

## Certification Memorandum

### Compliance with CS 27/29.952 (a) (4) for Helicopter external installations

**EASA CM No.: CM-S-011 Issue 03 issued 14 July 2022**

**Regulatory requirements: CS 27/29.865, CS 27/29.952**

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## Log of issues

Issue	Issue date	Change description
01	16/07/2017	First issue (consulted but not adopted)
02	12/03/2021	Content reviewed to further clarify the importance of a crash resistance fuel bladder. The title is simplified, and the scope is limited to design changes.
03	14/07/2022	Content reviewed to remove the reference in brackets to “above and underneath” describing the vicinity of the fuel tank in paragraph 3.1. Typos corrected.

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## 1. Introduction

### 1.1. Purpose and scope

The purpose of this Certification Memorandum is to provide specific guidance for the compliance of design changes with CS 27/29.952 a (4) [Ref. 3 and 4] for external helicopter installations in the vicinity of fuel tanks. It is also applicable to external loads that are certified in accordance with CS 27/29.865 [Ref. 1 and 2]

### 1.2. References

It is intended that the following reference material is used in conjunction with this Certification Memorandum (when applicable to the Rotorcraft Certification Basis):

Reference	Title	Code	Issue	Date
1	CS 27.865-External loads	CS-27	Initial Issue and all subsequent amendments	14 /11/2003
2	CS 29.865-External loads	CS-29	Initial Issue and all subsequent amendments	14/11/ 2003
3	CS 27.952-Fuel system crash resistance	CS-27	Initial Issue and all subsequent amendments	14 /11/ 2003
4	CS 29.952-Fuel system crash resistance	CS-29	Initial Issue and all subsequent amendments	14 /11/ 2003
5	AC 27.952-d1(i)-Fuel system crash resistance	AC 27-1B	Change 7 and all subsequent amendments	04/02/ 2016
6	AC 29.952-d1(i)-Fuel system crash resistance	AC 29-2C	Change 7 and all subsequent amendments	04 /02/ 2016
7	CM-CS-005-Helicopter External Loads Personnel Carrying Device System	---	001	08/12/2014
8	AMC 27.865- External loads	CS-27	Amendment 6 and subsequent amendments	17/12/2018
9	AMC 29.865- External loads	CS-29	Amendment 6 and subsequent amendments	17/12/2018
10	EASA CM-21.A-D-002-External Installations on Helicopters	---	Issue 01 and all subsequent amendments	27/09/2019
11	ROPWG -task 6- Final analysis report to the aviation rulemaking advisory committee (ARAC)	---	Issue 1 and all subsequent amendments	27/09/2018

### 1.3. Abbreviations

AC	FAA Advisory Circular
AMC	Accepted Means of Compliance
CFR	Code of Federal Regulations
CM	Certification Memorandum
CS	Certification Specification
CRFS	Crash Resistance Fuel System
DAH	Design Approval Holder
EASA	European Aviation Safety Agency
FAA	Federal Aviation Agency
FAR	Federal Aviation Regulation
HEC	Human External Cargo
ROPWG	Rotorcraft Occupant Protection Working Group
RTC	Restricted type certification
STC	Supplement Type Certificate
STCH	Supplement Type Certificate Holder
TC	Type Certificate
TCH	Type Certificate Holder

### 1.4. Definitions

External installations	Refers to external fixtures and external load attaching means.
External fixture	A structure external to and in addition to the basic airframe that does not have true jettison capability and has no significant payload capability in addition to its own weight. An example is an agricultural spray boom. These configurations are not approvable as 'External Loads' under CS 29.865 (see AMC 27/29.865 Amendment 6 and all subsequent amendments)
External load attaching means	Design feature in addition to the basic airframe related to the carriage of external loads. The related attachment means has a true jettison

capability (see definition AMC No 1 to 29.865 §(b)(20)) and is approved under CS 27/29.865-External Loads.

## 2. Background

Rotorcraft are operated in a wide range of uses including:

- External cargo operations
- Fire Fighting
- Power line inspection
- News gathering and live event transmission.
- Scientific measurement

For the purpose of the above uses, the installation of externally attached fixtures/loads (storage systems, water tank, external loads attaching means, massive hooks, steps, spray boom, etc.) is common practice.

The related external installations are mainly located under the rotorcraft fuselage, close to the centre of gravity and are often in the vicinity of fuel tanks (generally located below the passenger floor level and/or in the rear fuselage).

