



Certification Memorandum

Helicopter External Loads Personnel Carrying Device System

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Regulatory requirement(s): CS 27/29.865

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1. Introduction

1.1. Purpose and scope

The purpose of this Certification Memorandum is to provide specific clarification and additional guidance for certification of equipment and devices intended for use in operations involving carriage of human external cargo on helicopters by means of cargo hook or hoist.

1.2. References

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

Reference	Title	Code	Issue	Date
CS 27/29.865	External loads	---	---	---
AMC 27/29.865	Human External Cargo for Operations within Europe	---	---	---
AC 27 1B/ 29 2C.865B	§ 27.865 (Amendment 27-36) EXTERNAL LOAD ATTACHING MEANS.	---	---	---
AC 29.865B	§ 29.865 (Amendment 29-43) EXTERNAL LOAD ATTACHING MEANS.	---	---	---
EC Directive 89/686/EEC	COUNCIL DIRECTIVE on the approximation of the laws of the Member States relating to personal protective equipment and harmonised EN-standards	---	---	---
Directive 2006/42/EC	DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on machinery, and harmonised EN-standards	---	---	---
TSO C167	Technical Standard Order Personnel Carrying Device Systems (PCDS), also known as Human Harnesses	---	---	---
EN 354	Personal protective equipment for work positioning and prevention of falls from a height – Lanyards			
EN 355	Personal protective equipment against falls from a height – Energy absorbers			
EN 358	Personal protective equipment for work positioning and prevention of falls from a height – Belts for work positioning and restraint and work positioning lanyards	---	---	---
EN 361	Personal protective equipment against falls from a height – Full body harnesses	---	---	---
EN 362	Personal protective equipment against falls from a height – Connectors	---	---	---
EN 363	Personal fall protection equipment – Personal fall protection systems			
EN 364	Personal protective equipment against falls from a height – Test methods	---	---	---
EN 365	Marking/packaging/instructions to use	---	---	---
EN 813	Personal fall protection equipment – Sit harnesses	---	---	---



Reference	Title	Code	Issue	Date
EN 1497	Personal protective equipment against falls from a height – Rescue harnesses	---	---	---
EN 1498	Personal protective equipment against falls from a height – Rescue loops	---	---	---
EN 1891	Personal protective equipment for the prevention of falls from a height - Low stretch kernmantel ropes			
EN 12275	Mountaineering equipment – Connectors – Safety requirements and test methods	---	---	---
EN 12277	Mountaineering equipment – Harnesses – Safety requirements and test methods	---	---	---

1.3. Abbreviations

a/c	Aircraft
AC	Advisory Circular
(E)TSO	(European) Technical Standard Order
EN	European Norm – in relation to Personal Protective Equipment (PPE) harmonised with the EC Directive 89/686/EEC
HEC	Human External Cargo
FAA	Federal Aviation Administration
FOCA	Federal Office for Civil Aviation (Switzerland)
ICA	Instructions for Continued Airworthiness
PCDS	Personnel Carrying Device System
PPE	Personal Protective Equipment
QRS/BQRS	Quick Release System/ Back up QRS
SPO HESLO	Special Operations Helicopter External Sling Load Operations
STC	Supplemental Type Certificate
ULmin	Minimum Ultimate Load

1.4. Definitions

HEC	<p>The definition of HEC is in FAA AC 27/29.865: Human external cargo (HEC). A person(s) that at some point in the operation is carried external to the rotorcraft.</p> <p>For the purpose of this Certification Memorandum HEC is transport of individuals external to the rotorcraft with simple and / or complex PCDS connected to the cargo hook / hoist</p>
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Personal Carrying Device System	The PCDS is a device or system that has the structural capability and features needed to transport occupants external to the rotorcraft during HEC operations. A PCDS includes, but is not limited to, life safety harnesses (including if applicable quick release and strop with connector ring), rigid baskets and cages that are either attached to a hoist or cargo hook or mounted to the rotorcraft airframe.
Minor change	A minor change is a change to the type design that has no appreciable effect on the mass, balance, structural strengths, noise, fuel venting, exhaust emission or other characteristics effect into the airworthiness of the product. (as per definition in Part 21).
Major change	All changes to the type design not considered as minor (see also Part 21).

