Planned Updates to

MIL-STD-331

Fuze Engineering Standardization Working Group (FESWG)

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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

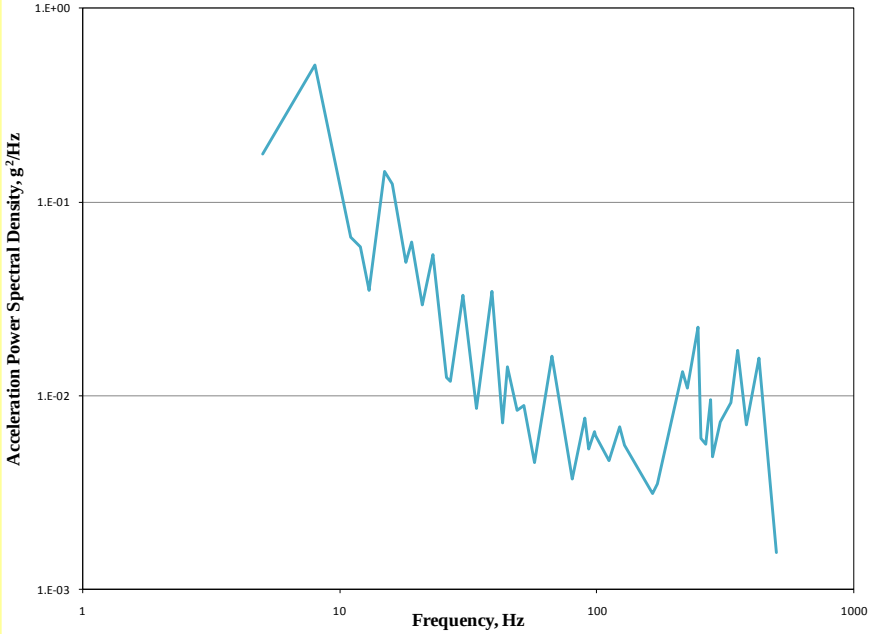
- Fuze and Fuze Components, Environmental and Performance Tests For
  - Tests used by the Department of Defense to determine the safety, reliability and performance characteristics of weapon initiation systems, fuzes and fuze components at any stage in their life cycle.

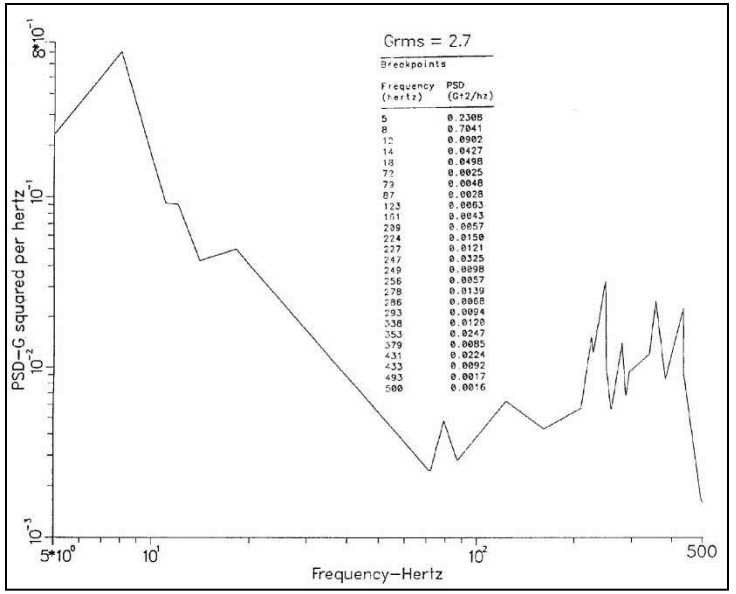
UPDATES TO MIL-STD-331

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

SAMPLE CHANGES TO TRANSPORTATION VIBRATION





NEW CURRENT

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 B1-II. Test Requirements For Specified Transportation Scenario (Note 4)
This table contains test requirements where the transportation modes and one-way distances are specified by the test directive. Requirements for unspecified scenarios are listed in Table B1-III.

