

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **FUEL FLOWMETERS**

### 1 - Applicability

This ETSO gives the requirements which fuel flowmeters that are 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 **Appendix 1**

##### 3.1.2 - Environmental Standard

The Fuel Flowmeter must be tested in accordance with SAE AS407C "*Fuel Flowmeters*" from July 1, 2001, unless otherwise specified by appendix 1 of this ETSO, SAE AS1055D "*Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components*" (sections 4 and 5) from June 1997, and EUROCAE ED-14E (RTCA DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005 unless otherwise specified by appendix 1 of this ETSO.

##### 3.1.3 - Computer Software

If the equipment design includes a digital computer, the software must be developed in accordance with EUROCAE ED-12B (RTCA DO-178B) "*Software Considerations in Airborne Systems and Equipment Certification*" from 1992.

#### 3.2 - Specific

None

#### **4 - Marking**

##### **4.1 - General**

Marking is 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.**

**MINIMUM PERFORMANCE STANDARD FOR FUEL FLOWMETERS**

**1. General Requirements.**

The applicable standard is SAE AS407C, *Fuel Flowmeters*, dated July 1, 2001.

Paragraphs 3.1, 3.1.1, 3.1.2, 3.2.b, and 4.2.1 of the SAE AS407C do not apply to this ETSO.

SAE AS407C must be applied as follows (changed text shown framed):

- a. **Temperature.** On Page 2 of SAE AS407C, replace Table 1 with the following table.

| <b>TABLE 1</b>                    |  |   |
|-----------------------------------|--|---|
| INSTRUMENT LOCATION               | <u>A</u>   | <u>B</u>  |
| Heated Areas (Temp. Controlled)   | -30 to 50 °C   | -65 to 70 °C  |
| Unheated Areas (Temp. Controlled) | -55 to <span style="border: 1px solid black; padding: 1px;">70 °C</span> | -65 to <span style="border: 1px solid black; padding: 1px;">100 °C</span> |
| Power Plant Compartment           | -55 to 70 °C   | -65 to 100 °C   |
| Power Plant Accessory Compartment | -55 to 70 °C   | -65 to 100 °C   |

- b. **Altitude.** In the first sentence of paragraph 3.3.4, Altitude, (page 3), replace "40.000 feet (12.192 m) standard altitude with 51.000 ft (15.545 m) standard altitude.
- c. **Leak Test.** In the second sentence of paragraph 6.3, Leak Test, (page 6), replace "to an air pressure of 40 psi (275.8 kPa)" with "to an air pressure in accordance with the manufacturer's recommendations."

**2. Testing Your Fuel Flowmeter.**

In addition to the qualification test requirements described in SAE AS407C, perform the following tests:

- a. **Thermal Shock Test.** This test applies to any hermetically sealed components. Subject the components to four cycles of exposure to water 85° ± 2° C and 5° ± 2° C. There should be no evidence of moisture damage to coating or enclosure. During each cycle of the test, immerse the component in water at 85° ± 2° C for 30 minutes. Within 5 seconds of removal from the bath, immerse the component for 30 minutes in the other bath maintained at 5° ± 2° C. Repeat this cycle continuously, one cycle following the other until four cycles are completed. After this test, subject the component to the sealing test in paragraph 2b. of this appendix. The component must have no leakage resulting from the test.

- b. **Sealing Test.** Apply this performance test to any hermetically sealed components. Immerse the component in a suitable liquid such as water. Then reduce the absolute pressure of the air above the liquid to about 1 inch of mercury (Hg) (3.4 kPa) Maintain this absolute pressure for 1 minute, or until the liquid stops giving off air bubbles, whichever is longer. Increase the absolute pressure by 2½ inches Hg (8.5 kPa) . If any bubbles come from the component case, consider it Leakage and reject the component. Do not consider bubbles, resulting from entrapped air in the exterior parts of the case, as leakage. If other test methods provide evidence equal to the immersion test, they can be used to test the integrity of the instrument's seals. If the component includes non-hermetically sealed appurtenances such as a case extension, these appurtenances can be removed before the sealing test.
- c. **Other Tests.** The following table lists where can be find other tests and conditions:

| <b>For:</b>                                   | <b>Use the test conditions in:</b>                       |
|---|--|
| Fire-resistant or fireproof test              | SAE AS 1055, Rev. D, , dated June 1997, Sections 4 and 5 |
| Explosion proofness test                      | EUROCAE ED-14E /RTCA/DO-160E Section 9                   |
| Power input test                              | EUROCAE ED-14E /RTCA/DO-160E Section 16                  |
| Voltage spike test                            | EUROCAE ED-14E /RTCA/DO-160E Section 17                  |
| Audio frequency conducted susceptibility test | EUROCAE ED-14E /RTCA/DO-160E Section 18                  |
| Induced signal susceptibility test            | EUROCAE ED-14E /RTCA/DO-160E Section 19                  |
| Radio frequency susceptibility test           | EUROCAE ED-14E /RTCA/DO-160E Section 20                  |

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **MANIFOLD PRESSURE INSTRUMENTS**

### 1 - Applicability

This ETSO gives the requirements which manifold pressure instruments that are 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

Standard set forth in the SAE Aerospace Standard (AS) document: SAE AS 8042 from December 1, 1985, unless otherwise specified by **Appendix 1** of this ETSO.

##### 3.1.2 - Environmental Standard

The Manifold Pressure Instruments must be tested according to Section 7 of SAE AS 8042 and EUROCAE ED-14E (RTCA DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005.

##### 3.1.3 - Computer Software

If the Manifold Pressure Instruments includes a digital computer, the software must be developed according to EUROCAE ED-12B (RTCA DO-178B), "*Software Considerations in Airborne Systems and Equipment Certification*", dated December 1992.

#### 3.2 - Specific

None

#### **4 - Marking**

##### **4.1 - General**

Marking is 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.**

### **MINIMUM PERFORMANCE STANDARD FOR MANIFOLD PRESSURE INSTRUMENTS**

This appendix lists EASA modifications to the MPS for Manifold Pressure Instruments.

The applicable standard is SAE AS 8042, Manifold Pressure Instruments, dated December 1, 1985.

1. Manifold Pressure Instruments are not required to meet the requirements in SAE AS 8042 paragraphs 3.1, 3.2, and 3.3.
2. Replacement of SAE AS 8042 paragraph 3.24.2 (Fire Hazards) by:  
"Except for small parts (such as fasteners, grommets, knobs, seals, and small electrical parts) that would not contribute significantly to the propagation of a fire, all material used must be self-extinguishing when tested in accordance with the requirements of CS 25.1713(c) and the applicable portions of Part I, Appendix F."

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **PRESSURE INSTRUMENTS – FUEL, OIL AND HYDRAULIC**

### 1 - Applicability

This ETSO gives the requirements which fuel, oil, and hydraulic pressure instruments that are 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 Aerospace Standard (AS) document: SAE AS 408C "*Pressure Instruments - Fuel, Oil and Hydraulic*" from July 1, 2001 unless otherwise specified by **Appendix 1** of this ETSO.

##### 3.1.2 - Environmental Standard

Testing fuel, oil, and hydraulic pressure instruments must be in accordance with SAE AS408C section 7 and EUROCAE ED-14E (RTCA DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005.

##### 3.1.3 - Computer Software

If fuel, oil, and hydraulic pressure instrument includes a digital computer, the software must be developed according to EUROCAE ED-12B (RTCA DO-178B) "*Software Considerations in Airborne Systems and Equipment Certification*" from 1992 .



### **3.1.4 Electronic Hardware Qualification.**

If the fuel, oil, and hydraulic pressure instrument includes a complex custom micro-coded component, this must be developed according to EUROCAE ED-80 (RTCA DO-254), "*Design Assurance Guidance for Airborne Electronic Hardware*" from April 2000.

### **3.2 - Specific**

None

### **4 - Marking**

#### **4.1 - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

#### **4.2 - Specific**

- a) At least one major component of the fuel, oil, and hydraulic pressure instrument shall be marked permanently and legibly with all the information as provided in SAE AS408C, Section 3.2 (except paragraph 3.2.b).
- b) Mark "Fire resistant" or "Fireproof" information legibly and permanently

### **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3

**APPENDIX 1.**

**MINIMUM PERFORMANCE STANDARDS (MPS) FOR PRESSURE  
INSTRUMENTS - FUEL, OIL, AND HYDRAULIC**

1. The MPS applying to this ETSO are provided in SAE AS408C, Pressure Instruments - Fuel, Oil, and Hydraulic, dated July 1, 2001, except for paragraphs 3.1, 3.1.1, 3.1.2, and 3.2.b.

Here are provided the modifications to be applied to the referenced SAE document:

**AS408C**

***modification:***

- |             |  |
|-------------|--|
| Title       | Replace "Pressure Instruments – Fuel, Oil, and Hydraulic (Reciprocating Engine Powered Aircraft)"<br>Substitute: "Pressure Instruments – Fuel, Oil, and Hydraulic" |
| Section 1.1 | Replace "...primarily for use with reciprocating engine powered transport aircraft, ..."<br>Substitute: "...for use with civil aircraft,..."                       |

**AS408C section 7**

***modification:***

- |           |  |
|-----------|--|
| Para 7.13 | Use test conditions in SAE AS1055 Rev D, "Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components", dated June 1, 1997, Sections 4 and 5. |
| Para 7.14 | Add test conditions in EUROCAE ED-14E / RTCA DO-160E, Section 16, Power Input.   |
| Para 7.15 | Add test conditions in EUROCAE ED-14E / RTCA DO-160E Section 17, Voltage Spike.  |
| Para 7.16 | Add test conditions in EUROCAE ED-14E / RTCA DO-160E Section 18, Audio Frequency Conducted Susceptibility – Power Inputs.  |
| Para 7.17 | Add test conditions in EUROCAE ED-14E / RTCA DO-160E Section 19, Induced Signal Susceptibility   |
| Para 7.18 | Add test conditions in EUROCAE ED-14E / RTCA DO-160E Section 20, Radio Frequency Susceptibility.   |

2. The performance of fuel, oil and hydraulic pressure instruments can be enhanced or made superior to this specification, depending on intended application and configuration.

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **ENGINE DRIVEN DIRECT CURRENT GENERATORS / STARTER GENERATORS**

### 1 - Applicability

This ETSO gives the requirements which Engine-driven Direct Current generators/starter generators that are 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 Aerospace Standard (AS) document: AS8020, "*Engine Driven D.C. Generators/Starter-Generators and Associated Voltage Regulators*", dated January 1980 (and reaffirmed by SAE in August 1991).

##### 3.1.2 - Environmental Standard

EUROCAE ED-14E (RTCA DO160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005.

##### 3.1.3 - Computer Software

If the Engine Driven Direct Current Generator / Starter Generator and the associated voltage regulators include a digital computer, the software must be developed according to EUROCAE ED-12B (RTCA DO-178B) "*Software Considerations in Airborne Systems and Equipment Certification*" from 1992.

#### 3.2 - Specific

None

## **4 - Marking**

### **4.1 - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

### **4.2 – Specific**

In addition to the information specified in §4.1, the following information is required:

- (1) Means of indicating if the article is a D.C. generator or a D.C. starter-generator;
- (2) Nominal power output (electrical voltage and watts);
- (3) Mechanical power input requirements (pad requirements).

## **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: CHILD RESTRAINT SYSTEM (CRS)

### 1 - Applicability

This ETSO gives the requirements which Child Restraint System (CRS) that is 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 applicable standard is SAE AS5276/1, "Child Restraint Systems in Transport Category Airplanes" dated October 2000, as modified, in attached **APPENDIX 1** "MINIMUM PERFORMANCE STANDARD FOR CRS" and **APPENDIX 2** "TEST CONDITIONS".

##### 3.1.2 - Environmental Standard

See CS-ETSO Subpart A paragraph 2.1

##### 3.1.3 - Computer Software

See CS-ETSO Subpart A paragraph 2.2

#### 3.2 - Specific

None.

### 4 - Marking

#### 4.1 - General

Marking is 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.  
49CFR571 and 49CFR572 may be obtained from U.S. Government Printing Office  
(web-site: [www.gpoaccess.gov](http://www.gpoaccess.gov)).

## APPENDIX 1.

### MINIMUM PERFORMANCE STANDARD (MPS) FOR CHILD RESTRAINT SYSTEM (CRS)

This appendix prescribes the MPS for CRS, modified by the Agency in this ETSO. The applicable standard is SAE AS5276/1, "Performances Standard for Child Restraint Systems in Transport Category Airplanes" dated November 2000, and is modified with additions in ***bold italics***, as follows:

1. Page 1, paragraphs 1. (SCOPE), 1.1 (PURPOSE), and 1.2 (APPLICABILITY), page 2, paragraph 2. (REFERENCES), 2.1 and 2.1.1. Disregard these paragraphs as similar text appears in TSO.

2. Page 2, paragraph 2.1.2 reads as follows:

ETSO C22g, Safety Belts

DOT/FAA/AAM/-94/19, The Performance of Child Restraint Devices in:

Transportation Category Seats. Gowdy and DeWeese, FAA Office of Aviation Medicine Report, September 1994

3. Page 4, replace paragraph 3.2 as follows:

***To secure a CRS in an airplane passenger seat, the device shall rely upon the passenger seat lap belt (pelvic restraint) or possibly rigid bar lower anchorages if the airplane seat is so equipped, as prescribed by 49 CFR § 571.225 S9. The latter would require the CRS to be equipped with lower anchorage hardware per 49 CFR § 571.213 S5.9(a), that is, adjustable webbing attachments or retractable/stowable rigid prongs.***

4. Page 5, paragraph 3.2.5 reads as follows:

3.2.5 Where a CRS is equipped with prongs that attach the CRS to a rigid bar anchorage system in automobiles, ***as referenced in 49 CFR § 571.225*** those prongs shall be retractable, in order to ensure proper positioning of the CRS in the airplane passenger seat and to avoid damage to the airplane seat.

