

Certification

National Institute of Standards and Technology (NIST) Traceable Certification of New Thermocouple Assemblies, New Thermocouple Wire, and Platinum RTDs

Introduction

The factory will provide a certification report which shows the degrees deviation from a standard at the temperatures certified in accordance with the provisions discussed below.

Certification

A reference RTD or type S thermocouple standard is used for temperatures above 200°F. A liquid-in-glass thermometer or reference RTD is used for temperatures below 200°F.

NIST traceability is available through 2650°F, where appropriate, based on thermocouple type. The minimum length of thermocouple wire or RTD that the factory will certify is 12 inches.

Only new, unused wire, thermocouples, and RTDs are certified.

Certain finished assemblies cannot be certified. The factory will determine if certification for an assembly is appropriate in our facilities.

Aerospace Material Specification AMS-2570, Rev. C, Section 3.1 provides for the use of thermocouples made from calibrated wire rolls. The charge for this service is the same as for certification of two individual thermocouples. All thermocouples on the order must use the same wire and be calibrated to identical temperatures. Consult the factory to determine the maximum number of thermocouples that may be calibrated from one wire length. Specify "end point certification per AMS-2750" when requesting this service.

The factory will not warrant or guarantee that sensors shall have accuracy better than specified in the following tables.

**Table 1.
Tolerances on Initial Values of
EMF v Temperature
for ANSI listed Thermocouples**

Type	Range		Tolerance * Reference Junction 0°C (32°F)	
	°C	°F	Standard	Special
			Greater of:	Greater of:
T	0 to 370	32 to 700	±1°C or ±0.75%	±0.5°C or ±0.4%
J	0 to 760	32 to 1400	±2.2°C or ±0.75%	±1.1°C or ±0.4%
E	0 to 870	32 to 1600	±1.7°C or ±0.5%	±1°C or ±0.4%
K or N	0 to 1260	32 to 2300	±2.2°C or ±0.75%	±1.1°C or ±0.4%
R or S	0 to 1480	32 to 2700	±1.5°C or ±0.25%	±0.6 or ±0.1%
B	870 to 1700	1600 to 3100	±0.5%	±0.25%

*°F tolerance is 1.8 times the °C tolerance at the equivalent °C temperature. Percentage tolerances apply only to temperatures expressed in °C.

Tolerances in this table apply to new assembly homogenous thermocouple wire, normally in the size range of 0.25 to 3 mm in diameter (#30 to #8 AWG) and used at temperatures not to exceed ASTM recommendations.

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Certain characteristics of thermocouple materials, including the EMF v temperature relationship may change with time in use. Consequently, test results and performance obtained at the time of manufacture may not necessarily apply throughout an extended period of use. Tolerances given in this table apply only to new wire as delivered, and do not allow for changes in characteristics with use. The magnitude of such changes will depend on such factors as wire size, temperature, time of exposure and environment. In addition, due to possible changes in homogeneity, attempting to re-calibrate used thermocouples is likely to yield irrelevant results, and is not recommended. However, it may be appropriate to compare used thermocouples in-situ with new or know good ones to ascertain their suitability for further service under the conditions of the comparison.

Table 2.
Non-ANSI Limits of Error
Thermocouples

Type	Range	Limits of Error
W-W, 26% Re	0 to 427°C 32 to 800°F	±4.4°C ±8°F
W, 5% Re-W, 26% Re	427 to 2316°C 800 to 4200°F	±1%
W, 3% Re-W, 25% Rh		
Platinel II (Platinel 5355 – Platinel 7674)	0 to 600°C (32 to 112°F) 600 to 700°C (1112 to 1192°F) 700 to 1300°C (1292 to 2372°F)	±0.10 mv ±0.15 mV ±0.20 mV

Table 3.
Platinum RTD

The following classification table represents values for 3 wire and 4 wire Platinum RTDs. Caution must be exercised with 2 wire RTDs because of possible error caused by connecting wires. Tabulated values are based on elements of 100.0 ohms (nominal) at 0°C.

Temp., (1) t (°C) (3)	ASTM Grade A (2) ±0.13 + (0.0017), (t) °C		ASTM Grade B (2) ±0.25 + (0.0042), (t) °C	
	(°C)	Ohm	(°C)	Ohm
-200	0.47	0.20	1.1	0.47
-100	0.30	0.12	0.67	0.27
0	0.13	0.05	0.25	0.10
100	0.30	0.11	0.67	0.25
200	0.47	0.17	1.1	0.40
300	0.64	0.23	1.5	0.53
400	0.81	0.28	1.9	0.66
500	0.98	0.33	2.4	0.78
600	1.15	0.37	2.8	0.88
650	1.24	0.40	3.0	0.94

(1) To convert temperature °C to °F, multiply by 1.8 and add 32. (2) To convert tolerance °C to °F, multiply by 1.8. (3) t = modulus of temperature in degrees Celsius without regard to sign.

Table 4.
Suggested Upper Limits for
Sheathed Thermocouples

These suggestions do not take into account environment temperature limitations of the sheath material, nor do they address compatibility considerations between the element materials and the sheath containing them. The actual maximum practical temperature in a particular situation will generally be limited to the lowest temperature among the several factors involved. Consult ASTM MNL 12 "Manual on the Use of Thermocouples in Temperature Measurement" (available from ASTM headquarters) and other literature sources for further application information.

