

SUBJECT : **Transportation of cargo in passenger compartments**

REQUIREMENTS incl. Amdt. : **CS 25.855 Amdt 24**

ASSOCIATED IM/MoC¹ : Yes ☒ / No ☐

ADVISORY MATERIAL : **EASA CM-CS-003 "Installation of Cargo Seat Bags on Passenger Seats"**
EASA CM-S-002 "Frequent Removal of Interior Structures"
EASA CM-CS-010 "Incomplete Passenger Cabin"
SAE ARP 4049A "Cargo Restraint on Aircraft Passenger Seats – Main Passenger Cabin"

INTRODUCTORY NOTE:

The following Special Condition (SC) has been classified as important and as such 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."


IDENTIFICATION OF ISSUE:

EASA has received applications proposing design changes aimed at carrying cargo, instead of passengers, in the passenger cabin of a (CS 25) Large Aeroplane beyond the already existing designated areas/volumes such as overhead bins, galleys or stowage compartments (used within their associated limitations).

The proposed designs will change the passenger compartment into a cargo compartment. The CS 25 provides certification specifications that do address the design of cargo compartments (ref. CS 25.855 and CS 25.857). However, the transportation of cargo on passenger seats or on the floor of the passenger cabin is not addressed in CS 25. To ensure an acceptable level of safety, in line with that required for the design of cargo compartments installed on large aeroplanes, additional Special Conditions need to be established.

The design of the passenger cabin does not meet any of the cargo compartment class definitions given in CS 25.857. The design of the stowage compartments available in the passenger cabin, the quantity and type of handheld fire extinguishers installed therein and the approved fire-fighting emergency procedures are driven by assumptions on the reasonable level of criticality of the fires that are likely to occur. In fact, cabin fires originate either from aircraft systems or from occupants personal belongings that are subject to high level of

¹ In case of SC, the associated Interpretative Material and/or Means of Compliance are published for awareness only and they are not subject to public consultation.

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|  European Union Aviation Safety Agency | Special Condition | Doc. No. : Issue : 1 Date : 09 JUN 2020 Proposed <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deadline for comments: 07 JUL 2020 |
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screening and control. Furthermore, it is assumed that passengers and crew members can timely detect cabin fires.

If the passenger cabin is used to transport cargo, the increased fire risk needs to be addressed through the installation of the additional aircraft systems required by CS 25.855 and CS 25.857 (e.g. smoke detection system, built-in fire suppression system, cargo liners, means to shut-off ventilation, smoke barrier).

If the cabin design is not upgraded to meet the requirements of a Class C, E or F cargo compartment, Special Conditions need to be established to achieve an acceptable level of safety.

Compliance with the Special Conditions can be demonstrated only through the introduction of severe restrictions to the type of cargo that can be transported in the cabin. The applicant needs to perform a risk assessment assuming that cargo items can be fully identified in content and are associated to a low fire risk. The main aspects that are covered by the Special Conditions are:

- the structural integrity and retention of cargo items under flight, ground and emergency landing conditions
- emergency evacuation
- fire detection and fire fighting in the cabin
- protection of aircraft systems
- the overall safety of the cabin occupants, including protection from hazardous quantities of smoke, flames, noxious gases and extinguishing agent

In case an applicant cannot or is not able to demonstrate compliance with this Special Condition or the stringent limitations to the kind of cargo transported in the cabin, a Deviation from the special conditions in Appendix A Chapter A may be proposed and will be assessed by EASA in accordance with point 21.A.101(e)1.(ii).

A Deviation in accordance with the above point will ensure that the level of safety targeted by the essential requirements of Annex II of the Basic Regulation (EU) 2018/1139 is achieved through mitigating factors although the proposed design does not comply with the certification specifications or this Special Condition. Mitigating factors might be e.g. operational and/or airworthiness limitations, inspections, limitations to the number of flight hours or flight cycles and/ or aircraft serial numbers. Limitations might be combined with alternative requirements to the CS, or dedicated characteristics of the design and/or procedures that ensure compliance to the essential requirements.