5. Page 5, paragraph 3.3, Fire Protection, with modification reads as follows:

3.3 Cushions, upholstery, and all other exposed materials ***except small parts (knobs, triggers, fasteners, seals and electrical parts) that would not contribute significantly to the propagation of a fire*** shall meet the fire protection provisions of CS 25.853(a)

[Appendix F, Part I (a)(1)(ii)]. ***Seat belts and shoulder harnesses shall meet [Appendix F, Part I (a)(iv)]***

6. Page 5, replace paragraph 4, Performance Test Specifications, as follows:

The dynamic test described in this section is used to evaluate the performance of the CRS in a horizontal impact where the force is applied against the longitudinal axis of a forward facing airplane passenger seat that holds the CRS. The structural adequacy of the CRS, the effectiveness of the CRS attachments and the adequacy of restraint of the child occupant, as prescribed in 4.1, are the issues evaluated. ***One dynamic impact test shall be performed, with the CRS secured using the passenger seat lap belt, for each category of child-occupant, as defined in paragraph 2.3 of this AS, for which the CRS is intended for use. In addition, CRS that are equipped with lower anchorage attachment hardware per 49 CFR § 571.213 S5.9(a) may be***

*tested with each category of child-occupant when secured using the rigid bar lower anchorages.*

7. Page 6, paragraph 4.2, Test Fixtures, reads as follows:

4.2 The fixture on which the CRS is installed for the dynamic test is based on the seat fixture defined in 49 CFR § 571.213. s61.1(a)(1), (FMVSS-213) **or a fixture that has been modified to accept the rigid bar lower anchorages per 49 CFR § 571.225 S9.** For the test specified by this AS, the back cushion, seat cushion, lap belts and belt anchor points are different from the standard FMVSS-213 seat configuration. Appendix A of this AS presents the locations, dimensions, and materials used to configure the FMVSS-213 fixture for the test specified by this AS.

8. Page 6, paragraph 4.2.1 reads as follows:

4.2.1 Passenger Seat Restraints: Airplane passenger seat lap belts shall be installed on the test fixture **as the primary means of attaching the CRS to the seat fixture depicted in Appendix A of this AS.** The buckle shall be a lift latch type release mechanism. The belts shall meet the requirements of ETSO-C22g and conform to the length dimensions shown in Appendix A, Figure A5 of this AS. The webbing shall be made of nylon or any suitable material that has been shown to be equivalent.

9. Page 6, new paragraph 4.2.2 reads as follows:

**4.2.2 Rigid Bar Lower Anchorages: Alternatively, CRS equipped with lower anchorage attachment hardware may be tested using the aforementioned modified test procedure.**

10. Page 7, the last sentence of paragraph 4.5, Photometric Instrumentation, reads as follows:

The resolution of the images shall be sufficient to enable accurate measurements of the maximum excursion of the head and knee of the ATD in Type **III** CRS tests, or the maximum rotation of the CRS in Type I and aft facing Type II CRS tests.

11. Page 7, new paragraph heading 5.1.1 reads as follows:

**5.1.1 Passenger Seat Restraint:** The CRS shall be installed in the test fixture and secured using the passenger seat lap belt in the manner specified by the manufacturer's instructions provided with the CRS. The maximum force applied to the free end of the lap belt webbing being pulled through the belt buckle tension retention mechanism shall not exceed 67 N (15lb) and the maximum force shall be applied for a period no longer than 3s. No other force may be applied to the CRS during the adjustment of the passenger seat lap belt. The CRS shall not be repositioned after the passenger seat lap belt has been tightened.

12. Page 7, new paragraph 5.1.2 reads as follows:

**5.1.2 Rigid Bar Lower Anchorages: The CRS may be installed in the modified test fixture and secured to the rigid bar lower anchorages as follows:**

13. Page 7, new paragraph 5.1.2.1 reads as follows:

**5.1.2.1 Flexible Lower Anchorage CRS Attachment: CRS equipped with adjustable webbing and latch plates may be secured to the rigid bar lower anchorages on the passenger seat. The maximum force applied to the free ends of the CRS's lower anchorage attachment webbing when**



*pulled through the tension retention mechanism shall be the same as paragraph 5.1 of this AS. These types of CRS may also be secured to the passenger seat by attaching them to the passenger seat lap belt anchorage in the manner specified by the manufacturer's instructions provided with the CRS.*

14. Page 7, new paragraph 5.1.2.2 reads as follows:

**5.1.2.2 Rigid Lower CRS Attachment: CRS equipped with rigid prongs may be secured to the rigid bar lower anchorages in the manner specified by the manufacturer's instructions provided with the CRS.**

15. Page 9, new second paragraph 6.1.2 reads as follows:

All portions of the Anthropomorphic Test Dummy (ATD) torso shall be retained within the CRS. The **centre point of the** target points on either side of the ATD head shall pass through the transverse orthogonal planes whose intersection contains the forward-most and top-most points on the CRS surfaces.

16. Page 10, new paragraph 6.5.1 reads as follows:

6.5.1 Post Test Release of Integral Restraints on the CRS: The force to release the buckle on the CRS integral restraints (**see 5.4**) shall not exceed **7,3 kg (16 pounds)**.

17. Page 10, disregard paragraphs 7.1a through e. Marking of the article shall be in accordance with paragraphs 7.1f through **7.1h**, and the paragraph 4 of this ETSO.

18. Page 11, disregard paragraphs 7.1h through m. New paragraph 7.1h reads as follows:

h. The following statement on yellow background with black text, regarding the installation and use of CRS:

"WARNING! DEATH OR SERIOUS INJURY CAN OCCUR. Follow all instructions on this child restraint and in the manufacturer's written instructions located \_\_\_\_\_."

- Do not place this device behind any wall or seat back in an airplane that has an airbag.
- Do not use in any passenger seat that has an inflatable seat belt.
- Use only in a forward facing seat. Do not use in a rear facing seat or a side facing seat.
- Attach this child restraint with the airplane passenger seat lap belt or rigid bar anchorage system if so equipped. This child restraint is not designed to be used with a shoulder strap or any other tether strap to the seat or airplane.
- Snugly adjust the belts provided with this child restraint around your child.

19. Page 12, paragraph 7.1i. Disregard this paragraph, as it has been included in the new paragraph 7.1h.

20. Page 16, Figure A6. Disregard this Figure, as it no longer applies. The substance of this warning is now in paragraph 7.1h.

## **APPENDIX 2.**

### **TEST CONDITIONS**

SAE AS 5276/1 incorporates, as references, the following test standards:

- SAE RP J211, Instrumentation for Impact Tests;
- SAE AS8049A, Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft and General Aviation Aircraft;
- SAE ARP4466, Dimensional Compatibility of Child Restraint Systems and Passenger Seat Systems in Civil Transport Airplanes;
- 49 CFR Part 572, Anthropomorphic Test Dummies;
- CS 25.853(a) [Appendix F, Part I(a)(iv)].

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **UNDERWATER LOCATING DEVICES (ACOUSTIC) (SELF-POWERED)**

### 1 - Applicability

This ETSO gives the requirements that new models of underwater locating devices (acoustic) (self powered) that are 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 Aerospace Standard (AS) document: AS8045 "*Minimum Performance Standard for Underwater Locating Devices (Acoustic) (Self-Powered)*", dated May 16, 1988, and from the American Society Testing Materials (ASTM) document D.1141-98 "*Standard Practice for the Preparation of Substitute Ocean Water*", dated September 2003.

##### 3.1.2 - Environmental Standards

The equipment must be tested according to EUROCAE ED-14E (RTCA DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005.

##### 3.1.3 - Computer Software

If the article includes a digital computer, the software must be developed according to EUROCAE ED-12B (RTCA DO-178B), *Software Considerations in Airborne Systems and Equipment Certification*, dated December 1, 1992.

### **3.1.4 - Electronic Hardware Qualification**

If the article includes a complex custom micro-coded component, the component must be developed according to EUROCAE ED-80 (RTCA DO-254), *Design Assurance Guidance for Airborne Electronic Hardware*, from April 2000.

### **3.2 - Specific**

The battery used in the underwater locating device authorised under this ETSO must be appropriate for the intended operational environment, not pose a hazard to the aircraft and meet the requirements of acceptable battery standards. If non rechargeable lithium batteries are used to power the underwater locating device, ETSO-C142a "*Lithium Batteries*" provides MPS for such lithium batteries.

## **4 - Marking**

### **4.1 - General**

Marking is 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

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject:      **GEOSYNCHRONOUS   ORBIT   AERONAUTICAL   MOBILE  
                  SATELLITE   SERVICES   AIRCRAFT   EARTH   STATION  
                  EQUIPMENT**

### **1 - Applicability**

This ETSO gives the requirements which Geosynchronous Orbit Aeronautical Mobile Satellite Services (AMSS) aircraft earth station equipment that is 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 Federal Aviation Administration standard "Geosynchronous Orbit Aeronautical Mobile Satellite Services Aircraft Earth Station Equipment".

This standard is based on RTCA document DO 210D "MOPS for Geosynchronous Orbit Aeronautical Mobile Satellite Services (AMSS) avionics" Section 2.0 dated April 19, 2000 including Change 1, dated December 14, 2000, and change 2, dated November 28, 2001.

##### **3.1.2 - Environmental Standard**

See CS-ETSO Subpart A paragraph 2.1.

##### **3.1.3 - Computer Software**

See CS-ETSO Subpart A paragraph 2.2.

#### **3.2 - Specific**

None.

#### **4 - Marking**

##### **4.1 - General**

Marking is 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.

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **NON-RECHARGEABLE LITHIUM CELLS and BATTERIES**

### 1 - Applicability

This ETSO gives the requirements which Non-Rechargeable Lithium Cells and Batteries that are manufactured on or after the effective date of this ETSO must meet in order to be identified with the applicable ETSO marking.

*Note:* Lithium sulphur dioxide (LiSO<sub>2</sub>) batteries approved under ETSO-C97 "Lithium Sulphur Dioxide Batteries" dated 24/10/2003 may still be manufactured under the provisions of their original approval, but new applications for non-rechargeable lithium sulphur dioxide batteries must meet the MPS of this new ETSO. If there are major design changes to lithium cells and batteries approved under current version of ETSO-C97, they must comply with this ETSO-C142a.

### 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

RTCA DO-227 "Minimum Operational Performance Standard for Lithium Batteries" from June 1995 unless otherwise specified by **Appendix 1** of this ETSO

##### 3.1.2 - Environmental Standard

Non-Rechargeable Lithium Cells and Batteries must be tested according to RTCA DO-227 Section 2.3 unless otherwise specified by **Appendix 1** of this ETSO

#### 3.2 - Specific

None

#### **4 - Marking**

##### **4.1. - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

##### **4.2. – Specific**

Each lithium cell or battery must be marked in accordance with RTCA DO-227, Section 1.4.6.

#### **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3



## APPENDIX 1.

### MINIMUM PERFORMANCE STANDARD FOR LITHIUM BATTERIES

#### PURPOSE.

This appendix prescribes the MPS for lithium batteries as modified by this ETSO.

#### REQUIREMENTS.

The standards applicable to this ETSO are set forth in the industry standard, RTCA/DO-227 "Minimum Operational Performance Standard for Lithium Batteries" dated June 23, 1995.

The standard is modified as follows:

Table 1. Modifications to RTCA/DO-227

| <b><i>RTCA/DO-227 section and title:</i></b> | <b><i>Required modification:</i></b>  |
|--|---|
| <b>1.5.11, Design Life</b>                   | <b>TO ADD at the end of the paragraph</b><br>"Equipment manufacturers are responsible for ensuring that the integrity of date coding systems used by the cell/battery supplier(s) will support design life criteria."   |
| <b>1.7.3, Lot Acceptance Test Goals</b>      | <b>TO ADD at the end of the paragraph</b><br>"It is recommended that the manufacture's lot acceptance testing include the discharge tests described by paragraph 2.4.1.1 Capacity-Verification Test."   |
| <b>2.1.2 b, Performance Requirements</b>     | <b>TO ADD at the end of the paragraph</b><br>"If the battery is required to operate in temperatures outside this envelope, test the battery using the more severe temperatures."  |
| <b>Table 2-1, Cell evaluation criteria</b>   | <b>TO DELETE the superscript "4" on the</b><br>Internal Short-Circuit Test row under the "FIRE" column. The superscript "4" is only used under the Forced-Discharge, External Short-Circuit, and Charging tests, and then only under the "LEAK" and "VENT" columns. |
| <b>2.1.8.2, Test Tolerances</b>              | <b>TO ADD new paragraphs after 2.1.8.2</b><br><b>Rated Capacity and Current</b><br>Except as otherwise specified in the test methods in subsections 2.3 and 2.4, the rated capacity and current must be the same for all testing in this standard.                  |
| <b>Warning - Hazards of Testing</b>          | When subjected to electrical testing specified in this document, cells or batteries may leak or vent hazardous materials, burn, or in exceptional cases, vent violently.  |
| <b>2.3.1, Vibration Test</b>                 | <b>TO REPLACE</b> Figure 2-3 with the modified Figure 2-3<br>STANDARD RANDOM VIBRATION Figure 2-3 in appendix 1 of this ETSO. This revised figure depicts different limit lines.  |

|  |  |
|--|--|
| <b>2.3.1, Vibration Test</b>           | <b>TO REPLACE</b> Figure 2-4 with the modified Figure 2-4<br>STANDARD RANDOM VIBRATION Figure 2-4 in appendix 1 of this ETSO.. This revised figure depicts different limit lines.  |
| <b>2.3.1, Vibration Test</b>           | <b>TO ADD</b> before the last sentence in the eighth paragraph "Measure the open circuit voltage (OCV) before, during, and after the tests."   |
| <b>2.3.2, Shock Test</b>               | <b>TO REPLACE</b> the wording with<br>"For the battery shock test, mount samples in the equipment in which they will be used. Perform this test using undischarged sample cells or batteries. Secure the sample to a shock table by a mechanically secured device. The shock test machine must be capable of imparting a series of calibrated shock impulses to the sample. The shock impulse waveform distortion at any point on the waveform may not be greater than 15 percent of the peak value of the shock pulse. The duration of the shock pulse is specified with reference to the zero points of the wave. The shock forces are specified in terms of peak amplitude g values. Measure the shock impulse using a calibrated accelerometer and associated instrumentation having a 3db response over a range of at least 5 to 250 Hz. Mount the sample on the shock test machine so that the shock impulses can be applied in both directions of the three orthogonal axes. For general purposes, use the following test parameters. Apply a 75 g saw tooth wave shock impulse with a duration of 11 +2 ms in both directions of the three orthogonal axes. Measure the open circuit voltage before and after the test. Examine each sample to determine if it meets the requirements of Table 2-1 and 2-2.<br>For applications with shock requirements in excess of the general test (that is, where crashworthiness, ELTs, or survivability is an issue), use the following more stringent requirements. Apply a 100 g half sine wave shock impulse with a duration of 23 +2 ms in both directions of the three orthogonal axes. Measure the open circuit voltage (OCV) before, during and after the test. Examine each sample to determine if it meets the requirements of Table 2-1 or Table 2-2." |
| <b>2.3.3, Temperature Cycling Test</b> | <b>TO CHANGE</b> 10 times to 9 times   |
| <b>2.3.3, Temperature Cycling Test</b> | <b>TO ADD</b> to the end of the paragraph, "...for either method."   |
| <b>2.4.1.2, Discharge Test</b>         | <b>TO ADD</b> after the second sentence in the first paragraph, "Set the DC power supply to a voltage limit equal to the number of cells per series string in the battery times the OCV of an individual cell."  |
| <b>2.4.1.2, Discharge Test</b>         | <b>TO ADD</b> to the end of the first paragraph  |

"If the sample contains one or more protective devices, set the test current to just below (by no more than 10 percent) the current at which any protective device will activate during the forced discharge test."

