ETSO- C55a
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Fuel and Oil Quantity Instruments

1 - Applicability

This ETSO gives the requirements which Fuel and Oil Quantity Instruments that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the SAE AS 405~~B~~C, Fuel and oil quantity Instruments, dated July 2001, as amended and supplemented by this ETSO:

(i) Conformance with the following paragraphs of AS 405~~B~~C is not required: 3.1; 3.1.1, 3.1.2, 3.2 and 4.2.1.

(ii) Substitute the following for paragraph 7: „Performance tests: The following tests, in addition to any others deemed necessary by the manufacturer, shall be the basis for determining compliance with the performance requirements of this standard".

3.1.2 - Environmental Standard

See CS-ETSO Subpart A paragraph 2.1.

As specified in the SAE Aerospace Standard AS 405-C.

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.

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

4 - Marking

4.1 - General

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

4.2 - Specific

a. Mark at least one major component permanently and legibly with all the information in SAE AS405C, Section 3.2 (except paragraph 3.2.b). Also, mark the component with the following information:

(1) The basic type and accuracy classification, and

(2) The fluids for which the instrument is substantiated

b. If the fuel and oil quantity instrument includes a digital computer, 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 to show the modification status.

NOTE: Similar software versions, approved for different software levels, must be differentiated by part number.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C62e
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Aircraft Tyres

1 - Applicability

This ETSO gives the requirements which tyres excluding tailwheel tyres that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the attached Appendix 1, "Federal Aviation Administration Standard for Aircraft Tyres", dated 29/09/2006.

3.1.2 - Environmental Standard

As stated in the Federal Aviation Administration Standard.

3.1.3 – Computer Software

None

3.1.4 - Electronic Hardware Qualification

None

3.2 - Specific

None

3.2.1 Failure Condition Classification

N/A

4 - Marking

4.1 - General

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

4.2 - Specific

1. Balance marker, consisting of a red dot, on the sidewall of the tire immediately above the bead to indicate the lightweight point of the tire.
2. Production date code (may be included in the established serial number).
3. Ply rating must be established. Submit these ratings to the Tire and Rim Association, Inc. (TRA) or European Tyre and Rim Technical Organization (ETRTO). If the ply rating is marked on the tire, the load rating marked on the tire must be consistent with the ply rating established.

   A.1.1.1.1.1.1.1.1 **NOTE:** for a new programme aircraft, define new tire dimensions and submit them to ETRTO for publication in the ETRTO Data Book. You do not have to wait until your submitted dimensions are incorporated into the Data Book before applying for the ETSO.
4. Serial number: the plant code and production date code may be included.
5. Size and load ratings, established and identified in a timely manner in the TRA *Aircraft Year Book*, latest edition or in the ETRTO *Aircraft Tyre and Rim Data Book*, latest revision. See the NOTE at paragraph g.
6. Skid depth, marked in inches to the nearest one-hundredth as defined in appendix 1.
7. Speed rating, in MPH and as identified in appendix 1, paragraph 4.b that is equal to or less than the speed at which the tire has been qualified.
8. Tire type. Mark tires requiring a tube with the words "Tube type."
9. Non-re-treadable tires must be marked accordingly.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C62e
Appendix 1
Date: 05.07.2012

APPENDIX 1. FAA STANDARD FOR AIRCRAFT TIRES

1. PURPOSE. Minimum performance standards for new and re-qualified radial and bias tires, excluding tailwheel tires, to be identified as meeting the standards of ETSO-C62e.

2. SCOPE. Minimum performance standards apply to aircraft tires having speed and load ratings based on the speeds and loads to which the tires have been tested.

3. DEFINITIONS.

Bias tire: a pneumatic tire whose ply cords extend to the beads and are laid at alternate angles substantially less than 90º to the centerline of the tread. May also have a bias belted tire with a circumferential belt.

Radial tire: a pneumatic tire whose ply cords extend to the beads and are laid approximately at 90º to the centerline of the tread, the carcass being stabilised by an essentially inextensible circumferential belt.

Load rating: maximum permissible static load at a specific inflation pressure. Use the rated load combined with the rated inflation pressure when selecting tires for application to an aircraft, and for testing to the performance requirements of this ETSO.

Rated inflation pressure: specified unloaded inflation pressure which will result in the tire deflecting to the specified static loaded radius when loaded to its rated load against a flat surface.

Static loaded radius (SLR): perpendicular distance between the axle centerline and a flat surface for a tire initially inflated to the unloaded rated inflation pressure and then loaded to its rated load.

Ply rating: an index of tire strength from which a rated inflation pressure and its corresponding maximum load rating are determined for a specific tire size.

Speed rating: maximum ground speed at which the tire has been tested in accordance with this ETSO.

Skid depth: distance between the tread surface and the bottom of the deepest groove as measured in the mold.

4. DESIGN AND CONSTRUCTION .

a. General Standards. Tires selected for use on a specific aircraft must demonstrate suitability through appropriate laboratory simulations described in paragraphs 5.a or 5.b of this appendix, as appropriate. Determine material suitability by:

(1) Temperature: show by tests or analysis that the physical properties of the tire materials are not degraded by exposure to temperature extremes of -40°C (-40ºF) and +71,1°C (+160ºF) for a period of not less than 24 hours at each extreme.

(2) Wheel rim heat: substantiate by the applicable tests or show by analysis that the physical properties of the tire materials have not been degraded by exposure of the tire to a wheel-bead seat temperature of not lower that 148,9°C (300°F) for at least 1 hour, except that low-speed tires or nose-wheel tires may be tested or analysed at the highest wheel-bead seat temperatures expected to be encountered during normal operations.

b. Speed Rating. See Table 1 below for applicable dynamometer test speeds for corresponding maximum takeoff ground speeds. For takeoff speeds over 245 mph, the tire must be tested to the maximum applicable load-speed-time requirements and identified with the proper speed rating.

TABLE 1. Applicable Dynamometer Test Speeds

Max Takeoff Speed *Mph at liftoff over:*	*But not over:*	Max takeoff Speed Of Aircraft *Max Tire mph:*	Min Dynamometer Speed (Figures 1, 2 or 3) *Min Tire mph*:
0	120	120	120
120	160	160	160
160	190	190	190
190	210	210	210
210	225	225	225
225	235	235	235
235	245	245	245

c. Overpressure. The tire must successfully withstand a hydrostatic pressure of at least four times its rated inflation pressure for 3 seconds without bursting.

d. Helicopter tires. You may use aircraft tires qualified according to this ETSO on helicopters. In such cases for standard tires, you may increase the maximum static load rating by a factor of 1.5 with a corresponding increase in rated inflation pressure without additional qualification testing (round loads to the nearest 10 lbs and inflation pressures to the nearest whole psi.). If significant taxi distance is expected, these guidelines may not apply. Consult tire and rim

manufacturers for appropriate tire size selection. Maximum permissible inflation for aircraft tires used on helicopters is 1.8 times the rated inflation pressure.

e. Dimensions. Maintain the tire size (outside diameter, shoulder diameter, section and shoulder width), within specified tolerances.

NOTE: for a new programme aircraft, define new tire dimensions and submit them to TRA for publication in the TRA Data Book. You do not have to wait until your submitted dimensions are incorporated into the Data Book before applying for the ETSO.

(1) Outside diameter, shoulder diameter, section width and shoulder width: For the bias ply tire, outside diameter and section width are specified to a maximum and minimum value after a 12 hour growth period at rated inflation pressure. Shoulder diameter and width dimensions are specified to a maximum value after a 12-hour growth period at rated inflation pressure. Radial tire dimensions are limited by the grown tire envelope according to the static loaded radius (SLR) requirements in paragraph 4.e.(3) below.

(2) Due to the increased inflation pressures permitted when using an aircraft tire in a helicopter application, we permit tire dimensions to be 4% larger.

(3) Static loaded radius (SLR):

(a) Bias tires: provide the nominal SLR. The actual SLR is determined on a new tire stretched for a minimum of 12 hours at rated inflation pressure.

(b) Radial tires: provide the nominal SLR. The actual SLR of a radial tire is determined at rated inflation pressure after running 50 takeoffs, following paragraph **5.a.(2)** requirements.

(4) Helicopter tires: maximum dimensions for new tires used on helicopters are 4% larger than maximum aircraft tire dimensions. (In calculating maximum overall and shoulder diameters, rim diameter should be deducted before applying 4%.)

f. Inflation retention. After an initial 12-hour minimum stabilisation period at rated inflation pressure, the tire must retain the inflation pressure with a loss of pressure not exceeding 5% of the initial pressure for 24 hours. Measure the ambient temperature at the start and finish of the test to ensure that any pressure change was not caused by an ambient temperature change.

g. Balance. Test all tires for static unbalance. A balance marker, consisting of a red dot, must be affixed on the sidewall of the tire immediately above the bead to indicate the lightweight point of the tire. The dot must remain for any period of storage plus the original tread life of the tire.

(1) Auxiliary tires (not main or tailwheel tires): the moment of static unbalance (M) for auxiliary tires shall not be greater than the value determined using this equation:

$M = 0.025D^2$

Round the computed equation values to the next lower whole number where M is in inch-ounces and D is the standardised maximum new tire inflated outside diameter in inches. Your design must include requirements to measure the level of unbalance on each tire, and approved procedures to correct the unbalance within the above limits if necessary.

(2) All main tires and all tires with 46-inch and larger outside diameter: the moment of static unbalance (M) for main tires shall not be greater than the value determined using this equation:

$M = 0.035D^2$

Round the computed equation values to the next lower whole number where M is in inch-ounces and D is the standardised maximum new tire inflated outside diameter in inches. Your design must include requirements to measure the level of unbalance on each tire, and approved procedures to correct the unbalance within the above limits if necessary.

5. TIRE TEST REQUIREMENTS.

a. Use a single test specimen for a qualification test. The tire must withstand the following dynamometer cycles without detectable signs of deterioration, other than normal expected tread surface abrasion, except when the overload takeoff condition is run last (see paragraph **5.a.(8)** below).

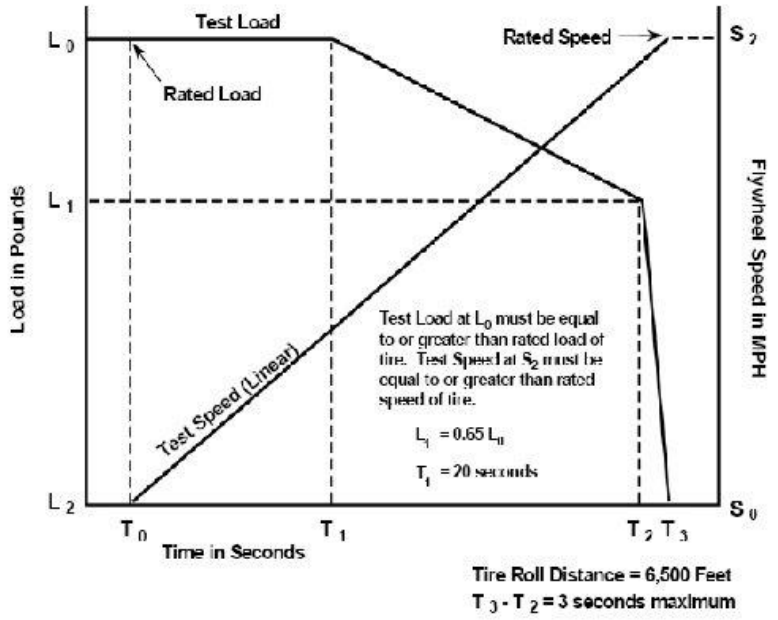
(1) Dynamometer cycle requirements: all aircraft tires must satisfactorily withstand 58 dynamometer cycles as a demonstration of overall performance, plus 3 overload dynamometer cycles as a demonstration of the casing's capability under overload. The 58 dynamometer cycles consists of 50 takeoff cycles, per **5.a.(2)**, and 8 taxi cycles, per **5.a.(7)**. The overload cycles consist of 2 taxi cycles, per **5.a.(7)** at 1.2 times rated load and 1 overload takeoff cycle per **5.a.(8)** starting at 1.5 times rated load. Run the dynamometer cycles in any order. However, if the overload takeoff cycle is not run last, the tire must not show detectable signs of deterioration after the cycle completion, other than normal expected tread surface abrasion.

