

Certification Specifications for European Technical Standard Orders (CS-ETSO)

Amendment 17

31 August 2022¹

¹ For the date of entry into force of this Amendment, please refer to Decision 2022/018/R at the [Official Publication](#) of EASA.

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PREAMBLE

ED Decision 2022/018/R

Amendment 17

The following is a list of paragraphs affected by this amendment:

Subpart A — Paragraphs 1.1, 1.2, 2.2, 2.3, 2.4, and 3.2	Amended
INDEX 1	
ETSO-C55a A1	Amended
ETSO-C63f	Amended
ETSO-C96c	Amended
ETSO-C106a	Amended
ETSO-C119e	Amended
ETSO-C127c	Amended
ETSO-C137a	Newly introduced
ETSO-C139a A1	Amended
ETSO-C157c	Amended
ETSO-C161b	Amended
ETSO-C162b	Amended
ETSO-C178a	Amended
INDEX 2	
ETSO-2C168a	Amended
ETSO-2C208	Newly introduced
ETSO-2C520	Newly introduced
ETSO-2C521	Newly introduced
ETSO-2C522	Newly introduced

SUBPART A – GENERAL

ED Decision 2022/018/R

1. APPLICABILITY

- 1.1 The requirements for the issue of European Technical Standard Order (ETSO) authorisations are found in Part 21, Section A, Subpart O.
- 1.2 The marking requirements for the issue of European Technical Standard Order (ETSO) authorisations are found in Part 21, Section A, Subpart Q.

2. STANDARDS TO MEET TECHNICAL CONDITIONS

2.1 Environmental standards

Unless otherwise stated in paragraph 3.1.2 of the specific ETSO, the applicable environmental standards are contained in EUROCAE/RTCA Document ED-14D, Change 3/DO 160D 'Environmental Conditions and Test Procedures for Airborne Equipment', Change 3, dated December 2002, ED 14E/DO-160E dated March 2005, ED-14F/DO-160F dated March 2008, ED 14G/DO-160G dated December 2010, or ED-14G Change 1/DO-160G Change 1 dated January 2015.

Compliance shall be demonstrated entirely with one of the above versions of the applicable environmental standards.

2.2 Software

If the ETSO article includes software, the software shall be developed with development assurance. The accepted means of compliance for the development assurance of airborne software is contained in the revision of AMC 20-115, entitled 'Airborne Software Development Assurance using EUROCAE ED-12 and RTCA Document DO-178', which is current at the time of the application, or in any later revision. The use of any other means of compliance shall be subject to a deviation request.

The software level, also known as the 'item development assurance level (IDAL)', shall be determined according to the failure conditions to which it contributes; see Section 2.4 for guidance. The applicant must declare the software level(s) to which the software has been developed and verified.

2.3 Airborne electronic hardware (AEH)

If the ETSO article includes airborne electronic hardware, the airborne electronic hardware shall be developed with development assurance. The accepted means of compliance for the development of airborne electronic hardware is contained in the revision of AMC 20 152¹, entitled 'Development Assurance for Airborne Electronic Hardware' that is current at the time of the application, or in any later revision. The use of any other means of compliance shall be subject to a deviation request.

The hardware development assurance level (DAL), also known as the 'item development assurance level (IDAL)', shall be determined according to the failure conditions to which it contributes; see Section 2.4 for guidance. The applicant must declare the hardware DAL(s) to which the item has been developed and verified.

¹ Refer to ED Decision 2020/010/R (<https://www.easa.europa.eu/document-library/agency-decisions>).

2.4 Failure conditions classification and development assurance

During the development of an ETSO article, consideration should be given to failure conditions, and the ETSO article should then be developed in accordance with the possible effects of those failure conditions at the system and aircraft levels (for further guidance see AMC material to related aircraft level requirements in the applicable certification specification (CS), for instance, AMC 25.1309 or AMC 23.2500/2510).

If the effects at the system or aircraft level are not known, due to the non-availability of aircraft or system design data, the applicant should make and declare an assumption for the failure classification. The assumed failure classification should be at least as high as the minimum hazard classification level required in the ETSO.

The classification of failure conditions at the level of the ETSO article may change as a result of particular aircraft installation architectures and characteristics.

Depending on the intended aircraft installation, EUROCAE/SAE Document ED-79A/ARP4754A, 'Guidelines for Development of Civil Aircraft and Systems', dated December 2010, or ASTM Document F3061M-17, 'Standard Specification for Systems and Equipment in Small Aircraft', dated November 2017, provide guidance to assign the development assurance levels of the ETSO article, software and airborne electronic hardware.

When the article implements software or airborne electronic hardware, the ETSO article shall be developed according to at least the development assurance level that is appropriate for the failure condition classifications that are expected for the intended installation.

EUROCAE/SAE Document ED-79A/ARP4754A should be used as guidance to ensure that a proper development, validation and verification process is followed for the ETSO article and its functional requirements.

2.5 ETSO article using an [ETSO-C153\(\)](#)-authorised IMA platform or module

If the ETSO article implements one (or several) [ETSO-C153\(\)](#)-authorised integrated modular avionics (IMA) platforms/modules and the applicant seeks compliance credit from this (these) ETSOA authorisation(s) to demonstrate compliance with one or several functional ETSO standard(s), the applicant shall apply for authorisation to the ETSO-C214 standard, together with the intended functional ETSO standard(s).

Note: A functional ETSO standard is any ETSO standard of CS-ETSO that describes an 'aircraft' function, i.e. typically any ETSO standard, except [ETSO-C153\(\)](#) and [ETSO-C214](#).

2.6 Information security protection

An ETSO article may be designed with a security assurance level (SAL) that is appropriate for specified security measures, according to the procedure provided in AMC 20-42.

2.7 Open problem reports (OPRs)

Problem reports that are related to ETSO articles that contain software or airborne electronic hardware shall be identified and managed. The accepted means of compliance for the management of OPRs is contained in the revision of AMC 20-189¹ 'Management of Open Problem Reports' that is current at the time of application, or in any later

¹ Refer to ED Decision 2020/010/R (<https://www.easa.europa.eu/document-library/agency-decisions>).

revision. The use of any other means of compliance shall be subject to a deviation request.

2.8 Embedded batteries

If an ETSO article embeds a lithium battery whose energy is equal to or greater than 2 Wh, the battery shall be approved in accordance with the applicable battery ETSO. Additionally, when the battery ETSO covers the article embedding the battery, the article shall also be approved in accordance with the applicable battery ETSO.

For rechargeable lithium batteries whose energy is less than 2 Wh, the battery shall comply with the UN Recommendations on the Transport of Dangerous Goods - Model Regulations and shall be certified to UL 1642, UL 2054 or IEC 62133, unless it is shown to meet the requirements of RTCA document DO-311A Energy Category 2.

For non-rechargeable lithium batteries whose energy is less than 2 Wh, the battery shall be certified to UL 1642 and shall comply with the UN Recommendations on the Transport of Dangerous Goods - Model Regulations.

If there is no ETSO that is applicable to a particular battery that an applicant intends to use in an ETSO article, the applicant should contact EASA.

3. ADDITIONAL INFORMATION

3.1 In some ETSOs, reference is made to an associated FAA standard. In these cases, the corresponding FAA technical standard order (TSO) can be consulted on http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgTSO.nsf/Frameset?OpenPage.

3.2 The standards documents referred to in this CS-ETSO may be purchased or obtained from the following organisations:

— ASD-STAN documents:

AeroSpace and Defence Industries Association of Europe – Standardization
Rue Montoyer 10 - 1000 Brussels

(Email: sales@asd-stan.org, website: www.asd-stan.org)

— ASTM documents:

American Society for Testing and Materials, ASTM International,
100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania
19428-2959, USA

(Website: www.astm.org)

— ETSI European Telecommunications Standards Institute

650, Route des Lucioles
06560 Valbonne - Sophia Antipolis
FRANCE

Telephone: +33 4 92 94 42 00

([https://www.etsi.org/standards#Pre-defined Collections](https://www.etsi.org/standards#Pre-defined%20Collections))

— EUROCAE documents:

European Organisation for Civil Aviation Equipment

9-23 rue Paul Lafargue, “Le Triangle” building, 93200 Saint-Denis, France

Telephone: +33 1 49 46 19 65

(Email: eurocae@eurocae.net, website: www.eurocae.net)

— EUROCONTROL Surveillance Document Library:

<https://www.eurocontrol.int/articles/surveillance-library>

— FAA standards:

Superintendent of Documents, Government Printing Office

732N Capitol Street NW, Washington DC 20401, USA

(Website: www.gpoaccess.gov)

— FCC Documents:

<http://www.fcc.gov>

— Global System, Inc., documents:

Global Systems, Inc., 2144 Michelson Drive, Irvine, California 92715, USA

Telephone: (714) 851-0119

— International Electrotechnical Commission

<https://webstore.iec.ch>

— MIL specifications:

DODSSP, Standardization Documents Order Desk

Building 4D, 700 Robbins Avenue, PHILADELPHIA, PA 19111-5094, USA

or from the ASSIST Customer Service Desk, telephone (215) 697-6396

(Website: <http://quicksearch.dla.mil/>)

— NAS specifications:

Aerospace Industries Association (AIA)

1327 Jones Drive, Ann Arbor, MI 48105, USA

(Website: www.techstreet.com)

— RTCA documents:

Radio Technical Commission for Aeronautics, Inc.

1828 L Street NW, Suite 805, Washington DC 20036, USA

(Website: www.rtca.org)

— RTCM documents:

Radio Technical Commission for Maritime Services

1621 N. Kent St., Suite 705

Arlington, Virginia 22209 USA

(Website: <https://www.rtcmm.org/>)

— SAE documents:

Society of Automotive Engineers, Inc.

400 Commonwealth Drive, WARRENDALE, PA 15096-001, USA

(Website: www.sae.org)

— UN United Nations Economic Commission for Europe transport regulations:

United Nations Bookshop

GA-1B-103

New York, NY 10017

USA

Tel: +1-212-963-7680

Email: bookshop@un.org

(Website:

https://www.unece.org/trans/danger/publi/unrec/rev13/13nature_e.html)

— UL Underwriters Laboratory standards:

(website: <https://standardscatalog.ul.com>)

[Amdt ETSO/3]

[Amdt ETSO/6]

[Amdt ETSO/7]

[Amdt ETSO/8]

[Amdt ETSO/12]

[Amdt ETSO/14]

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[Amdt ETSO/16]

[Amdt ETSO/17]

SUBPART B – LIST OF ETSOs

ED Decision 2022/018/R

This Subpart contains two Indexes:

1 INDEX 1

- 1.1 Index 1 lists all those ETSOs which are technically similar to FAA-TSOs.
- 1.2 When an article has been approved by the Agency to an ETSO listed in Index 1 the article is to be permanently marked with the appropriate ETSO number. Also, all documentation associated with Certification and Release for installation on an aircraft must record this ETSO number. The 'E' Symbol signifies that the article has been certified to the relevant ETSO by the Agency.
- 1.3 Index 1 lists all those ETSOs whose functional requirements are equivalent to those of the corresponding FAA TSOs that have the same identification numbers.
- 1.4 Reserved
- 1.5 The ETSO numbering system is explained as follows:
 - ETSO-C5e means: European TSO-Number and revision letter, and so
 - ETSO-C95 with no revision letter means initial issue.

NOTE: Copies of ETSOs are listed in Index 1.

2 INDEX 2

- 2.1 Index 2 lists all those ETSOs which are not technically similar to the FAA-TSOs. Index 2 ETSOs are identified by '2C' prefixes, and numbered as follows:
 - (a) An ETSO with significant differences in the MOPS in comparison with the corresponding FAA TSO is identified by the same number as the corresponding FAA TSO (related to the same type of equipment) with a number in the range from ETSO-2C1 to ETSO-2C499; or
 - (b) An ETSO for which there is no corresponding FAA TSO (related to the same type of equipment) is identified by a number in sequence from ETSO-2C500 upwards.

Index 1

EASA ETSO ref.	Title	Last amended by
ETSO-C1e	Cargo Compartment Fire Detection Instruments	CS-ETSO/13
ETSO-C2d	Airspeed Instruments	CS-ETSO/Initial Issue
ETSO-C3e	Turn and Slip Instruments	CS-ETSO/11
ETSO-C4c	Bank and Pitch Instruments	CS-ETSO/Initial Issue
ETSO-C5f	Direction Instrument, Non-Magnetic (Gyroscopically Stabilized)	CS-ETSO/11
ETSO-C6e	Direction Instrument, Magnetic (Gyroscopically Stabilized)	CS-ETSO/6
ETSO-C7d	Direction Instrument, Magnetic Non-Stabilized Type (Magnetic Compass)	CS-ETSO/Initial Issue
ETSO-C8e	Vertical Velocity Instrument (Rate-of-Climb)	CS-ETSO/6
ETSO-C10c	Pressure Altimeter System	CS-ETSO/16
ETSO-C13g	Life preservers	CS-ETSO/16
ETSO-C14b	Aircraft Fabric, Intermediate Grade; External Covering Material	CS-ETSO/Initial Issue
ETSO-C15d	Aircraft Fabric, Grade A; External Covering Material	CS-ETSO/Initial Issue
ETSO-C16b	Electrically Heated Pitot and Pitot-Static Tubes	CS-ETSO/13
ETSO-C20a	Combustion Heaters and Accessories	CS-ETSO/16
ETSO-C21b	Aircraft Turnbuckle Assemblies and/or Turnbuckle Safelying Devices	CS-ETSO/Initial Issue
ETSO-C22g	Safety Belts	CS-ETSO/Initial Issue
ETSO-C23f	Personal Parachute Assemblies and Components	CS-ETSO/13
ETSO-C25a	Aircraft Seats and Berths (Type I Transport 6g Forward Load)	CS-ETSO/Initial Issue
ETSO-C26d	Aircraft Wheels and Wheel-Brake Assemblies (CS-23, 27 and 29 aircraft)	CS-ETSO/12
ETSO-C27a	Twin Seaplane Floats	CS-ETSO/16
ETSO-C28	Aircraft Skis	CS-ETSO/Initial Issue
ETSO-C30d	Aircraft Position Lights	CS-ETSO/13
ETSO-C39c	Aircraft Seats and Berths Certified by Static Testing only	CS-ETSO/6
ETSO-C42	Propeller Feathering Hose Assemblies	CS-ETSO/Initial Issue
ETSO-C43d	Temperature Instruments	CS-ETSO/16
ETSO-C44c A1	Fuel Flowmeters	CS-ETSO/8
ETSO-C45b A1	Manifold Pressure Instruments	CS-ETSO/8
ETSO-C46a	Maximum Allowable Airspeed Indicator System	CS-ETSO/Initial Issue
ETSO-C47a A1	Pressure Instruments — Fuel, Oil, and Hydraulic (Reciprocating Engine-Powered Aircraft)	CS-ETSO/8
ETSO-C49b	Electric Tachometer: Magnetic Drag (Indicator and Generator)	CS-ETSO/Initial Issue
ETSO-C53a	Fuel and Engine Oil System Hose Assemblies	CS-ETSO/Initial Issue
ETSO-C54	Stall Warning Instruments	CS-ETSO/Initial Issue

ETSO-C55a A1	Fuel and Oil Quantity Instruments	CS-ETSO/17
ETSO-C56b A1	Engine-Driven Direct Current Generators/Starter Generators	CS-ETSO/8
ETSO-C59b	Airborne Selective Calling Equipment	CS-ETSO/13
ETSO-C62e	Aircraft Tyres	CS-ETSO/7
ETSO-C63f	Airborne Weather Radar Equipment	CS-ETSO/17
ETSO-C64b	Oxygen Mask Assembly, Continuous Flow, Passenger	CS-ETSO/12
ETSO-C69c	Emergency Evacuation Slides, Ramps and Slide/Rafts Combinations	CS-ETSO/Initial Issue
ETSO-C70b	Life Rafts	CS-ETSO/11
ETSO-C71	Airborne Static ('DC to DC') Electrical Power Converter (for Air Carrier Aircraft)	CS-ETSO/Initial Issue
ETSO-C72c	Individual Flotation Devices	CS-ETSO/Initial Issue
ETSO-C73	Static Electrical Power Inverter	CS-ETSO/Initial Issue
ETSO-C76b	Fuel Drain Valves	CS-ETSO/11
ETSO-C78a	Crewmember Demand Oxygen Mask	CS-ETSO/13
ETSO-C79	Fire Detectors (Radiation Sensing Types)	CS-ETSO/Initial Issue
ETSO-C80	Flexible Fuel and Oil Cell Material	CS-ETSO/Initial Issue
ETSO-C85b	Survivor Locator Lights	CS-ETSO/12
ETSO-C87a	Airborne Low-Range Radio Altimeter	CS-ETSO/8
ETSO-C88b	Automatic Pressure Altitude Reporting Code Generating Equipment	CS-ETSO/11
ETSO-C89a	Crew Member Oxygen Regulators, Demand	CS-ETSO/11
ETSO-C90d A1	Cargo Pallets, Nets and Containers	CS-ETSO/11
ETSO-C92c	Ground Proximity Warning, Glide Slope Deviation Alerting Equipment	CS-ETSO/Initial Issue
ETSO-C95a	Mach Meters	CS-ETSO/7
ETSO-C96c	Anticollision Light Systems	CS-ETSO/17
ETSO-C99a	Flight Deck (Sedentary) Crew Member Protective Breathing Equipment	CS-ETSO/11
ETSO-C100c	Aviation Child Safety Device (ACDS)	CS-ETSO/11
ETSO-C101	Overspeed Warning Instruments	CS-ETSO/Initial Issue
ETSO-C102	Airborne Radar Approach and Beacon Systems for Helicopters	CS-ETSO/Initial Issue
ETSO-C103	Continuous Flow Oxygen Mask Assembly (for Non-Transport Category Aircraft)	CS-ETSO/Initial Issue
ETSO-C105	Optional Display Equipment for Weather and Ground Mapping Radar Indicators	CS-ETSO/Initial Issue
ETSO-C106a	Air Data Computer	CS-ETSO/17
ETSO-C109	Airborne Navigation Data Storage System	CS-ETSO/Initial Issue
ETSO-C110a	Airborne Passive Thunderstorm Detection Systems	CS-ETSO/Initial Issue
ETSO-C112e	Secondary Surveillance Radar Mode S Transponder	CS-ETSO/11
ETSO-C113b	Airborne Multipurpose Electronic Displays	CS-ETSO/16

ETSO-C114 A1	Torso Restraint Systems	CS-ETSO/8
ETSO-C115d	Required Navigation Performance (RNP) Equipment using Multi-Sensor Inputs	CS-ETSO/13
ETSO-C116a	Crew Member Portable Protective Breathing Equipment	CS-ETSO/11
ETSO-C117b	Airborne Wind Shear Warning and Escape Guidance Systems (Reactive Type) for Transport Aeroplanes	CS-ETSO/16
ETSO-C118a	Traffic Alert and Collision Avoidance System I (TCAS I)	CS-ETSO/13
ETSO-C119e	Airborne Collision Avoidance System II (ACAS II) Version 7.1 with Hybrid Surveillance	CS-ETSO/17
ETSO-C121b	Underwater Locating Device	CS-ETSO/8
ETSO-C126c	Emergency Locator Transmitter	CS-ETSO/16
ETSO-C127c	Rotorcraft, Transport Aeroplane, and Small Aeroplane Seating Systems	CS-ETSO/17
ETSO-C132a	Geosynchronous Orbit Aeronautical Mobile Satellite Services Aircraft Earth Station Equipment	CS-ETSO/12
ETSO-C135a	Large Aeroplane Wheels, and Wheels and Brake Assemblies	CS-ETSO/6
ETSO-C137a	Aircraft Portable Megaphones	CS-ETSO/17
ETSO-C139a A1	Aircraft Audio Systems and Equipment	CS-ETSO/17
ETSO-C141	Aircraft Fluorescent Lighting Ballast/Fixture Equipment	CS-ETSO/Initial Issue
ETSO-C142b	Non-Rechargeable Lithium Cells and Batteries	CS-ETSO/16
ETSO-C144a	Passive Airborne Global Navigation Satellite System (GNSS) Antenna	CS-ETSO/6
ETSO-C145e A1	Airborne Navigation Sensors Using the Global Positioning System Augmented by the Satellite-Based Augmentation System	CS-ETSO/16
ETSO-C146e A1	Stand-Alone Airborne Navigation Equipment Using the Global Positioning System Augmented by the Satellite-Based Augmentation System	CS-ETSO/16
ETSO-C147a	Traffic Advisory System (TAS) Airborne Equipment	CS-ETSO/12
ETSO-C151d	Terrain Awareness and Warning System (TAWS)	CS-ETSO/16
ETSO-C153a	Integrated Modular Avionics (IMA) Platform and Modules	CS-ETSO/16
ETSO-C154c	Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment	CS-ETSO/7
ETSO-C155b	Recorder Independent Power Supply	CS-ETSO/13
ETSO-C157c	Flight Information Services-Broadcast (FIS-B) Equipment	CS-ETSO/17
ETSO-C158	Aeronautical Mobile High Frequency Data Link (HFDL) Equipment	CS-ETSO/7
ETSO-C159d	Next Generation Satellite Systems (NGSS) Equipment	CS-ETSO/16
ETSO-C160a A1	VDL Mode 2 Communications Equipment	CS-ETSO/16
ETSO-C161b	Ground-Based Augmentation System Positioning and Navigation Equipment	CS-ETSO/17
ETSO-C162b	Ground-Based Augmentation System Very High Frequency Data Broadcast Equipment	CS-ETSO/17
ETSO-C165b	Electronic Map Systems for Graphical Depiction of Aircraft Position	CS-ETSO/16

