
**Air cargo — Fire containment covers
— Design, performance and testing
requirements**

*Fret aérien — Couvertures anti-feu — Exigences de conception,
performances et essais*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

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Introduction

This International Standard specifies the design and performance criteria and testing methods applicable to fire containment covers intended to be used in conjunction with air cargo unit load devices in order to meet through oxygen depletion the fire containment regulations in certain civil transport aircraft cargo compartments.

Throughout this International Standard, the minimum essential criteria are identified by use of the key word “shall”. Recommended criteria are identified by use of the key word “should” and, while not mandatory, are considered to be of primary importance in providing fire containment covers meeting the applicable regulatory requirements and ensuring effective protection against fires. Deviation from recommended criteria should only occur after careful consideration, extensive testing, and thorough service evaluation have shown alternate methods to be satisfactory.

The requirements of this International Standard are expressed in the applicable SI units, with approximate inch-pound units conversion between brackets for convenience in those countries using that system. Where it is deemed necessary to use exact values, the SI unit ones are to be used.

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Air cargo — Fire containment covers — Design, performance and testing requirements

1 Scope

1.1 This International Standard specifies the minimum design and performance criteria and testing methods of fire containment covers (FCCs) used:

- a) either in those cargo compartments of civil transport aircraft where they constitute one means of complying with applicable airworthiness regulations,
- b) or on a voluntary basis, when deemed appropriate by operators to improve fire protection in aircraft cargo compartments where airworthiness regulations do not mandate their use.

1.2 The FCCs specified by this International Standard are intended to be used to cover unitized cargo contained/restrained in an air cargo pallet and net assembly, for loading into aircraft main deck cargo compartments:

- a) either class F aircraft cargo compartments according to CS-25 § 25.857(f) and AMC to CS-25.855 and 25.857, in accordance with 1.1 a) above,
- b) or class B aircraft cargo compartments according to CS-25, CCAR-25, JAS Part 3 or 14 CFR Part 25 § 25.857 (b), in accordance with 1.1 a) or 1.1 b) above,
- c) or class E aircraft cargo compartments according to CS-25, CCAR-25, JAS Part 3 or 14 CFR Part 25 § 25.857 (e), in accordance with 1.1 b) above.

NOTE Though nothing prevents an FCC from being carried in a lower deck class C aircraft cargo compartment, it is not intended for this use since its fire containment capability would be redundant with that of the aircraft's fire detection and suppression system, which it could hamper.

1.3 The FCCs specified by this International Standard may be of two types:

- a) type I: separate devices to be installed over a pallet's load below a net approved for this purpose; or
- b) type II: devices permanently attached to a pallet net approved for this purpose.

1.4 The unit load devices (pallet and net) used in conjunction with the fire containment cover are specified in this International Standard only insofar as their flammability requirements are concerned. They are not otherwise specified in this International Standard.

NOTE See Bibliography for applicable ULD airworthiness approval and general design standards.

1.5 This International Standard is not intended to cover fire containment of loose baggage or loose cargo loaded in bulk cargo compartments.

1.6 This International Standard does not cover requirements for fire detection or suppression devices. The specified FCCs are passive devices.

1.7 The use of fire containment covers meeting the requirements of this International Standard is not sufficient alone to ensure flight safety: this International Standard is based on the assumption that the approved fire containment covers will be installed and checked prior to aircraft loading in accordance with appropriate operating instructions, by competent, suitably trained personnel as defined, for example, in ISO 9001:2008^[9], 6.2.2 (see 9.3 hereafter).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO 7137, *Aircraft — Environmental conditions and test procedures for airborne equipment*¹⁾

ISO 7166, *Aircraft — Rail and stud configuration for passenger equipment and cargo restraint*

ISO 10046, *Aircraft — Methodology of calculating cargo compartment volumes*

ISO 10254, *Air cargo and ground equipment — Vocabulary*

ISO 12236, *Geosynthetics — Static puncture test (CBR test)*

CAAC CCAR-25, *Airworthiness Standards – Transport Category Airplanes*²⁾

CAAC Chinese Technical Standard Order CTSO C90d, *Cargo pallets, nets and containers*

EASA CS-25, *Certification Specifications for Large Aeroplanes*²⁾³⁾

EASA Acceptable Means of Compliance (AMC) to CS-25.855/25.857, *Cargo or baggage compartments*³⁾

EASA Technical Standard Order ETSO C90d, *Cargo pallets, nets and containers (Unit Load Devices)*³⁾

Japanese Airworthiness Standard Part 3 (Civil Aeronautics Law Article 10 § 4)^{2) 4)}

U.S.A. Code of Federal Regulations (CFR) Title 14 Part 25 – *Airworthiness Standards: Transport Category Airplanes* (“14 CFR Part 25”)^{2) 5)}

U.S. FAA Technical Standard Order TSO C90d, *Cargo pallets, nets and containers (Unit Load Devices)*⁵⁾

NOTE Also see ULD (TSO/ETSO) airworthiness approval standards under references^[7] and^[12] in Bibliography.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10254 and the following apply.

