



Environmental Testing for Reliability of Products and Components

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About Us

- ▶ CertifiGroup is the testing services division of Educated Design and Development
- ▶ CertifiGroup offers consulting, testing, and certifications.
- ▶ Educated Design and Development designs, manufactures, and supplies test equipment for the product safety industry.



- ▶ We are also the South East office of Eurofins/MET Labs.
 - ▶ An OSHA Nationally Recognized Test Lab (NRTL)
 - ▶ Provide UL, ANSI, and NFPA certifications/listings



MET Labs

ISO 17025 Accreditation

- ▶ CertifiGroup is ISO/IEC 17025 accredited by ANSI-ASQ National Accreditation Board



- ▶ Approved for multiple mechanical and electrical tests
 - ▶ (UL, IEC, NEMA, EN, ANSI, MIL, and more)
- ▶ Details of our full scope of accreditation can be found on our website

Test Equipment



- ▶ Almost all test equipment that will be covered in this presentation can be purchased directly from Educated Design and Development (ED&D)
- ▶ ED&D can build and fabricate custom test equipment specific to your application
- ▶ www.productsafet.com



Scratch Test Machine



CTI Tester

Goal

Environmental Tests

- ▶ Which tests should I perform?
- ▶ Why is Environmental Testing important to me?

Test Plan

- ▶ What is a Test Plan?
- ▶ Why is a certification not “good enough”?

Factors to Consider

- ▶ What factors should I consider when making a test plan?

Testing Principles

- ▶ How should I design a better product?

HALT & HASS

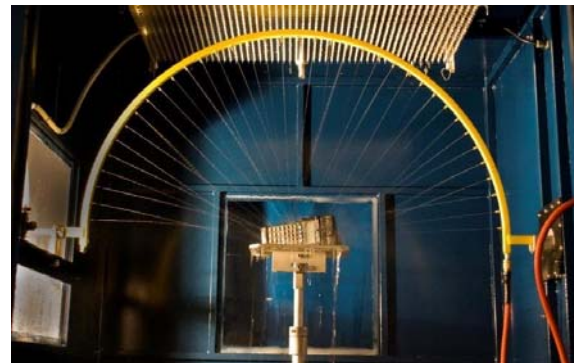
- ▶ Why is HALT important?



Environmental Tests

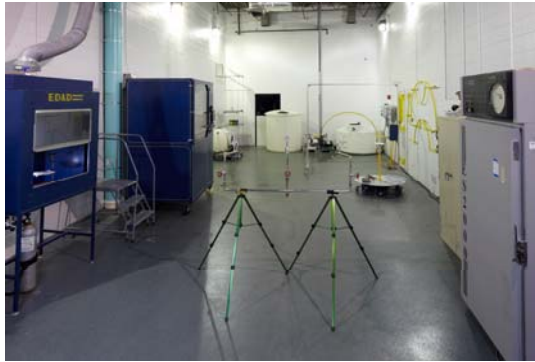
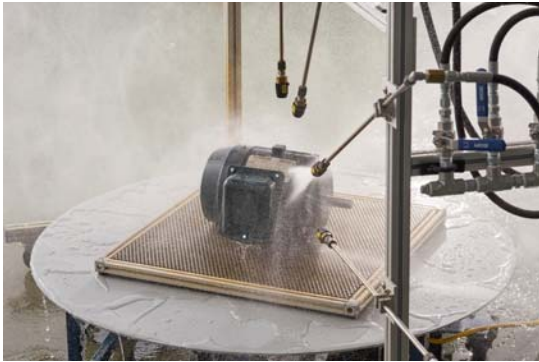
Environmental Testing

- ▶ CertifiGroup has the capability to perform various types of “Environmental Testing”
 - ▶ Water Ingress (IP & NEMA ratings)
 - ▶ Accessibility
 - ▶ Dust Ingress
 - ▶ Impact
 - ▶ Corrosion (Salt Fog)
 - ▶ Pressure Testing
 - ▶ Flame Testing
 - ▶ Thermal Shock
 - ▶ High & Low Temp and Humidity
 - ▶ Shock and Vibration
 - ▶ HALT/HASS



