

**NOTICE OF PROPOSED AMENDMENT (NPA) No 2007-14**

**DRAFT DECISION OF THE EXECUTIVE DIRECTOR OF THE EUROPEAN  
AVIATION SAFETY AGENCY**

**AMENDING  
DECISION No. 2003/10/RM OF THE EXECUTIVE DIRECTOR OF THE  
AGENCY  
of 24 October 2003**

**ON**

**Certification Specifications, Including Airworthiness Codes and Acceptable Means  
Of Compliant, for European Technical Standard Orders («CS-ETSO»)**

**Systematic review and transposition of existing FAA TSO standards for parts and  
appliances into EASA ETSO.**

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## A EXPLANATORY NOTE

### I. General

1. The purpose of this Notice of Proposed Amendment (NPA) is to envisage amending Decision N° 2003/10/RM of the Executive Director of the Agency of 24 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for European Technical Standard Orders (CS-ETSO). This NPA proposes to introduce new ETSO specifications that are technically similar to existing Federal Aviation Administration (FAA) TSO. The scope of this rulemaking activity is outlined in ToR ETSO.002 (Systematic review and transposition of existing FAA TSO standards for parts and appliances into EASA ETSO) and is described in more detail below.
2. The Agency is directly involved in the rule-shaping process. It assists the Commission in its executive tasks by preparing draft regulations, and amendments thereof, for the implementation of the Basic Regulation<sup>1</sup> which are adopted as “Opinions” (Article 14.1). It also adopts Certification Specifications, including Airworthiness Codes and Acceptable Means of Compliance and Guidance Material to be used in the certification process (Article 14.2).
3. When developing rules, the Agency is bound to the following of a structured process as required by article 43.1 of the Basic Regulation. Such process has been adopted by the Agency’s Management Board and is referred to as “The Rulemaking Procedure”<sup>2</sup>.
4. This rulemaking activity is included in the Agency’s 2008 rulemaking programme. It implements the rulemaking task ETSO.002 issue 1 “Systematic review and transposition of existing FAA TSO standards for parts and appliances into EASA ETSO”. Only FAA TSO are considered for transposition into ETSO that meet the definition of parts and appliances as stated in Article 3(d)) of the Basic Regulation and which are within the scope of the Agency as defined by Article 4(1) of the Basic Regulation.
5. This NPA is submitted for consultation of all interested parties in accordance with Article 43 of the Basic Regulation and Articles 5(3) and 5(6) of the EASA rulemaking procedure.

### II. Consultation

6. To achieve optimal consultation, the Agency is publishing the draft decision of the Executive Director on its internet site. Comments should be provided within 3 months in accordance with Article 6(4) of the EASA rulemaking procedure. Comments on this proposal should be submitted by one of the following methods:

**CRT:** Send your comments using the Comment-Response Tool (CRT) available at <http://hub.easa.europa.eu/crt/>

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<sup>1</sup> Regulation (EC) No 1592/2002 of the European Parliament and of the Council of 15 July 2002 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency. *OJ L 240*, 7.9.2002, p.1. Regulation as last amended by Regulation (EC) No 334/2007 (*OJ L 88*, 29.3.2007, p. 39).

<sup>2</sup> Management Board decision concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material (“rulemaking procedure”), EASA MB/08/07, 13.6.2007

**E-mail:** In case the use of CRT is prevented by technical problems these should be reported to the [CRT webmaster](#) and comments sent by email to [NPA@easa.europa.eu](mailto:NPA@easa.europa.eu).

**Correspondence:** If you do not have access to internet or e-mail you can send your comment by mail to:  
 Process Support  
 Rulemaking Directorate  
 EASA  
 Postfach 10 12 53  
 D-50452 Cologne  
 Germany

Comments should be received by the Agency **before 12-12-2007**. If received after this deadline they might not be treated.

### III. Comment response document

7. All comments received in time will be responded to and incorporated in a Comment Response Document (CRD). This may contain a list of all persons and/or organisations that have provided comments. The CRD will be widely available on the Agency's website.

