**8K4-SCB-*** **14K4-SCB-***
	Silicon carbide Single tube, Isopressed over a 1/2" steel pipe O.D. 2.0" (50.8 mm)	**6**	8 14	**8K4-SCI12-*** **14K4-SCI12-***
	Silicon carbide Single tube, Isopressed over a 3/4" steel pipe O.D. 2.0" (50.8 mm)	**6**	8 14	**8K4-SCI34-*** **14K4-SCI34-***
	Silicon carbide Single tube, O.D. 1 3/4" (44.5 mm) FSC2412 cast iron fitting, 3 stainless steel screws.	**7**	8 14	**8K4-SCF-*** **14K4-SCF-***

*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are in stock.**

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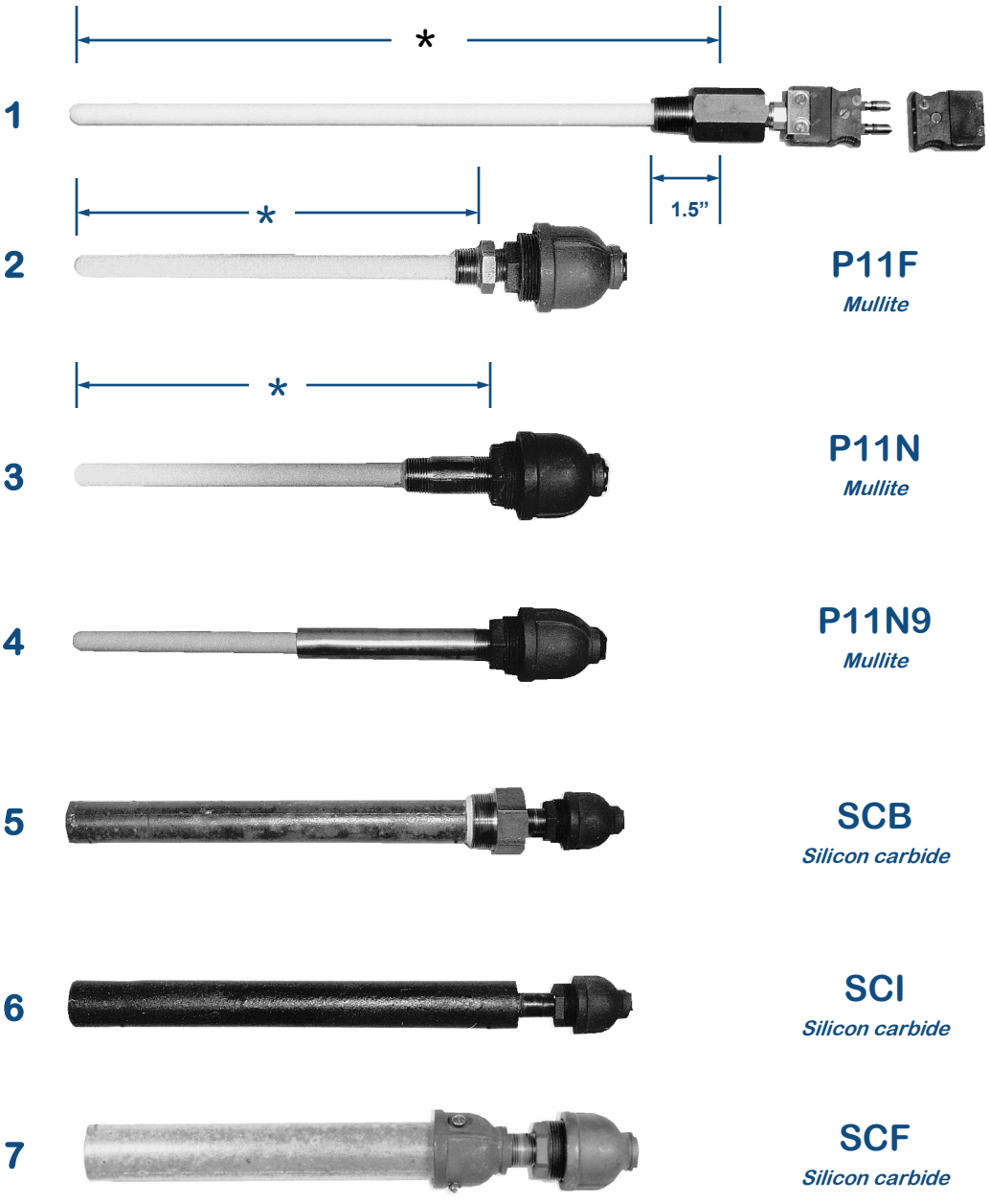
Straight Assemblies - Ceramic Tubes - Types E, J, K & N - Screw Cover Heads

The Richards Screw Cover Head makes inspection of the thermocouple easy. Unscrew the cover *without* disconnecting the leads. The single element can now be pulled out for inspection. The element is installed into the connector without bending, which prevents the insulators from cracking. If the element needs to be replaced, simply unscrew the two terminals and install a new one. The cover will never get dropped or lost since the extension wires pass through the center. The cover and bushing are cast iron, which have been coated and waxed to help prevent rust and corrosion.

Straight Assemblies
Configuration 4



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Straight Assemblies - Ceramic - Types E, J, K & N - Standard Head, Aluminum

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4 - Add letters for mounting attachments
5 - For Double Element Assembly add "D" to the
part number (**14K4D-P11F-12**)

Example: The part number describes the thermocouple giving the gauge, type of wire, construction, tube length and mounting device, if any. The part number **8K4-P11F-24-SH** signifies an 8 gauge, Type K complete assembly, 11/16" OD Mullite tube, 24" long, a 1/2" x 3/4" steel fitting, and a Standard Head (**SH**). Other combinations of thermocouples and tubes can be specified depending on your application.

! Note: If you would like to order a Type E, J, or N assembly, just substitute the K with an E, J, or N in the part numbers listed on this page.

Typical Application	Protection Tube		Wire Gauge	Type K
Mullite **63.5% Aluminum Oxide, balance Silicon Dioxide** Mullite has a maximum service temperature of 2900°F (1590°C). It is considered to be better than Alumina for thermal shock resistance. Mullite tubes should be used with care, since they have poor mechanical shock resistance. Secondary metal tubes can be added for protection from mechanical damage. Mullite tubes are considered gas tight at high temperatures. All tubes which are used in horizontal installations and at elevated temperatures should be supported. Mullite tubes should not be used for primary protection tubes on noble metal	**Mullite Porcelain** Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting	**1**	8 14	**8K4-P11F-*-SH** **14K4-P11F-*-SH**
	Mullite Porcelain Single tube, O.D. 11/16" (17.5 mm) 3/4" NPT steel nipple 2 1/2" long.	**2**	8 14	**8K4-P11N-*-SH** **14K4-P11N-*-SH**
	Mullite Porcelain Single tube, O.D. 11/16" (17.5 mm) 3/4" NPT alloy 600 nipple sleeve Specify sleeve length (**Z**)	**3**	8 14	**8K4-P11N9-Z-*-SH** **14K4-P11N9-Z-*-SH**
Silicon Carbide **90.0% Silicon Carbide, 9% Silicon Dioxide** Silicon Carbide has a maximum service temperature of 2730°F (1500°C). It has excellent resistance to thermal shock and the cutting action of flames. However, silicon carbide tubes are porous so they should not be used if a gas tight seal is required for protection of the thermocouple element. Because of their porosity, silicon carbide is usually used a the secondary thermocouple protection tube. The SCI type silicon carbide tubes are isopressed around a steel inner protection tube. This creates a gas tight unit, which is then considered a non-porous tube.	**Silicon carbide** Single tube, O.D. 1 3/4" (44.5 mm) 2.0" NPT Machined Steel Bushing	**4**	8 14	**8K4-SCB-*-SH** **14K4-SCB-*-SH**
	Silicon carbide Single tube, Isopressed over a 1/2" steel pipe O.D. 2.0" (50.8 mm)	**5**	8 14	**8K4-SCI12-*-SH** **14K4-SCI12-*-SH**
	Silicon carbide Single tube, Isopressed over a 3/4" steel pipe O.D. 2.0" (50.8 mm)	**5**	8 14	**8K4-SCI34-*-SH** **14K4-SCI34-*-SH**
	Silicon carbide Single tube, O.D. 1 3/4" (44.5 mm) **FSC2412** cast iron fitting, 3 stainless steel scre	**6**	8 14	**8K4-SCF-*-SH** **14K4-SCF-*-SH**
	Silicon carbide Single tube, O.D. 1 3/4" (44.5 mm) **SCFL** cast iron mounting flange for SCC type tube..	**7**	8 14	**8K4-SCFL-*-SH** **14K4-SCFL-*-SH**
	Silicon carbide Single tube, O.D. 1 3/4" (44.5 mm) **SCFC** cast iron clamp fitting for SCC type tube.	**8**	8 14	**8K4-SCFC-*-SH** **14K4-SCFC-*-SH**

*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are in stock.**

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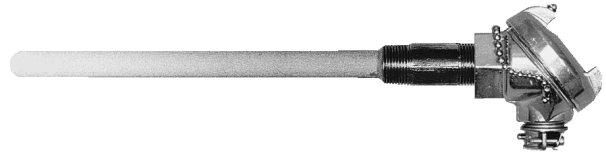
Straight Assemblies - Ceramic - Types E, J, K & N - Standard Head, Aluminum

The Richards die cast aluminum Standard Head (**SH**) is the most versatile head we offer. This head has a NEMA 4 rating for indoor or outdoor use in non-hazardous locations. The cover and body have been polished to help prevent corrosion. The cover has a special silicon gasket, which helps protect the connector block from wind-blown rain and dust. This gasket is also press fit into a grove to keep it from falling out when the cover is removed for inspection. A stainless steel chain is attached to the cover and body to prevent it from getting misplaced. One of the most beneficial advantages to this type of head is the variety of connector blocks which can be used. The Standard Head (**SH**) can also be fitted with our in-head style transmitters (**TS**).

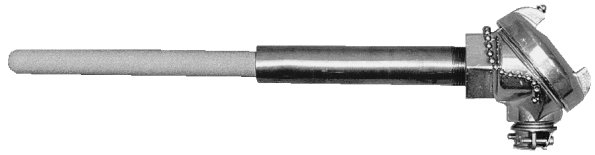
Straight Assemblies Configuration 4

1 

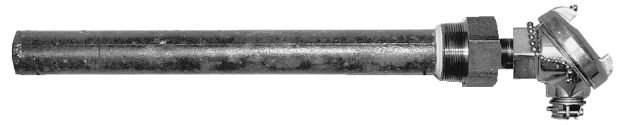
P11F
Mullite

2 

P11N
Mullite

3 

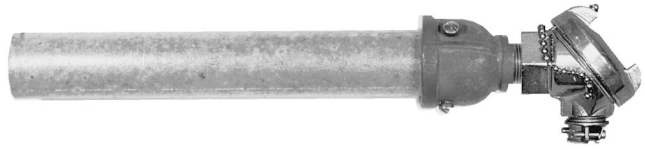
P11N9
Mullite

4 

SCB
Silicon Carbide

5 

SCI
Silicon Carbide

6 

SCF
Silicon Carbide

7 

SCFL
Silicon Carbide

SCFC
Silicon Carbide

8

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Straight Assemblies - Ceramic Tubes - Types B, R & S - Standard Head, Aluminum

Easy to Order -
1 - State quantity
2 - Specify the part number (ours or competitive)
3 - Specify the length * Multiples of 6" (152.4 mm) starting at 12" are stocked.
4 - Add letters for mounting attachments
5 - For Double Element Assembly add "D" to the part number (**24D4D-P11F-12-SH**)

Example: The part number describes the thermocouple giving the gauge, type of wire, construction, tube length and mounting device, if any. The part number **24S4-P11F-24-SH** signifies A 24 gauge, Type S complete assembly, 11/16" OD Mullite tube, 24" long, a 1/2" x 3/4" steel fitting, and a Standard Head (**SH**). Other combinations of thermocouples and tubes can be specified depending on your application.

! Note: If you would like to order a Type B, or Type R assembly, just substitute the S with an B, or R in the part numbers listed on this page.

Typical Application	Protection Tube		Wire Gauge	Type K
Alumina **99.8% Aluminum Oxide,** Alumina has a maximum service temperature of 3450°F (1900°C) in both oxidizing and reducing atmospheres. Alumina is considered to have better mechanical strength and chemical resistance than Mullite. Alumina tubes also have excellent abrasion resistance. Secondary metal tubes can be added for additional protection from mechanical damage. Alumina tubes are considered gas tight so they make excellent primary protection tubes. All tubes, which are used in horizontal installations and are at elevated temperatures, should be supported. Alumina tube can be used as primary protection tubes on noble (platinum based) thermocouples. Alumina tubes have a low silica content so they will not contaminate platinum thermocouple elements.	**Alumina** Single tube, O.D. 3/8" (9.5 mm) 3/8" NPT steel nipple 1 1/2" long Bushing, 1/2" x 3/8" NPT	**2**	24	**24S4-AP06N-*-SH**
	Alumina Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting	**3**	24	**24S4-AP11F-*-SH**
	Alumina Single tube, O.D. 11/16" (17.5 mm) 3/4" NPT alloy 600 nipple sleeve Specify sleeve length (**Z**)	**4**	24	**24S4-AP11N9-Z-*-SH**
Mullite **63.5% Aluminum Oxide, balance Silicon Dioxide** Mullite has a maximum service temperature of 2900°F (1590°C). It is considered to be better than Alumina for thermal shock resistance. Mullite tubes should be used with care, since they have poor mechanical shock resistance. Secondary metal tubes can be added for protection from mechanical damage. Mullite tubes are considered gas tight at high temperatures. All tubes which are used in horizontal installations and at elevated temperatures should be supported. Mullite tubes should not be used for primary protection tubes on noble metal (platinum based) thermocouples if the temperature will exceed 2200°F (1200°C). Above these temperatures the silica in the Mullite can contaminate the platinum element if there is not enough good air circulation inside the tube.	**Mullite Porcelain** Single tube, O.D. 3/8" (9.5 mm) Plug and Jack 3/8" NPT special steel hex fitting 1 1/2" long	**1**	24	**24S4-P06HXPJ-RS3-***
	Mullite Porcelain Single tube, O.D. 3/8" (9.5 mm) 1/2" NPT alloy 600 nipple sleeve Specify sleeve length (**Z**)	**5**	24	**24S4-P06N9-Z-*-SH**
	Mullite Porcelain Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting	**6**	24	**24S4-P11F-*-SH**
	Mullite Porcelain Single tube, O.D. 11/16" (17.5 mm) 3/4" NPT steel nipple 2 1/2" long.	**7**	24	**24S4-P11N-*-SH**

*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are in stock.** .

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Straight Assemblies - Ceramic Tubes - Types B, R & S - Standard Head, Aluminum

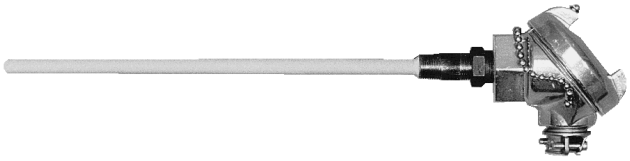
The Richards die cast aluminum Standard Head (**SH**) is the most versatile head we offer. This head has a NEMA 4 rating for indoor or outdoor use in non-hazardous locations. The cover and body have been polished to help prevent corrosion. The cover has a special silicon gasket, which helps protect the connector block from wind-blown rain and dust. This gasket is also press fit into a grove to keep it from falling out when the cover is removed for inspection. A stainless steel chain is attached to the cover and body to prevent it from getting misplaced. One of the most beneficial advantages to this type of head is the variety of connector blocks which can be used. The Standard Head (**SH**) can also be fitted with our in-head style transmitters (**TS**).

Straight Assemblies Configuration 4

1

P06HXPJ
Alumina

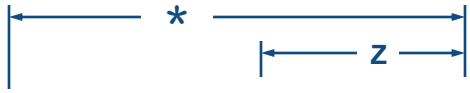
2



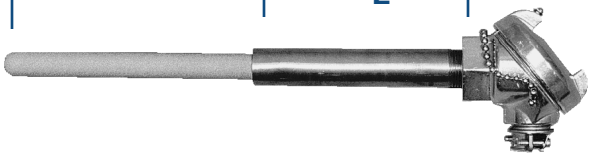
AP06N
Alumina

3

AP11F
Alumina

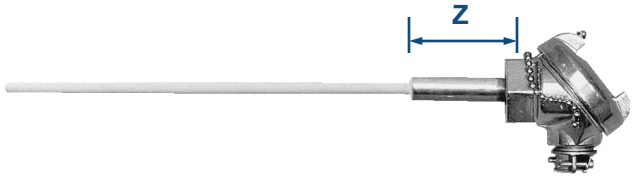


4



AP11N9
Alumina

5

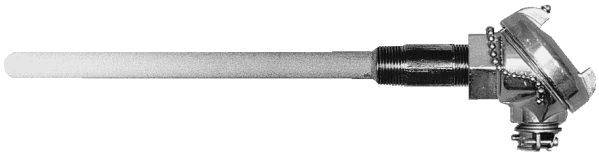


P06N9
Mullite

6

P11F
Mullite

7



P11N
Mullite

AP11N9 & **AP06N9** are composed of a ceramic tubes with a nipple of specified length "**Z**". If the length is not specified then it is assumed to be the standard length of 6" (152.4 mm). The number "**9**" signifies # 9 Alloy which is standard. Other alloy codes can be used (see codes on page 97)

Example: The part number **24S4-P06N9-4-24-SH** signifies A 24 gauge, Type S complete assembly , 3/8" OD Mullite tube, 24" long, a #9 alloy nipple 4" long, and a Standard Head (**SH**). Other combinations can be specified depending on your application.

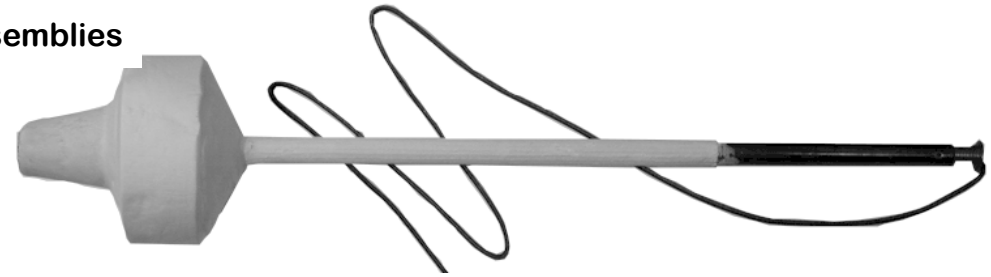
Refractory Thermocouple Assemblies and Tubes

Tube and Element

Application	Tube Inside Diameter Inches	Tube Inside Diameter mm	Shank Outside Diameter Inches	Shank Outside Diameter mm	Tip Outside Diameter Inches	Tip Outside Diameter mm	Fitting	Part Number
Refractory Thermocouple Assemblies Refractory fiber and cement laminate tubes have a maximum service temperature of 1500°F (815°C). The tubes come complete with a 20 gauge Type K thermocouple and 36" of lead wire installed. This eliminates the need to buy them separately. The tips of the tubes are made from silicon carbide to increase the response time. Refractory tubes are used in molten Zinc and Aluminum die casting applications. These refractory tubes will not shatter like ceramic tubes. They also will not contaminate the molten metal as a stain-	3/4"	19.1	1 5/8"	41.3	1 7/8"	45.3	3/4" NPT	**20K4RP30-***

* add the required thermocouple length (*) as the suffix. 12", 18" 21", 24", and 36" are considered stock items. Dual thermocouples available

Float and Element Assemblies



Application	Float Outside Diameter Inches	Float Outside Diameter mm	Float Length Inches	Float Length mm	Lead Wire Length	Fitting	Part Number
Floating Refractory Thermocouple Assemblies Refractory Floats are ideal for hand lading applications. They will read the temperature 3" below the molten metal surface. A silicon carbide tip gives them a fast response time. Ask one of our sales engineers for details.	4 1/4"	107.95	6"	152.4	36" 20 Gauge Type K	3/4" NPT	**20K4FT-***

* add the required thermocouple length (*) as the suffix. 6", 12" 16", and 24" are considered stock items.
The Floated stems are coated two thirds of their length.

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Refractory Tubes

Application	Tube Inside Diameter Inches	Tube Inside Diameter mm	Shank Outside Diameter Inches	Shank Outside Diameter mm	Tip Outside Diameter Inches	Tip Outside Diameter mm	Fitting	Part Number
Refractory Tubes Refractory fiber and cement laminate tubes have a maximum service temperature of 1500°F (815°C). The tips of the tubes are made from silicon carbide to increase the response time. Refractory tubes are used in molten Zinc and Aluminum die casting applications. These refractory tubes will not shatter like ceramic tubes. They also will not contaminate the molten metal as a stainless steel or iron protection tube.	3/4”	19.1	1 5/8”	41.3	1 7/8”	45.3	3/4” NPT	RP30-*
	1/2”	12.7	1 3/8”	34.9	1 5/8”	41.3	3/4” NPT	RP26-*

* add the required thermocouple length (*) as the suffix. 12”, 18” 21”, 24”, and 36” are considered stock items.

Refractory Cement

Refractory coating and bonding cement is available to provide an abrasive and shock resistant surface on refractory fibers, brick and other insulations. It is flame and heat resistant. It may be used also as a corrosion barrier for cast iron protection tubes, metal transfer troughs and other surfaces that come in contact with molten aluminum and zinc. It may be brushed or sprayed on. Available in pint, quart, gallon and 5 gallon pail sizes. Consult factory for availability and pricing.

Slip Cast Alumina Silica Refractory Tubes

Typical Application	Tube Outside Diameter Inches	Tube Outside Diameter mm	Emersion Length Inches	Emersion Length mm	Overall Length Inches	Overall Length mm	Pipe Size	Part Number Steel Tube	Part Number Stainless Tube
Slip Cast Alumina Silica Refractory Tubes Slip Cast alumina silica refractory tubes have a maximum service temperature of 1500°F (815°C). These tubes are constructed by casting the refractory material around an 1/2” steel or 304 stainless steel protection tube. Alumina silica refractory tubes are used in molten Zinc and Aluminum die casting applications. Alumina silica tubes have excellent thermal shock and mechanical damage resistance They are non-wetting and will not contaminate the molten metal as a stainless steel or iron protection tube.	2.0”	50.8	11”	0.43	13”	0.51	1/2” NPT	AS-12	ASSS-12
	2.0”	50.8	17”	0.67	19”	0.75		AS-18	ASSS-18
	2.0”	50.8	23”	0.91	25”	0.98		AS-24	ASSS-24
	2.0”	50.8	29”	1.14	31”	1.22		AS-30	ASSS-30
	2.0”	50.8	35”	1.38	37”	1.46		AS-36	ASSS-36

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Straight Assemblies - Double Tube -Types E, J, K & N - Screw Cover Head

The Richards Double Tube Thermocouple Assemblies are designed for severe service applications. The double tube assemblies with a metal outer tube are for applications where mechanical damage and thermal shock to the thermocouple is a problem. The double tube assemblies which have a Silicon Carbide outer tube are for applications where thermal shock and flame contact is a problem. Double ceramic tube assemblies are for extra protection against corrosive atmospheres. We offer many other combinations of double tubes, which we could not list in this catalog due to space limitations. Richards double tube assemblies can be made from any type of metal or ceramic tube, which is available.

! ***Note:*** If you would like to order a Type E, J, or Type N assembly, just substitute the K with an E, J, or N in the part numbers listed on this page. Triple tube assemblies are also available.

	Primary Tube (Inner)	Secondary Tube (Outer)	Wire Gauge	Type K
1	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**#7 Seamless Stainless Steel (446)** Chromium 23-27%, Manganese 1.5% Silicon 1%, Nitrogen .25%, Carbon 2%, Sulphur .030%, Phosphorous .040%, Iron (Balance) Construction: 3/4" pipe, Extra Heavy, Schedule 80	8 14	8K5-P11F-734XH-* 14K5-P11F-734XH-*
2	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**#9 Seamless Stainless Steel Alloy (600)** Nickel 76%, Chromium 15.5%, Iron 8%, Manganese .5%, Silicon .2%, Copper .2%, Carbon .08% Construction: 3/4" pipe, Schedule 40	8 14	8K5-P11F-934-* 14K5-P11F-934-*
3	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 3/8" (9.5 mm) Cemented	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	14 20	14K5-P06-P11F-* 20K5-P06-P11F-*
4	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) Cemented	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 1" (25.4 mm) 3/4" x 1" NPT steel fitting.	8 14	8K5-P11-P16F-* 14K5-P11-P16F-*
5	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**CIXH (Cast Iron Extra Heavy)** Extra Heavy wall, Cast Iron Tube Construction: Single tube, O.D. 1.63" (41.1 mm)	8 14	8K5-P11F-CIXH-* 14K5-P11F-CIXH-*
6	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**CIXHCBG (Cast Iron Extra Heavy Coated)** Extra Heavy wall, Coated Cast Iron Tube Construction: Single tube, O.D. 1.63" (41.1 mm)	8 14	8K5-P11F-CIXHCG* 14K5-P11F-CIXHCG*
7	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, O.D. 1 3/4" (44.5 mm) 2.0" NPT Machined Steel Bushing	8 14	8K5-P11F-SCB-* 14K5-P11F-SCB-*
8	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, O.D. 1 3/4" (44.5 mm) FSC1216 cast iron fitting and 3 stainless steel screws	8 14	8K5-P11F-SCF-* 14K5-P11F-SCF-*
9	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, Isopressed over a 3/4" NPT steel pipe. O.D. 2.0" (50.8 mm)	8 14	8K5-P11F-SCI34-* 14K5-P11F-SCI34-*

*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are in stock.**

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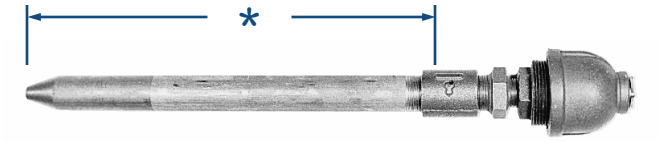
Straight Assemblies - Double Tubes - Types E, J, K & N - Screw Cover Head

The Richards Screw Cover Head makes inspection of the thermocouple easy. Unscrew the cover *without* disconnecting the leads. The single element can now be pulled out for inspection. The element is installed into the connector without bending, which prevents the insulators from cracking. If the element needs to be replaced, simply unscrew the two terminals and install a new one. The cover will never get dropped or lost since the extension wires pass through the center. The cover and bushing are cast iron, which have been coated and waxed to help prevent rust and corrosion.

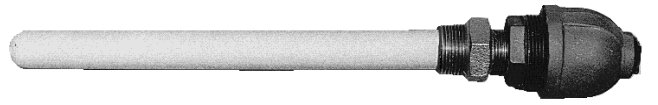
Straight Assemblies Configuration 5



1 **P11F-734XH**
Mullite - 446 Stainless

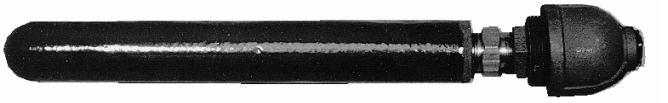
2 **P11F– 934**
Mullite—Alloy 600

3 **P06-P11F**
Mullite - Mullite



4 **P11-P16F**
Mullite-Mullite

5 **P11F-CIXH**
Mullite-Cast Iron



6 **P11F-CG**
Mullite-Cast Iron coated

7 **P11F-SCB**
Mullite-Silicon Carbide, Bushing

8 **P11F-SCF**
Mullite-Silicon carbide, Fitting

9 **P11F-SCI34**
Mullite-Silicon carbide, Isopressed

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Straight Assemblies - Double Tube -Types E, J, K & N - Standard Head, Aluminum

The Richards Double Tube Thermocouple Assemblies are designed for severe service applications. The double tube assemblies with a metal outer tube are for applications where mechanical damage and thermal shock to the thermocouple is a problem. The double tube assemblies which have a Silicon Carbide outer tube are for applications where thermal shock and flame contact is a problem. Double ceramic tube assemblies are for extra protection against corrosive atmospheres. We offer many other combinations of double tubes, which we could not list in this catalog due to space limitations. Richards double tube assemblies can be made from any type of metal or ceramic tube, which is available.

! ***Note:*** If you would like to order a Type E, J, or Type N assembly, just substitute the K with an E, J, or N in the part numbers listed on this page. Triple tube assemblies are also available.

	Primary Tube (Inner)	Secondary Tube (Outer)	Wire Gauge	Type K
1	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**#7 Seamless Stainless Steel (446)** Chromium 23-27%, Manganese 1.5% Silicon 1%, Nitrogen .25%, Carbon 2%, Sulphur .030%, Phosphorous .040%, Iron (Balance) Construction: 3/4" pipe, Extra Heavy, Schedule 80	8 14	**8K5-P11F-734XH-*-SH** **14K5-P11F-734XH-*-SH**
2	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**#9 Seamless Stainless Steel Alloy (600)** Nickel 76%, Chromium 15.5%, Iron 8%, Manganese .5%, Silicon .2%, Copper .2%, Carbon .08% Construction: 3/4" pipe, Schedule 40	8 14	**8K5-P11F-934-*-SH** **14K5-P11F-934-*-SH**
3	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 3/8" (9.5 mm) Cemented	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	14 20	**14K5-P06-P11F-*-SH** **20K5-P06-P11F-*-SH**
4	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) Cemented	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 1" (25.4 mm) 3/4" x 1" NPT steel fitting.	8 14	**8K5-P11-P16F-*-SH** **14K5-P11-P16F-*-SH**
5	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**CIXH (Cast Iron Extra Heavy)** Extra Heavy wall, Cast Iron Tube Construction: Single tube, O.D. 1.63" (41.1 mm)	8 14	**8K5-P11F-CIXH-*-SH** **14K5-P11F-CIXH-*-SH**
6	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**CIXHCBG (Cast Iron Extra Heavy Coated)** Extra Heavy wall, Coated Cast Iron Tube Construction: Single tube, O.D. 1.63" (41.1 mm)	8 14	**8K5-P11F-CIXHCG-*-SH** **14K5-P11F-CIXHCG-*-SH**
7	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, O.D. 1 3/4" (44.5 mm) 2.0" NPT Machined Steel Bushing	8 14	**8K5-P11F-SCB-*-SH** **14K5-P11F-SCB-*-SH**
8	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, O.D. 1 3/4" (44.5 mm) FSC1216 cast iron fitting and 3 stainless steel screws	8 14	**8K5-P11F-SCF-*-SH** **14K5-P11F-SCF-*-SH**
9	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, Isopressed over a 3/4" NPT steel pipe. O.D. 2.0" (50.8 mm)	8 14	**8K5-P11F-SCI34-*-SH** **14K5-P11F-SCI34-*-SH**
	*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are in stock.**			

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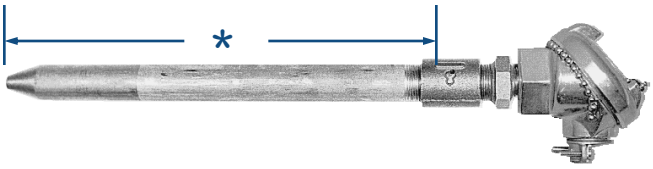
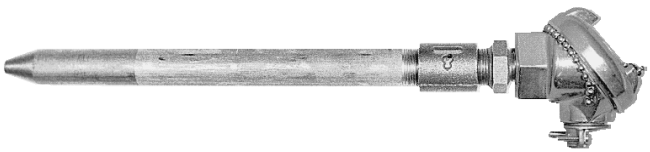
Straight Assemblies - Double Tubes - Types E, J, K & N - Standard Head, Aluminum

The Richards die cast aluminum Standard Head (**SH**) is the most versatile head we offer. This head has a NEMA 4 rating for indoor or outdoor use in non-hazardous locations. The cover and body have been polished to help prevent corrosion. The cover has a special silicon gasket, which helps protect the connector block from wind-blown rain and dust. This gasket is also press fit into a grove to keep it from falling out when the cover is removed for inspection. A stainless steel chain is attached to the cover and body to prevent it from getting misplaced. One of the most beneficial advantages to this type of head is the variety of connector blocks which can be used. The Standard Head (**SH**) can also be fitted with our in-head style transmitters (**TS**).

Straight Assemblies Configuration 5

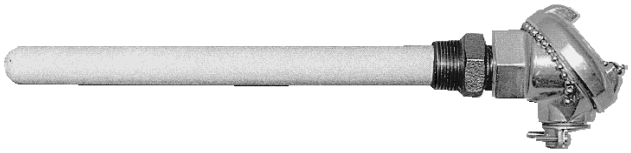


1 **P11F-734XH-SH**
Mullite - 446 Stainless

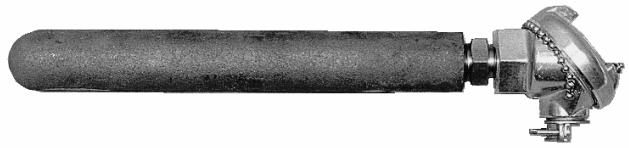


2 **P11F– 934-SH**
Mullite—Alloy 600

3 **P06-P11F-SH**
Mullite - Mullite



4 **P11-P16F-SH**
Mullite-Mullite



5 **P11F-CIXH-SH**
Mullite-Cast Iron

6 **P11F-CIXHCG-SH**
Mullite-Cast Iron coated

7 **P11F-SCB-SH**
Mullite-Silicon Carbide, Bushing

8 **P11F-SCF-SH**
Mullite-Silicon carbide, Fitting

9 **P11F-SCI34-SH**
Mullite-Silicon carbide, Isopressed

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Arklay S. Richards Co., Inc.

Straight Assemblies - Double Tube -Types B, R, & S - Standard Head, Aluminum

The Richards Double Tube Thermocouple Assemblies are designed for severe service applications and molten glass furnaces. The double tube assemblies with a metal outer tube are for applications where mechanical damage and thermal shock to the thermocouple is a problem. The double tube assemblies, which have a Silicon Carbide outer tube, are for applications where thermal shock and flame contact is a problem. Double ceramic tube assemblies are for extra protection against corrosive atmospheres. We offer many other combinations of double tubes, which we could not list in this catalog due to space limitations. Richards double tube assemblies can be made from any type of metal or ceramic tube, which is available.

! ***Note:*** If you would like to order a Type B, or Type R assembly, just substitute the S with a B or R in the part numbers listed on this page. Triple tube assemblies are also available.

	Primary Tube (Inner)	Secondary Tube (Outer)	Wire Gauge	Type K
1	**Alumina** 98.8 Aluminum Oxide Construction: Single tube, O.D. 3/8" (9.5 mm) Cemented.	**Alumina** 98.8 Aluminum Oxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	24	**24S5-AP06-AP11F-*-SH**
2	**Alumina** 98.8 Aluminum Oxide Construction: Single tube, O.D. 11/16" (17.5 mm) Cemented.	**Alumina** 98.8 Aluminum Oxide Construction: Single tube, O.D. 1" (25.4 mm) 3/4" x 1" NPT steel fitting.	24	**24S5-AP11-AP16F-*-SH**
3	**Alumina** 98.8 Aluminum Oxide Construction: Single tube, O.D. 1" (25.4 mm) 3/4" x 1" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, O.D. 1 3/4" (44.5 mm) 2.0" NPT Machined Steel Bushing	24	**24S5-AP11F-SCB-*-SH**
4	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) Cemented	**#7 Seamless Stainless Steel (446)** Chromium 23-27%, Manganese 1.5% Silicon 1%, Nitrogen .25%, Carbon 2%, Sulphur .030%, Phosphorous .040%, Iron (Balance) Construction: 3/4" pipe, Extra Heavy, Schedule 80	24	**24S5-P11F-734XH-*-SH**
5	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**#9 Seamless Stainless Steel Alloy (600)** Nickel 76%, Chromium 15.5%, Iron 8%, Manganese .5%, Silicon .2%, Copper .2%, Carbon .08% Construction: 3/4" pipe, Schedule 40	24	**24S5-P11F-934-*-SH**
6	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 3/8" (9.5 mm) Cemented	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	24	**24S5-P06-P11F-*-SH**
7	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, O.D. 1 3/4" (44.5 mm) 2.0" NPT Machined Steel Bushing	24	**24S5-P11F-SCB-*-SH**
8	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, O.D. 1 3/4" (44.5 mm) FSC1216 cast iron fitting and 3 stainless steel screws	24	**24S5-P11F-SCF-*-SH**
9	**Mullite Porcelain** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, Isopressed over a 3/4" NPT steel pipe. O.D. 2.0" (50.8 mm)	24	**24S5-P11F-SCI34-*-SH**

*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are in stock.**

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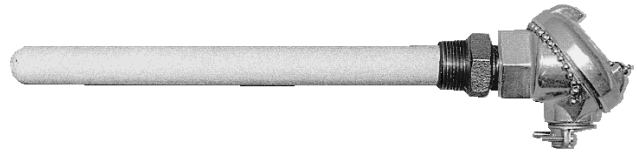
Straight Assemblies - Double Tubes - Types B, R & S - Standard Head, Aluminum

The Richards die cast aluminum Standard Head (**SH**) is the most versatile head we offer. This head has a NEMA 4 rating for indoor or outdoor use in non-hazardous locations. The cover and body have been polished to help prevent corrosion. The cover has a special silicon gasket, which helps protect the connector block from wind-blown rain and dust. This gasket is also press fit into a grove to keep it from falling out when the cover is removed for inspection. A stainless steel chain is attached to the cover and body to prevent it from getting misplaced. One of the most beneficial advantages to this type of head is the variety of connector blocks which can be used. The Standard Head (**SH**) can also be fitted with our in-head style transmitters (**TS**).

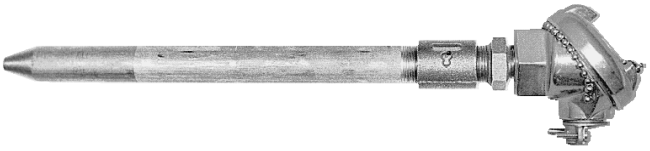
Straight Assemblies Configuration 5

1 **AP06-AP11F-SH**
Alumina - Alumina

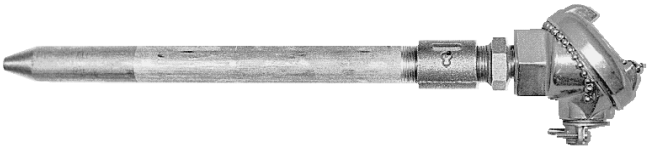


2 **AP11-AP16F-SH**
Alumina - Alumina

3 **AP11F-SCB-SH**
Alumina - Silicon Carbide, Bushing



4 **P11F-734XH-SH**
Mullite - 446 Stainless

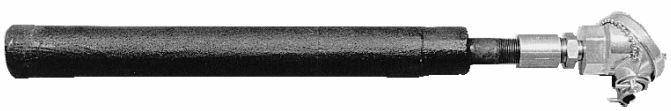


5 **P11F-934-SH**
Mullite - Alloy 600

6 **P06-P11F-SH**
Mullite - Mullite

7 **P11F-SCB-SH**
Mullite-Silicon Carbide, Bushing

8 **P11F-SCF-SH**
Mullite-Silicon Carbide, Fitting

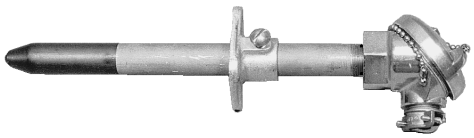


9 **P11F-SCI34-SH**
Mullite-Silicon Carbide, Isopressed

Straight Assemblies - Mounting Attachments

1

Metal Tube



Ceramic Tube

Adjustable Flange (AF)

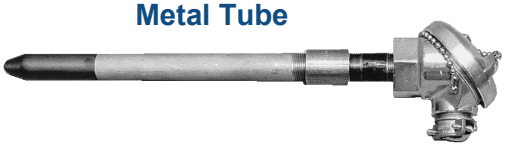
An adjustable flange is used to adjust the protection tube's depth of insertion. In most cases the tube should extend into fluids at least six times the out side diameter of the tube. If the tube is going into a gas, it should extend a minimum of eight times the outside diameter of the tube. The adjustable flange can also be used to extend the connection head away from excessive heat or corrosive gases. A flange will not give a gas tight seal. If a gas tight seal is required, a Threaded Fitting (**TF**) or a Welded fitting **(W**) should be used. On Ceramic tubes it is necessary to have a metal sleeve to mount the flange. This will prevent the tube from breaking when the set screw is tightened. This sleeve is normally made from high temperature #9 alloy (600).

To add an adjustable flange to a metal or ceramic assembly, add (**AF**) to the end of the part number.

Examples: Metal: 8K4-722-18-SH-AF (18", #7 alloy metal tube assembly, and an adjustable flange.)
Ceramic: 8K4-P11N9-6-18-SH-AF (18", Mullite tube assembly, 6" #9 alloy sleeve, and an adjustable flange.)

2

Metal Tube



Ceramic Tube

Extensions (E)

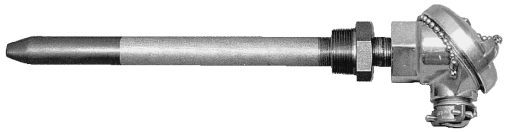
An Extension is used where it is not necessary to have the alloy pipe extend through the cool part of the furnace. By using a steel extension (or balance pipe), the total cost of the protection tube can be reduced. The extension also keeps the connection head out of any corrosive gases and away from excessive heat. Extensions can be added to metal or ceramic protection tubes.

To add an extension to a metal or ceramic assembly, add (**E**) and the number of inches to the end of the part number.

Examples: Metal: 8K4-722-18-E-12-SH (18", #7 alloy metal tube assembly, and a 12" extension.)
Ceramic: 8K4-P11F-18-E-12-SH (18", Mullite tube assembly, and a 12" extension.)

3

Metal Tube



Threaded Fitting (TF)

A Threaded Fitting has three threads; it is screwed on to the open end of a protection tube and then screwed into the furnace to give a gas tight seal. The third thread permits the tube to be extended beyond the fitting for mounting a terminal head. The replacement of a protection tube with a threaded fitting is less expensive than one with a welded bushing since only the tube needs to be changed. The standard outside thread size is 1 1/4" NPT. 1/2" NPT threaded fittings are standard outside threads on 1/4" and 1/8" pipe sizes. Other sizes can be ordered by specifying the size in 1/16ths of and inch.

Example: A 1 1/2" x 1/2" 1/2" NPT thread fitting would be a **TF2408**. See under "Accessories" for more details.

To add a threaded fitting to a metal assembly, add (**TF**) to the part number.

Example: Metal: 8K4-722-18-TF-6-SH (18", #7 alloy metal tube assembly, Threaded Fitting and a 6" extension.)

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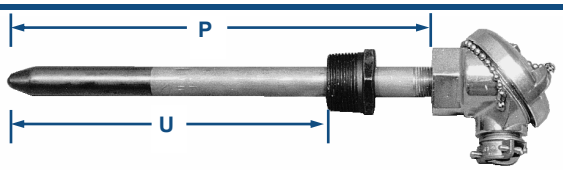
4



Welded Bushings (W)

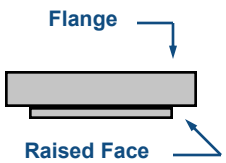
A welded bushing is welded directly on the protection tube. The tube can then be screwed into the furnace to give a gas tight seal. Protection tubes with a welded bushing are more expensive than threaded fittings since the alloy extends outside the furnace. Also the bushing must be replaced with the tube. The standard outside thread size on a welded bushing is 1 1/4" NPT. 1/2" NPT welded bushings are used as standard outside threads on 1/4" and 1/8" pipe sizes. Other sizes can be ordered by specifying the size in 1/16ths of and inch. See under accessories for lengths of bushings.

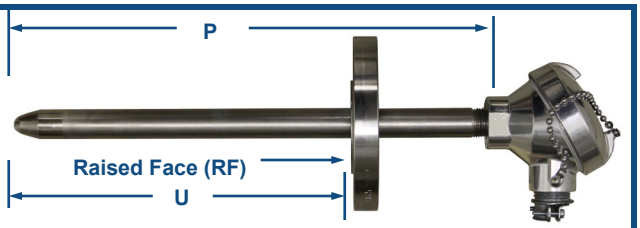
Example: A 1 1/2" x 1/2" 1/2" NPT welded bushing would be a **W2408**. See "Bushings" under "Accessories" for more details.

To add a welded bushing to a metal assembly, add (**W**) to the part number followed by the immersion "U" length

Example: Metal: 8K4-734XH-36-W-24-SH (36", #7 alloy metal tube assembly, 1 1/4" NPT welded bushing, 24" immersion (U) length measured from the tip of the tube to the bottom of the bushing.) The immersion length (U) is shown on the figure above. In most cases the tube should extend into fluids at least six times the outside diameter of the tube. If the tube is going into a gas, it should extend a minimum of eight times the outside diameter of the tube.

5





Metal Tube Flange (FS & RF) Assemblies

Stainless Steel ANSI Blind Flanges are available with a Raised Faced (**RF**) or Flat Faced (**FS**) gasket surface. A gasket gives a gas tight seal. The more commonly used Raised Faced flanges are the low pressure 150# Class or the high pressure 300# Class. All Raised Faced flanges are forged and meet ASTM A182 and ANSI/ASME B16.5 specifications. Raised faced thicknesses above the flange face are 1/16" (1.59 mm) for the 150 and 300 pressure classes and 1/4" (6.35 mm) in the 400, 600, 900, 1500, and 2500 classes.

Low pressure stainless steel Flat Faced (**FS**) 150# Class flanges, also known as the Manufacturers Standardization Society (MSS) flanges, are machined from castings. These Flat Flanges meet ASTM A351 and conform to MSS SP-42 for diameter and bolt holes and also MSS SP-51 for thickness. ANSI flanges (Flat & Raised Faced) are usually machined from 316 Stainless Steel stock. The 316 Stainless Steel contains more Nickel and has the addition of Molybdenum which gives it better corrosion resistance than 304 Stainless Steel.

Part Numbers are composed of : Tube-Tube Length "P"- Flange Number (see table)-Material Code (see table)- "U" Length– Head

Example: **722-18-FS2415-CS-12-SH** Assembly (FS = Flat Faced - Carbon Steel)

316SS flanges are standard (and the Material Code may be omitted from the part Number).

Example: **722-18-RF2415-12-SH** Assembly (pictured above is Raised Face)

Note: Blind Flanges are drilled for the required Protection Tube pipe size.

MC = Material Code from this table. Other Materials available upon request. Also see Material Code table on page 97 (Thermowells).

Flange Material Codes Selection	
Material	**Cod**
304 Stainless	08
316 Stainless	16
446 Stainless	07
Carbon Steel	CS
Inconel 600	09
Inconel 601	06

Partial Flange Table. For the complete table, see page 199.

FS & RF Part Number	Pipe Size	Lbs / Inch	Flange Diameter	RF Diameter	Flange Thickness, minimum	Bolt Circle Diameter	Number of Bolts	Bolt Hole Diameter
1615	1"	150	4.25	2"	0.56	3.12	4	0.62
2415	1 1/2"	150	5.00	2.88"	0.69	3.88	4	0.62
2430	1 1/2"	300	6.12	2.88"	0.81	4.50	4	0.88
2460	1 1/2"	600	6.12	2.88"	0.88	4.50	4	0.88
4815	3"	150	7.50	5.00"	0.94	6.00	4	0.75
6415	4"	150	9.00	6.19"	0.94	7.50	8	0.75
32150	2"	1500	8.50	3.62"	1.50	6.50	8	1.00

Straight Assemblies - Stepped Thermowell - Types E, J, K & N - Standard Head

Need To Customize Your Assembly? - Fine Tune The Part Number

After locating a standard part number, you can fine tune the assembly for your application. Substitute any "**MC**" charcters with your thermowell material code requirements. 316SS ("**16**") is standard. If you would like to order a type E, J, N, or Type T assembly, substitute the "**K**" with an "**E**", "**J**", "**N**", or "**T**" in the part numbers listed on this page. For elements having ungrounded junctions, add a "**U**" after the "**K**" in the part number. **Example**: **KUA030081604.5**

Thermocouple, Type K—Style "A"

Assembly Part Number	Type	Process Thread (P)	Insert Length (U)	Shank Dia. (Q)
KA03008MC02.5	K	1/2" NPT (male)	2 1/2"	0
KA03008MC04.5			4 1/2"	5/8"
KA03008MC07.5			7 1/2"	5/8"
KA03008MC10.5			10 1/2"	5/8"
KA03008MC13.5			13 1/2"	5/8"
KA03008MC16.5			16 1/2"	5/8"
KA03008MC22.5			22 1/2"	5/8"
KA03012MC02.5	K	3/4" NPT (male)	2 1/2"	0
KA03012MC04.5			4 1/2"	3/4"
KA03012MC07.5			7 1/2"	3/4"
KA03012MC10.5			10 1/2"	3/4"
KA03012MC13.5			13 1/2"	3/4"
KA03012MC16.5			16 1/2"	3/4"
KA03012MC22.5			22 1/2"	3/4"
KA03016MC02.5	K	1" NPT (male)	2 1/2"	0
KA03016MC04.5			4 1/2"	7/8"
KA03016MC07.5			7 1/2"	7/8"
KA03016MC10.5			10 1/2"	7/8"
KA03016MC13.5			13 1/2"	7/8"
KA03016MC16.5			16 1/2"	7/8"
KA03016MC22.5			22 1/2"	7/8"

MC = Select Material Code from table on opposite page 316 SS ("**16**') is standard.

Thermocouple, Type K—Style "B"

Assembly Part Number	Type	Process Thread (P)	Insert Length (U)	Shank Dia. (Q)
KB03008MC02.5E**	K	1/2" NPT (male)	2 1/2"	0
KB03008MC04.5E**			4 1/2"	5/8"
KB03008MC07.5E**			7 1/2"	5/8"
KB03008MC10.5E**			10 1/2"	5/8"
KB03008MC13.5E**			13 1/2"	5/8"
KB03008MC16.5E**			16 1/2"	5/8"
KB03008MC22.5E**			22 1/2"	5/8"
KB03012MC02.5E**	K	3/4" NPT (male)	2 1/2"	0
KB03012MC04.5E**			4 1/2"	3/4"
KB03012MC07.5E**			7 1/2"	3/4"
KB03012MC10.5E**			10 1/2"	3/4"
KB03012MC13.5E**			13 1/2"	3/4"
KB03012MC16.5E**			16 1/2"	3/4"
KB03012MC22.5E**			22 1/2"	3/4"
KB03016MC02.5E**	K	1" NPT (male)	2 1/2"	0
KB03016MC04.5E**			4 1/2"	7/8"
KB03016MC07.5E**			7 1/2"	7/8"
KB03016MC10.5E**			10 1/2"	7/8"
KB03016MC13.5E**			13 1/2"	7/8"
KB03016MC16.5E**			16 1/2"	7/8"
KB03016MC22.5E**			22 1/2"	7/8"

Union extends 3 inches (standard)
Example: KB030081607.5E05

Thermocouple, Type K—Style "C"

Assembly Part Number	Type	Process Thread (P)	Insert Length (U)	Shank Dia. (Q)
KC03008MC02.5E**	K	1/2" NPT (male)	2 1/2"	0
KC03008MC04.5E**			4 1/2"	5/8"
KC03008MC07.5E**			7 1/2"	5/8"
KC03008MC10.5E**			10 1/2"	5/8"
KC03008MC13.5E**			13 1/2"	5/8"
KC03008MC16.5E**			16 1/2"	5/8"
KC03008MC22.5E**			22 1/2"	5/8"
KC03012MC02.5E**	K	3/4" NPT (male)	2 1/2"	0
KC03012MC04.5E**			4 1/2"	3/4"
KC03012MC07.5E**			7 1/2"	3/4"
KC03012MC10.5E**			10 1/2"	3/4"
KC03012MC13.5E**			13 1/2"	3/4"
KC03012MC16.5E**			16 1/2"	3/4"
KC03012MC22.5E**			22 1/2"	3/4"
KC03016MC02.5E**	K	1" NPT (male)	2 1/2"	0
KC03016MC04.5E**			4 1/2"	7/8"
KC03016MC07.5E**			7 1/2"	7/8"
KC03016MC10.5E**			10 1/2"	7/8"
KC03016MC13.5E**			13 1/2"	7/8"
KC03016MC16.5E**			16 1/2"	7/8"
KC03016MC22.5E**			22 1/2"	7/8"

Extension, No Union

All assemblies on this page have the "SH" Standard Head (Aluminum).

Other heads are available just add the head catalog number to the end of these part numbers.

Example: (Cast Iron Head) KB03016MC10.5E05CIH

For Dual Element add a "D" after thermocouple Type: KAD

For ungrounded add "U" Type: KCU

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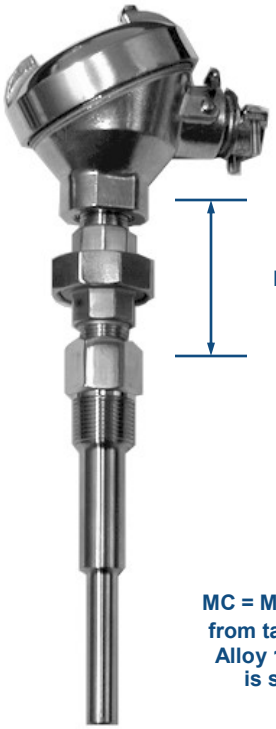
Straight Assemblies - Stepped Thermowell - Types E, J, K & N - Standard Heads

Thermocouple Assembly—Stepped Thermowell Standard Features:

- √ 316SS Step Shank Thermowell
- √ Male NPT Process Connection
- √ 316SS Union Fitting
- √ Spring Loaded Element
- √ 316SS 1/4" Diameter Sheath
- √ Types E, J, K, N &T
- √ Special Limits of Error
- √ High Purity MgO Insulation
- √ NEMA 4 Aluminum Head
- √ Grounded Junction
- √ Nipple Extensions: 316SS Schedule 80 Pipe

Type A
Union

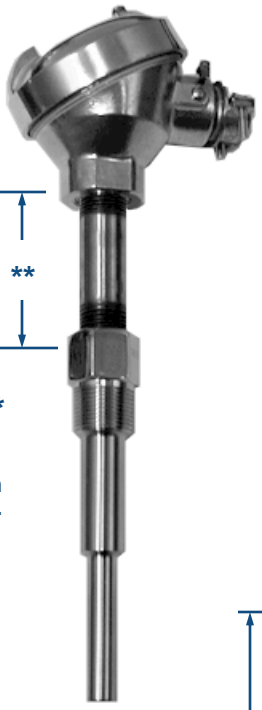


Union Extends 3"

MC = Material Code from table below - Alloy 16 (316SS) is standard.

Type B
Union & extension

Type C
Extension, no union



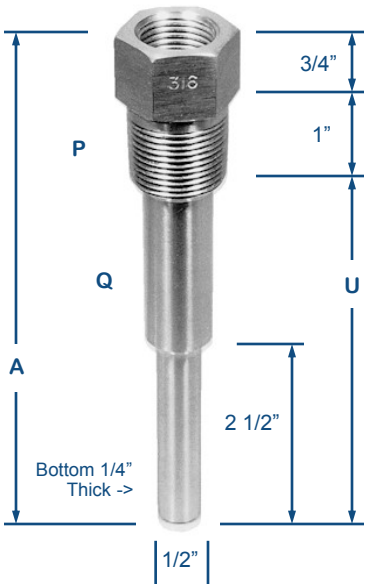
Nipple Extensions 5" Minimum **

Substitute the ** in the part number with the nipple extension length in inches.

! Note:

Any thermocouple assembly can be ordered without a union or spring loaded.

T030
Well



Note: MC in catalog numbers = Material Codes from this table							
Material Selection Codes							
Material	Code	Material	Code	Material	Code	Material	Code
304 Stainless	08	A105, Grade II	A2	Hastelloy B	HB	Nickel	NI
309 Stainless	18	Alloy 214	14	Hastelloy C-276	HC	Tantalum	TA
310 Stainless	20	Brass	BR	Incoloy	10	Titanium	TI
316 Stainless	16	Carbon Steel	CS	Inconel 600	09	Teflon	TF
347 Stainless	47	Carpenter 20	CA	Inconel 601	06	Other Materials available upon request.	
446 Stainless	07	F-11	11	Monel K	MK		
A105, Grade I	A1	F-22	22	Monel R	MR		

Thermocouples - Miniature and Subminiature Assemblies - Plugs and Jacks

	Application	Wire Gauge	O.D. Inches	O.D. mm	Part Number Type K
1	**Miniature, Plugs and Jacks** Miniature Thermocouple Assemblies have a maximum service temperature of 1300°F (700°C) depending on the type and gauge of thermocouple wire used. They have limited use at high temperatures due to the types of insulation used in their construction. Miniature thermocouples are more flexible than MgO (swaged) types. 1/8", 3/16" and 1/4" O.D. tube assemblies are made with silicon impregnated fiber-glass insulated elements. Standard assemblies are supplied with a floating junction and solid round pin male plug and female jack. Since the junction is floating, the tube or element can easily be replaced. Grounded junctions can, however, if required, are available. Insert "**-U**" after the "**4M**" in the part number.	16 20 20 24	1/4" 1/4" 3/16" 1/8"	6.4 6.4 4.8 3.3	**16K4M-9M4-K1-*** **20K4M-9M4-K1-*** **20K4M-9M3-K1-*** **24K4M-9M2-K1-***
2		16 20 20 24	1/4" 1/4" 3/16" 1/8"	6.4 6.4 4.8 3.3	**16K4M-9M4-K2-*** **20K4M-9M4-K2-*** **20K4M-9M3-K2-*** **24K4M-9M2-K2-***
3	Optional 1/8" NPT stainless steel compression fitting can be attached by adding a "**CF** to the end of the part number. An 1/8" NPT fitting is standard on 1/8" and 3/16" O.D. tubes. A 1/4" NPT compression fitting is standard on all 1/4" O.D. tubes.	16 20 20 24	1/4" 1/4" 3/16" 1/8"	6.4 6.4 4.8 3.3	**16K4M-9M4-K3-*** **20K4M-9M4-K3-*** **20K4M-9M3-K3-*** **24K4M-9M2-K3-***
4	**Subminiature, Plugs and Jacks** Subminiature Thermocouple Assemblies have a maximum service temperature of 400°F (204°C) depending on the type and gauge of thermocouple wire used. They have limited use at high temperatures due to the types of insulation used in their construction. Subminiature thermocouples are more flexible than MgO (swaged) types. The 1/16" diameter thermocouple assemblies are made with a Kapton® insu-lated thermocouple wire. Standard assemblies are supplied with a floating junction and a flat pin male plug and female jack. Since the junction is floating, the tube or element can easily be replaced. Grounded junctions can, however, if required, are available. Insert "**-U**" after the "**4M**" in the part number.	30	1/16"	1.6	**30K4M-9M4-KM1-***
5		30	1/16"	1.6	**30K4M-9M4-KM2-***
6	Optional 1/8" NPT stainless steel compression fitting can be attached by adding a "**CF** to the end of the part number.	30	1/16"	1.6	**30K4M-9M4-KM3-***
7	**Pointed Probes** A pointed probe is used to penetrate a soft material such as food products. When used with food products the probe should be made of 316 stainless steel. Add: "**PN**" to the part number.	**Example: 20K4M-16M3-PN-K1-06** Specifies a Type K Miniature thermocouple assembly, 6" pointed probe, and plug.			
8	**Ceramic Insulator, Collar, and Plug** A pointed probe is used to penetrate a soft material such as food products. When used with food products the probe should be made of 316 stainless steel. Add: "**PN**" to the part number.	**Example: 24R8C-RS1-12** Specifies a Type R thermocouple element in a 3/16" O.D. Alumina insulator, collar, plug and 18" length.			
9	**Flexible Extensions** Armored cable may be used as a Flexible Extension on miniature tubes. State miniature assembly by using the length of immersion "U" plus "**FE**" and the length of the flexible extension (in at least two digits).	**Example: 20K4M-9M3-K3-12-FE06** (12" protection tube and 6" of Flexible Extension)			
10	**Armored Cable** Armored cable may be used as a flexible protection on leads attached to Jacks (or Plugs). State miniature assembly plus "**AC**" and the length of the extension (in at least	**Example: 20K4M-9M3-K3-18-AC36** Specifies a Type K Miniature thermocouple assembly, Plug and Jack and 36" Armored covered lead.			

*** add the required thermocouple length (*) as the suffix. 12", 18" 21", 24", and 36" are considered stock items. Alloy #9 is standard, other alloys are available - see pages 88 & 90. For Dual thermocouples add a "D" to the part number: Example: 20KD4M**

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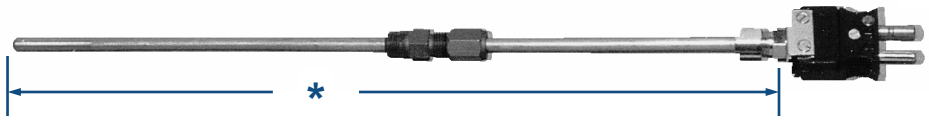
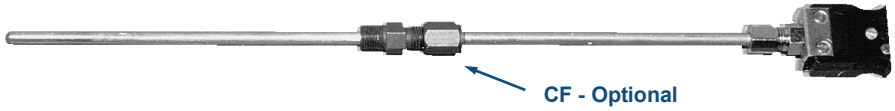
Straight Assemblies Configuration 4M

1 

Miniature
Standard Plug

2 

Miniature
Standard Jack

3 

Miniature
Standard Plug and Jack

4 

Subminiature
Flat Pin Plug

5 

Subminiature
Flat Pin Jack

6 

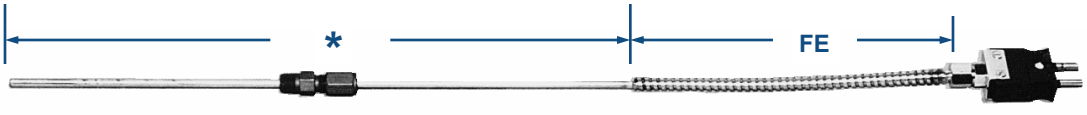
Subminiature
Flat Pin Plug and Jack

7 

Miniature
Pointed Probes

8 

Miniature
Insulator and Collar

9 

Miniature
Flexible Extensions

10 

Miniature
And Armored Cable

* Add the required thermocouple length (*) as the suffix. 12”, 18” 21”, 24”, and 36” are considered stock items.
Dual thermocouples also available.

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Thermocouples - Miniature Assemblies with Hex Fittings and Heads

Miniature Thermocouple Assemblies have a maximum service temperature of 1300° F (700°C) depending on the type and guage of the thermocouple wire used. They have limited use at higher temperatures due to the types of insulation used in theri construction. Miniature thermocouples are more felexible than MGO (Swaged) types. 1/8", 3/16" and 1/4" O.D. tube assemblies are made with silicon impregnated fiberglass elements.

! ***Note:*** If you would like to order a Type E, J, N, or Type T assembly, just substitute the "**K**" with a "**E**", "**J**", "**N**", or "**T**" in the part numbers listed on this page. Double element assemblies are also available. Add a "**D**" to the part number. **Example: 20K4DM-9M4-48-SH.** Probes can also be made with Types: B, R, and S, phone for details. Sheaths can be made of other materials and sizes - see page on "Miniature Tubes".

	Application	Wire Gauge	Outside Diameter Inches	Outside Diameter mm	Type K
1	**Miniature, Hex Fitting** Miniature Thermocouple Assemblies with a hex fitting (**HX**) are used where a stainless steel 1/2" x 1/2" NPT fitting is desirable for mounting to the process and connection head. The hex fittings are welded to the tube for strength and proper sealing. A grounded junction is standard to help prevent the element from pulling out of the tube. The elements in hex fitting assemblies are made with silicon impregnated fiberglass insulated wire.	16 20 20 24	1/4 1/4 3/16 1/8	6.4 6.4 4.8 3.3	**16K4M-G-9M4-HX-*** **20K4M-G-9M4-HX-*** **20K4M-G-9M3-HX-*** **20K4M-G-9M2-HX-***
2	**Miniature, Hex, Standard Head (SH) - Aluminum** A floating junction, stainless steel 1/2" x 1/2" NPT hex fitting, and (**SH**) style aluminum weather resistant head are all standard.	16 20 20 24	1/4 1/4 3/16 1/8	6.4 6.4 4.8 3.3	**16K4M-G-9M4-HX-*-SH** **20K4M-G-9M4-HX-*-SH** **20K4M-G-9M3-HX-*-SH** **20K4M-G-9M2-HX-*-SH**
3	**Miniature, Standard Head (SH) - Aluminum** A floating junction, stainless steel compression fitting (**CF**), bushing, and (**SH**) style aluminum weather resistant head are all standard.	16 20 20 24	1/4 1/4 3/16 1/8	6.4 6.4 4.8 3.3	**16K4M-G-9M4-*-SH** **20K4M-G-9M4-*-SH** **20K4M-G-9M3-*-SH** **20K4M-G-9M2-*-SH**
4	**Miniature, Hex, Nylon Head (NH)** A floating junction, stainless steel 1/2" x 1/2" NPT hex fitting, and (**NH**) style aluminum weather resistant head are all standard.	16 20 20 24	1/4 1/4 3/16 1/8	6.4 6.4 4.8 3.3	**16K4M-G-9M4-*-NH** **20K4M-G-9M4-*-NH** **20K4M-G-9M3-*-NH** **24K4M-G-9M2-*-NH**
5	**Miniature, Open Terminal (OTH)** Miniature Open Terminal (**OTH**) Assemblies are used in clean environment applications where the terminals can be exposed for easy access or low profile situations. 3/26" diameter tubes and floating junction are standard. The elements are made from silicon impregnated fiberglass insulated wire.	20 20 24	1/4 3/16 1/8	6.4 4.8 3.3	**20K4M-G-9M4-*-OTH4** **20K4M-G-9M3-*-OTH3** **20K4M-G-9M2-*-OTH2**
6	**Miniature, Molded Handle (MH)** Molded Handle (**MH**) assemblies are made with a plastic grip. The leads are covered with stainless steel overbraid for protection and the standard termination is a flat pin male mini connector. Floating junction is standard.	16 20 20 24 30	1/4 1/4 3/16 1/8 1/16	6.4 6.4 4.8 3.3 1.6	**16K4M-G-9M4-MH-Y-Z** **20K4M-G-9M4-MH-Y-Z** **20K4M-G-9M3-MH-Y-Z** **24K4M-G-9M2-MH-Y-Z** **30K4M-G-9M1-MH-Y-Z**

*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are in stock. Note: * = Probe length in figures shown.**

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Thermocouples - Miniature Assemblies with Hex Fittings and Heads

Junctions:

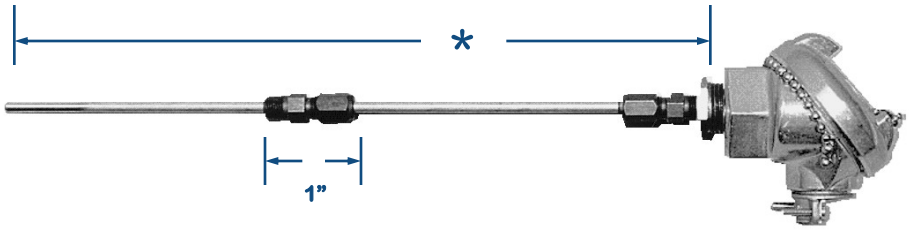
Note: If you need a junction other than the listed standard, substitute the "G" in the part number with a F, U, or E.

Straight Assemblies Configuration 4M

1 **Miniature**
1/2" x 1/2" Hex Fitting

2 **Miniature**
Hex Fitting, Standard Head

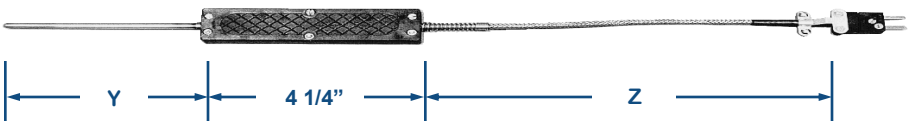
3 **Miniature**
Compression Fitting, Standard Head



4 **Miniature**
Hex Fitting and Nylon Head

5 **Miniature**
Open Terminal

6 **Miniature**
Molded Handle



Thermocouples - Probes without Connectors or Heads

! *Note:* If you would like to order a Type E, J, N, or Type T assembly, just substitute the "**K**" with a "**E**", "**J**", "**N**", or "**T**" in the part numbers listed on this page. Double element assemblies are also available. Add a "**D**" to the part number. **Example: 20K4DM-9M4-48-SH.**

Probes can also be made with Types: B, R, and S, phone for details. Also, sheaths can be made of other materials and sizes - see page on "Miniature Tubes"

Thermocouple Probes have a maximum service temperature of 1300°F (700°C) depending on the type and gauge of the thermocouple wire used in their construction. The elements are made with impregnated fiberglass wire. The 30 gauge 1/16" O.D. probes have a high temperature limit of 400°F (200°C) due to Kapton insulation on the element. A grounded junction is standard to help prevent the element from pulling out of the tube and to provide a rapid temperature response time.

	Application	Wire Gauge	Outside Diameter Inches	Outside Diameter mm	Type K
1	**Probe, Plain** Standard plain probe. Specify : "X" overall length, and "Y" probe sheath length.	16 20 20 24 30	1/4 1/4 3/16 1/8 1/16	6.4 6.4 4.8 3.3 1.6	**16K4P-G-9M4-X-Y** **20K4P-G-9M4-X-Y** **20K4P-G-9M3-X-Y** **24K4P-G-9M2-X-Y** **30K4P-G-9M1-X-Y**
2	**Probe, Overbraided OB8 = 304SS OB9 = Alloy 9 (600)** The overbraid is on the exposed insulated wire portion of the probe - from the sheath to the cold end. It is used to protect the insulation from abrasion and to help shield against electrical pick up.	16 20 20 24 30	1/4 1/4 3/16 1/8 1/16	6.4 6.4 4.8 3.3 1.6	**16K4P-G-9M4-X-Y-OB8** **20K4P-G-9M4-X-Y-OB8** **20K4P-G-9M3-X-Y-OB8** **24K4P-G-9M2-X-Y-OB8** **30K4P-G-9M1-X-Y-OB8**
3	**Probe, Compression Fitting** A Compression Fitting (**CF**) is added to the assembly. A 1/8" NPT stainless steel compression fitting for sheaths with outside diameters of 1/16" to 3/16"; 1/4" NPT for 1/4" sheaths. Special sizes are available - under Accessories, Compression Fittings.	16 20 20 24 30	1/4 1/4 3/16 1/8 1/16	6.4 6.4 4.8 3.3 1.6	**16K4P-G-9M4-X-Y-CF** **20K4P-G-9M4-X-Y-CF** **20K4P-G-9M3-X-Y-CF** **24K4P-G-9M2-X-Y-CF** **30K4P-G-9M1-X-Y-CF**
4	**Probe, Flexible Extension** Flexible extensions (**FE**) are made with Armored Cable (**AC**). The "**Z**" dimension may or may not completely cover the normally exposed insulated wire depending on what length you specify. The Compression Fitting is optional, if desired add "**CF**" to the part number.	16 20 20 24 30	1/4 1/4 3/16 1/8 1/16	6.4 6.4 4.8 3.3 1.6	**16K4P-G-9M4-X-Y-FEZ** **20K4P-G-9M4-X-Y-FEZ** **20K4P-G-9M3-X-Y-FEZ** **24K4P-G-9M2-X-Y-FEZ** **30K4P-G-9M1-X-Y-FEZ**
5	**Probe, Angle** 90 degree and 45 degree angel are standard, but other angels can be ordered. The part numbers shown are for 45 degree probes. For 90 degree, change the "45" to "90" in the part number. For the optional Relief Spring (**SR**) add " **SR**" to the end of the part number. The Compression Fitting is optional, if desired add "**CF**" to the part number.	16 20 20 24 30	1/4 1/4 3/16 1/8 1/16	6.4 6.4 4.8 3.3 1.6	**16K45P-G-9M4-X-H-C** **20K45P-G-9M4-X-H-C** **20K45P-G-9M3-X-H-C** **24K45P-G-9M2-X-H-C** **30K45P-G-9M1-X-H-C**
6	**Probe, Angle, Flexible Extension** 90 degree and 45 degree angel are standard, but other angels can be ordered. The part numbers shown are for 90 degree probes. For 45 degree, change the "90" to "45" in the part number. The Compression Fitting is optional, if desired add "**CF**" to the part number. Spade Lugs (**LS**) also available (at added cost).	16 20 20 24 30	1/4 1/4 3/16 1/8 1/16	6.4 6.4 4.8 3.3 1.6	**16K90P-G-9M4-X-H-C-FEZ** **20K90P-G-9M4-X-H-C-FEZ** **20K90P-G-9M3-X-H-C-FEZ** **24K90P-G-9M2-X-H-C-FEZ** **30K90P-G-9M1-X-H-C-FEZ**

#9 Alloy (600) is standard, but other alloys such as: #7 (446SS), #8 (304SS), *16 (316SS), Hastelloy C etc. are also available. See listings under "Miniature Metal Protection Tubes. Just replace the "9" in the part number with the desired alloy.

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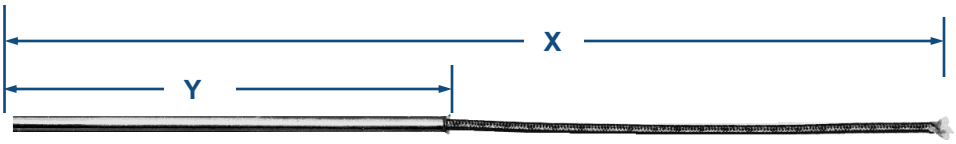
Probes without Connectors or Heads

Junctions:

Note: If you need a junction other than the listed standard, substitute the "G" in the part number with a F, U, or E.

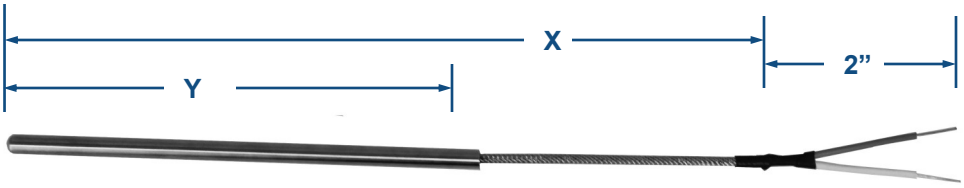
Straight Assemblies Configuration 4P

1



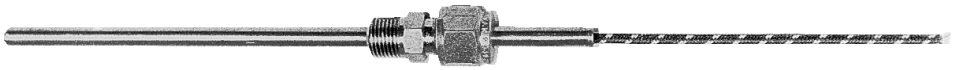
Probe
Plain

2



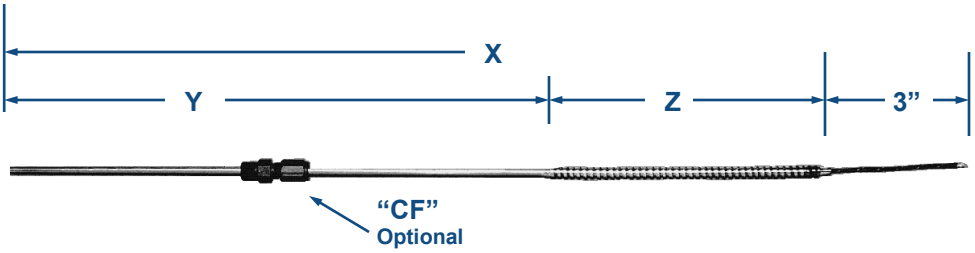
Probe
Overbraided

3



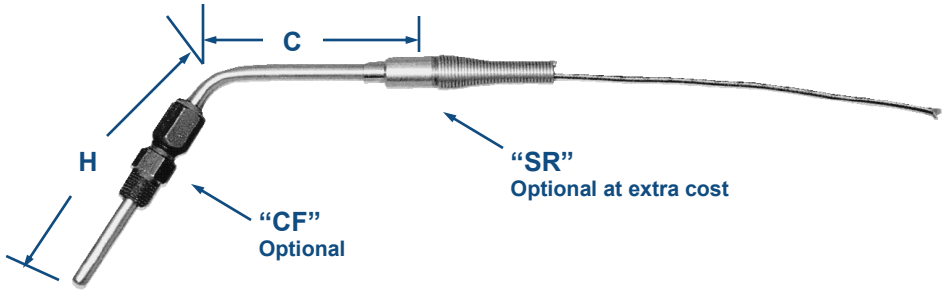
Probe
Compression Fitting

4



Probe
Flexible Extension,
3" leads standard

5



Probe, Angle
Plain

6

Probe, Angle
Flexible Extension

Dimension Key:

C = Cold Leg Length	**Y =** Metal Probe Length
H = Hot Leg Length	**Z =** Flexible Extension Length
X = Overall Length	

Thermocouples - Probes with Bayonet Fittings

! *Note:* If you would like to order a Type E, J, N, or Type T assembly, just substitute the "**K**" with a "**E**", "**J**", "**N**", or "**T**" in the part numbers listed on this page. Double element assemblies are also available. Add a "**D**" to the part number. **Example: 20KBDG9M3-X-Y-U**

Probes can also be made with Types: B, R, and S, phone for details. Also, sheaths can be made of other materials and sizes - see page on "Miniature Tubes". "**U**" = Bayonet Fitting Location, "**X**" = overall length, "**Y**" = probe length, "**Z**" = Flexible Extension Length, "**C**" = Cold Leg length, and "**H**" = Hot leg length.

Thermocouple Probes have a maximum service temperature of 1300°F (700°C) depending on the type and gauge of the thermocouple wire used in their construction. The Bayonet Fitting presets the depth and allows quick attachment and removal. The elements are made with impregnated fiberglass wire. The 30 gauge 1/16" O.D. probes have a high temperature limit of 400°F (200°C) due to Kapton insulation on the element. A grounded junction is standard to help prevent the element from pulling out of the tube and to provide a rapid temperature response time.

	Application	Wire Gauge	Outside Diameter Inches	Outside Diameter mm	Type K
1	**Probe, Bayonet Fitting** Standard plain Bayonet Fitting probe. Specify : "**X**" overall length, and "**Y**" probe sheath length. Specify "**U**" Length for location of Bayonet Fitting on probe. If it is at the tip of the hot end then "**U**" = 2 (2 inches).	20 24	3/16 1/8	4.8 3.3	**20KBG9M3-X-Y-U** **24KBG9M2-X-Y-U**
2	**Probe, Bayonet Fitting** **Overbraided OB8 = 304SS OB9 = Alloy 9 (600)** The overbraid is on the exposed insulated wire portion of the probe - from the sheath to the cold end. It is used to protect the insulation from abrasion and to help shield against electrical pick up.	20 24	3/16 1/8	4.8 3.3	**20KBG9M3-X-Y-U-OB8** **24KBG9M2-X-Y-U-OB8**
3	**Probe, Bayonet Fitting, Plug & Jack (K3)** A Quick disconnect Plug and Jack (**K3**) is added to the assembly. Removing (K3) and substituting a (**K1**) would be a Plug only,. Substituting a (**K2**) would be a Jack only..	20 24	3/16 1/8	4.8 3.3	**20KBF9M3-K3-Y-U** **24KBF9M2-K3-Y-U**
4	**Probe, Bayonet Fitting & Flexible Extension** Flexible extensions (**FE**) are made with Armored Cable (**AC**). The "**Z**" dimension may or may not completely cover the normally exposed insulated wire depending on what length you specify for the "**Z**" length.	20 24	3/16 1/8	4.8 3.3	**20KBG9M3-X-Y-U-Z** **24KBG9M2-X-Y-U-Z**
5	**Probe, Angle, Bayonet Fitting** 90 degree and 45 degree angel are standard, but other angels can be ordered. The part numbers shown are for 45 degree probes. For 90 degree, change the "45" to "90" in the part number. For the optional Relief Spring (**SR**) add " **SR**" to the end of the part number.	20 24	3/16 1/8	4.8 3.3	**20K45BG9M3-X-Y-U-Z** **24K45BG9M2-X-Y-U-Z**
6	**Probe, Angle, Bayonet Fitting, Flexible Extension** 90 degree and 45 degree angel are standard, but other angels can be ordered. The part numbers shown are for 90 degree probes. For 45 degree, change the "90" to "45" in the part number. The Compression Fitting is optional, if desired add "**CF**" to the part number. Spade Lugs (**LS**) also available (at added cost).	20 24	3/16 1/8	4.8 3.3	**20K90BG9M3-X-Y-U-Z** **24K90BG9M2-X-Y-U-Z**

#9 Alloy (600) is standard, but other alloys such as: #7 (446SS), #8 (304SS), *16 (316SS), Hastelloy C etc. are also available. See listings under "Miniature Metal Protection Tubes. Just replace the "9" in the part number with the desired alloy.

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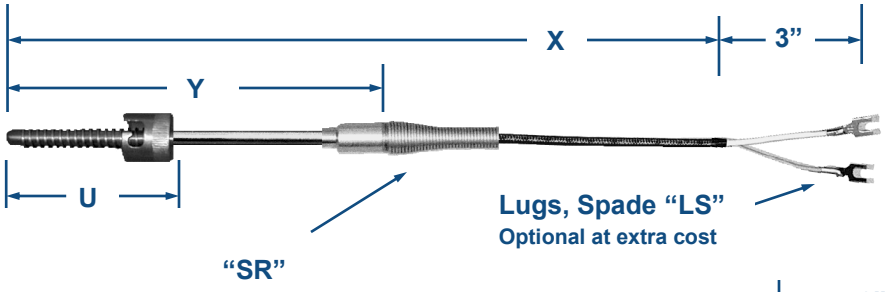
Thermocouples - Bayonet Fittings

Junctions: Floating (F) | Grounded (G) | Ungrounded (U) | Exposed (E))

Note: If you need a junction other than the listed standard "G" (Grounded), substitute the "G" in the part number with a F, U, or E.

