



Standard Specification for Emergency Conditions, Occupant Safety and Accommodations¹

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 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 may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

F3060 Terminology for Aircraft

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

14 CFR Part 23 Airworthiness Standards: Normal, Utility, Aerobatic and Commuter Category Airplanes (Amendment 62)

49 CFR Part 572 Anthropomorphic Test Devices (Subpart B)

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.

Current edition approved June 1, 2016. Published July 2016. Originally approved in 2015. Last previous edition approved in 2015 as F3083/F3083M – 15. DOI: 10.1520/F3083_F3083M-16.

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 the U.S. Government Printing Office at www.ecfr.gov.

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 Standard:*

PH1.25 Standard Specification for Safety Photographic Film

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.

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]:

⁴ Available from the European Aviation Safety Agency at www.easa.europa.eu.

- (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 Engine mount and supporting structure must withstand 15 g forward for engines installed behind and above the seating compartment.

4.1.7 For engines mounted inside the fuselage, aft of the cabin, it must be shown by test or analysis that the engine and attached accessories, and the engine 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 engine and its attached accessories from entering or protruding into the cabin should the engine mounts 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 or 4.2.5, 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.

4.2.3.2 The attachment between the seat/restraint system and the test fixture must remain intact, although the seat structure may have deformed.

4.2.3.3 Each shoulder harness strap must remain on the ATD's shoulder during the impact.

4.2.3.4 The safety belt must remain on the ATD's pelvis during the impact.

4.2.3.5 The results of the dynamic tests must show that the occupant is protected from serious head injury.

(1) When contact with adjacent seats, structure, or other items in the cabin can occur, protection must be provided so that the head impact does not exceed a head injury criteria (HIC) of 1000.

(2) The value of HIC is defined as:



$$HIC = \left\{ (t_2 - t_1) \left[\frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a(t) dt \right]^{2.5} \right\}_{Max} \quad (1)$$

where:

- t_1 = the initial integration time, expressed in seconds;
- t_2 = the final integration time, expressed in seconds; and
- $a(t)$ = the total acceleration vs. time curve for the head strike expressed as a multiple of g (units of gravity).

(3) Compliance with the HIC limit must be demonstrated by measuring the head impact during dynamic testing as prescribed in 4.2.2.1 and 4.2.2.2 or by a separate showing of compliance with the head injury criteria using test or analysis procedures.

4.2.3.6 Loads in individual shoulder harness straps must not exceed 7784 N [1750 lb_f]. If dual straps are used for retaining the upper torso, the total strap loads must not exceed 8896 N [2000 lb_f].

4.2.3.7 The compression load measured between the pelvis and the lumbar spine of the ATD must not exceed 6672 N [1500 lb_f].

4.2.4 For all single-engine airplanes with a V_{S0} of more than 113 km/h [61 kts] at maximum weight, and those multiengine airplanes of 2722 kg [6000 lb] or less maximum weight with a V_{S0} of more than 113 km/h [61 kts] at maximum weight that do not comply with §23.67(a)(1) of 14 CFR Part 23.

4.2.4.1 The ultimate load factors of 4.1.2 must be increased by multiplying the load factors by the square of the ratio of the increased stall speed to 113 km/h [61 kts]. The increased ultimate load factors need not exceed the values reached at a V_{S0} of 146 km/h [79 kts]. The upward ultimate load factor for aircraft approved for aerobatics need not exceed 5.0 g .

4.2.4.2 The seat/restraint system test required by 4.2.2.1 of this section must be conducted in accordance with the following criteria:

(1) The change in velocity must not be less than 9.4 m/s [31 ft/s].

(2) The peak deceleration (g_p) of 19 g and 15 g must be increased and multiplied by the square of the ratio of the increased stall speed to $V_{normalize} = 113$ km/h [61 kts]:

$$g_p = 19.0 (V_{S0} / V_{normalize})^2 \quad \text{or} \quad g_p = 15.0 (V_{S0} / V_{normalize})^2 \quad (2)$$

(a) The peak deceleration need not exceed the value reached at a V_{S0} of 146 km/h [79 kts].

(3) The peak deceleration must occur in not more than time (t_r), which must be computed as follows:

$$t_r = \frac{31}{32.2(g_p)} = \frac{0.96}{g_p} \quad (3)$$

where:

- g_p = the peak deceleration calculated in accordance with 4.2.4.2(2); and
- t_r = the rise time (in seconds) to the peak deceleration.

4.2.5 For Level 1 aircraft with a maximum takeoff weight of not more than 750 kg [1653 lb] and a stalling speed in the landing configuration of not more than 83 km/h [45 kts], the requirements of 4.2.2 and 4.2.3 are not required if the following conditions are met:

4.2.5.1 Each seat and its supporting structure must be designed for occupants weighing at least 86 kg [190 lb], and

for the maximum load factors corresponding to the specified flight and ground load conditions, including the emergency landing conditions prescribed in 4.1.2.2.

4.2.5.2 Each occupant must be protected from serious head injury by a safety belt and shoulder harness when the occupant experiences the inertia forces prescribed in 4.1.2.2. (For reference, see Appendix X1.)

4.2.6 An alternate approach that achieves an equivalent, or greater, level of occupant protection to that required by this section may be used if substantiated on a rational basis.