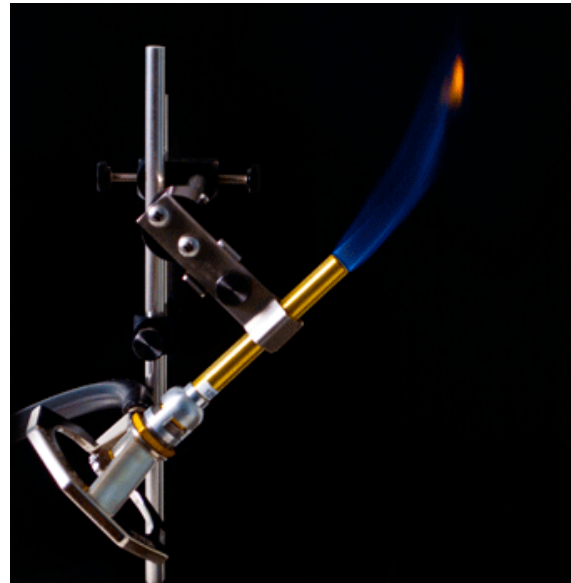
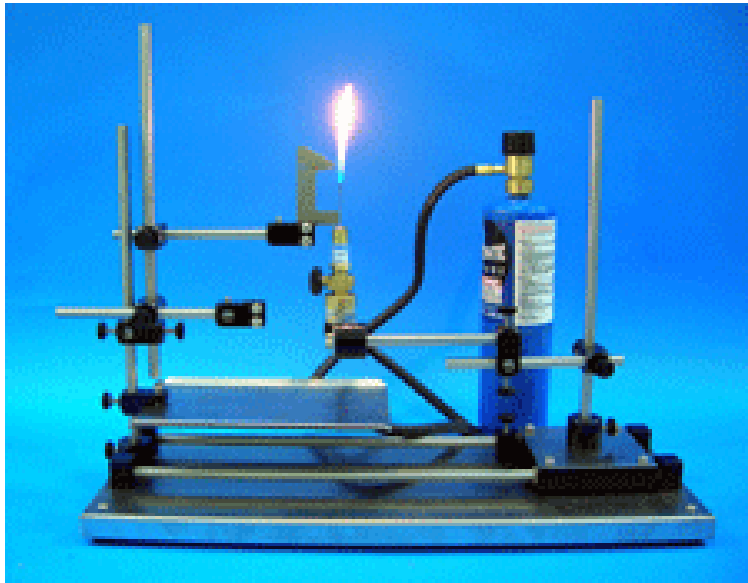
Ingress Tests

- ▶ Can perform all IP & NEMA enclosure type tests
- ▶ All testing is performed indoors



Flame Testing

- ▶ 5VA, 5VB, V-0, V-1, V-2, and more
- ▶ UL, CSA, IEC, EN standards



Temp, Humidity, and Thermal Shock

- ▶ -100C to +350C capabilities
- ▶ Change rates of up to 60C a minute
- ▶ Thermal Shock
 - ▶ “Hot” Chamber: 70 to 210C
 - ▶ “Cold” Chamber: -75C to 190C
 - ▶ Less than 5 second transfer



HALT/HASS

- ▶ -100 to 200C
- ▶ 60gRMS max
- ▶ 50C/min
- ▶ 500lb capacity
- ▶ 6 degrees of freedom
- ▶ Random Vibration





Test Plan

What is a Test Plan?

- ▶ A series of tests as defined by the manufacturer (designer) of a product for a specific product application
- ▶ Test plans are often dictated by either customer demands or the competition
 - ▶ *Customer:* To complete the sale it must meet a “spec” or proof of reliability
 - ▶ *Competition:* A similar product on the market is claiming a rating and you want to meet or exceed it
- ▶ A test lab must have a test plan
 - ▶ Exception: Unless test is defined in a standard

Test Plan vs Test Standard

- ▶ Using a list from a product safety standard (UL, ASTM, MIL, IEC, etc..) is not sufficient
- ▶ A test plan should supplement a standard
- ▶ Test Standards are considered to be a form of “type testing” to meet a pass/fail criteria
- ▶ A test standard is only a guide and multiple other factors need to be considered when testing your product



Certified Products & Testing

- ▶ A MET, UL, or NRTL certified product does not claim it has a better performance or reliability than a uncertified product
- ▶ A certification is only to verify that the product meets a safety specification to a UL standard
- ▶ UL standards do not indicate how well a product performs its function
- ▶ Manufacturers must take steps on their own to improve their product's performance
 - ▶ Do not wait for the competition, take action on your own



Type Testing

- ▶ “Type Testing” is testing performed on a product to verify compliance with a test standard
- ▶ Majority of test standards only require testing on one sample (new or unconditioned)
- ▶ Type testing does not take into consideration the “repeatability” of your results
 - ▶ Are you confident that it will pass after production or years in the field?
 - ▶ Are you willing to gamble on warranty claims on a single test?