1) ISO 7137 is the de facto recognition of the latest revisions of EUROCAE ED-14 and RTCA DO-160 with the same title. EUROCAE ED-14G can be obtained from the European Organization for Civil Aviation Equipment, 102 rue Etienne Dolet, 92240 Malakoff, France, or its website at www.eurocae.eu. RTCA DO-160G can be obtained from RTCA Inc, 1828 L Street, NW, Suite 805, Washington, DC 20036, USA, or through its website at www.rtca.org.

2) See paragraphs 25.855, 25.857 and Appendix F.

3) EASA CS-25, abbreviated throughout this standard as “CS-25”, constitutes the European governments’ transport aircraft airworthiness approval Regulations. It can be obtained from the European Aviation Safety Agency (EASA), Otto Platz 1, Postfach 101253, D-50452 Cologne, Germany, or its website at www.easa.europa.eu

4) The Japanese Airworthiness Standard Part 3 (ISBN 4-89279-661-1) constitutes the Japanese government transport aircraft airworthiness approval Regulations, and can be obtained from the Civil Aviation Bureau (CAB) of the Ministry of Land, Infrastructure, Tourism and Transport, Tokyo, Japan, or its website at www.mlit.go.jp/en

5) Code of Federal Regulations (CFR) Title 14 Part 25, abbreviated throughout this standard as “14 CFR Part 25”, constitutes the USA government transport aircraft airworthiness approval Regulations, and can be obtained from the US. Government Printing Office, Mail Stop SSOP, Washington DC 20402-9328, USA, or its website at www.ecfr.gov

3.1 fire containment fire control

ensuring that a fire does not grow to a state where damage to the aeroplane or harm to passengers or crew occurs during the time for which the fire containment system is demonstrated to be effective

3.2 fire containment cover FCC

passive device used in conjunction with an air cargo pallet and net in order to contain a possible cargo fire beneath it for a rated period

Note 1 to entry: Guidance addressing the use of FCCs is provided in airworthiness regulatory guidance as one allowable means of compliance with fire containment requirements in certain classes of aircraft cargo compartment.

3.3 active fire protection unit load device

unit load device incorporating built-in fire detection and/or fire extinguishing systems

3.4 passive unit load device

unit load device or accessory thereto (e.g. FCC) that includes neither fire detection nor fire extinguishing systems, and ensures fire containment by its use of fire-resistant or fire-proof material and limiting the supply of air

3.5 unit load device ULD

device for grouping, transferring and restraining cargo for transit

Note 1 to entry: It may consist of a pallet with a net or it may be a container.

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3.6 class A fire

fire in ordinary combustible materials, such as wood, cloth, paper, rubber, and plastics for which the quenching and cooling effects of quantities of water, or of solutions containing a large percentage of water, are of prime importance

3.7 fire resistant

grade designating components, equipment and structures capable of withstanding application of heat by a defined flame for 5 min

Note 1 to entry: See ISO 2685 and EUROCAE ED-14G [ISO 7137] sect. 26.

Note 2 to entry: Compare with fire proof (3.8).

3.8 fire proof

grade designating components, equipment and structures capable of withstanding the application of heat by a defined flame for 15 min

Note 1 to entry: See ISO 2685 and EUROCAE ED-14G [ISO 7137] sect. 26.

Note 2 to entry: Compare with fire resistant (3.7).

3.9 burn length

distance from the original edge to the farthest evidence of damage on a test specimen due to flame impingement, including areas of partial or complete consumption, charring or embrittlement, but not including areas sooted, stained, warped, or discoloured, nor areas where material has shrunk or melted away from the heat source

4 General requirements

4.1 Approval

4.1.1 The fire containment cover type design shall be approved on the basis of demonstration of compliance with the present International Standard, and a Certificate of Conformity shall accordingly be delivered by the manufacturer. Where the fire containment cover is intended to constitute a means of complying with applicable airworthiness regulations per 1.1 a) and 1.2 a) above, type approval should be sought from the airworthiness Authority concerned, who may include additional requirements.

4.1.2 The fire containment cover may be an entirely separate device (type I), or it may be attached to or integrated with an approved air cargo pallet net (type II). In the latter case, both sets of airworthiness approval requirements shall simultaneously be met, and no feature of either the cover or the net shall compromise an applicable requirement for the other function. The pallet net used in conjunction with the cover (type I) or attached to it (type II) shall be airworthiness approved under TSO/ETSO C90, and meet the additional flammability requirements in [5.1.3](#) hereafter. The TSO/ETSO C90 ultimate load requirements for the net and the flammability requirements are not required to be met simultaneously, because it is highly improbable that a cargo fire and maximum flight load condition would simultaneously occur.