ETSO-C166b A3	Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)	CS-ETSO/13
ETSO-C170	High-Frequency (HF) Radio Communication Transceiver Equipment Operating Within the Radio Frequency 1.5 to 30 Megahertz	CS-ETSO/7
ETSO-C172a	Cargo Restraint Strap Assemblies	CS-ETSO/12
ETSO-C173a	Nickel-Cadmium, Nickel Metal-Hydride, and Lead-Acid Batteries	CS-ETSO/11
ETSO-C174 A1	Battery-Based Emergency Power Unit (BEPU)	CS-ETSO/8
ETSO-C175	Galley Cart, Containers and Associated Components	CS-ETSO/3
ETSO-C178a	Aircraft Circuit Breakers	CS-ETSO/17
ETSO-C179b	Rechargeable Lithium Cells, Batteries, and Battery Systems	CS-ETSO/16
ETSO-C184	Galley Equipment	CS-ETSO/7
ETSO-C190	Active Airborne Global Navigation Satellite System (GNSS) Antenna	CS-ETSO/6
ETSO-C194	Helicopter Terrain Awareness and Warning System (HTAWS)	CS-ETSO/7
ETSO-C195b	Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance	CS-ETSO/12
ETSO-C196b	Airborne Supplemental Navigation Sensors for Global Positioning System Equipment Using Aircraft-Based Augmentation	CS-ETSO/16
ETSO-C198	Automatic Flight Guidance and Control System (AFGCS) Equipment	CS-ETSO/8
ETSO-C199 A1	Traffic Awareness Beacon System (TABS)	CS-ETSO/16
ETSO-C200a	Low-Frequency Underwater Locating Device (ULD)	CS-ETSO/12
ETSO-C201	Attitude and Heading Reference Systems (AHRS)	CS-ETSO/11
ETSO-C202	Cargo Stopper Devices	CS-ETSO/11
ETSO-C203 A1	Fire containment covers (FCC)	CS-ETSO/13
ETSO-C207a	Aeronautical Mobile Airport Communication System (AeroMACS)	CS-ETSO/16
ETSO-C209	Electronic Flight Instrument System (EFIS) Display	CS-ETSO/13
ETSO-C210	Airborne Head-Up Display	CS-ETSO/13
ETSO-C214 A1	Functional ETSO equipment using an ETSO-C153a-authorized IMA platform or module	CS-ETSO/16

Index 2

EASA ETSO ref.	Title	Last amended by
ETSO-2C11e	Power Plant Fire Detection Instruments (Thermal and Flame Contact Types)	CS-ETSO/Initial Issue
ETSO-2C19c A1	Portable Water-Solution Type Hand Fire Extinguishers	CS-ETSO/16
ETSO-2C34f	ILS Glide Slope Receiving Equipment Operating within the Radio Frequency Range of 328.6–335.4 Megahertz (MHz)	CS-ETSO/Initial Issue
ETSO-2C35d	Radar Marker Receiving Equipment	CS-ETSO/Initial Issue
ETSO-2C36f	Airborne ILS Localizer Receiving Equipment Operating within the Radio Frequency Range 108–112 Megahertz	CS-ETSO/Initial Issue
ETSO-2C40c	VOR Receiving Equipment Operating within the Radio Frequency Range of 108–117.95 Megahertz	CS-ETSO/Initial Issue
ETSO-2C41d	Airborne Automatic Direction Finding (ADF) Equipment	CS-ETSO/Initial Issue
ETSO-2C48a	Carbon Monoxide Detector Instruments	CS-ETSO/6
ETSO-2C66b	Distance Measuring Equipment (DME) Operating within the Radio Frequency Range 960–1215 Megahertz	CS-ETSO/Initial Issue
ETSO-2C75	Hydraulic Hose Assembly	CS-ETSO/Initial Issue
ETSO-2C93b	Airborne Interim Standard Microwave Landing System Converter Equipment	CS-ETSO/Initial Issue
ETSO-2C104a	Microwave Landing System (MLS) Airborne Receiving Equipment	CS-ETSO/Initial Issue
ETSO-2C122	Devices That Prevent Blocked Channels Used in Two-Way Radio Communications Due to Simultaneous Transmissions	CS-ETSO/Initial Issue
ETSO-2C123c	Cockpit Voice Recorder Systems	CS-ETSO/16
ETSO-2C124c	Flight Data Recorder Systems	CS-ETSO/16
ETSO-2C128	Devices That Prevent Blocked Channels Used in Two-Way Radio Communications Due to Unintentional Transmissions	CS-ETSO/Initial Issue
ETSO-2C168a	Aviation Visual Distress Signals	CS-ETSO/17
ETSO-2C169a	VHF Radio Communications Transceiver Equipment Operating within the Radio Frequency Range 117.975 to 137 Megahertz	CS-ETSO/6
ETSO-2C176a	Aircraft Cockpit Image Recorder Systems	CS-ETSO/16
ETSO-2C177a	Data Link Recorder Equipment	CS-ETSO/16
ETSO-2C197 A1	Information Collection and Monitoring Systems	CS-ETSO/16
ETSO-2C204a	Circuit Card Assembly (CCA) Functional Sensors Using the Satellite-Based Augmentation System (SBAS) for Navigation and Non-Navigation Position/Velocity/Time (PVT) Output	CS-ETSO/16
ETSO-2C205a	Circuit Card Assembly (CCA) Functional Class Delta Equipment Using the Satellite-Based Augmentation System (SBAS) for Navigation Applications	CS-ETSO/16
ETSO-2C206	Circuit Card Assembly (CCA) Functional Sensors Using Aircraft-Based Augmentation for Navigation and Non-Navigation Position/Velocity/Time (PVT) Output	CS-ETSO/16
ETSO-2C208	Electrical Hoist Equipment	CS-ETSO/17
ETSO-2C500a	Combined ILS/MLS Airborne Receiving Equipment	CS-ETSO/Initial Issue

ETSO-2C501	Mode S Aircraft Data Link Processor	CS-ETSO/Initial Issue
ETSO-2C502	Helicopter Crew and Passenger Integrated Immersion Suits	CS-ETSO/1
ETSO-2C503	Helicopter Crew and Passenger Immersion Suits for Operations to or from Helidecks Located in a Hostile Sea Area	CS-ETSO/1
ETSO-2C504	Helicopter Constant-Wear Life Jackets for Operations to or from Helidecks Located in a Hostile Sea Area	CS-ETSO/1
ETSO-2C505	Helicopter Life Rafts for Operations to or from Helidecks Located in a Hostile Sea Area	CS-ETSO/1
ETSO-2C509	Light Aviation Secondary Surveillance Transponders (LAST)	CS-ETSO/2
ETSO-2C512	Portable Gaseous Oxygen Supply (PGOS)	CS-ETSO/3
ETSO-2C513	Tow Release	CS-ETSO/3
ETSO-2C514a	Airborne Systems for Non-Required Telecommunication Services (in Non-Aeronautical Frequency Bands) (ASNRT)	CS-ETSO/13
ETSO-2C515 A1	Aircraft Halocarbon Clean Agent Hand-Held Fire Extinguishers	CS-ETSO/16
ETSO-2C516	Reserved	N/A
ETSO-2C517	Automatic Deployable Flight Recorder (ADFR) Systems for Large Aeroplanes	CS-ETSO/16
ETSO-2C518	Runway Overrun Awareness and Alerting Systems	CS-ETSO/16
ETSO-2C519	Emergency Breathing Systems (EBSs)	CS-ETSO/16
ETSO-2C520	406-MHz Satellite Personal Locator Beacon	CS-ETSO/17
ETSO-2C521	Electronic Flight Bag (EFB) Software Applications	CS-ETSO/17
ETSO-2C522	Helicopter Terrain Awareness and Warning System (HTAWS) Advanced Features	CS-ETSO/17

[Amdt ETSO/1]

[Amdt ETSO/2]

[Amdt ETSO/3]

[Amdt ETSO/4]

[Amdt ETSO/5]

[Amdt ETSO/6]

[Amdt ETSO/7]

[Amdt ETSO/8]

[Amdt ETSO/9]

[Amdt ETSO/10]

[Amdt ETSO/11]

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[Amdt ETSO/17]

INDEX 1 EUROPEAN TECHNICAL STANDARD ORDERS

ETSO-C55a A1

ED Decision 2022/018/R

FUEL AND OIL QUANTITY INSTRUMENTS

1 Applicability

This ETSO provides the requirements that fuel and oil quantity instruments that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

The applicable standards are those provided in:

- SAE Aerospace Standard (AS) 405C 'Fuel and oil quantity Instruments', dated July 2001; or
- SAE Aerospace Standard (AS) 405D 'Fuel and oil quantity Instruments', dated August 2012,

both modified by Appendix 1 to this ETSO.

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

As specified in SAE Aerospace Standard AS405C or AS405D.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

The failure condition classification will depend on the system on which the fuel and oil quantity instrument is installed. The classification must be determined by the safety assessment conducted as part of the installation approval. Each fuel and oil quantity instrument shall be developed to at least the design assurance level

assumed to be assigned to the system on which the fuel and oil quantity instrument will be installed.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

At least one major component must be permanently and legibly marked with all the information in SAE AS405C or AS405D, Section 3.2 (except paragraph 3.2.b). Also, the component must be marked with the following information:

- (1) The basic type and accuracy classification, and
- (2) The fluids for which the instrument is substantiated.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/7]

[Amdt ETSO/17]

APPENDIX 1 TO ETSO-C55a A1 — FUEL AND OIL QUANTITY INSTRUMENTS

ED Decision 2022/018/R

This Appendix prescribes the minimum performance standard for fuel and oil quantity instruments, as modified by EASA.

The applicable standard is:

- SAE AS405C Fuel and Oil Quantity Instruments', dated July 2001; or
- SAE AS405D 'Fuel and oil quantity Instruments', dated August 2012.

Conformance with the following paragraphs of SAE AS405C or AS405D is not required: 3.1, 3.1.1, 3.1.2, 3.2 and 4.2.1.

A.1. ADDITIONS TO SAE AS405C or AS405D, PARAGRAPH 5

Paragraph 5.7, Instrument Setup

- a. Before starting tests, set up the instrument as follows:
 - (1) place the sensor component in a simulated fuel or oil tank, and the indicator and other components in a convenient location; and
 - (2) connect all the components using the same means as is required when the instrument is in service.
- b. You may choose to test individual components. When testing components individually, provide proper inputs or outputs for the components being tested.

Paragraph 5.8, Accuracy Tolerances

All accuracy tolerances are for the complete system. Before testing components individually, connect the components per the manufacturer's instructions. The complete system must meet the tolerances of Table 1 (see SAE AS8029, 'Minimum Performance Standard for Fuel and Oil Quantity Indicating System Components', dated June 1983):

Table 1 — Accuracy tolerances for the complete system

Class	Accuracy tolerance
1	± 0.75 % full scale
2	± 2 % of full scale
3	± 3 % of full scale

Paragraph 5.9, Ambient Room Conditions

At ambient room conditions, test the instrument for scale errors, hysteresis errors, friction errors, and position errors. The resulting total error must not exceed the values in the applicable listing in Table 1 of this Appendix.

Paragraph 5.10, Applicable Environmental Conditions

Test the instrument under the applicable environmental conditions. The resulting total error must not exceed the values in the applicable listing in Table 1 of this Appendix.

A.2. MODIFICATIONS TO SAE AS405C or AS405D, PARAGRAPH 6

Replace all the wording in:	With:
Paragraph 6.1, Scale Error	Adjust the tank unit and all the components before the test. You cannot adjust anything during the test. Immerse the tank unit, and compensators when used, in the test fluid. Calculate the percentage of errors by comparing the readings taken from the design calibration of the system or component you are testing.
Paragraph 6.2, Friction	Test all the components with moving parts for friction errors at several points. Test the components by applying the needed inputs to bring the output to a desired test point. Hold the input constant while taking the two output readings. Take the first reading before vibrating the indicator. Take the second reading after vibrating the indicator.
Paragraph 6.4, Position Error	To obtain a reading near mid-scale, the fluid tank should be about half-full, or have the equivalent electrical input. Hold each component (except the tank unit) in several different positions and record any change in output. Test the instrument for position errors in several positions.

A.3. ADDITIONS TO SAE AS405C or AS405D, PARAGRAPH 6.
Paragraph 6.8, Hysteresis Error

Test the instrument for hysteresis at several points. Increase the test fluid level or apply equal inputs to each selected test point and hold them while taking a reading.

Paragraph 6.9, Speed of Response

At ambient room conditions, the indicator must register from empty to full or vice versa in less than 30 seconds, but more than 5 seconds. When testing at any environmental extremes, the speed of response must not exceed 3 times the time measured at ambient room conditions.

A.4. MODIFICATIONS TO SAE AS405C or AS405D, PARAGRAPH 7
Replace:

‘As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer’s recommendation.’

with the following:

‘Performance tests: The following tests, in addition to any others deemed necessary by the manufacturer, shall be the basis for determining compliance with the performance requirements of this standard.’

A.5. ADDITIONS TO SAE AS405C or AS405D, PARAGRAPH 7

Add the following new paragraphs:

Paragraph 7.7, Operational Shock Tests

Use the test requirements in Section 7 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.8, Explosion Proof Test

Use the test requirements in Section 9 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.9, Power Input Test

Use the test requirements in Section 16 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.10, Voltage Spike Test

Use the test requirements in Section 17 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.11, Audio Frequency Conducted Susceptibility Test

Use the test requirements in Section 18 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.12, Induced Signal Susceptibility Test

Use the test requirements in Section 19 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.13, Radio Frequency Susceptibility Test

Use the test requirements in Section 20 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.14, Emission of Radio Frequency Energy Test

Use the test requirements in Section 21 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.15, Lightning Induced Transient Susceptibility Test

Use the test requirements in Section 22 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.16, Lightning Direct Effects Test

Use the test requirements in Section 23 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.17, Electrostatic Discharge Test

Use the test requirements in Section 25 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.18, Flammability Test

All the materials used must be self-extinguishing when tested in accordance with the applicable requirements of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A,

paragraph 2.1, Section 26, Category C, Flammability Test. This requirement does not apply to small parts (where the greatest equipment dimension is less than 50 mm, such as knobs, fasteners, seals, grommets and small electrical parts) that do not contribute significantly to fire propagation.

[Amdt ETSO/17]

ETSO-C63f

ED Decision 2022/018/R

AIRBORNE WEATHER RADAR EQUIPMENT

1 Applicability

This ETSO provides the requirements that airborne weather radar equipment that is designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

This ETSO standard addresses weather detection and ground mapping, forward-looking wind shear detection, forward-looking turbulence detection, and atmospheric threat awareness capability. It does not include flight guidance system functionality in support of an approved wind shear detection and avoidance system.

2 Procedures

2.1 General

The 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

The applicable standard is that provided in RTCA Document DO-220A, Change 1, Minimum Operational Performance Standards for Airborne Weather Radar Systems, dated 17 August 2018, for the equipment classes defined in Table 1.

Table 1 — Airborne Weather Radar Equipment Classes and Applicable MPSs

Equipment Class	Equipment Type	Minimum Performance Standards
A	Forward-Looking Wind Shear Detection Capability	The following sections of RTCA DO-220A, Change 1: Section 2.2, with the following exclusions: paragraphs 2.2.1.3.6, 2.2.1.3.7, 2.2.2, 2.2.4, and 2.2.5., and Sections 2.3 (performance under environmental conditions) and 2.4 (test requirements) as applicable to the class.
B	Forward-Looking Turbulence Detection Capability	The following sections of RTCA DO-220A, Change 1: Section 2.2, with the following exclusions: paragraphs 2.2.1.3.5, 2.2.1.3.7, 2.2.2, 2.2.3, and 2.2.5., and Sections 2.3 (performance under environmental conditions) and 2.4 (test requirements) as applicable to the class.

Equipment Class	Equipment Type	Minimum Performance Standards
C	Airborne Weather and Ground Mapping Pulsed Radar	The following sections of RTCA DO-220A, Change 1: Section 2.2, with the following exclusions: paragraphs 2.2.1.3.5, 2.2.1.3.6, 2.2.1.3.7, 2.2.3, 2.2.4, and 2.2.5., and Sections 2.3 (performance under environmental conditions) and 2.4 (test requirements) as applicable to the class.
D	Atmospheric Threat Awareness Capability	The following sections of RTCA DO-220A, Change 1: Section 2.2, with the following exclusions: paragraphs 2.2.1.3.5, 2.2.1.3.6, 2.2.2, 2.2.3, and 2.2.4. Sections 2.3 (performance under environmental conditions) and 2.4 (test requirements) as applicable to the class.

Any of these classes may be implemented individually or in combination. Therefore, a piece of equipment may be eligible for one or more classes.

Functionality

This ETSO standard applies to equipment intended to:

- (1) Provide airborne wind shear detection (equipment Class A). Equipment Class A provides forward-looking wind shear detection functionality. However, this ETSO does not include flight guidance system functionality in support of an approved wind shear detection and avoidance system;
- (2) Provide advanced and advisory indication of potentially hazardous turbulence conditions detectable by weather radar, together with other flight information, to assist pilots with turbulence avoidance decisions (Equipment Class B);
- (3) Detect and display echoes from precipitation to assist in flight crew analysis of weather. Maintain contact with geographic features such as international shoreline boundaries as a supplement to navigational orientation (Equipment Class C); and
- (4) Provide timely and advisory information to pilots to enhance their situational awareness of atmospheric activity and assist with atmospheric threat avoidance decisions (Equipment Class D).

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

Failure of the function defined in paragraphs 3.1.1(2) or 3.1.1(4) resulting in unannounced malfunction or missed detection is a minor failure condition.

Failure of the function defined in paragraph 3.1.1(1) or 3.1.1(3) resulting in unannounced malfunction or missed detection is a major failure condition.

Loss of the functions defined in paragraph 3.1.1 is a minor failure condition.

3.2.2 Installation Manual

The applicant should provide a manual(s) containing the following items:

- (1) Operating instructions and equipment limitations sufficient to describe the equipment's operational capability;
- (2) For Equipment Class B, identify the installation instructions for the identified aircraft class selected from RTCA/DO-220A, Change 1, paragraph 2.2.4.1, Table 2-4;
- (3) The expected radome performance for the electromagnetic signals passing through it (paragraph 2.2 of RTC DO-213A, Change 1, Minimum Operational Performance Standards for Nose-Mounted Radomes, dated June 21, 2018);
- (4) The weather performance index (range) in accordance with the requirements of RTCA DO-220A, Change 1; and
- (5) The wind shear detection range in accordance with the requirements of RTCA DO-220A, Change 1.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

The markings must also include the equipment class(es), as defined in Table 1.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/13]

[Amdt ETSO/17]

ETSO-C96c

ED Decision 2022/018/R

ANTICOLLISION LIGHT SYSTEMS**1 Applicability**

This ETSO provides the requirements that anticollision light systems that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

The applicable standard is that provided in Society of Automotive Engineers, Inc., (SAE) Aerospace Standard AS8017D ‘Minimum Performance Standard for Anticollision Light Systems’, dated August 2017, as modified by Appendix 1 to this ETSO.

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

3.2.2 Others

Note: AS8017D does not reflect the impact of updates to Certification Specifications published after 15 August 2017, such as CS-23 Amendment 5.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

The following information shall be legibly and permanently marked on the major equipment components:

- (a) Class I, II, III or IV (refer to SAE AS8017D and Appendix 1 to this ETSO).
- (b) Nominal power input rating.

5 Availability of Referenced Document

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/13]

[Amdt ETSO/17]

APPENDIX 1 TO ETSO-C96c — ANTICOLLISION LIGHT SYSTEMS

ED Decision 2022/018/R

- A.1 In Section 1.2 of Society of Automotive Engineers, Inc., (SAE) Aerospace Standard AS8017D ‘Minimum Performance Standard for Anticollision Light Systems’, dated August 2017, below the row defining Class III and the new row defining Class IV, add the following:

‘Class IV — Fixed Wing Aircraft 400 Candelas with reduced elevation angle.’

Below the lines defining the different classes in Section 1.2 of Society of Automotive Engineers, Inc., (SAE) AS8017D ‘Minimum Performance Standard for Anticollision Light Systems’, dated August 2017, add the following:

‘The requirements for a Class IV anticollision light system are as for a Class II anticollision light system, except that there is no intensity requirement for angles above or below the horizontal plane which are greater than 30°.’

- A.2 In Section 1.2.1 of Society of Automotive Engineers, Inc., (SAE) AS8017D ‘Minimum Performance Standard for Anticollision Light Systems’, dated August 2017, remove the following:

‘Anticollision lights for fixed-wing aircraft must meet the requirements for Class III lights if certified prior to 11 August 1971, and the requirements for Class II lights if certified after that date.’

- A.3 In Section 3.4 of Society of Automotive Engineers, Inc., (SAE) AS8017D ‘Minimum Performance Standard for Anticollision Light Systems’, dated August 2017, replace the statement:

‘Caution: Compliance only to the alternate colour definitions detailed in Section 3.4.1 (without compliance to the CFR requirements) will require an Equivalent Level of Safety Finding by the Federal Aviation Administration in order to allow installation of the lights on certified aircraft.’

With the following revised statement:

‘Caution: Compliance only with the alternate colour definitions detailed in Section 3.4.1 (without compliance with the CS requirements) may require an equivalent level of safety finding in order to approve the installation of the lights on certified aircraft.’

[Amdt ETSO/17]

ETSO-C106a

ED Decision 2013/012/R

AIR DATA COMPUTER

1 Applicability

This ETSO provides the requirements that air data computers that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

The applicable standard is that provided in SAE AS8002B 'Air Data Computer', dated 28 April 2020.

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne electronic hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

None.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

Marking of the type of air data computer is required (i.e. Type 1 or Type 2).

5 Availability of referenced document

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/8]

[Amdt ETSO/17]

ETSO-C119e

ED Decision 2022/018/R

AIRBORNE COLLISION AVOIDANCE SYSTEM II (ACAS II) VERSION 7.1 WITH HYBRID SURVEILLANCE**1 Applicability**

This ETSO provides the requirements that Airborne Collision Avoidance System II (ACAS II) Version 7.1 equipment that is designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures**2.1 General**

The 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**

The applicable standards are those provided in EUROCAE Document ED-143, 'Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System II (TCAS II)', dated September 2008, Section 2 as modified by Change 1 dated April 2009, Change 2 (Version 7.1) dated April 2013, and by [Appendix 1](#) to this ETSO and EUROCAE Document ED-221A, 'Minimum Operational Performance Standards (MOPS) for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance', dated December 2015, Section 2, as modified by [Appendix 2](#) to this ETSO.

