NOTICE OF PROPOSED AMENDMENT (NPA) No 08/2005
DRAFT DECISION OF THE EXECUTIVE DIRECTOR,

AMENDING
DECISION NO 2003/10/RM OF THE EXECUTIVE DIRECTOR,

of 24 October 2003, ON

Certification Specifications, Including Airworthiness Codes And Acceptable Means Of Compliance, For European Technical Standard Orders (CS-ETSO)

Offshore safety and survivability equipment.

TABLE OF CONTENTS.

Explanatory Note

I. General

1. The purpose of this Notice of Proposed Amendment (NPA) is to envisage amending Decision N° 2003/10/RM of the Executive Director of the Agency of 24 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for European Technical Standard Orders (CS-ETSO) This NPA introduces new ETSO specifications for several offshore and survivability equipment. The scope of this rulemaking activity is outlined in ToR CS-ETSO/003. and is described in more detail below.

2. The Agency is directly involved in the rule-shaping process. It assists the Commission in its executive tasks by preparing draft regulations, and amendments thereof, for the implementation of the Basic Regulation[1] which are adopted as "Opinions" (Article 14.1). The Agency also adopts Certification Specifications, including Airworthiness Codes and Acceptable Means of Compliance and Guidance Material to be used in the certification process (Article 14.2(a) and (b)).

3. This rulemaking activity is included in the Agency's rulemaking programme for 2005. It implements the rulemaking task ETSO.003 Offshore safety and survivability equipment.

4. The text of this NPA is based on the JAA NPA TSO-9 which was developed by the JAA. It was adapted to the EASA regulatory context by the Agency. It is now submitted for consultation of all interested parties in accordance with Article 43 of the Basic Regulation and Articles 5(3) of the EASA rulemaking procedure[2].

[1] Regulation (EC) No 1592/2002. OJ L 240, 7.9.2002, p.1.

[2] Decision of the Management Board concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material ("rulemaking procedure"), EASA MB/7/03, 27.6.2003.

II. Consultation

5. To achieve optimal consultation, the Agency is publishing the draft decision on its internet site. Because the content of this NPA was already the subject of a full worldwide consultation through JAA NPA TSO-9, the transitional arrangements of article 15 of the EASA rulemaking procedure apply. They allow for a shorter consultation period of six weeks instead of the standard three months and also exempt from the requirement to produce a full Regulatory Impact Assessment.
Comments on this proposal may be forwarded *(preferably by e-mail)*, using the attached comment form, to:

By e-mail: **NPA@easa.eu.int**

By Fax: **+49(221) 89990 5508**

By correspondence: Process Support Unit
Rulemaking Directorate
EASA
Ref: NPA 08-2005
Postfach 10 12 53
D-50452 Köln
Germany

Comments should be received by the Agency **before 27-07-2005**. If received after this deadline they might not be treated. Comments may not be considered if the form provided for this purpose is not used.

III. Comment response document

6. All comments received will be responded to and incorporated in a Comment Response Document (CRD). This may contain a list of all persons and/or organisations that have provided comments. The CRD will be widely available ultimately before the Agency adopts its final decision.

IV. Content of the draft decision

7. The JAA NPA-TSO-9 was published by the JAA Headquarters in March 2003 and proposed the introduction of a number of JTSOs. After review of the comments a final draft was created by the Equipment Steering Group.

   Since in the meantime the European Aviation Safety Agency (EASA) became in charge of the rulemaking process, the proposed JTSOs have been transferred in the ETSO format.

   The following ETSO are introduced in Subpart B of CS-ETSO:

   Index 1
   ETSO-C13f: Life preservers
   This a new ETSO based on FAA TSO-C13f dated 24 September 1992.

   Index 2
   ETSO-2C70a: Life rafts
   This a new ETSO based on FAA TSO-C70a dated 13 April 1984, and included in index 2 because of an additional requirement to include reflective tape.
   The use of references to FAA regulations has been replaced by reference to EASA regulations.

   ETSO-2C502: Helicopter crew and passenger integrated immersion suits
   This a new ETSO based on the Draft JTSO-2C502 "Helicopter crew and passenger integrated immersion suits for operations to or from helidecks located in a hostile sea area**"** sponsored by the Helicopter Offshore Safety and Survivability Working Group (HOSS).
   Operational restrictions in the Draft JTSO-2C502 imposed by references to JAR-OPS 3 have been deleted since the ETSO should only reflect the technical standard for equipment.

   Regarding thermal protection requirements the following change has been introduced. You are especially invited to comment on this change.

   The original § 11.1 of the Draft JTSO-2C502 stated:

   > "The sealed integrated suit including the head and hand coverings, shall be so constructed that, when worn in conjunction with recommended clothing, shall provide insulation as required by JAR-OPS 3.827."

   However, JAR-OPS 3.827 requires use of survival suits if the sea temperature will be less than plus 10°C or the estimated rescue time exceeds the calculated survival time.

   The only immersion suit related values evolve from IEM JAR-OPS 3.827 Calculating Survival Times. These factors are Water exclusion (covered by §12 of this ETSO) and Insulation.

   Insulation is now covered by the modified § 11.1 "Thermal protection" of ETSO 2C502 which has been changed in such a way that the applicant for this ETSO should provide insulation value of the immersion suit. This is an equipment specification, in contradiction

to the insulation requirement as required by JAR-OPS 3.827 which is both an operational and equipment related specification.
The user of the immersion suit is then able to show compliance with the required survival time.

ETSO-2C503: Helicopter crew and passenger immersion suits
This a new ETSO based on the Draft JTSO-2C503 "Helicopter crew and passenger immersion suits for operations to or from helidecks located in a hostile sea area", sponsored by the HOSS. Operational restrictions in the Draft JTSO-2C503 imposed by references to JAR-OPS 3 have been deleted since the ETSO should only reflect the technical standard for equipment.
§ 9.1 "Thermal protection" of ETSO-2C503 has been changed for the same reason as described for §11.1 of ETSO-2C502.

ETSO-2C504: Helicopter constant-wear lifejackets
This a new ETSO based on the Draft JTSO-2C504 "Helicopter constant-wear lifejackets for operations to or from helidecks located in a hostile sea area", sponsored by the HOSS. Operational restrictions in the Draft JTSO-2C504 imposed by references to JAR-OPS 3 have been deleted since the ETSO should only reflect the technical standard for equipment.

ETSO-2C505: Helicopter liferafts
This a new ETSO based on the Draft JTSO-2C505 sponsored by the HOSS. Operational restrictions in the Draft JTSO-2C505 imposed by references to JAR-OPS 3 have been deleted since the ETSO should only reflect the technical standard for equipment.

9. In addition to the changes initiated by JAA NPA-TSO-9 the following is added with this NPA.

SUBPART B
SUBPART B – LIST OF ETSOs (INDEX 1 AND INDEX 2)

2 INDEX 2
In subpart B "List of ETSOs" index 2, §2.3 is added for clarification of the method used for updates of ETSO in index 2. The methodology followed for updating index 2 is identical to the method described for index 1 in § 1.4.

B. DRAFT DECISION

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

1. ~~Text to be deleted is shown with a line through it.~~
2. New text to be inserted is highlighted with grey shading.
3. New paragraph or parts are not highlighted with grey shading, but are accompanied by the following box text:

Insert new paragraph / part *(Include N° and title)*, ore replace existing paragraph/ part

4. ….
   in front of or following the reflected amendment indicates that remaining text is unchanged
   ....

I Draft Decision CS-ETSO

SUBPART B
SUBPART B LIST OF ETSOs (INDEX 1 AND INDEX 2)

2 INDEX 2

….

2.3 Index 2 will be updated from time to time, to reflect the latest edition of an ETSO, for example ETSO–2C11b to ETSO–2C11c. However, this does not mean that previous editions cannot still be used; it merely means that for new applications it would be the general rule to certificate to the latest edition. Exceptions to this rule would be subject to negotiation with the Agency.

….

SUBPART B
INDEX 1

Insert the following new ETSO based on FAA TSO in the index of index 1

ETSO-C13f Life preservers

INDEX 2

Insert the following new ETSOs in the index of index 2

ETSO-2C70a Life rafts (reversible and non-reversible)
ETSO-2C502 Helicopter crew and passenger integrated immersion suits.
ETSO-2C503 Helicopter crew and passenger immersion suits.
ETSO-2C504 Helicopter constant-wear lifejackets.
ETSO-2C505 Helicopter life rafts

INDEX 1

Insert the following ETSO to CS-ETSO index 1

ETSO-C13f
Date: xx.xx.xx

European Aviation Safety Agency

European Technical Standard Order

Subject: LIFE PRESERVERS

1 - Applicability

This ETSO gives the requirements which life preservers 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.

3.1.2 - Environmental Standard

None.

3.2 - Specific

None.

4 - Marking

4.1 - General

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

4.2 - Specific

As given in Appendix 1.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

APPENDIX 1. FEDERAL AVIATION ADMINISTRATION STANDARD FOR LIFE PRESERVERS

1. Purpose. This standard provides the minimum performance standards for life preservers.

2. Scope. This standard covers inflatable (Type I) and noninflatable (Type II) life preservers. Both Type I and Type II life preservers are divided into the following four categories: "Adult," "Adult-Child," "Child," and "Infant-Small Child."

3. Materials. The materials used must be of a quality which experience and/or tests have demonstrated to be suitable for use in life preservers.

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 or requalified per paragraph 5.1 Material Tests of this standard.

3.1.3 The materials must not support fungal growth.

3.1.4 Coated fabrics, including seams, subject to deterioration used in the manufacture of the devices must retain at least 90 percent of their original physical properties after these fabrics have been subjected to accelerated ageing test specified in paragraph 5.1 Material Tests of this standard.

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 37 N/mm (210 pounds/inch)
Fill 32 N/mm (180 pounds/inch)

Tear Strength
1.8 x 1.8 N/mm (10 x 10 pounds/inch) (Tongue Test) or
1.8 x 1.4 N/mm (10 x 8 pounds/inch) (Trapezoid Test)

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

Coat Adhesion
1.8 N/mm width at 21 ± 3°C at a separation rate of 50 to 65 mm/minute
(10 pounds/inch width at 70 ± 5 degrees F at a separation rate of 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 may not exceed 5 liters/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 as an equivalent to this permeability test by the manager of the FAA ACO to which this TSO data is to be submitted, as required in Paragraph (c), Data Requirements.

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.

3.1.5.1 Cemented Seams. Seams using adhesive on coated fabrics must be sealed with tape having a minimum width of 30 mm (1 3/16 inches). Devices manufactured with cemented seams must meet the following minimum strength requirements:

Seam Shear Strength (Grab Test)
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)
1.8 N/mm width at 21°C (10 pounds/inch width at 70 degrees F)

3.1.5.2 Heat Sealed Seams. The application of tape over heat sealed seams is optional. Devices manufactured with heat sealed seams used in the manufacture of the device must meet the following minimum strength requirements:

Seam Strength (Grab Test)
7.9 N/mm width at 21°C (45 pounds/inch width at 70 degrees F)
5.3 N/mm width at 60°C (30 pounds/inch width at 140 degrees F)

3.1.6 Seam Tape. If tape is used, the fabric used for the seam tape must have a minimum breaking strength (Grab Test) of not less than 8.8 N/mm (50 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 Materials Other Than Coated Fabrics.

3.1.7.1 Webbing. Webbing used to attach the life preserver to the wearer must have a minimum tensile strength of 1023 N (230 pounds).

3.1.7.2 Thread. Thread used in the life preserver must be Size E nylon or equivalent with a minimum tensile strength of 38 N (8.5 pounds).

3.1.8 Flammability. The device (including packaging) must be constructed of materials which are in compliance with FAR section 25.853(a) [Appendix F, Part I (a)(1)(iv)] in effect on July 20, 1990.

3.1.9 Molded Nonmetallic Fittings. Molded nonmetallic fittings must retain their physical characteristics when subjected to temperatures of –51 to +71°C (-60 to +160 degrees F).

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

4. Detail Requirements.

4.1 Design and Construction.

4.1.1 Reversibility. The life preserver must perform its intended function when reversed, unless the design of the preserver precludes the probability of improper donning.

4.1.2 Compartmentation, Type I Life Preserver. An inflatable life preserver may have one or more separate gas tight flotation chambers. Each separate flotation chamber must meet the inflation requirements of paragraph 4.1.4.

4.1.3 Protection Against Abrasion and Chafing, Type I Life Preserver. The flotation chambers must be protected in such a manner that metallic or nonmetallic parts do not cause chafing or abrasion of the material in either the packed or inflated condition.

4.1.4 Inflation, Type I Life Preserver.

4.1.4.1 Oral Inflation. A means must be provided by which the wearer, excluding child and infant-small child wearers who would require adult assistance, without previous instruction, may inflate each flotation chamber by blowing into a mouthpiece. The mouthpiece for oral inflation must be readily available to the wearer without interfering with the wearer's face or body. For infant-small child and child life preservers, the oral inflation means must be readily available to assisting persons.

