Planned Updates to
MIL-STD-331
Fuze Engineering Standardization Working Group (FESWG)

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Presented by:
Anthony DiGiacomo – Army ARDEC/ESIC/AFMO Picatinny Arsenal
Nick Cali – Army ARDEC/METC/FPAT Picatinny Arsenal

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.
UPDATES TO MIL-STD-331

Agenda

Sections Being Modified

- Vibration - Appendix B1 & B3
- Leak Test – Appendix C
- Electromagnetic - Appendix F
- Other – Corrections/Clarifications
MIL-STD-331

• Fuze and Fuze Components, Environmental and Performance Tests For
  – Tests used by the Department of Defense to determine the safety, reliability and performance characteristics of weapon initiation systems, fuzes and fuze components at any stage in their life cycle.
Major Changes to the Following Sections:

- MIL-STD-331 Transportation Vibration
  - Update various durations, G levels, profiles
  - Delete Tracked Vehicle in Transportation Vibe
- Update Leak Test
  - Delete Halogen Gas test method and add Radioisotope Gas method.
- Add High Voltage Corona Test to ESD
  - Test F1
- Add Electrical Stress Test to Appendix F
Figure B1-5. Vibration test spectrum for military wheeled vehicle (composite).

- Profiles are composites of MIL-STD-810 based on recent measurements.
- Same profile is run in all 3 Axes.
- More severe than MIL-STD-810.
SUMMARY OF CHANGES TO TRANSPORTATION VIBRATION

Changes to Appendix B1

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Transport Distance (mi (km))</th>
<th>Test Profile Figure</th>
<th>Test Duration Per Axis (minutes)</th>
<th>Test Level ( \mu ) (Grms)</th>
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<tbody>
<tr>
<td>Commercial Vehicle Procedure</td>
<td>3000 (4800)</td>
<td>B1-4</td>
<td>180</td>
<td>1.1</td>
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<td>Military Vehicle Procedures</td>
<td></td>
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<td>Military Wheeled Vehicle Procedure</td>
<td>500 (800)</td>
<td>B1-5</td>
<td>40-120</td>
<td>2.7 2.55</td>
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<td>Military Two-wheeled Vehicle Procedure</td>
<td>32 (50)</td>
<td>B1-6</td>
<td>32</td>
<td>3.9 4.43</td>
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<td>Military Tracked Vehicle Procedure</td>
<td>46 (25)</td>
<td>Five figures as follows:</td>
<td>60; subdivided as follows:</td>
<td>As follows for each phase:</td>
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<tr>
<td></td>
<td></td>
<td>Phase 1</td>
<td>B1-7</td>
<td>42-</td>
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<td>Phase 2</td>
<td>B1-8</td>
<td>42-</td>
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<td>Phase 3</td>
<td>B1-9</td>
<td>42-</td>
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<td>Phase 4</td>
<td>B1-10</td>
<td>42-</td>
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<td>Phase 5</td>
<td>B1-11</td>
<td>42-</td>
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<td>Jet Aircraft Procedure</td>
<td>15,000 (24,000)</td>
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<td>1</td>
<td>6.4 4.47</td>
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<td>B1-14</td>
<td>10 60</td>
<td>4.52 83 04/1.79</td>
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<td>Cargo Ship Procedure</td>
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<td>B1-15</td>
<td>120</td>
<td>0.31</td>
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<td>Combat Ship Procedure</td>
<td>15,000 (24,000)</td>
<td>B1-16</td>
<td>235 (sine sweep) 120 (sine) sweep</td>
<td>1.3g peak at 25 Hz</td>
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</tbody>
</table>
Appendix C

This test consists of 4 methods:

• The helium gas, mass spectrometry method is used to detect fine rates of leakage, less than $1 \times 10^{-6}$ atmosphere cubic centimeters per second (atm cc/s).

• **Added** - The radioisotope gas method is used to detect fine rates of leakage, less than $1 \times 10^{-6}$ atmosphere cubic centimeters per second (atm cc/s). The radioisotope method can be used as a single gross/fine test with the addition of a Kr85 gettering medium.

