safety equivalent to that provided by the TSO; and

(ii) The manufacturer has provided to the FAA one copy of the technical data required in the applicable performance standard through its State of Design.

(b) The FAA issues the letter of TSO design approval that lists any deviation granted under §21.618.

[Doc. No. FAA–2006–25877, Amdt. 21–92, 74 FR 53392, Oct. 16, 2009, as amended by Amdt. 21–92A, 75 FR 9095, Mar. 1, 2010]

Subpart P—Special Federal Aviation Regulations

SOURCE: Docket No. FAA–2011–0186, Amdt. 21–92, 76 FR 12555, Mar. 8, 2011, unless otherwise noted.

§21.700 SFAR No. 111—Lavatory Oxygen Systems.

The requirements of §121.1500 of this chapter also apply to this part.

PART 23—AIRWORTHINESS STANDARDS: NORMAL CATEGORY AIRPLANES

Sec.

Subpart F—Equipment

Subpart G—Flightcrew Interface and Other Information

AUTHORITY: 49 U.S.C. 106(f), 106(g), 40113, 44701–44702, 44704, Pub. L. 113–53, 127 Stat. 584 (49 U.S.C. 44704) note.

SOURCE: Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, unless otherwise noted.

§ 23.1457 Cockpit voice recorders.

(a) Each cockpit voice recorder required by the operating rules of this chapter must be approved and must be installed so that it will record the following:

(1) Voice communications transmitted from or received in the airplane by radio.

(2) Voice communications of flightcrew members on the flight deck.

(3) Voice communications of flightcrew members on the flight deck, using the airplane's interphone system.

(4) Voice or audio signals identifying navigation or approach aids introduced into a headset or speaker.

(5) Voice communications of flightcrew members using the passenger loudspeaker system, if there is such a system and if the fourth channel is available in accordance with the requirements of paragraph (c)(4)(ii) of this section.

(6) If datalink communication equipment is installed, all datalink communications, using an approved data message set. Datalink messages must be recorded as the output signal from the communications unit that translates the signal into usable data.

(b) The recording requirements of paragraph (a)(2) of this section must be met by installing a cockpit-mounted area microphone, located in the best position for recording voice communications originating at the first and second pilot stations and voice communications of other crewmembers on the flight deck when directed to those stations. The microphone must be so located and, if necessary, the preamplifiers and filters of the recorder must be so adjusted or supplemented, so that the intelligibility of the recorded communications is as high as practicable when recorded under flight cockpit noise conditions and played back. Repeated aural or visual playback of the record may be used in evaluating intelligibility.

(c) Each cockpit voice recorder must be installed so that the part of the communication or audio signals specified in paragraph (a) of this section obtained from each of the following sources is recorded on a separate channel:

(1) For the first channel, from each boom, mask, or handheld microphone, headset, or speaker used at the first pilot station.

(2) For the second channel from each boom, mask, or handheld microphone, headset, or speaker used at the second pilot station.

(3) For the third channel—from the cockpit-mounted area microphone.

(4) For the fourth channel from:

(i) Each boom, mask, or handheld microphone, headset, or speaker used at the station for the third and fourth crewmembers.

(ii) If the stations specified in paragraph (c)(4)(i) of this section are not required or if the signal at such a station is picked up by another channel, each microphone on the flight deck that is used with the passenger loudspeaker system, if its signals are not picked up by another channel.

(5) And that as far as is practicable all sounds received by the microphone

listed in paragraphs (c)(1), (2), and (4) of this section must be recorded without interruption irrespective of the position of the interphone-transmitter key switch. The design shall ensure that sidetone for the flightcrew is produced only when the interphone, public address system, or radio transmitters are in use.

(d) Each cockpit voice recorder must be installed so that:

(1)(i) It receives its electrical power from the bus that provides the maximum reliability for operation of the cockpit voice recorder without jeopardizing service to essential or emergency loads.

(ii) It remains powered for as long as possible without jeopardizing emergency operation of the airplane.

(2) There is an automatic means to simultaneously stop the recorder and prevent each erasure feature from functioning, within 10 minutes after crash impact.

(3) There is an aural or visual means for preflight checking of the recorder for proper operation.

(4) Any single electrical failure external to the recorder does not disable both the cockpit voice recorder and the flight data recorder.

(5) It has an independent power source—

(i) That provides 10 ±1 minutes of electrical power to operate both the cockpit voice recorder and cockpit-mounted area microphone;

(ii) That is located as close as practicable to the cockpit voice recorder; and

(iii) To which the cockpit voice recorder and cockpit-mounted area microphone are switched automatically in the event that all other power to the cockpit voice recorder is interrupted either by normal shutdown or by any other loss of power to the electrical power bus.

(6) It is in a separate container from the flight data recorder when both are required. If used to comply with only the cockpit voice recorder requirements, a combination unit may be installed.

(e) The recorder container must be located and mounted to minimize the probability of rupture of the container as a result of crash impact and consequent heat damage to the recorder from fire.

