

Our NVLAP Lab Code 200502-0 (National Voluntary Laboratory Accreditation Program) Accredited Metrology Laboratory provides comparison temperature calibrations from -196 °C to 1450 °C [-321 °F to 2642 °F] on the International Temperature Scale of 1990 (ITS-90) for temperature sensors and instruments.

Pyromation's laboratory managerial staff and technical team have documented education, training, technical knowledge and experience to precisely perform their assigned functions. The laboratory's test environment is constantly monitored and controlled to maintain all required conditions, while access is strictly defined and controlled.

Our Laboratory equipment includes fluidized baths and tube furnaces, standard platinum resistance thermometers, and type "B" and "S" thermocouples. All standards and calibrations are traceable to the National Institute of Standards and Technology (NIST), or have been derived from accepted values of natural physical constants, or by the ratio of self calibration. Note: Our quality system meets or exceeds the requirements for NIST Handbook 150:2006, ISO 9001:2000, ISO 10012-1:1992(E), ANSI/NCSL Z540-1-1994, and MIL-STD-45662A.

ORDER CODES

Example Order Numbers:

1 CAL (100, 200, 300) **3** F - **4** PTD - **5** TBL

1 Standard Calibrations

| CODE | DESCRIPTION |
|--------------------|--|
| CAL | Sensor Calibration - All sensors of line item calibrated to specified temperatures. |
| LOT | Lot Calibration - Beginning and End - (BE) - One sample from the beginning and the end of the lot will be tested at specified temperatures. |
| LOP ^[1] | Loop Calibration - One instrument and one sensor will be tested together at specified temperatures. |

[1] Note: Additional length may be required for loop calibrations.

2 Calibration Temperatures: Specified Required Calibration Points

3 Temperature Scale

| CODE | DESCRIPTION |
|------|--------------------|
| C | Degrees Celsius |
| F | Degrees Fahrenheit |

5 Custom Table Options

| CODE | DESCRIPTION |
|-----------|----------------------------------|
| TBL | Table in 1 degree increments |
| TBL (0.1) | Table in 0.1 degree increments |
| TBL (CVD) | Callendar Van Dusen Coefficients |

4 Tagging Options

| CODE | DESCRIPTION |
|------|---|
| PTD | Calibration Detail, Paper Tag |
| STD | Calibration Detail, Stainless Tag |
| ATD | Calibration Detail, Aluminum Tag |
| PTA | Tag all sensors with Beginning and End Calibration, Paper Tag |

1A Calibrations Per AMS 2750^[2]

| CODE | DESCRIPTION | ASTM E230 Tolerances |
|-------------|---|---|
| CAL-AMS-TUS | Temperature Uniformity Survey Calibration - All sensors of line item calibrated to specified temperatures. | ± 2.2 °C [± 4 °F] or ± 0.75% |
| CAL-AMS-SAT | System Accuracy Test Calibration - All sensors of line item calibrated to specified temperatures. | (J, K, T, E, N) ± 1.1 °C [± 2 °F] or ± 0.4% (R, S) ± 0.6 °C [± 1 °F] or ± 0.1% (B) ± 0.6 °C [± 1 °F] or ± 0.25% |
| CAL-AMS-CRM | Control, Recording & Monitoring Calibration - All sensors of line item calibrated to specified temperatures. | Class 1 & 2: ± 1.1 °C [± 2 °F] or ± 0.4% Class 3 to 6: ± 2.2 °C [± 4 °F] or ± 0.75% |
| CAL-AMS-L | Load Calibration - All sensors of line item calibrated to specified temperatures. | ± 2.2 °C [± 4 °F] or ± 0.75% |

1B Lot Calibrations Per AMS 2750^{[1][2]}

| CODE | DESCRIPTION | Max. Lot Length | | ASTM E230 Tolerances | Allowable Delta Limits |
|-------------|---|-----------------|---------|---|------------------------|
| | | Base | 5000 ft | | |
| LOT-AMS-TUS | Temperature Uniformity Survey Lot Calibration - Beginning and End - One sample from the beginning and the end of the lot will be tested at specified temperatures. | Noble | 2000 ft | ± 2.2 °C [± 4 °F] or ± 0.75% | ± 1.1 °C [± 2 °F] |
| | | Base | 5000 ft | | |
| LOT-AMS-SAT | System Accuracy Test Lot Calibration - One sample from the beginning and the end of the lot will be tested at specified temperatures. | Noble | 2000 ft | (J, K, T, E, N) ± 1.1 °C [± 2 °F] or ± 0.4% (R, S) ± 0.6 °C [± 1 °F] or ± 0.1% (B) ± 0.6 °C [± 1 °F] or ± 0.25% | ± 1.1 °C [± 2 °F] |
| | | Base | 5000 ft | | |
| LOT-AMS-CRM | Control, Recording & Monitoring Lot Calibration - One sample from the beginning and the end of the lot will be tested at specified temperatures. | Noble | 2000 ft | Class 1 & 2: ± 1.1 °C [± 2 °F] or ± 0.4% Class 3 to 6: ± 2.2 °C [± 4 °F] or ± 0.75% | ± 1.1 °C [± 2 °F] |
| | | Base | 5000 ft | | |
| LOT-AMS-L | Load Lot Calibration - One sample from the beginning and the end of the lot will be tested at specified temperatures. | Noble | 2000 ft | ± 2.2 °C [± 4 °F] or ± 0.75% | ± 1.1 °C [± 2 °F] |
| | | Base | 5000 ft | | |

[1] Lot AMS calibration reports contain beginning, end and average temperatures.

[2] Maximum interval between temperatures is 140 °C [250 °F]

Minimum Sensor Length Requirements for Temperature Calibrations

| | | | | | | | |
|-----------|-----------|----------------|----------------|-----------------|-----------------|------------------|-------------------|
| -196 °C | -75 °C | (-40 to 0) °C | (0 to 100) °C | (40 to 215) °C | (200 to 500) °C | (425 to 1204) °C | (800 to 1450) °C |
| [-321 °F] | [-103 °F] | [-40 to 32] °F | [32 to 212] °F | [104 to 420] °F | [392 to 932] °F | [800 to 2200] °F | [1472 to 2642] °F |
| 12 Inch | 12 Inch | 6 Inch | 6 Inch | 6 Inch | 18 Inch | 18 Inch | 30 Inch |

THERMOCOUPLES - Thermocouples are the most common, convenient, and versatile devices used to measure temperature. They convert units of heat into useable engineering units that serve as input signals for process controllers and recorders.

A thermocouple consists of a welded 'hot' junction between two dissimilar metals - usually wires - and a reference junction at opposite ends of the parent materials. Heating the 'hot' junction in the working environment produces a temperature gradient which generates an Electromotive Force (EMF). The EMF appears across the free ends of the thermocouple wires where it is measured and converted into units of heat calibration. Through selection of appropriate thermocouple wires and sheath components, thermocouples are suitable to be used in temperature ranges from (-200 to 2316) °C [-328 to 4200] °F.

RESISTANCE TEMPERATURE DETECTORS - Resistance temperature detectors (RTD) accurately sense temperature with an excellent degree of repeatability and interchangeability of elements. The RTD is composed of certain metallic elements whose change in resistance is a function of temperature. In operation, a small excitation current is passed across the element, and the voltage, which is proportional to resistance, is then measured and converted to units of temperature calibration. The RTD element is manufactured by winding a wire (wire wound elements) or plating a film (thin film elements) on a ceramic or glass core and sealing the element within a ceramic or glass capsule.

Since most RTDs have a low initial resistance, often 100 ohms, and have a small change in resistance per unit of temperature range, the resistance of the lead wire is often compensated for with a three or four wire bridge configuration built into the measuring devices. By selecting the proper elements and protective sheathing, RTDs can operate in a temperature range of (-200 to 600) °C [-328 to 1112] °F.

THERMISTORS - A thermistor is an economical means of precisely sensing heat over a limited range of temperatures. A thermistor is a metal oxide whose change in resistance is typically an inverse function of the change in temperature. An excitation current is passed across the sensor and the voltage, which is proportional to the resistance, is measured and converted to units of heat calibration. Since thermistors usually have a large base resistance and a large change in resistance per unit of temperature change, compensation for lead wire length is not generally needed. Thermistors can operate across a temperature range of (-40 to 150) °C [-40 to 302] °F by selecting the proper sensor and protective materials.

ADDITIONAL REQUIREMENTS - Other components usually essential in integrating the principles of thermocouple, RTD, and thermistor sensors into a functioning system may include: (1) a protection tube or sheath of a material suitable to protect the sensing element from the environment surrounding the point of measurement; (2) a connecting head and terminal block, or possibly a temperature transmitter; (3) leadwire of the correct material and insulation to connect the temperature sensor and the process instrumentation; and (4) recording or controlling instrumentation and control devices to provide a continuous temperature history of the system and to provide constant or programmed temperature regulation.

The thermocouple element materials listed below are those most commonly found in process applications. Selection of the proper thermocouple type for a particular application is determined by temperature expectations and by the environment in which the sensor will be placed. The following temperature and application tables are intended to aid in this selection. The thermocouples are listed by ASTM letter designations per thermocouple type.

Letter Designated Thermocouples

| TYPE | | TEMPERATURE RANGE | APPLICATION INFORMATION |
|-----------|--|---------------------------------------|---|
| J E230 | Iron (+) Copper - 45% Nickel (Constantan) (-) | (0 to 760) °C [32 to 1400] °F | Suitable for vacuum, reducing, or inert atmospheres, oxidizing atmosphere with reduced life. Iron oxidizes rapidly above 538 °C [1000 °F] so only heavy gauge wire is recommended for high temperature. Bare elements should not be exposed to sulphurous atmospheres above 538 °C [1000 °F]. |
| K E230 | Nickel - 10% Chromium (+) Nickel - 2% Aluminum, 2% Manganese, 1% Silicon (-) | (0 to 1260) °C [32 to 2300] °F | Recommended for continuous oxidizing or neutral atmospheres. Mostly used above 538 °C [1000 °F]. Subject to failure if exposed to sulphur. Preferential oxidation of chromium in positive leg at certain low oxygen concentrations causes 'green rot' and large negative calibration drifts most serious in the (816 to 1038) °C [1500 to 1900] °F range. Ventilation or inert-sealing of the protection tube can prevent this. |
| N E230 | Nickel - 14% Chromium, 1 1/2% Silicon (+) Nickel - 4 1/2% Silicon - 1/10% Magnesium (-) | (0 to 1260) °C [32 to 2300] °F | Can be used in applications where Type K elements have shorter life and stability problems due to oxidation and the development of 'green rot'. |
| T E230 | Copper (+) Copper - 45% Nickel (Constantan) (-) | (-200 to 370) °C [-328 to 700] °F | Useable in oxidizing, reducing, or inert atmospheres as well as vacuum. Not subject to corrosion in moist atmospheres. Limits of error published for sub-zero temperature ranges. |
| E E230 | Nickel - 10% Chromium (+) Copper - 45% Nickel (Constantan) (-) | (0 to 870) °C [32 to 1600] °F | Recommended for continuously oxidizing or inert atmospheres. Sub-zero limits of error not established. Highest thermoelectric output of common calibrations. |
| R E230 | Platinum - 13% Rhodium (+) Platinum (-) | (538 to 1482) °C [1000 to 2700] °F | Recommended for high temperature. Must be protected with non-metallic protection tube and ceramic insulators. Continued high temperature usage causes grain growth which can lead to mechanical failure. Negative calibration drift caused by Rhodium diffusion to pure leg as well as from Rhodium volatilization. Type R is used in industry; Type S in the laboratory. |
| S E230 | Platinum - 10% Rhodium (+) Platinum (-) | | |
| B E230 | Platinum - 30% Rhodium (+) Platinum - 6% Rhodium (-) | (871 to 1704) °C [1600 to 3100] °F | Same as R & S but output is lower. Also less susceptible to grain growth and drift. |
| C E230 | 95% Tungsten - 5% Rhenium (+) 74% Tungsten - 26% Rhenium (-) | (0 to 2315) °C [32 to 4200] °F | Very high temperature applications in inert or vacuum. Preferred over Tungsten/Tungsten-26% Rhenium because it is less brittle at low temperatures. |

Non-Letter Designated Thermocouples

| TYPE | | TEMPERATURE RANGE | APPLICATION INFORMATION |
|------------|---|--------------------------------------|---|
| M E1751 | Nickel - 18% Molybdenum (+) Nickel - 0.8% Cobalt (-) | (-50 to 1410) °C [-58 to 2570] °F | High temperature applications in inert or vacuum atmosphere. Useful in many hydrogen applications. Continuous cycling causes excessive grain growth. |
| P E1751 | Platinel II® Platinel 5355 (+) Platinel 7674 (-) | (0 to 1395) °C [32 to 2543] °F | Noble metal combination which approximates Type K curve but has much improved oxidation resistance. Should be treated as any noble metal calibration. |

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The tolerances shown in the table below apply to new, essentially homogeneous thermocouple wire in the size range of 30 AWG to 8 AWG. These tolerances only apply to thermocouples used at temperatures not exceeding the recommended limits. If thermocouples are used at temperatures above the recommended limits, or in detrimental environments, the below stated tolerances may not apply.

Tolerances on Initial Values of EMF vs Temperature for Thermocouples

Reference Junction 0 °C [32 °F]. Published in ASTM E230

| TYPE | TEMPERATURE RANGE for STANDARD TOLERANCES | STANDARD TOLERANCES | TEMPERATURE RANGE for SPECIAL TOLERANCES | SPECIAL TOLERANCES |
|------|--|---|---|---|
| J | (0 to 293) °C [32 to 559] °F (293 to 760) °C [559 to 1400] °F | ± 2.2 °C [± 4 °F] ± 0.75% | (0 to 275) °C [32 to 527] °F (275 to 760) °C [527 to 1400] °F | ± 1.1 °C [± 2 °F] ± 0.4% |
| K | (-200 to -110) °C [-328 to -166] °F (-110 to 0) °C [-166 to 32] °F (0 to 293) °C [32 to 559] °F (293 to 1260) °C [559 to 2300] °F | ± 2% ^[1] ± 2.2 °C [± 4 °F] ^[1] ± 2.2 °C [± 4 °F] ± 0.75% | (0 to 275) °C [32 to 527] °F (275 to 1260) °C [527 to 2300] °F | ± 1.1 °C [± 2 °F] ± 0.4% |
| N | (0 to 293) °C [32 to 559] °F (293 to 1260) °C [559 to 2300] °F | ± 2.2 °C [± 4 °F] ^[1] ± 0.75% | (0 to 275) °C [32 to 527] °F (275 to 1260) °C [527 to 2300] °F | ± 1.1 °C [± 2 °F] ± 0.4% |
| T | (-200 to -67) °C [-328 to -89] °F (-67 to 0) °C [-89 to 32] °F (0 to 133) °C [32 to 271] °F (133 to 370) °C [271 to 700] °F | ± 1.5% ^[1] ± 1 °C [± 1.8 °F] ^[1] ± 1 °C [± 1.8 °F] ± 0.75% | (0 to 125) °C [32 to 257] °F (125 to 370) °C [257 to 700] °F | ± 0.5 °C [± 0.9 °F] ± 0.4% |
| E | (0 to 870) °C [32 to 1600] °F | ± 1.7 °C [± 3.06 °F] ^[3] or ± 0.5% | (0 to 870) °C [32 to 1600] °F | ± 1.0 °C [± 1.8 °F] ^[3] or ± 0.4% |
| R | (0 to 600) °C [32 to 1112] °F (600 to 1480) °C [1112 to 2642] °F | ± 1.5 °C [± 2.7 °F] ± 0.25% | (0 to 600) °C [32 to 1112] °F (600 to 1480) °C [1112 to 2700] °F | ± 0.6 °C [± 1.1 °F] ± 0.1% |
| S | (0 to 600) °C [32 to 1112] °F (600 to 1480) °C [1112 to 2700] °F | ± 1.5 °C [± 2.7 °F] ± 0.25% | (0 to 600) °C [32 to 1112] °F (600 to 1480) °C [1112 to 2642] °F | ± 0.6 °C [± 1.1 °F] ± 0.1% |
| B | (870 to 1700) °C [1600 to 3100] °F | ± 0.5% | (870 to 1700) °C [1600 to 3100] °F | ± 0.25% |
| C | (0 to 400) °C [32 to 752] °F (400 to 2315) °C [752 to 4200] °F | ± 4.4 °C [± 8 °F] ± 1.0% | Not Available | |

[1] Thermocouples and thermocouple materials are supplied to meet the tolerance specified for temperatures above 0 °C. A thermocouple material may not conform to the published sub-zero limits of error for that material when purchased, unless conformance is agreed upon by customer and Pyromation when ordering.

[2] Special tolerances for sub-zero temperatures have not yet been established. The following limits for calibrations of types E and T are useful to start discussion between customer and Pyromation.

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

[3] The standard tolerances shown do not apply to Type E mineral-insulated, metal-sheathed (MIMS) thermocouples and thermocouple cables. The standard tolerances for MIMS Type E constructions are the greater of ± 2.2 °C or ± 1.75 % from 0 to 870 °C and the greater of ± 2.2 °C or ± 2 % from -200 to 0 °C.

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

Tolerances on Initial Values of EMF vs Temperature for Thermocouples

| CODE | MATERIAL | TEMPERATURE RANGE | TOLERANCE |
|------|--------------|-----------------------------------|-----------|
| M | Ni18Mo/Ni | (-50 to 1410) °C [-58 to 2570] °F | ± 0.75% |
| P | Platinel® II | (0 to 1395) °C [32 to 4200] °F | ± 0.10 mV |

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Thermocouples must be selected to meet application conditions and only general recommendations of size and type can be given. Selection considerations involve useful length of service life, temperature, atmosphere, and response time. Smaller gauges provide faster response times and less service life. Larger gauges provide longer service life and reduced response times. The recommended temperature limits below are to be used as a guideline in the selection process, and the table applies only to thermocouples protected by a suitable protecting tube, sheath, or well. The color coding chart below provides ANSI/ASTM standard color codes found on thermocouple wire, extension wire, and plug and jack connectors.

Suggested Upper Temperature Limits For Protected Industrial Thermocouples

| TYPE | MAXIMUM TEMPERATURE | | | | | | |
|------|---------------------|-------------|-------------|------------|-------------|------------|------------|
| | 8 GAUGE | 11 GAUGE | 14 GAUGE | 20 GAUGE | 24 GAUGE | 28 GAUGE | 30 GAUGE |
| | °C [°F] | °C [°F] | °C [°F] | °C [°F] | °C [°F] | °C [°F] | °C [°F] |
| T | | | 370 [700] | 260 [500] | 200 [400] | 200 [400] | 150 [300] |
| J | 760 [1400] | | 590 [1100] | 480 [900] | 370 [700] | 370 [700] | 320 [600] |
| E | 870 [1600] | | 650 [1200] | 540 [1000] | 430 [800] | 430 [800] | 370 [700] |
| K, N | 1260 [2300] | | 1090 [2000] | 980 [1800] | 870 [1600] | 870 [1600] | 760 [1400] |
| M | | 1287 [2250] | 1287 [2250] | | | | |
| R, S | | | | | 1480 [2700] | | |
| B | | | | | 1700 [3100] | | |
| C | | | | | 2330 [4200] | | |

| THERMO-COUPLE TYPE | U.S. & CANADIAN (ANSI/ASTM E230, ANSI/MC96.1) | | | |
|--------------------|--|-------------------------|---|-------------------------------|
| | ALLOY COMBINATION | THERMOCOUPLE GRADE | EXTENSION GRADE | PLUG & JACK |
| T | Copper | Brown Blue + Red - | + Blue Blue - Red Red | Blue ● |
| | Constantan (Copper-Nickel) | | | |
| J | Iron (magnetic) | Brown White + Red - | + White Black - Red Red | Black ● |
| | Constantan (Copper-Nickel) | | | |
| E | Nickel - Chromium | Brown Purple + Red - | + Purple Purple - Red Red | Purple ● |
| | Constantan (Copper-Nickel) | | | |
| K | Nickel - Chromium | Brown Yellow + Red - | + Yellow Yellow - Red Red | Yellow ○ |
| | Nickel - Aluminium (magnetic) | | | |
| N | Nicrosil (Nickel-Chromium-Silicon) | Brown Orange + Red - | + Orange Orange - Red Red | Orange ● |
| | Nisil (Nickel-Silicon-Magnesium) | | | |
| S | Platinum Rhodium -10% | None Established | + Black Green - Red Red | Green ● |
| | Platinum | | | |
| R | Platinum Rhodium -13% | None Established | + Black Green - Red Red | Green ● |
| | Platinum | | | |
| B | Platinum Rhodium - 30% | None Established | + Gray Gray - Red Red (Compensated Cable) | White (Uncompensated) ○ |
| | Platinum Rhodium - 6% | | | |
| C | Tungsten Rhenium - 5% | None Established | + Green Red - Red Red | Red ● |
| | Tungsten Rhenium - 26% | | | |

Pyromation provides a variety of common tubing, MgO sheath, protection tube, and drilled-well materials to protect temperature sensing elements from the environmental conditions typically found in industrial process applications. The following tables are intended as guidelines to aid in the selection of the proper materials for sensors used in different environments. Consult the factory for the availability of other protective materials for specialty applications. NOTE: All chemical compositions and temperature ratings are nominal and are stated as received from suppliers.

Material Code Index

| METALS | | | | | | CERAMICS and COMPOSITE MATERIALS | |
|------------------|--------------|------|--------------|------|-----------|----------------------------------|--------------------------------|
| CODE | MATERIAL | CODE | MATERIAL | CODE | MATERIAL | CODE | MATERIAL |
| 2 | Molybdenum | 25 | Tantalum | 37 | Alloy 800 | 12 | Metal Ceramic LT-1 |
| 3 | Alloy 600 | 26 | Titanium | 38 | Alloy 20 | 13 | Vesuvius |
| 4 | 310 S.S. | 27 | Alloy 400 | 41 | HR - 160® | 14 | Cerite® - II |
| 5 | 446 S.S. | 28 | Alloy B | 50 | Zirconium | 15 | Cerite® - III |
| 6 | Carbon Steel | 29 | Alloy C -276 | 59 | F22-1 | 16 | Mullite |
| 7 | Alloy 601 | 31 | Nickel 200 | 60 | F11-2 | 17 | Alumina |
| 8 | 316 S.S. | 32 | 304 LC S.S. | 61 | A105 | 18 | Silicon Carbide |
| 9 ^[2] | 304 S.S. | 33 | 316 LC S.S. | 91 | F91 | 19 | Hexoloy® SA |
| 11 | Cast Iron | 35 | 321 S.S. | | | 71 | Recrystallized Silicon Carbide |
| 22 | Brass | 36 | 347 S.S. | | | | |
| 23 | Copper | | | | | | |
| 24 | Platinum | | | | | | |

Metals

| CATALOG MATERIAL CODE | MATERIAL/COMPOSITION | TYPICAL AREAS OF USE | | | | APPLICATION GUIDELINE INFORMATION |
|-----------------------|--|----------------------|-------------|-------------|---------------|---|
| | | TUBING | MGO SHEATHS | PROT. TUBES | DRILLED WELLS | |
| 2 | MOLYBDENUM 99.9% min. Molybdenum, 0.03% Tungsten | X | X | | | Up to 1926 °C [3500 °F] in inert atmospheres, to 1871 °C [3400 °F] in vacuum at 10-4 torr. Has poor mechanical shock resistance after heated to 1038 °C [1900 °F]. Oxidizes in air above 427 °C [800 °F]. |
| 3 | ALLOY 600 (UNS N06600) 72% Nickel, 15% Chromium, 8% Iron | X | X | X | X | Up to 1149 °C [2100 °F] under oxidizing conditions. Reducing conditions reduce maximum temperature to 1038 °C [1900 °F]. Must not be placed in sulfurous atmospheres above 538 °C [1000 °F]. Main areas of application for thermocouple protection are carburizing, annealing and hardening furnaces, Cyanide saltbaths, blast furnace downcomers, open hearth flue stacks, steel soaking pits, waste heat boilers, ore roasters, cement exit flues, incinerators, and glass tank flues. (INCONEL® 600) |
| 4 | 310 STAINLESS STEEL (UNS S31000) 25% Chromium, 20% Nickel | X | X | X | X | Up to 1038 °C [1900 °F] continuous, 1149 °C [2100 °F] intermittent. Mechanical and corrosion resistance similar to and better than 304 stainless steel. |
| 5 | 446 STAINLESS STEEL (UNS S44600) 27% Chromium | | X | X | X | Up to 1093 °C [2000 °F] under oxidizing conditions. Excellent high temperature corrosion and oxidizing resistance. Main areas of application are hardening, nitriding, and annealing furnaces, salt baths, molten lead, tin and babbitt metal, sulfurous atmospheres. Not for carburizing atmospheres. Other areas of application are steel soaking pits, tinning pots, waste heat boilers, ore roasters, cement exit flues, boiler tubes to 982 °C [1800 °F], incinerators to 1093 °C [2000 °F], glass flue tanks. |
| 6 | CARBON STEEL^[1] | X | | X | X | Up to 538 °C [1000 °F] in non-oxidizing environments. Main areas of usage are galvanizing pots, tinning pots, molten babbitt metal, molten mangesium, molten zinc, Petroleum refinery applications such as dewaxing and thermal cracking. |
| 7 | ALLOY 601 (UNS N06601) 61% Nickel, 23% Chromium, 14% Iron, 1.35% Aluminum | | X | X | X | Similar applications to Inconel® 600 but with superior resistance to sulfur, high temperature oxidation resistance to 1260 °C [2300 °F]. (INCONEL® 601) |
| 8 | 316 STAINLESS STEEL (UNS S31600) 16% Chromium, 12% Nickel 2% Molybdenum | X | X | X | X | Up to 927 °C [1700 °F] under oxidizing conditions. Same areas of applications as 304 stainless steel. Has improved resistance to mild acid and pitting corrosion. |
| 9 ^[2] | 304 STAINLESS STEEL (UNS S30400) 18% Chromium, 8% Nickel | X | X | X | X | Up to 899 °C [1650 °F] under oxidizing conditions. Has general good oxidation and corrosion resistance in a wide range of industrial environments. Subject to carbide precipitation, which can reduce corrosion resistance in the (427 to 538) °C [800 to 1000] °F range. Good mechanical properties from (-184 to 788) °C [-300 to 1450] °F. Main areas of usage for thermocouple protection is in chemicals, foods, plastics and petroleum. Generally regarded as standard protection tube material. |

[1] Materials available in various alloys - consult factory
 [2] Machined fittings may be supplied as 303 Series stainless steel
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 INCONEL® is a registered trademark of Special Metals Corporation
 HR-160® is a registered trademark of Haynes International, Inc.

Metals

| CATALOG MATERIAL CODE | MATERIAL/COMPOSITION | TYPICAL AREAS OF USE | | | | APPLICATION GUIDELINE INFORMATION |
|-----------------------|--|----------------------|------------------|-------------|------------------|---|
| | | TUBING | MGO SHEATHS | PROT. TUBES | DRILLED WELLS | |
| 11 | CAST IRON | | | X | | Up to 704 °C [1300 °F] in oxidizing conditions. Main area of usage is in molten non-ferrous metals, daily whitening is recommended. Can be used to 871 °C [1600 °F] under reducing conditions. |
| 22 | BRASS ^[1] | X | | | X | Up to 538 °C [1000 °F] continuous. Good thermal conductivity and mechanical strength. |
| 23 | COPPER | X | X Limited Avail. | | | Up to 260 °C [500 °F] continuous. Excellent thermal conductivity. Poor mechanical strength. |
| 24 | PLATINUM ^[1] | X | X | | | Up to 1374 °C [2500 °F] continuous oxidizing atmospheres. Good thermal conductivity. Used in applications where high temperature, but no vacuum or inert atmosphere is available. |
| 25 | TANTALUM ^[2] | X | X | | X ^[2] | Up to 2349 °C [4350 °F]. Good resistance to corrosion and quick heat conductivity. Good mechanical strength. Used in chemical processes and high temperatures in vacuum or inert atmosphere. |
| 26 | TITANIUM | X | X | | X | Up to 1260 °C [2300 °F] in inert or vacuum atmosphere. Acid and chemical resistant. Oxidation resistance to 538 °C [1000 °F]. |
| 27 | ALLOY 400 (UNS N04400) 67% Nickel 30% Copper | X | X | X | X | Up to 538 °C [1000 °F] in sulfur-free atmosphere. Excellent resistance to corrosion. Used in chemical processing and food processing equipment. MONEL® 400 |
| 28 | ALLOY B (UNS N10001) 62% Nickel 28% Molybdenum, 5% Iron | X | X Limited Avail. | X | X | Up to 815 °C [1500 °F] in inert or vacuum atmospheres. 538 °C [1000 °F] in air. Has excellent resistance to pitting, to stress-corrosion cracking. Suitable for most chemical processes. Application excellent in hydrochloric acid. (HASTELLOY® B) |
| 29 | ALLOY C-276 (UNS N10276) 54% Nickel 16% Molybdenum, 15% Chromium | X | X Limited Avail. | X | X | Up to 1038 °C [1900 °F] in oxidizing atmospheres. Exceptional resistance to a wide variety of chemical environments. Withstands wet chlorine gas, hypochlorite and chlorine dioxide. (HASTELLOY® C-276) |
| 31 | NICKEL 200 (UNS N02200) 99% Nickel | | X Limited Avail. | | X | Up to 899 °C [1650 °F] in sulfur-free atmospheres. Good corrosion-resistance. Used in contact with reducing acids, foods, chemicals caustics, rayon, and plastics. |
| 32 | 304 STAINLESS STEEL LOW CARBON (UNS S30403) 18% Chromium, 8% Nickel | X | X | X | X | Same characteristics as 304 except the low carbon allows for corrosion-resistant weld areas. Not recommended to be used above 427 °C [800 °F]. (0.03% max. carbon) |
| 33 | 316 STAINLESS STEEL LOW CARBON (UNS S31603) 16% Chromium 12% Nickel 2% Molybdenum | X | X | X | X | Same characteristics as 316 except the low carbon allows for corrosion-resistant weld areas. Not recommended to be used above 427 °C [800 °F]. (0.03% max. carbon) |
| 35 | 321 STAINLESS STEEL (UNS S32100) 18% Chromium 10% Nickel, Titanium | X | X | X | X | Good corrosion resistance between (482 to 871) °C [900 to 1600] °F. Used where conditions are too severe for low carbon stainless steels. |
| 36 | 347 STAINLESS STEEL (UNS S34700) 18% Chromium, 10% Nickel, Columbium | X | X Limited Avail. | | X | Good corrosion resistance between (482 to 871) °C [900 to 1600] °F. Used where conditions are too severe for low carbon stainless steels. |
| 37 | ALLOY 800 (UNS N08800) 33% Nickel 42% Iron 21% Chromium | X | X Limited Avail. | X | X | Strong resistance to oxidation and carburization at high temperatures. Resists sulfur attack, internal oxidation, and scaling in a wide variety of atmospheres. (INCOLOY® 800) |
| 38 | ALLOY 20 (UNS N08020) 35% Nickel 35% Iron 20% Chromium Columbium | | X Limited Avail. | X | X | Superior resistance to stress-corrosion cracking in boiling 20-40% sulfuric acid. Also used in high octane gas, solvents, explosives, heavy chemicals and agri-chemicals. (CARPENTER 20Cb-3®) |
| 41 | HR - 160® (UNS N12160) 37% Nickel 30% Cobalt 28% Chromium | | X | X | | A premier alloy that provides excellent resistance to sulphur, vanadium, chlorines, chlorides, and other salt deposits up to 1204 °C [2200 °F]. A superior material for use in aggressive waste incineration processes. |

[1] Materials available in various alloys - consult factory

[2] Generally applied as a well jacket

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20Cb-3® is a registered trademark of Carpenter Technology Corporation

HR-160® is a registered trademark of Haynes International, Inc.



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Metals

| CATALOG MATERIAL CODE | MATERIAL/COMPOSITION | TYPICAL AREAS OF USE | | | | APPLICATION GUIDELINE INFORMATION |
|-----------------------|---|----------------------|-------------|-------------|---------------|--|
| | | TUBING | MGO SHEATHS | PROT. TUBES | DRILLED WELLS | |
| 50 | ZIRCONIUM (UNS R60702) 99.2% Zr | X | | X | X | Up to 400 °C [752 °F]. Zirconium has a high affinity to oxygen that results in the formation of a regenerative protective oxide layer in most media. This oxide layer gives the material chemical resistance and erosive resistance in high velocity applications. Zirconium is resistant to corrosion from most organic and inorganic acids and salts and it is totally resistant to alkalis. |
| 59 | F22 (UNS K21590) Cr 2.25%, Mo 1% | | | X | X | Carbon steel alloy typically used in power plant, boiler and turbine applications. |
| 60 | F11 (UNS K11572) Cr 1.25%, Mo .5%, Si | | | X | X | Carbon steel alloy typically used in power plant, boiler and turbine applications. |
| 61 | A105 C, Si | | | | X | Carbon steel alloy typically used in power plant, boiler and turbine applications. |
| 91 | F91 (UNS K91560) Cr 9%, Mo 1%, V | | | X | X | Chrome Moly alloy typically used in power plant, boiler and turbine applications. |

Ceramics and Composite Materials

| CATALOG MATERIAL CODE | MATERIAL/ COMPOSITION | TYPICAL AREAS OF USE | | | | APPLICATION GUIDELINE INFORMATION |
|-----------------------|---|----------------------|-------------|-------------|---------------|---|
| | | TUBING | MGO SHEATHS | PROT. TUBES | DRILLED WELLS | |
| 12 | METAL CERAMIC LT-1 (slip cast composite of chromium and aluminum oxide,) 77% chromium, 23% aluminum oxide | | | X | | Up to 1374 °C [2500 °F] in oxidizing conditions. Main areas of usage are molten copper base alloys to 1149 °C [2100 °F], blast furnace and stack gases to 1316 °C [2400 °F], Sulfur burners to 1093 °C [2000 °F], cement kilns to 1204 °C [2200 °F], chemical process reactors to 1371 °C [2500 °F]. A ceramic primary tube is required when a noble metal thermocouple is used. |
| 13 | VESUVIUS | | | X | | Up to 927 °C [1700 °F]. For use in aluminum and other non-ferrous metals. Not wetted by molten aluminum and other non-ferrous metals. No contamination. Resists thermal and mechanical shock. Brittle after heating. Handle carefully. |
| 14 | CERITE®-II (Cast oxide composites) | | | X | | Up to 1093 °C [2000 °F]. For submerged use in aluminum and other non-ferrous metals. Not wetted by molten aluminum and other non-ferrous metals. No contamination. Good thermal and mechanical shock resistance. |
| 15 | CERITE®-III (Cast oxide composites) | | | X | | Up to 1093 °C [2000 °F]. For submerged use in aluminum and other non-ferrous metals. Not wetted by molten aluminum and other non-ferrous metals. No contamination. Good thermal and mechanical shock resistance. |
| 16 | MULLITE 63% alumina | | | X | | Up to 1510 °C [2750 °F] when supported. Has poor mechanical shock resistance, but good thermal shock resistance. For barium chloride salt baths to 1288 °C [2350 °F]. Should be vertical mounted or supported if horizontal. For high temperature applications of ceramic industry, heat treating, glass manufacture. Impervious to gases at high temperatures. |
| 17 | ALUMINA (Recrystallized 99.7% AL ₂ O ₃) | | | X | | Up to 1889 °C [3400 °F] when supported. Has only fair resistance to thermal and mechanical shock. Essentially same applications as Mullite including induction melting, vacuum furnaces. Impervious to gases at high temperatures. |
| 18 | SILICON CARBIDE 90% silicon carbide, 9% silicon dioxide, balance aluminum oxide | | | X | | Up to 1650 °C [3000 °F]. For an outer protection tube with Alumina® or mullite primary tube. For brick and ceramic kilns, steel soaking pits, molten non-ferrous metals. Can withstand direct flame impingement. Fair thermal shock resistance. Approximately 14% porosity. |
| 19 | HEXOLOY® SA sintered alpha, silicon carbide | | | X | | Up to 1650 °C [3000 °F] in air. High thermal conductivity, excellent wear and abrasion resistance, high thermal shock resistance, and good mechanical strength. Superior chemical resistance in both reducing and oxidizing environments. Attacked by Halides, fused caustics, and ferrous metals. |
| 71 | RECRYSTALLIZED SILICON CARBIDE (Halsic R) 99% silicon | | | X | | Up to 1600 °C [2912 °F] in oxidizing atmosphere, and 2000 °C [3632 °F] in a vacuum atmosphere. Used as an outer protection tube in hot stack emissions, combustion chambers, chemical reactors, and incineration of medical, municipal, and industrial waste. Can withstand direct flame impingement, has excellent thermal shock characteristics, and excellent corrosion resistance. A ceramic inner tube is required when used with noble metal thermocouples. |

Hexoloy® is a registered trademark of Saint-Gobain Ceramics Corporation

The information contained in the following pages is intended as a guideline only for general sensor usage. The specific application and the environmental conditions may require that other sensor sheath materials, diameters, or construction styles be used to provide optimum temperature measurement results. The dimensions, temperature ratings, and response times indicated are nominal, and they may vary in actual practice.

Thermocouple Types and Sizes

| SHEATH DIAMETER (inches) - AWG WIRE SIZE | | | | | | | | | |
|--|--------------------|------------|------------|------------|-----------|----------|-----------|----------|----------|
| TYPE | MATERIAL | 0.020 O.D. | 0.032 O.D. | 0.040 O.D. | 1/16 O.D. | 1/8 O.D. | 3/16 O.D. | 1/4 O.D. | 3/8 O.D. |
| E | Chromel-Constantan | 38 | 35 | 32 | 30 | 24 | 21 | 19 | 15 |
| J | Iron-Constantan | 38 | 35 | 32 | 30 | 24 | 21 | 19 | 15 |
| K | Chromel-Alumel | 38 | 35 | 32 | 30 | 24 | 21 | 19 | 15 |
| T | Copper-Constantan | 38 | 35 | 32 | 30 | 24 | 21 | 19 | 15 |
| N | Nicrosil-Nisil | 38 | 35 | 34 | - | 29 | 21 | 19 | 15 |

Recommended Upper Temperature Limits For Protected Thermocouples Upper Temperature Limits (F) For Various Sheath & Diameter Combinations

| SHEATH TYPE | SHEATH MATERIAL | SHEATH DIAMETER (inches) | | | | | |
|-------------------|-----------------|--------------------------------------|---------------------------------------|--|--|--|--|
| | | 0.020, 0.032, 0.040 | 1/16 | 1/8 | 3/16 | 1/4 | 3/8 |
| TEMPERATURE RANGE | | | | | | | |
| J | 316 S.S. | (0 to 260) °C [32 to 500] °F | (0 to 441) °C [32 to 825] °F | (0 to 521) °C [32 to 970] °F | (0 to 621) °C [32 to 1150] °F | (0 to 721) °C [32 to 1330] °F | (0 to 721) °C [32 to 1330] °F |
| K or N | | (0 to 700) °C [0 to 1290] °F | (-200 to 921) °C [-328 to 1690] °F | (-200 to 927) °C [-328 to 1700] °F | (-200 to 927) °C [-328 to 1700] °F | (-200 to 927) °C [-328 to 1700] °F | (-200 to 927) °C [-328 to 1700] °F |
| E | | (-200 to 260) °C [-328 to 570] °F | (-200 to 510) °C [-328 to 950] °F | (-200 to 649) °C [-328 to 1200] °F | (-200 to 732) °C [-328 to 1350] °F | (-200 to 821) °C [-328 to 1510] °F | (-200 to 821) °C [-328 to 1510] °F |
| T | | (-200 to 260) °C [-324 to 500] °F | (-200 to 260) °C [-328 to 500] °F | (-200 to 371) °C [-328 to 700] °F | (-200 to 371) °C [-328 to 700] °F | (-200 to 371) °C [-328 to 700] °F | (-200 to 371) °C [-328 to 700] °F |
| K or N | ALLOY 600 | (0 to 700) °C [0 to 1290] °F | (-200 to 921) °C [-328 to 1690] °F | (-200 to 1071) °C [-328 to 1960] °F | (-200 to 1149) °C [-328 to 2100] °F | (-200 to 1149) °C [-328 to 2100] °F | (-200 to 1149) °C [-328 to 2100] °F |
| E | | (-200 to 300) °C [-328 to 570] °F | (-200 to 510) °C [-328 to 950] °F | (-200 to 649) °C [-328 to 1200] °F | (-200 to 732) °C [-328 to 1350] °F | (-200 to 821) °C [-328 to 1510] °F | (-200 to 821) °C [-328 to 1510] °F |

This table gives the suggested upper temperature limits for various thermocouples in several common sheath sizes. It does not address compatibility considerations between the thermoelement materials and the sheath containing them. The temperature limits given here are intended only as a guide to the purchaser and should not be taken as absolute values, nor as guarantees of satisfactory life or performance. These types and sizes are sometimes used at temperatures above the given limits, but usually at the expense of stability, life or both. In other instances, it may be necessary to reduce the given limits in order to achieve adequate service.

HOT or MEASURING JUNCTIONS and RESPONSE TIMES



UNGROUND JUNCTION (U)
The welded thermocouple junction is fully isolated from the welded closure of the sheath. This junction provides electrical isolation to reduce problems associated with electrical interference. Ungrounded junctions are also recommended for use in extreme positive or negative temperatures, rapid thermal cycling and for ultimate corrosion resistance of the sheath alloy. All ungrounded junctions exceed 1000 MΩ resistance @ 500 V dc at ambient room temperatures.



SHIELDED JUNCTION (S)
The thermocouple wires are welded and recessed inside the sheath with the tip of the sheath open. Insulation is not sealed against process conditions.



GROUND JUNCTION (G)
The thermocouple junction is welded securely into the closure end of the sheath, becoming an integral part of the weld. This is a good general purpose, low cost junction providing faster response times than an un-grounded junction of similar sheath diameter. Grounded junctions should not be used with Type T thermocouples, due to the copper wire.



EXPOSED JUNCTION (E)
The thermocouple wires are welded and exposed. The insulation is not sealed against liquid or gas penetration. Recommended where fast response is desired, and corrosive conditions are nonexistent. The exposed hot junction length for 1/8-inch diameter sheaths and above is typically 3/16" past sheath. The exposed junctions for sheath diameters less than 1/8-inch diameter are supplied as shielded junctions.

Typical Junction Response Times (63.2% of a (25 to 100) °C Step Change)

| SHEATH O.D. (inches) | "E" JUNCTION (seconds) | "G" JUNCTION (seconds) | "U" JUNCTION (seconds) |
|----------------------|------------------------|------------------------|------------------------|
| 0.020 | 0.02 s | 0.03 s | 0.24 s |
| 0.032 | 0.03 s | 0.05 s | 0.26 s |
| 0.040 | 0.03 s | 0.06 s | 0.28 s |
| 1/16 | 0.01 s | 0.3 s | 0.4 s |
| 1/8 | 0.1 s | 0.6 s | 1.6 s |
| 3/16 | 0.2 s | 0.9 s | 2.4 s |
| 1/4 | 0.3 s | 1.3 s | 2.9 s |
| 3/8 | 0.4 s | 3.5 s | 7.2 s |

Elements of several different materials, base resistances, temperature coefficients, accuracies, and construction styles are available for installation into final RTD temperature sensor assemblies to meet customer specifications. Pyromation's standard RTD constructions utilize both thin film and wire wound elements as specified by the part number. The temperature ranges are either dictated by the construction style or element type whichever is lower. These construction styles are listed below.

LOW RANGE - THIN-FILM CONSTRUCTION (L) (-50 to 200) °C [-58 to 392] °F

The element is welded to Fluoropolymer-insulated, silver-plated copper leads, and then placed inside a specially-cleaned stainless steel sheath. The space surrounding the element and leads is filled and loosely packed with alumina oxide powder to provide good heat transfer times, and to provide a damping cushion against vibration and mechanical shock. The filled sheath is then sealed with low temperature epoxies to prevent moisture penetration.

LOW RANGE - WIRE-WOUND CONSTRUCTION (L) (-200 to 200) °C [-328 to 392] °F

The element is welded to Fluoropolymer-insulated, silver-plated copper leads, and then placed inside a specially-cleaned stainless steel sheath. The space surrounding the element and leads is filled and loosely packed with alumina oxide powder to provide good heat transfer times, and to provide a damping cushion against vibration and mechanical shock. The filled sheath is then sealed with low temperature epoxies to prevent moisture penetration.

MEDIUM RANGE - THIN-FILM CONSTRUCTION (M) (-50 to 480) °C [-58 to 896] °F

The element is welded to fiberglass-insulated, nickel-plated copper leads, and then placed inside a specially-cleaned stainless steel sheath. The space surrounding the element and leads is filled and loosely packed with alumina oxide powder to provide good heat transfer times, and to provide a damping cushion against vibration and mechanical shock. The filled sheath is then sealed with low-temperature epoxies to prevent moisture penetration.

MEDIUM RANGE - THIN-FILM CONSTRUCTION (K) (-50 to 315) °C [-58 to 599] °F

The element is welded to Polyimide-insulated, nickel-plated copper leads, and then placed inside a specially-cleaned stainless steel sheath. The space surrounding the element and leads is filled and loosely packed with alumina oxide powder to provide good heat transfer times, and to provide a damping cushion against vibration and mechanical shock. The filled sheath is then sealed with low-temperature epoxies to prevent moisture penetration.

HIGH RANGE - WIRE-WOUND CONSTRUCTION (H) (-200 to 600) °C [-328 to 1112] °F

The element is welded to nickel leads that are insulated with compacted magnesium oxide (MgO) powder inside the stainless steel sheath. The void surrounding the element is packed with MgO powder and the sheath tip is welded closed with a stainless steel cap. The leads and sheath are sealed with low-temperature epoxies to prevent moisture penetration.

HIGH RANGE - THIN-FILM CONSTRUCTION (H) (-50 to 500) °C [-58 to 932] °F

The element is welded to nickel leads that are insulated with compacted magnesium oxide (MgO) powder inside the 316 stainless steel sheath. The void surrounding the element is packed with MgO powder and the sheath tip is welded closed with a 316 stainless steel cap. The leads and sheath are sealed with low-temperature epoxies to prevent moisture penetration.

RTD Element Terminology

TEMPERATURE COEFFICIENT OF RESISTANCE: The fractional change in element resistance per change of 1 °C, is expressed as $\Omega/\Omega/^\circ\text{C}$ or $\Omega \cdot \Omega^{-1} \cdot ^\circ\text{C}^{-1}$ or $^\circ\text{C}^{-1}$

TOLERANCE: Initial maximum allowable deviation expressed as $\Delta t(t)$ in °C from nominal temperature/resistance relationship $R(t)$.

SELF-HEATING: Self-heating is the rise in the measured temperature caused by the power dissipated in the element. Self-heating error is affected by the thermal conductivity and velocity of the process being measured and is negligible for most applications.

THERMAL RESPONSE: The time a thermometer takes to respond at a specified percentage to a step change in temperature. To specify response time, it is necessary to declare the percentage of response, usually $\tau_{0.9}$, $\tau_{0.5}$, or $\tau_{0.1}$, which gives 90%, 50% or 10% of the response. The test medium and its flow conditions have to be specified (usually flowing water or flowing air).

MINIMUM IMMERSION DEPTH: Immersion depth at which the change from calibration at full immersion does not exceed 0.1 °C.

REPEATABILITY-STABILITY: The ability of an element to reproduce the same resistance or temperature reading each time it is at equilibrium at a given repeated temperature. Expressed as a \pm resistance or temperature value over a given temperature range. This may also be expressed as the stability of its resistance. Typically platinum elements will not change more than 0.04% at 0 °C [32 °F] after receiving ten consecutive shocks from (-200 to 600) °C [-328 to 1112] °F.

VIBRATION: Pyromation's fully assembled sheathed RTD sensors are designed to withstand an average vibration level of 30 G's using random vibrating frequencies from (20 to 2,000) Hz at ambient temperature. Supporting test results indicate that initial RTD tolerances remain as specified when tested at these vibration levels.

HUMIDITY LIMITS: Sheaths, transition fittings, and lead seals capable of withstanding 100% humidity at normal atmospheric pressure, and at normal ambient temperatures.

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

Element Connections

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

Three-Wire: Provides one connection to one end of the element and two to the other end of the element. Connected to an instrument designed to accept three wire input, sufficient compensation is usually achieved for leadwire resistance and temperature change in leadwire resistance. This is the most commonly used configuration.

Four-Wire: Provides two connections to each end of the element to completely compensate for leadwire resistance and temperature change in leadwire. This configuration is used where highly accurate temperature measurement is vital.

2-WIRE SINGLE

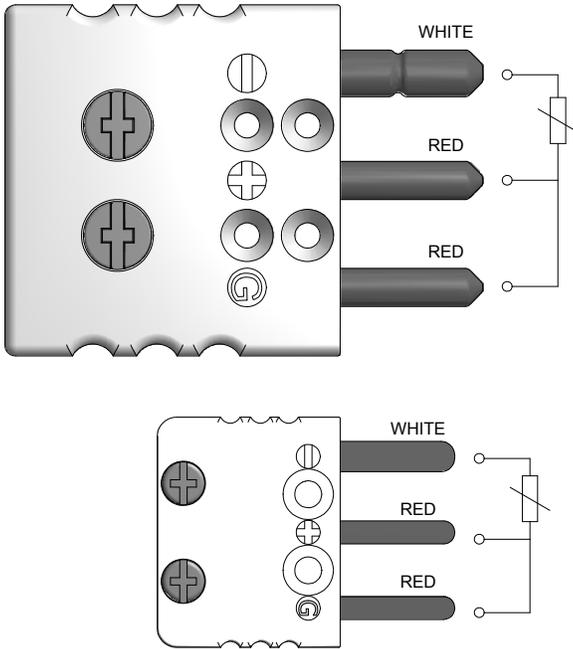
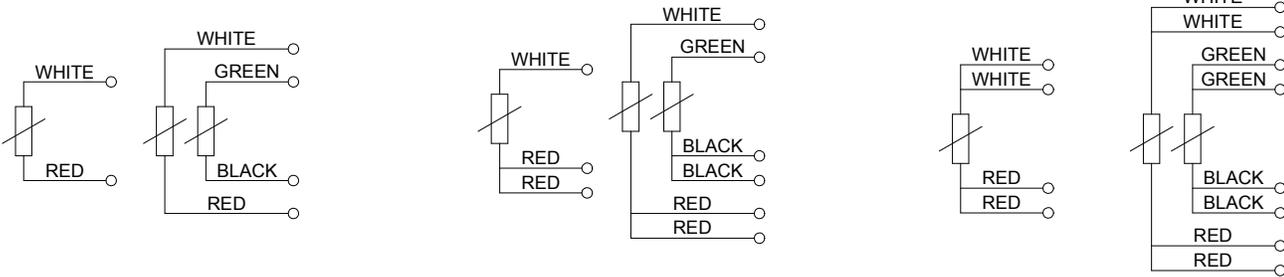
2-WIRE DUPLEX

3-WIRE SINGLE

3-WIRE DUPLEX

4-WIRE SINGLE

4-WIRE DUPLEX



Lead resistance has a large effect on RTD temperature measurement accuracy. A 2-wire circuit provides no compensation and can provide large measurement errors. The following table shows the effects of leadwire resistance on temperature measurements using low-temperature RTD assemblies with copper leadwire.

Leadwire Resistance

| LEADWIRE-WIRE GAUGE | RESISTANCE-OHMS PER FOOT | UNCOMPENSATED 2-WIRE CIRCUITS | |
|---------------------|--------------------------|--|----------------------------|
| | | MAX. LENGTH FOR 1 °F ERROR @ 20 °C [68 °F] | ERROR IN °F PER DOUBLE FT. |
| 30 | 0.133 | 0.81 ft | 1.24 °F |
| 28 | 0.0851 | 1.26 ft | 0.79 °F |
| 24 | 0.0333 | 3.2 ft | 0.31 °F |
| 22 | 0.0213 | 5.1 ft | 0.198 °F |
| 20 | 0.0148 | 7.27 ft | 0.14 °F |
| 18 | 0.0083 | 13.0 ft | 0.077 °F |
| 16 | 0.0052 | 20.7 ft | 0.048 °F |

STANDARD PLATINUM RTD ASSEMBLIES - Pyromation standard RTD assemblies are constructed using either wire-wound platinum elements or thin-film elements with a reference resistance of 100 ohms at 0 °C, a temperature coefficient 0.003 85 °C⁻¹ and which are in accordance with the following standards:

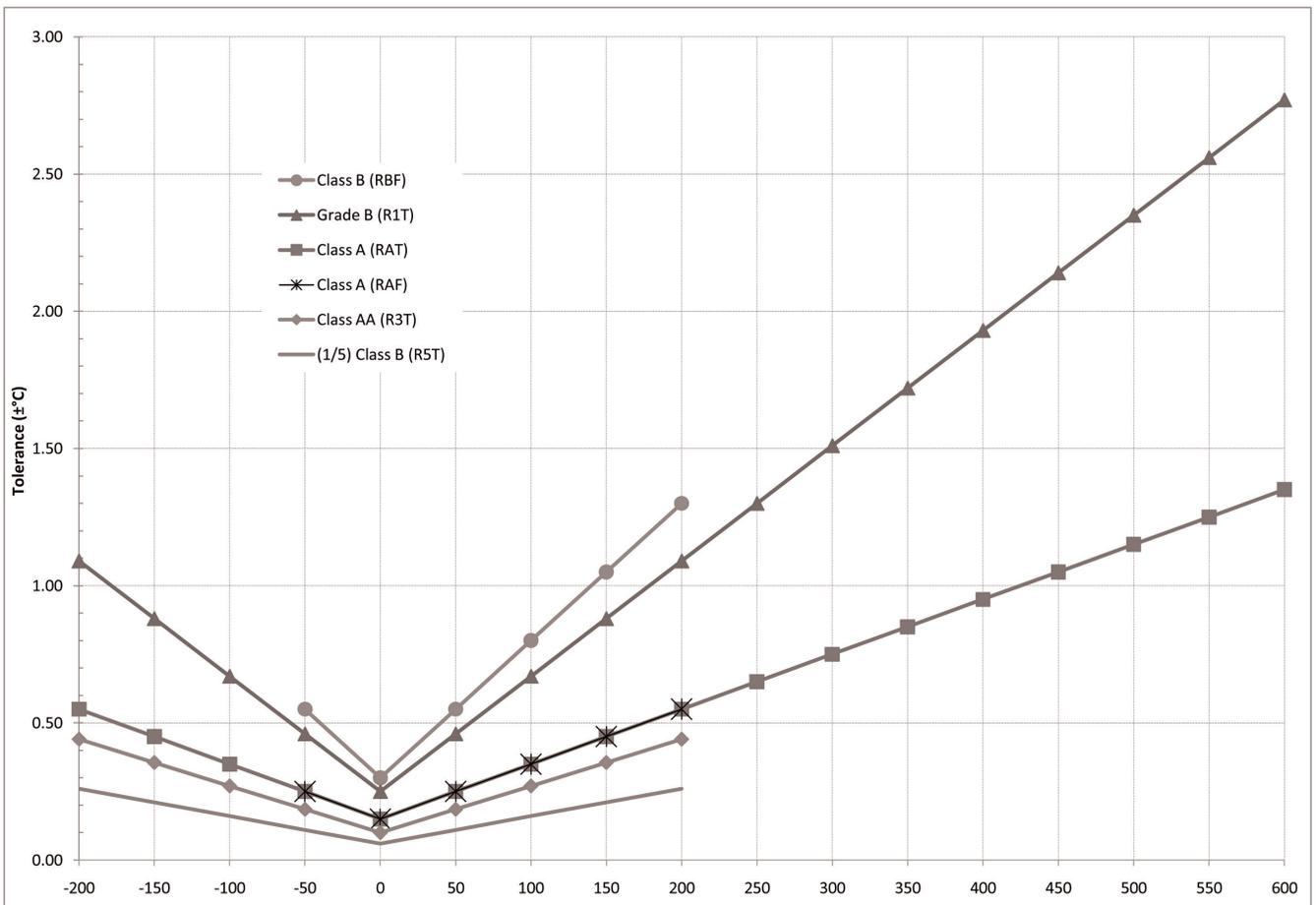
1. International Standard, IEC 60751 2. American Standard, ASTM E1137

| TEMPERATURE | | IEC CLASS B ^[1] | | ASTM GRADE B ^[1] | | IEC CLASS A ^[1] | | IEC CLASS AA ^[1] | | (1/5) IEC CLASS B ^[2] | |
|-------------|--------|-------------------------------|--------|------------------------------|--------|-------------------------------|--------|-------------------------------|--------|----------------------------------|--------|
| | | ± (0.12% × R ₀) Ω | | ± (0.1% × R ₀) Ω | | ± (0.06% × R ₀) Ω | | ± (0.04% × R ₀) Ω | | ± (0.02% × R ₀) Ω | |
| | | ± (0.3 + 0.005 t) °C | | ± (0.25 + 0.0042 t) °C | | ± (0.15 + 0.002 t) °C | | ± (0.1 + 0.0017 t) °C | | ± (0.06 + 0.001 t) °C | |
| °C | [°F] | °C | [°F] | °C | [°F] | °C | [°F] | °C | [°F] | °C | [°F] |
| -200 | [-328] | | | 1.09 | [1.96] | 0.55 | [0.99] | 0.44 | [0.79] | 0.26 | [0.47] |
| -100 | [-148] | | | 0.67 | [1.21] | 0.35 | [0.63] | 0.27 | [0.49] | 0.16 | [0.29] |
| -50 | [-58] | .55 | [0.99] | 0.46 | [0.83] | 0.25 | [0.45] | 0.19 | [0.34] | 0.11 | [0.20] |
| 0 | [32] | .30 | [0.54] | 0.25 | [0.45] | 0.15 | [0.27] | 0.10 | [0.18] | 0.06 | [0.11] |
| 100 | [212] | .80 | [1.44] | 0.67 | [1.21] | 0.35 | [0.63] | 0.27 | [0.49] | 0.16 | [0.29] |
| 200 | [392] | 1.3 | [2.34] | 1.09 | [1.96] | 0.55 | [0.99] | 0.44 | [0.79] | 0.26 | [0.47] |
| 300 | [572] | 1.8 | [3.24] | 1.51 | [2.72] | 0.75 | [1.35] | | | | |
| 400 | [752] | 2.3 | [4.14] | 1.93 | [3.47] | 0.95 | [1.71] | | | | |
| 500 | [932] | 2.8 | [5.04] | 2.35 | [4.23] | 1.15 | [2.07] | | | | |
| 600 | [1112] | | | 2.77 | [4.99] | 1.35 | [2.43] | | | | |

Where: |t| = value of temperature without regard to sign, °C

[1] The equations represent values for 3- and 4-wire PRTs. Caution must be exercised with 2-wire PRTs due to lead resistance.

[2] This tolerance can only be met with a 4-wire PRT.



Leadwire Transition Fitting Dimensions

| CODE | SHEATH DIAMETERS (inches) | FITTING O.D. (inches) | FITTING LENGTH | |
|----------|---------------------------|-----------------------|-------------------|---------------------|
| | | | W/SPRING (inches) | W/O SPRING (inches) |
| 15,16,19 | 0.020 | 3/8 | 2 (5/8) | 1 (3/16) |
| 15,16,19 | 0.032 | 3/8 | 2 (5/8) | 1 (3/16) |
| 15,16,19 | 0.040 | 3/8 | 2 (5/8) | 1 (3/16) |
| 15,16,19 | 1/16 | 1/4 | 2 (5/8) | 1 (3/16) |
| 15,16,19 | 1/16 ^[1] | 3/8 | 2 (5/8) | 1 (3/16) |
| 15,16,19 | 1/8 | 1/4 | 2 (5/8) | 1 (3/16) |
| 15,16,19 | 1/8 ^[1] | 3/8 | 2 (5/8) | 1 (3/16) |
| 15,16,19 | 3/16 | 3/8 | 2 (5/8) | 1 (3/16) |
| 15,16,19 | 1/4 | 3/8 | 2 (5/8) | 1 (3/16) |
| 15,16,19 | 3/8 | 7/16 | 2 (5/8) | 1 (3/16) |

[1] Used with flexible armor tubing, duplex T/C's, and wire codes P3, P1, and F3

Sheath Mounting Fitting Dimensions

| CODE | STYLE | SHEATH O.D. (inches) | NPT SIZE (inches) | LENGTH (inches) |
|--------|--------------------------------|----------------------|-------------------|-----------------|
| 01A | 303 SS one-time adjustable | 1/16, 1/8, 3/16, 1/4 | 1/8 | 1 5/16 |
| 05A | 316 SS one-time adjustable | 1/16, 1/8, 3/16, 1/4 | 1/8 | 1 1/4 |
| 05B | 316 SS one-time adjustable | 1/8, 3/16, 1/4, 3/8 | 1/4 | 1 7/8 |
| 05C | 316 SS one-time adjustable | 1/8, 1/4, 3/8 | 1/2 | 1 13/16 |
| 15A | Brass one-time adjustable | 1/8, 3/16, 1/4 | 1/8 | 1 1/4 |
| 15B | Brass one-time adjustable | 3/16, 1/4, 3/8 | 1/4 | 1 3/8 |
| 15C | Brass one-time adjustable | 1/4, 3/8 | 1/2 | 1 1/2 |
| 10A | 303 SS re-adjustable | 1/16, 1/8, 3/16 | 1/8 | 1 1/4 |
| 10B | 303 SS re-adjustable | 1/4, 3/8 | 1/4 | 2 7/16 |
| 10C | 303 SS re-adjustable | 1/4, 3/8 | 1/2 | 2 7/16 |
| 12A | 316 SS re-adjustable | 1/16, 1/8, 3/16, 1/4 | 1/8 | 1 1/4 |
| 12B | 316 SS re-adjustable | 1/8, 3/16, 1/4, 3/8 | 1/4 | 1 1/2 |
| 12C | 316 SS re-adjustable | 1/8, 1/4, 3/8 | 1/2 | 1 3/4 |
| 11A | Brass re-adjustable | 1/16, 1/8, 3/16, 1/4 | 1/8 | 1 19/64 |
| 11B | Brass re-adjustable | 1/8, 3/16, 1/4, 3/8 | 1/4 | 1 9/16 |
| 11C | Brass re-adjustable | 1/4, 3/8 | 1/2 | 1 13/16 |
| 19C | 303 SS spring-loaded well fig. | 3/16, 1/4 | 1/2 | 2 1/4 |
| 8A | 316 SS fixed bushing | All sizes | 1/8 | 5/8 |
| 8B | 316 SS fixed bushing | All sizes | 1/4 | 11/16 |
| 8C | 316 SS fixed bushing | All sizes | 1/2 | 15/16 |
| 8D | 316 SS fixed bushing | All sizes | 3/4 | 1 |
| 6HN | Steel hex fitting | 1/8, 3/16, 1/4, 3/8 | 1/2 | 2 |
| 8HN | 316 SS hex fitting | 1/8, 3/16, 1/4, 3/8 | 1/2 | 2 |
| 8RNDNC | 316 SS reducing hex fitting | 1/8, 3/16, 1/4, 3/8 | 3/4 x 1/2 | 2 |
| 9HNB | 303 SS hex fitting | 1/8, 3/16, 1/4, 3/8 | 1/4 | 1 3/16 |
| 13A | Fixed bayonet fitting | 1/8, 3/16 | N/A | 1 5/8 |
| 14 | Adjustable flange | 1/8, 3/16, 1/4, 3/8 | N/A | 1 1/2 |
| 16A | Adjustable bayonet fitting | 1/8 | N/A | 1 5/8 |

Compression Fitting Pressure Rating Table

| CODE | 05A | 05A, 05B, 05C | 05A, 05B | 05A, 05B, 05C | 05B, 05C |
|------------------------------------|---|--------------------|---------------------|--------------------|--------------------|
| Sheath O.D. & Wall Thickness | 1/6" O.D. x 0.0077" | 1/8" O.D. x 0.012" | 3/16" O.D. x 0.020" | 1/4" O.D. x 0.028" | 3/8" O.D. x 0.049" |
| TEMPERATURE | MAXIMUM ALLOWANCE WORKING PRESSURE (PSIG) | | | | |
| (-29 to 149) °C [-20 to 300] °F | 3300 | 2850 | 3150 | 3350 | 3900 |
| 204 °C [400 °F] | 3200 | 2750 | 3050 | 3250 | 3800 |
| 260 °C [500 °F] | 3000 | 2550 | 2850 | 3000 | 3500 |
| 316 °C [600 °F] | 2800 | 2400 | 2700 | 2850 | 3300 |
| 371 °C [700 °F] | 2700 | 2350 | 2600 | 2750 | 3200 |
| 427 °C [800 °F] | 2650 | 2300 | 2550 | 2650 | 3100 |
| 482 °C [900 °F] | 2600 | 2200 | 2450 | 2600 | 3050 |
| 538 °C [1000 °F] | 2400 | 2100 | 2300 | 2450 | 2850 |

Calculations are based on the following criteria: 316 stainless steel sheath, ultimate tensile stress of 75,000 PSI for seamless tube, Conservative Barlow Formula and safety factor of 4.0.

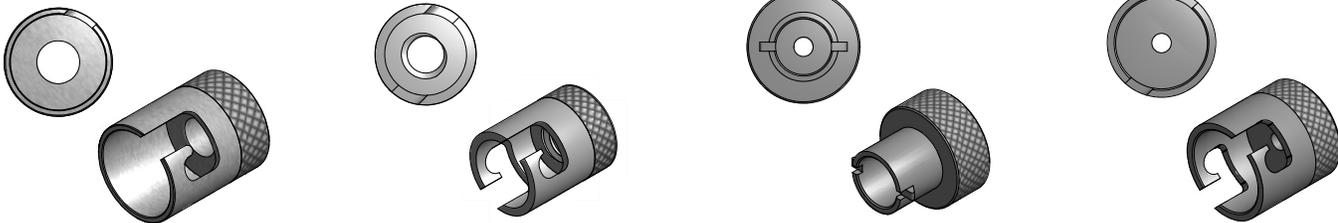
Bayonet Caps

7/16" I.D. single slot
Order code: A

12 mm I.D. double slot
Order code: B

12 mm O.D. dual pin
Order code: C

15 mm I.D. double slot
Order code: E



Corrosive Service Guide to Materials for Sheaths and Thermowells

Refer to A.S.M.E. Boiler Code, Section VIII for allowable stress levels
(Fluoropolymer coated thermowells and/or Fluoropolymer sheaths may be substituted for all corrosive agents listed)

| CORROSIVE AGENT | TEMP. °C | TEMP. °F | CONC. % | RECOM. MATERIAL | CORROSIVE AGENT | TEMP. °C | TEMP. °F | CONC. % | RECOM. MATERIAL |
|------------------------------|----------|----------|----------|-------------------------------------|------------------------------|----------|-----------|---------|-------------------------|
| Acetic Acid (Glacial) | 199 | [390] | ALL | 316 SS | Chlorine (Gas) | 93 | [200] | ALL | Monel® |
| Acetic Acid | 143 | [290] | 80% | Hast. C | | 199 | [390] | ALL | 316 SS ^[1] |
| | 199 | [390] | 50% | 316 SS | Chlorine (Gas - Moist) | 66 | [150] | ALL | Hast. C |
| | 143 | [290] | 80% | Carp. 20 ^[1] | Chloroacetic Acid | 182 | [360] | ALL | Hast. B |
| Acetic Anhydride | 132 | [270] | ALL | Hast. C | Chloroform | 93 | [200] | ALL | Nickel |
| | 199 | [390] | ALL | 316 SS ^[1] | | 93 | [200] | ALL | Carp. 20 ^[1] |
| Acetone | 199 | [390] | ALL | 316 SS | Chromic Acid | 93 | [200] | 50% | Titanium |
| Acetylene | 199 | [390] | ALL | 304 SS | | 93 | [200] | 50% | Hast. C ^[1] |
| Alcohol, Ethyl | 93 | [200] | ALL | Hast. C | Citric Acid | 127 | [260] | ALL | Hast. C |
| | 199 | [390] | ALL | 316 SS ^[1] | | 93 | [200] | ALL | Carp. 20 ^[1] |
| Aluminum Chloride (Aqueous) | 143 | [290] | ALL | Hast. B | Copper Chloride | 88 | [190] | ALL | Titanium |
| | 143 | [290] | ALL | Nickel ^[1] | | 88 | [190] | ALL | Hast. C ^[1] |
| Aluminum Nitrate (Saturated) | 93 | [200] | ALL | 446 SS | Copper Nitrate | 149 | [300] | ALL | 304 SS |
| | 88 | [190] | ALL | 316 SS ^[1] | Copper Sulfate | 93 | [200] | ALL | Hast. C |
| Aluminum Sulfate (Saturated) | 93 | [200] | ALL | Titanium | | 199 | [390] | ALL | 316 SS ^[1] |
| | 93 | [200] | ALL | 316 SS ^[1] | Corn Oil | 238 | [460] | ALL | TFE |
| Ammonia (Anhydrous) | 293 | [560] | ALL | 316 SS | | 193 | [380] | ALL | FEP |
| Ammonia (Gas) | 93 | [200] | ALL | 304 SS | Crude Oil | 171 | [340] | ALL | 316 SS ^[1] |
| Ammonium Chloride | 88 | [190] | ALL | Titanium | Cyanogen Gas | 93 | [200] | ALL | 304 SS |
| | 293 | [560] | ALL | Nickel ^[1] | | 238 | [460] | ALL | TFE |
| | 71 | [160] | 50% | Nickel | | 193 | [380] | ALL | FEP |
| Ammonium Hydroxide | 27 | [80] | ALL | Steel | | 171 | [340] | ALL | 316 SS ^[1] |
| | 82 | [180] | ALL | Steel ^[1] | Ether | 88 | [190] | ALL | 304 SS |
| Ammonium Nitrate | 93 | [200] | ALL | Carp. 20 | Ethyl Acetate | 93 | [200] | ALL | Titanium |
| Ammonium Sulfate | 93 | [200] | SAT. | Hast. B | | 199 | [390] | ALL | 316 SS ^[1] |
| | 143 | [290] | SAT. | 304 SS ^[1] | Ethyl Chloride (Dry) | 293 | [560] | ALL | 316 SS |
| | 93 | [200] | 10 - 40% | Titanium | Ethylene Glycol | 93 | [200] | ALL | Carp. 20 |
| | 199 | [390] | 10 - 40% | 316 SS ^[1] | | 93 | [200] | ALL | 304 SS ^[1] |
| Amyl Acetate | 143 | [290] | ALL | 304 SS | Ethylene Oxide | 21 | [70] | ALL | Hast. C |
| Aniline | 254 | [490] | ALL | 304 SS | | 199 | [390] | ALL | 316 SS ^[1] |
| Barium Chloride (Saturated) | 93 | [200] | ALL | Hast. C | Fatty Acids | 199 | [390] | ALL | 316 SS |
| | 293 | [560] | ALL | Inconel [®] ^[1] | Ferric Chloride | 143 | [290] | ALL | Titanium |
| Barium Hydroxide (Saturated) | 104 | [220] | 50% | Carp. 20 | Ferric Sulfate | 27 | [80] | ALL | Hast. C ^[1] |
| | 199 | [390] | ALL | 316 SS ^[1] | | 49 | [120] | ALL | Carp. 20 |
| Beer | 88 | [190] | | 304 SS | Ferrous Sulfate | 88 | [190] | 10% | 316 SS |
| Benzene (Benzol) | 104 | [220] | ALL | Carp. 20 | | 27 | [80] | | Titanium |
| | 104 | [220] | ALL | 304 SS ^[1] | Formaldehyde | 93 | [200] | ALL | 304 SS ^[1] |
| Benzoic Acid | 199 | [390] | ALL | Titanium | | 49 | [120] | ALL | 304 SS |
| | 199 | [390] | ALL | 304 SS ^[1] | Formic Acid (Anhydrous) | 49-293 | [120-560] | 50% | 304 SS ^[1] |
| Black Liquor | 238 | [460] | ALL | TFE | Freon (F-11) | 93 | [200] | 50% | Carp. 20 |
| | 193 | [380] | ALL | FEP | | 204 | [400] | ALL | Monel® |
| | 93 | [200] | ALL | Carp. 20 ^[1] | Furfural | 204 | [400] | ALL | 316 SS ^[1] |
| Bleach (Active Chlorine) | 60 | [140] | 12.5% | Hast. C | | 199 | [390] | ALL | Nickel |
| Borax | 199 | [390] | ALL | 316 SS | Gallic Acid | 199 | [390] | ALL | 304 SS ^[1] |
| Boric Acid | 293 | [560] | ALL | Hast. C | | 238 | [460] | ALL | TFE |
| | 93 | [200] | ALL | Nickel ^[1] | | 193 | [380] | ALL | FEP |
| Brine Acid | 60 | [140] | ALL | Hast. C | Gasoline (Unleaded) | 199 | [390] | ALL | 316 SS ^[1] |
| | 27 | [80] | ALL | Brass ^[1] | | 154 | [310] | ALL | Hast. C |
| Bromine (Liquid) | 293 | [560] | ALL | Tantalum | | 16 | [60] | | 446 SS |
| | 93 | [200] | ALL | Aluminum ^[1] | | 171 | [340] | | Steel ^[1] |
| Butane | 171 | [340] | ALL | Steel | Gasoline (Refined) | 238 | [460] | | TFE |
| Butyl Acetate | 93 | [200] | ALL | Titanium | | 193 | [380] | | FEP |
| | 188 | [370] | ALL | 316 SS ^[1] | | 88 | [190] | | Steel ^[1] |
| Butyl Alcohol | 199 | [390] | ALL | 316 SS | Glucose | 27 | [80] | ALL | Nickel |
| Butyric Acid | 143 | [290] | ALL | Carp. 20 | | 193 | [380] | ALL | 316 SS ^[1] |
| | 199 | [390] | ALL | 316 SS ^[1] | Glue | 27 | [80] | ALL | Hast. B |
| Calcium Bisulfite | 93 | [200] | ALL | TFE | | 60 | [140] | ALL | Steel ^[1] |
| | 193 | [380] | ALL | FEP | Glycerine | 127 | [260] | ALL | 304 SS |
| | 171 | [340] | ALL | 316 SS ^[1] | Hydrobromic Acid | 88 | [190] | 50% | Titanium |
| Calcium Chlorate | 238 | [460] | ALL | TFE | | 121 | [250] | 50% | Hast. B ^[1] |
| | 193 | [380] | ALL | FEP | Hydrochloric Acid | 60 | [140] | 38% | Hast. B |
| | 93 | [200] | ALL | 316 SS ^[1] | Hydrocyanic Acid | 238 | [460] | ALL | TFE |
| Calcium Chloride (Saturated) | 171 | [340] | ALL | Hast. C | | 193 | [380] | ALL | FEP |
| | 93 | [200] | ALL | Carp. 20 ^[1] | Hydrofluoric Acid | 171 | [340] | ALL | 316 SS ^[1] |
| Calcium Hydroxide | 93 | [200] | 50% | Hast. C | | 238 | [460] | ALL | TFE |
| | 88 | [190] | SAT. | 304 SS ^[1] | | 193 | [380] | ALL | FEP |
| Carbonic Acid | 293 | [560] | ALL | Carp. 20 | | 93 | [200] | ALL | Hast. C ^[1] |
| | 171 | [340] | ALL | 316 SS ^[1] | Hydrogen Chloride (Gas, Dry) | 293 | [560] | ALL | Carp. 20 |
| Carbon Dioxide (Dry) | 427 | [800] | ALL | Brass | Hydrogen Flouride (Dry) | 38 | [100] | ALL | 304 SS |
| Carbonated Beverages | 100 | [212] | ALL | 304 SS | | 199 | [390] | ALL | 304 SS ^[1] |
| Carbon Disulfide | 93 | [200] | ALL | Titanium | Hydrogen Peroxide | 88 | [190] | 90% | Hast. C |
| | 199 | [390] | ALL | 316 SS ^[1] | Hydrogen Sulfide (Dry) | 71 | [160] | ALL | 316 SS |
| Carbon Tetrachloride | 93 | [200] | ALL | 304 SS | | 293 | [560] | ALL | 316 SS |

All materials listed are rated < 2 Mills penetration/year except as noted: [1] = < 20 Mills penetration/year

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Corrosive Service Guide to Materials for Sheaths and Thermowells

Refer to A.S.M.E. Boiler Code, Section VIII for allowable stress levels
(Fluoropolymer coated thermowells and/or Fluoropolymer sheaths may be substituted for all corrosive agents listed)

| CORROSIVE AGENT | TEMP. °C | TEMP. °F | CONC. % | RECOM. MATERIAL | CORROSIVE AGENT | TEMP. °C | TEMP. °F | CONC. % | RECOM. MATERIAL |
|------------------------|----------|----------|---------|-------------------------|------------------------|----------|----------|-----------|-------------------------|
| Iodine | 83 | [190] | ALL | Hast. C | Sea Water (Cavitation) | | | | 316 SS |
| | 21 | [70] | ALL | Nickel | Soap Solutions | 16 | [60] | ALL | 446 SS |
| Kerosene | 238 | [460] | ALL | TFE | | 54 | [130] | ALL | Nickel ^[1] |
| | 193 | [380] | ALL | FEP | Sodium Bicarbonate | 171 | [340] | 20% | 316 SS |
| | 171 | [340] | | Steel ^[1] | Sodium Bisulfite | 71 | [160] | 10% | 316 SS |
| Ketones | 32 | [90] | ALL | Hast. C | | 93 | [200] | 10 - 40% | Carp. 20 |
| | 127 | [260] | ALL | 316 SS ^[1] | Sodium Carbonate | 93 | [200] | 30% | Carp. 20 |
| Lactic Acid | 154 | [310] | ALL | Titanium | | 293 | [560] | 10-100% | Hast. B ^[1] |
| | 116 | [240] | ALL | Hast. B ^[1] | Sodium Chloride | 27 | [80] | 30% | Nickel |
| Lime (Sulfur) | 238 | [460] | ALL | TFE | Sodium Flouride | 71 | [160] | ALL | Monel [®] |
| | 193 | [380] | ALL | FEP | | 77 | [170] | ALL | Carp. 20 ^[1] |
| | 154 | [310] | ALL | 316 SS ^[1] | Sodium Hydroxide | 104 | [220] | ALL | Monel [®] |
| Linseed Oil | 60 | [140] | ALL | Carp. 20 | | 71 | [160] | ALL | 316 SS ^[1] |
| | 27 | [80] | ALL | Steel ^[1] | Sodium Nitrate | 171 | [340] | 60% | 316 SS |
| Magnesium Chloride | 143 | [290] | ALL | Nickel | Sodium Nitrite | 93 | [200] | Saturated | Titanium |
| | 88 | [190] | 50% | Carp. 20 ^[1] | | 93 | [200] | 40% | 304 SS ^[1] |
| Magnesium Hydroxide | 93 | [200] | ALL | 304 SS | Sodium Peroxide | 16 | [60] | 10% | 446 SS |
| Magnesium Sulfate | 93 | [200] | 60% | Nickel | | 171 | [340] | 10% | 316 SS ^[1] |
| | 171 | [340] | ALL | 316 SS ^[1] | Sodium Phosphate Acid | 93 | [200] | ALL | Titanium |
| Mercuric Chloride | 143 | [290] | ALL | Tantalum | | 93 | [200] | ALL | 304 SS ^[1] |
| | 77 | [170] | 10% | Hast. C ^[1] | Sodium Silicate | 27 | [80] | ALL | 446 SS ^[1] |
| Mercury | 293 | [560] | ALL | 304 SS | | 166 | [330] | ALL | 316 SS ^[1] |
| Methyl Chloride (Dry) | 171 | [340] | ALL | 316 SS | Sodium Sulfate | 199 | [390] | ALL | 316 SS |
| Methylene Chloride | 93 | [200] | ALL | Carp. 20 | Sodium Sulfide | 238 | [460] | 50% | TFE |
| Milk | 93 | [200] | | 304 SS | | 193 | [380] | 50% | FEP |
| Naphtha | 16 | [60] | ALL | 446 SS | | 93 | [200] | 50% | 316 SS ^[1] |
| | 116 | [240] | ALL | 304 SS ^[1] | Sodium Sulfite | 93 | [200] | 10% | 304 SS |
| Natural Gas | 238 | [460] | | TFE | Sodium Thiosulfate | 16 | [60] | 25% | 446 SS |
| | 193 | [380] | | FEP | | 116 | [240] | ALL | 316 SS ^[1] |
| | 43 | [110] | | Steel ^[1] | Steam (Low Pressure) | | | | Inconel |
| Nickel Chloride | 93 | [200] | 80% | Hast. C | | | | | 304 SS ^[1] |
| Nickel Sulfate | 82 | [180] | 10% | Tantalum | (Medium Pressure) | | | | Nickel |
| | 93 | [200] | ALL | 304 SS ^[1] | | | | | 304 SS ^[1] |
| Nitric Acid | 21 | [70] | ALL | 304 SS | (High Pressure) | | | | 316 SS ^[1] |
| | 93 | [200] | 40% | 304 SS | Sulfur | 293 | [560] | ALL | 304 SS |
| Nitrobenzene | 143 | [290] | ALL | Carp. 20 | | 871 | [1600] | ALL | Alloy 556 |
| | 171 | [340] | ALL | 316 SS ^[1] | Sulfur Chloride (Dry) | 32 | [90] | ALL | Tantalum |
| Oleic Acid | 138 | [280] | ALL | 316 SS | | 293 | [560] | ALL | Nickel ^[1] |
| Oleum | 49 | [120] | 40% | Hast. C | Sulfur Dioxide (Dry) | 49 | [120] | ALL | Steel |
| | 116 | [240] | ALL | 316 SS ^[1] | | 293 | [560] | ALL | 316 SS ^[1] |
| Oxalic Acid | 93 | [200] | ALL | Tantalum | Sulfur Trioxide (Dry) | 238 | [460] | ALL | TFE |
| | 93 | [200] | ALL | Carp. 20 ^[1] | | 193 | [380] | ALL | FEP |
| Oxygen | 271 | [520] | ALL | Tantalum | | 293 | [560] | ALL | 304 SS ^[1] |
| | 16 | [60] | ALL | 446 SS | Sulfuric Acid | 38 | [100] | 100% | Carp. 20 |
| | 171 | [340] | ALL | 316 SS ^[1] | | 121 | [250] | 60% | Hast. B |
| Palmitic Acid | 238 | [460] | ALL | TFE | Sulfurous Acid | 71 | [160] | ALL | Titanium |
| | 193 | [380] | ALL | FEP | | 177 | [350] | ALL | Carp. 20 ^[1] |
| | 199 | [390] | ALL | 304 SS ^[1] | Tannic Acid | 93 | [200] | 10 - 20% | Titanium |
| Phenol (Carbolic Acid) | 293 | [560] | ALL | 316 SS | | 93 | [200] | ALL | 304 SS ^[1] |
| Phosphoric Acid | 93 | [200] | 50-85% | Hast. C | Tartaric Acid | 199 | [390] | ALL | 304 SS |
| Phosphoric | 43 | [110] | 50-85% | Carp. 20 | Titanium Tetrachloride | 27 | [80] | ALL | Carp. 20 |
| | 171 | [340] | ALL | 316 SS | | 138 | [280] | ALL | Titanium |
| Phosphoric Solutions | 27 | [80] | ALL | Titanium | Toluene (Toluol) | 171 | [340] | ALL | Steel |
| Picric Acid | 21 | [70] | ALL | Aluminum | | 93 | [200] | ALL | 304 SS |
| | 199 | [390] | ALL | 316 SS ^[1] | Trichloroacetic Acid | 238 | [460] | ALL | TFE |
| Potassium Bromide | 93 | [200] | 30% | Titanium | | 193 | [380] | ALL | FEP |
| | 93 | [200] | 30% | 446 SS | | 93 | [200] | ALL | Hast. C ^[1] |
| Potassium Carbonate | 93 | [200] | 50% | 304 SS | Trichloroethylene | 71 | [160] | ALL | Inconel [®] |
| Potassium Chlorate | 171 | [340] | 30% | 316 SS | Turpentine | 88 | [190] | ALL | 304 SS |
| Potassium Hydroxide | 93 | [200] | 50% | Nickel | Whiskey and Wine | | | ALL | 304 SS |
| Potassium Nitrate | 171 | [340] | 80% | Aluminum | Xylene (Xylol) | 88 | [190] | ALL | 446 SS |
| | 277 | [530] | 80% | 446 SS ^[1] | Zinc Chloride | 82 | [180] | to 70% | Titanium |
| Potassium Permanganate | 21 | [70] | 20% | Hast. C | | 293 | [560] | ALL | Hast. B ^[1] |
| | 171 | [340] | 20% | 316 SS ^[1] | Zinc Sulfate | 93 | [200] | SAT. | 316 SS |
| Potassium Sulfate | 171 | [340] | 10% | 316 SS | | | | | |
| Propane | 60 | [140] | ALL | 446 SS | | | | | |
| | 27 | [80] | ALL | Brass | | | | | |
| Pyrogalllic Acid | 27 | [80] | ALL | Copper | | | | | |
| | 171 | [340] | ALL | 316 SS ^[1] | | | | | |
| Salicylic Acid | 116 | [240] | ALL | Hast. C | | | | | |
| | 171 | [340] | ALL | 316 SS ^[1] | | | | | |
| Sea Water (Stagnant) | | | | Monel [®] | | | | | |

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All materials listed are rated < 2 Mils penetration/year except as noted: [1] = < 20 Mils penetration/year

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Read known temperature in bold face type. Corresponding temperature in degrees Fahrenheit will be found in column to the right. Corresponding temperature in degrees Celsius will be found in column to the left.