4.2 Dimensions

4.2.1 The fire containment cover shall completely enclose one of the standard ULD contours in [Annexes A](#) to [C](#) hereafter, down to its base pallet edges but not covering its surface (see Note 1).

NOTE 1 The absence of a floor covering requirement is based on the fact that all known modern approved pallets have aluminium alloy base sheets sufficient to meet regulatory requirements [CS-25 / 14 CFR Part 25 Appendix F Part I § (a) (2) (iii)] by themselves. FCCs built to the present International Standard may not be suitable for pallets constructed of other materials. See [5.1.2](#) hereafter: pallets not meeting this minimum performance requirement would at least require a cover with a bottom panel over the pallet's surface, not specified in the present standard.

NOTE 2 Industry standard ULD contours, applicable to pallets, are defined in the IATA ULD Regulations Standard Specification 50/0 (see [13](#) in Bibliography) Appendix E. Where the FCC is intended and approved for one aircraft type only, the specific maximum ULD contour for that aircraft is to be used. In all cases, maximum pallet load contour is 50 mm (2,0 in) inside the maximum ULD contour on all four sides (see ISO 10046).

NOTE 3 At the time of publication of this International Standard, there are no known aircraft lower deck cargo compartments where fire containment covers are allowed means of meeting the regulatory requirements. However, because pallets built-up to the lower deck contour can be carried on main deck, FCCs for this purpose may also be built to the lower deck P standard ULD contour (see [Annex C](#)).

4.2.2 The fire containment cover's size shall provide sufficient clearance over the allowable contour to allow installation, but also to enable minimizing the risk of air entry at the base edge after installation (see [9.2.4](#)).

4.3 Materials

4.3.1 The fire containment cover shall be constructed of flexible fire-proof or fire-resistant material, or multi-layer composite material, meeting the fire resistance (flammability and flame penetration) requirements specified in [5.1](#) hereafter.

4.3.2 Any other elements of the fire containment cover's construction, e.g. sewing thread, any seams, welding, gluing, bonding, closure devices, seals, attachments, labels, placard holders, shall meet the same requirements once fitted on the FCC assembly.

4.3.3 Material selection shall ensure the highest possible wear, abrasion, shearing, tearing and puncture resistance. See [6.1.2](#) for puncture resistance testing and [6.1.4](#) for abrasion testing.

4.3.4 During material selection, preference shall be given to recyclable materials where this does not compromise best fire protection performance. Asbestos or asbestos compounds shall not be used. Other materials shall be assessed prior to selection as to potential detrimental effects on human health.

4.3.5 Material heating should not produce hazardous amounts of toxic gases. See [5.2.4](#).

4.3.6 Material colour is open to purchaser's choice, but should be selected in order to be clearly different from and contrasting with that of any general purpose cargo covers (see 9.1.2 of ISO 16412:2005) used by the same operator in order to avoid mistakes. Where a composite material of a non-attached fire containment cover is such that one side must be the inner one to withstand fire, the inner and outer colours shall be different to prevent inverted installation (also see [7.4](#)).

4.4 Weight

4.4.1 The fire containment cover's weight shall be kept to a minimum, consistent with fire and puncture resistance requirements. As a target, a type I fire containment cover's mass should not exceed 45 kg (100 lb), in order to allow installation by 2 persons, and a type II (with attached net) FCC's mass should not exceed 70 kg (150 lb), to allow installation by three persons where mechanical aids are not available.

4.4.2 If the 45 kg (100 lb) target mass is exceeded, consideration should be given to providing mechanical handling aids at pallet build-up sites, and the fire containment cover should have features and/or provisions for their use (see [4.5.7](#)).

4.5 Design

4.5.1 The fire containment cover's design shall be such that any inner features provide the minimum required fire resistance.

4.5.2 Where cover installation/removal requires opening/closing, the closure devices shall provide the required minimum fire resistance, and be protected by a sealing feature to prevent air entry once closed.

4.5.3 The fire containment cover's outer surface should be as smooth as possible to avoid any interference with the aircraft's doors, compartment linings, and lights, and /or risk of snagging on adjacent ULDs hardware.

4.5.4 Where deemed necessary, the lower edges of the fire containment cover, if not attached to or integrated with an approved pallet net, may include attachment fittings to fix it to the pallet's outer seat track. Such fittings, if provided, shall meet ISO 7166 geometric requirements. No minimum ultimate load capability is required, but fittings shall withstand normal cargo handling without disengaging.

