PROPOSTA DE CRITÉRIOS DE AERONAVEGABILIDADE DE CLASSE ESPECIAL

para a aeronave Modelo EVE-100
da EVE Soluções de Mobilidade Aérea Urbana LTDA

1. PROPOSED AIRWORTHINESS CRITERIA

1.1. Applicability

These airworthiness criteria, established under the provisions of RBAC 21.17(b), are applicable to the Model EVE-100.

1.2. Instructions for Continued Airworthiness

EVE.1529 Instructions for Continued Airworthiness

The applicant must prepare Instructions for Continued Airworthiness (ICA), in accordance with Appendices A and A1 that are acceptable to ANAC. ICA for the aircraft and engines may be shown in a single aircraft ICA manual if the engine approval is sought through the aircraft certification program. Alternatively, the applicant may provide individual ICA for the aircraft and engines. The instructions may be incomplete at the time of type certification if a program exists to ensure their completion prior to delivery of the first aircraft, or issuance of a standard certificate of airworthiness, whichever occurs later.

1.3. Subpart A - General

EVE.2000 - Applicability and definitions.

(a) These airworthiness criteria prescribe airworthiness standards for the issuance of a type certificate, and changes to that type certificate, for the EVE Soluções de Mobilidade Aérea Urbana LTDA, Model EVE-100.
(b) For purposes of these airworthiness criteria, the following definitions apply:
(1) Continued safe flight and landing means the aircraft is capable of climbing to a safe altitude, on a flightpath clear of obstacles, and maintaining level flight to a planned destination or alternate landing, possibly using emergency procedures, without requiring exceptional pilot skill, strength, or alertness.
(2) Phases of flight means ground operations, takeoff, climb, cruise, descent, approach, hover, and landing.
(3) Source of lift means one of three sources of lift: thrust-borne, wing-borne, and semi- thrust-borne. Thrust-borne is defined as when the weight of the aircraft is predominately supported by lift generated by engine-driven lift devices. Wing-borne is defined as when the weight of the aircraft is predominately supported by aerodynamic lift from fixed airfoil surfaces. Semi-thrust-borne is the combination of thrust-borne and wing-borne, where both forms of lift are used to support the weight of the aircraft.
(4) Controlled emergency landing means the aircraft design allows direction and area of touchdown to be chosen while reasonably protecting occupants from serious injury. Upon landing, some damage to the aircraft may be acceptable.
(5) Critical change of thrust means the most adverse effect on performance or handling qualities resulting from failures of the flight control or propulsive system, either singular or in combination, not shown to be extremely improbable.

EVE.2005 - Reserved.

EVE.2010 - Accepted means of compliance.

(a) An applicant must comply with this regulation using a means of compliance, which may include consensus standards, accepted by the ANAC.

(b) An applicant requesting acceptance of a means of compliance must provide the means of compliance to ANAC in a form and manner acceptable to ANAC.

1.4. Subpart B - Flight

PERFORMANCE

EVE.2100 - Weight and center of gravity

(a) The applicant must determine limits for weights and centers of gravity that provide for the safe operation of the aircraft.
(b) The applicant must comply with each requirement at critical combinations of weight and center of gravity within the aircraft's range of loading conditions using tolerances acceptable to ANAC.
(c) The condition of the aircraft at the time of determining its empty weight and center of gravity must be well defined and easily repeatable.

EVE.2105 - Performance data

(a) Unless otherwise prescribed, the aircraft must meet the performance requirements of this subpart in still air and standard atmospheric conditions.
(b) Unless otherwise prescribed, the applicant must develop the performance data required for the following conditions:
(1) airport/vertiport altitudes from sea level to the maximum certified take-off and landing altitude; and
(2) Temperatures above and below standard day temperature that are within the range of operating limitations, if those temperatures could have a negative effect on performance.
(c) The procedures used for determining takeoff and landing performance must be executable consistently by pilots of average skill in atmospheric conditions expected to be encountered in service.
(d) Performance data determined in accordance with paragraph (b) of this section must account for losses due to atmospheric conditions, cooling needs, installation losses, downwash considerations, and other demands on power sources.
(e) The hovering ceiling, in and out of ground effect, must be determined over the ranges of weight, altitude, and temperature, if applicable.
(f) Continued safe flight and landing must be possible from any point within the approved flight envelope following a critical change of thrust.
(g) The aircraft must be capable of a controlled emergency landing, following a condition when the aircraft can no longer provide the commanded power or thrust required for continued safe flight and landing, by gliding or an equivalent means to mitigate the risk of loss of power or thrust.

EVE.2110 - Minimum safe speed.

The applicant must determine the aircraft minimum safe speed for each flight condition encountered in normal operations, including applicable sources of lift and phases of flight, to maintain controlled safe flight. The minimum safe speed determination must account for the most adverse conditions for each flight configuration.

EVE.2115 - Takeoff performance.

(a) The applicant must determine takeoff performance accounting for:
(1) All sources of lift for each takeoff flight path for which certification is sought;
(2) Minimum safe speed safety margins;
(3) Climb requirements; and
(4) Obstacle Clearance.
(b) Reserved
(c) The takeoff performance must be determined so that, following a critical change of thrust:
(1) A rejected takeoff prior to the takeoff decision speed and/or altitude where a safe stop or landing can be made;
(2) Passing the takeoff decision speed and/or altitude, continue the takeoff and climb to a safe height above the takeoff surface; and
(3) The aircraft can achieve the configuration and airspeed used in compliance with EVE.2120(d)(1).

EVE.2120 - Climb requirements

(a) The applicant must demonstrate minimum climb performance at each weight, altitude, and ambient temperature within the operating limitations using the procedures published in the flight manual.
(b) Reserved
(c) Reserved
(d) The climb performance after a critical change of thrust must be such that during climb:
(1) Takeoff phase or following a balked landing:
(i) The trajectory must clear all obstacles by sufficient margins for takeoff or landing and reach the Takeoff Safety Speed (VTOSS) at a safe height above the takeoff or landing surface with a positive rate of climb;
(ii) The minimum rate of climb without ground effect at initial takeoff height above the takeoff or landing surface in VTOSS is assured;
(iii) The minimum rate of climb without ground effect at final takeoff height above the takeoff or landing surface in Final Takeoff Speed (VFTO) is assured;
(iv) From the initial takeoff height above the takeoff surface, the aircraft path must be level or positive until the VFTO or the final takeoff height is attained, whichever is higher, with available rate of climb not less than the required by (d)(1)(iii).
(2) Enroute:
(i) Where applicable, the steady rate of climb (or descent) must be determined at each weight, altitude, temperature and source of lift at which the aircraft is expected to operate for which certification is requested.

EVE.2125 - Climb information

(a) The applicant must determine climb performance at each weight, altitude, and ambient temperature within the operating limitations using the procedures published in the flight manual.
(b) The applicant must determine climb performance accounting after a critical change of thrust.
(c) The applicant must determine the performance accordingly for the appropriate sources of lift for gliding or by equivalent means applicable to the condition defined in EVE.2105(g).

EVE.2130 - Landing.

The applicant must determine the following, for the critical combinations of weight, altitudes and temperatures within the operational limits:
(a) The approach, transition and landing speeds and procedures, which allow a pilot of average skill to land within the published landing performance consistently and without causing damage or injury, and which allow for a safe transition to the balked landing conditions of these airworthiness criteria accounting for:
(1) All sources of lift for each approach and landing flight path for which certification is sought,
(2) Any minimum or maximum speed safety margins, and
(b) Reserved
(c) The applicant must determine the landing performance from a safe height above the landing surface so that, following a critical change of thrust that occurs prior to the landing decision point, the aircraft can-
(1) Land and stop safely on the landing surface; or
(2) Transition to the balked landing condition and performance established in EVE.2120(d)(1).

FLIGHT CHARACTERISTICS

EVE.2135 - Controllability

(a) The aircraft must be controllable and maneuverable, without requiring exceptional piloting skill, alertness, or strength, within the approved flight envelope:
(1) At all loading conditions for which certification is requested;
(2) During all phases of flight while using applicable sources of lift;
(3) Reserved
(4) During configuration changes;
(5) In all flight and propulsion control system failures not shown to be extremely improbable; and
(6) In thrust-borne operation, and must be controllable in wind velocities from zero to a wind limit appropriate for the aircraft from any azimuth angle.
(b) The applicant must determine critical control parameters, such as limited control power margins, and if applicable, account for those parameters in appropriate operating limitations.
(c) It must be possible to make a smooth change from one flight condition to another (changes in configuration and in source of lift and phase of flight) without exceeding the approved flight envelope.

EVE.2140 - Trim

(a) The aircraft must maintain lateral and directional trim without further force upon, or movement of, the primary flight controls or corresponding trim controls by the pilot, or the flight-control system, under all normal operations while using applicable sources of lift.
(b) The aircraft must maintain longitudinal trim without further force upon, or movement of, the primary flight controls or corresponding trim controls by the pilot, or the flight-control system, under the following conditions:
(1) Climb.
(2) Level flight.
(3) Descent.
(4) Approach.
(c) Residual control forces must not fatigue or distract the pilot during normal operations of the aircraft and abnormal or emergency operations, including a critical change of thrust.