2. Background

When humans are transported under helicopter cargo hooks or hoists, the certification rules require approval of the Personal Carrying Device Systems (PCDS). However, the approval process for a PCDS using the current airworthiness requirements that constitute the a/c certification basis has been questioned by European operators as being non cost effective, in particular when the PCDS is of a simple design. When the PCDS is of a simple design and when it complies with the European Standards that have to be complied with for the same devices when used to protect humans in non-flying activities, EASA considers that a simplified approach will provide equivalent safety, under the conditions described in this certification memorandum. This approach stems from the work previously carried out by various national Aviation Authorities.

3. EASA Certification Policy

3.1. Applicability

This Certification Memorandum provides additional guidance for the EASA airworthiness approval of :

- Personnel Carrying Device Systems of simple design (also referenced as 'simple PCDS')
- elements connecting it to a cargo hook or hoist as part of the external loads of the rotorcraft
- Elements attaching hoist operators to the cabin inside the helicopter

Approval of external load not human (cargo only) and of the systems connecting it below the cargo hook is deemed to be covered under operational approval (Guidance Material for SPO HESLO).

3.2. Classification of simple vs complex Personnel Carrying Device System (PCDS)

For the purpose of this Certification Memorandum a PCDS could be classified as simple or complex.

The following are examples of simple design:

- A safety harness or rescue triangle for max. 2 individuals conforming to the harmonised EN-Standard (Personal Protective Equipment (PPE) in accordance with a EN standard under EU Directive 89/686/EEC, incl. mountaineering equipment (e.g. EN 361 for body Harnesses, EN 358 for restraint systems [straps], EN 362 for Karabiners/fasteners). The harness could be attached directly to the hoist hook, or to the cargo hook via means of rope system.
- A fix rope system to be attached under a single cargo hook or Y-rope to be attached to a dual hook. The ropes must be certified according to a EN standard and be designed to transport maximum 2 persons.



- Elements restraining a single hoist or cargo hook operator inside the cabin, when the ropes are certified according to a EN standard.

The following are examples of complex design:

- a cage which hosts one or more individuals
- A system connecting 3 persons or more to the cargo hook

In case of a simple PCDS having new or novel features or which are not proven by appreciable and satisfactory service experience, or in case of any doubt in the classification please contact EASA or the relevant National Aviation Authority.

3.3. Way of approving the PCDS

A simple PCDS that follows the guidance of this certification memorandum may be airworthiness approved as a minor change.

Note: In case of airworthiness approval of simple PCDS on multiple helicopter types, an “applicable model list” could be accepted as an acceptable method to include a particular PCDS on various helicopter types. This should be done via a (single) minor change and a compliance verification matrix covering each helicopter/HEC system combination for which approval is sought.

Approval of a PCDS of complex design - such as a cage, basket, net, double cargo hook system (QRS/BQRS) or other attaching means not showing compliance to a EN standard - should be airworthiness approved as a major change and certified according to CS 27/29.865 and related guidance material.

3.4. Regulatory references

CS/FAR 27/29.865(c)(2), dealing with external loads, requires that for rotorcraft-load combinations to be used for human external cargo (HEC) applications, the rotorcraft must have a reliable, approved, Personnel Carrying Device System (PCDS).

The previously applicable guidance material (MG12) of AC 27-1B and 29-2C was replaced in 2006 by the new AC 27/29.865B which provides acceptable means of compliance with CS 27/29.865 and FAR 27/29.865 at amendment 27-36 and 29-43 respectively.

CS 27/29.865(f) requires that for HEC, the fatigue evaluation of CS 27/29.571 applies to the entire quick-release and personnel-carrying device structural system and their attachments to the rotorcraft (e.g. including ropes or cables to the approved hoist or hook).

3.5. Compliance procedures

The existing paragraph of FAA AC 27/29.865 regarding PCDS states that TSO C167 is an approved minimum performance specification for HEC body harnesses. Currently EASA has no ETSO corresponding to the FAA TSO C167. The approval process for a PCDS in the absence of an ETSO and the application of the fatigue requirements using the normally accepted means of compliance (detailed fatigue analysis supported by test) as provided in AC 27/29 MG 8 and MG 11 has been called into question when the PCDS is of a simple design and complies with applicable European standards for such devices, used to protect the occupant in the workplace. EASA therefore offers an alternative means of compliance for the certification of a simple PCDS and attaching means to the hook, providing safety factors and consideration of calendar life replacement limits in lieu of dedicated fatigue analysis and test.

