Designation: F3083/F3083M – 23a

Standard Specification for Emergency Conditions, Occupant Safety and Accommodations[1]

This standard is issued under the fixed designation F3083/F3083M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification addresses emergency conditions, occupant safety and accommodations for occupants and cargo.

1.2 The applicant for a design approval must seek the individual guidance of their respective civil aviation authority (CAA) body concerning the use of this standard as part of a certification plan. For information on which CAA regulatory bodies have accepted this standard (in whole or in part) as a means of compliance to their airworthiness regulations (Hereinafter referred to as "the Rules"), refer to ASTM F44 webpage (www.ASTM.org/COMITTEE/F44.htm) which includes CAA website links.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F3060 Terminology for Aircraft

F3061/F3061M Specification for Systems and Equipment in Aircraft

F3179/F3179M Specification for Performance of Aircraft

2.2 *U.S. Code of Federal Regulations:*[3]

49 CFR Part 572 Anthropomorphic Test Devices (Subpart B)

2.3 *European Aviation Safety Agency Regulations:*[4]

CS-23 Certification Specifications for Normal, Utility, Aerobatic, and Commuter Category Aeroplanes (Amendment 3)

CS-VLA Certifications Specifications for Very Light Aeroplanes (Amendment 1)

2.4 *Other Standards:*

DOT/FAA/AR-00 Aircraft Materials Fire Test Handbook[5]

PH1.25 Standard Specifications for Safety Photographic Film[6]

3. Terminology

3.1 See Terminology F3060 for definitions of terms used in this standard.

3.2 *Abbreviations:*

3.2.1 g_p—peak deceleration for seat/restraint system test

3.2.2 *HIC*—head injury criteria

3.2.3 t_r—rise time to the peak deceleration, g_p

4. Emergency Landing Conditions

4.1 *General:*

4.1.1 The airplane, although it may be damaged in emergency landing conditions, must be designed as prescribed in this section to protect each occupant under those conditions.

4.1.2 The structure must be designed to give each occupant every reasonable chance of escaping serious injury when:

4.1.2.1 Proper use is made of the seats, safety belts, and shoulder harnesses provided for in the design.

[1] This specification is under the jurisdiction of ASTM Committee F44 on General Aviation Aircraft and is the direct responsibility of Subcommittee F44.30 on Structures.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from U.S. Government Publishing Office (GPO), 732 N. Capitol Street NW, Washington, D.C. 20401, http://www.ecfr.gov.

[4] Available from the European Aviation Safety Agency (EASA), Postfach 10 12 53, D-50452 Cologne, Germany, https://www.easa.europa.eu/.

[5] Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, http://www.faa.gov.

[6] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

4.1.2.2 The occupant experiences the static inertia loads corresponding to the following ultimate load factors:

(1) Upward, 3.0 g, or 4.5 g for airplanes approved for aerobatics;

(2) Forward, 9.0 g;

(3) Sideward, 1.5 g; and

(4) Downward, 6.0 g when certification to the emergency exit provisions of 5.6.4.1(*2*) is requested.

4.1.2.3 The items of mass within the cabin, that could injure an occupant, experience the static inertia loads corresponding to the following ultimate load factors:

(1) For Level 1 aircraft with a V_{S0} not more than 83 km/h [45 kts]:

(a) Upward, 3.0 g;

(b) Forward, 9.0 g; and

(c) Sideward, 1.5 g.

(2) For all other aircraft:

(a) Upward, 3.0 g;

(b) Forward, 18.0 g; and

(c) Sideward, 4.5 g.

4.1.3 Each airplane with retractable landing gear must be designed to protect each occupant in a landing:

4.1.3.1 With the wheels retracted;

4.1.3.2 With moderate descent velocity; and

4.1.3.3 Assuming, in the absence of a more rational analysis:

(1) A downward ultimate inertia force of 3 g; and

(2) A coefficient of friction of 0.5 at the ground.