Factors to Consider

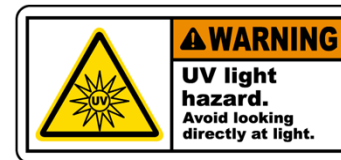
Factors to Consider

▶ Environmental Factors

- ▶ Temperature Extremes
- ▶ Humidity
- ▶ Altitude
- ▶ Corrosion
- ▶ Oil, Chemicals, Corrosive
- ▶ UV/Sunlight
- ▶ Vibration & Shock
- ▶ Impact
- ▶ Marine Environment
- ▶ Transportation

▶ Abuse

- ▶ How do users use the product?
- ▶ Should you test samples from the field?
- ▶ Are features incorporated in your product to prevent misuse?



Factors to Consider

- ▶ Manufacturing Processes?
 - ▶ Is there more than one manufacturing location for the product?
 - ▶ Are alternate suppliers used for parts or materials?
 - ▶ Should you randomly select products for testing?
 - ▶ How “repeatable” is the manufacturing process?
- ▶ Electrical
 - ▶ Operation at min and max
 - ▶ Voltage & Frequency
- ▶ Mounting means & Orientation
 - ▶ Does my product perform differently if mounted in alternate positions?
 - ▶ Does my literature or product design require only one type of mounting means?

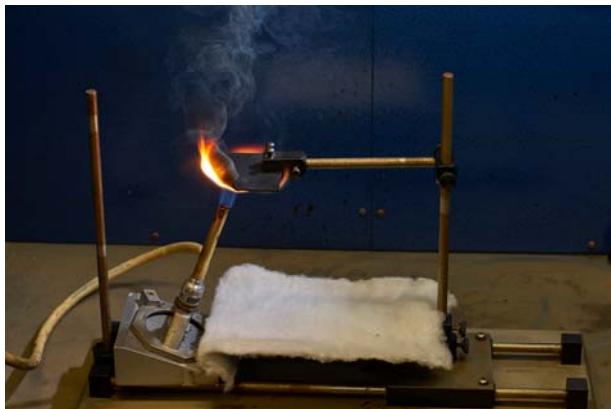
Factors to Consider

- ▶ Mounting Means & Orientation
 - ▶ Does my product perform differently if mounted in alternate positions?
 - ▶ Does my literature or product design require only one type of mounting means?
- ▶ Countries of Destination
 - ▶ What requirements or standards apply for my product for the country of destination/installation?
 - ▶ Requirements vary significantly from North America, Europe, and other countries
 - ▶ Testing ratings are not often universal



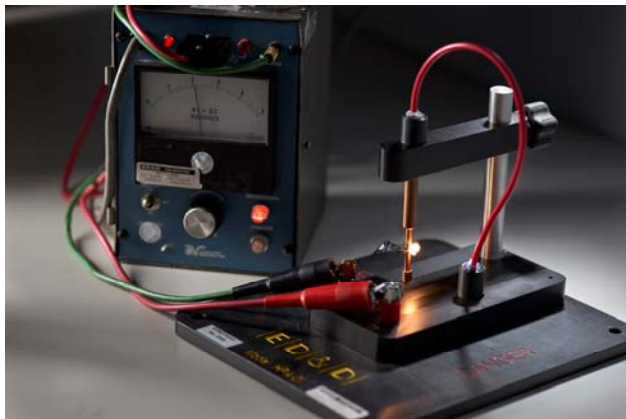
Pre-Conditioning

- ▶ Before testing should I pre-condition or age my sample?
- ▶ Many product safety standards do not require pre-conditioning prior to performing environmental tests
- ▶ Should I consider soaking my product in a chamber that reflects actual real life conditions prior to performing a water or dust test?
 - ▶ A rain or dust storm does not always occur at 72 degrees.
 - ▶ Why not test after being soaked in a chamber at 120 degrees or after freezing?



Production Line Testing

- ▶ Many UL or NRTL listed products mandate production line testing but typically these tests are very basic (Grounding or Dielectric).
- ▶ Should I add my own production line tests at the factory?
- ▶ Should I test 100% of all products?
- ▶ Should I randomly select products from manufacturing to be sent to a test lab for destructive testing?
- ▶ Am I using calibrated test equipment?





Testing Principles

Test Early and Often

- ▶ Testing plans should be considered well before production and better yet before a prototype is even built.
- ▶ The later testing begins, the more the cost will rise (product re-design, supplier changes, tooling, etc.)
- ▶ To improve your reliability you must find and fix failures
- ▶ Identifying failures is an opportunity to fix and repeat
- ▶ Do not test only to get a “pass”, test to learn!



