

## Certification Memorandum

# Loading Conditions for Occupant Safety in Cabin Interiors

**EASA CM No.: CM-S-009 Issue 01 issued 17 October 2018**

**Regulatory requirement(s): CS 25.601, CS 25.803, CS 25.785, CS 25.1309**

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## Log of issues

Issue	Issue date	Change description
001	17.10.2018	First issue

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## 1. Introduction

### 1.1. Purpose and scope

The purpose of this Certification Memorandum is to provide specific guidance for the certification of the installation of cabin interior components, which may potentially be subject to the application of concentrated loads by occupants in scenarios such as emergency evacuations, or during turbulence.

Concentrated loads may be applied as the result of occupants pulling, pushing, standing, stepping or sitting on interior components during any of the phases of flight, including emergency scenarios. For example, in order to evacuate from the flight deck of a large aeroplane, the flight crew may need to reach an escape hatch by stepping on certain interior components. The components that are used as steps, as well as those that are likely to be grabbed and pulled by the crew in order to climb to the hatch, should be shown to withstand the appropriate concentrated loads.

Design specifications issued by Type Certificate holders usually require the consideration of concentrated loads, not only in order to address potential safety issues for passengers and crew members, but also to demonstrate the robustness and the level of performance of interior components. Such loads may be referred to as 'abuse loads' or 'assist loads', depending on the type of scenario and the interaction that is being considered. Protection of the occupants is achieved through a combination of design considerations and compliance with specific requirements. It must be noted that the existing certification specifications do not consistently address the application of concentrated loads for the certification of cabin interiors. As a matter of fact, CS-25 Amendment 21 explicitly requires abuse load testing only on Large Glass Items (ref. AMC 25.603(a)) and Large Display Panels (ref. AMC 25.788(b)).

In the context of numerous certification projects, the industry has shown a growing concern over the inconsistency in the interpretation of existing certification standards with respect to the concentrated loads that are applied to cabin interior components.

EASA is of the opinion that additional guidance and interpretative material need to be established on this subject.

The guidance of this CM applies to large aeroplanes, but it may also be used as a reference for installations on other types of aircraft.

This document provides examples of acceptable values of loads to ensure the safety of the occupants, but it does not discuss the cases in which the integrity of the cabin components should be demonstrated by analysis or test. If compliance is shown through test, additional factors may be needed to adjust the value of the load to take into account variabilities in the material and the process of construction of the cabin component.

### 1.2. References

It is intended that the following reference materials should be used in conjunction with this Certification Memorandum:

Reference	Title	Code	Issue	Date
CS 25.301	Loads	CS-25	21	27/03/2018
CS 25.303	Factor of safety	CS-25	21	27/03/2018
CS 25.305	Strength and deformation	CS-25	21	27/03/2018
CS 25.365	Pressurized compartment loads	CS-25	21	27/03/2018
CS 25.561 (d)	Emergency landing deformations	CS-25	21	27/03/2018
CS 25.601	Design and construction, general	CS-25	21	27/03/2018
CS 25.603	Materials	CS-25	21	27/03/2018



Reference	Title	Code	Issue	Date
CS 25.785 (j)	Firm handhold	CS-25	21	27/03/2018
CS 25.788	Passenger amenities	CS-25	21	27/03/2018
CS 25.803 (a)	Emergency evacuation	CS-25	21	27/03/2018
CS 25.1301	Function and installation	CS-25	21	27/03/2018
CS 25.1309	Equipment, systems and installations	CS-25	21	27/03/2018
AMC 25.603(a)	Large glass items	CS-25	21	27/03/2018
AMC 25.788(b)	Large display panels	CS-25	21	27/03/2018
SAE ARP 5526D	Aircraft Seat Design Guidance and Clarifications	N/A	N/A	17/07/2015
SAE ARP 5475	Abuse load testing for In-Seat Deployable Video Systems	N/A	N/A	03/2001
SAE AS 8049C	Performance Standards for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft	N/A	N/A	08/2015
Gama pub. No. 13	ACCEPTABLE PRACTICES DOCUMENT, CABIN INTERIOR MONUMENT STRUCTURAL SUBSTANTIATION METHODS <a href="https://gama.aero/facts-and-statistics/publications/gama-and-industry-technical-publications-and-specifications/">https://gama.aero/facts-and-statistics/publications/gama-and-industry-technical-publications-and-specifications/</a>		1.0	20/05/2009
FAA Docket No. NM323; Special Conditions No. 25-311-SC	Special Conditions: Boeing Model 747-400 Airplane; Large Non-Structural Glass in the Passenger Compartment <a href="http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSC.nsf/0/AACCCFF3A99EC718862570F2004FF535?OpenDocument">http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSC.nsf/0/AACCCFF3A99EC718862570F2004FF535?OpenDocument</a>	---	Final	3/1/2016

## 2. Background

Where an interior component can be subject to critical interactions with occupants in scenarios such as turbulence or emergency evacuations, then appropriate concentrated loads should be taken into account to demonstrate that the critical interactions will not have any adverse effect on the safety of the occupants. Requirements that typically may need to be considered are shown below.