(1) Except as provided in paragraph (e)(2) of this section, the recorder container must be located as far aft as practicable, but need not be outside of the pressurized compartment, and may not be located where aft-mounted engines may crush the container during impact.

(2) If two separate combination digital flight data recorder and cockpit voice recorder units are installed instead of one cockpit voice recorder and one digital flight data recorder, the combination unit that is installed to comply with the cockpit voice recorder requirements may be located near the cockpit.

(f) If the cockpit voice recorder has a bulk erasure device, the installation must be designed to minimize the probability of inadvertent operation and actuation of the device during crash impact.

(g) Each recorder container must—

(1) Be either bright orange or bright yellow;

(2) Have reflective tape affixed to its external surface to facilitate its location under water; and

(3) Have an underwater locating device, when required by the operating rules of this chapter, on or adjacent to the container, which is secured in such manner that they are not likely to be separated during crash impact.

§ 23.1459 Flight data recorders.

(a) Each flight recorder required by the operating rules of this chapter must be installed so that—

(1) It is supplied with airspeed, altitude, and directional data obtained from sources that meet the aircraft level system requirements and the functionality specified in § 23.2500;

(2) The vertical acceleration sensor is rigidly attached, and located longitudinally either within the approved center of gravity limits of the airplane, or at a distance forward or aft of these limits that does not exceed 25 percent of the airplane's mean aerodynamic chord;

(3)(i) It receives its electrical power from the bus that provides the maximum reliability for operation of the

flight data recorder without jeopardizing service to essential or emergency loads;

(ii) It remains powered for as long as possible without jeopardizing emergency operation of the airplane;

(4) There is an aural or visual means for preflight checking of the recorder for proper recording of data in the storage medium;

(5) Except for recorders powered solely by the engine-driven electrical generator system, there is an automatic means to simultaneously stop a recorder that has a data erasure feature and prevent each erasure feature from functioning, within 10 minutes after crash impact;

(6) Any single electrical failure external to the recorder does not disable both the cockpit voice recorder and the flight data recorder; and

(7) It is in a separate container from the cockpit voice recorder when both are required. If used to comply with only the flight data recorder requirements, a combination unit may be installed. If a combination unit is installed as a cockpit voice recorder to comply with §23.1457(e)(2), a combination unit must be used to comply with this flight data recorder requirement.

(b) Each non-ejectable record container must be located and mounted so as to minimize the probability of container rupture resulting from crash impact and subsequent damage to the record from fire. In meeting this requirement, the record container must be located as far aft as practicable, but need not be aft of the pressurized compartment, and may not be where aft-mounted engines may crush the container upon impact.

(c) A correlation must be established between the flight recorder readings of airspeed, altitude, and heading and the corresponding readings (taking into account correction factors) of the first pilot's instruments. The correlation must cover the airspeed range over which the airplane is to be operated, the range of altitude to which the airplane is limited, and 360 degrees of heading. Correlation may be established on the ground as appropriate.

(d) Each recorder container must—

(1) Be either bright orange or bright yellow;

(2) Have reflective tape affixed to its external surface to facilitate its location under water; and

(3) Have an underwater locating device, when required by the operating rules of this chapter, on or adjacent to the container, which is secured in such a manner that they are not likely to be separated during crash impact.

(e) Any novel or unique design or operational characteristics of the aircraft shall be evaluated to determine if any dedicated parameters must be recorded on flight recorders in addition to or in place of existing requirements.

§ 23.1529 Instructions for continued airworthiness.

The applicant must prepare Instructions for Continued Airworthiness, in accordance with appendix A of this part, that are acceptable to the Administrator. The instructions may be incomplete at type certification if a program exists to ensure their completion prior to delivery of the first airplane or issuance of a standard certificate of airworthiness, whichever occurs later.

Subpart A—General

§ 23.2000 Applicability and definitions.

(a) This part prescribes airworthiness standards for the issuance of type certificates, and changes to those certificates, for airplanes in the normal category.

(b) For the purposes of this part, the following definition applies:

Continued safe flight and landing means an airplane is capable of continued controlled flight and landing, possibly using emergency procedures, without requiring exceptional pilot skill or strength. Upon landing, some airplane damage may occur as a result of a failure condition.

§ 23.2005 Certification of normal category airplanes.

(a) Certification in the normal category applies to airplanes with a passenger-seating configuration of 19 or less and a maximum certificated takeoff weight of 19,000 pounds or less.

(b) Airplane certification levels are:

(1) Level 1—for airplanes with a maximum seating configuration of 0 to 1 passengers.

(2) Level 2—for airplanes with a maximum seating configuration of 2 to 6 passengers.

(3) Level 3—for airplanes with a maximum seating configuration of 7 to 9 passengers.

(4) Level 4—for airplanes with a maximum seating configuration of 10 to 19 passengers.

(c) Airplane performance levels are:

(1) Low speed—for airplanes with a V_{NO} and $V_{MO} \leq 250$ Knots Calibrated Airspeed (KCAS) and a $M_{MO} \leq 0.6$.

(2) High speed—for airplanes with a V_{NO} or $V_{MO} > 250$ KCAS or a $M_{MO} > 0.6$.