**2.4.1.3, Forced Discharge Test**

**TO DELETE** the fourth sentence: If the sample contains one or more protective devices, the test current is just below (by no more than 10%) that at which any protective device will activate during the forced discharge test.

**2.4.1.3, Forced Discharge Test**

**TO ADD** to the end of the paragraph "This test is not required for single cell batteries. Test the cells up to and (possibly) including the maximum rate of discharge specified by the manufacturer. Rate any protective device at or below the discharge rate specified by the manufacturer. Perform all testing according to this rating."

**2.4.2.1, Internal Short-circuit Test**

**TO REPLACE** the first paragraph with "This test is designed to determine the effects of an internal short circuit in undischarged cells. At 24° C, deform the sample between a rod with a hard insulating surface and an insulated plate. Each cell is deformed until the open circuit voltage drops abruptly or is reduced to at least one third. At the point where the cell voltage drops, remove the applied force. Allow the sample to cool to 24 °C and then hold for a minimum of 24 hours. Examine each sample to determine if it meets the requirements of Table 2-1"

**3.4, Test Procedures for Installed Equipment Performance**

**TO ADD** new paragraph after 3.4.

**Toxic Gas Venting Precautions**

Do not install or use batteries that can vent toxic gases in the aircraft cockpit, because of an increased probability of immediate flight crew impairment. Batteries that can vent toxic gases may be installed or used in an aircraft passenger compartment, if the installer shows that this would not create a safety hazard. You can prevent a safety hazard by:

- a. Installing a system for overboard venting, absorption, or containment, or
- b. Showing that, if venting occurs, permissible exposure limits do not exceed those maintained by safety-standard organizations (Occupational Safety and Health Administration and the American Conference of Governmental Industrial Hygienists, Inc.).

**3.4, Test Procedures for Installed Equipment Performance**

**TO ADD** new paragraph after 3.4

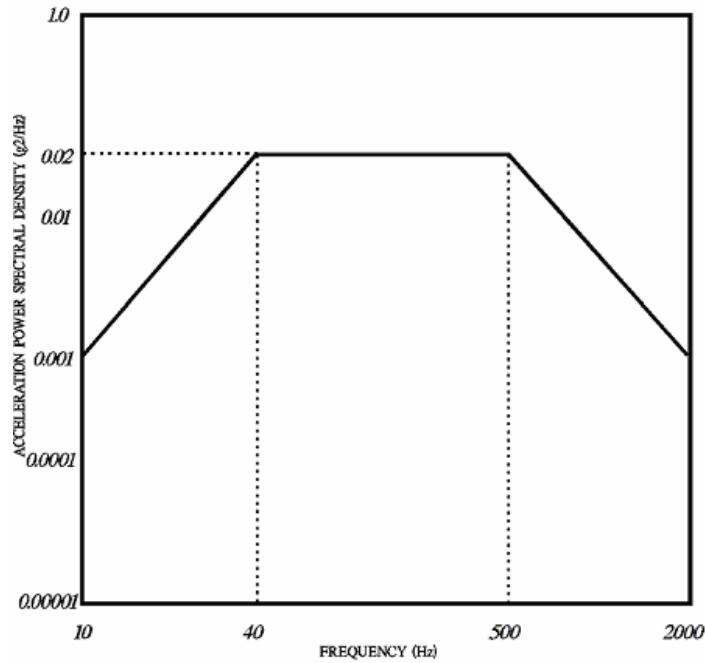
- (a) Because lithium batteries have ignited, vented gas or exploded, we require additional performance standards governing the use of lithium batteries or

equipment incorporating lithium cells or batteries on airplanes.

Airplane and equipment manufacturers incorporating lithium cells or batteries must ensure that if there is a fire within a single cell of the battery, the equipment unit will contain the fragments and debris (but not smoke/gases/vapors) from a battery explosion and fire. Fire within the equipment, such as from wires and electrical components, must self-extinguish.

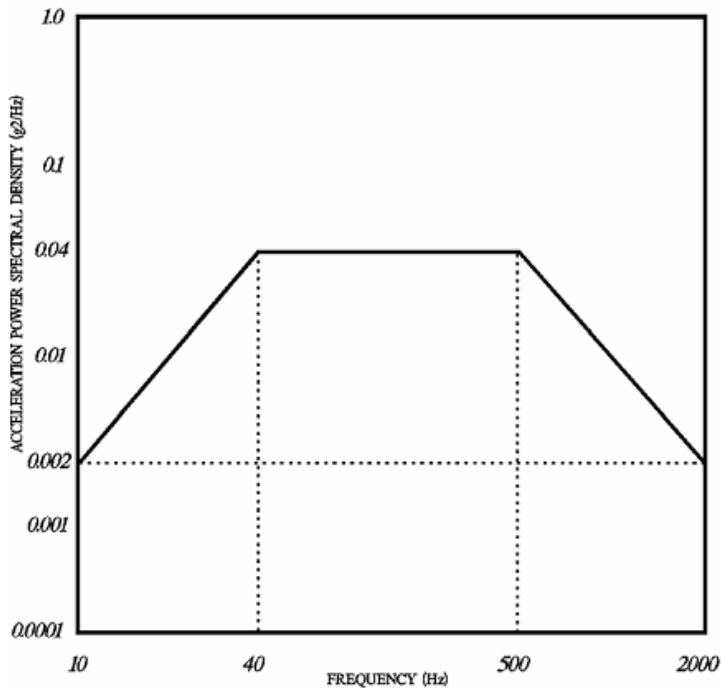
- (b) See Table 2, appendix 1 of this ETSO. for tests to ensure that the manufacturer has met the fire safety requirements for equipment incorporating lithium cells or batteries.

**Figure 2-3. Standard Random Vibration Test Curves for Equipment Installed in Fixed Wing Aircraft with Turbojet Engines**



*NOTE: All slopes are  $\pm 6$  dB/Octave and the cumulative spectral power density is 4.12 g (rms).*

**Figure 2-4. Robust Random Vibration Test Curves for Equipment Installed in Fixed Wing Aircraft with Turbojet Engines**



*NOTE: All slopes are  $\pm 6$  dB/Octave and the cumulative spectral power density is 6.08 g (rms).*

| <b>Table 2. TESTS FOR FIRE SAFETY REQUIREMENTS</b> |   |  |
|--|---|--|
| <b>Test</b>  | <b>Procedures</b>   | <b>Criteria to Pass</b>  |
| External Short Circuit                             | Measure direct connection between terminals through electric wire with resistance of 2m-ohm. State of Charge (SoC) of a cell : 100%             | No venting of gases/vapors.<br>No smoke produced.<br>No ignition or fire. No explosion.  |
| Crush  | Test battery by dropping an iron ball (9.1 kg) from the height of 61cm<br>SoC of a cell : 50%   | No venting of gases/vapors.<br>No smoke produced.<br>No ignition or fire. No explosion.  |
| Over discharge                                     | Test battery by discharging with a current of 1C for 1 hour (or to the maximum discharge time for the battery operation).<br>SoC of a cell : 0% | No venting of gases/vapors.<br>No smoke produced.<br>No ignition or fire. No explosion.  |
| Overheat   | Test battery by heating up to 115 degrees C in the oven.<br>SoC of a cell : 100%  | No venting of gases/vapors.<br>No smoke produced.<br>No ignition or fire. No explosion.  |
| Fire   | Test equipment unit with battery in place for fire penetration by igniting a single unit.<br>SoC of a cell : 100%                               | Unit must contain the fragments/debris from explosion but not gases/vapors/smoke. Fire within the unit must self-extinguish. Note that the presence of a fire extinguishing or suppression system outside the battery (such as in the equipment compartment) may be used to provide this feature if the system is designed to handle this fire threat. |

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **GROUND BASED AUGMENTATION SYSTEM (GBAS)  
POSITIONING AND NAVIGATION EQUIPMENT**

### **1 - Applicability**

This ETSO gives the requirements which "Ground Based Augmentation System (GBAS) Positioning and Navigation Equipment" manufactured on or after the effective date of this ETSO have to 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**

Section 2 of RTCA/DO-253A, "*Minimum Operational Performance Standards for GPS Local Area Augmentation System Airborne Equipment*," dated November 28, 2001.

##### **3.1.2 - Environmental Standard**

The equipment must be tested according to EUROCAE ED-14E (RTCA DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005.

##### **3.1.3 - Computer Software**

If the article includes a digital computer, the software must be developed according to EUROCAE ED-12B (RTCA DO-178B) "*Software Considerations in Airborne Systems and Equipment Certification*" from 1992.

### **3.2 – Specific**

Regarding the installation procedures and limitations, adequate specification of the interface between the equipment and other systems are mandatory to ensure proper functioning of the integrated system.

## **4 - Marking**

### **4.1. - General**

Marking is 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



# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE  
– BROADCAST (ADS-B) AND TRAFFIC INFORMATION SERVICES  
(TIS-B) EQUIPMENT OPERATING ON THE RADIO FREQUENCY  
OF 1090 MHZ**

### 1 - Applicability

This ETSO gives the requirements which Extended Squitter Automatic Dependant surveillance-Broadcast (ADS-B) and Traffic Information Services - Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 MHz that are manufactured on or after the effective 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

Section 2 of RTCA DO-260A " *Squitter Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Services - Broadcast (TIS-B)*", dated April 10, 2003, as modified by Change 1 to RTCA/DO-260A, dated June 27, 2006, and Change 2 to DO-260A, dated December 13, 2006. The 1090 MHz equipment classes applicable to this ETSO are defined in RTCA/DO-260A, Section 2.1.11.

This ETSO supports two major classes of 1090 MHz ADS-B and TIS-B equipment:

- (a) Class A equipment, consisting of transmit and receive subsystems; and
- (b) Class B equipment, containing a transmit subsystem only

**(a) Class A equipment** includes Classes A0, A1, A2 and A3. This standard requires 1090 MHz airborne Class A equipment to include the capability of receiving both ADS-B and TIS-B messages and delivering both ADS-B and TIS-B reports, as well as transmitting ADS-B messages. A Receive-only Class of equipment is allowed.

**(b) Class B equipment** includes Classes B0 and B1. Classes B0 and B1 are the same as A0 and A1, except they do not have receive subsystems. Note that Classes B2 and B3 are not for aircraft use.

**3.1.2 - Environmental Standard**

EUROCAE ED-14E (RTCA DO160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005.

The means for verifying equipment performance must be consistent with the test procedures specified in section 2.3 of RTCA/DO-260A dated April 10, 2003 Change 1 to RTCA/DO-260A, dated June 27, 2006, and Change 2 to DO-260A, dated December 13, 2006.

**3.1.3 - Computer Software**

If the article includes a digital computer, the software must be developed according to EUROCAE ED-12B (RTCA DO-178B) "*Software Considerations in Airborne Systems and Equipment Certification*" from 1992.

**3.2 - Specific**

None

**4 - Marking**

**4.1. - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

**4.2. – Specific**

Transmitting and receiving components must be permanently and legibly marked.

The following table explains how to mark components.

RTCA/DO-260A provides the equipment class in Section 2.1.11, and the receiving equipment type in Section 2.2.6.

| <b><i>If component can:</i></b> | <b><i>Mark it with:</i></b>                               | <b><i>Sample marking pattern:</i></b>      |
|---------------------------------|---|--|
| Transmit and receive            | Equipment class it supports, and Receiving equipment type | Class A0/Type 1                            |
| Transmit, but not receive       | Equipment class it supports                               | Class B1, or<br>Class A3-Transmitting Only |
| Receive, but not transmit       | Equipment class it supports, and Receiving equipment type | Class A2/Type 2-Receiving Only             |

**5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **NICKEL-CADMIUM AND LEAD-ACID BATTERIES**

### 1 - Applicability

This ETSO gives the requirements which Nickel-Cadmium and Lead-Acid Batteries that are manufactured on or after the effective 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

RTCA standard DO-293 *"Minimum Operational Performance Standards (MPS) for Nickel-Cadmium and Lead-Acid Batteries"* (from 29 July 2004).

##### 3.1.2 - Environmental Standard

Nickel-cadmium and lead-acid batteries must be tested according to the conditions specified in RTCA/DO-293.

Were in RTCA/DO-293, the information references to ED-14D (RTCA DO-160D) *"Environmental Conditions and Test Procedures for Airborne Equipment"*, from July 29,1997, ED-14E (RTCA DO-160E) from March 2005 must be used instead of ED-14D (RTCA DO-160D).

##### 3.1.3 - Computer Software

None

#### 3.2 – Specific

None

#### **4 - Marking**

##### **4.1. - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

##### **4.2. - Specific**

Each Nickel-Cadmium and Lead-Acid Battery must be permanently and legibly marked according to information provided in RTCA/DO-293, Section 1.10.

#### **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **BATTERY BASED EMERGENCY POWER UNIT (BEPU)**

### 1 - Applicability

This ETSO gives the requirements which Battery based Emergency Power Units (BEPU) that are manufactured on or after the date of this ETSO must meet in order to be identified with 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

Standard are given in **Appendix 1**.

Note: The battery used in the BEPU must meet the requirements of ETSO-C173 "*Nickel-Cadmium and Lead Acid Batteries*" or any other battery standards acceptable to the Agency.

##### 3.1.2 - Environmental Standard

As stated in **Appendix 1** chapter 2 of this ETSO.

##### 3.1.3 - Computer Software

If the article includes a digital computer, the software must be developed according to EUROCAE ED-12B (RTCA DO-178B) "*Software Considerations in Airborne Systems and Equipment Certification*" from 1992.

#### 3.2 - Specific

None

## **4 - Marking**

### **4.1 - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

### **4.2 - Specific**

Product label shall indicate:

- Battery capacity (e.g. 20 Amp-Hour (Ah))
- Nominal voltage
- Battery chemistry

## **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3

## APPENDIX 1

### MINIMUM PERFORMANCE STANDARD FOR BATTERY BASED EMERGENCY POWER UNIT (BEPU)

#### CHAPTER 1: MINIMUM PERFORMANCE STANDARD UNDER STANDARD CONDITIONS

##### 1 - PURPOSE

These are the requirements under standard conditions for a Battery Based Emergency Power Units (BEPU) to meet the Minimum Performance Standard for this ETSO. The performance of specific equipment may be enhanced, depending on its intended application and configuration.

##### 2 - GENERAL REQUIREMENTS

The BEPU must meet the power quality requirements of MIL-STD-704F, Aircraft Electrical Power Characteristics, dated March 12, 2004, and maintain the rated values and functionality according to its specification data sheet, unless otherwise specified in this ETSO.

