
DURATHERM

PROCESSING SYSTEMS, INC.

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"TRUTEMP" Plastics And General Purpose Sensors

The "TRUTEMP" plastics and general purpose sensors are intended for use in medium duty processing applications involving exposure temperatures of up to 900°F. The standard construction consists of an appropriate pair of insulated leads formed into a thermocouple junction or attached to RTD sensor elements. This sensor assembly is typically installed into assorted combinations of tubes and fittings to form a complete sensor assembly.

1

High Strength, Durable Design. Each sensor style has been engineered to provide an optimum blend of accuracy, strength and economy. Superior design and precision assembly ensure optimum sensor performance.

2

Versatile Construction Styles. The plastics and general purpose sensors are manufactured in a wide selection of standard and special purpose mounting configurations. Custom versions of these popular sensors can be manufactured to customer specifications when required.

3

Durable, Flex Resistant Lead Systems. All sensor configurations feature securely anchored leads. A variety of standard lead protection options enables matching of sensor lead systems to application requirements. Most sensor configurations allow a choice of several lead exit angles.

4

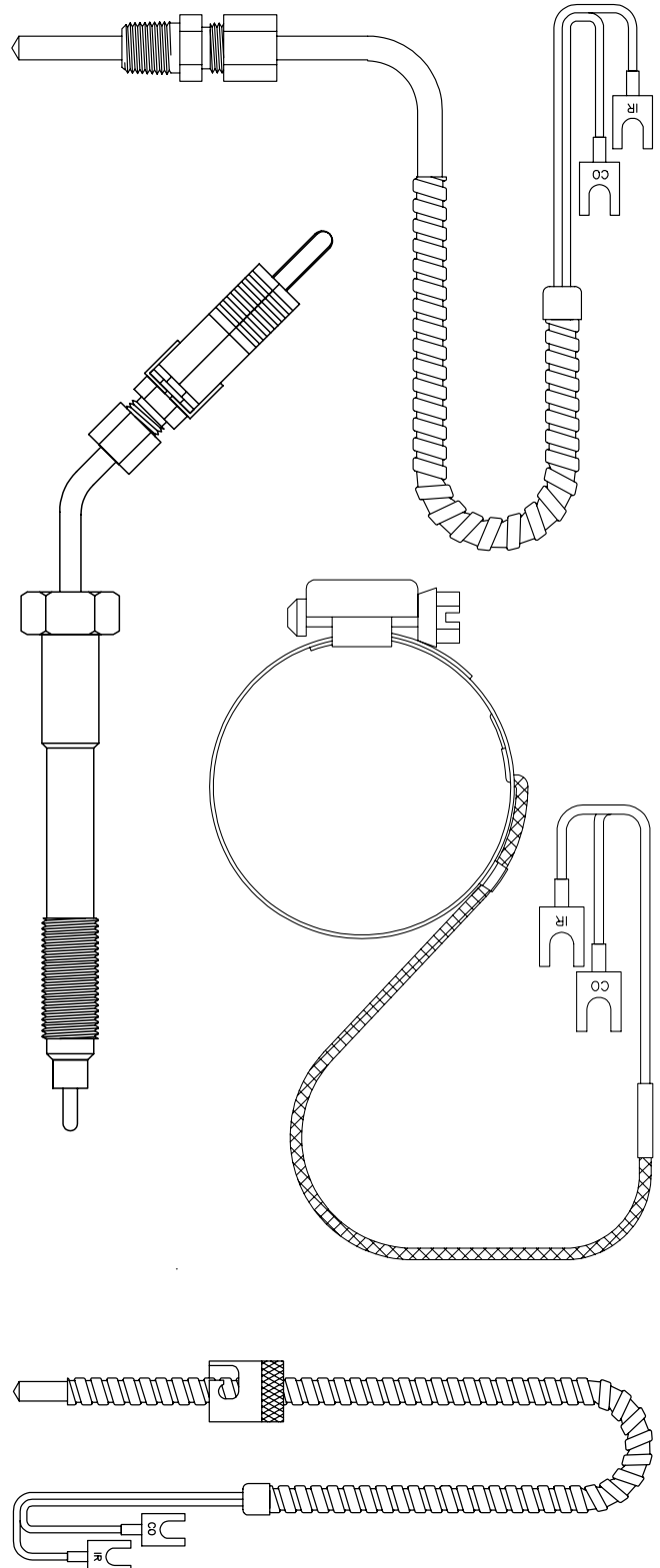
Oxidation Resistant Construction. Standard tube type thermocouples feature a 304 series stainless steel sheath. Fittings for all configurations can be supplied in a variety of materials. Standard fitting selections include stainless steel, nickel plated steel, nickel plated brass, brass and copper.