(d) Airplanes not certified for aerobatics may be used to perform any maneuver incident to normal flying, including—

(1) Stalls (except whip stalls); and

(2) Lazy eights, chandelles, and steep turns, in which the angle of bank is not more than 60 degrees.

(e) Airplanes certified for aerobatics may be used to perform maneuvers without limitations, other than those limitations established under subpart G of this part.

§ 23.2010 Accepted means of compliance.

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

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

Subpart B—Flight

PERFORMANCE

§ 23.2100 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 airplane.

(b) The applicant must comply with each requirement of this subpart at critical combinations of weight and center of gravity within the airplane's range of loading conditions using tolerances acceptable to the Administrator.

(c) The condition of the airplane at the time of determining its empty weight and center of gravity must be well defined and easily repeatable.

§ 23.2105 Performance data.

(a) Unless otherwise prescribed, an airplane must meet the performance requirements of this subpart in—

(1) Still air and standard atmospheric conditions at sea level for all airplanes; and

(2) Ambient atmospheric conditions within the operating envelope for levels 1 and 2 high-speed and levels 3 and 4 airplanes.

(b) Unless otherwise prescribed, the applicant must develop the performance data required by this subpart for the following conditions:

(1) Airport altitudes from sea level to 10,000 feet (3,048 meters); 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 distances 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, and other demands on power sources.

§ 23.2110 Stall speed.

The applicant must determine the airplane stall speed or the minimum steady flight speed for each flight configuration used in normal operations, including takeoff, climb, cruise, descent, approach, and landing. The stall speed or minimum steady flight speed determination must account for the most adverse conditions for each flight configuration with power set at—

(a) Idle or zero thrust for propulsion systems that are used primarily for thrust; and

(b) A nominal thrust for propulsion systems that are used for thrust, flight control, and/or high-lift systems.

§ 23.2115 Takeoff performance.

(a) The applicant must determine airplane takeoff performance accounting for—

(1) Stall speed safety margins;
(2) Minimum control speeds; and
(3) Climb gradients.
(b) For single engine airplanes and levels 1, 2, and 3 low-speed multiengine airplanes, takeoff performance includes the determination of ground roll and initial climb distance to 50 feet (15 meters) above the takeoff surface.
(c) For levels 1, 2, and 3 high-speed multiengine airplanes, and level 4 multiengine airplanes, takeoff performance includes a determination of the following distances after a sudden critical loss of thrust—
(1) An aborted takeoff at critical speed;
(2) Ground roll and initial climb to 35 feet (11 meters) above the takeoff surface; and
(3) Net takeoff flight path.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

§ 23.2120 Climb requirements.

The design must comply with the following minimum climb performance out of ground effect:
(a) With all engines operating and in the initial climb configuration(s)—
(1) For levels 1 and 2 low-speed airplanes, a climb gradient of 8.3 percent for landplanes and 6.7 percent for seaplanes and amphibians; and
(2) For levels 1 and 2 high-speed airplanes, all level 3 airplanes, and level 4 single-engines a climb gradient after takeoff of 4 percent.
(b) After a critical loss of thrust on multiengine airplanes—
(1) For levels 1 and 2 low-speed airplanes that do not meet single-engine crashworthiness requirements, a climb gradient of 1.5 percent at a pressure altitude of 5,000 feet (1,524 meters) in the cruise configuration(s);
(2) For levels 1 and 2 high-speed airplanes, and level 3 low-speed airplanes, a 1 percent climb gradient at 400 feet (122 meters) above the takeoff surface with the landing gear retracted and flaps in the takeoff configuration(s); and
(3) For level 3 high-speed airplanes and all level 4 airplanes, a 2 percent climb gradient at 400 feet (122 meters) above the takeoff surface with the landing gear retracted and flaps in the approach configuration(s).
(c) For a balked landing, a climb gradient of 3 percent without creating undue pilot workload with the landing gear extended and flaps in the landing configuration(s).

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

§ 23.2125 Climb information.

(a) The applicant must determine climb performance at each weight, altitude, and ambient temperature within the operating limitations—
(1) For all single-engine airplanes;
(2) For levels 1 and 2 high-speed multiengine airplanes and level 3 multiengine airplanes, following a critical loss of thrust on takeoff in the initial climb configuration; and
(3) For all multiengine airplanes, during the enroute phase of flight with all engines operating and after a critical loss of thrust in the cruise configuration.
(b) The applicant must determine the glide performance for single-engine airplanes after a complete loss of thrust.

§ 23.2130 Landing.

The applicant must determine the following, for standard temperatures at critical combinations of weight and altitude within the operational limits:
(a) The distance, starting from a height of 50 feet (15 meters) above the landing surface, required to land and come to a stop.
(b) The approach and landing speeds, configurations, and procedures, which allow a pilot of average skill to land within the published landing distance consistently and without causing damage or injury, and which allow for a safe transition to the balked landing conditions of this part accounting for:
(1) Stall speed safety margin; and
(2) Minimum control speeds.

FLIGHT CHARACTERISTICS

§ 23.2135 Controllability.