- (a) Design the BEPU to minimize the risk of causing or spreading a fire.
- (b) Storage batteries must be designed and installed as follows: Safe cell temperatures and pressures must be maintained during any probable charging or discharging condition. No uncontrolled increase in cell temperature may result when the battery is recharged (after previous complete discharge):
  - At maximum regulated voltage or power
  - During a flight of maximum duration, and
  - Under the most adverse cooling condition likely to occur in service
- (c) Demonstrate the above conditions by test, unless your experience with similar batteries and installations has shown that maintaining safe cell temperatures and pressures do not present a problem.
- (d) Systems like electronic circuits installed in the BEPU must be compatible with the battery chemistry.
- (e) During a failure of the normal power source to the emergency electrical bus, the BEPU supplies emergency electrical bus loads without intervention by the flight crew. After re-establishment of the normal power source, the emergency bus loads revert automatically from the BEPU to the normal power source, and the BEPU automatically returns to charging mode. To prevent inadvertent recharging of the BEPU from the aircraft battery when a normal power source is not available, the BEPU shall not enter the recharge mode when the BEPU input (source) voltage is below 24VDC.
- (f) Specify the value of voltage spikes occurring when the BEPU is switched on and off and between modes (if applicable).
- (g) Any single component failure within the BEPU (either open or short) cannot result in an over voltage condition on the battery.



- (h) The BEPU will not have any protection/provision that results in automatic removal of power from the emergency load.
- (i) The BEPU will not discharge through the input side of the BEPU.
- (j) If the BEPU provides backup power to multiple loads, equip the BEPU with protection provisions that allow for the isolation and removal of excess load on any of its output feeders that draw more than its pre-determined maximum current. This will protect remaining loads in case of a load short circuit.
- (k) The BEPU should not drain its battery power when the aircraft power is off.
- (l) Fully charge the battery before installation. Charge the battery every time the aircraft is powered up, independent of cockpit switch position.
- (m) The charging time from 20 % to 80 % capacity will be less than 3 hours.
- (n) Specify the nominal current and the short time maximum current.
- (o) Design the BEPU so separation devices placed between input, output, and battery will enable the current flow from input to output, even when there is a malfunction with other BEPU components. The separation devices will prevent current flow in the direction from output (respectively the battery) to input, and from output to battery. See Figure A-2 at the end of this Appendix. The minimum current rating of the separation devices must be greater than three times the continuous rated output current of the BEPU. Unless provided in the aircraft, design the BEPU to prevent output current greater than 30 milliamperes (mA) from flowing back to battery. The loss (breakdown) of voltage of such separation devices will exceed three times the BEPU rated voltage.
- (p) The maximum output voltage ripple cannot exceed the limits stated in MIL-STD-704F. Note this limit does not include the ripple already on the input line into the BEPU. (See Figure A-3 at the end of this Appendix.)
- (q) To preclude catastrophic effects of excess temperature, the BEPU will monitor battery temperature during battery-charging cycles, and remove power when over temperature limits are reached. Applications where excessive battery temperature cannot cause catastrophic events do not require monitoring.
- (r) If the BEPU contains a battery heater device, a single-fault failure redundancy protection is required to prevent heater runaway.

### 3 - CAPACITY AND RELATED PARAMETERS

The parameters listed in this section under environmentally benign and ground benign conditions at 25°C must be provided. Following are considered nominal conditions.

- (a) BEPU capacity. Specify the value for the nominal capacity in Amp-Hours (Ah) based on a constant discharge current for 1.0 hour. During capacity testing, the output voltage cannot degrade below 20VDC.
- (b) BEPU output voltage excursions. Provide graphs of output voltage versus time for the following conditions:
  - Complete discharge to low voltage dropout point after being fully charged.

- Complete discharge to low voltage dropout point after being charged to 72% capacity. This (72% capacity) represents a BEPU at end of its life and 90% state of charge.
- (c) BEPU life. Declare the expected battery life based on the number of 100% discharge cycles on the battery nameplate. Battery life is expired when 80% of nameplate stated capacity is reached.
- (d) BEPU maximum current consumption. Specify the maximum current consumption (excluding external loads) of the BEPU. Maximum current includes charging, heating, and other functionalities performed by electronic circuits.
- (e) BEPU output current. Specify the nominal current that can be delivered by the BEPU related to the nominal Ah rating specified in paragraph 3.a of this Chapter 1 "CAPACITY AND RELATED PARAMETERS", and the short time maximum current, versus time, if necessary.

#### 4 - MONITOR AND CONTROL.

- (a) Instrumentation, data read-outs, and controls can be provided by support equipment instead of the BEPU.
- (b) Design all instrumentation and data read-outs for easy interpretation to avoid misunderstandings.
- (c) The BEPU can have (but is not limited to) the following optional controls:
- BEPU Off: Battery power is disconnected from all loads
  - BEPU Arm: Ready to engage power to the loads if aircraft power is lost. The BEPU should be in "Charging Mode" unless there is a failure of the emergency bus.
  - BEPU On/Engage: Causes the battery to be applied to the loads. The BEPU should be in "Charging Mode" unless during failure of the emergency bus.
- (d) Provide a test function for pre-flight check, showing the system function and battery status. The battery is considered good with 80% state of charge. We recommend an in-flight low battery warning indication. Perform a lamp test where the checked segments are lighted.

## **CHAPTER 2: MINIMUM PERFORMANCE STANDARD UNDER ENVIRONMENTAL TEST CONDITIONS**

### 1 - GENERAL

Unless otherwise specified, applicable test procedures are in EUROCAE ED14E / RTCA DO-160E.

### 2 - PERFORMANCE TESTS

The following environmental tests verify BEPU operations based on manufacturer specifications and requirements under extreme environmental conditions. If the manufacturer's specifications during these tests are different than those recorded under benign environmental conditions as specified in paragraph 3 of Chapter 1 of this Appendix 1, the manufacturer will specify the modified rating and under what condition such ratings would occur. For the following tests, determine

compliance of the BEPU to the manufacturer's nominal ratings (unless otherwise specified) as referenced in paragraph 3 of Chapter 1 of this Appendix ~~±~~. Except when otherwise noted, charge the batteries to at least 80 % of manufacturers rated capacity before conducting these tests:

- BEPU capacity using nominal current discharge
- BEPU output voltage excursion
- BEPU current consumption

The applicable test requirements contained in EUROCAE ED14E / RTCA DO-160E are:

- (a). EUROCAE ED14E / RTCA DO-160E Section 4, Temperature and Altitude.
- Operating Low Temperature Test. You may use an internal battery heater for this test.
  - Operating High Temperature Test
  - Altitude Test
  - Decompression Test
  - Overpressure Test
- (b) EUROCAE ED14E / RTCA DO-160E Section 5, Temperature Variation. Combine this test with EUROCAE ED14E / RTCA DO-160E, Section 4 testing requirements.
- (c) EUROCAE ED14E / RTCA DO-160E Section 6, Humidity.
- (d) EUROCAE ED14E / RTCA DO-160E Section 7, Operational Shocks and Crash Safety. After this test, the equipment must remain in its mounting with no part of the equipment or its mounting becoming detached and free on the shock test table. Measure and record the BEPU capacity after completion.
- Note: These tests may damage the equipment. Therefore, these tests may be conducted last.*
- (e) EUROCAE ED14E / RTCA DO-160E Section 8, Vibration. While the equipment is subjected to this test, ensure that all mechanical devices operate satisfactorily and that the mechanical construction remains undamaged.
- (f) EUROCAE ED14E / RTCA DO-160E Section 9, Explosion Proofness. Required only if the BEPU contains components that are known to cause inductive arcing.
- (g) EUROCAE ED14E / RTCA DO-160E Section 10, Water Proofness (if required).
- (h) EUROCAE ED14E / RTCA DO-160E Section 11 Fluids Susceptibility (if required). Not mandatory for ETSO approval.
- (i) EUROCAE ED14E / RTCA DO-160E Section 12, Sand and Dust (if required).
- (j) EUROCAE ED14E / RTCA DO-160E Section 13, Fungus Resistance (if required). Compliance by analysis is acceptable.
- (k) EUROCAE ED14E / RTCA DO-160E Section 15, Magnetic Effect.
- (l) EUROCAE ED14E / RTCA DO-160E Section 16, Power Input.

- (m) EUROCAE ED14E / RTCA DO-160E Section 17, Voltage Spike. During and after this test, no failed parts must exist, including any degradation on component voltage and current ratings. No parasitic or transient mode switching can result from this test.
- (n) EUROCAE ED14E / RTCA DO-160E Section 18, Audio Frequency Conducted Susceptibility – Power Inputs. Conduct by charging the BEPU when its capacity is between 0% and 75%. No parasitic or transient mode switching can result from this test.
- (o) EUROCAE ED14E / RTCA DO-160E Section 19, Induced Signal Susceptibility. No parasitic or transient mode switching can result from this test.
- (p) EUROCAE ED14E / RTCA DO-160E Section 20, RF Susceptibility. No parasitic or transient mode switching can result from this test.
- (q) EUROCAE ED14E / RTCA DO-160E Section 21, Emission of RF Energy. Conduct while BEPU is being charged. Charge must be between 0% and 75% of capacity during this test.
- (r) EUROCAE ED14E / RTCA DO-160E Section 22, Lightning Induced Transient Susceptibility. No parasitic or transient mode switching can result from this test.
- (s) EUROCAE ED14E / RTCA DO-160E Section 23, Lightning Direct Effects. Not mandatory for this ETSO approval. If you conduct this test, no failed parts may exist during and after the test. Failed parts include any degradation on component voltage and current ratings. No parasitic or transient mode switching should result during this test.
- (t) EUROCAE ED14E / RTCA DO-160E Section 24, Icing. Not mandatory for this ETSO approval. If you conduct this test, no failed parts may exist during and after the test. Failed parts include any degradation on component voltage and current ratings.
- (u) EUROCAE ED14E / RTCA DO-160E Section 25, Electrical Discharge.

### **CHAPTER 3 : ELECTRICAL TEST PROCEDURES**

#### **1 - GENERAL**

Electrical test procedures covered under environmental test conditions in Chapter 2 of this Appendix are conducted according to EUROCAE ED14E / RTCA DO-160E. Test procedures that meet specific requirements for the BEPU are outlined below.

#### **2 - GENERAL TEST CONDITIONS**

Unless otherwise specified, the following test conditions apply:

- (a) Conduct all tests under conditions of ambient room temperature (except EUROCAE ED14E / RTCA DO-160E, sections 4, 5 and 6) and ambient pressure and humidity as outlined in EUROCAE ED14E / RTCA DO-160E, Section 1, Paragraph 3.
- (b) Unless otherwise specified, the input supply voltage will be within 10 % of the nominal value the BEPU is designed to operate.
- (c) A reasonable warm-up period for stabilization is permissible. Battery nominal capacity is defined at 25 °C.

### 3 - SPECIFIC TEST CONDITIONS

(Per paragraph 4 "MONITOR and CONTROL" of the Chapter 1 of this document)

- (a) Lamp test: All segments lighted.
- (b) Check load segment on when load is applied.

### 4 - ALIGNMENT, ADJUSTMENT AND CALIBRATION PRIOR TO TEST

If necessary, perform alignment, adjustment and calibration before testing.

### 5 - TEST EQUIPMENT

Calibrate the test equipment you use to verify final test results traceable to the National Bureau of Standards. Test equipment accuracy will be at least 2 %.

## **CHAPTER 4 : DESCRIPTION OF A BEPU**

### 1 - GENERAL

A BEPU supplies power for a specified time period to an emergency power bus (output) in case of main or emergency bus failure.

### 2 - PARTS OF A BEPU

The BEPU consists of a remote unit or panel-mounted device containing a rechargeable battery pack (accumulator) and means for providing charging, monitoring of battery temperature, battery state, current, as well as system testing and related functions. The batteries are kept fully charged during normal operation independent from surrounding temperature.

- (a) An indicator/test switch gives information on the battery status of the BEPU before commencing flight.
- (b) Figure A-1 block diagram illustrates the description of the BEPU functionality. It does not define a requirement.
- (c) Figure A-2 depicts an example BEPU current flow.
- (d) Figure A-3 depicts a recommended measurement of BEPU output voltage ripple.

