

HALT, HASS, and HASA Application Seminar

OBJECTIVES

Specifically targeted for those with the basic education in HALT, HASS, and HASA to show how to apply the techniques on products. We have also introduced the topics of Reliability Demonstration Testing and Accelerated Reliability Testing for comparison purposes.

WHO SHOULD ATTEND

This course is intended for those involved in HALT and HASS on products and need a better understanding on how to apply these principles to your particular products. This seminar will be application oriented with case studies and examples in over 50 different industries. The material for the course is based on HALT and HASS results on over 500 products.

OUTLINE

Introduction

- HALT and HASS as part of an overall reliability program
 - Elements of a Reliability Program and how HALT and HASS fit in
 - Basic Definitions
 - Reliability vs. Cost
 - Product Life Cycle Matrix
 - Why HALT and HASS?
- Evolution of HALT
 - Probability Ratio Sequential Testing (PRST)
 - Stress for Life (STRIFE)
- Evolution of HASS
 - Run-In / Burn-In
 - Environmental Stress Screening (ESS)

Highly Accelerated Life Testing (HALT)

- HALT: How it works
- HALT: Why it works
- Benefits of HALT
- Margin discovery process explained
- Failure Modes/Failure Mechanisms
- Testing to the Fundamental Limit of Technology (FLT)
- Fatigue vs. Overstress / Stress vs. Cycles Plot
- Rules of thumb for HALT limits

- Root cause analysis during HALT/Ask Why 5 times
- Verification HALT
- Common design problems
- Sample size for HALT
- Commercial vs. Industrial vs. Military Grade components
- Case Studies
- Summary of Results based on 100 HALTs
- Fixturing
 - How to fixture
 - Examples of fixturing
- Fixturing when portions of product are removed outside chamber
 - Power Supply from rest of product
 - Hard drive from rest of PC
- Fixturing when portions of product are removed but still inside chamber
 - PCI card separated from motherboard
 - Hard Disk heads separated from controller
- Equipment used during HALT/how to choose a chamber
- HALT Stresses beyond temperature and vibration
 - Humidity
 - Shock
 - Drop
 - Frequency Margining
 - Voltage Margining (AC/DC)
 - Power Cycling
 - Twisting/bending
 - Corrosion
- HALT Return on Investment (ROI) Calculations
- Classroom Exercises

Reliability Demonstration Test (RDT)/Accelerated Life Test (ALT)

- Definitions
- Types of Demonstration Tests
 - Failure Free Testing
 - Sequential Testing
 - Time Terminated Tests
 - Failure Terminated Tests
 - Accelerated Life Testing
 - Statistics for an ALT
 - Exponential Distribution
 - Weibull Distribution

- ALT Parameters
 - Length of Test
 - Number of Samples
 - Goal of Test
 - Confidence Desired
 - Accuracy Desired
 - Cost
 - Acceleration Factor
 - Field Environment vs. Test Environment
 - Acceleration Factor Calculation
 - Wearout Factor (Slope of Weibull Distribution)
- Acceleration Factor Models
 - Arrhenius Model
 - Eyring Model
 - Coffin-Manson
 - Norris-Lanzberg
 - Others
- Determining Acceleration Factor by Experimentation
- HALT vs. ALT: When to Use Which Technique?
 - Comparison Between HALT and ALT
 - Combining ALT with HALT
 - Developing ALT from HALT
 - Examples of Products for HALT and ALT
- On-Going Reliability Testing
 - Comparison Between ORT and HASA
- Integrating RDT into a Reliability Program
 - How to Use the Results of HALT in Planning an RDT
 - How to Use the Results of Reliability Predictions in Planning an RDT

Highly Accelerated Stress Screening (HASS)

- HASS: How it works
- HASS: Why it works
- Benefits of HASS
- When to start planning for HASS
 - HASS process steps before HALT is complete
 - HASS process steps after HALT is complete
- Screen tuning/Assuring an effective screen
- Precipitation/detection screen examples
- How to avoid wearout

- Fixturing
 - How to fixture for HASS
 - Examples of fixturing for high volume
 - Examples of fixturing for low volume
- Sample size for HASS Development
- What to do with soft failures during HASS
- Rules of thumb for HASS profile limits
- HASS Development: 4 different options
 - High volume/small HASS Development sample
 - Low volume/small HASS Development sample
 - Low volume/large HASS Development sample
 - Low volume/using No Trouble Found samples
- HASS Profile Examples
 - HASS for Wide Operating Limits
 - HASS for Narrow Operating Limits
 - Precipitation-Detection Screens, examples of
- Root cause analysis during HASS
- HASS results: examples of failures
- When to change a HASS profile
- Alternatives to HASS
 - Burn-In
 - ESS
 - System Level Vibration
 - 5DX x-ray
 - Acoustic testing
- HASS/ESS Hybrids
 - Board level HASS/System Level Vibration only
 - Temperature Cycling / Vibration separated
- HASS Return on Investment (ROI) Calculations

Highly Accelerated Stress Auditing (HASA)

- HASA: How it works
- HASA: Why it works
- Benefits of HASA
- Steps to HASA
- When to switch from HASS to HASA
- HASA Example
- Statistics behind HASA
- HASA Return on Investment (ROI) Calculations

General Information

- Thermocouples/Accelerometers
- Support Equipment
 - Vibration Analyzers
 - Dataloggers
- Troubleshooting Equipment
 - Strobes
 - Handheld vibration tools
 - Scopes
- Setting up a HALT lab
 - Writing a Plan
 - Writing a Report
 - List of the best HALT labs for reference
 - Equipment needed for Calibration

Summary of HALT, HASS, and HASA

- What is required for a Successful Program
- Champion
- Training
- Commitment
- Management Support
- Root Cause Analysis

Integrating HALT, HASS, and HASA with the rest of your Reliability Program

- Analytical tools that support the HALT, HASS, and HASA planning process
 - Predictions, Derating, FMECAs
 - Designs of Experiments (DoEs)
 - Finite Element Analysis
- Analytical tools that can be used in conjunction with HALT, HASS, and HASA
 - Failure Reporting Analysis and Corrective Action Process (FRACAS)
 - Root Cause Analysis Process
- Analytical and Testing tools that can be used after completion of HALT
 - Design of Experiments (DoEs)
 - Reliability Demonstration Tests (RDTs)
- Analytical and Testing tools that can be used to determine when to transition from HASS to HASA
 - Reliability Statistics
 - Control Charts, Paretos
 - Root Cause Analysis