

## Industrial Temperature Sensors, Probes, and Assemblies



### Highlights

- Industrial Thermowells and Sensors
- ANSI Standard and Special Precision Thermocouples
- Ultraprecision RTDs with interchangeability to  $\pm 0.03^{\circ}\text{C}$
- Vibration-resistant construction
- Single supply source for temperature measurement systems—thermowells, probes, housings, and transmitters

### Description

Accutech offers a wide variety of thermowells and industrial temperature probes. These are available as individual units or as completed assemblies, and may be shipped separately or in conjunction with Accutech's transmitters as an integrated industrial temperature measurement system.

Thermowells in various materials, lengths, and process fittings are kept in finished goods stock and at various stages of production for rapid delivery. Thermocouple and RTD sensors are assembled into industrial probes, with special precautions taken to meet the demands of the industrial marketplace.

Thermocouple Types B, E, J, K, N, R, S, and T may be assembled as grounded or ungrounded industrial probes. Accutech thermocouples are manufactured with ANSI standard or ANSI special accuracy thermocouple wire. The thermocouple junction is fusion-welded to ensure a pure, consistent junction and then packed into corrosion-resistant metallic tubing and sealed per your specifications. Various mechanical fittings may be specified depending on the type of mounting and connection desired.

For precision industrial temperature measurements, 100 $\Omega$  Pt RTDs are recommended. This type sensor has proven extremely stable and accurate in often difficult industrial environments. Accutech RTDs are constructed from solid platinum wire wound into a small diameter coil. The coil is fused in a ceramic body with a high-temperature glass adhesive to support the platinum wire coil and to form the RTD element. The element is then packed in a corrosion-resistant, sealed metallic probe. This type of construction has proven to be resistant to the type of vibration often present in industrial environments.

Accutech Platinum RTDs may be specified in a variety of tolerance bands. They may be paired, matched, or individually calibrated to meet the most demanding conditions. We would be pleased to work with you on your requirements for temperature sensors and measurement systems.



## Thermowells

Thermowells are normally used in industrial installations to shield the sensor from the process and to facilitate maintenance. Sensors are subject to age and drift. Under normal conditions, they must be inspected, calibrated, and occasionally replaced. Standard wells with standard bore dimensions make this process as easy as possible.

When selecting a thermowell, the length is important to the accuracy of the measurement and to the strength of the well. In liquids, the sensor should be immersed at least one inch beyond the length of the sensitive element. In gases, this immersion should be increased to at least three inches. It is also important to remember that a temperature gradient will exist even in turbulent flowing streams. The temperature-sensitive portion of the sensor must be in good thermal contact with a representative portion of the fluid in question.

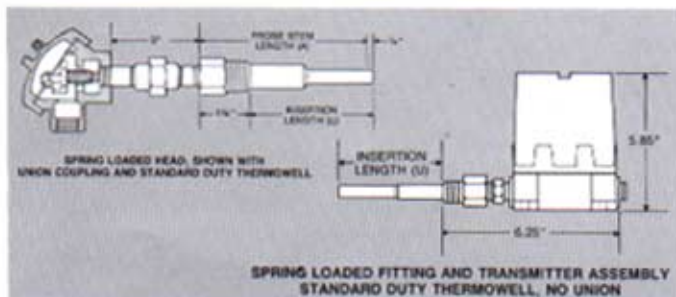
After installation, thermowells are subject to pressure and vibration. Their ability to withstand vibration effects is roughly proportional to the inverse of twice the length. At 1000°F, a ¾ in. stainless steel, standard duty well with an insertion length of 10½ in. can withstand a gas or liquid velocity of about 23 feet per second. The same well with a 4½ in. insertion length will withstand about 95 ft per second.

Heavy duty wells are able to withstand more vibration, but are not as quick to react to temperature changes when compared to standard duty wells. A heavy duty well can withstand almost twice the flow rates in the above example. Please note that these rough estimates should be used as a guide only. In fast-moving streams or where long insertion lengths are to be used, please consult factory for velocity and pressure ratings of thermowells.

## Thermowell Heads

Two types of heads are available. The spring-loaded head gives easy service. It allows removal of the sensor without disassembly. Accutech spring-loaded heads are cast aluminum with fully gasketed covers.

