



IPC-TM-650 TEST METHODS MANUAL

1.0 Scope The purpose of this method is to determine the physical endurance of printed boards to sudden exposure to extreme changes in temperature and the effect of alternate exposures to these extremes. The exposure of the printed board specimens to the high and low temperature extremes is designed to cause physical damage, deterioration, or significant changes in resistance.

2.0 Applicable Documents

IPC-D-275 Design Standard for Rigid Printed Boards and Rigid Printed Board Assemblies.

3.0 Test Specimen Test coupon "D" from IPC-D-275 or other suitable test coupon (see 6.1a).

4.0 Apparatus

4.1 An automatically controlled dual temperature environmental test chamber or other dual chamber apparatus capable of maintaining $-65, -55, -40$ or $0^{\circ}\text{C} + 0 -5^{\circ}\text{C}$ [$-85, -67, -40, +32^{\circ}\text{F} + 0 -9^{\circ}\text{F}$] in the low temperature chamber and $70, 85, 105, 125, 150$ or $170 +5 -0^{\circ}\text{C}$ [$158, 185, 221, 257, 302$ or $338^{\circ}\text{F} +9 -0^{\circ}\text{F}$] in the high temperature chamber.

NOTE: The temperature extremes (high and low) that are required is dependent on the base material of the specimen that is to be tested (see 6.1b). The recovery capacity of the test chambers shall be such that the internal chamber air temperature shall reach the specified temperature within 2 minutes after the specimen(s) have been transferred to the test chamber.

4.2 An electrical resistance meter capable of accuracies of 0.5 milliohm or better with Kelvin (4 terminal) type leads. A Kelvin type double bridge or potentiometer of the specified accuracy may also be used (see 6.2).

5.1 Preparation Wire up test specimen with Kelvin-type leads at the points where measurements will be made.

5.1.1 Operate chamber (or chambers) and allow to stabilize at the high and low temperature required. Clamp or suspend

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specimen in the approximate center of the high temperature chamber. First specimens shall be placed approximately 13 mm [0.5 in] apart and aligned in a manner to permit maximum heat transfer to the test specimen(s).

5.2 Test

5.2.1 Thermal Shock Cycle

5.2.1.1 The specimens shall be subjected to 100 temperature cycles in accordance with the applicable test condition of Table 1.

5.2.1.2 Transfer time between chambers shall be less than 2 minutes. The thermal capacity of the test chamber used shall be such that the ambient temperature shall reach the specified temperature within 2 minutes after the specimen has been transferred to the appropriate chamber.

5.2.1.3 Interconnection resistance measurements shall be taken before the test, during the first cycle at high temperature, and during the last cycle at high temperature. In-chamber resistance measurements should be taken during the last few minutes of chamber exposure. Care should also be taken to measure samples after approximately the same duration at chamber temperature.

5.3 Evaluation The maximum change in resistance between the first and 100th cycle shall be evaluated for acceptability to the requirements of the applicable specification.

6.0 Notes

6.1 The following details are to be specified in the applicable performance specification:

- Test specimen, if other than specified in 3.0.
- Test condition, if other than specified in 4.1.
- Maximum change in resistance.

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Table 1

Step	Test Condition A		Test Condition B		Test Condition C	
	Temperature	Time	Temperature	Time	Temperature	Time
1	0, +0/-5	15	-40, +0/-5	15	-55, +0/-5	15
2	25, +10/-5	0	25, +10/-5	0	25, +10/-5	0
3	+70, +5/-0	15	+85, +5/-0	15	+105, +5/-0	15
4	25, +10/-5	0	25, +10/-5	0	25, +10/-5	0
Step	Test Condition D		Test Condition E		Test Condition F	
	Temperature	Time	Temperature	Time	Temperature	Time
1	-55, +0/-5	15	-65, +0/-5	15	-65, +0/-5	15
2	25, +10/-5	0	25, +10/-5	0	25, +10/-5	0
3	+125, +5/-0	15	+150, +5/-0	15	+170, +5/-0	15
4	25, +10/-5	0	25, +10/-5	0	25, +10/-5	0

Tolerance shall be +2 and -0 minutes.

6.1.1 Unless otherwise specified by the applicable performance specification, the following base material types/temperature ratings are recommended.

Table 2

Rigid Type	NEMA	Test Condition
		A
GP, GT, GX, GY		B
GE		C
AF, BF, BI, CF, GF, GB		D
GH, GM		E
AI, GI, QI		F

6.2 Suggested sources for capable test equipment:

Cambridge Technology
 Model 510A Micro-Ohmmeter
 23 Elm Street
 Watertown, MA 02172
 (617) 923-1181

Hewlett-Packard
 Model 4338A Milliohmmeter
 9800 Muirlands Avenue
 Irvine, CA 92718
 (714) 472-3000

Keithly Instruments
 Model 580
 Micro-ohmmeter
 28775 Aurora Road
 Cleveland, OH 44139
 (800) 552-1115