

Safety Regulation Group



CAP 494

British Civil Airworthiness Requirements

Part 31 - Manned Free Balloons

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Safety Regulation Group



CAP 494

BCAR Part 31

Part 31 - Manned Free Balloons

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Explanatory note

1 Introduction

The purpose of this Issue 2 is to publish BCAR Working Draft Papers 31.6, 31.7 and 696 as requirements together with editorial corrections convenient to be incorporated at this time.

2 Technical Changes

The following changes have been made:

Part	Description
Explanatory Note	New Insertion
Foreword	Editorial Change
Subpart A	Editorial Change
Subpart C	As amended by Paper No. 31-6
Subpart D	As amended by Paper No. 31-6 & 31-7
Subpart E	Editorial Change
Supplement 1	As inserted by Paper No. 696

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Foreword

1 General

- 1.1 British Civil Airworthiness Requirements, of which Part 31 is a constituent part, are published by the Civil Aviation Authority (CAA). They comprise minimum requirements and constitute the basis for the CAA to issue Certificates of Airworthiness or Type Certificates, as required.
- 1.2 This BCAR 31 for Manned Free Balloons has been developed by the British Balloon and Airship Club (BBAC) in conjunction with the CAA Design and Production Standards Division and supersedes the British Airworthiness Requirements for Manned Free Balloons published by the BBAC.
- 1.3 This BCAR 31 has been based on FAR 31 (at Change 2), issued by the Federal Aviation Administration, and amended where experience has shown it to be necessary, or for administrative or legal purposes.
- 1.4 These requirements, with or without explanatory matter, should not be regarded as constituting a text book of current aeronautical knowledge; interpretation of the requirements against a background of such knowledge is essential.
- 1.5 It is implicit in requirements expressed qualitatively (e.g. 'readily visible', 'adequately tested') that the CAA will adjudicate in cases where doubt exists.

2 Presentation

Where entries in BCAR 31 are as Notes they are included as either Acceptable Means of Compliance or Interpretative Material and appear immediately under the paragraphs to which they relate.

3 Amendment and Issue

Material differences from the previous issue are indicated with a marginal line.

4 Effective Date

New requirements and amendments promulgated in BCAR Amendments are effective from the date printed on them.

5 Applications and Enquiries

Applications for permission to reproduce any part of the Requirements and any enquiries regarding their technical content should be addressed to the Civil Aviation Authority, Requirements and Policy Unit, Aviation House, Gatwick, RH6 0YR.

Subpart A General

31.1 **Applicability**

- a) This Part prescribes airworthiness standards for the issue of Type Certificates and Certificates of Airworthiness and changes to these certificates, for manned free balloons and hot air airships.
- b) Each person who applies for a certificate or change must show compliance with the applicable requirements of this Part.
- c) For the purposes of this Part:
 - i) A captive gas balloon is a balloon that derives its lift from a captive lighter-than-air gas;
 - ii) A hot air balloon is a balloon that derives its lift from heated air;
 - iii) The envelope is the enclosure in which the lifting means is contained;
 - iv) The basket is the container, suspended beneath the envelope, for the balloon occupants;
 - v) The trapeze is a harness or is a seat consisting of a horizontal bar or platform suspended beneath the envelope for the balloon occupants; and
 - vi) The design maximum weight is the maximum total weight of the balloon, less the lifting gas or air.

NOTE: The term 'Captive Gas Balloon' has been repeated in these requirements for the sake of maintaining identity with FAR Part 31. It is understood however to refer to a balloon where the gas is captive within the envelope, not to captive or tethered balloons.

- d) For the issue of a Type Certificate for a hot air airship the requirements of Supplement 1 must be complied with in addition to the requirements for hot air balloons.