5. Occupant and Cargo Accommodations

5.1 Seats, Berths, Litters, Safety Belts, and Shoulder Harnesses:

5.1.1 There must be a seat or berth for each occupant that meets the following:

5.1.1.1 Each seat/restraint system and the supporting structure must be designed to support occupants weighing at least 98 kg [215 lb] when subjected to the maximum load factors corresponding to the specified flight and ground load conditions, as defined in the approved operating envelope of the airplane. In addition, these loads must be multiplied by a factor of 1.33 in determining the strength of all fittings and the attachment of:

(1) Each seat to the structure; and

(2) Each safety belt and shoulder harness to the seat or structure.

5.1.1.2 Each forward-facing or aft-facing seat/restraint system in Level 1 through 3 airplanes must consist of a seat, a safety belt, and a shoulder harness, with a metal-to-metal latching device, that are designed to provide the occupant protection provisions required in 4.2. Other seat orientations must provide the same level of occupant protection as a forward-facing or aft-facing seat with a safety belt and a shoulder harness, and must provide the protection provisions of 4.2.

5.1.1.3 For Level 4 airplanes, each seat and the supporting structure must be designed for occupants weighing at least 77 kg [170 lb] when subjected to the inertia loads resulting from the ultimate static load factors prescribed in 4.1.2.2. Each occupant must be protected from serious head injury when subjected to the inertia loads resulting from these load factors by a safety belt and shoulder harness, with a metal-to-metal latching device, for the front seats and a safety belt, or a safety belt and shoulder harness, with a metal-to-metal latching device, for each seat other than the front seats.

5.1.1.4 Each restraint system must have a single-point release for occupant evacuation.

5.1.1.5 The restraint system for each crewmember must allow the crewmember, when seated with the safety belt and shoulder harness fastened, to perform all functions necessary for flight operations.

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

5.1.1.7 There must be a means to secure each safety belt and shoulder harness, when not in use, to prevent interference with the operation of the airplane and with rapid occupant egress in an emergency.

5.1.1.8 Unless otherwise placarded, each seat in an airplane approved for bank angles greater than 60°, spins or aerobatics must be designed to accommodate an occupant wearing a parachute.

5.1.1.9 The cabin area surrounding each seat, including the structure, interior walls, instrument panel, control wheel, pedals, and seats within striking distance of the occupant's head or torso (with the restraint system fastened) must be free of potentially injurious objects, sharp edges, protuberances, and hard surfaces. If energy absorbing designs or devices are used to meet this requirement, they must protect the occupant from serious injury when the occupant is subjected to the inertia loads resulting from the ultimate static load factors prescribed in 4.1.2.2, or they must comply with the occupant protection provisions of 4.2, as required in 5.1.1.2 and 5.1.1.3.

5.1.1.10 Each seat track must be fitted with stops to prevent the seat from sliding off the track.

5.1.1.11 Each seat/restraint system may use design features, such as crushing or separation of certain components, to reduce occupant loads when showing compliance with the requirements of 4.2; otherwise, the system must remain intact.

5.1.1.12 For the purposes of this section, a front seat is a seat located at a flight crewmember station or any seat located alongside such a seat.

5.1.1.13 Each berth, or provisions for a litter, installed parallel to the longitudinal axis of the airplane, must be designed so that the forward part has a padded end-board, canvas diaphragm, or equivalent means that can withstand the load reactions from a 98 kg [215 lb] occupant when subjected to the inertia loads resulting from the ultimate static load factors of 4.1.2.2. In addition:

(1) Each berth or litter must have an occupant restraint system and may not have corners or other parts likely to cause serious injury to a person occupying it during emergency landing conditions; and

(2) Occupant restraint system attachments for the berth or litter must withstand the inertia loads resulting from the ultimate static load factors of 4.1.2.2.

5.1.1.14 Proof of compliance with the static strength requirements of this section for seats and berths approved as part of the type design and for seat and berth installations may be shown by:

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

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

(3) Static load tests to ultimate loads.

5.2 Doors:

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

5.2.2 Passenger doors must not be located with respect to any propeller disk or any other potential hazard so as to endanger persons using the door.

5.2.3 In addition, for Level 4 airplanes, the following requirements apply:

5.2.3.1 Each passenger entry door must qualify as a floor level emergency exit. This exit must have a rectangular opening of not less than 0.61 m [2 ft] wide by 1.22 m [4 ft] high, with corner radii not greater than one-third the width of the exit.

5.2.3.2 If an integral stair is installed at a passenger entry door, the stair must be designed so that, when subjected to the inertia loads resulting from the ultimate static load factors in 4.1.2.2 and following the collapse of one or more legs of the landing gear, it will not reduce the effectiveness of emergency egress through the passenger entry door.

5.2.4 If lavatory doors are installed, they must be designed to preclude an occupant from becoming trapped inside the lavatory. If a locking mechanism is installed, it must be capable of being unlocked from outside of the lavatory.

5.3 Baggage and Cargo Compartments:

5.3.1 Each baggage and cargo compartment must:

5.3.1.1 Be designed for its placarded maximum weight of contents and for the critical load distributions at the appropriate maximum load factors corresponding to the specified flight and ground load conditions.

5.3.1.2 Have means to prevent the contents of any compartment from becoming a hazard by shifting, and to protect any controls, wiring, lines, equipment or accessories whose damage or failure would affect safe operations.

5.3.1.3 Have a means to protect occupants from injury by the contents of any compartment, located aft of the occupants and separated by structure, when the ultimate forward inertial load factor is 9 g and assuming the maximum allowed baggage or cargo weight for the compartment.

5.3.2 Designs that provide for baggage or cargo to be carried in the same compartment as passengers must have a means to protect the occupants from injury when the baggage or cargo is subjected to the inertial loads resulting from the ultimate static load factors of 4.1.2.3, assuming the maximum allowed baggage or cargo weight for the compartment.