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific**3.2.1 Failure Condition Classification**

See CS-ETSO, [Subpart A](#), paragraph 2.4.

Failure of the function defined in paragraph 3.1.1 of this ETSO resulting in misleading information is a hazardous failure condition.

Failure of the function defined in paragraph 3.1.1 of this ETSO resulting in a loss of function is a minor failure condition.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

None.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/11]

[Amdt ETSO/17]

APPENDIX 1 TO ETSO-C119e – TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM II (TCAS II) VERSION 7.1 AMENDMENT TO THE EUROCAE ED-143 CHANGE 2 REQUIREMENTS

ED Decision 2022/018/R

This Appendix lists the EASA modifications to the MPS for Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II Change 2, dated April 2013.

When the own ship is on the ground, clarification is required to allow the system to limit the output of TCAS intruders to the display to those within 3 000 feet of the own altitude. In lieu of section '2.2.2 System Performance' of EUROCAE ED-143 Change 2, substitute the following:

2.2.2 System Performance

Note: *When operating within the maximum aircraft transponder population and electromagnetic interference levels defined in subparagraph 2.2.1.2, TCAS II will provide a level of performance for active surveillance of targets-of-interest that will support the requirements for generation of collision advisory information.*

Specifically, TCAS II will generate a surveillance track in range and altitude on a target-of-interest at the range and with the track probability and range accuracy specified below. This is to ensure that a correct resolution advisory can be issued in time for the pilot to maintain adequate vertical separation at closest-point-of-approach.

TCAS II will also generate, whenever possible, a surveillance track in range and altitude on a target-of-interest at the range and with the track probability and range accuracy specified below such that a correct traffic advisory can be issued as a precursor to the resolution advisory.

In addition to the surveillance requirements to support the generation of resolution and traffic advisories, TCAS II will display the range and, if available, the altitude and bearing position information on targets that generate advisories. The bearing position information will be generated according to the accuracy requirement specified below.

TCAS II will also generate for display, whenever possible, surveillance range, altitude and bearing position information on Mode C and Mode S aircraft that are within the range specified below and within $\pm 10\,000$ ft altitude relative to TCAS II when airborne, and within $\pm 3\,000$ ft altitude relative to TCAS II when on the ground.

It is acceptable to limit the output of TCAS intruders to the display to those within 3 000 ft of the own altitude when the own aircraft is on the ground. This is permitted (but not required) so that the altitude surveillance volume for TCAS Mode C intruders can be consistent with the Mode S surveillance altitude limits modified in EUROCAE ED-143 Change 2 (section 2.2.4.6.2.2.1). This allowance to limit the display to $\pm 3\,000$ feet does not modify the surveillance altitude volumes which are defined in EUROCAE ED-143, section 2.2.4.6.

The system shall use the definition of on-ground as defined in EUROCAE ED-143, Volume II, Section 2.1.14. Alternatively, the system may use the definition of 'operating on surface' in EUROCAE ED-221A, Section 2.2.8, for on-ground.'

[Amdt ETSO/11]

[Amdt ETSO/17]

APPENDIX 2 TO ETSO-C119e – TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM II (TCAS II) VERSION 7.1 HYBRID SURVEILLANCE AMENDMENT TO THE EUROCAE ED-221A REQUIREMENTS

ED Decision 2022/018/R

This Appendix lists the EASA modifications to EUROCAE ED-221A for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance, dated December 2015.

To facilitate the monitoring by maintenance personnel of the hybrid surveillance functionality, add the following requirement as the fifth paragraph (including the Note) in Section 2.2.10, Monitoring Requirements:

‘TCAS II units shall provide a means for presenting logged hybrid surveillance faults to maintenance personnel to enable on-wing monitoring of hybrid surveillance functionality at periodic intervals.

Note: This requirement enables the implementation of a scheduled maintenance task to ensure that hybrid surveillance is functional on aircraft without a centralised warning system and/or an on-board maintenance computer.’

[Amdt ETSO/11]

[Amdt ETSO/17]

ETSO-C127c

ED Decision 2022/018/R

ROTORCRAFT, TRANSPORT AEROPLANE, AND SMALL AEROPLANE SEATING SYSTEMS

1 Applicability

This ETSO provides the Minimum Performance Standards (MPSs) that rotorcraft, large (transport) aeroplane, and small aeroplane seating systems of the following designated types that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

The standards of this ETSO apply to equipment intended to be utilised as aircraft seating systems of the following classifications:

- (1) Seat Type and applicable Aircraft Category:
 - (a) Type A Aeroplane. Aircraft Category: Transport
 - (b) Type B Rotorcraft. Aircraft Category: Large (Transport) or Small (Normal)
 - (c) Type C Small Aeroplane. Aircraft Category:
(CS-23 up to Amendment 4) Normal, Utility, Acrobatic, or Commuter;
(CS-23 Amendment 5 and subsequent amendments) Normal Level 1, Normal Level 2, Normal Level 3, Normal Level 4.
- (2) Seat Subtype:
 - (a) Subtype 1 Passenger
 - (b) Subtype 2 Flight Attendant
 - (c) Subtype 3 Observer
 - (d) Subtype 4 Pilot/Co-pilot
- (3) Seat Orientation:
 - (a) Forward facing — Installation of forward-facing seating systems in the aircraft at up to an angle of 18° relative to the aircraft longitudinal axis.
 - (b) Rearward facing — Installation of rearward-facing seating systems in the aircraft at up to an angle of 18° relative to the aircraft longitudinal axis.
 - (c) Side facing — Installation of side-facing seating systems in the aircraft at between 80° and 100° relative to the aircraft longitudinal axis.
 - (d) Oblique facing — Installation of forward-facing seating systems in the aircraft, at greater than 18° and no greater than 45° relative to the aircraft longitudinal axis.

2 Procedures

2.1 General

The applicable procedures are detailed in CS-ETSO, [Subpart A](#).

2.2 Specific

None.

3 Technical Conditions

3.1 Basic

The standards of this ETSO apply to equipment intended to be utilised as aircraft seating systems.

3.1.1 Minimum Performance Standard

New models of rotorcraft, large (transport) aeroplane, and small aeroplane seating systems identified and manufactured on or after the effective date of this ETSO must meet the requirements in the following standards:

- SAE AS8049C, 'Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft', dated August 2015, as modified by Appendix 1 to this ETSO;
- SAE AS8049/1B, 'Performance Standards for Side-Facing Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft', dated December 2016, as modified by Appendix 1 to this ETSO;
- SAE ARP5526D, 'Aircraft Seat Design Guidance and Clarifications', dated July 2015, as modified by Appendix 1 of this ETSO;
- SAE AS6316, 'Performance Standards for Oblique Facing Passenger Seats in Transport Aircraft', dated June 2017, as modified by Appendix 1 to this ETSO;
- SAE ARP6337, 'Design, Manufacturing, and Performance Standard for Composite Materials Used on Aircraft Seat Structures', dated November 2020, as modified by Appendix 1 of this ETSO, and by Appendix 2 to this ETSO for specific elective requirements.

3.1.1.1 Functional Qualification

Demonstrate the required functional performance under the test conditions specified in:

- SAE AS8049C, 'Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft', dated August 2015, as amended by Appendix 1 of this ETSO for forward- and aft-facing seats;
- SAE AS8049/1B, 'Performance Standards for Side-Facing Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft', dated December 2016, as modified by Appendix 1 to this ETSO for side-facing seats;
- SAE AS6316, 'Performance Standards for Oblique Facing Passenger Seats in Transport Aircraft', dated June 2017, as modified by Appendix 1 to this ETSO for oblique-facing seats;
- SAE ARP5526D, 'Aircraft Seat Design Guidance and Clarifications', dated July 2015, as amended by Appendix 1 to this ETSO;
- SAE ARP6337, 'Design, Manufacturing, and Performance Standard for Composite Materials Used on Aircraft Seat Structures', dated November 2020, as modified by Appendix 1 to this ETSO; and
- Appendix 2 of this ETSO for specific elective requirements.

3.1.2 Environmental Standard

Not applicable.

3.1.3 Software

Not applicable.

3.1.4 Airborne Electronic Hardware

Not applicable.

3.2 Specific

3.2.1 Failure Condition Classification

There is no standard minimum failure condition classification for this ETSO. The failure condition classification appropriate for the article will depend on the intended use of the article in a specific aircraft. The loss of function and the malfunction failure condition classifications for which the equipment is designed should be documented.

4 Marking

4.1 General

The permanent and legible marking of at least one major component is required, with all the information as detailed in CS-ETSO, Subpart A, paragraph 1.2.

4.2 Specific

The markings must also include the serial number and the following:

- (1) The specific seat MPS complied with as abbreviated by paragraphs 4.2(1)(a) to 4.2(1)(e) below. Separate each applicable identifier with a dash.

For example, a large (transport) aeroplane passenger seat that may be used as a forward facing or rearward facing seat and that meets the step load on the baggage bar standard and the higher static loads must be marked as: Type A-T-1-FF-RF-a-d.

- (a) The seat type, use: 'Type A' for Aeroplane, 'Type B' for Rotorcraft, or 'Type C' for Small Aeroplane.
- (b) The seat type shall be followed by the aircraft category, use: 'T' for Transport, 'N' for Normal, 'U' for Utility, 'A' for Acrobatic, or 'C' for Commuter. If the seat is intended to be used on aircraft compliant with CS-23 Amendment 5 or later amendments, the seat type must be followed by the aircraft category, use 'NL' for Normal and 1, 2, 3, 4 for the aircraft certification level, for example 'NL1' for Normal category Level 1, 'NL2' for Normal category Level 2, etc.
- (c) The aircraft category must be followed by the appropriate seat subtype, use: '1' for Passenger, '2' for Flight Attendant, '3' for Observer, or '4' for Pilot/Co-pilot.
- (d) The subtype must be followed by the appropriate seat-facing designation, use: 'FF' for Forward Facing, 'RF' for Rearward Facing, 'SF' for Side Facing, or 'OB' for Oblique Facing.
- (e) The seat-facing designations must be followed by the applicable paragraph letter of the elective criteria defined in appendix 2 of this ETSO, use: 'a' for

Step Load on Baggage Bars, 'b' for Electrically Actuated Features, 'c' for Secondary Structure Abuse Loads, 'd' for Testing to Higher Static Loads, 'e' for Hand Holds, 'f' for Lithium Containing Batteries, 'g' for Flammability — Non-Traditional, Large, Non-metallic Parts.

- (2) The seating system, safety belt restraint system, and seat cushion part numbers.
- (3) The document reference that contains the installation instructions and limitations.
- (4) For Type A and Type B-Transport passenger, flight attendant and observer seating systems, mark each seat cushion to be qualified with 'Meets the provisions of CS-25, Appendix F, Part II'.

Also, mark permanently and legibly the following, with at least the manufacturer's name, subassembly part number, and the ETSO number:

- (1) each component that is easily removable (without hand tools); and
- (2) each subassembly of the article that you determined may be interchangeable.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/11]

[Amdt ETSO/17]

APPENDIX 1 TO ETSO-C127c – MPS FOR ROTORCRAFT, TRANSPORT AEROPLANE, AND SMALL AEROPLANE SEATING SYSTEMS

ED Decision 2022/018/R

- 1.0. Forward- and aft-facing seating systems must meet the requirements of Table 1 of this Appendix. This Appendix prescribes the EASA modifications to the MPS for SAE International’s Aerospace Standard (AS) 8049C, ‘*Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft*’, dated August 2015. When the SAE section *recommends (or suggests, advises, etc.)* something, and it is part of the MPS, the recommendation becomes a *requirement*. In addition, modify AS8049C as follows:

Table 1 — SAE AS8049C

When reading AS8049C	Do the following:
Section 1	Disregard
Section 2	Disregard
Section 3	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 6, replace subsection 3.2.15 by the following:</p> <p><i>3.2.15 Except for rearward-facing seats and seats equipped with multiple anchorage point pelvic restraints (e.g. Y-belts), the pelvic restraint system must be designed such that the vertical angle between the pelvic restraint centre line and the seat reference point (SRP) waterline must range from 35° to 55°. The SRP waterline is a line/plane passing through the SRP parallel to the floor waterline. The pelvic restraint centre line is formed by a line from the pelvic restraint anchorage to a point located 9.75 inches (250 mm) forward of the SRP and 7.0 inches (180 mm) above the SRP waterline. In addition, the pelvic restraint anchorage point(s) must be located no further than 2.0 inches (51 mm) forward of the SRP (ref. ARP5526D). See AC 21-34 for additional guidance on acceptable seat belt geometries.</i></p> <p>-----</p> <p>On page 6, replace subsection 3.2.17 by the following:</p> <p><i>3.2.17 Safety belt restraint systems must meet the requirements of E/TSO-C22g ‘Safety Belts’ or E/TSO-C114 ‘Torso Restraint Systems’ (or later EASA/FAA revisions), and each must be equipped with a metal-to-metal latching device.</i></p> <p>-----</p> <p>On page 7, for Type B seats, replace subsection 3.3.1 by the following:</p> <p><i>3.3.1 The materials must be suitable and durable for use in aircraft seats, as established by tests or experience, accounting for statistical variability in the material and the effects of environmental conditions such as the temperature and humidity expected in service. Materials which could affect the safety of the aircraft or the occupants must be controlled to ensure the strength and other properties defined in the design data. Special factors must be developed for application per subsection 4.1 for each part of the structure whose strength is:</i></p> <p><i>(1) uncertain;</i></p> <p><i>(2) likely to deteriorate in service before normal replacement; or</i></p>

When reading AS8049C	Do the following:
	<p><i>(3) subject to appreciable variability due to uncertainties about:</i></p> <ul style="list-style-type: none"> <i>i. the manufacturing processes; or</i> <i>ii. the inspection methods.</i> <p><i>The use of materials such as fibre-reinforced materials (i.e. composites) used to fabricate components of the seat within the primary load path (to include seat backs and pans) requires unique considerations for material and process control, generation of design values, consideration of the environmental and variability factors, identification and substantiation of potential damage, developing criteria to assess the post-impact structural integrity, and creating instructions for continued airworthiness (ICAs). Applicants may follow the relevant guidance in AC 20-107B when addressing these concerns.</i></p> <p><i>Test plans to develop design allowable data and special factors or alternative justification for the use of service history must be approved in advance by EASA.</i></p> <p><i>Note: An ETSO approval does not include installation approval in an aircraft, and special conditions may be required to gain installation approval if the design includes new and novel materials and processes (e.g. composite materials, bonded joints, or additive manufacturing) in the primary load path.</i></p> <p><i>Applicants for seat installations under CS-27 and CS-29 should ensure that all the composite seat components comply with the relevant regulatory requirements for material and process control, and that the manufacturing and service instructions are adequate to ensure that the seat complies with the crashworthiness requirements throughout its life.</i></p> <p>-----</p> <p>On page 7, for Type A-T, Type C seats (all the aircraft categories detailed in 1(1)c of this ETSO), replace subsection 3.3.1 by the following:</p> <p><i>3.3.1 The materials must be suitable and durable for use in aircraft seats, as established by tests or experience, accounting for statistical variability in the material and the effects of environmental conditions such as the temperature and humidity expected in service. Materials which could affect the safety of the aircraft or the occupants must be controlled to ensure the strength and other properties defined in the design data. Special factors must be developed for application per subsection 4.1 for each part of the structure whose strength is:</i></p> <ul style="list-style-type: none"> <i>(1) uncertain;</i> <i>(2) likely to deteriorate in service before normal replacement; or</i> <i>(3) subject to appreciable variability due to uncertainties about:</i> <ul style="list-style-type: none"> <i>i. the manufacturing processes; or</i> <i>ii. the inspection methods.</i> <p><i>For the use of materials such as fibre-reinforced materials (i.e. composites) used to fabricate components of the seat within the primary load path (to include seat backs and pans) apply Table 5 of Appendix 1 of this ETSO.</i></p> <p><i>Note: An ETSO approval does not include installation approval in an aircraft, and special conditions may be required to gain installation approval if the design includes new and novel materials and processes (e.g. composite materials, bonded joints, or additive manufacturing) in the primary load path.</i></p>

When reading AS8049C	Do the following:
	<p><i>Applicants for seat installations under CS-23 and CS-25 should ensure that all the composite seat components comply with the relevant regulatory requirements for material and process control, and that the manufacturing and service instructions are adequate to ensure that the seat complies with the crashworthiness requirements throughout its life.</i></p> <p>-----</p> <p>On page 7, replace subsection 3.3.2 by the following:</p> <p><i>3.3.2 The methods and processes used for fabrication and assembly must produce consistently sound seats. If a fabrication process requires close control to reach this objective, the process must be performed in accordance with the design data (e.g. process specification).</i></p> <p>-----</p> <p>On page 7, add subsection 3.3.4 as follows:</p> <p><i>3.3.4 Each part of the seat structure must be protected against deterioration or loss of strength in service due to any cause (such as corrosion, wear, impact damage, environmental degradation, etc.) and have provisions for ventilation and drainage where necessary for protection.</i></p> <p>-----</p> <p>On page 7, replace subsection 3.4.1 by the following:</p> <p><i>3.4.1 All the materials used on seats must meet the requirements of subsection 3.4.1.1, 3.4.1.2, 3.4.1.3, or 3.4.1.4. The definition and use of parts that are considered small parts that would not contribute significantly to the propagation of a fire must be approved in advance by EASA. When inflatable materials are used (i.e. material used in the fabrication of inflatable restraints, airbags, etc.), the inflatable material must meet the flammability requirements of CS-25, Appendix F, Part I (a)(iv).</i></p> <p><i>Note: Inflatable materials used in devices to increase occupant safety are a novel or unusual design feature that may be subject to special conditions and additional certification requirements for installation approval. The fire protection properties of the material may be demonstrated by following FAA Policy Statement PS</i></p> <p><i>ANM-25.853-01 R2, ‘Flammability Testing of Interior Materials’ (dated 3 July 2013) or tested in accordance with the applicable chapter of the Aircraft Materials Fire Test Handbook — DOT/FAA/AR-00/12.</i></p> <p>-----</p> <p>Add subsections 3.4.1.1, 3.4.1.2, 3.4.1.3, and 3.4.1.4 as follows:</p> <p><i>3.4.1.1 All the materials used on Type A-T and Type B-T seats must be tested in accordance with the procedures, and meet the fire protection requirements, of CS-25, Appendix F, Part I, except where the material properties, size and quantity would not create or propagate a cabin fire. The fire protection properties of the material may also be demonstrated by following FAA Policy Statement PS-ANM-25.853-01 R2, ‘Flammability Testing of Interior Materials’ (dated 3 July 2013) or tested in accordance with the Aircraft Materials Fire Test Handbook — DOT/FAA/AR-00/12, Chapter 1 or 3.</i></p> <p><i>3.4.1.2 All the materials used on Type B-N, Type C-N, Type C-NL1, Type C-NL2, Type C NL3, Type C-U, and Type C-A seats must have flame-resistant properties.</i></p>

When reading AS8049C	Do the following:
	<p><i>The materials must be tested to and must meet the requirements of paragraph 8.b of FAA Advisory Circular (AC) 23-2A Change 1, ‘Flammability Tests’ (dated 15 February 2013).</i></p> <p><i>3.4.1.3 All the materials used on Type C-C seats must be tested in accordance with the test procedures of CS-23, Appendix F, Part I (Amendment 5) or the Aircraft Materials Fire Test Handbook — DOT/FAA/AR-00/12, Chapter 1 or 3, and must meet the following flammability performance requirements:</i></p> <p><i>3.4.1.3.1 The panels, walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing. The average burn length may not exceed 6 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 3 seconds after falling.</i></p> <p><i>3.4.1.3.2 Floor coverings, textiles (including draperies and upholstery), seat cushions, padding, decorative and non-decorative coated fabrics, leather, electrical conduits, transparencies, moulded and thermoformed parts, and trim strips (decorative and chafing) that are constructed of materials not covered in subsection 3.4.1.3.3 must be self-extinguishing. The average burn length may not exceed 8 inches and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.</i></p> <p><i>3.4.1.3.3 Acrylic windows and signs, parts constructed in whole or in part of elastomeric materials, seatbelts, and shoulder harnesses may not have an average burn rate greater than 2.5 inches per minute.</i></p> <p><i>3.4.1.3.4 Except for electrical wire cable insulation, and for small parts where the material properties, size, and quantity would not create or propagate a cabin fire, the materials in items not specified in subsections 3.4.1.3.1 through 3.4.1.3.3 may not have a burn rate greater than 4.0 inches per minute.</i></p> <p><i>3.4.1.4 All the materials used on Type C-NL4 seats must be self-extinguishing and tested in accordance with the test procedures of CS-23, Appendix F (Amendment 4), or the Aircraft Materials Fire Test Handbook — DOT/FAA/AR-00/12, Chapter 1.</i></p> <p>-----</p> <p>On page 8, replace subsection 3.4.2 by the following:</p> <p><i>Cushion systems on Type A-T and Type B-T passenger, flight attendant and observer seats must meet the fire protection requirements of CS-25, Appendix F, Part II. The fire protection properties of the material may also be demonstrated by following FAA AC 25.853-1, ‘Flammability Requirements for Aircraft Seat Cushions’ (dated 17 September 1986), tested in accordance with the Aircraft Materials Fire Test Handbook — DOT/FAA/AR-00/12, Chapter 7 and, where applicable, FAA Policy Statement ANM 115 07-002, ‘Policy Statement on Certification for Flammability of Lightweight Seat Cushions’ (dated 16 April 2009).</i></p> <p>-----</p> <p>On page 8, replace subsection 3.4.3 by the following:</p>

