

European Aviation Safety Agency

European Technical Standard Order (ETSO)

Subject: Low-Frequency Underwater Locating Devices (Acoustic) (Self-Powered)

1 — Applicability

This ETSO gives the requirements which Low-Frequency Underwater Locating Devices (Acoustic) (Self-Powered) that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 — Procedures

2.1 — General

Applicable procedures are detailed in CS-ETSO, Subpart A.

2.2 — Specific

None.

3 — Technical conditions

3.1 — Basic

3.1.1 — Minimum performance standard

Standards set forth in the SAE document AS6254A Minimum Performance Standard for Low-Frequency Underwater Locating Devices (Acoustic) (Self-Powered), dated December 6, 2015.

3.1.2 — Environmental standard

See CS-ETSO, Subpart A, paragraph 2.1.

3.1.3 — Software

See CS-ETSO, Subpart A, paragraph 2.2.

3.1.4 — Airborne electronic hardware

See CS-ETSO, Subpart A, paragraph 2.3.

3.2 — Specific

The battery used in the ULD authorised under this ETSO must meet the minimum performance standard found in the applicable battery ETSO such as ETSO-C142a, Non-Rechargeable Lithium Cells and Batteries for ULD powered by Lithium primary batteries. Lithium powered ULD must also meet the requirements in Appendix 1 of this ETSO in addition to its battery meeting ETSO-C142a.

3.2.1 Failure condition classification

See CS-ETSO, Subpart A, paragraph 2.4.

Failure or loss of the function defined in paragraph 3.1.1 of this ETSO has been determined to be a minor failure condition.

4 — Marking

4.1 — General

Marking as detailed in CS-ETSO, Subpart A, paragraph 1.2.

4.2 — Specific

None.

5 — Availability of referenced document

See CS-ETSO, Subpart A, paragraph 3.

APPENDIX 1.**Lithium Battery Containment Requirements**

The Airframe Low Frequency ULD must provide the containment of any hazardous products of the failure of its internal lithium battery without additional external containment devices other than the mounting bracket. Include the following note in the installation instructions and in the DDP.

*Note: The ULD is intended to be mounted to the structure of the aircraft and provide a locating signal after a crash in water. **Placing the ULD inside a containment vessel will prevent it from performing its intended function of transmitting low frequency ultrasonic pulses to aid the location of the mishap aircraft.***

Sections 1.5, 1.6, 1.7 and 2 of RTCA/DO-347, Certification Test Guidance for Small and Medium Sized Rechargeable Lithium Batteries and Battery Systems, dated December 18, 2013, provide safety, design and qualification requirements and guidelines pertinent to designing safe batteries meeting CS-23, CS-25, CS-27 and CS-29 requirements and additional Special Conditions (SC) required for installation for the low frequency ULD on aircraft. Consider each of these requirements and guidelines when designing cells and batteries.

The requirements below include tests from RTCA/DO-347. Although written for rechargeable lithium batteries, EASA and the FAA consider these tests appropriate for demonstrating that non-rechargeable lithium batteries meet the SCs where indicated below. When conducting these tests and the test method states 'charge the battery in accordance with the manufacturer's instructions', use a battery with a 100 % state of charge instead.

- 1) Lithium Primary Batteries used in Airframe Low Frequency ULD must independently:
 - a. Meet the requirements in ETSO-C142a, Non-rechargeable Lithium Cells and Batteries, including the tests in Appendix 1, Table 2, and
 - b. Pass the following tests in RTCA/DO-347, Certification Test Guidance for Small and Medium Sized Rechargeable Lithium Batteries and Battery Systems, dated December 18, 2013, as follows:
 - (1) Section 2.3.7 Short-circuit Test of a Cell
 - (2) Section 2.3.9 Short-circuit Test with Protection Disabled (required only for multi-cell batteries)
 - (3) Section 2.3.10 Insulation Resistance Test

Note: EASA published a [proposed special condition on 'Non-rechargeable Lithium Battery Installations'](#)¹ requiring each individual cell within a battery be designed to maintain safe temperatures and pressures (SC1) . The SC 2 addresses these same issues but at the battery level. SC 2 requires the battery to be designed to prevent propagation of a thermal event (i.e., self-sustained, uncontrolled increases in temperature or pressure) from one cell to adjacent cells.

