

TEMPERATURE CYCLING

1. PURPOSE. This test is conducted to determine the resistance of a part to extremes of high and low temperatures, and to the effect of alternate exposures to these extremes.

1.1 Terms and definitions.

1.1.1 Load. The specimens under test and the fixtures holding those specimens during the test. Maximum load shall be determined by using the worst case load temperature with specific specimen loading. Monolithic loads used to simulate loading may not be appropriate when air circulation is reduced by load configuration. The maximum loading must meet the specified conditions.

1.1.2 Monitoring sensor. The temperature sensor that is located and calibrated so as to indicate the same temperature as at the worst case indicator specimen location. The worst case indicator specimen location is identified during the periodic characterization of the worst case load temperature.

1.1.3 Worst case load temperature. The temperature of specific specimens as indicated by thermocouples imbedded in their bodies. These indicator specimens shall be located at the center and at each corner of the load. The worst case load temperature is determined at periodic intervals.

1.1.4 Working zone. The volume in the chamber(s) in which the temperature of the load is controlled within the limits specified in table I.

1.1.5 Specimen. The device or individual piece being tested.

1.1.6 Transfer time. The elapsed time between specimen removal from one temperature extreme and introduction into the other.

1.1.7 Maximum load. The largest load for which the worst case load temperature meets the timing requirements (see 3.1).

1.1.8 Dwell time. The time from introduction of the load into the chamber until the load is transferred out of the chamber.

2. APPARATUS. The chamber(s) used shall be capable of providing and controlling the specified temperatures in the working zone(s) when the chamber is loaded with a maximum load. The thermal capacity and air circulation must enable the working zone and loads to meet the specified conditions and timing (see 3.1). Worst case load temperature shall be continually monitored during test by indicators or recorders reading the monitoring sensor(s). Direct heat conduction to specimens shall be minimized.

3. PROCEDURE. Specimens shall be placed in such a position with respect to the airstream that there is substantially no obstruction to the flow of air across and around the specimen. When special mounting is required, it shall be specified. The specimen shall then be subjected to the specified condition for the specified number of cycles performed continuously. This test shall be conducted for a minimum of 10 cycles using test condition C. One cycle consists of steps 1 and 2 or the applicable test condition and must be completed without interruption to be counted as a cycle. Completion of the total number of cycles specified for the test may be interrupted for the purpose of test chamber loading or unloading of device lots or as the result of power or equipment failure. However, if the number of interruptions for any reason exceeds 10 percent of the total number of cycles specified, the test must be restarted from the beginning.

3.1 Timing. The total transfer time from hot to cold or from cold to hot shall not exceed one minute. The load may be transferred when the worst case load temperature is within the limits specified in table I. However, the dwell time shall not be less than 10 minutes and the load shall reach the specified temperature within 15 minutes.

TABLE I. Temperature-cycling test conditions.

Step	Minutes	Test condition temperature (°C)					
		A	B	C	D	E	F
1 Cold	≥10	-55 +0 -10	-55 +0 -10	-65 +0 -10	-65 +0 -10	-65 +0 -10	-65 +0 -10
2 Hot	≥10	85 +10 -0	125 +15 -0	150 +15 -0	200 +15 -0	300 +15 -0	175 +15 -0

NOTE: Steps 1 and 2 may be interchanged. The load temperature may exceed the + or - zero (0) tolerance during the recovery time. Other tolerances shall not be exceeded.

3.2 Examination. After completion of the final cycle, an external visual examination of the marking shall be performed without magnification or with a viewer having a magnification no greater than 3X. A visual examination of the case, leads, or seals shall be performed at a magnification between 10X and 20X (except the magnification for examination shall be 1.5X minimum when this method is used for 100 percent screening). This examination and any additional specified measurements and examination shall be made after completion of the final cycle or upon completion of a group, sequence, or subgroup of tests which include this test.

3.3 Failure criteria. After subjection to the test, failure of one or more specified end-point measurements or examinations (see 4.d.), evidence of defects or damage to the case, leads, or seals or illegible markings shall be considered a failure. Damage to the marking caused by fixturing or handling during tests shall not be cause for device rejection.

4. SUMMARY. The following details shall be specified in the applicable acquisition document:

- a. Special mounting, if applicable (see 3).
- b. Test condition letter, if other than test condition C (see 3).
- c. Number of test cycles, if other than 10 cycles (see 3).
- d. End-point measurements and examinations (see 3.1) (e.g., end-point electrical measurements, seal test (method 1014), or other acceptance criteria).