If frequent sensor removal is not required, the XP-HDC2-L weather and explosion-proof housing may be more convenient. These housings are epoxy painted, low magnesium aluminum. They are designed to be mounted directly on a thermowell, if desired, and are rated NEMA 4x and NEMA 7. They are FM approved and CSA certified for Division I and II; Class I, Groups B, C, and D, and Class II, Groups E, F, and G locations. If the XP housing is to be used in conjunction with a thermowell, the SLF spring-loaded probe fitting is also recommended.



## Industrial Temperature Sensors

Thermocouples and platinum RTDs are commonly used to make industrial temperature measurements. Platinum RTDs are generally more accurate, more precise and more stable than thermocouples, but they are generally restricted to temperature measurements under 800°C.

Thermocouples may be used for high-temperature measurements—up to several thousand degrees. They are somewhat more rugged and have a faster speed of response than do RTDs, but they are much more subject to drift. The metallurgy of the junction is critical to the performance of the sensor.

In choosing a sensor, consider temperature measurement range, accuracy, repeatability, and the effects of the environment into which it is to be installed along with the characteristics of drift, speed of response and cost.

THERMOCOUPLE		
Sensor	Range	Suitable Environment for Bare Wire
B	+109 to +3092°F	Oxidizing or Inert Beware of metal vapor contamination at high temperature
E	-328 to +1652°F	Oxidizing or Inert
J	+32 to +1382°F	Reducing or Inert
K	-328 to +2282°F	Clean Oxidizing or Inert
N	+32 to +2372°F	Clean Oxidizing or Inert Alternative to K, but more stable at high temperature
R	+32 to +2624°F	Oxidizing or Inert Beware of metal vapor contamination at high temperature
S	+32 to +2642°F	Oxidizing or Inert Beware of metal vapor contamination at high temperature
T	-328 to +662°F	Mildly Oxidizing or Inert Good in cryogenic or moisture laden environments

RTD		
Sensor	Range	Suitable Environment for Bare Wire
1000Pt	-328 to +1472°F	Oxidizing or Inert Beware of metal vapor contamination over 550°F

## Industrial Temperature Probes

Industrial temperature sensors are generally assembled as probes. These probes may be directly inserted into fluids or they may be used in conjunction with a thermowell.

Direct insertion probes are welded to a process connection fitting. Please consult factory for the pressure ratings of these welded fittings. Probes used in thermowells should be spring loaded. This allows them to make contact with the bottom of the well. Contact with the well assists in establishing thermal equilibrium. It also is very helpful in preventing vibration of the probe inside the well.