• The bubble method is used to detect gross rates of leakage, greater than $1 \times 10^{-4}$ atm cc/s.

• The volume-sharing method is an optional method for detecting gross leaks. It is referred to in Section C8.5.2.2.

❖ **Deleted** - Halogen Gas Method
• Modifications to the Electrostatic Discharge (ESD)
  – **Add High Voltage Corona Test**
    • This is a laboratory safety and reliability test simulating possible handling, ground & aircraft transportation, and in-flight conditions. The fuze must withstand high-potential electrostatic discharge (lightning environment is excluded).
SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

High Voltage Corona Set-Up

Distribution Statement A
Electrical Stress Test (EST)

- **Purpose of EST** is to identify any unexpected operation when safety related electronic devices are subjected to various credible stressing electrical stimuli and to establish a level of electrical ruggedness.
- Applies to Fuzes, ISDs, ESADs, HEO, and AFDs that contain electronics.
- **EST Test document is currently in draft form and is expected to change**
SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

Electrical Stress Test

• Currently required at the Fuze/subsystem level, but may also be required at the regulator and PLD level (see your relevant SSA)

• Currently Defined
  – Under-Voltage/Over-Voltage
  – Power Cycling
  – Voltage Rise/Fall Time
  – Power Dropout
  – Brownout/Surge
  – Floating I/O

• TBD Tests
  – Power Starved Input
  – Transient Loss of Ground
  – Shorting of I/O
SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

EST Test Requirements

• Selection of Test Points
  – Based on engineering judgment and system architecture
  – At a minimum, safety critical points should be monitored (ex. Safety switches, HV capacitor, etc)

• Configuration of test item shall be production representative hardware

• Number of Test Items
  – Minimum of 3 units

• Consult your relevant Service Safety Authority (SSA) for any unique requirements
EST Test Plan

- Since detailed requirements may vary, it is expected that the EST test plan be submitted to your SSA for concurrence

- Test Plan shall include:
  - Selection of test points and supporting rationale
  - Detailed description of the test
  - A statement of acceptable performance (pass/fail criteria)
  - A detailed timeline illustrating when the transient electrical stress conditions will be applied during the UUT’s mission
Criteria for Test Evaluation

• At the completion of any EST testing, no adverse conditions shall have occurred

• Examples of adverse conditions
  – Unintentional/premature arming
  – Unintentional/premature firing
  – Deactivation of a safety feature
  – Voltage generated on a firing capacitor
  – Etc.

• Any safety feature which is degraded to an unknown/unsafe state during EST shall require further analysis to determine pass/fail status
SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

EST Test Descriptions(1)

• Under Voltage/Over Voltage
  – Perform nominal mission at specified value less than minimum and greater than maximum specified voltage of supply

• Floating I/O
  – Determine the affect of floating I/O connections occurring at various times throughout UUT mission
  – Can be performed via analysis to maximum extent possible

• Power Cycling
  – Determine the affect of cycling each power source for specified periods time at various times throughout UUT mission
EST Test Descriptions (2)

• Voltage Rise/Fall Time
  – Allow voltage supplies to rise/fall at rates that are reasonably expected during a tactical mission
  – Can be a significantly long test – ex. HEO with active batteries

• Power Drop Out
  – Apply consecutive cycles of power drop outs at various times during the UUT mission

• Brownout/Surge
  – Apply brownout and surge conditions at various times during the UUT mission for each source supply
SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

TBD EST Tests(3)

• Transient Loss of Ground
  – Similar to power dropout, except with ground connections

• Shorting of I/O
  – Difficult to define relevant combinations to analyze test

• Power Starved Input
  – Intended to determine the behavior when UUT is exposed
to a dropout/brownout condition before it stores enough
initial energy on energy storage elements

• These tests may be required depending on unique
system applications and requirements
Summary

• Work is in process within FESWG to update MIL-STD-331

• Work with Standardization Office at Picatinny to release in 1 year (?)

• The EST may be available as a Guideline document until MIL-STD-331 D is ready for release