(a) The airplane must be controllable and maneuverable, without requiring exceptional piloting skill, alertness, or

strength, within the operating envelope—

(1) At all loading conditions for which certification is requested;

(2) During all phases of flight;

(3) With likely reversible flight control or propulsion system failure; and

(4) During configuration changes.

(b) The airplane must be able to complete a landing without causing substantial damage or serious injury using the steepest approved approach gradient procedures and providing a reasonable margin below V_{ref} or above approach angle of attack.

(c) V_{MC} is the calibrated airspeed at which, following the sudden critical loss of thrust, it is possible to maintain control of the airplane. For multiengine airplanes, the applicant must determine $V_{MC,}$ if applicable, for the most critical configurations used in takeoff and landing operations.

(d) If the applicant requests certification of an airplane for aerobatics, the applicant must demonstrate those aerobatic maneuvers for which certification is requested and determine entry speeds.

§ 23.2140 Trim.

(a) The airplane 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 the following conditions:

(1) For levels 1, 2, and 3 airplanes in cruise.

(2) For level 4 airplanes in normal operations.

(b) The airplane 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 airplane and likely abnormal or emergency operations, including a critical loss of thrust on multiengine airplanes.

§ 23.2145 Stability.

(a) Airplanes not certified for aerobatics must—

(1) Have static longitudinal, lateral, and directional stability in normal operations;

(2) Have dynamic short period and Dutch roll stability in normal operations; and

(3) Provide stable control force feedback throughout the operating envelope.

(b) No airplane may exhibit any divergent longitudinal stability characteristic so unstable as to increase the pilot's workload or otherwise endanger the airplane and its occupants.

§ 23.2150 Stall characteristics, stall warning, and spins.

(a) The airplane must have controllable stall characteristics in straight flight, turning flight, and accelerated turning flight with a clear and distinctive stall warning that provides sufficient margin to prevent inadvertent stalling.

(b) Single-engine airplanes, not certified for aerobatics, must not have a tendency to inadvertently depart controlled flight.

(c) Levels 1 and 2 multiengine airplanes, not certified for aerobatics, must not have a tendency to inadvertently depart controlled flight from thrust asymmetry after a critical loss of thrust.

(d) Airplanes certified for aerobatics that include spins must have controllable stall characteristics and the ability to recover within one and one-half additional turns after initiation of the first control action from any point in a spin, not exceeding six turns or any greater number of turns for which certification is requested, while remaining within the operating limitations of the airplane.

(e) Spin characteristics in airplanes certified for aerobatics that includes spins must recover without exceeding limitations and may not result in unrecoverable spins—

(1) With any typical use of the flight or engine power controls; or

(2) Due to pilot disorientation or incapacitation.

§ 23.2155 Ground and water handling characteristics.

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

§ 23.2160 Vibration, buffeting, and high-speed characteristics.

(a) Vibration and buffeting, for operations up to V_D/M_D, must not interfere with the control of the airplane or cause excessive fatigue to the flightcrew. Stall warning buffet within these limits is allowable.

(b) For high-speed airplanes and all airplanes with a maximum operating altitude greater than 25,000 feet (7,620 meters) pressure altitude, there must be no perceptible buffeting in cruise configuration at 1g and at any speed up to V_{MO}/M_{MO}, except stall buffeting.

(c) For high-speed airplanes, the applicant must determine the positive maneuvering load factors at which the onset of perceptible buffet occurs in the cruise configuration within the operational envelope. Likely inadvertent excursions beyond this boundary must not result in structural damage.

(d) High-speed airplanes must have recovery characteristics that do not result in structural damage or loss of control, beginning at any likely speed up to V_{MO}/M_{MO}, following—

(1) An inadvertent speed increase; and

(2) A high-speed trim upset for airplanes where dynamic pressure can impair the longitudinal trim system operation.

§ 23.2165 Performance and flight characteristics requirements for flight in icing conditions.

(a) An applicant who requests certification for flight in icing conditions defined in part 1 of appendix C to part 25 of this chapter, or an applicant who requests certification for flight in these icing conditions and any additional atmospheric icing conditions, must show the following in the icing conditions for which certification is requested under normal operation of the ice protection system(s):

(1) Compliance with each requirement of this subpart, except those applicable to spins and any that must be demonstrated at speeds in excess of—

(i) 250 KCAS;

(ii) V_{MO}/M_{MO} or V_{NE}; or

(iii) A speed at which the applicant demonstrates the airframe will be free of ice accretion.

(2) The means by which stall warning is provided to the pilot for flight in icing conditions and non-icing conditions is the same.

(b) If an applicant requests certification for flight in icing conditions, the applicant must provide a means to detect any icing conditions for which certification is not requested and show the airplane's ability to avoid or exit those conditions.

(c) The applicant must develop an operating limitation to prohibit intentional flight, including takeoff and landing, into icing conditions for which the airplane is not certified to operate.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

Subpart C—Structures

§ 23.2200 Structural design envelope.