EVE.2145 - Stability

(a) Within its flight envelopes, the aircraft must show suitable stability and control feel, in all axes.
(b) Within its flight envelopes, no aircraft may exhibit any divergent stability characteristic, so as to require exceptional piloting skills, alertness, or strength or otherwise endanger the aircraft and its occupants.

EVE.2150 - Minimum safe speed characteristics and warning.

(a) For wing borne operation, the aircraft must have controllable minimum safe speed flight characteristics in straight flight, turning flight, and accelerated turning flight. In case there is no high incidence protection system, a clear and distinctive minimum safe speed warning that provides sufficient margin to prevent inadvertent slowing below minimum safe speed.
(b) For wing borne and semi-thrust-borne operations, the aircraft must not have a tendency to inadvertently depart controlled safe flight.

EVE.2155 - Ground handling characteristics.

For aircraft intended for operation on land or water, the aircraft must have controllable longitudinal and directional handling characteristics during taxi, takeoff, and landing operations.

EVE.2160 - Vibration, buffeting, and high-speed characteristics

(a) Each part of the aircraft must be free from excessive vibration under each appropriate speed and power condition and must not interfere with the control of the aircraft or cause excessive fatigue to the flightcrew. Stall warning buffet within these limits is allowable.
(b) The aircraft must be recoverable to its approved flight envelope in the case of a reasonable speed exceedance, and must not have adverse recovery characteristics that result in structural damage or loss of control.

EVE.2165 - Performance and flight characteristics requirements for flight in atmospheric icing conditions.

(a) An applicant who requests certification for flight in atmospheric icing conditions must show the following in the icing conditions for which certification is requested:
(1) Compliance with each requirement of this subpart, except those that must be demonstrated at speeds in excess of VNE;
(2) The means by which minimum safe speed warning is provided to the pilot for flight in icing conditions and non-icing conditions is the same.
(b) The applicant must provide a means to detect icing conditions for which certification is not requested and show the aircraft's ability to avoid or exit those icing conditions.
(c) The applicant must develop an operating limitation to prohibit intentional flight, including takeoff and landing, into icing conditions for which the aircraft is not certified to operate.

1.5. Subpart C - Structures

EVE.2200 - Structural design envelope

The applicant must determine the structural design envelope, which describes the range and limits of aircraft design and operational parameters for which the applicant will show compliance with the requirements of this subpart. The applicant must account for all aircraft design and operational parameters that affect structural loads, strength, durability, and aeroelasticity, including:

(a) Structural design airspeeds, landing-descent speeds, and any other airspeed limitation at which the applicant must show compliance to the requirements of this subpart. The structural design airspeeds must:
(1) Be sufficiently greater than the minimum safe speed of the aircraft to safeguard against loss of control in turbulent air; and
(2) Provide sufficient margin for the establishment of practical operational limiting airspeeds.
(b) Design maneuvering load factors not less than those, which service history shows, may occur within the structural design envelope.
(c) Inertial properties including weight, center of gravity, and mass moments of inertia, accounting for:
(1) Each critical weight from the aircraft empty weight to the maximum weight; and
(2) The weight and distribution of occupants, payload, and energy-storage systems.
(d) Characteristics of aircraft control systems, including range of motion and tolerances for control surfaces, high lift devices, or other moveable surfaces.
(e) Each critical altitude up to the maximum altitude.
(f) Engine-driven lifting-device rotational speed and ranges, and the maximum rearward and sideward flight speeds.
(g) Thrust-borne, wing-borne, and semi-thrust-borne flight configurations, with associated flight load envelopes.

EVE.2205 - Interaction of systems and structures

For aircraft equipped with systems that affect structural performance, either directly or as a result of failure or malfunction, the applicant must account for the influence and failure conditions of these systems when showing compliance with the requirements of this Subpart.

STRUCTURAL LOADS

EVE.2210 - Structural design loads

(a) The applicant must:
(1) Determine the applicable structural design loads resulting from likely externally or internally applied pressures, forces, or moments that may occur in flight, ground and water operations, ground and water handling, and while the aircraft is parked or moored.
(2) Determine the loads required by paragraph (a)(1) of this section at all critical combinations of parameters, on and within the boundaries of the structural design envelope.
(b) The magnitude and distribution of the applicable structural design loads required by this section must be based on physical principles.

EVE.2215 - Flight Load Conditions

(a) The applicant must determine the structural design loads resulting from the following flight conditions:
(1) Atmospheric gusts where the magnitude and gradient of these gusts are based on measured gust statistics.
(2) Symmetric and asymmetric maneuvers.
(b) There must be no vibration or buffeting severe enough to result in structural damage, at any speed up to dive speed, within the flight envelope, in any configuration and power settings.
(c) Flight loads resulting from a likely failure of an aircraft system, component, or lift/thrust unit must be determined.

EVE.2220 - Ground and water load conditions

The applicant must determine the structural design loads resulting from taxi, takeoff, landing, and handling conditions on the applicable surface in normal and adverse attitudes and configurations. Effects of ground gusts on loads must be considered.

EVE.2225 - Component Loading Conditions

The applicant must determine the structural design loads acting on:
(a) Each engine mount and its supporting structure such that both are designed to withstand loads resulting from:
(1) Powerplant operation combined with flight gust and maneuver loads; and
(2) For non-reciprocating powerplants, sudden powerplant stoppage.
(b) Each flight control and high-lift surface, their associated system and supporting structure resulting from:
(1) The inertia of each surface and mass balance attachment;

(2) Flight gusts and maneuvers;
(3) Pilot or automated system inputs;
(4) System induced conditions, including jamming and friction; and
(5) Taxi, takeoff, and landing operations on the applicable surface, including downwind taxi and gusts occurring on the applicable surface.
(c) Engine-driven lifting-device assemblies, considering loads resulting from flight and ground conditions, as well limit input torque at any lifting device rotational speed.

EVE.2230 - Limit and ultimate loads

The applicant must determine:
(a) The limit loads, which are equal to the structural design loads unless otherwise specified elsewhere in this regulation; and
(b) The ultimate loads, which are equal to the limit loads multiplied by a 1,5 factor of safety unless otherwise specified elsewhere in this regulation.

STRUCTURAL PERFORMANCE

EVE.2235 - Structural strength

The structure must support:
(a) limit loads without:
(1) interference with the safe operation of the aircraft; and
(2) detrimental or permanent deformation.
(b) ultimate loads.

EVE.2240 - Structural durability.

(a) The applicant must develop and implement inspections or other procedures to prevent structural failures due to foreseeable causes of strength degradation, which could result in serious or fatal injuries, or extended periods of operation with reduced safety margins. Each of the inspections or other procedures developed under this section must be included in the Airworthiness Limitations Section of the Instructions for Continued Airworthiness required by section 23.1529.
(b) If safety-by-design (fail-safe) is used to comply with paragraph (a) of this section, safety-by-inspection (damage tolerance) must also be incorporated to reliably detect structural damage before the damage could result in structural failure.
(c) Reserved.
(d) The aircraft must be designed to minimize hazards to the aircraft due to structural damage caused by high-energy fragments from an uncontained engine or rotating machinery failure.

EVE.2241 - Aeromechanical stability

The aircraft must be free from aeromechanical instabilities for any configuration and condition of operation on the ground and in flight.

EVE.2245 - Aeroelasticity

(a) The aircraft must be free from flutter, control reversal, and divergence:
(1) At all speeds within and sufficiently beyond the structural design envelope;
(2) For any configuration and condition of operation;
(3) Accounting for critical structural modes; and
(4) Accounting for any critical failures or malfunctions.
(b) The applicant must establish tolerances for all quantities that affect Aeroelastic stability.
(c) Each component and rotating aerodynamic surface of the aircraft must be free from instability under each appropriate speed and power condition.

DESIGN

EVE.2250 - Design and construction principles

(a) The applicant must design each part, article, and assembly for the expected operating conditions of the aircraft.
(b) Design data must adequately define the part, article, or assembly configuration, its design features, and any materials and processes used.
(c) The applicant must determine the suitability of each design detail and part having an important bearing on safety in operations.

(d) The control system must be free from jamming, excessive friction, and excessive deflection when the aircraft is subjected to expected limit airloads.
(e) Doors, canopies, and exits must be protected against inadvertent opening in flight, unless shown to create no hazard when opened in flight.

EVE.2255 - Protection of Structure

(a) The applicant must protect each part of the aircraft, including small parts such as fasteners, against deterioration or loss of strength due to any cause likely to occur in the expected operational environment.
(b) Each part of the aircraft must have adequate provisions for ventilation and drainage.
(c) For each part that requires maintenance, preventive maintenance, or servicing, the applicant must incorporate a means into the aircraft design to allow such actions to be accomplished.

EVE.2260 - Materials and processes.