The 4 Stages of Testing

- ▶ 1) Develop the Test Plan
 - ▶ Formulate the requirements and understand your goals
- ▶ 2) Evaluate and Test the Prototype
 - ▶ Find and fix the failures
 - ▶ Where did my product fail and why?
 - ▶ HALT Testing
- ▶ 3) Verify reliability
 - ▶ Does my new product maintain the limits achieved in the previous testing?
- ▶ 4) Testing Production
 - ▶ Sample products from testing
 - ▶ Continually monitor performance of product over its lifetime
 - ▶ HASS Testing

Simulate vs Stimulate

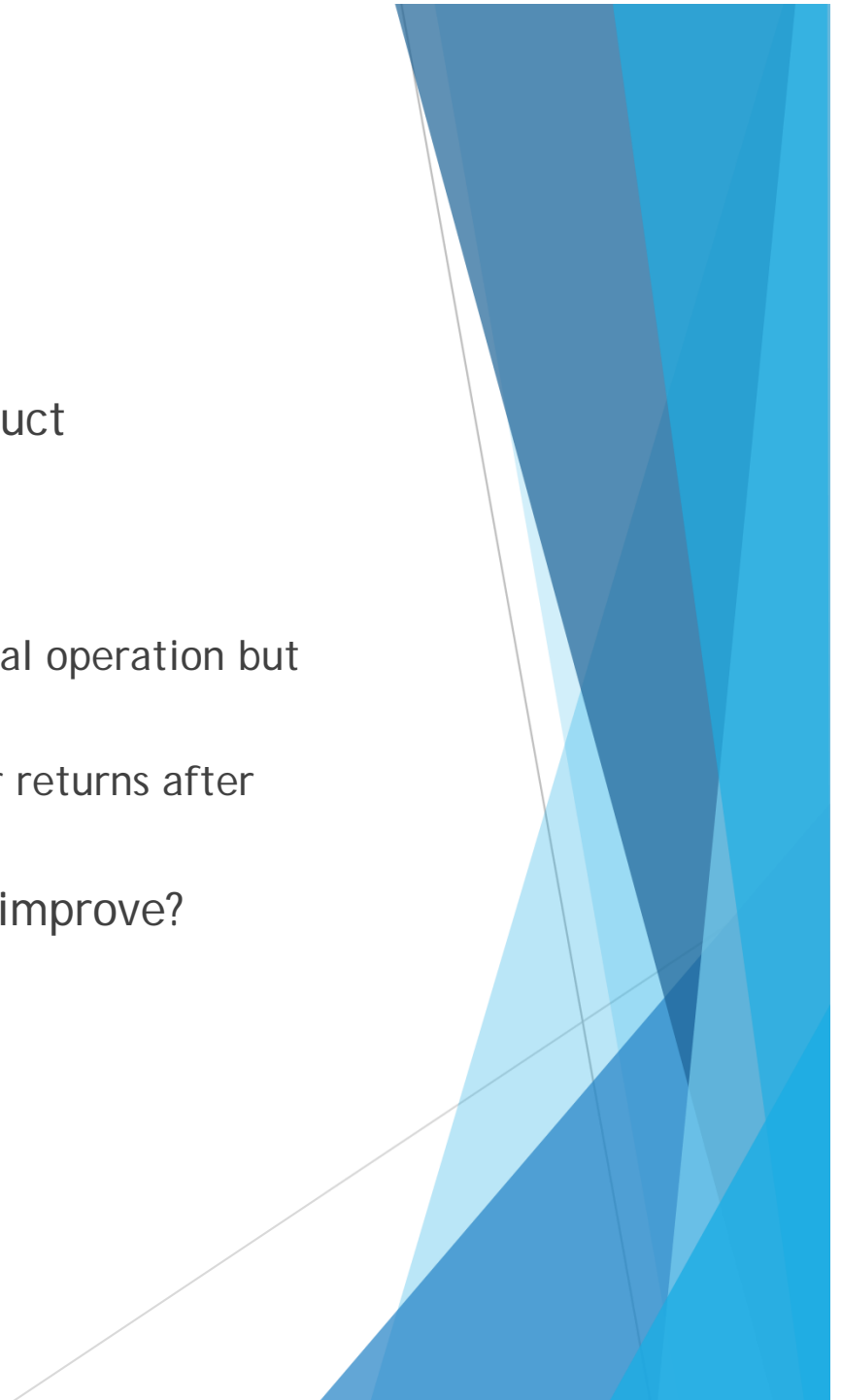
- ▶ Some tests are designed to “simulate” and some are to “stimulate”
- ▶ *Simulate*: Is subjecting a product to a test that reflects a actual real-life event.
 - ▶ Operating range or limits
- ▶ *Stimulate*: Is to encourage a product to achieve a result (good or bad)
 - ▶ HALT Testing is considered to be a accelerated form of stimulation testing because its goal is to find failure points.
 - ▶ No product would be subjected to real-life conditions that can be found in a HALT profile



HALT & HASS

What is HALT?

