Comment Response Document (CRD)
to Notice of Proposed Amendment (NPA) 8/2005

for amending the Executive Director Decision No 2003/10/RM
on
Certification Specifications, including Airworthiness Codes and Acceptable Means Of Compliance, for European Technical Standard Orders (CS-ETSO)

Offshore Safety and Survivability Equipment

Explanatory Note

I. General

1. The purpose of the Notice of Proposed Amendment (NPA), dated 15-06-2005 was to propose an amendment to 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) to introduce new ETSO specifications for several offshore and survivability equipment.

II. Consultation

2. The draft Executive Director Decision amending Decision N° 2003/10/RM was published on the web site (www.easa.eu.int) on 15-06-2005.

   By the closing date of 27-07-2005, the Agency had received 28 comments from 7 national authorities, professional organisations and private companies.

III. Publication of the CRD

3. All comments received have been acknowledged and incorporated into a Comment Response Document (CRD). This CRD contains a list of all persons and/or organisations that have provided comments and the answers of the Agency.

4. In responding to comments, a standard terminology has been applied to attest EASA's acceptance of the comment. This terminology is as follows:

   - **Accepted** – The comment is agreed by the Agency and any proposed amendment is wholly transferred to the revised text.
   - **Partially Accepted** – Either the comment is only agreed in part by the Agency, or the comment is agreed by the Agency but any proposed amendment is partially transferred to the revised text.
   - **Noted –** The comment is acknowledged by the Agency but no change to the existing text is considered necessary.
   - **Not Accepted** - The comment is not shared by the Agency

5. The Agency's Decision will be issued at least two months after the publication of this CRD to allow for any possible reactions of stakeholders regarding possible misunderstandings of the comments received and answers provided.

6. Such reactions should be received by EASA not later than Friday 17th March 2006 and should be sent by the following link: CRD@easa.eu.int;

Para	Commenter	Comment/Justification	Response	Resulting text
Explanatory note	CAA Norway	**Comment 1** In chapter 7 regarding thermal protection is it asked for comments in the requirement IEM OPS 3.827 – Calculating Survival Time is based on the theory about calculations of isolation values (clo) in conjunction with clothing underneath a survival suit. It is assumed that a survival suit has a standard influence that will change due to variation of the clothing underneath. The risk for leakage into the suit is the only factor that will affect the assumption. There is several weaknesses in the logic, among others that the clo value is calculated without consideration on the compression on the clothing underneath which will arise when a person is lying in the water. The calculation of survival time and corresponding need of isolation is an academic approach to a complex technical term. The method was earlier a part of the EN-ISO 15027 standard, but was withdrawn some time ago. The reason for this was among others that the practical use of the principle was impossible. EN-ISO 15027 standard is now developed on the principle that classification of suits is done according to verified performance under the same circumstances and equal clothing underneath. The quality of the suits is verified and qualifies from class A to D. This results in four predefined classes for the customers to rely in. The proposed text in chapter 11.1 (and 9.1 in ETSO 2C503) exists of 2 subsections. The first one requires that the producer shall identify and give an isolation value for the product. The second section requires that the product shall be tested in a specific way. The result of the written text in second subsection is not an isolation value in that context described in JAR-OPS 3.827. The two subsections in the text is therefore not consistent. First subsection requires an isolation value to be given without any format or criteria. The disengagement from JAR-OPS 3.827 will involve the Authority to interpret the meaning of isolation value. Second subsection indicates a known and unique test method. As it is written now is it the method that is required and not the inbuilt classification that is required. The way it is described in chapter 11.1 is now useless. First subsection requires an unidentified	Accepted. In paragraph IV Content of the draft decision it was requested to specifically comment on the change to the thermal protection standards for immersion suits. The comments received indicated that the proposed standard would not result in a practical standard that would provide a required level of insulation. The term “Recommended clothing” and other parameters introduce a number of variables that would prevent a clear minimum requirement. It is therefore decided to change the thermal protection standard in such a way that the ISO standard is adopted, and testing is performed with the specified standard clothing. This provides an international benchmark to determine the performance of the immersion suit.	ETSO-2C502, Appendix I, Paragraph 11.1 and ETSO-2C503, Appendix I, Paragraph 9.1 will be changed to read: The suit shall provide the user with thermal protection in the water that at least satisfies the test requirements of paragraph 3.8 of EN ISO 15027-3:2002 as a class B suit system.

Para	Commenter	Comment/Justification	Response	Resulting text
		isolatation value, and second subsection requires the completeness of a test that will not pass. When the operator shall use isolation values in his calculations, he shall use clo for the clothing underneath as a basis. The isolation value for the suit with proposed clothing underneath is in a size that will not fit in the calculation. The oil industry in Norway has required that suits used on the Norwegian continental shelf shall satisfy class A suit system, with tighten up the test procedure for receiving a closer relevance to practical scenario for use. Reference is made to OLF suit specification 094/2005 (www.olf.no). We suggest the text in chapter 11.1 (and 9.1 in ETSO 2C503) to be changed to: The suit shall provide the user with thermal protection in the water that at least satisfies the test requirements of paragraph 3.8 of EN ISO 15027-3:2002 as a class B suit system. **Justification** We suggest the text in chapter 11.1 (and 9.1 in ETSO 2C503) to be changed to: The suit shall provide the user with thermal protection in the water that at least satisfies the test requirements of paragraph 3.8 of EN ISO 15027-3:2002 as a class B suit system.		
Explanatory note	S.Coleshaw, Consultant	**Comment 2** a) “The insulation values of the sealed (integrated) suit including head and hand coverings, when worn in conjunction with recommended clothing, shall be provided”. This does not provide a requirement for thermal protection. “Testing shall be carried out in accordance with para 3.8 of EN ISO 1527-3:2002 for a Class B suit System”. By specifying that testing be conducted for a Class B suit (as specified in EN ISO 1527-3: 2002) a required level of insulation is implied. However, the European standard is currently problematic as there are no clear pass/failure criteria. The test method (3.8.2.3.1) states that suit system insulation shall be determined when the mean skin temperature becomes stable but the measurements stipulated in the method do not allow insulation to be estimated (no metabolic rate or heat loss measures are stipulated). Either the test method requires improvement to allow	Partially Accepted. In paragraph IV Content of the draft decision it was requested to specifically comment on the change to the thermal protection standards for immersion suits. The comments received indicated that the proposed standard would not result in a practical standard that would provide a required level of insulation. The term “Recommended clothing” and other parameters introduce a number of variables that would prevent a clear minimum requirement. It is therefore decided to change the thermal protection standard in such a way that the ISO standard is adopted, and testing is performed with the specified standard clothing. This provides an international benchmark to determine the	ETSO-2C502, Appendix I, Paragraph 11.1 and ETSO-2C503, Appendix I, Paragraph 9.1 will be changed to read: The suit shall provide the user with thermal protection in the water that at least satisfies the test requirements of paragraph 3.8 of EN ISO 15027-3:2002 as a class B suit

