

## § 31.16

(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—

(1) The highest weight selected by the applicant;

(2) The design maximum weight which is the highest weight at which compliance with each applicable structural loading condition of this part is shown; or

(3) 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 section must be made available to the pilot in accordance with § 31.81.

[Amdt. 31-3, 41 FR 55474, Dec. 20, 1976]

### § 31.16 Empty weight.

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

[Amdt. 31-4, 45 FR 60179, Sept. 11, 1980]

### § 31.17 Performance: Climb.

(a) Each balloon must be capable of climbing at least 300 feet in the first minute after takeoff with a steady rate of climb. Compliance with the requirements of this section 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 percent.

[Amdt. 31-4, 45 FR 60179, Sept. 11, 1980]

### § 31.19 Performance: Uncontrolled descent.

(a) The following must be determined for the most critical uncontrolled descent that can result from any single failure of the heater assembly, fuel cell system, gas valve system, or maneuvering vent system, or from any single tear in the balloon envelope between tear stoppers:

(1) The maximum vertical velocity attained.

(2) The altitude loss from the point of failure to the point at which maximum vertical velocity is attained.

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(3) The altitude required to achieve level flight after corrective action is initiated, with the balloon descending at the maximum vertical velocity determined in paragraph (a)(1) of this section.

(b) Procedures must be established for landing at the maximum vertical velocity determined in paragraph (a)(1) of this section and for arresting that descent rate in accordance with paragraph (a)(3) of this section.

[Amdt. 31-4, 45 FR 60179, Sept. 11, 1980]

### § 31.20 Controllability.

The applicant must show that the balloon is safely controllable and maneuverable during takeoff, ascent, descent, and landing without requiring exceptional piloting skill.

[Amdt. 31-3, 41 FR 55474, Dec. 20, 1976]

## 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 paragraphs (b) and (c) of this section, the factor of safety is 1.5.

(b) A factor of safety of at least five must be used in envelope design. A reduced factor of safety of at least two 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 five 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 jeopardize 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.

[Doc. No. 1437, 29 FR 8258, July 1, 1964, as amended by Amdt. 31-2, 30 FR 3377, Mar. 13, 1965]

#### § 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) An ultimate free-fall drop test must be made of the basket, trapeze, or other place provided for occupants. The test must be made at design maximum weight on a horizontal surface, with the basket, trapeze, or other means provided for carrying occupants, striking the surface at angles of 0, 15, and 30 degrees. The weight may be distributed to simulate actual conditions. There must be no distortion or failure that is likely to cause serious injury to the occupants. A drop test height of 36 inches, or a drop test height that produces, upon impact, a velocity equal to the maximum vertical velocity determined in accordance with § 31.19, whichever is higher, must be used.

[Doc. No. 1437, 29 FR 8258, July 1, 1964, as amended by Amdt. 31-4, 45 FR 60179, Sept. 11, 1980]

### Subpart D—Design 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 approved specifications that will ensure that they have the strength and other properties assumed in the design data.

(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.

#### § 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 require repeated inspection and adjustment.