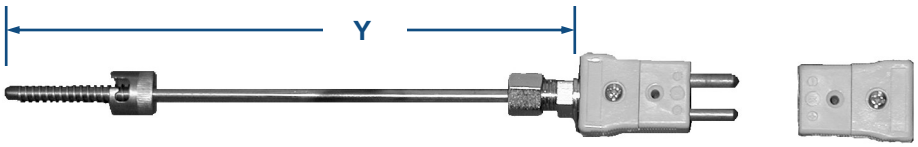
Straight Assemblies Configuration BG & BF

1 Bayonet Fitting
Plain- 3" leads standard

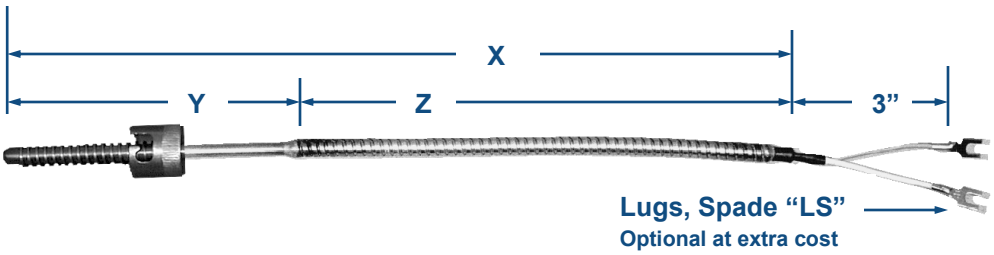


2 Bayonet Fitting
Overbraided

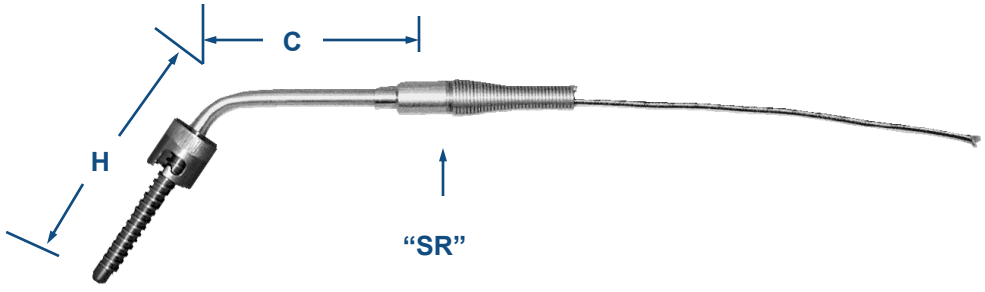
3 Bayonet Fitting
Plug and Jack



4 Bayonet Fitting
Flexible Extension (FE)
3" leads standard



5 Bayonet Fitting, Angle - *Plain*



6 Bayonet Fitting, Angle - *Flexible Extension*

Dimension Key:

C = Cold Leg Length	**Y =** Metal Probe Length
H = Hot Leg Length	**Z =** Flexible Extension Length
X = Overall Length	**U =** Bayonet Location

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Thermocouples - Swaged or MGO Assemblies

Swaged or MGO thermocouples have a metal sheath and compacted Magnesium Oxide powder for insulation. Since they have ceramic insulation, swaged thermocouples can go to a much higher temperature than Miniature and Probe types. **Swaged thermocouples are very flexible and can safely handle a bend around a surface two times the diameter of the sheath.**

! *Note:* If you would like to order a Type E, J, N, or Type T assembly, just substitute the K with a E, J, N, or T in the part numbers listed on this page. Double element assemblies are also available. Add a "**D**" to the part number. **Example: 18K4DS9-G-K1-***

Swaged thermocouples are also available in Types B, C, R, and S. Sheath materials other than the common ones listed at the bottom of this page can be ordered. Some of these include: Molybdenum, Tantalum, or Hastelloy. Phone one of our sales engineers for details.

We understand how important the quality of our thermocouples is to our customers. This is why our thermocouples are made with high purity Magnesium Oxide insulation and conductors which are within special limits of error.

Temperature Limits

O.D. Inches	Approx. Gauge	# 8 or # 16 Alloy		# 9 or # 20 Alloy		# 23 Alloy	
3/4	8	870°C	1600°F	1090°C	2000°F	-	-
1/2	11	870°C	1600°F	1090°C	2000°F	-	-
3/8	14	870°C	1600°F	1090°C	2000°F	-	-
5/16	16	870°C	1600°F	1090°C	2000°F	-	-
1/4	18	870°C	1600°F	980°C	1800°F	1260°C	2200°F
3/16	20	870°C	1600°F	870°C	1600°F	1260°C	2200°F
1/8	24	870°C	1600°F	870°C	1600°F	1260°C	2200°F
1/16	30	800°C	1470°F	800°C	1470°F	1260°C	2200°F

Note: Limits are based on Type K thermocouples.

	Application	Wire Gauge	Outside Diameter Inches	Outside Diameter mm	Type K
1	**Swaged or MGO, Male Plug** Swaged thermocouple with a standard size plug. The plug is constructed with **solid** pins. We do not sacrifice quality by selling plugs with hollow pins. A 1/8" NPT 316 stainless steel compression fitting (**CF**) can also be specified by adding "**CF**" to the end of the part number. A grounded junction is standard for rapid temperature response.	8 11 14 16 18 20 24 30	3/4 1/2 3/8 5/16 1/4 3/16 1/8 1/16	19.1 12.7 9.5 7.9 6.4 4.8 3.2 1.6	**8K4S9-G-K7-*** **11K4S9-G-K4-*** **14K4S9-G-K1-*** **16K4S9-G-K1-*** **18K4S9-G-K1-*** **20K4S9-G-K1-*** **24K4S9-G-K1-*** **30K4S9-G-K1-***
2	**Swaged or MGO, Female Jack** Swaged thermocouples typically have a male plug installed on the sheath, but are available with standard size female jack option. A 1/8" NPT 316 stainless steel compression fitting (**CF**) can also be specified by adding "**CF**" to the end of the part number. A grounded junction is standard for rapid temperature response.	8 11 14 16 18 20 24 30	3/4 1/2 3/8 5/16 1/4 3/16 1/8 1/16	19.1 12.7 9.5 7.9 6.4 4.8 3.2 1.6	**8K4S9-G-K8-*** **11K4S9-G-K5-*** **14K4S9-G-K5-*** **16K4S9-G-K2-*** **18K4S9-G-K2-*** **20K4S9-G-K2-*** **24K4S9-G-K2-*** **30K4S9-G-K2-***
3	**Swaged or MGO, Male Plug & Female Jack** Swaged thermocouples with a male plug and mating female jack. The plug is constructed with **solid** pins. We do not sacrifice quality by selling plugs with hollow pins. A female jack is also provided for attaching your lead wire. A 1/8" NPT 316 stainless steel compression fitting (**CF**) can also be specified by adding "**CF**" to the end of the part number. A grounded junction is standard for rapid temperature response.	8 11 14 16 18 20 24 30	3/4 1/2 3/8 5/16 1/4 3/16 1/8 1/16	19.1 12.7 9.5 7.9 6.4 4.8 3.2 1.6	**8K4S9-G-K9-*** **11K4S9-G-K6-*** **14K4S9-G-K6-*** **16K4S9-G-K3-*** **18K4S9-G-K3-*** **20K4S9-G-K3-*** **24K4S9-G-K3-*** **30K4S9-G-K3-***
4	**Swaged or MGO, Open Terminal (OTH)** Swaged open terminal block assemblies can be exposed for easy access. They are useful in situations where a low profile is needed. The terminal block is ceramic for maximum heat resistance. A 1/8" NPT 316 stainless steel compression fitting (**CF**) can also be specified by adding "**CF**" to the end of the part number. A grounded junction is standard	18 20 24	1/4 3/16 1/8	6.4 4.8 3.2	**18K4S9-G-OTH4-*** **20K4S9-G-OTH3-*** **24K4S9-G-OTH2-***

*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are in stock. Note: * = Probe length in figures shown.**

#9 Alloy (600) is standard, #7 (446SS), #8 (304SS), #16 (316SS), #23 (2200 cable) can be requested. Just replace the "9" in the part number.

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Junctions:	Floating (F)	Grounded (G)	Ungrounded (U)	Exposed (E)

Note: If you need a junction other than the listed standard, substitute the "G" in the part number with a F, U, or E.

Straight Assemblies
Configuration 4S

1

Swaged (MGO)
Male Plug

CF optional
add "CF" to Catalog Number

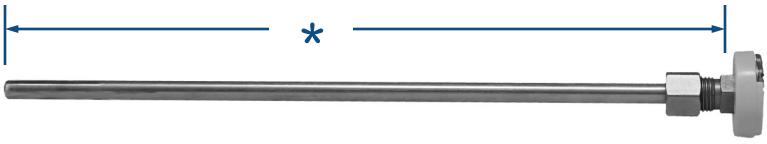
2

Swaged (MGO)
Female Jack

3

Swaged (MGO)
Plug & Jack, *Compression Fitting*

4



Swaged (MGO)
Open Terminal Head

5

Swaged (MGO)
Elements - See Page 46 - Figure 2S

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Thermocouples - Swaged or MGO Assemblies

Swaged or MGO thermocouples have a metal sheath and compacted Magnesium Oxide powder for insulation. Since they have ceramic insulation, swaged thermocouples can go to a much higher temperature than Miniature and Probe types. **Swaged thermocouples are very flexible and can safely handle a bend around a surface two times the diameter of the sheath.**

! *Note:* If you would like to order a Type E, J, N, or Type T assembly, just substitute the K with a E, J, N, or T in the part numbers listed on this page. Double element assemblies are also available. Add a "**D**" to the part number. **Example: 18K4DS9-G-K1-***

Swaged thermocouples are also available in Types B, C, R, and S. Sheath materials other than the common ones listed at the bottom of this page can be ordered. Some of these include: Molybdenum, Tantalum, or Hastelloy. Phone one of our sales engineers for details.

We understand how important the quality of our thermocouples is to our customers. This is why our thermocouples are made with high purity Magnesium Oxide insulation and conductors which are within special limits of error. A grounded junction is standard for quick response.

Temperature Limits

O.D. Inches	Approx. Gauge	# 8 or # 16 Alloy		# 9 or # 20 Alloy		# 23 Alloy	
3/4	8	870°C	1600°F	1090°C	2000°F	-	-
1/2	11	870°C	1600°F	1090°C	2000°F	-	-
3/8	14	870°C	1600°F	1090°C	2000°F	-	-
5/16	16	870°C	1600°F	1090°C	2000°F	-	-
1/4	18	870°C	1600°F	980°C	1800°F	1260°C	2200°F
3/16	20	870°C	1600°F	870°C	1600°F	1260°C	2200°F
1/8	24	870°C	1600°F	870°C	1600°F	1260°C	2200°F
1/16	30	800°C	1470°F	800°C	1470°F	1260°C	2200°F

Note: Limits are based on Type K thermocouples.

	Application	Wire Gauge	Outside Diameter Inches	Outside Diameter mm	Type K
1	**Hex Fitting (HX)** Swaged thermocouple with a hex fitting (**HX**) are used where a 316 stainless steel 1/2" x 1/2" NPT fitting is desirable for mounting to the process and to the connection head. The hex fittings are welded to the sheath for strength and proper seating. Other size Hex Fittings are also available - consult factory. 2" bare leads are standard.	8 11 14 16 18 20 24	3/4 1/2 3/8 5/16 1/4 3/16 1/8	19.1 12.7 9.5 7.9 6.4 4.8 3.2	**8K4S9-G-HX-*** **11K4S9-G-HX-*** **14K4S9-G-HX-*** **16K4S9-G-HX-*** **18K4S9-G-HX-*** **20K4S9-G-HX-*** **24K4S9-G-HX-***
2	**Hex Fitting (HX) and Standard Head (Aluminum) (SH)** Swaged thermocouple with a hex fitting (**HX**) are used where a 316 stainless steel 1/2" x 1/2" NPT fitting is desirable for mounting to the process and to the connection head. The hex fittings are welded to the sheath for strength and proper seating. These assemblies come with our (**SH**) Standard Heads.	8 11 14 16 18 20 24	3/4 1/2 3/8 5/16 1/4 3/16 1/8	19.1 12.7 9.5 7.9 6.4 4.8 3.2	**8K4S9-G-HX-*-SH** **11K4S9-G-HX-*-SH** **14K4S9-G-HX-*-SH** **16K4S9-G-HX-*-SH** **18K4S9-G-HX-*-SH** **20K4S9-G-HX-*-SH** **24K4S9-G-HX-*-SH**
3	**Two Compression Fittings (CF) and Standard Head (Aluminum) (SH)** A Compression Fitting (**CF**) is used to mount the Head instead of a hex fitting. These assemblies come with a (**SH**) Standard Head. A second 1/8" NPT 316 stainless steel compression fitting (**CF**) is added by the "**CF**" at the end of the part number to allow for adjusting the depth of insertion.	8 11 14 16 18 20 24	3/4 1/2 3/8 5/16 1/4 3/16 1/8	19.1 12.7 9.5 7.9 6.4 4.8 3.2	**8K4S9-G-*-SH-CF** **11K4S9-G-*-SH-CF** **14K4S9-G-*-SH-CF** **16K4S9-G-*-SH-CF** **18K4S9-G-*-SH-CF** **20K4S9-G-*-SH-CF** **24K4S9-G-*-SH-CF**
4	**Transition Fitting (TF)** These assemblies have extension wire attached to the thermocouple. This is beneficial when the instrument is located some distance from the area where the temperature is being measured. A relief Spring (**SR**) is installed to give protection to the potted junction. 3" of split leads are standard. A 316 stainless steel compression fitting (**CF**) allows for adjusting the depth of insertion.	18 20 24	1/4 3/16 1/8	6.4 4.8 3.2	**18K4S9-G-Y-TR-X** **20K4S9-G-Y-TR-X** **24K4S9-G-Y-TR-X**
5	**Transition Fittings (TR) and Armored Cable (AC)** These assemblies are the same as the ones above but with a some length (**Z**) of Armored Cable on the extension wire.	18 20 24	1/4 3/16 1/8	6.4 4.8 3.2	**18K4S9-G-Y-TR-X-Z** **20K4S9-G-Y-TR-X-Z** **24K4S9-G-Y-TR-X-Z**

*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are in stock. Note: * = Probe length in figures shown.**
#9 Alloy (600) is standard, but #7 (446SS), #8 (304SS), #16 (316SS), #23 (2200 cable) can be requested. Just replace the "9" in the part number.

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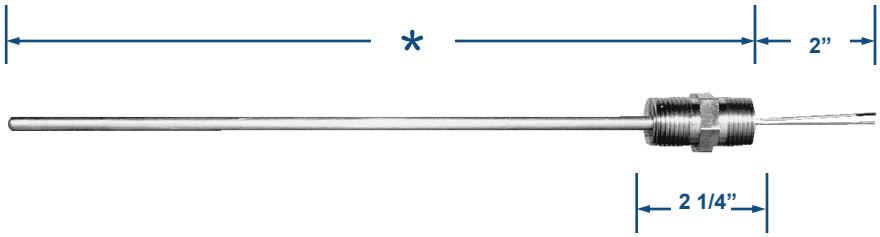
Thermocouples - Swaged or MGO Assemblies

Junctions:

Note: If you need a junction other than the listed standard, substitute the "G" in the part number with a F, U, or E.

Straight Assemblies Configuration 4S

1



Swaged (MGO)
Hex Fitting

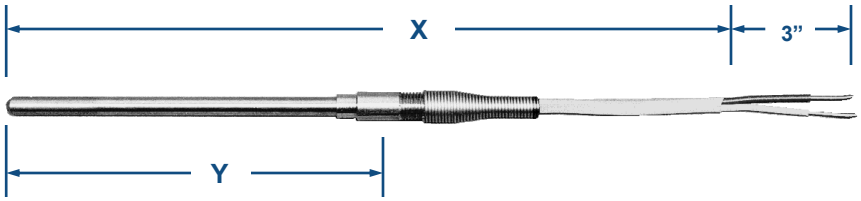
2

Swaged (MGO)
Hex Fitting & Standard Head (Aluminum)

3

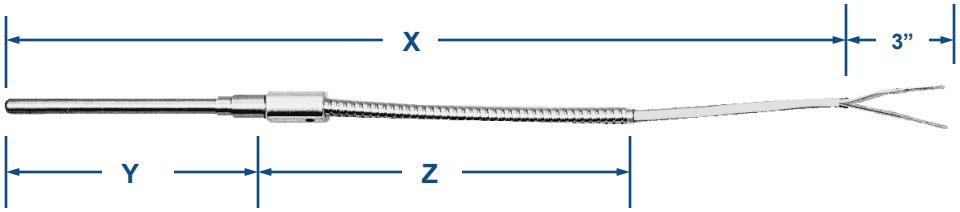
Swaged (MGO)
Compression Fitting & Standard Head (Aluminum)

4



Swaged (MGO)
Transition Fitting

5



Swaged (MGO)
Transition Fitting & Armored Cable

For a different length of lead than shown specify "L" plus length at the end of the part number.
Example: -L05 means 5" lead.

Thermocouples -Swaged or MgO Elements

Swaged or MGO thermocouples have a metal sheath and compacted Magnesium Oxide powder for insulation. Since they have ceramic insulation, swaged thermocouples can go to a much higher temperature than Miniature and Probe types. **Swaged thermocouples are very flexible and can safely handle a bend around a surface two times the diameter of the sheath.**

! *Note*: If you would like to order a Type E, J, N, or Type T assembly, just substitute the K with a E, J, N, or T in the part numbers listed on this page. Double element assemblies are also available. Add a "**D**" to the part number. **Example: 18K4DS9-G-K1-***

Swaged thermocouples are also available in Types B, C, R, and S. Sheath materials other than the common ones listed at the bottom of this page can be ordered. Some of these include: Molybdenum, Tantalum, or Hastelloy. Phone one of our sales engineers for details.

We understand how important the quality of our thermocouples is to our customers. This is why our thermocouples are made with high purity Magnesium Oxide insulation and conductors which are within special limits of error. A grounded junction is standard for quick response.

Temperature Limits

O.D. Inches	Approx. Gauge	# 8 or # 16 Alloy		# 9 or # 20 Alloy		# 23 Alloy	
3/4	8	870°C	1600°F	1090°C	2000°F	-	-
1/2	11	870°C	1600°F	1090°C	2000°F	-	-
3/8	14	870°C	1600°F	1090°C	2000°F	-	-
5/16	16	870°C	1600°F	1090°C	2000°F	-	-
1/4	18	870°C	1600°F	980°C	1800°F	1260°C	2200°F
3/16	20	870°C	1600°F	870°C	1600°F	1260°C	2200°F
1/8	24	870°C	1600°F	870°C	1600°F	1260°C	2200°F
1/16	30	800°C	1470°F	800°C	1470°F	1260°C	2200°F

Note: Limits are based on Type K thermocouples.

Junctions:

Note: If you need a junction other than the listed standard, substitute the "G" in the part number with a U, or E.

1

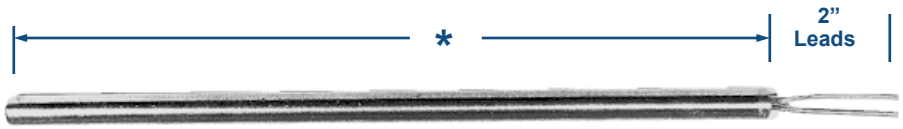


Figure 2S

Swaged MgO element, Alloy 600 sheath, Grounded, 2 inch bare leads standard.

#9 Alloy (600) is standard, but #7 (446SS), #8 (304SS), #16 (316SS), #23 (2300 cable) can be requested. Just replace the "9" in the part number. Other sheath materials are also available.

Elements , Swaged - Standard Element, Grounded Junction - Alloy #9 sheath

1

Sheath Diameter	Gauge	Diameter Inches	Diameter mm	Type E	Type J	Type K	Type N	Type T
3/4"	8	.128	3.25			8K2S9-G-*	consult factory	
1/2"	11	.091	2.31			11K2S9-G-*		
3/8"	14	.064	1.63	14E2S9-G-*	14J2S9-G-*	14K2S9-G-*		14T2S9-G-*
5/16"	16	.051	1.30			16K2S9-G-*		
1/4"	18	.040	1.02	18E2S9-G-*	18J2S9-G-*	18K2S9-G-*		
3/16"	20	.032	0.81	20E2S9-G-*	20J2S9-G-*	20K2S9-G-*		20T2S9-G-*
1/8"	24	.020	0.51	24E2S9-G-*	24J2S9-G-*	24K2S9-G-*		
1/16"	30	.010	0.25		30J2S9-G-*	30K2S9-G-*		24T2S9-G-*

*** Add the thermocouple length as the suffix. Multiples of 6 inches (152.4 mm) starting at 12 inches (304.8 mm) are considered stock.**

For lengths of cable not fabricated change "2S" in the part number to "1S" and state the "*" length.

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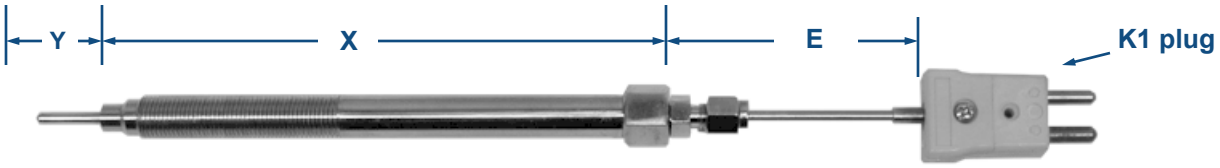
Plastic Industry Thermocouples - Melt Bolt and Spring Adjustable Bayonet

Melt Bolt Thermocouples are used to measure plastic melt temperatures as the material moves down the barrels in extruders and injection molding equipment. The Special Limits of Error element and heavy duty bolt are both constructed from 304 stainless steel. The Element is a MgO type with A grounded junction is standard for a rapid temperature response time. The extension and 3/16" diameter 304 stainless steel tip lengths can be specified for your application. Melt Bolts can be with 1/2" - 20 N.F. thread lengths of 3", 4", 6", and 9". Plugs connectors, if used, are made with solid pins.

! If you would like to order a Type E, J, N, or Type T assembly, just substitute "**K**" in the catalog number with an E, J, N, or T.
Example: MBTJ-3-5-1-J1 (Type J, Melt Bolt thermocouple, 3" long bolt, 5" extension, 1" tip, a male plug).

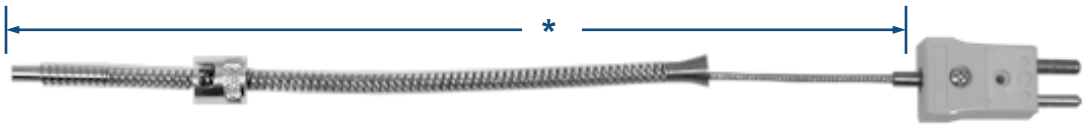


	Application	Wire Gauge	Type K	Bolt Lengths (X)	Type K
1	**Melt Bolt Thermocouples (MBT)** Bolt Thermocouples are machined from solid 304 stainless steel bar stock for corrosion resistance. The elements are constructed with MgO insulation for maximum temperature resistance. The tips are 3/16" in diameter and also made from 304 stainless steel. All melt bolts have a 1/2 - 20 N.F. thread for ease of installation. The extension portion of the thermocouple can be bent to suit your application. **K1 is the catalog number for a K plug.**	20	K	3" 4" 6" 9"	**MBTK-3-E-Y-K1** **MBTK-4-E-Y-K1** **MBTK-6-E-Y-K1** **MBTK-9-E-Y-K1**

Spring Adjustable Bayonet immersion type thermocouples give you the flexibility to adjust to a variety of well depths from 1" to 7" by use of an 8" adjustable spring. The bayonet adapter allows the thermocouple to be quickly disconnected from the process. This type of thermocouple is frequently used in the plastic Industry. A 304 Stainless Steel overbraid is for abrasion resistance on the impregnated fiberglass insulated 20 gauge stranded wire. The tips are 3/16" diameter made with 304 Stainless Steel. A grounded junction is standard to help prevent element from pulling out of the tube and to provide a rapid response time.

! If you would like to order a Type E, J, N, or Type T assembly, just substitute the "**K**" in the catalog number on this page with an E, J, N, or T.

Example: SABJ-OB8-J1-24 (Type J, thermocouple, a male plug and 24" long.)



	Application	Wire Gauge	Type	Style	Type K
1	**Spring Adjustable Bayonet Thermocouples (SAB)** Spring Adjustable Bayonet Thermocouples have a maximum service temperature of 900°F (482°C) due to the rating on the fiberglass inner insulation. The elements have impregnated fiberglass insulated wire with a 304 stainless steel overbraid. The tips are 3/16" in diameter and are made from 316 stainless steel.	20	K	Plain Plug Only Plug & Jack	**SABK-OB8-*** **SABK-OB8-K1-*** **SABK-OB8-K3-***

Extensions - Single

The most common single extension are listed on this page. Custom designs can easily be made with any type of thermocouple extension wire such as fiberglass as shown on the next pages. Phone one of our sales engineers for details.

! Note: If you would like to order a Type EX, JX, NX, TX, or Type RSX assembly, just substitute the KX with a EX, JX, NX, TX, or RSX in the part numbers listed on this page.

16 gauge extensions can be ordered by substituting the **20** with a **16** in the part numbers. **Example: K1-16PP-12-AC-18.**

Standard X and Y lengths are in multiples of 6" starting at 12", but other lengths can be ordered.

	Construction	Wire Gauge	Inner Insulation	Outer Insulation	Type KX
1	**Extension, 3" leads both ends** Extension with standard male plug, 304 stainless steel armored cable, 3" split leads both ends, and compensated spade lugs.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**20PP-X-Z** **20PPS-X-Z**
		20 Solid 20 Stranded	Teflon	Teflon	**K1-20TT-X-Z** **K1-20TTS-X-Z**
2	**Extension, Plug** Extension with standard male plug, 304 stainless steel armored cable, 3" split leads, and compensated spade lugs.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K1-20PP-X-Z** **K1-20PPS-X-Z**
		20 Solid 20 Stranded	Teflon	Teflon	**K1-20TT-X-Z** **K1-20TTS-X-Z**
3	**Extension, Jack** Extension with standard female jack, 304 stainless steel armored cable, 3" split leads, and compensated spade lugs.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K2-20PP-X-Z** **K2-20PPS-X-Z**
		20 Solid 20 Stranded	Teflon	Teflon	**K2-20TT-X-Z** **K2-20TTS-X-Z**
4	**Extension, Plug, Box Connector** Extension with standard male plug, 304 stainless steel armored cable, 3" split leads, 1/2" box connector and compensated spade lugs. Note: if you would like a 3/4" box connector, change the **CN** in the part number to **CN12**.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K1-20PP-X-Z-CN** **K1-20PPS-X-Z-CN**
		20 Solid 20 Stranded	Teflon	Teflon	**K1-20TT-X-Z-CN** **K1-20TTS-X-Z-CN**
5	**Extension, Jack, Box Connector** Extension with standard female jack, 304 stainless steel armored cable, 3" split leads, 1/2" box connector and compensated spade lugs. Note: if you would like a 3/4" box connector, change the **CN** in the part number to **CN12**.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K2-20PP-X-Z-CN** **K2-20PPS-X-Z-CN**
		20 Solid 20 Stranded	Teflon	Teflon	**K2-20TT-X-Z-CN** **K2-20TTS-X-Z-CN**
6	**Extension, Plug, Jack** Extension with standard male plug on one end and female jack on the other end, 304 stainless steel armored cable.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K1-20PP-X-Z-K2** **K1-20PPS-X-Z-K2**
		20 Solid 20 Stranded	Teflon	Teflon	**K1-20TT-X-Z-K2** **K1-20TTS-X-Z-K2**
	X= overall length - 3" Split leads and compensated spade lugs standard - Z = length of Armored Cable (AC)				

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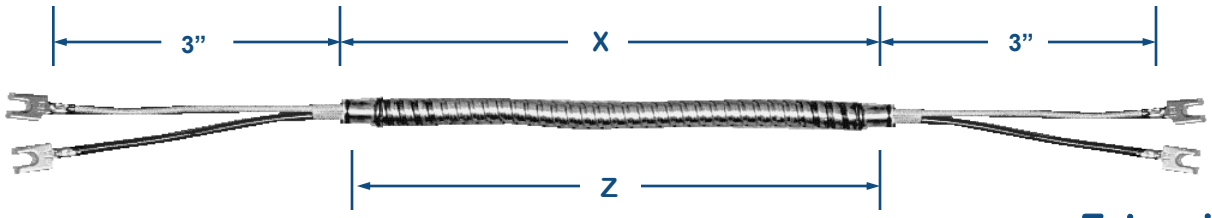

Extension
Only

2

Extension
Plug

3

Extension
Jack

4

Extension
Plug,
1/2” Box Connector

5

Extension
Jack,
1/2” Box Connector

6

Extension
Plug and Jack

Dimension Key:
X = Overall Length **Z =** Armored Cable (**AC**) Length
3” Leads with Compensated Spade Lugs (**LS**) are standard

Extensions - Dual

The most common dual extension are listed on this page. Custom designs can easily be made with any type of thermocouple extension wire. Phone one of our sales engineers for details.

! Note: If you would like to order a Type EX, JX, NX, TX, or Type RSX assembly, just substitute the K X with a EX, JX, NX, TX, or RSX in the part numbers listed on this page.

16 gauge extensions can be ordered by substituting the **20** with a **16** in the part numbers. **Example: K1-16PP-12-AC-18.**

Standard X and Y lengths are in multiples of 6" starting at 12", but other lengths can be ordered.

	Construction	Wire Gauge	Inner Insulation	Outer Insulation	Type KX
1	**Dual Extension, Plug** Double extension with standard male plugs, 304 stainless steel armored cable, 3" split leads, and compensated spade lugs.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K1-20PPD-X-Z** **K1-20PPSD-X-Z**
		20 Solid 20 Stranded	Fiberglass	Fiberglass	**K1-20GGD-X-Z** **K1-20GGSD-X-Z**
		20 Solid 20 Stranded	Teflon	Teflon	**K1-20TTD-X-Z** **K1-20TTSD-X-Z**
2	**Dual Extension, Jack** Double extension with standard female jacks, 304 stainless steel armored cable, 3" split leads, and compensated spade lugs.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K2-20PPD-X-Z** **K2-20PPSD-X-Z**
		20 Solid 20 Stranded	Fiberglass	Fiberglass	**K2-20GGD-X-Z** **K2-20GGSD-X-Z**
		20 Solid 20 Stranded	Teflon	Teflon	**K2-20TTD-X-Z** **K2-20TTSD-X-Z**
3	**Dual Extension, Plug, Box Connector** Double extension with standard male plugs, 304 stainless steel armored cable, 3" split leads, 1/2" box connector and compensated spade lugs. Note: if you would like a 3/4" box connector, change the **CN** in the part number to **CN12**.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K1-20PPD-X-Z-CN** **K1-20PPSD-X-Z-CN**
		20 Solid 20 Stranded	Fiberglass	Fiberglass	**K1-20GGD-X-Z-CN** **K1-20GGSD-X-Z-CN**
		20 Solid 20 Stranded	Teflon	Teflon	**K1-20TTD-X-Z-CN** **K1-20TTSD-X-Z-CN**
4	**Dual Extension, Jack, Box Connector** Double extension with standard female jacks, 304 stainless steel armored cable, 3" split leads, 1/2" box connector and compensated spade lugs. Note: if you would like a 3/4" box connector, change the **CN** in the part number to **CN12**.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K2-20PPD-X-Z-CN** **K2-20PPSD-X-Z-CN**
		20 Solid 20 Stranded	Fiberglass	Fiberglass	**K2-20GGD-X-Z-CN** **K2-20GGSD-X-Z-CN**
		20 Solid 20 Stranded	Teflon	Teflon	**K2-20TTD-X-Z-CN** **K2-20TTSD-X-Z-CN**
5	**Dual Extension, Plug, Jack** Double extension with standard male plugs on one end and female jacks on the other end, 304 stainless steel armored cable.	20 Solid 20 Stranded	PVC Plastic	PVC Plastic	**K1-20PPD-X-Z-K2** **K1-20PPSD-X-Z-K2**
		20 Solid 20 Stranded	Fiberglass	Fiberglass	**K1-20GGD-X-Z-K2** **K1-20GGSD-X-Z-K2**
		20 Solid 20 Stranded	Teflon	Teflon	**K1-20TTD-X-Z-K2** **K1-20TTSD-X-Z-K2**

X = overall length - 3" split leads and compensated spade lugs standard. - Z = length of Armored Cable (AC).

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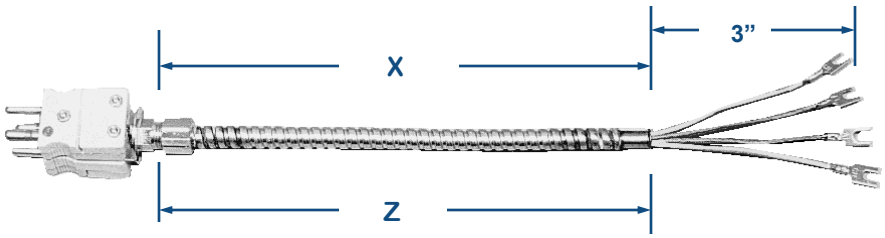
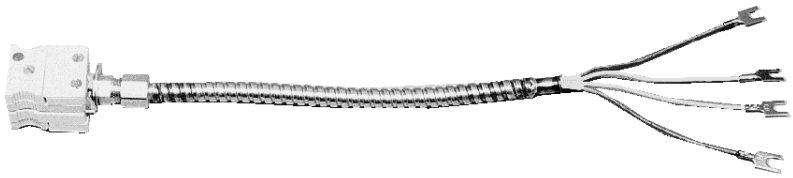
1



Dual Extension
Plug Only

2

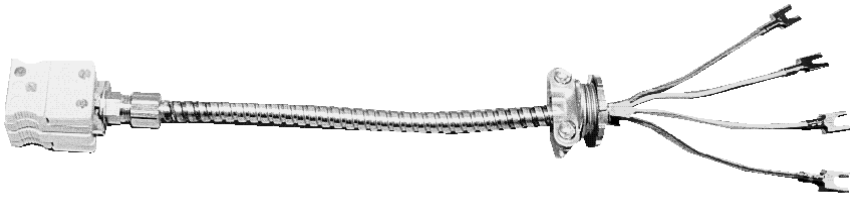


Dual Extension
Jack Only

3

Dual Extension
Plug and
1/2” Box Connector

4



Dual Extension
Jack and
1/2” Box Connector

5

Dual Extension
Plug and Jack

Dimension Key:
X = Overall Length **Z =** Armored Cable (**AC**) Length
3” Leads with Compensated Spade Lugs (**LS**) are standard

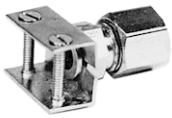
Plugs & Jacks - Standard and Miniature

Thermocouple plugs and jacks are made from thermocouple alloys to insure accuracy throughout the thermocouple circuit. Types R, S, and C, plugs use compensating alloys. All Richards plugs are made with solid pins to prevent loosening of the contacts. The pins are also polarized to prevent making mismatched connections. The connector bodies are color coded for easy identification. The pins and jacks are available in standard (with round pins) and a smaller miniature (flat pins) version.

Mounting: Plugs can be mounted on a thermocouple element with a compression type tube adaptor (**TA**) and screws, compression type insert (**TAI**), crimp insert (**CI**), or brazing insert (**BI**). Jacks can also be mounted to extension wire with a cable clamp (**CL**). See "Accessories" pages for more details on sizes and types.

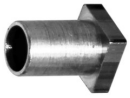
Wiring: Standard style plugs and jacks will accept wire up to 20 gauge. Larger gauges such as 14, 11, or 8 should use the jab style connectors. Miniature plugs can use 20 gauge or smaller thermocouple wires.

Tube Adaptor - TA



Tube Adaptor Insert - TAI

Tube Crimp Insert - CI



Tube Brazing Insert - CMI

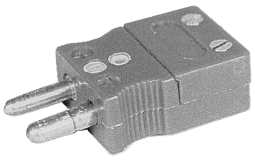
Cable Clamp - CL

See details under Accessories pages

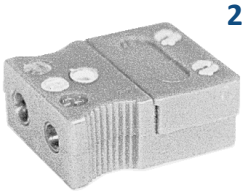
Standard Style - Round Pins (Solid)

	Number	Type Thermocouple	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
1				.50	12.7	1.00	25.4	1.88	47.6
	B1	B - Uncompensated	White						
	C1	C - Tungsten / 5% Rhenium - Tungsten / 26% Rhenium	Brown						
	E1	E - Nickel, 10% Chromium - Constantan	Purple						
	J1	J - Iron - Constantan	Black						
	K1	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	N1	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RS1	R - Platinum - Platinum / 13% Rhodium	Green						
	RS1	S - Platinum - Platinum / 10% Rhodium	Green						
	T1	T - Copper - Constantan	Blue						
2				.50	12.7	1.00	25.4	1.25	31.8
	B2	B - Uncompensated	White						
	C2	C - Tungsten / 5% Rhenium - Tungsten / 26% Rhenium	Brown						
	E2	E - Nickel, 10% Chromium - Constantan	Purple						
	J2	J - Iron - Constantan	Black						
	K2	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	N2	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RS2	R - Platinum - Platinum / 13% Rhodium	Green						
	RS2	S - Platinum - Platinum / 10% Rhodium	Green						
	T2	T - Copper - Constantan	Blue						

Male Plug 1



Female Jack 2



For 14 Gauge .064" (1.63 mm) or smaller wires. Maximum temperature 350°F (175°C). Plugs have solid round polarized pins.

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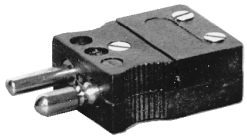
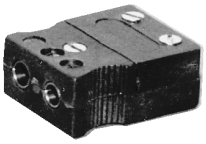
High Temperature (HT)

	Number	Type Thermocouple	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
1	B1HT C1HT E1HT J1HT K1HT N1HT RS1HT	B - Uncompensated C -Tungsten / 5% Rhenium - Tungsten / 26% Rhenium E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium	White Brown Purple Black Yellow Orange Green	.50	12.7	1.00	25.4	1.88	47.6
2	B2HT C2HT E2HT J2HT K2HT N2HT RS2HT RS2HT	B - Uncompensated C -Tungsten / 5% Rhenium - Tungsten / 26% Rhenium E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium	White Brown Purple Black Yellow Orange Green Green	.50	12.7	1.00	25.4	1.25	31.8

Male Plug 1



Female Jack 2



For 30 to 14 Gauge .064" (1.63 mm) wires. Maximum temperature 500°F (260°C). Plugs have solid round polarized pins.

Ceramic - Ultra High Alumina (UA)

	Number	Type Thermocouple	Color	Height Inches	Height mm	Width Inches	Width mm	Inches Inches	mm mm
3	E1UA J1UA K1UA N1UA RS1UA RS1UA	E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium	Purple Black Yellow Orange Green Green	.50	12.7	1.00	25.4	1.88	47.6
4	E2UA J2UA K2UA N2UA RS2UA RS2UA	E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium	Purple Black Yellow Orange Green Green	.50	12.7	1.00	25.4	1.25	31.8

Male Plug 3

Female Jack 4

For 30 to 14 Gauge .064" (1.63 mm) wires. Maximum temperature 1200°F (650°C). Plugs have solid round polarized pins.

Plugs and Jacks - Ultra High Resin and Three Pin Shielded

Resin - Ultra High Resin (UR)

	Number	Type Thermocouple	DOT Color	Height Inches	Height mm	Width Inches	Width mm	Inches Inches	mm mm
1	E1UR J1UR K1UR N1UR RS1UR RS1UR	E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium	Purple Black Yellow Orange Green Green	.50	12.7	1.00	25.4	1.88	47.6
				Male Plug 1 					
2	E2UR J2UR K2UR N2UR RS2UR RS2UR	E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium	Purple Black Yellow Orange Green Green	.50	12.7	1.00	25.4	1.25	31.8
				Female Jack 2 					

For 30 to 14 Gauge .064" (1.63 mm) wires. Maximum temperature: Continuous 800°F (427°C) - Intermittent 1000°F (538°C). Plugs have solid round polarized pins.

Three Pin Shielded (S)

	Number	Type Thermocouple	DOT Color	Height Inches	Height mm	Width Inches	Width mm	Inches Inches	mm mm
3	E1S J1S K1S N1S RS1S RS1S	E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium	Purple Black Yellow Orange Green Green	.50	12.7	1.00	25.4	1.88	47.6
				Male Plug 3 					
4	E2S J2S K2S N2S RS2S RS2S	E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium	Purple Black Yellow Orange Green Green	.50	12.7	1.00	25.4	1.25	31.8
				Female Jack 4 					

For 30 to 14 Gauge .064" (1.63 mm) wires. Maximum temperature 400°F (204°C). Plugs have solid round polarized pins.

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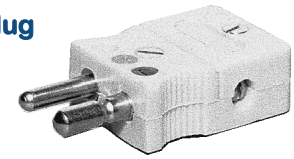
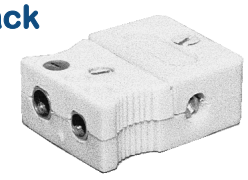
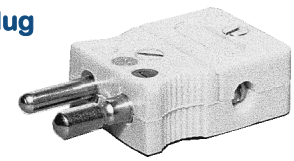
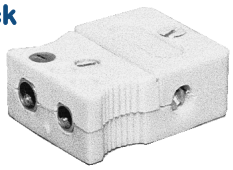
Jab Style thermocouple plugs and jacks are usually used for the larger gauge wires such as 14,11, or 8. We offer both large gauge and a small gauge (24-20) versions. The Jab Style connectors use set screws on the sides to give a solid connection. The thermocouple wires are fed up through the bottom of the connector. This allows the wires to be connected without opening the cover and wrapping the wires around screw terminals.

Jab Style - Small Gauge Wire

	Number	Type Thermocouple	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
1	B4	B - Uncompensated	White	.50	12.7	1.00	25.4	1.88	47.6
	C4	C -Tungsten / 5% Rhenium - Tungsten / 26% Rhenium	Brown						
	E4	E - Nickel, 10% Chromium - Constantan	Purple						
	J4	J - Iron - Constantan	Black						
	K4	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	N4	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RS4	R - Platinum - Platinum / 13% Rhodium	Green						
	RS4	S - Platinum - Platinum / 10% Rhodium	Green						
	T4	T - Copper - Constantan	Blue						
				Male Plug 1 					
2	B5	B - Uncompensated	White	.50	12.7	1.00	25.4	1.25	31.8
	C5	C -Tungsten / 5% Rhenium - Tungsten / 26% Rhenium	Brown						
	E5	E - Nickel, 10% Chromium - Constantan	Purple						
	J5	J - Iron - Constantan	Black						
	K5	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	N5	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RS5	R - Platinum - Platinum / 13% Rhodium	Green						
	RS5	S - Platinum - Platinum / 10% Rhodium	Green						
	T5	T - Copper - Constantan	Blue						
				Female Jack 2 					

For 20 Gauge (.81 mm) to 14 gauge (1.63) wires. Maximum temperature 350°F (175°C). Plugs have solid round polarized pins.

Jab Style - Large Gauge Wire

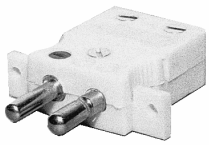
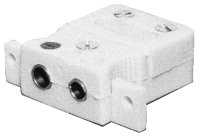
	Number	Type Thermocouple	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
3	B7	B - Uncompensated	White	.50	12.7	1.00	25.4	1.88	47.6
	C7	C -Tungsten / 5% Rhenium - Tungsten / 26% Rhenium	Brown						
	E7	E - Nickel, 10% Chromium - Constantan	Purple						
	J7	J - Iron - Constantan	Black						
	K7	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	N7	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RS7	R - Platinum - Platinum / 13% Rhodium	Green						
	RS7	S - Platinum - Platinum / 10% Rhodium	Green						
	T7	T - Copper - Constantan	Blue						
				Male Plug 3 					
4	B8	B - Uncompensated	White	.50	12.7	1.00	25.4	1.25	31.8
	C8	C -Tungsten / 5% Rhenium - Tungsten / 26% Rhenium	Brown						
	E8	E - Nickel, 10% Chromium - Constantan	Purple						
	J8	J - Iron - Constantan	Black						
	K8	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	N8	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RS8	R - Platinum - Platinum / 13% Rhodium	Green						
	RS8	S - Platinum - Platinum / 10% Rhodium	Green						
	T8	T - Copper - Constantan	Blue						
				Female Jack 4 					

For 14 gauge (1.63 mm) to 8 gauge (3.25 mm) wires. Maximum temperature 350°F (175°C). Plugs have solid round polarized pins.

Plugs and Jacks - Standard and Miniature - Panel Mount

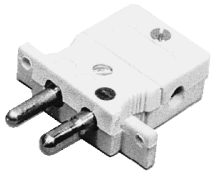
Panel Mount thermocouple plugs and jacks are used to mounting on our aluminum connector panels (**PL** & **PLM**). These connectors are available in both Jab Style and standard style versions depending on how large the gauge of the thermocouple wire is.

Standard Panel Mount - Round Pins (PM)

	Number	Type Thermocouple	DOT Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
1	B1PM E1PM J1PM K1PM N1PM RS1PM RS1PM T1PM	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.50	12.7	1.69	42.9	1.88	47.6
				Male Plug					**1**
2	B2PM E2PM J2PM K2PM N2PM RS2PM RS2PM T2PM	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.50	12.7	1.00	25.4	1.25	31.8
				Female Jack					**2**

For 20 gauge (.81 mm) to 14 gauge (1.63) wires. Maximum temperature 350°F (175°C). Plugs have solid round polarized pins.

Jab Style Panel Mount - Round Pins (PM)

	Number	Type Thermocouple	DOT Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
3	B4PM E4PM J4PM K4PM N4PM RS4PM RS4PM T4PM	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.50	12.7	1.69	42.9	1.88	47.6
				Male Plug					**3**
4	B5PM E5PM J5PM K5PM N5PM RS5PM RS5PM T5PM	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.50	12.7	1.00	25.4	1.25	31.8
				Female Jack					**4**

For 20 gauge (.81 mm) to 14 gauge (1.63) wires. Maximum temperature 350°F (175°C). Plugs have solid round polarized pins.

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Note: Standard style round panel mount plugs and jacks (round solid pins) are used to install thermocouple connectors in electrical boxes or in control panels. These connectors will fit in the 3/4" circular cutouts typically found in square electrical boxes. Miniature round panel mount connectors (flat pins) will fit in 1/2" cut outs on electrical boxes. For boxes and mounting panel details, see in "Accessories" pages.

Standard Round Panel Mount - Round Pins (RPM)

	Number	Type Thermocouple	DOT Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
1	B1RPM	B - Uncompensated	White	.50	12.7	1.5	38.1	1.88	47.6
	E1RPM	E - Nickel, 10% Chromium - Constantan	Purple						
	J1RPM	J - Iron - Constantan	Black						
	K1RPM	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	N1RPM	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RS1RPM	R - Platinum - Platinum / 13% Rhodium	Green						
	RS1RPM	S - Platinum - Platinum / 10% Rhodium	Green						
	T1RPM	T - Copper - Constantan	Blue						
				Male Plug					**1**
2	B2RPM	B - Uncompensated	White	.50	12.7	1.5	38.1	1.3	33.0
	E2RPM	E - Nickel, 10% Chromium - Constantan	Purple						
	J2RPM	J - Iron - Constantan	Black						
	K2RPM	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	N2RPM	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RS2RPM	R - Platinum - Platinum / 13% Rhodium	Green						
	RS2RPM	S - Platinum - Platinum / 10% Rhodium	Green						
	T2RPM	T - Copper - Constantan	Blue						
				Female Jack					**2**

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 350°F (175°C). Plugs have solid round polarized pins.

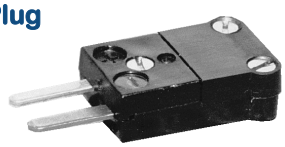
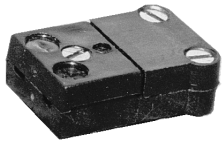
Miniature Round Panel Mount - Flat Pins (RPM)

	Number	Type Thermocouple	DOT Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
3	BM1-RPM	B - Uncompensated	White	.32	8.1	1.00	25.4	1.88	47.6
	EM1-RPM	E - Nickel, 10% Chromium - Constantan	Purple						
	JM1-RPM	J - Iron - Constantan	Black						
	KM1-RPM	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	NM1-RPM	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RSM1-RPM	R - Platinum - Platinum / 13% Rhodium	Green						
	RSM1-RPM	S - Platinum - Platinum / 10% Rhodium	Green						
	TM1-RPM	T - Copper - Constantan	Blue						
				Male Plug					**3**
4	BM2RPM	B - Uncompensated	White	.32	8.1	1.00	25.4	1.25	31.8
	EM2RPM	E - Nickel, 10% Chromium - Constantan	Purple						
	JM2RPM	J - Iron - Constantan	Black						
	KM2RPM	K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow						
	NM2RPM	N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange						
	RSM2RPM	R - Platinum - Platinum / 13% Rhodium	Green						
	RSM2RPM	S - Platinum - Platinum / 10% Rhodium	Green						
	TM2RPM	T - Copper - Constantan	Blue						
				Female Jack					**4**

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 350°F (175°C). Plugs have solid round polarized pins.

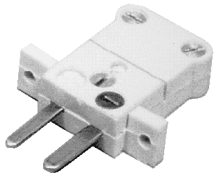
! Note If you need plugs and jacks for RTDs, look in the RTD section of this catalog for standard or miniature types.

Miniature Style - Flat Pins

	Number	Type Thermocouple	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
1	BM1 EM1 JM1 KM1 NM1 RSM1 RSM1 TM1	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.32	8.1	.73	18.5	1.50	38.1
	Male Plug								**1**
2	BM2 EM2 JM2 KM2 NM2 RSM2 RSM2 TM2	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.32	8.1	.73	18.5	1.00	25.4
	Female Jack								**2**

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 350°F (175°C). Plugs have flat polarized pins.

Miniature Panel Mount - Flat Pins (PM)

	Number	Type Thermocouple	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
3	BM1PM EM1PM JM1PM KM1PM NM1PM RSM1PM RSM1PM TM1PM	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.32	8.1	1.10	27.9	1.50	38.1
	Male Plug								**3**
4	BM2PM EM2PM JM2PM KM2PM NM2PM RSM2PM RSM2PM TM2PM	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.32	8.1	1.10	27.9	1.20	30.5
	Female								**4**

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 350°F (175°C). Plugs have flat polarized pins.

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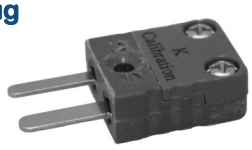
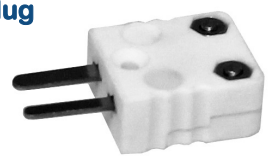
! Note If you need plugs and jacks for RTD's, look in the RTD section of this catalog for standard or miniature types.

Miniature Style - Flat Pins - High Temperature (HT)

	Number	Type Thermocouple	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
1	BM1HT EM1HT JM1HT KM1HT NM1HT RSM1HT RSM1HT TM1HT	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	Brown stamped with TC Type	.32	8.1	.73	18.5	1.50	38.1
				Male Plug 1 					
2	BM2HT EM2HT JM2HT KM2HT NM2HT RSM2HT RSM2HT TM2HT	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	Brown stamped with TC Type	.32	8.1	.73	18.5	1.00	25.4
				Female Jack 2 					

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 652°F (350°C). Plugs have flat polarized pins.

Miniature Style - Flat Pins - Ultra High Alumina (UA)

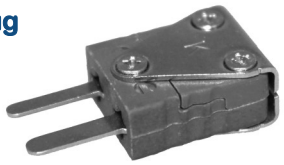
	Number	Type Thermocouple	DOT Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
3	BM1UA EM1UA JM1UA KM1UA NM1UA RSM1UA RSM1UA TM1UA	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.32	8.1	1.10	27.9	1.50	38.1
				Male Plug 3 					
4	BM2UA EM2UA JM2UA KM2UA NM2UA RSM2UA RSM2UA TM2UA	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.32	8.1	1.10	27.9	1.20	30.5
				Female Jack 4 					

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 1202°F (650°C). Plugs have flat polarized pins.

Plugs and Jacks - Miniature - Ultra Resin and Locking

! Note If you need plugs and jacks for RTD's, look in the RTD section of this catalog for standard or miniature types.

Miniature Style - Flat Pins - Ultra High Resin (UR)

	Number	Type Thermocouple	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
1	BM1UR EM1UR JM1UR KM1UR NM1UR RSM1UR RSM1UR TM1UR	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	Reddish Brown stamped with TC Type	.32	8.1	.73	18.5	1.50	38.1
	Male Plug 1								
2	BM2UR EM2UR JM2UR KM2UR NM2UR RSM2UR RSM2UR TM2UR	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	Reddish Brown stamped with TC Type	.32	8.1	.73	18.5	1.00	25.4
	Female Jack 2								

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 1004°F (540°C). Plugs have flat polarized pins.

Miniature Style - Flat Pins - Locking (L)

	Number	Type Thermocouple	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
3	BM1L EM1L JM1L KM1L NM1L RSM1L RSM1L TM1L	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.32	8.1	1.10	27.9	1.50	38.1
	Male Plug 3								
4	BM2L EM2L JM2L KM2L NM2L RSM2L RSM2L TM2L	B - Uncompensated E - Nickel, 10% Chromium - Constantan J - Iron - Constantan K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg R - Platinum - Platinum / 13% Rhodium S - Platinum - Platinum / 10% Rhodium T - Copper - Constantan	White Purple Black Yellow Orange Green Green Blue	.32	8.1	1.10	27.9	1.20	30.5
	Female Jack 4								

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 392°F (200°C). Plugs have flat polarized pins.

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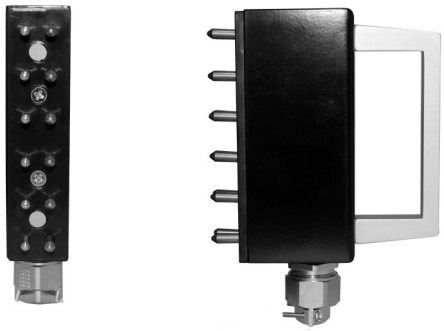
Multi Plug Vertical and Multi Jack Vertical Connectors

Multiple plug and jacks for thermocouple and RTD circuits. Suitable for connecting up to 6 standard circuits at the same time. Part Numbers below are for 6 circuits - for other setups change the "06" to the desired configuration. Example: For set of 3 change "06" to "03".

Construction: **Rugged steel epoxy painted housing. Aluminum handle for easy grip. Available in 1 thru 6 circuit versions. Accepts wire sizes up to 16 gauge (.051" or 1.5 mm). Entrance fitting will allow cable diameters up to .59" (15 mm)**

Temperature rating: 392°F (200°C).

Multi Plug Vertical Connector

	Part Number	Set of	Type Thermocouple	DOT Color	Figure
1	MPVB06	6 Plugs	B - Uncompensated	White	**Male Plugs (06)** 1 
	MPVE06		E - Nickel, 10% Chromium - Constantan	Purple	
	MPVJ06		J - Iron - Constantan	Black	
	MPVK06		K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow	
	MPVN06		N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange	
	MPVRS06		R - Platinum - Platinum / 13% Rhodium	Green	
	MPVRS06		S - Platinum - Platinum / 10% Rhodium	Green	
	MPVT06		T - Copper - Constantan	Blue	
2	MJVB06	6 Jacks	B -Uncompensated	White	**Female Jacks (06)** 2 
	MJVE06		E - Nickel, 10% Chromium - Constantan	Purple	
	MJVJ06		J - Iron - Constantan	Black	
	MJVK06		K - Nickel, 10% Chromium - Nickel, 5% Aluminum, Silicon	Yellow	
	MJVN06		N - Nickel, 14% Chromium, 15% Si - Nickel, 4.5% Si, .1% Mg	Orange	
	MJVRS06		R - Platinum - Platinum / 13% Rhodium	Green	
	MJVRS06		S - Platinum - Platinum / 10% Rhodium	Green	
	MJVT06		T - Copper - Constantan	Blue	

Angle Assemblies - Metal Tubes and Elbow -Types E, J, K & N

Easy to Order -
1 - State quantity
2 - Specify the part number (ours or competitive)
3 - Specify the hot (**H**) and cold leg (**C**) lengths.
Multiples of 6" (152.4 mm) starting at 12" are stocked
4 - Add letters for mounting attachments
5 - For Double Element Assembly add a "**D**" to the part number.
8K6D-601-12-18-SH

Example: The part number **8K6-1012XH-12-18-SH** signifies an gauge, Type K, Angle Assembly, 12" long hot leg made from 1/2" NPT Extra Heavy #10 alloy tube (32% Nickel-21% Chromium),18" long cold leg made from a steel balance pipe, and a Standard Head. Other combinations of thermocouples and tubes can be specified depending on your application.

! Note: If you would like to order a Type E, J, or N assembly, substitute the "**K**" with an E, J, or N in the part numbers listed on this page.

Typical Application	Protection Tube	Wire Gauge	Pipe Size	Outside Diameter Inches	Outside Diameter mm	Type K
601 Maximum service temperature 2300°F (1260°C) in oxidizing atmospheres. Good resistance to sulfidizing atmospheres.	**#6 Seamless Nickel Alloy (601)** Nickel 60.5%, Chromium 23% Iron 14%, Aluminum 1.4% Copper .5%, Manganese .5% Silicon .2%, Carbon .05%	8	1" Std	1.32	33.4	8K6-601-H-C-SH
		8	3/4" Std	1.05	26.7	8K6-634-H-C-SH
		8	1/2" Std	.84	21.3	8K6-622-H-C-SH
		11	3/8" Std	.68	17.2	11K6-638-H-C-SH
		14	3/8" Std	.68	17.2	14K6-638-H-C-SH
446SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Excellent resistance to sulfidizing atmospheres, corrosion, scaling, and abrasion.	**#7 Seamless Stainless Steel (446)** Chromium 23-27% Manganese 1.5% Silicon 1%, Nitrogen .25% Carbon .20%, Sulphur .030% Phosphorous .040% Iron (Balance)	8	1" Std	1.32	33.4	8K6-701-H-C-SH
		8	3/4" XH	1.05	26.7	8K6-734XH-H-C-SH
		8	3/4" NPT	1.25	31.8	8K6-734SP-H-C-SH
		8	1/2" Std	.84	21.3	8K6-722-H-C-SH
		14	1/2" NPT	1.00	25.4	14K6-712SP-H-C-SH
		11	3/8" Std	.54	13.7	11K6-738-H-C-SH
		14	3/8" Std	.68	17.2	14K6-738-H-C-SH
		14	1/4" Std	.54	13.7	14K4-714XH-H-C-SH
304SS Maximum service temperature 1600°F (871°C) in oxidizing atmospheres.	**#8 Seamless Stainless Steel (304)** Chromium 19% Nickel 10%, Manganese 2% Silicon 1%, Carbon .08% Phosphorous .045% Sulphur .030% Iron (Balance)	8	3/4" Std	1.05	26.7	8K6-834-H-C-SH
		8	3/4" XH	1.05	26.7	8K6-834XH-H-C-SH
		8	3/4" NPT	1.25	31.8	8K6-834SP-H-C-SH
		8	1/2" XH	.84	21.2	8K6-812XH-H-C-SH
		11	3/8" Std	.68	17.2	11K6-838-H-C-SH
		14	3/8" Std	.68	17.2	14K6-838-H-C-SH
		11	1/4" Std	.54	13.7	11K6-814-H-C-SH
		14	1/4" Std	.54	13.7	14K6-814-H-C-SH
		14	1/8" Std	.41	10.3	14K6-818-H-C-SH
600 Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Avoid sulfidizing atmospheres.	**#9 Seamless Nickel Alloy (600)** Nickel 76% Chromium 15.5% Iron 8% Manganese .5% Silicon .2%, Copper .2% Carbon .08%	8	1" Std	1.32	33.4	8K6-901-H-C-SH
		8	3/4" Std	1.05	26.7	8K6-934-H-C-SH
		8	3/4" XH	1.05	26.7	8K6-934XH-H-C-SH
		8	3/4" NPT	1.25	31.8	8K6-934SP-H-C-SH
		8	1/2" Std	.84	21.3	8K6-922-H-C-SH
		8	1/2" XH	.84	21.3	8K6-912XH-H-C-SH
		11	3/8" Std	.68	17.2	11K6-938-H-C-SH
		14	3/8" Std	.68	17.2	14K6-938-H-C-SH
		11	1/4" Std	.54	13.7	11K6-914-H-C-SH
		14	1/4" Std	.54	13.7	14K6-914-H-C-SH
		14	1/8" Std	.41	10.3	14K6-918-H-C-SH
800 Maximum service temperature 2100°F (1150°C) in oxidizing or reducing atmospheres. Good resistance to sulfidizing atmospheres.	**#10 Seamless Nickel Alloy (800)** Nickel 35%, Chromium 23% Iron 39.5%, Manganese 1.5% Silicon 1%, Copper .75% Aluminum & Titanium .6% Carbon .1%	8	1" Std	1.32	33.4	8K6-1001-H-C-SH
		8	3/4" Std	1.05	26.7	8K6-1034-H-C-SH
		8	1/2" XH	.84	21.3	8K6-1012XH-H-C-SH

Cold leg of thermocouple = C Hot Leg of Thermocouple = H

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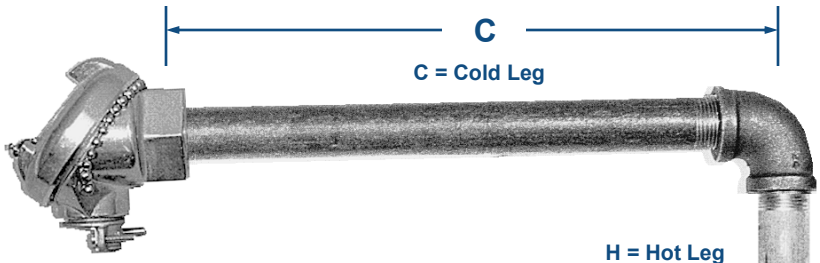
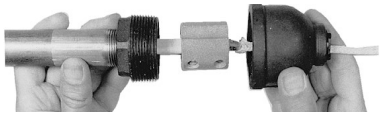
Straight Assemblies - Metal Tubes and Elbow - Types E, J, K & N

The Richards Standard Head (**SH**) (Aluminum) is the most versatile head we offer. This head has a NEMA 4 rating for indoor or outdoor use in non-hazardous locations. The cover and body have been polished to help prevent corrosion. The cover has a special silicon gasket, which helps protect the connector block from wind-blown rain and dust. This gasket is also press fit into a grove to keep it from falling out when the cover is removed for inspection. A stainless steel chain is attached to the cover and body to prevent it from getting misplaced. One of the most beneficial advantages to this type of head is the variety of connector blocks which can be used. The Standard Head (**SH**) can also be fitted with our in-head style transmitters (**TS**).

Angle Assemblies
Configuration 6



Note: If you would like to order a screw cover head, remove the (**SH**) from the end of the part number.



Example: 8K6-1012XH-12-18

1/8” *Pipe Size*

1/4” *Pipe Size*

3/8” *Pipe Size*

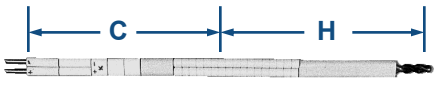
1/2” *Pipe Size*

3/4” *Pipe Size*

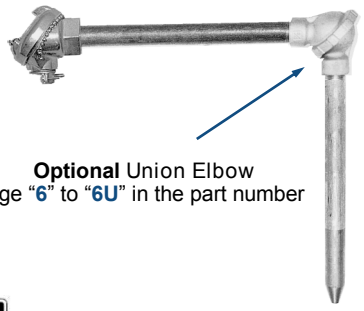
SP *Pipe Size*

1” *Pipe Size*

Jab Style plug termination for angle assembly, add termination number to end of the part number.
Example: BR08-K7 (Type K for 1/2”NPT pipe)



Element for angle assembly



Optional Union Elbow
Change “**6**” to “**6U**” in the part number

Angle Assemblies - Metal Tubes and Elbow -Types E, J, K & N

Easy to Order -
1 - State quantity
2 - Specify the part number (ours or competitive)
3 - Specify the hot (**H**) and cold leg (**C**) lengths. Multiples of 6" (152.4 mm) starting at 12" are stock.
4 - Add letters for mounting attachments
5 - For Double Element Assembly add a "**D**" to the part number. **8K6D-601-12-18-SH**

Example: The part number **8K6-1012XH-12-18-SH** signifies an gauge, Type K, angle Assembly, 12" long hot leg made from 1/2" NPT Extra Heavy #10 alloy tube (32% Nickel-21% Chromium), 18" long cold leg made from a steel balance pipe, and a Standard Head. Other combinations of thermocouples and tubes can be specified depending on your application.

! Note: If you would like to order a Type E, J, or N assembly, just substitute the "**K**" with an E, J, or N in the part numbers listed on this page.

Typical Application	Protection Tube	Wire Gauge	Pipe Size	Outside Diameter Inches	Outside Diameter mm	Type K
316SS Maximum service temperature 1600°F (780°C) in oxidizing atmospheres. Considered better than 304SS on corrosion.	**#16 Seamless Stainless Steel** Nickel 10-14%, Chromium 16-18% Molybdenum 2-3%, Manganese 2% Silicon 1%, Phosphorous .045% Carbon .08%, Sulfur .03%	8	1" Std	1.32	33.4	8K6-1601-H-C-SH
		8	3/4" Std	1.05	26.7	8K6-1634-H-C-SH
		8	3/4" XH	1.05	26.7	8K6-1634XH-H-C-SH
		8	3/4" NPT	1.25	31.8	8K6-1634SP-H-C-SH
		8	1/2" Std	.84	21.3	8K6-1612XH-H-C-SH
		11	3/8" Std	.68	17.2	11K6-1638-H-C-SH
		14	3/8" Std	.68	17.2	14K6-1638-H-C-SH
		11	1/4" Std	.54	13.7	11K6-1614-H-C-SH
		14	1/4" Std	.54	13.7	14K6-1614-H-C-SH
		14	1/8" Std	.41	10.3	14K6-1618-H-C-SH
310SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Resists heat scaling.	**#20 Seamless Stainless Steel** Chromium 24-26%, Nickel 19-22% Silicon 1.5%, Manganese 2% Carbon .25%, Phosphorous .045% Sulphur .03%, Iron (Balance)	8	1" Std	1.32	33.4	8K6-2001-H-C-SH
		8	3/4" Std	1.05	26.7	8K6-2034-H-C-SH
		8	1/2" Std	.84	21.3	8K4-2022-H-C-SH
		11	1/4" Std	.54	13.7	11K6-2014-H-C-SH
		14	1/4" Std	.54	13.7	14K6-2014H-C-SH
		14	1/8" Std	.41	10.3	14K4-2018-H-C-SH
Carbon Steel Maximum service temperature 1000°F (540°C) in non-oxidizing applications. Typically used in galvanizing, tin, molten Babbitt, molten magnesium, petroleum applications and water lines.	**Seamless Carbon Steel (SS)** Extra Heavy wall (**XH**) Double Extra Heavy wall (**DXH**)	8	1" DXH	1.32	1.32	8K6-SS01DHX-H-C-SH
		8	1" XH	1.32	1.32	8K6-SS01XH-H-C-SH
		8	3/4" XH	1.05	26.7	8K6-SS34XH-H-C-SH
		8	1/2" XH	.84	21.2	8K6-SS12XH-H-C-SH
		14	1/4" Std	.41	13.7	8K6-SS14-H-C-SH
HR160 Maximum service temperature 2200°F (1204°C) in oxidizing and reducing atmospheres. Excellent resistance to sulfur, chlorides, and hot corrosion. Typically used in waste incineration.	**HR160 Seamless Nickel Alloy** Nickel 37%, Cobalt 30%, Chromium 28%, Iron 3.5% Silicon 2.75%, Molybdenum 1% Tungsten 1%, Manganese .5% Titanium .5%, Carbon .05%	8	3/4" XH	1.05	26.7	8K6-160HR34XH-H-C-SH
Cast Iron Maximum service temperature 1300°F (700°C) in oxidizing atmospheres. Typically used in molten metal applications	**Cast Iron Extra Heavy (CIXH)** Extra Heavy wall. Cast Iron Protection Tube. Tube I.D. = .88" (22.4 mm). 3/4" NPT female thread.	8	3/4" FNPT	1.63	41.4	8K6-CIXH-H-C-SH
Coated Cast Iron Maximum service temperature 1300°F (700°C) in oxidizing atmospheres. Typically used in molten metal applications.	**Cast Iron Ceramic Grazed Extra Heavy (CIXH-CG)** Extra Heavy wall. Cast Iron Protection Tube. Tube I.D. = .88" (22.4 mm). 3/4" NPT female thread.	8	3/4" FNPT	1.63	41.4	8K6-CIXH-CG-H-C-SH

Hot Leg of Thermocouple = H Cold leg of thermocouple = C
Multiples of 6" (152.4 mm), starting at 12" (304.8 mm) are considered stock items

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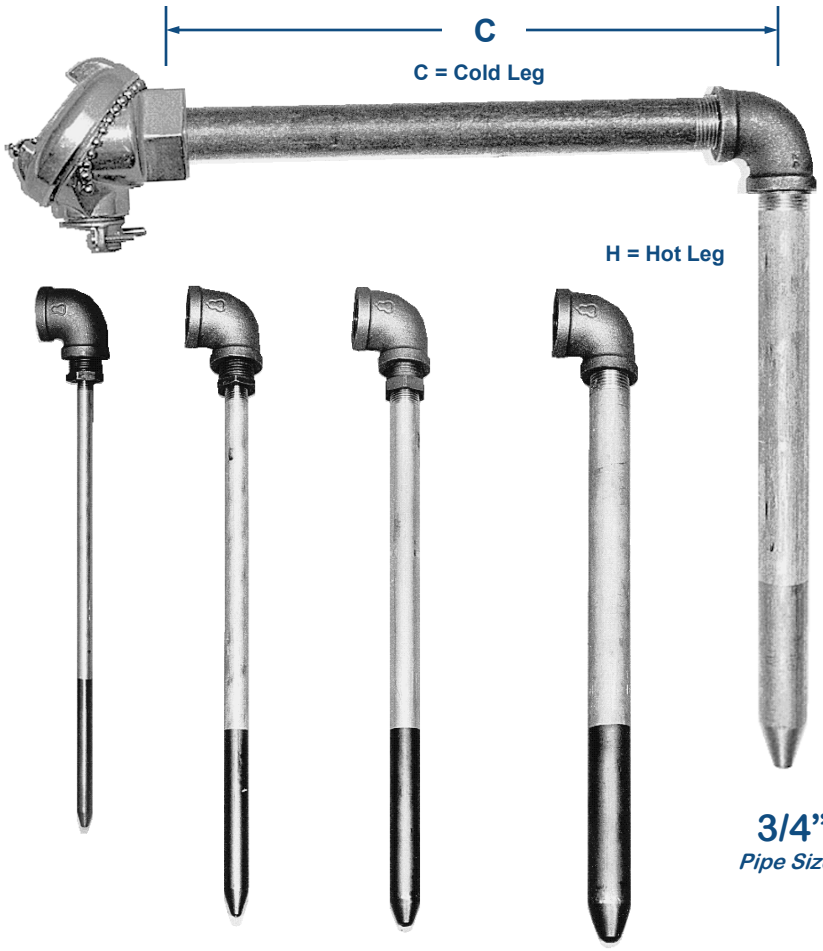
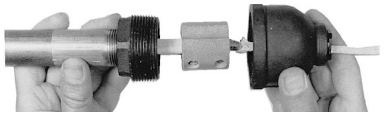
Angle Assemblies - Metal Tubes - Types E, J, K & N - Elbow

The Richards Standard Head (**SH**) (Aluminum) is the most versatile head we offer. This head has a NEMA 4 rating for indoor or outdoor use in non-hazardous locations. The cover and body have been polished to help prevent corrosion. The cover has a special silicon gasket, which helps protect the connector block from wind-blown rain and dust. This gasket is also press fit into a grove to keep it from falling out when the cover is removed for inspection. A stainless steel chain is attached to the cover and body to prevent it from getting misplaced. One of the most beneficial advantages to this type of head is the variety of connector blocks which can be used. The Standard Head (**SH**) can also be fitted with our in-head style transmitters (**TS**).

Angle Assemblies Configuration 6

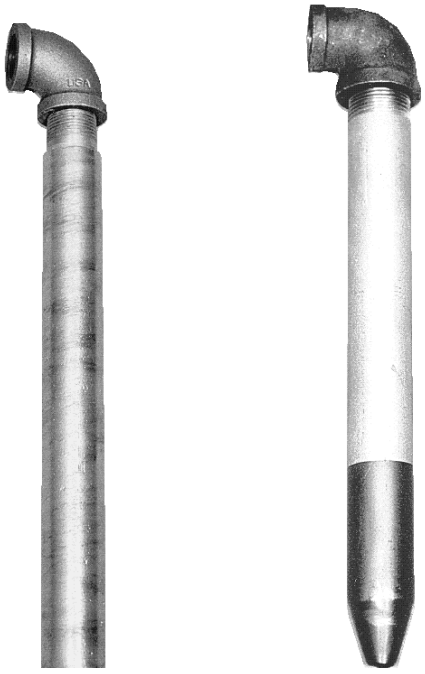


Note: If you would like to order a screw cover head, remove the (**SH**) from the end of the part number.

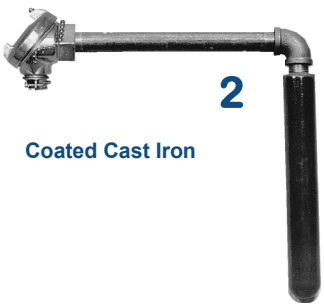


Example: 8K6-1012XH-12-18

1/8" *Pipe Size*
1/4" *Pipe Size*
3/8" *Pipe Size*
1/2" *Pipe Size*

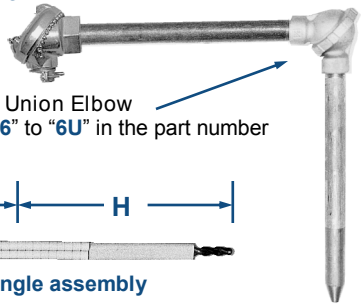


SP *Pipe Size*
1" *Pipe Size*

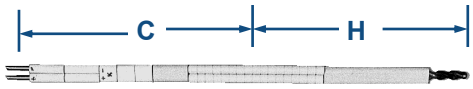


2
Coated Cast Iron

1
Uncoated Cast Iron



Optional Union Elbow
Change "**6**" to "**6U**" in the part number



Element for angle assembly

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Arklay S. Richards Co., Inc.

Angle Assemblies - Metal Tubes - Alloy Bent -Types E, J, K & N - Standard Head (SH)

Easy to Order -
1 - State quantity
2 - Specify the part number (ours or competitive)
3 - Specify the hot (**H**) and cold leg (**C**) lengths. Multiples of 6" (152.4 mm) starting at 12" are stocked
4 - Add letters for mounting attachments
5 - For Double Element Assembly add a "**D**" to the part number. **8K6ABD-601-12-18-SH**

Example: The part number **8K6AB-1012XH-12-18-SH** signifies an 8 gauge, Type K, alloy bend angle Assembly, 12" long hot leg made from a bent 1/2" NPT Extra Heavy #10 alloy tube (32% Nickel-21% Chromium), 18" long cold leg made from a steel balance pipe, and a Standard Head (**SH**). Other combinations of thermocouples and tubes can be specified depending on your application.

! **Note:** If you would like to order a Type E, J, or N assembly, just substitute the "**K**" with an E, J, or N in the part numbers listed on this page.

Typical Application	Protection Tube	Wire Gauge	Pipe Size	Outside Diameter Inches	Outside Diameter mm	Type K
601 Maximum service temperature 2300°F (1260°C) in oxidizing atmospheres. good resistance to sulfidizing atmospheres.	**#6 Seamless Nickel Alloy (601)** Nickel 60.5%, Chromium 23% Iron 14%, Aluminum 1.4% Copper .5%, Manganese .5% Silicon .2%, Carbon .05%	8	1" Std	1.32	33.4	8K6AB-601-H-C-SH
		8	3/4" Std	1.05	26.7	8K6AB-634-H-C-SH
		8	1/2" Std	.84	21.3	8K6AB-622-H-C-SH
		11	3/8" Std	.68	17.2	11K6AB-638-H-C-SH
		14	3/8" Std	.68	17.2	14K6AB-638-H-C-SH
446SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Excellent resistance to sulfidizing atmospheres , corrosion, scaling, and abrasion.	**#7 Seamless Stainless Steel (446)** Chromium 23-27% Manganese 1.5% Silicon 1%, Nitrogen .25% Carbon .20%, Sulphur .030% Phosphorous .040% Iron (Balance)	8	1" Std	1.32	33.4	8K6AB-701-H-C-SH
		8	3/4" XH	1.05	26.7	8K6AB-734XH-H-C-SH
		8	1/2" Std	.84	21.3	8K6AB-722-H-C-SH
		11	3/8" Std	.54	13.7	11K6AB-738-H-C-SH
		14	3/8" Std	.68	17.2	14K6AB-738-H-C-SH
		14	1/4" Std	.54	13.7	14K6AB-714XH-H-C-SH
304SS Maximum service temperature 1600°F (871°C) in oxidizing atmospheres.	**#8 Seamless Stainless Steel (304)** Chromium 19%, Nickel 10%, Manganese 2% Silicon 1%, Carbon .08% Phosphorous .045% Sulphur .030% Iron (Balance)	8	3/4" Std	1.05	26.7	8K6AB-834-H-C-SH
		8	3/4" XH	1.05	26.7	8K6AB-834XH-H-C-SH
		8	1/2" XH	.84	21.2	8K6AB-812XH-H-C-SH
		11	3/8" Std	.68	17.2	11K6AB-838-H-C-SH
		14	3/8" Std	.68	17.2	14K6AB-838-H-C-SH
		11	1/4" Std	.54	13.7	11K6AB-814-H-C-SH
		14	1/4" Std	.54	13.7	14K6AB-814-H-C-SH
		14	1/8" Std	.41	10.3	14K6AB-818-H-C-SH
600 Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Avoid sulfidizing atmospheres.	**#9 Seamless Nickel Alloy (600)** Nickel 76% Chromium 15.5% Iron 8% Manganese .5% Silicon .2%, Copper .2% Carbon .08%	8	1" Std	1.32	33.4	8K6AB-901-H-C-SH
		8	3/4" Std	1.05	26.7	8K6AB-934-H-C-SH
		8	3/4" XH	1.05	26.7	8K6AB-934XH-H-C-SH
		8	1/2" Std	.84	21.3	8K6AB-922-H-C-SH
		8	1/2" XH	.84	21.3	8K6AB-912XH-H-C-SH
		11	3/8" Std	.68	17.2	11K6AB-938-H-C-SH
		14	3/8" Std	.68	17.2	14K6AB-938-H-C-SH
		11	1/4" Std	.54	13.7	11K6AB-914-H-C-SH
		14	1/4" Std	.54	13.7	14K6AB-914-H-C-SH
		14	1/8" Std	.41	10.3	14K6AB-918-H-C-SH
800 Maximum service temperature 2100°F (1150°C) in oxidizing or reducing atmospheres. Good resistance to sulfidizing atmospheres.	**#10 Seamless Nickel Alloy (800)** Nickel 35%, Chromium 23% Iron 39.5%, Manganese 1.5% Silicon 1%, Copper .75% Aluminum & Titanium .6% Carbon .1%	8	1" Std	1.32	33.4	8K6AB-1001-H-C-SH
		8	3/4" Std	1.05	26.7	8K6AB-1034-H-C-SH
		8	1/2" XH	.84	21.3	8K6AB-1012XH-H-C-SH

Cold leg of thermocouple = C Hot Leg of Thermocouple = H

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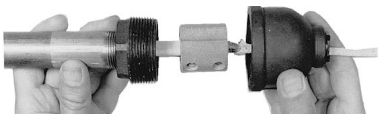
Angle Assemblies - Metal Tubes - Alloy Bent - Types E, J, K & N

All alloy bent tube assemblies can be made in two styles. The "**A**" and "**AB**" styles. The "**A**" style is constructed using a single alloy tube to make both the hot leg and the cold legs of the assembly. The "**AB**" style has an alloy tube covering the hot leg and only a portion of the cold leg. The balance of the cold leg is protected with a steel balance pipe and coupling. The "**A**" style is used in applications where the cold leg will be subject to molten metal splash, salt, high temperatures, or other corrosive materials. The "**AB**" style is a little more economical if the cold leg is not subject to any corrosive materials or high temperatures. If you would like to order an "**A**" style assembly, just remove the "**B**" from the part numbers listed on these pages.

Examples: **8K6A-1601-12-18-SH** is an all alloy bent tube assembly.
8K6AB-1601-12-18-SH is an alloy bent tube assembly having a coupling and a steel balance pipe on the cold end.