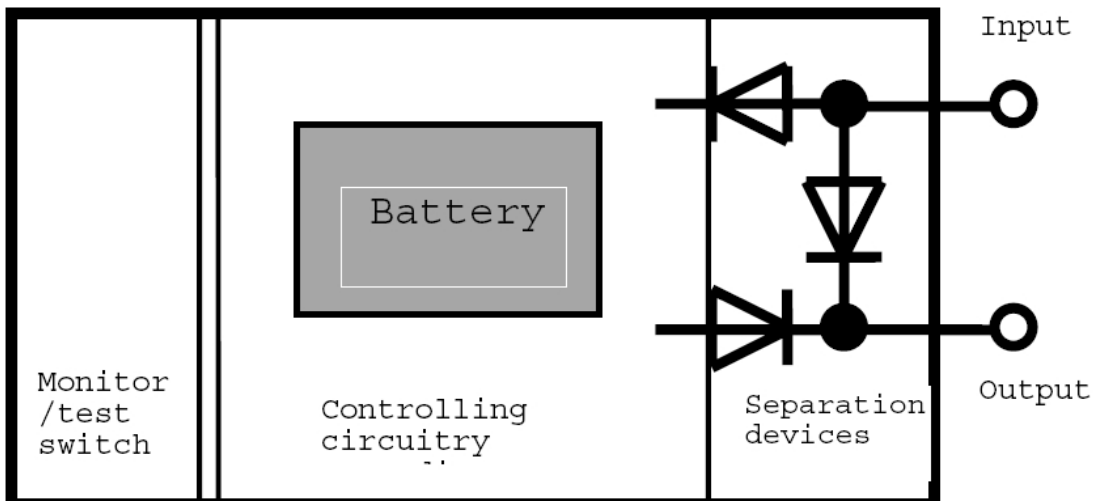


Figure A-1: BEPU Block Diagram

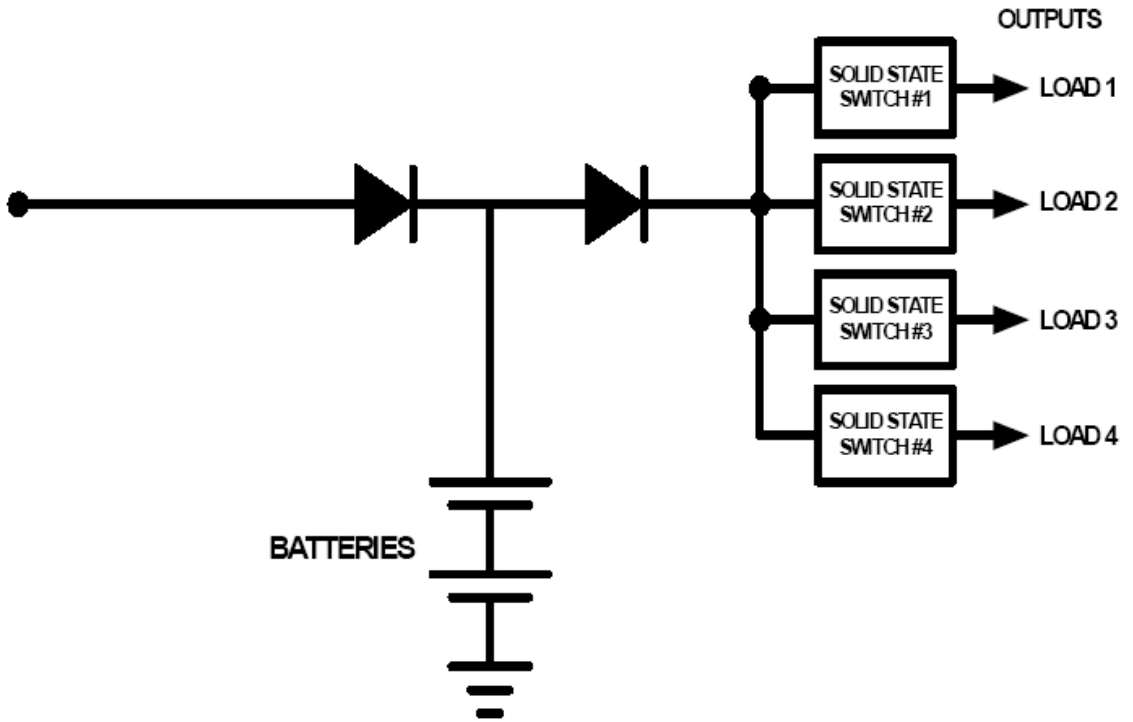


Figure A-2: An example BEPU Current Flow

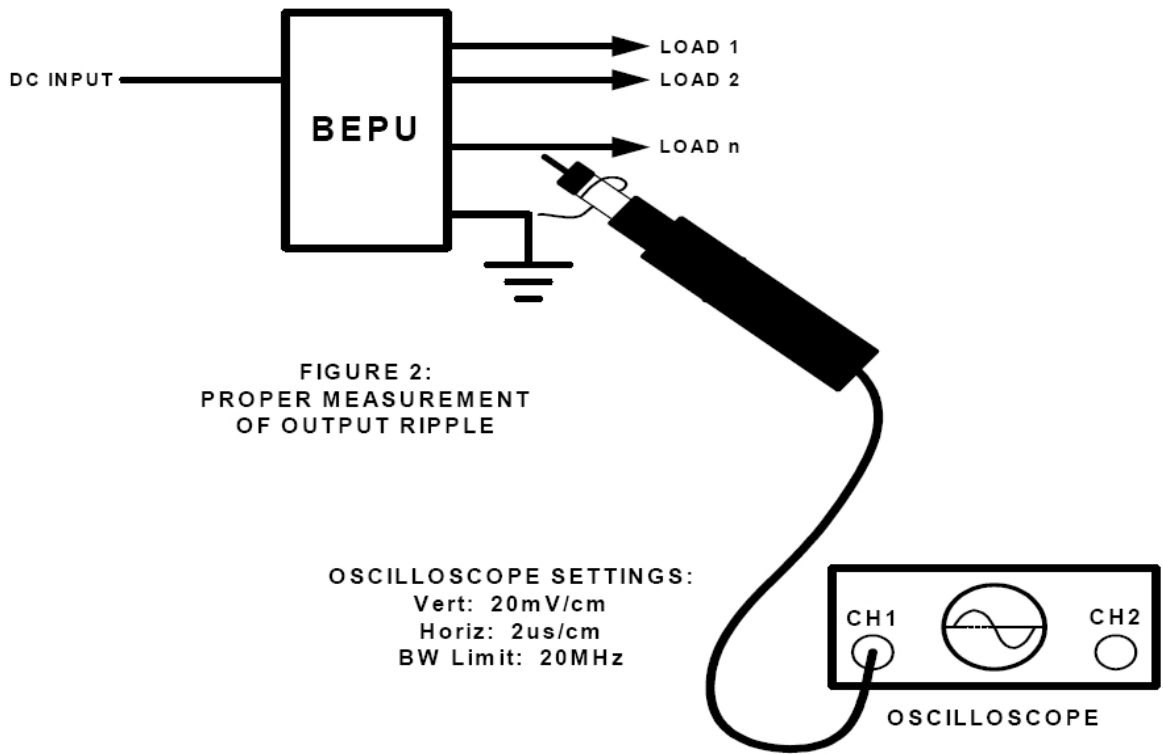


Figure A-3: Recommended Measurement of BEPU Output Voltage Ripple

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **GALLEY CART, CONTAINERS AND ASSOCIATED  
COMPONENTS**

### 1 - Applicability

This ETSO gives the requirements which Galley Cart, Containers and Associated Components that are manufactured on or after the effective 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

SAE AS 8056 "*Minimum Design and Performance of Airplane Galley In-Flight Carts, Containers, and Associated Components*" from November 2004, as amended by **Appendix 1** of this ETSO.

#### 3.2 – Specific

None

### 4 - Marking

#### 4.1. - General

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

#### 4.2. – Specific

Each manufactured Galley Cart, Containers and Associated Components must be permanently and legibly marked according to information provided in SAE AS 8056 paragraph 3.7



**5 - Availability of Referenced Document**

Refer to CS-ETSO Subpart A paragraph 3.

**APPENDIX 1.**

**MPS FOR GALLEY CARTS, CONTAINERS and ASSOCIATED COMPONENTS**

This ETSO's standards are set forth in the industry standard, SAE AS 8056, *Minimum Design and Performance of Airplane Galley In-Flight Carts, Containers, and Associated Components*, dated November 2004 modified as follows:

**Modifications to SAE AS 8056**

| <b>AS 8056 section:</b>                                      | <b>Action:</b>  |
|--|---|
| 3.2.1, Materials and Materials Control                       | TO DELETE "...or experience."   |
| 3.2.1.2, Materials   | TO CHANGE ALL TO: "Each batch, roll or sheet of non-metallic materials or finished metal (including finishes or decorative surfaces applied to the materials) shall meet the applicable test criteria prescribed in 14 CFR part 25, Appendix F, parts I, IV, V and VI."   |
| 3.2.5, Interface Clearances                                  | TO ADD AT END: "...and shall account for the equipment and aircraft tolerances."  |
| 3.3.5, Material Strength Properties and Material Variability | TO ADD after first paragraph: "The applicable specifications are Metallic Materials Process Development and Standardization (MMPDS, formerly MIL Handbook-5) and MIL Handbook-17."  |
| 3.5, Fire Properties   | TO ADD new sub section after 3.5.2:<br>"Flame Propagation: thermal /acoustic insulation material installed on the equipment shall meet the flame propagation requirements of 14 CFR § 25.856(a) when tested per Appendix F, part VI or other Agency approved equivalent test requirements. This requirement does not apply to "small parts" as defined in 14 CFR part 25, Appendix F part I." |
| 3.6, Fire Containment  | TO CHANGE 14 CFR 25.853 to 14 CFR § 25.853(h).  |
| 4.1, General   | ADD after 1st paragraph: "ETSO Applicants are encouraged to validate finite element models based on critical testing when such an approach is taken to substantiate design changes to ensure compliance with 14 CFR § 25.307."  |
| 4.2, Structural  | TO ADD between the 2nd and 3rd paragraph: "In order to maintain a maximum door deflection of 50 mm, the allowable retaining device envelope and the minimum retaining device engagement area shown in Figures 4 and 5 shall be developed by testing for both the primary and secondary retaining devices acting independently."   |

|                                |   |
|--------------------------------|---|
| 4.5, Fire Properties           | TO ADD new subsection after 4.5.2, Flame Propagation: "Thermal/Acoustic insulation materials shall be demonstrated to comply with the flame propagation requirements of 3.5."   |
| <b>AS 8056 section:</b>        | <b>Action:</b>  |
| 4.6, Fire Containment          | TO ADD between the 6th and 7th paragraph: "For air chilled carts, the test procedure step that reads <i>"Place the cart into the galley structure so that it is connected or attached to the chilled air distribution ducts with the designed airflow volume. Circulate air through the cart at the designated airflow rate"</i> may be substituted as follows:<br>"Simulate the galley seal at the cart/galley interface and circulate air through one of the cart air openings at a flow rate of 30.7 l/s (+0 / - 4.72) (65 (+0, -10) cf/m) and ambient temperature of 22.22deg C (+5.55 / -5.55) (72 deg F (+10, -10)). It is acceptable to increase the airflow rate as necessary to meet a manufacturer's requirements." |
| 5.1, Interface Control Drawing | TO ADD AT END: "For air-chilled carts, identify the flow rate of air (e.g., 47.2 l/s or 100 cf/m) circulated through the cart during the fire containment test."  |

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

**Subject: CREWMEMBER OXYGEN MASK**

### **1 - Applicability**

This ETSO gives the requirements which the crewmember constant flow mask or crewmember demand oxygen masks that are 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**

Both crewmember constant flow mask and crewmember demand oxygen masks must meet the standards set forth in the attached **Appendix 1**: "Standard for Crewmember Demand Oxygen Masks" and, when applicable, additional specific requirements as described here after in paragraph 3.2 – Specific.

##### **3.1.2 - Environmental Standard**

None.

##### **3.1.3 - Computer Software**

None.

#### **3.2 – Specific**

##### **3.2.1 - Breathing Bag Volume**

If a breathing bag is installed it shall meet the requirements of the Society of Automotive Engineers Inc (SAE) Aerospace Standard (AS) N° AS 8025,

"Passenger Oxygen Mask", Rev. A, dated January 1999, paragraphs 4.3 (volume) and 5.5.1 (strength).

### **3.2.2 - Oxygen Flow Indicators**

If an oxygen flow indicator is installed it shall meet the requirements of the Society of Automotive Engineers Inc (SAE) Aerospace Standard (AS) N° AS 916, "Oxygen Flow Indicators", Rev. B, dated July 1996, paragraph 3.2 (Low pressure continuous flow type).

### **3.2.3 - Flammability**

For flammability the applicable paragraphs of CS 25, Appendix F shall apply.

## **4 - Marking**

### **4.1. - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

### **4.2. - Specific**

#### **4.2.1 - Each constant flow mask shall be marked with:**

- (i) the term "Constant Flow Mask";
- (ii) the maximum environmental (cabin) altitude the mask is qualified for.

#### **4.2.2 - Each demand flow mask shall be marked to indicate:**

- (i) whether it is a "non-pressure demand" or a "pressure demand" mask;
- (ii) the maximum environmental (cabin) altitude for which it is qualified.

## **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3.

## APPENDIX 1

### STANDARD FOR CREWMEMBER DEMAND OXYGEN MASKS

#### 1.0 Purpose.

This Standard contains minimum performance standards for the manufacture of demand type oxygen masks for use with non-pressure demand (straight-demand and diluter-demand) and pressure-demand oxygen systems. It is based on the equivalent FAA standard for crewmember demand oxygen masks and the Agency has added values that are in imperial units also in SI units

#### 2.0 Design and Construction of Mask.

To be eligible for approval under a European Technical Standard Order Authorisation, the oxygen mask must possess the following design and construction characteristics.

2.1 Masks designed for use with a remotely located oxygen flow regulator must include a flexible oxygen supply tube fixed or detachable at the mask or at the regulator or at both. Oxygen supply tubes used in conjunction with mask-mounted oxygen flow regulators are not subject to this paragraph.

2.2 The mask must be designed for respiration through the nose and mouth (oronasal). The mask may also include integral goggles designed to protect the eyes from smoke and harmful gases (fullface).

2.3 The mask must be constructed of materials that –

- (a) do not contaminate air or oxygen;
- (b) are not adversely affected by continuous contact with oxygen; and
- (c) are at least flame resistant.

2.4 The mask must be designed to prevent the accumulation of hazardous quantities of expiratory gases within the facepiece chamber.

2.5 The mask must be designed to prevent the formation of accumulation of frost which would interfere with the function of the exhalation valve, unless it can be shown that the frost can be removed by external manipulation without removing the mask from the face of the user.

2.6 The full-face mask must be designed to include means for the prevention or the removal of condensation from the inside surfaces of the goggle lenses.

2.7 Masks equipped with oxygen supply tubes designed for quick disconnection at the mask or at the regulator must incorporate means to alert the user when his oxygen supply tube has become disconnected. Such means must not restrict the flow of ambient air through the oxygen supply tube by an amount exceeding 25 percent. This section does not apply if the quick disconnect device incorporates means to prevent inadvertent separation.

#### 3.0 Performance.

Five masks of each kind for which approval is sought must be shown to comply with the minimum performance standards set forth in paragraphs 3.1 through 3.12, except that only one mask of each kind is required to comply with the provisions of paragraphs 3.6, 3.8, 3.9, and 3.11. Tests must be conducted at ambient atmospheric conditions of approximately 102 KPa (30" hg.) and 21 °C (70°F.), except as otherwise specified. Gas flow rates and pressures must be corrected to STPD.

3.1 *Quick-disconnect Coupling.* The force required to separate quick disconnect couplings not designed to prevent inadvertent separation must not be less than 45 N (10 pounds) exerted along the axis of symmetry of the oxygen supply tube.

3.2 *Strength.*

(a) The mask must be capable of sustaining a pull force on the suspension device attachment fittings of not less than 156N (35 pounds) in any direction for a period of not less than 3 seconds.

(b) The oxygen supply tube assembly must be capable of sustaining a pull force of not less than 134 N (30 pounds) exerted along the axis of symmetry of the tube for a period of not less than 3 seconds.

(c) The oxygen supply tube assembly must be capable of sustaining an internal pressure of 10 KPa (1.5 p.s.i.g)

3.3 *Leakage.*

(a) The total inward leakage rate, with the complete mask positioned on the face or on a suitable test stand in a manner which simulates normal use, must not exceed 0.10 LPM STPD at any negative differential pressure within the range of from zero to 1.5 KPa (6.0 inches of water).

(b) Inhalation valves installed in pressure-demand masks must not back leak more than 0.015 LPM, STPD, when subjected to a suction pressure differential of 0.03 KPa (0.1" H<sub>2</sub>O) and not more than 0.15 LPM, STPD, when subjected to a suction pressure differential of 3 KPa(12.0" H<sub>2</sub>O).

