NOTICE OF PROPOSED AMENDMENT (NPA) NO 2011-01

DRAFT DECISION OF THE EXECUTIVE DIRECTOR OF THE EUROPEAN AVIATION SAFETY AGENCY

On Certification Specifications for Free Gas Balloons (*"CS-31GB"*)

and

Amending Decision No 2009/005/R of the Executive Director of the European Aviation Safety Agency of 26 February 2009 on Certification Specifications for Hot Air Balloons ("CS-31HB")

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A. Explanatory Note

I. General

1. The purpose of this Notice of Proposed Amendment (NPA) is to propose introduction of Certification Specifications and Acceptable Means of Compliance for Free Gas Balloons. The scope of this rulemaking activity is outlined in Terms of Reference (ToR) 31.003/004 and is described in more detail below.

2. The European Aviation Safety Agency (hereinafter referred to as the 'Agency') is directly involved in the rule-shaping process. It assists the Commission in its executive tasks by preparing draft regulations, and amendments thereof, for the implementation of the Basic Regulation[1] which are adopted as 'Opinions' (Article 19(1)). It also adopts Certification Specifications, including Airworthiness Codes and Acceptable Means of Compliance and Guidance Material to be used in the certification process (Article 19(2)).

3. When developing rules, the Agency is bound to follow a structured process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as 'The Rulemaking Procedure'[2].

4. This rulemaking activity is included in the Agency's Rulemaking Programme for 2011. It creates the Certification Specifications for Free Gas Balloons (CS-31GB) that is part of the rulemaking task 31.003/004. A separate NPA will be drafted for the introduction of Certification Specifications for Tethered Gas Balloons when consultation of this NPA for Free Gas Balloons is concluded.

5. The text of this NPA has been developed by the Agency, based on the input from the 31.003/004 drafting group. It is submitted for consultation of all interested parties in accordance with Article 52 of the Basic Regulation and Articles 5(3) and 6 of the Rulemaking Procedure.

6. The proposed rule has taken into account the development of European Union and International law (ICAO), and the harmonisation with the rules of other authorities of the European Union main partners as set out in the objectives of Article 2 of the Basic Regulation. The proposed rule:

   a. is not covered in the ICAO Standards and Recommended Practices;

   b. deviates from the rules of FAA as described in paragraph 15 of this NPA.

II. Consultation

7. To achieve optimal consultation, the Agency is publishing the draft Decision of the Executive Director on its Internet site. Comments should be provided within 3 months in accordance with Article 6(4) of the Rulemaking Procedure. Comments on this proposal should be submitted by one of the following methods:

   CRT: Send your comments using the Comment-Response Tool (CRT) available at **http://hub.easa.europa.eu/crt/.**

   E-mail: In case the use of CRT is prevented by technical problems, these should be reported to the CRT webmaster and comments sent by e-mail to NPA@easa.europa.eu.

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[1] Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.03.2008, p. 1). Regulation as last amended by Regulation (EC) No 1108/2009 of the European Parliament and of the Council of 21 October 2009 (OJ L 309, 24.11.2009, p. 51).

[2] Management Board decision concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material ("Rulemaking Procedure"), EASA MB 08-2007, 13.6.2007.

Correspondence: If you do not have access to the Internet or e-mail, you can send your comment by mail to:

Process Support
Rulemaking Directorate
EASA
Postfach 10 12 53
D-50452 Cologne
Germany

Comments should be received by the Agency before 10 May 2011. If received after this deadline, they might not be taken into account.

III. Comment response document

8. All comments received in time will be responded to and incorporated in a comment response document (CRD). The CRD will be available on the Agency's website and in the Comment-Response Tool (CRT).

IV. Content of the draft Decision

9. Introduction

As part of the legislative process leading to Agency establishment, the Basic Regulation requires the Commission to adopt a comprehensive framework of rules for the implementation of the essential requirements. In the field of initial airworthiness, the implementing rules are contained in the Commission Regulation (EC) No 1702/2003[3], (hereinafter referred to as 'Part-21').

Pursuant to the Basic Regulation the Agency shall, where appropriate, issue Certification Specifications, including airworthiness codes and Acceptable Means of Compliance, as well as Guidance Material for the application of the Basic Regulation and its implementing rules.

Certification Specifications (CS) are the Agency's suggestions on best practices to be used to demonstrate compliance with the Basic Regulation and its implementing rules. These include, in particular:

- airworthiness codes, which are standard technical interpretations of the essential requirements for airworthiness contained in Annex 1 to the Basic Regulation; and
- acceptable means of compliance, which are non-exclusive means of demonstrating compliance with airworthiness codes or implementing rules.

10. Background of the CS for Gas Balloons

Development of a CS for Gas Balloons has started before EASA came into existence by a subgroup of the JAA (Joint Aviation Authorities) Core Group 9 (CG9) for "Lighter-than-air aircraft Requirements". This group proposed a number of draft CS's for Lighter-than-air aircraft.

Between 2003 and 2006, an advisory group of certification experts (BAPE (Balloon and Airships Panel of Experts)) reviewed these CG9 draft CS's in order to include the latest certification developments. In this NPA the draft CS from that review is referred to as the "CG9/BAPE draft".

The EASA 31.003/004 drafting group used the CG9/BAPE draft as the starting point for the development of CS-31GB contained in this NPA. A comparison was made between the

[3] Commission Regulation (EC) No 1702/2003 of 24 September 2003 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations. (OJ L 243, 27.9.2003, p. 6). Regulation as last amended by Commission Regulation (EC) No 1194/2009 of 30 November 2009 (OJ L 321, 8.12.2009, p. 5).

CG9/BAPE draft and the already published CS-31HB for Hot-Air Balloons. This was done to achieve a consistent wording and structure between CSs, where possible, and includes lessons learned from the development of CS-31HB. A more detailed rationale for changes to the draft requirements or new requirements is provided in the paragraphs below.

Note: The drafting group discussions of the CG9/BAPE draft and the current CS-31HB also raised some issues where an amendment of CS-31HB is considered necessary. This NPA therefore also contains proposals to amend CS-31HB. The rationale for non-editorial changes is also provided in the drafting group considerations stated below.

11. Drafting group considerations

Draft CS 31GB Subpart A – General

The applicable definitions from CS-31HB are used and complemented by the definition for "disposable ballast". Definitions of masses that existed in the CG9/BAPE draft have been removed because their meaning is detailed in Subpart B. There was no need for a definition for "minimum ballast" since it was only used once in CS 31GB.51 Disposable Ballast.