- 2) The Airframe Low Frequency ULD with a primary lithium battery by itself or installed in its mounting bracket must pass the Section 2.3.15 Thermal Runaway Containment Test in RTCA/DO-347, Certification Test Guidance for Small and Medium Sized Rechargeable Lithium Batteries and Battery Systems, dated December 18, 2013. Do not compromise the integrity of the ULD to instrument or trigger the internal battery. Induce thermal runaway with either a. or b. below then complete c.

¹ <https://www.easa.europa.eu/documents/public-consultations/proposed-special-condition-%E2%80%98non-rechargeable-lithium-battery>

- a. Perform step e. of test method RTCA/DO-347 2.3.15.1 in lieu of RTCA/DO-347 2.3.15.1 steps c. and d. Step b is not required to complete step e. Apply the heating element to the exterior of the Airframe Low Frequency ULD or heat the ULD in a test chamber for this test to maintain the integrity of the item under test. Use of a test chamber heated to just above the triggering temperature will facilitate more accurate measurements of the ULD case temperature during the runaway.
- b. Alternate method to induce a thermal runaway
- In a cell closest to the center of the battery:
- (1) Connect the terminals of a single electrically isolated cell to a power supply set to a constant voltage of at least 1.5 times the rated nominal cell voltage and charge with a current limit of I1 (or I_{max} if less than I1) of a single cell (+/- 50mA).
 - (2) Monitor the battery voltage during charge and terminate the charge when the peak voltage is reached.
 - (3) Subject the cell to a direct short circuit of less than 5 mOhm.
 - (4) Install the battery into the ULD (and bracket, as necessary) prior to the onset of Thermal Runaway.
 - (5) Monitor and record the battery voltage and current, the ULD case temperature, the ULD bracket temperature and continue with RTCA/DO-347 2.3.15.2 step g.
- c. For RTCA/DO-347 2.3.15.1 steps g. and h., monitor and record the test chamber temperature and the external temperature of the ULD. Verify post-test that the battery did in fact experience thermal runaway by observing the ULD contained decomposition products akin to those obtained from conducting this test on a bare battery.
- 3) The ULD or the ULD in its mounting bracket must contain all non-gaseous products of 2 above. O-ring residue is acceptable. If any gasses are emitted, they must be emitted through a consistent, repeatable location such as around the closure threads or through a venting port.
- Note 1: SC 3 of the [proposed special condition on 'Non-rechargeable Lithium Battery Installations'](#)² does allow explosive and toxic gases to be uncontained and not vented overboard if they do not accumulate in hazardous quantities.*
- Note 2: EASA and the FAA may impose additional special condition requirements for installation. Installers may use ETSO test data, including the battery containment test data as part of the certification package in showing compliance with an EASA or FAA installation special condition.*
- 4) The applicant shall document and make available to EASA and to the installer:
- a. The test results to include the nature and volume of any gasses emitted, maximum case temperature during a thermal runaway, and whether or not the mounting bracket was required to attain containment.
 - b. If venting occurs, the venting location so that installers may design and fabricate appropriate venting systems that will not interfere with the intended function of the ULD as described in the Note at the beginning of this Appendix.
 - c. If the applicant chooses to incorporate a venting port in the ULD and/or ULD mounting bracket, the interface in the installation instructions or drawing.

² <https://www.easa.europa.eu/documents/public-consultations/proposed-special-condition-%E2%80%98non-rechargeable-lithium-battery>

- 5) Develop a means to prevent inadvertent opening of ULDs with failed batteries that may be under internal pressure. This may include voltage or external temperature checks prior to opening the device. The applicant shall include any appropriate cautions and warnings and document them in the installation and maintenance instructions.