

Ampro Rugged Design Methodology

vs. just ruggedized

Many commercial board manufacturers claim that they offer “ruggedized” products which gives the impression of durability and reliability under tough conditions. The term “ruggedized,” however often refers to desktop-grade designs which are screened at high temperatures with high yield fallout.

Ampro believes that ruggedness should be inherent in the design. Ampro rugged products are subjected to extensive voltage and temperature margin tests during the new product development process along with shock and vibration testing and HALT testing.

Ampro HALT Test Program. In order to maximize product reliability and durability, Ampro subjects rugged products to a comprehensive Highly Accelerated life Test (HALT) program during the product development process. This testing is performed at an outside test laboratory run by acknowledged industry experts.

The HALT process consists of progressively increased extremes of temperatures (both high and low), rapid thermal transition, six-axis vibration and finally, combined temperature and vibration stress. At each stress dwell extreme, power to the unit is margined at ± 5 percent. In each test, stress is progressively increased while the unit is operating in a continuous functional test loop that exercises key subsystems such as the CPU, I/O ports, disk controllers and video. If a failure is detected, the failure is evaluated and immediate fixes are made and the test is continues until destruct limits are reached. Failures and the physical damage found at the destruct limits provide data which is used to improve the ruggedness of the product design.

Random Vibration. Products are vibration-tested in accordance with the specifications of

MIL-STD-202F, Method 214A, Table 214-1, Condition D for Random Vibration for five minutes on each axis. This equates to a RMS value of 11.95G of random vibration between 100Hz and 1000Hz along each axis. The units under test are operational during the tests, performing functional diagnostics on all hardware subsystems. The test routine runs continuously to verify functionality of the system and catch any intermittent failures. External peripherals (Ethernet Server, hard drive, floppy drive) are mounted adjacent to the vibration table and are not subjected to the test conditions.

Mechanical Shock. Mechanical Shock testing is performed on Ampro’s rugged products per MIL-STD-202F, Method 213B, Table 213-1, Condition A. This specifies three 50G shocks (peak value, 11ms duration, half-sine waveform) along each of the three axes. The unit under test is mounted on a shock machine and subjected to shock pulses of 50g-peak value, 11ms duration with half-sine waveforms. Three shocks in each direction, for a total of 18 shocks, are applied along the three mutually perpendicular axes. After shocks in two directions (+ and -) along each axis, the products are tested for functionality.

Voltage and Temperature Margin Test Suite. During the margin test suite, the unit under test is subjected to temperatures well outside the “Extended” (-40° to $+85^{\circ}\text{C}$) operating temperature range offered for Ampro products. The UUT is simultaneously subjected to minimum and maximum rated voltages ($\pm 5^{\circ}$). This process verifies that Ampro products are functional and stable over combined extremes of both temperature and voltage. It also ensures wide design margins resulting in long-term reliability under all specified operating conditions.