(a) The applicant must determine the suitability and durability of materials used for parts, articles, and assemblies, accounting for the effects of likely environmental conditions expected in service, the failure of which could prevent continued safe flight and landing.
(b) The methods and processes of fabrication and assembly used must produce consistently sound structures. If a fabrication process requires close control to reach this objective, the applicant must perform the process under an approved process specification.
(c) Except as provided in paragraphs (f) and (g) of this section, the applicant must select design values that ensure material strength with probabilities that account for the criticality of the structural element. Design values must account for the probability of structural failure due to material variability.
(d) If material strength properties are required, a determination of those properties must be based on sufficient tests of material meeting specifications to establish design values on a statistical basis.
(e) If thermal effects are significant on a critical component or structure under normal operating conditions, the applicant must determine those effects on allowable stresses used for design.
(f) Design values, greater than the minimums specified by this section, may be used, where only guaranteed minimum values are normally allowed, if 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 the design.
(g) An applicant may use other material design values if approved by ANAC.

EVE.2265 - Special factors of safety

(a) The applicant must determine a special factor of safety for each critical design value for each part, article, or assembly for which that critical design value is uncertain, and for each part, article, or assembly that is:
(1) Likely to deteriorate in service before normal replacement; or
(2) Subject to appreciable variability because of uncertainties in manufacturing processes or inspection methods.
(b) The applicant must determine a special factor of safety using quality controls and specifications that account for each:
(1) Type of application;
(2) Inspection method;
(3) Structural test requirement;
(4) Sampling percentage; and
(5) Process and material control.
(c) The applicant must multiply the highest pertinent special factor of safety in the design for each part of the structure by each limit and ultimate load, or ultimate load only, if there is no corresponding limit load, such as occurs with emergency condition loading.

STRUCTURAL OCCUPANT PROTECTION

EVE.2270 - Emergency conditions

(a) The aircraft, even when damaged in an emergency landing, must protect each occupant against injury that would preclude egress when:
(1) Properly using safety equipment and features provided for in the design;
(2) The occupant experiences ultimate static inertia loads likely to occur in an emergency landing; and
(3) Items of mass, including engines or auxiliary power units (APUs), within or aft of the cabin, that could injure an occupant, experience ultimate static inertia loads likely to occur in an emergency landing.

(b) The emergency landing conditions specified in paragraph (a)(1) and (a)(2) of this section, must:
(1) Include dynamic conditions that are likely to occur in an emergency landing; and
(2) Not generate loads experienced by the occupants, which exceed established human injury criteria for human tolerance due to restraint or contact with objects in the aircraft.
(c) The aircraft must provide protection for all occupants, accounting for likely flight, ground, and emergency landing conditions.
(d) Each occupant protection system must perform its intended function and not create a hazard that could cause a secondary injury to an occupant. The occupant protection system must not prevent occupant egress or interfere with the operation of the aircraft when not in use.
(e) Each baggage and cargo compartment must:
(1) Be designed for its maximum weight of contents and for the critical load distributions at the maximum load factors corresponding to the flight and ground load conditions determined under this regulation;
(2) Have a means to prevent the contents of the compartment from becoming a hazard by impacting occupants or shifting; and
(3) Protect any controls, wiring, lines, equipment, or accessories whose damage or failure would affect safe operations.

1.6. Subpart D - Design and Construction

EVE.2300 - Flight Control Systems

(a) The applicant must design flight control systems to:
(1) Operate easily, smoothly, and positively enough to allow proper performance of their functions;
(2) Protect against likely hazards; and
(3) Ensure that the flightcrew is made suitably aware whenever the means of primary flight control approaches the limits of control authority.
(b) The applicant must design trim systems or trim functions, if installed, to:
(1) Protect against inadvertent, incorrect, or abrupt trim operation; and
(2) Provide information that is required for safe operation.
(c) Features that protect the aircraft against loss of control, or exceeding critical limits, must be designed such that there are no adverse flight characteristics in aircraft response to flight-control inputs, unsteady atmospheric conditions, and other likely conditions, including simultaneous limiting events.

EVE.2305 - Landing gear systems

(a) The landing gear must be designed to:
(1) Provide stable support and control to the aircraft during surface operation; and
(2) Account for likely system failures and likely operation environments (including anticipated limitation exceedances and emergency procedures).
(b) All aircraft must have a reliable means of stopping the aircraft with sufficient kinetic energy absorption to account for landing. aircraft that are required to demonstrate aborted takeoff capability must account for this additional kinetic energy.
(c) For aircraft that have a system that actuates the landing gear, there is:
(1) A positive means to keep the landing gear in the landing position; and
(2) An alternative means available to bring the landing gear in the landing position when a non-deployed system position would be a hazard

EVE.2310 - Reserved

EVE.2311 - Bird Strike.

The aircraft must be capable of continued safe flight and landing after a bird strike with a 2.2-lb (1.0 kg) bird.

OCCUPANT SYSTEM DESIGN PROTECTION

EVE.2315 - Means of egress and emergency exits

(a) With the cabin configured for takeoff or landing, the aircraft is designed to:
(1) Facilitate rapid and safe evacuation of the aircraft in conditions likely to occur following an emergency landing, excluding ditching.
(2) Have means of egress (openings, exits or emergency exits), that can be readily located and opened from

the inside and outside. The means of opening must be simple and obvious and marked inside and outside the aircraft.
(3) Have easy access to emergency exits when present.

EVE.2320 - Occupant physical environment.

(a) The applicant must design the aircraft to:
(1) Allow clear communication between the flightcrew and passengers;
(2) Protect the occupants and flight controls from propellers; and
(3) Protect the occupants from serious injury due to damage to windshields, windows, and canopies.
(b) Reserved.
(c) The aircraft must provide each occupant with air at a breathable pressure, free of hazardous concentrations of gases, vapors, and smoke during normal operations and likely failures.

FIRE AND HIGH ENERGY PROTECTION

EVE.2325 - Fire protection.

(a) The following materials must be self extinguishing
(1) Insulation on electrical wire and electrical cable;
(2) Materials in the baggage and cargo compartments inaccessible in flight;
(b) The following materials must be flame-resistant:
(1) Materials in each compartment accessible in flight; and
(2) Any equipment associated with any electrical cable installation and that would overheat in the event of circuit overload or fault.
(c) Thermal/acoustic materials in the fuselage, if installed, must not be a flame propagation hazard.
(d) Sources of heat within each baggage and cargo compartment that are capable of igniting adjacent objects must be shielded and insulated to prevent such ignition.
(e) Each baggage and cargo compartment must -
(1) Be located where a fire would be visible to the pilots and be accessible for the manual extinguishing of a fire, or
(2) Be equipped with a smoke or fire detection system that warns the pilot, or
(3) Be constructed of, or lined with, fire resistant materials.
(f) There must be a means to extinguish any fire in the cabin such that:
(1) The pilot, while seated, can easily access the fire extinguishing means; and
(g) Each area where flammable fluids or vapors might escape by leakage of a fluid system must:
(1) Be defined; and
(2) Have a means to minimize the probability of fluid and vapor ignition, and the resultant hazard, if ignition occurs.
(h) [Reserved]

EVE.2330 - Fire Protection in Fire Zones and Adjacent Areas

(a) Flight controls, engine mounts, and other flight structures within or adjacent to fire zones must be capable of withstanding the effects of a fire.
(b) Engines in a fire zone must remain attached to the aircraft in the event of a fire.
(c) In fire zones, terminals, equipment, and electrical cables used during emergency procedures must perform their intended function in the event of a fire.
(d) A fire in a fire zone must not preclude continued safe flight and landing.

EVE.2335 - Lightning and Static Electricity Protection

(a) The aircraft must be protected against catastrophic effects from lightning.
(b) The aircraft must be protected against hazardous effects caused by an accumulation of electrostatic charge.

1.7. Subpart E - Powerplant

EVE.2400 - Powerplant installation.

(a) For the purpose of this subpart, the aircraft powerplant installation must include each component necessary for propulsion, which affects propulsion safety.
(b) Each aircraft engine must have a type certificate or be approved under the aircraft type certificate using standards found in subpart H.

(c) Each propeller must have a type certificate;
(d) The applicant must construct and arrange each powerplant installation to account for:
(1) Likely operating conditions, including foreign object threats;
(2) Sufficient clearance of moving parts to other aircraft parts and their surroundings;
(3) Likely hazards in operation including hazards to ground personnel; and
(4) Vibration and fatigue.
(e) Hazardous accumulations of fluids, vapors, or gases must be isolated from the aircraft and personnel compartments, and be safely contained or discharged.
(f) Powerplant components must comply with their component limitations and installation instructions or be shown not to create a hazard.

EVE.2405 - Power or Thrust Control System

(a) Any power or thrust control system, or powerplant control system, must be designed so no unsafe condition results during normal operation of the system.
(b) Any single failure or likely combination of failures or malfunctions of a power or thrust control system, or powerplant control system, must not prevent continued safe flight and landing of the aircraft.
(c) Inadvertent flightcrew operation of a power or thrust control system, or powerplant control system, must be prevented, or if not prevented, must not prevent continued safe flight and landing of the aircraft.
(d) Unless the failure of an automatic power or thrust control system is extremely remote, the system must
(1) Provide a means for the flightcrew to verify the system is in an operating condition;
(2) Provide a means for the flightcrew to override the automatic function; and
(3) Prevent inadvertent deactivation of the system.