In order to request a potential deviation to this Special Condition, an applicant needs to propose mitigating factors that ensure as a minimum compliance with the essential requirements of the basic regulation (EU) 2018/1139 Annex II as per point 21.A.101(e)1.(ii).

Considering all the above, the following Special Condition is proposed:



Special Condition to CS 25.855 Amdt 24**Transportation of cargo in passenger compartments**

In lieu of CS 25.855(a), (b), (c), (d), (h) and (i) the passenger cabin compartment, when used as cargo compartment, shall meet the following special conditions:

1. Allowed cargo

1. The AFM shall include limitations to the type of cargo that is allowed to be transported in the passenger cabin.
2. Transportation of the following cargo in the cabin shall be prohibited:
 - a. dangerous goods, and
 - b. live animals.

2. Fire Protection

1. The AFM shall include the firefighting procedures that are adequate to address the fire risk posed by the type of cargo carried on board.
2. All materials installed in the cabin shall at least meet CS 25.853.
3. It shall be ensured that the presence of a fire would be timely detected considering all approved operating configurations and conditions.
4. The performance of fire and smoke detectors, if installed, shall be demonstrated.
5. There shall be means to extinguish the fire likely to occur in the areas where cargo is located.
6. There shall be means to protect the flight crew and any crew located in the cabin from hazardous quantities of smoke, flames, extinguishing agent or noxious gases.
7. The cargo installation in the cabin shall be designed such that:
 - a. Fires within the cabin compartment can be detected and extinguished by a crewmember having to manually fight the fire, and
 - b. There is an unrestricted access to the cargo transported within the compartment by the crew members equipped for fire detection and firefighting.
8. There shall be fire extinguishers and firefighting equipment installed in the cabin that
 - a. Are adequate to fight the kinds and classes of fires that are likely to occur considering the limitations applicable to the type of cargo allowed to be transported in the cabin.
 - b. Are adequately located to be in immediate reach for the personnel in charge of the fire fighting.
9. Depending on the fire protection means, it shall be demonstrated that no inadvertent operation of smoke or fire detectors in any compartment would occur as a result of fire contained in any other compartment, either during or after extinguishment, unless the extinguishing system floods each such compartment simultaneously.

3. Cabin occupants

The AFM shall:

1. Contain an operating limitation specifying the minimum number of crew members whose duties are to detect and fight a fire, and relay information to the flight crew. Additional occupants shall be justified based on a risk assessment.
2. Identify the seats that shall be occupied by the required occupants in the cabin during taxi, take-off and landing, also in emergency scenarios such as turbulence or decompression.
3. Specify that, if cargo is transported in the cabin, only occupants required by special condition 3.1. shall be transported in the cabin.
4. Specify that the occupants required by special condition 3.1. shall be trained on:
 - a. The operation of emergency exits (door opening, slide release)
 - b. The location and usage of oxygen equipment (automatic and portable) and procedures to be followed in case of depressurization
 - c. The usage of the two-way communication system between the flight deck and the cabin
 - d. The applicable fire protection procedures (e.g. fire detection, fire-fighting)
 - e. First aid.
5. Require that cabin occupants shall be physically able to accomplish the necessary procedures.
6. Require that a pre-flight safety briefing is delivered to the cabin occupants, highlighting the location of the available emergency equipment and which emergency exits will be used in an emergency evacuation.
7. Contain appropriate operating limitations for passenger and cockpit ventilation during firefighting, and after firefighting phase for smoke evacuation.
8. Require to carry portable oxygen equipment by any cabin occupant each time when leaving the seat for cabin walk through.
9. Require crew members to conduct a visual inspection of the cargo on a regular basis including prior to take-off and landing.