Draft CS 31GB Subpart B - Flight

Subpart B is fully consistent with Subpart B of CS-31HB. It should be noted that former airworthiness codes used for Gas Balloons did not have a "Performance: climb" requirement. The introduction of this requirement now provides a safe minimum climb performance that is equal to that for CS-31HB and serves as a minimum to clear obstacles when taking off.

Draft CS 31GB Subpart C - Structure

CS 31GB.23 Load factors

In comparison to hot air balloons, the inertia forces from the envelope weight encountered during a landing for a gas balloon are approximately ten times lower. A landing load factor like in CS 31HB.23(b) is therefore considered not applicable to gas balloons.

CS 31GB.25 Factors of safety

The CG9/BAPE draft and CS-31HB contain a requirement that the primary attachments of the envelope to the basket must be designed so that failure is extremely remote or any single failure will not jeopardise the safety of flight.

This NPA proposes **not** to keep the option to show that "failure is extremely remote".

Rationale

The structural requirements are first of all made sufficiently robust through application of conservative factors of safety of the suspension components in other paragraphs of this requirement. Secondly, the "calculation" of "extremely remote" is in practice not used because there is no appropriate statistical data available to make the analysis.

But most importantly, the "or" in this requirement would allow a design that meets the strength requirement but where a single failure could jeopardise the safety of flight. This is not acceptable when, for example, a human error in balloon rigging could occur.

HOT-AIR BALLOONS related proposed amendment to CS-31HB.25 Factors of safety

The above-mentioned practice and logic is also applicable to the primary attachments of the envelope to the basket for hot air balloons. The subject paragraph is therefore amended consistent with the draft CS-31GB.

CS 31GB.27 Strength and proof of strength

Elements of the CG9/BAPE draft that address how proof of compliance can be shown have been moved to AMC similar to CS-31HB.

The requirement for netted balloons from the CG9/BAPE draft is replaced by a requirement applicable to any type of envelope design. Specifics for netted balloons and an envelope material test to determine the resistance against damage propagation are introduced in the AMC 31.GB.27(c) and AMC 31.GB.44.

A requirement for items of mass that could cause a safety risk if they become detached during a hard or fast landing has been introduced. Typical examples are provided in the related AMC. A reference to this paragraph is added in CS 31GB.71 for equipment that typically can qualify as an item of mass (e.g. batteries).

HOT-AIR BALLOONS related new proposal CS 31HB.27(g) to CS 31HB.27 Strength and proof of strength

The above-mentioned requirement for items of mass is also proposed for CS-31HB. This is considered also applicable to fuel cell which is specifically mentioned in the related new AMC.

CS 31GB.28 Tethered flight loads

The requirements are taken from CS 31HB except for the landing loads that are not considered applicable to gas balloons as explained before in CS 31GB.23 Load factors.

CS 31GB.30 Restraint harness

This requirement was not included in the CG9/BAPE draft, but is considered equally applicable when restraint harnesses are installed.

Draft CS 31GB Subpart D – Design and construction

CS 31GB.31 General

In comparison to the CG9/BAPE draft and the current CS 31HB.31, a requirement is added that the suitability and reliability of each design detail or part that bears on safety should consider operations.

HOT-AIR BALLOONS related proposed amendment to CS 31HB.31 General

The above-mentioned amendment is also proposed for CS-31HB.

CS 31GB.33 Materials

The drafting group proposes to adopt the CS-31HB text for CS-31GB except for the burn requirement.

CS 31GB.35 Fabrication methods

The drafting group proposes to adopt the CS-31HB text for the CS-31GB requirement.

CG9/BAPE draft CS 31GB.36 Stress concentrations

The CG9/BAPE draft contained the following requirement:

"The structure shall - insofar as is feasible - be designed so that stress concentrations in areas where normal operation may produce varying stress beyond the limit of fatigue are avoided."

The drafting group does not support this proposal because its objective is already covered by CS 31GB.27(f) and has not included the CG9/BAPE paragraph in the proposal.

CS 31GB.37 Fasteners; CS 31GB.39 Protection of parts;
CS 31GB.41 Inspection provisions; CS 31GB.43 Fitting factors

The equivalent CS-31HB text is adopted for consistency. Only text that is specific to hot air balloons is deleted.

CS 31GB.44 Protection of envelope against tearing

The text from CS 31HB.44 is used as a basis for the CS 31GB.44 requirement. The undefined term "hazardous" is corrected to express that only the effect should not be hazardous.

Detailed AMC is introduced that includes means of showing compliance for envelope fabric.

Details of the test requirements to show compliance are added in the AMC 31GB.44.

HOT-AIR BALLOONS related proposed amendment to CS 31HB.44

The above-mentioned amendment is also proposed for CS 31HB.44 and related AMC.

CS 31GB.49 Control systems

The CG9/BAPE draft paragraph (c) is redrafted as an objective requirement. In the related AMC the protection against bursting by an automatic valve is removed because this is not a practical solution and has a potential safety risk if this should fail. The AMC will also only mention the envelope appendix and criteria that are applicable.

CS 31GB.51 Disposable ballast

A new paragraph is introduced to cover the "minimum ballast" definition that existed in the CG9/BAPE draft. New AMC is drafted based on CG9/BAPE draft showing that the minimum disposable ballast must be determined to stop a descent speed of at least 4 m/s. Other useful considerations are added.

CS 31GB.53, CS 31GB.55, CS 31GB.57, and CS 31GB.59.

These requirements are consistent with CS-31HB.

CS 31GB.61 Electrostatic discharge

The CG9/BAPE draft is considered too detailed and prescriptive. The paragraph is therefore redrafted providing the objective only. Details are moved to the related AMC. References to Electrostatic Discharge industry standards are added.

CS 31GB.63, CS 31GB.67, CS 31GB.71, CS 31GB.72, CS 31GB.81 and CS 31GB.82.

These requirements are consistent with CS-31HB.

CS 31GB.83 Conspicuity

A more objective requirement is introduced and the specifics are moved to a new AMC.

HOT-AIR BALLOONS related proposed amendment to CS 31HB.83

The above-mentioned amendment is also proposed for CS 31HB.83.

V. Regulatory Impact Assessment

12. Purpose and intended effect

The Agency shall, in accordance with Article 43 of the Basic Regulation and the implementing rules adopted by the Commission, develop Certification Specifications, including airworthiness codes and Acceptable Means of Compliance for each product, part or appliance for which a certificate is requested.

It is therefore that the Agency issues this Certification Specification for Gas Balloons with the intent to reflect the present state of the art and the best practices in this field.

Since 28 September 2003 the Agency has issued 4 Type Certificates for Gas Balloons using various Certification bases and Special Conditions.

