NPA 2024-03 (B) — PROPOSED AMENDMENTS

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Proposed amendments

The amendments are arranged as follows to show deleted, new and unchanged text:

— deleted text is ~~struck through~~;

— new text is highlighted in <mark>blue</mark>;

— an ellipsis, '[…]', indicates that the rest of the text is unchanged.

SUBPART A — GENERAL

1. APPLICABILITY

[…]

2. STANDARDS TO MEET TECHNICAL CONDITIONS

2.1 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~~ by using the guidance proposed in Section 2.4. The applicant must declare the software level(s) to which the software has been developed and verified.

<mark>If the ETSO article embeds a multi-core processor (MCP) with two or more activated cores, the software shall be developed in accordance with the acceptable means of compliance contained in AMC 20-193, entitled 'Use of multi-core processors'. The use of any other means of compliance shall be subject to a deviation request.</mark>

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 20-152[1], 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~~ by using the guidance proposed in Section 2.4.

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

The applicant must declare the hardware DAL(s) to which the item has been developed and verified.

If the ETSO article embeds a multi-core processor (MCP) with two or more activated cores, the airborne electronic hardware shall be developed in accordance with the acceptable means of compliance contained in AMC 20-193, entitled 'Use of multi-core processors'. The use of any other means of compliance shall be subject to a deviation request.

2.4 Failure conditions classification and ETSO article development assurance

2.4.1 Failure condition classification

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 (see, for instance, AMC CS xx.1309 or AMC CS 23.2500/2510 for further guidance).

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 in the intended installation. The assumed failure classification should be at least as high as the minimum hazard classification level required in the ETSO standard (when the ETSO standard requires a minimum level for a failure condition).

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 to the failure condition classifications that are expected for the intended installation.

EUROCAE/SAE document ED-79A/ARP 4754A 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 ED-135/ARP 4761A, 'Guidelines for Conducting the Safety Assessment Process on Civil Aircraft, Systems, and Equipment', dated 20.12.2023, should be used to assign the development assurance levels of the ETSO article, software and airborne electronic hardware.

2.4.2 Development assurance of the ETSO article

The ETSO article shall be developed according to at least the development assurance level that is assigned in accordance with the most critical failure condition classification determined per Section 2.4.1.

The accepted means of compliance for the development assurance of the ETSO article are contained in the EUROCAE/SAE document ED-79B/ARP 4754B, 'Guidelines for

Development of Civil Aircraft and Systems', dated 20.12.2023. When the ETSO article is composed of more than one piece of equipment, development assurance shall be applied on the ETSO article and on each piece of equipment composing the ETSO article.

The use of any other means of compliance shall be subject to a deviation request. If the applicant selects guidance other than ED-79B/ARP 4754B, the applicant shall demonstrate equivalence of that alternate guidance with the objectives of ED-79B/ARP 4754B.

Applicant's development assurance process

ETSO applicant's procedures required under Part 21, point 21.A.602B(b), should be used for documenting the development assurance process in compliance with ED-79B/ARP 4754B.

Regarding the development assurance activities and their outputs, the applicant shall observe the following requirements:

1. A planning document describing article level development assurance activities shall be provided, detailing transition criteria and relationship between processes. This planning could be documented either within procedures or within ETSO Certification Programme. The Certification Programme should at least reference the application of the planning procedure, and the particular adaptation for the specific ETSO article.

2. An 'accomplishment summary' shall be provided to complete the ETSO life-cycle data and as evidence for the application of development assurance planning activities on a given project. It could be a reference to a document in the Declaration of Design and Performance (DDP), or within ETSO compliance report. Typically, the accomplishment summary is not detailed within the DDP.

3. Independence shall be ensured for validation, verification and process assurance per ED-79B/ARP 4754B Appendix A Table A-1 objectives 4.x, 5.x and 7.x.

4. Process outputs identified in ED-79B/ARP 4754B Appendix A Table A-1 shall be controlled according to Control Categories defined in Table A-1.

5. Process assurance activities are expected per ED-79B/ARP 4754B, Appendix A, Table A-1, objectives 7.1 and 7.2. Depending on the intended aircraft installation of the ETSO article, there could be some possible exemption. If the applicant requests to exempt from demonstration of process assurance within ETSOA process, this exemption shall be identified in the Certification Programme and through the planning document.

2.5   ETSO article using an ETSO-C153()-authorised IMA platform or module

[…]

2.6   Information security protection

[…]

2.7   Open problem reports (OPRs)

[…]

2.8   Embedded batteries

[…]

3. **ADITIONAL INFORMATION**

[…]

[Amdt ETSO/3]
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SUBPART B — LIST OF ETSOs

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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 Safetying 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

EASA ETSO ref.	Title	Last amended by
ETSO-C27a	Twin Seaplane Floats	CS-ETSO/16
ETSO-C28	Aircraft Skis	CS-ETSO/Initial Issue
ETSO-C30d A1	Aircraft Position Lights	CS-ETSO/~~13~~19
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

EASA ETSO ref.	Title	Last amended by
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 A1e	Cargo Pallets, Nets and Containers	CS-ETSO/11 19
ETSO-C92c	Ground Proximity Warning, Glide Slope Deviation Alerting Equipment	CS-ETSO/Initial Issue
ETSO-C95a	Mach Meters	CS-ETSO/7
ETSO-C96c A1	Anticollision Light Systems	CS-ETSO/17 19
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

EASA ETSO ref.	Title	Last amended by
ETSO-C112ef	Secondary Surveillance Radar Mode S Transponder	CS-ETSO/1119
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-C132ab	Geosynchronous Orbit Aeronautical Mobile Satellite Services Aircraft Earth Station Equipment	CS-ETSO/1219
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

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EASA ETSO ref.	Title	Last amended by
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-C159de	Next Generation Satellite Systems (NGSS) Equipment	CS-ETSO/1619
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-C164a	Night Vision Googles	CS-ETSO/819
ETSO-C165b	Electronic Map Systems for Graphical Depiction of Aircraft Position	CS-ETSO/16
ETSO-C166c	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/1319
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

EASA ETSO ref.	Title	Last amended by
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-authorised IMA platform or module	CS-ETSO/16
ETSO-C219a	Airborne Collision Avoidance System (ACAS) Xa/Xo	CS-ETSO/18
ETSO-C220	GNSS-Aided Inertial System	CS-ETSO/19

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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-2C169a̶b̲	VHF Radio Communications Transceiver Equipment Operating within the Radio Frequency Range 117.975 to 137 Megahertz	CS-ETSO/6̶19
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

EASA ETSO ref.	Title	Last amended by
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-2C502a	Helicopter Crew and Passenger Integrated Immersion Suits	CS-ETSO/~~1~~19
ETSO-2C503a	Helicopter Crew and Passenger Immersion Suits for Operations to or from Helidecks Located in a Hostile Sea Area	CS-ETSO/~~1~~19
ETSO-2C504a	Helicopter Constant-Wear Life Jackets for Operations to or from Helidecks Located in a Hostile Sea Area	CS-ETSO/~~1~~19
ETSO-2C505a	Helicopter Life Rafts for Operations to or from Helidecks Located in a Hostile Sea Area	CS-ETSO/~~1~~19
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-2C519a	Emergency Breathing Systems (EBSs)	CS-ETSO/~~16~~19
ETSO-2C520	406-MHz Satellite Personal Locator Beacon	CS-ETSO/17
ETSO-2C521 A1	Electronic Flight Bag (EFB) Software Applications Approval	CS-ETSO/~~17~~19
ETSO-2C522	Helicopter Terrain Awareness and Warning System (HTAWS) Advanced Features	CS-ETSO/17

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ETSO-C30d A1

AIRCRAFT POSITION LIGHTS

1 Applicability

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

2 Procedures

2.1 General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 Specific

None.

3 Technical Conditions

3.1 Basic

3.1.1 Minimum Performance Standard

Standards set forth in the Society of Automotive Engineers, Inc., (SAE) Aerospace Standard (AS) Document AS 8037C 'Minimum Performance Standard for Aircraft Position Lights' dated July 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.

3.1.3 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

In lieu of the marking detailed in CS-ETSO Subpart A paragraph 1.2, the minimum lamp candle power or lamp part number shall be shown.

4.2 Specific

None.

5 Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

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[Amdt ETSO/13]
[Amdt ETSO/19]

Appendix 1 to ETSO-C30d A1 AIRCRAFT POSITION LIGHTS

In Section 3.2.2 of Society of Automotive Engineers, Inc., (SAE) Aerospace Standard (AS) Document AS 8037C 'Minimum Performance Standard for Aircraft Position Lights', dated July 2013, add below Figure 4 the following new paragraph:

The minimum intensity shall not be less than 75 % of its maximum value within the area defined by 'x' smaller than or equal to 10° as per Figure 4. The minimum intensity shall not be less than 75 % of its maximum value within the area defined by 'x' larger than 10° and 'x' smaller than or equal to 20° as per Figure 4. The minimum intensity shall not be less than 75 % of its maximum value within the area defined by 'x' larger than or equal to 110° as per Figure 4.

[Amdt ETSO/19]

ETSO-C90d-A1e

CARGO PALLETS, NETS AND CONTAINERS (UNIT LOAD DEVICES)

1   Applicability

This ETSO provides the requirements which Cargo Unit Load Devices (ULDs) 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. This ETSO also provides the requirements to enable a ULD to be additionally classified as a Fire-Resistant Container (FRC).

2   Procedures

2.1   General

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

2.2   Specific

None.

3   Technical Conditions

3.1   Basic

3.1.1   Minimum Performance Standard (MPS)

For new models of Type I ULDs, the standards set forth in standard of Aerospace Industries Association of America, Inc. (AIA), National Aerospace Standard, NAS 3610, *'Cargo Unit Load Devices.- Specification for'*, Revision 10, dated November 1, 1990, as modified by Appendix 1 to this ETSO, when applicable.

When using NAS 3610 Revision 10, the following errors must be corrected:

—   in lieu of Figure 31, sheet 87, substitute Figure 31, sheet 88;

—   for Figure 32 (missing from NAS 3610 Revision 10), use Figure 32 of NAS 3610 Revision 8 dated April 1987, or Revision 9 dated September 1987.

For new models of Type II ULDs, the standards set forth in the Society of Automotive Engineers, Inc. (SAE) Aerospace Standard (AS) 36100, *'Air Cargo Unit Load Devices - Performance Requirements and Test Parameters'*, Revision A, dated April 2006.Revision C, dated September 2020, as modified by Appendix 2 to this ETSO, when applicable.

NOTE: Reference paragraph 3.1 of SAE/AS 36100C for definitions of Type 1 and Type 2 ULDs, and paragraph 2.2 of the same standard for general definitions.

For Type I and II ULDs, the standards set forth in SAE AS36102, *'Air Cargo Unit Load Devices - Testing Methods'*, dated March 2005 are applicable.dated March 2017, as modified by Appendix 3 to this ETSO, are applicable.

For FRCs, all above-mentioned applicable ULD standards and the standards set forth in SAE AS8992, *'Fire Resistance Container Design, Performance and Testing*

Requirements', dated October 2020, as modified by Appendix 4 to this ETSO, when the ULD container integrates fire containment functionality.

3.1.2 Environmental Standard

3.1.2.1 Generic

See CS-ETSO, Subpart A, paragraph 2.1.

~~3.1.3 Computer Software~~

~~None.~~

~~3.1.4 Electronic Hardware Qualification~~

~~None.~~

3.1.2.2 Specific

For ULDs and FRCs, ~~E~~environmental degradation due to ageing, ultra-violet (UV)~~-~~ exposure, weathering, etc.~~.~~, for any ~~non-metallic~~ materials used in the construction of pallets, nets and containers must be considered. Where applicable, testing should take into account the requirements set forth in CS-ETSO Subpart A, paragraph 2.1.

~~In lieu of NAS 3610 Rev. 10, paragraph 3.7 and SAE AS36100 Rev. A, paragraph 4.7 use the following paragraph which provides the fire protection requirements for ULDs:~~

~~The materials used in the construction of pallets, nets and containers must meet the appropriate provisions in CS-25, Appendix F, Part I, paragraph (a)(2)(iv).~~

Textile Performance: See SAE Aerospace Information Report (AIR) 1490C, Environmental Degradation of Textiles, dated ~~December 2007~~April 2019, for available data for textile performance when exposed to environmental factors. This~~ese~~ data shall be taken into account for consideration of the effects of environmental degradation on nets commensurate with the expected storage and service life to satisfy SAE AS36100 Rev. ~~A~~C, paragraph 4.11.

Note: Environmental degradation data other than that documented in AIR1490~~B~~C may be used if substantiated by the Applicant and approved by EASA. A net must meet the MPS of this ETSO at any time during its service life.

FRCs shall meet the additional environmental requirements set forth in AS8992 paragraphs 3.6 and 4.2.

3.1.3 Computer Software

None.

3.1.4 Electronic Hardware Qualification

None.

3.2 Flammability Requirements

The materials used in the construction of ULDs must meet the applicable requirements set forth in CS-25 Appendix F, Part I:

— paragraph (a)(1)(ii): 12-second vertical test applicable

— paragraph (a)(2)(ii): 45-degree test applicable

— paragraph (a)(1)(iv): 2.5 inch/minute burn rate criterion for horizontal test

applicable as prescribed in Table 1 below.

ULDs additionally classified as FRCs shall meet the flammability requirements of AS8992 Section 4.

ULD pallets and nets used with Fire Containment Covers (FCCs) should be marked with 'FIRE CONTAINMENT COMPATIBLE' per paragraph 4.2 of this ETSO if the article meets the performance and testing requirements of the latest version of AS6453, 'Fire Containment Cover – Design, Performance, and Testing Requirements'. Table 1 summarises these flammability requirements; however, refer to the most recent version of AS6453 for additional information and required order of testing.

NOTE: The applicable requirements can also be found in Chapter 1, 2 and 3 of the FAA Aircraft Materials Fire Test Handbook available at https://www.fire.tc.faa.gov/Handbook.

Table 1: Summary of Flammability Requirements for ULDs and FRCs

	Vertical Bunsen Burner Test *(12-second test)*	45-degree Bunsen Burner Test	Horizontal Bunsen Burner Test *(2.5-inch/minute burn rate criteria)*
Article/Component:			
ULD side panels, rigid doors, non-metallic pallets and ceiling	X	X	
ULD curtain-style doors	X		
ULD nets			X
ULD nets compatible with FCCs	X		
Non-metallic ULD pallets compatible with FCCs	X	X	

3.~~2.1.~~3 Failure Condition Classification

N/A

4 Marking

4.1 General

Marking is detailed in CS-ETSO Subpart A paragraph 1.2. Marking shall be in an area that will typically remain visible after the ULD is loaded with cargo.

4.2   Specific

All ULDs:

In addition, the following information shall be legibly and permanently marked on the ULD:

1. The identification of the article in the code system explained in

    a. NAS 3610, Revision 10, paragraph 1.2.1, for Type I ULDs.

    b. SAE AS36100, ~~Rev. A, paragraph 3.5 for Type ii ULDs.~~ Revision C, paragraph 3.5 for Type II ULDs.

2. The nominal weight of the article in kilogram and pound in the format: Weight: …kg (…lb)

3. If the article is not ~~omni~~ omnidirectional, the words 'FORWARD', 'AFT', and 'SIDE' must be conspicuously and appropriately placed.

4. The manufacturer's serial number of the article, with the option to add the date of manufacture.

~~5.   The burning rate determined for the article under paragraph 3.2 of this ETSO.~~

~~6~~5. If applicable, the ~~expiration~~ expiry date in the format 'EXP YYYY-MM' must be marked on the ULD.

ULDs additionally classified as FRCs: FRCs must also be marked per the requirements in paragraphs 5.1.a, 5.1.c, and 5.2 to 5.4 of AS8992.

Nets and Pallets Compatible for Use with Fire Containment Covers: Refer to AS6453, *'Fire Containment Cover – Design, Performance, and Testing Requirements'*, testing requirements for pallets and nets that are operationally suited for use with a Fire Containment Cover (FCC) approved under ETSO-C203 A1 and SAE AS6453. If the pallet or net meets the testing requirements in that standard, it may be marked under this ETSO as follows:

1. Net: 'FIRE CONTAINMENT COMPATIBLE WITH SAE AS6453 CERTIFIED FIRE COVER' in bold characters at least 40 mm (1.6 inches) high;

    NOTE: Include the revision number of SAE AS6453 in the marking.

2. Pallets (non-metallic): 'FIRE CONTAINMENT COMPATIBLE' in legible characters.

5   Availability of Referenced Document

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/11]
[Amdt ETSO/19]

Appendix 1 to ETSO-C90e CARGO PALLETS, NETS AND CONTAINERS (UNIT LOAD DEVICES)

Purpose: This Appendix prescribes the MPS for Type I Unit Load Devices (ULDs). The applicable standard is AIA NAS 3610 Revision 10, *Specifications for Cargo Unit Load Devices*, dated 1 November 1990, as modified by this Appendix.

When reading NAS3610 Revision 10…	*Do the following:*
Paragraph 3.5	Replace with Section 4 of this ETSO for marking requirements.
Paragraph 3.7	Replace with paragraph 3.2 of this ETSO.
Sheet 87, Figure 31	Use revised Figure 31 from sheet 88.
Figure 32 (missing from NAS 3610 Rev. 10)	Use Figure 32 of NAS 3610 Rev. 9, dated November 1987, or NAS 3610 Rev. 8, dated September 1987.

[Amdt ETSO/19]

Appendix 2 to ETSO-C90e CARGO PALLETS, NETS AND CONTAINERS (UNIT LOAD DEVICES)

Purpose: This Appendix prescribes the MPS for Type II Unit Load Devices (ULDs). The applicable standard is SAE Aerospace Standard (AS) 36100, *Air Cargo Unit Load Devices – Performance Requirements and Test Parameters*, Revision C, dated September 2020, as modified by this Appendix.

When reading AS36100C…	*Do the following:*
Paragraphs 1.1–1.2	Disregard
Paragraph 4.5	Replace with Section **4** of this ETSO for marking requirements.
Paragraph 4.6	Disregard
Paragraph 4.7	Replace with paragraph **3.2** of this ETSO.
Section 6	Disregard

[Amdt ETSO/19]

Appendix 3 to ETSO-C90e CARGO PALLETS, NETS AND CONTAINERS (UNIT LOAD DEVICES)

Purpose: This Appendix prescribes the MPS for Type I and Type II Unit Load Devices (ULDs) including those classified as Fire-Resistant Containers (FRCs). The applicable standard is SAE Aerospace Standard AS36102B, *Air Cargo Unit Load Devices - Testing Methods*, dated March 2017, as modified by this Appendix.

When reading AS36102B…	*Do the following:*
Paragraph 4.1.2	
Paragraph 4.2.5	
Paragraph 4.3.5	Replace the word 'should' with 'shall'.
Paragraph 4.4.7	
Paragraph 6.2	
Paragraph 6.2.6	Replace wording of paragraph with the following: *6.2.6 Test Results* *A description of the results of each of the tests performed, with actual load, location of CG, how long the ULD was held clear of support, referred by exhaustive photographic and video proof, evidence of any deformations and damages and references to any drawings and/or pictures of test arrangements.*

[Amdt ETSO/19]

Appendix 4 to ETSO-C90e CARGO PALLETS, NETS AND CONTAINERS (UNIT LOAD DEVICES)

Purpose: This Appendix prescribes the MPS for Fire-Resistant Containers (FRCs). The applicable standard is SAE AS8992, *Fire Resistant Container Design, Performance, and Testing Requirements*, dated October 2020, as modified by this Appendix.

When reading AS8992…	*Do the following:*
Paragraph 3.1.2 NOTE	Disregard
Paragraph 3.3.4	Disregard
Paragraph 3.3.5	Disregard
Paragraph 3.4	Disregard
Section 5	ULDs classified as FRCs must meet the marking requirements of this section in addition to paragraphs 4.1 and 4.2 of this ETSO. Disregard paragraph 5.1.b of AS8992, as it is duplicative to paragraphs 4.1 and 4.2 of this ETSO.

[Amdt ETSO/19]

ETSO-C96c A1

ANTICOLLISION LIGHT SYSTEMS

[...]

[Amdt ETSO/13]
[Amdt ETSO/19]

Appendix 1 to ETSO-C96c A1 ANTICOLLISION LIGHT SYSTEMS

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~~ add ~~the~~ a 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 ~~s~~Section 1.2.1 of Society of Automotive Engineers, Inc., (SAE) Aerospace Standard AS8017D 'Minimum Performance Standard for Anticollision Light Systems', dated August 2017 remove the statement:

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

A.3   In Section 3.1, add new Section 3.1.4 'Effective Intensity Variation': for any angle (up to 30°) above or below the horizontal plane, the difference between the minimum and maximum effective intensity for different azimuths shall be less than 25 % of the maximum intensity.

A.4   In Section 3.2, add new Section 3.2.4 'Effective Intensity Variation': for any angle (up to 75°) above or below the horizontal plane, the difference between the minimum and maximum effective intensity for different azimuths shall be less than 25 % of the maximum intensity.

A.5   In Section 3.3, add new Section 3.3.4 'Effective Intensity Variation': for any angle (up to 30°) above or below the horizontal plane, the difference between the minimum and maximum effective intensity for different azimuths shall be less than 25 % of the maximum intensity.

A.~~3~~6   In ~~s~~Section 3.4 of Society of Automotive Engineers, Inc., (SAE) Aerospace Standard 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 to the alternate colour definitions detailed in Section 3.4.1 (without compliance to 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]
[Amdt ETSO/19]

ETSO-C112ef

SECONDARY SURVEILLANCE RADAR MODE S TRANSPONDER

1   Applicability

This ETSO provides the requirements which Secondary Surveillance Radar Mode S Transponder that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2   Procedures

2.1   General

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

2.2   Specific

None.

3   Technical Conditions

3.1   Basic

3.1.1 Minimum Performance Standard

Standards set forth in the EUROCAE ED-73EF, Minimum Operational Performance Standards for Secondary Surveillance Radar Mode S Transponders, dated May 2011December 2020, as modified by Change 1, dated January 2022, and as amended by Appendix 1 to this ETSO.

Note: Level 2 transponders are expected to comply with the Overlay Command Capability as per ED-73EF sections 3.23.1.12 and 3.18.4.40.

3.1.2 Environmental Standard

See CS-ETSO, Subpart A, paragraph 2.1.

3.1.3 Computer Software

See CS-ETSO, Subpart A, paragraph 2.2.

3.1.4 Electronic Hardware QualificationAirborne 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 major 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.

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4   Marking

4.1   General

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

4.2   Specific

The marking must also include the transponder's functional level and optional additional features as provided in ED-73~~E~~F, Section 1.4.2.2, as well as minimum peak output power identified by the transponder class as defined in ED-73~~E~~F, Section 1.4.2.4.

5   Availability of Referenced Document

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/11]
[Amdt ETSO/19]

Appendix 1 to ETSO-C112ef – Secondary Surveillance Radar Mode S Transponder Amendment to EUROCAE ED-73EF / RTCA DO-181F requirements

This Appendix lists the EASA modification to MPS for Secondary Surveillance Radar Mode S Transponder.

The applicable standard is EUROCAE ED-73E Secondary Surveillance Radar Mode S Transponder, dated May 2011, amended as described below.

Text from EUROCAE ED-73E is provided here as needed to provide context. Text to be added is underlined. Text to be removed is lined through.

1.   *EUROCAE ED-73E, page 59, Section 3.23.1.12.d*, is modified here to ensure multiple Comm-B message changes are processed properly.

   d.   Comm-B Broadcast

Note 1: A Comm-B broadcast is a message directed to all active interrogators in view. Messages are alternately numbered 1, 2, and are available for 18 seconds unless a waiting air-initiated Comm-B interrupts the cycle. Interrogators have no means to cancel the Comm-B broadcast.

Note 2: If there is more than one Comm-B message waiting for transmission, the timer is only started once the message becomes the current Comm-B broadcast.

A Comm-B broadcast starts, when no air-initiated Comm-B transaction is in effect, with the loading of the broadcast message into the Comm-B buffer, insertion of DR codes 4, 5, 6 or 7 into downlink transmissions of DFs 4, 5, 20, 21 and with the starting of the B-timer for the current Comm-B message. On receipt of the above DR codes, interrogators may extract the broadcast message by transmitting RR=16 with DI≠3 or 7 or with DI=3 or 7 and RRS=0 in subsequent interrogations. The change of the DR value is used by the interrogator to detect that a new Comm-B broadcast is announced and to extract the new Comm-B message. A new Comm-B broadcast shall not interrupt a current Comm-B broadcast. When the B-timer runs out after 18 ± 1 seconds, the transponder will reset the DR codes as required, will discard the previous broadcast message, and changes the broadcast message number from 1 to 2 (or vice versa).

If an air-initiated Comm-B transaction is initiated during the broadcasting interval (i.e. while the B-timer is running), the B-timer is stopped and reset, the appropriate code is inserted into the DR field, and the Comm-B transaction proceeds per Figure 3-18. The previous Comm-B broadcast message remains ready to be reactivated for 18 ± 1 seconds after conclusion of the air-initiated Comm-B transaction.

Waiting Comm-B broadcasts shall be retained for transmission once the current Comm-B broadcast is finished. If the contents of a waiting Comm-B broadcast changes, only the most recent value shall be broadcast. This prevents multiple changes from generating a sequence of broadcasts. Currently only BDS registers 1,0, Downlink Capability Report and, 2,0, Flight ID, make use of the Comm-B Broadcast protocol.

2. *A test procedure is added here to ensure the modified requirements in Section 1 of this Appendix are met. This test is intended to be introduced in EUROCAE ED-73E, Section 5.5.8.23, on pages 253 and 254.*

5.5.8.23   Procedures #21A and #21B Comm-B Broadcast

(Section 3.23.1.12 d protocol)

5.5.8.23.1 Test Procedure #21A Comm-B Broadcast

Note 1: The command to the transponder that a Comm-B broadcast message shall be sent originates in a peripheral device or in the device that holds the extended capability report.

Note 2: The Comm-B broadcast does not affect the existing Comm-B protocol, air- or ground-initiated. The existing test procedures remain unchanged.

Note 3: Verification of interface patterns is already part of the Comm-B test procedures and need not be repeated for the Comm-B Broadcast.

This test procedure verifies that the DR code command and the MB field of the Comm-B broadcast protocol is carried out correctly.

a.   STEP 1 — General Broadcast Protocol Test

During the Comm-B protocol test procedure (Procedure #18) insert the appropriate DR Code command and the MB field of the Comm-B broadcast into the transponder.

Verify that:
(1)   The transponder can correctly show the DR codes 4, 5, 6, 7 when NO air initiated Comm B is in progress and that it cannot show DR codes 4, 5, 6, 7 when an air initiated Comm B is in progress.
(2)   The Comm-B broadcast message can be extracted by the interrogator for 18 ± 1 seconds.
(3)   The Comm-B broadcast annunciation (DR = 4, 5, 6, or 7) and the Comm-B broadcast MB field are interrupted by an air initiated Comm-B and reappear when that transaction is concluded. For transponders implementing the enhanced airinitiated Comm-B protocol, the transponder will be independently interrupted by up to 16 Comm-B messages that are assigned to each II code. After the Comm-B is concluded for each II code, the Comm-B broadcast is again available to that interrogator. Verify that the next waiting broadcast message is not announced to any interrogators until the current broadcast message has timed out.
(4)   After interruption another 18 ± 1 seconds of broadcast time is available to the interrogator. For transponders implementing the enhanced air-initiated Comm-B protocol, the transponder will be independently interrupted by up to 16 Comm-B messages that are assigned to each II code. After interruption, another 18 ± 1 seconds of broadcast time is available for each II code.
(5)   A subsequent and different Comm-B broadcast message is announced with the alternate DR code and that this DR code also follows the verifications above. For transponders implementing the enhanced air-initiated Comm-B protocol, the transponder will be independently interrupted by up to 16 Comm-B messages that are assigned to each II code. The subsequent Comm-B broadcast is announced only after each Comm-B is broadcast timer has expired for all II codes.

b.   STEP 2 — Transponder-Initiated Broadcast

(1)   Enter an AIS Flight Identification into the transponder.
Verify that a broadcast is automatically initiated by the transponder.
Extract the broadcast and verify the correct flight ID.
Wait 20 seconds to allow the broadcast timer to time out and enter the same AIS value again.
Verify that no new broadcast is initiated by the transponder.
Repeat the test with a different AIS flight identification.

(2)   Enter a datalink capability report into the transponder.
Verify that a broadcast is automatically initiated by the transponder.
Extract the broadcast and verify the correct datalink capability report.
Wait 20 seconds to allow the broadcast timer to time out and enter the same datalink capability report again.
Verify that no new broadcast is initiated by the transponder.
Repeat the test with a different datalink capability report.

5.5.8.23.2   Test Procedure #21B Processing of multiple Comm-B messages

Note 1: *The command to the transponder that a Comm-B broadcast message shall be sent originates in a peripheral device or in the device that holds the extended capability report.*

Note 2: *The Comm-B broadcast does not affect the existing Comm-B protocol, air- or ground-initiated. The existing test procedures remain unchanged.*

Note 3: *Verification of interface patterns is already part of the Comm-B test procedures and need not be repeated for the Comm-B Broadcast.*

This test procedure verifies that multiple Comm-B broadcast messages are queued and processed correctly.

Generate one flight identification change followed by a data link capability report change and two more flight identification changes in less than 18 seconds.

Verify that:
(1) The first Flight ID change is available as a Comm-B Broadcast.
(2) The data link capability report change is made available as a Comm-B broadcast after the Flight ID Broadcast times out.
(3) The last flight ID change is made available as a Comm-B Broadcast after the Data Link Capability Broadcast times out.
(4) All three Comm-B Broadcasts are available for 18 ± 1 seconds each

Purpose

This Appendix lists the modifications to EUROCAE ED-73F / RTCA DO-181F, *Minimum Operational Performance Standards for Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment,* as modified by Change 1. To enhance readability, sections of EUROCAE ED-73F / RTCA DO-181F that are modified by Change 1 are shown with the modifications implemented as the baseline text. Text added to modify EUROCAE ED-73F / RTCA DO-181F is underlined. Text to be

removed is struck through. In between the sections an ellipsis, '[…]', is introduced to indicate that the rest of the text is unchanged. For easy reading, all cross references are provided to EUROCAE ED-73F sections. Due to the extensive modifications, Section 5.5.8.36 is included as a complete change.

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[…]

3.23.1.12.e.(3)   Updating of the Data Link Capability Report

The maximum update interval at which Register 10_{16} shall be reloaded with valid data is ≤ 1.0 seconds.

NOTE: Effectively, Register 10_{16} must be updated every 1.0 seconds or sooner.

If a particular data field in Register 10_{16} cannot be updated within 8.0 seconds, the data field shall be set to ZERO, with the exception of the following CAS version and capability fields: CAS Extended Version Number (Bit # 43 – 46 or MB Bit # 11 – 14), Hybrid Surveillance Capability (Bit # 69 or MB Bit # 37), CAS RA Capability Enabled (Bit # 70 or MB Bit # 38), and CAS Version (Bit # 71 – 72 or MB Bit # 39 – 40).