4. Emergency escape routes

1. The required emergency exits shall be easily accessible under any cargo loading condition.
2. If cargo is secured on seats, it shall not be installed in seat rows fore and aft or leading to emergency exits.
3. There shall be a clear separation of areas occupied by occupants and those loaded with cargo.
4. Cabin occupants shall be seated near an emergency exit on each side of the fuselage.
5. The installation of cargo in the cabin shall not decrease the width of the aisle(s) as per CS 25.815 considering the shifting of cargo items under the applicable ground, flight and emergency landing loads.
6. The installation of cargo in the cabin shall not obscure any portion of the required emergency exit marking and floor proximity emergency escape marking considering the shifting of cargo items under the applicable ground, flight and emergency landing loads.

5. Cargo loading

1. The means to provide the carriage of cargo (cargo seat bags, pallets,...), the means to restrain the cargo (nets, straps,...) and all of the attachment points (to seats, to pallets, to seat tracks/beams - including any fittings used) shall be designed for the placarded maximum weight of contents and for the critical load distribution (centre of gravity location) at the appropriate maximum load factors corresponding to the specified flight and ground load conditions and to the emergency landing conditions of CS 25.561(b).
2. In addition, as specified in CS 25.789(a), means shall be provided to prevent the cargo items from becoming a hazard by shifting under the appropriate maximum load factors corresponding to the specified flight and ground load conditions, and to the emergency landing conditions of CS 25.561(b).
3. Deflections and deformations of cargo items installations under the load conditions mentioned under 5.1. shall not result in additional forces being imposed on other items in the cabin (such as adjacent pallets, seats, sidewalls, ceiling panels and bulkheads) unless these additional forces are accounted for.
4. Deflections and deformations under emergency landing condition loads shall not block emergency evacuation paths nor access to emergency equipment.
5. Cargo loaded on seats should not extend above the seatback height.
6. If Cargo Seat Bags are installed:
 - a. As specified in CS 25.787(a), the cargo seat bags must fully enclose the contents and the enclosure shall meet the load conditions mentioned under 5.1.
 - b. Regardless of the extent to which they are filled with cargo, they shall be fully closed and secured to prevent anyone becoming trapped in an emergency case.
 - c. The supplier of the Cargo Seat Bags shall provide any limitation regarding loading and installation, instructions for continued airworthiness and instructions for use.
6. If the cargo installations do not provide a firm handhold, the occupants shall be able to steady themselves while using the aisles in moderately rough air (e.g. by a hand grip or rail along each aisle).
7. If cargo is loaded on the floor:
 - a. The height of the cargo shall not exceed 127 cm (50 inches).
 - b. The volume of each cargo loading area, whether on a pallet or directly tied to the floor shall not exceed 3.54m³ (125 ft³).
 - c. For appropriate access to the cargo and for firefighting purpose the following shall be provided:
 - ii. A longitudinal aisle(s) width of at least 51 cm (20"). Each longitudinal aisle shall enable a crewmember to traverse it while walking upright.
 - iii. A lateral access fore and aft of each loading area of at least 30 cm (15") wide.
 - iv. Access provisions shall be unobstructed by cargo restraint means and considering the shifting of cargo items under the applicable ground, flight and emergency landing loads.
 - d. Ventilation exhausts shall not be obstructed.

6. Electrical systems

1. Electrical systems and equipment, including installed in cabin areas in which cargo is transported shall be deactivated, removed, protected, relocated, or manipulated in a way that they do not cause an additional fire risk.
2. Equipment powered by batteries and installed in cabin areas where cargo is transported shall be protected in such a way that they do not cause an additional fire risk.

7. Oxygen systems

1. Oxygen systems installed in the cabin areas in which cargo is transported shall be deactivated, removed, protected, relocated or manipulated in such a way that they do not cause an additional fire risk.
2. Readily accessible portable oxygen shall be provided for the maximum number of occupants allowed in the cabin. The equipment shall meet CS 25.1439 (b) and CS 25.1443 (e) for hypoxia protection when walking around the cabin for fire detection.
3. Provisions shall be available to allow the flight crew members to notify the crew members in the cabin of emergencies (e.g. when to don the oxygen equipment, when returning to their seats is required).

Means of Compliance

The associated Means of Compliance is published for awareness only and is not subject to public consultation.