Para	Commenter	Comment/Justification	Response	Resulting text
		calculation of insulation or, the pass criterion should reflect the conditions of the Class B test and require that thermal protection is provided for at least 4 hours when immersed in water at < C (EN ISO 15027-3;2002;°2 3.8.2.3.3). b) The requirement as written refers to “recommended clothing”. This implies that a set clothing assembly would always be worn under a given suit. The stated insulation would thus depend on the clothing requirements set by the manufacturer. This would prevent an end-user from comparing the performance level of different suits and would make it difficult for an employee to set their own clothing policy if this did not comply with the clothing assembly recommended by the manufacturer. It is suggested that a standard set of clothing be stipulated for assessment/testing of thermal protection and/or insulation. **Justification** a) The aim of the European Technical Standard Order is to give minimum requirements that manufacturers must meet. By specifying that testing be conducted for a Type B suit (as specified in EN ISO 1527-3: 2002) a required level of insulation is implied but not stated. This makes assessment of a pass or failure ambiguous and problematic for an approval authority. b) The clause infers that the manufacturer recommends this clothing level. For a manufacturer to recommend a single level of clothing, they must make assumptions about operational requirements and environmental conditions. This goes against the statements made in the Explanatory Note 7.	performance of the immersion suit. Remark. The comment regarding implementation problems with ISO 1527-3:2002, due to the fact that clear pass/fail criteria are missing has been forwarded to the CEN. It is the Agency’s intention to keep the reference to the applicable ISO standard intact, and to pursue improvements to this standard, instead of de-harmonising with this ISO standard.	system.
Explanatory note	Multifabs Survival Ltd	**Comment 3** Relating to the changes introduced affecting the thermal protection requirements, see explanatory text below. Thermal Protection 11.1The insulation values of the sealed (integrated) suit including head and hand coverings, when worn in conjunction with recommended clothing, shall be provided. Testing shall be carried out in accordance with para 3.8 of EN ISO 1527-3:2002 for a Class B suit System. In principle, quantifying the insulation value	Partially Accepted. In paragraph IV Content of the draft decision it was requested to specifically comment on the change to the thermal protection standards for immersion suits. The comments received indicated that the proposed standard would not result in a practical standard that would provide a required level of insulation. The term “Recommended clothing” and	ETSO-2C502, Appendix I, Paragraph 11.1 and ETSO-2C503, Appendix I, Paragraph 9.1 will be changed to read: The suit shall provide

Para	Commenter	Comment/Justification	Response	Resulting text
		of an immersion suit ensemble is desirable: quantifying the degree of thermal protection the operator can then use this to determine the level of cold water protection. However, ignoring the JAR OPS 3 operational references to other survival macro-factors factors would be detrimental. These factors are outwith the scope of the immersion suit manufacturer. The current CAA Specification No. 19 standard defines the performance of a membrane immersion coverall. Such a coverall is non-insulating but does protect the clothing worn underneath from unacceptable water ingress. The Standard does not specify thermal insulation characteristics but does offer insulation and under clothing advice in Appendix 2. The Standard took the view that as long as the suit satisfied the water ingress test, and clothing worn as defined in Appendix 2, the requisite survival time would be achieved. This assumption was based on RAF Institute of Aviation Medicine data. Whilst Manufacturers have experience in providing immersion dry coveralls, they are not survival physiologists and will not quote guaranteed survival times. Manufacturers reference international Standards and academic expertise on immersion survival just as the Regulators and Operators do. The operators may consider placing the onus with the Manufacturer to recommend clothing levels as prescriptive. Specifying a single insulation level (ISO I5027 Class B) may cause such heat stress if flying in certain conditions. There are operational practicalities to consider: aircrew will shed insulation if they deem it as causing heat stress as a flight safety issue. (Passengers will also adapt accordingly). How effectively will operators control and police the wearing of such thermal insulation? In the offshore industry transportation environment, the manufacturer cannot control what the passengers will wear (as the scope of the new ETSO will include). That is a matter of control for the operators and their customers. Operators will not accept a manufacturer determining everything worn underneath an immersion suit (i.e. underwear, then base/intermediate layers & thermal layer). They may determine it to be anti-competitive or commercially restrictive. Thermal	other parameters introduce a number of variables that would prevent a clear minimum requirement. It is therefore decided to change the thermal protection standard in such a way that the ISO standard is adopted, and testing is performed with the specified standard clothing. This provides an international benchmark to determine the performance of the immersion suit. Remark. The comment regarding the fundamental issues with the ISO Standard as it exists today. In particular, the method of determination of thermal insulation and derived survival times has been forwarded to the CEN. It is the Agency's intention to keep the reference to the applicable ISO standard intact, and to pursue improvements to this standard, instead of de-harmonising with this ISO standard.	the user with thermal protection in the water that at least satisfies the test requirements of paragraph 3.8 of EN ISO 15027-3:2002 as a class B suit system.