(2) Takeoff cycles: the 50 takeoff cycles shall realistically simulate tire performance during runway operations for the most critical combination of takeoff weight and speed, and aircraft center-of-gravity position. When determining the most critical combination of the above, be sure to account for increased speeds resulting from high field elevation operations and high ambient temperatures, if applicable. Specify the appropriate load-speed-time data or parameters that correspond to the test envelope in which the tire is to be tested. Figures 1, 2, and 3 are graphic representations of the test. Starting at zero speed, load the tire against the dynamometer flywheel. The test cycles must simulate one of the curves illustrated in Figure 1 or 2 (as applicable to speed rating), or Figure 3.

- Figure 1 defines a test cycle that applies to any aircraft tire with a speed rating of 120 mph or 160 mph.
- Figure 2 defines a test cycle that applies to any aircraft tire with a speed rating greater than 160 mph.
- Figure 3 defines a test cycle that applies for any speed rating, is based on the most critical takeoff loads, speeds, and distances, and is aircraft specific.

Figure 1

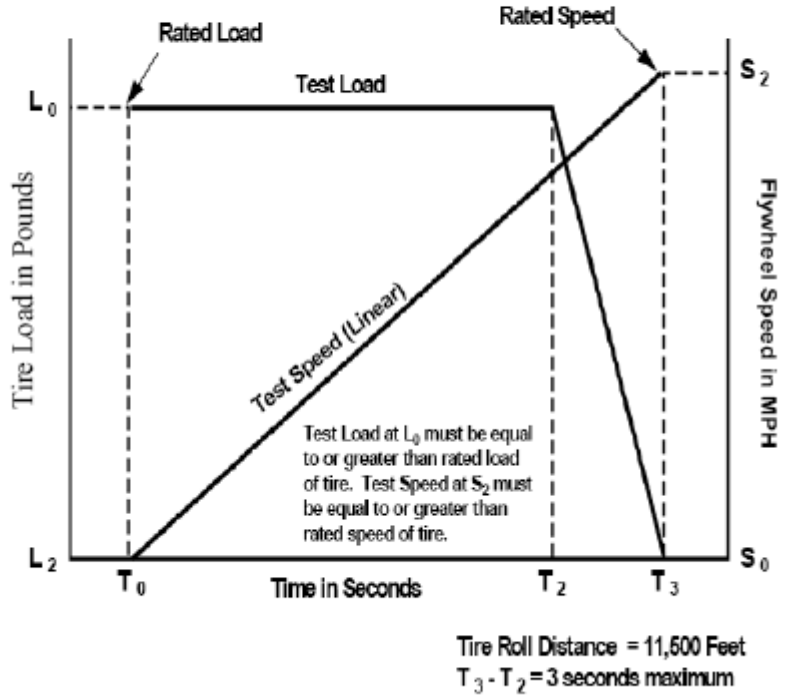
Graphic Representation of a Universal Load-Speed-Time Test Cycle
(For 120 MPH and 160 MPH Tires)



Symbol Definitions (Figures 1, 2, and 3)

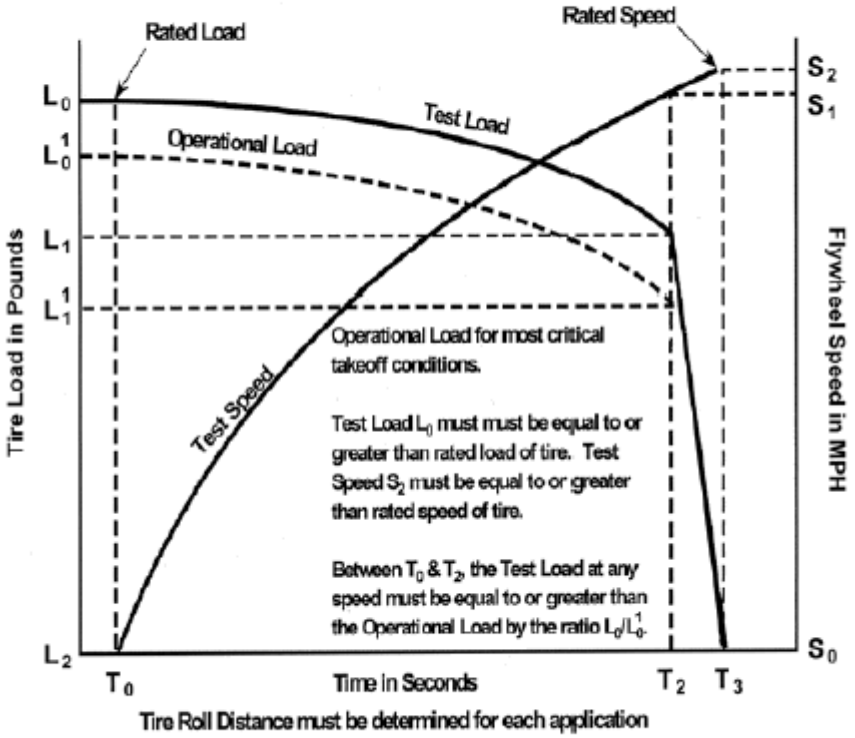
L_0 Tire load (lbs) at start of takeoff (not less than the load rating), Figures 1, 2, and 3.
L_0^1 Tire load (lbs) at start of takeoff for the operational load curve, Figure 3.
L_1 Tire load (lbs) at rotation, Figures 1 and 3.
L_1^1 Tire load (lbs), Figure 3.
L_2 Tire load at liftoff, 0 lbs, Figures 1, 2, and 3.
S_0 Zero (0) mph, Figures 1, 2, and 3.
S_1 Speed at rotation in mph, Figure 3.
S_2 Tire speed at liftoff in mph (not less than the speed rating), Figures 1, 2, and 3.
T_0 Time at start of takeoff, 0 s, Figures 1, 2, and 3.
T_1 20 seconds, Figure 1.
T_2 Time to rotation in seconds, Figures 1, 2, and 3.
T_3 Time to liftoff in seconds, Figures 1, 2, and 3.

Figure 2
Graphic Representation of a Typical Universal Load-Speed-Time Test Cycle
(For Tires Rated above 160 MPH)



Tire Roll Distance = 11,500 Feet
$T_3 - T_2 = 3$ seconds maximum

Figure 3
Graphic Representation of a Typical Rational Load-Speed-Time Test Cycle



(3) Test load: the minimum allowable load at the start of the test is the rated load of the tire. The test loads must conform to Figures 1 or 2 (as applicable), or Figure 3. Figures 1 and 2 define a test cycle generally applicable to any aircraft. If you use Figure 3 to define the test cycle, select the loads based on the most critical takeoff conditions you established. At any speed throughout the test cycle, the ratio of the test load to the operational load must be the same as, or greater than, the ratio at the start of the test.

(4) Test inflation pressure: the pressure needed to provide the same loaded radius on the flywheel as was obtained on a flat surface at the rated tire load and inflation pressure. Make both determinations at the same ambient temperature. Do not adjust the test inflation pressure to compensate for changes created by temperature variations during the test.

(5) Test temperatures and cycle interval: the temperature of the gas in the tire or the casing temperature measured at the hottest point of the tire may not be:

(a) Lower than 40,6°C (105ºF) at the start of the overload takeoff cycle and at the start of at least 45 of the 50 takeoff cycles, and

(b) Lower than 48,9°C (120ºF) at the start of at least 9 of the 10 taxi cycles.

For the remaining cycles, the contained gas or casing temperature may not be lower than 26,7°C (80ºF) at the start of each cycle. Rolling the tire on the dynamometer flywheel is an acceptable method for obtaining the minimum starting temperature.

(6) Dynamometer takeoff cycle speeds: see Table 1 for the dynamometer test speeds for the corresponding maximum aircraft takeoff speeds.

(7) Taxi cycles: tire must withstand 10 taxi cycles on a dynamometer under the test conditions in Table 2 below.

TABLE 2. Test Conditions

Number of Taxi Runs	Min Tire Load (lbs)	Min Speed (mph)	Tire speed rating 120/160 mph Min Rolling Distance (ft)	Tire speed rating Over 160 mph Min Rolling Distance (ft)
8	Rated	40	25,000	35,000
2	1.2 x Rated	40	25,000	35,000

(8) Overload takeoff cycle: the overload takeoff cycle shall duplicate the test described in paragraph **5.a.(2)** with the test load increased by a factor of 1.5 throughout. Good condition of the tire tread is not required after completion of this test cycle, if you run this test last. If the overload takeoff cycle is not run last, the tire must withstand the cycle without detectable signs of deterioration, other than normal expected tread surface abrasion.

(9) Diffusion test: after completing the 61 test cycles, the tire must retain the inflation pressure to within 10% of the initial test pressure for a period of 24 hours. Measure the ambient temperature at the start and finish of this test to ensure that any pressure change was not caused by an ambient temperature change.

(10) Tire/wheel slippage: tires should not slip on the wheel rim during the first five dynamometer cycles. Any slippage that subsequently occurs must not damage the tube valve of tube type tires, or the gas seal of the tire bead of tubeless tires.

b. Alternate qualification procedures: 120 mph rated tires. For 120 mph speed rating tires, you may use the following variable mass flywheel procedure:

(1) Test load: load must meet or exceed the tire rated load throughout the entire test roll distance.

(2) Test inflation pressure: pressure needed to provide the same loaded radius on the flywheel as was obtained on a flat surface at the rated tire load and inflation pressure. Make both

determinations at the same ambient temperature. Do not adjust the test inflation pressure to compensate for changes created by temperature variations during the test.

(3) Temperature and cycle interval: the temperature of the gas in the tire, or the casing temperature measured at the hottest point of the tire, may not be lower than 40,6°C (105ºF) at the start of at least 180 of the 200 landing cycles. For the remaining cycles, the contained gas or casing temperature may not be lower than 26,7°C (80ºF) at the start of each cycle. Rolling the tire on the dynamometer is an acceptable method for obtaining the minimum starting temperature.

(4) Kinetic energy: calculate the kinetic energy of the flywheel to be absorbed by the tire using this equation:

$KE = CW(V^2)$ = Kinetic energy (ft-lbs)

where
C = 0.0113
W = Load rating of the tire (lbs)
V = 120 mph

(5) Dynamometer cycle requirements: tire must satisfactorily withstand 200 landing cycles on a variable mass dynamometer flywheel. If you cannot use the exact number of flywheel plates to obtain the calculated kinetic energy value, select a greater number of plates and adjust the dynamometer speed to obtain the required kinetic energy. Divide the total number of dynamometer landings into two equal parts having the speed ranges provided in paragraphs **5.b.(5)(a)** and **5.b.(5)(b)**.

(a) Low speed landings: in the first series of 100 landings, the maximum landing speed is 90 mph and the minimum unlanding speed is 0 mph. Adjust the landing speed so the tire will absorb 56% of the kinetic energy calculated using the equation in paragraph **5.b.(4)** above. If the adjusted landing speed is calculated to be less than 80 mph, then determine the landing speed by adding 28% of the calculated kinetic energy (see paragraph **5.b.(4)** above) to the flywheel kinetic energy at 64 mph, and determine the unlanding speed by subtracting 28% of the calculated kinetic energy from the flywheel kinetic energy at 64 mph.

(b) High speed landings: in the second series of 100 landings, the minimum landing speed is 120 mph and the nominal unlanding speed is 90 mph. Adjust the unlanding speed as needed to ensure that the tire will absorb 44% of the calculated kinetic energy (see paragraph **5.b.(4)** above).

6. <u>REQUALIFICATION TESTS</u>.

a. Re-qualify altered tires, with changes in materials, design and/or manufacturing processes that could adversely affect the performance and reliability, to the dynamometer tests described under paragraph **5**. Some examples include **(1)** or **(2)** below, or both:

(1) Changes in casing construction, such as the number of plies and/or bead bundles, ply cord makeup (material, denier, number of strands) and configuration (radial and bias).

(2) Changes in tread construction, such as number or composition of tread reinforcing and/or protector plies, tread compound formulations, number and location of tread grooves, and an increase in skid depth.

b. Re-qualification by similarity (based on load rating). Re-qualifying a given load rated tire due to a change in material or tread design, automatically qualifies the same changes in a lesser load tire of the same size, speed rating, and skid depth, if:

(1) The lesser load rated tire was qualified to the applicable requirements specified in this ETSO, and

(2) The ratio of qualification test load to rated load for the lesser load rated tire does not exceed the same ratio to the higher load rated tire at any given test condition.

c. Re-qualification by similarity (blanket change). You can gain re-qualification of any change that affects all sizes by similarity, if:

(1) Five representative sizes, including tires of the highest load rating, speed rating and angular velocity, were qualified to the minimum performance standard with the change, and

(2) You submit data supporting the change in the listed sizes to EASA.

ETSO-C90d
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Cargo Pallets, Nets and Containers (Unit Load Devices)

1 - Applicability

This ETSO gives the requirements which Cargo Unit Load Devices 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

For new models of Type I ULDs 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.