(c) The oxygen supply tube assembly must not leak when subjected to an internal pressure of 10 KPa (1.5 p.s.i.g)

3.4 *Flow Resistance.*

(a) The inspiratory resistance of the mask and oxygen supply tube including the oxygen supply connector when inserted in an appropriate mating fitting must not exceed the following negative differential pressures at the corresponding oxygen flow rates:

| Differential Pressure<br>KPa (inches H <sub>2</sub> O) | Flow Rate<br>(LPM) |
|--|--------------------|
| 0.15 (0.6)   | 20                 |
| 0.37 (1.5)   | 70                 |
| 0.62 (2.5)   | 100                |

(b) The expiratory resistance of the mask must not exceed the following positive differential pressures at the corresponding oxygen flow rates:

| Differential Pressure<br>KPa (inches H <sub>2</sub> O) | Flow Rate<br>(LPM) |
|--|--------------------|
| 0.25 (1.0)   | 20                 |
| 0.50 (2.0)   | 70                 |
| 0.75 (3.0)   | 100                |

3.5 *Pressure-Demand. Exhalation Valve Performance.* The exhalation valve installed in a pressure demand mask must open when the pressure within the facepiece is 2.7 KPa (20 mm Hg) and the pressure in the supply tube is 2.0 KPa (15 mm Hg) to 2.7 KPa (19.9 mm Hg).

3.6 *Vibration.* The flow of gases during the respiratory process must not cause vibration, flutter, or chatter which would interfere with the satisfactory operation of the mask.

3.7 *Acceleration Load.* The exhalation valve must not inadvertently operate under a 3g load applied in any direction.

3.8 *Extreme Temperature.* The mask must comply with paragraphs 3.3 through 3.5 in an ambient temperature of 21°C (70°F.) within 15 minutes after being stored at a temperature of 71°C (160°F.) for 12 hours, and within 15 minutes after being stored at -18°C (0°F.) for 2 hours. The relative humidity during storage must vary from 5 to 95 percent. The mask facepiece must not be gummy or sticky and must provide a normal seal after the high temperature exposure.

3.9 *Low Temperature Test Delay.*

(a) The mask must function properly, without apparent delay, at a temperature of 21°C (70°F.) after being stored at a temperature of -7°C (20°F.) for not less than 2 hours.

(b) The mask must function properly, without apparent delay, and continue for a period of not less than 15 minutes when tested at a temperature of -7°C (20°F) after being stored at a temperature of 21°C (70° F.) for not less than 12 hours.

3.10 *Decompression.*

(a) A mask not equipped with a pressure relief valve must not suffer damage and must comply with paragraphs 3.3 through 3.5 after being subjected to a decrease in ambient pressure from 83 KPa (12 p.s.i.a.) to not less than 19 KPa (2.7 p.s.i.a.) for a straight or diluter-demand kind, or to not less than 14 KPa (2.1 p.s.i.a.) for a pressure demand kind, within a period of not more than 1 second. This decompression test must simulate the condition that could be imposed on a mask being worn by a crewmember during the specified decompression.

(b) A mask equipped with a pressure relief valve must be subjected to the decompression specified in subparagraph (a) of this section during which the pressure relief valve must open at a differential pressure of 4.2 KPa (17" H<sub>2</sub>O) and must relieve the differential pressure to a value not exceeding 4 KPa (16" H<sub>2</sub>O) within 5 seconds. During the 5 second interval, the pressure differential



must not exceed a value of 5 KPa (20" H<sub>2</sub>O). The pressure relief valve must close at a differential pressure of 3.5 KPa (14" H<sub>2</sub>O).

3.11 *Cycling*. The mask must comply with paragraphs 3.3 through 3.5 after being subjected to the following simulated breathing schedule for a total of 50,000 cycles:

| Respiratory Cycles | Minute Flow Rate LPM, STPD | Volume, Tidal Liters |
|--------------------|----------------------------|----------------------|
| 20,000             | 20                         | 1.0                  |
| 25,000             | 30                         | 1.5                  |
| 5,000              | 70                         | 2.0                  |

A constant time interval must be maintained between respiratory cycles.

3.12 *Microphone*. If the mask is designed to include a microphone, the installation of the microphone must not interfere with the operation of the mask.

#### 4.0 Quality Control.

4.1 *Production Tests*. Each mask must be shown to comply with the provisions of paragraph 3.3(a), total leakage.

4.2 *Random Tests*. One mask must be selected at random from each lot and must be shown to comply with paragraph 3.1 through 3.12. The lot size must be selected by the applicant, subject to the approval of the Agency, on the basis of evaluation of the applicant's quality control systems (see 21A.139b).

#### 5.0 Maximum Environmental (cabin) Altitude.

The minimum pressure to which the mask has been shown to decompress satisfactorily in accordance with paragraphs 3.10(a) or (b) of this standard determines the maximum environmental altitude of the mask, except that it shall not exceed the value shown in the following table:

| Maximum Environmental (Cabin) Altitude | Kind of Mask               |
|--|----------------------------|
| 40,000 feet                            | Straight or Diluted-Demand |
| 45,000 feet                            | Pressure-Demand            |

#### 6.0 Abbreviations and Definitions.

|              |  |
|--------------|--|
| LPM          | Liters per minute.   |
| STPD         | Standard temperature and pressure, dry (0°C. 760 mm.Hg.)                               |
| p.s.i.g.     | Pounds per square inch, gage.  |
| p.s.i.a.     | Pounds per square inch, absolute.  |
| g            | Acceleration or gravity, 9.81 m/second <sup>2</sup> (32.2 feet/ second <sup>2</sup> ). |
| Tidal volume | Volume of air inspired per breath.   |

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **PORTABLE GASEOUS OXYGEN SUPPLY (PGOS)**

### **1 - Applicability**

This ETSO gives the requirements which the Portable Gaseous Oxygen Supply that are manufactured on or after the date of this ETSO must meet in order to be identified with 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 Society of Automotive Engineers (SAE), Inc, Document Aerospace Standard (AS) no AS 1046, "Minimum Standard for Portable Gaseous Oxygen Equipment", Rev. B, dated 13 September 1989.

##### **3.1.2 - Environmental Standard**

The equipment must be tested according to the applicable environmental standards contained in EUROCAE ED-14E (RTCA/DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005.

##### **3.1.3 - Computer Software**

None.

#### **3.2 - Specific**

##### **3.2.1 - Proof and Ultimate Strength Factors**

For proof and ultimate strength factors CS 25.1453 (a) shall apply.

#### **4 - Marking**

##### **4.1 - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

##### **4.2 - Specific**

As per AS 1046 Rev. B, dated 13 September 1989.

#### **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3

# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **TOW RELEASE**

### **1 - Applicability**

This ETSO specifies the requirements which Tow Releases that are 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**

Standard given in the Minimum Performance Standard for Tow Release is given in the **Appendix 1**.

##### **3.1.2 - Environmental Standard**

The equipment must be tested according to the applicable environmental standards contained in EUROCAE ED-14E (RTCA/DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005.

##### **3.1.3 - Computer Software**

See CS-ETSO Subpart A paragraph 2.2

#### **3.2 - Specific**

None.

### **4 - Marking**

#### **4.1 - General**

Marking is 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.

A copy of the reference LN (Luftfahrt-Norm) may be obtained from the web-site:  
[www.normung.din.de](http://www.normung.din.de)

## **APPENDIX 1.**

### **TOW RELEASE**

#### **1. GENERAL**

##### **1.1 Type and applicability of airworthiness requirements**

These airworthiness requirements for tow releases (ETSO-2C513) are valid for proof of airworthiness of tow releases that are used for:

- a) towing steerable or non-steerable tow or built into such tow;
- b) or for towing by winch or motor vehicle.

*Note:* Gliders and powered gliders are examples of steerable tows.  
Banners are examples of non-steerable tows.

All the individual specifications listed below for ensuring the airworthiness of tow releases are minimum requirements that have been derived from operating experience and have been quantified as practical numerical values.

Deviations from these requirements may be approved or requested by the Agency, if justified by new findings or safety considerations.

##### **1.2 Type approval**

1.2.1. A tow release type can be approved on application in the form of an ETSO entitlement, provided that the airworthiness requirements are fully met, or, in the event of non-compliance of one or more requirements, if proof is provided that an equivalent safety level is achieved.

The decision of the Agency is final.

1.2.2. The burden of proof is borne by the applicant, who also has to compile the type documentation.

1.2.3. The type documentation includes all the documentation necessary for the design specification of the tow release and all its design features that are subject matters of this ETSO.

#### **2. DESIGN AND CONSTRUCTION**

##### **2.1 Materials**

The suitability and reliability of the materials used must be shown based on operating experience or materials testing.

All materials used for stressed parts must correspond to descriptions and specifications recognized by the Agency.

## **2.2 Protection of parts**

Each part of the load transmitting assembly must

- a) be protected as fully as possible against influences that could cause damage or diminish strength during operation, including corrosion and wear;
- b) and designed in such a way that:
  - no water can be collected and that;
  - any dirt inside the tow release can be removed without disassembly.

## **2.3 Securing connecting elements**

Accepted security devices must be used for all non permanent connecting elements of the tow release.

## **2.4 Connecting ring pair**

For each tow release with a hook, a connecting ring pair according to LN (Luftfahrt-Norm) 65091 in the current valid version must be used.

## **2.5 Attachment to the aircraft**

The tow release must be designed to be attached to the aircraft using non permanent connecting elements.

## **2.6 Special requirements**

2.6.1 Tow releases with a moveable or fixed ring jaw must be designed in such a way that it is impossible to hook up the large oval ring of the connecting ring pair. It must be also impossible for the connecting ring pair to jam behind or either side of the hook.

2.6.2 It must not be possible, in any operating state, for the connecting ring pair to jam in the tow release jaw and thus inhibit the release.

2.6.3 Tow releases installed near the centre of gravity of the aircraft must have a mean for automatic release.

## **2.7 Long-term performance**

The documentation must include proof of at least 10,000 actuations of the tow release under operating conditions. No damage should occur during this time.

# **3. STRENGTH**

## **3.1 Strength calculations**

Load tests according to § 4.2.5 and § 4.2.6 must show that the strength of the tow release is adequate to withstand any loads that may be put on it in any operating state that experience has shown may occur.

### 3.2 Criteria for sufficient dimensioning and safety factor

3.2.1 The strength requirements are specified by the safe test load (the maximum expected cable load during operation) and the calculated breaking load (the maximum cable load multiplied by the specified safety factor) defined in § 3.3.

These loads are specified as limiting values in the test schedules for the functional tests.

3.2.2 A safety factor of 1.5 is specified.

The unit must be able to:

- a) accept the safe test load without permanent damage in the form of deformation, notches, cracks, etc.;
- b) withstand the calculated breaking load without failure for at least 3 seconds.

### 3.3 Safe test load

Tow releases used for the purposes as listed in § 1.1 must be designed for a safe test load  $L_{\max}$  N that is derived as follows from CS 22.581 and CS 22.583:

$$L_{\max} = 1.2 \times 1.3 \times m \times 9.81 \text{ [N]}$$

where 1.2 and 1.3: safety factors  
m: max. take-off weight  
9.81 m/s<sup>2</sup>: gravitational acceleration/conversion to Newton

*Note:* For a maximum towed mass of, for instance, 850 kg the safe test load is thus:

$$L_{\max} = 1.2 \times 1.3 \times 850 \times 9.81 = 13,008 \text{ N} = L_{\max}$$

In-line weak links are ignored when determining the safe test load.

## 4. OPERATING BEHAVIOUR

### 4.1 Performance under load

#### 4.1.1 Safe operating range

Within the limits of cable loads and cable angles specified in § 5.1, every tow release must be able both to withstand the resultant load without impairing operational reliability and to release reliably.

#### 4.1.2 Automatic release angle

For tow releases for installation in gliders or powered gliders for towing by winch or motor vehicle the tow cable must release reliably at the automatic release angle specified in § 5.1.

#### 4.1.3 Release force



When loading the hook of the tow release within the limits specified for cable loads and cable angles, the maximum permissible release  $F_K$  measured at the release lever with a reference length  $l$  of 68 mm (see Fig. 1) must lie between 60 and 140 N.

## 4.2 Functional tests

### 4.2.1 Type of tests

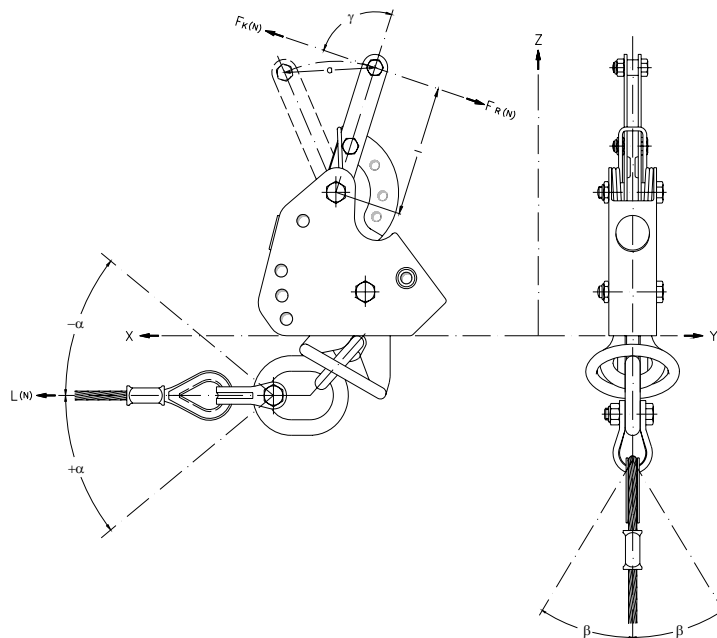
The aim of the functional tests using a suitable test rig is to prove that the tow release for which type approval is to be granted meets the requirements as listed above in § 4.1.1 to § 4.1.3.

The available restoring force after releasing the tow cable must be measured according to § 4.2.4.

**Note:** Type testing of a tow release should include its use in actual flight operations in order to gain more information on its operating performance.

### 4.2.2 Load schedule

Test loads must be applied according to the load schedule in Fig. 1



**Fig. 1:** Load schedule

- x-axis = Longitudinal axis (in flight direction)
- y-axis = Lateral axis (in wing span direction)
- z-axis = Vertical axis
- L = Cable load in N

$l$  = Original lever length of type in mm  
 $F_K$  = Release force of release lever in N  
 $F_R$  = Restoring force in N  
 $\alpha$  = Angle between L and x-y plane  
 $a$  = Travel of release lever  
 $\beta$  = Angle between L and x-z plane between stops in mm  
The normal or 0-degrees cable angle is parallel to the x-y plane

#### 4.2.3 Test rig

Using only the bore holes and bearing surface provided for installation in the aircraft, mount the tow release in a suitable test rig in such a way that the cable loads can be applied via the connecting ring pair for all specified load angles and that in each case the required release force  $F_K$  can be measured at the release lever.

