SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS8045 | REV. A

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Superseding AS8045

Minimum Performance Standard for Underwater Locating Devices (Acoustic) (Self-Powered)

RATIONALE

Technology exists to increase the minimum Underwater Locating Devices (ULD) operating life without changes to the form, fit or function of an installed ULD. For aircraft search and recovery in extremely remote areas, a ULD operating for 30 days may not be sufficient. This revision includes an increase of the minimum operating life in paragraph 4.7 from 30 days to 90 days and updates to the environmental testing.

1. PURPOSE

This SAE Aerospace Standard (AS) specifies minimum performance standards for Acoustic Underwater Locating Devices which are primarily intended for use with both fixed and rotary wing civil aircraft.

2. SCOPE

This AS covers ULD utilized in finding flight data recorders, cockpit voice recorders or aircraft. Such ULDs are installed adjacent to the recorders in a manner that they are unlikely to become separated during crash conditions.

2.1 Applicable Documents

The following publications form a part of this document only to the extent they are explicitly invoked by the requirements within this Aerospace Standard. The latest issue of SAE publications shall apply. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Documents

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AS8039 Minimum Performance Standard for Flight Recorders.

2.1.2 ASTM Documents

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

D 1141-98 Standard Practice for the Preparation of Substitute Ocean Water.

2.1.3 RTCA, Inc. Documents

Available from RTCA Inc., 1828 L Street, NW, Suite 805, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

RTCA/DO-160G Environmental Conditions and Test Procedures for Airborne Equipment.

2.2 Definitions

The word “shall” is used to express an essential requirement where compliance is mandatory.

3. GENERAL STANDARDS

3.1 Material: Material shall be of a quality which experience or tests, or both, have demonstrated to be suitable and dependable for use in aircraft. The correct functioning of the ULD shall not be impaired by any change of material properties arising from the tests defined in Sections 5 and 6.

3.2 Workmanship: Workmanship shall be consistent with high grade aircraft instrument manufacturing practice.

3.3 Compatibility: If components are individually acceptable but require matching for proper operation, they shall be identified in a manner that shall ensure performance to the requirements of this AS.

3.4 Interchangeability: Components or systems which are identified with the same manufacturer’s part or model number shall be physically and functionally interchangeable.

3.5 Flammability & Fire Test: The exposed surfaces of the ULD and mounting shall be non-flammable. The ULD shall be incapable of sustaining or initiating a fire or rupturing, or both, with or without fragmentation, due to a dead short of the power source.

3.6 Power Source: Means shall be provided to enable the ULD power source to be checked for voltage and longevity in its installed position. Such checks shall be defined in the ULD manufacturer’s instruction manual.

3.7 Identification: The following information shall be legible and, with the exception of battery replacement date, be indelibly marked on the ULD or on the nameplate attached. Markings on the ULD are to be as large as is practical.

a. Name of instrument.

b. Manufacturer’s part number.

c. Manufacturer’s serial number.

d. Federal Aviation Administration (FAA) Technical Standard Order (TSO) number, for example, FAA TSO-C121b if applicable (or SAE AS number or equivalent approval identification).

e. Manufacturer’s name or trademark.

f. Battery replacement information.

4. MINIMUM PERFORMANCE STANDARDS

The manufacturer shall conduct sufficient tests to prove compliance with this Aerospace Standard.

4.1 Actuation: Automatically by both fresh and salt water at all depths from 0.15 m (0.5 ft) to 6096 m (20 000 ft) within 4 hours after immersion.

NOTE: If the ULD is subjected to negligent or accidental contamination with water, either immersed or sprayed, (that is, other than in its operational mode) it shall, on drying out, revert to its original dormant state.

4.2 Operating Temperature: -2 °C (+28 °F) to +38 °C (+100 °F).

4.3 Radiation Pattern: 80% of a spherical pattern. (4.8.1 and 4.8.2 apply).

NOTE: If more than one ULD is needed to achieve this pattern then the limitation shall be defined by the instrument manufacturer. This will allow ULD's to be suitably installed in appropriate positions in the aircraft such that the pattern is likely to be maintained after a crash.

4.4 Operating Frequency: 37.5 ± 1 kHz.

4.5 Pulse Length: 9.0 ms MINIMUM.

4.6 Repetition Rate: 0.9 pulse/s MINIMUM.

4.7 Operating Life: 90 days.

4.8 Acoustic Outputs on Activation:

4.8.1 Initial Operation: 106 N/m2 (1060 dyne/cm2) r.m.s. (during the pulse) pressure normalized to 1 metre range, that is, at a level of 160.5 dB vs 1 µPa at 1 metre.

