

Combined Environments Testing

JG-PP Lead-Free Solder Project

Jeff Bradford

18 March 2004

Topics

- What is Combined Environments Testing (CET)?
- CET Chamber
- CET Profile
- CET Steps

What is Combined Environments Testing?

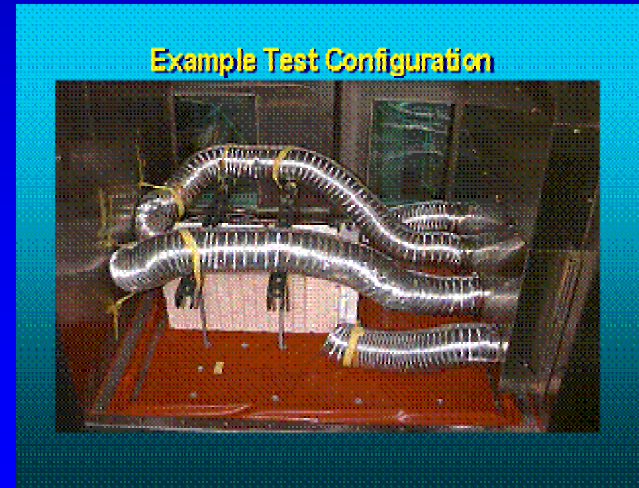
- Based on modified Highly Accelerated Life Test (HALT)
 - Modified test regime can identify design and process problems in a much shorter time frame than other development tests
- CET subjects products to accelerated environments to find weaknesses in the design and/or manufacturing process
 - Primary accelerated environments are temperature and vibration used in combination
 - CET will be used to compare Pb-free solder alloy performance against the standard Sn/Pb (63/37) eutectic solder

CET Chamber

- QualMark HALT HASS chamber located in McKinney, Texas
- Utilizes LN2 for cooling and nichrome heater elements for heating
- Thermal capability ranges from -100 to 200 °C
- Ramp rates of up to 60 °C per minute
- Vibration
 - Generated by pneumatically driven vibrators attached to the bottom of the table
 - Maximum levels of ≥ 60 Grms
 - 6 DOF application (i.e. X, Y, & Z axes with rotation in each axis simultaneously)
- Thermal and vibration environments can be applied separately or combined