4.1.4 Unless it is established that a turnover is unlikely during an emergency landing, the structure must be designed to protect the occupants in a complete turnover. For determining the loads to be applied to the inverted airplane after a turnover, in the absence of a more rational analysis, an upward ultimate inertia load factor of 3.0 g and a coefficient of friction with the ground of 0.5 must be used.

4.1.4.1 For Level 1 aircraft, it must be assumed that turnover is likely.

4.1.4.2 For Level 2 through 4 aircraft, the likelihood of a turnover may be shown by an analysis assuming the following conditions:

(1) The most adverse combination of weight and center of gravity position;

(2) Longitudinal load factor of 9.0 g;

(3) Vertical load factor of 1.0 g; and

(4) For airplanes with tricycle landing gear, the nose wheel strut failed with the nose contacting the ground.

4.1.5 Except as provided in 5.5.1.4, the supporting structure must be designed to restrain, under loads up to those specified in 4.1.2.3, each item of mass that could injure an occupant if it came loose in a minor crash landing.

4.1.6 Powerplant and ESS mounts and supporting structures must withstand 15.0 g forward for powerplants and ESS installed behind and above the seating compartment.

4.1.7 For powerplants and ESS mounted inside the fuselage, aft of the cabin, it must be shown by test or analysis that the powerplants and ESS, the attached accessories, and the associated mounting structure:

4.1.7.1 Can withstand a forward acting static ultimate inertia load factor of 18.0 g plus the maximum takeoff engine thrust; or

4.1.7.2 The airplane structure is designed to preclude the powerplant or ESS and its attached accessories from entering or protruding into the cabin should the mounting structure fail.

4.2 *Dynamic Conditions:*

4.2.1 Each seat/restraint system must be designed to protect each occupant during an emergency landing when:

4.2.1.1 Proper use is made of seats, safety belts, and shoulder harnesses provided for in the design; and

4.2.1.2 The occupant is exposed to the loads resulting from the conditions prescribed in this section.

4.2.2 Except for those seat/restraint systems that are required to meet 4.2.4, 4.2.5, or 4.2.6, each seat/restraint system for crew or passenger occupancy during takeoff and landing, must successfully complete dynamic tests, or be demonstrated by rational analysis supported by dynamic tests, in accordance with each of the following conditions. These tests must be conducted with an occupant simulated by an anthropomorphic test device (ATD) defined by 49 CFR part 572, subpart B, or an approved equivalent, with a nominal weight of 77 kg [170 lb] and seated in the normal upright position.

4.2.2.1 For the first test, the change in velocity must not be less than 9.4 m/s [31 ft/s]. The seat/restraint system must be oriented in its nominal position with respect to the airplane and with the horizontal plane of the airplane pitched up 60°, with no yaw, relative to the impact vector. For seat/restraint systems to be installed in the first row of the airplane, peak deceleration must occur in not more than 0.05 s after impact and must reach a minimum of 19 g. For all other seat/restraint systems, peak deceleration must occur in not more than 0.06 s after impact and must reach a minimum of 15 g.

4.2.2.2 For the second test, the change in velocity must not be less than 12.8 m/s [42 ft/s]. The seat/restraint system must be oriented in its nominal position with respect to the airplane and with the vertical plane of the airplane yawed 10°, with no pitch, relative to the impact vector in a direction that results in the greatest load on the shoulder harness. For seat/restraint systems to be installed in the first row of the airplane, peak deceleration must occur in not more than 0.05 s after impact and must reach a minimum of 26 g. For all other seat/restraint systems, peak deceleration must occur in not more than 0.06 s after impact and must reach a minimum of 21 g.

4.2.2.3 To account for floor warpage, the floor rails or attachment devices used to attach the seat/restraint system to the airframe structure must be preloaded to misalign with respect to each other by at least 10° vertically (that is, pitch out of parallel) and one of the rails or attachment devices must be preloaded to misalign by 10° in roll prior to conducting the test defined by 4.2.2.2.

4.2.3 Compliance with the following requirements must be shown during the dynamic tests conducted in accordance with 4.2.2:

4.2.3.1 The seat/restraint system must restrain the ATD although seat/restraint system components may experience deformation, elongation, displacement, or crushing intended as part of the design.