Certification Specification for Normal and Commuter Airships

FOREWORD

These Airworthiness Requirements for Airships have been based on the report "Airship Design Criteria" of the US Department of Transportation, Paper No. FAA P-8110-2, change 1, dated July 24, 1992. The purpose of the FAA report was to provide acceptable Airworthiness Requirements for the Type Certification of conventional, near-equilibrium, non-rigid airships. The report contained the design requirements necessary to provide an equivalent level of safety to that prescribed in 14 CFR 21.17(b) for special classes of aircraft. The criteria were applicable to airships certificated in the normal category that had a total seating configuration of 10 seats or less. The Criteria were referenced in Advisory Circular (AC) 21.17-1, "Type Certification-Airships", as an acceptable means for the type certification of conventional, non-rigid airships.

The FAA criteria have been amended by using material from BCAR Section Q and JAR/FAR 23 resulting in the LFLS, which has been effective in Germany since 1999. The LFLS provides airworthiness requirements for the type certification of airships in the categories Normal and Commuter.

By February 2003 a joint effort of CAA UK and LBA Germany elaborated a proposal for the Certification Specification CS 30N. The CS 30N amalgamated BCAR Section Q and LFLS to represent a common basis for Airship Certification within the EASA states. Changes were made according to EASA CG9 Paper "Airworthiness JARs to EASA CS conversion, general guidelines, Issue 24.09.2002" and to a subsequent review of recommended changes by an EASA Core Group 9-lead CAA/LBA sub-group and discussion of these further changes with interested parties; both NAAs and industry.

Content

SUBPART A - GENERAL

CS 30N.1 Applicability

(a) These regulations prescribe acceptable airworthiness requirements, applicable to near-equilibrium, conventional airships in the normal and commuter categories, consisting of an envelope filled with the lifting gas and pressurised slightly above ambient, for the issuance of type certificates and changes to those certificates.

(b) Each person who applies for such a certificate or change must show compliance with the applicable requirements in these regulations.

(c) Additional requirements may be stipulated to cover airship design features or operational characteristics not envisioned in this document.

(1) The Agency may prescribe Special Conditions for an airship, if the airworthiness requirements do not contain adequate or appropriate safety standards for the product, because:

(i) the product has novel or unusual design features relative to the design practices on which the applicable requirement is based; or:

(ii) the intended use of the product is unconventional

(2) The Special Conditions contain such safety standards as the Agency finds necessary to establish a level of safety equivalent to that intended in the regulations.

CS 30N.2 Definitions

The following apply.

(a) An airship is an engine-driven, lighter-than-air aircraft, that can be steered.

(b) A pressure envelope airship is one whose shape is maintained by the pressure of the lifting gas contained within the envelope.

(c) A near-equilibrium airship is one which is capable of achieving zero static heaviness during normal flight operations.

(d) A car is a structure attached to or suspended from the envelope or the structure for carrying crew members, passengers, cargo, equipment, or propulsion systems.

(e) Pressure height is the altitude at which the lifting gas fills the envelope with the ballonets completely deflated.

(f) Density of pure gases at standard sea level atmospheric condition of 1,013.25 hPa (29.92 in Hg) pressure and 15°C (59°F) temperature:

(1) Dry air: $\rho=1.2250\ kg/m^3$.($0.07647\ lb/ft^3$),

(2) Dry helium: $\rho=0.1689\ kg/m^3$ ($0.01054\ lb/ft^3$).

(g) Unit lift: the value used should be identified in the analysis of the design. In the absence of a rational analysis, $9.975\ N/m^3$ ($0.0635\ lb/ft^3$) should be used for helium (96% purity).

(h) Ballonet: a flexible and collapsible air cell contained within the envelope for the purpose of compensating for gas volume changes, maintaining internal pressure in the envelope, and assisting in trimming the airship.

(i) Virtual Inertia: the apparent additional inertia of a body moving in a fluid due to the motion imposed on the fluid by the motion of the body.

CS 30N.3 Airship categories

(a) The normal category is limited to airships that have a seating configuration, excluding pilot seats, of nine or less.

(b) The commuter category is limited to propeller-driven, multiengine airships that have a seating configuration excluding pilot seats, of 19 or less.

(c) Airships may be type certificated in more than one category of these regulations if the requirements of each requested category are met.

CS 30N.5 Abbreviations and symbols

Abbreviations and symbols are in accordance to FAR Part 1. Speeds are equivalent airspeeds (EAS) unless indicated otherwise.

SUBPART B - FLIGHT

GENERAL

CS 30N.21 Proof of compliance

(a) Each requirement of these regulations must be met at each appropriate combination of total mass, static heaviness and lightness and centre of gravity within the range of loading conditions that may occur during the operations for which certification is requested. This must be shown by tests upon an airship of the type for which certification is requested, or by calculations based on and equal in accuracy to the results of testing or a combination of each.

(b) Systematic investigation is required of each probable combination of mass and centre of gravity, if compliance cannot be reasonably inferred from combinations investigated.

(c) The controllability, stability, trim, and stalling characteristics, where relevant, of the airship must be shown at all airspeeds with various ballonet or gas cell levels.

(d) The following general tolerances from specified values are allowed during flight testing:

Item	Tolerance
Mass	+5%, -10%
Critical items affected by mass	+5%, -1%
Centre of gravity	±7%
Airspeed	±3 knots or ±3%, whichever is higher

The manner and extent to which variations of other relevant data of the airship are to be taken into account in establishing compliance with the performance requirement, and in scheduling performance data, must be established for the airship.

(e) If compliance with the flight characteristics requirements is dependent upon a stability augmentation system or upon any other automatic or power-operated system, compliance must be shown with CS 30N.672.

(f) For take-off, landing and ground handling the wind and gust velocity must be measured at the height of hull axis when moored, or corrected for the height at which the wind velocity is measured.

CS 30N.23 Load distribution limits

(a) Ranges of mass, static heaviness and lightness and lift and corresponding centres of gravity and lift must be established, within which the airship may be safely operated.

(b) The load distribution limits may not exceed the:

(1) Selected limits;

(2) Limits at which the structure is proven; or:

(3) Limits at which compliance with each applicable flight requirement of this subpart is shown.

CS 30N.25 Mass limits

(a) Maximum mass. The maximum mass is the highest mass at which compliance with each applicable requirement of these regulations is shown. The maximum mass must be established so that it is:

(1) Not more than

(i) The highest mass selected for the airship,

(ii) The design maximum mass, which is the highest mass at which compliance with each applicable structural loading condition of these regulations is shown, or

(iii) The highest mass at which compliance with each applicable flight requirement is shown;

(2) Assuming a mass of 77 kg (170 lb) for each occupant of each seat, not less than the mass with:

(i) Each seat occupied, oil at full tank capacity, and at least enough fuel for one-half hour of operation at rated maximum continuous power, or

(ii) The required minimum crew, and fuel and oil at full tank capacity;

(3) Not less than that which can be achieved with the car loaded to its maximum design mass

(b) Minimum mass. The design minimum mass must be established so that it is not more than the sum of:

(1) The empty mass determined under paragraph CS 30N.29;

(2) The mass of the required minimum crew (assuming a mass of 77 kg (170 lb) for each crew member); and

(3) The mass of the fuel necessary for one-half hour of operation at maximum continuous power.

CS 30N.27 Centre of gravity limits

The horizontal, vertical and lateral centre of gravity limitations must be established for each practicably separable operating condition.

CS 30N.29 Empty mass and corresponding centre of gravity

(a) The empty mass and corresponding centre of gravity must be determined from the mass of all items, including the structure, if any, and

(1) The mass of the deflated envelope;

(2) Fixed ballast;

(3) Unusable fuel determined under paragraph CS 30N.959; and

(4) Full operating fluids, including

(i) Oil and

(ii) Hydraulic fluid.

(iii) other fluids required for normal operation of the airship systems.

(b) The condition of the airship at the time of determining empty mass must be one that is well defined and repeatable.

(c) A means of accounting for empty mass and centre of gravity changes during the life of the airship, other than by calculation only, must be established.

CS 30N.31 Removable ballast

Removable ballast may be used in showing compliance with the flight requirements of this subpart, if

(a) The place for carrying ballast is properly designed and installed, and is marked under paragraph CS 30N.1557;

(b) Instructions are included in the Airship Flight Manual, approved manual material, or markings and placards, for the proper placement of the removable ballast under each loading condition for which removable ballast is necessary.

(c) Distribution of removable ballast in terms of inertia must be considered, beside basic mass and centre of gravity effects, as this may be a significant factor on handling characteristics such as oscillatory behaviour and/or stabilities.

CS 30N.33 Propeller speed and pitch limits

(a) General. The propeller speed and pitch must be limited to values that will assure safe operation under normal operating conditions.

(b) Propellers not controllable in flight. For each propeller whose pitch cannot be controlled in flight, during take-off and initial climb at best rate of climb speed, the propeller must limit the engine r.p.m., at full throttle or at maximum allowable take-off manifold pressure, to a speed not greater than the maximum allowable take-off r.p.m.

(c) Controllable pitch propellers without constant speed controls. Each propeller that can be controlled in flight, but that does not have constant speed controls, must have a means to limit the pitch range or an indication so that the lowest possible pitch allows compliance with subparagraph (b) of this paragraph.

(d) The means used to limit the low pitch position of the propeller blades must be set so that the engine does not exceed 103% of the maximum allowable engine rpm or 99% of an approved maximum overspeed, whichever is greater, with:

(1) The propeller blades at the low pitch limit and governor inoperative;

(2) The airship stationary under standard atmospheric conditions with no wind; and

(3) The engines operating at the maximum take-off torque limit for turboprop engine-powered airships.

(e) Controllable pitch propellers with constant speed controls: each controllable pitch propeller with constant speed controls must have:

(1) with the speed control in operation, a means at the speed control to limit the maximum engine speed to the maximum allowable take-off r.p.m.;

(2) with the speed control inoperative, a means to limit the maximum engine speed to 103% of the maximum allowable take-off r.p.m. with the propeller blades at the lowest possible pitch and with take-off manifold pressure, the airship stationary, and no wind.

PROCEDURES

CS 30N.40 General
See AMC 30N.40

(a) Appropriate techniques shall be established and scheduled, where applicable, for masting and unmasting, take-off and landing, en-route, hovering, cargo and/or passenger loading and unloading under the conditions for which certification is requested. The techniques shall be such that the manoeuvres can be conducted safely without requiring exceptional skills and, when they are used in tests to establish performance data, the results of the tests are reasonable repeatable.

(b) The established techniques shall, were appropriate, include the procedures to be followed by all required crew including ground handling crew and shall specify the composition and duty of the minimum crew. The minimum crew shall be specified in relation to the selected conditions and limitations.

(c) The techniques established must be published in the Airship Flight Manual.

(d) Engine failure shall be assumed to result in complete and immediate loss of propulsive power from the affected engine except for that momentarily supplied by the inertia of moving parts.

PERFORMANCE

CS 30N.45 General
See AMC 30N.45

(a) Unless otherwise prescribed, the performance requirements of this subpart must be met for still air; and

(1) Standard atmospheric conditions for normal category airships; or

(2) Ambient atmospheric conditions for commuter category airships.

(b) The performance data must correspond to the vectored, propulsive thrust available under the particular ambient atmospheric conditions, the particular flight condition, and the relative humidity specified in subparagraph (d) of this paragraph.

(c) The available propulsive thrust must correspond to engine power or thrust, not exceeding the approved power or thrust, less

(1) Installation losses;

(2) The power or equivalent thrust absorbed by the accessories and services appropriate to the particular ambient atmospheric conditions and the particular flight condition.

(d) The performance, also as affected by engine power or thrust, must be based on a relative humidity selected for the airship or as a minimum of:

(1) 80% at or below standard temperature;

(2) 34% at and above standard temperature, plus 28°C (50°F).

(3) Between the two temperatures listed in subparagraphs (d)(1) and (d)(2) of this paragraph, the relative humidity must vary linearly.

(e) For commuter category airships, the following also apply.

(1) Unless otherwise prescribed, the take-off or unmasting, en route, approach, and landing or masting configurations must be selected for the airship;

(2) The airship configuration may vary with mass, altitude, and temperature, to the extent they are compatible with the operating procedures required by subparagraph (e)(3) of this paragraph;

(3) Unless otherwise prescribed, in determining the critical-engine(s)-inoperative take-off performance, take-off flight path, , take-off distance, and landing distance, changes in the airship's configuration, speed, power, and thrust must be made in accordance with procedures established for operation of the airship in service;

(4) Procedures for the execution of missed approaches and balked landings associated with the conditions prescribed in paragraphs CS 30N.65, CS 30N.67 and CS 30N.77 must be established;

(5) The procedures established under subparagraphs (e)(3) and (e)(4) of this paragraph must

(i) Be able to be consistently executed by a crew of average skill,

(ii) Use methods or devices that are safe and reliable,

(iii) Include allowance for any reasonably expected time delays in the execution of the procedures.

(6) The performance data established shall be the minimum performance of an airship or group of airships being tested by an acceptable method in the specified conditions.

(7) For the determination of take-off performance:

(i) The starting point shall be the point on the take-off surface from which a stationary airship commences the take-off manoeuvre, and

(ii) The decision point shall be the latest point at which, as a result of power unit failure, the pilot is assumed to decide to continue or discontinue a take-off.

CS 30N.51 Take-off

See AMC 30N.51

(a) The take-off performance data and procedures for airships, equipped with landing gears and requiring a horizontal take-off when operating statically heavy, the distance*) required to take-off and clear a 15 m (50 ft) obstacle must be determined and included in the Airship Flight Manual:

(1) For each appropriate combination of total mass, static heaviness and the most unfavourable centre of gravity within the range of loading conditions for which certification is requested, and for ambient atmospheric temperature and wind conditions within the operational limits selected for the Airship;

(2) For the selected configuration for take-off;

(3) For the most unfavourable centre of gravity position;

(1) With the engines and vectored thrusters (if so equipped) operated within approved operating limits.

*)The take-off distance shall include the distance from the Spatial Reference Point to the tailpoint of the airship.

(b) For each scheduled take-off technique, the horizontal distance from the starting point to the point at which a screen height of 15 m (50 ft) is attained shall be measured when taking off at maximum mass:

(1) with all engines operating throughout, and

(2) With all engines operating up to the decision point then with the critical engine inoperative from the decision point onward.

In both cases the speed at the screen height must be not less than the initial steady climb speed appropriate to the number of operating engines and to the static heaviness.

(c) For each scheduled take-off technique, the horizontal distance to accelerate from the starting point to the decision point with all engines operating then to come to a complete stop with the critical engine(s) inoperative shall be established.

(d) The established techniques for take-off shall include the recommended pitch attitudes appropriate to the initial steady climb and the associated speeds appropriate to the number of operating engines and the static heaviness (or lightness). The initial climb speed shall be not less than:

(1) The speed at which the climb performance minimum of CS 30N.65 and CS 30N.67 appropriate to the number of engines can be met, and

(2) 1.10 times the minimum speed at which the requirements of CS 30N.149 can be met with a transient heading change of no more than 20° and with the ability to subsequently regain and maintain the original heading.

(3) The all engines operating initial climb speed may not be less than the one engine inoperative steady initial climb speed.

(e) The minimum space required for take-off shall be:

(1) a circle of diameter not less than the length of the airship plus whichever is the greater of:

(i) 100 m (33 ft)plus the measured take-off distance with all engines operating established in accordance with (b)(1),

(ii) 1.33 times the measured take-off distance with all engines operating established in accordance with (b)(1),

(iii) 60 m (196 ft)plus the measured take-off distance with one engine inoperative established in accordance with (b)(2),

(iv) 1.15 times the measured take-off distance with one engine inoperative established in accordance with (b)(2) and, where the decision point is later than the point where the ship is released by the ground crew,

(v) The accelerate-stop distance determined in accordance with (c), or

(2) A rectangle of length equal to the diameter of the circle defined in (e)(1) and a width not less than the width of the airship plus 200 m (656 ft).

(f) Where the minimum space required for take-off is scheduled as a rectangle, in accordance with (e)(2), the maximum permitted wind component at right angles to the major axis of the rectangle must be scheduled.

(g) Take-offs made to determine the data required by this paragraph must not require exceptional piloting skill or favourable conditions.

CS 30N.65 Climb: all engines operating

See AMC 30N.65

(a) Each airship, at maximum mass, static heaviness and at ambient atmospheric temperature within the operational limits established for the airship and with the most unfavourable centre of gravity for each configuration, and when the airship is operated in accordance with the take-off techniques established in accordance with CS 30N.51, must have a steady rate of climb at the airfield altitude of at least 2.0 m/s (400ft/min) and a steady angle of climb of at least 1:12 with:

(1) thrust and lift controls in their normal position for climb;

(2) the landing gear or device retracted, if applicable; and

(3) not more than maximum take-off power and at the initial all-engines-operating climb speed of CS 30N.51(d).

(b) The maximum rates of climb and descent, to be used for all operations, must be established for all conditions using maximum continuous forward thrust. It must be demonstrated that envelope and gas cell pressures remain within the maximum and minimum approved pressures during climbs and descents at maximum rates of ascent and descent of at least 7 m/s (1200 ft/min).

(c) For Airships in which the primary supply of air to the ballonets is dependent upon engine power, the maximum rate of descent shall be established and scheduled both for the all-engines-operating condition and with the critical engine inoperative. The latter case may be demonstrated either with the critical engine inoperative or with the air supply from the critical engine shut-off.

(d) Performance data must be determined for variations in mass, static heaviness, altitude and temperature at the most unfavourable centre of gravity for which approval is requested.

CS 30N.67 Climb: One engine inoperative

(a) Each airship, with the most critical engine(s) inoperative and with and without vectored thrust, at various combinations of mass, static heaviness and at ambient atmospheric temperature within the operational limits established for the airship and with the most unfavourable centre of gravity for each configuration, ,and when the airship is operated in accordance with the take-off techniques established in accordance with CS 30N.51, must have a steady rate of climb at the airfield altitude of at least 0.76 m/s (150 ft/min) with:

(1) thrust and lift controls in their normal position for climb;

(2) the landing gear or device retracted, if applicable; and

(3) the operating engines operating at not more than Maximum Take-off Power and at the initial one-engine-inoperative climb speed of CS 30N.51(d).

(b) Performance data must be determined for variations in mass, static heaviness, altitude and temperature at the most unfavourable centre of gravity for which approval is requested.

CS 30N.68 En-route flight path

(a) For the en-route configuration, the flight paths prescribed in (b) and (c) of this paragraph must be determined at each mass, altitude, and ambient temperature, within the operating limits established for the airship. The variation of mass along the flight path, accounting for the progressive consumption of fuel and oil by the operating engines, and also accounting for accumulation of water or snow onto the envelope of the airship must be included in the computation. The flight path must be determined at the associated climb speed and recommended pitch attitude, with:

(1) the most unfavourable centre of gravity;

(2) the critical engine(s) inoperative (except for the flight path prescribed in (d) of this paragraph;

(3) the operating engines at the available maximum continuous power or thrust, and;

(4) the means for controlling the engine cooling air supply in the position that provides adequate cooling in the hot day condition

(b) The one engine inoperative net flight path data must be established;

(c) For three- or more-engined airships, a minimum of two engines inoperative net flight path data must be established;

(d) The measured rate and gradient of climb with all engines operating must be established.

(e) The maximum level flight speed shall be not less than V_{Bmin} (see CS 30N.311) in the following conditions:

(1) Buoyancy. Maximum permitted Static Heaviness or Static Lightness, whichever affects speed more adversely.

(2) Power. All engines operating at not more than Maximum Continuous Power.

CS 30N.75 Landing

(a) For airships equipped with landing gears and capable of making horizontal landings the horizontal distance*) necessary to land and come to a complete stop from clearing a point 15 m (50 ft) above the landing surface must be determined for each scheduled technique, with the airship in the most critical configuration for landing. If any device is used that depends on the operation of any engine(s), and if the landing distance would be noticeably increased when a landing is made with engine(s) inoperative, the landing distance must be determined with that (those) engine(s) inoperative unless the use of compensating means will result in a landing distance not more than that with all engines operating.

*)The distance shall be measured from the obstacle to the bow of the stopped airship.

(b) For airships not equipped with a landing gear or for which landings are essentially vertical, performance data must be established for each scheduled technique with the airship in the most critical configuration for landing.

(c) Landing performance and data must be determined and included in the Airship Flight Manual:

(1) for standard temperatures at each mass and static heaviness, altitude and wind condition within the operational limits established for the Airship;

(2) for the selected configuration for landing;

(3) for the most unfavourable centre of gravity position that may occur during the approach;

(4) with the engines operated within approved operating limits

CS 30N.76 Engine failure

The airship must be capable of maintaining level flight and zero rate of descent following failure of one or more critical engine(s). Ballast may be dropped or helium valved to achieve these conditions. Only disposable ballast may be dropped.

CS 30N.77 Balked landing

Each airship must demonstrate the ability to transition to a balked landing climb from a descent and approach to landing at maximum landing mass without excessive sink or requiring excessive pilot skill. The airship configuration will include

(a) The airship trimmed for descent and landing;

(b) The landing gear extended, if applicable; and

(c) Thrust and lift controls initially in the position normally used for landing.

CS 30N.80 Loading/Unloading

(a) For airships intended to load and unload cargo or other ballast when the airship is in flight, hovering, or on the ground but not masted, performance data must be established with the airship in the most critical configuration.

(b) Loading/Unloading performance and data must be determined and included in the Airship Flight

Manual:

(1) for standard temperatures at each mass and static heaviness, altitude, and wind condition within the operational limits established for the Airship;

(2) for the selected configuration for loading/ unloading;

(3) for the most unfavourable centre of gravity position;

(4) with the engines operated within approved operating limits.

(c) During any cargo exchange or reballasting operation the airship must be capable of achieving a safe free flight condition within a time period short enough to recover from a potentially hazardous condition.

FLIGHT CHARACTERISTICS

CS 30N.141 General

(a) The airship must meet the requirements of CS 30N.143 through 261 at all approved operating altitudes and ambient atmospheric conditions without exceptional piloting skill, alertness, or strength.

(b) In the course of establishing compliance with the Handling Requirements, a general qualitative assessment of the handling qualities shall be made. If this assessment reveals any unusual features not specifically covered by the requirements then the handling qualities in this respect shall be satisfactory to the Agency.

(c) Although the Handling Requirements are, in general, associated with no appreciable atmospheric turbulence, a qualitative check shall be made to ensure that there is no undue deterioration in the handling characteristics in turbulent air.

CONTROLLABILITY AND MANOEUVRABILITY

CS 30N.143 General

(a) The airship must be safely controllable and manoeuvrable during

(1) Take-off;

(2) Climb;

(3) Level flight;

(4) Descent;

(5) Landing;

(6) Level flight with the critical engine(s) inoperative and remaining engines vectored in any allowable position.

(7) In flight cargo exchange and reballasting operations and during passenger or cargo loading and unloading with the airship on the ground but off the mast.

Dynamic response due to modes of motion must be considered to ascertain that no abnormal modes of motion, flight attitudes and accelerations will occur on account of the manoeuvres induced.

(b) It must be shown that without engine power a safe descent and landing under the conditions of paragraph CS 30N.561 can be made.

(c) It must be possible to make a smooth transition from one flight condition to any other flight condition without exceptional piloting skill, alertness, or strength and without danger of exceeding the limit-load factor under any probable operating condition, including the sudden failure of any engine, and:

(1) for airships with three or more engines the sudden failure of the second critical engine when the airship is in the en-route, approach, or landing configuration and is trimmed with the critical engine(s) inoperative; and:

(2) configuration changes, including use of deceleration devices.

(d) If, during the testing required by subparagraph (c) of this paragraph, marginal conditions exist with regard to required pilot strength, the pilot forces may not exceed the limits prescribed in Table 6 of the Appendix. For the purpose of complying with prolonged control force limitations the airship must be trimmed for buoyancy and pitch as close to neutral as possible.

CS 30N.145 Longitudinal control

With all engines operating at maximum continuous power, appropriate lift control settings, the airship trimmed and without exceeding the pilot forces of Table 6 in the Appendix,, it must be possible to produce:

(a) A nose down pitch change out of a stabilised climb with 30° nose-up deck angle at the most critical airspeed.

(b) A nose-up pitch change out of a stabilised descent with 30° nose-down deck angle at the most critical airspeed..

CS 30N.147 Directional control

There must be enough rudder control to enter and recover any turns appropriate to the conditions for which certification is requested with pilot forces not exceeding the values given in Table 6 of the Appendix. Additionally it must be demonstrated that directional control can be maintained with and against asymmetric engine thrust due to the failure of a (the) critical engine(s). One engine inoperative should be considered for all transport airships, and two engines inoperative for those types with three or more engines.

CS 30N.149 Minimum control speed

(a) V_{MC} is the calibrated airspeed at which, when the critical engine(s) is (are) suddenly made inoperative, it is possible to maintain control of the airship, with that (the) engine(s) still inoperative, and thereafter maintain straight flight at the same speed. The method used to simulate critical engine(s) failure must represent the most critical mode of powerplant failure with respect to controllability expected in service. One engine inoperative should be considered for all transport airships, and two engines inoperative for those types with three or more engines.

(b) For airships equipped with landing gears and capable of making horizontal landings the requirements of sub-paragraph (a) must also be met for the landing configuration with:

(1) Maximum available take-off power initially on each engine;

(2) The airship trimmed for an approach with all engines operating at an approach gradient equal to the steepest used in the landing distance demonstration of CS 30N.75;

(3) Landing gear (if applicable) extended; and

(4) All propeller controls throughout in the position recommended for approach with all engines operating.

(c) At V_{MC}, the temporary control forces specified in Table 6 of Appendix must not be exceeded and it must not be necessary to reduce power of the operative engine. During the manoeuvre the airship must not assume any dangerous attitude and it must be possible to prevent a heading change of more than 20°.

CS 30N.150 Minimum aerodynamic control speed

The minimum aerodynamic control speed V_{AM} is the minimum airspeed at which it is possible to maintain directional and longitudinal control and zero rate of descent of the airship with aerodynamic means for various combinations of mass and static heaviness during take-off, flight and landing.

CS 30N.153 Control during landing

(a) Sufficient pitch control authority must exist under normal approach and landing conditions defined in the Airship Flight Manual to permit the pilot to achieve the desired attitude. The means, technique and limits for such control must be published in the Airship Flight Manual.

(b) It shall be possible to make a landing without assistance from ground personnel in the maximum surface wind speed established in accordance with CS 30N.237. This requirement shall be met with all engines operating and with the critical engine(s) inoperative. Satisfactory techniques for such a landing, which shall include procedures for securing the airship to the ground, shall be determined and scheduled in the Flight Manual.

(c) A technique shall be determined and scheduled in the Flight Manual for making an emergency landing with all engines inoperative in wind speeds up to the permitted maximum for operation. The technique shall make reference to the emergency evacuation technique as established in accordance with CS 30N.803 and shall include procedures for securing the airship on the ground. If the use of a grapnel, or other device for bringing the airship to rest, is prescribed, procedures for its deployment shall be given.

TRIM

CS 30N.161 Trim

It shall be possible to trim the airship by means of static or aerodynamic trim, in all conditions of loading, configuration, speed and power, to ensure that the pilot will not be unduly fatigued or distracted by actions necessary for the safe handling of the airship. This applies both in normal operation and, if applicable, in the conditions associated with the failure of one engine, or with any likely single failure or malfunction of the ballonet air supply system.

STABILITY

CS 30N.171 Stability

It shall be demonstrated that the airship is sufficiently stable in both pitch and yaw axes in steady unaccelerated flight during climb, descent, and level flight when trimmed at the appropriate operating speeds and with consistent use of auxiliary thrust and lift controls to ensure that the pilot will not be unduly fatigued and distracted from his normal duties.

CS 30N.181 Dynamic stability

Any oscillation within the operating envelope of the airship must be controllable with normal use of the primary flight controls without requiring exceptional pilot skills.

MISCELLANEOUS FLIGHT REQUIREMENTS

CS 30N.201 Stall demonstration

Stall characteristics, where relevant, shall be investigated in straight flight and turns.

CS 30N.203 Stall characteristics

It must be possible to produce and to correct pitch and yaw by unreversed use of the controls, up to the time the airship is stalled. No abnormal pitching may occur. The longitudinal control force must be positive up to and throughout the stall. In addition, it must be possible to prevent stalling promptly and to recover from a stall by normal use of the controls.