4.8.2 Immediately after 90 Days Continuous Operation: 70 N/m2 (700 dyne/cm2) r.m.s. (during the pulse) pressure normalized at 1 metre range, that is, at a level of 157 dB vs 1 µPa at 1 metre.

5. TEST PROCEDURES (ENVIRONMENTAL)

Sequence may be in any order. Instrument with ULD in its inoperative mode, that is, dry at the commencement of each test clause and no ULD activation by test personnel during environmental tests. Operational or functional tests as required shall be conducted before and after each clause to verify the operational condition of the ULD under test.

5.1 Condensation: With the ULD in the most critical position, cold soak at -9 ± 3 °C (+16 ± 5 °F) for 6 hours and then immediately place in a chamber maintained at +35 ± 3 °C (+95 ± 5 °F) at a relative humidity of 95 ± 5% for 18 hours. Repeat this environmental cycle 15 times.

During this test there shall be no activation of the ULD transmitter or corrosion of vital parts.

5.2 Temperature Storage (Temperature): The ULD shall be subjected to the Ground Survival Low and High Temperature test requirements specified in RTCA/DO-160G, Section 4.5, Category D2.

During this test there shall be no activation of the ULD transmitter.

5.3 Temperature Variation: The ULD shall be subjected to the test requirements specified in RTCA/DO-160G, Section 5, Category A using -55 °C (-67 °F) and +70 °C (+158 °F) for low and high operating temperatures, respectively.

During this test there shall be no activation of the ULD transmitter.

5.4 Vibration: The ULD shall be subjected to the test requirements specified in RTCA/DO-160G, Section 8 using Figure 8-4, Curve C1 (fixed wing) and Table 8-2b, Curve G (rotary wing).

During this test there shall be no activation of the ULD transmitter.

5.5 Altitude, Decompression and Overpressure: The ULD shall be subjected to the test requirements specified in RTCA/DO-160G, Section 4.6, Category D2.

During this test there shall be no activation of the ULD transmitter.

5.6 Fluid Immersion (Fluids Susceptibility): The ULD shall be subjected to the immersion test requirements specified in RTCA/DO-160G, Section 11, Category F using fluids most likely to cause the ULD to become inoperative.

After drying out, the ULD shall not have deteriorated such that it would not satisfy the requirements of Section 4.

Alternatively, an analysis may be used to demonstrate the ULD's resistance to such fluids.

5.7 Induced Signal Susceptibility: The ULD shall be subjected to the relevant test requirements as specified in RTCA/DO-160G, Section 19, Category ZC.

During this test there shall be no activation of the ULD transmitter.

5.8 Magnetic Effect: The ULD shall be subjected to the test requirements specified in RTCA/DO-160G, Section 15 and shall meet the Category Z requirement.

5.9 Sand and Dust: The ULD shall be subjected to the test requirements specified in RTCA/DO-160G, Section 12, Category S.

During this test there shall be no activation of the ULD transmitter and there shall be no sand/dust lodged in vital parts such that the ULD would not satisfy the requirements of Section 4.

5.10 Salt Spray (Salt Fog): The ULD shall be subjected to the test requirements specified in RTCA/DO-160G, Section 14, Category S (fixed wing) and Category T (rotary wing).

During this test there shall be no activation of the ULD transmitter and there shall be no corrosion of vital parts such that the ULD would not satisfy the requirements of Section 4.

5.11 Fungus Resistance: The ULD shall be subjected to test requirements as specified in RTCA/DO-160G, Section 13, Category F.

During this test there shall be no activation of the ULD transmitter and there shall be no fungus growth developed in vital parts such that the ULD would not satisfy the requirements of Section 4.

5.12 Performance Verification (Environmental): On completion of all tests included in 5.1 - 5.11, the ULD shall meet all the requirements of Section 4.

5.13 Salt Water Immersion: This test is performed once only. (Note this is a passive test and does not require continuous monitoring). The ULD shall be submerged and operating in a standard seawater solution (ASTM D1141-98 or equivalent) at an ambient pressure for a period of 90 days. The test tank shall be non-metallic and throughout the test the water shall be maintained between +10 °C (+50 °F) and +21 °C (+70 °F). At the end of 90 days, the ULD shall be operating as specified in Section 4 and there shall be no signs of seepage or leakage into the ULD.

6. TEST PROCEDURES (CRASH SURVIVABILITY)

The ULD shall be subjected to crash survivability testing, performed in the order shown below, without making any repairs or modifications between tests. Operational or functional tests as required shall be conducted before and after each clause to verify the operational condition of the ULD under test.