When ordering your thermocouple, remember that on an all alloy bent tube assembly ("**A**"), the hot leg will be the specified length but the cold leg will actually be 3" longer than the specified length due bending. The balance pipe on the cold end of an "**AB**" style thermocouple assembly will be 7" shorter than the cold leg specified with the remainder being alloy pipe. The Hot leg will be as specified.

Note: If you would like to order a screw cover head, remove the (**SH**) from the end of the part number.



Example: **8K6AB-1012XH-12-18**

Angle Assemblies Configuration 6AB

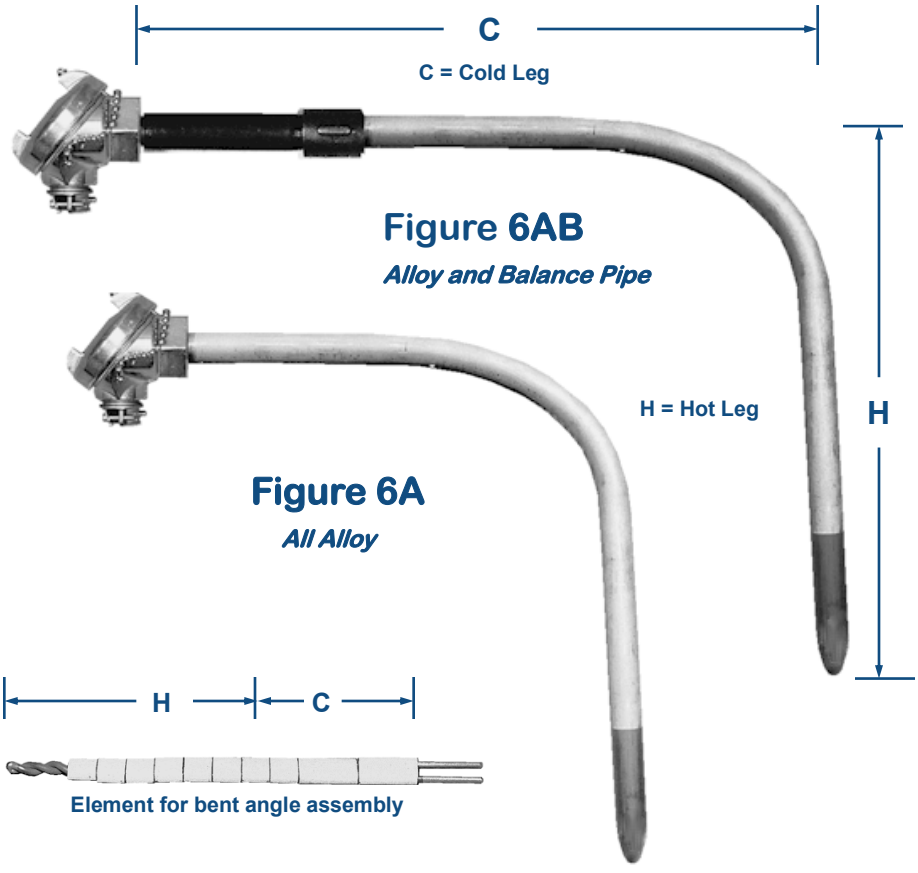


Figure 6AB
Alloy and Balance Pipe

Figure 6A
All Alloy

Element for bent angle assembly

Angle Assemblies - Metal Tubes - Alloy Bent -Types E, J, K & N

Easy to Order -
1 - State quantity
2 - Specify the part number (ours or competitive)
3 - Specify the hot (**H**) and cold leg (**C**) lengths. Multiples of 6" (152.4 mm) starting at 12" are stocked
4 - Add letters for mounting attachments
5 - For Double Element Assembly add a "**D**" to the part number. **8K6ABD-601-12-18-SH**

Example: The part number **8K6AB-1012XH-12-18-SH** signifies an 8 gauge, Type K, Alloy Bent Angle Assembly,12" long hot leg made from a bent 1/2" NPT Extra Heavy #10 alloy tube (32% Nickel-21% Chromium),18" long cold leg made from a steel balance pipe, and a Standard Head (**SH**). Other combinations of thermocouples and tubes can be specified depending on your application.

! **Note:** If you would like to order a Type E, J, or N, assembly, just substitute the "**K**" with an E, J, or N in the part numbers listed on this page.

Typical Application	Protection Tube	Wire Gauge	Pipe Size	Outside Diameter Inches	Outside Diameter mm	Type K
316SS Maximum service temperature 1600°F (780°C) in oxidizing atmospheres. Considered better than 304SS on corrosion.	**#16 Seamless Stainless Steel** Nickel 10-14%, Chromium 16-18% Molybdenum 2-3%, Manganese 2% Silicon 1%, Phosphorous .045% Carbon .08%, Sulfur .03%	8	1" Std	1.32	33.4	8K6AB-1601-H-C-SH
		8	3/4' Std	1.05	26.7	8K6AB-1634-H-C-SH
		8	3/4" XH	1.05	26.7	8K6AB-1634XH-H-C-SH
		8	1/2" Std	.84	21.3	8K6AB-1612XH-H-C-SH
		11	3/8" Std	.68	13.7	11K6AB-1638-H-C-SH
		14	3/8" Std	.68	17.2	14K6AB-1638-H-C-SH
310SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Resists heat scaling.	**#20 Seamless Stainless Steel** Chromium 24-26%, Nickel 19-22% Silicon 1.5%, Manganese 2% Carbon .25%, Phosphorous .045% Sulphur .03%, Iron (Balance)	8	1" Std	1.32	33.4	8K8AB-2001-H-C-SH
		8	3/4" Std	1.05	26.7	8K6AB-2034-H-C-SH
		8	1/2" XH	.84	21.2	8K6AB-2022-H-C-SH
		11	1/4" Std	.54	13.7	11K6AB-2014-H-C-SH
		14	1/4" Std	.54	13.7	14K6AB-2014-H-C-SH
Carbon Steel Maximum service temperature 1000°F (540°C) in non-oxidizing applications. Typically used in galvanizing, tin, molten Babbitt, molten magnesium, petroleum applications and water lines.	**#(SS) Seamless Carbon Steel** Extra Heavy wall (**XH**) Double Extra Heavy wall (**DXH**)	8	1" XH	1.32	33.7	8K6AB-SS01XH-H-C-SH
		8	3/4" XH	1.05	26.7	8K6AB-SS34XH-H-C-SH
		8	1/2" XH	.84	21.3	8K6AB-SS12XH-H-C-SH
HR-160 Maximum service temperature 2200°F (1204°C) in oxidizing and reducing atmospheres. Excellent resistance to sulfur, chlorides, and hot corrosion. Typically used in waste incineration.	**#160HR Seamless Nickel Alloy** Nickel 37%, Cobalt 30%, Chromium 28%, Iron 3.5% Silicon 2.75%, Molybdenum 1% Tungsten 1%, Manganese .5% Titanium .5%, Carbon .05%	8	3/4" XH	1.05	26.7	8K6AB-160HR34XH-H-C-SH

Cold leg of thermocouple = C Hot Leg of Thermocouple = H

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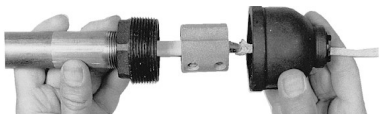
Angle Assemblies - Metal Tubes - Alloy Bent - Types E, J, K & N

All alloy bent tube assemblies can be made in two styles. The "**A**" and "**AB**" styles. The "**A**" style is constructed using a single alloy tube to make both the hot leg and the cold legs of the assembly. The "**AB**" style has an alloy tube covering the hot leg and only a portion of the cold leg. The balance of the cold leg is protected with a steel balance pipe and coupling. The "**A**" style is used in applications where the cold leg will be subject to molten metal splash, salt, high temperatures, or other corrosive materials. The "**AB**" style is a little more economical if the cold leg is not subject to any corrosive materials or high temperatures. If you would like to order an "**A**" style assembly, just remove the "**B**" from the part numbers listed on these pages.

Examples: **8K6A-1601-12-18-SH** is an all alloy bent tube assembly.
8K6AB-1601-12-18-SH is an alloy bent tube assembly having a coupling and a steel balance pipe on the cold end.

When ordering your thermocouple, remember that on an all alloy bent tube assembly ("**A**") the hot leg will be the specified length but the cold leg will actually be 3" longer than the specified length due bending. The balance pipe on the cold end of an "**AB**" style thermocouple assembly will be 7" shorter than the cold leg specified with the remainder being alloy pipe. The Hot leg will be as specified.

Note: If you would like to order a screw cover head, remove the (**SH**) from the end of the part number.



Example: **8K6AB-1012XH-12-18**

Angle Assemblies Configuration 6AB

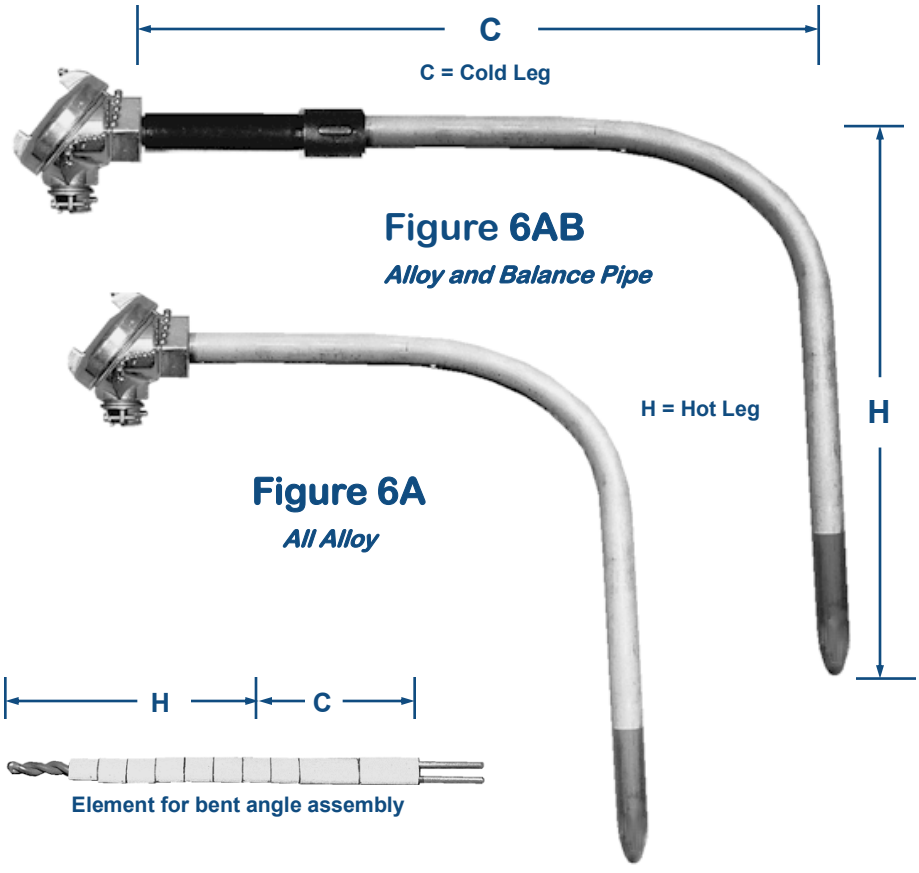


Figure 6AB
Alloy and Balance Pipe

Figure 6A
All Alloy

Element for bent angle assembly

Angle Assemblies - Ceramic Tubes - Types B, E, J, K, N, R, & S

Example: The part number **8K6-P11F-18-24-SH** signifies an angle assembly, 8 gauge, Type K, 18" **P11F** 11/16" O.D. Mullite tube hot leg, 1/2" x 3/4" steel fitting, 24" cold leg 3/4" NPT balance pipe, and a Standard Head (**SH**). Other combinations of thermocouples and ceramic tubes can be specified depending on your application.

! **Note:** If you would like to order a Type E, J, or N assembly, just substitute the "**K**" with an E, J, or N in the part numbers listed on this page.

If you would like to order a Type B, R, or S, just substitute the "**K"** with a B, R, or S. and "24" for the "8" in the part number. We also offer other types of ceramic tubes, such as Aluminum or Zirconia See the ceramic tube section of this catalog if you would like to specify a different type of protection tube on your assembly.

Typical Application	Photo	Protection Tube	Gauge	Type K
Mullite **63.5% Aluminum Oxide, Balance Silicon Dioxide** Mullite has a maximum service temperature of 2900°F (1590°C). It is considered to be better than Alumina for thermal shock resistance. Mullite tubes should be used with care, since they have poor mechanical shock resistance. Secondary metal tubes can be added for protection from mechanical damage. Mullite tubes are considered gas tight at high temperatures. All tubes which are used in horizontal installations and at elevated temperatures should be supported. Mullite tubes should not be used for primary protection tubes on noble metal (platinum based) thermocouples.	1	**Mullite Porcelain** Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel Fitting.	8	**8K6-P11F-H-C-SH**
Silicon Carbide **90.0% Silicon Carbide, 9% Silicon Dioxide** Silicon Carbide has a maximum service temperature of 2730°F (1500°C). It has excellent resistance to thermal shock and the cutting action of flames. However, silicon carbide tubes are porous so they should not be used if a gas tight seal is required for protection of the thermocouple element. Because of their porosity, silicon carbide is usually used a the secondary thermocouple protection tube. The SCI type silicon carbide tubes are isopressed around a steel inner protection tube. This creates a gas tight unit, which is then considered a non-porous tube.	2	**Silicon Carbide** Single tube, O.D. 1 3/4" (44.5 mm) 2.0" NPT Machined Steel Bushing.	8	**8K6-SCB-H-C-SH**
	3	**Silicon Carbide** Single tube, O.D. 2.0" (50.8 mm), Isopressed over a 1/2" NPT steel pipe.	8	**8K6-SCI12-H-C-SH**
	3	**Silicon Carbide** Single tube, O.D. 2.0" (50.8 mm), Isopressed over a 3/4" NPT steel pipe.	8	**8K6-SCI34-H-C-SH**
	4	**Silicon Carbide** Single tube, O.D. 1 3/4" (44.5 mm) FSC2412 cast iron fitting, 3 stainless steel screws.	8	**8K6-SCF-H-C-SH**
Alumina Silica **41.3% Silicon Dioxide, 39.4% Aluminum Oxide, 9.4% Calcium 6.3% Iron oxide, 3.8% Other** Slip cast Alumina Silica refractory tubes have a maximum service temperature of 1500°F (815°C). These tubes are constructed by casing the refractory material around a 1/2" steel protection tube. Alumina Silica refractory tubes are used in molten Zinc and Aluminum die casting applications. They have excellent thermal shock and mechanical damage resistance. They are non-wetting and will not contaminate the molten metal as a stainless steel or iron protection tube.	5	**Alumina Silica** Single tube, O.D. 2.0" (50.8 mm), Cast over a 1/2" NPT steel protection tube. **Note:** If you would like to order a 316 Stainless Steel inner protection tube, substitute the "**AS**" with "**ASSS**" in the part number.	8	**8K6-AS-H-C-SH**

Hot leg of thermocouple = H. Cold leg of thermocouple = C. Multiples of 6" (152.4 mm) starting at 12" are in stock.
Notes: * = Probe length in figures shown. The steel Balance Pipe on Types B, R, and S assemblies are 1/2" pipe size.

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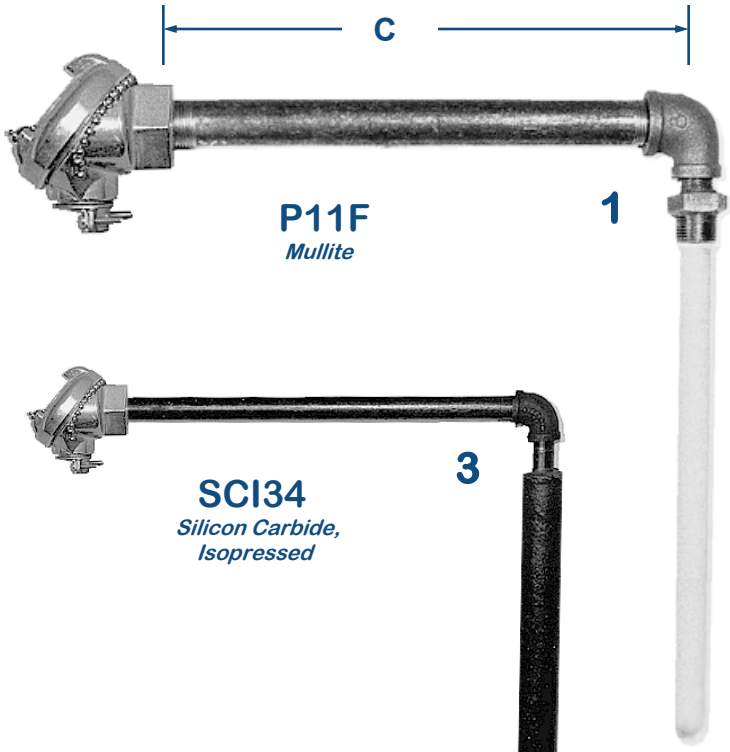
Angle Assemblies - Ceramic Tube - Types B, E, J, K, N, R, & S

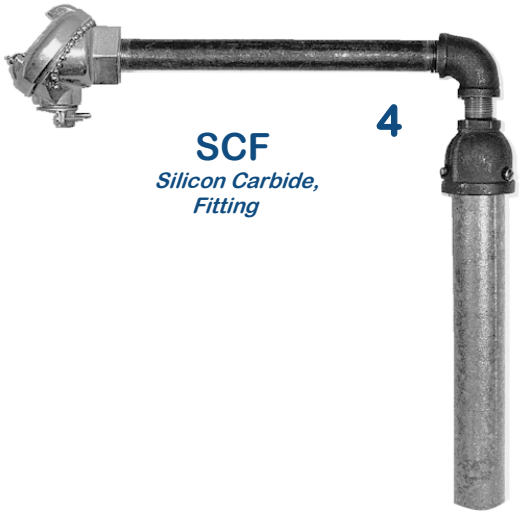
Angle Assemblies Configuration 6



P11F **1**
Mullite

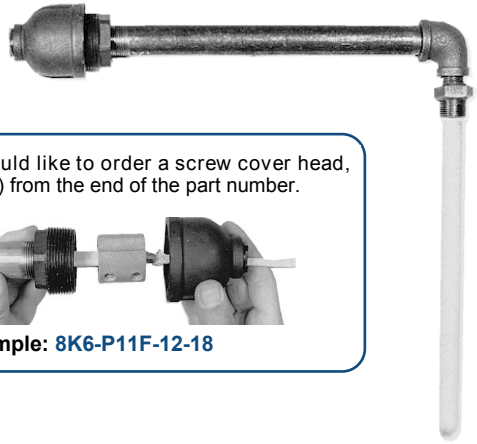
SCB **2**
Silicon Carbide, Bushing

SCI34 **3**
Silicon Carbide, Isopressed

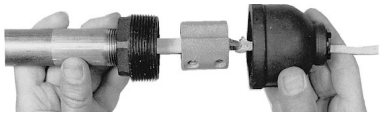


SCF **4**
Silicon Carbide, Fitting

AS **5**
Alumina Silica



Note: If you would like to order a screw cover head, remove the (**SH**) from the end of the part number.



Example: 8K6-P11F-12-18

RICHARDS®
Arklay S. Richards Co., Inc.

Angle Assemblies - Double Tube -Types B, E, J, K, N, R, & S - Standard Head (SH)

The Richards Double Tube Thermocouple Assemblies are designed for severe service applications. The double tube assemblies with a metal outer tube are for applications where mechanical damage and thermal shock to the thermocouple is a problem. The double tube assemblies, which have a Silicon Carbide outer tube are for applications where thermal shock and flame contact is a problem. Double ceramic tube assemblies are for extra protection against corrosive atmospheres. We offer many other combinations of double tubes, which we could not list in this catalog. Richards double tube assemblies can be made from any type of metal or ceramic tube, which is available.

! **Note:** If you would like to order a Type E, J, or Type N assembly, just substitute the **K** with an E, J, or N in the part numbers listed on this page. Triple Tube Assemblies are also available. If you would like to order a Type B, R, or S assembly just substitute the **K** with B, R, or S and the **8** with 24 in the part numbers listed on this page.

Example: The part number **24S6-P11F-734XH-18-24-SH** signified a double tube angle assembly, 24 gauge, Type S, 18" Mullite P11F inner primary tube, 18" 734XH outer secondary tube, 24" long cold leg , and a Standard Head (**SH**). Other combinations can be specified.

Triple tube assemblies are also available.

	Primary Tube (Inner)	Secondary Tube (Outer)	Wire Gauge	Type K
1	**Mullite Porcelain - P11F** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**#7 Seamless Stainless Steel (446) - 734XH** Chromium 23-27%, Manganese 1.5% Silicon 1%, Nitrogen .25%, Carbon 2%, Sulphur .030%, Phosphorous .040%, Iron (Balance) Construction: 3/4" pipe, Extra Heavy, Schedule 80	8 14	**8K6-P11F-734XH-*-SH** **14K6-P11F-734XH-*-SH**
2	**Mullite Porcelain - P11F** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**#9 Seamless Stainless Steel Alloy (600) - 934** Nickel 76%, Chromium 15.5%, Iron 8%, Manganese .5%, Silicon .2%, Copper .2%, Carbon .08% Construction: 3/4" pipe, Schedule 40	8 14	**8K6-P11F-934-*-SH** **14K6-P11F-934-*-SH**
3	**Mullite Porcelain - P06** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 3/8" (9.5 mm) Cemented	**Mullite Porcelain - P11F** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	14 20	**14K6-P06-P11F-*-SH** **20K6-P06-P11F-*-SH**
4	**Mullite Porcelain - P11** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) Cemented	**Mullite Porcelain - P16F** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 1" (25.4 mm) 3/4" x 1" NPT steel fitting.	8 14	**8K6-P11-P16F-*-SH** **14K6-P11-P16F-*-SH**
5	**Mullite Porcelain - P11F** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**CIXH (Cast Iron Extra Heavy) - CIXH** Extra Heavy wall, Cast Iron Tube Construction: Single tube, O.D. 1.63" (41.1 mm)	8 14	**8K6-P11F-CIXH-*-SH** **14K6-P11F-CIXH-*-SH**
6	**Mullite Porcelain - P11F** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**CIXHCG (Cast Iron Extra Heavy Coated) - CIXHCG** Extra Heavy wall, Coated Cast Iron Tube Construction: Single tube, O.D. 1.63" (41.1 mm)	8 14	**8K6-P11F-CIXHCG-*-SH** **14K6-P11F-CIXHCG-*-SH**
7	**Mullite Porcelain - P11F** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide, Bushing - SCB** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, O.D. 1 3/4" (44.5 mm) 2.0" NPT Machined Steel Bushing	8 14	**8K6-P11F-SCB-*-SH** **14K6-P11F-SCB-*-SH**
8	**Mullite Porcelain - P11F** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide, Fitting - SCF** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, O.D. 1 3/4" (44.5 mm) FSC1216 cast iron fitting and 3 stainless steel screws	8 14	**8K6-P11F-SCF-*-SH** **14K6-P11F-SCF-*-SH**
9	**Mullite Porcelain - P11F** 63.5% Aluminum Oxide. Balance Silicon Dioxide Construction: Single tube, O.D. 11/16" (17.5 mm) 1/2" x 3/4" NPT steel fitting.	**Silicon Carbide, Isopressed - SCI34** 90.0% Silicon Carbide, 9% Silicon Dioxide Construction: Single tube, Isopressed over a 3/4" NPT steel pipe. O.D. 2.0" (50.8 mm)	8 14	**8K6-P11F-SCI34-*-SH** **14K6-P11F-SCI34-*-SH**

*** Add required thermocouple length. Multiples of 6" (152.4 mm) starting at 12" are considered stock.**

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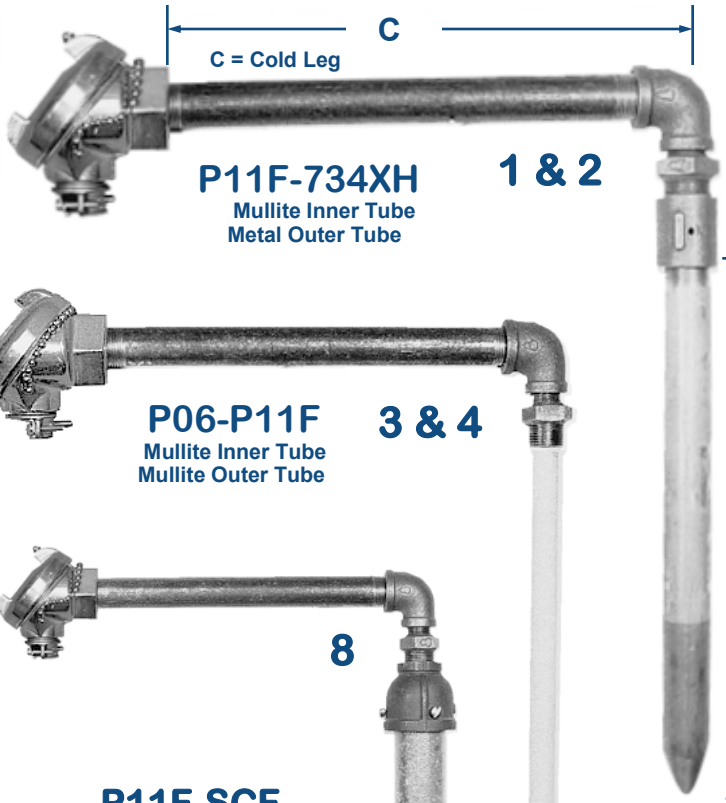
Angle Assemblies - Double Tube - Types B, E, J, K, N, R, & S - Standard Head (SH)

Angle Assemblies Configuration 6



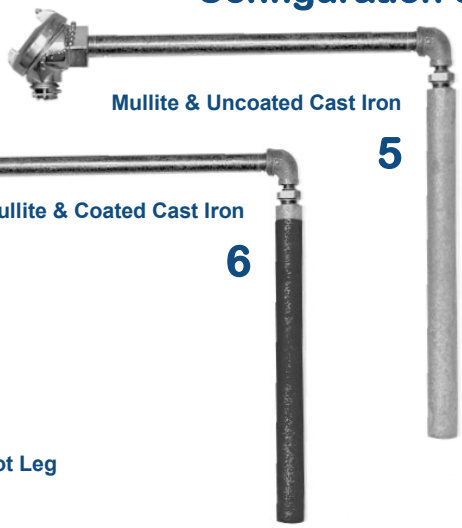
P11F-734XH — **1 & 2**
Mullite Inner Tube
Metal Outer Tube

P06-P11F — **3 & 4**
Mullite Inner Tube
Mullite Outer Tube

P11F-SCF — **8**
Silicon Carbide Outer Tube & Fitting
Mullite Inner Tube & Fitting

9

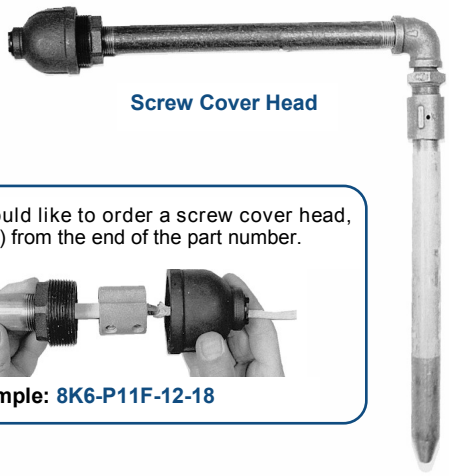
P11F-SCI34
Mullite - Silicon Carbide,
Isopressed



Mullite & Uncoated Cast Iron — **5**

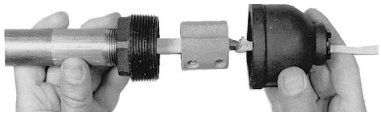
Mullite & Coated Cast Iron — **6**

P11F-SCB — **7**
Silicon Carbide Outer Tube & Bushing
Mullite Inner Tube & Fitting



Screw Cover Head

Note: If you would like to order a screw cover head, remove the (**SH**) from the end of the part number.

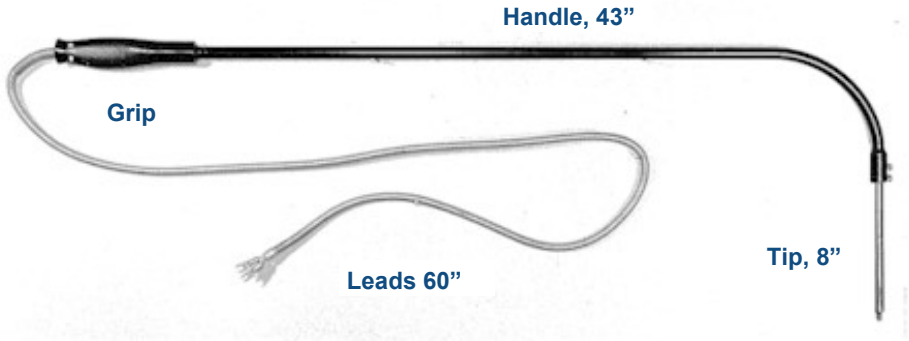


Example: 8K6-P11F-12-18

Molten Metal - Tips, Grips, and Curved Handles

Molten Metal tips are used for reading melt temperatures of non-ferrous metals such as Aluminum, Brass, Bronze (except Phosphor Bronze) and Magnesium. The tips are constructed from 446 stainless steel and have a maximum service temperature of **2300° F** (**1260° C**). Some other alloys, such as #8 & #9 may be specially ordered (Consult factory). The thermocouples are Type K and within standard limits of error (special limits can be specially ordered). The reduced tip diameter allows for quick response times when immersed into the melt (about 25 seconds). The Richards handles are constructed entirely from 304 stainless steel for maximum durability.

Complete Curved Assembly - MM Type K



Part Numbers	Items
Curved Assembly Items	
MM43	43” Handle and Plastic Grip.
MMAG	Aluminum Grip Only.
MMPG	Plastic Grip only.
MM43H	43” Handle only.
MM43-08	43” Handle, Plastic Grip, and 8” tip.
MM43-08-060	43” Handle, Plastic Grip, 8” tip and 60” Armored leads (**ML060**).

Elements for Curved & Straight Assemblies

	Tip Lengths Inches	mm
MM08-*	08	203.2
MM12-*	12	304.8
MM15-*	15	381.0
MM18-*	18	457.2
MM20-*	20	508.0
MM24-*	24	609.6
MM30-*	30	762.0
MM36-*	36	914.4
MM42-*	42	1068.8
MM48-*	48	1219.2

Add * Lead length to part number.
(43” of insulated Leads shown = MM08-43)

Available Standard length Leads for above tips:
31, 43, 55, 72, 96, and 120 inches.

Available Standard Handles for above tips:
31, 43, 55 inch, and, 6, 8, and 10 feet.

Other special lengths of leads and handles can be made on special order.

Handles can be made either curved or straight .

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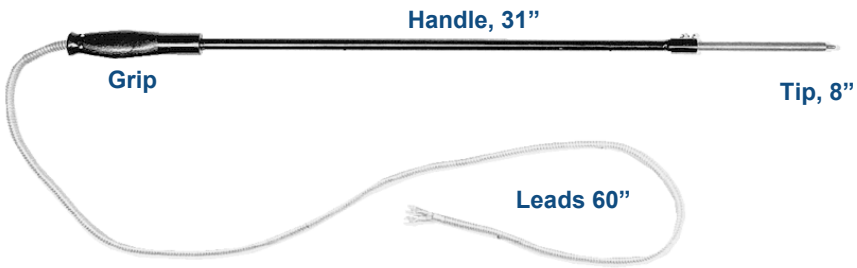
Complete Straight Assembly - MMS Type K



MMS31-08-060

Part Numbers	Items
	Straight Style Items
MMS31	31” Handle and Plastic Grip.
MMAG	Aluminum Grip Only.
MMPG	Plastic Grip only.
MMS31H	31” Handle only.
MMS31-08	31” Handle, Plastic Grip, and 8” tip.
MMS31-08-060	31” Handle, Plastic Grip, 8” tip and 60” Armored leads (ML060).

Molten Leads (ML)

Custom lengths or special extension wire insulation inside the 1/4” inside diameter 304 stainless steel armored cable (AC04), can be made to order. The armored cable can also be ordered with a Teflon® or PVC coating.

Note: Direct deflection meters may require recalibration for longer lead lengths.

Part Numbers	Description		Part Numbers	Description	
ML040	40” long with spade lugs	40 inches	ML240	240” long with spade lugs	20 foot
ML060	60” long with spade lugs	5 foot	ML300	300” long with spade lugs	30 foot
ML120	120” long with spade lugs	10 foot	ML360	360” long with spade lugs	30 foot
ML180	180” long with spade lugs	15 foot			

Molten Metal - Portable Pyrometers - Analog or Digital

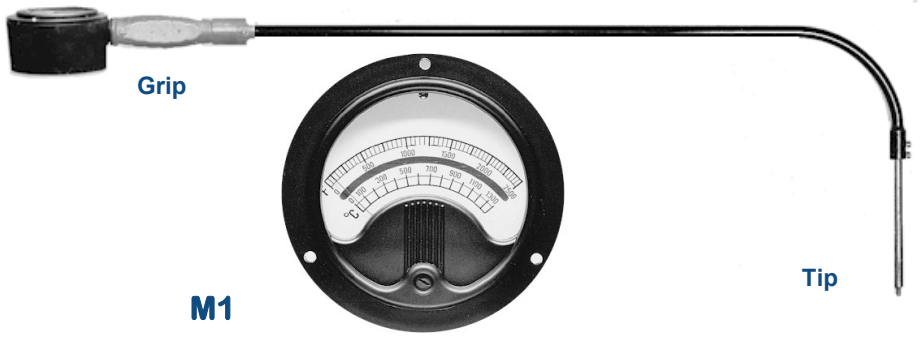
Molten ***metal*** tip portable pyrometers are used for reading melt temperatures of non-ferrous metals such as Aluminum, Brass, Bronze (except Phosphor Bronze) and Magnesium. The tips are constructed from 446 stainless steel and have a maximum service temperature of **2300° F** (**1260° C**). Some other alloys, such as **#8** & **#9** may be specially ordered (Consult factory). The thermocouples are Type K and are within standard limits of error (special limits can be specially ordered). The reduced tip diameter allows for quick response times when immersed into the melt (about 25 seconds).

The pyrometer assemblies with ***quartz*** tips are made with Type B, R, or S thermocouples, which give them a much higher service temperature range. These tips are especially good for molten gold and silver applications up to **3000° F** (**1649° C**). All of the Richards portable pyrometer handles are constructed entirely from 304 stainless steel for maximum durability.

Portable Pyrometer - Analog Meter - Type K

Part Numbers	Tip Inches	Tip mm
PP-MM43-08	08	203.2
PP-MM43-12	12	304.8
PP-MM43-15	15	381.0
PP-MM43-18	18	457.2
PP-MM43-20	20	508.0
PP-MM43-24	24	609.6
PP-MM43-30	30	762.0
PP-MM43-36	36	914.4
PP-MM43-42	42	1068.8
PP-MM43-48	48	1219.2

Construction **1**



Designed for foundry use. Direct reading, balanced construction, with instrument conveniently placed for easy reading and well away from the heat. Uses economical enclosed Molten Metal style tips.

Portable Pyrometer - Digital Meter- Type K- Degrees F is Factory Default Setting

Part Numbers	Tip Inches	Tip mm
DI100K-MM43-08	08	203.2
DI100K-MM43-12	12	304.8
DI100K-MM43-15	15	381.0
DI100K-MM43-18	18	457.2
DI100K-MM43-20	20	508.0
DI100K-MM43-24	24	609.6
DI100K-MM43-30	30	762.0
DI100K-MM43-36	36	914.4
DI100K-MM43-42	42	1068.8
DI100K-MM43-48	48	1219.2

Construction **2**

Designed and built by the Arklay S. Richards Co., Inc. for foundry use. Direct reading, balanced construction, battery operated, LED display with instrument conveniently placed for easy reading and well away from the heat. Instrument can be purchased separately.

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Telescoping Handle - Assemblies - With Digital Instrument

1

PI-100S-24S-QZ5-48 **Degrees F is Factory Default Setting**

Part Numbers	Type	Gauge	Maximum Service to	Construction
PI-100B-24B-QZ5-48 PI-100R-24R-QZ5-48 PI-100S-24S-QZ5-48	B R S	24	3000°F (1649°C) 2700°F (1480°C) 2700°F (1480°C)	Assemblies includes a Digital Instrument (DI100-), 304 stainless steel telescoping handle, aluminum grip, element, and 4 3/4" quartz tip. 10 replacement tips (QZ072047– 4 3/4) are provided with an order of a complete assembly.

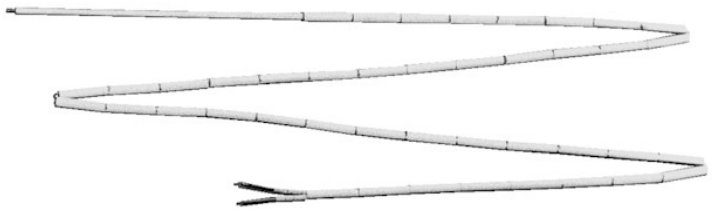
Telescoping Handles - Assemblies - Without Instrument

2

Part Numbers	Type	Gauge	Maximum Service to	Construction
TH-24B-QZ5-48 TH-24R-QZ5-48 TH-24S-QZ5-48	B R S	24	3000°F (1649°C) 2700°F (1480°C) 2700°F (1480°C)	Assemblies includes a 304 stainless steel telescoping handle, aluminum grip, element, and 4 3/4" quartz tip. 10 tips are provided with an order of a complete assembly. Extension Leads can be ordered separately - length and styles must be specified for your application. Leads can go back to any meter (including a wall mounted unit) as long as the type of thermocouple and the meter are compatible.

Telescoping Handles - Elements

3



Construction -

Alumina insulated element, butt welded, removable copper sleeves (SL) for connections.

Part Numbers	Type	Gauge	Service to
24B9Q-48 24R9Q-48 24S9Q-48	B R S	24	3000°F (1649°C) 2700°F (1480°C) 2700°F (1480°C)

Surface Temperature Thermocouples, Heavy Duty, Type K

General Information -

The **STP-01K** Type K series surface temperature thermocouple probe is used in applications where an instant surface temperature reading is required on a metal object. There is no need to wait for a thermocouple element junction to heat up to temperature. The **STP-01K** will give you an instantaneous accurate surface temperature reading the moment the two spring loaded prongs touch the metal object in question. Note that the object must be clean and uncoated in order for the sensor to function. The heavy duty handle is made of 304 stainless and the heavy duty grip is made of aluminum. The elements are of Special Limits of Error, and the leads are made with 304 stainless steel armored cable. A solid pin male plug is standard but a Digital Instrument (**DI100K**) may be attached (**STP-01K-DI100**).

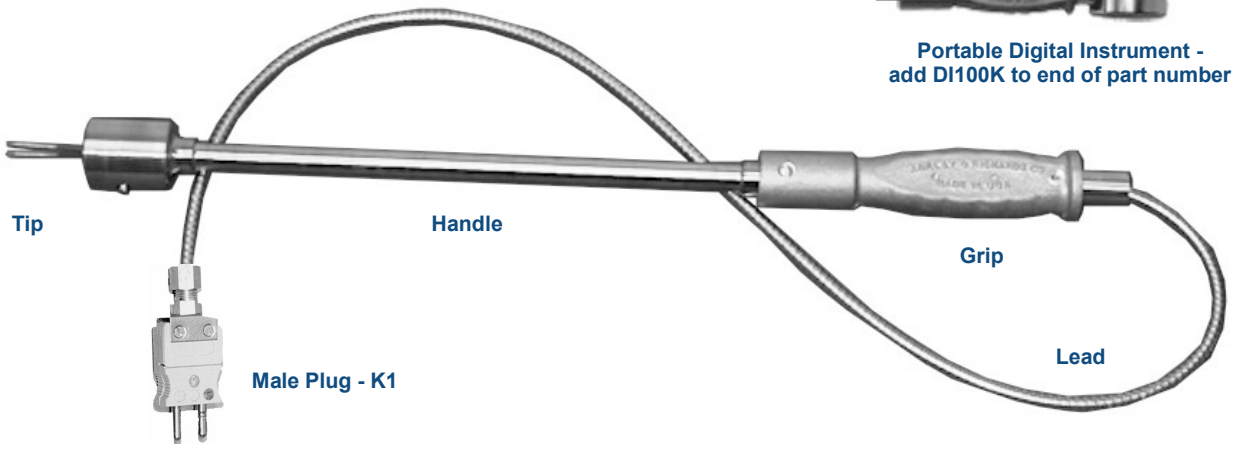
Applications -

The **STP-01K** can be used in many applications. Our sensors are frequently used for measurement of metal billet temperatures. As the billets are extruded, they move on a conveyor belt to a forging operation. The operator only has seconds to take a temperature reading prior to forging. The **STP-01K** is the perfect sensor. Just touch the surface with the two prongs. Instant accurate readings can be obtained with Richards quality and durability.

Note: If you would like to order a Type J or N assembly, substitute the "**K**" in the part number shown on this page with a J or N. Custom length leads and termination styles can also be specified - consult our sales department.

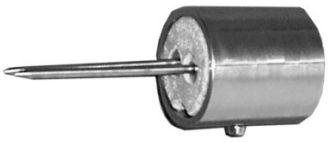
Surface Temperature Thermocouple - STP-01K

Portable Digital Instrument -
add DI100K to end of part number



Part Numbers	Type	Handle Length	Lead Length
STP-01-K-12-060-K1	K	12 Inches	60 Inches
STP-01-K-24-060-K1		24 Inches	60 Inches
STP-01-K-30-060-K1		30 Inches	60 Inches
STP-01-K-12-120-K1		12 Inches	120 Inches
STP-01-K-24-120-K1		24 Inches	120 Inches
STP-01-K-30-120-K1		30 Inches	120 Inches

Heavy Duty Aluminum Grip



Tip Assembly

Note: Units can be ordered with a 90 degree bend on the handle.

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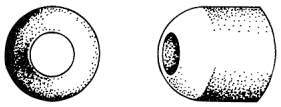
Richards Ceramic Insulators are made from the highest quality raw materials and carefully blended for superior mechanical strength, resistance to thermal shock and excellent insulating properties at high temperatures. Strict attention to hole size, wall thickness, and other details result in minimum breakage during installation. Our oval type insulators are designed to allow two thermocouples to be installed in a single protection tube. The part numbers below, and on the next two pages, describe the physical dimensions of the insulators

Example: The part number **823-O** signifies an 8 gauge insulator, two holes, three inches long, oval in shape.

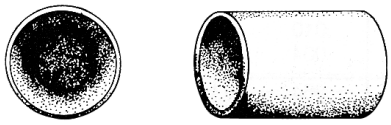
Insulators, Fish Spine - Steatite - maximum temperature of 1652°F (900°C)

	Inches						Millimeters					
Number	Gauge	Length	O.D.	Hole Dia.	No. / Lb	Feet/ Covered	Length	O.D.	Hole Dia.	No./ Kgs	Meters/ Covered	Construction
2F	2	.562	.562	.281	140	5.4	14.3	14.3	7.1	309	3.6	
3F	3	.540	.540	.240	200	5.7	13.7	13.7	6.7	440	3.8	
7F	7	.400	.400	.156	330	9.5	10.2	10.2	4.0	720	6.4	
8F	8	.260	.260	.152	1550	27.0	6.6	6.6	3.9	3415	18.1	
12F	12	.200	.200	.092	3100	43.0	5.1	5.1	2.3	6835	28.8	
14F	14	.170	.170	.068	4800	65.0	4.3	4.3	1.7	10500	43.6	
20F	20	.125	.125	.056	11200	100.0	3.2	3.2	1.4	24600	67.1	
24F	24	.110	.110	.056	20000	151.0	2.8	2.8	1.4	43800	101.0	

Glass Insulation - Glass braided tubing - maximum temperature of 1200°F (649°C)

			Inches			Millimeters			
Number	Gauge	Color	O.D.	I.D.	Feet / Lb	O.D.	I.D.	Meters/ Kg	Construction
GI.870GI.250	-	White	-	.870	-	-	22.1	-	
GI08	-	White	-	.250	-	-	6.35	-	
GI14	8	White	.161	.125	278	4.09	3.18	186	
GI14R	14	White	.094	.064	555	2.39	1.63	373	
GI14Y	14	Red	.094	.064	555	2.39	1.63	373	
GI20	14	Yellow	.094	.064	555	2.39	1.63	373	
	20	White	.054	.032	1111	1.37	0.81	746	

Junction Cups - Mullite - maximum temperature of 2900°F (1595°C)

	Inches				Millimeters				
Number	Length	O.D.	I.D.	Lb/ 1000	Length	O.D.	I.D.	Meters/ Kg	Construction
JC12	8	.50	.25	8	19.1	12.7	6.4	3.6	
JC16	14	.62	.44	18	25.4	15.7	11.2	8.2	
JC18	20	.75	.56	23	25.4	19.1	14.4	10.4	

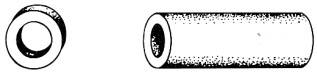
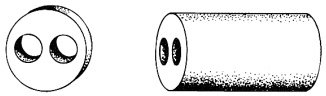
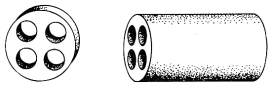
Pipe Size	1/2" Std	1/2" XH	3/4"	3/4" XH	1"	1" XH	1" MXH	1" DXH	CIXH
Junction Cup	JC12	JC12	JC16	JC16	JC18	JC18	JC18	JC12	JC16

Insulators - Short

Richards Ceramic Insulators are made from the highest quality raw materials and carefully blended for superior mechanical strength, resistance to thermal shock and excellent insulating properties at high temperatures. Strict attention to hole size, wall thickness, and other details result in minimum breakage during installation. Our oval type insulators are designed to allow two thermocouples to be installed in a single protection tube. The part numbers below, and on the next two pages, describe the physical dimensions of the insulators

Example: The part number **823-O** signifies an 8 gauge insulator, two holes, three inches long, oval in shape.

Insulators - Short, Cordierite - maximum temperature of 2012°F (1100°C)

			Inches				Millimeters				
Number	Gauge	Holes	Length	O.D.	Hole Dia.	Lbs/ 1000	Length	O.D.	Hole Dia.	Kgs/ 1000	Construction
811	6 or 8	1	1	.340	.204	5.5	25.4	8.7	5.2	2.5	
811-S	8	1	1	.250	.156	2.4	25.4	6.4	4.0	1.1	
813-S	8	1	3	.250	.156	7.2	76.2	6.4	4.0	3.3	
1411	14	1	1	.220	.090	2.5	25.4	5.5	2.3	1.1	
1411-S	14	1	1	.140	.080	1.0	25.4	3.6	2.0	.50	
1611	16	1	1	.140	.060	0.95	25.4	3.6	2.0	.43	
821	6 or 8	2	1	.500	.188	10.0	25.4	12.7	4.7	4.5	
823	6 or 8	2	3	.500	.188	30.0	76.2	12.7	4.7	13.6	
1421	14	2	1	.250	.080	3.0	25.4	6.4	2.0	1.4	
1423	14	2	3	.250	.080	9.0	76.2	6.4	2.0	4.1	
2021	20	2	1	.150	.042	1.3	25.4	3.8	1.1	0.6	
2023	20	2	3	.150	.042	3.9	76.2	3.8	1.1	1.8	
2223	22	2	3	.120	.030	2.3	76.2	3.0	0.8	1.0	
3023	30	2	3	.062	.015	0.6	76.2	1.6	0.4	0.3	
82-1/2-O	6 or 8	2	1/2	.50 x .28	.188	2.8	12.7	12.7 x 7.1	4.7	1.3	
821-O	6 or 8	2	1	.50 x .28	.188	5.6	25.4	12.7 x 7.1	4.7	2.5	
823-0	6 or 8	2	3	.50 x .28	.188	17.0	76.2	12.7 x 7.1	4.7	7.7	
1021-O	10	2	1	.435 x .25	.143	4.3	25.4	11.1 x 6.35	3.7	1.9	
1121-O	11	2	1	.35 x .22	.110	3.7	25.4	8.9 x 5.6	2.8	1.7	
142-1/2-O	14	2	1/2	.31 x .19	.090	1.4	12.7	7.9 x 4.8	2.3	0.6	
1421-O	14	2	1	.31 x .19	.090	2.7	25.4	7.9 x 4.8	2.3	1.2	
1423-O	14	2	3	.31 x .19	.090	8.0	76.2	7.9x 4.8	2.3	3.6	
2021-O	20	2	1	.17 x .12	.042	1.2	25.4	4.3 x 3.0	1.0	0.5	
2023-O	20	2	3	.17 x .12	.042	3.6	76.2	4.3 x 3.0	1.0	1.6	
841	8	4	1	.500	.140	8.5	25.4	12.7	3.6	3.9	
1441	14	4	1	.315	.080	5.0	25.4	8.0	2.0	2.3	
2041	20	4	1	.188	.040	2.0	25.4	4.7	1.0	0.9	

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Alumina Insulators and Rods - 99% - Maximum temperature of 3450°F (1900°C)

Number	Gauge	Holes	Inches Length	Inches O.D.	Inches Hole Dia.	Millimeters Length	Millimeters O.D.	Millimeters Hole Dia.	Construction
141A-*	14	1	*	.250	.125	*	6.4	3.2	Plain, full length
142A-*	14	2	*	.250	.078	*	6.4	2.0	
144A-*	14	4	*	.335	.098	*	8.5	2.5	
161A-*	16	1	*	.188	.094	*	4.8	2.4	
201A-*	20	1	*	.188	.060	*	4.8	1.5	Collar, add “C” to part number
202A-*	20	2	*	.188	.060	*	4.8	1.5	
202A-1/2	20	2	1/2	.188	.060	12.7	4.8	1.5	
204A-1	20	4	1	.188	.047	25.4	4.8	1.2	
204A-*	20	4	*	.188	.047	*	4.8	1.2	
221A-*	22	1	*	.156	.090	*	4.0	2.3	Four Hole / Two Hole / One Hole
222A-*	22	2	*	.163	.040	*	4.1	1.0	
242A-1/2	24	2	1/2	.125	.040	12.7	3.2	1.0	
242A-1	24	2	1	.125	.040	25.4	3.2	1.0	
242A-*	24	2	*	.125	.040	*	3.2	1.0	
244A-*	24	2	*	.125	.031	*	3.2	.79	
262A-*	26	2	*	.094	.020	*	2.4	0.5	
264A-*	26	4	*	.094	.020	*	2.4	0.5	
302A-*	30	2	*	.062	.015	*	1.6	0.4	
82A-*-O	8	2	*	.45x.26	.156	*	11.4x6.6	4.0	

Alumina Rods - Insulators without holes (may be used as spacers)

SA804	Solid	Round	4”	.500	0	101.6	12.7	0	
SA803-O	Solid	Oval	3”	.50x.28	0	76.2	12.7x7.1	0	

Mullite Insulators - Maximum temperature of 2900°F (1590°C)

Number	Gauge	Holes	Inches Length	Inches O.D.	Inches Hole Dia.	Millimeters Length	Millimeters O.D.	Millimeters Hole Dia.	Construction
141-*	14	1	*	.250	.125	*	6.4	3.2	Plain, full length
142-*	14	2	*	.250	.078	*	6.4	2.0	
144-*	14	4	*	.335	.098	*	8.5	2.5	
162-*	16	2	*	.188	.094	*	4.8	2.4	
201-*	20	1	*	.188	.060	*	4.8	1.5	Collar, add “C” to part number
202-*	20	2	*	.188	.060	*	4.8	1.5	
202-1/2	20	2	1/2	.188	.060	12.7	4.8	1.5	
204-1	20	4	1	.188	.047	25.4	4.8	1.2	
204-*	20	4	*	.188	.047	*	4.8	1.2	
241-*	24	1	*	.125	.062	*	3.2	1.6	Four Hole / Two Hole / One Hole
242-1/2	24	2	1/2	.125	.040	12.7	3.2	1.0	
242-1	24	2	1	.125	.040	25.4	3.2	1.0	
242-*	24	2	*	.125	.040	*	3.2	1.0	
262-*	26	2	*	.094	.020	*	2.4	0.5	
264-*	26	4	*	.094	.020	*	2.4	0.5	
302-*	30	2	*	.062	.015	*	1.6	0.4	

Elements - E, J, K, N, and T

Richards Thermocouple elements can be designed in many configurations. Some of the more common Types and forms are shown on these pages. If you nee a special type, phone one of our sales engineers and we can make them to your specifications. The part numbers below describe the thermocouple element type, wire gauge, method of insulation, and construction.

Example: The part number **8K2-36** signifies an 8 gauge (3.3 mm), Type K, oval ceramic insulated and 36 inch long (914.4 mm) element. Also see figure # 2 for a representation of that particular thermocouple element.

Elements, E, J, K, and T		Diameter							
		Gauge	Inches	mm	Type E	Type J	Type K	Type N	Type T
1	Bare wires twisted & welded, no insulators	6	.162	4.11			6K1-*		
		8	.128	3.25	8E1-*	8J1-*	8K1-*	8N1-*	8T1-*
		11	.091	2.31			11K1-*		
		14	.064	1.63	14E1-*	14J1-*	14K1-*		14T1-*
		16	.051	1.30	16E1-*	16J1-*	16K1-*		
		18	.040	1.02			18K1-*		
		20	.032	0.81	20E1-*	20J1-*	20K1-*		20T1-*
		22	.025	0.64			22K1-*		
		24	.020	0.51	24E1-*	24J1-*	24K1-*		24T1-*
		28	.013	0.33	28E1-*	28J1-*	28K1-*		28T1-*
		30	.010	0.25		30J1-*			
		38	.004	0.10	38E1-*	38J1-*	38K1-*		38T1-*
2	Standard element, wires twisted & welded, Oval insulators	6	.162	4.11			6K2-*		
		8	.128	3.25	8E2-*	8J2-*	8K2-*		8T2-*
		11	.091	2.31			11K2-*		
		14	.064	1.63	14E2-*	14J2-*	14K2-*		14T2-*
		16	.051	1.30	16E2-*	16J2-*	16K2-*		
		18	.040	1.02			18K2-*		
		20	.032	0.81	20E2-*	20J2-*	20K2-*		20T2-*
		22	.025	0.64			22K2-*		
		24	.020	0.51	24E2-*	24J2-*	24K2-*		24T2-*
		28	.013	0.33	28E2-*	28J2-*	28K2-*		28T2-*
		30	.010	0.25		30J2-*			
3	Element insulated for Angle Alloy Bent Assembly	8	.128	3.25	8E2AB-H-C	8J2AB-H-C	8K2AB-H-C	8N2AB-H-C	
		11	.091	2.31			11K2AB-H-C		
		14	.064	1.63	14E2AB-H-C	14J2AB-H-C	14K2AB-H-C		
4	Element insulated for Elbow Angle Assemblies	8	.128	3.25	8E2B-H-C	8J2B-H-C	8K2B-H-C	8N2B-H-C	
		11	.091	2.31			11K2B-H-C		
		14	.064	1.63	14E2B-H-C	14J2B-H-C	14K2B-H-C		
5	Element insulated for ceramic Tube Assemblies	8	.128	3.25	8E2C-*	8J2C-*	8K2C-*	8N2C-*	
		14	.064	1.63	14E2C-*	14J2C-*	14K2C-*		
6	Insulated for Angle Ceramic Hot leg Assembly	8	128	3.25	8E2BC-*	8J2BC-*	8K2BC-*	8N2BC-*	
		14	.064	1.63	14E2BC-*	14J2BC-*	14K2BC-*		
7	Dual Elements, twisted & welded, 1 inch round, 4 hole insulators	8	.128	3.25	8E2D-*	8J2D-*	8K2D-*	8N2D-*	8T2D-*
		11	.091	2.31			11K2D-*		
		14	.064	1.63	14E2D-*	14J2D-*	14K2D-*		14T2D-*
		20	.032	0.51	20E2D-*	20J2D-*	20K2D-*		20T2D-*
8	Dual elements twisted, welded, two hole, one inch, round insulators	8	.128	3.25	8E2DS-*	8J2DS-*	8K2DS-*	8N2DS-*	8T2DS-*
9	Element, Fish Spine insulators	8	.128	3.25	8E2F-*	8J2F-*	8K2F-*	8N2F-*	8T2F-*
		14	.064	1.63	14E2F-*	14J2F-*	14K2F-*		14T2F-*
		20	.032	0.51	20E2F-*	20J2F-*	20K2F-*		20T2F-*

* Add thermocouple length as the suffix. Multiples of 6 inches (152.4 mm) starting at 12 inches (304.8 mm) are considered stock.

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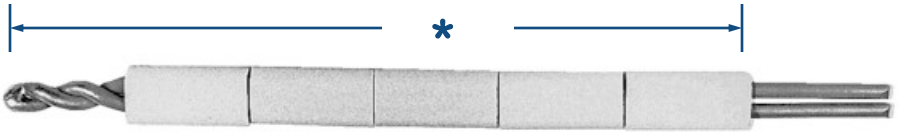
Elements - E, K, J, N, and T

1

Configuration 1
Bare Element, Twisted & welded - no insulators

2



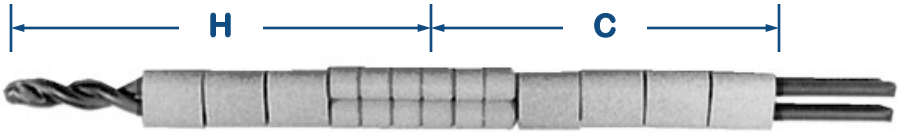
Configuration 2
Standard Element, wires twisted & welded, Oval insulation

For optional Round insulators add "R" to the part number (8K2R-18)

3

Configuration 2AB

4



Configuration 2B
Insulated for Elbow Angle Assemblies

5

Configuration 2C
Insulated for ceramic Tube Assemblies

6

Configuration 2BC
Insulated for Angle ceramic Hot leg Assemblies

7

Configuration 2D
Dual Elements, twisted, welded, & 1 inch round insulators

8

Configuration 2DS
Dual elements, twisted & welded, staggered oval insulators

9

Configuration 2F
Element, Fish spine insulators

Key: * = Nominal Length C = Cold Leg H = Hot Leg

Elements - E, J, K, N, & T and B,C,R,S, & Platinel II (PK)

Elements - E, J, K, and T

		Diameter							
		Gauge	Inches	mm	Type E	Type J	Type K	Type N	Type T
10	Standard element, twisted, welded, oval insulators, Richards 2158 connector attached	6 8 11 14 16 18 20	.162 .128 .091 .064 .051 .040 .032	4.11 3.25 2.31 1.63 1.30 1.02 0.81	 8E3-* 14E3-* 16E3-* 20E3-*	 8J3-* 14J3-* 16J3-* 20J3-*	6K3-* 8K3-* 11K3-* 14K3-* 16K3-* 18K3-* 20K3-*		 8T3-* 14T3-* 20T3-*
11	Element, twisted & welded, 2 hole Oval insulators, Jab Style Plug attached	8 11 14	.128 .091 .064	3.25 2.31 1.63	8E3P-* 14E3P-*	8J3P-* 14J3P-*	8K3P-* 11K3P-* 14K3P-*	8N3P-*	8T3P-* 14T3P-*
12	Element, bare wires butt welded	6 8 11 14 16 18 20 22 24 28 30 38	.162 .128 .091 .064 .051 .040 .032 .025 .020 .013 .010 .004 .004	4.11 3.25 2.31 1.63 1.30 1.02 0.81 0.64 0.51 0.33 0.25 0.10	 8E7-* 14E7-* 16E7-* 20E7-* 24E7-* 28E7-* 38E7-*	 8J7-* 14J7-* 16J7-* 20J7-* 24J7-* 28J7-* 30J7-* 38J7-*	6K7-* 8K7-* 11K7-* 14K7-* 16K7-* 18K7-* 20K7-* 22K7-* 24K7-* 28K7-* 38K7-*	8N7-*	 8T7-* 14T7-* 20T7-* 24T7-* 28T7-* 38T7-*
13	Elements, butt welded, Full Length round insulator. For Dual elements, add "D" to part number. Example: 14K8D-*	8 14 20	.128 .064 .032	3.25 1.63 0.81	8E8-* 14E8-* 20E8-*	8J8-* 14J8-* 20J8-*	8K8-* 14K8-* 20K8-*	8N8-*	8T8-* 14T8-* 20T8-*
16	Elements, butt welded, Oval insulators	8 14 20	.128 .064 .032	3.25 1.63 0.81	8E9-* 14E9-* 20E9-*	8J9-* 14J9-* 20J9-*	8K9-* 14K9-* 20K9-*	8N9-*	8T9-* 14T9-* 20T9-*
17	Element, butt welded, isolated ungrounded junction	8 14	.128 .064	3.25 1.63	8E9JC-* 14E9JC-*	8J9JC-* 14J9JC-*	8K9JC-* 14K9JC-*	8N9JC-*	8T9JC-* 14T9JC-*

Elements - B, C, R, S, Platinel

		Diameter							
		Gauge	Inches	mm	Type B	Type C	Type R	Type S	Platinel (PK)
12	Bare wires butt welded	24 30 38	.020 .010 .004	0.51 0.25 0.10	24B7-*	24C7-*	24R7-* 30R7-*	24S7-* 30S7-* 38S7-*	24PK7-*
14	Butt welded element in a full length 3/16" OD Alumina insulator, Fish spine insulators, Copper Sleeves	24 30 38	.020 .010 .004	0.51 0.25 0.10	24B8-*	24C8-* bare leads	24R8-* 30R8-*	24S8-* 30S8-* 38S8-*	24PK8-*
15	Two (Dual) Butt welded elements in a 3/16" OD full length four hole Alumina insulator, Fish spine Insulators, Copper Sleeves	24 30 38	.020 .010 .004	0.51 0.25 0.10	24B8D-*	24C8D-* bare leads	24R8D-*	24S8D-*	24PK8D-*
18	Butt welded element in one 6 inch full length, balance one inch round 3/16" OD Alumina insulators (For Telescoping Handle Page 73)	24	020	0.51	24B9QR-*		24R9QR-*	24S9QR-*	
16	Butt welded wires and one inch Round 3/16" OD Alumina insulators	24	020	0.51	24B9R-*		24R9R-*	24S9R-*	

* Add the thermocouple length as the suffix. Multiples of 6 inches (152.4 mm) starting at 12 inches (304.8 mm) are considered stock.

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Elements - E, J, K, N, & T and B,C,R,S, & Platinel II (PK)

10

Configuration 3
Standard element, twisted & welded, oval insulators, Richards 2158 connector attached

11

Configuration 3P
Element, twisted & welded, 2 hole Oval insulators, Jab Style Plug attached

12

Configuration 7
Bare wires butt welded

13

Configuration 8
Elements, butt welded, Full Length round insulator

14

Configuration 8SL
Bare wires butt welded, Full length Alumina Insulator, Fish spine Insulators, and Copper Sleeves

15

Configuration 8D
Dual butt welded, elements, Full length 4 hole Alumina Insulator, Fish spine Insulators, and Copper Sleeves

16

Configuration 9
Elements, butt welded, & Oval insulators

For optional Round insulators add “R” to the part number (8K9R-18)

17

Configuration 9JC
Elements, butt welded, round insulators, Isolated ungrounded Junction

18

Configuration 9QR
Telescoping Handle element, butt welded; one 6 inch , balance 1 inch round Alumina insulators, Fish spine Insulators, and Copper Sleeves

Metal Protection Tubes -

Some General Suggestions for Effective Metal Protection Tube Use:

- √ Carefully select the proper protection tube alloy for your process to maximize the service life.
- √ Use a thick walled tube, such as schedule 80, double extra heavy, or Richards heavy duty **SP** size for longer service life.
- √ Use a thin walled tube such as schedule 40, or smaller O.D. tube if you require a quicker response time.
- √ If the protection tube will be subject to severe mechanical shock or abrasion, use the Richards heavy duty **SP** size.
- √ Protection tubes should be inserted into fluids a minimum of **six** times the O.D. of the tube.
- √ Protection tubes should be inserted into gases a minimum of **eight** times to the O.D. of the tube.
- √ Insertion lengths for furnaces and salt baths are typically a minimum of 6 inches (152.4 mm).
- √ Protection tubes, which pass through a hot zone (muffle furnace), should be inserted at least 12 inches (304.8 mm).
- √ In molten salt baths, angle assembilies tube lengths should be a minimum of 18” to protect the elbow from level changes.
- √ If the elbow on angle assemblies will be subjected to high temperatures, an all alloy bent type tube should be used.
- √ Replace all metal protection tubes on a regular basis, since they will become porous over time.
- √ Never shorten the life of new thermocouple elements by placing them into old, worn-out, porous, protection tubes.
- √ Protection tube overall lengths should be long enough to insure that the head temperature will not exceed **400°F** or **204°C**.
- √ Use large O.D. or thick walled protection tubes where sagging is a problem at elevated temperatures.
- √ Note that metal tubes are somewhat porious above **1500°F** or **815°C**, so in some cases a ceramic inner is also used.

Pipe Size Dimension Chart

NPT			Standard Weight				Extra Heavy Weight				Schedule 160				Double Extra Heavy			
Pipe Size	O.D. Inch	O.D. mm	I.D. Inch	Wall Inch	I.D. mm	Wall mm	I.D. Inch	Wall Inch	I.D. mm	Wall mm	I.D. Inch	Wall Inch	I.D. mm	Wall mm	I.D. Inch	Wall Inch	I.D. mm	Wall mm
1/8”	.41	10.4	.27	.068	6.9	1.7	.22	.095	5.6	2.4	-	-	-	-	-	-	-	-
1/4”	.54	13.7	.36	.088	9.1	2.2	.30	.119	7.6	3.0	-	-	-	-	-	-	-	-
3/8”	.68	17.2	.49	.091	12.4	2.3	.42	.126	10.7	3.2	-	-	-	-	-	-	-	
1/2”	.84	21.3	.62	.109	15.7	2.8	.56	.147	14.0	3.7	.466	.187	11.8	4.7	.25	.29	6.4	7.4
3/4”	1.05	26.7	.82	.113	20.8	2.9	.74	.154	18.8	3.9	.614	.218	15.6	5.5	.43	.31	10.9	7.9
1”	1.32	33.5	1.05	.133	26.7	3.4	.96	.179	24.4	4.5	.815	.250	20.7	6.4	.60	.36	15.2	9.1
1 1/4”	1.66	42.2	1.38	.140	35.1	3.6	1.28	.191	32.5	4.9	1.16	.250	29.5	6.4	.90	.38	22.8	9.7
1 1/2”	1.90	48.3	1.61	.145	40.9	3.7	1.50	.200	38.1	5.1	1.34	.281	34.0	7.1	1.10	.40	27.98	10.2
2”	2.38	60.3	2.07	.154	52.6	3.9	1.94	.218	49.3	5.5	1.69	.343	42.9	8.7	1.50	.44	38.1	11.2
2 12”	2.88	73.0	2.47	.203	62.7	5.2	2.32	.276	59.0	7.0	2.13	.375	54.1	9.5	1.77	.55	45.0	14.0
3”	3.50	88.9	3.07	.216	77.9	5.5	2.90	.300	73.7	7.6	2.62	.438	66.5	11.1	2.30	.60	58.4	15.2
3 1/2”	4.00	101.6	3.55	.226	90.1	5.7	3.36	.318	85.4	8.1	-	-	-	-	2.73	.64	69.3	16.3
4”	4.50	114.3	4.03	.237	102.3	6.0	3.83	.337	97.2	8.6	3.44	.531	87.4	13.5	3.15	.67	80.1	17.0
5”	5.56	141.3	5.04	.258	128.0	6.6	4.81	.375	122.1	9.5	4.31	.625	109.4	15.9	4.06	.75	103.1	19.0
6”	6.63	168.3	6.07	.280	154.2	7.1	5.77	.432	146.6	10.7	5.19	.719	131.8	18.3	4.91	.86	124.7	21.8
8”	8.63	219.1	7.99	.322	202.9	8.2	7.63	.500	193.8	12.7	6.82	.906	173.2	23.0	6.87	.88	174.5	22.4
10”	10.75	273.1	10.02	.365	254.5	9.3	9.56	.594	242.8	15.1	8.50	1.125	215.9	28.6	8.75	1.00	222.3	25.4
12”	12.75	323.9	11.94	.406	303.3	10.3	11.37	.688	288.8	17.5	10.13	1.312	257.3	33.3	9.94	1.00	252.4	25.4

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Metal Tubes - Technical Information, Applications, and Suggestions

Process Chemical	Concentration & Temperature	Protection Tube Materials
Acetic Acid	50%, 212°F or 100°C	316SS, Hast C, Monel 400
Acetic Acid	99%, 212°F or 100°C	430SS, Hast C, Monel 400
Alcohol - Ethyl & methyl	212°F or 100°C	304 Stainless Steel
Ammonia	70°F or 21°C	304SS, 316SS
Ammonium chloride	212°F or 100°C	316SS, Monel 400
Ammonium nitrate	212 °F or 100°C	316 Stainless Steel
Ammonium Sulphate	10%, 212°F or 100°C	316 Stainless Steel
Barium chloride	70°F or 21°C	Monel 400, Hastelloy C
Barium hydroxide	70°F or 21°C	Low carbon steel
Barium sulphite		Hastelloy C
Brines		Monel 400
Bromine		Tantalum, Monel
Butadiene		304 Stainless Steel
Butane		304 Stainless Steel
Butyl acetate		Monel 400
Butyl alcohol		Monel 400
Calcium chlorate, dilute	150°F or 66°C	304 Stainless Steel
Calcium Hydroxide	10-50%. 212°F or 100°C	316SS, Hastelloy C
Carbolic acid	212°F or 100°C	316 Stainless Steel
Carbon dioxide		304 Stainless Steel
Chlorine gas, moist	212°F or 100°C	Hastelloy C
Chromic acid	10-50%, 212°F or 100°C	316SS, Hastelloy C
Citric acid	212°F or 100°C	316 Stainless Steel
Copper nitrate		304SS, 316SS
Copper Sulphate		304SS, 316SS
Cresols		304 Stainless Steel
Cyanogen gas		304 Stainless Steel
Ether		304 Stainless Steel
Ethyl acetate		304 Stainless Steel
Ethyl chloride	70°F or 21°C	304SS, low carbon steel
Ethyl Sulphate	70°F or 21°C	304 Stainless Steel
Ferric chloride	5%, 70°F or 21°C & B.P.	Tantalum, Hastelloy C
Ferric Sulphate	5%, 70°F to 21°C	304 Stainless Steel
Formaldehyde		304SS, 316SS
Formic acid	5%, 150°F or 70°C	316 Stainless Steel
Freon		Monel 400
Gallic acid	5%, 150°F or 70°C	Monel 400
Gasoline	70°F or 21°C	304SS, low carbon steel
Glucose	70°F or 21°C	304 Stainless Steel
Glycerine	70°F or 21°C	304 Stainless Steel
Glycerol		304 Stainless Steel
Hydrobromic acid	98%, 212°F or 100°C	Hastelloy B
Hydrochloric acid	25%, 212°F or 100°C	Hastelloy B
Hydrofluoric acid	60%, 212°F or 100°C	Hastelloy C, Monel 400
Hydrogen peroxide	212°F or 100°C	304SS, 316SS
Hydrogen Sulphide		316 Stainless Steel
Iodine		Tantalum
Lactic acid	212°F or 100°C	Tantalum
Magnesium chloride	212°F or 100°C	Nickel
Magnesium Sulphate		Monel 400
Muriatic acid	70°F or 21°C	Tantalum
Naptha	70°F or 21°C	304 Stainless Steel
Natural gas	70°F or 21°C	304SS, 316SS
Nickel chloride	70°F or 21°C	304 Stainless Steel
Nickel Sulphate		304 Stainless Steel
Nitric acid	65%, 212°F or 100°C	316 Stainless Steel
Nitrobenzene	70°F or 21°C	304 Stainless Steel
Oleic acid	10%, 212°F or 100°C	Monel 400
Oleum	70°F or 21°C	316 Stainless Steel
Oxalic acid	10%, 212°F or 100°C	Monel 400
Oxygen	Liquid & elevated temps	316 Stainless Steel
Palmitic acid		316 Stainless Steel
Pentane		304 Stainless Steel
Phenol		304SS, 316SS
Phosphoric acid	85%, 212°F or 100°C	Hastelloy B
Picric acid	70°F or 21°C	304 Stainless Steel
Potassium bromide	70°F or 21°C	316 Stainless Steel
Potassium carbonate	1%, 70°F or 21°C	304SS, 316SS
Potassium chlorate	70°F or 21°C	304 Stainless Steel
Potassium hydroxide	60%, 212°F or 100°C	316 Stainless Steel
Potassium nitrate	5%, 212°F or 100°C	304 Stainless Steel
Potassium permanganate	5%, 70°F or 21°C	304 Stainless Steel
Potassium Sulphate	5%, 70°F or 21°C	304SS, 316SS
Propane		304SS, low carbon steel
Pyrogallic acid		304 Stainless Steel
Quinine bisulphate, dry		316 Stainless Steel
Seawater		Monel 400, Hastelloy C
Salicylic acid		Nickel
Sodium bicarbonate	70°F or 21°C	304SS, 316SS
Sodium chloride	212°F or 100°C	316SS, Monel 400
Sodium fluoride	5%, 70°F or 21°C	Monel 400
Sodium hydroxide		304SS, 316SS, Hastelloy
Sodium hypochlorite	5%	316SS, Hastelloy C
Sodium nitrate, fused		316 Stainless Steel
Sodium Sulphate		304SS, 316SS
Sulphur dioxide, gas	575°F or 302°C	316 Stainless Steel
Sulphur, dry		304 Stainless Steel
Sulphur, wet		316 Stainless Steel
Sulphuric acid	50%, 212°F or 100°C	Hastelloy B
Sulphuric acid	90%, 212°F or 100°C	Hastelloy D
Tannic acid	70°F or 21°C	304SS, Hastelloy B
Tartaric acid	150°F or 66°C	316 Stainless Steel
Toluene		low carbon steel
Turpentine		304SS, 316SS
Whiskey and Wine		304SS, Nickel
Xylene		Copper
Zinc chloride		Monel 400
Zinc Sulphate	25%, 212°F or 100°C	304SS, 316SS

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Protection Tubes - Applications by Industry

KEYS

Code	Material	Code	Material	Code	Material	Code	Material
6	Inconel® 600	10	Incoloy® 800	CI	Cast Iron	QZ	Quartz
7	446 Stainless Steel	16	316 Stainless Steel	HX	Hexoloy® SA	RP	Refractory Tube
8	304 Stainless Steel	20	310 Stainless Steel	LT	Cermet (Metal Ceramic)	SC	Silicon Carbide
9	Inconel® 601	A	Alumina	M	Mullite	SS	Low Carbon Steel

Application By Industry	Protection Tube Material Code															
Heat Treating Industry	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Annealing - Up to 1300°F or 704°C				■	■				■							
Annealing - Over 1300°F or 704°C	■	■		■	■											
Annealing - Bright Batch	■										■		■			
Annealing - Bright Continuous	■										■		■			
Carburizing Hardening - Up to 1500°F or 816°C		■							■							
Carburizing Hardening - 1500°F - 2000°F or 816°C - 1093°C	■	■		■												
Carburizing Hardening - Over 2000°F or 1093°C											■					
Lead hardening		■														
Quench Oil			■						■							
Salt Bath - Cyanide	■	■		■	■											
Salt Bath - High Speed		■		■							■					
Salt Bath - Neutral	■	■		■							■					
Salt Bath - Nitriding	■	■			■											
Iron and Steel Industry	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Basic Oxygen furnace												■				
Billet and slab heating, Butt welding - Up to 2000°F or 1093°C	■	■		■	■						■		■			
Billet and slab heating, Butt welding - Over 2000°F or 1093°C					■						■		■			
Blast furnaces - Downcomer	■	■		■												
Blast furnaces - Stove dome													■			
Blast furnaces - Hot blast main	■			■												
Blast furnaces - Stove trunk	■			■												
Blast furnaces - Stove outlet tube			■						■							
Bright annealing batch - Top work temperature	■															
Bright annealing batch - Bottom work temperature		■														
Bright annealing batch - Continuous furnace section	■			■							■					
Forging furnaces											■		■			
Galvanizing - Hot dip									■				■			
Open hearth - Flues and stack	■	■		■	■											
Open hearth - Checkers	■				■										■	
Palm oil			■													
Pickling tanks													■			
Soaking pits - Up to 2000°F or 1093°C	■	■		■	■											
Soaking pits - Over 2000°F or 1093°C											■		■			
Tinning		■							■							
Vacuum melting - Induction up to 3200°F or 1761°C										■						
Waste heat boilers	■	■		■												
Jewelry Production	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Gold - Molten		■										■				
Silver - Molten		■										■				
Smelting and Refining	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Roasting Sulphur ores													■			
Zinc retort preheaters										■	■					
Zinc smelter													■			

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Protection Tubes - Applications by Industry

Application By Industry	Protection Tube Material Code															
Non-Ferrous Metals Industry	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Aluminum - Annealing									■							
Aluminum - Billet Heating	■	■														
Aluminum - Heat Treating			■						■							
Aluminum - Melting								■					■			■
Aluminum - Molten Die-casting								■					■			■
Babbit		■							■				■			
Brass or Bronze - Molten		■										■	■		■	
Copper		■											■	■	■	
Lead - Molten		■														
Magnesium		■						■	■							
Solder and Tin									■							
Smelting and ore	■	■											■			
Zinc		■							■				■			
Cement, Lime and Fertilizer Production	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Clinker Cooler - Up to 1200°F or 649°C				■												
Kiln- Exit Flues - 600°F to 2000°F or 316°F to 1093°C		■					■									
Kiln - Heating Zone				■												
Kiln - Hot end - Up to 2600°F or 1427°C										■	■					
Ceramic Industry	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Abrasive grits - To 2300°F or 1260°C										■	■					
Dryers - 300°F to 800°F or 149°C to 427°C			■						■				■			
Kiln - Brick - 1800°F to 2200°F or 982°C to 1204°C										■	■		■			
Pottery - Porcelain - Up to 2400°F or 1316°C										■	■					
Vitreous enameling - 1600°F to 2000°F or 871°C to 1093°C		■		■												
Grinding wheels - To 500°F or 260°C			■													
Glass Production	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Fore heaths and feeders (Use a platinum thimble)																
Lehrs			■						■							
Tanks - Roof and wall										■	■					
Tanks - Flues and checkers	■	■		■	■					■						
Paper Production	**6**	**7**	**8**	**9**	**101**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Pulp Digesters		■				■										
Petroleum Production																
Bridgewall	■	■	■	■		■	■		■							
Dewaxing			■			■	■		■							
Fractionating column			■			■	■		■							
Sulphur burners															■	
Towers			■			■	■		■							
Transfer lines			■			■	■		■							
Power Production	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Boiler tubes	■	■	■				■									
Coal-air mixtures		■	■													
Flue gasses		■			■				■							
Preheaters		■							■							
Steam and water lines			■			■										
Gas Production	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Producer gas	■	■		■												
Water gas - Carburetor	■	■		■												
Water gas - Superheater	■	■		■												
Water gas - Tar stills			■						■							
Incineration Plants	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**RP**
Incinerators - Up to 2000°F or 1093°C	■	■														
Incinerators - Over 2000°F or 1093°C										■	■		■	■		
Food Production	**6**	**7**	**8**	**9**	**10**	**16**	**20**	**CI**	**SS**	**A**	**M**	**QZ**	**SC**	**HX**	**LT**	**R**
Baking ovens and food products						■										

RICHARDS®
Arklay S. Richards Co., Inc.

Metal Tubes - Nominal Pipe Thread (NPT)

Richards metal thermocouple protection tubes are manufactured using our special processes to maximize the tube service life. This is evident by our uniquely shaped, heavy mass tips which have been proven in the field for years. Prior to shipment, each tube goes through our Hydro-Pneumatic testing to check for porosity. Protection tubes are typically made with a closed tip and one threaded on the cold end, but they are also available with open ends and various threading options.

Open Tube Examples:
The part number **601-YOBE-12** signifies a 1" O.D., Alloy 601, Open Both Ends, and no threads.
The part number **601-OBE-12** signifies a 1" O.D., Alloy 601, Open Both Ends, and one end threaded.
The part number **601-OBE2T-12** signifies a 1" O.D., Alloy 601, Open Both Ends, and both ends threaded.

Closed Tube Examples:
The part number **601-12** signifies a 1" O.D., Alloy 601, closed one end, and one end threaded.
The part number **601-12-NT** signifies a 1" O.D., Alloy 601, closed one end, and no threads.