Subpart B Flight Requirements

31.11 **[Reserved]**

31.12 **Proof of compliance**

- a) Each requirement of this Subpart must be met at each weight within the range of loading conditions for which certification is requested. This must be shown by:
 - i) 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
 - ii) systematic investigation of each weight if compliance cannot be reasonably inferred from the weights investigated.
- b) (Deleted)

31.14 **Weight Limits**

- a) The range of weights over which the balloon may be safely operated must be established.
- b) **Maximum weight.** The maximum weight is the highest weight at which compliance with each applicable requirement of this Part is shown. The maximum weight must be established so that it is not more than:
 - i) the highest weight selected by the applicant;
 - ii) the design maximum weight which is the highest weight at which compliance with each applicable structural loading condition of this Part is shown; or
 - iii) the highest weight at which compliance with each applicable flight requirement of this Part is shown.
- c) The information established under paragraphs a) and b) of this paragraph must be made available to the pilot in accordance with 31.81.

31.16 **Empty weight**

The empty weight must be determined by weighing the balloon with installed equipment but without lifting gas or heater fuel.

31.17 **Performance: climb**

- a) Each balloon must be capable of climbing at least 300 feet in the first minute after take-off with a steady rate of climb. Compliance with the requirements of this paragraph must be shown at each altitude and ambient temperature for which approval is sought.
- b) Compliance with the requirements of paragraph a) of this section must be shown at the maximum weight with a weight tolerance of +5%.

31.19 **Unpremeditated descents**

Procedures must be established and published in the Flight Manual for arresting unpremeditated fast descents and for hard landings.

31.20 **Controllability**

The applicant must show that the balloon is safely controllable and manoeuvrable during take-off, ascent, descent, and landing without requiring exceptional piloting skill.

Subpart C Strength Requirements

31.21 **Loads**

Strength requirements are specified in terms of limit loads, that are the maximum load to be expected in service, and ultimate loads, that are limit loads multiplied by prescribed factors of safety. Unless otherwise specified, all prescribed loads are limit loads.

31.23 **Flight load factor**

In determining limit load, the limit flight load factor must be at least 1.4.

31.25 **Factor of safety**

- a) Except as specified in sub-paragraphs b) and c) of this paragraph, the factor of safety is 1.5.
- b) A factor of safety of at least 5 must be used in envelope design. A reduced factor of safety of at least 2 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.
- c) A factor of safety of at least 5 must be used in the design of all fibrous or non-metallic parts of the rigging and related attachments of the envelope to basket, trapeze, or other means provided for carrying occupants. The primary attachments of the envelope to the basket, trapeze, or other means provided for carrying occupants must be designed so that failure is extremely remote or so that any single failure will not jeopardise safety of flight.
- d) In applying factors of safety, the effect of temperature, and other operating characteristics, or both, that may affect strength of the balloon must be accounted for.
- e) For design purposes, an occupant weight of at least 170 pounds must be assumed.

31.27 **Strength**

- a) The structure must be able to support limit loads without detrimental effect.
- b) The structure must be substantiated by test to be able to withstand the ultimate loads for at least three seconds without failure. For the envelope, a test of a representative part is acceptable, if the part tested is large enough to include critical seams, joints, and load attachment points and members.
- c) The basket or crew carrying system must be generally robust and must afford adequate protection to all occupants during a rough landing. There must be no design feature which by distortion or failure would be likely to cause serious injury to the occupants.

31.29 **Restraint harness**

- a) When an occupant restraint harness is installed, the occupant must be safely restrained within the basket or gondola when subjected to the following ultimate inertia load factors, subject to a maximum resultant of 3.0g:
 - i) 2.0g upwards

- ii) 3.0g horizontally in all directions

An occupant weight of at least 170 pounds 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 or gondola, restraining the occupant, shall not be less strong than the strength necessary for 1.33 times the loads corresponding to the accelerations specified in 31.29 a).

Subpart D Design and Construction

31.31 General

The suitability of each design detail or part that bears on safety must be established by tests or analysis.

31.33 Materials

- a) The suitability and durability of all materials must be established on the basis of experience or tests. Materials must conform to acceptable specifications that will ensure that they have the strength and other properties assumed in the design data. Reputable commercial material design data may be acceptable subject to an additional reserve factor on strengths of 1.33.
- b) Material strength properties must be based on enough tests of material conforming to specifications so as to establish design values on a statistical basis.
- c) Envelope materials must be shown not to support continued burning if ignited by the heater when the balloon is inflated or in flight.

31.35 Fabrication methods

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.