The EC Directive 89/686/EEC and corresponding EN standards are an acceptable basis for certification of a PCDS to EASA requirements provided that:

- The PCDS is of a simple design. See paragraph 3.2 for examples.



- The applicable EC Directive 89/686/EEC and corresponding EN standards for the respective components are complied with (EC Type Examination Certificate).
- The applicant for the minor change has obtained from the manufacturer and keeps on record the applicable EC Conformity Certificate(s).
- The EC certified components are appropriately qualified for the intended use and environmental conditions.

Note 1: A simple PCDS has an EC Type Examination Certificate (similar to an STC), issued by a Notified Certification Body and, for the production and marketing, an EC Conformity Certificate (similar to an EASA Form 1) issued by the Manufacturer.

Note 2: In case of ropes or elements connecting simple PCDS to the hoist/cargo hook or internal helicopter cabin, the EN certification can be achieved by a body meeting the transposition into national law of the applicable EC regulation as for instance reported on the following website: http://ec.europa.eu/enterprise/sectors/mechanical/documents/legislation/personal-protective-equipment/transposition/index_en.htm

- The maximum load applied to each component between the HEC and the hook is conservatively estimated. This is particularly important when more than one person is attached by a single system to the cargo hook/ hoist. Appendix 1 defines the appropriate minimum ultimate load (ULmin). If ULmin is above the static strength currently declared by the supplier of the PCDS or of a component of the attachments, through compliance with a EN standard, then proof of sufficient strength for compliance with CS/FAR 27/29 is to be provided by static tests. All possible service load cases (including asymmetric load distribution) are to be considered. In this case the PCDS and/or the attachment means (e.g. rope, carabineer, shackles, etc.) must be capable of supporting ULmin for a minimum of three minutes without failure. There should be no deformation of components that could allow release of the HEC. Components and details added to the EN approved equipment (such as splicing, knots, stitching, seams, press fits, etc.) or the materials used (textiles, composites, etc.) that might reduce the strength of a product or could (in combination) have other detrimental effects have been investigated by the applicant and accounted for in the substantiation.
- Effects of ageing (due to sunlight, temperature, water immersion, etc.) and other operational factors that may affect strength are accounted for through appropriate inspections and application of a calendar life limit as appropriate. The PCDS and the related attachment elements are limited to the carriage of HEC.
- The risk of fatigue failure is minimised. See Appendix 1 for further details.
- Instructions for continued airworthiness (ICA) should be provided. Typically the ICA would comprise of an inspection programme and maintenance instructions based on the applicable manufacturer's data. The ICA should ensure that specific operational uses of the system that might affect its strength are accounted for. A calendar life limit should be applied when appropriate.
- When the harness is not designed to transport an incapacitated or untrained person, then the labelling and/or in the user/flight manual should include a specific limitation of use as applicable.
- In general for PPE the only repair design as per Part 21 should be a direct replacement. In case of doubt or for complex PCDS EASA or the relevant Competent Authority should be contacted.

3.6. PCDS / Helicopter Compatibility

The ingress/egress of the PCDS in the cabin should be verified on the specific helicopter by means of a test. The compatibility with the hoist hook, unless the ring is already specified in the Rotorcraft Flight Manual, should also be verified by means of test.

The hook PCDS compatibility should also verify absence of roll out /jamming phenomenon, in order:



- to prevent inadvertent release of the load from the cargo hook and /or
- to prevent that the ring jams on the load beam during the release.

3.7. Manufacturing and Identification

PCDS of simple design that comply with the applicable EC Directive 89/686/EEC and corresponding EN standards for the respective components are labelled by the manufacturer according to the standard. If not already contained in the manufacturer labelling, the following additional labelling –as applicable– should be made visible on the PCDS:

- Manufacturing date
- Life limit date (If lower than any existing one marked on the PPE)
- Manufacturer's identification
- Part Number
- Serial Number or unique identification of the single PCDS
- STC/minor change approval number (if applicable)
- Authorised load in kg
- Authorised number of persons
- Any other limitation not recorded in the manufacturer labelling

3.8. Operational considerations

3.8.1. Operator responsibility

The ICA should specify that the operator should keep a record of individual PCDS and fixed rope systems identifying at least the scheduled inspections and the related operational limitations (such as maximum load, maximum life limit and inspections). At least once a year the PCDS and ropes should go through a detailed inspection to check if there are any visible defects or alterations.

