

SUBJECT : Class E Main Deck Cargo Compartment – Partial Liner Installation
REQUIREMENTS incl. Amdt. : CS 25.855(b)(1) at Amdt. 28
ASSOCIATED IM/MoC : Yes / No
ADVISORY MATERIAL :

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INTRODUCTORY NOTE:

The following Deviation (DEV) shall be subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

ABBREVIATIONS:

A/C	Aircraft
CS	Certification Specifications
DEV	Deviation
MDCC	Main Deck Cargo Compartement

IDENTIFICATION OF ISSUE:

EASA has received an application for a Major Change to Type Certificate for a Large aeroplane. The proposed design change aims at installing a fire detection system in a class E Main Deck Cargo Compartement to meet CS 25.857(e)(2) specification. However, the MDCC would remain with a partial liner installation only, although CS 25.855(b)(1) does request that:

(b) The following cargo or baggage compartments, as defined in CS 25.857, must have a liner that is separate from, but may be attached to, the aeroplane structure:

(1) Class B through Class E cargo or baggage compartments; and (...)

For this specific aircraft type, the MDCC is unpressurized and unventilated. As such, by design, when operated above 20.000 ft, the typical Class E oxygen starving procedure is already being applied. The MDCC is the only compartment on the Main Deck. The only occupied compartment is below the cargo floor and is designed as a separate pressurized compartment.

Additionally, the applicant will demonstrate that, in the event of a cargo fire in the MDCC and where heat would not be shielded by a liner, sufficient structural integrity of the airframe until the A/C is landed and evacuated is demonstrated.

As detailed in this paper (M-TS-0000394), the proposed pre-conditions and mitigating factors ensure compliance with the applicable Essential Requirements of Annex II of Regulation (EU) 2018/1139.

Considering all the above, the following Deviation is proposed.

M-TS-0000394

Deviation

Class E Main Deck Cargo Compartment – Partial Liner Installation

1. APPLICABILITY

This Deviation is applicable to Large Aeroplanes in Freighter Configuration with a Class E Main Deck Cargo Compartment installed.

1.1 AFFECTED CS

CS 25.855(b)(1) at Amendment 28

1.2 PRE-CONDITIONS FOR APPLICATION OF THE DEVIATION

The design of the cargo compartment must be neither pressurized nor actively ventilated.

2. APPLICABLE ESSENTIAL REQUIREMENTS OF REGULATION (EU) 2018/1139

The following paragraphs of the “*Essential Requirements*” for *Airworthiness* as defined in Annex II of Regulation (EU) 2018/1139 are related to the CS identified in 1.1 for which a non-compliance exists:

Annex II – Essential Requirements for Airworthiness:

...

2. AIRWORTHINESS ASPECTS OF PRODUCT OPERATION

2.3. Product operations must be protected from hazards resulting from adverse external and internal conditions, including environmental conditions.

...

(b) Cabin compartments, as appropriate to the type of operations, must provide passengers with suitable transport conditions and adequate protection from any expected hazard arising in flight operations or resulting in emergency situations, including fire, smoke, toxic gases and rapid decompression hazards, taking into account the size and configuration of the aircraft. Provisions must be made to give occupants every reasonable chance of avoiding serious injury and quickly evacuating the aircraft and to protect them from the effect of the deceleration forces in the event of an emergency landing on land or water. Clear and unambiguous signs or announcements must be provided, as necessary, to instruct occupants in appropriate safe behaviour and the location and correct use of safety equipment. Required safety equipment must be readily accessible;

3. STATEMENT OF DEVIATION

To address the non-compliance with the affected CS, the mitigating factors in chapter 4 shall be met. Compliance with the mitigating factors ensures compliance with the applicable essential requirements.

4. MITIGATING FACTORS

The following mitigating factors have been identified as alternative means to ensure compliance with the above identified essential requirements.

- a. As the Main Deck Cargo Compartment is neither pressurized nor actively ventilated, operations above 20.000 ft cabin altitude are by design equivalent to typical Class E oxygen starving procedure.
- b. It must be shown that, in the event of a cargo fire in the MDCC and where heat would not be shielded by a liner, sufficient structural integrity of the airframe until the aeroplane is landed and evacuated is demonstrated.
- c. Operational instructions and limitations must be developed by the Design Approval Holder aimed to ensure that no cargo items to be loaded/unloaded and carried in the MDCC may damage the aircraft structure.

Annex – Copy of Regulation (EU) 2018/1139 Annex II

(Published January 2023)

Annex II – Essential Requirements for Airworthiness:

1. PRODUCT INTEGRITY

Product integrity, including protection against information security threats, must be assured for all anticipated flight conditions for the operational life of the aircraft. Compliance with all requirements must be shown by assessment or analysis, supported, where necessary, by tests.