31.37 Fastenings

Only approved bolts, pins, screws, and rivets may be used in the structure. Approved locking devices or methods must be used for all these bolts, pins, and screws, unless the installation is shown to be free from vibration. Self-locking nuts may not be used on bolts that are subject to rotation in service.

31.39 Protection

Each part of the balloon must be suitably protected against deterioration or loss of strength in service due to weathering, corrosion, or other causes.

31.41 Inspection provisions

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

31.43 Fitting factor

- a) A fitting factor of at least 1.15 must be used in the analysis of each fitting the strength of which is not proven by limit and ultimate load tests in which the actual stress conditions are simulated in the fitting and surrounding structure. This factor applies to all parts of the fitting, the means of attachment, and the bearing on the members 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 is based on comprehensive test data.

31.45 Fuel cells

If fuel cells are used the attachments and related supporting structure must be able to withstand without failure any inertia loads to which the installation may be subjected.

31.46 Pressurised fuel systems

For pressurised fuel systems each element, including the lines and connecting fittings, must be tested to, or have a safe working pressure of, at least twice the maximum pressure to which the system will be subjected in normal operation. In the test no part of the system may fail or malfunction. All parts of a pressurised fuel system must be robust and capable of withstanding impact loads which are likely in service. In particular no part of the system may have an unprotected rigid extension which could be broken by a likely impact load.

31.47 Heaters

- a) If a heater is used to provide the lifting means, the system must be designed and installed so as not to create a fire hazard.
- b) Parts adjacent to the burner flame, and the occupants must be protected from excessive heat.
- c) There must be controls, instruments, or other equipment essential to the safe control and operation of the heater. They must be shown to be able to perform their intended functions during normal and emergency operation.
- d) The heater system (including the burner unit, controls, fuel lines, fuel cells, regulators, control valves, and other related elements) must be substantiated by an endurance test designed to reflect the limiting conditions likely to be encountered in service, both in kind and duration. The endurance test proposed by the manufacturers must be approved by the Civil Aviation Authority.
- e) The test must also include at least three flameouts and restarts.
- f) Each element of the system must be serviceable at the end of the test.
- g) The pilot light (or other means of ignition) must be shown to operate reliably in typical gusts and rain, must be readily accessible for relighting and must be easily re-lit.

31.49 Control systems

- a) Each control must operate easily, smoothly, and positively enough to allow proper performance of its functions. Controls must be arranged and identified to provide for convenience of operation and to prevent the possibility of confusion and subsequent inadvertent operation.
- b) Each control system and operating device must be designed and installed in a manner that will prevent jamming, chafing, or interference from passengers, cargo, or loose objects. Precaution must be taken to prevent foreign objects from jamming the controls. 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) Each balloon using a captive gas as the lifting means must have an automatic valve or appendix that is able to release gas automatically at the rate of at least 3% of the total volume per minute when the balloon is at its maximum operating pressure.

- d) Each hot air balloon must have a means to allow the controlled release of hot air during flight unless the Civil Aviation Authority is satisfied that the balloon complies with 31.20 without it.
- e) Each hot air balloon must have a means to indicate the maximum envelope skin temperature during operation. The indicator must be readily visible to the pilot and marked to indicate the limiting safe temperature of the envelope material. If the markings are on the cover glass of the instrument, there must be provisions to maintain the correct alignment of the glass cover with the face of the dial.

NOTE: The use of a signal warning device which actuates at a temperature below the limiting safe temperature is an acceptable means of compliance.

31.51 **Ballast**

Each captive gas balloon must have a means for the safe storage and controlled release of ballast. The ballast must consist of material that, if released during flight, is not hazardous to persons on the ground.

31.53 **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.

31.55 **Deflation means**

There must be a means to allow emergency deflation of the envelope so as to allow a safe emergency landing. The system must be designed to prevent the possibility of inadvertent operation. If a system other than a manual system is used, the reliability of the system used must be substantiated.

31.57 **Control Cords**

a) **General**

All control cords used for flight control must be designed and installed to preclude entanglement and inadvertent operation.