1. Allowed cargo

1. The adequacy of the fire protection design and strategy developed to meet the Special Conditions in Chapter 2 should be justified by means of a fire risk assessment.
The fire risk assessment should be made for the type of cargo that is permitted to be transported in the cabin. This assessment should cover:
 - The control of the cargo before loading: the type and quantity of cargo loaded in the cabin should be identified in detail,
 - The capability of the cargo load to self-ignite,
 - The flammability of the cargo load,
 - ...
2. Procedures should be developed to ensure that the pilot-in-command is provided with information on the content of all the cargo such as through the cargo manifest or other appropriate documentation.
3. In case the strategy for fire protection is based on crew members manually fighting the fire, the AFM limitations should include a positive list of items with low fire risk (e.g. items that are non-flammable) that are allowed to be transported in the cabin. In case of no process to control the content of the cargo items that are transported in the cabin, the design of the cabin should be changed to be in compliance with CS 25.855 and CS 25.857.

2. Fire Protection

1. If cargo seat bags are used to transport cargo in the cabin, they should meet at least CS-25 Appendix F Part 1(a)(1)(iv) and (v). The appropriate flammability standard that the bags should meet needs to be derived from the risk assessment conducted as per Means of Compliance 1. above. For instance, for a certain type of cargo, it may be possible to establish a fire protection strategy that relies on fire containment rather than on manual fire-fighting. This will involve that the material and construction of the bags meet the same flammability standard as fire containment covers (ref. CS-25 Appendix F, Part III).
2. Smoke detection could be achieved either with smoke detectors, or with crewmembers adequately located in the cabin where cargo is transported.
Any smoke or fire detection system that is installed to meet Special Condition 2.3. is subject to CS 25.858.
If no smoke detection or fire suppression system is installed, dedicated and trained personnel should inspect the cargo periodically during the entire duration of the flight. Crew may use technical carry-on devices that ease the detection of heat, fire or smoke.
3. Flight test data may be used to demonstrate compliance with the provisions of the special condition concerning:
 - a. The entry of hazardous quantities of smoke or extinguishing agent into compartments occupied by the flight crew or crew in the cabin; and
 - b. The dissipation of the extinguishing agent.

4. Cabin ventilation should be minimized to cope with the number of aircraft occupants in order to minimize the oxygen supply to a potential fire.
5. If the ECS system is configured with gasper outlets they should be in closed or off position at all phases of flight.
6. Regarding cockpit and cabin ventilation, it should be justified that the procedure contained in the AFM:
 - a. Does not slow down the fire extinction during the firefighting phase
 - b. Does not reactivate the fire after being extinguished during the smoke evacuation
7. For twin aisle airplanes, adequate access for fire-fighting is ensured if, among other things, cargo is loaded so that in each section of the cabin there is a means to cross from one aisle to the other at approximately equal distance from the existing cross-aisles (an empty seat row is considered to provide sufficient access from one aisle to the other).
8. The number, the type and location of fire extinguishers required to be installed in the cabin should be determined considering CS 25.851(a), AMC 25.851(a), AMC 25.851(a)(1), AMC 25.851(a)(2) and AMC 25.851(c), which include a reference to FAA AC 20-42D. In particular, fire extinguishers:
 - a. should be of an approved type,
 - b. should contain an extinguishing agent that is appropriate for the kinds and classes of fires likely to occur, and
 - c. should have a capacity that is adequate for any fire likely to occur in the compartment, considering the volume of the cargo, compartment and the ventilation rate.
9. As a minimum, the firefighting equipment installed at appropriate locations within the cabin and readily accessible for firefighting crew should include:
 - a. A smoke hood (ETSO C116 or equivalent)
 - b. Fire protecting gloves
 - c. A crow bar
 - d. A torch

The equipment may be part of the aircraft's basic emergency equipment.

3. Cabin occupants

1. Occupants required by special condition 3.1. should not share seat rows with installed cargo seat bags.
2. The personnel authorised to be in the cabin where the cargo is located may belong to one of the following categories:
 - a. A crew member whose presence is necessary to effectively perform the applicable fire protection procedures,
 - b. Any person determined by the operator for the particular flight, to be necessary for:
 - i. the safety of flight
 - ii. the loading or unloading of cargo
 - c. A person travelling to or from an assignment by the operator involving a function related to the operation of the aircraft to or from the assignment.