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

- in lieu of Figure 31, sheet 87, substitute Figure 31, sheet 88;
- in lieu of Figure 31, sheet 88, substitute Figure 32, sheet 87 of NAS 3610 Revision 8 dated April 1987

For new models of Type II ULDs 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.

For Type I and II ULDs, the standards set forth in SAE AS 36102, Air Cargo Unit Load Devices - Testing Methods, dated March 2005 are applicable.

3.1.2 - Environmental Standard

See CS-ETSO Subpart A paragraph 2.1.

3.1.3 – Computer Software

None

3.1.4 - Electronic Hardware Qualification

None

3.2 - Specific

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.

In lieu of NAS 3610 Rev. 10, paragraph 3.7 and SAE AS 36100 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) 1490B, Environmental Degradation of Textiles, dated December 2007, for available data for textile performance when exposed to environmental factors. These 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 AS 36100 Rev. A, paragraph 4.11.

NOTE: Environmental degradation data other than that documented in AIR1490B may be used if substantiated by the applicant and approved by EASA.

~~None~~

3.2.1 Failure Condition Classification

N/A

4 - Marking

4.1 - General

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

4.2 - Specific

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 AS 36100, Rev. A, 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-directional, 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. If applicable, the expiration date in the format " EXP YYYY-MM" must be marked on the ULD.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C95a
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Mach Meters

1 - Applicability

This ETSO gives the requirements which Mach Meters that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the SAE AS 8018A, Mach Meters, dated 01/09/1996.

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

~~None~~

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 as detailed in CS-ETSO Subpart A paragraph 1.2.

4.2 - Specific

None, marking in accordance with AS 8018A addendum 1 section 2 is optional.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C126a
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: 406MHz Emergency Locator Transmitter

1 - Applicability

This ETSO gives the requirements which 406MHz Emergency Locator Transmitter that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the EUROCAE ED-62A, Minimum Operational Performance Specification for Aircraft Emergency Locator Transmitters 406 MHz and 121.5 MHz (Optional 243 MHz), dated February 2009.

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 minor failure condition.

4 - Marking

4.1 - General

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

4.2 - Specific

See EUROCAE ED-62A paragraph 2.7.3.~~None~~

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C154c
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Universal Access Transceiver (UAT) Automatic Dependent Surveillance - Broadcast (ADS-B) Equipment Operating on the Frequency of 978 MHz

1 - Applicability

This ETSO gives the requirements which Universal Access Transceiver (UAT) Automatic Dependent Surveillance - Broadcast (ADS-B) Equipment Operating on the Frequency of 978 MHz that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the Radio Technical Commission for Aeronautics (RTCA) Document DO-282B, Minimum Operational Performance Standards for Universal Access Transceiver (UAT) Automatic Dependent Surveillance Broadcast (ADS-B), dated 02/12/2009.

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 as detailed in CS-ETSO Subpart A paragraph 1.2.

4.2 - Specific

Transmitting and receiving components must be permanently and legibly marked. The following table explains how to mark components. Find the equipment class in RTCA/DO-282B, Section 2.1.11.

If component can:	***Mark it with:***	***Sample marking pattern:***
Transmit and receive	Equipment class it supports	Class A1H or Class A3
Transmit, but not receive	Equipment class it supports	Class B1 or Class A3 - Transmit Only
Receive, but not transmit	Equipment class it supports	Class A2 - Receive Only
Perform the optional frequency diplexer function developed under this ETSO	The words "UAT Diplexer," Maximum amplitude attenuation between the antenna port (A) and UAT port (U) of the diplexer, and Maximum amplitude attenuation between the antenna port (A) and transponder port (T) of the diplexer	UAT Diplexer A/U -0.x dB A/T -0.x dB

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C157a
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Aircraft Flight Information Services-Broadcast (FIS-B) Data Link Systems and Equipment

1 - Applicability

This ETSO gives the requirements which Aircraft Flight Information Services-Broadcast (FIS-B) Data Link Systems and Equipment 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

This standard apply to equipment intended to display weather and other non-control flight advisory information to pilots in a manner that will enhance their awareness of the flight conditions.

Standards set forth in the Radio Technical Commission for Aeronautics (RTCA) Document DO-267A, Minimum Aviation System Performance Standards (MASPS) for Flight Information Services-Broadcast (FIS-B) Data Link, Rev. A dated 29 April 2004. The standard applies to the equipment classes as defined in the following table 1. Demonstrate the required functional performance under the test conditions specified in RTCA/DO-267A Section 4.

Equipment Class	Equipment Name	Functionality
1	FIS-B Equipment using Universal Access Transceiver (UAT) and Interoperable with the Surveillance and Broadcast Services (SBS) Provider	RTCA/DO-267A Sections 2 and 3, with amendments per Appendix 1 of this ETSO.
2	FIS-B Equipment not Interoperable with the SBS Provider	RTCA/DO-267A Section 2 (except 2.1.4; 2.2.12; and 2.2.13) and Section 3.8.

Table 1. Equipment Classes for FIS-B

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.

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

4 - Marking

4.1 - General

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

4.2 - Specific

None

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

APPENDIX 1. AMENDMENTS TO THE MINIMUM PERFORMANCE STANDARD FOR EQUIPMENT PROVIDING FIS-B VIA THE UNIVERSAL ACCESS TRANCEIVER

This Appendix prescribes addendums to the MPS for aircraft FIS-B systems and equipment when using the Surveillance Broadcast Services system.

1.1 RTCA/DO-267A. The applicable standard is RTCA/DO-267A Sections 2 and 3. We modified it as follows:

1.1.1 Page 19*,* 3.6.2.3, Reassembly of Linked Application Protocol Data Units (APDU) to Form an FIS-B Product File, Paragraph 3, Sentence 1, reads as follows:

Change from:

…Separate APDU sequences are maintained for each Product and ground station combination for which linked APDUs are transmitted.

To:

… Separate APDU sequences are maintained for each Product and *each Product File ID or* ground station combination for which linked APDUs are transmitted.

1.1.2 Appendix D, Page D-1, Paragraph 2, Sentence 1:

Change from:

… The APDU structure shall begin with an APDU Header consisting of data fields as shown in Table D-1.

To:

… The APDU structure shall begin with an APDU Header consisting of data fields as shown in Table D-1, except the UAT transmission of the APDU header does not include the 16-bit FIS-B APDU ID field.

1.1.3 Appendix D, Page D-1, Table D-1 FIS-B APDU Header Format, replace Header. Time rows as follows:

Change From:

Head Time	22 – 37 bits	Section D.4
Time Option Bits	2 bits	
Date (optional)	9 bits (if included)	
Month of Year	4 bits	
Day of month	5 bits	

UTC Time Hours	5 bits	
Time Minutes	6 bits	
Time Seconds (optional)	6 bits (if included)	

To:

Head Time	22 – 37 bits	Section D.4
Time Option Bits	2 bits	
Month of Year (optional)	4 bits (if included)	
Day of month (optional)	5 bits (if included)	
UTC Time Hours	5 bits	
Time Minutes	6 bits	
Time Seconds (optional)	6 bits (if included)	

1.1.4 Appendix D, Page D-1, amend the Segmentation Data Block entries and add a new Product File ID entry in Table D-1 to read as follows:

Change From:

Field	Number of Bits	Document Section
Product File Length	12 bits	
Number	12 bits	
Zero Padding Bits	0-7 bits to force octet-alignment	Section D.6

To:

Field	Number of Bits	Document Section
Product File ID	10 bits	ETSO-C157a Appendix 1 paragraph 1.1.9
Product File Length	9 bits	Section D.5.1
APDU Number	9 bits	Section D.5.2
Zero Padding Bits	0-7 bits to force octet-alignment	Section D.6

1.1.5 Appendix D, Page D-3, Table D-2 Format of the FIS-B Product Descriptor, reads as follows:

Change from:

Geographic Locator (region) (optional)	20 bits (if present)	Section D.2.4

To:

Geographic Locator (region) (optional)	20 bits (if present)	Section D.2.4
Latitude	7 bits	Section D.2.4
Longitude	8 bits	Section D.2.4
Extent	5 bits	Section D.2.4

1.1.6 Appendix D, Page D-15, Figure D-3, Block Reference Indicator Format, reads as follows:

Change from:

Byte #	Bit Number							
	7	6	5	4	3	2	1	0
0	Element Identifier	N/S	Spare		Block Number (MSb)			
1	Block Number							
2	Block Number (LSB)							

To:

Byte #	Bit Number							
	7	6	5	4	3	2	1	0
0	Element Identifier	N/S	Scale		Block Number (MSb)			
1	Block Number							
2	Block Number (LSB)							

1.1.7 Appendix D, Page D-15, Section 2.3.5.2.2 The Block Reference Indicator, after the "Hemisphere N/S" paragraph add new paragraph to read as follows:

"Scale: an encoded multiplier applied to the base size of the GBR block in both latitude and longitude dimensions. Values represented by the Scale encoding are either system or product specific. Any mathematical calculations that are needed to reduce a high-resolution product down to a lower-resolution 'scaled' product are left for the implementer to separately describe/document."

1.1.8 Appendix D, Page D-21, D.5, Segmentation Data Block, Sentence 5, reads as follows:

Change from:

…The Segmentation Data Block (if present) shall consist of two components, the Product File Length field and the APDU Number field.

To:

…The Segmentation Data Block (if present) shall consist of three components, the Product File *ID* field, Product File Length field and the APDU Number field.

1.1.9 Appendix D, Page D-21, supplement section D.5 with the following:

The Product File ID Field contains a reference number to associate segmented APDUs with the appropriate Product File. Such a reference is necessary when broadcasting the same APDU segments for a Product File from multiple radio stations.

1.1.10 Appendix D, Page D-23, Figure D-9 APDU Header Layouts, amend the optional Segmentation Data Block fields to read as follows:

Change from:

<table>
<tr><td colspan="5">ADPU Header (48 to 112 bits)</td></tr>
<tr><td rowspan="2">FIS-B APDU ID
(16 bits)</td><td rowspan="3">• • •</td><td colspan="2">Segmentation Data Block (Optional 24 bits)</td><td rowspan="2">Zero Pad
(0 – 7 bits)</td></tr>
<tr><td>Product File Length
(12 bits)</td><td>APDU Number
(12 bits)</td></tr>
<tr><td>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0</td><td></td><td></td><td></td></tr>
</table>

To:

<table>
<tr><td colspan="6">ADPU Header (48 to 112 bits)</td></tr>
<tr><td rowspan="2">FIS-B APDU ID
(16 bits)</td><td rowspan="3">• • •</td><td colspan="3">Segmentation Data Block (Optional 28 bits)</td><td rowspan="2">Zero Pad
(0 – 7 bits)</td></tr>
<tr><td>Product File ID
(10 bits)</td><td>Product File Length
(9 bits)</td><td>APDU Number
(9 bits)</td></tr>
<tr><td>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0</td><td></td><td></td><td></td><td></td></tr>
</table>

1.1.11 Appendix D, Page D-23, Figure D-9 APDU Header Layouts, amend the APDU Header Time field text to read as follows:

Change from:

APDU Header Time (13 or 28 bits)

To:

APDU Header Time (13, *19, or 22* bits)

1.1.12 Appendix D, Page D-23, Figure D-9, APDU Header Layouts, add note to Option Flags table to read as follows:

"Note: A given APDU shall not have Time Flag #1 and Time Flag #2 set to one (1) within the same APDU Header."

1.1.13 Appendix K, Page K-1*,* the last entry in Table K-1, reads as follows:

Change from:

The last entry in Table K-1 shows the encoding of the CC (Change Cipher) character as "011111."

To:

The last entry in Table K-1 shows the encoding of the "**|**" character as "011111."

1.1.14 Appendix K, Page K-1, new note at the bottom of the table, reads as follows:

"**|** = The change cipher character is not used by FIS-B (per MASPS), so there is no expected impact on legacy users."

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European Aviation Safety Agency

European Technical Standard Order

Subject: Aeronautical Mobile High Frequency Data Link (HFDL) Equipment

1 - Applicability

This ETSO gives the requirements which Aeronautical Mobile High Frequency Data Link (HFDL) Equipment that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the Radio Technical Commission for Aeronautics (RTCA) Document DO-265, Minimum Operational Performance Standards for Aeronautical Mobile High Frequency Data Link (HFDL)", dated 14/12/2000.

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 minor failure condition.