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 the 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.

d) **Venting cords**

- i) 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 handled by the pilot must be coloured with red and white bands.
- ii) If a further cord is required to re-seal any vent, the part of the cord which is handled by the pilot must be coloured white.

e) **Rapid or emergency deflation cords**

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

- ii) The force required to operate the emergency deflation cord must not be less than 25lbf. (110 N), or more than 75lbf. (330 N.)
- iii) The emergency deflation cord must be long enough to allow an increase of at least 10% in the vertical dimension of the envelope.

31.59 **Trapeze, basket or other means provided for occupants**

- a) (No corresponding BCAR.)
- b) Each projecting object on the trapeze, basket, or other means provided for carrying occupants, that could cause injury to the occupants, must be padded.

31.61 **Static discharge**

Unless shown not to be necessary for safety, there must be appropriate bonding means in the design of each balloon using flammable gas as a lifting means to ensure that the effects of static discharges will not create a hazard.

31.63 **Restraint harness**

- a) For balloons having a separate pilot compartment, there must be a suitable restraint for the pilot which must meet the strength requirements of Subpart C. Additionally, the restraint must be designed so that:
 - i) The pilot can reach all the necessary controls when the restraint is correctly worn and adjusted.
 - ii) There is a method of quick release that is simple and obvious.
 - iii) The possibility of inadvertent release is minimised.
 - iv) The possibility of injury to the pilot under the accelerations specified in 31.29 is minimised.

NOTE: National operational regulations may require pilot restraint to be fitted to balloons which have a single compartment basket.

- b) There must be a restraint harness or other restraining means for all other occupants, unless the Certificating Authority finds it unnecessary. If installed, the means and its supporting structure must meet the requirements of Subpart C.
- c) Where restraining harnesses or other restraining means are not required (other than for the pilot) on baskets or gondolas, there must be hand holds of adequate strength and number."

31.65 **Position lights**

- a) to e) Deleted.

- NOTES:**
- 1) A free balloon while flying at night must display signals and lights as required by United Kingdom law.
 - 2) The Rules of the Air and other operational legislation are not restated in these airworthiness requirements.

Subpart E Equipment

31.71 **Function and installation**

Each item of equipment on a balloon must be:

- a) Designed and installed to ensure that it will perform the intended function reliably under permitted operation conditions;
 - i) Deleted
 - ii) Deleted
 - iii) Deleted
 - iv) Deleted
- b) Designed to safeguard against hazards to the balloon if it malfunctions; and
- c) Shown to function properly in the balloon.

Subpart F **Operating Limitations and Information**

31.81 **General**

- a) Deleted
- b) Deleted

The operating limitations, normal and emergency procedures, and other pertinent information peculiar to the balloon's operating characteristics and necessary for safe operation must be provided by the manufacturer, by a balloon flight manual furnished with each balloon, or by a placard or marking on the balloon that is clearly visible to the operator. The operating limitations must include the maximum certificated weight.

31.82 **Instructions for continued airworthiness**

The applicant must provide a maintenance manual for the balloon and a maintenance schedule against which the balloon must be inspected and maintained in a serviceable condition.

31.83 **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.

31.85 **Required basic equipment**

In addition to any equipment required by this Subpart for a specific kind of operation, the following equipment is required:

- a) For flight in IMC:
 - i) An altimeter;
 - ii) A rate-of-climb indicator.
- b) For hot air balloons:
 - i) A fuel quantity gauge or other means (such as isolated tanks which can be used in sequence) which enable the pilot to know his fuel quantity remaining;
 - ii) An envelope temperature indicator which may either be of the continuous reading type or a type which gives a warning signal.
- c) Deleted.

Supplement 1 Small Hot Air Airships (Not exceeding 4250 cubic metres capacity)

1 Purpose

These requirements constitute the basis for the issue of a United Kingdom Certificate of Airworthiness in the Private or Aerial Work Category to a hot air airship.

2 Appliability

These requirements apply to hot air airships which:

- a) Are propelled by internal combustion engines, other than gas turbine engines;
- b) Achieve altitude control solely by variation of static lift; and
- c) Do not depend on varying the angle of attack of the aircraft or vectoring the thrust in the pitching plane for any normal manoeuvre.