INTERPOLATION FACTORS

| | | | |
|----------|-------|-----------|--------|
| °C | °F | °C | °F |
| 0.56 - 1 | - 1.8 | 3.33 - 6 | - 10.8 |
| 1.11 - 2 | - 3.6 | 3.89 - 7 | - 12.6 |
| 1.67 - 3 | - 5.4 | 4.44 - 8 | - 14.4 |
| 2.22 - 4 | - 7.2 | 5.00 - 9 | - 16.2 |
| 2.78 - 5 | - 9.0 | 5.56 - 10 | - 18.0 |

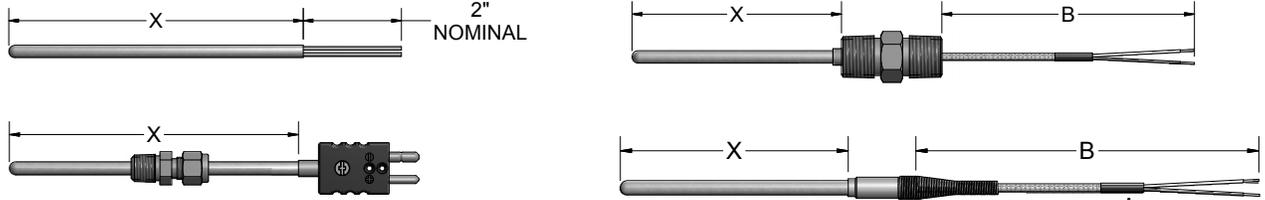
TEMPERATURE CONVERSION FORMULA

$$°C = (°F - 32) \div 1.8$$

$$°F = (°C \times 1.8) + 32$$

| 0 to 100 | | | 100 to 1000 | | | | | | 1000 to 2000 | | | | | | 2000 to 3000 | | | | | | | | |
|----------|-----------|-------|-------------|-----------|-------|-----|------------|-----|--------------|------------|------|-----|-------------|------|--------------|-------------|------|------|-------------|------|------|-------------|------|
| °C | | °F | °C | | °F | °C | | °F | °C | | °F | °C | | °F | °C | | °F | °C | | °F | | | |
| -17.8 | 0 | 32. | 10.0 | 50 | 122.0 | 38 | 100 | 212 | 260 | 500 | 932 | 538 | 1000 | 1832 | 816 | 1500 | 2732 | 1093 | 2000 | 3632 | 1371 | 2500 | 4532 |
| -17.8 | 1 | 33.8 | 10.6 | 51 | 123.8 | 43 | 110 | 230 | 266 | 510 | 950 | 543 | 1010 | 1850 | 821 | 1510 | 2750 | 1099 | 2010 | 3650 | 1377 | 2510 | 4550 |
| -16.7 | 2 | 35.6 | 11.1 | 52 | 125.6 | 49 | 120 | 248 | 271 | 520 | 968 | 549 | 1020 | 1868 | 827 | 1520 | 2768 | 1104 | 2020 | 3668 | 1382 | 2520 | 4568 |
| -16.1 | 3 | 37.4 | 11.7 | 53 | 127.4 | 54 | 130 | 266 | 277 | 530 | 986 | 554 | 1030 | 1886 | 832 | 1530 | 2786 | 1110 | 2030 | 3686 | 1388 | 2530 | 4586 |
| -15.6 | 4 | 39.2 | 12.2 | 54 | 129.2 | 60 | 140 | 284 | 282 | 540 | 1004 | 560 | 1040 | 1904 | 838 | 1540 | 2804 | 1116 | 2040 | 3704 | 1393 | 2540 | 4604 |
| -15.0 | 5 | 41.0 | 12.8 | 55 | 131.0 | 66 | 150 | 302 | 288 | 550 | 1022 | 566 | 1050 | 1922 | 843 | 1550 | 2822 | 1121 | 2050 | 3722 | 1399 | 2550 | 4622 |
| -14.4 | 6 | 42.8 | 13.3 | 56 | 132.8 | 71 | 160 | 320 | 293 | 560 | 1040 | 571 | 1060 | 1940 | 849 | 1560 | 2840 | 1127 | 2060 | 3740 | 1404 | 2560 | 4640 |
| -13.9 | 7 | 44.6 | 13.9 | 57 | 134.6 | 77 | 170 | 338 | 299 | 570 | 1058 | 577 | 1070 | 1958 | 854 | 1570 | 2858 | 1132 | 2070 | 3758 | 1410 | 2570 | 4658 |
| -13.3 | 8 | 46.4 | 14.4 | 58 | 136.4 | 82 | 180 | 356 | 304 | 580 | 1076 | 582 | 1080 | 1976 | 860 | 1580 | 2876 | 1138 | 2080 | 3776 | 1416 | 2580 | 4676 |
| -12.8 | 9 | 48.2 | 15.0 | 59 | 138.2 | 88 | 190 | 374 | 310 | 590 | 1094 | 588 | 1090 | 1994 | 866 | 1590 | 2894 | 1143 | 2090 | 3794 | 1421 | 2590 | 4694 |
| -12.2 | 10 | 50.0 | 15.6 | 60 | 140.0 | 93 | 200 | 392 | 316 | 600 | 1112 | 593 | 1100 | 2012 | 871 | 1600 | 2912 | 1149 | 2100 | 3812 | 1427 | 2600 | 4712 |
| -11.7 | 11 | 51.8 | 16.1 | 61 | 141.8 | 99 | 210 | 410 | 321 | 610 | 1130 | 599 | 1110 | 2030 | 877 | 1610 | 2930 | 1154 | 2110 | 3830 | 1432 | 2610 | 4730 |
| -11.1 | 12 | 53.6 | 16.7 | 62 | 143.6 | 100 | 212 | 413 | 327 | 620 | 1148 | 604 | 1120 | 2048 | 882 | 1620 | 2948 | 1160 | 2120 | 3848 | 1438 | 2620 | 4748 |
| -10.6 | 13 | 55.4 | 17.2 | 63 | 145.4 | 104 | 220 | 428 | 332 | 630 | 1166 | 610 | 1130 | 2066 | 888 | 1630 | 2966 | 1166 | 2130 | 3866 | 1443 | 2630 | 4766 |
| -10.0 | 14 | 57.2 | 17.8 | 64 | 147.2 | 110 | 230 | 446 | 338 | 640 | 1184 | 616 | 1140 | 2084 | 893 | 1640 | 2984 | 1171 | 2140 | 3884 | 1449 | 2640 | 4784 |
| -9.44 | 15 | 59.0 | 18.3 | 65 | 149.0 | 116 | 240 | 464 | 343 | 650 | 1202 | 621 | 1150 | 2102 | 899 | 1650 | 3002 | 1177 | 2150 | 3902 | 1454 | 2650 | 4802 |
| -8.89 | 16 | 60.8 | 18.9 | 66 | 150.8 | 121 | 250 | 482 | 349 | 660 | 1220 | 627 | 1160 | 2120 | 904 | 1660 | 3020 | 1182 | 2160 | 3920 | 1460 | 2660 | 4820 |
| -8.33 | 17 | 62.6 | 19.4 | 67 | 152.6 | 127 | 260 | 500 | 354 | 670 | 1238 | 632 | 1170 | 2138 | 910 | 1670 | 3038 | 1188 | 2170 | 3938 | 1466 | 2670 | 4838 |
| -7.78 | 18 | 64.4 | 20.0 | 68 | 154.4 | 132 | 270 | 518 | 360 | 680 | 1256 | 638 | 1180 | 2156 | 916 | 1680 | 3056 | 1193 | 2180 | 3956 | 1471 | 2680 | 4856 |
| -7.22 | 19 | 66.2 | 20.6 | 69 | 156.2 | 138 | 280 | 536 | 366 | 690 | 1274 | 643 | 1190 | 2174 | 921 | 1690 | 3074 | 1199 | 2190 | 3974 | 1477 | 2690 | 4874 |
| -6.67 | 20 | 68.0 | 21.1 | 70 | 158.0 | 143 | 290 | 554 | 371 | 700 | 1292 | 649 | 1200 | 2192 | 927 | 1700 | 3092 | 1204 | 2200 | 3992 | 1482 | 2700 | 4892 |
| -6.11 | 21 | 69.8 | 21.7 | 71 | 159.8 | 149 | 300 | 572 | 377 | 710 | 1310 | 654 | 1210 | 2210 | 932 | 1710 | 3110 | 1210 | 2210 | 4010 | 1488 | 2710 | 4910 |
| -5.56 | 22 | 71.6 | 22.2 | 72 | 161.6 | 154 | 310 | 590 | 382 | 720 | 1328 | 660 | 1220 | 2228 | 938 | 1720 | 3128 | 1216 | 2220 | 4028 | 1493 | 2720 | 4928 |
| -5.00 | 23 | 73.4 | 22.8 | 73 | 163.4 | 160 | 320 | 608 | 388 | 730 | 1346 | 666 | 1230 | 2246 | 943 | 1730 | 3146 | 1221 | 2230 | 4046 | 1499 | 2730 | 4946 |
| -4.44 | 24 | 75.2 | 23.3 | 74 | 165.2 | 166 | 330 | 626 | 393 | 740 | 1364 | 671 | 1240 | 2264 | 949 | 1740 | 3164 | 1227 | 2240 | 4064 | 1504 | 2740 | 4964 |
| -3.89 | 25 | 77.0 | 23.9 | 75 | 167.0 | 171 | 340 | 644 | 399 | 750 | 1382 | 677 | 1250 | 2282 | 954 | 1750 | 3182 | 1232 | 2250 | 4082 | 1510 | 2750 | 4982 |
| -3.33 | 26 | 78.8 | 24.4 | 76 | 168.8 | 177 | 350 | 662 | 404 | 760 | 1400 | 682 | 1260 | 2300 | 960 | 1760 | 3200 | 1238 | 2260 | 4100 | 1516 | 2760 | 5000 |
| -2.78 | 27 | 80.6 | 25.0 | 77 | 170.6 | 182 | 360 | 680 | 410 | 770 | 1418 | 688 | 1270 | 2318 | 966 | 1770 | 3218 | 1243 | 2270 | 4118 | 1521 | 2770 | 5018 |
| -2.22 | 28 | 82.4 | 25.6 | 78 | 172.4 | 188 | 370 | 698 | 416 | 780 | 1436 | 693 | 1280 | 2336 | 971 | 1780 | 3236 | 1249 | 2280 | 4136 | 1527 | 2780 | 5036 |
| -1.67 | 29 | 84.2 | 26.1 | 79 | 174.2 | 193 | 380 | 716 | 421 | 790 | 1454 | 699 | 1290 | 2354 | 977 | 1790 | 3254 | 1254 | 2290 | 4154 | 1532 | 2790 | 5054 |
| -1.11 | 30 | 86.0 | 26.7 | 80 | 176.0 | 199 | 390 | 734 | 427 | 800 | 1472 | 704 | 1300 | 2372 | 982 | 1800 | 3272 | 1260 | 2300 | 4172 | 1538 | 2800 | 5072 |
| -0.56 | 31 | 87.8 | 27.2 | 81 | 177.8 | 204 | 400 | 752 | 432 | 810 | 1490 | 710 | 1310 | 2390 | 988 | 1810 | 3290 | 1266 | 2310 | 4190 | 1543 | 2810 | 5090 |
| 0 | 32 | 89.6 | 27.8 | 82 | 179.6 | 210 | 410 | 770 | 438 | 820 | 1508 | 716 | 1320 | 2408 | 993 | 1820 | 3308 | 1271 | 2320 | 4208 | 1549 | 2820 | 5108 |
| 0.56 | 33 | 91.4 | 28.3 | 83 | 181.4 | 216 | 420 | 788 | 443 | 830 | 1526 | 721 | 1330 | 2426 | 999 | 1830 | 3326 | 1277 | 2330 | 4226 | 1554 | 2830 | 5126 |
| 1.11 | 34 | 93.2 | 28.9 | 84 | 183.2 | 221 | 430 | 806 | 449 | 840 | 1544 | 727 | 1340 | 2444 | 1004 | 1840 | 3344 | 1282 | 2340 | 4244 | 1560 | 2840 | 5144 |
| 1.67 | 35 | 95.0 | 29.4 | 85 | 185.0 | 227 | 440 | 824 | 454 | 850 | 1562 | 732 | 1350 | 2462 | 1010 | 1850 | 3362 | 1288 | 2350 | 4262 | 1566 | 2850 | 5162 |
| 2.22 | 36 | 96.8 | 30.0 | 86 | 186.8 | 232 | 450 | 842 | 460 | 860 | 1580 | 738 | 1360 | 2480 | 1016 | 1860 | 3380 | 1293 | 2360 | 4280 | 1571 | 2860 | 5180 |
| 2.78 | 37 | 98.6 | 30.6 | 87 | 188.6 | 238 | 460 | 860 | 466 | 870 | 1598 | 743 | 1370 | 2498 | 1021 | 1870 | 3398 | 1299 | 2370 | 4298 | 1577 | 2870 | 5198 |
| 3.33 | 38 | 100.4 | 31.1 | 88 | 190.4 | 243 | 470 | 878 | 471 | 880 | 1616 | 749 | 1380 | 2516 | 1027 | 1880 | 3416 | 1304 | 2380 | 4316 | 1582 | 2880 | 5216 |
| 3.89 | 39 | 102.2 | 31.7 | 89 | 192.2 | 249 | 480 | 896 | 477 | 890 | 1634 | 754 | 1390 | 2534 | 1032 | 1890 | 3434 | 1310 | 2390 | 4334 | 1588 | 2890 | 5234 |
| 4.44 | 40 | 104.0 | 32.2 | 90 | 194.0 | 254 | 490 | 914 | 482 | 900 | 1652 | 760 | 1400 | 2552 | 1038 | 1900 | 3452 | 1316 | 2400 | 4352 | 1593 | 2900 | 5252 |
| 5.00 | 41 | 105.8 | 32.8 | 91 | 195.8 | | | | 488 | 910 | 1670 | 766 | 1410 | 2570 | 1043 | 1910 | 3470 | 1321 | 2410 | 4370 | 1599 | 2910 | 5270 |
| 5.56 | 42 | 107.6 | 33.3 | 92 | 197.6 | | | | 493 | 920 | 1688 | 771 | 1420 | 2588 | 1049 | 1920 | 3488 | 1327 | 2420 | 4388 | 1604 | 2920 | 5288 |
| 6.11 | 43 | 109.4 | 33.9 | 93 | 199.4 | | | | 499 | 930 | 1706 | 777 | 1430 | 2606 | 1054 | 1930 | 3506 | 1332 | 2430 | 4406 | 1610 | 2930 | 5306 |
| 6.67 | 44 | 111.2 | 34.4 | 94 | 201.2 | | | | 504 | 940 | 1724 | 782 | 1440 | 2624 | 1060 | 1940 | 3524 | 1338 | 2440 | 4424 | 1616 | 2940 | 5324 |
| 7.22 | 45 | 113.0 | 35.0 | 95 | 203.0 | | | | 510 | 950 | 1742 | 788 | 1450 | 2642 | 1066 | 1950 | 3542 | 1343 | 2450 | 4442 | 1621 | 2950 | 5342 |
| 7.78 | 46 | 114.8 | 35.6 | 96 | 204.8 | | | | 516 | 960 | 1760 | 793 | 1460 | 2660 | 1071 | 1960 | 3560 | 1349 | 2460 | 4460 | 1627 | 2960 | 5360 |
| 8.33 | 47 | 116.6 | 36.1 | 97 | 206.6 | | | | | | | | | | | | | | | | | | |

A Pyromation MgO thermocouple assembly consists of a thermocouple element swaged in hard-packed, standard-purity (96%) Magnesium Oxide mineral insulation and encased in a metal sheath. Thermocouple sheaths have been fully annealed; they can be formed into many configurations, and can be bent into a radius of twice the size of its outer sheath. The tables found on this page and the following pages allow customer selection of standard thermocouple types, sheath diameters, mounting fittings and terminations. Custom built products are available upon request.



ORDER CODES

Example Order Number:

1-1 1-2 1-3 1-4 1-4 A 1-5
K 4 8 G M - 012 - For Optional Sheath Mounting Fittings See Page MgO-2

1-1 Thermocouple Types

| CODE | |
|--------|--------|
| SINGLE | DUPLEX |
| E | EE |
| J | JJ |
| K | KK |
| T | TT |
| N | NN |

1-2 Sheath Diameters

| CODE | DIAMETER (inches) |
|------|---------------------|
| 1 | 1/16 ^[1] |
| 2 | 1/8 |
| 3 | 3/16 |
| 4 | 1/4 |
| 6 | 3/8 |

[1] 1/16" will be coiled unless otherwise specified for 36" and longer lengths.

1-3 Sheath Materials

| CODE | MATERIAL | STANDARD AVAILABLE TYPES |
|------|---------------------|--------------------------|
| 3 | Alloy 600 | K, N |
| 4 | 310 Stainless steel | K |
| 5 | 446 Stainless steel | K ^[1] |
| 8 | 316 Stainless steel | E, J, K, T |

[1] All sensors with 446SS sheaths must have an ungrounded measuring junction.

1-5 "X" Dimension

Insert three digit sheath length ("X" Dimension) in inches
 Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

1-4 A Special Options

| CODE | DESCRIPTION |
|------|---|
| M | Special limits of error |
| H | High-Purity MgO Insulation (99.4% Pure) |

Use this table only if options are desired.

1-4 Measuring Junctions

| CODE | DESCRIPTION |
|------------------|---------------------------|
| G | Grounded junction |
| U | Ungrounded junction |
| E ^[1] | Exposed junction |
| S | Exposed shielded junction |

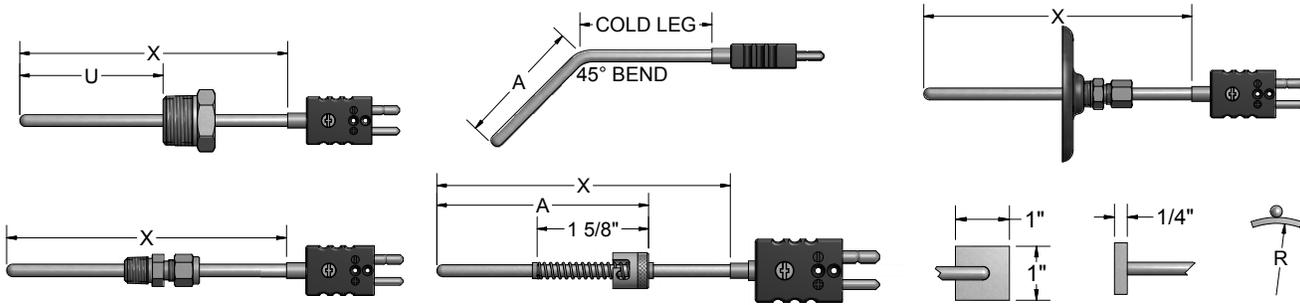
[1] Not available with 1/16" O.D..

1-2 A Reduced-Tip MgO Thermocouples

| CODE | NORMAL SHEATH DIA. O.D. (inches) | TIP DIA. (inches) | TIP LENGTH (inches) | MATERIAL |
|-------|----------------------------------|-------------------|---------------------|----------|
| 88R48 | 1/2 | 1/4 | 1 (1/4) | 316 SS |
| 68R38 | 3/8 | 3/16 | 1 (1/4) | 316 SS |
| 48R28 | 1/4 | 1/8 | 1 (1/4) | 316 SS |

Table 1-2 A lists thermocouple elements with reduced-tip sheaths. To order, use order code numbers from Tbl. 1-2 A in place of straight sheath order code numbers from Tbl. 1-2 and 1-3. EXAMPLE: J88R48

Select Sheath Mounting or Bend Options as desired from tables below.



ORDER CODES

2

Example Order Number:

K48GM - 012 - 01A,306

Page MgO-3

Page MgO-4

Page MgO-5

2-1 No Fitting or Bend Options

| | |
|------|----|
| CODE | 00 |
|------|----|

2-2 One-Time Adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | PRESSURE RATED | AVAILABLE SHEATH DIAMETERS (inches) |
|------|---------------------|-------------------|----------------|-------------------------------------|
| 01A | 303 Stainless steel | 1/8 | NO | 1/16, 1/8, 3/16, 1/4 |
| 05A | 316 Stainless steel | 1/8 | YES | 1/16, 1/8, 3/16, 1/4 |
| 05B | 316 Stainless steel | 1/4 | YES | 1/8, 3/16, 1/4, 3/8 |
| 05C | 316 Stainless steel | 1/2 | YES | 1/8, 1/4, 3/8 |
| 15A | Brass | 1/8 | NO | 1/8, 3/16, 1/4 |
| 15B | Brass | 1/4 | NO | 3/16, 1/4, 3/8 |
| 15C | Brass | 1/2 | NO | 1/4, 3/8 |

2-3 Re-Adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------------------------|-------------------|-------------------------------------|
| 10A | 303 Stainless steel | 1/8 | 1/16, 1/8, 3/16 |
| 10B | 303 Stainless steel | 1/4 | 1/4, 3/8 |
| 10C | 303 Stainless steel | 1/2 | 1/4, 3/8 |
| 12A | 316 Stainless steel | 1/8 | 1/16, 1/8, 3/16, 1/4 |
| 12B | 316 Stainless steel | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 12C | 316 Stainless steel | 1/2 | 1/8, 1/4, 3/8 |
| 11A | Brass | 1/8 | 1/16, 1/8, 3/16, 1/4 |
| 11B | Brass | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 11C | Brass | 1/2 | 1/4, 3/8 |
| 19C | Spring-loaded SS well fitting | 1/2 | 3/16, 1/4 |

FEP gland standard 204 °C [400 °F] max. For lava gland 649 °C [1200 °F] max. opt. 10A and 10B only use letter suffix "L" after compression fitting order code. EXAMPLE: 10AL for lava gland.

2-4 Fixed Bushings

| CODE | MOUNTING THREAD NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|-----------|------------------------------|-------------------------------------|
| 316 SS | | |
| 8A __ [1] | 1/8 | 1/16, 1/8, 3/16, 1/4 |
| 8B __ [1] | 1/4 | 1/16, 1/8, 3/16, 1/4, 3/8 |
| 8C __ [1] | 1/2 | 1/8, 3/16, 1/4, 3/8 |
| 8D __ [1] | 3/4 | 1/8, 3/16, 1/4, 3/8 |

[1] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

2-5 Sheath Bends

| CODE | DESCRIPTION |
|------|-----------------|
| 2 __ | Sheath bent 45° |
| 3 __ | Sheath bent 90° |

When ordering bend options, specify hot leg dim. "A". EX: order code 206 is a 45° bend with 6" hot leg. Total sheath length in Table 1, referred to as "X" length = hot leg plus cold leg.

2-6 Weld Pads

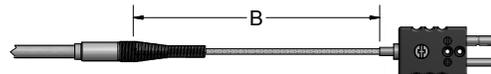
| CODE | DESCRIPTION |
|------|--|
| 17 | 316 SS weld pad 1" x 1" x 1/4" thick perpendicular mount |
| 18 | 316 SS weld pad 1" x 1" x 1/4" thick horizontal mount |
| 17R | 316 SS weld pad 1" x 1" x 1/8" thick perpendicular mount with radius bend (specify radius) |
| 18R | 316 SS weld pad 1" x 1" x 1/8" thick horizontal mount with radius bend (specify radius) |

2-7 Miscellaneous Options

| CODE | DESCRIPTION | AVAILABLE SHEATH DIAMETERS (inches) |
|------------|--|-------------------------------------|
| 13A __ [1] | Spring-loaded bayonet fitting | 1/8, 3/16 |
| 14 | Adjustable flange with brass compression fitting | 1/8, 3/16, 1/4, 3/8 |
| 16A | Compression fitting with bayonet cap and spring | 1/8 (2 5/8" min. "A" dim.) |

[1] When ordering fixed bayonet fitting, specify hot leg dimension "A". EXAMPLE: order code 13A06 for a fixed bayonet adapter with 6" hot leg. Total sheath length is Table 1 "X" length = hot leg plus cold leg.

Select desired leadwire type by order code number, followed by desired length in inches



ORDER CODES

Example Order Number: **K48GM - 012 - 01A,306 - 15 - F1048** - Page MgO-5

| | CODE | DESCRIPTION | AVAILABLE CALI-BRATIONS | | | | | TEMP. RATING |
|----------------------|-------|---|-------------------------|---|---|---|---|------------------|
| | | | J | K | T | E | N | |
| Fiberglass | F1 | Fiberglass insulation - solid conductor | J | K | T | E | N | 482 °C [900 °F] |
| | F1A | Fiberglass insulation - solid conductor - flexible armor | J | K | T | E | N | 482 °C [900 °F] |
| | F1B | Fiberglass insulation - solid conductor - stainless steel overbraid | J | K | T | E | | 482 °C [900 °F] |
| | F3 | Fiberglass insulation - stranded conductor | J | K | T | | | 482 °C [900 °F] |
| | F3A | Fiberglass insulation - stranded conductor - flexible armor | J | K | T | | | 482 °C [900 °F] |
| | F3B | Fiberglass insulation - stranded conductor - stainless steel overbraid | J | K | T | | | 482 °C [900 °F] |
| | H1 | Hi-temp fiberglass insulation - solid conductor | J | K | | | | 704 °C [1300 °F] |
| | H1A | Hi-temp fiberglass insulation - solid conductor - flexible armor | J | K | | | | 704 °C [1300 °F] |
| | H1B | Hi-temp fiberglass insulation - solid conductor - stainless steel overbraid | J | K | | | | 704 °C [1300 °F] |
| Fluoropolymer | T3J | Individual stranded fluoropolymer leads - 12 inch limit | J | K | | E | | 204 °C [400 °F] |
| | T1 | Fluoropolymer insulation - solid conductor | J | K | T | | | 204 °C [400 °F] |
| | T1A | Fluoropolymer insulation - solid conductor - flexible armor | J | K | T | | | 204 °C [400 °F] |
| | T1B | Fluoropolymer insulation - solid conductor - stainless steel overbraid | J | K | | | | 204 °C [400 °F] |
| | T1M | Fluoropolymer insulation - solid conductor - polyester shield | J | K | | | | 204 °C [400 °F] |
| | T3 | Fluoropolymer insulation - stranded conductor | J | K | T | | | 204 °C [400 °F] |
| | T3A | Fluoropolymer insulation - stranded conductor - flexible armor | J | K | T | | | 204 °C [400 °F] |
| | T3B | Fluoropolymer insulation - stranded conductor - stainless steel overbraid | J | K | | | | 204 °C [400 °F] |
| PVC | P5 | PVC insulation - solid conductor | J | K | T | E | N | 105 °C [221 °F] |
| | P7 | PVC insulation - stranded conductor | J | K | T | | | 105 °C [221 °F] |
| | P5M | PVC insulation - solid conductor - polyester shield | J | K | T | | | 105 °C [221 °F] |
| | P7M | PVC insulation - stranded conductor - polyester shield | J | K | | | | 105 °C [221 °F] |
| | C3060 | PVC insulated coil cord - stranded; 60" extended | J | K | T | E | | 105 °C [221 °F] |
| | C3120 | PVC insulated coil cord - stranded; 120" extended | J | K | T | | | 105 °C [221 °F] |
| Polyimide | K1 | Polyimide insulation - solid conductor | J | K | | | | 316 °C [600 °F] |
| | K1A | Polyimide insulation - solid conductor - flexible armor | J | K | | | | 316 °C [600 °F] |
| | K3 | Polyimide insulation - stranded conductor | J | K | | | | 316 °C [600 °F] |
| | K3A | Polyimide insulation - stranded conductor - flexible armor | J | K | | | | 316 °C [600 °F] |

Insert wire code number and 3 digit "B" length code. **Example: F1036 = 36" "B" length.**

For assemblies requiring leadwire beyond the flexible armor, illustrated as "C" in drawing, insert 3 digit "C" length after armor length. **Example: T1A036-012 = 36" "B" length with additional 12" "C" length leads beyond armor.**

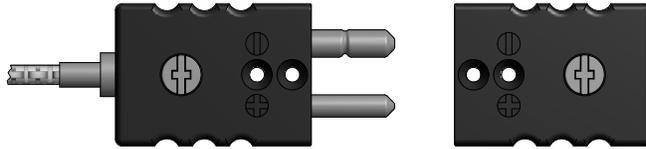
Insulated leadwires in flexible armor are available with either extruded PVC or FEP covering over the flexible armor. Substitute suffix codes T (FEP) or P (PVC) for the suffix "A" code above. **Example: T3T is FEP covered armor.**

Duplex elements supplied with individual leads.

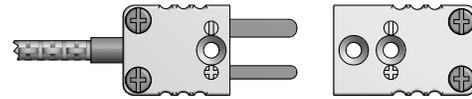


Select desired leadwire termination and options (if desired) by order code numbers below

OPTIONS 4 OR 4,MC



OPTIONS 6 OR 6,MC



OPTION 3



OPTION 8



ORDER CODES

Example Order Number: **K48GM - 012 - 01A,306 - 15 - F1048 -** 5-1
4, 5-2
CC

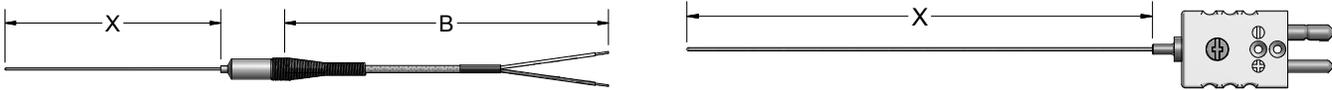
5-1 Terminations

| CODE | DESCRIPTION |
|------|--|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" quick disconnect female terminal lugs |

5-2 Options

| CODE | DESCRIPTION |
|-----------------------------------|---|
| BX | 1/2" NPT BX connector with Opt. 0, 2, 3, or 8 |
| CC | Plug or jack secured to leads with cable clamp |
| RB | Rubber boot |
| SP ^[1] | Solid pin plug |
| CG | Cord grip (1/2" NPT weatherproof PVC connector) |
| MC | Mating connector |
| HT | High temp. connector 350 °C [660 °F] |
| [1] Standard with 350 °C [660 °F] | |

Miniature thermocouple assemblies have very small swaged sheath diameters containing standard-purity MgO (96%) insulated thermocouple elements. The small sheath size provides accurate and fast response time temperature measurement in a variety of laboratory, process, and special applications. These units are only offered with ungrounded junctions to prolong their useful life. Illustrated below are the most commonly used assemblies, however, other sensor configurations are available upon request.



ORDER CODES

Example Order Number:

1-1 1-2 1-3 1-4 2 3 4 5
J 040 8 U - 012 - 00 - 16 - PAGE PAGE
MGO-7 MGO-7

1-1 Thermocouple Types

| CODE |
|------|
| J |
| K |

1-2 Sheath Diameter

| CODE | DIAMETER (INCHES) |
|------|-------------------|
| 032 | 0.032 |
| 040 | 0.040 |

1-3 Sheath Material

| CODE | MATERIAL |
|------|---------------------|
| 3 | Alloy 600 |
| 8 | 316 Stainless steel |

1-4 Measuring Junction

| CODE | MATERIAL |
|------|----------------------------------|
| U | Ungrounded junction |
| M | Special limits (consult factory) |

2 "X" Dimension

Insert three digit sheath length ("X" Dimension) in inches

3 Sheath Terminations

| CODE | DESCRIPTION |
|-----------------------------|--|
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| Options | |
| MC | Mating connector |
| Leadwire Transitions | |
| 15 | Extension leadwire transition fitting with relief spring 204 °C [400 °F] |
| 16 | Extension leadwire transition fitting with heat-shrink tubing 104 °C [220 °F] |
| 19 | Extension leadwire transition ftg. w/o relief spring or heat-shrink tubing 204 °C [400 °F] |
| Options | |
| HT ^[1] | High Temperature Potting 538 °C [1000 °F] |

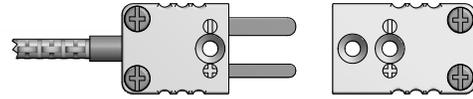
[1] Not available with option 16. When specifying flex armor, Option 19 must be selected.

Select desired extension leadwire type (in inches) and leadwire termination and options (if desired) by order code number from the tables below.

OPTIONS 4 OR 4,MC



OPTIONS 6 OR 6,MC



OPTION 3



OPTION 8



ORDER CODES

Example Order Number:

J0408UM - 012 - 00 - 16 - F1048 - 6

4 Extension Leadwire

| | CODE | DESCRIPTION | AVAILABLE CALIBRATIONS | | TEMP. RATING |
|----------------------|------|--|------------------------|---|-----------------|
| Fiberglass | F1 | Fiberglass insulation - solid conductor | J | K | 482 °C [900 °F] |
| | F1A | Fiberglass insulation - solid conductor - flexible armor | J | K | 482 °C [900 °F] |
| | F1B | Fiberglass insulation - solid conductor - stainless steel overbraid | J | K | 482 °C [900 °F] |
| | F3 | Fiberglass insulation - stranded conductor | J | K | 482 °C [900 °F] |
| | F3B | Fiberglass insulation - stranded conductor - stainless steel overbraid | J | K | 482 °C [900 °F] |
| Fluoropolymer | T1 | Fluoropolymer insulation - solid conductor | J | K | 204 °C [400 °F] |
| | T1A | Fluoropolymer insulation - solid conductor - flexible armor | J | K | 204 °C [400 °F] |
| | T3 | Fluoropolymer insulation - stranded conductor | J | K | 204 °C [400 °F] |
| PVC | P5 | PVC insulation - solid conductor | J | K | 105 °C [221 °F] |

Insert wire code number and 3 digit "B" length code. Example: F1036 = 36" "B" Length

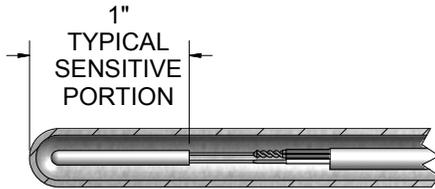
5 Terminations

| CODE | DESCRIPTION |
|----------------|--|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| Options | |
| MC | Mating connector |
| CC | Plug or jack secured to leads with cable clamp |

RTD

Configuration Code RT01 RTD Assemblies with Extension Leadwire Configuration Code RT02 RTD Assemblies with Sheath Terminations

The RTD elements illustrated and described on this page are designed to measure temperature in a variety of process and laboratory applications. These RTDs are specifically designed for use in two different process temperature ranges and will provide accurate and repeatable temperature measurement through a broad range. Low range RTDs are constructed using fluoropolymer-insulated, silver-plated copper internal leads with potting compounds to resist moisture penetration. High range RTDs are constructed with nickel internal leads inside swaged MgO insulated cable to allow higher temperature measurements at the RTD element and provide higher temperature lead protection along the sheath. The following tables allow customer selection of standard element materials, tolerances, sheath diameters, mounting fittings and terminations. Custom-built assemblies with non-standard specifications are available upon request.



ORDER CODES

Example Order Number:

R5T185L ¹⁻¹ **48** ^{1-2(A)} **3** ¹⁻³ - **006** ¹⁻⁴ - Page RTD-2 - Page RTD-3 - Page RTD-4 - Page RTD-5

1-1 Single Platinum RTD Elements

| CODE | TOLERANCE ^[1] | BASE RESISTANCE @ 0 °C (R ₀) | TEMPERATURE COEFFICIENT | CODE | | | |
|---|--------------------------|--|-------------------------------|------------------|-------------------|------------------|------------------|
| <i>LOW RANGE WIRE WOUND (-200 to 200) °C [-328 to 392] °F</i> | | | | <i>1/8" O.D.</i> | <i>3/16" O.D.</i> | <i>1/4" O.D.</i> | <i>3/8" O.D.</i> |
| R1T185L | Grade B | 100 Ω | α = 0.003 85 °C ⁻¹ | 28 | 38 | 48 | 68 |
| R3T185L | Class AA | 100 Ω | α = 0.003 85 °C ⁻¹ | 28 | 38 | 48 | 68 |
| R5T185L | (1/5) Class B | 100 Ω | α = 0.003 85 °C ⁻¹ | 28 | 38 | 48 | 68 |
| R1T192L | Grade B | 100 Ω | α = 0.003 92 °C ⁻¹ | 28 | 38 | 48 | 68 |
| R3T192L | Class AA | 100 Ω | α = 0.003 92 °C ⁻¹ | 28 | 38 | 48 | 68 |
| <i>LOW RANGE THIN FILM (-50 to 200) °C [-58 to 392] °F</i> | | | | | | | |
| RBF185L | Class B | 100 Ω | α = 0.003 85 °C ⁻¹ | 28 | 38 | 48 | 68 |
| RAF185L | Class A | 100 Ω | α = 0.003 85 °C ⁻¹ | 28 | 38 | 48 | 68 |
| RBF195L | Class B | 1000 Ω | α = 0.003 85 °C ⁻¹ | 28 | 38 | 48 | 68 |
| <i>HIGH RANGE WIRE WOUND (-200 to 600) °C [-328 to 1112] °F</i> | | | | | | | |
| R1T185H | Grade B | 100 Ω | α = 0.003 85 °C ⁻¹ | 28 | 38 | 48 | 68 |
| RAT185H | Class A | 100 Ω | α = 0.003 85 °C ⁻¹ | 28 | 38 | 48 | 68 |
| R1T192H | Grade B | 100 Ω | α = 0.003 92 °C ⁻¹ | 28 | 38 | 48 | 68 |

[1] Refer to RTD tolerance information in the general information section for calculations to determine specific tolerance at temperature.

1-1 Duplex Platinum RTD Elements

| CODE | TOLERANCE ^[1] | BASE RESISTANCE @ 0 °C (R ₀) | TEMPERATURE COEFFICIENT | CODE | | |
|---|--------------------------|--|-------------------------------|-------------------|------------------|------------------|
| <i>LOW RANGE WIRE WOUND (-200 to 200) °C [-328 to 392] °F</i> | | | | <i>3/16" O.D.</i> | <i>1/4" O.D.</i> | <i>3/8" O.D.</i> |
| R1T285L | Grade B | 100 Ω | α = 0.003 85 °C ⁻¹ | 38 | 48 | 68 |
| R3T285L | Class AA | 100 Ω | α = 0.003 85 °C ⁻¹ | 38 | 48 | 68 |
| R5T285L | (1/5) Class B | 100 Ω | α = 0.003 85 °C ⁻¹ | 38 | 48 | 68 |
| R1T292L | Grade B | 100 Ω | α = 0.003 92 °C ⁻¹ | 38 | 48 | 68 |
| R3T292L | Class AA | 100 Ω | α = 0.003 92 °C ⁻¹ | 38 | 48 | 68 |
| <i>LOW RANGE THIN FILM (-50 to 200) °C [-58 to 392] °F</i> | | | | | | |
| RBF285L | Class B | 100 Ω | α = 0.003 85 °C ⁻¹ | 38 | 48 | 68 |
| RAF285L | Class A | 100 Ω | α = 0.003 85 °C ⁻¹ | 38 | 48 | 68 |
| RBF295L | Class B | 1000 Ω | α = 0.003 85 °C ⁻¹ | 38 | 48 | 68 |
| <i>HIGH RANGE WIRE WOUND (-200 to 600) °C [-328 to 1112] °F</i> | | | | | | |
| R1T285H | Class B | 100 Ω | α = 0.003 85 °C ⁻¹ | 38 | 48 | 68 |
| RAT285H | Class A | 100 Ω | α = 0.003 85 °C ⁻¹ | 38 | 48 | 68 |
| R1T292H | Grade B | 100 Ω | α = 0.003 92 °C ⁻¹ | 38 | 48 | 68 |

[1] Refer to RTD tolerance information in the general information section for calculations to determine specific tolerance at temperature.

1-2 Available Sheath Diameters 316SS

1-4 Length

| CODE |
|--------------------|
| 3 Digit 'X' Length |

1-3 Element Connection

| CODE | DESCRIPTION |
|------------------|-------------|
| 2 | 2-wire |
| 3 | 3-wire |
| 4 ^[1] | 4-wire |

[1] Not available in duplex

1-2A

| CODE | NOMINAL SHEATH DIAMETER (inches) | TIP DIA. O.D. (inches) | TIP LENGTH (inches) |
|-------|----------------------------------|------------------------|---------------------|
| 88R48 | 1/2 | 1/4 | 1 1/4 |
| 68R38 | 3/8 | 3/16 | 1 1/4 |
| 48R28 | 1/4 | 1/8 | 1 1/4 |

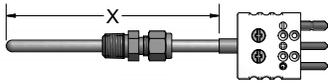
REDUCED-TIP RTD's

Table 1-2A lists RTD elements with reduced tip sheaths. To order, use order code numbers from Tbl. 1-2A in place of straight sheath order code numbers from Tbl. 1-2. Other reduced tips are available upon request. EXAMPLE: R1T185L **88R483**-006.

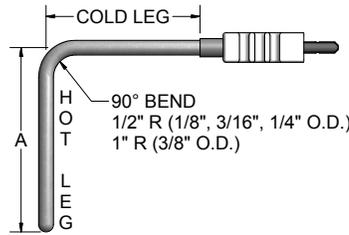
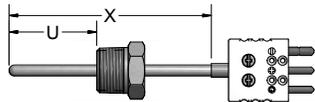


Select Sheath Mounting or Bend Options as desired from tables below.

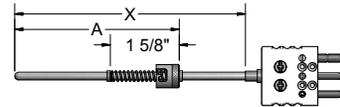
COMPRESSION FITTING



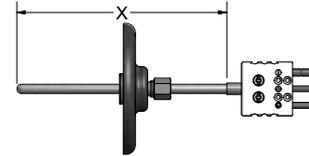
FIXED BUSHING



BAYONET CAP and SPRING (OPTION 13A)



ADJUSTABLE FLANGE (OPTION 14)



ORDER CODES

2

Example Order Number:

R5T185L483-006 -

01A,304

PAGE RTD 3

PAGE RTD 4

PAGE RTD 5

2-1 No Fitting or Bend Options

| | |
|------|----|
| CODE | 00 |
|------|----|

2-2 One-time Adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | PRESSURE RATED | AVAILABLE SHEATH DIAMETERS (inches) |
|------|---------------------|-------------------|----------------|-------------------------------------|
| 01A | 303 stainless steel | 1/8 | NO | 1/8, 3/16, 1/4 |
| 05A | 316 stainless steel | 1/8 | YES | 1/8, 3/16, 1/4 |
| 05B | 316 stainless steel | 1/4 | YES | 1/8, 3/16, 1/4, 3/8 |
| 05C | 316 stainless steel | 1/2 | YES | 1/8, 1/4, 3/8 |
| 15A | Brass | 1/8 | NO | 1/8, 3/16, 1/4 |
| 15B | Brass | 1/4 | NO | 3/16, 1/4, 3/8 |
| 15C | Brass | 1/2 | NO | 1/4, 3/8 |

2-3 Re-adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------------------------|-------------------|-------------------------------------|
| 10A | 303 stainless steel | 1/8 | 1/8, 3/16 |
| 10B | 303 stainless steel | 1/4 | 1/4, 3/8 |
| 10C | 303 stainless steel | 1/2 | 1/4, 3/8 |
| 12A | 316 stainless steel | 1/8 | 1/8, 3/16, 1/4 |
| 12B | 316 stainless steel | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 12C | 316 stainless steel | 1/2 | 1/8, 1/4, 3/8 |
| 11A | Brass | 1/8 | 1/8, 3/16, 1/4 |
| 11B | Brass | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 11C | Brass | 1/2 | 1/4, 3/8 |
| 19C | Spring-loaded SS well fitting | 1/2 | 3/16, 1/4 |

FEP gland standard 204 °C [400 °F] max. For lava gland 649 °C [1200 °F] max. opt. 10A and 10B only use letter suffix "L" after compression fitting order code. EXAMPLE: 10AL for lava gland.

2-6 Miscellaneous Options

| CODE | TYPE | AVAILABLE SHEATH DIAMETER (inches) |
|------------|--|------------------------------------|
| 13A __ [1] | Spring-loaded bayonet fitting | 1/8, 3/16 |
| 14 | Adjustable flange with brass compression fitting | 1/8, 3/16, 1/4, 3/8 |
| 16A | Spring-loaded adjustable bayonet compression fitting | 1/8 |

[1] When ordering fixed bayonet fitting specify dimension "A".
EXAMPLE: order code 13A06 is for a fixed bayonet adapter with 6" A Dimension.

2-5 Fixed Bushings

| CODE | MOUNTING THREAD NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|-----------|------------------------------|-------------------------------------|
| 316 SS | | |
| 8A __ [1] | 1/8 | 1/8, 3/16, 1/4 |
| 8B __ [1] | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 8C __ [1] | 1/2 | 1/8, 3/16, 1/4, 3/8 |
| 8D __ [1] | 3/4 | 1/8, 3/16, 1/4, 3/8 |

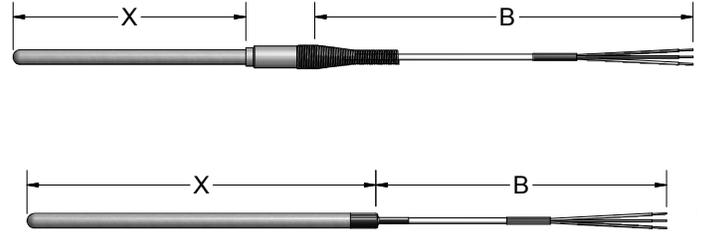
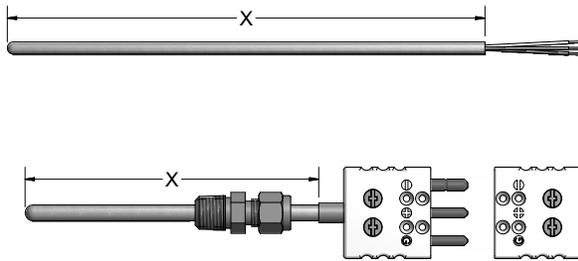
[1] When ordering fixed bushings, specify order code above, plus insertion length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

2-4 Sheath Bends

| CODE | DESCRIPTION |
|---|-----------------|
| 2 __ | Sheath bent 45° |
| 3 __ | Sheath bent 90° |
| 2" minimum hot leg length | |
| When ordering bend options, specify hot leg dim. "A". EXAMPLE: order code 206 is a 45° bend with 6" hot leg. Total sheath length is Table 1 "X" length = hot leg plus cold leg. | |

RTD

Configuration Code RT02
Sheath Terminations
 Configuration Code RT01
Leadwire Transitions



RT02

ORDER CODES

RT01

Example Order Number:

R5T185L483-006-00 - ³⁻¹ **4, MC** or R5T185L483-006-01A,304 - ³⁻² **16** - **PAGE RTD-4** - **PAGE RTD-5**

3-1 Plug and Jack Sheath Terminations

| CODE | DESCRIPTION |
|---|--|
| 4 ^[1] | Standard plug |
| 5 ^[1] | Standard jack |
| 6 ^[2] | Miniature plug |
| 7 ^[2] | Miniature jack |
| Options | |
| MC | Mating connector |
| CL ^[3] | Compression L bracket to hold plug to sheath |
| [1] If used with 3/8" O.D., option CL must be specified [2] Not available with 1/4" O.D. or 3/8" O.D. sheath [3] Not available with miniature connector | |

3-1 Sheath Terminations

| CODE | DESCRIPTION |
|---|--|
| 22 ^[1] | 3" individual leads with terminal pins |
| [1] High temp RTDs are supplied with 1" long transition | |

3-2 Leadwire transitions

(Requires Table 4 and 5 selections)

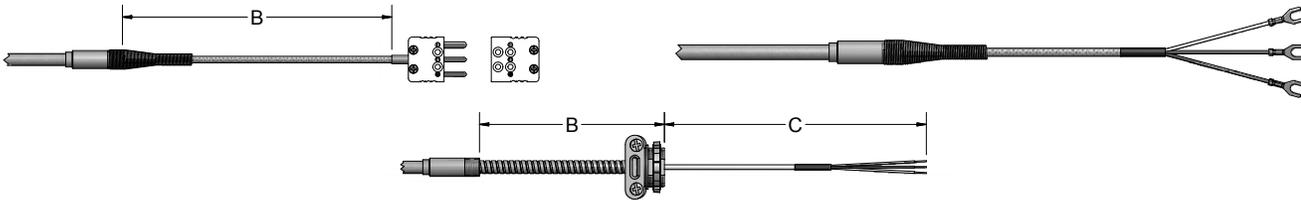
| CODE | DESCRIPTION |
|---|--|
| 13 ^[1] | Same size transition with heat-shrink tubing 104 °C [220 °F] |
| 15 | Extension leadwire transition with relief spring 204 °C [400 °F] |
| 16 | Extension leadwire transition with heat-shrink tubing 104 °C [220 °F] |
| 18 ^[1] | Same size transition without heat-shrink tubing 204 °C [400 °F] |
| 19 | Extension leadwire transition without spring or heat-shrink tubing 204 °C [400 °F] |
| Options | |
| HT ^[2] | High temperature potting 538 °C [1000 °F] not available with option 13 or 16 |
| [1] Not available with flex armor | |
| [2] Not available with option 13 or 16. When specifying high temp potting with Flex Armor option 19 must be selected. | |

3-2 Threaded Fittings with Extension Leadwire

(Requires Table 4 and 5 selections)

| CODE | DESCRIPTION |
|---------|---|
| 6HN23 | 1/2" x 1/2" NPT steel hex nipple |
| 8HN23 | 1/2" x 1/2" NPT stainless steel hex nipple |
| 9HP23 | 1/2" NPT stainless steel bushing (no process threads) |
| 8RNDC23 | 3/4" process x 1/2" NPT stainless steel hex nipple |

Select desired leadwire type by order code number, followed by desired length in inches.



ORDER CODES

Example Order Number:

R5T185L483-006-01A,304-16

T3 036

**PAGE
RTD-5**

4 Extension Leadwire Type and B + C Dimension

| CODE | DESCRIPTION | TEMP. RATING |
|-----------------------|--|-----------------|
| FIBERGLASS | | |
| F3J___ | Fiberglass insulation - individual leads - stranded conductor (12" limit) | 482 °C [900 °F] |
| F3___ | Fiberglass insulation - stranded conductor | |
| F3A___ | Fiberglass insulation - stranded conductor - flexible armor | |
| F3B___ | Fiberglass insulation - stranded conductor - stainless steel overbraid | |
| FLUOROPOLYMER | | |
| T3J___ | Fluoropolymer insulation - individual leads - stranded conductor (12" limit) | 204 °C [400 °F] |
| T3___ | Fluoropolymer insulation - stranded conductor | |
| T3A___ | Fluoropolymer insulation - stranded conductor - flexible armor | |
| T3B___ | Fluoropolymer insulation - stranded conductor - stainless steel overbraid | |
| M3___ | Fluoropolymer insulation - stranded conductor - stainless steel overbraid - Fluoropolymer insulation | |
| T3M___ | Fluoropolymer insulation - stranded conductor - polyester shield | |
| T3MA___ | Fluoropolymer insulation - stranded conductor - polyester shield - flexible armor | |
| POLYIMIDE | | |
| K3___ | Polyimide insulation - stranded conductor | 316 °C [600 °F] |
| K3A___ | Polyimide insulation - stranded conductor - flexible armor | |
| K3B___ | Polyimide insulation - stranded conductor - stainless steel overbraid | |
| SILICON RUBBER | | |
| S3___ | Fluoropolymer insulation - stranded conductor - silicon rubber | 204 °C [400 °F] |
| COIL CORDS | | |
| C3060 | PVC insulation - stranded conductor - coil cord - 60" extended length | 104 °C [220 °F] |
| C3120 | PVC insulation - stranded conductor - coil cord - 120" extended length | |

Insert wire code number and 3 digit 'B' length in inches EXAMPLE: T3036 = 36" B length

For assemblies requiring leadwire beyond the flexible armor (illustrated in 'C' in drawing), insert 3 digit 'C' length after armor length.
EXAMPLE: F3A036 -012 = 36" B length with additional 12" 'C' length leads beyond armor.

All insulated leadwires in flexible armor are available with either extruded PVC or FEP covering over the flexible armor.
Substitute suffix codes T (FEP) or P (PVC) for the suffix 'A' code above. EXAMPLE: T3T is FEP covered armor.

Select desired leadwire termination and options (if desired), by order code numbers below.

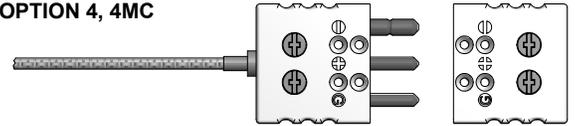
OPTION 3



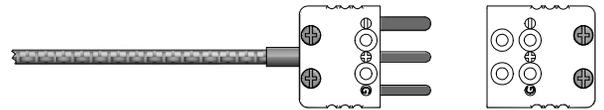
OPTION 8



OPTION 4, 4MC



OPTION 6, 6MC



ORDER CODES

Example Order Number:

R5T185L483-006-01A,304-16-T3036 - 4, MC

5-1 5-2

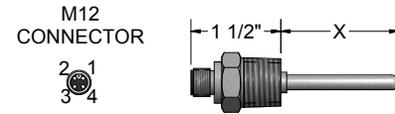
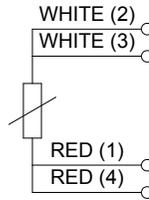
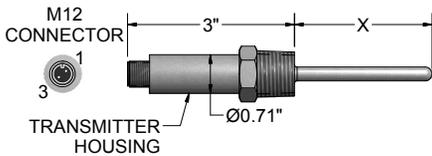
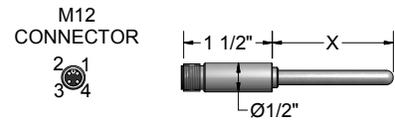
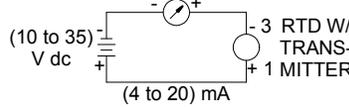
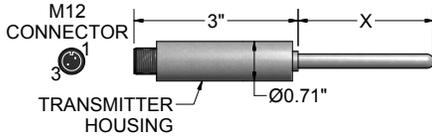
5-1 Terminations

| CODE | DESCRIPTION |
|------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female quick disconnects |

5-2 Options

| CODE | DESCRIPTION |
|------|--|
| BX | 1/2" NPT BX connector with Options 0, 2, 3, or 8 |
| CC | Plug or jack secured to leads with cable clamp |
| CG | Cord grip (1/2" NPT PVC) |
| MC | Mating connector |
| RB | Rubber boot |

These RTD Assemblies house an optional Series 450 Temperature Transmitter (no connection head is required) that is ideal for monitoring temperature in small areas such as tanks and pipes. The water-tight construction meets the NEMA 6P, IP68 Protection Rating requirements. Standard units include a sensor, an M12 process connection housing, and optional transmitter. The transmitter is a 2-wire unit with an analog output. It has measurement input for Pt100 resistance thermometers (RTD) in 4-wire connections. Transmitters can be ranged from (-51 to 160) °C [-60 to 320] °F. With a 10 °C [18 °F] minimum span requirement. **The ambient temperature limits for the M12 connector is (-40 to 85) °C.**



ORDER CODES

Example Order Number: **R1T185L** - **484** - **06** - **00** - **C45, T** - **450** - **U** - **S(0-200)** **F**

1 Pt100 ($\alpha=0.00385\text{ }^{\circ}\text{C}^{-1}$) RTD Assemblies

| CODE | TOLERANCE ^[1] |
|---------|--------------------------|
| R1T185L | Grade B |
| R3T185L | Class AA |
| R5T185L | (1/5) Class B |
| RAF185L | Class A |
| RBF185L | Class B |

[1] Refer to RTD tolerance information in the General information section for calculations to determine specific tolerance at temperature. See Instrument Section for total sensor and transmitter output accuracy.

2 316 S.S. Sheath

| CODE | DIAMETER O.D. (inches) |
|------|------------------------|
| 284 | 1/8 |
| 384 | 3/16 |
| 484 | 1/4 |

3 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired. EXAMPLE: 04 = 4", 04(1/2) = 4.5"

4-1 Sheath Fittings

| CODE | DESCRIPTION |
|------|-------------|
| 00 | No Fitting |

4-2 Re-Adjustable Compression Fittings

| CODE | DESCRIPTION | NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------------------------|--------------|-------------------------------------|
| 12A | Stainless Steel | 1/8 | 1/8, 3/16 |
| 12B | Stainless Steel | 1/4 | 3/16, 1/4 |
| 12C | Stainless Steel | 1/2 | 1/8, 1/4 |
| 19C | Spring-loaded SS well fitting | 1/2 | 3/16, 1/4 |

FEP gland standard 204 °C [400 °F] max.

4-3 One-Time Adjustable Compression Fittings

| CODE | DESCRIPTION | NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-----------------|--------------|-------------------------------------|
| 05A | Stainless Steel | 1/8 | 1/8, 3/16, 1/4 |
| 05B | Stainless Steel | 1/4 | 1/8, 3/16, 1/4 |
| 05C | Stainless Steel | 1/2 | 1/8, 1/4 |

4-4 316SS Fixed Bushings^[1]

| CODE | MOUNTING THREAD NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|------------------------------|-------------------------------------|
| 8A__ | 1/8 | 1/8, 3/16, 1/4 |
| 8B__ | 1/4 | 1/8, 3/16, 1/4 |
| 8C__ | 1/2 | 1/8, 3/16, 1/4 |
| 8D__ | 3/4 | 1/8, 3/16, 1/4 |

[1] Requires Table 5 - Option 45 Selection

When ordering fixed bushings, specify order code above plus insertion length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

5 M12 Connector Termination

| CODE | DESCRIPTION |
|------|-----------------------------|
| 45 | No process connection |
| C45 | 1/2" NPT process connection |
| B45 | 1/4" NPT process connection |
| D45 | 3/4" NPT process connection |

OPTIONAL TRANSMITTER

| | |
|---|---|
| T | 4 to 20 mA Temperature Transmitter (Requires Table 6 selection) |
|---|---|

6 Transmitter

| CODE | DESCRIPTION |
|--------|---------------------------------------|
| 450-00 | Programmable transmitter-unconfigured |
| 450 | Programmable transmitter-configured |

7 Fault Signal

| CODE | DESCRIPTION |
|------|-------------------|
| U | Upscale burnout |
| D | Downscale burnout |

8 Range

| CODE | DESCRIPTION |
|------|-----------------------------|
| S | (lower limit - upper limit) |

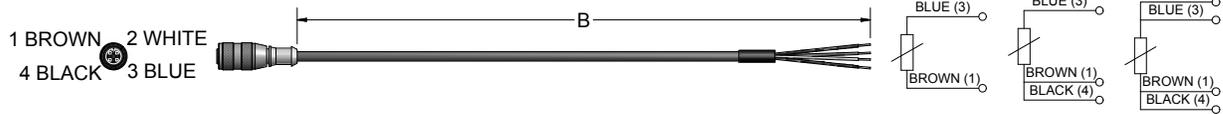
9 Units

| CODE | DESCRIPTION |
|------|-------------|
| C | Celsius |
| F | Fahrenheit |

M12 Molded and Field-Wireable cables are available for connection to Pyromation Water-Tight Assemblies with Optional Series 450 Transmitters. The M12 quick disconnect plug eliminates all external screw connections, simplifying the electrical installation process and solving the problems caused by moisture, loose connections, and corrosion. They are easier to install and more secure than conventional field-wired connections. Both are available in 2-, 3-, and 4-wire connection options, and in straight or 90° angle styles. Molded cables are PVC insulated and meet NEMA 1, 3, 4, 6P and IEC IP68. Field-Wireable Cable insulations are listed below and meet IP67 requirements. Cable lengths are manufactured to customer specifications. All M12 Molded Cables are supplied as 4-wire and are terminated as specified in part number.

ORDER CODES

M12 MOLDED CABLE



Example Order Number:

RT3E46MS - P3072 - 2

1 M12 Connector Options

| CODE | NUMBER OF WIRES | DESCRIPTION |
|----------|-----------------|--------------------------------|
| RT2E46MS | 2 | Straight M12 Molded Connector |
| RT3E46MS | 3 | |
| RT4E46MS | 4 | |
| RT2E46MA | 2 | 90° Angle M12 Molded Connector |
| RT3E46MA | 3 | |
| RT4E46MA | 4 | |

2 Extension Cable

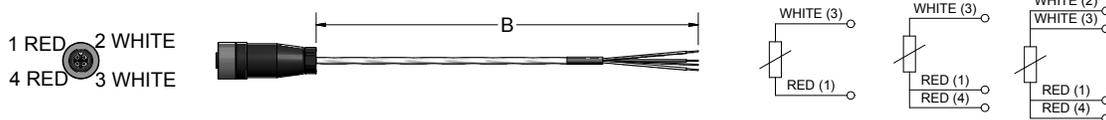
| CODE | DESCRIPTION |
|-----------------------------|-----------------------|
| P3_ _ _ [1] | 22 AWG PVC insulation |
| [1] Insert length in inches | |

3 Terminations and Options

| CODE | DESCRIPTION |
|---------|--------------------------------|
| 0 | No termination |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard Jack |
| Options | |
| BX | Box connector |
| CC | Cable clamp |
| CG | 1/2" NPT plastic cord grip |
| MC | Mating connector |
| RB | Rubber boot |

ORDER CODES

M12 FIELD-WIREABLE CABLES



Example Order Number:

RT3E46S - T3072 - 2

1 M12 Connector Options

| CODE | NUMBER OF WIRES | DESCRIPTION |
|---------|-----------------|-------------------------|
| RT2E46S | 2 | Straight M12 Connector |
| RT3E46S | 3 | |
| RT4E46S | 4 | |
| RT2E46A | 2 | 90° Angle M12 Connector |
| RT3E46A | 3 | |
| RT4E46A | 4 | |

2 Extension Leadwire and B + C Dimension

| CODE [1] | WIRE DESCRIPTION |
|---|--|
| P3_ _ _ | Stranded; PVC insulation |
| T3_ _ _ | Stranded; fluoropolymer insulation |
| T3M_ _ _ | Stranded; fluoropolymer with aluminum polyester shield and drain |
| [1] Insert 3 digit B length in inches. EXAMPLE: T3036=36" B length. | |

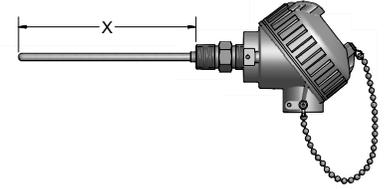
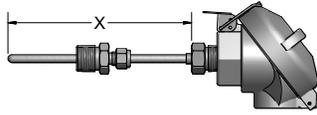
3 Terminations and Options

| CODE | DESCRIPTION |
|---------|---|
| 0 | No termination |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |
| Options | |
| BX | Box connector |
| CC | Cable clamp |
| CG | 1/2" NPT plastic cord grip |
| MC | Mating connector |
| RB | Rubber boot |

SENSORS WITH CONNECTION HEADS

Configuration Code GP01 Fixed-Sheath RTD Assemblies with General-Purpose Connection Heads

Fixed-Sheath RTD Assemblies with General-Purpose Connection Heads are provided with head mounting fittings that are welded or brazed to the sheath for direct immersion into a process. To order an assembly with an optional 4 to 20 mA transmitter, select the assembly below and the transmitter from the back of this section. The RTD assemblies are supplied with a 316 stainless steel sheath in several diameters. They are available in various tolerances and temperature ranges as noted below.



ORDER CODES

Example Order Number: **RBF185L 48 3 - 006(1/2) - 00 - 8HN 31, SB, T** Select Type and Range from back of section

1-0 100 Ω Platinum RTD Elements α = 0.003 85 °C⁻¹

| CODE | TOLERANCE ^[1] | |
|--|--------------------------|---------------|
| LOW RANGE WIRE WOUND (-200 to 200) °C | | |
| SINGLE | DUPLEX | |
| R1T185L | R1T285L | Grade B |
| R5T185L | R5T285L | (1/5) Class B |
| LOW RANGE THIN FILM (-50 to 200) °C | | |
| RBF185L | RBF285L | Class B |
| RAF185L | RAF285L | Class A |
| HIGH RANGE WIRE WOUND (-200 to 600) °C | | |
| R1T185H | R1T285H | Grade B |
| RAT185H | RAT285H | Class A |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

3-0 No Fitting

| CODE | 00 | | | | |
|---|-------------|-------------------|----------------|-------------------------------------|--|
| 3-1 One-Time Adjustable Fittings | | | | | |
| CODE | TYPE | NPT SIZE (inches) | PRESSURE-RATED | AVAILABLE SHEATH DIAMETERS (inches) | |
| 01A | 303 SS | 1/8 | NO | 1/8, 3/16, 1/4 | |
| 05A | 316 SS | 1/8 | YES | 1/8, 3/16, 1/4 | |
| 05B | 316 SS | 1/4 | YES | 1/8, 3/16, 1/4, 3/8 | |
| 05C | 316 SS | 1/2 | YES | 1/8, 1/4, 3/8 | |
| 15A | Brass | 1/8 | NO | 1/8, 3/16, 1/4 | |
| 15B | Brass | 1/4 | NO | 3/16, 1/4, 3/8 | |
| 15C | Brass | 1/2 | NO | 1/4, 3/8 | |
| 14 | Brass/Steel | Flange | NO | 1/8, 3/16, 1/4, 3/8 | |

4-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|-------|--|
| 6HN | 1/2" x 1/2" NPT steel hex nipple 1" "E" length |
| 8HN | 1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length |
| 9HP | 1/2" NPT stainless steel bushing (no process threads) |
| 8RNDC | 3/4" x 1/2" NPT stainless steel hex nipple |

1-1 Sheath Diameters

| CODE | DIAMETERS (inches) 316 SS |
|-------------------|---------------------------|
| 28 ^[1] | 1/8 |
| 38 | 3/16 |
| 48 | 1/4 |
| 68 | 3/8 |

[1] Not available in duplex

1-2 Element Connection

| CODE | DESCRIPTION |
|------------------|----------------|
| 2 | 2-wire element |
| 3 | 3-wire element |
| 4 ^[1] | 4-wire element |

[1] Not available in duplex or with 440 Series Transmitter

2-0 "X" Dimensions

Insert three digit "X" length in inches.

Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-2 Re-Adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------------------------|-------------------|-------------------------------------|
| 10A | 303 SS | 1/8 | 1/8, 3/16 |
| 10B | 303 SS | 1/4 | 1/4, 3/8 |
| 10C | 303 SS | 1/2 | 1/4, 3/8 |
| 12A | 316 SS | 1/8 | 1/8, 3/16, 1/4 |
| 12B | 316 SS | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 12C | 316 SS | 1/2 | 1/8, 1/4, 3/8 |
| 11A | Brass | 1/8 | 1/8, 3/16, 1/4 |
| 11B | Brass | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 11C | Brass | 1/2 | 1/4, 3/8 |
| 19C | Spring-loaded SS well fitting | 1/2 | 3/16, 1/4 |

FEP gland standard 204 °C [400 °F] max.

3-3 Fixed Bushings^[1]

| CODE | MOUNTING THREAD NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|----------------------|------------------------------|-------------------------------------|
| 316 SS | | |
| 8A __ ^[2] | 1/8 | 1/8, 3/16, 1/4 |
| 8B __ ^[2] | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 8C __ ^[2] | 1/2 | 1/8, 3/16, 1/4, 3/8 |
| 8D __ ^[2] | 3/4 | 1/8, 3/16, 1/4, 3/8 |

[1] Requires Table 4, Option 9HP Selection
[2] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing.
EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-1 Head and Sheath Terminations

| CODE | DESCRIPTION |
|-----------|--|
| 22 | 3" Individual fluoropolymer leads with terminal pins |
| 31 | Aluminum screw-cover head |
| 34 | Cast iron screw-cover head |
| 35T-642A | (4 to 20) mA HART [®] Field Transmitter with aluminum general-purpose housing |
| 36T82-D10 | (4 to 20) mA dual input HART [®] transmitter with digital display and general-purpose aluminum housing with glass lid |
| 49 | Flip-top aluminum head |
| 63 | White polypropylene screw-cover head |
| 91 | 316 L stainless steel screw-cover head |

4-2 Options

| | |
|------------------|--|
| W ^[1] | Epoxy Coating |
| GS | Ground screw |
| I | Stainless tag |
| NB | 1/2" NPT nylon conduit reducer bushing |
| SB | 1/2" NPT conduit reducer bushing |
| T-440 | (4 to 20) mA head-mounted RTD transmitter |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA isolated HART [®] head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input HART [®] head-mounted transmitter |

See transmitter ordering information in back of section.

[1] Available with option 31 only.

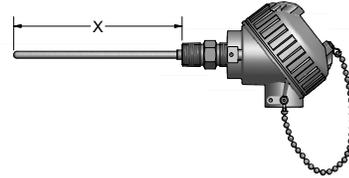
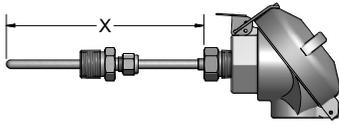
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SENSORS WITH CONNECTION HEADS

Configuration Code GP02 Fixed-Sheath Thermocouple Assemblies with General-Purpose Connection Heads

Fixed-Sheath Thermocouple Assemblies with General-Purpose Connection Heads have head mounting fittings that are welded or brazed to the sheath for direct immersion into a process. To order an assembly with an optional 4 to 20 mA transmitter, select the assembly below and the transmitter from the back of this section. The MgO-insulated thermocouple assemblies are offered in a variety of calibrations, sheath diameters, and sheath materials.



ORDER CODES

Example Order Number: **J 3 8 U** - **012** - **01A** - **9HP 49, T** Select Type and Range from back of section

1-0 Thermocouple Types

| CODE | DESCRIPTION |
|---------------|---------------|
| SINGLE | DUPLEX |
| E | EE |
| J | JJ |
| K | KK |
| T | TT |

1-1 Sheath Diameters

| CODE | DIAMETER (inches) |
|------|-------------------|
| 2 | 1/8 |
| 3 | 3/16 |
| 4 | 1/4 |
| 6 | 3/8 |

1-2 Sheath Materials

| CODE | MATERIAL | STANDARD AVAILABLE TYPES |
|------|-----------|--------------------------|
| 3 | Alloy 600 | K |
| 4 | 310 SS | K |
| 5 | 446 SS | K ^[1] |
| 8 | 316 SS | E, J, K, T |

[1] All sensors with 446SS sheaths must have an ungrounded measuring junction.

1-3 Measuring Junctions

| CODE | DESCRIPTION |
|------|---------------------|
| G | Grounded junction |
| U | Ungrounded junction |
| E | Exposed junction |

2-0 'X' Dimension

Insert three digit "X" length in inches

Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

| CODE | DESCRIPTION |
|------|-------------|
| 00 | No fitting |

3-1 One-Time Adjustable Fittings

| CODE | TYPE | NPT SIZE (inches) | PRESSURE RATED | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------|-------------------|----------------|-------------------------------------|
| 01A | 303 SS | 1/8 | NO | 1/8, 3/16, 1/4 |
| 05A | 316 SS | 1/8 | YES | 1/8, 3/16, 1/4 |
| 05B | 316 SS | 1/4 | YES | 1/8, 3/16, 1/4, 3/8 |
| 05C | 316 SS | 1/2 | YES | 1/8, 1/4, 3/8 |
| 15A | Brass | 1/8 | NO | 1/8, 3/16, 1/4 |
| 15B | Brass | 1/4 | NO | 3/16, 1/4, 3/8 |
| 15C | Brass | 1/2 | NO | 1/4, 3/8 |
| 14 | Brass/Steel | Flange | NO | 1/8, 3/16, 1/4, 3/8 |

3-2 Re-Adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------------------------|-------------------|-------------------------------------|
| 10A | 303 SS | 1/8 | 1/8, 3/16 |
| 10B | 303 SS | 1/4 | 1/4, 3/8 |
| 10C | 303 SS | 1/2 | 1/4, 3/8 |
| 12A | 316 SS | 1/8 | 1/8, 3/16, 1/4 |
| 12B | 316 SS | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 12C | 316 SS | 1/2 | 1/8, 1/4, 3/8 |
| 11A | Brass | 1/8 | 1/8, 3/16, 1/4 |
| 11B | Brass | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 11C | Brass | 1/2 | 1/4, 3/8 |
| 19C | Spring-loaded SS well fitting | 1/2 | 3/16, 1/4 |

FEP gland standard 204 °C [400 °F] max.

3-3 Fixed Bushings^[1]

| CODE | MOUNTING THREAD NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|----------------------|------------------------------|-------------------------------------|
| 316 SS | | |
| 8A __ ^[2] | 1/8 | 1/8, 3/16, 1/4 |
| 8B __ ^[2] | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 8C __ ^[2] | 1/2 | 1/8, 3/16, 1/4, 3/8 |
| 8D __ ^[2] | 3/4 | 1/8, 3/16, 1/4, 3/8 |

[1] Requires Table 4, Option 9HP Selection

[2] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|-------|--|
| 6HN | 1/2" x 1/2" NPT steel hex nipple 1" "E" length |
| 8HN | 1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length |
| 9HP | 1/2" NPT stainless steel bushing (no process threads) |
| 8RNDC | 3/4" x 1/2" NPT stainless steel hex nipple |

4-1 Head and Sheath Terminations

| CODE | DESCRIPTION |
|-----------|--|
| 22 | 3" Individual fluoropolymer leads with terminal pins |
| 31 | Aluminum screw-cover head |
| 34 | Cast iron screw-cover head |
| 35T-642A | (4 to 20) mA HART® Field Transmitter with aluminum general-purpose housing |
| 36T82-D10 | (4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid |
| 49 | Flip-top aluminum head |
| 63 | White polypropylene screw-cover head |
| 91 | 316 L stainless steel screw-cover head |

4-2 Options

| | |
|------------------|--|
| W ^[1] | Epoxy Coating |
| GS | Ground screw |
| I | Stainless tag |
| NB | 1/2" NPT nylon conduit reducer bushing |
| SB | 1/2" NPT conduit reducer bushing |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA isolated Hart® head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input HART® head-mounted transmitter |

See transmitter ordering information in back of section.

[1] Available with option 31 only.

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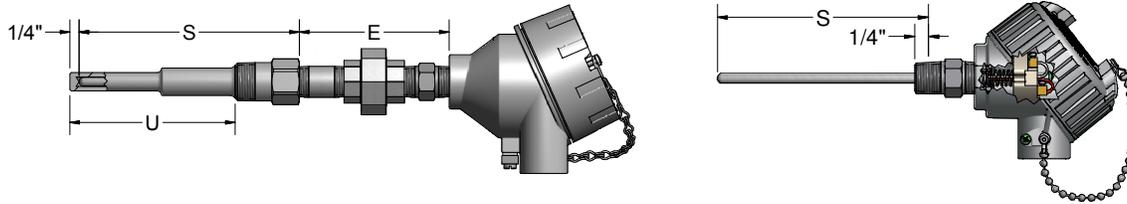


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SENSORS WITH CONNECTION HEADS

Configuration Code GP04 Spring-Loaded MgO Thermocouple/Thermowell Assemblies with Explosion-Proof Connection Heads

Spring-Loaded MgO Thermocouple/Thermowell Assemblies with Explosion-Proof Connection Heads are designed for use with various thermowell types. Complete assemblies can be ordered by selecting the MgO assembly below, the thermowell from the thermowell section of the catalog, and a temperature transmitter from the back of this section. Assemblies without a thermowell can be ordered by selecting the sensor assembly from this page and inserting the "S" length in table 2-0. These sensors are supplied with a 316 stainless steel sheath and as standard limits or error. **Note:** The "S" dimension will measure 1/4" longer than specified when the spring is in the relaxed position. The "S" dimension is calculated when the sensor is compressed or in the installed position. This design allows 1/4" spring compression to ensure positive contact with the bottom of the thermowell.



ORDER CODES

Example Order Number: **J 48 U** - Select Thermowell Part # or Insert 3 Digit Length Code - **SL** - **8XU4 93, T** - Select Type and Range from back of section

1-0 Thermocouple Types

| CODE | |
|---------------|---------------|
| <i>SINGLE</i> | <i>DUPLEX</i> |
| E | EE |
| J | JJ |
| K | KK |
| T | TT |

1-1 Sheath Diameters

| CODE | DIAMETERS (inches) 316 SS |
|------|---------------------------|
| 38 | 3/16 |
| 48 | 1/4 |

1-2 Measuring Junction

| CODE | DESCRIPTION |
|------|---------------------|
| G | Grounded junction |
| U | Ungrounded junction |

2-0

Select thermowell part number from Thermowell Section, or specify 3 digit "S" length in inches if no thermowell is required.

3-0 Element Options

| CODE | DESCRIPTION |
|------|--|
| SL | Spring-loaded element |
| SC | Self-contained spring-loaded element |
| SN | Self-contained spring-loaded element with Buna-N oil seal 121°C [250°F] 100 PSI Max. |

4-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|------------------------------------|--|
| <i>STEEL FITTINGS</i> | |
| 6HN | 1/2" x 1/2" NPT hex nipple 1" "E" length |
| 6PN_ | 1/2" NPT pipe nipple (specify "E" length in inches) |
| 6XU_ [1] | 1/2" NPT union/nipple (specify "E" length in inches) |
| <i>316 SS FITTINGS</i> | |
| 8HN | 1/2" x 1/2" NPT hex nipple 1" "E" length |
| 8PN_ | 1/2" NPT pipe nipple (specify "E" length in inches) |
| 8XU_ [1] | 1/2" NPT union/nipple (specify "E" length in inches) |
| [1] 3 1/2" Minimum length required | |

4-1 Head Terminations

| CODE | DESCRIPTION |
|----------|---|
| 74 | DIN form B aluminum explosion-proof head, Group A |
| 75T-642C | (4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316L stainless steel explosion-proof head, Group A |

4-2 Options

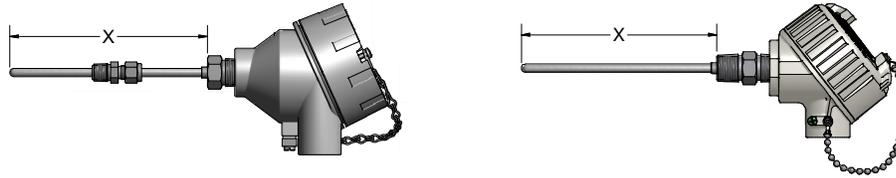
| | |
|---|--|
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless tag |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA isolated HART® head-mounted transmitter |
| T82-00 | (4 to 20) mA Dual input, isolated HART® head-mounted transmitter |
| See transmitter ordering information in back of section. | |

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SENSORS WITH CONNECTION HEADS

Configuration Code GP01 Fixed-Sheath RTD Assemblies with Explosion-Proof Connection Heads

Fixed-Sheath RTD Assemblies with Explosion-Proof Connection Heads are provided with head mounting fittings that are welded or brazed to the sheath for direct immersion into a process. To order an assembly with an option 4 to 20 mA transmitter, select the assembly below and the transmitter from the back of this section. The RTD assemblies are supplied with a 316 stainless steel sheath in several diameters. They are available in various tolerances and temperature ranges as noted below.



ORDER CODES

Example Order Number: **RAF185L 48 3 - 012(1/2) - 00 - 8HN 94, SB, T-** Select Type and Range from back of section

1-0 100 Ω Platinum RTD Elements α = 0.003 85 °C⁻¹

| CODE | | TOLERANCE ^[1] |
|--|---------------|--------------------------|
| LOW RANGE WIRE WOUND (-200 to 200) °C | | |
| SINGLE | DUPLEX | |
| R1T185L | R1T285L | Grade B |
| R5T185L | R5T285L | (1/5) Class B |
| LOW RANGE THIN FILM (-50 to 200) °C | | |
| RBF185L | RBF285L | Class B |
| RAF185L | RAF285L | Class A |
| HIGH RANGE WIRE WOUND (-200 to 600) °C | | |
| R1T185H | R1T285H | Grade B |
| RAT185H | RAT285H | Class A |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

1-1 Sheath Diameters

| CODE | DIAMETERS (inches) 316 SS |
|-------------------|---------------------------|
| 28 ^[1] | 1/8 |
| 38 | 3/16 |
| 48 | 1/4 |
| 68 | 3/8 |

[1] Not available in duplex

1-2 Element Connection

| CODE | DESCRIPTION |
|------------------|----------------|
| 2 | 2-wire element |
| 3 | 3-wire element |
| 4 ^[1] | 4-wire element |

[1] Not available in duplex or with 440 Series Transmitter

2-0 "X" Dimensions

Insert three digit "X" length in inches.
Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

| CODE | DESCRIPTION |
|------|-------------|
| 00 | No fitting |

3-1 One-Time Adjustable Fittings

| CODE | TYPE | NPT SIZE (inches) | PRESSURE-RATED | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------|-------------------|----------------|-------------------------------------|
| 01A | 303 SS | 1/8 | NO | 1/8, 3/16, 1/4 |
| 05A | 316 SS | 1/8 | YES | 1/8, 3/16, 1/4 |
| 05B | 316 SS | 1/4 | YES | 1/8, 3/16, 1/4, 3/8 |
| 05C | 316 SS | 1/2 | YES | 1/8, 1/4, 3/8 |
| 15A | Brass | 1/8 | NO | 1/8, 3/16, 1/4 |
| 15B | Brass | 1/4 | NO | 3/16, 1/4, 3/8 |
| 15C | Brass | 1/2 | NO | 1/4, 3/8 |
| 14 | Brass/Steel | Flange | NO | 1/8, 3/16, 1/4, 3/8 |

3-2 Re-Adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------------------------|-------------------|-------------------------------------|
| 10A | 303 SS | 1/8 | 1/8, 3/16 |
| 10B | 303 SS | 1/4 | 1/4, 3/8 |
| 10C | 303 SS | 1/2 | 1/4, 3/8 |
| 12A | 316 SS | 1/8 | 1/8, 3/16, 1/4 |
| 12B | 316 SS | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 12C | 316 SS | 1/2 | 1/8, 1/4, 3/8 |
| 11A | Brass | 1/8 | 1/8, 3/16, 1/4 |
| 11B | Brass | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 11C | Brass | 1/2 | 1/4, 3/8 |
| 19C | Spring-loaded SS well fitting | 1/2 | 3/16, 1/4 |

FEP gland standard 204 °C [400 °F] max.

3-3 Fixed Bushings^[1]

| CODE | MOUNTING THREAD NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|---------------------|------------------------------|-------------------------------------|
| 8A__ ^[1] | 1/8 | 1/8, 3/16, 1/4 |
| 8B__ ^[1] | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 8C__ ^[1] | 1/2 | 1/8, 3/16, 1/4, 3/8 |
| 8D__ ^[1] | 3/4 | 1/8, 3/16, 1/4, 3/8 |

[1] Requires Table 4, Option 9HP Selection

[2] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|-------|--|
| 6HN | 1/2" x 1/2" NPT steel hex nipple 1" "E" length |
| 8HN | 1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length |
| 9HP | 1/2" NPT stainless steel bushing (no process threads) |
| 8RNDC | 3/4" x 1/2" NPT stainless steel hex nipple |

4-1 Head Terminations

| CODE | DESCRIPTION |
|----------|---|
| 74 | DIN form B aluminum explosion-proof head, Group A |
| 75T-642C | (4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316L stainless steel explosion-proof head, Group A |

4-2 Options

| | |
|----------------------|--|
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless tag |
| T-440 ^[1] | (4 to 20) mA head-mounted RTD transmitter |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA isolated HART® head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |

See transmitter ordering information in back of section.

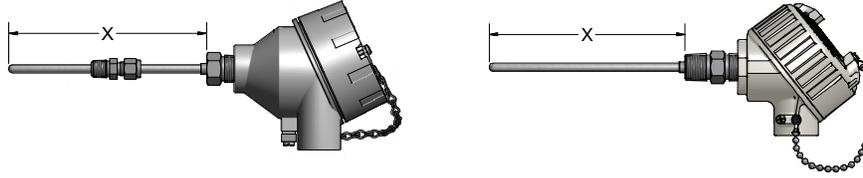
[1] Not available with option 74.

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SENSORS WITH CONNECTION HEADS

Configuration Code GP02 Fixed-Sheath Thermocouple Assemblies with Explosion-Proof Connection Heads

Fixed-Sheath Thermocouple Assemblies with Explosion-Proof Connection Heads are provided with head mounting fittings that are welded or brazed to the sheath for direct immersion into a process. To order an assembly with an optional 4 to 20 mA transmitter, select the assembly below and the transmitter from the back of this section. The MgO-insulated thermocouple assemblies are offered in a variety of calibrations, sheath diameters, and sheath materials.



ORDER CODES

Example Order Number: **J 2 8 U** - **012** - **01A** - **9HP 74, T** Select Type and Range from back of section

1-0 Thermocouple Types

| CODE | |
|--------|--------|
| SINGLE | DUPLEX |
| E | EE |
| J | JJ |
| K | KK |
| T | TT |

1-1 Sheath Diameters

| CODE | DIAMETER (inches) |
|------|-------------------|
| 2 | 1/8 |
| 3 | 3/16 |
| 4 | 1/4 |
| 6 | 3/8 |

1-2 Sheath Materials

| CODE | MATERIAL | STANDARD AVAILABLE TYPES |
|------|-----------|--------------------------|
| 3 | Alloy 600 | K |
| 4 | 310 SS | K |
| 5 | 446 SS | K ^[1] |
| 8 | 316 SS | E, J, K, T |

[1] All sensors with 446SS sheaths must have an ungrounded measuring junction.

1-3 Measuring Junctions

| CODE | DESCRIPTION |
|------|---------------------|
| G | Grounded junction |
| U | Ungrounded junction |
| E | Exposed junction |

2-0 'X' Dimension

Insert three digit "X" length in inches

Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

| CODE | DESCRIPTION |
|------|-------------|
| 00 | No fitting |

3-1 One-Time Adjustable Fittings

| CODE | TYPE | NPT SIZE (inches) | PRESSURE-RATED | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------|-------------------|----------------|-------------------------------------|
| 01A | 303 SS | 1/8 | NO | 1/8, 3/16, 1/4 |
| 05A | 316 SS | 1/8 | YES | 1/8, 3/16, 1/4 |
| 05B | 316 SS | 1/4 | YES | 1/8, 3/16, 1/4, 3/8 |
| 05C | 316 SS | 1/2 | YES | 1/8, 1/4, 3/8 |
| 15A | Brass | 1/8 | NO | 1/8, 3/16, 1/4 |
| 15B | Brass | 1/4 | NO | 3/16, 1/4, 3/8 |
| 15C | Brass | 1/2 | NO | 1/4, 3/8 |
| 14 | Brass/Steel | Flange | NO | 1/8, 3/16, 1/4, 3/8 |

3-2 Re-Adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------------------------|-------------------|-------------------------------------|
| 10A | 303 SS | 1/8 | 1/8, 3/16 |
| 10B | 303 SS | 1/4 | 1/4, 3/8 |
| 10C | 303 SS | 1/2 | 1/4, 3/8 |
| 12A | 316 SS | 1/8 | 1/8, 3/16, 1/4 |
| 12B | 316 SS | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 12C | 316 SS | 1/2 | 1/8, 1/4, 3/8 |
| 11A | Brass | 1/8 | 1/8, 3/16, 1/4 |
| 11B | Brass | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 11C | Brass | 1/2 | 1/4, 3/8 |
| 19C | Spring-loaded SS well fitting | 1/2 | 3/16, 1/4 |

FEP gland standard 204 °C [400 °F] max.

3-3 Fixed Bushings^[1]

| CODE | MOUNTING THREAD NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|----------------------|------------------------------|-------------------------------------|
| 8A __ ^[1] | 1/8 | 1/8, 3/16, 1/4 |
| 8B __ ^[1] | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 8C __ ^[1] | 1/2 | 1/8, 3/16, 1/4, 3/8 |
| 8D __ ^[1] | 3/4 | 1/8, 3/16, 1/4, 3/8 |

[1] Requires Table 4, Option 9HP Selection

[2] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|-------|--|
| 6HN | 1/2" x 1/2" NPT steel hex nipple 1" "E" length |
| 8HN | 1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length |
| 9HP | 1/2" NPT stainless steel bushing (no process threads) |
| 8RNDC | 3/4" x 1/2" NPT stainless steel hex nipple |

4-1 Head Terminations

| CODE | DESCRIPTION |
|----------|---|
| 74 | DIN form B aluminum explosion-proof head, Group A |
| 75T-642C | (4 to 20) mA HART® field transmitter with aluminum explosion-proof housing, Group A |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316L stainless steel explosion-proof head, Group A |

4-2 Options

| CODE | DESCRIPTION |
|--------|--|
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless tag |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA isolated HART® head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |

See transmitter ordering information in back of section.

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SENSORS WITH CONNECTION HEADS

Thermocouple and RTD Spring-Loaded Replacement Elements

Thermocouple and RTD spring-Loaded Replacement elements are designed for spring-loaded thermowell assemblies. The replacement elements can be ordered by selecting the sensor type below and inserting the "X" length in table 2-0. The RTD assemblies are supplied with a 316 stainless steel sheath and are available in various tolerances and temperature ranges as noted in the tables below. The MgO-insulated thermocouple assemblies are supplied with a 316 stainless steel sheath, various calibrations, and as standard limits of error.



ORDER CODES

Configuration Code GP06

Thermocouple

Example Order Number:

1-0 1-1 2-0 3-0 4-0
J48 U - 012 - SL - 22(06)

1-0 Thermocouple Types

| CODE | | AVAILABLE SHEATH DIAMETERS (316 SS) | |
|--------|--------|-------------------------------------|-----------|
| SINGLE | DUPLEX | 3/16" O.D. | 1/4" O.D. |
| E | EE | 38 | 48 |
| J | JJ | 38 | 48 |
| K | KK | 38 | 48 |
| T | TT | 38 | 48 |

1-1 Measuring Junction

| CODE | DESCRIPTION |
|------|---------------------|
| G | Grounded junction |
| U | Ungrounded junction |

4-0 Sheath Terminations

| CODE | DESCRIPTION |
|-------------------|--|
| 22 ^[1] | 3" Individual fluoropolymer leads with terminal pins |

[1] For longer leads, insert 2 digit length in inches. Example: 22(06)

3-0 Element Style

| CODE | DESCRIPTION |
|------|-----------------------|
| SL | Spring-loaded element |

2-0 Length

| CODE |
|-------------------------------------|
| Insert 3 Digit "X" length in inches |

ORDER CODES

Configuration Code GP05

RTD Example Order Number:

1-0 1-1 1-2 2-0 3-0 4-0
R1T185L 48 3 - 012(1/2) - SL - 22

1-0 100 Ω Platinum RTD Elements $\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$

| CODE | | TOLERANCE ^[1] |
|--|---------|--------------------------|
| LOW RANGE WIRE WOUND (-200 to 200) °C | | |
| SINGLE | DUPLEX | |
| R1T185L | R1T285L | Grade B |
| R5T185L | R5T285L | (1/5) Class B |
| LOW RANGE THIN FILM (-50 to 200) °C | | |
| RBF185L | RBF285L | Class B |
| RAF185L | RAF285L | Class A |
| HIGH RANGE WIRE WOUND (-200 to 600) °C | | |
| R1T185H | R1T285H | Grade B |
| RAT185H | RAT285H | Class A |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

1-1 Sheath Diameters

| CODE | DIAMETERS (inches) 316 SS |
|------|---------------------------|
| 38 | 3/16 |
| 48 | 1/4 |

4-0 Sheath Terminations

| CODE | DESCRIPTION |
|-------------------|--|
| 22 ^[1] | 3" Individual fluoropolymer leads with terminal pins |

[1] For longer leads insert 2 digit length in inches. Example: 22(06)

3-0 Element Style

| CODE | DESCRIPTION |
|------|-----------------------|
| SL | Spring-loaded element |

2-0 Length

| CODE |
|-------------------------------------|
| Insert 3 Digit "X" length in inches |

1-2 Element Connection

| CODE | DESCRIPTION |
|------|----------------|
| 2 | 2-wire element |
| 3 | 3-wire element |
| 4 | 4-wire element |



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ORDER CODES

Example Order Number: 1-0 **440** - 1-1 - 1-2 **3** 1-3 **85** 1-4 **U** - 1-5 **S(0-200)** 1-6 **C**

1-0 Transmitter Type

| CODE | DESCRIPTION |
|--------------------------|---|
| 440 ^[1] | (4 to 20) mA programmable head-mounted RTD Transmitter |
| 441 | (4 to 20) mA programmable head-mounted universal Transmitter |
| 442 | (4 to 20) mA HART® programmable head-mounted universal Transmitter |
| 35T-642A | (4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing |
| 75T-642C | (4 to 20) mA HART® Field Transmitter with explosion-proof aluminum housing FM/CSA / XP Class I / Div 1 / Groups A,B,C,D / DIP Class II / Div 1 / Groups E,F,G / Class III / NI Class I / Div 2 / Groups A,B,C,D |
| T82-00 ^[2] | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |
| 36T82-D10 ^[2] | (4 to 20) mA dual input HART® transmitter with digital display and general-purpose aluminum housing with glass lid |

[1] Only available with 2- or 3-wire input connection and Pt100 sensor type
 [2] See transmitter section for ordering information

1-1 Options (For 642 Series only)

| CODE | DESCRIPTION |
|---------------------------------------|----------------------------------|
| T | Solid cover |
| D | Glass cover with digital display |
| Leave blank if using 440, 441, or 442 | |

1-2 Input Type

| CODE | DESCRIPTION |
|-------------------|-------------------|
| 00 ^[1] | Unconfigured |
| 1 | Thermocouple (TC) |
| 2 | RTD (2-wire) |
| 3 | RTD (3-wire) |
| 4 | RTD (4-wire) |

[1] Default setting supplied as 3-wire Pt100 (0-100) °C

1-6 Unit of Measure

| CODE | DESCRIPTION |
|------|-------------|
| C | Celsius |
| F | Fahrenheit |

1-5 Range

| CODE | DESCRIPTION |
|------|-----------------------------|
| S | (lower limit – upper limit) |

1-4 Failure Mode

| CODE | DESCRIPTION |
|------|----------------------------|
| U | Upscale Burnout ≥ 20.5 mA |
| D | Downscale Burnout ≤ 3.8 mA |

1-3 Sensor Type

| CODE | DESCRIPTION |
|------|--|
| J | Type J thermocouple |
| K | Type K thermocouple |
| T | Type T thermocouple |
| N | Type N thermocouple |
| E | Type E thermocouple |
| 85 | 100 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |

For complete transmitter specifications see Transmitter Section.

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Fixed-sheath RTD assemblies with miniature heads are offered with mounting fittings that are welded or brazed to the sheath for direct immersion into a process. The miniature heads offer a compact design and are ideal for laboratory applications or applications where space is limited. The RTD assemblies are supplied with a 316 stainless steel sheath in several diameters. They are offered in various tolerances and temperature ranges as noted below.



ORDER CODES

Example Order Number: **1-0** **1-1** **1-2** **2-0** **3** **4-0** **4-1**
RBF185L 48 3 - 006(1/2) - 00 - 8HPB 25

1-0 100 Ω Platinum RTD Elements $\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$

| CODE | TOLERANCE ^[1] |
|--|--------------------------|
| LOW RANGE WIRE WOUND (-200 to 200) °C | |
| SINGLE | |
| R1T185L | Grade B |
| R5T185L | (1/5) Class B |
| LOW RANGE THIN FILM (-50 to 200) °C | |
| RBF185L | Class B |
| RAF185L | Class A |
| HIGH RANGE WIRE WOUND (-200 to 600) °C | |
| R1T185H | Grade B |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

1-1 Sheath Diameters

| CODE | DIAMETERS (inches) 316 SS |
|------|---------------------------|
| 28 | 1/8 |
| 38 | 3/16 |
| 48 | 1/4 |
| 68 | 3/8 |

1-2 Element Connection

| CODE | DESCRIPTION |
|------|----------------|
| 2 | 2 wire element |
| 3 | 3 wire element |
| 4 | 4 wire element |

2-0 "X" Dimensions

Insert three digit "X" length in inches.

Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

| CODE | DESCRIPTION |
|------|-------------|
| 00 | No fitting |

3-1 One-Time Adjustable Fittings

| CODE | TYPE | NPT SIZE (inches) | PRESSURE-RATED | AVAILABLE SHEATH DIAMETERS (inches) |
|------|--------|-------------------|----------------|-------------------------------------|
| 01A | 303 SS | 1/8 | NO | 1/8, 3/16, 1/4 |
| 05A | 316 SS | 1/8 | YES | 1/8, 3/16, 1/4 |
| 05B | 316 SS | 1/4 | YES | 1/8, 3/16, 1/4, 3/8 |
| 05C | 316 SS | 1/2 | YES | 1/8, 1/4, 3/8 |
| 15A | Brass | 1/8 | NO | 1/8, 3/16, 1/4 |
| 15B | Brass | 1/4 | NO | 3/16, 1/4, 3/8 |
| 15C | Brass | 1/2 | NO | 1/4, 3/8 |

3-2 Re-Adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------------------------|-------------------|-------------------------------------|
| 10A | 303 SS | 1/8 | 1/8, 3/16 |
| 10B | 303 SS | 1/4 | 1/4, 3/8 |
| 10C | 303 SS | 1/2 | 1/4, 3/8 |
| 12A | 316 SS | 1/8 | 1/8, 3/16, 1/4 |
| 12B | 316 SS | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 12C | 316 SS | 1/2 | 1/8, 1/4, 3/8 |
| 11A | Brass | 1/8 | 1/8, 3/16, 1/4 |
| 11B | Brass | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 11C | Brass | 1/2 | 1/4, 3/8 |
| 19C | Spring-loaded SS well fitting | 1/2 | 3/16, 1/4 |

FEP gland standard 204 °C [400 °F] max.