Typical Application	Protection Tube Alloy	Pipe Size	O.D. Inches	O.D. mm	I.D. Inches	I.D. mm	Lbs/ Foot	Kg./ Meter	Type K
601 Maximum service temperature 2300°F (1260°C) in oxidizing atmospheres. good resistance to sulfidizing atmospheres.	**#6 Seamless Nickel Alloy** Nickel 60.5%, Chromium 23% Iron 14%, Aluminum 1.4% Copper .5%, Manganese .5% Silicon .2%, Carbon .05%	1" Std 3/4" Std 1/2" Std 3/8" Std	1.32 1.05 .84 .68	33.5 26.7 21.3 17.2	1.05 .82 .62 .49	26.7 20.8 15.7 12.4	1.80 1.20 .91 .61	2.66 1.79 1.35 .91	**601-*** **634-*** **622-*** **638-***
446SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Excellent resistance to sulfidizing atmospheres , corrosion, scaling, and abrasion.	**#7 Seamless Stainless Steel** Chromium 23-27% Manganese 1.5% Silicon 1%, Nitrogen .25% Carbon .20%, Sulphur .030% Phosphorous .040% Iron (Balance)	1" Std 3/4" XH 3/4" NPT 1/2" Std 1/2"XH 3/8" Std 1/4" XH	1.32 1.05 1.25 .84 .84 .68 .54	33.5 26.7 31.8 21.3 21.3 17.3 13.7	1.05 .74 .56 .62 .55 .49 .25	26.7 18.8 14.2 15.7 14.0 12.4 6.4	1.68 1.47 3.20 .85 1.09 .57 .42	2.50 2.19 4.76 1.27 1.62 .85 .63	**701-*** **734XH-*** **734SP-*** **722-*** **712XH** **738-*** **714XH-***
304SS Maximum service temperature 1600°F (871°C) in oxidizing atmospheres.	**#8 Seamless Stainless Steel** Chromium 19% Nickel 10%, Manganese 2% Silicon 1%, Carbon .08% Phosphorous .045% Sulphur .030% Iron (Balance)	1" Std 3/4" Std 3/4" XH 3/4" NPT 1/2" Std 1/2" XH 3/8" Std 1/4" Std 1/8" Std	1.32 1.05 1.05 1.25 .84 .84 .68 .54 .41	33.5 26.7 26.7 31.8 21.3 21.3 17.3 13.7 10.4	1.05 .82 .74 .56 .62 .55 .49 .36 .27	26.7 20.8 18.8 14.2 15.7 14.0 12.4 9.1 6.9	1.68 1.13 1.47 3.20 .85 1.09 .57 .42 .24	2.50 1.68 2.19 4.76 1.27 1.62 .85 .63 .36	**801-*** **834-*** **834XH-*** **834SP-*** **822-*** **812XH-*** **838-*** **814-*** **818-***
600 Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Avoid sulfidizing atmospheres.	**#9 Seamless Nickel Alloy** Nickel 76% Chromium 15.5% Iron 8% Manganese .5% Silicon .2%, Copper .2% Carbon .08%	1" Std 3/4" Std 3/4" XH 3/4" NPT 1/2" Std 1/2" XH 3/8" Std 1/4" Std 1/8" Std	1.32 1.05 1.05 1.25 .84 .84 .68 .54 .41	33.5 26.7 26.7 31.8 21.3 21.3 17.2 13.7 10.3	1.05 .82 .74 .56 .62 .55 .49 .36 .27	26.7 20.8 18.8 14.2 15.7 14.0 12.4 9.1 6.9	1.80 1.22 1.51 3.20 .91 1.17 .61 .46 .26	2.66 1.81 2.25 4.76 1.35 1.74 .91 .68 .39	**901-*** **934-*** **934XH-*** **934SP-*** **922-*** **912XH-*** **938-*** **914-*** **918-***
800 Maximum service temperature 2100°F (1150°C) in oxidizing or reducing atmospheres. Good resistance to sulfidizing	**#10 Seamless Nickel Alloy** Nickel 35%, Chromium 23% Iron 39.5%, Manganese 1.5% Silicon 1%, Copper .75% Aluminum & Titanium .6% Carbon .1%	1" Std 3/4" Std 1/2" XH	1.32 1.05 .84	33.5 26.7 21.3	1.05 .82 .55	26.7 20.8 14.0	1.72 1.15 1.12	2.56 1.71 1.66	**1001-*** **1034-*** **1012XH-***

Replace the * in the above part numbers with the required length as the suffix.
Protection tubes are stocked in multiples of 6 inches starting at 12 inches, although any length can be specified.

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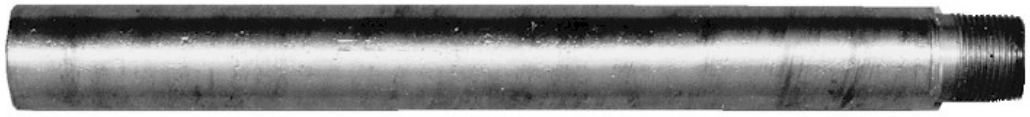
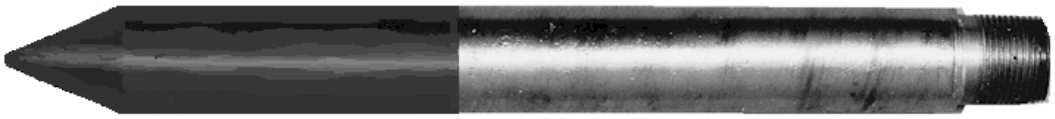
Metal Tubes - Nominal Pipe Thread (NPT)

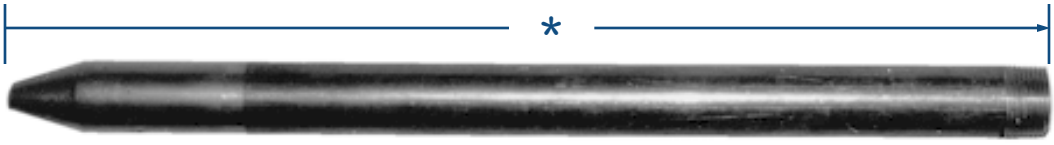
! **Note:** Richards **SP** metal protection tubes are manufactured from drilled solid bar stock to maximize the wall thickness. They are excellent for high temperature, severe service applications where extra stiffness and wear resistance are critical.

1 

SP
3/4" NPT Thread

2 

SPN
Pointed 3/4" NPT Thread

3 

1"
Pipe Size

4 

3/4"
Pipe Size

5 

1/2"
Pipe Size

6 

3/8"
Pipe Size

7 

1/4"
Pipe Size

8 

1/8"
Pipe Size

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Metal Tubes - Nominal Pipe Thread (NPT)

Richards metal thermocouple protection tubes are manufactured using our special processes to maximize the tube service life. This is evident by our uniquely shaped, heavy mass tips which have been proven in the field for years. Prior to shipment, each tube goes through our Hydro-Pneumatic testing to check for porosity.

Typical Application	Protection Tube Alloy	Pipe Size	O.D. Inches	O.D. mm	I.D. Inches	I.D. mm	Lbs/ Foot	Kg./ Meter	Type K
214 Maximum service temperature 2200°F (1204°C) in low stress, oxidizing atmospheres. Best over 1750°F (955°C) and to 2200°F (1204°C) short term. Excellent resistance to carburization, Ni-triding, and Chlorine attack.	**#14 Seamless Nickel Alloy (214)** Nickel 75%, Chromium 16% Aluminum 4.5%, Iron 3% Manganese .5%, Silicon 2%, Zirconium 1% Carbon .05%, Yttrium .01%	3/4" Std 1/2" Std 1/4" Std	1.05 .84 .54	26.7 21.3 13.7	.82 .62 .36	20.8 15.7 9.1	1.13 .85 .42	1.68 1.27 .63	1434-* 1422-* 1414-*
316SS Maximum service temperature 1600°F (780°C) in oxidizing atmospheres. Considered better than 304SS on corrosion.	**#16 Seamless Stainless Steel (316)** Nickel 10-14%, Chromium 16-18% Molybdenum 2-3%, Manganese 2% Silicon 1%, Phosphorous .045% Carbon .08%, Sulfur .03%	1" Std 3/4" Std 3/4" XH 3/4" NPT 1/2" Std 1/2"XH 3/8" Std 1/4" Std 1/8" Std	1.32 1.05 1.05 1.25 .84 .84 .68 .54 .41	33.5 26.7 26.7 31.8 21.3 21.3 17.2 13.7 10.4	1.05 .82 .74 .56 .62 .55 .49 .36 .27	26.7 20.8 18.8 14.2 15.7 14.0 12.4 9.1 6.9	1.68 1.13 1.47 3.20 .85 1.09 .57 .42 .24	2.50 1.68 2.19 4.76 1.27 1.62 .85 .63 .36	1601-* 1634-* 1634XH-* 1634SP-* 1622-* 1612XH 1638-* 1614-* 1618-*
310SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Resists heat scaling.	**#20 Seamless Stainless Steel (310)** Chromium 24-26%, Nickel 19-22% Silicon 1.5%, Manganese 2% Carbon .25%, Phosphorous .045% Sulphur .03%, Iron (Balance)	1" Std 3/4" Std 1/2" Std 1/4" Std 1/8" Std	1.32 1.05 .84 .54 .41	33.5 26.7 21.3 13.7 10.4	1.05 .82 .62 .36 .27	26.7 20.8 15.7 9.1 6.9	1.68 1.13 .85 .42 .24	2.50 1.68 1.27 .63 .36	2001-* 2034-* 2022-* 2014-* 2018-*
Carbon Steel Maximum service temperature 1000°F (540°C) in non-oxidizing applications. Typically used in galvanizing, tin, molten Babbitt, molten magnesium, petroleum applications and water lines.	**#SS Seamless Carbon Steel** Extra Heavy wall (**XH**) Double Extra Heavy wall (**DXH**)	1" DXH 1" XH 3/4" XH 1/2" XH 3/8" Std 1/4" Std 1/8" Std	1.32 1.32 1.05 .84 .68 .54 .41	33.5 33.5 26.7 21.3 17.3 13.7 10.4	.60 .96 .74 .55 .49 .36 .27	15.2 24.4 18.8 14.0 12.4 9.1 6.9	3.1 2.2 1.47 1.09 .57 .42 .24	4.61 3.27 2.19 1.62 .85 .63 .36	SS01DXH-* SS01XH-* SS34XH-* SS12XH-* SS38-* SS14-* SS18-*
HR-160 Maximum service temperature 2200°F (1204°C) in oxidizing and reducing atmospheres. Excellent resistance to sulfur, chlorides, and hot corrosion. Typically used in waste incineration.	**#160HR Seamless Nickel Alloy** Nickel 37%, Cobalt 30%, Chromium 28%, Iron 3.5% Silicon 2.75%, Molybdenum 1% Tungsten 1%, Manganese .5% Titanium .5%, Carbon .05%	3/4" Std 3/4" XH 1/2" Std	1.05 1.05 .84	26.7 26.7 21.3	.82 .74 ..62	20.8 18.8 15.7	1.13 1.47 .85	1.68 2.19 1.27	160HR34-* 160HR34XH-* 160HR22-*
Cast Iron Maximum service temperature 1300°F (700°C) in oxidizing atmospheres. Typically used in molten metal.	**#CI Cast Iron** Extra Heavy wall (**CIXH**). Cast Iron Protection Tube.	3/4"FNPT	1.63	41.4	.88	22.4	4.8	7.14	CIXH-*
Cast Iron, Coated Maximum service temperature 1300°F (700°C) in oxidizing atmospheres. Typically used in molten metal applications.	**#CIXH-CG Cast Iron Extra Heavy Ceramic Glazed** Extra Heavy wall.	3/4"FNPT	1.63	41.4	.88	22.4	4.8	7.14	CIXH-CG-*

Replace the * in the above part numbers with the required length as the suffix.
Protection tubes are stocked in multiples of 6 inches starting at 12 inches, although any length can be specified.

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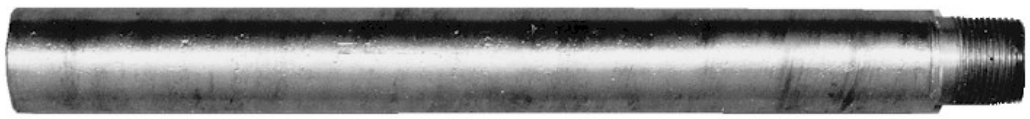
Metal Tubes - Nominal Pipe Threads (NPT)

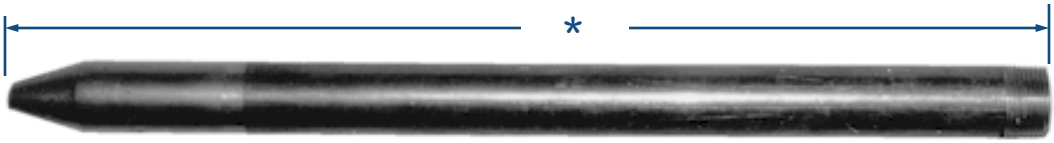
! **Note:** Richards **SP** metal protection tubes are manufactured from drilled solid bar stock to maximize the wall thickness. They are excellent for high temperature, severe service applications where extra stiffness and wear resistance are critical.

1



SP & SPN Pointed
3/4" NPT Thread

2



1"
Pipe Size

3

3/4"
Pipe Size

4

1/2"
Pipe Size

5

3/8"
Pipe Size

6

1/4"
Pipe Size

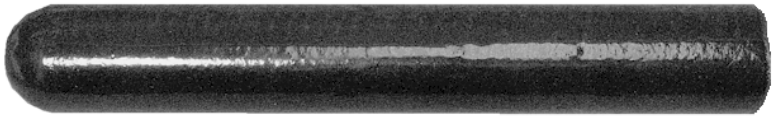
7

1/8"
Pipe Size

8

Cast Iron
Uncoated

9



Cast Iron
Coated

Protection tubes are typically made with a closed tip and one threaded on the cold end, but they are also available with open ends and various threading options.

Open Tube Examples:
The part number **601-YOBE-12** signifies a 1" O.D., Alloy 601, Open Both Ends, and no threads.
The part number **601-OBE-12** signifies a 1" O.D., Alloy 601, Open Both Ends, and one end threaded.
The part number **601-OBE2T-12** signifies a 1" O.D., Alloy 601, Open Both Ends, and both ends threaded.

Closed Tube Examples:
The part number **601-12** signifies a 1" O.D., Alloy 601, closed one end, and one end threaded.
The part number **601-12-NT** signifies a 1" O.D., Alloy 601, closed one end, and no threads.

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Metal Tubes - Miniature Sizes

Typical Application	Protection Tube Alloy	O.D. Inches	I.D. Inches	Wall	O.D. mm	I.D. mm	Wall mm	Part Number
601 Maximum service temperature 2300°F (1260°C) in oxidizing atmospheres. good resistance to sulfidizing atmospheres.	**#6 Seamless Nickel Alloy** Nickel 60.5%, Chromium 23% Iron 14%, Aluminum 1.4% Copper .5%, Manganese .5% Silicon .2%, Carbon .05%	3/4” 1/2” 3/8” 1/4” 3/16” 1/8”	.620 .370 .277 .180 .148 .085	.065 .065 .049 .035 .020 .020	19.05 12.70 9.52 6.35 4.76 3.18	15.74 9.39 7.03 4.57 3.76 2.16	1.65 1.65 1.24 .89 .51 .51	6M12-* 6M8-* 6M6-* 6M4-* 6M3-* 6M2-*
446SS Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Excellent resistance to sulfidizing atmospheres, corrosion, scaling, and abrasion.	**#7 Seamless Stainless Steel** Chromium 23-27%, Manganese 1.5% Silicon 1%, Nitrogen .25% Carbon .20%, Sulphur .030% Phosphorous .040%, Iron (Balance)	3/4” 1/2” 3/8” 1/4” 3/16” 1/8”	.620 .370 .277 .180 .148 .085	.065 .065 .049 .035 .020 .020	19.05 12.70 9.52 6.35 4.76 3.18	15.74 9.39 7.03 4.57 3.76 2.16	1.65 1.65 1.24 .89 .51 .51	7M12-* 7M8-* 7M6-* 7M4-* 7M3-* 7M2-*
304SS Maximum service temperature 1600°F (871°C) in oxidizing atmospheres	**#8 Seamless Stainless Steel** Chromium 19%, Nickel 10%, Manganese 2%, Silicon 1%, Carbon .08%, Phosphorous .045% Sulphur .030%, Iron (Balance)	3/4” 1/2” 3/8” 1/4” 3/16” 1/8” 1/16”	.620 .370 .277 .180 .148 .085 .043	.065 .065 .049 .035 .020 .020 .010	19.05 12.70 9.52 6.35 4.76 3.18 1.57	15.74 9.39 7.03 4.57 3.76 2.16 1.09	1.65 1.65 1.24 .89 .51 .51 .25	8M12-* 8M8-* 8M6-* 8M4-* 8M3-* 8M2-* 8M1-*
600 Maximum service temperature 2100°F (1150°C) in oxidizing atmospheres. Avoid sulfidizing atmospheres.	**#9 Seamless Nickel Alloy** Nickel 76%, Chromium 15.5% Iron 8%, Manganese .5% Silicon .2%, Copper .2% Carbon .08%	3/4” 1/2” 3/8” 1/4” 3/16” 1/8” 1/16”	.620 .370 .277 .180 .148 .085 .043	.065 .065 .049 .035 .020 .020 .010	19.05 12.70 9.52 6.35 4.76 3.18 1.57	15.74 9.39 7.03 4.57 3.76 2.16 1.09	1.65 1.65 1.24 .89 .51 .51 .25	9M12-* 9M8-* 9M6-* 9M4-* 9M3-* 9M2-* 9M1-*
800 Maximum service temperature 2100°F (1150°C) in oxidizing or reducing atmospheres. Good resistance to sulfidizing atmospheres.	**#10 Seamless Nickel Alloy** Nickel 35%, Chromium 23% , Iron 39.5%, Manganese 1.5% Silicon 1%, Copper .75% Aluminum & Titanium .6%, Carbon .1%	1/4”	.180	.035	6.35	4.57	.89	10M4
316SS Maximum service temperature 1600°F (780°C) in oxidizing atmospheres. Considered better than 304SS on corrosion.	**#16 Seamless Stainless Steel (316)** Nickel 10-14%, Chromium 16-18% Molybdenum 2-3%, Manganese 2% Silicon 1%, Phosphorous .045% Carbon .08%, Sulfur .03%	3/4” 1/2” 7/16 3/8” 1/4” 3/16” 1/8” 1/16”	.620 .370 .270 .277 .180 .148 .085 .043	.065 .065 .083 .049 .035 .020 .020 .010	19.05 12.70 11.18 9.52 6.35 4.76 3.18 1.57	15.74 9.39 6.86 7.03 4.57 3.76 2.16 1.09	1.65 1.65 2.11 1.24 .89 .51 .51 .25	16M12-* 16M8-* 16M7-* 16M6-* 16M4-* 16M3-* 16M2-* 16M1-*
C-276 Maximum service temperature 1000°F (538°C) in oxidizing and reducing atmospheres. Excellent resistance to corrosion in aqueous chemical process applications including ferric, and cupric chlorides, sea water and brine solutions, chlorine, formic and acetic acids, wet chlorine gas, hypochlorite chlorine dioxide. It is also frequently used in flue gas desulphurization systems, since it has excellent resistance to sulfur and chloride ions.	**#HC C-276** Nickel 57%, Chromium 16%, Molybdenum 16%, Iron 5%, Tungsten 4%, Cobalt 2.5%, Manganese 1%, Vanadium .35%, Silicon .08%, Carbon .01%.	1/4” 3/16” 1/8”	.180 .148 .085	.035 .020 .020	6.35 4.76 3.18	4.57 3.76 2.16	.89 .51 .651	HCM4-* HCM3-* HCM2-*

Replace the * in the above part numbers with the required length as the suffix.
Protection tubes are stocked in multiples of 6 inches starting at 12 inches, although any length can be specified.

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Description of Common Options	Construction

Standard, Plain & Flare

1

A flare is provided to help prevent fraying or wearing of the insulation on the thermocouple element where it exits the tube. This is standard on all miniature tubes unless otherwise specified.

12" part number example: 9M2-12

Tube, Compression Fitting (CF)

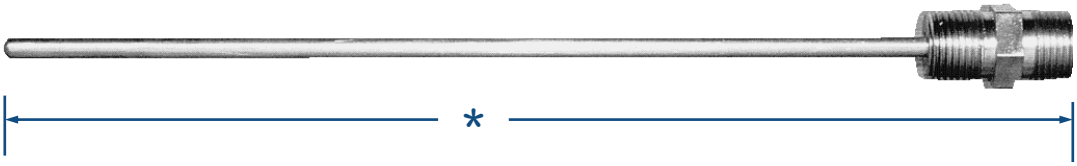
2

The Compression Fitting is first screwed in to place then the tube is adjusted to the desired insertion length. The compression nut is tightened to compress the ferule and lock the tube into place. To order add **CF** to the part number. The Compression Fittings are made of 316 Stainless Steel.

12" part number example: 9M2-12-CF

Tube, Hex Fitting (HX)

3



Tube Plain, No Flare (NF)

4

Tube, Pointed Tip (PT)

5

Standard lengths are multiples of 6" (152.4 mm) starting at 12 inches (304.8) but any length may be ordered.

Thermowells - Machined Bar Stock

Richards thermowells are available in all typical configurations shown in this section. We offer many material options as listed in the code charts. If you need a special material or design, which is not listed, phone one of our sales engineers and we can make it special for you. Our standard thermocouple thermowells are the **T030** series threaded wells in 304 or 326 stainless steel. These are bored for 1/4" diameter probes. The process connections are available in 1/2" , 3/4", and 1" NPT configurations. The shank is straight and stepped for rapid temperature response. Immersion lengths are shown in the Series **T030** Table.

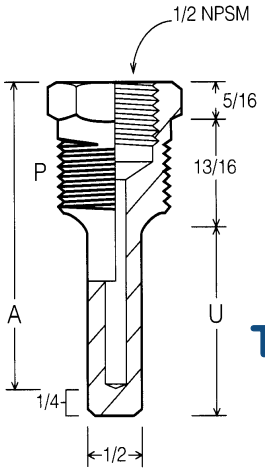
Cap and Chain	Part Number			
Thread Size	Brass	304SS	316SS	Construction
1/4"	CC04-BR	CC04-08	CC04-16	
1/2"	CC08-BR	CC08-08	CC08-16	
1 1/4-18 *	CC20-BR	CC20-08	CC20-16	

Cap and chain are options on all thermowells. Add above part number to the end of the thermowell part number.
* Special thread used in industrial style thermowells.

T010 Series - Limited Space Threaded Well

Part Number	Bore Inches	Process Thread (P)	Element Length (A)	Insertion Length (U)
T01008-MC-01 5/8	.260	1/2" NPT	2 1/2"	1 5/8"
T01012-MC-01 5/8	.260	3/4" NPT	2 1/2"	1 5/8"
T01016-MC-01 5/8	.260	1" NPT	2 1/2"	1 5/8"

MC = Material Code from Table Bore is for 1/4" element

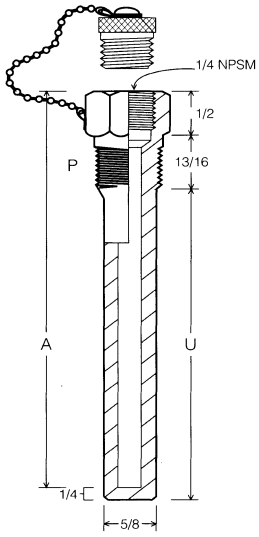


T010

T020 Series - Laboratory Style Test Well

Part Number	Bore Inches	Process Thread (P)	Element Length (A)	Insertion Length (U)
T02008-MC-01 1/2	.385	1/2" NPT	2 3/4"	1 1/2"
T02008-MC-03	.385	1/2" NPT	4 1/4"	3"
T02008-MC-04 1/2	.385	1/2" NPT	5 3/4"	4 1/2"

MC = Material Code from Table Bore is for 3/8" element



T020

You Ring We Spring into ACTION
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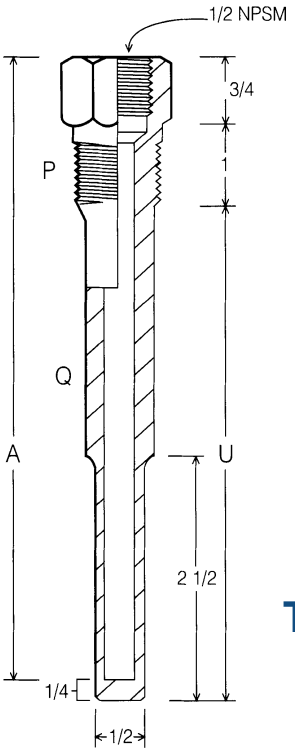
Material Selection Codes				Note: MC = Material Code from this table. Other materials available upon request.					
Material	Code	Material	Code	Material	Code	Material	Code	Material	Code
214 Alloy	14	316 Stainless Steel	16	Carbon Steel	CS	Hastelloy C	HC	Monel R	MR
446 Stainless Steel	07	347 Stainless Steel	47	Carpenter 20	CA	Incoloy	10	Nickel	NI
304 Stainless Steel	08	A105, Grade I	A1	F-11	11	Inconel 600	09	Tantalum	TA
309 Stainless Steel	18	A105, Grade II	A2	F-22	22	Inconel 601	06	Titanium	TI
310 Stainless Steel	20	Brass	BR	Hastelloy B	HB	Monel K	MK	Teflon	TF

T030 Series - Stepped, Threaded -

For "A" = 2 1/2", "U" = 1 5/8" - see T010 Series

Part Number	Bore Inches	Process Thread (P)	Element Length (A)	Insertion Length (U)	Shank Diameter (Q)
T03008-MC-02 1/2	.260	1/2" NPT	4	2 1/2"	0
T03008-MC-04 1/2			6	4 1/2"	5/8"
T03008-MC-07 1/2			9	7 1/2"	5/8"
T03008-MC-10 1/2			12	10 1/2"	5/8"
T03008-MC-13 1/2			15	13 1/2"	5/8"
T03008-MC-16 1/2			18	16 1/2"	5/8"
T03008-MC-22 1/2			24	22 1/2"	5/8"
T03012-MC-02 1/2	.260	3/4" NPT	4	2 1/2"	0
T03012-MC-04 1/2			6	4 1/2"	3/4"
T03012-MC-07 1/2			9	7 1/2"	3/4"
T03012-MC-10 1/2			12	10 1/2"	3/4"
T03012-MC-13 1/2			15	13 1/2"	3/4"
T03012-MC-16 1/2			18	16 1/2"	3/4"
T03012-MC-22 1/2			24	22 1/2"	3/4"
T03016-MC-02 1/2	.260	1" NPT	4	2 1/2"	0
T03016-MC-04 1/2			6	4 1/2"	7/8"
T03016-MC-07 1/2			9	7 1/2"	7/8"
T03016-MC-10 1/2			12	10 1/2"	7/8"
T03016-MC-13 1/2			15	13 1/2"	7/8"
T03016-MC-16 1/2			18	16 1/2"	7/8"
T03016-MC-22 1/2			24	22 1/2"	7/8"

MC = Material Code from Table Bore is for 1/4" element

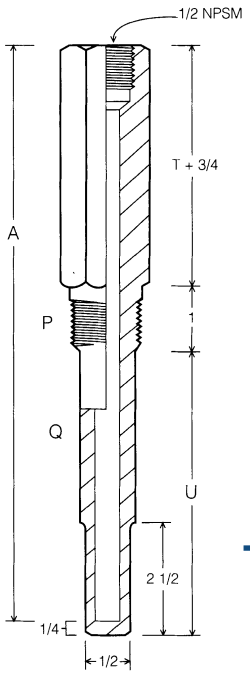


T030

T040 Series - Stepped, Threaded

Part Number	Bore Inches	Process Thread (P)	Element Length (A)	Insertion Length (U)	Shank Diameter (Q)	Lagging Extension (T)
T04008-MC-02 1/2	.260	1/2" NPT	6	2 1/2"	0	2
T04008-MC-04 1/2			9	4 1/2"	5/8"	3
T04008-MC-07 1/2			12	7 1/2"	5/8"	3
T04008-MC-10 1/2			15	10 1/2"	5/8"	3
T04008-MC-13 1/2			18	13 1/2"	5/8"	3
T04008-MC-19 1/2			24	19 1/2"	5/8"	3
T04012-MC-02 1/2	.260	3/4" NPT	6	2 1/2"	0	2
T04012-MC-04 1/2			9	4 1/2"	3/4"	3
T04012-MC-07 1/2			12	7 1/2"	3/4"	3
T04012-MC-10 1/2			15	10 1/2"	3/4"	3
T04012-MC-13 1/2			18	13 1/2"	3/4"	3
T04012-MC-19 1/2			24	19 1/2"	3/4"	3
T04016-MC-02 1/2	.260	1" NPT	6	2 1/2"	0	2
T04016-MC-04 1/2			9	4 1/2"	7/8"	3
T04016-MC-07 1/2			12	7 1/2"	7/8"	3
T04016-MC-10 1/2			15	10 1/2"	7/8"	3
T04016-MC-13 1/2			18	13 1/2"	7/8"	3
T04016-MC-19 1/2			24	19 1/2"	7/8"	3

MC = Material Code from Table Bore is for 1/4" element



T040

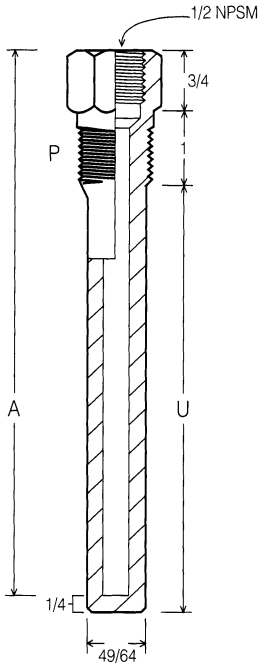
Thermowells - Machined Bar Stock

Material Selection Codes				Note: MC = Material Code from this table. Other materials available upon request.					
Material	Code	Material	Code	Material	Code	Material	Code	Material	Code
214 Alloy	14	316 Stainless Steel	16	Carbon Steel	CS	Hastelloy C	HC	Monel R	MR
446 Stainless Steel	07	347 Stainless Steel	47	Carpenter 20	CA	Incoloy	10	Nickel	NI
304 Stainless Steel	08	A105, Grade I	A1	F-11	11	Inconel 600	09	Tantalum	TA
309 Stainless Steel	18	A105, Grade II	A2	F-22	22	Inconel 601	06	Titanium	TI
310 Stainless Steel	20	Brass	BR	Hastelloy B	HB	Monel K	MK	Teflon	TF

T050 Series - Threaded, Straight Shank

Part Number	Bore Inches	Process Thread (P)	Element Length (A)	Insertion Length (U)
T05012-MC-02 1/2	.385	3/4" NPT	4	2 1/2"
T05012-MC-04 1/2			6	4 1/2"
T05012-MC-07 1/2			9	7 1/2"
T05012-MC-10 1/2			12	10 1/2"
T05012-MC-13 1/2			15	13 1/2"
T05012-MC-16 1/2			18	16 1/2"
T05012-MC-22 1/2			24	22 1/2"
T05016-MC-02 1/2	.385	1" NPT	4	2 1/2"
T05016-MC-04 1/2			6	4 1/2"
T05016-MC-07 1/2			9	7 1/2"
T05016-MC-10 1/2			12	10 1/2"
T05016-MC-13 1/2			15	13 1/2"
T05016-MC-16 1/2			18	16 1/2"
T05016-MC-22 1/2			24	22 1/2"

MC = Material Code from Table Bore is for 3/8" element

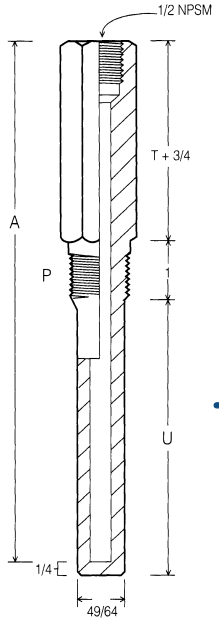


T050

T060 Series - Threaded, Lagging Extension

Part Number	Bore Inches	Process Thread (P)	Element Length (A)	Insertion Length (U)	Lagging Extension (T)
T06012-MC-02 1/2	.385	3/4" NPT	6	2 1/2"	2
T06012-MC-04 1/2			9	4 1/2"	3
T06012-MC-07 1/2			12	7 1/2"	3
T06012-MC-10 1/2			15	10 1/2"	3
T06012-MC-13 1/2			18	13 1/2"	3
T06012-MC-19 1/2			24	19 1/2"	3
T06016-MC-02 1/2	.385	1" NPT	6	2 1/2"	2
T06016-MC-04 1/2			9	4 1/2"	3
T06016-MC-07 1/2			12	7 1/2"	3
T06016-MC-10 1/2			15	10 1/2"	3
T06016-MC-13 1/2			18	13 1/2"	3
T06016-MC-19 1/2			24	19 1/2"	3

MC = Material Code from Table Bore is for 3/8" element



T060

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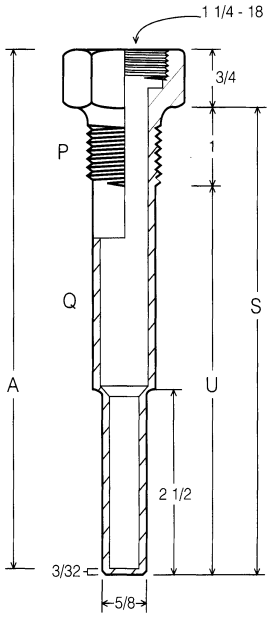
T070 Series - For Industrial Glass Thermometers

Part Number	Shank Diameter (Q)	Process Thread (P)	Element Length (A)	Stem Length (S)	Insertion Length (U)
T07012-MC-02 1/2 T07012-MC-05 T07012-MC-07 T07012-MC-08 T07012-MC-11	7/8”	3/4” NPT	4 5/32” 6 21/32” 8 23/32” 9 21/32” 12 21/32”	3 1/2” 6” 8” 9” 12”	2 1/2” 5” 7” 8” 11”
T07016-MC-02 1/2 T07016-MC-05 T07016-MC-07 T07016-MC-08 T07016-MC-11	7/8”	1” NPT	4 5/32” 6 21/32” 8 23/32” 9 21/32” 12 21/32”	3 1/2” 6” 8” 9” 12”	2 1/2” 5” 7” 8” 11”

MC = Material Code from Table For liquid filled glass thermometers.

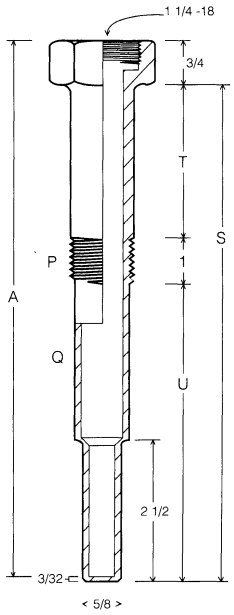


T070

T080 Series - Industrial Thermometers, Lagging Extensions

Part Number	Shank Diameter (Q)	Process Thread (P)	Element Length (A)	Stem Length (S)	Insertion Length (U)	Lagging Extension (T)
T08012-MC-02 1/2 T08012-MC-05 T08012-MC-07 T08012-MC-08 T08012-MC-11	7/8”	3/4” NPT	4 5/32” 6 21/32” 8 23/32” 9 21/32” 12 21/32”	3 1/2” 6” 8” 9” 12”	1 1/2” 2 1/2” 4 1/2” 5 1/2” 8 1/2”	1” 2 1/2” 2 1/2” 2 1/2” 2 1/2”
T08016-MC-02 1/2 T08016-MC-05 T08016-MC-07 T08016-MC-08 T08016-MC-11	7/8”	1” NPT	4 5/32” 6 21/32” 8 23/32” 9 21/32” 12 21/32”	3 1/2” 6” 8” 9” 12”	1 1/2” 2 1/2” 4 1/2” 5 1/2” 8 1/2”	1” 2 1/2” 2 1/2” 2 1/2” 2 1/2”

MC = Material Code from Table For liquid filled glass thermometers.



T080

Thermowells - Machined Bar Stock

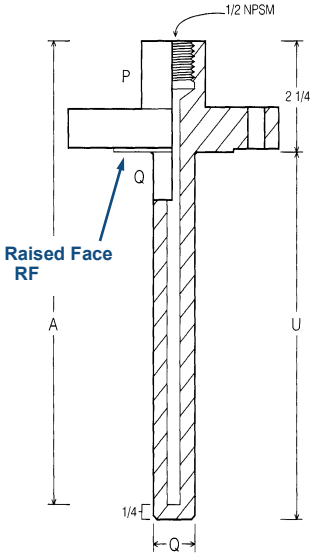
T090 & T096 Series - ANSI Flange Style Shank

For a tapered shank, change 090 to 094, or, 096 to 098

Part Number	Bore Inches	Element Length (A)	Insertion Length (U)	Shank Diameter (Q)
T09000-MC-RFxxxx-02 T09000-MC-RFxxxx-04 T09000-MC-RFxxxx-07 T09000-MC-RFxxxx-10 T09000-MC-RFxxxx-12 T09000-MC-RFxxxx-16 T09000-MC-RFxxxx-22	.260	4” 6” 9” 12” 15” 18” 24”	2” 4” 7” 10” 13” 16” 22”	3/4”
T09600-MC-RFxxxx-02 T09600-MC-RFxxxx-04 T09600-MC-RFxxxx-07 T09600-MC-RFxxxx-10 T09600-MC-RFxxxx-12 T09600-MC-RFxxxx-16 T09600-MC-RFxxxx-22	.385	4” 6” 9” 12” 15” 18” 24”	2” 4” 7” 10” 13” 16” 22”	7/8”

MC = Material Code from Table.
RFxxxx = Raised Face actual Diameter + Pounds / inch flange size.
For inserting a code see instructions and table on page 31

P = 1 1/4” nominal.

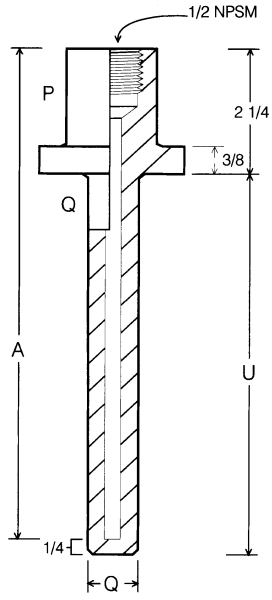


T090
T096

T100 & T160 Series - Van Stone Style

For a tapered shank, change 100 to 104, or, 106 to 108

Part Number	Bore Inches	Nominal Diameter (P)	Element Length (A)	Insertion Length (U)	Shank Diameter (Q)	Raised Face (R)
T010016-MC-FGxxx-02 T010016-MC-FGxxx-04 T010016-MC-FGxxx-07 T010016-MC-FGxxx-10 T010016-MC-FGxxx-13 T010016-MC-FGxxx-16 T010016-MC-FGxxx-22	.260	1” NPT (1.315” Dia. actual)	4” 6” 9” 12” 15” 18” 24”	2” 4” 7” 10” 13” 16” 22”	3/4”	2” Dia.
T010024-MC-FGxxx-02 T010024-MC-FGxxx-04 T010024-MC-FGxxx-07 T010024-MC-FGxxx-10 T010024-MC-FGxxx-13 T010024-MC-FGxxx-16 T010024-MC-FGxxx-22	.260	1 1/2” NPT (1.900” Dia. actual)	4” 6” 9” 12” 15” 18” 24”	2” 4” 7” 10” 13” 16” 22”	3/4”	2 1/2” Dia.
T010616-MC-FGxxx-02 T010616-MC-FGxxx-04 T010616-MC-FGxxx-07 T010616-MC-FGxxx-10 T010616-MC-FGxxx-13 T010616-MC-FGxxx-16 T010616-MC-FGxxx-22	.385	1” NPT (1.315” Dia. actual)	4” 6” 9” 12” 15” 18” 24”	2” 4” 7” 10” 13” 16” 22”	7/8”	2” Dia.
T010624-MC-FGxxx-02 T010624-MC-FGxxx-04 T010624-MC-FGxxx-07 T010624-MC-FGxxx-10 T010624-MC-FGxxx-13 T010624-MC-FGxxx-16 T010624-MC-FGxxx-22	.385	1 1/2” NPT (1.900” Dia. actual)	4” 6” 9” 12” 15” 18” 24”	2” 4” 7” 10” 13” 16” 22”	7/8”	2 1/2” Dia.



T100
T160

MC = Material Code from Table.

FS = Flange is not shown in picture and drawing above. For adding a flange and code, see instructions and table on page 31

If no FS flange then leave “FGxxx” out of the part number

.260 Bore is for a 1/4” diameter element.
.385 Bore is for a 3/8” diameter element.

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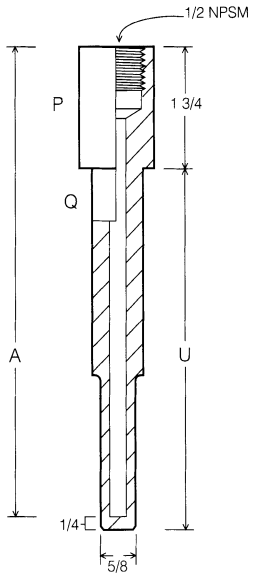
Material Selection Codes				Note: MC = Material Code from this table. Other materials available upon request.					
Material	Code	Material	Code	Material	Code	Material	Code	Material	Code
214 Alloy	14	316 Stainless Steel	16	Carbon Steel	CS	Hastelloy C	HC	Monel R	MR
446 Stainless Steel	07	347 Stainless Steel	47	Carpenter 20	CA	Incoloy	10	Nickel	NI
304 Stainless Steel	08	A105, Grade I	A1	F-11	11	Inconel 600	09	Tantalum	TA
309 Stainless Steel	18	A105, Grade II	A2	F-22	22	Inconel 601	06	Titanium	TI
310 Stainless Steel	20	Brass	BR	Hastelloy B	HB	Monel K	MK	Teflon	TF

T110 Series - Socket Weld Style, Stepped Shank

Part Number	Bore Inches	Nominal Pipe Size (P)	Element Length (A)	Insertion Length (U)	Shank Diameter (Q)
T11012-MC-02 1/2 T11012-MC-04 1/2 T11012-MC-07 1/2 T11012-MC-10 1/2 T11012-MC-13 1/2 T11012-MC-16 1/2 T11012-MC-22 1/2	.260	3/4" NPT	4 6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	3/4"
T11016-MC-02 1/2 T11016-MC-04 1/2 T11016-MC-07 1/2 T11016-MC-10 1/2 T11016-MC-13 1/2 T11016-MC-16 1/2 T11016-MC-22 1/2	.260	1" NPT	4 6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	7/8"

MC = Material Code from Table Bore is for 1/4" element

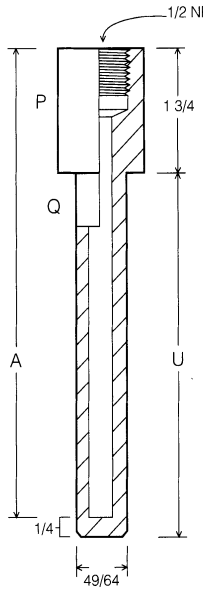


T110

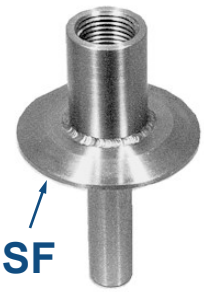
T120 Series - Stepped, Threaded

Part Number	Bore Inches	Nominal Pipe Size (P)	Element Length (A)	Insertion Length (U)
T12012-MC-02 1/2 T12012-MC-04 1/2 T12012-MC-07 1/2 T12012-MC-10 1/2 T12012-MC-13 1/2 T12012-MC-19 1/2	.385	3/4" NPT	4 6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"
T12016-MC-02 1/2 T12016-MC-04 1/2 T12016-MC-07 1/2 T12016-MC-10 1/2 T12016-MC-13 1/2 T12016-MC-19 1/2	.385	1" NPT	4 6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"

MC = Material Code from Table Bore is for 3/8" element



T120



SF

Sanitary Flanges:

If you would like to add a Sanitary Flange (**SF**), add the following codes to the end of the above part numbers.

SF16 = 1 inch flange **SF24** = 1 1/2 inch flange **SF32** = 2 inch flange
SF40 = 2 1/2 inch flange **SF48** = 3 inch flange **SF64** = 4 inch flange

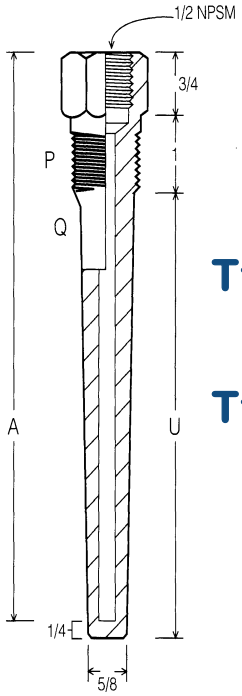
Thermowells - Machined Bar Stock

Material Selection Codes				Note: MC = Material Code from this table. Other materials available upon request.					
Material	Code	Material	Code	Material	Code	Material	Code	Material	Code
214 Alloy	14	316 Stainless Steel	16	Carbon Steel	CS	Hastelloy C	HC	Monel R	MR
446 Stainless Steel	07	347 Stainless Steel	47	Carpenter 20	CA	Incoloy	10	Nickel	NI
304 Stainless Steel	08	A105, Grade I	A1	F-11	11	Inconel 600	09	Tantalum	TA
309 Stainless Steel	18	A105, Grade II	A2	F-22	22	Inconel 601	06	Titanium	TI
310 Stainless Steel	20	Brass	BR	Hastelloy B	HB	Monel K	MK	Teflon	TF

T130 & T140 Series - Threaded, Tapered Shank

Part Number	Bore Inches	Process Thread (P)	Element Length (A)	Insertion Length (U)	Shank Diameter (Q)
T13012-MC-02 1/2 T13012-MC-04 1/2 T13012-MC-07 1/2 T13012-MC-10 1/2 T13012-MC-13 1/2 T13012-MC-16 1/2 T13012-MC-22 1/2	.260	3/4" NPT	4 6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	7/8"
T13016-MC-02 1/2 T13016-MC-04 1/2 T13016-MC-07 1/2 T13016-MC-10 1/2 T13016-MC-13 1/2 T13016-MC-16 1/2 T13016-MC-22 1/2	.260	1" NPT	4 6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	1 1/16"
T14012-MC-02 1/2 T14012-MC-04 1/2 T14012-MC-07 1/2 T14012-MC-10 1/2 T14012-MC-13 1/2 T14012-MC-16 1/2 T14012-MC-22 1/2	.385	3/4" NPT	4 6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	7/8"
T14016-MC-02 1/2 T14016-MC-04 1/2 T14016-MC-07 1/2 T14016-MC-10 1/2 T14016-MC-13 1/2 T14016-MC-16 1/2 T14016-MC-22 1/2	.385	1" NPT	4 6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	1 1/6"

MC = Material Code from Table Bore is for 1/4" & 3/8" elements



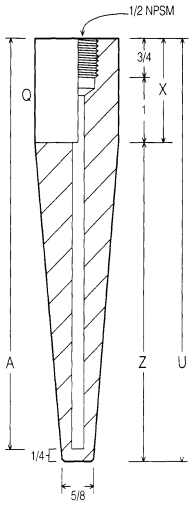
T130

T140

T150 Series - Weld In Style

Part Number	Bore Inches	Internal Thread	Element Length (A)	Insertion Length (U)	Shank Diameter (Q)	Straight Length (X)	Tapered Length (Z)
T15000-MC-04 1/4 T15000-MC-06 1/4 T15000-MC-09 1/4 T15000-MC-12 1/4	.260	1/2" NPT	4 6 9 12	4 1/4" 6 1/4" 9 1/4" 12 1/4"	1 1/2"	1 1/2"	2 1/2" 4 1/2" 7 1/2" 10 1/2"
T15000-MC-13 1/2 T15000-MC-16 1/2 T15000-MC-22 1/2	.260	1/2" NPT	15 18 24	13 1/2" 16 1/2" 22 1/2"	1 1/2"	1 1/2"	6 1/2" 6 1/2" 6 1/2"

MC = Material Code from Table Bore is for 1/4" element



T150

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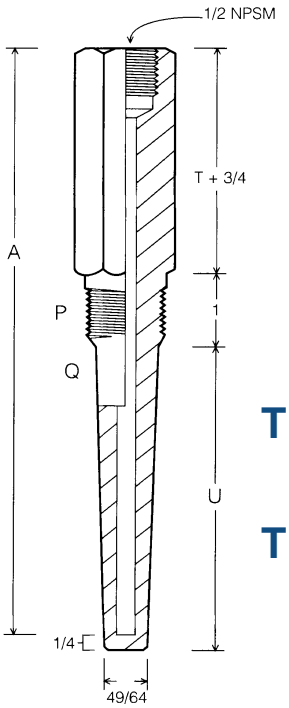
T160 & T170 Series - Threaded, Tapered, Lagging Extension

Part Number	Bore Inches	Process Thread (P)	Element Length (A)	Insertion Length (U)	Shank Diameter (Q)	Lagging Extension (T)
T16012-MC-02 1/2 T16012-MC-04 1/2 T16012-MC-07 1/2 T16012-MC-10 1/2 T16012-MC-13 1/2 T16012-MC-19 1/2	.260	3/4" NPT	6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 19 1/2"	7/8"	2 3 3 3 3 3
T16016-MC-02 1/2 T16016-MC-04 1/2 T16016-MC-07 1/2 T16016-MC-10 1/2 T16016-MC-13 1/2 T16016-MC-19 1/2	.260	1" NPT	6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 19 1/2"	1 1/16"	2 3 3 3 3 3
T17012-MC-02 1/2 T17012-MC-04 1/2 T17012-MC-07 1/2 T17012-MC-10 1/2 T17012-MC-13 1/2 T17012-MC-19 1/2	.385	3/4" NPT	6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 19 1/2"	7/8"	2 3 3 3 3 3
T17016-MC-02 1/2 T17016-MC-04 1/2 T17016-MC-07 1/2 T17016-MC-10 1/2 T17016-MC-13 1/2 T17016-MC-19 1/2	.385	1" NPT	6 9 12 15 18 24	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 19 1/2"	1 1/16"	2 3 3 3 3 3

MC = Material Code from Table. Bores are for 1/4" and 3/8" elements.



T160

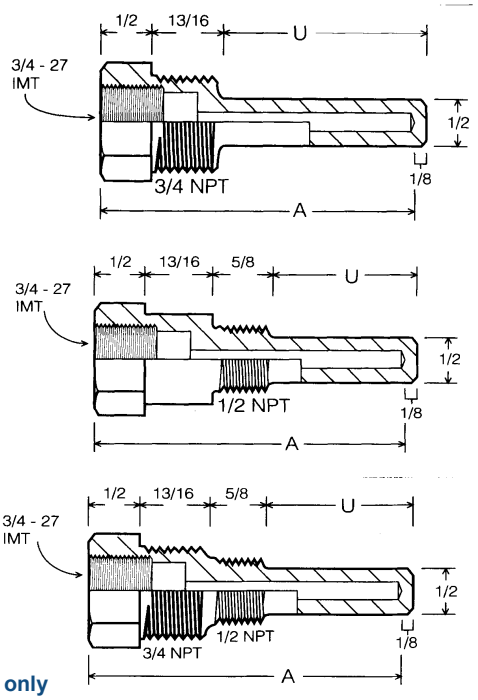
T170

T180 Series - Sub Socket Style

Part Number	Class	Element Length (A)	Insertion Length (U)
T18001-MC-01 3/16 T18001-MC-02 3/16 T18001-MC-03 3/16	I	3 4 5	1 13/16" 2 13/16" 3 13/16"
T18002-MC-01 3/16 T18002-MC-02 3/16 T18002-MC-03 3/16	II	3 4 5	1 13/16" 2 13/16" 3 13/16"
T18003-MC-01 3/16 T18003-MC-02 3/16 T18003-MC-03 3/16	III	3 4 5	1 13/16" 2 13/16" 3 13/16"
T18003-MC-01 T18003-MC-02 T18003-MC-03	IV	3 4 5	2" 3" 4"

MC = Material Code from Table.

Class IV
use above 1/2" NPT only

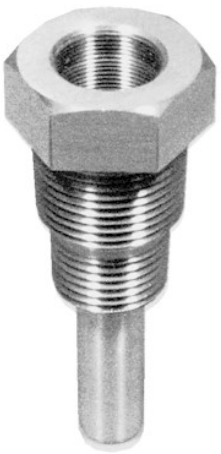


T180

Class I
3/4" NPT
only

Class I I
1/2" NPT
only

Class I I I
1/2" NPT &
3/4" NPT



Ceramic Protection Tubes - Alumina, Mullite, and Zirconia

Alumina - 99.8% Aluminum Oxide

Alumina has a maximum service temperature of **3450°F (1900°C)** in both oxidizing and reducing atmospheres. Alumina is considered to have better mechanical strength (twice the tensile strength of Mullite) and chemical resistance than Mullite. Alumina tubes also have excellent abrasion resistance. Secondary metal tubes can be added for additional protection from mechanical damage. Alumina tubes are considered gas tight so they make excellent primary protection tubes. All tubes, which are used in horizontal installations and at elevated temperatures, should be supported. Alumina tubes can be used for primary and secondary protection tubes on noble metal (platinum based) thermocouples. Since they have a very low silica content, they will not contaminate platinum elements above 2200°F (1200°C) as a Mullite protection tube. Alumina tubes should be supported horizontally over 2600°F (1427°C).

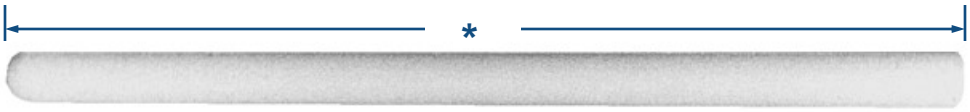
Mullite Porcelain - 63.5% Aluminum Oxide, Balance Silicon Dioxide

Mullite has a maximum service temperature of **2900°F (1590°C)**. It is considered to be better than Alumina for thermal shock resistance. Mullite tube should be used with care, since they have poor mechanical shock resistance. Secondary metal tubes can be added for protection from mechanical damage. Mullite tubes are considered gas tight at higher temperatures. All tubes which are used in horizontal installations and at elevated temperatures, should be supported. Mullite tube should not be used for primary protection tubes on noble metal (platinum based) thermocouples if the temperature will exceed 2200°F (1200°C). Above these temperatures the silica in the Mullite can contaminate the platinum element if there is not enough air circulation in the tube. Mullite tubes should be supported horizontally over 2100°F (1149°C).

Zirconia - 89.5% Zirconia, 10.5% Yttria

Zirconia has a maximum service temperature of **4172°F (2300°C)** in oxidizing, reducing, and vacuum environments. This material is Yttria (10.5%) stabilized. Zirconia is chemically inert and has excellent corrosion resistance. Zirconia tubes should not be used in contact with Alumina above 1112°F (600°C). Zirconia is gas tight, but above 1112°F (600°C) Oxygen will permeate through its structure. To prevent thermal shock, heat or cool at a rate less than 302°F (150°C) per hour. Zirconia tubes should not be used in sulfur atmospheres or in acids.

Plain End



1

Alumina	Mullite	Zirconia	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	Mounting: None	Tolerances: O.D. and Length
AP03-*	P03-*		3/16	1/8	4.8	3.2	None	**O.D.** ± 5% or .025” **Length** ± .062”
AP04-*	P04-*	ZP04-*	1/4	5/32	6.4	4.0		
AP05-*	P05-*		5/16	3/16	7.9	4.8		
AP06-*	P06-*	ZP06-*	3/8	1/4	9.5	6.4		
AP07-*	P07-*	ZP07-*	7/16	5/16	11.1	8.0		
AP08-*	P08-*	ZP08-*	1/2	3/8	12.7	9.5		
AP11-*	P11-*	ZP11-*	11/16	7/16	17.5	11.1		
AP12-*	P12-*	ZP12-*	3/4	1/2	19.1	12.7		
AP14-*	P14-*	ZP14-*	7/8	5/8	22.2	15.9		
AP16-*	P16-*	ZP16-*	1	3/4	25.4	19.1		
AP18-*	P18-*	ZP18-*	1 1/8	7/8	28.6	22.2		
AP20-*	P20-*	ZP20-*	1 1/4	1	31.8	25.4		
AP30-*	P30-*	ZP30-*	1 7/8	1 5/8	47.6	41.3		

Tubes Open Both Ends (OBE)

2

Tubes may be ordered with Both Ends Open by adding “**OBE**” to the part number before the length. Normally stock closed end lengths of multiples of 6 inches starting at 12 inches are cut off making the tube slightly shorter, which in most applications is not a problem (there is a cutting charge).

Common cuts are: 3/8” = 1/2 11/16” = 1/2” 1/2” = 1/2” 1” = 1” 1 1/4” = 1” 1 3/4” = 1 1/2”.

For example a P11-12 would be cut to P11-OBE-11 1/2. However, an actual 12 inch OBE can be made by cutting down the next standard longer length (18 inches) but it would add additional material cost (5 1/2 inches) for the 1/2 inch lost.

Tubes with mountings on one end can also be open both ends. **Example: P16F-OBE-17.**

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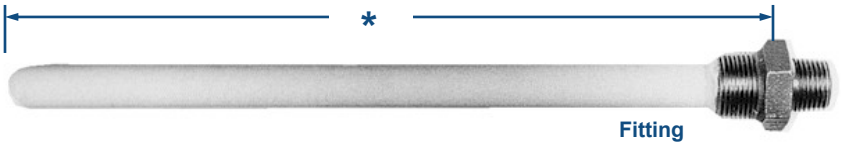
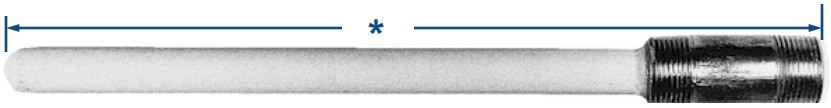
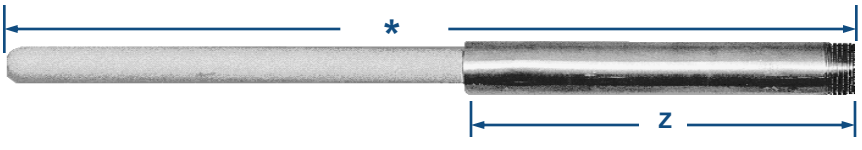
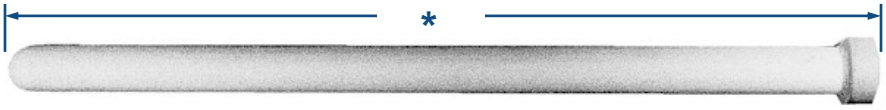
Ceramic Protection Tubes, Alumina, Mullite, and Zirconia

	Alumina	Mullite	Zirconia	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	O.D. and Length	Tolerances
	Fitting, Steel								
1	AP08F-* AP11F-* AP12F-* AP16F-* AP18F-* AP20F-*	P08F-* P11F-* P12F-* P16F-* P18F-* P20F-*	ZP08F-* ZP11F-* ZP12F-* ZP16F-*	1/2 11/16 3/4 1 1 1/8 1 1/4	3/8 7/16 1/2 1 7/8 1 5/8	12.7 17.5 19.1 25.4 28.6 31.8	9.5 11.1 12.7 19.1 22.2 25.4	1/2” NPT x 3/4” NPT 1/2” NPT x 3/4” NPT 1/2” NPT x 3/4” NPT 3/4” NPT x 1” NPT 1” NPT x 1 1/4” NPT 1” NPT x 1 1/4” NPT	O.D. ± 5% or .025” Length ± .062”
	For a Fitting made of 316 Stainless Steel add SS16 to part number. Example: P11FSS16-12.								
	Hex Fitting								
2	AP03HX-* AP04HX-* AP06HX-* AP08HX-* AP11HX-* AP16HX-* AP18HX-* AP20HX-*	P03HX-* P04HX-* P06HX-* P08HX-* P11HX-* P16HX-* P18HX-* P20HX-*	ZP04HX-* ZP06HX-* ZP08HX-* ZP11HX-* ZP16HX-*	3/16 1/4 3/8 1/2 11/16 1 1 1/8 1 1/4	1/8 5/32 1/4 3/8 7/16 3/4 7/8 1	4.8 6.4 9.5 12.7 17.5 25.4 28.6 31.8	3.2 4.0 6.4 9.5 11.1 19.1 22.2 25.4	1/8” NPT x 1/8” NPT x 2” 1/4” NPT x 1/4” NPT x 2.25” 1/2” NPT x 1/2” NPT x 2” 3/4” NPT x 3/4” NPT x 2” 3/4” NPT x 3/4” NPT x 2” 1” NPT x 1” NPT 1 1/4” NPT x 1 1/4” NPT 1 1/4” NPT x 1 1/4” NPT	O.D. ± 5% or .025” Length ± .062”
	Nipple, Steel								
3	AP04N-* AP06N-* AP08N-* AP11N-* AP12N-* AP16N-* AP18N-* AP20N-*	P04N-* P06N-* P08N-* P11N-* P12N-* P16N-* P18N-* P20N-*	ZP04N-* ZP06N-* ZP08N-* ZP11N-* ZP12N-* ZP16N-*	1/4 3/8 1/2 11/16 3/4 1 1 1/8 1 1/4	5/32 1/4 3/8 7/16 1/2 3/4 7/8 1	6.4 9.5 12.7 17.5 19.1 25.4 28.6 31.8	4.0 6.4 9.5 11.1 12.7 19.1 22.2 25.4	1/4” x 1/4” 3/8” x 3/8” 3/4” x 3/4” 3/4” x 3/4” 3/4” x 3/4” 1” x 1” 1 1/4” x 1 1/4” 1 1/4” x 1 1/4”	1” 1 1/2” 2 1/2” 2 1/2” 2 1/2” 3” 3” 3”	O.D. ± 5% or .025” Length ± .062”
	Nipple, Alloy									
4	AP04N9-* AP06N9-* AP08N9-* AP11N9-* AP12N9-* AP16N9-* AP18N9-* AP20N9-*	P04N9-* P06N9-* P08N9-* P11N9-* P12N9-* P16N9-* P18N9-* P20N9-*	ZP04N9-* ZP06N9-* ZP08N9-* ZP11N9-* ZP12N9-* ZP16N9-*	1/4 3/8 1/2 11/16 3/4 1 1 1/8 1 1/4	5/32 1/4 3/8 7/16 1/2 3/4 7/8 1	6.4 9.5 12.7 17.5 19.1 25.4 28.6 31.8	4.0 6.4 9.5 11.1 12.7 19.1 22.2 25.4	1/4” NPT 3/8” NPT 3/4” NPT 3/4” NPT 3/4” NPT 1” NPT 1 1/4” NPT 1 1/4” NPT	IF no “Z” Length then “Z” = 6” Standard	O.D. ± 5% or .025” Length ± .062”

These are composed of a ceramic tubes with a nipple of specified length “**Z**”. If the length is not specified then it is the standard length of 6 inches (152.4 mm). The number “**9**” signifies # 9 Alloy which is standard. Other alloy codes can be used (see codes on page 93) **Example:** The part number **AP11N9-4-24** signifies A 24 gauge, 11/16” O.D. Mullite tube, 24” long, and a #9 alloy nipple 4” long. Other combinations can be specified depending on your application.

Ceramic Protection Tubes - Alumina, Mullite, and Zirconia

3 Collar

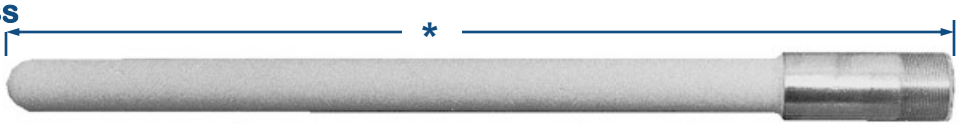


Alumina	Mullite	Zirconia	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	O.D. x Width	Tolerances O.D. and
AP03C-*	P03C-*		3/16	1/8	4.8	3.2	1/2" x 3/8"	O.D. ± 5% or .025"
AP04C-*	P04C-*	ZP04C-*	1/4	5/32	6.4	4.0	5/8" x 1/4"	
AP06C-*	P06C-*	ZP06C-*	3/8	1/4	9.5	6.4	5/8" x 1/4"	
AP08C-*	P08C-*	ZP08C-*	1/2	3/8	12.7	9.5	5/8" x 1/4"	
AP11C-*	P11C-*	ZP11C-*	11/16	7/16	17.5	11.1	1" x 3/8"	
AP12C-*	P12C-*	ZP12C-*	3/4	1/2	19.1	12.7	1 1/4" x 3/8"	
AP16C-*	P16C-*	ZP16C-*	1	3/4	25.4	19.1	1 1/2" x 3/8"	Length ± .062"
AP18C-*	P18C-*		1 1/8	7/8	28.6	22.2	1 5/8" x 5/16"	
AP20C-*	P20C-*		1 1/4	1	31.8	25.4	1 5/8" x 5/16"	
AP30C-*	P30C-*		1 7/8	1 5/8	47.6	41.3	2.5" x 1/2"	

4 Coupling, Steel

Alumina	Mullite	Zirconia	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	NPT	Length	Tolerances O.D. and
AP03CP02-*	P03CP02-*		3/16	1/8	4.8	3.2	1/8"	3/4"	
AP04CP02-*	P04CP02-*	ZP04CP02-*	1/4	5/32	6.4	4.0	1/8"	3/4"	
AP06CP04-*	P06CP04-*	ZP06CP04-*	3/8	1/4	9.5	6.4	1/4"	1"	
AP08CP04-*	P08CP04-*	ZP08CP04-*	1/2	3/8	12.7	9.5	1/4"	1"	
AP11CP06-*	P11CP06-*	ZP11CP06-*	11/16	7/16	17.5	11.1	3/8"	1 3/16"	O.D. ± 5% or .025"
AP11CP08-*	P11CP08-*	ZP11CP08-*	11/16	7/16	17.5	11.1	1/2"	1 1/2"	
AP12CP08-*	P12CP08-*	ZP12CP08-*	3/4	1/2	19.1	12.7	1/2"	1 1/2"	
AP14CP12-*	P14CP12-*	ZP14CP12-*	7/8	3/4	22.2	15.9	3/4"	1 5/8"	
AP16CP12-*	P16CP12-*	ZP16CP12-*	1	5/8	25.4	19.1	3/4"	1 5/8"	Length ± .062"
AP18CP12-*	P20CP16-*		1 1/4	1	31.8	25.4	1"	2"	
AP20CP16-*	P18CP20-*		1 7/8	1 5/8	47.6	41.3	1 1/4"	2 1/2"	
AP30CPT20-*	P30CPT20-*		1 7/8	1 5/8	47.8	41.3	1 1/2"	2 1/2"	
AP30CPT24-*	P30CPT24-*								

Nipple, Brass



Alumina	Mullite	Zirconia	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.		Tolerances O.D. and
AP11NL-*	P11NL-*	ZP11NL-*	11/16	7/16	17.5	11.1	2" length 7/8" fine thread	Same as above

Tubes may be ordered with Both Ends Open by adding "**OBE**" to the part number before the length. Normally stock lengths of multiples of 6 inches starting at 12 inches are cut off making the tube approximately 1/2 inch shorter, which in most applications is not a problem. **For example** a **P11F-12** would be cut to **P11F-OBE-11 1/2**. However, an actual 12 inch OBE can be made by cutting down the next standard length (18 inches) but it would add additional material cost (5 1/2 inches) for the 1/2 inch lost.

Tubes with, or without, mountings on one end can be open both ends. **Example: P16F-OBE-18**.

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Silicon Carbide - Oxide Bonded

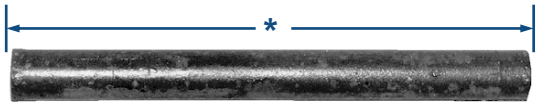
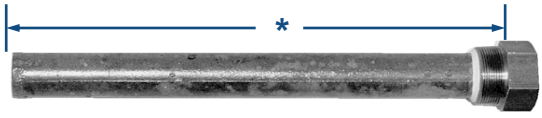
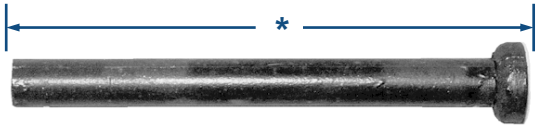
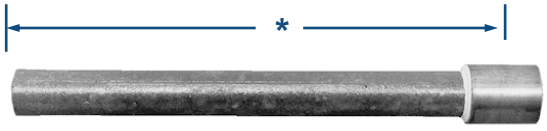
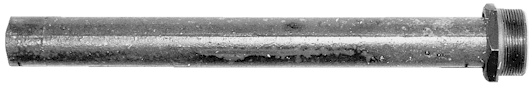
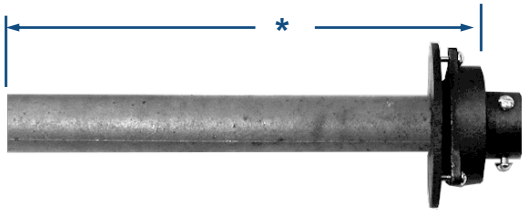
Silicon Carbide (**SC)** protection tubes have a maximum service temperature of **2730°F (1500°C).** Silicon Carbide tubes are not gas tight. They are about 14% porous. Silicon Carbide also has good thermal shock and corrosion resistance and has excellent thermal conductivity. Because of this they are best used as a secondary protection tube to protect Mullite or Alumina primary tubes from direct flame impingement. Silicon carbide tubes are also frequently used in oxygen atmosphere furnaces and in molten non-ferrous metals such as Aluminum, since they are very resistant to oxidation and slag attack.

Composition: 89.6% Silicon Carbide (Black, coarse grained Alpha / Beta mix), 8.5% Silicon Dioxide, .7% Aluminum Oxide, .7% Iron Oxide.

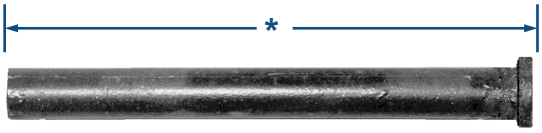
Silicon Carbide - Nitride Bonded

Nitride bonded silicon carbide tubes (**SCN**) have the same characteristics as oxide bonded silicon carbide with a few exceptions. The have a maximum service temperature of **2800°F (1500°C**). Nitride bonded tubes are more dense and less porous than oxide bonded tubes. They also have slightly better thermal shock, corrosion resistance, and twice the crushing strength of the oxide bonded tubes.

Composition: 75.0% Silicon Carbide (Black, coarse grained Alpha / Beta mix), 23.4% Silicon Nitride, .5% Silicon Dioxide, .3% Aluminum Oxide, .3% Iron Oxide.

Part Number	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	Mounting	Figure
SCP-* SCNP-*	1 3/4	1	44.5	25.4	**Plain Tube**	 1
SCB-* SCNB-*	1 3/4	1	44.5	25.4	**Bushing** 2" NPT x 3/4" FNPT Cement on	 2
SCC-*	1 3/4	1	44.5	25.4	**Collar** 3" O.D. x 1" wide	 3
SCCP20-* SCNCP20-* SCCP24-*	1 3/4	1	44.5	25.4	**Coupling** 1 1/4" FNPT 1 1/4" FNPT 1 1/2" FNPT	 4
SCF-* SCNF-*	1 3/4	1	44.5	25.4	**Fitting** 3/4" NPT female	 5
SCRB-* SCNRB-*	1 3/4	1	44.5	25.4	**Reversed Bushing** 2" Male NPT	 6
SCFL-* SCNFL-*	1 3/4	1	44.5	25.4	**Mounting Flange** Steel Mounting Flange attached to tube having a collar (Tube and flange are shipped dis-assembled)	 7

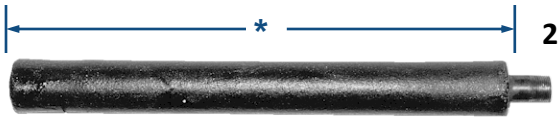
Ceramic Tubes - Silicon Carbide, Small Collar and Silicon Carbide Isopressed

	Part Number	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	Mounting	Figure
1	SCNCS-*	1 3/4	1	44.5	25.4	**Collar, Small** 2 1/8" O.D. x 3/8" wide (Nitride Bonded tube)	 1

Silicon Carbide - Carbide Bonded Isopressed

Carbon bonded isopressed silicon carbide tubes (**SCI**) are less porous (8%) than Nitride bonded silicon carbide but not as dense as Oxide or Nitride bonded tubes. They have a maximum service temperature of **2800°F (1550°C).**
Composition: 78.2.0% Silicon Carbide (Black, coarse grained Alpha / Beta mix), 18% Silica, 2.1% Sodium Oxide, 1.43% Aluminum Oxide, .44% Iron Oxide.

Note: Protection tubes are coated with a silicon carbide glaze to reduce open porosity and reactive surface area of the protection tube. This glaze is used to help prolong the service of the tube.

Part Number	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	Mounting	Figure
SCI12-* SCI34-*	2 2	.62 .82	50.8 50.8	15.7 20.8	**Isopressed** around a steel tube 1/2" NPT 3/4" NPT	 2

Silicon Carbide - Spout Nozzle

Used for pouring Molten Metals.

 3

Part Number	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	Length Inches	Length mm
SCP-OBE-VG-4.25	1 3/4	1	44.5	25.4	4.25	107.95

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Silicon Carbide - Hexoloy®

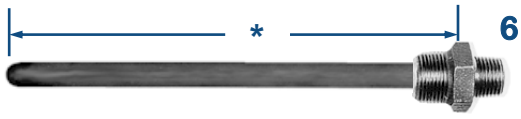
Hexoloy® silicon carbide (**SCHX**) has a maximum service temperature of **3000°F (1650°C)** in both oxidizing and corrosive atmospheres. It can be used in chemicals including strong acids and bases. Hexoloy® is chemically inert and has excellent thermal shock resistance ten times superior to Alumina. It is very hard, second only to diamonds, with excellent wear and abrasion resistance. It has five times the thermal conductivity of Alumina. Unlike other forms of silicon carbide Hexoloy® can be used as a single primary protection tube since it is gas tight. High temperature strength - will not slump even under load at 3000°F (1650°C). Various fittings can be mounted on the tube, see below.
Composition: 99% Sintered fined grain green Alpha-Silicon Carbide.

Tubes may be ordered with Both Ends Open by adding "**OBE**" to the part number before the length. **For example SCHX0604-OBE-***

	Part Number	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	Mounting	Figure
1	**Lengths to 54"** **SCHX0604-*** **SCHX1006-*** **SCHX1208-*** **SCHX1608-*** **SCHX2012-*** **SCHX2014.75-*** **SCHX2416-***	 3/8 5/8 3/4 1 1 1/4 1 1/4 1 1/2	 1/4 3/8 1/2 1/2 3/4 .922 1	 9.5 15.9 19.1 25.4 31.8 31.8 38.1	 6.4 9.5 12.7 12.7 19.1 23.4 25.4	**Plain, Closed One End**	 1
2	**SCHX1006F-*** **SCHX1208F-*** **SCHX1608F-***	5/8 3/4 1	3/8 1/2 1/2	15.9 19.1 25.4	9.5 12.7 12.7	**Fitting** 3/4" X 1/2" NPT 3/4" X 1/2" NPT 1" X 3/4" NPT	 2
3	**SCHX1006N-*** **SCHX1208N-*** **SCHX1608N-***	5/8 3/4 1	3/8 1/2 1/2	15.9 19.1 25.4	9.5 12.7 12.7	**Nipple** 3/4" NPT X 2 1/2" 3/4" NPT X 2 1/2" 1" NPT X 3"	 3
4	**AP06-SCHX1208F-***	3/4	1/2	19.1	12.7	**Double Tube** **Alumina - Hexoloy** 3/4" x 1/2" NPT	 4

Metal Ceramic, LT-1

Metal Ceramic (**LT**) tubes are hard abrasion-resistant and dense. A slip-cast composite of two compatible high temperature materials, chromium and aluminum oxide. have a maximum service temperature in oxidizing of **2200°F (1204°C)**. The LT has excellent oxidation resistance and resists wetting by many metals and alloys, as well as basic furnace slag. Above **2800°F (1538°C)** it begins to soften and becomes plastic. They have been used successfully for dip immersion at a temperature of **3000°F (1649°C)**. In use or service care must be taken to avoid conditions of extreme thermal shock, extreme thermal gradients, mechanical shock, and impact. Should be preheated to about 900°F (482°C) before immersion in molten metal at 2000°F (1093°C) or higher. For use with 8 Gauge or smaller wire. A ceramic primary tube is required when noble metal thermocouples are used.

	Part Number	Inches O.D.	Inches I.D.	Millimeters O.D.	Millimeters I.D.	Mounting	Figure
1	**LT1404-*** ***= Lengths: 9, 12, 18, 24, 30, 36, & 48"**	7/8	1/4	22.2	6.4	**Plain, Closed One End**	 5
2	**LT1404F-*** ***= Lengths: 9, 12, 18, 24, 30, 36, & 48"**	7/8	1/4	22.2	6.4	**Fitting** 1" X 3/4" NPT	 6

Thermocouple and Extension Wire - General Information

Thermocouple Wire -

Thermocouple grade wire is typically used to make the actual thermocouple element. **Note:** thermocouple wire maybe used as extension wire but the outer jacket may have a different color code and in some cases it may be more expensive than using extension grade wire. Depending on the application service temperature range, environmental conditions, and physical constraints; a wire gauge, calibration type, and insulation material can be specified. Each of the calibration types have their own insulation standard color code for easy identification. *See the thermocouple wire color codes in the index in this catalog.* To aid in the installation of the thermocouple, the **RED** wire is always the **NEGATIVE** leg of the element. If the thermocouple wires are installed incorrectly the instrument in the circuit will give backwards or false readings. Thermocouple grade wire is offered with solid or stranded conductors and in a wide range of gauges. If he thermocouple wire will be in an application where it is subjected to repeated flexing stranded wire should be used to prevent conductor fatigue and failure. Thermocouple wire is available in AWG wire gauges from 40 (0.0031 inch - 0.079 mm) to 6 (0.1620 inch - 4.11 mm) in bare wire form or insulated with any of the common insulation materials. Insulation materials for thermocouple grade wire are available to cover temperature ranges from **-190°F** to **2000°F** (**-123°C** to **1093°C**).

Extension Wire -

Extension grade wire is used to complete the thermocouple circuit from the thermocouple element to the temperature instrument. ***Note: extension grade wire should not be used to make thermocouple elements.*** Extension wires can be divided into two categories. Category 1 extension wires are made with conductors which are the same as the thermocouple. Category 2 extension wires are made with conductors which are different from the thermocouple. The base metal thermocouples are used with Category 1 extension wires. Noble metal and a few non-standardized thermocouples are used with Category 2 extension wires. The extension wire and thermocouple wire ***must both be of the same calibration type*** to maintain the accuracy of the thermocouple. The polarity of each set of wires must also be maintained during installation in order for the thermocouple circuit to function properly. The **RED** wire is always the **NEGATIVE** leg of the extension wire. Extension grade wire is also color coded to help with the identification and installation. *See the extension grade wire color codes in the index in this catalog*. If the extension wire will be subject to repeated flexing, a stranded wire should be used to prevent fatigue and failure. For typical, non-flexing, ambient temperature, indoor use, a 20 gauge (.032 inch - 1.3 mm) solid conductor with PVC insulation is an excellent choice. ***Note: Never install extension wire in the same conduit as power lines.*** This will cause interference and errors in the temperature readings. It is good practice to keep the extension wire at least 1 foot away from power lines to maintain an accurate thermocouple circuit.

Limits of Error for Thermocouple and Extension Wire -

The limits of error for the calibration types listed in this catalog have been extracted from standards set by the American National Standards Institute, Inc. as shown in **ASTM Standard E 230.** All thermocouple grade and extension grade wire are tested and calibrated in our own calibration laboratory to insure that they are within these standards or better.

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Thermocouple and Extension Wire - General Information and Limits of Error

Limits of Error for Thermocouple Wire -

Type	Calibration Material	CELSIUS Temperature Range	CELSIUS Standard Grade (Larger of)	CELSIUS Special Grade (Larger of)	FAHRENHEIT Temperature Range	FAHRENHEIT Standard Grade (Larger of)	FAHRENHEIT Special Grade (Larger of)
B	Platinum, 30% Rhodium **vs.** Platinum, 6% Rhodium	870°C to 1700°C	±0.5%	-	1600°F to 3100°F	±0.5%	-
E	Nickel, 10% Chromium **vs.** Constantan	0°C to 900°C	±1.7°C or ±0.5%	±1°C or ±0.4%	32°F to 1650°F	±3°F or ±0.4%	±2°F or ±0.4%
J	Iron **vs.** Constantan	0°C to 750°C	±2.2°C or ±0.75%	±1.1°C or ±0.4%	32°F to 1400°F	±4°F or ±0.75%	±2°F or ±0.4%
K	Nickel, 10% Chromium **vs.** Nickel, 5%, Al, Si, .1% Mg	0°C to 1260°C	±2.2°C or ±0.75%	±1.1°C or ±0.4%	32°F to 2300°F	±4°F or ±0.75%	±2°F or ±0.4%
N	Ni, 14% Cr, 1.5% Si **vs.** Ni, 4.5% Si, 1% Mg	0°C to 1260°C	±2.2°C or ±0.75%	±1.1°C or ±0.4%	32°F to 2300°F	±4°F or ±0.75%	±2°F or ±0.4%
R	Platinum **vs.** Platinum, 13% Rhodium	0°C to 1480°C	±1.5°C or ±0.25%	-	32°F to 2700°F	±3°F or ±0.25%	-
S	Platinum **vs.** Platinum, 10% Rhodium	0°C to 1480°C	±1.5°C or ±0.25%	-	32°F to 2700°F	±3°F or ±0.25%	-
T	Copper **vs.** Constantan	0°C to 350°C	±1°C or ±0.75%	±0.5°C or ±0.4%	32°F to 660°F	±1.8°F or ±0.75%	±1°F or ±0.4%
C	Tungsten, 5% Rhenium **vs.** Tungsten, 26% Rhenium	0°C to 2315°C	±4.4°C or ±1%	-	32°F to 4200°F	±8°F or ±1%	-

Percent (%) refers to the measuring temperature, not the range. Tolerances in this table are not for the accuracy of thermocouples that have been in use. They are only for readings during the first initial; heating of the thermocouple elements.
For cryogenic temperature materials - phone for details.