The applicant must determine the structural design envelope, which describes the range and limits of airplane design and operational parameters for which the applicant will show compliance with the requirements of this subpart. The applicant must account for all airplane 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 stalling speed of the airplane 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 airplane empty weight to the maximum weight; and

(2) The weight and distribution of occupants, payload, and fuel.

(d) Characteristics of airplane 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.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

§ 23.2205 Interaction of systems and structures.

For airplanes equipped with systems that modify structural performance, alleviate the impact of this subpart's requirements, or provide a means of compliance with this subpart, the applicant must account for the influence and failure of these systems when showing compliance with the requirements of this subpart.

STRUCTURAL LOADS

§ 23.2210 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 airplane 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.

§ 23.2215 Flight load conditions.

The applicant must determine the structural design loads resulting from the following flight conditions:

(a) Atmospheric gusts where the magnitude and gradient of these gusts are based on measured gust statistics.

(b) Symmetric and asymmetric maneuvers.

(c) Asymmetric thrust resulting from the failure of a powerplant unit.

§ 23.2220 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.

§ 23.2225 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) A pressurized cabin resulting from the pressurization differential—

(1) From zero up to the maximum relief pressure combined with gust and maneuver loads;

(2) From zero up to the maximum relief pressure combined with ground and water loads if the airplane may land with the cabin pressurized; and

(3) At the maximum relief pressure multiplied by 1.33, omitting all other loads.

§ 23.2230 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 part; 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 part.

STRUCTURAL PERFORMANCE

§ 23.2235 Structural strength.

The structure must support:

(a) Limit loads without—

(1) Interference with the safe operation of the airplane; and

(2) Detrimental permanent deformation.

(b) Ultimate loads.

§ 23.2240 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 § 23.1529.

(b) For Level 4 airplanes, the procedures developed for compliance with paragraph (a) of this section must be capable of detecting structural damage before the damage could result in structural failure.

(c) For pressurized airplanes:

(1) The airplane must be capable of continued safe flight and landing following a sudden release of cabin pressure, including sudden releases caused by door and window failures.

(2) For airplanes with maximum operating altitude greater than 41,000 feet, the procedures developed for compliance with paragraph (a) of this section must be capable of detecting damage to the pressurized cabin structure before the damage could result in rapid decompression that would result in serious or fatal injuries.

(d) The airplane must be designed to minimize hazards to the airplane due to structural damage caused by high-energy fragments from an uncontained engine or rotating machinery failure.

§ 23.2245 Aeroelasticity.

(a) The airplane 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 degrees of freedom; and

(4) Accounting for any critical failures or malfunctions.

(b) The applicant must establish tolerances for all quantities that affect flutter.

DESIGN

§ 23.2250 Design and construction principles.

(a) The applicant must design each part, article, and assembly for the expected operating conditions of the airplane.

(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 airplane 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.

§ 23.2255 Protection of structure.

(a) The applicant must protect each part of the airplane, 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 airplane 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 airplane design to allow such actions to be accomplished.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

§ 23.2260 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 the Administrator.

§ 23.2265 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

§ 23.2270 Emergency conditions.

(a) The airplane, 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 airplane.

(c) The airplane 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 airplane 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 part;

(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.

Subpart D—Design and Construction

§ 23.2300 Flight control systems.

(a) The applicant must design airplane flight control systems to:

(1) Operate easily, smoothly, and positively enough to allow proper performance of their functions.

(2) Protect against likely hazards.

(b) The applicant must design trim systems, if installed, to:

(1) Protect against inadvertent, incorrect, or abrupt trim operation.

(2) Provide a means to indicate—

(i) The direction of trim control movement relative to airplane motion;

(ii) The trim position with respect to the trim range;

(iii) The neutral position for lateral and directional trim; and

(iv) The range for takeoff for all applicant requested center of gravity ranges and configurations.

§ 23.2305 Landing gear systems.

(a) The landing gear must be designed to—

(1) Provide stable support and control to the airplane during surface operation; and

(2) Account for likely system failures and likely operation environments (including anticipated limitation exceedances and emergency procedures).

(b) All airplanes must have a reliable means of stopping the airplane with sufficient kinetic energy absorption to account for landing. Airplanes that are required to demonstrate aborted takeoff capability must account for this additional kinetic energy.

(c) For airplanes 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.

§ 23.2310 Buoyancy for seaplanes and amphibians.

Airplanes intended for operations on water, must—

(a) Provide buoyancy of 80 percent in excess of the buoyancy required to support the maximum weight of the airplane in fresh water; and

(b) Have sufficient margin so the airplane will stay afloat at rest in calm water without capsizing in case of a likely float or hull flooding.

OCCUPANT SYSTEM DESIGN PROTECTION

§ 23.2315 Means of egress and emergency exits.

(a) With the cabin configured for takeoff or landing, the airplane is designed to:

(1) Facilitate rapid and safe evacuation of the airplane in conditions likely to occur following an emergency landing, excluding ditching for level 1, level 2, and single-engine level 3 airplanes.

(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 airplane.

(3) Have easy access to emergency exits when present.

(b) Airplanes approved for aerobatics must have a means to egress the airplane in flight.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

§ 23.2320 Occupant physical environment.