CS 25.601 requires that *'the aeroplane may not have design features or details that experience has shown to be hazardous or unreliable[...]*'

For equipment, according to CS 25.1309(a) *'The aeroplane equipment and systems must be designed and installed so that:*

- (1) Those required for type certification or by operating rules, or whose improper functioning would reduce safety, perform as intended under the aeroplane operating and environmental conditions.*
- (2) Other equipment and systems are not a source of danger in themselves and do not adversely affect the proper functioning of those covered by sub-paragraph (a)(1) of this paragraph.'*

CS 25.803 (a) requires the following: *'Each crew and passenger area must have emergency means to allow rapid evacuation in crash landings [...]*'

CS 25.785 (j) requires that: *' If the seat backs do not provide a firm handhold, there must be a handgrip or rail along each aisle to enable persons to steady themselves while using the aisles in moderately rough air.'*



It appears that a safe cabin inherently results from the application of good design practices over many years. Several OEMs have developed specifications for abuse and assist load values, based on ergonomics and human factors considerations, and supported by in-service experience. The values reflected in this CM have been accepted by EASA in previous certification projects, and they reflect current and past practices.

Based on experience, the relatively low frequency of occurrence of abuse loads makes it more appropriate to consider them as ultimate static loads. No additional factors such as fitting or casting factors need to be considered.

### 3. EASA Certification Policy

The integrity of interior cabin items such as monuments or pieces of equipment, to which cabin occupants may apply concentrated loads, either deliberately, or accidentally because of their location or configuration, must be substantiated when there is a potential for:

- injury to the crew or passengers; or
- the loss of a function that is necessary to ensure safe flight and landing; or
- a detrimental effect on evacuation; or
- physical distress or an excessive workload such that the flight/cabin crew cannot be relied upon to perform their tasks accurately or completely.

All such interior cabin items should be substantiated, considering the above criteria, through testing and/or analysis following the application of concentrated loads. The loads should be applied at what is realistically the most critical point and in the most critical direction.

The determination of the cabin items to be substantiated, as well as of the load to be applied to an item and the direction of the load, should be based on the specific cabin installation to be certified. In other words, no cabin item needs to be substantiated unless its installation is such that a critical interaction with occupants can be assumed to occur in certain scenarios. The value of the load and its direction depend on the type of the interaction, and not on the type of the cabin item that is under consideration.

Load cases from other applicable specifications such as CS 25.321 (flight loads), CS 25.471 (ground loads) or CS 25.561 (emergency landing conditions) also need to be complied with. Items located in compartments that are accessible in flight, e.g. certain cargo compartments and crew rest compartments, should also be considered.

EASA accepts comprehensive Type Certificate holders' specifications, as well as industry standards, as means to address the safety effects of concentrated loads on interior components.

Section 3.1 provides guidance on the concentrated loads that reflect the content of the current manufacturer design specifications and industry standards. These loads may be used as general references to generate substantiation data that is acceptable to EASA. Different values may be considered to be acceptable by EASA if they are justified as being appropriate for the specific configurations to be certified, for example, values from an existing, proven Type Certificate holder specification.



### 3.1. Guidance for concentrated loads

	0 to 150 cm above floor daN	At 200 cm above floor (linear reduction between 150 cm and 200 cm) daN	Concentrated load application area
Pushing	133	44	10 cm x 10 cm
Horizontal Pull 1 hand	66	22	10 cm x 10 cm
Horizontal Pull 2 hands	66 to 133*	44	10 cm x 10 cm
Up	66	22	10 cm x 10 cm
Down	88 to 133*	44	10 cm x 10 cm
Seating or stepping	133 to 222*	N/A (up to 100 cm)	Seat 30 cm x 30 cm Step 10 cm x 20 cm

Table 1: General concentrated loads

\*The appropriate value in the range must be selected considering the design of the specific feature. For example, glass panels exposed to a seating or stepping load will have to withstand 222 daN (ref. AMC 25.603(a)).