3-3 Fixed Bushings

| CODE | MOUNTING THREAD NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|----------------------|------------------------------|-------------------------------------|
| 316 SS | | |
| 8A __ ^[1] | 1/8 | 1/8, 3/16, 1/4 |
| 8B __ ^[1] | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 8C __ ^[1] | 1/2 | 1/8, 3/16, 1/4, 3/8 |
| 8D __ ^[1] | 3/4 | 1/8, 3/16, 1/4, 3/8 |

[1] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|-------|---|
| 9HNB | 1/4" x 1/4" stainless steel hex nipple |
| 8HPB | 1/4" stainless steel hex bushing (no process threads) |
| 8CFB | 1/4" NPT 316 stainless steel compression fitting (no process threads) |
| 22CFB | 1/4" NPT brass compression fitting (no process threads) |

4-1 Miniature Head Terminations

| CODE | DESCRIPTION |
|------|---|
| 17 | Miniature plastic head (3/8" NPT conduit opening) |
| 25 | Miniature nickel-plated head |

SENSORS WITH CONNECTION HEADS

Configuration Code GP08 Fixed-Sheath Thermocouple Assemblies with Miniature Connection Heads

Fixed-Sheath Thermocouple Assemblies with miniature connection heads are offered with mounting fittings that are welded or brazed to the sheath for direct immersion into a process. The miniature heads offer a compact design and are ideal for laboratory applications or applications where space is limited. The MgO-insulated thermocouple assemblies are offered in a variety of calibrations, sheath diameters, and sheath materials.



ORDER CODES

Example Order Number: 1-0 1-1 1-2 1-3 - 2-0 - 3 - 4-0 4-1
J 3 8 U - 012 - 01A - 8HPB 25

1-0 Thermocouple Types

| CODE | |
|--------|--------|
| SINGLE | DUPLEX |
| E | EE |
| J | JJ |
| K | KK |
| T | TT |

1-1 Sheath Diameters

| CODE | DIAMETER (inches) |
|------|-------------------|
| 2 | 1/8 |
| 3 | 3/16 |
| 4 | 1/4 |
| 6 | 3/8 |

1-2 Sheath Materials

| CODE | MATERIAL | STANDARD AVAILABLE TYPES |
|------|-----------|--------------------------|
| 3 | Alloy 600 | K |
| 4 | 310 SS | K |
| 5 | 446 SS | K ^[1] |
| 8 | 316 SS | E, J, K, T |

[1] All sensors with 446SS sheaths must have an ungrounded measuring junction.

1-3 Measuring Junctions

| CODE | DESCRIPTION |
|------|---------------------|
| G | Grounded junction |
| U | Ungrounded junction |
| E | Exposed junction |

2-0 'X' Dimension

Insert three digit "X" length in inches

Sheath lengths over 72" will be shipped in a coiled configuration unless otherwise specified.

3-0 No Fitting

| CODE | DESCRIPTION |
|------|-------------|
| 00 | No fitting |

3-1 One-Time Adjustable Fittings

| CODE | TYPE | NPT SIZE (inches) | PRESSURE RATED | AVAILABLE SHEATH DIAMETERS (inches) |
|------|--------|-------------------|----------------|-------------------------------------|
| 01A | 303 SS | 1/8 | NO | 1/8, 3/16, 1/4 |
| 05A | 316 SS | 1/8 | YES | 1/8, 3/16, 1/4 |
| 05B | 316 SS | 1/4 | YES | 1/8, 3/16, 1/4, 3/8 |
| 05C | 316 SS | 1/2 | YES | 1/8, 1/4, 3/8 |
| 15A | Brass | 1/8 | NO | 1/8, 3/16, 1/4 |
| 15B | Brass | 1/4 | NO | 3/16, 1/4, 3/8 |
| 15C | Brass | 1/2 | NO | 1/4, 3/8 |

3-2 Re-Adjustable Compression Fittings

| CODE | TYPE | NPT SIZE (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|-------------------------------|-------------------|-------------------------------------|
| 10A | 303 SS | 1/8 | 1/8, 3/16 |
| 10B | 303 SS | 1/4 | 1/4, 3/8 |
| 10C | 303 SS | 1/2 | 1/4, 3/8 |
| 12A | 316 SS | 1/8 | 1/8, 3/16, 1/4 |
| 12B | 316 SS | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 12C | 316 SS | 1/2 | 1/8, 1/4, 3/8 |
| 11A | Brass | 1/8 | 1/8, 3/16, 1/4 |
| 11B | Brass | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 11C | Brass | 1/2 | 1/4, 3/8 |
| 19C | Spring-loaded SS well fitting | 1/2 | 3/16, 1/4 |

FEP gland standard 204 °C [400 °F] max.

3-3 Fixed Bushings

| CODE | MOUNTING THREAD NPT (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|----------------------|------------------------------|-------------------------------------|
| 316 SS | | |
| 8A __ ^[1] | 1/8 | 1/8, 3/16, 1/4 |
| 8B __ ^[1] | 1/4 | 1/8, 3/16, 1/4, 3/8 |
| 8C __ ^[1] | 1/2 | 1/8, 3/16, 1/4, 3/8 |
| 8D __ ^[1] | 3/4 | 1/8, 3/16, 1/4, 3/8 |

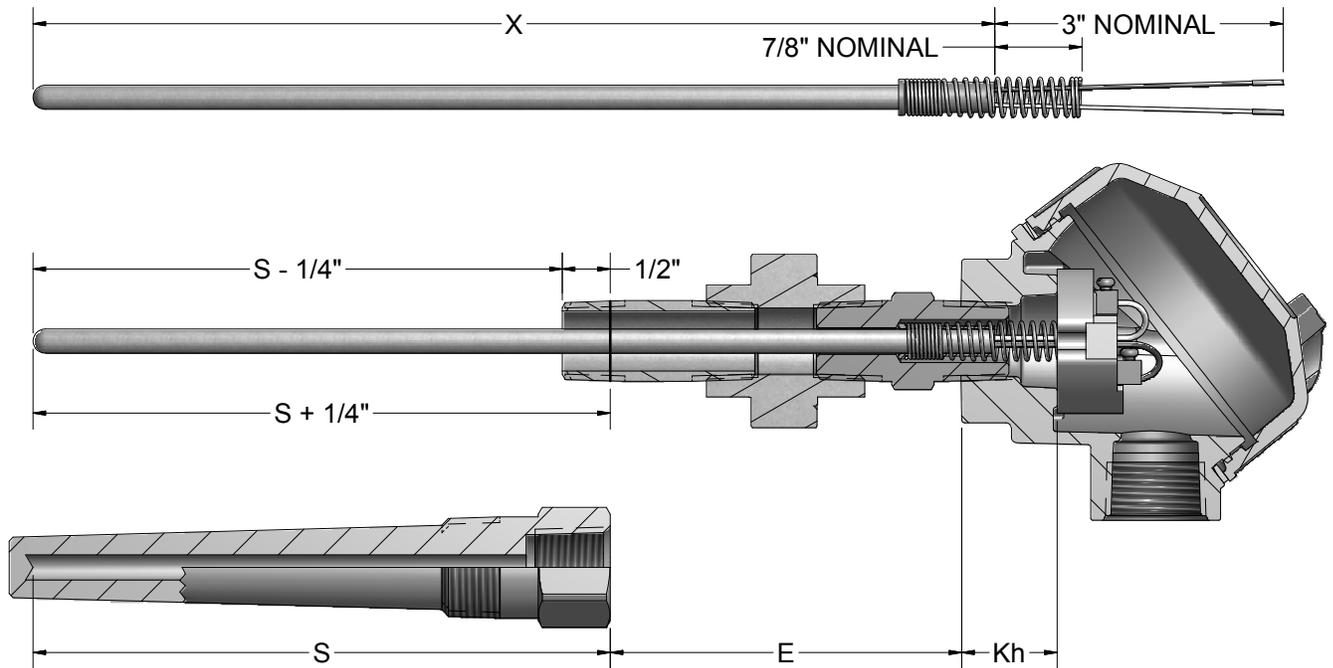
[1] When ordering fixed bushings, specify order code above plus insert length "U", as measured from hot tip to bottom of threaded bushing. EXAMPLE: order code 8A06 is 1/8" NPT, 316 SS bushing located 6" from hot tip.

4-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|-------|---|
| 9HNB | 1/4" x 1/4" stainless steel hex nipple |
| 8HPB | 1/4" stainless steel hex bushing (no process threads) |
| 8CFB | 1/4" NPT 316 stainless steel compression fitting (no process threads) |
| 22CFB | 1/4" NPT brass compression fitting (no process threads) |

4-1 Miniature Head Terminations

| CODE | DESCRIPTION |
|------|---|
| 17 | Miniature plastic head (3/8" NPT conduit opening) |
| 25 | Miniature nickel-plated head |

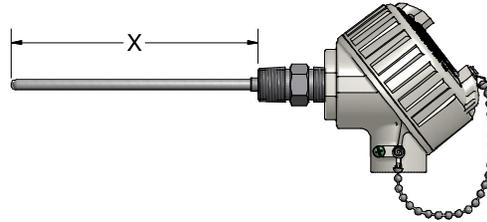


| Pyromation Head Order Code | Kh Dimension in inches | Formula for SL option | Formula for SC option |
|----------------------------|------------------------|-----------------------|-----------------------|
| 31 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |
| 34 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |
| 49 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |
| 63 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |
| 74 | 1.625 | $X = S + E + 1\ 1/4"$ | $X = S + E$ |
| 91 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |
| 93 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |
| 94 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |
| 71 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |
| 72 | 1.125 | $X = S + E + 3/4"$ | $X = S + E$ |
| 81 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |
| 82 | 1.00 | $X = S + E + 5/8"$ | $X = S + E$ |

| <p><i>Complete Transmitter Specifications are located in the Transmitter Section.</i></p> <p><i>Complete Connection Head Specifications are located in the Accessories Section.</i></p> | | | | Connection Heads | | | | | |
|---|---|---------------------------------|---|---|---|--|---|---|---|
| | | | | 31 | 34 | 35 | 49 | 63 | 91 |
| | | | |  |  |  |  |  |  |
| Temperature Transmitters | | | | Aluminum Screw-Cover Head | Cast Iron Screw-Cover Head | Aluminum Field Transmitter Housing | Flip-Top Aluminum Head | White Polypropylene Screw-Cover Head | 316L Stainless Steel Screw-Cover Head |
| T-440 |  | Input: Pt100 RTD Only | Programmable head-mounted transmitter, (4 to 20) mA analog output | X | X | | X | X | X |
| T-441 |  | Input: Thermocouple, RTD, Other | Programmable head-mounted transmitter, isolated, (4 to 20) mA analog output | X | X | | X | X | X |
| T-442 |  | Input: Thermocouple, RTD, Other | Programmable head-mounted transmitter, isolated, HART® protocol, (4 to 20) mA analog output | X | X | | X | X | X |
| T-82 |  | Input: Thermocouple, RTD, Other | (4 to 20) mA dual input, isolated HART® head-mounted transmitter | X | X | | X | X | X |
| T-642 |  | Input: Thermocouple, RTD, Other | Programmable field transmitter, isolated, HART® protocol, (4 to 20) mA analog output | | | X | | | |
| T-642 w/ display |  | Input: Thermocouple, RTD, Other | Programmable field transmitter, isolated, HART® protocol, (4 to 20) mA analog output with digital display | | | X | | | |
| 36T82-D10 |  | Input: Thermocouple, RTD, Other | (4 to 20) mA dual input, HART® transmitter with digital display and general purpose aluminum housing, Group A | Unit includes housing and transmitter. | | | | | |

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Explosion-Proof, Fixed-Element RTDs are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependent on connection head type, meet XP Class I, Division 1, Group A, B, C and D; DIP Class II, Division I, Groups E, F, G, and Class III, Division 1. They may be installed directly in the process without being inserted into a thermowell. The assemblies feature 316 stainless steel sheaths in various diameter sizes. They are available with or without process mountings and with aluminum or stainless steel explosion-proof connection heads.



ORDER CODES

Example Order Number:

1-0 2-0 2-1 2-2 3-0 4-0 5-0 5-1 5-2
XP - R1T185L 48 3 - 012 - 00 - 8HN 94, T- Select Type and Range from back of Section

1-0 Agency Approval

| CODE | DESCRIPTION |
|------|--|
| XP | FM/CSA explosion-proof-approved assembly |

2-0 100 Ω Platinum RTD Elements $\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$

| CODE | | TOLERANCE ^[1] |
|--|---------------|--------------------------|
| LOW RANGE WIRE WOUND (-200 to 200) °C | | |
| SINGLE | DUPLEX | |
| R1T185L | R1T285L | Grade B |
| R5T185L | R5T285L | (1/5) Class B |
| LOW RANGE THIN FILM (-50 to 200) °C | | |
| RBF185L | RBF285L | Class B |
| RAF185L | RAF285L | Class A |
| HIGH RANGE WIRE WOUND (-200 to 600) °C | | |
| R1T185H | R1T285H | Grade B |
| RAT185H | RAT285H | Class A |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2-1 Sheath Diameters 316 SS

| CODE | DIAMETERS (inches) |
|-------------------|--------------------|
| 28 ^[1] | 1/8 |
| 38 | 3/16 |
| 48 | 1/4 |
| 68 | 3/8 |

[1] Not available in duplex

2-2 Element Connection

| CODE | DESCRIPTION |
|------------------|----------------|
| 2 | 2-wire element |
| 3 | 3-wire element |
| 4 ^[1] | 4-wire element |

[1] Not available in duplex or with 440 Series Transmitter

5-1 Head Terminations

| CODE | DESCRIPTION |
|-----------|---|
| 74 | DIN form B aluminum explosion-proof head, Group A |
| 75T-642B | (4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group A |
| 76T82-D10 | (4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof housing, Group A |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316L stainless steel explosion-proof head, Group A |

5-2 Options

| | |
|----------------------|--|
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless steel tag |
| T-440 ^[1] | (4 to 20) mA head-mounted transmitter |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA HART® isolated head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |

See transmitter ordering information in back of section.

[1] Not available with option 74

5-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|-------|--|
| 6HN | 1/2" x 1/2" NPT steel hex nipple 1" "E" length |
| 8HN | 1/2" x 1/2" NPT stainless steel hex nipple 1" "E" length |
| 9HP | 1/2" NPT stainless steel bushing (no process threads) |
| 8RNDC | 3/4" x 1/2" NPT stainless steel hex nipple |

4-0 Sheath Mounting Fittings

| CODE | DESCRIPTION |
|------|-------------|
| 00 | No Fitting |

3-0 "X" Dimensions

Insert three digit sheath length ("X" Dimension) in inches.

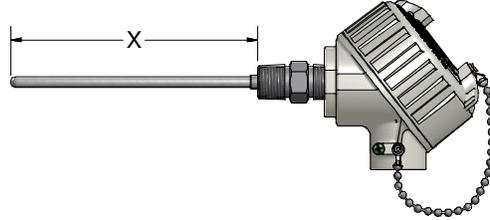
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EXPLOSION-PROOF

Configuration Code XP02 Hazardous Location Explosion-Proof-Approved, Fixed-Element Thermocouple Assemblies - Model 70-82

Explosion-Proof, Fixed-Element Thermocouples are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependant on connection head type, meet XP Class I, Division 1, Group A, B, C and D; DIP Class II, Division I, Groups E, F, G and Class III, Division 1. They may be installed directly in the process without being inserted into a thermowell. The assemblies feature 316 stainless steel sheaths in various diameter sizes and ungrounded isolated junctions. They are available with or without process mountings and with aluminum or stainless steel explosion-proof connection heads.



ORDER CODES

**Example
Order Number:**

1-0 2-0 2-1 2-2 2-3 3-0 4-0 5-0 5-1 5-2
XP - K 4 8 U - 012 - 00 - 8HN 93, T- Select Type and Range from back of Section

1-0 Agency Approval

| CODE | DESCRIPTION |
|------|--|
| XP | FM/CSA explosion-proof-approved assembly |

2-0 Thermocouple Types

| CODE | CODE |
|--------|--------|
| SINGLE | DUPLEX |
| E | EE |
| J | JJ |
| K | KK |
| T | TT |

2-1 Sheath Diameters

| CODE | DIAMETER (inches) |
|------|-------------------|
| 2 | 1/8 |
| 3 | 3/16 |
| 4 | 1/4 |
| 6 | 3/8 |

2-2 Sheath Materials

| CODE | MATERIAL | STANDARD AVAILABLE TYPES |
|------|-----------|--------------------------|
| 3 | Alloy 600 | K |
| 4 | 310 SS | K |
| 5 | 446 SS | K |
| 8 | 316 SS | E, J, K, T |

2-3 Measuring Junction

| CODE | DESCRIPTION |
|------|-------------|
| U | Ungrounded |

5-1 Head Terminations

| CODE | DESCRIPTION |
|-----------|---|
| 74 | DIN form B aluminum explosion-proof head, Group B |
| 75T-642B | (4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group A |
| 76T82-D10 | (4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof housing, Group A |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316L stainless steel explosion-proof head, Group A |

5-2 Options

| | |
|--------|--|
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless steel tag |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA HART® isolated head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |

See transmitter ordering information in back of section.

5-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|-------|---|
| 6HN | 1/2" x 1/2" NPT steel hex nipple |
| 8HN | 1/2" x 1/2" NPT stainless steel hex nipple |
| 9HP | 1/2" NPT stainless steel bushing (no process threads) |
| 8RNDC | 3/4" x 1/2" NPT stainless steel hex nipple |

4-0 Sheath Mounting Fittings

| CODE | DESCRIPTION |
|------|-------------|
| 00 | No Fitting |

3-0 "X" Dimensions

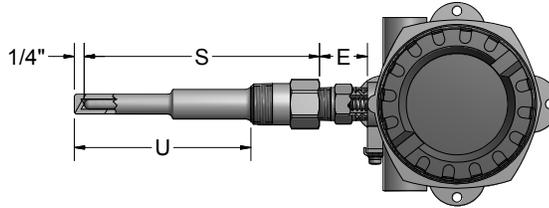
Insert three digit sheath length ("X" Dimension) in inches.

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Explosion-Proof RTD Assemblies with Thermowells are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependant on connection head type, meet XP Class I, Division 1, Group A, B, C, and D; DIP Class II, Division I, Groups E, F, G and Class III, Division 1. The required thermowell is available in standard, heavy-duty, and flanged constructions. The assemblies feature 316 stainless steel sheaths. They are available with aluminum or stainless steel explosion-proof connection heads.



ORDER CODES

Example Order Number: **XP** - **R1T185L** **48** **3** - **SC** - **8HN** **75T-642B**, **I**

1-0 Agency Approval 2-0 100 Ω Platinum RTD Elements 2-1 Sheath Diameters 316 SS 2-2 Element Connection 3-0 Thermowell 4-0 Element Options 5-0 Head Mounting Fittings 5-1 Head Terminations 5-2 Options

1-0 Agency Approval

| CODE | DESCRIPTION |
|------|--|
| XP | FM/CSA explosion-proof-approved assembly |

2-0 100 Ω Platinum RTD Elements $\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$

| CODE | | TOLERANCE ^[1] |
|--|---------------|--------------------------|
| LOW RANGE WIRE WOUND (-200 to 200) °C | | |
| SINGLE | DUPLEX | |
| R1T185L | R1T285L | Grade B |
| R5T185L | R5T285L | (1/5) Class B |
| LOW RANGE THIN FILM (-50 to 200) °C | | |
| RBF185L | RBF285L | Class B |
| RAF185L | RAF285L | Class A |
| HIGH RANGE WIRE WOUND (-200 to 600) °C | | |
| R1T185H | R1T285H | Grade B |
| RAT185H | RAT285H | Class A |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2-1 Sheath Diameters 316 SS

| CODE | DIAMETERS (inches) |
|------|--------------------|
| 48 | 1/4 |

2-2 Element Connection

| CODE | DESCRIPTION |
|------------------|-------------|
| 2 | 2-wire |
| 3 | 3-wire |
| 4 ^[1] | 4-wire |

[1] Not available in duplex or with 440 Series Transmitter

3-0 Thermowell

Select thermowell part number from Thermowell Section.

5-1 Head Terminations

| CODE | DESCRIPTION |
|-----------|---|
| 74 | DIN form B aluminum explosion-proof head, Group A |
| 75T-642B | (4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group A |
| 76T82-D10 | (4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof housing, Group A |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316L stainless steel explosion-proof head, Group A |

5-2 Options

| | |
|----------------------|--|
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless steel tag |
| T-440 ^[1] | (4 to 20) mA head-mounted transmitter |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA HART® isolated head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |

See transmitter ordering information in back of section.

[1] Not available with option 74.

5-0 Head Mounting Fittings

| CODE | DESCRIPTION | CODE | DESCRIPTION |
|-----------------------|--|-----------------------|--|
| <i>STEEL FITTINGS</i> | | <i>316SS FITTINGS</i> | |
| 6HN | 1/2" x 1/2" NPT hex nipple 1" length | 8HN | 1/2" x 1/2" NPT hex nipple 1" length |
| 6PN ₋ | 1/2" NPT pipe nipple (specify "E" length in inches) | 8PN | 1/2" NPT pipe nipple (specify "E" length in inches) |
| 6XU ₋₁ | 1/2" NPT union/nipple (specify "E" length in inches) | 8XU ₋₁ | 1/2" NPT union/nipple (specify "E" length in inches) |

[1] 3 1/2" Minimum length required. Maximum allowable "E" length is 9"

4-0 Element Options

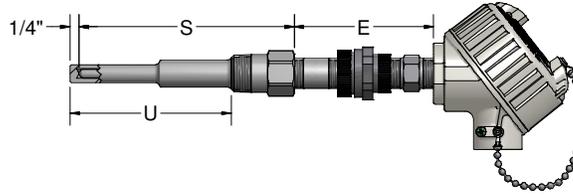
| CODE | DESCRIPTION |
|-------------------|---------------------------------------|
| SL ^[1] | Spring-loaded element |
| SC | Self-contained, spring-loaded element |

[1] Not available with option 75T-642B

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Explosion-Proof Thermocouple Assemblies with Thermowells are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependant on connection head type, meet XP Class I, Division 1, Group A, B, C, and D; DIP Class II, Division I, Groups E, F, G and Class III, Division 1. The required thermowell is available in standard, heavy-duty, and flanged constructions. The assemblies feature 316 stainless steel sheaths and ungrounded isolated junctions. They are available with aluminum or stainless steel explosion-proof connection heads.



ORDER CODES

Example Order Number:

1-0 2-1 2-2 2-3 3-0 4-0 5-0 5-1 5-2
XP - J 48 U - **- SL - 8XU4 94, I**

1-0 Agency Approval

| CODE | DESCRIPTION |
|------|--|
| XP | FM/CSA explosion-proof-approved assembly |

2-1 Thermocouple Types

| CODE | CODE |
|--------|--------|
| SINGLE | DUPLEX |
| E | EE |
| J | JJ |
| K | KK |
| T | TT |

2-2 Sheath Diameters 316 SS

| CODE | DIAMETER (inches) |
|------|-------------------|
| 48 | 1/4 |

2-3 Measuring Junction

| CODE | DESCRIPTION |
|------|-------------|
| U | Ungrounded |

3-0 Thermowell

Select thermowell from Thermowell Section.

4-0 Element Options

| | |
|-------------------|--------------------------------------|
| SL ^[1] | Spring-loaded element |
| SC | Self-contained spring-loaded element |

[1] Not available with option 75T-642B

5-0 Head Mounting Fittings

| CODE | DESCRIPTION | CODE | DESCRIPTION |
|---------------------------------|--|---------------------------------|--|
| <i>STEEL FITTINGS</i> | | <i>316SS FITTINGS</i> | |
| 6HN | 1/2" x 1/2" NPT hex nipple 1" length | 8HN | 1/2" x 1/2" NPT hex nipple 1" length |
| 6PN ₋ | 1/2" NPT pipe nipple (specify "E" length in inches) | 8PN | 1/2" NPT pipe nipple (specify "E" length in inches) |
| 6XU ₋ ^[1] | 1/2" NPT union/nipple (specify "E" length in inches) | 8XU ₋ ^[1] | 1/2" NPT union/nipple (specify "E" length in inches) |

[1] 3 1/2" minimum length required.
 Maximum allowable "E" length is 9"

5-1 Head Terminations

| CODE | DESCRIPTION |
|-----------|---|
| 74 | DIN form B aluminum explosion-proof head, Group A |
| 75T-642B | (4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group A |
| 76T82-D10 | (4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof housing, Group A |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316L stainless steel explosion-proof head, Group A |

5-2 Options

| | |
|--------|--|
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless steel tag |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA HART® isolated head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |

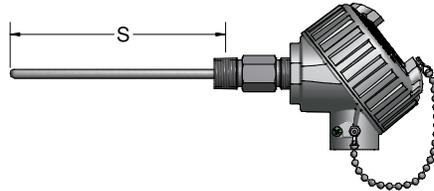
See transmitter ordering information in back of section.

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Explosion-Proof, Spring-Loaded RTDs are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependant on connection head type, meet XP Class I, Division 1, Group B, C and D; DIP Class II, Division I, Groups E, F, G and Class III, Division 1. Pyromation provides sensors for installation into your existing thermowell or provides the required thermowell as part of the assembly. Refer to the Thermowell Section of this catalog for product selection. The assemblies feature 316 stainless steel sheaths. They are available with aluminum or stainless steel explosion-proof connection heads. **Note:** The "S" dimension will measure 1/4" longer than specified when the spring is in the relaxed position. The "S" dimension is calculated when the sensor is compressed or in the installed position. This design allows 1/4" spring compression to ensure positive contact with the bottom of the thermowell.



ORDER CODES

Example Order Number:

1-0 2-0 2-1 2-2 3-0 4-0 5-0 5-1 5-2
XP - R1T185L 48 3 - 006 - FP - 8HN 93, T- Select Type and Range from back of Section

1-0 Agency Approval

| CODE | DESCRIPTION |
|------|--|
| XP | FM/CSA explosion-proof-approved assembly |

2-0 100 Ω Platinum RTD Elements $\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$

| CODE | | TOLERANCE ^[1] |
|--|---------------|--------------------------|
| LOW RANGE WIRE WOUND (-200 to 200) °C | | |
| SINGLE | DUPLEX | |
| R1T185L | R1T285L | Grade B |
| R5T185L | R5T285L | (1/5) Class B |
| LOW RANGE THIN FILM (-50 to 200) °C | | |
| RBF185L | RBF285L | Class B |
| RAF185L | RAF285L | Class A |
| HIGH RANGE WIRE WOUND (-200 to 600) °C | | |
| R1T185H | R1T285H | Grade B |
| RAT185H | RAT285H | Class A |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2-1 Sheath Diameters 316 SS

| CODE | DIAMETERS (inches) |
|------|--------------------|
| 48 | 1/4 |

2-2 Element Connection

| CODE | DESCRIPTION |
|------------------|-------------|
| 2 | 2-wire |
| 3 | 3-wire |
| 4 ^[1] | 4-wire |

[1] Not available in duplex or with 440 Series Transmitter

5-1 Head Terminations

| CODE | DESCRIPTION |
|-----------|---|
| 74 | DIN form B aluminum explosion-proof head, Group A |
| 75T-642D | (4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group B |
| 76T82-D10 | (4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof housing, Group A |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316L stainless steel explosion-proof head, Group A |

5-2 Options

| CODE | DESCRIPTION |
|--------|--|
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless steel tag |
| T-440 | (4 to 20) mA head-mounted transmitter |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA HART® isolated head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |

See transmitter ordering information in back of section.

5-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|-------------------------------------|--|
| 316 STAINLESS STEEL FITTINGS | |
| 8HN | 1/2" NPT flame-path fitting (1-1/2" "E" length) |
| 8PU4 ^[1] | 1/2" NPT union/nipple with flame-path fitting (specify "E" length in inches, maximum allowable 9") |

[1] For longer lengths replace "4" with length in inches.

4-0 Element Options

| | |
|----|---------------------------------------|
| FP | Spring-loaded element with flame path |
|----|---------------------------------------|

3-0 "S" Dimensions

Insert three digit sheath length ("S" Dimension) in inches

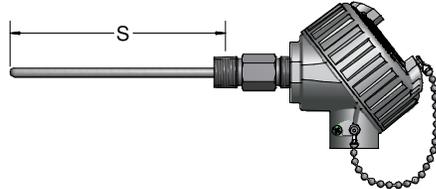
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EXPLOSION-PROOF

Configuration Code XP06 Hazardous Location Explosion-Proof-Approved , Spring-Loaded Thermocouple Assemblies - Model 70-81

Explosion-Proof, Spring-Loaded Thermocouples are made for use in U.S. and Canadian hazardous areas. They are designed to extinguish flames inside the device, eliminating the potential for ignition of flammable mixtures in the surrounding atmosphere. FM and CSA approved assemblies, dependant on connection head type, meet XP Class I, Division 1, Group B, C and D; DIP Class II, Division I, Groups E, F, G and Class III, Division 1. Pyromation provides sensors for installation into your existing thermowell or provides the required thermowell as part of the assembly. Refer to the Thermowell Section of this catalog for product selection. The assemblies feature 316 stainless steel sheaths and ungrounded isolated junctions. They are available with aluminum or stainless steel explosion-proof connection heads. **Note:** The "S" dimension will measure 1/4" longer than specified when the spring is in the relaxed position. The "S" dimension is calculated when the sensor is compressed or in the installed position. This design allows 1/4" spring compression to ensure positive contact with the bottom of the thermowell.



ORDER CODES

Example Order Number:

1-0 2-1 2-2 2-3 3-0 4-0 5-0 5-1 5-2
XP - J 48 U - 012 - FP - 8HN 94, T- Select Type and Range from back of Section

1-0 Agency Approval

| CODE | DESCRIPTION |
|------|--|
| XP | FM/CSA explosion-proof-approved assembly |

2-1 Thermocouple Types

| CODE | CODE |
|--------|--------|
| SINGLE | DUPLEX |
| E | EE |
| J | JJ |
| K | KK |
| T | TT |

2-2 Sheath Diameters 316 SS

| CODE | DIAMETER (inches) |
|------|-------------------|
| 48 | 1/4 |

2-3 Measuring Junction

| CODE | DESCRIPTION |
|------|-------------|
| U | Ungrounded |

3-0 "S" Dimensions

Insert three digit sheath length ("S" Dimension) in inches

5-1 Head Terminations

| CODE | DESCRIPTION |
|-----------|---|
| 74 | DIN form B aluminum explosion-proof head, Group A |
| 75T-642D | (4 to 20) mA HART® Field Transmitter with aluminum explosion-proof housing, Group B |
| 76T82-D10 | (4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof housing, Group A |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316L stainless steel explosion-proof head, Group A |

5-2 Options

| | |
|--|--|
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless steel tag |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA HART® isolated head-mounted transmitter |
| T82-00 | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |
| See transmitter ordering information in back of section. | |

5-0 Head Mounting Fittings

| CODE | DESCRIPTION |
|---|--|
| 316 STAINLESS STEEL FITTINGS | |
| 8HN | 1/2" NPT flame-path fitting (1-1/2" "E" length) |
| 8PU4 ⁽¹⁾ | 1/2" NPT union/nipple with flame-path fitting (specify "E" length in inches, maximum allowable 9") |
| [1] For longer lengths replace "4" with length in inches. | |

4-0 Element Options

| | |
|----|---------------------------------------|
| FP | Spring-loaded element with flame path |
|----|---------------------------------------|

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ORDER CODES

Example Order Number: ¹⁻⁰ **75T-642B** - ¹⁻¹ **D** - ¹⁻² **3** ¹⁻³ **85** ¹⁻⁴ **U** - ¹⁻⁵ **S(0-200)** ¹⁻⁶ **C**

1-0 Transmitter Type

| CODE | DESCRIPTION |
|---|--|
| 440 ^[1] | (4 to 20) mA programmable head-mounted RTD transmitter |
| 441 | (4 to 20) mA programmable head-mounted universal transmitter |
| 442 | (4 to 20) mA HART® programmable head-mounted universal transmitter |
| 75T-642B | (4 to 20) mA HART® Field Transmitter with explosion-proof aluminum housing FM/CSA Class I, Div I, Groups A,B,C,D; Class II, Groups E,F,G: Class III |
| 75T-642D | (4 to 20) mA HART® Field Transmitter with explosion-proof aluminum housing FM/CSA Class I, Div I, Groups B,C,D; Class II, Groups E,F,G: Class III |
| 76T82-D10 ^[1] | (4 to 20) mA HART® Transmitter with digital display and explosion-proof aluminum housing FM/CSA, NI, IS, XP, DIP Class I/Div I and Div II, Groups A,B,C, and D |
| T82-00 ^[2] | (4 to 20) mA dual input, isolated HART® head-mounted transmitter |
| [1] Only available with 2- or 3-wire input connection and Pt100 sensor type | |
| [2] See transmitter section for ordering information | |

1-1 Options (For 642 Series only)

| CODE | DESCRIPTION |
|---------------------------------------|----------------------------------|
| T | Solid cover |
| D | Glass cover with digital display |
| Leave blank if using 440, 441, or 442 | |

1-2 Input Type

| CODE | DESCRIPTION |
|---|-------------------|
| 00 ^[1] | Unconfigured |
| 1 | Thermocouple (TC) |
| 2 | RTD (2-wire) |
| 3 | RTD (3-wire) |
| 4 | RTD (4-wire) |
| [1] Default setting supplied as 3-wire Pt100 (0-100) °C | |

1-6 Unit of Measure

| CODE | DESCRIPTION |
|------|-------------|
| C | Celsius |
| F | Fahrenheit |

1-5 Range

| CODE | DESCRIPTION |
|------|-----------------------------|
| S | (lower limit – upper limit) |

1-4 Failure Mode

| CODE | DESCRIPTION |
|------|----------------------------|
| U | Upscale burnout ≥ 20.5 mA |
| D | Downscale burnout ≤ 3.8 mA |

1-3 Sensor Type

| CODE | DESCRIPTION |
|------|---|
| J | Type J thermocouple |
| K | Type K thermocouple |
| T | Type T thermocouple |
| N | Type N thermocouple |
| E | Type E thermocouple |
| 85 | 100 ohm platinum ($\alpha = 0.003\ 85\ ^\circ\text{C}$) |

For complete transmitter specifications see Transmitter Section.

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| <p><i>Complete Transmitter Specifications are located in Transmitter Section.</i></p> <p><i>Complete Connection Head Specifications are located in the Accessories Section.</i></p> | | | | Connection Heads | | | |
|---|---|---------------------------------|---|---|--|---|---|
| | | | | 74 | 75 | 93 | 94 |
| | | | |  |  |  |  |
| | | | | DIN form B Aluminum Explosion-Proof Head, Group A | Aluminum Explosion-Proof Field Transmitter Housing, Group A | Aluminum Explosion-Proof Head, Group B | 316L Stainless Steel Explosion-Proof Head, Group A |
| Temperature Transmitters | | | | | | | |
| T-440 |  | Input: Pt100 RTD Only | Programmable head-mounted transmitter, (4 to 20) mA analog output | | | | X |
| T-441 |  | Input: Thermocouple, RTD, Other | Programmable head-mounted transmitter, isolated, (4 to 20) mA analog output | X | | X | |
| T-442 |  | Input: Thermocouple, RTD, Other | Programmable head-mounted transmitter, isolated, HART® protocol, (4 to 20) mA analog output | X | | X | |
| T82-00 |  | Input: Thermocouple, RTD, Other | (4 to 20) mA dual input, isolated HART® head-mounted transmitter | X | | X | X |
| T-642 |  | Input: Thermocouple, RTD, Other | Programmable field transmitter, isolated, HART® protocol, (4 to 20) mA analog output | | X | | |
| T-642 w/ display |  | Input: Thermocouple, RTD, Other | Programmable field transmitter, isolated, HART® protocol, (4 to 20) mA analog output with digital display | | X | | |
| 76T82-D10 |  | Input: Thermocouple, RTD, Other | (4 to 20) mA dual input HART® Field Transmitter with digital display and explosion-proof housing, Group A | Unit includes housing and transmitter. | | | |

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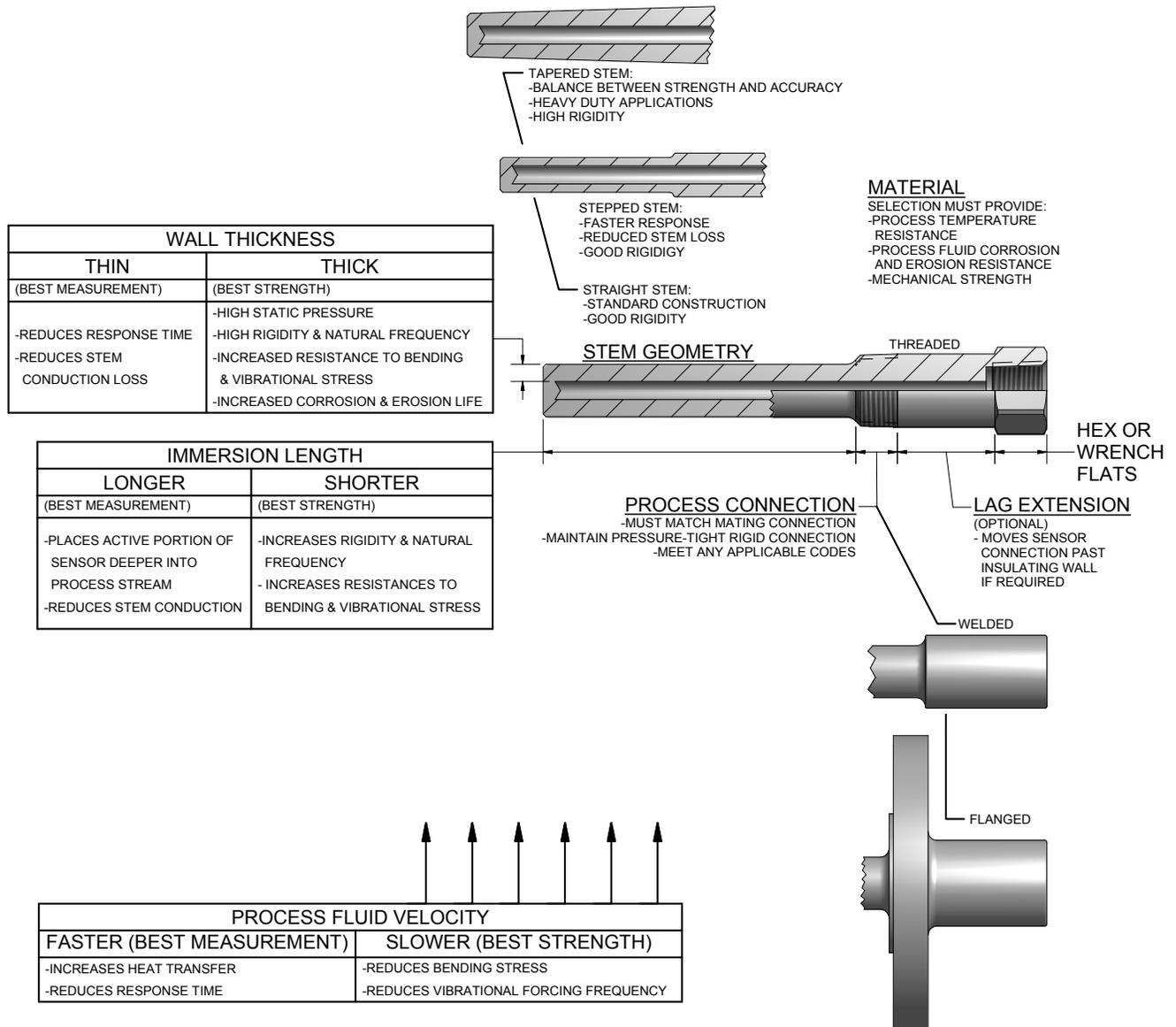
| Classes | Groups | Divisions | |
|---|---|--|--|
| | | 1 | 2 |
| Class I | Examples | | |
| Location in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. | Group A: Acetylene Group B: Hydrogen Group C: Ethylene Group D: Propane, fuels, solvents | Locations where hazardous material exists under normal operating conditions or through breakdown or repair. | Locations where hazardous materials are expected to be confined within closed containers of closed systems but may become present through a leak or process failure. |
| Class II | Examples | | |
| Locations that are hazardous because of the presence of combustible dust. | E: Metal dusts F: Carbon dust G: Combustible dust, flour, grain, wood, plastic, chemicals | Combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures or through breakdown or repair. | Combustible dust may be in the air in sufficient quantities to produce an explosion due to abnormal operations or failure of electrical equipment. |
| Class III | | | |
| Locations that are hazardous because of the presence of easily ignitable fibers or flyings, but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. | There are no defined groups. Examples are textiles, woodworking, paper fibers. | Easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used. | Easily ignitable fibers are stored or handled other than in the process of manufacture. |

| Methods of Protection | | | |
|---|---|---|--|
| Explosionproof (XP) Class I, Division 1, 2 | Dust-Ignitionproof (DIP) Class II, Division 1, 2 | Intrinsically Safe (IS) Class I, Division 1, 2 Class II, Division 1, 2 Class III, Division 1, 2 | Nonincendive (NI) Class I, Division 2 Class II, Division 2 Class III, Division 1, 2 |
| Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby. | Equipment enclosed in a manner that excludes dust and does not permit arcs, sparks, or heat otherwise generated or liberated inside of the enclosure to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure. | Equipment not capable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific flammable or combustible atmospheric mixture in its most easily ignitable concentration. | Equipment having electrical circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas-air, vapor-air, or dust-air mixture due to arcing or thermal means. |

This material is for reference only. Refer to *The NEC® 2005 Handbook, NFPA 70: National Electrical Code® International Electrical Code® Series* (Quincy, MA, 2005) for authoritative and complete documentation.

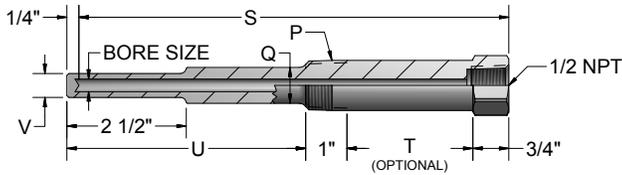
A thermowell is a pressure-tight receptacle that protects and extends the life of a temperature sensor in processing applications where the sensor is not mechanically or chemically compatible with the process environment. Installed directly into the piping systems, thermowells facilitate sensor replacement in high-pressure pipelines and eliminate the need to interrupt the process flow or drain the process system for sensor maintenance functions. The use of standardized thermowells permits simple relocation of sensors throughout a plant.

Strength versus accurate and fast temperature measurement is a balancing act. The factors which tend to produce high strength also tend to reduce the temperature sensor's accuracy and speed of response. A properly selected thermowell will balance these opposing factors to produce a design capable of functioning satisfactorily in the intended application. The listed factors are a general guide and are not all inclusive. Refer to ASME PTC 19.3 TW for a more authoritative dissertation on proper thermowell selection.

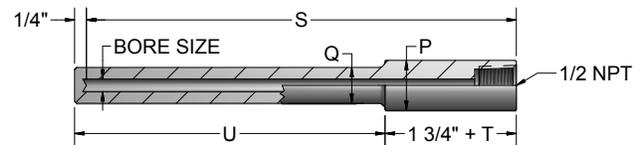


The drilled thermowells listed below are those most commonly found in process applications. Other types and styles are listed later in this section. The thermowells listed below are available as separate component wells and can be ordered by the code numbers listed below. They can also be ordered as a part of a complete sensor assembly. Consult factory for wells with different mounting threads, lengths, and materials.

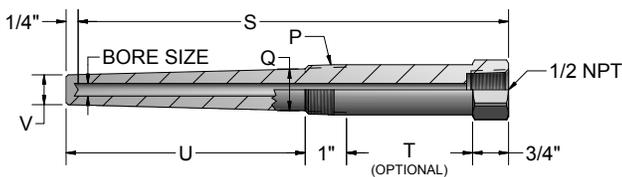
STANDARD-DUTY WELLS



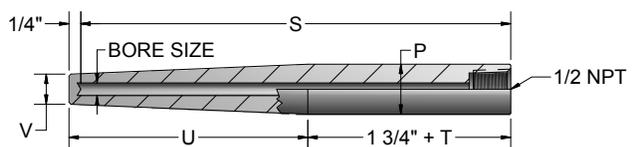
STRAIGHT-SHANK, SOCKET-WELD



HEAVY-DUTY WELLS



WELD-IN WELLS



ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6
S 4 D 06 08 T2 S

1-0 Well Type

| CODE | DESCRIPTION |
|------|------------------------------|
| S | Standard-duty threaded (NPT) |
| H | Heavy-duty threaded (NPT) |
| SW | Straight-shank, socket-weld |
| WI | Weld-in |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|-----------------|
| 4 | 0.260 Dia. Bore |

1-2 Pipe Size "P"

| CODE | DESCRIPTION |
|------|--------------------------|
| C | 1/2" Pipe ^[1] |
| D | 3/4" Pipe |
| E | 1" Pipe |

[1] Only available with well type S or H

1-3 Length Dimensions (inches)

| CODE | "S" DIMENSIONS | "U" DIMENSIONS | |
|------|----------------|----------------|-------------------|
| | | NO LAG | WITH STANDARD LAG |
| 04 | 4 | 2(1/2) | N/A |
| 06 | 6 | 4(1/2) | 2(1/2) |
| 09 | 9 | 7(1/2) | 4(1/2) |
| 12 | 12 | 10(1/2) | 7(1/2) |
| 15 | 15 | 13(1/2) | 10(1/2) |
| 18 | 18 | 16(1/2) | 13(1/2) |
| 24 | 24 | 22(1/2) | 19(1/2) |

1-6 Well Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Customer specified part number marked on the thermowell - (10 digit maximum) |

1-5 Optional "T" Lag Dimension

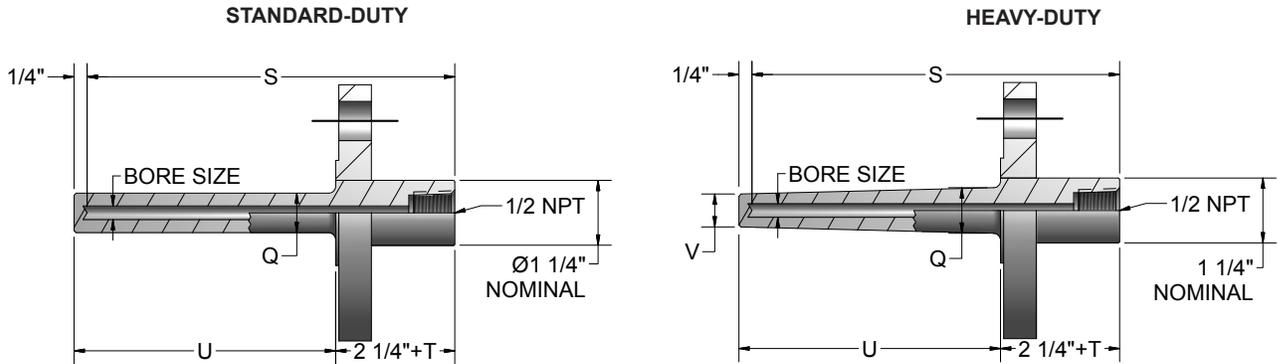
| CODE | DESCRIPTION |
|-----------------------------------|---|
| Leave blank if No Lag is required | |
| T2 | 2" Lag standard on 6" well |
| T3 | 3" Lag standard on 9, 12, 15, 18, 24" wells |
| T__ | Special Lag specify "T" dimension in inches |

1-4 Material

| CODE | DESCRIPTION |
|------|---------------------|
| 8 | 316 stainless steel |
| 9 | 304 stainless steel |

The flanged thermowells described on this page are those commonly found in most process applications. These wells are supplied as standard- or heavy-duty with raised-faced flanges. Other types and styles are listed later in this section. Consult factory for wells with different flange sides, lengths, and materials.

FLANGED THERMOWELLS



ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6 1-7 1-8
SF 4 15 R 3 12 08 T2 C8

1-0 Well Type

| CODE | DESCRIPTION |
|------|-----------------------|
| SF | Standard-duty flanged |
| HF | Heavy-duty flanged |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|-------------|
| 4 | 0.260 Bore |

1-2 Flange Size

| CODE | DESCRIPTION |
|------|-------------|
| 10 | 1" |
| 15 | 1 1/2" |
| 20 | 2" |

1-3 Flange Type

| CODE | DESCRIPTION |
|------|-------------|
| R | Raised face |

1-4 Pressure Rating

| CODE | DESCRIPTION |
|------|-------------|
| 1 | 150 class |
| 3 | 300 class |

1-8 Well Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Customer specified part number marked on thermowell (10 digit maximum) |

1-7 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

1-6 Well Material

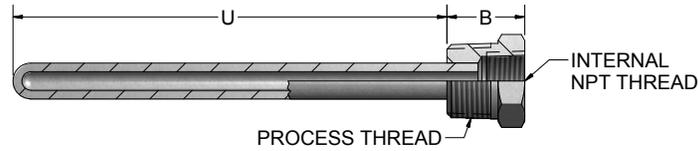
| CODE | DESCRIPTION |
|------|---------------------|
| 08 | 316 Stainless steel |
| 09 | 304 Stainless steel |

1-5 Well Length (inches)

| CODE | DESCRIPTION | |
|------|---------------|---------------|
| | "S" DIMENSION | "U" DIMENSION |
| 06 | 6 | 4 |
| 09 | 9 | 7 |
| 12 | 12 | 10 |
| 15 | 15 | 13 |
| 18 | 18 | 16 |
| 24 | 24 | 22 |

ORDER CODES

Built-Up Protection Wells are small diameter general-purpose wells for use in low temperature, low pressure, and low fluid velocity applications. Built-Up Protection Wells are constructed by welding or brazing bushings onto tubing. Built-Up Protection Wells of all stainless steel construction have welded-on bushings. Built-Up Protection Wells with brass bushings have brazed-on bushings.



Example Order Number:

26 - 48 - 06 - 803

1 Well Size and Material

| CODE | TUBE (inches) | | MATERIAL |
|------|---------------------------|-------|----------|
| | O.D. | I.D. | |
| 48 | 0.250 | 0.194 | 316 SS |
| 58 | 0.313 | 0.257 | 316 SS |
| 88 | 0.500 | 0.260 | 316 SS |
| Z | Special (Consult factory) | | |

2 Well 'U' Dimensions

Insert (2) digit 'U' length in inches.
 EXAMPLES: 06 = 6" U Dim. 02 (1/2) = 2(1/2)" U Dim.

3 Mounting Bushing Material - Dimensions

| CODE | BRASS | 316 SS | BUSHING THREADS (inches) | | BUSHING 'B' DIM. (inches) |
|---------------------|--------------------|--------|--------------------------|------|---------------------------|
| | | | EXT. | INT. | |
| 2201 ^[1] | 801 ^[1] | | 1/4 | 1/8 | 3/4 |
| 2202 | 802 | | 3/8 | 1/8 | 3/4 |
| 2203 | 803 | | 3/8 | 1/4 | 3/4 |
| 2204 | 804 | | 1/2 | 1/8 | 15/16 |
| 2205 | 805 | | 1/2 | 1/4 | 15/16 |
| 2206 | 806 | | 1/2 | 3/8 | 15/16 |
| 2207 | 807 | | 1/2 | 1/2 | 1 1/2 |
| 2208 | 808 | | 3/4 | 1/8 | 1 |
| 2209 | 809 | | 3/4 | 1/4 | 1 |
| 2210 | 810 | | 3/4 | 3/8 | 1 |
| 2211 | 811 | | 3/4 | 1/2 | 1 |

[1] Not available with 1/2" O.D. wells

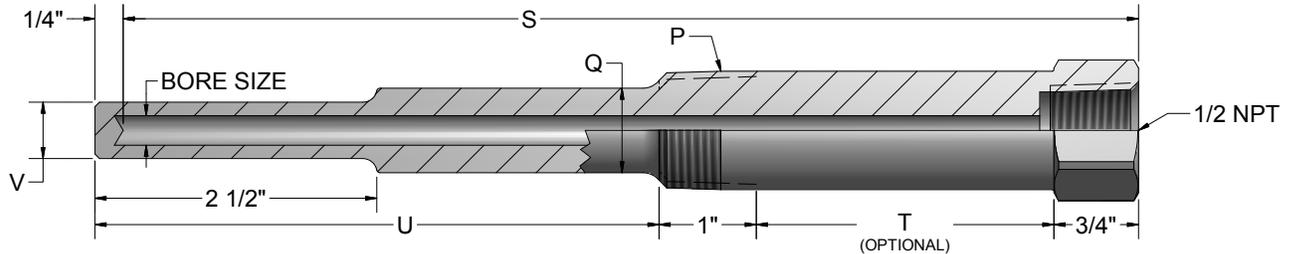
| Code | Description | UNS Number | Trade Names |
|--|----------------------|------------|---------------|
| 03 | Alloy 600 | N06600 | Inconel® |
| 04 | 310 SS | S31000 | |
| 05 | 446 SS | S44600 | |
| 07 | Alloy 601 | N06601 | Inconel® |
| 08 | 316 SS/316 L | S31603 | |
| 09 | 304 SS/304 L | S30403 | |
| 22 | Brass ^[1] | | |
| 27 | Alloy 400 | N04400 | Monel® |
| 28 | Alloy B-3 | N10675 | Hastelloy® |
| 29 | Alloy C-276 | N10276 | Hastelloy® |
| 31 | Nickel 200 | N02200 | |
| 35 | 321 SS | S32100 | |
| 36 | 347 SS | S34700 | |
| 37 | Alloy 800 | N08800 | Incoloy® |
| 38 | Alloy 20 | N08020 | Carpenter |
| 41 | HR-160 | N12160 | Haynes® |
| 50 | Zirconium | R60702 | |
| 51 | Alloy X | | Hastelloy® |
| 56 | Fluoropolymer | | Fluoropolymer |
| 59 | F22 | K21590 | |
| 60 | F11 | K11572 | |
| 61 | A105 | K03504 | |
| 91 | F91 | K90901 | |
| [1] Materials available in various alloys - Consult factory. | | | |

Incoloy®, Monel® and Inconel® are registered trademarks of Special Metals Corporation.
Haynes® and Hastelloy® are registered trademarks of Haynes International, Inc.

The following options are available on Pyromation thermowells. Please contact our sales department for information and current pricing.

| Documentation/Testing | |
|---|--|
| Certificate of Compliance | C of C |
| Hydrostatic Test (Internal or External) | ASTM E1003 Compliant |
| Liquid Dye Penetrant Test | ASTM E165 Compliant |
| Material Test Reports | MTR |
| NACE | NACE Certification available for applicable materials. (Barstock thermowells meet this specification. Flanged thermowells can be heat treated to comply.) |
| Positive Material Identification (PMI) | X-Ray Fluorescence Spectrometry |
| Surface Roughness Test | ASME B46.1 |
| Wake Frequency Calculation | ASME PTC 19.3 TW |
| Weld X-Ray Inspection | Call for Pricing |
| Services | |
| Expedited Delivery | Call for Pricing |
| Oxygen cleaning | ASTM G93 Compliant (when specified) |
| Stamping | 10 Characters Maximum |
| Full-Penetration Weld | Performed by welders certified to ASME Section IX, Boiler and Pressure Vessel Code |
| Components/Coatings | |
| Abrasive Coatings | Call for Pricing |
| Plug and Chain - Brass | Call for Pricing |
| Plug and Chain - Stainless Steel | Call for Pricing |
| Ring-Joint Flange | Call for Pricing |
| Tantalum Jacket | Call for Pricing |
| FEP Coating | Call for Pricing |
| Industry Specifications | |
| Canadian Registration Numbers (CRN) | ASME B31.3 Process Piping |
| Flanged Thermowells | ASME B16.5 prior to fabrication |
| Heat Treating | Stress relief, annealing, and custom heat treating available upon request. |
| Material | ASTM Compliance and other applicable National Standards |
| Pipe Threads | ASME B1.20.1 |
| Sanitary Thermowells | 3-A Sanitary Council Standard. Authorization Number: 487 32 μ m R _a Food Grade Surface Finish |
| Manufacturing Tolerances and Maximums | |
| "S" Length Maximum | 32" maximum for standard drilled thermowells. For over 32" or for multi-piece construction, consult factory. |
| Bore "Bottom" Shape | "W" (nominal) |
| Bore Concentricity | ± 10% of minimum wall thickness |
| Bore Depth | ±0.020" (through 32.00") |
| Bore Diameter | +0.005" / -0.003" (bore sizes 0.125" through 0.406" I.D.) |
| Insertion Length | Lengths up to 22.50" ± 0.0625". Lengths from 22.50" through 48" ±0.125". Lengths over 48" ±0.25". |
| Stem Outside Diameter | ±0.010" |
| Tapered Allowance | Maximum tapered length is 16.00". "U" dimensions greater than 16.00" in length are manufactured with a straight O.D. beginning below the process connection radius and following throughout with only the last 16.00" of "U" dimension tapered to minor O.D. |
| Surface Finish | 32 μ m R _a standard |
| Internal Threads | 1/2"-14 - NPT per ANSI B1.20.1 (1 to 3 turns deep per UL 866 and CSA C22.2 No. 30-M1986) |
| Marking | Standard marking includes material grade, material traceability codes, and CRN when applicable on drilled barstock and flanged thermowells |

Standard-Duty, Threaded Thermowells are available in a variety of materials, process connection sizes, lengths, and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The stepped construction is used in standard-duty applications and increases the speed of response while maintaining mechanical strength. These thermowells are designed with standard 0.260" bore diameters to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



Wells are made from round bar with milled wrench hex. 1 1/4" NPT and 1 1/2" NPT wells are supplied as round bar with milled wrench flats.

("U" length for non-lagging wells) = "S" - 1 1/2"
 ("U" length for lagging wells) = "S" - 1 1/2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 1 1/2" (When "U" and "S" are specified)

Thermowell Dimensions

| "P" | "Q" | "V" |
|------------|-------------|-----------|
| 1/2" NPT | 5/8" Dia. | 1/2" Dia. |
| 3/4" NPT | 3/4" Dia. | 1/2" Dia. |
| 1" NPT | 7/8" Dia. | 1/2" Dia. |
| 1 1/4" NPT | 1 1/4" Dia. | 7/8" Dia. |
| 1 1/2" NPT | 1 1/2" Dia. | 7/8" Dia. |

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6
S 4 D 06 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|------------------------|
| S | Standard-duty threaded |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |

1-2 Pipe Size "P"

| CODE | DESCRIPTION |
|------|-------------|
| C | 1/2" NPT |
| D | 3/4" NPT |
| E | 1" NPT |
| F | 1 1/4" NPT |
| G | 1 1/2" NPT |

1-6 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-5 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

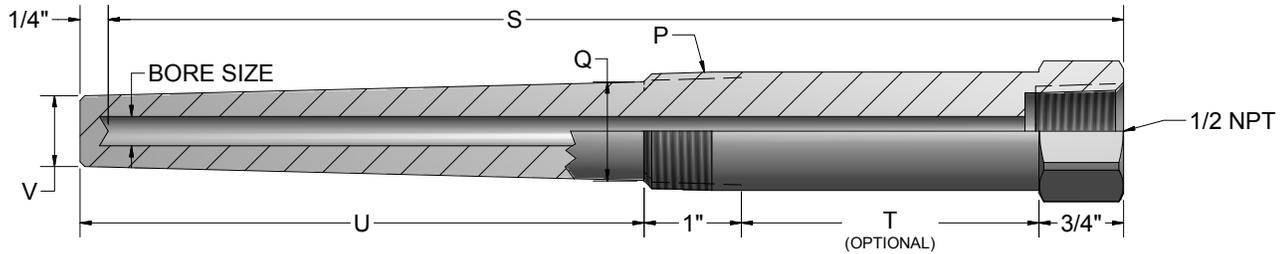
1-4 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-3 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

Heavy-Duty, Threaded Thermowells are available in a variety of materials, process connection sizes, lengths and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with either a 0.252" or 0.377" maximum diameter, respectively. The tapered design is suited for heavy-duty applications where greater rigidity is required for increased pressure and flow due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Thermowell Dimensions

| "P" | "Q" | "V" (0.260") | "V" (0.385") |
|------------|--------------|--------------|--------------|
| 1/2" NPT | 11/16" Dia. | 5/8" Dia. | N/A |
| 3/4" NPT | 7/8" Dia. | 5/8" Dia. | 49/64" Dia. |
| 1" NPT | 1 1/16" Dia. | 5/8" Dia. | 49/64" Dia. |
| 1 1/4" NPT | 1 3/8" Dia. | 7/8" Dia. | 7/8" Dia. |
| 1 1/2" NPT | 1 5/8" Dia. | 1" Dia. | 1" Dia. |

Wells are made from round bar with milled wrench hex. 1 1/4" NPT and 1 1/2" NPT wells are supplied as round bar with milled wrench flats.

("U" length for non-lagging wells) = "S" - 1 1/2"

("U" length for lagging wells) = "S" - 1 1/2" - "T"

(To solve for "T"), "T" = "S" - "U" - 1 1/2" (When "U" and "S" are specified)

Maximum tapered length is 16"

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6
H 4 D 06 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|---------------------|
| H | Heavy-duty threaded |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |
| 6 | 0.385" Dia. bore |

1-2 Pipe Size "P"

| CODE | DESCRIPTION |
|------------------|-------------|
| C ^[1] | 1/2" NPT |
| D | 3/4" NPT |
| E | 1" NPT |
| F | 1 1/4" NPT |
| G | 1 1/2" NPT |

^[1]Not available with 0.385" Dia. Bore

1-6 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-5 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

1-4 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

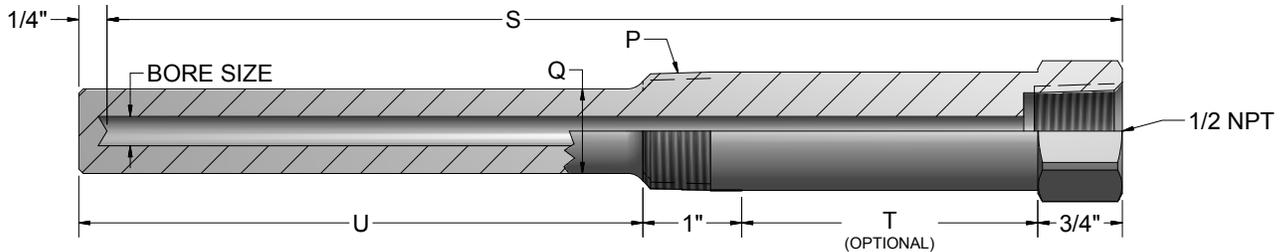
1-3 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

THERMOWELLS

Straight-Shank, Threaded Thermowells

Straight-Shank, Threaded Thermowells are available in a variety of materials, process connection sizes, lengths, and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with either a 0.252" or 0.377" maximum diameter, respectively. These wells are available as separate components or as part of complete sensor assemblies.



Wells are made from round bar with milled wrench hex. 1 1/4" NPT and 1 1/2" NPT wells are supplied as round bar with milled wrench flats.

("U" length for non-lagging wells) = "S" - 1 1/2"

("U" length for lagging wells) = "S" - 1 1/2" - "T"

(To solve for "T"), "T" = "S" - "U" - 1 1/2" (When "U" and "S" are specified)

Thermowell Dimensions

| "P" | "Q" |
|------------|-------------|
| 1/2" NPT | 5/8" Dia. |
| 3/4" NPT | 3/4" Dia. |
| 1" NPT | 7/8" Dia. |
| 1 1/4" NPT | 1 1/4" Dia. |
| 1 1/2" NPT | 1 1/2" Dia. |

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6
ST 4 D 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|-------------------------|
| ST | Straight-shank threaded |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260 Dia. bore |
| 6 | 0.385" Dia. bore |

1-2 Pipe Size "P"

| CODE | DESCRIPTION |
|------|-------------|
| C | 1/2" NPT |
| D | 3/4" NPT |
| E | 1" NPT |
| F | 1 1/4" NPT |
| G | 1 1/2" NPT |

1-6 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-5 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

1-4 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-3 "S" Length

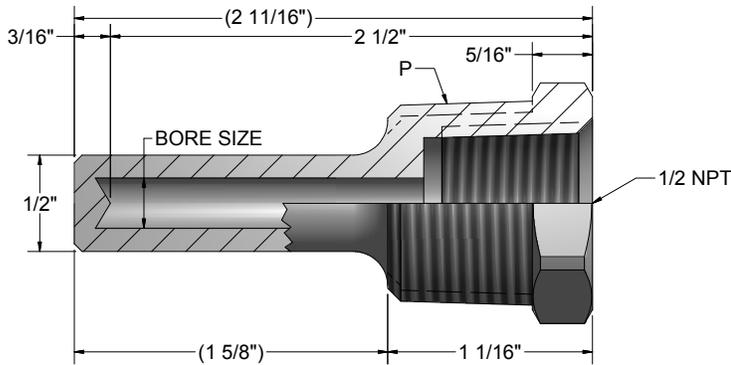
| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |



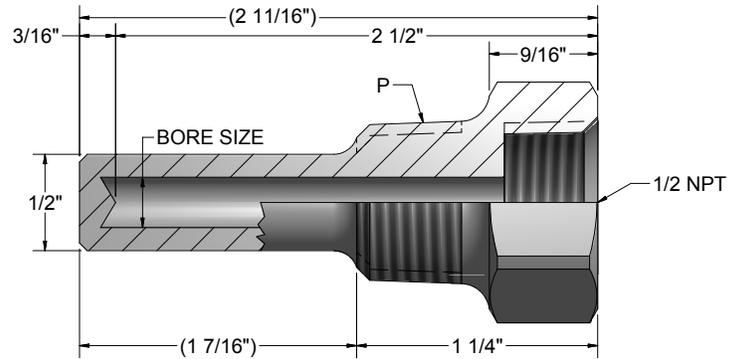
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Limited-Space Thermowells are available in a variety of materials and process connection sizes. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. They are intended for use in piping systems where space is limited. They are designed with a standard 0.260" bore diameter to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.

3/4" and 1" NPT



1/2" NPT



ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4
LS 4 D 2.5 08 C8

1-0 Well Type

| CODE | DESCRIPTION |
|------|------------------------|
| LS | Limited-space threaded |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |

1-2 Pipe Size "P"

| CODE | DESCRIPTION |
|------|-------------|
| C | 1/2" NPT |
| D | 3/4" NPT |
| E | 1" NPT |

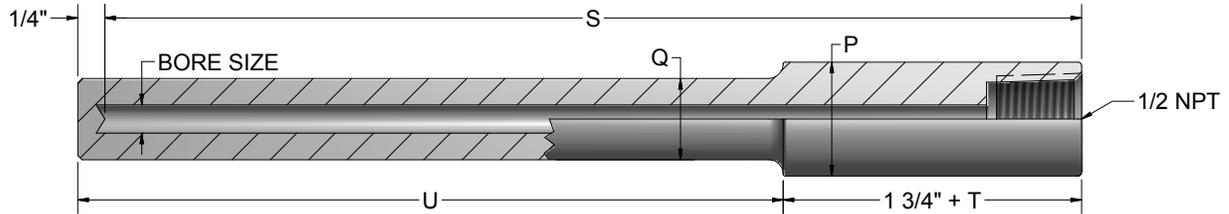
1-4 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-3 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

Straight-Shank, Socket-Weld Thermowells are available in a variety of materials, process connection sizes, lengths, and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The Straight-Shank Socket-Weld is designed to be used with a 3000 class weld-o-let which allows the thermowell to be welded permanently into the process. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with either a 0.252" or 0.377" maximum diameter, respectively. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" - 1 1/2"
 ("U" length for lagging wells) = "S" - 1 1/2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 1 1/2" (When "U" and "S" are specified)

Thermowell Dimensions

| "P" PIPE SIZE | | "Q" |
|---------------|--------|-------------|
| NOM. | DIA. | |
| 3/4" | 1.050" | 3/4" Dia. |
| 1" | 1.315" | 7/8" Dia. |
| 1 1/4" | 1.660" | 1 1/4" Dia. |
| 1 1/2" | 1.900" | 1 1/2" Dia. |

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6
SW 4 D 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|-----------------------------|
| SW | Straight- shank socket-weld |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |
| 6 | 0.385" Dia. bore |

1-2 Pipe Size "P"

| CODE | DESCRIPTION |
|------|-------------|
| D | 3/4" NPS |
| E | 1" NPS |
| F | 1 1/4" NPS |
| G | 1 1/2" NPS |

1-6 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-5 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

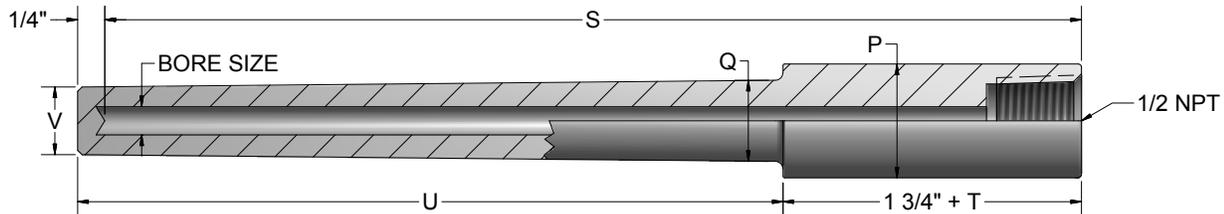
1-4 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-3 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

Heavy-Duty, Socket-Weld Thermowells are available in a variety of materials, process connection sizes, lengths and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The Heavy-Duty Socket-Weld is designed to be used with a 3000 class weld-o-let which allows the thermowell to be welded permanently into the process. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. The tapered design is suited for heavy-duty applications where greater rigidity is required due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Thermowell Dimensions

| "P" PIPE SIZE | | "Q" | "V" 0.260 | "V" 0.385 |
|---------------|--------|-------------|--------------|--------------|
| NOM. | DIA. | | | |
| 3/4" | 1.050" | 3/4" Dia. | 5/8" Dia. | 5/8" Dia. |
| 1" | 1.315" | 7/8" Dia. | 5/8" Dia. | 49/64" Dia. |
| 1 1/4" | 1.660" | 1 1/4" Dia. | 7/8" Dia. | 7/8" Dia. |
| 1 1/2" | 1.900" | 1 1/2" Dia. | 7/8" Dia. | 7/8" Dia. |

("U" length for non-lagging wells) = "S" - 1 1/2"

("U" length for lagging wells) = "S" - 1 1/2" - "T"

(To solve for "T"), "T" = "S" - "U" - 1 1/2" (When "U" and "S" are specified)

ORDER CODES

Example Order Number: **HW 4 D 09 08 T2 C8S**

1-0 Well Type

| CODE | DESCRIPTION |
|------|------------------------|
| HW | Heavy-duty socket-weld |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |
| 6 | 0.385" Dia. bore |

1-2 Pipe Size "P"

| CODE | DESCRIPTION |
|------|-------------|
| D | 3/4" NPS |
| E | 1" NPS |
| F | 1 1/4" NPS |
| G | 1 1/2" NPS |

1-6 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-5 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

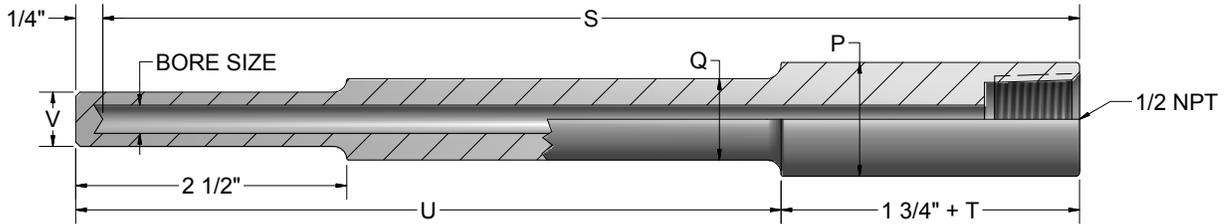
1-4 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-3 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

Reduced-Tip, Socket-Weld Thermowells are available in a variety of materials, process connection sizes, lengths, and optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The Reduced-Tip Socket-Weld is designed to be used with a class 3000 weld-o-let which allows the thermowell to be welded permanently into the process. The stepped construction is used in standard-duty applications and increases the speed of response while maintaining mechanical strength. They are designed with standard 0.260" bore diameters to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" - 1 1/2"
 ("U" length for lagging wells) = "S" - 1 1/2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 1 1/2" (When "U" and "S" are specified)

Thermowell Dimensions

| "P" PIPE SIZE | | "Q" | "V" |
|---------------|--------|-------------|-----------|
| NOM. | DIA. | | |
| 3/4" | 1.050" | 3/4" Dia. | 1/2" Dia. |
| 1" | 1.315" | 7/8" Dia. | 1/2" Dia. |
| 1 1/4" | 1.660" | 1 1/4" Dia. | 7/8" Dia. |
| 1 1/2" | 1.900" | 1 1/2" Dia. | 7/8" Dia. |

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6
RW 4 D 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|-------------------------|
| RW | Reduced-tip socket-weld |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |

1-2 Pipe Size "P"

| CODE | DESCRIPTION |
|------|-------------|
| D | 3/4" NPS |
| E | 1" NPS |
| F | 1 1/4" NPS |
| G | 1 1/2" NPS |

1-6 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-5 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

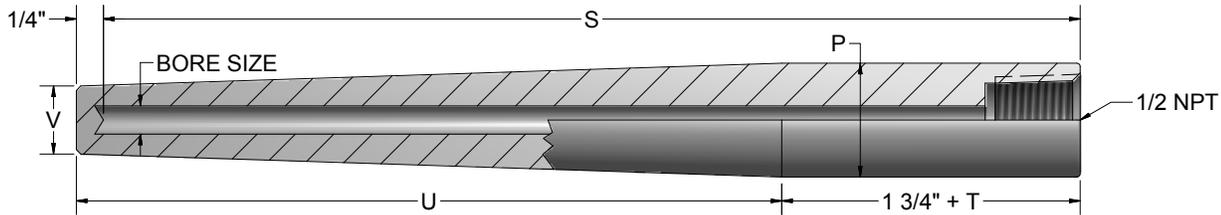
1-4 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-3 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

Weld-In Thermowells are available in a variety of materials, process connection sizes, lengths and optional lagging extensions. Thermowell specifications should be based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Weld-In thermowells are welded directly into the process apparatus. They are designed with a standard 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. The tapered design is suited for heavy-duty applications where greater rigidity is required due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Thermowell Dimensions

| "P" PIPE SIZE | | "V" (0.260") | "V" (0.385") |
|---------------|--------|-----------------|-----------------|
| NOM. | DIA. | | |
| 3/4" | 1.050" | 5/8" Dia. | 49/64" Dia. |
| 1" | 1.315" | 49/64" Dia. | 49/64" Dia. |
| 1 1/4" | 1.660" | 1" Dia. | 1" Dia. |
| 1 1/2" | 1.900" | 1 1/8" Dia. | 1 1/8" Dia. |

("U" length for non-lagging wells) = "S" - 1 1/2"
 ("U" length for lagging wells) = "S" - 1 1/2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 1 1/2" (When "U" and "S" are specified)

ORDER CODES

Example Order Number: **WI 4 D 09 08 T2 C8S**

1-0 Well Type

| CODE | DESCRIPTION |
|------|-------------|
| WI | Weld-In |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |
| 6 | 0.385" Dia. bore |

1-2 Pipe Size "P"

| CODE | DESCRIPTION |
|------|-------------|
| D | 3/4" NPS |
| E | 1" NPS |
| F | 1 1/4" NPS |
| G | 1 1/2" NPS |

1-6 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-5 "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

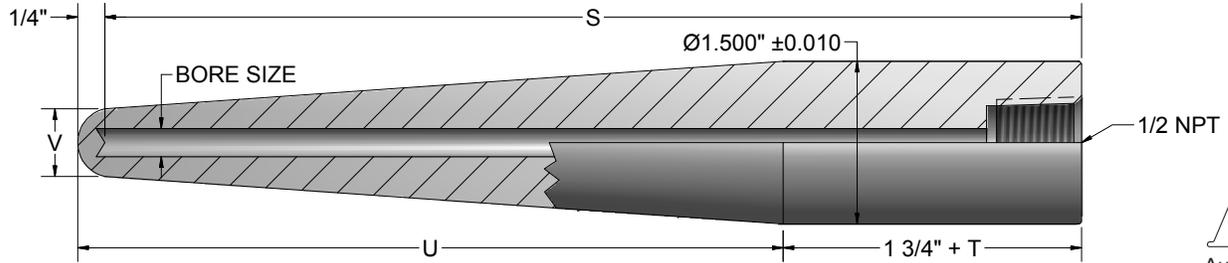
1-4 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-3 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

Sanitary, Weld-In Thermowells are offered in 304 and 316 stainless steel. They are available in a variety of lengths, process connection sizes, and optional lagging extensions. This type of thermowell is designed to be welded into a tank or vat with a full crevice-free fillet-weld to prevent corrosion, bacteria growth, and product contamination. Thermowells are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. These thermowells are designed with standard 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. These wells are available as separate components or as part of complete sensor assemblies.



Thermowell Dimensions

| BORE SIZE | "V" |
|-------------|-------------|
| 0.260" Dia. | 5/8" Dia. |
| 0.385" Dia. | 49/64" Dia. |

("U" length for non-lagging wells) = "S" - 1 1/2"
 ("U" length for lagging wells) = "S" - 1 1/2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 1 1/2" (When "U" and "S" are specified)

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6
WS 4 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|------------------|
| WS | Sanitary weld-in |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|-----------------|
| 4 | 0.260 Dia. bore |
| 6 | 0.385 Dia. bore |

1-2 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

1-5 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

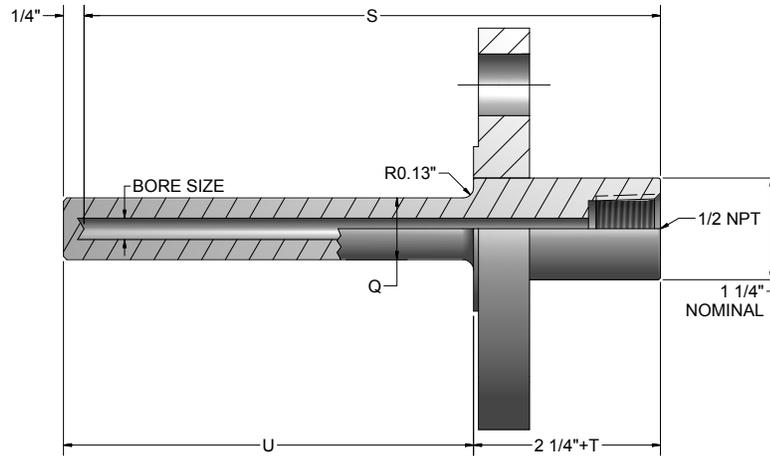
1-4 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

1-3 Material

| CODE | DESCRIPTION |
|------|---------------------|
| 08 | 316 stainless steel |
| 09 | 304 stainless steel |

Standard Flanged Thermowells are available in a variety of materials, flange types, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Standard flanged thermowells are supplied with a straight shank and are designed with a 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377 maximum diameter, respectively. These wells are available as separate components or as part of complete sensor assemblies.



Thermowell Dimensions

| BORE | "Q" Dim. |
|-------|----------|
| 0.260 | 3/4" |
| 0.385 | 7/8" |

("U" length for non-lagging wells) = "S" - 2"
 ("U" length for lagging wells) = "S" - 2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 2" (When "U" and "S" are specified)

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6 1-7 1-8
SF 4 15 R 1 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|------------------|
| SF | Standard flanged |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |
| 6 | 0.385" Dia. bore |

1-2 Flange Size

| CODE | DESCRIPTION |
|------|----------------|
| 10 | 1" (DN 25) |
| 13 | 1 1/4" (DN 32) |
| 15 | 1 1/2" (DN 40) |
| 20 | 2" (DN 50) |
| 30 | 3" (DN 80) |

1-3 Flange Type

| CODE | DESCRIPTION |
|------|-------------|
| F | Flat face |
| J | Ring joint |
| R | Raised face |

1-4 Pressure Rating

| CODE | DESCRIPTION |
|------|-------------|
| 1 | 150 Class |
| 3 | 300 Class |
| 6 | 600 Class |
| 9 | 900 Class |
| 15 | 1500 Class |

1-8 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| F | Full penetration weld |
| S | Well stamped with customer-specified part number |

1-7 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|---|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches using two digits plus any fractional length |

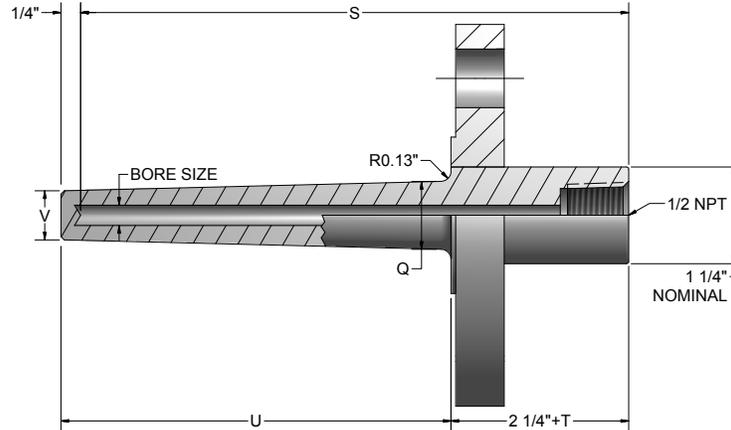
1-6 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-5 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

Heavy-Duty, Flanged Thermowells are available in a variety of materials, flange types, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Heavy-duty flanged thermowells are supplied with a 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. The tapered design is suited for heavy-duty applications where greater rigidity is required for increased pressure and flow due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Maximum tapered length is 16"
 ("U" length for non-lagging wells) = "S" - 2"
 ("U" length for lagging wells) = "S" - 2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 2" (When "U" and "S" are specified)

| Thermowell Dimensions | | | |
|-----------------------|--------------|-------------|-------------|
| FLANGE | "Q" (0.260") | "V"(0.260") | "V"(0.385") |
| 1" | 7/8" Dia. | 5/8" Dia. | 49/64" Dia. |
| 1 1/4" thru 3" | 1 1/16" Dia. | 5/8" Dia. | 49/64" Dia. |

ORDER CODES

Example Order Number: 1-0 1-1 1-2 1-3 1-4 1-5 1-6 1-7 1-8
HF 4 15 R 1 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|--------------------|
| HF | Heavy-duty flanged |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |
| 6 | 0.385" Dia. bore |

1-2 Flange Size

| CODE | DESCRIPTION |
|------|----------------|
| 10 | 1" (DN 25) |
| 13 | 1 1/4" (DN 32) |
| 15 | 1 1/2" (DN 40) |
| 20 | 2" (DN 50) |
| 30 | 3" (DN 80) |

1-3 Flange Type

| CODE | DESCRIPTION |
|------|-------------|
| F | Flat face |
| J | Ring joint |
| R | Raised face |

1-4 Pressure Rating

| CODE | DESCRIPTION |
|------|-------------|
| 1 | 150 Class |
| 3 | 300 Class |
| 6 | 600 Class |
| 9 | 900 Class |
| 15 | 1500 Class |

1-8 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| F | Full penetration weld |
| S | Well stamped with customer specified part number |

1-7 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

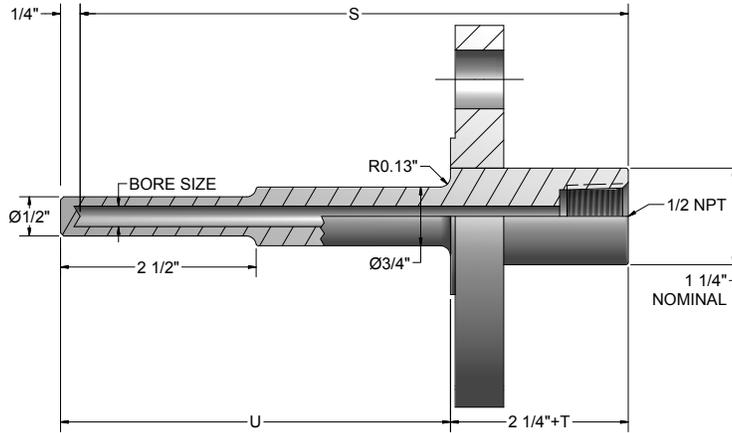
1-6 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-5 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

Reduced-Tip, Flanged Thermowells are available in a variety of materials, flange types, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The stepped construction is normally used in standard-duty applications, and increases the speed of response while maintaining mechanical strength. They are designed with standard 0.260" bore diameters to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" - 2"
 ("U" length for lagging wells) = "S" - 2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 2" (When "U" and "S" are specified)

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6 1-7 1-8
RF 4 15 R 1 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|---------------------|
| RF | Reduced-tip flanged |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |

1-2 Flange Size

| CODE | DESCRIPTION |
|------|----------------|
| 10 | 1" (DN 25) |
| 13 | 1 1/4" (DN 32) |
| 15 | 1 1/2" (DN 40) |
| 20 | 2" (DN 50) |
| 30 | 3" (DN 80) |

1-3 Flange Type

| CODE | DESCRIPTION |
|------|-------------|
| F | Flat face |
| J | Ring joint |
| R | Raised face |

1-4 Pressure Rating

| CODE | DESCRIPTION |
|------|-------------|
| 1 | 150 Class |
| 3 | 300 Class |
| 6 | 600 Class |
| 9 | 900 Class |
| 15 | 1500 Class |

1-8 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| F | Full penetration weld |
| S | Well stamped with customer specified part number |

1-7 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

1-6 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

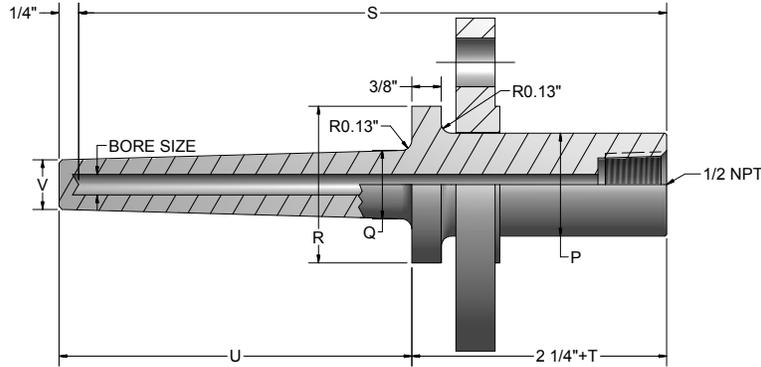
1-5 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

THERMOWELLS

Heavy-Duty Van Stone Thermowells

Heavy-Duty Van Stone Thermowells are available in a variety of materials, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Heavy-duty Van Stone thermowells are supplied with a 0.260" or 0.385" bore diameter to accommodate sensing elements with 0.252" or 0.377" maximum diameter, respectively. Van Stone thermowells are connected using a separate and reusable backing flange, eliminating the need for expensive flange materials. The tapered design is suited for heavy-duty applications where greater rigidity is required for increased pressure and flow due to process conditions. These wells are available as separate components or as part of complete sensor assemblies.



Maximum tapered length is 16"
 ("U" length for non-lagging wells) = "S" - 2"
 ("U" length for lagging wells) = "S" - 2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 2" (When "U"
 and "S" are specified)

| Thermowell Dimensions | | | | | |
|-----------------------|--------|----------|----------|-----------------|-----------------|
| "P" PIPE SIZE | | "R" DIA. | "Q" DIA. | "V" 0.260" DIA. | "V" 0.385" DIA. |
| NOM. | DIA. | | | | |
| 1" | 1.315" | 2" | 7/8" | 5/8" | 49/64" |
| 1 1/2" | 1.900" | 2 7/8" | 1 1/16" | 5/8" | 49/64" |

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6 1-7 1-8
HF 4 15 V 1 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|----------------------|
| HF | Heavy-Duty Van Stone |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |
| 6 | 0.385" Dia. bore |

1-2 Flange Size

| CODE | DESCRIPTION |
|------|----------------|
| 10 | 1" (DN 25) |
| 15 | 1 1/2" (DN 40) |

1-3 Flange Type

| CODE | DESCRIPTION |
|------|-----------------------|
| V | Van Stone (lap joint) |

1-4 Pressure Rating

| CODE | DESCRIPTION |
|------|--|
| 0 | No backing flange |
| 1 | 150 Class |
| 3 | 300 Class |
| 6 | 600 Class |
| 9 | 900 Class |
| 15 | 1500 Class |
| | Carbon steel lap joint flange standard |

1-8 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-7 "T" Lag Dimension

| CODE | DESCRIPTION |
|------|---|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches using two digits plus any fractional length |

1-6 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

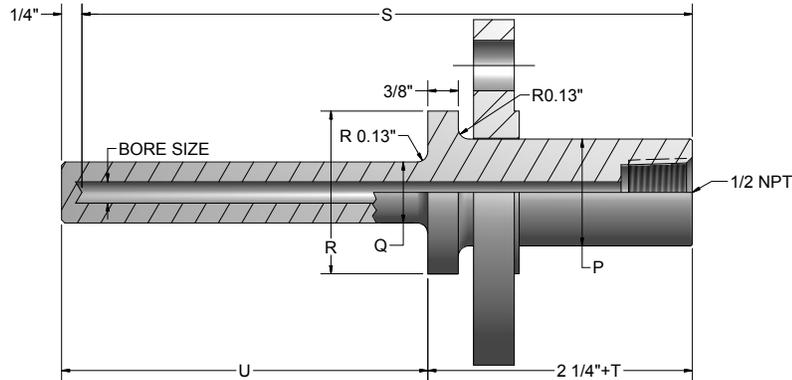
1-5 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |



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Straight Van Stone Thermowells are available in a variety of materials, flange sizes, and pressure ratings. They are also available in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. Straight Van Stone thermowells are supplied with a 0.260" or 0.385" bore diameter to accommodate sensing elements with a 0.252" or 0.377" maximum diameter, respectively. Van Stone thermowells are connected using a separate and reusable backing flange, eliminating the need for expensive flange materials. These wells are available as separate components or as part of complete sensor assemblies.



("U" length for non-lagging wells) = "S" - 2"
 ("U" length for lagging wells) = "S" - 2" - "T"
 (To solve for "T"), "T" = "S" - "U" - 2"
 (When "U" and "S" are specified)

Thermowell Dimensions

| "P" PIPE SIZE | | "R" DIA. | "Q" 0.260" DIA. | "Q" 0.385" DIA. |
|---------------|--------|----------|-----------------|-----------------|
| NOM. | DIA. | | | |
| 1" | 1.315" | 2" | 3/4" | 7/8" |
| 1 1/2" | 1.900" | 2 7/8" | 3/4" | 7/8" |

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6 1-7 1-8
SF 4 15 V 1 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|--------------------|
| SF | Straight Van Stone |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |
| 6 | 0.385" Dia. bore |

1-2 Flange Size

| CODE | DESCRIPTION |
|------|---------------|
| 10 | 1" (DN25) |
| 15 | 1 1/2" (DN40) |

1-3 Flange Type

| CODE | DESCRIPTION |
|------|-----------------------|
| V | Van Stone (lap joint) |

1-4 Pressure Rating

| CODE | DESCRIPTION |
|--|-------------------|
| 0 | No backing flange |
| 1 | 150 Class |
| 3 | 300 Class |
| 6 | 600 Class |
| 9 | 900 Class |
| 15 | 1500 Class |
| Carbon steel lap joint flange standard | |

1-8 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer specified part number |

1-7 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

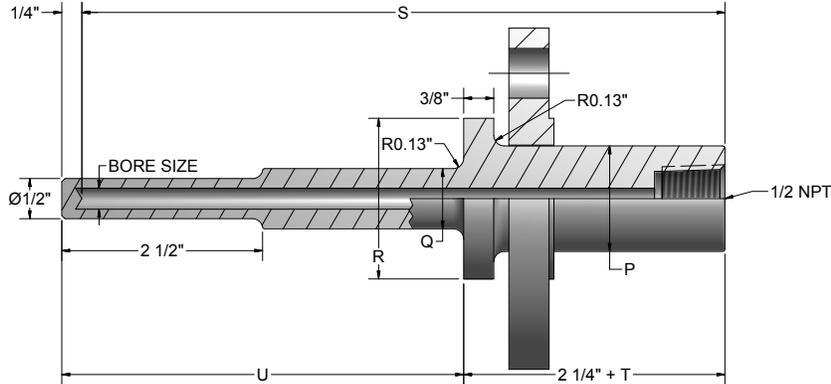
1-6 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-5 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

Reduced-Tip Van Stone Thermowells are available in a variety of materials, flange sizes, and pressure ratings. They are also offered in various lengths and with optional lagging extensions. Thermowell specifications should be determined based on process conditions which include strength, temperature, pressure and corrosion-resistance requirements. The Reduced Tip Van Stone thermowell is supplied with a 0.260" bore diameter to accommodate sensing elements with a 0.252" maximum diameter. The stepped construction is normally used in standard-duty applications and increases the speed of response while maintaining mechanical strength. Van Stone thermowells are connected using a separate and reusable backing flange, eliminating the need for expensive flange materials. These wells are available as separate components or as part of complete sensor assemblies.