(a) The applicant must design the airplane to—

(1) Allow clear communication between the flightcrew and passengers;

(2) Protect the pilot and flight controls from propellers; and

(3) Protect the occupants from serious injury due to damage to windshields, windows, and canopies.

(b) For level 4 airplanes, each windshield and its supporting structure directly in front of the pilot must withstand, without penetration, the impact equivalent to a two-pound bird when the velocity of the airplane is equal to the airplane's maximum approach flap speed.

(c) The airplane 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.

(d) If a pressurization system is installed in the airplane, it must be designed to protect against—

(1) Decompression to an unsafe level; and

(2) Excessive differential pressure.

(e) If an oxygen system is installed in the airplane, it must—

(1) Effectively provide oxygen to each user to prevent the effects of hypoxia; and

(2) Be free from hazards in itself, in its method of operation, and its effect upon other components.

FIRE AND HIGH ENERGY PROTECTION

§ 23.2325 Fire protection.

(a) The following materials must be self-extinguishing—

(1) Insulation on electrical wire and electrical cable;

(2) For levels 1, 2, and 3 airplanes, materials in the baggage and cargo compartments inaccessible in flight; and

(3) For level 4 airplanes, materials in the cockpit, cabin, baggage, and cargo compartments.

(b) The following materials must be flame resistant—

(1) For levels 1, 2 and 3 airplanes, 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) For level 4 airplanes, each baggage and cargo compartment must—

(1) Be located where a fire would be visible to the pilots, or equipped with a fire detection system and warning system; and

(2) Be accessible for the manual extinguishing of a fire, have a built-in fire extinguishing system, or be constructed and sealed to contain any fire within the compartment.

(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

(2) For levels 3 and 4 airplanes, passengers have a fire extinguishing means available within the passenger compartment.

(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) Combustion heater installations must be protected from uncontained fire.

§ 23.2330 Fire protection in designated fire zones and adjacent areas.

(a) Flight controls, engine mounts, and other flight structures within or adjacent to designated fire zones must be capable of withstanding the effects of a fire.

(b) Engines in a designated fire zone must remain attached to the airplane in the event of a fire.

(c) In designated fire zones, terminals, equipment, and electrical cables used during emergency procedures must be fire-resistant.

§ 23.2335 Lightning protection.

The airplane must be protected against catastrophic effects from lightning.

Subpart E—Powerplant

§ 23.2400 Powerplant installation.

(a) For the purpose of this subpart, the airplane powerplant installation must include each component necessary for propulsion, which affects propulsion safety, or provides auxiliary power to the airplane.

(b) Each airplane engine and propeller must be type certificated, except for engines and propellers installed on level 1 low-speed airplanes, which may be approved under the airplane type certificate in accordance with a standard accepted by the Administrator that contains airworthiness criteria the Administrator has found appropriate and applicable to the specific design and intended use of the engine or propeller and provides a level of safety acceptable to the Administrator.

(c) 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 airplane parts and their surroundings;

(3) Likely hazards in operation including hazards to ground personnel; and

(4) Vibration and fatigue.

(d) Hazardous accumulations of fluids, vapors, or gases must be isolated from the airplane and personnel compartments, and be safely contained or discharged.

(e) Powerplant components must comply with their component limitations and installation instructions or be shown not to create a hazard.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

§ 23.2405 Automatic power or thrust control systems.

(a) An automatic power or thrust control system intended for in-flight use must be designed so no unsafe condition will result during normal operation of the system.

(b) Any single failure or likely combination of failures of an automatic power or thrust control system must not prevent continued safe flight and landing of the airplane.

(c) Inadvertent operation of an automatic power or thrust control system by the flightcrew must be prevented, or if not prevented, must not result in an unsafe condition.

(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.

§ 23.2410 Powerplant installation hazard assessment.

The applicant must assess each powerplant separately and in relation to other airplane 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 crewmember for continued operation of any remaining powerplant system.

§ 23.2415 Powerplant ice protection.

(a) The airplane 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.

§ 23.2420 Reversing systems.

Each reversing system must be designed so that—

(a) No unsafe condition will result during normal operation of the system; and

(b) The airplane is capable of continued safe flight and landing after any single failure, likely combination of failures, or malfunction of the reversing system.

§ 23.2425 Powerplant operational characteristics.

(a) The installed powerplant must operate without any hazardous characteristics during normal and emergency operation within the range of operating limitations for the airplane and the engine.

(b) The pilot must have the capability to stop the powerplant in flight and restart the powerplant within an established operational envelope.

§ 23.2430 Fuel systems.