In addition, for tow releases with automatic release (so-called safety tow releases), the cable angle and the magnitude of the cable load that results in automatic release must be measured.

#### 4.2.4 Measurement of the restoring force

Measure the restoring force as follows prior to the start of the actual functional tests:

- a) Fully open the unloaded tow release mounted in the test rig using the release lever (lever length  $l = 68$  mm).
- b) Measure the restoring force between the release lever stops, in relation to the release travel  $a$ .

Enter the measurement results in a diagram.

The restoring force  $F_R$  must not be greater than 100 N nor less than 60 N.

#### 4.2.5 Test schedules and determination of the load diagram:

**Tow releases for aero tow of steerable and non-steerable tows** (use according to § 1.1.a)

- a) Test up to safe test load  
With the tow release mounted in the test rig, load the hook via the connecting ring pair according to the cable (test) load schedule in Table 1.
  - Apply the load at a rate of 300 N/s.
  - Apply the load for 5 seconds at each load stage and measure the release force  $F_K$  using a reference release lever length of  $l = 68$  mm.
  - Disassembly test

Disassemble the tow release completely on completion of the load test.

Inspect the tow release to ensure that

- no part of it is permanently deformed and that no notches, cracks, etc., have appeared and that
- on reassembly the tow release is once again fully functional.

Table 1

| Cable (test) load |      | Cable angle |             | Cable (test) load |      | Cable angle |             |
|-------------------|------|-------------|-------------|-------------------|------|-------------|-------------|
| L                 |      | $\alpha$    | $\pm \beta$ | L                 |      | $\alpha$    | $\pm \beta$ |
| N                 |      | Degrees     | Degrees     | N                 |      | Degrees     | Degrees     |
| 1500              |      | -45         | 0           | 1500              |      | +30         | 0           |
| 6000              |      | -45         | 0           | 6000              |      | +30         | 0           |
| 7500              |      | -45         | 0           | 7500              |      | +30         | 0           |
| 9000              |      | -45         | 0           | 9000              |      | +30         | 0           |
| 11700             |      | -45         | 0           |                   |      |             |             |
|                   |      |             |             | 0,80              | Lmax | +30         | 0           |
|                   | Lmax | -45         | 0           | 0,60              | Lmax | +30         | 30          |
| 0,60              | Lmax | -45         | 30          | 0,80              | Lmax | +30         | 30          |
| 0,80              | Lmax | -45         | 30          | 0,60              | Lmax | +30         | 45          |
| 0,60              | Lmax | -45         | 45          | 0,80              | Lmax | +30         | 45          |
| 0,80              | Lmax | -45         | 45          | 1500              |      | +45         | 0           |
|                   |      |             |             | 6000              |      | +45         | 0           |
| 1500              |      | -30         | 0           | 7500              |      | +45         | 0           |
| 6000              |      | -30         | 0           | 9000              |      | +45         | 0           |
| 7500              |      | -30         | 0           | 11700             |      | +45         | 0           |
| 9000              |      | -30         | 0           |                   |      |             |             |
|                   |      |             |             |                   | Lmax | +45         | 0           |
| 0,80              | Lmax | -30         | 0           | 0,60              | Lmax | +45         | 30          |
| 0,60              | Lmax | -30         | 30          | 0,80              | Lmax | +45         | 30          |
| 0,80              | Lmax | -30         | 30          | 0,60              | Lmax | +45         | 45          |
| 0,60              | Lmax | -30         | 45          | 0,80              | Lmax | +45         | 45          |
| 0,80              | Lmax | -30         | 45          | 0,80              | Lmax | +30         | 60          |
|                   |      |             |             | 0,80              | Lmax | +30         | 75          |
| 1500              |      | 0           | 0           | 0,80              | Lmax | +45         | 60          |
| 6000              |      | 0           | 0           | 0,80              | Lmax | +45         | 75          |
| 7500              |      | 0           | 0           | 0,80              | Lmax | +60         | 0           |
| 9000              |      | 0           | 0           | 0,80              | Lmax | +60         | 30          |
| 11700             |      | 0           | 0           | 0,80              | Lmax | +60         | 45          |
|                   | Lmax | 0           | 0           | 0,80              | Lmax | +60         | 60          |
|                   |      |             |             | 0,80              | Lmax | +60         | 75          |
| 1500              |      | 0           | 30          |                   |      |             |             |
| 6000              |      | 0           | 30          | 9000              |      | +60         | 87          |
| 7500              |      | 0           | 30          | 11700             |      | +60         | 87          |
| 9000              |      | 0           | 30          |                   | Lmax | +60         | 87          |
| 11700             |      | 0           | 30          | 0,40              | Lmax | +120        | 0           |
|                   | Lmax | 0           | 30          | 0,40              | Lmax | -120        | 0           |
|                   |      |             |             |                   |      |             |             |
| 1500              |      | 0           | 45          |                   |      |             |             |
| 6000              |      | 0           | 45          |                   |      |             |             |
| 7500              |      | 0           | 45          |                   |      |             |             |
| 9000              |      | 0           | 45          |                   |      |             |             |
| 11700             |      | 0           | 45          |                   |      |             |             |
|                   | Lmax | 0           | 45          |                   |      |             |             |
| 0,60              | Lmax | 0           | 90          |                   |      |             |             |
| 0,80              | Lmax | 0           | 90          |                   |      |             |             |

b) Test to calculated breaking load

Subsequent to the disassembly test and with the tow release remounted in the test rig, load the hook via the connecting ring pair up to the calculated breaking load with cable angles  
 $\alpha = 0$  degrees and  $\beta = 0$  degrees.

Maintain the calculated breaking load for 3 seconds. Then release and measure the release force  $F_K$ . Then disassemble the tow release completely and inspect it for any permanent deformation, notches, cracks, etc.

4.2.6 Test schedules and determination of the load diagram:

**Tow release for installation in gliders or powered gliders for towing by winch or motor vehicle** (use according to § 1.1.b)

a) Test up to safe test load

With the tow release mounted in the test rig, load the hook via the connecting ring pair according to the cable (test) load schedule in Table 2.

- Apply the load at a rate of 300 N/s.
- Apply the load for 5 seconds at each load stage and measure the release force  $F_K$  using a reference release lever length of  $l = 68$  mm.

Automatic release of the tow release is not allowed during this test schedule.

Table 2

| Cable<br>(test)<br>load<br>L | Cable<br>angle |             | Cable<br>(test)<br>load<br>L | Cable<br>angle |             |    |
|------------------------------|----------------|-------------|------------------------------|----------------|-------------|----|
|                              | $\alpha$       | $\pm \beta$ |                              | $\alpha$       | $\pm \beta$ |    |
| N                            | Degrees        | Degrees     | N                            | Degrees        | Degrees     |    |
| 1500                         | 0              | 0           | 1500                         | +45            | 0           |    |
| 6000                         | 0              | 0           | 6000                         | +45            | 0           |    |
| 7500                         | 0              | 0           | 7500                         | +45            | 0           |    |
| 9000                         | 0              | 0           | 9000                         | +45            | 0           |    |
| 11700                        | 0              | 0           |                              |                |             |    |
| Lmax                         | 0              | 0           | 0,80                         | Lmax           | +45         | 0  |
| 1500                         | 0              | 30          | 1500                         | +45            | 30          |    |
| 6000                         | 0              | 30          | 6000                         | +45            | 30          |    |
| 7500                         | 0              | 30          | 7500                         | +45            | 30          |    |
| 9000                         | 0              | 30          | 9000                         | +45            | 30          |    |
| 11700                        | 0              | 30          | 11700                        | +45            | 30          |    |
| Lmax                         | 0              | 30          |                              | Lmax           | +45         | 30 |
| 1500                         | 0              | 45          | 1500                         | +45            | 45          |    |
| 6000                         | 0              | 45          | 6000                         | +45            | 45          |    |
| 7500                         | 0              | 45          | 7500                         | +45            | 45          |    |
| 9000                         | 0              | 45          | 9000                         | +45            | 45          |    |
| 11700                        | 0              | 45          | 0,80                         | Lmax           | +45         | 45 |
| Lmax                         | 0              | 45          |                              |                |             |    |
| 1500                         | +30            | 0           | 1500                         | +45            | 60          |    |
| 6000                         | +30            | 0           | 6000                         | +45            | 60          |    |
| 7500                         | +30            | 0           | 7500                         | +45            | 60          |    |
| 9000                         | +30            | 0           | 9000                         | +45            | 60          |    |
| 0,80                         | Lmax           | +30         | 0                            | 11700          | +45         | 60 |
| 1500                         | +30            | 30          | 1500                         | +45            | 75          |    |
| 6000                         | +30            | 30          | 6000                         | +45            | 75          |    |
| 7500                         | +30            | 30          | 7500                         | +45            | 75          |    |
| 9000                         | +30            | 30          | 9000                         | +45            | 75          |    |
| 11700                        | +30            | 30          | 11700                        | +45            | 75          |    |
| Lmax                         | +30            | 30          |                              | Lmax           | +45         | 75 |
| 0,60                         | Lmax           | +30         | 0,60                         | Lmax           | +60         | 0  |
| 0,80                         | Lmax           | +30         | 0,80                         | Lmax           | +60         | 0  |
| 0,60                         | Lmax           | +30         | 0,60                         | Lmax           | +60         | 30 |
| 0,80                         | Lmax           | +30         | 0,80                         | Lmax           | +60         | 30 |
| 1500                         | +30            | 45          | 1500                         | +60            | 45          |    |
| 0,60                         | Lmax           | +30         | 0,60                         | +60            | 45          |    |
| 0,80                         | Lmax           | +30         | 0,80                         | +60            | 45          |    |
| 1500                         | +30            | 60          | 1500                         | +60            | 45          |    |
| 0,60                         | Lmax           | +30         | 0,60                         | +60            | 45          |    |
| 0,80                         | Lmax           | +30         | 0,80                         | +60            | 45          |    |
| 1500                         | +30            | 75          | 1500                         | +60            | 45          |    |
| 6000                         | +30            | 75          | 6000                         | +60            | 45          |    |
| 7500                         | +30            | 75          | 7500                         | +60            | 45          |    |
| 9000                         | +30            | 75          | 9000                         | +60            | 45          |    |
| 11700                        | +30            | 75          | 11700                        | +60            | 45          |    |
| Lmax                         | +30            | 75          |                              | Lmax           | +60         | 45 |
| Lmax                         | +30            | 75          |                              |                |             |    |

Table 2 (cont.)

| Cable (test) load |      | Cable angle |             |
|-------------------|------|-------------|-------------|
| L                 |      | $\alpha$    | $\pm \beta$ |
| N                 |      | Degrees     | Degrees     |
| 0,60              | Lmax | +60         | 60          |
| 0,80              | Lmax | +60         | 60          |
| 1500              |      | +60         | 75          |
| 6000              |      | +60         | 75          |
| 7500              |      | +60         | 75          |
| 9000              |      | +60         | 75          |
| 11700             |      | +60         | 75          |
|                   | Lmax | +60         | 75          |
| 11700             |      | +60         | 87          |
|                   | Lmax | +60         | 87          |
| 1500              |      | +75         | 0           |
| 6000              |      | +75         | 0           |
| 7500              |      | +75         | 0           |
| 9000              |      | +75         | 0           |
| 11700             |      | +75         | 0           |
|                   | Lmax | +75         | 0           |
| 0,60              | Lmax | +75         | 30          |
| 0,80              | Lmax | +75         | 30          |
| 0,60              | Lmax | +75         | 45          |
| 0,80              | Lmax | +75         | 45          |
| 0,60              | Lmax | +75         | 60          |
| 0,80              | Lmax | +75         | 60          |
| 0,80              | Lmax | 0           | 75          |
| 1500              |      | 0           | 87          |
| 6000              |      | 0           | 87          |
| 7500              |      | 0           | 87          |
| 9000              |      | 0           | 87          |
| 11700             |      | 0           | 87          |
|                   | Lmax | 0           | 87          |

- Disassembly test  
 Disassemble the tow release completely on completion of the load test. Inspection the tow release to ensure that
  - no part of it is permanently deformed and that no notches, cracks, etc., have appeared and that
  - on reassembly the tow release is once again fully functional.
- b) Determining the angle for automatic release
  - With the tow release mounted in the test rig, load the hook via the connecting ring pair according to the cable (test) load schedule in Table 3.
  - At each load stage measure the angle  $\alpha_{s,r}$  at which release occurs automatically.

**Table 3**

| Cable (test)<br>load<br>L<br>N | Cable angle<br>$\beta$<br>Degrees |  | Cable (test)<br>load<br>L<br>N | Cable angle<br>$\beta$<br>Degrees |
|--------------------------------|-----------------------------------|--|--------------------------------|-----------------------------------|
| 20                             | 0                                 |  | 100                            | 75                                |
| 20                             | 45                                |  | 150                            | 0                                 |
| 20                             | 75                                |  | 150                            | 45                                |
| 30                             | 0                                 |  | 150                            | 75                                |
| 30                             | 45                                |  | 500                            | 0                                 |
| 30                             | 75                                |  | 500                            | 30                                |
| 40                             | 0                                 |  | 500                            | 45                                |
| 40                             | 45                                |  | 500                            | 60                                |
| 40                             | 75                                |  | 500                            | 75                                |
| 50                             | 0                                 |  | 1000                           | 0                                 |
| 50                             | 45                                |  | 1000                           | 0                                 |
| 50                             | 75                                |  | 2000                           | 0                                 |
| 100                            | 0                                 |  | 2000                           | 60                                |
| 100                            | 45                                |  | 3000                           | 0                                 |
|                                |                                   |  | 3000                           | 80                                |

- c) Test to calculated breaking load  
On completion of the load test according to a) with subsequent disassembly test and the determination of the angle at which automatic release occurs according to b), remount the tow release in the test rig and load the hook via the connecting ring pair up to the calculated breaking load with cable angles  $\alpha = 0$  degrees and  $\beta = 0$  degrees.  
Maintain the calculated breaking load for 3 seconds. Then release and measure the release force  $F_K$ . Then disassemble the tow release completely and inspect it for any permanent deformation, notches, cracks, etc.

## 5. OPERATING LIMITS, MARKINGS AND DOCUMENTATION

### 5.1 Operating limits

5.1.1 The operating limits listed in § 4.2.5 and § 4.2.6 must be specified for every tow release and be provided to the holder of the aircraft in which a tow release of the type in question is being installed (see also Table 4).