4.1.4.2 Oral Inflation Valve. The opening pressure of the oral inflation valve, with no back pressure applied to the valve, may not exceed 3 kN/m^2 (0.44 pounds per square inch gage (psig)). The oral inflation valve may not leak when back pressure throughout the range from 0 – 69 kN/m^2 (0 psig through 10 psig) is applied. The joint between the oral inflation valve and the flotation chamber may not fail when a 445 N (100-pound) tensile load is applied for at least 3 seconds outwardly from and perpendicular to the surface of the flotation chamber at the point of valve attachment. To support the flotation chamber fabric during load application, an adapter having an inside diameter at least 19 mm (3/4 inch) larger than the outside diameter of the valve at the point of attachment must be used.

4.1.4.3 Manual Mechanical Inflation. A means must be provided by which the wearer, or person assisting a child or infant-small child wearer who would require adult assistance, without previous instruction, may inflate each flotation chamber of the life preserver by manual operation.

4.1.4.3.1 Gas Reservoir. A reservoir containing a suitable compressed gas must be provided to inflate each flotation chamber of the life preserver. If

carbon dioxide (CO_2) cylinders are used, the standards of MIL-C-601G Amendment 1 dated August 31, 1972 or the equivalent are acceptable not withstanding any size or weight limitations.

4.1.4.3.2 Pull Cord Assembly. The mechanical inflation means must have a pull cord assembly for each gas reservoir. The pull cords must be identical in length, clearly visible, and extend between 38 to 76 mm (1 1/2 to 3 inches) below the edge of the life preserver. The end of each pull cord assembly must be attached to a red pull knob or tab having rounded edges.

4.1.5 Deflation, Type I Life Preserver. A means by which the wearer or the person assisting a child or infant-small child wearer who would require adult assistance, may quickly deflate each flotation chamber must be provided. Use of the deflation means may not preclude subsequent re-inflation of the flotation chamber by either oral or mechanical inflation means. Inadvertent deflation of the flotation chamber must be precluded. In particular, inadvertent deflation from movement of a child or infant-small child and deliberate deflation by a child or small child must be precluded.

4.1.6 Functional Temperature Range. The life preserver must be cable of satisfactory inflation after exposure to the temperature range from –40 to +60°C (-40 to +140 degrees F) for a minimum period of five minutes.

4.1.7 Overpressure Protection. Type I Life Preserver. A flotation chamber, when orally inflated to a operating pressure not less than 7 kN/m^2 (l psig), must not burst upon subsequent discharge of the mechanical inflation system.

4.1.8 Buoyancy. The life preserver must provide a buoyant force not less than that shown in Table I, Minimum Buoyant Force. The buoyant force of the life preserver is equal to the weight of the volume of fresh water displaced by the life preserver when totally submerged. Buoyancy must be demonstrated using the standard gas reservoirs described in 4.1.4.3.1 without further oral inflation, starting from a vacuumed flat unit.

TABLE I, MINIMUM BUOYANT FORCE

Category of preserver	Weight of wearer (kg / pounds)	Minimum buoyant force in fresh water at 21 ± 3°C (70 ± 5 degrees F) (N / pounds)
Adult	Above 41kg (90 pounds)	156N (35 pounds)
Adult - Child Combination	16kg (35 pounds) and above	156N (35 pounds)
Child	16kg (35 pounds) to	111N (25 pounds)
Infant - Small Child	Under 16kg (35 pounds)	89N (20 pounds)

4.1.9 Flotation Attitude.

4.1.9.1 Adult, Adult-Child, and Child Life Preservers. The life preserver must, within 5 seconds, right the wearer, who is in the water in a face-down attitude. The life preserver must provide lateral and rear support to the wearer's head such that the mouth and nose of a completely relaxed wearer is held clear of the water line with the trunk of the body inclined backward from the vertical position at an angle of 30 degrees minimum.

4.l.9.2 Infant-Small Child Life Preservers. The life preserver must prevent contact of the wearer's upper torso (i.e., from the waist up) with the water. There must be a means to confine the wearer in the proper position for utilization of the life preserver and prevent the wearer from releasing the confining means. With the wearer in the most adverse condition of weight and position attainable when the confining means are properly used, there must be no tendency of the life preserver to capsize or become unstable, take on water, or allow contact of the upper torso with water. Means must be provided to prevent the entrapment of rain or choppy water.

4.1.10 Tether Infant-Small Child Category Life Preserver. A tether not less than 2.83 m (72 inches) in length, must be attached to the infant-small child life preserver. The attach point must be located such that the flotation attitude specified in paragraph 4.1.9.2 is maintained when the line is under sufficient tension to remove the slack as when held by an adult in the water. With the life preserver on the infant-small child, there must be provisions for stowing or securing the tether in a manner that it remains readily accessible and will not dangle loosely so as to pose a hazard during an emergency evacuation.

4.1.11 Life Preserver Retention and Donning Characteristics. The means of retaining the life preserver on the wearer, excluding infant-small child wearers, must require that the wearer secure no more than one attachment and make no more than one adjustment for fit. It must be demonstrated, in accordance with the donning tests specified in paragraph 5.9, that at least 75% of the total number of test subjects and at least 60% of the test subjects in each age group specified in paragraph 5.9 can don the life preserver within 25 seconds unassisted, starting with the life preserver in its storage package. Percentage calculations may not be increased when rounded off. It must be demonstrated that an adult unassisted can install an appropriate life preserver on another adult or a child within 30 seconds. It also must be demonstrated, in accordance with the donning tests specified in paragraph 5.9, that 60% of the adult test subjects can install an infant-small child dummy in an infant-small child life preserver within 90 seconds.

4.1.12 Comfort, Fit, and Adaptability. The design of the life preserver must be such that:

4.1.12.1 After donning, inadvertent release by the wearer is not likely.

4.1.12.2 Adjustment may be made by the wearer, or the person assisting a child or infant-small child wearer, while in the water.

4.1.12.3 Unobstructed view by the wearer, excluding infant-small child wearers, is allowed in both the forward and sideward directions. An observation window must be provided for viewing of an infant-small child wearer by the assisting person if the life preserver is enclosed.

4.1.12.4 Blood circulation of the wearer is not restricted.

4.1.12.5 The wearer's breathing is not restricted.

4.1.13 Survivor Locator Light. The life preserver must be equipped with a survivor locator light which meets the requirements of TSO-C85. The light must be

automatically activated. This can be accomplished upon contact with water, upon inflation or by any other means not requiring additional user action.

4.1.14 Life Preserver Package. A package must be provided for the life preserver for storage of the life preserver on board the aircraft. The means of opening the package must be simple and obvious, and must be accomplished in one operation without the use of any tool or excessive physical force.

4.1.15 Color. The color of the life preserver must be an approved international orange-yellow or similar high visibility color. The color of the flight crew life preservers may be an approved red-orange or similar high visibility contrasting color.

4.2 Marking. The following information and instructions must be shown:

4.2.1 Pictorial Presentation. The proper donning procedure and other operational instructions on the use of the life preserver must be simple, obvious, and presented primarily pictorially with minimum use of words.

4.2.1.1 Orientation of Instructions. Instructions pertaining to operations which would normally be accomplished after the life preserver has been donned must be oriented so that the wearer, or the person assisting a child or an infant-small child wearer, may read them while in the water.

4.2.1.2 Readability in Emergency Lighting Conditions. Size, position, and contrast of instructions must be such that the pictorial descriptions and written instructions are easily distinguishable and readable in low level illumination. The markings and instructions must be readable by a person having 20/20 vision at a minimum viewing distance of 610 mm (24 inches) with illumination no greater than 0.54 lx (0.05 foot-candle). For written instructions, an acceptable means of complying with this requirement is by use of bold lettering approximately 5.6 mm (0.22 inch) high with a stroke width of 1.2 mm (0.047 inch).

4.2.3 Date of manufacture of fabric (month and year).

4.2.4 Size category: “Adult,” “Adult-Child,” “Child,” or “Infant-Small Child,” as appropriate and weight limitation of each category.

4.2.5 The life preserver package must clearly indicate that it contains a life preserver, the size category and the weight limitation of the life preserver. The package also must be marked with the life preserver TSO and part number or the information must be visible through the package.

5. Tests.

5.1 Material Tests. The material properties specified in paragraph 3. of this standard must be conducted in accordance with the following test methods or other approved equivalent methods:

Accelerated Age	Method 5850(9)(1)
Tensile Strength (Grab Test)	Method 5100(9)(7)
Tear Strength (Trapezoid Test)	Method 5136(9)(5)
Tear Strength (Tongue Test)	Method 5134(9) (Alternate to Trapezoid Test see 3.1.4.1)
Ply Adhesion	Method 5960(9)(3)
Coat Adhesion	Method 5970(9)(8)
Permeability	Method 5460 (5)(6)
Seam Shear Strength	(9)(2)
Seam Peel Strength	Method 5960(9)(3)
Flammability	FAR Part 25, Appendix F, Part I(b)(5), Horizontal Burn Rate (4)

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

(2) Samples must consist of two strips of material 50mm (2 inches) maximum width by 127 mm (5 inches) maximum length. Strips must be bonded or heat sealed together along the width with an overlap of 19 mm (3/4 inch) maximum. Heat sealed seams must have a 3.2 ± 0.8 mm (1/8 ± 1/32) inch width minimum heat seal bead with the heat seal 6.3 mm (1/4 inch) from each end. The free ends must be placed in the testing machine described in FTMS 191A, Method 5100 and separated at a rate of 305 ± 13 mm/minute (12 ± 0.5 inches/minute). The average value of two samples must be reported. Samples may be multilayered to ensure against premature material failure. Samples may be gripped across the full 50 mm (two inches) of width.

(3) Separation rate must be 50 to 65 mm/minute (2.0 to 2.5 inches/minute). Sample shall be 25 mm (one inch).

(4) The material must meet the flammability requirements of FAR section 25.853(a) [Appendix F, Part I (a) (l) (iv)] in effect July 20, 1990

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

(6) ASTM Method D1434-82, Procedure V, approved July 30, 1982, is an acceptable alternate method.

(7) Use of pneumatic grips, for holding test samples, is an acceptable alternate to the mechanical grips described in Method 5100.

(8) The sample shall be prepared using the adhesive and construction methods used to manufacture the life preserver. Separation rate must be 50 to 65 mm/minute (2.0 to 2.5 inches/minute).

(9) Federal Test Method Standard No. 191A dated July 20, 1978.

5.2 Leakage Test, Type I Life Preserver. The life preserver may not lose more than 3.5 kN/m^2 (1/2 psig) per flotation chamber after each flotation chamber has been inflated to not less than 13.8 kN/m^2 (2 psig) and hung in a rack for at least 12 hours.

5.3 Overpressure Test, Type I Life Preserver. Each flotation chamber of the life preserver must withstand an inflation pressure of not less than 69 kN/m^2 (10 psig) for at least 5 minutes.

5.4 Submersion Test. The life preserver must be submerged in fresh water at 22 ± 3°C (72 ± 5 degrees F) so that no part of it is less than 610 mm (24 inches) below the surface. The buoyancy of the preserver must not be less than the value specified in paragraph 4.1.8 of this standard. Submersion must continue for at least 8 hours, except that the test may be discontinued in less than 8 hours if buoyancy measurements taken at four successive 30-minute intervals show that the buoyancy of the preserver has stabilized at a value at least equal to the value specified in paragraph 4.1.8 of this standard.

5.5 Salt Spray Test.

5.5.1 Salt Spray Test Procedure. All metal parts must be placed in an atomized salt solution spray for a period of not less than 100 hours. The solution must be atomized in the chamber at a rate of 10 litres per cubic metre of chamber volume (3 quarts per 10 cubic feet of chamber volume) per each 24-hour period. The temperature in the chamber must be maintained at 35 ± 1°C (95 ± 2 degrees F) throughout the test.

5.5.2 Salt Spray Solution. The salt used must be sodium chloride or equivalent containing not more than 0.2 percent of impurities on the dry weight basis. The spray solution must be prepared by dissolving 20 ± 2 parts by weight of salt in 80 ± 2 parts by weight of water containing not more than 200 parts per million of solids. The spray solution must be kept from exceeding this level of solids throughout the test. The spray solution must be maintained at a specific gravity of from 1.126 to 1.157 and a pH between 6.5 and 7.2 when measured at 35 ± 1°C (95 ± 2 degrees F).

5.6 Inflator Test, Type I Life Preserver.

5.6.1 Operating Force. The force necessary to operate the mechanical inflation means may not exceed 67 N (15 pounds) when applied through the pull cord.

5.6.2 Pull Cord Strength. The pull cord may not fail or separate from the mechanical inflation means when a minimum tension load of 267 N (60 pounds) is applied to the cord for at least 3 seconds. If the pull cord is designed to separate from the mechanical

inflation means when operated, the pull cord shall be capable of withstanding a minimum tension load of 133 N (30 pounds) for 3 seconds without failure.

5.6.3 Proof Pressure. The mechanical inflation means must withstand a hydrostatic pressure of not less than 10.3 MN/m^2 (1,500 psig) without deformation or leakage. The mechanical inflation means may not leak when subjected to 13.8 kN/m^2 (2 psig) air pressure and may not lose more than 3.4 kN/m^2 (0.5 psig) when subjected to 276 kN/m^2 (40 psig) air pressure. Each test pressure must be applied for not less than 30 seconds.