Thermowell Dimensions

| "P" PIPE SIZE NOM. | "p" DIA. | "R" DIA. | "Q" DIA. |
|-----------------------|-------------|-------------|-------------|
| 1" | 1.315" | 2" | 3/4" |
| 1 1/2" | 1.900" | 2 7/8" | 7/8" |

("U" length for non-lagging wells) = "S" - 2"

("U" length for lagging wells) = "S" - 2" - "T"

(To solve for "T"), "T" = "S" - "U" - 2" (When "U" and "S" are specified)

ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6 1-7 1-8
RF 4 15 V 1 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|-----------------------|
| RF | Reduced-Tip Van Stone |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |

1-2 Flange Size

| CODE | DESCRIPTION |
|------|---------------|
| 10 | 1" (DN25) |
| 15 | 1 1/2" (DN40) |

1-3 Flange Type

| CODE | DESCRIPTION |
|------|-----------------------|
| V | Van Stone (lap joint) |

1-4 Pressure Rating

| CODE | DESCRIPTION |
|--------------------------------------|-------------------|
| 0 | No backing flange |
| 1 | 150 Class |
| 3 | 300 Class |
| 6 | 600 Class |
| 9 | 900 Class |
| 15 | 1500 Class |
| Carbon steel backing flange standard | |

1-8 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| C22 | Brass well cap and chain |
| S | Well stamped with customer-specified part number |

1-7 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

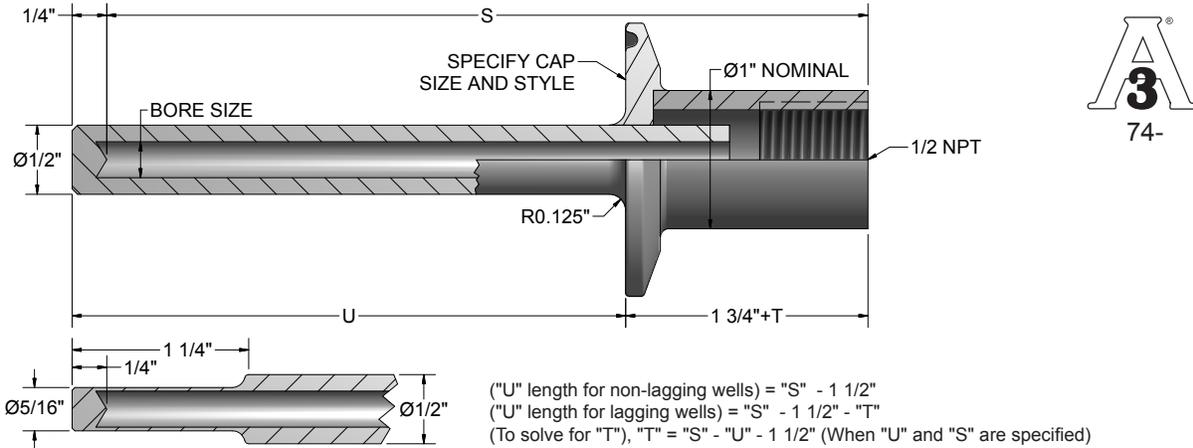
1-6 Material

| CODE | DESCRIPTION |
|------|---|
| XX | Specify two digit material code as stated in the Thermowell Material Table located earlier in section |

1-5 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

Sanitary-Connected Thermowells are offered in 316 stainless steel. The DW and DR series are welded constructions, and they are available in a variety of lengths, cap styles, cap sizes, and optional lagging extensions. Thermowells are supplied with a surface finish that meets or exceeds $32\mu\text{in } R_a$. Surface finishes of $15\mu\text{in } R_a$ or better are available upon request. They are designed with standard 0.260" bore diameters to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6
DW 4 25 09 08 T2 C8S

1-0 Well Type

| CODE | DESCRIPTION |
|------|---------------------------|
| DW | Sanitary well |
| DR | Reduced-tip sanitary well |

1-1 Bore Size

| CODE | DESCRIPTION |
|------|------------------|
| 4 | 0.260" Dia. bore |

1-2 Cap Size & Style

| CODE | DESCRIPTION |
|--|------------------------------|
| 15 | 1", 1 1/2" Tri-clamp® 16 AMP |
| 25 | 2" Tri-clamp® 16 AMP |
| 35 | 2 1/2" Tri-clamp® 16 AMP |
| 45 | 3" Tri-clamp® 16 AMP |
| Other styles - sizes available. Consult factory. | |

Tri-clamp® is a registered trademark of Alfa Laval, Inc.

1-6 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| S | Well stamped with customer-specified part number |

1-5 Optional "T" Lag Dimension

| CODE | DESCRIPTION |
|------|-----------------------------------|
| | Leave blank if no lag is required |
| T__ | Specify "T" dimension in inches |

1-4 Material

| CODE | DESCRIPTION |
|------|---------------------|
| 08 | 316 stainless steel |

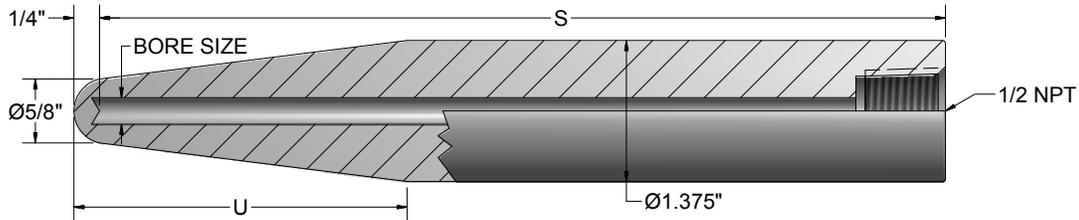
1-3 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits plus fractional length |

THERMOWELLS

W81 Series Sanitary Weld-In Thermowells

Sanitary Weld-In Thermowells are offered in 316 stainless steel. The thermowell is designed to be welded into a tank or vat with a full crevice-free fillet-weld to prevent corrosion, bacteria growth, and product contamination. Thermowells are supplied with a surface finish that meets or exceeds 32 μ in R_a. Surface finishes of 15 μ in R_a or better are available upon request. They are designed with a standard 0.260" bore diameter to accommodate sensing elements with a 0.252" maximum diameter. These wells are available as separate components or as part of complete sensor assemblies.



ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3
W81 - 1 8 S

1-0 Well Type

| CODE | DESCRIPTION |
|------|------------------|
| W81 | Sanitary weld-in |

1-1 Length

| CODE | "S" LENGTH | "U" LENGTH |
|------|------------|------------|
| 1 | 8 1/4" | 3 1/4" |
| 2 | 9 7/8" | 3 1/4" |
| 3 | 11 5/8" | 5" |
| 4 | 12 7/8" | 3 3/4" |

1-3 Options

| CODE | DESCRIPTION |
|------|--|
| C8 | 316 stainless steel well cap and chain |
| S | Well stamped with customer-specified part number |

1-2 Material

| CODE | DESCRIPTION |
|------|---------------------|
| 8 | 316 stainless steel |

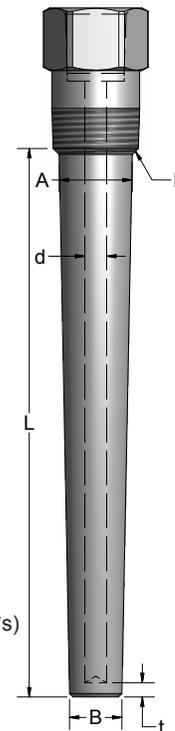
Based on calculations in accordance with ASME PTC 19.3 TW

ASME PTC 19.3 TW, the U.S. standard for evaluating the mechanical design of a thermowell used in a broad range of applications, was updated in 2010 to include a greater number of thermowell and process variables. Sometimes referred to as "Wake Frequency Calculation", the revision incorporates new elements for evaluating thermowell constructions that will reduce the chance of vibration and stress damage to the vessel, as well as avoid vibration damage to the temperature sensor it protects.

Please input data regarding your thermowell dimensions, thermowell properties and material/media/process properties in the designated spaces below. We will review the data, process the calculations and contact you with the results. Feel free to contact one of our Product Engineers to go through the process calculations.

| | | |
|--|---------------|---------------------------|
| Unit of Measure: | English Units | ▼ |
| Mounting Type: | Threaded | ▼ |
| Shank Profile: | Tapered | ▼ |
| Material: | 316SS | ▼ |
| Process Connection: | 1" NPT | ▼ |
| Unsupported Length (L): | 6 | in |
| Bore Diameter (d): | 0.260 | ▼ in |
| Root Diameter (A): | 1.0625 | in |
| Tip Diameter (B): | 0.625 | in |
| Minimum Tip Thickness (t): | 0.188 | in |
| ? Fillet Radius at Support Plane (b): | 0.178 | in |
| ? Fillet Radius at Base of Step (b _s): | | in |
| Reduced-Diameter Shank Length (L _s): | | in |
| ? Damping Factor (ζ): | 0.0005 | |
| ? Shielded Length of T-Well (L _s): | 0 | in |
| Max. Fluid Velocity (V): | 15.5 | ft/s |
| Fluid Density (ρ): | 4.3 | lb/ft ³ |
| Max. Operating Temperature (T): | 450 | F |
| Max. Operating Pressure (P): | 150 | psig |
| Dynamic Viscosity (μ): | | cP (1 centipoise = mPa*s) |
| Tag/Reference #: | TW-100 | |

1. Input your data online
2. We review and process the calculations
3. We will contact you with results
4. (Optional) Contact one of our Product Engineers to go through process calculation questions



Find this page at: www.Pyromation.com/TechInfo/WakeFreq.aspx

Pyromation makes no claims regarding performance or safety based on the calculations provided. The results communicated are based on the ASME PTC 19.3 TW design standard for reliable service of tapered, straight and stepped-shank thermowells in a broad range of applications. The user assumes full responsibility for installation, application and operation of the product.

THIS IS A RESPONSE EXAMPLE ONLY - DO NOT USE DATA FOR ANY OTHER PURPOSE



5211 Industrial Road, Fort Wayne, IN 46825

**Straight or Tapered Thermowell
Wake Frequency Evaluation Results**
per PTC 19.3-TW 2010

Date: 8/3/2011
Customer Name: Dave Myers
Company/Org. Name: Pyromation, Inc
E-mail Address: dmyers@pyromation.com
Tag Number: TW-100

OUTPUTS

| | |
|----------------------------------|-------------|
| Frequency Condition | PASS |
| Frequency Ratio | 0.073 |
| Steady State Stress Limit | PASS |
| Dynamic Stress Limit | PASS |
| Pressure Limit | PASS |

INPUTS

Mounting Type: Threaded
Material type: 316SS

Dimensions:

| | | | | | |
|-----------------------|------------------|--------|-------------------|-------|---|
| Length | L= | 6.000 | in | 0.152 | m |
| Root diameter | A= | 1.063 | in | 0.027 | m |
| Tip diameter | B= | 0.625 | in | 0.016 | m |
| Bore diameter | d= | 0.260 | in | 0.007 | m |
| Tip thickness | t= | 0.188 | in | 0.005 | m |
| Fillet radius at base | b= | 0.178 | in | 0.005 | m |
| Damping Factor | ζ= | 0.0005 | | | |
| Shielded length | L ₀ = | 0.000 | in | 0.000 | m |
| Sensor density | ρ _s = | 2700 | kg/m ³ | | |

Fluid Properties:

| | | | | | |
|-------------------|----|-------|--------------------|-----------|-------------------|
| Fluid velocity | V= | 15.50 | ft/s | 4.72 | m/s |
| Fluid density | ρ= | 4.300 | lb/ft ³ | 68.9 | kg/m ³ |
| Fluid temperature | T= | 450.0 | °F | 232.2 | °C |
| Gauge pressure | P= | 150.0 | psig | 1034214.0 | Pa |
| Viscosity | μ= | 0.019 | cp | | |

T-Well Material Properties

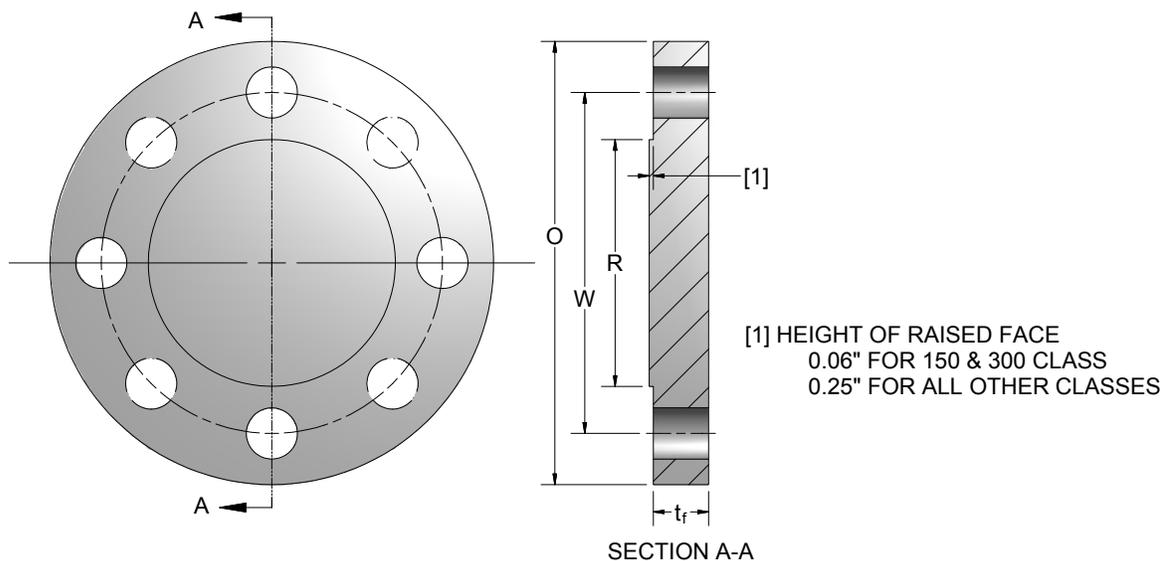
| | | | | | |
|----------------------------|------------------|----------|---------------------|----------|-------------------|
| Allowable stress | S= | 18000 | psi | 1.24E+08 | Pa |
| Fatigue limit | S _f = | 5400 | psi | 3.72E+07 | Pa |
| Modulus at temperature | E= | 25900000 | lbf/in ² | 1.79E+11 | Pa |
| Density of t-well material | ρ _m = | 0.290 | lbf/in ³ | 8026.9 | kg/m ³ |

Summary/ Suggestions:

*Pyromation makes no claims regarding performance or safety based on the calculations provided. The results communicated are based on the ASME PTC 19.3 TW-2010 design standard for reliable service of tapered, straight and stepped-shank thermowells in a broad range of applications. The user assumes full responsibility for installation, application and operation of the product.

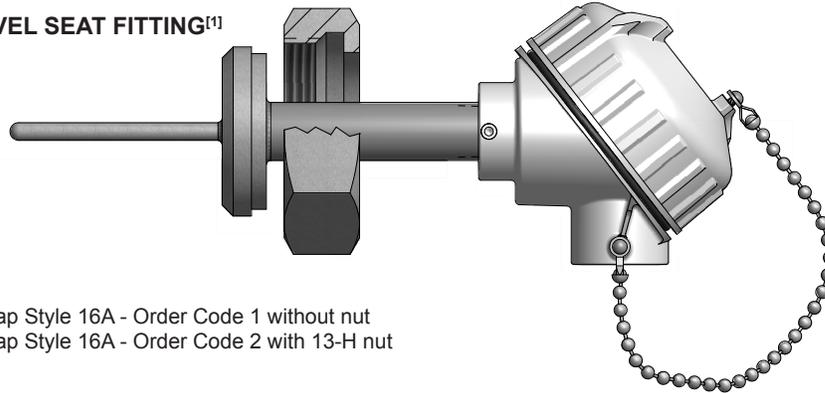
Flanges comply with ASME B16.5 and are welded in accordance with the Boiler Code ASME Section IX. Certified welders use ASME Section II Compliant materials. Gaskets are not supplied with flanged thermowells and assemblies.

| Nominal Pipe Size (inches) | Nominal Diameter DN | Flange Class | "O" Outside Diameter of Flange | "R" Outside Diameter Raised Face Large Male and Large Tongue | "W" Diameter of Bolt Circle | Number of Bolts | "t _f " Thickness of Flange Min. |
|----------------------------|---------------------|--------------|--------------------------------|--|-----------------------------|-----------------|--|
| 1/2 | 15 | 150 | 3.50 | 1.38 | 2.38 | 4 | 0.38 |
| 3/4 | 20 | 150 | 3.88 | 1.69 | 2.75 | 4 | 0.44 |
| 1 | 25 | 150 | 4.25 | 2.00 | 3.12 | 4 | 0.50 |
| 1 1/4 | 32 | 150 | 4.62 | 2.50 | 3.50 | 4 | 0.56 |
| 1 1/2 | 40 | 150 | 5.00 | 2.88 | 3.88 | 4 | 0.62 |
| 2 | 50 | 150 | 6.00 | 3.62 | 4.75 | 4 | 0.69 |
| 2 1/2 | 65 | 150 | 7.00 | 4.12 | 5.50 | 4 | 0.81 |
| 3 | 80 | 150 | 7.50 | 5.00 | 6.00 | 4 | 0.88 |
| 3 1/2 | 90 | 150 | 8.50 | 5.50 | 7.00 | 8 | 0.88 |
| 4 | 100 | 150 | 9.00 | 6.19 | 7.50 | 8 | 0.88 |
| 1/2 | 15 | 300 | 3.75 | 1.38 | 2.62 | 4 | 0.50 |
| 3/4 | 20 | 300 | 4.62 | 1.69 | 3.25 | 4 | 0.56 |
| 1 | 25 | 300 | 4.88 | 2.00 | 3.50 | 4 | 0.62 |
| 1 1/4 | 32 | 300 | 5.25 | 2.50 | 3.88 | 4 | 0.69 |
| 1 1/2 | 40 | 300 | 6.12 | 2.88 | 4.50 | 4 | 0.75 |
| 2 | 50 | 300 | 6.50 | 3.62 | 5.00 | 8 | 0.81 |
| 2 1/2 | 65 | 300 | 7.50 | 4.12 | 5.88 | 8 | 0.94 |
| 3 | 80 | 300 | 8.25 | 5.00 | 6.62 | 8 | 1.06 |
| 3 1/2 | 90 | 300 | 9.00 | 5.50 | 7.25 | 8 | 1.12 |
| 4 | 100 | 300 | 10.00 | 6.19 | 7.88 | 8 | 1.19 |
| 1/2 | 15 | 600 | 3.75 | 1.38 | 2.62 | 4 | 0.56 |
| 3/4 | 20 | 600 | 4.62 | 1.69 | 3.25 | 4 | 0.62 |
| 1 | 25 | 600 | 4.88 | 2.00 | 3.50 | 4 | 0.69 |
| 1 1/4 | 32 | 600 | 5.25 | 2.50 | 3.88 | 4 | 0.81 |
| 1 1/2 | 40 | 600 | 6.12 | 2.88 | 4.50 | 4 | 0.88 |
| 2 | 50 | 600 | 6.50 | 3.62 | 5.00 | 8 | 1.00 |
| 2 1/2 | 65 | 600 | 7.50 | 4.12 | 5.88 | 8 | 1.12 |
| 3 | 80 | 600 | 8.25 | 5.00 | 6.62 | 8 | 1.25 |
| 3.50 | 90 | 600 | 9.00 | 5.50 | 7.25 | 8 | 1.38 |
| 4.00 | 100 | 600 | 10.75 | 6.19 | 8.50 | 8 | 1.50 |



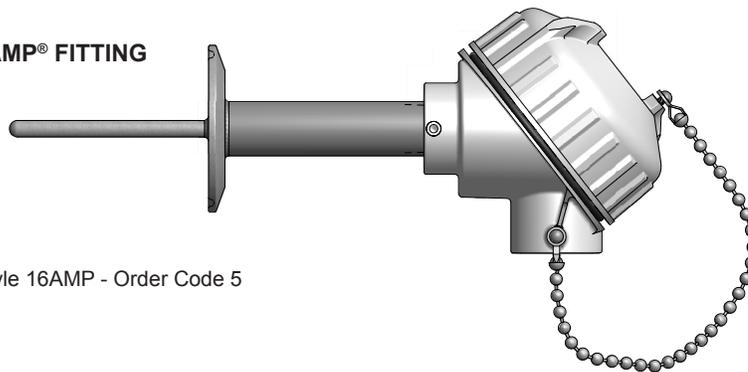
The CIP (clean in place) sanitary connections illustrated on this page are the most commonly used fittings in food, dairy, beverage, pharmaceutical, and chemical processes where contamination and cleanliness is of concern. Fittings other than those illustrated are available upon request. The illustrations are provided for reference purposes to aid in the selection of the correct fitting style for new or replacement sensor assemblies. Most CIP sensor assemblies manufactured by Pyromation are constructed in accordance with the **3-A Sanitary Council Standard 74-** for instrument fittings and connections.

BEVEL SEAT FITTING^[1]



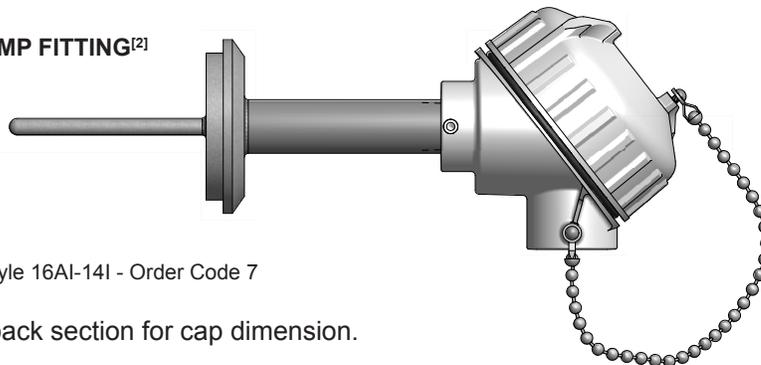
Cap Style 16A - Order Code 1 without nut
Cap Style 16A - Order Code 2 with 13-H nut

TRI-CLAMP® FITTING



Cap Style 16AMP - Order Code 5

"I" CLAMP FITTING^[2]



Cap Style 16AI-14I - Order Code 7

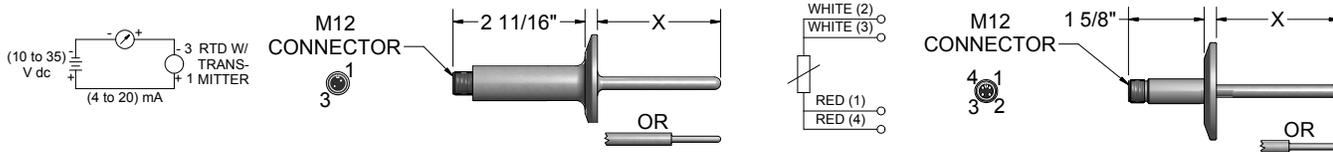
See back section for cap dimension.

[1] Must be manually cleaned.

[2] Not 3-A authorized.

Tri-Clamp® is a registered trademark of Alfa Laval, Inc.

The Water-Tight CIP RTD Assembly houses an optional integral Series 450 Temperature Transmitter (no connection head is required) that is ideal for monitoring temperature in small areas such as tanks and pipes. The water-tight construction meets NEMA 6P requirements. Assemblies are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. Standard units include a M12 process connection housing. The transmitter is a 2-wire unit with an analog output. It has measurement input for Pt100 resistance thermometers (RTD) in 4-wire connections. Transmitters can be ranged from (-51 to 160) °C [-60 to 320] °F with a 10 °C [18 °F] minimum span requirement. **Ambient temperature limits for the M12 connector are (-40 to 85) °C.**



ORDER CODES

Example Order Number:



1 Standard Tip Pt100 (α = 0.003 85 °C⁻¹) RTD Assemblies

| CODE | TOLERANCE ^[1] | NOMINAL SHEATH DIAMETER O.D. (inches) |
|------------|--------------------------|---------------------------------------|
| RAF185L484 | Class A | 1/4 |
| R1T185L484 | Grade B | 1/4 |
| R5T185L484 | (1/5) Class B | 1/4 |

1-1 Reduced Tip Pt100 (α = 0.003 85 °C⁻¹) RTD Reduced Tip Assemblies

| CODE | TOLERANCE ^[1] | NOMINAL SHEATH DIAMETER O.D. (inches) | TIP OUTER DIA. (inches) |
|---------------|--------------------------|---------------------------------------|-------------------------|
| RAF185L88R484 | Class A | 1/2 | 1/4 |
| RAF185L68R384 | Class A | 3/8 | 3/16 |
| R1T185L88R484 | Grade B | 1/2 | 1/4 |
| R1T185L68R384 | Grade B | 3/8 | 3/16 |
| R5T185L88R484 | (1/5) Class B | 1/2 | 1/4 |
| R5T185L68R384 | (1/5) Class B | 3/8 | 3/16 |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length
Examples: 04 = 4", 04(1/2) = 4.5"

For field-wireable and molded extensions see RTD Section.

Tri-Clamp® is a registered trademark of Alfa Laval, Inc.

3 Sanitary Cap Size and Style 316 SS

| CODE | DESCRIPTION |
|--|-------------------------------------|
| 1-5 | 1" & 1 1/2" 16 AMP cap - Tri-Clamp® |
| 2-5 | 2" 16 AMP cap - Tri-Clamp® |
| 3-5 | 2 1/2" 16 AMP cap - Tri-Clamp® |
| 4-5 | 3" 16 AMP cap - Tri-Clamp® |
| Other cap styles available - consult factory | |

4 Termination

| CODE | DESCRIPTION |
|------|---------------------------|
| 45 | M12 Water-tight connector |

Optional Transmitter

| | |
|------------------|--|
| T ^[1] | (4 to 20)mA Temperature Transmitter (requires table 5 selection) |
|------------------|--|

[1] See Transmitter Section for total sensor and transmitter output accuracy.

5 Transmitter

| CODE | DESCRIPTION |
|--------|---------------------------------------|
| 450-00 | Programmable transmitter-unconfigured |
| 450 | Programmable transmitter-configured |

6 Fault Signal

| CODE | DESCRIPTION |
|------|-------------------|
| U | Upscale burnout |
| D | Downscale burnout |

7 Range

| | |
|---|-----------------------------|
| S | (lower limit - upper limit) |
|---|-----------------------------|

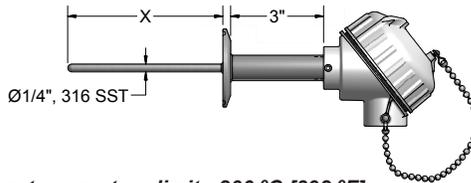
8 Units

| CODE | DESCRIPTION |
|------|-------------|
| C | Celsius |
| F | Fahrenheit |

General-purpose CIP sanitary-connected RTD temperature sensors are used in food, dairy, beverage, pharmaceutical, and chemical processing applications where sensor corrosion and product contamination are critical factors. The sanitary caps listed are those most commonly used in such processes. Sanitary caps are welded to the sheath and to a heavier support tube, all made of stainless steel, and then ground and polished to a finish that exceeds the No. 4 minimum finish required by the **3-A Sanitary Standard 74**. Assemblies are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. The process contact surfaces are free of pits, crevices, and pockets thus preventing corrosion and bacteria growth. The 3-wire constructed sensor assembly consists of a high-accuracy platinum element sealed inside a 316 stainless steel sheath, and is provided with a FDA-compliant white thermoplastic gasketed connecting head. The complete assembly provides excellent washdown protection. It is recommended that once customer connections are made, the connecting terminals be further protected by applying a coating of moisture-proof sealant over the connections.



74-



Maximum temperature limit: 200 °C [392 °F]

ORDER CODES

Example Order Number: **R5T185L483** - **04** - **CIP** - **2** - **5** - **63, T**

1-1 Pt100 (α = 0.003 85 °C⁻¹) RTD Assemblies

| CODE | TOLERANCE ^[1] |
|---------------|--------------------------|
| SINGLE | |
| RAF185L483 | Class A |
| R1T185L483 | Grade B |
| R3T185L483 | Class AA |
| R5T185L483 | (1/5) Class B |
| DUPLEX | |
| RAF285L483 | Class A |
| R1T285L483 | Grade B |
| R3T285L483 | Class AA |
| R5T285L483 | (1/5) Class B |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

Thermocouple Assemblies

For CIP thermocouple assemblies use T/C types J, K, T, or E and options G for grounded junction or U for ungrounded junction as per example.
EXAMPLE: TP48G-04 - CIP - 2 - 5 - 63

1-2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired
Examples: 04 = 4", 05(1/2) = 5.5"

2 Sanitary Cap Size

| CODE | TUBE O.D. (inches) | CODE | TUBE O.D. (inches) |
|------|--------------------|------|--------------------|
| 1 | 1(1/2) | 4 | 3 |
| 2 | 2 | 5 | Other (specify) |
| 3 | 2 (1/2) | | |

4 Terminations

| CODE | DESCRIPTION |
|---------------------|---|
| 91 | 316L stainless steel screw-cover head |
| 63 | White polypropylene screw-cover head |
| 31,W | Aluminum screw-cover head with white epoxy coating |
| 22 (06) | 6" individual fluoropolymer leads with terminal pins |
| 02 | 1/2" O.D., 2 1/4" long extension leadwire transition (requires table 4 & 5 selections from RTD section) |
| Head Options | |
| T | Head-mounted transmitter (see Transmitter Section) |
| I | Stainless steel tags |
| HS | Wire seal security screws |

3 Sanitary Cap Style

| CODE | DESCRIPTION |
|------|---|
| 2 | 16A cap - Bevel Seat with 13-H Nut ^[1] 304SS |
| 5 | 16 AMP cap - Tri-Clamp [®] 316SS |
| 7 | 16AI-14I cap ^[2] 304SS |
| 8 | Other (describe) |

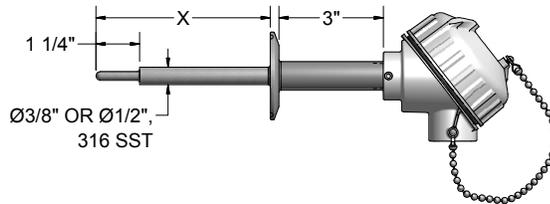
[1] Must be manually cleaned [2] Not 3-A authorized

Tri-Clamp[®] is a registered trademark of Alfa Laval, Inc.

General-purpose reduced-tip CIP sanitary-connected RTD temperature sensors are used in food, dairy, beverage, pharmaceutical, and chemical processing applications where sensor corrosion and product contamination are critical factors. The reduced tip construction provides strength along the major sheath length, and faster temperature response times at the reduced tip. The reduced tip sizes listed below are the most common constructions. For other configurations please consult the factory. The sanitary caps listed are those most commonly used in such processes. The sanitary caps are welded to the sheath and to a heavier support tube, all made of stainless steel, and then ground and polished to a finish that exceeds the No. 4 minimum finish required by the **3-A Sanitary Standard 74**. Assemblies are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. The process contact surfaces are free of pits, crevices, and pockets thus preventing corrosion and bacteria growth. The 3-wire constructed sensor assembly consists of a high-accuracy platinum element sealed inside a 316 stainless steel sheath, and is provided with a FDA compliant white thermoplastic gasketed connecting head. The complete assembly provides excellent washdown protection. It is recommended that once customer connections are made, the connecting terminals be further protected by applying a coating of moisture-proof sealant over the connections.



74-



Maximum temperature limit: 200 °C [392 °F]

ORDER CODES

Example Order Number: **R5T185L68R383** - **04** - **CIP** - **2** - **5** - **63, I**

1-1 Pt100 (α = 0.003 85 °C⁻¹) RTD Assemblies

| CODE | | TOLERANCE ^[1] | NORMAL SHEATH DIA. O.D. (inches) | TIP DIAMETER OD (inches) |
|---------------|---------------|--------------------------|----------------------------------|--------------------------|
| SINGLE | DUPLEX | | | |
| RAF185L88R483 | RAF285L88R483 | Class A | 1/2 | 1/4 |
| RAF185L68R383 | RAF285L68R383 | Class A | 3/8 | 3/16 |
| R1T185L88R483 | R1T285L88R483 | Grade B | 1/2 | 1/4 |
| R1T185L68R383 | R1T285L68R383 | Grade B | 3/8 | 3/16 |
| R3T185L88R483 | R3T285L88R483 | Class AA | 1/2 | 1/4 |
| R3T185L68R383 | R3T285L68R383 | Class AA | 3/8 | 3/16 |
| R5T185L88R483 | R5T285L88R483 | (1/5) Class B | 1/2 | 1/4 |
| R5T185L68R383 | R5T285L68R383 | (1/5) Class B | 3/8 | 3/16 |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

Thermocouple Assemblies

For CIP thermocouple assemblies use T/C types J, K, T, or E and options G for grounded junction or U for ungrounded junction as per example.
EXAMPLE: TP68R38G-04 - CIP - 2 - 5 - 63

1-2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired. Examples: 04 = 4", 05(1/2) = 5.5"

2 Sanitary Cap Size

| CODE | TUBE O.D. (inches) | CODE | TUBE O.D. (inches) |
|------|--------------------|------|--------------------|
| 1 | 1(1/2) | 4 | 3 |
| 2 | 2 | 5 | Other (specify) |
| 3 | 2 (1/2) | | |

4 Terminations

| CODE | DESCRIPTION |
|--------------|---|
| 91 | 316L stainless steel screw-cover head |
| 63 | White polypropylene screw-cover head |
| 31,W | Aluminum screw-cover head with white epoxy coating |
| 22 (06) | 6" individual fluoropolymer leads with terminal pins |
| 02 | 1/2" O.D., 2 1/4" long extension leadwire transition (requires table 5 & 6 selections from RTD section) |
| Head Options | |
| T | Head-mounted transmitter (see Transmitter Section) |
| I | Stainless steel tags |
| HS | Wire seal security screws |

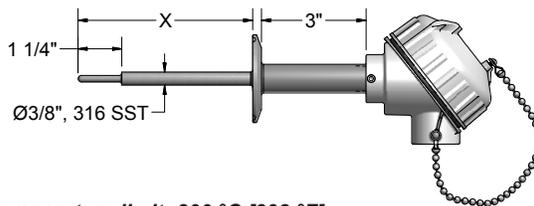
3 Sanitary Cap Style

| CODE | DESCRIPTION |
|------|---|
| 2 | 16A cap - bevel seat with 13-H nut ^[1] 304SS |
| 5 | 16 AMP cap - Tri-Clamp [®] 316SS |
| 7 | 16AI-14I cap ^[2] 304SS |
| 8 | Other (describe) |

[1] Must be manually cleaned [2] Not 3-A authorized

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The sensors listed below are sanitary-connected RTD temperature sensor assemblies designed to meet the stringent requirements of HTST pasteurization systems. HTST requirements are described in the Grade "A" Milk Pasteurization Ordinance. The sensors listed on this page have response times below four seconds and come standard in accuracies at 100 °C [212 °F] ± 0.5 °C. The below listed assemblies are available in a variety of sanitary connections. All wetted parts are ground and polished to a finish that exceeds the No. 4 minimum finish required by the 3-A Sanitary Standards for Sensors and Sensor Fittings and Connections used on Milk and Milk Product Equipment Standard 74-. Assemblies are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. The three-wire constructed sensor assembly consists of a high accuracy platinum element sealed inside a 316 stainless steel sheath and a white FDA compliant polypropylene connecting head. The complete assembly provides excellent wash down protection. It is recommended that once customer connections are made, the connecting terminals be further protected by applying a coating of moisture-proof sealant over the connections.



Maximum temperature limit: 200 °C [392 °F]
Pasteurization Test Response Time: 2 to 3 seconds typical

ORDER CODES

Example Order Number: **R5T185L68R383** - **04** - **HTST** - **2** - **5** - **63**

1-1 Pt100 (α = 0.003 85 °C⁻¹) RTD Assemblies

| CODE | | TOLERANCE ^[1] |
|---------------|---------------|--------------------------|
| SINGLE | DUPLEX | |
| R3T185L68R383 | R3T285L68R383 | Class AA |
| R5T185L68R383 | R5T285L68R383 | (1/5) Class B |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

1-2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired.
Examples: 04 = 4", 05(1/2) = 5.5"

2 Sanitary Cap Size

| CODE | TUBE O.D. (inches) | CODE | TUBE O.D. (inches) |
|------|--------------------|------|--------------------|
| 1 | 1(1/2) | 4 | 3 |
| 2 | 2 | 5 | Other (specify) |
| 3 | 2 (1/2) | | |

3 Sanitary Cap Style

| CODE | DESCRIPTION |
|------|---|
| 2 | 16A cap - bevel seat with 13-H nut ^[1] 304SS |
| 5 | 16 AMP cap - Tri-Clamp [®] 316SS |
| 7 | 16AI-14I cap ^[2] 304SS |
| 8 | Other (describe) |

[1] Must be manually cleaned [2] Not 3-A authorized

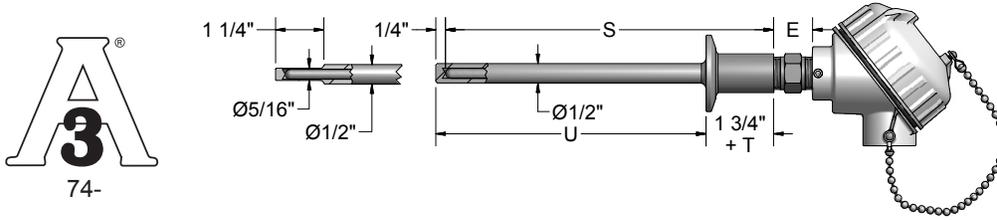
4 Terminations

| CODE | DESCRIPTION |
|---------|---|
| 91 | 316L stainless steel screw-cover head |
| 63 | White polypropylene screw-cover head |
| 31,W | Aluminum screw-cover head with white epoxy coating |
| 22 (06) | 6" individual fluoropolymer leads with terminal pins |
| 02 | 1/2" O.D., 2 1/4" long extension leadwire transition (requires table 5 & 6 selections from RTD section) |

| Head Options | |
|--------------|--|
| T | Head-mounted transmitter (see Transmitter Section) |
| I | Stainless steel tags |
| HS | Wire seal security screws |

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The RTD sensors listed below are constructed with the CIP sanitary-connected cap thermowell, which is then mounted into the process with a clamp and mating sanitary cap. A 3-wire spring-loaded RTD element and sheath is then screwed into the back of the thermowell. This construction method allows for easy removal of both the well and/or the sensor assembly. The well and sanitary cap in contact with the process are all ground and polished to a finish that exceeds the **3-A Sanitary Standard 74-**. Thermowells are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request.



ORDER CODES

Example Order Number: **R5T185L483** - **DW4** **25** **06** **08** - **SL** - **8HN** **63**

1 Pt100 (α = 0.003 85 °C⁻¹) RTD Assemblies

| CODE | TOLERANCE ^[1] |
|---------------|--------------------------|
| SINGLE | |
| R1T185L483 | Grade B |
| R3T185L483 | Class AA |
| R5T185L483 | (1/5) Class B |
| RAF185L483 | Class A |
| DUPLEX | |
| R1T285L483 | Grade B |
| R3T285L483 | Class AA |
| R5T285L483 | (1/5) Class B |
| RAF285L483 | Class A |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2 Well Type

| CODE | DESCRIPTION |
|--------------------|---|
| DW4 ^[1] | 0.260" bore straight-stem sanitary well |
| DR4 ^[2] | 0.260" bore reduced-tip sanitary well |

[1] Wells with "S" dimensions of 12" or less are supplied with drilled barstock stem. "S" dimensions above 12" will be supplied as tubing and welded tip.
[2] Maximum "S" Dimension is 7 1/2"

2.1 Cap Size and Style

| CODE | DESCRIPTION |
|------|--|
| 15 | 1", 1 1/2" Tri-clamp [®] 16 AMP |
| 25 | 2" Tri-clamp [®] 16 AMP |
| 35 | 2 1/2" Tri-clamp [®] 16 AMP |
| 45 | 3" Tri-clamp [®] 16 AMP |

Other styles - sizes available. Consult factory.

2.2 "S" Length

| CODE | DESCRIPTION |
|------|--|
| XX | Specify length in inches using two digits. |

2.3 Well Material

| CODE | DESCRIPTION |
|------|-------------|
| 08 | 316SS |

3 Element Style

| CODE | DESCRIPTION |
|------|-----------------------|
| SL | Spring-loaded element |

4 Head Mounting Fittings

| CODE | DESCRIPTION |
|--------|------------------------------------|
| 8HN | 316SS hex fitting |
| 8PN(E) | 316SS pipe nipple specify E length |

5 Terminations

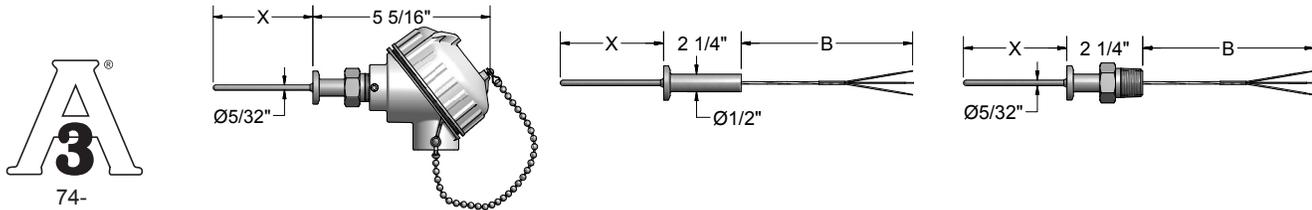
| CODE | DESCRIPTION |
|------|--|
| 91 | 316L stainless steel screw-cover head |
| 63 | White polypropylene screw-cover head |
| 31,W | Aluminum screw-cover head with white epoxy coating |

Head Options

| | |
|---|--|
| T | Head-mounted transmitter (see Transmitter Section) |
| I | Stainless steel tags (specify tag #) |

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Miniature CIP sanitary RTD temperature sensors are provided with 16AMP sanitary caps to fit 1/2" and 3/4" tube size sanitary fittings. They are used in pharmaceutical, chemical, biotech, R & D laboratory, and food process applications. The sanitary caps are welded to the sheath and to a heavier support tube, all made of 316 stainless steel, and then ground and polished to a finish that exceeds the No. 4 minimum finish required by the **3-A Sanitary Standard 74-**. Assemblies are supplied with a surface finish that meets or exceeds 15µin R_a. The process contact surfaces are free of pits, crevices, and pockets thus preventing corrosion and bacteria growth. All leads are fluoropolymer insulated to further provide moisture and chemical resistance. The listed sheath lengths provide assurance that the sensing element is properly placed in the flowing medium when used with typical sanitary tees and tube fittings, and the small sheath diameter provides fast temperature response times.



ORDER CODES

Example Order Number: **R1T185L(156)83** - **02** - **CIP** - **075-5** - **02** - **T3T120** - **3**

1 Pt100 (α = 0.003 85 °C⁻¹) RTD Assemblies

| CODE | TOLERANCE ^[1] |
|----------------|--------------------------|
| R1T185L(156)83 | Grade B |
| R3T185L(156)83 | Class AA |
| R5T185L(156)83 | (1/5) Class B |
| RAF185L(156)83 | Class A |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired
Examples: 02 = 2", 02(1/2) = 2.5"

3 16 AMP Sanitary Cap Size

| CODE | DESCRIPTION |
|-------|---------------------------------|
| 075-5 | 1/2", 3/4" 16AMP cap Tri-Clamp® |

4 Terminations

| CODE | DESCRIPTION |
|------|---|
| 91 | 316L stainless steel screw-cover head |
| 63 | White polypropylene screw-cover head |
| 31,W | Aluminum screw-cover head with white epoxy coating |
| 02 | 1/2" O.D., 2 1/4" long extension leadwire transition (requires table 5 and 6 selection) |
| 8HP | 1/2" NPT 316 SS hex fitting for conduit box or head mounting (use w/lead options from Tbl. 5 and 6) |

6 Lead Terminations

| CODE | DESCRIPTION |
|------|-------------------------------|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads w/spade lugs |
| 4 | Standard plug |
| 6 | Miniature plug |

Options

| | |
|----|--|
| CG | 1/2" NPT weatherproof nylon cord grip on FEP covered flex. armor |
| HS | Head supplied with wire seal security screws |
| I | Stainless steel tags |
| MC | Mating connector |
| T | Head-mounted transmitter (see Transmitter Section) |

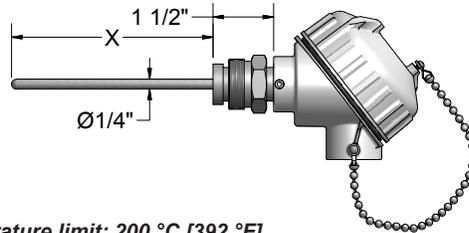
5 Extension Leadwire

| CODE | DESCRIPTION | TEMP RATING |
|-----------------------|--|-----------------|
| T3___ ^[1] | Fluoropolymer Insulation - stranded conductor | 204 °C [400 °F] |
| T3T___ ^[1] | Fluoropolymer Insulation - stranded conductor - flexible armor - FEP coated | 204 °C [400 °F] |
| M3___ ^[1] | Fluoropolymer Insulation - stranded conductor - stainless steel overbraid - FEP Insulation | 204 °C [400 °F] |

[1] Insert 3 digit "B" dimension in inches.

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Thermometer replacement RTD temperature sensor assemblies are used when converting instrumentation from older direct reading thermometers to electronic instruments requiring RTD inputs. These RTD assemblies replace the filled system capillary actuating bulbs and will fit into the old existing bulb wells as listed below. These 3-wire constructed sensor assemblies consist of a high-accuracy platinum element sealed inside a spring-loaded 316 stainless steel sheath and are supplied with a FDA-compliant white thermoplastic gasketed head. Each sensor is supplied with a free-rotating stainless steel mounting fitting with the appropriate threading for the wells listed below.



Maximum temperature limit: 200 °C [392 °F]

ORDER CODES

Example Order Number:

1 R5T185L483 - **2** 09(1/2) - **TR** - **3** 63, I

1 Pt100 ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$)
RTD Assemblies

| CODE | | TOLERANCE ^[1] |
|------------|------------|--------------------------|
| SINGLE | DUPLEX | |
| R1T185L483 | R1T285L483 | Grade B |
| R3T185L483 | R3T285L483 | Class AA |
| R5T185L483 | R5T285L483 | (1/5) Class B |
| RAF185L483 | RAF285L483 | Class A |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

Thermocouple Assemblies

For thermocouple assemblies use T/C types J, K, T, or E and options G for grounded junction or U for ungrounded junction as per example. EX.: TP48G - 09 (1/2) - TR - 63.

2 Immersion Length "X"

Specify "X" length in inches using 2 digits, plus any fractional length desired.
Examples: 04 = 4", 05(1/2) = 5.5

3 Terminations

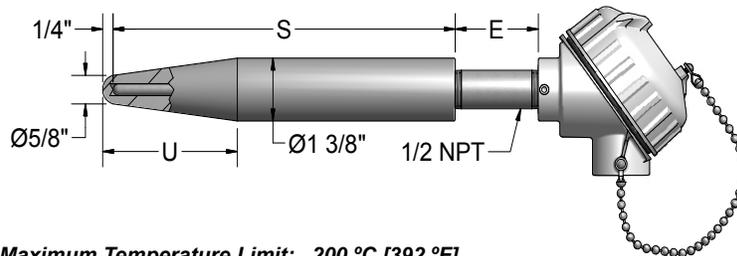
| CODE | DESCRIPTION |
|--------------|--|
| 91 | 316L stainless steel screw-cover head |
| 63 | White polypropylene screw-cover head |
| 31,W | Aluminum screw-cover head with white epoxy coating |
| Head Options | |
| T | Head-mounted transmitter (see Transmitter Section) |
| I | Stainless steel tags |
| HS | Head supplied w/wire seal security screw |

Immersion Length "X"

| "X" IMMERSION LENGTH ^[1] (inches) | LENGTH AND MOUNTING FITTING TO FIT BELOW LISTED WELL PART NUMBER | | MOUNTING FITTING THREAD |
|--|--|----------|-------------------------|
| | TAYLOR | ANDERSON | |
| 9 (1/2) | 26P397 | 41247 | 1 (1/4)"-18 UNEF |
| 12 (1/2) | 26P398 | 41279 | 1 (1/4)"-18 UNEF |
| 11 (1/2) | SK10274 | 41280 | 1 (1/4)"-18 UNEF |

[1] "X" dimension indicates length with spring in its fully expanded position. Spring will retract 1/2" minimum to 3/4" maximum.

The Weld-In RTD temperature sensor assemblies listed below are commonly used in the food, dairy, beverage, pharmaceutical, and chemical processing industries. The complete assemblies are provided with a 3-wire platinum RTD element sealed inside a 1/4" O.D., spring-loaded, stainless steel sheath, and with a heavy wall sanitary protection well. Thermowells are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. The well is to be welded into a tank or vat with a full crevice-free fillet-weld to prevent corrosion, bacteria growth, and product contamination. Assemblies are provided with a FDA-compliant white thermoplastic-gasketed connection head. The complete assembly provides excellent washdown protection.



Maximum Temperature Limit: 200 °C [392 °F]

ORDER CODES

Example Order Number: **R1T185L483** - **W81-18** - **SL** - **8PN4** - **63**

1 Pt100 (α = 0.003 85 °C⁻¹) RTD Assemblies

| CODE | TOLERANCE ^[1] | NORMAL SHEATH DIAMETER O.D. (inches) |
|---------------|--------------------------|--------------------------------------|
| SINGLE | | |
| R1T185L483 | Grade B | 1/4 |
| R3T185L483 | Class AA | 1/4 |
| R5T185L483 | (1/5) Class B | 1/4 |
| RAF185L483 | Class A | 1/4 |
| DUPLEX | | |
| R1T285L483 | Grade B | 1/4 |
| R3T285L483 | Class AA | 1/4 |
| R5T285L483 | (1/5) Class B | 1/4 |
| RAF285L483 | Class A | 1/4 |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2 Weld - In Wells

| CODE | WELL DIMENSIONS (inches) | |
|--------|--------------------------|---------|
| | S | U |
| 316SS | | |
| W81-18 | 8 (1/4) | 3 (1/4) |
| W81-28 | 9 (7/8) | 3 (1/4) |
| W81-38 | 11 (5/8) | 5 |
| W81-48 | 12 (7/8) | 3 (3/4) |

3 Element Style

| CODE | DESCRIPTION |
|------|-----------------------|
| SL | Spring-loaded element |

4 Head Extensions

| CODE | DESCRIPTION |
|--------|--|
| 8HN | 316SS 1/2" NPT hex fitting |
| 8PN(E) | 316SS pipe nipple (specify length in inches) |

5 Terminations

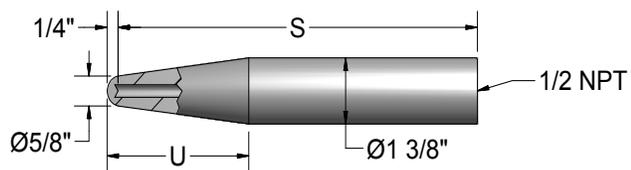
| CODE | DESCRIPTION |
|------|--|
| 91 | 316L stainless steel screw-cover head |
| 63 | White polypropylene screw-cover head |
| 31,W | Aluminum screw-cover head with white epoxy coating |

Head Options

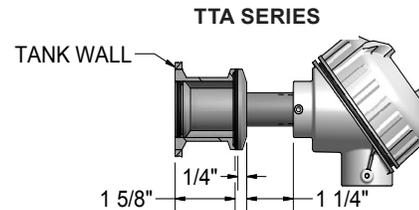
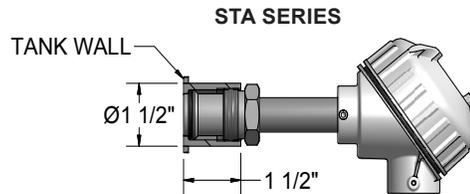
| | |
|---|--|
| T | Head-mounted transmitter (see Transmitter Section) |
| I | Stainless steel tag |

Example Order Number: **W81-18**

| PART NUMBER | S LENGTH (inches) | U LENGTH (inches) |
|-------------|-------------------|-------------------|
| W81-18 | 8 (1/4) | 3 (1/4) |
| W81-28 | 9 (7/8) | 3 (1/4) |
| W81-38 | 11 (5/8) | 5 |
| W81-48 | 12 (7/8) | 3 (3/4) |



The non-intrusive tank sensors listed on this page are designed to mount flush with the interior tank wall for maximum product contact. This allows the wiping or mixing blades to properly mix the product within the tank without damaging the temperature sensor. The temperature sensors are manufactured of highly polished stainless steel and use various mounting methods for simple installation. These sensors are supplied standard with a 100 Ω, Platinum RTD sensing element. These RTD assemblies are constructed of 316 stainless steel and all wetted parts are supplied with a surface finish that meets or exceeds 32µin R_a. Surface finishes of 15µin R_a or better are available upon request. These RTD assemblies have an operation temperature of (-50 to 200) °C [-58 to 400] °F. See back of section for complete dimensions and installation instructions.



ORDER CODES

Example Order Number: 1-0 **RAF185L** 1-1 **3** - 1-2 **DTA** - 1-3 **63**

1-0 100 Ω Platinum RTD Elements

| CODE | | TOLERANCE | TEMPERATURE COEFFICIENT |
|---------|---------|-----------|--|
| Single | Duplex | | |
| RBF185L | RBF285L | Class B | $\alpha = 0.003 \text{ 85 } ^\circ\text{C}^{-1}$ |
| RAF185L | RAF285L | Class A | $\alpha = 0.003 \text{ 85 } ^\circ\text{C}^{-1}$ |

1-1 Element Connection

| CODE | DESCRIPTION |
|-------|----------------|
| 3 | 3-Wire Element |
| 4 [1] | 4-Wire Element |

[1] Not Available in Duplex

1-2 Assembly Types and Options

| SINGLE-WALL RTD SENSOR | |
|------------------------|--|
| CODE | DESCRIPTION |
| STA | Complete assembly, includes sensor, mounting adaptor, and O-ring |
| STS | Replacement sensor, includes sensor, and O-ring |
| DUAL-WALL RTD SENSOR | |
| CODE | DESCRIPTION |
| DTA | Complete assembly, includes sensor, mounting adaptor and O-ring |
| DTS | Replacement sensor, includes sensor and O-ring |
| TRI-CLAMP® RTD SENSOR | |
| CODE | DESCRIPTION |
| TTA | Complete assembly, includes sensor, mounting adaptor, clamp, gasket and O-ring |
| TTS | Replacement sensor, includes sensor and O-ring |
| CAN STYLE RTD SENSOR | |
| CODE | DESCRIPTION |
| FCA | Complete assembly, includes sensor, backing nut, mounting adaptor and FEP gasket |
| FCS | Replacement sensor, includes sensor and FEP gasket |

1-3 Head Terminations and Options

| CODE | DESCRIPTION |
|--|--|
| 63 | White polypropylene screw-cover head |
| 31,W | Aluminum screw-cover head with white epoxy coating |
| 91 | 316 Stainless steel screw-cover head |
| Optional Temperature Transmitters and Head Options | |
| CODE | DESCRIPTION |
| T-440 | (4 to 20) mA head-mounted RTD transmitter |
| T-441 | (4 to 20) mA isolated head-mounted transmitter |
| T-442 | (4 to 20) mA isolated Hart® head-mounted transmitter |
| I | Stainless steel identification tag |
| SB | 1/2" NPT conduit reducer bushing |
| NB | 1/2" NPT nylon conduit reducer bushing |

Replacement Parts

| CODE | DESCRIPTION |
|-------|--|
| 13445 | Single-wall tank mounting adaptor (STA assembly) |
| 13446 | Dual-wall tank mounting adaptor (DTA assembly) |
| 13538 | Silicon/FEP O-ring for STA and DTA assemblies |
| 13470 | Tank mounting adaptor for Tri-Clamp® assembly |
| 13542 | Silicon/FEP O-ring for TTA Tri-Clamp® assembly |
| 13439 | 1 1/2" clamp for TTA Tri-Clamp® assembly |
| 13440 | EDPM gasket for TTA Tri-Clamp® assembly |
| 13447 | Tank mounting adaptor for FCA Can style assembly |
| 13449 | Backing nut for FCA Can style assembly |
| 13448 | FEP gasket for FCA Can style assembly |

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Pyromation insertion probes with formed pistol grip handles, are used to measure internal temperature of meat, fish, poultry, and other food products, both fresh and slightly frozen varieties. Other uses include penetration of soft process materials such as rubber and plastic compounds. The materials of construction are all FDA compliant for use in sanitary applications. The sheath tips are made of full hard-drawn 304SS hypodermic tubing with a sharp needle-point insertion tip. Handles are constructed of formed stainless steel tubing and are available in three size and strength configurations to match the process duty requirements. All leads are epoxy sealed.

FIGURE 1

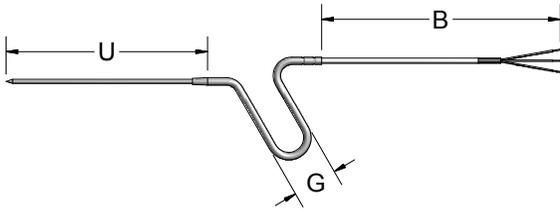
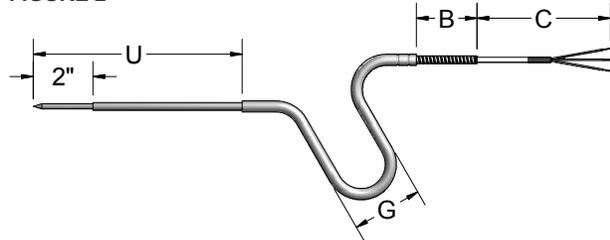


FIGURE 2



ORDER CODES

Example Thermocouple Order Number:

JPGM**2**G - **06** - **M3036** - **4**

Example RTD Order Number:

RBF185PG**M3** - **06** - **M3120** - **2**

1 Penetration Thermocouple

| CODE | TIP DIA. (inches) | GRIP "G" DIM. (inches) | GRIP DIA. (inches) |
|--------------------------------------|-------------------|------------------------|--------------------|
| <i>LIGHT-DUTY HANDLE - FIGURE 1</i> | | | |
| JPGL2G | 0.134 | 1 1/4 | 1/4 |
| <i>MEDIUM-DUTY HANDLE - FIGURE 2</i> | | | |
| JPGM2G | 0.134 | 2 3/8 | 5/16 |
| JPGM3G | 0.180 | 2 3/8 | 5/16 |
| <i>HEAVY-DUTY HANDLE - FIGURE 2</i> | | | |
| JPGH3G | 0.180 | 2 3/8 | 3/8 |
| <i>DUPLEX - FIGURE 2</i> | | | |
| JJPGH3G | 0.180 | 2 3/8 | 3/8 |

To specify other calibrations, change first digit to K or T.
To specify ungrounded junction, change last digit from G to U.

2 Immersion "U" Length

DESCRIPTION
Specify "U" dimension in inches using 2 digits, plus any fractional lengths. Examples: 02 = 2", 02(1/2) = 2.5". 12" maximum insertion length.

4 Terminations

| CODE | DESCRIPTION |
|----------------|--------------------------------|
| 2 | 2" split leads 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 6 | Miniature plug |
| Options | |
| RB | Rubber boot (2 pin plugs only) |
| MC | Mating connector |
| CG | Cord grip (1/2" NPT PVC) |

3 Extension Leadwire

| CODE | DESCRIPTION | TEMP RATING |
|----------------|--|-----------------|
| T3_ _ _ [1] | Fluoropolymer Insulation - Stranded Conductor | 204 °C [400 °F] |
| T3T_ _ _ [1] | Fluoropolymer Insulation - Stranded Conductor - Flexible Armor | 204 °C [400 °F] |
| T3T_ _ _ [1] | Fluoropolymer Insulation - Stranded Conductor - Flexible Armor - FEP coated | 204 °C [400 °F] |
| T3P_ _ _ [1] | Fluoropolymer Insulation - Stranded Conductor - Flexible Armor - PVC-Coated | 105 °C [221 °F] |
| M3_ _ _ [1][2] | Fluoropolymer Insulation - Stranded Conductor - Stainless Steel Overbraid - FEP Insulation | 204 °C [400 °F] |
| S3_ _ _ [1][3] | Fluoropolymer Insulation - Stranded Conductor - Silicon Rubber Jacket | 204 °C [400 °F] |

[1] Insert 3 digit "B" dimension in inches.

[2] Not available with Type K.

[3] Only available in single 3-wire RTD.

1 Penetration Style 3-Wire RTDs Pt100 ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$)

| CODE | TOLERANCE [1] | TIP DIA. (inches) | GRIP 'G' DIM (inches) | GRIP DIA. (inches) |
|--------------------------------------|---------------|-------------------|-----------------------|--------------------|
| <i>LIGHT-DUTY HANDLE - FIGURE 1</i> | | | | |
| RBF185PGL2 | Class B | 0.134 | 1 1/4 | 1/4 |
| <i>MEDIUM-DUTY HANDLE - FIGURE 2</i> | | | | |
| RBF185PGM2 | Class B | 0.134 | 2 3/8 | 5/16 |
| RBF185PGM3 | Class B | 0.180 | 2 3/8 | 5/16 |
| <i>HEAVY-DUTY HANDLE - FIGURE 2</i> | | | | |
| RBF185PGH3 | Class B | 0.180 | 2 3/8 | 3/8 |
| <i>DUPLEX - FIGURE 2</i> | | | | |
| RBF285PGH3 | Class B | 0.180 | 2 3/8 | 3/8 |

Consult factory for other accuracies and types.

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

Insertion RTD probes are used to monitor internal temperatures of meat, fish, poultry, dough, and other food products, both fresh and slightly frozen varieties. Other uses include penetration of soft process materials such as rubber and plastic compounds. The materials of construction are all FDA compliant for use in sanitary applications. The sheaths are made of full hard-drawn 304SS, hypodermic tubing with a sharp needle-point insertion tip. Several varieties of handles, leadwire, and termination configurations are available. All assemblies are 3-wire construction and use a 100 ohm platinum element with a Temperature Coefficient of 0.003 85 °C⁻¹ (Class B) and are rated to 200 °C [392 °F] maximum temperature limit.

FIGURE 1

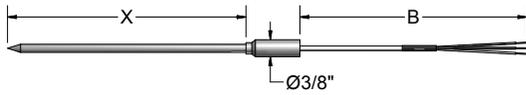


FIGURE 2

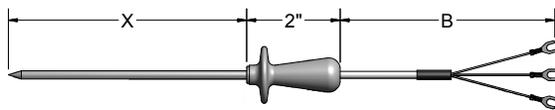


FIGURE 3

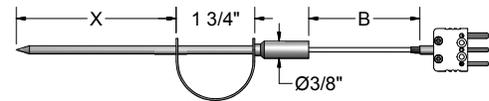
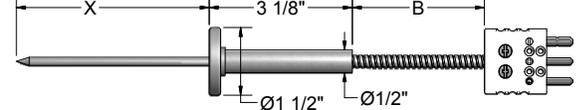


FIGURE 4



ORDER CODES

Example Order Number:

1 RBF185MH2

2 - 06

3 - T3120

4 - 4

**1 Pt100 ($\alpha = 0.003\ 85\ ^\circ\text{C}^{-1}$)
3-Wire RTD Assemblies**

| CODE | | NOM. SHEATH DIAMETER (inches) |
|---|-----------|-------------------------------|
| SINGLE | DUPLEX | |
| FIGURE 1 LESS HANDLE | | |
| RBF185LH2 | | 0.134 |
| RBF185LH3 | RBF285LH3 | 0.180 |
| FIGURE 2 MOLDED PBT HANDLE 135 °C [275 °F] | | |
| RBF185MH2 | | 0.134 |
| RBF185MH3 | RBF285MH3 | 0.180 |
| FIGURE 3 SABRE HANDLE | | |
| RBF185SH2 | | 0.134 |
| RBF185SH3 | RBF285SH3 | 0.180 |
| FIGURE 4 HEAVY DUTY HANDLE | | |
| RBF185HD2 | | 0.134 |
| RBF185HD3 | RBF285HD3 | 0.180 |

2 Sheath 'X' Dimension

Specify "X" length in inches using 2 digits plus any fractional length. Examples: 02 = 2", 02(1/2)" = 2.5"

12" max. standard construction length.

4 Terminations

| CODE | DESCRIPTION |
|----------------|--------------------------------|
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 6 | Miniature plug |
| Options | |
| RB | Rubber boot (2 pin plugs only) |
| MC | Mating connector |
| CG | Cord grip (1/2" NPT PVC) |

3 Extension Leadwire

| CODE | DESCRIPTION | TEMP RATING |
|--------------|--|-----------------|
| T3_ _ _ [1] | Fluoropolymer Insulation - stranded conductor | 200 °C [392 °F] |
| T3A_ _ _ [1] | Fluoropolymer Insulation - stranded conductor - flexible armor | 200 °C [392 °F] |
| T3T_ _ _ [1] | Fluoropolymer Insulation - stranded conductor - flexible armor - FEP coated | 200 °C [392 °F] |
| T3P_ _ _ [1] | Fluoropolymer Insulation - stranded conductor - flexible armor - PVC-coated | 105 °C [221 °F] |
| M3_ _ _ [1] | Fluoropolymer Insulation - stranded conductor - stainless steel overbraid - FEP Insulation | 200 °C [392 °F] |
| S3_ _ _ [1] | Fluoropolymer Insulation - stranded conductor - silicon rubber jacket | 200 °C [392 °F] |

[1] Insert 3 digit "B" dimension in inches.

Insertion thermocouple probes are used to monitor internal temperatures of meat, fish, poultry, dough, and other food products, both fresh and slightly frozen varieties. Other uses include penetration of soft process materials such as rubber and plastic compounds. The materials of construction are all FDA compliant for use in sanitary applications. The sheaths are made of full hard-drawn 304SS hypodermic tubing with a sharp needle-point insertion tip. Several varieties of handles, leadwire, and termination configurations are available. Probes are supplied with grounded hot junctions unless otherwise specified and are rated to 200 °C [392 °F] maximum temperature limit.

FIGURE 1

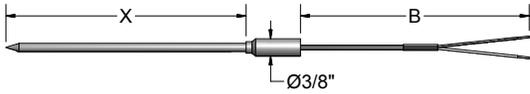


FIGURE 3

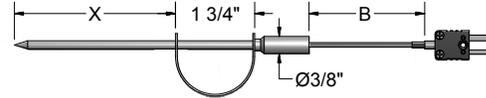


FIGURE 2

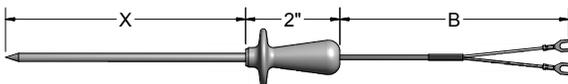
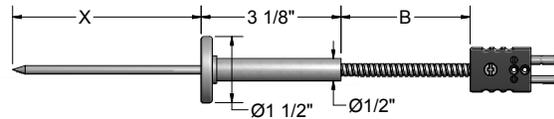


FIGURE 4



ORDER CODES

Example Order Number:

1 2 3 4
JMH2G - 06 - T3120 - 4

1 Thermocouple Type

| CODE | | NOM. SHEATH DIAMETER (inches) | |
|---|--------|-------------------------------|-------|
| SINGLE | DUPLEX | | |
| FIGURE 1 LESS HANDLE | | | |
| JLH2G | | J | 0.134 |
| JLH3G | JJLH3G | J | 0.180 |
| FIGURE 2 MOLDED PBT HANDLE 135 °C [275 °F] | | | |
| JMH2G | | J | 0.134 |
| JMH3G | JJMH3G | J | 0.180 |
| FIGURE 3 SABRE HANDLE | | | |
| JSH2G | | J | 0.134 |
| JSH3G | JJSH3G | J | 0.180 |
| FIGURE 4 HEAVY-DUTY HANDLE | | | |
| JHD2G | | J | 0.134 |
| JHD3G | JJHD3G | J | 0.180 |
| To specify other calibrations, change first digit to K or T. To specify ungrounded junctions, change last digit from G to U. | | | |

4 Terminations

| CODE | DESCRIPTION |
|----------------|--------------------------------|
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 6 | Miniature plug |
| Options | |
| RB | Rubber boot (2 pin plugs only) |
| MC | Mating connector |
| CG | Cord grip (1/2" NPT PVC) |

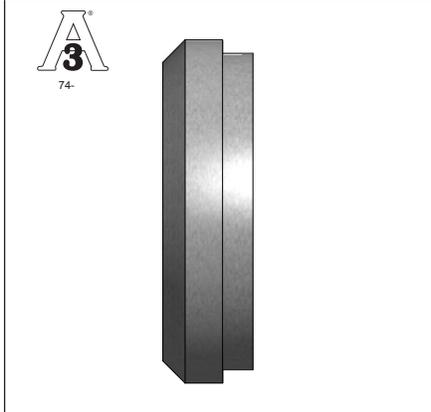
3 Extension Leadwire

| CODE | DESCRIPTION | TEMP RATING |
|---|--|-----------------|
| T3___ ^[1] | Fluoropolymer Insulation - stranded conductor | 200 °C [392 °F] |
| T3A___ ^[1] | Fluoropolymer Insulation - stranded conductor - flexible armor | 200 °C [392 °F] |
| T3T___ ^[1] | Fluoropolymer Insulation - stranded conductor - flexible armor - FEP coated | 200 °C [392 °F] |
| T3P___ ^[1] | Fluoropolymer Insulation - stranded conductor - flexible armor - PVC-coated | 105 °C [221 °F] |
| M3___ ^{[1][2]} | Fluoropolymer Insulation - stranded conductor - stainless steel overbraid - FEP Insulation | 200 °C [392 °F] |
| [1] Insert 3 digit "B" dimension in inches. [2] Not available with Type K. | | |

2 Sheath "X" Dimension

| |
|--|
| Specify "X" length in inches using 2 digits. |
| 12" max. standard construction length. |

16A Bevel Seat^[1]



| TUBE SIZE (inches) | O.D. (inches) | THICKNESS (inches) |
|--------------------|---------------|--------------------|
| 1 | 1.31 | 0.46 |
| 1 1/2 | 1.84 | 0.56 |
| 2 | 2.37 | 0.62 |
| 2 1/2 | 2.90 | 0.66 |
| 3 | 3.43 | 0.71 |
| 4 | 4.50 | 0.81 |

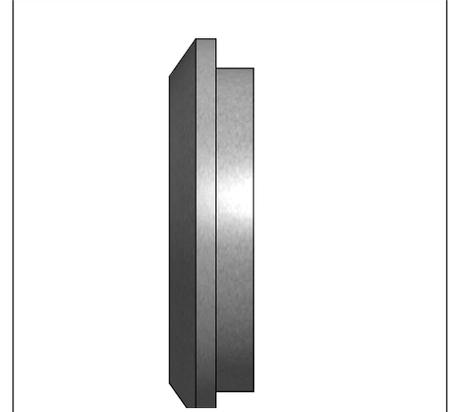
[1] Must be manually cleaned

16AH H-Line



| TUBE SIZE (inches) | O.D. (inches) | THICKNESS (inches) |
|--------------------|---------------|--------------------|
| 1 1/2 | 2.00 | 0.250 |
| 2 | 2.50 | 0.250 |
| 2 1/2 | 3.03 | 0.250 |
| 3 | 3.56 | 0.250 |
| 4 | 4.68 | 0.250 |

16AI - 14I



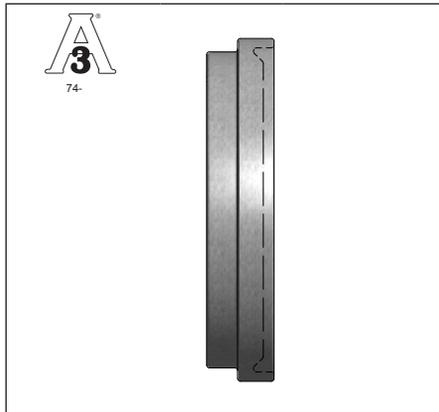
| TUBE SIZE (inches) | O.D. (inches) | THICKNESS (inches) |
|--------------------|---------------|--------------------|
| 1 or 1 1/2 | 2.00 | 0.50 |
| 2 | 2.65 | 0.56 |
| 2 1/2 | 3.12 | 0.56 |
| 3 | 3.87 | 0.75 |
| 4 | 4.87 | 0.75 |

16AMP



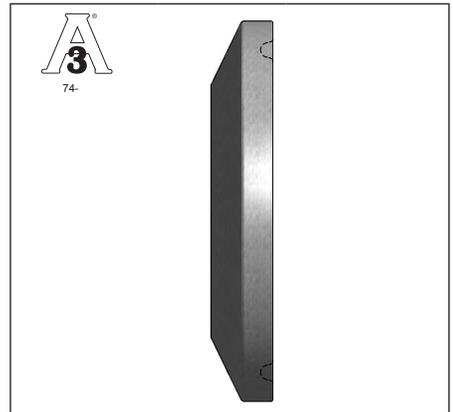
| TUBE SIZE (inches) | O.D. (inches) | THICKNESS (inches) |
|--------------------|---------------|--------------------|
| 1/2 or 3/4 | 1.00 | 0.25 |
| 1 or 1 1/2 | 1.98 | 0.25 |
| 2 | 2.51 | 0.25 |
| 2 1/2 | 3.03 | 0.25 |
| 3 | 3.57 | 0.25 |
| 4 | 4.68 | 0.31 |

16APV



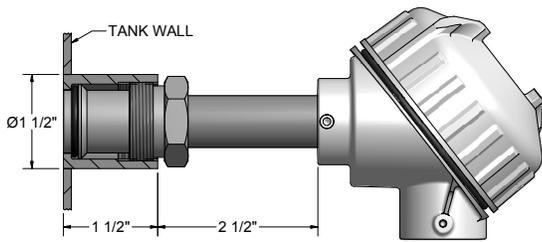
| TUBE SIZE (inches) | O.D. (inches) | THICKNESS (inches) |
|--------------------|---------------|--------------------|
| 1 | 1.38 | 0.29 |
| 1 1/2 | 1.88 | 0.42 |
| 2 | 2.38 | 0.46 |
| 2 1/2 | 2.88 | 0.47 |
| 3 | 3.38 | 0.50 |
| 4 | 4.38 | 0.53 |

16AQ - 14Q

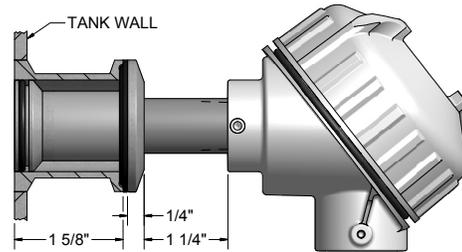


| TUBE SIZE (inches) | O.D. (inches) | THICKNESS (inches) |
|--------------------|---------------|--------------------|
| 1 or 1 1/2 | 1.98 | 0.31 |
| 2 | 2.64 | 0.43 |
| 2 1/2 | 3.30 | 9.50 |
| 3 | 3.87 | 0.50 |
| 4 | 4.87 | 0.62 |

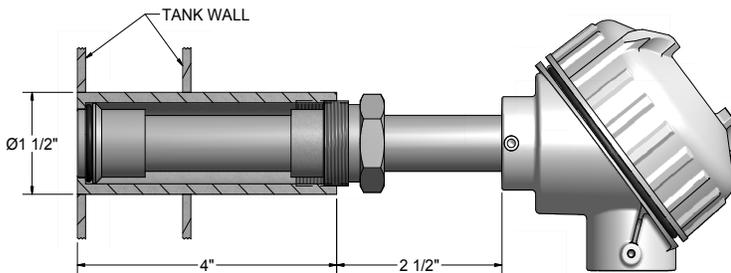
STA



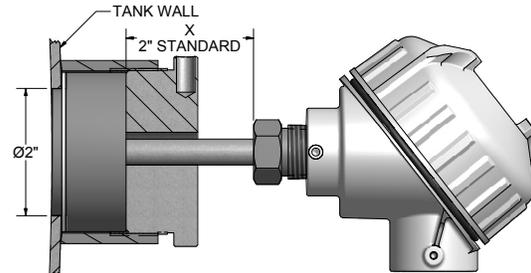
TTA



DTA



FCA



STA and DTA Series Tank Sensors

1. Drill a 1.50" Dia. (1 1/2") hole through the tank wall for tank adaptor.
2. Bevel tank wall(s) and/or tank adaptor as needed.
3. Tack weld (GTAW preferred) tank adaptor 3 to 4 places inside of tank wall to ensure flush/square fit.
4. Seal weld (GTAW preferred) tank adaptor to inside tank wall, grind weld as needed, provide sanitary finish to 180 grit minimum.
5. Weld (GTAW preferred) tank adaptor to outside of tank wall, grind weld as needed.
6. Slide O-ring onto sensor housing assembly.
7. Insert assembly into tank adaptor and tighten backing nut.

TTA Series Tank Sensors

1. Drill a 2.00" hole through the tank wall for tank adaptor.
2. Bevel tank wall(s) and/or tank adapter as needed.
3. Tack weld (GTAW preferred) tank spud 3 to 4 places inside of tank wall to ensure flush/square fit.
4. Seal weld (GTAW preferred) tank spud to inside tank wall, grind weld as needed, provide sanitary finish to 180 grit minimum.
5. Weld (GTAW preferred) tank spud to outside of tank wall, grind weld as needed.
6. Slide O-ring onto sensor housing assembly.
7. Insert assembly into tank adaptor and tighten clamp.

FCA Tank Sensors

1. Drill a 2.00" hole through the tank wall(s) for the tank adaptor.
2. Deburr tank wall(s) as needed.
3. Use the sensor housing to align the tank adaptor to the tank wall.
4. Tack weld (GTAW preferred) the tank adaptor to the outside of the tank wall, grind weld as needed.
5. Slide the FEP Gasket onto the end of the sensor housing.
6. Insert assembly into the tank mounting adaptor and tighten backing nut.

The straight base metal thermocouple elements illustrated on this catalog page are replacement elements for use in Pyromation's complete industrial thermocouple assemblies as found elsewhere in this catalog section. These replacement elements are also compatible for use in other manufacturers' thermocouple assemblies. These thermocouples are available as bare wire or ceramic insulated elements, with options as listed below, and with special construction designs.

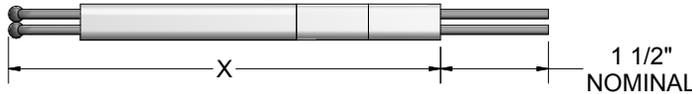
BARE ELEMENT



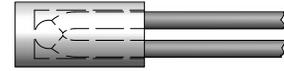
INSULATED ELEMENT



DUPLEX INSULATED



INSULATED JUNCTION



TWIST WELD



TIG WELD



ORDER CODES

Example Order Number:

1 2 3 4
K8 C M - 24 - 1,341

1 Single Straight Element Type

| CODE (Type + Wire Gauge) | | | | DESCRIPTION |
|--|-----|-----|-----|-------------------|
| J8 | | J14 | J20 | Iron - Constantan |
| K8 | K11 | K14 | K20 | Chromel - Alumel |
| N8 | | N14 | | Nicrosil - Nisil |
| DUPLEX STRAIGHT ELEMENTS | | | | |
| Use thermocouple type code letter twice. Example: JJ14 or KK11. Dual elements with ceramic insulators are supplied as two single elements. | | | | |

2 Element Insulation

| CODE | DESCRIPTION | WIRE GAUGE | INSULATOR DIMENSIONS (inches) | |
|------|---------------|------------|-------------------------------|------------|
| | | | SINGLE | DUPLEX |
| O | Bare Element | | None Used | |
| C | Oval Ceramic | 8 Ga. | 0.500 x 0.281 | |
| | | 11 Ga. | 0.375 x 0.218 | |
| | | 14 Ga. | 0.313 x 0.188 | |
| R | Round Ceramic | 8 Ga. | 0.465 O.D. | 0.500 O.D. |
| | | 11 Ga. | 0.465 O.D. | 0.500 O.D. |
| | | 14 Ga. | 0.250 O.D. | 0.320 O.D. |
| | | 20 Ga. | 0.150 O.D. | 0.188 O.D. |

The above insulated elements are supplied with refractory insulators: 1277 °C [2330 °F] maximum temperature.

Element Options

| CODE | DESCRIPTION |
|------|---|
| M | Special limits wire - types J and K (consult factory for other types) |

4 Element Options

| CODE | DESCRIPTION |
|------|--|
| 0 | Standard weld as noted below |
| 1 | Twist and tig weld (not available with 8 gauge duplex) |
| 2 | Tig weld without twist |
| L | Insulated hot junction |
| 341 | Single terminal block on element |
| 342 | Duplex terminal block on element |

Unless specified by option numbers above, all 8, 11, and 14 gauge elements will be provided with Opt. 2 (tig weld without twist). 20 gauge elements will be provided with Opt. 1 (twist and tig weld). All elements, regardless of gauge, over 96" will be supplied with Opt. 1 (twist and tig weld).

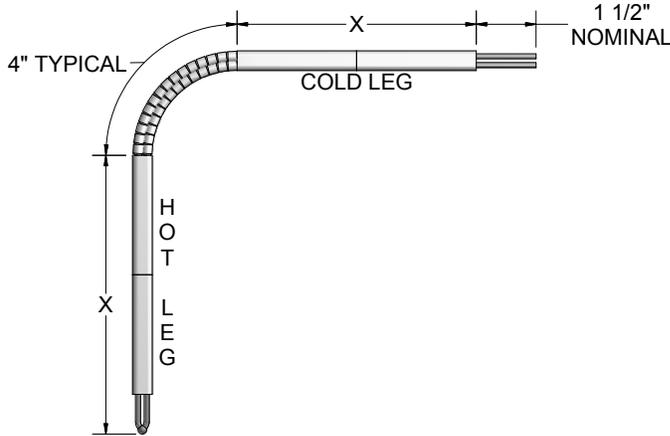
3 Element "X" Length

| LENGTH (inches) | LENGTH (inches) |
|-----------------|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |

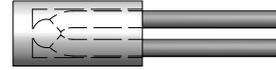
Specify other lengths in 1" increments.

Actual cut length will be 1(1/2)" longer than specified length to allow for terminal connections.

The angle base metal thermocouple elements illustrated on this catalog page are replacement elements for use in Pyromation's complete angle thermocouple assemblies as found elsewhere in this catalog section. These replacement elements are also compatible for use in other manufacturers' angle thermocouple assemblies. These thermocouples are available with the options listed below and with special construction designs. These replacement elements are shipped in a straight configuration and are to be bent at the time of installation.



INSULATED JUNCTION



TWIST WELD



TIG WELD



ORDER CODES

Example Order Number:



1 Single Angle Element Type

| CODE (Type + Wire Gauge) | DESCRIPTION |
|--------------------------|-------------------|
| J8 J14 | Iron - Constantan |
| K8 K11 K14 | Chromel - Alumel |
| N8 N14 | Nicrosil - Nisil |

DUPLEX ANGLE ELEMENTS

Requires the use of 2 single elements.

2 Element Insulation

| CODE | INSULATOR DESCRIPTION | WIRE GAUGE | INSULATOR DIMENSIONS (inches) |
|------|---|------------|-------------------------------|
| | | | SINGLE |
| A | Two hole oval ceramic insulators on hot and cold legs. Ball and socket insulators at bend | 8 Ga. | 0.500 x 0.281 |
| | | 11 Ga. | 0.500 x 0.286 |
| | | 14 Ga. | 0.375 x 0.218 |

The above insulated elements are supplied with refractory insulators: 1277 °C [2330 °F] maximum temperature.

Element Options

| CODE | DESCRIPTION |
|------|---|
| M | Special limits wire - types J and K (consult factory for other types) |

3 Hot Leg "X" Length

| LENGTH (inches) | LENGTH (inches) |
|-----------------|-----------------------|
| 12 | 30 |
| 18 | 36 |
| 24 | Specify Other Lengths |

5 Element Options

| CODE | DESCRIPTION |
|------|----------------------------------|
| 0 | Standard weld as noted below |
| 1 | Twist and tig weld |
| 2 | Tig weld without twist |
| L | Insulated hot junction |
| 341 | Single terminal block on element |
| 342 | Duplex terminal block on element |

Unless specified by option numbers above, all 8, 11, and 14 gauge elements will be provided with Opt. 2 (tig weld without twist).

All elements, regardless of gauge, over 96" will be supplied with Option 1 (twist and tig weld).

4 Cold Leg "X" Length

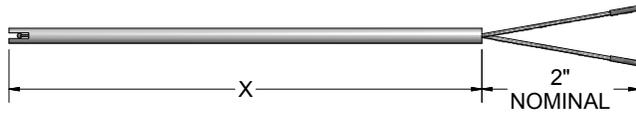
| LENGTH (inches) | LENGTH (inches) |
|-----------------|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |

Specify other lengths in 1" increments.

Actual cut length will be 1(1/2)" longer than specified length to allow for terminal connections.

The noble-metal platinum thermocouple elements illustrated on this catalog page are replacement elements for use in Pyromation's complete high temperature industrial thermocouple assemblies as found elsewhere in this catalog section. These replacement elements are also compatible for use in other manufacturers' high temperature thermocouple assemblies. All insulated elements are supplied with high temperature alumina insulators and are available with the options as listed below. Element types R, S, and B are supplied with a fusion weld. Custom designed constructions are available.

INSULATED ELEMENT without COLLAR
 (supplied with recessed junction as standard)



Note: Elements supplied without collars are intended to be used with ceramic tubes that are not supplied with hex fittings.

INSULATED ELEMENT with COLLAR



Note: Elements supplied with collars are intended to be used with ceramic tubes with hex fittings.

ORDER CODES

Example Order Number:

1 2 3 4
R24 - **R** - **18** - **3**

1 Single Straight Element Type

| CODE (Type + Wire Gauge) | | DESCRIPTION |
|--|-----|--|
| R24 | R26 | Platinum - Platinum 13% Rhodium |
| S24 | S26 | Platinum - Platinum 10% Rhodium |
| B24 | | Platinum - 30% Rhodium - Platinum 6% Rhodium |
| DUPLEX STRAIGHT ELEMENTS | | |
| Use thermocouple type code letter twice. EXAMPLES: RR24 or SS26 | | |

2 Element Insulation

| CODE | INSULATOR DESCRIPTION | WIRE GAUGE | INSULATOR DIMENSIONS (inches) |
|------|--|------------|--------------------------------|
| | | | <i>SINGLE and DUPLEX</i> |
| O | Uninsulated bare element | | None |
| R | Round, 99.7% Alumina Insulator (4-hole, single and duplex) 1871 °C [3400 °F] maximum temp. | 24 | 0.188 O.D. w 0.535 O.D. Collar |
| | | 26 | 0.188 O.D. w 0.535 O.D. Collar |
| CODE | DESCRIPTION | | |
| M | Reference grade (consult factory for other types) | | |

4 Element Options

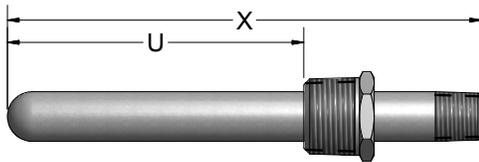
| CODE | DESCRIPTION |
|------|---------------------------------|
| 3 | Supplied without ceramic collar |
| L | Recessed insulated hot junction |

3 Element "X" Length

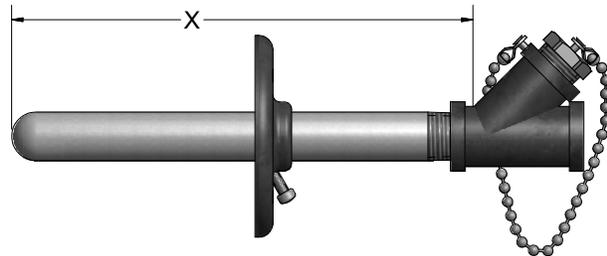
| LENGTH (inches) | LENGTH (inches) |
|---|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |
| Specify other lengths in 1" increments. | |

The thermocouple protection tubes illustrated on this catalog page are replacement tubes for Pyromation's complete thermocouple assemblies as found elsewhere in this catalog section. They are compatible replacements for other manufacturers' protection tubes. The materials of construction are those most commonly used in general purpose industrial process heating applications. These protection tubes are available with the options as listed below, with other pipe schedule sizes, and they can be supplied with custom designed constructions. **Note: Welded bushings will be welded at maximum length possible when X and U dimensions are specified as the same length. Actual U dimension will be 1 to 2 inches shorter than specified depending on bushing size.**

TUBE with OPTIONAL WELDED BUSHING



TUBE with OPTION CODE H and 6Y



ORDER CODES

Example Order Number:

1 **8-50** - **2** **18** - **3** **8D16**

1 Protection Tube NPT Connections

| CODE | NPT SIZE (inches) | PIPE SCHEDULE ^[1] |
|---|-------------------|------------------------------|
| <i>CARBON STEEL 538 °C [1000 °F] Max.</i> | | |
| 6 - 25 | 1/4 | 40 |
| 6 - 50 | 1/2 | 40 |
| 6 - 75 | 3/4 | 40 |
| 6 - 100 | 1 | 40 |
| <i>316 SS 927 °C [1700 °F] Max.</i> | | |
| 8 - 25 | 1/4 | 40 |
| 8 - 50 | 1/2 | 40 |
| 8 - 75 | 3/4 | 40 |
| 8 - 100 | 1 | 40 |
| <i>446 SS 1093 °C [2000 °F] Max.</i> | | |
| 5 - 50 | 1/2 | 40 |
| 5 - 75 | 3/4 | 40 |
| <i>ALLOY 600 1149 °C [2100 °F] Max.</i> | | |
| 3 - 50 | 1/2 | 40 |
| 3 - 75 | 3/4 | 40 |
| <i>ALLOY 601 1260 °C [2300 °F] Max.</i> | | |
| 7 - 50 | 1/2 | 40 |
| 7 - 75 | 3/4 | 40 |
| 7 - 100 | 1 | 40 |
| <i>HR-160 1204 °C [2200 °F] Max.</i> | | |
| 41 - 50 | 1/2 | 40 |
| 41 - 75 | 3/4 | 40 |
| 41 - 100 | 1 | 40 |

2 Tube "X" Length

| LENGTH (inches) |
|---|
| 12 |
| 18 |
| 24 |
| 30 |
| 36 |
| Specify other lengths in 1" increments up to 240". Consult factory for lengths above 20'. |

[1] Schedule 80 and 160 are available in some alloys as special order items. Consult factory for price and delivery.

3 Protection Tube Options

| CODE | DESCRIPTION |
|------|-------------------------------------|
| A | Open end tube (closed end standard) |
| H | Adjustable steel mounting flange |
| NT | Supplied without threads |
| 6Y | Steel temperature check fitting |

Optional Welded Bushings

| CODE | DESCRIPTION |
|-----------------------|---|
| <i>STEEL</i> | <i>316 SS</i> |
| BUSHING SIZE (inches) | |
| 6C(U) | 8C(U) 1/2 NPT Bushing (25 tubes only) |
| 6D(U) | 8D(U) 3/4 NPT Bushing (25 and 50 tubes only) |
| 6E(U) | 8E(U) 1 NPT Bushing (25, 50, and 75 tubes only) |
| 6F(U) | 8F(U) 1(1/4) NPT Bushing |
| 6G(U) | 8G(U) 1(1/2) NPT Bushing |

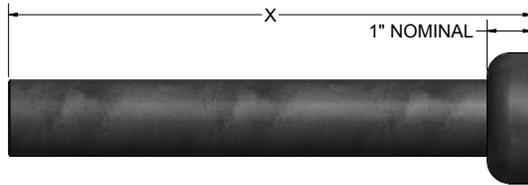
Substitute insertion length, in inches, measured from hot tip to bottom of bushing for (U) above. Insert NW in place of insertion length (U) for bushing supplied loose on tube.