5

High Quality Sensor Elements. Available sensor types include all standard base metal thermocouple alloys as well as an assortment of RTD sensor elements. Standard thermocouple sensors are constructed to the standard limits of error as specified by ANSI MC96.1-1982. Special tolerances to ANSI MC96.1-1982 can also be supplied when required.

6

Extended Style and Size Selection. The large range of sensor configurations and sizes offered meets the needs of most common applications. Single and multiple element configurations can be readily manufacture to suit any special application requirements.



"TRUTEMP" PLASTICS AND GENERAL PURPOSE SENSORS

Plastics And General Purpose Sensor Specifications And Application Data

Standard Plastics And General Purpose Sensors

Duratherm maintains a large inventory of common plastics and general purpose sensors and can provide quick shipment of both standard and custom sensors. The highly versatile plastics and general purpose sensors are supplied in a virtually unlimited number of application specific constructions. These low cost sensors can be readily manufactured with any desired combination of custom design features. Special fittings, flanges and connectors are supplied on a routine basis. Our modern CNC equipped machine shop ensures in-house control of quality and delivery of component parts.

Duratherm has produced thousands of unique, plastics and general purpose sensor designs and would welcome the opportunity to quote, design and manufacture any custom sensor your application requires.

Plastics And General Purpose Sensor Applications

- Plastic injection molds and equipment
- Packaging equipment
- Thermoset mold and platen heating
- Food processing equipment
- Refrigeration temperature control
- Oven and hot plate temperature control
- Radiant heating control applications
- Pipe trace heating control
- Liquid temperature measurement and control
- Deicing systems
- Vapor cleaning and degreasing systems
- Plastic extrusion dies and equipment
- Industrial Processing
- Medical and dental equipment
- Plating baths
- Drying Equipment
- Photographic and X-ray film developing systems

General Purpose Sensor Insulation Materials

The majority of general purpose sensors utilize the thermal and electrical properties of the wire insulation to isolate the sensor elements from the mechanical portion of the sensor. For this reason it is necessary to select the wire on the basis of sensor application temperature. If you have special requirements requiring the use of extension wire rated at temperatures below the sensor exposure temperature, contact our engineering department for design recommendations.

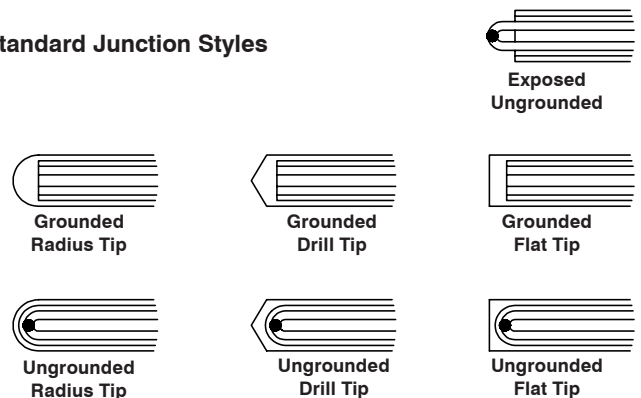
Calibration Tolerances

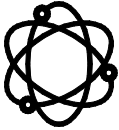
"TRUTEMP" plastics and general purpose thermocouple sensor assemblies meet or exceed the standard tolerances of ANSI Circular MC96.1-1982. Special tolerances meeting the standards of ANSI MC96.1-1982 can also be supplied when required. "TRUTEMP" plastics and general purpose RTD sensor assemblies meet or exceed the standard tolerances of DIN specification 43760. For critical applications, Duratherm can provide complete calibration, traceable to the National Institute of Standards and Technology. Equipment is available to test your sensors over a wide range of temperatures. When calibration is requested, tested materials and components will be tagged and supplied with a calibration report. If calibration services are required, contact our sales office for details.

