CS-31HB AMENDMENT 1 - CHANGE INFORMATION

The Agency publishes amendments to Certification Specifications as consolidated documents. These documents are used for establishing the certification basis for applications made after the date of entry into force of the amendment.

Consequently, except for a note “Amdt. 31HB/1” under the amended paragraph, the consolidated text of CS-31HB does not allow readers to see the detailed changes introduced by the new amendment. To allow readers to also see these detailed changes this document has been created. The same format as for publication of Notices of Proposed Amendments has been used to show the changes:

1. deleted text is shown with a strike through: ~~deleted~~
2. new text is highlighted with grey shading: new
3. ....
   Indicates that remaining text is unchanged in front of or following the reflected amendment.
   ....

Editorial Changes:

- **For administrative reasons and for consistency with new CS-31GB, a new format has been applied in this amendment (Book 1 text has been changed from 2 columns to 1 column).**
- **Throughout the document double quotes (“ ”) are changed to single quotes (‘ ’).**

Amend main cover page to read:

Certification Specifications

and

Acceptable Means of Compliance

For

Hot Air Balloons
CS-31HB

Amend Table of contents to read:

CONTENTS
CS–31HB – Hot Air Balloons

Amend Book 1 cover page to read:

~~**EASA Certification Specifications**~~

~~**for**~~

~~**Hot Air Balloons**~~

~~**CS-31HB**~~

~~**Book 1**~~

~~**Airworthiness Code**~~

CS-31HB

Book 1

Certification Specifications

Book 1

SUBPART A – GENERAL

Amend CS 31HB.1 to read:

CS 31HB.1 Applicability

~~This airworthiness code is~~ These Certification Specifications (SCs) are applicable to manned free balloons that derive their lift from:

(a) heated air (Hot Air Balloons)

(b) a combination of heated air and a non flammable gas being lighter than air (Mixed Balloons, also called Rozière).

Amend CS 31HB.2 to read:

CS 31HB.2 Definitions

Definition of terms used:

(a) The 'envelope' contains the medium which provides the lift.

(b) A '~~B~~basket' is the ~~container~~ basket, seat frame or other means suspended beneath the envelope provided for the carriage of the balloon occupants.

….

SUBPART C – STRUCTURE

Amend CS 31HB.25 as follows:

CS 31HB.25 factors of safety (See AMC 31HB.25)

~~(a) Except as specified in paragraph (b) and (c) of this section, the factor of safety is 1·5.~~

~~(b) A factor of safety of 5 or more must be used in envelope design. A reduced factor of 2 or more may be used if it is shown that the selected factor will preclude failure due to creep or instantaneous rupture from lack of rip stoppers. The selected factor must be applied to the more critical of the maximum operating pressure or envelope stress. (See AMC 31HB.25(b))~~

~~(c) A factor of safety of at least 2·25 must be used in the design of all fibrous or non-metallic suspension components. The primary attachments of the envelope to the basket must be designed so that failure is extremely remote or so that any single failure will not jeopardise safety of flight. (See AMC 31HB.25(c))~~

(a) A factor of safety must be used in the balloon design as provided in the table.

	Safety factor
Envelope	5·00
Suspension components (fibrous or non-metallic)	2·25
Suspension components (metallic)	1·50
Other	1 50

(b) A reduced factor of 2 or more may be used in the envelope design if it is shown that the selected factor will preclude failure due to creep or instantaneous rupture

from lack of rip stoppers. The selected factor must be applied to the more critical of the maximum operating pressure or envelope stress.

(c) The primary attachments of the envelope to the basket must be designed so that any single failure will not jeopardise safety of flight.

(d) For design purposes, an occupant mass of at least 77 kg must be assumed.

Introduce CS 31HB.27(g) as follows:

CS 31HB.27 Strength and proof of strength (See AMC 31HB.27)

….

(g) Each item of mass that could cause an unsafe condition if it broke loose must be restrained under all loads up to the ultimate loads specified in this paragraph. The local attachments in the load path between the restrains and the structure should be designed to withstand 1·33 times the specified ultimate loads (See AMC 31HB.27(g)):
- Horizontal 6·0g,
- Downward 6·0g,
- Upward 2·0g.

SUBPART D – DESIGN AND CONSTRUCTION

Amend CS 31HB.44 to read:

CS 31HB.44 Protection of envelope against tearing

~~The envelope must be designed so that hazardous propagation of tears or local damage will not result in a hazardous effect while the envelope is supporting limit loads.~~ The design of the envelope must be such that, while supporting limit load, local damage will not grow to an extent that results in uncontrolled flight or landing. (See AMC 31HB.44)

Amend CS 31HB.59 to read:

CS 31HB.59 Baskets

….