CS 30N.207 Stall warning

A stall warning must be installed:

(a) if the airship can be stalled; and,

(b) the stall of the airship cannot be detected

CS 30N.237 Wind velocities

A maximum surface wind speed in which the airship is allowed to operate shall be established and scheduled in the Flight Manual and in the Ground Handling Manual. This speed shall not be greater than the lesser of:

(a) 75% of the maximum still air speed of which the airship is capable with the critical engine inoperative and the remaining engines operating at not more than maximum continuous power, or,

(b) The maximum surface winds in which the airship may be handled by the established minimum ground handling crew.

CS 30N.251 Vibration and buffeting

(a) Each part of the airship must be free from excessive vibration under any appropriate speed and power condition up to V_D as defined in CS 30N.311. In addition, buffeting must not occur in any normal flight condition severe enough to interfere with the satisfactory control of the airship, cause excessive fatigue to the crew, or result in loading beyond the limit load. .

(b) The requirements of (a) shall be met when the airship is flown with normal use of the controls (including deliberate small, sharp inputs) and in all permitted conditions of buoyancy.

CS 30N.253 Envelope pressure and distortion

It must be shown that any envelope or hull distortion will not interfere with flight path control throughout the range of speed, power, and envelope pressure to be used in normal flight. For non-rigid and semi-rigid airships the following apply:

(a) A means must be provided for the pilot to determine and control the envelope pressure within the design pressure range, if applicable.

(b) Improper use of the procedure and the controls necessary to comply with subparagraph (a) must not damage the envelope or the structure attached to it.

CS 30N.255 Ground handling characteristics
see AMC 30N.255

(a) Satisfactory ground handling procedures must be developed assuming the specified minimum flight and ground crew, all anticipated airship mass, buoyancy, failure and the wind conditions specified in CS 30N.237.

(b) Mooring procedures must be developed.

(c) Towing with mechanical means such as tractors and/or winches must strictly avoid line snapping or whipping by using appropriate means of pre-tensioning and controlled yield in case of suddenly incurred forces.

(d) Ground handling equipment must be able to counteract ground gust conditions and wind shifts safely.

(e) The Ground Handling Manual shall define the wind conditions addressed in (d)

CS 30N.261 Flight in rough air

(a) Procedures and performance information of the airship at various levels of turbulence must be established for combinations of mass and static heaviness and be incorporated in the Airship Flight Manual.

(b) The lifting gas pressure must remain within its limits during flight in rough air.

SUBPART C - STRUCTURE

GENERAL

CS 30N.301 Loads

(a) Strength requirements are specified in terms of limit loads (the maximum loads expected in service) and ultimate loads (limit loads multiplied by prescribed factors of safety). Unless otherwise provided, prescribed loads are limit loads.

(b) Unless otherwise provided, the air and ground loads must be placed in equilibrium with inertia forces, considering each item of mass in the airship, and, where appropriate, taking into account the effects of virtual inertia of the airship.

(c) Compliance with the structural requirements must be shown at any combination of mass, from the design minimum mass to the design maximum mass and the most adverse centre of gravity position within the range for which certification is sought.

(d) If deflections under load would significantly change the distribution of external or internal loads, this redistribution must be taken into account.

CS 30N.303 Factors of safety

Unless otherwise provided, a factor of safety of 1.5 must be used.

CS 30N.305 Strength and deformation

(a) The structure must be able to support limit loads without detrimental permanent deformation. At any load up to limit loads, the deformation may not interfere with safe operation.

(b) The structure must be able to support ultimate loads without failure for at least 3 seconds. However, when proof of strength is shown by dynamic tests simulating actual load conditions, the 3 second limit does not apply.

CS 30N.307 Proof of structure

(a) Compliance with the strength and deformation requirements must be shown for each critical load condition. Structural analysis may be used only if the structure conforms to those for which experience has shown this method to be reliable. In other cases, substantiating load tests must be made. Dynamic tests, including structural flight tests, are acceptable if the design load conditions have been simulated.

(b) Certain parts of the structure must be tested as specified in Subpart D of these regulations.

CS 30N.309 Design weights

The weight of the airship is equivalent to its maximum design static buoyancy plus any additional weight which may be carried by dynamic lift (distributed the envelope and empennage in an acceptable manner) or by vectored thrust.

(a) Maximum design weight. The maximum weights at which compliance is shown with each applicable structural and flight requirement are defined:

(1) Maximum design equilibrium weight W_0;

(2) Maximum static heaviness W_{sh} (The amount by which the weight of an airship exceeds the displacement buoyancy);

(3) Maximum landing weight W_l;

(4) Maximum take-off weight $W_t = W_0 + W_{sh}$;

(5) Maximum car weight.

(b) Minimum design weight. The minimum weight at which compliance is with each applicable requirement are defined:

(1) Minimum design weight W_m;

(2) Maximum static lightness W_{sl} (The amount by which the weight of an airship is less than the displacement buoyancy).

CS 30N.311 Design airspeeds

The selected design airspeed are equivalent airspeeds (EAS) except as provided in specific requirements.

(a) Design maximum level flight airspeed, V_H. V_H is the maximum speed obtainable in level flight with all engines operating at maximum continuous power and the airship loaded to equilibrium buoyancy or to loading which will produce minimum drag.

(b) Design airspeed for maximum gust intensity, V_B. V_B shall not be less than 65 km/h (35 knots) or 0.65 V_H, whichever is higher.

(c) Design dive airspeed, V_D. V_D may not be less than the greater of

(1) V_H; or the

(2) maximum airspeed obtainable in a dive with all engines at maximum continuous power and the airship in the minimum drag configuration.

(d) Design manoeuvring speed V_A. (*reserved*)

FLIGHT LOADS

CS 30N.321 General

Compliance with the flight load requirements of this subpart must be shown

(a) At each critical altitude within the range in which the airship may be expected to operate;

(b) At each weight from the minimum design weight to the maximum design weight;

(c) For each required altitude and weight, at any practicable distribution of disposable load within the operating limitations specified in paragraphs CS 30N.1583 through CS 30N.1589.

CS 30N.333 Design manoeuvre loads

(a) The airship, including control surfaces, is considered to be subjected to the loads resulting from the manoeuvring conditions listed in Table 1 of the appendix. Steady state and transient effects during checked and unchecked manoeuvre must be taken into account.

(b) Consideration of the manoeuvring conditions must include the investigation of both the separate and the combined effects of the rudder and elevator controls.

(c) Consideration of the manoeuvring conditions must include the investigation of the effect of the vectored thrust.

CS 30N.341 Gust loads

(a) The airship is assumed to be subjected to the loads resulting from encounters with the following atmospheric gusts in level flight.

(1) Discrete gust of U_m=7.6 m/s (25 ft/s) while flying at speed $v=V_H$ (m/s).

(2) Discrete gust of U_m=10,7 m/s (35 ft/s) while flying at speed v=V_B (m/s).

(3) Gust shapes and intensities, u, are defined as follows,

$$u = \frac{U_m}{2} \cdot \left[1 - \cos\left(\pi \cdot \frac{X}{H}\right)\right] \quad \left[\frac{\text{m}}{\text{s}}\right],$$

where

- U_m gust velocity specified above (m/s),
- X penetration distance (m), 0 ≤ X ≤ 2 H,
- H gust gradient length (m), L/4 ≤ H ≤ 245 m (800 ft),
- L length of the airship (m).

(4) The dynamic response of the airship to the design gusts as well as the steady state loads must be taken into account.

(b) The gusts are applied in any direction, including parallel to the airship axis, with the control surfaces in both the neutral position and the maximum effective angles required to counteract the gust.

(c) In the absence of a more rational analysis, the maximum aerodynamic bending moment M, applied to the envelope, must be computed as follows,

$$M = K_1 \cdot 0.058 \cdot \left[1 + (f - 4) \cdot \left(0.5624 \cdot \left(K_2 \cdot L^{0.02}\right) - \frac{1}{2}\right) \cdot \left(\frac{K_2 \cdot L}{2}\right)^{\frac{1}{4}} \cdot K_3 \cdot \left(q \cdot \frac{U_m}{v} \cdot V\right)\right] \quad [\text{N} \cdot \text{m}]$$

where

- f envelope ratio, f = L/D, f ≥ 4,
- U_m gust velocity from subparagraph (a) of this paragraph (m/s),
- q dynamic pressure (Pa) at the velocity v (m/s) under consideration, q=ρ v²/2,
- L length of the airship (m),
- D maximum envelope diameter (m),
- ρ density of air (kg/m³),
- v airship equivalent speed (m/s) from subparagraph (a) of this paragraph,
- V total envelope volume (m³).
- K_1 1.355818 (converts lbf∗ft to Nm)
- K_2 3.2808399 (converts ft to m)
- K_3 0.7375621 (converts slugs/ft³, ft²/s² and ft³ to SI units)

(d) The empennage is assumed to be subjected to the discrete gusts defined in subparagraph (a) applied under the following conditions.

(1) The airship is in straight and level flight;

(2) The gust is applied at 90° to either side of tail surfaces;

(3) Control surfaces must be considered to be in both the neutral position and at the maximum effective angles required to counteract the gust;

(4) The effective angle of attack is assumed to be

$$\alpha = 1.25 \cdot \tan^{-1}\left(\frac{Um}{v}\right) \quad [\text{-}]\ 1$$

(5) Control surface loads plus stern aerodynamic forces in the envelope induced by the empennage must be placed in equilibrium with opposing inertia forces in a rational or conservative manner with the airship at its maximum weight.

CS 30N.361 Engine torque

(a) Each engine mount and its supporting structure must be designed for the effects off

(1) A limit engine torque corresponding to take-off power and propeller speed acting simultaneously with 75% of the limit loads from the design manoeuvre conditions of paragraph CS 30N.333;

(2) A limit engine torque corresponding to the maximum continuous power and propeller speed acting

simultaneously with the limit loads from the design manoeuvre conditions of paragraph CS 30N.333;

(3) For turbopropeller installations, in addition to the conditions specified in subparagraphs (a)(1) and (a)(2) of this paragraph, a limit engine torque corresponding to take-off power and propeller speed, multiplied by a factor accounting for propeller control system malfunction, including quick feathering, acting simultaneously with 1 g level flight loads. In the absence of a rational analysis, a factor of 1.6 must be used.

(b) For turbine engine installations, the engine mounts and supporting structure must be designed to withstand each of the following.

(1) A limit engine torque load imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming);

(2) A limit engine torque load imposed by the maximum acceleration of the engine.

(c) The limit engine torque, to be considered under subparagraph (a) of this paragraph, must be obtained by multiplying the mean torque by a factor of

(1) 1.25 for turbopropeller installations, unless power transients can cause a higher limit torque;

(2) 1.33 for engines with five or more cylinders;

(3) two, three, or four for engines with four, three, or two cylinders, respectively.

(d) When the airflow through the propeller is not symmetrical, due to airship yawing and pitching, or engine vectoring, the additional forces must be considered.

CS 30N.363 Side load on engine mount

(a) Each engine mount and its supporting structure must be designed for a limit load factor in a lateral direction, for the side load on the engine mount, of not less than

(1) 1.33; or

(2) One-third of the limit load factor for design manoeuvre conditions specified in paragraph CS 30N.333.

(b) The side load prescribed in subparagraph (a) of this paragraph may be assumed to be independent of other flight conditions.

CS 30N.367 Engine failure loads

For turbopropeller powered airships, the engine mount and support structure must be designed for the loads resulting from the failure of any one engine in combination with a single malfunction of the propeller drag limiting system. The following conditions apply.

(a) The loads resulting from power failure because of fuel flow interruption are considered to be limit loads.

(b) The loads resulting from the disconnection of the engine compressor from the turbine or from loss of the turbine blades are considered to be ultimate loads.

CS 30N.371 Gyroscopic loads

For turbine powered airships, each engine mount and its supporting structure must be designed for the gyroscopic loads resulting from the manoeuvre loads combined with the maximum rate of angular change in vectored thrust with the engines at maximum continuous r.p.m.

CONTROL SURFACE AND SYSTEM LOADS

CS 30N.391 Control surface loads

(a) Control surfaces must be designed for the control surface loads resulting from the conditions described in paragraphs CS 30N.333 and CS 30N.341.

(b) In the flight loading conditions, the airloads on movable surfaces and the corresponding deflections need not exceed those that would result in flight from the application of any pilot force within the ranges specified in subparagraph CS 30N.397(b). However, these pilot forces may not be less than the actual maximum pilot forces determined when complying with subparagraph CS 30N.143(c). In applying this requirement, the effects of control system boost and servo-mechanisms, and the effects of tabs must be considered. The automatic pilot effort must be used for design if it alone can produce higher control surface loads than the human pilot.

CS 30N.395 Control system loads

(a) Each flight control system and its supporting structure must be designed for loads corresponding to at least 1.25 of the computed hinge moments of the movable control surface in the conditions prescribed in paragraphs CS 30N.333 and CS 30N.341. However, these loads need not exceed the higher of the loads that can be produced by the pilot or by the autopilot.

(b) The system must be designed for the maximum effort of the pilot or autopilot, whichever is higher. In addition, if the pilot and the autopilot act in opposition, the part of the system between them may be designed for the maximum effort of the one that imposes the lesser load. Pilot forces used for design need not exceed the maximum forces prescribed in subparagraph CS 30N.397(b).

(c) The design must, in any case, provide a rugged system for service use. Compliance with this paragraph may be shown by designing for loads resulting from application of the minimum forces prescribed in subparagraph CS 30N.397(b).

CS 30N.397 Pilot forces

(a) Pilot forces used for design are assumed to act at the appropriate control grips or pads as the would in flight, and to be reacted at the attachments of the control system to the control surface horns.

(b) The pilot forces and torques are presented in Table 2 of the appendix.

CS 30N.399 Dual control system

(a) Each dual control system must be designed for the pilots operating in position, using individual pilot forces not less than

(1) 0.75 times those obtained under paragraph CS 30N.391; or

(2) The minimum forces specified in subparagraph CS 30N.397(b).

(b) The control system must be designed for pilot forces applied in the same direction, using individual pilot forces not less than 0.75 times those obtained under paragraph CS 30N.391.

CS 30N.405 Secondary control system

Secondary controls, such as valve and damper controls, must be designed for the maximum forces that a pilot is likely to apply to those controls.

CS 30N.407 Trim tabs effects

The effects of trim tabs on the control surface design conditions must be accounted for only where the surface loads are limited by maximum pilot effort. In these cases, the tabs are considered to be deflected in the direction that would assist the pilot.

CS 30N.409 Tabs

Control surface tabs must be designed for the most severe combination of airspeed and tab deflection likely to be obtained.

CS 30N.411 Supplementary conditions for control surfaces

For airships with control surfaces having appreciable angles with respect to the horizontal and vertical axes or having inter surface supports, the surfaces and supporting structure must be designed for the combined surface loads prescribed for the separate systems.

CS 30N.415 Tail-to-wind loads

(a) The control surface hinges and control system must be designed, as follows, for control surface loads due to tail-to-wind loads.

(1) In the absence of a more rational analysis, the load distribution on the movable control surface must be computed as varying linearly from zero at the hinge to a maximum value at the trailing edge.

(2) The control system, from the control surface horns to the location reacting the loads (stops, gust locks, pilot controls), must be designed for loads corresponding to the hinge moment, H, of subparagraph (3).

(3) Control surface hinge moments computed from the following formula need not exceed the loads corresponding to the maximum pilot loads in subparagraph CS 30N.397(b).

$$H = C \cdot S \cdot q \cdot K, 2$$

where

H limit hinge moment (Nm),

C mean chord of the control surface aft of the hinge line (m), S area of the control surface aft of the hinge line (m^2),

q Dynamic pressure (Pa) based on a design speed of not less than 4.6 m/s (15 ft/s),

K hinge moment factor 1.40.

(b) The resulting loads on each surface must be determined for locked and unlocked controls in positive and negative positions with the surface against the stops and in the neutral position.

GROUND LOADS

CS 30N.471 General

The limit ground loads specified in this subpart are considered to be external loads that act upon the airship structure. In each specified ground load condition, the external loads must be placed in equilibrium with the linear and angular inertia forces in a rational or conservative manner.

CS 30N.473 Ground load conditions and assumptions

(a) The ground load requirements of this subpart must be complied with at the weights and shock absorber extensions shown in Table 3 of the appendix.

(b) The selected limit vertical inertia load factor at the centre of gravity of the airship for the landing load conditions prescribed in this subpart may not be less than that which would be obtained when landing with the maximum descent velocity expected to occur in service but may not be less than 0.914 m/s (3 ft/s). Proper consideration may be given to the distribution of the landing energy between the car and the envelope. No allowance shall be made for dynamic lift throughout the landing impact. The limit vertical inertia load factor, n, represents the ratio of the externally applied vertical forces to the weight of the airship.

(c) Energy absorption tests (to determine the limit load factor, n, corresponding to the required limit descent velocities) must be made under subparagraph CS 30N.723(a).

CS 30N.479 Landing conditions

The landing gear and airship structure are considered to be subjected to the loads resulting from the take-off and landing conditions listed in Table 3 of the appendix. In determining the ground loads an the landing gear and affected support structure, the following apply.

(a) When investigating landing conditions, the drag components simulating the forces required to accelerate the tires and wheels up to the landing speed must be properly combined with the corresponding instantaneous vertical ground reactions assuming a tire sliding coefficient of friction of 0.8. The contact speed must be appropriate to landing the airship at the maximum anticipated forward landing speed. In determining wheel spin-up loads, the method set forth in FAR Part 23 Appendix D, may be used.

(b) If a swivel (without lock, steering device or shimmy damper) is used, in addition to the above requirements, the gear is assumed to be swivelled 90° to the airship longitudinal axis, with the resultant ground load passing through the axle.

(c) Auxiliary landing gear (wheels mounted on tail fin) must be designed to withstand the loads resulting from expected service.

CS 30N.481 Mooring and handling conditions

The limit loads specified in this paragraph are considered to be external loads that act upon the airship structure and handling lines. These loads are those resulting from the mooring and handling conditions listed in Table 4 of the appendix. For these conditions, the airship is considered in the landing configuration.

OTHER LOADS

CS 30N.505 Snow loads

The limit load of precipitated snow on the moored airship's surface must be established.

CS 30N.507 Jacking loads

(a) The airship must with the envelope deflated designed for the loads developed when the airship is supported on jacks at the design maximum weight assuming the following load factors for landing gear jacking points at a three-point attitude and for primary flight structure jacking points in the level attitude.

(1) Vertical-load factor of 1.35 times the static reactions;

(2) Fore, aft, and lateral load factors of 0.4 times the vertical static reactions.

(b) The horizontal loads at the jack points must be reacted by inertia forces so as to result in no change in the direction of the resultant loads at the jack points.

(c) The horizontal loads must be considered in all combinations with the vertical load.

CS 30N.509 Step section

Part of the structure that may be used for supporting a person during the rigging procedure, inspection, maintenance, or repair must be designed to withstand a limit load of 1,067 N (240 lbf) and a load factor of 1.35.

EMERGENCY LANDING CONDITIONS

CS 30N.561 General

(a) The airship, including its propulsion system, although it may be damaged in emergency landing conditions, must be designed as prescribed in this paragraph to protect each occupant under those conditions.

(b) The structure must be designed to give each occupant every reasonable chance of escaping serious injury in a minor crash landing when

(1) Proper use is made of seat belts provided for in the design;

(2) The occupant experiences the ultimate inertia forces shown in Table 7 of the appendix.

(c) The supporting structure must be designed to restrain, under loads up to those specified in subparagraph (b)(2) of this paragraph, each item of mass that could injure an occupant if it came loose in a minor crash landing.

FATIGUE EVALUATION

CS 30N.572 Airship structures

(a) The strength, detail design, and fabrication of those parts of the airship structures, whose failure would be catastrophic, must be evaluated under either of the following unless it is shown that the structure, operating stress level, materials, and expected uses are comparable, from a fatigue standpoint, to a similar design that has had extensive satisfactory service experience:

(1) A fatigue strength investigation, in which the structure is shown by analysis, tests, or both, to be able to withstand the repeated loads of variable magnitude expected in service. Analysis alone is acceptable only when it is conservative and applied to simple structures; or

(2) A fail-safe strength investigation in which it is shown by analysis, tests, or both, that catastrophic failure of the structure is not probably after fatigue failure, or obvious partial failure, of a principal structural element, and that the remaining structure is able to withstand a static ultimate load factor of 0.75 of the critical limit load factor at V_C. These loads must be multiplied by a factor of 1.15 unless the dynamic effects of failure under static load are otherwise considered.

(b) Each evaluation required by this paragraph must

(1) Include typical loading spectra (taxi, ground-air-ground cycles, manoeuvre, gust);

(2) Account for any significant effects due to the mutual influence of aerodynamic surfaces;

(3) Consider any significant effects from propeller slipstream loading, and buffet from vortex impingements.

CS 30N.573 Damage tolerance and fatigue evaluation of structure

(a) Composite airframe structure. Composite airframe structure must be evaluated under this paragraph instead of paragraph CS 30N.572. The composite airframe structure must be evaluated using the damage-tolerance criteria prescribed in subparagraphs (a)(1) through (a)(4) of this paragraph unless shown to be impractical. If it is established that the damage-tolerance criteria are impractical for a particular structure, the structure must be evaluated in accordance with subparagraphs (a)(1) and (a)(6) of this paragraph. Where bonded joints are used the structure must also be evaluated in accordance with subparagraph (a)(5) of this paragraph. The effects of material variability and environmental conditions on the strength and durability properties of the composite materials must be accounted for in the evaluations required by this paragraph.

(1) It must be demonstrated by tests, or by analysis supported by tests, that the structure is capable of carrying ultimate load with damage up to threshold of detectability considering the inspection procedures employed.

(2) The growth rate or no-growth of damage that may occur from fatigue, corrosion, manufacturing flaws or impact damage, under repeated loads expected in service, must be established by tests or analysis supported by tests.

(3) The structure must be shown by residual strength tests, or analysis supported by residual strength tests, to be able to withstand critical limit flight loads, considered as ultimate loads, with the extent of detectable damage consistent with the results of the damage tolerance evaluations.

(4) The damage growth, between initial detectability and the value selected for residual strength demonstrations, factored to obtain inspection intervals, must allow development of an inspection program suitable for application by operation and maintenance personnel.

(5) The limit load capacity of each bonded joint must be substantiated by one of the following methods.

(i) The maximum disbonds of each bonded joint consistent with the capability to withstand the loads in subparagraph (a)(3) of this paragraph must be determined by analysis, tests, or both. Disbonds of each bonded joint greater than this must be prevented by design features; or

(ii) Proof testing must be conducted on each production article that will apply the critical limit design load to each critical bonded joint; or

(iii) Repeatable and reliable non-destructive inspection techniques must be established that ensure the strength of each joint.

(6) Structural components for which the damage tolerance method is shown to be impractical must be shown by component fatigue tests, or analysis supported by tests, to be able to withstand the repeated loads of variable magnitude expected in service. Sufficient component, subcomponent, element, of coupon tests must be done to establish the fatigue scatter factor and the environmental effects, Damage up to the threshold of detectability and ultimate load residual strength capability must be considered in the demonstration.

(b) Inspection. Based on evaluations required by this paragraph, inspections or other procedures must be established as necessary to prevent catastrophic failure and must be included in the Airworthiness Limitations section of the Instructions for Continued Airworthiness required by paragraph CS 30N.1529.

SUBPART D - DESIGN AND CONSTRUCTION

CS 30N.601 General

The suitability of each questionable design detail and part having an important bearing on safety must be established by tests.

CS 30N.603 Materials and workmanship

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

(1) Be established by experience or test;

(2) Meet approved specifications that ensure their having the strength and other properties assumed in the design data;

(3) Take into account the effects of environmental conditions expected in service.

(b) Workmanship must be of a high standard.

CS 30N.605 Fabrication methods

(a) 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.

(b) Each new aircraft fabrication method must be substantiated by a test program.

CS 30N.607 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.

CS 30N.609 Protection of structure

Each part of the airship must

(a) Be suitably protected against deterioration or loss of strength in service due to weathering, corrosion, abrasion, or other causes;

(b) Have adequate provisions for ventilation and drainage.

CS 30N.611 Accessibility

Means must be provided to allow inspection, close examination, repair, and replacement of each part requiring maintenance, adjustments, lubrication or servicing.

CS 30N.613 Material strength properties and design values

see AMC 30N.613

(a) Material strength properties must be based on enough tests of material meeting specifications to establish design values on a statistical basis.

(b) Design values must be chosen to minimise the probability of structural failure due to material variability. Except as provided in subparagraph (e) of this paragraph, compliance with this paragraph must be shown by selecting design values that ensure material strength with the following probability.

(1) Where applied loads are eventually distributed through a single member within an assembly, the failure of which would result in loss of structural integrity of the component; 0.99 probability with 0.95 confidence.

(2) For redundant structure, in which the failure of individual elements would result in applied loads being safely distributed to other load carrying members; 0.90 probability with 0.95 confidence.

(c) The effects of temperature on allowable stresses used for design in an essential component or structure must be considered where thermal effects are significant under normal operating conditions.

(d) The design of the structure must minimise the probability of catastrophic fatigue failure, particularly at points of stress concentration.

(e) Design values greater than the guaranteed minima required by this paragraph may be used where only guaranteed minimum values are normally allowed if a 'premium selection' of the material is made in which a specimen of each individual item is tested before use to determine that the actual strength properties of that particular item will equal or exceed those used in design.

CS 30N.619 Special factors

The factor of safety prescribed in paragraph CS 30N.303 must be multiplied by the highest pertinent special factors of safety determined in paragraphs CS 30N.621 through CS 30N.625 for each part of the structure whose strength is

(a) Uncertain; or

(b) Likely to deteriorate in service before normal replacement; or

(c) Subject to appreciable variability because of uncertainties in manufacturing processes or inspection methods.

CS 30N.621 Casting factors

(a) General. The factors, tests, and inspections specified in subparagraphs (b) through (d) of this paragraph must be applied in addition to those necessary to establish foundry quality control. The inspections must meet approved specifications, subparagraphs (c) and (d) of this paragraph apply to any structural castings except castings that are pressure tested as parts of hydraulic or other fluid systems and do not support structural loads.

(b) Bearing stresses and surfaces. The casting factors specified in subparagraphs (c) and (d) of this paragraph

(1) Need not exceed 1.25 with respect to bearing stresses, regardless of the method of inspection used;

(2) Need not be used with respect to the bearing surfaces of a part whose bearing factor is larger than the applicable casting factor.

(c) Critical castings. For each casting whose failure would preclude continued safe flight and landing of the airship or result in serious injury to occupants, the following apply.

(1) Each critical casting must

(i) Have a casting factor of not less than 1.25;

(ii) Receive 100% inspection by visual, radiographic, and magnetic particle or penetrant inspection methods or approved equivalent non-destructive inspection methods.

(2) For each critical casting with a casting factor less than 1.50, three sample castings must be static tested and shown to meet the strength requirements of paragraph CS 30N.305 at an ultimate load corresponding to a casting factor of 1.25, and the deformation requirements of paragraph CS 30N.305 at a load of 1.15 times the limit load.

(3) Examples of these castings are structural attachment fittings, parts of flight control systems, control surface hinges and balance weight attachments, seat, berth, safety belt, and fuel and oil tank supports and attachments, and cabin pressure valves.

(d) Noncritical castings. For each casting other than those specified in subparagraph (c) of this paragraph, the following apply.

(1) Except as provided in subparagraphs (2) and (3) of this paragraph, the casting factors and corresponding inspections must meet the Table 8 of the appendix.

(2) The percentage of castings inspected by nonvisual methods may be reduced below that specified in subparagraph (1) of this paragraph when an approved quality control procedure is established.

(3) For castings procured to a specification that guarantees the mechanical properties of the material in the casting and provides for demonstration of these properties by test of coupons cut from the castings on a sampling basis

(i) A casting factor of 1.0 may be used;

(ii) The casting must be inspected as provided in subparagraph (1) of this paragraph for casting factors of 1.25 through 1.50, and tested under subparagraph (c)(2) of this paragraph.

CS 30N.623 Bearing factors

(a) Each part that has clearance (free fit), and that is subject to pounding or vibration, must have a bearing factor large enough to provide for the effects of normal relative motion.

(b) For control system joints, compliance with the factors prescribed in paragraph CS 30N.625, meets subparagraph (a) of this paragraph

CS 30N.625 Fitting factors

For each fitting (a part or terminal used to join one structural member to another), the following apply.

(a) For each fitting whose strength is not proven by limit and ultimate load tests in which actual stress conditions are simulated in the fitting and surrounding structures, a fitting factor of at least 1.15 must be applied to each part of

(1) The fitting;

(2) The attachment means;

(3) The bearing on the joined members.

(b) A fitting factor is not required for joint designs based on comprehensive test data (such as continuous joints in metal plating, welded joints, and scarf joints in wood).