13. Options

The identified options for this subject would be to continue using the presently available Certification bases and special conditions as a certification basis, or to establish a common Certification Specification.

An Agency certification specification would provide common safety standard, improve transparency, and provide a level playing field for future type-certification of Gas Balloons.

14. Sectors concerned

Introduction of Certification Specifications for Gas Balloons will mainly affect manufacturers of Gas Balloons. There are approximately three major Gas Balloon manufacturers in EU member states.

15. Impacts

Safety

The introduction of a Certification Specification for Gas Balloons will have no direct effect on present safety levels, since it is based on existing national airworthiness requirements. It will on the other hand provide a better understanding and implementation due to standardised specifications, improved wording of the paragraphs and more detailed and extended AMC material.

Economic

A positive economic impact can be expected by developing an Agency Certification Specification that will become the normal means of gaining type-certification in the EU. Furthermore, as this proposed Certification Specification is based on several existing national airworthiness codes, with a high degree of similarities, no adverse economic impact is expected.

The introduction of the new AMC for testing envelope protection against tearing (AMC 31GB.44) could necessitate performing an artificial ageing test. The costs for such a material test are approximately € 5000 for a 1500 hrs test. This is considered acceptable because such material properties can be used over a range of similar products that use the same material at a loading equal or lower to the test.

Social

No social impacts are expected from the introduction of CS-31GB.

Other aviation requirements outside EASA scope

There are no impacts on other aviation requirements outside the scope of EASA, such as security, Air Traffic Management and airports.

Foreign comparable regulatory requirements

The proposals are based on the CG9/BAPE draft that took several European Certification bases and Special Conditions as well as 14 CFR Part 31 (FAR 31) into account. The proposals in this NPA are aiming for a consistent standard and a level playing field. Although the CS-31GB is not harmonised with FAR 31, the similarity to FAR 31 will reduce certification efforts. Full harmonisation with FAR 31 is not considered appropriate because, with respect to gas balloons, FAR 31 has not been updated since 1976.

Equity and fairness issues identified

When these new Certification Specifications come into force, they will become applicable for new applications for both EU and non-EU applicants.

16. Summary and Final Assessment

Based on this RIA, the proposal of this NPA is considered as having no safety, social or environmental impact. However, providing a new CS will lead to a better understanding

and consistency across type-certification projects and will lead to reduced certification costs and a positive economic impact. The obligation from the Basic Regulation Article 19 justifies progression of this rulemaking task.

B Draft Decision

I. Draft Decision to CS-31HB

The text of the amendment is arranged to show deleted text, new text or new paragraph as shown below:

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.

CS 31HB.2 Definitions

Definition of terms used:

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

….

CS 31HB.25 factors of safety

….

(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))

….

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

….

(g) Items of mass must be secured and must not detach under typical g-loads experienced during a hard or fast landing. (See AMC 31HB.27(g))

CS 31HB.31 General

The suitability of each design detail or part that bears on safety must:

(1) be established by tests or analysis; and
(2) consider operations.

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 damage due to foreseeable threats, under limit load, will not grow to an extent that results in uncontrolled flight or landing. (See AMC 31HB.44)

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.~~

The balloon must be conspicuous during operation. (See AMC 31HB.83)

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

Items of mass (e.g. fuel cells or batteries) within the basket should be secured (e.g. with straps) and should not detach under typical g-loads experienced during a hard or fast landing. Calculations of the static ultimate loads should assume g-loads experienced equal or higher to the loads in the 30° drop test (Refer to AMC31HB.27(d)). The following minimum values should be considered:

- Horizontal speed should not be less than 2·25 m/s
- Deceleration travel (braking distance) not less than 0·3 m for items attached in or to the basket
- Load factor 1·4
- Factor of safety 1·5

Also items of mass 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 31HB.44
Protection of envelope against tearing

~~Unless it can be demonstrated that basic envelope material 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.~~

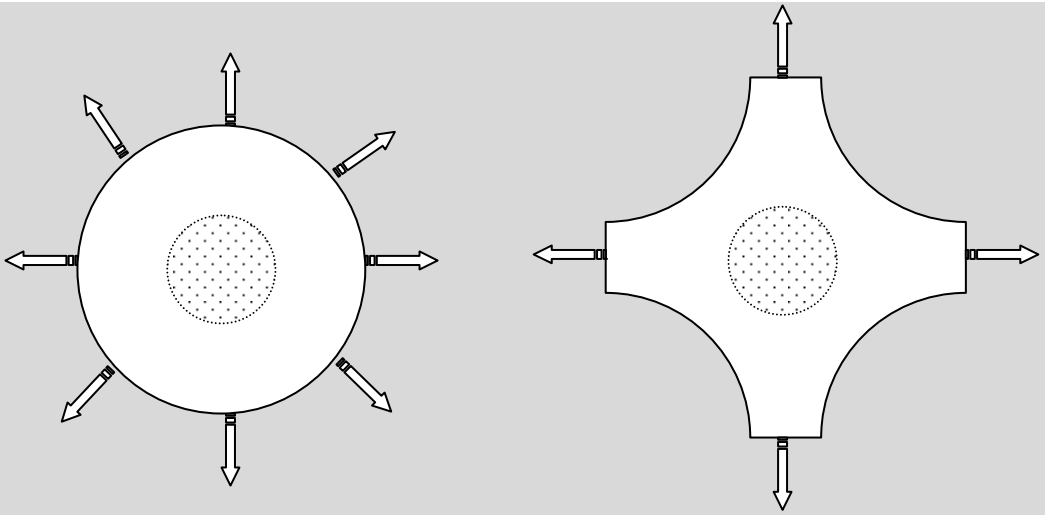
The damages to be considered are:

- Damage that may be undetected during pre-flight inspection, and
- Damage due to foreseeable threats,

where the size of the damage in itself would not result in a catastrophic failure.
Examples of foreseeable threats that can cause in-flight damage are hitting a branch or other basket during take off that causes a damage that without propagation due to operational loads would not result in a catastrophic failure.

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.
Typical damage to be considered is:
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 31GB.27(g)).

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.

AMC 31HB.83

Conspicuity

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.

II. Draft Decision to CS-31GB

The text of the new proposed CS-31GB is shown in the format that will be used for publication of the future Agency's Decision introducing this new Certification Specification.

European Aviation Safety Agency

Certification Specifications
for
Gas Balloons

CS-31GB

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CS–31GB - Gas Balloons

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BOOK 1: SUBPART A – GENERAL

CS 31GB.1 Applicability

This airworthiness code is applicable to manned free balloons that derive their lift from gas being lighter than air.

CS 31GB.2 Definitions

Definition of terms used:

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

(b) A "Basket" is the container suspended beneath the envelope for the carriage of the balloon occupants.