(a) Each fuel system must—

(1) Be designed and arranged to provide independence between multiple fuel storage and supply systems so that failure of any one component in one system will not result in loss of fuel storage or supply of another system;

(2) Be designed and arranged to prevent ignition of the fuel within the system by direct lightning strikes or swept lightning strokes to areas where such occurrences are highly probable, or by corona or streamering at fuel vent outlets;

(3) Provide the fuel necessary to ensure each powerplant and auxiliary power unit functions properly in all likely operating conditions;

(4) Provide the flightcrew with a means to determine the total useable fuel available and provide uninterrupted supply of that fuel when the system is correctly operated, accounting for likely fuel fluctuations;

(5) Provide a means to safely remove or isolate the fuel stored in the system from the airplane;

(6) Be designed to retain fuel under all likely operating conditions and minimize hazards to the occupants during any survivable emergency landing. For level 4 airplanes, failure due to overload of the landing system must be taken into account; and

(7) Prevent hazardous contamination of the fuel supplied to each powerplant and auxiliary power unit.

(b) Each fuel storage system must—

(1) Withstand the loads under likely operating conditions without failure;

(2) Be isolated from personnel compartments and protected from hazards due to unintended temperature influences;

(3) Be designed to prevent significant loss of stored fuel from any vent system due to fuel transfer between fuel storage or supply systems, or under likely operating conditions;

(4) Provide fuel for at least one-half hour of operation at maximum continuous power or thrust; and

(5) Be capable of jettisoning fuel safely if required for landing.

(c) Each fuel storage refilling or recharging system must be designed to—

(1) Prevent improper refilling or recharging;

(2) Prevent contamination of the fuel stored during likely operating conditions; and

(3) Prevent the occurrence of any hazard to the airplane or to persons during refilling or recharging.

§ 23.2435 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.

§ 23.2440 Powerplant fire protection.

(a) A powerplant, auxiliary power unit, or combustion heater that includes a flammable fluid and an ignition source for that fluid must be installed in a designated fire zone.

(b) Each designated fire zone must provide a means to isolate and mitigate hazards to the airplane in the event of fire or overheat within the zone.

(c) Each component, line, fitting, and control subject to fire conditions must—

(1) Be designed and located to prevent hazards resulting from a fire, including any located adjacent to a designated fire zone that may be affected by fire within that zone;

(2) Be fire-resistant if carrying flammable fluid, gas or air, or is required to operate in the event of a fire; and

(3) Be fireproof or enclosed by a fire proof shield if storing concentrated flammable fluids.

(d) The applicant must provide a means to prevent hazardous quantities of flammable fluids from flowing into, within or through each designated fire zone. This means must—

(1) Not restrict flow or limit operation of any remaining powerplant or auxiliary power unit, or equipment necessary for safety;

(2) Prevent inadvertent operation; and

(3) Be located outside the fire zone unless an equal degree of safety is provided with a means inside the fire zone.

(e) A means to ensure the prompt detection of fire must be provided for each designated fire zone—

(1) On a multiengine airplane where detection will mitigate likely hazards to the airplane; or

(2) That contains a fire extinguisher.

(f) A means to extinguish fire within a fire zone, except a combustion heater fire zone, must be provided for—

(1) Any fire zone located outside the pilot's view;

(2) Any fire zone embedded within the fuselage, which must also include a redundant means to extinguish fire; and

(3) Any fire zone on a level 4 airplane.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

Subpart F—Equipment

§ 23.2500 Airplane level systems requirements.

This section applies generally to installed equipment and systems unless a section of this part imposes requirements for a specific piece of equipment, system, or systems.

(a) The equipment and systems required for an airplane 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 airplane; and

(2) Perform their intended function throughout the operating and environmental limits for which the airplane is certificated.

(b) The systems and equipment not covered by paragraph (a) of this section—considered separately and in relation to other systems—must be designed and installed so their operation does not have an adverse effect on the airplane or its occupants.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

§ 23.2505 Function and installation.

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

§ 23.2510 Equipment, systems, and installations.

For any airplane system or equipment whose failure or abnormal operation has not been specifically addressed by another requirement in this part, 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.

§ 23.2515 Electrical and electronic system lightning protection.

An airplane approved for IFR operations must meet the following requirements, unless an applicant shows that exposure to lightning is unlikely:

(a) Each electrical or electronic system that performs a function, the failure of which would prevent the continued safe flight and landing of the airplane, must be designed and installed such that—

(1) The function at the airplane level is not adversely affected during and after the time the airplane is exposed to lightning; and

(2) The system recovers normal operation of that function in a timely manner after the airplane is exposed to lightning 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 significantly reduce the capability of the airplane 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 airplane is exposed to lightning.

§ 23.2520 High-intensity Radiated Fields (HIRF) protection.

(a) Each electrical and electronic system that performs a function, the failure of which would prevent the continued safe flight and landing of the airplane, must be designed and installed such that—

(1) The function at the airplane level is not adversely affected during and after the time the airplane is exposed to the HIRF environment; and

(2) The system recovers normal operation of that function in a timely manner after the airplane is exposed to the HIRF environment, unless the system's recovery conflicts with other operational or functional requirements of the system.

(b) For airplanes approved for IFR operations, each electrical and electronic system that performs a function, the failure of which would significantly reduce the capability of the airplane 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 airplane is exposed to the HIRF environment.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

§ 23.2525 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 non-continuous essential loads for the time needed to complete the function required for continued safe flight and landing.