Junction Configurations

Duratherm offers three basic thermocouple junctions. Exposed junctions have the best thermal response but is unprotected. Grounded junctions offer the next best thermal response and the junction is fully protected. Ungrounded junctions feature slightly lower thermal response than the grounded type, but are protected and also electrically isolate the junction from the sensor sheath. Grounded and ungrounded junctions of tube style sensors can be provided with shaped tip configurations to enhance response. The drawing below illustrates the standard junction styles as they appear on tube type general purpose sensors. The junctions of other general purpose sensors are also available in the basic three types but will differ in appearance depending on sensor construction.

Standard Junction Styles




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"TRUTEMP" Drawn Metal Sheathed Cable Sensors

The "TRUTEMP" drawn cable sensors feature durability, fast response and high temperature capabilities. Drawn cable sensor constructions combine precision fabrication techniques with premium quality mineral insulated cable and feature rugged construction in a particularly compact size.

The standard construction consists of an appropriate pair of elements embedded in compacted ceramic and encased in an appropriate tubular sheath. These elements are welded to form a thermocouple junction or attached to RTD sensor elements. A wide variety of standard and custom fittings can be added to the sensor to simplify installation and application. The lead end of the cable is typically equipped with connectors or leads to accommodate connection to control system wiring.

1

Durable Drawn Cable Construction. Ceramic insulated sensor elements are sheathed in high temperature alloy tubing and drawn to final dimensions. The resulting sheathed cable construction protects the internal elements from oxidation and corrosion as well as providing protection from mechanical abuse. The high strength cable construction can be readily formed into most desired configurations with no damage to the sheath or elements. The cable in its' standard, dead soft, bright annealed condition can be formed around a mandrel with a minimum diameter equal to two times the cable diameter.

2

Corrosion Resistant Alloy Sheath. Common sheath materials include 304, 310, 316 series stainless steels and Alloy 600. Other high temperature and corrosion resistant sheath materials are also available. The mineral insulated, cable style thermocouple can be manufactured with a sheath of virtually any malleable alloy.

3

High Quality Thermocouple Alloys. Available sensor calibrations include a full selection of common base metal alloys including type J, K, E and T. Noble metal sensor alloys such as type R and S are also available.

4

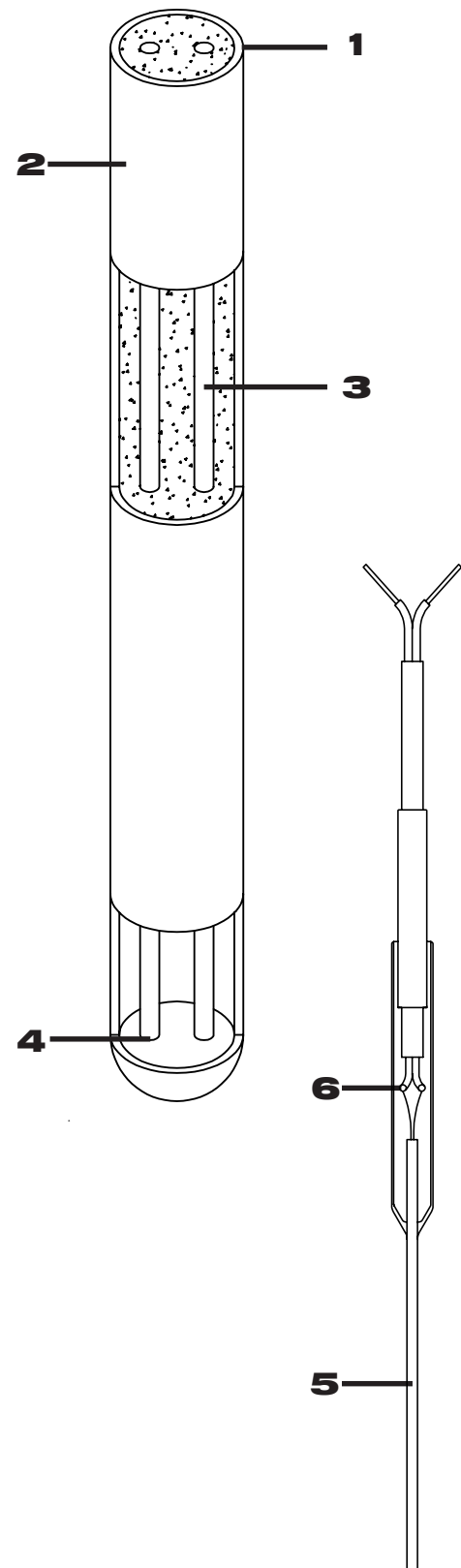
Precision Welded Sensor Junctions. Available junctions include grounded, ungrounded and exposed ungrounded styles. Special welding techniques allow precise control of welded tip dimension and allows subsequent shaping of the tip when required.