Limits of Error for Extension Wire -

Type	Calibration Material	CELSIUS Temperature Range	CELSIUS Standard Grade	CELSIUS Special Grade	FAHRENHEIT Temperature Range	FAHRENHEIT Standard Grade	FAHRENHEIT Special Grade
BX	Copper/Magnesium **vs.** Copper	-	-	-	-	-	-
EX	Nickel, 10% Chromium **vs.** Constantan	0°C to 200°C	±1.7°C	-	32°F to 400°F	±3°F	-
JX	Iron **vs.** Constantan	0°C to 200°C	±2.2°C	±1.1°C	32°F to 400°F	±4°F	±2°F
KX	Nickel, 10% Chromium **vs.** Nickel, 5%, Al, Si	0°C to 200°C	±2.2°C	-	32°F to 400°F	±4°F	-
NX	Ni, 14% Cr, 1.5% Si **vs.** NI, 4.5% Si, 1% Mg	0°C to 200°C	±2.2°C	±1.1°C	32°F to 400°F	±4°F	±2°F
RX	Copper **vs.** #11 Alloy	0°C to 200°C	±.057 mv (±5°C) *	-	32°F to 400°F	±.057 mv (±5°C) *	-
SX	Copper **vs.** #11 Alloy	0°C to 200°C	±.057 mv (±5°C) *	-	32°F to 400°F	±.057 mv (±5°C) *	-
TX	Copper **vs.** Constantan	0°C to 200°C	±1°C	±0.5°C	32°F to 400°F	±1.8°F	±.9°F
CX	Alloy 405 **vs.** Alloy 426	0°C to 200°C	±.11 mv	-	32°F to 400°F	±.11 mv	-

* Due to the non-linearity of the Type R and S emf curves, the degree error introduced into a thermocouple system (i.e. the thermocouple and extension wire) will vary with temperature. Consequently, the degree Celsius and degree Fahrenheit tolerances shown in brackets, applies only when the hot measuring junction temperature is greater than 1598°F or 870°C.

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Thermocouple and Extension Wire - Gauge Temperature Limits, Insulation Characteristics

The Arklay S. Richards Co., Inc. always stocks a wide variety of thermocouple wire, which covers a service temperature range from **-123** to **1093°C (-190 to 2000°F)**. This enables you to select the most suitable and economical wire for your application. The maximum service temperature is based on the lower limit of the wire gauge, or insulation characteristics. Refer to the two charts below. All **Richards** thermocouple wire are carefully selected and match to conform to **ANSI MC 96.1** STANDARDS. The testing for accuracy and color coding is completed here in our own labortories. Refer to our limits of error table in this catalog. Special premium grade wire is available upon request. Premium grade thermocouple wire can be designated by adding a double type letter to the catalog number. An example of a catalog number for premium grade thermocouple wire would be **20KK-HG.**

Temperature Limits for Wire Gauges -

Type	Wire Materials	Gauge	8	11	14	20	24	28	30	36	38	40
		Inches	.128	.091	.064	.032	.020	.013	.010	.005	.004	.003
		mm	3.25	2.31	1.63	0.81	0.51	0.33	0.25	0.13	0.10	0.08
B	Platinum 30% Rhodium vs. Platinum 6% Rhodium						1700°C 3100°F					
E	Ni, 10% Cr vs. Constantan		870°C 1600°F		650°C 1200°F	540°C 1000°F	460°C 860°F	430°C 800°F	370°C 700°F	300°C 570°F	300°C 570°F	
J	Iron vs. Constantan		760°C 1400°F		590°C 1100°F	480°C 900°F	370°C 700°F	370°C 700°F	320°C 600°F	300°C 570°F	300°C 570°F	
K	Ni, 105 Cr vs. Ni, 5% Al, Si		1260°C 2300°F	1090°C 2000°F	1090°C 2000°F	980°C 1800°F	870°C 1600°F	870°C 1600°F	760°C 1400°F	750°C 1380°F	750°C 1380°F	
N	Ni, 14% Cr vs. Ni, 4.5% Si, .1% Mg		1260°C 2300°F		1090°C 2000°F	980°C 1800°F	870°C 1600°F	870°C 1600°F	760°C 1400°F			
R	Platinum vs. Platinum 13% Rhodium						1480°C 2700°F	1300°C 2400°F	1300°C 2400°F		1200°C 2200°F	
S	Platinum vs. Platinum 10% Rhodium						1480°C 2700°F	1300°C 2400°F	1300°C 2400°F		1200°C 2200°F	
T	Copper vs. Constantan				370°C 700°F	260°C 500°F	200°C 400°F	200°C 400°F	150°C 302°F	150°C 302°F	150°C 302°F	
C	Tungsten, 5% Rhenium vs. Tungsten, 26% Rhenium						2310°C 4200°F					

Insulation Characteristics -

Type	Wire Insulation Type	Abrasion Resistance	Moisture Resistance	Maximum Continuous Temp. °C	Maximum Single Use °C	Maximum Continuous Temp. °F	Maximum Single Use °F	Color Coding
CF	Ceramic Fiber	Poor	Poor	1200°C	1427°C	2200°F	2600°F	
HG	Fiber Glass, High Temperature	Fair	Poor	704°C	870°C	1300°F	1600°F	
GG	Fiber Glass, Varnish Impregnated	Fair	Fair	-23 to 480°C	540°C	-10 to 900°F	1000°F	Yes
KK	Kapton (fused tape)	Excellent	Excellent	-240 to 204°C	316°C	-400 to 400°F	600°F	
NN	Nylon	Excellent	Excellent	-40 to 150°C	—-	-40 to 300°F	—-	Yes
PP	Polyvinyl, PVP (extruded)	Good	Excellent	-17.8 to 105°C	—-	0 to 220°F	—-	Yes
TT-ex	Teflon, FEP (extruded)	Very Good	Excellent	204°C	260°C	400°F	500°F	Yes
TT	Teflon, TFE (fused tape)	Very Good	Excellent	260°C	316°C	500°F	600°F	Yes
TT-PFA	Teflon , PFA (fused tape)	Very Good	Excellent	260°C	316°C	500°F	600°F	Yes
TT-ex-PFA	Teflon, PFA (extruded)	Very Good	Excellent	260°C	316°C	500°F	600°F	Yes
VS	Vitreous Silica Fiber	Poor	Poor	0 to 980°C	1093°C	32 to 1800°F	2000°F	Yes

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Thermocouple and Extension Wire - Resistance

! Note: These figures are approximations. If you require resistance in OHMS per meter, multiply the value shown by 3.281.
* If the thermocouple resistance is a fair percent of the total resistance of your millivolt meter, use these factors for making your calculations.

Type	Wire Material	6	8	11	14	16	18	20	22	24	28	30	38	Multiplying Factor For Various Temperatures * (Both wires same gauge) 93°C 200°F	204°C 400°F	427°C 800°F	871°C 1600°F	1371°C 2500°F
B	Platinum 30% Rhodium +	-	-	-	-	-	-	-	-	.282	-	1.13	7.16	-	-	-	-	-
	Platinum 6% Rhodium -	-	-	-	-	-	-	-	-	.267	-	1.07	6.71	-	-	-	-	-
	Combined									**.549**		**2.20**	**13.95**	1.1	1.2	1.6	2.1	2.8
BX	Copper Manganese +	-	-	-	-	-	.088	-	-	-	-	-	-	-	-	-	-	-
	Copper -	-	-	-	-	-	.010	-	-	-	-	-	-	-	-	-	-	
	Combined						**.098**							-	-	-	-	-
E	Ni, 10% Cr +	-	.026	-	.014	.164	-	.415	.663	1.050	2.68	4.29	27.04	-	-	-	-	-
	Constantan -	-	.018	-	.072	.114	-	.291	.415	.728	1.85	3.15	18.70	-	-	-	-	-
	Combined		**.044**		**.176**	**.278**		**.706**	**1.078**	**1.778**	**4.53**	**7.44**	**45.74**	1.02	1.05	1.13	1.2	-
J	Iron +	-	.004	-	.015	.023	-	.059	-	.149	-	.600	3.83	-	-	-	-	-
	Constantan -	-	.018	-	.072	.114	-	.291	-	.728	-	2.92	18.70	-	-	-	-	-
	Combined		**.022**		**.087**	**.137**		**.350**		**.877**		**3.52**	**22.53**	1.13	1.33	1.7	2.5	-
K	Ni, 10% Cr +	.016	.026	.051	.104	.164	-	.415	.663	1.050	2.68	4.29	27.04	-	-	-	-	-
	Ni, 5% Al, Si -	.007	.011	.021	.043	.069	-	.173	.276	.438	1.11	1.78	11.26	-	-	-	-	-
	Combined	**.023**	**.037**	**.072**	**.147**	**.233**		**.588**	**.939**	**1.488**	**3.79**	**6.07**	**38.30**	1.05	1.14	1.30	1.62	2.01
N	Ni, 14% Cr +	-	.036	-	.143	.225	-	.571	-	1.448	3.69	-	36.56	-	-	-	-	-
	Ni, 4.5% Si, .1% Mg -	-	.013	-	.053	.083	-	.210	-	.532	1.35	-	13.44	-	-	-	-	-
	Combined		**.049**		**.195**	**.308**		**.781**		**1.980**	**5.04**		**50.00**	-	-	-	-	-
R	Platinum -	-	-	-	-	-	-	.059	-	.150	-	.600	3.81	-	-	-	-	-
	Platinum 13% Rhodium +	-	-	-	-	-	-	.117	-	.300	-	1.20	7.61	-	-	-	-	-
	Combined							**.176**		**.450**		**1.80**	**11.42**	1.1	1.3	1.75	2.5	-
RSX	Copper +	-	-	-	-	.004	-	.010	-	-	-	-	-	-	-	-	-	-
	#11 Alloy -	-	-	-	-	.014	-	.024	-	-	-	-	-	-	-	-	-	-
	Combined					**.018**		**.034**						-	-	-	-	-
S	Platinum -	-	-	-	-	-	-	.059	-	.150	-	.600	3.81	-	-	-	-	-
	Platinum 10% Rhodium +	-	-	-	-	-	-	.011 2	-	.288	-	1.15	7.30	-	-	-	-	-
	Combined							**.171**		**.438**		**1.75**	**11.11**	1.1	1.3	1.8	2.6	3.5
T	Copper +	-	-	-	.003	.004	-	.010	-	.026	0.07	.220	.650	-	-	-	-	-
	Constantan -	-	-	-	.072	.014	-	.291	-	.728	1.85	3.15	18.70	-	-	-	-	-
	Combined				**.075**	**.018**		**.301**		**.754**	**1.95**	**3.37**	**19.35**	1.10	1.25	-	-	-
C	Tungsten 5% Rhenium +	-	-	-	-	-	-	-	-	.111	-	-	-	-	-	-	-	-
	Tungsten 26% Rhenium -	-	-	-	-	-	-	-	-	.382	-	-	-	-	-	-	-	-
	Combined									**.493**				-	-	-	-	-
CX	CXP (Was Alloy 405) +	-	-	-	-	-	-	.173	-	-	-	-	-	-	-	-	-	-
	CXN (Was Alloy 426) -	-	-	-	-	-	-	.287	-	-	-	-	-	-	-	-	-	-
	Combined							**.460**						-	-	-	-	-

RICHARDS®
Arklay S. Richards Co., Inc.

Thermocouple Wire - Bare

Type - B

Bare Wire			B +			B -		
Gauge	Diameter (Inches)	Diameter (mm)	Part Number	Inches / Troy Oz.	mm / Gram	Part Number	Inches / Troy Oz.	mm / Gram
24	.020	0.51	24BP	343	280	24BN	294	240
Wire Composition			Platinum, 30% Rhodium			Platinum, 6% Rhodium		

Type - C

Bare Wire			C +			C -		
Gauge	Diameter (Inches)	Diameter (mm)	Part Number	Feet / Pound	mm / Kg.	Part Number	Feet / Pound	mm / Kg.
24	.020	0.51	24CP	-	-	24CN	-	-
26	.016	0.41	26CP	-	-	26CN	-	-
30	.010	0.25	30CP	-	-	30CN	-	-
36	.005	0.13	36CP	-	-	36CN	-	-
40	.003	0.08	40CP	-	-	40CN	-	-
Wire Composition			Tungsten, 5% Rhenium			Tungsten, 5% Rhenium		

Type - E

Bare Wire			E +			E -		
Gauge	Diameter (Inches)	Diameter (mm)	Part Number	Feet / Pound	mm / Kg.	Part Number	Feet / Pound	mm / Kg.
8	.128	3.25	8EP	21	14.1	8EN	21	14.1
14	.064	1.63	14EP	93	55.6	14EN	83	55.6
20	.032	0.81	20EP	331	221.9	20EN	331	221.9
24	.020	0.51	24EP	840	563.3	24EN	840	563.3
28	.013	0.33	28EP	2130	1428.3	28EN	2130	1428.3
38	.004	0.10	38EP	21200	14215.9	38EN	21200	14215.9
Wire Composition			Nickel, 10% Chromium			Constantan		

Type - J

Bare Wire			J +			J -		
Gauge	Diameter (Inches)	Diameter (mm)	Part Number	Feet / Pound	mm / Kg.	Part Number	Feet / Pound	mm / Kg.
8	.128	3.25	8JP	21	14.1	8JN	21	14.1
14	.064	1.63	14JP	83	55.6	14JN	83	55.6
16	.051	1.30	16JP	140	94.1	16JN	130	87.4
20	.032	0.81	20JP	331	221.9	20JN	331	221.9
24	.020	0.51	24JP	840	563.3	24JN	840	563.3
30	.010	0.25	30JP	3850	2581.7	30JN	3450	2313.4
38	.004	0.10	38JP	21200	14215.9	38JN	21200	14215.9
Wire Composition			Iron			Constantan		

Type - K

Bare Wire			K +			K -		
Gauge	Diameter (Inches)	Diameter (mm)	Part Number	Feet / Pound	mm / Kg.	Part Number	Feet / Pound	mm / Kg.
6	.162	4.11	6KP	13	8.7	6KN	13	8.7
8	.128	3.25	8KP	21	14.1	8JN	21	14.1
11	.091	2.31	11KP	41	27.5	11KN	41	27.5
14	.064	1.63	14KP	83	55.6	14KN	83	55.6
16	.051	1.30	16KP	130	87.2	16KN	130	87.2
18	.040	1.02	18KP	212	142.2	18KN	212	142.2
20	.032	0.81	20KP	331	221.9	20KN	331	221.9
22	.025	.064	22KP	530	355.4	22KN	530	355.4
24	.020	0.51	24KP	840	563.3	24KN	840	563.3
28	.031	0.33	28KP	2130	1428.3	28KN	2130	1428.3
38	.004	0.10	38KP	21200	14215.9	38KN	21200	14215.9
Wire Composition			Nickel, 10% Chromium			Nickel, 5% Aluminum, Silicon		

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Thermocouple Wire - Bare

When selecting bare thermocouple wire, keep in mind that a larger gauge wire will give a longer service life and a higher maximum temperature limit. A smaller gauge wire will give you a lower maximum temperature limit and shorter service life, but will have a faster response time. Standard limits of error are provided as specified by the part numbers shown below. Special Limits of error can be specified by doubling the Type letter in the part number. **Example: 20KKP**

Bare thermocouple wire orders will be spooled plus or minus 10% of the total quantity unless otherwise specified by the customer. Bare thermocouple wires can be supplied on spools, coils, or in cut and straightened lengths.

! **Note:** 24 gauge Platinel II and 11 gauge Nickel vs. Nickel Moly bare wire is also available. Phone for details.

Type -

N

Bare Wire			N +			N -		
Gauge	Diameter (inches)	Diameter (mm)	Part Number	Feet / Pound	mm / Kg.	Part Number	Feet / Pound	mm / Kg.
8	.128	3.25	8NP	21	14.1	8NN	21	14.1
14	.064	1.63	14NP	83	55.6	14NN	83	55.6
20	.032	0.81	20NP	331	221.9	20NN	331	221.9
Wire Composition			Nickel, 14% Chromium, 1.5% Si			Nickel, 45% Silicon, 1% Mg		

Type -

R

Bare Wire			R +			R -		
Gauge	Diameter (Inches)	Diameter (mm)	Part Number	Feet / Pound	mm / Kg.	Part Number	Feet / Pound	mm / Kg.
24	.020	0.51	24RP	306	249	24RSN	282	230
30	.010	0.25	30RP	1230	1005	30RSN	1127	920
Wire Composition			Platinum, 13% Rhodium			Platinum		

Type -

S

Bare Wire			S +			S -		
Gauge	Diameter (Inches)	Diameter (mm)	Part Number	Feet / Pound	mm / Kg.	Part Number	Feet / Pound	mm / Kg.
24	.020	0.51	24SP	301	245	24RSN	282	230
30	.010	0.25	30SP	1206	986	30RSN	1127	920
38	.004	0.10	38SP	7510	6130	38RSN	7040	5745
Wire Composition			Platinum, 10% Rhodium			Platinum		

Type -

T

Bare Wire			T +			T -		
Gauge	Diameter	Diameter	Part	Feet /	mm /	Part	Feet /	mm /
14	.064	1.63	14TP	83	55.6	14TN	83	55.6
20	.032	0.81	20TP	332	221.9	20TN	331	221.9
24	.020	0.51	24TP	840	563.3	24TN	840	563.3
28	.013	0.33	28TP	2130	1428.3	28TN	2130	1428.3
38	.004	0.10	38TP	21200	14215.9	38TN	21200	1415.9
Wire Composition			Copper			Constantan		

Thermocouple Wire - Insulated

Insulated thermocouple wire can be supplied on spools, coils, or in element form. Wire orders will be spooled plus or minus 10% of the total quantity unless otherwise specified by the customer. Thermocouple elements can also be made from any of the insulated wires shown below. Elements made from wire with fiberglass insulation are low cost, flexible, and can be used either with or without protection tubes depending upon the atmosphere in which they are installed. Insulated thermocouple wire is also used to manufacture elements for miniature thermocouple assemblies due to ease of replacement and low cost. Elements are nominal length plus two inches for leads (unless otherwise indicated in figures), and butt welded is standard construction. If you require spooled wire just specify the part number and the footage. If you are ordering a element, specify the part number followed by the overall length in inches. The insulated thermocouple wire part numbers below, specify the wire gauge, type, insulation material and length.

Spool example: 50 Feet of **24K-GG**

Thermocouple example: **24K-GG-24** (24 inch thermocouple)

! **Notes:** Special limits can be specified by doubling the type letter in the part number. **Example:** **24KK-GG-24**

If you prefer a fiberglass wrap style of insulation on the single wires, add a "**W**" to the part number **Example:** **24KK-WGG-24**

Stainless steel Over Braid is available for many wires. It is used to protect from abrasion and fraying of wires, and, to use as an electric shielding when grounded. Eight is the designation for 304 Stainless Steel - "**OB8**"; and nine is the designation for alloy 600 - "**OB9**". They are just added to the end of the part number. **Example:** **20J-GG-OB8**

"**TB**" added to the end of the part number means the insulation is a Tight Braid. **Example:** **20K-HG-TB**

Type E - Insulated Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
20E-GG	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	7.7	11.44	.11 x .08	2.8 x 2.0
20E-HG	20	Solid	High Temperature Glass	High Temperature Glass	1000	540	16.0	23.80	.15 x .10	3.8 x 2.5
20E-HG-TB	20	Solid	High Temperature Glass	High Temperature Glass	1000	540	15.0	22.32	.13 x .09	3.4 x 2.2
20E-TT	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	500	260	10.0	14.88	.11 x .06	2.7 x 1.6
24E-GG	24	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	800	427	5.0	7.44	.07 x .05	1.8 x 1.3
24E-TT-ex	24	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	5.0	7.44	.10 x .06	2.6 x 1.6
30E-KK	30	Solid	Kapton (one wire only)	Kapton	400	204	1.2	1.76	.04 x .03	1.0 x .76
36E-TT-ex	36	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	2.0	2.96	.04 x .03	1.0 x .76
40E-TT-ex	40	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	2.0	2.96	.02 x .01	.61 x .38

Color Code: **Purple** (Positive, Non-magnetic, Nickel, 10% Cr) and **Red** (Negative, Non-magnetic, Constantan) Outer jacket - **Brown, Purple** tracer.

Type J - Insulated Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
20J-GG	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	7.7	11.44	.10 x .06	2.5 x 1.5
20J-GG-OB8	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	20.0	29.76	.13 x .16	3.3 x 4.1
20J-GG-S	20	Stranded	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	17.0	25.29	.12 x .08	3.0 x 2.0
20J-GG-S-OB8	20	Stranded	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	22.0	32.73	.13 x .16	3.3 x 4.1
20J-HG	20	Solid	High Temperature Glass	High Temperature Glass	1000	540	16.0	23.80	.15 x .10	3.8 x 2.5
20J-HG-TB	20	Solid	High Temperature Glass	High Temperature Glass	1000	540	15.0	22.32	.13 x .09	3.4 x 2.2
20J-TT	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	500	260	10.0	14.88	.11 x .06	2.7 x 1.6
20J-TT-ex	20	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	11.0	16.37	.12 x .07	3.1 x 1.8
24J-GG	24	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	700	371	7.7	11.46	.07 x .05	1.8 x 1.3
24J-P	24	Solid	Polyvinyl Plastic	Rip cord construction	212	100	3.3	4.91	.09 x .05	2.2 x 1.2
24J-TT	24	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	500	260	5.0	7.44	.08 x .05	2.0 x 1.2
24J-TT-ex	24	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	5.0	8.18	.10 x .06	2.5 x 1.5
30J-GG	30	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	700	371	2.00	2.98	.05 x .04	1.4 x .09
30J-KK	30	Solid	Kapton (one wire only)	Kapton	400	204	1.18	1.75	.04 x .03	1.0 x .76
30J-TT	30	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	500	260	3.33	4.95	.07 x .05	1.8 x 1.3
36J-TT-ex	36	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	2.0	2.96	.04 x .03	1.0 x .76
40J-TT-ex	40	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	2.0	2.96	.02 x .01	.61 x .38

Color Code: **White** (Positive, Magnetic, Iron) and **Red** (Negative, Non-magnetic, Constantan) Outer jacket - **Brown, Black or White** tracer.

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Type K - Insulated Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
14K-CF	14	Solid	Ceramic Fiber	Ceramic Fiber	2000	1093	38.46	57.22	.25 x .15	6.3 x 3.8
14K-HG	14	Solid	High Temperature Glass	High Temperature Glass	1300	704	25.64	38.15	.20 x .11	5.1 x 2.8
16K-HG	16	Solid	High Temperature Glass	High Temperature Glass	1300	704	21.28	31.66	.15 x .09	3.8 x 2.3
20K-CF	20	Solid	Ceramic Fiber	Ceramic Fiber	1800	982	16.00	23.80	.15 x .11	3.8 x 2.8
20K-CF-OB9	20	Solid	Ceramic Fiber	Ceramic Fiber	1800	982	20.50	30.50	.13 x .16	3.2 X 3.9
20K-GG	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	8.00	11.90	.10 x .06	2.5 x 1.4
20K-GG-OB8	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	15.40	22.90	.12 x .07	2.8 x 1.7
20K-GG-S	20	Stranded	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	17.00	25.29	.12 x .08	3.0 x 2.0
20K-GG-S-OB8	20	Stranded	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	22.00	32.73	.13 x .16	3.3 x 4.1
20K-HG	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	1300	704	16.00	23.80	.15 x .10	3.8 x 2.5
20K-HG-OB8	20	Solid	High Temperature Glass	High Temperature Glass	1300	704	20.00	29.76	.13 x .16	3.2 x 3.9
20K-HG-TB	20	Solid	High Temperature Glass	High Temperature Glass	1300	704	15.00	22.32	.13 x .09	3.4 x 2.2
20K-TT	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	500	260	10.00	14.88	.11 x .06	2.7 x 1.6
20K-TT-ex	20	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	11.00	16.37	.12 x .07	3.1 x 1.8
20K-VS	20	Solid	Vitreous Silica Fiber	Vitreous Silica Fiber	1800	982	16.00	23.80	.16 x .10	3.9 x 2.5
24K-GG	24	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	4.00	5.95	.08 x .05	2.0 x 1.1
24K-GG-TB	24	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	4.00	5.95	.08 x .05	2.0 x 1.1
24K-HG	24	Solid	High Temperature Glass	High Temperature Glass	1300	704	5.50	8.18	.01 x .06	2.6 x 1.6
24K-HG-TB	24	Solid	High Temperature Glass	High Temperature Glass	1300	704	5.00	7.44	.09 x .06	2.3 x 1.4
24K-TT	24	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	500	260	4.55	6.77	.08 x .05	2.0 x 1.2
28K-GG	28	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	3.00	4.46	.06 x .04	1.6 x 1.0
30K-KK	30	Solid	Kapton (one wire only)	Kapton	400	204	1.75	2.68	.04 x .03	1.0 x .76
36K-TT-ex	36	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	2.00	2.96	.04 x .03	1.0 x .76
40K-TT-ex	40	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	2.00	2.96	.02 x .01	.61 x .38

Color Code: **Yellow** (Positive, Non-magnetic, Ni, 10% Cr) and **Red** (Negative, Magnetic, Ni, 5% Al, Si) Outer jacket - **Brown, Yellow** tracer.

Type N - Insulated Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
20N-GG	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	482	22.00	32.73	.13 x .16	3.3 x 4.1

Color Code: **Orange** (Positive, Non-magnetic, Ni, 14% Cr) and **Red** (Negative, Non-magnetic, Ni, 4.5%, Si, .1% Mg) Outer jacket - **Brown, Orange** tracer.

Type T - Insulated Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
20T-GG	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	500	260	7.69	11.49	.09 x .06	2.3 x 1.5
20T-TT	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	500	260	10.00	14.88	.11 x .06	2.7 x 1.6
20T-TT-ex	20	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	11.00	16.37	.12 x .07	3.1 x 1.8
20T-TT-ex-S	20	Stranded	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	12.00	17.85	.13 x .08	3.4 x 2.0
24T-GG	24	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	4.35	6.49	.07 x .05	1.8 x 1.3
24T-NN	24	Solid	Nylon	Nylon	300	150	3.64	5.43	.09 x .05	2.3 x 1.3
24T-P	24	Solid	Polyvinyl Plastic	Rip cord construction	175	80	3.33	4.98	.08 x .04	2.0 x 1.0
24T-TT	24	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	4.55	6.77	.08 x .05	2.0 x 1.2
28T-GG	28	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	3.00	4.46	.06 x .04	1.6 x 1.0
30T-KK	30	Solid	Kapton (one wire only)	Kapton	400	204	1.25	1.87	.04 x .03	1.0 x 0.8
36T-TT-ex	36	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	2.22	3.32	.06 x .04	1.5 x .10
40T-TT-ex	40	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	1.25	1.87	.04 x .03	1.0 x 0.8

Color Code: **Blue** (Positive, Non-magnetic, Copper) and **Red** (Negative, Non-Magnetic, Constantan) Outer jacket - **Brown, Blue** tracer.

Specialty Thermocouples & Attachments - Pipe & Washer Styles

The Richards pipe style are used to mount swaged (MgO) or miniature probe thermocouples to the outside surface of pipes. This will give a relative temperature of the pipe. The sensor is attached to the outside of the pipe by using a stainless steel band clamp. Richards RTDs can also be used with these types of attachments. Custom configurations of these items are available. Phone one of our sales engineers for details. Actual surface temperatures of pipes should be made by welding the positive and negative thermocouple wires on the pipe separate but close to each other.

Pipe Style Attachments - width of Stainless Steel band is 9/16".

Part Number	Range Inches	Range mm	Fits Pipe Size NPT	Fits Pipe Size mm	Figure
PSCF10	7/8 to 1	22.2 to 25.4	3/4"	26.7	For 1/8 NPT 1  Compression Fitting (CF)
PSCF16	1 1/16 to 1 1/2	27.0 to 38.1	1"	33.5	
PSCF20	1 3/8 to 1 3/4	34.9 to 44.5	1 1/4"	42.2	
PSCF28	1 5/16 to 2 1/4	33.3 to 57.2	1 1/2"	48.3	
PSCF40	2 1/16 to 3	52.4 to 76.2	2" to 1 1/2"	60.5 to 73.0	
PSBF10	7/8 to 1	22.2 to 25.4	3/4"	26.7	2  Bayonet Fitting (BF)
PSBF16	1 1/16 to 1 1/2	27.0 to 38.1	1"	33.5	
PSBF20	1 3/8 to 1 3/4	34.9 to 44.5	1 1/4"	42.2	
PSBF28	1 5/16 to 2 1/4	33.3 to 57.2	1 1/2"	48.3	
PSBF40	2 1/16 to 3	52.4 to 76.2	2" to 1 1/2"	60.5 to 73.0	

Pipe Style Welded Bantam - Type K (for other types, change **K** to **E**, **J**, **N**, or **T**) - width of Stainless Steel band is 9/16".

Part Number	Type	Range Inches	Range mm	Fits Pipe Size NPT	Fits Pipe Size mm	Figure
24K4BAM10-X-KM1	K	7/8 to 1	22.2 to 25.4	3/4"	26.7	3  1/8" O.D. Attached Miniature (AM)
24K4BAM16-X-KM1		1 1/16 to 1 1/2	27.0 to 38.1	1"	33.5	
24K4BAM20-X-KM1		1 3/8 to 1 3/4	34.9 to 44.5	1 1/4"	42.2	
24K4BAM28-X-KM1		1 5/16 to 2 1/4	33.3 to 57.2	1 1/2"	48.3	
24K4BAM40-X-KM1		2 1/16 to 3	52.4 to 76.2	2" to 1 1/2"	60.5 to 73.0	
24K4BDP10-X-Y	K	7/8 to 1	22.2 to 25.4	3/4"	26.7	4  1/8" O.D. Detachable Probe (DP)
24K4BDP16-X-Y		1 1/16 to 1 1/2	27.0 to 38.1	1"	33.5	
24K4BDP20-X-Y		1 3/8 to 1 3/4	34.9 to 44.5	1 1/4"	42.2	
24K4BDP28-X-Y		1 5/16 to 2 1/4	33.3 to 57.2	1 1/2"	48.3	
24K4BDP40-X-Y		2 1/16 to 3	52.4 to 76.2	2" to 1 1/2"	60.5 to 73.0	

X = Overall length Y = Probe length For other calibration types, change the "K" in the part number to "E", "J", "N", or "T".
For detachable miniature thermocouple, change the BAM to BDM For attached probe, change BDP to BAP in the part number.

Washer Style Thermocouple -Type K From glass insulated wire (GG). Other insulations and overbraid (OB) also available.

Part Number	Washer Outside Diameter Inches	Washer Outside Diameter mm	Washer Inside Diameter Inch	Washer Inside Diameter mm	Fits Bolt / Screw	Construction
20K4WSGG260	.575	14.61	.260	6.60	# 12 to 1/4"	Washer Style (WS) X .260 5  .210
20K4WSGG210	.470	11.94	.210	5.33	# 6 to # 8	
20K4WSGG200	.610	15.49	.200	5.08	# 6 to # 10	

X = Overall length For other calibration types, change the "K" in the part number to "E", "J", "N", or "T". 2" Leads Standard

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Extension Wire Coils

Molded extension cords are available for thermocouples and RTDs. The inner conductors are insulated with PVC and the outer jacket is molded from Polyurethane. Cords can be specified in either coiled or straight configurations and with or without attached plugs and jacks. It is important to note that the maximum service temperature, which will not distort the coil form is **104°F** (**40°C**). The straight configurations have a maximum service temperature of **220°F** (**104°C**). The **C** in the part number designates coiled. If you would like to specify straight, change the **C** to **S** in the part number.
Coiled Example: **26EXC-PPU-12** **Straight Example:** **26EXS-PPU-12**

Molded Extension Cords Type EX

Part Number	Nominal Coil length Inches	mm	Extended Length Feet	Meters	Construction
26EXC-PPU-12	12	304.8	5	1.52	Coiled and plain ends
26EXC-PPU-12-EM1	12	304.8	5	1.52	Coiled and one mini molded plug

Molded Extension Cords Type JX

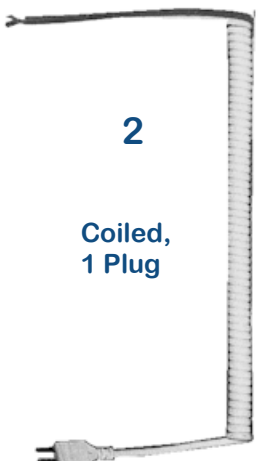
Part Number	Nominal Coil length Inches	mm	Extended Length Feet	Meters	Construction
26JXC-PPU-12	12	304.8	5	1.52	Coiled and plain ends
26JXC-PPU-24	24	609.6	10	3.04	Coiled and plain ends
26JXC-PPU-32	32	812.8	15	4.67	Coiled and plain ends
26JXC-PPU-60	60	1524.0	30	9.14	Coiled and plain ends
26JXC-PPU-96	96	2438.4	45	13.72	Coiled and plain ends
26JXC-PPU-12-JM1	12	304.8	5	1.52	Coiled and one mini molded plug
26JXC-PPU-24-JM1	24	609.6	10	3.04	Coiled and one mini molded plug
JM1-26JXC-PPU-12-JM1	12	304.8	5	1.52	Coiled and two mini molded plugs
26JXS-PPU-18-JM1	18	457.2	Straight	Straight	Straight cable and one mini molded plug

1

Coiled, plain ends

Molded Extension Cords Type KX

Part Number	Nominal Coil length Inches	mm	Extended Length Feet	Meters	Construction
26KXC-PPU-12	12	304.8	5	1.52	Coiled and plain ends
26KXC-PPU-24	24	609.6	10	3.04	Coiled and plain ends
26KXC-PPU-32	32	812.8	15	4.67	Coiled and plain ends
26KXC-PPU-60	60	1524.0	30	9.14	Coiled and plain ends
26KXC-PPU-96	96	2438.4	45	13.72	Coiled and plain ends
26KXC-PPU-12-KM1	12	304.8	5	1.52	Coiled and one mini molded plug
26KXC-PPU-24-KM1	24	609.6	10	3.04	Coiled and one mini molded plug
KM1-26KXC-PPU-12-KM1	12	304.8	5	1.52	Coiled and two mini molded plugs
26KXS-PPU-18-KM1	18	457.2	Straight	Straight	Straight cable and one mini molded plug
26KXS-PPU-30-KM1	30	762.0	Straight	Straight	Straight cable and one mini molded plug



2

Coiled, 1 Plug

Molded Extension Cords Type TX

Part Number	Nominal Coil length Inches	mm	Extended Length Feet	Meters	Construction
26TXC-PPU-12	12	304.8	5	1.52	Coiled and plain ends
26TXC-PPU-24	24	609.6	10	3.04	Coiled and plain ends
26TXC-PPU-60	60	1524.0	30	9.14	Coiled and plain ends
26TXC-PPU-96	96	2438.4	45	13.72	Coiled and plain ends
26TXC-PPU-12-TM1	12	304.8	5	1.52	Coiled and one mini molded plug
26TXC-PPU-24-TM1	24	609.6	10	3.04	Coiled and one mini molded plug
26TXS-PPU-18-TM1	18	457.2	Straight	Straight	Straight cable and one mini molded plug

3

Coiled, 2 Plugs

Molded Extension Cords Type UX - Uncompensated

Part Number	Nominal Coil length Inches	mm	Extended Length Feet	Meters	Construction
26UXC-PPU-12	12	304.8	5	1.52	Coiled and plain ends
26UXC-PPU-12-	12	304.8	5	1.52	Coiled and one mini molded plug

Molded Extension Cords For 3 Wire RTDs

Part Number	Nominal Coil length Inches	mm	Extended Length Feet	Meters	Construction
26RTD3XC-PPU-12	12	304.8	5	1.52	Coiled and plain ends
26RTD3XC-PPU-36	36	914.4	17	5.18	Coiled and plain ends
26RTD3XC-PPU-96	96	2438.4	45	13.72	Coiled and plain ends

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Extension Wire - Insulated

Richards Extension wire is used to complete the circuit from the thermocouple element to the temperature instrument. The extension wire and the thermocouple wire ***must both be of the same calibration type*** to maintain the accuracy of the thermocouple. The polarity of each set of wires must also be maintained during the installation or errors will be introduced into the circuit. The **RED** wire is always the **NEGATIVE** leg of the extension wire. Extension wire is also color coded to help with identification and installation. See the extension wire color coding chart in this catalog and the coding under the tables. If the wire will be subject to repeated flexing, a stranded wire should be used to prevent conductor breakage. To specify stranded conductors, add a **S** to the end of the part number. For typical, non-flexing, ambient temperatures, indoor use, a 20 gauge (1.3 mm) solid conductor with PVC (Polyvinyl Plastic) insulation wire is an excellent choice. This wire is low cost and resistant to oils, chemicals, abrasion, moisture, and acids. Never install extension wire in the same conduit as power lines. This will cause interference and errors in the temperature readings. It is a good practice to keep the extension wire at least 1 foot away from power lines to maintain an accurate thermocouple circuit. Thermocouple extension wire can be supplied on spools or coils. Wire orders will be spooled plus or minus 10% of the quantity unless otherwise specified by the customer and indicated on the purchase order. If you require spooled wire just specify the part number and the footage. The extension wire part numbers below, specify the wire gauge, Type, and insulation material. **Example:** 50 Feet of **24JX-TT** (in **24JX-TT-ex** the "ex" indicates "extruded" Teflon®)

! **Notes:** Special limits can be specified by doubling the type letter in the part number. **Example: 20KKX-TT**

Stainless steel Over Braid is available for many wires. It is used to protect from abrasion and fraying of wires and as an electric shielding when grounded. Eight is the designation for 304 Stainless Steel - "**OB8**"; It is just added to the end of the part number.
Example: 20JX-GG-OB8

Nickel vs. Nickel Moly thermocouples - can use Type KX extension wire at room temperature.

Type C thermocouples - can use Type RSX at room temperatures.

Type B thermocouples - can use ordinary copper wire for extension wire at room temperatures.

Type P (Platinel II) thermocouples - can use Type KX extension wire at room temperature.

Type BX - Extension Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
20BX-TT	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	10.0	14.9	.12 x .06	3.1 x 1.5

Color Code: Gray (Positive, Non-magnetic, Copper Manganese and **Red** (Negative, Non-magnetic, Copper) Outer jacket - **Gray**.

Type EX - Extension Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000 Ft.	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
16EX-PP	16	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	25.0	37.2	.20 x .13	5.1 x 3.3
16EX-TT	16	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	25.0	37.2	.16 x .10	4.1 x 2.5
20E-GG *	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	7.7	11.5	.09 x .06	2.3 x 1.5
20EX-PP	20	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	12.5	18.6	.16 x .10	4.1 x 2.5

Color Code: Purple (Positive, Non-magnetic, Nickel, 10% Chromium) and **Red** (Negative, Non-magnetic, Constantan) Outer jacket - **Purple**.
* Thermocouple Grade quality - Overall **Brown**, if tracer - **Purple**.

Type JX - Extension Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
14JX-PP	14	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	34.5	51.3	.22 x .15	5.6 x 3.8
16JX-GG	16	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	17.9	26.6	.15 x .09	3.8 x 2.2
16JX-GG-S	16	Stranded	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	20.8	31.0	.16 x .10	4.1 x 2.5
16JX-PP	16	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	25.0	37.2	.20 x .13	5.1 x 3.3
16JX-TT	16	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	25.0	37.2	.16 x .10	4.1 x 2.5
20J-GG *	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	480	7.7	11.5	.09 x .06	2.3 x 1.5
20JX-PP	20	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	12.5	18.6	.16 x .10	4.1 x 2.5
20JX-PP-S	20	Stranded	Polyvinyl Plastic	Polyvinyl Plastic	220	104	14.0	20.8	.19 x .11	4.7 x 2.7
20J-TT *	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	500	260	10.0	14.9	.11 x .06	2.7 x 1.6
20JX-TT-ex	20	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	11.0	16.4	.12 x .07	3.1 x 1.8

Color Code: White (Positive, Magnetic, Iron) and **Red** (Negative, Non-magnetic, Constantan) Outer jacket - **Black**.
* Thermocouple Grade quality - Overall **Brown**, if tracer - **Black** or **White.**

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Type KX - Extension Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max °F	Max °C	Lbs./ 1000	Kgs./ Kilometer	Nominal Size Inches	Nominal Size mm
14KX-PP	14	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	34.5	51.3	.22 x .15	5.6 x 3.8
16KX-GG	16	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	17.9	26.6	.15 x .09	3.8 x 2.2
16KX-GG-S	16	Stranded	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	20.8	31.0	.16 x .10	4.1 x 2.5
16KX-PP	16	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	25.0	37.2	.20 x .13	5.1 x 3.3
16KX-TT	16	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	25.0	37.2	.16 x .10	4.1 x 2.5
20K-GG *	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	900	480	7.7	11.5	.09 x .06	2.3 x 1.5
20KX-PP	20	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	12.5	18.6	.16 x .10	4.1 x 2.5
20KX-PP-S	20	Stranded	Polyvinyl Plastic	Polyvinyl Plastic	220	104	14.0	20.8	.19 x .11	4.7 x 2.7
20KX-TT	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	11.0	16.4	.12 x .07	3.1 x 1.8
20KX-TT-ex	20	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	11.0	16.4	.12 x .07	3.1 x 1.8

Color Code: Yellow (Positive, Non-magnetic, Nickel, 10% Chromium) and **Red** (Negative, Magnetic, Nickel, 5% Aluminum, Silicon) Outer jacket - **Yellow**.
* Thermocouple Grade quality - Overall **Brown**, if tracer - **Yellow.**

Type NX - Extension Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max °F	Max °C	Lbs./ 1000	Kgs./ Kilometer	Nominal Size Inches	Nominal Size mm
20NX-PP	20	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	12.5	18.6	.15 x .09	3.8 x 2.4
20NX-TT	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	11.0	16.4	.10 x .07	2.5 x 1.8

Color Code: Orange (Positive, Non-Magnetic, Nickel, 14% Ch., 1.5% Si) and **Red** (Negative, Non-Magnetic., Nickel, 45% Si, .1% Mg)
Outer jacket - **Orange.** If Thermocouple Grade quality - Overall **Brown**, if tracer - **Orange.**

Type RSX - Extension Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max °F	Max °C	Lbs./ 1000	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
16RSX-GG	16	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	17.9	26.6	.15 x .09	3.8 x 2.2
16RSX-GG-S	16	Stranded	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	20.8	31.0	.16 x .10	4.1 x 2.5
16RSX-PP	16	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	25.0	37.2	.20 x .13	5.1 x 3.3
16RSX-TT	16	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	25.0	37.2	.16 x .10	4.1 x 2.5
16RSX-TT-S	16	Stranded	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	28.6	42.5	.18 x .11	4.6 x 2.8
20RSX-GG	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	400	204	11.0	16.4	.11 x .07	2.8 x 1.7
20RSX-PN	20	Solid	Polyvinyl Plastic	Nylon	220	104	12.5	18.6	.16 x .10	4.1 x 2.5
20RSX-PP	20	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	12.5	18.6	.16 x .10	4.1 x 2.5
20RSX-TT-ex	20	Solid	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	11.0	16.4	.12 x .07	3.1 x 1.8
20RSX-TT-ex-S	20	Stranded	Teflon FEP (Extruded)	Teflon FEP (Extruded)	400	204	12.6	17.9	.13 x .08	3.4 x 2.0

Color Code: Black (Positive, Non-magnetic, Copper) and **Red** (Negative, Non-magnetic, Copper Nickel - # 11 Alloy) Outer jacket - **Green**.

Type TX - Extension Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max °F	Max °C	Lbs./ 1000	Kgs./ Kilometer	Nominal Size Inches	Nominal Size mm
16TX-PP	16	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	25.0	37.2	.20 x .13	5.1 x 3.3
16TX-TT	16	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	25.0	37.2	.16 x .10	4.1 x 2.5
20T-GG *	20	Solid	Fiberglass, Impregnated	Fiberglass, Impregnated	500	480	7.7	11.5	.09 x .06	2.3 x 1.5
20TX-PP	20	Solid	Polyvinyl Plastic	Polyvinyl Plastic	220	104	12.5	18.6	.16 x .10	4.1 x 2.5
20TX-PP-S	20	Stranded	Polyvinyl Plastic	Polyvinyl Plastic	220	104	14.0	20.8	.19 x .11	4.7 x 2.7
20TX-TT	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	200	93	11.0	16.4	.12 x .07	3.1 x 1.8
20TX-TT-ex-S	20	Stranded	Teflon FEP (Extruded)	Teflon FEP (Extruded)	200	93	12.0	17.9	.13 x .08	3.4 x 2.0

Color Code: Blue (Positive, Non-magnetic, Copper) and **Red** (Negative, Non-magnetic, Constantan) Outer jacket - **Blue**.
* Thermocouple Grade quality - Overall **Brown**, if tracer - **Yellow.**

Type CX - Extension Wire

Part Number	Wire Gauge	Wire Form	Wire Insulation	Jacket Insulation	Max °F	Max °C	Lbs./ 1000	Kgs./ Kilometer	Nominal Size Inches	Nominal Size mm
20CX-TT	20	Solid	Teflon TFE (Fused Tape)	Teflon TFE (Fused Tape)	400	204	10.0	14.9	.12 x .06	3.1 x 1.5

Color Code: White and Red (Positive, Alloy #405) and **Red** (Negative, Allot #426) Outer jacket - **White and Red** .

RICHARDS®
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Extension Wire - Multicable - Twisted Pairs and Overall Shielded - Twisted Pairs, Individually & Overall Shielded (SD) - Stranded wire is standard.

Multicable extension wire is a cost effective and space saving method of running multiple sensor leads to the process instrumentation. **Stranded wire is standard.** Multicable extension wire is constructed to protect the thermocouple circuits from electrical interference. Overall shielded wire has an Aluminum Mylar Tape (**AMT**) covering the bundle of twisted wire pairs and a copper drain wire. This gives protection from external noise. **Example: 20KX04-PP**

The individually and overall shielded wire (**SD**) has the Aluminum Mylar Tape (**AMT**) wrapped around each twisted pair and again over all of the pairs. A copper drain wire is included with each pair and a copper drain wire is included with the overall shielding. This gives excellent protection against external and internal noise. Just add "**SD**" to the end of the part number . **Example: 20KX04-PP-SD**

Numbers in the part numbers signify the number of pairs, i.e. 01 = 1 pair, 02 = 2 pairs, etc.

Special limits can be specified by doubling the type letter in the part number. **Example: 20KKX04-PP**

Stainless steel Over Braid is available for many wires. It is used to protect from abrasion and fraying of wires and is an electric shielding when grounded. Eight is the designation for 304 Stainless Steel - "**OB8**". Just added letters to the end of the part number. **Example: 20JX02-PP-OB8**

If a communications wire is required add "**CW**" to the end of the part number. **Example: 20KX04-PP-CW**

Type EX - For part numbers take KX numbers below and change them to EX

Color Code: Purple (Positive, Non-magnetic, Nickel, 10% Chromium) and **Red** (Negative, Non-magnetic, Constantan) Outer jacket - **Purple**.

Type JX - For part numbers take KX numbers below and change them to JX

Color Code: White (Positive, Magnetic, Iron) and **Red** (Negative, Non-magnetic, Constantan) Outer jacket - **Black**.

Type TX - For part numbers take KX numbers below and change them to TX

Color Code: Blue (Positive, Non-magnetic, Copper) and **RED** (Negative, Magnetic, Constantan) Outer jacket - **Blue.**

Type KX - Multicable Extension Wire - Twisted Pairs, Overall Shielded

Part Number	Wire Gauge	No. Pairs	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000 Ft.	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
16KX01-PP	16	1	Polyvinyl Plastic	Polyvinyl Plastic			30	49.7	.249	6.30
20KX01-PP	20	1	Polyvinyl Plastic	Polyvinyl Plastic	Single 221	Single 105	28	53.1	.205	5.21
20KX02-PP	20	2	Polyvinyl Plastic	Polyvinyl Plastic			45	67.0	.290	7.37
20KX04-PP	20	4	Polyvinyl Plastic	Polyvinyl Plastic			83	123.5	.350	8.89
20KX08-PP	20	8	Polyvinyl Plastic	Polyvinyl Plastic	Overall 194	Overall 90	181	194.9	.420	10.64
20KX12-PP	20	12	Polyvinyl Plastic	Polyvinyl Plastic			198	294.6	.495	12.57
20KX24-PP	20	24	Polyvinyl Plastic	Polyvinyl Plastic			338	503.0	.665	16.89

Color Code: Yellow (Positive, Non-magnetic, Nickel, 10% Chromium) and **Red** (Negative, Magnetic, Nickel, 5% Aluminum, Silicon) Outer jacket - **Yellow**.

Type KX - Multicable Extension Wire - Twisted Pairs, Individually & Overall Shielded (SD)

Part Number	Wire Gauge	No. Pairs	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000 Ft.	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
16KX01-PP-SD	16	1	Polyvinyl Plastic	Polyvinyl Plastic			25	49.7	.252	6.30
20KX01-PP-SD	20	1	Polyvinyl Plastic	Polyvinyl Plastic	Single 221	Single 105	28	53.1	.210	5.33
20KX02-PP-SD	20	2	Polyvinyl Plastic	Polyvinyl Plastic			51	75.9	.295	7.49
20KX04-PP-SD	20	4	Polyvinyl Plastic	Polyvinyl Plastic			94	139.8	.395	10.03
20KX08-PP-SD	20	8	Polyvinyl Plastic	Polyvinyl Plastic	Overall 194	Overall 90	142	211.3	.455	11.56
20KX12-PP-SD	20	12	Polyvinyl Plastic	Polyvinyl Plastic			220	327.4	.550	13.97
20KX24-PP-SD	20	24	Polyvinyl Plastic	Polyvinyl Plastic			428	636.9	.842	21.39

Color Code: Yellow (Positive, Non-magnetic, Nickel, 10% Chromium) and **Red** (Negative, Magnetic, Nickel, 5% Aluminum, Silicon) Outer jacket - **Yellow**.

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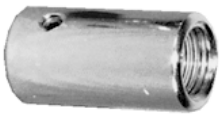
Mounting attachments such as bushings and threaded fittings, are used to provide a gas tight seal when installing thermocouples into the process. They also give ceramic tubes support to prevent mechanical breakage. Adjustable flanges can be used to adjust the immersion length of metal protection tubes and ceramic tubs having a metal sleeve. Armor adaptors can be used to attach Bantam or MgO thermocouple sheaths to armored cables. Bayonet fittings can be used for quick disconnect applications on small thermocouples.

Armor Adaptor -

Part Number	Outside Inches	Outside mm	Length Inches	Length mm	Tube Size	Description	Figure
AA	1/2”	12.7	1”	25.4	All	Steel Armor Adaptor to attach armored cable to Bantam or MgO thermocouple sheaths.	1
AA-SS	1/2”	12.7	1”	25.4	All	Stainless Steel Armor Adaptor to attach armored cable to Bantam or MgO thermocouple sheaths.	



Armor Adaptor (AA)

Armor Cable -

Part Number	Inside Diameter Inches	Inside Diameter mm	Outside Diameter Inches	Outside Diameter mm	Construction	Application	Figure
AC02	1/8”	3.18	.210”	5.33	Stainless Steel	Provides outer protection for insulated wires	2
AC03	3/16”	4.76	9/32”	7.14	Stainless Steel		
AC03GP	3/16”	4.76	5/16”	7.94	Galvan. Steel, PVC Coat		
AC03P	3/16”	4.76	5/16”	7.94	Stainless, PVC Coat		
AC03TB	3/16”	4.76	5/16”	7.94	Stainless, Teflon, Black		
AC03TW	3/16”	4.76	5/16”	7.94	Stainless, Teflon, White		
AC04	1/4”	6.35	11/32”	8.73	Stainless Steel		
AC04P	1/4”	6.35	11/32”	8.73	Galvan. Steel, PVC Coat		
AC05	5/16”	7.94	.425”	10.80	Stainless Steel		
AC06	3/8”	9.53	1/2”	12.70	Stainless Steel		
AC08	1/2”	12.70	5/8”	15.88	Stainless Steel		
AC08P	1/2”	12.70	5/8”	15.88	Galvan. Steel, PVC Coat		
AC10	5/8”	15.88	3/4”	19.05	Stainless Steel		
AC12	3/4”	19.05	.890”	22.61	Stainless Steel		

Armor Cable (AC)

Adjustable Flanges -

Part Number	Pipe Size	Inside Diameter Inches	Inside Diameter mm	Base Inches	Height Inches	Description	Figure
AF0416	1/4” NPT	.87	21.3	1.75 sq.	1.50	Aluminum flange with a set screw to limit the depth of insertion of metal or ceramic tubes, which have a sleeve.	3
AF0616	3/8” NPT	.87	21.3	1.75 sq.	1.50		
AF0816	1/2” NPT	.87	21.3	1.75 sq.	1.50		
AF1216	3/4” NPT	1.06	26.7	1.75 sq.	1.50		
AF1616	1” NPT	1.33	33.5	1.75 sq.	1.75		
AF2016	1 1/4” NPT	1.93	49.0	3.50 sq.	2.50		
AF2416	1 1/2” NPT	1.93	49.0	3.50 sq.	2.50		

Adjustable

Bayonet Fittings -

Part Number	Fits Tube Size Inches	Fits Tube Size mm	Outside Diameter Inches	Outside Diameter mm	Description	Figure
BF03	3/16”	4.78	.57	14.5	Stainless Steel is the standard construction. A bayonet fitting is used to mount bantam thermocouple and RTDs into bayonet nipples in quick disconnect applications in the Plastic industry. Includes a spring and two brazing rings.	4
BF03-SS	3/16”	4.78	.57	14.5		

Bayonet

Accessories - Mounting

! **Note:** To specify an attachment to a thermocouple assembly, generally you just add the attachment part number to the end of the thermocouple assembly part number. **Example:** 8K4-734XH-24-SH-AF

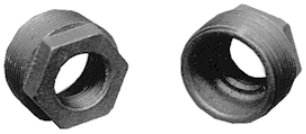
Bushings - Carbon Steel

Part Number	Pipe Diameter Inches	Pipe Diameter mm	Thread Size - NPT Outside	Thread Size - NPT Inside	Bushing Length	Construction	Figure
BH0402	0.41	10.4	1/4”	1/8”	5/8”	Screws into existing female threads to reduce the thread size. Provides two independent threads. A male external tread and a female internal thread. Some sizes may be drilled out and welded on metal protection tubes. Some sizes may be cemented on ceramic tubes.	1
BH0602	0.41	10.4	3/8”	1/8”	3/4”		
BH0604	0.54	13.7	3/8”	1/4”	3/4”		
BH0802	0.41	10.4	1/2”	1/8”	7/8”		
BH0804	0.54	13.7	1/2”	1/4”	7/8”		
BH0806	0.68	17.2	1/2”	3/8”	7/8”		
BH1202	0.41	10.4	3/4”	1/8”	7/8”		
BH1204	0.54	13.7	3/4”	1/4”	1”		
BH1206	0.68	17.2	3/4”	3/8”	1”		
BH1208	0.84	21.3	3/4”	1/2”	1”		
BH1602	0.41	10.4	1”	1/8”	1 3/8”		
BH1604	0.54	13.7	1”	1/4”	1 3/8”		
BH1606	0.68	17.2	1”	3/8”	1 3/8”		
BH1608	0.84	21.3	1”	1/2”	1 1/4”		
BH1612	1.05	26.7	1”	3/4”	1 1/4”		
BH2004	0.54	13.7	1 1/4”	1/4”	1 1/4”		
BH2006	0.68	17.2	1 1/4”	3/8”	1 1/4”		
BH2008	0.84	21.3	1 1/4”	1/2”	1 1/4”		
BH2012	1.05	26.7	1 1/4”	3/4”	1 1/4”		
BH2016	1.32	33.5	1 1/4”	1”	1 1/4”		
BH2404	0.54	13.7	1 1/2”	1/4”	-		
BH2406	0.68	17.2	1 1/2”	3/8”	-		
BH2408	0.84	21.3	1 1/2”	1/2”	1 3/8”		
BH2412	1.05	26.7	1 1/2”	3/4”	1 3/8”		
BH2416	1.32	33.5	1 1/2”	1”	1 3/8”		
BH2420	1.66	42.2	1 1/2”	1 1/4”	-		
BH3212	1.05	26.7	2”	3/4”	1 3/8”		
BH3216	1.32	33.5	2”	1”	1 3/8”		
BH3220	1.66	42.2	2”	1 14”	1 3/8”		
BH3224	1.90	48.3	2”	1 1/2’	1 3/8”		

Bushing (BH)

Bushings - Carbon Steel

Part Number	Pipe Diameter Inches	Pipe Diameter mm	Thread Size - NPT Outside	Thread Size - NPT Inside	Bushing Length	Construction	Figure
BH2408	0.84	21.3	1 1/2”	1/2”	1 1/4”	Iron Bushings for H08, H12, and H16, screw cover heads.	2
BH2412	1.05	26.7	1 1/2”	3/4”	1 1/4”		
BH2416	1.32	33.5	1 1/2”	1”	1 1/4”		



Bushing for screw cover heads (BHH)

Brackets - Plug Conversion - Type K

Part Number	Fits Pipe Size	Construction	Figure
BR02-K1	1/8” NPT	Brackets for attaching Jab Style plugs and jacks to pipe sizes 1/8” NPT to 1” NPT pipe. Smaller sizes use bushings and tube adaptors. May be used on straight or angle assemblies. For other thermocouple Types, change the letter K.	3
BR04-K4	1/4” NPT		
BR06-K7	3/8” NPT		
BR08-K7	1/2” NPT		
BR12-K7	3/4” NPT		
BR16-K7	1” NPT		

Bracket, Jab Style Plugs and Jacks to Pipe (BR)

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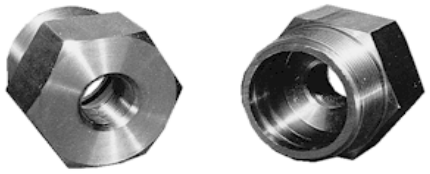
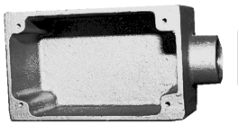
Large Cementing Bushing - Steel

Part Number	Pipe Thread	Description	Figure
BSC3212	2" NPT x 3/4" NPT	Bar Stock machined steel cementing bushing for plain Silicon Carbide tubes. They are used to provide threads for mounting into the process (2" NPT male). A female 3/4" NPT thread is on the instrument side for pipe extension or connection head mounting.	1  **Bushing for Silicon Carbide Tubes (BSC)**

Conduit Boxes - For Plug & Jack Panels

Part Number	Material	Conduit Size	Height	Width	Depth	Description	Figure
BX12A	Aluminum	3/4"	4 9/16"	2 13/16"	2	Box for mounting plugs and jacks.	**Box for** 2 
BX12AC	Aluminum Cast	3/4"	4 9/16"	2 13/16"	2		
BX12N	Nylon	3/4"	4 5/8"	2 13/16"	2		
BX12F	Fiberglass	3/4"	4 5/8"	2 13/16"	2		

Composition Bushing -

Part Number	Thread Size	Application	Figure
CB08	1/2"	Composition Bushings are used in outlet boxes and thermocouple heads to protect extension lead wires from fraying.	**Composition Bushing (CB)** 3 
CB12	3/4"		

Compression Fittings - Bore thru, 316 Stainless

Part Number	Teflon® Ferrule	Bore Inches	Bore mm	NPT Thread	Length Inches		Figure
CFSS01	CFSS01R	.063	1.6	1/8"	1.05	Bore thru compression fittings are used for mounting thermocouples and RTD probes. Standard compression fittings are made from 316 stainless steel with dual 316 stainless ferrules. Single re-adjustable Teflon® ferrules can be specified by adding a R to the end of the part number. Fittings can be ordered in other materials such as 304SS, carbon steel, brass, or polypropylene.	4  **Compression Fitting (CFSS)**
CFSS02	CFSS02R	.125	3.2	1/8"	1.25		
CFSS03	CFSS03R	.188	4.8	1/8"	1.25		
CFSS0308	CFSS0308R	.188	4.8	1/2"	1.50		
CFSS04	CFSS04R	.250	6.4	1/4"	1.50		
CFSS0402	CFSS0402R	.250	6.4	1/8"	1.50		
CFSS0408	CFSS0408R	.250	6.4	1/2"	1.50		
CFSS05	CFSS05R	.312	7.9	1/2"	1.54		
CFSS0508	CFSS0508R	.312	7.9	1/4"	1.54		
CFSS06	CFSS06R	.375	9.6	1/2"	1.57		
CFSS08	CFSS08R	.500	12.7	1/2"	1.90		
CFSS10	CFSS10R	.625	15.9	3/4"	1.93		
CFSS12	CFSS12R	.750	19.1	3/4"	2.00		

Accessories - Mounting

Cable Clamps -

Part Number	Application	Notes	Figure
CL CLM	Cable Clamp for standard style plugs and jacks. Cable Clamp for miniature style plugs and jacks.	Cable Clamps can be used with plugs and jacks but are not always required. Cable Clamps are not used with Jab Style connectors.	Cable Clamp (CL or CLM)  1

Cable Connector -

Part Number	Thread Size	Notes	Figure
CN08 CN12	1/2" NPT 3/4" NPT	Clamps extension wire exiting from connection heads or outlet boxes.	Cable Connector  2

Couplings - Steel

Part Number	O.D. Inches	O.D. mm	NPT Thread	Length Inches	Notes	Figure
CP02	.59	14.99	1/8"	.83"	Couplings are cemented on to ceramic protection tubes. They have a female thread for process mounting. The bore is determined by the tube size to be cemented. Couplings are carbon steel with a 316 stainless option. If you require threads on both ends of the coupling repeat the last numbers of the in the part number (CP1212).	 3
CP04	.72	18.29	1/4"	1.25"		
CP06	.87	22.10	3/8"	1.17"		
CP08	1.06	26.92	1/2"	1.56"		
CP12	1.32	33.53	3/4"	1.62"		
CP16	1.57	39.88	1"	1.98"		
CP20	1.91	48.51	1 1/4"	2.10"		
CP24	2.00	50.80	1 1/2"	2.30"		
CPT20	2.25	57.15	1 1/4"	2.63"	Couplings for Target Tubes	Couplings (CP & CPT)
CPT24	2.25	57.15	1 1/2"	2.63"		

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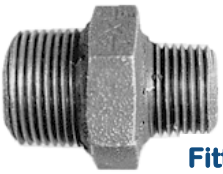
Elbows - Cast Iron

Part Number	Elbow Threads	Notes	Figure
EB0202	1/8” NPT x 1/8” NPT	Most commonly used to provide a right angle on angle type assemblies.	1  Elbow (EB)
EB0404	1/4” NPT x 1/4” NPT		
EB0606	3/8” NPT x 3/8” NPT		
EB0804	1/2” NPT x 1/4” NPT		
EB0806	1/2” NPT x 3/8” NPT		
EB0808	1/2” NPT x 1/2” NPT		
EB1204	3/4” NPT x 1/4” NPT		
EB1206	3/4” NPT x 3/8” NPT		
EB1208	3/4” NPT x 1/2” NPT		
EB1212	3/4” NPT x 3/4” NPT		
EB1606	1” NPT x 3/8” NPT		
EB1608	1” NPT x 1/2” NPT		
EB1612	1” NPT x 3/4” NPT		
EB1616	1” NPT x 1” NPT		
EB2016	1 1/4” NPT x 1” NPT		
EB2416	1 1/2” NPT x 1” NPT		
EB2420	1 1/2” NPT x 1 1/4” NPT		

Fitting - For Cementing to Ceramic Tubes

Part Number	Material	Tube Size Inches	Tube Size mm	Pipe Thread Process	Pipe Thread Head	Notes	Figure
F1208	Steel	.69	17.5	3/4” NPT	1/2” NPT	Cemented to ceramic tubes to provide male process and instrument connection threads.	2  Fitting (F)
F1612		1.00	25.4	1” NPT	3/4” NPT		
F2016		1.25	31.8	1 1/4” NPT	1” NPT		
FSS161208	316 Stainless Steel	69	17.5	3/4” NPT	1/2” NPT		
FSS161612		1.00	25.4	1” NPT	3/4” NPT		
FSS162016		1.25	31.8	1 1/4” NPT	1” NPT		

Fitting for Silicon Carbide Tube - Cast Iron

Part Number	Bore Inches	Bore mm	Diameter Inches	Diameter mm	Length Inches	Length mm	Notes	Figure
FSC2412	1.75	44.5	2.5”	63.5	2.4	61.0	Holds plain silicon carbide tubes with three set screws and provides 3/4” female NPT threads to mount a connection head or elbow.1/2” and 1” NPT are also available.	3  Fitting, Silicon Carbide Tube (FSC)

Floor Flange - Cast Iron

Part Number	Diameter	Height	Female Pipe Thread	Notes	Figure
FF02	2.375	.500	1/8” NPT	Used to provide a female NPT thread to mount thermocouples or RTDs in process equipment. 1 1/4” NPT (FF20) is recommended as the default, as it provides the option of reducing to smaller sizes if needed with a bushing.	4  Floor Flange (FF)
FF04	2.375	.500	1/4” NPT		
FF06	2.625	.500	3/8” NPT		
FF08	2.625	.625	1/2” NPT		
FF12	3.500	.625	3/4” NPT		
FF16	4.000	.625	1” NPT		
FF20	4.000	.750	1 1/4” NPT		

Accessories - Mounting

Grommets - Rubber

Part Number	Bore Inches	Bore mm	O.D. Inches	O.D. mm	Thickness Inches	Thickness mm	Notes	Figure
GRM00 GRM03 GRM04	.055 .127 .140	1.40 3.23 3.56	2.50 2.50 3.13	6.35 6.35 7.95	.060 .250 .313	1.53 6.35 7.95	Rubber Grommets are used to provide strain relief for thermocouple wires connected to plugs and jacks.	 1 Rubber Grommets (GRM)

Hexagonal Fittings - Types Bored Thru and Threaded one end

Part Number	Type	Pipe Threads NPT	For Tube O.D.	Bored end Inches	Bored end mm	Length Inches	Length mm	Notes	Figure
HX0802 HX0804 HX1202 HX1204 HX1206 HX1208	Has female thread in one end	1/2" x 1/2" x 1/8" 1/2" x 1/2" x 1/4" 3/4" x 3/4" x 1/8" 3/4" x 3/4" x 1/4" 3/4" x 3/4" x 3/8" 3/4" x 3/4" x 1/2"		.340 .443 .340 .443 - .726	8.64 11.25 8.64 8.64 - 18.54	2 2 1/4 2 2 - 2 1/4	50.8 57.2 50.8 50.8 - 57.2	Hexagonal fittings are used as mountings, extensions, or as fittings to be cemented, or welded, on tubes to provide mechanical connections.	 2
HX02B02 HX04B04 HX08B02 HX08B03 HX08B04	Bored Thru	1/8" x 1/8" 1/4" x 1/4" 1/2" x 1/2" 1/2" x 1/2" 1/2" x 1/2"	1/8" 1/4" 1/8" 3/16" 1/4"	.184 .283 .137 .196 .263	4.67 7.19 3.48 4.98 6.68	1 1 1/2 2 2 2	25.4 38.1 50.8 50.8 50.8		 3

Lugs - Spade Lugs & Ring Terminals - Compensated

Spade Part No.	Ring Part No.	Alloy	Width Inches	Width mm	Length Inches	Length mm	Dia. Hole or U Inches	Dia. Hole or U mm	Notes	Figure
LSEP LSEN LSJP LSJN LSKP LSKN LSNP LSNN LSTP LSTN	LREP LREN LRJP LRJN LRKP LRKN LRNP LRNN LRTP LRTN	EP - Constantan EN - Chromel JP - Iron JN - Constantan KP - Chromel KN - Alumel NP - Nicrosil NN - Nisil TP - Copper TN - Constantan	Spade .303 Ring .300	Spade 7.70 Ring 7.62	Spade .736 Ring .73	Spade 18.69 Ring 18.56	Spade .158 Ring .160	Spade 13.99 Ring 4.04	Compensated spade lugs and ring terminals for termination of thermocouple and extension wires.	 4 Lugs, Spade, (shown) Lugs, Ring (LS & LR)

Nipples - Bayonet Fitting Nipples - Zinc Plated Steel, or 304 Stainless Steel

Part No. Steel	Part No. 304SS	Pipe Thread NPT	Nipple Length Inches	Nipple Length mm	Notes	Figure
NB0214 NB0224 NB0240 NB0256 NB0264 NB0280	NBSS0214 NBSS0224 NBSS0240 NBSS0256 NBSS0264 NBSS0280	1/8" 1/8" 1/8" 1/8" 1/8" 1/8"	7/8 1 1/2 2 1/2 3 1/2 4 5	22.25 38.10 63.50 88.90 101.60 127.00	Nipples for mounting bayonet style probes.	 5 Nipples for Bayonet Fittings (NB)

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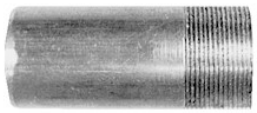
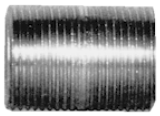
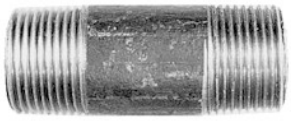
Nipple, Brass - Open Head, NS Thread

Part Number	Fine Thread	O.D. Inches	O.D. mm	I.D.. Inches	I.D.. mm	Length Inches	Length mm	Notes	Figure
NL	3/4-27	.875	22.25	.750	19.05	2.00	50.8	Special brass nipple for cementing on ceramic tubes. The thread is typical for mounting Open style heads with platinum elements.	1  Nipple, Brass (NL)

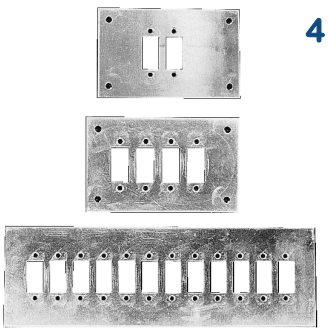
Nipples, Close - Steel, Schedule 40

Part Number	Thread NPT	O.D. Inches	O.D. mm	I.D. Inches	I.D. mm	Length Inches	Length mm	Notes	Figure
NC0214	1/8”	.41	10.4	.27	6.9	.88	22.35	Close nipples are cemented to ceramic tubes to provide pipe threads for mounting to the process and to add a connection head. Shown as standard is schedule 40 pipe. Add XH to the end of the part number to specify schedule 80 pipe.	2  Nipple, Close (NC)
NC0414	1/4”	.54	13.7	.36	9.1	.88	22.35		
NC0616	3/8”	.68	17.2	.49	12.4	1.00	25.40		
NC0819	1/2”	.84	21.32	.62	15.7	1.19	30.23		
NC1221	3/4”	1.05	6.7	.82	20.8	1.31	33.27		
NC1624	1”	1.32	33.5	1.05	26.7	1.50	38.10		
NC2026	1 1/4”	1.66	42.2	1.38	35.1	1.63	41.40		

Nipples, Space - Steel, Schedule 40

Part Number	Thread NPT	O.D. Inches	O.D. mm	I.D. Inches	I.D. mm	Length Inches	Length mm	Notes	Figure
NS0223	1/8”	.41	10.4	.27	6.9	1.44	36.58	Close nipples are cemented to ceramic tubes to provide pipe threads for mounting to the process and to add a connection head. Shown as standard is schedule 40 pipe. Add XH to the end of the part number to specify schedule 80 pipe.	3  Nipple, Space (NS)
NS0424	1/4”	.54	13.7	.36	9.1	1.50	38.10		
NS0624	3/8”	.68	17.2	.49	12.4	1.50	38.10		
NS0832	1/2”	.84	21.32	.62	15.7	2.00	50.80		
NS1240	3/4”	1.05	6.7	.82	20.8	2.50	50.80		
NS1648	1”	1.32	33.5	1.05	26.7	3.00	76.20		
NS2048	1 1/4”	1.66	42.2	1.38	35.1	3.00	76.20		

Panels, Aluminum - For Jacks

Part Number	Slots	Width Inches	Width mm	Length Inches	Length mm	Thickness Inches	Thickness mm	Notes	Figure
PL01	1	2.75	69.85	4.50	144.3	3/32	2.38	Aluminum panels for standard plugs or jacks. Normally used with jacks. PL01 through PL04 fit in BX12A, BX12AC, and BX12N boxes.	4  Panels (PL)
PL02	2	2.75	69.85	4.50	144.3	3/32	2.38		
PL03	3	2.75	69.85	4.50	144.3	3/32	2.38		
PL04	4	2.75	69.85	4.50	144.3	3/32	2.38		
PL05	5	2.75	69.85	4.50	144.3	3/32	2.38		
PL06	6	2.75	69.85	5.75	146.1	3/32	2.38		
PL08	8	2.75	69.85	7.25	184.2	3/32	2.38		
PL10	10	2.75	69.85	8.75	222.3	3/32	2.38		
PL12	12	2.75	69.85	10.25	260.4	3/32	2.38		
PL20	20	2.75	69.85	19.00	482.6	3/32	2.38		
PLM02	2	2.00	50.80	4.00	101.60	3/32	2.38	Aluminum panels for mini plugs or jacks. Normally used with jacks.	
PLM04	4	2.00	50.80	4.00	101.60	3/32	2.38		
PLM06	6	2.00	50.80	5.00	127.00	3/32	2.38		
PLM08	8	2.00	50.80	6.00	152.40	3/32	2.38		

Accessories - Mounting

Sleeves, Copper

Part Number	O.D. Inches	O.D. mm	I.D. Inches	I.D. mm	Length Inches	Length mm	Notes	Figure
SL	.09	2.36	.04	1.02	.63	15.88	Copper Sleeves are crimped on to 24 gauge platinum wires to assist in making a solid electrical contact in set screw style connector blocks.	 1 Sleeves, Copper (SL)

Spring, Strain Relief

Part Number	O.D. Inches	O.D. mm	I.D. Inches	I.D. mm	Length Inches	Length mm		Notes	Figure
SR	.42	10.67	.33	8.38	1.54	39.12	Transition Fitting end	Threads on to transition fittings TR01, TR02, TR03, TR04, on probes to provide strain relief of the wires.	 2 Spring, Strain Relief (SR)
	.29	7.37	.20	5.08	1.54	39.12	Wire end		

Terminal Barriers - Compensated, Glass Filled Nylon

For other types of terminals, substitute the K in the part number with an E, J, N, R/S, T, or U.
Lugs can be ordered separately by using the terminal lug part numbers indicated in the table below.

Part Number	Type	Terminals	Width Inches	Width mm	Length Inches	Length mm
TBK04	K	4	1 1/8	28.58	2 1/2	63.50
TBK06		6			3 3/8	85.73
TBK08		8			4 1/4	107.95
TBK10		10			5 1/8	130.18
TBK12		12			6	152.40
TBK14		14			6 7/8	174.63
TBK16		16			7 3/4	196.85
TBK18		18			8 5/8	219.08
TBK20		20			9 1/2	241.30

Lugs		
LTEP	Type E	Positive
LTEN	Type E	Negative
LTJP	Type J	Positive
LTJN	Type J	Negative
LTKP	Type K	Positive
LTKN	Type K	Negative
LTRSP	Type RS	Positive
LTRSN	Type RS	Negative
LTTP	Type T	Positive
LTTN	Type T	Negative
LTU	Type U	Copper

Figure

3 Terminal Barriers (TBK)

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Tube Adaptor - Single

Part Number	Fits Tube	Width Inches	Width mm	Thickness Inches	Thickness mm	Length Inches	Length mm	Notes	Figure
TA01	1/16”	.813	20.64	.563	14.29	1.25	31.75	Single **TA** adaptors are used to mount one standard size plug or jack to a single thermocouple probe.	1
TA02	1/8”	.813	20.64	.563	14.29	1.25	31.75		
TA03	3/16”	.813	20.64	.563	14.29	1.25	31.75		
TA04	1/4”	.813	20.64	.563	14.29	1.25	31.75		
TA05	5/16”	.813	20.64	.563	14.29	1.25	31.75		
TA06	3/8”	.813	20.64	.563	14.29	1.25	31.75		
TA08	1/2”	.813	20.64	.563	14.29	1.25	31.75		
TAUA01	1/16”	.949	24.11	.675	17.14	1.54	38.99	Single **TAUA** adaptors are used to mount one standard size Ceramic Alumina plug or jack to a single thermocouple probe.	2
TAUA02	1/8”	.949	24.11	.675	17.14	1.54	38.99		
TAUA03	3/16”	.949	24.11	.675	17.14	1.54	38.99		
TAUA04	1/4”	.949	24.11	.675	17.14	1.54	38.99		
TAUA05	5/16”	.949	24.11	.675	17.14	1.54	38.99		
TAUR01	1/16”	.949	24.11	.675	17.14	1.54	38.99	Single **TAUR** adaptors are used to mount one standard size Ultra High Temperature Resin plug or jack to a single thermocouple probe.	3
TAUR02	1/8”	.949	24.11	.675	17.14	1.54	38.99		
TAUR03	3/16”	.949	24.11	.675	17.14	1.54	38.99		
TAUR04	1/4”	.949	24.11	.675	17.14	1.54	38.99		
TAUR05	5/16”	.949	24.11	.675	17.14	1.54	38.99		

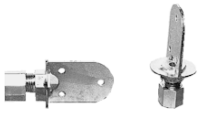
Tube, Adaptor, Single (TA)

Tube, Adaptor, Single (TAUA)

Tube, Adaptor, Single (TAUR)

Tube Adaptor - Dual

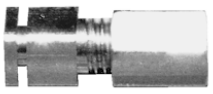
Part Number	Fits Tube	Width Inches	Width mm	Thickness Inches	Thickness mm	Length Inches	Length mm	Notes	Figure
TA02	1/8”	.90	22.86	.90	22.86	2.10	53.34	Double adaptors are used to mount two standard size plug or jack to a dual thermocouple probe.	4
TA03	3/16”	.90	22.86	.90	22.86	2.10	53.34		
TA04	1/4”	.90	22.86	.90	22.86	2.10	53.34		



Tube, Adaptor, Dual (TAD)

Tube Adaptor, Insert

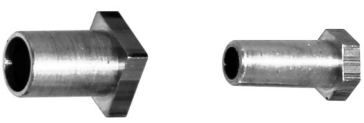
Part Number	Fits Tube	Width Inches	Width mm	Thickness Inches	Thickness mm	Length Inches	Length mm	Notes	Figure
TAI01	1/16”	.315	8.00	.315	8.00	1.00	25.4	Insert style tube adaptors for standard plugs and jacks.	5
TAI02	1/8”	.315	8.00	.315	8.00	1.00	25.4		
TAIM01	1/16”	.250	8.00	.250	8.00	.85	21.6	Insert style tube adaptors for mini plugs and jacks.	
TAIM02	1/8”	.250	8.00	.250	8.00	.85	21.6		



Tube, Adaptor, Insert (TAI)

Tube Crimp Inserts - Brass or Nickel Plated Brass

Part Number	Material	Fits Tube	Length	Base	Description	Figure
CI01	Brass, or Nickel plated Brass	1/16”	5/8”	5/16” sq.	Used to mount plugs or jacks to Bantam type thermocouple protection tubes. **CI** style are used for regular plugs (round pin) and jacks. **CIM** style are used for miniature plugs (flat pin) and jacks.	6
CI02		1/8”	1/2”	1/4” sq.		
CI03		3/16”	9/16”	3/8” sq.		
CI04		1/4”	9/16”	3/8” sq.		
CIM01		1/16”	1/2”	1/4” hex.		
CIM02		1/8”	1/2”	1/4” hex.		
CIM03		3/16”	1/2”	1/4” hex.		
CIM04		1/4”	1/2”	1/4” hex.		