EVE.2410 - Powerplant installation hazard assessment.

The applicant must assess each powerplant separately and in relation to other aircraft systems and installations to show that any hazard resulting from the likely failure of any powerplant system, component, or accessory will not:
(a) Prevent continued safe flight and landing or, if continued safe flight and landing cannot be ensured, the hazard has been minimized;
(b) Cause serious injury that may be avoided; and
(c) Require immediate action by any crew member for continued operation of any remaining powerplant system.

EVE.2415 - Powerplant ice protection.

(a) The aircraft design, including the induction and inlet system, must prevent foreseeable accumulation of ice or snow that adversely affects powerplant operation.
(b) The powerplant installation design must prevent any accumulation of ice or snow that adversely affects powerplant operation, in those icing conditions for which certification is requested.

EVE.2420 - Reserved

EVE.2425 - Powerplant Operational Characteristics

(a) Each installed powerplant must operate without any hazardous characteristics during normal and emergency operation within the range of operating limitations for the aircraft and the engine.
(b) The design must provide for the shutdown and restart of the powerplant in flight within an established operational envelope.

EVE.2430 - Energy Systems

(a) Each energy system must:
(1) Be designed and arranged to provide independence between multiple energy-storage and supply systems, so that failure of any one component in one system will not result in loss of energy storage or supply of another system;
(2) Be designed to prevent catastrophic events due to lightning strikes, taking into account direct and indirect effects on the aircraft areas where the exposure to lightning is likely;
(3) Provide the energy necessary to ensure each powerplant and auxiliary power unit functions properly in all likely operating conditions;
(4) provide usable energy level information to the flight crew and provide adequate supply of that energy when the system is correctly operated, accounting for likely energy fluctuations.
(5) Provide a means to safely remove or isolate the energy stored in the system from the aircraft; and

(6) Be designed to retain energy under all likely operating conditions and to minimize hazards to occupants following an emergency landing or otherwise survivable impact (crash landing).
(b) Each energy-storage system must:
(1) withstand the loads under likely operating conditions without failure; and
(2) be isolated from personnel compartments and protected from likely hazards;
(3) be designed to prevent significant loss of stored energy;
(4) provide energy for a sufficient reserve based on a standard flight;
(c) Each energy recharging system must be designed to:
(1) prevent improper recharging;
(2) reserved
(3) prevent the occurrence of any hazard to the aircraft or to persons during recharging.

EVE.2435 - Powerplant induction and exhaust systems.

(a) The air induction system for each powerplant or auxiliary power unit and their accessories must:
(1) Supply the air required by that powerplant or auxiliary power unit and its accessories under likely operating conditions;
(2) Be designed to prevent likely hazards in the event of fire or backfire;
(3) Minimize the ingestion of foreign matter; and
(4) Provide an alternate intake if blockage of the primary intake is likely.
(b) The exhaust system, including exhaust heat exchangers for each powerplant or auxiliary power unit, must:
(1) Provide a means to safely discharge potential harmful material; and
(2) Be designed to prevent likely hazards from heat, corrosion, or blockage.

EVE.2440 - Powerplant Fire Protection

There must be means to isolate and mitigate hazards to the aircraft in the event of a powerplant-system fire or overheat in operation.

1.8. Subpart F - Equipment

EQUIPMENT

EVE.2500 - Aircraft level systems requirements.

This section applies generally to installed equipment and systems unless a section of this regulation imposes requirements for a specific piece of equipment, system, or systems.
(a) The equipment and systems required for an aircraft to operate safely in the kinds of operations for which certification is requested (Day VFR, Night VFR, IFR) must be designed and installed to:
(1) Meet the level of safety applicable to the certification and performance level of the aircraft; and
(2) Perform their intended function throughout the operating and environmental limits for which the aircraft is certificated.
(b) The systems and equipment not covered by paragraph (a), considered separately and in relation to other systems, must be designed and installed so their operation does not have an adverse effect on the aircraft or its occupants.

EVE.2505 - Function and installation.

When installed, each item of equipment must function as intended.

EVE.2510 - Equipment, systems, and installations.

For any aircraft system or equipment whose failure or abnormal operation has not been specifically addressed by another requirement in this regulation, the applicant must design and install each system and equipment, such that there is a logical and acceptable inverse relationship between the average probability and the severity of failure conditions to the extent that:
(a) Each catastrophic failure condition is extremely improbable;
(b) Each hazardous failure condition is extremely remote; and
(c) Each major failure condition is remote.

EVE.2515 - Electrical and Electronic-System Lightning Protection

(a) Each electrical or electronic system that performs a function, the failure of which would prevent the continued safe flight and landing of the aircraft, must be designed and installed such that:
(1) The function at the aircraft level is not adversely affected during and after the time the aircraft is exposed to lightning; and
(2) The system recovers normal operation of that function in a timely manner after the aircraft is exposed to lightning unless the system's recovery conflicts with other operational or functional requirements of the system.
(b) For an aircraft approved for operation under instrument flight rules (IFR), each electrical and electronic system that performs a function, the failure of which would reduce the capability of the aircraft or the ability of the flight crew to respond to an adverse operating condition, must be designed and installed such that the system recovers normal operation of that function in a timely manner after the aircraft is exposed to lightning.

EVE.2520 - High-intensity Radiated Fields (HIRF) protection

(a) Each electrical and electronic systems that perform a function, the failure of which would prevent the continued safe flight and landing of the aircraft, must be designed and installed such that:
(1) The function at the aircraft level is not adversely affected during and after the time the aircraft is exposed to the HIRF environment; and
(2) The system recovers normal operation of that function in a timely manner after the aircraft is exposed to the HIRF environment, unless the system's recovery conflicts with other operational or functional requirements of the system.
(b) Each electrical and electronic system that performs a function, the failure of which would reduce the capability of the aircraft or the ability of the flightcrew to respond to an adverse operating condition, must be designed and installed such that the system recovers normal operation of that function in a timely manner after the aircraft is exposed to the HIRF environment.

EVE.2525 - System power generation, storage, and distribution.

The power generation, storage, and distribution for any system must be designed and installed to:
(a) Supply the power required for operation of connected loads during all intended operating conditions;
(b) Ensure no single failure or malfunction of any one power supply, distribution system, or other utilization system will prevent the system from supplying the essential loads required for continued safe flight and landing; and
(c) Have enough capacity, if the primary source fails, to supply essential loads, including noncontinuous essential loads for the time needed to complete the function required for continued safe flight and landing.

EVE.2530 - External and cockpit lighting.

(a) The applicant must design and install all lights to minimize any adverse effects on the performance of flightcrew duties.
(b) Any position and anti-collision lights, if required by operational rules, must have the intensities, flash rate, colors, fields of coverage, and other characteristics to provide sufficient time for another aircraft to avoid a collision.
(c) Any position lights, if required by operational rules, must include a red light on the left side of the aircraft, a green light on the right side of the aircraft, spaced laterally as far apart as practicable, and a white light facing aft, located on an aft portion of the aircraft or on the wing tips.
(d) Any taxi and landing lights must be designed and installed so they provide sufficient light for night operations.

EVE.2535 - Safety equipment.

Safety and survival equipment, required by the operating rules, must be reliable, readily, easily identifiable, and clearly marked to identify its method of operation.

EVE.2540 - Flight in Icing Conditions

An applicant who requests certification for flight in icing conditions must show the following in the icing conditions for which certification is requested:
(a) The ice protection system provides for safe operation; and
(b) The aircraft design must provide protection from slowing to less than the minimum safe speed when the autopilot is operating.

EVE.2545 - Pressurized systems elements.

Pressurized systems must withstand appropriate proof and burst pressures.

EVE.2550 - Equipment containing high-energy rotors.

Equipment containing high-energy rotors must be designed or installed to protect the occupants and aircraft from uncontained fragments.

EVE.2555 - Installation of recorders

The aircraft must be equipped with a recorder or recorders that:
(a) is installed so as to ensure accurate and intelligible recording and appropriate safeguarding of the data supportive for accident investigation, considering conditions encountered during crash, water immersion or fire;
(b) is powered by the most reliable power source and remains powered for as long as possible without jeopardizing service to essential or emergency loads and emergency operation of the aircraft;
(c) includes features to facilitate the localization of a memory medium after an accident;
(d) is installed so that it automatically records when the aircraft is capable of moving under its own power; and
(e) records in an accepted format;
(f) alternatively some data may be transmitted and recorded remotely.

1.9. Subpart G - Flightcrew Interface and Other Information

EVE.2600 - Flightcrew interface.