5.3.2.1 For Level 1 aircraft with a V_{SO} not more than 83 km/h [45 kts], if there is no structure between baggage and occupant compartments the baggage items located behind the occupants and those which might become a hazard in a crash must be secured for 1.33×9 g.

5.4 Emergency Evacuation:

5.4.1 For Level 4 airplanes, an evacuation demonstration must be conducted utilizing the maximum number of occupants for which certification is desired. The demonstration must be conducted under simulated night conditions using only the emergency exits on the most critical side of the airplane. The participants must be representative of average passengers with no prior practice or rehearsal for the demonstration. Evacuation must be completed within 90 s.

5.4.2 In addition, when certification to the emergency exit provisions of 5.6.4.1(2) is requested, only the emergency lighting system required by 5.8 may be used to provide cabin interior illumination during the evacuation demonstration required in 5.4.1.

5.5 Flightcrew Emergency Exits:

5.5.1 For airplanes where the proximity of the passenger emergency exits to the flightcrew area does not offer a convenient and readily accessible means of evacuation for the flightcrew, the following apply:

5.5.1.1 There must be either one emergency exit on each side of the airplane, or a top hatch emergency exit, in the flightcrew area;

5.5.1.2 Each emergency exit must be located to allow rapid evacuation of the crew and have a size and shape of at least a 0.48 m [1.58 ft] by 0.51 m [1.67 ft] unobstructed rectangular opening; and

5.5.1.3 For each emergency exit that is not less than 1.83 m [6 ft] from the ground, an assisting means must be provided. The assisting means may be a rope or any other means demonstrated to be suitable for the purpose. If the assisting means is a rope, or an approved device equivalent to a rope, it must be:

(1) Attached to the fuselage structure at or above the top of the emergency exit opening or, for a device at a pilot's emergency exit window, at another approved location if the stowed device, or its attachment, would reduce the pilot's view; and

(2) Able (with its attachment) to withstand a 1779 N [400 lbf] static load.

5.5.1.4 For airplanes that are used only for the carriage of cargo, the flightcrew emergency exits must meet the requirements of 5.6 under any cargo loading conditions.

5.6 Emergency Exits:

5.6.1 *Number and Location*—Emergency exits must be located to allow escape without crowding in any normal or probable crash attitude. The airplane must have at least the following emergency exits:

5.6.1.1 For all airplanes with a seating capacity of two or more, excluding airplanes with canopies, at least one emergency exit on the opposite side of the cabin from the main door specified in 5.2.

5.6.1.2 If the pilot compartment is separated from the cabin by a door that is likely to block the pilot's escape in a minor crash, there must be an exit in the pilot's compartment. The number of exits required by 5.6.1.1 must then be separately determined for the passenger compartment, using the seating capacity of that compartment.

5.6.1.3 Emergency exits must not be located with respect to any propeller disk or any other potential hazard so as to endanger persons using that exit.

5.6.2 *Type and Operation*—Emergency exits must be movable windows, panels, canopies, or external doors, openable from both inside and outside the airplane, that provide a clear and unobstructed opening large enough to admit a 0.48 m [1.58 ft] by 0.66 m [2.17 ft] ellipse. Auxiliary locking devices used to secure the airplane must be designed to be overridden by the normal internal opening means. The inside handles of emergency exits that open outward must be adequately protected against inadvertent operation. In addition, each emergency exit must:

5.6.2.1 Be readily accessible, requiring no exceptional agility to be used in emergencies;

5.6.2.2 Have a method of opening that is simple and obvious;

5.6.2.3 Be arranged and marked for easy location and operation, even in darkness;

5.6.2.4 Have reasonable provisions against jamming by fuselage deformation;

5.6.2.5 In the case of airplanes approved for aerobatics, allow each occupant to abandon the airplane at any speed between V_{S0} and V_D ; and

5.6.2.6 In the case of airplanes approved for intentional spins only, allow each occupant to abandon the airplane at the highest speed likely to be achieved in the maneuver for which the airplane is certificated.

5.6.3 *Tests*—The proper functioning of each emergency exit must be shown by tests.

5.6.4 *Doors and Exits*—In addition, for Level 4 airplanes, the following requirements apply:

5.6.4.1 In addition to the passenger entry door:

(1) There must be emergency exits, as defined in 5.6.2, in the following locations:

(a) For an airplane with a total passenger seating capacity of 15 or fewer, an emergency exit is required on each side of the cabin;

(b) For an airplane with a total passenger seating capacity of 16 through 19, three emergency exits are required with one on the same side as the passenger entry door and two on the side opposite the door; or

(2) There must be an emergency exit on the side of the cabin opposite the passenger entry door that:

(a) Has a rectangular opening measuring not less than 0.51 m [1.67 ft] by 0.91 m [3 ft] high, with corner radii not greater than one-third the width of the exit;

(b) Has a step up inside the airplane of not more than 0.51 m [1.67 ft];

(c) If the exit is located over the wing, the step down outside the airplane may not exceed 0.69 m [2.25 ft]; and

(d) The airplane complies with the additional requirements of 4.1.2.2(4), 5.4.2, 5.7.3, 5.8, 5.10.2, and 5.11.

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

5.6.4.3 Each required emergency exit, except floor level exits, must be located over the wing or, if not less than 1.8 m [6 ft] from the ground, must be provided with an acceptable means to assist the occupants to descend to the ground. Emergency exits must be distributed as uniformly as practical, taking into account passenger seating configuration.

