

## DESIGN NOTES

### Accelerated Testing Helps Manufacturers Bring Products to Market Sooner

Contributed by QualMark Corporation

As the saying goes, “First to market, first to profit.” In the race to debut new products, every marketing manager knows that beating the competition to the punch can provide a head start that can last throughout the product’s life cycle. Yet, to securely maintain that edge, the product must consistently deliver on its promise, which means that quality can never be compromised.

To fulfill the requirements of delivering reliable products, on-time, accelerated testing techniques are quickly being adopted to the point that manufacturers who don’t employ them stand to fall out of the race. For this reason, both HALT (Highly Accelerated Life Testing) and HASS (Highly Accelerated Stress Screenings) are gaining acceptance as the new standards for product development and process control.

#### A Proactive Testing Mentality

Every manufacturer whose product contains electronic circuitry or an electromechanical assembly can benefit from accelerated test methods that enable companies to develop products quickly, within budget, and with assurance that they are free of design flaws.

The proactive approach of accelerated testing stands in contrast to past procedures that typically consumed weeks or months. And because many conventional test procedures stay within specification, they miss design defects that can be detected by over-stress techniques. This can result in product failures in the field, costly product recalls, ongoing warranty expenses and time-consuming support programs.

HALT and HASS techniques shortcut and avoid these problems by quickly exposing any weak links in a product so they can be fixed before they become expensive field issues. In effect, HALT and HASS ferret out any weak links in design and production processes in order to make great products even better.

#### HALT and HASS Defined

HALT testing is a proven method to find design defects. Without discovery, design defects often appear in end-use applications, causing product failures after release. But HALT increases product reliability by pushing a product to its operating limits and beyond.



Accelerated testing requires test chambers capable of creating a high-stress environment of temperature and vibration

With HALT, a product is subjected to the outer margins of temperature, rapid thermal cycling, and vibration testing to rapidly uncover any design weaknesses.

“Most traditional testing checks the product up to the spec, but HALT goes way beyond that,” says Mike Silverman, Managing Partner of Ops Ala Carte, LLC, a professional consulting firm that focuses on reliability engineering services. “For example, let’s say a cell-phone manufacturer says their product will work up to 50° C. Well, HALT will actually take that phone up to 70, 80, or 90° C, in order to find any weaknesses before the product goes out the door.”

After HALT has revealed any product weaknesses, proper Root Cause of Failure analysis facilitates the corrective action necessary to improve the design. As a result, HALT reduces R&D costs, shortens the time to market, and increases product quality and reliability.

Once an approved design goes into production, HASS testing comes into play to ensure that any weak links in the manufacturing processes do not undermine the already-proven design. In essence, the goal of a HASS is to detect failure modes that can be introduced in the production of the product.

“In HASS, the product is subjected to much the same tests performed in HALT, but the goals of the test are different,” says Silverman. “HASS is a manufacturing screening process that focuses on process issues, such as assembly errors, in order to remove any possible infant mortality in the product—mostly in the area of hardware—before the product is released.”

HASS proves effective in screening-out failures

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that may have gone undetected during traditional burn-in testing processes. It also goes beyond normal testing to verify the integrity of mechanical interconnects and component tolerance compatibility. A product that passes HASS testing assures manufacturing-process quality and workmanship integrity. The result is increased out-of-box quality and field reliability, with decreased field service and warranty costs.

### Maximizing the Benefits of HALT and HASS

Ultimately, the benefits of increased product reliability help push up the bottom line of any manufacturer. In the long run, the outcome is higher customer satisfaction and confidence, improved company image and reputation, and increased market share.

“I would say that the main thing that accelerates products to market is that failures can be created much more quickly by using HALT and HASS than with standard reliability improvement techniques,” says Ed Kyser, Ph.D., consultant and author of several articles on accelerated stress testing. Dr. Kyser’s company, Reliability Economics, provides assessment and economic analysis of all aspects of reliability and quality improvements programs. “The reason: we’re stressing the product/component beyond its design limits. To me, that is the genius behind this kind of approach to finding faults and fixing them.”

Because accelerated testing covers an extremely broad range of products, applying that “genius” requires expertise in determining which equipment and testing procedures are best for a particular application. For instance, HASS is not intended to be a rigid process that has an endpoint, but rather a dynamic process that may need modification or adjustment over the life of the product. Since HASS levels are more aggressive than conventional screening tools, a proof-of-screen (POS) procedure is vital to determine that the HASS stresses are capable of revealing production defects.

Testing equipment companies, such as QualMark Corporation add value to the sale of accelerated testing equipment by counseling manufacturers on how to successfully set up these testing procedures. QualMark has installed more than 600 of its proprietary testing systems in 30 countries for many major corporations. The company recently acquired Massachusetts-based Ling Electronics, a manufacturer of a complete line of electrodynamic shakers and amplifiers, ranging from 100 force pounds to 40,000 force pounds.

QualMark’s patented OVS (OmniAxial Vibration System) tables used in their HALT and HASS chambers excite every part of a product, down to the component level, at its resonant frequency. This requires vibration in all three axes as well as the rotation around those axes, simultaneously, across a wide frequency range. At the same time, and within the same chamber, thermal tests are undertaken. The chamber’s patented air-handling technology drives products from ambient to the appropriate stress temperature quickly using less electricity and liquid nitrogen, lowering the total cost of chamber ownership.

Charlie Bates, vice president of program development for QualMark notes that an analysis of all possible defects will show that certain percentages appear at extreme high and low temperatures, during thermal cycling, under vibration in all axes, and during combined vibration and thermal cycling. Testing vibration and temperature simultaneously is needed because, without it, studies have shown that 25 to 30 percent of the defects can be missed.

HALT and HASS testing also requires broad frequency excitation, far beyond what a product might see in the end use environment. QualMark equipment can shift the energy in the frequency domain down to the zero to 5,000 Hz range. With 50 percent of the energy below 2,000 Hz and 50 percent above, the system can stimulate the resonant frequencies in various types of electronic hardware, including printed circuit boards, exposing such problems as weak solder joints and incomplete surface mount connections.

### Summary

Properly selected and applied, HALT and HASS accelerated testing enables manufacturers to bring products to market more quickly, with the confidence that the product is as reliable as possible. In this manner, companies that adopt accelerated testing procedures can enjoy a large jump on their competition to help capture a market-leading share.

This note was provided by QualMark Corporation. For further information, readers may contact Alan Perkins, Vice President of Sales and Marketing at [perkinsa@qualmark.com](mailto:perkinsa@qualmark.com).

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