Para	Commenter	Comment/Justification	Response	Resulting text
		Insulation values for clothing assemblies vary on an individual basis: different clothing ensembles, different materials, different sizes, different conditions of age, wear and tear, care and maintenance, soiling, damping, damage, and so forth. It is not economically viable to calculate the insulation worn underneath an immersion dry coverall on an ensemble by ensemble basis i.e. for different clothing levels for different operators. ISO Standard There are fundamental issues with the ISO Standard as it exists today. In particular, the method of determination of thermal insulation and derived survival times do not correlate. For instance, the Type B Test should correlate to a value 0.5 clo (immersed). The test describes immersing six subjects in water at 2 deg C for 4 hours. However, referring to the Annex Guidelines, the 0.5 Clo curve, the anticipated survival time at 2 deg C is significantly less than 4 hours: the test conditions exceed the survival conditions. This aside, the testing described does not quantify an immersed clothing value (this seems to be a flaw in the ISO Standard). The Standard assumes that if they endure the test without breaching the withdrawal conditions (Body core drop of more than 2 deg C, and/or a skin temp of 10 deg C), then they achieve the Class B conditions. The actual insulation is not determined (The subject's metabolic rates would have to be monitored – this is not conducted in the test as written). Testing the recommended test clothing ISO 15027 test method but changing the test clothing also makes the testing invalid. The ISO 15027 Standard specifies standard test clothing to be worn with the immersion suit. This provides an international benchmark to determine the performance of the immersion suit. For membrane-style immersion coveralls, the standard test clothing may be all that is worn underneath. It is interesting to note that the UK CEN Committee voted against the human subject testing of this Standard on the grounds that it was unethical to use human subjects for routine suit approval testing. There are also methodological difficulties. For instance, the selection of six human subjects can be manipulated to skew the data. Picking six		

Para	Commenter	Comment/Justification	Response	Resulting text
		subjects with previous cold water immersion experience can result in a different outcome to six I subjects. Human subject testing tests the subjects' resistance to cold water (aside from the physiological body cooling data) and does not calculate immersed insulation values. Testing a range of alternative thermal insulating layers will be uneconomic to the immersion suit manufacturer, particularly if relying on human subject testing. (The use of a thermal manikin to determine immersed insulation values provides an alternative, but this option is not currently accepted by ISO 15027). **Justification** The requirement is not viable.		
Draft Decision CS-ETSO	DGAC, France	**Comment 4** These ETSO are all presented for use on helicopters. What is the reason for limiting their use on helicopters? **Justification** Clarification	Noted. The performance standards have specific requirements related to the safety risks of helicopters operating to or from helidecks located in a hostile sea environment. Refer to JAR OPS 3.837.	No text change
Draft Decision CS-ETSO	Multifabs Survival Ltd	**Comment 5** Introduce a material specification caveat, removing the Tensile strength after illumination/rot requirement. **Justification** Please refer to attached document (Appendix I) highlighting an inconsistency in material performance requirements, relating to inherent flame retardancy & mechanical performance after ageing. Also, summarised are the operational & economical impact that such a requirement may have.	Partially Accepted. The requirements for all materials used shall be to an acceptable specification which shows the material to be suitable for its intended application. The comment has made it clear that an operational conflict will generate from the material performance requirement for Tensile strength after illumination/rot, thermal comfort and flame retardancy requirements. Based on the practice that these suits would not be extensively used outside the aircraft; and (b) routine inspection and testing would lead to a withdrawal before failure, the deterioration due to light is assumed not to result in a problem. Since regular inspections in accordance with manufacturer's recommendations must be covered by manuals that are part of the	ETSO-2C502 and ETSO-2C503 Appendix 1 § 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

Para	Commenter	Comment/Justification	Response	Resulting text
			DDP (Part 21A.608), and performing these tasks for this emergency equipment is covered by Part M, it is decided to remove the Tensile strength after illumination/rot requirement from the materials specification paragraph in Appendix 1. The low flammability standard for the outer fabric will remain a higher standard compared to the ISO 15027 standard as specified in the NPA.	EN ISO 15027-1:2002, with the exception of paragraph 4.14.3 of EN ISO 15027-3:2002 Resistance to Illumination Test.
Draft Decision CS-ETSO	DGAC, France	**Comment 6** Only metric units should be used in European standards **Justification** Self explanatory	Not Accepted. The ETSO in this NPA where earlier published in JAA NPA. Therefore the "old" figures used in these ETSO are kept between brackets as described in the explanatory note to CS-ETSO.	No text change
Draft Decision ETSO-C13f	DGAC, France	**Comment 7** a) Paragraph 5 should mention where test methods referenced in Appendix 1, 5.1 may be obtained b) Appendix 1, 3.1.4.3 last sentence makes a reference to a paragraph (c) which does not exist. c) In Appendix 1, 4.1.8, table 1, the maximum weight limit for Child is missing (16kg to 40kg?) d) In Appendix 1, 4.1.13, why is reference made to TSO-C85 when the current version for survivor locator lights is ETSO-C85a ? **Justification** a) Completeness b) Coherence c) Completeness d) Clarification	a) Accepted. b) Partially Accepted. The reference was incorrect in this ETSO and will be replaced by "the Agency".. c) Partially Accepted. The upper limit for maximum weight for the "Child" category, 41 kg (90 pounds), will be added in the table. d) Accepted. Reference to TSO-C85 will be replaced by ETSO-C85a.	a) add to Para 5 Federal Test Method Standards No 191A may be obtained (or purchased) from the General Service Administration, Business Service Center, Region 3, 7th and D Streets, S.W., Washington DC 20407. b) 3.1.4.3 … has been approved as an equivalent to this permeability test by the Agency ... c) 4.1.8 table 1: Child: 16kg (35

Para	Commenter	Comment/Justification	Response	Resulting text
				pounds) to 41kg (90 pounds) d) 4.1.13 … meets the requirements of ETSO-C85a …
Draft Decision ETSO-C13f	S.Coleshaw, Consultant	**Comment 8** Editorial: Reword clause. It is not clear what the "minimum period of five minutes" applies to - presumably this relates to the inflation time. If this is the case, suggest: "The life preserver must be capable of satisfactory inflation for a minimum period of five minutes after exposure to the temperature range from -40 to +60 ºC". **Justification** The meaning of the current wording is ambiguous.	Partially Accepted. The minimum period of five minutes relates to the time that the life preserver is exposed to the mentioned temperature. The sentence will be rephrased.	4.1.6 Functional Temperature Range. The life preserver must be capable of satisfactory inflation after exposure for a minimum period of five minutes to the temperature range from –40 to +60°C (-40 to +140 degrees F).