At intervals not exceeding four seconds, the transponder compares the current basic data link capability status with that last reported and if a difference is noted, initiates a revised basic data link capability report by Comm-B broadcast for BDS1=1 and BDS2=0.

The transponder shall initiate, generate and announce the revised basic data link capability report even if the aircraft data link capability is degraded or lost. To support this requirement, the transponder shall set the BDS for the basic data link capability report.

NOTE: The setting of the BDS code by the transponder ensures that a broadcast change of the capability report will contain the BDS code for all cases of data link failure (e.g. the loss of the transponder data link interface).

[…]

3.27.1.2 b.(1)   Data Link Capability Codes in MB for All Transponder/CAS Systems

The following bits of the Data Link Capability report are allocated to providing information about the CAS system on the aircraft.

Bit #	MB #	Field	Notes
43	11	CAS Extended Version Number	1
44	12		
45	13		
46	14		
48	16	CAS Out of Standby	2
69	37	Hybrid Surveillance Capability	3
70	38	CAS RA Capability Enabled	4
71	39	CAS Version	5
72	40		

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Notes:

1. *CAS Extended Version Number will be 0000 for all versions of TCAS. The definition of this field is as follows:*

Bits 43 – 46 'MB' Bits 11 – 14	Meaning
0000	Non-extended version
0001	ACAS Xa version 1
0010	ACAS Xu version 1
0011 – 1111	Reserved for future versions

2. *CAS Out of Standby, Bit 48 ('MB' bit 16), set to ONE (1) indicates that the both the transponder & CAS functions are operational and the transponder is receiving RI=1, 2, or 3 from the CAS unit. Transponders will only receive RI=1 from CAS that are Active CAS of junior status or passive CAS, i.e. CAS with reduced capability that are limited when interacting with other CAS.*

3. *Hybrid Surveillance Capability, Bit 69 ('MB' bit 37), set to ONE (1) indicates capability of Hybrid Surveillance, and set to ZERO (0) indicates that there is no Hybrid Surveillance capability.*

4. *CAS RA Capability Enabled, Bit 70 ('MB' bit 38), is only relevant if CAS Out of Standby is a ONE (1). This field set to ONE (1) indicates that the CAS is currently capable of generating RAs. This field set to ZERO (0) indicates that CAS is not currently capable of generating RAs. In some systems, such as TCAS and ACAS Xa, this means that the system is currently only able to generate TAs. For other systems, such as ACAS Xu, this means that the system is not currently capable of generating Remain Well Clear (RWC) alerting and guidance.*

5. *CAS Version, Bits 71, 72 ('MB' bits 39, 40), are encoded in accordance with the following table. Note that unlike most other fields in a BDS Register, the MSB of this field is the higher numbered bit.*

Bit 72 'MB' Bit 40	Bit 71 'MB' Bit 39	Meaning
0	0	DO-185 (TCAS 6.04A) (ETSO-C119a)
0	1	DO-185A (TCAS 7.0) (ETSO-C119b)
1	0	EUROCAE ED-143 (TCAS 7.1) (ETSO-C119c – TSO-C119e)
1	1	See CAS Extended Version Number

If the transponder / CAS are no longer communicating or if a failure of the CAS system is detected by the transponder, the transponder **shall** set ~~all CAS related bits in the Data Link Capability report~~ CAS Out of Standby (Bit # ~~43, 44, 45, 46,~~ 48~~, 69, 70, 71, &~~ ~~72~~ or MB Bit # ~~11, 12, 13, 14,~~ 16~~, 37, 38, 39, & 40~~) to ZERO (0).

Interrogators, such as ground based Mode S sensors, learn of the specific data link capabilities on board the aircraft by using the Data Link Capability Report protocol specified in §3.23.1.12 e.

The data bits discussed here reside in the MB field of the Data Link Capability Report. The transponder inserts these bits such that the data appears appropriately in response to a request for Data Link Capability Report when BDS1=1 and BDS2=0. As such, these data bits comprise only a small fraction of the entire Data Link Capability Report which may collate data from multiple sources for transfer in the downlink. Care must be taken to ensure that the data fields discussed in the following paragraphs are not compromised when other sources attempt to update the Data Link Capability Report, and that updating of these bits does not compromise other parts of the Data Link Capability Report.

[…]

3.27.1.2 b.(2) Data Link Capability Codes in MB for Systems Loaded Directly by CAS

The following guidance applies to all 'loaded directly by CAS' (as defined in §3.27.f) transponder/CAS.

In this system, the CAS unit will directly provide the data necessary to set all of the CAS related bits in the Data Link Capability Report (Bit # 43, 44, 45, 46, 48, 69, 70, 71, & 72 or MB Bit # 11, 12, 13, 14, 16, 37, 38, 39, & 40). The transponder **shall** set the bits in the Data Link Capability Report as provided by the CAS, except when a failure is detected as specified in §3.27.2.3. None of the other bits in this register are to be affected by the loading of these bits by CAS.

[…]

3.27.2.3 CAS Failure Data Handling

When a CAS failure is detected, the transponder shall perform the following:

- Set RI (see §**Error! Reference source not found.**) to ZERO.
- Set SL (see §3.18.4.35) to ZERO.
- Set BDS 1,0 bits 11-14, 16, 37-40 to ZERO.
- Set BDS 0,F and 3,2 through 3,F to ZERO.
- Set BDS E,5 and E,6 to ZERO.
- Set BDS 3,0 and 3,1 to zero when the RAT field (§**Error! Reference source not found.**ca) is ZEROONE.

Notes:

1. *Ways in which the transponder detects a CAS failure include, but are not limited to: (a) non-operational CAS (§3.27.1.5); (b) a failure of the CAS/transponder interface (§3.27.2.2). The reception of RI=0 with SL=1 indicates that the CAS is in standby and is not considered to be a failure condition.*

2. *A CAS failure during an active RA will trigger RA termination (RAT=1). The frozen RA report will be retained while RAT=1 and set to ZERO upon RAT expiration.*

[…]

3.31.3 Update Interval

a. The maximum update interval at which a data field in a Register will be reloaded with valid data is defined for each register in Table B-2-1 in Appendix B.

b. The transponder will load valid data into the related transponder Register as soon as it becomes available at the Mode S Specific Services Entity.

c. The time between availability of data that causes a change in a data field of a Register and the time that the change is made to the Register will be less than the maximum update interval specified in Table B-2-1 in Appendix B.

d. If a data field cannot be updated with valid data within twice the specified maximum update interval defined for the Register or 2.6 seconds (whichever is the greater), then Status Bit (if specified) of the field will be set to ZERO ('0' (INVALID) and that data field will be ~~ZERO~~zeroed.

[…]

5.5.8.34 Procedure #30: Sensitivity Level Operation (§Error! Reference source not found.)

This test verifies that the transponder receives sensitivity level information from the CAS unit and correctly reports this information in outgoing DF=0, 16 replies.

Note: *When the following tests are performed with a EUROCAE 143 (or later) transponder/CAS interface, bit=48 of the Data Link Capability Report must be set consistent with the RI field specified for the test (see §3.27.1.2.b).*

a. Send a status = 'Active CAS with resolution capability' and a sensitivity level=6 to the transponder via the transponder/CAS interface.

Interrogate the transponder with a UF=0 and a UF=16 non-acquisition interrogation.

Show that the transponder correctly reports the CAS status and sensitivity level in the RI and SL fields respectively.

b. Not used.

c. Not used.

d. Send a sensitivity level=4 to the transponder via the transponder/CAS interface. Interrogate the transponder with a UF=0 and a UF=16 non-acquisition interrogation.

Show that the transponder correctly reports the CAS status and sensitivity level in the RI and SL fields respectively.

e. Send a status = 'CAS with resolution capability inhibited' and a sensitivity level=2 to the transponder via the transponder/CAS interface.

Interrogate the transponder with a UF=0 and a UF=16 non-acquisition interrogation.

Show that the transponder correctly reports the CAS status and sensitivity level in the RI and SL fields respectively.

f. Send a status = 'No operating CAS' and a sensitivity level=1 to the transponder via the transponder/CAS interface.

Interrogate the transponder with a UF=0 and a UF=16 non-acquisition interrogation.

Show that the transponder correctly reports the CAS status and sensitivity level in the RI and SL fields respectively (RI=0, SL=1).

g. Send a status = 'Active CAS of junior status with resolution capability or Passive CAS with resolution capability' and a sensitivity level=3 to the transponder via the transponder/CAS interface.

Interrogate the transponder with a UF=0 and a UF=16 non-acquisition interrogation.

Show that the transponder correctly reports the CAS status and sensitivity level in the RI and SL fields respectively.

[…]

5.5.8.36.2 Procedure #32: Transmission of CAS Capability Information to a Mode S Sensor (§3.27.g, §3.27.1.2.b, §3.27.1.2.b.1, and Error! Reference source not found.**) and to other CAS Aircraft (§3.27.1.5) for a Transponder Capable of Being Loaded Directly by CAS**

a. Enable the transponder only (i.e. establish the state where the transponder/CAS interface is not operational).

b. Interrogate the transponder with a non-acquisition UF=0 interrogation.

Show that the transponder replies with the correct capability information in the DF=0 reply (i.e. RI=0).

c. Interrogate the transponder with the following four interrogations:

UF=4 with RR=17 and DI≠7;

UF=5 with RR=17 and DI≠7;

UF=20 with RR=17, DI=7, and RRS=0;

UF=21 with RR=17, DI=7, and RRS=0.

Show, in each of the four cases, that the transponder replies with the correct capability information in the DF=20, 21 replies (i.e. BDS1=1, BDS2=0, bits 43 – 46 = 0000, bit 48=0, bits 69, 70, 71 and 72 =0000 and bits 69 – 72 = 0000). Additionally show that in each of the four cases bits 43, 44, 45 and 46 = 0000.

d. Establish the transponder/CAS interface. Repeat the procedures in steps b and c above for each of the following 32 cases in substep (1a), (1b), (2a), (2b), (3a), (3b), (4a), and (4b) below. For each case use the following values for validating that the CAS version is correctly reported in the Data Link Capability Report:

DO-185A TCAS:	Bits 43 – 46: 0000, Bits 71, 72: 10
DO-185B / ED-143 TCAS:	Bits 43 – 46: 0000, Bits 71, 72: 01
DO-385 / ED-256 ACAS Xa:	Bits 43 – 46: 0001, Bits 71, 72: 11
DO-386 / ED-275 ACAS Xu:	Bits 43 – 46: 0010, Bits 71, 72: 11

(1) CAS reports (RI=2) and reports bit 48=1, bit 69=1 and bit 70=0 in its Data Link Capability Report information to the transponder via the transponder/CAS interface.

Show that the transponder replies with RI=2 in the DF=0 reply.

Show that the transponder replies with bits 43 – 46, 71 and 72 reporting the correct CAS version, bit 48=1, bit 69=1 and bit 70=0 in the DF=20, 21 replies.

(2)   CAS reports (RI=3) and reports bit 48=1, bit 69=0 and bit 70=1 in its Data Link Capability Report information to the transponder via the transponder/CAS interface.

Show that the transponder replies with RI=3 in the DF=0 reply.

Show that the transponder replies with bits 43 – 46, 71 and 72 reporting the correct CAS version, bit 48=1, bit 69=0 and bit 70=1 in the DF=20, 21 replies.

(3)   CAS reports RI=0 and reports bit 48=0, bit 69=1, and bit 70=0 in its Data Link Capability Report information to the transponder via the transponder/CAS interface.

Show that the transponder replies with RI=0 in the DF=0 reply.

Show that the transponder replies with bits 43 – 46, 71 and 72 reporting the correct CAS version, bit 48=0, bit 69=1 and bit 70=0 in the DF=20, 21 replies.

[…]

5.5.8.37.1   Procedure #33: CAS or transponder/CAS Interface Failure During Transmission of RA Report and Data Link Capability Report to a Mode S Sensor (§3.27.1.2 a (2) and §3.27.1.2 b (2) for a Transponder Operating with an RTCA DO-185A or EUROCAE ED-143 or EUROCAE ED-256 compatible CAS

For each of the CAS versions use the following values to validate that the CAS version is correctly reported in the Data Link Capability Report:

DO-185A TCAS: Bits 43 – 46: 0000 , Bits 71, 72: 10

DO-185B TCAS: Bits 43 – 46: 0000 , Bits 71, 72: 01

ED-256 ACAS Xa: Bits 43 – 46: 0001 , Bits 71, 72: 11

a.   Send the following content for the RA report to the transponder via the transponder/CAS interface once per second for 5 seconds.

BDS	Bits 41 – 58	RAI	Bits 60 – 88
48	010101010101010101	0	1100110011001100110011001001

During the 5th second, cause the CAS unit to report a CAS failure to the transponder ~~(i.e. RI=0 and SL=1)~~.

Interrogate the transponder once per second during the 5 seconds described above and for an additional 25 seconds (30 seconds total) with UF=4 interrogations with RR=19, DI=7, and RRS=0 and with UF=4 interrogations with RR=19, DI=7, and RRS=1.

Show that in the DF=20 RA report replies:

For the first 23 ±1 seconds, the ~~'ACAS Resolution report available code'~~ 'TCAS bit' is set in the DR field. Thereafter, it is cleared.

For the first 5 seconds, the RA Report has the following content:

BDS	Bits 41 – 58	RAT	Bits 60 – 88
48	Same as input	0	Same as input

BDS	Bits 41 − 88
49	0

For the next 18 ±1 seconds, the content is:

BDS	Bits 41 − 58	RAT	Bits 60 − 88
48	Same as input	1	Same as input

BDS	Bits 41 − 88
49	0

For the remaining 7 ±1 seconds, the values are:

BDS	Bits 41 − 58	RAT	Bits 60 − 88
48	000000000000000000	0	00000000000000000000000000000

BDS	Bits 41 − 88
49	0

b. Repeat the steps in step 'a', except during the 5th second, cause the transponder to recognize a failure on the transponder/CAS interface (i.e. disconnect or otherwise interrupt the interface). The results should be the same as in step 'a'.

c. Send 'Active CAS with resolution capability' (RI=3), CA operational = 1, hybrid surveillance capability, and the CAS version to the transponder via the transponder/CAS interface for 5 seconds.

During the 5th second, cause the ~~transponder to recognize a failure on the transponder/CAS interface (i.e. disconnect or otherwise interrupt the interface)~~ CAS unit to report a CAS failure to the transponder.

Interrogate the transponder once per second for 30 seconds with UF=4 interrogations with RR=17, DI 7 and RRS=0.

Show that in the DF=20 Data Capability Report replies:

For the first 5 seconds, bits 43, 44, 45, 46, 71 and 72 indicate the correct CAS version, bit 48=1, bit 69=1, and bit 70=1.

For the next 25 seconds, ~~bits 43, 44, 45, 46, 48, 69, 70, 71, and 72 all = 0~~ bits 43 − 46, 71 and 72 indicate the correct CAS version, bit 48=0, bit 69=1 and bit 70=1.

d. Repeat steps a., b. and c., this time using the following content as input:

BDS	Bits 41 − 58	RAI	Bits 60 − 88
48	10101010101010101010	0	00110011001100110011001100110

The results should be the same as in test steps a., b. and c.

[…]

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5.5.8.37.2 **Procedure #33: CAS or transponder/CAS Interface Failure During Transmission of RA Report and Data Link Capability Report to a Mode S Sensor (§3.27.1.2 a (2) and §3.27.1.2 b (2)) for a Transponder Operating with an EUROCAE ED-275/RTCA DO-386 Compatible ACAS Xu**

a. Send the following content for the RA report to the transponder via the transponder/CAS interface once per second for 5 seconds:

Part 1 of RA report: Content for BDS register 30_{16}

BDS	Bits 41 − 58	RAI	Bits 60 − 88
48	010101010101010101	0	11001100110011001100110011001

Part 2 of RA report: Content for BDS register 31_{16}

BDS	Bits 41 − 88
49	0001110001110001110001110001110001110001110001110001110001110001110001110001

During the 5th second, cause the CAS unit to report a CAS failure to the transponder (i.e. RI=0 and SL=1).

Interrogate the transponder once per second during the 5 seconds described above and for an additional 25 seconds (30 seconds total) with UF=4 interrogations with RR=19, DI=7, and RRS=0 and with UF=4 interrogations with RR=19, DI=7, and RRS=1.

Show that in the DF=20 RA report replies:

For the first 23 ±1 seconds, the 'ACAS Resolution report available code' 'TCAS bit' is set in the DR field. Thereafter, it is cleared.

For the first 5 seconds, the RA Report has the following content:

BDS	Bits 41 − 58	RAT	Bits 60 − 88
48	Same as input	0	Same as input

BDS	Bits 41 − 88
49	Same as input

For the next 18 ±1 seconds, the content is:

BDS	Bits 41 − 58	RAT	Bits 60 − 88
48	Same as input	1	Same as input

BDS	Bits 41 − 88
49	Same as input

For the remaining 7 ±1 seconds, the values are:

BDS	Bits 41 − 58	RAT	Bits 60 − 88
48	000000000000000000	0	00000000000000000000000000000

BDS	Bits 41 − 88
49	000000000000000000000000000000000000000000000000

b. Repeat the steps in step 'a', except during the 5th second, cause the transponder to recognize a failure on the transponder/CAS interface (i.e. disconnect or otherwise interrupt the interface). The results should be the same as in step 'a'.

c. Send 'Active CAS with resolution capability' (RI=3), CA operational = 1, ~~no~~ hybrid surveillance capability, and CAS of ACAS Xu version 1 to the transponder via the transponder/CAS interface for 5 seconds.

    During the 5th second, cause the ~~transponder to recognize a failure on the transponder/CAS interface (i.e. disconnect or otherwise interrupt the interface)~~ <u>CAS unit to report a CAS failure to the transponder</u>.

    Interrogate the transponder once per second for 30 seconds with UF=4 interrogations with RR=17 and DI<u>=</u>7.

    Show that in the DF=20 Data Capability Report replies:

    For the first 5 seconds, bits 43, 44, 45, and 46 ~~are~~ <u>=</u>'0010', bit 48=1, and bits 69, 70, 71, and 72='1111'.

    For the next 25 seconds, ~~bits 43, 44, 45, 46, 48, 69, 70, 71, and 72 all = 0~~ <u>bits 43 − 46='0010', bit 48=0, and bits 69 − 72='1111'</u>.

d. Repeat steps a., b. and c., this time using the following content as input:

    Part 1 of RA report: Content for BDS register 30_{16}

BDS	Bits 41 − 58	RAI	Bits 60 − 88
48	101010101010101010	0	00110011001100110011001100110

    Part 2 of RA report: Content for BDS register 31_{16}

BDS	Bits 41 − 88
49	111000111000111000111000111000111000111000111000

The results should be the same as in test steps a., b. and c.

[…]

5.8   Generic <u>Register XX</u> Test Procedures (§3.31)

Introduction:

The following general test procedure is intended to provide guidelines for minimal verification that newly implemented GICB registers are properly being serviced. <u>This test procedure is not intended for Extended Squitter registers; tests for Extended Squitter are included in EUROCAE ED-102B as modified by Change 1.</u>

5.8.1   Purpose and Definition (§Error! Reference source not found.**)**

NOTE: *In the following subsections, '**ddd**' means the decimal equivalent to **XX_{16}**. For instance, for 40_{16}, '**ddd**' = 64_{10} = 64.*

For any newly added given Register **XX_{16}**, refer to Appendix B, Table B-3-**ddd** for appropriate format and definition of the register.

5.8.2   Data Requirement (§Error! Reference source not found.**)**

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a. Ensure that no data is being provided to the transponder that could be used to fill any field in the Register **XX₁₆** that is being tested.

b. Interrogate the transponder using GICB protocols as specified in §3.23.1.12.

> *NOTE 1:* *See §5.7.7.1.a and b as example interrogations used to extract Register 60₁₆.*

c. Verify that the transponder replies with a DF=20 reply with <u>all externally provided data in </u>Bits 33 through 88 (bits 1 through 56 of the 'MB' field) set to ALL ZERO (0).

> *NOTE 2:* *Some registers are required to fill bits 1 through 8 with the Register Number, e.g. **XX₁₆**. In such cases, bits 1 through 8 of the 'MB' field will contain the Register number **XX₁₆** and the remaining bits (9 through 56) of the 'MB' field will be set to ZERO (0).*

5.8.2.1 Data Field 'y' (§Error! Reference source not found.)

a. Via an appropriate interface, provide the transponder with appropriate valid data for each parameter 'y' in Register **XX₁₆** that is to be tested.

b. Interrogate the transponder using GICB protocols as ~~specified~~ <u>described</u> in §3.23.1.12.

> *NOTE:* *See §**Error! Reference source not found.**.a and b as example interrogations used to extract Register 60₁₆.*

c. For each 'y' parameter, verify that the transponder replies with an 'MB' field having:

(1). Each 'y' parameter encoded in the proper register location.

(2). Each 'y' parameter encoded in two's complement arithmetic unless otherwise specified.

(3). Each 'y' parameter value properly rounded to preserve accuracy of ±½ LSB.

(4). Status bit for each applicable 'y' parameter set to ONE (1) if data is valid and set to ZERO (0) if data is invalid.

[…]

5.8.3 Update Rate (§Error! Reference source not found.)

Change the data provided to the transponder and repeat the interrogation given in §0.b as necessary to complete the following steps:

a. For each 'y' parameter, verify that the data changes to the appropriate value required in §0.c within the maximum update interval time specified in Appendix B, Table B-2-1 for the given Register **XX₁₆** being tested.

b. If the appropriate value required in 'a' above cannot be realized within twice the maximum update interval time specified or ~~2~~ <u>2.6</u> seconds (whichever is greater), verify that the parameter 'y' subfield and its associated status bit is set to ALL ZERO (0).

5.8.4 Service Reporting (§Error! Reference source not found.)

Change the data provided to the transponder and repeat the interrogation given in §0.b as necessary to complete the following steps:

a. Verify that the servicing of Register **XX₁₆** during the power-on cycle of the transponder is properly reported in Registers 18₁₆ through 1C₁₆ as required in

Appendix B, Table B-3-24 to Table B-3-28.

b.   Verify that the real-time (not just since power-on) servicing of Register XX_{16} is properly reported in Register 17_{16} (see Appendix B, Table B-3-23) if such reporting is required for Register XX_{16}.

c.   Verify that an appropriate Comm. – B Broadcast is initiated if a change to Register XX_{16} forces a change to Register 10_{16}.

> *Note: See §Error! Reference source not found..b.(2) as an example of validating presence of the Broadcast using Register 60_{16}.*

d.   Extract the Broadcast and verify that the contents of Register 10_{16} have been changed in accordance with the change action affecting Register XX_{16} under test.

> *Note: See §Error! Reference source not found..g as an example of validating the Broadcast using Register 60_{16} as the register forcing the change to Register 10_{16}.*

5.8.5   Register XX_{16} – Repeat §5.8.1 through §5.8.4 using Extended Data Source Extraction with 'DI' = 3 (§3.31)

> *Note: The following procedure uses XY to define the register as opposed to XX used in §Error! Reference source not found..*

Repeat all of §0 through §0 using the following interrogation.

REGISTER XY_{16} GICB EXTRACTION							
EXTENDED DATA SOURCE INTERROGATION SETUP USING DI=3							
1 ---- 5	6 ---- 8	9 --- 13	14 - 16	17 -- 22	23	24 – 27	28 – 32
				'SD'			
'UF' =	'PC' =	'RR' =	'DI' =	'SIS' =	'LSS' =	'RRS' =	Not Assigned =
4	0	16 + X (1X HEX)	3	1	1	Y (Y HEX)	0

Table B-2-1: GICB Register Number Assignments

Transponder Register Number	Assignment	Implementation Reference	Maximum update interval (Note 1)
00_{16}	Not valid	Not defined as a specific register, however corresponding protocol used to extract AICB and Comm-B Broadcast on Level 2	N/A
01_{16}	Reserved		N/A
02_{16}	Linked Comm-B, segment 2	Level 2 with AICB Capability	N/A
03_{16}	Linked Comm-B, segment 3	Level 2 with AICB Capability	N/A

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Transponder Register Number	Assignment	Implementation Reference	Maximum update interval (Note 1)
04_{16}	Linked Comm-B, segment 4	Level 2 with AICB Capability	N/A
05_{16}	Extended Squitter Airborne Position	ADS-B (6)	0.2s
06_{16}	Extended Squitter Surface Position	ADS-B (6)	0.2s
07_{16}	Reserved (Removed from subnetwork version number 6)	ADS-B v0 – v2 (6)	N/A
08_{16}	Extended Squitter Identification and Category	ADS-B (3, 6)	15.0s
09_{16}	Extended Squitter Airborne Velocity	ADS-B (6)	1.3s
$0A_{16}$	Reserved (Removed from ADS-B v3)	ADS-B v1 and v2 (6) transmission of 61_{16}. Not for direct reading (2).	N/A
$0B_{16} - 0C_{16}$	Reserved (Removed from subnetwork version number 6)		N/A
$0D_{16} - 0E_{16}$	Reserved		N/A
$0F_{16}$	Reserved for CAS		N/A
10_{16}	Data Link Capability Report	Level 2	$\leq$4.0s (7)
11_{16}	Data Link Capability Report (extension)	Level 2 with Basic Dataflash	5.0s
$12_{16} - 16_{16}$	Reserved for extension to datalink capability reports		5.0s
17_{16}	Common usage GICB Capability Report	Level 2	5.0s
$18_{16} - 1C_{16}$	Mode S Specific Services Capability Reports (GICB Capability)	Level 2	5.0s
$1D_{16} - 1F_{16}$	Mode S Specific Services Capability Reports (MSP Capability)	Level 2	5.0s
20_{16}	Aircraft Identification	Level 2	5.0s
21_{16}	Aircraft and airline registration markings		15.0s
22_{16}	Reserved (Removed from subnetwork version number 6)		N/A
$23_{16} - 24_{16}$	Reserved		N/A
25_{16}	Aircraft type		15.0s
$26_{16} - 2F_{16}$	Reserved		N/A
30_{16}	CAS Active Resolution Advisory	Level 2 with CAS	1.0s (when RA active)
31_{16}	CAS Active Resolution Advisory (Part 2)		1.0s
32_{16}	Reserved for CAS		N/A

Transponder Register Number	Assignment	Implementation Reference	Maximum update interval (Note 1)
$33_{16} - 37_{16}$	Extended Squitter Operational Coordination Message		1.0s (when RA active)
$38_{16} - 3F_{16}$	Reserved for CAS		N/A
40_{16}	Selected vertical intention	EHS (5)	1.0s
41_{16}	Next waypoint identifier		1.0s
42_{16}	Next waypoint position		1.0s
43_{16}	Next waypoint information		0.5s
$44_{16} - 45_{16}$	Reserved (Removed from subnetwork version number 6)		N/A
$46_{16} - 47_{16}$	Reserved		N/A
48_{16}	VHF channel report		5.0s
$49_{16} - 4F_{16}$	Reserved		N/A
50_{16}	Track and turn report	EHS (5)	1.3s
51_{16}	Position report coarse		1.3s
52_{16}	Position report fine		1.3s
53_{16}	Air-referenced state vector		1.3s
54_{16}	Waypoint 1		5.0s
55_{16}	Waypoint 2		5.0s
56_{16}	Waypoint 3		5.0s
$57_{16} - 5E_{16}$	Reserved		N/A
$5F_{16}$	Reserved (Removed from subnetwork version number 6)		N/A
60_{16}	Heading and speed report	EHS (5)	1.3s
61_{16}	Extended Squitter Aircraft Status (Subtype 1: Emergency/Priority Status)	ADS-B v1 – v3 (6)	15.0s
62_{16}	Extended Squitter Target State and Status Information	ADS-B v1 – v3 (6)	0.5
63_{16}	Extended Squitter Aircraft Status (Subtype 4: UAS/RPAS Lost Link, Current TCP)	ADS-B v3 (6)	1.0s
64_{16}	Extended Squitter Aircraft Status (Subtype 4: UAS/RPAS Lost Link, Next TCP)	ADS-B v3 (6)	1.0s
65_{16}	Extended Squitter Aircraft Operational Status	ADS-B v1 – v3 (6)	2.5 s
66_{16}	IRM – Interrogation Rate Monitor	ADS-B v3 (6)	5.0s
67_{16}	IRM – Reply Rate Monitor	ADS-B v3 (6)	5.0s
68_{16}	ADS-B Wx AIREP (Subtype 0: Aircraft State)	ADS-B v3 (6)	60 s
69_{16}	ADS-B Wx AIREP (Subtype 1: Weather State)	ADS-B v3 (6)	5.0 s

Transponder Register Number	Assignment	Implementation Reference	Maximum update interval (Note 1)
$6A_{16}$	ADS-B Wx AIREP (Subtype 2: Alternate Weather State)	EHS (5) and ADS-B v3 (6)	5.0 s
$6B_{16}$	ADS-B Wx PIREP (Subtype 0: Flight Weather)	ADS-B v3 (6)	Indefinite
$6C_{16}$	ADS-B Wx PIREP (Subtype 1: Temp, Wind & Turbulence)	ADS-B v3 (6)	Indefinite
$6D_{16}$	ADS-B Wx PIREP (Subtype 2: Hazardous Weather)	ADS-B v3 (6)	Indefinite
$6E_{16}$	High Velocity and/or Altitude (Subtype 0: Position)	ADS-B v3 (6)	0.2s
$6F_{16}$	High Velocity and/or Altitude (Subtype 1: Velocity)	ADS-B v3 (6)	0.2s
70_{16}	Reserved		N/A
71_{16}	Interval Management Report	EHS (5) and IM (4)	10 s
$72_{16} - DD_{16}$	Reserved		N/A
$DE_{16} - DF_{16}$	Mode S BITE	ICAO Doc 9871 and Doc 9924	N/A
$E0_{16}$	Reserved		N/A
$E1_{16} - E2_{16}$	Mode S BITE	ICAO Doc 9871 and Doc 9924	N/A
$E3_{16}$	Transponder type/part number	Recommended in European CS-ACNS AMC1 ACNS.D.ELS.015	15 s
$E4_{16}$	Transponder software revision number	Recommended in European CS-ACNS AMC1 ACNS.D.ELS.015	15 s
$E5_{16}$	CAS unit part number	Level 2 with CAS	~~15 s~~ <u>Indefinite</u>
$E6_{16}$	CAS unit software revision number	Level 2 with CAS	~~15 s~~ <u>Indefinite</u>
$E7_{16}$	Transponder Status and Diagnostics		15 s
$E8_{16} - E9_{16}$	Reserved		N/A
EA_{16}	Vendor Specific Status and Diagnostics		15 s
$EB_{16} - F0_{16}$	Reserved		N/A
$F1_{16} - F2_{16}$	Reserved (Removed from subnetwork version number 6)		N/A
$F3_{16} - FF_{16}$	Reserved		N/A

NOTES <u>for Table B-2-1:</u>

1   The term 'minimum update rate' is used in this document. The minimum update rate is obtained when data is loaded in one Register field once every maximum update interval.