### IV. Content of the draft decision

8. The text of this NPA was developed by EUROCAE in the framework of a specific contract awarded to EUROCAE by the Agency.

The basis for the revision of each ETSO and main differences with the current ETSO are specified below.

#### Index 1

##### **ETSO-C44c: Fuel Flowmeters**

This is an update of ETSO-C44b based on FAA TSO-C44c issued on 22 August 2004.

The referenced Minimum Performance Specifications standard is changed from SAE Aeronautical Standard AS407B (March 1, 1960) to SAE AS407C (July 1, 2001). Deviations from the SAE Aeronautical Standard AS407B applicable to ETSO-C44c are specified in a new Appendix 1 which is similar to the FAA TSO Appendix 1.

The referenced environmental standard is also changed from SAE Aeronautical Standard AS407B to AS407C. In addition to SAE AS407C, the following new referenced standards are introduced:

- SAE AS1055D "*Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components*", (from June 1997)
- EUROCAE ED-14E (RTCA/DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment*" (March 2005).

##### **ETSO-C45b: Manifold Pressure Instruments**

This is an update of ETSO-C45a based on FAA TSO-C45b issued on 22 August 2006.

The referenced Minimum Performance Specifications standard is changed from SAE Aeronautical Standard AS411 (November 1, 1948) to SAE AS8042 (December 1, 1985). Deviations from the SAE Aeronautical Standard AS8042 applicable to ETSO-C45b are specified in a new Appendix 1 which is similar to the FAA TSO-C45b Appendix 1.

The referenced environmental standard is changed from AS411 to Section 7 of SAE AS 8042 (December 1, 1985) and EUROCAE ED-14E (RTCA/DO-160E) “*Environmental Conditions and Test Procedures for Airborne Equipment*” (March 2005).

#### **ETSO-C47a: Pressure Instruments - Fuel, Oil and Hydraulic**

This is an update of ETSO-C47 based on FAA TSO-C47a issued on 8<sup>th</sup> August 2006.

The referenced Minimum Performance Specifications standard is changed from SAE Aeronautical Standard AS408A (December 15, 1954) to SAE AS408C (July 1, 2001). Deviations from the SAE Aeronautical Standard AS408C applicable to ETSO-C47a are specified in a new Appendix 1 which is similar to the FAA TSO Appendix 1.

Environmental Standards, Computer Software considerations and Electronic Hardware Qualifications are newly introduced similar to the FAA TSO-C47a.

#### **ETSO-C56b: Engine Driven Direct Current Generator / Starter Generators**

This is an update of ETSO-C56a based on FAA TSO-C56b issued 1<sup>st</sup> June 2006.

In addition to editorial changes introduced for harmonisation reasons, the following has been changed.

The referenced environmental standard is changed from the reference to CS-ETSO Subpart A paragraph 2.1. (In effect reference to EUROCAE ED-14D) to EUROCAE ED-14E (RTCA/DO-160E) “*Environmental Conditions and Test Procedures for Airborne Equipment*” (March 2005)

Computer Software considerations are newly introduced

Marking requirements are harmonised with the FAA TSO-C56b.

#### **ETSO-C121a: Underwater Locating Devices (acoustic) (self-powered)**

This is an update of ETSO-C121 based on FAA TSO-C121a issued on 21<sup>st</sup> July 2006.

A reference to the American Society Testing Materials (ASTM) document D.1141-98 “*Standard Practice for the Preparation of Substitute Ocean Water*” (September 2003) is added to the Minimum Performance Standard.

The referenced environmental standard is changed from the reference to CS-ETSO Subpart A paragraph 2.1. (In effect reference to EUROCAE ED-14D) to EUROCAE ED-14E (RTCA/DO-160E) “*Environmental Conditions and Test Procedures for Airborne Equipment*” (March 2005).

Computer Software considerations and Electronic Hardware Qualifications are newly introduced similar to the FAA TSO-C121a.

Marking requirements that are already specified in Part 21 Subpart Q have been removed from paragraph 4.1.

Specific Technical Conditions for batteries used to power the underwater locating device are added to ETSO-C121a, consistent with TSO-C121a.

The following new ETSO are introduced based on existing FAA TSO.