Para	Commenter	Comment/Justification	Response	Resulting text
Draft Decision ETSO-C13f	S.Coleshaw, Consultant	**Comment 9** This test could be conducted without the use of an adult test subject to jump with the infant dummy. Research conducted on behalf of CEN TC 162/WG6 into the use of dummies to test infant/child lifejackets has shown that a child dummy can be dropped from heights of up to 3m, with reproducible results. Damage and poor design has been demonstrated using this method. This test procedure has been included in prEN ISO 12402-9:2002; 5.5.10.3. **Justification** Use of an adult test subject to hold the dummy is unnecessary and risks injury to the adult.	Not Accepted. This test will not be changed in order to maintain the technical similarity with the FAA TSO.	No text change
Draft Decision ETSO-2C70a	Boeing	**Comment 10** APPENDIX 1, Paragraph 4.1.1.2.2., which states: "*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*." and APPENDIX 1, Paragraph 4.1.1.2.4., which states: *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.* For escape slide/rafts, the normal positioning of raft occupants within the center areas of the raft is with their backs to each other for back support. Based on paragraph 4.1.1.2.4, it appears that this practice is acceptable, notwithstanding the requirements of paragraph 4.1.1.2.2. Boeing requests clarification to confirm that this positioning of passengers in center areas is acceptable in demonstrating compliance with the back support requirement.	Not Accepted. Paragraph 4.1.1.2.(x) describe the requirements in respect of demonstrating the rated capacity of the liferaft. Paragraph 4.1.1.2.4 in this only reflects the kind off assistance and instructions that can be given during this demonstration, and does not change the need to have a back support for each occupant. Similar to the demonstration of rated capacity in Paragraph 4.1.1.2 the need for a back support for each occupant is also described in alternative method for determination of the rated capacity in Paragraph 4.1.1.1 Approval for deviation from the ETSO standard remains possible in accordance with Part 21A 610 Back to back positioning of passengers in the centre areas of escape slide/rafts is only applicable for slide/rafts that must comply with ETSO-2C69c and is not related to ETSO-2C70a liferafts.	No text change

Para	Commenter	Comment/Justification	Response	Resulting text
Draft Decision ETSO-2C70a	Boeing	**Comment 11** The differences between requirements in proposed ETSO 2C70a and the parallel FAA TSO C70a for liferafts are relatively minor. Yet there is a small difference: With the acceptance of this NPA, will liferafts approved under the FAA TSO no longer receive approval for use on JAA/EASA-certified airplanes? Are JAA/EASA certified airplanes limited to only installation of liferafts that are approved under the ETSO? Boeing requests clarification on this issue. **Justification** Clarification	Noted. Approval for installation of ETSO is not within the remit of this ETSO NPA and an operational issue. JAR-OPS 1.360 states: Instruments and equipment complying with design and performance specifications other than JTSO on the date of JAROPS implementation may remain in service, or be installed, unless additional requirements are prescribed in this Subpart. Instruments and equipment that have already been approved do not need to comply with a revised JTSO or a revised specification, other than JTSO, unless a retroactive requirement is prescribed.	No text change
Draft Decision ETSO-2C502	S.Coleshaw, Consultant	**Comment 12** The requirements for test subjects are too onerous (see justification below). Medical screening should be sufficient for most of the water performance tests. A note is suggested stating that that medical examination, witnessing of tests by a physician and ethical approval are only necessary for cold water tests where there is some medical risk to the test subject. **Justification** Para 3.3 of EN ISO 15027-3:2002 requires a medical check up of subjects and that "the tests and a reasonable pre-treatment and follow-up shall be witnessed by a physician". It is considered that this is an error in the European standard and that this requirement relates to cold-water thermal testing only.	Accepted. Paragraph 2.2 from Appendix 2 will be removed. Remark. The remark in the justification mentioning an error in the EN ISO has been forwarded to CEN for review.	~~2.2 Test Subjects~~ ~~The test subjects shall comply with the requirements of paragraph 3.3 of EN ISO 15027-3:2002.~~

Para	Commenter	Comment/Justification	Response	Resulting text
Draft Decision ETSO-2C502	CAA Norway	**Comment 13** ETSO 2C502 og 2C503 Appendix 1 chapter 4.2 is identical I both standards. It is logical that this requirement will be followed up with a requirement regarding the marking of sizes of the suits, so the user can identify suits to their own size. We suggest to implement “Size or Size range” in the list of what to marked on the passenger suits. Reference to ETSO 2C502 appendix 1 chapter 19.2, and ETSO 2C503 appendix 1 chapter 13.2.	Not Accepted. Marking requirements are consistent with other industry standard marking requirements. Therefore the minimum marking requirement will not be made more detailed.	No text change
Draft Decision ETSO-2C502	S.Coleshaw, Consultant	**Comment 14** Reconsideration is requested regarding the need for an unconscious or incapacitated person to be turned to the face-up position. **Justification** This standard applies to "an immersion that incorporates the functionality of a lifejacket". Lifejackets are designed to turn an unconscious or incapacitated wearer from the face-down to the face-up position. This performance requirement is highly desirable and can be achieved with immersion suit/lifejacket combinations. In the helicopter accident near the Cormorant Alpha platform in the North Sea (1992), at least one of the victims who made a successful escape from the helicopter cabin was found face-down in the water. The constant-wear lifejacket standard ETSO-2C504 requires automatic turning from the face-down position within 5 seconds. The risk of drowning is the same whether a victim is wearing a lifejacket only, a suit and lifejacket combination or an integrated immersion suit.	Not Accepted. The self righting requirement in earlier drafts for these ETSO was replaced by the ISO turning test with the following justification: The lifejacket wearer has to be conscious to escape from the helicopter and inflate the lifejacket. It is therefore probable that the wearer will remain conscious for the time required to adopt the face up position. The face up position is required to be stable and should be maintained even if the wearer drifts into unconsciousness. Hence, self righting only offers a benefit if, after inflating the lifejacket, the wearer falls face down into the water from the helicopter, become immediately unconscious and do not receive assistance. To ensure reliable self righting when wearing an immersion suit a high buoyancy lifejacket is required. There are a number of disadvantages associated with these lifejackets. The buoyancy is achieved by having large front lobes which when inflated make it very difficult to board a liferaft. They also make the wearer ride high in the water and therefore more susceptible to be being swept away, the lobes acting as sails. On balance, the Turning Test is believed to offer the best solution to the overall safety objective.	No text change