2   Register $0A_{16}$ is not to be used for GICB or ACAS crosslink readout.

3 *If Extended Squitter is implemented, then Register 08_{16} is not cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08_{16} is not cleared since it provides information that is fundamental to track file management in the ADS-B environment. (See §2.2.5.1.11.c in RTCA DO-260C / EUROCAE ED-102B).*

4 *The maximum update interval of register 71_{16} is used to determine if new IM data is provided and when the IM data has to be reset. An empty message will be sent every 10s by the Flight-deck Interval Management (FIM) application, the reception of this message is sufficient for the transponder to declare support for the Interval Management Report in BDS 1,A and 1,7. When an IM clearance is active the FIM application will send the data every 1s for a limited period of time, as defined in DO-361A/ED-236A.*

5 *The EHS (Enhanced Surveillance) parameters are defined in European* <u>*Union*</u> *regulation and in ICAO Doc 7030.* ~~*EU 1207/2011*~~<u>*Commission Implementing Regulation (EU) 2023/1770*</u> *requires the transmission of parameters. CS-ACNS indicates which registers shall or should be transmitted.* ~~*EU 1207/2011 requires that any information transmitted must be tested.*~~

6 *ADS-B requirements are defined by state regulations including but not limited to U.S. 14 CFR 91.225 and 91.227, European* <u>*Commission Implementing*</u> *Regulation* ~~*(EU) 1207/2011, (EU) 1028/2014, (EU) 2017/386, (EU) 2020/587*~~<u>*(EU) 2023/1770*</u> *and associated CS-ACNS, Canadian Operations Specifications 609 for domestic or 610 for foreign operators and Advisory Circular AC700-009 revision 2, Australian CAO 20.18, 82.1, 82.3, 83.5, and Advisory Circular AC-21-45(v2.2).*

7 <u>*A CAS compatible transponder populates the following CAS version and capability fields of Register 10_{16} as corresponding data is received by the CAS: CAS Extended Version Number (Bit # 43 – 46 or MB Bit # 11 – 14), Hybrid Surveillance Capability (Bit # 69 or MB Bit # 37), CAS RA Capability Enabled (Bit # 70 or MB Bit # 38), and CAS Version (Bit # 71 – 72 or MB Bit # 39 – 40). Once populated with non-zero data, these fields are not cleared or ZEROed during the current power cycle.*</u>

[...]

Table B-3-17: BDS Code 1,1 — Data Link Capability Report (extension)

MB FIELD

1	MSB	
2		
3		
4		
5	BDS Code 1,1 (11_{16})	
6		
7		
8	LSB	
9	Continuation flag (see 6)	
10	Reserved	
11	MSB	BDS 4,0 (40_{16}) Selected Vertical Intent change
12	LSB	(see 2)
13	MSB	Reserved for future Basic Dataflash Register Expansion
14	LSB	(see 2)
15	MSB	Reserved for future Basic Dataflash Register Expansion
16	LSB	(see 2)

PURPOSE: To extend the reporting of data link capability of the Mode S transponder/data link installation.

1) See Table B-3-16a (BDS 1,0) Note 7.

2) Encoding of Monitoring bits for each Basic Dataflash Register shall be encoded as follows:

Monitoring Bit Encoding		
MSB	**LSB**	**Meaning**
0	0	Register is NOT monitored. (see §3.32.3.a and §3.32.4.f).
0	1	Register is monitored but there has been no update change in the register contents ~~since the last time that the register was included in a Basic Dataflash Broadcast~~. (see §3.32.3.b <u>).</u>

17	MSB	Reserved for future Basic Dataflash Register Expansion
18	LSB	(see 2)
19	MSB	BDS 4,8 (48_{16}) VHF Channel Report change
20	LSB	(see 2)
21	MSB	Reserved for future Basic Dataflash Register Expansion
22	LSB	(see 2)
23	MSB	Reserved for future Basic Dataflash Register Expansion
24	LSB	(see 2)
25	MSB	Reserved for future Basic Dataflash Register Expansion
26	LSB	(see 2)
27	MSB	BDS 7,1 (71_{16}) Interval Management Report
28	LSB	(see 2)
29	MSB	Reserved for future Basic Dataflash Register Expansion
30	LSB	(see 2)
31	MSB	Reserved for future Basic Dataflash Register Expansion
32	LSB	(see 2)
33	MSB	Reserved for future Basic Dataflash Register Expansion
34	LSB	(see 2)
35	MSB	Reserved for future Basic Dataflash Register Expansion
36	LSB	(see 2)
37		
38		
39		Reserved (see 3)
40		
41	MSB	
42		
43		
44		
45		
46		
47		
48		Bit array indicating the support status of DTE Sub-addresses 0 to 15 (see 4 and 5)
49		
50		
51		
52		
53		
54		
55		
56	LSB	

1	0	Register is monitored and data contents are changing such that the Monitoring Bits shall be toggled '10', '11', '10', etc., each time the contents change in accordance with §3.32.4.b. through §3.32.4.e.
1	1	

3) These bits remain reserved for future system expansion needs.

4) Starting from the MSB, each subsequent bit position **shall** represent the DTE sub-address in the range of 0 to 15.

5) The current status of the on-board DTE **shall** be periodically reported to the GDLP by on-board sources. Since a change in this field results in a broadcast of the capability report, status inputs **shall** be sampled at approximately one minute intervals.

6) In order to determine the extent of any continuation of the data link capability report (into those registers reserved for this purpose: register 11_{16} to register 16_{16}), bit 9 **shall** be reserved as a continuation flag to indicate if the subsequent register can be extracted by the interrogator. For example: upon detection of bit 9 = 1 in register 10_{16}, then register 11_{16} can be extracted by the interrogator. If bit 9 = 1, in register 11_{16}, then register 12_{16} can be extracted by the interrogator, and so on (up to register 16_{16}). Note that if bit 9 = 1 in register 16_{16}, then this is considered as an error condition

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ETSO-C132~~a~~b

GEOSYNCHRONOUS ORBIT AERONAUTICAL MOBILE SATELLITE SERVICES AIRCRAFT EARTH STATION EQUIPMENT

1 Applicability

This ETSO gives the requirements which Geosynchronous Orbit Aeronautical Mobile Satellite Services (AMSS) aircraft earth station equipment that is designed and manufactured on or after the date of this ETSO, must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 Specific

None.

3 Technical Conditions

3.1 Basic

3.1.1 Minimum Performance Standard

Standards set forth in ~~the Federal Aviation Administration standard 'Geosynchronous Orbit Aeronautical Mobile Satellite Services Aircraft Earth Station Equipment'.~~

~~This standard is based on~~ RTCA document DO 210D "~~'~~MOPS for Geosynchronous Orbit Aeronautical Mobile Satellite Services (AMSS) avionics~~'~~" Section 2.0 dated April 19, 2000 including Change 1, dated December 14, 2000, Change 2, dated November 28, 2001, Change 3 dated September 19, 2006; ~~and~~ Change 4, dated March 24, 2015; and Change 5, dated March 26, 2020.

AMSS AES manufactured under ETSO-C132a can be upgraded to this ETSO by replacing the Diplexer Low Noise Amplifier (DLNA) with one identified and manufactured using this ETSO.

Functionality. This ETSO's standards apply to AMSS AES equipment that provides direct worldwide communications between aircraft subnetworks and ground subnetworks using aeronautical mobile satellites in geosynchronous orbit and their ground earth stations. AMSS will support both data and voice communications between aircraft users and ground-based users, such as air route traffic control ~~centers~~ centres (ARTCC) and aircraft operators. Communication services with AMSS functions include four categories: air traffic services (ATS), aircraft operational control (AOC), aeronautical administrative communications (AAC), and aeronautical passenger communications (APC).

3.1.2 Environmental Standard

See CS-ETSO Subpart A paragraph 2.1.

3.1.3 Computer Software

See CS-ETSO Subpart A paragraph 2.2.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO Subpart A paragraph 2.4.

(1)   Failure of the function defined in paragraph 3.1.1 is a minor failure condition.

(2)   Loss of the function defined in paragraph 3.1.1 of this ETSO is a minor failure condition. Satellite communication is a supplemental service operation, with high frequency (HF) radio required for primary communication. The loss of satellite communication is mitigated by availability of HF communications.

(3)   AMSS equipment is intended for procedural airspace area operations. FAA determined the failure condition specified in paragraph 3.2.1 of this ETSO based on AMSS equipment operating as an approved long-range communication system (LRCS) in oceanic airspace area environments. Use of AMSS equipment in other operating environments (for example, high-density terminal/en-route domestic airspace) may impact equipment performance and safety considerations.

Note: Equipment authorised to this ETSO might not be approved for use in dual SATCOM or dual-dissimilar SATCOM configuration, if the failure condition classification for design was MINOR.

4   Marking

4.1   General

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

4.2   Specific

~~None.~~

Mark also the DLNA subassemblies permanently and legibly, with at least the manufacturer's name, subassembly part number, and this ETSO number.

5   Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

[Amdt ETSO/3]
[Amdt ETSO/12]
[Amdt ETSO/19]

ETSO-C159de

NEXT GENERATION SATELLITE SYSTEMS (NGSS) EQUIPMENT

1   Applicability

This ETSO provides the requirements which next generation satellite systems (NGSS) 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 standards are those provided in EUROCAE ED-243C / RTCA DO-262F 'Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS)', dated AprilJune, 20172021; including Errata 1 published in September 2021 and Change 1 published in September 2022.

Note: There are no MPS security requirements for NGSS equipment. However, a security risk assessment may be required at the time of installation, and if needed, security controls may be implemented in connected aircraft systems or addressed by flight crew procedures.

3.1.2   Environmental Standard

See CS-ETSO, Subpart A, paragraph 2.1.

3.1.3   Software

See CS-ETSO, Subpart A, paragraph 2.2.

3.1.4   Airborne Electronic Hardware

See CS-ETSO, Subpart A, paragraph 2.3.

3.2   Specific

The MPS allows for different equipment classes and subclasses as defined by EUROCAE ED-243C / RTCA DO-262F. There are 610 applicable equipment classes and 11 equipment subclass components identified as shown in Tables 1A, 1B, 1C and Tables 2A, 2B of this ETSO. Tables 1A and 2A show the requirements for satellite communication (short burst data) (SATCOM (SBD)) equipment classes and subclass components., and Tables 1B and 2B show the requirements for satellite communication (swift Broadband) (SATCOM (SBB)) equipment classes and subclass components. Table 1C shows the requirements for SATCOM Certus Broadband (SATCOM CBB). The manufacturer must declare the equipment class requirements from those identified in the applicable table of this ETSO. The equipment configuration shall satisfy the relevant requirements of the EUROCAE ED-243C / RTCA DO-262F (as modified by Errata 1 and Change 1) minimum operational

performance standards (MOPS) as identified in Tables 1A, ~~and~~ 1B and 1C, and Tables 2A and 2B of this ETSO.

Table 1A — Equipment Class Identifiers supporting SATCOM (SBD)

Equipment Class Identifier	Description	Requirement
All SATCOM SBD equipment classes	ALL SATCOM SBD equipment produced under EUROCAE ED-243C / RTCA DO-262F, Appendix D, identified as Equipment Class AES1, AES2 or AES3.	Appendix D Section D.2.1 and Appendix D Section D.2.2 requirements applicable to all SATCOM SBD equipment classes and Section 2.4 for the applicable test requirements.
AES1	AES using a single channel Satellite Data Unit (SDU) that contains one SBD (96XX) transceiver for Aeronautical Mobile Satellite (Route) Services (AMS(R)S) data-only applications. AES1 is a Short Burst Data (SBD)-only transceiver and cannot support voice calling. A passive Low Gain Antenna (LGA) is required for use with the AES1. Also see EUROCAE ED-243C / RTCA DO-262F, Appendix D, Figure D-13.	Appendix D~~,~~ Section D.2.2 requirements specifically applicable to AES1 Appendix D Section D.2.2.1.1 and Section 2.4 for the applicable test requirements.
AES2	AES using a single or dual channel SDU that contains one or two LBT (95XX) transceivers for voice and/or data applications. A passive LGA is part of the AES2 system. Also see EUROCAE ED-243C / RTCA DO-262F, Appendix D, Figure D-14. ~~AES2 is capable of multiple services using a single or dual channel SDU that contains one or two transceivers for data and/or voice applications. A passive LGA is required for use with the AES2.~~	Appendix D~~,~~ Section D.2.2 requirements specifically applicable to AES2 Appendix D Section D.2.2.1.2 and Section 2.4 for the applicable test requirements.
AES3	AES using two or more LBT (95XX) and/or SBD (96XX) transceivers for multiple channel data and/or voice applications. A passive LGA is part of the AES3 system. Also see EUROCAE ED-243C / RTCA	Appendix D~~,~~ Section D.2.2 requirements specifically applicable to AES3 Appendix D Section D.2.2.1.3 and Section 2.4 for the applicable test requirements.

	DO-262F, Appendix D, Figure D-15. ~~AES using two or more transceivers for multiple data and/or voice applications. A passive LGA is required for use with the AES3.~~	

Table 1B — Equipment Class Identifiers supporting SATCOM (SBB)

Equipment Class Identifier	Description	Requirement
All SATCOM SBB equipment classes	ALL SATCOM SBB equipment produced under EUROCAE ED-243C / RTCA DO-262F, Appendix D, identified as Equipment Class AES4, AES6 or AES7.	Appendix E Section E.2.1 and Appendix E Section E.2.2 requirements applicable to all SATCOM SBB equipment classes, and Section 2.4 for the applicable test requirements.
AES4	AES using an enhanced Low Gain Antenna (ELGA). AES4 configured as a complete system. Also see EUROCAE ED-243C / RTCA DO-262F, Appendix E, Figure E-8.	Appendix E~~,~~ Section E.2.2 requirements specifically applicable to AES4, specifically including Section 2.2.1.1.1 and Section 2.4 for the applicable test requirements.
AES6	AES using a High Gain Antenna (HGA)~~,~~ transceiver~~,~~ and Diplexer Low Noise Amplifier (DLNA). AES6 is defined as an entire system. Also see EUROCAE ED-243C / RTCA DO-262F, Appendix E, Figure E-9.	Appendix E~~,~~ Section E.2.2 requirements specifically applicable to AES6, specifically including Section 2.2.1.1.2 and Section 2.4 for the applicable test requirements.
AES7	AES using an Intermediate Gain Antenna (IGA)~~,~~ transceiver~~,~~ and DLNA. AES7 is defined as an entire system. Also see EUROCAE ED-243C / RTCA DO-262F, Appendix E, Figure E-10.	Appendix E~~,~~ Section E.2.2 requirements specifically applicable to AES7, specifically including Section 2.2.1.1.3 and Section 2.4 for the applicable test requirements.

Table 1C — Equipment Class Identifiers supporting SATCOM (SBB)

Equipment Class Identifier	Description	Requirement
All SATCOM CBB equipment classes	ALL SATCOM CBB equipment produced under EUROCAE ED-243C / RTCA DO-262F, Appendix F, identified as Equipment Class AES8, AES9, AES10 or AES11.	Appendix F Section F.2.1 and Appendix F Section F.2.2 requirements applicable to all SATCOM CBB equipment classes, and Section 2.4 for the applicable test requirements.
AES8	An AES using either an omni L-Class (ALGA) or a steered M-	Appendix F Section F.2.2 requirements specifically

	Class antenna (MGA) for one carrier uplink. AES8 is configured as a complete system. Also see EUROCAE ED243C / RTCA DO-262F, Appendix F, Table F-9.	applicable to AES8, and Section 2.4 for the applicable test requirements.
AES9	An AES using either an omni L-Class (ALGA) or a steered M-Class antenna (MGA) for two sub-carrier uplinks. AES9 is configured as a complete system. Also see EUROCAE ED243C / RTCA DO-262F, Appendix F, Table F-9.	Appendix F Section F.2.2 requirements specifically applicable to AES9, and Section 2.4 for the applicable test requirements.
AES10	An AES using a steered H-Class antenna (HGA) for one carrier uplink. AES10 is configured as a complete system. Also see EUROCAE ED243C / RTCA DO-262F, Appendix F, Table F-9.	Appendix F Section F.2.2 requirements specifically applicable to AES10, and Section 2.4 for the applicable test requirements.
AES11	Appendix D Section D.2.1 requirements that apply to LGA Appendix D Section D.2.2 requirements applicable to all SATCOM SBD equipment.	Appendix F Section F.2.2 requirements specifically applicable to AES11, and Section 2.4 for the applicable test requirements.

Table 2A — Equipment Subclass Identifiers supporting SATCOM (SBD)

Subclass Identifier	Description	Requirement
LGA	Passive LGA for use with AES1, AES2 or AES3.	Appendix D Section D.2.1 requirements that apply to LGA Appendix D Section D.2.2 requirements applicable to all SATCOM SBD equipment. Appendix D, Section D.2.2 requirements specifically applicable to LGA, specifically including Section D.2.2.3.1.1.

Table 2B — Equipment Subclass Identifiers supporting SATCOM (SBB)

Subclass Identifier	Description	Requirement
All SATCOM SBB equipment subclasses	All SATCOM SBB system components produced under EUROCAE ED-243C / RTCA DO-262F, Appendix E, identified as Equipment Subclass HGA, IGA, 6J, 6F, 7J, 7F, 6D, 7D, DJ or DFL.	Appendix E Section E.2.1 requirements applicable to equipment subclass. Appendix E Section E.2.2 requirements applicable to all SATCOM SBB equipment. Appendix E Section E.2.2 requirements specifically

Subclass Identifier	Description	Requirement
		applicable to the equipment subclass, specifically including the sections listed for each subclass below.
HGA	HGA for AES6.	Appendix E, Section E.2.2.3.1.2
IGA	IGA for AES7.	Appendix E, Section E.2.2.3.1.2
~~6MA~~6J	A transceiver for AES6, using a DJ (or, in certain conditions, DFL) DLNA and HGA antenna. ~~Transceiver, SDU Configuration Module (SCM), SDU, Modified Type A (DMA) Diplexer Low Noise Amplifier (DLNA), and HGA for use with AES6.~~	Appendix E, Section E.2.2.1.1.4 as modified by RTCA/DO-262F Errata 1
6F	A transceiver for AES6, using a DFL DLNA and HGA antenna.	Appendix E Section E.2.2.1.1.5
~~7MA~~7J	A transceiver for AES7, using a DJ (or, in certain conditions, DFL) DLNA and IGA antenna. ~~Transceiver, SDU, SCM, DMA DLNA, and IGA for use with AES7.~~	Appendix E, Section E.2.2.1.1.6 as modified by RTCA/DO-262F Errata 1.
7F	A transceiver for AES7, using a DFL DLNA and IGA antenna.	Appendix E Section E.2.2.1.1.7
6D	Transceiver with integrated DLNA for AES6, using a HGA antenna. ~~Transceiver and DLNA combination includes SDU, High-Power Amplifier (HPA), DLNA, SCM, and HGA functions for use with AES6.~~	Appendix E, Section E.2.2.1.1.8
7D	Transceiver with integrated DLNA for AES7, using an IGA antenna. ~~Transceiver and DLNA combination includes SDU, HPA, DLNA, SCM, and IGA functions for use with AES7.~~	Appendix E, Section E.2.2.1.1.9
~~6F~~	~~Transceiver and Type F (DF) DLNA includes SDU, HPA, SCM, and HGA functions for use with AES6.~~	~~Appendix E, Section 2.2.1.1.5~~
~~7F~~	~~Transceiver and DF DLNA includes SDU, HPA, SCM, and IGA functions for use with AES7.~~	~~Appendix E, Section 2.2.1.1.7~~

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Subclass Identifier	Description	Requirement
~~DMA~~DJ	Type J diplexer (DLNA) as described in ARINC-781. Configures with 6J transceiver and HGA for use with AES6, or 7J transceiver and IGA for use with AES7. ~~DLNA with standard Transmitter (Tx) filter configures with 6MA transceiver and HGA for use with AES6, or 7MA transceiver and IGA for use with AES7.~~	Appendix E~~,~~ Section E.2.2.1.1.10
DFL	Type F – LTE diplexer (DLNA) as described in ARINC-781. Configures with 6F (and, under certain conditions, 6J) transceiver and HGA for use with AES6, or with 7F (and, under certain conditions, 7J) transceiver and IGA for use with AES7. ~~DLNA with enhanced Tx filter configures with 6MA or 6F transceiver and HGA for use with AES6, or with 7MA or 7F transceiver and IGA for use with AES7.~~	Appendix E~~,~~ Section E.2.2.1.1.11

This ETSO standard applies to equipment intended for long-range communication services, procedural and continental communication services, aeronautical mobile satellite (route) services (AMS(R)S) by means of satellite communications between AES, corresponding satellites, and ground earth stations (GES). The NGSS supports voice and data communications between aircraft users and ground-based users, such as air navigation service providers (ANSPs) and aircraft operators.

The functionality of an NGSS supports four categories of communication service in the aircraft control domain (ACD) and/or aircraft information services domain (AISD). Two are safety of flight communication used for air traffic services (ATS) and aeronautical operational control (AOC) communication. The other two are aeronautical administrative communication (AAC) and special-purpose aeronautical passenger communication (APC) under the physical or virtual access control of the flight crew.

EUROCAE ED-243C / RTCA DO-262F, Normative Appendix E (as modified by Errata 1) and Appendix F (as modified by Change 1), also contains provisions for supporting a non-priority and non-safety of flight communications service known as passenger information and entertainment services (PIES). EUROCAE ED-243, Normative Appendix E, states that non-priority services are outside the scope of that Appendix. However, PIES communications, if supported, must be partitioned from communications in the ACD and AISD for security reasons. Therefore, PIES communications are non-ETSO functions, and equipment that supports shared ACD and PIES communications must provide security

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partitioning of the PIES functionality from priority communications services in the ACD and AISD in accordance with this ETSO.

See paragraphs 3.1.3, 3.1.4 and 3.2.1 of this ETSO for specific additional data, design/security assurance and verification requirements related to the required security partitioning for equipment intended to support shared ACD/AISD and PIES communications.

NGSS equipment is intended for procedural/continental airspace area operations. The failure conditions specified in paragraph 3.2.1 of this ETSO have been determined based on NGSS equipment that supplements or complements primary HF/VHF voice or data communications in procedural/continental airspace area operations, and on equipment that provides 'Segregation & arbitration' as described in EUROCAE ED-243, Appendix E, Section 1.3.4, or the equivalent functionality. Use of NGSS equipment in other operating environments (for example, high-density terminal/en route airspace) may impact equipment performance and safety considerations.

3.2.1 Failure Condition Classification

See CS-ETSO, Subpart A, paragraph 2.4.

A loss or malfunction of the security partitioning required by paragraph 3.2 of this ETSO that enables unauthorised or inadvertent access to ACD or AISD communications from outside the ACD or AISD is a major failure condition.

A loss or malfunction of the functions defined in paragraph 3.1.1 of this ETSO, except for a loss or malfunction of the security partitioning required by paragraph 3.2 of this ETSO, is a minor failure condition.

Note: The use of NGSS equipment as the sole means of routine ATS communication may change the classification of the failure conditions.

4   Marking

4.1   General

See CS-ETSO, Subpart A, paragraph 1.2.

4.2   Specific

(1)   For an article produced as a complete system according to Table 3 of this ETSO (AES1-1, AES2-3, AES3-5, AES4-101, AES6-106, AES7-111, AES8-1, AES8-2, AES9-3, AES9-4, AES10-5 or AES11-6), additionally mark at least one major component of the system with the applicable Valid Combination for the system according to Table 3 of this ETSO.

(2)   For an article produced as an individual component, additionally mark the article with the applicable Subclass Identifier according to Table 2A or 2B of this ETSO; or for SBD (96XX) or LBT (95XX) transceivers, with 'SBD' or 'LBT' as applicable.

For valid combinations of system component markings, see Table 3 below.

Table 3 — Valid Combinations of System Components
(Also see EUROCAE ED-243C / RTCA DO-262F, Tables D-6 and E-4, and Errata 1)

Valid Combinations		DO-262F Normative Appendix	Transceiver							Transceiver & DLNA		DLNA		Antenna					Complete System
			SBD (96XX)	LBT (95XX)	BCX	6J	6F	7J	7F	6D	7D	DJ	DFL	LGA (passive)	ALGA	MGA (Steered)	HGA (Steered)	IGA	
AES1	1	D																	X
	2	D	X											X					
AES2	3	D																	X
	4	D		X										X					
AES3	5	D																	X
	6	D	X	X										X					
AES4	101	E																	X
AES6	102	E				X						X					X		
	103	E					X						X [1]				X		
	104	E								X							X		
	105	E				X							X [1]				X		
	106	E																	X
AES7	107	E						X				X						X	
	108	E							X				X [1]					X	
	109	E									X							X	
	110	E							X				X [1]					X	
	111	E																	X
AES8	1	F																	X
	2	F																	X
AES9	3	F																	X
	4	F																	X
AES10	5	F																	X
AES11	6	F																	X

~~Valid Combinations~~		~~EUROCAE ED-243 Normative Appendix~~	~~Transceiver~~						~~Transceiver & DLNA~~		~~DLNA~~		~~Antenna~~			~~Complete System~~
			~~SBD~~	~~LBT~~	~~6MA~~	~~6F~~	~~7MA~~	~~7F~~	~~6D~~	~~7D~~	~~DMA~~	~~DF~~	~~LGA (passive)~~	~~HGA~~	~~IGA~~	
~~AES1~~	~~1~~	~~D~~														~~*~~
	~~2~~	~~D~~	~~*~~										~~*~~			
~~AES2~~	~~3~~	~~D~~														~~*~~
	~~4~~	~~D~~		~~*~~									~~*~~			
~~AES3~~	~~5~~	~~D~~														~~*~~
	~~6~~	~~D~~	~~*~~	~~*~~									~~*~~			
~~AES4~~	~~1~~	~~E~~														~~*~~
~~AES6~~	~~2~~	~~E~~			~~*~~						~~*~~			~~*~~		
	~~3~~	~~E~~				~~*~~						~~*~~		~~*~~		
	~~4~~	~~E~~							~~*~~					~~*~~		
	~~5~~	~~E~~			~~*~~							~~*~~		~~*~~		
	~~6~~	~~E~~														~~*~~
~~AES7~~	~~7~~	~~E~~					~~*~~				~~*~~				~~*~~	
	~~8~~	~~E~~						~~*~~				~~*~~			~~*~~	

9	E							✱					✱	
10	E				✱				✱				✱	
11	E													✱

Note [1]: Systems with DLNA-type DFL do not have blocking immunity to interfering signals in the 1526–1536 MHz band. These may be used in regions where this blocker is not present due to local Spectrum Management. See EUROCAE ED-243C / RTCA DO-262F, Appendix E, Section E.2.2.1.1.11 for description.

5 Availability of Referenced Documents

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/11]
[Amdt ETSO/13]
[Amdt ETSO/16]
[Amdt ETSO/19]

ETSO-C164a

NIGHT VISION GOGGLES (NVG)

1   Applicability

This ETSO gives the requirements which Night Vision Goggles (NVG) equipment that is~~are~~ manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2   Procedures

2.1   General

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

2.2   Specific

None.

3   Technical conditions

3.1   Basic

3.1.1   Minimum performance standard

Standards set forth in the applicable sections of RTCA DO-275, Minimum Operational Performance Standards for Integrated Night Vision Imaging System Equipment, dated 12/10/2001, as modified by Appendix 1 to this document.

Note that the equipment is portable (battery-powered only), with no interface with aircraft systems. For batteries, see CS-ETSO, Subpart A, paragraph 2.8.

The NVG power source shall be designed to minimise the simultaneous loss of battery power to both tubes using one of the two methods below:

a.   Provide separate and independent power sources to each tube; or

b.   Provide the user with a visual alert of pending power loss. The time available between the alert and the actual loss of power to the tubes must be a minimum of 30 minutes. The performance of this alert requirement shall be demonstrated to not be affected when the NVGs are operated or stored within the environmental conditions for which the equipment is qualified.

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 (loss of or inaccurate image) defined in paragraph 3.1.1 of this ETSO has been determined to be not less than ~~at major~~ Major ~~failure condition~~.

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3.2.2   Manuals

a.   The Installation and/or Operational Manual shall include operating instructions and equipment limitations sufficient to describe the equipment's operational capability. Include notes with the following statements:

'Night vision imaging systems (NVIS) are an aid to night VFR flight. NVIS systems consist of a set of night vision goggles (NVG) and NVG compatible aircraft lighting systems. NVG compatibility with aircraft lighting is not part of this ETSO authorisation and requires separate installation approval.'

'CAUTION: Some LED lighting systems that are clearly visible to the naked eye are not visible to NVGs, including some red LED obstruction lights.' See Safety Information Bulletin SIB 2019-04 for additional information.

b.   The Maintenance Manual shall include instructions covering periodic maintenance, calibration, and repair, to ensure that the night vision goggles continue to meet the ETSO approved design. Include recommended inspection intervals and service life, as appropriate. Inspection intervals must meet the minimum requirements of RTCA DO-275.

4   Marking

4.1   General

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

4.2   Specific

~~If the night vision goggle includes airborne software, then the part number must include hardware and software identification. Or, you can use a separate part number for hardware and software. Either way, you must include a means for showing the modification status.~~

Mark NVG ETSO article compatible with Heads-Up Display (HUD) with 'Modified Class B' when NVGs implements a modified Class B filter designed to allow their use with a HUD.

5   Availability of referenced document

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/8]
[Amdt ETSO/19]

Appendix 1 to ETSO-C164a

MODIFICATIONS TO RTCA-DO-275 MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR INTEGRATED NIGHT VISION IMAGING SYSTEM EQUIPMENT

The following sections of RTCA DO-275 are updated with these revised standards:

[DO-275] 2.2.1.1 System Resolution

The system resolution shall be a minimum of 1.3 cycles per milliradian (cy/mrad) on-axis under optimum light conditions using a nominal 100 % contrast dark bar on white background resolution target chart. At 14 degrees off-axis, the resolution shall be not less than 0.81 cycles per milliradian. If each monocular has a variable focus objective lens, then it shall focus through infinity, and at the through-infinity mechanical stop shall maintain an on-axis resolution of not less than 0.49 cycles per milliradian. If each monocular has a fixed focus objective lens, then 1.0 cycle per milliradian will be maintained at infinity.

[DO-275] 2.2.1.2 System Luminance Gain

At 1×10^{-4} footlamberts input light level, the luminance gain shall not be less than 4,000 footlamberts (fL) per footlambert. The output luminance averaged across the full field of view shall not exceed 4 footlamberts. Output brightness uniformity shall be such that the ratio of the maximum to minimum brightness variation over the useful image area shall not exceed 3:1. The ratio of luminance gain between any two channels shall not exceed 1.5.