Tube Crimp Inserts (CI & CIM)

Threaded Fittings - Carbon Steel

Part Number	Male NPT Thread	Female NPT Thread	Female NPT Thread	Notes	Figure
TF0802	1/2”	1/8”	1/8”	Threaded Fittings provide two female threads and one male thread. The three NPT threads can be used to mount a protection tube, a connection head and then install in the process with the remaining thread.	1
TF0804	1/2”	1/4”	1/4”		
TF0806	1/2”	3/8”	3/8”		
TF1202	3/4”	1/8”	1/8”		
TF1204	3/4”	1/4”	1/4”		
TF1206	3/4”	3/8”	3/8”		
TF1208	3/4”	1/2”	1/2”		
TF1602	1”	1/8”	1/8”		
TF1604	1”	1/4”	1/4”		
TF1606	1”	3/8”	3/8”		
TF1608	1”	1/2”	1/2”		
TF1612	1”	3/4”	3/4”		
TF2004	1 1/4”	1/4”	1/4”		
TF2006	1 1/4”	3/8”	3/8”		
TF2008	1 1/4”	1/2”	1/2”		
TF2012	1 1/4”	3/4”	3/4”		
TF2016	1 1/4”	1”	1”		
TF2404	1 1/2”	1/4”	1/4”		
TF2406	1 1/2”	3/8”	3/8”		
TF2408	1 1/2”	1/2”	1/2”		
TF2412	1 1/2”	3/4”	3/4”		
TF2416	1 1/2”	1”	1”		
TF2420	1 1/2”	1 1/4”	1 1/4”		
TF3204	2”	1/4”	1/4”		
TF3206	2”	3/8”	3/8”		
TF3208	2”	1/2”	1/2”		
TF3212	2”	3/4”	3/4”		
TF3216	2”	1”	1”		
TF3220	2”	1 1/4”	1 1/4”		
TF3224	2”	1 1/2”	1 1/2”		

Threaded Fitting (TF)

Transition Fittings - 304 Stainless Steel

Part Number	Tube Size Inches	Tube Size mm	Length Inches	Length mm	Notes	Figure
TR01	1/16”	1.59	1 1/4”	31.75	Acts as a sleeve where the junctions between the thermocouple and extension wires can be potted with ceramics or epoxy.	2
TR02	1/8”	3.18	1 1/4”	31.75		
TR03	3/16”	4.76	1 1/4”	31.75		
TR04	1/4”	6.35	1 1/4”	31.75		

Transition Fittings (TR)

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Tube Support Assembly (Flange) for Silicon Carbide with Collar (SCC & SCNC) - Steel

Part Number	Tube Size O.D. Inches	Tube Size O.D. mm	Diameter Inches	Diameter mm	Height Inches	Height mm	Notes	Figure
SCFL	1 3/4	44.5	4.875	123.8	2.375	60.33	The steel protection tube mounting flange is used to mount thermocouple assemblies, which have silicon carbide tubes with collars (SCC & SCNC). The assembly consists of a three hole mounting plate, gasket, screws, and support flange.	1  Tube Support (SCFL)

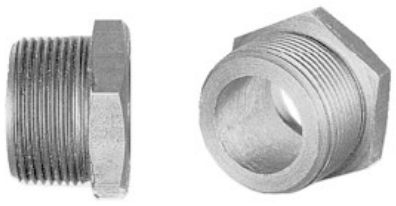
Unions - 316 Stainless Steel

Part Number	Threads (NPT) Connection	Threads (NPT) Process	Length Inches	Length mm	Notes	Figure
UN0808	1/2" Female	1/2" Female	1.60	40.6	Used to separate extensions between head and protection tube without having to unscrew the threads on pipes and mountings.	2  Unions (UN)
UN0808A	1/2" Male	1/2" Male	3.00	76.2		
UN0808B	1/2" Male	1/2" Female	2.40	61.0		

Union Elbows - Cast Iron

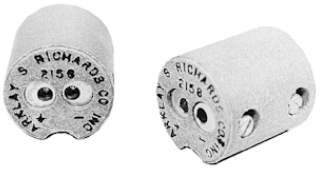
Part Number	Threads (NPT) Connection	Threads (NPT) Process	Notes	Figure
UE0808	1/2" Female	1/2" Female	Provides an adjustable elbow from zero to 90 degrees for use on angle assemblies. Allows for easy dismantling of the assembly. Sturdy cast iron construction. **Note: The elbows may not provide a gas tight seal.**	3  Union Elbows (UE)
UE1212	3/4" Female	3/4" Female		
UE1616	1" Female	1" Female		

Welded Bushings - Carbon Steel

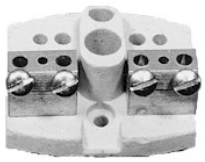
Part Number	Machined I.D. For Pipe Size	Hole I.D. Inches	Hole I.D. mm	Male NPT Thread	Height Inches	Height mm	Notes	Figure
W1204	1/4" NPT	.54	13.7	3/4"	1.02	25.91	Machined bushings can be welded on to metal protection tubes to provide a gas tight seal on the process connection. Steel fittings are provided as the standard. Stainless steel fittings are also available. Add SS16 or SS08 for 316 or 304 Stainless Steel respectively. **Example: W1608SS16**	4  Welded Bushings (W)
W1206	3/8" NPT	.68	17.2	3/4"	1.02	25.91		
W1208	1/2" NPT	.84	21.3	3/4"	1.02	25.91		
W1604	1/4" NPT	.54	13.7	1'	1.33	33.78		
W1606	3/8" NPT	.68	17.2	1"	1.05	26.67		
W1608	1/2" NPT	.84	21.3	1"	1.05	26.67		
W1612	3/4" NPT	1.05	26.7	1"	1.32	33.53		
W2006	3/8" NPT	.68	17.2	1 1/4"	1.20	30.48		
W2008	1/2" NPT	.84	21.3	1 1/4"	1.20	30.48		
W2012	3/4" NPT	1.05	26.7	1 1/4"	1.20	30.48		
W2016	1" NPT	1.32	33.5	1 1/4"	1.20	30.48		
W2408	1/2" NPT	.84	21.3	1 1/2"	1.33	33.78		
W2412	3/4" NPT	1.05	26.7	1 1/2"	1.26	32.00		
W2416	1" NPT	1.32	33.5	1 1/2"	1.31	33.27		
W2420	1 1/4" NPT	1.66	42.2	1 1/2"	1.31	33.27		
W3208	1/2" NPT	.84	21.3	2"	1.39	35.31		
W3212	3/4" NPT	1.05	26.7	2"	1.39	35.31		
W3216	1" NPT	1.32	33.5	2"	1.39	35.31		
W3220	1 1/4" NPT	1.66	42.2	2"	1.39	35.31		
W3224	1 1/2" NPT	1.90	48.3	2"	1.39	35.31		

Accessories - Connector Blocks - Ceramic

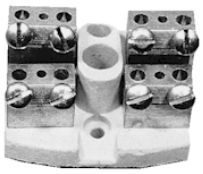
2158 - Single Round - Cement

Part Number	Height Inches	Height mm	O.D. Inches	O.D. mm	Weight ounces	Weight grams	Used in the Following Heads	Figure
2158	1.5	38.1	1.38	34.9	3	1.75	H08, H12, H16 Can be used for 6 gauge (4.1 mm) or smaller wires. 8 gauge insulated thermocouple elements enter without bending. Maximum service temperature 500ºF (260ºC) Use copper sleeves (SL) for wires under 20 gauge.	 1 Two Wire (2158)

ACTS - Single - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
ACTS	1 7/8	47.6	1 9/16	39.7	-	-	ACHS08	 2 Two Wire (ACTS)

ACTD - Duplex - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
ACTD	1 7/8	47.6	1 9/16	39.7	-	-	ACHD08	 3 Four Wire (ACTD)

ACTT - Triplex Oval - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
ACTT	1 7/8	47.6	1 9/16	39.7	-	-	ACHT08	 4 Six Wire (ACTT)

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Single General Purpose - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
AMTS	7/8	22.2	1 5/16	33.33	-	-	AMHS08	1  Two Wire (AMTS)

Single General Purpose - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
AMTS	7/8	22.2	1 5/16	33.33	-	-	AMHS08	2  Four Wire (AMTD)

Single General Purpose - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
ATS	1 3/4	44.5	15/16	23.8	13/16	20.6	AHS02, AHS08, AHS12	4  Two Wire (ATS)

Duplex General Purpose - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
ATD	1 11/16	42.9	15/16	23.8	11/16	17.5	AHD02, AHD08, AHD12	4  Four Wire (ATD)

Accessories - Connector Blocks

AWTS - Single Oval - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
AWTS	2	50.8	1 7/16	36.5	11/16	1.75	AFTHS02, AFTHS08, AFTHS12, AWHS02, AWHS08, AWHS12, AWHS16, BFTHS02, BFTHS08, BFTHS12, CIHS08, CIHS12, CIHS16, SSHS08, SSHS12, SHS02, SHS08, SHS12, SHS16, WFTHS02, WFTHS08, WFTHS12	1  Two Wire (AWTS)

AWTD - Duplex Oval - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
AWTD	2	50.8	1 7/16	36.5	1 5/32	29.4	AFTHD02, AFTHD08, AFTHD12, AWHD02, AWHD08, AWHD12, AWHD16, BFTHD02, BFTHD08, BFTHD12, CIHD08, CIHD12, CIHD16, SSHD08, SSHD12, SHD02, SHD08, SHD12, SHD16, WFTHD02, WFTHD08, WFTHD12	2  Four Wire (AWTD)

AWTT - Triplex Oval - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
AWTT	2	50.8	1 7/16	36.5	7/8	22.2	AFTHT02, AFTHT08, AFTHD12, AWHT02, AWHT08, AWHT12, AWHT16, BFTHT02, BFTHT08, BFTHT12, CIHT08, CIHT12, CIHT16, SSHT08, SSHT12, SHT02, SHT08, SHT12, SHT16, WFTHT02, WFTHT08, WFTHT12	3  Six Wire (AWTT)

AWTTR - Triplex Oval - Ceramic

Part Number	Length Inches	Length mm	Width Inches	Width mm	Thickness Inches	Thickness mm	Used in the Following Heads	Figure
AWTTR	2	50.8	1 7/16	36.5	1/2	12.7	AFTHTR02, AFTHTR08, AFTRHD12, AWHTR02, AWHTR08, AWHTR12, AWHTR16, BFTHTR02, BFTHTR08, BFTHTR12, CIHTR08, CIHTR12, CIHTR16, SSHTR08, SSHTR12, SHTR02, SHTR08, SHTR12, SHTR16, WFTHTR02, WFTHTR08, WFTHTR12	4  Six Wire (AWTTR)

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GPT - Single General Purpose - Ceramic

Part Number	O.D. Inches	O.D. mm	Height Inches	Height mm	Weight Ounce	Weight Gram	Used in the Following Heads
GPT	1.38	34.9	1.50	3`8.1	3.0	85.0	GPH08, GPH12, GPH16

Two Wire — **5** — **(GPT)**

MT2, MT3, MT4 - Miniature Blocks - Ceramic

2 — **(MT2)** — **Two Wire**

3 — **(MT3)** — **Three Wire**

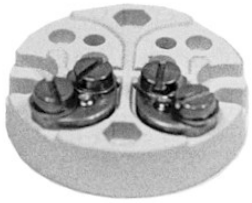
6 — **(MT4)** — **Four Wire**

Part Number	O.D. Inches	O.D. mm	Height Inches	Height mm	TCs	RTDs		Used in the Following Heads
MT2	1 1/8	28.6	1 3/4	44.5	1	1	Two Terminals (2 wires)	MSH202, MSH204
MT3	1 1/8	28.6	1 3/4	44.5		1	Three Terminals (3 wires)	MSH302, MSH304
MT4	1 1/8	28.6	1 3/4	44.5	2	1	Four Terminals (4 wires)	MSH402, MSH404

WTS - Single DIN Size Connector - Ceramic

Part Number	O.D. Inches	O.D. mm	Length Inches	Length mm	Weight Ounce	Weight Gram	Used in the Following Heads
WTS	1.56	39.6	.56	14.2	1.75	49.6	ASHLHS08, CIHS08, CIHS12, CIHS16, NHS08, SHS08, SHS12, SHS16, WHS08

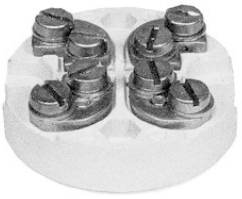
Two Wire — **7** — **(WTS)**



WTS - Single DIN Size Connector - Ceramic

Part Number	O.D. Inches	O.D. mm	Length Inches	Length mm	Weight Ounce	Weight Gram	Used in the Following Heads
WTD	1.56	39.6	.56	14.2	1.75	49.6	ASHLHD08, CIHD08, CIHD12, CIHD16, NHD08, SHD08, SHD12, SHD16, WHD08

Four Wire — **8** — **(WTD)**



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Thermocouple Heads - Aluminum

Thermocouple connection heads are available in a variety of materials and configurations. Our more common styles are shown in this catalog. If you are looking for a particular type, which is not shown here, please phone on of our sales engineers since we have other heads in stock. All thermocouple connection heads are sold with connector blocks. if you would like to order connection heads without blocks add **WOC** after the part number. **Example: AWH08WOC**

AWH - Aluminum Weatherproof Head - Screw Cover & Chain

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
	NPT	NPT				1
AWHS02	1/8”	3/4”	AWTS	Single / 2		
AWHS08	1/2”	3/4”	AWTS	Single / 2		
AWHS12	3/4”	3/4”	AWTS	Single / 2		
AWHS16	1”	3/4”	AWTS	Single / 2	Height 3 3/16” or 81.0 mm	
AWHD02	1/8”	3/4”	AWTD	Double / 4		
AWHD08	1/2”	3/4”	AWTD	Double / 4		
AWHD12	3/4”	3/4”	AWTD	Double / 4	Width 2 15/16” or 74.6 mm	
AWHD16	1”	3/4”	AWTD	Double / 4		
AWHT02	1/8”	3/4”	AWTT	Triple / 6		
AWHT08	1/2”	3/4”	AWTT	Triple / 6		
AWHT12	3/4”	3/4”	AWTT	Triple / 6	Cap Diameter 3 1/16” or 77.8 mm	
AWHT16	1”	3/4”	AWTT	Triple / 6		
AWHTR02	1/8”	3/4”	AWTR	RTD / 6		
AWHTR08	1/2”	3/4”	AWTR	RTD / 6		
AWHTR12	3/4”	3/4”	AWTR	RTD / 6	**NEMA Rating - Type 4**	
AWHTR16	1”	3/4”	AWTR	RTD / 6		

AWH

AWH - Aluminum Weatherproof Head - Screw Cover & Chain

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
	NPT	NPT				2
AWHS02	1/8”	3/4”	ATS	Single / 2		
AWHS08	1/2”	3/4”	ATS	Single / 2		
AWHS12	3/4”	3/4”	ATS	Single / 2	Width 2 15/16” or 74.6 mm	
AWHD02	1/8”	3/4”	ATD	Double / 4		
AWHD08	1/2”	3/4”	ATD	Double / 4	Cap Diameter 3 1/16” or 77.8 mm	
AWHD12	3/4”	3/4”	ATD	Double / 4		
					NEMA Rating - Type 2	

ASLH

ASLH - Aluminum Domed Flip-Top Head

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating
	NPT	NPT			
ASLHS02	1/2”	1/2”	ASLS	Two / 2	
ASLHD08	1/2”	1/2”	ASLS	Four / 4	Width 2 15/16” or 74.6 mm
ASLHTT12	1/2”	1/2”	ASLS	Six / 6	Cap Diameter 3 1/16” or 77.8 mm
					NEMA Rating - Type 2

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The NEMA enclosure performance ratings for each of our heads are listed to help you select the proper head for your application. The most common NEMA Ratings for thermocouple connection heads in our catalog are the NEMA Type 2, 4, and Type 4X. Their definitions from the National Electrical Manufacturers Association Classification detailed in **NEMA 250-1997** are shown below.

√ **NEMA 2:** For indoor use to provide personnel protection against incidental contact with the enclosed equipment and provide protection against from falling dirt, dripping, or light splashing water.

√ **NEMA 4:** For indoor or outdoor use to provide protection from falling dirt, rain, sleet, snow, windblown dust, splashing water, hose directed water, and will be undamaged by the formation of ice on the external surface of the head.

√ **NEMA 4X:** For indoor or outdoor use to provide protection from falling dirt, rain, sleet, snow, windblown dust, splashing water, hose directed water, **corrosion**, and will be undamaged by the formation of ice on the external surface of the head.

SH - Standard Head - Screw Cap & Chain - Aluminum

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating
SHS02	NPT 1/8”	NPT 3/4”	AWTS	Single / 2	
SHS08	1/2”	3/4”	AWTS	Single / 2	
SHS12	3/4”	3/4”	AWTS	Single / 2	Height 3.6” or 91.4 mm
SHD02	1/8”	3/4”	AWTD	Double / 4	
SHD08	1/2”	3/4”	AWTD	Double / 4	Width 3.6” or 91.4 mm
SHD12	3/4”	3/4”	AWTD	Double / 4	
SHT02	1/8”	3/4”	AWTT	Triple / 6	Cap Diameter 3.1” or 78.7 mm
SHT08	1/2”	3/4”	AWTT	Triple / 6	
SHT12	3/4”	3/4”	AWTT	Triple / 6	**NEMA Rating - Type 4**
SHTR02	1/8”	3/4”	AWTR	RTD / 6	
SHTR08	1/2”	3/4”	AWTR	RTD / 6	
SHTR12	3/4”	3/4”	AWTR	RTD / 6	

For 1” NPT Process Threads use the following AWH Heads:
AWHS16, AWHD16, AWHT16 AND AWHTR16
Use Connector Blocks: AWTS, AWTD, AWTT and AWTR, respectively.

Figure 1

SH

AFTH - Aluminum Flip-Top Head

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating
AFTHS02	NPT 1/8”	NPT 3/4”	AWTS	Single / 2	
AFTHS08	1/2”	3/4”	AWTS	Single / 2	
AFTHS12	3/4”	3/4”	AWTS	Single / 2	Height 3.4” or 86.4 mm
AFTHD02	1/8”	3/4”	AWTD	Double / 4	
AFTHD08	1/2”	3/4”	AWTD	Double / 4	Width 3.1” or 78.7 mm
AFTHD12	3/4”	3/4”	AWTD	Double / 4	
AFTHT02	1/8”	3/4”	AWTT	Triple / 6	Cap Diameter 3.3” or 83.8 mm
AFTHT08	1/2”	3/4”	AWTT	Triple / 6	
AFTHT12	3/4”	3/4”	AWTT	Triple / 6	**NEMA Rating - Type 4**
AFTHTR02	1/8”	3/4”	AWTR	RTD / 6	
AFTHTR08	1/2”	3/4”	AWTR	RTD / 6	
AFTHTR12	3/4”	3/4”	AWTR	RTD / 6	

Figure 2

AFTH

Thermocouple Heads - Aluminum

ACH - Large Head - Aluminum - Screw Cap & Chain

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
ACHS08	NPT 1/2”	NPT 3/4”	ACTS	Single / 2	Height 3 3/16” or 81.0 mm Width 2 15/16” or 74.6 mm Diameter 3 1/16” or 77.8 mm **NEMA Rating** None	1
ACHD08	1/2”	3/4”	ACTD	Double / 4		
ACHT08	1/2”	3/4”	ACTT	Triple / 6		

ACH

AMH - Miniature Head - Aluminum - Screw Cap & Chain

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
AMHS08	NPT 1/2”	NPT 3/4”	AMTS	Single / 2	Height 2 3/4” or 69.9 mm Width 2 7/8” or 73.0 mm Diameter 2 1/4” or 57.1 mm **NEMA Rating** None	2
AMHD08	1/2”	3/4”	AMTD	Double / 4		

AMH

WH - Small Head - Aluminum - Twist Cap

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
WHS08	NPT 1/2”	NPT 1/2”	WTS	Single / 2	Height 3” or 76.2 mm Width 2.8” or 71.1 mm Weight 7.0 oz or 198.4 g **NEMA Rating** None	3
WHD08	1/2”	1/2”	WTD	Double / 4		

WH

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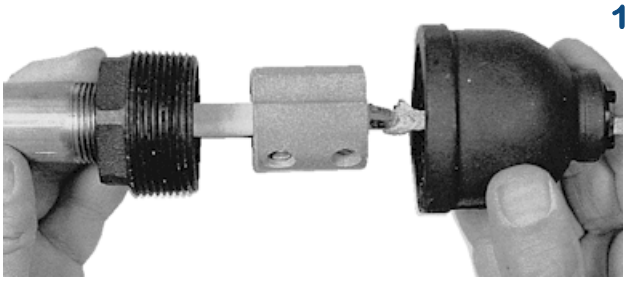
Screw Cover Head - Cast Iron

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
H08 H12 H16	NPT 1/2” 3/4” 1”	Wire Grommet	2158 2158 2158	Single / 2 Single / 2 Single / 2	Height 2 1/2” or 63.5 mm Diameter 2 1/2” or 63.5 mm Weight 1.4 Lbs. or .6 Kg. **NEMA Rating -** none	1  H

CIH - Heavy Duty Screw Cover Head with Chain - Cast Iron

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
CIHS02 CIHS08 CIHS12 CIHD02 CIHD08 CIHD12 CIHT02 CIHT08 CIHT12	NPT 1/2” 3/4” 1” 1/2” 3/4” 1” 1/2” 3/4” 1”	NPT 3/4” 3/4” 3/4” 3/4” 3/4” 3/4” 3/4” 3/4” 3/4”	AWTS AWTS AWTS AWTD AWTD AWTD AWTT AWTT AWTT	Single / 2 Single / 2 Single / 2 Double / 4 Double / 4 Double / 4 Triple / 6 Triple / 6 Triple / 6	Height 3.6” or 91.4 mm Width 3.6” or 91.4 mm Cap Diameter 3.8” or 96.5 mm **NEMA Rating -** **Type 4**	2  CIH

IH - Large Screw Cover Head with Chain - Cast Iron

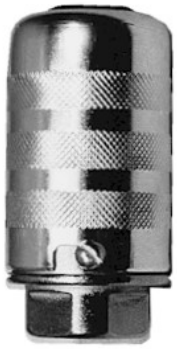
Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
IHS08 IHS12 IHS16 IHD08 IHD12 IHD16 IHT08 IHT12 IHT16	NPT 1/2” 3/4” 1” 1/2” 3/4” 1” 1/2” 3/4” 1”	NPT 3/4” 3/4” 3/4” 3/4” 3/4” 3/4” 3/4” 3/4” 3/4”	ACTS ACTS ACTS ACTD ACTD ACTD ACTT ACTT ACTT	Single / 2 Single / 2 Single / 2 Double / 4 Double / 4 Double / 4 Triple / 6 Triple / 6 Triple / 6	Height 3.75” or 95.3 mm Diameter 3.38” or 85.7 mm **NEMA Rating -** none	3  IH

Thermocouple Heads - Cast Iron, Nickel Plated Steel, & Brass

GPH - General Purpose Head - Cast Iron - Steel Cover

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
GPH08	NPT 1/2”	NPT 1/2”	GPT	Single / 2	Height 1.5” or 38.1 mm O.D. 1.38” or 34.9 mm Weight 3 oz. or 85.0 g. **NEMA Rating –2**	 GPH
GPH12	3/4”	1/2”	GPT	Single / 2		
GPH16	1”	1/2”	GPT	Single / 2		

MSH - Miniature Head - Nickel Plated Steel

Part Number	Process Thread	Neoprene Grommet Wire opening	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
MSH0202	NPT 1/8”	Neoprene grommet will allow up to 5/16” O.D. tubing or armor cable for extension wires. The cover has a an O-ring seal to pre-vent dirt and dust from entering the head. A 5/16” compression fitting is optional on the cover wire opening.	MT2	Two / 2	Height 2 1/4” or 57.2 mm O.D. 1 1/8” or 28.6 mm **NEMA Rating –** none	 2 MSH
MSH0204	1/4”		MT2	Two / 2		
MSH0302	1/8”		MT3	Three / 3		
MSH0304	1/4”		MT3	Three / 3		
MSH0402	1/8”		MT4	Four / 4		
MSH0404	1/4”		MT4	Four / 4		

OTHS - Open Terminal Head - Brass

Part Number	Process Thread	Typical Usage	Terminals Wires	Dimensions NEMA Rating	Figure
OTHS	7/8” Female Fine Thread	Used in Platinum silicon carbide double tube and triple assemblies. No terminal block is required.	Two / 2	Height 2” or 50.8 mm O.D. 1 7/8” or 47.6 mm **NEMA Rating –** none	 3 OTHS

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SSH - Corrosion Resistant Head - 316L Stainless Steel

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
	NPT	NPT			Height 3.6” or 91.4 mm	1
SSHS12	3/4”	3/4”	AWTS	Single / 2	Width 3.5” or 88.9 mm	
SSHD12	3/4”	3/4”	AWTD	Double / 4	Cap Diameter 3.1” or 78.7 mm	
SSHT12	3/4”	3/4”	AWTT	Triple / 6	**NEMA Rating - 4X**	
SSHTR12	3/4”	3/4”	AWTR	RTD / 6		

SSH

ALH - Aluminum Head - All Purpose

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
	NPT	NPT				2
ALHS02	1/8”	3/4”	AWTS	Single / 2		
ALHS06	3/8”	3/4”	AWTS	Single / 2		
ALHS08	1/2”	3/4”	AWTS	Single / 2		
ALHS12	3/4”	3/4”	AWTS	Single / 2		
ALHS16	1”	3/4”	AWTS	Single / 2		
ALHD02	1/8”	3/4”	AWTD	Double / 4	Height 3.75” or 95.25 mm	
ALHD06	3/8”	3/4”	AWTD	Double / 4		
ALHD08	1/2”	3/4”	AWTD	Double / 4		
ALHD12	3/4”	3/4”	AWTD	Double / 4	Width 3.93” or 99.82 mm	
ALHD16	1”	3/4”	AWTD	Double / 4		
ALHT02	1/8”	3/4”	AWTT	Triple / 6	Cap Diameter 3.43” or 87.15 mm	
ALHT06	3/8”	3/4”	AWTT	Triple / 6		
ALHT08	1/2”	3/4”	AWTT	Triple / 6		
ALHT12	3/4”	3/4”	AWTT	Triple / 6		
ALHT16	1”	3/4”	AWTT	Triple / 6	**NEMA Rating - 4X / I P66**	
ALHTR02	1/8”	3/4”	AWTR	RTD / 6		
ALHTR06	3/8”	3/4”	AWTR	RTD / 6		
ALHTR08	1/2”	3/4”	AWTR	RTD / 6		
ALHTR12	3/4”	3/4”	AWTR	RTD / 6		
ALHTR16	1”	3/4”	AWTR	RTD / 6		

ALH

RICHARDS®
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Thermocouple Heads - Explosion Resistant Heads for Hazardous Locations, UL Listed

Thermocouple connection heads are available in UL listed, explosion resistant configurations for uses in hazardous locations. Our more common styles are shown in this catalog. If you are looking for a particular type, which is not shown here, please phone one of our sales engineers since we have other heads in stock. All thermocouple connection heads are sold with connector blocks. If you would like to order connection heads without blocks add **WOC** after the part number. **Example: EXALH08-WOC**

The hazardous location classifications of the heads are listed below. They are divided into classes, groups and divisions as listed in the National Fire Protection Association (NFPA) Codes and Article 505 in the National Electric Code (NEC). Refer to these documents for specific details.

EXALH - Explosion Resistant Head - Aluminum Body & Cover

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
EXALHS08	NPT 1/2"	NPT 3/4"	AWTS	Single / 2	Height 3 3/16" or 81.0 mm	1
EXALHS12	3/4"	3/4"	AWTS	Single / 2	Width 2 15/16" or 74.6 mm	
EXALHD08	1/2"	3/4"	AWTD	Double / 4	Cap Diameter 3 1/16" or 77.8 mm	
EXALHD12	3/4"	3/4"	AWTD	Double / 4	**NFPA Hazardous Area Classification**	
EXALHT08	1/2"	3/4"	AWTT	Triple / 6	**Class I Group C, D Class II Group E, F, G UL Listed**	
EXALHT12	3/4"	3/4"	AWTT	Triple / 6		
EXALHTR08	1/2"	3/4"	AWTR	RTD / 6		
EXALHTR12	3/4"	3/4"	AWTR	RTD / 6		

EXALH

EXSSH - Explosion Resistant Head - 316 Stainless Steel

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
EXSSHS08	NPT 1/2"	NPT 3/4"	AWTS	Single / 2	Height 3 3/16" or 81.0 mm	2
EXSSHS12	3/4"	3/4"	AWTS	Single / 2	Width 2 15/16" or 74.6 mm	
EXSSHD08	1/2"	3/4"	AWTD	Double / 4	Cap Diameter 3 1/16" or 77.8 mm	
EXSSHD12	3/4"	3/4"	AWTD	Double / 4	**NFPA Hazardous Area Classification**	
EXSSHT08	1/2"	3/4"	AWTT	Triple / 6	**Class I Group C, D Class II Group E, F, G UL Listed**	
EXSSHT12	3/4"	3/4"	AWTT	Triple / 6		
EXSSHTR08	1/2"	3/4"	AWTR	RTD / 6		
EXSSHTR12	3/4"	3/4"	AWTR	RTD / 6		

EXSSH

Epoxy Coating for Thermocouple Heads

Thermocouple connection heads are available with a white epoxy coating for increased corrosion resistance. This is common in sanitary applications. Any of our metal thermocouple connection heads can be provided with this option. To specify the epoxy coating, add an **E** to the front of connection head part number.

Example #1: **EEXALH12** is a white epoxy coated **EXALHS12** thermocouple head.

Example #2: **EEXSSHS12** is a white epoxy coated **EXSSHS12** thermocouple head.

3

ESH

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High Performance Industrial Wind Sensors – Anemometers, Wind Vanes, and Wind Alarms

High Speed Industrial Wind Sensors and Systems -

Superior Design and Superior Performance - The Richards' Wind Sensor product line includes a variety of our cup anemometers and wind direction vanes which we specifically developed to perform in a variety of extreme weather conditions and in harsh industrial applications. Our wind sensors are typically used in industrial applications for high wind speed monitoring and wind alarm systems.

All wind sensor components are precision machined from corrosion resistant 316 series stainless steel or Titanium solid bar stock. The Arklay S. Richards Co., Inc. is the only manufacturer of mechanical anemometers which have stainless steel wind cups. By using the finest materials and components we insure that our wind sensors will be corrosion resistant, light weight, incredibly strong and perform with superior accuracy in an industrial environment.

A variety of sensor options are also available including; internal heaters, anti-ice coatings, multiple mounting options, cable types, output signals, LCD wind displays, wind speed alarms, 4-20 mA transmitters, and a complete cloud based wind monitoring system. Custom wind sensors can also be manufactured for your specific wind monitoring application or made to seamlessly interface with your industrial equipment. Further information can be found on our website or by requesting our High Performance Wind Sensor and Systems Catalog 19W.

View the Richards High Performance Wind Sensors and Systems Catalog 19W online at www.asrichards.com , or request your hard copy.

Heads - Explosion Resistant, Heavy Duty - Aluminum, 316L Stainless Steel

EXAH - Explosion Resistant Head - Aluminum

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating		Figure
EXAHS08	NPT 1/2"	NPT 3/4"	EXTS	Single / 2	**Height** 3.75" or 95.25 mm **Width** 6.62" or 91.95 mm **Cap Diameter** 3.60" or 91.44 mm	**NFPA Hazardous Area Classification Class I, Division 1, Group B, C, D Class II Group E, F, G Factory Mutual and CSA Explosion Proof Approval, NEMA 4 Max Temp. 175° (80°C)**	1  EXAH
EXAHD08	1/2"	3/4"	EXTD	Double / 4			
EXAHT08	1/2"	3/4"	EXTT	Triple / 6			
EXAHTR08	1/2"	3/4"	AWTR	RTD / 6			

EXSH - Explosion Resistant Head - 316 Stainless

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating		Figure
EXSTHS08	NPT 1/2"	NPT 3/4"	EXTS	Single / 2	**Height** 3.75" or 95.25 mm **Width** 6.62" or 91.95 mm	**NFPA Hazardous Area Classification Class I, Division 1, Group B, C, D Class II Group E, F, G Factory Mutual and CSA Explosion Proof**	2  EXSTH
EXSTHD08	1/2"	3/4"	EXTD	Double / 4			
EXSTHT08	1/2"	3/4"	EXTT	Triple / 6			

FTHB or FTHW - Plastic Flip -Top Head - Black or FDA Approved White Polypropylene

Part Number	Process Thread	Conduit Thread	Block Included	Elements Wires	Dimensions NEMA Rating	Figure
Black:	NPT	NPT	AWTS	Single / 2	**Height** 3.25" or 82.6 mm **Width** 3.1" or 78.7 mm **Cap Diameter** 3" or 76.2 mm **NEMA Rating - Type 4X** **Temperature Rating - 198ºF**	3  FTHB (Black) - FTHW (White)
FTHBS02	1/8"	3/4"	AWTS	Single / 2		
FTHBS08	1/2"	3/4"	AWTS	Single / 2		
FTHBS12	3/4"	3/4"				
			AWTD	Double / 4		
FTHBD02	1/8"	3/4"	AWTD	Double / 4		
FTHBD08	1/2"	3/4"	AWTD	Double / 4		
FTHBD12	3/4"	3/4"				
			AWTT	Triple / 6		
FTHBT02	1/8"	3/4"	AWTT	Triple / 6		
FTHBT08	1/2"	3/4"	AWTT	Triple / 6		
FTHBT12	3/4"	3/4"				
White:			AWTS	Single / 2		
FTHWS02	1/8"	3/4"	AWTS	Single / 2		

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Thermocouple Heads - Black Nylon, White Polypropylene, & Gray Delrin

Plastic Thermocouple Head Material Characteristics -

√ **Delrin© (Grey):** Delrin is a grey pigmented acetal homopolymer made from Dupont resin. It is resistant to most acids, alkalies, sea water and has a maximum service temperature rating of **275°F** or **135°C**. Delrin is not FDA approved for sanitary applications.

√ **Nylon (Black):** Nylon provides excellent electrical insulation and chemical resistance. It has a maximum service temperature rating of **350°F** or **176.6°C** Nylon is not FDA approved for sanitary applications.

√ **Polypropylene (Black):** Black Polypropylene is **not** approved for sanitary applications. It has excellent resistance to organic solvents, degreasing agents, acids, alkalies and most chemicals. Polypropylene has poor resistance to aliphatic and clorinated solvents. Polypropylene has a maximum service temperature rating of **198°F** or **92.2°C** and will start to distort its shape after **220°F** or **104.4°C**.

√ **Polypropylene (White):** White Polypropylene is approved for sanitary applications. It has excellent resistance to organic solvents, degreasing agents, acids, alkalies and most chemicals. Polypropylene has poor resistance to aliphatic and clorinated solvents. Polypropylene has a maximum service temperature rating of **198°F** or **92.2°C** and will start to distort its shape after **220°F** or **104.4°C**.

NH - Nylon Head - Black, Screw Cover

Part Number	Process Thread	Conduit Thread	Block Included	Terminals Wires	Dimensions NEMA Rating	Figure
NHS	**NPT** 1/2”	**NPT** 1/2”	**AWTS**	Two / 2	**Height** 3” or 76.2 mm **Width** 2.8” or 71.1 mm **Weight** 3.9 oz. or 110 g. **NFPA Rating** None **Temperature Rating: 350ºF**	1  NH
NHD	1/2”	1/2”	**AWTD**	Four / 4		

PPH - Plastic Head - White FDA Polypropylene or Delrin, Screw Cover

Part Number	Process Thread	Conduit Thread	Terminals Wires	Temperature Rating	Dimensions NEMA Rating	Figure
White FDA Polypropylene **PPH**	**NPT** 1/2”	**NPT** 3/4”	Three / 3	198°F or 92.2°C	**Height** 3.2” or 81.3 mm **Width** 2.8” or 71.1 mm **NFPA Rating 4x**	3  PPH & DHD
Non – FDA Delrin© **DH**	1/2”	3/4”	Three / 3	275°F or 135°C		

PPSH - Plastic Sanitary Head - White FDA Polypropylene or Delrin, Screw Cover

Part Number	Process Thread	Conduit Thread	Block Included	Terminals Wires	Temperature Rating	Dimensions NEMA Rating	Figure
White FDA Polypropylene **PPSHD**	**NPT** 1/2”	**NPT** 1/2”	**PPSD**	Four / 4	198°F or 92.2°C	**Height** 3.2” or 81.3 mm **Width** 2.8” or 71.1 mm **NFPA Rating 4x**	2  PPSH & DSHD
Non - FDA Delrin© **DSHD**	1/2”	1/2”	**PPSD**	Four / 4	275°F or 135°C		

Resistance Temperature Detector (RTD) Selection Guide

√ Step #1 - Select the Ohms of the Element:

When choosing a RTD (Resistance Temperature Detector or Platinum Resistance Thermometer) for your application, you will first need to determine the ohms of resistance for the platinum element. This is determined by the capability of your temperature indicating instrument. The Richards RTD sensor is available in 100 ohm, 500 ohm, and 1000 ohm configurations. The ohm value is the base resistance of the platium element at a reference point of 0°C. In typical industrial applications the 100 ohm type is the most commonly used element and is the standard in this catalog.

√ Step #2 - Select the Alpha:

RTDs have a temperature coefficient or "curve" of either .003920 ohms/ohms/°C or .003850 ohms/ohms/°C. This value is commonly called the alpha of the sensor. The **.00392** or "**American**" alpha is the U.S. industral standard and the Japanese Standard (JIS C1604-1989). The **.00385** or "**European**" alpha is the German (DIN 43760-1980), British (BS 1904-1984), and the International Electrotechnical Commission (IEC 751-1983) standard. In typical industrial applications the "European" curve is more commonly used than the "American" curve and is also the standard alpha in this catalog.

√ Step #3 - Select the Accuracy:

The accuracy of RTD elements are freqauently classified using the DIN 43760 classification standard. This classification is also used by the International Electrotechnical Commission (IEC 751). The classes are divided into four groups (A, B, C, D) by the amount of allowable resistance and temperature deviation over a temperature range. These base values are usually listed at 0°C. The smaller the deviation the lower the class (A) and the greater the accuracy of the sensor. In order to give our customers a high quality product, all standard Richards RTD sensors perform with an accuracy greater than class A. The standard Richards RTD has an accuracy of **±0.04% resistance or ±0.1°C**, which is more accurate than the DIN Class A. We also offer a very high accuracy version, which can be specified by the "**AA**" (American Curve) or "**EE**" (European Curve) in our part number. For comparision purposes, the Richards and DIN accuracy classes (at 0°C) are shown below.

Richards Premium AA or EE = ±0.02% resistance or ±0.05°C **DIN Class A = ±0.06% resistance or ±0.15°C**

Richards Standard A or E = ±0.04% resistance or ±0.1°C **DIN Class B = ±0.12% resistance or ±0.3 °C**

√ Step #4 - Select the Figure which best represents the Style RTD you require:

Browse through the catalog and locate one of the RTD photographs which would best suit your application. Due to space limitations, if you do not find exactly what you are looking for, phone one of our sales engineers, and we can help with the part number.

√ Step #5 - Fine Tune the Part Number:

After locating a figure and part number, you can fine tune the sensor for your application. If you require an American curve sensor and not the European curve, change the "**E**" to an "**A**" in the part number. If you require a 500 **Ω** and not the standard 100 **Ω** sensor, change the "**11**" in the part number to "**51**". 1000 **Ω** sensors can be ordered by changing the "**11**" to "**101**". Substitute any "**X**" and "**Y**" characters with your length requirements. RTDs are provided in four wire configurations as standard. This is the most accurate configuration. Note: if you are using a transmitter you may be only able to use a three wire sensor. This can be designated by changing the "**4**" in the part number to "**3**". Two wire RTDs can be specified by changing the "**4**" to "**2**" in the part number. **Note the RTD wiring congiguration diagrams shown on the next page.** The standard metal sheath for RTD elements is 1/4" diameter made of 316 stainless steel. Inconel 600 sheaths can be specified by changing the "**16**" in the part number to a "**09**".

Example part number: **4E164-11-12-24** is a four wire, European curve, 316 Stainless Steel 1/4 inch diameter sheath, 100**Ω,** 12" probe, 24" probe and leads overall.

Note: Richards standard RTDs have a maximum service temperature rating of **400°C** (**752°F**). Our high temperature RTDs have a maimum service temperature rating of **650°C** (**1202°F**). If you would like to specify this option, add a "**H**" after the curve designation letter (**A** or **E**) in the catalog number.

Example Part Number: **4EH164-11-12-24**
High Temperature, Four wire, European curve, 316 Stainless Steel 1/4 inch diameter sheath, 100**Ω,** 12" probe, 24" probe and leads overall.

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Typical RTD Wiring Configurations and Richards Color Codes

The Two Wire RTD (Red & Black)

The Richards two wire RTD is constructed with only one red and one black lead wire. This type of sensor is the least accurate form of RTD since it does not compensate for lead wire resistance. The total resistance of the lead wire will be added to the calibrated element's resistance. This will result in a higher temperature reading than is actually being measured. The error created by the lead wire can be quite substantial if it is not compensated. The two wire RTD is the least common type of lead configuration.

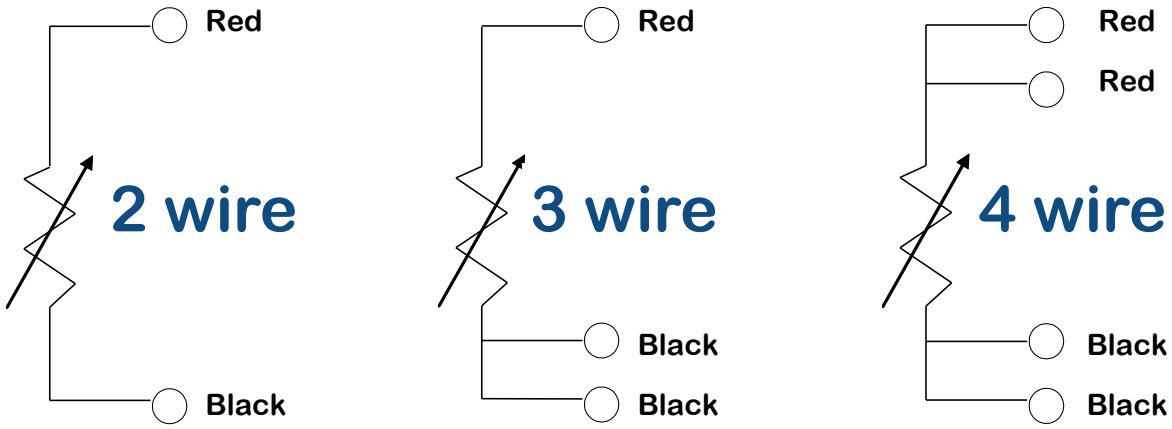
The Three Wire RTD (Red, Black & Black)

The Richards three wire RTD is constructed with two black lead wires and one red lead wire. This is the most common configuration for RTD sensors used today. The three wire RTD is more accurate than the two wire version since the instrument or transmitter can use this third lead to compensate for added resistance and ambient temperature changes along the lead length.

The Four Wire RTD (Red, Red, Black & Black)

The Richards four wire RTD is constructed with two black lead wires and two red lead wires. It is the most accurate RTD configuration since the instrument or transmitter can completely compensate for lead wire resistance and ambient temperature changes along the leads. The four wire RTD can also compensate for errors caused by mismatched lead wires (this does not occur often). This is accomplished by passing a current through the outer leads (First Red + First Black) and measuring the voltage drop across the inner leads (Second Red + Second Black). The instrument or transmitter can then calculate the resistance of the element alone. These sensors are not as common as the three wire version. They are only used where very high accuracy is critical. Four wire RTDs can be used as three wire or two wire by removing one of the red leads, or one of the red and one of the black leads.

Note: The lead color codes are Richards standards. There is not an industry standard for lead color codes.



Resistance Temperature Detectors (RTDs) - Thin Film

Thin Film RTDs elements are less expensive than wire round, better on vibration, but their temperature range is narrower.

Thin Film:	-70°C to 500°C	-94°F to 932°F
Wire wound:	-200°C to 650°C	-328°F to 1202°F

Wire wound RTDs elements in this catalog are the Richards standard. Thin Film elements add "**F**" in the catalog number after the curve letter "**E**" or "**A**". **Example: 4EF164-11-12-24**

Resistance Temperature Detectors (RTDs) - Platinum - Resistance Data - (ITS-90)

Resistance Data Based on the International Temperature Scale of 1990 (ITS-90)

Temp. C	European 100 Ω 0.00385	European 500 Ω 0.00385	European 1000 Ω 0.00385	American 100 Ω 0.00392	American 500 Ω 0.00392
-200	18.52	92.60	185.20	17.05	85.25
-195	20.65	103.24	206.47	19.22	96.08
-190	22.78	113.91	227.83	21.39	106.95
-185	24.90	124.60	249.20	32.56	117.82
-180	27.06	135.28	270.55	25.74	128.69
-175	29.19	145.93	291.85	27.91	139.53
-170	31.31	156.54	313.09	30.07	150.34
-165	33.42	167.12	334.24	32.22	161.11
-160	35.53	177.66	355.32	34.37	171.83
-155	37.63	188.16	376.31	36.50	182.52
-150	39.72	198.61	397.23	38.63	193.16
-145	41.81	209.03	418.06	40.75	203.77
-140	43.88	219.41	438.82	42.87	214.33
-135	45.95	229.75	459.51	44.97	224.86
-130	48.01	240.06	480.13	47.07	235.36
-125	50.07	250.34	500.68	49.16	245.82
-120	52.12	260.59	521.17	51.25	256.25
-115	54.16	270.81	541.61	53.33	266.65
-110	56.20	281.00	561.99	55.41	277.03
-105	58.23	291.16	582.32	57.48	287.38
-100	60.26	301.30	602.60	59.54	297.70
-95	62.28	311.42	622.83	61.60	308.00
-90	64.30	321.51	643.02	63.65	318.27
-85	66.32	331.58	663.16	65.71	328.53
-80	68.33	341.63	683.26	67.75	338.76
-75	70.33	351.66	703.33	69.79	348.97
-70	72.33	361.67	723.35	71.83	359.17
-65	74.33	371.67	743.33	73.87	369.34
-60	76.33	381.64	763.28	75.90	379.49
-55	78.32	391.59	783.19	77.93	389.63
-50	80.31	401.53	803.06	79.95	399.74
-45	82.29	411.45	822.90	81.97	409.84
-40	84.27	421.35	842.71	83.99	419.93
-35	86.25	431.24	862.48	86.00	429.99
-30	88.22	441.11	882.22	88.01	440.04
-25	90.19	450.96	901.93	90.01	450.07
-20	92.16	460.80	921.60	92.02	460.09
-15	94.12	470.62	941.25	94.02	470.09
-10	96.09	480.43	960.86	96.02	480.08
-05	98.04	490.22	980.45	98.01	490.05

Temp. C	European 100 Ω 0.00385	European 500 Ω 0.00385	European 1000 Ω 0.00385	American 100 Ω 0.00392	American 500 Ω 0.00392
0	100.00	500.00	1000.00	100.00	500.00
5	101.95	509.76	1019.53	101.99	509.94
10	103.90	519.51	1039.02	103.97	519.87
15	105.85	529.24	1058.49	105.96	529.78
20	107.79	538.96	1077.93	107.93	539.67
25	109.73	548.67	1097.34	109.91	549.56
30	111.67	558.36	1116.72	111.88	559.42
35	113.61	568.03	1136.07	113.85	569.27
40	115.54	577.70	1155.39	115.82	579.11
45	117.47	587.34	1174.68	117.79	588.93
50	119.39	596.97	1193.95	119.75	598.74
55	121.32	606.59	1213.18	121.71	608.53
60	123.24	616.19	1232.39	123.66	618.31
65	125.16	625.78	1251.57	125.61	628.07
70	127.07	635.36	1270.71	127.56	637.83
75	128.98	644.92	1289.83	129.51	647.55
80	130.89	654.46	1308.93	131.45	657.27
85	132.80	663.99	1327.99	133.40	666.98
90	134.70	673.51	1347.02	135.33	676.67
95	136.60	683.01	1366.02	137.27	686.34
100	138.50	692.50	1385.00	139.20	696.00
105	140.39	701.97	1403.95	141.13	705.64
110	142.29	711.43	1422.86	143.06	715.28
115	144.18	720.88	1441.75	144.98	724.89
120	146.06	730.30	1460.61	146.90	734.49
125	147.94	739.72	1479.44	148.82	744.08
130	149.82	749.12	1498.25	150.73	753.65
135	151.70	758.51	1517.02	152.64	763.21
140	153.58	767.88	1535.77	154.55	772.75
145	155.45	777.24	1554.48	156.45	782.27
150	157.32	786.59	1573.17	158.36	791.79
155	159.18	795.91	1591.83	160.26	801.29
160	161.05	805.23	1610.46	162.15	810.77
165	162.91	814.53	1629.06	164.05	820.24
170	164.76	823.82	1647.63	165.94	829.69
175	166.62	833.09	1666.18	167.83	839.13
180	168.47	842.35	1684.69	169.71	848.56
185	170.32	851.59	1703.18	171.59	857.97
190	172.16	860.82	1721.64	173.47	867.36
195	174.01	870.03	1740.67	175.35	876.74

Phone: 617.527.4385 Fax: 617.964.3746 Email: sales@asrichards.com

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Resistance Temperature Detectors (RTDs) - Platinum - Resistance Data - (ITS-90)

Resistance Data Based on the International Temperature Scale of 1990 (ITS-90)

Temp. C	European 100 Ω 0.00385	European 500 Ω 0.00385	European 1000 Ω 0.00385	American 100 Ω 0.00392	American 500 Ω 0.00392	Temp. C	European 100 Ω 0.00385	European 500 Ω 0.00385	European 1000 Ω 0.00385	American 100 Ω 0.00392	American 500 Ω 0.00392
200	175.85	879.23	1758.47	177.22	886.11	430	257.41	1287.04	2574.08	260.26	1301.32
205	177.68	888.42	1776.84	179.09	895.46	435	259.11	1295.57	2591.14	262.00	1310.01
210	179.52	897.59	1795.19	180.96	904.80	440	260.82	1304.09	2608.17	263.74	1318.68
215	181.35	906.75	1813.50	182.82	914.12	445	262.52	1312.58	2625.17	265.47	1327.33
220	183.15	915.89	1831.79	184.69	923.43	450	264.21	1321.07	2642.14	267.19	1335.97
225	185.00	925.02	1850.05	186.55	932.73	455	265.91	1329.54	2659.08	268.92	1344.60
230	186.00	934.14	1862.28	188.40	942.01	460	267.60	1338.00	2675.99	270.64	1353.21
235	188.65	943.24	1886.48	190.25	951.27	465	269.29	1346.44	2692.87	272.36	1361.81
240	190.46	952.32	1904.65	192.10	960.52	470	270.97	1354.86	2709.73	274.08	1370.39
245	192.28	961.40	1922.79	193.95	969.76	475	272.65	1363.27	2726.55	275.79	1378.96
250	194.09	970.45	1940.91	195.80	978.98	480	274.33	1371.67	2743.34	277.50	1387.51
255	195.90	979.50	1959.00	197.64	988.19	485	276.01	1380.05	2760.11	279.21	1396.04
260	197.71	988.53	1877.05	199.48	997.38	490	277.68	1388.42	2776.84	280.91	1404.57
265	199.51	997.54	1995.08	201.31	1006.56	495	279.35	1396.77	2793.55	282.61	1413.07
270	201.31	1006.54	2013.09	203.14	1015.72	500	281.02	1405.11	2810.22	284.31	1421.56
275	203.11	1015.53	1031.06	204.97	1024.87	505	282.69	1413.44	2826.87	286.01	1430.04
280	204.90	1024.50	2049.00	206.80	1034.01	510	284.35	1421.74	2843.49	287.70	1438.50
285	206.69	1033.46	2066.92	208.63	1042.13	515	286.01	1430.04	2860.07	289.39	1446.95
290	208.48	1042.40	2084.81	210.45	1052.23	520	287.66	1438.31	2876.63	291.08	1455.38
295	210.27	1051.33	2102.67	212.26	1061.32	525	289.32	1446.58	2893.16	292.76	1463.80
300	212.05	1060.25	2120.50	214.08	1070.40	530	290.97	1454.83	2909.65	294.44	1472.20
305	213.83	1069.15	2138.30	215.89	1079.46	535	292.61	1463.06	2926.12	296.12	1480.59
310	215.61	1078.04	2156.08	217.70	1088.51	540	294.26	1471.28	2942.56	297.79	1488.96
315	217.38	1089.91	2173.82	219.51	1097.54	545	295.90	1479.48	2958.96	299.46	1497.31
320	219.15	1095.77	2191.54	221.31	1106.56	550	297.53	1487.67	2975.34	301.13	1505.65
325	220.92	1104.61	2209.23	223.11	1115.57	555	299.17	1495.84	2991.69	302.80	1513.98
330	222.69	1113.44	2226.89	224.91	1124.56	560	300.80	1504.00	3008.00	304.46	1522.29
335	224.45	1122.26	2244.52	226.71	1133.54	565	302.43	1512.14	3024.29	306.12	1530.58
340	226.21	1131.06	2262.12	228.50	1142.50	570	304.05	1520.27	3040.54	307.77	1538.86
345	227.97	1139.85	2279.70	230.29	1151.44	575	305.68	1528.38	3056.77	309.43	1547.13
350	229.92	1148.62	2297.24	232.08	1160.38	580	307.30	1538.48	3072.96	311.08	1555.38
355	231.48	1157.38	2314.76	233.86	1169.29	585	308.91	1544.56	3089.13	312.72	1563.61
360	233.23	1166.13	2332.25	235.64	1178.20	590	310.53	1552.63	3105.26	314.37	1571.83
365	234.97	1174.86	2349.71	237.42	1187.09	595	312.14	1560.68	3121.36	316.01	1580.03
370	236.71	1183.57	2367.14	239.19	1195.96	600	313.74	1568.72	3137.43	317.64	1588.22
375	238.45	1192.27	2384.55	240.96	1204.82	605	315.35	1576.74	3153.48	319.28	1596.39
380	240.19	1200.96	2401.92	242.73	1212.67	610	316.95	1584.74	3169.49	320.91	1604.95
385	241.93	1209.63	2419.27	244.50	1222.50	615	318.55	1592.73	3185.47	322.54	1612.69
390	243.66	1218.29	2436.59	246.26	1231.32	620	320.14	1600.71	3201.42	324.16	1620.81
395	245.39	1226.94	2453.87	248.02	1240.12	625	321.73	1608.67	3217.34	325.78	1628.92
400	247.11	1235.57	2471.13	249.78	1248.90	630	323.32	1616.61	3233.22	327.40	1637.01
405	248.84	1244.18	2488.36	251.54	1257.68	635	324.91	1624.54	3249.08	329.02	1645.09
410	250.56	1252.78	2505.57	253.29	1266.44	640	326.49	1632.45	3264.91	330.63	1653.16
415	252.27	1291.37	2522.74	255.04	1275.18	645	328.07	1640.35	3280.70	332.24	1661.20
420	253.99	1269.94	2539.88	256.78	1283.91	650	329.65	1648.23	3296.48	333.85	1669.23
425	255.70	1278.50	2557.00	258.52	1292.62	655	331.22	1656.10	3312.20	335.45	1677.25
						660	332.79	1663.95	3327.90	337.05	1685.25

Resistance Temperature Detectors (RTDs) - Platinum

√ Need To Customize Your Assembly? - Fine Tune The Part Number

After locating a standard part number, fine tune the assembly for your application. Substitute any "**MC**" characters with your thermowell material code requirements. Note 316SS ("**16**") is standard.

RTD Thermowell Assembly - Style "A"

Assembly Part Number	Ohms (Ω)	Curve (Alpha)	Process Thread	Insert Length	Shank Dia.
4E1A03008MC02.5 4E1A03008MC04.5 4E1A03008MC07.5 4E1A03008MC10.5 4E1A03008MC13.5 4E1A03008MC16.5 4E1A03008MC22.5	100 Ω	European (0.00385)	1/2" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 5/8" 5/8" 5/8" 5/8" 5/8" 5/8"
4E1A03012MC02.5 4E1A03012MC04.5 4E1A03012MC07.5 4E1A03012MC10.5 4E1A03012MC13.5 4E1A03012MC16.5 4E1A03012MC22.5	100 Ω	European (0.00385)	3/4" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 3/4" 3/4" 3/4" 3/4" 3/4" 3/4"
4E1A03016MC02.5 4E1A03016MC04.5 4E1A03016MC07.5 4E1A03016MC10.5 4E1A03016MC13.5 4E1A03016MC16.5 4E1A03016MC22.5	100 Ω	European (0.00385)	1" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 7/8" 7/8" 7/8" 7/8" 7/8" 7/8"

MC = Select Material Code from table on opposite page. 316 SS ("16') is standard.

RTD Thermowell Assembly - Style "B"

Assembly Part Number	Ohms (Ω)	Curve (Alpha)	Process Thread (P)	Insert Length (U)	Shank Dia. (Q)
4E1B03008MC02.5E** 4E1B03008MC04.5E** 4E1B03008MC07.5E** 4E1B03008MC10.5E** 4E1B03008MC13.5E** 4E1B03008MC16.5E** 4E1B03008MC22.5E**	100 Ω	European (0.00385)	1/2" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 5/8" 5/8" 5/8" 5/8" 5/8" 5/8"
4E1B03012MC02.5E** 4E1B03012MC04.5E** 4E1B03012MC07.5E** 4E1B03012MC10.5E** 4E1B03012MC13.5E** 4E1B03012MC16.5E** 4E1B03012MC22.5E**	100 Ω	European (0.00385)	3/4" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 3/4" 3/4" 3/4" 3/4" 3/4" 3/4"
4E1B03016MC02.5E** 4E1B03016MC04.5E** 4E1B03016MC07.5E** 4E1B03016MC10.5E** 4E1B03016MC13.5E** 4E1B03016MC16.5E** 4E1B03016MC22.5E**	100 Ω	European (0.00385)	1" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 7/8" 7/8" 7/8" 7/8" 7/8" 7/8"

Union extends 3 inches (standard)
Example: 4E1BB030081607.5E05

RTD Thermowell Assembly - Style "C"

Assembly Part Number	Ohms (Ω)	Curve (Alpha)	Process Thread (P)	Insert Length (U)	Shank Dia. (Q)
4E1C03008MC02.5E** 4E1C03008MC04.5E** 4E1C03008MC07.5E** 4E1C03008MC10.5E** 4E1C03008MC13.5E** 4E1C03008MC16.5E** 4E1C03008MC22.5E**	100 Ω	European (0.00385)	1/2" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 5/8" 5/8" 5/8" 5/8" 5/8" 5/8"
4E1C03012MC02.5E** 4E1C03012MC04.5E** 4E1C03012MC07.5E** 4E1C03012MC10.5E** 4E1C03012MC13.5E** 4E1C03012MC16.5E** 4E1C03012MC22.5E**	100 Ω	European (0.00385)	3/4" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 3/4" 3/4" 3/4" 3/4" 3/4" 3/4"
4E1C03016MC02.5E** 4E1C03016MC04.5E** 4E1C03016MC07.5E** 4E1C03016MC10.5E** 4E1C03016MC13.5E** 4E1C03016MC16.5E** 4E1C03016MC22.5E**	100 Ω	European (0.00385)	1" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 7/8" 7/8" 7/8" 7/8" 7/8" 7/8"

Extension, No Union

All assemblies on this page have the "**SH**" Standard Head (Aluminum).

AWTTR Connector Block is standard.

Other heads are available just add the head catalog number to the end of these part numbers.

Example:
4E1B03016MC10.5E05CIH
(Cast Iron Head)

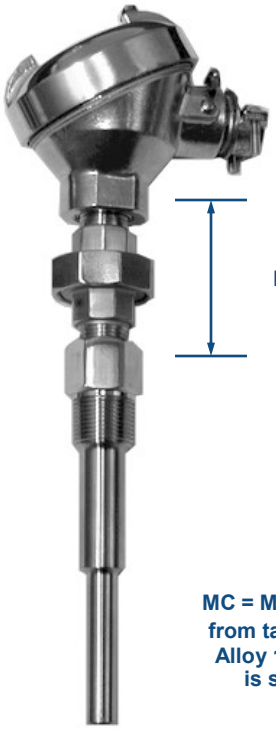
Phone: 617.527.4385 Fax: 617.964.3746 Email: sales@asrichards.com

Phone: 617.527.4385 *Fax: 617.964.3746* *Email: sales@asrichards.com*

RTD Assembly - Stepped Thermowell Standard Features:

- √ 316SS Step Shank Thermowell
- √ Male NPT Process Connection
- √ 316SS Union Fitting
- √ Spring Loaded Element
- √ 316SS 1/4" Dia. European Curve Element
- √ 100Ω Resistance
- √ Four Wire Lead Configuration
- √ ±0.04% resistance or ±0.1°C Accuracy
- √ NEMA 4 Aluminum Head
- √ Max. Temp. 400°C (752°F) or High Temp. Option 650°C (1202°F)
- √ Nipple Extensions: 316SS Sch. 80 pipe

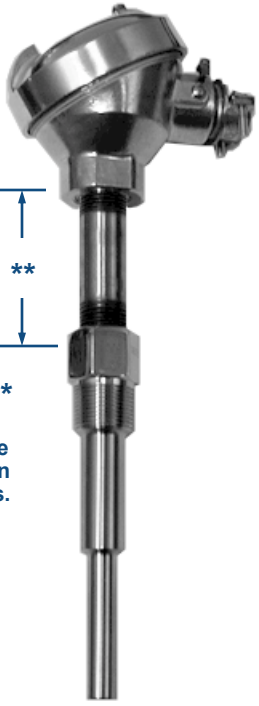
Type A
Union



MC = Material Code from table below - Alloy 16 (316SS) is standard.

Type B
Union & extension

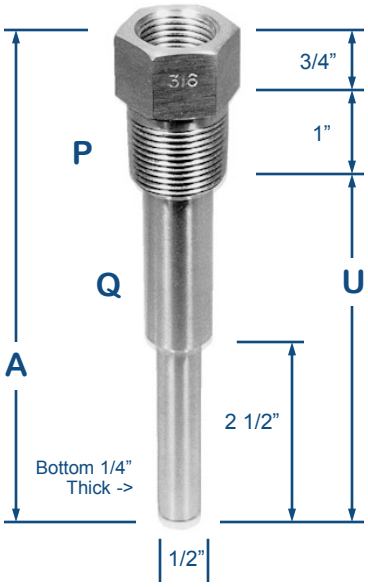
Type C
Extension, no union



Substitute the ** in the part number with the nipple extension length in inches.

! Note:
Any RTD assembly can be ordered without a union or spring loaded.

T030
Well



Note: MC in catalog numbers = Material Codes from this table							
Material Selection Codes							
Material	Code	Material	Code	Material	Code	Material	Code
304 Stainless	08	A105, Grade II	A2	Hastelloy B	HB	Nickel	NI
309 Stainless	18	Alloy 214	14	Hastelloy C	HC	Tantalum	TA
310 Stainless	20	Brass	BR	Incoloy	10	Titanium	TI
316 Stainless	16	Carbon Steel	CS	Inconel 600	09	Teflon	TF
347 Stainless	47	Carpenter 20	CA	Inconel 601	06	Other Materials available upon request.	
446 Stainless	07	F-11	11	Monel K	MK		
A105, Grade I	A1	F-22	22	Monel R	MR		

Resistance Temperature Detectors (RTDs) - Platinum

√ Need To Customize Your Assembly? - Fine Tune The Part Number

After locating a standard part number, fine tune the assembly for your application. Substitute any "**MC**" characters with your thermowell material code requirements. Note 316SS ("**16**") is standard.

RTD Thermowell Assembly - Style "A" - EX

Assembly Part Number	Ohms (Ω)	Curve (Alpha)	Process Thread	Insert Length	Shank Dia.
4E1A03008MC02.5EX 4E1A03008MC04.5EX 4E1A03008MC07.5EX 4E1A03008MC10.5EX 4E1A03008MC13.5EX 4E1A03008MC16.5EX 4E1A03008MC22.5EX	100 Ω	European (0.00385)	1/2" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 5/8" 5/8" 5/8" 5/8" 5/8" 5/8"
4E1A03012MC02.5EX 4E1A03012MC04.5EX 4E1A03012MC07.5EX 4E1A03012MC10.5EX 4E1A03012MC13.5EX 4E1A03012MC16.5EX 4E1A03012MC22.5EX	100 Ω	European (0.00385)	3/4" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 3/4" 3/4" 3/4" 3/4" 3/4" 3/4"
4E1A03016MC02.5EX 4E1A03016MC04.5EX 4E1A03016MC07.5EX 4E1A03016MC10.5EX 4E1A03016MC13.5EX 4E1A03016MC16.5EX 4E1A03016MC22.5EX	100 Ω	European (0.00385)	1" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 7/8" 7/8" 7/8" 7/8" 7/8" 7/8"

MC = Select Material Code from table on opposite page.
316 SS ("16') is standard.

RTD Thermowell Assembly - Style "B" - EX

Assembly Part Number	Ohms (Ω)	Curve (Alpha)	Process Thread	Insert Length	Shank Dia.
4E1B03008MC02.5EX 4E1B03008MC04.5EX 4E1B03008MC07.5EX 4E1B03008MC10.5EX 4E1B03008MC13.5EX 4E1B03008MC16.5EX 4E1B03008MC22.5EX	100 Ω	European (0.00385)	1/2" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 5/8" 5/8" 5/8" 5/8" 5/8" 5/8"
4E1B03012MC02.5EX 4E1B03012MC04.5EX 4E1B03012MC07.5EX 4E1B03012MC10.5EX 4E1B03012MC13.5EX 4E1B03012MC16.5EX 4E1B03012MC22.5EX	100 Ω	European (0.00385)	3/4" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 3/4" 3/4" 3/4" 3/4" 3/4" 3/4"
4E1B03016MC02.5EX 4E1B03016MC04.5EX 4E1B03016MC07.5EX 4E1B03016MC10.5EX 4E1B03016MC13.5EX 4E1B03016MC16.5EX 4E1B03016MC22.5EX	100 Ω	European (0.00385)	1" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 7/8" 7/8" 7/8" 7/8" 7/8" 7/8"

Union Extends 3 inches (standard)
Example: 4E1B030081607.5E05

RTD Thermowell Assembly - Style "C" - EX

Assembly Part Number	Ohms (Ω)	Curve (Alpha)	Process Thread	Insert Length	Shank Dia.
4E1C03008MC02.5EX 4E1C03008MC04.5EX 4E1C03008MC07.5EX 4E1C03008MC10.5EX 4E1C03008MC13.5EX 4E1C03008MC16.5EX 4E1C03008MC22.5EX	100 Ω	European (0.00385)	1/2" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 5/8" 5/8" 5/8" 5/8" 5/8" 5/8"
4E1C03012MC02.5EX 4E1C03012MC04.5EX 4E1C03012MC07.5EX 4E1C03012MC10.5EX 4E1C03012MC13.5EX 4E1C03012MC16.5EX 4E103012MC22.5EX	100 Ω	European (0.00385)	3/4" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 3/4" 3/4" 3/4" 3/4" 3/4" 3/4"
4E1C03016MC02.5EX 4E1C03016MC04.5EX 4E1C03016MC07.5EX 4E1C03016MC10.5EX 4E1C03016MC13.5EX 4E1C03016MC16.5EX 4E1C03016MC22.5EX	100 Ω	European (0.00385)	1" NPT (male)	2 1/2" 4 1/2" 7 1/2" 10 1/2" 13 1/2" 16 1/2" 22 1/2"	0 7/8" 7/8" 7/8" 7/8" 7/8" 7/8"

Extension, No Union

All assemblies on this page have the "**EX**" Explosion resistant Head (Aluminum).

AWTTR Connector Block is standard.

Other heads are available just change the "**EX**" in the catalog number to the new head part number.

Example:
4E1C03016MC10.5E05CIH
(Cast Iron Head)

Need to customize your assembly?
See page 140

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Phone: 617.527.4385 *Fax: 617.964.3746* *Email: sales@asrichards.com*

RTD Assembly - Stepped Thermowell Standard Features:

√ **316SS Step Shank Thermowell** √ **A variety of Thermowell materials** √ **Male NPT Process Connection**

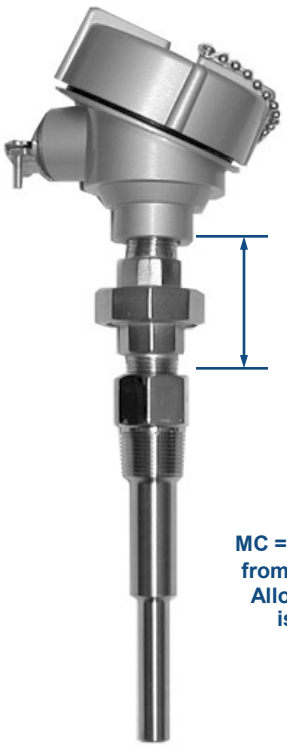
√ **Spring Loaded Element** √ **316SS 1/4" Dia. European Curve Element** √ **100Ω Resistance**

√ **Four Wire Lead Configuration** √ **±0.04% resistance or ±0.1°C Accuracy** √ **316SS Union Fitting**

√ **Max. Temp. 400°C (752°F) or High Temp. Option 650°C (1202°F)** √ **Nipple Extensions: 316SS Sch. 80 pipe**

√ **Explosion Resistant Aluminum Head** (NFPA Hazardous Area Classification - Class I, Division I, Group B, C, D, Class II, Division I, Group E, F, G, Factory Mutual and CSA explosion Proof, NEMA-4) Maximum connection head not to exceed 176°F.

Type A
Union

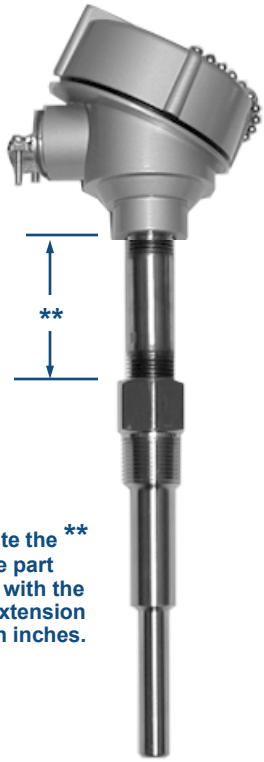


Union Extends 3"

MC = Material Code from table below - Alloy 16 (316SS) is standard.

Type B
Union & extension

Type C
Extension, no union

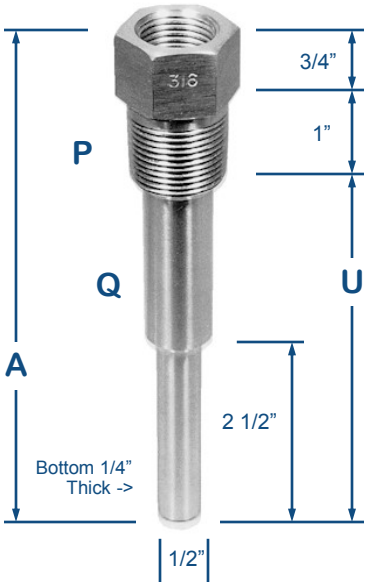


Nipple Extensions 5" Minimum

Substitute the ** in the part number with the nipple extension length in inches.

! Note: Any RTD assembly can be ordered without a union or spring loaded.

T030
Well



Note: MC in catalog numbers = Material Codes from this table

Material Selection Codes

Material	Code	Material	Code	Material	Code	Material	Code
304 Stainless	08	A105, Grade II	A2	Hastelloy B	HB	Nickel	NI
309 Stainless	18	Alloy 214	14	Hastelloy C	HC	Tantalum	TA
310 Stainless	20	Brass	BR	Incoloy	10	Titanium	TI
316 Stainless	16	Carbon Steel	CS	Inconel 600	09	Teflon	TF
347 Stainless	47	Carpenter 20	CA	Inconel 601	06	Other Materials available upon request.	
446 Stainless	07	F-11	11	Monel K	MK		
A105, Grade I	A1	F-22	22	Monel R	MR		

RTD Assembly - Sanitary Clamp Style Straight Thermowell - T190SFxx, Epoxy Coated Aluminum Head

- √ 316SS Straight Thermowell (#4 RMS Finish)
- √ 316SS 1/4" Dia. European Curve Element
- √ White Epoxy Coated Aluminum Head (NEMA 4)
- √ Max. Temp. 400°C (752°F) or High Temp. Option 650°C (1202°F)
- √ Sanitary Flange Process Connection
- √ 100Ω Resistance
- √ Spring Loaded Element
- √ Four Wire Lead Configuration
- √ ± 0.04% resistance or ±0.1°C Accuracy
- √ 316SS Hex Fitting

Sanitary Flanges T190SFxx and T191SFxx:

If you would like to add a Sanitary Flange (**SF**), add the following flange codes to the part numbers as below and on the next page:

SF16 = 1 inch. **SF24** = 1 1/2 inch. **SF32** = 2 inch. **SF40** = 2 1/2 inch. **SF48** = 3 inch. **SF56** = 3 1/2" **SF64** = 4 inch.

Thermocouple elements can be used in place of RTDs as well.

RTD Thermowell Assembly - Series T190 - ESH

Assembly Part Number	Ohms (Ω)	Curve (Alpha)	Flange	Insert Length (U)	Shank Dia. (Q)
4E1T190SF24MC01.5ESH 4E1T190SF24MC02.5ESH 4E1T190SF24MC04.5ESH 4E1T190SF24MC07.5ESH	100 Ω	European (0.00385)	1 1/2" Size (Clamp)	1 1/2" 2 1/2" 4 1/2" 7 1/2"	1/2" 1/2" 1/2" 1/2"
4E1T190SF32MC01.5ESH 4E1T190SF32MC02.5ESH 4E1T190SF32MC04.5ESH 4E1T190SF32MC07.5ESH	100 Ω	European (0.00385)	2" (Clamp)	1 1/2" 2 1/2" 4 1/2" 7 1/2"	1/2" 1/2" 1/2" 1/2"
4E1T190SF40MC01.5ESH 4E1T190SF40MC02.5ESH 4E1T190SF40MC04.5ESH 4E1T190SF40MC07.5ESH	100 Ω	European (0.00385)	2 1/2" (Clamp)	1 1/2" 2 1/2" 4 1/2" 7 1/2"	1/2" 1/2" 1/2" 1/2"
4E1T190SF56MC01.5ESH 4E1T190SF56MC02.5ESH 4E1T190SF56MC04.5ESH 4E1T190SF56MC07.5ESH	100 Ω	European (0.00385)	3 1/2" (Clamp)	1 1/2" 2 1/2" 4 1/2" 7 1/2"	1/2" 1/2" 1/2" 1/2"
4E1T190SF64MC01.5ESH 4E1T190SF64MC02.5ESH 4E1T190SF64MC04.5ESH 4E1T190SF64MC07.5ESH	100 Ω	European (0.00385)	4" (Clamp)	1 1/2" 2 1/2" 4 1/2" 7 1/2"	1/2" 1/2" 1/2" 1/2"

MC = Select Material Code from table on opposite page 316SS ("16') is standard.

√ Need To Customize Your Assembly? - Fine Tune The Part Number

After locating a standard part number, you can fine tune the assembly for your application. Substitute any "**MC**" charcters with your thermowell material code requirements. 316SS ("**16**") is standard. See also page 140 for further details.

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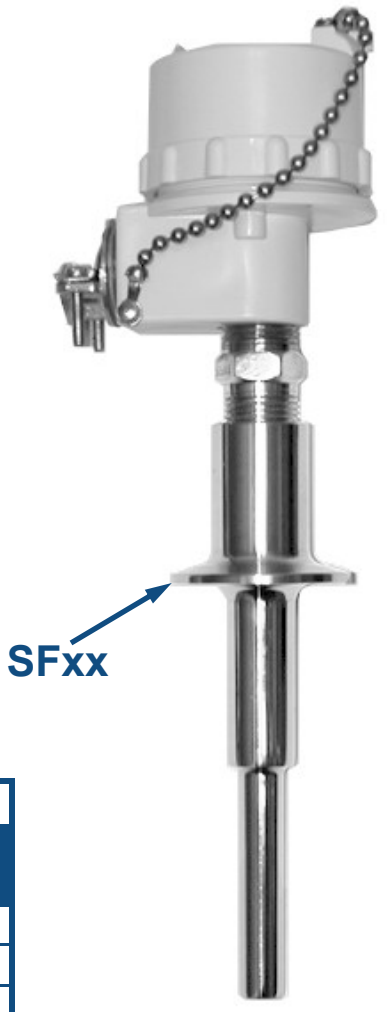
RTD Assembly - Sanitary Clamp Style Stepped Thermowell - T191SFxx: White FDA Approved Polypropylene Head (NEMA 4X)

- √ 316SS Stepped Thermowell (#4 RMS Finish)
- √ 316SS 1/4" Dia. European Curve Element
- √ White FDA Approved Polypropylene Head (NEMA 4X)
- √ Max. Temp. 400°C (752°F) or High Temp. Option 650°C (1202°F)
- √ Sanitary Flange Process Connection
- √ 100Ω Resistance
- √ Spring Loaded Element
- √ Four Wire Lead Configuration
- √ ± 0.04% resistance or ±0.1°C Accuracy
- √ 316SS Hex Fitting

RTD Thermowell Assembly - Series T191 - PSH

Assembly Part Number	Ohms (Ω)	Curve (Alpha)	Flange	Insert Length (U)	Shank Dia. (Q)
4E1T191SF24MC02.5PSH 4E1T191SF24MC04.0PSH 4E1T191SF24MC06.0PSH 4E1T191SF24MC07.5PSH	100 Ω	European (0.00385)	1 1/2" Size (Clamp)	2 1/2" 4" 6" 7 1/2"	1/2" 1/2" 1/2" 1/2"
4E1T191SF32MC02.5PSH 4E1T191SF32MC04.0PSH 4E1T191SF32MC06.0PSH 4E1T191SF32MC07.5PSH	100 Ω	European (0.00385)	2" (Clamp)	2 1/2" 4" 6" 7 1/2"	1/2" 1/2" 1/2" 1/2"
4E1T191SF40MC02.5PSH 4E1T191SF40MC04.0PSH 4E1T191SF40MC06.0PSH 4E1T191SF40MC07.5PSH	100 Ω	European (0.00385)	2 1/2" (Clamp)	2 1/2" 4" 6" 7 1/2"	1/2" 1/2" 1/2" 1/2"
4E1T191SF56MC02.5PSH 4E1T191SF56MC04.0PSH 4E1T191SF56MC06.0PSH 4E1T191SF56MC07.5PSH	100 Ω	European (0.00385)	3 1/2" (Clamp)	2 1/2" 4" 6" 7 1/2"	1/2" 1/2" 1/2" 1/2"
4E1T191SF64MC02.5PSH 4E1T191SF64MC04.0PSH 4E1T191SF64MC06.0PSH 4E1T191SF64MC07.5PSH	100 Ω	European (0.00385)	4" (Clamp)	2 1/2" 4" 6" 7 1/2"	1/2" 1/2" 1/2" 1/2"

MC = Select Material Code from table on opposite page 316 SS ("16') is standard.



Note: MC in catalog numbers = Material Codes from this table

Material Selection Codes

Material	Code	Material	Code	Material	Code	Material	Code
304 Stainless	08	A105, Grade II	A2	Hastelloy B	HB	Nickel	NI
309 Stainless	18	Alloy 214	14	Hastelloy C-276	HC	Tantalum	TA
310 Stainless	20	Brass	BR	Incoloy	10	Titanium	TI
316 Stainless	16	Carbon Steel	CS	Inconel 600	09	Teflon	TF
347 Stainless	47	Carpenter 20	CA	Inconel 601	06	Other Materials available upon request.	
446 Stainless	07	F-11	11	Monel K	MK		
A105, Grade I	A1	F-22	22	Monel R	MR		

Resistance Temperature Detectors (RTDs) - Platinum - Elements and Assemblies

√ 316SS 1/4" Dia. European Curve Element **√ 100Ω Resistance** **√ Four Wire Lead Configuration**

√ Max. Temp. 400°C (752°F) or High Temp. Option 650°C (1202°F) **√ ± 0.04% resistance or ±0.1°C Accuracy**

√ Need to Customize Your Assembly - Fine Tune the Part Number:

After locating a figure and part number, you can fine tune the sensor for your application. If you require an American curve sensor and not the European curve, change the "**E**" to an "**A**" in the part number. If you require a 500 **Ω** and not the standard 100 **Ω** sensor, change the "**11**" in the part number to "**51**". 1000 **Ω** sensors can be ordered by changing the "**11**" to an "**101**". Substitute any "**X**" and "**Y**" characters with your length requirements. RTDs are provided in four wire configurations as standard. This is the most accurate configuration. **Note:** if you are using a transmitter you may be only able to use a three wire sensor. This can be designated by changing the "**4**" in the part number to a "**3**". Two wire RTDs can be specified by changing the "**4**" with a "**2**" in the part number. **Note the RTD wiring configuration diagrams shown on page 149.**

The standard metal sheath for RTD elements is 1/4" diameter made of 316 stainless steel. Inconel 600 sheaths can be specified by changing the "**16**" in the part number to a "**09**". **Example part number: 4E164-11-12-24** is a four wire, European curve, 316 Stainless Steel 1/4 inch diameter sheath, 100 **Ω**,12" probe, 24" probe and leads overall.

Note: Richards standard RTD's have a maximum service temperature rating of **400°C** (**752°F**). Our high temperature RTD's have a maimum service temperature rating of **650°C** (**1202°F**). If you would like to specify this option, add a "**H**" after the curve designation letter (**A** or **E**) in the catalog number.

Example Part Number: 4EH164-11-12-24 is a High Temperature, four wire, European curve, 316 Stainless Steel 1/4 inch diameter sheath, 100 Ω, 12" probe, 24" probe and leads overall.

RTD Elements and Assemblies

	Description	Part Number	Ohms Ω	Curve (Alpha)	Sheath Material	Sheath Diameter Inches	Sheath Diameter mm
1	 1						
	Probe, Plain Plain Probe with Teflon Leads.	4E162-11-X-Y 4E163-11-X-Y 4E164-11-X-Y	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
2	 2						
	Probe, Compression Fitting Plain Probe with Teflon leads and a 316 Stainless Steel compression fitting (**CF**).	4E162-11-X-Y-CF 4E163-11-X-Y-CF 4E164-11-X-Y-CF	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
3	 3						
	Probe, Forward Facing Bushing Plain Probe with Teflon leads and a forward facing Bushing (**B**).	4E162-11-X-Y-B 4E163-11-X-Y-B 4E164-11-X-Y-B	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35

X = Overall Length. **Y** = Probe or insertion length. **Note:** For an Inconel sheath (Alloy #9), substitute the "**16**" in the part number with a "**9**". Other special alloys also available.

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Resistance Temperature Detectors (RTDs) - Platinum - Elements and Assemblies

√ **Need to order a Dual element or Assembly? -** Insert "**D**" after the "**E**" in the catalog number.
Example: **4ED164-1-12-24** **Note:** Other configurations are also available which may not be shown.