Para	Commenter	Comment/Justification	Response	Resulting text
Draft Decision ETSO-2C502	S.Coleshaw, Consultant	**Comment 15** Reduce jump height to 3m. **Justification** A 3m jump is sufficient to demonstrate lifejacket 'riding-up' problems or similar issues relating to a shift in the position of the buoyancy that might reduce lifejacket performance. If lifejacket design or materials are poor, than a jump from this height will result in damage. Many test subjects find a jump from 4.5m rather frightening whilst they will generally tolerate a jump from 3m. More test facilities are available with a firm 3m platform that is suitable for running this test.	Not Accepted. ISO NORM is kept as the agreed standard. The comment is forwarded to CEN for information towards future amendments to ISO standards. Remark. The question raised to this test method has been forwarded to CEN for review.	No text change
Draft Decision ETSO-2C502	CAA Norway	**Comment 16** As described in draft to ETSO 2C502 chapter 13.4, no emergency lights on the market can comply with the requirement. A new emergency light has to be developed for the limited market. The requirement of 2 lights with a minimum light intensity of 0,75 candela (cd) instead of a light with the strength of 1 cd, seems strange. The range and visibility is 25% better with an increase of light strength of 25%. The increase of light intensity and visibility will be 0% by changing from on to two lights of 0,75 cd, since the light source is equal. The experts do not agree on the use of non- or flashing lights, and can therefore be assumed that the modulation does not affect the visibility. In addition is the risk that the light will reduce the suits characteristics at evacuation double, when two lights will be placed in the same area on the suits breast area. The amount of batteries that follows the personal equipment in the cabin will be increased considerably. It is appropriate that ETSO 2C502 and ETSO 2C504 will be reconsiders, so that requirements regarding emergency lights will be common, either so that common standards will be used, so that lights available on the market can be used, or in a way that the requirements will be so clear that unique emergency lights for ETSO 2C502 and ETSO 2C504 can be developed and separately approved. **Justification** Specification of requirement regarding on/off switch Standard for	Partially Accepted. Verification with the former HOSS working group revealed that the specifications in ETSO 2C502 and 2C504 unintentionally deviate from existing survivor locator light specifications. Furthermore, recommendation 12.7 from the CAP641 report made after the helicopter crash at the Cormorant Alpha platform in 1992, recommends considering issuing a requirement for strobe lights to be carried as part of personal survival equipment. It is therefore that the specifications for the survivor locator lights will be changed to one flashing ETSO-C85a survivor locator light	ETSO-2C502 Chapter 13.4 The integrated suit shall be fitted with a flashing survivor locator light that meets the requirements of ETSO-C85a. The light shall flash at a rate between 50 and 70 flashes per minute The location of the light shall be such that maximum practical conspicuity is achieved when in the water with the suit inflated. The light shall activate automatically and have a manually operated on/off switch. ETSO-2C504

Para	Commenter	Comment/Justification	Response	Resulting text
		emergency flashing light		APPENDIX 1: 10.2 Each lifejacket shall be fitted with a flashing survivor locator light that meets the requirements of ETSO-C85a. The light shall flash at a rate between 50 and 70 flashes per minute. The location of the light shall be such that maximum practical conspicuity is achieved when in the water with the suit inflated. The light shall activate automatically and have a manually operated on/off switch.

Para	Commenter	Comment/Justification	Response	Resulting text
Draft Decision ETSO-2C503	S.Coleshaw, Consultant	**Comment 17** The requirements for test subjects are too onerous (see justification below). Medical screening should be sufficient for most of the water performance tests. A note is suggested stating that that medical examination, witnessing of tests by a physician and ethical approval are only necessary for cold water tests where there is some medical risk to the test subject. **Justification** Para 3.3 of EN ISO 15027-3:2002 requires a medical check up of subjects and that "the tests and a reasonable pre-treatment and follow-up shall be witnessed by a physician". It is considered that this is an error in the European standard and that this requirement relates to cold-water thermal testing only.	Accepted Paragraph 2.2 from Appendix 2 will be removed.	~~2.2 Test Subjects The test subjects shall comply with the requirements of paragraph 3.3 of EN ISO 15027-3:2002.~~
Draft Decision ETSO-2C503	CAA Norway	**Comment 18** ETSO 2C502 og 2C503 Appendix 1 chapter 4.2 is identical I both standards. It is logical that this requirement will be followed up with a requirement regarding the marking of sizes of the suits, so the user can identify suits to their own size. We suggest to implement “Size or Size range” in the list of what to marked on the passenger suits. Reference to ETSO 2C502 appendix 1 chapter 19.2, and ETSO 2C503 appendix 1 chapter 13.2.	Not Accepted. Marking requirements are consistent with other industry standard marking requirements. Therefore the minimum marking requirement will not be made more detailed.	No text change
Draft Decision ETSO-2C503	CAA Norway	**Comment 19** Structure ETSO 2C503 and C2504 seem to be redundant. The only difference between 2C502 and the total of 2C503 and 2C504 is if the buoyancy remedy that gives 120 mm freeboard is integrated or not. The result of this structure is that the operator can choose if he wants an integrated suit, or if he wants to use a combination of suit or dedicated life jacket. It has to be pinpointed that the requirements in appendix 2 chapter 3.2 in ETSO 2C502 and 2C503 are identical. The requirements regarding self adjusting in ETSO 2C504 Appendix 1 chapter 8.3 will not result in a required combination of ETSO 2C503 and 2C504 being self adjusted. Experience from Norway (Norwegian Maritime	Not Accepted. It is correctly concluded that the operator can choose if he wants an integrated suit, or if he wants to use a combination of suit or dedicated life jacket. The integrated immersion suit (ETSO-2C502) and a combination of immersion suit (ETSO-2C503) and lifejacket (ETSO-2C504) have the same requirement in respect of the turn test. Both do not require self righting as explained in the response to ETSO-2C502 CRD page 13. It is the Agency’s opinion that this provides	No text change