(a) The pilot compartment, its equipment, and its arrangement to include pilot view, must allow each pilot to perform their duties for all sources of lift and phases of flight and perform any maneuvers within the operating envelope of the aircraft, without excessive concentration, skill, alertness, or fatigue.
(b) The applicant must install flight, navigation, surveillance, and powerplant controls and displays so qualified flightcrew can monitor and perform defined tasks associated with the intended functions of systems and equipment. The system and equipment design must minimize flightcrew errors, which could result in additional hazards.
(c) The flight crew interface design must allow for continued safe flight and landing after the loss of vision through the windshield panel.

EVE.2605 - Installation and operation.

(a) Each item of installed equipment related to the flightcrew interface must be labelled, if applicable, as to it identification, function, or operating limitations, or any combination of these factors.
(b) There must be a discernible means of providing system operating parameters required to operate the aircraft, including warnings, cautions, and normal indications to the responsible crewmember.
(c) Information concerning an unsafe system operating condition must be provided in a timely manner to the crewmember responsible for taking corrective action. The information must be clear enough to avoid likely crewmember errors.

EVE.2610 - Instrument markings, control markings, and placards.

(a) Each aircraft must display in a conspicuous manner any placard and instrument marking necessary for operation.
(b) The design must clearly indicate the function of each cockpit control, other than primary flight controls.
(c) The applicant must include instrument marking and placard information in the Aircraft Flight Manual.

EVE.2615 - Flight, navigation, and powerplant instruments.

(a) Installed systems must provide the flight crew member who sets or monitors parameters for the flight, navigation, and lift/thrust system the information necessary to do so during each phase of flight. This information must:
(1) be presented in a manner that the crew members can monitor the parameters and trends, as needed to operate the aircraft; and
(2) include limitations, unless the limitation cannot be exceeded in all intended operations.
(b) Indication systems that integrate the display of flight or lift/thrust system parameters required to safely operate the aircraft, or required by the operating rules, must:
(1) not inhibit the primary display of flight or lift/thrust system parameters needed by any flight crew

member in any normal mode of operation;
(2) In combination with other systems, be designed and installed so information essential for continued safe flight and landing will be available to the flightcrew in a timely manner after any single failure or probable combination of failures.

EVE.2620 - Aircraft flight manual.

The applicant must provide an Aircraft Flight Manual that must be delivered with each aircraft.
(a) The Aircraft Flight Manual must contain the following information:
(1) Aircraft operating limitations;
(2) Aircraft operating procedures;
(3) Performance information;
(4) Loading information; and
(5) Other information that is necessary for safe operation because of design, operating, or handling characteristics.
(b) The portions of the Aircraft Flight Manual containing the information specified in paragraphs (a)(1) through (a)(4) of this section must be approved by the ANAC.

1.10. Subpart H - Electric Engine Requirements

EVE.3305 - Instruction manual for installing and operating the engine.

(a) Installation instructions.
(1) The location of engine mounting attachments, the method of attaching the engine to the aircraft, and the maximum allowable load for the mounting attachments and related structure.
(2) The location and description of engine connections to be attached to accessories, pipes, wires, cables, ducts, and cowling.
(3) An outline drawing of the engine including overall dimensions.
(4) A definition of the physical and functional interfaces with the aircraft and aircraft equipment, including the propeller when applicable.
(5) Where an engine system relies on components that are not part of the engine type design, the interface conditions and reliability requirements for those components upon which engine type certification is based must be specified in the engine installation instructions directly or by reference to appropriate documentation.
(6) A list of the instruments necessary for control of the engine, including the overall limits of accuracy and transient response required of such instruments for control of the operation of the engine, must also be stated so that the suitability of the instruments as installed may be assessed.
(b) Operation instructions.
(1) The operating limitations established by ANAC.
(2) The power or thrust ratings and procedures for correcting for nonstandard atmosphere.
(3) The recommended procedures, under normal and extreme ambient conditions for:
(i) Starting;
(ii) Operating on the ground; and
(iii) Operating during flight.
(4) For rotorcraft engines having one or more OEI ratings, applicants must provide data on engine performance characteristics and variability to enable the aircraft manufacturer to establish aircraft power assurance procedures.
(5) A description of the primary and all alternate modes, and any back-up system, together with any associated limitations, of the engine control system and its interface with the aircraft systems, including the propeller when applicable.
(c) Safety analysis assumptions. The assumptions of the safety analysis as described in EVE.3375(b) with respect to the reliability of safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures that are outside the control of the engine manufacturer.

EVE.3307 - Engine ratings and operating limits.

(a) Engine ratings and operating limitations are established by ANAC and included in the engine certificate data sheet specified in RBAC 21.41, including ratings and limitations based on the operating conditions and information specified in this section, as applicable, and any other information found necessary for safe operation of the engine.
(b) Ratings and operating limits must be established and included in the type certificate data sheet based

on:
(1) Shaft power, torque, rotational speed, and temperature for:
(i) Rated takeoff power;
(ii) Rated maximum continuous power; and
(iii) Rated maximum temporary power and associated time limit.
(2) Duty Cycle and the rating at that duty cycle. The duty cycle must be declared in the type certificate data sheet.
(3) Power-supply requirements.
(4) Any other ratings or limitations that are necessary for the safe operation of the engine.

EVE.3308 - Selection of Engine Power and Thrust Ratings

(a) Requested engine power and thrust ratings must be selected by the applicant.
(b) Each selected rating must be for the lowest power or thrust that all engines of the same type may be expected to produce under the conditions used to determine that rating.

EVE.3315 - Materials

(a) Be established on the basis of experience or tests; and
(b) Conform to approved specifications (such as industry or military specifications) that ensure their having the strength and other properties assumed in the design data.

EVE.3317 - Fire protection

(a) The design and construction of the engine and the materials used must minimize the probability of the occurrence and spread of fire during normal operation and failure conditions, and must minimize the effect of such a fire. In addition, the design and construction of electrical engines must minimize the probability of the occurrence of an internal fire that could result in structural failure or other hazardous effects.
(b) An engine component designed, constructed, and installed to act as a firewall must be:
(1) Fireproof;
(2) Constructed so that no hazardous quantity of air, fluid or flame can pass around or through the firewall; and,
(3) Protected against corrosion;
(c) In addition to the requirements of paragraph (a) of this section, engine control system components that are located in a designated fire zone must perform their intended function in the event of a fire, as determined by ANAC.
(d) Any components, modules, or equipment, which are susceptible to or are potential sources of static discharges or electrical fault currents must be designed and constructed to be properly grounded to the engine reference, to minimize the risk of ignition in external areas where flammable fluids or vapors could be present.
(e) High-voltage electrical wiring interconnect systems must be protected against arc faults. Non-protected electrical wiring interconnects must be analyzed to show that arc faults do not cause a hazardous engine effect.

EVE.3319 - Durability.

The engine design and construction must minimize the development of an unsafe condition of the engine between maintenance intervals, overhaul periods, or mandatory actions described in the applicable ICA.
EVE.3321 - Engine cooling.
(a) Engine design and construction must provide the necessary cooling under conditions in which the aircraft is expected to operate.
(b) If cooling is required to satisfy the safety analysis as described in EVE.3375, the cooling-system monitoring features and usage must be documented in the engine installation manual.
EVE.3323 - Engine Mounting Attachment and Structure
(a) The maximum allowable limit and ultimate loads for engine mounting attachments and related engine structure must be specified.
(b) The engine mounting attachments and related engine structure must be able to withstand:
(1) The specified limit loads without permanent deformation; and
(2) The specified ultimate loads without failure, but may exhibit permanent deformation."

EVE.3325 - Accessory Attachments

The engine must operate properly with the accessory drive and mounting attachments loaded. Each engine accessory drive and mounting attachment must include provisions for sealing to prevent contamination of, or unacceptable leakage from, the engine interior. A drive and mounting attachment requiring lubrication for external drive splines, or coupling by engine oil, must include provisions for sealing to prevent unacceptable loss of oil and to prevent contamination from sources outside the chamber enclosing the drive connection. The design of the engine must allow for the examination, adjustment, or removal of each accessory required for engine operation.

EVE.3327 - Overspeed

(a) A rotor overspeed must not result in a burst, rotor growth, or damage that results in a hazardous engine effect, as defined in EVE.3375(d)(2). Compliance with this paragraph must be shown by test, validated analysis, or a combination of both. Applicable assumed rotor speeds must be declared and justified.
(b) Rotors must possess sufficient strength with a margin to burst above certified operating conditions and above failure conditions leading to rotor overspeed. The margin to burst must be shown by test, validated analysis, or a combination thereof.
(c) The engine must not exceed the rotor-speed operational limitations that could affect rotor structural integrity.

EVE.3328 - Engine control systems.