5.6.5 For multiengine airplanes, ditching emergency exits must be provided in accordance with the following requirements, unless the emergency exits required by 5.6.1 or 5.6.4 already comply with them:

5.6.5.1 One exit above the waterline on each side of the airplane having the dimensions specified in 5.6.2 or 5.6.4, as applicable; and

5.6.5.2 If side exits cannot be above the waterline, there must be a readily accessible overhead hatch emergency exit that has a rectangular opening measuring not less than 0.51 m [1.67 ft] by 0.91 m [3 ft] long, with corner radii not greater than one-third the width of the exit.

5.6.5.3 In lieu of 5.6.5.2, if any side exit(s) cannot be above the waterline, a device may be placed at each of such exit(s) prior to ditching. This device must slow the inflow of water when such exit(s) is opened with the airplane ditched. For Level 4 airplanes, the clear opening of such exit(s) must meet the requirements defined in 5.6.4.

5.7 Emergency Exit Marking:

5.7.1 Each emergency exit and external door in the passenger compartment must be externally marked and readily identifiable from outside the airplane by:

5.7.1.1 A conspicuous visual identification scheme; and

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

5.7.2 In addition, for Level 4 airplanes, these exits and doors must be internally marked with the word “exit” by a sign which has white letters 25 mm [1 in.] high on a red background 51 mm [2 in.] high, be self-illuminated or independently, internally electrically illuminated, and have a minimum brightness of at least 0.51 cd/m² [160 microlamberts]. The color may be reversed if the passenger compartment illumination is essentially the same.

5.7.3 In addition, when certification to the emergency exit provisions of 5.6.4.1(2) is requested, the following apply:

5.7.3.1 Each emergency exit, its means of access, and its means of opening, must be conspicuously marked;

5.7.3.2 The identity and location of each emergency exit must be recognizable from a distance equal to the width of the cabin;

5.7.3.3 Means must be provided to assist occupants in locating the emergency exits in conditions of dense smoke;

5.7.3.4 The location of the operating handle and instructions for opening each emergency exit from inside the airplane must be shown by marking that is readable from a distance of 0.76 m [2.5 ft];

5.7.3.5 Each passenger entry door operating handle must:

(1) Be self-illuminated with an initial brightness of at least 0.51 cd/m² [160 microlamberts]; or

(2) Be conspicuously located and well illuminated by the emergency lighting even in conditions of occupant crowding at the door;

5.7.3.6 Each passenger entry door with a locking mechanism that is released by rotary motion of the handle must be marked:

(1) With a red arrow, with a shaft of at least 19 mm [0.75 in.] wide and a head twice the width of the shaft, extending along at least 70° of arc at a radius approximately equal to three-fourths of the handle length;

(2) So that the center line of the exit handle is within ±25 mm [1 in.] of the projected point of the arrow when the handle has reached full travel and has released the locking mechanism;

(3) With the word “open” in red letters, 25 mm [1 in.] high, placed horizontally near the head of the arrow; and

5.7.3.7 In addition to the requirements of 5.7.1, the external marking of each emergency exit must:

(1) Include a 51 mm [2 in.] color band outlining the exit; and

(2) Have a color contrast that is readily distinguishable from the surrounding fuselage surface. The contrast must be such that if the reflectance of the darker color is 15 % or less, the reflectance of the lighter color must be at least 45 %. “Reflectance” is the ratio of the luminous flux reflected by a body to the luminous flux it receives. When the reflectance of the darker color is greater than 15 %, at least a 30 % difference between its reflectance and the reflectance of the lighter color must be provided.

5.8 Emergency Lighting:

5.8.1 When certification to the emergency exit provisions of 5.6.4.1(2) is requested, the following apply:

5.8.1.1 An emergency lighting system, independent of the main cabin lighting system, must be installed. However, the source of general cabin illumination may be common to both the emergency and main lighting systems if the power supply to the emergency lighting system is independent of the power supply to the main lighting system.

5.8.1.2 There must be a crew warning indication in the cockpit when power is on in the airplane and the emergency lighting control device is not armed.

5.8.1.3 The emergency lights must be operable manually from the flightcrew station and be provided with automatic activation. The cockpit control device must have “on,” “off,” and “armed” positions so that, when armed in the cockpit, the lights will operate by automatic activation.

5.8.1.4 There must be a means to safeguard against inadvertent operation of the cockpit control device from the “armed” or “on” positions.

5.8.1.5 The cockpit control device must have provisions to allow the emergency lighting system to be armed or activated at any time that it may be needed.

5.8.1.6 When armed, the emergency lighting system must activate and remain lighted when:

(1) The normal electrical power of the airplane is lost; or

(2) The airplane is subjected to an impact that results in a deceleration in excess of 2 g and a velocity change in excess of 1.07 m/s [3.5 ft/s], acting along the longitudinal axis of the airplane; or

(3) Any other emergency condition exists where automatic activation of the emergency lighting is necessary to aid with occupant evacuation.

5.8.1.7 The emergency lighting system must be capable of being turned off and reset by the flightcrew after automatic activation.

5.8.1.8 The emergency lighting system must provide internal lighting, including:

(1) Illuminated emergency exit marking and locating signs, including those required in 5.7.2;

(2) Sources of general illumination in the cabin that provide an average illumination of not less than 0.5 lux [0.05 foot-candle] and an illumination at any point of not less than 0.1 lux [0.01 foot-candle] when measured along the center line of the main passenger aisle(s) and at the seat armrest height; and

(3) Floor proximity emergency escape path marking that provides emergency evacuation guidance for the airplane occupants when all sources of illumination more than 1.2 m [4 ft] above the cabin aisle floor are totally obscured.