5.6.4 Mechanical Inflation Valve. The mechanical inflation valve must allow a minimum flow of 4 liters of air per minute at 276 kN/m^2 (40 psig) inlet pressure. The valve may not leak when subjected to a vacuum of 3 kN/m^2 (12 inches of water) applied so as to reduce the seating spring pressure and with atmospheric pressure on the opposite side. The joint between the valve and the flotation chamber may not fail when a 1112 N (250-pound) load is applied, for at least 3 seconds, outwardly from and perpendicular to the surface of the flotation chamber at the point of valve attachment. To secure the joint during application of the load, an adapter having an inside diameter at least 19 mm (3/4 inch) larger than the outside diameter of the valve at the point of attachment must be used.

5.7 Jump Test.

5.7.1 Adult, Adult-Child or Child. An inflated adult, adult-child, or child Type I or Type II life preserver, excluding infant-small child life preservers, must remain attached and not cause injury to the wearer when the wearer jumps into the water at any attitude from a height above the water of at least 1.5 m (5 feet). There must not be any damage to the preserver following the jump. Minor skin chafing is not considered an injury in this respect.

5.7.2 Infant-Small Child. An infant-small child life preserver must remain inflated and undamaged and the infant-small child dummy, specified in paragraph 5.9.1, must remain properly secured when an adult holding the dummy, with the preserver installed on the dummy, jumps into the water from a height above the water of at least 1.5 m (5 feet). The adult must be wearing an inflated life preserver for the test.

5.8 Fire Protection Test. Materials used in the life preserver and the storage package for the life preserver must be tested by the horizontal burn rate test prescribed in paragraph 5.1 of this standard.

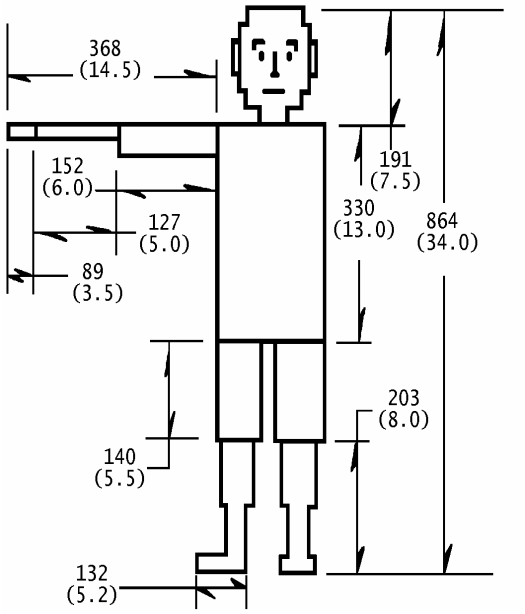
5.9 Donning Test.

5.9.1 Test Subjects. There must be a minimum of 25 test subjects. There must be a minimum of five test subjects in each of the following age groups: 20-29 years; 30-39 years; 40-49 years; 50-59 years; and 60-69 years. Not more than 60% of the test subjects in any age group may be of the same sex. The number of test subjects in any age group may not exceed 30% of the total number of test subjects. Infant-small child donning tests must be performed by a minimum of 5 adult test subjects of both sexes between the ages of 20-40. Tests must be performed using an articulating infant-small child dummy, as described below. Adult test subjects must have no prior experience in donning tests of life preservers.

5.9.2 Infant-Small Child Test Dummy. The dummy to be used in the donning tests must have the basic physical characteristics for a composite 50th percentile unisex child of 24 months with a height of 864 mm (34 inches) and weighing 12.3 kg (27.2 pounds). The dummy shall have articulating joints and, if used for water testing, must not absorb water. The anthropometric values for the dummy are presented in Table II. These data are considered valid for the stated chronological age plus or minus three months and are representative of U.S. children, as reported by the University of Michigan from 1975-1985.

TABLE II, ANTHROPOMETRIC CHARACTERISTICS OF TWO YEAR OLD CHILD

Body Segment	Length (mm (in))	Weight (gm)	Volume (%)
Top of Head (ref.) -			
Top of Shoulder/			
Upper Arm Pivot -	191 (7.5)*	1, 591.6	12.9
Elbow Pivot -	152 (6.0)	876.0 (2)	7.1
Wrist Pivot -	127 (5.0)	530.5 (2)	4.3
Finger Tip -	89 (3.5)	123.5 (2)	1.0
Top of Shoulder/			
Upper Arm Pivot -			
Crotch/ Thigh Pivot	330 (13.0)*	5, 564.4	45.1
Knee Pivot -	140 (5.5)*	579.9 (2)	4.7
Bottom of Foot	203 (8.0)*	481.1 (2)	3.9
Total	*864 (34.0) Height	12,338.0 (27.2 lb)	100.0
Shoulder Breadth	234 (9.2)		
Chest Breadth	168 (6.6)		
Chest Depth	117 (4.6)		
Waist Breadth	150 (5.9)		
Waist Depth, seated	150 (5.9)		
Hip Breadth	185 (7.3)		
Foot	132 (5.2)		
Circumferences			
Head	488 (19.2)		
Neck	234 (9.2)		
Chest	488 (19.2)		
Waist	460 (18.1)		
Hip	470 (18.5)		
Mid-Thigh	251 (9.9)		
Calf	196 (7.7)		
Ankle	135 (5.3)		
Upper Arm	150 (5.9)		
Forearm	147 (5.8)		
Wrist	130 (5.1)		



5.9.3 Test Arrangement. Subjects must be seated in actual or simulated air carrier coach class seating with a seat row in front of the subjects creating a seat row pitch not exceeding 31 inches. Each subject must have the seat belt fastened. Subjects may be tested singularly or in groups seated side by side. Infant-small child life preserver donning tests must be performed with adults in adjacent seats who must not assist or hamper the adult performing the donning test. Subjects must receive no donning information other than a typical preflight briefing and donning demonstration on the use of life preservers.

5.9.4 Test Procedure. The donning test must be begun with the life preserver contained in the storage package required by paragraph 4.1.14, and the package held in the test subject's hand. Separate timing must be kept for each test subject. Timing starts on signal when the test subject has both hands on the packaged life preserver and stops when the life preserver is properly donned, secured, and adjusted for fit. During the test, the test subject may release the seat belt and rise from the seat but may not move to any extent from the area immediately in front of the seat.

INDEX 2

Insert the following ETSOs to CS-ETSO index 2

Date : xx.xx.xx

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 0.15m^2 (250in^2) 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

As given in Appendix 1.

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)

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(i)
Type II rafts must meet CS 25 Appendix F Part 1 a(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 m^2/person (3.6 $feet^2$/person)

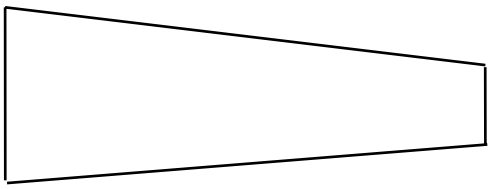
Overload Capacity 0.22 m^2/person (2.4 $feet^2$/person)

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 SUPPORT ALONG THIS SIDE. 373 mm (14.7 inches)



183 mm (7.2 inches)

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 m^2 (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:

Tests Required	Test Method 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.

European Aviation Safety Agency

European Technical Standard Order

Subject: HELICOPTER CREW AND PASSENGER INTEGRATED IMMERSION SUITS

1 - Applicability

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

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2- Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in Appendix 1 to this ETSO.

3.1.2 - Environmental Standard

None.

3.2 - Specific

None.

4 - Marking

4.1 - General

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

4.2 - Specific

As given in Appendix 1.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

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

APPENDIX 1. EASA STANDARD FOR HELICOPTER CREW AND PASSENGER INTEGRATED IMMERSION SUITS.

1. Purpose

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

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

2. Scope

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

2.2 The integrated suit shall comprise at least the following:-
a) A dry coverall
b) Hand and head coverings

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

3. Donning

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

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

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

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

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

4. Freedom of movement

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

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

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

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

4.5 The integrated suit, when correctly donned and adjusted, shall not prevent the wearer from having an acceptable field of vision. This shall be demonstrated by testing to paragraph 3.7 of Appendix 2.

5. Comfort

5.1 The design of the integrated suit shall minimise any discomfort to the wearer so as to avoid jeopardising safety. Particular attention should be given to the level of thermal comfort afforded the wearer on long into-sun flights in summer.

6. Compatibility

6.1 The integrated suit shall be designed, and the materials used in its construction chosen, to have no features which would be likely to have any detrimental effect on the operation of any helicopter or its equipment. In particular any part of the suit which might pose a snagging hazard during flight, emergency egress or recovery, shall be suitably covered, protected or restrained. All materials used shall be compatible with materials used in the construction of approved liferafts.

6.2 Any attached equipment shall not compromise the basic survival function of the suit by causing puncturing, fretting or distortion of the material, or changes in its mechanical properties.

7. Materials

7.1 All materials used shall be to an acceptable specification which shows the material to be suitable for its intended application. The materials used shall meet the requirements of paragraph 4.14 of EN ISO 15027-1:2002.

7.2 The integrated suit and its equipment shall be so designed and constructed as to remain serviceable for the period between scheduled inspections. The choice of materials used shall be such that, when stowed in accordance with the relevant instructions, neither the suit nor its attached equipment shall be liable to become unserviceable through material deterioration or chafing, or from any other cause. Due consideration shall be taken of the possible temperature variations during stowage which may range between -30°C and +65°C (-22°F and +149°F). This shall be demonstrated by testing to paragraph 3.9 of EN ISO 15027-3:2002. The normal operating temperatures for the immersion suit shall be -5°C to +40°C (23°F to 104°F).

7.3 The outer fabric used in the construction of the suit shall be of low flammability. It shall not have a burn rate greater than 100mm/min (4in/min) when tested in accordance with the horizontal test of CS-25 Book 1 Appendix F Part 1 (b)(5)or other approved equivalent method.

8. Evacuation

8.1 A person wearing the uninflated suit shall be able to exit the helicopter through any Emergency Exit or Push-out Window down to the minimum acceptable size of 430mm x 355mm (17in x 14in). This action shall be possible in air or under water. This shall be demonstrated by testing to paragraph 3.3 of Appendix 2.

9. Buoyancy and floating position

9.1 The trapped buoyancy due to the suit and recommended clothing, with the suit fully vented, shall be no more than 150N (33.7lbf) when measured in accordance with paragraph 3.11.7.2 of EN ISO 15027-3:2002.

9.2 The buoyancy of the inflated suit shall be sufficient to ensure that a person wearing clothing and the integrated suit shall have a floating position such that the angle between the body and the horizontal is not greater than 60°. This shall be demonstrated by testing to paragraph 3.6 of Appendix 2.

9.3 The mouth must be at least 120mm (4.7in) above the waterline (mouth freeboard) and the nose freeboard shall not be less than the mouth freeboard, even when the wearer is incapacitated. This shall be demonstrated by testing to paragraph 3.5 of Appendix 2.

9.4 The inflated suit shall allow the wearer to turn from a face down position into a stable face up floating position within 5 seconds. This shall be demonstrated by testing to paragraph 3.2 of Appendix 2.

10. Breathing protection

10.1 A sprayhood shall be fitted.

10.1.1 The wearer shall be able to deploy the sprayhood within 20 seconds when wearing the inflated suit in or out of the water.

10.1.2 The sprayhood will not be considered suitable if it can in any way retain water when deployed.

10.1.3 The angles of vision shall not be unduly restricted, and the ability to swim and manoeuvre shall not be impaired with the sprayhood deployed.

10.1.4 The suit's light source shall not be masked by the presence of the sprayhood.

10.1.5 The materials used in the sprayhood's construction shall be compatible with those of the suit and shall in no way be able to cause damage to the buoyancy chambers or fabric of the suit or liferaft.

10.1.6 The sprayhood, whether stowed or deployed, should not cause inconvenience during winching or other rescue and recovery operations.

10.1.7 Means shall be provided to ensure that the level of carbon dioxide in the deployed sprayhood is within safe limits. This shall be demonstrated by testing to paragraph 6.10 of EN 396:1993 or equivalent.

11. Thermal protection

11.1 The insulation values of the sealed integrated suit including the head and hand coverings, when worn in conjunction with recommended clothing, shall be provided. Testing shall be carried out in accordance with paragraph 3.8 of EN ISO 15027-3:2002 for a Class B suit system.

12. Water ingress

12.1 The integrated suit shall be so constructed that not more than 200g (7oz) of water shall leak into the suit when measured in accordance with paragraph 3.7 of EN ISO 15027-3:2002.

13. Conspicuity and location aids

13.1 Passenger Integrated Immersion Suits
To facilitate search and rescue operations, those parts of the suit which will be visible when in the water shall be of a highly conspicuous colour and comply with paragraph 4.5 of EN ISO 15027-1:2002.

13.2 Crew Integrated Immersion Suits
Where possible integrated suits for crew use shall meet the requirements of 13.1. However, the choice of suit colour may vary to minimise the risk of the suit reflecting on surfaces within the flight deck.

13.3 A passive light system of retro-reflective material shall be provided. This shall conform to the technical specification detailed in IMO SOLAS 83, Chapter III, Resolution A.658(16), Annex 2 or equivalent. A minimum area of 300cm^2 (46in^2) shall be provided, distributed in accordance with paragraph 4.12 of EN ISO 15027-1:2002.