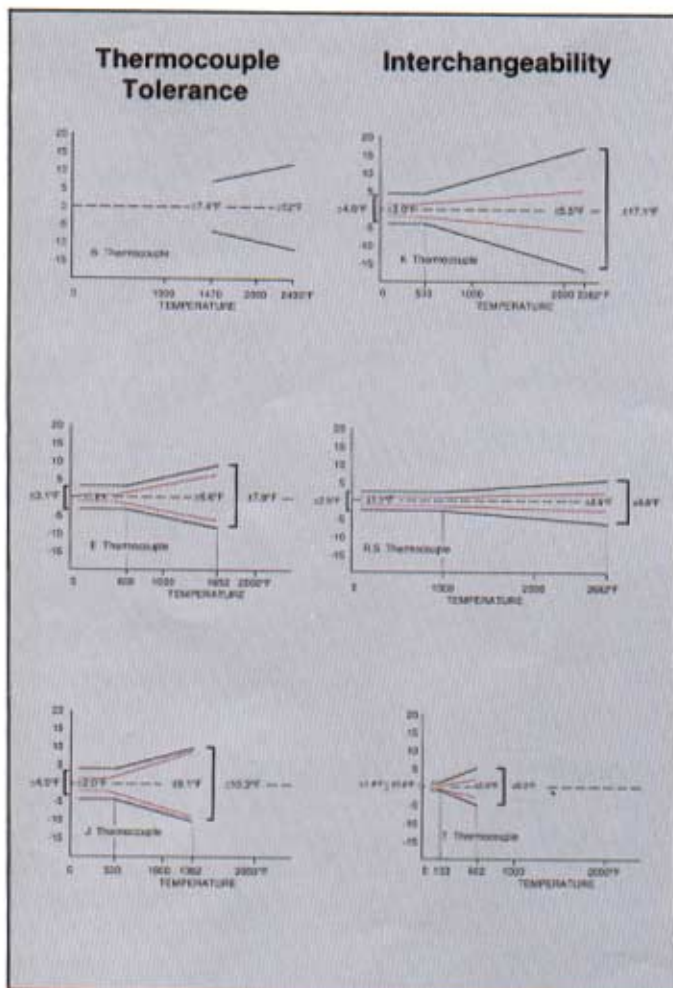
## Thermocouples

Thermocouples have long been used in the process industries to make temperature measurements. These elements are inexpensive and extremely rugged. They are especially useful for temperature measurements over 500°C (932°F).

Accutech thermocouples are manufactured from ANSI Standard Grade or ANSI Special Grade thermocouple wire. This wire has a very high chemical purity. All of the junctions are fusion-welded to ensure consistency. To minimize the effect of chemical attack on the junction, the thermocouples are inserted into metallic probes, packed, and then sealed.

Generally the probe material is Stainless Steel, although other materials may be selected to meet the demands of the situation. Magnesium oxide insulation is packed into the probes for insulation and mechanical support. After packing with MgO, the diameter of the metallic probe is drawn down in diameter. This ensures tight compacted insulation and excellent resistance to the harmful effects of vibration.

Interchangeability tolerance of Accutech thermocouples conforms to ANSI special accuracy tolerance. For the common elements, this interchangeability tolerance is shown in the following graphs.



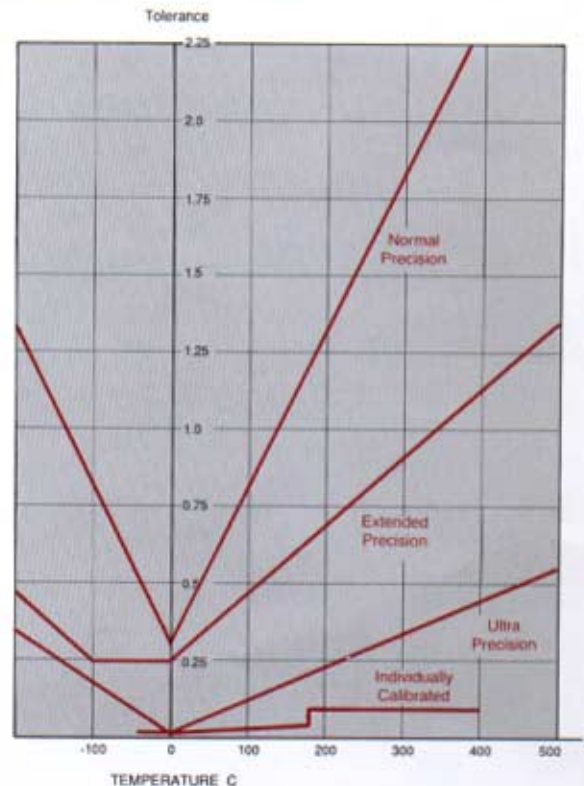
## Platinum RTDs

For precision temperature measurements, the 100Ω Pt RTD is hard to beat. Accuracy and stability of this sensor has made it a favorite for industrial temperature measurements.

Accutech sensors are made from solid platinum wire. The resistance of this wire varies directly as a function of the absolute temperature. This resistance/temperature relationship is precisely defined by the International Practical Temperature Scale (IPTS).

As a noble metal, platinum is extremely stable and resistant to chemical attack. This feature is very desirable in a temperature sensor. Platinum sensors are much less susceptible to drift than virtually any other type of sensor.

Accutech RTDs conform to the DIN 43760-1980 specification. This is identical to the BS 1904:1984 and the IEC 751:1983 standards. This is commonly known as the DIN curve and is characterized by an alpha ( $\alpha$ ) of 0.00385. These RTDs are available in a variety of precision bands to meet the cost and performance requirements in even the most demanding installations. Tolerance bands are shown in the following graph.