When reading AS8049C	Do the following:																																								
	<p>The insulation on electrical wires and cables on all Type A, Type B and Type C seats must meet the fire protection requirements of CS-25, Appendix F, Part I, (a)(3), or the Aircraft Materials Fire Test Handbook — DOT/FAA/AR-00/12, Chapter 4.</p>																																								
Section 4	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 14, revise column 5 in Table 4A as follows:</p> <table border="1" data-bbox="523 589 1072 891"> <thead> <tr> <th colspan="2">Type C-C and C-NL4 Seats</th> </tr> <tr> <th colspan="2">General Aviation (Commuter Category)</th> </tr> <tr> <th colspan="2">General Aviation (Normal Category Level 4)</th> </tr> <tr> <th>Factor</th> <th></th> </tr> </thead> <tbody> <tr> <td>9.0 ⁽⁴⁾</td> <td></td> </tr> <tr> <td>1.5 ⁽²⁾⁽⁴⁾</td> <td></td> </tr> <tr> <td>3.0 ⁽²⁾⁽⁴⁾</td> <td></td> </tr> <tr> <td>6.0 ⁽²⁾⁽⁴⁾</td> <td></td> </tr> <tr> <td>N/A</td> <td></td> </tr> <tr> <td colspan="2">170 pounds (77 kg) ⁽⁵⁾</td> </tr> </tbody> </table> <p>-----</p> <p>On page 14, add an additional column in Table 4A as follows:</p> <table border="1" data-bbox="523 1010 1098 1335"> <thead> <tr> <th colspan="2">Type C-NL1, NL2, and NL3 Seats</th> </tr> <tr> <th colspan="2">General Aviation</th> </tr> <tr> <th colspan="2">(Normal Category Level 1, Level 2, and Level 3)</th> </tr> <tr> <th>Factor</th> <th></th> </tr> </thead> <tbody> <tr> <td>9.0 ⁽⁴⁾</td> <td></td> </tr> <tr> <td>1.5 ⁽²⁾⁽⁴⁾</td> <td></td> </tr> <tr> <td>3.0 or 4.5 ⁽²⁾⁽⁴⁾</td> <td></td> </tr> <tr> <td>3.0 ⁽²⁾⁽⁴⁾</td> <td></td> </tr> <tr> <td>N/A</td> <td></td> </tr> <tr> <td colspan="2">170 pounds (77 kg) or 190 pounds (86 kg) ⁽⁵⁾⁽⁶⁾</td> </tr> </tbody> </table> <p>-----</p> <p>On page 14, replace Note (6) in Table 4A by the following:</p> <p><i>Use a 190-pound occupant weight to account for the weight of a parachute.</i></p> <p>-----</p> <p>On page 14, replace Note (4) in Table 4A by the following:</p> <p><i>For Type C seats, the load factors may need to be increased according to CS 23.562(d), or CS 23.2270, Amendment 5.</i></p> <p>-----</p> <p>On page 14, replace Note (2) in Table 4A by the following:</p> <p><i>Elective: Increase these load factors as necessary for aircraft-model-specific flight and ground loads. All the seat adjustment positions and occupancy variations, including those used in flight, must be evaluated when using these increased load factors. Load factors at directions other than those prescribed by Table 4A as modified by this Appendix may be tested. Document the increased load factors and report them. You must also mark them on the ETSO placard (see Appendix 2, paragraph (d) of ETSO-C127c).</i></p>	Type C-C and C-NL4 Seats		General Aviation (Commuter Category)		General Aviation (Normal Category Level 4)		Factor		9.0 ⁽⁴⁾		1.5 ⁽²⁾⁽⁴⁾		3.0 ⁽²⁾⁽⁴⁾		6.0 ⁽²⁾⁽⁴⁾		N/A		170 pounds (77 kg) ⁽⁵⁾		Type C-NL1, NL2, and NL3 Seats		General Aviation		(Normal Category Level 1, Level 2, and Level 3)		Factor		9.0 ⁽⁴⁾		1.5 ⁽²⁾⁽⁴⁾		3.0 or 4.5 ⁽²⁾⁽⁴⁾		3.0 ⁽²⁾⁽⁴⁾		N/A		170 pounds (77 kg) or 190 pounds (86 kg) ⁽⁵⁾⁽⁶⁾	
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When reading AS8049C	Do the following:
	<p>-----</p> <p>On page 17, replace Note (1) in Table 4C by the following:</p> <p><i>Applicable only to Type C-N, C-NL1, C-NL2, C-NL3, C-NL4, Type C-U, Type C-C, and Type C-A seats.</i></p>
Section 5	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 18, replace Section 5.0 by the following:</p> <p><i>The initial qualification of a seat shall be performed by static and dynamic tests. Computer modelling analytical techniques may be used as established by AC 20-146, Revision A, paragraph 2.5. The use of computer modelling analytical techniques must be established by the applicant and accepted by EASA.</i></p> <p>-----</p> <p>On page 22, replace subsection 5.1.9 by the following:</p> <p><i>The load due to any item of mass, including the seat that is not restrained by the occupant restraint system, must be applied in a representative manner at the CG of the mass, or with a corrective factor applied in a conservative manner relative to the CG of the item of mass.</i></p> <p><i>Note: If the retention of an item of mass attached to the seat is demonstrated by the dynamic qualification tests of subsection 5.3, no further demonstration of retention for the forward and downward static conditions is required; however, a demonstration of retention of items of mass for the side, up, and aft static conditions is still required.</i></p> <p>-----</p> <p>On page 24, replace subsection 5.3 by the following:</p> <p>5.3 Dynamic Qualification Tests</p> <p><i>This section specifies the dynamic tests to satisfy the requirements of this document.</i></p> <p><i>For Type A seats: You may demonstrate compliance with the dynamic test procedures and documentation of subsection 5.3.1 ‘Dynamic Impact Test Parameters’ to subsection 5.3.9.2 ‘Impact Pulse Shape’ of SAE AS8049C by the equivalent procedures of FAA AC 25.562-1B, Change 1. The equivalent method must be included in the document that contains the installation instructions and limitations, and must be used consistently when evaluating all the variations of the seat and any subsequent changes to the seat design.</i></p> <p><i>For Type A seats: You can also use the simplified procedures for head injury criteria (HIC) outlined in AC 25.562-1B, Change 1, instead of the test conditions in AS8049C subsection 5.3.6.2.</i></p> <p><i>Except for Hybrid III ATDs (49 CFR Part 572, Subpart E) modified in accordance with SAE Technical Paper 1999-01-1609, the use of an equivalent ATD must be established by the applicant and accepted by EASA.</i></p> <p>-----</p> <p>Add subsection 5.3.1.5 as follows:</p> <p>5.3.1.5 Sensor-driven restraint systems</p>

When reading AS8049C	Do the following:
	<p><i>If a sensor-driven restraint system (e.g. an airbag, inflatable restraint, seatbelt pre tensioner, deployable panel) is used as part of the seating system, additional threshold testing must be conducted to ensure that the structural and occupant injury criteria continue to be met when the sensor-driven restraint system does not activate. The threshold test must test the seating system at an inertial load no less than the maximum dynamic impact acceleration allowed by the sensor-driven restraint system without activating.</i></p> <p><i>For seats with sensor-driven restraint systems, it must be shown that the system will activate and provide protection under emergency landing conditions where it is necessary to prevent serious injury to the occupants. The system must provide a consistent approach to injury protection throughout the range of occupants (2-year-old child to 95th percentile male) whether it is designed to manage injury parameters (e.g. HIC, Nij, neck rotation, etc.) or occupant motion. The system must be included in each test. If sensor driven restraint systems influence the test results, they must be active during the test.</i></p> <p><i>Seats that require a sensor-driven restraint system to meet the requirements of this ETSO must include the detailed design definition of the system and any other information required for installation as part of the document that contains the installation instructions and limitations.</i></p> <p><i>Sensor-driven restraint systems may be used to control occupant motion. The intended function of the system must be demonstrated during each applicable test.</i></p> <p>-----</p> <p>On page 35, replace subsection 5.3.3.5(i) by the following:</p> <p><i>(i) The side-facing seat requirements are defined in Table 3 of the Appendix to this ETSO.</i></p> <p>-----</p> <p>On page 35, add subsection 5.3.3.5(j) as follows:</p> <p><i>(j) The oblique-facing seat requirements are defined in Table 4 of the Appendix to this ETSO.</i></p> <p>-----</p> <p>On page 39, replace subsection 5.3.4.1(a) by the following:</p> <p><i>(a) Sled or drop tower vehicle acceleration data measurements must be in accordance with the Channel Class 60 requirements.</i></p> <p>-----</p> <p>On page 42, replace subsection 5.3.6.3 by the following:</p> <p><i>5.3.6.3 If a non-symmetrical upper torso restraint system (such as a single diagonal shoulder belt) is used in a system, it must be installed in the test fixture in a position representative of that in the aircraft.</i></p> <p><i>For a forward-facing seat equipped with a single diagonal shoulder belt, the Test 2 yaw direction must be selected to address the direction which would increase the likelihood of the occupant not being restrained (typically over the trailing shoulder) and assessment of the maximum upper torso restraint load, which requires testing in the critical structural direction. In some cases, this may require testing in both directions of yaw.</i></p>

When reading AS8049C	Do the following:
	<p>For a Type A seat, testing per AC-25.562-1B, Change 1, paragraph 3.b(3), may be used.</p> <p>-----</p> <p>On page 44, replace subsection 5.3.8.3(a) by the following:</p> <p><i>(a) Prior to seating the ATD, all the seat adjustments and controls must be set as indicated in 5.3.6.4. To the extent that they influence the injury criteria, all the seat adjustments and controls should be in the design position intended for a 50th percentile male occupant. If seat restraint systems are being tested that are to be used in applications where special requirements dictate their position for landing or take-off, those positions should be used in the tests.</i></p> <p>-----</p> <p>On page 44, replace subsection 5.3.8.3(d) and (e) by the following:</p> <p><i>(d) Once all lifting devices have been removed from the ATD, it should be rocked slightly to settle it in the seat.</i></p> <p><i>(e) The ATD's knees should be separated by approximately 4 inches (100 mm).</i></p> <p>-----</p> <p>On page 47, replace subsection 5.3.9.4 by the following:</p> <p>5.3.9.4 Head Injury Criteria (HIC)</p> <p><i>Head Injury Criterion (HIC) data for determining the HIC needs to be collected during the tests discussed in this document only if the ATD's head is exposed to impact on aircraft interior features (not including the floor or the ATD's own leg) during the test. The HIC is calculated according to the following equation:</i></p> <div data-bbox="523 1198 1053 1332" data-label="Equation-Block"> $HIC = \left[(t_2 - t_1) \left\{ \frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a(t) dt \right\}^{2.5} \right]_{max}$ </div> <p><i>where t1 and t2 are any two points in time (in seconds) during the head impact, and a(t) is the resultant head acceleration (expressed in g) during the head impact.</i></p> <p><i>The HIC is a method for defining an acceptable limit, i.e. the maximum value of the HIC must not exceed 1000 for head impact against interior surfaces in a crash. The HIC is invariably calculated by computer-based data analysis systems, and the discussion that follows outlines the basic method for computation. The HIC is based on data obtained from three mutually perpendicular accelerometers installed in the head of the ATD in accordance with the ATD specification. Data from these accelerometers is obtained using a data system conforming to Channel Class 1000, as described in SAE J211. Only the data taken during head impact with the aircraft interior needs to be considered; this is usually indicated by a rapid change in the magnitude of the acceleration data. Film of the test may show head impacts that can be correlated with the acceleration data by using the time base common to both the electronic and photographic instrumentation. Simple contact switches that do not significantly alter the surface profile could also be used to define the initial contact time.</i></p> <p><i>In many cases, a full system sled test to evaluate specific occupant injury conditions may not be needed to evaluate a redesign of the seat system that affects only the HIC. In such cases, the photometric head path data can be</i></p>

When reading AS8049C	Do the following:
	<p><i>gathered and used to ensure that no contact will occur, or to define the head angle and velocity at impact. This data can then be used in a component test of severity comparable to the whole-system sled test. Other factors, such as the inertial response of the impact target, must be accounted for in the component test conditions so that the impact condition is representative. The component testing methods used for HIC measurements must be demonstrably equivalent to whole-system sled test HIC measurements.</i></p> <p><i>Additionally, a seat may be designed for use in multiple locations where head contact against a range of unknown bulkhead targets is anticipated (e.g. front-row seats). For these seats, the HIC may be measured using a representative impact target mounted in front of the seat at the installation setback, or a range of setbacks. This target will represent typical fixtures such as galleys, partitions, lavatories, and closets, and its stiffness will be representative for those monuments. If contact occurs, the HIC must not exceed 1000.</i></p> <p><i>When the seat is evaluated against unknown bulkhead targets using a representative impact target, the detailed design definition of the impact target, and any other information required for the installation (e.g. the stiffness), must be included as part of the document that contains the installation instructions and limitations.</i></p> <p><i>When considering multiple seat pitches or setbacks from interior components, or considering a range of occupant statures, the HIC evaluation should be made when a solid head strike occurs during the dynamic test. Regardless of whether the head contact is a solid strike or a glancing blow, the HIC value must be calculated and must not exceed 1000.</i></p> <p><i>The ATD head should not sweep by the seat back/interior component with no apparent interruption in the head path movement, even though there may have been contact on the top of the head.</i></p> <p><i>The following evaluations of the test data can be used to determine whether a solid head strike has occurred:</i></p> <ol style="list-style-type: none"> <li data-bbox="598 1332 1396 1456"><i>a. A review of the dynamic test videos and evaluation of the ATD head path movement, head contact, and head reaction at contact should be made. There should be a noticeable change in the head movement at the time of contact.</i> <li data-bbox="598 1473 1396 1601"><i>b. A review of the post-test photographs and an evaluation of the ATD head contact markings should be made. The contact marks (see subsection 5.3.8.4) should show that the area of the ATD head contact was not only across the top of the head.</i> <li data-bbox="598 1619 1396 2004"><i>c. A review and evaluation of the ATD head acceleration plots (x, y, z and resultant) should be made. The resultant ATD head acceleration plot during the time period in which the critical HIC calculation was made should show an abrupt change in the head acceleration. In addition, the individual direction ATD head acceleration plots should be evaluated to determine which component direction contributes primarily to the resultant head acceleration. A primary contribution of the x-component indicates more of a solid head strike occurring. A primary contribution of the z-component indicates more of a top of the head contact and the top of the head moving forward into the seat/interior component as the head is sweeping by the seat/interior component.</i>

When reading AS8049C

Do the following:

On page 49, replace subsection 5.3.9.9 by the following:

5.3.9.9 Femur load (type A-T seats): Data for measuring femur loads can be collected in the tests discussed in this document if the ATD's legs contact seats or other structures. The maximum compressive load in the femur can be obtained directly from a plot or listing of each femur load transducer output. If the value of peak acceleration measured in the test exceeds the level given in Figure 6, 7A, or 7B, the femur load measured in the test may be adjusted by no more than 10 % by multiplying the measured values by the ratio of the peak acceleration given in Figure 6, 7A, or 7B, divided by the measured peak acceleration, if necessary. Data need not be recorded in each individual test if a rational comparative analysis is available for showing compliance. For large clearance installations (distance from the seat reference point (SRP) to the strike target is greater than 40 inches (100 cm) nominally), no data is necessary to substantiate the femur loads; however, appropriate limitations must be included in the document that contains the installation instructions and limitations.

Extensive seat testing has shown that the femur loading criterion is not usually exceeded; therefore, recording femur loads may not be necessary during the test if you can show compliance by rational comparative analysis using data from previous tests. However, the rational analysis must show that the testing applies to the seat design, and you must include appropriate limitations in the document that contains the installation instructions and limitations.

On page 49, replace subsection 5.3.9.12 by the following:

5.3.9.12 Seat Attachment Reactions

The data of the maximum loads imposed on the tracks or fittings at all the seat attachment points must be collected and recorded (see subsection 5.3.3.2). This data can be obtained directly from the output of the load cell at each attachment location.

On page 50, replace subsection 5.3.10.1.1(e) and (f) by the following:

(e) A statement confirming that the data collection was performed in accordance with the requirements of this document, or a detailed description of the actual procedure used and a technical analysis showing equivalence to the requirements of this document.

Note: Unless otherwise specified in the ETSO, you must obtain EASA approval for any deviations from the requirements of the AS8049C subsections identified as the MPS of this ETSO.

(f) The manufacturer, governing specification, serial number, and test weights of the ATDs used in the tests, and a description of any modifications or repairs performed on the ATDs that could cause them to deviate from the specification.

Note: Unless otherwise specified in the ETSO, you must obtain EASA approval for any deviations from the requirements of the AS8049C subsections identified as the MPS of this ETSO.

Add subsection 5.4.11 as follows:

When reading AS8049C	Do the following:
	<p>5.4.11 <i>If the ATD is exposed to impact with aircraft interior features during the test:</i></p> <p>(a) <i>if the test uses a Hybrid II ATD, then:</i></p> <p>(1) <i>the interaction must not rotate the head about its vertical axis, relative to the torso, by more than 105 degrees in either direction from forward facing, or introduce a feature or surface that produces concentrated loading on the neck, and</i></p> <p>(2) <i>the head centre of gravity must not stop sliding down the seat back for more than 10 milliseconds while the torso is still moving downward; or</i></p> <p>(b) <i>if the test uses an FAA Hybrid III or equivalent, then:</i></p> <p>(1) <i>the interaction must not rotate the head about its vertical axis, relative to the torso, by more than 105 degrees in either direction from forward facing, or introduce a feature or surface that produces concentrated loading on the neck, and</i></p> <p>(2) <i>the N_{ij} (calculated in accordance with 49 CFR 571.208) must be below 1.0, where $N_{ij} = (F_z/F_{zc}) + (M_{oc}/M_{yc})$, and the N_{ij} critical values are:</i></p> <p style="margin-left: 40px;">i. $F_{zc} = 1\,530$ lbf for tension</p> <p style="margin-left: 40px;">ii. $F_{zc} = 1\,385$ lbf for compression</p> <p style="margin-left: 40px;">iii. $M_{yc} = 229$ lbf ft in flexion</p> <p style="margin-left: 40px;">iv. $M_{yc} = 100$ lbf ft in extension</p> <p>(3) <i>the peak upper neck F_z is less than 937 lbf in tension and 899 lbf in compression.</i></p> <p>(c) <i>If testing is first conducted with the Hybrid II ATD and the interaction could cause serious human injury as defined in paragraph (a)(2) (e.g. chin snagging on a horizontal seat back feature), then subsequent testing may be accomplished with the FAA Hybrid III or equivalent. To show acceptability using the FAA Hybrid III or equivalent:</i></p> <p>(1) <i>the ATD must be positioned so that the chin will strike above the seat feature which caused the unacceptable interaction in the initial Hybrid II ATD test,</i></p> <p>(2) <i>testing must demonstrate the same behaviour as shown with the Hybrid II ATD in order for the safety demonstration to be valid, and</i></p> <p>(3) <i>the loads in (b)(1) and (b)(2) must be reported.</i></p> <p>(4) <i>If the test demonstrates an acceptable interaction per paragraph (a)(1), and the loads in (b)(1) and (b)(2) are below the limits, no further substantiation is necessary.</i></p> <p>(5) <i>Due to differing chin shapes and neck stiffnesses, the chin of the FAA Hybrid III ATD or equivalent may or may not hang up on the seat feature. If the head stops, the stop time may</i></p>

When reading AS8049C	Do the following:
	<i>exceed 10 ms provided that the loads in (b)(1) and (b)(2) are not exceeded.</i>
Section 6	Disregard and refer to paragraph 4 of this ETSO.
Section 7	Disregard
Appendix A	No Changes

2.0 This paragraph prescribes the MPS for SAE International ARP5526D ‘Aircraft Seat Design Guidance and Clarifications’, dated July 2015. When the SAE section recommends (or suggests, advises, etc.) something, and it is part of the MPS, the recommendation becomes a requirement. In addition, modify ARP5526D as follows:

Table 2 — SAE ARP5526D

When reading ARP5526D	Do the following:
Section 1	Disregard
Section 2	Disregard
Section 3	<p>Disregard all the subsections in Section 3 not listed below. The following subsections apply as modified:</p> <p>On page 7, replace subsection 3.2.2. by the following:</p> <p><i>3.2.2 Recommended Practice</i></p> <p><i>Seatbelt misalignment is a condition where the seatbelt and/or shackle is positioned to give the impression that the belt has been properly tightened, when in fact there is slack in the system or the shackle is positioned so that it will not carry the force generated in an emergency landing or turbulence condition.</i></p> <p><i>Restraint system anchorages should provide self-aligning features. If self-aligning features are not provided, the static and dynamic tests in this document should be conducted with the restraints and anchorages positioned in the most adverse configuration allowed by the design. The anchorage system must minimise the possibility of incorrect installation or inadvertent disconnection of the restraints.</i></p> <p><i>The seat belt installation should not appear to the belted occupant to be properly adjusted (snug) while there is significant (2.54 cm (1 inch) or more) slack in the system, which may pay out in an emergency landing situation. For example, the belt installation should not be able to be caught between seat features such that the occupant would not know that there was slack in the belt, which could allow the occupant to slide forward during an emergency landing or turbulence.</i></p> <p><i>When the seat system is adjusted to and from all in-flight positions, it must not allow the occupant restraint to become trapped or damaged in the seat structure or mechanisms.</i></p> <p><i>To evaluate this requirement, translate the unoccupied seat through all the adjustable positions with the restraint system unfastened and the seat cushions installed. Evaluate the size and location of any gap created for the potential of the unfastened restraint to become trapped or damaged with subsequent seat motion.</i></p> <p><i>To test the installed seat belt for misalignment, the seat should be positioned in its taxi, take-off and landing conditions. Installations on seats having bottom</i></p>