5

Compact Sensor Configuration. A wide range of cable sensor sizes with diameters of .020 to .250 inches permits simple installation into restricted access areas of an application. Single and multiple element thermocouple configurations are readily manufactured.

6

Superior Lead Systems. All lead style cable thermocouples feature precision welded element to lead connections. These connections are housed in a protective metal transition fitting filled with an electrical grade potting compound. A full selection of lead styles and lead restraints provide additional abuse resistance when required. A wide variety of connectors, spade lugs and other termination devices are also available.



"TRUTEMP" MINERAL INSULATED CABLE SENSORS

Metal Sheathed Cable Sensor Specifications And Application Data

Cable Sheath Materials

Duratherm mineral insulated cable can be fabricated with a sheath consisting of virtually any malleable metal. All cable material is annealed in a protective atmosphere to provide a bright and ductile finished product. The table below outlines the most common cable sheath materials and their maximum recommended operating temperatures under continuous exposure to an oxidizing atmosphere.

Sheath Material	Maximum Temperature	Application Information
304 SS	1650 °F. 900 °C.	Most common low temperature sheath. Used in food processing, packaging, plastics processing and other industries where corrosion resistance is required.
316 SS	1650 °F. 900 °C.	Highest corrosion resistance of austenitic stainless steels. Used most frequently in food processing and chemical industries.
310 SS	2100 °F. 1150 °C.	Corrosion resistance slightly superior to 304 SS and substantially higher heat resistance. Less ductile material than 304 SS.
600 Alloy	2150 °F. 2110 °C.	Most common high temperature sheath material. Very good high temperature strength and excellent high temperature oxidation resistance.

Cable Insulation Materials

Standard cable insulation consists of standard or high purity magnesium oxide powder. Other insulation materials can be supplied when required. Note that cable insulation materials are normally selected on the basis of high temperature insulation resistance. The ceramic insulation is compacted to near theoretical density during the manufacturing process, resulting in high heat transfer rates and rapid thermal response.

Calibration Tolerances

All mineral insulated cable sensor materials meet or exceed ANSI standards. "TRUTEMP" cable sensor assemblies meet or exceed the standard tolerances of ANSI Circular MC96.1-1982. Special tolerances meeting the standards of ANSI MC96.1-1982 can also be supplied when required.

