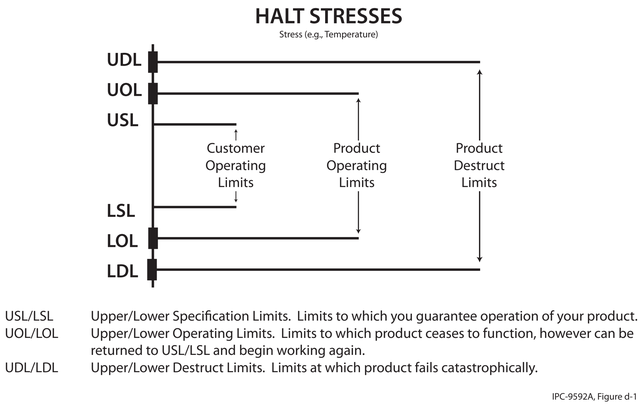
IPC-9592A 2010 Requirements for Power Conversion Devices for the Computer and Telecommunications Industries

IPC Introduced 9592 as a standard in 2008. Section 5.4 Stress Testing included HALT (Highly Accelerated Life Test), HASS (Highly Accelerated Stress Screen), and HASA (Highly Accelerated Stress Audit).

Rev A provides much greater detail on HALT/HASS purpose and process.

- Changes came from a desire to clarify and specify a process that was not well defined in the industry
- Included requirement for HALT, recommendation for HASS
- Defined the HALT and HASS processes



USL/LSL Upper/Lower Specification Limits. Limits to which you guarantee operation of your product.
UOL/LOL Upper/Lower Operating Limits. Limits to which product ceases to function, however can be returned to USL/LSL and begin working again.
UDL/LDL Upper/Lower Destruct Limits. Limits at which product fails catastrophically.

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HALT Highly Accelerated Life Test

Section 5.2.3 Definition

"HALT is a series of tests performed on a product as part of the design process to aid in improving product robustness. The principal idea of HALT is to find design weaknesses as quickly as possible and then fix them. After improving one weakness, the next design weakness is found and improved and so on until no design weaknesses remain that could result in field failures. During HALT, a product is stressed beyond the product specifications… to quickly accelerate and identify design weaknesses. … HALT is not a pass/fail test."

HALT environmental stresses and order are based on industry standard usage

- Cold Step
- Hot Step
- Rapid Thermal
- Vibration
- Combined

Courtesy of Qualmark Corporation

HALT Equipment Requirements

5.2.3.2.1 HALT Chamber Equipment Requirements

- Repetitive shock vibration via pneumatic hammers
- 6 degrees of freedom (3 linear and 3 rotational) vibration
- Pseudo-random vibration
- 50 gRMS minimum
- Wide thermal range, -80 to +170°C
- Rapid (60°C/minute preferred) ramps

Definition of HALT requires:

- Combined thermal and vibration environment
- Extreme stresses to achieve desired results
- Liquid Nitrogen (LN2) cooling to achieve recommended thermal ramp rates

TABLE 5-1 MINIMUM SAMPLE SIZE FOR HALT TESTS

	Low Temperature Step Test	High Temperature Step Test	Rapid Thermal Cycling Test	6-DOF Random Vibration Test	Input Voltage Test	Output Load Test	Combined Stresses Test
All Classes and Categories[1]	3	3	3	3	3	3	3

Note 1: For Categories 1 and 3 (Power Supplies/Adapters), users have the option of starting with less than 21 samples and re-using samples which survive a given sequence of testing. Users are cautioned that some HALT failures require extensive repairs after failures during early testing and may not be suited for subsequent testing. Category 2 (BMPM) must begin with 3 new units for each test sequence, except for units which have not failed a HALT test when the equipment capability limits have been reached. These units may be used in the next test rather than replacing them with new units.

HALT Functional Testing

D1.1.5 and D1.1.6 define product specific stresses to be used in HALT
Applies concept of HALT to input and output stresses on PCU
Specifications are not considered in stress levels
Upper and lower input voltage, upper output current limits are determined
Step stressing is applied to these stresses as well
Product specific stresses are applied between vibration and combined environment testing

5.2.3.8: "All failures found during HALT tests shall be analyzed to their root causes."
Critical to HALT success
Corrective actions must be thoroughly documented
Any decision not to implement corrective action on a failure must be described in documentation
Documentation on units tested and test equipment also defined
HALT is done early while board and system revisions are still changing
Status of tested units can make a significant difference in test results

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HASS - Highly Accelerated Stress Screen • HASA - Highly Accelerated Stress Audit

First version of 9592 described HASS and HASA
Desired by OEMs; Stated as an alternative to Burn-In

9592A expanded descriptions and recommendations for usage

- HASS now recommended as more effective than Burn-In
- Product Supplier can choose between HASS or Burn-in

Defined in 7.3.2, detailed description in Appendix D
Screen development process unchanged from 9592

- Based on HALT limits
- Requires proof of screen before implementation
- Demonstrate both safety and efficacy of screen