ETSO number	ETSO Subject	Based on, and similar to FAA TSO:
ETSO-C142a	Non-Rechargeable Lithium Cells and Batteries	TSO-C142a issued on 7 <sup>th</sup> August 2006
ETSO-C161	Ground Based Augmentation System (GBAS) Positioning and Navigation Equipment	TSO-C161 issued on 30 <sup>th</sup> May 2003
ETSO-C166a	Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)	TSO-C166a issued on 21 <sup>st</sup> December 2006
ETSO-C173	Nickel-Cadmium and Lead-Acid Batteries	TSO-C173 issued on 2 <sup>nd</sup> May 2005
ETSO-C174	Battery Based Emergency Power Unit (BEPU)	TSO-C174 issued on 25 <sup>th</sup> July 2005
ETSO-C175	Galley Cart, Containers and Associated Components	TSO-C175 issued on 4 <sup>th</sup> November 2005

## V. Regulatory Impact Assessment.

### 9. Purpose and Intended Effect.

#### a) Issue which the NPA is intended to address

Approval of part and appliances that meet the requirements of a TSO, but for which there is no equivalent ETSO can only be approved when they are part of an (S)TC. This results in a disadvantage for European parts and appliance producers and installers of these parts and appliances.

#### b) Scale of the issue

A substantial number of manufacturers and installers are facing this problem.

#### c) Brief statement of the objectives of the NPA

The objective of this NPA is to introduce new ETSO or revise existing ETSO specifications in order to harmonise with existing commonly accepted TSO standards.

### 11 Options.

The options identified are:

Option 1 Do nothing

Option 2 Transposition of selected TSO specifications into technically similar ETSO.

### 12 Sectors concerned.

The introduction of these identified subjects into CS-ETSOs will mainly affect equipment manufactures and aircraft operators.

13 Impacts.

i Safety

Adoption of these TSO has no impact on safety since these standards are already commonly used as TSO within the FAA system or as part of the certification basis in (S)TC.

ii Economic

The establishment and the application of harmonised standards between ETSO and TSO on subjects of common interest provide the basis for equipment approvals independent from aircraft approvals. This has a positive effect on the market value and applicability of these equipments. The harmonisation of the ETSO and TSO standards will have a positive economic effect.

iii Environmental

No impact expected.

iv Social

No impact expected.

v Other aviation requirements outside EASA scope

No impact expected.

vi Foreign comparable regulatory requirements

Option 2 provides the possibility to harmonise with US FAA TSO.

14. Equity and Fairness issues

All applicants are equally affected.

15. Summary and Final Assessment

The proposals contained in this NPA are intended to achieve a common international standard with regard to the approval of equipments.

Harmonisation of CS-ETSO and FAR-TSO would save costs by minimising any duplication of certification and maintenance activities. Parts and appliances that meet the requirements of a TSO, but for which there is no similar ETSO, can only be approved when they are part of an (S)TC. This results in a disadvantage for installers of these parts and appliances. European equipment manufacturers seeking TSO approval in the US cannot obtain such approval in the absence of an ETSO authorisation based on an ETSO standard.

Adoption of these TSO has no impact on safety since these standards are already used.

## **B DRAFT DECISION**

The text of the amendment is arranged to show deleted text, new text or new paragraph as shown below:

1. ~~Text to be deleted is shown with a line through it.~~
2. New text to be inserted is highlighted with grey shading.
3. ....  
Indicates that remaining text is unchanged in front of or following the reflected amendment.  
....

## **I Draft Decision CS-ETSO**

### **SUBPART A – GENERAL**

#### **3. Additional Information**

EUROCAE documents may be purchased from:

European Organisation for Civil Aviation Equipment  
~~17, rue Hamelin 75116 PARIS Cedex 16 FRANCE~~  
 102 rue Etienne Dolet – 92240 Malakoff - France.  
 Telephone : +33 1 40 92 79 30 ; FAX +33 1 46 55 62 65 ;  
 (web site : ~~www.eurocae.org~~ eu ).