Test Procedure	Transport Distance (mi (km))	Test Requirements		
		Test Profile Figure	Test Duration Per Axis (minutes)	Test Level (Grms) Note 2
Commercial Vehicle Procedure	3000 (4800)	B1-4	180	1.1
Military Vehicle Procedures				
Military Wheeled Vehicle Procedure	500 (800)	B1-5	~~40~~ 120	~~2.7~~ 2.55
Military Two-wheeled Vehicle Procedure	32 (50)	B1-6	32	~~3.9~~ 4.43
~~Military Tracked Vehicle Procedure Note 1~~	~~16 (25)~~	~~Five figures as follows:~~	~~60; subdivided as follows:~~	~~As follows for each phase:~~
-	~~Phase 1~~	~~B1-7~~	~~12~~	~~4.252~~
-	~~Phase 2~~	~~B1-8~~	~~12~~	~~4.148~~
-	~~Phase 3~~	~~B1-9~~	~~12~~	~~6.148~~
-	~~Phase 4~~	~~B1-10~~	~~12~~	~~4.263~~
-	~~Phase 5~~	~~B1-11~~	~~12~~	~~5.847~~
Jet Aircraft Procedure	15,000 (24,000)	B1-12	1	~~5.1~~ 4.47
Turboprop Aircraft Procedure	1,000 (1,600)	B1-13	120	5.~~44~~ 52
Helicopter Procedure	250 (400)	B1-14	10 ~~60~~	~~4.5/2.8~~3.04/1.79 Note 3
Cargo Ship Procedure	15,000 (24,000)	B1-15	120	0.~~3~~ 31
Combat Ship Procedure	15,000 (24,000)	B1-16	235 (sine sweep) 120 (sine) sweep	1.3g peak at 25 Hz

SUMMARY OF CHANGES TO LEAK TESTING

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 x 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 x 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 x 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.

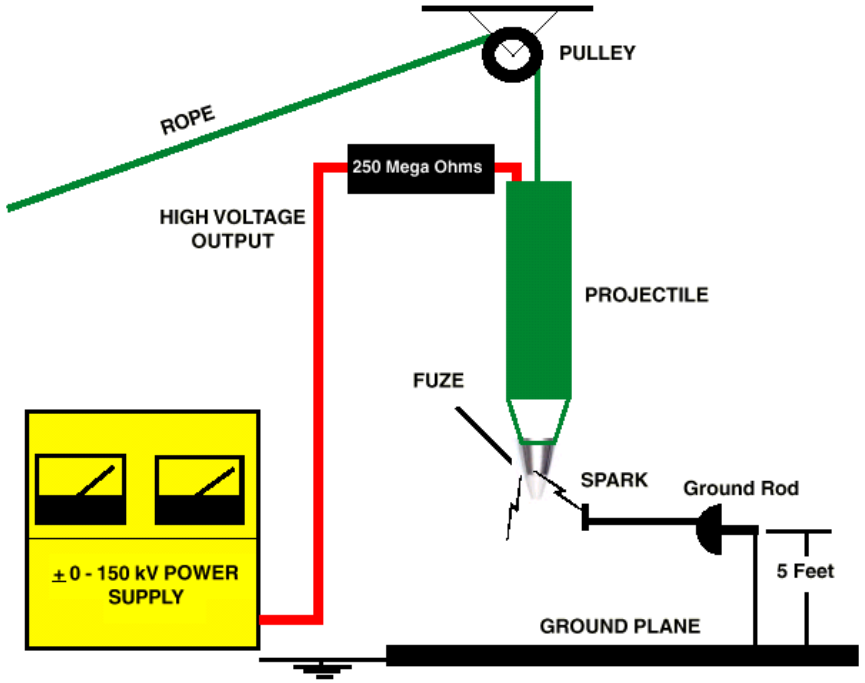
❖ Deleted - Halogen Gas Method

SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

- **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



SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

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*

SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

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

SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

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

SUMMARY OF CHANGES TO ELECTROMAGNETIC TESTING

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*

UPDATES TO MIL-STD-331

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