4 - Marking

4.1 - General

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

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

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European Aviation Safety Agency

European Technical Standard Order

Subject: Avionics Supporting Next Generation Satellite Systems (NGSS) = Airborne Iridium Satellite Transceiver for Voice or Data

1 - Applicability

This ETSO gives the requirements which Avionics Supporting Next Generation Satellite Systems (NGSS) = Airborne Iridium Satellite Transceiver for Voice or Data that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

The ETSO Authorisation does not include the verification of aspects (e.g. quality and continuity of electric power) which shall be assessed at aircraft level, but it includes verification of the system behaviour in presence of such failure conditions.

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 Radio Technical Commission for Aeronautics (RTCA) Document DO-262A, Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS), dated 16/12/2008.

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 minor failure condition.

4 - Marking

4.1 - General

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

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

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European Aviation Safety Agency

European Technical Standard Order

Subject: Ground Based Augmentation System Positioning and Navigation Equipment

1 - Applicability

This ETSO gives the requirements which that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the Radio Technical Commission for Aeronautics (RTCA) Document DO-253C, Minimum Operational Performance Standards for GPS Local Area Augmentation System Airborne Equipment, dated 16/12/2008, section 2 as modified by appendices 1 and 2 of this ETSO for airborne equipment class (AEC) C to support Category I precision approach. These standards also apply to equipment that implements the optional GBAS positioning service. This ETSO does not apply to AEC D equipment as the additional requirements to support the GBAS Approach Service Type D and Category III precision approaches have not been validated. A new ETSO or a revision to this ETSO for AEC D equipment will be issued once these additional requirements are validated.

This TSO's standards apply to equipment intended to output deviations relative to a precision approach path using GBAS, and to provide position information to an ETSO-C161a navigation management unit that outputs deviation commands referenced to a desired flight path. These standards do not address integration issues with other avionics except for automatic dependent surveillance. The positioning and navigation functions are defined in section 2.3 of RTCA/DO-253C. In accordance with section 2.1 of RTCA/DO-253C, equipment obtaining this ETSOA must also comply with the position, velocity and time (PVT) output requirements of either, ETSO-C145c, ETSO-C146c or ETSO-C196a.

Note: ETSO-C196a, which is based on RTCA/DO-316, Minimum Operational Performance Standards for Global Positioning System/Aircraft Based Augmentation System Airborne Equipment, is not referenced in RTCA DO-253C. RTCA/DO-316 was published after the publication of DO-253C. ETSO-C129a is not applicable to this ETSO.

3.1.2 - Environmental Standard

See CS-ETSO Subpart A paragraph 2.1. The required performance is defined in RTCA/DO253C section 2.4.

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 for the malfunction of position data and a hazardous failure condition for the malfunction of precision approach navigation data.

Failure of the function defined in paragraph 3.1.1 of this ETSO has been determined to be a minor failure condition for the loss of position data and a minor failure condition for the loss of precision approach navigation data.

4 - Marking

4.1 - General

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

4.2 - Specific

None

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C161a
Appendix 1
Date: 05.07.2012

APPENDIX 1. MINIMUM PERFORMANCE STANDARD FOR GROUND BASED AUGMENTATION SYSTEM POSITIONING AND NAVIGATION EQUIPMENT

This Appendix prescribes the minimum performance standards (MPS) for GBAS equipment for airborne equipment class (AEC) C and equipment using the GBAS Positioning Service. The applicable standard is RTCA/DO-253C, *Minimum Operational Performance Standards for GPS Local Area Augmentation System Airborne Equipment*, dated 16/12/2008, section 2. The applicable standard is modified as follows:

1. Except as modified by appendix 2 of this ETSO, for all RTCA/DO-253C references to RTCA/DO 246(), use RTCA/DO-246B, *GNSS-Based Precision Approach Local Area Augmentation System (LAAS) Signal-In-Space Interface Control Document (ICD)*, dated 28/11/2001.

2. Page 35, section 2.3.6.4.1, ***modify*** Table 2-7 and the note under the table as highlighted below (rest of section unchanged):

Table 2-7 GPS Tracking Constraints for DD DLL Discriminators

Region (see Figure 2-3)	3 dB Pre-correlation bandwidth, BW	Average Correlator Spacing (d_1 and $2d_1$) [C/A chips]	Instantaneous Correlator Spacing (d_1 and $2d_1$) [C/A chips]	Differential Group Delay	Applicable AEC
1	(-50*x)+12<BW≤7 MHz	0.1-0.2	0.09-0.22	≤ 600 ns – D_A – D_C	C
	2<BW≤7 MHz	0.2-0.6	0.18-0.65		
2	(-50*x)+12<BW≤(133.33*x)+2.667 MHz	0.07-0.085	0.063-0.094	≤ 150 ns – D_A – D_C	C & D
	(-50*x)+12<BW≤14 MHz	0.085-0.1	0.077-0.11		
	7<BW≤14 MHz	0.1-0.24	0.09-0.26		
3	14<BW≤16 MHz	0.1-0.24	0.09-0.26	≤ 150 ns – D_A – D_C	C & D
	(133.33*x)+2.667<BW≤16 MHz	0.085-0.1	0.077-0.11		

Note (1): D_A *is the differential group delay contribution of the antenna through the output of the pre-amp.* D_C *is the differential group delay contribution of the installation specific connection between the antenna and the PAN equipment*.

Note (2): x denotes the average correlator spacing for d_1 in C/A chips.

3. Page 49, section 2.3.8.1.3, ***add*** a new paragraph g. to the list of conditions as follows:

g) The distance (slant range) between the aircraft and the GBAS reference point is less than the maximum GBAS usable distance, if the maximum GBAS usable distance (D_{max}) is provided in the Type 2 message being used *[LAAS-281]*.

4. Page 57, section 2.3.9.5, ***replace*** the differential correction magnitude check, δPR_i equation as follows:

$$\delta PR_i = PRC_i + RRC_i*(t-t_{zcount}) + TC_i$$

5. Page A-6, ***replace*** the Maximum Use Distance (D_{max}) definition as follows:

Maximum Use Distance (Dmax) – the maximum distance from the GBAS reference point for which the integrity is assured.

6. If a manufacturer elects to provide the authentication capability in its equipment as specified in section 2.3.7.3 of RTCA/DO-253C, the equipment shall also perform the differential correction magnitude check in section 2.3.9.5.

NOTE: There are additional sections of RTCA DO-246D that are applicable when VDB authentication is implemented. These are specified in appendix **2**.

7. Summary of ETSO changes relative to DO-253C.

LAAS Requirement Designator [LAAS-xxx]	Change Status from DO-253C
093	Changed
123	Changed
281	Added
351 and 352	New application (see item 6 above)

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Appendix 2
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APPENDIX 2. MINIMUM PERFORMANCE STANDARD FOR GNSS-BASED PRECISION APPROACH LOCAL AREA AUGMENTATION SYSTEM (LAAS) SIGNAL-IN-SPACE INTERFACE CONTROL DOCUMENT (ICD)

This Appendix prescribes the interface control document for GBAS as it applies to AEC C for this ETSO. The applicable standard is RTCA/DO-246B, GNSS-Based Precision Approach Local Area Augmentation System (LAAS) Signal-in-Space Interface Control Document, dated 28 November 2001. The applicable standard is modified as follows:

1. Page 22, ***replace*** the ephemeris CRC bit order of transmission in section 2.4.3.2. *Message Type 1* parameters, ***with*** the updated definition in the latest revision, RTCA/DO-246D, dated December 16, 2008, section 2.4.3.2.

NOTE: This change reorders the bits of the ephemeris CRC from their previous transmission order of r1, r2, r3, r4 … r16, where r1 is the least significant bit and bit r16 is the most significant bit, to r9, r10, r11 … r16, followed by r1, r2, … r8, where r9 and r1 are the first bits of each bite into the bit scrambler. This change is not backwards compatible with the existing standard. The change was adopted for compatibility with a significant number of current implementations of ground equipment and avionics. This change affects [LAAS-107], [LAAS-117], [LAAS-118], and [LAAS-214]. Other changes to RTCA/DO-246B, reflected in RTCA/DO-246D, to support the newly incorporated GBAS Approach Service Type D are not relevant for this ETSO and should not be implemented.

2. Appendix A, ***replace*** appendix A, *Cyclic Redundancy Checks (CRCs)*, ***with*** RTCA/DO-246D, Appendix A.

3. Page B-2, ***replace*** Table B-1 *Example of Type 1 Message*, with RTCA/DO-246D, Table B-1.

4. Page B-4, ***replace*** Table B-2 *Example of Type 1 and Type 2 Messages in One Burst* ***with*** RTCA/DO-246D, Table B-2.

5. Page B-7, ***replace*** Table B-3 *Example of Type 4 Message* ***with*** RTCA/DO-246D, Table B-4 as modified below for the runway number valid range.

The valid range for runway number is 1-36.

6. Page B-10, ***replace*** Table B-4 *Example of Type 5 Message* ***with*** RTCA/DO-246D, appendix B, Table B-6, *Example of Type 5 Message*.

7. If a manufacturer elects to provide the authentication capability in its equipment as specified in section 2.3.7.3 of RTCA/DO-253C, the following paragraphs from RTCA/DO-246D, dated 16/12/2008 are applicable:

a. *Message Type 2, Additional Data Block 4, VDB Authentication Parameters* description and Table 2-16 in DO-246D, section 2.4.4.1, pages 33 and 35.

b. *Message Type 3 – Null Message* and Table 2-17 *Format of Message Type 3* in DO-246D, section 2.4.5, page 37.

c. *Reference Path Identifier* in DO-246D, section 2.4.6.4, page 53.

8. Summary of RTCA/DO-253C requirements affected by these modifications to DO-246B.

Appendix 2 Item number	**LAAS Requirement Designator [LAAS-xxx]**
1	**107, 117, 118, 214**
2	**Editorial**
3	**Editorial**
4	**Editorial**
5	**Editorial**
6	**Editorial**
7	**328, 329, 330 and 331**

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European Aviation Safety Agency

European Technical Standard Order

Subject: Ground Based Augmentation System Very High Frequency Data Broadcast Equipment

1 - Applicability

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

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the Radio Technical Commission for Aeronautics (RTCA) Document DO-253C, Minimum Operational Performance Standards for GPS Local Area Augmentation System Airborne Equipment, dated 16/12/2008.

NOTE: All RTCA/DO-253C references to RTCA/DO 246() apply to RTCA/DO-246B, *GNSS-Based Precision Approach Local Area Augmentation System (LAAS) Signal-In-Space Interface Control Document (ICD)*, dated November 28, 2001. Modifications to these references are noted in appendix 2 of ETSO-C161a.

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

4 - Marking

4.1 - General

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

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

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European Aviation Safety Agency

European Technical Standard Order

Subject: Extended Squitter Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Services (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)

1 - Applicability

This ETSO gives 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 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 RTCA DO-260B, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Services - Broadcast (TIS-B), dated 02/12/2009, section 2.

This ETSO supports two major classes of 1090 MHz ADS-B and TIS-B equipment:
(a) Class A equipment, consisting of transmit and receive subsystems; and

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

(a) Class A equipment includes Classes A0, A1, A1S, A2 and A3. This standard requires 1090 MHz airborne Class A equipment to include the capability of receiving both ADS-B and TISB messages and delivering both ADS-B and TIS-B reports, as well as transmitting ADS-B messages. A Receive-only Class of equipment is allowed.

(b) **Class B equipment** includes Classes B0, 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 RTCA/DO-260B section 2.4

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

~~None~~

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.

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

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.

The following table explains how to mark components.

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

If component can:	***Mark it with:***	***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.

ETSO-C170
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: High Frequency (HF) Radio Communications Transceiver Equipment Operating Within the Radio Frequency 1.5 to 30 Megahertz

1 - Applicability

This ETSO gives the requirements which High Frequency (HF) Radio Communications Transceiver Equipment Operating Within the Radio Frequency 1.5 to 30 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-C31d "High Frequency (HF) Radio Communications Transmitting Equipment Operating within the Radio Frequency Range 1.5-30 Megahertz" and ETSO-C32d "High Frequency (HF) Radio Communications Receiving Equipment Operating within the Radio Frequency Range 1.5-30 Megahertz".

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 Radio Technical Commission for Aeronautics (RTCA) Document DO-163, Minimum Operational Performance Standards - Airborne HF Radio Communications Transmitting and Receiving Equipment Operating within the Radio-Frequency Range of 1.5 to 30 MHz, dated 09/03/1976.

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 minor failure condition.

4 - Marking

4.1 - General

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

4.2 - Specific

None

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C172
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Cargo Restraint Strap Assemblies

1 - Applicability

This ETSO gives the requirements which Cargo Restraint Strap Assemblies that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the SAE AS 5385C, Cargo Restraint Straps - Design Criteria and Testing Methods, dated January 2007, as amended by Appendix 1 of this ETSO.

