CS-25 AMENDMENT 12 - CHANGE INFORMATION

The Agency publishes amendments to Certification Specifications as consolidated documents. These documents are used for establishing the certification basis for applications made after the date of entry into force of the Amendment.

Consequently, except for a note "Amdt 25/12" under the amended paragraph, the consolidated text of CS-25 does not allow readers to see the detailed changes introduced by the new amendment. To allow readers to also see these detailed changes this document has been created. The same format as for publication of Notices of Proposed Amendments has been used to show the changes:

1. text not affected by the new amendment remains the same: unchanged
2. deleted text is shown with a strike through: ~~deleted~~
3. new or changed text is highlighted with grey shading: new
4. … indicates that remaining text is unchanged in front of or following the reflected Amendment.

<u>Book 1</u>

SUBPART C – STRUCTURE

<u>Amend CS 25.341(a)(4) as follows: replace the value 350 in the equation by 107 as follows:</u>

$$U_{ds} = U_{ref} F_g (\frac{H}{107})^{1/6}$$

…

SUBPART D – DESIGN AND CONSTRUCTION

<u>Amend CS 25.785 as follows:</u>

CS 25.785 Seats, berths, safety belts and harnesses

…

(h) Each seat located in the passenger compartment and designated for use during take-off and landing by a cabin crew member required by the Operating Rules must be -

(1) Near a required floor-level emergency exit, except that another location is acceptable if the emergency egress of passengers would be enhanced with that location. A cabin crew member seat must be located adjacent to each Type A or B emergency exit. Other cabin crew member seats must be evenly distributed among the required floor-level emergency exits to the extent feasible.

(2) …

…

<u>Amend CS 25.807 as follows:</u>

CS 25.807 Emergency exits
(See AMC ~~to~~ 25.807 ~~and 25.813 and AMC 25.807~~)

(a) *Type.* For the purpose of this CS-25, the types of exits are defined as follows:

(1) *Type I.* This type is a floor-level exit with a rectangular opening of not less than 61 cm (24 inches) wide by 1.22 m (48 inches) high, with corner radii not greater than ~~one-third the width of the exit~~ 20.3 cm (8 inches).

(2) *Type II.* This type is a rectangular opening of not less than 51 cm (20 inches) wide by 1.12 m (44 inches) high, with corner radii not greater than ~~one-third the width of the exit~~

17.8 cm (7 inches). Type II exits must be floor-level exits unless located over the wing, in which case they ~~may~~ must not have a step-up inside the aeroplane of more than 25 cm (10 inches) nor a step-down outside the aeroplane of more than 43 cm (17 inches).

(3) *Type III.* This type is a rectangular opening of not less than 51 cm (20 inches) wide by 91.4 cm (36 inches) high with corner radii not greater than ~~one-third the width of the exit~~ 17.8 cm (7 inches), and with a step-up inside the aeroplane of not more than 51 cm (20 inches). If the exit is located over the wing, the step-down outside the aeroplane may not exceed 69 cm (27 inches).

(4) *Type IV.* This type is a rectangular opening of not less than 48 cm (19 inches) wide by 66 cm (26 inches) high, with corner radii not greater than ~~one-third the width of the exit~~ 16 cm (6.3 inches), located over the wing, with a step-up inside the aeroplane of not more than ~~74~~73.7 cm (29 inches) and a step-down outside the aeroplane of not more than 91.4 cm (36 inches).

(5) *Ventral.* This type is an exit from the passenger compartment through the pressure shell and the bottom fuselage skin. The dimensions and physical configuration of this type of exit must allow at least the same rate of egress as a Type I exit with the aeroplane in the normal ground attitude, with landing gear extended.

(6) *Tail cone.* This type is an aft exit from the passenger compartment though the pressure shell and through an openable cone of the fuselage aft of the pressure shell. The means of opening the tail cone must be simple and obvious and must employ a single operation.

