



Designation: E1684 – 05

# Standard Specification for Miniature Thermocouple Connectors<sup>1</sup>

This standard is issued under the fixed designation E1684; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers separable single-circuit miniature thermocouple connectors with two flat pins. Connectors covered by this specification must be rated for continuous use to at least 300 °F (150 °C), but they may optionally be rated higher.

1.2 This specification does not cover multiple-circuit connectors, multi-pin connectors, standard size connectors, or connectors intended primarily for panel mounting. High-temperature connectors (for example, those designed for continuous use at temperatures significantly above approximately 500 °F (260 °C)) are not intended to be covered by this specification.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 The following precautionary statement pertains only to the test methods portion, Section 9, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 The following documents of the latest issue form a part of this specification to the extent referenced herein. In case of conflict between this specification and another referenced document, this specification shall take precedence.

2.2 *ASTM Standards*:<sup>2</sup>

E230 Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples

E344 Terminology Relating to Thermometry and Hydrometry

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee E20 on Temperature Measurement and is the direct responsibility of Subcommittee E20.04 on Thermocouples.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

## 3. Terminology

3.1 *Definitions*—The definitions given in Terminology E344 shall apply.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *connector pair, n*—assembly consisting of a plug and a jack, each having both positive and negative inserts, that will connect two parts of an electrical circuit and provide a means of physically disconnecting the two parts without the use of tools.

3.2.2 *contact insert, n*—metallic conductor assemblies that, when installed in connector bodies, provide connections between two parts of an electrical circuit. Plug connectors will contain projecting prong contacts, while jack connectors will contain recessed socket or receptacle contacts.

3.2.3 *service life, n*—interval of time that a connector assembly will be put to use and retain all physical and thermoelectric properties.

3.2.4 *test difference, n*—apparent thermoelectric difference attributable to mated connectors observed by the test procedure of this specification.

## 4. Significance and Use

4.1 The widespread use of thermocouple connectors requires standardization of mating dimensions and performance characteristics.

4.2 This specification describes miniaturized thermocouple connector dimensions and capabilities and includes test procedures suitable for evaluating the performance of a particular specimen or design. The tests described are not intended for routine inspection or rapid testing of large groups of connectors or for quality control purposes.

## 5. Classification

5.1 *Plugs or Jacks*:

5.1.1 Connectors shall be constructed as either plugs or jacks, and these two forms shall be designed to connect with each other.

5.1.2 Plug connectors shall have two external prong contacts of differing sizes to prevent improper mating. The negative prong shall be the wider, as indicated in Table 1.

5.1.3 Jack connector shall have two internal socket contacts sized and spaced to receive and accommodate the prong contacts of the mating plug. Jack connectors shall also include

**TABLE 1 Dimensions**

Dimension	Symbol <sup>A</sup>	Minimum Size, in. (mm)	Maximum Size, in. (mm)
Plug body length	PL	...	0.788 (20.00)
Jack body length	JL	...	1.069 (27.13)
Body width	W	...	0.635 (16.10)
Body thickness	T	...	0.385 (9.78)
Length of prong	P	0.406 (10.31)	0.515 (13.10)
Depth of socket	J	0.515 (13.10)	...
Prong spacing	X	0.307 (7.80)	0.317 (8.05)
Positive pin width	W1	0.090 (2.28)	0.098 (2.49)
Negative pin width	W2	0.121 (3.07)	0.129 (3.27)
Pin thickness	T1	0.030 (0.73)	0.034 (0.86)

<sup>A</sup> Symbol reference corresponds to Fig. 1.

a means of producing and maintaining sufficient contact pressure to meet all the other requirements of this specification.

### 5.2 ANSI/ASTM Type:

5.2.1 Connectors shall be produced in versions to match each of the standardized ANSI/ASTM thermocouple types as given in Table 2.

5.2.2 The insert materials of each plug and jack shall have thermoelectric properties conforming to the characteristics of the corresponding thermocouple type as given in Specification E230 over the temperature range specified in Table 3.

5.2.3 Calibration conformance and gradient testing is not applicable to Type B thermoelectrically neutral (Cu/Cu) connectors.

## 6. Ordering Information

6.1 Orders for connectors under this specification shall include the following:

6.1.1 Quantity of plugs or jacks (specify which);

6.1.2 ANSI/ASTM calibration thermocouple type (see Table 2);

6.1.3 Any optional accessories that may be required, such as those listed in 7.4.3;

6.1.4 Special testing requirements; and

6.1.5 Requirements for certificates of conformance to the specifications or reports of the results of any required testing.

## 7. Materials and Manufacture

### 7.1 Body:

7.1.1 The dimensions of the connector bodies shall fall within the limits given in Table 1.

7.1.2 The connector body shall be made of an insulating material capable of continuous use at any temperature between

**TABLE 2 Identification**

ANSI/ASTM Type <sup>A</sup>	Body Color Coding
T	blue
J	black
E	purple
K	yellow
N	orange
R or S	green
B (Cu/Cu) <sup>A</sup>	white
C	red

<sup>A</sup> Thermoelectrically neutral (Cu/Cu) connectors are customarily used with Type B thermocouples.

**TABLE 3 Ratings**

Characteristic	min	max
Operating temperature	0 °F (–18 °C)	300 °F (150 °C)
Contact resistance (each leg)	...	0.04 Ω
Insulation resistance at room temperature	10 <sup>7</sup> Ω	...
Insulation resistance at 300 °F (150 °C)	10 <sup>6</sup> Ω	...
Test difference	...	±2 °F (±1.1 °C)
Repeated coupling cycles (coupled or uncoupled)	25	...
Service life	5000 h	...
Withdraw force	8 oz	...

0 °F (–18 °C) and 300 °F (150 °C) for the service life given in Table 3, without losing its ability to conform to this specification.

7.1.3 The connector bodies shall be colored in accordance with the color code given in Table 2 to provide rapid and permanent identification of the thermocouple calibration with which it is designed to be used. Each plug and jack shall be permanently marked with a symbol or symbols to identify positive and negative conductor inserts. All connectors shall bear the supplier's name or other means of source identification, unless otherwise specified in the purchasing documents.

7.1.4 An insulating barrier shall be incorporated into each connector body to prevent inadvertent contact between thermoelements or wires.

### 7.2 Inserts:

7.2.1 Contact inserts shall be fabricated of paired materials of the same thermocouple type as the thermocouple with which they are to be used.

7.2.2 The inside width and depth of the jack connector shall be such as to receive the corresponding plug prong smoothly and easily when inserted.

7.2.3 The force required for complete disengagement shall conform to the requirements of Table 3.

### 7.3 Construction and Assembly:

7.3.1 Wire attachment shall be by means of a screw or clamp suitable for use with wire diameters from 30 AWG (0.01 in. or 0.25 mm in diameter) to 20 AWG (0.032 in. or 0.8 mm in diameter).

7.3.2 Contact inserts and wire attaching parts shall be held captive to one of the body parts.

7.3.3 Connections and final closures of the connector shall be accomplished with simple hand tools such as screwdrivers, wrenches, or pliers.

### 7.4 Optional Accessories:

7.4.1 Connector accessories are not covered by this specification and may be unique to a manufacturer's specific design.

7.4.2 All required optional accessories are to be specified separately from the connectors.

7.4.3 The following is a partial list of useful accessory items:

7.4.3.1 Cable clamping devices for attaching flexible cables;

7.4.3.2 Clamps for rigid tubing and sheaths in a range of diameters whose conductor sizes are within the range specified in 7.3.1;

7.4.3.3 Elastomeric boots to seal connector assemblies against moisture in service;