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EIA STANDARD

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THERMAL CYCLING TEST PROCEDURE FOR ELECTRICAL CONNECTORS AND SOCKETS

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Electronic Components, Assemblies & Materials Association

THE ELECTRONIC COMPONENTS SECTOR OF THE ELECTRONIC INDUSTRIES ALLIANCE



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(From Standards Proposal No. 5064 formulated under the cognizance of the CE-2.0 National Connector Standards Committee.

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TEST PROCEDURE No. 110

THERMAL CYCLING TEST PROCEDURE FOR
ELECTRICAL CONNECTORS AND SOCKETS

(From EIA Standards Proposal No. 5064, formulated under the cognizance EIA CE-2.0 Committee on National Connector Standards.)

1 Introduction

1.1 Scope

This standard establishes a test method to expose connectors and sockets to extremes of high and low temperatures at a specified ramp up and ramp down rate.

NOTE — If the ramp time between temperature extremes is ≤ 2.0 minutes, this test procedure shall not be used. The procedure as specified in EIA-364-32 (Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors and Sockets) shall be performed as a substitute.

2 Test resources

2.1 Test equipment

The chamber and accessories shall be constructed of material that will not be affected by the temperature extremes as specified. A suitable open screen tray, rack or other suitable holding feature shall be provided to ensure that the specimen shall be exposed to circulating air. Specimens shall not be subjected to radiant heat from chamber conditioning processes. The circulation of air within the chamber shall be sufficient to assure a no-load temperature uniformity of $\pm 5^{\circ}\text{C}$. A temperature recorder and controller shall be provided, capable of controlling and recording the temperature within $\pm 2^{\circ}\text{C}$ at any setting throughout the temperature range.

3 Test specimen

3.1 Description

A test specimen shall consist of a mated connector, unless otherwise specified in the referencing document.

3.2 Preparation

3.2.1 The test specimen shall be assembled with contacts and all accessories required for proper function of the specimen under test, unless otherwise specified in the referencing document.

3.2.2 The test specimen shall be tested in a terminated and mated state, unless otherwise specified in the referencing document.

3.2.3 When applicable the conductor lengths (directly terminated to the contacts or as attached to support vehicles) shall be of sufficient length to interconnect the test specimen to applicable test equipment as may be specified for pre and post measurements or for monitoring during the test exposure.

3.2.4 If required, fixtures shall be lightweight with low thermal capacity in order to minimize “heat sink” effects.

4 Test procedure

4.1 Mounting

The test specimens shall be placed in such a position with respect to the air stream so that there is substantially no obstruction to the flow of air across and around each specimen, unless otherwise specified in the referencing document. When special mounting is required it shall be specified in the referencing document.

4.2 Initial and final measurements

The specified measurements shall be made prior to the first cycle at room ambient conditions, and after the last cycle after recovery to room ambient conditions, unless otherwise specified in the referencing document.

4.3 Test cycle

4.3.1 The specimen shall be placed in the test chamber, as specified in 4.1, when the chamber is at room ambient (15 °C to 35 °C).

4.3.2 The specimen shall be cycled at the rates specified in the following manner:

- step a: ramp up to the high (hot) temperature level,
- step b: dwell at the high (hot) temperature level,
- step c: ramp down to the low (cold) temperature level,
- step d: dwell at the low (cold) temperature level,
- step e: repeat steps a through d until the specified number of cycles has been completed,
- step f: return to room ambient as defined in 4.3.1 at the same ramp rate used in step a.

4.4 Ramp rate

4.4.1 If necessary, based on the specified ramp rate (hot to cold) liquid nitrogen may be used. If used, liquid nitrogen shall be introduced in such a manner that it shall not be directed onto the test specimen.

4.4.2 Unless otherwise specified in the referencing document, the ramp rate shall be an average of 5 °C/minute.

4.4.3 A chamber temperature overshoot may be used to help achieve the desired test sample temperature. It shall not exceed -10 °C on the cold side nor more than +10 °C on the hot side.

4.4.4 Humidity shall be uncontrolled.

4.5 Dwell time

4.5.1 The temperature extremes shall be maintained within ± 3 °C, with the exception of overshoot as noted in 4.4.3.

4.5.2 The minimum dwell time shall be 10 minutes after the specimen(s) has reached the chamber temperature specified, unless otherwise specified in the referencing document. This shall be determined by placing a thermocouple at the midpoint along the longitudinal length on the side of the test specimen. Only one specimen needs to be monitored located near the center of the group of specimens under test.

4.6 Unless otherwise specified in the referencing document, the severity level and duration shall be in accordance with one of the conditions as indicated in table 1 and 2 respectively.

Table 1 - Test conditions

Test condition	Low temperature	High temperature
A	+15 °C	+85 °C
B	-15 °C	+85 °C
C	0 °C	+100 °C

Table 2 - Test durations

Test duration	Number of cycles
A	10
B	100
C	500
D	1000
E	2000
F	3500

5 Details to be specified

The following details shall be specified in the referencing document:

- 5.1 Number of specimens to be tested
- 5.2 Test specimen description, if other than specified in 3.1
- 5.3 Special mounting if required
- 5.4 Test temperatures if other than indicated in table 1.
- 5.5 Dwell time if other than specified in 4.5.2
- 5.6 Ramp rates, if other than specified in 4.4
- 5.7 Number of cycles, if other than indicated in table 2
- 5.8 Measurements to be made before, during or after the exposure

6 Test documentation

Documentation shall contain the details specified in clause 5, with any exceptions, and the following:

- 6.1 Report number and test procedure number
- 6.2 Test equipment used, and date of last and next calibration
- 6.3 Actual temperature extremes (charts or a data log)
- 6.4 Dwell times (charts or a data log)
- 6.5 Ramp up and ramp down times (charts or a data log)
- 6.6 Values and observations
- 6.7 Name of operator and start/finish dates of test

EIA Document Improvement Proposal

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Revision History

Revision letter	Project number	Additions, changes and deletions
	SP-5064	Initial release