3.1.2 - Environmental Standard

See Section 4 of SAE AS 5385C.

3.1.3 – Computer Software

None.

3.1.4 - Electronic Hardware Qualification

None.

3.2 - Specific

3.2.1 Failure Condition Classification

N/A

4 - Marking

4.1 - General

Marking as detailed in CS-ETSO Subpart A paragraph 1.2. In addition, each Cargo Restraint Strap Assemblies shall be legibly and permanently marked in accordance

with SAE AS 5385C, section 7.3 with the following:

(i) dates of manufacture and expiration per SAE AS 5385C, section 4.5.2. Format the dates per SAE AS 5385C, section 7.2.

(ii) the rated ultimate load in daN and lbf.

(iii) a unique identifier if required by SAE AS 5385C, section 4.5.2(b).

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

(1) each component that is easily removable (without hand tool), and

(2) each subassembly of the article that may be interchangeable.

NOTE 1: any extra information listed in SAE AS 5385C, section 7, not specifically required in this paragraph, may be marked.

NOTE 2: Compliance with this ETSO does not necessarily indicate compliance with SAE AS 5385C. To make the cargo strap assembly as complying with SAE AS 5385C, the cargo strap assembly must be shown to meet the requirements of SAE AS 5385C in conformance with SAE AS 5385C, Para 7.1 and Note 8.

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C172
Appendix 1
Date: 05.07.2012

APPENDIX 1. MINIMUM PERFORMANCE STANDARD FOR CARGO RESTRAINT STRAP ASSEMBLIES

This Appendix prescribes the MPS for cargo restraint strap assemblies. The applicable standard is SAE AS 5385C *"Cargo Restraint Straps – Design Criteria and Testing Methods"*, dated January 2007 modified as follows:

AS5385C Section	Action
1	Disregard
2	Modify Paragraph 2. "REFERENCES" by disregarding the last sentence.
3	Disregard 3.14
4	Disregard 4.5.4 and 4.9.1 Modify 4.5.1 by adding the following note: "NOTE: Environmental degradation data other than that documented in AIR490B may be used if substantiated by the Applicant and approved by the Agency."
5	Disregard 5.9, 5.10 and 5.11 Modify 5.1 by adding the following note: "NOTE: Equivalent alternate methods must be approved by the Agency".
6	Disregard
7	Apply per Paragraph 4 of this ETSO
8	Disregard
9	Disregard
10	Disregard

ETSO-C179a
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Permanently Installed Rechargeable Lithium Cells, Batteries, and Battery Systems

1 - Applicability

This ETSO gives the requirements which permanetly installed rechargeable lithium cells, batteries, and battery systems 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

For permanently installed rechargeable lithium cells, batteries and lithium battery systems intended to provide power for aircraft equipment Standards set forth in Sections 2 and 3 of Radio Technical Commission for Aeronautics (RTCA) Document DO-311, Minimum Operational Performance Standards for Rechargeable Lithium Battery Systems, dated March 13, 2008. Refer to Table 4-1 of DO-311 for test schedule information.

3.1.2 - Environmental Standard

Test the equipment according to Section 3 of RTCA/DO-311 , *Minimum Operational Performance Standards for Rechargeable Lithium Battery Systems* document dated March 13, 2008.

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 as detailed in CS-ETSO Subpart A paragraph 1.2.

4.2 - Specific

Specific marking requirements are detailed in Section 1.9.7 of RTCA/DO-311, *Minimum Operational Performance Standards for Rechargeable Lithium Battery Systems* document, dated March 13, 2008.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C184
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Airplane Galley Insert Equipment, Electrical/Pressurised

1 - Applicability

This ETSO gives the requirements which Airplane Galley Insert Equipment, Electrical/Pressurised that is manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the Society of Automotive Engineers (SAE) Aerospace Standard (AS) 8057, Minimum Design and Performance of Airplane Galley Insert Equipment, Electrical/Pressurized, issued July, 2008 as modified by Appendix 1 of this document.

3.1.2 - Environmental Standard

See *AS 8057, paragraph 3.17* as modified by appendix 1 of this document.

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 minor failure condition.

4 - Marking

4.1 - General

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

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C184
Appendix 1
Date: 05.07.2012

APPENDIX 1. MINIMUM PERFORMANCE STANDARD FOR AIRPLANE GALLEY INSERT EQUIPMENT, ELECTRICAL/PRESSURIZED

This Appendix prescribes the minimum performance standards (MPS) for airplane galley insert equipment. The applicable standard is SAE AS 8057, *Minimum Design and Performance of Airplane Galley Insert Equipment, Electrical/Pressurized,* issued July, 2008. EASA did revise it as follows:

1 . Page 5, replace paragraph 1.3.b. with:

"The word "should" indicates a criterion for which an alternative, including non-compliance, may be applied."

2 . Page 8, disregard paragraph 2.2 Definitions: "ACCEPTANCE TEST", "ASSOCIATED COMPONENTS", "DETRIMENTAL PERMANENT DEFORMATION", and "FAILSAFE".

3 . Page 8, replace paragraph 2.2 Definitions: "FAILURE" with: "FAILURE: is a failure to meet the Minimum Performance Standard of the ETSO. The standard ensures a level of safety that is acceptable.

4 . Page 9, replace paragraph 2.2 Definitions: INTERCHANGEABILITY with:

"INTERCHANGEABILITY: That quality which allows an assembly or part to substitute or be substituted for another and to meet all physical, functional, and structural requirements of the original."

5 . Page 9, replace paragraph 2.2 Definitions: MAXIMUM NORMAL OPERATING

PRESSURE (MNOP) with: "MAXIMUM NORMAL OPERATING PRESSURE (MNOP):

The maximum attainable pressure of the equipment's pressure system when all the equipment's components are functioning normally."

6 . Page 9, replace paragraph 2.2 Definitions: OPTION with

"OPTION: A function capable of being included as part of equipment. It shall be fully developed and able to be incorporated without adverse effects to meeting the performance requirements of this AS included in this ETSO."

7 . Page 9, disregard paragraph 2.2 Definitions: "PERIODIC TESTING".

8 . Page 10, disregard paragraph 2.2 Definitions: "PROCESS SPECIFICATION"

9 . Page 10, replace paragraph 3.1 with:

"Table 1 identifies applicable requirements for typical galley insert equipment designs. Novel designs may require compliance to additional requirements, or requirements in Table 1 not identified by a bullet. To use the table, find the equipment in question along the top row, and then read down that column; the row in which a bullet appears indicates

requirements that shall be addressed. A bullet in brackets indicates that the requirements are applicable for only a part of the equipment in question."

10 . Page 11, disregard paragraphs 3.2.1 and 3.2.1.1.

11 . Page 12, disregard paragraph 3.2.1.2.a.

12 . Page 12, replace paragraph 3.2.1.2.c with:

"Aluminium honeycomb core shall be finished for corrosion resistance."

13 . Page 12, disregard paragraphs 3.2.1.4. through 3.2.1.6.

14 . Page 12, replace paragraph 3.2.1.8 with:

"Components shall be protected against deterioration or loss of strength in service due to environmental causes. Selection and finishing of material (including fasteners), where dissimilar metals may be placed in contact, shall be per MIL-STD-889 or equivalent. Material not inherently corrosion resistant shall be finished with a protective treatment or coating. Magnesium alloys shall not be used."

15 . Page 13, disregard paragraphs 3.2.1.9. through 3.2.2.3.

16 . Page 14, replace paragraph 3.2.2.4 with:

"Bonded joints shall not be loaded primarily in tension"

Disregard paragraphs 3.2.2.4.a through d.

17 . Page 14, disregard paragraph 3.2.2.5.

18 . Page 14, replace paragraph 3.2.3 with:

"Construction for Trash Compactors

Trash compactors shall be constructed of fire-resistant materials capable of containing fire (see 3.10) under the conditions expected to result in service."

Note: Fire-resistant, with respect to sheet or structural members, means the capacity to withstand the heat associated with fire at least as well as aluminium alloy in dimensions appropriate for the purpose for which they are used.

19 . Page 15, disregard paragraph 3.2.4.

20 . Page 15, replace paragraph 3.2.5 with:

"Interface clearances between equipment and the surrounding galley or structure required for ventilation, heat dissipation, installation, loading, etc. shall be clearly defined and included in the application data for this ETSO."

21 . Page 15, replace paragraph 3.2.6 with:

"Equipment shall comply with US Food and Drug Administration (FDA) requirements for sanitary construction in Sections 1, 2, 4, and 6 of Attachment 3 *Guidelines for Sanitary Construction of Aircraft Galleys and Galley Equipmen*t, to FDA document, *Guide to Inspections of Interstate Carriers and Support Facilities*, (Reference 2.1.5)."

22 . Page 15, disregard paragraph 3.2.7.

23 . Page 16, disregard paragraph 3.2.8.

24 . Page 16, replace paragraph 3.3.1.a. with:

"Equipment shall be designed to meet the structural loading as specified in 4.2.1."

25 . Page 16, replace paragraph 3.3.2.a. with:

"The structure of equipment shall address the load case in each direction and be verified according to 4.2.1."

26 . Page 16, replace paragraph 3.3.2.b with:

"The loading conditions shall be determined by assuming installation of equipment around the z-axis of the airplane (see Figure 1)."

27 . Page 16, disregard paragraph 3.3.2.c.

28 . Page 16, replace paragraph 3.3.2.d. with:

"Failure shall not occur under ultimate load cases. All permanent deformation that occurs under ultimate or limit load cases shall be reported in the data furnished with each article."

Disregard "NOTE" following paragraph 3.3.2.d.

29 . Page 16, replace paragraph 3.3.3 with:

"A local attachment factor of 1.33 shall be applied in addition to the design load factors for attachments (such as door hinges, latches and retaining devices)."

30 . Page 16, replace paragraph 3.3.4 with:

"Material strength properties shall be based on tests of material meeting industry specifications to establish design values on a statistical basis. Design values shall be chosen to minimize the probability of structural failure due to material variability. The applicable specifications are Metallic Materials Process Development and Standardization (MMPDS, formerly MIL-Handbook-5) and the Composite Materials Handbook (CMH-17, formerly MIL-Handbook-17).

Analytical substantiation of material strength shall be based on material design values shown to be statistically reliable by repeated structural testing. Strength substantiation shown by full scale testing shall account for the variability of the materials and processes used to fabricate the parts by applying an appropriate overload factor. See chapter 2 in

General Aviation Manufacturer's Association (GAMA) document Publication 13 for guidance in determining the appropriate overload factor."

31 . Page 18, replace paragraph 3.3.5.i. with:

"Forces generated by the conditions tested in 3.17, 4.2.1., or the weight of the retaining device itself, shall not cause the retaining device to release."

32 . Page 18, replace paragraph 3.3.5.m. with:

"Equipment with a stowage compartment (e.g., trash compactors, ovens, refrigerators and freezers, wine chillers) shall be designed such that the stowage compartment completely encloses its contents."

33 . Page 18, correct 3.3.6.b.2. to read:

"maximum wet weight, including associated components used for normal operation of the equipment (with the exception of attached hoses, tubes, pipes and/or electrical conduit), maximum amount of water in the equipment plumbing system and including water in tank, beverage in server, soaked pillow pack (if applicable)."

34 . Page 19, disregard paragraph 3.3.8.

35 . Page 19, disregard paragraph 3.3.9.

36 . Page 19, replace paragraph 3.4.1.a. with:

"Equipment shall be designed for the primary power levels typically found in aircraft (e.g., 28VDC, and/or 115 VAC (Constant frequency (CF) or Wide variable frequency (WF), or 230 VAC (CF) or (WF))."

37 . Page 20, replace paragraph 3.4.4 with:

"Equipment shall be designed to be capable of withstanding over-voltage events without arcing, sparking, smoke or fire. Equipment shall be designed to pass the following dielectric tests: (Note: Components (filters, protection diodes) normally not capable of withstanding the dielectric withstanding voltage test without damage may be disconnected or individually disabled (e.g., short circuited) for these tests. The dielectric withstanding voltage test shall be run prior to the insulation resistance test.)" Paragraphs 3.4.4.a and b. remain unchanged.

38 . Page 21, replace paragraph 3.4.7. with:

"In addition to the requirements of this document, microwave ovens shall meet the provisions of the U.S.A. Code of Federal Regulation 21 CFR § 1030.10, Performance Standards for Microwave and Radio Frequency Emitting Products."

39 . Page 21, replace paragraph 3.4.8.a. with:

"Equipment shall be designed to minimize the generation of or susceptibility to electromagnetic interference."