(c) For each integral fitting, the part must be treated as a fitting up to the point at which the section properties become typical of the member.

(d) For each seat, berth, and safety belt, its attachment to the structure must be shown, by analysis, tests, or both, to be able to withstand the inertia forces prescribed in paragraph CS 30N.561 multiplied by a fitting factor of 1.33.

CS 30N.627 Fatigue strength

The structure must be designed, as far as practicable, to avoid points of stress concentration where variable stresses above the fatigue limit are likely to occur in normal service.

CONTROL SURFACES

CS 30N.651 Proof of strength

(a) Limit load tests of control surfaces are required. These tests must include the horn or fitting to which the control system is attached.

(b) In structural analyses, rigging loads due to wire bracing must be accounted for in a rational or conservative manner.

CS 30N.655 Installation

(a) Movable tail surfaces must be installed so that there is no interference between any surfaces or their bracing when one surface is held in its extreme position and the others are operated through their full angular movement.

(b) If an adjustable stabiliser is used, it must have stops that will limit its range of travel to that allowing safe flight and landing.

CS 30N.657 Hinges

(a) Control surface hinges, except ball and roller bearing hinges, must have a factor of safety of not less than 6.67 with respect to the ultimate bearing strength of the softest material used as a bearing.

(b) For ball or roller bearing hinges, the approved rating of the bearing may not be exceeded.

(c) Hinges must have enough strength and rigidity for loads parallel to the hinge line.

CS 30N.659 Mass balance

The supporting structure and the attachment of concentrated mass balance weights used on control surfaces must be designed for

(a) 24 g normal to the plane of the control surface;

(b) 12 g fore and aft;

(c) 12 g parallel to the hinge line.

CONTROL SYSTEMS

CS 30N.671 General

(a) Each control and control system must operate with ease smoothness, and positiveness appropriate to its functions.

(b) Controls must be arranged and identified to provide for convenience in operation and to minimise the possibility of confusion and subsequent inadvertent operation. Controls other than primary flight controls, shall give clear and unambiguous indication, visually and where necessary, by fee, of their settings.

(c) The airship must be shown by analysis, test, or both, to be capable of continued safe flight and landing after any of the following failures or jamming in the flight control system and surfaces (including trim, lift, drag and artificial feel systems) within the normal flight envelope, without requiring exceptional piloting skill or strength. Probable malfunctions must have only minor effects on control system operation and must be capable of being readily counteracted by the pilot:

(1) Any single failure not shown to be extremely improbable, excluding jamming, (for example, disconnection or failure of mechanical elements, or structural failure of hydraulic components, such as actuators, control spool housing, and valves).

(2) Any combination of failures not shown to be extremely improbable, excluding jamming (for example dual electrical or hydraulic system failures, or any single failure in combination with any probable hydraulic or electrical failure).

(3) Any jam in a control position normally encountered during cargo loading/unloading, passenger boarding/unboarding, take-off, climb, cruise, normal turns, descent and landing unless the jam is shown to be extremely improbable or can be alleviated. A runaway of a flight control to an adverse position and jam must be accounted for if such runaway and subsequent jamming is not extremely improbable.

(d) As required by CS 30N.143 the airship must be capable of maintaining a statically stable condition and have sufficient control of attitude and altitude to allow a forced landing under the conditions of CS 30N.561 if all propulsive engines fail. Compliance with this requirement may be shown by analysis where that method has been shown to be reliable.

CS 30N.672 Stability augmentation and automatic power-operated systems

If the functioning of stability augmentation or other automatic or power-operated system is necessary to show compliance with flight characteristics requirements, the system must comply with CS 30N.671 and the following:

(a) A warning which is clearly distinguishable to the pilot under expected flight conditions must be provided for any failure in the stability augmentation system or in any other automatic or power-operated system which could result in an unsafe condition if the pilot is unaware of the failure. Warning systems must not activate the control systems.

(b) The design of the stability augmentation system or of any other automatic or power-operated system must allow initial counteraction of failures without requiring exceptional pilot skill or strength, by overriding the failure by moving the flight controls in the normal sense, and by deactivating the failed system.

(c) It must be shown that after any single failure of the stability augmentation system or any other automatic or power-operated system:

(1) The airship is safely controllable when the failure or malfunction occurs at any speed or altitude within the approved operating limitations; and:

(2) The controllability and manoeuvrability requirements are met within a practical operational flight envelope (for example, speed, altitude and normal acceleration configurations) which is described in the flight manual.

CS 30N.673 Primary flight controls

(a) Primary flight controls are those used by the pilot for the immediate control of pitch and yaw.

(b) Regardless of the type of control system, the design must minimise the probability of complete loss of control in the event of failure of any connecting or transmitting element in the control system. A means must be provided the pilot to rapidly disable or disconnect the control system in the event of any malfunction and transition to the backup system where backup systems are provided.

(c) For any mechanical control system (primary or backup) installed, where envelope expansion or contraction could adversely affect control cable tension or mechanical freedom, a means must be provided to automatically adjust and maintain control cable tension or mechanical freedom.

(d) In the event that there is not direct mechanical linkage provided between the pilot's primary controls and the control surfaces, a dual redundant means of controlling those surfaces must be provided and a method for the pilot to easily and rapidly transition from the primary means of controlling those surfaces to the backup means such that no unsafe flight characteristics are encountered and the probability of complete loss of control is unlikely.

CS 30N.675 Stops

(a) Each control system must have stops that positively limit the range of motion of each movable aerodynamic surface controlled by the system.

(b) Each stop must be located so that wear, slackness, or take-up adjustments will not adversely affect the control characteristics of the airship because of a change in the range of surface travel.

(c) Each stop must be able to withstand any loads corresponding to the design conditions for the control system.

CS 30N.677 Trim Systems

(a) Trim systems include ballonets, trim tabs on aerodynamic control surfaces, or any other system which directly affects the long-term, in-flight, attitude of the airship. Proper precautions must be taken to prevent inadvertent, improper, or abrupt trim operation.

(b) When ballonets are used for trimming, the pilot must be capable of determining when they are completely empty and completely full.

(c) When trim tabs are used, there must be means near the trim control to indicate to the pilot the direction of trim control movement relative to airship motion. In addition, there must be means to indicate to the pilot the position of the trim device with respect to the range of adjustment. This means must be visible to the pilot and must be located and designed to prevent confusion.

(d) Tab controls must be irreversible unless the tab is properly balanced and has no unsafe flutter characteristics. Irreversible tab systems must have adequate rigidity and reliability in the portion of the system from the tab to the attachment of the irreversible unit to the airship structure.

CS 30N.679 Control system locks

If there is a device to lock the control system on the ground or water, there must be means to

(a) Give unmistakable warning to the pilot when the lock is engaged;

(b) Prevent the lock from engaging in flight.

CS 30N.681 Limit load static tests

(a) Compliance with the limit load requirements of this part must be shown by tests in which

(1) The direction of the test loads produces the most severe loading in the control system;

(2) Each fitting, pulley, and bracket used in attaching the system to the main structure is included.

(b) Compliance must be shown (by analysis or individual load tests) with the special factor requirements for control system joints subject to angular motion.

CS 30N.683 Operation tests

(a) It must be shown by operation tests that, when the controls are operated from the pilot compartment with the system loaded as prescribed in subparagraph (b) of this paragraph, the system is free from

(1) Jamming;

(2) Excessive friction;

(3) Excessive deflection.

(b) The prescribed test loads are

(1) For the entire system, loads corresponding to the limit airloads on the appropriate surface, or the limit pilot forces, whichever are less;

(2) For secondary controls, loads not less than those corresponding to the maximum pilot effort established under paragraph CS 30N.405.

(c) For non-mechanical flight control systems, it must be shown by operating tests that the airship is fully controllable following hard-over in any axis such that no unsafe condition exists between the time the hard-over occurs, pilot recognition of the hard-over, and the time to revert to the back-up system, unless it can be shown that such a failure is extremely improbable. Furthermore, it must be shown that, following recognition time after the hard-over input, the pilot can successfully, safely transit to a manual system without exceptional pilot skill, alertness, or strength. Furthermore, the airship must be fully controllable following any single failure in the system.

CS 30N.685 Control system details

(a) Each detail of each control system must be designed and installed to prevent jamming, chafing, and interference from cargo, passengers, loose objects, or the freezing of moisture.

(b) There must be means in the cockpit to prevent the entry of foreign objects into places where they would jam the system.

(c) There must be means to prevent the rubbing of cables or tubes against other parts.

(d) Each element of the flight control system must have design features, or must be distinctively and permanently marked, to minimise the possibility of incorrect assembly that could result in malfunctioning of the control system.

CS 30N.687 Spring devices

The reliability of any spring device used in the control system must be established by tests simulating service conditions unless failure of the spring will not cause flutter or unsafe flight characteristics.

CS 30N.689 Cable systems

(a) Each cable, cable fitting, turnbuckle, splice, and pulley used must meet approved specifications. In addition

(1) No cable smaller than 3.2 mm (0.125 in) diameter may be used in primary control systems;

(2) Each cable system must be designed so that there will be no hazardous change in cable tension throughout the range of travel under operating conditions and temperature variations;

(3) There must be means for visual inspection at each fairlead, pulley, terminal, and turnbuckle.

(b) Each kind and size of pulley must correspond to the cable with which it is used. Each pulley must have closely-fitted guards to prevent the cables from being misplaced or fouled, even when slack. Each pulley must lie in the plane passing through the cable so that the cable does not rub against the pulley flange.

(c) Fairleads must be installed so that they do not cause a change in cable direction of more than 3°.

(d) Clevis pins subject to load or motion and retained only by cotter pins may not be used in the control system.

(e) Turnbuckles must be attached to parts having angular motion in a manner that will positively prevent binding throughout the range of travel.

(f) Tab control cables are not part of the primary control system and may be less than 3.2 mm (0.125 in) diameter in airship that are safely controllable with the tabs in the most adverse positions.

CS 30N.693 Joints

Control system joints (in push-pull system) that are subject to angular motion, except those in ball and roller bearing systems, must have a special factor of safety of not less than 3.33 with respect to the ultimate bearing strength of the softest material used as a bearing. This factor may be reduced to 2.0 for joints in cable control systems. For ball or roller bearings, the approved ratings may not be exceeded.

LANDING GEAR

CS 30N.721 General

For commuter category airships that have a passenger seating configuration, excluding pilot seats, of 10 or more, the following general requirements for the landing gear apply.

(a) The main landing gear system must be designed so that if it fails due to overloads during take-off and landing (assuming the overloads to act in the upward and aft directions), the failure mode is not likely to cause the spillage of enough fuel from any part of the fuel system to constitute a fire hazard.

(b) Each airship must be designed so that, with the airship under control, it can be landed on a paved runway with any one or more landing gear legs not extended without sustaining a structural component failure that is likely to cause the spillage of enough fuel to constitute a fire hazard.

(c) Compliance with the provisions of this paragraph may be shown by analysis or tests, or both.

CS 30N.723 Shock absorption test

(a) It must be shown that the limit load factors selected for design in accordance with paragraph CS 30N.473 will not be exceeded. This must be shown by energy absorption tests except that analysis based on tests conducted on a landing gear system with identical energy absorption characteristics may be used for increases in previously approved take-off and landing weights.

(b) The landing gear may not fail, but may yield, in the test showing its reserved energy absorption capacity, simulating a descent velocity of 1.2 times the limit descent velocity.

CS 30N.729 Landing gear extension and retraction system

(a) General. For airships with retractable landing gear, the following apply.

(1) Each landing gear retracting mechanism and its supporting structure must be designed for maximum flight-load factors with the gear retracted and must be designed for the combination of friction, inertia, and air loads, occurring during retraction at any airspeed up to V_{LO}, selected for the airship;

(2) The landing gear and retracting mechanism, including the wheel well doors, must withstand flight loads, including loads resulting from all yawing conditions specified in the structure subpart with the landing gear extended at any speed up to V_{LO}.

(b) Landing gear lock. There must be positive means (other than the use of hydraulic pressure) to keep the landing gear extended.

(c) Emergency operation. For airships having retractable landing gear that cannot be extended manually, unless it can be demonstrated that a safe landing can be made with the gear retracted, there must be a means to extend the landing gear in the event of either

(1) Any reasonably probable failure in the normal landing gear operation system; or

(2) Any reasonably probable failure in a power source that would prevent the operation of the normal landing gear operation system.

(d) Operation test. The proper functioning of the retracting mechanism must be shown by operation tests.

(e) Position indicator. If a retractable landing gear is used, there must be a landing gear position indicator (as well as necessary switches to actuate the indicator) or other means to inform the pilot that the gear is secured in the extended (or retracted) position. If switches are used, they must be located and coupled to the landing gear mechanical system in a manner that prevents an erroneous indication of either 'down and locked' if the landing gear is not in the fully extended position, or of 'up and locked' if the landing gear is not in the fully retracted position. The switches may be located where they are operated by the actual landing gear locking latch or device.

(f) Landing gear warning. Either of the following aural or equally effective landing gear warning devices must be provided.

(1) A device that functions continuously when one or more throttles are closed if the landing gear is not fully extended and locked. A throttle stop may not be used in place of an aural device. If there is a manual shut-off for the warning device prescribed in this paragraph, the warning system must be designed so that, when the warning has been suspended after one or more throttles are closed, subsequent retardation of any throttle to or beyond the position for normal landing approach will activate the warning device.

(2) A device that functions continuously when the landing gear is not fully extended and locked and the altitude of the airship is less than 30 m (100 feet) above ground level. If the altitude sensor portion of the warning system fails, the warning system must be designed to activate until the landing gear is fully extended and locked.

CS 30N.731 Wheels

(a) Each landing gear wheel must be approved.

(b) The maximum static load rating of each wheel may not be less than the corresponding static ground reaction with the maximum take-off weight.

(c) The maximum limit load rating of each wheel must equal or exceed the maximum radial limit load determined under the loading conditions prescribed in paragraph CS 30N.471.

CS 30N.733 Tires

(a) Each tire must be approved.

(b) Tires must be such that, when fitted to the airship wheel(s) and inflated to the recommended pressures, they will be capable of withstanding the permitted operation of the airship.

(c) If specially constructed tires are used, the wheels must be plainly and conspicuously marked to that effect, the markings must include the make, size, number of plies, and identification marking of the proper tire.

(d) Each tire installed on a retractable landing gear system must, with the maximum size of the tire type expected in service, have a clearance to surrounding structure and systems that is adequate to prevent contact between the tire and any part of the structure or system.

PERSONNEL AND CARGO ACCOMMODATIONS

CS 30N.771 Pilot compartment

For each pilot compartment

(a) The compartment and its equipment must allow each pilot to perform his duties without unreasonable concentration or fatigue;

(b) Where the flight crew are separated from the passengers by a partition, an opening or openable window or door must be provided to facilitate communication between flight crew and the passengers;

(c) The aerodynamic controls listed in paragraph CS 30N.779(a), excluding cables and control rods, must be located with respect to the propellers so that no part of the pilot or the controls lies in the region between the plane of rotation of any inboard propeller and the surface generated by a line passing through the centre of the propeller hub making an angle of 5° forward or aft of the plane of rotation of the propeller.

CS 30N.773 Pilot compartment view

(a) Each pilot compartment must be free from glare and reflections that could interfere with the pilot's vision, and designed so that

(1) The pilot's view is sufficiently extensive, clear, and undistorted, for safe operation;

(2) Each pilot is protected from the elements so that moderate rain conditions do not unduly impair his view of the flight path in normal flight and while landing;

(3) Internal fogging of the windows covered under subparagraph (a)(1) of this paragraph can be easily cleared by each pilot unless means are provided to prevent fogging.

(b) If certification for night operation is requested, compliance with subparagraph (a) of this paragraph must be shown in night-flight tests.

CS 30N.775 Windshields and windows

(a) Non-splintering safety glass must be used in glass windshields and windows.

(b) The windshield and windows forward of the pilot's back when seated in the normal flight position must have a luminous transmittance value of not less than 70%.

CS 30N.777 Cockpit controls

(a) Each cockpit control must be located and (except where its function is obvious) identified to provide convenient operation and to prevent confusion and inadvertent operation, either by personnel entering or leaving the Airship or by the flight crew during normal movement in the crew accommodation.

(b) The controls must be located and arranged so that the pilot, when seated, has full and unrestricted movement of each control without interference from either his clothing or the cockpit structure.

(c) Identical powerplant controls for each engine must be located to prevent confusion as to the engines they control, and must be arranged from left to right in the following order.

(1) Throttles or power levers;

(2) Propeller pitch controls;

(3) Mixtures of fuel control/cut-off.

(d) The landing gear control must be located to the left of the throttle centreline or pedestal centreline.

(e) Each fuel feed selector control must be located and arranged so that the pilot can see and reach it without moving any seat or primary flight control when his seat is at any position in which it can be placed.

(f) Operating controls, other than those which are under constant supervision (e.g. primary flight controls) shall maintain any chosen setting without subsequent attention by the flight crew and shall not tend to creep under control loads or vibration.

CS 30N.779 Motion and effect of cockpit controls

(a) Cockpit controls must be designed so that they operate accordingly to the Table 9 of the appendix. Wherever practicable, the sense of motion involved in the operation of other controls must correspond to the sense of the effect of the operation upon the airship or upon the part operated.

(b) Essential services and their control systems shall be so designed that when a movement to one position has been selected, a different position can be selected without having to wait for completion of the initially selected movement. It shall not be necessary for the pilot to follow other than normal control sequence in selecting the new position. Following this selection, the service being operated shall arrive at the finally selected position without further crew action. The movement(s) which follow and the time taken shall not be such as to adversely affect the airworthiness of the Airship.

(c) All control systems and operating controls shall be designed and installed so as to prevent:

(i) jamming; chafing; interference by passengers, cargo or loose objects

(ii) slapping of chains, cables or tubes against the Airship

(iii) the jamming of controls by the accumulation of frost; or by the freezing of water in any part where it is likely to freeze.

(d) Means shall be provided in the flight crew accomodation to prevent the entry of foreign objects where they could jam the control system.

(e) Sprocket shall be guarded so as to prevent chains jamming or coming off when slack

(f) All control systems shall be provided with stops which positively limit the range of movement of the pilot's controls. These stops shall be capable of withstanding the loads corresponding to the design conditions for the control system and shall be so located in the control system that the range of travel of the control surface is not appreciably affected by wear, slackness or tensioning adjustments.

(g) Provision shall be made for inspecting visually all fairleads, pulleys, terminal fittings and turnbuckles.

CS 30N.783 Doors

(a) Each closed cabin with passenger accommodations must have at least one adequate and easily accessible external door.

(b) No passenger door may be located with respect to any propeller disc so as to endanger persons using that door.

(c) Each external passenger or crew door must comply with the following requirements.

(1) There must be a means to lock and safeguard the door against inadvertent opening during flight by persons, by cargo, or as a result of mechanical failure;

(2) The door must be openable from the inside and the outside when the internal locking mechanism is in the locked position;

(3) There must be a means of opening which is simple and obvious and is arranged and marked inside and outside so that the door can be readily located, unlocked, and opened, even in darkness;

(4) The door must meet the marking requirements of paragraph CS 30N.811 of these regulations;

(5) The door must be reasonably free from jamming as a result of fuselage deformation in an emergency landing;

(6) Auxiliary locking devices that are actuated externally to the airship may be used but such devices must be overridden by the normal internal opening means.

(d) In addition, each external passenger or crew door, for a commuter category airship, must comply with the following requirements.

(1) Each door must be openable from both the inside and outside, even though persons may be crowded against the door on the inside of the airship;

(2) If inward opening doors are used, there must be a means to prevent occupant from crowding against the door to the extent that would interfere with opening the door;

(3) Auxiliary locking devices may be used.

(e) Each external door on a commuter category airship, and each external door forward of any engine or propeller on a normal category airship must comply with the following requirements.

(1) There must be a means to lock and safeguard each external door, including cargo and service type doors, against inadvertent opening in flight, by persons, by cargo, or failure of a single structural element, either during or after closure;

(2) There must be a provision for direct visual inspection of the locking mechanism to determine, if the external door, for which the initial opening movement is not inward, is fully closed and locked;

(3) The provisions must be discernible, under operating lighting conditions, by a crewmember using a flashlight or an equivalent lighting source;

(4) There must be a visual warning means to signal a flight crewmember if the external door is not fully closed and locked. The means must be designed so that any failure, or combination of failures, that would result in an erroneous closed and locked indication is improbable for doors for which the initial opening movement is not inward.

CS 30N.785 Seats, berths, and safety belts

(a) Each seat, berth, and its supporting structure must be designed for occupants weighing at least 77 kg (170 lb) and for the maximum load factors corresponding to the specified flight and ground load conditions, including emergency landing conditions. For commuter category airships, each occupant must be protected from serious head injury when subjected to the inertia loads resulting from these load factors by a safety belt.

(b) Each seat, berth, and safety belt must be approved.

(c) Each pilot seat must be designed for the reactions resulting from the application of pilot forces to the primary flight controls.

(d) Each berth installed parallel to the longitudinal axis of the airship must be designed so that the forward part has a padded end-board, canvas diaphragm, or equivalent means that can withstand the static load reaction of the occupant when the occupant is subjected to the forward inertia forces prescribed in paragraph CS 30N.561. In addition each berth must have an approved safety belt and may not have corners or other parts likely to cause serious injury to a person occupying it during emergency conditions.

(e) Proof of compliance with the strength and deformation requirements of this paragraph for seats, berths, and safety belts, approved as part of the type design and for their installation, may be shown by

(1) Structural analysis, if the structure conforms to conventional aircraft types for which existing methods of analysis are known to be reliable; or

(2) A combination of structural analysis and static load tests to limit loads; or

(3) Static load tests to ultimate loads.

(f) Each occupant must be protected from serious injury when he experiences the inertia forces prescribed in paragraph CS 30N.561 by a safety belt for each seat.

(g) There must be a means to secure each safety belt, when not in use, so as to prevent interference with the operation of the airship and with rapid egress in an emergency.

(h) The cabin area surrounding each seat, including the structure, interior walls, instrument panel, control wheel, pedals, and seats, within striking distance of the occupants head or torso (with the safety belt fastened), must be free of potentially injurious objects, sharp edges, protuberances, and hard surfaces. If energy absorbing designs or devices are used to meet this requirement, they must protect the occupant from serious injury when the occupant experiences the ultimate inertia forces prescribed in paragraph CS 30N.561.

(i) Each seat track must be fitted with stops to prevent the seat from sliding off the track.

CS 30N.787 Baggage and cargo compartments

(a) Each cargo compartment

(1) must be designed for its placarded maximum weight of contents and for the critical load distributions at the appropriate maximum-load-factors corresponding to the flight and ground load conditions of these requirements;

(2) must contain provisions to prevent the contents of any cargo from becoming a hazard by shifting and to protect any controls, wiring, lines, equipment, or accessories whose damage or failure would affect safe operations;

(3) must be constructed of materials which are at least flame resistant;

(4) designed to provide for cargo to be carried in the same compartment or adjacent to the compartment with the occupants, must have means to protect the occupants from injury under the ultimate inertia forces specified in paragraph CS 30N.561;

(5) where lamps are installed, each lamp must be installed so as to prevent contact between lamp bulb and cargo;

(6) not accessible to the crew while in flight must have provisions to contain a fire to allow continued safe flight and landing.

(b) Baggage compartments must also meet the requirements of this paragraph, if applicable.

CS 30N.803 Emergency evacuation demonstration

(a) A technique shall be established and included in the Airship Flight Manual for rapid evacuation of the airship by all occupants in emergency

(1) when power is available from all engines or with one engine inoperative, and

(2) with all engines inoperative.

(b) The technique shall include the crew procedures for controlling passenger evacuation in a reasonable time.

(c) When following this technique, the operation of the airship's controls, including the emergency deflation means shall be such that, during the evacuation, the airship will not leave the ground to an extent that would prevent the occupants leaving the airship, and the envelope must not deflate at a rate that would permit the envelope to entrap an occupant.

(d) The technique shall include any special precautions to be taken in surface wind speeds between zero and the maximum in which operation is permitted.

(e) For commuter category airships, an evacuation demonstration must be conducted utilising the maximum number of occupants for which certification is desired. The demonstration must be conducted under simulated night conditions using only the emergency exits on the most critical side of the airship. The participants must be representative of average airline passengers with no prior practice or rehearsal for the demonstration. Evacuation must be completed in 90 seconds.

CS 30N.807 Emergency exits

(a) Number and location. Emergency exits must be located to allow escape without crowding in any probable crash attitude. The airship must have at least the following emergency exits.

(1) For all airships, at least one emergency exit on the opposite side of the cabin from the main door specified in paragraph CS 30N.783;

(2) If the pilot compartment is separated from the passenger compartment with a door that is likely to block the pilot's escape in a minor crash, there must be an exit in the pilot's compartment;

(3) The number of exits required by subparagraph (1) must then be separately determined for the passenger compartment, using the seating capacity of that compartment.

(b) Type and operation. Emergency exits must be movable windows, panels, or external doors, that provide a clear and unobstructed opening large enough to admit a 48.3 x 66 cm (19 x 26 in) ellipse. In addition, each emergency exit must

(1) Be readily accessible, requiring no exceptional agility when used in emergencies;

(2) Have a method of opening that is simple and obvious;

(3) Be arranged and marked for easy location and operation, even in darkness;

(4) Have reasonable provisions against jamming by car deformation.

(c) The proper function of each emergency exit must be shown by tests.

(d) Doors and exits. In addition, for commuter category airships the following requirements apply.

(1) The passenger entrance door must qualify as a floor level emergency exit. If an integral stair is installed at such a passenger entry door, the stair must be designed so that when subjected to the inertia forces specified in paragraph CS 30N.561, and following the collapse of one or more legs of the landing gear, it will not interfere to an extent that will reduce the effectiveness of emergency egress through the passenger entry door. Each additional required emergency exit, except floor level exits, must be provided with acceptable means to assist the occupants in descending to the ground. In addition to the passenger entrance door

(i) For a total passenger seating capacity of 15 or less, an emergency exit as defined in subparagraph (b) of this paragraph is required on each side of the cabin;

(ii) For a total passenger seating capacity of 16 through 19, three emergency exits, as defined in subparagraph (b) of this paragraph, are required with one on the same side as the door and two on the side opposite the door.

(2) A means must be provided to lock each emergency exit and to safeguard against its opening in flight, either inadvertently by persons or as a result of mechanical failure. In addition, a means for direct visual inspection of the locking mechanism must be provided to determine that each emergency exit for which the initial opening movement is outward is fully locked.

CS 30N.811 Emergency exit marking

(a) Each emergency exit and external door in the passenger compartment must be externally marked and readily identifiable from outside the airship by

(1) A conspicuous visual identification scheme;

(2) A permanent decal or placard on or adjacent to the emergency exit which shows the means of opening the emergency exit, including any special instructions, if applicable.

(b) In addition, for commuter category airships, these exists and doors must be internally marked with the words 'exit' by a sign which has white letters 25 mm (1 in) high on a red background 50 mm (2 in) high, be self-illuminated or independently, internally electrically illuminated, and have a minimum brightness of at least 548 µcd/m² (160 microlamberts). The colour may be reversed if the passenger compartment illumination is essentially the same.

CS 30N.813 Emergency exit access

For commuter category airships, access to window-type emergency exists may not be obstructed by seats or seat backs.

CS 30N.815 Width of aisle

For commuter category airships having more than nine passenger seats, the minimum main passenger aisle width at any point between seats must not be less than the following values:

(a) less than 63.5 cm (25 in) from floor: 23 cm (9 in);

(b) more than 63.5 cm (25 in) from floor: 38 cm (15 in).

CS 30N.831 Ventilation

All passenger and flight crew accommodations must be suitably ventilated.

(a) Carbon monoxide concentration may not exceed one part in 20,000 parts of air.

(b) Fuel vapour may not be present in hazardous concentrations.

FIRE PROTECTION AND LIGHTNING EVALUATION

CS 30N.851 Fire extinguishers

(a) There must be at least one hand fire extinguisher for use in the pilot compartment that is located within easy access of the pilot while seated.

(b) There must be at least one hand fire extinguisher located conveniently in the passenger compartment

(1) of each airship accommodating more than 6 passengers;

(2) of each commuter category airship.

(c) For hand fire extinguishers, the following apply.

(1) The type and quantity of each extinguishing agent used must be appropriate to the kinds of fire likely to occur where that agent is to be used;

(2) Each extinguisher for use in a personnel compartment must be designed to minimise the hazard of toxic gas concentrations.

CS 30N.853 Compartment interiors

For each compartment to be used by the crew or passengers, the following apply.

(a) The materials must be at least flame-resistant.