(c) "Disposable Ballast" is the amount of ballast required to be available for flight path management.

(d) "Tethered Flight" is the temporary restraint of a free balloon whilst in flight for the purposes of conducting an entire flight at a single location.

(e) "Launch Restraint" is the temporary restraint of a free balloon for the purpose of initiating a free flight.

BOOK 1: SUBPART B - FLIGHT

CS 31GB.12 Proof of compliance

Each requirement of this Subpart must be met at each mass within the range of loading conditions for which certification is requested. This must be shown by:

(a) Tests upon a balloon of the type for which certification is requested or by calculations based on, and equal in accuracy to, the results of testing; and

(b) Systematic investigation of each mass if compliance cannot be reasonably inferred from the masses investigated.

CS 31GB.14 Mass limits

The range of masses over which the balloon may be safely operated must be established and at least consists of:

(a) Maximum mass.

The maximum mass is the highest mass at which compliance with each applicable requirement of CS-31GB is shown. The maximum mass must be established so that it is not more than the least of: (See AMC 31GB.14(a))

(1) The maximum mass selected for the product;

(2) The design maximum mass, which is the highest mass at which each structural loading condition is shown; or

(3) The maximum mass at which compliance with each applicable flight requirement is shown.

(b) Minimum mass.

The minimum mass is the lowest mass at which compliance with each applicable flight requirement is shown. (See AMC 31GB.14(b))

Mass limitation information related to safe operation of the balloon must be included in the Flight Manual. (See CS 31GB.81(b)(2))

CS 31GB.16 Empty mass

(See AMC 31GB.16)

The empty mass must be determined by weighing the balloon with installed equipment but without lifting gas.

CS 31GB.17 Performance: climb

(See AMC 31GB.17)

The balloon must be capable of climbing at least 90 metres in the first minute from a start in equilibrium at ground level. Compliance must be shown at the maximum mass appropriate to the conditions of the test.

CS 31GB.20 Controllability

The balloon must be safely controllable and manoeuvrable without requiring exceptional piloting skill. Associated operational limitations must be established and included in the Flight Manual. (See CS 31GB.81(b)(2))

BOOK 1: SUBPART C - STRUCTURE

CS 31GB.21 Loads

Strength requirements are specified in terms of:

(a) limit loads that are the maximum loads to be expected in service, taking into account the load factors of CS 31GB.23 and

(b) ultimate loads that are limit loads multiplied by factors of safety of CS 31GB.25.

CS 31GB.23 Load factor

Flight load factor. In determining limit loads, the load factor must be at least 1·4.

CS 31GB.25 Factors of safety

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

(b) A factor of safety of 5 or more must be used in the design of:

(1) the envelope and

(2) non-metallic components of the suspension system of the basket.

(c) A factor of safety of 3.5 or more must be used in the design of metallic connections in the suspension system.

(d) The suspension system must be designed so that failure of any single component will not jeopardise safety of flight (see AMC 31GB.25(d)).

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

CS 31GB.27 Strength and proof of strength

(See AMC 31GB.27)

(a) The structure must be able to support limit loads without permanent deformations or other detrimental effects.

(b) The structure must be able to withstand ultimate loads for at least 3 seconds without failure.

(c) Proof of strength of the envelope material and other critical design features must be tested. (See AMC 31GB.27(c))

(d) The basket must be of a generally robust design and afford the occupants adequate protection during a hard or fast landing. There must be no design feature that by reasonably envisaged distortion or failure would be likely to cause serious injury to the occupants. (See AMC 31GB.27(d))

(e) Items of mass must be secured and must not detach under typical g-loads experienced during a hard or fast landing. (See AMC 31GB.27(e))

(f) The design and strength of components must also consider the effects of recurrent and other loads experienced during transportation, ground handling and rigging. (See AMC 31GB.27(f))

(g) The effect of temperature and other operating characteristics that may affect strength of the balloon must be accounted for.

CS 31GB.28 Tethered flight loads

(a) The effects of the loads associated with tethered flight on the balloon's components and any additional equipment (if required) must be considered in the design. (See AMC 31GB.28(a))

(b) The tethered restraint system must be designed so that any single failure will not jeopardise the safety of the occupants, the balloon and or third parties.

(c) Operational limitations, associated to tethered flight, must be established and recorded in the Flight Manual. (See CS 31GB.81(b)(2))

CS 31GB.30 Restraint harness

(a) When an occupant restraint harness is installed, the harness must not fail when subjected to loads resulting from the occupant mass submitted to the following acceleration (See Figure 1):

(1) 2·0g Upwards

(2) 3·0g Horizontally in all directions.

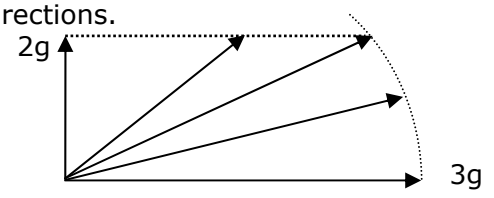


Figure 1 Restraint harness loads

An occupant mass of at least 86 kg must be assumed for the purposes of this paragraph.

(b) Local attachments in the load path between the safety belt or harness and the main structure of the basket, restraining the occupant, must be shown to be able to withstand the loads prescribed in CS 31GB.30(a) multiplied by a fitting factor of 1·33.

BOOK 1: SUBPART D - DESIGN AND CONSTRUCTION

CS 31GB.31 General

The suitability of each design detail or part that bears on safety must

(a) be established by tests or analysis; and

(b) consider operations.

CS 31GB.33 Materials

The suitability and durability of materials used for parts, the failure of which could adversely affect safety, must

(a) be established by experience or tests; and

(b) meet approved specifications that ensure that the materials have the strength and other properties assumed in the design data. (See AMC 31GB.33(b))

CS 31GB.35 Fabrication methods

(See AMC 31GB.35)

The methods of fabrication used must produce a consistently sound structure. If a fabrication process requires close control to reach this objective, the process must be performed in accordance with an approved process specification.

CS 31GB.37 Fasteners

(a) Fasteners (e.g. bolts, pins, screws, karabiners) used in the structure must conform to approved specifications. (See AMC 31GB.37(a))

(b) Locking methods must be established and documented.

(c) Unless a joint is free from relative movement, secondary locking means must be used.

(d) Self-locking nuts may not be used on bolts that are subject to rotation in service.

CS 31GB.39 Protection of parts

(See AMC 31GB.39)

Parts, the failure of which could adversely affect safety must be suitably protected against deterioration or loss of strength in service due to weathering, corrosion, heat, abrasion, ground handling, ground transport, flight conditions or other causes.