When reading ARP5526D	Do the following:
	<p><i>cushions that can be removed or incorrectly repositioned without tools should be evaluated with the cushions installed, removed and incorrectly repositioned. The belt and shackle combination should be manipulated with one hand in an attempt to place the restraint in a non-design configuration where it could carry the seatbelt adjustment forces. Particular effort should be made to place the restraint in a position that the restraint forces would not be applied to the hook of the shackle in the same manner as they would be applied in a straight tension pull on the belt. Attempts should be made with the restraint in its normal shape, a single twist of the webbing and/or a single fold of the webbing. Typical areas around the restraint shackle that should be checked are the plastic shrouding around the armrest, the hydraulic seat recline device, the seat pan, anti-rotation brackets/stops, seat pan supports and exposed fasteners. If a condition of potential misalignment is identified, the seatbelt and shackle, in that condition, should be loaded by a restorative force of 22.2 N (5 pounds) applied through the belt in the direction in which it would be loaded in the emergency landing or turbulence situation. If the load is carried in the misaligned condition, the design is unacceptable. The examples in subsection 3.2.3 illustrate various misalignment conditions that have been found to be unacceptable, as indicated. These examples are not intended to be all inclusive.</i></p> <p><i>To test the belt for inadvertent disengagement, where disengagement is defined as the separation of the restraint’s attachment fitting from the seat structure, the belt should be tested in all orientations with the seat in the taxi, take-off and landing conditions with the seat cushions installed. Interactions with belts in adjacent seats, where the belts could be inadvertently crossed and used by occupants in those adjacent seats, must be evaluated for the possibility of disengagement.</i></p> <p>-----</p> <p>On page 13, replace subsection 3.3.2 by the following:</p> <p>3.3.2 Recommended Practice</p> <p><i>The terms ‘life preserver’, ‘life vest’ and ‘life jacket’ may be used interchangeably. When life preserver stowage provisions are included as part of the seat design, the stowage provisions must provide access to a life preserver for each seating position. The life preserver stowage must be designed and located such that the requirements of this section are met. The installation, operating and maintenance instructions must also reflect the requirements of this section. For example, the installation instructions must account for the allowable life preserver weight and size, and marking requirements, as well as the required unobstructed area to remove the life preserver from the container. Furthermore, the operating instructions must report the detailed content of the simulated preflight briefing and any special instructions for unique aspects of the operation of the design that should be considered for operational use and continued performance.</i></p> <ol style="list-style-type: none"> <li data-bbox="528 1749 1402 1906">a. <i>The life preserver must be restrained under all applicable loading conditions; i.e. the retention device must not allow the preserver to come free during emergency landing static and dynamic conditions, taxi, take-off, landing, turbulence, and during stowage and removal of underseat baggage.</i> <li data-bbox="528 1928 1402 2016">b. <i>Any life preserver locating placard installed on the seat must accurately state the location of the life preserver and be adequately marked per 3.8.2 of ARP5526D, as modified by this Appendix (e.g. ‘LIFE PRESERVER</i>

When reading ARP5526D	Do the following:
	<p><i>UNDER CENTRE ARMREST’). For life preserver locations other than under the seat or under a console between the seats, mark ‘LIFE PRESERVER’ or ‘LIFE PRESERVER INSIDE’ on the container or compartment, unless the location is identified with a pull strap. Pull straps must be red or labelled ‘PULL’ or ‘PULL FOR LIFE PRESERVER’ in a contrasting colour.</i></p> <p><i>A symbolic placard may be used in lieu of text provided it has been shown to be comprehensible to the flying public. For seats intended to be installed in sequential rows, a placard may be fixed on the seat back, stating the location of the life preserver for the occupant seated behind.</i></p> <p>c. <i>The retrieval path of the life preserver must be free of obstructions due to movement of the life preserver container, and/or seat or aircraft components (e.g. seat legs, cushions, baggage bars, shrouds, etc.) when the seat is in the configuration for taxi, take-off and landing.</i></p> <p>d. <i>The life preserver stowage must not present any sharp edges or points that could damage the life preserver or cause injury to the occupants.</i></p> <p>e. <i>For underseat pan storage on passenger seats (excluding centre console storage):</i></p> <ol style="list-style-type: none"> 1) <i>a pull strap must be connected to the life preserver, or a pull strap or latch must be on the compartment opening, such that when the strap or latch is pulled, the preserver is presented on the strap or the occupant can reach into the compartment to retrieve the life preserver;</i> 2) <i>the life preserver must be located no more than 3 inches (7.62 cm) aft of the front edge of the seat bottom (i.e. the seat frame or cushion), whichever is further forward;</i> 3) <i>unless limited by seat cushions or structures (e.g. the seat leg, floor, etc.), designs utilising a pull strap must permit retrieval of the life preserver when pulled from any angle between:</i> <ol style="list-style-type: none"> a) <i>45 degrees up and 50 degrees down from the horizontal plane,</i> b) <i>45 degrees left and 45 degrees right from the container centre line;</i> 4) <i>for designs utilising a pull strap, normal seat operation or underseat baggage storage activities must not sweep the pull strap into an unreachable location;</i> 5) <i>the life preserver container, or compartment, as installed on the seat must protect the life preserver from inadvertent damage from normal passenger movements such as the stowage and removal of underseat baggage.</i> <p>f. <i>Demonstrate that the life preserver is within easy reach of, and may be readily removed by a seated and belted occupant (shoulder strap(s) may be removed prior to demonstration), for all seat orientations and installations that are intended for use during taxi, take-off and landing. In lieu of an actual life preserver, a representative object (e.g. in size and weight) may be utilised for testing. The evaluation to quickly retrieve the preserver is to begin with the occupant in the seated position, hands in their lap. Timing begins with the movement of their hand(s) from their lap to reach for the preserver, and ends with the occupant having the</i></p>

When reading ARP5526D	Do the following:
	<p><i>preserver in their hand(s) and fully removed from the stowage container. It does not include the time for the occupant to return to the upright position, to remove a pull strap from the preserver (if used) or to open the preserver package provided by the preserver manufacturer. Test the critical configuration(s) (including the minimum approved seat pitch for passenger seats, and the most confined surrounding area for the flight attendant and cockpit seats) to demonstrate retrieval in less than 10 seconds by a minimum of 5 test subjects with a success rate of no less than 75 per cent. The test must evaluate three anticipated occupant test subject size categories: the 5th, 50th and 95th percentile. At least one occupant from each size category must demonstrate successful retrieval within 10 seconds. The test subjects for either the 5th or 95th percentile occupant category must not exceed 40 % of the overall test subject population.</i></p> <ol style="list-style-type: none"> 1) <i>For passenger seats, the test subjects must be naïve. For the purpose of this test, naïve test subjects are defined as ones who must have had no experience within the prior 24 months in retrieving a life preserver. The subjects must receive no retrieval information other than a typical preflight briefing. The occupant size categories to be evaluated must be defined as follows:</i> <ol style="list-style-type: none"> a. <i>a 5th percentile occupant is no taller than 60 inches (1.5 m),</i> b. <i>a 50th percentile occupant is at least 63 inches (1.6 m) tall but no taller than 70 inches (1.8 m),</i> c. <i>a 95th percentile occupant weighs at least 244 lb (110.7 kg).</i> 2) <i>For flight attendant and observer seats, the test subjects do not need to be naïve. The occupant size categories to be evaluated must be defined as follows:</i> <ol style="list-style-type: none"> a. <i>a 5th percentile occupant is no taller than 60 inches (1.5 m),</i> b. <i>a 50th percentile occupant is at least 63 inches (1.6 m) tall but no taller than 70 inches (1.8 m),</i> c. <i>a 95th percentile occupant weighs at least 244 lb (110.7 kg).</i> 3) <i>For pilot/co-pilot seats, the test subjects do not need to be naïve. The occupant size categories to be evaluated must be defined as follows:</i> <ol style="list-style-type: none"> a. <i>a 5th percentile occupant is no taller than 62 inches (1.57 m),</i> b. <i>a 50th percentile occupant is at least 63 inches (1.6 m) tall but no taller than 70 inches (1.8 m),</i> c. <i>a 95th percentile occupant weighs at least 244 lb (110.7 kg).</i> <hr style="border-top: 1px dashed black;"/> <p>On page 14, replace subsection 3.3.3 by the following:</p>

When reading ARP5526D	Do the following:
	<p>3.3.3 Recommended Practice for Life Vests in Leg Rests</p> <p>All the requirements under 3.3.2 are applicable to life vests in leg rests, with the following additions:</p> <ul style="list-style-type: none"> — Retrieval of life vest <p>The footrest must not impact on the accessibility of the pull strap or life vest, and must be evaluated in all its positions to ensure that it can be readily moved out of the way.</p> <ul style="list-style-type: none"> — Inadvertent opening <p>The life vest container must not be susceptible to inadvertent opening by a seated occupant's foot or feet.</p> <ul style="list-style-type: none"> — Effect of static and dynamic deformations on life vest retrievability <p>The distance between the life vest container post deformation (plastic deformation only) and the aircraft floor should be such that the retrieval of the life vest will not be obstructed. Seat tracks and track covers should be considered.</p> <hr/> <p>3.6.2 for Type A-T seats, apply as written. 3.7.2 for Type A-T seats, apply as written.</p> <hr/> <p>On page 20, replace subsection 3.8.2 by the following:</p> <p>3.8.2 Recommended Practice</p> <p>Safety placards on occupant seats should be permanently affixed, located such that they cannot be easily obscured, and of a type that cannot be easily erased. The height and colour contrast of the lettering should be sufficient to allow the placard to be read by the intended occupant (e.g. a placard located on the back of the seat should be designed to allow the occupant seated behind to easily read it at the anticipated installed pitch.)</p> <hr/> <p>3.10.2: apply as written. 3.11.2: apply as written.</p> <hr/> <p>On page 29, replace subsection 3.12.2 by the following:</p> <p>3.12.2 Recommended Practice</p> <p>Edges that could cut skin during normal use (including edges on electrical equipment) should be eliminated, and for maintenance, should be minimised. To be considered non injurious, edges that are accessible (as defined in subsection 3.11.2.1) and could cut skin during normal use must meet either of the standards listed below:</p> <ol style="list-style-type: none"> 1. NASA Standard 3000 Volume I (NASA-STD-3000 Vol I), Man-Systems Integration Standards, Revision B, July 1995, Section 6.3.3, <p>or</p> <ol style="list-style-type: none"> 2. UL 1439, Standard for Tests for Sharpness of Edges on Equipment, Edition 4, 26 February 1998, with revisions up to 6/1/2004.

When reading ARP5526D	Do the following:										
	<p><i>In addition, the seat should not have any features whose edges or corners are exposed when deployed and present an impediment to an occupant’s egress (e.g. a cocktail table, seat back and in-arm video, flip-out PCU, ashtray, etc.).</i></p> <p>-----</p> <p>On page 30, replace subsection 3.13.2 by the following:</p> <p><i>3.13.2 This section recommends a test method that demonstrates that items on seats located within the striking radius of the head are not injurious to the occupant of a seat or a nearby seat. The component tests are defined in FAA Policy Memo ANM-03-115-31, and in this context, the striking radius of the head is defined in AC 25-17A, Change 1, Section 25.785.88.b(8), see Figure 88-2.</i></p> <p>3.14.2: apply as written. 3.15.2: apply as written. 3.17.2: apply as written for Type A-T passenger seats.</p> <p>-----</p> <p>On page 46, replace subsection 3.19.2 by the following:</p> <p><i>3.19.2 Recommended Practice</i></p> <p><i>Flight crew seats (cockpit) and restraints should accommodate adult occupants ranging in stature (standing height) from 5 feet 2 inches (1.57 m) to 6 feet 3 inches (1.9 m).</i></p> <p><i>Flight attendant seats and restraints should accommodate adult occupants ranging in stature (standing height) from a 5th percentile female to a 95th percentile male according to Table 7. If required, additional anthropometric measurements can be obtained from the CAESAR study (reference 2.1.2).</i></p> <p>Table 7 — CAESAR anthropometric database sitting and standing heights</p> <table border="1" data-bbox="533 1258 1326 1451"> <thead> <tr> <th></th> <th>CAESAR</th> </tr> </thead> <tbody> <tr> <td>Sitting 5% Female</td> <td>31.86 inches (80.9 cm)</td> </tr> <tr> <td>Sitting 95% Male</td> <td>38.78 inches (98.5 cm)</td> </tr> <tr> <td>Standing 5% Female</td> <td>60.08 inches (152.6 cm)</td> </tr> <tr> <td>Standing 95% Male</td> <td>74.83 inches (190.1 cm)</td> </tr> </tbody> </table> <p>Crew restraint systems, while fastened, should neither significantly impede access to controls nor prevent the crew from performing their duties.</p> <p>-----</p> <p>3.20.2: apply as written. 3.21.2: apply as written. 3.24.2: apply as written.</p> <p>-----</p> <p>On page 50, replace subsection 3.25.2 by the following:</p> <p><i>3.25.2 Recommended Practice</i></p> <p><i>Where the seat being reclined could adversely affect emergency evacuation, the passenger seat recline and control mechanisms should have an override feature so that the reclined seat back may be moved to the upright position without activating the recline control button.</i></p> <p>-----</p>		CAESAR	Sitting 5% Female	31.86 inches (80.9 cm)	Sitting 95% Male	38.78 inches (98.5 cm)	Standing 5% Female	60.08 inches (152.6 cm)	Standing 95% Male	74.83 inches (190.1 cm)
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Sitting 5% Female	31.86 inches (80.9 cm)										
Sitting 95% Male	38.78 inches (98.5 cm)										
Standing 5% Female	60.08 inches (152.6 cm)										
Standing 95% Male	74.83 inches (190.1 cm)										

When reading ARP5526D	Do the following:
	<p>3.32.2: apply as written.</p> <p>In addition, the selected seat reference point (SRP) method must be documented, and must be used consistently when evaluating all variations of the seat ETSOA model and subsequent changes to the seat ETSOA model design.</p> <p>-----</p> <p>Add '3.41.2 Recommended Practice' as follows:</p> <p><i>3.41.2 Recommended Practice</i></p> <p><i>The passenger should not have ready access to the internal contents or electrical connections of any electrical components on the seat.</i></p>

- 3.0. Side-facing seats must meet the requirements of Table 3 of the Appendix to this ETSO. It prescribes the MPS for SAE International AS8049/1B, 'Performance Standards for Side-Facing Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft', dated December 2016. When the SAE section recommends (or suggests, advises, etc.) something, and it is part of the MPS, the recommendation becomes a requirement. For the purpose of meeting the side-facing seat requirements of Table 3 of the Appendix to this ETSO, all the references to 'AS8049C' must be replaced by 'AS8049C as modified by Table 1 of the Appendix to this ETSO'. In addition, SAE AS8049/1B is modified as follows:

Table 3 — SAE AS8049/1B

When reading AS8049/1B	Do the following:
Section 1	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 3, replace subsection 1.1 by the following:</p> <p><i>1.1 Purpose</i></p> <p><i>This SAE Aerospace Standard (AS) defines the Minimum Performance Standards (MPSs), qualification requirements, and minimum documentation requirements for side-facing seats in civil rotorcraft, transport aircraft, and general aviation aircraft. The goal is to achieve comfort, durability, and occupant protection under normal operational loads and to define test and evaluation criteria to demonstrate occupant protection when a side-facing seat/occupant/restraint system is subjected to statically applied ultimate loads and to dynamic test conditions.</i></p> <p>-----</p> <p>On page 3, replace subsection 1.3 by the following:</p> <p><i>1.3 Seat Types</i></p> <p><i>This document covers all passenger and crew seats except pilot and co-pilot seats. Additionally, flight attendant seats are excluded for Type A-T seats.</i></p>
Section 2	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 4, replace subsection 2.1 by the following:</p> <p><i>2.1 Applicable Documents</i></p>

When reading AS8049/1B	Do the following:
	<p><i>This document is explicitly linked with and cannot be used without AS8049C. The requirements of each section of AS8049C apply to this document unless specifically modified by this document. Sections 3 to 7 of this document note only differences between the standards of this document and the standards of AS8049C. Sections 8 and 9 are reserved for future use, and the content specific to side-facing seats is found in Section 10. Test pulse evaluations must use the method defined in AS8049C Appendix A.</i></p>
Section 3	Apply as written
Section 4	Apply as written
Section 5	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 8, subsection 5.3 is modified by adding subsection 5.3.1.5 as follows:</p> <p><i>5.3.1.5 If smaller occupants are permitted to occupy the seat, the range of occupants must include a 2 year-old child up to a 95th percentile male (see 10.8 for further discussion on the range of occupants). This requirement applies whether the sensor-driven restraint system is designed to manage injury parameters (HIC, neck rotation, etc.) or occupant motion.</i></p> <p><i>Side-facing seating systems, including sensor-driven restraint systems, must be shown to meet the occupant injury criteria of subsection 10.7, as modified by this Appendix, throughout the entire range of yaw that encompasses installation angles ± 10 degrees relative to the aircraft longitudinal axis.</i></p> <p><i>If a shoulder belt incorporating an airbag is used, care must be taken when placing the webbing load cell to ensure that an accurate measurement is made and that the load cell does not affect the performance of the airbag.</i></p>
Section 6	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 12, replace Section 6 by the following:</p> <p><i>6. Markings</i></p> <p><i>The requirements prescribed in paragraph 4 of this ETSO are applicable to all side-facing seats, with the exception that side-facing seats must also be identified with the applicable occupant limitations prescribed by subsection 10.8.</i></p>
Section 7	Disregard
Section 10	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 12, add subsection 10.1.2.1 as follows:</p> <p><i>10.1.2.1 When a contactable item is not part of the seat design (e.g. interior furnishing, bulkhead) and is evaluated per subsection 10.1.2, then the detailed design definition of the contactable item evaluated per subsection 10.1.2 and any other information required for the installation (e.g. stiffness) must be included as part of the installation instructions and limitations document.</i></p> <p>-----</p> <p>On page 13, add subsection 10.2.2.1 as follows:</p>

When reading AS8049/1B**Do the following:**

When a contactable item is not part of the seat design (e.g. interior furnishing, bulkhead) and is evaluated per subsection 10.2.2, then the detailed design definition of the contactable item evaluated per subsection 10.2.2 and any other information required for the installation (e.g. stiffness) must be included as part of the installation instructions and limitations document.

On page 13, replace subsection 10.3.1 by the following:

10.3.1 Occupant Simulation

Injury assessments must be evaluated for all the seat places of a multiple occupant seat structure. Injury assessments must be accomplished by performing one test with ES-2re ATD (49 CFR Part 572 Subpart U) at all seat places. Alternatively, these assessments must be accomplished by multiple tests that use an ES-2re in the seat place being evaluated, and a Hybrid II ATD (49 CFR Part 572, Subpart B) or its equivalent in all the seat places forward of the one being assessed, to evaluate the occupant interactions. In this case, the seat places aft of the one being assessed may be unoccupied.

On page 14, add subsection 10.3.2.1 as follows:

10.3.2.1 When a contactable item is not part of the seat design (e.g. interior furnishing, bulkhead) and is evaluated per subsection 10.3.2, then the detailed design definition of the contactable item evaluated per subsection 10.3.2 and any other information required for the installation (e.g. stiffness) must be included as part of the installation instructions and limitations document.

On page 14, add subsection 10.3.3.1 as follows:

10.3.3.1 When a contactable item is not part of the seat design (e.g. interior furnishing, bulkhead) and is evaluated per subsection 10.3.3, then the detailed design definition of the contactable item evaluated per subsection 10.3.3 and any other information required for the installation (e.g. stiffness) must be included as part of the installation instructions and limitations document.

On page 17, replace subsection 10.7, Item 5, by the following:

5. Leg: Axial rotation of the upper-leg (femur) is limited to 35 degrees in either direction from the nominal (pre-test) ATD seated position. This limit only applies to femur axial rotations caused by the lateral (relative to the ATD) swinging action of the lower legs, and not to any rotations caused by other leg articulations or rebound motion. For the purposes of this criteria, the rebound begins when the forward motion of the lower leg has stopped. The rotation can be measured by using video evidence or femur axial rotation sensors on the ATD.

For threshold tests only, if the pulse used for the threshold test has a lower energy than the research pulse used to develop the criteria (see FAA Report DOT/FAA/AM-17/2, 'Supplemental Injury Risk Considerations for Aircraft Side-Facing Seat Certification', dated January 2017), it is not necessary to meet the leg axial rotation requirement of AS8049/1B, subsection 10.7, Item 5, as modified by this Appendix.