(b) (reserved)

(c) If smoking is prohibited, there must be a placarded stating this, and if smoking is not prohibited:

(1) There must be an adequate number of self-contained removable ashtrays;

(2) Where the crew compartment is separated from the passenger compartment, there must be at least one illuminated sign (using either letters or symbols) notifying all passengers when smoking is prohibited. Signs which notify when smoking is prohibited must

(i) When illuminated, be legible to each passenger seated in the passenger cabin under all probable lighting conditions;

(ii) Be constructed so that the crew can turn the illumination on and off.

(d) In addition, for commuter category airships the following requirements apply.

(1) Each disposal receptacle for towels, paper, or waste must be fully enclosed and constructed of at least fire resistant materials and must contain fires likely to occur in it under normal use. The ability of the disposal receptacle to contain those fires under all probable conditions of wear, misalignment, and ventilation expected in service must be demonstrated by test. A placard containing the legible words 'No Cigarette Disposal' must be located on or near each disposal receptacle door.

(2) Lavatories must have 'No Smoking' or 'No Smoking in Lavatory' placards located conspicuously on each side of the entry door and self-contained, removable ashtrays located conspicuously on or near the entry side of each lavatory door, except that one ashtray may serve more than one lavatory door if it can be seen from the cabin side of each lavatory door served. The placards must have red letters at least 13 mm (0.5 in) high on a white background at least 25 mm (1 in) high (a 'No Smoking' symbol may be included on the placard).

(3) Materials (including finishes or decorative surfaces applied to the materials) used in each compartment occupied by the crew or passengers must meet the following test criteria as applicable.

(i) Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of FAR Part 23 Appendix F or by other equivalent methods. The average burn length may not exceed 15 cm (6 in) and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 3 seconds after falling.

(ii) Floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and nondecorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation and insulation covering, air ducting, joint and edge covering, cargo compartment liners, insulation blankets, cargo covers and transparencies, moulded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing), that are constructed of materials not covered in subparagraph (d)(3)(iv) of this paragraph must be self extinguishing when tested vertically in accordance with the applicable portions of FAR Part 23 Appendix F or other approved equivalent methods. The average burn length may not exceed 20 cm (8 in) and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.

(iii) *(reserved)*

(iv) Acrylic windows and signs, parts constructed in whole or in part of elastomeric materials, edgelighted instrument assemblies consisting of two or more instruments in a common housing, seat belts, shoulder harnesses, and cargo and baggage tiedown equipment, including containers, bins, pallets, etc., used in passenger or crew compartments, may not have an average burn rate greater than 64 mm (2.5 in) per minute when tested horizontally in accordance with the applicable portions of FAR Part 23 Appendix F or by other approved equivalent methods.

(v) Except for electrical wire cable insulation, and for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that the Administrator finds would not contribute significantly to the propagation of a fire, materials in items not specified in subparagraphs (d)(3)(i), (ii), (iii), or (iv) of this paragraph may not have a burn rate greater than 10.2 cm (4 in) per minute when tested horizontally in accordance with the applicable portions of FAR Part 23 Appendix F or by other approved equivalent methods.

(e) Lines, tanks, or equipment containing fuel, oil, or other flammable fluids may not be installed in such compartments unless adequately shielded, isolated, or otherwise protected so that any breakage or failure of such an item would not create a hazard.

(f) Materials located on the cabin side of the firewall must be self-extinguishing or be located at such a distance from the firewall, or otherwise protected so that ignition will not occur if the firewall is subject to a flame temperature of not less than 1,100°C (2,000°F) for 15 minutes. For self-extinguishing materials (except electrical wire and cable insulation and small parts that the Agency finds would not contribute significantly to the propagation of a fire), a vertical self-extinguishing test must be conducted in accordance with FAR Part 23 Appendix F or an equivalent method approved by the Agency. The average burn length of the material my not exceed 15 cm (6 in) and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the material test specimen may not continue to flame for more than an average of 3 seconds after falling.

CS 30N.863 Flammable fluid fire protection

(a) In each area where flammable fluids or vapours might escape by leakage of a fluid system, there must be means to minimise the probability of ignition of the fluids and vapours, and the resultant hazard if ignition does occur.

(b) Compliance with subparagraph (a) of this paragraph must be shown by analysis or tests, and the following factors must be considered:

(1) Possible sources and paths of fluid leakage, and means of detecting leakage;

(2) Flammability characteristics of fluids, including effects of any combustible or absorbing materials;

(3) Possible ignition sources, including electrical faults, overheating of equipment, and malfunctioning of protective devices;

(4) Means available for controlling or extinguishing a fire, such as stopping flow of fluids, shutting down equipment, fireproof containment, or use of extinguishing agents;

(5) Ability of airship components that are critical to safety of flight to withstand fire and heat.

(c) If action by the flight crew is required to prevent or counteract a fluid fire (equipment shutdown or actuation of a fire extinguisher), quick acting means must be provided to alert the crew.

(d) Each area where flammable fluids or vapours might escape by leakage of a fluid system must be identified and defined.

CS 30N.865 Fire protection of flight controls and other flight structure

Flight controls, engine mounts, and other flight structure located in the engine compartment must be constructed of fireproof material or shielded so that they will withstand the effect of the fire.

CS 30N.867 Electrical bonding and lightning discharge protection

(a) The airship must be protected against catastrophic effects from lightning. All items, which by the accumulation and discharge of static charges may cause a danger of electric shock, ignition of flammable vapours, or interference with essential equipment, must be adequately bonded to the main ground system.

(b) Provisions must be made to minimise damage to the airship structure and to avoid injury to occupants in the case of lightning strikes either while on the ground or in flight.

ENVELOPE

CS 30N.881 Envelope design

(a) The envelope must be designed to be pressurised and maintain sufficient superpressure (amount of envelope pressure in excess of ambient pressure) to remain in tension while supporting the limit design loads for all flight conditions and ground conditions, except for mooring and handling conditions, where wrinkling at the ends of the battens is permitted. The effects of all local aerodynamic pressures (including thrust slipstream impingement) and pitch angles must be included in the determination of stresses to arrive at the limit-strength requirements for the envelope fabric.

(b) The envelope fabric must have an ultimate strength not less than four times the limit load determined by the maximum design internal pressure combined with the maximum load resulting from any of the requirements specified herein.

(c) Suspension system components made of fabric or non-metallic material must have an ultimate strength of not less than four times the prescribed limit loads.

(d) It must be demonstrated by test in accordance with the section Tearing Strength of the appendix that the envelope fabric (in both the warp and woof (fill) directions) can withstand limit design loads without further tearing.

(e) Ballonets must be designed and installed such that their centre of displacement must coincide longitudinally with the centre of buoyancy of the envelope. The ballonet system must be designed so that the static trim capabilities of the system about the centre of buoyancy of the airship are equally divided between the for and aft ballonets. The effective trim capabilities of the ballonets must be maintained approximately equal between the limits of 0% to 100% ballonet fullness. Sufficient means must be provided to prevent trapping of air when partially deflated.

(f) Provisions must be maintained to permit rapid envelope deflation should the airship break away from the mast during mooring. If the airship is to be left unattended, automatic deflation must be provided. The system must be protected against inadvertent use, and must be properly identified and available to crew members.

(g) A means must be provided to permit emergency deflation of the envelope on the ground during emergency evacuation of the occupants. Normal valving of helium may be considered in meeting this requirement.

(h) Internal and/or external suspension systems for supporting components such as the car must be designed to transmit and distribute the resulting loads to the envelope in a uniform manner for all flight conditions. The fabric parts of such systems and their connection with the envelope must be designed and constructed in such a manner that the bond are not subjected to peeling loads. Provisions must be incorporated to prevent chafing between suspension system components and air system components. Suspension system cables must be adjustable as may be necessary to ensure proper load distribution.

(i) The nose of the envelope must be designed to prevent wrinkling due to high speed flight or from limit-mooring loads.

CS 30N.883 Pressure system

A means shall be provided to control the internal pressure of the envelope and to provide air to the ballonets and must contain at least the following components.

(a) Helium Valve(s). At least one valve must be provided. The valve(s) may be located either on or near the envelope but not higher than 10° above the equator. They must be designed for both manual and automatic operation, be operable at specified pressure settings at all attainable air speeds, and be designed to open and close positively. The valve(s) must not discharge helium into the car interior, the engine intake system, or the ballonets. The valve(s) must be of sufficient capacity to permit ascent above pressure height at the maximum design rate-of-climb without exceeding helium pressure of 1.25 times maximum operating pressure.

(b) Air Valve(s). At least one air valve must be provided to discharge air from each ballonet. The valves may be located in the envelope or connected to it by a suitable duct. The valve(s) must be capable of manual and automatic operation and be capable of operating at appropriate pressure settings at all attainable air speeds and must be designed to open and close positively. The valve(s) must be of sufficient capacity to permit ascent below pressure height at the maximum design rate-of-climb without exceeding helium pressure of 1.15 times maximum operating pressure.

(c) Ballonet Air Induction System. Scoops, ducts, blowers, or combinations of these must be of sufficient capacity to permit descent at the maximum design rate, without a reduction in envelope pressure below the specified design value. On multiengine airships, where ballonet pressurisation is dependent upon the engines, means must be provided to pressure all ballonets during a single-engine failure.

(d) Air supply source. A reliable means of supplying air to the ballonet, must be provided, and must have adequate capacity to enable the pressure in the envelope to be maintained during flight at low engine powers and forward speeds, and, if appropriate, when thrust vectoring reduces the effectiveness of the engines in supplying air. The means shall also be able to maintain envelope shape to permit operation of systems dependent upon that shape following the failure of all engines for a sufficient time to permit a landing to be made.

(e) Provisions must be made to blow air into the helium space to supplement the ballonet in case of excessive helium loss. The control(s) for this system must be readily accessible and quickly operable by the crew. A helium pressure sufficient to prevent wrinkling of the envelope at a forward speed of 0.25 V_H must be maintained with a descent rate of 1.5 m/s (5 ft/s).

CS 30N.885 Ground handling

Provisions for ground handling must be provided. Handling lines must be manufactured of non-conducting materials. All fabric patches and fittings of ground handling lines must be designed with a breaking strength which exceeds the specified breaking strength of the attached cable or line assembly strength by a minimum of 15%.

CS 30N.887 Flutter

The envelope and all fixed and movable control surfaces must be shown to be free from flutter, by analysis or flight test, at all speeds up to the maximum airspeed attained from the airship speed plus head-on gusts in accordance with paragraph CS 30N.341, the mooring wind speeds, or V_D, whichever is greater.

MISCELLANEOUS

CS 30N.891 Lifting gas

The lifting gas must be non-flammable.

CS 30N.893 Ballast system

If a ballast system is installed the following apply.

(a) General. The ballast system, including all controls and related components, must be designed and installed so as to ensure positive, controlled disposal of the ballast by the pilot under all normal operating conditions.

(b) Capacity. The airship must contain sufficient ballast capacity, when used with other provisions, to restore itself to a condition of equilibrium at any time during normal flight operations. Adequate provisions for safe storage of the ballast under all design loading conditions must be provided.

(c) Ballast material. Ballast may be in the form of water or other disposable material such as sand or shot. It must be easily dissipated without causing injury to persons or property on the ground. If water is used, means must be provided to prevent freezing.

(d) Discharge rate. Means must be provided to discharge liquid ballast at a rate not less than 378 litres (100 gal) per minute. Ballast tank vents must be installed to accommodate this discharge rate. Leakage from the tank or vents is not permitted in normal flight attitudes. The liquid discharge value must be designed to allow the crew to close the valve during any part of the discharge operation.

(e) Location of ballast ports. The ballast discharge ports or vents must not be located in the immediate vicinity or the engines, air scoops, or so as to cause impingement on the airship.

(f) Controls and instruments. Controls and instruments necessary for controlled release of the ballast by the pilot must be provided. Such controls and instruments shall be located and arranged so that they may be operated by the pilot in the correct manner without undue concentration or fatigue. If electrically actuated dump valves are used, a mechanical backup system must be provided.

CS 30N.895 Levelling means

There must be means for determining when the airship is in a level position on the ground.

SUBPART E - POWERPLANT

GENERAL

CS 30N.901 Installation

(a) For the purpose of these regulations, airship powerplant installations include each component that

(1) Is necessary for propulsion;

(2) Affects the safety and control of the major propulsion unit(s).

(b) Each powerplant must be constructed, arranged, and installed to

(1) Ensure safe operation to the maximum altitude for which approval is requested;

(2) Be accessible for necessary inspections and maintenance.

(c) Engine cowls and nacelles must be easily removable or operable by the pilot to provide adequate access to and exposure of the engine compartment for pre-flight checks.

(d) Each turbine engine installation must be constructed and arranged to

(1) Result in vibration characteristics that do not exceed those established during the type certification of the engine;

(2) Provide continued safe operation without a hazardous loss of power or thrust while being operated in rain for at least 3 minutes with the rate of water ingestion being not less than 4% by weight, of the engine induction airflow rate at the maximum installed power or thrust approved for take-off and at flight idle. The engine must accelerate and decelerate safely following stabilised operation under these rain conditions.

(e) The installation must comply with

(1) The installation instructions provided under FAR § 33.5;

(2) The applicable provisions of these regulations.

(f) Each auxiliary power unit installation must meet the applicable airworthiness requirements.

(g) Services essential for the continued safe operation of the airship shall be such that the functioning and performance of the services will be adequate in the conditions following irretrievable loss of power from any one engine.

CS 30N.903 Engines

(a) Engine type certificate.

(1) Each engine must be approved and either

(i) Have a type certificate; or

(ii) Be certificated as a part of the airship. FAR Part 33 may be used as a guide for the certification basis.

(2) Each turbine engine must either

(i) Comply with FAR § 33.77 in effect on October 31, 1974, or as later amended; or

(ii) Be shown to have a foreign object ingestion service history in similar installation locations that has not resulted in any unsafe condition.

(b) Turbine engine installations. For turbine engine installations

(1) Design precautions must be taken to minimise the hazards to the airship in the event of an engine-rotor failure of a fire originating inside the engine which burns through the engine case;

(2) The powerplant systems associated with engine control devices, systems, and instrumentation must be designed to give reasonable assurance that those operating limitations that adversely affect turbine rotor structural integrity will not be exceeded in service.

(c) The powerplants must be arranged and isolated from each other to allow operation, in at least one configuration, so that the failure or malfunction of any engine, or the failure or malfunction (including destruction by fire in the engine compartment) of any system that can affect an engine (other than a fuel tank if only one fuel tank is installed), will not

(1) Prevent the continued safe operation of the remaining engines; or

(2) Require immediate action by the crew member for continued safe operation of the remaining engines.

(d) Starting and stopping (piston engine). The design of the installation must be such that risk of fire or mechanical damage to the engine or airship, as a result of starting is reduced to a minimum. Any techniques and associated limitations for engine starting must be established and included in the Airship Flight Manual, approved manual material, or applicable operating placards. Means must be provided for stopping and restarting each engine in flight. In addition, for commuter category airships, the following apply.

(i) Each component of the stopping system on the engine side of the firewall that might be exposed to fire must be at least fire resistant;

(ii) If hydraulic propeller feathering systems are used for this purpose, the feathering lines must be at least fire resistant under the operating conditions that may be expected to exist during feathering.

(e) Starting and stopping (turbine engine). Turbine engine installations must comply with the following.

(1) The design of the installation must be such that risk of fire or mechanical damage to the engine or the airship as a result of starting the engine is reduced to a minimum. Any techniques and associated limitations must be established and included in the Airship Flight Manual, approved manual material, or applicable operating placards.

(2) Means must be provided for stopping combustion and rotation of any engine. All those components provided for compliance with this requirement, which are within any engine compartment, on the engine side of the firewall, must be at least fire resistant. In addition, for commuter category airships, each component of the restarting system on the engine side of the firewall and those components that might be exposed to fire must be at least fire resistant. If hydraulic propeller feathering systems are used for this purpose, the feathering lines must be at least fire resistant under the operating conditions that may be expected to exist during feathering.

(3) It must be possible to restart an engine in flight. Any techniques and associated limitations must be established and included in the Airship Flight Manual, approved manual material, or applicable operating placards.

(4) It must be demonstrated in flight that when restarting engines following a false start, all fuel or vapour is discharged in such a way that it does not constitute a fire hazard.

(f) Restart capability. An altitude and airspeed envelope must be established for the airship for in-flight engine restarting, and each installed engine must have a restart capability within that envelope.

(g) For turbine engine powered airships, if the minimum windmilling speed of the engines, following the inflight shutdown of all engines, is insufficient to provide the necessary electrical power for engine ignition, a power source independent of the engine-driven electrical power generating system must be provided to permit inflight engine ignition for restarting.

CS 30N.905 Propellers

(a) Each propeller must be approved and either

(1) Have a type certificate; or

(2) Be certificated as a part of the airship. FAR Part 35 will normally be used as a guide for the certification basis.

(b) Engine power and propeller shaft rotational speed may not exceed the limits for which the propeller is certificated.

(c) Each featherable propeller must have a means to unfeather it in flight.

(d) Each component of the propeller blade pitch control system must meet the requirements of FAR § 35.42

CS 30N.907 Propeller vibration

(a) Each propeller and/or shroud with metal blades or highly stressed metal components must be shown to have vibration stresses, in normal operating conditions, that do not exceed values shown by the propeller manufacturer to be safe for continuous operation. This must be shown by

(1) Measurement of stresses through direct testing of the propeller and shroud through all anticipated mission configurations; or

(2) Comparison with similar installations for which these measurement have been made; or

(3) Any other acceptable test method or service experience that proves the safety of the installation.

(b) Proof of safe vibration characteristics for any type of propeller, must be shown where necessary.

(c) (*Reserved for composite propellers*)

CS 30N.909 Turbosuperchargers

(a) Each turbosupercharger must be approved under the engine type certificate, or it must be shown that the turbosupercharger system

(1) Can withstand, without defect, an endurance test of 150 hours that meets the applicable requirements of FAR § 33.49;

(2) Will have no adverse effect upon the engine.

(b) Control system malfunctions, vibrations, and abnormal speeds and temperatures expected in service may not damage the turbosupercharger compressor or turbine.

(c) Each turbosupercharger case must be able to contain fragments of a compressor or turbine that fails at the highest speed that is obtainable with normal speed control devices inoperative.

(d) Each intercooler installation, where provided, must comply with the following.

(1) The mounting provisions of the intercooler must be designed to withstand the loads imposed on the system;

(2) It must be shown that, under the installed vibration environment, the intercooler will not fail in a manner allowing portions of the intercooler to be ingested by the engine;

(3) Airflow through the intercooler must not discharge directly on any airship component (windshield) unless such discharge is shown to cause no hazard to the airship under all operating conditions.

(e) Engine power, cooling characteristics, operating limits, and procedures affected by the turbocharger system installations must be evaluated. Turbocharger operating procedures and limitations must be included in the Airship Flight Manual in accordance with paragraph CS 30N.1581.

CS 30N.925 Propeller clearance

(a) Ground clearance.

(1) Propellers. Unless smaller clearances are substantiated, propeller clearances with the airship at maximum weight and with the most adverse centre of gravity may not be less than 23 cm (9 in) with the ground with the airship in the level, normal take-off, normal landing or taxing attitude, whichever is most critical. In addition, the propellers must have positive ground clearance in the take-off attitude with the critical tire completely deflated and the corresponding shock strut bottomed.

(2) Shrouds. The shrouds must have positive ground clearance in the take-off attitude with the critical tire completely deflated and the corresponding shock strut bottomed.

(3) Propeller to shroud clearance. Propellers must have positive clearance from shrouds under all flight and ground conditions specified in these regulations.

(b) Structural clearance. There must be

(1) At least 13 mm (0.5 in) longitudinal clearance between the propeller blades or cuffs and stationary part of the airship;

(2) Positive clearance between other rotating part of the propeller or spinner and stationary part of the airship;

(3) Sufficient clearance between the propeller and the envelope so as to minimise damage from debris or ice thrown by the propellers. There must be a clearance of at least 0.6 m (2 feet) unless propeller shrouds or equivalent protective means are provided.

(c) Hazards from propeller and shroud interference for minor crash landings must be considered in the design.

CS 30N.929 Engine installation ice protection

Propeller (except wooden propellers) and other complete engine installations must be protected against the accumulation of ice as necessary to enable satisfactory functioning without appreciable loss of power when operated in the icing conditions for which certification is requested. For airships, where the envelope is not protected from ice being thrown from the propellers, anti-icing devices rather than de-icing devices must be used.

CS 30N.933 Reversing systems

Reversing systems must be designed so that no single failure or malfunction of the system will result in unwanted reverse thrust under any expected operating condition. Failure of structural elements need not be considered if the probability of this kind of failure is extremely remote.

CS 30N.937 Turbopropeller -- drag limiting systems

Turbopropeller-powered airship propeller-drag limiting systems must be designed so that no single failure or malfunction of any of the systems during normal or emergency operation results in propeller drag in excess of that for which the engine mount and support structure were designed under the structural requirements of these regulations. Failure of structural elements of the drag limiting systems need not be considered if the probability of this kind of failure is extremely remote.

CS 30N.939 Powerplant operating characteristics

(a) Turbine engine powerplant operating characteristics must be investigated in flight to determine that no adverse characteristics (such as stall, surge, or flameout) are present, to a hazardous degree, during normal and emergency operation within the range of operating limitations of the airship and of the engine.

(b) Turbocharged reciprocating engine operating characteristics must be investigated in flight to assure that no adverse characteristics, as a result of an inadvertent overboost, surge, flooding, or vapour lock, are present during normal or emergency operation of the engine(s) throughout the range of operating limitations of both airship and engine.

(c) For turbine engines, the air inlet system must not, as a result of airflow distortion during normal operation, cause vibration harmful to the engine.

CS 30N.943 Negative acceleration

No hazardous malfunction of an engine, an auxiliary power unit approved for use in flight, or any component or system associated with the powerplant or auxiliary power unit may occur when the airship is operated at the negative accelerations within the flight envelopes prescribed in paragraph CS 30N.333. This must be shown for the greatest duration expected for the acceleration.

FUEL SYSTEM

CS 30N.951 General

(a) Each fuel system must be constructed and arranged to ensure a flow of fuel at a rate and pressure established for proper engine functioning under each likely operating condition, including any manoeuvre for which certification is requested.

(b) Each fuel system must be arranged so that

(1) No fuel pump can draw fuel from more than one tank at a time; or

(2) There are means to prevent introducing air into the system.

(c) Each fuel system for a turbine engine must be capable of sustained operation throughout its flow and pressure range with fuel initially saturated with water at 27°C (80°F) and having 0.2 cm³ of free water per litre added and cooled to the most critical condition for icing likely to be encountered in operation.

(d) Each fuel system for a turbine engine powered airship must meet the applicable fuel venting requirements of FAR Part 34.

CS 30N.953 Fuel system independence

(a) Each fuel system for a multiengine airship must be arranged so that, in at least one system configuration, the failure of any one component (other than a fuel tank) will not result in the loss of power of more than one engine or require immediate action by the pilot to prevent the loss of power of more than one engine.

(b) If a series of fuel tanks interconnected to function as a single fuel tank is used on a multiengine airship, the following must be provided.

(1) Independent tank outlets for each engine, each incorporating a shut-off valve at the tank. This shut-off valve may also serve as the fire walls shut-off valve required if the line between the valve and the engine compartment does not contain more than 1 litre (1 qt) of fuel (or any greater amount shown to be safe) that can drain into the engine compartment.

(2) At least two vents arranged to minimise the probability of both vents becoming obstructed simultaneously.

(3) Filler caps designed to minimise the probability of incorrect installation or in flight loss.

(4) A fuel system in which those parts of the system from each tank outlet to any engine are independent of each part of the system supplying fuel to any other engine.

CS 30N.954 Fuel System lightning protection

The fuel system must be designed and arranged to prevent the ignition of fuel vapour within the system by

(a) Direct lightning strikes to areas having a high probability of stroke attachment:

(b) Swept lightning strokes on areas where swept strokes are highly probable;

(c) Corona or streamering at fuel vent outlets.

CS 30N.955 Fuel Flow

(a) General. The ability of the fuel system to provide fuel at the rates specified in this paragraph and at a pressure sufficient for proper engine operation must be shown in the attitude that is most critical with respect to fuel feed and quantity of unusable fuel. These conditions may be simulated in a suitable mock-up. In addition

(1) The quantity of fuel in the tank may not exceed the amount established as the unusable fuel supply for that tank under paragraph CS 30N.959 plus that necessary to show compliance with this paragraph;

(2) If there is a fuel flowmeter, it must be blocked during the flow test, and the fuel must flow through the meter bypass.

(b) Gravity systems. The minimum fuel-flow rate for gravity systems (main and reserve supply) must be 150% of the fuel-flow rate of the engine at the maximum power approved for take-off under these regulations.

(c) Pump systems. The minimum fuel-flow rate for each pump system (main and reserve supply) for each reciprocating engine, must be 125% of the fuel flow rate of the engine at the maximum power approved for take-off under these regulations.

(1) This flow rate is required for each main pump and each emergency pump, and must be available when the pump is running as it would during take-off;

(2) For each hand-operated pump, this rate must occur at not more than 60 complete cycles (120 single strokes) per minute.

(d) Auxiliary fuel systems and fuel transfer systems. Subparagraphs (b), (c), and (f) of this paragraph apply to each auxiliary and transfer system, except that

(1) The required fuel-flow rate must be established upon the basis of maximum continuous power and engine rotational speed, instead of take-off power and fuel consumption;

(2) A lesser flow rate my be used for a small, auxiliary tank feeding into a large, main tank, if there is a suitable placard stating that the auxiliary tank is not to be opened to the main tank unless a predetermined amount of fuel remains in the main tank.

(e) Multiple fuel tanks. If a reciprocating engine can be supplied with fuel from more than one tank, it must be possible, in level flight, to restart that engine after switching to any full tank after engine stopping, due to fuel depletion, while the engine is being supplied from any other tank.

(f) Turbine engine fuel systems.

(1) Each turbine engine fuel system must provide at least 100% of the fuel flow required by the engine under each intended operation condition and manoeuvre. The conditions may be simulated in a suitable mock-up. This flow must be shown with the airship in the most adverse fuel-feed condition (with respect to altitudes, attitudes, and other conditions) that is expected in operation.

(2) If a turbine engine can be supplied with fuel from more than one tank, it must be possible, in level flight, to restart that engine after switching to any full tank after engine stopping, due to fuel depletion, while the engine is being supplied from any other tank.

CS 30N.957 Flow between interconnected tanks

It must be impossible, in a gravity-feed system with interconnected tank outlets, for enough fuel to flow between the tanks to cause an overflow of fuel from any tank vent under the conditions in paragraph CS 30N.959, except that full tanks must be used.

CS 30N.959 Unusable fuel supply

The unusable fuel supply for each tank must be established as not less than that quantity at which the first evidence of malfunctioning occurs under the most adverse fuel-feed condition occurring under each intended operation and flight manoeuvre involving that tank.

CS 30N.961 Fuel system hot weather operation

Each fuel system must be free from vapour lock when using fuel at a temperature of 43°C (110ºF) under critical operating conditions.

CS 30N.963 Fuel tanks: general

(a) Each fuel tank must be able to withstand, without failure, the vibration, inertia, fluid, and structural loads that it may be subjected to in operation.

(b) Each flexible fuel tank liner must be of an acceptable kind.

(c) Each integral fuel tank must have adequate facilities for interior inspection and repair.

(d) The total usable capacity of the fuel tanks must be enough for at least one-half hour of operation at maximum continuous power.

(e) Each fuel-quantity indicator must be adjusted to account for the unusable-fuel supply determined under paragraph CS 30N.959.

(f) For commuter category airships, fuel tanks must be able to resist rupture and to retain fuel under the inertia forces prescribed for the emergency landing conditions in paragraph CS 30N.561. In addition, fuel tanks must be in a protected position so that exposure of the tanks to scraping action with the ground is unlikely.

CS 30N.965 Fuel tank tests

(a) Each fuel tank must be able to withstand the following pressures without failure or leakage.

(1) For each conventional metal tank and non-metallic tank with walls not supported by the airship structure, a pressure of 241 hPa (3.5 psi), or that pressure developed during maximum ultimate acceleration with a full tank, whichever is greater.

(2) For each integral tank, the pressure developed during the maximum limit acceleration of the airship with a full tank, with simultaneous application of the critical limit structural loads.

(3) For each non-metallic tank with walls supported by the airship structure and constructed in an acceptable manner using acceptable basic tank material, and with actual or simulated support conditions, a pressure of 138 hPa (2 psi) for the first tank of a specific design. The supporting structure must be designed for the critical loads occurring in the flight or landing conditions combined with the fuel-pressure loads resulting from the corresponding accelerations.