RTD Elements and Assemblies

	Description	Part Number	Ohms Ω	Curve (Alpha)	Sheath Material	Sheath Diameter Inches	Sheath Diameter mm
4	 **Probe, Rear Facing Bushing** Plain Probe with Teflon leads and a Rear facing Bushing (**RB**).	**4E162-11-X-Y-RB** **4E163-11-X-Y-RB** **4E164-11-X-Y-RB**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
5	 **Probe, 1/2" x 1/2" NPT Hex Fitting** Plain Probe with Teflon leads and 1/2" x 1/2" male NPT Hex Fitting (**HX**).	**4E162-11-X-Y-HX** **4E163-11-X-Y-HX** **4E164-11-X-Y-HX**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
6	 **Probe, Male Plug & Female Jack** Plain Probe with mating standard (Round 3 Pin) plastic male plug and standard female jack (**P3**).	**4E162-11-X-Y-P3** **4E163-11-X-Y-P3** **4E164-11-X-Y-P3**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
7	 **Probe, Mini Male Plug & Female Jack** Plain Probe with miniature (3 flat pin) plastic male plug and miniature female jack.	**4E162-11-X-Y-PM3** **4E163-11-X-Y-PM3** **4E164-11-X-Y-PM3**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
8	 **Probe, Quick Response Tip** Plain Probe with Teflon leads and a quick response tip (**QR**).	**4E162-11-X-Y-QR** **4E163-11-X-Y-QR** **4E164-11-X-Y-QR**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35

X = Overall Length. **Y** = Probe or insertion length. **Note:** For an Inconel sheath (Alloy #9), substitute the "**16**" in the part number with a "**9**". Other special alloys also available.

Resistance Temperature Detectors (RTD's) - Platinum - Elements and Assemblies

√ 316SS 1/4" Dia. European Curve Element √ 100Ω Resistance √ Four Wire Lead Configuration

√ Max. Temp. 400°C (752°F) or High Temp. Option 650°C (1202°F) √ ± 0.04% resistance or ±0.1°C Accuracy

√ Need to Customize Your Assembly - Fine Tune the Part Number:

After locating a figure and part number, you can fine tune the sensor for your application. If you require an American curve sensor and not the European curve, change the "**E**" to an "**A**" in the part number. If you require a 500 **Ω** and not the standard 100 **Ω** sensor, change the "**11**" in the part number to "**51**". 1000 **Ω** sensors can be ordered by changing the "**11**" to an "**101**". Substitute any "**X**" and "**Y**" characters with your length requirements. RTDs are provided in four wire configurations as standard. This is the most accurate configuration. **Note:** if you are using a transmitter you may be only able to use a three wire sensor. This can be designated by changing the "**4**" in the part number to a "**3**". Two wire RTDs can be specified by changing the "**4**" with a "**2**" in the part number. **Note the RTD wiring configuration diagrams shown on page 149.** The standard metal sheath for RTD elements is 1/4" diameter made of 316 stainless steel. Inconel 600 sheaths can be specified by changing the "**16**" in the part number to a "**09**". **Example part number:** **4E164-11-12-24** is a four wire, European curve, 316 Stainless Steel 1/4 inch diameter sheath, 100 **Ω,** 12" probe, 24" probe and leads overall.

Note: Richards standard RTDs have a maximum service temperature rating of **400°C** (**752°F**). Our high temperature RTDs have a maimum service temperature rating of **650°C** (**1202°F**). If you would like to specify this option, add a "**H**" after the curve designation letter (**A** or **E**) in the catalog number.

Example Part Number: **4EH164-11-12-24** is a High Temperature, Four wire, European curve, 316 Stainless Steel 1/4 inch diameter sheath, 100 **Ω,** 12" probe, 24" probe and leads overall.

RTD Elements and Assemblies

	Description	Part Number	Ohms Ω	Curve (Alpha)	Sheath Material	Sheath Diameter Inches	Sheath Diameter mm
1	 1						
	Probe, Reduced Tip Plain Probe with Teflon leads and reduced diameter hot end to increase the temperature	**4E162-11-X-Y-RE** **4E163-11-X-Y-RE** **4E164-11-X-Y-RE**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
2	 2						
	Probe, Spring Loaded Plain Probe with Teflon leads and spring load sleeve assembly (**SP**).	**4E162-11-X-Y-SP** **4E163-11-X-Y-SP** **4E164-11-X-Y-SP**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
3	 3						
	Probe, Flexible Armored Extension Plain Probe with Teflon leads and 316 stainless steel flexible armored extension (**FEZ**).	**4E162-11-X-Y-FEZ** **4E163-11-X-Y-FEZ** **4E164-11-X-Y-FEZ**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35

X = Overall Length. **Y** = Probe or insertion length.
Note: For an Inconel sheath (Alloy #9), substitute the "**16**" in the part number with a "**9**". Other special alloys also available.

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Resistance Temperature Detectors (RTDs) - Platinum - Elements and Assemblies

√ **Need to order a Dual element or Assembly? -** Insert "**D**" after the "**E**" in the catalog number.
Example: **4ED164-1-12-24** **Note:** Other configurations are also available which may not be shown.

RTD Elements and Assemblies

	Description	Part Number	Ohms Ω	Curve (Alpha)	Sheath Material	Sheath Diameter Inches	Sheath Diameter mm
4	 **Probe, Miniature Steel Head (MSH)** Plain Probe with miniature steel connection head.	4E162-11-X-Y-MSH 4E163-11-X-Y-MSH 4E164-11-X-Y-MSH	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
5	 **Probe, Compression Fitting (CF) and Standard Head (SH)** Plain Probe with stainless steel Compression Fitting (**CF**) and Aluminum Standard Head (**SH**).	4E162-11-X-Y-CF-SH 4E163-11-X-Y-CF-SH 4E164-11-X-Y-CF-SH	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
6	 **Probe, Hex Fitting (HX) and Standard Head (SH)** Plain Probe with stainless steel Compression Fitting (**HX**) and Aluminum Standard Head (**SH**).	4E162-11-X-Y-HX-SH 4E163-11-X-Y-HX-SH 4E164-11-X-Y-HX-SH	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35

X = Overall Length. **Y** = Probe or insertion length. **Z** = Flexible Armored Lead length
Note: For an Inconel sheath (Alloy #9), substitute the "**16**" in the part number with a "**9**". Other special alloys also available.

Resistance Temperature Detectors (RTD's) - Platinum - Elements and Assemblies

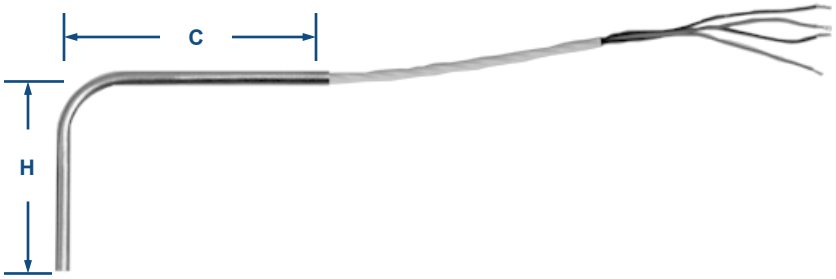
RTD Lead Wire - Fiberglass (GG) and Extruded Teflon® (TT-ex)

Part Number	Wire Gauge	Wire Form	Wires	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Nominal Size Inches	Nominal Size mm
24RTD3-GG-S	24	Stranded Nickel	3	Fiberglass	Fiberglass	900	482	.092	2.34
24RTD4-GG-S	24	Plated copper	4	Fiberglass	Fiberglass	900	482	.101	2.57
24RTD3-TT-ex-S	24	Stranded Nickel	3	Teflon FEP Extruded	Teflon FEP Extruded	400	204	.108	2.74
24RTD4-TT-ex-S	24	Plated copper	4	Teflon FEP Extruded	Teflon FEP Extruded	400	204	.119	3.02

Color Codes: 3 Wire Cable: Conductors - Two RED and one White, Outer Jacket - WHITE
4 Wire Cable: Conductors - Two RED and two White, Outer Jacket - WHITE

Other insulation types and six wire RTD cables are also available. Phone one of our sales engineers for details.

RTD and Assemblies - Bent Probes and Bayonet Fittings

	Description	Part Number	Ohms Ω	Curve (Alpha)	Sheath Material	Sheath Inches	Diameter mm
1	 1 **Probe, 90° Bend** Plain 90° bent probe with Teflon leads.	4E162-B90-11-X--H-C 4E163-B90-11-X-H-C 4E164-B90-11-X-H-C	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
2	 2 **Probe, 45° Bend** Plain 45° bent probe with Teflon leads .	4E162-B45-11-X-H-C 4E163-B45-11-X-H-C 4E164-B45-11-X-H-C	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35

X = Overall Length including leads. **Y** = Probe or insertion length. **C** = Cold Leg Length. **H** = Hot Leg Length.
Note: For an Inconel sheath (Alloy #9), substitute the "**16**" in the part number with a "**9**". Other special alloys also available.

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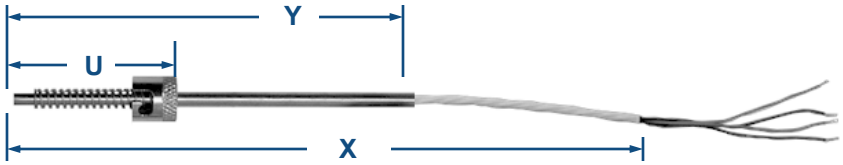
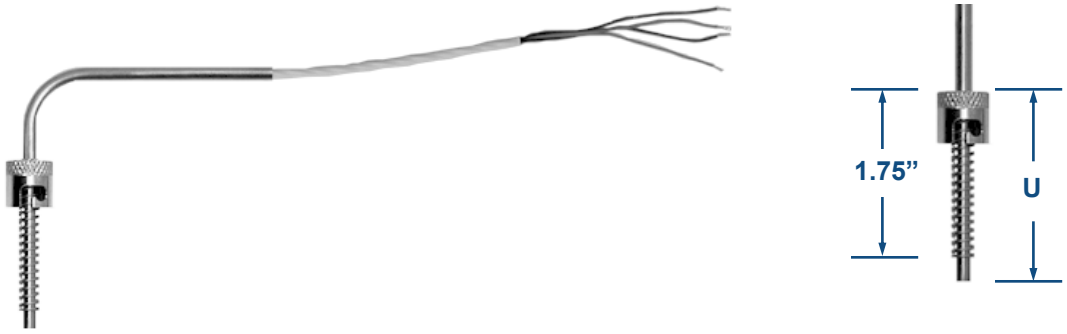
Resistance Temperature Detectors (RTD's) - Platinum - Elements and Assemblies

RTD and Assemblies - Bayonet Fittings

	Description	Part Number	Ohms	Curve	Sheath	Sheath Diameter	
1	 1 **Probe, Straight, Bayonet Fitting** Plain Probe with Teflon leads and Bayonet Fitting (**BFU**). "U" Length is from top of cap to tip of probe.	**4E162-11-X-Y-BFU** **4E163-11-X-Y-BFU** **4E164-11-X-Y-BFU**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
2	 2 **Probe, 90° Bend** Plain 90° bent probe with Teflon leads and Bayonet Fitting (**BFU**). "U" Length is from top of cap to tip of probe.	**4E162-B90-11-X-Y-BFU** **4E163-B90-11-X-Y-BFU** **4E164-B90-11-X-Y-BFU**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35
3	 3 **Probe, 45° Bend** Plain 45° bent probe with Teflon leads and Bayonet Fitting (**BFU**). "U" Length is from top of cap to tip of probe.	**4E162-B45-11-X-Y-BFU** **4E163-B45-11-X-Y-BFU** **4E164-B45-11-X-Y-BFU**	100 Ω	European (0.00385)	316 Stainless Steel	1/8" (.125) 3/16" (.188) 1/4" (.250)	3.18 4.76 6.35

X = Overall Length including leads. **Y** = Probe or insertion length. **C** = Cold Leg Length. **H** = Hot Leg Length.
Note: For an Inconel sheath (Alloy #9), substitute the "**16**" in the part number with a "**9**". Other special alloys also available.

Resistance Temperature Detectors (RTD's) - Platinum - 3 Pin Plugs and Jacks

RTD Standard Style - Round Pins (Solid)

Number	Type	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
P1	Uncompensated standard size male plug for RTDs. Three solid round copper polarized pins.	White	.49	12.25	1.46	37.08	2.08	52.83
			Male Plug 1 					
P2	Uncompensated standard size female jack for RTDs. Three solid round copper polarized sockets.	White	.49	12.45	1.46	37.08	1.52	38.60
			Female Jack 2 					

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 350°F (175°C). Plugs have three round, solid, copper, polarized pins.
To order both Plug and Jack specify P3 (P1 + P2)

RTD Miniature Style - Flat Pins

Number	Type	Color	Height inches	Height mm	Width inches	Width mm	Length inches	Length mm
PM1	Uncompensated miniature size male plug for RTDs. Three solid flat copper polarized pins.	White	.32	8.13	1.11	28.19	1.63	41.40
			Male Plug 3 					
PM2	Uncompensated miniature size female jack for RTDs. Three solid flat copper polarized sockets.	White	.32	8.13	1.11	28.19	1.15	29.21
			Female Jack 4 					

For 20 Gauge (.81 mm) or smaller wires. Maximum temperature 350°F (175°C). Plugs have three flat, solid, copper, polarized pins.
To order both Plug and Jack specify PM3 (PM1 + PM2)

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Heater Wire - Type A (80%) and Type C (60%)

The **Richards** **NWA** or Type A heater wire is composed of 80% Nickel and 20% Chromium. It has a *lower* temperature coefficient of resistance when compared to Type C wire. Type A has a usable temperature range up to **1150°C** or **2100°F**. Our **NWC** or Type C is composed of 60% Nickel, 16% Chromium, and 24% Iron. The Type C has a usable temperature range up to **1000°C** or **1850°F**. It has a *higher* coefficient of resistance than the Type A. Both types have excellent corrosion resistance. The Type C wire is very useful in applications where a high resistance is required within a limited space. In heating and technical applications, the Type A is most commonly used.

Gauges		
Wire Gauge	Inches	MM
0	0.410	10.414
0	0.365	9.271
0	0.325	8.255
1	0.289	7.341
2	0.258	6.553
3	0.229	5.817
4	0.204	5.182
5	0.182	4.623
6	0.162	4.115
7	0.144	3.658
8	0.128	3.251
9	0.114	2.896
10	0.102	2.591
11	0.091	2.311
12	0.081	2.057
13	0.072	1.829
14	0.064	1.626
15	0.057	1.448
16	0.051	1.295
17	0.045	1.143
18	0.040	1.016
19	0.0360	0.9140
20	0.0320	0.8130
21	0.0285	0.7239
22	0.0253	0.6426
23	0.0226	0.5740
24	0.0201	0.5105
25	0.0179	0.4547
26	0.0159	0.4039
27	0.0142	0.3607
28	0.0126	0.3200
29	0.0113	0.2870
30	0.0100	0.2540
31	0.0089	0.2261
32	0.0080	0.2032
33	0.0071	0.1803
34	0.0063	0.1600
35	0.0056	0.1422
36	0.0050	0.1270
37	0.0045	0.1143
38	0.0040	0.1016
39	0.0035	0.0889
40	0.00310	0.0787
41	0.00275	0.0699
42	0.00250	0.0635
43	0.00225	0.0672
44	0.00200	0.0508
45	0.00175	0.0445
46	0.00150	0.0381

Type A (80% Nickel)		
Type A Part Number	Ohms / Foot	Feet / Pound
NWA910	0.003867	2.077
NWA920	0.004879	2.621
NWA930	0.006154	3.305
NWA010	0.007782	4.180
NWA020	0.009765	5.245
NWA030	0.01240	6.658
NWA040	0.01562	8.390
NWA050	0.01962	10.54
NWA060	0.02477	13.30
NWA070	0.03135	16.84
NWA080	0.03967	21.31
NWA090	0.05002	26.87
NWA100	0.06248	33.56
NWA110	0.07849	42.16
NWA120	0.09907	53.21
NWA130	0.01254	67.35
NWA140	0.01587	85.24
NWA150	0.2001	107.50
NWA160	0.2499	134.20
NWA170	0.3210	172.40
NWA180	0.4063	218.20
NWA190	0.5015	269.40
NWA200	0.6348	341.00
NWA210	0.8002	429.80
NWA220	1.015	545.50
NWA230	1.273	683.60
NWA240	1.609	864.20
NWA250	2.029	1090
NWA260	2.571	1381
NWA270	3.224	1731
NWA280	4.094	2199
NWA290	5.090	2734
NWA300	6.500	3491
NWA310	8.206	4408
NWA320	10.160	5455
NWA330	12.890	5626
NWA340	16.380	8797
NWA350	20.730	11130
NWA360	26.000	13970
NWA370	32.100	17240
NWA380	40.630	21820
NWA390	53.060	28500
NWA400	67.640	36330
NWA410	85.950	46170
NWA420	104.000	55860
NWA430	128.400	68970
NWA440	162.500	87280
NWA450	212.00	114000
NWA460	288.900	155200

Type C (60% Nickel)		
Type C Part Number	Ohms / Foot	Feet / Pound
NWC910	0.004015	2.119
NWC920	0.005067	2.673
NWC930	0.006391	3.372
NWC010	0.008082	4.264
NWC020	0.01014	5.351
NWC030	0.01287	6.792
NWC040	0.01622	8.559
NWC050	0.02038	10.75
NWC060	0.02572	13.57
NWC070	0.03255	17.18
NWC080	0.04120	21.74
NWC090	0.05194	17.41
NWC100	0.06488	34.23
NWC110	0.08151	43.01
NWC120	0.1029	54.29
NWC130	0.1302	68.71
NWC140	0.1648	86.96
NWC150	0.2078	109.6
NWC160	0.2595	136.9
NWC170	0.3333	175.9
NWC180	0.4219	222.6
NWC190	0.5208	274.8
NWC200	0.6592	347.8
NWC210	0.831	438.5
NWC220	1.055	556.4
NWC230	1.322	697.3
NWC240	1.671	881.6
NWC250	2.107	1112
NWC260	2.670	1409
NWC270	3.348	1766
NWC280	4.252	2243
NWC290	5.286	2289
NWC300	6.750	3562
NWC310	8.522	4497
NWC320	10.55	5565
NWC330	13.39	7065
NWC340	17.01	8974
NWC350	21.52	11360
NWC360	27.00	14250
NWC370	33.33	17590
NWC380	42.19	22260
NWC390	55.10	29080
NWC400	70.24	37060
NWC410	89.26	47100
NWC420	108.00	55990
NWC430	133.30	70350
NWC440	168.80	89040
NWC450	220.40	116300
NWC460	300.00	158300

RICHARDS®
Arklay S. Richards Co., Inc.

Heater Ribbon - Type A (80% Nickel and 20% Chromium)

The Arklay S. Richards Co., Inc. offers two types of resistance heating ribbon. The **Richards NRA** or Type A heater ribbon is composed of 80% Nickel and 20% Chromium. It has a *lower* temperature coefficient of resistance when compared to Type C ribbon. The Type A has a usable temperature range up to **1150°C** or **2100°F**. Our **NRC** or Type C is composed of 60% Nickel, 16% Chromium, and 24% Iron. The Type C has a usable temperature range up to **1000°C** or **1850°F**. It has a *higher* coefficient of resistance than the Type A. Both types have excellent corrosion resistance. The Type C wire is very useful in applications where a high resistance is required within a limited space. In heating and technical applications, the Type A is most commonly used. The values in the chart are Ohms / foot.

Use the chart below to build a part number. For Type A take **NRA** plus Code 1 (thickness) and Code 2 (width) for the desired type, thickness and width. **Example:** Type A 0.0100 thick x 1/8" wide = **NRA2108.** For Type C change the "**A**" to a "**C**".

Heater Ribbon - Type A (80% Nickel, 20% Chromium)

Part Number = NRA + Code 1 & Code 2			.0156 in 1/64 in .397 mm	.0312 in 1/32 in .794 mm	.0625 in 1/16 in 1.59 mm	.0937 in 3/32 in 2.38 mm	.1250 in 1/8 in 3.18 mm	.1875 in 3/16 in 4.76 mm	.2500 in 1/4 in 6.35 mm	.3750 in 3/8 in 9.53 mm	.5000 in 1/2 in 12.7 mm	.6250 in 5/8 in 15.88 mm	.7500 in 3/4 in 19.05 mm	1.000 in 1 in 25.4 mm
THICKNESS			CODE 2 - WIDTHS											
C	Inches	mm	01	02	03	06	08	12	16	24	32	40	48	64
0	0.102	2.59							.02128	.01333	.01000	.008000	.006667	.005000
0	0.091	2.31							.02385	.01495	.01121	.008967	.007473	.005604
0	0.081	2.06							.02679	.01679	.01259	.01007	.008395	.006296
0	0.072	1.83							.03014	.01889	.01417	.01133	.009444	.007083
0	0.064	1.63						.04521	.03391	.02125	.01594	.01275	.01063	.007969
0	0.057	1.45						.05077	.03807	.02386	.01790	.01432	.01193	.008947
0	0.051	1.295						.05674	.04255	.02667	.02000	.01600	.01333	.01000
0	0.045	1.143						.06430	.04823	.03022	.02267	.01813	.01517	.01133
0	0.040	1.016					.1085	.07234	.05426	.03400	.02550	.02040	.01700	.01275
1	0.036	0.914					.1206	.08038	.06028	.03778	.02833	.02267	.01889	.01417
1	0.032	0.813					.1356	.09043	.06782	.04250	.03188	.02550	.02125	.01594
1	0.0285	0.724					.1523	.1015	.07615	.04772	.03579	.02863	.02386	.01790
1	0.0253	0.6426					.1716	.1144	.08578	.05376	.04032	.03225	.02688	.02016
1	0.0226	0.5740					.1921	.1204	.09027	.06018	.04513	.03611	.03009	.02257
1	0.0201	0.5105			.4319	.2879	.2159	.1353	.11015	.06766	.05075	.04060	.03383	.02537
1	0.0179	0.4547			.4850	.3233	.2425	.1520	.1140	.07598	.05698	.04559	.03799	.02849
1	0.0159	0.4039		1.092	.5460	.3640	.2730	.1711	.1283	.08554	.06415	.05232	.04277	.03208
1	0.0142	0.3607		1.223	.6113	.4076	.3057	.1915	.1437	.09578	.07183	.05747	.04789	.03592
1	0.0126	0.3200		1.378	.6890	.4593	.3445	.2159	.1619	.1079	.08095	.06476	.05397	.04048
2	0.0113	0.2870		1.536	.7682	.5121	.3841	.2407	.1805	.1204	.09027	.07221	.06018	.04513
2	0.0100	0.2540	3.472	1.736	.8681	.5787	.4340	.2720	.2040	.1360	.1020	.08180	.06800	.05100
2	0.0089	0.2261	3.902	1.951	.9754	.6503	.4877	.3056	.2292	.1528	.1146	.09169	.07640	.05730
2	0.0080	0.2032	4.340	2.170	1.085	.7234	.6145	.3400	.2550	.1700	.1275	.1020	.08500	.06375
2	0.0071	0.1803	4.891	2.445	1.223	.8151	.6923	.3831	.2873	.1915	.1437	.1149	.09578	.07183
2	0.0063	0.1600	5.512	2.756	1.378	.9186	.7803	.4317	.3238	.2159	.1619	.1295	.1079	.08095
2	0.0056	0.1422	6.201	3.100	1.550	1.170	.8778	.4857	.3643	.2429	.1821	.1457	.1214	.09107
2	0.0050	0.1270	6.945	3.472	1.736	1.311	.9831	.5440	.4080	.2720	.2040	.1632	.1360	.1020
2	0.0045	0.1143	7.716	3.858	1.929	1.456	1.092	.6044	.4533	.3022	.2267	.1813	.1511	.1133
2	0.0040	0.1016	8.681	4.340	2.458	1.639	1.229	.6800	.5100	.3400	.2550	.2040	.1700	.1275
3	0.0035	0.0889	9.921	4.960	2.809	1.873	1.404	.7771	.5829	.3886	.2914	.2331	.1943	.1457
3	0.0031	0.0787	11.20	5.601	3.171	2.114	1.586	.8774	.6581	.4387	.3290	.2632	.2194	.1645
3	0.00275	0.0699	12.63	6.313	3.575	2.383	1.788	.9891	.7418	.4945	.3709	.2967	.2473	.1855
3	0.00250	0.0635	13.89	6.945	3.933	2.622	1.966	1.088	.8160	.5440	.4080	.3264	.2720	.2040
3	0.00225	0.0559	15.43	7.716	4.369	2.913	2.185	1.209	.9067	.6044	.4533	.3627	.3022	.2267
3	0.00200	0.0508	17.36	9.831	4.916	3.277	2.458	1.360	1.020	.6800	.5100	.4080	.3400	.2550

Phone: 617.527.4385 Fax: 617.964.3746 Email: sales@asrichards.com

Phone: 617.527.4385 *Fax: 617.964.3746* *Email: sales@asrichards.com*

Heater Ribbon - Type C (60% Nickel, 16% Chromium, 24% Iron)

Heater Ribbon - S specifications

Type A - √ **Resistivity** - 510 Ohms / square mil foot at 68°F (20°C) √ **Density -** 0.3039 pounds /cubic inch

Type C - √ **Resistivity** - 530 Ohms / square mil foot at 68°F (20°C) √ **Density -** 0.2979 pounds /cubic inch

Note: all ribbon sizes listed in the shaded areas of the tables are rolled from flats and are considered to have true rectangular cross-sections. Ribbons in the white areas, however, are rolled from wire and have round edges. Therefore, the values shown for these sizes have been calculated in accordance with ASTM recommendations.

Heater Ribbon - Type C (60% Nickel, 16% Chromium, 24% Iron)

Part Number = NRC + Code 1 & Code 2			.0156 in 1/64 in .397 mm	.0312 in 1/32 in .794 mm	.0625 in 1/16 in 1.59 mm	.0937 in 3/32 in 2.38 mm	.1250 in 1/8 in 3.18 mm	.1875 in 3/16 in 4.76 mm	.2500 in 1/4 in 6.35 mm	.3750 in 3/8 in 9.53 mm	.5000 in 1/2 in 12.7 mm	.6250 in 5/8 in 15.88 mm	.7500 in 3/4 in 19.05 mm	1.000 in 1 in 25.4 mm
THICKNESS			CODE 2 - WIDTHS											
Code 1	Inches	mm	01	02	03	06	08	12	16	24	32	40	48	64
01	0.102	2.59							.02211	.01386	.01039	.008314	.006928	.005196
02	0.091	2.31							.02478	.01553	.01165	.009319	.007766	.005824
03	0.081	2.06							.02784	.01745	.01309	.01047	.008724	.006543
04	0.072	1.83							.03132	.01963	.01472	.01178	.009815	.007361
05	0.064	1.63						.04699	.03524	.02208	.01656	.01325	.01104	.008281
06	0.057	1.45						.05276	.03957	.02480	.01860	.01488	.01240	.009298
07	0.051	1.295						.05896	.04422	.02771	.02078	.01663	.01386	.01039
08	0.045	1.143						.06682	.05012	.03141	.02356	.01884	.01570	.01178
09	0.040	1.016					.1128	.07518	.05638	.03533	.02650	.02120	.01767	.01325
10	0.036	0.914					.1253	.08353	.06265	.03926	.02944	.02356	.01963	.01472
11	0.032	0.813					.1410	.09397	.07048	.04417	0.3313	.02650	.02208	.01656
12	0.0285	0.724					.1583	.1055	.07913	.04959	.03719	.02975	.02480	.01860
13	0.0253	0.6426					.1783	.1189	.08914	.05586	.04190	.03352	.02793	.02095
14	0.0226	0.5740					.1996	.1251	.09381	.06254	.04690	.03752	.03127	.02345
15	0.0201	0.5105			.4488	.2992	.2244	.1406	.1055	.07032	.05274	.04219	.03516	.02637
16	0.0179	0.4547			.5040	.3360	.2520	.1579	.1184	.07896	.05922	.04737	.03948	.02961
17	0.0159	0.4039		1.135	.5674	.3783	.2837	.1778	.1333	.08889	.06667	.05333	.04444	.03333
18	0.0142	0.3607		1.271	.6353	.4235	.3177	.1991	.1493	.09953	.07465	.05972	.04977	.03732
19	0.0126	0.3200		1.432	.7160	.4773	.3580	.2243	.1683	.1122	.08413	.06730	.05609	.04006
20	0.0113	0.2870		1.597	.7983	.5322	.3992	.2501	.1876	.1251	.09381	.07504	.06254	.04690
21	0.0100	0.2540	3.609	1.804	.9021	.6014	.4511	.2827	.2120	.1413	.1060	.08480	.07067	.05300
22	0.0089	0.2261	4.055	2.027	1.014	.6758	.5068	.3176	.2382	.1588	.1191	.09528	.07940	.05955
23	0.0080	0.2032	4.511	2.255	1.128	.7518	.6386	.3533	.2650	.1767	.1325	.1060	.08833	.06625
24	0.0071	0.1803	5.082	2.541	1.271	.8471	.7195	.3981	.2886	.1991	.1493	.1194	.09953	.07465
25	0.0063	0.1600	5.728	2.864	1.432	.9546	.8109	.4487	.3365	.2243	.1683	.1346	.1122	.0841
26	0.0056	0.1422	6.444	3.222	1.611	1.216	.9122	.5048	.3786	.2524	.1893	.1514	.1262	.09464
27	0.0050	0.1270	7.217	3.609	1.804	1.362	1.022	.5653	.4240	.2627	.2120	.1696	.1413	.1060
28	0.0045	0.1143	8.019	4.009	2.005	1.514	1.135	.6281	.4711	.3141	.2356	.1884	.1570	.1178
29	0.0040	0.1016	9.021	4.511	2.554	1.703	1.277	.7067	.5300	.3533	.2650	.2120	.1767	.1325
30	0.0035	0.0889	10.31	5.155	2.919	1.946	1.460	.8076	.6057	.4038	.3029	.2423	.2019	.1514
31	0.0031	0.0787	11.64	5.820	3.296	2.197	1.648	.9118	.6839	.4559	.3419	.2735	.2280	.1710
32	0.0027	0.0699	13.12	6.561	3.715	2.477	1.858	1.028	.7709	.5139	.3855	.3084	.2570	.1927
33	0.0025	0.0635	14.43	7.271	4.087	2.724	2.043	1.131	.8480	.5653	.4240	.3392	.2827	.2120
34	0.0022	0.0559	16.04	8.019	4.541	3.027	2.270	1.256	.9422	.6281	.4711	.3769	.3141	.2356
35	0.0020	0.0508	18.04	10.22	5.108	3.406	2.554	1.413	1.060	.7067	.5300	.4240	.3533	.2650

Transmitters - In Head Style, Wiring - Factory Programmed

The **Richards** **TS** and **TSI** series transmitters are available for both thermocouples and RTD inputs. The thermocouple inputs cover all standard calibrations. RTD inputs cover three and four wire, PT100, alpha 0.00385 (European or DIN Standard) and three and four wire alpha 0.003916 (American Standard) sensors The output is temperature linearized 4-20 mA VDC. All of our transmitters are 2 wire looped powered. **TS** and **TSI** series transmitters can be mounted in the following DIN-B compatible connection Heads: **ASLH**, **SH**, **AFTH**, **WH**, **CIH**, **EXSHT**, **NH**, and **PPSH**.

Part Number Construction:

√ **1)** Select the series **TS** (Isolated) or **TSI** (non-Isolated).

√ **2)** Select your sensor Type: **Thermocouples** B, C (AE), E, J, K, N, R, S, T
RTDs PTE (European Curve), or PTA (American Curve)

√ **3)** Select your temperature span.

√ **4)** Select your degrees Celsius or Fahrenheit.

Example (Thermocouple): **TSK500-1000F** (Non-Isolated, Type K thermocouple, Span 500-1000°F)

Example (RTD): **TSIPTE0-500C** (Non-Isolated, Pt100, European Curve, RTD, Span 0-500°C)

! **Note: When using thermocouples with grounded junctions, be sure to use our TSI series transmitters.**

See transmitter wiring hook-ups on pages 170 and 171

Transmitters - TS and TSI - In Connection Head or 35 mm DIN Rail Mount

Specifications	Descriptions	Figure
RTD Inputs - 0.00385 (E) or 0.00392(A)	Three wire sensor: -200 to 1000°C or -328 to 1832°F	
Thermocouple inputs:	B, C (AE), E, J, K, N, R, S, and T	
Maximum sensor wire resistance	25 Ohms / Wire	
Sensor Failure Monitoring	Upscale or Downscale	
Output, Analog	4-20 mA DC, temperature linear	
Ambient Storage and Operation Temperature	140 to 85°C or –40 to 185°F	
Isolation In / Out	**TS** (Non-isolated) **TSI** (Isolated)	
Power Supply	8-6 VDS, 2 wire	
Accuracy-RTDs	±0.2%	
Accuracy Thermocouples	±0.3%	
Cold Junction Compensation for Thermocou-	±0.5%°C or ±0.9%°F	
Housing Construction	PC and ABS plastic	
Mounting	DIN-B size Connection Head, DIN Rail with Kit.	
Connection	Single or stranded 16 AWG wire	
Weight	50 grams (1.76 ounces)	

TS

TSI

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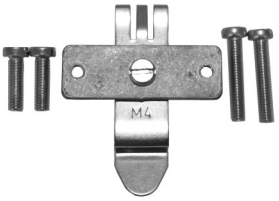
Transmitters (TSDR) and (TSIDR) DIN Rail Mount -

Part Number	General Description	Figure
TSDR TSIDR	TSDR non-isolated and TSIDR isolated transmitters for mounting to a standard 35 mm DIN Rail (DIN 50022).	 1 TSDR

Din Rail Mounting Kit - 35mm

Part Number	General Description	Figure
DRMK-100	35 mm DIN Rail Mounting Kit - For mounting TS and TSI Series round In head transmitters to a 35 mm DIN Rail (DIN 50022).	 2 DRMK

DC Power Supplies -

Part Number	General Description
Consult Factory	Transmitter Power Supply - 115 / 230 VAC, supplies power for up to four 2-wire, 4-20 mA Transmitters, all four loops are galvanically isolated, maximum output current of 30 mA with a short circuit protection of 35 mA maximum output - Wall or 35 mm DIN Rail Mount (DIN 50022).

Instrument Cable - Copper Wire (Not for Thermocouples)

Part Number	Wire Gauge	Type Wire	No. Pairs	Wire Insulation	Jacket Insulation	Max. °F	Max. °C	Lbs./ 1000 Ft.	Kgs,/ Kilometer	Nominal Size Inches	Nominal Size mm
16I01-PP-S	16	Stranded	1	Polyvinyl Plastic	Polyvinyl Plastic	Single	Single	54	79.9	.270	6.86
20I01-PP-S	20	Stranded	1	Polyvinyl Plastic	Polyvinyl Plastic	194	90	20	29.8	.226	5.74
20I02-PP-S	20	Stranded	2	Polyvinyl Plastic	Polyvinyl Plastic			63	93.2	.385	9.78
20I04-PP-S	20	Stranded	4	Polyvinyl Plastic	Polyvinyl Plastic	Overall	Overall	105	156.4	.455	11.56
20I08-PP-S	20	Stranded	8	Polyvinyl Plastic	Polyvinyl Plastic	176	80	174	257.5	.570	14.48
20I12-PP-S	20	Stranded	12	Polyvinyl Plastic	Polyvinyl Plastic			241	356.7	.685	17.40
20I16-PP-S	20	Stranded	16	Polyvinyl Plastic	Polyvinyl Plastic			318	470.8	.765	19.43
20I24-PP-S	20	Stranded	24	Polyvinyl Plastic	Polyvinyl Plastic			450	666.0	.915	23.24

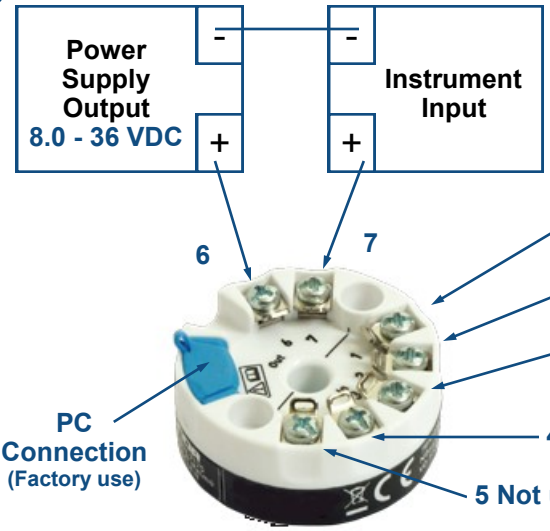
Transmitters - In Head Style, Wiring - Non-Isolated Transmitter - TS

Transmitter Wiring - TS Types

The typical wiring for the **TS** series transmitters is shown below. The system would include a transmitter, power supply and digital instrument. If you have any difficulties with setting up your transmitter, our sales engineers are available to provide technical support.

RTDs may have different color coding than our standard Black, Black, Red, and Red. As a general rule, for 3 wire RTDs, connect two of the like colors to terminal #1 and #2 and one of the second colors to terminal #3 (The remaining wire can be cut off or taped back). For 4 wire RTDs, connect the second two like color wires to terminals #3 and #4. To connect the transmitter to your instrument and power supply, use our part number **20I02-PP-S** (see page 169) and attach the instrument wire on terminals #5 and #6.

Note: When wiring your transmitter the **NEGATIVE** wire of a thermocouple is always coded **RED.**



4 wire RTD Hookup - TS

Factory Configured Non - Isolated

3 Wire RTDs use terminals 1, 2, & 3

4 wire RTDS use terminals 1, 2, 3, & 4

Power Supply 8.0 - 36 VDC

Ambient temperature range:
-40 to +185°F

DIN head mount

Size 1.75” Diameter x 1.08” tall

Permissible R Load =
Supply Voltage (VDC) -8/0.022

Factory Configured Non - Isolated

Thermocouples:
B, C (AE), E, J, K, N, R, S, T

Thermocouples use terminals 1 & 2

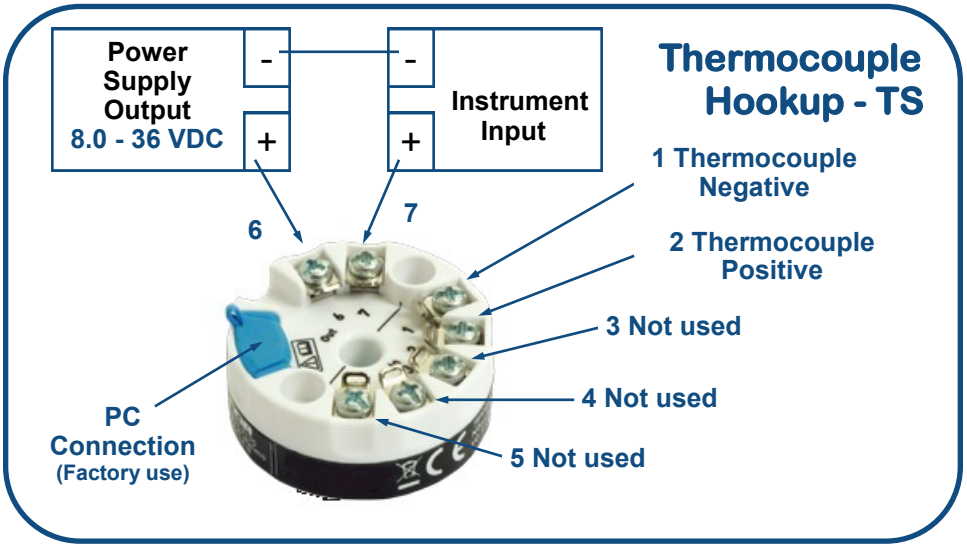
Power Supply 8.0 - 36 VDC

Ambient temperature range:
-40 to +185°F

DIN head mount

Size 1.75” Diameter x 1.08” tall

Permissible R Load =
Supply Voltage (VDC) -8/0.022



Thermocouple Hookup - TS

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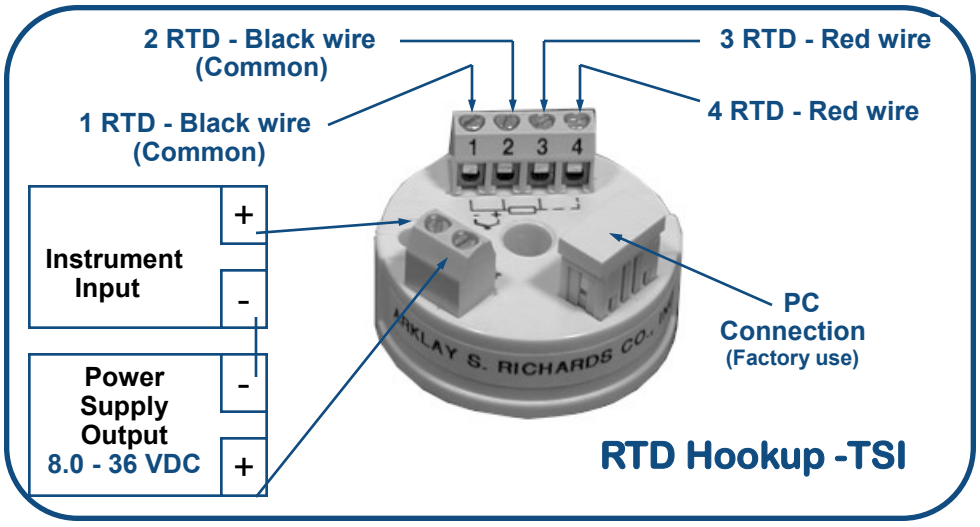
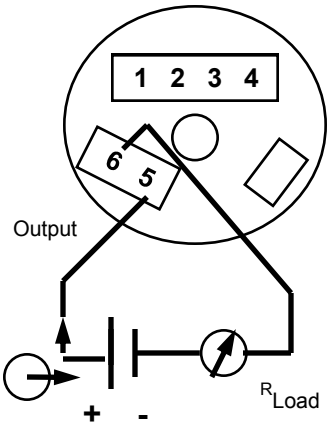
Transmitter Wiring - TSI Types

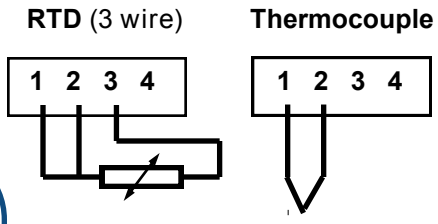
The typical wiring for the **TSI** series transmitters is shown below. The system would include a transmitter, power supply and digital instrument. If you have any difficulties with setting up your transmitter, our sales engineers are available to provide technical support.

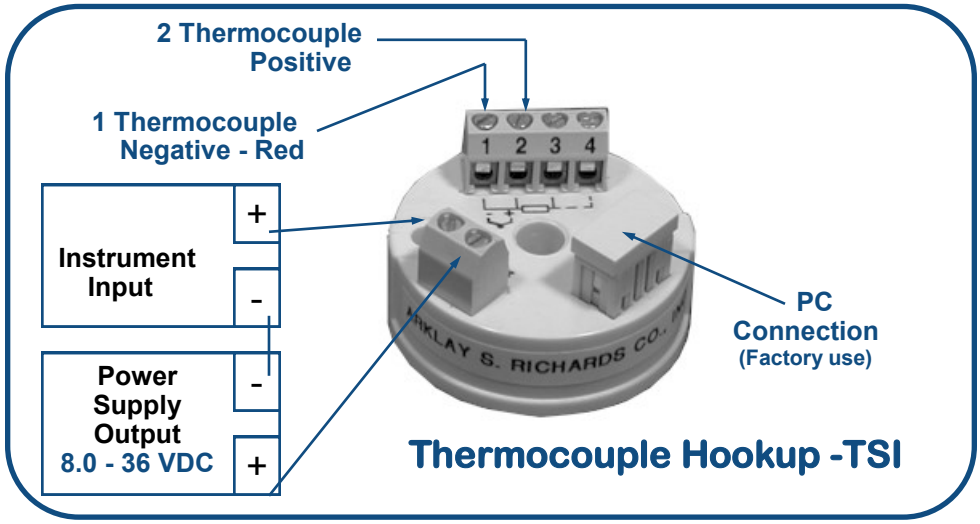
RTDs may have different color coding than our standard Black, Black, Red, and Red. As a general rule, for 3 wire RTDs, connect two of the like colors to terminal #1 and #2 and one of the second colors to terminal #3 (The remaining wire can be cut off or taped back). For 4 wire RTDs, connect the second two like color wires to terminals #3 and #4. To connect the transmitter to your instrument and power supply, use our part number **20I02-PP-S** (see page 169) and attach the instrument wire on terminals #5 and #6.

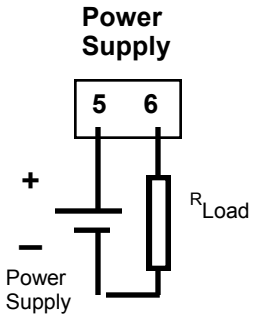
Note: When wiring your transmitter the **NEGATIVE** wire of a thermocouple is always coded **RED.**











Rotary Switches, Gold Fuses and Gold Fuse Elements

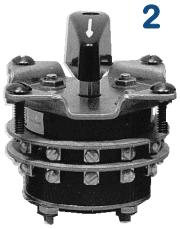
Switch - Rotary, Two Decks , Four Decks

Part Number	Selection Positions	Decks	Number of Thermocouples Switched	Terminal Screw Material
SWRO2-07	7	2	One Thermocouple can be switched at a time.	Silver
SWRO2-11	11	2		Silver
SWRO2-15	15	2		Silver
SWRO4-07	7	4	Two Thermocouples can be switched at a time.	Silver
SWRO4-11	11	4		
SWRO4-15	15	4		

1

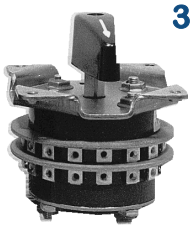
SWR02-07

2



SWR02-11

3



SWR02-15

4

SWR04-07

Some other constructions are also available on special order. Consult factory.

Fuse, Gold - Assemblies and Elements

Part Number	Application	Construction	Figure
16GF4-P11F-*	The gold fuse in the assembly will melt at **1945°F (1062°C)** to protect from an over temperature situation.	Complete Assembly with a single Mullite protection tube. **O.D. -** 11/16" (175 mm) **Connection -** 3/4" male NPT **Head -** Cast Iron Screw Cover	5 
16GF4-P11F-*-AFTH		Complete Assembly with a single Mullite protection tube. **O.D. -** 11/16" (175 mm) **Connection -** 3/4" male NPT **Head -** Aluminum Flip-top	6 
16GF-*		Replacement gold fuse element for the above complete assemblies	7 

*** Add length as the suffix (*). Standard lengths, multiples of 6" starting at 12".**

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Richards Analog Panel Meters are available for both Type K and Type J thermocouples. It is important to note that the **M10-K**, **M10-J**, and the **M11-J**, have an external resistance requirement of 10 Ohms. In order to maintain the accuracy of the readings, the total resistance of the thermocouple and the extension wires combined must be equal to 10 Ohms. The **M1** unit has an 1 Ohm external resistance requirement. This requires that the total resistance of the thermocouple and the extension wires combined must be equal to 1 Ohm.

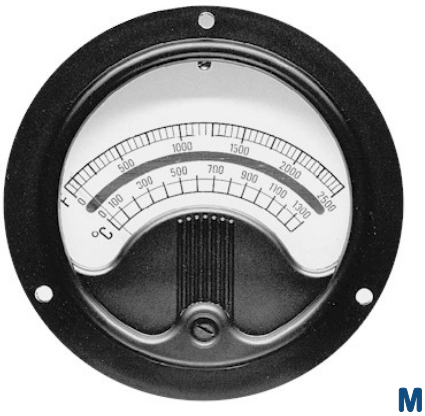
The **M1** meter is normally used in our portable molten metal handle assembly, but they may be used in situations where long extension wires are not required. The M10 and M11 type instruments are usually used in situations where longer extension wires are needed.

! Note: Resistance values for thermocouple and extension wires can be found in the engineering section of this catalog.

Analog Panel Meter, Round Portable Type -

Part Number	Range	Type	External Resistance	Accuracy	Dimensions
M1	0 to 2500°F or 0 to 1370°C	K	1 Ohm	± 2% or 50°F	Diameter - 4.50" or 114.3 mm Depth - 1.50" or 38.1 mm

1



M1

Analog Panel Meter, Rectangular

Part Number	Range	Type	External Resistance	Accuracy	Dimensions
M10-K	0 to 2500°F or -20 to 1370°C	K	10 Ohm	± 1% or 25°F	Diameter - 4.50" or 114.3 mm Depth - 1.50" or 38.1 mm
M10-J	0 to 1000°F or -20 to 540°C	J	10 Ohm	± 1% or 10°F	
M11-J	0 to 500°F or -20 to 260°C	J	10 Ohm	± 1% or 5°F	

2

M10 & M11

RICHARDS®
Arklay S. Richards Co., Inc.

Digital Temperature Controllers - ASR400 and ASR900

The Richards model **ASR400** and **ASR900** micro processor temperature process controllers are very economical solutions for temperature control in your process. These instruments are also inexpensive enough that they can also be used in situations where just an indicator is required. They are accurate and have selectable inputs for all standard thermocouple Types (B, C, E, J, K, N, R, S, T & Platinel II) and Pt100 JIS three wire RTD's. Their sizes are excellent for panel mounting of multiple instruments. The **ASR400** and **ASR900** are bezel mount instruments, which require no mounting screws for installation in panels.

Features:
- √ **ASR400:** Up to two alarms
- √ **ASR900:** Up to three alarm
- √ Multi range input (TCs and RTDs)
- √ Two individual outputs
- √ Self-diagnosis function
- √ RS232 and RS485 communication
- √ Fuzzy Logic PID control
- √ Adjustable output range
- √ 4 levels of security and lock-out
- √ 0.2% accuracy (displayed)
- √ **ASR900:** Bar graph % output display

Output options: Relay contact - SPDT 3A-240VAC SSR Voltage pulse - 20VDC-20mA Current 4-20mA

Example range: Type K (Thermocouple): 0 to 1200°C (**0 to 2192°F**)

ASR400 - 1/16 DIN Panel Mount
ASR900 - 1/4 DIN Panel Mount

Item	General Specifications
Power supply	AC 85V to 265V 50/60Hz
Power Consumption	About 4 VA
Memory Element	EEPROM
Accuracy	Within .02% of displayed value + 1 digit
Sampling Time	250 ms
Isolation	Output part (Control alarm transfer) and input part (measuring, CPU) are isolated separately.
Dielectricity	Measuring terminal-ground terminal AC 1000V, 1 min. Power supply terminal-ground terminal AC1500, 1 min.
Isolated Resistance	Measuring terminal-ground terminal DC 500V more than 10M Ohms.
Operating temperature	0 to 50°C or 122°F
Storage Temperature	-25 to 65°C or 149°F
Humidity Range	50 to 85% RH (not dew)
Net Weights:	**ASR400** 150 grams **ASR900** 320 grams
Panel Cut Out Dimensions	**ASR400** 44.5 mm x 44.5 mm (1.75" x 1.75") **ASR900** 90.5 mm x 90.5 mm (3.56" x 3.56")
Instrument Outline Dimensions	**ASR400** 50 mm x 50 mm x 97 mm (1.97" x 1.97" x 3.82") **ASR900** 96 mm x 96 mm x 97 mm (3.78" x 3.78" x 3.82")

ASR400

1

ASR900

2

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Digital Temperature Controller - ASR900HY

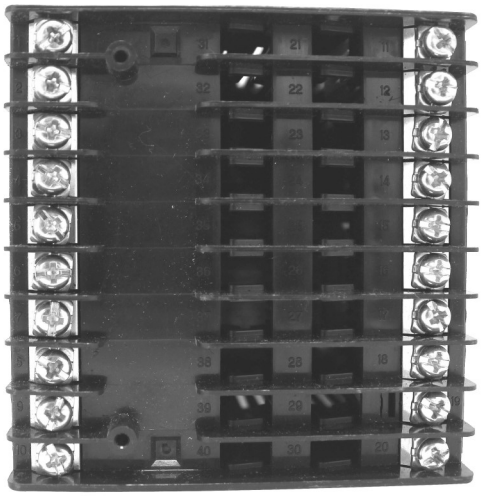
The Richards model **ASR900HY** micro processor temperature process controller is a very economical solution for temperature control in your process. These instruments are also inexpensive enough that they can also be used in situations where just an indicator is required. They are accurate and have selectable inputs for all standard thermocouple Types (B, C, E, J, K, N, R, S, T, & Platinel II) and Pt100Ω & KPt100Ω three wire RTDs. Their sizes are excellent for panel mounting of multiple instruments. The **ASR900HY** is a bezel mount instrument, which require no mounting screws for installation in panels.

Features: √ Fuzzy Function, PID auto tuning √ Control Outputs: Relay, SSR, & SCR √ RS485/422 communication function

Example range: Type K (Thermocouple): -200 to 1370°C (0 to 2498°F)

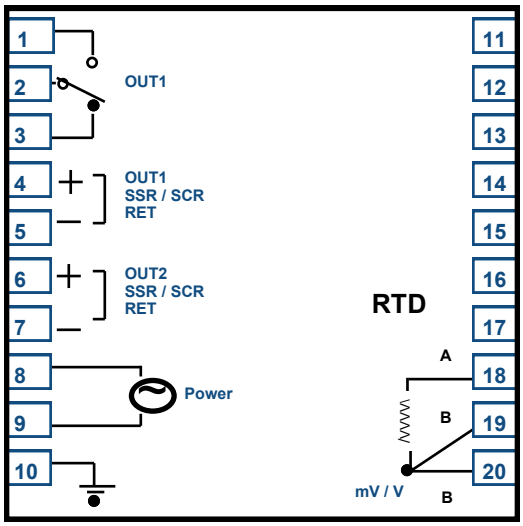
ASR900HY - 1/4 DIN Panel Mount

Item	General Specifications
Power supply	100-240 VAC, 50-60 Hz
Power Consumption	10 VA max.
Display Accuracy	±0.5% of FS ±1 Digit, thermocouple (B, E, J, K, L, R, S, T, U, W, PL2) ±01.0% of FS ±1 Digit, thermocouple (N) ±0.5% of FS ±1 Digit, RTD (KPt100Ω, Pt100Ω)
Sampling Time	250 ms
Control Output	**Relay:** Contact capacity: 1C, 240V AC, 3 A, 30V DC, 3A (resistive load)
	SSR: More than approx. 12V DC (Min 600Ω resistive load), with disconnection, limit within approx. 30 mA, Time resolving power: smaller one between 0.1% and 10 ms
	SCR: 4 - 20 mA DC (resistive load less than 600Ω) Accuracy: ±0.5% of FS (range 4 - 20 mA DC) resolving power : approx. 3,000
Dielectric strength	2,300 V AC, 50 / 60 Hz, for 1 min (1st terminal - 2nd terminal - between the earth terminal) 1,500 V AC, 50 / 60 Hz, for 1 min (2nd terminal - between the F.G)
Insulation Resistance	Min 20 MΩ (500V DC), 1st terminal - 2nd terminal - between the earth terminal
Ambient temperature	0 to 50°C
Storage Temperature	-25 ~ 65°C
Ambient Humidity Range	35 ~85 % RH (without dew condensation)
Net Weight	Approximately 472 grams
Panel Cut-out	92.0 mm x 92.0 mm (3.62" x 3.62")
Instrument Outline	96 mm x 96 mm x 112.5 mm (3.78" x 3.78" x 4.43")
Allowable wiring resistance	RTD (max 10Ω, however resistance among 3 wires should be same)
Cold junction compensation error	±1.5°C (15 ~ 35°C), ±2.0°C (0 ~ 50°C)
Input signal break detection	OFF, UP/DOWN Scale selection (Thermocouple), UP Scale (RTD)

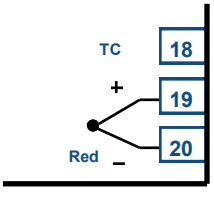


1

Instrument Rear Panel - Hookups



Thermocouple



ASR900HY

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Arklay S. Richards Co., Inc.

Digital Instrument for Handle or Self Mount

The Richards model **DI100** and **DI101** Digital Instruments are very flexible temperature indicators and can be used in situations where just an indicator is required. They are battery operated so they can be conveniently moved from area to area. They are accurate and the **DI100** has selectable inputs for all standard thermocouples:Types B, E, J, K, N, R, S, & T. The **DI200** has selectable inputs for Pt100 and Ni120 RTD's.

Powered by a Single AA Size 3.6 V Lithium Battery. **Low Battery Alarm.** **RTD or T/C inputs.**
Explosion Proof and NEMA 4X Housings. **°F (standard) or °C - Selectable.** **Decimal Point Position.**
4 digit, 7 LCD segment Display. **3 Terminal Screw Block.** **Ambient Storage: -4 to 185°F.**

DI100 - Portable Digital Instruments for Thermocouples (Selectable)

Part Number	Type Setting	Range	Accuracy	Dimensions	Construction
DI100K	K	-328 to 2498°F (-200 to 1372°C)	±0.1% of FSR ±0.9°F	Out of Housing: 2.87" Diameter x 1.5" High In ABS NEMA 4X Side Port Housing: 3.75" x 2.17" High	1  DI100 / DI200
DI100J	J	-328 to 2192°F (-200 to 1200°C)			
DI100E	E	-328 to 1832°F (-200 to 1000°C)			
DI100N	N	-292 to 2372°F (-180 to 1300°C)			
DI100B	B	32 to 3272°F (0 to 1800°C)	±0.1% of FSR ±0.9°F (Accuracy over range of 750 to 3250°F)		
DI100T	T	-346 to 752°F (-210 to 400°C)	±0.2% of FSR ±0.9°F		
DI100R	R	14 to 3200°F (-10 to 1760°C)	±0.9°F ±0.1% of FSR (Only over the range of 1472 to 2912°F)		
DI100S	S	14 to 3200°F (-10 to 1760°C)			

Note: Accuracy for Thermocouples do not include sensor and cold junction errors.

DI200 - Portable Digital Instruments for RTDs (Selectable)

Part Number	Meter Setting	Range	Accuracy	Dimensions	Construction
DI200PT	Pt100	-328 to 1562°F (-200 to 850°C)	±0.18°F ±0.05% of Reading	**Same as DI100 above**	See Figure 1 above.
DI200NI	Ni120	-100 to 600°F (-72 to 315°C)			

Notes: Accuracy for Pt100 and Ni120 do not include sensor and cold junction errors. **FSR = Full Scale Range; Rdg = Reading.**

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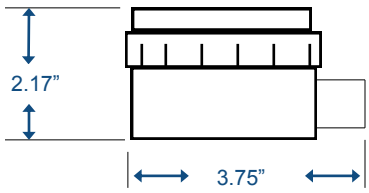
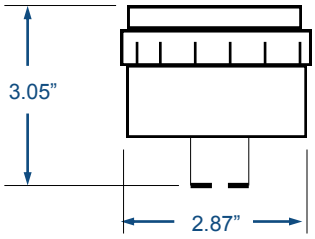
The options for the Richards model **DI100** and **DI101** Digital Instruments are shown below. Basically the assembly part numbers are constructed by adding the part numbers to the selected instrument. **Example:** an assembly consisting of a Digital Instrument set for a Type K thermocouple in a polycarbonate housing **100HP** would be: **DI100KHP**. Parts alone would be ordered by just using their part number only. **Example:** a polycarbonate housing only would be: **100HP**.

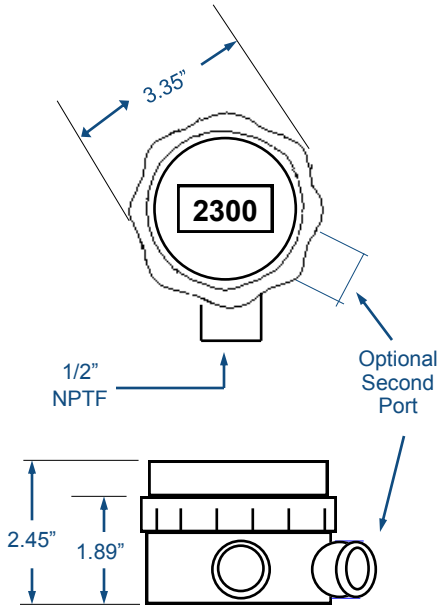
Polycarbonate Housing - HPS
ABS NEMA 4X - Side port **1**



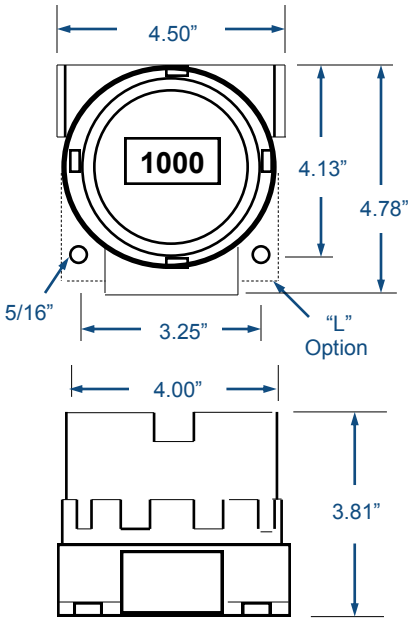
Polycarbonate Housing - HPB
ABS NEMA 4X - Bottom port **2**



Stainless Steel Housing - HSS **3 & 4**



Aluminum EX Housing - HAE
FM(3615) - Side port **5 & 6**



Accessory Parts for DI100 and DI200 - Digital Instruments - Ports are 1/2” Female NPT

Figure	Part Number	Description	Port Location	Type	Color
1	**HPS**	Polycarbonate Housing for **DI100** or **DI200** instruments.	Side	NEMA 4X, IP67	Off White
2	**HPB**	Polycarbonate Housing for **DI100** or **DI200** instruments.	Base	NEMA 4X, IP67	Off White
3	**HSS**	Stainless Steel Housing for **DI100** or **DI200** instruments.	Side	NEMA 4X, IP67	Silver
4	**HSS2**	Stainless Steel Housing for **DI100** or **DI200** instruments.	2 Sides (Optional)	NEMA 4X, IP67	Silver
5	**HAE**	Aluminum EX (Explosion Proof) Housing for **DI100** or **DI200** instruments.	Side	FM (3615)	Blue Polyester Powder Coating
6	**HAEL**	Aluminum EX (Explosion Proof) Housing for **DI100** or **DI200** instruments with Optional “L” mounting	Side	FM (3615)	Blue Polyester Powder Coating
7	**HPRA**	DIN Rail Adaptor for HPS	-	-	-
8	**HAEM**	Mounting Kit for **HAE**	-	-	-

Notes

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Thermometer - Bi-Metal, 2" Dial Size, Dual Scale

Part Number	Dial Diameter	Temperature Range	Sensor Stem Length	Sensor Stem Diameter
B12M-M40P160F-2.5	2"	-40 to 160°F -40 to 70°C	2.5"	1/4"
B12M-M40P160F-4			4"	
B12M-M40P160F-6			6"	
B12M-P0P250F-2.5	2"	0 to 250°F -20 to 120°C	2.5"	1/4"
B12M-P0P250F-4			4"	
B12M-P0P250F-6			6"	
B12M-P50P500F-2.5	2"	50 to 500°F 10 to 260°C	2.5"	1/4"
B12M-P50P500F-4			4"	
B12M-P50P500F-6			6"	

Key Features:

- √ Waterproof seal.
- √ Durable polycarbonate lens (200°F or 93°C Max. Temp.).
- √ Stainless Steel Stem (1/4" O.D.) and case.
- √ 316 Stainless Steel 1/2" NPT back connection.
- √ Easy to read 2" white aluminum dial and black pointer.
- √ Standard Temperature Range: 0 to 250°F (Dual Scale)

1

B12

Thermometer - Bi-Metal, 3" Dial Size, Dual Scale

Part Number	Dial Diameter	Temperature Range	Sensor Stem Length	Sensor Stem Diameter
B13M-M40P160F-2.5	3	-40 to 160°F -40 to 70°C	2.5"	1/4"
B13M-M40P160F-4			4"	
B13M-M40P160F-6			6"	
B13M-P0P250F-2.5	3"	0 to 250°F -20 to 120°C	2.5"	1/4"
B13M-P0P250F-4			4"	
B13M-P0P250F-6			6"	
B13M-P50P500F-2.5	3'	50 to 500°F 10 to 260°C	2.5"	1/4"
B13M-P50P500F-4			4"	
B13M-P50P500F-6			6"	

Key Features:

- √ Waterproof seal.
- √ Durable polycarbonate lens (200°F or 93°C Max. Temp.).
- √ Stainless Steel Stem (1/4" O.D.) and case.
- √ 316 Stainless Steel 1/2" NPT back connection.
- √ Easy to read 3" white aluminum dial and black pointer.
- √ Standard Temperature Range: 0 to 250°F (Dual Scale)

2

B13

Thermometers - Bi-Metal, 5” Dial Size, Dual Scale, Adjustable Angle

Thermometer - Bi-Metal, 5” Dial Size, Dual Scale, Adjustable Angle

Part Number	Dial Diameter	Thermocouple Range	Sensor Stem Length	Sensor Stem Diameter
B15AJ-M40P160F-2.5	5”	-40 to 160°F -40 to 70°C	2.5”	1/4”
B15AJ-M40P160F-4			4”	
B15AJ-M40P160F-6			6”	
B15AJ-P0P250F-2.5	5”	0 to 250°F -20 to 120°C	2.5”	1/4”
B15AJ-P0P250F-4			4”	
B15AJ-P0P250F-6			6”	
B15AJ-P50P500F-2.5	5”	50 to 500°F 10 to 260°C	2.5”	1/4”
B15AJ-P50P500F-4			4”	
B15AJ-P50P500F-6			6”	

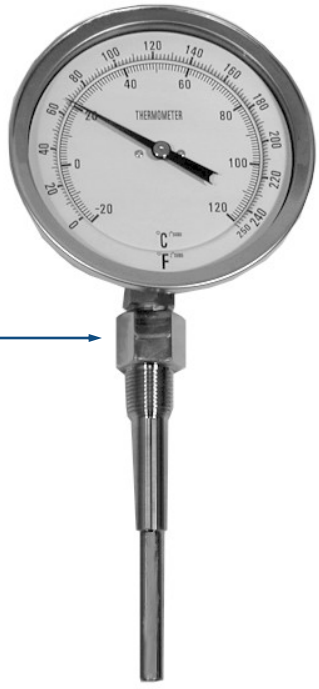
Key Features:
√ Waterproof seal. √ Glass lens.
√ Durable polycarbonate lens (200°F or 93°C Max. Temp.).
√ Stainless Steel Stem (1/4” O.D.) and case.
√ 316 Stainless Steel 1/2” NPT back connection.
√ Easy to read 2” white aluminum dial and black pointer.
√ Standard Temperature Range: 0 to 250°F (Dual Scale)

1

B15AJ

Thermowells for Thermometers -

Thermowells or “Separate Sockets” can be used in applications where the thermometer must be periodically removed without disturbing the process. Our complete line of thermowells can be seen in the thermowell section of this catalog. Many alloys and styles are available to protect the thermometer against forms of mechanical damage, corrosion, and abrasion.



Thermowell →

Note: When selecting your thermowell make sure the bore is at least .260” (6.6 mm). This will allow sufficient clearance for the insertion of the 1/4” (.250” 6.35 mm) diameter thermometer stem without causing damage to the instrument.

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Thermometers - Vapor Actuated, Dual Scale

Key Features:

- √ NSF approved for usage in the food industry
- √ 4 feet of Nickel plated copper tubing (100 feet Max.)
- √ Easy to read 2" black aluminum dial
- √ Standard Temperature Range: -40 to 65°F
- √ Durable polycarbonate lens
- √ Stainless Steel Case
- √ Accuracy is ±1 scale division
- √ Phosphor bronze bourdon tube
- √ Color coded hot (Red) and cold (Blue) zones
- √ Plain Nickel plated copper bulb (1/4" Diameter x 2" long)

Figure	Part Number	Dial Diameter	Temperature Range	Sensor Tubing Length
1	**Thermometer - Vapor Actuated, U-Clamp**			
	VAT2U-M40P65CF-48	2"	-40 to 65°F -40 to 65°C	48 inches
2	**Thermometer - Vapor Actuated, Flush Mount, Front Flange**			
	VAT2PM-M40P65CF-48	2"	-40 to 65°F -40 to 65°C	48 inches
3	**Thermometer - Vapor Actuated, Wall Mount, Rear Flange**			
	VAT2WM-M40P65CF-48	2"	-40 to 65°F -40 to 65°C	48 inches
4	**Thermometer - Vapor Actuated, Hanging Mount**			
	VAT2HM-M40P65CF-48	2"	-40 to 65°F -40 to 65°C	48 inches

VAT2U 1

VAT2PM 2

VAT2WM 3

VAT2HM 4

Thermometers - Vapor Actuated and Solar Powered LCD Digital

Thermometer - Vapor Actuated, Adjustable Bracket

Part Number	Dial Diameter	Temperature Range	Sensor Tube Length
VAT3ABM-M40P65CF-48	3 1/2 inches	-40 to 65°F -40 to 65°C	48 inches

Key Features:

- √ Durable polycarbonate lens.
- √ Stainless Steel case.
- √ 4 feet of Nickel plated Copper tubing.
- √ Plain Nickel plated Copper bulb (7/16" Dia. x 2 1/2" long).
- √ Easy to read 3 1/2" white aluminum dial.
- √ NSF approved for usage in the food industry.
- √ Accuracy is ±1 scale division.
- √ Color coded hot (Red) and cold (Blue).
- √ Phosphor bronze bourdon tube.
- √ Standard Temperature range: -40 to 65°F & C (dual scale)

1

VAT3ABM

Digital Thermometer - Solar Powered Thermistor, LCD Surface Mount

Part Number	Case Size Inches	Temperature Range	Sensor Tube Length
SP-M50P158F-56	4 1/2" Wide 1 1/8" High 5/8" Deep	-50 to 158°F	56 inches

Key Features:

- √ Durable black ABS plastic case.
- √ 56 inch black PVC Sensor lead.
- √ Easy to read 3/8 inch LCD display.
- √ 0.1 degree resolution (Celsius or Fahrenheit.
- √ Compact size (4 1/2" x 1 1/8" x 5/8").
- √ NSF approved for usage in the food industry.
- √ Accuracy is ±2 degrees.
- √ 10 second update time.
- √ Nickel plated brass bulb tubing.
- √ Plain Nickel plated Copper bulb.
- √ 50 Lux minimum light level (1-AAA battery for backup).

2

SP-M

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Ceramic Tapes - Aluminum Oxide Based

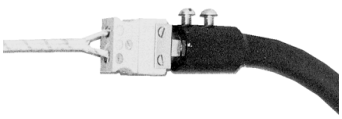
High purity Aluminum Oxide ceramic tape can be used in a variety of applications. It is especially useful for flame gasket material in kilns between metal plates in the seams. Ceramic tape can be easily formed and cut with ordinary scissors. It has a maximum service temperature of **2500°F** or **1371°C**. Ceramic tape has low thermal conductivity, excellent resistance to thermal shock, and provides good electrical insulation. This particular tape was designed to replace asbestos products, which were only useful up to 1200°F.