The temperature limits suggested here are intended only as a guide and should not be taken as absolute values, or as guarantees of satisfactory performance. These types and sizes are sometimes used at temperatures above the given limits, but usually at the expense of stability or life, or both. In other instances, it may be necessary to reduce the given limits in order to achieve adequate service.

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**Table 4 (continued)
Suggested Upper Limits for
Sheathed Thermocouples**

Barber-Colman Part Number		Calibration Type	Sheath		Maximum Suggested Temperature	
Special Limits	Standard Limits		Material	Outside Diameter		
MJ12	M112	J	304 SS	0.040"	500°F	
MJ22	M122		Inconel 600			
MJ13	M113		304 SS	0.063"	825°F	
MJ23	M123		Inconel 600			
MJ33	M133		316 SS			
MJ43	M143		310 SS			
MJ14	M114		304 SS	0.125"	970°F	
MJ24	M124		Inconel 600			
MJ34	M134		316 SS			
MJ44	M144		310 SS			
MJ15	M115		304 SS	0.188"	1150°F	
MJ25	M125		Inconel 600			
MJ35	M135		316 SS			
MJ45	M145		310 SS			
MJ16	M116		304 SS	0.250"	1330°F	
MJ26	M126		Inconel 600			
MJ36	M136		316 SS			
MJ46	M146		310 SS			
MK12	M212		K	304 SS	0.040"	1290°F
MK22	M222			Inconel 600		
MK32	M232	316 SS				
MK42	M242	310 SS		0.063"	1600°F	
MK13	M213	304 SS				
MK23	M223	Inconel 600				
MK33	M233	316 SS		0.125"	1690°F	
MK43	M243	310 SS				
MK14	M214	304 SS				
MK24	M224	Inconel 600				
MK34	M234	316 SS		0.188"	1600°F	
MK44	M244	310 SS				
MK64		MI 2300				
MK15	M215	304 SS				
MK25	M225	Inconel 600		0.250"	1960°F	
MK35	M235	316 SS				
MK45	M245	310 SS				
MK16	M216	304 SS				
MK26	M226	Inconel 600		0.188"	2100°F	
MK36	M236	316 SS				
MK46	M246	310 SS				
MK66		MI 2300				
ME12	M312	E	304 SS	0.040"	570°F	
ME13	M313			0.063"	950°F	
ME14	M314			0.125"	1200°F	
ME15	M315			0.188"	1350°F	
ME16	M316			0.250"	1510°F	
ME34	M334			0.125"	1200°F	
MT12	M412	T	304 SS	0.040"	500°F	
MT13	M413			0.063"		
MT14	M414			0.125"	600°F	
MT15	M415			0.188"	700°F	
MT16	M416			0.250"		
MJ43-90000	M143-90000			J	310 SS	0.063"
MJ14-90000	M114-90000	304 SS	0.125"		970°F	
MJ15-90000	M115-90000		0.188"		1150°F	
MJ16-90000	M116-90000	310 SS	0.250"		1330°F	
MK23-90000	M223-90000	K	Inconel	0.063"	1690°F	
MK24-90000	M224-90000			0.125"	1960°F	
MK25-90000	M225-90000			0.188"	2100°F	
MK26-90000	M226-90000			0.250"		
ME14-90000	M314-90000	E	304 SS	0.125"	1200°F	
MT16-90000	M416-90000	T		0.250"	700°F	

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Table 5
Recommended T/C and RTD
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Ranges

The following table shows the allowable temperature limits for commonly used thermocouples and RTDs. These limits apply to thermocouples in conventional closed end protection tubes. In any general recommendations of temperature elements, it is not practicable to take into account special cases. In actual operation there may be instances where the temperature limits recommended can be exceeded. Likewise, there may be applications where satisfactory life will not be obtained at the recommended temperature limits. However, in general, the temperature limits listed are such as to provide satisfactory element life when the wires are operated continuously at these temperatures.

Type	Gauge	°F Range	°C Range
J	8	-70 to 1400	-57 to 760
	14	-70 to 1100	-57 to 593
	20	-70 to 900	-57 to 482
	24	-70 to 700	-57 to 371
K or N	8	-70 to 2300	-57 to 1260
	14	-70 to 2000	-57 to 1093
	20	-70 to 1800	-57 to 982
	24	-70 to 1600	-57 to 870
T	14	-70 to 700	-57 to 371
	20	-70 to 500	-57 to 260
	24	-70 to 400	-57 to 200
E	8	-70 to 1600	-57 to 871
	14	-70 to 1200	-57 to 649
	20	-70 to 1000	-57 to 538
R or S	24	-50 to 2650	-46 to 1454
B	24	32 to 2650	0 to 1454
0.00385 Platinum RTD		-70 to 450	-57 to 232
0.00391 Platinum RTD		-70 to 450	-57 to 232

Ordering Information

Certification at temperatures of 200° to 2650°F (93 to 1454°C)

For thermocouple, thermocouple wire, or RTD consult price list

Certification at temperatures of 32° to 199°F (0 to 93°C)

For thermocouple, thermocouple wire, or RTD consult price list

Dual element sensors are priced as two individual sensors.

Certification is not available for ring, bolt or lug type thermocouples. Sensors are calibrated to ITS-90 except where reference tables are referenced to IPTS-68.

Consult factory for cost of certification at temperatures below 0°C, or above 1454°C.