- ▶ Highly Accelerated Life Testing
- ▶ Is intended to find failures in your product
- ▶ The goal is to find limits
 - ▶ Spec (operating range)
 - ▶ Operational (product diverts from normal operation but returns when stress is removed)
 - ▶ Destructive (product diverges but never returns after stress is removed)
- ▶ Why did my product fail and how can I improve?
- ▶ There is no pass/fail in HALT!



What is HALT?

- ▶ Utilizes a chamber that can perform rapid changes of temperature and vibration
- ▶ Temp. Range: 100 to 200C
- ▶ Change Rate: 50C/min
- ▶ 60gRMS max
- ▶ Repetitive Shock in X, Y, Z axis
 - ▶ Six Degrees of Freedom
- ▶ Test profile to be defined by the manufacturer; HALT not found in product safety standards

HALT Process

▶ Typically the HALT process is comprised of 5 main steps

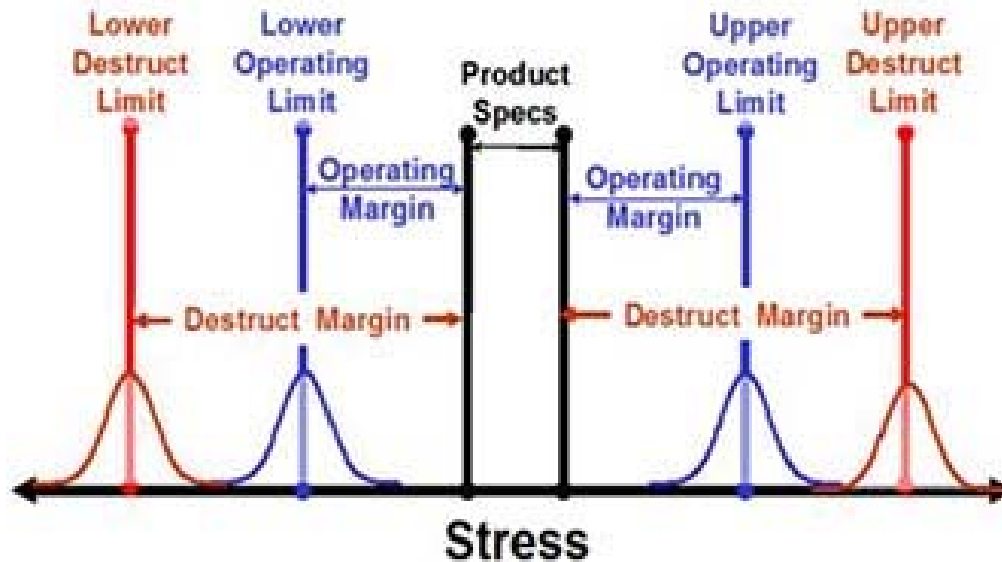


HALT Timeframe

- ▶ A HALT test can take anywhere from 1-4 weeks
- ▶ While the overall test profile may only be 1-2 days long, the time spent on finding and fixing failures can take multiple days
- ▶ Multiple samples are recommended
- ▶ It is up to manufacturer to determine the limits, not the test lab
- ▶ Manufacturer must be present during testing to monitor and observe
 - ▶ The test lab is not the expert on the product
 - ▶ Requires the manufacturer to have good communication within all of their Engineering departments to analyze results and determine possible solutions

HALT Results and Conclusion

- ▶ What are my Lower and Upper Operating limits?
- ▶ What are my Lower and Upper Destruct limits?
- ▶ During which stress did it fail?
- ▶ What failed and what changes did I make?



HASS

- ▶ Highly Accelerated Stress Screen
- ▶ Uses the same chamber used for HALT testing
- ▶ Follows HALT testing
- ▶ Test profile is determined based on results from the HALT test results
 - ▶ Tested at stresses just below the operating limit of the product
- ▶ HASS is intended for units that are in production
- ▶ High volume of units and testing



Thank you for your interest and participation

Please let us know if we can assist you with your
regulatory compliance or testing needs.

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