5.8.1.9 The energy supply to each emergency lighting unit must provide the required level of illumination for at least 10 min at the critical ambient conditions after activation of the emergency lighting system.

5.8.1.10 If rechargeable batteries are used as the energy supply for the emergency lighting system, they may be recharged from the main electrical power system of the airplane provided the charging circuit is designed to preclude inadvertent battery discharge into the charging circuit faults. If the emergency lighting system does not include a charging circuit, battery condition monitors are required.

5.8.1.11 Components of the emergency lighting system, including batteries, wiring, relays, lamps, and switches, must be capable of normal operation after being subjected to the inertia forces resulting from the ultimate load factors prescribed in 4.1.2.2.

5.8.1.12 The emergency lighting system must be designed so that after any single transverse vertical separation of the fuselage during a crash landing:

(1) At least 75 % of all electrically illuminated emergency lights required by this section remain operative; and

(2) Each electrically illuminated exit sign required by 5.7.2 and 5.7.3 remains operative, except those that are directly damaged by the fuselage separation.

5.9 Passenger Information Signs:

5.9.1 For those airplanes in which the flightcrew members cannot observe the other occupants' seats or where the flightcrew members' compartment is separated from the passenger compartment, there must be at least one illuminated sign (using either letters or symbols) notifying all passengers when seat belts should be fastened. Signs that notify when seat belts should be fastened must:

5.9.1.1 When illuminated, be legible to each person seated in the passenger compartment under all probable lighting conditions; and

5.9.1.2 Be installed so that a flightcrew member can, when seated at the flightcrew member's station, turn the illumination on and off.

5.10 Emergency Exit Access:

5.10.1 For Level 4 airplanes, access to window-type emergency exits must not be obstructed by seats or seat backs.

5.10.2 In addition, when certification to the emergency exit provisions of 5.6.4.1(2) is requested, the following emergency exit access must be provided:

5.10.2.1 The passageway leading from the aisle to the passenger entry door must be unobstructed and at least 0.51 m [1.67 ft] wide.

5.10.2.2 There must be enough space next to the passenger entry door to allow assistance in evacuation of passengers without reducing the unobstructed width of the passageway below 0.51 m [1.67 ft].

5.10.2.3 If it is necessary to pass through a passageway between passenger compartments to reach a required emergency exit from any seat in the passenger cabin, the passageway must be unobstructed; however, curtains may be used if they allow free entry through the passageway.

5.10.2.4 No door may be installed in any partition between passenger compartments unless that door has a means to latch it in the open position. The latching means must be able to withstand the loads imposed upon it by the door when the door is subjected to the inertia loads resulting from the ultimate static load factors prescribed in 4.1.2.2.

5.10.2.5 If it is necessary to pass through a doorway separating the passenger cabin from other areas to reach a required emergency exit from any passenger seat, the door must have a means to latch it in the open position. The latching means must be able to withstand the loads imposed upon it by the door when the door is subjected to the inertia loads resulting from the ultimate static load factors prescribed in 4.1.2.2.

5.11 Width of Aisle:

5.11.1 Except as provided in 5.11.2, for Level 4 airplanes, the width of the main passenger aisle at any point between seats must equal or exceed the values in the following table:

Minimum main passenger aisle width	
Less than 0.63 m [2.07 ft] from floor	0.63 m [2.07 ft] and more from floor
0.23 m [0.75 ft]	0.38 m [1.25 ft]

5.11.2 When certification to the emergency exit provisions of 5.6.4.1(2) is requested, the main passenger aisle width at any point between the seats must equal or exceed the following values:

Minimum main passenger aisle width	
Less than 0.63 m [2.07 ft] from floor	0.63 m [2.07 ft] and more from floor
0.3 m [1 ft]	0.51 m [1.67 ft]

6. Fire Protection

6.1 Fire Extinguishers:

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

6.1.2 There must be at least one hand fire extinguisher located conveniently in the passenger compartment of each airplane accommodating more than 6 passengers.

6.1.3 For hand fire extinguishers, the following apply:

6.1.3.1 The type and quantity of each extinguishing agent used must be appropriate to the kinds of fire likely to occur where that agent is to be used.

6.1.3.2 Each extinguisher for use in a personnel compartment must be designed to minimize the hazard of toxic gas concentrations.

6.2 Passenger and Crew Compartment Interiors:

6.2.1 For each compartment to be used by the crew or passengers:

6.2.1.1 The materials must be at least flame-resistant;

6.2.1.2 If smoking is to be prohibited, there must be a placard so stating, and if smoking is to be allowed:

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

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

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

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

6.2.1.3 In addition, for Level 4 airplanes the following requirements apply:

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

(2) Lavatories must have “No Smoking” or “No Smoking in Lavatory” placards located conspicuously on the inside and outside of the entrance.

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

(a) Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than under seat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of 14 CFR Part 23 or by other equivalent methods. The average burn length must not exceed 0.15 m [0.5 ft] and the average flame time after removal of the flame source must not exceed 15 s. Drippings from the test specimen must not continue to flame for more than an average of 3 s after falling.

(b) Floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and non-decorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation and insulation covering, air ducting, joint and edge covering, cargo compartment liners, insulation blankets, cargo covers and transparencies, molded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing), that are constructed of materials not covered in 6.2.1.3(3)(d) must be self extinguishing when tested vertically in accordance with the applicable portions of Appendix F of 14 CFR Part 23 or other approved equivalent methods. The average burn length must not exceed 0.2 m [0.67 ft] and the average flame time after

removal of the flame source must not exceed 15 s. Drippings from the test specimen must not continue to flame for more than an average of 5 s after falling.