(7) *Type A.* This type is a floor-level exit with a rectangular opening of not less than 1.07 m (42 inches) wide by 1.83 m (72 inches) high, with corner radii not greater than ~~one-sixth of the width of the exit~~ 17.8 cm (7 inches).

(8) *Type B.* This type is a floor-level exit with a rectangular opening of not less than 81.3 cm (32 inches) wide by 182.9 cm (72 inches) high, with corner radii not greater than 15.3 cm (6 inches).

(9) *Type C.* This type is a floor-level exit with a rectangular opening of not less than 76.2 cm (30 inches) wide by 121.9 cm (48 inches) high, with corner radii not greater than 25.4 cm (10 inches).

(b) *Step down distance*. Step down distance, as used in this paragraph, means the actual distance between the bottom of the required opening and a usable foot hold, extending out from the fuselage, that is large enough to be effective without searching by sight or feel.

(c) *Over-sized exits*. Openings larger than those specified in this paragraph, whether or not of rectangular shape, may be used if the specified rectangular opening can be inscribed within the opening and the base of the inscribed rectangular opening meets the specified step-up and step-down heights.

(d) Asymmetry. Exits of an exit pair need not be diametrically opposite each other nor of the same size; however, the number of passenger seats permitted under subparagraph (g) of this paragraph is based on the smaller of the two exits.

Passenger emergency exits. (See AMC 25.807 (d). Except as provided in subparagraphs (d)(3) to (7) of this paragraph, the minimum number and type of passenger emergency exits is as follows:

(1) For passenger seating configurations of 1 to 299 seats –

Passenger seating configuration (crew member seats not included)	Emergency exits for each side of the fuselage Type I	Type II	Type III	Type IV	Additional exits are required for passenger seating configurations greater than 179 seats in accordance with the following table:
1 to 9				1	
10 to 19			1		
20 to 39		1	1		
40 to 79	1		1		
80 to 109	1		2		
110 to 139	2		1		
140 to 179	2		2		

Additional emergency exits (each side of fuselage)	Increase in passenger seating configuration allowed
Type A	110
Type I	45
Type II	40
Type III	35

(2) For passenger seating configurations greater than 299 seats, each emergency exit in the side of the fuselage must be either a Type A or a Type I. A passenger seating configuration of 110 seats is allowed for each pair of Type A exits and a passenger seating configuration of 45 seats is allowed for each pair of Type I exits.

(3) If a passenger ventral or tail cone exit is installed and that exit provides at least the same rate of egress as a Type III exit with the aeroplane in the most adverse exit opening condition that would result from the collapse of one or more legs of the landing gear, an increase in the passenger seating configuration beyond the limits specified in sub-paragraph (d)(1) or (2) of this paragraph may be allowed as follows:

(i) For a ventral exit, 12 additional passenger seats.

(ii) For a tail cone exit incorporating a floor level opening of not less than 51 cm (20 inches) wide by 1·52 m (60 inches) high, with corner radii not greater than one third the width of the exit, in the pressure shell and incorporating an approved assist means in accordance with CS 25.810(a), 25 additional passenger seats.

(iii) For a tail cone exit incorporating an opening in the pressure shell which is at least equivalent to a Type III emergency exit with respect to dimensions, step-up and step-down distance, and with the top of the opening not less than 1.42 m (56 inches) from the passenger compartment floor, 15 additional passenger seats.

(4) For aeroplanes on which the vertical location of the wing does not allow the installation of over-wing exits, an exit of at least the dimensions of a Type III exit must be installed instead of each Type IV exit required by sub-paragraph (1) of this paragraph.

(5) An alternate emergency exit configuration may be approved in lieu of that specified in sub-paragraph (d)(1) or (2) of this paragraph provided the overall evacuation capability is shown to be equal to or greater than that of the specified emergency exit configuration.

(6) The following must also meet the applicable emergency exit requirements of CS 25.809 to 25.813:

(i) Each emergency exit in the passenger compartment in excess of the minimum number of required emergency exits.