(a) Applicability. - These requirements apply to any system or device that is part of the engine type design that controls, limits, monitors, or protects engine operation and is necessary for the continued airworthiness of the engine.
(b) Engine control. - The engine control system must ensure the engine does not experience any unacceptable operating characteristics or exceed its operating limits, including in failure conditions where the fault or failure results in a change from one control mode to another, from one channel to another, or from the primary system to the back-up system, if applicable.
(c) Design assurance. The software and complex electronic hardware, including programmable logic devices, must be:
(1) Designed and developed using a structured and systematic approach that provides a level of assurance for the logic commensurate with the hazard associated with the failure or malfunction of the systems in which the devices are located; and
(2) Substantiated by a verification methodology acceptable to ANAC.
(d) Validation
(1) Functional aspects. The applicant must substantiate by tests, analysis, or a combination thereof, that the engine control system performs the intended functions throughout the declared operational envelope in a manner which:
(i) Enables selected values of relevant control parameters to be maintained and the engine kept within the approved operating limits over changing atmospheric conditions in the declared flight envelope;
(ii) Allows modulation of engine power or thrust with adequate sensitivity over the declared range of engine operating conditions; and
(iii) Does not create unacceptable power or thrust oscillations.
(e) Environmental limits. Environmental limits that cannot be adequately substantiated by endurance demonstration, validated analysis, or a combination thereof must be demonstrated by the system and component tests in EVE.3391.
(f) Engine control system failures. The engine control system must:
(1) Have a maximum rate of Loss of Power Control (LOPC) that is suitable for the intended aircraft application. The estimated LOPC rate must be specified in the engine installation manual;
(2) When in the full-up configuration, be single fault tolerant, as determined by ANAC, for electrical, electrically detectable, and electronic failures involving LOPC events;
(3) Not have any single failure that results in hazardous engine effects; and
(4) Not have any likely failures or malfunctions that lead to local events in the intended aircraft application.
(g) System-safety assessment. The applicant must perform a system-safety assessment. This assessment must identify faults or failures that affect normal operation, together with the predicted frequency of occurrence of these faults or failures. The intended aircraft application must be taken into account to assure the assessment of the engine control system safety is valid.
(h) Protection systems. The engine control devices and systems' design and function, together with engine instruments, operating instructions, and maintenance instructions, must ensure that engine operating limits

that can lead to a hazard will not be exceeded in-service.
(i) Aircraft-supplied data. Any single failure leading to loss, interruption, or corruption of aircraft-supplied data (other than power command signals from the aircraft), or aircraft-supplied data shared between engine systems within a single engine or between fully independent engine systems, must:
(1) Not result in a hazardous engine effect, as defined in EVE.3375(d)(2), for any engine installed on the aircraft; and
(2) Be able to be detected and accommodated by the control system.
(j) Engine control system electrical power.
(1) The engine control system must be designed such that the loss, malfunction, or interruption of the control system electrical power source will not result in a hazardous engine effect, as defined in EVE.3375(d)(2), the unacceptable transmission of erroneous data, or continued engine operation in the absence of the control function. The engine control system must be capable of resuming normal operation when aircraft-supplied power returns to within the declared limits.
(2) The applicant must identify and declare, in the engine installation manual, the characteristics of any electrical power supplied from the aircraft to the engine control system, including transient and steady-state voltage limits, and any other characteristics necessary for safe operation of the engine.

EVE.3329 - Instrument connection.

(a) In addition, as part of the system-safety assessment of EVE.3328(g) and EVE.33100(h), the applicant must assess the possibility and subsequent effect of incorrect fit of instruments, sensors, or connectors. Where practicable, the applicant must take design precautions to prevent incorrect configuration of the system.
(b) The applicant must provide instrumentation enabling the flightcrew to monitor the functioning of the engine cooling system unless evidence shows that:
(1) Other existing instrumentation provides adequate warning of failure or impending failure;
(2) Failure of the cooling system would not lead to hazardous engine effects before detection; or
(3) The probability of failure of the cooling system is extremely remote.
(c) Unless it is constructed to prevent its connection to an incorrect instrument, each connection provided for powerplant instruments required by aircraft airworthiness regulations or necessary to ensure operation of the engine in compliance with any engine limitation must be marked to identify it with its corresponding instrument.
(d) The applicant must make provision for the installation of instrumentation necessary to ensure operation in compliance with engine operating limitations. Where, in presenting the safety analysis, or complying with any other requirement, dependence is placed on instrumentation that is not otherwise mandatory in the assumed aircraft installation, then the applicant must specify this instrumentation in the engine installation instructions and declare it mandatory in the engine approval documentation.
(e) The sensors, together with associated wiring and signal conditioning, must be segregated, electrically and physically, to the extent necessary to ensure that the probability of a fault propagating from instrumentation and monitoring functions to control functions, or vice versa, is consistent with the failure effect of the fault.

EVE.3362 - Stress analysis.

(a) A mechanical and thermal stress analysis, as well as the stress caused by electromagnetic forces, must show a sufficient design margin to prevent unacceptable operating characteristics and hazardous engine effects.
(b) Maximum stresses in the engine must be determined by test, validated analysis, or a combination thereof, and must be shown not to exceed minimum material properties.

EVE.3363 - Vibration demonstration

(a) The engine must be designed and constructed to function throughout its normal operating range of rotor speeds and engine output power, including defined exceedances, without inducing excessive stress in any of the engine parts because of vibration and without imparting excessive vibration forces to the aircraft structure.
(b) Each engine design must undergo a vibration survey to establish that the vibration characteristics of those components subject to induced vibration are acceptable throughout the declared flight envelope and engine operating range for the specific installation configuration. The possible sources of the induced vibration that the survey must assess are mechanical, aerodynamic, acoustical, internally induced

electromagnetic, installation induced effects that can affect the engine vibration characteristics, and likely environmental effects. This survey must be shown by test, validated analysis, or a combination thereof.

EVE.3370 - Engine life-limited parts.

(a) By a procedure approved by ANAC, operating limitations must be established which specify the maximum allowable number of flight cycles for each engine life-limited part. Engine life-limited parts are rotor and major static structural parts whose primary failure is likely to result in a hazardous engine effect. Typically, engine life-limited parts include, but are not limited to disks, spacers, hubs, shafts, high-pressure casings, and non-redundant mount components. For the purposes of this section, a hazardous engine effect is any of the conditions listed in EVE.3375. The applicant will establish the integrity of each engine life-limited part by:
(a)
(1) An engineering plan that contains the steps required to ensure each engine life-limited part is withdrawn from service at an approved life before hazardous engine effects can occur. These steps include validated analysis, test, or service experience which ensures that the combination of loads, material properties, environmental influences and operating conditions, including the effects of other engine parts influencing these parameters, are sufficiently well known and predictable so that the operating limitations can be established and maintained for each engine life-limited part. Applicants must perform appropriate damage tolerance assessments to address the potential for failure from material, manufacturing, and service induced anomalies within the approved life of the part. Applicants must publish a list of the life-limited engine parts and the approved life for each part in the Airworthiness Limitations Section of the Instructions for Continued Airworthiness as required by EVE.1529.
(2) A manufacturing plan that identifies the specific manufacturing constraints necessary to consistently produce each engine life-limited part with the attributes required by the engineering plan.
(3) A service management plan that defines in-service processes for maintenance and the limitations to repair for each engine life-limited part that will maintain attributes consistent with those required by the engineering plan. These processes and limitations will become part of the Instructions for Continued Airworthiness.
(b) The applicant must show, by a safety analysis or means acceptable to ANAC, whether rotating or moving components, bearings, shafts, static parts, and non-redundant mount components should be classified, designed, manufactured, and managed throughout their service life as critical or life-limited parts;
(1) Critical part means a part that must meet prescribed integrity specifications to avoid its primary failure, which is likely to result in a hazardous engine effect as defined in EVE.3375(d)(2).
(2) Life-limited parts may include, but are not limited to, a rotor and major structural static part, the failure of which can result in a hazardous engine effect due to low-cycle fatigue.
(c) In establishing the integrity of each critical part or life-limited part, the applicant must provide to ANAC the following three plans for approval: an engineering plan, a manufacturing plan, and a service-management plan, as defined in EVE.3370(a).

EVE.3373 - Power response.

The design and construction of the engine, including its control system, must enable an increase:
(a) From the minimum power setting to the highest rated power without detrimental engine effects;
(b) From the minimum obtainable power while in flight, and while on the ground, to the highest rated power within a time interval determined to be appropriate for the intended aircraft application; and;
(c) From the minimum torque to the highest rated torque without detrimental engine effects in the intended aircraft application.
EVE.3374 - Continued rotation.
If the design allows any of the engine main rotating systems to continue to rotate after the engine is shut down while in-flight, this continued rotation must not result in hazardous engine effects, as specified in EVE.3375(d)(2).

EVE.3375 - Safety Analysis

(a)(1) The applicant must analyze the engine, including the control system, to assess the likely consequences of all failures that can reasonably be expected to occur. This analysis will take into account, if applicable:
(i) Aircraft-level devices and procedures assumed to be associated with a typical installation. Such assumptions must be stated in the analysis.