(c) Motion picture film must be safety film meeting the Standard Specifications for Safety Photographic Film PH1.25 or an approved equivalent. If the film travels through ducts, the ducts must meet the requirements of 6.2.1.3(3)(b).

(d) Acrylic windows and signs, parts constructed in whole or in part of elastomeric materials, edge-lighted instrument assemblies consisting of two or more instruments in a common housing, seatbelts, shoulder harnesses, and cargo and baggage tiedown equipment, including containers, bins, pallets, etc., used in passenger or crew compartments, must not have an average burn rate greater than 63 mm [2.5 in.] per minute when tested horizontally in accordance with the applicable portions of Appendix F of 14 CFR Part 23 or by other approved equivalent methods.

(e) Except for electrical wire cable insulation, and for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that are found would not contribute significantly to the propagation of a fire, materials in items not specified in 6.2.1.3(3)(a), (b), (c) or (d) must not have a burn rate greater than 100 mm [4 in.] per minute when tested horizontally in accordance with the applicable portions of Appendix F of 14 CFR Part 23 or by other approved equivalent methods.

6.2.1.4 Airplane materials located on the cabin side of the firewall must be self-extinguishing or be located at such a distance from the firewall, or otherwise protected, so that ignition will not occur if the firewall is subjected to a flame temperature of not less than 1093°C [2000°F] for 15 min. For self-extinguishing materials (except electrical wire and cable insulation and small parts that are found would not contribute significantly to the propagation of a fire), a vertical self-extinguishing test must be conducted in accordance with Appendix F of 14 CFR Part 23 or an equivalent method. The average burn length of the material must not exceed 0.15 m [0.5 ft] and the average flame time after removal of the flame source must not exceed 15 s. Drippings from the material test specimen must not continue to flame for more than an average of 3 s after falling.

6.3 Cargo and Baggage Compartment Fire Protection:

6.3.1 Each cargo and baggage compartment must be constructed of materials that meet the appropriate provisions of 6.2.1.3(3). For Level 1 aircraft, each cargo and baggage compartment may be constructed of materials that are at least flame resistant.

6.3.2 In addition, for Level 4 airplanes, each cargo and baggage compartment that does not meet the requirements of 14 CFR Part 23 §23.855(c) (1) must:

6.3.2.1 Have ceiling and sidewall liners and floor panels constructed of materials that have been subjected to and meet the 45° angle test of Appendix F of 14 CFR Part 23. The flame must not penetrate (pass through) the material during application of the flame or subsequent to its removal. The average flame time after removal of the flame source must not exceed 15 s, and the average glow time must not exceed 10 s. The

compartment must be constructed to provide fire protection that is not less than that required of its individual panels; or

6.3.2.2 Be constructed and sealed to contain any fire within the compartment.

6.4 Thermal/Acoustic Insulation Materials:

6.4.1 For Level 2 through 4 aircraft or aircraft with a V_{SO} greater than 45 knots, thermal/acoustic insulation material installed in the fuselage must meet the flame propagation test requirements of part II of Appendix F of 14 CFR Part 23, or other approved equivalent test requirements. This requirement does not apply to “small parts,” as defined in 6.2.1.3(3)(e).

7. Safety Equipment

7.1 General:

7.1.1 Required safety equipment to be used by the flight crew in an emergency, such as automatic life raft releases, must be readily accessible.

7.1.2 Stowage provisions for required safety equipment must be furnished and must:

7.1.2.1 Be arranged so that the equipment is directly accessible and its location is obvious; and

7.1.2.2 Protect the safety equipment from damage caused by being subjected to the inertia loads resulting from the ultimate static load factors specified in 4.1.2.3.

7.2 Ditching Equipment:

7.2.1 If required by an operating rule, emergency flotation and signaling equipment must be installed so that it is readily available to the crew and passengers.

7.2.2 Each raft released automatically or by the pilot must be attached to the airplane by a line to keep it alongside the airplane. This line must be weak enough to break before submerging the empty raft to which it is attached.

7.2.3 Each signaling device required by an operating rule must be accessible, function satisfactorily, and must be free of any hazard in its operation.

APPENDIXES

(Nonmandatory Information)

X1. SEATS, SAFETY BELTS AND HARNESES

X1.1 Installation of Shoulder Harness

X1.1.1 Figs. X1.1-X1.3 show the recommended installation geometry for this type of restraint.

X1.1.2 Where possible, it is recommended that a negative g or crotch strap is fitted, otherwise during abrupt decelerations the shoulder straps tend to raise the belt portion (unless tightly

adjusted) from around the hips onto the stomach, thus allowing the wearer to slide underneath the lap portion of the belt.