### **SUBPART B – LIST OF ETSOs (INDEX 1 AND INDEX2)**

#### **INDEX 1**

....	
ETSO-C44 <del>bc</del>	Fuel Flowmeters
ETSO-C45 <del>ab</del>	Manifold Pressure Instruments
ETSO-C47 <del>a</del>	Pressure Instruments-Fuel, Oil and Hydraulic
....	
ETSO-C56 <del>ab</del>	Engine-Driven Direct Current Generators/Starter-Generator
....	
ETSO-C121 <del>a</del>	Underwater Locating Devices (Acoustic) (Self-Powered)
....	
ETSO-C142 <del>a</del>	Non-rechargeable Lithium Cells and Batteries
....	
ETSO-C161	Ground Based Augmentation System (GBAS) Positioning and Navigation Equipment
ETSO-C166a	Extended Squiter Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Services (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)
ETSO-C173	Nickel-Cadmium and Lead-Acid Batteries
ETSO-C174	Battery Based Emergency Power Unit (BEPU)
ETSO-C175	Galley Cart, Containers and Associated Components



# 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 the SAE Aeronautical Standard AS 407B „Fuel Flowmeters“, revised March 1, 1960, and reconfirmed May 1991, as amended and supplemented by this ETSO. Exceptions:~~

- ~~(i) Correction to Section 1. of AS 407B: As referenced in this ETSO, AS 407B specifies minimum requirements for fuel flowmeters for use on reciprocating engines or turbine-powered civil aircraft. In addition, the following specifically numbered subparagraphs in AS 407B do not concern minimum performance and, therefore, it is not essential to show compliance with this paragraphs: 3.1, 3.2 and 4.2.1.~~
- ~~(ii) Thermal shock: This test shall apply to any hermetically sealed components. The components shall be subjected to four cycles of exposure to water at  $85^{\circ}\pm 2^{\circ}$  and  $5^{\circ}\pm 2^{\circ}\text{C}$  without evidence of moisture penetration or damage to coating or enclosure. Each cycle of the test shall consist of immersing the component in water at  $85^{\circ}\pm 2^{\circ}\text{C}$  for a period of 30 minutes and then within 5 seconds of removal from the bath, the component shall be immersed for a period of 30 minutes in the other bath maintained at  $5^{\circ}\pm 2^{\circ}\text{C}$ . This cycle shall be repeated continuously, one cycle following the other until four cycles have been completed. Following this test, the component shall be subjected to the Sealing test specified in (ii). No leakage shall occur as a result of the test.~~
- ~~(iii) Sealing: This performance test shall apply to any hermetically sealed components. The component shall be immersed in a suitable liquid, such as water. The absolute pressure of the air above the liquid shall then be reduced to approximately 34 hPa (1 inch of mercury (Hg)) and maintained for 1 minute, or until air bubbles cease to be given off by the liquid, whichever is longer. The absolute pressure shall then be increased by 85 hPa (2 1/2 inches Hg). Any bubbles coming from within the indicator case shall be considered as leakage and shall be cause for rejection. Bubbles which are the result of entrapped air in the various exterior parts of the case shall not be considered as leakage. Other test methods which provide evidence equal to the immersion test of the integrity of the instrument's seals may be used. If the component incorporates non hermetically sealed appurtenances such as a case extension, these appurtenances may be removed prior to the Sealing test.~~

(iv) ~~Correction to subparagraph 3.3.1: Under column A, the temperature values for unheated areas (Temperature Uncontrolled) shall be -55° to 70°C.~~

Standards set forth in **Appendix 1**

### 3.1.2 - Environmental Standard

~~The conditions and procedures prescribed in AS 407B are to be used.~~

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

See CS-ETSO Subpart A paragraph 2.2

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. ~~In addition, the range (transmitters only) and electrical rating shall be shown.~~