(ii) Consequential secondary failures and latent failures.
(iii) Multiple failures referred to in paragraph (b) of this section or that result in the hazardous engine effects defined in paragraph (d)(2) of this section.
(a)(2) The applicant must summarize those failures that could result in major engine effects or hazardous engine effects, as defined in paragraph (d) of this section, and estimate the probability of occurrence of those effects. Any engine part the failure of which could reasonably result in a hazardous engine effect must be clearly identified in this summary.
(b) If reliance is placed on a safety system to prevent a failure from progressing to hazardous engine effects, the possibility of a safety system failure in combination with a basic engine failure must be included in the analysis. Such a safety system may include safety devices, instrumentation, early warning devices, maintenance checks, and other similar equipment or procedures. If items of a safety system are outside the control of the engine manufacturer, the assumptions of the safety analysis with respect to the reliability of these parts must be clearly stated in the analysis and identified in the installation instructions under EVE.3305.
(c) If the safety analysis depends on one or more of the following items, those items must be identified in the analysis and appropriately substantiated.
(1) Maintenance actions being carried out at stated intervals. This includes the verification of the serviceability of items that could fail in a latent manner. When necessary to prevent hazardous engine effects, these maintenance actions and intervals must be published in the instructions for continued airworthiness required under EVE.1529. Additionally, if errors in maintenance of the engine, including the control system, could lead to hazardous engine effects, the appropriate procedures must be included in the relevant engine manuals.
(2) Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The details of this satisfactory functioning must be published in the appropriate manual.
(3) The provisions of specific instrumentation not otherwise required.
(4) Flight crew actions to be specified in the operating instructions established under EVE.3305.
(d) Unless otherwise approved by ANAC and stated in the safety analysis, the following failure definitions apply to the engine:
(1) A minor engine effect does not prohibit the engine from meeting its type-design requirements and the intended functions in a manner consistent with EVE.3328(d)(1)(i), (d)(1)(ii), and (d)(1)(iii), and the engine complies with the operability requirements such as EVE.3373 and EVE.3389, as appropriate.
(2) The following effects will be regarded as hazardous engine effects:
(i) Non-containment of high-energy debris;
(ii) Concentration of toxic products in the engine bleed air intended for the cabin sufficient to incapacitate crew or passengers;
(iii) Significant thrust in the opposite direction to that commanded by the pilot;
(iv) Uncontrolled fire;
(v) Failure of the engine mount system leading to inadvertent engine separation;
(vi) Release of the propeller by the engine, if applicable;
(vii) Complete inability to shut the engine down;
(viii) Electrocution of the crew, passengers, operators, maintainers, or others; and
(ix) Blockage of cooling systems that are required for the engine to operate within temperature limits.
(3) Any other engine effect is a major engine effect.
(e) The applicant must comply with EVE. 3375(a)(1), (2),(b) and (c) using the failure definitions in paragraph (g) of this section and the ICA in EVE.1529.
(f) The primary failure of certain single elements cannot be sensibly estimated in numerical terms. If the failure of such elements is likely to result in hazardous engine effects, then the applicant may show compliance by reliance on the prescribed integrity requirements such as EVE 3315, EVE.3327, EVE.3370, or combinations thereof, as applicable. The failure of such elements and associated prescribed integrity requirements must be stated in the safety analysis.
(g) The results of the safety analysis and the assumptions about the aircraft application used in the safety analysis must be documented in the engine installation manual.

EVE.3377 - Ingestion

(a) Rain, ice and hail ingestion must not result in an abnormal operation such as shutdown, power loss, erratic operation, or power oscillations throughout the engine operating range.
(b) Ingestion from other likely sources (birds, induction system ice, foreign objects, ice) must not result in hazardous engine effects defined by EVE.3375(d)(2), or unacceptable power loss.

(c) If the design of the engine relies on features, attachments, or systems that the installer may supply, for the prevention of unacceptable power loss or hazardous engine effects following potential ingestion, then the features, attachments, or systems must be documented in the engine installation manual.
(d) Ingestion sources that are considered in (b) that are not evaluated must be declared in the engine installation manual.

EVE.3384 - Engine overtorque test.

When approval is sought for a transient maximum engine overtorque, the applicant must demonstrate by test, validated analysis, or a combination thereof, that the engine can continue operation after operating at the maximum engine overtorque condition without maintenance action. Upon conclusion of overtorque tests conducted to show compliance with this subpart, or any other tests that are conducted in combination with the overtorque test, each engine part or individual groups of components must meet the requirements of EVE.3393.

EVE.3385 - Calibration Test

Each engine must be subjected to calibration tests to establish its power characteristics and the conditions both before and after the endurance and durability demonstrations specified in EVE.3387 and EVE.3390.

EVE.3387 - Endurance Demonstration

(a) The applicant must subject the engine to an endurance demonstration, acceptable to ANAC, to demonstrate the engine's limit capabilities.
(b) The endurance demonstration must include increases and decreases of the engine's power settings, energy regeneration, and dwellings at the power settings or energy regeneration for durations that produce the extreme physical conditions the engine experiences at rated performance levels, operational limits, and at any other conditions or power settings that are required to verify the limit capabilities of the engine.

EVE.3388 - Engine overtemperature test.

The engine design must demonstrate its capability to endure operation at its temperature limits plus an acceptable margin. The applicant must quantify and justify to ANAC the margin. The demonstration must be repeated for all declared duty cycles and ratings, and operating environments, that would impact temperature limits.

EVE.3389 - Operation demonstration

The engine design must demonstrate safe operating characteristics, including but not limited to power cycling, starting, acceleration, and overspeeding throughout its declared flight envelope and operating range. The declared engine operational characteristics must account for installation loads and effects.

EVE.3390 - Durability Demonstration

The engine must be subjected to a durability demonstration to show that each part of the engine has been designed and constructed to minimize any unsafe condition of the system between overhaul periods or between engine replacement intervals if the overhaul is not defined. This test must simulate the conditions in which the engine is expected to operate in service, including typical start-stop cycles to establish when the initial maintenance is required.

EVE.3391 - System and component tests.

The applicant must show that systems and components not adequately substantiated as part of the endurance demonstration or other demonstrations will perform their intended functions in all declared environmental and operating conditions.

EVE.3392 - Rotor locking demonstration

If shaft rotation is prevented by locking the rotor(s), the engine must demonstrate:
(a) Reliable rotor locking performance;
(b) Reliable unlocking performance; and
(c) That no hazardous engine effects, as specified in EVE.3375(d)(2), will occur.

EVE.3393 - Teardown inspection

The applicant must comply with either paragraph (a) or (b) of this section as follows:
(a) Teardown evaluation.
(1) After the endurance and durability demonstrations have been completed, the each engine must be

completely disassembled. Each engine component and lubricant must be within service limits and eligible for continued operation in accordance with the information submitted for showing compliance with EVE.1529.
(2) Each engine component having an adjustment setting and a functioning characteristic that can be established independent of installation on or in the engine must retain each setting and functioning characteristic within the established and recorded limits at the beginning of the endurance and durability demonstrations.
(b) Non-Teardown evaluation.
If a teardown cannot be performed for all engine components in a non-destructive manner, then the inspection or replacement intervals for these components and lubricants must be established based on the endurance and durability demonstrations and documented in the ICA in accordance with EVE.1529.

EVE.3394 - Containment

The engine must be designed and constructed to protect against likely hazards from rotating components as follows:
(a) The design of the case surrounding rotating components must provide for the containment of the rotating components in the event of failure, unless the applicant shows that the margin to rotor burst precludes the possibility of a rotor burst;
(b) If the margin to burst shows the case must have containment features in the event of failure, the case must provide for the containment of the failed rotating components. The applicant must define by test, validated analysis, or a combination thereof, and document in the engine installation manual, the energy level, trajectory, and size of fragments released from damage caused by the main rotor failure, and that pass forward or aft of the surrounding case.

EVE.3399 - General conduct of tests.

(a) Maintenance of the engine may be made during the tests in accordance with the service and maintenance instructions submitted in compliance with EVE.1529.
(b) The applicant must subject the engine or its parts to maintenance and additional tests that ANAC finds necessary if:
(1) The frequency of the service is excessive;
(2) The number of stops due to engine malfunction is excessive;
(3) Major repairs are needed; or
(4) Replacement of a part is found necessary during the tests or due to the teardown inspection findings.
(c) Upon completion of all demonstrations and testing specified in these airworthiness criteria, the engine and its components must be:
(1) Within serviceable limits;
(2) Safe for continued operation; and
(3) Capable of operating at declared ratings while remaining within limits.

EVE.33100 - Engine electrical systems.