(ii) Any other floor level door or exit that is accessible from the passenger compartment and is as large or larger than a Type II exit, but less than 1·17 m (46 inches) wide.

(iii) Any other passenger ventral or tail cone exit.

(7) For an aeroplane that is required to have more than one passenger emergency exit for each side of the fuselage, no passenger emergency exit must be more than 18·3 m (60 feet) from any adjacent passenger emergency exit on the same side of the same deck of the fuselage, as measured parallel to the aeroplane's longitudinal axis between the nearest exit edges.

(e) *Uniformity.* Exits must be distributed as uniformly as practical, taking into account passenger seat distribution.

Ditching emergency exits for passengers. Ditching emergency exits must be provided in accordance with the following requirements whether or not certification with ditching provisions is requested:

(1) For aeroplanes that have a passenger seating configuration of nine seats or less, excluding pilots seats, one exit above the waterline in each side of the aeroplane, meeting at least the dimensions of a Type IV exit.

(2) For aeroplanes that have a passenger seating configuration of 10 seats or more, excluding pilots seats, one exit above the waterline in a side of the aeroplane, meeting at least the dimensions of a Type III exit for each unit (or part of a unit) of 35 passenger seats, but no less than two such exits in the passenger cabin, with one on each side of the aeroplane. The passenger seat/exit ratio may be increased through the use of larger exits, or other means, provided it is

shown that the evacuation capability during ditching has been improved accordingly.
(3) If it is impractical to locate side exits above the waterline, the side exits must be replaced by an equal number of readily accessible overhead hatches of not less than the dimensions of a Type III exit, except that for aeroplanes with a passenger configuration of 35 seats or less, excluding pilots seats, the two required Type III side
exits need be replaced by only one overhead hatch.

(f) *Location.*

(1) Each required passenger emergency exit must be accessible to the passengers and located where it will afford the most effective means of passenger evacuation.

(2) If only one floor-level exit per side is prescribed, and the aeroplane does not have a tail cone or ventral emergency exit, the floor-level exits must be in the rearward part of the passenger compartment unless another location affords a more effective means of passenger evacuation.

(3) If more than one floor-level exit per side is prescribed, and the aeroplane does not have a combination cargo and passenger configuration, at least one floor-level exit must be located on each side near each end of the cabin.

(4) For an aeroplane that is required to have more than one passenger emergency exits for each side of the fuselage, no passenger emergency exit shall be more than 18.3 metres (60 feet) from any adjacent passenger emergency exit on the same side of the same deck of the fuselage, as measured parallel to the aeroplane's longitudinal axis between the nearest edges.

Flight crew emergency exits. For aeroplanes in which the proximity of passenger emergency exits to the flight crew area does not offer a convenient and readily accessible means of evacuation of the flight crew, and for all aeroplanes having a passenger seating capacity greater than 20, flight crew exits must be located in the flight crew area. Such exits must be of sufficient size and so located as to permit rapid evacuation by the crew. One exit must be provided on each side of the aeroplane; or, alternatively, a top hatch must be provided. Each exit must encompass an unobstructed rectangular opening of at least 48 by 51 cm (19 by 20 inches) unless satisfactory exit utility can be demonstrated by a typical crewmember.

(g) [Reserved] *Type and number required.* The maximum number of passenger seats permitted depends on the type and number of exits installed on each side of the fuselage. Except as further restricted in subparagraphs (g)(1) through (g)(9) of this paragraph, the maximum number of passenger seats permitted for each exit of a specific type installed on each side of the fuselage is as follows:

Type A	110
Type B	75
Type C	55
Type I	45
Type II	40
Type III	35
Type IV	9

(1) For a passenger seating configuration of 1 to 9 seats, there must be at least one Type IV or larger over-wing exit on each side of the fuselage or, if over-wing exits are not provided, at least one exit on each side that meets the minimum dimensions of a Type III exit.