4.5.5 The cover's normal and emergency (rapid decompression) pressure equalization functions (see ISO 11242^[10]) are to be ensured by there being no airtight closure between the bottom edges and the pallet edges. No specific feature is required.

4.5.6 For a type II fire containment cover attached to a pallet net, net attachment to the fire containment cover shall meet the flammability requirements for the net per [5.1.3](#).

4.5.7 The fire containment cover's design shall minimize installation and removal time. The target for installation over a full contour cargo pallet assembly built-up to the same maximum contour should not exceed 2 persons for a duration no longer than a standard net's, and installation should be possible without tools except means of access (e.g. ladder). Where a 45 kg (100 lb) target mass is exceeded, consideration should be given to providing mechanical handling aids at cargo terminals, and any provisions necessary for their use on the fire containment cover. If provisions for handling aids are fixed on the cover, they shall meet the requirements of [5.1](#).

4.5.8 The target time for removal should not exceed 2 persons for a duration no longer than a standard net's, preferably without mechanical handling aids.

4.5.9 Two placard holders shall be provided on opposite long sides of the outer surface of the fire containment cover at a height between 1 200 mm and 1 600 mm (48 in and 64 in) above the pallet edge. They shall receive a minimum ISO A5 format (148 × 210 mm, 8 1/4 × 5 7/8 in) standard pallet tag.

4.6 Environment

4.6.1 The fire containment cover shall be designed and its materials selected assuming it will be operated outdoors throughout temperature ranges of -40 °C (-40 °F) to 60 °C (140 °F) with relative humidity between 20 % and 85 %, including ice, snow and soaking in water.

4.6.2 The fire containment cover's materials shall be assessed for potential deterioration of their fire and puncture resistance due to weathering or other environmental factors, including U.V. and chemicals (e.g. kerosene, solvents, lubricants, aircraft hydraulic fluid, glycol-based de-icing or anti-icing fluid), temperature variations, humidity or fungus exposure, likely to be encountered in the course of worldwide air cargo operations. The manufacturer shall inform the purchaser about expected performance degradation and any identified chemical incompatibility.

4.6.3 The above shall be substantiated by at least the following tests performed on material specimens:

- a) U.V. and humidity test (see [6.1.3](#) for methods and requirements);
- b) puncture test (see [6.1.2](#) for methods and requirements);
- c) abrasion test (see [6.1.4](#) for methods and requirements).

4.6.4 Where applicable, testing should take into account the requirements of the EUROCAE ED-14G [ISO 7137] standard, and be accordingly subject to an Environment Qualification Form identifying the performed tests.

NOTE See EUROCAE ED-14G Appendix A for Environment Qualification Form. RTCA DO-160G^[20] is equivalent to EUROCAE ED-14G and may alternately be used.

4.6.5 An expiry date after which the rated performance may not be expected to be maintained shall be provided to the purchaser at or before the time of delivery of each production batch, and shall be marked on each cover as part of the required traceability code (see [7.2](#)). The expiry date may take into account the expected storage duration, provided storage conditions which might affect performance degradation are identified and catered for.

4.6.6 If the fire containment cover's construction includes woven textile material or thread, the available data concerning degradation of woven textile fibre performance when exposed to environment factors should be taken into account for material and thread selection and treatment, commensurate with the expected storage and service life of the fire containment cover unit. See ISO/TR 8647.

NOTE SAE AIR 1490C^[21] is equivalent to ISO/TR 8647 and may alternately be referred to.

4.6.7 In addition, the fire containment cover's components and materials should be selected in order to allow identified recycling methods when the unit is out of use or after its expiry date. Instructions for recycling shall be provided by the manufacturer (see [8.1](#)).

4.7 Maintenance

4.7.1 The manufacturer should, where feasible, provide approved procedures and repair kits meeting the fire resistance (flammability and flame penetration) requirements specified in [5.1](#) to durably repair punctures or tears in excess of the allowable damage limits (see [5.3](#)) in the fire containment covers.

4.7.2 The approved repair method(s) shall be defined in the Component Maintenance Manual (CMM, see [8.2](#) hereafter). Any approved repairs shall re-establish the unit's fire containment and air-tightness performance. This shall be substantiated by a repaired cover being subjected to a full scale FCC assembly test (see [6.2](#)). For this test, the repaired part should be located adjacent to and over the ignition box (see [6.2.2](#) and [Annex E](#)).

4.7.3 Whenever possible, repairs should be achievable using field kits without returning the damaged unit to a specialized workshop. Any curing time for bonding or equivalent shall be specified, and should not exceed 2 h in the open in the defined weather conditions. The allowable minimum and maximum