(l) ~~Information~~ Limitations on ~~limiting~~ the occupancy~~t~~ and configuration~~s~~ of a basket must be provided in the Flight Manual. (See CS 31HB.81~~). (See~~ and AMC 31HB.59(l))

SUBPART F – EQUIPMENT

Amend CS 31HB.72 to read:

CS 31HB.72 Miscellaneous equipment

….
(4) A fire extinguisher. (See AMC 31HB.72(a)(~~5~~4)
….

SUBPART G – OPERATING LIMITATIONS AND INFORMATION

Delete CS 31HB.83 as follows:

~~**CS 31HB.83 Conspicuity**~~

~~The exterior surface of the envelope must be of a contrasting colour or colours so that it~~

~~will be conspicuous during operation. However, multi-coloured banners or streamers are acceptable if it can be shown that they are large enough, and there are enough of them of contrasting colour, to make the balloon conspicuous during flight.~~

Book 2 cover page

Amend Book 2 cover page to read:

~~Certification Specifications for Hot Air Balloons~~

~~CS-31HB Book 2 Acceptable Means of Compliance~~

CS-31HB

Book 2

Acceptable Means of Compliance

Book 2

AMC SUBPART C – STRUCTURE

Amend AMC 31HB.25(b & c) to read:

AMC 31HB.25~~(b)~~
Factors of safety

The term 'envelope' here includes the integral vertical and horizontal load tapes as well as the envelope fabric(s). It should be noted that the envelope to suspension system pick-up points (sometimes known as 'turnbacks') should be regarded as part of the suspension system, rather than the envelope, as far as CS 31HB.25~~(a) & (b) are~~ is concerned.

~~AMC 31HB.25(c)~~
~~Factors of Safety~~

"Suspension components" here are those components, from the base of the envelope down, upon which form the primary load paths of the trapeze, basket or other means provided for the occupants.
~~Note: Envelope to suspension system pick-up points should be included as part of the suspension system in accordance with AMC 31HB.25(b).~~

The individual structural elements in the suspension system should be dimensioned and configured or duplicated so that failure of one structural element (single failure) does not cause any uncontrollable operating condition. The factors of safety apply to all parts of the load bearing path (e.g. joints, splices, knots, terminals etc).

The post-single failure case should be justified with the application of limit loads.
…

Introduce a new AMC 31HB.27(g) as follows:

AMC 31HB.27(g)
Strength and proof of strength

This requirement for items of mass does not apply to fuel cells that are subject to specific requirements in CS 31HB.45(c)
Items of mass (e.g. batteries or equipment) inside the basket or attached to the suspension system near or above the occupants should be considered because of their risk to the occupants.
Items of mass that do not cause a risk to the occupants during a hard or fast landing, but could become detached from the balloon (e.g. ballast attached to the outside of the basket in case of a mixed balloon), should be considered because of the potential loss of mass.

AMC SUBPART D – DESIGN AND CONSTRUCTION

Amend AMC 31HB.44 to read:

AMC 31HB.44
Protection of envelope against tearing

Unless it can be demonstrated that basic envelope ~~material~~ fabric has sufficient ~~can provide such a~~ rip-stopping capability, horizontal and vertical load tapes and/or other rip-stoppers should be incorporated into the structure of the envelope so that likely tear lengths are limited to those for which level flight can be maintained. Failure of the envelope fabric between rip-stoppers should be taken into account in the proof of the structure.

Demonstration of sufficient rip-stopping capability of the envelope fabric.
The objective of this demonstration is to show that the envelope fabric is sufficiently

damage resistant. It therefore needs to be determined at what tear size the envelope fabric would continue to tear under the maximum tension and conditions (Temperature) experienced in normal operation. In this AMC this tear size is called the critical damage.
In order to establish that the determined damage resistance is sufficient, the critical damage should be reviewed in relation to local damage foreseeable in normal operation. The local damages to be considered are:

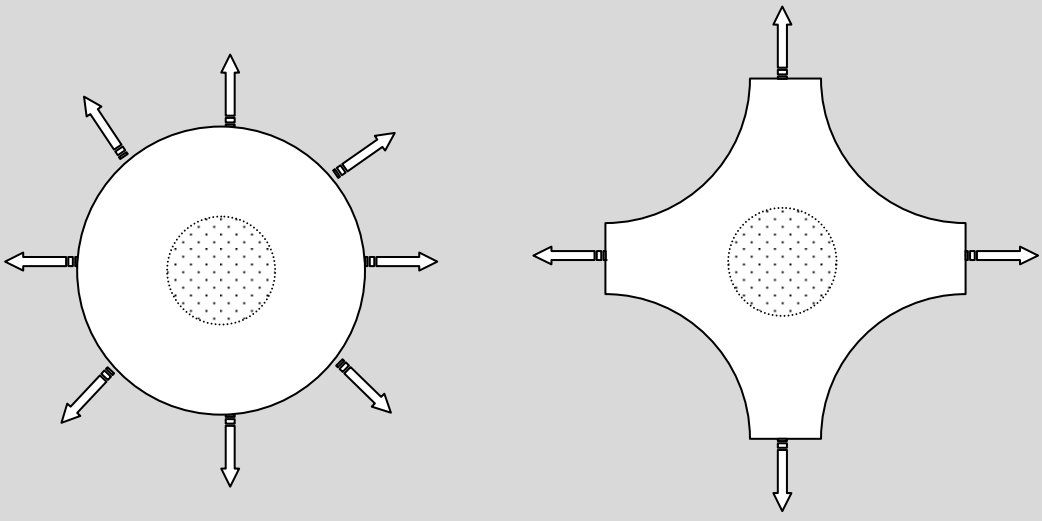
- Existing damage that may be undetected during pre-flight inspection, and
- Limited damage, inflicted during flight where the size of the damage in itself would not result in a catastrophic failure. (e.g. a limited damage caused by hitting a branch or other basket during take off)

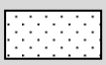
The resistance of envelope fabric to damage propagation should be determined by test.
Determine the critical damage to the envelope fabric at the maximum tension experienced in service. Critical damage is the maximum damage at which growth does not occur.
Damages to be considered are:

- A slit in the most unfavourable direction;
- A crosswise slit in the most unfavourable directions.

Test requirements

The envelope fabric should be tested at maximum tension experienced in service. The effects of temperature on the material properties must be taken into account.
The tension in the test area of the specimen of the fabric should be equal to the maximum tension experienced in service and the test method should not create unacceptable tension re-distributions in the test area when the test is conducted.
A step-wise increase of the damage (e.g. a cut with a sharp knife) should be used to determine the critical damage size.
Between the step-wise increases of the damage, enough time should be permitted for the tension re-distribution at the damage location.
The critical damage length of the material should be recorded.





Test area at limit load not influenced by the fabric clamp method

Examples of a circular or 2-directional test set-up.

Pre-flight inspection requirements

The design of the envelope and pre-flight Inspection method should be such that visible damage considerably smaller in length than the critical damage length can be detected

during a pre-flight inspection. The impact of ageing and operating circumstances should be considered when establishing the margin between critical damage and detectable damage length (refer to CS 31HB.27(f)).
Design features that could possibly hinder detection of damage during a pre-flight inspection should be avoided or taken into consideration when the detectable damage length is determined.
Note 1: It is assumed that a visual pre-flight inspection will detect damage above 10 cm.
Note 2: The critical damage is a design property that should not be confused with acceptable damage as provided in the flight manual.

Amend AMC 31HB.45(c) to read:

AMC 31HB.45(c)
Fuel cells

The ~~fastening~~ restraint of a full fuel cell (e.g. straps) should not detach under typical high g-loads experienced during a hard or fast landing.

In case of fuel cells supported at the lower end by the basket floor or other structure, the straps and buckle restraining a fuel cell shall be designed as applicable to a horizontal limit load of 6·0g and upward limit load of 2·0g. The factor of safety of 1·50 is applicable to these fuel cell straps.

The strap and buckle design should be shown to maintain sufficient pre-tensioned after a flight to withstand the upward limit load of 2·0g. The handling of the strap and buckle shall allow proper pre-tension, reliable locking, but also easy release e.g. for emergency fuel cell removal. Industry standards like EN 12195-2, ASTM D3950 or equivalent using the appropriate strap type and grade are considered appropriate standards.

Consideration of applied loads on fuel cells should include handling and transport cases.

AMC SUBPART F – EQUIPMENT

Amend AMC 31HB.72(a)(5) to read:

AMC 31HB.72(a)(~~5~~4)
…