- d. Other categories of personnel authorized by the operational authorities of the operator
- 3. For cabin occupants to be seated “near” an emergency exit, the term “near” should be understood as specified in FAA AC 25.785-1B.
- 4. The use of crew rest compartments is allowed only if the available evacuation paths do not lead to cabin areas in which cargo is transported.

4. Emergency escape routes

- 1. The installation of cargo should not compromise compliance with the requirements of CS 25.812, considering the evacuation paths available to each cabin occupant. It should be evaluated if the floor proximity emergency escape path marking is required to guide occupants to an emergency exit. For example, cabin occupants may be located in an area which makes it necessary to move through the aisle(s) to reach any emergency exit, or the flight crew may need to move through the cabin to reach any emergency exit. The demonstration of compliance with CS 25.812 should be conducted simulating the presence and maximum envelope of the cargo. The time to charge the non-electrical floor path marking stripes should be defined for a cabin fitted with cargo.

5. Cargo loading

1. Structural Integrity

- a. When assessing deflections and deformations of the cargo installations under the load conditions mentioned under Special Condition 5.1, minimum distance requirements to already installed items in the cabin should be observed.
- b. Appropriate special factors (CS 25.619) such as fitting factors (CS 25.625) and wear & tear factors (CS 25.561) should be applied. Refer to CM-S-002 “Frequent Removal of Interior Structures” for more guidance on the application of the wear & tear factor.
- c. Structural loading limits and allowables (of the seats, cargo seat bags, pallets, nets, straps, seat tracks/beams,...) provided by the OEM should be adhered to, as well as any airframe limitations (weight and balance, floor loading capacity and running loads - per fuselage frame and in total). Minimum distance between adjacent load introduction points may be prescribed, e.g. for seat tracks/beams. For bulkheads that have a placard indicating maximum capacity, the cargo items stowed aft of these bulkheads should not exceed the maximum capacity indicated in the placard.
- d. Items for which (E)TSOs exist, such as pallets and nets, should be (E)TSO approved or shown to meet the minimum specification requirements of the applicable (E)TSOs.
- e. The installation of pallets on seat tracks/beams requires further attention. Special attachment means are typically needed as the existing seat track/beam arrangement is usually not compatible with the dimensions of the pallets, and pallets require specific locks/latches and pick-up points for tie-down. In addition, a passenger compartment floor is typically more flexible than a cargo compartment floor, so a careful design of the pallet

installation is to be considered. Large pallets attached on multiple seat track locations should not alter significantly the aircraft floor stiffness.

- f. Loads should be appropriately introduced (only adequate strong points should be used) and adequate strength should be provided in the direction of the acting loads.
- g. For items made of fabrics (such as nets, straps and cargo seat bags) environmental degradation (CS 25.603) should be accounted for (e.g. through the application of a special factor or establishment of a life limit).
- h. Any pre-tension loads in attachment means such as straps, nets, floor fittings, etc. should be accounted for.
- i. Cargo placed under seats should not exceed 9 kg (20 lbs) and should be properly restrained, including in the aft direction.

2. Pressure Loads / Decompression.

In relation to pressure loads / decompression, the following considerations apply:

- a. All cargo packaging should be able to equalize or sustain the (delta) pressure occurring during flight.
- b. Features that allow for reduction of decompression loads should be maintained, i.e. pallets or cargo should not obstruct the operation of decompression vents or air flow.
- c. If a significant amount of cabin volume is taken by cargo and the remaining cabin air volume is correspondingly reduced, this will lead to an increase in decompression loads on the floor structure in upward direction in case of a blow-out occurring above the floor. Depending on the OEM analysis assumptions, this case may exceed the available floor strength and needs to be checked.