13.4 The integrated suit shall be fitted with a light that meets the requirements of paragraph 4.2 of EN394:1994 Type B. An additional flashing light that flashes at a rate between 50 and 70 flashes per minute and has an effective luminous intensity of at least 0.75cd shall also be fitted. The location of the lights shall be such that maximum practical conspicuity is achieved when in the water with the suit inflated. The lights shall activate automatically and have a manually operated on/off switch.

13.5 A whistle shall be provided which complies with the requirements of paragraph 4.3 of EN394:1994 or equivalent.

14. Recoverability

14.1 The integrated suit must be fitted with a lifting becket which complies with the requirements of paragraph 4.15 of EN396:1993 or equivalent.

14.2 The inflated or uninflated suit shall not adversely affect recovery of the wearer by the use of a rescue strop with a circumference of 180cm (70in).

15. Group help

15.1 The integrated suit shall be equipped with a buddy line which complies with the requirements of paragraph 4.6 of EN394:1994 or equivalent.

16. Inflation system

The integrated suit must comply with this section unless it can, without additional inflation, meet the requirements of paragraphs 9.2 and 9.3 and maintain them for the duration of the test period of paragraph 17.2.

16.1 General

16.1.1 The integrated suit shall have two separate means of inflation. The primary means shall be a manually-initiated stored gas system together with a standby oral inflation system capable of repeated use. The required buoyancy shall be obtainable by either method.

16.1.2 A means of releasing the pressure in the suit is required and shall be of a type capable of repeated use. Protection shall be provided against inadvertent deflation.

16.1.3 After inflation by either method, it shall be possible to deflate the suit and then to reinflate it by using the standby system. The standby inflation system shall be readily accessible, simple and obvious in operation and it shall be impossible for any valve which may be used to be inadvertently left open. It shall be possible to "top up" the suit orally whilst in use and without loss of inflation pressure.

16.2 Stored Gas System

16.2.1 Location of the actuating means of this type of system shall be such that it can be operated by either hand, in or out of the water. The method of releasing the stored gas into the suit shall be obvious; however, suitable marking shall be provided to advise the user.

16.2.2 The amount of stored gas provided shall be capable of inflating the suit to achieve the correct buoyancy as specified in paragraph 9.3 within 5 seconds of actuation at +20°C (68°F).

16.2.3 Adequate protection shall be provided to guard against any inadvertent initiation of an inflation when the wearer is passing through an emergency exit or when the suit is dropped from a height of 1.5m (5 feet).

16.2.4 The force required to manually initiate inflation must be a minimum of 20N (4.5lbf) and a maximum of 120N (27lbf) when tested in accordance with paragraph 6.8.4 of EN396:1993 or equivalent.

16.3 Oral Inflation System

16.3.1 The oral inflation tube shall comply with the requirements of paragraph 4.5 of EN396:1993 or equivalent.

16.3.2 It shall be positioned such that it can readily be used in and out of the water. After use, the device shall return to a position such that it will not produce facial injuries during a jump into the water as specified in paragraph 3.1 of Appendix 2.

17. Testing

17.1 Strength Pressure Test
The integrated suit shall have proof and ultimate factors of not less than 3 and 5 respectively on the pressure at which it is designed to be inflated by the primary means, at a stabilised ambient temperature of +45°C (113°F), and in no case shall the proof and ultimate pressures be less than 15kPa (2lbf/in^2) and 25kPa (3.3lbf/in^2) respectively.

17.2 Buoyancy
The integrated suit shall retain buoyancy after use of the primary inflation system to such an extent that after a period of 12 hours the requirements of paragraphs 3.5 and 3.6 of Appendix 2 are still met.

17.3 Performance Tests
The performance of all integrated suits shall be tested in accordance with Appendix 2.

18. Inspection Testing and Repair

18.1 The procedure for inspecting, testing and repairing integrated suits shall be established by the manufacturer and shall be capable of ensuring that all suits satisfy the requirements of this specification throughout their service lives.
As part of the procedure, suits shall be inspected at intervals to ensure they are always ready for immediate and effective use in the water. Special attention shall be paid to seals and fasteners. Suits shall be required to be immediately removed from service for repair or replacement if damage or deterioration is discovered that may lead to the suit failing to satisfy a routine leak test when one is next carried out.

18.2 The procedures for servicing, inspection, repair and testing shall be described in the manufacturer's manual.

18.3 The frequency of servicing and inspections shall be agreed with the manufacturer holding design approval for the suit.

19. Marking

19.1 Each detachable part of the integrated suit assembly shall, where reasonably practicable, be marked with:-
(a) The manufacturer's approved inspection stamp.
(b) The part number.
(c) Date of manufacture or batch record.
(d) Serial number

19.2 In the case of passenger integrated suits, the suit shall be marked with:-
(a) Suit model designation
(b) The manufacturer's name and address
(c) Date of manufacture and Serial Number
(d) Date at which next scheduled service and overhaul are due
(e) Modification standard

19.3 In the case of crew integrated suits, the suit shall be marked with:-
(a) The name of the crew member to whom it has been allocated
(b) Rank of crew member marked externally, e.g. epaulettes.
(c) Suit model designation
(d) The manufacturer's name and address
(e) Date of manufacture and Serial Number
(f) Date at which next scheduled service and overhaul are due
(g) Modification standard

19.4 The charged inflation cylinder shall be marked in accordance with paragraph 8.2 of EN396:1993 or equivalent, and include its date of manufacture.

19.5 When marking is not practicable alternative means must be agreed.

APPENDIX 2. INTEGRATED IMMERSION SUIT SYSTEM PERFORMANCE TESTING

1. Purpose

1.1 These tests are to demonstrate satisfactory performance of the integrated immersion suit system.

2. Test conditions

2.1 The following tests shall be conducted in calm water. The water temperature shall be 25±2°C (77±4°F).

2.2 Test Subjects
The test subjects shall comply with the requirements of paragraph 3.3 of EN ISO 15027-3:2002.

2.3 Pass/fail criteria
All samples shall pass all objective tests to meet the requirements of ETSO-2C502 Integrated Immersion Suits. However, due to the high variability between subjects and the difficulty in assessing some subjective measures, it is permitted that an integrated immersion suit does not completely meet the requirements of the following subjective tests in a single example and in no more than in one test subject. In these circumstances, two other subjects within the same weight category and with the same sex should be subjected to the same test. If this additional test is still not clearly passed then the integrated immersion suit shall be deemed to have failed, whilst if it is clearly passed then it may be deemed to have passed the test overall.

3. Performance tests

3.1 Jump Test.
Each test subject shall perform a jump test in accordance with paragraph 3.11.6.1 of EN ISO 15027-3:2002.

3.2 Turning Test
Each test subject shall perform a turning test in accordance with paragraph 3.11.6.3 of EN ISO 15027-3:2002.

3.3 Escape Test Underwater
Each test subject shall be required to swim through an opening not greater than 430mm x 355mm (17in x 14in) (minimum acceptable size of helicopter escape window) positioned with the top of the opening at least 300mm (12in) below the surface of the water with the suit uninflated. At least one of the subjects for this test shall be required to have a shoulder width measurement of at least 500mm (19.7in).

3.4 Swim Test

Each test subject wearing the integrated suit and clothing shall swim on their back for 20 minutes. The hands and arms shall be kept in the water even if not being used for propulsion. Each test subject shall then board a liferaft fitted with boarding facilities, without undue effort and without assistance, with the suit sealed, inflated and the sprayhood deployed. The pool used shall be of sufficient size and depth to prevent the subject gaining assistance by "pushing off" from the side or bottom while performing this test.

3.5 Freeboard

Immediately following the swim test, the clearance of each test subject's face above the water shall be measured, with the subject behaving normally and when simulating unconsciousness. The clearance of the mouth (mouth freeboard) shall be a minimum of 120mm (4.7in) above the waterline in both cases. It shall be established that the nose freeboard is not less than the mouth freeboard.

3.6 Floating position

The angle of the test subject's body shall be measured by an appropriate method. The angle between the body and the horizontal shall be recorded and shall not be greater than 60°.

3.7 Field of vision

The wearer's field of vision shall not be unduly restricted when tested in accordance with paragraph 3.11.6.6 of EN ISO 15027-3:2002.

European Aviation Safety Agency

European Technical Standard Order

Subject: HELICOPTER CREW AND PASSENGER IMMERSION SUITS.

1 - Applicability

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

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2- Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in Appendix 1 to this ETSO.

3.1.2 - Environmental Standard

None.

3.2 - Specific

None.

4 - Marking

4.1 - General

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

4.2 - Specific

As given in Appendix 1.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

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

APPENDIX 1. EASA STANDARD FOR HELICOPTER CREW AND PASSENGER IMMERSION SUITS.

1. Purpose

1.1 This specification prescribes the minimum standard of design and performance for helicopter crew and passenger immersion suits that are designed to be used with an approved lifejacket.

2. Scope

2.1 This standard covers immersion suits that are designed to be used with an approved lifejacket for use on helicopters.

2.2 The immersion suit shall comprise at least the following:-
a) A dry coverall
b) Hand and head coverings

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

3. Donning

3.1 It is assumed for the purpose of this specification that the suit is donned prior to boarding the aircraft and is worn with an approved lifejacket.

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

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

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

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

4. Freedom of movement

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

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

4.3 The immersion suit, when correctly donned and adjusted, shall not prevent the wearer from having an acceptable field of vision. This shall be demonstrated by testing to paragraph 3.7 of Appendix 2.

4.4 The immersion suit when worn with the inflated lifejacket shall allow the wearer to turn from a face down position into a stable face up floating position within 5 seconds. This shall be demonstrated by testing to paragraph 3.2 of Appendix 2.

5. Comfort

5.1 The design of the immersion suit shall minimise any discomfort to the wearer so as to avoid jeopardising safety. Particular attention should be given to the level of thermal comfort afforded the wearer on long into-sun flights in summer.

6. Compatibility

6.1 Approval of an immersion suit to this specification shall take into account the compatibility between the suit and any approved lifejacket and sprayhood that is intended to be worn with it. The performance of the suit and lifejacket combination shall be tested in accordance with Appendix 2 of this specification.

6.2 The immersion suit shall be tested with each type of lifejacket that the suit is designed to be compatible with. If it is to be approved for use with more than one type of lifejacket, the performance testing of Appendix 2 shall be repeated with each additional type of lifejacket.

6.3 The immersion suit shall be designed, and the materials used in its construction chosen, to have no features which would be likely to have any detrimental effect on the operation of any helicopter or its equipment. In particular any part of the suit which might pose a snagging hazard during flight, emergency egress or recovery, shall be suitably covered, protected or restrained. All materials used shall be compatible with materials used in the construction of the appropriate approved lifejacket, sprayhood or liferaft.

6.4 Any attached equipment shall not compromise the basic survival function of the immersion suit by causing puncturing, fretting or distortion of the material, or changes in its mechanical properties.

7. Materials

7.1 All materials used shall be to an acceptable specification which shows the material to be suitable for its intended application. The materials used shall meet the requirements of paragraph 4.14 of EN ISO 15027-1:2002.

7.2 The immersion suit and its equipment shall be so designed and constructed as to remain serviceable for the period between scheduled inspections. The choice of materials used shall be such that, when stowed in accordance with the relevant instructions, neither the immersion suit nor its attached equipment shall be liable to become unserviceable through material deterioration or chafing, or from any other cause. Due consideration shall be taken of the possible temperature variations during stowage which may range between -30°C and +65°C (-22°F and +149°F). This shall be demonstrated by testing to paragraph 3.9 of EN ISO 15027-3:2002. The normal operating temperatures for the immersion suit shall be -5°C to +40°C (23°F to 104°F).

7.3 The outer fabric used in the construction of the suit shall be of low flammability. It shall not have a burn rate greater than 100mm/min (4in/min) when tested in accordance with the horizontal test of CS-25 Book 1 Appendix F Part 1 (b)(5)or other approved equivalent method.

8. Buoyancy

8.1 The trapped buoyancy due to the suit and recommended clothing, with the suit fully vented, shall be no more than 150N (33.7lbf) when measured in accordance with paragraph 3.11.7.2 of EN ISO 15027-3:2002.

9. Thermal protection

9.1 The insulation values of the sealed integrated suit including the head and hand coverings, when worn in conjunction with recommended clothing, shall be provided. Testing shall be carried out in accordance with paragraph 3.8 of EN ISO 15027-3:2002 for a Class B suit system.

10. Water ingress

10.1 The immersion suit shall be so constructed that not more than 200g (7oz) of water shall leak into the suit when measured in accordance with paragraph 3.7 of EN ISO 15027-3:2002.

11. Conspicuity

11.1 Passenger Immersion Suits
To facilitate search and rescue operations, those parts of the suit which will be visible when in the water shall be of a highly conspicuous colour and comply with paragraph 4.5 of EN ISO 15027-1:2002.

11.2 Crew Immersion Suits
Where possible immersion suits for crew use shall meet the requirements of 11.1. However, the choice of suit colour may vary to minimise the risk of the suit reflecting on surfaces within the flight deck.