X1.1.3 Where there is more than 0.15 m [0.5 ft] of webbing between the attachment point of the shoulder straps and the top of the seat back, suitable means should be provided to limit sideways movement (for example, guide loops) in order to

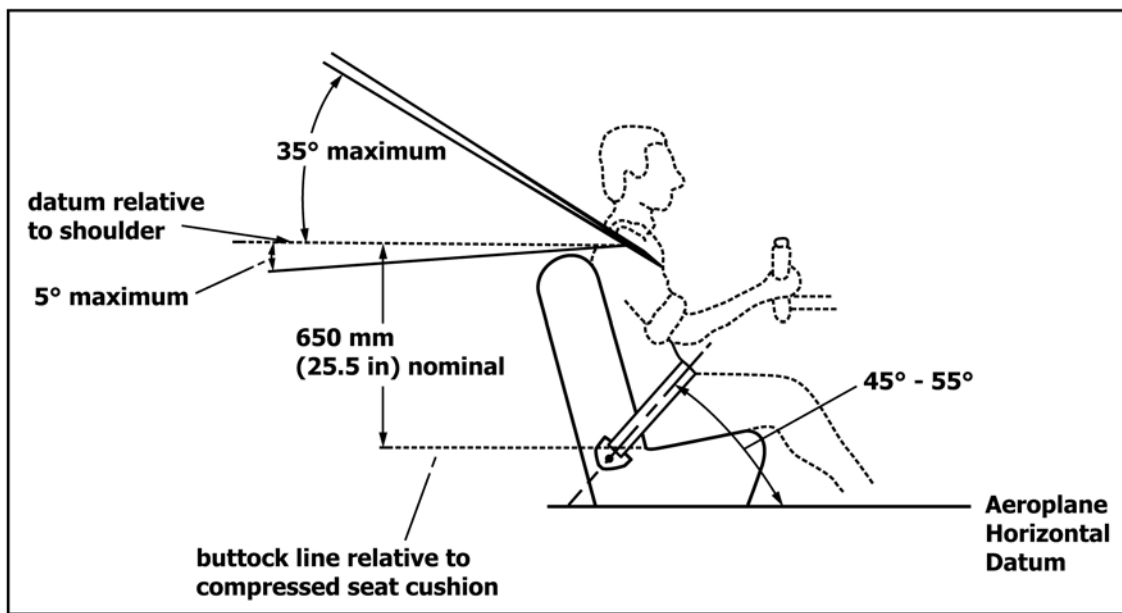


FIG. X1.1 Recommended Shoulder Harness Installation Geometry

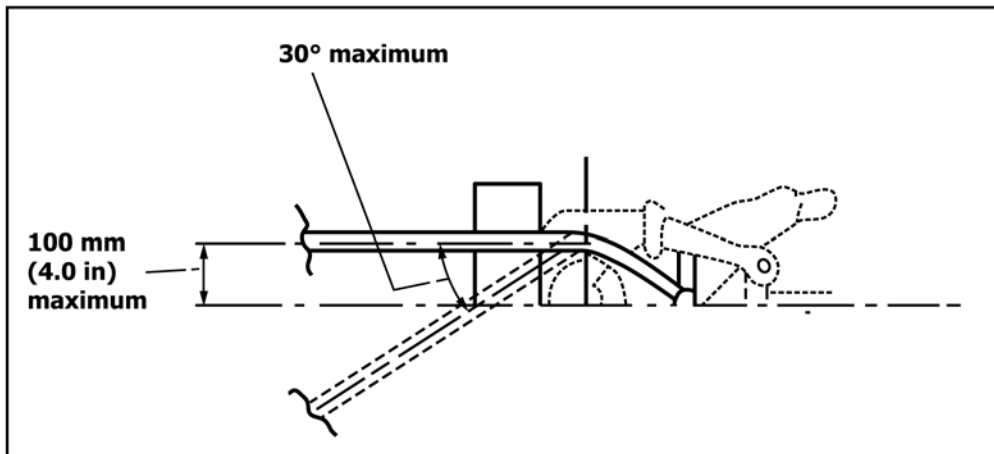


FIG. X1.2 Recommended Shoulder Harness Installation Geometry

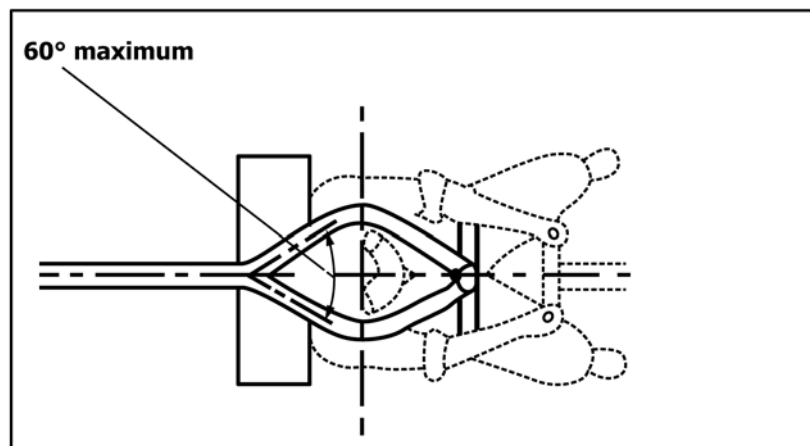


FIG. X1.3 Recommended Shoulder Harness Installation Geometry

ensure compliance and to ensure adequate separation of shoulder straps to minimize injury or chafing of the wearer's neck.

X1.1.4 Where the seat back is of adequate strength and such height that the harness geometry relative to the shoulder conforms to Fig. X1.1 (that is, 0.65 m [25.5 in.]), it is permissible to attach the shoulder straps to the seat back or, via guide loops, to the airplane floor.

X1.1.5 Where the seat back is of adequate strength the use of means such as a guide loop of suitable strength will limit sideways movement during the emergency alighting accelerations.

X1.2 Installation of Safety Belt with One Diagonal Shoulder Strap (ODS Safety Belt)

X1.2.1 Figs. X1.4 and X1.5 show the recommended installation geometry for this type of restraint.