40 . Page 21, disregard paragraph 3.4.8.b.

41 . Page 22, replace paragraph 3.4.9.b. with:

"Hidden installed equipment (e.g., remote water heater, air chiller) may have a separate control module capable of being installed on the front of the galley for the following functions:" Information in bullets remains unchanged.

42 . Page 23, replace paragraph 3.6.2.a. with:

"Show the complete equipment plumbing interface in the application data for this ETSO."

43 . Page 23, disregard paragraphs 3.6.2.c and 3.6.2.d.

44 . Page 23, replace paragraph 3.6.3 with:

"Equipment, capable of being connected to the potable water system of an airplane, that heats and stores water shall incorporate a feature for sensing a low water condition. Indication of low water shall both illuminate a warning light and interrupt power to the equipment heating elements."

45 . Page 23, replace paragraph 3.6.4.a. with:

"Equipment capable of being connected to an airplane potable water system shall incorporate a self-venting device."

46 . Page 23, replace paragraph 3.6.4.b. with:

"Equipment capable of being connected to an airplane potable water system shall be self-draining."

47 . Page 24, replace paragraph 3.6.6.a. with:

"Demonstrate equipment proof and burst pressure values by test and provide pressure values in the application data for this ETSO."

48 . Page 25, replace paragraph 3.6.7.b. with:

"Water taps/faucets shall be self-closing unless the application data for this ETSO specify this equipment is intended for installation above a sink in the galley monument."

49 . Page 25, revise paragraph 3.8.c. first sentence with:

"External surfaces that have to be heated directly to meet the equipment purpose (e.g., toaster slot, skillet surface, heating plates of a sandwich press, warmer pad for beverage server) are excluded from 3.8.a. and 3.8.b.

50 . Page 25, replace paragraph 3.9 with:

"Materials (including finishes or decorative surfaces applied to the materials) shall comply with the appropriate paragraphs of CS-25, App. F, as follows:"

51 . Page 25, replace paragraph 3.9.1.a. with:

"Equipment shall comply with the appropriate flammability requirements of CS-25 when tested per Appendix F, Part I."

52 . Page 25, replace paragraph 3.9.1.b. with:

"Thermal and acoustic insulation material and components (batting, cover foil, foam, etc.) shall comply with the flame propagation requirements of CS-25, Appendix F, Part

VI. Consult Advisory Circular AC 25.856-1, *Thermal/AcousticInsulation Flame Propagation Test Method Details*, for appropriate guidance."

53 . Page 26, replace paragraph 3.9.2. with:

"Exposed surfaces of equipment, when stowed, shall meet the heat release and smoke density requirements of CS-25, Appendix F, Parts IV and V."

54 . Page 26, replace paragraph 3.10.a. with:

"Equipment dedicated to, or that may be used for, waste stowage (e.g., trash compactors) shall meet AC 25-17A *Transport Airplane Cabin Interiors Crashworthiness Handbook* Appendix 8 *Fire Containment Test Methods,* Sections 4.2 CARTS and 5.2 ACCEPTANCE CRITERIA*.*"

55 . Page 26, replace paragraph 3.11. with:

"Equipment shall be marked using materials and/or processes that will ensure legibility during its lifespan. Markings shall be conspicuous and worded in mandatory "command" English. Non-English language marking is acceptable, in addition to English. Non-English marking may be used alone when airworthiness requirements are not involved. Marking location, style and wording should be consistent. Weight placards shall include both English and metric units. The location and wording of placards shall be shown in the application data for this ETSO."

56 . Page 26, replace paragraph 3.11.3.a. with:

""No Cigarette Disposal" shall be placed on or near each waste receptacle disposal door (e.g., the waste disposal flap of a trash compactor)."

57 . Page 27, disregard paragraphs 3.14.a, 3.14.b, and 3.14.c.

58 . Page 27, disregard paragraph 3.17 Note #1 on Pass/Fail criteria at bottom of Table 2 and replace Note #2 with:

"(2) Equipment shall comply with the performance requirements of this ETSO in each instance RTCA/DO-160 reads 'DETERMINE COMPLIANCE WITH APPLICABLE EQUIPMENT

PERFORMANCE STANDARDS'. The equipment shall also comply with the performance standards of this ETSO after DO-160 testing.

59 . Page 30, replace paragraph 3.18.1 with:

"The power consumption of the equipment shall be defined in the application data for this ETSO."

60 . Page 32, replace paragraph 3.19. with:

"A Failure Mode and Effects Analysis (FMEA) shall be performed at the equipment level independent of the aircraft. The analysis shall include typical and hidden failure modes throughout the entire operating range and include the effects of mishandling."

61 . Page 33, replace paragraph 4.2.1 Table 3 Note (2) with:

"(2) Load factors may be increased to meet aircraft flight and ground cases. If increased factors are used, they shall be provided in a manual, containing operating instructions and equipment limitations sufficient to describe the equipment's operational capability, as part of the application data for this ETSO."

62 . Page 33, replace paragraph 4.2.1 Table 3 Note (5) with:

"(5) For equipment with a stowage compartment, maximum door deflections shall meet 3.3.5.n.

63 . Page 34, replace paragraph 4.2.4.a. with:

"Proof Pressure Test: The qualification unit shall have its pressurized components tested to the required proof pressure; this pressure shall be held for five minutes. The equipment shall not be damaged nor leak as a result of the test."

64 . Page 35, replace paragraph 4.2.6.2.b. with:

"The top, sides and front surfaces of equipment shall be tested per CS-25, Appendix F, Parts IV and V."

65 . Page 35, correct 4.2.7. to read:

"Trash compactors used to receive combustible material shall comply with the fire containment requirements of 3.10, when substantiated per AS 8056, 4.6."

66 . Page 35, disregard section 4.2.9.

67 . Page 37, replace paragraph 4.2.15. with:

"Conduct and prepare the FMEA in accordance with ARP 4761 at the equipment level independent from the aircraft."

68 . Page 38, disregard section 4.3.

69 . Page 39, replace paragraph 5.1.b.12 with:

"Maximum amount of discharge air emitted by equipment, if applicable."

70 . Page 40, disregard section 5.2.

71 . Page 41, disregard section 6.

ETSO-C194
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Helicopter Terrain Awareness and Warning System (HTAWS)

1 - Applicability

This ETSO gives the requirements which Helicopter Terrain Awareness and Warning System (HTAWS) that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the Radio Technical Commission for Aeronautics (RTCA) Document DO-309, Minimum Operational Performance Standards (MOPS) for Helicopter Terrain Awareness and Warning System (HTAWS) Airborne Equipment, dated 13/03/2008.

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 as detailed in CS-ETSO Subpart A paragraph 1.2.

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C195a
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Avionics Supporting Automatic Dependent Surveillance - Broadcast (ADS-B) Aircraft Surveillance Applications (ASA)

1 - Applicability

This ETSO gives the requirements which Avionics Supporting Automatic Dependent Surveillance - Broadcast (ADS-B) Aircraft Surveillance Applications (ASA) 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 Section 2 of EUROCAE ED-194, dated January 2012/ Radio Technical Commission for Aeronautics (RTCA) DO-317A, dated December 13, 2011, Minimum Operational Performance Standards for Aircraft Surveillance Applications System.

Functional equipment classes for this ETSO are defined by the avionics equipment functionality they provide for one or more of the applications listed in Table 1. The three equipment functionalities are Cockpit Display of Traffic Information (CDTI) (Surface Only), CDTI, and Airborne Surveillance and Separation Assurance Processing (ASSAP). Applicable performance standards for these classes are identified per equipment class in Appendix L of ED-194/DO-317A and are based on Section 2 of ED-194/ED-317A. The functional equipment classes are shown in the following table.

			Equipment Classes		
	Application	Criticality Level	CDTI (Surface Only) (A)	CDTI (B)	ASSAP (C)
	Enhanced Visual Acquisition (EVAcq)	Major	Not Permitted	B1	C1
2	Basic Surface (Runways)	Major (> 80 Knots) Minor (< 80 Knots)	A2	B2	C2
3	Basic Surface (Runways + Taxiways)	Major (> 80 Knots) Minor (< 80 Knots)	A3	B3	C3
	Visual Separation on Approach (VSA)	Major	Not Permitted	B4	C4
	Basic Airborne (AIRB)	Major	Not Permitted	B5	C5
	In-Trail Procedures (ITP)	Major	Not Permitted	B6	C6

Table 1 – ASA Functional Equipment Classes

Class A and B equipment authorized under this ETSO must comply with ETSO-C165() when implementing Surface Applications. This ETSO shall take precedence where it differs from ETSO-C165(). Databases used to support moving maps integrated with the SURF application must meet at least 5 meter accuracy and 1 meter resolution. Databases used to support moving maps integrated with the SURF application must meet EUROCAE ED-76/RTCA DO-200A Data Process Assurance Level 2 for state-provided data with Essential Integrity as defined in RTCA DO-272B.

Equipment authorized under this TSO may include or interface with airborne multipurpose electronic display equipment complying with ETSO-C113().

Equipment authorized under this ETSO must contain or support an interface to position sources that meet one of the following ETSOs: ETSO-C129(), ETSO-C145(), ETSO-C146(), ETSO-C196() or equivalent.

3.1.2 - Environmental Standard

See CS-ETSO Subpart A paragraph 2.1. The system performance to be demonstrated during the environmental testing is defined in EUROCAE ED-194/RTCADO-317A section 2.4.

Explosion testing in accordance with EUROCAE ED-14( )/RTCA DO-160( ) section 9 is considered optional.

Electrostatic Discharge testing in accordance with EUROCAE ED-14( )/RTCA DO-160( ) section 25 is required for all equipment having control elements and are expected to be touched during operation.

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 for malfunctions causing the display of hazardously misleading information in airborne aircraft and aircraft on the ground greater than 80 knots. Failure of the function defined in paragraph 3.1.1 of this ETSO has been determined to be a minor failure condition for malfunctions causing the display of hazardously misleading information in aircraft on the ground less than 80 knots groundspeed. Loss of function has been determined to be a minor failure condition.

4 - Marking

4.1 - General

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

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-C196a
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Airborne Supplemental Navigation Sensors for Global Positioning System Equipment Using Aircraft-Based Augmentation

1 - Applicability

This ETSO gives the requirements which Airborne Supplemental Navigation Sensors for Global Positioning System Equipment Using Aircraft-Based Augmentation 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-C129a *Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS)*

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 Radio Technical Commission for Aeronautics (RTCA) document DO-316, Minimum Operational Performance Standards (MOPS) for Global Positioning System/Aircraft Based Augmentation System Airborne Equipment, dated 14/04/2009, Section 2.

3.1.2 - Environmental Standard

See CS-ETSO Subpart A paragraph 2.1.

Test to EUROCAE ED-14( ) section9 and 26 are considered optional. Test to section 10, 11, 12, 13, and 14 are required only, when the component is installed on the outside of the aircraft, like the antenna.

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 for malfunction of oceanic/remote, en route and terminal navigation and lateral navigation (LNAV) approaches.

Failure of the function defined in paragraph 3.1.1 of this ETSO has been determined to be a minor failure condition for loss of navigation of oceanic/remote, en route and terminal navigation and lateral navigation (LNAV) approaches.

3.2.2

Barometric-aided Fault Detection and Exclusion (FDE). If the equipment uses barometric-aiding to enhance FDE availability, then the equipment must meet the requirements in RTCA/DO-316, Appendix G.

4 - Marking

4.1 - General

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

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-2C70b
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: LIFERAFTS (REVERSIBLE AND NONREVERSIBLE)

1 - Applicability

This ETSO gives the requirements which liferafts that are manufactured on or after the date of this ETSO, must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General
Applicable procedures are detailed in CS-ETSO Subpart A.

2.2- Specific
None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the appendix 1 to this ETSO.

Additions:

(i) Retro-reflective materials shall be fitted around the canopy of the liferaft. The material shall be sufficiently wide and long to give a minimum area of 0.15m2 (250in2) and be spaced at suitable intervals (approximately 0.8m (30in) from centre to centre) at a suitable height above the waterline, doorways included, if suitable. Retro-reflective materials shall also be fitted to the underside of the floor, cross-shaped in the centre. The dimension of the cross shall be half the diameter of the liferaft and a similar cross shall be applied to the top of the canopy. 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.

3.1.2 - 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

In addition, weight and rated and overload capacities of the liferaft must be shown also. The weight of the liferaft includes any accessories required in this ETSO.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

Federal Test Method Standard No. 191A may be obtained (or purchased) from the General Services Administration, Business Service Center, Region 3, 7th and D Streets, S.W., Washington, D.C. 20407.

