

HALT (Highly Accelerated Life Testing)

HALT, also referred to as AST (Accelerated Stress Testing) is an advanced product reliability test method focused on finding defects in products so they can be modified before entering the commercial phase.

The objective of HALT testing is to verify and qualify electronic designs, manufacturing processes and specific components. The tests utilize rapid temperature changes and random vibration stress modes, in a controlled environment while monitoring the process. The technique is different from conventional qualification plans in that the product's weakest link components are identified by accelerating their fatigue. Most verification test programs only confirm the specification of the system, not taking into account the robustness of the product beyond the upper or lower limits. HALT identifies all possible failure modes and does it in much less time than Stress Screening.

Using the HALT five-step process, engineers can identify failure modes, corrective actions and design changes. To verify the effects of these changes, abbreviated HALT tests, or RAPID HALT tests can be performed, focusing on the more stressful stages.

When all design defects have been reduced or eliminated and the product is deemed ready for production, a HASS (Highly Accelerated Stress Screen) program is used to identify failure modes introduced during the manufacturing process. HASS also is useful in screening undetected failures during burn-in processes. Finding these problems before the product is shipped will reduce warranty costs significantly.

HALT/HASS uncovers weaknesses in product design and manufacturing. With appropriate action taken, the limits of the product can be clearly identified and operating parameters can be extended as far as possible, resulting in a more stable product which can be introduced reliably and more quickly to market.

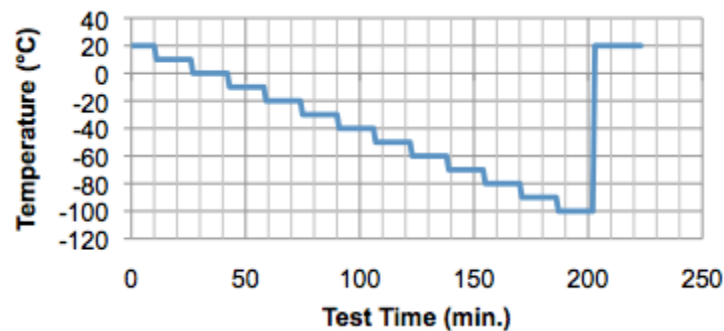
Classic HALT

Typically conducted in 5 steps:

Cold Step Stress, Hot Step Stress, Rapid Thermal Cycling, Vibration Step Stress, Combined Thermal with Vibration

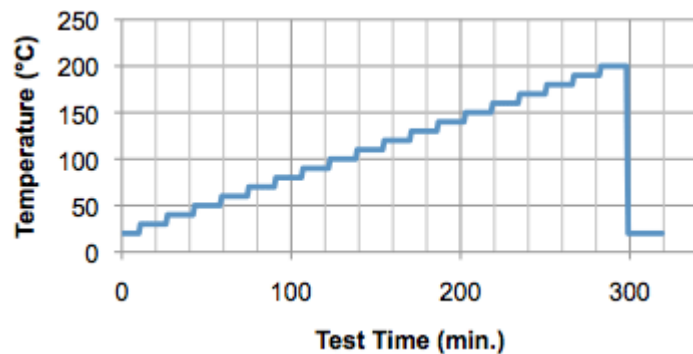
Cold Step Stress

- Starts at room temperature
- Cool down in 10°C steps to lower operating or destruct limit
- Dwell times are typically 15-20 minutes to stabilize product



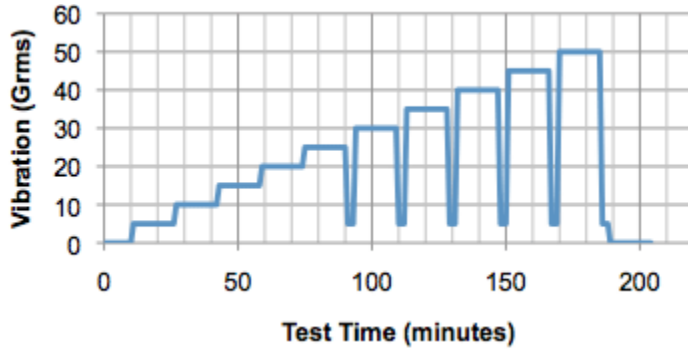
Hot Step Stress

- Starting at room temperature
- Heat up in 10°C steps to upper operating or destruct limit
- Dwell times are typically 15-20 minutes to stabilize product



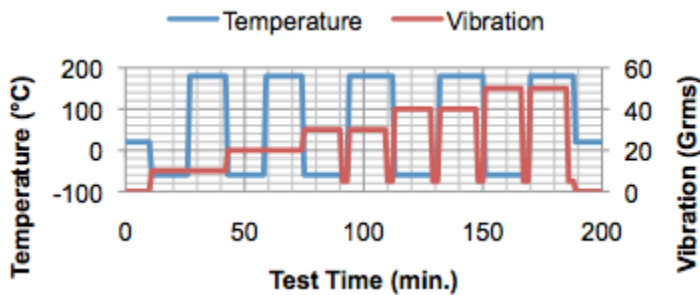
Rapid Thermal Cycling

- Cycle between the upper and lower operating limits
- Maximum rate of change the chamber is capable of
- Test a minimum of 5 cycles
- Dwell times are typically 15-20 minutes to stabilize product
- Important to monitor product



Combined Thermal with Vibration

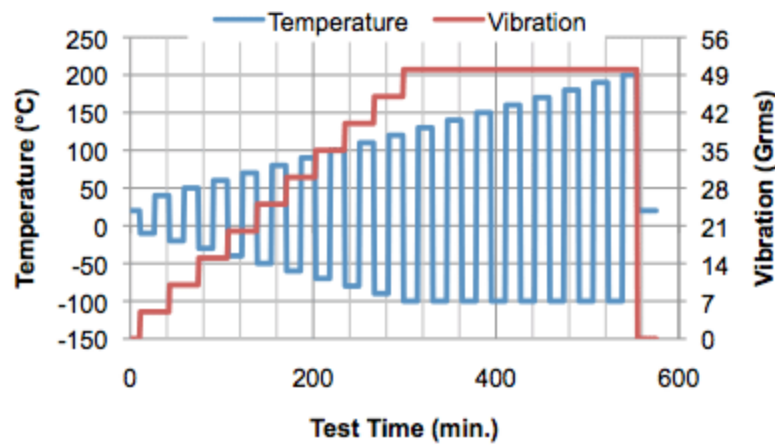
- Rapid thermal cycling combined vibration step stressing
- Uses same limits as Rapid Thermal Cycling
- Vibration follows limits discovered in Vibration Step Stress
- Dwell times are typically 15-20 minutes to stabilize product
- “Tickle vibration” also used here



Rapid HALT

When to perform Rapid Halt

1. Re-HALTING of corrective actions from a previous HALT
2. An annual reHALT of an previously HALTEd product to verify margins are stable, or
3. HALT testing simple products with simple test requirements.
 - A shorter more efficient form of HALT
 - Combines Thermal and Vibration step stressing
 - Takes approximately 50% of the time of Classic HALT
 - Temp cooling steps of 10°C begin at room temperature
 - Vibration steps of 5Grms at same time
 - Dwell time of steps contingent on product heat transfer rates
 - Typical dwell times are 15-20 minutes
 - A hot and cold temperature ramp is programmed at each dwell
 - See plot below for details of temp and vbe ramp profile



Let us know if you don't see the testing you need. DynaQual is planning to add complementary testing services such as Pressure, Calibration, X-ray, etc. We would like to hear from you regarding your interest obtaining these other testing services at our Houston location. Please use the inquiry form in the Contact Us (281-773-7944) tab to submit your request.