Metal Alloy Tube Dimensions

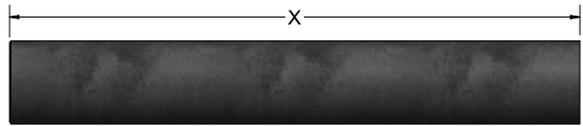
| PIPE SIZE (inches) | O.D. (inches) | SCH. 40 I.D. (inches) | SCH. 80 I.D. (inches) | SCH. 160 I.D. (inches) |
|--------------------|---------------|-----------------------|-----------------------|------------------------|
| 1/4 | 0.540 | 0.364 | 0.302 | |
| 1/2 | 0.840 | 0.622 | 0.546 | 0.466 |
| 3/4 | 1.050 | 0.824 | 0.742 | 0.612 |
| 1 | 1.315 | 1.049 | 0.957 | 0.815 |

The protection tubes listed below are designed for use in high temperature corrosive service applications. These protection tubes can be used in waste incineration, cement kilns, lime kilns, and other harsh process environments where high levels of sulfur, chlorides, ash, and salt deposits are commonly found. The series 12 protection tube is also an excellent choice for immersion into molten copper and brass alloys. The series 71 and series 18 protection tubes are typically used as outer protection tubes in high temperature applications such as ceramic kilns, brick kilns, and steel melting furnaces. These tubes are excellent choices in applications where direct flame impingement occurs.

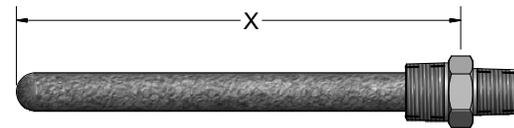
TUBE CODE 18JC



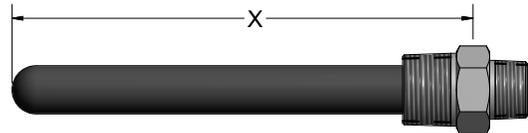
TUBE CODE 18J



TUBE CODE 71BH



TUBE CODE 12



ORDER CODES

Example Order Number:

12W4 - 24 - 8,NT

1

| Metal Ceramic (LT-1) 1371 °C [2500 °F]^[1] | | | | | |
|--|-----------------------|-----------------------|--|--------------------------|-----------------------|
| CODE | Nominal I.D. (inches) | Nominal O.D. (inches) | FITTING DESCRIPTION | PROCESS THREADS (inches) | TERM THREADS (inches) |
| 12WH | 5/8 | 7/8 | Steel hex fitting | 1 | 3/4 |
| 12W(E) | 5/8 | 7/8 | Steel pipe nipple (specify "E" length) | 1 | 1 |
| Silicate-Bonded Silicon Carbide 1649 °C [3000 °F] | | | | | |
| 18J | 1 | 1(3/4) | Plain tube | None | None |
| 18JC | 1 | 1(3/4) | Tube with 3" O.D. collar | None | None |
| Recrystallized Silicon Carbide (RSiC) 1600 °C [2912 °F] | | | | | |
| 71BH | 3/8 | 11/16 | Steel hex fitting | 3/4 | 1/2 |
| 71B(E) | 3/8 | 11/16 | Steel pipe nipple (specify "E" length) | 3/4 | 3/4 |
| 71WH | 1/2 | 7/8 | Steel hex fitting | 1 | 3/4 |
| 71W(E) | 1/2 | 7/8 | Steel pipe nipple (specify "E" length) | 1 | 1 |

[1] O.D. Tolerance ± 1/16", I.D. Tolerance + 1/16", - 3/32"

2 Tube "X" Length

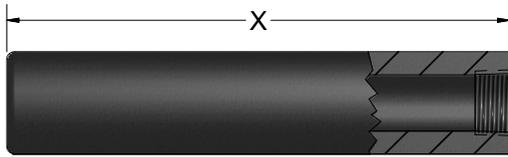
| LENGTH (inches) |
|-----------------|
| 12 |
| 18 |
| 24 |
| 30 |
| 36 |
| 42 |
| 48 |

3 Options

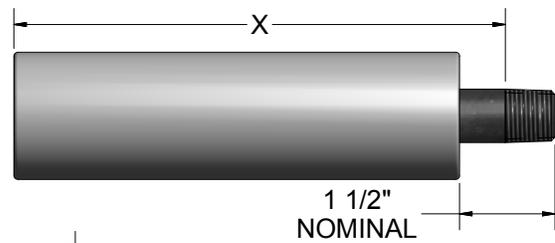
| CODE | DESCRIPTION |
|------|---|
| 8 | 316 SS nipple or hex tube fitting |
| NT | No process mounting threads on pipe nipples |

The Series 11, 13, and 14 protection tubes are used to protect thermocouple elements in molten aluminum and zinc applications such as diecasting, melting, smelting, and high temperature holding furnace environments. Series 13 and 14 protection tubes should be preheated and slowly immersed into any molten materials.

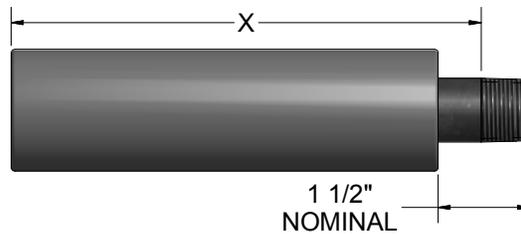
TUBE CODE 11



TUBE CODE 14^[1]



TUBE CODE 13^[1]



[1] Refractory length is 1" shorter than specified length

ORDER CODES

Example Order Number:

11-75 - 24

1 Protection Tube NPT Connections

| CODE | DESCRIPTION | NPT SIZE (inches) | TUBE | | MAX. LENGTH (inches) |
|--|---------------------|-------------------|-----------------------|-----------------------|----------------------|
| | | | Nominal O.D. (inches) | Nominal I.D. (inches) | |
| <i>CAST-IRON 871 °C [1600 °F] Max.</i> | | | | | |
| 11 - 75 | Internally threaded | 3/4 | 1.625 | 0.075 | 72 |
| <i>VESUVIUS 927 °C [1700 °F] Max.</i> | | | | | |
| 13 - 75 | | 3/4 | 2.00 | 0.824 | 48 |
| <i>CERITE® 815 °C [1300 °F] (36" maximum "X" length)</i> | | | | | |
| 14-50 ^[1] | Cerite® II | 1/2 | 2.00 | 0.622 | 36 |
| [1] For Cerite® protection tubes supplied with 316SS pipe instead of a carbon steel pipe, change model number prefix code 14 to 148. EXAMPLE: 148-50-24 | | | | | |

2 Tube "X" Length

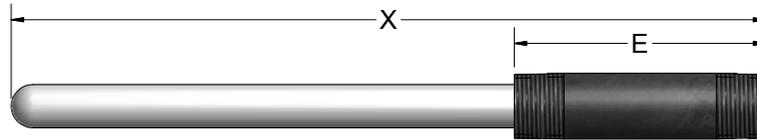
| LENGTH (inches) |
|-----------------|
| 12 |
| 18 |
| 24 |
| 30 |
| 36 |
| 42 |
| 48 |

Recommended Applications

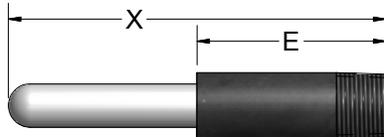
| | |
|-----------|----------------|
| CAST-IRON | Aluminum |
| VESUVIUS | Aluminum |
| CERITE® | Aluminum, Zinc |

The thermocouple protection tubes illustrated on this catalog page are replacement tubes for Pyromation's complete ceramic protection tube thermocouple assemblies as found elsewhere in this catalog section, and they are compatible replacements for other manufacturers' protection tubes. The Series 16 mullite tubes are composed of 63% alumina, and have slightly more porosity than the Series 17 alumina tube composed of 99.7% alumina, which is considered to be more gas tight.

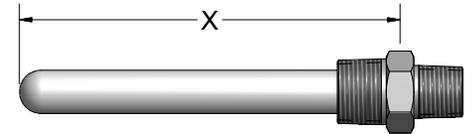
PIPE NIPPLE



BRASS FERRULE for OPEN STYLE HEAD or NT OPTION



HEX FITTING



ORDER CODES

Example Order Number:

1 2 3
17A4 - **18** - **8**

1 Ceramic Protection Tube Materials - Sizes - Fittings

| TUBE MATERIAL | | TUBE SIZE | | FITTING DESCRIPTION | PROCESS THREAD (inches) | TERMINATION THREAD (inches) |
|---------------------------------|---------------------------------|---------------|---------------|--|-------------------------|-----------------------------|
| CODE | | I.D. (inches) | O.D. (inches) | | | |
| MULLITE 1482 °C [2700 °F] | ALUMINA 1871 °C [3400 °F] | | | | | |
| 16AH | 17AH | 1/4 | 3/8 | Steel hex fitting | 1/2 NPT | 1/2 NPT |
| 16A(E) | 17A(E) | 1/4 | 3/8 | Steel pipe nipple (specify "E" length) | 1/2 NPT | 1/2 NPT |
| 16AF | 17AF | 1/4 | 3/8 | 7/8" O.D. x 2" L brass ferrule for open head | None | 7/8 x 27 UNS |
| 16A | 17A | 1/4 | 3/8 | Plain tube | None | None |
| 16BH | 17BH | 7/16 | 11/16 | Steel hex fitting | 3/4 NPT | 1/2 NPT |
| 16B(E) | 17B(E) | 7/16 | 11/16 | Steel pipe nipple (specify "E" length) | 3/4 NPT | 3/4 NPT |
| 16BF | 17BF | 7/16 | 11/16 | 7/8" O.D. x 2" L brass ferrule for open head | None | 7/8 x 27 UNS |
| 16B | 17B | 7/16 | 11/16 | Plain tube | None | None |
| 16CH | 17CH | 1/2 | 3/4 | Steel hex fitting | 3/4 NPT | 1/2 NPT |
| 16C(E) | 17C(E) | 1/2 | 3/4 | Steel pipe nipple (specify "E" length) | 3/4 NPT | 3/4 NPT |
| 16C | 17C | 1/2 | 3/4 | Plain tube | None | None |
| 16WH | 17WH | 5/8 | 7/8 | Steel hex fitting | 1 NPT | 3/4 NPT |
| 16W(E) | 17W(E) | 5/8 | 7/8 | Steel pipe nipple (specify "E" length) | 1 NPT | 1 NPT |
| 16W | 17W | 5/8 | 7/8 | Plain tube | None | None |

3 Options

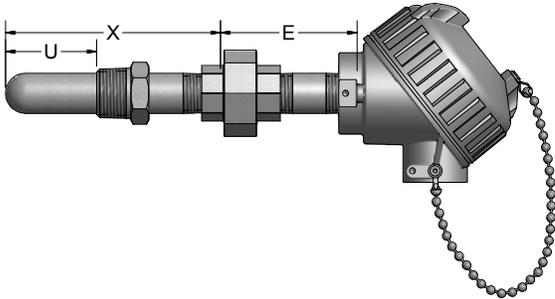
| CODE | DESCRIPTION |
|------|---|
| 8 | 316 SS nipple or hex tube fitting |
| NT | No process mounting threads on pipe nipples |

2 Tube "X" Length

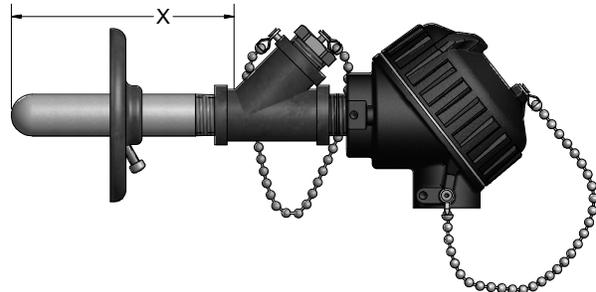
| LENGTH (inches) |
|---|
| 12 |
| 18 |
| 24 |
| 30 |
| 36 |
| Specify other lengths in 1" increments. |

The straight base metal thermocouple assemblies illustrated on this page are those most commonly used in industrial process heating applications. All listed assemblies are provided with schedule 40 protection tubes, and are available with listed options. Heavier pipe schedule protection tubes and special construction designs are also available. **Note: Welded bushings will be welded at maximum length possible when X and U dimensions are specified as the same length. Actual U dimension will be 1 to 2 inches shorter than specified depending on bushing size.**

ASSEMBLY with WELDED BUSHING



ASSEMBLY with OPTIONAL FLANGE



ORDER CODES

Example Order Number: **K8C** - **7** - **50** - **24** - **6E20** - **34**

1 Thermocouple Type and Wire Gauge Size

| CODE | | |
|---|--------------|------|
| J8C | K8C | N8C |
| J14C | K11C K14C | N14C |
| Thermocouples of 8 ga. wire require minimum of 1/2" NPT tube | | |
| DUPLEX T/C ASSEMBLIES | | |
| For duplex assemblies use the T/C type code letter twice. Example: K8C - 7 - 75 becomes KK8C - 7 - 75 | | |

2 Protection Tube Material

| CODE | MATERIAL | 3 NPT Thread Size (inches) | | | |
|------|--------------|----------------------------|-----|-----|-----|
| | | 1/4 | 1/2 | 3/4 | 1 |
| 6 | CARBON STEEL | 25 | 50 | 75 | 100 |
| 8 | 316 SS | 25 | 50 | 75 | 100 |
| 5 | 446 SS | | 50 | 75 | 100 |
| 3 | ALLOY 600 | | 50 | 75 | |
| 7 | ALLOY 601 | | 50 | 75 | 100 |
| 41 | HR 160® | | 50 | 75 | 100 |

4 Tube "X" Length

| LENGTH (inches) | LENGTH (inches) |
|---|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |
| Specify other lengths in 1" increments up to 240". Consult factory for lengths above 20'. | |

Duplex 8, 11, and 14 ga. assemblies require a minimum 1/2" NPT protection tube size (size codes 50 and larger).

8 gauge duplex thermocouple elements supplied in 1/2" NPT protection tubes will be supplied with round insulators.

5 Optional Welded Bushings

| CODE | | DESCRIPTION |
|--|-----------------------|---|
| STEEL | 316SS | BUSHING SIZE (inches) |
| 6C(U) | 8C(U) | 1/2 NPT Bushing (25 tubes only) |
| 6D(U) | 8D(U) | 3/4 NPT Bushing (25 and 50 tubes only) |
| 6E(U) | 8E(U) | 1 NPT Bushing (25, 50 and 75 tubes only) |
| 6F(U) | 8F(U) | 1(1/4) NPT Bushing |
| 6G(U) | 8G(U) | 1(1/2) NPT Bushing |
| Substitute insertion length, in inches, measured from hot tip to bottom of bushing for (U) above. Insert NW in place of insertion length (U) for bushing supplied loose on tube. | | |
| Optional Union and Nipple Head Connection | | |
| STEEL | 316 SS | Union-nipple supplied as material specified |
| 6PU(E) ^[1] | 8PU(E) ^[1] | |
| [1] Insert extension length, in inches, for (E) above. | | |

6 Head Terminations

| CODE | DESCRIPTION |
|---|--|
| 31 | Aluminum screw-cover head |
| 34 | Cast-Iron screw-cover head |
| 49 | Flip-top aluminum head |
| 91 ^[1] | 316L SS screw-cover head |
| 93 ^[1] | Aluminum explosion-proof head, Group B |
| 94 ^[1] | 316L SS explosion-proof head, Group A |
| [1] Not available with 1" NPT protection tubes. | |

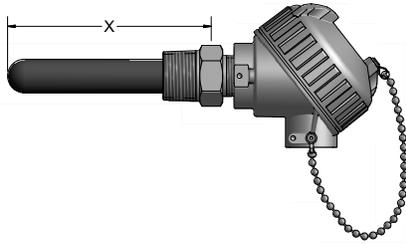
6-1 Assembly Options

| CODE | DESCRIPTION |
|------|----------------------------------|
| SB | 1/2" NPT conduit reducer bushing |
| GS | Ground screw |
| H | Adjustable steel mounting flange |
| I | Stainless tag |
| 6Y | Steel temperature check fitting |
| L | Insulated hot junction |

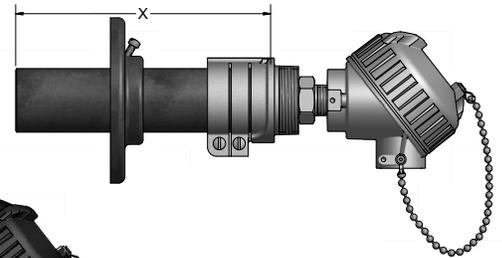
HR-160® is a registered trademark of Haynes International, Inc.

The straight base-metal thermocouple assemblies illustrated on this page are typically used in high temperature and highly corrosive applications commonly found in waste incinerators, cement and lime kilns, utility and waste recovery boilers, and other severe process environments. Special construction designs are also available.

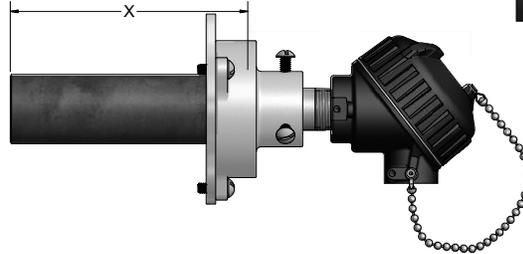
SERIES 12WH or 71WH ASSEMBLY with 1" STEEL HEX FITTING



SERIES 18J ASSEMBLY with OPTIONAL FLANGE



SERIES 18JC ASSEMBLY



ORDER CODES

Example Order Number:

K8C - 12WH - 36 - 34, I

1 Thermocouple Type and Wire Gauge Size

| CODE | DESCRIPTION |
|------|--|
| K8C | Type K 8 Gauge ceramic oval insulators |
| N8C | Type N 8 Gauge ceramic oval insulators |

For duplex assemblies use the T/C type code letter twice. Round insulators will be supplied with 71 series tubes and duplex elements in 12 series tubes. Duplex elements are not available in series 71 tubes.

3 Tube "X" Length

| LENGTH (inches) | |
|-----------------|----|
| 12 | 36 |
| 18 | 42 |
| 24 | 48 |
| 30 | |

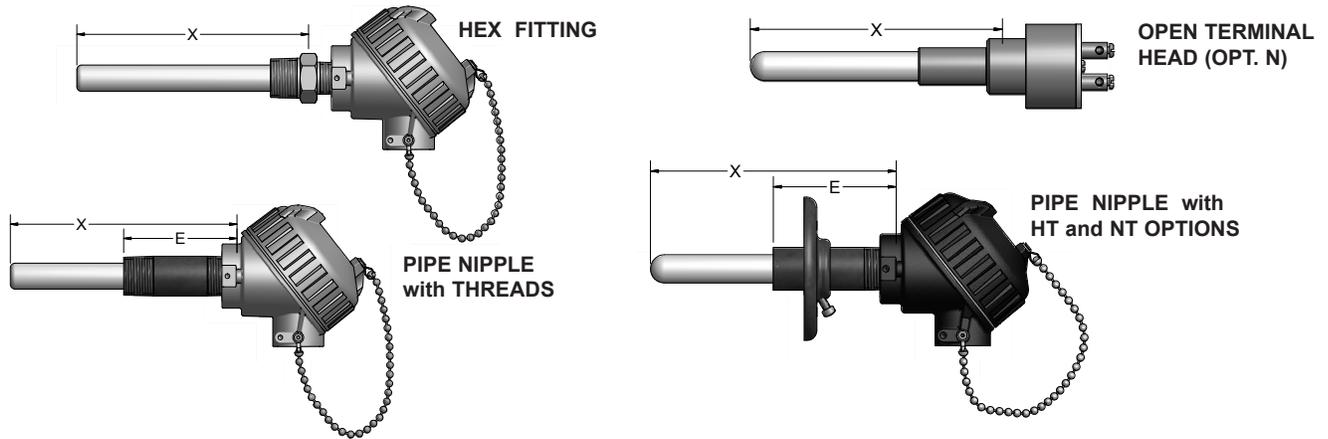
2 Protection Tube Material NPT Connection

| CODE | I.D. (inches) | O.D. (inches) | FITTING DESCRIPTION | PROCESS THREADS (inches) | TERM THREADS (inches) |
|--|---------------|---------------|--|--------------------------|-----------------------|
| Metal Ceramic (LT-1) 1371 °C [2500 °F] | | | | | |
| 12WH | 5/8 | 7/8 | Steel hex fitting | 1 | 3/4 |
| 12W(E) | 5/8 | 7/8 | Steel pipe nipple (specify "E" length) | 1 | 1 |
| Silicate-Bonded Silicon Carbide 1649 °C [3000 °F] | | | | | |
| 18J | 1 | 1(3/4) | Plain tube | None | None |
| 18JC | 1 | 1(3/4) | Tube with 3" O.D. collar | None | None |
| Recrystallized Silicon Carbide (RSiC) 1600 °C [2912 °F] | | | | | |
| 71WH | 1/2 | 7/8 | Steel hex fitting | 1 | 3/4 |
| 71W(E) | 1/2 | 7/8 | Steel pipe nipple (specify "E" length) | 1 | 1 |

4 Head Terminations

| CODE | DESCRIPTION |
|-----------------|---|
| 31 | Aluminum screw-cover head |
| 34 | Cast-Iron screw-cover head |
| 49 | Flip-top aluminum head |
| 91 | 316 stainless steel screw-cover head |
| Assembly | |
| SB | 1/2" NPT conduit reducer bushing |
| GS | Internal ground screw |
| H | Adjustable mounting flange |
| HT | Threaded flange on nipple |
| SB | 1/2" NPT conduit reducer bushing |
| I | Stainless tag |
| 8 | 316 stainless steel nipple or hex fitting |
| NT | Supplied without threads |

The straight noble- and base-metal thermocouple assemblies, with Series 16 mullite and Series 17 alumina protection tubes, illustrated on this catalog page are those most commonly used in high temperature process heating applications. These assemblies are available with a variety of process mounting fittings and assembly options as listed below. Special construction designs are also available.



ORDER CODES

Example Order Number: **1** **R24R** - **2** **17BH** - **3** **18** - **4** **31**, **4-1** **8**

1 Thermocouple Type and Wire Gauge Size

| CODE | | |
|---|--|--|
| B24R R24R R26R S24R S26R | K8R ^[1] N8R ^[1] [1] Use only with 16C or 16W series tubes | K11C ^[2] N14C ^[2] [2] Use only with 16B or 16C series tubes |
| 8 ga. duplex elements only available in W series tubes. For duplex T/C's, use element type twice. Example: RR24R | | |

2 Protection Tube

| TUBE MATERIAL AND SIZE | | | | |
|---------------------------------|---------------------------------|--------------------|-------------------|--|
| CODE | | TUBE O.D. (inches) | NPT SIZE (inches) | PROCESS MOUNTING FITTING |
| MULLITE 1482 °C [2700 °F] | ALUMINA 1871 °C [3400 °F] | | | |
| 16AH ^[1] | 17AH ^[1] | 3/8 | 1/2 | Steel hex fitting |
| 16A(E) ^[1] | 17A(E) ^[1] | 3/8 | 1/2 | Steel pipe nipple (Specify "E" length) |
| 16AF | 17AF | 3/8 | None | 7/8" O.D. x 2" L open head fitting |
| 16BH | 17BH | 11/16 | 3/4 | Steel hex fitting |
| 16B(E) | 17B(E) | 11/16 | 3/4 | Steel pipe nipple (Specify "E" length) |
| 16BF | 17BF | 11/16 | None | 7/8" O.D. x 2" L open head fitting |
| 16CH | | 3/4 | 3/4 | Steel hex fitting |
| 16C(E) | | 3/4 | 3/4 | Steel pipe nipple (Specify "E" length) |
| 16WH | | 7/8 | 1 | Steel hex fitting |

[1] All assemblies with a 3/8" O.D. tube should be ordered with an aluminum termination head.

4 Head Terminations

| CODE | DESCRIPTION |
|------|---|
| 31 | Aluminum screw-cover head |
| 34 | Cast-Iron screw-cover head |
| 49 | Flip-top aluminum head |
| 91 | 316L SS screw-cover head |
| N | Open terminal head - R, S, B only (require AF or BF protection tubes) |

4-1 Assembly Options

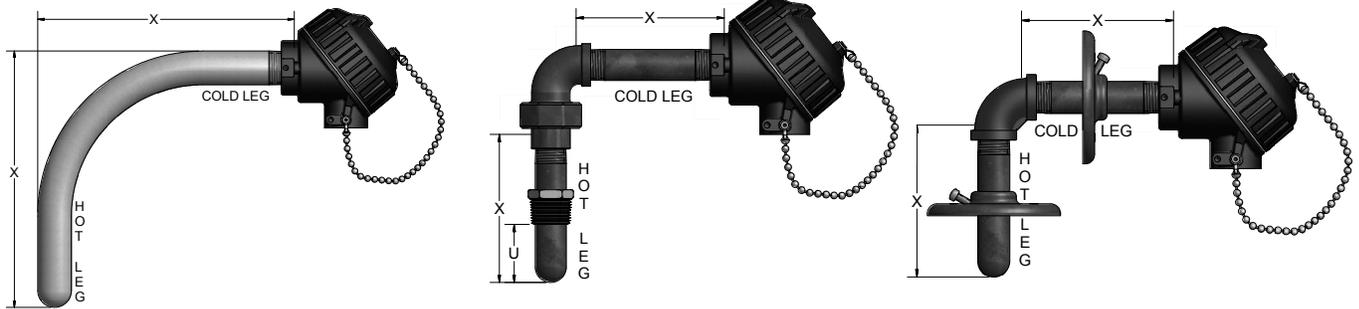
| CODE | DESCRIPTION |
|------|-----------------------------------|
| SB | 1/2" NPT conduit reducer bushing |
| GS | Ground screw |
| NT | No process threads on pipe nipple |
| HT | Threaded flange on nipple |
| I | Stainless tag |
| 8 | 316SS nipple or hex tube fitting |
| H | Adjustable steel mounting flange |

3 Tube "X" Length

| LENGTH (inches) | LENGTH (inches) |
|---|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |
| Specify other lengths in 1 inch increments. | |

Angle Thermocouples with Metal-Alloy Protection Tubes

Angle thermocouple assemblies are most commonly used in general process applications requiring the use of "over-the-side" temperature sensors with metal-alloy protection tubes. Special construction designs are available. Assemblies may be shipped with the hot leg unattached for assembly at time of installation due to size limitations. Cold leg as standard is supplied as carbon steel.



ORDER CODES

Example Order Number:

K8A - **8** - **75** - **18** - **18** - **8E16** - **34**, **GS**

1 Thermocouple Type and Wire Gauge Size

| CODE | | |
|------|------|------|
| J8A | K8A | N8A |
| | K11A | |
| J14A | K14A | N14A |

For duplex assemblies use the T/C type code letter twice. Example: J8A - 7 - 75 becomes JJ8A - 7 - 75

2 Hot Leg Protection Tube Material

| CODE | MATERIAL | CODE (inches) | | |
|------|--------------|---------------|-----|-----|
| | | 1/2 | 3/4 | 1 |
| 6 | CARBON STEEL | 50 | 75 | 100 |
| 8 | 316 SS | 50 | 75 | 100 |
| 5 | 446 SS | 50 | 75 | 100 |
| 3 | ALLOY 600 | 50 | 75 | N/A |
| 7 | ALLOY 601 | 50 | 75 | 100 |

3 Hot Leg NPT Thread Pipe Size

4 Hot Leg "X" Length

| LENGTH (inches) | LENGTH (inches) |
|-----------------|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |

Specify other lengths in 1" increments.

5 Cold Leg "X" Length

| LENGTH (inches) | LENGTH (inches) |
|-----------------|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |

Specify other lengths in 1" increments.

Continuous Bend Radius

| |
|--------------------|
| 1/2" NPT = 4(5/8)" |
| 3/4" NPT = 4(5/8)" |
| 1" NPT = 5(7/8)" |

6 Optional Welded Bushings

| CODE | | DESCRIPTION |
|-------|-------|--------------------------------------|
| STEEL | 316SS | BUSHING SIZE (inches) |
| 6D(U) | 8D(U) | 3/4 NPT Bushing (50 tubes only) |
| 6E(U) | 8E(U) | 1 NPT Bushing (50 and 75 tubes only) |
| 6F(U) | 8F(U) | 1(1/4) NPT Bushing |
| 6G(U) | 8G(U) | 1(1/2) NPT Bushing |

Substitute insertion length, in inches, measured from hot tip to bottom of bushing for (U) above.
Insert NW in place of insertion length (U) for bushing supplied loose on tube.

7 Head Terminations

| CODE | DESCRIPTION |
|------|----------------------------|
| 31 | Aluminum screw-cover head |
| 34 | Cast-Iron screw-cover head |
| 49 | Flip-top aluminum head |

7-1 Assembly Options

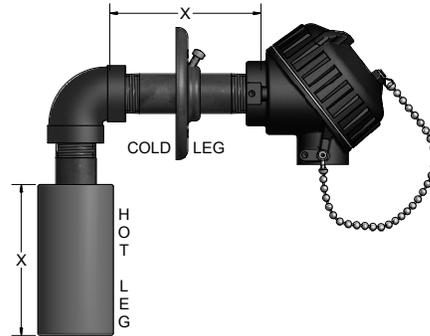
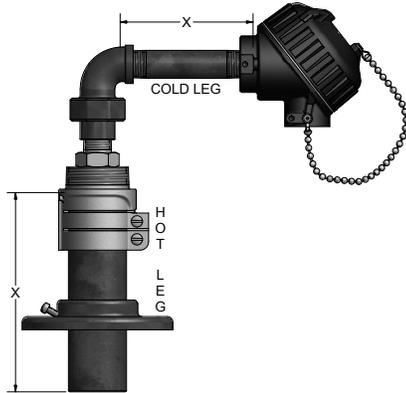
| CODE | DESCRIPTION |
|-------------------|------------------------------------|
| SB | 1/2" NPT conduit reducer bushing |
| GS | Ground screw |
| H | Adjustable steel mounting flange |
| HC | Adjustable steel flange (cold leg) |
| L | Insulated hot junction |
| I | Stainless tag |
| UL | Steel union elbow |
| CB ^[1] | Continuous bend-angle assembly |

^[1] Requires 12" minimum on Hot Leg and Cold Leg

Standard Assembly Specifications

| ELEMENT | HOT LEG TUBE CODE AVAIL. | COLD LEG SUPPLIED |
|---------------|--------------------------|--|
| SINGLE | | |
| 8, 11, 14 GA. | 50, 75, 100 | 3/4" NPT on HL tube codes 50, 75. 1" NPT on HL tube codes 100. 1" NPT on duplex 8 and 11 gauge assemblies. |
| DUPLEX | | |
| 8, 11 GA. | 75, 100 | |
| 14 GA. | 50, 75, 100 | |

Angle thermocouple assemblies are those commonly used in industrial process heating applications requiring the use of "over-the-side" temperature sensors with special metal alloy, composite material, or silicon carbide protection tubes. Special construction designs are available. Assemblies may be shipped with the hot leg unattached for assembly at time of installation due to size limitations. Cold leg as standard is supplied as carbon steel.



ORDER CODES

Example Order Number: **K8A** - **14-50** - **18** - **18** - **49, L**

1 Thermocouple Type and Wire Gauge Size

| CODE | |
|------|------|
| K8A | N8A |
| K11A | |
| K14A | N14A |

For duplex assemblies use the T/C type code letter twice.
Example: K14A - 12 - 75 becomes KK14A - 12 - 75.

2 Protection Tube Material NPT Connection

| CODE | HOT LEG PROT. TUBE | TUBE O.D. or NPT SIZE (inches) |
|------------------------|--------------------|--------------------------------|
| 11 - 75 | Cast-Iron | 1.625 |
| 12WH | Metal Ceramic | 0.875 |
| 13 - 75 | Vesuvius | 2.000 |
| 18J | Silicone Carbide | 1.750 |
| 14 - 50 ^[1] | Cerite® II | 1/2 NPT |

[1] For protection tubes with 316SS pipe instead of a carbon steel pipe, change order number to 148.
Example: K8A-148-50-24-K.

3 Hot Leg "X" Length

| LENGTH (inches) | LENGTH (inches) |
|-----------------|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |

4 Cold Leg "X" Length

| LENGTH (inches) | LENGTH (inches) |
|-----------------|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |

Specify other lengths in 1" increments.

Code 14 Cerite® II actual length is one inch shorter than above.

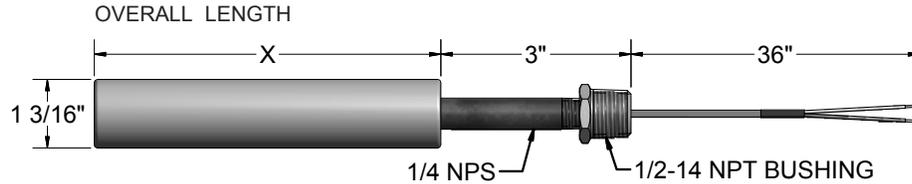
5 Head Terminations

| CODE | DESCRIPTION |
|------|----------------------------|
| 31 | Aluminum screw-cover head |
| 34 | Cast-Iron screw-cover head |
| 49 | Flip-top aluminum head |
| 91 | 316L SS screw-cover head |

5-1 Assembly Options

| CODE | DESCRIPTION |
|------|------------------------------------|
| SB | 1/2 NPT conduit reducer bushing |
| GS | Ground screw |
| H | Adjustable steel mounting flange |
| HC | Adjustable steel flange (cold leg) |
| L | Insulated hot junction |
| UL | Steel union elbow |
| I | Stainless tag |

Cerite® III thermocouples are provided with a protection tube, integral thermocouple element with 36" of high temperature 704 °C [1300 °F] fiberglass leads, and a 1/2" NPT steel male face bushing for use in mounting. They are constructed by casting a phosphate bonded refractory material containing 85% alumina, 4% silica, and other trace elements around a 1/4" NPT steel pipe, containing an integral stainless steel sheathed magnesium oxide (MgO) insulated thermocouple element. The cast refractory material was developed for use in molten non-ferrous metals, specifically molten aluminum and zinc. It has excellent non-wetting properties, allowing easy slag removal, and the small diameter provides fast thermal response to process temperature changes. These assemblies provide good resistance to thermal shock and mechanical breakage. The refractory material is rated at 1538 °C [2800 °F] however, its use as a Cerite® III thermocouple assembly is generally limited to 815 °C [1500 °F] maximum. **Protection tube pre-heating and slow immersion into the process is recommended.**



ORDER CODES

Example Order Number:

1
2
K39G - 15 - 25 - 24 - 36 - 4

1 Cerite® Thermocouple Specifications

| CODE | T/C TYPE | "X" DIMENSION IMMERSION LENGTH (inches) | OVERALL LENGTH (inches) | LEAD LENGTH (inches) | APPROX. WGHT. (lbs.) |
|------------------|----------|---|-------------------------|----------------------|----------------------|
| <i>SINGLE</i> | | | | | |
| K39G-15-25-12-36 | K | 12 | 15 | 36 | 1.75 |
| K39G-15-25-18-36 | K | 18 | 21 | 36 | 2.50 |
| K39G-15-25-24-36 | K | 24 | 27 | 36 | 3.25 |
| K39G-15-25-30-36 | K | 30 | 33 | 36 | 4.00 |
| K39G-15-25-36-36 | K | 36 | 39 | 36 | 4.75 |

2 Terminations

| CODE | DESCRIPTION |
|----------------|---|
| 0 | No lead termination |
| 2 | 2" split leads with 1/4" stripped leads |
| 4 | Standard plug |
| Options | |
| MC | Mating connector |

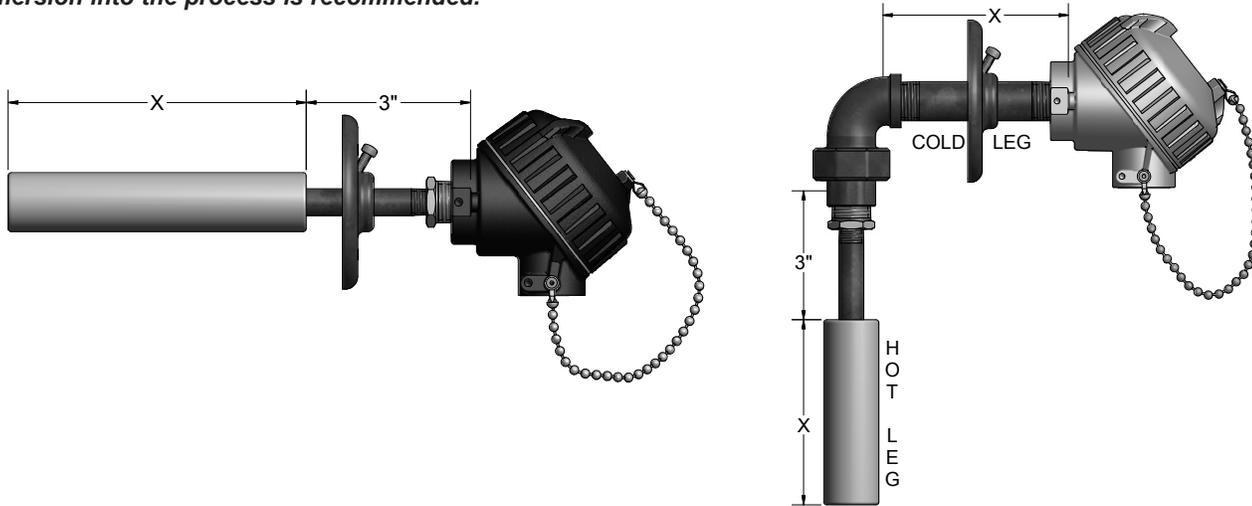
For duplex assemblies use thermocouple letter twice. **Example: KK39U - 15 - 25 - 24 - 36 - 0**

For assemblies with ungrounded junctions, substitute U for G in order code number. **Example: K39U - 15 - 25 - 24 - 36 - 0**

For additional lead length, change the last 2 digits of the order code number to desired length. **Example: K39G - 15 - 25 - 24 - 48 - 0**

For assemblies supplied with optional 316SS pipe insert, change order code number 15 to 158. **Example: K39G - 158 - 25 - 24 - 36 - 0**

Cerite® III thermocouple assemblies are complete thermocouple and protection tube assemblies. These Cerite® III assemblies are constructed by casting a phosphate bonded refractory material containing 85% alumina, 4% silica, and other trace elements around a 1/4" NPT steel pipe containing an integral stainless steel sheathed magnesium oxide (MgO) insulated thermocouple element. The cast refractory material was developed for use in molten non-ferrous metals, specifically molten aluminum and zinc. It has excellent non-wetting properties allowing easy slag removal, and the small diameter provides fast thermal response to process temperature changes. These assemblies also provide good resistance to thermal shock and mechanical breakage. The refractory material is rated at 1538 °C [2800 °F] however its use as a Cerite® III thermocouple assembly is generally limited to 815 °C [1500 °F] maximum. Cold leg as standard is supplied as carbon steel. **Protection tube pre-heating and slow immersion into the process is recommended.**



ORDER CODES

Example Order Number:

K39GS-15-25 - **24** - **—** - **34, H** *Straight Assembly, Single*

K39GA-15-25 - **24** - **24** - **49, HC** *Angle Assembly, Single*

1 Thermocouple Type and Assembly Style

| CODE | STYLE | CODE | STYLE |
|-----------------------|----------|-----------------------|----------|
| SINGLE ELEMENT | | DUPLEX ELEMENT | |
| K39GS-15-25 | Straight | KK39GS-15-25 | Straight |
| K39GA-15-25 | Angle | KK39GA-15-25 | Angle |

For ungrounded hot junctions change above letter code "G" to letter code "U". Example: K39US

For assemblies supplied with optional 316SS pipe insert, change order code number 15 to 158. Example: K39G-158-25-24-36-34

2 Straight or Angle Hot Leg Length

| "X" LENGTH (inches) | "X" LENGTH (inches) |
|---------------------|---------------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |

4 Head Terminations

| CODE | DESCRIPTION |
|------|----------------------------|
| 31 | Aluminum screw-cover head |
| 34 | Cast-Iron screw-cover head |
| 49 | Flip-top aluminum head |

4-1 Assembly Options

| CODE | DESCRIPTION |
|------|------------------------------------|
| SB | 1/2" NPT conduit reducer bushing |
| GS | Ground screw |
| H | Adjustable steel mounting flange |
| HC | Adjustable steel flange (cold leg) |
| I | Stainless tags |

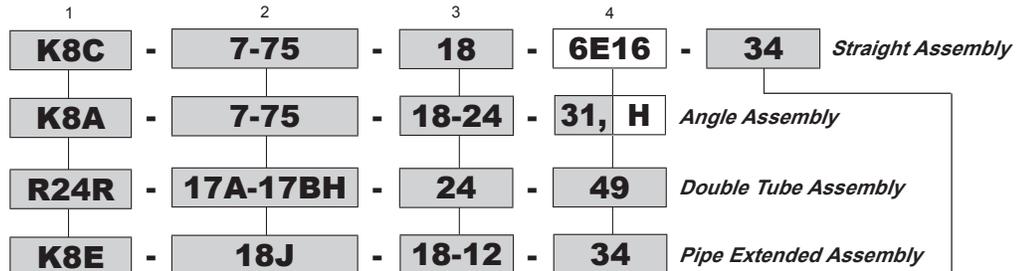
3 Angle Assembly Cold Leg Length

| "X" LENGTH (inches) | "X" LENGTH (inches) |
|---------------------|---------------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |

The preceding catalog pages have provided order code numbers for thermocouple elements, protection tubes, and the most commonly used industrial thermocouple assemblies. Non-standard assemblies can be designated by selecting the proper thermocouple element(s) and protection tube(s) from the appropriate pages in this catalog section. Component part order code numbers selected from those pages, and assembled as described below, with desired options from below, will provide the part number for a complete industrial thermocouple assembly. Special construction designs, using non-cataloged components, are also available. Consult factory for details.

ORDER CODES

Example Order Number:



1 Thermocouple Element

Insert **order code** for thermocouple type, wire gauge size, and insulator type from the appropriate thermocouple element pages located in this catalog section.

2 Protection Tube

Insert **order code** for tube material and size from the appropriate protection tube pages located in this catalog section.

Double protection tube assemblies require selection of 2 tubes. **Example: 17A - 17BH**

3 Protection Tube Length

STRAIGHT ASSEMBLIES: Insert the desired protection tube "X" length in inches.

ANGLE ASSEMBLIES: Requires specifying hot and cold leg length in inches.

PIPE EXTENDED ASSEMBLIES: (Supplied with steel coupling and pipe extension beyond protection tube) Insert letter code "E" after wire gauge and specify extension length in inches.

4 Optional Welding Bushings (Applies to Metal-Alloy Tubes only)

| CODE | | DESCRIPTION |
|--------------|--------------|--|
| <i>STEEL</i> | <i>316SS</i> | BUSHING SIZE (inches) |
| 6C(U) | 8C(U) | 1/2 NPT bushing (25 tubes) |
| 6D(U) | 8D(U) | 3/4 NPT bushing (25 and 50 tubes) |
| 6E(U) | 8E(U) | 1 NPT bushing (25, 50, 75 tubes) |
| 6F(U) | 8F(U) | 1(1/4) NPT bushing (50, 75, 100 tubes) |
| 6G(U) | | 1(1/2) NPT bushing (50, 75, 100 tubes) |

Substitute insertion length, in inches, measured from hot tip to bottom of bushing for (U) above. Insert NW in place of insertion length (U) for bushing supplied loose on tube.

Optional Union and Nipple Connections

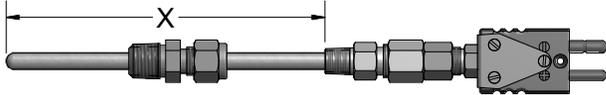
| CODE | | DESCRIPTION |
|--------------|--------------|--|
| <i>STEEL</i> | <i>316SS</i> | Both union and nipple supplied as material specified |
| 6PU(E) | 8PU(E) | |

Insert extension length, in inches, for (E)

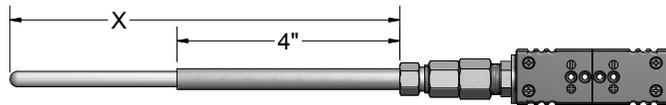
| Head Terminations | | Assembly Options | |
|--|--|------------------|---|
| CODE | DESCRIPTION | CODE | DESCRIPTION |
| 31 | Aluminum screw-cover head | A | Open-end protection tube |
| 34 | Cast-Iron screw-cover head | CB | Continuous-bend angle assembly |
| 49 | Flip-top aluminum head | GS | Ground screw |
| 91 ^[1] | 316L SS screw-cover head | 6Y | Steel temperature check fitting |
| 93 ^[1] | Aluminum explosion-proof head, Group B | H | Adjustable steel mounting flange |
| 94 ^[1] | 316L SS explosion-proof head, Group A | HC | Adjustable steel flange (cold leg) |
| N | Open type terminal head (B,R,S) with 16AF, 16BF, 17AF, 17BF tubes only | HT | Threaded flange on nipple |
| [1] Not Available with 1" NPT protection tubes | | I | Stainless tags |
| | | L | Insulated hot junction or recessed junction |
| | | NT | Supplied without threads |
| | | UL | Steel union elbows |
| | | SB | 1/2" NPT Conduit Reducer Bushing |

Pyromation's high-temperature thermocouples are designed to operate in a temperature range of (982 to 1871) °C [1800 to 3400] °F. They are designed for use in vacuum furnaces and other applications requiring high-temperature measurement in controlled atmospheric conditions. Metal sheaths of Alloy 600 and molybdenum are available as well as alumina ceramic sheaths. All assemblies are supplied with ungrounded, isolated hot junctions. The construction style consists of an alumina-insulated element inside the tube of choice as listed below. Special construction designs are also available.

METAL-SHEATHED ASSEMBLY



ALUMINA-SHEATHED ASSEMBLY



ORDER CODES

Example Order Number:

1 2 3 4 5 6 7
R24U - **403** - **24** - **05A** - **TBL. 5** - **TBL. 6** - **TBL. 7**

Select from following page

1 Single Elements

2 Sheath Size and Material

| TYPE AND WIRE GAUGE | CODE | SHEATH DIA. (inches) | MAX. TEMP. | ATMOSPHERE |
|--|---|--------------------------|--|--|
| ALLOY 600 | ALLOY 600 | | | |
| B24U C24U R24U S24U | R26U S26U | 303 303 303 303 | 0.188 0.188 0.188 0.188 | 1149 °C [2100 °F] Oxidizing, Inert or Vacuum |
| B24U C24U R24U S24U | R26U S26U | 403 403 403 403 | 0.250 0.250 0.250 0.250 | 1149 °C [2100 °F] Inert or Vacuum |
| MOLYBDENUM | MOLYBDENUM | | | |
| B24U C24U R24U S24U | R26U S26U | 302 302 302 302 | 0.188 0.188 0.188 0.188 | 1704 °C [3100 °F] 1871 °C [3400 °F] 1482 °C [2700 °F] 1482 °C [2700 °F] Inert or Vacuum |
| B24U C24U R24U S24U | R26U S26U | 402 402 402 402 | 0.250 0.250 0.250 0.250 | 1704 °C [3100 °F] 1871 °C [3400 °F] 1482 °C [2700 °F] 1482 °C [2700 °F] Inert or Vacuum |
| ALUMINA | ALUMINA | | | |
| B24U C24U R24U S24U | R26U S26U | 617 617 617 617 | 0.275 ^[1] 0.275 ^[1] 0.275 ^[1] 0.275 ^[1] | 1704 °C [3100 °F] 1871 °C [3400 °F] 1482 °C [2700 °F] 1482 °C [2700 °F] Oxidizing, Inert or Vacuum |
| For duplex elements use order code pre-fix letter twice. Example: RR24U | [1] Sheath supplied with 3/8" O.D. x 4" long stainless steel sleeve on tube cold end. Only available with size B and C compression fittings. | | | |
| CC24 assemblies not available in 0.188" O.D. sheath diameter. | Consult factory for availability of other diameters or insulations. | | | |

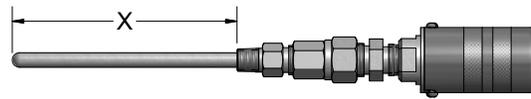
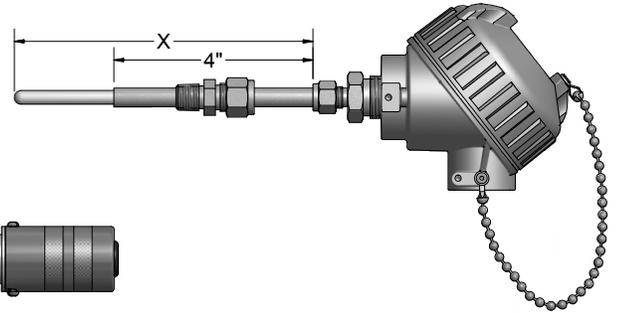
4 Sheath Mounting Fittings

| CODE | TYPE | NPT SIZE (inches) | AVAILABLE SHEATH DIA. (inches) |
|---|----------------------------|-------------------|--------------------------------|
| 00 | No sheath mounting fitting | | |
| One-Time Adjustable Compression Fittings | | | |
| 05A | Stainless steel | 1/8 | 3/16, 1/4 |
| 05B | Stainless steel | 1/4 | 3/16, 1/4, 3/8 |
| 05C | Stainless steel | 1/2 | 1/4, 3/8 |
| Re-Adjustable Compression Fittings | | | |
| 12A | Stainless steel | 1/8 | 3/16, 1/4 |
| 12B | Stainless steel | 1/4 | 1/4, 3/8 |
| 12C | Stainless steel | 1/2 | 1/4, 3/8 |
| FEP gland standard (400 °F max.) | | | |

3 Sheath "X" Length

| LENGTH (inches) | LENGTH (inches) |
|---|-----------------|
| 12 | 30 |
| 18 | 36 |
| 24 | |
| Specify other lengths in 1" increments. | |

All assemblies are provided with wire seal fitting except platinum element assemblies in Alloy protection tubes.
 All C24 assemblies in alumina protection tubes can only be used in inert or vacuum atmospheres.



ORDER CODES

Example Order Number:

R24U - **403** - **24** - **05A** - **15** - **F1A036** - **4**

Select from preceding pages

5 Plug and Jack Terminations

| CODE | DESCRIPTION | SHEATH O.D. (inches) |
|------|--|----------------------|
| 4 | Standard plug | 3/16 thru 3/8 |
| 4,HT | Standard hi-temp plug 385 °C [725 °F] | 3/16 thru 3/8 |
| MC | Mating connector | |

Head Terminations

| CODE | DESCRIPTION |
|----------------------|---|
| 9CF31 | Aluminum screw-cover head secured to sheath with SS compression fitting |
| 8HN31 ^[1] | Aluminum screw-cover head with 1/2" NPT stainless steel hex fitting |
| 9CF25 | Mini nickel-plated steel head |

Leadwire Transitions (requires leadwire selections)

| CODE | DESCRIPTION |
|---------------------|--|
| 15 ^[1] | Extension leadwire transition fitting with relief spring 204 °C [400 °F] |
| 15HT ^[1] | Extension leadwire transition fitting with relief spring and High temperature potting 538 °C [1000 °F] |

7 Terminations

| CODE | DESCRIPTION |
|------------------|--------------------------------|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4", stripped |
| 3 | 2" split leads with spade lugs |
| 4 ^[1] | Standard plug |
| 6 ^[1] | Miniature plug |

Options

| CODE | DESCRIPTION |
|-------------------|------------------|
| MC ^[1] | Mating connector |

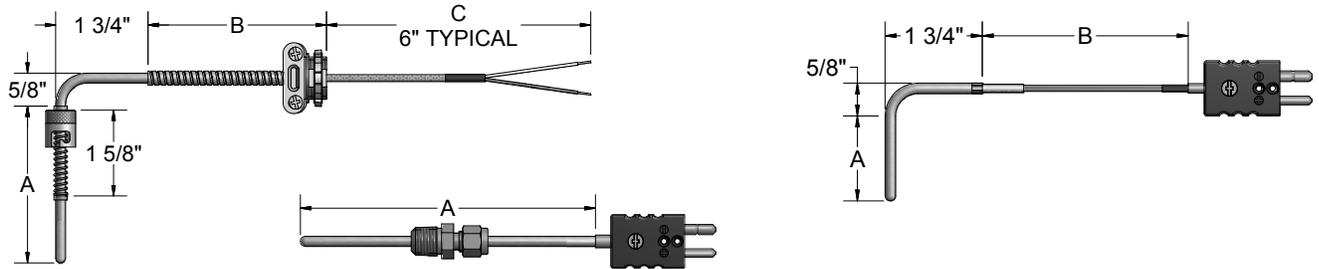
6 Extension Leadwire

| CODE | WIRE GAUGE INSULATION DESCRIPTION | T/C AVAILABLE |
|------|--|---------------|
| F1 | Solid; fiberglass insulation | R,S,B |
| F1A | Solid; fiberglass insulation with flexible S.S. armor | R,S,B |
| T1 | Solid; fluoropolymer insulation | R,S |
| T1A | Solid; fluoropolymer insulation with flexible S.S. armor | R,S |

To complete order code, insert wire code and 3 digit "B" length code. Example: F1A036=36" "B" length

[1] Only with platinum elements in 303-403 sheaths.

The thermocouples described below are commonly used in the plastic process industry. These assemblies can be used in many general applications where a 1/8" NPT fitting is preferred by utilizing either a compression fitting or a bayonet adapter. These sensors are constructed using a 316 stainless steel sheath and insulated thermocouple wire.



ORDER CODES

Example Order Number:

1-1 1-2 1-3 - 2 - 3 - 4 - 5
JP3 3 U - 04 - 13A - F1A012 - 2, BX

1-1 Thermocouple Type

| CODE | | SHEATH O.D. (inches) |
|--------|--------|----------------------|
| SINGLE | DUPLEX | |
| JP2 | | 1/8 |
| JP3 | JJP3 | 3/16 |
| JP4 | JJP4 | 1/4 |

Other Element Types

For type E, K or T thermocouples, replace J in order code with required letter designation.

1-2 Bend Angle

| CODE | DESCRIPTION |
|------|----------------|
| 1 | Straight |
| 2 | 45 degree bend |
| 3 | 90 degree bend |

1-3 Junction

Grounded junctions supplied as standard. Insert "U" only when requiring an ungrounded junction.

2 "A" Dimension

Insert 2 digit "A" length in inches (1" min).
EX: 04 = 4 inch "A" dimension.

3 Sheath Fittings

| CODE | DESCRIPTION | NOMINAL LENGTH (inches) |
|--------------------|--|-------------------------|
| 00 | No fitting | |
| 13A ^[1] | 7/16" I.D. single slot spring-loaded bayonet fitting | 1 5/8 |
| 15A | 1/8" NPT brass one time adjustable comp. fitting | 1 1/8 |
| 01A | 1/8" NPT SS one time adjustable comp. fitting | 1 1/4 |
| 16A | Comp. fitting with bayonet cap and spring - 1/8" O.D. sheaths only (2 5/8" min. 'A' dimension) | 2 3/8 |

[1] 13A are not available with 1/4" O.D. sheaths

4 Extension Leadwire Type and "B"+"C" Dimension

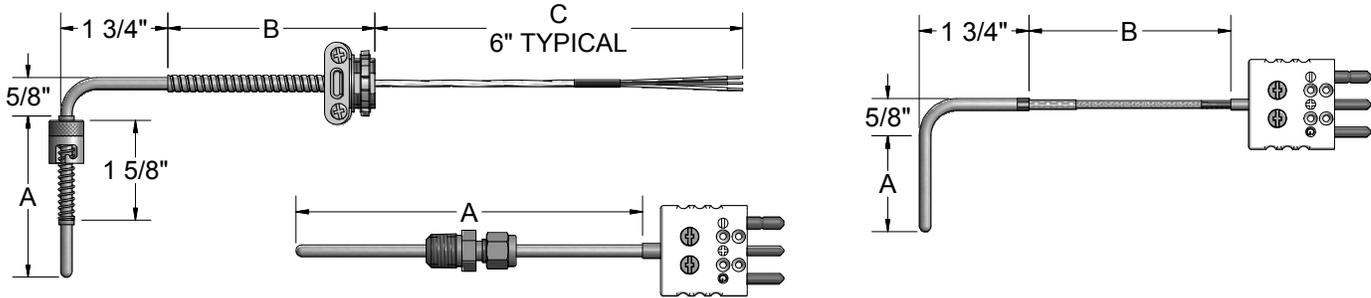
| CODE ^[1] | DESCRIPTION |
|---------------------|--|
| 000 | No leadwire, connector attached to sheath |
| F1 ___ | Fiberglass insulation - solid conductor |
| F1A ___ | Fiberglass insulation - solid conductor - flexible armor |
| F1B ___ | Fiberglass insulation - solid conductor - stainless steel overbraid |
| F3 ___ | Fiberglass insulation - stranded conductor |
| F3A ___ | Fiberglass insulation - stranded conductor - flexible armor |
| F3B ___ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| T1 ___ | Fluoropolymer insulation - solid conductor |
| T1A ___ | Fluoropolymer insulation - solid conductor - flexible armor |
| T3 ___ | Fluoropolymer insulation - stranded conductor |
| T3A ___ | Fluoropolymer insulation - stranded conductor - flexible armor |

[1] Insert 3 digit "B" length in inches. EX: F1036=36" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" leads beyond armor.

5 Terminations and Options

| CODE | DESCRIPTION |
|---------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnect lugs |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

The RTDs described below are those most commonly used in the plastic process industry. These assemblies can be used in many general applications where a 1/8" NPT fitting is preferred by utilizing either a compression fitting or a bayonet adapter. These assemblies are supplied standard using 316 stainless steel sheath material and a 100 Ω platinum element with a temperature coefficient of 0.003 85 °C⁻¹ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number: **RBF1853P** **3** **3** - **06** - **13A** - **F3B012** - **2, BX**

1-1 RTD Element

| CODE | DUPLEX ^[1] | ELEMENT CONNECTION |
|---------------|-----------------------|--------------------|
| SINGLE | | |
| RBF1853P | RBF2853P | 3-wire |
| RBF1852P | RBF2852P | 2-wire |

[1] Duplex: no 1/8" O.D.; 3/16" O.D. limited to polyimide or fluoropolymer leadwire.

1-2 Sheath Diameter

| CODE | DESCRIPTION (inches) |
|------------------|----------------------|
| 2 ^[1] | 1/8 |
| 3 | 3/16 |
| 4 | 1/4 |

[1] Only available with polyimide or fluoropolymer leads.

1-3 Bend Angle

| CODE | DESCRIPTION |
|------|----------------|
| 1 | Straight |
| 2 | 45 degree bend |
| 3 | 90 degree bend |

2 "A" Dimension

Insert 2 digit "A" length in inches (1" min). EX: 06 = 6 inch "A" dimension.

3 Sheath Fittings

| CODE | DESCRIPTION | NOMINAL LENGTH (inches) |
|--------------------|--|-------------------------|
| 00 | No fitting | |
| 13A ^[1] | 7/16" I.D. single slot spring loaded bayonet ftg | 1 5/8 |
| 15A | 1/8" NPT brass one time adjustable comp. ftg | 1 1/8 |
| 01A | 1/8" NPT SS one time adjustable comp. fitting | 1 1/4 |
| 16A | Comp. fitting with bayonet cap and spring - 1/8" O.D. sheaths only (2 5/8" min. 'A' dimension) | 2 3/8 |

[1] 13A are not available with 1/4" O.D. sheaths

4 Extension Leadwire Type and "B"+"C" Dimension

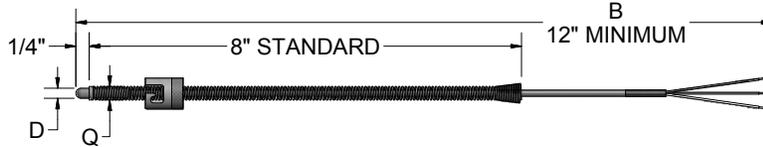
| CODE ^[1] | DESCRIPTION |
|---------------------|---|
| 000 | No leadwire, connector attached to sheath |
| F3 ___ | Fiberglass insulation - stranded conductor |
| F3A ___ | Fiberglass insulation - stranded conductor - flexible armor |
| F3B ___ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| F3J ___ | Fiberglass insulation - individual leads - stranded conductor (12" limit) |
| T3 ___ | Fluoropolymer insulation - stranded conductor |
| T3A ___ | Fluoropolymer insulation - stranded conductor - flexible armor |
| K3 ___ | Polyimide insulation - stranded conductor |
| K3A ___ | Polyimide insulation - stranded conductor - flexible armor |
| K3B ___ | Polyimide insulation - stranded conductor - stainless steel overbraid |

[1] Insert 3 digit "B" length in inches. EX: F1036=36" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" leads beyond armor.

5 Terminations and Options

| CODE | DESCRIPTION |
|---------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnect lugs |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

This RTD spring-adjustable immersion sensor has a bayonet cap on an 8" spring (standard) to allow for immersion depths of 1/2" to 7". This assembly is used in a variety of applications (with a bayonet adapter) where ease of installation and quick disconnect is preferred. Standard and metric size bayonet caps and adapters are available. These assemblies are supplied standard using 316 stainless steel sheath material and a 100 Ω platinum element with a temperature coefficient of 0.003 85 °C⁻¹ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1-1
1-2
1-3
2
3
RBF1853B - **A** - **3** - **F3B024** - **2**

1-1 RTD Element Type

| CODE | | ELEMENT CONNECTION |
|--|-----------------------------|--------------------|
| <i>SINGLE</i> | <i>DUPLEX^[1]</i> | |
| RBF1853B | RBF2853B | 3-wire |
| RBF1852B | RBF2852B | 2-wire |
| [1] Duplex assemblies available, with polyimide wire only. | | |

1-2 Bayonet Cap Style

| CODE | DESCRIPTION |
|------|---|
| A | 7/16" I.D. single slot (standard) (not available with Opt. 4 tip) |
| B | 12 mm I.D. dual slot |
| C | 12 mm O.D. dual pin |
| E | 15 mm ID dual slot |

1-3 Tip and Spring Diameters

| CODE | TIP O.D. "D" DIM. (inches) | SPRING O.D. "Q" DIM. (inches) |
|------|----------------------------|-------------------------------|
| 3 | 0.188 | 0.263 |
| 4 | 0.250 | 0.324 |

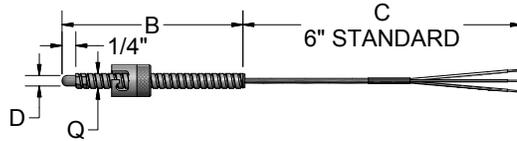
2 Extension Length "B"

| CODE ^[1] | DESCRIPTION |
|---|--|
| F3B_ _ _ | Fiberglass insulation - stranded conductor - stainless steel overbraided |
| K3B_ _ _ | Polyimide insulation - stranded conductor - stainless steel overbraided |
| [1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length. | |

3 Terminations and Options

| CODE | DESCRIPTION |
|----------------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |
| LS | 12" long spring (3/16" O.D. only) |

The RTD version of an armor-adjustable immersion sensor has a bayonet cap on the flexible armor and allows for immersion of the entire specified "B" dimension. This assembly is used in a variety of applications (with a bayonet adapter) where ease of installation and quick disconnect is preferred. Standard and metric size bayonet caps and adapters are available. These assemblies are supplied standard using 316 stainless steel sheath material and a 100 Ω platinum element with a temperature coefficient of 0.003 85 °C⁻¹ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1-1
1-2
1-3
2
3
RBF1853A - **A** - **3** - **F3A012** - **3**

1-1 RTD Element Type

| CODE | | ELEMENT CONNECTION |
|----------|-----------------------|--------------------|
| SINGLE | DUPLEX ^[1] | |
| RBF1852A | RBF2852A | 2 wire |
| RBF1853A | RBF2853A | 3 wire |

[1] Duplex not available with 1/8" O.D.; 3/16" O.D. limited to polyimide leadwire.

1-2 Bayonet Cap Style

| CODE | DESCRIPTION |
|------|-----------------------------------|
| A | 7/16" I.D. single slot (standard) |
| B | 12 mm I.D. dual slot |
| C | 12 mm O.D. dual pin |
| D | Positive seat indicating |
| E | 15 mm I.D. dual slot |

1-3 Tip and Flex Armor Diameters

| CODE | TIP O.D. "D" DIM. (inches) | FLEX O.D. "Q" DIM. (inches) |
|------|----------------------------|-----------------------------|
| 2 | 0.125 | 0.210 |
| 3 | 0.188 | 0.275 |

2 Extension Leadwire "B" + "C"

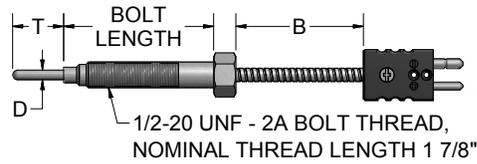
| CODE ^[1] | DESCRIPTION |
|---------------------|---|
| F3A_ _ _ | Fiberglass insulation - stranded conductor - flexible armor |
| K3A_ _ _ | Polyimide insulation - stranded conductor - flexible armor |

[1] Insert 3 digit "B" length in inches. EX: F3B036=36" "B" length; for assemblies other than standard that require leadwire beyond the flexible armor, insert 3 digit "C" length after armor length. EX: F3A036-012=36" "B" length with additional 12" leads beyond armor.

3 Terminations and Options

| CODE | DESCRIPTION |
|---------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

The melt-bolt thermocouple illustrated below is made of 300 series stainless steel and is constructed using a fiberglass insulated element. This style of thermocouple is used on extruders and injection molding machines to directly measure the melt temperature of plastic as it moves down the extruder barrel.



ORDER CODES

Example Order Number:

1-1 1-2 1-3 2 3 4
JFMB2 **3** **U** - **02** - **F1A006** - **4**

1-1 Thermocouple Type

| CODE | | TIP O.D. "D" DIM. (inches) |
|--|---------------|----------------------------|
| <i>SINGLE</i> | <i>DUPLEX</i> | |
| JFMB2 | | 1/8 |
| JFMB3 | JJFMB3 | 3/16 |
| Other Element Types | | |
| For type E, K, or T thermocouples, replace J in order code with required letter designation. | | |

1-2 Bolt Length

| CODE | LENGTH (inches) |
|------------------------------------|-----------------|
| 3 | 3 |
| 4 | 4 |
| 6 | 6 |
| Consult factory for other lengths. | |

1-3 Junction

Grounded junctions supplied as standard. Insert 'U' only when requiring an ungrounded junction.

2 Tip Length

| CODE | "T" TIP LENGTH (inches) | CODE | "T" TIP LENGTH (inches) |
|------------------------------------|-------------------------|------|-------------------------|
| 00 | Flush | 08 | 1/2 |
| 02 | 1/8 | 12 | 3/4 |
| 04 | 1/4 | 16 | 1 |
| Consult factory for other lengths. | | | |

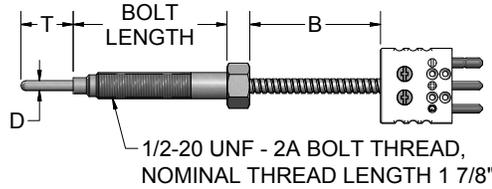
3 Extension Leadwire "B"

| CODE ^[1] | DESCRIPTION |
|---|---|
| 000 | No leadwire, connector attached to sheath |
| F1A_ _ _ | Fiberglass insulation - solid conductor - flexible armor |
| F3A_ _ _ | Fiberglass insulation - stranded conductor - flexible armor |
| [1] Insert 3 digit "B" length in inches. EX: F1A012=12" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" "C" length. | |

4 Terminations and Options

| CODE | DESCRIPTION |
|----------------|--------------------------------|
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| Options | |
| MC | Mating connector |

The melt-bolt RTD sensor illustrated below is used on extruders and injection molding machines to directly measure the melt temperature of plastic as it moves down the extruder barrel. This sensor is made of 300 series stainless steel and is constructed using a 100 Ω platinum element with a temperature coefficient of 0.003 85 °C⁻¹ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1-1 1-2 1-3 2 3 4
RBF1852MB - **2** - **3** - **02** - **F3A012** - **4**

1-1 RTD Element Type

| CODE | | ELEMENT CONNECTION |
|-----------|-----------------------|--------------------|
| SINGLE | DUPLEX ^[1] | |
| RBF1853MB | RBF2853MB | 3 wire |
| RBF1852MB | RBF2852MB | 2 wire |

Other Element Types

[1] Duplex not available with 1/8" O.D.; 3/16" O.D. limited to polyimide leadwire.

1-2 Tip Diameter

| CODE | TIP O.D. "D" DIM. (inches) |
|------|----------------------------|
| 2 | 1/8 |
| 3 | 3/16 |

1-3 Bolt Length

| CODE | LENGTH (inches) |
|------|-----------------|
| 3 | 3 |
| 4 | 4 |
| 6 | 6 |

Consult factory for other lengths.

2 Tip Length

| CODE | "T" TIP LENGTH (inches) | CODE | "T" TIP LENGTH (inches) |
|------|-------------------------|------|-------------------------|
| 00 | Flush | 08 | 1/2 |
| 02 | 1/8 | 12 | 3/4 |
| 04 | 1/4 | 16 | 1 |

Consult factory for other lengths.

3 Extension Leadwire

| CODE ^[1] | DESCRIPTION |
|---------------------|---|
| 000 | No leadwire, connector attached to sheath |
| F3A_ _ _ | Fiberglass insulation - stranded conductor - flexible armor |
| K3A_ _ _ | Polyimide insulation - stranded conductor - flexible armor |

[1] Insert 3 digit "B" length in inches.

EX: F1A012=12" "B" length; for assemblies requiring other than the standard 6" "C" dimension.

EX: F1A036-012=36" "B" length with additional 12" "C" length.

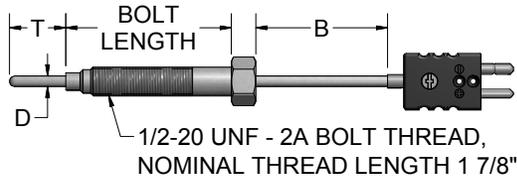
4 Terminations and Options

| CODE | DESCRIPTION |
|------|---|
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |

Options

| | |
|----|------------------|
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

The melt-bolt thermocouples illustrated below are used on extruders and injection molding machines to directly measure the melt temperature of plastic as it moves down the extruder barrel. These melt-bolts are made with 300 series stainless steel and are constructed using a metal-sheathed MgO element. The fixed tip style consists of an MgO element brazed to the bolt at a specified tip length and is supplied with a grounded junction as standard. Pyromation's Precision Tip Re-adjustable Melt-Bolt Thermocouples come standard with a fast response exposed junction. The precision tip is manufactured from hardened stainless steel and creates a positive shut off to prevent the back flow of plastic into the bolt. The 5/32" O.D. tip has an adjustment range of 0"-1".



ORDER CODES

Example Order Number:

1-1
1-2
2 or 2A
3
4
JMMB23 U - 02 - 004 - 4

1-1 Thermocouple Type

| CODE | | DESCRIPTION | | |
|--------|---------|-------------------|-------------|------------|
| SINGLE | DUPLEX | TIP O.D. "D" DIM. | BOLT LENGTH | TIP STYLE |
| JMMB23 | JJMMB23 | 1/8" | 3" | Fixed |
| JMMB24 | JJMMB24 | 1/8" | 4" | Fixed |
| JMMB26 | JJMMB26 | 1/8" | 6" | Fixed |
| JMMB33 | JJMMB33 | 3/16" | 3" | Fixed |
| JMMB34 | JJMMB34 | 3/16" | 4" | Fixed |
| JMMB36 | JJMMB36 | 3/16" | 6" | Fixed |
| JAMB3E | JJAMB3E | 5/32" | 3" | Adjustable |
| JAMB6E | JJAMB6E | 5/32" | 6" | Adjustable |

Other Element Types

For type E, K or T thermocouples, replace J in order code with required letter designation.

1-2 Junction

Grounded junctions supplied as standard on fixed tip melt-bolts and exposed tip junctions are standard on adjustable tip melt-bolts. For junction styles other than the standard, specify "U" for ungrounded or "G" for grounded junction.

2 Tip Length for Fixed Tip Melt-Bolt

| CODE | "T" TIP LENGTH | CODE | "T" TIP LENGTH |
|------|----------------|------|----------------|
| 00 | Flush | 08 | 1/2" |
| 02 | 1/8" | 12 | 3/4" |
| 04 | 1/4" | 16 | 1" |

2A Tip Length for Adjustable Tip Melt-Bolt

| CODE | "T" TIP LENGTH |
|------|---------------------------|
| 01 | Adjustable range 0" to 1" |

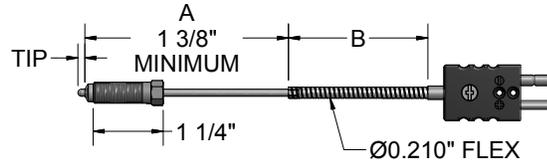
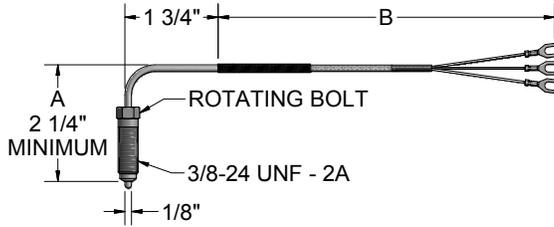
3 MgO Extension "B"

| CODE | DESCRIPTION |
|------|--|
| 000 | Connector 1/2" from bolt |
| --- | Insert "B" length in inches using 3 digits |

4 Terminations and Options

| CODE | DESCRIPTION |
|---------|-----------------------|
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| Options | |
| MC | Mating connector |
| CL | Compression L bracket |

The nozzle-melt temperature sensors listed below are typically placed into the nozzle of a plastic injection molding machine and sense the temperature of the molten plastic prior to being injected into the mold. They are offered in a variety of thermocouple types as listed below. The RTDs are constructed using a 100 Ω platinum element with a temperature coefficient of 0.003 85 °C⁻¹ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1 or 1A 2 3 4
JNM32 - **04** - **F3B036** - **3, BX**

1 Thermocouple Type, Tip Length, and Sheath Style

| CODE | DESCRIPTION | |
|--|-------------|----------|
| | TIP LENGTH | BEND |
| JNM12 | 1/8" | Straight |
| JNM14 | 1/4" | Straight |
| JNM22 | 1/8" | 45° |
| JNM24 | 1/4" | 45° |
| JNM32 | 1/8" | 90° |
| JNM34 | 1/4" | 90° |
| Other Element Types | | |
| For type E, K, or T thermocouples, replace J in order code with required letter designation. | | |

1A RTD Type, Tip Length, and Sheath Style

| CODE | DESCRIPTION | |
|--|-------------|----------|
| | TIP LENGTH | BEND |
| RBF1853NM12 | 1/8" | Straight |
| RBF1853NM14 | 1/4" | Straight |
| RBF1853NM22 | 1/8" | 45° |
| RBF1853NM24 | 1/4" | 45° |
| RBF1853NM32 | 1/8" | 90° |
| RBF1853NM34 | 1/4" | 90° |
| Other Element Types | | |
| All RTDs are supplied as 3 wire construction. Replace the 3 in the part number with a 2 for 2 wire construction. | | |

2 Sheath extension "A"

Insert 'A' dimension in inches using 2 digits.

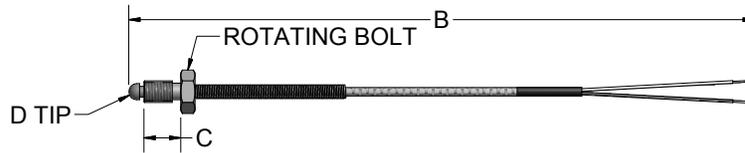
3 Extension Length "B"

| CODE ^[1] | DESCRIPTION |
|---|--|
| 000 | No leadwire, connector attached to sheath |
| F1_ _ _ | Fiberglass insulation - solid conductor |
| F1A_ _ _ _ | Fiberglass insulation - solid conductor - flexible armor |
| F3_ _ _ | Fiberglass insulation - stranded conductor |
| F3A_ _ _ _ | Fiberglass insulation - stranded conductor - flexible armor |
| F3B_ _ _ _ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| [1] Insert 3 digit "B" length in inches. EX: F1A012=12" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" "C" length. | |

4 Terminations and Options

| CODE | DESCRIPTION |
|----------------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

The threaded nozzle thermocouple illustrated below is generally used to measure the temperature of the nozzle of an injection molding machine. This style is not in direct contact with the molten plastic. Due to the relatively small size of this sensor, other general areas of use include mounting in bearing housings, sealing bars, heat plates, and other limited space applications.



ORDER CODES

Example Order Number:

1-1 1-2 2 3 4
JTN U - F6 - F1B024 - 2

1-1 Thermocouple Type

| CODE | DESCRIPTION |
|---|-------------------|
| JTN | Iron - Constantan |
| Other Element Types | |
| For type E, K or T thermocouples, replace J in order code with required letter designation. | |

1-2 Junction

Grounded junctions supplied as standard. Insert "U" only when requiring an ungrounded junction.

2 Bolt Designation

| CODE | NOZZLE SIZE | | |
|--|-----------------|------------------|------------|
| | THREADS | "D" TIP (inches) | "C" LENGTH |
| F6 | 1/4" - 28 | 3/16 | 3/8" |
| G8 | 3/8" - 24 | 1/4 | 1/2" |
| I6 | 6 mm x 1 mm | 3/16 | 10 mm |
| K6 | 8 mm x 1.25 mm | 1/4 | 10 mm |
| M10 | 10 mm x 1.50 mm | 1/4 | 16 mm |
| Other bolt sizes available; consult factory. | | | |

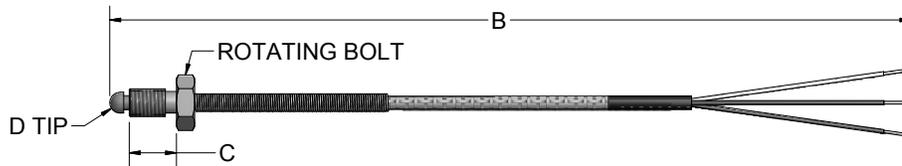
3 Extension Length "B"

| CODE ^[1] | WIRE DESCRIPTION |
|--|--|
| F1 ___ | Fiberglass insulation - solid conductor |
| F1B ___ | Fiberglass insulation - solid conductor - stainless steel overbraid |
| F3 ___ | Fiberglass insulation - stranded conductor |
| F3B ___ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| [1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length. | |

4 Terminations and Options

| CODE | DESCRIPTION |
|----------------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

The threaded nozzle RTD illustrated below is generally used to measure the temperature of the nozzle of an injection molding machine. This style is not in direct contact with the molten plastic. Due to the relatively small size of this sensor, other general areas of use include mounting in bearing housings, sealing bars, heat plates, and other limited space applications. These assemblies are supplied standard using a 100 ohm platinum element with a temperature coefficient of 0.003 85 °C⁻¹ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

RBF1852TN - **F6** - **F3B012** - **2**

1 RTD Element Type

| CODE | ELEMENT CONNECTION |
|-----------|--------------------|
| RBF1853TN | 3 wire |
| RBF1852TN | 2 wire |

2 Bolt Designation

| CODE | NOZZLE SIZE | | |
|--|-----------------|------------------|------------|
| | THREADS | "D" TIP (inches) | "C" LENGTH |
| F6 | 1/4" - 28 | 3/16 | 3/8" |
| G8 | 3/8" - 24 | 1/4 | 1/2" |
| I6 | 6 mm x 1 mm | 3/16 | 10 mm |
| K6 | 8 mm x 1.25 mm | 1/4 | 10 mm |
| M10 | 10 mm x 1.50 mm | 1/4 | 16 mm |
| Other bolt sizes available; consult factory. | | | |

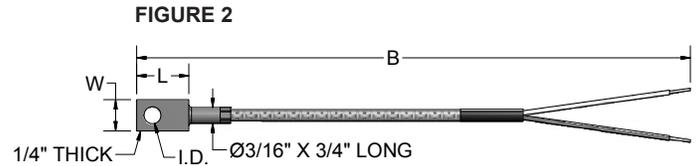
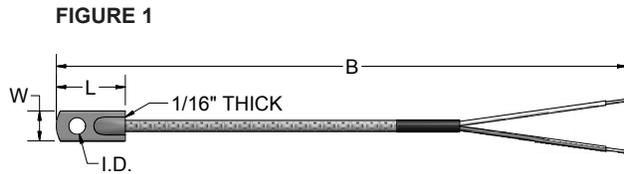
3 Extension Length "B"

| CODE ^[1] | WIRE DESCRIPTION |
|---|--|
| F3_ _ _ | Fiberglass insulation - stranded conductor |
| F3B_ _ _ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| K3_ _ _ | Polyimide insulation - stranded conductor |
| K3B_ _ _ | Polyimide insulation - stranded conductor - stainless steel overbraid |
| [1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length | |

4 Terminations and Options

| CODE | DESCRIPTION |
|----------------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

The ring type assemblies pictured below have the thermocouples embedded either into a stainless steel stamping for grounded junctions (figure 1) or a brass ring for ungrounded junctions (figure 2). Various ring sizes are available to measure the surface temperature of nozzles, extruder barrels, die heads, molds, and many other applicable surfaces.



ORDER CODES

Example Order Number:

JRS1

F3012

8

FIGURE 1
1 Grounded Thermocouples - Ring Size

| CODE | RING SIZE | | | SCREW or BOLT SIZE |
|------|---------------|------------|------------|--------------------------------|
| | I.D. (inches) | W (inches) | L (inches) | |
| JRS1 | 0.20 | 3/8 | 7/8 | #6 - #10 4mm-5mm |
| JRS2 | 0.33 | 7/16 | 1 | #12, 1/4" - 5/16" 5mm - 8mm |
| JRS3 | 0.44 | 9/16 | 1 1/8 | 5/16" - 3/8" 8mm - 10mm |

FIGURE 2
1 Ungrounded Thermocouples - Ring Size

| CODE | RING SIZE | | | SCREW SIZE |
|-------|---------------|------------|------------|--------------------------------|
| | I.D. (inches) | W (inches) | L (inches) | |
| JRB1U | 0.20 | 3/8 | 5/8 | #6 - #10 4mm-5mm |
| JRB2U | 0.33 | 5/8 | 7/8 | #12, 1/4" - 5/16" 5mm - 8mm |
| JRB3U | 0.44 | 5/8 | 7/8 | 5/16" - 3/8" 8mm - 10mm |

Other Element Types

For type E, K, or T thermocouples, replace J in order code with required letter designation.

2 Extension Leadwire "B"

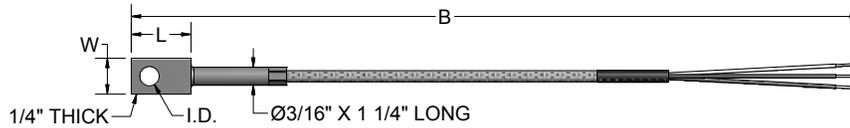
| CODE ^[1] | DESCRIPTION |
|---------------------|--|
| F1_ _ _ | Fiberglass insulation - solid conductor |
| F1B_ _ _ | Fiberglass insulation - solid conductor - stainless steel overbraid |
| F3_ _ _ | Fiberglass insulation - stranded conductor |
| F3B_ _ _ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| T1_ _ _ | Fluoropolymer insulation - solid conductor |
| T3_ _ _ | Fluoropolymer insulation - stranded conductor |
| K1_ _ _ | Polyimide insulation - solid conductor |

[1] Insert 3 digit "B" length in inches. EX: F3B024=24" "B" length.

3 Terminations and Options

| CODE | DESCRIPTION |
|---------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnect lugs |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

The ring type assembly pictured below has the RTD element embedded into a brass ring. Various ring sizes are available to measure the surface temperature of nozzles, extruder barrels, die heads, molds, and many other applicable surfaces. This assembly is supplied standard using a 100 Ω platinum element with a temperature coefficient of 0.003 85 °C⁻¹ (IEC Class B). Elements of other materials, values, and tolerances are available upon request.



ORDER CODES

Example Order Number:

1
1-2
2
3
RBF1853RB - **2** - **F3B012** - **2**

1-1 RTD Element Type

| CODE | | ELEMENT CONNECTION |
|-----------|-----------------------|--------------------|
| SINGLE | DUPLEX ^[1] | |
| RBF1853RB | RBF2853RB | 3-wire |
| RBF1852RB | RBF2852RB | 2-wire |

[1] Duplex assemblies available with polyimide or fluoropolymer wire only.

1-2 Ring Size

| CODE | I.D. (inches) | W (inches) | L (inches) | SCREW SIZE |
|------|---------------|------------|------------|-----------------------------|
| 1 | 0.20 | 3/8 | 5/8 | #6 - #10 4mm - 5mm |
| 2 | 0.33 | 5/8 | 7/8 | #12, 1/4" - 5/16" 5mm - 8mm |
| 3 | 0.44 | 5/8 | 7/8 | 5/16" - 3/8" 8mm - 10mm |

2 Extension Leadwire Type and "B" + "C" Dimension

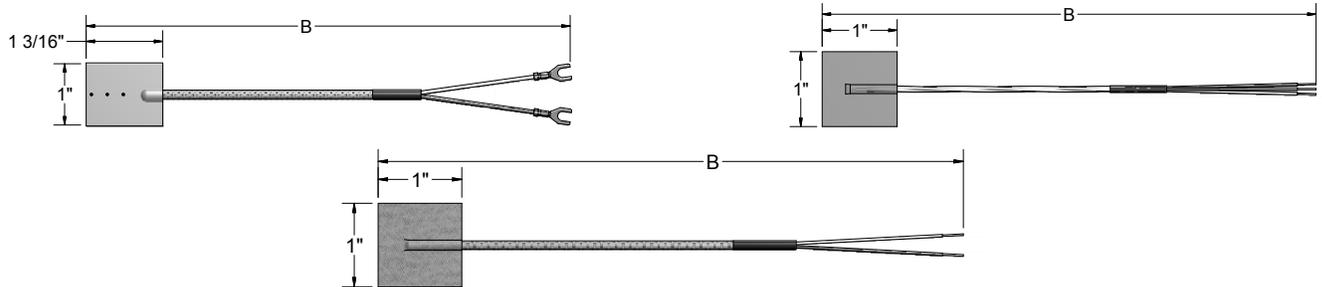
| CODE ^[1] | WIRE DESCRIPTION |
|---------------------|--|
| F3_ _ _ | Fiberglass insulation - stranded conductor |
| F3A_ _ _ | Fiberglass insulation - stranded conductor - flexible armor |
| F3B_ _ _ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| T3_ _ _ | Fluoropolymer insulation - stranded conductor |
| T3A_ _ _ | Fluoropolymer insulation - stranded conductor - flexible armor |
| K3_ _ _ | Polyimide insulation - stranded conductor |
| K3A_ _ _ | Polyimide insulation - stranded conductor - flexible armor |
| K3B_ _ _ | Polyimide insulation - stranded conductor - stainless steel overbraid |

[1] Insert 3 digit "B" length in inches. EX: F1A012=12" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" "C" length.

3 Terminations and Options

| CODE | DESCRIPTION |
|---------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

The temperature sensors illustrated below are generally used for surface temperature measurement. The series SS and ST spade thermocouples are sandwiched between two thin shims of either stainless steel or two pieces of fiberglass tape. They can be attached using a worm drive hose clamp or by placing under heater bands. These spades can be formed and secured to the outside of various size tubes, pipes, or nozzles. The SK series sensors are sealed in epoxy between two layers of polyimide tape and are provided with an adhesive backing for easy attachment to many surfaces. The SK series sensors are available in various thermocouple types or RTDs. The RTDs are constructed using a 100 Ω platinum element with a temperature coefficient of 0.003 85 °C⁻¹ (IEC Class B).



ORDER CODES

Example Order Number: **JSS** - **F1B036** - **3**

1 Thermocouple Type

| CODE | DESCRIPTION |
|--|---|
| JSS | Stainless steel spade |
| JST | Flexible fiberglass spade 204 °C [400 °F] max |
| JSK | Flexible Polyimide spade with adhesive tape backing 204 °C [400 °F] |
| Nominal spade thickness is 0.020" min to 0.090" max | |
| Other Element Types | |
| For type E, K, or T thermocouples, replace J in order code with required letter designation. | |

1a RTD Type 100 Ω Platinum A = 0.003 85 °C⁻¹

| CODE | ELEMENT CONNECTION | DESCRIPTION |
|---|--------------------|---|
| RBF1853SK | 3 wire | Flexible polyimide spade with adhesive tape backing 204 °C [400 °F] |
| RBF1852SK | 2 wire | Flexible polyimide spade with adhesive tape backing 204 °C [400 °F] |
| Nominal spade thickness is 0.060" min to 0.100" max | | |

2 Extension Leadwire "B"

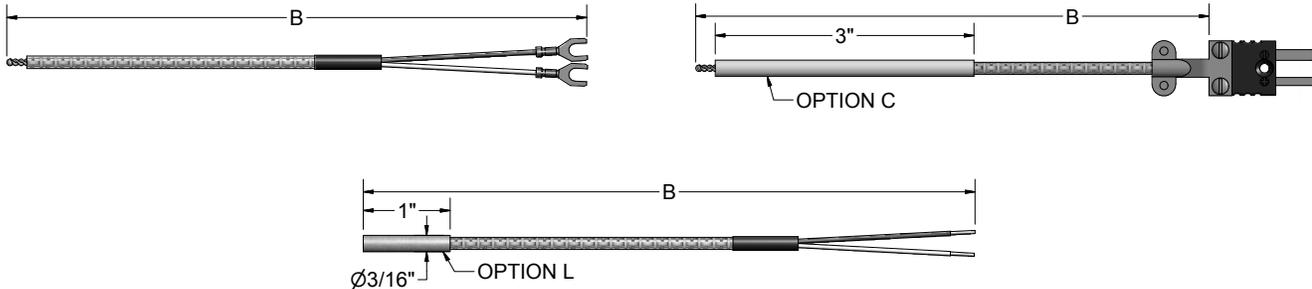
| CODE ^[1] | DESCRIPTION |
|---------------------|--|
| F1 ___ | Fiberglass insulation - solid conductor |
| F1B ___ | Fiberglass insulation - solid conductor - stainless steel overbraid |
| F3 ___ | Fiberglass insulation - stranded conductor |
| F3B ___ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| T1 ___ | Fluoropolymer insulation - solid conductor |
| T3 ___ | Fluoropolymer insulation - stranded conductor |
| K1 ___ | Polyimide insulation - solid conductor |

[1] Insert 3 digit "B" length in inches.
EX: F3B024=24" "B" length.

3 Terminations and Options

| CODE | DESCRIPTION |
|----------------|---|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| BX | Box connector |

The multiple-purpose thermocouples listed below are constructed with insulated thermocouple wire and provided with twisted and TIG-welded hot junctions. Insulations and overbraids are offered to satisfy many industrial processes, furnace certification, load checking, and laboratory test temperature measurement applications.