3.8.2. Applicability provisions to existing non certified simple PCDS

Existing non certified simple PCDS should be updated with PCDS following this certification guideline in a period of time not more than three years after publication of this Certification Memorandum. Any existing PCDS previously approved by the relevant Competent Authority might be continued to be used up to its expiration date.

3.9. Who this Certification Memorandum affects

Operators, Competent Authorities and Applicants for minor changes, supplemental type certificates and major changes concerning certification of human external cargo equipment, except when these are involved in operations addressed by the Art 1.2 of Regulation (EC) No 216/2008 (Exclusions).



4. Remarks

1. Suggestions for amendment(s) to this EASA Certification Memorandum should be referred to the Certification Policy and Safety Information Department, Certification Directorate, EASA. E-mail CM@easa.europa.eu or fax +49 (0)221 89990 4459.

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

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Appendix 1

Static strength.

The PCDS should be substantiated for the loading conditions determined under the applicable paragraphs of the FAA AC 27/29.865. For a PCDS to be certificated separately from the hoist using the guidance of this certification memo, the minimum ultimate load (ULmin) to be substantiated is defined as follows:

$$UL_{min} = M * n * j * j_f * K * g \quad (\text{Units are Newtons})$$

Where;

M is the total mass of the PCDS equipment/component and persons restrained by the part being substantiated. (This is equivalent to the working load rating of an EN.) The mass of each person should be assumed to be 100 Kg. Note: If the person(s) or their task requires the personal carriage of heavy items (backpacks, tools, fire extinguishers, etc.), these must be accounted for in the total mass M, in addition to the person's mass of 100kg.

n is the helicopter manoeuvring limit load factor and must be assumed = 3.5 (CS 27/29.337 and 27/29.865)

j is the ultimate load factor of safety for all parts = 1.5 (CS 27/29.303)

K is an additional safety factor for textiles = 2.0 (see Note (1)) (CS 27/29.619)

j_f is an additional fitting factor = 1.33 applying to all joints, fittings etc. (CS 27/29.619)

g is acceleration due to gravity of 9.81 m/s²

The resulting values to ensure compliance with CS 27/29 static strength requirements are:

ULmin for metallic elements with fitting factor (needed for all joints and fittings): = 7Mg

(Note: to address fatigue a value of 10Mg may be required - see section below on fatigue)

ULmin for textiles (webbing, ropes etc.) with fitting factor: = 14Mg (see Note(1))

ULmin may be compared to the strength of the PCDS components already substantiated according to EC Directive 89/686/EEC and corresponding EN-Standards or EC Directive 2006/42/EC, Annex I, Art. 6. Where ULmin is greater than the EC directive/EN requirements, a static test to not less than ULmin will be necessary. The test load must be sustained for three minutes. In addition, there should be no detrimental or permanent deformation of metallic components at 3.5Mg (CS 27/29.305).

Note (1), EC Directive 2006/42/EC, Annex I, Art. 6. recommends a safety factor of 14 (2 * 7) for textiles applied to the working load (equivalent to 14M above) for equipment lifting humans, whereas for a rescue harness EN 1497 requires a static test load of not less than the greater of either 15kN or 10 times the working load. In consideration of this difference, for each textile component within the PCDS certificated to one of the following ENs, the value of K may be reduced, such that ULmin is not less than 10Mg where M is not more than 150kg:

For a harnesses, EN 361, EN 1497 or EN 12277A, EN 813 or EN 12277C; for a for a belt or strap and for a lanyard, EN 354. This allowance is not applicable to ropes.

Furthermore, to allow this reduced value of ULmin and to address potential deterioration of textiles due to environmental and other hidden damages, the ICA must include a life limitation of 5 years (or the life indicated by the PCDS manufacturer if less) and an annual detailed inspection of the general condition of the harness.



Fatigue.

When the simple PCDS and the related attachment elements are limited to the carriage of HEC only, no further specific fatigue substantiation is necessary for each part of the PCDS that is either

- 1) certificated in accordance with an applicable EN referenced in this Certification Memorandum for which the allowable working load is not exceeded by the mass M.
- 2) substantiated for static strength as described above with ULmin not less than 10Mg.