11.3 A passive light system of retro-reflective material shall be provided. This shall conform to the technical specification detailed in IMO SOLAS 83, Chapter III, Resolution A.658(16), Annex 2 or equivalent. A minimum area of 300cm^2 (46in^2) shall be provided, distributed in accordance with paragraph 4.12 of EN ISO 15027-1:2002.

12. Inspection Testing and Repair

12.1 The procedure for inspecting, testing and repairing immersion suits shall be established by the manufacturer and shall be capable of ensuring that all suits satisfy the requirements of this specification throughout their service lives.
As part of the procedure, suits shall be inspected at intervals to ensure they are always ready for immediate and effective use in the water. Special attention shall be paid to seals and fasteners. Suits shall be required to be immediately removed from service for repair or replacement if damage or deterioration is discovered that may lead to the suit failing to satisfy a routine leak test when one is next carried out.

12.2 The procedures for servicing, inspection, repair and testing shall be described in the manufacturer's manual.

12.3 The frequency of servicing and inspections shall be agreed with the manufacturer holding design approval for the suit.

13. Marking

13.1 Each detachable part of the immersion suit assembly shall, where reasonably practicable, be marked with:-
(a) The manufacturer's approved inspection stamp.
(b) The part number.
(c) Date of manufacture or batch record.
(d) Serial number

13.2 In the case of passenger immersion suits, the immersion suit shall be marked with:-
(a) Suit model designation
(b) The manufacturer's name and address
(c) Date of manufacture and Serial Number
(d) Date at which next scheduled service and overhaul are due
(e) Modification standard

13.3 In the case of crew immersion suits, the immersion suit shall be marked with:-
(a) The name of the crew member to whom it has been allocated
(b) Rank of crew member marked externally, e.g. epaulettes.
(c) Suit model designation
(d) The manufacturer's name and address
(e) Date of manufacture and Serial Number
(f) Date at which next scheduled service and overhaul are due
(g) Modification standard

13.4 When marking is not practicable alternative means must be agreed.

APPENDIX 2. IMMERSION SUIT / LIFEJACKET SYSTEM PERFORMANCE TESTING

1. Purpose

1.1 These tests are to demonstrate satisfactory performance of the specified immersion suit/lifejacket combination which together make a unique safety system. They shall be carried out for every immersion suit/lifejacket combination for which approval is required to ensure compatibility for that combination.

2. Test conditions

2.1 The following tests shall be conducted in calm water. The water temperature shall be 25±2°C (77±4°F).

2.2 Test Subjects
The test subjects shall comply with the requirements of paragraph 3.3 of EN ISO 15027-3:2002.

2.3 Pass/fail criteria
All samples shall pass all objective tests for the entire system to meet the requirements of ETSO-2C503 Immersion Suits and ETSO-2C504 Lifejackets. However, due to the high variability between subjects and the difficulty in assessing some subjective measures, it is permitted that an immersion suit / lifejacket combination does not completely meet the requirements of the following subjective tests in a single example and in no more than in one test subject. In these circumstances, two other subjects within the same weight category and with the same sex, should be subjected to the same test. If this additional test is still not clearly passed then the immersion suit / lifejacket combination shall be deemed to have failed, whilst if it is clearly passed then both items may be deemed to have passed the test overall when used in the tested combination.

3. Performance tests

3.1 Jump Test.
Each test subject shall perform a jump test in accordance with paragraph 3.11.6.1 of EN ISO 15027-3:2002.

3.2 Turning Test
Each test subject shall perform a turning test in accordance with paragraph 3.11.6.3 of EN ISO 15027-3:2002.

3.3 Escape Test Underwater
Each test subject shall be required to swim through an opening not greater than 430mm x 355mm (17in x 14in) (minimum acceptable size of helicopter escape window) positioned with the top of the opening at least 300mm (12in) below the surface of the water wearing the uninflated lifejacket. At least one of the subjects for this test shall be required to have a shoulder width measurement of at least 500mm (19.7in).

3.4 Swim Test

Each test subject wearing the immersion suit, clothing and inflated lifejacket shall swim on their back for 20 minutes. The hands and arms shall be kept in the water even if not being used for propulsion. Each test subject shall then board a liferaft fitted with boarding facilities, without undue effort and without assistance, with the suit sealed, the lifejacket inflated and the sprayhood deployed. The pool used shall be of sufficient size and depth to prevent the subject gaining assistance by "pushing off" from the side or bottom while performing this test.

3.5 Freeboard

Immediately following the swim test, the clearance of each test subject's face above the water shall be measured, with the subject behaving normally and when simulating unconsciousness. The clearance of the mouth (mouth freeboard) shall be a minimum of 120mm (4.7in) above the waterline in both cases. It shall be established that the nose freeboard is not less than the mouth freeboard.

3.6 Floating position

The angle of the test subject's body shall be measured by an appropriate method. The angle between the body and the horizontal shall be recorded and shall not be greater than 60°.

3.7 Field of vision

The wearer's field of vision shall not be unduly restricted when tested in accordance with paragraph 3.11.6.6 of EN ISO 15027-3:2002.

European Aviation Safety Agency

European Technical Standard Order

Subject: HELICOPTER CONSTANT-WEAR LIFEJACKETS.

1 - Applicability

This ETSO gives the requirements which adult constant-wear lifejackets for use on helicopters that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2- Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in Appendix 1 to this ETSO.

3.1.2 - Environmental Standard

None.

3.2 - Specific

None.

4 - Marking

4.1 - General

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

4.2 - Specific

As given in Appendix 1.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

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

APPENDIX 1. EASA STANDARD FOR HELICOPTER CONSTANT-WEAR LIFEJACKETS.

1. Purpose

1.1 This specification prescribes the minimum standard of design and performance for helicopter constant-wear lifejackets.

2. Scope

2.1 This standard covers adult constant-wear lifejackets for use on helicopters. Such lifejackets may be designed to be worn with or without an approved immersion suit.

3. Donning

3.1 The correct method of donning the lifejacket shall be self-evident and means shall be provided to indicate that the lifejacket lobe(s) are correctly oriented. The lifejacket should be fully adjustable for all likely wearers whose significant body dimensions range from the 5^{th} percentile female to the 95^{th} percentile male, and adequate for most of the 5% at each extreme. A means of adjustment to make the lifejacket fit securely shall be provided. The wearer shall be able to make any re-adjustment without removing the lifejacket.

3.2 Subsequent to proper donning, inadvertent release or loosening of the lifejacket such that its flotation characteristics are unacceptably altered, shall be prevented.

3.3 Means shall be provided as necessary in the design of the lifejacket, whether it is worn with or without an approved immersion suit, to prevent it from riding up the body of the wearer.

4. Freedom of movement

4.1 The uninflated lifejacket shall allow the wearer to carry out all normal and emergency functions and movements necessary for the operation of a helicopter and its equipment.4.2 The wearing of the lifejacket inflated or uninflated shall not prevent the wearer from assisting others while in the water nor from assisting them to board a liferaft from the water.

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

5. Compatibility

5.1 Approval of a lifejacket and sprayhood to this specification shall take into account the compatibility between the lifejacket and any approved immersion suit that is intended to be worn with it. The performance of the lifejacket and immersion suit combination shall be tested in accordance with Appendix 2 of this specification.

5.2 Where a lifejacket is to be approved for use with an immersion suit(s) then it shall be tested with each type of immersion suit that the lifejacket is designed to be compatible with. If it is to be approved for use with more than one type of immersion suit, the performance testing of Appendix 2 shall be repeated with each additional type of immersion suit.

5.3 The lifejacket and its attached equipment, including the sprayhood, shall be designed and the materials used in their construction chosen to have no features which would be likely to have any detrimental effect on the operation of any helicopter or its equipment. In particular any part of the lifejacket which might pose a snagging hazard during flight, emergency egress or recovery, shall be suitably covered, protected or restrained. All materials used shall be compatible with materials used in the construction of any approved immersion suit, or liferaft.

5.4 Any other attached equipment shall be demonstrated as having no adverse effects on the operation, life and performance of the lifejacket.

6. Materials

6.1 All materials used shall be to an acceptable specification which shows the material to be suitable for its intended application. Textile and fabric materials and components shall pass the test requirements of paragraph 4.3 of EN396:1993 or equivalent. Metal components shall pass the test requirements of paragraph 4.4 of EN396:1993 or equivalent.

6.2 The lifejacket and its equipment shall be so designed and constructed as to remain serviceable for the period between scheduled inspections. The choice of materials used shall be such that, when stowed in accordance with the relevant instructions, neither the lifejacket nor its attached equipment shall be liable to become unserviceable through material deterioration or chafing, or from any other likely cause. Due consideration shall be taken of the possible temperature variations during stowage which may range between -30°C and +65°C (-22°F and +149°F). This shall be demonstrated by testing to paragraph 6.1 of EN396:1993 or equivalent. The normal operating temperatures for the lifejacket shall be -5°C to +40°C (23°F to 104°F).

6.3 The materials used for the lifejacket's outer cover and its means of retention on the wearer shall be of low flammability. These materials shall not have a burn rate greater than 100mm/min (4in/min) when tested in accordance with the horizontal test of CS-25 Book 1 Appendix F Part 1 (b)(5)or other approved equivalent method.

7. Evacuation

7.1 A person wearing the uninflated lifejacket shall be able to exit the helicopter through any Emergency Exit or Push-out Window down to the minimum acceptable size of 430mm x 355mm (17in x 14in). This action shall be possible in air or under water. This shall be demonstrated by testing to paragraph 3.3 of Appendix 2.

8. Buoyancy and floating position

8.1 The buoyancy of the inflated lifejacket shall be sufficient to ensure that a person wearing clothing and the inflated lifejacket shall have a floating position such that the angle between the body and the horizontal is not greater than 60°. This shall be demonstrated by testing to paragraph 3.6 of Appendix 2.

8.2 The mouth must be at least 120mm (4.7in) above the waterline (mouth freeboard) and the nose freeboard shall not be less than the mouth freeboard, even when the wearer is incapacitated. This shall be demonstrated by testing to paragraph 3.5 of Appendix 2.

8.3 The inflated lifejacket shall automatically turn an unconscious wearer from a face down position into the position required by paragraph 8.1 within 5 seconds. This shall be demonstrated by testing to paragraph 6.6.7 of EN 396:1993 or equivalent.

9. Breathing protection

9.1 The shape of the lifejacket shall not restrict breathing. When in the water the lifejacket shall not tend to channel water or spray into the wearer's face.

9.2 A sprayhood shall be fitted.

9.2.1 The wearer shall be able to deploy the sprayhood within 20 seconds when wearing the inflated lifejacket in or out of the water.

9.2.2 The sprayhood will not be considered suitable if it can in any way retain water when deployed.

9.2.3 The angles of vision shall not be unduly restricted, and the ability to swim and manoeuvre shall not be impaired by the lifejacket with the sprayhood deployed.

9.2.4 The lifejacket's light source shall not be masked by the presence of the sprayhood.

9.2.5 The materials used in the hood's construction shall be compatible with those of the lifejacket and shall in no way be able to cause damage to the buoyancy chambers or fabric of the lifejacket or liferaft.

9.2.6 The lifejacket and its sprayhood, whether stowed or deployed, should not cause inconvenience during winching or other rescue and recovery operations.

9.2.7 Means shall be provided to ensure that the level of carbon dioxide in the deployed sprayhood is within safe limits. This shall be demonstrated by testing to paragraph 6.10 of EN 396:1993 or equivalent.

10. Location aids

10.1 A passive light system of retro-reflective material shall be provided. This shall conform to the technical specification detailed in IMO SOLAS 83, Chapter III, Resolution A.658(16), Annex 2 or equivalent. A minimum area of 300cm^2 (46in^2) shall be provided. This material shall be placed on surfaces which are normally above the water when the lifejacket is in use.

10.2 Each lifejacket shall be fitted with a light that meets the requirements of paragraph 4.2 of EN394:1994 Type B. An additional flashing light that flashes at a rate between 50 and 70 flashes per minute and has an effective luminous intensity of at least 0.75cd shall also be fitted. The location of the lights shall be such that maximum practical conspicuity is achieved with the lifejacket worn in the normal manner when in the water. The lights shall activate automatically and have a manually operated on/off switch.

10.3 A whistle shall be provided which complies with the requirements of paragraph 4.3 of EN394:1994 or equivalent.

11. Recoverability

11.1 The lifejacket must be fitted with a lifting becket which complies with the requirements of paragraph 4.15 of EN396:1993 or equivalent.

11.2 The inflated or uninflated lifejacket shall not adversely affect recovery of the wearer by the use of a rescue strop with a circumference of 180cm (70in).

12. Group help

12.1 The lifejacket shall be equipped with a buddy line which complies with the requirements of paragraph 4.6 of EN394:1994 or equivalent.

13. Inflation system

13.1 General

13.1.1 The lifejacket shall have two separate means of inflation, the primary means being a manually-initiated stored gas system and a standby oral inflation system capable of repeated use. The required buoyancy shall be obtainable by either method.

13.1.2 A means of releasing the pressure in the lifejacket is required and shall be of a type capable of repeated use. Protection shall be provided against inadvertent deflation.

13.1.3 After inflation by either method, it shall be possible to deflate the lifejacket and then to reinflate it by using the standby system. The standby inflation system shall be readily accessible, simple and obvious in operation and it shall be impossible for any valve which may be used to be inadvertently left open. It shall be possible to "top up" the lifejacket orally whilst in use and without loss of inflation pressure.