The Specification 3AA (49 CFR 178.37) or Specification 3HT (49 CFR 178.44) can be obtained from the USA Department of Transportation. (www.dot.gov)

Technical Specification for Retro Reflective Material in accordance with IMO Resolutions can be obtained from the US Coast Guard. (www.uscg.mil)

ETSO-2C70b
Appendix 1
Date: 05.07.2012

APPENDIX 1. STANDARD FOR LIFERAFTS (REVERSIBLE AND NONREVERSIBLE)

1. Purpose. This standard provides the minimum performance standards for liferafts.

2. Scope. This standard covers the following types of liferafts:

TYPE I For use in any aircraft.

TYPE II For use in any aircraft except for large aeroplanes (CS-25) and large rotorcraft (CS-29).

3. Material and Workmanship.

3.1 Nonmetallic Materials.

3.1.1 The finished device must be clean and free from any defects that might affect its function.

3.1.2 Coated fabrics and other items, such as webbing, subject to deterioration must have been manufactured not more than 18 months prior to the date of delivery of the finished product.

3.1.3 The materials must not support fungus growth.

3.1.4 Coated fabrics - General. Coated fabrics, including seams, subject to deterioration used in the manufacture of the devices must possess at least 90 percent of their original physical properties after these fabrics have been subjected to the accelerated ageing test specified in paragraph 6.1 of this standard. Material used in the construction of flotation chambers and decks must be capable of withstanding the detrimental effects of exposure to fuels, oils and hydraulic fluids.

3.1.4.1 Strength. Coated fabrics used for these applications must conform to the following minimum strengths after ageing:

Tensile Strength (Grab Test)
Warp 33 N/mm (190 pounds/inch)
Fill 33 N/mm (190 pounds/inch)

Tear Strength
Trapezoid Test: 2.3 x 2.3 N/mm minimum (13 x 13 pounds/inch); or
Tongue Test: 2.3 x 2.3 N/mm minimum (13 x 13 pounds/inch)

3.1.4.2 Adhesion. In addition to the requirements of 3.1.4.1, coated fabrics must meet the following minimum strengths after ageing:

Ply Adhesion -
0.9 N/mm width at 21 ± 1°C at a pull of 50 to 65 mm/minute

(5 pounds/inch width at 70 ± 2 degrees F at a pull of 2.0 to 2.5 inches/minute)

Coat Adhesion -
0.9 N/mm width at 21 ± 1°C at a pull of 50 to 65 mm/minute
(5 pounds/inch width at 70 ± 2 degrees F at 2.0 to 2.5 inches/minute)

3.1.4.3 Permeability. For coated fabrics used in the manufacture of inflation chambers, the maximum permeability to helium (Permeability Test Method) may not exceed 10 liters per square meter in 24 hours at 25°C (77 degrees F), or its equivalent using hydrogen. The permeameter must be calibrated for the gas used. In lieu of this permeability test, an alternate test may be used provided the alternate test has been approved by the Agency.

3.1.5 Seam Strength and Adhesives. Cemented or heat sealable seams used in the manufacture of the device must meet the following minimum strength requirements:

Shear Strength (Seam Shear Test Method) –
30.6 N/mm width at 24°C (175 pounds/inch width at 75 degrees F);
7.0 N/mm width at 60°C (40 pounds/inch width at 140 degrees F)

Peel Strength (Peel Test Method) -
0.9 N/mm width at 21°C (5 pounds/inch width at 70 degrees F)

3.1.6 Seam Tape. If tape is used for seam reinforcement or abrasion protection of seams or both, the tape must have minimum breaking strength (Grab Test Method) of 7 N/mm width (40 pounds/inch width) in both the warp and fill directions. When applied to the seam area, the adhesion strength characteristics must meet the seam strength requirements in paragraph 3.1.5.

3.1.7 Canopy. Fabrics used for this purpose must be waterproof and resistant to sun penetration, and must not affect the potability of collected water, and must meet the following minimum requirements in the applicable tests prescribed in paragraph 6.1 of this standard, except that in lieu of meeting the tensile strength requirements, a fabricated canopy may be demonstrated to withstand 65 km/h (35-knot) winds and 96 km/h (52-knot) gusts:

Tensile Strength (Grab Test)
Warp 13 N/mm (75 pounds/inch)
Fill 13 N/mm (75 pounds/inch)

Tear Strength
Trapezoid Test: 0.7 x 0.7 N/mm (4 x 4 pounds/inch); or
Tongue Test: 0.7 x 0.7 N/mm (4 x 4 pounds/inch)

Coat Adhesion of Coated Fabrics
0.6 N/mm width at 21 ± 1°C at a separation rate of 50 to 65 mm/minute

(3.5 pounds/inch width at 70 ± 2 degrees F at a separation rate of 2.0 to 2.5 inches/minute)

3.1.8 Flammability. The device (including carrying case or stowage container) must be constructed of materials which meet CS 25.853, as follows:

Type I rafts must meet CS 25 Appendix F Part 1 a(1)(ii)

Type II rafts must meet CS 25 Appendix F Part 1 a(1)(v)

3.2 Metallic Parts. All metallic parts must be made of corrosion-resistant material or must be suitably protected against corrosion.

3.3 Protection. All inflation chambers and load carrying fabrics must be protected in such a manner that nonfabric parts do not cause chafing or abrasion of the material in either the packed or the inflated condition.

4. Design and Construction.

4.1 Capacity. The rated and overload capacities of a life raft must be based on not less than the following usable sitting areas on the deck of the life raft:

Rated Capacity 0.33 m2/person (3.6 feet2/person)

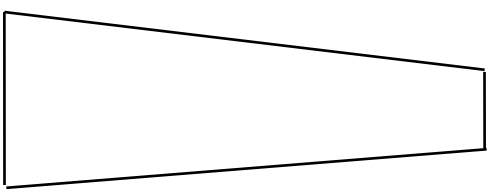
Overload Capacity 0.22 m2/person (2.4 feet2/person)

4.1.1 Capacity, Alternate Rating Methods. In lieu of the rated capacity as determined by paragraph 4.1 of this standard, one of the following methods may be used:

4.1.1.1 The rated capacity of a Type I or Type II liferaft may be determined by the number of occupant seating spaces which can be accommodated within the occupiable area exclusive of the perimeter structure (such as buoyancy tubes) without overlapping of the occupant seating spaces and with the occupant seating spaces located to provide each occupant with a back support of not less than 200mm (8 inches) high. The occupant seating spaces may not be less than the following size:

1000mm (39.4 inches)

BACK ALONG THIS SIDE. 373 mm (14.7 inches)



183 mm (7.2 inches) SUPPORT

4.1.1.2 The rated capacity of a Type I or Type II liferaft may be determined on the basis of a controlled pool or fresh water demonstration which

includes conditions prescribed under paragraph 6.2.3 of this standard and the following:

4.1.1.2.1 The sitting area on the liferaft deck may not be less than 0.28 m2 (3 square feet) per person.

4.1.1.2.2 The liferaft must have a back support for each occupant of not less than 373mm (14.7 inches) wide and 200 mm (8 inches) high.

4.1.1.2.3 At least 30 percent but no more than 50 percent of the participants must be female.

4.1.1.2.4 Except as provided below, all participants must select their sitting space without outside placement assistance. Instructions, either identified on the raft or announced prior to the demonstration, may be used informing that each participant should have a back support. A raft commander, acting in the capacity of a crewmember, may direct occupant seating to the extent necessary to achieve reasonable weight distribution within the raft.

4.1.1.2.5 All participants must not have practiced, rehearsed, or have had the demonstration procedures described to them within the past 6 months.

4.2 Buoyancy. An average occupant weight of not less than 77 kg (170 pounds) must be used in all applicable calculations and tests specified herein. In tests, ballast in the form of sand bags or equivalent may be used to achieve the 77 kg (170 pound) average, provided the appropriate weight distribution within the raft is maintained.

4.2.1 Type I Liferaft. Buoyancy must be provided by two independent buoyancy tubes each of which, including the raft floor, must be capable of supporting the rated and overload capacities in fresh water if the other tube is deflated. The liferaft loaded to its rated capacity must have a freeboard of at least 300 mm (12 inches) with both buoyancy tubes at minimum operating pressure. The liferaft loaded to its rated capacity with the critical tube deflated and the remaining tube at minimum operating pressure must have a freeboard of at least 150 mm (6 inches). The liferaft loaded to its overload capacity with the critical tube deflated must have a measurable freeboard.

4.2.2 Type II Liferaft. When single tube construction is used to provide the buoyancy, internal bulkheads must divide the flotation tube into at least two separate chambers such that the liferaft will be capable of supporting the rated number of occupants out of fresh water in the event that one chamber is deflated. The complete liferaft loaded to its rated capacity must have a freeboard of at least 150 mm (6 inches).

4.3 Inflation. The inflation system must be arranged so that failure of one inflatable chamber or manifold will not result in loss of gas from the other chambers. The inflation equipment must be located so as not to interfere with boarding operation. Components of the inflation system must meet the USA Department of Transportation Specification 3AA (49 CFR 178.37) or Specification 3HT (49 CFR 178.44) in effect May 30, 1976, as applicable, or an equivalent approved by the Agency. The inflation system must be constructed to minimize leakage due to back pressure after inflation. If an air aspirator system is used, the system must be constructed either to prevent the ingestion of foreign objects or to prevent failure or malfunction as a result of ingestion of small foreign objects. For Type I liferafts, there must be an independent inflation source for each primary flotation tube, except that there may be a single inflation source for all flotation tubes if data substantiating the reliability of the single inflation source is approved by the Agency.

4.4 Liferaft Canopy. A canopy must be packed with or attached to the raft. The erected canopy must be capable of withstanding 65 km/h (35-knot winds) and 96 km/h (52-knot) gusts in open water. The canopy must provide adequate headroom and must have provision for openings 180 degrees apart. Means must be provided to make the openings weathertight. If the canopy is not integral with the raft, it must be capable of being erected by occupants following conspicuously posted, simple instructions. It must be capable of being erected by one occupant of an otherwise empty raft and by occupants of a raft filled to rated capacity. For a reversible raft, attachment provisions must be installed to permit the canopy to be installed on either side of the raft.

4.5 Capsize Resistance. There must be water pockets or other means to provide capsize resistance for an empty or lightly loaded raft.

4.6 Boarding Aids. For Type I liferafts, boarding aids must be provided at two opposing positions on the raft. One boarding aid is sufficient for a Type II liferaft. Boarding aids must permit unassisted entry from the water into the unoccupied raft and must not at any time impair either the rigidity or the inflation characteristics of the raft. Puncturing of inflatable boarding aids must not affect the buoyancy of the raft buoyancy chambers. Boarding handles and/or stirrups used in conjunction with the boarding aids must withstand a pull of 2200 N (500 pounds).

4.7 Righting Aids. Means must be provided to right a nonreversible liferaft if it inflates in an inverted position. The means provided for righting must be such that they may be used by one person in the water.

4.8 Lifeline. A nonrotting lifeline of contrasting color and at least 9.5 mm (3/8-inch) diameter or 19mm (3/4-inch) width must encircle the liferaft on the outside periphery so that it can be easily grasped by persons in the water. The lifeline and its attachments must be capable of withstanding a minimum load of 2200 N (500 pounds) and must not interfere with the liferaft inflation.

4.9 Grasp Line. A grasp line, meeting the size and strength requirements for the lifeline, must be provided with sufficient slack for use by liferaft occupants to steady themselves when seated on the liferaft deck with their backs to the main flotation tube(s).

4.10 Color. The color of the liferaft's surfaces, including the canopy surface, visible from the air must be an International Orange-Yellow or an equivalent high visibility color.

4.11 Placards. Suitable placarding must be provided in contrasting colors in waterproof paint which is not detrimental to the fabric, that denotes use and location of the inflation systems, raft equipment, boarding aids, and righting aids. For reversible rafts, placement of the placarding must take into account usage of either side of the raft. The letters used for such placarding must be at least 50 mm (2 inches) high except that details and miscellaneous instructions may be of smaller lettering. Applicable placarding must take into account persons boarding or righting the raft from the water.

4.12 Lights. One or more survivor locator lights must be provided that are approved under ETSO-C85a. The lights must be automatically activated upon raft inflation in the water, and visible from any direction by persons in the water.

4.13 Raft Sea Performance. The raft must meet the seaworthiness requirements in 6.2.3.2 and must be capable with its equipment of withstanding a saltwater marine environment for a period of at least 15 days.

5. Liferaft Equipment. All lines must be suitably stowed and secured to prevent entanglement during launching/inflation of a liferaft.