Para	Commenter	Comment/Justification	Response	Resulting text
		Directorate) shows that a survival suit which is verified to self adjust an unconscious person in swimsuit, not will self adjust a person that wear survival suit or winter clothes. The disadvantage using a combination of survival suit and life jacket can therefore not compensate of any realistic advantages. There are some practical and economical disadvantages by using a combination survival suit and life jacket instead of an immersion suit. Mainly will a immersion suit eliminate a safety risk obliged with the person which shall wear two different types of equipment working together, and complexity in an immersion suit is reduced since the components are less and the function easier. We suggest that ETSO 2C503 and 2C504 withdraws, because they contribute the regulation unnecessary complexity without a positive or operational security. Same comment made for ETSO 2C504	operational flexibility and both option meet the minimum requirements.	
Draft Decision ETSO-2C503	S.Coleshaw, Consultant	**Comment 20** Reconsideration is requested regarding the need for an unconscious or incapacitated person to be turned to the face-up position. **Justification** This standard applies to "an immersion that incorporates the functionality of a lifejacket". Lifejackets are designed to turn an unconscious or incapacitated wearer from the face-down to the face-up position. This performance requirement is highly desirable and can be achieved with immersion suit/lifejacket combinations. In the helicopter accident near the Cormorant Alpha platform in the North Sea (1992), at least one of the victims who made a successful escape from the helicopter cabin was found face-down in the water. The constant-wear lifejacket standard ETSO-2C504 requires automatic turning from the face-down position within 5 seconds. The risk of drowning is the same whether a victim is wearing a lifejacket only, a suit and lifejacket combination or an integrated immersion suit.	Not Accepted. Also see the response to the same comment made for the integrated immersion suit (ETSO-2C502, CRD page 13) The turn test requirement is therefore the same in ETSO-2C502 and 503.	No text change
Draft Decision	S.Coleshaw, Consultant	**Comment 21** Reduce jump height to 3m.	Not Accepted. ISO NORM is kept as the agreed standard.	No text change

Para	Commenter	Comment/Justification	Response	Resulting text
ETSO-2C503		**Justification** A 3m jump is sufficient to demonstrate lifejacket 'riding-up' problems or similar issues relating to a shift in the position of the buoyancy that might reduce lifejacket performance. If lifejacket design or materials are poor, than a jump from this height will result in damage. Many test subjects find a jump from 4.5m rather frightening whilst they will generally tolerate a jump from 3m. More test facilities are available with a firm 3m platform that is suitable for running this test.		
Draft Decision ETSO-2C504	S.Coleshaw, Consultant	**Comment 22** The requirements for test subjects are too onerous (see justification below). Medical screening should be sufficient for most of the water performance tests. A note is suggested stating that that medical examination, witnessing of tests by a physician and ethical approval are only necessary for cold water tests where there is some medical risk to the test subject. **Justification** Para 3.3 of EN ISO 15027-3:2002 requires a medical check up of subjects and that "the tests and a reasonable pre-treatment and follow-up shall be witnessed by a physician". It is considered that this is an error in the European standard and that this requirement relates to cold-water thermal testing only.	Accepted Paragraph 2.2 from Appendix 2 will be removed.	~~2.2 Test Subjects The test subjects shall comply with the requirements of paragraph 3.3 of EN ISO 15027-3:2002.~~
Draft Decision ETSO-2C504	CAA Norway	**Comment 23** Structure ETSO 2C503 and C2504 seem to be redundant. The only difference between 2C502 and the total of 2C503 and 2C504 is if the buoyancy remedy that gives 120 mm freeboard is integrated or not. The result of this structure is that the operator can choose if he wants an integrated suit, or if he wants to use a combination of suit or dedicated life jacket. It has to be pinpointed that the requirements in appendix 2 chapter 3.2 in ETSO 2C502 and 2C503 are identical. The requirements regarding self adjusting in ETSO 2C504 Appendix 1 chapter 8.3 will not result in a required combination of ETSO 2C503 and 2C504 being self adjusted. Experience from Norway (Norwegian Maritime	Not Accepted. It is correctly concluded that the operator can choose if he wants an integrated suit, or if he wants to use a combination of suit or dedicated life jacket. The integrated immersion suit (ETSO-2C502) and a combination of immersion suit (ETSO-2C503) and lifejacket (ETSO-2C504) have the same requirement in respect of the turn test. Both do not require self righting as explained in the response to ETSO-2C502 CRD page 13. It is the Agency's opinion that this provides	No text change

Para	Commenter	Comment/Justification	Response	Resulting text
		Directorate) shows that a survival suit which is verified to self adjust an unconscious person in swimsuit, not will self adjust a person that wear survival suit or winter clothes. The disadvantage using a combination of survival suit and life jacket can therefore not compensate of any realistic advantages. There are some practical and economical disadvantages by using a combination survival suit and life jacket instead of an immersion suit. Mainly will a immersion suit eliminate a safety risk obliged with the person which shall wear two different types of equipment working together, and complexity in an immersion suit is reduced since the components are less and the function easier. We suggest that ETSO 2C503 and 2C504 withdraws, because they contribute the regulation unnecessary complexity without a positive or operational security. Same comment made for ETSO 2C503	operational flexibility and both option meet the minimum requirements.	
Draft Decision ETSO-2C504	S.Coleshaw, Consultant	**Comment 24** In "Appendix 1, 8.3 Buoyancy and floating position" amend reference to test method from "6.6.7 of EN 396:1993" to "6.7.7 of EN 396:1993". **Justification** a) Editorial error: Clause 6.6 of EN 396 refers to thermal stability of buoyancy material; Clause 6.7.7 refers to self-righting.	Accepted	This shall be demonstrated by testing to paragraph ~~6.6.7~~ 6.7.7 of EN 396:1993 or equivalent.
Draft Decision ETSO-2C504	S.Coleshaw, Consultant	**Comment 25** The requirement given in Appendix 1, 8.3 is in conflict with the requirement implied by the test method in Appendix 2, 3.2. All lifejacket and suit systems should require automatic self-righting performance. This performance requirement is highly desirable and can be achieved with lifejacket/immersion suit combinations. The test for stability should be kept but the turning test should be replaced by the self-righting test. **Justification** The risk of drowning is the same whether a helicopter occupant is wearing a lifejacket only, a lifejacket plus immersion suit or an integrated immersion suit. In the helicopter accident near the Cormorant Alpha platform in the North Sea (1992), at least one of	Not Accepted. The requirements in the mentioned Appendices are different for a reason and therefore not in conflict. On balance, the Turning Test is believed to offer the best solution to the overall safety objective for immersion suits and immersion suit/life jacket systems as explained on page 13 of this CRD. An automatic self-righting performance for lifejacket is required. There was no conclusion drawn from the investigation of the mentioned accident (Report CAP 641) that indicates a requirement change to	No text change