13.2 Stored Gas System

13.2.1 Location of the actuating means of this type of system shall be such that it can be operated by either hand, in or out of the water. The method of releasing the stored gas into the lifejacket shall be obvious; however, suitable marking shall be provided to advise the user.

13.2.2 The amount of stored gas provided shall be capable of inflating the lifejacket to achieve the correct buoyancy as specified in paragraph 8.2 within 5 seconds of actuation at +20°C (68°F).

13.2.3 Adequate protection shall be provided to guard against any inadvertent initiation of an inflation when the wearer is passing through an emergency exit or when the lifejacket is dropped from a height of 1.5m (5 feet).

13.2.4 The force required to manually initiate inflation must be a minimum of 20N (4.5lbf) and a maximum of 120N (27lbf) when tested in accordance with paragraph 6.8.4 of EN396:1993 or equivalent.

13.3 Oral Inflation System

13.3.1 The oral inflation tube shall comply with the requirements of paragraph 4.5 of EN396:1993 or equivalent.

13.3.2 It shall be positioned such that it can readily be used in and out of the water. After use, the device shall return to a position such that it will not produce facial injuries during a jump into the water as specified in paragraph 3.1 of Appendix 2.

14. Testing

14.1 Strength Pressure Test
The lifejacket shall have proof and ultimate factors of not less than 3 and 5 respectively on the pressure at which it is designed to be inflated by the primary means, at a stabilised ambient temperature of +45°C (113°F), and in no case shall the proof and ultimate pressures be less than 15kPa (2lbf/in^2) and 25kPa (3.3lbf/in^2) respectively.

14.2 Buoyancy
The lifejacket shall retain buoyancy after use of the primary inflation system to such an extent that after a period of 12 hours the requirements of paragraphs 3.5 and 3.6 of Appendix 2 are still met.

14.3 Performance Tests
All lifejackets shall be tested in accordance with Appendix 2. For lifejackets not designed to be used with an immersion suit, the tests shall be carried out with the test subjects wearing only the stipulated clothing.

15. Inspection Testing and Repair

15.1 The procedure for inspecting, testing and repairing lifejackets shall be established by the manufacturer and shall be capable of ensuring that all lifejackets satisfy the requirements of this specification throughout their service lives.

15.2 The procedures for servicing, inspection, repair and testing shall be described in the manufacturer's manual.

15.3 The frequency of servicing and inspections shall be agreed with the manufacturer holding design approval for the lifejacket.

16. Markings

16.1 If lifejackets are designed or manufactured specifically for crew use or passenger use then they shall be marked accordingly.

16.2 Each detachable part of the lifejacket shall where practicable be marked with:-
- (a) The manufacturer's approved inspection stamp
- (b) The part number
- (c) Date of manufacture or batch record

N.B. Where marking is not practicable alternative means shall be agreed.

16.3 The lifejacket assembly shall be clearly marked with:-
- (a) The lifejacket model designation
- (b) The manufacturer's name and address
- (c) Date of manufacture
- (d) Serial number
- (e) Date at which next service and overhaul are due.

16.4 The charged inflation cylinder shall be marked in accordance with paragraph 8.2 of EN396:1993 or equivalent, and include its date of manufacture.

APPENDIX 2. IMMERSION SUIT / LIFEJACKET SYSTEM PERFORMANCE TESTING

1. Purpose

1.1 These tests are to demonstrate satisfactory performance of the specified immersion suit/lifejacket combination which together make a unique safety system. They shall be carried out for every immersion suit/lifejacket combination for which approval is required to ensure compatibility for that combination.

2. Test conditions

2.1 The following tests shall be conducted in calm water. The water temperature shall be 25±2°C (77±4°F).

2.2 Test Subjects
The test subjects shall comply with the requirements of paragraph 3.3 of EN ISO 15027-3:2002.

2.3 Pass/fail criteria
All samples shall pass all objective tests for the entire system to meet the requirements of ETSO-2C503 Immersion Suits and ETSO-2C504 Lifejackets. However, due to the high variability between subjects and the difficulty in assessing some subjective measures, it is permitted that an immersion suit / lifejacket combination does not completely meet the requirements of the following subjective tests in a single example and in no more than in one test subject. In these circumstances, two other subjects within the same weight category and with the same sex, should be subjected to the same test. If this additional test is still not clearly passed then the immersion suit / lifejacket combination shall be deemed to have failed, whilst if it is clearly passed then both items may be deemed to have passed the test overall when used in the tested combination.

3. Performance tests

3.1 Jump Test.
Each test subject shall perform a jump test in accordance with paragraph 3.11.6.1 of EN ISO 15027-3:2002.

3.2 Turning Test
Each test subject shall perform a turning test in accordance with paragraph 3.11.6.3 of EN ISO 15027-3:2002.

3.3 Escape Test Underwater
Each test subject shall be required to swim through an opening not greater than 430mm x 355mm (17in x 14in) (minimum acceptable size of helicopter escape window) positioned with the top of the opening at least 300mm (12in) below the surface of the water wearing the uninflated lifejacket. At least one of the subjects for this test shall be required to have a shoulder width measurement of at least 500mm (19.7in).

3.4 Swim Test

Each test subject wearing the immersion suit, clothing and inflated lifejacket shall swim on their back for 20 minutes. The hands and arms shall be kept in the water even if not being used for propulsion. Each test subject shall then board a liferaft fitted with boarding facilities, without undue effort and without assistance, with the suit sealed, the lifejacket inflated and the sprayhood deployed. The pool used shall be of sufficient size and depth to prevent the subject gaining assistance by "pushing off" from the side or bottom while performing this test.

3.5 Freeboard

Immediately following the swim test, the clearance of each test subject's face above the water shall be measured, with the subject behaving normally and when simulating unconsciousness. The clearance of the mouth (mouth freeboard) shall be a minimum of 120mm (4.7in) above the waterline in both cases. It shall be established that the nose freeboard is not less than the mouth freeboard.

3.6 Floating position

The angle of the test subject's body shall be measured by an appropriate method. The angle between the body and the horizontal shall be recorded and shall not be greater than 60°.

3.7 Field of vision

The wearer's field of vision shall not be unduly restricted when tested in accordance with paragraph 3.11.6.6 of EN ISO 15027-3:2002.

European Aviation Safety Agency

European Technical Standard Order

Subject: HELICOPTER LIFERAFTS.

1 - Applicability

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

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2- Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standards set forth in Appendix 1 to this ETSO.

3.1.2 - Environmental Standard

None.

3.2 - Specific

None.

4 - Marking

4.1 - General

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

4.2 - Specific

As given in Appendix 1.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

APPENDIX 1. EASA STANDARD FOR HELICOPTER LIFERAFTS.

1. Purpose

1.1 This standard provides the minimum performance standards for helicopter liferafts.

2. Scope

2.1 This standard covers liferafts required to be carried on helicopters.

3. General

3.1 Approval of a liferaft in accordance with this Specification shall take into account the valise or container, the liferaft itself, and any attached or stowed equipment. The liferaft and its associated equipment shall be seaworthy and designed to maximise occupant survivability in all operating conditions.

3.2 With the exception of its floor diaphragm, full inflation of the liferaft shall be achieved by the operation of a single device with the liferaft initially in any attitude. The operation to initiate the automatic inflation of the liferaft shall be within the capability of one person, either in or out of the water.

3.3 Secondary inflatable compartments, e.g. canopy supports, boarding ramps and floor, shall be so designed and arranged that damage to them will not significantly affect the primary buoyancy of the liferaft.

3.4 Provision shall be made to insulate those areas of the floor diaphragm that are in contact with the occupants of the liferaft. The insulation shall be at least equal to that given by a 25mm (1in) air cushion.
N.B. Where the insulation is provided by inflation of the floor diaphragm this Specification takes no account of its buoyancy.

3.5 The attachment of all lines and equipment to the liferaft shall be such that failure or tearing off of the attachment will not damage any inflated compartment or the canopy.

3.6 Retro-reflective Surfaces

3.6.1 The liferaft shall be provided with flexible retro-reflective external surfaces, of a minimum total area of $0.15m^2$ ($250in^2$), for increased conspicuity and to enhance the effectiveness of search lights, during search and rescue operation.

3.6.2 The arranged pattern of the retro-reflective material shall be generally as shown in Figure 1.

3.6.3 The retro-reflective materials shall comply with the Technical Specification for Retro-Reflective Material for use on Life-Saving Appliances (IMO Resolution 658 (16) Annex 2), or equivalent.

3.7 The requirements of this Specification, insofar as they are applicable, should be met for the normal and overload occupancy ratings of the liferaft.

4. Operation and Environment

4.1 The packed liferaft shall be suitable for fitment in an aircraft in accordance with the applicable aircraft installation requirements.

4.2 The method of packing the liferaft into its valise or container shall be such that the liferaft will successfully deploy in the correct attitude for boarding with a probability of not less than 0.90 under the conditions described in paragraph 16.

4.3 The packed liferaft shall be designed to inflate by means of its primary inflation system and be suitable for boarding in respect of buoyancy and stability within 30 seconds of the start of inflation, when soaked at all temperatures between -30°C and +65°C (-22°F and +149°F).

4.4 The liferaft, when packed in its valise or container shall be capable of withstanding temperatures of -30°C to +65°C (-22°F to +149°F) without any adverse effects for at least the period between inspections.

4.5 The liferaft in its container shall be capable of withstanding without significant deterioration such fluids and greases as it might come into contact with for at least the period between inspections. The liferaft when inflated shall withstand those fluids likely to be spread on the surface of the water in the event of an aircraft ditching. All materials used in construction of the liferaft and its equipment shall be suitably resistant to corrosion and fungus growth.

5. Buoyancy

5.1 The liferaft shall incorporate a minimum of two independent primary buoyancy chambers. With all chambers inflated to minimum design pressure the liferaft shall be capable of supporting its occupants up to the normal and overload rated occupancy in fresh water. The following minimum amount of freeboard shall be available: -

(a) 300mm (12in) at normal rated occupancy.

(b) 150mm (6in) at normal rated occupancy with the most critical chamber deflated.

(c) A positive freeboard at overload rated occupancy with the most critical chamber deflated.

5.2 The liferaft shall have a high level of tolerance to such accidental damage that may be incurred from contact with the exterior of the helicopter while the liferaft is on the water adjacent to the helicopter. This may be achieved by providing adequate redundancy or damage tolerance. To demonstrate adequate damage tolerance, the liferaft shall withstand puncture when subjected to a 0.794mm (1/32 inch) diameter, flat end metal point under a load of 45N (10lbf).

6. Occupancy Ratings

6.1 An average occupant weight of 90kg (200lb) shall be assumed to take account of the weight of the occupant's clothing with water saturation.

6.2 The normal rated capacity of the liferaft shall be taken as the number of occupants that can be accommodated when each occupant is provided with a minimum width of back support of 460mm (18ins) and a minimum of 0.33m^2 (3.6ft^2) of floor area.

6.3 The minimum overload rating for the liferaft shall be the nearest whole number of occupants to the normal rated capacity times 1.50 with a minimum floor area of $0.22m^2$ ($2.4ft^2$).

7. Inflation Systems and Hand Pump

7.1 The primary inflation system shall meet all applicable equipment Specifications and shall be capable of meeting all performance and environmental criteria contained in this Specification. The primary inflation system shall be fully automatic subsequent to initiation. Aspirators shall be protected and designed to preclude ingestion of objects which may prevent the seating of the gas seal. Any water ingested via the aspirator, if used, shall not prejudice the operation of the inflation system and the liferaft's performance.

7.2 The inflation system shall be designed to prevent gas flow-back from a primary chamber or between primary chambers.

7.3 Protection shall be provided against chamber overpressure. Where this is by means of a relief valve the maximum hysteresis shall not exceed 20% of the valve's cracking pressure.

7.4 The means of activating the primary inflation system(s) shall be such that proper inflation of the liferaft can be achieved, even when the liferaft in its valise is submerged, by operating a single mechanism by the application of a force of 110 ± 20N (25 ± 5lbf).

7.5 Each inflation chamber shall also be provided with a means to enable inflation using a hand operated pump.

7.6 The function of every valve fitted in the surface of the liferaft shall be clearly marked in the vicinity of the valve. All such valves shall be located to enable their operation and observation to be carried out by occupants in the liferaft.

7.7 The method of operation and positioning of valves shall be such that they will not be operated inadvertently, and such as to minimise the risk of injury to occupants when boarding the liferaft.

7.8 Inflation valves to be used with hand operated pumps shall be of the non-metallic friction fit type with a minimum inside diameter of 16mm ($^5/_8$in). They shall be fitted with a non-return valve, be located so as to facilitate inflation by hand pump, and shall not interfere with the comfort of the occupants.

7.9 Hand-operated inflation pumps shall be capable of easy connection to and disconnection from each inflation valve and of maintaining each inflated compartment at the minimum design pressure.

7.10 Hand pumps shall have a minimum displacement of air of 0.5litres ($32in^3$) for each complete cycle of operation, and shall have a means of being attached to the liferaft when stowed and during operation at each inflation point.