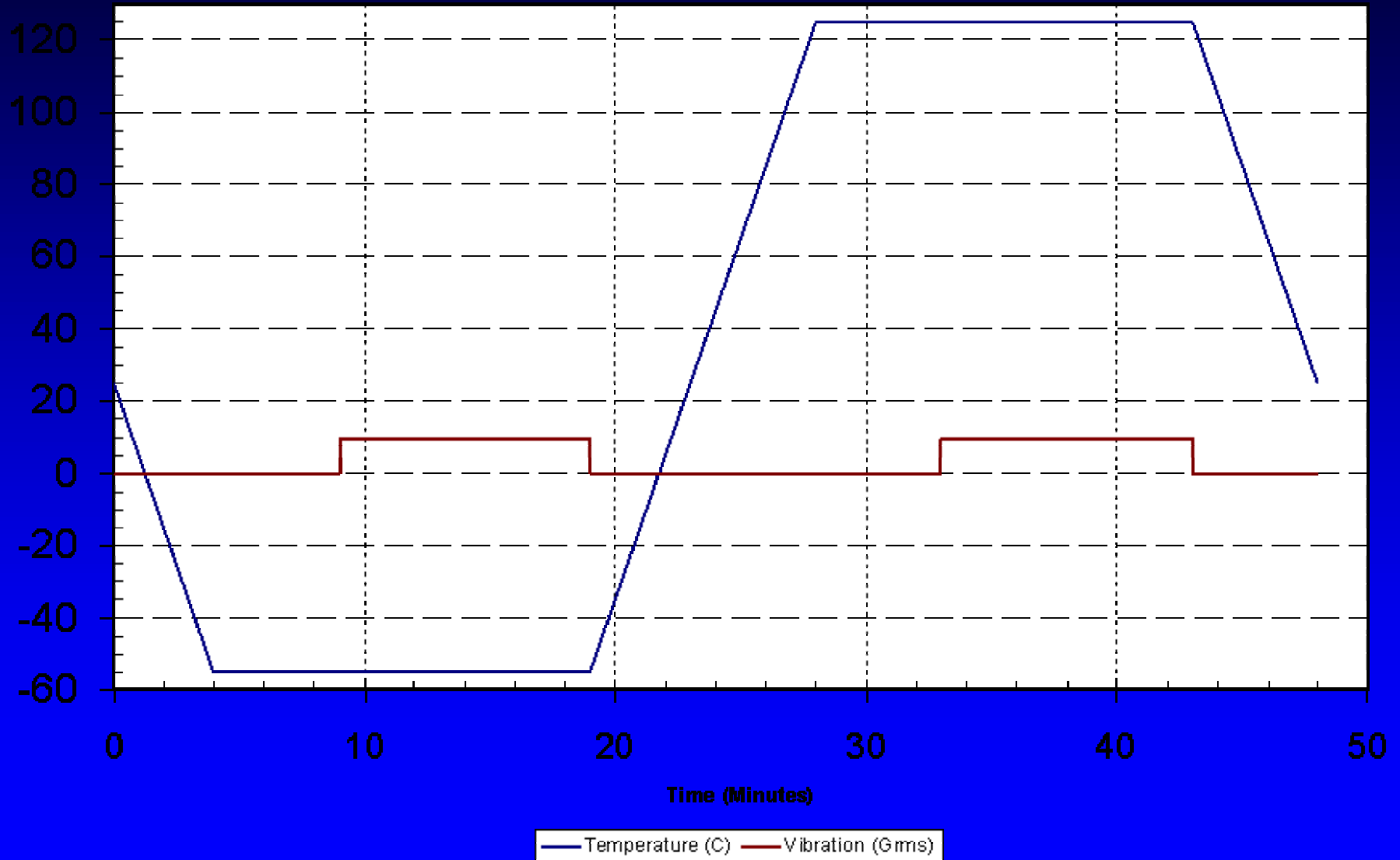
Chamber



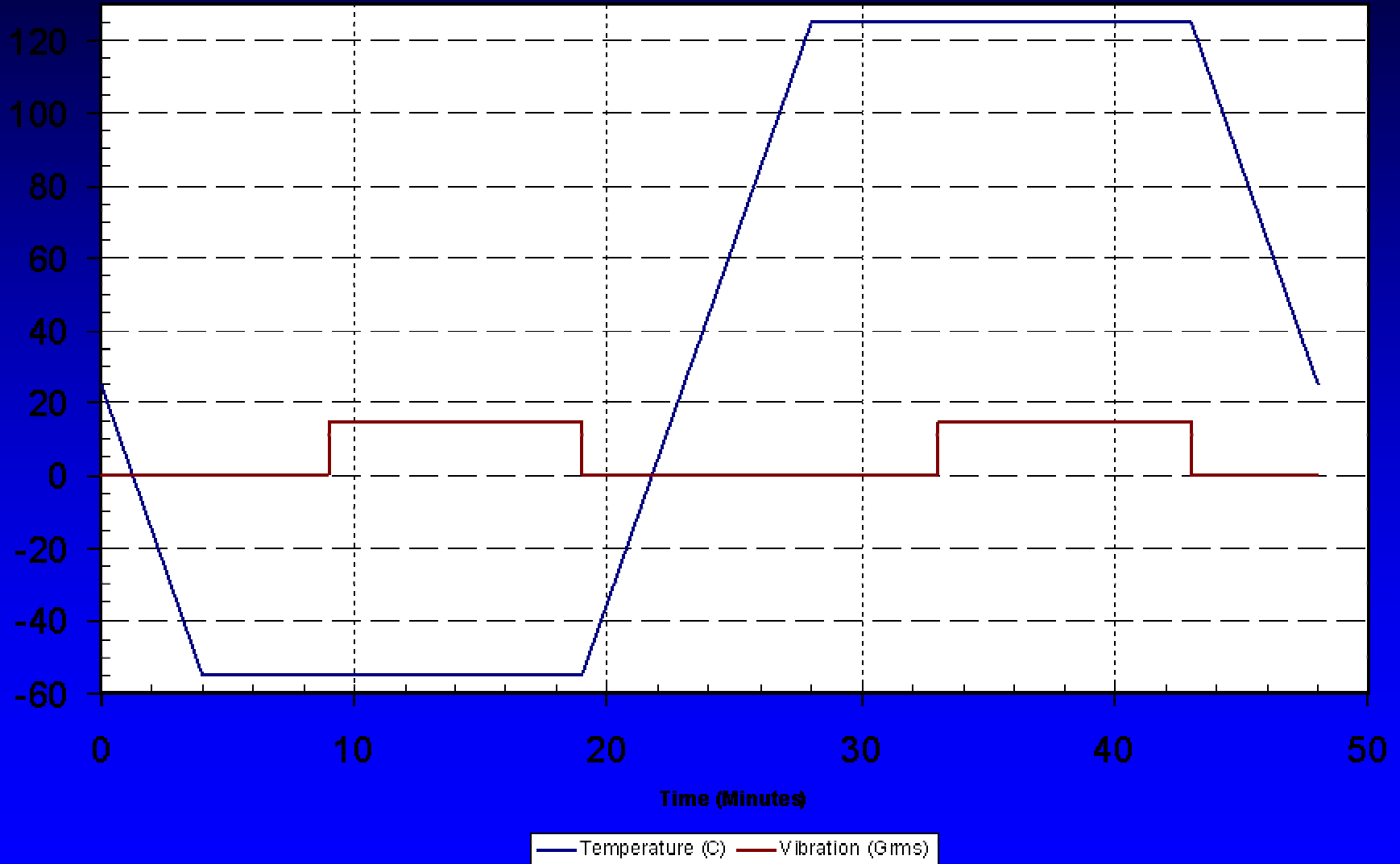
CET Parameters

- -55 to 125 °C temperature cycle
- 20 °C per minute ramp
- 15 minute soak
- Vibration
 - During last 10 minute soak period
 - 10 Grms initial
 - Increase 5 Grms after 100 cycles
 - 20 Grms to significant failures
- Test Vehicles
 - Total: 30
 - 15 Manufacturing
 - 15 Repair