NOTE: The requirements apply to hot air airships having an envelope capacity not exceeding 4250 cu. metres (150,000 cu. ft.). The CAA should be consulted concerning the requirements applicable for airships having an envelope capacity greater than 4250 cu. metres.

3 General

The hot air airship, hereinafter referred to as 'the aircraft' shall comply with British Civil Airworthiness Requirements Part 31 - Manned Free Balloons, together with the additional requirements prescribed in this Supplement.

4 Design and Construction

4.1 Envelope

4.1.1 The envelope shall not distort in a manner likely to lead to a hazardous loss of lift or control when subjected to:

- a) The most critical combination of airspeed (within the scheduled operational limitations) and gust velocity likely to arise in service; or
- b) An engine failure and the resulting effects at the maximum permissible forward speed.

NOTE: If an applicant proposes to pressurise the envelope to an extent greater than the pressure available from ram air or propeller slipstream, the proposed design shall be discussed with the CAA at an early stage. The CAA may then impose additional requirements which would be based on the requirements of BCAR Section Q - Non-Rigid Airships.

4.1.2 **Design Gust.** The envelope and stabilising surfaces shall be assumed to meet a sharp edged gust of a magnitude of 25 ft/sec EAS from any direction at any speed up to the maximum level flight speed.

All significant forces on the aircraft shall be placed in equilibrium in a rational or conservative manner. In establishing such equilibrium, it may be assumed in each case that the aerodynamic loads and associated moments are balanced by linear inertia forces and inertia couples, respectively.

4.1.3 **Manoeuvres.** Where control surfaces are fitted to manoeuvre the aircraft, they shall have sufficient strength not to be damaged if the control surfaces are fully deflected at maximum level flight speed.

4.1.4 **Fabric Tear Resistance.** The properties of the envelope material shall be such that hazardous propagation of tears or local damage will not occur while the envelope is supporting limit loads. The material shall have properties such that, in the event of a source of ignition being applied accidentally to the envelope, combustion will not propagate beyond the immediate area of the ignition source.

NOTE: Proposed methods for establishing compliance with this requirement should be discussed with the CAA.

4.2 **Protection of Occupants During Landing**

4.2.1 Adequate protection shall be provided for the occupants when the aircraft lands, with or without propulsion power, in all wind speeds up to the declared maximum, taking into account all likely directions and attitudes in which the car is liable to strike the ground, including the case of the car tipping onto its side.

4.2.2 The mounting(s) of the engine(s), fuel tank(s), or other heavy objects shall be such that no injury to occupants or likelihood of fire will result, should the heavy object become detached as a result of the car striking a solid object at the maximum anticipated descent velocity, combined with a speed in any direction equal to the maximum declared wind speed. In the absence of more accurate information, such mountings shall be designed to withstand an ultimate acceleration of 6 g acting in any direction within which the heavy object if released would endanger the occupants or the fuel tanks.

5 **Propulsion Powerplant Installation (including fuel tanks)**

5.1 **General.** The powerplant installation shall be constructed and arranged in such a manner that it does not constitute a hazard to the aircraft, the aircraft occupants or third parties under all normal and likely emergency conditions of operation.

5.2 **Propeller installation.** The propeller shall be suitably positioned or guarded so that it does not constitute a hazard to the ground crew or occupants of the aircraft and to preclude entanglement of control lines, including the rip cord.

5.3 **Fuel system**

5.3.1 Fuel systems shall be installed and supported so as to guard them against excessive vibration and, when connected to components between which relative motion may occur, shall incorporate provisions for flexibility.

5.3.2 Means shall be provided to enable the crew to shut off rapidly the flow of fuel independently to each engine. Operation of the control of such means shall not be prevented by the occurrence of a fire adjacent to the engine or fuel tank.

5.3.3 Each liquid fuel tank shall:

- a) Withstand without leakage the pressure resulting from the acceleration specified in 4.2.2;
- b) Be protected from impact with a solid object whilst landing; and
- c) Be provided with a fuel-tight filler cap, except that a small opening for venting purposes is permissible. The filler cap shall be permanently attached by a chain or equivalent means.