Dimensional Tolerances

Standard Assembled Probe Length Tolerances		
Cable Diameter	Probe Lgth. <= 24 In.	Probe Lgth. > 24 In.
Less Than .039	± 1/4 Inch	± 1% Of Length
.040 To .059	± 3/16 Inch	± 3/4% Of Length
.060 And Greater	± 1/8 Inch	± 1/2% Of Length

Assembled Flexible Lead Tolerances	
Lead Length	Lead Length Tolerance
Less Than 10 Ft.	+ 6 - 0 Inches
10 Ft. And Longer	+ 5% - 0% Of Length

Cable Diameter Tolerance	
.010 - .057	+ .001 - .0005
.058 - .093	± .001
.094 - 188	+ .002 - .001
.189 - 500	+ .003 - .001

Custom Sheathed Cable Sensors

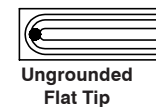
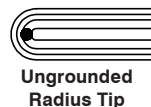
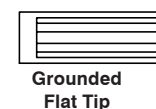
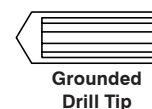
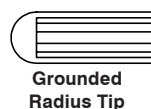
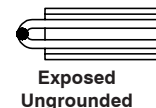
Custom sensors with virtually any desired combination of special design features can be readily manufactured. Our modern CNC equipped machine shop ensures in-house control of quality and delivery of component parts. Common design variations such as special fittings, flanges and connectors are supplied on a routine basis.

Duratherm has produced thousands of sophisticated, special purpose sensors and would welcome the opportunity to quote, design and manufacture any custom sensor your application requires.

Junction Configurations

Duratherm offers three basic thermocouple junctions. Exposed junctions have the best thermal response but bared junction is unprotected. Grounded junctions offer the next best thermal response and the junction is sealed. Ungrounded junctions feature slightly lower thermal response than the grounded type, but are sealed and electrically isolate the junction from the sensor sheath. Grounded and ungrounded junctions of cable sensors .040 and greater in diameter can be provided with shaped tip configurations to enhance response.

Standard Junction Styles

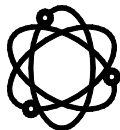


Forming Of Cable Material

The fully annealed, ductile cable portion of any assembly can be readily formed into any desired configuration. As a general rule, the cable can be formed around a mandrel equal to twice the sheath outside diameter. Note that repeated bending of mineral insulated cable will require additional annealing of the bend area.

Welding Attachment Procedures

The cable portion of a sensor assembly can be welded or brazed to the application provided that care is taken to avoid melting through the sheath. In cases where the cable is .040 or smaller in diameter we recommend the use of a weld sleeve. This sleeve can be factory installed and would consist of a .010 to .015 wall tube swaged into place on the cable.



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“TRUTEMP” Sensor Element Specifications And Initial Calibration Tolerances

"TRUTEMP" sensors are manufactured to rigid specifications. Thermocouple materials and testing conform to standard tolerances of ANSI Circular MC96.1-1982. Platinum RTD elements conform to DIN specification 43760, with a temperature coefficient of .000385 ohms/ohm/°C. Special tolerances and specifications are available on a special order basis, at additional cost.

For critical applications, Duratherm can provide complete calibration, traceable to the National Institute of Standards and Technology. Equipment is available to test your sensors over a wide range of temperatures. When calibration is requested, tested materials and components will be tagged and supplied with a calibration report. If calibration services are required, contact our sales office for details.

Thermocouple Specifications And Initial Calibration Tolerances For Standard Temperature Ranges

ANSI T/C Calibration	ANSI Wire Designation	ANSI Color Codes	Typical Generic And Trade Names*	Magnetic Properties	Temperature Range		Tolerances**	
					Degrees F.	Degrees C.	Standard	Special
T	TP	Blue	Copper	None	32 - 662	0 - 350	± 1.0 °C Or ± 0.75 %	± 0.5 °C Or ± 0.4 %
	TN	Red	Constantan	None				
J	JP	White	Iron	Strong	32 - 1382	0 - 750	± 2.2 °C Or ± 0.75 %	± 1.1 °C Or ± 0.4 %
	JN	Red	Constantan	None				
E	EP	Purple	Chromel	None	32 - 1652	0 - 900	± 1.7 °C Or ± 0.5 %	± 1.1 °C Or ± 0.4 %
	EN	Red	Constantan	None				
K	KP	Yellow	Chromel	None	32 - 2282	0 - 1250	± 2.2 °C Or ± 0.75 %	± 1.1 °C Or ± 0.4 %
	KN	Red	Alumel	Weak				
R	RP	Black	Platinum 13% Rhodium	None	32 - 2462	0 - 1450	± 1.5 °C Or ± 0.25 %	± 0.6 °C Or ± 0.1 %
	RN	Red	Platinum	None				
S	SP	Black	Platinum 10% Rhodium	None	32 - 2642	0 - 1450	± 1.5 °C Or ± 0.25 %	± 0.6 °C Or ± 0.1 %
	SN	Red	Platinum	None				
B	BP	Grey	Platinum 30% Rhodium	None	1598 - 3092	870 - 1700	± 0.5 °C	N/A
	BN	Red	Platinum 6% Rhodium	None				
N	NP	Orange	Nicrosil	None	32 - 2282	0 - 1250	± 2.2 °C Or ± 0.75 %	± 1.1 °C Or ± 0.4 %
	NN	Red	Nisil	None				