### 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 boxed):

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

<b>TABLE 1</b>		
<b>INSTRUMENT LOCATION</b>	<b>A</b>	<b>B</b>
Heated Areas (Temp. Controlled)	-30 to 50 °C	-65 to 70 °C
Unheated Areas (Temp. Controlled)	-55 to <span style="border: 1px solid black;">70 °C</span>	-65 to <span style="border: 1px solid black;">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  $85^{\circ} \pm 2^{\circ} \text{C}$  and  $5^{\circ} \pm 2^{\circ} \text{C}$ . There should be no evidence of moisture damage to coating or enclosure. During each cycle of the test, immerse the component in water at  $85^{\circ} \pm 2^{\circ} \text{C}$  for 30 minutes. Within 5 seconds of removal from the bath, immerse the component for 30 minutes in the other bath maintained at  $5^{\circ} \pm 2^{\circ} \text{C}$ . 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 (2) 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  $2\frac{1}{2}$  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 nonhermetically 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

ETSO-C45ab
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# 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

~~Standards set forth in the SAE Aerospace Standard (AS) document : AS 4 1 1 „Manifold Pressure Instruments“, dated November 1, 1948~~

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

~~As indicated in AS 411~~

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

~~None~~

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. ~~in lieu of the weight, the range shall be shown.~~

##### **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 25.869(a)(4) and the applicable portions of Part I, Appendix F.”

ETSO-C47a

# 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: AS 408A „Pressure Instruments Fuel, Oil and Hydraulic, dated December 15, 1954.“~~

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; ~~in lieu of the weight, the range shall be shown.~~

### 4.2 - Specific

~~None~~

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:

<b>AS408C</b>	<b>modification:</b>
Title	Replace "Pressure Instruments – Fuel, Oil, and Hydraulic (Reciprocating Engine Powered Aircraft)" Substitute: "Pressure Instruments – Fuel, Oil, and Hydraulic"
Section 1.1	Replace "...primarily for use with reciprocating engine powered transport aircraft, ..." Substitute: "...for use with civil aircraft,..."
<b>AS408C section 7</b>	<b>modification:</b>
Para 7.13	Use test conditions in SAE AS1055 Rev D, " <i>Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components</i> ", 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.

ETSO-C56ab

# 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 ~~D.C.~~ **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 Society of Automotive Engineers, Inc., (SAE) Aerospace Standard (AS) 8020 „Engine Driven D.C. Generators/Starter Generators and Associated Voltage Regulators“, dated January 1980.~~

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

~~See CS-ETSO Subpart A paragraph 2.1.~~

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

##### 3.1.3 - Computer Software

None

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; ~~In addition to this marking, the following information shall be legibly and permanently marked on the equipment:~~

- ~~(1) The environmental categories in which it has been qualified to operate in accordance with the applicable SAE document; however this marking is not necessary when the alternative is used as described in EUROCAE/RTCA document ED-14D/DO-160D.~~
- ~~(2) The digital computer software version (if applicable) and the environmental categories over which it has been tested.~~
- ~~(3) Indicate D.C. generator or starter generator.~~
- ~~(4) Nominal power output (electrical voltage and watts).~~
- ~~(5) Mechanical power input requirements (pad requirements).~~

### 4.2 – Specific

None

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

ETSO-C121a

# 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 SAE document AS 8045 dated May 16, 1988, Sections 4 through 7, as amended and supplemented by this ETSO~~

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

~~(i) See CS-ETSO Subpart A paragraph 2.1 and in addition~~

~~(ii) Salt Water Immersion American Society Testing Materials (ASTM) Document D. 1141-75 „Standard Specification for Substitute Ocean Water“, dated 1980.~~

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

None

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

None

The battery used in the underwater locating device authorized 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. ~~In addition, the following information shall be legibly and permanently marked on the major equipment components:~~

~~Each separate component of equipment that is manufactured under this ETSO (antenna, receiver, sensors, display panels, etc.) must be legibly and permanently marked with at least the name of the manufacturer, the ETSO number and part number.~~

### 4.2 - Specific

None

## 5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3

## ETSO-C142a

**European  
Aviation  
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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