Part Number	Width x Length	Thickness
T-CF-16-05 **T-CF-32-05** **T-CF-48-05**	1 inch x 50 feet 2 inches x 50 feet 3 inches x 50 feet	1/32 inch
T-CF-16-1 **T-CF-32-1** **T-CF-48-1**	1 inch x 50 feet 2 inches x 50 feet 3 inches x 50 feet	1/16 inch
T-CF-16-2 **T-CF-32-2** **T-CF-48-2**	1 inch x 25 feet 2 inches x 25 feet 3 inches x 25 feet	1/8 inch

Dip Style Thermocouples - High Temperature Glass (HG) and Ceramic Fiber (CF)

Element

Element & Male Plug - K4



Element, Male Plug - K4 & Handle

Part Numbers	Wire Gauge	Diameter Inches		Type	Description	Maximum Temperature	
Elements							
14K-DP-HG-*	14	.062	1.63	K	Ceramic Fiber over Ceramic Fiber	870°F	704°C
16K-DP-HG-*	14	.051	1.63	K	High Temperature Glass over High Temperature Glass	870°F	704°C
and Plug							
14K-DP-CF-*-K4							
16K-DP-HG-*-K4	16	.051	1.30	K	Ceramic Fiber over Ceramic Fiber, Jab Style Plug (**K4**)	1427°F	1200°C
	16	.051	1.30	K	High Temperature Glass over High Temperature Glass, Jab Style Plug (**K4**)	1427°F	1200°C

Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

(QZ) - Closed One End

Outside Diameters - 3 mm to 22.5 mm

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	Part Number
QZ030010-*	0.1181	0.04	0.04	48	3	1	1	1219.2	QT030010-*
QZ030020-*	0.1181	0.08	0.04	48	3	2	0.05	1219.2	QT030020-*
QZ040020-*	0.1575	0.08	0.04	48	4	2	1	1219.2	QT040020-*
QZ040030-*	0.1575	0.12	0.04	48	4	3	0.05	1219.2	QT040030-*
QZ050020-*	0.1969	0.08	0.06	48	5	2	1.5	1219.2	QT050020-*
QZ050030-*	0.1969	0.12	0.04	48	5	3	1	1219.2	QT050030-*
QZ060010-*	0.2362	0.04	0.10	48	6	1	2.5	1219.2	QT060010-*
QZ060020-*	0.2362	0.08	0.08	48	6	2	2	1219.2	QT060020-*
QZ060030-*	0.2362	0.12	0.05	48	6	3	1.5	1219.2	QT060030-*
QZ060040-*	0.2362	0.16	0.04	48	6	4	1	1219.2	QT060040-*
QZ063023-*	0.2482	0.09	0.08	48	6.3	2.3	2	1219.2	QT063023-*
QZ063.5040-*	0.2500	0.16	0.05	48	6.35	4	1.175	1219.2	QT063.5040-*
QZ070050-*	0.2756	0.20	0.04	48	7	5	1	1219.2	QT070050-*
QZ072047-*	0.2835	0.19	0.05	10	7.2	4.7	1.25	254.0	QT072047-*
QZ072.5050-*	0.2854	0.20	0.04	48	7.25	5	1.125	1219.2	QT072.5050-*
QZ080020-*	0.3150	0.08	0.12	48	8	2	3	1219.2	QT080020-*
QZ080036-*	0.3150	0.14	0.09	48	8	3.6	2.2	1219.2	QT080036-*
QZ080040-*	0.3150	0.16	0.08	48	8	4	2	1219.2	QT080040-*
QZ080060-*	0.3150	0.24	0.04	48	8	6	1	1219.2	QT080060-*
QZ090070-*	0.3543	0.28	0.04	48	9	7	1	1219.2	QT090070-*
QZ096070-*	0.3780	0.28	0.05	48	9.6	7	1.3	1219.2	QT096070-*
QZ097.5077.5-*	0.3840	0.31	0.04	48	9.75	7.75	1	1219.2	QT097.5077.5-*
QZ099079-*	0.3898	0.31	0.04	18	9.9	7.9	1	457.2	QT099079-*
QZ100060-*	0.3937	0.24	0.08	48	10	6	2	1219.2	QT100060-*
QZ100080-*	0.3937	0.32	0.04	48	10	8	1	1219.2	QT100080-*
QZ104070-*	0.4094	0.28	0.07	48	10.4	7	1.4	1219.2	QT104070-*
QZ110060-*	0.4331	0.24	0.10	48	11	6	2.5	1219.2	QT110060-*
QZ110090-*	0.4331	0.35	0.04	48	11	9	1	1219.2	QT110090-*
QZ118090-*	0.4650	0.35	0.06	48	11.8	9	1.4	1219.2	QT118090-*
QZ120060-*	0.4724	0.24	0.12	48	12	6	3	1219.2	QT120060-*
QZ120080-*	0.4724	0.32	0.08	48	12	8	2	1219.2	QT120080-*
QZ120100-*	0.4724	0.39	0.04	48	12	10	1	1219.2	QT120100-*
QZ127.50105-*	0.5020	0.41	0.04	48	12.75	10.5	1.125	1219.2	QT127.50105-*
QZ130040-*	0.5118	0.16	0.18	13	13	4	4.5	330.2	QT130040-*
QZ130105-*	0.5118	0.41	0.05	48	13	10.5	1.25	1219.2	QT130105-*
QZ130110-*	0.5118	0.43	0.04	48	13	11	1	1219.2	QT130110-*
QZ140100-*	0.5512	0.39	0.08	48	14	10	2	1219.2	QT140100-*
QZ140120-*	0.5512	0.47	0.04	48	14	12	1	1219.2	QT140120-*
QZ150090-*	0.5906	0.35	0.08	48	15	9	2	1219.2	QT150090-*
QZ150120-*	0.5906	0.47	0.06	48	15	12	1.5	1219.2	QT150120-*
QZ150130-*	0.5906	0.51	0.04	48	15	13	1	1219.2	QT150130-*
QZ158130-*	0.6220	0.51	0.06	48	15.8	13	1.4	1219.2	QT158130-*
QZ160140-*	0.6299	0.55	0.04	48	16	14	1	1219.2	QT160140-*
QZ162130-*	0.6378	0.51	0.06	48	16.2	13	1.5	1219.2	QT162130-*
QZ170150-*	0.6693	0.59	0.04	48	17	15	1	1219.2	QT170150-*
QZ180150-*	0.7087	0.59	0.06	48	18	15	1.5	1219.2	QT180150-*
QZ180160-*	0.7087	0.63	0.04	48	18	16	1	1219.2	QT180160-*
QZ190135-*	0.7480	0.53	0.11	48	19	13.5	2.75	1219.2	QT190135-*
QZ190170-*	0.7480	0.67	0.04	48	19	17	1	1219.2	QT190170-*
QZ200160-*	0.7874	0.63	0.08	48	20	16	2	1219.2	QT200160-*
QZ205180-*	0.8071	0.71	0.05	48	20.5	18	1.25	1219.2	QT205180-*
QZ216180-*	0.8504	0.71	0.07	48	21.6	18	1.8	1219.2	QT216180-*
QZ220200-*	0.8661	0.79	0.04	48	22	20	1	1219.2	QT220200-*
QZ225200-*	0.8858	0.79	0.05	48	22.5	20	1.25	1219.2	QT225200-*

*Specify tube or tubing length in inches (standard) or millimeters (add “mm” after length).
Tolerances on Outside and Inside Diameters ±2 %
Other tube sizes, square tubes, and stirring rod also available. Phone for details

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Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

(QZ) - Closed One End

Outside Diameters - 23 mm to 130 mm

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	Part Number
QZ230200-*	0.9055	0.79	0.06	48	23	20	1.5	1219.2	QT230200-*
QZ245220-*	0.9646	0.87	0.05	48	24.5	22	1.25	1219.2	QT245220-*
QZ250220-*	0.9843	0.87	0.06	48	25	22	1.5	1219.2	QT250220-*
QZ258220-*	1.0157	0.87	0.07	48	25.8	22	1.9	1219.2	QT258220-*
QZ270250-*	1.0630	0.98	0.04	48	27	25	1	1219.2	QT270250-*
QZ275250-*	1.0827	0.98	0.05	48	27.5	25	1.25	1219.2	QT275250-*
QZ280250-*	1.1024	0.98	0.06	48	28	25	1.5	1219.2	QT280250-*
QZ288250-*	1.1339	0.98	0.07	48	28.8	25	1.9	1219.2	QT288250-*
QZ300260-*	1.1811	1.02	0.08	48	30	26	2	1219.2	QT300260-*
QZ300270-*	1.1811	1.06	0.06	48	30	27	1.5	1219.2	QT300270-*
QZ320280-*	1.2598	1.10	0.08	48	32	28	2	1219.2	QT320280-*
QZ330300-*	1.2992	1.18	0.06	48	33	30	1.5	1219.2	QT330300-*
QZ340300-*	1.3386	1.18	0.08	48	34	30	2	1219.2	QT340300-*
QZ350320-*	1.3780	1.26	0.06	48	35	32	1.5	1219.2	QT350320-*
QZ360300-*	1.4173	1.18	0.12	48	36	30	3	1219.2	QT360300-*
QZ380350-*	1.4961	1.38	0.06	48	38	35	1.5	1219.2	QT380350-*
QZ400360-*	1.5748	1.42	0.08	48	40	36	2	1219.2	QT400360-*
QZ400370-*	1.5748	1.46	0.06	48	40	37	1.5	1219.2	QT400370-*
QZ421381-*	1.6575	1.50	0.08	48	42.1	38.1	2	1219.2	QT421381-*
QZ430400-*	1.6929	1.57	0.06	48	43	40	1.5	1219.2	QT430400-*
QZ440400-*	1.7323	1.57	0.08	48	44	40	2	1219.2	QT440400-*
QZ450420-*	1.7717	1.65	0.06	48	45	42	1.5	1219.2	QT450420-*
QZ480440-*	1.8898	1.73	0.08	48	48	45	1.5	1219.2	QT480440-*
QZ480450-*	1.8898	1.77	0.06	48	48	44	2	1219.2	QT480450-*
QZ500460-*	1.9685	1.81	0.08	48	50	46	2	1219.2	QT500460-*
QZ500470-*	1.9685	1.85	0.06	48	50	47	1.5	1219.2	QT500470-*
QZ520480-*	2.0472	1.89	0.08	48	52	48	2	1219.2	QT520480-*
QZ540500-*	2.1260	1.97	0.08	48	54	50	2	1219.2	QT540500-*
QZ550500-*	2.1654	1.97	0.10	48	55	50	2.5	1219.2	QT550500-*
QZ570530-*	2.2441	2.09	0.08	48	57	53	2	1219.2	QT570530-*
QZ580520-*	2.2835	2.05	0.12	48	58	52	3	1219.2	QT580520-*
QZ590550-*	2.3228	2.17	0.08	48	59	55	2	1219.2	QT590550-*
QZ610570-*	2.4016	2.24	0.08	48	61	57	2	1219.2	QT610570-*
QZ640600-*	2.5197	2.36	0.08	48	64	60	2	1219.2	QT640600-*
QZ650600-*	2.5591	2.36	0.10	48	65	60	2.5	1219.2	QT650600-*
QZ670630-*	2.6378	2.48	0.08	48	67	63	2	1219.2	QT670630-*
QZ680640-*	2.6772	2.52	0.08	48	68	64	2	1219.2	QT680640-*
QZ690650-*	2.7165	2.56	0.08	48	69	65	2	1219.2	QT690650-*
QZ700660-*	2.7559	2.60	0.08	48	70	66	2	1219.2	QT700660-*
QZ740700-*	2.9134	2.76	0.08	48	74	70	2	1219.2	QT740700-*
QZ750700-*	2.9528	2.76	0.10	72	85	70	2.5	1828.8	QT750700-*
QZ770730-*	3.0315	2.87	0.08	72	77	73	2	1828.8	QT770730-*
QZ800750-*	3.1496	2.95	0.10	72	80	75	2.5	1828.8	QT800750-*
QZ850800-*	3.3465	3.15	0.10	72	85	80	2.5	1828.8	QT850800-*
QZ900850-*	3.5433	3.35	0.10	72	90	85	2.5	1828.8	QT900850-*
QZ950900-*	3.7402	3.54	0.10	72	95	90	2.5	1828.8	QT950900-*
QZ1000950-*	3.9370	3.74	0.10	72	100	95	2.5	1828.8	QT1000950-*
QZ10661016-*	4.1969	4.00	0.10	72	106.6	101.6	2.5	1828.8	QT10661016-*
QZ11001050-*	4.3307	4.13	0.10	72	110	105	2.5	1828.8	QT11001050-*
QZ11501100-*	4.5276	4.33	0.10	72	115	110	2.5	1828.8	QT11501100-*
QZ12001150-*	4.7244	4.53	0.10	72	120	115	2.5	1828.8	QT12001150-*
QZ12501200-*	4.9213	4.72	0.10	72	125	120	2.5	1828.8	QT12501200-*
QZ13001250-*	5.1181	4.92	0.10	72	130	125	2.5	1828.8	QT13001250-*

*Specify tube or tubing length in inches (standard) or millimeters (add “mm” after length). Minimum of two digits (e.g. 6” = 06)
Tolerances on Outside and Inside Diameters ±2 %
Other tube sizes, square tubes, and stirring rod also available. Phone for details

Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

(QZ) - Closed One End

Outside Diameters - 135 mm to 330 mm

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	Part Number
QZ13501300-*	5.3150	5.12	0.10	72	135	130	2.5	1828.8	QT13501300-*
QZ13601300-*	5.3543	5.12	0.10	72	136	130	2.5	1828.8	QT13601300-*
QZ14101350-*	5.5512	5.32	0.12	72	141	135	3	1828.8	QT14101350-*
QZ14601400-*	5.7480	5.51	0.12	72	146	140	3	1828.8	QT14601400-*
QZ15101450-*	5.9449	5.71	0.12	72	151	145	3	1828.8	QT15101450-*
QZ15601500-*	6.1417	5.91	0.12	72	156	150	3	1828.8	QT15601500-*
QZ16101550-*	6.3386	6.10	0.12	72	161	155	3	1828.8	QT16101550-*
QZ16601600-*	6.5354	6.30	0.12	72	166	160	3	1828.8	QT16601600-*
QZ17101650-*	6.7323	6.50	0.12	72	171	165	3	1828.8	QT17101650-*
QZ17601700-*	6.9291	6.69	0.12	72	176	170	3	1828.8	QT17601700-*
QZ18401760-*	7.2441	4.00	0.16	72	184	176	4	1828.8	QT18401760-*
QZ18501780-*	7.2835	7.01	0.14	72	185	178	3.5	1828.8	QT18501780-*
QZ19001840-*	7.4803	7.51	0.12	72	190	184	3	1828.8	QT19001840-*
QZ19601900-*	7.7165	7.48	0.12	72	196	190	3	1828.8	QT19601900-*
QZ20101950-*	7.9134	7.68	0.12	72	201	195	3	1828.8	QT20101950-*
QZ20602000-*	8.1102	7.87	0.12	72	206	200	3	1828.8	QT20602000-*
QZ21102030-*	8.3071	7.99	0.16	72	211	203	4	1828.8	QT21102030-*
QZ21602080-*	8.5039	8.19	0.16	72	216	208	4	1828.8	QT21602080-*
QZ22102110-*	8.7008	8.31	0.20	72	221	211	5	1828.8	QT22102110-*
QZ22102150-*	8.7008	8.46	0.12	72	221	215	3	1828.8	QT22102150-*
QZ22502150-*	8.8583	8.46	0.20	72	225	215	5	1828.8	QT22202150-*
QZ22602200-*	8.8976	8.66	0.12	72	226	220	3	1828.8	QT22602200-*
QZ22802200-*	8.9764	8.66	0.16	72	228	220	4	1828.8	QT22802200-*
QZ22902210-*	9.0157	8.70	0.16	72	229	221	4	1828.8	QT22902210-*
QZ23002200-*	9.0551	8.66	0.20	72	230	220	5	1828.8	QT23002200-*
QZ23502250-*	9.2520	8.86	0.20	72	235	225	5	1828.8	QT23502250-*
QZ23502270-*	9.2520	8.94	0.16	72	235	227	4	1828.8	QT23502270-*
QZ23602300-*	9.2913	9.06	0.12	72	236	230	3	1828.8	QT23602300-*
QZ24002300-*	9.4488	9.06	0.20	72	240	230	5	1828.8	QT24002300-*
QZ24502350-*	9.6457	9.25	0.20	72	245	235	5	1828.8	QT24502350-*
QZ24602400-*	9.6850	9.45	0.12	72	246	240	3	1828.8	QT24602400-*
QZ24902410-*	9.8031	9.49	0.16	72	249	241	4	1828.8	QT24902410-*
QZ25102410-*	9.8819	9.49	0.20	72	251	241	5	1828.8	QT25102410-*
QZ25302450-*	9.9606	9.65	0.16	72	253	245	4	1828.8	QT25302450-*
QZ26002500-*	10.2362	9.84	0.20	72	260	250	5	1828.8	QT26002500-*
QZ26502570-*	10.4331	10.12	0.16	72	265	257	4	1828.8	QT26502570-*
QZ26702590-*	10.5118	10.20	0.16	72	267	259	4	1828.8	QT26702590-*
QZ26802600-*	10.5512	10.24	0.16	72	268	260	4	1828.8	QT26802600-*
QZ27502650-*	10.8268	10.43	0.20	72	275	265	5	1828.8	QT27502650-*
QZ28002700-*	11.0236	10.63	0.20	72	280	270	5	1828.8	QT28002700-*
QZ30002900-*	11.8110	11.42	0.20	72	300	290	5	1828.8	QT30002900-*
QZ30903000-*	12.1654	11.79	0.18	72	309	300	4.5	1828.8	QT30903000-*
QZ31503060-*	12.4016	12.05	0.18	72	315	306	4.5	1828.8	QT31503060-*
QZ33003200-*	12.9921	12.60	0.20	72	330	320	5	1828.8	QT33003200-*

*Specify tube or tubing length in inches (standard) or millimeters (add “mm” after length). Minimum two digits (e.g. 6” = 06)
Tolerances on Outside and Inside Diameters ±2 %
Other tube sizes, square tubes, and stirring rod also available. Phone for details

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Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

(QZ) - Closed One End

Inside Diameters - 1 mm to 22 mm

(QT) - Open Both Ends

	Inches			Maximum	Millimeters			Maximum	
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	Part Number
QZ030010-*	0.1181	0.04	0.04	48	3	1	1	1219.2	QT030010-*
QZ030020-*	0.1181	0.08	0.04	48	3	2	0.05	1219.2	QT030020-*
QZ040020-*	0.1575	0.08	0.04	48	4	2	1	1219.2	QT040020-*
QZ060020-*	0.2362	0.08	0.08	48	6	2	2	1219.2	QT060020-*
QZ080020-*	0.3150	0.08	0.12	48	8	2	3	1219.2	QT080020-*
QZ040030-*	0.1575	0.12	0.04	48	4	3	0.05	1219.2	QT040030-*
QZ050030-*	0.1969	0.12	0.04	48	5	3	1	1219.2	QT050030-*
QZ080036-*	0.3150	0.14	0.09	48	8	3.6	2.2	1219.2	QT080036-*
QZ060040-*	0.2362	0.16	0.04	48	6	4	1	1219.2	QT060040-*
QZ063.5040-*	0.2500	0.16	0.05	48	6.35	4	1.175	1219.2	QT063.5040-*
QZ080040-*	0.3150	0.16	0.08	48	8	4	2	1219.2	QT080040-*
QZ130040-*	0.5118	0.16	0.18	13	13	4	4.5	330.2	QT130040-*
QZ072047-*	0.2835	0.19	0.05	9.75	7.2	4.7	1.25	247.7	QT072047-*
QZ070050-*	0.2756	0.20	0.04	48	7	5	1	1219.2	QT070050-*
QZ072.5050-*	0.2854	0.20	0.04	48	7.25	5	1.125	1219.2	QT072.5050-*
QZ080060-*	0.3150	0.24	0.04	48	8	6	1	1219.2	QT080060-*
QZ100060-*	0.3937	0.24	0.08	48	10	6	2	1219.2	QT100060-*
QZ110060-*	0.4331	0.24	0.10	48	11	6	2.5	1219.2	QT110060-*
QZ120060-*	0.4724	0.24	0.12	48	12	6	3	1219.2	QT120060-*
QZ090070-*	0.3543	0.28	0.04	48	9	7	1	1219.2	QT090070-*
QZ096070-*	0.3685	0.28	0.05	48	9.6	7	1.3	1219.2	QT096070-*
QZ104070-*	0.4094	0.28	0.07	48	10.4	7	1.7	1219.2	QT104070-*
QZ097.5077.5-*	0.3840	0.31	0.04	48	9.75	7.75	1	1219.2	QT097.5077.5-*
QZ099079-*	0.3898	0.31	0.04	18	9.9	7.9	1	457.2	QT099079-*
QZ100080-*	0.3937	0.32	0.04	48	10	8	1	1219.2	QT100080-*
QZ012080-*	0.4724	0.32	0.08	48	12	8	2	1219.2	QT012080-*
QZ110090-*	0.4331	0.35	0.04	48	11	9	1	1219.2	QT110090-*
QZ118090-*	0.4650	0.35	0.06	48	11.8	9	1.4	1219.2	QT118090-*
QZ150090-*	0.5906	0.35	0.08	48	15	9	2	1219.2	QT150090-*
QZ120100-*	0.4724	0.39	0.04	48	12	10	1	1219.2	QT120100-*
QZ140100-*	0.5512	0.39	0.08	48	14	10	2	1219.2	QT140100-*
QZ127.5105-*	0.5020	0.41	0.04	48	12.75	10.5	1.125	1219.2	QT127.5105-*
QZ130105-*	0.5118	0.41	0.05	48	13	10.5	1.25	1219.2	QT130105-*
QZ130110-*	0.5118	0.43	0.04	48	13	11	1	1219.2	QT130110-*
QZ140120-*	0.5512	0.47	0.04	48	14	12	1	1219.2	QT140120-*
QZ150130-*	0.5906	0.51	0.04	48	15	13	1	1219.2	QT150130-*
QZ158130-*	0.6220	0.51	0.06	48	15.8	13	1.4	1219.2	QT158130-*
QZ162130-*	0.6378	0.51	0.06	48	16.2	13	1.6	1219.2	QT162130-*
QZ190135-*	0.7480	0.53	0.11	48	19	13.5	2.75	1219.2	QT190135-*
QZ160140-*	0.6299	0.55	0.04	48	16	14	1	1219.2	QT160140-*
QZ170150-*	0.6693	0.59	0.04	48	17	15	1	1219.2	QT170150-*
QZ180150-*	0.7087	0.59	0.06	48	18	15	1.5	1219.2	QT180150-*
QZ180160-*	0.7087	0.63	0.04	48	18	16	1	1219.2	QT180160-*
QZ200160-*	0.7874	0.63	0.08	48	20	16	2	1219.2	QT200160-*
QZ190170-*	0.7480	0.67	0.04	48	19	17	1	1219.2	QT190170-*
QZ205180-*	0.8071	0.71	0.05	48	20.5	18	1.25	1219.2	QT205180-*
QZ216180-*	0.8504	0.71	0.07	48	21.6	18	1.8	1219.2	QT216180-*
QZ220200-*	0.8661	0.79	0.04	48	22	20	1	1219.2	QT220200-*
QZ225200-*	0.8858	0.79	0.05	48	22.5	20	1.25	1219.2	QT225200-*
QZ230200-*	0.9055	0.79	0.06	48	23	20	1.5	1219.2	QT230200-*
QZ245220-*	0.9646	0.87	0.05	48	24.5	22	1.25	1219.2	QT245220-*
QZ250220-*	0.9843	0.87	0.06	48	25	22	1.5	1219.2	QT250220-*
QZ258220-*	1.0157	0.87	0.07	48	25.8	22	1.9	1219.2	QT258220-*

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Tolerances on Outside and Inside Diameters ±2 %
Other tube sizes, square tubes, and stirring rod also available. Phone for details

Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

(QZ) - Closed One End

Inside Diameters - 25 mm to 140 mm

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	Part Number
QZ270250-*	1.0630	0.98	0.04	48	27	25	1	1219.2	QT270250-*
QZ275250-*	1.0827	0.98	0.05	48	27.5	25	1.25	1219.2	QT275250-*
QZ280250-*	1.1024	0.98	0.06	48	28	25	1.5	1219.2	QT280250-*
QZ288250-*	1.1339	0.98	0.07	48	28.8	25	1.9	1219.2	QT288250-*
QZ300260-*	1.1811	1.02	0.08	48	30	26	2	1219.2	QT300260-*
QZ300270-*	1.1811	1.06	0.06	48	30	27	1.5	1219.2	QT300270-*
QZ320280-*	1.2598	1.10	0.08	48	32	28	2	1219.2	QT320280-*
QZ330300-*	1.2992	1.18	0.06	48	33	30	1.5	1219.2	QT330300-*
QZ340300-*	1.3386	1.18	0.08	48	34	30	2	1219.2	QT340300-*
QZ360300-*	1.4173	1.18	0.12	48	36	30	3	1219.2	QT360300-*
QZ350320-*	1.3780	1.26	0.06	48	35	32	1.5	1219.2	QT350320-*
QZ380350-*	1.4961	1.38	0.06	48	38	35	1.5	1219.2	QT380350-*
QZ400360-*	1.5748	1.42	0.08	48	40	36	2	1219.2	QT400360-*
QZ400370-*	1.5748	1.46	0.06	48	40	37	1.5	1219.2	QT400370-*
QZ421381-*	1.6575	1.50	0.08	48	42.1	38.1	2	1219.2	QT421381-*
QZ430400-*	1.6929	1.57	0.06	48	43	40	1.5	1219.2	QT430400-*
QZ440400-*	1.7323	1.57	0.08	48	44	40	2	1219.2	QT440400-*
QZ450420-*	1.7717	1.65	0.06	48	45	42	1.5	1219.2	QT450420-*
QZ480440-*	1.8898	1.73	0.08	48	48	44	2	1219.2	QT480440-*
QZ480450-*	1.8898	1.77	0.06	48	48	45	1.5	1219.2	QT480450-*
QZ500460-*	1.9685	1.81	0.08	48	50	46	2	1219.2	QT500460-*
QZ500470-*	1.9685	1.85	0.06	48	50	47	1.5	1219.2	QT500470-*
QZ520480-*	2.0472	1.89	0.08	48	52	48	2	1219.2	QT520480-*
QZ540500-*	2.1260	1.97	0.08	48	54	50	2	1219.2	QT540500-*
QZ550500-*	2.1654	1.97	0.10	48	55	50	2.5	1219.2	QT550500-*
QZ580520-*	2.2835	2.05	0.12	48	58	52	3	1219.2	QT580520-*
QZ570530-*	2.2441	2.09	0.08	48	57	53	2	1219.2	QT570530-*
QZ590550-*	2.3228	2.17	0.08	48	59	55	2	1219.2	QT590550-*
QZ610570-*	2.4016	2.24	0.08	48	61	57	2	1219.2	QT610570-*
QZ640600-*	2.5197	2.36	0.08	48	64	60	2	1219.2	QT640600-*
QZ650600-*	2.5591	2.36	0.10	48	65	60	2.5	1219.2	QT650600-*
QZ670630-*	2.6378	2.48	0.08	48	67	63	2	1219.2	QT670630-*
QZ680640-*	2.6772	2.52	0.08	48	68	64	2	1219.2	QT680640-*
QZ690650-*	2.7165	2.56	0.08	48	69	65	2	1219.2	QT690650-*
QZ700660-*	2.7559	2.60	0.08	48	70	66	2	1219.2	QT700660-*
QZ740700-*	2.9134	2.76	0.08	48	74	70	2	1219.2	QT740700-*
QZ750700-*	2.9528	2.76	0.10	72	75	70	2.5	1828.8	QT750700-*
QZ770730-*	3.0315	2.87	0.08	72	77	73	2	1828.8	QT770730-*
QZ800750-*	3.1496	2.95	0.10	72	80	75	2.5	1828.8	QT800750-*
QZ850800-*	3.3465	3.15	0.10	72	85	80	2.5	1828.8	QT850800-*
QZ900850-*	3.5433	3.35	0.10	72	90	85	2.5	1828.8	QT900850-*
QZ950900-*	3.7402	3.54	0.10	72	95	90	2.5	1828.8	QT950900-*
QZ1000950-*	3.9370	3.74	0.10	72	100	95	2.5	1828.8	QT1000950-*
QZ10661016-*	4.1969	4.00	0.10	72	106.6	101.6	2.5	1828.8	QT11001050-*
QZ11001050-*	4.3307	4.13	0.10	72	110	105	2.5	1828.8	QT11501100-*
QZ11501100-*	4.5276	4.33	0.10	72	115	110	2.5	1828.8	QT12001150-*
QZ12001150-*	4.7244	4.53	0.10	72	120	115	2.5	1828.8	QT12501200-*
QZ12501200-*	4.9213	4.72	0.10	72	125	120	2.5	1828.8	QT13001250-*
QZ13001250-*	5.1181	4.92	0.10	72	130	125	2.5	1828.8	QT13501300-*
QZ13501300-*	5.3150	5.12	0.10	72	135	130	2.5	1828.8	QT13501300-*
QZ13601300-*	5.3543	5.12	0.10	72	136	130	2.5	1828.8	QT13601300-*
QZ14101350-*	5.5512	5.32	0.12	72	141	135	3	1828.8	QT14101350-*
QZ14601400-*	5.7480	5.51	0.12	72	146	140	3	1828.8	QT14601400-*

*Specify tube or tubing length in inches (standard) or millimeters (add “mm” after length).
Tolerances on Outside and Inside Diameters ±2 %
Other tube sizes, square tubes, and stirring rod also available. Phone for details

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Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

(QZ) - Closed One End

Inside Diameters - 145 mm to 320 mm

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	Part Number
QZ15101450-*	5.9449	5.71	0.12	72	151	145	3	1828.8	QT15101450-*
QZ15601500-*	6.1417	5.91	0.12	72	156	150	3	1828.8	QT15601500-*
QZ16101550-*	6.3386	6.10	0.12	72	161	155	3	1828.8	QT16101550-*
QZ16601600-*	6.5354	6.30	0.12	72	166	160	3	1828.8	QT16601600-*
QZ17101650-*	6.7323	6.50	0.12	72	171	165	3	1828.8	QT17101650-*
QZ17601700-*	6.9291	6.69	0.12	72	176	170	3	1828.8	QT17601700-*
QZ18401760-*	7.2441	4.00	0.16	72	184	176	4	1828.8	QT18401760-*
QZ18501780-*	7.2835	7.01	0.14	72	185	178	3.5	1828.8	QT18501780-*
QZ19001840-*	7.4803	7.51	0.12	72	190	184	3	1828.8	QT19001840-*
QZ19601900-*	7.7165	7.48	0.12	72	196	190	3	1828.8	QT19601900-*
QT20101950-*	7.9134	7.68	0.12	72	201	195	3	1828.8	QT20101950-*
QZ20602000-*	8.1102	7.87	0.12	72	206	200	3	1828.8	QT20602000-*
QZ21102030-*	8.3071	7.99	0.16	72	211	203	4	1828.8	QT21102030-*
QZ21602080-*	8.5039	8.19	0.16	72	216	208	4	1828.8	QT21602080-*
QZ22102150-*	8.7008	8.31	0.20	72	221	211	5	1828.8	QT22102150-*
QZ22102110-*	8.7008	8.46	0.12	72	221	215	3	1828.8	QT22102110-*
QZ22102150-*	8.8583	8.46	0.20	72	225	215	5	1828.8	QT22102150-*
QZ22502150-*	8.8976	8.66	.012	72	226	220	3	1828.8	QT22502150-*
QZ22602200-*	8.9764	8.66	0.16	72	228	220	4	1828.8	QT22602200-*
QZ22802200-*	9.0551	8.66	0.20	72	230	220	5	1828.8	QT22802200-*
QZ23002200-*	9.0157	8.70	0.16	72	229	221	4	1828.8	QT23002200-*
QZ22902210-*	9.2520	8.86	0.20	72	235	225	5	1828.8	QT22902210-*
QZ23502250-*	9.2520	8.94	0.16	72	235	227	4	1828.8	QT23502250-*
QZ23502270-*	9.2913	9.06	0.12	72	236	230	3	1828.8	QT23502270-*
QZ23602300-*	9.4488	9.06	0.20	72	240	230	5	1828.8	QT23602300-*
QZ24502350-*	9.6457	9.25	0.20	72	245	235	5	1828.8	QT24502350-*
QZ24602400-*	9.6850	9.45	0.12	72	246	240	3	1828.8	QT24602400-*
QZ24902410-*	9.8031	9.49	0.16	72	249	241	4	1828.8	QT24902410-*
QZ25102410-*	9.8819	9.49	0.20	72	251	241	5	1828.8	QT25102410-*
QZ25302450-*	9.9606	9.65	0.16	72	253	245	4	1828.8	QT25302450-*
QZ26002500-*	10.2362	9.84	0.20	72	260	250	5	1828.8	QT26002500-*
QZ26502570-*	10.4331	10.12	0.16	72	265	257	4	1828.8	QT26502570-*
QZ26702590-*	10.5118	10.20	0.16	72	267	259	4	1828.8	QT26702590-*
QZ26802600-*	10.5512	10.24	0.16	72	268	260	4	1828.8	QT26802600-*
QZ27502650-*	10.8268	10.43	0.20	72	275	265	5	1828.8	QT27502650-*
QZ28002700-*	11.0236	10.63	0.20	72	280	270	5	1828.8	QT28002700-*
QZ30002900-*	11.8110	11.42	0.20	72	300	290	5	1828.8	QT30002900-*
QZ30903000-*	12.1654	11.79	0.18	72	309	300	4.5	1828.8	QT30903000-*
QZ31503060-*	12.4016	12.05	0.18	72	315	306	4.5	1828.8	QT31503060-*
QZ33003200-*	12.9921	12.60	0.20	72	330	320	5	1828.8	QT33003200-*

*Specify tube or tubing length in inches (standard) or millimeters (add “mm” after length).
Tolerances on Outside and Inside Diameters ±2 %
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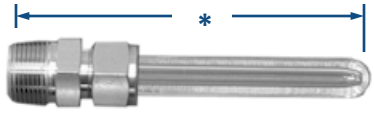
Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

Outside Diameters - 3 mm to 15.8 mm - Compression Fitting - "CF"



(QZ) - Closed One End

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	"CF" Fitting	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	Tube O.D. x NPT	Part Number
QZ030010CF-*	0.1181	0.0394	0.0394	48	3	1	1	1219.2	1/8" x 1/8"	QT030010CF-*
QZ063.5040CF-*	0.2500	0.1575	0.0463	48	6.35	4	1.175	1219.2	1/4" x 1/8"	QT063.5040CF-*
QZ096070CF-*	0.3780	0.2756	0.0512	48	9.6	7	1.3	1219.2	3/8" x 1/2"	QT096070CF-*
QZ127.5105CF-*	0.5020	0.4134	0.0443	48	12.75	10.5	1.125	1219.2	1/2" x 1/2"	QT127.5105CF-*
QZ158130CF-*	0.6220	0.5118	0.0551	48	15.8	13	1.4	1219.2	5/8" x 3/4"	QT158130CF-*

Outside Diameters - 3 mm to 19 mm - Hex Fitting - "HX"

(QZ) - Closed One End

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	Hex Fitting	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	Process x Head	Part Number
QZ030010HX-*	0.1181	0.04	0.04	48	3	1	1	1219.2	1/2" x 1/2" NPT	QT030010HX-*
QZ040020HX-*	0.1575	0.08	0.04	48	4	2	1	1219.2	1/2" x 1/2" NPT	QT040020HX-*
QZ050030HX-*	0.1969	0.12	0.04	48	5	3	1	1219.2	1/2" x 1/2" NPT	QT050030HX-*
QZ060020HX-*	0.2362	0.08	0.08	48	6	2	2	1219.2	1/2" x 1/2" NPT	QT060020HX-*
QZ060040HX-*	0.2362	0.16	0.04	48	6	4	1	1219.2	1/2" x 1/2" NPT	QT060040HX-*
QZ063.5040HX-*	0.2500	0.16	0.05	48	6.35	4	1.175	1219.2	1/2" x 1/2" NPT	QT063.5040HX-*
QZ070050HX-*	0.2756	0.20	0.04	48	7	5	1	1219.2	1/2" x 1/2" NPT	QT070050HX-*
QZ072047HX-*	0.2835	0.19	0.05	10	7.2	4.7	1.25	254.0	1/2" x 1/2" NPT	QT072047HX-*
QZ080020HX-*	0.3150	0.08	0.12	48	8	2	3	1219.2	1/2" x 1/2" NPT	QT080036HX-*
QZ080036HX-*	0.3150	0.14	0.09	48	8	3.6	2.2	1219.2	1/2" x 1/2" NPT	QT080020HX-*
QZ080040HX-*	0.3150	0.16	0.08	48	8	4	2	1219.2	1/2" x 1/2" NPT	QT080060HX-*
QZ080060HX-*	0.3150	0.24	0.04	48	8	6	1	1219.2	1/2" x 1/2" NPT	QT080040HX-*
QZ090070HX-*	0.3543	0.28	0.04	48	9	7	1	1219.2	1/2" x 1/2" NPT	QT090070HX-*
QZ096070HX-*	0.3780	0.28	0.05	48	9.6	7	1.3	1219.2	1/2" x 1/2" NPT	QT096070HX-*
QZ097.5077.5HX-*	0.3840	0.31	0.04	48	9.75	7.75	1	1219.2	1/2" x 1/2" NPT	QT097.5077.5HX-*
QZ099079HX-*	0.3898	0.31	0.04	18	9.9	7.9	1	457.2	1/2" x 1/2" NPT	QT099079HX-*
QZ100060HX-*	0.3937	0.24	0.08	48	10	6	2	1219.2	1/2" x 1/2" NPT	QT100060HX-*
QZ104070HX-*	0.4094	0.28	0.07	48	10.4	7	1.7	1219.2	1/2" x 1/2" NPT	QT104070HX-*
QZ110060HX-*	0.4331	0.24	0.10	48	11	6	2.5	1219.2	1/2" x 1/2" NPT	QT110060HX-*
QZ118090HX-*	0.4650	0.35	0.06	48	11.8	9	1.4	1219.2	1/2" x 1/2" NPT	QT118090HX-*
QZ120060HX-*	0.4724	0.24	0.12	48	12	6	3	1219.2	1/2" x 1/2" NPT	QT120060HX-*
QZ012080HX-*	0.4724	0.32	0.08	48	12	8	2	1219.2	1/2" x 1/2" NPT	QT012080HX-*
QZ130040HX-*	0.5118	0.16	0.18	13	13	4	4.5	330.2	1/2" x 1/2" NPT	QT130040HX-*
QZ140100HX-*	0.5512	0.39	0.08	48	14	10	2	1219.2	1/2" x 1/2" NPT	QT140100HX-*
QZ150090HX-*	0.5906	0.35	0.08	48	15	9	2	1219.2	1/2" x 1/2" NPT	QT150090HX-*
QZ158130HX-*	0.6220	0.51	0.06	48	15.8	13	1.4	1219.2	1/2" x 1/2" NPT	QT158130HX-*
QZ162130HX-*	0.6378	0.51	0.06	48	16.2	13	1.6	1219.2	1/2" x 1/2" NPT	QT162130HX-*
QZ180150HX-*	0.7087	0.59	0.06	48	18	15	1.5	1219.2	3/4" x 3/4" NPT	QT180150HX-*
QZ190135HX-*	0.7480	0.53	0.11	48	19	13.5	2.75	1219.2	3/4" x 3/4"NPT	QT190135HX-*

*Specify tube or tubing length in inches (standard) or millimeters (add "mm" after length).
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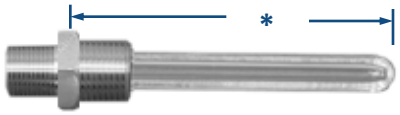
Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

Outside Diameters - 17 mm to 32 mm - Steel Fitting - "F"

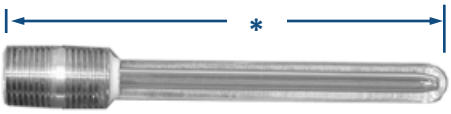


(QZ) - Closed One End

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	Fitting	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	Process x Head	Part Number
QZ170150F-*	0.6693	0.5906	0.0394	48	17	15	1	1219.2	3/4" x 1/2" NPT	QT170150F-*
QZ250220F-*	0.9843	0.8671	0.0591	48	25	22	1.5	1219.2	1" x 3/4" NPT	QT250220F-*
QZ320280F-*	1.2598	1.2598	0.0787	48	32	28	2	1219.2	1 1/2" x 1" NPT	QT320280F-*

Outside Diameters - 3 mm to 32 mm - Close Nipple - "NC"



(QZ) - Closed One End

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	Close Nipple	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	NPT x Length	Part Number
QZ030010NC-*	0.1181	0.04	0.04	48	3	1	1	1219.2	1/8 x 7/8"	QT030010NC-*
QZ040020NC-*	0.1575	0.08	0.04	48	4	2	1	1219.2	1/8 x 7/8"	QT040020NC-*
QZ050030NC-*	0.1969	0.12	0.04	48	5	3	1	1219.2	1/8 x 7/8"	QT050030NC-*
QZ060020NC-*	0.2362	0.08	0.08	48	6	2	2	1219.2	1/8 x 7/8"	QT060020NC-*
QZ060040NC-*	0.2362	0.16	0.04	48	6	4	1	1219.2	1/8 x 7/8"	QT060040NC-*
QZ063.5040NC-*	0.2500	0.16	0.05	48	6.35	4	1.175	1219.2	1/4 x 7/8"	QT063.5040NC-*
QZ070050NC-*	0.2756	0.20	0.04	48	7	5	1	1219.2	1/4 x 7/8"	QT070050NC-*
QZ072047NC-*	0.2835	0.19	0.05	10	7.2	4.7	1.25	254.0	1/4 x 7/8"	QT072047NC-*
QZ080020NC-*	0.3150	0.08	0.12	48	8	2	3	1219.2	1/4 x 7/8"	QT080020NC-*
QZ080036NC-*	0.3150	0.14	0.09	48	8	3.6	2.2	1219.2	1/4 x 7/8"	QT080036NC-*
QZ080040NC-*	0.3150	0.16	0.08	48	8	4	2	1219.2	1/4 x 7/8"	QT080040NC-*
QZ080060NC-*	0.3150	0.24	0.04	48	8	6	1	1219.2	1/4 x 7/8"	QT080060NC-*
QZ090070NC-*	0.3543	0.28	0.04	48	9	7	1	1219.2	3/8 x 1"	QT090070NC-*
QZ096070NC-*	0.3780	0.28	0.05	48	9.6	7	1.3	1219.2	3/8 x 1"	QT096070NC-*
QZ097.5077.5NC-*	0.3840	0.31	0.04	48	9.75	7.75	1	1219.2	3/8 x 1"	QT097.5077.5NC-*
QZ099079NC-*	0.3898	0.31	0.04	18	9.9	7.9	1	457.2	3/8 x 1"	QT099079NC-*
QZ100060NC-*	0.3937	0.24	0.08	48	10	6	2	1219.2	3/8 x 1"	QT100060NC-*
QZ104070NC-*	0.4094	0.28	0.07	48	10.4	7	1.7	1219.2	3/8 x 1"	QT104070NC-*
QZ110060NC-*	0.4331	0.24	0.10	48	11	6	2.5	1219.2	3/8 x 1"	QT110060NC-*
QZ118090NC-*	0.4650	0.35	0.06	48	11.8	9	1.4	1219.2	3/8 x 1"	QT118090NC-*
QZ120060NC-*	0.4724	0.24	0.12	48	12	6	3	1219.2	1/2 x 1 3/16"	QT120060NC-*
QZ012080NC-*	0.4724	0.32	0.08	48	12	8	2	1219.2	1/2 x 1 3/16"	QT012080NC-*
QZ130040NC-*	0.5118	0.16	0.18	13	13	4	4.5	330.2	1/2 x 1 3/16"	QT130040NC-*
QZ140100NC-*	0.5512	0.39	0.08	48	14	10	2	1219.2	1/2 x 1 3/16"	QT140100NC-*
QZ150090NC-*	0.5906	0.35	0.08	48	15	9	2	1219.2	1/2 x 1 3/16"	QT150090NC-*
QZ158130NC-*	0.6220	0.51	0.06	48	15.8	13	1.4	1219.2	1/2 x 1 3/16"	QT158130NC-*
QZ162130NC-*	0.6378	0.51	0.06	48	16.2	13	1.6	1219.2	1/2 x 1 3/16"	QT162130NC-*
QZ180150NC-*	0.7087	0.59	0.06	48	18	15	1.5	1219.2	3/4 x 1 5/16"	QT180150NC-*
QZ190135NC-*	0.7480	0.53	0.11	48	19	13.5	2.75	1219.2	3/4 x 1 5/16"	QT190135NC-*
QZ200160NC-*	0.7874	0.63	0.08	48	20	16	2	1219.2	1 x 1 1/2"	QT200160NC-*
QZ205180NC-*	0.8071	0.71	0.05	48	20.5	18	1.25	1219.2	1 x 1 1/2"	QT205180NC-*
QZ216180NC-*	0.8504	0.71	0.07	48	21.6	18	1.8	1219.2	1 x 1 1/2"	QT216180NC-*
QZ230200NC-*	0.9055	0.79	0.06	48	23	20	1.5	1219.2	1 x 1 1/2"	QT230200NC-*
QZ250220NC-*	0.9843	0.87	0.06	48	25	22	1.5	1219.2	1 x 1 1/2"	QT250220NC-*
QZ258220NC-*	1.0157	0.87	0.07	48	25.8	22	1.9	1219.2	1 1/4 x 1 5/8"	QT258220NC-*
QZ288250NC-*	1.1339	0.98	0.07	48	25.8	25	1.9	1219.2	1 1/4 x 1 5/8"	QT288250NC-*
QZ300260NC-*	1.1811	1.18	0.08	48	30	26	2	1219.2	1 1/4 x 1 5/8"	QT300260NC-*
QZ320280NC-*	1.2598	1.26	0.08	48	32	28	2	1219.2	1 1/4 x 1 5/8"	QT320280NC-*

*Specify tube or tubing length in inches (standard) or millimeters (add "mm" after length).
Tolerances on Outside and Inside Diameters ±2 %
Other tube sizes, square tubes, and stirring rod also available. Phone for details

Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

Outside Diameters - 3 mm to 32 mm - #9 Alloy Nipple - "NS9"

(QZ) - Closed One End

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	NS9 Nipple	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	NPT x Length	Part Number
QZ030010NS9-*	0.1181	0.0394	0.0394	48	3	1	1	1219.2	1/8 x 6"	QT030010NS9-*
QZ040020NS9-*	0.1575	0.0787	0.0394	48	4	2	1	1219.2	1/8 x 6"	QT04002NS9-*
QZ050030NS9-*	0.1969	0.1181	0.0394	48	5	3	1	1219.2	1/8 x 6"	QT050030NS9-*
QZ060020NS9-*	0.2362	0.0787	0.0787	48	6	2	2	1219.2	1/8 x 6"	QT060020NS9-*
QZ060040NS9-*	0.2362	0.1575	0.0394	48	6	4	1	1219.2	1/8 x 6"	QT060040NS9-*
QZ06.35040NS9-*	0.2500	0.16	0.05	48	6.35	4	1.175	1219.2	1/4 x 6"	QZ06.35040NS9-*
QZ070050NS9-*	0.2756	0.20	0.04	48	7	5	1	1219.2	1/4 x 6"	QZ070050NS9-*
QZ072047NS9-*	0.2835	0.19	0.05	10	7.2	4.7	1.25	254.0	1/4 x 6"	QZ072047NS9-*
QZ080020NS9-*	0.3150	0.08 .0	0.12	48	8	2	3	1219.2	1/4 x 6"	QZ080020NS9-*
QZ080036NS9-*	0.3150	14	0.09	48	8	3.6	2.2	1219.2	1/4 x 6"	QZ080036NS9-*
QZ080040NS9- *	0.3150	0.16	0.08	48	8	4	2	1219.2	1/4 x 6"	QZ080040NS9-*
QZ080060NS9-*	0.3150	0.24	0.04	48	8	6	1	1219.2	1/4 x 6"	QZ080060NS9-*
QZ090070NS9-*	0.3543	0.28	0.04	48	9	7	1	1219.2	3/8 x 6"	QZ090070NS9-*
QZ096070NS9-*	0.3780	0.28	0.05	48	9.6	7	1.3	1219.2	3/8 x 6"	QZ096070NS9-*
QZ09.7507.75NS9-*	0.3840	0.31	0.04	48	9.75	7.75	1	1219.2	3/8 x 6"	QZ09.7507.75NS9-*
QZ099079NS9-*	0.3898	0.31	0.04	18	9.9	7.9	1	457.2	3/8 x 6"	QZ099079NS9-*
QZ100060NS9-*	0.3937	0.24	0.08	48	10	6	2	1219.2	3/8 x 6"	QZ100060NS9-*
QZ104070NS9-*	0.4094	0.28	0.07	48	10.4	7	1.7	1219.2	3/8 x 6"	QZ104070NS9-*
QZ110060NS9-*	0.4331	0.24	0.10	48	11	6	2.5	1219.2	3/8 x 6"	QZ118090NS9-*
QZ118090NS9-*	0.4650	0.35	0.06	48	11.8	9	1.4	1219.2	3/8 x 6"	QZ120060NS9-*
QZ120060NS9-*	0.4724	0.24	0.12	48	12	6	3	1219.2	1/2 x 6"	QZ012080NS9-*
QZ012080NS9-*	0.4724	0.32	0.08	48	12	8	2	1219.2	1/2 x 6"	QZ012080NS9-*
QZ130040NS9-*	0.5118	0.16	0.18	13	13	4	4.5	330.2	1/2 x 6"	QZ130040NS9-*
QZ140100NS9-*	0.5512	0.39	0.08	48	14	10	2	1219.2	1/2 x 6"	QZ140100NS9-*
QZ150090NS9-*	0.5906	0.35	0.08	48	15	9	2	1219.2	1/2 x 6"	QZ150090NS9-*
QZ158130NS9-*	0.6220	0.51	0.06	48	15.8	13	1.4	1219.2	1/2 x 6"	QZ158130NS9-*
QZ162130NS9-*	0.6378	0.51	0.06	48	16.2	13	1.6	1219.2	1/2 x 6"	QZ162130NS9-*
QZ180150NS9-*	0.7087	0.59	0.06	48	18	15	1.5	1219.2	3/4 x 6"	QZ180150NS9-*
QZ190135NS9-*	0.7480	0.53	0.11	48	19	13.5	2.75	1219.2	3/4 x 6"	QZ190135NS9-*
QZ200160NS9-*	0.7874	0.63	0.08	48	20	16	2	1219.2	1 x 6"	QZ200160NS9-*
QZ205180NS9-*	0.8071	0.71	0.05	48	20.5	18	1.25	1219.2	1 x 6"	QZ205180NS9-*
QZ216180NS9-*	0.8504	0.71	0.07	48	21.6	18	1.8	1219.2	1 x 6"	QZ216180NS9-*
QZ230200NS9-*	0.9055	0.79	0.06	48	23	20	1.5	1219.2	1 x 6"	QZ230200NS9-*
QZ250220NS9-*	0.9843	0.87	0.06	48	25	22	1.5	1219.2	1 x 6"	QZ250220NS9-*
QZ258220NS9-*	1.0157	0.87	0.07	48	25.8	22	1.9	1219.2	1 1/4 x 6"	QZ258220NS9-*
QZ288250NS9-*	1.1339	0.98	0.07	48	28.8	25	1.9	1219.2	1 1/4 x 6"	QZ288250NS9-*
QZ300260NS9-*	1.1811	1.18	0.08	48	30	26	2	1219.2	1 1/4 x 6"	QZ300260NS9-*
QZ320280NS9-*	1.2598	1.26	0.08	48	32	28	2	1219.2	1 1/4 x 6"	QZ320280NS9-*

*Specify tube or tubing length in inches (standard) or millimeters (add "mm" after length).
Tolerances on Outside and Inside Diameters ±2 %
Other tube sizes, square tubes, and stirring rod also available. Phone for details

! Notes: #9 nipple is constructed from Alloy 600 material as standard. Other alloys are available.

Substitute the "**9**" in the "**NS9**" part number with a "**7**" (446), "**8**" (304SS) or "**16**" (316SS) if you require a different alloy. 6" nipples are standard. Other lengths can be specified by inserting a "**A**" and the length to the part number.

Example Part Number: **QZ30010NS16A4-*** has a 4", 316SS nipple.

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Quartz - Fused Quartz Tubes and Tubing - Maximum 2192°F (1200°C)

Outside Diameters - 3 mm to 32 mm - Carbon Steel Space Nipple - "N"

(QZ) - Closed One End

(QT) - Open Both Ends

Closed	Inches			Maximum	Millimeters			Maximum	Space Nipple	Open
Part Number	O.D.	I.D.	Wall	Length	O.D.	I.D.	Wall	Length	NPT x Length	Part Number
QZ030010N-*	0.1181	0.04	0.04	48	3	1	1	1219.2	1/8 x 1"	QT030010N-*
QZ040020N-*	0.1575	0.08	0.04	48	4	2	1	1219.2	1/8 x 1"	QT040020N-*
QZ050030N-*	0.1969	0.12	0.04	48	5	3	1	1219.2	1/8 x 1"	QT050030N-*
QZ060020N-*	0.2362	0.08	0.08	48	6	2	2	1219.2	1/8 x 1"	QT060020N-*
QZ060040N-*	0.2362	0.16	0.04	48	6	4	1	1219.2	1/8 x 1"	QT060040N-*
QZ063.5040N-*	0.2500	0.16	0.05	48	6.35	4	1.175	1219.2	1/4 x 1"	QT063.5040N-*
QZ070050N-*	0.2756	0.20	0.04	48	7	5	1	1219.2	1/4 x 1"	QT070050N-*
QZ072047N-*	0.2835	0.19	0.05	10	7.2	4.7	1.25	254.0	1/4 x 1"	QT072047N-*
QZ080020N-*	0.3150	0.14	0.09	48	8	3.6	2.2	1219.2	1/4 x 1"	QT080036N-*
QZ080036N-*	0.3150	0.08	0.12	48	8	2	3	1219.2	1/4 x 1"	QT080020N-*
QZ080040N-*	0.3150	0.24	0.04	48	8	6	1	1219.2	1/4 x 1"	QT080060N-*
QZ080060N-*	0.3150	0.16	0.08	48	8	4	2	1219.2	1/4 x 1"	QT080040N-*
QZ090070N-*	0.3543	0.28	0.04	48	9	7	1	1219.2	3/8 x 1 1/2"	QT090070N-*
QZ096070N-*	0.3780	0.28	0.05	48	9.6	7	1.3	1219.2	3/8 x 1 1/2"	QT096070N-*
QZ097.5077.5N-*	0.3840	0.31	0.04	48	9.75	7.75	1	1219.2	3/8 x 1 1/2"	QT097.5077.5N-*
QZ099079N-*	0.3898	0.31	0.04	18	9.9	7.9	1	457.2	3/8 x 1 1/2"	QT099079N-*
QZ100060N-*	0.3937	0.24	0.08	48	10	6	2	1219.2	3/8 x 1 1/2"	QT100060N-*
QZ104070N-*	0.4094	0.28	0.07	48	10.4	7	1.7	1219.2	3/8 x 1 1/2"	QT104070N-*
QZ110060N-*	0.4331	0.24	0.10	48	11	6	2.5	1219.2	3/8 x 1 1/2"	QT110060N-*
QZ118090N-*	0.4650	0.35	0.06	48	11.8	9	1.4	1219.2	3/8 x 1 1/2"	QT118090N-*
QZ120060N-*	0.4724	0.24	0.12	48	12	6	3	1219.2	1/2 x 2"	QT120060N-*
QZ012080N-*	0.4724	0.32	0.08	48	12	8	2	1219.2	1/2 x 2"	QT012080N-*
QZ130040N-*	0.5118	0.16	0.18	13	13	4	4.5	330.2	1/2 x 2"	QT130040N-*
QZ140100N-*	0.5512	0.39	0.08	48	14	10	2	1219.2	1/2 x 2"	QT140100N-*
QZ150090N-*	0.5906	0.35	0.08	48	15	9	2	1219.2	1/2 x 2"	QT150090N-*
QZ158130N-*	0.6220	0.51	0.06	48	15.8	13	1.4	1219.2	3/4 x 2 1/2"	QT158130N-*
QZ162130N-*	0.6378	0.51	0.06	48	16.2	13	1.6	1219.2	3/4 x 2 1/2"	QT162130N-*
QZ180150N-*	0.7087	0.59	0.06	48	18	15	1.5	1219.2	3/4 x 2 1/2"	QT180150N-*
QZ190135N-*	0.7480	0.53	0.11	48	19	13.5	2.75	1219.2	3/4 x 2 1/2"	QT190135N-*
QZ200160N-*	0.7874	0.63	0.08	48	20	16	2	1219.2	1 x 3"	QT200160N-*
QZ205180N-*	0.8071	0.71	0.05	48	20.5	18	1.25	1219.2	1 x 3"	QT205180N-*
QZ216180N-*	0.8504	0.71	0.07	48	21.6	18	1.8	1219.2	1 x 3"	QT216180N-*
QZ230200N-*	0.9055	0.79	0.06	48	23	20	1.5	1219.2	1 x 3"	QT230200N-*
QZ250220N-*	0.9843	0.87	0.06	48	25	22	1.5	1219.2	1 x 3"	QT250220N-*
QZ258220N-*	1.0157	0.87	0.07	48	25.8	22	1.9	1219.2	1 1/4 x 3"	QT258220N-*
QZ288250N-*	1.1339	0.98	0.07	48	25.8	25	1.9	1219.2	1 1/4 x 3"	QT288250N-*
QZ300260N-*	1.1811	1.18	0.08	48	30	26	2	1219.2	1 1/4 x 3"	QT300260N-*
QZ320280N-*	1.2598	1.26	0.08	48	32	28	2	1219.2	1 1/4 x 3"	QT320280N-*

*Specify tube or tubing length in inches (standard) or millimeters (add "mm" after length).
Tolerances on Outside and Inside Diameters ±2 %
Other tube sizes, square tubes, and stirring rod also available. Phone for details

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Unit of Measure Conversions, Inches to Feet and Millimeters

Fraction	Inches	mm
1/16	0.0625	1.588
1/8	0.1250	3.175
3/16	0.1875	4.763
1/4	0.2500	6.350
5/16	0.3125	7.938
3/8	0.3750	9.525
7/16	0.4375	11.113
1/2	0.5000	12.700
9/16	0.5625	14.288
5/8	0.6250	15.875
11/16	0.6875	17.463
3/4	0.7500	19.050
13/16	0.8125	20.638
7/8	0.8750	22.225
15/16	0.9375	23.813

Feet	Inches	mm
0.083	1	25.4
0.167	2	50.8
0.250	3	76.2
0.333	4	101.6
0.417	5	127.0
0.500	6	152.4
0.583	7	177.8
0.667	8	203.2
0.750	9	228.6
0.833	10	254.0
0.917	11	279.4
1.000	12	304.8
1.083	13	330.2
1.167	14	355.6
1.250	15	381.0
1.333	16	406.4
1.417	17	431.8
1.500	18	457.2
1.583	19	482.6
1.667	20	508.0
1.750	21	533.4
1.833	22	558.8
1.917	23	584.2
2.000	24	609.6
2.083	25	635.0
2.167	26	660.4
2.250	27	685.8
2.333	28	711.2
2.417	29	736.6
2.500	30	762.0
2.583	31	787.4
2.667	32	812.8
2.750	33	838.2
2.833	34	863.6
2.917	35	889.0
3.000	36	914.4
3.083	37	939.8
3.167	38	965.2
3.250	39	990.6

Feet	Inches	mm
3.333	40	1016.0
3.417	41	1041.4
3.500	42	1066.8
3.583	43	1092.2
3.667	44	1117.6
3.750	45	1143.0
3.833	46	1168.4
3.917	47	1193.8
4.000	48	1219.2
4.083	49	1244.6
4.167	50	1270.0
4.250	51	1295.4
4.333	52	1320.8
4.417	53	1346.2
4.500	54	1371.6
4.583	55	1397.0
4.667	56	1422.4
4.750	57	1447.8
4.833	58	1473.2
4.917	59	1498.6
5.000	60	1524.0
5.083	61	1549.4
5.167	62	1574.8
5.250	63	1600.2
5.333	64	1625.6
5.417	65	1651.6
5.500	66	1676.4
5.583	67	1701.8
5.667	68	1727.2
5.750	69	1752.6
5.833	70	1778.0
5.917	71	1803.4
6.000	72	1828.8
6.083	73	1854.2
6.167	74	1879.6
6.250	75	1905.0
6.333	76	1930.4
6.417	77	1955.8
6.500	78	1981.2
6.583	79	2006.6
6.667	80	2032.0
6.750	81	2057.4
6.833	82	2082.8
6.917	83	2108.2
7.000	84	2133.6
7.083	85	2159.0
7.167	86	2184.4
7.250	87	2209.8
7.333	88	2235.2
7.417	89	2260.6
7.500	90	2286.0
7.583	91	2311.4
7.667	92	2236.8
7.750	93	2362.2
7.833	94	2387.6
7.917	95	2413.0

Feet	Inches	mm
8.000	96	2438.4
8.083	97	2463.8
8.167	98	2489.2
8.250	99	2514.6
8.333	100	2540.0
8.417	101	2565.4
8.500	102	2590.8
8.583	103	2616.2
8.667	104	2641.6
8.750	105	2667.0
8.833	106	2692.4
8.917	107	2717.8
9.000	108	2743.2
9.083	109	2768.6
9.167	110	2794.0
9.250	111	2819.4
9.333	112	2844.8
9.417	113	2870.2
9.500	114	2895.6
9.583	115	2921.0
9.667	116	2946.4
9.750	117	2971.8
9.833	118	2997.2
9.917	119	3022.6
10.000	120	3048.0
10.083	121	3073.4
10.167	122	3098.8
10.250	123	3124.2
10.333	124	3149.6
10.417	125	3175.0
10.500	126	3200.4
10.583	127	3225.8
10.667	128	3251.2
10.750	129	3276.6
10.833	130	3302.0
10.917	131	3327.4
11.000	132	3352.8
11.083	133	3378.2
11.167	134	3403.6
11.250	135	3429.0
11.333	136	3454.4
11.417	137	3479.8
11.500	138	3505.2
11.583	139	3503.6
11.667	140	3556.0
11.750	141	3581.4
11.833	142	3606.8
11.917	143	3632.2
12.000	144	3657.6
12.083	145	3683.0
12.167	146	3708.4
12.250	147	3733.8
12.333	148	3759.2
12.417	149	3784.6
12.500	150	3810.0
12.583	151	3835.4

Feet	Inches	mm
12.667	152	3860.8
12.750	153	3886.2
12.833	154	3911.6
12.917	155	3937.0
13.000	156	3962.4
13.083	157	3987.8
13.167	158	4013.2
13.250	159	4038.6
13.333	160	4064.0
13.417	161	4089.4
13.500	162	4114.8
13.583	163	4140.2
13.667	164	4165.6
13.750	165	4191.0
13.833	166	4216.4
13.917	167	4241.8
14.000	168	4267.2
14.083	169	4292.6
14.167	170	4318.0
14.250	171	4343.4
14.333	172	4368.8
14.417	173	4394.2
14.500	174	4419.6
14.583	175	4445.0
14.667	176	4470.4
14.750	177	4495.8
14.833	178	4521.2
14.917	179	4546.6
15.000	180	4572.0
15.083	181	4597.4
15.167	182	4622.8
15.250	183	4648.2
15.333	184	4673.6
15.417	185	4699.0
15.500	186	4724.4
15.583	187	4749.8
15.667	188	4775.2
15.750	189	4800.6
15.833	190	4826.0
15.917	191	4851.4
16.000	192	4876.8
16.083	193	4902.2
16.167	194	4927.6
16.250	195	4953.0
16.333	196	4978.4
16.417	197	2003.8
16.500	198	5029.2
16.583	199	5054.6
16.667	200	5080.0
16.750	201	5105.4
16.833	202	5130.8
16.917	203	5156.2
17.000	204	5181.6

Conversion equals:

Millimeters = inches times 25.4
Inches = feet divided by 12

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Conversion Table - Millimeters to Inches and Feet

Inches	mm	Feet	Inches	mm	Feet	Inches	mm	Feet	Inches	mm	Feet	Inches	mm	Feet
0.004	0.1	0.0003	1.81	46	0.151	3.98	101	0.331	6.14	156	0.512	8.31	211	0.692
0.008	0.2	0.0007	1.85	47	0.154	4.02	102	0.335	6.18	157	0.515	8.35	212	0.696
0.012	0.3	0.0010	1.89	48	0.158	4.06	103	0.338	6.22	158	0.518	8.39	213	0.699
0.016	0.4	0.0013	1.93	49	0.161	4.09	104	0.341	6.26	159	0.522	8.43	214	0.702
0.020	0.5	0.0017	1.97	50	0.164	4.13	105	0.345	6.30	160	0.525	8.47	215	0.705
0.024	0.6	0.0020	2.01	51	0.168	4.17	106	0.348	6.34	161	0.528	8.50	216	0.709
0.028	0.7	0.0023	2.05	52	0.171	4.21	107	0.351	6.38	162	0.532	8.54	217	0.712
0.031	0.8	0.0026	2.09	53	0.174	4.25	108	0.354	6.42	163	0.535	8.58	218	0.715
0.035	0.9	0.0029	2.13	54	0.178	4.29	109	0.358	6.46	164	0.538	8.62	219	0.719
0.039	1	0.0033	2.17	55	0.181	4.33	110	0.361	6.50	165	0.541	8.66	220	0.722
0.079	2	0.0066	2.20	56	0.183	4/.37	111	0.364	6.54	166	0.545	8.70	221	0.725
0.118	3	0.0098	2.24	57	0.187	4.41	112	0.367	6.58	167	0.548	8.74	222	0.728
0.157	4	0.0131	2.28	58	0.190	4.45	113	0.371	6.61	168	0.551	8.78	223	0.732
0.197	5	0.0164	2.32	59	0.193	4.49	114	0.374	6.65	169	0.555	8.82	224	0.735
0.236	6	0.0197	2.36	60	0.197	4.53	115	0.377	6.69	170	0.558	8.86	225	0.738
0.276	7	0.0230	2.40	61	0.200	4.57	116	0.381	6.73	171	0.561	8.90	226	0.742
0.315	8	0.0263	2.44	62	0.203	4.61	117	0.384	6.77	172	0.564	8.94	227	0.745
0.354	9	0.0295	2.48	63	0.207	4.65	118	0.387	6.81	173	0.568	8.98	228	0.748
0.394	10	0.0328	2.52	64	0.210	4.69	119	0.390	6.85	174	0.571	9.02	229	0.751
0.433	11	0.0361	2.56	65	0.213	4.72	120	0.394	6.89	175	0.574	9.06	230	0.755
0.472	12	0.0393	2.60	66	0.217	4.76	121	0.397	6.93	176	0.577	9.09	231	0.758
0.512	13	0.0427	2.64	67	0.220	4.80	122	0.400	6.97	177	0.581	9.13	232	0.761
0.551	14	0.0459	2.68	68	0.223	4.84	123	0.404	7.01	178	0.584	9.17	233	0.764
0.591	15	0.0493	2.72	69	0.227	4.88	124	0.407	7.05	179	0.587	9.21	234	0.768
0.630	16	0.0525	2.76	70	0.230	4.92	125	0.410	7.09	180	0.591	9.25	235	0.771
0.669	17	0.0558	2.80	71	0.233	4.96	126	0.413	7.13	181	0.594	9.29	236	0.774
0.709	18	0.0591	2.83	72	0.236	5.00	127	0.417	7.17	182	0.597	9.33	237	0.778
0.748	19	0.0623	2.87	73	0.239	5.04	128	0.420	7.21	183	0.600	9.37	238	0.781
0.787	20	0.0656	2.91	74	0.243	5.08	129	0.423	7.24	184	0.604	9.41	239	0.784
0.827	21	0.0689	2.95	75	0.246	5.12	130	0.427	7.28	185	0.607	9.45	240	0.787
0.866	22	0.0722	2.99	76	0.249	5.16	131	0.430	7.32	186	0.610	9.49	241	0.791
0.906	23	0.0755	3.03	77	0.253	5.20	132	0.433	7.36	187	0.614	9.53	242	0.794
0.945	24	0.0788	3.07	78	0.256	5.24	133	0.436	7.40	188	0.617	9.57	243	0.797
0.984	25	0.0820	3.11	79	0.259	5.28	134	0.440	7.44	189	0.620	9.61	244	0.801
1.024	26	0.0853	3.15	80	0.263	5.32	135	0.443	7.48	190	0.623	9.65	245	0.804
1.063	27	0.0886	3.19	81	0.266	5.35	136	0.446	7.52	191	0.627	9.69	246	0.807
1.102	28	0.0918	3.23	82	0.269	5.39	137	0.450	7.56	192	0.630	9.72	247	0.810
1.142	29	0.0952	3.27	83	0.273	5.43	138	0.453	7.60	193	0.633	9.76	248	0.814
1.181	30	0.0984	3.31	84	0.276	5.47	139	0.456	7.64	194	0.637	9.80	249	0.817
1.220	31	0.1017	3.35	85	0.279	5.51	140	0.459	7.68	195	0.640	9.84	250	0.820
1.260	32	0.1050	3.39	86	0.283	5.55	141	0.463	7.72	196	0.643	9.88	251	0.824
1.299	33	0.1083	3.43	87	0.286	5.59	142	0.466	7.76	197	0.646	9.92	252	0.827
1.339	34	0.1116	3.46	88	0.288	5.63	143	0.469	7.80	198	0.650	9.96	253	0.830
1.378	35	0.1148	3.50	89	0.292	5.67	144	0.472	7.84	199	0.653	10.00	254	0.833
1.417	36	0.1181	3.54	90	0.295	5.71	145	0.476	7.87	200	0.656	10.04	255	0.837
1.457	37	0.1214	3.58	91	0.298	5.75	146	0.479	7.91	201	0.659	10.08	256	0.840
1.496	38	0.1247	3.62	92	0.302	5.79	147	0.482	7.95	202	0.663	10.12	257	0.843
1.535	39	0.1279	3.66	93	0.305	5.83	148	0.486	7.99	203	0.666	10.16	258	0.846
1.575	40	0.1313	3.70	94	0.308	5.87	149	0.489	8.03	204	0.669	10.20	259	0.850
1.614	41	0.1345	3.74	95	0.312	5.91	150	0.492	8.07	205	0.673	10.24	260	0.853
1.654	42	0.1378	3.78	96	0.315	5.95	151	0.495	8.11	206	0.676			
1.693	43	0.1411	3.82	97	0.318	5.98	152	0.499	8.15	207	0.679			
1.732	44	0.1443	3.86	98	0.322	6.02	153	0.502	8.19	208	0.682			
1.772	45	0.1477	3.90	99	0.325	6.06	154	0.505	8.23	209	0.686			
			3.94	100	0.328	6.10	155	0.509	8.27	210	0.689			

Conversion equals:

Inches = mm divided by 25.4

Feet = inches divided by 12

Engineering Data - Units of Measure

Bare Wire (AWG) Conversion

Bare Wire Gauges - AWG
In Inches and Millimeters

Gauge	Inches	mm
0	0.3239	8.25
1	0.2893	7.35
2	0.2576	6.54
3	0.2294	5.83
4	0.2043	5.19
5	0.1819	4.62
6	0.1620	4.11
7	0.1443	3.67
8	0.1285	3.26
9	0.1144	2.91
10	0.1019	2.59
11	0.0907	2.30
12	0.0808	2.05
13	0.0720	1.83
14	0.0641	1.63

Bare Wire Gauges - AWG
In Inches and Millimeters

Gauge	Inches	mm
15	0.0571	1.45
16	0.0508	1.29
17	0.0453	1.15
18	0.0403	1.02
19	0.0359	0.912
20	0.0320	0.813
21	0.0285	0.724
22	0.0253	0.643
23	0.0226	0.574
24	0.0201	0.511
25	0.0179	0.455
26	0.0159	0.404
27	0.0142	0.361
28	0.0126	0.320
29	0.0113	0.287

Bare Wire Gauges - AWG
In Inches and Millimeters

Gauge	Inches	mm
30	0.0100	0.254
31	0.0089	0.226
32	0.0080	0.203
33	0.0071	0.180
34	0.0063	0.160
35	0.0056	0.142
36	0.0050	0.127
37	0.0045	0.114
38	0.0040	0.102
39	0.0035	0.089
40	0.0031	0.079
41	0.0028	0.071
42	0.0025	0.064
43	0.0022	0.056
44	0.0020	0.051
45	0.0018	0.046

Length - Conversions

To Convert to -	Meters (M)	Centimeters (cm)	Millimeters (mm)	Inches (in)	Feet (ft)
Multiply the	**By**	**By**	**By**	**By**	**By**
Meters	1	100	1000	39.37	3.28
Centimeters	0.01	1	10	0.394	0.0328
Millimeters	0.001	0.1	1	0.0394	0.00328
Inches	0.0254	2.540	25.4	1	0.0833
Feet	0.3048	30.48	304.8	12	1

Temperature Conversion Formulas:

Centigrade = (°F – 32) x 5/9

Fahrenheit = (°C x 95) +32

Kelvin = °C + 273

Conversion Equivalents

Length

1 foot = 12 inches
1 inch = 25.4 millimeters
1 micron = .000039 inches
1 meter = 3.281 feet
1 foot = .3048 meters
1 meter = 100 centimeters
1 meter = 1000 millimeters
1 centimeter = 10 millimeters
1 millimeter = .03937 inches

Weight

1 kilogram = 2.205 pounds
1 pound = 453.5924 grams
1 pound = 0.4536 kilograms
1 gram = 2.205 x 10^{-3} pounds
1 gram = 0.03215 Troy ounces
1 Troy ounce = 31.103481 grams

Stranded Wire Table
In Inches

Gauge	Strands/ Gauge	Diameter
2	665 / 30	0.331
4	133 / 25	0.255
6	133 / 27	0.202
8	133 / 29	0.161
10	105 / 30	0.111
10	37 / 26	0.110
10	19/23	.110
10	7/18	.110
12	165 / 34	0.095
12	65 / 30	0.095
12	19 / 25	0.093
12	7 / 20	0.093
14	19 / 27	0.076
14	7 / 22	0.073
16	65 / 34	0.059
16	26 / 30	0.059
16	19 / 29	0.058
16	7 / 24	0.060
18	41 / 34	0.050
18	19 / 30	0.049
18	16 /30	0.050
18	7 / 26	0.048
20	19 / 32	0.037
20	10 / 30	0.037
20	7 / 28	0.037
22	19 / 34	0.031
22	7 / 30	0.030
24	19 / 36	0.024
24	7 / 32	0.024
26	19 / 38	0.020
26	7 / 34	0.019
28	19 / 40	0.016
28	7 / 36	0.015
30	19 / 42	0.012
30	7 / 38	0.012

Phone: 617.527.4385 Fax: 617.964.3746 Email: sales@asrichards.com

Phone: 617.527.4385 *Fax: 617.964.3746* *Email: sales@asrichards.com*

Temperature Conversion Table - Celsius & Fahrenheit

Instructions: Look up your temperature reading in the shaded middle column. If it is Celsius, read the Fahrenheit equivalent in the right-hand column. If your reading is Fahrenheit, read the Celsius equivalent in the left-hand column.

°C		°F	°C		°F	°C		°F	°C		°F	°C		°F	°C		°F
-17.8	**0**	32	260	**500**	932	538	**1000**	1832	816	**1500**	2732	1093	**2000**	3632	1371	**2500**	4532
-12.2	**10**	50	266	**510**	950	543	**1010**	1850	821	**1510**	2750	1099	**2010**	3650	1377	**2510**	4550
-6.7	**20**	68	271	**520**	968	549	**1020**	1868	827	**1520**	2768	1104	**2020**	3668	1382	**2520**	4568
-1.1	**30**	86	277	**530**	896	554	**1030**	1886	832	**1530**	2786	1110	**2030**	3686	1388	**2530**	4586
4.4	**40**	104	282	**540**	1004	560	**1040**	1904	838	**1540**	2804	1116	**2040**	3704	1393	**2540**	4604
10	**50**	122	288	**550**	1022	566	**1050**	1922	843	**1550**	2822	1121	**2050**	3722	1399	**2550**	4622
15.6	**60**	140	293	**560**	1040	571	**1060**	1940	849	**1560**	2840	1127	**2060**	3740	1404	**2560**	4640
21.1	**70**	158	299	**570**	1058	577	**1070**	1958	854	**1570**	2858	1132	**2070**	3758	1410	**2570**	4658
26.7	**80**	176	304	**580**	1076	582	**1080**	1976	860	**1580**	2876	1138	**2080**	3776	1416	**2580**	4676
32.2	**90**	194	310	**590**	1094	588	**1090**	1994	866	**1590**	2894	1143	**2090**	2732	1421	**2590**	4694
38	**100**	212	316	**600**	1112	593	**1100**	2012	871	**1600**	2912	1149	**2100**	3812	1427	**2600**	4712
43	**110**	230	321	**610**	1130	599	**1110**	2030	877	**1610**	2930	1154	**2110**	3830	1432	**2610**	4730
49	**120**	248	327	**620**	1148	604	**1120**	2048	882	**1620**	2948	1160	**2120**	3848	1438	**2620**	4748
54	**130**	266	332	**630**	1166	610	**1130**	2066	888	**1630**	2966	1166	**2130**	3866	1443	**2630**	4766
60	**140**	284	338	**640**	1184	616	**1140**	2084	893	**1640**	2984	1171	**2140**	3884	1449	**2640**	4784
66	**150**	302	343	**650**	1202	621	**1150**	2102	899	**1650**	3002	1177	**2150**	3902	1454	**2650**	4802
71	**160**	320	349	**660**	1220	627	**1160**	2120	904	**1660**	3020	1182	**2160**	3920	1460	**2660**	4820
77	**170**	338	354	**670**	1238	632	**1170**	2138	910	**1670**	3038	1188	**2170**	3938	1466	**2670**	4838
82	**180**	356	360	**680**	1256	638	**1180**	2156	916	**1680**	3056	1193	**2180**	3956	1471	**2680**	4856
88	**190**	374	366	**690**	1274	643	**1190**	2174	921	**1690**	3074	1199	**2190**	3974	1477	**2690**	4874
93	**200**	392	371	**700**	1292	649	**1200**	2192	927	**1700**	3092	1204	**2200**	3992	1482	**2700**	4892
99	**210**	410	377	**710**	1310	654	**1210**	2210	932	**1710**	3110	1210	**2210**	4010	1488	**2710**	4910
100	**212**	414	382	**720**	1328	660	**1220**	2228	938	**1720**	3128	1216	**2220**	4028	1493	**2720**	4928
104	**220**	428	388	**730**	1346	666	**1230**	2246	943	**1730**	3146	1221	**2230**	4046	1499	**2730**	4946
110	**230**	446	393	**740**	1364	671	**1240**	2264	949	**1740**	3164	1227	**2240**	4064	1504	**2740**	4964
116	**240**	464	399	**750**	1382	677	**1250**	2282	954	**1750**	3182	1232	**2250**	4082	1510	**2750**	4982
121	**250**	482	404	**760**	1400	682	**1260**	2300	960	**1760**	3200	1238	**2260**	4100	1516	**2760**	5000
127	**260**	500	410	**770**	1418	688	**1270**	2318	966	**1770**	3218	1243	**2270**	4118	1521	**2770**	5018
132	**270**	518	416	**780**	1436	693	**1280**	2336	971	**1780**	3236	1249	**2280**	4136	1527	**2780**	5036
138	**280**	536	421	**790**	1454	699	**1290**	2354	977	**1790**	3254	1254	**2290**	4154	1532	**2790**	5054
143	**290**	554	427	**800**	1472	704	**1300**	2372	982	**1800**	3272	1260	**2300**	4172	1538	**2800**	5072
149	**300**	572	432	**810**	1490	710	**1310**	2390	988	**1810**	3290	1266	**2310**	4190	1543	**2810**	5090
154	**310**	590	438	**820**	1508	716	**1320**	2408	993	**1820**	3308	1271	**2320**	4208	1549	**2820**	5108
160	**320**	608	443	**830**	1526	721	**1330**	2426	999	**1830**	3326	1277	**2330**	4226	1554	**2830**	5126
166	**330**	626	449	**840**	1544	727	**1340**	2444	1004	**1840**	3344	1282	**2340**	4244	1560	**2840**	5144
171	**340**	644	454	**850**	1562	732	**1350**	2462	1010	**1850**	3362	1288	**2350**	4262	1566	**2850**	5162
177	**350**	662	460	**860**	1580	738	**1360**	2480	1016	**1860**	3380	1293	**2360**	4280	1571	**2860**	5180
182	**360**	680	466	**870**	1598	743	**1370**	2498	1021	**1870**	3398	1299	**2370**	4298	1577	**2870**	5198
188	**370**	698	471	**880**	1616	749	**1380**	2516	1027	**1880**	3416	1304	**2380**	4316	1582	**2880**	5216
193	**380**	716	477	**890**	1634	754	**1390**	2534	1032	**1890**	3434	1310	**2390**	4334	1588	**2890**	5234
199	**390**	734	482	**900**	1652	760	**1400**	2552	1038	**1900**	3452	1316	**2400**	4352	1593	**2900**	5252
204	**400**	752	488	**910**	1670	766	**1410**	2570	1043	**1910**	3470	1321	**2410**	4370	1599	**2910**	5270
210	**410**	770	493	**920**	1688	771	**1420**	2588	1049	**1920**	3488	1327	**2420**	4388	1604	**2920**	5288
216	**420**	788	499	**930**	1706	777	**1430**	2606	1054	**1930**	3506	1332	**2430**	4406	1610	**2930**	5306
221	**430**	806	504	**940**	1724	782	**1440**	2624	1060	**1940**	3524	1338	**2440**	4424	1616	**2940**	5324
227	**440**	824	510	**950**	1742	788	**1450**	2642	1066	**1950**	3542	1343	**2450**	4442	1621	**2950**	5342
232	**450**	842	516	**960**	1760	793	**1460**	2660	1071	**1960**	3560	1349	**2460**	4460	1627	**2960**	5360
238	**460**	860	521	**970**	1778	799	**1470**	2678	1077	**1970**	3578	1354	**2470**	4478	1632	**2970**	5378
243	**470**	878	527	**980**	1796	804	**1480**	2696	1082	**1980**	3596	1360	**2480**	4496	1638	**2980**	5396
249	**480**	896	532	**990**	1814	810	**1490**	2714	1088	**1990**	3614	1366	**2490**	4514	1643	**2990**	5414
254	**490**	914	538	**1000**	1832	816	**1500**	2732	1093	**2000**	3632	1371	**2500**	4532	1649	**3000**	5432

Engineering Data - Fractions of Inches to Decimal Inches and Millimeters

Fractions of Inches - Decimal Inches and Millimeters

Fractions in Inches						Decimal	Decimal
64ths	32nds	16ths	8ths	4ths	Halves	(Inches)	(mm)
1/64						.0156	0.3969
2/64	1/32					.0312	0.7937
3/64						.0468	1.1906
4/64	2/32	1/16				.0625	1.5875
5/64						.0781	1.9844
6/64	3/32					.0937	2.3812
7/64						.1093	2.7781
8/64	4/32	2/16	1/8			.1250	3.1750
9/64						.1406	3.5719
10/64	5/32					.1562	3.9687
11/64						.1718	4.3656
12/64	6/32	3/16				.1875	4.7625
13/64						.2031	5.1594
14/64	7/32					.2187	5.5562
15/64						.2343	5.9531
16/64	8/32	4/16	2/8	1/4		.2500	6.3500
17/64						.2656	6.7469
18/64	9/32					.2812	7.1437
19/64						.2968	7.5406
20/64	10/32	5/16				.3125	7.9375
21/64						.3281	8.3344
22/64	11/32					.3437	8.7312
23/64						.3593	9.1281
24/64	12/32	6/16	3/8			.3750	9.5250
25/64						.3906	9.9219
26/64	13/32					.4062	10.3187
27/64						.4218	10.7156
28/64	14/32	7/16				.4375	11.1125
29/64						.4531	11.5094
30/64	15/32					.4687	11.9062
31/64						.4843	12.3031
32/64	6/32	8/16	4/8	2/4	1/2	.5000	12.7000

Fractions in Inches						Decimal	Decimal
64ths	32nds	16ths	8ths	4ths	Halves	(Inches)	(mm)
33/64						.5156	13.0969
34/64	17/32					.5312	13.4937
35/64						.5468	13.8900
36/64	18/32	9/16				.5625	14.2875
37/64						.5781	14.6844
38/64	19/32					.5937	15.0812
39/64						.6093	15.4781
40/64	20/32	10/16	5/8			.6250	15.8750
41/64						.6406	16.2719
42/64	21/32					.6562	16.6687
43/64						.6718	17.0656
44/64	22/32	11/16				.6875	17.4625
45/64						.7031	17.8594
46/64	23/32					.7187	18.2562
47/64						.7343	18.6531
48/64	24/32	12/16	6/8	3/4		.7500	19.0500
49/64						.7656	19.4469
50/64	25/32					.7812	19.8437
51/64						.7968	20.2406
52/64	26/32	13/16				.8125	20.6375
53/64						.8281	21.0344
54/64	27/32					.8437	21.4312
55/64						.8593	21.8281
56/64	28/32	14/16	7/8			.8750	22.2250
57/64						.8906	22.6219
58/64	29/32					.9062	23.0187
59/64						.9218	23.4156
60/64	30/32	15/16				.9375	23.8125
61/64						.9531	24.2094
62/64	31/32					.9687	24.6062
63/64						.9843	25.0031
64/64	32/32	16/16	8/8	4/4	2/2	1.000	25.4001

Phone: 617.527.4385 Fax: 617.964.3746 Email: sales@asrichards.com

Phone: 617.527.4385 *Fax: 617.964.3746* *Email: sales@asrichards.com*

Flange Table

ANSI Class 150

Nominal Pipe Size	1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8	10
Flange Diameter	3.50	3.88	4.25	5.00	6.00	7.00	7.50	9.00	11.00	13.50	16.00
Raised Face Diameter	1.38	1.69	2.00	2.88	3.62	4.12	5.00	6.19	8.50	10.62	12.75
Flange thickness, min.	0.44	0.50	0.56	0.69	0.75	0.88	0.94	0.94	1.00	1.12	1.19
Bolt circle diameter	2.38	2.75	3.12	3.88	4.75	5.50	6.00	7.50	9.50	11.75	14.25
Number of bolts	4	4	4	4	4	4	4	8	8	8	12
Bolt hole diameter	0.62	0.62	0.62	0.62	0.75	0.75	0.75	0.75	0.88	0.88	1.00

ANSI Class 300

Nominal Pipe Size	1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8	10
Flange Diameter	3.75	4.62	4.88	6.12	6.50	7.50	8.25	10.00	12.50	15.00	17.50
Raised Face Diameter	1.38	1.69	2.00	2.88	3.62	4.12	5.00	6.19	8.50	10.62	12.75
Flange thickness, min.	0.56	0.62	0.69	0.81	0.88	1.00	1.12	1.25	1.44	1.62	1.88
Bolt circle diameter	2.62	3.25	3.50	4.50	5.00	5.88	6.62	7.88	10.62	13.00	15.25
Number of bolts	4	4	4	4	8	8	8	8	12	12	16
Bolt hole diameter	0.62	0.75	0.75	0.88	0.75	0.88	0.88	0.88	0.88	1.00	1.12

ANSI Class 600

Nominal Pipe Size	1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8	10
Flange Diameter	3.75	4.62	4.88	6.12	6.50	7.50	8.25	10.75	14.00	16.50	20.00
Raised Face Diameter	1.38	1.69	2.00	2.88	3.62	4.12	5.00	6.19	8.50	10.62	12.75
Flange thickness, min.	0.56	0.62	0.69	0.88	1.00	1.12	1.12	1.50	1.88	2.19	2.50
Bolt circle diameter	2.62	3.25	3.50	4.50	5.00	5.88	6.62	8.50	11.50	13.75	17.00
Number of bolts	4	4	4	4	8	8	8	8	12	12	16
Bolt hole diameter	0.62	0.75	0.75	0.88	0.75	0.88	0.88	1.00	1.12	1.25	1.38

ANSI Class 900

Nominal Pipe Size	1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8	10
Flange Diameter	4.75	5.12	5.88	7.00	8.50	9.62	9.50	11.50	15.00	18.50	21.50
Raised Face Diameter	1.38	1.69	2.00	2.88	3.62	4.12	5.00	6.19	8.50	10.62	12.75
Flange thickness, min.	0.88	1.00	1.12	1.25	1.50	1.62	1.50	1.75	2.19	2.50	2.75
Bolt circle diameter	3.25	3.50	4.00	4.88	6.50	7.50	7.50	9.25	12.50	15.50	18.50
Number of bolts	4	4	4	4	8	8	8	8	12	12	16
Bolt hole diameter	0.88	0.88	1.00	1.12	1.00	1.12	1.12	1.25	1.25	1.50	1.50

ANSI Class 1500

Nominal Pipe Size	1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8	10
Flange Diameter	4.75	5.12	5.88	7.00	8.50	9.62	10.50	12.50	15.50	19.00	23.00
Raised Face Diameter	1.38	1.69	2.00	2.88	3.62	4.12	5.00	6.19	8.50	10.62	12.75
Flange thickness, min.	0.88	1.00	1.12	1.25	1.50	1.62	1.88	2.12	3.25	3.62	4.25
Bolt circle diameter	3.25	3.50	4.00	4.88	6.50	7.50	8.00	9.50	12.50	15.50	19.00
Number of bolts	4	4	4	4	8	8	8	8	12	12	12
Bolt hole diameter	0.88	0.88	1.00	1.12	1.00	1.12	1.25	1.38	1.50	1.75	2.00

ANSI Class 2500

Nominal Pipe Size	1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8	10
Flange Diameter	5.25	5.50	6.25	8.00	9.25	10.50	12.00	14.00	19.00	21.75	26.50
Raised Face Diameter	1.38	1.69	2.00	2.88	3.62	4.12	5.00	6.19	8.50	10.62	12.75
Flange thickness, min.	1.19	1.25	1.38	1.75	2.00	2.25	2.62	3.00	4.25	5.00	6.50
Bolt circle diameter	3.50	3.75	4.25	5.75	6.75	7.75	9.00	10.75	14.50	17.25	21.25
Number of bolts	4	4	4	4	8	8	8	8	8	12	12
Bolt hole diameter	0.88	0.88	1.00	1.25	1.12	1.25	1.38	1.62	2.12	2.12	2.62

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Thermocouple Wire Color Codes

Thermocouple Type	K	T	J	N	E	S	R	B
ANSI MC96.1-1982 — Thermocouple Grade Wire	KK	TT	JJ	NN	EE	*N/E	*N/E	*N/E
ANSI MC96.1-1982 — Thermocouple Extension Wire	KX	TX	JX	NX	EX	SX	RX	BX
IEC 60584-3								
BS 1843								
DIN 13711								
NFC 42324								
JIS 1610 - 1981								

Redundant international color coding for insulation of thermocouple cables

*None Established

Arklay S. Richards Co., Inc.

Arklay S. Richards Co., Inc.

72 Winchester Street
Newton Highlands, MA 02461, USA
617-527-4385
617-964-3746
sales@asrichards.com
www.asrichards.com

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