CS 31GB.41 Inspection provisions

There must be a means to allow close examination of each part that requires repeated inspection and adjustment.

CS 31GB.43 Fitting factor

(a) A fitting factor of at least 1·15 must be used in the analysis of each fitting if the strength is not proven by limit and ultimate load tests that simulate the actual stress conditions in the fitting and surrounding structure. This factor applies to all parts of the fitting, the means of attachment, and the bearing on the structural elements joined.

(b) Each part with an integral fitting must be treated as a fitting up to the point where the section properties become typical of the member.

(c) The fitting factor need not be used if the joint design is made in accordance with approved practices and the safety of which is based on comprehensive test data. (See AMC 31GB.43(c))

CS 31GB.44 Protection of envelope against tearing

(See AMC 31GB.44)

The design of the envelope must be such that damage due to foreseeable threats, under limit load, will not grow to an extent that results in uncontrolled flight or landing.

CS 31GB.49 Control systems

(a) Each control must operate easily, smoothly, and positively enough to allow proper performance of its functions. Controls must be so arranged and identified to prevent confusion and inadvertent operation.

(b) Each control system and operating device must be designed and installed in a manner that will prevent jamming, chafing, or unintended interference from passengers or loose items of equipment. The elements of the control system must have design

features or must be distinctly and permanently marked to minimise the possibility of incorrect assembly that could result in malfunctioning of the control system.

(c) The envelope must be protected against bursting using a valve or appendix. (See AMC 31GB.49(c))

(d) There must be a valve to control the flight of the balloon. Proof of its reliable operation must be provided.

CS 31GB.51 Disposable Ballast

(See AMC 31GB.51)

(a) Disposable ballast must have means for safe storage and release. (See also CS 31GB.27(e))

(b) A minimum amount of ballast must be defined and reserved for the final landing which is sufficient (when jettisoned) to reduce the speed of descent to an acceptable value. The minimum ballast must be provided in the Flight Manual. (See CS 31GB.81)

CS 31GB.53 Drag rope

If a drag rope is used, the end that is released overboard must be stiffened to preclude the probability of the rope becoming entangled with trees, wires, or other objects on the ground.

CS 31GB.55 Rapid deflation means

(a) The envelope must have means to allow for rapid deflation after landing. The system must be designed to minimise the possibility of inadvertent operation. If a system other than a manual system is used, the reliability of the system used must be substantiated. (See AMC 31GB.55(a))

(b) If a balloon is equipped with a lateral rapid deflation means, a device must be installed to align the balloon during landing in order to turn the rapid deflation means into its designated position. (See AMC 31GB.55(b))

CS 31GB.57 Control cords

(a) General

(1) All control cords used for flight control must be designed and installed to preclude entanglement.

(2) The function of control cords should be identified to the pilot and marked in accordance with paragraph (b), (c), (d) and (e) if applicable.

(3) The maximum force required for their operation must not exceed 340 N.

(4) All control cords used for flight control must be long enough to allow for an increase of at least 10% in the vertical dimension of the envelope.

(b) Arming cords

If an arming device is employed to prevent inadvertent operation of an irreversible control, the part of the cord to be handled by the pilot must be coloured with yellow and black bands.

(c) Turning vent cords

If turning vent cords are used to orient the balloon for landing, the part of cords to be handled by the pilot for turning to the left must be coloured black and the corresponding part of the cord used for turning to the right must be coloured green. (See AMC 31GB.57(c))

(d) Venting cords

(1) If a venting cord is used to allow controlled release of the lifting gas and the vent can be resealed in flight, the part of the cord to be handled by the pilot must be coloured with red and white bands.

(2) If a further cord is required to reseal any vent, the part of the cord handled by the pilot must be coloured white.

(e) Rapid or emergency deflation cords

(1) If a cord is used for rapid or emergency deflation of the envelope and the device cannot be resealed in flight, the part of the cord to be handled by the pilot must be coloured red.

(2) In addition to the force requirement of 31GB.57(a)(3) above, the force required to operate an emergency deflation cord must not be less than 110 N.

CS 31GB.59 Baskets

(a) The basket may not rotate independently of the envelope unless:

(1) the rotation is under control of the pilot; and

(2) entanglement of operating lines is prevented. (See AMC 31GB.59(a))

(b) Each projecting object on the basket, that could cause injury to the occupants, must be padded.

(c) Occupants of a basket must be protected during hard or fast landings against:

(1) falling from the basket;

(2) serious injuries. (See AMC 31GB.59(c))

(d) When more than six occupants are carried, the basket must be divided into compartments, each containing not more than six occupants.

(e) Where basket proportions and compartmentation are such that more than one occupant may fall on top of another during landing, there must be means to minimise this possibility. (See AMC 31GB.59(e))

(f) Reasonable space must be provided for all occupants, with regard to both comfort during the flight and to safety during the landing. (See AMC 31GB.59(f))

(g) The space for the pilot must provide unobstructed operation in all flight phases.

(h) There must be hand holds for each occupant. (See AMC 31GB.59(h))

(i) Means must be provided to allow drainage of vapour or liquid from the bottom of the basket.

(j) The load-bearing parts (e.g. ropes or cables) of the suspension system must be protected against damage in normal service.

(k) The basket floor must not project beyond the sidewalls.

(l) Information on limiting occupant configurations must be provided in the Flight Manual. (See CS 31GB.81). (See AMC 31GB.59(l))

CS 31GB.61 Electrostatic discharge

(See AMC 31GB.61)

There must be appropriate electrostatic discharge means in the design of each balloon whose lift-producing medium contains a flammable gas to ensure that the effects of electrostatic discharge will not create a hazard.

CS 31GB.63 Occupant restraint

(a) There must be a restraining means for all occupants, which can take the form of hand holds. (See CS 31GB.59(h)).

(b) For baskets having a separate pilot compartment, there must be a suitable restraint for the pilot which must meet the strength requirements of CS 31GB.30. Additionally, the restraint must be designed so that:

(1) the pilot can reach all the necessary controls when the restraint is correctly worn and adjusted;

(2) there is a method of quick release that is simple and obvious; and

(3) the possibility of inadvertent release is minimised.

CS 31GB.67 Tethered flight

(See AMC 31GB.67)

The pilot must be provided with an indication that any applicable limitations for tethered flight are being, or have been reached.