3. Weight & Balance / Maintenance Program / Instructions for Continued Airworthiness (CAW).

Any instructions and limitations regarding the loading and installation of cargo in the passenger cabin as well as instructions for CAW need to be provided. Some examples of this would include:

- a. Cargo loading in a storage location that is not addressed in the airplane Weight & Balance Manual (WBM) would require a change to the WBM;
- b. Instructions on how to load cargo (i.e. distribute cargo items, considering for example rigid objects and vertical and horizontal centre of gravity locations) in seat bags or on pallets;
- c. Instructions on how to properly restrain cargo items with the use of seat bags, straps, nets and pallets and identification of the appropriate tie-down points;
- d. Instructions on how to maintain/store or repair items made out of fabrics (e.g. nets, straps and seat bags) that are subject to wear and tear as well as environmental degradation;

- e. The transportation of cargo (especially if palletized) through passenger doors may pose an increased risk of additional damage being inflicted to the doors and the airframe door surround area. Additional inspections to detect such damages may be needed. Likewise, the cabin floor may be subject (unless suitably protected, e.g. with additional foil) to an increased risk of additional damage compared to normal operation (with passengers).
- f. Applicants should verify if the assumptions that support the aircraft maintenance program (including the Airworthiness Limitations) remain valid due to the change in operations (e.g. change from passenger to cargo operation may invalidate the TC Holder's assumption on average payload factors or mission/flight durations used to establish the fatigue spectrum).
- g. Transportation of certain types of cargo (e.g. cargo that may release fluids) may increase the risk of contamination and consequent environmental damage to the aircraft structure and systems. This may pose a hazard that could compromise continued safe flight and landing of the aircraft and should therefore be addressed through dedicated inspections and maintenance tasks.

6. Electrical Systems

1. All systems and equipment (e.g. those powered by batteries) that could be involved in a cargo fire should be identified, and either adequately protected or relocated. It should also be prevented that a cargo fire may originate from the failure of a system or equipment that is part of the aircraft design. The evaluation should address also batteries that:
 - a. are part of the design of fixed ELTs, airbag systems and escape slides,
 - b. may be located in inaccessible areas adjacent to the cabin.
2. If an equipment that contains a battery (e.g. ELTs, flashlight, etc.) needs to be relocated, the impact on safety and training of crew members in the cabin should be considered. Such relocation makes the special conditions for lithium batteries applicable.
3. Wires shall be removed, or kept installed unpowered, capped and stowed, being not accessible. Potential damage that could be created by the loading/unloading of cargo should be avoided.
4. If portable wireless equipment is used as a means to detect a cargo fire, then EMI and/or T-PED tolerance should be evaluated in all phases of flight in which their use is foreseen.

7. Oxygen Systems

1. Portable oxygen equipment should be removed where cargo is installed.
2. For centralized passenger gaseous oxygen system, the applicant should get confirmation from the aircraft manufacturer that no oxygen is present in the passenger oxygen lines under normal operation.

- a. If confirmed, the opening of the PSU oxygen door should be forbidden by using for example the test knob button.
 - b. In case the aircraft manufacturer cannot confirm that no oxygen is present in the passenger oxygen lines under normal operation, or the firefighting procedure includes cabin depressurization, the oxygen source should be deactivated and cabin occupants should be provided with portable equipment for hypoxia protection meeting 25.1443(e) for a sufficient duration.
3. For decentralized oxygen systems, gaseous or chemical, the applicant should either remove the passenger oxygen system, or assess the maximum temperature to which the PSUs could be subject in case of fire developing in the cabin. This assessment should conservatively consider the maximum time to detect the fire associated with the longest time to extinguish the fire, and the shortest distance between the cargo and ceiling.
- a. If this temperature is below the one for which the system is qualified, the opening of the PSU oxygen door should be forbidden by using for example the test knob button.
 - b. If this temperature is above the one for which the system is qualified, the system should be removed or adequately protected from excessive temperatures. In no case, the protection means should adversely impact the capability of the crew members in the cabin or detection equipment/system, to detect the fire in due time. The protection means should also not obscure any portion of the required emergency exit marking and floor proximity emergency escape marking.