(b) Each fuel tank with large, unsupported, or unstiffened flat areas must be able to withstand the following tests without leakage or failure.

(1) Each complete tank assembly and its supports must be vibration tested while mounted to simulate the actual installation.

(2) Except as specified in subparagraph (4) of this paragraph, the tank assembly must be vibrated for 25 hours at an amplitude of not less than 0.8 mm (1/32 in) (unless another amplitude is substantiated) while 2/3 filled with water or other suitable test fluid.

(3) The test frequency of vibration must be as follows.

(i) If no frequency of vibration resulting from any r.p.m. within the normal operating range of engine speeds is critical, the test frequency of vibration, in number of cycles per minute, must be the number obtained by multiplying the maximum continuous engine speed (r.p.m.) by 0.9.

(ii) If only one frequency of vibration resulting from any r.p.m. within the normal operating range of engine speeds is critical, that frequency of vibration must be the test frequency.

(iii) If more than one frequency of vibration resulting from any r.p.m. within the normal operating range of engine speeds is critical, the most critical of these frequencies must be the test frequency.

(4) Under subparagraphs (3)(ii) and (iii) of this paragraph, the time of test must be adjusted to accomplish the same number of vibration cycles that would be accomplished in 25 hours at the frequency specified in subparagraph (3)(i) of this paragraph.

(5) During the test, the tank assembly must be rocked at a rate of 16 to 20 complete cycles per minute, through an angle of 15° an either side of the horizontal (30° total), about an axis parallel to the axis of the car, for 25 hours.

(c) Each integral tank using methods of construction and sealing not previously proven to be adequate by test data or service experience must be able to withstand the vibration test specified in subparagraphs (1) through (4) of subparagraph (b).

(d) Each tank with a non-metallic liner must be subjected to the sloshing test outline in subparagraph (b)(5) of this paragraph, with the fuel at room temperature. In addition, a specimen liner of the same basic construction as that to be used in the airship must, when installed in a suitable test tank, withstand the sloshing test with fuel at a temperature of 43°C (110ºF).

CS 30N.967 Fuel tank installation

(a) Each fuel tank must be supported so that tank loads are not concentrated. In addition

(1) There must be pads, if necessary, to prevent chafing between each tank and its supports;

(2) Padding must be non-absorbent, or treated to prevent the absorption of fuel;

(3) If a flexible tank liner is used, it must be supported so that it is not required to withstand fluid loads;

(4) Interior surfaces adjacent to the liner must be smooth and free from projections that could cause wear of the liner, unless

(i) Provisions are made for protection of the liner at those points, or

(ii) The liner construction itself provides such protection;

(5) A positive pressure must be maintained within the vapour space of each bladder cell under all conditions of operation except for particular condition for which it is shown that a zero or negative pressure will not cause the bladder cell to collapse;

(6) Siphoning of fuel (other than minor spillage) or collapse of bladder fuel cells may not result from improper securing or loss of the fuel filler cap.

(b) Each tank compartment must be ventilated and drained to prevent the accumulation of flammable fluids or vapours. Each compartment adjacent to a tank that is an integral part of the airship structure must also be ventilated and drained.

(c) No fuel tank may be on the engine side of the firewall. There must be at least 13 mm (0.5 in) of clearance between the fuel tank and the firewall. No part of the engine nacelle skin that lies immediately behind a major air opening from the engine compartment may act as the wall of an integral tank.

(d) If a fuel tanks is installed in the personnel compartment, it must be isolated by fume and fuel-proof enclosures that are drained and vented to the exterior of the car. A bladder-type fuel cell, if used, must have a retaining shell at least equivalent to a metal fuel tank in structural integrity.

(e) Fuel tanks must be designed, located, and installed so as to retain fuel

(1) Under the inertia forces prescribed for the emergency landing conditions in paragraph CS 30N.561;

(2) Under conditions likely to occur when the airship lands either with its landing gear retracted, or when one landing gear is collapsed.

CS 30N.969 Fuel tank expansion space

Each fuel tank must have an expansion space of not less than 2% of the tank capacity unless the tank vent discharges clear of the airship. It must be impossible to fill the expansion space inadvertently with the airship in the normal ground attitude.

CS 30N.971 Fuel tank sump

(a) Each fuel tank must have a drainable sump with an effective capacity, in the normal ground and flight attitudes, of 0.25% of the tank capacity, or 237 cm³ (1/16 gal), whichever is greater, unless

(1) The fuel system has a sediment bowl or chamber that is accessible for drainage and has a capacity of 30 cm³ (1 fl oz) for every 75 litres (20 gal) of fuel tank capacity;

(2) Each fuel tank outlet is located so that, in the normal ground attitude, water will drain from all parts of the tank to the sediment bowl or chamber.

(b) Each sump, sediment bowl, and sediment chamber drain required by subparagraph (a) of this paragraph must comply with the drain provisions of subparagraph CS 30N.999(b).

CS 30N.973 Fuel tank filler connection.

(a) Each fuel tank filler connection must be marked as prescribed in subparagraph CS 30N.1557(c).

(b) Spilled fuel must be prevented from entering the fuel tank compartment or any part to the airship other than the tank itself.

(c) Each filler cap must provide a fuel-tight seal for the main filler opening. However, there may be small openings in the fuel tank cap for venting purposes or for the purpose of allowing passage of a fuel gauge through the cap, providing water cannot enter the tank.

(d) Each fuel-filling point, except pressure fuelling connection points, must have a provision for electrically bonding the airship to ground fuelling equipment.

CS 30N.975 Fuel tank vents and carburettor vapour vents

(a) Each fuel tank must be vented from the top part of the expansion space. In addition

(1) Each vent outlet must be located and constructed in a manner that minimises the possibility of being obstructed by ice or other foreign matter;

(2) Each vent must be constructed to prevent siphoning of fuel during normal operation;

(3) The venting capacity must allow the rapid relief of excessive differences of pressure between the interior and exterior of the tank;

(4) Airspaces of tanks with interconnected outlets must be interconnected;

(5) There may be no undrainable points in any vent line where moisture can accumulate with the airship in either the ground or level flight attitudes;

(6) No vent may terminate at a point where the discharge of fuel from the vent outlet will constitute a fire hazard or from which fumes may enter personnel compartments.

(b) Each carburettor with vapour elimination connections and each fuel injection engine employing vapour return provisions must have a separate vent line to lead vapours back to the top of a fuel tank. If there is more than one fuel tank, and it is necessary to use these tanks in a definite sequence for any reason, the vapour vent return line must lead back to the fuel tank to be used first, unless the relative capacities of the tanks are such that return to another tank is preferable.

CS 30N.977 Fuel tank outlet

(a) There must be a fuel strainer for the fuel tank outlet or for the booster pump. This strainer must

(1) For reciprocating engine-powered airships, have 3 to 6 meshes per cm (8 to 16 meshes per in);

(2) For turbine engine-powered airships, prevent the passage of any object that could restrict fuel flow or damage any fuel-system component.

(b) The clear area of each fuel tank outlet strainer must be at least five times the area of the outlet line.

(c) The diameter of each strainer must be at least that of the fuel tank outlet.

(d) Each finger strainer must be accessible for inspection and cleaning.

CS 30N.979 Pressure fuelling system

For pressure fuelling systems, the following apply.

(a) Each pressure fuelling system fuel manifold connection must have means to prevent the escape of hazardous quantities of fuel from the system if the fuel entry valve fails.

(b) An automatic shutoff means must be provided to prevent the quantity of fuel in each tank from exceeding the maximum quantity approved for that tank. This means must allow checking for proper shutoff operation before each fuelling of the tank.

(c) A means must be provided to prevent damage to the fuel system in the event of failure of the automatic shutoff means prescribed in subparagraph (b) of this paragraph.

(d) All parts of the fuel system up to the tank which are subjected to fuelling pressures must have a proof pressure of 1.33 times, and an ultimate pressure of at least 2 times the surge pressure likely to occur during fuelling.

FUEL SYSTEM COMPONENTS

CS 30N.991 Fuel pumps

(a) Main pumps. Each fuel pump required for proper engine operation, or required to meet the fuel system requirements of this subpart (other than those in subparagraph (b) of this paragraph), is a main pump. For each main pump, provision must be made to allow the by pass of each positive displacement fuel pump other than a fuel injection pump (a pump that supplies the proper flow and pressure for fuel injection when the injection is not accomplished in a carburettor) approved as part of the engine.

(1) For reciprocating engine installations having fuel pumps to supply fuel to the engine, there must be at least one main pump which must be either directly driven by the engine or be electrically driven. If the pump is electrically driven, the following apply.

(i) The electrical system, including the power supply, for the emergency pump for each engine must be independent of the electrical system for each main pump for any other engine;

(ii) The electrical system, including the power supply, for the emergency pump for each engine must be independent of the electrical system for the main pump for the same engine;

(iii) Except during the engine starting operation, the independent fuel pump electrical systems must not be connected to any common electrical load, either engine or airframe, during normal operations;

(iv) A failure in any other electrical system, including both engine and airframe systems, must not adversely affect any part of any fuel pump electrical system;

(v) The main fuel pump control switches in the cockpit must be independent from all other switches and guarded to prevent an inadvertent actuation.

(2) For turbine engine installations, each fuel pump required for proper engine operation, or required to meet the fuel system requirements of this subpart (other than those in subparagraph (b) of this paragraph), is a main pump. In addition

(i) There must be a least one main pump for each turbine engine;

(ii) The power supply for the main pump for each engine must be independent of the power supply for each main pump for any other engine;

(iii) For each main pump, provision must be made to allow the bypass of each positive displacement fuel pump other than a fuel injection pump approved as part of the engine.

(b) Emergency pumps. There must be an emergency pump immediately available to supply fuel to the engine if any main pump (other than a fuel injection pump approved as part of an engine) fails. The power supply for each emergency pump must be independent of the power supply for each corresponding main pump.

(c) Warning means. If both the normal pump and emergency pump operate continuously, there must be a means to indicate to the appropriate flight crewmember a malfunction of either pump.

(d) Operation of any fuel pump may not affect engine operation so as to create a hazard, regardless of the engine power or thrust setting or functional status of any other fuel pump.

CS 30N.993 Fuel system lines and fittings

(a) Each fuel line must be installed and supported to prevent excessive vibration and to withstand loads due to fuel pressure and accelerated flight conditions.

(b) Each fuel line connected to components of the airship between which relative motion could exist must have provisions for flexibility.

(c) Each flexible connection in fuel lines that may be under pressure and subjected to axial loading must use flexible hose assemblies.

(d) Each flexible hose must be approved or must be shown to be suitable for the particular application.

(e) No flexible hose that might be adversely affected by exposure to high temperatures may be used where excessive temperatures will exist during operation or after engine shutdown.

CS 30N.994 Fuel system components

Fuel system components in an engine nacelle or in the car must be protected from damage which could result in spillage of enough fuel to constitute a fire hazard as a result of a wheels-up landing on a paved runway.

CS 30N.995 Fuel valves and controls

(a) There must be a means to allow appropriate flight crewmembers to rapidly shut off the fuel to each engine individually in flight.

(b) No shutoff valve may be on the engine side of any firewall. In addition, there must be means to

(1) Guard against inadvertent operation of each shutoff valve;

(2) Allow appropriate flight crewmembers to reopen each valve rapidly after it has been closed.

(c) Each valve and fuel system control must be supported so that loads resulting from its operation or from accelerated flight conditions are not transmitted to the lines connected to the valve.

(d) Each valve and fuel system control must be installed so that gravity and vibration will not affect the selected position.

(e) Each fuel valve handle and its connections to the valve mechanism must have design features that minimise the possibility of incorrect installation.

(f) Each check valve must be constructed, or otherwise incorporate provisions, to preclude incorrect installation of the valve.

(g) Fuel tank selector valves must

(1) Require a separate and distinct action to place the selector in the 'off' position;

(2) Have the tank selector positions located in such a manner that it is impossible for the selector to pass through the 'off' position when changing from one tank to another.

CS 30N.997 Fuel strainer or filter

There must be a fuel strainer or filter between the fuel tank outlet and the inlet of either the fuel metering device or an engine-driven positive displacement pump, whichever is nearer the fuel tank outlet. This fuel strainer or filter must

(a) Be accessible for draining and cleaning and must incorporate as screen or element which is easily removable;

(b) Have a sediment trap and drain except that it need not have a drain if the strainer or filter is easily removable for drain purposes;

(c) Be mounted so that its weight is not supported by the connecting lines or by the inlet or outlet connections of the strainer or filter itself;

(d) Have the capacity (with respect to operating limitations established for the engine) and the mesh to ensure that engine fuel system functioning is not impaired, with the fuel contaminated to a degree (with respect to particle size and density) that is greater than the established for the engine in FAR Part 33, or equivalent regulations.

(e) In addition, for commuter category airships, unless means are provided in the fuel system to prevent the accumulation of ice on the filter, a means must be provided to automatically maintain the fuel flow if ice clogging of the filter occurs.

CS 30N.999 Fuel system drains

(a) There must be at least one drain to allow safe drainage of the entire fuel system with the airship in its normal ground attitude.

(b) Each drain required by subparagraph (a) of this paragraph and paragraph CS 30N.971 must

(1) discharge clear of all parts of the airship;

(2) Have manual or automatic means for positive locking in the closed position;

(3) Have a drain valve that is readily accessible and which can be easily opened and closed; and that is either located or protected to prevent fuel spillage in the event of a landing with landing gear retracted.

CS 30N.1001 Fuel jettisoning system

If a fuel jettisoning system is installed, it must be able to jettison fuel at the rate of 378 litres (100 gal) per minute. The system must be designed so that is not possible to jettison that fuel necessary to make a safe landing.

(a) Fuel jettisoning must be demonstrated in a descent, climb, and level flight. During this flight test, it must be shown that

(1) The fuel jettisoning system and its operation are free from fire hazard;

(2) The fuel discharges clear of any part of the airship;

(3) Fuel or fumes do not enter any part of the airship;

(4) The jettisoning operation does not adversely affect the controllability of the airship.

(b) The fuel jettisoning valve must be designed to allow the crew to close the valve during any part of the jettisoning operation.

(c) Unless it is shown that engine operation, engine vectoring or operation of auxiliary power units does not adversely affect fuel jettisoning, there must be a placard, adjacent to the jettisoning control, to warn crew members against jettisoning during those operations.

(d) The fuel jettisoning system must be designed so that any reasonably probable single malfunction in the system will not result in a hazardous condition due to the inability to jettison fuel.

OIL SYSTEM

CS 30N.1011 General

(a) Each engine must have an independent oil system that can supply it with an appropriate quantity of oil at a temperature not above that safe for continuous operation.

(b) The usable oil tank capacity may not be less than the product of the endurance of the airship under critical operating conditions and the maximum oil consumption of the engine under the same conditions, plus a suitable margin to ensure adequate circulation and cooling.

(c) For an oil system without an oil transfer system, only the usable oil tank capacity may be considered. The amount of oil in the engine oil lines, the oil radiator, and the feathering reserve, may not be considered.

(d) If an oil transfer system is used, the amount of oil in the transfer lines that can be pumped by the transfer pump may be included in the oil capacity.

CS 30N.1013 Oil tanks

(a) Installation. Each oil tank must be installed to

(1) Meet the requirements of subparagraphs CS 30N.967(a) and (b);

(2) Withstand any vibration, inertia, and fluid loads expected in operation.

(b) Expansion space. Oil tank expansion space must be provided so that

(1) Each oil tank used with a reciprocating engine has an expansion space of not less than the greater of 10% of the tank capacity or 1.9 litres (0.5 gal), and each oil tank used with a turbine engine has an expansion space of not less than 10% of the tank capacity;

(2) It is impossible to fill the expansion space inadvertently with the airship in the normal ground attitude.

(c) Filler connection. Each recessed oil tank filler connection that can retain any appreciable quantity of oil must have a drain that discharges clear of each part of the airship. In addition

(1) Each oil tank filler cap must provide an oil tight seal;

(2) Each oil tank filler must be marked as prescribed in subparagraph CS 30N.1557(c).

(d) Vent. Oil tanks must be vented as follows.

(1) Each oil tank must be vented to the engine crankcase from the top part of the expansion space so that the vent connection is not covered by oil under any normal flight conditions;

(2) Oil tank vents must be arranged so that condensed water vapour that might freeze and obstruct the line cannot accumulate at any point.

(e) Outlet. No oil tank outlet may be enclosed by any screen or guard that would reduce the flow of oil below a safe value at any operating temperature. No oil tank outlet diameter may be less than the diameter of the engine oil pump inlet. Each oil tank used with a turbine engine must have means to prevent entrance into the tank itself, or into the tank outlet, of any object that might obstruct the flow of oil through the system. There must be a shutoff valve at the outlet of each oil tank used with a turbine engine, unless the external portion of the oil system (including of tank supports) is fireproof.

(f) Flexible liners. Each flexible oil tank liner must be of an acceptable kind.

(g) Each oil tank filler cap of an oil tank that is used with a turbine engine must provide an oiltight seal.

CS 30N.1015 Oil tank tests

Each oil tank must be tested under paragraph CS 30N.965 except that

(a) The applied pressure must be 345 hPa (5 psi) for the tank construction instead of the pressures specified in subparagraph CS 30N.965(a);

(b) For a tank with a non-metallic liner, the test fluid must be oil rather than fuel as specified in subparagraph CS 30N.965(d), and the slosh test on a specimen liner must be conducted with the oil at 120°C (250°F);

(c) For pressurised tanks used with a turbine engine the test pressure may not be less than 345 hPa (5 psi) plus the maximum operating pressure of the tank.

CS 30N.1017 Oil lines and fittings

(a) Oil lines. Oil lines must meet paragraph CS 30N.993, and must accommodate a flow of oil at a rate and pressure adequate for proper engine functioning under any normal operating condition.

(b) Breather lines. Breather lines must be arranged so that

(1) Condensed water vapour or oil that might freeze and obstruct the line cannot accumulate at any point;

(2) The breather discharge will not constitute a fire hazard if foaming occurs, or cause emitted oil to strike the pilot's windshield;

(3) The breather does not discharge into the engine air-induction system;

(4) The breather outlet its protected against blockage by ice or foreign matter.

CS 30N.1019 Oil strainer or filter

(a) Each turbine engine installation must incorporate an oil strainer or filter through which all of the engine oil flows and which meets the following requirements.

(1) Each oil strainer or filter that has a bypass, must be constructed and installed so that oil will flow at the normal rate through the rest of the system with the strainer or filter completely blocked.

(2) The oil strainer or filter must have the capacity (with respect to operating limitations established for the engine) and the mesh to ensure that engine oil system functioning is not impaired when the oil is contaminated to a degree (with respect to particle size and density) that is greater than that established for the engine in FAR Part 33 or equivalent regulations.

(3) The oil strainer or filter, unless it is installed at an oil tank outlet, must incorporate an indicator that will indicate contamination of the screen before it reaches the capacity established in accordance with subparagraph (2) of this paragraph.

(4) The bypass of a strainer or filter must be constructed and installed so that the release of collected contaminants is minimised by appropriate location of the bypass to ensure that collected contaminants are not in the bypass flow path.

(5) An oil strainer or filter that has no bypass, except on that is installed at an oil tank outlet, must have a means to connect it to the warning system required in subparagraph CS 30N.1305(c)(7).

(b) Each oil strainer or filter in a powerplant installation using reciprocating engines must be constructed and installed so that oil will flow at the normal rate through the rest of the system with the strainer or filter element completely blocked.

CS 30N.1021 Oil system drains

There must be at least one accessible drain that

(a) Allows safe drainage of the entire oil system;

(b) Has manual or automatic means for positive locking in the closed position.

CS 30N.1023 Oil radiators

If installed, each oil radiator and its supporting structures must be able to withstand the vibration, inertia, and oil pressure loads to which it would be subjected in operation.

CS 30N.1027 Propeller feathering system

(a) If the propeller feathering system depends on engine oil, there must be means to trap an amount of oil in the tank if the supply becomes depleted due to failure of any part of the lubricating system, other than the tank itself.

(b) The amount of trapped oil must be enough to accomplish feathering and must be available only to the feathering pump.

(c) The ability of the system to accomplish feathering with the trapped oil must be shown.

(d) Provisions must be made to prevent sludge or other foreign matter from affecting the safe operation of the propeller feathering system.

COOLING

CS 30N.1041 General

The powerplant cooling provisions must be able to maintain the temperatures of powerplant components and engine fluids, within the temperature limits established during ground and flight operations to the maximum altitude for which approval is requested.

CS 30N.1043 Cooling tests

(a) General. Compliance with paragraph CS 30N.1041 must be shown under critical ground and flight operating conditions (including loiter, hover, climb, and descent) to the maximum altitude for which approval is requested. For turbosupercharged engines, each turbosupercharger must be operated through that part of the climb profile for which operation with the turbosupercharger is requested and in a manner consistent with its intended operation. For these tests, the following apply.

(1) If the test are conducted under conditions deviating from the maximum ambient atmospheric temperature specified in subparagraph (b), of this paragraph, the recorded powerplant temperature must be corrected under subparagraphs (c) and (d) of this paragraph, unless a more rational correction method is applicable.

(2) No corrected temperature determined under subparagraph (1) of this paragraph may exceed established limits.

(3) The fuel used during the cooling tests must be the most critical grade approved for the engines, and the mixture settings must be those used in normal operation.

(b) Maximum ambient atmospheric temperature. A maximum ambient atmospheric temperature corresponding to sea level conditions of at least 38°C (100°F) must be established. The assumed temperature lapse rate is 0.65°C per 100 m (3.6°F per 1,000 ft) of altitude above sea level. However, for winterization installations, a maximum ambient atmospheric temperature corresponding to sea level conditions of less than 38°C (100°F) may be selected.

(c) Correction factor (except cylinder barrels). Unless a more rational correction applies, temperatures of engine fluids and powerplant components (except cylinder barrels) for which temperature limits are established, must be corrected by adding to them the difference between the maximum ambient atmospheric temperature and the temperature of the ambient air at the time of the first occurrence of the maximum component or fluid temperature recorded during the cooling test.

(d) Correction factor for cylinder barrel temperatures. Cylinder barrel temperatures must be corrected by adding to them 0.7 times the difference between the maximum ambient atmospheric temperature and the temperature of the ambient air at the time of the first occurrence of the maximum cylinder barrel temperature recorded during the cooling test.

CS 30N.1046 Cooling test procedures

(a) General. For each stage of flight, the cooling test must be conducted with the airship

(1) In the configuration most critical for cooling (including cowl flap settings selected for reciprocating engine powered airships, and where vectored thrust is provided, including vectoring procedures established for the airship);

(2) Under the conditions most critical for cooling.

(b) Temperature stabilisation. For the purpose of the cooling tests, a temperatures is 'stabilised' when its rate of change is less than 1.1°C (2°F) per minute. The following stabilisation rules apply. For each airships, and for each stage of flight

(1) The temperatures must be stabilised under the conditions from which entry is made into the stage of flight being investigated; or

(2) If the entry condition normally does not allow temperatures to stabilise, operation through the full entry condition must be conducted before entry into the stage of flight being investigated in order to allow the temperatures to attained their natural levels at the time of entry.

(c) Duration of test. For each stage of flight the test must be continued until

(1) The component and engine-fluid temperatures stabilise; or

(2) The stage of flight is completed; or

(3) An operating limitation is reached.

(d) Turbine engine powered airships. The following additional requirement applies: The take-off cooling test must be preceded by a period during which the powerplant component and engine-fluid temperatures are stabilised with the engines at ground idle.

(e) Reciprocating engine-powered airships. The following additional requirements apply.

(1) For each single-engine airships, engine-cooling tests during climb must be conducted as follows.

(i) Engine temperature must be stabilised in level flight with the engine at not less than 75% of maximum continuous power.

(ii) The climb must begin at the lowest practicable altitude with the engine at take-off power for the specified duration of take-off power and thence with maximum continuous power.

(iii) The climb must be conducted at a speed not more than the best rate of climb speed with maximum continuous power unless the slope of the flight path at the speed chose for the cooling test is equal to or greater than the minimum required angle of climb determined under paragraph CS 30N.65 and the airship has a cylinder head temperature indicator.

(iv) The climb must be continued at maximum continuous power for at least 5 minutes after the occurrence of the highest temperature recorded.

(2) For each multiengine airship engine-cooling tests during climb must be conducted as follows.

(i) One engine is inoperative.

(ii) Engine temperatures must be stabilised in level flight with the operating engines at not less than 75% of maximum continuous power.

(iii) The climb must begin at the lowest practicable altitude with the engine at take-off power for the specified duration of take-off power and thence with maximum continuous power.

(iv) The climb must be conducted at a speed not more than the best rate of climb speed with maximum continuous power unless the slope of the flight path at the speed chosen for the cooling test is equal to or greater than the minimum required angle of climb determined under paragraph CS 30N.67 and the airship has a cylinder head temperature indicator.

(v) The climb must be continued at maximum continuous power for at least 5 minutes after the occurrence of the highest temperature recorded.

LIQUID COOLING

(*reserved*)

INDUCTION SYSTEM

CS 30N.1091 Air induction

(a) The air induction system for each engine must supply the air required by that engine under the operating conditions for which certification is requested.

(b) Each reciprocating engine installation must have at least two separate air intake sources and must meet the following.

(1) Primary air intakes may open within the cowling if that part of the cowling is isolated from the engine accessory section by a fire-resistant diaphragm or if there are means to prevent the emergence of backfire flames.

(2) Each alternate air intake must be located in a sheltered position and my not open within the cowling if the emergence of backfire flames will result in a hazard.

(3) The supplying of air to the engine through the alternate air intake system may not result in a loss of excessive power in addition to the power loss due to the rise in air temperature.

(c) For turbine engine-powered installations

(1) There must be means to prevent hazardous quantities of fuel leakage or overflow from drains, vents, or other components of flammable fluid systems from entering the engine intake system;

(2) The air inlet ducts must be located or protected so as to minimise the ingestion of foreign matter during take-off, landing, and taxing.

CS 30N.1093 Induction system icing protection

(a) Reciprocating engines. Each reciprocating engine air-induction system must have means to prevent and eliminate icing. Unless this is done by other means, it must be shown that, in air free of visible moisture at a temperature of -1.1°C (30°F)

(1) Each airship with sea level engines using conventional venture carburettors has a preheater that can provide a heat rise of 50°C (90°F) with the engines at 75% of maximum continuous power;

(2) Each airship with altitude engines using conventional venturi carburettors has a preheater that can provide a rise of 67°C (120°F) with the engines at 75% of maximum continuous power;

(3) Each airship with altitude engines using carburettors tending to prevent icing has a preheater that, with the engines at 60% of maximum continuous power, can provide a heat rise of 56°C (100°F);

(4) Each single-engine airship with a sea level engine using a carburettor tending to prevent icing has a sheltered alternate source of air with a preheat of not less than that provided by the engine cooling air downstream of the cylinders;

(5) Each multiengine airship with sea level engines using a carburettor tending to prevent icing has a

preheater that can provide a heat rise of 50°C (90°F) with the engines at 75% of maximum continuous power.

(b) Turbine engines.

(1) Each turbine engine and its air-inlet system must operate throughout the flight-power range of the engine (including idling), within the limitations established for the airship, without the accumulation of ice on engine or inlet system components that would adversely affect engine operation or cause a serious loss of power or thrust

(i) Under the icing conditions specified in FAR Part 25 Appendix C;

(ii) In snow, both falling and blowing.

(2) Each turbine engine must idle for 30 minutes on the ground, with the air bleed available for engine icing protection at its critical condition, without adverse effect, in an atmosphere that is at a temperature between -9°C and -1°C (15°F and 30°F) and has a liquid water content not less than 0.3 grams per cubic meter in the form of drops having a mean effective diameter not less than 20 microns, followed by momentary operation at take-off power or thrust. During the 30 minutes of idle operation, the engine may be run up periodically to a moderate power or thrust setting in a manner acceptable to the Agency.

(c) For airships with reciprocating engines having supercharges to pressurise the air before it enters the carburettor, the heat rise in the air caused by that supercharging at any altitude may be utilised in determining compliance with subparagraph (a) of this paragraph if the heat rise utilised is that which will be available, automatically, for the applicable altitudes and operating condition because of supercharging.

CS 30N.1101 Carburettor air preheater design

If a carburettor air preheater is installed, it must be designed and constructed to

(a) Ensure ventilation of the preheater when the engine is operated in cold air;

(b) Allow inspection of the exhaust manifold parts that it surrounds;

(c) Allow inspection of critical parts of the preheater itself.

CS 30N.1103 Induction system ducts

(a) Each induction system duct must have a drain to prevent the accumulation of fuel or moisture in the normal ground and flight attitudes. No drain may discharge where it will cause a fire hazard.