5.4 Controls

- 5.4.1 The engine power controls shall be grouped and arranged so as to permit both separate control of each engine and simultaneous control of all engines and shall be such that a forward (in relation to the aircraft) movement of the operating control is necessary to increase forward thrust.
- 5.4.2 Ignition switches shall be provided for each ignition circuit on each engine.

5.5 Fire precautions

- 5.5.1 Fuel tanks shall:
- Be adequately separated from burner units and other possible sources of ignition in the powerplant either by ventilated spaces or by fireproof bulkheads; and
 - Be vented clear of all possible ignition sources.
- 5.5.2 Areas which may be subject to accumulation of flammable fluids due to spillage or leakage shall be adequately drained. Fluid discharged from drains shall not re-enter the aircraft at any point where a fire hazard could result.
- 5.5.3 Precautions shall be taken to reduce as far as is practicable the hazard of fire in conditions following a crash of moderate severity.
- 5.5.4 Precautions shall be taken to prevent a hazardous loss of lift from the envelope in the event of an engine fire.
- 5.5.5 There shall be at least one portable fire extinguisher readily accessible to the crew and capable of extinguishing a fuel fire.

6 Engines, Reduction Gears and Propellers

- 6.1 The applicant shall show either:
- That no failure of the engine(s), transmission(s) or propeller(s) will hazard the aircraft or its occupants; or
 - That such a failure is extremely remote.
- 6.2 Where compliance with 6.1 b) is claimed, the applicant shall provide the following:
- A declaration by a CAA approved propeller manufacturer of the suitability of the propeller for its intended use. A declaration from a foreign manufacturer not approved by the CAA may be acceptable if endorsed by a National Airworthiness Authority with whom the CAA has an appropriate agreement. In other cases such data as are necessary to enable the CAA to make its own finding of suitability will be required. (JAR-P (Propellers) or an equivalent recognised code may be used for guidance).
 - Evidence of acceptable torsional stresses (taking into account typical ignition defects) where failure of the crankshaft could cause a hazard by releasing the propeller. This may be provided as either a calculated torsional analysis or as an assessment based on tests. This evidence shall be produced by a suitably qualified organisation acceptable to the CAA (e.g. a University or an appropriately approved organisation).
 - Evidence that those areas which contribute to the support of the propeller where a reduction gear is employed are able to withstand the loads applied. This may take the form of strip examination of a gear which has run a minimum of 50 hours of typical operation in the aircraft.

7 **Flight**

- 7.1 In steady flight at the lesser of the maximum permissible forward airspeed or the speed obtained using maximum continuous engine power, the aircraft shall be able to maintain any desired course with reasonable accuracy in winds up to the declared maximum.
- 7.2 Engine failure in proximity to the ground shall not produce a hazardous change of attitude or rate of sink.
- 7.3 The behaviour of the aircraft in flight shall be explored in flight trials in which a representative of the CAA shall have the right to participate. These trials shall include operation, including a power-off landing , in winds up to the declared maximum.

8 **Flight Experience**

The CAA reserves the right to make certification conditional on satisfactory completion of an agreed number of flying hours.

9 **Operating Limitations**

- 9.1 The applicant shall declare the operating limitations and instructions necessary for safe operation and shall publish them in the Operating Manual (see also Subpart F, paragraph 31.81).
- 9.2 The Operating Manual shall contain as a minimum the limitations of 9.3 and 9.4.

9.3 **Speed limitations**

- a) The maximum surface wind speed for safe operation on take-off and landing.
- b) The maximum permissible forward airspeed.

NOTE: If the maximum permissible forward airspeed is less than the maximum forward airspeed of which the aircraft is capable with the engine(s) operating at full power, an instrument capable of indicating when the maximum speed is reached shall be provided.

- c) The maximum speeds so declared shall be such as to provide a margin acceptable to the CAA between the authorised maximum and any speed at which a hazard could arise to the aircraft or its occupants.
- d) The margin shall be sufficient to allow for inadvertent speed increases, including the effect of atmospheric gusts, likely to be encountered.

- 9.4 **Limitation of weight, altitude and temperature.** Weight, altitude and temperature limitations, provided in accordance with Subpart F, paragraph 31.81, shall be based on the use of hot air only as the lifting medium without taking account of any additional lift which may be derived from operation of the propulsion system.