[DO-275] 2.2.1.8 Image Cosmetic Defects (Table 2-1 Spot Criteria)

Diameter of Spots [inches]	Quantity of spots allowed within 0.22 inch diameter circle	Quantity of spots allowed within annulus bounded by 2 circles 0.22 and 0.58 inch diameter circle	Quantity of spots allowed within the annulus bounded by 2 circles 0.58 inch diameter circle and total screen diameter
> 0.009	0	0	0
0.006 - 0.009	0	1	1
0.003 - 0.006	0	2	2

Note: The circles on the image screen, defined in the table above, shall be concentric and centred on the optical axis of the assembly. Spots smaller than .003 inches shall be ignored.

[DO-275] 2.2.1.10 Halo Size

Halos shall be no greater than 1.0 mm in diameter at the output of the image intensifier tube.

[DO-275] 5.2.1 Description of Maintenance Performed

Change second paragraph to read: '… preventative maintenance (Pilot/ Crew Member performed preventative maintenance exempt from record keeping except for Removing or Installing Helmet or Headband Mounting Assembly), and alteration …'.

[DO-275] 5.4 (Table 5-1 Authorized Preventative Maintenance Allocations)

Type	Preventive Maintenance					
	Functional / Pre-flight Check	Battery Replacement	Cleaning with no disassembly required	Cleaning of Power Sourced Battery Contacts	Removing or Installing Helmet or Headband Mounting Assembly	Minor Adjustments for fit, focus or other adjustments required to complete functional check
*Pilot/ Crew Member	Yes	Yes	Yes	Yes	Yes	Yes
Airframe Mechanic	Yes	Yes	Yes	Yes	Yes	Yes
Repair Station	Yes	Yes	Yes	Yes	Yes	Yes

* Pilot/Crew Member performed preventative maintenance exempt from the record-keeping requirement of Section 5.2.1 except for Removing or Installing Helmet or Headband Mounting Assembly.

[DO-275] 5.4.1 (Table 5-2)

Change 'Pilot' to read 'Pilot/Crew Member'.

[Amdt ETSO/19]

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

1   Applicability

This ETSO provides the requirements which Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz) that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2   Procedures

2.1   General

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

2.2   Specific

None.

3   Technical conditions

3.1   Basic

3.1.1   Minimum performance standard

Standards set forth in ~~the~~ EUROCAE ED-102~~A~~B, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B), as modified by Change 1, issued January 2022 and as amended by Appendix 1 to this ETSO. ~~dated December 2009, section 2. EUROCAE ED-102A Corrigendum 1 dated January 2012 is also acceptable.~~

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

(a)   Class A equipment, consisting of transmit and receive subsystems; and

(b)   Class B equipment, containing a transmit subsystem only.

Class A equipment includes Classes A0, A1, A1S, A2 and A3 as defined in EUROCAE ED-102B. This standard requires 1090 MHz airborne Class A equipment to include the capability of receiving both ADS-B and TIS-B messages and delivering both ADS-B and TIS-B reports, as well as transmitting ADS-B messages. A receive-only Class of equipment is allowed.

Class B equipment includes Classes B0, B1, and B1S. Classes B0, B1, and B1S are the same as A0, A1, and A1S, except they do not have receive subsystems. Note that Classes B2 and B3 are not for aircraft use.

3.1.2   Environmental standard

See CS-ETSO, Subpart A, paragraph 2.1. The required performance under test conditions is defined in EUROCAE ED-102~~A~~B, ~~s~~Section 2.~~4~~3.

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 major failure condition.

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

Note*:* The major failure condition for transmission of incorrect ADS-B messages is based on the use of the data by other aircraft or Air Traffic Control for separation services.

Note: COMMISSION IMPLEMENTING REGULATION (EU) No 1207/2011 of 22 November 2011 laying down requirements for the performance and the interoperability of surveillance for the single European sky requires that the probability of discontinuity of the transmit function defined in paragraph 3.1.1 of this ETSO at aircraft level shall be equal to or less than 2*10⁻⁴ per flight hour.

4   Marking

4.1   General

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

4.2   Specific

Transmitting and receiving components must be permanently and legibly marked in accordance with EUROCAE ED-102B Section 2.1.11 'Equipage Class Definitions', the receiving equipment type in accordance with Section 2.2.6 'ADS-B Receiving Device Message Processor Characteristics' and Section 1.3.6 'optional additional features'.

The following table explains how to mark components.

EUROCAE ED-102A provides the equipment class in Section 2.1.11, and the receiving equipment type in Section 2.2.6.

If the component can:	Mark it with the:	Sample marking pattern:
Transmit and receive	Equipment class it supports, and Receiving equipment type	Class A0/Type 1
Transmit, but not receive	Equipment class it supports	Class B1, or Class A3 Transmitting only
Receive, but not transmit	Equipment class it supports, and Receiving equipment type	Class A2/Type 2 Receiving only

5   Availability of referenced document

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/11]
[Amdt ETSO/13]
[Amdt ETSO/19]

Appendix 1 to ETSO-C166c — EASA modifications to EUROCAE ED-102B / RTCA DO-260C

Purpose. This appendix lists EASA modifications to EUROCAE ED-102B / RTCA DO-260C. Text added to modify EUROCAE ED-102B / RTCA DO-260C is underlined. Text to be removed is struck through. In between the sections an ellipsis, '[…]', is introduced to indicate that the rest of the text is unchanged. Due to the extensive modifications, Section 2.4.5.2.12 is included as a complete change. Excerpts from EUROCAE ED-102B / RTCA DO-260C are reprinted with the permission of EUROCAE and @RTCA, Inc - All rights reserved.

[…]

2.4.3.2.7.6.4.4   Verification of 'Wind Speed' Subfield in ADS-B Wx Weather State Messages (§2.2.3.2.7.6.4.4)

This test procedure is used to verify that the ADS-B Transmitting Subsystem correctly encodes the 'Wind Speed' subfield in the Weather State Message as a dynamic value from a variable data input.

Table 2-240: 'Wind Speed' Subfield Encoding Test Values

Coding		Meaning
(Binary)	(Decimal)	
~~0000 0000~~	~~0~~	~~NO or INVALID data~~
0000 0001	1	0 ≤ Wind Speed [kts] < 1
0000 0010	2	1 ≤ Wind Speed [kts] < 2
0000 0100	4	3 ≤ Wind Speed [kts] < 4
0000 1000	8	7 ≤ Wind Speed [kts] < 8
0001 0000	16	15 ≤ Wind Speed [kts] < 16
0010 0000	32	31 ≤ Wind Speed [kts] < 32
0100 0000	64	63 ≤ Wind Speed [kts] < 64
1000 0000	128	127 ≤ Wind Speed [kts] < 128
1111 1110	254	253 ≤ Wind Speed [kts] < 254
1111 1111	255	254 ≤ Wind Speed [kts]

Measurement Procedure:

Step 1:   Conduct variable data input tests

    a.   Configure the ADS-B system as for installed operation

    b.   Power on the ADS-B system and perform start-up procedures (§2.2.3.3.2.1)

    c.   Operate the ADS-B system so as to broadcast Airborne Position Messages (§2.2.3.3.2.2).

    d.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Wind Speed' and 'Wind Direction' subfields.

    e.   For each 'Wind Speed' decimal value in Table 2-240, verify that the system generates Weather State Messages with the 'Wind Speed' subfield in each such message set equal to the binary coding value corresponding to the decimal value tested.

    f.   Provide an updated 'Wind Speed' subfield value to the ADS-B Transmitting Subsystem input interface. Verify that the 'Wind Speed'

subfield for subsequent Weather State Messages is set to the updated value within 100 milliseconds of the data being made available to the input interface.

2.4.3.2.7.6.4.5 Verification of 'Wind Direction' Subfield in ADS-B Wx Weather State Messages (§2.2.3.2.7.6.4.5)

This test procedure is used to verify that the ADS-B Transmitting Subsystem correctly encodes the 'Wind Direction' subfield in the Weather State Message as a dynamic value from a variable data input.

Table 2-241: 'Wind Direction' Subfield Encoding

Coding		Meaning
(Binary)	(Decimal)	
~~00 0000 0000~~	~~0~~	~~NO or INVALID data~~
00 0000 0001	1	0.000 ≤ Wind Direction [degrees] < 0.352
00 0000 0010	2	0.352 ≤ Wind Direction [degrees] < 0.704
00 0000 0100	4	1.056 ≤ Wind Direction [degrees] < 1.408
00 0000 1000	8	2.463 ≤ Wind Direction [degrees] < 2.815
00 0001 0000	16	5.279 ≤ Wind Direction [degrees] < 5.630
00 0010 0000	32	10.909 ≤ Wind Direction [degrees] < 11.261
00 0100 0000	64	22.170 ≤ Wind Direction [degrees] < 22.522
00 1000 0000	128	44.692 ≤ Wind Direction [degrees] < 45.044
01 0000 0000	256	89.736 ≤ Wind Direction [degrees] < 90.088
10 0000 0000	512	179.824 ≤ Wind Direction [degrees] < 180.176
11 1111 1110	1022	359.296 ≤ Wind Direction [degrees] < 359.648
11 1111 1111	1023	359.648 ≤ Wind Direction [degrees] < 360.000

Measurement Procedure:

Step 1:   Conduct variable data input tests

   a.   Configure the ADS-B system as for installed operation

   b.   Power on the ADS-B system and perform start-up procedures (§2.2.3.3.2.1)

   c.   Operate the ADS-B system so as to broadcast Airborne Position Messages (§2.2.3.3.2.2).

   d.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Wind Speed' and 'Wind Direction' subfields.

   e.   For each 'Wind Direction' decimal value in Table 2-241, verify that the system generates Weather State Messages with the 'Wind Direction' subfield in each such message set equal to the binary coding value corresponding to the decimal value tested.

   f.   Provide an updated 'Wind Direction' subfield value to the ADS-B Transmitting Subsystem input interface. Verify that the 'Wind Direction' subfield for subsequent Weather State Messages is set to the updated value within 100 milliseconds of the data being made available to the input interface.

2.4.3.2.7.6.4.6 Verification of 'Air Temperature Type' Subfield in ADS-B Wx Weather State Messages (§2.2.3.2.7.6.4.6)

This test procedure is used to verify that the ADS-B Transmitting Subsystem correctly encodes the 'Air Temperature Type' subfield in the Weather State Message, as either a preconfigured, static value or as a dynamic value based on variable data input(s). It also verifies the encoding of 'Air Temperature Type' in the Alternate Weather State Message.

Note: *This test procedure assumes 'Air Temperature Type' may be preconfigured, provided explicitly, or may be determined from the provision of Total Air Temperature data or Static Air Temperature data. If one or more method is not supported, the test steps associated with that method may be omitted.*

Measurement Procedure:

Step 1: Conduct preconfigured data tests

    a. Configure the ADS-B system as for installed operation, preconfiguring the Weather State Message, 'Air Temperature Type' subfield with decimal value '0' (binary 0) in Table 2-90, as appropriate per §2.2.3.2.7.6.4.6.

    b. Power on the ADS-B system and perform start-up procedures (§2.2.3.3.2.1).

    c. Operate the ADS-B system so as to broadcast Airborne Position Messages (§2.2.3.3.2.2).

    d. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Wind Speed' and 'Wind Direction' subfields.

    e. Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Air Temperature Type' subfield set to the preconfigured value.

    f. Perform Steps 1.a through 1.e, substituting the untested 'Air Temperature Type' decimal value '1' (binary 1) in Table 2-90 for the '0' in Step 1.a.

    g. Perform Steps 1.a through 1.c.

    h. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Roll Angle' subfield.

    i. Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Air Temperature Type' subfield set to the preconfigured value.

    j. Perform Steps 1.a through 1.c and 1.h, substituting the untested 'Air Temperature Type' decimal value '1' (binary 1) in Table 2-90 for the '0' in Step 1.a.

    k. Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Air Temperature Type' subfield set to the preconfigured value.

Step 2: Conduct variable data input tests for dynamic, explicitly provided Air Temperature Type variable input

    a. Perform Steps 1.b through 1.d

b. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature Type' subfield in the form of 'Air Temperature Type' data set to decimal '0' (binary 0)

c. Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '0' (binary 0).

d. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature Type' subfield in the form of 'Air Temperature Type' data set to decimal '1' (binary 1).

e. Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '1' (binary 1).

f. Provide an updated 'Air Temperature Type' subfield value to the ADS-B Transmitting Subsystem input interface. Verify that the 'Air Temperature Type' subfield for subsequent Weather State Messages is set to the updated value within 100 milliseconds of the data being made available to the input interface.

g. Perform Steps 1.b and 1.c and 1.h.

h. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature Type' subfield in the form of 'Air Temperature Type' data set to decimal '0' (binary 0).

i. Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '0' (binary 0).

j. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature Type' subfield in the form of 'Air Temperature Type' data set to decimal '1' (binary 1).

k. Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '1' (binary 1).

l. Provide an updated 'Air Temperature Type' subfield value to the ADS-B Transmitting Subsystem input interface. Verify that the 'Air Temperature Type' subfield for subsequent Alternate Weather State Messages is set to the updated value within 100 milliseconds of the data being made available to the input interface.

Step 3: Conduct variable data input tests for determining Air Temperature Type from variable input of Total Air Temperature data

a. Perform Steps 1.b through 1.d

b. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature' subfield in the form of 'Total Air Temperature' data only.

c. Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '0' (binary 0).

d. Provide an updated 'Air Temperature' subfield value to the ADS-B Transmitting Subsystem input interface in the form of Static Air Temperature. Verify that the 'Air Temperature Type' subfield for

subsequent Weather State Messages is set to decimal '1' (binary 1) within 100 milliseconds of the data being made available to the input interface.

e.   Perform Steps 1.b and 1.c.

f.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature' subfield in the form of 'Total Air Temperature' data only.

g.   Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '0' (binary 0).

h.   Provide an updated 'Air Temperature' subfield value to the ADS-B Transmitting Subsystem input interface in the form of Static Air Temperature. Verify that the 'Air Temperature Type' subfield for subsequent Alternate Weather State Messages is set to decimal '1' (binary 1) within 100 milliseconds of the data being made available to the input interface.

Step 4:   Conduct variable data input tests for determining Air Temperature Type from variable input of Static Air Temperature data

a.   Perform Steps 1.b through 1.d.

b.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature' subfield in the form of 'Static Air Temperature' data only.

c.   Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '1' (binary 1).

d.   Discontinue the input of Static Air Temperature. Provide an updated 'Air Temperature' subfield value to the ADS-B Transmitting Subsystem input interface in the form of Total Air Temperature. Verify that the 'Air Temperature Type' subfield for subsequent Weather State Messages is set to decimal '0' (binary 0) within 100 milliseconds of the data being made available to the input interface.

e.   Perform Steps 1.b and 1.c.

f.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature' subfield in the form of 'Static Air Temperature' data only.

g.   Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '1' (binary 1).

h.   Discontinue the input of Static Air Temperature. Provide an updated 'Air Temperature' subfield value to the ADS-B Transmitting Subsystem input interface in the form of Total Air Temperature. Verify that <u>for Alternate Weather State messages sent within 2.0 seconds after discontinuing the input of Static Air Temperature, the 'Air Temperature Type' subfield is set to decimal '1' (binary 1), and that for Alternate Weather State messages sent more than 2.0 seconds after discontinuing the input of Static Air Temperature,</u> the 'Air Temperature Type' subfield ~~for subsequent Alternate Weather~~

~~State Messages~~ is set to decimal '0' (binary 0) ~~within 100 milliseconds of the data being made available to the input interface.~~

Step 5: Conduct variable data input tests for determining Air Temperature Type from variable input of both Total Air Temperature data and Static Air Temperature data

a.   Perform Steps 1.b through 1.d

b.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature' subfield in the form of both 'Total Air Temperature' data, and 'Static Air Temperature'.

c.   Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '1' (binary 1).

d.   Perform Steps 1.b and 1.c.

e.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Air Temperature' subfield in the form of both 'Total Air Temperature' data and 'Static Air Temperature' data.

f.   Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Air Temperature Type' subfield in each such message set to decimal '1' (binary 1).

[…]

2.4.3.2.7.6.4.8 Verification of 'Airspeed Type' Subfield in ADS-B Wx Weather State Messages (§2.2.3.2.7.6.4.8)

This test procedure is used to verify that the ADS-B Transmitting Subsystem correctly encodes the 'Airspeed Type' subfield in the Weather State Message, as either a preconfigured, static value or as a dynamic value based on variable data input(s). It also verifies the encoding of 'Airspeed Type' in the Alternate Weather State Message.

Note: *This test procedure assumes 'Airspeed Type' may be preconfigured, provided explicitly, or may be determined from the provision of Indicated Airspeed data or True Airspeed data. If one or more method is not available, the test steps associated with that method may be omitted.*

Measurement Procedure:

Step 1:   Conduct preconfigured data tests

a.   Configure the ADS-B system as for installed operation, preconfiguring the Weather State Message, 'Airspeed Type' subfield with decimal value '0' (binary 0) in Table 2-92, as appropriate per §2.2.3.2.7.6.4.8.

b.   Power on the ADS-B system and perform start-up procedures (§2.2.3.3.2.1).

c.   Operate the ADS-B system so as to broadcast Airborne Position Messages (§2.2.3.3.2.2).

d.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Wind Speed' and 'Wind Direction' subfields.

e.   Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Airspeed Type' subfield set to the preconfigured value.

f.   Perform Steps 1.a through 1.e, substituting the untested 'Airspeed Type' decimal value '1' (binary 1) in Table 2-92 for the '0' in Step 1.a.

g.   Perform Steps 1.a through 1.c.

h.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Roll Angle' subfield.

i.   Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Airspeed Type' subfield set to the preconfigured value.

j.   Perform Steps 1.a through 1.c and 1.h, substituting the untested 'Airspeed Type' decimal value '1' (binary 1) in Table 2-92 for the '0' in Step 1.a.

k.   Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Airspeed Type' subfield set to the preconfigured value.

Step 2:   Conduct variable data input tests for dynamic, explicitly provided Airspeed Type variable input

a.   Perform Steps 1.b through 1.d.

b.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed Type' subfield in the form of 'Airspeed Type' data set to decimal '0' (binary 0).

c.   Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '0' (binary 0).

d.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed Type' subfield in the form of 'Airspeed Type' data set to decimal '1' (binary 1).

e.   Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '1' (binary 1).

f.   Provide an updated 'Airspeed Type' subfield value to the ADS-B Transmitting Subsystem input interface. Verify that the 'Airspeed Type' subfield for subsequent Weather State Messages is set to the updated value within 100 milliseconds of the data being made available to the input interface.

g.   Perform Steps 1.b and 1.c and 1.h

h.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed Type' subfield in the form of 'Airspeed Type' data set to decimal '0' (binary 0).

i.   Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '0' (binary 0).

j.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed Type' subfield in the form of 'Airspeed Type' data set to decimal '1' (binary 1).

k. Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '1' (binary 1).

l. Provide an updated 'Airspeed Type' subfield value to the ADS-B Transmitting Subsystem input interface. Verify that the 'Airspeed Type' subfield for subsequent Alternate Weather State Messages is set to the updated value within 100 milliseconds of the data being made available to the input interface.

Step 3: Conduct variable data input tests for determining Airspeed Type from variable input of Indicated Airspeed data

a. Perform Steps 1.b through 1.d.

b. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed' subfield in the form of 'Indicated Airspeed' data only.

c. Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '0' (binary 0).

d. Provide an updated 'Airspeed' subfield value to the ADS-B Transmitting Subsystem input interface in the form of True Airspeed. Verify that the 'Airspeed Type' subfield for subsequent Weather State Messages is set to decimal '1' (binary 1) within 100 milliseconds of the data being made available to the input interface.

e. Perform Steps 1.b and 1.c.

f. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed' subfield in the form of 'Indicated Airspeed' data only.

g. Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '0' (binary 0).

h. Ensure that the 'Air Temperature Type' subfield is set to 'Static Air Temperature'. Provide an updated 'Airspeed' subfield value to the ADS-B Transmitting Subsystem input interface in the form of True Airspeed. Verify that the 'Airspeed Type' subfield for subsequent Alternate Weather State Messages is set to decimal '1' (binary 1) within 100 milliseconds of the data being made available to the input interface.

Step 4: Conduct variable data input tests for determining Airspeed Type from variable input of True Airspeed data

a. Perform Steps 1.b through 1.d.

b. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed' subfield in the form of 'True Airspeed' data only.

c. Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '1' (binary 1).

d. Discontinue the input of True Airspeed. Provide an updated 'Airspeed' subfield value to the ADS-B Transmitting Subsystem input

interface in the form of Indicated Airspeed. Verify that for Weather State messages sent within 2.0 seconds after discontinuing the input of True Airspeed, the 'Airspeed Type' subfield for subsequent Weather State Messages is set to decimal '1' (binary 1), and that for Weather State messages sent more than 2.0 seconds after discontinuing the input of True Airspeed, the 'Airspeed Type' subfield for subsequent Weather State Messages is set to decimal '0' (binary 0) within 100 milliseconds of the data being made available to the input interface.

e.   Perform Steps 1.b and 1.c

f.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed' subfield in the form of 'True Airspeed' data only.

g.   Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '1' (binary 1).

h.   Discontinue the input of True Airspeed. Provide an updated 'Airspeed' subfield value to the ADS-B Transmitting Subsystem input interface in the form of Indicated Airspeed. Verify that for Weather State messages sent within 2.0 seconds after discontinuing the input of True Airspeed, the 'Airspeed Type' subfield for subsequent Weather State Messages is set to decimal '1' (binary 1), and that for Weather State messages sent more than 2.0 seconds after discontinuing the input of True Airspeed, the 'Airspeed Type' subfield for subsequent Alternate Weather State Messages is set to decimal '0' (binary 0) within 100 milliseconds of the data being made available to the input interface.

Step 5:   Conduct variable data input tests for determining Airspeed Type from variable input of both Indicated Airspeed data and True Airspeed data

a.   Perform Steps 1.b through 1.d.

b.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed' subfield in the form of both 'Indicated Airspeed' data and 'True Airspeed' data.

c.   Verify that the ADS-B Transmitting Subsystem transmits Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '1' (binary 1).

d.   Perform Steps 1.b and 1.c.

e.   Ensure that the 'Air Temperature Type' subfield is set to 'Static Air Temperature'. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed' subfield in the form of both 'Indicated Airspeed' data and 'True Airspeed' data.

f.   Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '1' (binary 1).

g.   Ensure that the 'Air Temperature Type' subfield is set to 'Total Air Temperature'. Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Airspeed' subfield in the form of both 'Indicated Airspeed' data and 'True Airspeed' data.

h.   Verify that the ADS-B Transmitting Subsystem transmits Alternate Weather State Messages with the 'Airspeed Type' subfield in each such message set to decimal '0' (binary 0).

[...]

2.4.3.2.7.8.1.6 Verification of 'Peak EDR Offset' Subfield in Emergency / Priority Status Messages (§2.2.3.2.7.8.1.6)

Purpose/Introduction:

If supporting the ADS-B Wx AIREP option, this test procedure is used to verify that the ADS-B Transmitting Subsystem correctly encodes the 'Peak EDR Offset' subfield in the Emergency / Priority Status Message as a dynamic value from a variable data input. The test procedures in §2.4.3.3.2.6.3 verify that encodings other than 'NO or INVALID Data' occur only when Airborne Position Messages are being broadcast. If ADS-B Wx AIREPs are not supported, this test verifies that the 'Peak EDR Offset' subfield is set to ALL ZEROs.

Measurement Procedure:

If NOT implementing ADS-B Wx AIREP:

Configure the ADS-B Transmitting Subsystem to transmit Airborne Position Messages. Set the ADS-B Transmitting Subsystem to Airborne status. Produce valid Airborne Position Messages at the nominal rate with valid position and altitude data. Verify that the ADS-B Transmitting Subsystem begins to transmit Extended Squitter Aircraft Status Messages at the nominal rate with the TYPE Subfield set to 28 (binary 1 1100) and the Subtype Subfield set to ONE (binary 001). Verify that the 'Peak EDR Offset' subfield ('ME' bits 40 – 42; Message bits 72 – 74) is set to ALL ZEROs.

If implementing ADS-B Wx AIREP:

Conduct variable data input tests

a.   Configure the ADS-B system as for installed operation
b.   Power on the ADS-B system and perform start-up procedures (§2.2.3.3.2.1)
c.   Operate the ADS-B system so as to broadcast Airborne Position Messages (§2.2.3.3.2.2).
d.   Provide variable input data to the ADS-B Transmitting Subsystem at the nominal update rate for the 'Peak EDR Offset' subfield.
e.   For each valid 'Peak EDR Offset' decimal value in Table 2-102, verify that the system generates Emergency / Priority Status Messages with the 'Peak EDR Offset' subfield in each such message set equal to the binary coding value corresponding to the decimal value tested.
f.   ~~For variable input values greater than the 'Peak EDR Offset' subfield range maximum in Table 2-102, verify that the system generates Emergency / Priority Status Messages with the 'Peak EDR Offset' subfield coding in each such message is set to decimal '7' (binary 111).~~
g.   Provide an updated 'Peak EDR Offset' subfield value to the ADS-B Transmitting Subsystem input interface. Verify that the 'Peak EDR Offset' subfield for subsequent Emergency/Priority Status Messages is set to the updated value within 100 milliseconds of the data being made available to the input interface.

[...]

2.4.3.3.2.3 Verification of ADS-B Surface Position Message Broadcast Rate (§2.2.3.3.2.3)

Purpose/Introduction:

This test verifies the Surface Position broadcast rates. Broadcast rates for 1090 MHz Extended Squitter ADS-B Messages are summarized in Table 2-128.

Equipment Required:

Provide a method of loading valid data for broadcasting ADS-B Messages into the ADS-B equipment under test. Provide a method of monitoring the transmitted ADS-B Messages and measuring the rate at which they are output.

Measurement Procedure:

Step 1: Broadcast Rate (§2.2.3.3.2.3.a, b and c)

Ensure that the equipment is set to the 'On-Ground' condition and that the appropriate valid ADS-B Surface Position data are available such that the position data is initiated and changes such that the position reflects an increased displacement from the initial position of 1 meter each second.

After 15 seconds, verify that the ADS-B Surface Position Messages are broadcast at random intervals that are uniformly distributed over the range of 0.4 to 0.6 seconds using a time quantization no greater than 15 milliseconds as specified in §2.2.3.3.2.3.b.

Provide position and movement data to the ADS-B equipment such that the position is stationary. Note the initial time that the position data is no longer changing. After 15 minutes and 10 seconds from the start of the input of stationary position data, verify that the ADS-B Surface Position Messages are broadcast at random intervals that are uniformly distributed over the range of 4.8 to 5.2 seconds using a time quantization no greater than 15 milliseconds as specified in §2.2.3.3.2.3.c.

Provide position data such that the position is moving 10 meters per minute and note the time the input changes from stationary to moving. After 61 seconds from the change from stationary position to moving, verify that the ADS-B Surface Position Messages are broadcast at random intervals that are uniformly distributed over the range of 0.4 to 0.6 seconds.

Step 2: Initiation, Timeout, and Termination (§2.2.3.3.2.1.2, §2.2.3.3.2.11.b, §2.2.3.3.2.12.b)

Ensure that the equipment is set to the 'On-Ground' condition. Input Movement and Heading / Ground Track, but do not input position. Verify that Surface Position Messages are not broadcast.

Cease input of Movement and Heading / Ground Track. Input position with a simulated movement at a rate high enough to result in a 'High' broadcast rate. Verify that Surface Position messages are initiated.

Input all data for the Surface Position Messages. Stop the input of position data, but continue with data sufficient to populate the Movement and Heading / Ground Track subfields.

Verify that the Surface Position Messages broadcast within 2.6 seconds after stopping the data input have all data bits set to the last reported valid value.

Verify that Surface Position Messages broadcast more than 2.6 seconds after stopping the data input have all data bits set to ZERO. Verify that the ADS-B Surface Position Messages cease to be broadcast 60 seconds from stopping the position input.

Note: *The 60 second termination does not apply to Non-Transponder Devices.*

Resume input of position data and stop the input of Movement data. Verify that the Surface Position Messages broadcast within 2.6 seconds after stopping the data input have the Movement subfield set to the last reported valid value. Verify that Surface Position Messages broadcast more than 2.6 seconds after stopping the data input have the Movement subfield set to ZERO with all other subfields correctly populated.

Resume input of Movement data and stop the input of Heading / Ground Track data. Verify that the Surface Position Messages broadcast within 2.6 seconds after stopping the data input have the Heading / Ground Track subfield set to the last reported valid value. Verify that Surface Position Messages broadcast more than 2.6 seconds after stopping the data input have the Heading / Ground Track subfield set to ZERO with all other subfields correctly populated.

Note: *It is acceptable to validate the data in the subsequent Surface Position Message received after the indicated time has elapsed.*

Step 3:   Switching between High Rate and Low Rate (§2.2.3.3.2.3.a)

Ensure that the equipment is set to the 'On-Ground' condition and that the appropriate valid ADS-B Surface Position data are provided such that the position is changing at a rate of 10.1 meters in any 15 minute interval. After the initial data input, verify that the ADS-B Surface Position Messages are broadcast at a low rate. 15 minutes and 10 seconds after the start of the data input, verify that the ADS-B Surface Position Messages are the high rate.

Input new ADS-B Surface Position data with the position data changing at a rate of 9.9 meters in any 15 minute interval. Verify that high rate broadcasts are maintained for at least 14 minutes and 50 seconds. 15 minutes and 10 seconds after the inputting of the new data, verify that the ADS-B Surface Position Messages are broadcast at the low rate.

Note: *It is acceptable to validate the data in the subsequent Surface Position Message received after the indicated time has elapsed.*

[...]

2.4.3.3.2.4 Verification of ADS-B Aircraft Identification and Category Message Broadcast Rate (§2.2.3.3.2.4)

Purpose/Introduction:

This test verifies the Aircraft Identification and Category broadcast rates. Broadcast rates for 1090 MHz Extended Squitter ADS-B Messages are summarized in Table 2-128.

Equipment Required:

Provide a method of loading valid data for ADS-B broadcast messages into the ADS-B equipment under test. Provide a method of monitoring the transmitted ADS-B Messages and measuring the rate at which they are output.

Measurement Procedure:

Step 1: Broadcast Rate (§2.2.3.3.2.4)

Ensure that the equipment is set to the 'Airborne' condition and that the appropriate valid Aircraft Identification and Category data are available. Verify that the Aircraft Identification and Category Messages are broadcast at random intervals that are uniformly distributed over the range of 4.8 to 5.2 seconds using a time quantization no greater than 15 milliseconds as specified in §2.2.3.3.2.4.a.

Ensure that the equipment is set to the 'On-Ground' condition, the appropriate valid ADS-B Surface Position data are provided such that the position is stationary, the Surface Position Message is transmitting at the 'Low' rate, and the appropriate valid ADS-B Aircraft Identification and Category data are available. Verify that the ADS-B Aircraft Identification and Category Messages are broadcast at random intervals that are uniformly distributed over the range of 9.8 to 10.2 seconds using a time quantization no greater than 15 milliseconds as specified in §2.2.3.3.2.4.b.

Discontinue input of position data and wait 60 seconds. Verify that the ADS-B Aircraft Identification and Category Messages are broadcast at intervals that are uniformly distributed over the range of 4.8 to 5.2 seconds using a time quantization no greater than 15 milliseconds as specified in §2.2.3.3.2.4.c.