(b) Each duct connected to components between which relative motion could exist must have means for flexibility.

CS 30N.1105 Induction system screens

If induction system screens are used

(a) Each screen must be upstream of the carburettor;

(b) No screen may be in any part of the induction system that is the only passage through which air can reach the engine, unless

(1) The available preheat is at least 56°C (100°F);

(2) The screen can be deiced by heated air;

(c) No screen may be deiced by alcohol alone;

(d) It must be impossible for fuel to strike any screen.

CS 30N.1111 Turbine engine bleed-air system

For turbine engine bleed-air systems, the following apply.

(a) No hazard may result if duct rupture or failure occurs anywhere between the engine port and the airship unit served by the bleed air.

(b) The effect on airship and engine performance of using maximum bleed air must be established.

(c) Hazardous contamination of cabin air systems may not result from failures of the engine lubricating system.

EXHAUST SYSTEM

CS 30N.1121 General

(a) Each exhaust system must ensure safe disposal of exhaust gases without fire hazard or carbon monoxide contamination in any personnel compartment.

(b) Each exhaust system part with a surface hot enough to ignite flammable fluids or vapours must be located or shielded so that leakage from any system carrying flammable fluids or vapours will not result in a fire caused by impingement of the fluids or vapours on any part of the exhaust system including shields for the exhaust system.

(c) Each exhaust system component must be separated by fireproof shields from adjacent flammable parts of the airship that are outside the engine compartment.

(d) No exhaust gases may discharge near any flammable fluid, vent, or drain that may cause a fire hazard.

(e) Each exhaust system component must be ventilated to prevent points of excessively high temperature.

(f) No exhaust gases my be discharged where they will cause a glare seriously affecting pilot vision at night.

(g) If significant traps exist, each turbine engine exhaust system must have drains discharging clear of the airship, in any normal ground and flight attitude, to prevent fuel accumulation after the failure of an attempted engine start.

(h) Each exhaust heat exchanger must incorporate means to prevent blockage of the exhaust port after any internal heat exchanger failure.

CS 30N.1123 Exhaust manifold

(a) Each exhaust manifold must be fireproof and corrosion-resistant, and must have means to prevent failure due to expansion caused by operating temperatures.

(b) Each exhaust manifold must be supported to withstand the vibration and inertia loads to which it may be subjected in operation.

(c) Parts of the manifold connected to components between which relative motion could exist must have means for flexibility.

CS 30N.1125 Exhaust heat exchangers

For reciprocating engine-powered airships, the following apply.

(a) Each exhaust heat exchanger must be constructed and installed to withstand the vibration, inertia, and other loads that it may be subjected to in normal operation. In addition:

(1) Each exchanger must be suitable for continued operation at high temperatures and resistant to corrosion from exhaust gases;

(2) There must be means for inspection of critical parts of each exchanger;

(3) Each exchanger must be ventilated wherever it is subject to contact with exhaust gases.

(b) Each heat exchanger used for heating ventilating air must be constructed so that exhaust gases may not enter the ventilating air.

POWERPLANT CONTROLS AND ACCESSORIES

CS 30N.1141 Powerplant controls: general

(a) Powerplant controls must be located and arranged under paragraph CS 30N.777 and marked under subparagraph CS 30N.1555(a).

(b) Each flexible control must be an acceptable kind.

(c) Each control must be able to maintain any necessary position without

(1) Constant attention by flight crewmembers; or

(2) Tendency to creep due to control loads or vibration.

(d) Each control must be able to withstand operating loads without failure or excessive deflection.

(e) For turbine engine-powered airships, no single failure or malfunction, or probable combination thereof, in any powerplant control system may cause the failure of any powerplant function necessary for safety.

(f) The portion of each powerplant control located in the engine compartment that is required to be operated in the event of fire must be at least fire resistant.

(g) Powerplant valve controls located in the cockpit must have

(1) For manual valves, positive stops, or in the case of fuel valves, suitable index provisions, in the open and closes position;

(2) For power-assisted valves, a means to indicate to the flight crew when the valve

(i) Is in the fully open or fully closed,

(ii) Is moving between the fully open and fully closed position.

CS 30N.1143 Engine controls

(a) There must be a separate and independent power or thrust control for each engine, and a separate control for each supercharger that requires a control.

(b) Each power, thrust, and supercharger control must give a positive and immediately responsive means for controlling its engine or supercharger.

(c) Power controls must be arranged to allow separate control and simultaneous control of all engines.

(d) If a power or thrust control incorporates a fuel-shutoff feature, the control must have a means to prevent the inadvertent movement of the control into the shutoff position. The control must

(1) Have a positive lock or stop at the idle position;

(2) Require a separate and distinct operation to place the control in the shutoff position.

CS 30N.1145 Ignition switches

(a) Ignition switches must control each ignition circuit on each engine.

(b) There must be means to quickly shut off all ignition on multiengine airships by the groupings of switches or by a master ignition control.

(c) Each group of ignition switches, except ignition switches for turbine engines for which continuous ignition is not required, and each master ignition control must have a means to prevent its inadvertent operation.

CS 30N.1147 Mixture controls

If there are mixture controls, each engine must have a separate control, and each mixture control must have guards or must be shaped or arranged to prevent confusion by feel with other controls. The controls must be grouped and arranged to allow separate control of each engine and simultaneous control of all engines.

CS 30N.1149 Propeller speed and pitch controls

(a) If there are propeller speed or pitch controls, they must be grouped and arranged to allow

(1) Separate control of each propeller;

(2) Simultaneous control of all propellers.

(b) The controls must allow ready synchronisation of all propellers on multiengine airships.

CS 30N.1153 Propeller feathering controls

If there are propeller feathering controls, each propeller must have a separate control. Each control must have means to prevent inadvertent operation.

CS 30N.11157 Carburettor air temperature controls

There must be a separate carburettor air temperature control for each engine.

CS 30N.1163 Powerplant accessories

(a) Each engine-driven accessory must

(1) Be approved for mounting on the engine involved;

(2) Use the provisions on the engine for mounting;

(3) Be sealed to prevent contamination of the engine oil system and the accessory system.

(b) Electrical equipment subject to arcing or sparking must be installed to minimise the probability of contact with any flammable fluids or vapours that might be present in a free state.

(c) Each generator rated at or more than 6 kilowatts must be designed and installed to minimise the probability of a fire hazard in the event it malfunctions.

(d) In addition, for commuter category airships, if the continued rotation of any accessory remotely driven by the engine is hazardous when malfunctioning occurs, a means to prevent rotation without interfering with the continued operation of the engine must be provided.

(e) The generator cooling provisions must be able to maintain the temperatures of generator components within the established temperature limits during ground and flight operations.

CS 30N.1165 Engine ignition systems

(a) Each battery ignition system must be supplemented by a generator that is automatically available as an alternate source of electrical energy to allow continued energy operation if any battery becomes depleted.

(b) The capacity of batteries and generators must be large enough to meet the simultaneous demands of the engine-ignition system and the greatest demands of any electrical system components that draw from the same source.

(c) The design of the engine-ignition system must account for

(1) The condition of an inoperative generator;

(2) The condition of a completely depleted battery with the generator running at its normal operating speed;

(3) The condition of a completely depleted battery with the generator operating at idling speed if there is only one battery.

(d) There must be means to warn appropriate crewmembers if malfunctioning of any part of the electrical system is causing the continuous discharge of any battery used for engine ignition.

(e) Each turbine engine ignition system must be independent of any other turbine engine ignition system and must be protected from airframe electrical loads and/or faults.

(f) In addition, for commuter category airships, each turbopropeller ignition system must be an essential electrical load.

CS 30N.1167 Vectored thrust controls

If thrust vectoring is provided, the following requirements must be met.

(a) Each vectoring control must be independent of all other controls, if appropriate, and must provide a positive and immediate response.

(b) The vector controls must be readily available to the pilot, and must be such that the pilot can readily and positively select each appropriate thrust position.

(c) If separate vector controls are provided for each propulsion

(1) They must be arranged to allow separate control and simultaneous control of all propulsions;

(2) The airship must be demonstrated to have safe flight characteristics when the vectored thrust units are in the normal flight position on one side and in the fully vectored position on the other, with engines operating at maximum take-off power.

(d) In the event of a vectoring-system failure, an auxiliary means be provided to return the system to a normal-operating position.

CS 30N.1169 Auxiliary power unit controls

Means must be provided at the pilots station for starting, stopping, and emergency shutdown of each installed auxiliary power unit.

POWERPLANT FIRE PROTECTION

CS 30N.1182 Nacelle areas adjacent to engine firewalls

Components, lines, and fittings located adjacent to the engine compartment firewall must be constructed of such materials and located at such distances from the firewall that they will not suffer damage sufficient to endanger the airship if a portion of the engine side of the firewall is subjected to a flame temperature of not less than 1,100°C (2,000°F) for 15 minutes.

CS 30N.1183 Lines, fittings, and components

(a) Except as provided in subparagraph (b) of this paragraph, each component, line, and fitting carrying flammable fluids, gas, or air in any area subject to engine fire conditions must be at least fire resistant, except that flammable fluid tanks and supports which are part of and attached to the engine must be fireproof or be enclosed by a fireproof shield unless damage by fire to any non-fireproof part will not cause leakage or spillage of flammable fluid. Components must be shielded or located so as to safeguard against the ignition of leaking flammable fluids. Flexible hose assemblies (hose and end fittings) must be approved. An integral oil sump of less than 23.7 litres (25 qt) capacity on a reciprocating engine need not be fireproof nor be enclosed by a fireproof shield.

(b) Subparagraph (a) of this paragraph, does not apply to

(1) Lines, fittings, and components which are already approved as part of a type certificated engine;

(2) Vent and drain lines, and their fittings, whose failure will not result in, or add to, a fire hazard.

CS 30N.1188 Ventilation

Each compartment containing any part of the powerplant installation must have provision for ventilation to prevent the accumulation of flammable vapours

CS 30N.1189 Shutoff means

(a) Each engine installation must have means to shut off or otherwise prevent hazardous quantities of fuel, oil, and other flammable liquids from flowing into, within, or through any engine compartment, except in lines, fittings, and components forming an integral part of an engine.

(b) The closing of the fuel shutoff valve for any engine may not make fuel unavailable to the remaining engines.

(c) Operation of any shutoff means may not interfere with the later emergency operation of other equipment such as propeller feathering devices.

(d) Each shutoff must be outside of the engine compartment unless an equal degree of safety is provided with the shutoff inside the compartment.

(e) No hazardous amount of flammable fluid may drain into the engine compartment after shutoff.

(f) There must be means to guard against inadvertent operations of each shutoff means, and to make it possible for the crew to reopen the shutoff means in flight after it has been closed.

(g) Turbine engine installations need not have an engine oil system shutoff if

(1) The oil tank is integral with, or mounted on, the engine;

(2) All oil system components external to the engine are fireproof or located in areas not subject to engine fire conditions.

CS 30N.1191 Firewalls

(a) Each engine, auxiliary-power unit, fuel-burning heater, and other combustion equipment intended for operation in flight, must be isolated from the rest of the airship by firewalls, shrouds, or other equivalent means.

(b) Each firewall or shroud must be constructed so that no hazardous quantity of liquid, gas, or flame can pass from the engine compartment to other part of the airship.

(c) Each opening in the firewall or shroud must be sealed with close-fitting, fireproof grommets, bushings, or firewall fittings.

(d) Each firewall and shroud must be fireproof and protected against corrosion.

(e) Compliance with the criteria for fireproof materials or components, must be shown as follows.

(1) The flame to which the materials or components are subjected must be 1,100°C ±28°C (2,000°F±50°F);

(2) Sheet materials approximately 25 cm (10 in) square must be subjected to the flame from a suitable burner;

(3) The flame must be large enough to maintain the required test temperature over an area approximately 13 cm (5 in) square.

(f) Firewall materials and fittings must resist flame penetration for at least 15 minutes.

(g) The following materials may be used in firewalls or shrouds without being tested as required by this paragraph:

(1) Stainless steel sheet, 0.38 mm (0.015 in) thick;

(2) Mild steel sheet (coated with aluminium or otherwise protected against corrosion), 0.45 mm (0.018 in) thick;

(3) Terne plate, 0.45 mm (0.018 in) thick;

(4) Monel metal, 0.45 mm (0.018 in) thick;

(5) Steel or copper base alloy firewall fittings.

CS 30N.1192 Engine accessory compartment diaphragm

For air-cooled radial engines, the engine power paragraph and all portions of the exhaust system must be isolated from the engine accessory compartment by a diaphragm that meets the firewall requirements of paragraph CS 30N.1191.

CS 30N.1193 Engine cowling

(a) The cowling must be constructed and supported so that it can resist the vibration, inertia, and air loads to which it may be subjected in operation.

(b) There must be means for rapid and complete drainage of each part of the cowling in the normal ground and flight attitudes. No drain may discharge where it will cause a fire hazard.

(c) Cowling must be at least fire-resistant.

(d) All surfaces aft of or near an opening in the engine compartment cowling must be at least fire-resistant for a distance of at least 61 cm (24 in) of the opening.

(e) Each part of the cowling subjected to high temperatures due to its nearness to exhaust-system port or exhaust gas impingement must be fireproof.

(f) Each nacelle of a multiengine airship with supercharged engines must be designed and constructed so that with the landing gear retracted, a fire in the engine compartment will not burn through a cowling or nacelle and enter a nacelle area other than the engine compartment.

(g) In addition, for commuter category airships, the airship must be designed so that no fire originating in any engine compartment can enter, either through openings or by burn-through, any other region where it would create additional hazards.

CS 30N.1195 Fire extinguishing systems

For commuter category airships, fire extinguishing systems must be installed and compliance shown with the following.

(a) Except for combustor, turbine, and tailpipe sections of turbine engine installations that contain lines or components carrying flammable fluids or gases for which a fire originating in these sections is shown to be controllable, a fire extinguisher system must serve each engine compartment.

(b) The fire extinguishing system, the quantity of the extinguishing agent, the rate of discharge, and the discharge distribution must be adequate to extinguish fires. An individual 'one shot' system may be used.

(c) The fire extinguishing system for a nacelle must be able to simultaneously protect each compartment of the nacelle for which protection is provided.

CS 30N.1197 Fire extinguishing agents

For commuter category airships, the following applies.

(a) Fire extinguishing agents must

(1) Be capable of extinguishing flames emanating from any burning of fluids or other combustible materials in the area protected by the fire extinguishing system;

(2) Have thermal stability over the temperature range likely to be experienced in the compartment in which they are stored.

(b) If any toxic extinguishing agent is used, provisions must be made to prevent harmful concentrations of fluid vapours (from leakage during normal operation of the airship or as a result of discharging the fire extinguisher on the ground or in flight) from entering any personnel compartment, even though a defect may exist in the extinguishing system. This must be shown by test except for built-in carbon dioxide fuselage compartment fire extinguishing systems for which

(1) 2.3 kg (5 lb) or less of carbon dioxide will be discharged, under established fire control procedures, into any fuselage compartment; or

(2) Protective breathing equipment is available for each flight crewmember on flight deck duty.

CS 30N.1199 Extinguishing agent containers

For commuter category airships, the following applies.

(a) Each extinguishing agent container must have a pressure relief to prevent bursting of the container by excessive internal pressures.

(b) The discharge end of each discharge line from a pressure relief connection must be located so that discharge of the fire extinguishing agent would not damage the airship. The line must also be located or protected to prevent clogging caused by ice or other foreign matter.

(c) A means must be provided for each fire extinguishing agent container to indicate that the container has discharged or that the charging pressure is below the established minimum necessary for proper functioning.

(d) The temperature of each container must be maintained, under intended operating conditions, to prevent the pressure in the container from

(1) Falling below that necessary to provide an adequate rate of discharge; or

(2) Rising high enough to cause premature discharge.

(e) If a pyrotechnic capsule is used to discharge the extinguishing agent, each container must be installed so that temperature conditions will not cause hazardous deterioration of the pyrotechnic capsule.

CS 30N.1201 Fire extinguishing system materials

For commuter category airships, the following apply.

(a) No material in any fire extinguishing system may react chemically with any extinguishing agent so as to create a hazard.

(b) Each system component in an engine compartment must be fireproof.

CS 30N.1203 Fire detector system

For multiengine turbine powered airships, multiengine reciprocating engine powered airships incorporating turbo-superchargers, and all commuter category airships the following apply.

(a) There must be a means which ensures the prompt detection of a fire in an engine compartment.

(b) Each fire detector must be constructed and installed to withstand the vibration, inertia, and other loads to which it may be subjected in operation.

(c) No fire detector may be affected by any oil, water, other fluids, or fumes that might be present.

(d) There must be means to allow the crew to check, in flight, the functioning of each fire detector electric circuit.

(e) Wiring and other components of each fire detector system in an engine compartment must be at least fire resistant.

CS 30N.1205 Vectored thrust

For airships utilising vectored-thrust systems, the engine exhaust impingement effect on the airship may not cause an increase in the temperature of airship materials or components beyond safe limits.

SUBPART F - EQUIPMENT

GENERAL

CS 30N.1301 Function and installation

Each item of installed equipment must

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

(b) Be labelled as to its identification, function, or operating limitations, or any applicable combination of these factors;

(c) Be installed according to limitations specified for that equipment;

(d) Function properly when installed.

CS 30N.1303 Flight and navigation instruments

The following flight and navigational instruments are required.

(a) An airspeed indicator;

(b) An altimeter (sensitive);

(c) A magnetic direction indicator;

(d) A free air-temperature indicator;

(e) Means to indicate pressure in the envelope and ballonets;

(f) Means for measuring the temperature differential between the lifting gas and the outside air;

(g) A means to indicate the pitch attitude of the airship;

(h) Rate-of-climb indicator.

CS 30N.1305 Powerplant instruments

(a) The following are required powerplant instruments for all airships.

(1) A fuel-quantity indicator for each fuel tank;

(2) An oil-quantity indicator for each oil tank (dipstick or sight gauge);

(3) An oil-pressure indicator for each independent pressure oil system of each engine;

(4) An oil-temperature indicator for each engine and for each turbosupercharger oil system that is separate from other oil systems;

(5) A fire-warning indicator for those airships required to comply with paragraph CS 30N.1195.

(b) For reciprocating engine-powered airships in addition to the powerplant instruments required by subparagraph (a) of this paragraph, the following powerplant instruments are required.

(1) A tachometer for each engine;

(2) A cylinder head temperature indicator for each engine;

(3) A fuel-pressure indicator (to indicate the pressure at which the fuel is supplied) for each pump-fed engine;

(4) A manifold-pressure indicator for each altitude engine;

(5) For turbosupercharger installations, if limitations are established for either carburettor air inlet temperature or exhaust gas temperature, indicators must be furnished for each temperature for which the limitation is established unless it is shown that the limitation will not be exceeded in all intended operations.

(c) For turbine engine-powered airships in addition to the powerplant instruments required by subparagraph (a) of this paragraph, the following powerplant instruments are required.

(1) A gas-temperature indicator for each engine;

(2) A fuel flowmeter for each engine;

(3) A tachometer (to indicate the speed of the rotors with established limiting speeds) for each engine;

(4) A means to indicate, to the flight crew, the operation of each engine starter that can be operated continuously but that is neither designed for continuous operation nor designed to prevent hazard if it failed;

(5) An indicator to indicate the functioning of the powerplant ice-protection system;

(6) An indicator for the fuel strainer or filter required by paragraph CS 30N.997 to indicate the occurrence of contamination of the strainer or filter before it reaches the capacity established in accordance with CS 30N.997(d);

(7) A warning means for the oil strainer or filter required by paragraph CS 30N.1019, if it has no bypass, to warn the pilot of the occurrence of contamination of the strainer or filter screen before it reaches the capacity established in accordance with subparagraph CS 30N.1019(a)(2);

(8) A low oil-pressure warning means for each engine;

(9) An indicator to indicate the proper functioning of any heater used to prevent ice clogging of fuel-system components.

(d) For turbopropeller-powered airships in addition to the powerplant instruments required by subparagraphs (a) and (c) of this paragraph, the following powerplant instruments are required.

(1) A torque indicator for each engine;

(2) Position-indicating means to indicate to the flight crew when the propeller-blade angle is below the flight low pitch position, for each propeller;

(3) A means to indicate to the pilot when the propeller is in reverse pitch, for each reversing propeller.

CS 30N.1306 Miscellaneous equipment instruments

The following are additional required instruments for auxiliary systems, if installed.

(a) Electrical power generating systems:

(1) Volt/load meter for each DC generating system;

(2) Volt/frequency meter for each AC generating system.

(b) Auxiliary-power unit:

(1) Gas producer speed indicator for turbine engines;

(2) A temperature indicator to provide overtemperature protection for turbine engine;

(3) An indicator to show that the APU is operating;

(4) An indicator to indicate APU shutdown when the APU switch is in the 'on' or 'run' position;

(5) A tachometer for reciprocating engines;

(6) A cylinder head temperature indicator for air-cooled reciprocating engines.

(c) Thrust-vectoring system:

(1) A thrust vector angle position indicator for each engine or propeller.

(d) Hydraulic systems:

(1) Hydraulic-quantity gauge for each system (dipstick or sight gauge);

(2) Hydraulic-pressure gauge for each system.

(e) Fly-by-wire / flight control system:

(1) A means to indicate control surface position to the crew relative to commanded position;

(2) A means to indicate to the pilot that the fly-by-wire / flight control system is not functioning properly.

CS 30N.1307 Miscellaneous equipment

The following miscellaneous equipment is required.

(a) A seat or berth for each occupant;

(b) A master switch arrangement;

(c) Electrical protective devices, as prescribed in these regulations.

CS 30N.1309 Equipment, systems, and installations

(a) Each item of equipment, when performing its intended function, may not adversely affect

(1) The response, operation, or accuracy of any equipment essential to safe operation; or

(2) The response, operation, or accuracy of any other equipment unless there is a means to inform the pilot of the effect.

(b) The equipment, systems, and installations of a multiengine airship must be designed to prevent hazards to the airship in the event of a probable malfunction or failure.

(c) The equipment, systems, and installations of a single-engine airship must be designed to minimise hazards to the airship in the event of a probable malfunction or failure.

(d) In addition, for commuter category airships, systems and installations must be designed to safeguard against hazards to the airship in the event of their malfunction or failure. When an installation requires a power supply and the function of that installation is necessary to show compliance with the applicable requirements, the installation must be considered an essential load on the power supply. The power sources and the distribution system must be capable of supplying the following power loads in probable operation combinations and for probable durations.

(1) All essential loads after failure of any prime mover, power converter, or energy storage device;

(2) All essential loads after failure of any one engine on two-engine airships;

(3) In determining the probable operating combinations and durations of essential loads for the power failure conditions described in subparagraphs (d)(1) and (2) of this paragraph, the assumption may be that the power loads are reduced in accordance with a monitoring procedure which is consistent with safety for the types of operations for which approval is requested.

CS 30N.1311 Protection from the effects of HIRF

(reserved)

CS 30N.1316 System lightning protection

(a) For functions whose failure would contribute to or cause a condition that would prevent the continued safe flight and landing of the airship each electrical and electronic system that performs these functions must be designed and installed to ensure that the operation and operational capabilities of the systems to perform these functions are not adversely affected when the airship is exposed to lightning.

(b) For functions whose failure would contribute to or cause a condition that would reduce the capability of the airship or the ability of the flightcrew to cope with adverse operating conditions, each electrical and electronic system that performs these functions must be designed and installed to ensure that these functions can be recovered in a timely manner after the airship is exposed to lightning.

(c) Compliance with the lightning protection criteria prescribed in subparagraphs (a) and (b) of this paragraph must be shown for exposure to a severe lightning environment. The design and the verification must be such that the airship's electrical/electronic systems are protected against the effects of lightning by

(1) Determining to lightning strike zones for the airship;

(2) Establishing the external lightning environment for the zones;

(3) Establishing the international environment;

(4) Identifying all the electrical and electronic systems that are subject to the requirements of this paragraph, and their locations on or within the airship;

(5) Establishing the susceptibility of the systems to the internal and external lightning environment;

(6) Designing protection;

(7) Verifying that protection is adequate.

INSTRUMENTS: INSTALLATION

CS 30N.1321 Arrangement and visibility

(a) Each flight, navigation, envelope and ballonet pressure, and powerplant instrument for use by any pilot must be plainly visible to him from his station with the minimum practicable deviation from his normal position and line of vision when he is looking forward along the flight path.

(b) For each multiengine airship, identical powerplant instruments must be located so as to prevent confusion as to which engine each instrument relates.

(c) Instrument panel vibration may not damage or impair the accuracy of any instrument.

(d) For each airship, intended for operation under Instrument Flight Rules, the flight instruments required by paragraph CS 30N.1303 and, as applicable, by the operating rules must be grouped on the instrument panel and centred as near as practicable about the vertical plane of the pilot's forward vision. In addition

(1) The instrument that most effectively indicates the attitude must be on the panel in the top centre position;

(2) The instrument that most effectively indicates airspeed must be adjacent to and directly to the left of the instrument in the top centre position;

(3) The instrument that most effectively indicates altitude must be adjacent to and directly to the right of the instrument in the top centre position;

(4) The instrument that most effectively indicates direction of flight, other than the magnetic direction indicator, must be adjacent to and directly below the instrument in the top centre position.

(e) If a visual indicator is provided to indicate malfunction of an instrument, it must be effective under all probable cockpit lighting conditions.

CS 30N.1322 Warning, caution, and advisory lights

If warning, caution, or advisory lights are installed in the cockpit, they must, unless otherwise approved by the Agency, be

(a) Red, for warning lights (lights indicating a hazard which requires immediate corrective action);

(b) Amber, for caution lights (lights indicating the possible need for future corrective action);

(c) Green, for safe operation lights;

(d) Any other colour, including white, for light not described in subparagraphs (a) through (c) of this paragraph, provided the colour differs sufficiently from the collars prescribed in subparagraphs (a) through (c) of this paragraph to avoid possible confusion.

CS 30N.1323 Airspeed indicating system

(a) Each airspeed indicating instrument must be calibrated to indicate true airspeed (at sea level with a standard atmosphere) with a minimum practicable instrument calibration error when the corresponding pilot and static pressure are applied.

(b) Each airspeed system must be calibrated in flight to determine the system error. The system error, including position error, but excluding the airspeed indicator instrument calibration error, may not exceed 9.3 km/h (5 knots) throughout the range from 37 km/h (20 knots) to V_{MO}.

(c) Each system must be arranged, so for as practicable, to prevent malfunction or serious error due to the entry of moisture, dirt, or other substances.

CS 30N.1325 Static pressure system

(a) Each instrument provided with static pressure case connections must be so vented that the influence of airship speed, the opening and closing of windows, airflow variations, moisture, or other foreign matter will least affect the accuracy of the instruments except as noted in subparagraph (b)(3) of this paragraph.

(b) If a static pressure system is necessary for the functioning of instruments, systems, or devices, it must comply with the provisions of subparagraphs (1) through (3) of this paragraph.

(1) The design and installation of a static pressure system must be such that

(i) Positive drainage of moisture is provided;

(ii) Chafing of the tubing, and excessive distortion or restriction at bends in tubing, is avoided;

(iii) The materials used are durable and suitable for the purpose intended, and protected against corrosion.

(2) A proof test must be conducted to demonstrate the integrity of the static pressure system in the following manner: Evacuate the static pressure system to a pressure differential of approximately 25 mm (1 in) of mercury or to a reading on the altimeter, 305 m (1,000 feet) above the airship elevation at the time of the test. Without additional pumping for a period of 1 minute, the loss of indicated altitude must not exceed 30 m (100 feet) on the altimeter.

(3) For those airships intended for operation under Instrument Flight Rules or in known icing conditions, and if a static pressure system is provided for any instrument, device, or system required by the operating rules applicable, each static pressure port must be located in such a manner that the correlations between air pressure in the static pressure is not altered when the airship encounters icing conditions. An anti-icing means or an alternate source of static pressure may be used in showing compliance with this requirement. If the reading of the altimeter, when on the alternate static pressure system differs from the reading of the altimeter when on the primary static system by more than 15 m (50 feet), a correction card must be provided for the alternate static system.

(c) Except as provided in subparagraph (d) of this paragraph, if the static pressure system incorporates both a primary and an alternate static pressure source, the means for selecting one or the other source must be designed so that

(1) When either source is selected, the other is blocked off;

(2) Both sources cannot be blocked off simultaneously.

(d) Subparagraph (c)(1) of this paragraph does not apply if it can be demonstrated that the static pressure system calibration, when either static pressure source is selected, is not changed by the other static pressure source being open or blocked.