BOOK 1: SUBPART F - EQUIPMENT

CS 31GB.71 Function and installation

(a) Each item of required equipment must:

(1) be of a kind and design appropriate to its intended function;

(2) be labelled or marked to identify its function or operating limitations, or any applicable combination of these factors;

(3) be installed according to limitations specified for that equipment; and

(4) function properly when installed. (See AMC 31GB.71(a)(4))

(b) Instruments and other equipment may not in themselves, or by their effect upon the balloon, constitute a hazard to safe operation. (See also CS 31GB.27(e))

CS 31GB.72 Miscellaneous equipment

Each balloon must be equipped with a rate of climb/descent indicator (variometer).

BOOK 1: SUBPART G - OPERATING LIMITATIONS AND INFORMATION

CS 31GB.81 Operating instructions

(See AMC 31GB.81)

(a) Operating instructions must be furnished in a Flight Manual with each balloon.

(b) The Flight Manual must contain:

(1) A description of the balloon and its technical equipment with explanatory sketches;

(2) Operating limitations, normal procedures (including rigging, inflation, deflation and tethered flight (if applicable)), emergency procedures, and other relevant information specific to the balloon's operating characteristics and necessary for safe operation. This section of the manual requires approval (See AMC 31GB.81(b)(2));

(3) Specification of the permissible lifting gas;

(4) Information for ground handling, transport and storage.

(c) The operating limitations, normal and emergency procedures, and other relevant information specific to the balloon's operating characteristics and necessary for safe operation must be provided to the pilot. (See AMC 31GB.81(c))

CS 31GB.82 Instructions for continued airworthiness

(See AMC 31GB.82)

(a) The instructions for Continued Airworthiness must include information essential to the Continued Airworthiness of all parts and appliances of the balloon as required by CS 31GB.

(b) The instructions for Continued Airworthiness must be in the form of a manual or manuals as appropriate for the quantity of data provided.

(c) The format of the manual or manuals must provide for a practical arrangement.

(d) The instructions for Continued Airworthiness must cover:

(1) detailed description of the balloon and its components, systems and installations;

(2) Handling instructions;

(3) Basic control and operating information describing how the balloon's components, systems and installations operate;

(4) Servicing information;

(5) A maintenance schedule against which the balloon must be inspected and maintained;

(6) Maintenance and inspection instructions;

(7) Repair instructions;

(8) Trouble-shooting information;

(9) Airworthiness limitations that set forth each mandatory replacement time, inspection interval and related inspection procedure. This section of the manual requires approval.

CS 31GB.83 Conspicuity

(See AMC 31GB.83)

The balloon must be conspicuous during operation.

CS 31GB BOOK 2

EASA Certification Specifications

for

Gas Balloons

CS 31GB
Book 2

Acceptable Means of Compliance

AMC SUBPART B – FLIGHT

AMC 31GB.14(a)
Mass limits

The maximum mass corresponds to the maximum buoyancy. The lift-producing medium is not part of the maximum mass.

AMC 31GB.14(b)
Mass limits

Minimum mass. The determination of the minimum mass should take into consideration that the controllability of the balloon might be affected by a low internal pressure at low mass.

At least the following should be demonstrated:

In landing configuration with minimum crew, untaut condition and already disposed minimum ballast, all controls (e.g. parachute, valve, rip panel, control lines, etc.) should have a positive performance and function easily and smoothly.

Note: An untaut condition is a flight with a "slack" envelope and open appendix.

AMC 31GB.16
Empty mass

The equipment and configuration that are included in the empty mass need to be specified. Refer also to AMC 31GB.81(b)(2).

AMC 31GB.17
Performance: climb

"Conditions of the test" here refers to the combination of launch field elevation (launch altitude) and corresponding ambient air temperature.

BOOK 2: SUBPART C – STRUCTURE

AMC 31GB.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 suspension system pick-up points (sometimes known as 'turnbacks') at the envelope should be regarded as part of the suspension system, rather than the envelope, as far as 31GB.25(b),(c) & (d) are concerned.

AMC 31GB.25(d)
Factors of Safety

"Suspension components" here are those parts of the balloon that carry the load between the lift force of the envelope and the weight force of the basket.

A net around the envelope taking these loads or suspension system pick-up points should be considered as part of the suspension system in accordance with AMC 31GB.25(b).

The individual structural elements in the suspension system should be dimensioned and configured or duplicated so that failure or absence of one structural element 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 only needs to be justified with the application of limit loads.

AMC 31GB.27
Strength and proof of strength

Proof of compliance with the strength requirements must cover the balloon's entire operating range. Proof by calculation only can be accepted for designs where it has been demonstrated by experience that such calculation gives reliable results. Load tests need to be performed in all other cases.

AMC 31GB.27(c)
Strength and proof of strength

The envelope tests may be performed on representative portions of the envelope provided the dimensions of these portions are sufficiently large to include critical design features and details such as critical seams, joints, load-attachment points, net mesh, etc. Also refer to CS 31GB.44 for Specific tear propagation requirements.

AMC 31GB.27(d)
Strength and proof of strength

A drop test needs to be performed if it is not possible to make use of an existing proven basket of the same or similar design (in terms of construction method, size, layout, etc.) for a balloon of the size that is the subject of the application. In the absence of an alternative test proposal, this test must be performed at the maximum design mass of the basket in a manner that simulates the effects of gravity that occur as realistically as possible. The basket is dropped onto a horizontal concrete surface from a height of 1 m at 0°, 15° and 30°. The drop test should not result in deformation or fractures which, by their nature, could lead to the serious injury of occupants.

Note: It has been shown by a number of decades of in-service experience that the traditional reinforced woven wicker and willow basket design offers a combination of resilience and impact resistance that can contribute considerably to the protection of occupants. The structure is also able to absorb considerable kinetic energy during impact on the ground or against obstacles.

AMC 31GB.27(e)
Strength and proof of strength

Items of mass within the basket should be secured (e.g. straps) and should not detach under typical g-loads experienced during a hard or fast landing. Calculations of the static ultimate loads should assume g-loads experienced equal or higher to the loads in the 30° drop test (Refer to AMC31GB.27(d)). The following minimum values should be considered:

- Horizontal speed should not be less than 2·25 m/s
- Deceleration travel (braking distance) not less than 0·3 m for items attached in or to the basket
- Load factor 1·4
- Factor of safety 1·5

Also items of mass 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), should be considered because of the mass lost.

AMC 31GB.27(f)
Strength and proof of strength

The strength requirements need to include consideration of loads during transport, ground handling and rigging. The loads need to be determined and the parts and components need to be designed in accordance with their designated use and dimensioned such as not to fail under recurrent loads.

AMC 31GB.28(a)
Tethered Flight Loads

Due to the complexity of tethered flight loading, a simple analysis using configurations based on industry best practice (e.g. 'restraints/tether lines in a "flat tripod" configuration with upwind and downwind v-bridles) can be used to determine the suitability of a design.