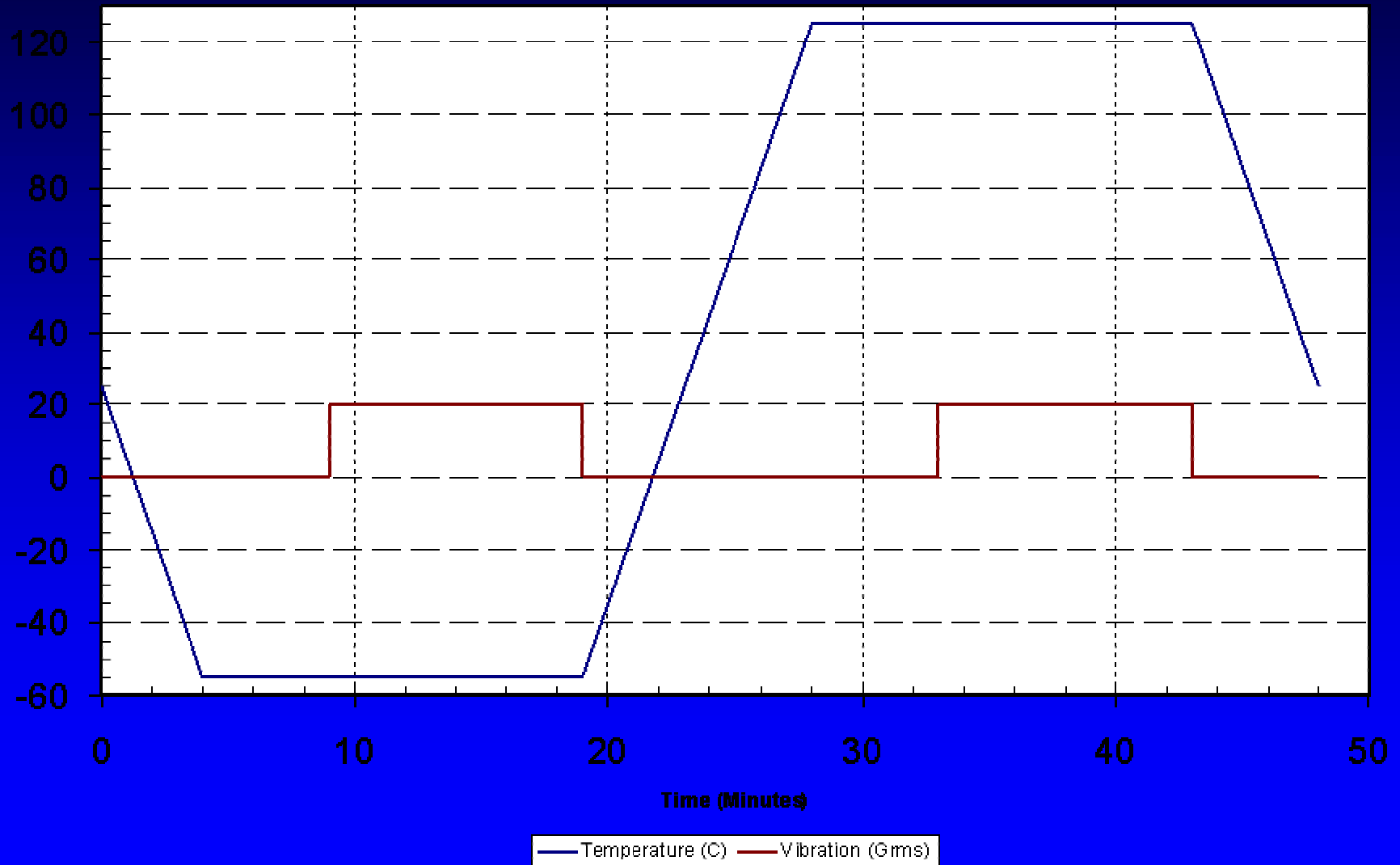
First 100 Cycle Profile



Next 100 Cycle Profile



Final Cycle Profile (to failure)



Combined Environments Testing Steps

- Test Setup
 - Fabricate fixture
 - Solder connectors to test vehicles
 - Assemble wiring harnesses
 - Pretest inspection
- Execute Test
 - Test 3 lots of 10 test vehicles at a time
 - Utilize Anatech event detectors
 - Post test inspection
- Failure Analysis
 - Microsection analysis
- Data Analysis
- Publish Test Report

CET is not funded