8. Strength

8.1 All materials, compartments, valves, attached equipment, and seams shall be of sufficient strength and durability to preclude premature failure during operation.

8.2 All inflated fabric compartments shall have minimum proof and ultimate strength factors of 2.0 and 3.0 respectively based on the maximum relief value of the pressure relief valves fitted to the primary buoyancy chambers. The design condition shall be assessed at a temperature of +45°C (113°F) and in no case should the proof pressure be less than $20kN/m^2$ ($3lbf/in^2$).

8.3 It shall be demonstrated that all fabricated material joints are of sufficient strength and integrity to achieve a declared absolute life. Guidance shall be given in the appropriate manuals regarding the inspection, maintenance and repair information necessary to maintain the serviceability of the liferaft between servicing.

9. Attached Equipment

9.1 General.
Any equipment attached to the liferaft shall be of such design and location that it will not interfere with the liferaft's operation and performance in any way. The attachment shall be such that the equipment will be retained if liferaft inflation occurs in the upright or inverted position.

9.2 Painter Line

9.2.1 A painter line which can be easily attached to the aircraft shall be provided. The line shall be of a length which is compatible with the operation and inflation of the liferaft, but shall be not less than 6m (20ft) nor greater than 20m (65ft) with the inflation initiation point at least 4.5m (15ft) from the free end of the line. The painter line shall be distinctly coloured to indicate to the person inflating the liferaft the position of the inflation initiation point within 3m (10ft).
N.B. The painter line should be a minimum of 9.5mm ($^3/_8$in) diameter under load to provide satisfactory graspability.

9.2.2 The painter line shall be manufactured from a material that will float, has resistance to rotting, and has a minimum breaking strength of 5300N (1200lbf). The attachment of the line to the liferaft shall be designed to release the liferaft without damage in the event of either the line being loaded to or beyond its ultimate strength value or the line being loaded to 0.75 times the load required to submerge the liferaft with the critical chamber deflated, whichever is the lower.

9.2.3 The location of the painter line attachment to the liferaft shall be such that it is readily accessible to the occupants of the liferaft and can be easily severed with the knife provided.

9.3 Sea Anchor

9.3.1 A sea anchor, which is permanently attached to the liferaft and is readily accessible to the occupants under all conditions, shall be provided.

9.3.2 Where the sea anchor is a trailing anchor device it must comply with the following:

(a) The anchor shall have a minimum effective area equivalent to $0.8m^2$ ($1200in^2$).

(b) The anchor shall be attached to the liferaft by a line of 10.5m (35ft) minimum length with a minimum breaking strength of 2200N (500lbf). Attachment of the sea anchor to the liferaft shall be so designed that the liferaft will be released without damage in the event of the line being loaded to or beyond its ultimate strength.

(c) The anchor attachment line assembly shall include a swivel link with a strength at least equal to the strength of the anchor attachment line.

(d) The anchor shall be arranged to minimise the risk of entanglement.

9.3.3 The location of the sea anchor attachment point on the liferaft shall be such that the deployed line does not interfere with boarding or with the operation and manipulation of the painter line.

9.4 Rescue Line and 'Quoit'

9.4.1 At least one rot-resistant rescue line, which will float and of not less than 23m (75ft) in length, shall be provided to enable a survivor to be hauled to the boarding point. It shall be attached to the liferaft in the vicinity of, and accessible from, the primary boarding point. Attached to the free end of the line shall be a floatable device (quoit) of suitable size to be grasped by a survivor in the water.

9.4.2 The rescue line facility shall have a minimum breaking strength of 1300N (300lbf). The line attachment to the liferaft shall withstand 1.5 times the line's minimum breaking strength.

9.5 Lights

The liferaft shall be fitted with an internal and external light source.

9.5.1 Internal Light

9.5.1.1 The internal light shall have an output sufficient to enable all printed instructions on the liferaft's internal surfaces or attached equipment to be read in the hours of darkness by a person with normal eyesight. The internal light source shall have an effective output of at least 1.0 lumen for a continuous period of not less than 12 hours.

9.5.1.2 The light shall be capable of being switched on and off by the occupants of the liferaft in all appropriate environmental conditions.

9.5.2 External Light

9.5.2.1 The light shall be fitted to the canopy in such a way as to provide maximum practical conspicuity for search and rescue operations and shall have:
(i) a vertical light beam with a divergence of at least 5° above the vertical axis of the light fitting; and
(ii) a horizontal light beam that is radially continuous and have an emission angle of at least 5° above the horizontal plane of the light bulb element.

9.5.2.2 The light shall be switched on automatically as soon as the liferaft is inflated on water.

9.5.2.3 The light shall be capable of being switched on and off by the occupants of the liferaft in all appropriate environmental conditions.

9.5.2.4 Output of the light shall be such that it is visible at night in clear atmospheric conditions at a distance of not less than 2 nautical miles, for a continuous period of not less than 12 hours.

9.5.2.5 If the light is a flashing beacon, the flash rate shall be between 50 and 70 flashes per minute, with an interval between flashes of 1.0 ± 0.15 second.

9.6 Knife

9.6.1 A knife which will float shall be provided and located in a position inside the liferaft to enable it to be readily used for cutting the painter line. The knife shall be suitably sheathed and attached to the liferaft by a line of sufficient length to facilitate its use without difficulty.

9.6.2 The shape of the knife shall be such that it will not damage the liferaft's fabric if dropped inside the liferaft.

9.7 Survival Kit and Case

9.7.1 The liferaft shall be provided with a survival kit containing, as a minimum,

i One life-raft repair kit;
ii. One bailing bucket;
iii. One signalling mirror;
iv. One police whistle;
v. One buoyant raft knife;
vi. One supplementary means of inflation;
vii. Seasickness tablets;
viii. One first-aid kit;
ix. One portable means of illumination;
x. One half litre of pure water and one sea water desalting kit;
xi. One comprehensive illustrated survival booklet in an appropriate language.

The components of the kit shall be contained in a case which in turn can easily be attached to and detached from the liferaft. The contents of the survival kit shall be so packed that immersion in salt water will not cause them to be unfit for use.

10. Canopy

10.1 A canopy, covering the total occupiable area of the liferaft, and supported above the heads of seated occupants shall be provided. If the primary inflation system is used to deploy the canopy via a primary buoyancy chamber the canopy support system shall remain inflated in the event of damage to the buoyancy chamber. The canopy support system shall include a facility for inflation by means of the hand operated pump provided.

10.2 The canopy fitted to liferafts with a normal rated occupancy of more than 10 persons shall include a minimum of 2 entry points. Liferafts with a normal occupancy rating of 10 persons or less need only be provided with 1 entry point. The size and positioning of liferaft entry facilities shall be agreed with the Authority.

10.3 Each canopy entry point shall have a closing flap which can easily be closed or opened by the occupants. The flap shall be capable of being secured in a fully open or closed position or in intermediate positions. Where two entry facilities are provided they shall be positioned 180° apart. The painter line attachment and location of the knife shall be adjacent to one entry point.

10.4 The canopy, with the flaps open or closed, shall be capable of withstanding winds of 60 km/h (40 mph) with gusts of 90 km/h (60 mph). With the flaps closed the occupants shall be adequately protected from wind, rain, spray and breaking waves.

10.5 A facility should be provided for the erection of a radio transmitting aerial.

10.6 The deployed canopy shall be able to withstand without damage or permanent collapse the impact of a jump by a person of weight 90kg (200lb) from a height of 3m (10ft) above water level on to the top of the canopy.

10.7 The canopy should remain usable in the event of deflation of the most critical buoyancy chamber.

11. Life Lines and Grab Lines

11.1 Life lines of a colour contrasting to that of the liferaft shall be provided around the external periphery of the buoyancy chambers. The lines shall be easily identified and readily available to support survivors in the water.

11.2 Grab lines of a colour contrasting to that of the liferaft shall be provided around the internal periphery of the buoyancy chambers. The lines shall facilitate use by the occupants to support themselves.

11.3 Life lines, grab lines and their attachments shall be capable of withstanding a minimum load of 2200N (500lbf).

12. Boarding Facilities

12.1 A boarding facility shall be provided at each entry point, which is self-erecting during the inflation of the liferaft and remains continuously available.

12.2 The design of the boarding aid(s) shall be such that a 90kg (200lb) fully clothed person wearing a fully inflated lifejacket can board the liferaft without assistance. It shall also be possible for the liferaft occupants to retrieve unconscious survivors from the water with the aid of the boarding facility.

12.3 The strength of attachment of an inflated boarding facility to the liferaft's structure shall be such that excessive load on the facility will not prejudice the integrity of the primary buoyancy chamber.

12.4 Markings shall be provided on the external surfaces of the liferaft to indicate to survivors in the water the location of the boarding facility and, if appropriate, the best method of use.

13. Righting

13.1 The liferaft shall be fully reversible unless it can be demonstrated that it is self righting in the fully inflated condition.

14. Valise or Container

14.1 The liferaft shall be packed into a valise or container which in turn will be stowed and restrained on board the aircraft. The material used for the construction of the valise or container shall be of low flammability and have a burn rate not greater than 100mm/min (4in/min) when tested in accordance with the horizontal test of CS-25 Book 1 Appendix F Part 1 (b)(5)or other approved equivalent method. It shall be durable and chafe resistant. The liferaft packed and ready for stowage shall not support combustion, nor shall it be likely to be rendered unserviceable by inadvertent contact with a lighted match or cigarette.

14.2 The packed liferaft shall be capable of being dropped from a height of 3m (10ft) on to a hard surface without adversely affecting the performance of the liferaft as prescribed by this Specification.

14.3 The valise or container shall include suitable lifting handles so the packed liferaft can be moved within the aircraft.

14.4 The packed liferaft shall have a positive buoyancy in fresh water at a temperature of +20°C (68°F). This shall be demonstrated and the buoyancy value established.

14.5 The external dimensions of the packed valise/container shall be established.

14.6 Closing of the valise or container shall be by lacing with cord of a minimum breaking strength of 220N (50lbf) or by equivalent means.

14.7 Where automatic launching of liferafts is not possible, the weight and dimensions of the packed valise or container shall be such that it can be easily moved to, and launched from, any prescribed ditching emergency exit by one person (male or female).
N.B. It is recommended that the maximum weight should not exceed 36kg (80lb).

15. Materials and Processes

15.1 All materials used shall be to an acceptable Specification which shows the material to be suitable for its intended application and compatible with other materials used in the liferaft's construction.

15.2 The choice of materials and protective treatments shall be such that, during the period between inspections, corrosion or deterioration will not render the liferaft unserviceable.

15.3 The liferaft when fully equipped and stowed in the aircraft shall not cause more than 1° deflection of an aircraft compass reading at a distance of 300mm (1ft).

16. Seaworthiness

16.1 The liferaft and its equipment shall be capable of withstanding a marine environment in accordance with this Specification for a minimum period of 14 days when occupied to its prescribed maximum overload rating.
N.B. A shorter time may be agreed between the operator and the Authority for operations within helicopter SAR coverage and where all aircraft occupants wear survival suits.

16.2 The liferaft and equipment shall be capable of withstanding, without malfunction, sea and wind conditions of at least Sea State 6 and 60km/h (40mph) respectively.

16.3 The design of the liferaft shall be such that the possibility of the liferaft overturning in any sea or wind condition up to the maximum of paragraph 16.2 is minimised. Any stabilising equipment, e.g. stabilising keels or equivalent, shall be effective by the time the liferaft is ready for boarding, and shall remain automatically effective all the time the liferaft is floating.

16.4 Means shall be provided to enable the occupants (wearing cover-all immersion suits and inflated lifejackets) to propel the liferaft over short distances.

17. Tests

17.1 A liferaft of the type for which approval is sought shall be tested in both calm and disturbed water (e.g. in a swimming pool and in choppy sea or simulated choppy sea conditions). The Manufacturer's evaluation schedule for the liferaft to show compliance with this Specification shall be agreed with the Authority and shall include the following tests or demonstrations.

17.1.1 Inflation Tests

With the valised liferaft floating in the water, operation of the primary inflation system shall be demonstrated as being in compliance with paragraph 7 by a person in the water wearing a lifejacket. A sufficient number of tests shall be carried out to show compliance with paragraph 4.2. Connection, disconnection and satisfactory operation of the hand operated pump shall also be demonstrated.

17.1.2 Freeboard Measurement (Buoyancy)

The liferaft shall be demonstrated to comply with paragraphs 5 and 6 for all prescribed conditions of occupancy and inflation appropriate to the intended application of the liferaft.

17.1.3 Boarding

Compliance with the requirements of paragraph 12 shall be demonstrated by male and female subjects for each boarding facility fitted to the liferaft.

17.1.4 Propulsion

With the liferaft fully inflated and overloaded to the prescribed rating the practicability of its propulsion over short distances, using the paddles or other equipment provided, shall be demonstrated.

17.1.5 Jump Test

Tests shall be made in accordance with the requirements of paragraph 10.7. This test can be simulated by using a weighted bag or equivalent weight.

17.1.6 Righting

Righting of the liferaft shall be demonstrated both fully inflated and with the most critical primary buoyancy chamber deflated in accordance with paragraph 5.1(b).