(e) Each system must be designed and installed so that the error in indicated pressure altitude, at sea level, with a standard atmosphere, excluding instrument calibration error does not result in an error or more than ±9 m (±30 feet) in the speed range between 37 km/h (20 knots) and V_{MO}.

CS 30N.1327 Magnetic direction indicator

(a) Except as provided in subparagraph (b) of this paragraph

(1) Each magnetic direction indicator must be installed so that its accuracy is not excessively affected by the airships vibration or magnetic fields;

(2) The compensated installation may not have a deviation, in level flight, greater than 10° on any heading.

(b) A magnetic nonstabilized direction indicator may deviate more than 10° due to the operation of electrically-powered system such as electrically-heated windshields if either a magnetic stabilised direction indicator, which does not have a deviation in level flight greater than 10° on any heading, or a gyroscopic direction indicator, is installed. Deviations of a magnetic nonstabilized-direction indicator of more than 10° must be placarded in accordance with subparagraph CS 30N.1547(e).

CS 30N.1329 Automatic pilot system

If an automatic pilot system is installed, it must meet the following.

(a) Each system must be designed so that the automatic pilot can

(1) Be quickly and positively disengaged by the pilots to prevent it from interfering with their control of the airship; or

(2) Be sufficiently overpowered by one pilot to let him control the airship.

(b) Unless there is automatic synchronisation, each system must have a means to readily indicate to the pilot the alignment of the actuating device in relation to the control system it operates.

(c) Each manually operated control for the system operation must be readily accessible to the pilot. Each control must operate in the same plane and sense of motion as does the corresponding primary flight control. The direction of motion must be plainly indicated on or near each control.

(d) Each system must be designed and adjusted so that, within the range of adjustment available to the pilot, it cannot produce hazardous loads on the airship or create hazardous deviations in the flight path, under any flight condition appropriate to its use, either during normal operation or in the event of a malfunction, assuming that correction action begins within a reasonable period of time (recognition plus 3 seconds).

(e) Each system must be designed so that a single malfunction will not produce a hardover signal in more than one control axis. If the automatic pilot integrates signals from auxiliary controls or furnishes signals for operation of other equipment, positive interlocks and sequencing of engagement to prevent improper operation are required.

(f) There must be protection against adverse interaction of integrated components, resulting from a malfunction.

(g) If the automatic pilot system can be coupled to airborne navigation equipment, means must be provided to indicate to the flight crew the current mode of operation. Selector switch position is not acceptable as a means of indication.

CS 30N.1330 Electronic flight instrument system (EFIS)

(a) Electronic display units used for attitude and navigation reference may be installed in lieu of mechanical or electromechanical instruments if the display units

(1) Are easily legible under all lighting conditions encountered in the cockpit, including direct sunlight;

(2) Do not inhibit the primary display of attitude;

(3) Incorporate sensory cues for the pilot that are equivalent to those in the instruments being replaced by the electronic display units;

(4) Incorporate visual display of instrument markings required by paragraphs CS 30N.1541 through CS 30N.1553, or visual display that alert the pilot to abnormal operational values, or approaches to unsafe values, of any parameter required to be displayed by these regulations.

(b) The display units, including their systems and installations, must be designed so that one display of information essential to continued safe flight and landing will remain available to the crew, without need for immediate action for continued safe operation, after any single failure or probable combination of failures under any anticipated operating condition, or it must be shown that such failures are extremely improbable.

(c) Electronic display indicators required by subparagraphs CS 30N.1303(a), (b), and (c) must be independent of the airship's electrical power system.

CS 30N.1331 Instruments using a power supply

For each instrument that uses a power supply, there must be a visual means to indicate when power adequate to sustain proper instrument performance is not being supplied. The power must be measured at or near the point where it enters the instruments, for electrical instruments, the power is considered adequate when the voltage is within approved limits.

CS 30N.1335 Flight director systems

If a flight director system is installed, means must be provided to indicate to the flight crew its current mode of operation. Selector switch position is not acceptable as a means of indication.

CS 30N.1337 Powerplant instruments

(a) Instruments and instrument lines.

(1) Each powerplant instrument line must meet the requirements of paragraph CS 30N.993.

(2) Each line carrying flammable fluids under pressure must

(i) Have restricting orifices or other safety devices at the source of pressure to prevent the escape of excessive fluid if the line fails;

(ii) Be installed and located so that the escape of fluids would not create a hazard.

(3) Each powerplant instrument that utilises flammable fluids must be installed and located so that the escape of fluid would not create a hazard.

(b) Fuel quantity indicator. There must be a means to indicate to the flight crew members the quantity of fuel in each tank during flight. An indicator, calibrated in litres (gallons), kilograms (pounds), or equivalent units, and clearly marked to indicate which scale is being used, may be used. In addition

(1) Each fuel-quantity indicator must be calibrated to read 'zero' during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply determined under paragraph CS 30N.959;

(2) Each exposed sight gauge used as a fuel-quantity indicator must be protected against damage;

(3) Tanks with interconnected outlets and airspaces may be considered as one tank and need not have separate indicators;

(4) No fuel-quantity indicator is required for a small auxiliary tank that is used only to transfer fuel to other tanks if the relative size of the tank, the rate of fuel transfer, and operating instructions are adequate to

(i) Guard against overflow;

(ii) Give the flight crew members prompt warning if transfer is not proceeding as planned.

(c) Fuel flow meter system. If a fuel flow meter system is installed, each metering component must have a means to bypass the fuel supply if malfunctioning of that component severely restricts fuel flow.

(d) Oil-quantity indicator. There must be a means to indicate the quantity of oil in each tank

(1) On the ground (such as by a stick gauge);

(2) In flight, to the flight crew members, if there is an oil transfer system, or a reserve oil-supply system.

ELECTRICAL SYSTEMS AND EQUIPMENT

CS 30N.1351 General

(a) Electrical system capacity. Each electrical system must be adequate for the intended use. In addition:

(1) Electrical power sources, their transmission cables, and their associated control and protective devices, must be able to furnish the required power at the proper voltage to each load circuit essential for safe operation;

(2) Compliance with subparagraph (1) of this paragraph must be shown by an electrical load analysis, or by electrical measurements, that account for the electrical loads applied to the electrical system in probable combinations and for probable durations.

(b) Functions. For each electrical system, the following apply.

(1) Each system, when installed, must be

(i) Free from hazards in itself, in its method of operation, and in its effects on other parts of the airship;

(ii) Protected from fuel, oil, water, other detrimental substances, and mechanical damage;

(iii) So designed that the risk of electrical shock to crew, passengers, and ground personnel is reduced to a minimum.

(2) Electrical power sources must function properly when connected in combination or independently.

(3) No failure or malfunction of any electrical-power source may impair the ability of any remaining source to supply load circuits essential for safe operation.

(4) Each electric power source control must allow the independent operation of each source, except that controls associated with alternators that depend on a battery for initial excitation or for stabilisation need not break the connection between the alternator and its battery.

(5) In addition, for commuter category airships, the following apply.

(i) Each system must be designed so that essential load circuits can be supplied in the event of reasonably probable faults or open circuits including faults in heavy current carrying cables;

(ii) A means must be accessible in flight to the flight crewmembers for the individual and collective disconnection of the electrical power sources from the system;

(iii) The system must be designed so that voltage and frequency, if applicable, at the terminals of all essential load equipment can be maintained within the limits for which the equipment is designed during any probable operating conditions;

(iv) If two independent sources of electrical power for particular equipment or systems are required, their electrical energy supply must be ensured by means such as duplicate electrical equipment, throwover switching, or multichannel or loop circuits separately routed;

(v) For the purpose of complying with subparagraph (b)(5) of this paragraph, the distribution system includes the distribution busses, their associated feeders, and each control and protective device.

(c) Generating system. There must be at least one generator if the electrical system supplies power to load circuits essential for safe operation. In addition

(1) Each generator must be able to deliver its continuous rated power;

(2) Generator voltage control equipment must be able to regulate the generator output within rated limits;

(3) Each generator must have a reverse current cut-out designed to disconnect the generator from the battery and from the other generators when enough reverse current exists to damage that generator;

(4) There must be a means to give immediate warning to the flight crew of a failure of any generator;

(5) Each generator must have an over voltage control designed and installed to prevent damage to the electrical system, or to equipment supplied by the electrical system, that could result if that generator were to develop an over voltage condition.

(d) Instruments. There must be a means to indicate to appropriate flight crew members the electric power system quantities essential for safe operation. For direct current systems, an ammeter that can be switched into each generator feeder may be used and if there is only one generator, the ammeter may be in the battery feeder. For commuter category airships, the essential electric power system quantities include the voltage and current supplied by each generator.

(e) Fire resistance. Electrical equipment must be so designed and installed that in the event of a fire in the engine compartment, during which the surface of the firewall adjacent to the fire is heated to 1,100°C (2,000°F) for 5 minutes or to a lesser temperature substantiated for the product, the equipment essential to continued safe operation and located behind the firewall will function satisfactorily and will not create an additional fire hazard.

(f) External power. If provisions are made for connecting external power to the airship, and that external power can be electrically connected to equipment other than that used for engine starting, means must be provided to ensure that no external power supply having a reverse polarity, or a reverse-phase sequence, can supply power to the airship's electrical system.

(g) Electrical/electronic equipment and systems. Each piece of electrical/electronic equipment or systems installed in the airship must be shown through electromagnetic interference and electromagnetic compatibility tests to function properly and not interfere with any other piece of equipment or system aboard the airship.

(h) Operation without normal electrical power. The following apply:

(1) Unless it can be shown that the loss of the normal electrical power generating system(s) is extremely improbable, alternate high integrity electrical power system(s), independent of the normal electrical power generating system(s), must be provided to power those services necessary to complete a flight and make a safe landing.

(2) The services to be powered must include:

(i) Those required for immediate safety and which must continue to operate following the loss of the normal electrical power generating system(s), without the need for flight crew action;

(ii) Those required for continued controlled flight; and

(iii) Those required for descent, approach and landing.

(3) Failures, including junction box, control panel or wire bundle fires, which would result in the loss of the normal and alternate systems must be shown to be extremely improbable.

(g) Operation without normal electrical power. The following apply:

(1) Unless it can be shown that the loss of the normal electrical power generating system(s) is extremely

improbable, alternate high integrity electrical power system(s), independent of the normal electrical power generating system(s), must be provided to power those services necessary to complete a flight and make a safe landing.

(2) The services to be powered must include:

(i) Those required for immediate safety and which must continue to operate following the loss of the normal electrical power generating system(s), without the need for flight crew action;

(ii) Those required for continued controlled flight; and

(iii) Those required for descent, approach and landing.

(3) Failures, including junction box, control panel or wire bundle fires, which would result in the loss of the normal and alternate systems must be shown to be extremely improbable.

CS 30N.1353 Storage battery design and installation

(a) Each storage battery must be designed and installed as prescribed in this paragraph.

(b) Safe cell temperatures and pressures must be maintained during any probable charging and discharging condition. No uncontrolled increase in cell temperature may result when the battery is recharged (after previous complete discharge)

(1) At maximum regulated voltage or power;

(2) During a flight of maximum duration;

(3) Under the most adverse cooling condition likely to occur in service.

(c) Compliance with subparagraph (b) of this paragraph must be shown by tests unless experience with similar batteries and installations has shown that maintaining safe cell temperatures and pressures presents no problem.

(d) No explosive or toxic gases emitted by any battery in normal operation, or as the result of any probable malfunction in the charging system or battery installation, may accumulate in hazardous quantities within the airship.

(e) No corrosive fluids or gases that may escape from the battery may damage surrounding structures or adjacent essential equipment.

(f) Each nickel cadmium battery installation capable of being used to start an engine or auxiliary power unit must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

(g) Nickel cadmium battery installations capable of being used to start an engine or auxiliary power unit must have

(1) A system to control the charging rate of the battery automatically to prevent battery overheating; or

(2) A battery temperature sensing and over-temperature warning system with a means for disconnecting the battery from its charging source in the event of an over-temperature condition; or

(3) A battery failure sensing and warning system with a means for disconnecting the battery from its charging source in the event of battery failure.

CS 30N.1357 Circuit protective devices

(a) Protective devices, such as fuses or circuit breakers, must be installed in all electrical circuits other than

(1) The main circuits of starter motors;

(2) Circuits in which no hazard is presented by their mission.

(b) A protective device for a circuit essential to flight safety my not be used to protect any other circuit.

(c) Each resettable circuit protective device ('trip free' device in which the tripping mechanism cannot be overridden by the operating control) must be designed so that

(1) A manual operation is required to restore service after tripping;

(2) If an overload or circuit fault exists, the device will open the circuit regardless of the position of the operating control.

(d) If the ability to reset a circuit breaker or replace a fuse is essential to safety in flight, that circuit breaker or fuse must be so located and identified that it can be readily reset or replaces in flight.

(e) If fuses are used, there must be one spare of each rating, or 50% spare fuses of each rating, whichever is greater.

CS 30N.1361 Master switch arrangement

(a) There must be a master switch arrangement to allow ready disconnection of electric power sources from the main bus. The point of disconnection must be adjacent to the sources controlled by the switch.

(b) Load circuits may be connected so that they remain energised after the switch is opened, if they are protected by circuit protective devices, rated at five amperes or less, adjacent to the electric power source. These circuits must be isolated, or physically shielded, to prevent their igniting flammable fluids or vapours that might be liberated by the leakage or rupture of flammable fluid systems.

(c) The master switch or its controls must be so installed that the switch is easily discernible and accessible to a crew member in flight.

CS 30N.1365 Electric cables and equipment

(a) Each electric connecting cable must be of adequate capacity.

(b) Each cable and associated equipment that would overheat in the event or circuit overload or fault must be at least flame resistant and may not emit dangerous quantities of toxic fumes.

CS 30N.1367 Switches

Each switches must be

(a) Able to carry it rated current;

(b) Constructed with enough distance or insulating material between current carrying parts and the housing so that vibration in flight will not cause shorting:

(c) Accessible to appropriate flight crew members;

(d) Labelled as to operation and the circuit controlled.

LIGHTS

CS 30N.1381 Instrument lights

(a) The instrument lights must

(1) Make each instrument and control easily readable and discernible;

(2) Be installed so that their direct rays, and any reflections caused directly or indirectly from it are shielded from the pilot's eyes;

(3) Have enough distance or insulating material between current-carrying parts and the housing so that vibration in flight will not cause shorting.

(b) A cabin dome light is not an instrument light.

CS 30N.1383 Landing lights

(a) Each installed landing light must be acceptable.

(b) Each landing light must be installed so that

(1) No dangerous glare is visible to the pilot;

(2) The pilot is not seriously affected by halation;

(3) It provides enough light for night landing.

CS 30N.1385 Position light system installation

(a) General. Each part of each position light system must meet the applicable requirements of this paragraph and each system as a whole must meet the requirements of paragraphs CS 30N.1387 through CS 30N.1397.

(b) Bow position light. The bow position light must be a white light mounted as for forward as possible on the envelope and must be approved.

(c) Forward position lights. Forward position lights must consist of a red and green light spaces laterally as far apart as practicable and installed forward on the airship so that, with the airship in the normal flying position, the red light is on the left side and the green light in on the right side. Each light must be approved.

(d) Rear position light. The rear position light must be a white light mounted as far aft a practicable on the tail and must be approved.

(e) Circuit. The bow position light, the two forward position light, and the rear position light must make a single circuit.

(f) Light covers and colour filters. Each light cover or colour filter must be at least flame resistant and may not change colour or shape or lose any appreciable light transmission during normal use.

CS 30N.1387 Position light system dihedral angles

(a) Except as provide in subparagraph (f) of this paragraph, each bow, forward, and rear position light must, as installed, show unbroken light within the dihedral angles described in this paragraph.

(b) Dihedral angle F (forward) is formed by two intersecting vertical planes making angles of 110° to the right and to the left, resp., to a vertical plane passing through the longitudinal axis, as viewed when looking forward along the longitudinal axis.

(c) Dihedral angle L (left) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the airship, and the other at 110° to the left of the first, as viewed when looking forward along the longitudinal axis.

(d) Dihedral angle R (right) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the airship, and the other at 110° to the left of the first, as viewed when looking forward along the longitudinal axis.

(e) Dihedral angel A (aft) is formed by two intersecting vertical planes making angels of 70° to the right and to the left, resp., to a vertical plane passing through the longitudinal axis, as viewed when looking aft along the longitudinal axis.

(f) If the rear position light, when mounted as far aft a practicable in accordance with subparagraph CS 30N.1385(d), cannot show unbroken light within dihedral angel A (as defined in subparagraph (d) of this paragraph), a solid angle or angles of obstructed visibility totalling not more than 0.04 steradians is allowable within that dihedral angle, if such solid angle is within a cone whose apex is at the rear position light and whose elements make an angle of 30° with a vertical line passing through the rear position light.

CS 30N.1389 Position light distribution and intensities

(a) General. The intensities prescribed in this paragraph must e provided by new equipment with each light cover and colour filter in place. Intensities must be determined with the light source operating at a steady value equal to the average luminous output of the source at the normal operating voltage of the airship. The light distribution and intensity of each position light must meet the requirements of subparagraph (b) of this paragraph.

(b) Bow, forward and rear position lights. The light distribution and intensities of bow, forward, and rear position light must be expressed in terms of minimum intensities in the horizontal plane, minimum intensities in any vertical plane, and maximum intensities in overlapping beams, within dihedral angles F, L, R, and A, and must meet the following requirements.

(1) Intensities in the horizontal plane. Each intensity in the horizontal plane (a plane containing the longitudinal axis of the airship and perpendicular to the plane of symmetry of the airship) must equal or exceed the values in paragraph CS 30N.1391.

(2) Intensities in any vertical plane. Each intensity in any vertical plane (a plane perpendicular to the horizontal plane) must equal or exceed the appropriate value in paragraph CS 30N.1393, where I is the minimum intensity prescribed in paragraph CS 30N.1391 for the corresponding angles in the horizontal plane.

(3) Intensities in overlaps between adjacent signals. No intensity in any overlap between adjacent signals may exceed the values in paragraph CS 30N.1395, except that higher intensities in overlaps may be used with main beam intensities substantially greater than the minimum specified in paragraphs CS 30N.1391 and 1393, if the overlap intensities in relation to the main beam intensities do not adversely affect signal clarity. When the peak intensity of the forward position lights is more than 100 cd (candles), the maximum overlap intensities between them may exceed the values in paragraph CS 30N.1395 if the overlap intensity in Area A is not more than 10% of peak position light intensity and the overlap intensity in Area B is not more than 2.5% of peak position light intensity.

(c) Bow or rear position light installation. A single-position light may be installed in a position displaced laterally from the plane of symmetry of an airship if

(1) The axis of the maximum cone of illumination is parallel to the flight path in level flight;

(2) There is no obstruction aft of the light and between planes 70° to the right and left of the axis of

maximum illumination.

CS 30N.1391 Minimum intensities in the horizontal plane of bow, forward, and rear position lights

Each position light intensity must equal or exceed the applicable values in Table 10 of the appendix.

CS 30N.1393 Minimum intensities in any vertical plane of bow, forward, and rear position lights

Each position light intensity must equal or exceed the applicable values in Table 11 of the appendix.

CS 30N.1395 Maximum intensities in overlapping beams of forward and rear position light

No position light intensity may exceed the applicable values in the Table 12 of the appendix, except as provided in subparagraph CS 30N.1389(b)(3).

CS 30N.1397 Colour specifications

Each position light colour must have the applicable International Commission on Illumination chromaticity coordinates as follows, where y_0 is the y-coordinate of the Planckian radiator for the value of x considered.

(a) Aviation red.
y is not greater than 0.335; and
z is not greater than 0.002.

(b) Aviation green.
x is not greater than 0.440 - 0.320 y;
x is not greater than y - 0.170; and
y is not less than 0.390 - 0.170 x.

(c) Aviation white.
x is not less than 0.300 and not greater than 0.540;
y is not less than x - 0.040 or y0 - 0.010, whichever is the smaller; and
y is not greater than x + 0.020 nor 0.636 - 0.400 x.

CS 30N.1401 Anticollision light system

(a) General. If certification for night operation is requested, the airship must have an anticollision light system that

(1) Consists of one or more approved anticollision lights located so that their light will not impair the flight crew members vision or detract from the conspicuity of the position lights;

(2) Meets the requirements of subparagraphs (b) through (f) of this paragraph.

(b) Field of coverage. The system must consist of enough lights to illuminate the vital areas around the airship, considering the physical configuration and flight characteristics of the airship. The field of coverage must extend in each direction within at least 75° above and 75° below the horizontal plane of the airship, except that there may be solid angles of obstructed visibility totalling not more than 0.5 steradians.

(c) Flashing characteristics. The arrangement of the system, that is, the number of light sources, beam width, speed of rotation, and other characteristics, must give an effective flash frequency of not less than 40, nor frequency at which the airship's complete anticollision light system is observed from a distance, and applies to each sector of light including any overlaps that exist when the system consists of more than one light source. In overlaps, flash frequencies may exceed 100, but not 180, cycles per minute.

(d) Colour. Each anticollision light must be either aviation red or aviation white and must meet the applicable requirements of paragraph CS 30N.1397.

(e) Light intensity. The minimum light intensities in any vertical plane, measured with the red filter (if used) and expressed in terms of 'effective' intensities, must meet the requirements of subparagraph (f) of this paragraph. The following relation must be assumed.

$$I_E = \frac{\int_{t_1}^{t_2} I(t)dt}{0.2 + (t_2 - t_1)},3$$

where

I_E effective intensity (candela),
$I(t)$ instantaneous intensity as a function of time,

t_2-t_1 flash time interval (seconds).

Normally, the maximum value of effective intensity is obtained when t_2 and t_1 are chosen so that the effective intensity is equal to the instantaneous intensity at $t_2$and t_1.

(f) Minimum effective intensities for anticollision lights. Each anticollision light effective intensity must equal exceed the applicable values in Table 13 of the appendix.

SAFETY EQUIPMENT

CS 30N.1411 General

(a) Required safety equipment to be used by the flight crew in an emergency, such as automatic life raft releases, must be readily accessible.

(b) Stowage provisions for required safety equipment must be furnished and must

(1) Be arranged so that the equipment is directly accessible and its location obvious;

(2) Protect the safety equipment from damage caused by being subjected to the inertia loads specified in paragraph CS 30N.561.

CS 30N.1413 Safety belts

(a) The rated strength of safety belts may not be less than that corresponding with the ultimate load factors specified in paragraph CS 30N.561 considering the dimensional characteristics of the belt installation for the specific seat or berth arrangement.

(b) For safety belts for berths parallel to the longitudinal axis of the airship, the forward load factor specified in paragraph CS 30N.561 need not be applied.

(c) Each safety belt must be equipped with a metal to metal latching device.

CS 30N.1414 Electrostatic discharge equipment

A means must be provided for electrostatic discharge during landing and ground handling and while the airship is on the ground.

CS 30N.1415 Ditching equipment

If certification with ditching provisions is requested, the airship must meet the requirements of this paragraph.

(a) Emergency flotation and signalling equipment required by the rules under which the airship is operated must be installed so that it is readily available to the crew and passengers.

(b) Each raft and each lift preserver must be approved.

(c) Each raft released from the airship must be attached to the airship by a line to keep it near the airship. This line must be designed to break before submerging the empty raft to which it is attached.

(d) Each signalling device required by any operating rule must be accessible, function satisfactorily, and must be free of any hazard in its operation.

CS 30N.1419 Ice protection equipment

If certification with ice protection provisions is desired, compliance with the following requirements must be shown.

(a) The recommended procedures for the use of the ice protection equipment must be set forth in the Airship Flight Manual.

(b) An analysis must be performed to establish, on the basis of the airship's operational needs, the adequacy of the ice protection system for the various components of the airship. In addition, tests of the ice protection system must be conducted to demonstrate that the airship is capable of operating safely in continuous maximum and intermittent maximum icing conditions as described in FAR Part 25 Appendix C.

(c) Compliance with all or portions of this paragraph may be accomplished by reference, where applicable because of similarity of the designs, to analysis and tests performed for the type certification of a type-certificated airship.

(d) If night operation is desired and when monitoring of external portions of the airship by the flight crew is required for proper operation of the ice protection equipment, external lighting must be provided which is adequate to enable the monitoring to be done at night.

MISCELLANEOUS EQUIPMENT

CS 30N.1431 Electronic equipment

(a) In showing compliance with paragraph CS 30N.1309 with respect to radio and electronic equipment and their installations, critical environmental conditions must be considered.

(b) Radio and electronic equipment, controls, and wiring must be installed so that operation of any unit or system of units will not adversely affect the simultaneous operation of any other radio or electronic unit, or system of units, required by any applicable aviation rule or regulation.

CS 30N.1435 Hydraulic systems

(a) Design. Each hydraulic system must be designed as follows.

(1) Each hydraulic system and its elements must withstand, without yielding, the structural loads expected in addition to hydraulic loads.

(2) A means to indicate the pressure in each hydraulic system which supplies two or more primary function must be provided to the flight crew.

(3) There must be means to ensure that the pressure, including transient (surge) pressure, in any part of the system will not exceed the safe limit above design operating pressure and to prevent excessive pressure resulting from fluid volumetric changes in all lines which are likely to remain closed long enough for such changes to occur.

(4) The minimum design burst pressure must be 2.5 times the operating pressure.

(b) Tests. Each system must be substantiated by proof pressure tests. When proof tested, no part of any system may fail, malfunction, or experience a permanent set. The proof load of each system must be at least 1.5 times the maximum operating pressure of that system.

(c) Accumulators. No hydraulic accumulator or pressurised reservoir may be installed on the engine side of any firewall, unless it is an integral part of an engine or propeller.

CS 30N.1437 Accessories for multiengine airships

For multiengine airships, engine-driven accessories essential to safe operation must be distributed among two or more engines so that the failure of any one engine will not impair safe operation through the malfunctioning of these accessories.

CS 30N.1438 Pressurisation and pneumatic systems

The following requirements apply to all pressurisation and pneumatic systems in the airship except those systems dedicated to the pressurisation of the envelope and ballonets.

(a) Pressurisation system elements must be burst pressure tested to 2 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(b) Pneumatic system elements must be burst pressure tested to 3 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(c) An analysis, or a combination of analysis and test may be substituted for any test required by subparagraph (a) or (b) of this paragraph if the Agency finds it equivalent to the required test.

CS 30N.1461 Equipment containing high energy rotors

(a) Equipment containing high energy rotors must meet subparagraph (b), (c), or (d) of this paragraph.

(b) High energy rotors contained in equipment must be able to withstand damage caused by malfunctions, vibration, abnormal speeds, and abnormal temperatures. In addition

(1) Auxiliary rotor cases must be able to contain damage caused by the failure of high energy rotor blades;

(2) Equipment control devices, systems, and instrumentation must reasonably ensure that no operating limitations affecting the integrity of high energy rotors will be exceeded in service.

(c) It must be shown by test that equipment containing high energy rotors can contain any failure of a high energy rotor that occurs at the highest speed obtainable with the normal speed control devices inoperative.

(d) Equipment containing high energy rotors must be located where rotor failure will neither endanger the occupants nor adversely affect continued safe flight.

SUBPART G - OPERATING LIMITATIONS AND INFORMATION

CS 30N.1501 General

(a) Each operating limitation specified in paragraphs CS 30N.1505 through CS 30N.1528 and other limitations and information necessary for safe operation must be established.

(b) The operating limitations and other information necessary for safe operation must be made available to the crew members as prescribed in paragraphs CS 30N.1541 through CS 30N.1589.

OPERATING LIMITATIONS

CS 30N.1505 Airspeed limitations

(a) The maximum operating limit speed, V_{MO}, must be established as a speed that may not be deliberately exceeded in any regime of flight (climb, cruise, or descent). V_{MO} must be established so that it is not greater than V_H.

(b) The maximum landing gear operating speed, V_{LO}, may not exceed the speed determined under paragraph CS 30N.729 or by flight characteristics.

CS 30N.1519 Weight and centre of gravity

The weight and centre of gravity limitations determined under paragraph CS 30N.23 must be established as operating limitations. This includes the maximum take-off weight, maximum landing weight, maximum car weight, and maximum permissible static heaviness and static lightness.

CS 30N.1521 Powerplant limitations

(a) General. The powerplant limitations prescribed in this paragraph must be established so that they do not exceed the corresponding limits for which the engines or propellers are either approved or type certificated.

(b) Take-off operation. The powerplant take-off operation must be limited by

(1) The maximum rotational speed (r.p.m.);

(2) The maximum allowable manifold pressure (for reciprocating, altitude engines);

(3) The maximum allowable gas temperature (for turbine engines);

(4) The time limit for the use of the power or thrust corresponding to the limitations established in subparagraphs (1) through (3) of this paragraph;

(5) If the time limit in subparagraph (4) of this paragraph exceeds 2 minutes, the maximum allowable cylinder head (as applicable), oil, and liquid coolant temperatures.