Thermocouple Specifications And Initial Calibration Tolerances For Cryogenic Temperature Ranges***

ANSI T/C Calibration	ANSI Wire Designation	ANSI Color Codes	Typical Generic And Trade Names*	Magnetic Properties	Temperature Range		Tolerances**	
					Degrees F.	Degrees C.	Standard	Special
T	TP	Blue	Copper	None	-328 - 32	-200 - 0	± 1.0 °C Or ± 1.5 %	N/A
	TN	Red	Constantan	None				
E	EP	Purple	Chromel	None	-328 - 32	-200 - 0	± 1.7 °C Or ± 1.0 %	N/A
	EN	Red	Constantan	None				
K	KP	Yellow	Chromel	None	-328 - 32	-200 - 0	± 2.2 °C Or ± 2.0 %	N/A
	KN	Red	Alumel	Weak				

* Trade Names - Chromel and Alumel - Hoskins Manufacturing Co.

** When tolerances are given in two values, appropriate tolerances are determined by selecting the larger of the two values shown.

*** Thermocouples are normally calibrated for standard temperature ranges. If cryogenic use is intended, your order must specifically request cryogenic tolerances.

Temperature	Resistance Value	DIN 43760 Tolerances				Industrial Tolerances	
		Class A		Class B		Class C	
-200 °C	18.49 Ohms	± 0.55 °C	± 0.24 Ohms	± 1.3 °C	± 0.56 Ohms	± 2.27 °C	± 1.15 Ohms
-100 °C	60.25 Ohms	± 0.35 °C	± 0.14 Ohms	± 0.8 °C	± 0.32 Ohms	± 1.77 °C	± 0.71 Ohms
0 °C	100.00 Ohms	± 0.15 °C	± 0.06 Ohms	± 0.3 °C	± 0.12 Ohms	± 1.27 °C	± 0.50 Ohms
100 °C	138.50 Ohms	± 0.35 °C	± 0.13 Ohms	± 0.8 °C	± 0.30 Ohms	± 1.77 °C	± 0.67 Ohms
200 °C	175.84 Ohms	± 0.55 °C	± 0.20 Ohms	± 1.3 °C	± 0.48 Ohms	± 2.27 °C	± 0.83 Ohms
300 °C	212.02 Ohms	± 0.75 °C	± 0.27 Ohms	± 1.8 °C	± 0.64 Ohms	± 2.77 °C	± 0.98 Ohms
400 °C	247.04 Ohms	± 0.95 °C	± 0.33 Ohms	± 2.3 °C	± 0.79 Ohms	± 3.27 °C	± 1.10 Ohms
500 °C	280.90 Ohms	± 1.15 °C	± 0.38 Ohms	± 2.8 °C	± 0.93 Ohms	± 3.77 °C	± 1.22 Ohms
600 °C	313.59 Ohms	± 1.35 °C	± 0.43 Ohms	± 3.3 °C	± 1.06 Ohms	± 4.27 °C	± 1.32 Ohms
650 °C	329.51 Ohms	± 1.45 °C	± 0.46 Ohms	± 3.6 °C	± 1.13 Ohms	± 4.52 °C	± 1.36 Ohms