(2) For a passenger seating configuration of more than 9 seats, each exit must be a Type III or larger exit.

(3) For a passenger seating configuration of 10 to 19 seats, there must be at least one Type III or larger exit on each side of the fuselage.

(4) For a passenger seating configuration of 20 to 40 seats, there must be at least two exits, one of which must be a Type II or larger exit, on each side of the fuselage.

(5) For a passenger seating configuration of 41 to 110 seats, there must be at least two exits, one of which must be a Type I or larger exit, on each side of the fuselage.

(6) For a passenger seating configuration of more than 110 seats, the emergency exits on each side of the fuselage must include at least two Type I or larger exits.

(7) The combined maximum number of passenger seats permitted for all Type III exits is 70, and the combined maximum number of passenger seats permitted for two Type III exits on each side of the fuselage that are separated by fewer than three passenger seat rows is 65.

(8) If a Type A, Type B, or Type C exit is installed, there must be at least two Type C or larger exits on each side of the fuselage.

(9) If a passenger ventral or tail cone exit is installed and that exit provides at least the same rate of egress as a Type III exit with the aeroplane in the most adverse exit opening condition that would result from the collapse of one or more legs of the landing gear, an increase in the passenger seating configuration ~~beyond the limits specified in sub-paragraph (d) (1) or (2) of this paragraph may be allowed~~ is permitted as follows:

(i) For a ventral exit, 12 additional passenger seats.

(ii) For a tail cone exit incorporating a floor-level opening of not less than ~~51~~50.8 cm (20 inches) wide by 1.52 m (60 inches) high, with corner radii not greater than ~~one third the width of the exit~~ 17.8 cm (7 inches), in the pressure shell and incorporating an approved assisting means in accordance with CS 25.810(a), 25 additional passenger seats.

(iii) For a tail cone exit incorporating an opening in the pressure shell which is at least equivalent to a Type III emergency exit with respect to dimensions, step-up and step-down distance, and with the top of the opening not less than 1.42 m (56 inches) from the passenger compartment floor, 15 additional passenger seats.

(h) *Other exits*. The following exits must also meet the applicable emergency exit requirements of CS 25.809 through 25.812, and must be readily accessible:

(1) Each emergency exit in the passenger compartment in excess of the minimum number of required emergency exits.

(2) Any other floor-level door or exit that is accessible from the passenger compartment and is as large or larger than a Type II exit, but less than 1.17 m (46 inches) wide.

(3) Any other ventral or tail cone passenger exit.

(i) ~~[Reserved]~~ *Ditching emergency exits for passengers.* Whether or not ditching certification is requested, ditching emergency exits must be provided in accordance with the following conditions, unless the emergency exits required by subparagraph (g) of this paragraph already meet them:

(1) For aeroplanes that have a passenger seating configuration of nine seats or less, excluding pilot seats, one exit above the waterline in each side of the aeroplane, meeting at least the dimensions of a Type IV exit.

(2) For aeroplanes that have a passenger seating configuration of 10 seats or more, excluding pilot seats, one exit above the waterline in a side of the aeroplane, meeting at least the dimensions of a Type III exit for each unit (or part of a unit) of 35 passenger seats, but no less than two such exits in the passenger cabin, with one on each side of the aeroplane. The passenger seat/exit ratio may be increased through the use of larger exits, or other means, provided it is shown that the evacuation capability during ditching has been improved accordingly.

(3) If it is impractical to locate side exits above the waterline, the side exits must be replaced by an equal number of readily accessible overhead hatches of not less than the dimensions of a Type III exit, except that for aeroplanes with a passenger configuration of 35 seats or less, excluding pilot seats, the two required Type III side exits need to be replaced by only one overhead hatch.