The structure needs to be designed so that stress concentrations beyond the limit of fatigue are avoided in areas where normal operation may produce varying stress.

Note: The greatest danger during tethering is if any element of the tethering equipment should fail with insufficient positive buoyancy for safe free flight. For this reason single point/single element tethering should not be considered.

BOOK 2: SUBPART D - DESIGN AND CONSTRUCTION

AMC 31GB.33(b)
Materials

Approved specifications here should be taken as being those produced by the applicant or those meeting internationally recognised standards as defined applicable in the type design data. Material specifications should be those contained in documents accepted either specifically by the Agency or by having been prepared by an organisation or person which the Agency accepts has the necessary capabilities. In defining design properties, these material specification values should be modified and/or extended as necessary by the constructor to take account of manufacturing practices (for example method of construction, forming, machining and subsequent heat treatment). Also the effects of environmental conditions, such as temperature and humidity expected in service need to be taken into account.

AMC 31GB.35
Fabrication methods

Approved fabrication methods here should be taken as being those produced by the applicant or those meeting internationally recognised standards as defined in the applicable type design data. Fabrication methods should be those contained in documents accepted either specifically by the Agency or by having been prepared by an organisation or person which the Agency accepts has the necessary capabilities.

AMC 31GB.37(a)
Fasteners

Approved specifications in the sense of these requirements are the standards described in the AMC 31GB.33(a)(2).

AMC 31GB.39
Protection of parts

Suspension system cables and components manufactured from stainless steels (corrosion resistant steels) are considered compliant with this requirement.

To ensure the suitable protection of parts against deterioration or loss of strength, it is permissible to rely on instructions for continued airworthiness (e.g. recommended inspections or mandatory replacement of parts) (see also CS 31GB.82).

AMC 31GB.43(c)
Fitting factors

Approved practices here should be taken as being those produced by the applicant or those meeting internationally recognised standards as defined in the applicable type design data. Approved practices should be those contained in documents accepted either specifically by the Agency or by having been prepared by an organisation or person which the Agency accepts has the necessary capabilities.

AMC 31GB.44
Protection of the envelope against tearing

The damages to be considered are:

- Damage that may be undetected during pre-flight inspection, and
- Damage due to foreseeable threats,

where the size of the damage in itself would not result in a catastrophic failure.

Examples of foreseeable threats that can cause in-flight damage are hitting a branch or other basket during take off that causes a damage that without propagation due to operational loads would not result in a catastrophic failure.

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.

Typical damage to be considered is:
A slit in the most unfavourable direction.
A crosswise slit in the most unfavourable directions.

Test requirements

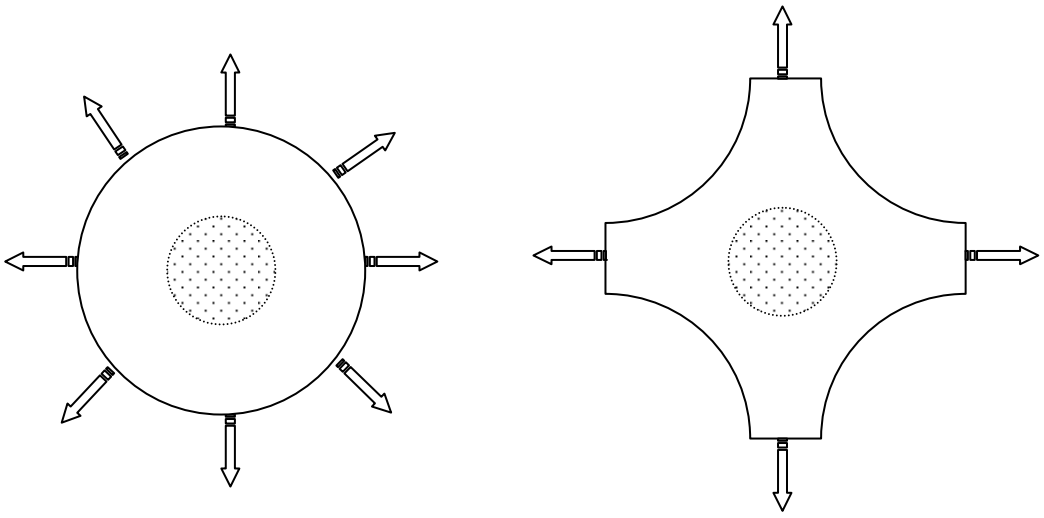
The envelope fabric should be tested at maximum tension experienced in service. The effects of temperature on the material properties must be taken into account.

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 increase 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 a damage length considerably smaller than the critical damage length will be discovered during a pre-flight inspection. The impact of aging and operating circumstances should be considered when establishing the margin between critical damage and detectable damage. (Refer to CS 31GB.27(g))

Design features that could possibly hinder discovery of damage during a pre-flight inspection should be avoided or taken into consideration when the detectable damage size is determined.

Note 1: It is assumed that an envelope damage exceeding 5 cm will be detected before flight due to the loss of gas.

Note 2: The critical damage is a design property that should not be confused with acceptable damage as provided in the flight manual.

AMC 31GB.49(c)
Control systems

The envelope is protected against bursting when it is equipped with an appendix that can release gas at the rate of at least 3% of the total volume per minute at the balloon's maximum operating pressure. The appendix should be designed to prevent possible blockage during flight due to e.g. freezing or a flattening of the appendix caused by the position on the envelope.

AMC 31GB.51
Disposable Ballast

Ballast material should be easily transferred, disposed of and dissipated. Means need to be provided to prevent freezing and/or blocking the release of the ballast material. The material should not pollute the environment.

Dry sand is a well-proven material and is considered as suitable in the sense of this paragraph and this AMC.

The disposable ballast may be necessary for the pilot to perform the flight path management. The pre-take-off decision on the amount of disposable ballast should be left to the pilot as it is dependent on the flight task, the weather, etc.

A minimum ballast quantity is considered sufficient if, when jettisoned, it stops a descent speed of 4 m/s.

Note: The shape and drag of the envelope can have an effect on minimum descent speed, resulting in a minimum descent speed above 4 m/s.

AMC 31GB.55(a)
Rapid deflation means

A deflation is considered as "rapid" if after touch-down the balloon envelope is adequately prevented from "sailing" and being dragged too much over the ground by the wind.

AMC 31GB.55(b)
Rapid deflation means

The installation of turning vents or a drag rope is considered as a suitable device to align the balloon during landing in the sense of this subparagraph.

AMC 31GB.57(c)
Control cords; Turning vent cords

In the interest of reducing the pilot's workload during the critical approach phase, it should be possible to operate the turning vents (to a sufficient extent to align the basket for landing, if this is required) with one hand.