- 4.0. Oblique-facing seats must meet the requirements of Table 4 of the Appendix to this ETSO. It prescribes the MPS for SAE International SAE AS6316, ‘Performance Standards for Oblique Facing Passenger Seats in Transport Aircraft’, dated June 2017. When the SAE section recommends (or suggests, advises, etc.) something, and it is part of the MPS, the recommendation becomes a requirement. For the purpose of meeting the oblique-facing seat requirements of Table 4 of the Appendix to this ETSO, all the references to ‘AS8049C’ must be replaced by ‘AS8049C as modified by Table 1 of the Appendix to this ETSO’. In addition, we have also modified AS6316 as follows:

Table 4 — SAE AS6316

When reading AS6316	Do the following:
Section 1	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 3, replace subsection 1.1 by the following:</p> <p><i>1.1 Purpose</i></p> <p><i>This SAE Aerospace Standard (AS) defines the Minimum Performance Standards (MPSs), qualification requirements, and minimum documentation requirements for oblique-facing seats in transport aircraft. The goal is to achieve comfort, durability, and occupant protection under normal operational loads and to define test and evaluation criteria to demonstrate occupant protection when an oblique-facing seat/occupant/restraint system is subjected to statically applied ultimate loads and to dynamic test conditions.</i></p> <p><i>These criteria are limited to seats with an occupant facing direction greater than 18° and no greater than 45° relative to the aircraft longitudinal axis. Seats installed at angles greater than 30° relative to the aircraft longitudinal axis must have an energy-absorbing rest or shoulder harness and must satisfy the criteria listed in Table 2 as modified by this Appendix.</i></p> <p>-----</p> <p>On page 3, replace subsection 1.2 by the following:</p> <p><i>1.2 Seat Types</i></p> <p><i>This document covers only Type A-T passenger seats.</i></p>
Section 2	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 3, replace subsection 2.1 by the following:</p> <p><i>2.1 Applicable Documents</i></p> <p><i>This document is explicitly linked with and cannot be used without AS8049C. The requirements of each section of AS8049C apply to this document unless specifically modified by this document. Sections 3 through 7 of this document note only the differences between the standards of this document and the standards of AS8049C. Sections 8 and 9 are reserved for future use, and the content specific to oblique-facing seats is found in Section 10. Test pulse evaluations must use the method defined in AS8049C Appendix A.</i></p> <p>-----</p> <p>On page 3, disregard Section 2.1.1.</p>

When reading AS6316	Do the following:
Section 3	Apply all the subsections unless disregarded or modified as shown below: ----- On page 7, disregard the modification to subsection 3.4.1.
Section 4	Apply as written
Section 5	Apply all the subsections unless disregarded or modified as shown below: ----- On page 7, subsection 5.3.4.1 is modified by adding the following: <i>g. The ATD neck forces shall be measured in accordance with the requirements of Channel Class 1000.</i> <i>h. The ATD neck forces used for calculating Nij shall be measured in accordance with the requirements of Channel Class 600.</i> <i>i. The ATD neck moments shall be measured in accordance with the requirements of Channel Class 600.</i> <i>j. The ATD spine accelerations shall be measured in accordance with the requirements of Channel Class 180.</i> <i>k. The leg axial rotation obtained from the measured leg angular velocity by integration shall require angular velocity data measured in accordance with the requirements of Channel Class 180.</i> ----- On page 7, subsection 5.3.1.5 is modified by adding the following: <i>Oblique-facing seating systems including sensor-driven restraint systems must be shown to meet the occupant injury criteria of Table 2 as modified by this Appendix throughout the entire range of yaw that encompasses installations at ± 10° relative to the aircraft longitudinal axis.</i>
Section 6	Disregard
Section 7	Disregard
Section 10	Apply all the subsections unless disregarded or modified as shown below: ----- On page 9, add subsection 10.1.2.1 as follows: <i>10.1.2.1 When a contactable item is not part of the seat design (e.g. interior furnishing, bulkhead) and is evaluated per subsection 10.1.2, then the detailed design definition of the contactable item evaluated per subsection 10.1.2 and any other information required for the installation (e.g. stiffness), must be included as part of the installation instructions and limitations document.</i> ----- On page 10, add subsection 10.2.2.1 as follows: <i>10.2.2.1 When a contactable item is not part of the seat design (e.g. interior furnishing, bulkhead) and is evaluated per subsection 10.2.2, then the detailed design definition of the contactable item evaluated per subsection 10.2.2 and any other information required for the installation (e.g. stiffness) must be included as part of the installation instructions and limitations document.</i>

When reading AS6316	Do the following:
	<p>-----</p> <p>On page 11, replace Table 2, ‘Neck’, Item (4), by the following:</p> <p><i>The neck must not impact on any surface that would produce significant concentrated loading on the neck.</i></p> <p>-----</p> <p>On page 12, in Table 2, ‘Femur’, add Item (1) as follows:</p> <p><i>Note: If contact occurs with other structure that is not part of the seat design (e.g. interior furnishing, bulkhead) and is evaluated during the axial compressive load, then the detailed design definition of the item must be included as part of the installation instructions and limitations document.</i></p> <p>-----</p> <p>On page 12, in Table 2, ‘Femur’, add Item (2) as follows:</p> <p><i>Note: For threshold tests only, if the pulse used for the threshold test has a lower energy than the research pulse used to develop the criteria (see FAA Report DOT/FAA/AM-17/2, ‘Supplemental Injury Risk Considerations for Aircraft Side-Facing Seat Certification’, dated January 2017), it is not necessary to meet the leg axial rotation requirement of Table 2 as modified by this Appendix, Femur, Item (2).</i></p>

- 5.0. Table 5 of the Appendix to this ETSO prescribes the MPS for SAE International ARP6337, ‘Design, Manufacturing, and Performance Standard for Composite Materials Used on Aircraft Seat Structures’, dated November 2020. When the SAE section recommends (or suggests, advises, etc.) something, and it is part of the MPS, the recommendation becomes a requirement. For the purpose of meeting the requirements of Table 5 of the Appendix to this ETSO, all the references to ‘AS8049’ and ‘ARP5526’ must be replaced by ‘AS8049C as modified by Table 1 of the Appendix to this ETSO’ and ‘ARP5526D as modified by Table 3 of the Appendix to this ETSO’ respectively.

In addition, SAE ARP6337 is also modified as follows:

Table 5 — SAE AS63376

When reading AS6337	Do the following:									
Section 1	<p>Apply all the subsections unless disregarded or modified as shown below:</p> <p>-----</p> <p>On page 3, replace Table 1 by the following:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #cccccc;">Seat Type</th> <th style="background-color: #cccccc;">Aircraft Category</th> <th style="background-color: #cccccc;">Applicable CSs</th> </tr> </thead> <tbody> <tr> <td style="background-color: #cccccc;">A-T</td> <td>Large (Transport) Aeroplane</td> <td>CS-25</td> </tr> <tr> <td style="background-color: #cccccc;">C</td> <td>General Aviation Aircraft — All categories as specified in 1(1)(c) of this ETSO</td> <td>CS-23</td> </tr> </tbody> </table>	Seat Type	Aircraft Category	Applicable CSs	A-T	Large (Transport) Aeroplane	CS-25	C	General Aviation Aircraft — All categories as specified in 1(1)(c) of this ETSO	CS-23
Seat Type	Aircraft Category	Applicable CSs								
A-T	Large (Transport) Aeroplane	CS-25								
C	General Aviation Aircraft — All categories as specified in 1(1)(c) of this ETSO	CS-23								

When reading AS6337	Do the following:
Section 2	Apply all the subsections unless disregarded or modified as shown below: ----- On page 6, disregard 2.1.
Section 3	Apply as written
Section 4	Apply as written
Section 5	Apply as written
Section 6	Apply all the subsections unless disregarded or modified as shown below: ----- On page 18, Section 6 is modified as follows: <i>6. Optionally, the composite seat structure can be subjected to the following environmental conditions described in EUROCAE ED-14/RTCA DO-160, according to paragraph 2.1 of CS-ETSO Subpart A, as outlined in Table 2 below. Comparison by similarity is acceptable if the test data is directly applicable to the material system, design details, and environmental conditions characteristic of the application. Testing may be combined sequentially to reduce the number of tests and optimise the use of test resources as noted in Section 3.2 of EUROCAE ED-14/RTCA DO 160.</i> ----- On page 18, Section 6.1 is modified as follows: 6.1 Fluid Susceptibility <i>The composite seat structure should be exposed to the fluids at the temperatures listed in Table 3 using one of the methods described in EUROCAE ED-14/RTCA DO-160, according to paragraph 2.1 of CS-ETSO Subpart A, Section 11.0. Resin-dominated shear tests are best for detecting the effects of solvent exposure on resins; refer to DOT/FAA/AR-02/109 for guidance on the recommended tests. The solvent exposure and subsequent testing should be conducted at the temperatures expected during service.</i> ----- On page 18, Section 6.2 is modified as follows: 6.2 Waterproofness <i>The composite seat structure shall withstand the effects of liquid water falling onto the seat, or the effects of condensation. The seat system shall be tested per Section 10.3.2 (drip test only) of EUROCAE ED-14/RTCA DO-160, according to paragraph 2.1 of CS-ETSO Subpart A. The seat manufacturer shall be able to demonstrate that the seat and the associated components are not adversely affected by the parameters considered.</i>
Section 7	Apply as written
Section 8	Disregard
Appendix A	Disregard

[Amdt ETSO/11]

[Amdt ETSO/17]

APPENDIX 2 TO ETSO-C127c – ELECTIVE MPS FOR ROTORCRAFT, TRANSPORT AEROPLANE, AND SMALL AEROPLANE SEATING SYSTEMS

ED Decision 2022/018/R

Compliance with the MPS described in these paragraphs is elective; however, the MPS must be followed for the MPS with which the applicant has elected to comply. Deviations from an elective MPS must be approved by EASA. Applicants should document and report which elective MPS subparagraphs they complied with so they can receive credit under this ETSO. In addition, see ETSO paragraph 4(a)(1) for the marking requirements.

- a. Step Load on Baggage Bars: For seats where the baggage restraint allows application of a foot step load, apply the test criteria of ARP5526D, subsection 3.7.2. The testing must not degrade either the basic forward nor the side load carrying capabilities noted in AS8049C Table 4A, nor result in deformation, thus posing a tripping hazard.
- b. Electrically Actuated Features: For seats with electrically actuated moving parts, which could potentially entrap and cause injury to passengers, apply ARP5526D, subsection 3.18.2.
- c. Secondary Structure Abuse Loads: For seats that include the features listed in ARP5526D, Section 3.26.2, Table 9, apply the loads within the table to qualify the design.
- d. Testing to Higher Static Loads: To substantiate seats to load factors higher than those specified in Table 4A of AS8049C, or to combine load factors, the higher load factors must be reported. The higher load factors must be marked on the ETSO placard.
- e. Hand Holds: For seats designed to provide a handhold for passengers moving about the aeroplane, apply ARP5526D, Section 3.1.2.
- f. Batteries Containing Lithium: For seats with batteries containing lithium in their design, test and meet the requirements defined in ETSO-C142b (or later EASA-approved ETSO for non-rechargeable lithium batteries) or ETSO-C179b (or later EASA-approved ETSO for rechargeable lithium batteries). An ETSO approval does not include installation approval in an aircraft, and special conditions may be required to gain installation approval if the design includes lithium batteries
- g. Flammability — Large Exposed Non-metallic Parts: For Type A seats incorporating non-traditional, large non-metallic panels in their design, test and meet the fire protection provisions of Appendix F, Parts IV and V (heat release and smoke emission) of CS-25. Demonstrate the fire protection properties of the materials by using the methods provided in FAA policy statement PS ANM-25.853-01-R2, 'Flammability Testing of Interior Materials', which may permit substantiation based on previously tested materials, and SAE ARP6199A, 'Method to Evaluate Aircraft Passenger Seats for the Test Requirements of 14 CFR Part 25 Appendix F, Parts IV and V'. Although ARP6199A provides an acceptable compliance method for determining which panels on the seat must be evaluated and substantiated to comply with certain special conditions, the intent is to limit the quantities of materials that do not comply with the smoke emission and heat release test requirements.

In addition, report which parts meet the requirements of Appendix F, Parts IV and V, as part of your ETSO-furnished data.

[Amdt ETSO/11]

[Amdt ETSO/17]

ETSO-C137a

ED Decision 2022/018/R

AIRCRAFT PORTABLE MEGAPHONES**1 Applicability**

This ETSO provides the requirements that portable aircraft megaphones that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

The applicable standard is that provided in SAE International's Aerospace Standard (AS) 4950B, 'Design and Performance Criteria for Transport Aircraft Portable Megaphones', dated March 2007, as modified by Appendix 1 to this ETSO.

3.1.2 Environmental Standard

See CS-ETSO, Subpart A, paragraph 2.1.

3.1.3 Software

See CS-ETSO, Subpart A, paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, Subpart A, paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, Subpart A, paragraph 2.4.

3.2.2 Embedded Batteries

See CS-ETSO, Subpart A, paragraph 2.8.

4 Marking

4.1 General

See CS-ETSO, Subpart A, paragraph 1.2.

4.2 Specific

None.

5 Availability of Referenced Documents

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/17]

APPENDIX 1 TO ETSO-C137a — MPS FOR AIRCRAFT PORTABLE MEGAPHONES

ED Decision 2022/018/R

SAE International's Aerospace Standard (AS) AS4950B, 'Design and Performance Criteria for Transport Aircraft Portable Megaphones', dated March 2007, is modified as per Table 1 below.

Table 1 — Modification of AS4950B, 'Design and Performance Criteria for Transport Aircraft Portable Megaphones'

Location in AS4950B	Initial AS4950B text	Amending text
3.4.1	All materials used except small parts (knobs, triggers, fasteners, seals, and small electrical parts) that would not contribute significantly to the propagation of a fire shall be self-extinguishing when tested in accordance with the applicable requirements of 14 CFR 25.853.	Compliance shall be shown with the flammability test specified in EUROCAE ED-14G / RTCA DO-160G, Section 26 for Category C: Flammability. If ignition occurs inside or outside the equipment, the equipment shall not propagate the flame.

[Amdt ETSO/17]

ETSO-C139a A1

ED Decision 2022/018/R

AUDIO SYSTEMS AND EQUIPMENT**1 Applicability**

This ETSO provides the requirements that Audio Systems and Equipment that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

The applicable standard is that provided in RTCA DO-214A, 'Audio Systems Characteristics and Minimum Performance Standards for Aircraft Audio Systems and Equipment', dated 18 December 2013 as modified by Appendix 1 to this ETSO.

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

None.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/11]

[Amdt ETSO/17]

APPENDIX 1 TO ETSO-C139a A1 — CORRECTION TO RTCA DO-214A, ‘AUDIO SYSTEMS CHARACTERISTICS AND MINIMUM PERFORMANCE STANDARDS FOR AIRCRAFT AUDIO SYSTEMS AND EQUIPMENT’

ED Decision 2022/018/R

A1.1 Introduction

This Appendix corrects RTCA DO-214A, ‘Audio Systems Characteristics and Minimum Performance Standards for Aircraft Audio Systems and Equipment’, regarding an optical character recognition error in the value of a test capacitor in a test procedure not detected during the peer review process. The value was ‘1E-14 F (0.01 pF)’ instead of the required ‘1E-8 F (0.01 μF)’, so it was six orders of magnitude too low for interphone channels.

In addition, this Appendix clarifies RTCA DO-214A, ‘Audio Systems Characteristics and Minimum Performance Standards for Aircraft Audio Systems and Equipment’, regarding an ambiguous requirement for the HOT microphone feature in Section 1.4.5.

A1.2 Correction

In Section 2.8.2.9 of RTCA DO-214A, ‘Audio Systems Characteristics and Minimum Performance Standards for Aircraft Audio Systems and Equipment’, ‘0.01 pF’ is replaced by ‘10 nF’.

[Amdt ETSO/17]

ETSO-C157c

ED Decision 2022/018/R

FLIGHT INFORMATION SERVICES-BROADCAST (FIS-B) EQUIPMENT

1 Applicability

This ETSO provides the requirements that Aircraft Flight Information Services-Broadcast (FIS-B) Data Link Systems and Equipment that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

These standards apply to equipment intended to display weather and other non-air-traffic-control-related flight advisory information to pilots in a manner that will enhance their awareness of the conditions of flight.

The applicable standards are those provided in RTCA document DO-267A, ‘Minimum Aviation System Performance Standards (MASPS) for Flight Information Services-Broadcast (FIS-B) Data Link’, Rev. A dated 29 April 2004 or DO-358A, ‘Minimum Operational Performance Standards (MOPS) for Flight Information Services-Broadcast (FIS-B) with Universal Access Transceiver (UAT)’, dated 27 June 2019 defined in the following Table 1.

The applicant shall demonstrate the required functional performance under the test conditions as specified in Table 1.

Table 1 — Equipment classes for FIS-B

Equipment Class	Equipment Name	Functionality	Test conditions
1	FIS-B Equipment using Universal Access Transceiver (UAT) and Interoperable with the Surveillance and Broadcast Services (SBS) Provider	RTCA/DO358A Sections 2.1, 2.2 and 2.3. In accordance with Section 2.1.9, ‘Equipment Classes’, this includes the requirements in Appendix K, DO-358A EQUIPMENT CLASS TO REQUIREMENT MAPPING, for all the applicable FIS-B Equipment Class(es) in Table 2-1, FIS-B Equipment Classes, for which the	RTCA/DO-358A, Sections 2.2 and 2.3, which are applicable to the FIS-B Equipment Class(es) implemented within the equipment as determined by DO-358A Table 2-1, Table K-1, and Table 2-33 and Section 2.4.

Equipment Class	Equipment Name	Functionality	Test conditions
		<p>manufacturer seeks ETSO authorisation. Manufacturers may implement as many, or as few, of the FIS-B Equipment Classes identified in Table 2-1 as are desired in their FIS-B equipment. Identify the supported FIS-B Equipment Classes in accordance with paragraph 4 of this ETSO.</p>	
2	FIS-B Equipment not Interoperable with the SBS Provider	RTCA/DO-267A Section 2 (except 2.1.4; 2.2.12; and 2.2.13) and Section 3.8.	RTCA/DO-267A, Section 4.

Note: This ETSO is intended for equipment used in the US National Airspace System. UAT is not intended to be operated in European airspace.

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

Failure of the function defined in paragraph 3.1.1 resulting in misleading weather or flight advisory information is a minor failure condition.

Loss of the function defined in paragraph 3.1.1 is a minor failure condition.

3.2.2 Manual

The applicant shall produce a manual that includes operating instructions and equipment limitations. This manual must state the following:

‘FIS-B information may be used for pilot planning decisions focused on updating the pilot’s awareness of the dynamic flight environment, including avoiding areas of inclement weather that are beyond visual range and pilot near-term decisions where poor visibility precludes visual acquisition of inclement weather. FIS-B weather and NAS status information may be used as follows:

- (a) *To promote pilot awareness of the own ship location with respect to the reported weather, including hazardous meteorological conditions; NAS status indicators to enhance pilot planning decisions; and pilot near-term decision-making.*

- (b) *To cue the pilot to communicate with Air Traffic Control, a Flight Service Station specialist, operator dispatch, or airline operations control centre for general and mission-critical meteorological information, NAS status conditions, or both.*

FIS-B information, including weather information, NOTAMs, and TFR areas, are intended for the sole purpose of assisting in long- and near-term planning and decision making. The system lacks sufficient resolution and the updating capability necessary for aerial manoeuvring associated with immediate decisions. In particular, in extreme scenarios, the oldest weather radar data on the display can be up to 15 to 20 minutes older than the display's age indication for that weather radar data. Therefore, do not attempt to use FIS-B weather information to manoeuvre the aircraft at minimum safe distances from hazardous weather.

FIS-B information may be used to support the preflight preparation required by the applicable regulations. However, depending on the intended operation, FIS-B may not provide all the available aeronautical or meteorological information concerning the flight. Regulatory compliant preflight preparation may be accomplished using automated resources or by contacting a Flight Service Station.'

In addition to the above operating instructions and equipment limitations, the following paragraph should be added for FIS-B Class 1 equipment only.

- (c) *'FIS-B uplink is an FAA-approved source for METAR , TAF, WINDS, PIREPs, NEXRAD, AIRMET, SIGMET, and TFR information subject to the range limits for the broadcast of these products. FIS-B uplink is not an FAA-approved source for NOTAMs.'*

In addition to the above operating instructions and equipment limitations, the following paragraph should be added for FIS-B Class 2 equipment only.

- (d) *'This FIS-B Class 2 equipment is not interoperable with the FAA SBS provider.'*

The manual shall describe in detail the functionality of each FIS-B Equipment Class (as defined in Table 2-1 of RTCA/DO-358A) implemented within the FIS-B equipment.

The manual shall describe any deviation in detail.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

- (a) The markings shall also identify the Equipment Class as defined in Table 1 of this ETSO, and for Equipment Class 1 (as defined in Table 1 of this ETSO) shall identify all the FIS-B Equipment Classes implemented within the FIS-B equipment as listed in RTCA/DO-358A, Table 2-1, as follows:

- (1) Class 1 equipment (as defined in Table 1 of this ETSO) that incorporates all the FIS B products listed in RTCA/DO-358A, Table 2-1, shall be marked as 'Equipment Class 1A'.

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- (2) Class 1 equipment (as defined in Table 1 of this ETSO) that incorporates all the FIS B products listed in RTCA/DO-358A, Table 2-1, except for AIRMET, shall be marked as 'Equipment Class 1B'.
- (3) Class 1 equipment (as defined in Table 1 of this ETSO) other than Equipment Class 1A and 1B as 'Equipment Class 1[suffix the Equipment Class Letters for all supported FIS-B products according to RTCA DO-358A, Table 2-1]'.
For example, mark equipment that incorporates only METAR (C), TAF (D), PIREP (E), and Winds (F), as 'Equipment Class 1CDEF'.
- (b) Class 2 equipment (as defined in Table 1 of this ETSO) shall be marked as 'Equipment Class 2'.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/7]

[Amdt ETSO/12]

[Amdt ETSO/17]

ETSO-C161b

ED Decision 2022/018/R

GROUND-BASED AUGMENTATION SYSTEM POSITIONING AND NAVIGATION EQUIPMENT

1 Applicability

This ETSO provides the requirements that Ground-Based Augmentation System Positioning and Navigation Equipment that is designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

The applicable standard is that provided in (RTCA) document RTCA/DO-253D Change 1, Section 2, for GBAS airborne equipment class (GAEC) C to support GBAS Approach Service Type (GAST) C, or GAEC D to support both GAST C and GAST D approach service types. This ETSO also applies to equipment that implements the optional GBAS positioning service as defined in RTCA/DO-253D Change 1, Section 2.3.

The standards of this ETSO apply to equipment intended to output deviations relative to a precision approach path using GBAS, and to provide position information to a navigation management unit that outputs deviation commands referenced to a desired flight path. The positioning and navigation functions are defined in section 2.3 of RTCA/DO-253D Change 1. In accordance with section 2.1 of RTCA/DO-253D Change 1, equipment obtaining this ETSOA must also comply with the position, velocity and time (PVT) output requirements of either, ETSO-C145e, ETSO-C146e or ETSO-C196b.