ORDER CODES

Example Order Number:

1 **K20-1-S-304** - 2 **072** - 3 **4**

1 Thermocouple and Insulation Type

| CODE (Insert T/C Type Prefix Letter) | WIRE GA. | COND. TYPE | INSULATION ^[1] | INSULATION TEMPERATURE RATING | LIMITS OF ERROR ^[2] |
|--|-------------|---------------|---------------------------|-------------------------------------|-----------------------------------|
| (J,K,E) 20-1-304 | 20 | Solid | Fiberglass | 482 °C [900 °F] | Standard |
| (J,K) 20-1-S-304 | 20 | Solid | Fiberglass/SS ovb. | 482 °C [900 °F] | Standard |
| (K) 20-3-302 | 20 | Strnd | Fiberglass | 482 °C [900 °F] | Standard |
| (J,K) 20-3-S-317 | 20 | Strnd | Fiberglass/SS ovb. | 482 °C [900 °F] | Standard |
| (J,K) 20-2-321 | 20 | Solid | Hi-temp fiberglass | 704 °C [1300 °F] | Special |
| (J,K) 20-1-508 | 20 | Solid | TFE | 260 °C [500 °F] | Standard |
| (J,K) 20-2-513 | 20 | Solid | Polyimide | 316 °C [600 °F] | Special |
| (K) 20-2-301 | 20 | Solid | Vitreous sil. fiber | 871 °C [1600 °F] | Special |
| (K) 20-2-350 | 20 | Solid | Ceramic fiber | 1204 °C [2200 °F] | Special |
| (K) 20-2-N-350 | 20 | Solid | Cer.fiber/Inc. ovb. | 1204 °C [2200 °F] | Special |
| (J,K) 24-1-304 | 24 | Solid | Fiberglass | 482 °C [900 °F] | Standard |
| (J,K) 24-1-508 | 24 | Solid | TFE | 260 °C [500 °F] | Standard |
| (J,K) 30-1-305 | 30 | Solid | Fiberglass | 482 °C [900 °F] | Standard |
| (J,K,T) 30-2-506 | 30 | Solid | FEP | 204 °C [400 °F] | Special |

[1] See Wire Section, for additional insulation specifications.

[2] Consult factory for availability of non-listed Special Limits of Error wire.

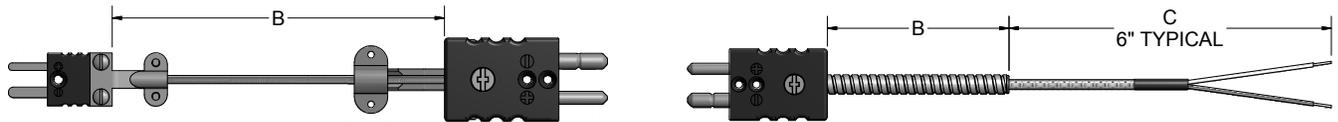
3 Terminations and Options

| CODE | DESCRIPTION |
|---------|--------------------------------------|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | Leads split 2" with spade lugs |
| 4 | Standard plug |
| 6 | Miniature plug |
| Options | |
| MC | Mating connector |
| CC | Cable clamp |
| L | Ungrounded hot junction |
| C | 3" ceramic insulator at hot junction |

2 Length

Insert 3 Digit Length Order Code in Inches.

The flexible thermocouple extensions illustrated below are constructed using thermocouple wire or thermocouple extension wire. They are used as extension cords to provide suitable connections between sensors, jack panels, or instrumentation.



ORDER CODES

Example Order Number:

1
2
3
JE6, CC - **F1B036** - **4, CC**

1 Terminations and Options

| CODE | DESCRIPTION |
|--|---|
| JE1 | 2" split leads with compensated spade lugs |
| JE2 | 2" split leads, 1/4" stripped |
| JE3 | 2" split leads with spade lugs |
| JE4 | Standard plug |
| JE5 | Standard jack |
| JE6 | Miniature plug |
| JE7 | Miniature jack |
| JE8 | 2" split leads with 1/4" female disconnects |
| For type E, K, or T thermocouples, replace J in order code with required letter designation. | |
| Options | |
| BX | Box connector |
| CC | Cable clamp |
| CG | 1/2" NPT plastic cord grip |
| MC | Mating connector |
| RB | Rubber boot |
| SP | Solid pin plug |

2 Extension Leadwire "B" + "C" Dimension

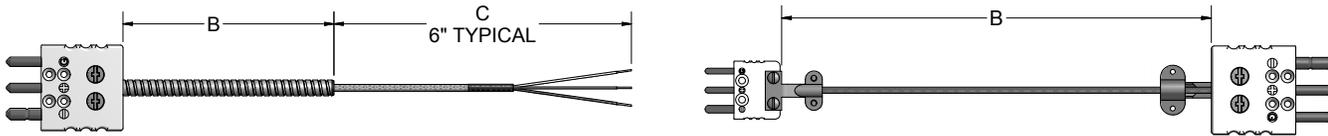
| CODE ^[1] | DESCRIPTION |
|---------------------|--|
| F1_ _ _ | Fiberglass insulation - solid conductor |
| F1A_ _ _ _ | Fiberglass insulation - solid conductor - flexible armor |
| F1B_ _ _ _ | Fiberglass insulation - solid conductor - stainless steel overbraid |
| F3_ _ _ | Fiberglass insulation - stranded conductor |
| F3A_ _ _ _ | Fiberglass insulation - stranded conductor - flexible armor |
| F3B_ _ _ _ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| T1_ _ _ _ | Fluoropolymer insulation - solid conductor |
| T1A_ _ _ _ | Fluoropolymer insulation - solid conductor - flexible armor |
| T3_ _ _ _ | Fluoropolymer insulation - stranded conductor |
| T3A_ _ _ _ | Fluoropolymer insulation - stranded conductor - flexible armor |
| C3_ _ _ _ | PVC insulated - stranded conductor - coil cord (only available in 60" and 120" extended lengths) |

[1] Insert 3 digit "B" length in inches.
 EX: F1036=36" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" "C" length.
 For PVC-coated or FEP coated flex, substitute suffix code A with P for PVC and T for FEP coating. Example: F3P is stranded fiberglass leads with PVC flex.

3 Terminations and Options

| CODE | DESCRIPTION |
|----------------|---|
| 0 | No termination |
| 1 | 2" split leads with compensated spade lugs |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnect lugs |
| Options | |
| BX | Box connector |
| CC | Cable clamp |
| CG | 1/2" NPT plastic cord grip |
| MC | Mating connector |
| RB | Rubber boot |
| SP | Solid pin plug |

The flexible RTD extensions illustrated below are constructed using stranded copper wire with various insulations. They are used as extension cords to provide suitable connections between sensors, jack panels, or instrumentation.



ORDER CODES

Example Order Number:

RT3E4, CC - F3B036 - 2

1 Terminations and Options

| CODE | | DESCRIPTION |
|----------------|----------------------------|---|
| 2 WIRE | 3 WIRE | |
| RT2E2 | RT3E2 | 2" split leads, 1/4" stripped |
| RT2E3 | RT3E3 | 2" split leads with spade lugs |
| RT2E4 | RT3E4 | Standard plug |
| RT2E5 | RT3E5 | Standard jack |
| RT2E6 | RT3E6 | Miniature plug |
| RT2E7 | RT3E7 | Miniature jack |
| RT2E8 | RT3E8 | 2" split leads with 1/4" female disconnects |
| Options | | |
| BX | Box connector | |
| CC | Cable clamp | |
| CG | 1/2" NPT plastic cord grip | |
| MC | Mating connector | |
| RB | Rubber boot | |

2 Extension Leadwire and "B" + "C" Dimension

| CODE ^[1] | DESCRIPTION |
|---------------------|--|
| F3_ _ _ | Fiberglass insulation - stranded conductor |
| F3A_ _ _ | Fiberglass insulation - stranded conductor - flexible armor |
| F3B_ _ _ | Fiberglass insulation - stranded conductor - stainless steel overbraid |
| T3_ _ _ | Fluoropolymer insulation - stranded conductor |
| T3A_ _ _ | Fluoropolymer insulation - stranded conductor - flexible armor |
| K3_ _ _ | Polyimide insulation - stranded conductor |
| K3A_ _ _ | Polyimide insulation - stranded conductor - flexible armor |
| K3B_ _ _ | Polyimide insulation - stranded conductor - stainless steel overbraid |
| C3_ _ _ | PVC insulated - stranded conductor - coil cord (only available in 60" and 120" extended lengths) |

[1] Insert 3 digit "B" length in inches.
EX: F1036=36" "B" length; for assemblies requiring other than the standard 6" "C" dimension, insert 3 digit "C" length in inches after "B" dimension. EX: F1A036-012=36" "B" length with additional 12" leads beyond armor.

For PVC-coated or FEP coated flex, substitute suffix code A with P for PVC and T for FEP coating. Example: T3P is stranded Fluoropolymer leads with PVC flex.

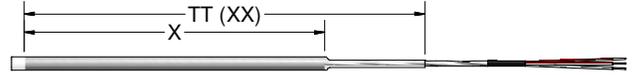
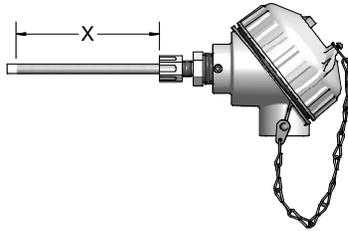
3 Terminations and Options

| CODE | DESCRIPTION |
|----------------|---|
| 0 | No termination |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" female disconnects |
| Options | |
| BX | Box connector |
| CC | Cable clamp |
| CG | 1/2" NPT plastic cord grip |
| MC | Mating connector |
| RB | Rubber boot |

SPECIAL-PURPOSE

Configuration Code SP01
FEP-Coated Thermocouple Assemblies
 Configuration Code SP02
FEP-Coated RTD Assemblies

The assemblies listed below are designed for a broad range of applications that require resistance to corrosion and chemical attack. They provide very good temperature measurement and service life in plating, pickling, and acid bath applications. The stainless steel sheath is coated with FEP and includes a fused FEP tip for excellent corrosion resistance.



Maximum Temperature Rating 200 °C

ORDER CODES

Example Order Number: **JP38UT** - **012** - **00** - **TT(36)** - **T3072** - **4**

1 Thermocouple Types

| CODE | T/C TYPE | SHEATH O.D. (inches) |
|--------|----------|----------------------|
| JP38UT | J | 3/16 |
| JP48UT | J | 1/4 |
| KP38UT | K | 3/16 |
| KP48UT | K | 1/4 |
| TP38UT | T | 3/16 |
| TP48UT | T | 1/4 |

For grounded hot junctions substitute the letter 'G' in place of the 'U' above.

1-2 100 Ω Platinum RTD α = 0.003 85 °C⁻¹ Tolerance^[1] Class B

| CODE | LEADS | SHEATH O.D. (inches) |
|-------------|-------|----------------------|
| RBF185L383T | 3 | 3/16 |
| RBF185L483T | 3 | 1/4 |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

2 'X' Dimension

Insert 3 Digit Sheath Length (X dimension) in Inches.

3 Sheath Mountings

| CODE | DESCRIPTION |
|------|-------------|
| 00 | No fitting |

Re-Adjustable Compression Fittings

| CODE | DESCRIPTION | NPT SIZE (inches) | AVAILABLE SHEATH DIAMETERS (inches) |
|------|---------------------|-------------------|-------------------------------------|
| 10A | 303 stainless steel | 1/8 | 3/16 |
| 10B | 303 stainless steel | 1/4 | 1/4 |
| 10C | 303 stainless steel | 1/2 | 1/4 |
| 56B | FEP | 1/4 | 1/4 |
| 56C | FEP | 1/2 | 1/4 |

6 Leadwire Terminations

| CODE | DESCRIPTION |
|------|--------------------------------|
| 0 | No termination |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 6 | Miniature plug |

Options

| | |
|----|------------------|
| MC | Mating connector |
| RB | Rubber boot |

5 Extension Leadwire

| CODE | DESCRIPTION |
|------|--|
| T1 | Fluoropolymer insulation - solid conductor (available in thermocouples only) |
| T3 | Fluoropolymer insulation - stranded conductor |

4 Head Terminations

| CODE | DESCRIPTION |
|-----------------------|--|
| 8HN63 | White polypropylene screw-cover head with 1/2" NPT stainless steel hex mounting fitting |
| 9HP63 | White polypropylene screw-cover head with 1/2" NPT bushing holding head to sheath |
| 56CF63 ^[1] | White polypropylene screw-cover head with FEP compression fitting holding head to sheath |

[1] Not available with 3/16" O.D. sheath

4-1 Sheath Terminations

| CODE | DESCRIPTION |
|----------------|------------------|
| 4 | Standard plug |
| 5 | Standard jack |
| Options | |
| MC | Mating connector |
| RB | Rubber boot |

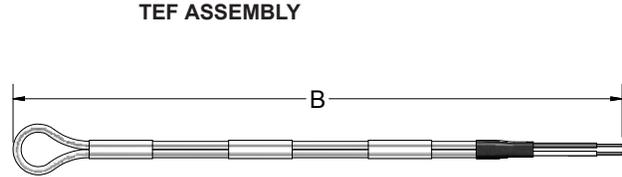
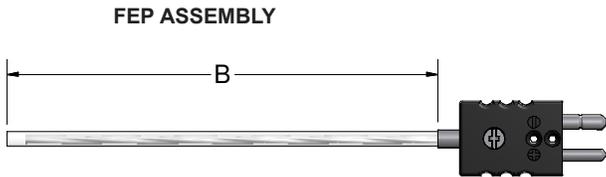
4-2 Leadwire Transitions

| CODE | DESCRIPTION |
|------|---|
| TT | FEP coating: both sheath and leads (specify total length of FPE coating) Example: TT(36) |
| 15 | Extension leadwire transition with relief spring |
| 16 | Extension leadwire transition with heat-shrink tubing |



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The thermocouples listed below are designed for a broad range of uses in applications that require resistance to corrosion and chemical attack. They provide very good temperature measurement and service life in plating, pickling, and acid bath applications. The fluoropolymer assemblies provide excellent resistance to strong acids, alkalines, and saline solutions.



ORDER CODES

Example Order Number:

1-1 1-2 2 3
J4 TEF - 072 - 4, RB

1-1 Thermocouple Type

| CODE | DESCRIPTION |
|------|-------------|
| J4 | Type J |
| K4 | Type K |
| T4 | Type T |

1-2 Outer Tubing

| CODE | DESCRIPTION | TEMPERATURE RATING |
|------|-------------|--------------------|
| TEF | TFE | 260 °C [500 °F] |
| FEP | FEP | 200 °C [392 °F] |

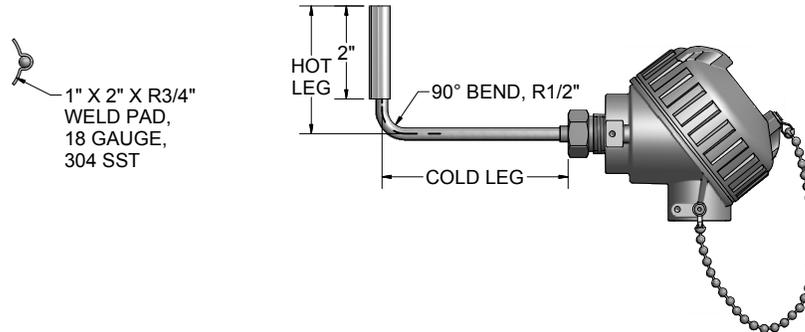
2 Length

3 Digit "B" Length in Inches.

3 Terminations

| CODE | DESCRIPTION |
|---------|--------------------------------|
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| Options | |
| MC | Mating connector |
| CG | Cord grip (1/2" NPT PVC) |
| RB | Rubber boot |
| SP | Solid pin plug |

Heat-tracing temperature sensors are made for use in systems that measure the surface temperature of process pipe that is carrying products whose temperatures must be controlled to prevent freeze-up, or to maintain a viscosity level so that the inner medium will flow. These sensors are offered with either Thermocouple or RTD sensing elements inside 316SS sheaths, and with a 3/4" Radius stainless steel mounting pad. Cold legs are available in customer-specified lengths to accommodate pipe insulation thickness.



ORDER CODES

Example Order Number:

1-1 1-2 3 4 5 5-1
RBF185L483 - HT - 0304 - 18RD - 31, I

1-1 Thermocouple Styles

| CODE | T/C TYPE | HOT JUNCTION STYLE | SHEATH INSULATION |
|-------|----------|--------------------|-------------------|
| JP48G | J | Grounded | Fiberglass |
| KP48G | K | Grounded | Fiberglass |
| TP48G | T | Grounded | Fiberglass |
| EP48G | E | Grounded | Fiberglass |

For ungrounded hot junctions substitute the letter "U" in place of the "G" above.

1-2 100 Ω Platinum 3 Wire RTD Styles α = 0.003 85 °C⁻¹

| CODE | TOLERANCE ^[1] | MAX. TEMP. RATING | INSULATION TYPE |
|------------|--------------------------|-------------------|-----------------|
| RBF185L483 | Class B | 200 °C [392 °F] | PTFE |
| RBF185M483 | Class B | 482 °C [900 °F] | Fiberglass |
| R1T185H483 | Grade B | 593 °C [1100 °F] | MgO |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

3 Sheath Lengths

| CODE | HOT LEG (inches) | COLD LEG (inches) |
|------|------------------|-------------------|
| 0304 | 3 | 4 |
| 0306 | 3 | 6 |
| 0308 | 3 | 8 |

Consult factory for other hot leg lengths or cold leg lengths.

4 Radius Mounting Pads 1" W x 2" L x 18 Ga. 304 SS

| CODE | RADIUS (inches) | NPT PIPE SIZE (inches) |
|------|-----------------|------------------------|
| 18RD | 3/4 | 1 1/2 |

Mounting pad is flexible enough to be formed around pipe sizes from 1" to 12" NPS pipe.

5 Standard Head Terminations

| CODE | DESCRIPTION |
|------|--|
| 31 | Aluminum screw-cover head |
| 34 | Cast iron screw-cover head |
| 49 | Flip-top aluminum head |
| 63 | White polypropylene screw-cover head |
| 91 | 316 L Stainless steel screw-cover head |
| 93 | Aluminum explosion-proof head, Group B |
| 94 | 316 L SS explosion-proof head, Group A |

5-1 Standard Head Options

| CODE | DESCRIPTION |
|-------|--|
| CG | Nylon cord grip |
| GS | Ground screw |
| I | Stainless steel tag |
| NB | 1/2" NPT nylon conduit reducer bushing |
| SB | 1/2" NPT conduit reducer bushing |
| T-440 | 4-20 mA head-mounted RTD transmitter (see instrument section) |
| T-441 | 4-20 mA isolated head-mounted transmitter (see instrument section) |
| T-442 | 4-20 mA Hart® isolated head-mounted transmitter (see instrument section) |

The hardened tip aggregate temperature sensor assemblies illustrated in Figures 1, 2, and 3 below are typically used to measure the temperature of severely abrasive materials found in asphalt aggregate mixers and other granular material mixing and drying processes. Three styles of hardened tip constructions are offered to resist destructive abrasion and wear. Figure 4 illustrates an open-end tube style thermocouple assembly used to measure the temperature of hot sand and other similar free flowing materials on conveyors, or at drop chutes, where abrasion is not as severe, but where product temperature response time is important.

FIG. 1 FLAME-SPRAYED, TUNGSTEN CARBIDE TIP

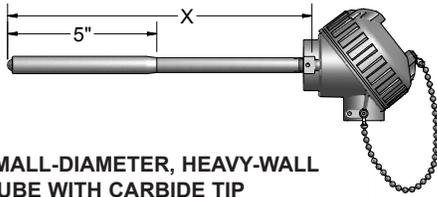


FIG. 2 RUGGEDIZED BULLET-NOSED, HARDENED-TOOL STEEL WITH CARBIDE TIP



FIG. 3 SMALL-DIAMETER, HEAVY-WALL TUBE WITH CARBIDE TIP

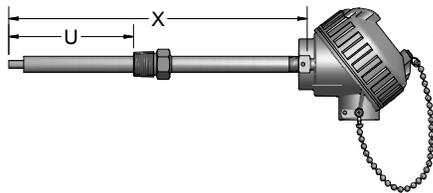
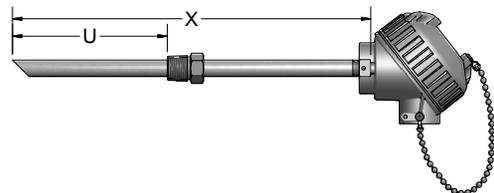


FIG. 4 BEVELED OPEN END TIP



ORDER CODES

Example Order Number:

J29GA1 - **18** - **6D12** - **31, H**

1 Thermocouple Styles

| CODE | T/C TYPE | NOM. PIPE DIA. (inches) | MEASURING TIP CONSTRUCTION | FIG. NO. |
|--------|----------|-------------------------|--------------------------------|----------|
| J29GA1 | J | 0.540 | Flame-sprayed tungsten carbide | 1 |
| J29GA2 | J | 0.840 | Tool steel with carbide tip | 2 |
| J29GA3 | J | 0.540 | Carbide tip | 3 |
| J14CS | J | 0.540 | Open end tube | 4 |

For ungrounded junctions, change 'G' in above order code to 'U'. Consult factory for availability of other thermocouple types and duplex elements.

2 Length 'X'

| CODE | LENGTH (inches) | CODE | LENGTH (inches) |
|------|-----------------|-----------------------|-----------------|
| 12 | 12 | 20 | 20 |
| 14 | 14 | 24 | 24 |
| 18 | 18 | Specify other lengths | |

4 Head Terminations

| CODE | DESCRIPTION |
|-------------------|--|
| 22 ^[1] | 3" individual leads with terminal pins |
| 31 | Aluminum screw-cover head |
| 34 | Cast iron screw-cover head |
| 49 | Flip-top aluminum head |
| 91 | 316L stainless steel screw-cover head |

[1] Not available with J14CS Series

Options

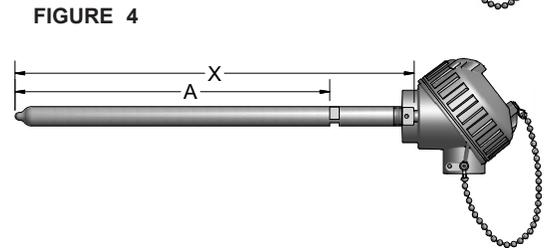
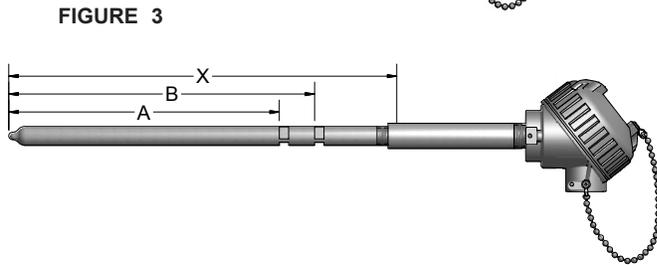
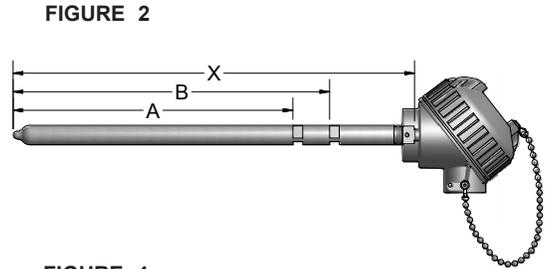
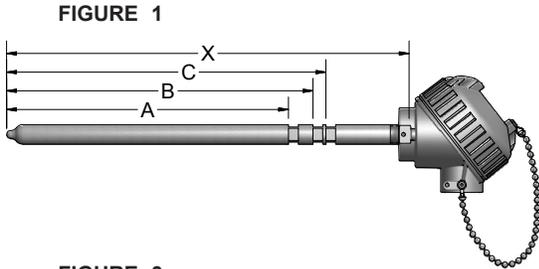
| | |
|----|----------------------------------|
| H | Adjustable steel mounting flange |
| SB | 1/2" NPT conduit reducer bushing |

3 Welded Bushings

| CODE | DESCRIPTION |
|-------|--|
| 6C(U) | 1/2" NPT steel bushing (for use with figures 1, 3, and 4 only) |
| 6D(U) | 3/4" NPT welded steel bushing |
| 6E(U) | 1" NPT welded steel bushing |

Substitute length in inches from hot tip to bottom of bushing for 'U' above

The below illustrated thermocouples are most commonly used in the mixing of rubber compounds and other abrasive substances. All standard thermocouples are individually tested to meet or surpass the Industry Time Response Test Standard. Thermocouple sensors are supplied with grounded hot junctions as standard. Thermocouples may be ordered with a choice of either a hard-chrome plated tip, or with a XH-5 coated tip that provides greater abrasion and wear resistance.



All mill slots are 5/16" wide. Abrasion-resistant tips are 0.625" O.D. x 1/2" long.

ORDER CODES

Example Order Number:

J050G - **CM** - **10** - **31**

1 Measuring Element

| CODE | | ELEMENT TYPE |
|--|--------|---------------------|
| SINGLE | DUPLEX | |
| J050G | JJ050G | Type J thermocouple |
| To order type K thermocouple replace 'J' in the above order code with desired (K). | | |

3 Termination Options

| CODE | ELEMENT TYPE |
|---|-----------------------------|
| 31 | Aluminum screw-cover head |
| 49 | Aluminum flip-top head |
| [1]K1_ _ _ | Polyimide - solid conductor |
| [1] Specify lead length in inches using 3 digits. | |

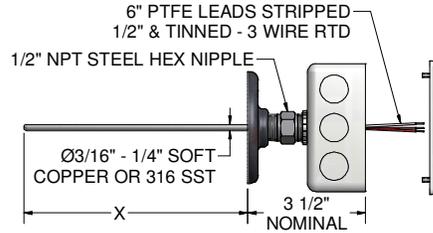
2 Mounting Configuration

| CODE | | MOUNTING NOTCH CONFIGURATION | TYPICAL APPLICATION BY MIXER MODELS | FIG. NO. |
|--|-----------------|--|-------------------------------------|----------|
| HARD CHROME-PLATED TIP | XH-5 COATED TIP | | | |
| 10 | 12 | 3 notch (square) | 11D, F80, 9D, 3D | 1 |
| 20 | 22 | 2 notch (triangular) | F270, F620 | 2 |
| 20E | 22E | 2 notch (triangular) w/ nipple extension | F370, F620 | 3 |
| 40 | 42 | 1 notch (triangular) | F270 | 4 |
| Applications are typical, but may vary by machine. | | | | |

Critical Sensor Dimensions

| MOUNTING CONFIG. CODE | FIG. NO. | DIMENSIONS (inches) | | | | |
|--------------------------------------|----------|---------------------|----------|---------|--------|---|
| | | A | B | C | X | E |
| 10 or 12 | 1 | 9 1/16 | 9 13/16 | 10 5/16 | 13 | |
| 20 or 22 | 2 | 13 31/32 | 15 31/32 | | 18 | |
| 20E or 22E | 3 | 13 31/32 | 15 31/32 | | 17 5/8 | 5 |
| 40 or 42 | 4 | 10 7/32 | | | 12 | |
| All notches are 5/16" wide (nominal) | | | | | | |

The averaging RTD sensor listed below measures the temperature over the entire sheath length to provide an average temperature measurement of the cross sectional area of air ducts, room gradient temperatures, and other low temperature averaging applications. The sensing element has a resistance output that conforms to a 100 Ω platinum element with a 0.003 85 °C⁻¹ temperature coefficient within a measurement range of (0 to 100) °C [32 to 212] °F. The RTD sensors are available in copper or 316 stainless steel sheath materials and can be supplied in various lengths up to 800 inches. All RTD sensors 48 inches and longer will be shipped in a coiled configuration. The sensors on this page can be provided with a (4 to 20) mA Transmitter integrally mounted inside the available enclosures.



ORDER CODES

Example Order Number:

2290L 4(23)3 - 120 - 8HN 47, HT

1 RTD Averaging Sensor

| CODE | DESCRIPTION |
|-------|--|
| 2290L | 3-wire continuous averaging RTD sensor |

2 Sheath Material and Diameter

| CODE | DESCRIPTION | |
|--------|-------------------|----------|
| | DIAMETER (inches) | MATERIAL |
| 3(23)3 | 3/16 | Copper |
| 4(23)3 | 1/4 | Copper |
| 383 | 3/16 | 316 SS |
| 483 | 1/4 | 316 SS |

3 Length

| AVAIL. LENGTHS (inches) | DIAMETER O.D. (inches) | BENDABILITY |
|-------------------------|------------------------|-------------|
| 12 | 3/16, 1/4 | Rigid |
| 24 | 3/16, 1/4 | Rigid |
| 36 | 3/16, 1/4 | Rigid |
| 37 to 324 | 3/16, 1/4 | Bendable |
| 325 to 828 | 1/4 | Bendable |

Specify length in inches using 3 digits.

Initial averaging RTD accuracy calculation: $\pm [1.3 + 0.005 |t|] \text{ } ^\circ\text{C}$
 |t| = Value of temperature without regard to sign, °C

| TEMPERATURE | °C | °F | TEMPERATURE | °C | °F |
|----------------|-----|-----|-----------------|-----|-----|
| 0 °C [32 °F] | 1.3 | 2.3 | 60 °C [140 °F] | 1.6 | 2.9 |
| 20 °C [68 °F] | 1.4 | 2.5 | 80 °C [176 °F] | 1.7 | 3.1 |
| 40 °C [104 °F] | 1.5 | 2.7 | 100 °C [212 °F] | 1.8 | 3.2 |

4 Head Mounting Fittings

| CODE | DESCRIPTION |
|------|--|
| 8HN | 1/2" x 1/2" NPT stainless steel hex nipple |
| 6HN | 1/2" x 1/2" NPT steel hex nipple |

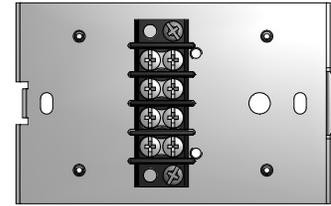
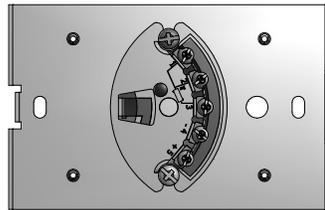
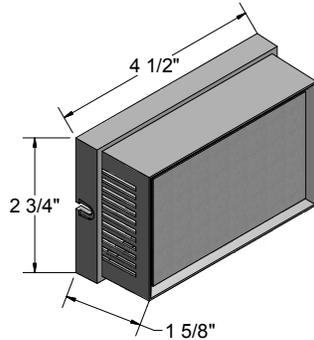
5 Terminations

| CODE | DESCRIPTION |
|---------|---|
| 22(06) | 6" individual fluoropolymer leads with terminal pins |
| 31 | Aluminum screw-cover head |
| 49 | Flip-top aluminum head |
| 47 | 2" x 4" electrical handibox |
| Options | |
| HT | Floor flange threaded on hex |
| T-440 | 4-20 mA head-mounted transmitter (see instrument section) |

SPECIAL-PURPOSE

Configuration Code SP07 Thermostat Temperature Sensors

The Pyromation thermostat temperature sensors are provided with the sensor, or the sensor and a (4 to 20) mA temperature transmitter, mounted on a subplate within a standard size thermostat housing. The thermostat housing measures 2 3/4" x 4 1/2" and can be mounted either horizontally or vertically on a 2" x 4" electrical handibox. The cover is vented on two sides to provide for airflow over the sensing element, regardless of mounting position. The standard temperature sensing elements are available as a fluoropolymer insulated thermocouple or a three-wire RTD. Matching transmitters are available for all configurations and output ranges.



Temperature Range (-40 to 85) °C

ORDER CODES

Example Order Number:

2215-RBF185L3

- T

Thermostat Housings

| CODE | DESCRIPTION |
|---------------------|---|
| 2215 - RBF185L3 | Thermostat housing with integral 100 Ω platinum RTD 0.003 85 0 °C ⁻¹ temperature coefficient Class B |
| 2215 - (J, K, T, E) | Thermostat housing with integral thermocouple element |
| 2415 | Thermostat housing with base plate and 4-position terminal strip - no sensing element |

Option

| CODE | DESCRIPTION |
|-------|--|
| T-440 | 4-20 mA RTD transmitter mounted in housing with sensor (see instrument section) |
| T-441 | 4-20 mA isolated transmitter mounted in housing with sensor (see instrument section) |

SPECIAL-PURPOSE

Configuration Code SP08 Variable-Length RTD Elements

The sensing elements listed on this page can be cut to any desired length over 3" long by using an ordinary tubing cutter. All sheaths are provided in 316 stainless steel.



ORDER CODES

Example Order Number:

R1T185L48 - **3** - **012** - **VCL** - **T3012** - **2**

1 3-Wire RTD Assemblies Pt100 $\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$

| CODE | | TOLERANCE ^[1] | SHEATH DIAMETER O.D. (inches) |
|------------|------------|--------------------------|-------------------------------|
| SINGLE | DUPLEX | | |
| RBF185L483 | RBF285L483 | Class B | 1/4 |
| R1T185L483 | R1T285L483 | Grade B | 1/4 |
| RBF185L683 | RBF285L683 | Class B | 3/8 |
| R1T185L683 | R1T285L683 | Grade B | 3/8 |

Consult factory for other RTD elements.

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

3 RTD Extension Leadwire

| CODE ^[1] | DESCRIPTION | TEMP. RATING |
|---------------------|--|-----------------|
| T3J _ _ _ | Fluoropolymer insulation - individual leads stranded conductor (12" limit) | 204 °C [400 °F] |
| T3 _ _ _ | Fluoropolymer insulation - stranded conductor | 204 °C [400 °F] |

Leads supplied stripped and tinned 1/2"
[1] Insert wire code number and 3 digit "E" length code in inches

2 Sheath "X" Length

Specify "X" Length in Inches Using (3) Digits

Configuration Code SP10 Variable-Length Thermocouple Elements

ORDER CODES

Maximum T/C Temperature Limits:

Fiberglass insulated lead style: 482 °C [900 °F]

Fluoropolymer insulated lead style: 204 °C [400 °F]



Example Order Number:

JP48 - **G** - **006** - **VCL** - **T1012** - **2**

1-1 Thermocouple Assemblies

| CODE | | T/C TYPE | SHEATH DIAMETER O.D. (inches) |
|--------|--------|----------|-------------------------------|
| SINGLE | DUPLEX | | |
| JP48 | JJP48 | J | 1/4 |
| KP48 | KKP48 | K | 1/4 |
| TP48 | TTP48 | T | 1/4 |
| EP48 | EEP48 | E | 1/4 |
| JP68 | JJP68 | J | 3/8 |
| KP68 | KKP68 | K | 3/8 |
| TP68 | TTP68 | T | 3/8 |
| EP68 | EEP68 | E | 3/8 |

1-2 Hot Junction

| CODE | DESCRIPTION |
|------|-------------|
| G | Grounded |
| U | Ungrounded |

3 Thermocouple Extension Leadwire

| CODE ^[1] | DESCRIPTION | INSUL. TEMP. LIMIT |
|---------------------|--|--------------------|
| F1 _ _ _ | Fiberglass insulation - solid conductor | 482 °C [900 °F] |
| T1 _ _ _ | Fluoropolymer insulation - solid conductor | 204 °C [400 °F] |

Leads supplied split 2", 1/4" stripped
[1] Insert wire code number and 3 digit "E" length code in inches

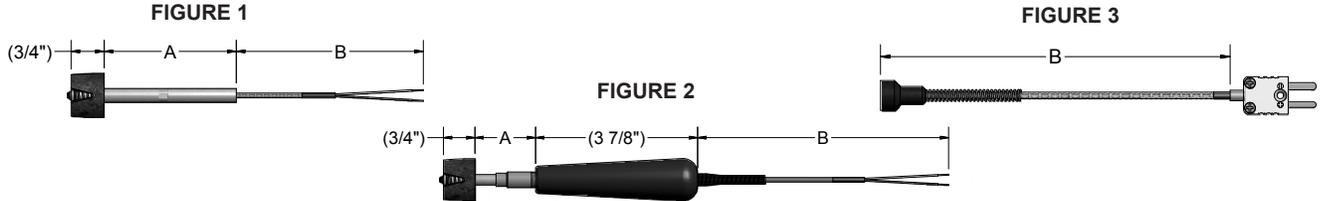
2 Sheath "X" Length

Specify "X" Length in Inches Using (3) Digits



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The magnet sensors are designed to measure the surface temperature of ferrous metals with a convenient and non-destructive magnetic attachment. These sensors are designed to be mounted either vertically or horizontally and may be attached to molding press platens, bearing/motor housings and various other metal surfaces. These sensors provide stabilized temperature readings in less than 5 seconds. The magnet sensors have a continuous operating temperature of 400 °F. The T and H series can take intermittent temperatures up to 600 °F, but the pull of the magnet will be degraded at temperatures above 450 °F. The M series has a 2 lb. pull force magnet and the T and H series have a 16 lb. pull force magnet.



ORDER CODES

Example Order Number:

JMAG - T - 006 - 304 - T1B072 - 2

1 Thermocouple Types

| CODE | DESCRIPTION |
|------|----------------------|
| JMAG | Type J magnet sensor |
| KMAG | Type K magnet sensor |

2 Magnet Assembly Styles

SHEATH STYLE (FIGURE 1)

| CODE | DESCRIPTION |
|------------------|---|
| T ^[1] | 16 lb. Pull magnet with 5/16" O.D. sheath |

PHENOLIC HANDLE STYLE (FIGURE 2)

| CODE | DESCRIPTION |
|------------------|--------------------------------|
| H ^[2] | 16 lb. Pull magnet with handle |

MINIATURE STYLE (FIGURE 3)

| CODE | DESCRIPTION |
|------------------|-------------------|
| M ^[3] | 2 lb. Pull magnet |

[1] 3 inch minimum "A" dimension

[2] 1 inch minimum "A" dimension

[3] No "A" Dimension required-specify as 000

3 "A" Dimension

Specify 3 digit "A" Dimension length in inches.

4 Bend Options^[1]

| CODE | DESCRIPTION |
|------|-----------------|
| 00 | No Bend |
| 2__ | Sheath bent 45° |
| 3__ | Sheath bent 90° |

[1] Only available with "T" style magnet sensor. Requires a minimum "A" dimension of 4 3/4 inches.

5 Extension Leadwire Type

| CODE | DESCRIPTION |
|--------------------|---|
| F1 | Fiberglass insulation-solid conductor |
| F1B | Fiberglass insulation-solid conductor-stainless steel overbraid |
| F1A ^[1] | Fiberglass insulation-solid conductor-flexible armor |
| F3 | Fiberglass insulation-stranded conductor |
| F3B | Fiberglass insulation-stranded conductor-stainless steel overbraid |
| F3A ^[1] | Fiberglass insulation-stranded conductor-flexible armor |
| T1 | Fluoropolymer insulation-solid conductor |
| T1B | Fluoropolymer insulation-solid conductor-stainless steel overbraid |
| T1A ^[1] | Fluoropolymer insulation-solid conductor-flexible armor |
| T3 | Fluoropolymer insulation-stranded conductor |
| T3B | Fluoropolymer insulation-stranded conductor-stainless steel overbraid |
| T3A ^[1] | Fluoropolymer insulation-stranded conductor-flexible armor |

[1] Not available with M1 series assembly

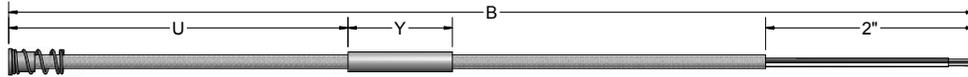
6 Terminations and Options

| CODE | DESCRIPTION |
|------|--|
| 0 | Leads not stripped |
| 2 | 2" split leads, 1/4" stripped |
| 3 | 2" split leads with spade lugs |
| 4 | Standard plug |
| 5 | Standard jack |
| 6 | Miniature plug |
| 7 | Miniature jack |
| 8 | 2" split leads with 1/4" quick-disconnect female terminal lugs |

Options

| CODE | DESCRIPTION |
|------|---|
| MC | Mating Connector |
| CC | Connector secured to leads with cable clamp |
| BX | 1/2" NPT junction box connector |

The miniature sensors are designed to measure the critical temperature of equipment such as sleeve bearings, thrust bearings, bearing shoes, and various other bearings where temperature is critical to performance. These types of bearings are generally used in the operation of high-speed rotating equipment such as compressors, generators, and turbines. The sensors are typically imbedded or installed beneath the Babbitt layer of the bearing to monitor the temperature, allowing early warning of the breakdown of the lubricants. This early warning allows preventative maintenance to take place before major problems occur.



ORDER CODES

Example Order Number: HL30 - RBF185LBS 3 - BST - 3P02(1/2),24 - T3120 - 2

0 ATEX Certification^[1]

| CODE | DESCRIPTION |
|------|---|
| HL30 | ATEX Certified CE Ex II3G Ex ic IIC T4 |

[1] Selection optional, not required for general-purpose sensors

1-1 Element Connection

| CODE | DESCRIPTION |
|------|-------------|
| 2 | 2-Wire |
| 3 | 3-Wire |

2 Case Options

| CASE STYLE | |
|------------------|---|
| CODE | DESCRIPTION |
| A | 0.275" O.D. x 0.250" Long |
| B | 0.188" O.D. x 0.250" Long |
| BS | 0.188" O.D. x 0.250" Long (Includes spring and washer) |
| C ^[1] | 0.125" O.D. x 0.300" Long |
| D ^[1] | 0.080" O.D. x 0.300" Long |

| CASE MATERIAL | |
|---------------|----------------------|
| CODE | DESCRIPTION |
| T | Tin-plated copper |
| N | Nickel-plated copper |

[1] Not available in duplex

3 Sealing Options

| CODE | DESCRIPTION |
|------------|---|
| 00 | No sealing option |
| E "U" | Elastomer fill (must specify length of elastomer fill "u" dimension) 72" maximum fill length. T3BT wire type must be specified. |
| 3P"Y", "U" | 3/16" O.D. pass through (must specify "Y" length and "U" length) |
| 4P"Y", "U" | 1/4" O.D. pass through (must specify "Y" length and "U" length) |

4 Extension Leadwire Type ("B" Dimension)

| CODE | DESCRIPTION |
|------|---|
| T3J | Fluoropolymer insulation-individual leads-stranded conductor |
| T3 | Fluoropolymer insulation-stranded conductor |
| T3B | Fluoropolymer insulation-stranded conductor-stainless steel overbraid |
| T3BT | Fluoropolymer insulation-stranded conductor-stainless steel overbraid |

5 Termination

| CODE | DESCRIPTION |
|------|--------------------------------|
| 0 | No Termination |
| 2 | 2" split leads 1/4" strip |
| 3 | 2" split leads with spade lugs |

1 100 Ω Platinum RTD Elements (-40 to 204 °C)

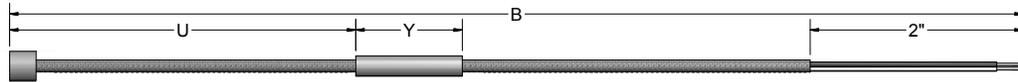
| SENSOR TYPE | | DESCRIPTION | |
|-------------|-----------|--------------------------|---|
| CODE | | TOLERANCE ^[1] | TEMPERATURE COEFFICIENT |
| SINGLE | DUPLEX | | |
| RBF185LBS | RBF285LBS | Class B | $\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$ |
| RBF192LBS | RBF292LBS | Class B | $\alpha = 0.00392 \text{ } ^\circ\text{C}^{-1}$ |

[1] Refer to RTD tolerance information in the General Information section for calculations to determine specific tolerance at temperature.

| WIRE TYPE | | CASE STYLE A ^[1] | | CASE STYLE B ^[1] | | CASE STYLE C ^[1] | | CASE STYLE D ^[1] | |
|-----------|--|-----------------------------|------------------------|-----------------------------|------------------------|-----------------------------|------------------------|-----------------------------|--------|
| CODE | DESCRIPTION | Single | Duplex | Single | Duplex | Single | Duplex | Single | Duplex |
| T3J | Fluoropolymer insulation-individual leads-stranded conductor | 2- or 3-wire 24 AWG | 2- or 3-wire 28 AWG | 2- or 3-wire 24 AWG | 2- or 3-wire 28 AWG | 2- or 3-wire 28 AWG | 2- or 3-wire 30 AWG | 2- or 3-wire 30 AWG | N/A |
| T3 | Fluoropolymer insulation-stranded conductor | 2- or 3-wire 24 AWG | 2- or 3-wire 28 AWG | 2- or 3-wire 24 AWG | 2- or 3-wire 28 AWG | 2- or 3-wire 28 AWG | 2- or 3-wire 28 AWG | N/A | N/A |
| T3B | Fluoropolymer insulation-stranded conductor-stainless steel overbraid | 2- or 3-wire 24 AWG | 2- or 3-wire 28 AWG | 2- or 3-wire 24 AWG | 2- or 3-wire 28 AWG | N/A | N/A | N/A | N/A |
| T3BT | Fluoropolymer insulation-stranded conductor-stainless steel overbraid-Fluoropolymer outer jacket | 2- or 3-wire 24 AWG | 2- or 3-wire 30 AWG | 2- or 3-wire 24 AWG | 2- or 3-wire 30 AWG | N/A | N/A | N/A | N/A |

[1] Refer to page SP-12 for case style dimenons.

The miniature sensors are designed to measure the critical temperature of equipment such as sleeve bearings, thrust bearings, bearing shoes, and various other bearings where temperature is critical to performance. These types of bearings are generally used in the operation of high-speed rotating equipment such as compressors, generators, and turbines. The sensors are typically imbedded or installed beneath the Babbitt layer of the bearing to monitor the temperature, allowing early warning of the breakdown of the lubricants. This early warning allows preventative maintenance to take place before major problems occur.



ORDER CODES

**Example
Order Number:**

0 1 2 3 4 5
HL30 - JBSU - AT - 00 - T3120 - 2

0 ATEX Certification^[1]

| CODE | DESCRIPTION |
|------|---|
| HL30 | ATEX Certified CE Ex II3G Ex ic IIC T4 |

[1] Selection optional, not required for general-purpose sensors

1 Thermocouple Type

| CODE | DESCRIPTION |
|--------|-------------|
| SINGLE | DUPLEX |
| JBSU | JJBSU |
| KBSU | KKBSU |
| TBSU | TTBSU |
| EBSU | EEBSU |

3 Sealing Options

| CODE | DESCRIPTION |
|------------|--|
| 00 | No sealing option |
| 3P"Y", "U" | 3/16" O.D. pass through (must specify "Y" length and "U" length) |
| 4P"Y", "U" | 1/4" O.D. pass through (must specify "Y" length and "U" length) |

2 Case Options

| CASE STYLE | |
|------------------|---|
| CODE | DESCRIPTION |
| A | 0.275" O.D. x 0.250" Long |
| B | 0.188" O.D. x 0.250" Long |
| BS | 0.188" O.D. x 0.250" Long (Includes spring and washer) |
| C ^[1] | 0.125" O.D. x 0.300" Long |
| D ^[1] | 0.080" O.D. x 0.300" Long |
| CASE MATERIAL | |
| CODE | DESCRIPTION |
| T | Tin-plated copper |
| N | Nickel-plated copper |

[1] Not available in duplex

4 Extension Leadwire Type ("B" Dimension)

| CODE | DESCRIPTION | AVAILABLE CALIBRATIONS | | | |
|------|---|------------------------|---|---|---|
| | | J | K | T | E |
| T1 | Fluoropolymer insulation-solid conductor | X | X | X | |
| T3J | Fluoropolymer insulation-individual leads-stranded conductor | X | X | X | X |
| T3 | Fluoropolymer insulation-stranded conductor | X | X | X | X |
| T3B | Fluoropolymer insulation-stranded conductor-stainless steel overbraid | X | X | | |

5 Termination

| CODE | DESCRIPTION |
|------|--------------------------------|
| 0 | No Termination |
| 2 | 2" split leads 1/4" strip |
| 3 | 2" split leads with spade lugs |

| WIRE TYPE | | CASE STYLE A ^[1] | | CASE STYLE B ^[1] | | CASE STYLE C ^[1] | | CASE STYLE D ^[1] | |
|-----------|---|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|
| CODE | DESCRIPTION | Single | Duplex | Single | Duplex | Single | Duplex | Single | Duplex |
| T1 | Fluoropolymer insulation-solid conductor | 24 AWG | 24 AWG | 24 AWG | 24 AWG | 24 AWG | N/A | 30 AWG | N/A |
| T3J | Fluoropolymer insulation-individual leads-stranded conductor | 24 AWG | 24 AWG | 24 AWG | 24 AWG | 24 AWG | N/A | N/A | N/A |
| T3 | Fluoropolymer insulation-stranded conductor | 24 AWG | 24 AWG | 24 AWG | 24 AWG | 24 AWG | N/A | N/A | N/A |
| T3B | Fluoropolymer insulation-stranded conductor-stainless steel overbraid | 24 AWG | 24 AWG | 24 AWG | N/A | 24 AWG | N/A | N/A | N/A |

[1] Refer to page SP-12 for case style dimensions.

Installation Instructions

| CASE STYLE | INSTALLATION | ILLUSTRATION |
|------------|--|--------------|
| A | Install sensor just below the babbitt layer – near bearing shoe surface, then puddle the babbitt metal over the sensor tip and smooth. | |
| B | This sensor is designed with a spring and retaining washer that allows for spring loading. Slide the spring and washer over the leads. Insert the sensor tip into a hole bored into the bearing shoe and push down on the retaining ring to compress the spring and secure the sensor. | |
| C & D | Bore the sensor hole in the bearing shoe near, but not touching, the babbitt surface. Insert sensor and secure by potting/bonding with epoxy. | |

Case Style Dimensions

| |
|--|
| <p>CASE STYLE A</p> <p>Ø 0.275" O.D. x 0.250" L</p> |
| <p>CASE STYLE B</p> <p>Ø 0.188" O.D. x 0.250" L Flange 0.250" O.D. x 0.030" L</p> |
| <p>CASE STYLE C</p> <p>Ø 0.125" O.D. x 0.300" L</p> |
| <p>CASE STYLE D</p> <p>Ø 0.080" O.D. x 0.300" L</p> |

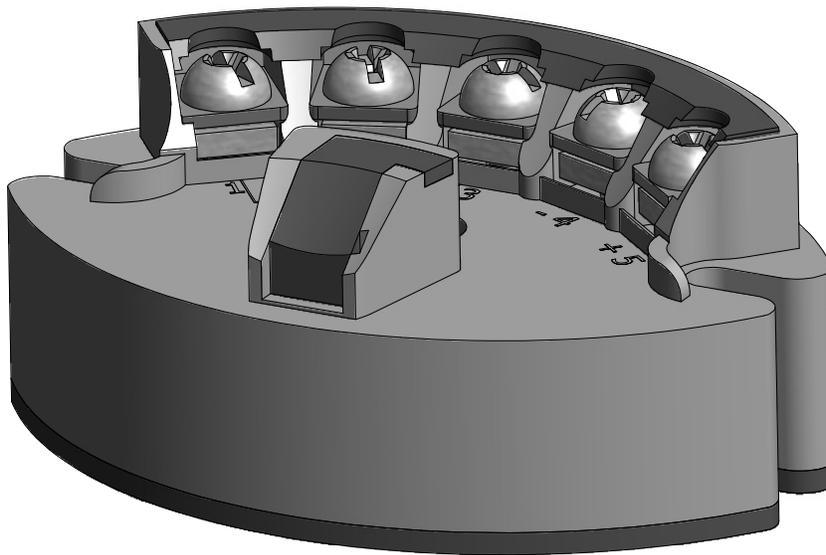
Accessories

| PART NUMBER | DESCRIPTION | ILLUSTRATION |
|-------------|------------------|--------------|
| 12920 | Spring | |
| 12919 | Retaining Washer | |
| 10494 | Retaining Ring | |

The Series 440 programmable RTD temperature transmitter is a 2-wire transmitter with an analog output. It has measurement input for Pt100 resistance thermometers (RTD) in 2- or 3-wire connections. Setting up of the transmitter is done using the communication cable. These small units can be mounted in Pyromation connection heads or they can be used for surface mounting by using a 35 mm DIN-rail mounting clip.

TEMPERATURE HEAD TRANSMITTER

Universal head transmitter for Pt100 resistance thermometers (RTD), programmable using a PC, for installation in a sensor head.



Patent #D350, 596

Application Areas

- PC programmable temperature head transmitter for converting Pt100 input signal into an scaleable (4 to 20) mA analog output signal
- Platinum resistance thermometer (RTD)
- Online configuration using PC with SETUP connector.

Features and Benefits

- Universally PC programmable for Pt100 signals
- 2-wire technology, (4 to 20) mA analog output
- High accuracy in total ambient temperature range
- Fault signal on sensor break or short circuit
- RFI/EMI Protected, **CE** marked
- **UL** US UL Recognized Component
- **FM** **CS** General Purpose and non-incendive for use in hazardous locations
- Online configuration during measurement using SETUP connector
- Output simulation

ORDER CODES

Unconfigured Order Number: 440-00^[1]

Example Configured Order Number: **4 4 0** - **3 85 U** - **S (50-300) F**

1

| CODE | DESCRIPTION |
|------|--------------|
| 2 | RTD (2-wire) |
| 3 | RTD (3-wire) |

2

| CODE | DESCRIPTION |
|------|--|
| 85 | 100 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |

[1] Default setting for unconfigured transmitter is 3-wire Pt100 (0 -100) $^\circ\text{C}$.



3

| CODE | DESCRIPTION |
|------|---|
| U | Upscale Burnout $\geq 21.0 \text{ mA}$ |
| D | Downscale Burnout $\leq 3.6 \text{ mA}$ |

4

| RANGE |
|--------------------------------|
| S (lower limit – upper limit) |

5

| CODE | DESCRIPTION |
|------|-------------|
| C | Celsius |
| F | Fahrenheit |

Accessories

| CODE | DESCRIPTION |
|-------|--|
| 10303 | Communication Cable and Software (USB) |
| 10307 | 35 mm DIN-rail mounting clip |

Resistance Thermometer Input (RTD)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|---|--|--|
| Pt100 ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) | (-200 to 650) $^\circ\text{C}$ [-328 to 1202] $^\circ\text{F}$ | 10 $^\circ\text{C}$ [18 $^\circ\text{F}$] |
| Connection Type | 2- or 3-wire connection cable resistance compensation possible in the 2-wire system (0 to 20) Ω | |
| Sensor cable resistance | maximum 11 Ω per cable | |
| Sensor current | $\leq 0.6 \text{ mA}$ | |

Output (Analog)

| | |
|---------------------------|---|
| Output signal | (4 to 20) mA or (20 to 4) mA |
| Transmission as | Temperature linear |
| Maximum load | $(V_{\text{power supply}} - 10 \text{ V}) / 0.023 \text{ A}$ (current output) |
| Digital filter 1st degree | (0 to 8) s |
| Induced current required | $\leq 3.5 \text{ mA}$ |
| Current limit | $\leq 23 \text{ mA}$ |
| Switch on delay | 4 s (during power $I_a = 3.8 \text{ mA}$) |
| Electronic response time | 1 s |

Failure Mode

| | |
|---------------------------------|---|
| Undershooting measurement range | Decrease to 3.8 mA |
| Exceeding measurement range | Increase to 20.5 mA |
| Sensor breakage/short circuit | $\leq 3.6 \text{ mA}$ or $\geq 21.0 \text{ mA}$ |

Electronic Connection

| | |
|------------------|---|
| Power supply | $U_b = (10 \text{ to } 30) \text{ V dc}$, polarity protected |
| Allowable ripple | $U_{ss} \leq 5 \text{ V}$ at $U_b \geq 13 \text{ V}$, $f_{\text{max}} = 1 \text{ kHz}$ |

Resistance Thermometer Accuracy (RTD)

| TYPE | MEASUREMENT ACCURACY |
|----------------------|---|
| Pt100 | $\pm 0.2 \text{ } ^\circ\text{C}$ or 0.08% ^[1] |
| Reference conditions | Calibration temperature (23 \pm 5) $^\circ\text{C}$ [73 \pm 9] $^\circ\text{F}$ |

General Accuracy

| | |
|---------------------------|---|
| Influence of power supply | $\pm 0.01\%/V$ deviation from 24 V ^[2] |
| Load influence | $\pm 0.02\%/100 \Omega$ ^[2] |
| Temperature drift | $T_d = \pm (15 \text{ ppm}/^\circ\text{C} \times (\text{range end value} + 200) + 50 \text{ ppm}/^\circ\text{C} \times \text{measurement range}) \times \Delta\vartheta$ $\Delta\vartheta =$ deviation of the ambient temperature according to the reference condition |
| Long term stability | $\leq 0.1 \text{ } ^\circ\text{C}/\text{year}$ ^[3] or $\leq 0.05\%/year$ ^{[1][3]} |

[1] % is related to the adjusted measurement range (the value to be applied is the greater)

[2] All data is related to a measurement end value of 20 mA

[3] Under reference conditions

Ambient Conditions

| | |
|---------------------|---|
| Ambient temperature | (-40 to 85) °C [-40 to 185] °F |
| Storage temperature | (-40 to 100) °C [-40 to 212] °F |
| Climatic class | EN 60 654-1, Class C |
| Condensation | Permitted |
| Shock resistance | 4 g / (2 to 150) Hz according to IEC 60 068-2-6 |
| EMC immunity | Interference immunity and interference emission according to EN 61 326-1 (IEC 1326) |

Mechanical Construction

| | | |
|------------|--|--|
| Dimensions | | |
| | DIMENSIONS IN INCHES [mm] | |
| Weight | Approximately 44 g | |
| Materials | Housing: Polycarbonate • Potting: Polyurethane | |
| Terminals | 15 AWG (maximum) | |

Terminal Connections

| | |
|--|--|
| <p>Power supply and current output</p> <p>5 + (10 to 30) V dc 4 - (4 to 20) mA</p> | |
| <p>2-Wire</p> | |
| <p>3-Wire</p> | |

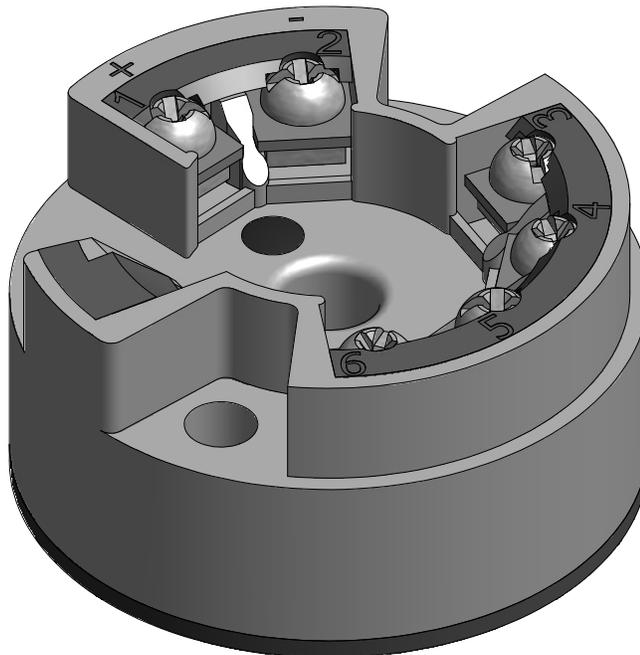
Approvals

| | |
|--|---|
| | Unit complies with the legal requirements set forth by the EU regulations. |
| | UL Recognized Component |
| | General Purpose and non-incendive for use in hazardous locations Class I, Division 2 Groups A, B, C and D |

The Series 441 programmable temperature transmitter is a 2-wire transmitter with an analog output. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connections, thermocouples, resistance and voltage inputs. Setting up of the transmitter is done using the communication cable. These small units can be mounted in Pyromation DIN (Form B) connection heads or they can be used for surface mounting by using a 35 mm DIN-rail mounting clip.

TEMPERATURE HEAD TRANSMITTER

Universal head transmitter for resistance thermometers (RTD), thermocouples, resistance and voltage inputs, programmable using a PC, for installation in a sensor head (Form B)



Application Areas

- PC programmable temperature head transmitter for converting various input signals into an scalable (4 to 20) mA analog output signal
- Input:
 - Resistance thermometer (RTD)
 - Thermocouple (TC)
 - Resistance (Ω)
 - Voltage (mV)
- Online configuration using PC with SETUP connector

Features and Benefits

- Universally PC programmable for various signals
- Galvanic isolation
- 2-wire technology, (4 to 20) mA analog output
- High accuracy in total ambient temperature range
- Fault signal on sensor break or short circuit
- RFI/EMI Protected, **CE** marked
- **UL** US UL Recognized Component
- **FM** Intrinsicly safe and non-incendive for hazardous locations
- **FM** Intrinsicly safe and non-incendive for hazardous locations
- Online configuration during measurement using SETUP connector
- Output simulation

ORDER CODES

Unconfigured Order Number: 441-00^[1]

Example Configured Order Number:

4 4 1 - **1 J U** - **S (50-300) F**

1

| CODE | DESCRIPTION |
|------|-------------------|
| 1 | Thermocouple (TC) |
| 2 | RTD (2-wire) |
| 3 | RTD (3-wire) |
| 4 | RTD (4-wire) |

2

| CODE | DESCRIPTION |
|------|---|
| J | Type J thermocouple |
| K | Type K thermocouple |
| T | Type T thermocouple |
| N | Type N thermocouple |
| E | Type E thermocouple |
| R | Type R thermocouple |
| S | Type S thermocouple |
| B | Type B thermocouple |
| 85 | 100 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |
| 55 | 500 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |
| 95 | 1000 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |
| MV | Millivolts |
| W | Resistance |

3

| CODE | DESCRIPTION |
|------|---|
| U | Upscale Burnout $\geq 21.0 \text{ mA}$ |
| D | Downscale Burnout $\leq 3.5 \text{ mA}$ |

4

| RANGE |
|--------------------------------|
| S (lower limit – upper limit) |

5

| CODE | DESCRIPTION |
|------|-------------|
| C | Celsius |
| F | Fahrenheit |

Accessories

| CODE | DESCRIPTION |
|-------|--|
| 10303 | Communication cable and software (USB) |
| 10307 | 35 mm DIN-rail mounting clip |

[1] Default setting for unconfigured transmitter is 3-wire Pt100 (0 - 100) °C.

INPUT

Resistance Thermometer (RTD)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|---|---|---------------|
| Pt100 ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) | (-200 to 850) °C [-328 to 1562] °F | 10° C [18 °F] |
| Pt500 | (-200 to 250) °C [-328 to 482] °F | 10° C [18 °F] |
| Pt1000 | (-200 to 250) °C [-328 to 482] °F | 10° C [18 °F] |
| Ni100 ($\alpha = 0.00618 \text{ } ^\circ\text{C}^{-1}$) | (-60 to 180) °C [-76 to 356] °F | 10° C [18 °F] |
| Ni500 | (-60 to 150) °C [-76 to 302] °F | 10° C [18 °F] |
| Ni1000 | (-60 to 150) °C [-76 to 302] °F | 10° C [18 °F] |
| Connection type | 2-, 3- or 4-wire connection cable. Resistance compensation possible in the 2-wire system (0 to 20) Ω | |
| Sensor cable resistance | maximum 11 Ω per cable | |
| Sensor current | $\leq 0.6 \text{ mA}$ | |

Resistance (Ω)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|-------------------------|---|-----------------------------|
| Resistance (Ω) | (10 to 400) Ω (10 to 2000) Ω | 10 Ω 100 Ω |

Thermocouples (TC)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|--|--|-----------------|
| B (PtRh30-PtRh6) | (0 to 1820) °C [32 to 3308] °F | 500 °C [900 °F] |
| C (W5Re-W26Re) | (0 to 2320) °C [32 to 4208] °F | 500 °C [900 °F] |
| D (W3Re-W25Re) [3] | (0 to 2495) °C [32 to 4523] °F | 500 °C [900 °F] |
| E (NiCr-CuNi) | (-200 to 915) °C [-328 to 1679] °F | 50 °C [90 °F] |
| J (Fe-CuNi) | (-200 to 1200) °C [-328 to 2192] °F | 50 °C [90 °F] |
| K (NiCr-Ni) | (-200 to 1372) °C [-328 to 2501] °F | 50 °C [90 °F] |
| L (Fe-CuNi) [2] | (-200 to 900) °C [-328 to 1652] °F | 50 °C [90 °F] |
| N (NiCrSi-NiSi) | (-270 to 1300) °C [-454 to 2372] °F | 50 °C [90 °F] |
| R (PtRh13-Pt) | (0 to 1768) °C [32 to 3214] °F | 500 °C [900 °F] |
| S (PtRh10-Pt) | (0 to 1768) °C [32 to 3214] °F | 500 °C [900 °F] |
| T (Cu-CuNi) | (-200 to 400) °C [-328 to 752] °F | 50 °C [90 °F] |
| U (Cu-CuNi) [2] | (-200 to 600) °C [-328 to 1112] °F | 50 °C [90 °F] |
| MoRe5-MoRe41 [1] | (0 to 2000) °C [32 to 3632] °F | 500 °C [900 °F] |
| Cold junction | internal (Pt100) or external (0 to 80) °C [32 to 176] °F | |
| Cold junction accuracy | $\pm 1 \text{ } ^\circ\text{C}$ | |
| [1] no reference [2] according to DIN 43710 [3] according to ASTM E988 | | |

Voltage (mV)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|----------------|-------------------|---------------|
| Millivolt (mV) | (-10 to 100) mV | 5 mV |

OUTPUT

Output (Analog)

| | |
|---------------------------|--|
| Output signal | (4 to 20) mA or (20 to 4) mA |
| Transmission as | Temperature linear, resistance linear, voltage linear |
| Maximum load | $(V_{\text{power supply}} - 8 \text{ V}) / 0.025 \text{ A}$ (current output) |
| Digital filter 1st degree | (0 to 8) s |
| Induced current required | $\leq 3.5 \text{ mA}$ |
| Current limit | $\leq 25 \text{ mA}$ |
| Switch on delay | 4 s (during power up $I_a = 3.8 \text{ mA}$) |
| Electronic response time | 1 s |

Failure Mode

| | |
|--|---|
| Undershooting measurement range | Decrease to 3.8 mA |
| Exceeding measurement range | Increase to 20.5 mA |
| Sensor breakage/short circuit ^[1] | $\leq 3.5 \text{ mA}$ or $\geq 21.0 \text{ mA}$ |

Electrical Connection

| | |
|-----------------------------|---|
| Power supply | $U_b = (8 \text{ to } 30) \text{ V}$ dc, polarity protected |
| Galvanic isolation (In/out) | $\hat{U} = 3.75 \text{ kV}$ ac |
| Allowable ripple | $U_{ss} \leq 5 \text{ V}$ at $U_b \geq 13 \text{ V}$, $f_{\text{max}} = 1 \text{ kHz}$ |

ACCURACY

| | |
|----------------------|---|
| Reference conditions | Calibration temperature $(23 \pm 5) \text{ }^\circ\text{C}$ $[73 \pm 9] \text{ }^\circ\text{F}$ |
|----------------------|---|

Resistance Thermometer (RTD)

| TYPE | MEASUREMENT ACCURACY |
|----------------|--|
| Pt100, Ni100 | $\pm 0.2 \text{ }^\circ\text{C}$ or 0.08% ^[2] |
| Pt500, Ni500 | $\pm 0.5 \text{ }^\circ\text{C}$ or 0.20% ^[2] |
| Pt1000, Ni1000 | $\pm 0.3 \text{ }^\circ\text{C}$ or 0.12% ^[2] |

Resistance (Ω)

| TYPE | MEASUREMENT ACCURACY | MEASUREMENT RANGE |
|------------|---|-----------------------|
| Resistance | $\pm 0.1 \text{ } \Omega$ or 0.08% ^[2] | (10 to 400) Ω |
| | $\pm 1.5 \text{ } \Omega$ or 0.12% ^[2] | (10 to 2000) Ω |

[1] Not for thermocouple

[2] % is related to the adjusted measurement range (the value to be applied is the greater)

ACCURACY (continued)

Thermocouple (TC)

| TYPE | MEASUREMENT ACCURACY |
|---|--|
| K, J, T, E, L, U N, C, D S, B, R MoRe5-MoRe41 | ± 0.5 °C or 0.08% ^[1] ± 1.0 °C or 0.08% ^[1] ± 2.0 °C or 0.08% ^[1] |
| Influence of the internal reference junction | Pt100 ± (0.30 + 0.005 t) °C t = value of temperature without regard to sign °C |

Voltage (mV)

| TYPE | MEASUREMENT ACCURACY | MEASUREMENT RANGE |
|----------------|---------------------------------|-------------------|
| Millivolt (mV) | ± 20 µV or 0.08% ^[1] | (-10 to 100) mV |

General Accuracy

| | |
|---|---|
| Influence of power supply | ± 0.01%/V deviation from 24 V ^[2] |
| Load influence | ± 0.02%/100 Ω ^[2] |
| Temperature drift | Resistive thermometer (RTD): $T_d = \pm (15 \text{ ppm}/^\circ\text{C} \times \text{range end value} + 50 \text{ ppm}/^\circ\text{C} \times \text{measurement range}) \times \Delta\theta$ Resistive thermometer Pt100: $T_d = \pm (15 \text{ ppm}/^\circ\text{C} \times (\text{range end value} + 200) + 50 \text{ ppm}/^\circ\text{C} \times \text{measurement range}) \times \Delta\theta$ Thermocouple (TC): $T_d = \pm (50 \text{ ppm}/^\circ\text{C} \times \text{range end value} + 50 \text{ ppm}/^\circ\text{C} \times \text{measurement range}) \times \Delta\theta$ $\Delta\theta$ = Deviation of the ambient temperature according to the reference condition |
| Long term stability | ≤ 0.1 °C/year ^[3] or ≤ 0.05%/year ^{[1][3]} |
| <p>[1] % is related to the adjusted measurement range (the value to be applied is the greater) [2] All data is related to a measurement end value of 20 mA [3] Under reference conditions</p> | |

INSTALLATION CONDITIONS

Ambient Conditions

| | |
|-----------------------|---|
| Ambient temperature | (-40 to 85) °C [-40 to 185] °F |
| Storage temperature | (-40 to 100) °C [-40 to 212] °F |
| Climatic class | To EN 60 654-1, Class C |
| Moisture condensation | Allowable |
| Vibration protection | 4 g / (2 to 150) Hz according to IEC 60 068-2-6 |
| EMC immunity | Interference immunity and interference emission as per EN 61 326-1 (IEC 1326) |

MECHANICAL CONSTRUCTION

| | |
|------------|---|
| Dimensions | <p>DIMENSIONS IN INCHES [mm]</p> <p>0.197 [5] 0.28 [7] 1.3 [33] 1.73 [44] 0.89 [23]</p> |
| Weight | approximately 40 g |
| Materials | Housing: Polycarbonate • Potting: Polyurethane |
| Terminals | 15 AWG (maximum) |

Terminal Connections

| | | | | |
|--|--------------------------|---|---|---|
| <p>Power supply and current output</p> <p>2 (-) 1 (+)</p> <p>(8 to 30) V dc (4 to 20) mA</p> | <p>SETUP socket</p> | | | |
| <p>Sensor Connection</p> <p>6 5 4 3</p> | <p>TC</p> <p>6 4</p> | <p>2-Wire</p> <p>RTD Ω</p> <p>6 Ω 3</p> | <p>3-Wire</p> <p>RTD Ω</p> <p>6 Ω 5 3</p> | <p>4-Wire</p> <p>RTD Ω</p> <p>6 Ω 5 4 3</p> |

Remote Operation

| | |
|-------------------------|---|
| Configurable parameters | Sensor type and connection type, engineering units ($^{\circ}\text{C}/^{\circ}\text{F}$), measurement range, internal/external cold junction compensation, cable resistance compensation on 2 wire connection, fault conditioning, output signal (4 to 20) mA or (20 to 4) mA, digital filter (damping), offset, measurement point identification (8 characters), output simulation |
|-------------------------|---|

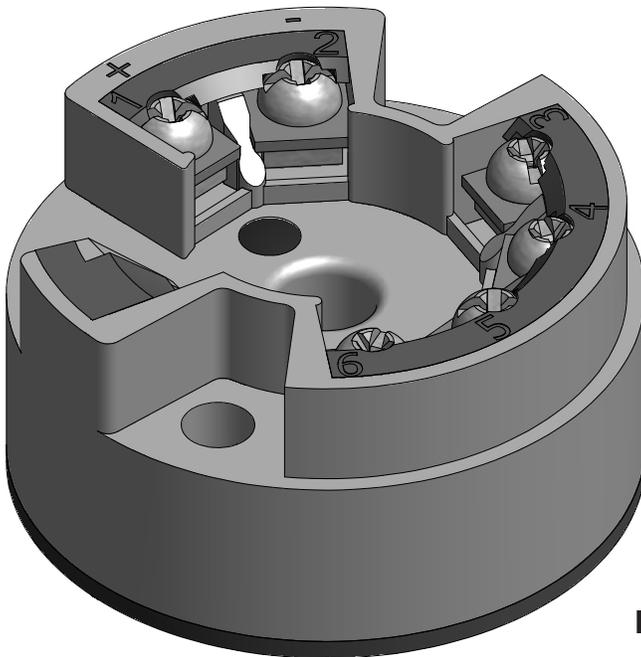
Approvals

| | |
|--|---|
| | Unit complies with the legal requirements set forth by the EU regulations. |
| | UL Recognized Component |
| | General Purpose and non-incendive for use in hazardous locations Class I, Division 2 Groups A, B, C and D |

The Series 442 programmable HART® temperature transmitter is a 2-wire transmitter with an analog output. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connections, thermocouples, resistance and voltage inputs. The transmitter can be programmed with a PC or HART® protocol hand-held terminal. These small units can be mounted in Pyromation DIN (Form B) connection heads, or they can be used for surface mounting by using a 35 mm DIN-rail mounting clip.

TEMPERATURE HEAD TRANSMITTER

Intrinsically safe universal head transmitter for resistance thermometers (RTD), thermocouples, resistance and voltage inputs, programmable using HART® protocol, for installation in a sensor head (Form B).



Features and Benefits

- Universal settings with HART® protocol for various signals.
- Galvanic isolation
- 2-wire technology, (4 to 20) mA analog output
- High accuracy in total ambient temperature range
- Fault signal on sensor break or short circuit
- RFI/EMI Protected, **CE** marked
- **UL** US UL Recognized Component
- **IS** Intrinsically safe and non-incendive for hazardous locations
- **FM** Intrinsically safe and non-incendive for hazardous locations
- Output simulation

HART® is a registered trademark of HART Communication Foundation



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ORDER CODES

Unconfigured Order Number: 442-00^[1]

Example Configured Order Number:

4 4 2

-

1 J U

-

S (50-300)

F

1

| CODE | DESCRIPTION |
|------|-------------------|
| 1 | Thermocouple (TC) |
| 2 | RTD (2-wire) |
| 3 | RTD (3-wire) |
| 4 | RTD (4-wire) |

3

| CODE | DESCRIPTION |
|------|----------------------------|
| U | Upscale Burnout ≥ 21.0 mA |
| D | Downscale Burnout ≤ 3.6 mA |

2

| CODE | DESCRIPTION |
|------|---|
| J | Type J thermocouple |
| K | Type K thermocouple |
| T | Type T thermocouple |
| N | Type N thermocouple |
| E | Type E thermocouple |
| R | Type R thermocouple |
| S | Type S thermocouple |
| B | Type B thermocouple |
| 85 | 100 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |
| 55 | 500 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |
| 95 | 1000 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |
| MV | Millivolts |
| W | Resistance |

4

| RANGE |
|---------------------------------|
| S (lower limit – upper limit) |

5

| CODE | DESCRIPTION |
|------|-------------|
| C | Celsius |
| F | Fahrenheit |

Accessories

| CODE | DESCRIPTION |
|-------|------------------------------|
| 10307 | 35 mm DIN rail mounting clip |

[1] Default setting for unconfigured transmitters is 3-wire Pt100 (0 - 100) °C.

HART® is a registered trademark of HART Communication Foundation



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INPUT

Resistance Thermometer (RTD)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|---|---|---------------|
| Pt100 ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) | (-200 to 850) °C [-328 to 1562] °F | 10° C [18 °F] |
| Pt500 | (-200 to 250) °C [-328 to 482] °F | 10° C [18 °F] |
| Pt1000 | (-200 to 250) °C [-328 to 482] °F | 10° C [18 °F] |
| Ni100 ($\alpha = 0.00618 \text{ } ^\circ\text{C}^{-1}$) | (-60 to 250) °C [-76 to 356] °F | 10° C [18 °F] |
| Ni500 | (-60 to 150) °C [-76 to 302] °F | 10° C [18 °F] |
| Ni1000 | (-60 to 150) °C [-76 to 302] °F | 10° C [18 °F] |
| Connection Type | 2-, 3- or 4-wire connection cable. Resistance compensation possible in the 2 wire system (0 to 30) Ω | |
| Sensor cable resistance | maximum 11 Ω per cable | |
| Sensor current | ≤ 0.2 mA | |

Resistance (Ω)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|-------------------------|---|-----------------------------|
| Resistance (Ω) | (10 to 400) Ω (10 to 2000) Ω | 10 Ω 100 Ω |

Thermocouples (TC)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|--|--|-----------------|
| B (PtRh30-PtRh6) | (0 to 1820) °C [32 to 3308] °F | 500 °C [900 °F] |
| C (W5Re-W26Re) | (0 to 2320) °C [32 to 4208] °F | 500 °C [900 °F] |
| D (W3Re-W25Re) [3] | (0 to 2495) °C [32 to 4523] °F | 500 °C [900 °F] |
| E (NiCr-CuNi) | (-270 to 1000) °C [-454 to 1832] °F | 50 °C [90 °F] |
| J (Fe-CuNi) | (-210 to 1200) °C [-346 to 2192] °F | 50 °C [90 °F] |
| K (NiCr-Ni) | (-270 to 1372) °C [-454 to 2501] °F | 50 °C [90 °F] |
| L (Fe-CuNi) [2] | (-200 to 900) °C [-328 to 1652] °F | 50 °C [90 °F] |
| N (NiCrSi-NiSi) | (-270 to 1300) °C [-454 to 2372] °F | 50 °C [90 °F] |
| R (PtRh13-Pt) | (-50 to 1768) °C [-58 to 3214] °F | 500 °C [900 °F] |
| S (PtRh10-Pt) | (-50 to 1768) °C [-58 to 3214] °F | 500 °C [900 °F] |
| T (Cu-CuNi) | (-270 to 400) °C [-454 to 752] °F | 50 °C [90 °F] |
| U (Cu-CuNi) [2] | (-200 to 600) °C [-328 to 1112] °F | 50 °C [90 °F] |
| MoRe5-MoRe41 [1] | (0 to 2000) °C [32 to 3632] °F | 500 °C [900 °F] |
| Cold junction | internal (Pt100) or external (0 to 80) °C [32 to 176] °F | |
| Cold junction accuracy | ± 1 °C | |
| [1] no reference [2] according to DIN 43710 [3] according to ASTM E988 | | |

Voltage (mV)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|----------------|-------------------|---------------|
| Millivolt (mV) | (-10 to 75) mV | 5 mV |

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OUTPUT

Output (Analog)

| | |
|---------------------------|---|
| Output signal | (4 to 20) mA or (20 to 4) mA |
| Transmission as | Temperature linear, resistance linear, voltage linear |
| Maximum load | $(V_{\text{power supply}} - 11.5\text{V}) / 0.022 \text{ A current output}$ |
| Digital filter 1st degree | (0 to 60) s |
| Induced current required | $\leq 3.5 \text{ mA}$ |
| Current limit | $\leq 25 \text{ mA}$ |
| Switch on delay | 4 s (during power up $I_a = 3.8 \text{ mA}$) |
| Electronic response time | 1 s |

Failure Mode

| | |
|--|---|
| Undershooting measurement range | Decrease to 3.8 mA |
| Exceeding measurement range | Increase to 20.5 mA |
| Sensor breakage/short circuit ^[1] | $\leq 3.6 \text{ mA}$ or $\geq 21.0 \text{ mA}$ |
| [1] Not for thermocouple | |

Electrical Connection

| | |
|-----------------------------|---|
| Power supply | $U_b = (11.5 \text{ to } 30) \text{ V dc}$, polarity protected |
| Galvanic isolation (In/out) | $\hat{U} = 2 \text{ kV ac}$ |
| Allowable ripple | $U_{ss} \leq 3 \text{ V}$ at $U_b \geq 13 \text{ V}$, $f_{\text{max}} = 1 \text{ kHz}$ |

ACCURACY

| | |
|----------------------|---|
| Reference conditions | Calibration temperature $(23 \pm 5) \text{ }^\circ\text{C}$ $[73 \pm 9] \text{ }^\circ\text{F}$ |
|----------------------|---|

Resistance Thermometer (RTD)

| TYPE | MEASUREMENT ACCURACY |
|----------------|---|
| Pt100, Ni100 | $\pm 0.2 \text{ }^\circ\text{C}$ or $0.08\% \text{ }^{[2]}$ |
| Pt500, Ni500 | $\pm 0.5 \text{ }^\circ\text{C}$ or $0.20\% \text{ }^{[2]}$ |
| Pt1000, Ni1000 | $\pm 0.3 \text{ }^\circ\text{C}$ or $0.12\% \text{ }^{[2]}$ |

Resistance (Ω)

| TYPE | MEASUREMENT ACCURACY | MEASUREMENT RANGE |
|------------|--|-----------------------|
| Resistance | $\pm 0.1 \text{ } \Omega$ or $0.08\% \text{ }^{[2]}$ | (10 to 400) Ω |
| | $\pm 1.5 \text{ } \Omega$ or $0.12\% \text{ }^{[2]}$ | (10 to 2000) Ω |

[2] % is related to the adjusted measurement range (the value to be applied is the greater)

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ACCURACY (continued)

Thermocouple (TC)

| TYPE | MEASUREMENT ACCURACY ^[1] |
|---|---|
| K, J, T, E, L, U N, C, D S, B, R MoRe5-MoRe41 | ± 0.5 °C or 0.08% ± 1.0 °C or 0.08% ± 2.0 °C or 0.08% |
| Influence of the internal reference junction | Pt100 ± (0.30 + 0.005 t) °C t = value of temperature without regard to sign °C |

Voltage (mV)

| TYPE | MEASUREMENT ACCURACY | MEASUREMENT RANGE |
|----------------|---------------------------------|-------------------|
| Millivolt (mV) | ± 20 µV or 0.08% ^[1] | (-10 to 100) mV |

General Accuracy

| | |
|---|---|
| Influence of power supply | ± 0.01%/V deviation from 24 V ^[2] |
| Load influence | ± 0.02%/100 Ω ^[2] |
| Temperature drift | Resistive thermometer (RTD): $T_d = \pm (15 \text{ ppm/}^\circ\text{C} \times \text{range end value} + 50 \text{ ppm/}^\circ\text{C measurement range}) \times \Delta\theta$ Resistive thermometer Pt100: $T_d = \pm (15 \text{ ppm/}^\circ\text{C} \times (\text{range end value} + 200) + 50 \text{ ppm/}^\circ\text{C} \times \text{measurement range}) \times \Delta\theta$ Thermocouple (TC): $T_d = \pm (50 \text{ ppm/}^\circ\text{C} \times \text{range end value} + 50 \text{ ppm/}^\circ\text{C measurement range}) \times \Delta\theta$ $\Delta\theta$ = Deviation of the ambient temperature according to the reference condition |
| Long term stability | ≤ 0.1 °C/year ^[3] or ≤ 0.05%/year ^{[1][3]} |
| <p>[1] % is related to the adjusted measurement range (the value to be applied is the greater) [2] All data is related to a measurement end value of 20 mA [3] Under reference conditions</p> | |

INSTALLATION CONDITIONS

Ambient Conditions

| | |
|-----------------------|---|
| Ambient temperature | (-40 to 85) °C [-40 to 185] °F |
| Storage temperature | (-40 to 100) °C [-40 to 212] °F |
| Climatic class | To EN 60 654-1, Class C |
| Moisture condensation | Allowable |
| Vibration protection | 4 g / (2 to 150) Hz according to IEC 60 068-2-6 |
| EMC immunity | Interference immunity and interference emission as per EN 61 326-1 (IEC 1326) |

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MECHANICAL CONSTRUCTION

| | |
|------------|--|
| Dimensions | <p>DIMENSIONS IN INCHES [mm]</p> |
| Weight | approximately 40 g |
| Materials | Housing: Polycarbonate • Potting: Polyurethane |
| Terminals | 15 AWG (maximum) |

Terminal Connections

| | | | |
|--|--|--|--|
| <p>Power supply and current output</p> <p>2 (-) (11.5 to 30) V dc 1 (+) (4 to 20) mA</p> | <p>HART® Communication on (4 to 20) mA</p> | | |
| <p>Sensor Connection</p> <p>6 5 4 3</p> <p>TC 6 4</p> | <p>2-Wire</p> <p>RTD Ω</p> | <p>3-Wire</p> <p>RTD Ω</p> | <p>4-Wire</p> <p>RTD Ω</p> |

Remote Operation

| | |
|-------------------------|---|
| Configurable parameters | Sensor type and connection type, engineering units ($^{\circ}\text{C}/^{\circ}\text{F}$), measurement range, internal/external cold junction compensation, cable resistance compensation on 2-wire connection, fault conditioning, output signal (4 to 20) mA or (20 to 4) mA, digital filter (damping), offset, measurement point identification (8 characters), output simulation |
|-------------------------|---|

Approvals

| | |
|--|---|
| | Unit complies with the legal requirements set forth by the EU regulations. |
| | UL Recognized Component |
| | General Purpose and non-incendive for use in hazardous locations Class I, Division 2 Groups A, B, C and D |

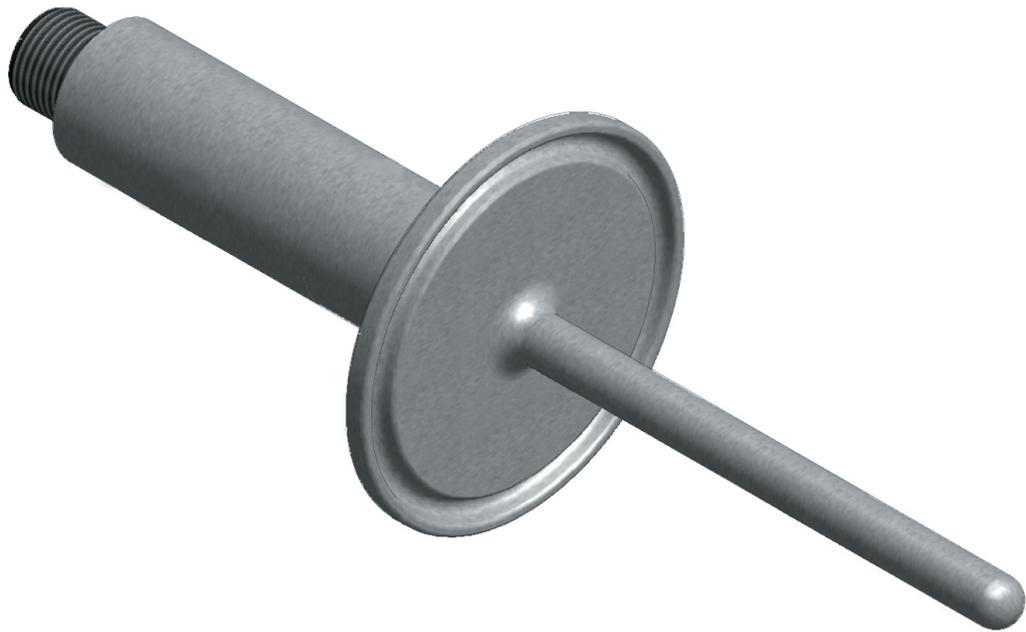
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The Series 450 Programmable Integral Temperature Transmitter is ideal for monitoring temperature in highly moist or corrosive environments and in small areas such as pipes and tanks. The unit consists of a 4-wire Pt100 RTD sensor, built-in (4 to 20) mA transmitter, and process connection. The integral design eliminates all external screw connections, simplifying the electrical installation process and solving the problems caused by moisture, loose connections, and corrosion. A "quick disconnect" M12 plug adapter connects the transmitter to a PC for ease of calibration, re-programming, and wiring accuracy.