17.1.7 Strength Test (Refer to paragraph 8.2).

17.1.7.1 A proof pressure test shall be carried out on all inflated fabric components.

17.1.7.2 An ultimate pressure test shall be carried out on the most critical section of all primary buoyancy chambers.

17.1.8 Seaworthiness

Sufficient tests shall be completed to demonstrate that the liferaft can provide a survival capability when subjected to the most adverse combination of temperature, sea and wind states defined in this Specification.

18. Colour, Operational Markings, and Packaging

18.1 The predominant colour of the liferaft shall be highly conspicuous.

18.2 The valise or container in which the liferaft is to be kept whilst on board the aircraft shall be approved as part of the liferaft's general assembly. The valise or container shall be clearly marked to the effect that a liferaft is contained therein. The method of operating and any precautionary information shall be clearly marked.

18.3 Instructions relating to boarding and operation of all equipment shall be provided with the liferaft, shall be bold and readable in low levels of illumination, and shall be kept to a minimum with the purpose of achieving speed of correct operation with minimum confusion.

19. Marking

19.1 Each detachable part of the liferaft shall where practicable be marked with:
(a) The manufacturer's approved inspection stamp.
(b) The part number.
(c) Date of manufacture or batch record.
N.B. Where marking is not practicable alternative means may be agreed with the Authority.

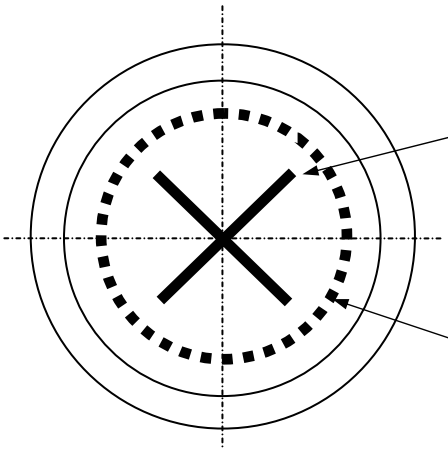
19.2 The liferaft assembly shall be marked with:
(a) The liferaft model designation.
(b) The manufacturer's name and address.
(c) Date of manufacture.
(d) Serial Number.
(e) Date at which next service and overhaul are due.

19.3 The charged inflation cylinder shall be marked with its weight and the weight of charge.

19.4 All markings prescribed in 7.6, 12.4, 18.2, 18.3, 19.1, 19.2 and 19.3 shall be made such that they remain legible.

Figure 1

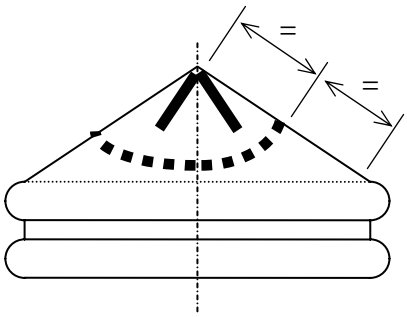
TYPICAL LIFERAFT - ARRANGEMENT OF RETRO-REFLECTIVE TAPE



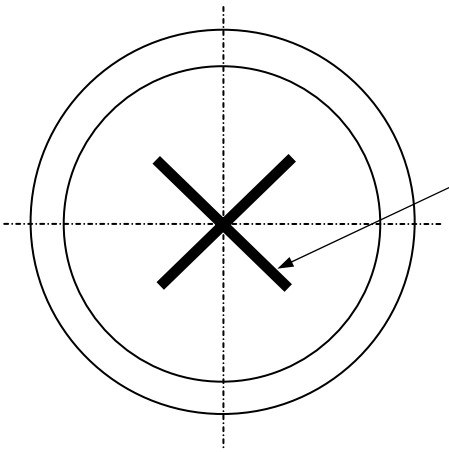
LENGTH OF STRIPS TO BE HALF THE DIAMETER OF LIFERAFT

SHORT STRIPS TO FORM CIRCLE AROUND CANOPY, APPROX. 500mm (20 inches) APART

PLAN VIEW OF LIFERAFT



SIDE VIEW



LONG STRIPS TO FORM CROSS ON EXTERNAL SURFACE OF FLOOR DIAPHRAGM. STRIPS TO BE HALF THE DIAMETER OF LIFERAFT

VIEW OF EXTERNAL LOWER SURFACE

NOTE:
SHORT STRIPS TO BE 300mm LONG x 50mm WIDE (12 x 2 inches)
LONG STRIPS TO BE 50mm (2 inches) WIDE

APPENDICES.

I. ORIGINAL JUSTIFICATION FOR JAA NPA TSO-9

1. GENERAL

The JAA NPA TSO-9 contains 6 "HOSS" Helicopter Offshore Safety and Survivability Working Group JTSOs (JTSO-C13f, -C70a, -2C502, -2C503, -2C504 and –2C505).

1.1 *"HOSS" JTSOs :*

In 1995, the CAA-UK proposed to issue 2 JTSOs on life vests and life rafts (-C13f and -C70a) with major alterations to existing equivalent FAA TSOs. That proposal was discussed within the JTSO SG and finally a P-NPA-TSO-3, sponsored by CAA-UK only, was issued in January 1996.

Following a preliminary review of the P-NPA, harmonisation between FAA and JAA on the subject was requested by the Regulation Advisory Panel in April 1997. No further action has been undertaken since then.

In 1999, the HOSS proposed to issue specific life vests and life rafts JTSOs for helicopter offshore operations. That proposal has been deeply reviewed by the JTSO SG, and finally accepted provided that P-NPA-TSO-3 is cancelled and that the FAA TSOs-C13f and –C70a are included in the NPA. This is the reason why NPA-TSO-9 contains specific HOSS JTSOs as well as JTSOs for normal operations.

The NPA has been circulated for comment to the Regulation Sectorial Team (RST), the Joint Steering Assembly (JSA) and to NPA subscribers. The comment period passed on 01 June 2003 and a Comment-Response document has been prepared.

II. ORIGINAL JAA NPA TSO-9 COMMENT-RESPONSE DOCUMENT

The CAA Lithuania, SLV Denmark, LBA Germany and the DGAC France have informed the JAA that they agree with the proposed amendment or have no comment. These entries have not been included in the table below.

Comments demanding alterations to the proposed text were received from CAA-UK, SBAC-UK, AERAZUR-France and the Multifabs Survival Ltd. UK.

The table summarizes the entries and the JAA responses:

1-3	Misc.	Agreement	No comments	Misc.	Noted
4	General comment	Agreement	Follow the guidelines adopted by EASA Core group 9.	CAA-UK	Change to metric units as appropriate
5	JTSO-C70a	Agreement	Propose to add the requirement for retro-reflective tape into the JTSO, which leads to a 2C J/ETSO	CAA-UK	J/ETSO 2C70a created with this additional requirement.
6	JTSO-C13f	Agreement	… not support fungal growth.	CAA-UK	Supersede Appendix 1 § 3.1.3 with the new sentence.
7	JTSO-C70a	Agreement	Applicable placarding….righting the raft from the water	CAA-UK	Appendix 1 § 4.11, last line, typographical error
8	Misc.	Agreement		DGAC.	Noted
9	General comment	Comment	JTSO-C13f and JTSO-C70a. References to FAA, FARs, MIL Standards and non-SI units of measurement to be replaced/corrected upon publication.	SBAC	Rejected. The FAA document stays unchanged as annex to the J/ETSO. JAR-TSO Subpart A § 3.2 applies as regulation with higher priority.
10	Number not used				
11	JTSO-2C505	Disagree	Appendix 1, Add a new § 10.8	AERAZUR	Rejected. Editorial - the requirement is already in § 10.6 of Appendix 1
12	JTSO-2C505	Disagree	Appendix 1 Propose additional text in § 10.1 ‘The canopy shall be automatically erected in sequence with the inflation of the liferaft.’	AERAZUR	If the standard had automatic erection it may preclude a reversible design. If the design is not reversible then righting may be required if it deployed upside down. This might cause problems in high sea states. Erection of the canopy (from inverted or non-inverted) is seen as preferable to righting an inverted dinghy. Note: Aerazur have agreed that there is an alternative method of compliance within the rule and withdraw the disagreement.
13	JTSO-2C505	Agreement	Appendix 1 § 1.1: Cancel the word “Heliraft” (Company Name)	AERAZUR	Cancel the word “Heliraft” in the whole document.

14	JTSO-2C505	Disagree	Appendix 1 Propose additional text in § 13.1 '…or unless it is fitted with a facility such that the liferaft can be righted in all wind and sea conditions.'	AERAZUR	See comment in 12 above. (1) The phrase "all sea states" is not verifiable. (2) A manual action may not feasible for injured people and has been demonstrated as ineffective in a recent marine accident. (3) Alternative methods of compliance are available.
15	JTSO-2C505	Disagree	Appendix 1 Propose different text in § 2.1 to remove reference to a hostile sea area.	AERAZUR	It is not intended that this standard be mandatory for all helicopter operations. Title amended for clarification. It does not preclude this raft, or other rafts in accordance with C70a, being used in non-hostile areas. Note: Aerazur now agree that this Standard is only applicable to the 'defined' hostile environment and withdraw their disagreement.
16	JTSO-2C505	Agreement	Appendix 1 Propose different text in § 3.4: Cancel "If the life raft is normally in contact with the water"....	AERAZUR	Cancel the phrase.
17	JTSO-2C505	Partially agree	Appendix 1 Propose different text in § 5.1 to reduce the number of independent primary flotation chambers from 4 to 2.	AERAZUR	Improved resistance to accidental damage was found to be neccessary following a number of accidents where the liferaft was punctured by helicopter structure or rotor blades. However it is agreed that providing additional redundancy is not the only way of achieving this. Therefore § 5.1 will be amended as requested and a new § 5.2 will be added to provide an objective

					requirement for damage tolerance. Note: Aerazur have been consulted in the development of the new text and agree with the new paragraph.
18	JTSO-2C505	Agreement	Appendix 1 § 9.3.2 (a) Minimum effective area for anchor 0,8 m^2	AERAZUR	The text will be amended to point to a single standard of 0,8 m^2.
19	JTSO-2C505	Agreement	Title Cancel the word “Heliraft” (Company Name)	AERAZUR	See comment 13
20	JTSO-2C502 JTSO-2C503	Disagree	Appendix 1 Donning a) § 3.4 b) § 3.5 c) §7.2 Temperature cycling range -30°C to +40°C d) § 7.3	Multifabs Survival	a) and b) Rejected. It seems to be a misinterpretation. We cannot see the requirement to don the gloves within the 10 seconds. c) Rejected. We agreed to stay with the ISO requirement. d) Information only
21	JTSO-2C502	Disagree	Appendix 1 § 8.1 Evacuation Emergency exit size 430x355mm	Multifabs Survival	The size is consistent with JAR-OPS 3.837(a)(6) (pop-out windows). Every seat row has an ajacent window which can be removed by removing the quick release rubber seal – the text takes account of these windows in operations where suits are worn.
22	JTSO-2C502 JTSO-2C503	Disagree	Appendix 1 § 9.1 Thermal Protection	Multifabs Survival	The standard will not change. The ongoing work is concerned with general guidance on survival issues.
23	JTSO-2C502 JTSO-2C503	Disagree	Appendix 2 § 2.2 Different weight categories ISO to CAA Spec. 19	Multifabs Survival	Rejected. We keep ISO Norm as the agreed standard.
24	JTSO-2C502 JTSO-2C503	Disagree	Appendix 2 § 3.1 Different requirements; ISO to CAA Spec. 19	Multifabs Survival	Rejected. We keep ISO Norm as the agreed standard.
25	JTSO-2C502 JTSO-2C503	Disagree	Appendix 2 § 3.2 Turning test	Multifabs Survival	The fact that you have to be conscious to escape from the helicopter and the inherent safety and stability of an

					integrated suit system outweighs the requirement for self-righting. This is consistent with ISO.
26	JTSO-2C502 JTSO-2C503	Agree	Appendix 2 § 3.3 Different requirements ISO to CAA Spec. 19 Refers to Comment 21	Multifabs Survival	Amend text to ISO standard.
27	JTSO-2C504	Disagree	Appendix 1 § 8.1 Different requirements ISO to CAA Spec. 19. Emergency exit size 430x355mm. Refers to Comment 21	Multifabs Survival	See response to 21
28	JTSO-2C504	Disagree	Appendix 1 § 8.3	Multifabs Survival	See comment on 25 above. Although self righting for the integrated suit system is not paramount the lifejacket should be inherently self-righting. This is also consistent with ISO.
29	JTSO-2C504	Comment	Appendix 1 § 14.3	Multifabs Survival	Noted
30	JTSO-2C504	Disagree	Appendix 2 § 2.2 Different weight categories ISO to CAA Spec. 19 See Comment 23	Multifabs Survival	See response to 23
31	JTSO-2C504	Disagree	Appendix 2 § 3.1 Different requirements; ISO to CAA Spec. 19. See Comment 24	Multifabs Survival	See response to 24
32	JTSO-2C504	Disagree	Appendix 2 § 3.2 Turning Test Conflicts with section 8.3 See comment 25	Multifabs Survival	See response to 25 and 28
33	JTSO-2C504	Agree	Appendix 2 § 3.3 Different requirements ISO to CAA Spec. 19 Refers to Comment 26	Multifabs Survival	See response to 26