Resume input of ~~Input new~~ ADS-B Surface Position data such that the position is changing at a rate of 5 m/s. Two (2) seconds after inputting the new data, verify that the ADS-B Aircraft Identification and Category Messages are broadcast at random intervals that are uniformly distributed over the range of 4.8 to 5.2 seconds using a time quantization no greater than 15 milliseconds as specified in §2.2.3.3.2.4.a.

Note: *It is acceptable to validate the data in the subsequent Aircraft Identification and Category Message received after the indicated time has elapsed.*

Step 2: Initiation, Timeout, and Termination (§2.2.3.3.2.1.2, §2.2.3.3.2.11.d, §2.2.3.3.2.12.c)

Reset the ADS-B device. Input only ADS-B Emitter Category data. Verify that the Aircraft Identification and Category Messages are initiated.

Stop the input of data. At least 60 seconds later, verify that the Aircraft Identification and Category Messages continue to be broadcast with the same data that existed prior to stopping the data input.

Reset the ADS-B system. Input only Aircraft Identification data. Verify that the Aircraft Identification and Category Messages are initiated.

Stop the input of data. At least 60 seconds later, verify that the Aircraft Identification and Category Messages continue to be broadcast with the same data that existed prior to stopping the data input.

[…]

2.4.3.3.2.6.1 Verification of ADS-B Target State and Status Message Broadcast Rates (§2.2.3.3.2.6.1)

Purpose/Introduction:

This test verifies the Target State and Status broadcast rates. Broadcast rates for 1090 MHz Extended Squitter ADS-B Messages are summarized in Table 2-128.

Equipment Required:

Provide a Method of loading valid data for ADS-B broadcast messages into the ADS-B equipment under test. Provide a method of monitoring the transmitted ADS-B Messages and measuring the rate at which they are output.

Measurement Procedure:

Step 1: Broadcast Rate (§2.2.3.3.2.6.1)

Ensure that the equipment is set to the 'Airborne' condition and that the appropriate valid Target State and Status data are available. Verify that the Target State and Status Messages are broadcast at random intervals that are uniformly distributed over the range of 1.2 to 1.3 seconds using a time quantization no greater than 15 milliseconds as specified in §2.2.3.3.2.6.1.

Step 2: Initiation, Timeout, and Termination (§2.2.3.3.2.1.2, §2.2.3.3.2.11.e, §2.2.3.3.2.12.e)

Provide the ADS-B Transmitting Subsystem with valid data necessary for the generation of Target State and Status Messages and Surface Position Messages. Ensure that the equipment is set to the 'On-Ground' condition. Verify that Target State and Status Messages are not broadcast.

Discontinue the input of Selected Altitude, Selected Heading, and BPS data. Ensure that the equipment is set to the 'Airborne' condition. Generate Airborne Position messages. Verify that Target State and Status Messages are not broadcast.

Input valid Selected Altitude data. Verify that Target State and Status Messages are initiated.

Discontinue input of Selected Altitude data. Verify that the Target State and Status Messages cease to be broadcast 2.6 seconds after stopping the data input.

Input valid Selected Heading data. Verify that the Target State and Status Messages are initiated.

Discontinue input of Selected Heading data. Verify that the Target State and Status Messages cease to be broadcast 2.6 seconds after stopping the data input.

Input valid BPS data. Verify that the Target State and Status Messages are initiated. Discontinue input of BPS data. Verify that the Target State and Status Messages cease to be broadcast 2.6 seconds after stopping the data input.

Input valid Target State and Status data, and discontinue Airborne Position Message broadcast (e.g. no position or altitude data provided to the system). Verify that the ADS-B Transmitting Subsystem is not broadcasting any ADS-B Target State and Status Messages.

Input valid Target State and Status data and Airborne Position data. Discontinue input of Selected Altitude. Verify that the Target State and Status Messages broadcast within ~~2.0~~ 2.6 seconds after stopping the data input have the Selected Altitude subfield set to the last reported valid value. Verify that Target State and Status Messages broadcast more than ~~2.0~~ 2.6 seconds after stopping the data input have the Selected Altitude subfield set to ALL ZEROs with all other subfields correctly populated.

Resume input of Selected Altitude and discontinue input of Selected Heading. Verify that the Target State and Status Messages broadcast within ~~2.0~~ 2.6 seconds after stopping the data input have the Selected Heading subfield set to the last reported valid value. Verify that Target State and Status Messages broadcast more than ~~2.0~~ 2.6 seconds after stopping the data input have the Selected Heading subfield set to ALL ZEROs with all other subfields correctly populated.

Resume input of Selected Heading and discontinue input of BPS. Verify that the Target State and Status Messages broadcast within ~~2.0~~ 2.6 seconds after stopping the data input have the BPS subfield set to the last reported valid value. Verify that Target State and Status Messages broadcast more than ~~2.0~~ 2.6 seconds after stopping the data input have the BPS subfield set to ALL ZEROs with all other subfields correctly populated.

Note: It is acceptable to validate the data in the subsequent Target State and Status Message received after the indicated time has elapsed.

[...]

2.4.3.3.2.6.3   Verification of ADS-B Emergency/Priority Status Message Broadcast Rate (§2.2.3.3.2.6.3)

Purpose/Introduction:

This test verifies the Emergency/Priority Status Message broadcast rates. Broadcast rates for 1090 MHz Extended Squitter ADS-B Messages are summarized in Table 2-128.

Equipment Required:

Provide a method of loading valid data for ADS-B broadcast messages into the ADS-B equipment under test. Provide a method of monitoring the transmitted ADS-B Messages and measuring the rate at which they are output.

Measurement Procedure:

Step 1:   Broadcast Rate (§2.2.3.3.2.6.3)

Ensure that appropriate valid Emergency/Priority Status Message data are available. Verify that the Emergency/Priority Status Messages are broadcast at random intervals that are uniformly distributed over the range of 4.8 to 5.2 seconds using a time quantization no greater than 15 milliseconds as specified in §2.2.3.3.2.6.3.b.

Input a Mode A Code of 1000. Verify that the Emergency/Priority Status Messages are broadcast at random intervals that are uniformly distributed over the range of 0.7 to 0.9 seconds using a time quantization no greater than 15 milliseconds seconds as specified in §2.2.3.3.2.6.3.a. Verify that the Emergency/Priority Status Messages return to the nominal rate 24 ±1 seconds after changing the data.

Input a Mode A Code of 7400. Verify that the Emergency/Priority Status Messages are broadcast at random intervals that are uniformly distributed over the range of 0.7 to 0.9 seconds using a time quantization no greater than 15 milliseconds seconds as specified in §2.2.3.3.2.6.3.a. At least 60 seconds after changing the Mode A Code, verify that the Emergency/Priority Status Messages remain at the higher rate.

Input a Mode A Code of 1000. After the Emergency/Priority Status Message reverts to the low broadcast rate, input a Mode A Code of 7500. At least 60 seconds after changing the Mode A Code to 7500, verify that the Emergency/Priority Status Messages are broadcast at the higher rate.

Input a Mode A Code of 1000. After the Emergency/Priority Status Message reverts to the low broadcast rate, input a Mode A Code of 7600. At least 60 seconds after changing the Mode A Code to 7600, verify that the Emergency/Priority Status Messages are broadcast at the higher rate.

Input a Mode A Code of 1000. After the Emergency/Priority Status Message reverts to the low broadcast rate, input a Mode A Code of 7700. At least 60 seconds after changing the Mode A Code to 7700, verify that the Emergency/Priority Status Messages are broadcast at the higher rate.

Input a Mode A Code of 1000. After the Emergency/Priority Status Message reverts to the low broadcast rate, input an Emergency/Priority Status of decimal 6. At least 60 seconds after changing the Emergency/Priority Status,

verify that the Emergency/Priority Status Messages are broadcast at the higher rate.

Step 2: Initiation, Timeout, and Termination (§2.2.3.3.2.1.2, §2.2.3.3.2.11.i, §2.2.3.3.2.12.g)

Provide the ADS-B Transmitting Subsystem with only Emergency/Priority Status data. Verify that the Emergency/Priority Status Message is initiated.

Discontinue input of Emergency/Priority Status data. At least 60 seconds later, verify that the Emergency/Priority Status Messages continue to be broadcast.

Reset the ADS-B Transmitting Subsystem. Provide the ADS-B Transmitting Subsystem with only Mode A Code data. Verify that the Emergency/Priority Status Message is initiated.

Reset the ADS-B Transmitting Subsystem. Provide the ADS-B Transmitting Subsystem with Mode A Code data and with Manned/Unmanned Operation data setting the subfield to ONE (binary 1). Verify that the Emergency/Priority Status Message is initiated.

Discontinue input of Mode A Code and Manned/Unmanned Operation data. At least 60 seconds later, verify that the Emergency/Priority Status Messages continue to be broadcast with the same Mode A Code data as was previously input and with the Manned/Unmanned Operation subfield set to ONE (binary 1).

If implementing support for the optional ADS-B Wx AIREP Messages, the following additional tests apply:

Reset the ADS-B Transmitting Subsystem. Operate the ADS-B system so as to broadcast Surface Position Messages (§2.2.3.3.2.2). Provide the ADS-B Transmitting Subsystem, additionally, with Mean EDR data only. Verify that the Emergency/Priority Status Message is not initiated. Provide the ADS-B Transmitting Subsystem with Mode A Code data in addition to Mean EDR data. Verify that the Emergency/Priority Status Message is initiated and that the Mean EDR subfield is set to <u>ALL</u> ZERO<u>s</u> in the Emergency/Priority Status Messages generated.

<u>Reset the ADS-B Transmitting Subsystem.</u> Operate the ADS-B system so as to broadcast Airborne Position Messages. Provide the ADS-B Transmitting Subsystem, additionally, with Mean EDR data only. Verify that the Emergency/Priority Status Message is initiated.

Discontinue input of Mean EDR data. Verify that the Emergency/Priority Status Messages broadcast within 15 seconds after stopping the data input have the Mean EDR subfield set to the last reported valid value and that any Emergency/Priority Status Messages broadcast more than 15 seconds after stopping the data input have the Mean EDR subfield set to <u>ALL</u> ZEROs. At least 60 seconds later, verify that the Emergency/Priority Status Messages continue to be broadcast.

Reset the ADS-B Transmitting Subsystem. Operate the ADS-B system so as to broadcast Surface Position Messages. Provide the ADS-B Transmitting Subsystem, additionally, with Peak EDR data only. Verify that the Emergency/Priority Status Message is not initiated. Provide the ADS-B

Transmitting Subsystem with Mode A Code data in addition to Peak EDR data. Verify that the Emergency/Priority Status Message is initiated and that the Peak EDR subfield is set to ALL ZEROs in the Emergency/Priority Status Messages generated.

Reset the ADS-B Transmitting Subsystem. Operate the ADS-B system so as to broadcast Airborne Position Messages. Provide the ADS-B Transmitting Subsystem, additionally, with Peak EDR data only. Verify that the Emergency/Priority Status Message is initiated.

Discontinue input of Peak EDR data. Verify that the Emergency/Priority Status Messages broadcast within 15 seconds after stopping the data input have the Peak EDR subfield set to the last reported valid value and that any Emergency/Priority Status Messages broadcast more than 15 seconds after stopping the data input have the Peak EDR and Peak EDR Offset subfields set to ALL ZEROs. At least 60 seconds later, verify that the Emergency/Priority Status Messages continue to be broadcast.

Reset the ADS-B Transmitting Subsystem. Operate the ADS-B system so as to broadcast Surface Position Messages. Provide the ADS-B Transmitting Subsystem, additionally, with Peak EDR Offset data only. Verify that the Emergency/Priority Status Message is not initiated. Provide the ADS-B Transmitting Subsystem with Mode A Code data in addition to Peak EDR Offset data. Verify that the Emergency/Priority Status Message is initiated and that the Peak EDR Offset subfields are set to ALL ZEROs in the Emergency/Priority Status Messages generated.

Reset the ADS-B Transmitting Subsystem. Operate the ADS-B system so as to broadcast Airborne Position Messages. Provide the ADS-B Transmitting Subsystem, additionally, with Peak EDR Offset data only. Verify that the Emergency/Priority Status Message is not initiated. Provide the ADS-B Transmitting Subsystem with Peak EDR data in addition to Peak EDR Offset data. Verify that the Emergency/Priority Status Message is initiated.

Discontinue the input of Peak EDR Offset data. Verify that the Emergency/Priority Status Messages broadcast within 15 seconds after stopping the data input have the Peak EDR Offset subfield set to the last reported valid value and that any Emergency/Priority Status Messages broadcast more than 15 seconds after stopping the data input have the Peak EDR Offset subfield set to ALL ZEROs. At least 60 seconds later, verify that the Emergency/Priority Status Messages continue to be broadcast.

Reset the ADS-B Transmitting Subsystem. Operate the ADS-B system so as to broadcast Surface Position Messages. Provide the ADS-B Transmitting Subsystem, additionally, with Water Vapor data only. Verify that the Emergency/Priority Status Message is not initiated. Provide the ADS-B Transmitting Subsystem with Mode A Code data in addition to Water Vapor data. Verify that the Emergency/Priority Status Message is initiated and that the Water Vapor subfield is set to ALL ZEROs in the Emergency/Priority Status Messages generated.

Reset the ADS-B Transmitting Subsystem. Operate the ADS-B system so as to broadcast Airborne Position Messages. Provide the ADS-B Transmitting Subsystem, additionally, with Water Vapor data only. Verify that the Emergency/Priority Status Message is initiated.

Discontinue input of Water Vapor data. Verify that the Emergency/Priority Status Messages broadcast within 6 seconds after stopping the data input have the Water Vapor subfield set to the last reported valid value and that any Emergency/Priority Status Messages broadcast more than 6 seconds after stopping the data input have the Water Vapor subfield set to ALL ZEROs. At least 60 seconds later, verify that the Emergency/Priority Status Messages continue to be broadcast.

Note: *It is acceptable to validate the data in the subsequent Emergency/Priority Status Message received after the indicated time has elapsed.*

[...]

2.4.5.2.4 Verification of Airborne Velocity Message – Subtype=1 Latency (§2.2.5.2.4, §2.2.3.2.6.1)

Purpose/Introduction:

This test verifies the latency of the Airborne Velocity Message – Subtype=1. ~~The following test procedures are used to test Airborne Velocity Messages – Subtype=1 transmitted by Airborne ADS-B Transmitting Subsystems when the transmitting device is installed in an environment having NON-supersonic airspeed capabilities. These test procedures verify that any changes in the data used to structure the subfields of the Airborne Velocity Message – Subtype=1 are reflected in the affected subfield of the next scheduled Airborne Velocity Message – Subtype=1 provided that the change occurs at least 100 milliseconds prior to the next scheduled Airborne Velocity Message – Subtype=1 transmission.~~

Measurement Procedure:

Step 1: Airborne Velocity Message - Subtype=1 – 'TYPE' Subfield (§2.2.3.2.6.1.1 and §2.2.5.2.4)

Configure the ADS-B Transmitting Subsystem to transmit Airborne Velocity Messages – Subtype=1 by providing subsonic velocity information at the nominal update rate. Provide the data externally at the interface to the ADS-B system. Set the ADS-B Transmitting Subsystem to Airborne status. Provide valid non-zero subsonic velocity data to the ADS-B System. Continue transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged. Verify that the TYPE subfield in the Airborne Velocity Message – Subtype=1 equals 19, which is the only TYPE value assigned to Airborne Velocity Messages.

Step 2: Airborne Velocity Message - Subtype=1 – 'Subtype' Subfield (§2.2.3.2.6.1.2 and §2.2.5.2.4)

Continue transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged. Increase the velocity data input to the ADS-B System to a supersonic value so that the change occurs at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the 'Subtype' subfield value has changed to TWO (2) in the next transmitted Airborne Velocity Message.

Step 3: Airborne Velocity Message - Subtype=1 – 'NAC$_V$' Subfield (§2.2.3.2.6.1.5 and §2.2.5.2.4)

Continue transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged. Verify that the NAC$_V$ value equals Zero (0). Insert changed data to the ADS-B System to cause a change to occur in the NAC$_V$ value and so that the change is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the NAC$_V$ subfield value has changed to the correct value in the next transmitted Airborne Velocity Message.

Step 4: Airborne Velocity Message - Subtype=1 – 'East/West Direction Bit' Subfield (§2.2.3.2.6.1.6 and §2.2.5.2.4)

Continue transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged. Verify that the East/West Direction Bit equals Zero (0). Insert changed data to the ADS-B System to cause a change to occur in the East/West Direction Bit so that the direction will become 'West' and so that the change is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the East/West Direction Bit subfield value has changed to ONE (1) in the next transmitted Airborne Velocity Message.

Step 5: Airborne Velocity Message - Subtype=1 – 'East/West Velocity' Subfield (§2.2.3.2.6.1.7 and §2.2.5.2.4)

Configure the ADS-B Transmitting Subsystem to transmit Airborne Velocity Messages – Subtype=1 by providing subsonic velocity information at the nominal update rate. Provide the data externally at the interface to the ADS-B system. Set the ADS-B Transmitting Subsystem to Airborne status. Provide valid non-zero subsonic East/West Velocity data to the ADS-B System. Continue transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged.

Insert changed data to the ADS-B System to cause a change to occur in the East/West Velocity so that it is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the East/West Velocity subfield value has changed in the next transmitted Airborne Velocity Message and that the value in the subfield is correct.

Step 6: Airborne Velocity Message - Subtype=1 – 'North/South Direction Bit' Subfield (§2.2.3.2.6.1.8 and §2.2.5.2.4)

Repeat the tests in Step ~~6~~4 above changing the word 'East' to 'North' and the word 'West' to 'South'.

Step 7: Airborne Velocity Message - Subtype=1 – 'North/South Velocity' Subfield (§2.2.3.2.6.1.9 and §2.2.5.2.4)

Repeat the tests in Step 5 ~~7~~ above changing the word 'East' to 'North' and the word 'West' to 'South'.

Step 8: Airborne Velocity Message - Subtype=1 – 'Vertical Rate Source Bit' Subfield (§2.2.3.2.6.1.10 and §2.2.5.2.4)

a. Continue transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged. Verify that the Source Bit for Vertical Rate equals Zero (0), indicating receipt of Vertical Rate

information from a Non-Barometric Source. Insert changed data to the ADS-B System to cause a change to occur in the Source Bit for Vertical Rate so that the Vertical Rate information will come from a Barometric Source or Barometric Source blended with another Source, and so that the change is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Wait for 2.6 seconds. Verify that the 'Source Bit for Vertical Rate' subfield value has changed to ONE (1) in the next transmitted Airborne Velocity Message.

b. Continue transmitting Airborne Velocity Messages – Subtype=1 at the nominal rate with all parameters unchanged and verify that the Source Bit for Vertical Rate contains the value ONE (1). Continue transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged. Insert changed data to the ADS-B System to cause a change to occur in the Source Bit for Vertical Rate so that the Vertical rate information will come from a Non-Barometric Source, and so that the change is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Wait for 2.6 seconds. Verify that the 'Source Bit for Vertical Rate' subfield value has changed to ZERO (0) in the next transmitted Airborne Velocity Message.

Step 9: Airborne Velocity Message - Subtype=1 – 'Sign Bit for Vertical Rate' Subfield (§2.2.3.2.6.1.11 and §2.2.5.2.4)

a. Continue transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged. Verify that the 'Sign Bit for Vertical Rate' subfield equals ZERO (0), indicating Vertical Rate information in the UP Direction. Insert changed data to the ADS-B System to cause a change to occur in the 'Sign Bit for Vertical Rate' so that the Vertical Direction information will be DOWN, and so that the change is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the 'Sign Bit for Vertical Rate' subfield value has changed to ONE (1) in the next transmitted Airborne Velocity Message.

b. Continue transmitting Airborne Velocity Messages – Subtype=1 at the nominal rate with all parameters unchanged and verify that the 'Sign Bit for Vertical Rate' subfield contains the value of ONE (1). Continue transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged. Insert changed data to the ADS-B System to cause a change to occur in the 'Sign Bit for Vertical Rate' so that the Vertical Direction information will be UP, and so that the change is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the 'Sign Bit for Vertical Rate' subfield value has changed to ZERO (0) in the next transmitted Airborne Velocity Message.

Step 10: Airborne Velocity Message - Subtype=1 – 'Vertical Rate' Subfield (§2.2.3.2.6.1.12 and §2.2.5.2.4)

Configure the ADS-B Transmitting Subsystem to transmit Airborne Velocity Messages – Subtype=1 by providing subsonic velocity information at the nominal update rate. Provide the data externally at the interface to the ADS-B system. Set the ADS-B Transmitting Subsystem to Airborne status. Provide valid non zero Vertical Rate data to the ADS-B System. Continue

transmitting Airborne Velocity Messages - Subtype=1 at the nominal rate with all parameters unchanged.

Insert changed data to the ADS-B System to cause a change to occur in the Vertical Rate so that it is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the Vertical Rate subfield value has changed in the next transmitted Airborne Velocity Message and that the value in the subfield is correct.

Step 11: Airborne Velocity Message - Subtype=1 – 'Extended Difference From Barometric Altitude Sign Bit' Subfield (§2.2.3.2.6.1.14 and §2.2.5.2.4)

Configure the ADS-B Transmitting Subsystem to transmit Airborne Velocity Messages - Subtype=1 by providing subsonic velocity information at the nominal update rate, including non-zero Barometric and Geometric Altitude data. Provide the data externally at the interface to the ADS-B system. Ensure that the 'Extended Difference From Barometric Altitude Sign Bit' subfield equals ZERO (0), indicating geometric altitude source data is greater than or equal to barometric. Insert changed data to the ADS-B System to cause a change to occur in the 'Extended Difference From Barometric Altitude Sign Bit' so that the geometric altitude source data is less than barometric, and so that the change is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the 'Extended Difference From Barometric Altitude Sign Bit' subfield value has changed to ONE (1) in the next transmitted Airborne Velocity Message.

Step 12: Airborne Velocity Message - Subtype=1 – 'Extended Difference From Barometric Altitude' Subfield (§2.2.3.2.6.1.15 and §2.2.5.2.4)

Configure the ADS-B Transmitting Subsystem to transmit Airborne Velocity Messages – Subtype=1 at the nominal rate with all parameters unchanged. Insert data to the ADS-B System to cause a change to occur in the Extended Difference From Barometric Altitude so that it is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the Extended Difference From Barometric Altitude subfield value has changed in the next transmitted Airborne Velocity Message and that the value in the subfield is correct.

Step 13: Airborne Velocity Message - Subtype=1 – 'NIC Supplement-D' Subfield (§2.2.3.2.6.1.16 and §2.2.5.2.4)

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Airborne Velocity Messages – Subtype=1 at the nominal rate. For Type Codes=20 & 22, insert changed data to the ADS-B System to cause a change to occur in the NIC Supplement-D subfield, so that the change is detected at least 100 milliseconds prior to the next scheduled Airborne Velocity Message transmission. Verify that the value in the NIC Supplement-D subfield equals the corresponding value in the NIC Supplement-D column in the applicable row of Table 2-28.

[…]

2.4.5.2.12   Verification of Aircraft Operational Status Message Latency (§2.2.3.2.7.2, §2.2.5.2.12)

Purpose/Introduction:

This test verifies the latency of the Aircraft Operational Status Message.

Measurement Procedure:

Step 1:   Aircraft Operational Status Message - 'TYPE' Subfield (§2.2.3.2.7.2.1 and §2.2.5.2.12)

Configure the ADS-B Transmitting Subsystem to transmit Aircraft Operational Status Messages by providing data at the nominal update rate. Provide the data externally at the interface to the ADS-B system. Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with all parameters unchanged. Verify that the TYPE subfield in the Aircraft Operational Status Message equals 31, which is the only TYPE value assigned to Aircraft Operational Status Messages.

Step 2:   Aircraft Operational Status Message - 'Subtype' Subfield (§2.2.3.2.7.2.2 and §2.2.5.2.12)

Continue transmitting Aircraft Operational Status Messages at the nominal rate with all parameters unchanged. Verify that the Subtype subfield in the Aircraft Operational Status Messages equals ZERO (0).

Insert data to the ADS-B System to simulate an On-Ground status, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that the Subtype subfield is set to ONE (1).

Step 3:   Aircraft Operational Status Message - 'Capability Class' (CC) Subfield (§2.2.3.2.7.2.3 and §2.2.5.2.12)

a.   Capability Class Code for 'CA Operational' (§2.2.3.2.7.2.3.2)

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with CA Operational indicated. Verify that 'ME' bit 11 is set to ONE (1). Insert data to the ADS-B System to cause a change to occur in the Capability Class subfield with Collision Avoidance System is NOT operational indicated, and so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 11 is set to ZERO (0).

b.   Capability Class Code for '1090ES IN' (§2.2.3.2.7.2.3.3)

This test is only applicable to systems setting the 1090ES IN subfield via data received from an external interface.

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with ADS-R and/or TIS-B 1090ES reception capability indicated. Verify that 'ME' bit 12 is set to ONE (1). Insert data to the ADS-B System to cause a change to occur in the Capability Class subfield which indicates that there is no ADS-R and/or TIS-B 1090ES reception capability available, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 12 is set to ZERO (0).

Set the ADS-B Transmitting Subsystem to On-Ground Status. Rerun this procedure and verify that the Subtype is set to ONE (1) and that 'ME' bit 12 is set to the appropriate state.

c. Capability Class Code for 'UAT IN' (§2.2.3.2.7.2.3.9)

This test is only applicable to systems setting the UAT IN subfield via data received from an external interface.

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with ADS-R and/or TIS-B UAT reception capability indicated. Verify that 'ME' bit 19 is set to ONE (1). Insert data to the ADS-B System to cause a change to occur in the Capability Class subfield which indicates that there is no ADS-R and/or TIS-B UAT reception capability available, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 19 is set to ZERO (0).

Set the ADS-B Transmitting Subsystem to On-Ground Status. Rerun this procedure and verify that the Subtype is set to ONE (1) and that 'ME' bit 19 is set to the appropriate state.

d. Capability Class Code for 'Transponder Side Indication' (§2.2.3.2.7.2.3.4)

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with unknown transponder side data. Verify that 'ME' bits 15 – 16 are set to ALL ZEROs (binary 00). Insert data to the ADS-B System to cause a change to occur in the Capability Class subfield with Transponder #1 indicated, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bits 15 – 16 are set to ONE (binary 01).

e. Capability Class Code for 'Tx Power' (§2.2.3.2.7.2.3.6)

Tx Power is a static parameter that is verified in §2.4.3.2.7.2.3.6.

f. Capability Class Code for 'B2 Low' (§2.2.3.2.7.2.3.7)

B2 Low is a static parameter that is verified in §2.4.3.2.7.2.3.7.

g. Capability Class Code for 'NAC$_V$' (§2.2.3.2.7.2.3.8)

Set the ADS-B Transmitting Subsystem to On-Ground Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with unknown horizontal velocity error data. Verify that 'ME' bits 17 – 19 are set to ALL ZEROs (binary 000). Insert data to the ADS-B System to cause a change to occur in the Capability Class subfield with a horizontal velocity error < 10 m/s indicated, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bits 17 – 19 are set to ONE (binary 001).

h. Capability Class Code for 'NIC Supplement-C' (§2.2.3.2.7.2.3.10)

Continue transmitting Aircraft Operational Status Messages at the nominal rate with NIC Supplement-C set to ZERO. Verify that 'ME' bit

20 is set to ZERO. Insert data to the ADS-B System to cause a change to occur in the Capability Class subfield with NIC Supplement-C set to ONE, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 20 is set to ONE.

i. Capability Class Code for 'RCE' (§2.2.3.2.7.2.3.11)

RCE is a static parameter that is verified in §2.4.3.2.7.2.3.11.

j. Capability Class Code for 'DAA' (§2.2.3.2.7.2.3.12)

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with no RWC capability indicated. Verify that 'ME' bits 23 – 24 are set to ALL ZEROs (binary 00). Insert data to the ADS-B System to cause a change to occur in the Capability Class subfield to indicate an RWC function capable of receiving TCAS Resolution messages and ADS-B OCMs, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bits 23 – 24 are set to ONE (binary 01).

Step 4:   Aircraft Operational Status Message – Subtype 0/1 - 'Operational Mode' (OM) Subfield (§2.2.3.2.7.2.4 and §2.2.5.2.12)

a. Operational Mode Code for 'CA Resolution Advisory Active' (§2.2.3.2.7.2.4.2)

Configure the ADS-B Transmitting Subsystem to transmit Aircraft Operational Status Messages by providing data at the nominal update rate. Provide the data externally at the interface to the ADS-B system. Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with no CA Resolution Advisory Active indicated. Verify that 'ME' bit 27 is set to ZERO (0). Insert data to the ADS-B System to cause a change to occur in the Operational Mode subfield with a CA Resolution Advisory Active indicated, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 27 is set to ONE (1).

Set the ADS-B Transmitting Subsystem to On-Ground Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with no CA Resolution Advisory Active indicated. Verify that 'ME' bit 27 is set to ZERO (0) when the OM subfield format code is equal to ZERO (binary 00). Insert changed data to the ADS-B System to cause a change to occur in the Operational Mode subfield with a CA Resolution Advisory Active indicated, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 27 is set to ONE (1) when the OM subfield format code is equal to ZERO (binary 00).

b. Operational Mode Code for 'IDENT Switch Active' (§2.2.3.2.7.2.4.3)

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with IDENT switch not active indicated. Verify that 'ME' bit 28 is set to ZERO (0). Insert data to the ADS-B System to cause a change to occur in

the Operational Mode subfield with IDENT switch active indicated, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 28 is set to ONE (1).

Set the ADS-B Transmitting Subsystem to On-Ground Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with IDENT switch not active indicated. Verify that 'ME' bit 28 is set to ZERO (0) when the OM subfield format code is equal to ZERO (binary 00). Insert data to the ADS-B System to cause a change to occur in the Operational Mode subfield with IDENT switch active indicated, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 28 is set to ONE (1) when the OM subfield format code is equal to ZERO (binary 00).

c. Operational Mode Code for 'Single Antenna Flag' (§2.2.3.2.7.2.4.5)

The Single Antenna Flag (SAF) is a static parameter that is configured at the aircraft level to indicate whether the aircraft is equipped with Diversity or Non-Diversity antenna. The stimulus required to specify this will be implementation dependent.

Provide stimulus to indicate that the aircraft has a single antenna and, if required, reset the ADS-B System for this stimulus to take effect. Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate. Verify that 'ME' bit 30 is set to ONE (1).

Provide stimulus to indicate that the aircraft has multiple antennas and, if required, reset the ADS-B System for this stimulus to take effect. Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate. Verify that 'ME' bit 30 is set to ZERO (0).