## Selecting a Sensor

Sensor selection is frequently an involved subject and is discussed in many books and articles. For a more detailed analysis, see *Chemical Engineering*, May 1990, pages 114-125, "Measure Remote Temperatures Efficiently," *Temperature, Its Measurement and Control in Science and Industry*, published by the American Institute of Physics, or *Industrial Temperature Measurement* by Thomas W. Kerlin and Robert L. Shepard.



### THERMOWELL PART NUMBERS

TWELL = THERMOWELL

CODE	PROCESS CONNECTION
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P = Pipe Threads

CODE	SIZE CONNECTION
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3/4 = 3/4" Male NPT Pipe Thread Process Fitting  
 1 = 1" Male NPT Pipe Thread Process Fitting

CODE	THERMOWELL TYPE
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260S = Standard Threaded Well, 0.260" Bore  
 260H = Heavy Duty Threaded Well, 0.260" Bore

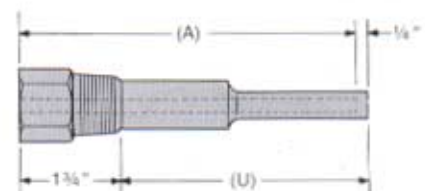
CODE	MATERIAL OF CONSTRUCTION
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304 = Type 304 Stainless Steel  
 316 = Type 316 Stainless Steel

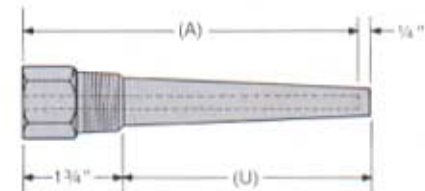
CODE	LENGTH
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04.5 = Insertion Length, U= 4.5"; Probe Stem Length, A= 6"  
 07.5 = Insertion Length, U= 7.5"; Probe Stem Length, A= 9"  
 10.5 = Insertion Length, U=10.5"; Probe Stem Length, A=12"  
 XX.X = Insertion Length as specified

TWELL P 3/4 260S 304 07.5 TYPICAL THERMOWELL PART NUMBER



STANDARD DUTY THERMOWELL



HEAVY DUTY THERMOWELL

### INDUSTRIAL PROBE PART NUMBERS

PROB = INDUSTRIAL TEMPERATURE PROBE, 1/4" DIAM.

CODE	FITTING
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SLH= Spring Loaded Head for use with thermowell  
 SLF= Spring Loaded Fitting, 2 1/4" length for use with thermowell  
 DIW= Direct Insertion, Welded Fitting, 2 1/4" length; no thermowell req.

CODE	UNION COUPLING
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C = 304 Stainless Steel Union & Nipples; 3" overall length  
 N = No Union Coupling

CODE	LENGTH
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06.0 = 6" Probe Stem Length (A) 1/4" Diameter 316 Stainless Steel  
 09.0 = 9" Probe Stem Length (A) 1/4" Diameter 316 Stainless Steel  
 12.0 = 12" Probe Stem Length (A) 1/4" Diameter 316 Stainless Steel  
 XX.X = Probe Stem Length (A) Specified in inches, 1/4" Diameter 316 Stainless Steel

CODE	SENSOR TYPE
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JT/C= J Type Thermocouple, Grounded Junction, MgO Insulation  
 KT/C= K Type Thermocouple, Grounded Junction, MgO Insulation  
 Pt100= 100Ω Platinum RTD, 4 Wire, DIN Curve

CODE	PRECISION
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NP = Normal Precision thermocouple or DIN RTD  
 EX = Extended Precision thermocouple or Class A DIN Curve RTD  
 UP = Ultra Precision, DIN RTD only

CODE	LEAD LENGTH
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XX.X Lead Wire Length in Inches as Specified

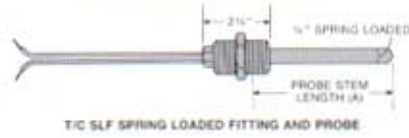
CODE	MEASURED TEMPERATURE
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HI Above 400°F  
 LO Below 400°F

PROB SLF N 09.0 JT/C EX 12.0 HI TYPICAL PROBE PART NUMBER



Pt 100 SLF SPRING LOADED FITTING AND PROBE



T/C SLF SPRING LOADED FITTING AND PROBE



Pt 100 DIW DIRECT INSERTION FITTING AND PROBE



T/C DIW DIRECT INSERTION FITTING AND PROBE

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