1.1. Structures and materials

1.1.1. The integrity of the structure must be ensured throughout, and sufficiently beyond, the operational envelope for the aircraft, including its propulsion system, and maintained for the operational life of the aircraft.

1.1.2. All parts of the aircraft, the failure of which could reduce the structural integrity, must comply with the following conditions without detrimental deformation or failure. This includes all items of significant mass and their means of restraint.

(a) All combinations of load reasonably expected to occur within and sufficiently beyond, the weights, centre of gravity range, operational envelope and life of the aircraft must be considered. This includes loads due to gusts, manoeuvres, pressurisation, movable surfaces, control and propulsion systems both in flight and on the ground.

(b) Consideration must be given to the loads and likely failures induced by emergency landings either on land or water.

(c) As appropriate to the type of operation, dynamic effects must be covered in the structural response to those loads, taking into account the size and configuration of the aircraft.

1.1.3. The aircraft must be free from any aero elastic instability and excessive vibration.

1.1.4. The production processes and materials used in the construction of the aircraft must result in known and reproducible structural properties. Any changes in material performance related to the operational environment must be accounted for.

1.1.5. It must be ensured, to the extent practicable, that the effects of cyclic loading, environmental degradation, accidental and discrete source damage do not reduce the structural integrity below an acceptable residual strength level. All necessary instructions for ensuring continued airworthiness in this regard must be promulgated.

1.2. Propulsion

1.2.1. The integrity of the propulsion system (i.e. engine and, where appropriate, propeller) must be demonstrated throughout and sufficiently beyond the operational envelope of the propulsion system and must be maintained for the operational life of the propulsion system, taking into account the role of the propulsion system in the overall safety concept of the aircraft.

1.2.2. The propulsion system must produce, within its stated limits, the thrust or power demanded of it at all required flight conditions, taking into account environmental effects and conditions.

1.2.3. The production process and materials used in the construction of the propulsion system must result in known and reproducible structural behaviour. Any changes in material performance related to the operational environment must be accounted for.

1.2.4. The effects of cyclic loading, environmental and operational degradation and likely subsequent part failures must not reduce the integrity of the propulsion system below acceptable levels. All necessary instructions for ensuring continued airworthiness in this regard must be promulgated.

1.2.5. All necessary instructions, information and requirements for the safe and correct interface between the propulsion system and the aircraft must be promulgated.

1.3. Systems and equipment (other than non-installed equipment):

1.3.1. The aircraft must not have design features or details that experience has shown to be hazardous.



- 1.3.2. The aircraft, including those systems, and equipment required for the assessment of the type design, or by operating rules, must function as intended under any foreseeable operating conditions, throughout and sufficiently beyond, the operational envelope of the aircraft, taking due account of the system or equipment operating environment. Other systems or equipment not required for type-certification, or by operating rules, whether functioning properly or improperly, must not reduce safety and must not adversely affect the proper functioning of any other system or equipment. Systems and equipment must be operable without needing exceptional skill or strength.
- 1.3.3. The aircraft systems and equipment, considered separately and in relation to each other, must be designed such that any catastrophic failure condition does not result from a single failure not shown to be extremely improbable and an inverse relationship must exist between the probability of a failure condition and the severity of its effect on the aircraft and its occupants. With respect to the single failure criterion above, it is accepted that due allowance must be made for the size and broad configuration of the aircraft and that this may prevent this single failure criterion from being met for some parts and some systems on helicopters and small aeroplanes.
- 1.3.4. Information needed for the safe conduct of the flight and information concerning unsafe conditions must be provided to the crew or maintenance personnel, as appropriate, in a clear, consistent and unambiguous manner. Systems, equipment and controls, including signs and announcements must be designed and located to minimise errors which could contribute to the creation of hazards.
- 1.3.5. Design precautions must be taken to minimise the hazards to the aircraft and occupants from reasonably probable threats, including information security threats, both inside and external to the aircraft, including protecting against the possibility of a significant failure in, or disruption of, any non-installed equipment.
- 1.4. Non-installed equipment
 - 1.4.1. Non-installed equipment must perform its safety function or function relevant for safety as intended under any foreseeable operating conditions unless that function can also be performed by other means.
 - 1.4.2. Non-installed equipment must be operable without needing exceptional skill or strength.
 - 1.4.3. Non-installed equipment, whether functioning properly or improperly, must not reduce safety and must not adversely affect the proper functioning of any other equipment, system or appliance.
- 1.5. Continuing airworthiness
 - 1.5.1. All necessary documents including instructions for continuing airworthiness must be established and made available to ensure that the airworthiness standard related to the aircraft type and any associated part is maintained throughout the operational life of the aircraft.
 - 1.5.2. Means must be provided to allow inspection, adjustment, lubrication, removal or replacement of parts and non-installed equipment as necessary for continuing airworthiness.
 - 1.5.3. The instructions for continuing airworthiness must be in the form of a manual, or manuals, as appropriate for the quantity of data to be provided. The manuals must cover maintenance and repair instructions, servicing information, trouble-shooting and inspection procedures, in a format that provides for a practical arrangement.
 - 1.5.4. The instructions for continuing airworthiness must contain airworthiness limitations that set forth each mandatory replacement time, inspection interval and related inspection procedure.
2. AIRWORTHINESS ASPECTS OF PRODUCT OPERATION
 - 2.1. The following must be shown to have been addressed to ensure safety for those on board or on the ground during the operation of the product:



- (a) the kinds of operation for which the aircraft is approved must be established and limitations and information necessary for safe operation, including environmental limitations and performance, must be established;
 - (b) the aircraft must be safely controllable and manoeuvrable under all anticipated operating conditions including following the failure of one or, if appropriate, more propulsion systems, taking into account the size and configuration of the aircraft. Due account must be taken of pilot strength, flight deck environment, pilot workload and other human-factor considerations and of the phase of flight and its duration;
 - (c) it must be possible to make a smooth transition from one flight phase to another without requiring exceptional piloting skill, alertness, strength or workload under any probable operating condition;
 - (d) the aircraft must have such stability as to ensure that the demands made on the pilot are not excessive taking into account the phase of flight and its duration;
 - (e) procedures for normal operations, failure and emergency conditions must be established;
 - (f) warnings or other deterrents intended to prevent exceedance of the normal flight envelope, must be provided, as appropriate to the aircraft type;
 - (g) the characteristics of the aircraft and its systems must allow a safe return from extremes of the flight envelope that may be encountered.
- 2.2. The operating limitations and other information necessary for safe operation must be made available to the crew members.
- 2.3. Product operations must be protected from hazards resulting from adverse external and internal conditions, including environmental conditions.
- (a) In particular, and as appropriate to the type of operation, no unsafe condition must occur from exposure to phenomena such as, but not limited to, adverse weather, lightning, bird strike, high frequency radiated fields, ozone, etc., reasonably expected to occur during product operation, taking into account the size and configuration of the aircraft;
 - (b) Cabin compartments, as appropriate to the type of operations, must provide passengers with suitable transport conditions and adequate protection from any expected hazard arising in flight operations or resulting in emergency situations, including fire, smoke, toxic gases and rapid decompression hazards, taking into account the size and configuration of the aircraft. Provisions must be made to give occupants every reasonable chance of avoiding serious injury and quickly evacuating the aircraft and to protect them from the effect of the deceleration forces in the event of an emergency landing on land or water. Clear and unambiguous signs or announcements must be provided, as necessary, to instruct occupants in appropriate safe behaviour and the location and correct use of safety equipment. Required safety equipment must be readily accessible;
 - (c) Crew compartments, as appropriate to the type of operations, must be arranged in order to facilitate flight operations, including means providing situational awareness, and management of any expected situation and emergencies. The environment of crew compartments must not jeopardise the crew's ability to perform their tasks and its design must be such as to avoid interference during operation and misuse of the controls.
3. ORGANISATIONS (INCLUDING NATURAL PERSONS UNDERTAKING DESIGN, PRODUCTION, CONTINUED AIRWORTHINESS MANAGEMENT OR MAINTENANCE)
- 3.1. As appropriate to the type of activity, organisation approvals must be issued when the following conditions are met:
- (a) the organisation must have all the means necessary for the scope of work. Those means comprise, but are not limited to, the following: facilities, personnel, equipment, tools and material, documentation of tasks, responsibilities and procedures, access to relevant data and record-keeping;
 - (b) as appropriate for the type of activity undertaken and the size of the organisation, the organisation must implement and maintain a management system to ensure compliance



- with the essential requirements set out in this Annex, manage safety risks and aim for continuous improvement of that system;
- (c) the organisation shall establish arrangements with other relevant organisations, as necessary, to ensure continuing compliance with the essential requirements for airworthiness set out in this Annex;
 - (d) the organisation shall establish an occurrence reporting system as part of the management system under point (b) and the arrangements under point (c), in order to contribute to the aim of continuous improvement of safety. The occurrence reporting system shall be compliant with the applicable Union law.
- 3.2. In the case of maintenance training organisations, the conditions under points 3.1(c) and 3.1(d) do not apply.
- 3.3. Natural persons undertaking maintenance must acquire and maintain a level of theoretical knowledge, practical skills and experience as appropriate to the type of activity.