AMC 31GB.59(a)
Baskets

The purpose of this subparagraph is to prevent entanglement of operating lines due to uncontrolled rotation.

It should be noted that uncontrolled rotation may also occur during landings with basket tip-over if the plan view of the basket floor is circular or more than hexagonal.

AMC 31GB.59(c)
Baskets

An internal height of the basket of 1·10 m, protecting the occupants carried from falling from the basket is considered compliant to this requirement.

AMC 31GB.59(e)
Baskets

Alignment of the basket for landing using turning vents or a drag rope or an equivalent feature and Flight Manual instructions specifying that the basket should be aligned to land on one of its longer sides can be used to show compliance to this requirement. No more than two occupants may be positioned in the landing direction without means to prevent them from falling on top of each other.

AMC 31GB.59(f)
Baskets

Unless otherwise justified on safety grounds, a minimum figure of between 0·25 m² and 0·3m² plan area should be used for each standing occupant, with proper account being taken of the specified size, number and position of equipment when applying this figure. There needs to be enough space provided for passengers to take a brace position for landing. The Agency should be consulted in cases where a basket's shape or compartmentation makes the measurement of this figure subjective.

AMC 31GB.59(h)
Baskets

Handholds need to be provided as an obvious means for the occupants to safely hold on to during a landing. The location or design of the handholds need to provide protection of the hands from impact during a landing.

AMC 31GB.59(l)
Baskets

This information should state, for each permissible model of basket or other means provided for the occupants, the maximum permitted occupancy in relation to specified sizes, numbers and positions of equipment items.

AMC 31GB.61
Electrostatic discharge

Appropriate electrostatic discharge means are met when compliance with all of the following requirements is demonstrated.

(a) The surface resistance on one side of the balloon envelope (inside or outside) after 24-hour storage at a relative air humidity of less than 50% must be value 10^9 Ω or lower. The values are to be determined using approved measuring methods.

(b) The respective layer of non-conductive material (surface resistance in excess of 10^9 Ω) must not be thicker than 0·3 mm unless it is enclosed by conductive layers.

(c) The balloon envelope and all other conductive parts of the balloon (surface resistance less than 10^9 Ω) must be conductively connected to each other (resistance of connection less than 10^6 Ω). This requirement also applies to the joints between the panels and reinforcements.

(d) There must be at least three independent discharge paths for the safe balance of the electrostatic charges.

(e) The discharge paths should run on the conductive side of the envelope from top to bottom and then further down to the ground. This requirement applies to the case when the balloon is in contact with earth's surface.

(f) Each discharge path under (d) must be of different kind or design to the other.

Note: More detailed information can be found in:

EN 61340-5-1&2:2007 *Protection of electronic devices from electrostatic phenomena – General Requirements & User guide*

IEC 60093 *Methods of Test for Volume Resistivity and Surface Resistivity of Solid Electrical Insulating Materials*

AMC 31GB.67
Tethered flight

The inclusion of an appropriate device or instrument (rated "weak link", hand held anemometer, windsock, etc.) to provide the pilot with an attention-getting indication of the balloon’s tethering limitation, is considered compliant with CS 31GB.67.

BOOK 2: SUBPART F - EQUIPMENT

AMC 31GB.71(a)(4)
Function and installation

The correct functioning should not be impaired by operational circumstances such as icing, heavy rain, high humidity or low and high temperatures. The equipment, systems, and installations need to be designed to prevent hazards to the balloon in the event of a probable malfunction or failure of that equipment.

When ATC equipment and/or positioning lights as possibly required by operational rules are installed, it should be shown that the electrical system is such that the operation of this equipment is not adversely affected.

BOOK 2: SUBPART G - OPERATING LIMITS AND DETAILS

AMC 31GB.81
General

(a) It is recommended that the Specimen Flight Manual of CS-22 (AMC 22.1581) be used as guidance in the creation of a Balloon Flight Manual.

(b) Each part of the Flight Manual that is required to be approved needs to be segregated, identified and clearly distinguished from each unapproved part of that manual.

(c) A comprehensive list of approved basket and envelope configurations needs to be provided for each balloon model to enable operators, inspectors, etc. to easily establish an item's acceptability.

(d) If applicable, the operating limitations, normal and emergency procedures need to include procedures and limitations for tethered flight. These procedures and limitations need to include:

1. Site selection, layout and assembly,
2. The maximum wind speed and meteorological conditions for tethered operation,
3. The MTOM (if different from free flight),
4. The maximum height of the tether,
5. The minimum strength of ropes, rigging, etc.,
6. Limitations on occupancy (if applicable).

AMC 31GB.81(b)(2)
General

Operating procedures need to provide empty mass information required by CS 31GB.16 in an unambiguous manner that will allow the verification of the balloon's mass limitations before flight.

AMC 31GB.81(c)
General

The operating limitations, normal and emergency procedures need to be available to the pilot during operation by providing the specific sections of the flight manual or by other means (e.g. placards, quick reference cards) that effectively accomplish the purpose.

AMC 31GB.82
Instructions for continued airworthiness

The paragraph numbering of this AMC relates to the paragraph numbering of CS 31GB.82

(c) If instructions for continued airworthiness are not supplied by the manufacturer or designer of parts and appliances installed in the balloon, the instructions for continued airworthiness for the balloon need to include the information essential to the continued airworthiness of the balloon.

If manuals from different manufacturers are used, they need to provide a practical arrangement.

(d)(1) The detailed description of the balloon and its components needs to include for each balloon:

- A description of the systems including the assembly and disassembly instructions;
- A parts list covering all construction and equipment components and the assemblies. Where applicable, individual parts need to be numbered so that they can be related to the different assemblies and that their number corresponds to the type plate of the assembly;

- A summary of the materials and consumables used with procurement details.

(d)(5) If applicable, the maintenance schedule may include instructions for continued airworthiness (e.g. recommended inspections or mandatory replacement of parts) to ensure the suitable protection of parts against deterioration or loss of strength, objective pass or fail criteria, e.g. applicable wear tolerances need to be provided.

(d)(6) The maintenance and inspection instructions need to provide information for removal and installation, cleaning, inspecting, adjusting, testing and lubrication of systems, parts and appliances of the balloon as required for continued airworthiness. Reference may be made to information from an accessory, instrument or equipment manufacturer as the source of this information if it is shown that the item has an exceptionally high degree of complexity requiring specialised maintenance techniques, test equipment or expertise.

(d)(9) If the instructions for continued airworthiness consist of multiple documents, the Airworthiness Limitations section need to be included in the principal manual.

AMC 31GB.83
Conspicuity

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.

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