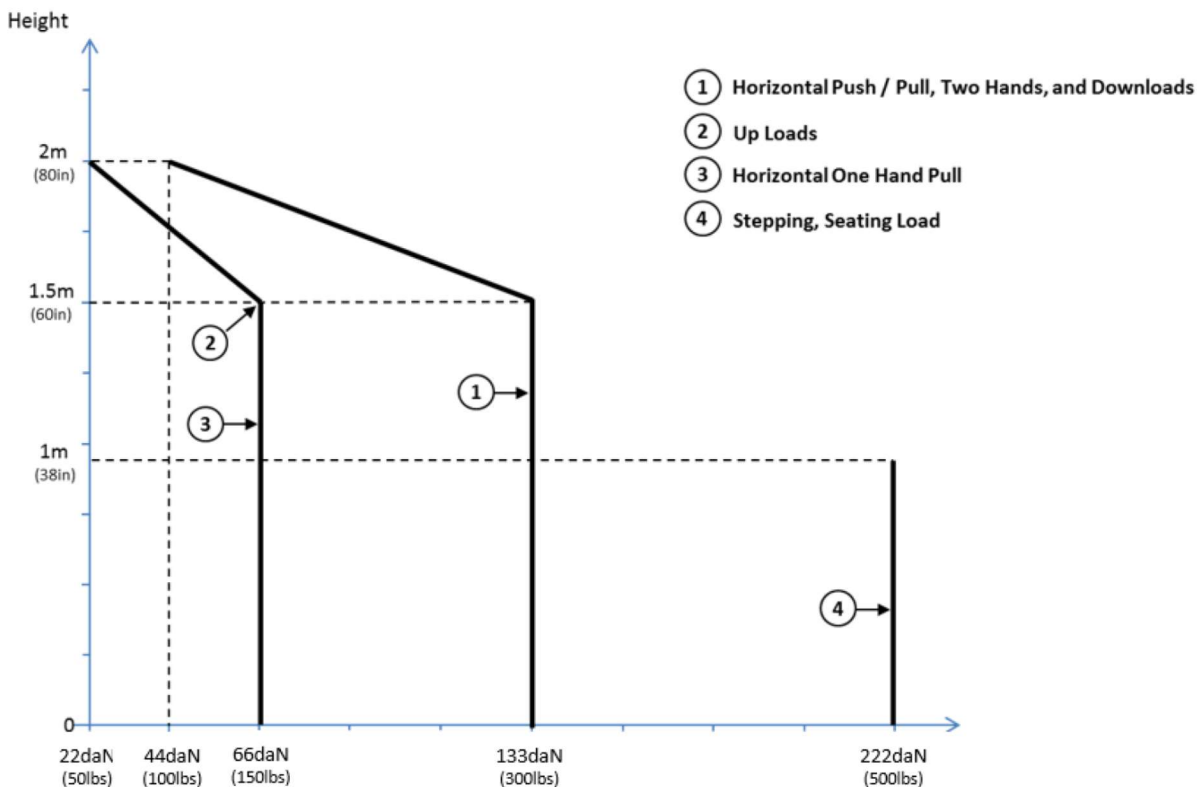


Figure 1: General concentrated loads



	daN	Comments
Seat back	89	If used as a firm handhold
Electronic Flight Bag	30	If loaded with one hand from a seated position
Bassinet fittings	133	Down direction
Partitions, galleys, lavatories	89	If used as firm handholds
Hand grip interior components (e.g. galley handle)	89	If used as firm handholds
Hand grip exit areas and doors (e.g. handle required by CS 25.813(b)(6))	133	Pull load
Hand Rail (e.g. overhead bin rail)	133	Down direction, if used as a firm handhold
Hand Rail (e.g. overhead bin rail)	89	Side direction, if used as a firm handhold
Free span curtain track (accessible to grasp)	89	From floor level to 200 cm at all critical locations , down direction
Curtain tracks with no free span	44	From floor level to 200 cm at all critical locations, down direction

Table 2: Examples of concentrated loads on specific cabin interior components

### 3.2. Whom this Certification Memorandum affects

This Certification Memorandum affects applicants for certification projects who install items in the cabin to which concentrated loads may be applied in critical scenarios.

## 4. Remarks

1. Suggestions for amendment of this EASA Proposed Certification Memorandum should be referred to the Certification Policy and Safety Information Department, Certification Directorate, EASA. E-mail [CM@easa.europa.eu](mailto:CM@easa.europa.eu).
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