Reset the ADS-B Transmitting Subsystem to On-Ground Status and rerun the above tests and verify 'ME' bit 30 is set appropriately.

d. Operational Mode Code for 'System Design Assurance' (§2.2.3.2.7.2.4.6)

Continue transmitting Aircraft Operational Status Messages at the nominal rate with unknown SDA data. Verify that the SDA subfield ('ME' bits 31 − 32) equals ZERO (binary 00). Insert data to the ADS-B System to cause a change to occur in the SDA subfield to indicate 1×10^{-3} per flight hour, and so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that the SDA subfield equals ONE (binary 01).

Set the ADS-B Transmitting Subsystem to On-Ground Status. Rerun this procedure and verify that the Subtype is set to ONE (1) and that 'ME' bits 31 − 32 are set to the appropriate values.

e. Operational Mode Code for 'GPS Antenna Offset' (§2.2.3.2.7.2.4.7)

Set the ADS-B Transmitting Subsystem to On-Ground Status. Via the appropriate input interface provide the ADS-B Transmitting Subsystem

with no GPS Antenna Offset data. Transmit Aircraft Operational Status Messages at the nominal rate. Verify that 'ME' bits 33 – 40 (Message bits 65 – 72) are set to All ZEROs in the Surface Aircraft Operational Status Messages when the OM subfield format code is equal to ZERO (binary 00). Change the Lateral and Longitudinal GPS Antenna Offset inputs such that both the Lateral and Longitudinal Offsets are non-zero. Make the change such that it is detected at least 100 milliseconds prior to the next scheduled Surface Aircraft Operational Status Message transmission. Verify that the Lateral and Longitudinal Offsets are properly reported in the next transmitted Surface Aircraft Operational Status Message when the OM subfield format code is equal to ZERO (binary 00).

f. Operational Mode Code for 'Mode S Reply Rate Limiting Status' (§2.2.3.2.7.2.4.4)

The Mode S Reply Rate Limiting Status is verified in §2.4.3.2.7.2.4.4.

g. Operational Mode Code for 'CCCB' (§2.2.3.2.7.2.4.8, §2.2.3.2.7.2.4.9, §2.2.3.2.7.2.4.10)

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with CCCB data set to ZERO. Verify that the Sense: Vertical and Horizontal and Aircraft CAS Type/Capability ('ME' bits 33 – 39) are set to ZERO. Insert data to the ADS-B System to cause a change to occur in the CCCB subfield, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that the Sense: Vertical and Horizontal and Aircraft CAS Type/Capability are set to the updated values.

h. Operational Mode Code for 'RWC Active' (§2.2.3.2.7.2.4.12)

Continue transmitting Aircraft Operational Status Messages at the nominal rate with no active RWC corrective alert. Verify that RWC Active ('ME' bit 40) is set to ZERO. Insert data to the ADS-B System to cause an RWC corrective alert to be active, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that RWC Active ('ME' bit 40) is set to ONE.

i. Operational Mode Code for 'Transponder Antenna Offset' (§2.2.3.2.7.2.4.13)

Set the ADS-B Transmitting Subsystem to On-Ground Status. Via the appropriate input interface provide the ADS-B Transmitting Subsystem with no Transponder Antenna Offset data. Transmit Aircraft Operational Status Messages at the nominal rate. Verify that 'ME' bits 36 – 40 are set to ALL ZEROs in the Surface Aircraft Operational Status Messages when the OM subfield format code is equal to ONE (binary 01). Change the Transponder Antenna Offset input such that it is non-zero. Make the change such that it is detected at least 100 milliseconds prior to the next scheduled Surface Aircraft Operational Status Message transmission. Verify that the Transponder Antenna Offset is properly reported in the next transmitted Surface Aircraft Operational Status

Message when the OM subfield format code is equal to ONE (binary 01).

Step 5:   Aircraft Operational Status Message – 'Aircraft Length and Width Code' Subfield (§2.2.3.2.7.2.11)

Set the ADS-B Transmitting Subsystem to On-Ground Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with the Minimum Length and Width values from Table 2-71 indicated. Verify that the 'ME' bits 21 – 24 are set to ALL ZEROs (binary 0000). Insert changed data to the ADS-B System to cause a change to occur in the Length and Width subfield, and so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that the binary values in 'ME' bits 21 – 24 equals the corresponding binary values in the same row of the table.

Step 6:   Aircraft Operational Status Message – Subtype '0/1' – 'ADS-B Version Number' Subfield (§2.2.3.2.7.2.5)

The ADS-B Version Number is a static parameter that is verified in §2.4.3.2.7.2.5.

Step 7:   Aircraft Operational Status Message – Subtype '0/1' – 'NIC Supplement-A' Subfield (§2.2.3.2.7.2.6)

Continue transmitting Aircraft Operational Status Messages at the nominal rate with NIC Supplement-A set to ZERO. Verify that 'ME' bit 44 is set to ZERO. Insert data to the ADS-B System to cause a change to occur in the subfield with NIC Supplement-A set to ONE, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 44 is set to ONE.

Set the ADS-B Transmitting Subsystem to On-Ground Status. Repeat this procedure and verify that the Subtype is set to ONE (1) and that 'ME' bit 44 is set to the appropriate value.

Step 8:   Aircraft Operational Status Message – Subtype '0/1' – 'NAC$_P$' Subfield (§2.2.3.2.7.2.7)

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with an EPU greater than or equal to 10 NM indicated. Verify that the NAC$_P$ Subfield ('ME' bits 45 – 48) is set to ZERO (binary 0000). Insert data to the ADS-B System to cause a change to occur in the NAC$_P$ subfield, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that the binary value in the NAC$_P$ Subfield equals the corresponding binary value in the NAC$_P$ Binary column in the same row of the table.

Set the ADS-B Transmitting Subsystem to On-Ground Status. Repeat this procedure and verify that the Subtype is set to ONE (1) and that 'ME' bits 45 – 48 are set to the appropriate values.

Step 9:   Aircraft Operational Status Message – Subtype '0/1' – 'SIL' Subfield (§2.2.3.2.7.2.9)

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with

unknown SIL Data. Verify that the SIL subfield ('ME' bits 51 – 52) equals ZERO (binary 00). Insert data to the ADS-B System to cause a change to occur in the SIL subfield to indicate 1×10^{-3} per flight hour or per sample, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that the SIL subfield equals ONE (binary 01).

Set the ADS-B Transmitting Subsystem to On-Ground Status. Repeat this procedure and verify that the Subtype is set to ONE (1) and that 'ME' bits 51 – 52 are set to the appropriate values.

Step 10: Aircraft Operational Status Message – Subtype=1 – 'Track Angle/Heading' Subfield (§2.2.3.2.7.2.12)

Set the ADS-B Transmitting Subsystem to On-Ground Status. Continue transmitting Aircraft Operational Status – Subtype=1 Messages at the nominal rate with Track Angle indicated. Verify that 'ME' bit 53 is set to ZERO (0). Insert data to the ADS-B System to cause a change to occur in the Track Angle/Heading subfield with Heading indicated and such that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 53 is set to ONE (1).

Step 11: Aircraft Operational Status Message – Subtype '1' – 'HRD' Subfield (§2.2.3.2.7.2.13)

Set the ADS-B Transmitting Subsystem to On-Ground Status. Continue transmitting Aircraft Operational Status – Subtype '1' Messages at the nominal rate with True North indicated. Verify that 'ME' bit 54 is set to ZERO (0). Insert data to the ADS-B System to cause a change to occur in the HRD subfield with Magnetic North indicated, such that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that 'ME' bit 54 is set to ONE (1).

Step 12: Aircraft Operational Status Message – Subtype=0 – 'GVA' Subfield (§2.2.3.2.7.2.8)

Set the ADS-B Transmitting Subsystem to Airborne Status. Continue transmitting Aircraft Operational Status Messages at the nominal rate with an unknown geometric vertical accuracy. Verify that the GVA subfield ('ME' bits 49 – 50) is set to ZERO (binary 00). Insert data to the ADS-B System to cause the GVA to be set to < 150 meters, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that the GVA subfield is set to ONE (binary 01).

Step 13: Aircraft Operational Status Message – Subtype '0/1' – 'SIL Supplement' Subfield (§2.2.3.2.7.2.14)

Continue transmitting Aircraft Operational Status Messages at the nominal rate with a SIL probability based on a 'per hour' probability. Verify that the SIL Supplement subfield ('ME' bit 55) is set to ZERO (0). Insert data to the ADS-B System to cause the SIL probability to be based on a 'per sample' probability, so that the change is detected at least 100 milliseconds prior to the next scheduled Aircraft Operational Status Message transmission. Verify that the SIL Supplement subfield is set to ONE (1).

Set the ADS-B Transmitting Subsystem to On-Ground Status. Repeat this procedure and verify that the Subtype is set to ONE (1) and that 'ME' bit 55 is set to the appropriate value.

[Amdt ETSO/19]

ETSO-2C169ab

VHF RADIO COMMUNICATIONS EQUIPMENT OPERATING WITHIN THE RADIO FREQUENCY RANGE 117.975 TO 137.000 MEGAHERTZ

1   Applicability

This ETSO gives the requirements which new models of VHF Radio Communications Equipment Operating within the Radio Frequency Range 117.975 to 137.000 Megahertz that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

This ETSO cancels ETSO-2C37e 'VHF Radio Communication Transmitting Equipment Operating within the Radio Frequency Range 117.975-137.000 Megahertz' and ETSO-2C38e 'VHF Radio communication Receiving Equipment Operating within the Radio Frequency Range 117.975-137.000 Megahertz'.

2   Procedures

2.1   General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2   Specific

This ETSO applies to equipment intended for aircraft VHF amplitude modulated (AM) communications operating within 117.975 to 137.000 MHz. This includes 25 and 8.33 kHz channel spacing capabilities. VHF communication equipment covered by this ETSO is primarily intended for aeronautical operational control (AOC) and air traffic services (ATS) safety communications.

3   Technical Conditions

3.1   Basic

3.1.1 Minimum Performance Standard

a) Receiver–Transmitter Equipment

Standards set forth in EUROCAE document ED-23C 'Minimum Operational Performance Standards for Airborne VHF Receiver-Transmitter Operating within the Radio Frequency Range 117.975-137.000 MHz', dated June 2009 for the equipment classes defined in the following table.

Table of Equipment Classes for VHF Communication Equipment

Equipment Class	Description
C	Receiver used in a 25 kHz channel separation environment having off-set carrier operation
D	Receiver used in a 25 kHz channel separation environment not having off-set carrier operation
E	Receiver used in an 8.33 kHz channel separation environment not having off-set carrier operation
H1 and H2	Receivers which are to be used in an 8,33 kHz channel separation environment and

Equipment Class	Description
	intended for off-set carrier operation with only two carriers.
3	Transmitter used in a 25 kHz channel separation environment and intended to operate with a range of 200 nautical miles.
4	Transmitter used in a 25 kHz channel separation environment and intended to operate with a range of 100 nautical miles.
5	Transmitter used in an 8.33 kHz channel separation environment and intended to operate with a range of 200 nautical miles.
6	Transmitter used in an 8.33 kHz channel separation environment and intended to operate with a range of 100 nautical miles.

It is recommended that, when applying for ETSO-2C169a authorisation, the applicant also applies for ETSO-2C128 'Devices that Prevent Blocked Channels Used in Two-Way Radio Communications due to Unintentional Transmission' authorisation.

For equipment embedding audio intercom functions for more than two intercom users (2 microphones and 2 audio outputs), the applicant has to apply also for ETSO-C139() 'Aircraft Audio Systems and Equipment'.

For equipment that also provide Control Panel functionalities, the additional requirements set forth in Appendix 1 of this standard also applies.

b) Antenna Equipment

Requirements set forth in paragraphs 2.1, 2.2.14, 2.2.15, 2.3.9 and 2.3.10, and associated test procedures, of RTCA document DO-186B 'Minimum Operational Performance Standards for Airborne Radio Communications Equipment Operating within the Radio Frequency Range 117.975-137.000 MHz', dated 8 November 2005.

The Antenna shall be qualified according to the applicable sections of the environmental standard referenced in Section 3.1.2 below.

3.1.2 Environmental Standard

See CS-ETSO Subpart A paragraph 2.1.

3.1.3 Computer Software

See CS-ETSO Subpart A paragraph 2.2.

3.1.4 Electronic Hardware Qualification.

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 has been determined to be a major failure condition.

4   Marking

4.1   General

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

4.2   Specific

None

5   Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

[Amdt ETSO/6]
[Amdt ETSO/19]

Appendix 1 to ETSO-C169b

ADDITIONAL REQUIREMENTS FOR CONTROL PANELS

For a system that provides an interface for human interaction, such as a control panel and/or display screen, human performance becomes an essential part of overall system performance. It is therefore essential that human machine interface designers conduct early evaluations of the capability of the human and system to perform the intended functions. For this reason, the following additional requirements applies to communication equipment embedding a control panel.

1.1   Definitions

Control Panel: a set of controls used by the operator to select adjust the operational settings of the communication equipment including, but no limited to, the following functionalities:

—   Adjusting the Volume of the Audio output

—   Tuning of the operative frequency

—   Adjusting the Squelch Level

—   Means to monitor the current operational status.

1.2   General

The design of the physical and functional features of the Communication Equipment Control Panel shall be simple as possible to allow an easy, fast and intuitive operation of the equipment under any foreseeable flight condition and to avoid any misleading or erroneous operation.
For knob controls, the following apply:

—   Clockwise turn: increase of values, digits, or item selection to the right, scrolling down;

—   Counter-clockwise: decrease of values, digits, or item selection to the left, scrolling up.

For pushbuttons controls, the following apply:

—   The legend shall be coherent with the intended function;

—   The control can be a toggle, or the function shall not require more than two pushes to revert to the previous values/setting.

If the physical control is shared between different functions, there must be a clear indication of the active function (i.e. Volume knob used for Tuning).
Control Panel layout shall be designed to prevent any inadvertent operation of controls while operating the equipment.

1.3   Volume Control

The control for the Volume of the Audio Output shall be implemented by physical control with immediate access (i.e. setting the Volume by means of a menu setting is not acceptable).
If the physical control is shared with other functions, there must be a mean to automatically revert to the Volume control after a predetermined time.

1.4   Tuning Control

The control for the Tuning Function shall be implemented by a physical control not requiring more than two actions to operate.

1.5   Squelch Level

The control for the Squelch shall be implemented by a physical control not requiring more than two actions to operate.

1.6   Monitoring of the Equipment Status

The monitoring of the equipment status (i.e. Display) shall be simple, intuitive, and effective under every foreseeable light condition.

[Amdt ETSO/19]

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ETSO-C220

GNSS-AIDED INERTIAL SYSTEMS

1 Applicability

This ETSO provides the requirements that GNSS-aided inertial systems providing position outputs 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

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 Specific

a. Some GNSS-aided inertial systems have approval using RTCA/DO-229() or RTCA/DO-316(), Appendix R for the requirements and test procedures for the tightly integrated GPS/Inertial system. However, EASA will no longer accept any application for developments of new articles or Major changes to existing articles using these criteria after 12 months from the effective date of this ETSO.

b. Some GNSS-aided inertial systems have approval under ETSO-C201(), Attitude and Heading Reference Systems (AHRS), with the navigation capability of the product approved as a non-ETSO function (e.g. the position outputs of the GNSS-aided inertial system making up the AHRS). ETSO-C201() remains effective and is a prerequisite for GNSS-aided inertial systems incorporating Attitude and Heading functions. However, EASA will no longer accept any new applications for ETSO-C201() that seek approval of the position outputs as a non-ETSO function.

c. Due to the wide range of possible GNSS-aided inertial systems capabilities, manufacturers shall define the equipment's intended function and demonstrated performance. The word 'system' includes all components or units necessary for the GNSS-aided inertial system to perform its intended function (excluding GNSS receiver function which meets requirements of ETSO-C196(), -C145() or -C146() and AHRS functions which meet requirements of ETSO-C201()).

3 Technical Conditions

3.1 Basic

3.1.1 Minimum Performance Standard

The applicable standard is that provided in RTCA/DO-384, 'Minimum Operational Performance Standards (MOPS) for GNSS Aided Inertial Systems', dated 17 December 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

3.2.1 Failure Condition Classification

See CS-ETSO Subpart A paragraph 2.4.

3.2.2 Integrity Protection Limits

Both Advanced Receiver Autonomous Integrity Monitoring (ARAIM) and RTCA/DO-384 for GNSS-aided inertial systems define ways to compute protection limits with the same integrity and continuity objectives. However, hypotheses taken into account, for example by ARAIM, are much more stringent than the hypotheses taken into account by RTCA/DO-384.

a.   While RTCA/DO-384 integrity relies on the GPS prior satellite failure rate of 10^{-5}/hr, it does not take into account the temporal effects considered by ARAIM that lead to more pessimistic probabilities of missed detection to guarantee the integrity risk over the exposure period. For GNSS-aided inertial systems, manufacturers shall evaluate whether RTCA/DO-384 temporal error characterisation, satellite mean fault duration, and algorithm sampling rate is adequate.

b.   When assigning probability of misleading information equal to or less than 10^{-7}, manufacturers shall consider additional fault modes or anomalies affecting multiple (two or more) satellites. GPS Standard Positioning Service (SPS) Performance Standard specifies that the probability of a GPS major service failure on two or more satellites due to a common cause (Pconst) shall not exceed 10^{-8} (consistent with the proposed amendment to International Civil Aviation Organization (ICAO) Annex 10 — Aeronautical Telecommunications, Volume I — Radio Navigation Aids). Manufacturers may use the tests described in RTCA/DO-384, Appendix Q: Alternate Trajectories, to demonstrate the performance of the GNSS-aided inertial system in detecting, mitigating, and recovering from multiple satellite failures.

3.2.3 Gravity Model

The following reference should be considered in addition to the references listed in RTCA/DO-384 Appendix O: *Needham, T. and M. Braasch, 'Gravity Modeling in GNSS-Aided Inertial Navigation System Safety Considerations,' NAVIGATION: Journal of the Institute of Navigation June 2022, 69 (2) navi.520; DOI.*

3.2.4 Alternate GNSS Trajectories

If the equipment provides detection and mitigation against the effects of erroneous (or alternate) GNSS trajectories, then the applicant shall test the equipment according to RTCA/DO-384, Appendix Q: Alternate Trajectories.

4   Marking

4.1   General

See CS-ETSO Subpart A paragraph 1.2.

4.2   Specific

None.

5   Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

[Amdt ETSO/19]

ETSO-2C502a

~~HELICOPTER CREW AND PASSENGER~~ROTORCRAFT INTEGRATED IMMERSION SUITS

1   Applicability

This ETSO gives the requirements which integrated immersion suits for use on ~~helicopters~~rotorcraft, that are manufactured on or after the date of this ETSO, must meet in order to be identified with the applicable ETSO marking.

2   Procedures

  2.1   General

  Applicable procedures are detailed in CS-ETSO Subpart A.

  2.2   Specific

  None.

3   Technical Conditions

  3.1   Basic

  3.1.1   Minimum Performance Standard

  ~~Standards set forth in Appendix 1 to this ETSO.~~ The applicable standards are those provided in AeroSpace and Defence Industries Association of Europe — Standardization (ASD-STAN) document EN4863:2023, dated May 2023.

  3.1.2 Environmental Standard

  None.

  3.2   Specific

  None.

4   Marking

  4.1   General

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

  4.2   Specific

  ~~As given in Appendix 1.~~The specific marking requirements are detailed in ASD-STAN document EN4863:2023.

5   Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

~~EN documents may be purchased from the European Committee for Standardisation (CEN), Rue de Stassart 36, B-1050 Brussels, Belgium or any CEN member.~~

[Amdt ETSO/1]
[Amdt ETSO/19]

Appendix 1 to ETSO-2C502 – EASA Standard for Helicopter Crew and Passenger Integrated Immersion Suits

1. Purpose

   1.1 This specification prescribes the minimum standard of design and performance for helicopter crew and passenger integrated immersion suits.

   1.2 An integrated immersion suit is defined as an immersion suit which incorporates the functionality of a lifejacket. The wearing of a separate lifejacket is not required.

2. Scope

   2.1 This standard covers integrated immersion suits for use on helicopters.

   2.2 The integrated suit shall comprise at least the following:

   a) A dry coverall

   b) Hand and head coverings

   2.3 Where applicable any additional or optional items designed to be used with the suit e.g. thermal liner, shall be considered as part of the integrated immersion suit as far as this specification is concerned.

3. Donning

   3.1 It is assumed for the purpose of this specification that the suit is donned prior to boarding the aircraft.

   3.2 The integrated suit and any attached equipment shall be capable of being donned without assistance and shall be capable of being sealed and adjusted by the wearer without assistance prior to boarding the aircraft.

   3.3 Air retained inside the suit after donning which could adversely affect egress, the manoeuvrability or flotation attitude, shall be capable of being exhausted, either automatically or by the wearer.

   3.4 It must be possible to complete all actions required to don the head covering required by paragraph 2.2(b) and seal the suit within 10 seconds. These actions shall be possible both when seated with harness fastened and when in the water with the suit inflated.

   3.5 The wearer shall be able to complete all actions required to don the hand covering required by paragraph 2.2(b) when tested in accordance with paragraph 3.11.6.5 of EN ISO 15027-3:2002 except that this shall be demonstrated by each subject after immersion in water at a temperature no higher than 10°C (50°F) for a period of 3 minutes.

4. Freedom of movement

   4.1 The integrated suit shall be designed to a standard which will allow the wearer to carry out all normal and emergency functions and movements necessary for the operation of a helicopter and its equipment.

   4.2 The design of the integrated suit shall allow tailoring to fit the individual wearer or, where suits are not individually tailored, the size range must be satisfactory for all wearers whose significant body dimensions range from the 5th percentile female to the 95th percentile male, and adequate for most of the 5% at each extreme.

4.3 The inflated suit shall not significantly hinder the boarding of a liferaft with the sprayhood deployed. This shall be demonstrated by testing to paragraph 3.4 of Appendix 2.

4.4 The wearing of the integrated suit, inflated or uninflated, shall not prevent the wearer from assisting others while in the water nor from assisting them to board a liferaft from the water.

4.5 The integrated suit, when correctly donned and adjusted, shall not prevent the wearer from having an acceptable field of vision. This shall be demonstrated by testing to paragraph 3.7 of Appendix 2.

5. Comfort

5.1 The design of the integrated suit shall minimise any discomfort to the wearer so as to avoid jeopardising safety. Particular attention should be given to the level of thermal comfort afforded the wearer on long into-sun flights in summer.

6. Compatibility

6.1 The integrated suit shall be designed, and the materials used in its construction chosen, to have no features which would be likely to have any detrimental effect on the operation of any helicopter or its equipment. In particular any part of the suit which might pose a snagging hazard during flight, emergency egress or recovery, shall be suitably covered, protected or restrained. All materials used shall be compatible with materials used in the construction of approved liferafts.

6.2 Any attached equipment shall not compromise the basic survival function of the suit by causing puncturing, fretting or distortion of the material, or changes in its mechanical properties.

7. Materials

7.1 All materials used shall be to an acceptable specification which shows the material to be suitable for its intended application. The materials used shall meet the requirements of paragraph 4.14 of EN ISO 15027-1:2002, with the exception of paragraph 4.14.3 of EN ISO 15027-3:2002 Resistance to Illumination Test.

7.2 The integrated suit and its equipment shall be so designed and constructed as to remain serviceable for the period between scheduled inspections. The choice of materials used shall be such that, when stowed in accordance with the relevant instructions, neither the suit nor its attached equipment shall be liable to become unserviceable through material deterioration or chafing, or from any other cause. Due consideration shall be taken of the possible temperature variations during stowage which may range between -30°C and +65°C (-22°F and +149°F). This shall be demonstrated by testing to paragraph 3.9 of EN ISO 15027-3:2002. The normal operating temperatures for the immersion suit shall be -5°C to +40°C (23°F to 104°F).

7.3 The outer fabric used in the construction of the suit shall be of low flammability. It shall not have a burn rate greater than 100mm/min (4in/min) when tested in accordance with the horizontal test of CS-25 Book 1 Appendix F Part 1 (b)(5) or other approved equivalent method.

8. Evacuation

8.1 A person wearing the uninflated suit shall be able to exit the helicopter through any Emergency Exit or Push-out Window down to the minimum acceptable size of 430mm x 355mm (17in x 14in). This action shall be possible in air or under water. This shall be demonstrated by testing to paragraph 3.3 of Appendix 2.

9. Buoyancy and floating position

9.1 The trapped buoyancy due to the suit and recommended clothing, with the suit fully vented, shall be no more than 150N (33.7lbf) when measured in accordance with paragraph 3.11.7.2 of EN ISO 15027-3:2002.

9.2 The buoyancy of the inflated suit shall be sufficient to ensure that a person wearing clothing and the integrated suit shall have a floating position such that the angle between the body and the horizontal is not greater than 60°. This shall be demonstrated by testing to paragraph 3.6 of Appendix 2.

9.3 The mouth must be at least 120mm (4.7in) above the waterline (mouth freeboard) and the nose freeboard shall not be less than the mouth freeboard, even when the wearer is incapacitated. This shall be demonstrated by testing to paragraph 3.5 of Appendix 2.

9.4 The inflated suit shall allow the wearer to turn from a face down position into a stable face up floating position within 5 seconds. This shall be demonstrated by testing to paragraph 3.2 of Appendix 2.

10. Breathing protection

10.1 A sprayhood shall be fitted.

10.1.1 The wearer shall be able to deploy the sprayhood within 20 seconds when wearing the inflated suit in or out of the water.

10.1.2 The sprayhood will not be considered suitable if it can in any way retain water when deployed.

10.1.3 The angles of vision shall not be unduly restricted, and the ability to swim and manoeuvre shall not be impaired with the sprayhood deployed.

10.1.4 The suit's light source shall not be masked by the presence of the sprayhood.

10.1.5 The materials used in the sprayhood's construction shall be compatible with those of the suit and shall in no way be able to cause damage to the buoyancy chambers or fabric of the suit or liferaft.

10.1.6 The sprayhood, whether stowed or deployed, should not cause inconvenience during winching or other rescue and recovery operations.

10.1.7 Means shall be provided to ensure that the level of carbon dioxide in the deployed sprayhood is within safe limits. This shall be demonstrated by testing to paragraph 6.10 of EN 396:1993 or equivalent.

11. Thermal protection

11.1 The suit shall provide the user with thermal protection in the water that at least satisfies the test requirements of paragraph 3.8 of EN ISO 15027-3:2002 as a class B suit system.

12. Water ingress

12.1 The integrated suit shall be so constructed that not more than 200g (7oz) of water shall leak into the suit when measured in accordance with paragraph 3.7 of EN ISO 15027-3:2002.

13. Conspicuity and location aids

13.1 Passenger Integrated Immersion Suits

To facilitate search and rescue operations, those parts of the suit which will be visible when in the water shall be of a highly conspicuous colour and comply with paragraph 4.5 of EN ISO 15027-1:2002.

13.2 Crew Integrated Immersion Suits

Where possible integrated suits for crew use shall meet the requirements of 13.1. However, the choice of suit colour may vary to minimise the risk of the suit reflecting on surfaces within the flight deck.

13.3 A passive light system of retro-reflective material shall be provided. This shall conform to the technical specification detailed in IMO SOLAS 83, Chapter III, Resolution A.658(16), Annex 2 or equivalent. A minimum area of 300cm2 (46in2) shall be provided, distributed in accordance with paragraph 4.12 of EN ISO 15027-1:2002.

13.4 The integrated suit shall be fitted with a flashing survivor locator light that meets the requirements of ETSO-C85a. The light shall flash at a rate between 50 and 70 flashes per minute. The location of the light shall be such that maximum practical conspicuity is achieved when in the water with the suit inflated. The light shall activate automatically and have a manually operated on/off switch.

13.5 A whistle shall be provided which complies with the requirements of paragraph 4.3 of EN394:1994 or equivalent.

14. Recoverability

14.1 The integrated suit must be fitted with a lifting becket which complies with the requirements of paragraph 4.15 of EN396:1993 or equivalent.

14.2 The inflated or uninflated suit shall not adversely affect recovery of the wearer by the use of a rescue strop with a circumference of 180cm (70in).

15. Group help

15.1 The integrated suit shall be equipped with a buddy line which complies with the requirements of paragraph 4.6 of EN394:1994 or equivalent.

16. Inflation system. The integrated suit must comply with this section unless it can, without additional inflation, meet the requirements of paragraphs 9.2 and 9.3 and maintain them for the duration of the test period of paragraph 17.2.

16.1 General

16.1.1 The integrated suit shall have two separate means of inflation. The primary means shall be a manually-initiated stored gas system together with a standby oral inflation system capable of repeated use. The required buoyancy shall be obtainable by either method.

16.1.2 A means of releasing the pressure in the suit is required and shall be of a type capable of repeated use. Protection shall be provided against inadvertent deflation.

16.1.3 After inflation by either method, it shall be possible to deflate the suit and then to reinflate it by using the standby system. The standby inflation system shall be readily accessible, simple and obvious in operation and it shall be impossible for any valve which may be used to be inadvertently left open. It shall be possible to 'top up' the suit orally whilst in use and without loss of inflation pressure.

16.2 Stored Gas System

16.2.1 Location of the actuating means of this type of system shall be such that it can be operated by either hand, in or out of the water. The method of releasing the stored gas into the suit shall be obvious; however, suitable marking shall be provided to advise the user.

16.2.2 The amount of stored gas provided shall be capable of inflating the suit to achieve the correct buoyancy as specified in paragraph 9.3 within 5 seconds of actuation at +20°C (68°F).

16.2.3 Adequate protection shall be provided to guard against any inadvertent initiation of an inflation when the wearer is passing through an emergency exit or when the suit is dropped from a height of 1.5m (5 feet).

16.2.4 The force required to manually initiate inflation must be a minimum of 20N (4.5lbf) and a maximum of 120N (27lbf) when tested in accordance with paragraph 6.8.4 of EN396:1993 or equivalent.

16.3 Oral Inflation System

16.3.1 The oral inflation tube shall comply with the requirements of paragraph 4.5 of EN396:1993 or equivalent.

16.3.2 It shall be positioned such that it can readily be used in and out of the water. After use, the device shall return to a position such that it will not produce facial injuries during a jump into the water as specified in paragraph 3.1 of Appendix 2.

17. Testing

17.1 Strength Pressure Test

The integrated suit shall have proof and ultimate factors of not less than 3 and 5 respectively on the pressure at which it is designed to be inflated by the primary means, at a stabilised ambient temperature of +45°C (113°F), and in no case shall the proof and ultimate pressures be less than 15kPa (2lbf/in2) and 25kPa (3.3lbf/in2) respectively.

17.2 Buoyancy

The integrated suit shall retain buoyancy after use of the primary inflation system to such an extent that after a period of 12 hours the requirements of paragraphs 3.5 and 3.6 of Appendix 2 are still met.

17.3 Performance Tests

The performance of all integrated suits shall be tested in accordance with Appendix 2.

18. Inspection Testing and Repair

18.1 The procedure for inspecting, testing and repairing integrated suits shall be established by the manufacturer and shall be capable of ensuring that all suits satisfy the requirements of this specification throughout their service lives. As part of the procedure, suits shall be inspected at intervals to ensure they are always ready for immediate and effective use in the water. Special attention shall be paid to seals and fasteners. Suits shall be required to be immediately removed from service for repair or replacement if damage or deterioration is discovered that may lead to the suit failing to satisfy a routine leak test when one is next carried out.