**Table 4**

|   |            |            |
|---|------------|------------|
| Tow release according to §  | 1.1.a)     | 1.1.b)     |
| <b>Cable angle</b> at which the tow cable can be reliably released                    |            |            |
| $\alpha$ (upwards)  | -90°       | -,-        |
| $\alpha$ (downwards)  | +90°       | +75°       |
| $\beta$ (to either side)  | 0-87°      | 0-87°      |
| <b>Maximum permissible cable load</b> at which the tow cable can be reliably released |            |            |
| $L_{\max}$  | Cable load | Cable load |
| <b>Automatic release angle</b>  |            |            |
| $\alpha_s$  | -,-        | 75°-90°    |

## 5.2 Operating and maintenance documentation

5.2.1 On delivery, each tow release must be accompanied by operating and maintenance documentation. This documentation must contain all the information necessary to maintain the tow release in a fully operational condition.

5.2.2 A copy of the service and maintenance documentation must be shown to the Agency.

5.2.3 All the information in § 5.1 and any further information necessary for safe and reliable operation of the tow release must be included in the operating documentation.

5.2.4 As a minimum, the maintenance documentation must cover the following:

- a) Installation of the tow release in the aircraft
- b) Set-up data necessary for the safe and reliable functioning of the tow release
- c) Checks and tests to be carried out after installation
- d) Cleaning and care of the tow release
- e) Detailed description and frequency of maintenance work (inspection schedules)



# European Aviation Safety Agency

## European Technical Standard Order (ETSO)

Subject: **AIRBORNE SYSTEMS FOR NON REQUIRED  
TELECOMMUNICATION SERVICES (IN NON AERONAUTICAL  
FREQUENCY BANDS) (ASNRT)**

### **1 - Applicability**

This ETSO gives the requirements which Airborne Systems to be installed on Aircraft for Non Required Telecommunication Services (in Non Aeronautical Frequency Bands) (ASNRT) that are manufactured on or after the date of this ETSO must meet in order to be identified with 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 **Appendix 1**.

##### **3.1.2 - Environmental Standard**

The equipment must be tested according to the applicable environmental standards contained in EUROCAE ED-14E (RTCA/DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" from March 2005.

##### **3.1.3 - Computer Software**

See CS-ETSO Subpart A paragraph 2.2.

#### **3.2 - Specific**

None.

#### **4 - Marking**

##### **4.1 - General**

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

##### **4.2 - Specific**

The label shall indicate the communication system or network used.

#### **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3.

## APPENDIX 1.

### AIRBORNE SYSTEMS FOR NON REQUIRED TELECOMMUNICATION SERVICES (IN NON AERONAUTICAL FREQUENCY BANDS) (ASNRT)

#### 1. GENERAL

##### PURPOSE AND SCOPE

This minimum operational performance specification defines the minimum performance expected from an Airborne System to be installed on Aircraft for Non Required Telecommunication Services in Non Aeronautical Frequency Bands (ASNRT). The performance of specific equipment may be enhanced or superior to this specification depending on the intended application and configuration.

Chapter 1 describes typical equipment applications and operational objectives and is the basis for the performance criteria specified in Chapter 2 and Chapter 3. Definitions essential to proper understanding of this document are also provided in Chapter 1.

Chapter 2 contains general design requirements.

Chapter 3 contains the minimum performance specification for the equipment, defining performance under standard operating conditions.

Chapter 4 prescribes the environmental test conditions which provide a laboratory means of determining the performance characteristics of the equipment under conditions representative of those which may be encountered in actual operations.

Chapter 5 specifies the performance of the equipment and gives guidance for the installation.

##### APPLICATION

Compliance with this minimum operational performance specification by manufacturers, installers and users is recommended as a means of ensuring that the equipment will satisfactorily perform its intended functions under the conditions normally encountered in routine aircraft operations.

This specification does not cover telecommunication aspects. It is the responsibility of the manufacturer as well as the operator to obtain the necessary approvals from the responsible telecommunication authority and from the network provider, if applicable.

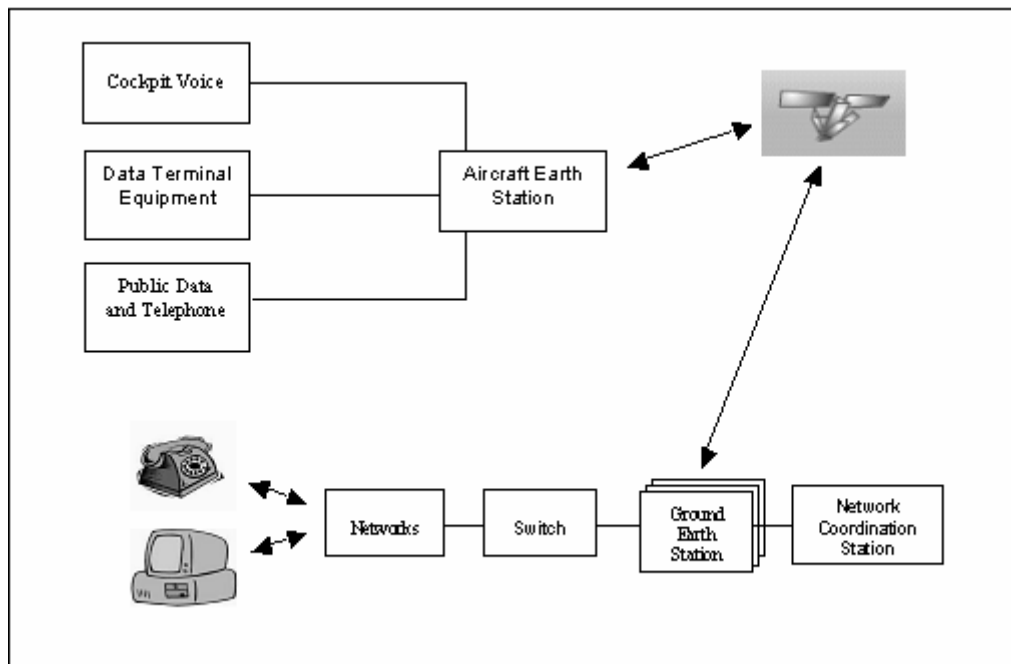
##### DESCRIPTION OF SYSTEM

The purpose of the Airborne System for Non-Required Telecommunication Services (ASNRT) is to provide flight crew and passengers with additional air-ground / air-air voice and data communication service. The system does not support safety related applications like Air Traffic Service (ATS).

It consists of electronic on board equipment which is not required for any phase of flight by any aviation rule. It is normally not connected to nor interacted with any aircraft system except the intercom, electrical power and

mechanical mounting. In special cases it may be useful to establish additional interfaces to other systems. Examples are communication management Systems for transmission of data such as position, heading, etc. as well as company data. Furthermore it might be useful to connect the ASNRT to devices serving as antenna steering units.

The following drawing shows an example of such a system utilising Iridium satellite network. It does not define a requirement.



Example Block Diagram:  
Airborne System for Non-Required Communication Services  
using the IRIDIUM satellite network

## 2. GENERAL DESIGN REQUIREMENTS

### AIRWORTHINESS

The equipment shall not, under either normal or failure conditions; impair the airworthiness of the aircraft in which it is installed.

### OPERATION OF CONTROLS

The operation of controls intended for use during flight, in all possible positions, combinations and sequences, shall not result in a condition whose presence or continuation would be detrimental to the continued safe operation of the aircraft.

Operating the system shall not significantly affect the workload of the air crew.

### DESIGN OF CONTROLS

Controls and indicators intended for use by flight crew shall be of suitable design for the intended cockpit environment / philosophy (e.g. size, readability, illumination).

#### EFFECTS OF TESTS

Unless otherwise provided, the design of the equipment shall be such that, subsequent to the application of the specific tests, no condition exists which would be detrimental to the continued safe operation of the aircraft.

### **3. MINIMUM PERFORMANCE SPECIFICATION UNDER STANDARD CONDITIONS**

#### GENERAL

The Aeronautical System for Non-Required Telecommunication Services (ASNRT) must meet the basic requirement not to interfere with on-board systems.

It must be ensured that the equipment can neither become a source of danger in them nor threaten the proper functioning of any essential system or service.

Note: It is assumed that the manufacturer also consults the telecommunication administration and (if applicable) the network provider as early as possible for approval of the technical parameters and requirements for the usage of the equipment.

#### SYSTEM SPECIFIC PARAMETERS

If appropriate, the manufacturer shall define details to show compliance with "GENERAL" subpart of this document.

A set of technical parameters showing that the system performs its intended functions shall be declared by the manufacturer. This set of data should include the quality, availability and reliability of the information channel and all the requirements which may be defined by the telecommunication administration or network provider for such equipment. However, when agreed by EASA, compliance demonstration is only necessary for a very basic requirement like "communication link established".

If the system interfaces to other on board equipment, compliance with the interface related requirements for that equipment has to be shown in order to exclude adverse effects on connected systems and the aircraft itself. In case of the intercom system electrical interface related parts of RTCA DO-214 (Audio Systems Characteristics and Minimum Operational Performance Standards for Aircraft Audio Systems and Equipment) Section 2.4 apply.

Means to disconnect the equipment from power bus or other systems (if applicable) shall be provided (i.e. Master Switch) for the case of unexpected interference, fire, smoke or other hazards.

Note: Compliance with this requirement can be achieved by the design of the equipment itself or measures described in the Installation Manual.

#### CLASSES OF EQUIPMENT

There are two classes defined in accordance with technical means to ensure the proper operation of the equipment. There may be additional operational requirements which are not covered by this specification.

- Class 1: Equipment with the operation restriction to parked and (air-) taxiing aircraft:

Technical means shall be provided to ensure that the equipment cannot be operated during other phases of flight (eg. by connection to sensors for airspeed, weight on wheels, etc.).

*Note:* Equipment which can, due to interference problems, only be allowed to operate in a parked aircraft with engines and other systems switched off, is not in the scope of this specification.

- Class 2: Equipment for operation during all phases of flight:

The manufacturer shall obtain concurrence for the intended operation from the telecommunication authority or network provider (if applicable) before applying for an airworthiness approval.

#### **4. MINIMUM PERFORMANCE SPECIFICATION UNDER ENVIRONMENTAL TEST CONDITIONS**

##### INTRODUCTION

The environmental tests and performance requirements described in this chapter provide a laboratory means of determining the performance characteristics of the equipment under conditions representative of those which may be encountered in actual operations.

The Airborne System for Non-Required Telecommunication Services in Non Aeronautical Frequency Bands (ASNRT) needs to comply with environmental tests so far as it is necessary to ensure that the equipment cannot become a source of danger under environmental conditions.

Some of the tests contained in this chapter are identified with the phrase "if required". They do not have to be performed unless the manufacturer wishes to qualify the equipment to these additional environmental conditions or if requested by EASA.

Unless otherwise specified, the test procedures applicable to a determination of equipment performance under environmental test conditions are specified in ETSO-2C514 § 3.1.2

##### EQUIPMENT PERFORMANCE COMPLIANCE

The performance requirements as defined in chapter 3 are not required to be tested under all of the conditions specified in CS-ETSO Subpart A paragraph 2.1.

When exposed to high temperature and/or pressure as well as power input and voltage spike test, it shall be ensured that there is no risk of fire, smoke or similar induced by the equipment.

During all shock and vibration tests the equipment shall remain in its mounting and no part of the equipment or its mounting shall have become detached and free of the shock test table.

Direct lightning tests for antennas or other equipment to be mounted outside the aircraft are only intended to ensure that a lightning strike is already

blocked at the antenna itself and cannot influence other installations or the aircraft itself.

#### PERFORMANCE TESTS

The equipment is sorted in two categories. Category 1 is for devices which are to be installed inside the aircraft, e.g. in the avionics bay. Category 2 covers subsystems to be installed outside, especially antennas.

| EUROCAE ED-14 / RTCA-DO160 Test            | Section | Category 1 | Category 2 |
|--|---------|------------|------------|
| Temperature and Altitude                   | 4       | +          | +          |
| Temperature Variation                      | 5.0     | -          | -          |
| Humidity                                   | 6.0     | -          | -          |
| Operational Shocks and Crash Safety        | 7.0     | +          | +          |
| Vibration                                  | 8.0     | +          | +          |
| Explosion Proofness                        | 9.0     | -          | -          |
| Water proofness                            | 10.0    | -          | -          |
| Fluids Susceptibility                      | 11.0    | -          | -          |
| Sand and Dust                              | 12.0    | -          | -          |
| Fungus Resistance                          | 13.0    | -          | -          |
| Salt Spray                                 | 14.0    | -          | -          |
| Magnetic Effect                            | 15.0    | +          | +(1)       |
| Power Input                                | 16.0    | +          | -          |
| Voltage Spike                              | 17.0    | +          | -          |
| Audio Frequency Cond. Susceptibility       | 18.0    | -          | -          |
| Induced Signal Susceptibility              | 19.0    | -          | -          |
| Radio Frequency Susceptibility             | 20.0    | -          | -          |
| Emission of Radio Frequency Energy         | 21.0    | +          | +(1),(3)   |
| Lightning Induced Transient Susceptibility | 22.0    | -          | -          |
| Lightning Direct Effects                   | 23.0    | -          | +(2)       |
| Icing                                      | 24.0    | -          | -          |
| Electrostatic Discharge                    | 25.0    | +          | +          |

+ mandatory test

- if required

(1) active antenna only

(2) This test can be omitted if compliance with the requirement is ensured by other means

(3) non intended radiation

The tests marked with "if required" may become mandatory in case of specific technical reasons. This shall be agreed with EASA.

Note: the above table is based on ED-14E / DO-160E and test conditions should be reevaluated should the CS-ETSO require compliance with a later revision.

#### **5. INSTALLED EQUIPMENT PERFORMANCE**

The material contained in the following paragraphs is intended as guidance material only and does not have direct significance in the type certification of

the equipment concerned. The aircraft installation must comply with the applicable airworthiness requirements and needs to be agreed by EASA.

#### EQUIPMENT INSTALLATION

General guidance on installation which can be found in FAA AC 25-10, 25-16, 43.13-1b (or later editions) should be applied. Special care should be taken in selecting the antenna installation location in relation to other receiving and transmitting RF systems. Non interference tests are required. Aircraft lightning zones and system lightning protection has to be determined. Additionally, for satellite systems a free sight to the sky is necessary for good system performance. Covering the antenna by structural elements will directly influence the installed communication performance. The interface to the on board intercom or other systems shall be installed in a manner so that a malfunction of the communication system does not cause conditions which prevent the safe continuation of the flight. The equipment shall be installed in accordance with the manufacturer's installation instructions.

#### OPERATING RESTRICTIONS

All operation restrictions which are defined e.g. by the rules of telecommunication authority and/or network provider should be enforced by technical provisions and procedures stated in Installation Manual as well as Operation Manual.