3.1.2 Environmental Standard

See CS-ETSO [Subpart A](#), paragraph 2.1. The required performance is defined in RTCA/DO253D, Change 1, section 2.4.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 - Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

None.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3

[Amdt ETSO/3]

[Amdt ETSO/7]

[Amdt ETSO/17]

ETSO-C162b

ED Decision 2022/018/R

GROUND-BASED AUGMENTATION SYSTEM VERY HIGH FREQUENCY DATA BROADCAST EQUIPMENT

1 Applicability

This ETSO provides the requirements that Ground-Based Augmentation System Very High Frequency Data Broadcast Equipment that is designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

The applicable standards are those provided in RTCA document DO-253D, Change 1, 'Minimum Operational Performance Standards for GPS Local Area Augmentation System Airborne Equipment', dated 27 June 2019.

Note: All RTCA/DO-253D Change 1 references to RTCA/DO 246() apply to RTCA/DO-246E, including Change 1, 'GNSS-Based Precision Approach Local Area Augmentation System (LAAS) Signal-In-Space Interface Control Document (ICD)'.

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

None.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/7]

[Amdt ETSO/17]

ETSO-C178a

ED Decision 2022/018/R

AIRCRAFT CIRCUIT BREAKERS

1 Applicability

This ETSO provides the requirements that aircraft circuit breakers that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

The applicable standards are those provided in Table 1 for the intended equipment class:

Table 1 — Equipment class standards

Equipment Class	Equipment Type	Minimum Performance Standards
1	Alternating Current (AC) Arc Fault Circuit Breakers	SAE Aerospace Standard (AS) AS5692A, 'ARC Fault Circuit Breaker (AFCB), Aircraft, Trip-Free Single Phase and Three Phase 115 VAC, 400 Hz - Constant Frequency', dated December 2009
2	Direct Current (DC) Arc Fault Circuit Breakers	SAE Aerospace Standard (AS) AS6019, 'ARC Fault Circuit Breaker (AFCB), Aircraft, Trip-Free 28 VDC', dated June 2012
3	AC or DC Thermal Circuit Breakers	SAE Aerospace Standard (AS) AS58091A, 'Circuit Breakers, Trip-Free, Aircraft General Specification For', dated May 2012

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

The class of the equipment shall be legibly and permanently marked.

5 Availability of referenced documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/8]

[Amdt ETSO/17]

INDEX 2 EUROPEAN TECHNICAL STANDARD ORDERS

ETSO-2C168a

ED Decision 2022/018/R

AVIATION VISUAL DISTRESS SIGNALS

1 Applicability

This ETSO provides the requirements that aviation visual distress signals that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

For handheld, high-intensity, stroboscopic light sources that can be added to aviation survival kits to supplement pyrotechnic devices, the standard is that provided in SAE International's Aerospace Standard AS5134A, 'Aviation Distress Signal', dated 27 September 2007.

For handheld, high-intensity, light-emitting diode (LED) technology sources that can be added to aviation survival kits to supplement pyrotechnic devices, the standard is that provided in SAE International's Aerospace Standard AS5134C, 'Aviation Visual Distress Signals', dated August 2020, with the angle θ of Section 4.3.3 increased from 80° to 95°.

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

3.2.2 Others

These light sources must:

- eliminate the significant potential equipment and personnel hazards that are posed by untrained personnel using pyrotechnics in inflatable life rafts; and
- provide an equivalent level of safety to pyrotechnics that aid in locating and rescuing aviation accident survivors.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

None.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/16]

[Amdt ETSO/17]

ETSO-2C208

ED Decision 2022/018/R

ELECTRICAL HOIST EQUIPMENT**1 Applicability**

This ETSO provides the requirements for electrical hoist equipment that is designed and manufactured on or after the date of this ETSO.

To be eligible for the ETSO, the hoist equipment shall be equipped with an overload protection device.

Hoist equipment includes the hoist itself, load attachment means (cable, hook, etc.), control and monitoring interfaces, a structural interface to attach the hoist to the boom/rotorcraft structure and the overload protection device. The boom itself is not considered to be a part of the hoist equipment.

Electrical hoist equipment designed in accordance with this ETSO must be identified with the applicable ETSO marking.

This hoist ETSO covers articles which are intended to be operated in the complete range of possible hoist missions.

2 Procedures**2.1 General**

The 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**

The applicable standard for hoist equipment is provided in SAE Aerospace Standard (AS) 6342, Minimum Operation Performance Standard for Helicopter Hoist Systems, dated December 2020, as modified by Appendix 1 to this ETSO.

Whenever the term 'hoist' is used in this SAE document, it is equivalent to the hoist equipment.

3.1.2 Environmental Standard

See CS-ETSO, Subpart A, paragraph 2.1.

3.1.3 Software

See CS-ETSO, Subpart A, paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, Subpart A, paragraph 2.3.

3.1.5 Development Assurance

See CS-ETSO, Subpart A, paragraph 2.4.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, Subpart A, paragraph 2.4.

The failure of the function defined in paragraph 3.1.1 of this ETSO is:

- Catastrophic for loss or malfunction of the hoist equipment (including the overload protection device), which could lead to serious injuries or a fatality (including the HEC).

In addition, no single failure of the hoist equipment shall result in a Catastrophic Failure Condition.

For the compliance demonstration of structural parts / structural elements, the single failure criteria should be addressed through, but not limited to, static, fatigue, damage tolerance and critical parts requirements.

Supporting information is provided in AMC 27/29.865(c)(2) and CS 27/29.1309.

3.2.2 Equipment Safety Assessment

The hoist manufacturer shall conduct an Equipment Safety Assessment, including a systematic, comprehensive evaluation of the hoist equipment to show that the safety objectives from the Functional Hazard Assessment (FHA) of the ETSO article and the derived safety requirements are met.

The latest revision of SAE ARP4761 provides guidance for the safety assessment process. Any assumptions taken by the hoist manufacturer shall be documented in the safety assessment. See also CS-ETSO, Subpart A, paragraph 2.4.

Note: Particular aircraft installations will drive additional, and more stringent, safety requirements for the hoist equipment. The ETSO applicant may elect to comply with these more severe aircraft installation requirements for the hoist equipment in the ETSO article FHA. If this option is selected, this shall be identified in the ETSO Certification programme, and demonstrated within the ETSO data package. Compliance with non-ETSO requirements will also be assessed during the approval (TC/STC) of the installation.

3.2.3 Installation Manual

The applicant shall document in an installation manual all information needed to substantiate the installation of the hoist equipment on a rotorcraft, including the following:

- Electrical interface definition and structural interface loads from the hoist system to the rotorcraft hoist attachment;
- Definition of the control and monitoring interfaces (per Appendix 1, Section 3.4.1.1);
- Maximum permanent deformation of the hoist after the application of the crash load factor (per Appendix 1 — Table 1 Section 3.6);
- Impact speed for the bird strike test (per Appendix 1 — Table 1 Section 3.6);
- Control means for the PQRS and BQRS (per Appendix 1 — Table 1 Section 4.6).
- The maximum rated load.

4 Marking

4.1 General

See CS-ETSO, Subpart A, paragraph 1.2.

4.2 Specific

5 Availability of Referenced Documents

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/17]

APPENDIX 1 TO ETSO-2C208 — ELECTRICAL HOIST EQUIPMENT

ED Decision 2022/018/R

Appendix 1 identifies sections, paragraphs, figures or sentences from the SAE AS 6342 standard that are not applicable as minimum performance standards (MPS), and identifies requirements that are applicable in lieu of the referenced SAE text, or that are added to some sections of the SAE AS6342 standard. The information is provided in the form of three tables:

- Table 1 presents the amended text or additional text.
- Table 2 presents the additional definitions necessary for the ETSO.
- Table 3 presents the additional list of acronyms.

Table 1 — Modifications of requirements for the ETSO

When reading SAE AS6342 section	Apply the following:
2.3	<p>Add to the HOIST definition the following:</p> <p>The hoist is equivalent to the hoist equipment. Hoist equipment includes the hoist itself, load attachment means (cable, hook, etc.), control and monitoring interfaces (including pendants, controllers and their interconnecting wires), a structural interface to attach the hoist to the boom/rotorcraft structure and the overload protection device. The boom itself is not considered to be a part of the hoist equipment.</p> <p>Replace the HOIST SYSTEM definition as follows:</p> <p>The system, inclusive of the hoist and ancillary components. For clarification, the hoist system includes the hoist equipment and other systems needed for integration to the rotorcraft and operation of the hoist. This includes but is not limited to, displays, controls within the cockpit and cabin, boom, rotorcraft wiring and the power supply.</p> <p>Add at the beginning of the LIMIT LOAD definition the following:</p> <p>Limit loads are the maximum loads to be expected in service.</p> <p>Add at the end of the Limit Load Factor definition:</p> <p>Note: For structure requirements, and systems such as OLPD, the static limit load factor of 3.5g can be reduced to the maximum load factor the rotorcraft can reach within the hoist operational envelope, but not less than 2.5g.</p> <p>Add at the beginning of the ULTIMATE LOAD definition the following:</p> <p>Ultimate Loads are the limit loads multiplied by the prescribed factor of safety.</p> <p>Add Table 2 of Appendix 1 (see further below) to the section.</p>
2.4	Add Table 3 of Appendix 1 (see further below) to the section.
3.1	<p>Replace the section with the following:</p> <p>Specific installation requirements additional to this minimum operation standard shall be defined in the ETSO certification programme.</p>
3.3.2	Replace the section with the following:

When reading SAE AS6342 section	Apply the following:
	The hoist shall have a system to manage the reeling out and reeling in of the cable, minimising the possibilities of jamming, fouling, kinking, or excessive wear on the cable.
3.3.2.2	Replace the section with the following: The storage provision (e.g. drum) shall be able to attach the cable end, and store all the usable cable. The storage provision shall minimise wear affecting either the cable or the storage provision. The design shall account for prevention of unravelling and damage of the cable on the drum. Potential environmental conditions such as vibration shall be taken into account. A means shall be provided to visibly check/inspect the storage of the cable. All reference to storage visibility shall be for maintenance on the ground, not necessarily for hoisting operations.
3.3.4 2 nd paragraph	Replace the paragraph with the following: Cable rebound shall be characterised through testing by the hoist manufacturer, and a characterisation report shall be provided as part of the certification application. The rebound characterisation report shall include information about the influence of the different loading conditions and the influence of the different cable lengths related to the rebound behaviour.
3.3.4 3 rd paragraph	Replace the paragraph with the following: For the structural substantiation, any damage threats and manufacturing flaws that can be encountered during manufacturing and in service, shall be taken into account.
3.3.4 6 th paragraph	Replace the paragraph with the following: The cable is a life-limited part. Cable fatigue characteristics shall be determined by the hoist manufacturer. Methods for cable life calculation shall be defined. Cable inspection and acceptance criteria shall be defined by the hoist manufacturer and shall be provided in the maintenance manual. See 3.6.2.
3.3.5 1 st paragraph	Replace the paragraph with the following: If a mis-wrap event can lead to a complete loss of hoisting function or to a loss of load, the hoist shall be provided with a cable foul/mis-wrap system that shall stop the hoist if a cable foul/mis-wrap develops. The system shall protect the cable from the effects of continued running when fouled or jammed.
3.3.5 2 nd paragraph	Replace the paragraph with the following: Once initiated, the mis-wrap protection system may be capable of being overridden. The risk for continued hoist operation when overriding shall be identified by the hoist manufacturer.
3.3.6	Replace the section with the following: Load Attachment Means A load attachment means, such as a hook, shall be part of the hoist equipment. The load attachment means (i.e. hook) shall be attached such that it can freely rotate through 360 degrees in either direction. The load attachment means assembly shall be designed to mitigate the risk of entanglement on obstacles. Mechanism(s) shall be incorporated to avoid the possibility of unintentional load release. The mechanism(s) shall be designed to prevent tip loading and dynamic rollout.

When reading SAE AS6342 section	Apply the following:
3.3.8	Replace the section with the following: The hoist shall be equipped with overload protection capability.
3.4.1.1	Replace the section with the following: The hoist equipment shall monitor the safe operation of the hoist, through specific parameters including but not limited to the weight of the load, the fleet angle, the temperature of the temperature-sensitive components. The hoist equipment shall provide the status information (I) to the aircrew. The hoist manufacturer should define the recorded information (R) that is to be stored until the next scheduled maintenance and made available before the next flight. This recording may be performed either by the hoist equipment itself or be provided as an output to the aircraft systems for recording. Typical information needed to ensure a safe operation of the hoist is, but not limited to, the following: <ul style="list-style-type: none"> • Hoist active (I) • End of travel (I) • Caution zone (I) • Quick-release system status (I+R) • Fleet angle exceedance (R) As a minimum, the flight crew shall be made aware of a fleet angle exceedance during post-flight check. <ul style="list-style-type: none"> • Activation of overload protection (I+R) • Load exceedance (I+R) (sampling rates need to be sufficient to capture shock loads) All operating limitations and other information necessary for safe operation must be provided as an output of the hoist equipment. The monitoring (I and R) shall be described in the installation manual. The display or recording of this information may be included in the ETSO article or may be handled as additional equipment by the STC or TC applicant for the installation. Note: in the latter case, the additional equipment to display or recording of the information in the cockpit are not considered as part of the ETSO function.
3.4.1.2	Replace the headline of the section with the following: Hoist Display and Recording Equipment
3.4.1.2.3	Replace the section with the following: In addition to 3.3.5, if a mis-wrap event can lead to a hoist failure, the hoist equipment shall have a mis-wrap indicator, indicating that a cable foul/mis-wrap has occurred.
3.4.1.2.4	Replace the section with the following: The hoist shall indicate and record when an over temperature condition is present. The hoist over temperature condition shall be defined by the hoist manufacturer, based on the specific design of the hoist equipment.

When reading SAE AS6342 section	Apply the following:
3.4.2 1 st paragraph	Replace the section with the following: The hoist equipment shall be enabled to receive the following control signal inputs, with the following commands:
3.4.3 8 th paragraph	Replace the paragraph with the following: The operator control shall meet the applicable environmental requirements, as stated in section 3.1.2. of the core part of the ETSO standard, for outside use. If the only storage position of the pendant is inside the cabin, the vibration level of chapter 4.9.5 of AS6342 for internally mounted equipment is sufficient.
3.4.3 End of paragraph	Complete the section with the following: The operator control may include a BQRS activation. The operator control shall be designed such that it minimises the inadvertent activation of critical functions during stowage.
3.4.9 2 nd paragraph	Replace the paragraph with the following: A means to protect the hoist equipment from over-current (motor over torque) conditions shall be provided.
3.4.10	Replace the section with the following: The hoist shall have a means to measure and record the usage of the system. The usage shall be calculated in operating hours (time while the hoist drive is active), hoist cycles or other equivalent method.
3.5.1.1	Delete the section (covered by ETSO standard text Chapter 3.2.2).
3.5.4	Delete the section.
3.5.5	Delete the section.
3.5.6	Delete the section.
3.6	Complete the section with the following: Single critical load paths should be minimised. <u>Additional structural requirements</u> The hoist shall be able to withstand the most critical load factor expected in service. The load factors shall cover the entire rotorcraft operational envelope in which hoisting is allowed, including rapid direction reversal and rapid stops. <ul style="list-style-type: none"> • Static flight load factor The static flight load factor shall not be less than 2.5 g for HEC applications. The substantiated load factor shall be stated in the hoist limitations. • Dynamic load magnification factors Any significant dynamic load magnification factors should be taken into account. A dynamic load magnification factor is the difference between the static load factor (measured at the CG of the hoist) and the load factor at the load attachment means (e.g. hook). This occurs for example during maneuvering of the rotorcraft when the cable is at an angle compared to the hoist vertical axis.

When reading SAE AS6342 section	Apply the following:
	<ul style="list-style-type: none"> • Crash load factors The hoist equipment shall withstand the following load factors without failure for at least 3 seconds during a static load test. The 3 seconds do not apply if the tests are performed dynamically to simulate actual loading application. (1) Upward – 1.5 g (2) Forward – 12 g (3) Sideward – 6 g (4) Downward – 12 g (5) Rearward – 1.5 g The hoist cable is expected to be fully stowed during load factor tests. The maximum permanent deformation resulting from the application of the load factors shall be documented in the installation manual. <u>Hoist-Critical Parts</u> A hoist-critical part is a part, the failure of which could lead to serious injuries or a fatality (including the HEC), and for which critical characteristics have been identified and must be controlled to ensure the required level of integrity. If the ETSO article includes hoist-critical parts, a list of the critical parts shall be established. Procedures shall be established to define the critical design characteristics, identify processes that affect those characteristics, and identify the design change and process change controls necessary for maintaining compliance with the ETSO standard. <u>Bird Strike</u> If the applicant has elected to demonstrate robustness against bird strike within the ETSO certification programme, an impact with a 1-kg bird, at a velocity compatible with the maximum allowed speed installed on a rotorcraft, shall not lead to the detachment of parts which could prevent continued safe flight and landing. Compliance must be shown by tests. The impact speed shall be documented in the installation manual. <u>Cable attachment</u> The cable shall be attached to the drum. The attachment shall be able to withstand limit load conditions, or if limit load carrying capability cannot be shown, alternative means shall be provided to minimise the possibility of losing the load. <u>Interactions Systems and Structures</u> For ETSO article equipped with systems that affect structural performance, either directly or as a result of a failure or malfunction, the influence of these systems and their

When reading SAE AS6342 section	Apply the following:
	failure conditions shall be taken into account when showing compliance with the requirements of this ETSO standard. Appendix K to the CS-25 Amendment that is current at the time of the application, or in any later revision, should be used to evaluate the structural performance of ETSO article equipped with these systems.
3.6.1 End of chapter	Complete the section with the following: For static strength substantiation of composite structure, AMC 20-29 provides further guidance. If a safety factor of 3.0 or more is used, it is acceptable to perform a standard static analysis to show compliance. The safety factor should be applied to the yield strength of the weakest component in the system (QRS, complex PCDS, and attachment load path). If a safety factor of less than 3.0 is used, both an analysis and a full-scale ultimate load test of the relevant parts of the system should be performed. Note: The static load factor at installation level depends on the performance of the rotorcraft, but in any case it cannot be less than 2.5g.
3.6.2 End of chapter	Complete the section with the following: For fatigue tolerance substantiation of composite structure, AMC 20-29 provides further guidance.
3.6.4.1 End of chapter	Complete the section with the following: Strength reduction factors such as environmental effects (see 3.6.4.3) of the cable can be included in the testing. Strength reduction factors that are used shall be established by individual tests. If separate strength reduction factors are used, they should not influence each other.
4.1	Replace the section with the following: The arresting system shall be designed to sustain ultimate load without cable reel out. If not otherwise protected, engaging the arresting system shall not lead to an overload of the hoist equipment structure and shall reasonably protect human cargo on the hook.
4.2	Replace the section with the following: The fairlead mechanism shall accommodate a 30-degree angle minimum in all directions from the vertical axis of the hoist. The fairlead mechanism shall be able to withstand a combination of angles not less than 30 degrees in all directions and with loads up to the static limit load without detrimental or permanent deformation or damage to the hoist or to the cable, and until ultimate load without failure.
4.3	Replace the section with the following: The load shall be applied in any direction making the maximum angle with the vertical of the hoist axis, but not less than 30° (60° cone). The most critical fleet angle in the most critical direction shall be taken into account for the static strength substantiation (Limit and Ultimate Load). Note: It may be necessary to substantiate greater angles than the hoist operational envelope, since the hoist might be installed at different angles on different airframes.
4.6	Replace the section with the following:

When reading SAE AS6342 section	Apply the following:
	<p>The hoist shall have the capability of performing an emergency quick release of the attached load in all operating conditions.</p> <p>This QRS shall consist of a primary quick-release subsystem (PQRS) and a backup quick-release subsystem (BQRS).</p> <p>The intention of the PQRS is an intentional, instantaneous release of NHEC or HEC in a pre-set sequence by the QRS that is normally in an emergency to prevent a significant reduction in the safety margins for continued safe flight and landing of the rotorcraft.</p> <p>The following design features shall be considered:</p> <ul style="list-style-type: none"> • The PQRS, BQRS and their load-release devices and subsystems (such as electronically actuated guillotines) shall be separated (e.g. physically, systematically, and functionally independent). • The controls for the PQRS shall be installed on the ETSO article at a location readily accessible to the hoist operator (e.g. the control pendant). Additionally, an independent means to control the PQRS shall be provided to the installer (for instance, to allow connection to a cockpit control). • The control means for the BQRS shall be described in the installation manual. They may be less sophisticated than those of the PQRS (e.g. manual cable cutters). • The PQRS shall release the external load in less than 5 seconds. The BQRS shall release the external load in less than 30 seconds. This time interval shall begin at the moment an emergency is declared and shall end when the load is released. <p>During HEC operations, both the PQRS and BQRS are required to have a dual activation device (DAD) for external cargo release. The switch design shall be evaluated by ground test. Additional safety precautions (such as the use of a lock wire) should be considered for a remote hoist console in the cabin.</p>
4.7	<p>Replace the section with the following:</p> <p>The purpose of the overload protection is to protect the aircraft, its occupants and the person being hoisted. It provides to the crewmembers the possibility to either stabilise the aircraft or to safely activate the PQRS and release the external load in less than 5 seconds after the declared emergency (i.e. crew detects snagging of the cable/hook), as requested in AMC 27/29.865.</p> <p>The hoist shall be equipped with an overload protection capability, which needs to comply to the following requirements:</p> <ul style="list-style-type: none"> • The overload protection system shall be capable of reliably withstanding the dynamic loads and the sustained overloads, as defined by the hoist manufacturer. It shall be designed to hold any static load coming from the cable up to the static limit load. • For dynamic overload events, the overload protection system may allow limited unspooling of the cable at lower loads, as long as the dynamic load holding capability does not fall below the maximum operational load with an adequate safety margin. An example for such dynamic load holding capability is the capability to absorb shock loads. • The load shall be arrested within a maximum of 10 m during a dynamic cable unspooling event. Limited unspooling of the cable for functions other than overload protection could be also accepted (e.g. for cargo vibration reduction).