(j) ~~[Reserved]~~ *Flight crew emergency exits*. For aeroplanes in which the proximity of passenger emergency exits to the flight crew area does not offer a convenient and readily accessible means of evacuation of the flight crew, and for all aeroplanes having a passenger seating capacity greater than 20, flight crew exits must be located in the flight crew area. Such exits must be of sufficient size and so located as to permit rapid evacuation by the crew. One exit must be provided on each side of the aeroplane; or, alternatively, a top hatch must be provided. Each exit must encompass an unobstructed rectangular opening of at least 48.3 cm by ~~51~~50.8 cm (19 by 20 inches) unless satisfactory exit utility can be demonstrated by a typical crew member.

~~(k) Each passenger entry door in the side of the fuselage must qualify as a Type A, Type I, or Type II passenger emergency exit.~~

Amend CS 25.809 as follows:

CS 25.809 Emergency exit arrangement
(See AMC 25.809 (a))

(a) (1) Each emergency exit, including a flight crew emergency exit, must be a movable door or hatch in the external walls of the fuselage, allowing unobstructed opening to the outside.

(2) Each emergency exit, including a flight crew emergency exit, must have means to permit viewing of the conditions outside the exit when the exit is closed, in all ambient lighting conditions with the landing gears extended or in any condition of collapse. The viewing means may be on or adjacent to the exit provided no obstructions exist between the exit and the viewing means.

(3) For non-over-wing passenger emergency exits, a means must also be provided to permit viewing of the likely areas of evacuee ground contact when the exit is closed with the landing gears extended or in any condition of collapse. Furthermore, the likely areas of evacuee ground contact must be viewable with the exit closed during all ambient lighting conditions when all landing gears are extended.

(b) …

(h) [Reserved]

(i) Each emergency exit must have a means to retain the exit in the open position, once the exit is opened in an emergency. The means must not require separate action to engage when the exit is opened, and must require positive action to disengage.

Amend CS 25.810 as follows:

CS-25.810 Emergency egress assisting means and escape routes
(See AMC 25.810(c)(2))

(a) Each non-over-wing Type A, Type B or Type C exit, and any other non-over-wing landplane emergency exit more than 1.8 m (6 feet) from the ground with the aeroplane on the ground and the landing gear extended, ~~and each non-over-wing Type A exit~~ must have an approved means to assist the occupants in descending to the ground.

(1) The assisting means for each passenger emergency exit must be a self-supporting slide or equivalent; and, in the case of Type A or Type B exits, it must be capable of

carrying simultaneously two parallel lines of evacuees. In addition, the assisting means must be designed to meet the following requirements:

(i) It must be automatically deployed and deployment must begin during the interval between the time the exit opening means is actuated from inside the aeroplane and the time the exit is fully opened. However, each passenger emergency exit which is also a passenger entrance door or a service door must be provided with means to prevent deployment of the assisting means when it is opened from either the inside or the outside under non-emergency conditions for normal use.

(ii) Except for assisting means installed at Type C exits, it must be automatically erected within ~~10~~ 6 seconds after deployment is begun or within 10 seconds from the time the opening means of the exit is actuated. Assisting means installed at Type C exits must be automatically erected within 10 seconds from the time the opening means of the exit is actuated.

(iii) It must be of such length after full deployment that the lower end is self-supporting on the ground and provides safe evacuation of occupants to the ground after collapse of one or more legs of the landing gear.

(iv) It must have the capability, in 46 km/hr (25-knot) winds directed from the most critical angle, to deploy and, with the assistance of only one person, to remain usable after full deployment to evacuate occupants safely to the ground.

(v) For each system installation (mock-up or aeroplane installed), five consecutive deployment and inflation tests must be conducted (per exit) without failure, and at least three tests of each such five-test series must be conducted using a single representative sample of the device. The sample devices must be deployed and inflated by the system's primary means after being subjected to the inertia forces specified in CS 25.561(b). If any part of the system fails or does not function properly during the required tests, the cause of the failure or malfunction must be corrected by positive means and after that, the full series of five consecutive deployment and inflation tests must be conducted without failure.