§ 23.2530 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 part 91 of this chapter, 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 part 91 of this chapter, must include a red light on the left side of the airplane, a green light on the right side of the airplane, spaced laterally as far

apart as practicable, and a white light facing aft, located on an aft portion of the airplane or on the wing tips.

(d) Any taxi and landing lights must be designed and installed so they provide sufficient light for night operations.

(e) For seaplanes or amphibian airplanes, riding lights must provide a white light visible in clear atmospheric conditions.

§ 23.2535 Safety equipment.

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

§ 23.2540 Flight in icing conditions.

An applicant who requests certification for flight in icing conditions defined in part 1 of appendix C to part 25 of this chapter, or an applicant who requests certification for flight in these icing conditions and any additional atmospheric icing conditions, must show the following in the icing conditions for which certification is requested:

(a) The ice protection system provides for safe operation.

(b) The airplane design must provide protection from stalling when the autopilot is operating.

§ 23.2545 Pressurized systems elements.

Pressurized systems must withstand appropriate proof and burst pressures.

§ 23.2550 Equipment containing high-energy rotors.

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

Subpart G—Flightcrew Interface and Other Information

§ 23.2600 Flightcrew interface.

(a) The pilot compartment, its equipment, and its arrangement to include pilot view, must allow each pilot to perform his or her duties, including taxi, takeoff, climb, cruise, descent, approach, landing, and perform any maneuvers within the operating envelope of the airplane, without excessive concentration, skill, alertness, or fatigue.

(b) The applicant must install flight, navigation, surveillance, and powerplant controls and displays so flightcrew members 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) For level 4 airplanes, the flightcrew interface design must allow for continued safe flight and landing after the loss of vision through any one of the windshield panels.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

§ 23.2605 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 airplane, 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.

§ 23.2610 Instrument markings, control markings, and placards.

(a) Each airplane 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 Airplane Flight Manual.

§ 23.2615 Flight, navigation, and powerplant instruments.

(a) Installed systems must provide the flightcrew member who sets or monitors parameters for the flight, navigation, and powerplant, the information necessary to do so during each phase of flight. This information must—

(1) Be presented in a manner that the crewmember can monitor the parameter and determine trends, as needed, to operate the airplane; and

(2) Include limitations, unless the limitation cannot be exceeded in all intended operations.

(b) Indication systems that integrate the display of flight or powerplant parameters to operate the airplane or are required by the operating rules of this chapter must—

(1) Not inhibit the primary display of flight or powerplant parameters needed by any flightcrew member in any normal mode of operation; and

(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.

§ 23.2620 Airplane flight manual.

The applicant must provide an Airplane Flight Manual that must be delivered with each airplane.

(a) The Airplane Flight Manual must contain the following information—

(1) Airplane operating limitations;

(2) Airplane 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 following sections of the Airplane Flight Manual must be approved by the FAA in a manner specified by the Administrator—

(1) For low-speed, level 1 and 2 airplanes, those portions of the Airplane Flight Manual containing the information specified in paragraph (a)(1) of this section; and

(2) For high-speed level 1 and 2 airplanes and all level 3 and 4 airplanes, those portions of the Airplane Flight Manual containing the information specified in paragraphs (a)(1) thru (a)(4) of this section.

[Doc. No. FAA–2015–1621, Amdt. 23–64, 81 FR 96689, Dec. 30, 2016, as amended by Doc. No. FAA–2022–1355, Amdt. 23–65, 87 FR 75710, Dec. 9, 2022]

APPENDIX A TO PART 23—INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

A23.1 General

(a) This appendix specifies requirements for the preparation of Instructions for Continued Airworthiness as required by this part.

(b) The Instructions for Continued Airworthiness for each airplane must include the Instructions for Continued Airworthiness for each engine and propeller (hereinafter designated ''products''), for each appliance required by this chapter, and any required information relating to the interface of those appliances and products with the airplane. If Instructions for Continued Airworthiness are not supplied by the manufacturer of an appliance or product installed in the airplane, the Instructions for Continued Airworthiness for the airplane must include the information essential to the continued airworthiness of the airplane.

(c) The applicant must submit to the FAA 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 airplane will be distributed.

A23.2 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.

A23.3 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 and information:

(a) Airplane maintenance manual or section.

(1) Introduction information that includes an explanation of the airplane's features and data to the extent necessary for maintenance or preventive maintenance.

(2) A description of the airplane and its systems and installations including its engines, propellers, and appliances.

(3) Basic control and operation information describing how the airplane 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 airplane 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 airplane.

(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) In addition, for level 4 airplanes, the following information must be furnished—

(1) Electrical loads applicable to the various systems;

(2) Methods of balancing control surfaces;

(3) Identification of primary and secondary structures; and

(4) Special repair methods applicable to the airplane.

A23.4 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 FAA approved and specifies maintenance required under §§43.16 and 91.403 of Title 14 of the Code of Federal Regulations unless an alternative program has been FAA approved.''

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

SPECIAL FEDERAL AVIATION REGULATION NO. 13

SPECIAL FEDERAL AVIATION REGULATION NO. 109

Subpart A—General

Subpart B—Flight

GENERAL

PERFORMANCE