Para	Commenter	Comment/Justification	Response	Resulting text
		the victims who made a successful escape from the helicopter cabin was found face-down in the water.	immersion suits.	
Draft Decision ETSO-2C504	S.Coleshaw, Consultant	**Comment 26** Reduce jump height to 3m. **Justification** A 3m jump is sufficient to demonstrate lifejacket 'riding-up' problems or similar issues relating to a shift in the position of the buoyancy that might reduce lifejacket performance. If lifejacket design or materials are poor, than a jump from this height will result in damage. Many test subjects find a jump from 4.5m rather frightening whilst they will generally tolerate a jump from 3m. More test facilities are available with a firm 3m platform that is suitable for running this test.	Not Accepted. ISO NORM is kept as the agreed standard.	No text change
Draft Decision ETSO-2C505	DGAC, France	**Comment 27** a) What is the reason for adding survival kit equipment in this ETSO (Appendix 1, 9.7) when no such equipment is required in the similar ETSO 2C70f ? In addition what is “an appropriate language” required for the survival booklet ? b) Appendix 1, 14 requires that the liferaft be packed in a valise or container closed by lacing a cord of minimum breaking strength. What means are requires to ensure that the liferaft can be liberated from its container ? **Justification** a) Coherence and clarification b) Clarification	Partially Accepted. a) The survival kit equipment and it's content was added to replace the reference to JAR OPS 3. For consistency with similar ETSO 2C70a and other TSO this survival kit equipment requirement will be removed from this ETSO. Noted. b) Liferaft liberation from it's container must be in accordance with the requirement Appendix 1 paragraph 7.4.	a) Appendix 1 ~~9.7 Survival Kit and Case…~~
General	ACG, Austria	NPA is fully supported	Noted	No text change
General	FAA, USA	No comments.	Noted	No text change
General	CAA, UK	No comments.	Noted	No text change
General	CAA, Belgium	**Comment 28** Add a new paragraph in each of the following TSOs : “Life preservers”, “Helicopter crew and passenger integrated immersion suits”, ”Helicopter crew and passenger immersion suits”, “Helicopter constant-wear lifejackets” The ETSO-C13f: Life	Not Accepted. Resistance to puncture of a liferaft is included in the performance standard of liferaft by means of material standards and also described in ETSO-2C505 in paragraph 5.2 of appendix I. This is not	No text change

Para	Commenter	Comment/Justification	Response	Resulting text
		preservers, request 5.7.1 Adult, Adult-Child or Child. An inflated […] life preservers, must […] not cause injury to the wearer when the wearer jumps into the water […] The ETSO: LIFERAFTS (REVERSIBLE AND NONREVERSIBLE) request 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. There is no link between those TSOs. There is nothing to prevent “Life preservers”, “Helicopter crew and passenger integrated immersion suits”, ”Helicopter crew and passenger immersion suits”, “Helicopter constant-wear lifejackets” to cause damage to life-rafts when people will try to climb on board. Those pieces of equipment, including any accessory such as gas bottle etc., should be designated in such a way that they will not damage the life raft when people wearing them try to climb on board, are pulled on board by someone else also wearing such an equipment or simply when sitting in the raft. **Justification** It would be bad luck to puncture the life-raft with an equipment intended for survival.	specifically related to puncture by other safety equipment but to any object that could cause this, and therefore a link between these ETSO is not required. The performance standard to limit the risk of injury to persons or damage to other equipment of life preservers, immersion suits and lifejackets is sufficiently covered in the paragraph "Compatibility".	

Appendix I. Attachment to comment No 5 Multifabs Survival Ltd

Introduction

The ETSO immersion suit performance standards set out a comprehensive profile of performance requirements with the aim of ensuring that the immersion suits in question are fit for purpose. The objectives of the Standards are to ensure that operational needs are satisfied as well as ensuring basic threat protection in the event of ditching and exposure to immersion at sea are met.

Thermal Comfort

The provision of an immersion suit for continuous wear by crew when operating a helicopter should not jeopardise safety by causing discomfort which could result in degradation of crew performance.

Thermal comfort for passengers wearing immersion suits during transit offshore is also an important consideration.

The two ETSO Standards highlight the issue of comfort in Section 5.1;

'The design of the (integrated) 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.'

Optimising thermal comfort ensures that insulation worn underneath the immersion suit is not reduced by the effects of damping by perspiration. Developments in fabric technology in the last twenty years have seen the introduction of high performance water proof, breathable fabric laminates in aviation immersion suits that have greatly contributed to increased levels of helicopter occupant comfort.

These materials have been certified in accordance with the material performance profile defined CAA Specification No. 19, the current UK CAA performance standard.

ETSO Material Requirements

In both ETSO Standards, a set of material requirements are defined that encompass mechanical characteristics, low flammability characteristics, storage and operating conditions (in Section 7 of the Standards). The mechanical requirements in particular refer to ISO 15027 Part 1, Para 4.14.

ISO 15027 is a recently published [2002] worldwide harmonised standard relating to immersion suits, intended to provide a conformance standard that will satisfy the requirements of immersion suit validation to the European Union (EU) Personal Protective Equipment (PPE) Directive and the EU Marine Equipment Directive (MED).

The ISO Standard is presented in three parts, and embraces constant wear immersion suits including helicopter transit suits (Part 1), abandonment suits (Part 2), and associated Test Methods (Part 3).