18.2 The procedures for servicing, inspection, repair and testing shall be described in the manufacturer's manual.

18.3   The frequency of servicing and inspections shall be agreed with the manufacturer holding design approval for the suit.

19.   Marking

19.1   Each detachable part of the integrated suit assembly shall, where reasonably practicable, be marked with:-

(a)   The manufacturer's approved inspection stamp.

(b)   The part number.

(c)   Date of manufacture or batch record.

(d)   Serial number

19.2   In the case of passenger integrated suits, the suit shall be marked with:-

(a)   Suit model designation

(b)   The manufacturer's name and address

(c)   Date of manufacture and Serial Number

(d)   Date at which next scheduled service and overhaul are due

(e)   Modification standard

19.3   In the case of crew integrated suits, the suit shall be marked with:-

(a)   The name of the crew member to whom it has been allocated

(b)   Rank of crew member marked externally, e.g. epaulettes.

(c)   Suit model designation

(d)   The manufacturer's name and address

(e)   Date of manufacture and Serial Number

(f)   Date at which next scheduled service and overhaul are due

(g)   Modification standard

19.4   The charged inflation cylinder shall be marked in accordance with paragraph 8.2 of EN396:1993 or equivalent, and include its date of manufacture.

19.5   When marking is not practicable alternative means must be agreed.

[Amdt ETSO/1]

Appendix 2 to ETSO-2C502 – Integrated Immersion Suit System Performance Testing

1. Purpose

   1.1 These tests are to demonstrate satisfactory performance of the integrated immersion suit system.

2. Test conditions

   2.1 The following tests shall be conducted in calm water. The water temperature shall be 25±2°C (77±4°F).

   2.2 Pass/fail criteria

   All samples shall pass all objective tests to meet the requirements of ETSO-2C502 Integrated Immersion Suits. However, due to the high variability between subjects and the difficulty in assessing some subjective measures, it is permitted that an integrated immersion suit does not completely meet the requirements of the following subjective tests in a single example and in no more than in one test subject. In these circumstances, two other subjects within the same weight category and with the same sex should be subjected to the same test. If this additional test is still not clearly passed then the integrated immersion suit shall be deemed to have failed, whilst if it is clearly passed then it may be deemed to have passed the test overall.

3. Performance tests

   3.1 Jump Test.

   Each test subject shall perform a jump test in accordance with paragraph 3.11.6.1 of EN ISO 15027-3:2002.

   3.2 Turning Test

   Each test subject shall perform a turning test in accordance with paragraph 3.11.6.3 of EN ISO 15027-3:2002.

   3.3 Escape Test Underwater

   Each test subject shall be required to swim through an opening not greater than 430mm x 355mm (17in x 14in) (minimum acceptable size of helicopter escape window) positioned with the top of the opening at least 300mm (12in) below the surface of the water with the suit uninflated. At least one of the subjects for this test shall be required to have a shoulder width measurement of at least 500mm (19.7in).

   3.4 Swim Test

   Each test subject wearing the integrated suit and clothing shall swim on their back for 20 minutes. The hands and arms shall be kept in the water even if not being used for propulsion. Each test subject shall then board a liferaft fitted with boarding facilities, without undue effort and without assistance, with the suit sealed, inflated and the sprayhood deployed. The pool used shall be of sufficient size and depth to prevent the subject gaining assistance by 'pushing off' from the side or bottom while performing this test.

3.5   Freeboard

Immediately following the swim test, the clearance of each test subject's face above the water shall be measured, with the subject behaving normally and when simulating unconsciousness. The clearance of the mouth (mouth freeboard) shall be a minimum of 120mm (4.7in) above the waterline in both cases. It shall be established that the nose freeboard is not less than the mouth freeboard.

3.6   Floating position

The angle of the test subject's body shall be measured by an appropriate method. The angle between the body and the horizontal shall be recorded and shall not be greater than 60°.

3.7   Field of vision

The wearer's field of vision shall not be unduly restricted when tested in accordance with paragraph 3.11.6.6 of EN ISO 15027-3:2002

[Amdt ETSO/1]

ETSO-2C503a

~~HELICOPTER CREW AND PASSENGER~~ROTORCRAFT IMMERSION SUITS FOR OPERATIONS TO OR FROM HELIDECKS LOCATED IN A HOSTILE SEA AREA

1   Applicability

This ETSO gives the requirements which immersion suits for use on ~~helicopters~~rotorcraft operating to or from helidecks located in a hostile sea area (as defined in ~~JAR-OPS 3.480(a)(12)(ii)(a))~~ Annex I (Definitions for terms used in Annexes II to V) to Commission Regulation (EU) No 965/2012), that are manufactured on or after the date of this ETSO, must meet in order to be identified with the applicable ETSO marking.

2   Procedures

2.1   General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2   Specific

~~This ETSO and the appendices refer to JAR-OPS 3 at Amendment 2 dated 1 January 2002.~~ None.

3   Technical Conditions

3.1   Basic

3.1.1   Minimum Performance Standard

~~Standards set forth in Appendix 1 to this ETSO.~~ The applicable standards are those provided in AeroSpace and Defence Industries Association of Europe — Standardization (ASD-STAN) document EN4863:2023, dated May 2023.

3.1.2   Environmental Standard

None.

3.2   Specific

None.

4   Marking

4.1   General

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

4.2   Specific

~~As given in Appendix 1.~~ The specific marking requirements are detailed in ASD-STAN document EN4863:2023.

5   Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

~~EN documents may be purchased from the European Committee for Standardisation (CEN), Rue de Stassart 36, B-1050 Brussels, Belgium or any CEN member.~~

~~JAA documents may be purchased through Information Handling Services. Addresses of the worldwide IHS offices are listed on the JAA website (www.jaa.nl) and IHS's website (www.global.ihs.com)~~

[Amdt ETSO/1]
[Amdt ETSO/19]

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Appendix 1 to ETSO-2C503 – EASA Standard for Helicopter Crew and Passenger Integrated Immersion Suits for Operations to or from Helidecks Located in a Hostile Sea Area

ED Decision 2006/004/R

1. **Purpose**

    1.1   This specification prescribes the minimum standard of design and performance for helicopter crew and passenger immersion suits that are designed to be used with an approved lifejacket.

2. **Scope**

    2.1   This standard covers immersion suits for use on helicopters operating to or from helidecks located in a hostile sea area (as defined in JAR-OPS 3.480(a)(12)(ii)(a)).

    2.2   The immersion suit shall comprise at least the following:

    a)   A dry coverall

    b)   Hand and head coverings

    2.3   Where applicable any additional or optional items designed to be used with the suit (but excluding the lifejacket) e.g. thermal liner, shall be considered as part of the immersion suit as far as this specification is concerned.

3. **Donning**

    3.1   It is assumed for the purpose of this specification that the suit is donned prior to boarding the aircraft and is worn with an approved lifejacket.

    3.2   The immersion suit and any attached equipment shall be capable of being donned without assistance and shall be capable of being sealed and adjusted by the wearer without assistance prior to boarding the aircraft.

    3.3   Air retained inside the suit after donning which could adversely affect egress, the manoeuvrability or flotation attitude, shall be capable of being exhausted, either automatically or by the wearer.

    3.4   It must be possible to complete all actions required to don the head covering required by paragraph 2.2(b) and seal the suit within 10 seconds. These actions shall be possible both when seated with harness fastened and wearing the uninflated lifejacket and when in the water while wearing the inflated lifejacket.

    3.5   The wearer shall be able to complete all actions required to don the hand covering required by paragraph 2.2(b) when tested in accordance with paragraph 3.11.6.5 of EN ISO 15027-3:2002 except that this shall be demonstrated by each subject after immersion in water at a temperature no higher than 10°C (50°F) for a period of 3 minutes.

4. **Freedom of movement**

    4.1   The immersion suit shall be designed to a standard which will allow the wearer to carry out all normal and emergency functions and movements necessary for the operation of a helicopter and its equipment.

    4.2   The design of the immersion suit shall allow tailoring to fit the individual wearer or, where suits are not individually tailored, the size range must be satisfactory for all wearers whose significant body dimensions range from the 5th percentile female to the 95th percentile male, and adequate for most of the 5% at each extreme.

4.3 The immersion suit, when correctly donned and adjusted, shall not prevent the wearer from having an acceptable field of vision. This shall be demonstrated by testing to paragraph 3.7 of Appendix 2.

4.4 The immersion suit when worn with the inflated lifejacket shall allow the wearer to turn from a face down position into a stable face up floating position within 5 seconds. This shall be demonstrated by testing to paragraph 3.2 of Appendix 2.

5. Comfort

5.1 The design of the immersion suit shall minimise any discomfort to the wearer so as to avoid jeopardising safety. Particular attention should be given to the level of thermal comfort afforded the wearer on long into-sun flights in summer.

6. Compatibility

6.1 Approval of an immersion suit to this specification shall take into account the compatibility between the suit and any approved lifejacket and sprayhood that is intended to be worn with it. The performance of the suit and lifejacket combination shall be tested in accordance with Appendix 2 of this specification.

6.2 The immersion suit shall be tested with each type of lifejacket that the suit is designed to be compatible with. If it is to be approved for use with more than one type of lifejacket, the performance testing of Appendix 2 shall be repeated with each additional type of lifejacket.

6.3 The immersion suit shall be designed, and the materials used in its construction chosen, to have no features which would be likely to have any detrimental effect on the operation of any helicopter or its equipment. In particular any part of the suit which might pose a snagging hazard during flight, emergency egress or recovery, shall be suitably covered, protected or restrained. All materials used shall be compatible with materials used in the construction of the appropriate approved lifejacket, sprayhood or liferaft.

6.4 Any attached equipment shall not compromise the basic survival function of the immersion suit by causing puncturing, fretting or distortion of the material, or changes in its mechanical properties.

7. Materials

7.1 All materials used shall be to an acceptable specification which shows the material to be suitable for its intended application. The materials used shall meet the requirements of paragraph 4.14 of EN ISO 15027-1:2002, with the exception of paragraph 4.14.3 of EN ISO 15027-3:2002 Resistance to illumination test.

7.2 The immersion suit and its equipment shall be so designed and constructed as to remain serviceable for the period between scheduled inspections. The choice of materials used shall be such that, when stowed in accordance with the relevant instructions, neither the immersion suit nor its attached equipment shall be liable to become unserviceable through material deterioration or chafing, or from any other cause. Due consideration shall be taken of the possible temperature variations during stowage which may range between -30°C and +65°C (-22°F and +149°F). This shall be demonstrated by testing to paragraph 3.9 of EN ISO 15027-3:2002. The normal operating temperatures for the immersion suit shall be -5°C to +40°C (23°F to 104°F).

7.3 The outer fabric used in the construction of the suit shall be of low flammability. It shall not have a burn rate greater than 100mm/min (4in/min) when tested in accordance with the horizontal test of JAR-25 Appendix F Part 1 or other approved equivalent method.

8. Buoyancy

8.1 The trapped buoyancy due to the suit and recommended clothing, with the suit fully vented, shall be no more than 150N (33.7lbf) when measured in accordance with paragraph 3.11.7.2 of EN ISO 15027-3:2002.

9. Thermal protection

9.1 The suit shall provide the user with thermal protection in the water that at least satisfies the test requirements of paragraph 3.8 of EN ISO 15027-3:2002 as a class B suit system.

10. Water ingress

10.1 The immersion suit shall be so constructed that not more than 200g (7oz) of water shall leak into the suit when measured in accordance with paragraph 3.7 of EN ISO 15027-3:2002.

11. Conspicuity

11.1 Passenger Immersion Suits

To facilitate search and rescue operations, those parts of the suit which will be visible when in the water shall be of a highly conspicuous colour and comply with paragraph 4.5 of EN ISO 15027-1:2002.

11.2 Crew Immersion Suits

Where possible immersion suits for crew use shall meet the requirements of 11.1. However, the choice of suit colour may vary to minimise the risk of the suit reflecting on surfaces within the flight deck.

11.3 A passive light system of retro-reflective material shall be provided. This shall conform to the technical specification detailed in IMO SOLAS 83, Chapter III, Resolution A.658(16), Annex 2 or equivalent. A minimum area of 300cm2 (46in2) shall be provided, distributed in accordance with paragraph 4.12 of EN ISO 15027-1:2002.

12. Inspection Testing and Repair

12.1 The procedure for inspecting, testing and repairing immersion suits shall be established by the manufacturer and shall be capable of ensuring that all suits satisfy the requirements of this specification throughout their service lives.

As part of the procedure, suits shall be inspected at intervals to ensure they are always ready for immediate and effective use in the water. Special attention shall be paid to seals and fasteners. Suits shall be required to be immediately removed from service for repair or replacement if damage or deterioration is discovered that may lead to the suit failing to satisfy a routine leak test when one is next carried out.

12.2 The procedures for servicing, inspection, repair and testing shall be described in the manufacturer's manual.

12.3 The frequency of servicing and inspections shall be agreed with the manufacturer holding design approval for the suit.

13. Marking

13.1 Each detachable part of the immersion suit assembly shall, where reasonably practicable, be marked with:

(a) The manufacturer's approved inspection stamp.

(b) The part number.

(c) Date of manufacture or batch record.

(d) Serial number

13.2 In the case of passenger immersion suits, the immersion suit shall be marked with:

(a) Suit model designation

(b) The manufacturer's name and address

(c) Date of manufacture and Serial Number

(d) Date at which next scheduled service and overhaul are due

(e) Modification standard

13.3 In the case of crew immersion suits, the immersion suit shall be marked with:

(a) The name of the crew member to whom it has been allocated

(b) Rank of crew member marked externally, e.g. epaulettes.

(c) Suit model designation

(d) The manufacturer's name and address

(e) Date of manufacture and Serial Number

(f) Date at which next scheduled service and overhaul are due

(g) Modification standard

13.4 When marking is not practicable alternative means must be agreed.

[Amdt ETSO/1]

Appendix 2 to ETSO-2C503 – Immersion Suit / Lifejacket System Performance Testing

1. Purpose

1.1 These tests are to demonstrate satisfactory performance of the specified immersion suit/lifejacket combination which together make a unique safety system. They shall be carried out for every immersion suit/lifejacket combination for which approval is required to ensure compatibility for that combination.

2. Test conditions

2.1 The following tests shall be conducted in calm water. The water temperature shall be 25±2°C (77±4°F).

2.2 Pass/fail criteria

All samples shall pass all objective tests for the entire system to meet the requirements of ETSO-2C503 Immersion Suits and ETSO-2C504 Lifejackets. However, due to the high variability between subjects and the difficulty in assessing some subjective measures, it is permitted that an immersion suit / lifejacket combination does not completely meet the requirements of the following subjective tests in a single example and in no more than in one test subject. In these circumstances, two other subjects within the same weight category and with the same sex, should be subjected to the same test. If this additional test is still not clearly passed then the immersion suit / lifejacket combination shall be deemed to have failed, whilst if it is clearly passed then both items may be deemed to have passed the test overall when used in the tested combination.

3. Performance tests

3.1 Jump Test.

Each test subject shall perform a jump test in accordance with paragraph 3.11.6.1 of EN ISO 15027-3:2002.

3.2 Turning Test

Each test subject shall perform a turning test in accordance with paragraph 3.11.6.3 of EN ISO 15027-3:2002.

3.3 Escape Test Underwater

Each test subject shall be required to swim through an opening not greater than 430mm x 355mm (17in x 14in) (minimum acceptable size of helicopter escape window) positioned with the top of the opening at least 300mm (12in) below the surface of the water wearing the uninflated lifejacket. At least one of the subjects for this test shall be required to have a shoulder width measurement of at least 500mm (19.7in).

3.4 Swim Test

Each test subject wearing the immersion suit, clothing and inflated lifejacket shall swim on their back for 20 minutes. The hands and arms shall be kept in the water even if not being used for propulsion. Each test subject shall then board a liferaft fitted with boarding facilities, without undue effort and without assistance, with the suit sealed, the lifejacket inflated and the sprayhood deployed. The pool used shall be of sufficient size and depth to prevent the subject gaining assistance by 'pushing off' from the side or bottom while performing this test.

3.5   Freeboard

Immediately following the swim test, the clearance of each test subject's face above the water shall be measured, with the subject behaving normally and when simulating unconsciousness. The clearance of the mouth (mouth freeboard) shall be a minimum of 120mm (4.7in) above the waterline in both cases. It shall be established that the nose freeboard is not less than the mouth freeboard.

3.6   Floating position

The angle of the test subject's body shall be measured by an appropriate method. The angle between the body and the horizontal shall be recorded and shall not be greater than 60°.

3.7   Field of vision

The wearer's field of vision shall not be unduly restricted when tested in accordance with paragraph 3.11.6.6 of EN ISO 15027-3:2002.

[Amdt ETSO/1]

ETSO-2C504a

~~HELICOPTER~~ ROTORCRAFT CONSTANT-WEAR ~~LIFEJACKETS~~ LIFE JACKETS FOR OPERATIONS TO OR FROM HELIDECKS LOCATED IN A HOSTILE SEA AREA

1 Applicability

This ETSO gives the requirements which adult constant-wear ~~lifejackets~~ life jackets for use on rotorcraft~~s~~ operating to or from helidecks located in a hostile sea area (as defined in ~~JAR-OPS 3.480(a)(12)(ii)(a)~~ Annex I (Definitions for terms used in Annexes II to V) to Commission Regulation (EU) No 965/2012), that are manufactured on or after the date of this ETSO, must meet in order to be identified with the applicable ETSO marking.

2 Procedures

    2.1 General

        Applicable procedures are detailed in CS-ETSO Subpart A.

    2.2 Specific

        ~~This ETSO and the appendices refer to JAR-OPS 3 at Amendment 2 dated 1 January 2002.~~ None.

3 Technical Conditions

    3.1 Basic

        3.1.1 Minimum Performance Standard

            ~~Standards set forth in Appendix 1 to this ETSO.~~ The applicable standards are those provided in AeroSpace and Defence Industries Association of Europe — Standardization (ASD-STAN) document EN4862:2023, dated May 2023.

        3.1.2 Environmental Standard

            None.

    3.2 Specific

        None.

4 Marking

    4.1 General

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

    4.2 Specific

        ~~As given in Appendix 1.~~ The specific marking requirements are detailed in ASD-STAN document EN4862:2023.

5 Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

~~EN documents may be purchased from the European Committee for Standardisation (CEN), Rue de Stassart 36, B-1050 Brussels, Belgium or any CEN member.~~

~~JAA documents may be purchased through Information Handling Services. Addresses of the worldwide IHS offices are listed on the JAA website (www.jaa.nl) and IHS's website (www.global.ihs.com)~~

[Amdt ETSO/1]

[Amdt ETSO/19]

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~~Appendix 1 to ETSO-2C504 – EASA Standard for Helicopter Constant-Wear Lifejackets for Operations to or from Helidecks Located in a Hostile Sea Area~~

~~*ED Decision 2006/004/R*~~

~~1. Purpose~~

~~1.1 This specification prescribes the minimum standard of design and performance for helicopter constant-wear lifejackets.~~

~~2. Scope~~

~~2.1 This standard covers adult constant-wear lifejackets for use on helicopters operating to or from helidecks located in a hostile sea area (as defined in JAR-OPS 3.480(a)(12)(ii)(a)). Such lifejackets may therefore be designed to be worn with or without an approved immersion suit.~~

~~3. Donning~~

~~3.1 The correct method of donning the lifejacket shall be self-evident and means shall be provided to indicate that the lifejacket lobe(s) are correctly oriented. The lifejacket should be fully adjustable for all likely wearers whose significant body dimensions range from the 5th percentile female to the 95th percentile male, and adequate for most of the 5% at each extreme. A means of adjustment to make the lifejacket fit securely shall be provided. The wearer shall be able to make any re-adjustment without removing the lifejacket.~~

~~3.2 Subsequent to proper donning, inadvertent release or loosening of the lifejacket such that its flotation characteristics are unacceptably altered, shall be prevented.~~

~~3.3 Means shall be provided as necessary in the design of the lifejacket, whether it is worn with or without an approved immersion suit, to prevent it from riding up the body of the wearer.~~

~~4. Freedom of movement~~

~~4.1 The uninflated lifejacket shall allow the wearer to carry out all normal and emergency functions and movements necessary for the operation of a helicopter and its equipment.~~

~~4.2 The wearing of the lifejacket inflated or uninflated shall not prevent the wearer from assisting others while in the water nor from assisting them to board a liferaft from the water.~~

~~4.3 The inflated lifejacket shall not significantly hinder the boarding of a liferaft with the sprayhood deployed. This shall be demonstrated by testing to paragraph 3.4 of Appendix 2.~~

~~5. Compatibility~~

~~5.1 Approval of a lifejacket and sprayhood to this specification shall take into account the compatibility between the lifejacket and any approved immersion suit that is intended to be worn with it. The performance of the lifejacket and immersion suit combination shall be tested in accordance with Appendix 2 of this specification.~~

~~5.2 Where a lifejacket is to be approved for use with an immersion suit(s) then it shall be tested with each type of immersion suit that the lifejacket is designed to be compatible with. If it is to be approved for use with more than one type of immersion suit, the~~

performance testing of Appendix 2 shall be repeated with each additional type of immersion suit.

5.3   The lifejacket and its attached equipment, including the sprayhood, shall be designed and the materials used in their construction chosen to have no features which would be likely to have any detrimental effect on the operation of any helicopter or its equipment. In particular any part of the lifejacket which might pose a snagging hazard during flight, emergency egress or recovery, shall be suitably covered, protected or restrained. All materials used shall be compatible with materials used in the construction of any approved immersion suit, or liferaft.

5.4   Any other attached equipment shall be demonstrated as having no adverse effects on the operation, life and performance of the lifejacket.

6.   Materials

6.1   All materials used shall be to an acceptable specification which shows the material to be suitable for its intended application. Textile and fabric materials and components shall pass the test requirements of paragraph 4.3 of EN396:1993 or equivalent. Metal components shall pass the test requirements of paragraph 4.4 of EN396:1993 or equivalent.

6.2   The lifejacket and its equipment shall be so designed and constructed as to remain serviceable for the period between scheduled inspections. The choice of materials used shall be such that, when stowed in accordance with the relevant instructions, neither the lifejacket nor its attached equipment shall be liable to become unserviceable through material deterioration or chafing, or from any other likely cause. Due consideration shall be taken of the possible temperature variations during stowage which may range between -30°C and +65°C (-22°F and +149°F). This shall be demonstrated by testing to paragraph 6.1 of EN396:1993 or equivalent. The normal operating temperatures for the lifejacket shall be -5°C to +40°C (23°F to 104°F).

6.3   The materials used for the lifejacket's outer cover and its means of retention on the wearer shall be of low flammability. These materials shall not have a burn rate greater than 100mm/min (4in/min) when tested in accordance with the horizontal test of JAR 25 Appendix F Part 1 or other approved equivalent method.

7.   Evacuation

7.1   A person wearing the uninflated lifejacket shall be able to exit the helicopter through any Emergency Exit or Push-out Window down to the minimum acceptable size of 430mm x 355mm (17in x 14in). This action shall be possible in air or under water. This shall be demonstrated by testing to paragraph 3.3 of Appendix 2.

8.   Buoyancy and floating position

8.1   The buoyancy of the inflated lifejacket shall be sufficient to ensure that a person wearing clothing and the inflated lifejacket shall have a floating position such that the angle between the body and the horizontal is not greater than 60°. This shall be demonstrated by testing to paragraph 3.6 of Appendix 2.

8.2   The mouth must be at least 120mm (4.7in) above the waterline (mouth freeboard) and the nose freeboard shall not be less than the mouth freeboard, even when the wearer is incapacitated. This shall be demonstrated by testing to paragraph 3.5 of Appendix 2.

8.3   The inflated lifejacket shall automatically turn an unconscious wearer from a face down position into the position required by paragraph 8.1 within 5 seconds. This shall be demonstrated by testing to paragraph 6.7.7 of EN 396:1993 or equivalent.

9. Breathing protection

9.1 The shape of the lifejacket shall not restrict breathing. When in the water the lifejacket shall not tend to channel water or spray into the wearer's face.

9.2 A sprayhood shall be fitted.

9.2.1 The wearer shall be able to deploy the sprayhood within 20 seconds when wearing the inflated lifejacket in or out of the water.

9.2.2 The sprayhood will not be considered suitable if it can in any way retain water when deployed.

9.2.3 The angles of vision shall not be unduly restricted, and the ability to swim and manoeuvre shall not be impaired by the lifejacket with the sprayhood deployed.

9.2.4 The lifejacket's light source shall not be masked by the presence of the sprayhood.

9.2.5 The materials used in the hood's construction shall be compatible with those of the lifejacket and shall in no way be able to cause damage to the buoyancy chambers or fabric of the lifejacket or liferaft.

9.2.6 The lifejacket and its sprayhood, whether stowed or deployed, should not cause inconvenience during winching or other rescue and recovery operations.

9.2.7 Means shall be provided to ensure that the level of carbon dioxide in the deployed sprayhood is within safe limits. This shall be demonstrated by testing to paragraph 6.10 of EN 396:1993 or equivalent.

10. Location aids

10.1 A passive light system of retro-reflective material shall be provided. This shall conform to the technical specification detailed in IMO SOLAS 83, Chapter III, Resolution A.658(16), Annex 2 or equivalent. A minimum area of 300cm² (46in²) shall be provided. This material shall be placed on surfaces which are normally above the water when the lifejacket is in use.

10.2 Each lifejacket shall be fitted with a flashing survivor locator light that meets the requirements of ETSO-C85a. The light shall flash at a rate between 50 and 70 flashes per minute. The location of the light shall be such that maximum practical conspicuity is achieved with the lifejacket worn in the normal manner when in the water. The light shall activate automatically and have a manually operated on/off switch.

10.3 A whistle shall be provided which complies with the requirements of paragraph 4.3 of EN394:1994 or equivalent.

11. Recoverability

11.1 The lifejacket must be fitted with a lifting becket which complies with the requirements of paragraph 4.15 of EN396:1993 or equivalent.

11.2 The inflated or uninflated lifejacket shall not adversely affect recovery of the wearer by the use of a rescue strop with a circumference of 180cm (70in).

12. Group help

   12.1 The lifejacket shall be equipped with a buddy line which complies with the requirements of paragraph 4.6 of EN394:1994 or equivalent.

13. Inflation system

   13.1 General

      13.1.1 The lifejacket shall have two separate means of inflation, the primary means being a manually-initiated stored gas system and a standby oral inflation system capable of repeated use. The required buoyancy shall be obtainable by either method.

      13.1.2 A means of releasing the pressure in the lifejacket is required and shall be of a type capable of repeated use. Protection shall be provided against inadvertent deflation.

      13.1.3 After inflation by either method, it shall be possible to deflate the lifejacket and then to reinflate it by using the standby system. The standby inflation system shall be readily accessible, simple and obvious in operation and it shall be impossible for any valve which may be used to be inadvertently left open. It shall be possible to 'top up' the lifejacket orally whilst in use and without loss of inflation pressure.

   13.2 Stored Gas System

      13.2.1 Location of the actuating means of this type of system shall be such that it can be operated by either hand, in or out of the water. The method of releasing the stored gas into the lifejacket shall be obvious; however, suitable marking shall be provided to advise the user.

      13.2.2 The amount of stored gas provided shall be capable of inflating the lifejacket to achieve the correct buoyancy as specified in paragraph 8.2 within 5 seconds of actuation at +20°C (68°F).

      13.2.3 Adequate protection shall be provided to guard against any inadvertent initiation of an inflation when the wearer is passing through an emergency exit or when the lifejacket is dropped from a height of 1.5m (5 feet).

      13.2.4 The force required to manually initiate inflation must be a minimum of 20N (4.5lbf) and a maximum of 120N (27lbf) when tested in accordance with paragraph 6.8.4 of EN396:1993 or equivalent.

   13.3 Oral Inflation System

      13.3.1 The oral inflation tube shall comply with the requirements of paragraph 4.5 of EN396:1993 or equivalent.

      13.3.2 It shall be positioned such that it can readily be used in and out of the water. After use, the device shall return to a position such that it will not produce facial injuries during a jump into the water as specified in paragraph 3.1 of Appendix 2.

14. Testing

   14.1 Strength Pressure Test

      The lifejacket shall have proof and ultimate factors of not less than 3 and 5 respectively on the pressure at which it is designed to be inflated by the primary means, at a stabilised ambient temperature of +45°C (113°F), and in no case shall the proof and ultimate pressures be less than 15kPa (2lbf/in2) and 25kPa (3.3lbf/in2) respectively.

   14.2 Buoyancy

The lifejacket shall retain buoyancy after use of the primary inflation system to such an extent that after a period of 12 hours the requirements of paragraphs 3.5 and 3.6 of Appendix 2 are still met.

14.3 Performance Tests

All lifejackets shall be tested in accordance with Appendix 2. For lifejackets not designed to be used with an immersion suit, the tests shall be carried out with the test subjects wearing only the stipulated clothing.

15. Inspection Testing and Repair

15.1 The procedure for inspecting, testing and repairing lifejackets shall be established by the manufacturer and shall be capable of ensuring that all lifejackets satisfy the requirements of this specification throughout their service lives.

15.2 The procedures for servicing, inspection, repair and testing shall be described in the manufacturer's manual.

15.3 The frequency of servicing and inspections shall be agreed with the manufacturer holding design approval for the lifejacket.

16. Markings

16.1 If lifejackets are designed or manufactured specifically for crew use or passenger use then they shall be marked accordingly.

16.2 Each detachable part of the lifejacket shall where practicable be marked with:-

(a) The manufacturer's approved inspection stamp

(b) The part number

(c) Date of manufacture or batch record

N.B. Where marking is not practicable alternative means shall be agreed.

16.3 The lifejacket assembly shall be clearly marked with:-

(a) The lifejacket model designation

(b) The manufacturer's name and address

(c) Date of manufacture

(d) Serial number

(e) Date at which next service and overhaul are due.

16.4 The charged inflation cylinder shall be marked in accordance with paragraph 8.2 of EN396:1993 or equivalent, and include its date of manufacture.

[Amdt ETSO/1]
[Amdt ETSO/19]

Appendix 2 to ETSO-2C504 – Immersion Suit / Lifejacket System Performance Testing

1. Purpose

1.1 These tests are to demonstrate satisfactory performance of the specified immersion suit/lifejacket combination which together make a unique safety system. They shall be carried out for every immersion suit/lifejacket combination for which approval is required to ensure compatibility for that combination.

2. Test conditions

2.1 The following tests shall be conducted in calm water. The water temperature shall be 25±2°C (77±4°F).

2.2 Pass/fail criteria

All samples shall pass all objective tests for the entire system to meet the requirements of ETSO-2C503 Immersion Suits and ETSO-2C504 Lifejackets. However, due to the high variability between subjects and the difficulty in assessing some subjective measures, it is permitted that an immersion suit / lifejacket combination does not completely meet the requirements of the following subjective tests in a single example and in no more than in one test subject. In these circumstances, two other subjects within the same weight category and with the same sex, should be subjected to the same test. If this additional test is still not clearly passed then the immersion suit / lifejacket combination shall be deemed to have failed, whilst if it is clearly passed then both items may be deemed to have passed the test overall when used in the tested combination.