SERIES 450 PROGRAMMABLE INTEGRAL TEMPERATURE TRANSMITTER



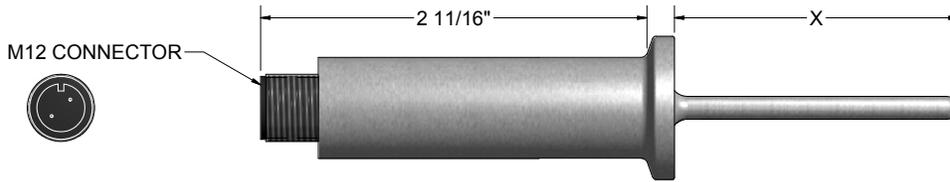
Application Areas

- PC programmable temperature transmitter for converting Pt100 input signal into a scaleable (4 to 20) mA analog output signal
- Platinum Resistance Thermometer (RTD)
- Ideal for use in applications where sanitary wash-down procedures are required
- Compact design is well suited for use in small areas such as tanks and pipes
- Used for measuring temperatures from (-51 to 160) °C [-60 to 320] °F

Features and Benefits

- PC programmable transmitter with (4 to 20) mA output
- Reliable measurements despite fluctuations in ambient temperature
- Available in threaded and Clean-In-Place (CIP) connections
- RFI/EMI Protected
-  UL Recognized Component

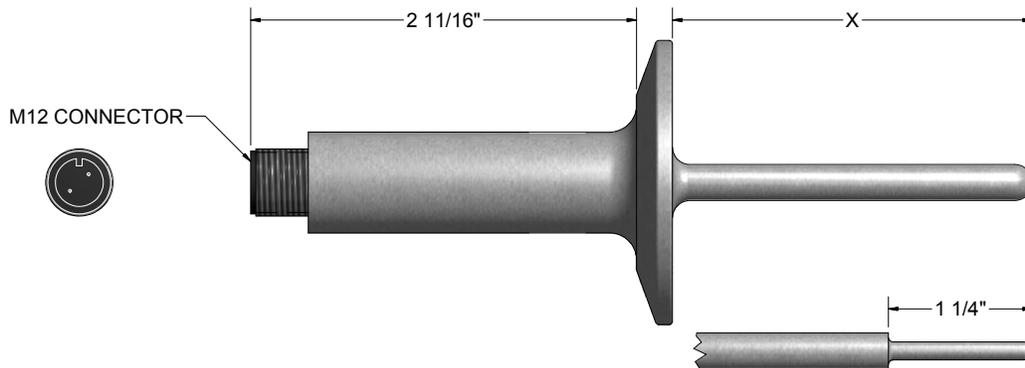
MINIATURE CIP RTD ASSEMBLY



See Food & Dairy Section For Ordering Information



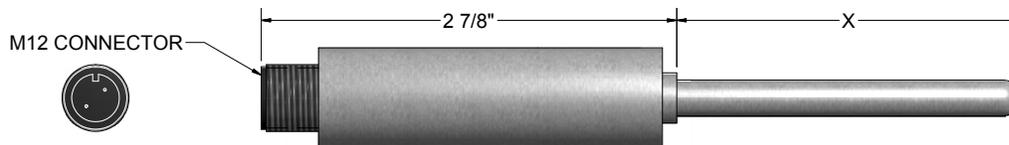
CIP RTD ASSEMBLY



See Food & Dairy Section For Ordering Information

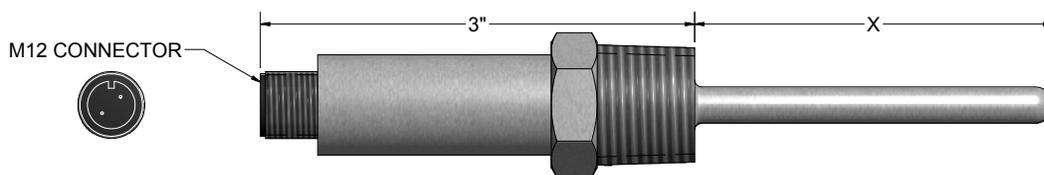


RTD ASSEMBLY WITH NO PROCESS FITTING



See RTD Section For Ordering Information

RTD ASSEMBLY WITH THREADED CONNECTION



See RTD Section For Ordering Information

INPUT

Resistance Thermometer Input (RTD)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|------------------------------|---------------------------------|---------------|
| Pt100 ($\alpha = 0.00385$) | (-51 to 160) °C [-60 to 320] °F | 10 °C [18 °F] |
| Connection Type | 4 wire connection (standard) | |
| Sensor current | ≤ 0.6 mA | |

OUTPUT

Output (Analog)

| | |
|--------------------------|---|
| Output signal | (4 to 20) mA or (20 to 4) mA |
| Transmission as | Temperature linear |
| Maximum load | $(V_{\text{power supply}} - 10 \text{ V}) / 0.023 \text{ A}$ (current output) |
| Induced current required | ≤ 3.5 mA |
| Current limit | ≤ 23 mA |
| Switch on delay | 2 s |
| Electronic response time | 1 s |

Failure Mode

| | |
|---------------------------------|-----------------------|
| Undershooting measurement range | Decreases to 3.8 mA |
| Exceeding measurement range | Increases to 20.5 mA |
| Sensor breakage/short circuit | ≤ 3.6 mA or ≥ 21.0 mA |

ACCURACY

Accuracy

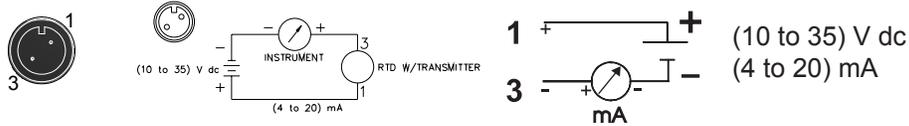
| | |
|---------------------------------|---|
| Electronics measurement error | 0.1 °C or 0.08% ^[1] |
| Reference conditions | Calibration temperature (23 ± 5) °C [73 ± 9] °F |
| Sensor measurement error | Class A ± (0.15 + 0.002 t) °C Class B ± (0.3 + 0.005 t) °C Grade B ± (0.25 + 0.0042 t) °C Class AA ± (0.01 + 0.0017 t) °C 1/5 Class B ± (0.06 + 0.0017 t) °C t = value of temperature without regard to sign, °C |
| Influence of power supply | ± 0.01%/V deviation from 24 V ^[2] |
| Load influence | ± 0.02%/100 Ω ^[2] |
| Temperature drift | $T_d = \pm (15 \text{ ppm}/^\circ\text{C} \times (\text{full scale value} + 200) + 50 \text{ ppm}/^\circ\text{C} \text{ of set measuring range}) \times \Delta^\circ$ Δ° = deviation of ambient temperature from the reference operation condition |
| Electronics long term stability | ≤ 0.1 °C/year ^[3] or ≤ 0.05%/year ^{[1][3]} |

[1] % is related to the adjusted measurement range (the value to be applied is the greater)

[2] All data is related to a measurement and value of 20 mA

[3] Under reference conditions

Electrical Connection

| | |
|------------------------------|--|
| <p>Electrical connection</p> |  <p>Electrical connection of the compact thermometer (view from above) - M12 plug, 4-pin Pin 1: Power supply (10 to 35) V dc; Current output (4 to 20) mA Pin 2: PC configuration cable connection Pin 3: Power supply 0 V dc; current output (4 to 20) mA Pin 4: PC configuration cable connection</p> |
| <p>Power supply</p> | <p>$U_b = (10 \text{ to } 35) \text{ V dc}$, polarity protected</p> |
| <p>Allowable ripple</p> | <p>$U_{ss} \leq 3\text{V}$ at $U_b \geq 13\text{V}$, $f_{\text{max}} = 1 \text{ kHz}$</p> |

Environmental Conditions

| | |
|----------------------------|--|
| <p>Ambient Temperature</p> | <p>(-40 to 85) °C [-40 to 185] °F</p> |
| <p>Storage Temperature</p> | <p>(-40 to 100) °C [-40 to 212] °F</p> |
| <p>Climatic Class</p> | <p>EN 60 654-1, class C</p> |
| <p>Condensation</p> | <p>Permitted</p> |
| <p>Ingress protection</p> | <p>IP 67</p> |
| <p>Shock resistance</p> | <p>4g / (2 to 150) Hz as per IEC 60 068-2-6</p> |
| <p>EMC immunity</p> | <p>Interference immunity and interference emission as per EN 61 326-1 (IEC 1326)</p> |

Process

| | MAXIMUM AMBIENT | MAXIMUM PROCESS |
|----------------------------------|--|---|
| <p>Process temperature limit</p> | <p>to 25 °C [77 °F] to 40 °C [104 °F] to 60 °C [140 °F] to 85 °C [185 °F]</p> | <p>160 °C [320 °F] 135 °C [275 °F] 120 °C [248 °F] 100 °C [212 °F]</p> |

Approvals

| | |
|--|---|
|  | <p>UL Recognized Component</p> |
|  | <p>3-A Sanitary Council Standard 74- (CIP sensors only)</p> |

The Series 642 programmable HART® field temperature transmitter is a 2-wire unit with analog output. It includes input for RTDs; resistance inputs in 2-wire, 3-wire, and 4-wire connections; thermocouples and voltage signals. The transmitter can be supplied with or without a digital display, in either a general-purpose aluminum housing, or explosion-proof aluminum housing. The Series 642 can be programmed with a PC or a HART® protocol handheld terminal. When supplied with a digital display, the LC screen shows the current measured value and a bar graph with limit value violation indicator.

PROGRAMMABLE FIELD TEMPERATURE TRANSMITTER

Programmable temperature transmitter for resistance thermometers (RTDs), thermocouples, resistance inputs and voltage inputs:
adjustable via HART® protocol.



Application Areas

- Temperature field transmitter with HART® protocol for converting various input signals to an analog, scaleable (4 to 20) mA output signal
- Input:
 - Resistance thermometer (RTD)
 - Thermocouples (TC)
 - Resistance input (Ohm)
 - Voltage input (mV)
- HART® protocol for operating the device on site using a handheld communicator or remotely via the PC

Features and Benefits

- Universally programmable with HART® protocol for various input signals
- Illuminated display, rotatable
- Operation, visualization and maintenance with PC; e.g. using TransComm Light operating software
- 2-wire technology, analog output (4 to 20) mA
- Undervoltage detection
- Highly accurate in entire operating temperature range
- Approvals:
 - FM and CSA (IS, NI, XP and DIP)
- Galvanic isolation
- Output simulation
- Min./max. process values recorded
- Customized measuring range setup or expanded SETUP; see questionnaire

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ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6
642A - **D** - **3 85 U** - **S(0-200)** **C**

1-0 Transmitter Type

| CODE | DESCRIPTION |
|------|---|
| 642A | (4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing |
| 642C | (4 to 20) mA HART® Field Transmitter with explosion-proof aluminum housing FM/CSA / XP Class I / Div 1 / Groups A,B,C,D / DIP Class II / Div 1 / Groups E,F,G / Class III / NI Class I / Div 2 / Groups A,B,C,D |
| 642F | (4 to 20) mA HART® Field Transmitter with general-purpose aluminum housing FM/CSA IS Class I / Div 1 / Groups A,B,C,D / NI Class I / Div 2 / Groups A,B,C,D |

1-1 Options

| CODE | DESCRIPTION |
|------|----------------------------------|
| T | Solid cover |
| D | Glass cover with digital display |

1-2 Input Type

| CODE | DESCRIPTION |
|------|--------------------------------|
| 00 | Unconfigured ^[1] |
| 1 | Thermocouple (TC) or millivolt |
| 2 | RTD (2-wire) or resistance |
| 3 | RTD (3-wire) or resistance |
| 4 | RTD (4-wire) or resistance |

[1] Default setting for unconfigured transmitter is 3-wire Pt100 (0 - 100) °C

Accessories

| CODE | DESCRIPTION |
|-------|---|
| 10321 | Pipe mounting bracket for use on pipes with a diameter between 1.5" to 3.3" |

1-6 Unit of Measure

| CODE | DESCRIPTION |
|------|-------------|
| C | Celsius |
| F | Fahrenheit |
| K | Kelvin |

1-5 Range

| CODE | DESCRIPTION |
|------|-----------------------------|
| S | (lower limit – upper limit) |

1-4 Failure Mode

| CODE | DESCRIPTION |
|------|--------------------------|
| U | Upscale Burnout ≥ 23 mA |
| D | Downscale Burnout ≤ 3 mA |

1-3 Sensor Type

| CODE | DESCRIPTION |
|---|---|
| J | Type J thermocouple |
| K | Type K thermocouple |
| T | Type T thermocouple |
| N | Type N thermocouple |
| E | Type E thermocouple |
| R | Type R thermocouple |
| S | Type S thermocouple |
| B | Type B thermocouple |
| 85 | 100 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |
| 55 | 500 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |
| 95 | 1000 ohm platinum ($\alpha = 0.00385 \text{ } ^\circ\text{C}^{-1}$) |
| MV | Millivolts |
| W | Resistance |
| Other types available. Consult factory. | |

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INPUT

Resistance Thermometer (RTD)

| TYPE | STANDARDS | MEASUREMENT RANGE | MINIMUM RANGE |
|--|--------------------------|---|--|
| Pt100 ($\alpha = 0.00385\text{ }^{\circ}\text{C}^{-1}$) Pt200 Pt500 Pt1000 | ASTM E1137 IEC 60 751 | (-200 to 850) °C [-328 to 1562] °F (-200 to 850) °C [-328 to 1562] °F (-200 to 250) °C [-328 to 482] °F (-200 to 250) °C [-328 to 482] °F | 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] |
| Pt100 ($\alpha = 0.003916$) | JIS C1604 | (-200 to 649) °C [-328 to 1200] °F | 10 °C [18 °F] |
| Pt100 ($\alpha = 0.003923$) | SAMA | (-100 to 700) °C [-148 to 1292] °F | 10 °C [18 °F] |
| Ni100 ($\alpha = 0.006180$) Ni1000 ($\alpha = 0.006180$) | DIN 43 760 | (-60 to 250) °C [-76 to 482] °F (-60 to 150) °C [-76 to 302] °F | 10 °C [18 °F] 10 °C [18 °F] |
| Ni120 ($\alpha = 0.006720$) Cu10 ($\alpha = 0.004274$) | Edison Curve | (-70 to 270) °C [-94 to 518] °F (-100 to 260) °C [-148 to 500] °F | 10 °C [18 °F] 10 °C [18 °F] |
| Pt50 ($\alpha = 0.003911$) Pt100 ($\alpha = 0.003911$) Cu50 ($\alpha = 0.004278$) Cu100 ($\alpha = 0.004278$) | GOST | (-200 to 1100) °C [-328 to 2012] °F (-200 to 850) °C [-328 to 1562] °F (-200 to 200) °C [-328 to 392] °F (-200 to 200) °C [-328 to 392] °F | 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] |
| Polynomial RTD Pt100 (Callendar - van Dusen) | | (-200 to 850) °C [-328 to 1562] °F (-200 to 850) °C [-328 to 1562] °F | 10 °C [18 °F] 10 °C [18 °F] |
| Connection type | | 2-, 3- or 4-wire connection cable resistance compensation possible in the 2 wire system (0 to 30) Ω | |
| Sensor cable resistance | | 3-wire and 4-wire connection, sensor wire resistance to maximum 50 Ω per wire | |
| Sensor current | | ≤ 0.3 mA | |

Resistance (Ω)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|-------------------------|---|-----------------------------|
| Resistance (Ω) | (10 to 400) Ω (10 to 2000) Ω | 10 Ω 100 Ω |

Thermocouples (TC) (ASTM E230)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|---|--|-----------------|
| B (PtRh30-PtRh6) | (0 to 1820) °C [32 to 3308] °F | 500 °C [900 °F] |
| C (W5Re-W26Re) | (0 to 2320) °C [32 to 4208] °F | 500 °C [900 °F] |
| D (W3Re-W25Re) ^[1] | (0 to 2495) °C [32 to 4523] °F | 500 °C [900 °F] |
| E (NiCr-CuNi) | (-270 to 1000) °C [-454 to 1832] °F | 50 °C [90 °F] |
| J (Fe-CuNi) | (-210 to 1200) °C [-346 to 2192] °F | 50 °C [90 °F] |
| K (NiCr-Ni) | (-270 to 1372) °C [-454 to 2501] °F | 50 °C [90 °F] |
| L (Fe-CuNi) ^[2] | (-200 to 900) °C [-328 to 1652] °F | 50 °C [90 °F] |
| N (NiCrSi-NiSi) | (-270 to 1300) °C [-454 to 2372] °F | 50 °C [90 °F] |
| R (PtRh13-Pt) | (-50 to 1768) °C [-58 to 3214] °F | 500 °C [900 °F] |
| S (PtRh10-Pt) | (-50 to 1768) °C [-58 to 3214] °F | 500 °C [900 °F] |
| T (Cu-CuNi) | (-270 to 400) °C [-454 to 752] °F | 50 °C [90 °F] |
| U (Cu-CuNi) ^[2] | (-200 to 600) °C [-328 to 1112] °F | 50 °C [90 °F] |
| Cold junction | internal (Pt100) or external (0 to 80) °C [32 to 176] °F | |
| Cold junction accuracy | ± 1 °C | |
| Max. sensor resistance | 10 k Ω | |
| [1] no reference [2] according to DIN 43 710 | | |

Voltage (mV)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|----------------|-------------------|---------------|
| Millivolt (mV) | (-20 to 100) mV | 5 mV |

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OUTPUT

Output (Analog)

| | |
|---------------------------|--|
| Output signal | Analog (4 to 20) mA or (20 to 4) mA |
| Transmission as | Temperature linear, resistance linear, voltage linear |
| Maximum load | $(V_{\text{power supply}} - 11V) / 0.022 \text{ A}$ (current output) |
| Digital filter 1st degree | (0 to 60) s |
| Induced current required | $\leq 3.5 \text{ mA}$ |
| Current limit | $\leq 23 \text{ mA}$ |
| Switch on delay | 4 s (during switch-on operation $I_a = 4 \text{ mA}$) |
| Response time | 1 s |

Failure Mode

| | |
|---------------------------------|---|
| Undershooting measurement range | Decrease to 3.8 mA |
| Exceeding measurement range | Increase to 20.5 mA |
| Sensor breakage/short circuit | $\leq 3.6 \text{ mA}$ or $\geq 21.0 \text{ mA}$ (configurable 21.6 mA to 23 mA) |

Electrical Connection

| | |
|------------------|---|
| Power supply | $U_b = 11$ to 40 V (8 to 40 without display), reverse polarity protected |
| Cable entry | Three 1/2" NPT openings |
| Allowable ripple | $U_{ss} \leq 3 \text{ V}$ at $U_b \geq 13.5 \text{ V}$, $f_{\text{max}} = 1 \text{ kHz}$ |

ACCURACY

| | |
|----------------------|---|
| Reference conditions | Calibration temperature $(23 \pm 5) \text{ }^\circ\text{C}$ [73.4 ± 9] $^\circ\text{F}$ |
|----------------------|---|

Resistance Thermometer (RTD)

| TYPE | MEASUREMENT ACCURACY - DIGITAL | MEASUREMENT ACCURACY - D/A ^[1] |
|----------------------------|---|---|
| Cu100, Pt100, Ni100, Ni120 | $\pm 0.2 \text{ }^\circ\text{C}$ [0.36 $^\circ\text{F}$] | $\pm 0.02\%$ |
| Pt500 | $\pm 0.6 \text{ }^\circ\text{C}$ [1.08 $^\circ\text{F}$] | $\pm 0.02\%$ |
| Cu50, Pt50, Pt1000, Ni1000 | $\pm 0.4 \text{ }^\circ\text{C}$ [0.72 $^\circ\text{F}$] | $\pm 0.02\%$ |
| Cu10, Pt200 | $\pm 2 \text{ }^\circ\text{C}$ [3.6 $^\circ\text{F}$] | $\pm 0.02\%$ |

Thermocouple (TC)

| TYPE | MEASUREMENT ACCURACY - DIGITAL | MEASUREMENT ACCURACY - D/A ^[1] |
|------------------|--|---|
| K, J, T, E, L, U | Typical $\pm 0.5 \text{ }^\circ\text{C}$ [0.9 $^\circ\text{F}$] | $\pm 0.02\%$ |
| N, C, D | Typical $\pm 1 \text{ }^\circ\text{C}$ [0.18 $^\circ\text{F}$] | $\pm 0.02\%$ |
| S, B, R | Typical $\pm 2 \text{ }^\circ\text{C}$ [3.6 $^\circ\text{F}$] | $\pm 0.02\%$ |

Resistance (Ω)

| TYPE | MEASUREMENT ACCURACY - DIGITAL | MEASUREMENT ACCURACY - D/A ^[1] | MEASUREMENT RANGE |
|------------|--------------------------------|---|-----------------------|
| Resistance | $\pm 0.08 \text{ } \Omega$ | $\pm 0.02\%$ | (10 to 400) Ω |
| | $\pm 1.6 \text{ } \Omega$ | $\pm 0.02\%$ | (10 to 2000) Ω |

Voltage (mV)

| TYPE | MEASUREMENT ACCURACY - DIGITAL | MEASUREMENT ACCURACY - D/A ^[1] | MEASUREMENT RANGE |
|---------|--------------------------------|---|-------------------|
| Voltage | $\pm 20 \text{ } \mu\text{V}$ | $\pm 0.02\%$ | (20 to 100) mV |

[1] % relates to the set span. Accuracy = digital + D/A accuracy

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ACCURACY (continued)

Physical input range of the sensors

| TYPE | MEASUREMENT ACCURACY ^[1] |
|-----------------|--|
| (10 to 400) Ω | Cu10, Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120 |
| (10 to 2000) Ω | Pt200, Pt500, Pt1000, Ni1000 |
| (-20 to 100) mV | Thermocouple type: C, D, E, J, K, L, N |
| (-5 to 30) mV | Thermocouple type: B, R, S, T, U |

[1] % is related to the adjusted measurement range (the value to be applied is the greater)

General

| | |
|---------------------|--|
| Repeatability | 0.03% of the physical input range (15 Bit) Resolution A/D conversion: 18 Bit |
| Load influence | ≤ ± 0.005%/V deviation from 24 V, related to the full-scale value |
| Long term stability | ≤ 0.1 °C [0.18 °F] / year or ≤ 0.05%/year Date under reference conditions. % relates to the set span. The larger value applies. |

Temperature Drift

| | | |
|---|--|--|
| Total temperature drift = input temperature drift + output temperature drift | Effect on the accuracy when ambient temperature changes by 1 °C [1.8 °F] | |
| | Input (10 to 400) Ω | 0.002% of measured value |
| | Input (10 to 2000) Ω | 0.002% of measured value |
| | Input (-20 to 100) mV | typ. 0.002% of measured value (maximum value = 1.5 x typical) |
| | Input (5 to 30) mV | typ. 0.002% of measured value (maximum value = 1.5 x typical) |
| | Output (4 to 20) mA | typ. 0.002% of measured value (maximum value = 1.5 x typical) |

INSTALLATION CONDITIONS

Ambient Conditions

| | |
|--------------------------------|--|
| Ambient temperature | Without display: (-40 to 85) °C [-40 to 185] °F With display: (-40 to 70) °C [-40 to 158] °F NOTE: The display can react slowly for temperature < -20 °C [< -4 °F] |
| Storage temperature | Without display: (-40 to 100) °C [-40 to 212] °F With display: (-40 to 85) °C [-40 to 185] °F |
| Allowable Altitude | 6500 ft. above sea level |
| Climatic class | As per EN 60 654-1, Class C |
| Moisture condensation | Allowable |
| Shock and vibration protection | 3 g / (2 to 150) Hz according to IEC 60 068-2-6 |
| EMC immunity | Interference immunity and interference emission as per EN 61 326-1 (IEC 1326) (0.08 to 2) GHz 10 V/m; (1.4 to 2) GHz 30 V/m to EN 61 000-4-3 |
| Protection | IP67, NEMA 4X, Class 1, Division 1, Group A, B, C; Class II Division I, Groups E, F, G and Class III, Division I (when specified) |

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INTERFACE

Display Elements

LC display of the field transmitter
(illuminated, can be rotated in 90° increments)

- Item 1: Bar graph display in 10% increments with indicators for overranging / underranging
- Item 2: 'Caution' display
- Item 3: Unit display K, °F, or °C or %
- Item 4: Measured value display (digit height 20.5 mm / 0.81 ")
- Item 5: Status and information display
- Item 6: 'Communication' display
- Item 7: 'Programming disabled' display

Operating Elements

No operating elements are present directly on the display. The device parameters of the field transmitter are configured using the handheld communicator or a PC with HART® Modem and operating software TransComm Light.

Remote Operation

| | |
|--------------------------------|--|
| Interface | HART® communication via transmitter power supply |
| Configurable device parameters | Sensor type and connection type, engineering units (°C/°F), measurement ranges, internal/external cold junction compensation of wire resistance with 2-wire connection, failure mode, output signal (4 to 20) mA (20 to 4) mA, digital filter (damping), offset, TAG+descriptor (8+16 characters), output simulation, customized linearization, recording of min./max process value, analog output: Option: customized linearization |

STANDARDS

Approvals

| | |
|--------------------------------|---|
| CE marked | Unit complies with the legal requirements set forth by the EU regulations. |
| FM APPROVED and IEC | Intrinsically safe and non-incendive or explosion proof for hazardous locations Class I, Division 1 and 2, Groups A, B, C and D |
| Other standards and guidelines | IEC 60 529: Degrees of protection through housing (IP code) IEC 61 010: Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures IEC1326: Electromagnetic compatibility (EMC requirements) |

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MECHANICAL CONSTRUCTION

| | | | | |
|------------|--|---------------------------|--|--|
| Dimensions | | DIMENSIONS IN INCHES [mm] | | |
| | Display rotatable in 90° increments | | | |
| Weight | approximately 1.6 kg [3.53 lb] | | | |
| Materials | Housing: die-cast aluminum with powder coating | | | |
| Terminals | Cables / wires up to max. 2.5 mm ² (AWG 13) | | | |

Terminal Connections

| | | | |
|-------------------------|-----------------------------------|-------------------------------------|-----------------------------------|
| | | HART® Communication on (4 to 20) mA | |
| Sensor TC | 2-wire Ω RTD | 3-wire Ω RTD | 4-wire Ω RTD |

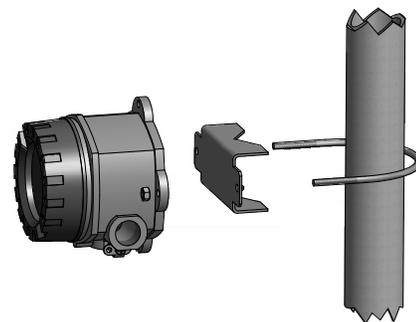
Optional Mounting Bracket

Part Number: 10321

Designed for use on pipes with a diameter between 1.5" to 3.3".

The additional mounting plate must be used for pipes with a diameter of 1.5" to 2.2". No plate is required for pipes with a diameter of 2.2" to 3.3".

Assembly includes bracket, screws, and mounting plate.

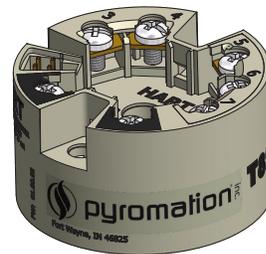
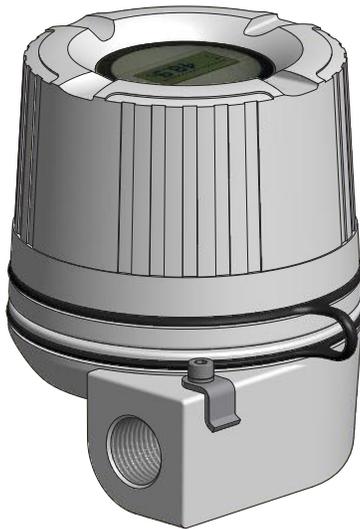


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The T82 programmable HART® field temperature transmitter is a 2-wire unit with analog output. It includes input for RTDs: resistance inputs in 2-wire, 3-wire, and 4-wire connections; thermocouples and voltage signals. The transmitter can be supplied with or without a digital display, in a general-purpose aluminum screw-cover housing. The T82 can be programmed using a HART® protocol handheld terminal. When supplied with a digital display, the LCD display shows the current measured value.

PROGRAMMABLE DUAL INPUT TEMPERATURE TRANSMITTER

Programmable temperature transmitter for resistance thermometers (RTDs), thermocouples, resistance inputs and voltage inputs:
adjustable via HART® protocol.



Application Areas

- Temperature transmitter with 2 input channels and HART® protocol for converting various input signals to an analog, scaleable (4 to 20) mA output signal
- Input:
 - Resistance thermometer (RTD)
 - Thermocouples (TC)
 - Resistance input (Ohm)
 - Voltage input (mV)
- HART® protocol for operating the device on site using a handheld communicator

Features and Benefits

- Universally programmable with HART® protocol for various input signals
- 2-wire, single, analog output (4 to 20) mA
- Undervoltage detection
- Highly accurate in entire operating temperature range
- Approvals: FM and CSA (IS, NI)
- Galvanic isolation
- Output simulation
- Customized measuring range setup or expanded SETUP; see manual

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CE marked



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ORDER CODES

Example Order Number:

1-0 1-1 1-2 1-3 1-4 1-5 1-6 1-7
36T82-D10 - 33 - 85 - 85 - E - U - S(0-200) C

1-0 Transmitter Type

| CODE | DESCRIPTION |
|-----------|--|
| T82-00 | No display (transmitter only) |
| T82-D10 | Transmitter with digital display |
| 36T82-D10 | Transmitter with digital display and general purpose screw-cover housing |

1-1 Configuration Input

| CODE | DESCRIPTION |
|------|--------------------------------------|
| 00 | Unconfigured |
| 2I | Ch1: RTD 2-wire, Ch2: inactive |
| 22 | Ch1: RTD 2-wire, Ch2: RTD 2-wire |
| 23 | Ch1: RTD 2-wire, Ch2: RTD 3-wire |
| 2T | Ch1: RTD 2-wire, Ch2: Thermocouple |
| 3I | Ch1: RTD 3-wire, Ch2: inactive |
| 32 | Ch1: RTD 3-wire, Ch2: RTD 2-wire |
| 33 | Ch1: RTD 3-wire, Ch2: RTD 3-wire |
| 3T | Ch1: RTD 3-wire, Ch2: Thermocouple |
| 4I | Ch1: RTD 4-wire, Ch2: inactive |
| 4T | Ch1: RTD 4-wire, Ch2: Thermocouple |
| TI | Ch1: Thermocouple, Ch2: inactive |
| TT | Ch1: Thermocouple, Ch2: Thermocouple |

1-2 Sensor Input Channel 1

| CODE | DESCRIPTION |
|------|--|
| J | Type J thermocouple |
| K | Type K thermocouple |
| T | Type T thermocouple |
| N | Type N thermocouple |
| E | Type E thermocouple |
| R | Type R thermocouple |
| S | Type S thermocouple |
| B | Type B thermocouple |
| 85 | 100 ohm platinum ($\alpha = 0.003 \text{ 85 } ^\circ\text{C}^{-1}$) |
| 55 | 500 ohm platinum ($\alpha = 0.003 \text{ 85 } ^\circ\text{C}^{-1}$) |
| 95 | 1000 ohm platinum ($\alpha = 0.003 \text{ 85 } ^\circ\text{C}^{-1}$) |

1-7 Unit of Measure

| CODE | DESCRIPTION |
|------|-------------|
| C | Celsius |
| F | Fahrenheit |

1-6 Range

| CODE | DESCRIPTION |
|------|-----------------------------|
| S | (lower limit – upper limit) |

1-5 Failure Mode

| CODE | DESCRIPTION |
|------|---------------------------------------|
| U | Upscale Burnout $\geq 23 \text{ mA}$ |
| D | Downscale Burnout $\leq 3 \text{ mA}$ |

1-4 Input Set-ups

| CODE | DESCRIPTION |
|------|---|
| A | Process variable = Ch1; Ch2 = inactive |
| B | Process variable = Ch1; Secondary value = Ch2 |
| C | Process variable = the difference between Ch1 and Ch2 |
| D | Process variable = average of Ch1 and Ch2 |
| E | Sensor backup; Process variable = Ch1 and Ch2 |

1-3 Sensor Input Channel 2

| CODE | DESCRIPTION |
|------|--|
| 00 | No second channel |
| J | Type J thermocouple |
| K | Type K thermocouple |
| T | Type T thermocouple |
| N | Type N thermocouple |
| E | Type E thermocouple |
| R | Type R thermocouple |
| S | Type S thermocouple |
| B | Type B thermocouple |
| 85 | 100 ohm platinum ($\alpha = 0.003 \text{ 85 } ^\circ\text{C}^{-1}$) |
| 55 | 500 ohm platinum ($\alpha = 0.003 \text{ 85 } ^\circ\text{C}^{-1}$) |
| 95 | 1000 ohm platinum ($\alpha = 0.003 \text{ 85 } ^\circ\text{C}^{-1}$) |

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INPUT

Resistance Thermometer (RTD)

| TYPE | STANDARD | MEASUREMENT RANGE | MINIMUM RANGE |
|--|-------------------------|--|--|
| Pt100 ($\alpha = 0.00385\text{ }^{\circ}\text{C}^{-1}$) Pt200 Pt500 Pt1000 | ASTM E1137 IEC 60751 | (-200 to 850) °C [-328 to 1562] °F (-200 to 850) °C [-328 to 1562] °F (-200 to 500) °C [-328 to 932] °F (-200 to 250) °C [-328 to 482] °F | 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] |
| Pt100 ($\alpha = 0.003916$) | JIS C1604:1984 | (-200 to 510) °C [-328 to 950] °F | 10 °C [18 °F] |
| Ni100 ($\alpha = 0.00618$) Ni120 ($\alpha = 0.00618$) | DIN 43760 IPTS-68 | (-60 to 250) °C [-76 to 482] °F (-60 to 250) °C [-76 to 482] °F | 10 °C [18 °F] 10 °C [18 °F] |
| Pt50 ($\alpha = 0.00391$) Pt100 ($\alpha = 0.00391$) Cu50 ($\alpha = 0.00428$) | GOST 6651-94 | (-185 to 1100) °C [-301 to 2012] °F (-200 to 850) °C [-328 to 1562] °F (-175 to 200) °C [-283 to 392] °F | 10 °C [18 °F] 10 °C [18 °F] 10 °C [18 °F] |
| Pt100 (Callendar van Dusen) Nickel polynomial Copper polynomial | | The measuring range limits are specified by entering the limit values that depend on the coefficients A to C and R_0 . | 10 °C [18 °F] |

Type of connection: 2-wire, 3-wire or 4-wire connection, sensor current: $\leq 0.3\text{ mA}$
 With 2-wire circuit, compensation of wire resistance possible (0 to 30 Ω)
 With 3-wire and 4-wire connection, sensor wire resistance up to max. 50 Ω per wire

Resistance (Ω)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|-------------------------|---|-----------------------------|
| Resistance (Ω) | (10 to 400) Ω (10 to 2000) Ω | 10 Ω 100 Ω |

Thermocouples (TC)

| TYPE | STANDARD | MEASUREMENT RANGE | RECOMMENDED TEMPERATURE RANGE | MINIMUM RANGE |
|---|-----------------------------|---|---|--|
| B (PtRh30-PtRh6) E (NiCr-CuNi) J (Fe-CuNi) K (NiCr-Ni) N (NiCrSi-NiSi) R (PtRh13-Pt) S (PtRh10-Pt) T (Cu-CuNi) | IEC 584 part 1 ASTM E230 | (40 to 1820) °C [104 to 3308] °F (-270 to 1000) °C [-454 to 1832] °F (-210 to 1200) °C [-346 to 2192] °F (-270 to 1372) °C [-454 to 2501] °F (-270 to 1300) °C [-454 to 2372] °F (-50 to 1768) °C [-58 to 3214] °F (-50 to 1768) °C [-58 to 3214] °F (-260 to 400) °C [-436 to 752] °F | (100 to 1500) °C [212 to 2732] °F (0 to 750) °C [32 to 1382] °F (20 to 700) °C [68 to 1292] °F (0 to 1100) °C [32 to 2012] °F (0 to 1100) °C [32 to 2012] °F (0 to 1400) °C [32 to 2552] °F (0 to 1400) °C [32 to 2552] °F (-185 to 350) °C [-301 to 662] °F | 50 °C [90 °F] 50 °C [90 °F] |
| C (W5Re-W26Re) D (W3Re-W25Re) | ASTM E230 ASTM E1751 | (0 to 2315) °C [32 to 4199] °F (0 to 2315) °C [32 to 4199] °F | (0 to 2000) °C [32 to 3632] °F (0 to 2000) °C [32 to 3632] °F | 50 °C [90 °F] 50 °C [90 °F] |
| L (Fe-CuNi) U (Cu-CuNi) | DIN 43710 | (-200 to 900) °C [-328 to 1652] °F (-200 to 600) °C [-328 to 1112] °F | (0 to 750) °C [32 to 1382] °F (-185 to 400) °C [-301 to 752] °F | 50 °C [90 °F] 50 °C [90 °F] |
| Cold junction | | internal (Pt100) or external (-40 to 85) °C [-40 to 185] °F | | |
| Max. sensor resistance | | 10 k Ω | | |

Voltage (mV)

| TYPE | MEASUREMENT RANGE | MINIMUM RANGE |
|----------------|-------------------|---------------|
| Millivolt (mV) | (-20 to 100) mV | 5 mV |

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OUTPUT

Output (Analog)

| | | |
|---------------------------|---|--|
| Output signal | Analog (4 to 20) mA or (20 to 4) mA | |
| Transmission as | Temperature linear, resistance linear, voltage linear | |
| Maximum load | $(U_{b\max} - 11V) / 0.023\text{ A}$ (current output) | |
| Digital filter 1st degree | (0 to 120) s | |
| Minimum current required | 3.5 mA, multidrop mode 4 mA | |
| Current limit | ≤ 23 mA | |
| Switch on delay | 10 s (during switch-on operation $I_a \leq 3.8\text{ mA}$) | |
| Response time | Resistance thermometer (RTD) | 0.9 to 1.2 s (depends on the connection method 2/3/4-wire) |
| | Thermocouples (TC) | 0.7 s |
| | Reference temperature | 0.5 s |

Failure Mode

| | |
|--|---|
| Underranging | Linear drop from 4.0 mA to 3.8 mA |
| Overranging | Linear increase from 20.0 mA to 20.5 mA |
| Failure, e.g. sensor breakage; sensor short circuit | ≤ 3.6 mA or ≥ 21 mA (configurable 21.5 mA to 23 mA) |

Electrical Connection

| | |
|----------------|---|
| Supply Voltage | $11V \leq V_{cc} \leq 42\text{ V}$ non-hazardous area, reverse polarity protected, see XP documentation for hazardous locations |
| Entry | 3/4 inch NPT conduit connection x 1/2 inch NPT process connection |
| Residual | $U_{ss} \leq 3\text{ V}$ at $U_b \geq 13.5\text{ V}$, $f_{\max} = 1\text{ kHz}$ |

ACCURACY

| | |
|----------------------|--|
| Reference conditions | Calibration temperature $(25 \pm 5)\text{ °C}$ [$77 \pm 9\text{ °F}$] Supply voltage: 24 V dc 4-wire circuit for resistance adjustment |
|----------------------|--|

Resistance Thermometer (RTD)

| TYPE | MEASUREMENT ACCURACY - DIGITAL ^[1] | MEASUREMENT ACCURACY - D/A ^[2] |
|---------------------|---|---|
| Pt100, Ni100, Ni120 | 0.1 °C [0.18 °F] | 0.03% |
| Pt500 | 0.3 °C [0.54 °F] | 0.03% |
| Cu50, Pt50, Pt1000 | 0.2 °C [0.36 °F] | 0.03% |
| Pt200 | 1.0 °C [1.8 °F] | 0.03% |

Thermocouple (TC)

| TYPE | MEASUREMENT ACCURACY - DIGITAL ^[1] | MEASUREMENT ACCURACY - D/A ^[2] |
|------------------|---|---|
| K, J, T, E, L, U | 0.25 °C [0.45 °F] | 0.03% |
| N, C, D | 0.5 °C [0.9 °F] | 0.03% |
| S, B, R | 1.0 °C [1.8 °F] | 0.03% |

Resistance (Ω)

| TYPE | MEASUREMENT ACCURACY - DIGITAL ^[1] | MEASUREMENT ACCURACY - D/A ^[2] | MEASUREMENT RANGE |
|------------|---|---|-------------------|
| Resistance | ± 0.04 Ω | 0.03% | (10 to 400) Ω |
| | ± 0.8 Ω | 0.03% | (10 to 2000) Ω |

Voltage (mV)

| TYPE | MEASUREMENT ACCURACY - DIGITAL ^[1] | MEASUREMENT ACCURACY - D/A ^[2] | MEASUREMENT RANGE |
|---------|---|---|-------------------|
| Voltage | ± 10 μV | 0.03% | (-20 to 100) mV |

[1] Using HART® transmitted measured value

[2] % refers to the set span. Accuracy of current output = digital + D/A accuracy

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ACCURACY (continued)

Physical input range of the sensors

| | |
|-----------------|--|
| (10 to 400) Ω | Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120 |
| (10 to 2000) Ω | Pt200, Pt500, Pt1000 |
| (-20 to 100) mV | Thermocouple type: B, C, D, E, J, K, L, N, R, S, T, U |

General

| | |
|---------------------|---|
| Load influence | ≤ ± 0.0025%/V with reference to the span |
| Long term stability | ≤ 0.1 °C [0.18 °F] / year or ≤ 0.05%/year Date under reference conditions. % relates to the set span. The larger value is valid. |

Influence of ambient temperature (temperature drift)

| | | | |
|---|--|--|--|
| Total temperature drift = input temperature drift + output temperature drift | Impact on the accuracy when ambient temperature changes by 1 °C [1.8 °F] | | |
| | Input (10 to 400) Ω | typ. 0.001% of measured value, min. 1 mΩ | |
| | Input (10 to 2000) Ω | typ. 0.001% of measured value, min. 10 mΩ | |
| | Input (-20 to 100) mV | typ. 0.001% of measured value, min. 0.2 μV | |
| | Output (4 to 20) mA | typ. 0.0015% of the span | |

INSTALLATION CONDITIONS

Ambient Conditions

| | | | | |
|-------------------------------------|--|------------------|----------------------|-------------------------|
| Ambient temperature | Without display: (-40 to 85) °C [-40 to 185] °F non-hazardous location (for hazardous locations, see XP documentation) | | | |
| Storage temperature | Without display: (-50 to 100) °C [-58 to 212] °F | | | |
| Altitude | Up to 4000 m (4374.5 yards) above mean sea level per IEC 61010-1, CAN/CSA C22.2 No. 61010-1 | | | |
| Climatic class | As per EN 60 654-1, Class C | | | |
| Humidity | Condensation permitted per IEC 60 068-2-33/Max. rel. humidity: 95% per IEC 60068-2-30 | | | |
| Shock and vibration protection | (25 to 100) Hz for 4g | | | |
| Electromagnetic compatibility (EMC) | Electromagnetic compatibility in accordance with all the relevant requirements of the EN 61326 series and NAMUR Recommendation EMC (NE21), | | | |
| | ESD (electrostatic discharge) | EN/IEC 61000-4-2 | 6 kV cont., 8 kV air | |
| | Electromagnetic fields | EN/IEC 61000-4-3 | 0.08 to 2.7 GHz | 10 V/m |
| | Burst (fast transients) | EN/IEC 61000-4-4 | | 2 kV |
| | Surge (surge voltage) | EN/IEC 61000-4-5 | | 0.5 kV sym./1 kV assym. |
| Conducted RF | EN/IEC 61000-4-6 | 0.01 to 80 MHz | 10 V | |
| Protection | IP 20 with screw terminals in the installed state. NEMA 4X, IP 66/67 when installed in field housing option 36. | | | |

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INTERFACE

Display Elements

| | |
|--|---|
| | <ul style="list-style-type: none"> Item 1: Displays the TAG Item 2: 'Communication' symbol Item 3: Unit display Item 4: Measured value display Item 5: Value/channel display S1, S2, DT, PV, I, % Item 6: 'Configuration locked' symbol Item 7: Status signals |
|--|---|

Remote Operation

| | |
|--------------------------------|---|
| Interface | HART® (Version 6) communication via transmitter power supply |
| Configurable device parameters | Sensor type and connection type, engineering units (°C/°F), measurement ranges, internal/external cold junction compensation of wire resistance with 2-wire connection, failure mode, output signal (4 to 20) mA (20 to 4) mA, digital filter (damping), offset, TAG+descriptor (8+16 characters), output simulation, analog output: option: customized linearization |

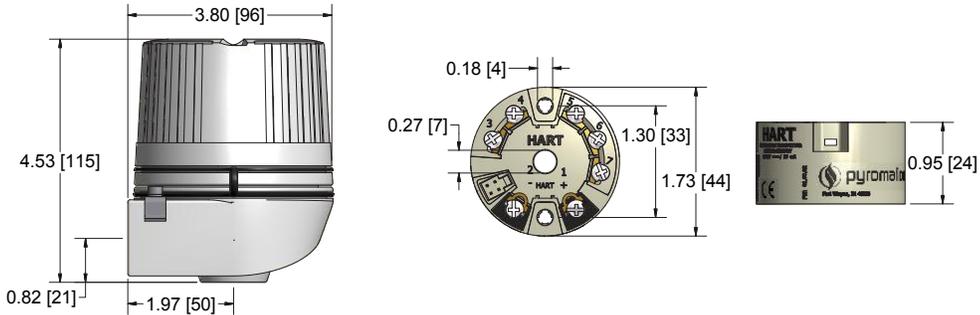
APPROVALS

Approvals

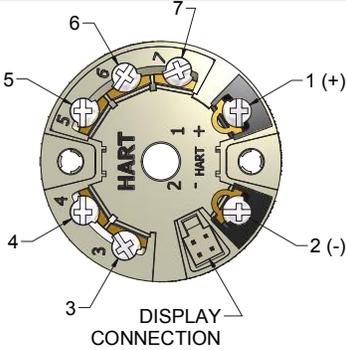
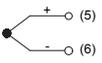
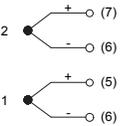
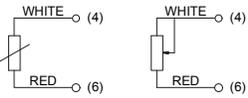
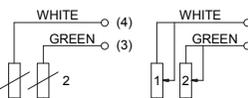
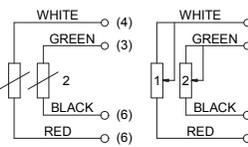
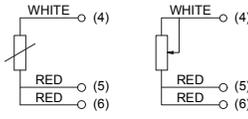
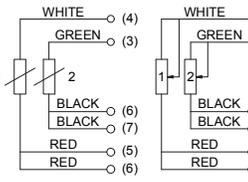
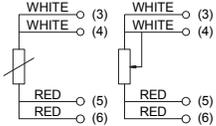
| | |
|--|--|
| | Unit complies with the legal requirements set forth by the EU regulations. |
| | Intrinsically safe and non-incendive Class I, Division 1 and 2, Groups A, B, C and D |

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MECHANICAL CONSTRUCTION

| | |
|-------------------|--|
| <p>Dimensions</p> |  |
| <p>Weight</p> | <p>Housing, transmitter, and display: approximately 970 g (2 1/4 lbs)</p> |
| <p>Materials</p> | <p>Transmitter only: approximately 50 g (1/4 lb)</p> |
| <p>Materials</p> | <p>Housing: die-cast aluminum with powder coating</p> |
| <p>Terminals</p> | <p>15 AWG Maximum</p> |

Terminal Connections

| | | | | |
|---|---|---|---|--|
|  | | | | |
| <p>TC</p> <p>SINGLE (INPUT 1)</p>  <p>DUPLEX (INPUT 2)</p>  | <p>2 WIRE</p> <p>RTD OR Ω</p>    | <p>3 WIRE</p> <p>RTD OR Ω</p>   | <p>4 WIRE</p> <p>RTD OR Ω</p>   | |

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ANSI Limits of Error

Unless otherwise specified, all thermocouple wire and extension wire is supplied to meet either Standard or Special Limits of Error per ASTM/ANSI E - 230.

The Standard and Special Limits of Error for thermocouple and extension wires are given in the accompanying tables.

Where Limits of Error are given in percent, the percentage applies to the temperature being measured.

Limits of Error for Thermocouples and Thermocouple Wire

Reference Junction 0 °C [32 °F]

| T/C TYPE | TEMPERATURE RANGE | LIMITS OF ERROR | |
|------------------|--|----------------------------|---------------------------|
| | | STANDARD | SPECIAL |
| T | (0 to 133) °C [32 to 270] °F (133 to 350) °C [270 to 662] °F | ± 1 °C [2 °F] ± 0.75% | ± 0.5 °C [1 °F] ± 0.4% |
| J | (0 to 293) °C [32 to 559] °F (293 to 750) °C [559 to 1382] °F | ± 2.2 °C [4 °F] ± 0.75% | ± 1.1 °C [2 °F] ± 0.4% |
| E | (0 to 340) °C [32 to 644] °F (340 to 900) °C [644 to 1652] °F | ± 1.7 °C [3 °F] ± 0.5% | ± 1 °C [2 °F] ± 0.4% |
| K | (0 to 293) °C [32 to 559] °F (293 to 1250) °C [559 to 2282] °F | ± 2.2 °C [4 °F] ± 0.75% | ± 1.1 °C [2 °F] ± 0.4% |
| N | (0 to 293) °C [32 to 559] °F (0 to 1250) °C [559 to 2282] °F | ± 2.2 °C [4 °F] ± 0.75% | ± 1.1 °C [2 °F] ± 0.4% |
| R, S | (0 to 600) °C [32 to 1112] °F (600 to 1450) °C [1112 to 2642] °F | ± 1.5 °C [3 °F] ± 0.25% | ± 0.6 °C [1 °F] ± 0.1% |
| B | (870 to 1700) °C [1598 to 3092] °F | ± 0.5% | |
| T ^[1] | (-200 to -66) °C [-328 to -87] °F (-66 to 0) °C [-87 to + 32] °F | ± 1 °C [2 °F] ± 1.5% | |
| E ^[1] | (-200 to -100) °C [-328 to -148] °F (-100 to 0) °C [- 148 to 32] °F | ± 1.1 °C [3 °F] ± 1% | |
| K ^[1] | (-200 to -110) °C [-328 to -166] °F (-110 to 0) °C [-166 to 32] °F | ± 2.2 °C [4 °F] ± 2% | |

[1] Thermocouples and thermocouple materials are normally supplied to meet the limits of error specified in the table for temperatures above 0 °C [32 °F]. The same materials, however, may not fall within the sub-zero limits of error given in the second section of the table. If materials are required to meet the sub-zero limits, the purchase order must so state. Selection of materials usually will be required. Little information is available to justify establishing special limits of error for sub-zero temperatures. Limited experience suggest the following limits for types E and T thermocouples:

| | |
|--------|-----------------------------------|
| Type E | (-200 to 0) °C [-328 to 32] °F |
| Type T | (-200 to 0) °C [-328 to 32] °F |

These limits are given only as a guide for information purposes. Due to the characteristics of the materials, sub-zero limits of error for type J thermocouples and special sub-zero limits for type K thermocouples are not listed.

Limits of Error for Thermocouple

Extension Wire Reference Junction 0 °C [32 °F]

| EXT. WIRE TYPE | TEMPERATURE RANGE | LIMITS OF ERROR | |
|----------------|------------------------------|-----------------|-----------------|
| | | STANDARD | SPECIAL |
| KX | (0 to 200) °C [32 to 392] °F | ± 2.2 °C [4 °F] | |
| JX | (0 to 200) °C [32 to 392] °F | ± 2.2 °C [4 °F] | ± 1.1 °C [2 °F] |
| EX | (0 to 200) °C [32 to 392] °F | ± 1.7 °C [3 °F] | |
| TX | (0 to 100) °C [32 to 212] °F | ± 1.0 °C [2 °F] | ± 0.5 °C [1 °F] |
| NX | (0 to 200) °C [32 to 392] °F | ± 2.2 °C [4 °F] | |

Limits of Error for Thermocouple Compensating

Extension Wire Reference Junction 0 °C [32 °F]

| T/C TYPE | COMPENSATION WIRE TYPE | TEMPERATURE RANGE | LIMITS OF ERROR ^[1] |
|----------|------------------------|------------------------------|---------------------------------|
| R, S | SX§ | (0 to 200) °C [32 to 392] °F | ± 5 °C [9 °F] |
| B | BX# | (0 to 100) °C [32 to 212] °F | 0 °C [0 °F] -3.7 °C [- 6 °F] |

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

| WIRE TYPE | MEASURING JUNCTION TEMPERATURE |
|-----------|--------------------------------|
| SX | Greater than 870 °C [1598] °F |
| BX | Greater than 1000 °C [1832] °F |

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

Copper versus copper compensating extension wire, usable to 100 °C [212 °F] with maximum errors as indicated, but with no significant error over (0 to 50) °C [32 to 122] °F range. Matched proprietary alloy compensating wire is available for use over the range (0 to 200) °C [32 to 392] °F with claimed tolerances of (+ 0.033 mV + 3.7) °C⁻¹.

Calibrating, Checking, and Tagging

Pyromation thermocouple wire and extension wire is available calibrated, "checked and tagged" when so specified, at an extra charge. Wires of this classification are within the Standard Limits of Error but, most important, their specific departure at temperatures specified is known and can be taken into account. Each thermocouple, coil, reel, or spool of wire is checked and tagged to show the departure from the curve. Single conductors will be calibrated to show their EMF values versus pure platinum, with a 0 °C [32 °F] reference junction unless otherwise specified. Thermocouples and wire sample sent to the factory for evaluation must be at least 36" long.

The temperature range for all checking and selecting is from 0 °C [32 °F] to 1371 °C [2500 °F], depending on type and gauge of wire. Sub-zero checking to -79 °C [-110 °F] and high temperature rising from 1371 °F [2500 °F] to 1649 °C [3000 °F] is available. Calibration can also be accomplished at standard check points such as boiling points of helium, oxygen, and nitrogen.

Shipping

Each coil or spool is marked with its exact length, however, Pyromation reserves the right to ship plus or minus 10% of the total amount of either standard or special wire ordered.

ASTM/ANSI Letter Designations

Thermocouple and extension wires are now generally ordered and specified by ASTM/ANSI designations for calibration. Popular generic and trade name examples are Chromel/Alumel-ASTM/ANSI Type K; Iron/Constantan-ASTM/ANSI Type J; Copper/Constantan-ASTM/ANSI Type T; Chromel/Constantan-ASTM/ANSI Type E; Nicrosil/Nisil-ASTM/ANSI Type N; Platinum/Platinum 10% Rhodium-ASTM/ANSI Type S; Platinum/Platinum 13% Rhodium-ASTM/ANSI Type R; and Platinum 6% Rhodium/Platinum 30% Rhodium-ASTM/ANSI Type B. Positive and negative legs are identified by the appropriate letter suffixes P and N, respectively. Those not familiar with this system will find this table helpful.

| ANSI Letter Designations | Generic or Trade Names |
|--------------------------|------------------------------|
| JP | Iron |
| JN, EN, or TN | Constantan, Cupron®, Advance |
| TP | Copper |
| KP or EP | Chromel®, Tophel®, T1 |
| NP | Nicrosil |
| KN | Alumel®, Nial®, T2 |
| NN | Nisil |
| RP | Platinum 13% Rhodium |
| SP | Platinum 10% Rhodium |
| RN or SN | Pure Platinum |
| BN | Platinum 6% Rhodium |
| BP | Platinum 30% Rhodium |

Color Coding

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

| ASTM/ANSI TYPE | | MAGNETIC | | ASTM/ANSI COLOR CODE | | |
|----------------|------------------|----------|--------|----------------------|------------------------|------------------|
| T/C | Sgl. | Yes | No | Sgl. | Overall Extension Wire | Overall T/C Wire |
| T | TP TN | | X X | Blue Red | Blue | Brown |
| J | JP JN | X | X | White Red | Black | Brown |
| E | EP EN | | X X | Purple Red | Purple | Brown |
| K | KP KN | X | X | Yellow Red | Yellow | Brown |
| N | NP NN | | X X | Orange Red | Orange | Brown |
| R, S | RP, SP RN, SN | | X X | Black Red | Green | |
| B | BP BN | | X X | Grey Red | Grey | |

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Solid and Stranded Conductors

Thermocouple wire and extension wire are usually solid conductors. When greater flexibility is required, either are available in stranded construction. The accompanying table gives the stranding combinations used in Pyromation wire. However, other stranding combinations may be ordered to suit requirements.

Stranding Combinations

| CONDUCTOR | | STRANDING | |
|-----------|-------------|----------------|-------|
| GAUGE | I.S.I. TYPE | NO. of STRANDS | GAUGE |
| 14 | ALL | 7 | 22 |
| 16 | ALL | 7 | 24 |
| 18 | ALL | 7 | 26 |
| 20 | ALL | 7 | 28 |
| 22 | ALL | 7 | 30 |
| 24 | ALL | 7 | 32 |

Stock Insulated Wire

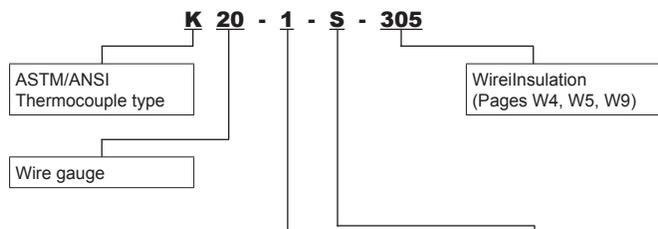
'Stocked' insulated thermocouple and extension wire, as indicated in the catalog pages, is available in the following "standard packaging": 50 ft. coils - 100 ft. coils - 250 ft. spools - 500 ft. spools - 1,000 ft. spools. Coils or spools of less than 1,000 ft. packaged in non-standard lengths, are available at an additional charge and may result in a delay in shipment. Spools or reels of over 1,000 ft. can be supplied at no extra charge, but may also result in a delay in shipment.

Non-Stock Insulated Wire

'Non-stocked' insulated thermocouple and extension wire in 1,000 ft. spools and over is available at no additional charge. Coils or spools of less than 1,000 ft. are available at an additional charge. Minimum order is 100 ft.

How to Read Pyromation Catalog Numbers

EXAMPLE ORDER NUMBER:



Conductor Type

| CODE | DESCRIPTION | | | |
|-------------|-------------|----------|-------------|---------|
| T/C Grades | Solid | Stranded | Std. Limits | Special |
| 1 | X | | X | |
| 2 | X | | | X |
| 3 | | X | X | |
| 4 | | X | | X |
| Ext. Grades | Solid | Stranded | Std. Limits | Special |
| 5 | X | | X | |
| 6 | X | | | X |
| 7 | | X | X | |
| 8 | | X | | X |

Opt. Overbraid Selections

| CODE | DESCRIPTION |
|------|--|
| S | SS wire braid |
| C | Tinned copper wire braid |
| F | Flat SS ribbon wrap |
| W | Flat SS spiral wrap |
| G | Half oval galvanized steel spiral wrap |
| N | Alloy 600 wire braid |

| | | | | |
|-------|-------|----------|-------|----------|
| 1/32 | 1/64 | 0.015625 | 33/64 | 0.515625 |
| | 3/64 | 0.03125 | 17/32 | 0.53125 |
| | 5/64 | 0.046875 | 9/16 | 0.5625 |
| 1/16 | 7/64 | 0.0625 | 37/64 | 0.578125 |
| | 9/64 | 0.078125 | 19/32 | 0.59375 |
| 3/32 | 11/64 | 0.09375 | 39/64 | 0.609375 |
| | 13/64 | 0.109375 | 5/8 | 0.625 |
| 1/8 | 15/64 | 0.125 | 41/64 | 0.640625 |
| | 17/64 | 0.140625 | 21/32 | 0.65625 |
| 5/32 | 19/64 | 0.15625 | 43/64 | 0.671875 |
| | 21/64 | 0.171875 | | |
| 3/16 | 23/64 | 0.1875 | 11/16 | 0.6875 |
| | 25/64 | 0.203125 | 45/64 | 0.703125 |
| 7/32 | 27/64 | 0.21875 | 23/32 | 0.71875 |
| | 29/64 | 0.234375 | 47/64 | 0.734375 |
| 1/4 | 31/64 | 0.25 | 3/4 | 0.75 |
| | 33/64 | 0.265625 | 49/64 | 0.765625 |
| 9/32 | 35/64 | 0.28125 | 25/32 | 0.78125 |
| | 37/64 | 0.296875 | 51/64 | 0.796875 |
| 5/16 | 39/64 | 0.3125 | 13/16 | 0.8125 |
| | 41/64 | 0.328125 | 53/64 | 0.828125 |
| 11/32 | 43/64 | 0.34375 | 27/32 | 0.84375 |
| | 45/64 | 0.359375 | 55/64 | 0.859375 |
| 3/8 | 47/64 | 0.375 | 7/8 | 0.875 |
| | 49/64 | 0.390625 | 57/64 | 0.890625 |
| 13/32 | 51/64 | 0.40625 | 29/32 | 0.90625 |
| | 53/64 | 0.421875 | 59/64 | 0.921875 |
| 7/16 | 55/64 | 0.4375 | 15/16 | 0.9375 |
| | 57/64 | 0.453125 | 61/64 | 0.953125 |
| 15/32 | 59/64 | 0.46875 | 31/32 | 0.96875 |
| | 61/64 | 0.484375 | 63/64 | 0.984375 |
| 1/2 | 63/64 | 0.5 | 1 | 1 |

INCHES in DECIMALS of a FOOT

| | |
|---------------|-------------|
| 1/16 - 0.0052 | 1 - 0.0833 |
| 3/32 - 0.0078 | 2 - 0.1667 |
| 1/8 - 0.0104 | 3 - 0.2500 |
| 3/16 - 0.0156 | 4 - 0.3333 |
| 1/4 - 0.0208 | 5 - 0.4167 |
| 5/16 - 0.0260 | 6 - 0.5000 |
| 3/8 - 0.0313 | 7 - 0.5833 |
| 1/2 - 0.0417 | 8 - 0.6667 |
| 5/8 - 0.0521 | 9 - 0.7500 |
| 3/4 - 0.0625 | 10 - 0.8333 |
| 7/8 - 0.0729 | 11 - 0.9167 |

Standard Wire Gauges in Approximate Decimals of an Inch and mm.

| WIRE GAUGE | AMERICAN or BROWN AND SHARP DIAMETER (inches) | DIAMETER MILLIMETERS | BIRMINGHAM or STUBS | US STANDARD |
|------------|---|----------------------|---------------------|-------------|
| 1 | 0.2893 | 7.348 | 0.300 | 0.281 |
| 2 | 0.2576 | 6.544 | 0.284 | 0.266 |
| 3 | 0.2294 | 5.827 | 0.259 | 0.250 |
| 4 | 0.2043 | 5.189 | 0.238 | 0.234 |
| 5 | 0.1819 | 4.621 | 0.220 | 0.219 |
| 6 | 0.1620 | 4.115 | 0.203 | 0.203 |
| 7 | 0.1443 | 3.665 | 0.180 | 0.188 |
| 8 | 0.1285 | 3.264 | 0.165 | 0.172 |
| 9 | 0.1144 | 2.906 | 0.148 | 0.156 |
| 10 | 0.1019 | 2.588 | 0.134 | 0.141 |
| 11 | 0.0907 | 2.304 | 0.120 | 0.125 |
| 12 | 0.0808 | 2.053 | 0.109 | 0.109 |
| 13 | 0.0720 | 1.829 | 0.095 | 0.0938 |
| 14 | 0.0641 | 1.628 | 0.083 | 0.0781 |
| 15 | 0.0571 | 1.450 | 0.072 | 0.0703 |
| 16 | 0.0508 | 1.291 | 0.065 | 0.0625 |
| 17 | 0.0453 | 1.150 | 0.058 | 0.0563 |
| 18 | 0.0403 | 1.024 | 0.049 | 0.0500 |
| 19 | 0.0359 | 0.9116 | 0.042 | 0.0438 |
| 20 | 0.0320 | 0.8118 | 0.035 | 0.0375 |
| 21 | 0.0285 | 0.7230 | 0.032 | 0.0344 |
| 22 | 0.0253 | 0.6438 | 0.028 | 0.0313 |
| 23 | 0.0226 | 0.5733 | 0.025 | 0.0281 |
| 24 | 0.0201 | 0.5106 | 0.022 | 0.0250 |
| 25 | 0.0179 | 0.4547 | 0.020 | 0.0219 |
| 26 | 0.0159 | 0.4049 | 0.018 | 0.0188 |
| 27 | 0.0142 | 0.3606 | 0.016 | 0.0172 |
| 28 | 0.0126 | 0.3211 | 0.014 | 0.0156 |
| 29 | 0.0113 | 0.2859 | 0.013 | 0.0141 |
| 30 | 0.0100 | 0.2546 | 0.012 | 0.0125 |
| 31 | 0.0089 | 0.2268 | 0.010 | 0.0109 |
| 32 | 0.0080 | 0.2019 | 0.009 | 0.0102 |
| 33 | 0.00708 | 0.178 | 0.008 | 0.0094 |
| 34 | 0.00630 | 0.152 | 0.007 | 0.0086 |
| 35 | 0.00561 | 0.138 | 0.005 | 0.0078 |
| 36 | 0.00500 | 0.127 | 0.004 | 0.0070 |
| 37 | 0.00445 | 0.1131 | | 0.0066 |
| 38 | 0.00397 | 0.1007 | | 0.0063 |
| 39 | 0.00353 | 0.08969 | | |
| 40 | 0.00314 | 0.07987 | | |

| CONDUIT SIZE (I.P.S.) | Approximate No. of Insulated Double Conductor Lengths of Extension | | | | | |
|-----------------------|--|-----------------------|--------|-----------------------|--------|--------|
| | Wire - Size Conductor | | | | | |
| | NO. 14 | NO. 14 ^[1] | NO. 16 | NO. 16 ^[2] | NO. 20 | NO. 24 |
| 1/2" | 1 | 2 | 2 | 1 | 7 | 9 |
| 3/4" | 3 | 7 | 4 | 2 | 16 | 21 |
| 1" | 5 | 10 | 6 | 4 | 24 | 29 |
| 1 1/4" | 7 | 14 | 10 | 5 | 35 | 44 |
| 1 1/2" | 13 | 23 | 13 | 7 | 48 | 69 |
| 2" | 18 | 48 | 20 | 11 | 73 | 95 |

[1] Single Conductor Insulated

[2] Three Conductor Insulated



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STANDARD INSULATED BASE METAL THERMOCOUPLE WIRE

The following four pages give the details of the standard insulated thermocouple wires generally available for stock delivery. All of these wires are selected and matched to meet the Standards Limits of Error of ASTM/ANSI E230 given on page one of this catalog section. If the closer accuracy of the Special Limits of Error wire is desired, then special limit wires can be selected and matched. To order, change the fourth figure of the catalog number to the next higher "even" digit (example: K20-1-305 becomes K20-2-305). With the aid of the wire temperature limit tables from page one and the tabulated wire insulation data below, thermocouple wire can be selected to meet most industrial process requirements. When conditions call for other than the listed standard wires, special wires and insulations can be made to fulfill application requirements with minimum purchases. Complete process requirements and specifications should accompany quotation requests.

Thermocouple Wire Types, Construction and Characteristics

Standard Fiberglass Insulations

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING | | PHYSICAL PROPERTIES | | | |
|------------------|--|--------------------|------------------------|----------------|-----------------|------------------------|---------------------|---------------------|---------------------|--|
| Type | Insulation (Inches) | Impregnation | Insulation (Inches) | Impregnation | Continuous | ASTM/ANSI Sgl. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 302 | Double glass braid 0.12 wall | Modified resin | Glass braid 0.006 | Modified resin | 482 °C [900 °F] | 538 °C [1000 °F] | Yes | Good | Good | Impregnation retained to 204 °C [400 °F] |
| 304 | Glass braid 0.006 | Modified resin | Glass braid 0.006 | Modified resin | 482 °C [900 °F] | 538 °C [1000 °F] | Yes | Fair | Good | Impregnation retained to 204 °C [400 °F] |
| 305 | Double glass wrap 0.005 | High-temp. varnish | Glass braid 0.006 | Modified resin | 482 °C [900 °F] | 538 °C [1000 °F] | Yes | Fair | Good | Impregnation retained to 204 °C [400 °F] |
| 306 | Glass braid 0.006 | None | Glass braid 0.006 | None | 482 °C [900 °F] | 538 °C [1000 °F] | No | Fair | Fair | Heat treated |
| 307 | TFE tape (not fused) 0.004 TFE coated glass, 0.006 | None | TFE coated glass braid | None | 482 °C [900 °F] | 538 °C [1000 °F] | Yes | Good | Excellent | TFE good to 316 °C [600 °F] |
| 313 | Glass braid 0.008 | Modified resin | Glass braid 0.006 | Modified resin | 482 °C [900 °F] | 538 °C [1000 °F] | Yes | Good | Good | Impregnation retained to 204 °C [400 °F] |
| 315 | Glass braid 0.008 | Modified resin | None twisted | None | 482 °C [900 °F] | 538 °C [1000 °F] | Yes | Good | Good | Impregnation retained to 204 °C [400 °F] |
| 317 | Heavy glass braid | High-temp. varnish | None twisted | None | 482 °C [900 °F] | 538 °C [1000 °F] | Yes | Good | Good | Impregnation retained to 204 °C [400 °F] |

High Temperature Fiberglass Insulations

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING | | PHYSICAL PROPERTIES | | | |
|------------------|------------------------------|--------------------|------------------------------|--------------------|------------------|------------------------|---------------------|---------------------|---------------------|--|
| Type | Insulation (Inches) | Impregnation | Insulation (Inches) | Impregnation | Continuous | ASTM/ANSI Sgl. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 309 | High-temp. glass braid 0.012 | None | High-temp. glass braid 0.012 | Modified resin | 704 °C [1300 °F] | 871 °C [1600 °F] | Tracer | Good | Fair | Impregnation retained to 204 °C [400 °F] |
| 311 | High-temp. glass braid 0.012 | None | High-temp. glass braid 0.012 | Light lacquer | 704 °C [1300 °F] | 871 °C [1600 °F] | No | Fair | Fair | Coating retained to 149 °C [300 °F] |
| 314 | High-temp. glass braid 0.008 | High-temp. varnish | None twisted | None | 704 °C [1300 °F] | 871 °C [1600 °F] | Yes | Good | Good | Impregnation retained to 204 °C [400 °F] |
| 321 | High-temp. glass braid | High-temp. varnish | High-temp. glass braid | High temp. varnish | 704 °C [1300 °F] | 871 °C [1600 °F] | Yes | Good | Good | Impregnation retained to 204 °C [400 °F] |

Vitreous Silica Insulation

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING | | PHYSICAL PROPERTIES | | | |
|------------------|-----------------------------|--------------|-----------------------------|--------------|------------------|-------------------|---------------------|---------------------|---------------------|-------|
| Type | Insulation (Inches) | Impregnation | Insulation (Inches) | Impregnation | Continuous | ANSI Sg. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 301 | Vitreous Silica Fiber 0.015 | None | Vitreous Silica Fiber 0.020 | None | 871 °C [1600 °F] | 1093 °C [2000 °F] | No | Fair | Fair | |

Ceramic Fiber Insulation

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING ^[1] | | PHYSICAL PROPERTIES | | | |
|------------------|---------------------------|--------------|---------------------------|--------------|-----------------------------|-------------------|---------------------|---------------------|---------------------|-------|
| Type | Insulation (Inches) | Impregnation | Insulation (Inches) | Impregnation | Continuous | ANSI Sg. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 350 | Ceramic Fiber Braid 0.018 | None | Ceramic Fiber Braid 0.018 | None | 1204 °C [2200 °F] | 1430 °C [2600 °F] | No | Good | Fair | |

Polyvinyl Insulation

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING | | PHYSICAL PROPERTIES | | | |
|------------------|-----------------------------|--------------|-----------------------|--------------|---------------------------------|------------------|---------------------|---------------------|---------------------|-------|
| Type | Insulation (Inches) | Impregnation | Insulation | Impregnation | Continuous | ANSI Sg. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 505 | Polyvinyl Extr. 0.012-0.014 | None | Singles Fused-Ripcord | None | (-29 to 105) °C [-20 to 221] °F | None | Yes | Good | Excellent | |

Fluoropolymer Insulations

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING | | PHYSICAL PROPERTIES | | | |
|------------------|----------------------|--------------|----------------------------|--------------|-----------------|------------------|---------------------|---------------------|---------------------|------------------------------------|
| Type | Insulation (Inches) | Impregnation | Insulation (Inches) | Impregnation | Continuous | ANSI Sg. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 506 | FEP Extr. 0.005 | None | FEP Extr. 0.005 | None | 204 °C [400 °F] | 260 °C [500 °F] | Yes | Good | Excellent | |
| 507 | FEP Extr. 0.008 | None | FEP Extr. 0.010 | None | 204 °C [400 °F] | 260 °C [500 °F] | Yes | Good | Excellent | |
| 508 | TFE tape fused 0.005 | None | TFE Tape fused 0.0075 | None | 260 °C [500 °F] | 316 °C [600 °F] | Yes | Very Good | Excellent | |
| 509 | FEP Extr. 0.009 | None | FEP Extr. 0.010 Twisted | None | 204 °C [400 °F] | 260 °C [500 °F] | Yes | Good | Excellent | Polyester shield w/ #20 drain wire |
| 516 | Extruded PFA | None | Extruded PFA | None | 260 °C [500 °F] | 316 °C [600 °F] | Yes | Good | Excellent | |
| 517 | Extruded PFA | None | Twisted; Extr. PFA Overall | None | 260 °C [500 °F] | 316 °C [600 °F] | Yes | Good | Excellent | Polyester shield w/ drain wire |
| 595 | FEP Extruded | None | FEP Extruded | None | 204 °C [400 °F] | 260 °C [500 °F] | Yes | Good | Excellent | Stainless steel overbraid inner |

Polyimide Insulations

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING | | PHYSICAL PROPERTIES | | | |
|------------------|--|--------------|-----------------------|--------------|-----------------|------------------|----------------------------------|---------------------|---------------------|------------------------------------|
| Type | Insulation (Inches) | Impregnation | Insulation (Inches) | Impregnation | Continuous | ANSI Sg. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 511 | Fused Polyimide Tape 0.004 | None | None twisted | None | 316 °C [600 °F] | 427 °C [800 °F] | ^[2] ^[2] | Excellent | Excellent | FEP binder melts @ 260 °C [500 °F] |
| 512 | Fused Polyimide Tape 0.004 | None | Fused Polyimide 0.004 | None | 316 °C [600 °F] | 427 °C [800 °F] | ^[2] | Excellent | Excellent | FEP binder melts @ 260 °C [500 °F] |
| 513 | Fused Polyimide Tape, 0.006 Polyimide Enamel | None | Fused Polyimide 0.004 | None | 316 °C [600 °F] | 427 °C [800 °F] | Yes singles only | Excellent | Excellent | FEP binder melts @ 260 °C [500 °F] |

Fluoropolymer Insulation

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING | | PHYSICAL PROPERTIES | | | |
|------------------|---------------------|--------------|---------------------|--------------|-----------------|------------------|---------------------|---------------------|---------------------|-------|
| Type | Insulation (Inches) | Impregnation | Insulation (Inches) | Impregnation | Continuous | ANSI Sg. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 514 | ETFE Extr. 0.008 | None | ETFE Extr. 0.010 | None | 150 °C [302 °F] | 200 °C [392 °F] | Yes | Good | Excellent | |

[1] These wires have no impregnation on insulation

[2] Both legs have Tracer

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ASTM/ANSI Type J

ASTM/ANSI Color Code: Negative wire, red; Positive wire, white; Overall brown, with Tracer where possible.

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-------------------|------|-----------|------------------------|------------------------|---------------------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| J20 - 1 - 304 | 20 | Solid | Glass braid | Glass braid | | Std. | 0.059 x 0.097 | 8 |
| J20 - 1 - S - 304 | 20 | Solid | Glass braid | Glass braid | Stainless overbraid | Std. | 0.080 x 0.119 | 17 |
| J20 - 2 - 304 | 20 | Solid | Glass braid | Glass braid | | Spl. | 0.059 x 0.097 | 8 |
| J20 - 1 - 305 | 20 | Solid | Glass wrap | Glass braid | | Std. | 0.054 x 0.095 | 8 |
| J20 - 1 - 314 | 20 | Solid | High-temp. glass braid | None - twisted | | Std. | 0.120 | 8 |
| J20 - 2 - 321 | 20 | Solid | High-temp. glass braid | High-temp. glass braid | | Spl. | 0.085 x 0.140 | 15 |
| J20 - 1 - 507 | 20 | Solid | FEP extruded | FEP extruded | | Std. | 0.072 x 0.124 | 11 |
| J20 - 1 - 508 | 20 | Solid | Fused TFE tape | Fused TFE tape | | Std. | 0.059 x 0.100 | 10 |
| J20 - 2 - 513 | 20 | Solid | Fused Polyimide tape | Fused Polyimide tape | | Spl. | 0.065 x 0.100 | 11 |
| J20 - 3 - S - 302 | 20 | Strd. | Double glass braid | Glass braid | Stainless overbraid | Std. | 0.093 x 0.140 | 16 |
| J20 - 3 - 304 | 20 | Strd. | Glass braid | Glass braid | | Std. | 0.072 x 0.132 | 9 |
| J20 - 3 - 507 | 20 | Strd. | FEP extruded | FEP extruded | | Std. | 0.077 x 0.128 | 12 |
| J20 - 3 - S - 507 | 20 | Strd. | FEP extruded | FEP extruded | Stainless overbraid | Std. | 0.092 x 0.144 | 15 |
| J20 - 3 - 512 | 20 | Strd. | Polyimide | Polyimide | | Std. | 0.055 x 0.1020 | 11 |
| J24 - 1 - 304 | 24 | Solid | Glass braid | Glass braid | | Std. | 0.047 x 0.081 | 4 |
| J24 - 1 - S - 305 | 24 | Solid | Glass wrap | Glass braid | Stainless overbraid | Std. | 0.067 x 0.095 | 9 |
| J24 - 1 - 508 | 24 | Solid | Fused TFE tape | Fused TFE tape | | Std. | 0.047 x 0.078 | 5 |
| J24 - 2 - 513 | 24 | Solid | Fused polyimide tape | Fused polyimide tape | | Spl. | 0.060 x 0.085 | 6 |
| J24 - 3 - 304 | 24 | Strd. | Glass braid | Glass braid | | Std. | 0.043 x 0.082 | 8 |
| J24 - 3 - S - 305 | 24 | Strd. | Glass wrap | Glass braid | Stainless overbraid | Std. | 0.074 x 0.104 | 11 |
| J24 - 3 - 507 | 24 | Strd. | FEP extruded | FEP extruded | | Std. | 0.065 x 0.110 | 8 |
| J24 - 3 - 595 | 24 | Strd. | FEP | FEP/Stainless OB | FEP | Std. | 0.145 | 17 |
| J28 - 1 - 305 | 28 | Solid | Glass wrap | Glass braid | | Std. | 0.036 x 0.057 | 3 |
| J30 - 1 - 304 | 30 | Solid | Glass braid | Glass braid | | Std. | 0.037 x 0.059 | 3 |
| J30 - 2 - 506 | 30 | Solid | FEP extruded | FEP extruded | | Spl. | 0.030 x 0.050 | 4 |

Type J Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 14 | 0.0641 | | 0.086 | |
| 16 | 0.0508 | 0.0600 | 0.137 | 0.125 |
| 18 | | 0.0490 | | 0.185 |
| 20 | 0.0320 | 0.0390 | 0.357 | 0.343 |
| 24 | 0.0201 | 0.0250 | 0.877 | 0.842 |
| 28 | 0.0126 | | 2.216 | |
| 30 | 0.0100 | | 3.520 | |

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ASTM/ANSI Type K

ASTM/ANSI Color Code: Negative wire, red; Positive wire, yellow; Overall brown, with Tracer where possible.

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-------------------|------|-----------|-----------------------------|-----------------------------|---------------------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| K20 - 2 - 301 | 20 | Solid | Vitreous silica fiber braid | Vitreous silica fiber braid | | Spl. | 0.100 x 0.155 | 16 |
| K20 - 1 - 304 | 20 | Solid | Glass braid | Glass braid | | Std. | 0.059 x 0.097 | 8 |
| K20 - 1 - S - 304 | 20 | Solid | Glass braid | Glass braid | Stainless overbraid | Std. | 0.080 x 0.119 | 17 |
| K20 - 1 - 305 | 20 | Solid | Glass wrap | Glass braid | | Std. | 0.054 x 0.095 | 8 |
| K20 - 2 - 321 | 20 | Solid | High-temp. glass braid | High-temp. glass braid | | Spl. | 0.085 x 0.140 | 15 |
| K20 - 2 - S - 321 | 20 | Solid | High-temp. glass braid | High-temp. glass braid | Stainless overbraid | Spl. | 0.101 x 0.161 | 15 |
| K20 - 2 - 350 | 20 | Solid | Ceramic fiber braid | Ceramic fiber braid | | Spl. | 0.096 x 0.175 | 16 |
| K20 - 2 - N - 350 | 20 | Solid | Ceramic fiber braid | Ceramic fiber braid | Alloy 600 overbraid | Spl. | 0.126 x 0.166 | 23 |
| K20 - 1 - 507 | 20 | Solid | FEP extruded | FEP extruded | | Std. | 0.072 x 0.124 | 11 |
| K20 - 1 - 508 | 20 | Solid | Fused TFE tape | Fused TFE tape | | Std. | 0.059 x 0.100 | 10 |
| K20 - 2 - 509 | 20 | Solid | FEP extruded | Twisted polyester | FEP | Spl. | 0.132 | 16 |
| K20 - 2 - 513 | 20 | Solid | Fused polyimide tape | Fused polyimide tape | | Spl. | 0.065 x 0.100 | 11 |
| K20 - 3 - 302 | 20 | Strd. | Double glass braid | Glass braid | | Std. | 0.093 x 0.140 | 9 |
| K20 - 3 - S - 302 | 20 | Strd. | Double glass braid | Glass braid | Stainless overbraid | Std. | 0.093 x 0.140 | 16 |
| K20 - 3 - 304 | 20 | Strd. | Glass braid | Glass braid | | Std. | 0.077 x 0.113 | 10 |
| K20 - 3 - 507 | 20 | Strd. | FEP extruded | FEP extruded | | Std. | 0.077 x 0.128 | 12 |
| K20 - 3 - S - 507 | 20 | Strd. | FEP extruded | FEP extruded | Stainless overbraid | Std. | 0.110 x 0.130 | 13 |
| K24 - 1 - 304 | 24 | Solid | Glass braid | Glass braid | | Std. | 0.047 x 0.081 | 4 |
| K24 - 1 - S - 305 | 24 | Solid | Glass wrap | Glass braid | Stainless overbraid | Std. | 0.067 x 0.095 | 13 |
| K24 - 1 - 508 | 24 | Solid | Fused TFE tape | Fused TFE tape | | Std. | 0.047 x 0.078 | 5 |
| K24 - 3 - S - 305 | 24 | Strd. | Glass wrap | Glass braid | Stainless overbraid | Std. | 0.070 x 0.100 | 9 |

Type K Thermocouple and Extension Wire Conductor Specifications

| AWG. | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 14 | 0.0641 | 0.0760 | 0.147 | 0.134 |
| 16 | 0.0508 | 0.0600 | 0.233 | 0.213 |
| 20 | 0.0320 | 0.0390 | 0.590 | 0.538 |
| 24 | 0.0201 | 0.0250 | 1.490 | 1.435 |
| 28 | 0.0126 | | 3.770 | |
| 30 | 0.0100 | | 5.980 | |
| 36 | 0.0050 | | 24.080 | |

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ANSI Type T

ASTM/ANSI Color Code: Negative wire, red; Positive wire, blue; Overall brown, with Tracer where possible.

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|---------------|------|-----------|----------------|------------------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| T20 - 1 - 507 | 20 | Solid | FEP extruded | FEP extruded | | Std. | 0.072 x 0.124 | 11 |
| T20 - 3 - 507 | 20 | Stranded | FEP extruded | FEP extruded | | Std. | 0.080 x 0.137 | 12 |
| T24 - 1 - 304 | 24 | Solid | Glass braid | Glass braid | | Std. | 0.047 x 0.081 | 4 |
| T24 - 1 - 505 | 24 | Solid | Polyvinyl | None (ripcord constr.) | | Std. | 0.048 x 0.086 | 3 |
| T24 - 2 - 508 | 24 | Solid | Fused TFE tape | Fused TFE tape | | Spl. | 0.047 x 0.078 | 5 |
| T24 - 1 - 507 | 24 | Stranded | FEP extruded | FEP extruded | | Std. | 0.065 x 0.110 | 8 |
| T24 - 3 - 595 | 24 | Stranded | FEP | FEP/stainless OB | FEP | Std. | 0.145 | 17 |

Duplex - ANSI Type E

ASTM/ANSI Color Code: Negative wire, red; Positive wire, purple; Overall brown, with Tracer where possible.

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-------------------|------|-----------|----------------|--------------|---------------------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| E20 - 1 - 304 | 20 | Solid | Glass braid | Glass braid | | Std. | 0.059 x 0.097 | 8 |
| E20 - 1 - S - 304 | 20 | Solid | Glass Braid | Glass braid | Stainless Overbraid | Std. | 0.080 x 0.119 | 17 |

Type T Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 16 | 0.0508 | | 0.118 | |
| 20 | 0.0320 | 0.0390 | 0.298 | 0.272 |
| 24 | 0.0201 | 0.0250 | 0.272 | |
| 30 | 0.0100 | | 3.520 | |
| 36 | 0.0050 | | 12.174 | |

Type E Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 16 | | 0.0600 | | 0.254 |
| 20 | 0.0320 | | 0.704 | |

Type N Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 20 | 0.0320 | | 0.352 | |
| 24 | 0.0201 | | 1.980 | |

STANDARD INSULATED THERMOCOUPLE EXTENSION WIRE

On this and the following pages are the details of the standard insulated thermocouple extension wires generally available for base and noble metal thermocouple installations. By using the tabulated wire insulation data below, one can select a wire suitable for most process applications. When process conditions require the use of a special construction wire, please provide complete process requirements and specifications with your request for quotation. Minimums of 2,000 feet are generally required for special constructions.

Extension Wire Types, Construction and Characteristics

ServTex Insulations

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING ^[1] | | PHYSICAL PROPERTIES | | | |
|------------------|--|---------------------------------|------------------|-----------------------------|-----------------------------|-------------------|---------------------|---------------------|---------------------|---|
| Type | Insulation | Impregnation | Insulation | Impregnation | Continuous | ANSI Sgl. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 155 | Heavy fiberglass braid single insulation | Moisture resistant impregnation | ServTex Braid | Ceramic-like impregnation | 288 °C [550 °F] | 343 °C [650 °F] | Yes | Good | Fair | Impregnation retained to 200 °C [400 °F] |
| 157 | TFE tape (not fused). Heavy fiberglass braid single insulation | Modified resin | ServTex Braid | Moisture-resistant compound | 288 °C [550 °F] | 343 °C [650 °F] | Yes | Good | Fair | Impregnation retained to 204 °C [400 °F]; TFE good to 260 °C [500 °F] |

Fiberglass Insulation

| | | | | | | | | | | |
|-----|---------------------------|----------------|--------------------|----------------|-----------------|------------------|-----|------|------|--|
| 303 | Enamel/glass braid 0.006" | Modified resin | Glass braid 0.006" | Modified resin | 482 °C [900 °F] | 538 °C [1000 °F] | Yes | Good | Fair | Impregnation retained to 204 °C [400 °F] |
|-----|---------------------------|----------------|--------------------|----------------|-----------------|------------------|-----|------|------|--|

Polyvinyl Insulations

| SINGLE CONDUCTOR | | | DUPLEX CONDUCTOR | | TEMP. RATING ^[1] | | PHYSICAL PROPERTIES | | | |
|------------------|--|--------------|-------------------------------------|--------------|----------------------------------|------------------|---------------------|---------------------|---------------------|--|
| Type | Insulation | Impregnation | Insulation | Impregnation | Continuous | ANSI Sg. Reading | Color-Code | Abrasion-Resistance | Moisture-Resistance | Notes |
| 502 | Polyvinyl Extr. 0.012" to #20; #16 to 0.018" | None | Polyvinyl Extr., 0.016" | None | (-29 to 105) °C [-20 to +221] °F | | Yes | Good | Excellent | |
| 503 | Polyvinyl Extr. 0.015" | None | Twisted w/cotton filler; PVC 0.030" | None | (-29 to 105) °C [-20 to +221] °F | | Yes | Good | Excellent | Stranded conductors only |
| 510 | Polyvinyl Extr. 0.015" | None | Polyvinyl 0.020" Twisted | None | (-29 to 105) °C [-20 to +221] °F | | Yes | Good | Excellent | Polyester shield for computer application #16 uses #18 drain wire; #20 uses #20 drain wire |

Fluoropolymer Insulations

| | | | | | | | | | | |
|-----|--------------------|------|--------------|------|-----------------|-----------------|-----|-----------|-----------|--------------------------------------|
| 514 | ETFE Extr., 0.008" | None | ETFE 0.0010" | None | 150 °C [302 °F] | 200 °C [392 °F] | Yes | Excellent | Excellent | |
| 515 | ETFE Extr., 0.008" | None | Twisted | None | 150 °C [302 °F] | 200 °C [392 °F] | Yes | Excellent | Excellent | Polyester shield w/20 AWG drain wire |

[1] Thermocouple extension grade wire is only calibrated up to 204 °C [400 °F]

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ASTM/ANSI Type JX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, white; Overall black.

| CODE | AWG. GAUGE | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|---------------|------------|-----------|----------------|-----------------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| J16 - 5 - 502 | 16 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.111 x 0.188 | 27 |
| J16 - 5 - 510 | 16 | Solid | Polyvinyl | Twisted Polyester | PVC | Std. | 0.206 | 28 |
| J18 - 7 - 503 | 18 | Strd. | Polyvinyl | Twisted cotton filler | PVC | Spl. | 0.254 | 35 |
| J20 - 5 - 502 | 20 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.095 x 0.158 | 14 |
| J20 - 5 - 510 | 20 | Solid | Polyvinyl | Twisted Polyester | PVC | Std. | 0.170 | 20 |
| J20 - 7 - 502 | 20 | Strd. | Polyvinyl | Polyvinyl | | Std. | 0.108 x 0.185 | 14 |
| J20 - 7 - 510 | 20 | Strd. | Polyvinyl | Twisted Polyester | PVC | Std. | 0.176 | 24 |

Duplex - ASTM/ANSI Type KX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, yellow; Overall yellow.

| | | | | | | | | |
|---------------|----|-------|-----------------------|-----------------------|-----|------|---------------|----|
| K16 - 5 - 157 | 16 | Solid | TFE heavy glass braid | ServTex braid | | Std. | 0.170 x 0.220 | 33 |
| K16 - 5 - 303 | 16 | Solid | Enamel glass braid | Glass braid | | Std. | 0.100 x 0.160 | 23 |
| K16 - 5 - 502 | 16 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.111 x 0.188 | 27 |
| K16 - 5 - 510 | 16 | Solid | Polyvinyl | Twisted Polyester | PVC | Std. | 0.206 | 28 |
| K20 - 5 - 502 | 20 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.095 x 0.158 | 14 |
| K20 - 5 - 510 | 20 | Solid | Polyvinyl | Twisted Polyester | PVC | Std. | 0.170 | 20 |
| K20 - 7 - 502 | 20 | Strd. | Polyvinyl | Polyvinyl | | Std. | 0.108 x 0.185 | 14 |
| K20 - 7 - 503 | 20 | Strd. | Polyvinyl | Twisted cotton filler | PVC | Std. | 0.225 | 35 |
| K20 - 7 - 510 | 20 | Strd. | Polyvinyl | Twisted Polyester | PVC | Std. | 0.198 | 20 |

Duplex - ASTM/ANSI Type TX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, blue; Overall blue.

| | | | | | | | | |
|---------------|----|-------|-----------|-------------------|-----|------|--------------|----|
| T20 - 5 - 502 | 20 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.095 x .158 | 15 |
| T20 - 5 - 510 | 20 | Solid | Polyvinyl | Twisted Polyester | PVC | Std. | 0.170 | 20 |

Type J Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 14 | 0.0641 | | 0.086 | |
| 16 | 0.0508 | 0.0600 | 0.137 | 0.125 |
| 18 | | 0.0490 | | 0.185 |
| 20 | 0.0320 | 0.0390 | 0.357 | 0.343 |
| 24 | 0.0201 | 0.0250 | 0.877 | 0.842 |
| 28 | 0.0126 | | 2.216 | |
| 30 | 0.0100 | | 3.520 | |

Type K Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 14 | 0.0641 | 0.0760 | 0.147 | 0.134 |
| 16 | 0.0508 | 0.0600 | 0.233 | 0.213 |
| 20 | 0.0320 | 0.0390 | 0.590 | 0.538 |
| 24 | 0.0201 | 0.0250 | 1.490 | 1.435 |
| 28 | 0.0126 | | 3.770 | |
| 30 | 0.0100 | | 5.980 | |
| 36 | 0.0050 | | 24.080 | |

Type T Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 16 | 0.0508 | | 0.118 | |
| 20 | 0.0320 | 0.0390 | 0.298 | 0.272 |
| 24 | 0.0201 | | 0.272 | |
| 30 | 0.0100 | | 3.025 | |
| 36 | 0.0050 | | 12.174 | |

Standard length spools are in 50 ft. increments. Non-standard lengths are available at an extra charge.

Duplex - ASTM/ANSI Type NX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, orange; Overall orange.

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|---------------|------|-----------|----------------|--------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| N20 - 5 - 502 | 20 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.111 x 0.188 | 15 |

Duplex - ASTM/ANSI Type SX and RX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, black; Overall green; Compensating extension wires for Type R, S thermocouples

| | | | | | | | | |
|---------------|----|-------|----------------------------|-------------------|-----|------|---------------|----|
| S16 - 5 - 157 | 16 | Solid | TFE tape/heavy glass braid | ServTex braid | | Std. | 0.170 x 0.220 | 30 |
| S20 - 5 - 304 | 20 | Solid | Glass braid | Glass braid | | Std. | 0.056 x 0.096 | 8 |
| S20 - 5 - 502 | 20 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.095 x 0.158 | 13 |
| S20 - 5 - 507 | 20 | Solid | FEP extruded | FEP extruded | | Std. | 0.070 x 0.120 | 13 |
| S20 - 5 - 510 | 20 | Solid | Polyvinyl | Twisted Polyester | PVC | Std. | 0.170 | 20 |

Duplex - ASTM/ANSI Type BX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, grey; Overall grey; Compensating extension wires for ANSI Type B thermocouples

| | | | | | | | | |
|---------------|----|-------|-------------|-------------|--|------|---------------|---|
| B20 - 5 - 304 | 20 | Solid | Glass braid | Glass braid | | Std. | 0.056 x 0.096 | 8 |
|---------------|----|-------|-------------|-------------|--|------|---------------|---|

Type N Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 20 | 0.0320 | | 0.352 | |
| 24 | 0.0201 | | 1.980 | |

Type S Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 16 | 0.0508 | 0.0600 | 0.016 | 0.014 |
| 20 | 0.0320 | | 0.040 | |
| 24 | 0.0201 | | 0.087 | |

Type B Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 20 | 0.0320 | | 0.069 | |

Type C Thermocouple and Extension Wire Conductor Specifications

| WIRE GAUGE | CONDUCTOR DIAMETER | | OHMS PER DOUBLE FOOT | |
|------------|--------------------|-------------------|----------------------|-----------------|
| | SOLID (inches) | STRANDED (inches) | SOLID (ohms) | STRANDED (ohms) |
| 24 | 0.0201 | | 0.940 | |

Pyromation offers several special construction thermocouple wire and RTD cables for process applications. Those listed below, because of their specialized construction, have been used in many unusual applications to solve problems where standard "off-the-shelf" wire and cable would not suffice. The listed wire and cable is normally carried in stock. Other non-standard wire and cable is available on special order. Please contact us with your specifications for a quotation. Minimum order quantities may apply on special construction items.