ISO 15027-Part 1, Para 4.14 details requirements for materials, fabrics and components and describes:

- Temperature cycling
- Exposure to Salt Water
- Immersion in Fuel
- Resistance to Rot
- Resistance to Illumination [Colour fastness]
- Tensile Strength, following exposure to rot or illumination.
- Coated fabrics [extensive testing applicable]
- Other Fabrics

Performance Requirement Conflict

It has recently been discovered through laboratory testing that a performance conflict exists between the requirement of low flammability and material tensile strength after exposure to illumination, as defined by the ETSO material requirement criteria.

Recent material testing has indicated that currently available inherently flame retardant waterproof, breathable laminates used satisfactorily in aircrew immersion suits worldwide do not perform to the specified ISO 15027 tensile strength test after exposure to illumination.

The illumination test is in accordance with ISO 105-B04 Textiles - Tests for Colour Fastness to Artificial Weathering using a Xenon arc fading lamp test. The material is exposed to intense light from a xenon arc lamp in controlled conditions until it has undergone a significant and measurable change in colour.

Once the material has undertaken the illumination test, the tensile properties of the material are tested using a grab method, as described in EN ISO 13934-2.

Flame Retardancy

To exceed the ETSO specified low flammability standard, the suit fabric must be inherently flame retardant. This necessitates the use of fabrics constructed of fibres that are chemically resistant to exposure to heat, such as aramid fibres commercially known as ‘Nomex’ by Du Pont. This material can then laminated to a waterproof, breathable membrane (such as Goretex) to produce a finished material suitable for immersion suits.

The ISO 15027 standard contains a flammability test, but this is a much lower performance requirement than the ETSO low flammability test [described in Section 7.3 of the ETSOs]. The ISO test method described [in ISO 15027 Part 3, Section 3.5] originates from the International Maritime Organisation (IMO) Safety Of Life At Sea (SOLAS) Regulations and consists of the suit being passed over a burning test pan, briefly exposed for 2 seconds.

ISO 15027: Immersion Suit Standard Predisposition

The ISO 15027 material performance profile combination of a basic level of flammability combined with a high level of environmental durability is in accordance with maritime-orientated immersion dry suit standards in accordance with IMO SOLAS Regulations.

The performance criteria describing exposure to rot and illumination simulates the anticipated adverse storage and operating conditions in a maritime environment. This particular environmental exposure combination seems extreme and unlikely to be experienced in an aviation application given the controlled service and maintenance regimes in place [as part of JAR-145 servicing structure for instance]

Over 20 years experience of inherently flame retardant waterproof breathable fabric laminates used in the both civil and military aviation operational environment for demonstrate that currently available material performs acceptably. Such material fulfils current CAA Specification No. 19 performance criteria, as well as meeting UK, US and other European military performance requirements, yet would fall short on this element of the performance criteria.

It is interesting to note that during the formulation of the ISO Immersion Suit Standard there was little contribution by national or international aviation regulatory authorities. As a result, the stance of the ISO Standard tends towards the adoption of a maritime orientated performance profile that has been imposed on an aviation focused product. The result being that such suits are designed with a maritime theatre of operations in mind and do not accommodate the different operational requirements of an aviation environment.

ISO Standard defines a ‘constant wear immersion suit’ as ‘an immersion suit designed to be routinely worn for activities on or near water in anticipation of accidental immersion in water, but permitting physical activity by the wearer to such an extent that actions may be undertaken without undue encumbrance.’

With regard to the issue of thermal comfort, the ISO Standard defines heat strain as the 'increase of body temperature induced by sustained heat stress which cannot be fully compensated by temperature regulation, or activation of thermoeffector activities in response to heat stress which cause sustained changes in the state of other, non-thermal, regulatory systems.'

The ISO Standard specifies that the suit system shall be constructed in such a way to reduce the risk of heat strain during physical activities. The relevant testing includes walking, climbing, donning, dexterity, jumping into water and boarding a platform. This testing is performed at an ambient room temperature of around 20 deg C.

No thermal comfort testing is defined to assess the environmental exposure at elevated temperatures, such as cabin temperature when flying long into-sun flights in summer.

As such, it would be possible to produce a non-breathable immersion suit that would pass the testing described in the ISO Standard, yet this would be operationally unacceptable to wearers (particularly aircrew) in an aviation environment.

Addressing the Material Specification Conflict

Preliminary indications suggest that overcoming this performance conflict would necessitate the use of a heavier face fabric. This would have both operational and economic implications. A heavier fabric would result in a less breathable, heavier and more bulky laminate. This would produce a detrimental effect on comfort and increase thermal stress in elevated temperatures. Economically, producers of such waterproof, breathable laminates would need to re-engineer standard products with implications for material already manufactured.

A qualification exists within the Resistance to Illumination Test in ISO 15027-Part 3, section 4.14.3, in that 'Materials which are screened by some form of cover when in normal use shall not undergo illumination testing'.

In practice, the level of fabric degradation resulting from the ISO colour fastness to artificial weathering test is not experienced in actual operational conditions, suggesting that the detrimental effects of high intensity light required by the Standard are extreme (perhaps filtered by the canopy). Normal routine use of an aircrew immersion suit is essentially within the cockpit cabin: effectively the material is screened during normal use.

In conclusion, the recommendation would be to expand on this caveat such that current commercial inherently FR waterproof, breathable fabrics in service remain approved. This would ensure that current state of the art lightweight, highly breathable materials remain in service to ensure that the optimum levels of thermal comfort are achieved to ensure flight safety.

Reference Documents

- ETSO 2C502 Helicopter Crew and Passenger Integrated Immersion Suits for Operations to or From Helidecks Located in a Hostile Sea Area.
- ETSO 2C503 Helicopter Crew and Passenger Immersion Suits for Operations to or From Helidecks Located in a Hostile Sea Area.
- ISO 15027 Part 1: Immersion Suits - Constant Wear Suits.
- ISO 15027 Part 2: Immersion Suits - Abandonment Suits.
- ISO 15027 Part 3: Immersion Suits - Test Methods.
- ISO 105-B04 Textiles - Tests for Colour Fastness - Part B04: Colour Fastness to Artificial Weathering: Xenon arc fading lamp test.
- EN ISO 13934-2 Textiles - Tensile Properties of Fabrics - Part 2: determination of Maximum Force using the Grab Method