



SURFACE VEHICLE RECOMMENDED PRACTICE

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Highly Accelerated Failure Test (HAFT) for Automotive Lamps with LED Assembly

RATIONALE

Highly accelerated failure test (HAFT), or sometimes referred as accelerated life test (ALT) or highly accelerated life test (HALT) has been an industry's practice for long period time, both in automotive lighting as well as in general lighting applications. The purpose of HALT is to identify defined failures that may relate to the "weakest link", quality or design faults, or claimed life of the products. With fast growth of LED sources being used in the lighting applications, the lumen maintenance alone may not be the measure of reliability. Other types of failures, within the LED lamp assembly, must be identified as a quality or reliability concern. HAFT is intended to identify LED lamp assembly failure modes; the test results do not and should not be used to predict operational life of the product. For practical reasons, the HAFT should be completed within a one-day period.

With all possible impact from environment and usage in automotive applications, it is identified based on the known best practice in the industry that three major stressors can be used to induce earlier failures. These stressors are temperature, vibration, and input voltage to LED source assembly. This test is used to realize the operating and destructive limits of a product, when subjected to thermal, electrical and vibration loads.

Humidity is not considered as an independent stressor because it is a function of temperature and the formation of condensation naturally occurs as temperatures are lowered. Controlling humidity requires air exchange and conditioning. Controlling humidity during temperature changes is slow and mechanically challenging. During rapid thermal transitions it is not possible to control humidity. The HAFT test will produce rapid uncontrolled humidity swings as temperature changes and will be a stressor on the DUT, but it will not be specified as a variable in the test.

The analysis of the test results may also help recognize variations and uncover factors that may affect the intended performance. The sequences or combinations of applied stressors to the DUT are recommended based on the current practices.

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1. SCOPE

This SAE Recommended Practice provides test procedures, requirements, and equipment recommendations for the methods of the measurement that characterizes potential design failures by utilizing a step stress approach to subject a device under test to thermal, vibration, and electrical stresses of types and levels beyond what it may see in actual use, but which will rapidly induce failure modes, allowing them to be detected and corrected.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J387 Terminology - Motor Vehicle Lighting

SAE J575 Test Methods and Equipment for Lighting Devices and Components for Use on Vehicles Less Than 2032 mm in Overall Width

2.1.2 Other Publications

Available at Qualmark, 10390 East 48th Avenue, Denver, CO 80238, <http://www.qualmark.com>

HALT Testing Guidelines, Document 933-0336_04_Qualmark-HALT-Testing-Guideline.pdf

HALT and HASS in IPC 9592A

2.2 Related Documents

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J2357 Application Guidelines for Electronically Driven and/or Controlled Exterior Automotive Lighting Equipment

3. DEFINITIONS

3.1 OPERATING LIMITS

Product ceases to operate as intended when subjected to the stressor load, but resumes operating when the stressor load is removed.

3.2 DESTRUCTIVE LIMITS

Product ceases to operate as intended even after the stressor load is removed.

3.3 DUT

An acronym for “device under test”.

3.4 LED ASSEMBLY

A lighting functional component consisting of LED(s), drive and control circuit components, printed circuit board (PCB, if applicable), and interconnects to the circuit.

3.5 HALT

An acronym for “highly accelerated life test”

3.6 ALT

An acronym for “accelerated life test”

3.7 HAFT

An acronym for “highly accelerated failure test”