**3.1.3 - Computer Software**

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

**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**

### **1. PURPOSE.**

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

### **2. 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> “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>TO ADD at the end of the paragraph</b>
<b>1.7.3, Lot Acceptance Test Goals</b>	<b>TO ADD at the end of the paragraph</b> “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> “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</b> the superscript "4" on the 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 Rated Capacity and Current</b> 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> Figure 2-3	<b>TO REPLACE</b> Figure 2-3 with the modified 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> Figure 2-4	<b>TO REPLACE</b> Figure 2-4 with the modified 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 “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. 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.”
<b>2.4.1.3, Forced Discharge Test</b>	<b>TO DELETE</b> 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.
<b>2.4.1.3, Forced Discharge Test</b>	<b>TO ADD</b> 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.”
<b>2.4.2.1, Internal Short-circuit Test</b>	<b>TO REPLACE</b> 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”
<b>3.4, Test Procedures for Installed Equipment Performance</b>	<b>TO ADD</b> new paragraph after 3.4 <b>Toxic Gas Venting Precautions</b>

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**

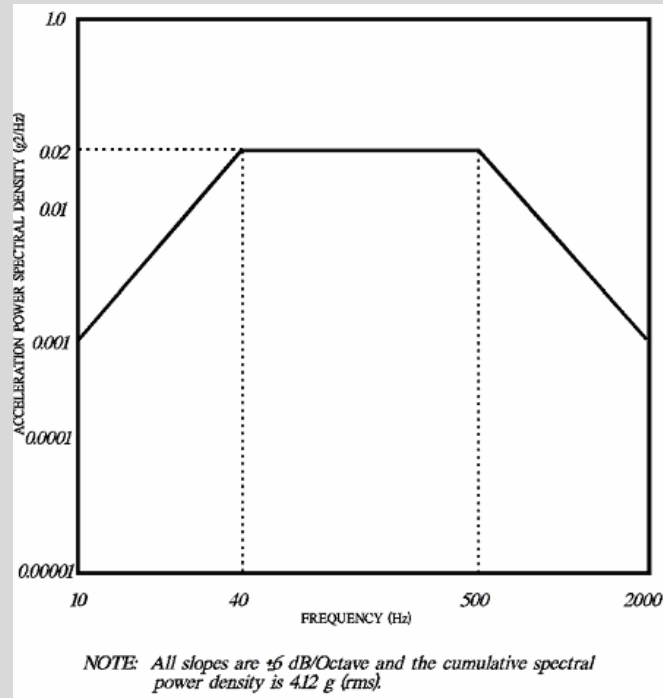
**TO ADD** new paragraph after 3.4

(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.

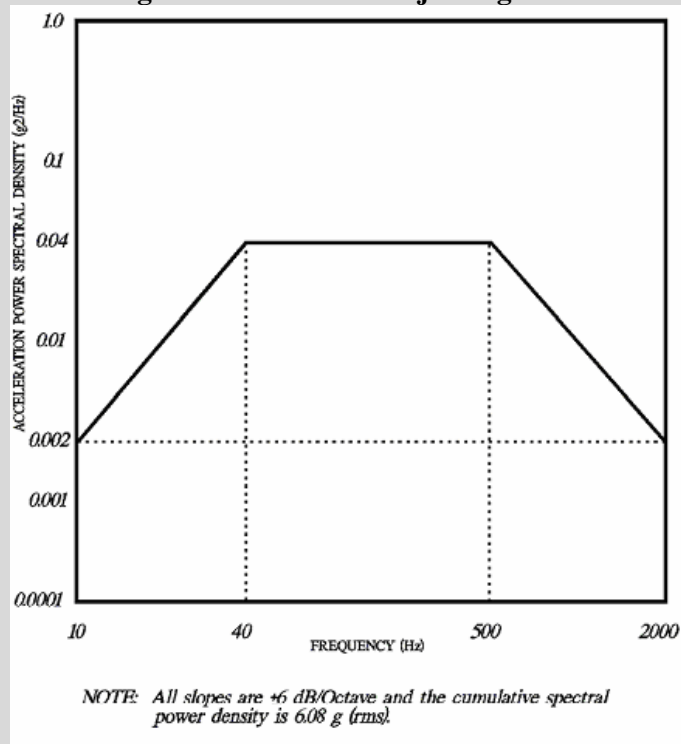
Airplane and equipment manufacturers incorporating lithium cells or batteries must ensure that if there is a fire within a single cell of the battery, the equipment unit will contain the fragments and debris (but not smoke/gases/vapors) from a battery explosion and fire. Fire within the equipment, such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