X1.2.2 The total length of the diagonal shoulder strap should be kept as short as possible in order to reduce the effect of webbing stretch under the emergency alighting loads.

X1.2.3 Where the seat back is of adequate strength and such height that the harness geometry relative to the shoulder conforms with the Fig. X1.4 (that is, 0.65 m [25.5 in.]), it is permissible to attach the shoulder strap to the seat back or via guide loops to the airplane floor.

X1.2.4 The installation should be such as to minimize the risk of injury or chafing of the wearer's neck. A guide loop may assist in achieving this.

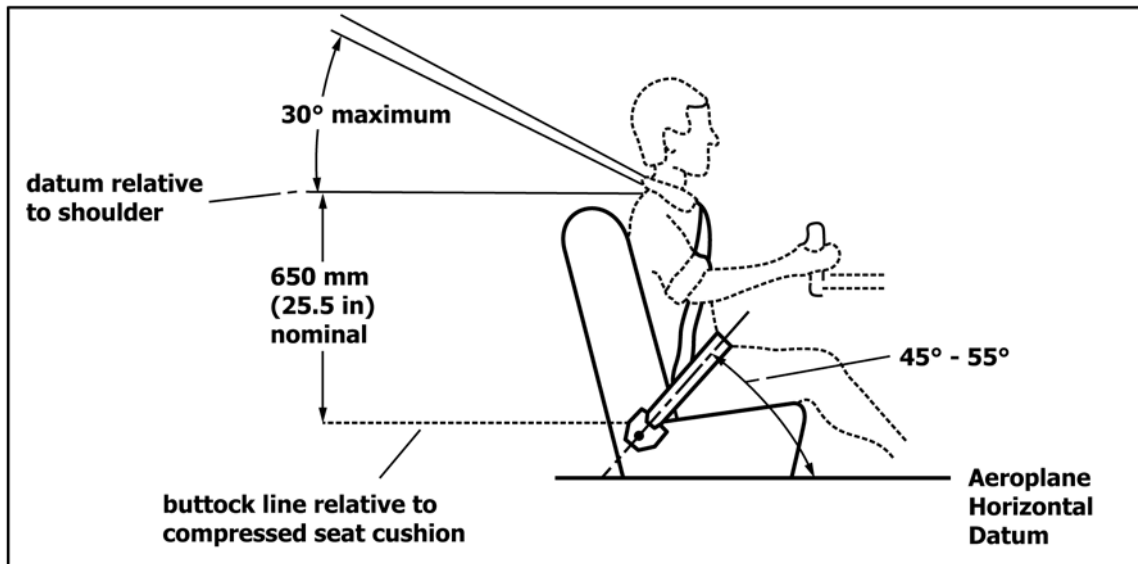


FIG. X1.4 Recommended ODS Safety Belt Installation Geometry

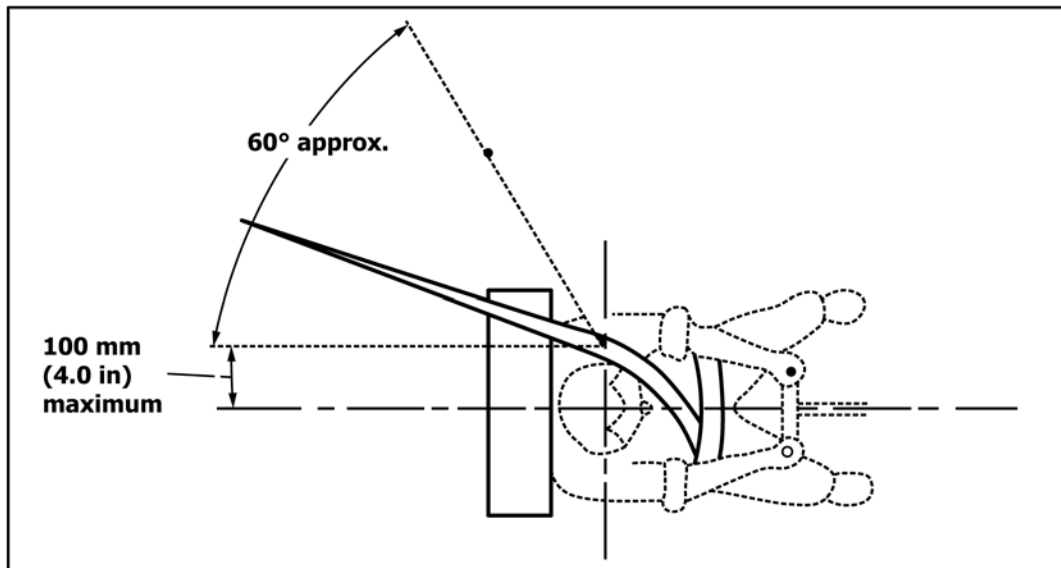


FIG. X1.5 Recommended ODS Safety Belt Installation Geometry

X2. SUMMARY AND RATIONALE FOR CHANGES

X2.1 Summary of Changes to Revision F3083/F3083M – 15

X2.1.1 The language in 5.6.4 was modified to clarify the two options that exist in regard to doors and exits on Level 4 aeroplanes.

X2.1.2 5.6.4 and 5.11 were modified to make the passenger numbers specified in the paragraphs consistent with the definition of Level 4 aeroplanes.

X2.1.3 The language in 5.4.1 was modified to remove the phrase “airline passengers” and replace it with passenger.

X2.1.4 The language in 6.2.1.3(2) was modified to change the overly specific language “entry door” to the more general “entrance.”



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