(a) Applicability. Any system or device that provides, uses, conditions, or distributes electrical power, and is part of the engine type design, must provide for the continued airworthiness of the engine and maintain electric engine ratings.
(b) Electrical systems. The electrical system must ensure the safe generation and transmission of power, electrical load shedding, and the engine does not experience any unacceptable operating characteristics or exceed its operating limits.
(c) Electrical-power distribution.
(1) The engine electrical-power distribution system must be designed to provide the safe transfer of electrical energy throughout the electrical power plant. The system must be designed to provide electrical power so that the loss, malfunction, or interruption of the electrical power source will not result in a hazardous engine effect, as defined in EVE.3375(d)(2).
(2) The system must be designed and maintained to withstand normal and abnormal conditions during all ground and flight operations
(3) The system must provide mechanical or automatic means to mitigate a faulted electrical-energy generation or storage device from leading to hazardous engine effects or detrimental effects in the intended aircraft application.
(d) Protection systems. The engine electrical system must be designed such that the loss, malfunction, interruption of the electrical power source, or power conditions that exceed design limits, will not result in

hazardous engine effects, as defined in EVE.3375(d)(2), or detrimental effects in the intended aircraft application.
(e) Electrical Power Characteristics. The applicant must identify and declare, in the engine installation manual, the characteristics of any electrical power:
(1) Supplied from the aircraft to the engine electrical system, for starting and operating the engine, including transient and steady-state voltage limits, or;
(2) Supplied from the engine to the aircraft via energy regeneration, and any other characteristics necessary for safe operation of the engine.
(f) Environmental limits. Environmental limits that cannot be adequately substantiated by endurance demonstration, validated analysis, or a combination thereof must be demonstrated by the system and component tests in EVE.3391.
(g) Electrical-system failures. The engine electrical system must:
(1) Have a maximum rate of Loss of Power Control (LOPC) that is suitable for the intended aircraft application;
(2) When in the full-up configuration, be single fault tolerant, as determined by ANAC, for electrical, electrically detectable, and electronic failures involving LOPC events;
(3) Not have any single failure that results in hazardous engine effects; and
(4) Not have any likely failure or malfunction that leads to local events in the intended aircraft application.
(h) System-safety assessment. The applicant must perform a system-safety assessment. This assessment must identify faults or failures that affect normal operation, together with the predicted frequency of occurrence of these faults or failures. The intended aircraft application must be taken into account to assure the assessment of the engine system safety is valid.

1.11. Appendix A - Instructions for Continued Airworthiness

EVE.A.1 - General

(a) This appendix specifies requirements for the preparation of Instructions for Continued Airworthiness as required by this regulation.
(b) The Instructions for Continued Airworthiness for each aircraft must include the Instructions for Continued Airworthiness for each engine and propeller (hereinafter designated “products”), for each appliance required by ANAC, and any required information relating to the interface of those appliances and products with the aircraft. If Instructions for Continued Airworthiness are not supplied by the manufacturer of an appliance or product installed in the aircraft, the Instructions for Continued Airworthiness for the aircraft must include the information essential to the continued airworthiness of the aircraft.
(c) The applicant must submit to ANAC a program to show how changes to the Instructions for Continued Airworthiness made by the applicant or by the manufacturers of products and appliances installed in the aircraft will be distributed.

EVE.A.2 - Format

(a) The Instructions for Continued Airworthiness must be in the form of a manual or manuals as appropriate for the quantity of data to be provided.
(b) The format of the manual or manuals must provide for a practical arrangement.

EVE.A.3 - Content

The contents of the manual or manuals must be prepared in the English or Portuguese language. The Instructions for Continued Airworthiness must contain the following manuals or sections and information:
(a) aircraft maintenance manual or section.
(1) Introduction information that includes an explanation of the aircraft's features and data to the extent necessary for maintenance or preventive maintenance.
(2) A description of the aircraft and its systems and installations including its engines, propellers, and appliances.
(3) Basic control and operation information describing how the aircraft components and systems are controlled and how they operate, including any special procedures and limitations that apply.
(4) Servicing information that covers details regarding servicing points, capacities of tanks, reservoirs, types of fluids to be used, pressures applicable to the various systems, location of access panels for inspection and servicing, locations of lubrication points, lubricants to be used, equipment required for servicing, tow instructions and limitations, mooring, jacking, and leveling information.

(b) Maintenance Instructions.
(1) Scheduling information for each part of the aircraft and its engines, auxiliary power units, propellers, accessories, instruments, and equipment that provides the recommended periods at which they should be cleaned, inspected, adjusted, tested, and lubricated, and the degree of inspection, the applicable wear tolerances, and work recommended at these periods. However, the applicant may refer to an accessory, instrument, or equipment manufacturer as the source of this information if the applicant shows that the item has an exceptionally high degree of complexity requiring specialized
maintenance techniques, test equipment, or expertise. The recommended overhaul periods and necessary cross-reference to the Airworthiness Limitations section of the manual must also be included. In addition, the applicant must include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the aircraft.
(2) Troubleshooting information describing probable malfunctions, how to recognize those malfunctions, and the remedial action for those malfunctions.
(3) Information describing the order and method of removing and replacing products and parts with any necessary precautions to be taken.
(4) Other general procedural instructions including procedures for system testing during ground running, symmetry checks, weighing and determining the center of gravity, lifting and shoring, and storage limitations.
(c) Diagrams of structural access plates and information needed to gain access for inspections when access plates are not provided.
(d) Details for the application of special inspection techniques including radiographic and ultrasonic testing where such processes are specified by the applicant.
(e) Information needed to apply protective treatments to the structure after inspection.
(f) All data relative to structural fasteners such as identification, discard recommendations, and torque values.
(g) A list of special tools needed.
(h) Reserved

EVE.A.4 - Airworthiness limitations section

The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document. This section must set forth each mandatory replacement time, structural inspection interval, and related structural inspection procedure required for type certification. If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principal manual. This section must contain a legible statement in a prominent location that reads “The Airworthiness Limitations section is ANAC approved and specifies maintenance required under section 43.16 of RBAC 43 and under section 91.403 of RBHA 91 unless an alternative program has been ANAC approved."

1.12. Appendix A1 - Instructions for Continued Airworthiness (Electric Engine)

EVE.A.33.1 - General.

(a) This appendix specifies requirements for the preparation of ICA for the engines as required by EVE.1529.
(b) The ICA for the engine must include the ICA for all engine parts.
(c) The applicant must submit to ANAC a program to show how the applicant’s changes to the ICA will be distributed, if applicable.

EVE.A.33.2 - Format

(a) The Instructions for Continued Airworthiness must be in the form of a manual or manuals as appropriate for the quantity of data to be provided.
(b) The format of the manual or manuals must provide for a practical arrangement.

EVE.A.33.3 - Content

The contents of the manual or manuals must be prepared in the English language. The Instructions for Continued Airworthiness must contain the following manuals or sections, as appropriate, and information:
(a) Engine Maintenance Manual or Section.
(1) Introduction information that includes an explanation of the engine's features and data to the extent necessary for maintenance or preventive maintenance.

(2) A detailed description of the engine and its components, systems, and installations.
(3) Installation instructions, including proper procedures for uncrating, deinhibiting, acceptance checking, lifting, and attaching accessories, with any necessary checks.
(4) Basic control and operating information describing how the engine components, systems, and installations operate, and information describing the methods of starting, running, testing, and stopping the engine and its parts including any special procedures and limitations that apply.
(5) Servicing information that covers details regarding servicing points, capacities of tanks, reservoirs, types of fluids to be used, pressures applicable to the various systems, locations of lubrication points, lubricants to be used, and equipment required for servicing.
(6) Scheduling information for each part of the engine that provides the recommended periods at which it should be cleaned, inspected, adjusted, tested, and lubricated, and the degree of inspection the applicable wear tolerances, and work recommended at these periods. However, the applicant may refer to an accessory, instrument, or equipment manufacturer as the source of this information if the applicant shows that the item has an exceptionally high degree of complexity requiring specialized maintenance techniques, test equipment, or expertise. The recommended overhaul periods and necessary cross references to the Airworthiness Limitations section of the manual must also be included. In addition, the applicant must include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the engine.
(7) Troubleshooting information describing probable malfunctions, how to recognize those malfunctions, and the remedial action for those malfunctions.
(8) Information describing the order and method of removing the engine and its parts and replacing parts, with any necessary precautions to be taken. Instructions for proper ground handling, crating, and shipping must also be included.
(9) A list of the tools and equipment necessary for maintenance and directions as to their method of use.
(b) Engine Overhaul Manual or Section.
(1) Disassembly information including the order and method of disassembly for overhaul.
(2) Cleaning and inspection instructions that cover the materials and apparatus to be used and methods and precautions to be taken during overhaul. Methods of overhaul inspection must also be included.
(3) Details of all fits and clearances relevant to overhaul.
(4) Details of repair methods for worn or otherwise substandard parts and components along with the information necessary to determine when replacement is necessary.
(5) The order and method of assembly at overhaul.
(6) Instructions for testing after overhaul.
(7) Instructions for storage preparation, including any storage limits.
(8) A list of tools needed for overhaul.
(c) Reserved.

EVE.A.33.4 - Airworthiness limitations section

The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the manual.
(a) For all engines:
(1) The Airworthiness Limitations section must set forth each mandatory replacement time, inspection interval, and related procedure required for type certification. If the Instructions for Continued Airworthiness consist of multiple documents, the section required under this paragraph must be included in the principal manual.
(2) This section must contain a legible statement in a prominent location that reads: “The Airworthiness Limitations section is approved and specifies maintenance required under RBAC 43 and RBAC 91 unless an alternative program has been approved.”
(b) Reserved.

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