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



**Table 2. TESTS FOR FIRE SAFETY REQUIREMENTS**

<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. No smoke produced. No ignition or fire. No explosion.
Crush	Test battery by dropping an iron ball (9.1 kg) from the height of 61cm SoC of a cell : 50%	No venting of gases/vapors. No smoke produced. 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). SoC of a cell : 0%	No venting of gases/vapors. No smoke produced. No ignition or fire. No explosion.
Overheat	Test battery by heating up to 115 degrees C in the oven. SoC of a cell : 100%	No venting of gases/vapors. No smoke produced. No ignition or fire. No explosion.
Fire	Test equipment unit with battery in place for fire penetration by igniting a single unit. 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.

**ETSO-C161****European  
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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. In particular, one shall refer to ETSO-C144 “*Airborne Global Positioning System Antenna*” regarding the maximum tolerable currents and voltages into the antenna.

#### **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



## ETSO-C166a

**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.

<i><b>If component can:</b></i>	<i><b>Mark it with:</b></i>	<i><b>Sample marking pattern:</b></i>
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 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

ETSO-C173

# 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

ETSO-C174

# 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 4, 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 4. 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.

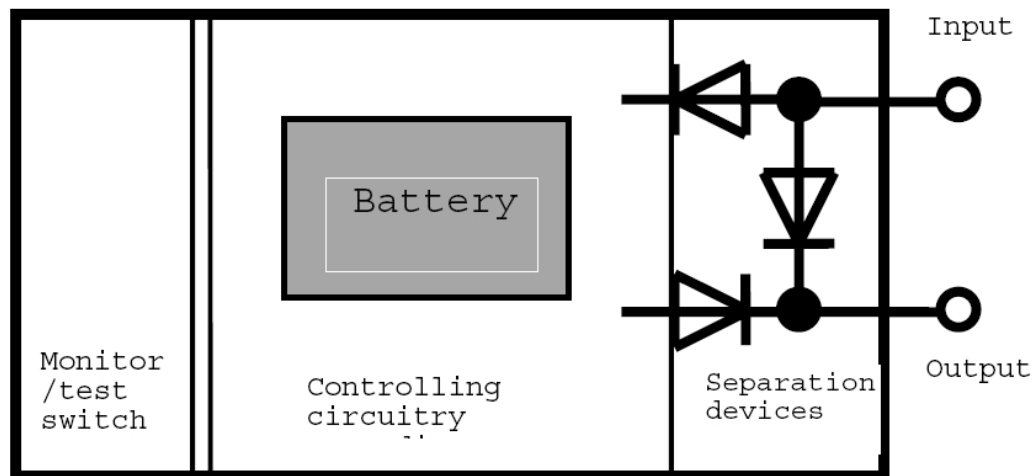


Figure A-1: BEPU Block Diagram

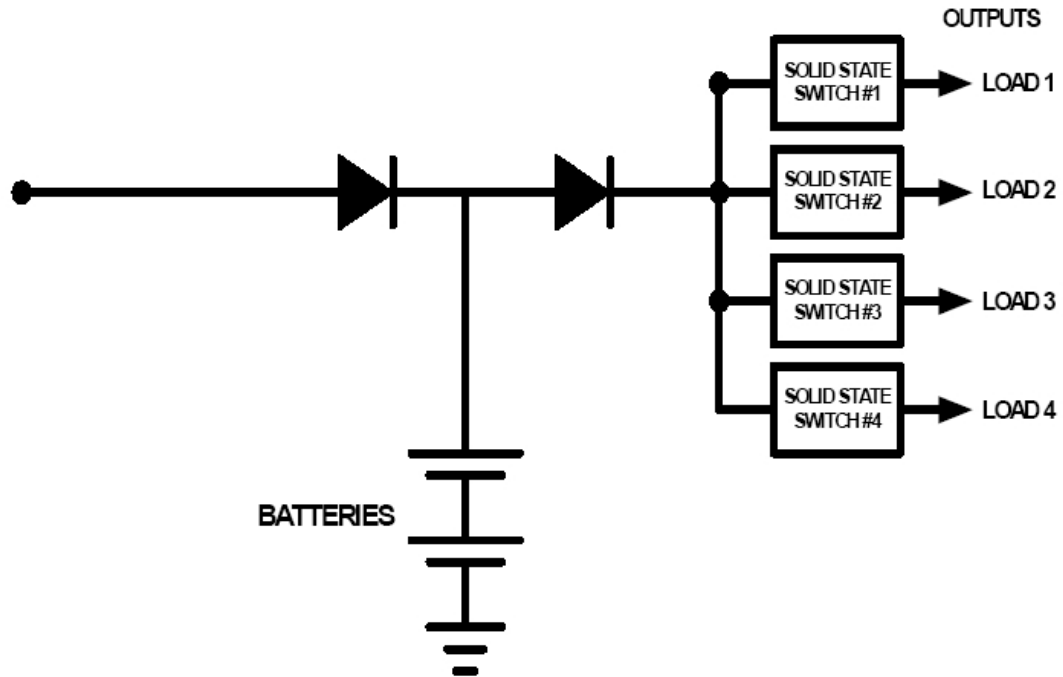


Figure A-2: An example BEPU Current Flow

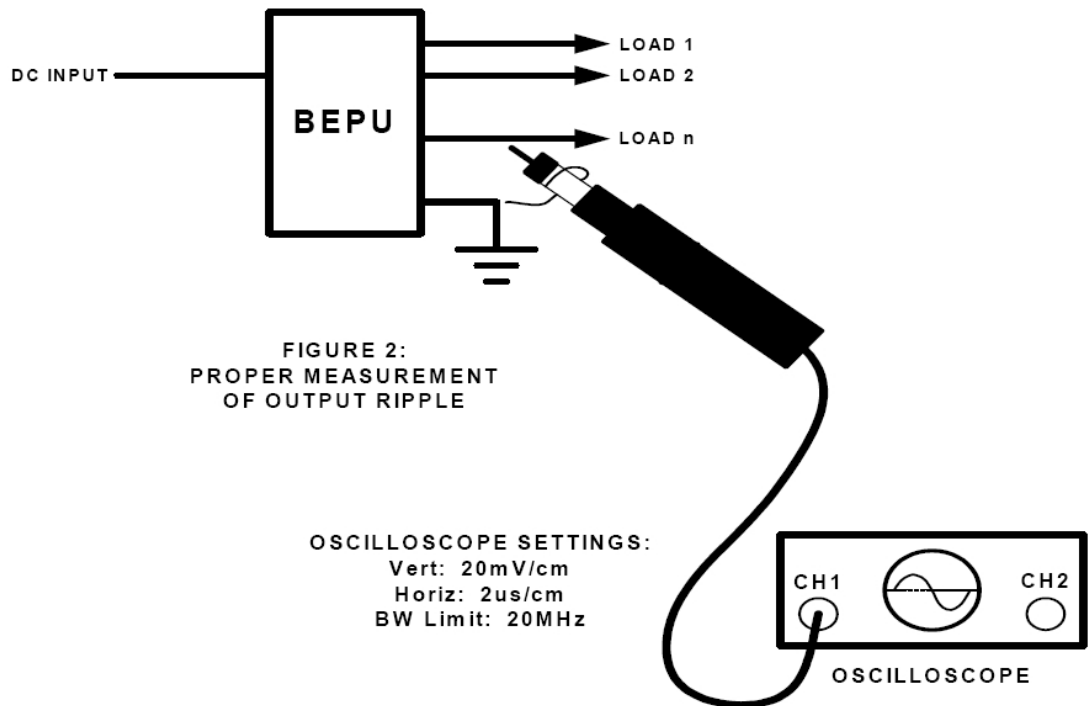


Figure A-3: Recommended Measurement of BEPU Output Voltage Ripple

**ETSO-C175****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: "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	<p>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:</p> <p>“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.”</p>
5.1, Interface Control Drawing	<p>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.”</p>