3. Performance tests

3.1 Jump Test.

Each test subject shall perform a jump test in accordance with paragraph 3.11.6.1 of EN ISO 15027-3:2002.

3.2 Turning Test

Each test subject shall perform a turning test in accordance with paragraph 3.11.6.3 of EN ISO 15027-3:2002.

3.3 Escape Test Underwater

Each test subject shall be required to swim through an opening not greater than 430mm x 355mm (17in x 14in) (minimum acceptable size of helicopter escape window) positioned with the top of the opening at least 300mm (12in) below the surface of the water wearing the uninflated lifejacket. At least one of the subjects for this test shall be required to have a shoulder width measurement of at least 500mm (19.7in).

3.4 Swim Test

Each test subject wearing the immersion suit, clothing and inflated lifejacket shall swim on their back for 20 minutes. The hands and arms shall be kept in the water even if not being used for propulsion. Each test subject shall then board a liferaft fitted with boarding facilities, without undue effort and without assistance, with the suit sealed, the lifejacket inflated and the sprayhood deployed. The pool used shall be of sufficient size and depth to prevent the subject gaining assistance by 'pushing off' from the side or bottom while performing this test.

3.5   Freeboard

Immediately following the swim test, the clearance of each test subject's face above the water shall be measured, with the subject behaving normally and when simulating unconsciousness. The clearance of the mouth (mouth freeboard) shall be a minimum of 120mm (4.7in) above the waterline in both cases. It shall be established that the nose freeboard is not less than the mouth freeboard.

3.6   Floating position

The angle of the test subject's body shall be measured by an appropriate method. The angle between the body and the horizontal shall be recorded and shall not be greater than 60°.

3.7   Field of vision

The wearer's field of vision shall not be unduly restricted when tested in accordance with paragraph 3.11.6.6 of EN ISO 15027-3:2002

[Amdt ETSO/1]
[Amdt ETSO/19]

ETSO-2C505a

HELICOPTERROTORCRAFT LIFERAFTS LIFE RAFTS FOR OPERATIONS TO OR FROM HELIDECKS LOCATED IN A HOSTILE SEA AREA

1 Applicability

This ETSO gives the requirements which ~~liferafts~~ life rafts required to be carried on ~~helicopters~~ rotorcraft operating to or from helidecks located in a hostile sea area (as defined in ~~JAR-OPS 3.480(a)(12)(ii)(a)~~ Annex I (Definitions for terms used in Annexes II to V) to Commission Regulation (EU) No 965/2012), that are manufactured on or after the date of this ETSO, must meet in order to be identified with the applicable ETSO marking.

2 Procedures

    2.1 General

        Applicable procedures are detailed in CS-ETSO Subpart A.

    2.2 Specific

        ~~This ETSO and the appendices refer to JAR-OPS 3 at Amendment 2 dated 1 January 2002.~~ None.

3 Technical Conditions

    3.1 Basic

        3.1.1 Minimum Performance Standard

            ~~Standards set forth in Appendix 1 to this ETSO.~~ The applicable standards are those provided in AeroSpace and Defence Industries Association of Europe — Standardization (ASD-STAN) document prEN4886:2022, dated November 2022.

        3.1.2 Environmental Standard

            None.

    3.2 Specific

        None.

4 Marking

    4.1 General

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

    4.2 Specific

        ~~As given in Appendix 1.~~ The specific marking requirements are detailed in ASD-STAN document prEN4886:2022.

5 Availability of Referenced Document

    See CS-ETSO Subpart A paragraph 3.

    ~~JAA documents may be purchased through Information Handling Services. Addresses of the worldwide IHS offices are listed on the JAA website (www.jaa.nl) and IHS's website (www.global.ihs.com)~~

[Amdt ETSO/1]
[Amdt ETSO/19]

Appendix 1 to ETSO-2C505 – EASA Standard for Helicopter Liferafts for Operations to or from Helidecks Located in a Hostile Sea Area

ED Decision 2006/004/R

1. Purpose

1.1 This standard provides the minimum performance standards for helicopter liferafts.

2. Scope

2.1 This standard covers liferafts required to be carried on helicopters operating to or from helidecks located in a hostile sea area (as defined in JAR-OPS 3.480(a)(12)(ii)(a)).

3. General

3.1 Approval of a liferaft in accordance with this Specification shall take into account the valise or container, the liferaft itself, and any attached or stowed equipment. The liferaft and its associated equipment shall be seaworthy and designed to maximise occupant survivability in all operating conditions.

3.2 With the exception of its floor diaphragm, full inflation of the liferaft shall be achieved by the operation of a single device with the liferaft initially in any attitude. The operation to initiate the automatic inflation of the liferaft shall be within the capability of one person, either in or out of the water.

3.3 Secondary inflatable compartments, e.g. canopy supports, boarding ramps and floor, shall be so designed and arranged that damage to them will not significantly affect the primary buoyancy of the liferaft.

3.4 Provision shall be made to insulate those areas of the floor diaphragm that are in contact with the occupants of the liferaft. The insulation shall be at least equal to that given by a 25mm (1in) air cushion.

N.B. Where the insulation is provided by inflation of the floor diaphragm this Specification takes no account of its buoyancy.

3.5 The attachment of all lines and equipment to the liferaft shall be such that failure or tearing off of the attachment will not damage any inflated compartment or the canopy.

3.6 Retro-reflective Surfaces

3.6.1 The liferaft shall be provided with flexible retro-reflective external surfaces, of a minimum total area of 0.15m² (250in²), for increased conspicuity and to enhance the effectiveness of search lights, during search and rescue operation.

3.6.2 The arranged pattern of the retro-reflective material shall be generally as shown in Figure 1.

3.6.3 The retro-reflective materials shall comply with the Technical Specification for Retro Reflective Material for use on Life-Saving Appliances (IMO Resolution 658 (16) Annex 2), or equivalent.

3.7 The requirements of this Specification, insofar as they are applicable, should be met for the normal and overload occupancy ratings of the liferaft.

4. Operation and Environment

4.1 The packed liferaft shall be suitable for fitment in an aircraft in accordance with the applicable aircraft installation requirements.

4.2 The method of packing the liferaft into its valise or container shall be such that the liferaft will successfully deploy in the correct attitude for boarding with a probability of not less than 0.90 under the conditions described in paragraph 16.

4.3 The packed liferaft shall be designed to inflate by means of its primary inflation system and be suitable for boarding in respect of buoyancy and stability within 30 seconds of the start of inflation, when soaked at all temperatures between -30°C and +65°C (-22°F and +149°F).

4.4 The liferaft, when packed in its valise or container shall be capable of withstanding temperatures of -30°C to +65°C (-22°F to +149°F) without any adverse effects for at least the period between inspections.

4.5 The liferaft in its container shall be capable of withstanding without significant deterioration such fluids and greases as it might come into contact with for at least the period between inspections. The liferaft when inflated shall withstand those fluids likely to be spread on the surface of the water in the event of an aircraft ditching. All materials used in construction of the liferaft and its equipment shall be suitably resistant to corrosion and fungus growth.

5. Buoyancy

5.1 The liferaft shall incorporate a minimum of two independent primary buoyancy chambers. With all chambers inflated to minimum design pressure the liferaft shall be capable of supporting its occupants up to the normal and overload rated occupancy in fresh water. The following minimum amount of freeboard shall be available:

(a) 300mm (12in) at normal rated occupancy.

(b) 150mm (6in) at normal rated occupancy with the most critical chamber deflated.

(c) A positive freeboard at overload rated occupancy with the most critical chamber deflated.

5.2 The liferaft shall have a high level of tolerance to such accidental damage that may be incurred from contact with the exterior of the helicopter while the liferaft is on the water adjacent to the helicopter. This may be achieved by providing adequate redundancy or damage tolerance. To demonstrate adequate damage tolerance, the liferaft shall withstand puncture when subjected to a 0.794mm (1/32 inch) diameter, flat end metal point under a load of 45N (10lbf).

6. Occupancy Ratings

6.1 An average occupant weight of 90kg (200lb) shall be assumed to take account of the weight of the occupant's clothing with water saturation.

6.2 The normal rated capacity of the liferaft shall be taken as the number of occupants that can be accommodated when each occupant is provided with a minimum width of back support of 460mm (18ins) and a minimum of 0.33m² (3.6ft²) of floor area.

6.3 The minimum overload rating for the liferaft shall be the nearest whole number of occupants to the normal rated capacity times 1.50 with a minimum floor area of 0.22m² (2.4ft²).

7. Inflation Systems and Hand Pump

7.1 The primary inflation system shall meet all applicable equipment Specifications and shall be capable of meeting all performance and environmental criteria contained in this Specification. The primary inflation system shall be fully automatic subsequent to initiation. Aspirators shall be protected and designed to preclude ingestion of objects which may prevent the seating of the gas seal. Any water ingested via the aspirator, if used, shall not prejudice the operation of the inflation system and the liferaft's performance.

7.2 The inflation system shall be designed to prevent gas flow-back from a primary chamber or between primary chambers.

7.3 Protection shall be provided against chamber overpressure. Where this is by means of a relief valve the maximum hysteresis shall not exceed 20% of the valve's cracking pressure.

7.4 The means of activating the primary inflation system(s) shall be such that proper inflation of the liferaft can be achieved, even when the liferaft in its valise is submerged, by operating a single mechanism by the application of a force of 110 ± 20N (25 ± 5lbf).

7.5 Each inflation chamber shall also be provided with a means to enable inflation using a hand operated pump.

7.6 The function of every valve fitted in the surface of the liferaft shall be clearly marked in the vicinity of the valve. All such valves shall be located to enable their operation and observation to be carried out by occupants in the liferaft.

7.7 The method of operation and positioning of valves shall be such that they will not be operated inadvertently, and such as to minimise the risk of injury to occupants when boarding the liferaft.

7.8 Inflation valves to be used with hand operated pumps shall be of the non-metallic friction fit type with a minimum inside diameter of 16mm (5/8in). They shall be fitted with a non-return valve, be located so as to facilitate inflation by hand pump, and shall not interfere with the comfort of the occupants.

7.9 Hand-operated inflation pumps shall be capable of easy connection to and disconnection from each inflation valve and of maintaining each inflated compartment at the minimum design pressure.

7.10 Hand pumps shall have a minimum displacement of air of 0.5litres (32in³) for each complete cycle of operation, and shall have a means of being attached to the liferaft when stowed and during operation at each inflation point.

8. Strength

8.1 All materials, compartments, valves, attached equipment, and seams shall be of sufficient strength and durability to preclude premature failure during operation.

8.2 All inflated fabric compartments shall have minimum proof and ultimate strength factors of 2.0 and 3.0 respectively based on the maximum relief value of the pressure relief valves fitted to the primary buoyancy chambers. The design condition shall be assessed at a temperature of +45°C (113°F) and in no case should the proof pressure be less than 20kN/m² (3lbf/in²).

8.3 It shall be demonstrated that all fabricated material joints are of sufficient strength and integrity to achieve a declared absolute life. Guidance shall be given in the appropriate manuals regarding the inspection, maintenance and repair information necessary to maintain the serviceability of the liferaft between servicing.

9. Attached Equipment

9.1 ~~General.~~

~~Any equipment attached to the liferaft (including that required by JAR-OPS 3) shall be of such design and location that it will not interfere with the liferaft's operation and performance in any way. The attachment shall be such that the equipment will be retained if liferaft inflation occurs in the upright or inverted position.~~

9.2 ~~Painter Line~~

9.2.1 ~~A painter line which can be easily attached to the aircraft shall be provided. The line shall be of a length which is compatible with the operation and inflation of the liferaft, but shall be not less than 6m (20ft) nor greater than 20m (65ft) with the inflation initiation point at least 4.5m (15ft) from the free end of the line. The painter line shall be distinctly coloured to indicate to the person inflating the liferaft the position of the inflation initiation point within 3m (10ft).~~

~~N.B. The painter line should be a minimum of 9.5mm (3/8in) diameter under load to provide satisfactory graspability.~~

9.2.2 ~~The painter line shall be manufactured from a material that will float, has resistance to rotting, and has a minimum breaking strength of 5300N (1200lbf). The attachment of the line to the liferaft shall be designed to release the liferaft without damage in the event of either the line being loaded to or beyond its ultimate strength value or the line being loaded to 0.75 times the load required to submerge the liferaft with the critical chamber deflated, whichever is the lower.~~

9.2.3 ~~The location of the painter line attachment to the liferaft shall be such that it is readily accessible to the occupants of the liferaft and can be easily severed with the knife provided.~~

9.3 ~~Sea Anchor~~

9.3.1 ~~A sea anchor, which is permanently attached to the liferaft and is readily accessible to the occupants under all conditions, shall be provided.~~

9.3.2 ~~Where the sea anchor is a trailing anchor device it must comply with the following:~~

(a) ~~The anchor shall have a minimum effective area equivalent to 0.8m² (1200in²).~~

(b) ~~The anchor shall be attached to the liferaft by a line of 10.5m (35ft) minimum length with a minimum breaking strength of 2200N (500lbf). Attachment of the sea anchor to the liferaft shall be so designed that the liferaft will be released without damage in the event of the line being loaded to or beyond its ultimate strength.~~

(c) ~~The anchor attachment line assembly shall include a swivel link with a strength at least equal to the strength of the anchor attachment line.~~

(d) ~~The anchor shall be arranged to minimise the risk of entanglement.~~

9.3.3 ~~The location of the sea anchor attachment point on the liferaft shall be such that the deployed line does not interfere with boarding or with the operation and manipulation of the painter line.~~

9.4 ~~Rescue Line and 'Quoit'~~

9.4.1 ~~At least one rot-resistant rescue line, which will float and of not less than 23m (75ft) in length, shall be provided to enable a survivor to be hauled to the boarding point. It shall be attached to the liferaft in the vicinity of, and accessible from, the~~

primary boarding point. Attached to the free end of the line shall be a floatable device (quoit) of suitable size to be grasped by a survivor in the water.

9.4.2 The rescue line facility shall have a minimum breaking strength of 1300N (300lbf). The line attachment to the liferaft shall withstand 1.5 times the line's minimum breaking strength.

9.5 Lights

The liferaft shall be fitted with an internal and external light source.

9.5.1 Internal Light

9.5.1.1 The internal light shall have an output sufficient to enable all printed instructions on the liferaft's internal surfaces or attached equipment to be read in the hours of darkness by a person with normal eyesight. The internal light source shall have an effective output of at least 1.0 lumen for a continuous period of not less than 12 hours.

9.5.1.2 The light shall be capable of being switched on and off by the occupants of the liferaft in all appropriate environmental conditions.

9.5.2 External Light

9.5.2.1 The light shall be fitted to the canopy in such a way as to provide maximum practical conspicuity for search and rescue operations and shall have:

(i) a vertical light beam with a divergence of at least 5º above the vertical axis of the light fitting; and

(ii) a horizontal light beam that is radially continuous and have an emission angle of at least 5º above the horizontal plane of the light bulb element.

9.5.2.2 The light shall be switched on automatically as soon as the liferaft is inflated on water.

9.5.2.3 The light shall be capable of being switched on and off by the occupants of the liferaft in all appropriate environmental conditions.

9.5.2.4 Output of the light shall be such that it is visible at night in clear atmospheric conditions at a distance of not less than 2 nautical miles, for a continuous period of not less than 12 hours.

9.5.2.5 If the light is a flashing beacon, the flash rate shall be between 50 and 70 flashes per minute, with an interval between flashes of 1.0 ± 0.15 second.

9.6 Knife

9.6.1 A knife which will float shall be provided and located in a position inside the liferaft to enable it to be readily used for cutting the painter line. The knife shall be suitably sheathed and attached to the liferaft by a line of sufficient length to facilitate its use without difficulty.

9.6.2 The shape of the knife shall be such that it will not damage the liferaft's fabric if dropped inside the liferaft.

10. Canopy

10.1 A canopy, covering the total occupiable area of the liferaft, and supported above the heads of seated occupants shall be provided. If the primary inflation system is used to deploy the canopy via a primary buoyancy chamber the canopy support system shall

remain inflated in the event of damage to the buoyancy chamber. The canopy support system shall include a facility for inflation by means of the hand operated pump provided.

10.2 The canopy fitted to liferafts with a normal rated occupancy of more than 10 persons shall include a minimum of 2 entry points. Liferafts with a normal occupancy rating of 10 persons or less need only be provided with 1 entry point. The size and positioning of liferaft entry facilities shall be agreed with the Authority.

10.3 Each canopy entry point shall have a closing flap which can easily be closed or opened by the occupants. The flap shall be capable of being secured in a fully open or closed position or in intermediate positions. Where two entry facilities are provided they shall be positioned 180° apart. The painter line attachment and location of the knife shall be adjacent to one entry point.

10.4 The canopy, with the flaps open or closed, shall be capable of withstanding winds of 60 km/h (40 mph) with gusts of 90 km/h (60 mph). With the flaps closed the occupants shall be adequately protected from wind, rain, spray and breaking waves.

10.5 A facility should be provided for the erection of a radio transmitting aerial.

10.6 The deployed canopy shall be able to withstand without damage or permanent collapse the impact of a jump by a person of weight 90kg (200lb) from a height of 3m (10ft) above water level on to the top of the canopy.

10.7 The canopy should remain usable in the event of deflation of the most critical buoyancy chamber.

11. Life Lines and Grab Lines

11.1 Life lines of a colour contrasting to that of the liferaft shall be provided around the external periphery of the buoyancy chambers. The lines shall be easily identified and readily available to support survivors in the water.

11.2 Grab lines of a colour contrasting to that of the liferaft shall be provided around the internal periphery of the buoyancy chambers. The lines shall facilitate use by the occupants to support themselves.

11.3 Life lines, grab lines and their attachments shall be capable of withstanding a minimum load of 2200N (500lbf).

12. Boarding Facilities

12.1 A boarding facility shall be provided at each entry point, which is self-erecting during the inflation of the liferaft and remains continuously available.

12.2 The design of the boarding aid(s) shall be such that a 90kg (200lb) fully clothed person wearing a fully inflated lifejacket can board the liferaft without assistance. It shall also be possible for the liferaft occupants to retrieve unconscious survivors from the water with the aid of the boarding facility.

12.3 The strength of attachment of an inflated boarding facility to the liferaft's structure shall be such that excessive load on the facility will not prejudice the integrity of the primary buoyancy chamber.

12.4 Markings shall be provided on the external surfaces of the liferaft to indicate to survivors in the water the location of the boarding facility and, if appropriate, the best method of use.

13. Righting

13.1 The liferaft shall be fully reversible unless it can be demonstrated that it is self righting in the fully inflated condition.

14. Valise or Container

14.1 The liferaft shall be packed into a valise or container which in turn will be stowed and restrained on board the aircraft. The material used for the construction of the valise or container shall be of low flammability and have a burn rate not greater than 100mm/min (4in/min) when tested in accordance with the horizontal test of JAR 25 Appendix F Part 1 or other approved equivalent method. It shall be durable and chafe resistant. The liferaft packed and ready for stowage shall not support combustion, nor shall it be likely to be rendered unserviceable by inadvertent contact with a lighted match or cigarette.

14.2 The packed liferaft shall be capable of being dropped from a height of 3m (10ft) on to a hard surface without adversely affecting the performance of the liferaft as prescribed by this Specification.

14.3 The valise or container shall include suitable lifting handles so the packed liferaft can be moved within the aircraft.

14.4 The packed liferaft shall have a positive buoyancy in fresh water at a temperature of +20°C (68°F). This shall be demonstrated and the buoyancy value established.

14.5 The external dimensions of the packed valise/container shall be established.

14.6 Closing of the valise or container shall be by lacing with cord of a minimum breaking strength of 220N (50lbf) or by equivalent means.

14.7 Where automatic launching of liferafts is not possible, the weight and dimensions of the packed valise or container shall be such that it can be easily moved to, and launched from, any prescribed ditching emergency exit by one person (male or female).

N.B. It is recommended that the maximum weight should not exceed 36kg (80lb).

15. Materials and Processes

15.1 All materials used shall be to an acceptable Specification which shows the material to be suitable for its intended application and compatible with other materials used in the liferaft's construction.

15.2 The choice of materials and protective treatments shall be such that, during the period between inspections, corrosion or deterioration will not render the liferaft unserviceable.

15.3 The liferaft when fully equipped and stowed in the aircraft shall not cause more than 1° deflection of an aircraft compass reading at a distance of 300mm (1ft).

16. Seaworthiness

16.1 The liferaft and its equipment shall be capable of withstanding a marine environment in accordance with this Specification for a minimum period of 14 days when occupied to its prescribed maximum overload rating.

N.B. A shorter time may be agreed between the operator and the Authority for operations within helicopter SAR coverage and where all aircraft occupants wear survival suits.

16.2 The liferaft and equipment shall be capable of withstanding, without malfunction, sea and wind conditions of at least Sea State 6 and 60km/h (40mph) respectively.

16.3 The design of the liferaft shall be such that the possibility of the liferaft overturning in any sea or wind condition up to the maximum of paragraph 16.2 is minimised. Any stabilising

equipment, e.g. stabilising keels or equivalent, shall be effective by the time the liferaft is ready for boarding, and shall remain automatically effective all the time the liferaft is floating.

16.4   Means shall be provided to enable the occupants (wearing cover-all immersion suits and inflated lifejackets) to propel the liferaft over short distances.

17.   Tests

17.1   A liferaft of the type for which approval is sought shall be tested in both calm and disturbed water (e.g. in a swimming pool and in choppy sea or simulated choppy sea conditions). The Manufacturer's evaluation schedule for the liferaft to show compliance with this Specification shall be agreed with the Authority and shall include the following tests or demonstrations.

17.1.1 Inflation Tests

With the valised liferaft floating in the water, operation of the primary inflation system shall be demonstrated as being in compliance with paragraph 7 by a person in the water wearing a lifejacket. A sufficient number of tests shall be carried out to show compliance with paragraph 4.2. Connection, disconnection and satisfactory operation of the hand operated pump shall also be demonstrated.

17.1.2 Freeboard Measurement (Buoyancy)

The liferaft shall be demonstrated to comply with paragraphs 5 and 6 for all prescribed conditions of occupancy and inflation appropriate to the intended application of the liferaft.

17.1.3 Boarding

Compliance with the requirements of paragraph 12 shall be demonstrated by male and female subjects for each boarding facility fitted to the liferaft.

17.1.4 Propulsion

With the liferaft fully inflated and overloaded to the prescribed rating the practicability of its propulsion over short distances, using the paddles or other equipment provided, shall be demonstrated.

17.1.5 Jump Test

Tests shall be made in accordance with the requirements of paragraph 10.7. This test can be simulated by using a weighted bag or equivalent weight.

17.1.6 Righting

Righting of the liferaft shall be demonstrated both fully inflated and with the most critical primary buoyancy chamber deflated in accordance with paragraph 5.1(b).

17.1.7 Strength Test (Refer to paragraph 8.2).

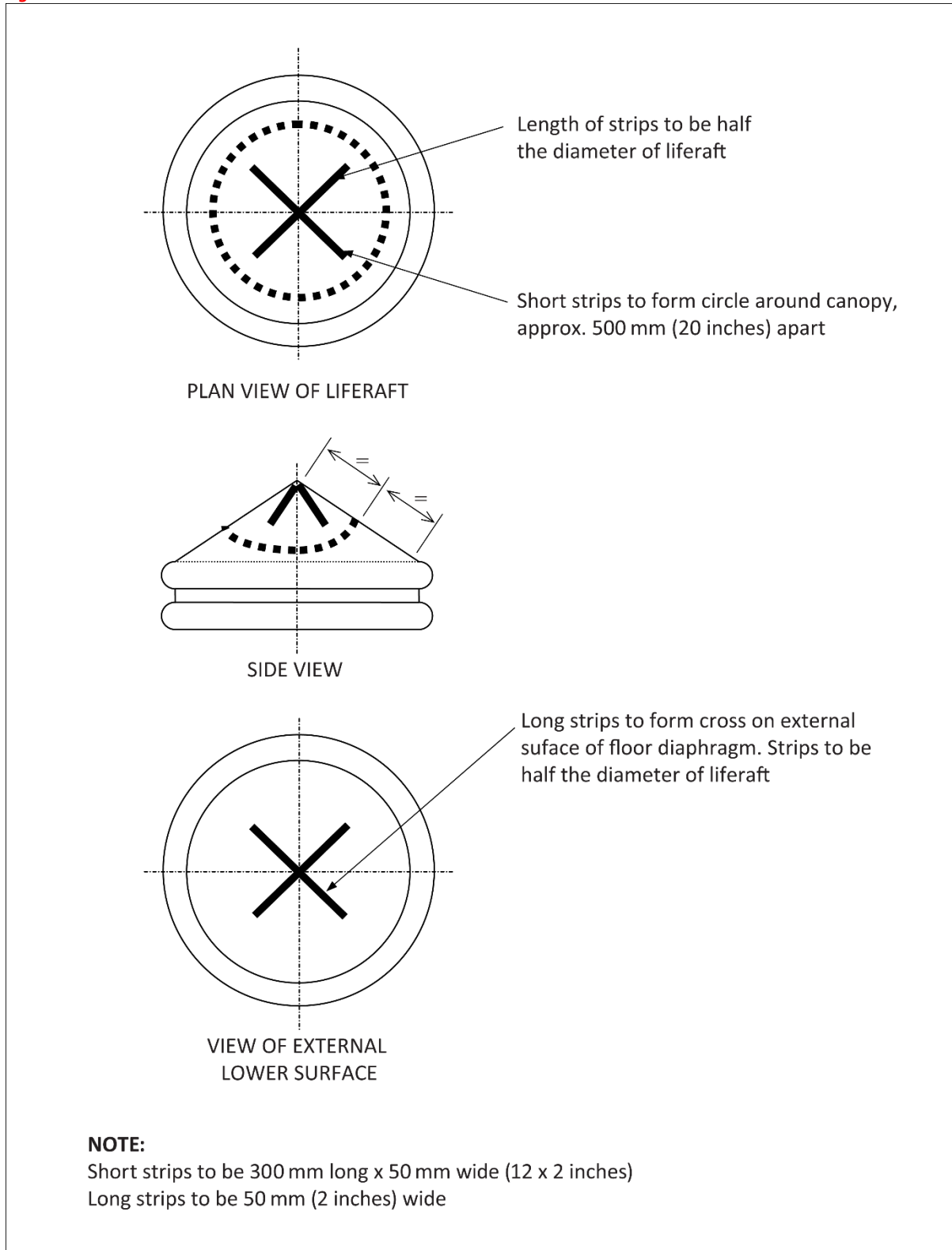17.1.7.1 A proof pressure test shall be carried out on all inflated fabric components.

17.1.7.2 An ultimate pressure test shall be carried out on the most critical section of all primary buoyancy chambers.

17.1.8 Seaworthiness

Sufficient tests shall be completed to demonstrate that the liferaft can provide a survival capability when subjected to the most adverse combination of temperature, sea and wind states defined in this Specification.

18.   Colour, Operational Markings, and Packaging

18.1   The predominant colour of the liferaft shall be highly conspicuous.

18.2   The valise or container in which the liferaft is to be kept whilst on board the aircraft shall be approved as part of the liferaft's general assembly. The valise or container shall be clearly marked to the effect that a liferaft is contained therein. The method of operating and any precautionary information shall be clearly marked.

18.3   Instructions relating to boarding and operation of all equipment shall be provided with the liferaft, shall be bold and readable in low levels of illumination, and shall be kept to a minimum with the purpose of achieving speed of correct operation with minimum confusion.

19.   Marking

19.1   Each detachable part of the liferaft shall where practicable be marked with:

(a)   The manufacturer's approved inspection stamp.

(b)   The part number.

(c)   Date of manufacture or batch record.

N.B. Where marking is not practicable alternative means may be agreed with the Authority.

19.2   The liferaft assembly shall be marked with:

(a)   The liferaft model designation.

(b)   The manufacturer's name and address.

(c)   Date of manufacture.

(d)   Serial Number.

(e)   Date at which next service and overhaul are due.

19.3   The charged inflation cylinder shall be marked with its weight and the weight of charge.

19.4   All markings prescribed in 7.6, 12.4, 18.2, 18.3, 19.1, 19.2 and 19.3 shall be made such that they remain legible.

Figure 1 — TYPICAL LIFERAFT – ARRANGEMENT OF RETRO-REFLECTIVE TAPE

Length of strips to be half the diameter of liferaft

Short strips to form circle around canopy, approx. 500 mm (20 inches) apart

PLAN VIEW OF LIFERAFT

SIDE VIEW

Long strips to form cross on external suface of floor diaphragm. Strips to be half the diameter of liferaft

VIEW OF EXTERNAL LOWER SURFACE

NOTE:
Short strips to be 300 mm long x 50 mm wide (12 x 2 inches)
Long strips to be 50 mm (2 inches) wide

[Amdt ETSO/1]

ETSO-2C519a

EMERGENCY BREATHING SYSTEMS (EBSs)

1   Applicability

This ETSO provides the requirements which emergency breathing systems (EBSs) ~~category A,~~ for operations to or from helidecks that are located in hostile sea areas (as defined in Annex I (Definitions for terms used in Annexes II to V) to Commission Regulation (EU) No 965/2012), 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.

~~EBS category A means EBSs that are capable of being successfully deployed underwater.~~

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 AeroSpace and Defence Industries Association of Europe — Standardization (ASD-STAN) document EN4856:~~2018~~2023, dated ~~December 2018~~ February 2023.

3.1.2   Environmental Standard

See CS-ETSO, Subpart A, paragraph 2.1.

3.1.3   Software

None.

3.1.4   Airborne Electronic Hardware

None.

3.2   Specific

3.2.1   Failure Condition Classification

None.

4   Marking

4.1   General

See CS-ETSO, Subpart A, paragraph 1.2.

4.2   Specific

The specific marking requirements are detailed in ASD-STAN document EN4856:~~2018~~2022.

5   Availability of Referenced Documents

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/16]
[Amdt ETSO/19]

ETSO-2C521 A1

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

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, 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.

See CS-ETSO Subpart A paragraph 2.4.

3.2.2   Documentation

The applicant shall develop and make available to the aircraft operator the ~~application operational data~~operational, loading and configuration instructions as defined in EUROCAE ED-273, Chapter 4, including the following data:~~.~~

— The minimum performance specifications for the EFB Host Platform (Hardware + Operating system). These should be in consistency with the environment that has been used to demonstrate the functionalities of the EFB application.

— The test procedures to be performed by the installer once the EFB application is loaded and configured into the final host platform.

Please refer to EUROCAE ED-273 Section 4.2 for additional guidance.

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 Document

See CS-ETSO Subpart A paragraph 3.

[Amdt ETSO/17]
[Amdt ETSO/19]