5.1 Mooring Line. A nonrotting mooring line at least 6m (20 feet) in length must be attached at one end to the raft, with the remainder of the line held flaked to the carrying case (See 5.2). The mooring line must be capable of keeping the raft, loaded to maximum rated capacity, attached to a floating aircraft, and not endanger the raft or cause the raft to spill occupants if the aircraft sinks. The line may be equipped with a mechanical release linkage. The breaking strength of the line must be at least 2200 N (500 pounds), or 40 times the rated capacity of the raft, whichever is greater, but need not exceed 4450 N (1,000 pounds).

5.2 Liferaft Launching Equipment. A parachute ripcord grip and retaining pocket must form the primary inflation control. The ripcord grip or the attached static mooring line must be provided with means for attachment to the aircraft. If the ripcord grip is designed to attach to the aircraft, its strength may not be less than that of the static mooring line. The position of the ripcord grip must be standardized. When facing the release end of the carrying case, the center line of the ripcord grip retaining pocket must lie at 45 degrees in the right upper quadrant of the end section. The outermost extremity of the ripcord grip may not extend beyond the outer margin of the carrying case. The line attached to the ripcord grip must serve both to retain the liferaft and to actuate the gas release(s). The tension required to withdraw the static mooring line and to actuate the gas release mechanism(s) must be between 90 N and 135 N (20 and 30 pounds). The strength of the gas release mechanism(s), its fittings, and its attachments may not be less than 445 N (100 pounds).

5.3 Sea Anchor. A sea anchor, or anchors, or other equivalent means must be provided to maintain the raft, with rated capacity and canopy installed, on a substantially constant

heading relative to the wind and have the ability to reduce the drift to 4 km/h (2 knots) in 31 to 50 km/h (17 to 27-knot) winds. Unless analysis and/or test data substantiating the adequacy of a lower breaking strength is approved by the Agency, the line securing a sea anchor to the raft must have a breaking strength of 2200 N (500 pounds) or 40 pounds time the rated capacity of the raft, whichever is greater. The attachment of the line to the raft must be capable of withstanding a load of 1.5 times the line-rated strength without damaging the raft. The line must be at least 7.6 m (25 feet) in length and must be protected to prevent it from being cut inadvertently by raft occupants.

5.4 Heaving-Trailing Line. At least one floating heaving-trailing line not less than 23 m (75 feet) in length for Type I rafts and not less than 10.6 m (35 feet) in length for Type II rafts, and at least 1100 N (250 pounds) strength, must be located on the main flotation tube near the sea anchor attachment. The attach point of the line must withstand a pull of not less than 1.5 times the line rated strength without damage to the raft. A heaving-trailing line must be accessible in any inflated position of a reversible liferaft.

5.5 Emergency Inflation. Means readily accessible to occupants of the raft, and having a displacement of at least 0.5 litres (32 cubic inches) per full stroke, must be provided to manually inflate and maintain chambers at minimum operating pressure. Manual inflation valves, with a nonreturn opening adequate for the size and capacity of the inflation means, must be located to permit inflation of all chambers. The location must take into consideration occupancy of each side of reversible raft. The inflation means and valves must have provisions to prevent inadvertent removal and loss when either stowed or in use.

5.6 Accessory Case Tiedowns. Provisions must be made for tiedowns to hold any accessory case. Each accessory case tiedown must withstand a pull of 1100 N (250 pounds).

5.7 Carrying Case. A carrying case which meets the flammability requirement of this standard and which properly fits the packed liferaft must be provided. Carrying case materials must be of a highly visible color, be fungus proof, and be resistant to aircraft fuels and other fluids. The carrying case must provide chafe protection to the liferaft. The carrying case must be provided with easily distinguishable handles so that it may be carried by one person, carried by two persons in tandem, or dragged by either end; none of these carrying operations must tend to pull the carrying case open. Each handle must be easily grasped and its strength must be at least four time the total weight of the liferaft and case. Conventional zippers may not be employed for closure. Location of and instructions for use of the inflation handle must be clearly identified and marked on the carrying case surface.

5.8 Knife. A hook type knife secured by a retaining line must be sheathed and attached to the raft adjacent to the point of mooring line attachment.

6 Tests.

6.1 Material Tests. The material tests required in paragraph 3.0 of this standard must be determined in accordance with the following test method or other approved equivalent methods:

Test Method

Tests Required	Federal Test Method Standard No. l91A dated July 20, 1978	Notes
Accelerated Age	Method 5850	Per Note (1)
Tensile Strength (Grab Test)	Method 5100	
Tear Strength(Trapezoid Test)	Method 5136 (4)	
Tear Strength (Tongue Test)	Method 5134	
	(Alternate to Trapezoid Test See 3.1.4.1)	
Ply Adhesion	Method 5960	
Coat Adhesion	Method 5970	
Permeability	Method 5460 (4)	
Seam Shear Strength		Per Note (2)
Seam Peel Strength	Method 5960	Per Note (3)

NOTES:

(1) Samples for the accelerated aging tests must be exposed to a temperature of 70 ± 3°C (158 ± 5 degrees Fahrenheit) for not less than 168 hours. After exposure, the samples must be allowed to cool to 21 ± 1°C (70 ± 2 degrees Fahrenheit) for neither less than 16 hours nor more than 96 hours before determining their physical properties in accordance with 3.1 of this standard.

(2) Each sample shall consist of two strips 50 mm (2 inches) maximum width by 127 mm (5 inches) maximum length bonded together with an overlap 19 mm (3/4 inches) maximum. The free ends must be placed in the testing machine described in Method 5100 and separated at a rate of 305 ± 13 mm/min (12 ± 0.5 inches per minute). The average value of two samples must be reported. Samples may be multilayered as required to provide adequate strength to ensure against premature material failure.

(3) Separation rate must be 50 to 65 mm/minute (2.0 to 2.5 inches per minute).

(4) Federal Test Method Standard No. 191 in effect December 31, 1968.

6.2 Liferaft Tests.

6.2.1 Pressure Retention. Under static conditions and when inflated and stabilized at the nominal operating pressure, the pressure in each inflatable chamber must not fall below the minimum operating pressure in less than 24 hours. The minimum operating pressure is the pressure required to meet the minimum design buoyancy requirements of paragraph 4.2 of this standard.

6.2.2 Overpressure Tests.

6.2.2.1 The device must be shown by test to withstand a pressure at least 1.5 times the maximum operating pressure for at least 5 minutes without sustaining damage.

6.2.2.2 At least one specimen of the inflatable device model must be shown by test to withstand a pressure at least 2 times the maximum operating pressure without failure. Devices so tested must be clearly identified.

6.2.3 Functional Tests. Each liferaft model must pass the following tests:

6.2.3.1 Water Tests. In either a controlled pool or fresh water, the liferaft capacity and buoyancy must be demonstrated as follows:

6.2.3.1.1 Both rated and overload capacities established in accordance with the requirements of paragraph 4.1 of this standard must be demonstrated with inflation tubes at minimum operating pressure and with the critical buoyancy chamber deflated. The resultant freeboard in each case must meet the requirements of paragraph 4.2 of this standard.

6.2.3.1.2 Persons used in the demonstration must have an average weight of not less than 77 kg (170 pounds). Ballast in the form of sand bags or equivalent may be used to achieve proper loading provided the appropriate weight distribution within the raft is maintained.

6.2.3.1.3 Persons used in the demonstration must wear life preservers with at least one chamber inflated.

6.2.3.1.4 The required liferaft equipment, including one emergency locator transmitter or a weight simulating a transmitter, must be aboard the liferaft.

6.2.3.1.5 It must be demonstrated that the raft is self-righting, or can be righted by one person in water, or while inverted can be boarded and provide flotation for the normal rated capacity.

6.2.3.1.6 It must be demonstrated that the boarding aids are adequate for the purpose intended and that it is possible for an adult wearing an inflated life preserver to board the raft unassisted.

6.2.3.2 Sea Trials. The liferaft must be demonstrated by tests or analysis, or a combination of both, to be seaworthy in an open sea condition of 31 to 50 km/h (17 to 27-knot) winds and waves of 1.8 m to 3 m (6 to 10 feet). In tests, ballast in the form of sand bags or equivalent may be used to achieve proper loading provided the appropriate weight distribution within the raft is maintained. If analysis is used, the analysis must be approved by the Agency. For this seaworthiness demonstration, the following apply:

6.2.3.2.1 The liferaft must be deployed to simulate deployment from an aircraft under the most adverse wind direction and wave condition. If the liferaft is an aspirated inflated type, it must be demonstrated that water ingested during inflation will not cause the raft to fail to meet the requirement for buoyancy under rated capacity in 4.2.

6.2.3.2.2 All required equipment must be aboard and the proper functioning of each item of equipment must be demonstrated.

6.2.3.2.3 The canopy must be erected for a sufficient time to assess its resistance to tearing and the protection it affords. The method of erection must be shown to be accomplished by one occupant of an otherwise empty raft, and by occupants of a raft filled to rated capacity.

6.2.3.2.4 The stability of the raft must be demonstrated when occupied at normal rated capacity and at 50 percent rated capacity.

6.2.3.3 Liferaft Drop Test. A complete liferaft package must be dropped or thrown from a height of 1.5 m (5 feet) onto a hard surface floor after which it must be inflated and meet the pressure retention requirements of paragraph 6.2.1 of this standard.

6.2.3.4 Portability Test. If the liferaft is to be manually deployed, it must be demonstrated that the complete liferaft package can be moved from a typical stowage installation by no more that two persons and then deployed at another suitable exit.

6.2.3.5 Carrying Case. It must be demonstrated at least 10 times that the carrying case will open satisfactorily and cause no delay in the deployment and inflation of the liferaft.

6.2.3.6 Gas Cylinder Releases. It must be demonstrated that pulling the ripcord grip from any position will actuate the primary gas release(s).

6.2.5 Temperature Exposure and Inflation. The manufacturer shall determine the minimum temperature at which the complete liferaft assembly with its inflation bottles, will be "rounded out" (i.e., attain its design shape and approximate dimension) so that the liferaft will be able to receive and to support the first

occupant within one minute after the start of inflation. Thereafter, the rate of inflation must progress in such a manner and rate as to ensure a serviceable and rigid liferaft for boarding by the remainder of the occupants. Similarly, a maximum environmental temperature to which the liferaft assembly may be exposed and still remain in a seaworthy condition upon inflation must be determined. The temperature limitations must be submitted to the Agency and liferaft purchaser in accordance with the data requirements of this ETSO.

6.2.5.1 Test Procedure. The packed liferaft assembly with its inflation bottles installed must be exposed to each of the above temperatures for not less than 24 hours and must be inflated within 5 minutes after removal from such temperatures. The liferaft must be allowed to return to a temperature of approximately 21 ± 3°C (70 ± 5 degrees Fahrenheit) before being deflated, repacked, and subjected to a second exposure. After the above tests have been completed, the liferaft must be able to pass tests required by paragraphs 6.2.1 and 6.2.2 of this standard.

ETSO-2C197
Date: 05.07.2012

European Aviation Safety Agency

European Technical Standard Order

Subject: Information Collection and Monitoring Systems

1 - Applicability

This ETSO gives the requirements which Information Collection and Monitoring Systems that record cockpit audio, aircraft data, airborne images, or data link communications and that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in the EUROCAE ED-155, Minimum Operational Performance Specification for Lightweight Flight Recording Systems, dated July 2009.

All ICMS must meet the requirements in ED-155 Chapters 2-1, 2-2, 2-3 and 2-4 of Section 2. All deployable ICMS must also meet the requirements in ED-155 Chapters 3-1, 3-2, 3-3 and 3-4 of Section 3. Additionally, each Type of ICMS must meet the requirements of ED-155 listed in the table below.

ICMS Type	Your design must also meet the following requirements in ED-155	Your design does not need to meet the following requirements in ED-155
I	Part I, Cockpit Audio Recording System	I-2.1.7 and I-6
II	Part II, Aircraft Data Recording System	II-2.1.7, II-2.1.9, II-2.1.12, and II-6

III	Part III, Airborne Image Recording System	III-2.2 and III-6
IV	Part IV, Data-link Recording System	IV-2.1.6, IV-2.1.11, and IV-6

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 - The height (a), width (b), and depth (c) of the crash enclosure must each be 4 cm (1.5 inches) or greater.

3.2.2 - 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 minor failure condition. Loss of the function defined in paragraph 3.1.1 of this ETSO has been determined to be a minor failure condition.

Note: The failure classification is driven by the accident investigation need.

4 - Marking

4.1 - General

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

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.