For rotorcraft that include the provisions of CS 27/29.952 in their certification basis, compliance with CS 27/29.952(a)(4) - Fuel systems crash resistance, is potentially affected by these external installations.

The installation of a crash resistance fuel bladder has been shown to be the most significant element of an effective craft resistant CRFS [Ref. 11].

EASA also considers that a crash resistance fuel bladder fundamentally contributes to the crashworthiness capability of a rotorcraft. The material of a fuel bladder is typically qualified according to ETSO-C80-Flexible fuel and oil cell material, which ensures that the minimum performance requirements (including a minimum puncture resistance) are achieved.

The purpose of this CM is to clarify to applicants and DAHs of the need to consider potential effect design changes for external installations on the compliance of the design with CS 27/29.952 (a)(4) and provide further guidance on the interpretation of these requirements and their acceptable means of compliance.

## 3. EASA Certification Policy

### 3.1. EASA Policy

CS 27/29.952 (a)(4) is applicable to the certification of external installations in the vicinity of fuel tanks.

Each application for a design change should be examined to identify if there are any external installations (such as: equipment, non-jettisonable external load attaching means, hooks, etc., including the associated structural reinforcement) in the vicinity of the fuel tank that could be a contributing hazard to the integrity of the fuel tank in the event of an impact as a result of a crash.

CS 27/29.952 (a)(4) requires the fuel tank to be tested and states that it:

*"(...) must be enclosed in a surrounding structure representative of the installation unless it can be established that the surrounding structure is free of projections or other design features likely to contribute to rupture of the tank".*

EASA considers that any external installations [Ref. 7, 8, 9, 10] in the vicinity of a fuel tank are part of the rotorcraft surrounding structure as defined in the CS 27/29 952(a)(4) and therefore can be considered to be a contributing hazard to the fuel tank in the event of a crash. In the case of jettisonable cargo or Human External Cargo (HEC) external loads operations, all parts of the external load attaching means that remain attached to the rotorcraft should be evaluated for compliance to CS 27/29.952(a)(4). This should be conducted despite the fact that CS 27/29.865 on External loads and the related AMC 27/29.865 and AC

27/29.865 (Amendment 27-36/29-43-External load attaching means) do not contain a reference to CS 27/29.952(a)(4).

FAA AC 27/29.952 d1(i) [Ref. 5 and 6] (which through AMC 27 General and AMC 29 General are considered to be AMC to CS 27/29.952) provides guidance on how to evaluate if the design change constitutes a hazard to the integrity of the fuel tank when compared to the surrounding structure that is tested in the rotorcraft reference drop test. In addition, the surrounding structure definition in the AC should also be considered to include any equipment that is installed in the vicinity of the fuel tank for certification.

The guidance for compliance demonstration that is provided in paragraph 3.2 of this CM is considered to be acceptable for EASA.

### 3.2. Guidance for compliance demonstration

EASA considers that the crash-resistant fuel bladder is the most significant element of an effective CRFS.

For rotorcraft that have been certified with CS 27/29.952 in their certification basis, EASA recommends that for design changes the risk of interaction between the fuel tank and external installations should be minimised. The applicant should consider the following design precautions as necessary:

- Applicants should either install external fixtures/loads out of the boundaries of the fuel tank when possible; or
- Applicants should take benefit from the installation or inclusion of shield and/or fuel tank protection features.

With such design precautions, applicants should be capable of showing that the surrounding structure that is representative of the installation is *“free of projections or other design features likely to contribute to rupture of the tank”* (CS 27/29.952 (a)(4) without the need for additional compliance demonstration through testing.

In the absence of such design precautions, an additional compliance demonstration will be necessary to evaluate if the design change constitutes an additional hazard to the fuel tank when compared to the surrounding structure used in the rotorcraft reference drop test (see FAA AC 27/29.952 d1(i)).

EASA supports the use of dynamic simulation that is correlated with the certification drop test for this purpose. However, it is not acceptable for dynamic simulation to be used for direct compliance with CS 27/29.952.

### 3.3. Who this Certification Memorandum affects

This Certification Memorandum affects all applicants (TC holders, STC holders) who incorporate an external installation in the vicinity of a fuel tank in a rotorcraft type design that was demonstrated to be compliant with CS 27/29.952 or a similar requirement in the applicable airworthiness code (JAR 27.952, JAR 29.952, FAR 27.952, FAR 29.952, etc.), according to its Certification Basis.

## 4. Remarks

For any question concerning the technical content of this EASA Certification Memorandum, please contact:

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