When reading SAE AS6342 section	Apply the following:
	<ul style="list-style-type: none"> • If sustained overload resulting from an entanglement is still present after 5 seconds of cable unspooling, further unspooling is acceptable. • The person(s) being hoisted shall also be reasonably protected against serious injury (see 5.1.9.1.2). • An overload activation tolerance band shall be defined taking into account e.g. production and maintenance tolerances, variations due to the environment (e.g. temperature and humidity), and operations (i.e. length of cable paid out). The above-mentioned load holding requirements shall be met in the entire activation tolerance band. • With regard to aging effects, all functional elements of the overload protection that are subject to aging effects leading to potential degradation of the overload protection shall be considered. <p>The corresponding tests in 5.1.9. provide the means of compliance for sustained overload and dynamic loads including demonstration that the person(s) being hoisted is (are) reasonably protected in the complete hoist envelope.</p> <p>NOTE: The OLPD static holding capability should be adjustable in order to adapt it to the specific rotorcraft capability within the hoist operational envelope defined by the installer.</p>
4.9	<p>Replace the section with the following:</p> <p>The hoist shall meet environmental test procedures per DO-160. For the DO-160 environmental standard, refer to Section 3.1.2 of the main part of the ETSO standard for acceptable ED-14/DO-160 revisions. The hoist shall meet all performance data included in Chapters 3.3, 3.4 and 4.1-4.7 under the below-stated environmental conditions.</p> <p>The operator control pendant shall meet the applicable environmental requirements for outside environmental conditions.</p>
4.9.5	<p>Add to the end of the section the following:</p> <p>Routing of electrical wires to the hoist interface shall include protection against chaffing or damage due to vibration introduced by the aircraft.</p>
4.9.21	<p>Replace the section with the following:</p> <p>The hoist equipment (including pendants, controllers, cable, and interconnecting wires) shall meet the requirements per RTCA DO-160 Section 25, Category A.</p>
4.9.23	<p>Replace the section with the following:</p> <p>The intent of the endurance requirement is to validate the interval for time between overhaul (TBO) and total time (TT). This shall be accomplished by running a full TBO test, with margin, that simulates actual use in a heavy usage environment. (See Chapter 5.1.3)</p>
4.9.24 1 st paragraph	<p>Complete the section with the following.</p> <p>This duty cycle testing is to show the robustness of the hoist system and is not considered to be a fatigue or endurance test in their own right.</p>
5.1.3 1 st paragraph	<p>Replace the paragraph with the following:</p>

When reading SAE AS6342 section	Apply the following:
	The hoist manufacturer shall perform endurance testing and provide a formal test report. The test results from this testing may be used by the hoist manufacturer to define the overhaul period (TBO and TT).
5.1.3 3 rd paragraph	Replace the paragraph with the following: The test cycle may be made up of a series of hoist cycles and in any order to minimise test set-up.
5.1.3 4 th paragraph	Replace the paragraph with the following: Testing for endurance (the ability of parts moving relative to each other to continue to perform their intended function) should be sufficient to show: <ul style="list-style-type: none"> • that the assumptions used in demonstrating compliance with the required safety level are correct, and • via a test that the equipment is free from design errors, specifically when there is the introduction of a new technology to reach a compliance demonstration for full life, either by a full TT test or by X% TT test supported by analysis. Testing for performance can be included in endurance testing which should demonstrate the rates and responses required for proper system operation.
5.1.3 Table 2	Delete the table.
5.1.4	Replace the section with the following The hoist manufacturer shall perform duty cycle testing and provide formal test report.
5.1.5	Delete the last sentence of the section
5.1.7	Replace the section with the following: The mis-wrap detector shall be validated through test, and can be supported by analysis or simulations.
5.1.8 before 1 st paragraph	Complete the section with the following before the paragraph: Jettison demonstrations, with different loading conditions, using the QRS shall be conducted.
5.1.9.1	Replace the section with the following: The following tests shall be performed.
5.1.9.1.1	Replace the section with the following: To show arresting capability after a sustained overload (e.g. entanglement / extreme manoeuvre), the hoist equipment including the overload protection device (OLPD) shall be able to arrest the cable in accordance with the following test. The OLPD activation point for the test shall be set at the most detrimental setting within the tolerance range. The test sequence should be as follows:

When reading SAE AS6342 section	Apply the following:
	<ol style="list-style-type: none"> 1. Continuous pull with a speed of more than 2 m/s for 5 seconds. The load for the continuous pull must be between operational loads and limit load for the hoist equipment. 2. Deceleration of the cable to zero cable speed within 5 seconds by: <ol style="list-style-type: none"> a. reducing the pulling tension through the test equipment. The tension must always be greater than or equal to the rated load; or b. increase of the cable tension through the hoist. The cable tension must always be below limit load. <p>The test shall be repeated 5 times. The OLPD may be reset after each pull (if reset function is available). After the completion of the test, the hoist equipment including the OLPD shall function normally.</p>
5.1.9.1.2	<p>Replace the section with the following:</p> <p>The hoist equipment including the OLPD shall be able to arrest the load with a limited height loss after a shock load event.</p> <p>The arresting capability shall be demonstrated by an instrumented drop test in accordance with the following criteria:</p> <ul style="list-style-type: none"> • Rated load solid block • Free fall factor of 1 on 71 inches (180 cm) • Height loss <197 inches (500 cm) • For each hoisted person <ul style="list-style-type: none"> o maximum arresting force <1 798 lbf (8 kN) o A transient peak is acceptable. The force and duration shall be such that the person being hoisted is reasonably protected against serious injury (e.g. 12.5 kN for maximum of 30 ms) o Limit Load shall not be exceeded <p>The above test shall be repeated for a 101.2 kg solid block.</p> <p>The above test must be repeated for a total of 5 times for each load level (rated load and 101.2 kg). The OLPD including the dampening device can be reset after each test, if a reset function is available. After each set of 5 tests the cable and OLPD can be replaced.</p> <p>The most detrimental setting within the OLPD activation tolerance band must be tested.</p> <p>The hoist must function normally (i.e. continues to lift at the rated load and speed) after completion of each set of 5 tests.</p>
5.1.11	<p>Replace the section with the following:</p> <p>Using a milliohm meter measure the bonding resistance between the hoist bonding location as indicated by the hoist manufacturer and the appropriate connector mounting block screw as indicated by the hoist manufacturer. Verify that the reading is compatible with the bonding requirements in Chapters 4.9.25 and 4.9.26.</p>
5.2	<p>Complete the section with the following:</p>

When reading SAE AS6342 section	Apply the following:
	<p>The cable shall sustain limit and ultimate load conditions. The test shall be performed at the hoist (with the OLPD locked) or a mock-up representing all influencing factors of the installation on the hoist. The load attachment end of the cable shall be able to swivel freely. The cable shall be tested at its most critical length and most critical fleet angle if this influences the static strength characteristics.</p> <p>The cable being tested shall represent the minimum manufacturing quality as specified by the cable manufacturer. This includes all foreseeable damage and manufacturing flaws which are not inspectable by scheduled maintenance or are allowed to remain in the cable. In addition, all material strength reduction factors shall be taken into account.</p>
5.2.1 Headline	Replace the headline of the section with the following: Minimum Breaking (Rupture) Strength Test
5.2.2 Headline	Replace the headline of the section with the following: Cable Endurance and Fatigue Testing
5.2.2 1 st paragraph	Replace the paragraph with the following: Fatigue and endurance testing of the hoist cable shall be conducted in laboratory tests. These tests shall be conducted to determine the suitability of the rescue hoist cable compared to several scenarios.
5.2.2 2 nd paragraph	Replace the paragraph with the following: The manufacturer shall determine each hoist’s maximum cable usage (MCU) which is a number used to determine the maximum number of hoist cycles, or maximum number of cable extensions, a cable can undergo in field usage before requiring replacement in order to preclude cable fatigue considerations. The manufacturer shall also determine and publish all inspection criteria related to the as-designed cable in the maintenance manual, and this inspection criteria shall be used in the following fatigue testing.
5.2.2 end of chapter	Complete the section with the following: In addition of the requirements of sections 3.6.2 and 5.1.5 of AS6342, section 5.2.2.1 and 5.2.2.2 are considered to be part of the cable fatigue testing. The cable bending and tension fatigue test should be performed to evaluate the fatigue life of the cable. The fatigue evaluation of the cable should be determined considering the effect of the worst of bending, tension or a combination of both applied simultaneously. The tests described in section 5.2.2.1 and 5.2.2.2 are not considered to generate the complete data set required for cable fatigue evaluation. 5.2.2.3, 5.2.2.4 and 5.2.2.5 are part of the cable endurance testing and in addition to the hoist endurance testing in section 4.9.23. and 5.1.3.
5.2.2.1 1 st paragraph	Replace the paragraph with the following: A cyclic bending fatigue test shall be performed. The test configuration must be representative of the specific hoist design configuration (including diameter of sheaves and number of sheaves, the pressure of the crowder, and the internal routing of the cable such as number of bendings and reverse bendings) planned for certification.

When reading SAE AS6342 section	Apply the following:
	One of the acceptable methods of testing for the determination of the bending fatigue characteristics of the cable is defined in MIL-DTL-83140B Figure 4, using the geometry and cable design required in this ETSO.
5.2.2.1 Figure 1	Delete the figure.
5.2.2.1 2 nd to 4 th paragraph	Delete the paragraphs.
5.2.2.1 5 th paragraph	Replace the paragraph with the following: The total travel of the wire rope in one direction shall ensure that the test portion of the cable runs through the entire hoist configuration from the storage drum to the cable output. The application of lubricant to the fatigue test sample in addition to the lubricant applied during manufacture of the cable shall not be permitted.
5.2.2.1 6 th paragraph	Delete the paragraph, including table 3.
5.2.2.1 7 th paragraph	Replace the paragraph with the following: Following the fatigue testing described above, the test sample shall be inspected for damage and tested for minimum breaking strength. The minimum breaking strength shall be greater than the hoist's ultimate load (5.25 times the rated load).
5.2.2.2 1 st paragraph	Replace the paragraph with the following: A cable sample representative of damage and flaws that could be encountered during manufacturing or in service shall be prepared with two end fittings identical to the cable assembly design requirements of the hook end and subjected to fluctuating cable loads between 1 to 2 g times the rated load in accordance with DIN EN14311-8 Section 5.2.2.3. The cable shall be tested for 75 000 test cycles (150 000 reversals) with one end of the cable attached to a free swivel.
5.2.2.2 2 nd paragraph	Replace the paragraph with the following: Following the fatigue testing described above, the test sample shall be inspected for damage and tested for minimum breaking strength. The minimum breaking strength shall be greater than the hoist's ultimate load (5.25 times the rated load).
5.2.2.3 headline	Replace the headline of the section with the following: Unloaded Endurance Testing within Hoist
5.2.2.4 headline	Replace the headline of the section with the following: Loaded Endurance Testing within Hoist

When reading SAE AS6342 section	Apply the following:
5.2.4	Replace the paragraph with the following: Cable robustness testing is intended to demonstrate the hoist load bearing wire rope (cable) robustness or resistance to catastrophic failure after unintended and incidental contact with ground objects and rotorcraft structure. The cable may sustain damage necessitating post-mission replacement but shall have residual structural integrity to safely complete the lift where the contact occurred, or safely return the HEC to the ground. The hoist manufacturer must test, and provide test results, for the scenarios identified below.
5.2.4.1 4 th sentence	Replace the sentence with the following: The hoist cable may become damaged in such incident where the damage will be readily observable to the hoist operator or at post-flight inspection; however, the cable shall be of such construction as to provide robustness that it will not fail under load during the immediate rescue lift.
5.2.4.1.1	Replace the section with the following: The static cable (i.e. not reeling in or out) shall suspend the rated load. The cable shall be dragged over the A36 or equivalent standard steel plate edge for a total distance reasonably expected to occur in service with a load hanging freely on the hoist (note: multiple strokes may be used). The plate surface roughness and edge diameter should represent a severe scenario expected to be found in a ship construction. The angle between the vertical axis of the hoist and the cable should be at a minimum 30°. <p>The force required to drag the cable shall be applied at least 1 foot (30 cm) higher than the edge. After exposure, damage is acceptable, if the cable damage is reliably detectable within a few hoist cycles, but the cable shall be able to support limit load without failure.</p> <p>The test shall be repeated with a load corresponding to the OLPD activation point to simulate an entanglement. The distance the cable slides along the steel plate shall reflect a distance which can be reasonably expected in such an event.</p>
5.2.4.1.2	Replace the section with the following: The cable shall suspend a rated load below a A36 or equivalent standard steel plate edge. The plate surface roughness and edge diameter should represent a severe scenario expected to be found in a ship construction. The angle between the vertical axis and the cable should be at a minimum 30°. The cable shall be reeled in until achieving maximum speed (minimum cable reel-in length is 1.5 m) and then reeled out three times. After exposure, damage is acceptable, if the cable damage is reliably detectable within a few hoist cycles, but the cable shall be able to support limit load without failure.
5.2.4.2.1 Last sentence	Replace the sentence with the following: After testing the cable shall be demonstrated to support at least limit load without failure if cable damage is reliably detectable within a few hoist cycles. If no cable damage is detectable by operations or ramp maintenance personnel within a few hoist cycles, the cable shall be demonstrated to support ultimate load for at least 3 seconds without failure.

Table 2 — Additional definitions

Term	Definition
Backup quick-release subsystem (BQRS):	The secondary or ‘second choice’ subsystem used to perform a normal or emergency jettison of external cargo.
Cable	The means to suspend the external load being lowered and raised. The cable can be made of metallic and/or other materials.
Dual actuation device (DAD):	<p>This is a sequential control that requires two distinct successive actions (e.g. thumb movements) to be completed for actuation.</p> <p>Examples of a DAD are the removal of a lock pin or opening of a guarded cover followed by the activation of a ‘then free’ switch for load release to occur or opening of a cover and activate an additional guarded switch with a distinguished separate thumb movement. In this scenario, a simple covered switch does not qualify as a DAD. Familiarity with covered switches allows the operator to both open the cover and activate the switch in one motion. This has led to inadvertent load release.</p> <p>Cover = a means to mask or cover a switch that can be either moved up or to the side (sometimes called a ‘flip-guard’) Guard = fix activation protection around/for a switch or cover like a small wall, recess, lock pin or lock wire Switch = lever or push button</p>
Dynamic Load	A dynamic load is a load which occurs in a rapid manner, such as shock loads or vibration.
Emergency jettison (or complete load release)	The intentional, instantaneous release of NHEC or HEC in a pre-set sequence by the quick-release system (QRS) that is normally performed in an emergency to prevent a significant reduction in the safety margins to ensure continued safe flight and landing of the rotorcraft
Moving surface	A surface that is not fixed, such as heaving ships or water surface
Primary quick-release subsystem (PQRS):	The primary or ‘first choice’ subsystem used to perform a normal or emergency jettison of external cargo.
Quick-release system (QRS):	The entire release system for jettisonable external cargo (i.e. the sum total of both the primary and backup quick-release subsystem). The QRS consists of all the components including the controls, the release devices, and everything in between.
Serious injury	<p>According to Annex 13 to the Convention on International Civil Aviation: Aircraft Accident and Incident Investigation. Ninth Edition - July 2001. Chapter 1 - Definitions:</p> <p>Serious injury. An injury which is sustained by a person in an accident and which:</p> <ul style="list-style-type: none"> a) requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or b) results in a fracture of any bone (except simple fractures of fingers, toes, nose); or

Term	Definition
	c) involves lacerations which cause severe hemorrhage, nerve, muscle or tendon damage; or d) involves injury to any internal organ; or e) involves second- or third-degree burns, or any burns affecting more than 5 per cent of the body surface; or f) involves verified exposure to infectious substances or injurious radiation.
Stowage position	This is typically the hoist and/or cable position used when hoisting operations are not being performed.

Table 3 — Additional list of acronyms

Acronyms	Definition
AC	Advisory Circular (FAA)
AMC	acceptable means of compliance (EASA)
BQRS	Backup quick-release subsystem
CG	centre of gravity
CMR	certification maintenance requirements
CS	certification specification
DAL	design assurance level
ETSO	European Technical Standard Order
FMECA	Failure Modes Effects and Criticality Analysis
HEC	human external cargo
ICS	integrated communication system
kN	kilo Newton
MCU	Maximum Cable Usage
OLPD	Overload Protection Device
TT	Total Time

[Amdt ETSO/17]

ETSO-2C520

ED Decision 2022/018/R

406-MHZ SATELLITE PERSONAL LOCATOR BEACON**1 Applicability**

This ETSO provides the requirements that personal locator beacons (PLBs) intended to be carried by a person on board an aircraft and that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures**2.1 General**

The 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**

The applicable standard is that provided in Radio Technical Commission for Maritime Services (RTCM) Standard 11010.3 'Standard for 406 MHz Satellite Personal Locator Beacons (PLBs)', dated 25 June 2018.

3.1.2 Environmental Standard

See RTCM 11010.3, Appendix A.

3.1.3 Software

See CS-ETSO, Subpart A, paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, Subpart A, paragraph 2.3.

3.2 Specific**3.2.1 Failure Condition Classification**

See CS-ETSO, Subpart A, paragraph 2.4.

A classification of 'no safety effect' is acceptable for failures of PLBs that are not intended to be installed and not required to be approved by operational regulations.

3.2.2 Embedded Batteries

Subpart A Section 2.7 applies only to PLBs that are intended to be attached to or stowed in an aircraft.

3.2.3 Compliance Demonstration

The PLB shall have been issued with a COSPAS-SARSAT type approval certificate, which shall be provided as part of the compliance documentation.

In addition, the applicant shall provide a certificate from an independent test facility accredited to ISO/IEC 17025, with a scope covering the applicable requirements and test procedures, stating that the article complies with the electrical and environmental standards of RTCM 11010.3.

The applicant shall declare in the declaration of design and performance (DDP) the PLB generation, category, class and group, as defined in RTCM 11010.3, Section 1.5.

4 Marking

4.1 General

See CS-ETSO, Subpart A, paragraph 1.2.

4.2 Specific

See RTCM 11010.3, Section 4.5.

5 Availability of Referenced Documents

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/17]

ETSO-2C521

ED Decision 2022/018/R

ELECTRONIC FLIGHT BAG (EFB) SOFTWARE APPLICATIONS**1 Applicability**

This ETSO provides the requirements that electronic flight bag software applications that are designed 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

The 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

The applicable standard is that provided in EUROCAE ED-273, 'Minimum Operational Performance Standard for Electronic Flight Bag (EFB) Software Applications', dated August 2021.

3.1.2 Environmental Standard

Not applicable.

3.1.3 Software

See the software development assurance method described in EUROCAE ED-273, 'Minimum Operational Performance Standard for Electronic Flight Bag (EFB) Software Applications', Section 2.4.

Alternatively, see CS-ETSO, Subpart A, paragraph 2.2.

3.1.4 Airborne Electronic Hardware

Not applicable.

3.2 Specific

3.2.1 Failure Condition Classification

A safety risk assessment must be performed per EUROCAE ED-273, 'Minimum Operational Performance Standard for Electronic Flight Bag (EFB) Software Applications', Section 2.2. The assumptions, mitigation and prevention means identified in this risk assessment must be made available to the aircraft operator as required by the standard.

3.2.2 Documentation

The applicant shall develop and make available to the aircraft operator the application operational data as defined in EUROCAE ED-273, Chapter 4.

4 Marking**4.1 General**

The application shall include a function permitting the user to retrieve the markings required by CS-ETSO, Subpart A, paragraph 1.2.

Note: The date of the official release of the EFB software application is a means to comply with point 21.A.807(a)(3).

4.2 Specific

None.

5 Availability of Referenced Documents

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/17]

ETSO-2C522

ED Decision 2022/018/R

HELICOPTER TERRAIN AWARENESS AND WARNING SYSTEM (HTAWS) ADVANCED FEATURES

1 Applicability

This ETSO provides the requirements that helicopter terrain awareness and warning system (HTAWS) advanced features that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The 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

The applicable standard is that provided in Table 1 for the intended equipment class.

Table 1 — Equipment class standards

Equipment class	Equipment type	Minimum Performance Standards
Helicopter Offshore Operations (HOFO)	Offshore Helicopter Terrain Awareness and Warning System (HTAWS)	EUROCAE ED-285 'Minimum Operational Performance Standard for Offshore Helicopter Terrain Awareness and Warning System (HTAWS)' dated March 2021.

Table 2 describes the modes covered by this ETSO standard.

Table 2 — HTAWS modes

Mode		Equipment class HOFO
1	Excessive rate of descent	Required
3A	Altitude loss during take-off	Required
3B	Loss of airspeed during take-off	Required
4A	Flight near terrain when not in landing configuration	Required
4B	Flight near terrain when in landing configuration	Required
5	Excessive downward glideslope/glidepath deviation	ILS: Required GLS/LPV: Optional

Mode		Equipment class HOFO
7A	Airspeed versus total torque	Optional
7B	Vortex ring state	Optional
N/A	Fixed altitude callout	Optional
N/A	Terrain display	Not covered*
N/A	Forward looking terrain avoidance (FLTA)	Not covered*
N/A	Radio altitude interface	Not covered*

* Local regulations on air operations may require additional modes as defined in ETSO-C194, 'Helicopter Terrain Awareness and Warning System (HTAWS)'.

3.1.2 Environmental Standard

See CS-ETSO, Subpart A, paragraph 2.1.

3.1.3 Software

See CS-ETSO, Subpart A, paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, Subpart A, paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, Subpart A, paragraph 2.4.

Failure of the function defined in paragraph 3.1.1 resulting in false warnings or an unannounced loss of function is a major failure condition.

A loss of the function defined in paragraph 3.1.1 is a minor failure condition.

3.2.2 Documentation

The manufacturer of the offshore HTAWS shall document in its declaration of design and performance (DDP), installation and operator manuals the transition speed between the two-mode 4A alerts, and, when the corresponding modes are implemented, the intended helicopter type for which the mode 7A and/or 7B alerts have been designed.

4 Marking

4.1 General

See CS-ETSO, Subpart A, paragraph 1.2.

4.2 Specific

None.

5 Availability of Referenced Documents

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/17]