(c) Continuous operation. The continuous operation must be limited by

(1) The maximum rational speed;

(2) The maximum allowable manifold pressure (for reciprocating, altitude engines);

(3) The maximum allowable gas temperature (for turbine engines);

(4) The maximum allowable cylinder head (as applicable), oil, and liquid coolant temperatures.

(d) Fuel grade or designation. The minimum fuel grade (for reciprocating engines) or fuel designation (for turbine engines) must be established so that it is not less than that required for the operation of the engines within the limitations of subparagraphs (b) and (c) of this paragraph.

(e) Ambient temperature. For turbine engines, ambient temperature limitations (including limitations for winterization installations if applicable) must be established as the maximum ambient atmospheric temperature at which compliance with the cooling provisions is shown.

CS 30N.1522 Auxiliary power unit limitations

If an auxiliary power unit is installed in the airship, the limitations established for that auxiliary power unit must be specified as operating limitations for the airship. These operating limitations must include, at least, the following.

(a) Maximum speed for the gas producer of turbine engines;

(b) Maximum temperatures for overtemperature protection for turbine engines;

(c) Maximum speed for reciprocating engines;

(d) Maximum cylinder head temperature for air-cooled reciprocating engines.

CS 30N.1523 Minimum flight crew

The minimum flight crew must be established so that it is sufficient for safe operation considering

(a) The workload on individual crew members;

(b) The accessibility and ease of operation of necessary controls by the appropriate crew members;

(c) The kinds of operation authorised under paragraph CS 30N.1525.

CS 30N.1524 Maximum passenger-seating configuration

The maximum passenger-seating configuration must be established.

CS 30N.1525 Kinds of operation

The kinds of operation to which the airship is limited are established by the category in which it is eligible for certification and by the installed equipment.

CS 30N.1526 Maximum rates of ascent and descent

The maximum rates of ascent and descent determined under subparagraphs CS 30N.65(b) through CS 30N.65(d) must be established.

CS 30N.1527 Engine vectoring

The maximum engine vectoring angles to which operation is allowed, as limited by flight, structural, powerplant, and functional requirements, must be established.

CS 30N.1528 Envelope and ballonet pressures

Operating pressure limitations for the envelope and ballonets, as limited by flight, structural, and functional, must be established, and must include the following.

(a) Maximum and minimum operating pressure in the envelope;

(b) Maximum operating pressure in the ballonets.

CS 30N.1529 Instructions for continued airworthiness

Instructions for Continued Airworthiness must be prepared in accordance with FAR Part 23 Appendix G, as appropriate, that are acceptable to the Agency. The instructions may be incomplete at type certification if a program exists to ensure their completion prior delivery of the first airship or issuance of a standard certificate of airworthiness whichever occurs later.

MARKINGS AND PLACARDS

CS 30N.1541 General

(a) The airship must contain

(1) The specified markings and placards;

(2) Any additional information, instrument markings, and placards required for the safe operation of the airship.

(b) Each marking and placard prescribed in subparagraph (a) of this paragraph

(1) Must be displayed in a conspicuous place;

(2) May not be easily erased, disfigured, or obscured.

CS 30N.1543 Instrument markings: general

For each instrument

(a) When markings are on the cover glass of the instrument, there must be means to maintain the correct alignment of the lass cover with the face of the dial;

(b) Each arc and line must be wide enough and located to be clearly visible to the pilot;

(c) When digital instruments are used, an analogue trend indication must be provided unless, it is determined that the trend indicator advantages of an analogue indicator are not needed. The limiting values must be marked on the analogue indicator, if an analogue indicator is needed.

CS 30N.1545 Airspeed indicator

There must be a radial red line marking for V_{MO} made at the lowest value of V_{MO} established for any altitude up to the maximum operating altitude for the airship.

CS 30N.1547 Magnetic direction indicator

(a) A placard meeting the requirements of this paragraph must be installed on or near the magnetic direction indicator.

(b) The placard must show the calibration of the instruments in level flight with the engines operating.

(c) The placard must state whether the calibration was made with radio receivers on or off.

(d) Each calibration reading must be in terms of magnetic heading in not more than 30° increments.

(e) If a magnetic nonstabilized direction indicator can have a deviation of more than 10° caused by the operation of electrical equipment, the placard must state which electrical loads, or combination of loads, would cause a deviation of more than 10° when turned on.

CS 30N.1549 Powerplant and auxiliary power unit instruments

For each required powerplant and auxiliary power unit instrument, as appropriate to the type of instrument

(a) Each maximum and, if applicable, minimum safe operating limit must be marked with a red radial or a red line;

(b) Each normal operating range must be marked with a green arc or green line, not extending beyond the maximum and minimum safe limits;

(c) Each take-off and precautionary range must be marked with a yellow arc or a yellow line;

(d) Each engine, auxiliary power unit, or propeller speed range that is restricted because of excessive vibration stresses must be marked with red arcs or red lines.

CS 30N.1551 Oil quantity indicator

Each oil quantity indicator must be marked in sufficient increments to indicate readily and accurately the quantity of oil.

CS 30N.1553 Fuel quantity indicator

If the unusable fuel supply for any tank exceed 3.8 litres (1 gal), or 5% of the tank capacity, whichever is greater, a red arc must be marked on its indicator extending from the calibrated zero reading to the lowest reading obtainable in level flight.

CS 30N.1555 Control markings

(a) Each cockpit control, other than primary flight controls and controls whose function is obvious, must be plainly marked as to its function and method of operation.

(b) Each secondary control must be suitably marked.

(c) For powerplant fuel controls

(1) Each fuel tank selector control must be marked to indicate the position corresponding to each tank and to each existing cross feed position;

(2) If safe operation requires the use of any tanks in a specific sequence, that sequence must be marked on or near the selector for those tanks;

(3) The conditions under which the full amount of usable fuel in any restricted usage fuel tank can safely be used must be stated on a placard adjacent to the selector valve for that tank;

(4) Each valve control for any engine of a multiengine airship must be marked to indicate the position corresponding to each engine controlled.

(d) Usable fuel capacity must be marked as follows.

(1) For fuel systems having no selector controls, the usable fuel capacity of the system must be indicated at the fuel quantity indicator.

(2) For fuel systems having selector controls, the usable fuel capacity available at each selector control position must be indicated near the selector control.

(e) For accessory, auxiliary, and emergency controls

(1) If retractable landing gear is used, the indicator required by subparagraph CS 30N.729(e) must be marked so that the pilot can, at any time, ascertain that the wheels are secured in the extreme positions;

(2) Each emergency control must be red and must be marked as to method of operation.

CS 30N.1557 Miscellaneous markings and placards

(a) Baggage and cargo compartments, and ballast location. Each baggage and cargo compartment, and each ballast location, must have a placard stating any limitations on contents, including weight, that are necessary under the loading requirements.

(b) Seats. If the maximum allowable weight to be carried in a seat is less than 77 kg (170 lb), a placard stating the lesser weight must be permanently attached to the seat structure.

(c) Fuel and oil filler openings. The following apply.

(1) Fuel filler openings must be marked to or near the filler cover with

(i) The word 'FUEL';

(ii) For reciprocating engine-powered airships, the minimum fuel grade;

(iii) For turbine engine-powered airships, the permissible fuel designations;

(iv) For pressure fuelling systems, the maximum permissible fuelling supply pressure and the maximum permissible defuelling pressure.

(2) Oil filter openings must be marked to or near the filler cover with the word 'oil', the oil capacity, and the approved grade and specification of oil.

(d) Emergency exit placards. Each placard and operating control for each emergency exit must be red. A placard must be near each emergency exit control an must clearly indicate the location of that exit and its method of operation.

(e) The system voltage of each direct current installation must be clearly marked adjacent to its external power connection.

(f) Unusable fuel. If the unusable fuel supply in any tank exceeds 5% of the tank capacity, or 3.8 litres (1 gal), whichever is greater, a placard must be installed next to the fuel quantity indicator for that tank, stating that the fuel remaining when the quantity indicator reads 'zero' in level flight cannot be used safely in flight.

CS 30N.1559 Operating limitations placard

There must be a placard in clear view of the pilot that specifies the kind of operations (such as VFR, IFR, day, or night) and meteorological conditions (such as icing conditions) to which the operation of the airship is limited, or from which it is prohibited, by the equipment installed.

CS 30N.1561 Safety equipment

(a) Safety equipment must be plainly marked as to method of operation.

(b) Stowage provisions for required safety equipment must be marked for the benefit of the occupants.

CS 30N.1563 Airspeed placard

There must be an airspeed placard in clear view of the pilot and as close as practicable to the airspeed indicator. This placard must list the maximum landing gear operating speed V_{LO}.

AIRSHIP FLIGHT MANUAL

CS 30N.1581 General

(a) Furnishing information. An Airship Flight Manual and an Airship Ground Handling Manual, for ground handling procedures, must be furnished with each airship, and they must contain the following.

(1) Information required by paragraphs CS 30N.1583 through CS 30N.1589;

(2) Other information that is necessary for safe operation because of design, operating, or handling characteristics.

(b) Approved information.

(1) Except as provided in subparagraph (b)(2) of this paragraph, each part of the Airship Flight Manual containing information prescribed in paragraphs CS 30N.1583 through CS 30N.1589 must be approved, segregated, identified, and clearly distinguished from each unproved part of that manual.

(2) The requirements of subparagraph (b)(1) of this paragraph do not apply if the following is met.

(i) Each part of the Airship Flight Manual containing information prescribed in paragraph CS 30N.1583 must be limited to such information, and must be approved, identified, and clearly distinguished from each other part of the Airship Flight Manual.

(ii) The information prescribed in paragraphs CS 30N.1585 through CS 30N.1589 must be determines in accordance with the applicable requirements of these regulations and presented in its entirety in a manner acceptable to the Agency.

(3) Each page of the Airship Flight Manual containing information prescribed in this paragraph must be

of a type that is not easily erased, disfigured, or misplaced, and is capable of being inserted in a manual, or in a folder, or in any other permanent binder.

(c) Each Airship Flight Manual must include a table of contents if the complexity of the manual indicates a need for it.

CS 30N.1583 Operating Limitations

(a) Airspeed limitations. The following information must be furnished.

(1) The maximum operating limit speed, V_{MO}, and a statement that this speed limit may not be deliberately exceeded in any regime of flight (climb, cruise, or descent) unless a higher speed is authorised for flight test or pilot training;

(2) The landing gear operating speed.

(b) Powerplant limitations. The following information must be furnished.

(1) Limitations required by paragraph CS 30N.1521;

(2) Explanation of the limitations, when appropriate;

(3) Information necessary for marking the instruments required by paragraphs CS 30N.1549 through CS 30N.1553.

(c) Weight. The Airship Flight Manual must include the following weight limitations.

(1) Maximum weight (take-off);

(2) Maximum landing weight;

(3) Maximum permissible static heaviness and static lightness;

(4) Maximum car weight;

(5) Maximum baggage compartment weights.

(d) Centre of gravity. The established centre of gravity limits must be furnished.

(e) Flight crew. The minimum crew required must be stated and if more than one is required for safety, the number and functions of the minimum flight crew must be furnished.

(f) Kinds of operation. The kinds of operation (such as VFR, IFR, day, or night) and the meteorological conditions under which the airship may or may not be used, must be furnished. Installed equipment that affects any operating limitation must be listed and identified as to its operational function.

(g) Maximum passenger seating configuration. The maximum passenger seating configuration must be furnished.

(h) Envelope pressure. The minimum and maximum envelope and ballonet pressures must be furnished.

(i) Maximum rates of ascent and descent. The maximum rates of ascent and descent must be furnished.

(j) Manoeuvres. The maximum pitch angles for the airship must be furnished.

(k) Placards. Any placards which are required by paragraphs CS 30N.1541 through CS 30N.1563 must be reproduced together with a written description of the appropriate locations of each on the airship.

(l) Snow loads. The maximum depth of snow established in paragraph CS 30N.505 must be furnished.

CS 30N.1585 Operating procedures

(a) For each airship, information concerning normal and emergency procedures and other pertinent information necessary for safe operation must be furnished, including

(1) The recommended climb speed and any variation with altitude;

(2) The recommended take-off and climb profiles including use of auxiliary thrust, lift, and trim controls, and power management for normal take-off and climb as well as for short field operations, if different;

(3) The recommended approach and landing speeds and profiles including use of auxiliary thrust, lift and trim controls and power management for normal approach and landing as well as for short field operations, if different;

(4) The recommended balked landing climb airspeeds and procedures for transitioning from approach and landing to the balked landing climb;

(5) The recommended procedures for transitioning from powered flight to free balloon mode and associated descent and landing procedures in the free balloon mode;

(6) Operational procedures for maintaining envelope pressures based on the requirements of paragraph CS 30N.23;

(7) Instructions covering the use of control system locks, when used;

(8) Flammable fluid fire protection instructions and procedures based on the requirements of paragraph CS 30N.863;

(9) The recommended procedures for starting and stopping engines as required by subparagraphs CS 30N.903(d) and (e);

(10)Ditching instructions and procedures (including the procedures based on the requirements of subparagraph CS 30N.807(b), paragraphs CS 30N.1411 and CS 30N.1415);

(11)Instructions and procedures covering the use of fuel ice protection equipment required by paragraph CS 30N.1419;

(12)Instructions and procedures covering the use of fuel jettisoning equipment, including any operating precautions relevant to the use of the system;

(13)The recommended ground handling, mast handling, and mooring procedures required by paragraph CS 30N.255 (These procedures will reflect the design capabilities of the airship as required by paragraph CS 30N.481.);

(14)Operational procedures covering ballast disposal based on the requirements of paragraph CS 30N.893;

(15)Operational procedures covering fuel jettisoning based on the requirements of paragraph CS 30N.1001;

(16)Operational procedures covering the emergency evacuation based on the requirements of paragraph CS 30N.803 (for commuter only) and (for all airships) of subparagraph CS 30N.881(g).

(b) For multiengine airships, the following information and procedures must also be included.

(1) Normal and emergency procedures for single engine operations and all engine out operations;

(2) Procedures for obtaining the best performance with one engine inoperative including the effects of various configurations of the airship, prop and auxiliary thrust and lift controls;

(3) Procedures for take-off determined in accordance with paragraph CS 30N.51;

(4) Information identifying each operating condition in which the fuel system independence prescribed in paragraph CS 30N.953 is necessary for safety must be furnished, together with instructions for placing the fuel system in a configuration used to show compliance with that paragraph.

(c) For each airship showing compliance with subparagraph CS 30N.1353(g), the operating procedures for disconnecting the battery from its charging source must be furnished.

(d) If the unusable fuel supply in any tank exceed 5% of the tank capacity, or 3.8 litres (1 gal), whichever is greater, information must be furnished which indicates that when the fuel quantity indicator reads 'zero' in level flight, any fuel remaining in the fuel tank cannot be used safely in flight.

(e) Information on the total quantity of usable fuel for each fuel tank must be furnished.

(f) In addition, for commuter category airships, the procedures for restarting turbine engines in flight, including the effects of altitude, must be set forth in the Airship Flight Manual.

CS 30N.1587 Performance information

(a) Each airship. For each airship, the following information must be furnished.

(1) Any loss of altitude more than 30 m (100 feet), or any pitch angle more than 30°, occurring during the recovery prescribed in paragraph CS 30N.76;

(2) The conditions under which the full amount of usable fuel in each tank can safely be used;

(3) The take-off distance determined under paragraph CS 30N.51, the airspeed at the 15 m-height (50-foot), the airship configuration (if pertinent), the kind of surface in the tests, and the pertinent information with respect to cowl flap position, use of flight path control devices, and use of the landing gear retraction system;

(4) The landing distance determined under paragraph CS 30N.75, the airship configuration (if pertinent), and the kind of surface used in the tests;

(5) The steady rate or gradient of climb determined under paragraphs CS 30N.65 and CS 30N.67, the airspeed, power, and the airship configuration;

(6) The calculated approximate effect on take-off distance (subparagraph (a)(3) of this paragraph),

landing distance (subparagraph (a)(4) of this paragraph), and steady rates of climb (subparagraph (a)(5) of this paragraph), of variations in

(i) Altitude from sea level to maximum design take-off altitude;

(ii) Temperature at these altitudes from 33°C (60°F) below standard to 22°C (40°F) above standard;

(iii) Relative humidity at these altitudes from 20% to 100%;

(iv) Lifting gas purity.

(7) For reciprocating engine-powered airships, the maximum atmospheric temperature at which compliance with the cooling provisions of paragraphs CS 30N.1041 through CS 30N.1063 is shown.

(b) Multiengine airships. For multiengine airships, the following information must be furnished.

(1) The best rate of climb speed with one engine inoperative;

(2) The speed used in showing compliance with the cooling and climb requirements of subparagraph CS 30N.1046 (e)(2)(iv), if this speed is greater that the best rate of climb speed with one engine inoperative;

(3) The steady rate or gradient of climb determined under paragraph CS 30N.67 and the airspeed, power, and airship configuration;

(4) The calculated approximate effect on the climb performance determined under paragraph CS 30N.67 of variations in

(i) Altitude from sea level to maximum design altitude;

(ii) Temperature at these altitudes from 33°C (60°F) below standard of 22°C (40°F) above standard;

(iii) Relative humidity at these altitudes from 20% to 100%;

(iv) Lifting gas purity.

(c) Commuter category airships. In addition, for commuter category airships, the Airship Flight Manual must contain at least the following performance information.

(1) Sufficient information so that the take-off weight limits specified in paragraph CS 30N.1583 can be determined for all temperatures and altitudes within the operational limitations selected for the airship;

(2) The conditions under which the performance information was obtained including the airspeed at the 50-foot height used to determine the landing distance as required by paragraph CS 30N.75;

(3) The performance information (determined by extrapolation and computed for the range of weights between the maximum landing and maximum take-off weights) for

(4) Climb in the landing configuration as determined by paragraph CS 30N.77; and landing distance as determined by paragraph CS 30N.75;

(5) Procedures information established in accordance with the limitations and other information for safe operation of the airship in the form of recommended procedures;

(6) An explanation of significant or unusual flight and ground handling characteristics of the airship.

CS 30N.1589 Loading information

The following loading information must be furnished.

(a) The weight and location of each item of equipment included in the empty weight as determined under paragraph CS 30N.29.

(b) Appropriate loading instructions for each possible loading condition between the maximum and minimum weights determined under paragraph CS 30N.25 that can result in a centre of gravity beyond

(1) The extremes selected for the airship; or

(2) The extremes within which the structure is proven; or

(3) The extremes within which compliance with each functional requirement is shown.

Appendices

TABLE 1 - DESIGN MANOEUVRE CONDITIONS

No	Condition	Speed	Weight	Attitude	Thrust Direction	Control Surface Position	
						Rudder	Elevator
1	Level Flight	V_H	W_t	(2)	Forward	Neutral	(2)
2	Level Flight	0.71 V_H	W_l	(2)	Reverse	Neutral	(2)
3	Nose Down	V_H	W_0	+30°	Forward	Neutral	(2)
4	Nose Up	V_H	W_0	-30°	-	Neutral	(2)
5	Descent & Pull-Up	V_H	W_t	(2)	Forward	Neutral	(2)
6	Turn Entry	V_H	W_0	Horizontal	Forward	Full Over	Neutral
7	Turn & Reverse	V_H	W_0	Horizontal	Forward	(3)	Neutral
8	Dive Entry	V_H	W_0	Horizontal	Forward	Neutral	Full Down
9	Climb Entry	V_H	W_0	Horizontal	Forward	Neutral	Full Up
10	Turn & Climb	V_H	W_0	Horizontal	Forward	Full Over	Full Up
11	Turn & Dive	V_H	W_0	Horizontal	Forward	Full Over	Full Down
12	Turn	(1)	W_0	Horizontal	Forward	Full Over	Neutral
13	Turn Recovery	(1)	W_0	Horizontal	Forward	(3)	Neutral
14	Turn Rec. & Climb	(1)	W_0	Horizontal	Forward	(3)	Full Up
15	Turn Rec. & Dive	(1)	W_0	Horizontal	Forward	(3)	Full Down
16	Light Flight	V_H	(2)	(2)	Forward	Neutral	(2)

Notes

(1) Velocity values must be determined for a steady state condition.

(2) That necessary to produce maximum loading conditions.

(3) Full rudder must be applied followed by full reverse rudder after 75° of turn.

TABLE 2 - PILOT FORCES

Control	Forces or torques	
	Maximum	Minimum
Elevator		
Capstan wheel (1)	745 N (167 lbf)	445 N (100 lbf)
Wheel mounted on a column (Symmetrical)	890 N (200 lbf)	445 N (100 lbf)
Wheel mounted on a column (Unsymmetrical) (2)	-	445 N (100 lbf)
Stick	745 N (167 lbf)	445 N (100 lbf)
Rudder		
Rudder pedals	890 N (200 lbf)	578 N (130 lbf)
Wheel mounted on a column (3)	87.5 x D in N (4) (50 x D in lbf)	70 x D in N (4) (40 x D in lbf)
Stick	300 N (67 lbf)	178 N (40 lbf)

Notes

(1) When a capstan wheel is mounted beside the pilot, the fore-and-aft force is applied to the highest point on the rim of the wheel.

(2) The unsymmetrical force must be applied at one of the normal hand grip points on the control wheel.

(3) When the rudder operating control is a wheel mounted on a column in front of the pilot, the loads must be applied tangentially to the rim of the wheel.

(4) D is the wheel diameter in cm (in).

TABLE 3 - TAKE-OFF AND LANDING CONDITIONS

Condition	Attitude	Weight	Shook Absorber Extension	Landing Gear Loads (3)		
				Vertical	Lateral (2)	Longitudinal (2)
Take-off	Level	W_t	static	1.5 W_{sh}	0	0.275 W_{sh}
Level Landing	Level	W_l	Maximum	n W_l	0	±0.25 nW_l
Level Landing	Level	W_l	Maximum	n W_l	0	(1)
Side Drift Landing	Level	W_l	static	W_l	0.55 W_l	0

Notes

(1) This load is based upon spin-up or spring-back conditions.

(2) Lateral and longitudinal loads act in a horizontal plane.

(3) For landing gear equipped with dual wheels, use a 60/40 load distribution between wheels.

(4) n is the limit vertical inertia load factor, at the C.G. of the airship, selected under subparagraph CS 30N.473(b).

TABLE 4 - MOORING AND HANDLING CONDITIONS

Conditions (6)	Weight	Wind Velocity	Wind Angle
Symmetrical Mooring	W_t	130 km/h (70 knots)	0
Unsymmetrical Mooring	W_t	130 km/h (70 knots)	(2)
Mast Handling-Heavy (3)	W_t	(1)	(2)
Mast Handling - Equilibrium (3)	W_0	(1)	(2)
Mast Handling - Override (4)	W_t	0	0
Line Handling (3), (5)	W_t	(1)	(2)
Line Handling (3), (5)	W_0	(1)	(2)

Notes

(1) The maximum wind velocities expected to occur during ground handling are selected by the designer and listed in the airship operating limitations, but may not be less than 8.5 km/h (10 knots).

(2) The wind angle must be determined from the lateral wind force and the longitudinal wind force assumed imposed on the envelope with maximum design gas pressure. These wind forces are based on an instantaneous directional change to either side. In the absence of a more rational analysis, a wind angle of 10° must be used.

(3) An envelope of ground loads must be determined based on critical effective relative wind angles.

(4) Loads must be determined based on a compressive force between mast and airship resulting from a differential speed of 5.6 km/h (3 knots).

(5) For nose lines, use wind angles determined for mooring conditions with line angles of 0°-120° laterally with respect to a vertical plane through the airship axis and at an angle of 30° below the horizontal plane through the airship axis. For tail or after quarter lines, an envelope of ground loads must be determined, using wind angles determined for mast handling. In the absence of a more rational analysis, use line angles of 60°-120° laterally to the same reference planes as for the nose lines. Line angles selected must be listed in the airship handling procedures.

(6) Compressive loads caused by elastic rebound of the airship due to a sudden change in wind velocity must be considered for all applicable mooring conditions.

TABLE 5 - GENERAL TOLERANCES DURING FLIGHT TESTING

see CS 30N.21(f)

TABLE 6 - MAXIMUM PILOT FORCES

	Forces applied to the control as specified	
	Pitch Axis	Yaw Axis
Temporary application		
Stick	267 N (60 lbf)	133 N (30 lbf)
Wheel (applied to rim)	334 N (75 lbf)	267 N (60 lbf)
Capstan wheel	267 N (60 lbf)	-
Rudder pedal	-	667 N (150 lbf)
Prolonged application		
Stick or wheel (applied to rim)	44.5 N (10 lbf)	22 N (5 lbf)
Capstan wheel	44.5 N (10 lbf)	-
Rudder pedal	-	89 N (20 lbf)

TABLE 7 - ULTIMATE INERTIA FORCES IN UNITS OF GRAVITY

Upward	n.a.
Downward	3.0
Forward	2.5
Rearward	1.0
Sideward	1.0

TABLE 8 - NONCRITICAL CASTINGS

Casting factor	Inspection
2.0 or more	100% visual
Less than 2.0 but more than 1.5	100% visual, and magnetic particle or penetrant, or equivalent non-destructive inspection methods
1.25 through 1.50	100% visual, magnetic particle or penetrant, and equivalent non-destructive inspection methods

TABLE 9 - MOTION AND EFFECT OF COCKPIT CONTROLS

Controls	Motion and effect
Elevator	Rearward for nose up
Rudder	Right pedal forward for nose right, or, for wheel or stick control, right (clockwise) for right rudder
Throttle	Forward to open

TABLE 10 - MINIMUM INTENSITIES IN THE HORIZONTAL PLANE POSITION LIGHTS

Dihedral angle (light included)	Angle from right or left of longitudinal axis, measured from dead ahead	Intensity (candela)
F (forward white)	0° to 110°	20
L and R (forward red and green)	0° to 10°	40
	10° to 20°	30
	20° to 110°	5
A (rear white)	110° to 180°	20

TABLE 11 - MINIMUM INTENSITIES IN ANY VERTICAL PLANE POSITION LIGHTS

Angle above or below the horizontal plane	Intensity
0°	1.00
0° to 5°	0.90
5° to 10°	0.80
10° to 15°	0.70
15° to 20°	0.50
20° to 30°	0.30
30° to 40°	0.10
40° to 90°	0.05

TABLE 12 - MAXIMUM INTENSITIES IN OVERLAPPING BEAMS

Overlaps	Maximum Intensity (candela)	
	Area A	Area B
Green in dihedral angle L	10	1
Red in dihedral angle R	10	1
Green in dihedral angle A	5	1
Red in dihedral angle A	5	1
Rear white in dihedral angle L	5	1
Rear white in dihedral angle R	5	1

Note

Area A includes all directions in the adjacent dihedral angle that pass through the light source and intersect the common boundary plan at more than 10° but less than 20°. Area B includes all directions in the adjacent dihedral angle that pass through the light source and intersect the common boundary plan at more than 20°.

TABLE 13 - MINIMUM EFFECTIVE INTENSITIES FOR ANTICOLLISION LIGHTS

Angle above or below the horizontal plane	Effective intensity (candela)
0° to 5°	400
5° to 10°	240
10° to 20°	80
20° to 30°	40
30° to 75°	20

TEARING STRENGTH

Scope. This method is intended for use in determining the tearing strength of envelope fabric.

Specimen. The sample must consist of a 4 x 6 inches (101.6 x 152.4 mm) sample having a 1.25 inch (31.75 mm) wide slit made with a razor blade across the centre of the sample at right angles to the longest dimension.

Apparatus. The apparatus must be approved.

Procedures. The specimen must be placed symmetrically in the clamps of the machine with the long dimension parallel and the short dimension at right angles to the direction of application of the load. The yarn running parallel to the long dimension must be aligned parallel with one outside edge of the front jaw of each clamp to ensure the same yarns being gripped in both clamps. The clamps must be 1 inch (25.4 mm) wide and must grip the yarns that have been slit. The distance between clamps must be 3 inches (76.2 mm) at the start of the test, with the slit in the specimen an equal distance from each clamp jaw. Breaking force must be applied to the specimen at such a rate that the pulling clamp will travel at a uniform speed of 12 ±0.5 inches (304.8 ±12.7 mm) per minute. After rupture of the specimen, the breaking force must be read form the dial, scale, or chart and the value recorded. Five specimens in both the warp and woof (fill) directions must be tested and results reported for each fabric type.

Result. The tearing strength is the average load of the highest recorded peaks of the five specimens.

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