Special Construction RTD Cables

| CODE | CONSTRUCTION STYLE | GAUGE AND TYPE | OHMS ^[1] | INSULATIONS | | | TEMP. RATING | COLOR CODE | OUTER JACKET | NOMINAL SIZE (inches) |
|--------------|--------------------|--------------------------------------|---------------------|---------------|----------------------------------|---------------------------|-----------------|--------------------------------------|--------------|-----------------------|
| | | | | EACH COND. | INNER JACKET | OUTER JACKET | | | | |
| RT24-3-595 | Triplex | 24 - stranded (silver-plated copper) | 0.066 | Fluoropolymer | FEP & stainless steel overbraid | Fluoropolymer | 204 °C [400 °F] | Red, red, white | White | 0.160 O.D. |
| RT24-3-527 | Triplex | 24 - stranded (silver-plated copper) | 0.066 | Fluoropolymer | None | Fluoropolymer | 204 °C [400 °F] | Red, red, white | White | 0.110 O.D. |
| RT28-6-527 | Six conductor | 28 - stranded (silver-plated copper) | 0.175 | Fluoropolymer | None | Fluoropolymer | 204 °C [400 °F] | Red, red, white, black, black, green | White | 0.132 O.D. |
| RT24-2-S-330 | Duplex | 24 - stranded (nickel-plated copper) | 0.060 | Glass braid | Glass braid | Stainless steel overbraid | 482 °C [900 °F] | Red, white | - | 0.110 O.D. |
| RT24-3-S-330 | Triplex | 24 - stranded (nickel-plated copper) | 0.090 | Glass braid | Glass braid | Stainless steel overbraid | 482 °C [900 °F] | Red, red, white | - | 0.120 O.D. |
| RT24-3-330 | Triplex | 24 - stranded (nickel-plated copper) | 0.090 | Glass braid | None | Glass braid | 482 °C [900 °F] | Red, red, white | White | 0.072 O.D. |
| RT22-3-502 | Triplex | 22 - stranded tinned copper | 0.044 | PVC | None | PVC | 105 °C [221 °F] | Red, red, white | White | 0.160 O.D. |
| RT22-4-502 | Four conductor | 22 - stranded tinned copper | 0.059 | PVC | None | PVC | 105 °C [221 °F] | Red, red white, white | White | 0.175 O.D. |
| RT24-3-509 | Triplex | 24 - stranded tinned copper | 0.066 | Fluoropolymer | Polyester shield with drain wire | Fluoropolymer | 204 °C [400 °F] | Red, red, white | White | 0.150 O.D. |
| RT24-4-509 | Four conductor | 24 - stranded tinned copper | 0.066 | Fluoropolymer | Polyester shield with drain wire | Fluoropolymer | 204 °C [400 °F] | Red, red, white, white | White | 0.150 O.D. |

[1] Ohms per double or triple foot @ 20 °C [68 °F]

Cables made up of multi-pairs of thermocouple extension wire have gained wide acceptance as a cost effective means of running thermocouple extension wire from the process area to central control locations. Installation cost reductions are achieved by running one or more cables containing many pairs of wires rather than individual pairs in separate conduits. Pyromation offers two standard constructions of multi-pair cable as listed below, however special made-to-order cables are also available. Contact us with your complete specifications for a quotation. Minimum order quantities will apply on special cables.

900 SERIES STANDARD MULTI-PAIR THERMOCOUPLE EXTENSION CABLE SPECIFICATIONS

Single Conductor Insulation: Extruded PVC (pairs twisted)

Shield: Spiral wrapped aluminized polyester tape over all pairs w/copper drain wire

Overall Insulation: Extruded PVC jacket with a jacket splitting ripcord

Communication Wire: Insulated copper wire

Color Coding: ASTM/ANSI standard color codes

Numbering: Each pair

Temperature Rating: [-20° to 221] °F (-29° to 105) °C

Physical Properties: Abrasion-resistance: good
Moisture-resistance: excellent
Chemical-resistance: good

ASTM/ANSI Type JX Pairs

ASTM/ANSI Color Code:
Negative wire, red; Positive wire, white; Overall black

| CODE | NUMBER OF PAIRS | B & S GAUGE | APPROX. O.D. (inches) | APPROX. SHIP WT. PER 1000 FT. (pounds) |
|-----------|-----------------|-------------|-----------------------|--|
| J20-5-904 | 4 - Twisted | 20 | 0.350 | 83 |
| J20-5-908 | 8 - Twisted | 20 | 0.420 | 131 |
| J20-5-912 | 12 - Twisted | 20 | 0.495 | 198 |
| J20-5-924 | 24 - Twisted | 20 | 0.665 | 338 |

ASTM/ANSI Type KX Pairs

ASTM/ANSI Color Code:
Negative wire, red; Positive wire, yellow; Overall yellow

| CODE | NUMBER OF PAIRS | B & S GAUGE | APPROX. O.D. (inches) | APPROX. SHIP WT. PER 1000 FT. (pounds) |
|-----------|-----------------|-------------|-----------------------|--|
| K20-5-904 | 4 - Twisted | 20 | 0.350 | 83 |
| K20-5-908 | 8 - Twisted | 20 | 0.420 | 131 |
| K20-5-912 | 12 - Twisted | 20 | 0.495 | 198 |
| K20-5-924 | 24 - Twisted | 20 | 0.665 | 338 |

1000 SERIES STANDARD MULTI-PAIR THERMOCOUPLE EXTENSION CABLE SPECIFICATIONS

Single Conductor Insulation: Extruded PVC (pairs twisted)

Shield: Spiral wrapped aluminized polyester tape over each pair w/copper drain wire

Overall Insulation: Extruded PVC jacket with a jacket splitting ripcord

Communication Wire: Insulated copper wire

Color Coding: ASTM/ANSI standard color codes

Numbering: Each pair

Temperature Rating: [-20° to 221] °F (-29° to 105) °C

Physical Properties: Abrasion-resistance: good
Moisture-resistance: excellent
Chemical-resistance: good

ASTM/ANSI Type JX Pairs

ASTM/ANSI Color Code:
Negative wire, red; Positive wire, white; Overall black

| CODE | NUMBER OF PAIRS | B & S GAUGE | APPROX. O.D. (inches) | APPROX. SHIP WT. PER 1000 FT. (pounds) |
|------------|-----------------|-------------|-----------------------|--|
| J20-5-1004 | 4 - Twisted | 20 | 0.395 | 94 |
| J20-5-1008 | 8 - Twisted | 20 | 0.455 | 142 |
| J20-5-1012 | 12 - Twisted | 20 | 0.550 | 220 |
| J20-5-1024 | 24 - Twisted | 20 | 0.842 | 428 |

ASTM/ANSI Type KX Pairs

ASTM/ANSI Color Code:
Negative wire, red; Positive wire, yellow; Overall yellow

| CODE | NUMBER OF PAIRS | B & S GAUGE | APPROX. O.D. (inches) | APPROX. SHIP WT. PER 1000 FT. (pounds) |
|------------|-----------------|-------------|-----------------------|--|
| K20-5-1004 | 4 - Twisted | 20 | 0.395 | 94 |
| K20-5-1008 | 8 - Twisted | 20 | 0.455 | 142 |
| K20-5-1012 | 12 - Twisted | 20 | 0.550 | 220 |
| K20-5-1024 | 24 - Twisted | 20 | 0.842 | 428 |

Minimum order quantities apply to all multi-pair cables. Consult factory for minimum purchase quantities, price and availability.

The thermocouple wire types listed below are not stocked at the factory, but may be available on a special order basis. Minimum order quantities may apply.

Duplex - ASTM/ANSI Type J

ASTM/ANSI Color Code: Negative wire, red; Positive wire, white; Overall brown, with Tracer where possible. Non-stock wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|------------------------|------------------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| J14-1-309 | 14 | Solid | High-temp. glass braid | High-temp. glass braid | | Std. | 0.125 x 0.195 | 36 |
| J20-1-509 | 20 | Solid | FEP extruded | Twisted polyester | FEP | Std. | 0.059 x 0.100 | 10 |
| J20-1-511 | 20 | Solid | Fused Polyimide tape | Twisted | | Std. | 0.087 | 10 |
| J20-1-516 | 20 | Solid | Extruded PFA | Extruded PFA | | Std. | 0.070 x 0.120 | 11 |
| J20-1-517 | 20 | Solid | Extruded PFA | Extruded PFA | | Std. | 0.131 | 16 |
| J20-2-305 | 20 | Solid | Glass braid | Glass braid | | Spl. | 0.054 x 0.095 | 8 |
| J24-3-508 | 24 | Strd. | Fused TFE tape | Fused TFE tape | | Std. | 0.047 x 0.086 | 7 |
| J24-1-511 | 24 | Solid | Fused Polyimide tape | Twisted | | Std. | 0.063 | 5 |
| J30-2-513 | 30 | Solid | Fused Polyimide tape | Fused Polyimide tape | | Spl. | 0.048 x 0.058 | 4 |

Duplex - ASTM/ANSI Type K

ASTM/ANSI Color Code: Negative wire, red; Positive wire, yellow; Overall brown, with Tracer where possible. Non-stock wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|------------------------|------------------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| K20-1-311 | 20 | Solid | High-temp. glass braid | High-temp. glass braid | | Std. | 0.100 x 0.150 | 16 |
| K20-1-314 | 20 | Solid | High-temp. glass braid | None - twisted | | Std. | 0.120 | 8 |
| K20-1-509 | 20 | Solid | FEP extruded | Twisted Polyester | FEP | Std. | 0.132 | 16 |
| K20-1-516 | 20 | Solid | Extruded PFA | Extruded PFA | | Std. | 0.070 x 0.120 | 11 |
| K20-1-517 | 20 | Solid | Extruded PFA | Extruded PFA | | Std. | 0.131 | 16 |
| K20-2-355 | 20 | Solid | Ceramic fiber braid | Ceramic fiber braid | | Spl. | 0.090 x 0.135 | 14 |
| K20-2-511 | 20 | Solid | Fused Polyimide tape | Fused Polyimide tape | | Spl. | 0.087 | 10 |
| K24-2-513 | 24 | Solid | Fused Polyimide tape | Fused Polyimide tape | | Spl. | 0.060 x 0.085 | 6 |
| K24-3-508 | 24 | Strd. | Fused TFE tape | Fused TFE tape | | Std. | 0.047 x 0.085 | 6 |
| K28-1-304 | 28 | Solid | Glass braid | Glass braid | | Std. | 0.039 x 0.064 | 3 |
| K28-1-305 | 28 | Solid | Glass wrap | Glass braid | | Std. | 0.036 x 0.057 | 3 |
| K30-1-305 | 30 | Solid | Glass wrap | Glass braid | | Std. | 0.043 x 0.067 | 2 |
| K30-2-506 | 30 | Solid | FEP extruded | FEP extruded | | Spl. | 0.030 x 0.050 | 4 |
| K30-2-513 | 30 | Solid | Fused Polyimide tape | Fused Polyimide tape | | Spl. | 0.048 x 0.058 | 4 |
| K36-2-506 | 36 | Solid | FEP extruded | FEP extruded | | Spl. | 0.029 x 0.042 | 2 |

The thermocouple wire types listed below are not stocked at the factory, but may be available on a special order basis. Minimum order quantities may apply.

Duplex - ASTM/ANSI Type T

ASTM/ANSI Color Code: Negative wire, red; Positive wire, blue; Overall brown, with Tracer where possible. Non-stock wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-------------|------|-----------|----------------------|----------------------|---------------------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| T20-1-S-304 | 20 | Solid | Glass braid | Glass braid | Stainless overbraid | Std. | 0.080 x 0.097 | 17 |
| T20-1-305 | 20 | Solid | Glass braid | Glass braid | | Std. | 0.054 x 0.095 | 8 |
| T20-1-508 | 20 | Solid | Fused TFE tape | Fused TFE tape | | Std. | 0.059 x 0.100 | 10 |
| T20-1-509 | 20 | Solid | FEP extruded | Twisted polyester | FEP | Std. | 0.132 | 16 |
| T20-1-516 | 20 | Solid | Extruded PFA | Extruded PFA | | Std. | 0.070 x 0.120 | 11 |
| T20-1-517 | 20 | Solid | Extruded PFA | Extruded PFA | | Std. | 0.070 x 0.120 | 16 |
| T20-2-513 | 20 | Solid | Fused Polyimide tape | Fused Polyimide tape | | Spl. | 0.065 x 0.100 | 11 |
| T20-3-512 | 20 | Strd. | Polyimide | Polyimide | | Std. | 0.055 x 0.102 | 11 |
| T24-1-S-304 | 24 | Solid | Glass braid | Glass braid | Stainless overbraid | Std. | 0.067 x 0.095 | 13 |
| T24-1-305 | 24 | Solid | Glass wrap | Glass braid | | Std. | 0.045 x 0.077 | 4 |
| T24-2-513 | 24 | Solid | Fused Polyimide tape | Fused Polyimide tape | | Spl. | 0.060 x 0.085 | 5 |
| T30-1-305 | 30 | Solid | Glass wrap | Glass braid | | Std. | 0.043 x 0.067 | 2 |
| T30-2-506 | 30 | Solid | FEP extruded | FEP extruded | | Spl. | 0.030 x 0.050 | 4 |
| T30-2-513 | 30 | Solid | Fused Polyimide tape | Fused Polyimide tape | | Spl. | 0.048 x 0.058 | 4 |
| T36-2-506 | 36 | Solid | FEP extruded | FEP extruded | | Spl. | 0.029 x 0.042 | 2 |

Duplex - ASTM/ANSI Type E

ASTM/ANSI Color Code: Negative wire, red; Positive wire, purple; Overall brown, with Tracer where possible. Non-stock wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|----------------|----------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| E20-1-508 | 20 | Solid | Fused TFE tape | Fused TFE tape | | Std. | 0.059 x 0.100 | 10 |
| E20-1-516 | 20 | Solid | Extruded PFA | Extruded PFA | | Std. | 0.070 x 0.120 | 11 |
| E20-1-517 | 20 | Solid | Extruded PFA | Extruded PFA | | Std. | 0.070 x 0.120 | 16 |

Duplex - ASTM/ANSI Type N

ASTM/ANSI Color Code: Negative wire, red; Positive wire, orange; Overall brown, with Tracer where possible. Non-stock wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-------------|------|-----------|-----------------------------|-----------------------------|---------------------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| N20-1-304 | 20 | Solid | Glass braid | Glass braid | | Std. | 0.059 x 0.097 | 8 |
| N20-2-301 | 20 | Solid | Vitreous silica fiber braid | Vitreous silica fiber braid | | Spl. | 0.100 x 0.155 | 16 |
| N24-1-304 | 24 | Solid | Glass braid | Glass braid | | Std. | 0.047 x 0.081 | 4 |
| N20-1-S-304 | 20 | Solid | Glass braid/TFE impregnated | Glass braid/TFE impregnated | Stainless overbraid | Std. | 0.075 x 0.117 | 11 |
| N20-1-S-307 | 20 | Solid | Impregnated glass braid | Glass braid | Stainless overbraid | Std. | 0.095 x 0.138 | 13 |

The thermocouple extension wire types listed below are not stocked at the factory, but may be available on a special order basis. Minimum order quantities may apply.

Duplex - ASTM/ANSI Type J

ASTM/ANSI Color Code: Negative wire, red; Positive wire, white; Overall black. Non-stock extension wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|--------------------|-------------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| J14-6-502 | 14 | Solid | Polyvinyl | Polyvinyl | | Spl. | 0.130 x 0.226 | 37 |
| J16-5-303 | 16 | Solid | Enamel glass braid | Glass braid | | Std. | 0.100 x 0.160 | 18 |
| J16-7-155 | 16 | Strd. | ServTex | ServTex braid | | Std. | 0.188 x 0.260 | 31 |
| J16-7-515 | 16 | Strd. | ETFE | Twisted polyester | | Std. | 0.185 | 29 |
| J20-5-514 | 20 | Solid | ETFE | ETFE | ETFE | Std. | 0.080 x 0.130 | 10 |

Duplex - ASTM/ANSI Type KX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, yellow; Overall yellow. Non-stock extension wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|----------------|-------------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| K14-5-502 | 14 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.130 x 0.226 | 38 |
| K16-7-515 | 16 | Strd. | ETFE | Twisted Polyester | ETFE | Std. | 0.185 | 30 |
| K20-5-514 | 20 | Solid | ETFE | ETFE | | Std. | 0.080 x 0.130 | 10 |

Duplex - ASTM/ANSI Type TX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, blue; Overall blue. Non-stock extension wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|----------------|--------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| T16-5-502 | 14 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.111 x 0.188 | 38 |
| T20-7-502 | 16 | Strd. | Polyvinyl | Polyvinyl | | Std. | 0.108 x 0.185 | 30 |

Duplex - ASTM/ANSI Type EX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, purple; Overall purple. Non-stock extension wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|----------------|-------------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| E16-7-515 | 16 | Strd. | ETFE | Twisted polyester | ETFE | Std. | 0.185 | 30 |
| E20-5-502 | 20 | Solid | Polyvinyl | Polyvinyl | | Std. | 0.095 x 0.158 | 15 |

Duplex - ASTM/ANSI Type NX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, orange; Overall orange. Non-stock extension wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|----------------|-------------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| N20-5-510 | 20 | Solid | Polyvinyl | Twisted polyester | PVC | Std. | 0.170 | 20 |

Duplex - ASTM/ANSI Type SX and RX

ASTM/ANSI Color Code: Negative wire, red; Positive wire, black; Overall green; Compensating extension wire for ANSI Types R, S thermocouples. Non-stock extension wire

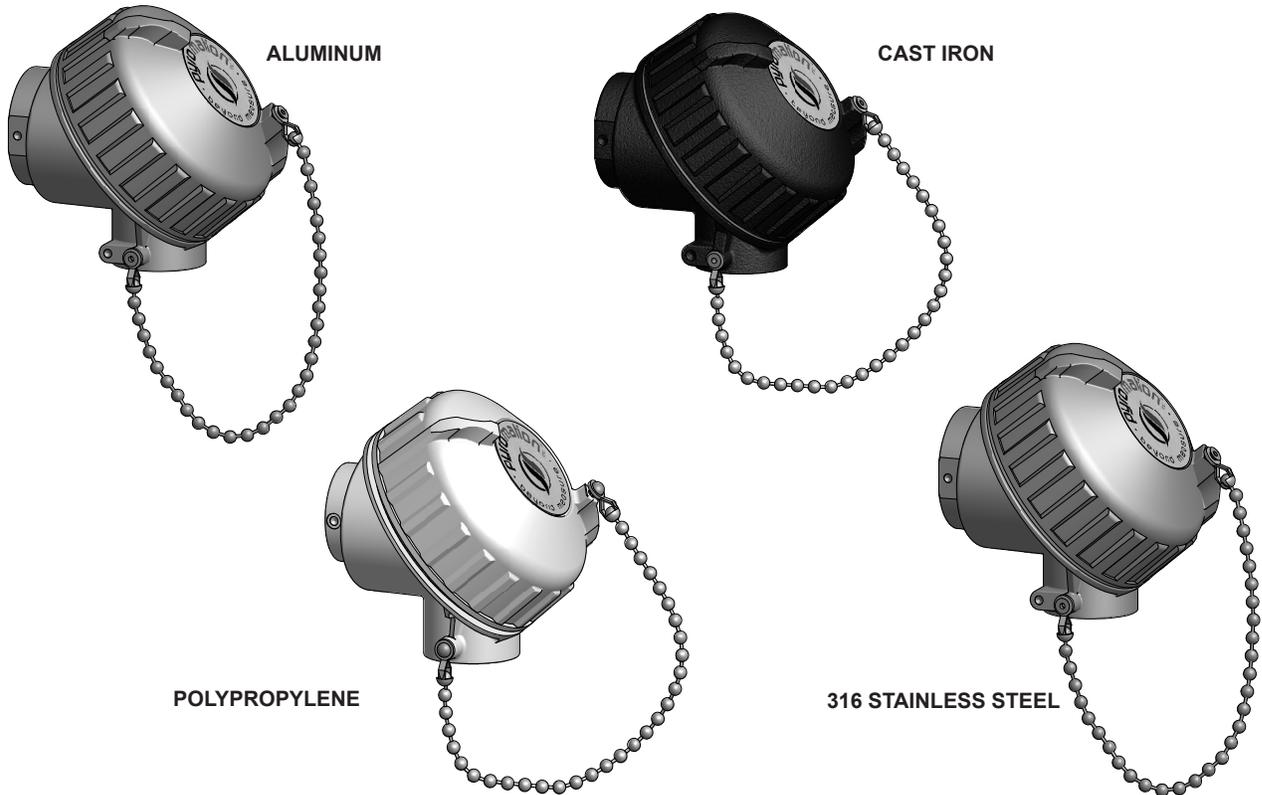
| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|----------------|--------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| S24-5-304 | 24 | Solid | Glass Braid | Glass Braid | | Std. | 0.045 x 0.077 | 4 |

Tungsten/Tungsten Rhenium Type C

ASTM/ANSI Color Code: Negative wire, red; Positive wire, orange; Overall orange. Non-stock extension wire

| CODE | AWG. | CONDUCTOR | INSULATIONS | | | LIMITS OF ERROR | NOMINAL SIZE (inches) | WEIGHT per 1000 FT. (pounds) |
|-----------|------|-----------|----------------|--------------|---------|-----------------|-----------------------|------------------------------|
| | | | EACH CONDUCTOR | OUTER JACKET | OVERALL | | | |
| C24-5-304 | 24 | Solid | Glass Braid | Glass Braid | | Std. | 0.045 x 0.072 | 7 |

The general-purpose, screw-cover connection heads listed below are NEMA/IP66 rated for indoor or outdoor use providing protection against dust, rain, splashing and hose-directed water. These Pyromation design-patented connection heads have easy access, one-turn caps; accept Pyromation 300 series and DIN terminal blocks and transmitters, and provides greater volume for ease of field wiring. Please refer to page AC-5 & 6 for additional head descriptions and complete specifications.



ORDER CODES

Example Order Number: 1-1 **31C** - 1-2 **GS-OR** - 1-3 **343-3**

1-1 General-Purpose Aluminum

| ORDER CODE | DESCRIPTION | | |
|------------|-----------------|-----------------|-----------------|
| | Process Opening | Conduit Opening | Standard Gasket |
| 31A | 1/8" NPT | 3/4" NPT | Graphite |
| 31B | 1/4" NPT | 3/4" NPT | Graphite |
| 31Q | 3/8" NPT | 3/4" NPT | Graphite |
| 31C | 1/2" NPT | 3/4" NPT | Graphite |
| 31D | 3/4" NPT | 3/4" NPT | Graphite |
| 31E | 1" NPT | 3/4" NPT | Graphite |

1-1 General-Purpose Cast Iron

| ORDER CODE | DESCRIPTION | | |
|------------|-----------------|-----------------|-----------------|
| | Process Opening | Conduit Opening | Standard Gasket |
| 34C | 1/2" NPT | 3/4" NPT | Graphite |
| 34D | 3/4" NPT | 3/4" NPT | Graphite |
| 34E | 1" NPT | 3/4" NPT | Graphite |

1-1 General-Purpose 316 Stainless Steel

| ORDER CODE | DESCRIPTION | | |
|------------|-----------------|-----------------|-----------------|
| | Process Opening | Conduit Opening | Standard Gasket |
| 91C | 1/2" NPT | 3/4" NPT | Graphite |
| 91D | 3/4" NPT | 3/4" NPT | Graphite |

1-1 General-Purpose White Polypropylene

| ORDER CODE | DESCRIPTION | | |
|------------|-----------------|-----------------|-----------------|
| | Process Opening | Conduit Opening | Standard Gasket |
| 63C | 1/2" NPT | 3/4" NPT | Buna N O-ring |

1-2 Head Options

| ORDER CODE | DESCRIPTION |
|------------|-----------------------|
| W [1] | White epoxy coating |
| PS | Process set screw |
| GS | Internal ground screw |
| OR | Buna N O-ring |
| HS | Security screw |

[1] Only available on 31C

1-3 Terminal Blocks

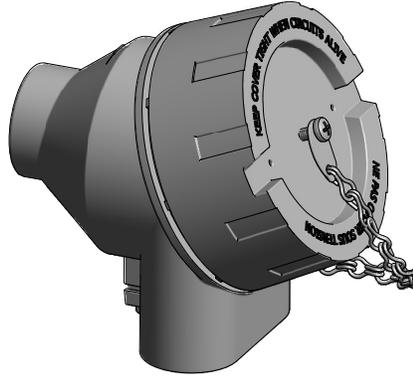
| ORDER CODE | DESCRIPTION | CONDUCTOR SIZE |
|------------|---|----------------|
| 341 | Single terminal block | Up to 8 AWG |
| 342 | Duplex terminal block | Up to 8 AWG |
| 343-2 | Triplex terminal block with 2 brass terminals | Up to 12 AWG |
| 343-3 | Triplex terminal block with 3 brass terminals | Up to 12 AWG |
| 343-4 | Triplex terminal block with 4 brass terminals | Up to 12 AWG |
| 343-6 | Triplex terminal block with 6 brass terminals | Up to 12 AWG |

Refer to page AC-4 for block specifications.

The hazardous location-rated connection heads shown below are designed for Class I, Division I locations. Please refer to page AC-7 for descriptions, specifications and ratings for each head. See the "Overview of NEC Hazardous Location Classifications and Methods of Protection" table in the Explosion-Proof (XP) Sensors section of the Pyromation catalog for complete definitions of ratings.



**93 Series XP
Connection Heads**



**215807 Series XP
Connection Head**



**94 Series XP
Connection Heads**

ORDER CODES

Example Order Number:

1-1 1-2
93C - 341

1-1 Explosion-Proof Aluminum

| ORDER CODE | DESCRIPTION | | | Maximum Gas Group Rating |
|------------|-----------------|-----------------|-----------------|--------------------------|
| | Process Opening | Conduit Opening | Standard Gasket | |
| 93C | 1/2" NPT | 3/4" NPT | Buna N O-ring | B |
| 93D | 3/4" NPT | 3/4" NPT | Buna N O-ring | B |

1-1 Explosion-Proof 316 Stainless Steel

| ORDER CODE | DESCRIPTION | | | Maximum Gas Group Rating |
|------------|-----------------|-----------------|-----------------|--------------------------|
| | Process Opening | Conduit Opening | Standard Gasket | |
| 94C | 1/2" NPT | 3/4" NPT | Buna N O-ring | A |
| 94D | 3/4" NPT | 3/4" NPT | Buna N O-ring | A |

1-1 Explosion-Proof Aluminum DIN Style

| ORDER CODE | DESCRIPTION | | | Maximum Gas Group Rating |
|------------|-----------------|-----------------|-----------------|--------------------------|
| | Process Opening | Conduit Opening | Standard Gasket | |
| 215807 | 1/2" NPT | 3/4" NPT | Buna N O-ring | A |

1-2 Ceramic Terminal Blocks^[1]

| ORDER CODE | DESCRIPTION | CONDUCTOR SIZE |
|------------|---|----------------|
| 341 | Single terminal block | Up to 8 AWG |
| 342 | Duplex terminal block | Up to 8 AWG |
| 343-2 | Triplex terminal block with 2 brass terminals | Up to 12 AWG |
| 343-3 | Triplex terminal block with 3 brass terminals | Up to 12 AWG |
| 343-4 | Triplex terminal block with 4 brass terminals | Up to 12 AWG |
| 343-6 | Triplex terminal block with 6 brass terminals | Up to 12 AWG |

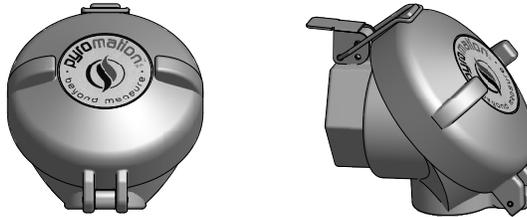
^[1] Not available with 215807 head.

1-2 DIN Form B Style Ceramic Terminal Blocks

| ORDER CODE | DESCRIPTION | CONDUCTOR SIZE |
|------------|---|----------------|
| 210304 | Duplex terminal block | Up to 16 AWG |
| 210332 | Triplex terminal block with 2 brass terminals | Up to 16 AWG |
| 210333 | Triplex terminal block with 3 brass terminals | Up to 16 AWG |
| 210334 | Triplex terminal block with 4 brass terminals | Up to 16 AWG |
| 210336 | Triplex terminal block with 6 brass terminals | Up to 16 AWG |

DIE-CAST ALUMINUM FLIP-TOP CONNECTION HEADS

The 49 series flip-top aluminum connection heads listed below meet NEMA 4 requirements for indoor or outdoor applications. The 49 series flip-top aluminum head utilize an EPDM O-ring seal with a maximum temperature rating of 400 °F. The flip cover provides easy access to the terminals for wiring or maintenance. These connection heads accept the Pyromation 340 series terminal blocks, 400 series transmitters, and DIN Form B blocks and transmitters.



Example Order Number:

1-1 1-2 1-3
49C - GS - 343-3

1-1 General-Purpose Aluminum Flip-Top

| ORDER CODE | DESCRIPTION | | |
|------------|-----------------|-----------------|-----------------|
| | Process Opening | Conduit Opening | Standard Gasket |
| 49C | 1/2" NPT | 3/4" NPT | EPDM O-ring |
| 49D | 3/4" NPT | 3/4" NPT | EPDM O-ring |

1-2 Head Options

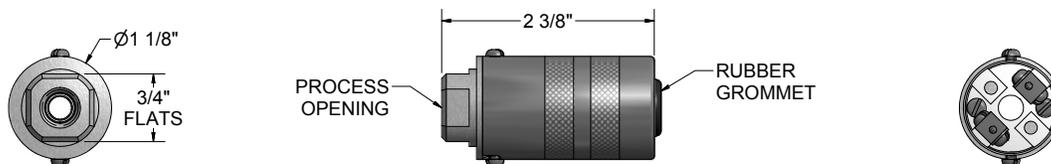
| ORDER CODE | DESCRIPTION |
|------------|-----------------------|
| GS | Internal ground screw |

1-3 Terminal Blocks

| ORDER CODE | DESCRIPTION | CONDUCTOR SIZE |
|------------|---|----------------|
| 341 | Single terminal block | Up to 8 AWG |
| 342 | Duplex terminal block | Up to 8 AWG |
| 343-2 | Triplex terminal block with 2 brass terminals | Up to 12 AWG |
| 343-3 | Triplex terminal block with 3 brass terminals | Up to 12 AWG |
| 343-4 | Triplex terminal block with 4 brass terminals | Up to 12 AWG |
| 343-6 | Triplex terminal block with 6 brass terminals | Up to 12 AWG |

MINIATURE NICKEL-PLATED STEEL CONNECTION HEADS

The miniature nickel-plated connection heads listed below are for indoor or outdoor non-hazardous locations. They provide some degree of protection from dust, rain, and splashing water. The heads come standard with an O-ring moisture seal where the cap connects to the body, and a rubber grommet where the wire exits the cap. The nickel plating provides good corrosion protection. The 362 series connection heads are available with a 1/8" NPT or 1/4" NPT process connections, along with 2-, 3-, or 4-terminal configurations.



Example Order Number:

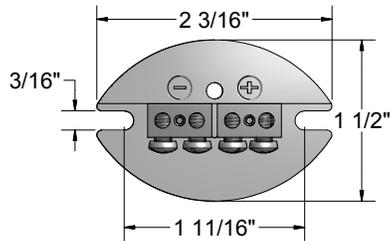
1-1
364A

1-1 Complete Head Assemblies

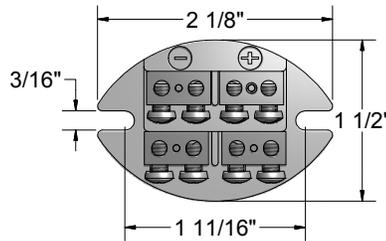
| CODE | NO. OF TERMINALS | PROCESS OPENING (inches) | CODE | NO. OF TERMINALS | PROCESS OPENING (inches) |
|------|------------------|--------------------------|------|------------------|--------------------------|
| 362A | 2 | 1/8 NPT | 362B | 2 | 1/4 NPT |
| 363A | 3 | 1/8 NPT | 363B | 3 | 1/4 NPT |
| 364A | 4 | 1/8 NPT | 364B | 4 | 1/4 NPT |

CERAMIC TERMINAL BLOCKS

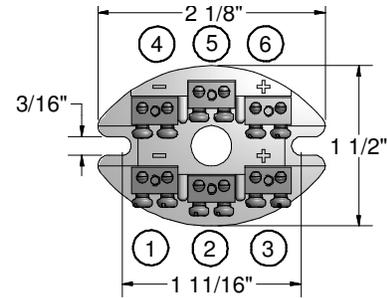
The terminal blocks, listed below, fit all Pyromation series 31, 34, 49, 63, 91 and 800 series connection heads. The terminal blocks are provided with a steatite ceramic base, brass terminal pieces, and stainless steel screws. These terminal blocks are not rated for high voltage use, but can be used in temperature sensor or low voltage Class 2 circuits. Series 341 and 342 terminal blocks accept up to an #8 gauge wire, and the series 343 accepts up to a #12 gauge wire.



Series 341



Series 342



Series 343

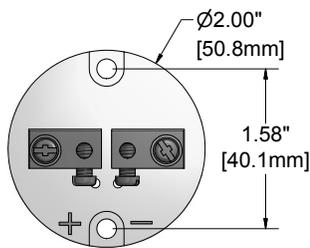
(See table for complete 343- Series)

Terminal Blocks

| CODE | DESCRIPTION | CONDUCTOR SIZE | TERMINAL POSITION AS SUPPLIED |
|-------|---|----------------|-------------------------------|
| 341 | Single terminal block | Up to 8 AWG | N/A |
| 342 | Duplex terminal block | Up to 8 AWG | N/A |
| 343-2 | Triplex terminal block with 2 brass terminals | Up to 12 AWG | ①-③ |
| 343-3 | Triplex terminal block with 3 brass terminals | Up to 12 AWG | ②-④-⑥ |
| 343-4 | Triplex terminal block with 4 brass terminals | Up to 12 AWG | ①-③-④-⑥ |
| 343-6 | Triplex terminal block with 6 brass terminals | Up to 12 AWG | All Positions |

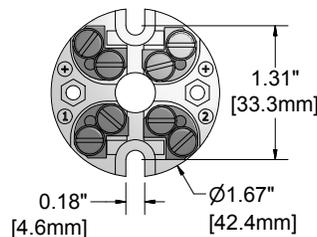
DIN FORM B STYLE CERAMIC TERMINAL BLOCKS

The DIN Style terminal blocks are 42 mm and 50 mm in diameter. The terminal blocks are supplied with a ceramic base. They can be provided in 2-, 3-, 4-, or 6-terminal configurations.

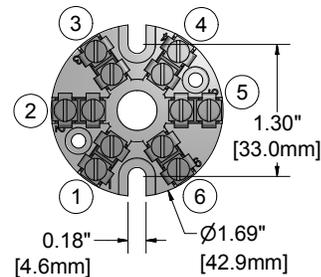


210412

Dimensions In Inches [mm]



210304



210336

(See table for complete 21033- Series)

Terminal Blocks

| CODE | DESCRIPTION | CONDUCTOR SIZE | TERMINAL POSITIONS |
|-----------------------|---------------------------------------|----------------|--------------------|
| 210412 ^[1] | 2-Pole terminal block (8, 11, 14 AWG) | Up to 8 AWG | N/A |
| 210304 | 4-Pole terminal block | Up to 16 AWG | N/A |
| 210332 | 2-Pole terminal block | Up to 16 AWG | ①-③ |
| 210333 | 3-Pole terminal block | Up to 16 AWG | ①-③-⑤ |
| 210334 | 4-Pole terminal block | Up to 16 AWG | ①-③-④-⑥ |
| 210336 | 6-Pole terminal block | Up to 16 AWG | All positions |

[1] Not available with 215807

These general-purpose connection heads are designed and manufactured by Pyromation. The enhanced connection head series design provides^[1]:

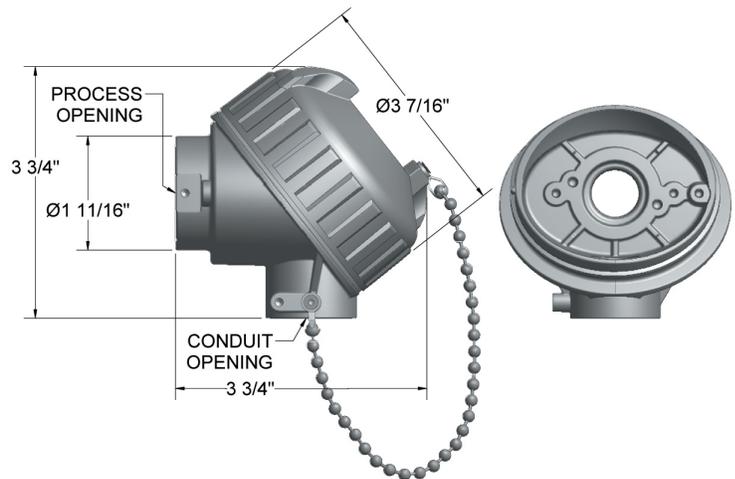
- Greater internal volume for easier wire termination and storage
- Elevated terminal block allowing easy access to terminals for attachment of extension wire
- Conduit stop to prevent damage to interior wiring/block/transmitter during installation
- Optional ground screw (not available on the polypropylene head) and process set screw positions
- Easy single-twist cap removal that maintains strong seal when closed

[1] The connection head series changes are not incorporated in the flip-top aluminum connection head.

GENERAL-PURPOSE, DIE-CAST ALUMINUM CONNECTION HEADS

The General-Purpose, Die-cast Aluminum connection heads are NEMA 4X/IP66 rated for indoor or outdoor use, providing protection against dust, rain, splashing and hose-directed water.

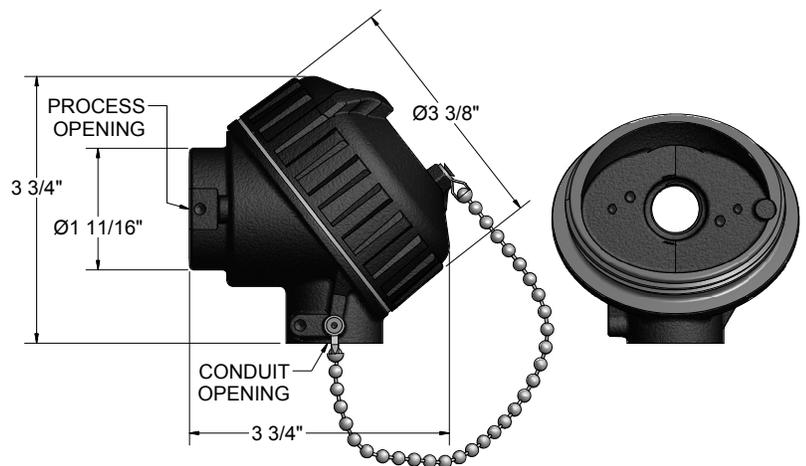
Some configurations are available in a white epoxy coating (which comes with an O-ring seal). All other units come with a standard graphite material gasket that provides good chemical stability, superior creep resistance and a maximum temperature rating of 825 °F. These heads accept Pyromation 340 series terminal blocks or 400 series transmitters and DIN Form B blocks or transmitters.



GENERAL-PURPOSE, CAST IRON CONNECTION HEADS

The General-Purpose, Cast Iron connection heads are NEMA 4X/IP66 rated for indoor or outdoor use, providing protection against dust, rain, splashing and hose-directed water.

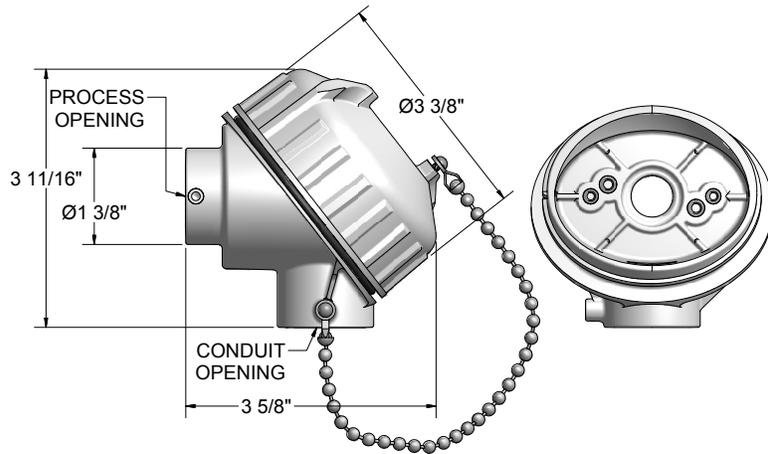
These heads have a black epoxy electrocoat that provides good corrosion- and chemical-resistance; however, it does not provide UV protection for outdoor applications. These heads include a standard graphite material gasket that provides good chemical stability, superior creep resistance and a maximum temperature rating of 825 °F. Pyromation 340 series terminal blocks or 400 series transmitters and DIN Form B blocks or transmitters can be mounted in these heads.



GENERAL-PURPOSE, POLYPROPYLENE (PLASTIC) CONNECTION HEADS

The plastic connection heads are molded from white polypropylene and include a stainless steel cap chain and pins. They have been tested and meet NEMA 4X wash-down and corrosion requirements for indoor or outdoor use, providing protection against dust, rain, splashing and hose-directed water. The head material is FDA approved for food contact.

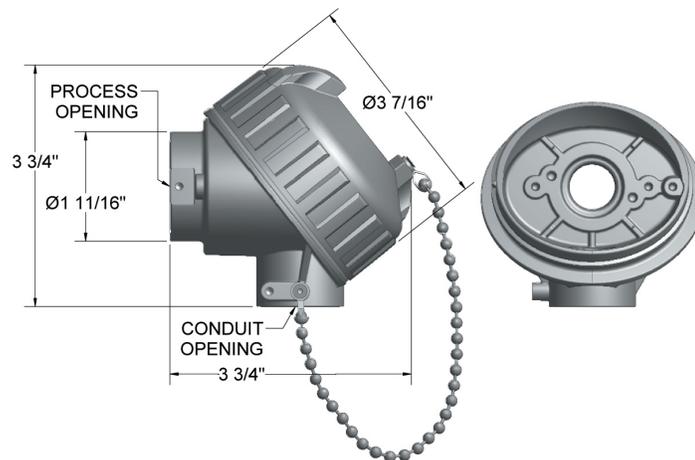
These heads come with an O-ring seal providing a maximum temperature rating of 250 °F. Each head has a ½" NPT process opening and a ¼" conduit opening. They will accept Pyromation 340 series blocks, 400 series transmitters and DIN Form B blocks or transmitters.



GENERAL-PURPOSE, STAINLESS STEEL CONNECTION HEADS

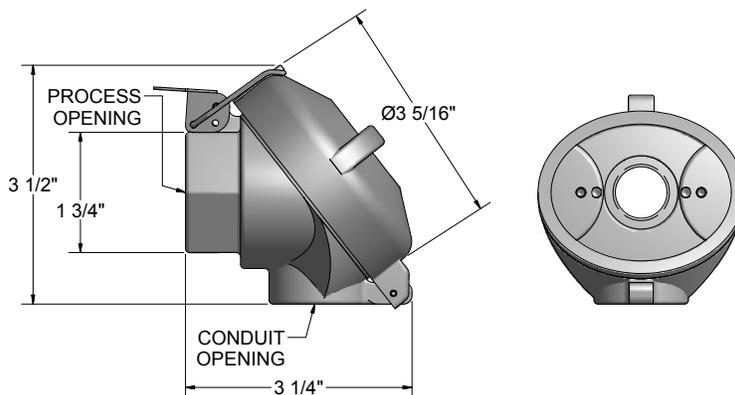
The General-Purpose, 316L Stainless Steel connection heads are NEMA 4X/IP66 rated for indoor or outdoor use, providing protection against dust, rain, splashing and hose-directed water.

The stainless steel heads offer excellent corrosion- and chemical-resistance. They include a standard graphite material gasket that provides good chemical stability, superior creep resistance and a maximum temperature rating of 825 °F. These heads accept Pyromation 340 series terminal blocks, 400 series transmitters and DIN Form B blocks or transmitters.



GENERAL-PURPOSE, FLIP-TOP ALUMINUM CONNECTION HEADS

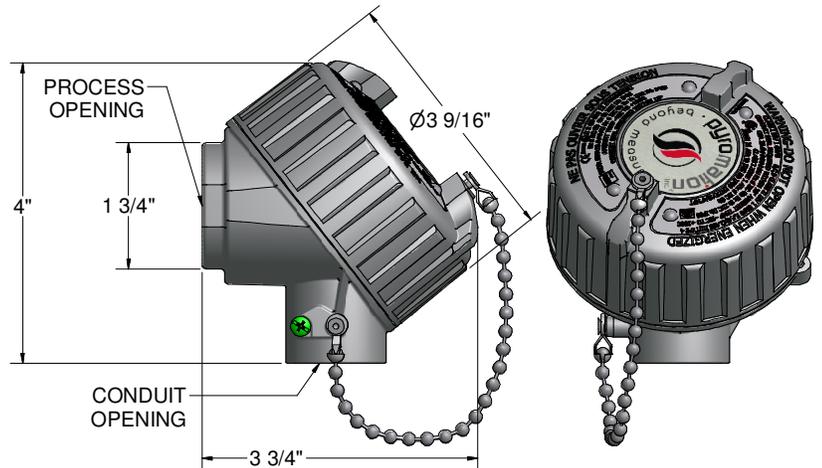
These Flip-Top, Die-cast Aluminum connection heads feature an easy-to-open, flip-top cap that is hinged on one side so the cap cannot be lost. These heads come with a standard O-ring that provides good chemical stability, excellent wet/steam sealing characteristics and a maximum temperature rating of 400 °F. The heads accept Pyromation 340 series terminal blocks, 400 series transmitters and DIN Form B blocks or transmitters.



These connection heads are designed for use in hazardous locations; places where flammable or explosive conditions exist. The following connection head types meet CSA or FM standards for hazardous locations and, depending on application, can be used as part of explosion-proof (XP) temperature sensor assemblies in Class I, Division I hazardous locations.

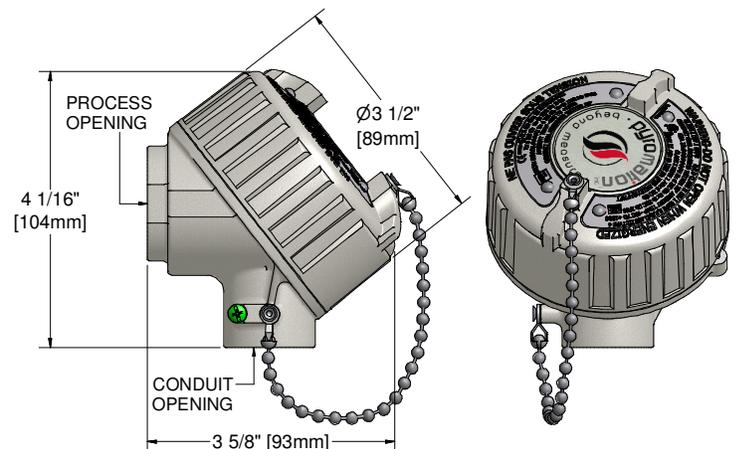
93 SERIES ALUMINUM CONNECTION HEADS

The series 93 connection heads are FM and CSA listed and meet the requirements for Class I, Division I Groups B, C and D; Class II Groups E, F and G. These connection heads accommodate any of the 340 series or DIN Form B terminal blocks and a variety of transmitters including Pyromation head-mounted transmitters. These heads also are NEMA 4 and IP66 rated.



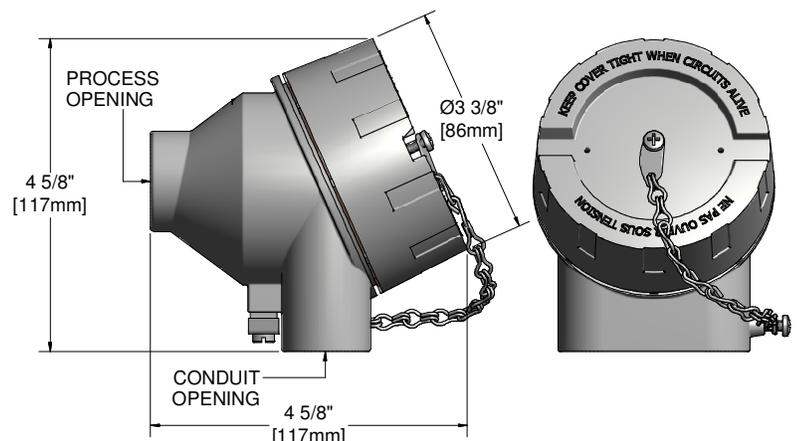
94 SERIES 316L STAINLESS STEEL SCREW-COVER CONNECTION HEADS

The series 94 connection heads are FM and CSA listed and meet the requirements for Class I, Division I Groups A, B, C and D; Class II Groups E, F and G. These connection heads accommodate any of the 340 series or DIN Form B terminal blocks and a variety of transmitters including Pyromation head-mounted transmitters. These heads also are NEMA 4X and IP66 rated.

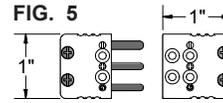
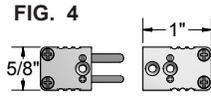
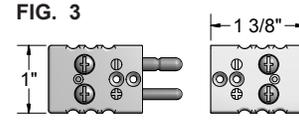
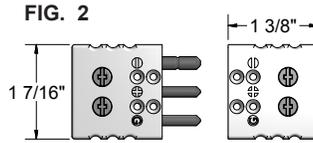
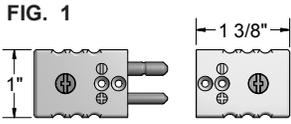


DIN STYLE SCREW-COVER CONNECTION HEADS

The 215807 is an aluminum DIN Style connection head with a 1/2" NPT process opening and a 3/4" conduit connection. The second conduit opening is built-in for optional dual access. It is also FM and CSA listed. This head meets the requirements for Class I, Division I Groups A, B, C and D for use in hazardous locations as outlined by the National Electrical Code (NEC). These heads meet NEMA 4 requirements.



STANDARD and MINIATURE PLUGS and JACKS



EXAMPLE ORDER NUMBER: 81J or 81J-H

Standard Plugs

| CODE | | DESCRIPTION | | | | |
|----------------------------------|-----------------------|-------------|----------|-------------|----------|--|
| STANDARD PLUGS | STANDARD JACKS | NO. PINS | PIN TYPE | TEMP RATING | FIG. NO. | |
| 81 ^[1] | 82 ^[1] | 2 | Hollow | 200 °C | 1 | |
| 81U ^[1] - 3 | 82 ^[1] - 3 | 3 | Hollow | 200 °C | 2 | |
| 81 ^[1] - H | 82 ^[1] - H | 2 | Hollow | 350 °C | 1 | |
| 2 Pin JAB - In Connectors | | | | | | |
| 81 ^[1] - J | 82 ^[1] - J | 14 ga. max | | 200 °C | 3 | |
| 61K - E | 62K - E | 8 ga. max | | 177 °C | 3 | |

[1] = Insert calibration code J, K, T, E, N, R, S, or U

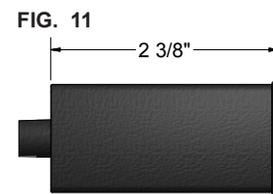
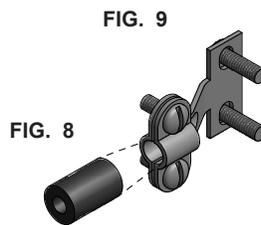
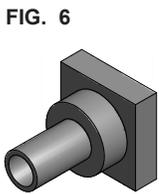
EXAMPLE ORDER NUMBER: 84K-H

Miniature Plugs

| CODE | | DESCRIPTION | | | | |
|------------------------|-----------------------|-------------|-------------|----------|--|--|
| MINIATURE PLUGS | MINIATURE JACKS | NO. PINS | TEMP RATING | FIG. NO. | | |
| 83 ^[1] | 84 ^[1] | 2 | 200 °C | 4 | | |
| 83U ^[1] - 3 | 84 ^[1] - 3 | 3 | 200 °C | 5 | | |

[1] Insert calibration code J, K, T, E, N, R, S, or U

MOUNTING HARDWARE FOR PLUGS AND JACKS



EXAMPLE ORDER NUMBER: 8S1 or 8S2-2

Mounting Hardware

| CODE | DESCRIPTION | FIG. NO. |
|----------------------|---|----------|
| 8S1 | Std. size cable clamp for 200 and 350 °C connectors | 9 |
| 8S2 - ^[1] | Std. size brass crimp adaptor for 200 and 350 °C connectors | 6 |
| 8S3 - ^[1] | Std. size compression bracket for 200 and 350 °C connectors | 7 |
| 8M1 | Mini cable clamp | 9 |
| 8M2 - ^[1] | Mini brass crimp adaptor | 6 |

[1] = Insert tube size code where required 1 = 1/16" 2 = 1/8"
3 = 3/16" 4 = 1/4" (1/4" O.D. is not available with mini brass crimp)

Miscellaneous Hardware

| CODE | DESCRIPTION | FIG. NO. |
|-----------------------------|------------------------------------|----------|
| Standard Connectors | | |
| 811 | Rubber boot for 200 °F connectors | 11 |
| 816 | Wire grommet for 200 °F connectors | 10 |
| 629 | Cable clamp bushing | 8 |
| Miniature Connectors | | |
| 821 | Wire grommet | 10 |
| 831 | Rubber boot | 11 |
| 629 | Cable clamp bushing | 8 |

THERMOCOUPLE AND RTD JACK PANELS FOR FS CONDUIT BOX MOUNTING

All listed panels are 2(3/4)" w x 4(1/2)" h aluminum plates

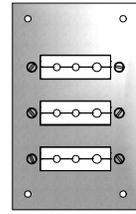
FIG. 1



FIG. 2



FIG. 3



EXAMPLE ORDER NUMBER: FMF-K-3

Thermocouple Jack Panels

| CODE | | DESCRIPTION | |
|---------------|----------------|--------------|----------|
| STANDARD SIZE | MINIATURE SIZE | NO. CIRCUITS | FIG. NO. |
| FSB - [1] - 1 | FMF - [1] - 1 | 1 | 1 |
| FSB - [1] - 2 | FMF - [1] - 2 | 2 | 1 |
| FSB - [1] - 3 | FMF - [1] - 3 | 3 | 1 |
| FSB - [1] - 4 | FMF - [1] - 4 | 4 | 1 |
| FSB - [1] - 5 | FMF - [1] - 5 | 5 | 1 |
| FSF - [1] - 6 | FMF - [1] - 6 | 6 | 1 |

[1] = Insert calibration code J,K,T,E,N,R,S, or U (type N supplied in standard size only).

3-Wire RTD Jack Panels

| CODE | | DESCRIPTION | |
|-----------------|--------------|-------------|--|
| STANDARD SIZE | NO. CIRCUITS | FIG. NO. | |
| FSF - U - 1 - T | 1 | 3 | |
| FSF - U - 2 - T | 2 | 3 | |
| FSF - U - 3 - T | 3 | 3 | |
| FSF - U - 4 - T | 4 | 3 | |
| FSF - U - 5 - T | 5 | 3 | |
| FSF - U - 6 - T | 6 | 3 | |

Above panels are 3-pin connections.

FS Conduit Boxes For Above Jack Panels

| CODE | BOX MATERIAL | MAX. NUMBER OF CIRCUITS | CONDUIT OPENING (inches) | FIG. NO. |
|------|------------------|-------------------------|--------------------------|----------|
| 638 | Diecast aluminum | 4 | 3/4 NPT | 2 |
| 640 | Diecast aluminum | 5 | 3/4 NPT | 2 |
| 639 | Glass/nylon | 6 | 3/4 NPT | 2 |

THERMOCOUPLE AND RTD JACK PANELS

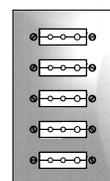
FIG. 4



FIG. 5



FIG. 6



EXAMPLE ORDER NUMBER: SSB-T-8

Thermocouple Jack Panels

| CODE | | DESCRIPTION | |
|----------------|----------------|--------------|----------|
| STANDARD SIZE | MINIATURE SIZE | NO. CIRCUITS | FIG. NO. |
| 82 - [1] - R | 84 - [1] - R | 1 | 4 |
| SSB - [1] - 6 | SMF - [1] - 6 | 6 | 5 |
| SSB - [1] - 8 | SMF - [1] - 8 | 8 | 5 |
| SSB - [1] - 10 | SMF - [1] - 10 | 10 | 5 |
| SSB - [1] - 12 | SMF - [1] - 12 | 12 | 5 |

[1] = Insert calibration code J,K,T,E,N,R,S, or U. (type N supplied in standard size only)

3-Wire RTD Jack Panels

| CODE | | DESCRIPTION | |
|------------------|--------------|-------------|--|
| STANDARD SIZE | NO. CIRCUITS | FIG. NO. | |
| SSF - U - 6 - T | 6 | 6 | |
| SSF - U - 8 - T | 8 | 6 | |
| SSF - U - 10 - T | 10 | 6 | |
| SSF - U - 12 - T | 12 | 6 | |

Above panels are 3-pin connections.

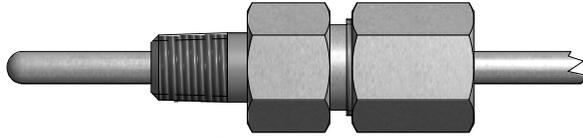
Jack Panels Dimensions

| NO. CIRCUITS | WIDTH (inches) | LENGTH (inches) | WIDTH (inches) | | LENGTH (inches) | |
|--------------|---|-----------------|----------------|----------------|-----------------|----------------|
| | | | STANDARD SIZE | MINIATURE SIZE | STANDARD SIZE | MINIATURE SIZE |
| 6 | 3 1/4 | 5 3/4 | 2 | 5 | | |
| 8 | 3 1/4 | 7 1/4 | 2 | 6 | | |
| 10 | 3 1/4 | 8 3/4 | 2 | 7 1/4 | | |
| 12 | 3 1/4 | 10 1/4 | 2 | 8 1/2 | | |
| 1 | Conduit knockout sizes for round panel jacks. Standard size: 3/4" Miniature size: 1/2" | | | | | |

Standard and miniature jack panels can be custom designed to provide other dimensions, number of jacks, or mixed calibrations. Consult factory for availability.



RE-ADJUSTABLE COMPRESSION FITTINGS



Stainless Steel with FEP Ferrule

| CODE | TUBE SIZE (inches) | PROCESS THREAD (inches) | LENGTH (inches) |
|----------|--------------------|-------------------------|-----------------|
| 6109T-1A | 1/16 O.D. | 1/8 NPT | 1 1/4 |
| 6109T-2A | 1/8 O.D. | 1/8 NPT | 1 1/4 |
| 6109T-3A | 3/16 O.D. | 1/8 NPT | 1 1/4 |
| 6109T-4B | 1/4 O.D. | 1/4 NPT | 2 1/2 |
| 6109T-6B | 3/8 O.D. | 1/4 NPT | 2 1/2 |
| 6109T-4C | 1/4 O.D. | 1/2 NPT | 2 1/2 |
| 6109T-6C | 3/8 O.D. | 1/2 NPT | 2 1/2 |

Stainless Steel Re-Adjustable Spring-Loaded Well Fittings with FEP Ferrule

| CODE | TUBE SIZE (inches) | PROCESS THREAD (inches) | LENGTH (inches) |
|------------|--------------------|-------------------------|-----------------|
| 6109TSL-3C | 3/16 O.D. | 1/2 NPT | 2 3/8 |
| 6109TSL-4C | 1/4 O.D. | 1/2 NPT | 2 3/8 |

Brass with FEP Ferrule

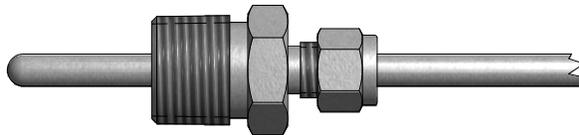
| CODE | TUBE SIZE (inches) | PROCESS THREAD (inches) | LENGTH (inches) |
|----------|--------------------|-------------------------|-----------------|
| 6122T-1A | 1/16 O.D. | 1/8 NPT | 1 |
| 6122T-2A | 1/8 O.D. | 1/8 NPT | 1 1/4 |
| 6122T-3A | 3/16 O.D. | 1/8 NPT | 1 1/4 |
| 6122T-2B | 1/8 O.D. | 1/4 NPT | 1 3/8 |
| 6122T-3B | 3/16 O.D. | 1/4 NPT | 1 1/2 |
| 6122T-4B | 1/4 O.D. | 1/4 NPT | 1 1/2 |
| 6122T-6B | 3/8 O.D. | 1/4 NPT | 1 9/16 |
| 6122T-4C | 1/4 O.D. | 1/2 NPT | 1 13/16 |
| 6122T-6C | 3/8 O.D. | 1/2 NPT | 1 13/16 |

Ferrule Temperature Ratings

| CODE | MATERIAL | MAX. TEMP. |
|------|----------|------------|
| N | Neoprene | 200 °F |
| T | FEP | 450 °F |
| L | Lava | 1600 °F |

Substitute ferrule code N or L for the letter T for fittings supplied with other than FEP ferrules.

ONE-TIME ADJUSTABLE COMPRESSION FITTINGS



Stainless Steel with SS Ferrule

| CODE | TUBE SIZE (inches) | PROCESS THREAD (inches) | LENGTH (inches) |
|---------|--------------------|-------------------------|-----------------|
| 6009-1A | 1/16 O.D. | 1/8 NPT | 1 1/4 |
| 6009-2A | 1/8 O.D. | 1/8 NPT | 1 1/4 |
| 6009-3A | 3/16 O.D. | 1/8 NPT | 1 1/4 |
| 6009-4A | 1/4 O.D. | 1/8 NPT | 1 1/4 |
| 6008-2B | 1/8 O.D. | 1/4 NPT | 1 7/16 |
| 6008-3B | 3/16 O.D. | 1/4 NPT | 1 1/2 |
| 6008-4B | 1/4 O.D. | 1/4 NPT | 1 9/16 |
| 6008-6B | 3/8 O.D. | 1/4 NPT | 1 5/8 |
| 6008-2C | 1/8 O.D. | 1/2 NPT | 1 5/8 |
| 6008-4C | 1/4 O.D. | 1/2 NPT | 1 3/4 |
| 6008-6C | 3/8 O.D. | 1/2 NPT | 1 7/8 |

Brass with Brass Ferrule

| CODE | TUBE SIZE (inches) | PROCESS THREAD (inches) | LENGTH (inches) |
|---------|--------------------|-------------------------|-----------------|
| 6022-2A | 1/8 O.D. | 1/8 NPT | 1 1/16 |
| 6022-3A | 3/16 O.D. | 1/8 NPT | 1 1/16 |
| 6022-4A | 1/4 O.D. | 1/8 NPT | 1 3/16 |
| 6022-3B | 3/16 O.D. | 1/4 NPT | 1 3/16 |
| 6022-4B | 1/4 O.D. | 1/4 NPT | 1 1/4 |
| 6022-6B | 3/8 O.D. | 1/4 NPT | 1 5/16 |
| 6022-4C | 1/4 O.D. | 1/2 NPT | 1 3/8 |
| 6022-6C | 3/8 O.D. | 1/2 NPT | 1 1/2 |

FIG. 1

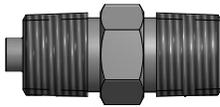


FIG. 2

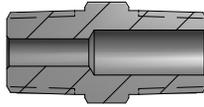


FIG. 3

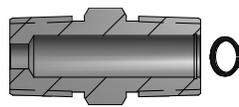


FIG. 4

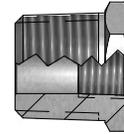


FIG. 5



Machined Double Thread Hex Fittings

| CODE | SHEATH SIZE (inches) | DESCRIPTION | FIG. NO |
|---|----------------------|------------------------------|---------|
| <i>CARBON STEEL 1/2" NPT x 1/2" NPT</i> | | | |
| 6HN-CC-125-B | 0.125 | Braze hub | 1 |
| 6HN-CC-188-B | 0.188 | Braze hub | 1 |
| 6HN-CC-250-B | 0.250 | Braze hub | 1 |
| 6HN-CC-375-B | 0.375 | Braze hub | 1 |
| 6HN-CC-188-SL | 0.188 | Spring-loaded | 2 |
| 6HN-CC-250-SL | 0.250 | Spring-loaded | 2 |
| 6HN-CC-188-SC ^[1] | 0.188 | Self contained spring-loaded | 3 |
| 6HN-CC-250-SC ^[1] | 0.250 | Self contained spring-loaded | 3 |
| <i>316SS 1/2" NPT x 1/2" NPT</i> | | | |
| 8HN-CC-125-W | 0.125 | Weld hub | 1 |
| 8HN-CC-188-W | 0.188 | Weld hub | 1 |
| 8HN-CC-250-W | 0.250 | Weld hub | 1 |
| 8HN-CC-375-W | 0.375 | Weld hub | 1 |
| 8HN-CC-188-SL | 0.188 | Spring-loaded | 2 |
| 8HN-CC-250-SL | 0.250 | Spring-loaded | 2 |
| 8HN-CC-188-SC ^[1] | 0.188 | Self contained spring-loaded | 3 |
| 8HN-CC-250-SC ^[1] | 0.250 | Self contained spring-loaded | 3 |
| <i>316SS 3/4" NPT x 1/2" NPT</i> | | | |
| 8HN-DC-250-W | 0.250 | Weld hub | 1 |

[1] Requires snap-ring pliers to install.

Hex Head Reducing Bushings

| CODE | | THREAD SIZE (inches) | LENGTH (inches) | FIG. NO |
|---------|--------|------------------------|-----------------|---------|
| BRASS | 316SS | | | |
| 22RB-BA | 8RB-BA | 1/4 NPT x 1/8 NPT | 11/16 | 4 |
| 22RB-CA | 8RB-CA | 1/2 NPT x 1/8 NPT | 15/16 | 4 |
| 22RB-CB | 8RB-CB | 1/2 NPT x 1/4 NPT | 15/16 | 4 |
| 22RB-DC | 8RB-DC | 3/4 NPT x 1/2 NPT | 1 | 4 |
| | 8RB-EC | 1 NPT x 1/2 NPT | 1 3/16 | 4 |
| | 8RB-ED | 1 NPT x 3/4 NPT | 1 3/16 | 4 |
| | 8RB-FC | 1 1/4 NPT x 1/2 NPT | 1 1/8 | 4 |
| | 679 | 1 1/4-18 NEF x 1/2 NPT | 15/16 | 4 |

Pipe Nipples (Schedule 40)

| CODE | | THREAD (inches) | LENGTH (inches) | FIG. NO |
|--------------|--------------|-----------------|-----------------|---------|
| CARBON STEEL | 316SS | | | |
| 6PN - C - CL | 8PN - C - CL | 1/2 NPT | 1 | 5 |
| 6PN - C - 2 | 8PN - C - 2 | 1/2 NPT | 2 | 5 |
| 6PN - C - 3 | 8PN - C - 3 | 1/2 NPT | 3 | 5 |
| 6PN - C - 4 | 8PN - C - 4 | 1/2 NPT | 4 | 5 |
| 6PN - C - 5 | 8PN - C - 5 | 1/2 NPT | 5 | 5 |
| 6PN - C - 6 | 8PN - C - 6 | 1/2 NPT | 6 | 5 |

FIG. 6

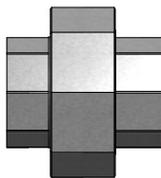


FIG. 7



FIG. 8



FIG. 9



Union Fittings

| CODE | NPT SIZE (inches) | DESCRIPTION | FITTING MATERIAL | FIG. NO |
|-------------|-------------------|------------------------------|-------------------|---------|
| 6FU - C | 1/2 | Female union-150# | Malleable iron | 6 |
| 8FU - C | 1/2 | Female union-150# | 316 SS | 6 |
| 6FU - C - X | 1/2 | Explosion-proof female union | Zinc plated steel | 6 |
| 6UE - C | 1/2 | 90° union elbow-150# | Malleable iron | 7 |

Malleable Iron Mounting Flanges

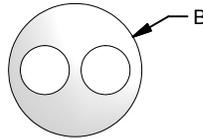
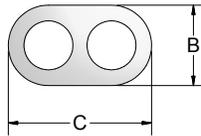
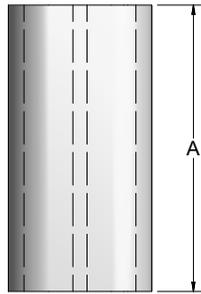
| CODE | NPT PIPE SIZE (inches) | DESCRIPTION | FIG. NO |
|---------|------------------------|---------------------------------------|---------|
| 6FF - B | 1/4 | Internal threads | 8 |
| 6FF - C | 1/2 | | 8 |
| 6FF - D | 3/4 | | 8 |
| 6FF - E | 1 | | 8 |
| 6BF - B | 1/4 | Slip fit bore for indicated pipe size | 9 |
| 6BF - C | 1/2 | | 9 |
| 6BF - D | 3/4 | | 9 |
| 6BF - E | 1 | | 9 |

BARE WIRE, INSULATORS, TERMINAL and SPADE LUGS

Bare Base Metal Thermocouple Wire

| CODE | TYPE / POL. | MATERIAL | GA. | FT. / LB. |
|-------|-------------|------------|-----|-----------|
| JP08B | J (+) | Iron | 8 | 23 |
| JN08B | J (-) | Constantan | 8 | 20 |
| JP14B | J (+) | Iron | 14 | 91 |
| JN14B | J (-) | Constantan | 14 | 80 |
| JP20B | J (+) | Iron | 20 | 365 |
| JN20B | J (-) | Constantan | 20 | 323 |
| KP08B | K (+) | Chromel® | 8 | 21 |
| KN08B | K (-) | Alumel® | 8 | 21 |
| KP14B | K (+) | Chromel® | 14 | 83 |
| KN14B | K (-) | Alumel® | 14 | 83 |
| KP20B | K (+) | Chromel® | 20 | 333 |
| KN20B | K (-) | Alumel® | 20 | 333 |

INSULATOR DIMENSIONS



Cordierite Insulators (2250 °F max)

| CODE | STYLE | GA. | A DIM. (inches) | B DIM. (inches) | C DIM. (inches) | NO BORE(S) |
|------------------------|------------|-----|-----------------|-----------------|-----------------|------------|
| 408-1C | Oval | 8 | 1 | 0.281 | 0.500 | 2 |
| 408-1R | Round | 8 | 1 | 0.465 | | 2 |
| 408-3C | Oval | 8 | 3 | 0.281 | 0.500 | 2 |
| 408-3R | Round | 8 | 3 | 0.465 | | 2 |
| 408-12S ^[1] | Fish spine | 8 | 12 | 0.260 | | 1 |
| 411-1C | Oval | 11 | 1 | 0.218 | 0.375 | 2 |
| 411-3C | Oval | 11 | 3 | 0.218 | 0.375 | 2 |
| 414-1C | Oval | 14 | 1 | 0.188 | 0.313 | 2 |
| 414-1R | Round | 14 | 1 | 0.250 | | 2 |
| 414-3C | Oval | 14 | 3 | 0.188 | 0.313 | 2 |
| 414-12S ^[1] | Fish spine | 14 | 12 | 0.200 | | 1 |
| 420-1C | Oval | 20 | 1 | 0.188 | 0.172 | 2 |

[1] 12S fish spine insulators supplied in continuous 12" sleeves.

Bare Noble Metal Thermocouple Wire

| CODE | TYPE / POL. | MATERIAL | GA. | IN. / TROY OZ. |
|-------|-------------|---------------|-----|----------------|
| RP24B | R (+) | Plat. 13% Rh | 24 | 309 |
| SP24B | S (+) | Plat. 10% Rh | 24 | 302 |
| PN24B | R S (-) | Pure Platinum | 24 | 282 |
| RP26B | R (+) | Plat. 13% Rh | 26 | 482 |
| SP26B | S (+) | Plat. 10% Rh | 26 | 473 |
| PN26B | R S (-) | Pure Platinum | 26 | 440 |

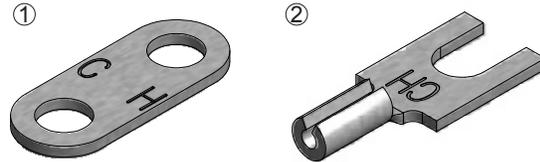
NOTES: All wire supplied bright annealed. Wire orders must be for equal amounts of both legs. All listed wire is supplied as standard limits of error.

Alumina Insulators (3400 °F max)

| CODE | STYLE | GA. | A DIM. (inches) | B DIM. (inches) | C DIM. (inches) | NO BORE(S) |
|--------|-------|-----|-----------------|-----------------|-----------------|------------|
| 424-12 | Round | 24 | 12 | 0.188 | | 4 |
| 424-18 | Round | 24 | 18 | 0.188 | | 4 |
| 424-24 | Round | 24 | 24 | 0.188 | | 4 |
| 424-30 | Round | 24 | 30 | 0.188 | | 4 |

Thermocouple Alloy Terminal and Spade Lugs

| TERMINAL LUG CODE ^[1] | SPADE LUG CODE ^[2] | ANSI LETTER DESIGNATION | THERMOCOUPLE ALLOY |
|----------------------------------|-------------------------------|-------------------------|--------------------|
| 460053 | 460060 | KP, EP | Chromel® |
| 460052 | 460059 | KN | Alumel® |
| 460056 | 460063 | JP | Iron |
| 460054 | 460061 | JN, EN, TN | Constantan |
| 460055 | 460062 | TP, RP, SP | Copper |
| 460051 | 460116 | RN, SN | Alloy #11 |



[1] Terminal lugs fit Cinch Jones Series #141 and equivalent Barrier terminal blocks with 27/64" screw spacing and #6-32 terminal screws.

[2] Spade lugs are crimp-on style to fit #6-32 terminal screws and 18 awg. wire or smaller.

COMPLETE COMPENSATED TERMINAL BLOCKS

EXAMPLE ORDER NUMBER:

26 - 240 - 08

Terminal Block Thermocouple Type

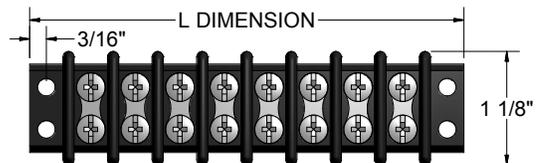
| PREFIX CODE | T/C TYPE | THERMOCOUPLE ALLOY | |
|-------------|----------|--------------------|------------|
| | | POSITIVE | NEGATIVE |
| 26 - 220 | E | Chromel® | Constantan |
| 26 - 230 | J | Iron | Constantan |
| 26 - 240 | K | Chromel® | Alumel® |
| 26 - 250 | R-S | Copper | Alloy #11 |
| 26 - 260 | T | Copper | Constantan |
| 26 - 270 | U | Copper | Copper |

Consult factory for combination blocks.

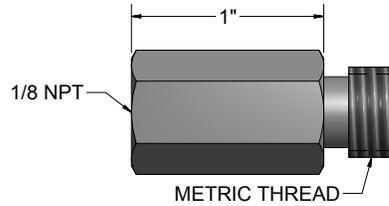
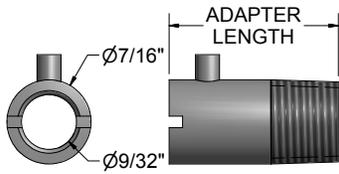
Number of Circuits

| SUFFIX CODE | CIRCUITS (TERMINALS) | L DIMENSION (inches) |
|-------------|----------------------|----------------------|
| 02 | 2 (4) | 2 1/2 |
| 04 | 4 (8) | 4 1/2 |
| 05 | 5 (10) | 5 3/8 |
| 06 | 6 (12) | 6 |
| 08 | 8 (16) | 7 3/4 |
| 10 | 10 (20) | 9 1/2 |

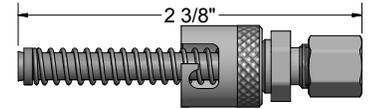
Consult factory for other number of circuits.



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NICKEL PLATED BRASS
COMPRESSION FITTING



Bayonet Fitting Adapters

| CODE | LENGTH (inches) | THREAD (inches) |
|----------|-----------------|-----------------|
| 705-0.88 | 7/8 | 1/8 NPT |
| 705-1.25 | 1 1/4 | 1/8 NPT |
| 705-1.5 | 1 1/2 | 1/8 NPT |
| 705-2 | 2 | 1/8 NPT |
| 705-2.25 | 2 1/4 | 1/8 NPT |
| 705-2.5 | 2 1/2 | 1/8 NPT |
| 705-3.5 | 3 1/2 | 1/8 NPT |
| 735-0.88 | 7/8 | 3/8 - 24 |
| 735-1.5 | 1 1/2 | 3/8 - 24 |
| 735-2.5 | 2 1/2 | 3/8 - 24 |
| 735-3.5 | 3 1/2 | 3/8 - 24 |

The plated steel bayonet adapter accommodates the bayonet lock cap assembly to bottom the hot junction in holes in machine walls, cylinder, or dies.

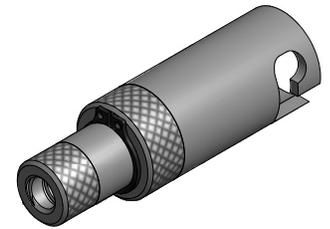
Metric to 1/8" NPT Adapters

| CODE | METRIC THREAD (mm) |
|-------|--------------------|
| 40001 | 10 x 1.5 |
| 40002 | 12 x 1 |
| 40003 | 12 x 1.5 |
| 40004 | 14 x 1.5 |
| 40005 | 14 x 2 |

Adds 1" to bayonet adapter length.

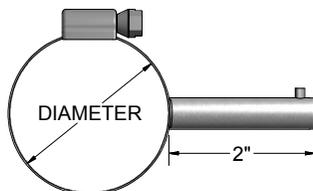
Adjustable Bayonet Cap

| CODE | SHEATH SIZE (inches) | DESCRIPTION |
|------|----------------------|-----------------------------------|
| 718 | 1/16 | Adjustable bayonet cap and spring |
| 728 | 1/8 | |



Positive Bottoming Indicating Bayonet Cap

| CODE | DESCRIPTION |
|--------------|--|
| D702 - A - 2 | Adjustable bayonet cap for 0.210" O.D. flex with red bottoming indication. |

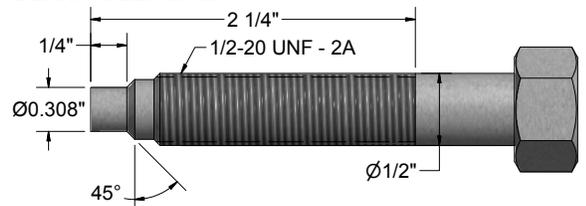


Pipe Clamp Adapters

| CODE | CLAMP DIA. MIN. / MAX. (inches) | PIPE SIZE (inches) | PIPE DIAMETER (inches) |
|---------|---------------------------------|--------------------|------------------------|
| PCA-075 | 11/16 - 1 1/4 | 1/2 - 3/4 IPS | 0.840 - 1.050 |
| PCA-150 | 1 1/16 - 2 | 1 - 1 1/2 IPS | 1.315 - 1.900 |
| PCA-250 | 2 1/16 - 3 | 2 - 2 1/2 IPS | 2.375 - 2.875 |
| PCA-350 | 3 5/16 - 4 1/4 | 3 - 3 1/2 IPS | 3.500 - 4.000 |
| PCA-400 | 4 1/8 - 7 | 4 IPS | 4.500 |

Use 2(3/4)" sensor 'A' dimension when using fixed bayonet type thermocouples with above adapters.

BLANK MELT BOLT

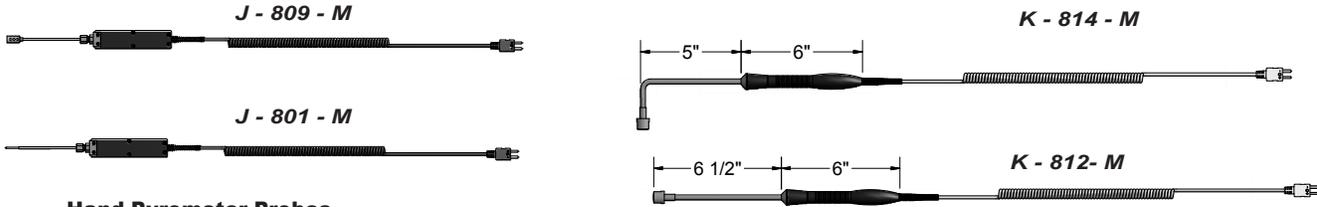


Blank Melt Bolts

| CODE | DESCRIPTION |
|------|---------------|
| 743 | 3" blank bolt |
| 746 | 6" blank bolt |

HANDHELD THERMOCOUPLE PROBES

The hand pyrometer thermocouple probes listed below are suitable for use in many process and laboratory applications for "spot checking" temperatures of a variety of products and air flows. The probes are designed for use with Pyromation's and other manufacturers' handheld pyrometers. All probes are supplied with retractable coiled cordset leads with an expandable length of 5 feet.



Hand Pyrometer Probes

| CODES | PROBE STYLE | DESCRIPTION |
|--------------------------|----------------------------|--|
| COMPLETE ASSEMBLY | | |
| J - 801 - M | Insertion probe | 1/8" x 3" long sheath w/ a 1/16" x 3/4" long hypodermic needle tip |
| J - 803 - M | General-purpose probe | 1/8" O.D. x 6" long pointed sheath |
| J - 805 - M | Heavy-duty general purpose | 3/16" O.D. x 6" long pointed sheath |
| J - 809 - M | Air / gas shielded tip | 1/8" O.D. x 6" long w/radiation shield |
| ^[1] K-812-M | Surface probe - straight | Heavy-Duty, Fast-Responding Tip 6 1/2" long |
| ^[1] K-814-M | Surface probe - 90° bend | Heavy-Duty, Fast-Responding Tip 6 1/2" long |

[1] Only Available in Type "K"

To order other calibrations, change prefix letter to J or T.

All probes are supplied with 316 Stainless Steel sheaths.

To order thermocouples with sheath lengths other than what is specified, add the letter "X" after the calibration prefix and specify length. Example: JX-803-M X=12

MOLTEN NON-FERROUS METAL LANCES AND THERMOCOUPLE TIPS

FIG. 1



FIG. 2



FIG. 3



Lances and Tips

| CODE | DESCRIPTION | FIG. NO. |
|--------------------------|---|----------|
| 26 - 101P ^[1] | Ladle type, straight lance handle with plastic grip, 43" long | 1 |
| 26 - 501P ^[1] | Furnace type, 90° lance handle with plastic grip, 43" long | 2 |
| 26 - 501T - 8 | 8" Type K 446SS thermocouple tip with 43" leads | 3 |
| 26 - 501T - 12 | 12" Type K 446SS thermocouple tip with 43" leads | 3 |
| 26 - 501T - 15 | 15" Type K 446SS thermocouple tip with 43" leads | 3 |
| 26 - 501T - 18 | 18" Type K 446SS thermocouple tip with 43" leads | 3 |

[1] Does not include sensor.



FIG. 1



FIG. 2

Nylon Weatherproof Cord Grips

| CODE | CABLE SIZE RANGE (inches) | NPT SIZE (inches) |
|------|---------------------------|-------------------|
| 1399 | 0.197 to 0.348 | 1/2 |

Stainless Steel Square Lock Flexible Armor

| CODE | I.D. (inches) | O.D. (inches) | COATING | FIG. NO. |
|----------|---------------|---------------|-------------|----------|
| FX188SL | 3/16 | 0.275 | None | 1 |
| FX125SL | 1/8 | 0.207 | None | 1 |
| FX250SL | 1/4 | 0.345 | None | 1 |
| FX188SLP | 3/16 | 0.328 | PVC (black) | 2 |
| FX188SLF | 3/16 | 0.313 | FEP (white) | 2 |

FIG. 3



FIG. 4



Holding Fixtures for Silicon Carbide Tubes

| CODE | DESCRIPTION | FIG. NO. |
|--------------------------|-----------------------------|----------|
| <i>18J SERIES TUBES</i> | | |
| 370006 | 3/4" NPT x 1(7/8)" I.D. | 3 |
| <i>18JC SERIES TUBES</i> | | |
| 370007 | Support casting with flange | 4 |

FIG. 6

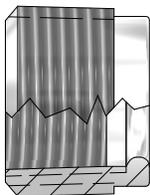
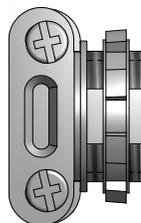


FIG. 7



Coil Cords

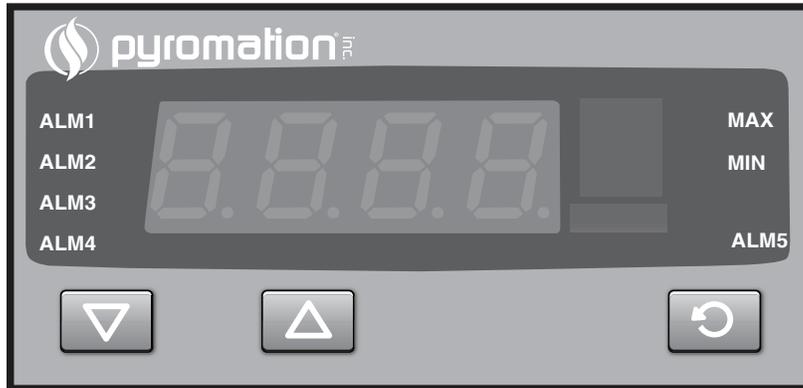
| CODE | DESCRIPTION | RETRACTED LENGTH (inches) | EXTENDED LENGTH (inches) |
|------------|---|---------------------------|--------------------------|
| [1]32060-0 | Polyurethane outer, PVC inner, 2 free ends, stripped | 12 | 60 |
| [1]32120-0 | Polyurethane outer, PVC inner, 2 free ends, stripped | 24 | 120 |
| RTD32060-0 | Polyurethane outer, PVC inner, 3 conductor with 2 free ends, stripped | 12 | 60 |

[1] Insert calibration code: J, K, T, E, R, S, U
Consult factory for availability of other lengths

Miscellaneous Items

| CODE | DESCRIPTION | FIG. NO. |
|----------|--|----------|
| 440017 | 3/4 oz. silicone rubber head sealant (RTV) | |
| 440040 | 10cc heat transfer compound (300 °F max) | |
| 6EB - DC | 3/4" x 1/2" reducing face bushing | 6 |
| 710 | 1/2" box connector | 7 |

The Series 810 1/8 DIN Panel Indicator is loaded with standard and optional features that provide a flexible and economical solution for almost any application. Customize the unit with just the functions your application requires, minimizing your cost. Features flexible input/output options and large LED display. The digital indicator is fitted with one latching relay as standard. Plug-in modules allow two additional relays, process variable retransmission, or transmitter power supply. Each alarm has its own LED indicator for fast identification of alarms. Configuration can be modified in the field through the front panel or through use of a computer interface.



Features and Benefits

- Four-digit LED display
- Up To 3 Alarms
- Transmitter power supply option
- Min/Max value hold
- Engineering units
- PC configuration
- Process variable retransmit option

TECHNICAL DATA

General

| | |
|----------------------|---|
| Output Configuration | Up to 3 total, max 3 for alarms, max 1 for retransmit of PV, max 1 transmitter power supply |
| Alarm Types | Process high, process low, direct acting, process high, process low reverse and logical OR |
| Human Interface | 3 button operation, 4 digit 13 mm high red display, plus set-up alarm, min and max indicators |
| PC Configuration | Off-line configuration from serial port to dedicated configuration socket |

Output and Options

| | |
|--------------------------|--|
| Alarms Relay(s) | Contacts: SPDT 2 resistive at 240 V ac, > 500,000 operations, latching or non-latching |
| Retransmit Output | (0 to 20) mA or (4 to 20) mA, (0 to 10) V or (0 to 5) V into 500 Ω min. Accuracy typically $\pm 0.25\%$ |
| Transmitter Power Supply | (20 to 28) V dc (24 V nominal) max load 910 Ω (22 mA at 20 V) |

Inputs

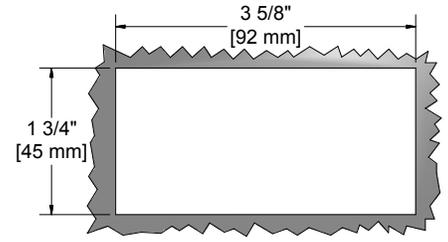
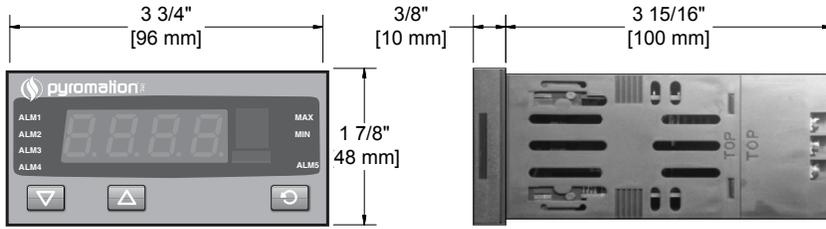
| | |
|------------------------|--|
| Thermocouple Types | J,K,R,S,T,B,L, & N |
| RTD | 3-wire Pt100 ($\alpha = 0.00385\text{ }^{\circ}\text{C}^{-1}$), 50 Ω per lead maximum (balanced) |
| DC Linear | (0 to 20) mA or (4 to 20) mA, (0 to 50) mV or (10 to 50) mV, (0 to 5) V or (1 to 5) V, (0 to 10) V or (2 to 10) V. Scalable -1999 to 9999, decimal point available |
| Impedance | > 100 M Ω for Thermocouple and mV ranges, 47 K Ω for V ranges and 4.7 Ω for mA ranges |
| Accuracy | $\pm 0.25\%$ of input span ± 1 LSD (T/C CJC better than 0.7 $^{\circ}\text{C}$) |
| Sampling | 4 s, 14 bit resolution (approximately) |
| Sensor Break Detection | < 2 second (except zero based DC ranges), high alarms activate (low for RTD, mA or V) |

Operating Conditions

| | |
|------------------------|---|
| Temperature & RH | (0 to 55) $^{\circ}\text{C}$, 20% to 95% RH non-condensing, (-20 to 80) $^{\circ}\text{C}$ for storage |
| Power supply | (100 to 240) V ac 50/60 Hz 7.5VA |
| Front Panel Protection | IEC IP66 (Behind panel protection is IP20) |

Approvals

| | |
|---|--|
|  marked | Unit complies with the legal requirements set forth by the EU regulations. |
|  | UL recognized component. |



ORDER CODES

Example Order Number:

1 **810** - **2** **1** **3** **1** - **4** **00**

1

| CODE | DESCRIPTION |
|------|-------------------|
| 810 | (100 to 240) V ac |

3

| CODE | DESCRIPTION |
|------|--------------------------|
| 0 | Not Fitted |
| 1 | Relay |
| 8 | Transmitter Power Supply |

2

| CODE | DESCRIPTION |
|------|-------------------------|
| 0 | Not fitted |
| 1 | Relay |
| 7 | (4 to 20) mA Retransmit |

4

| CODE | DESCRIPTION |
|------|----------------|
| 00 | Non-Configured |