(2) The assisting means for flight crew emergency exits may be a rope or any other means demonstrated to be suitable for the purpose. If the assisting means is a rope, or an unapproved device equivalent to a rope, it must be:

(i) 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 in flight;

(ii) Able (with its attachment) to withstand a 1779 N (400-lbf) static load.

(b) Assisting means from the cabin to the wing are required for each Type A or Type B exit located above the wing and having a step-down unless the exit without an assisting means can be shown to have a rate of passenger egress at least equal to that of the same type of non-over-wing exit. If an assisting means is required, it must be automatically deployed and automatically erected concurrent with the opening of the exit ~~and self-supporting within 10~~

~~seconds~~. In the case of assisting means installed at Type C exits, it must be self-supporting within 10 seconds from the time the opening means of the exits is actuated. For all other exit types, it must be self-supporting 6 seconds after deployment has begun.

(c) An escape route must be established from each over-wing emergency exit, and (except for flap surfaces suitable as slides) covered with a slip resistant surface. Except where a means for channelling the flow of evacuees is provided:

(1) The escape route from each Type A or Type B emergency exit, or any common escape route from two Type III emergency exits, must be at least 1.07 m (42 inches) wide ~~at type A passenger emergency exits and~~; that from any other passenger emergency exit must be at least 61 cm (24 inches ~~2 feet~~) wide ~~at all other passenger emergency exits~~; and

(2) The escape route surface must have a reflectance of at least 80 %, and must be defined by markings with a surface-to-marking contrast ratio of at least 5:1. ~~(see AMC 25.810 (c) (2).)~~

(d) Assisting means must be provided to enable evacuees to reach the ground for all Type C exits located over the wing and, if the place on the aeroplane structure at which the escape route required in subparagraph (c) of this paragraph terminates is more than 1.8 m (6 feet) from the ground with the aeroplane on the ground and the landing gear extended ~~means to reach the ground must be provided to assist evacuees who have used the escape route~~, for all other exit types.

(1) If the escape route is over the flap, the height of the terminal edge must be measured with the flap in the take-off or landing position, whichever is higher from the ground.

(2) The assisting means must be usable and self-supporting with one or more landing gear legs collapsed and under a 46 km/hr (25-knot) wind directed from the most critical angle.

(3) The assisting means provided for each escape route leading from a Type A or B emergency exit must be capable of carrying simultaneously two parallel lines of evacuees; and, the assisting means leading from any other exit type ~~For other than Type A exits, the assist means~~ must be capable of carrying as many parallel lines of evacuees as there are required escape routes.

(4) The assisting means provided for each escape route leading from a Type C exit must be automatically erected within 10 seconds from the time the opening means of the exit is actuated, and that provided for the escape route leading from any other exit type must be automatically erected within 10 seconds after actuation of the erection system.

(e) If an integral stair is installed in a passenger entry door that is qualified as a passenger emergency exit, the stair must be designed so that, under the following conditions, the effectiveness of passenger emergency egress will not be impaired:

(1) The door, integral stair, and operating mechanism have been subjected to the inertia forces specified in CS 25.561(b)(3), acting separately relative to the surrounding structure;

(2) The aeroplane is in the normal ground attitude and in each of the attitudes corresponding to collapse of one or more legs of the landing gear.

Amend CS 25.812 as follows:

CS 25.812 Emergency lighting
(See AMC 25.812)

[…]

(f) Except for sub-systems provided in accordance with subparagraph (h) of this paragraph that serve no more than one assisting means, are independent of the aeroplane's main emergency lighting system, and are automatically activated when the assisting means is […]

(g) […]

(1) […]

(ii) Not less than 0.5 lux (0.05 foot-candle) (measured normal to the direction of the incident light) for a minimum width of 1.07 m (42 inches) for a Type A over-wing exit and 61 cm (24 inches) for all other over-wing emergency exits along the 30 % of the slip-resistant portion of the escape route required in CS 25.810(c) that is farthest from the exit ~~for the minimum required width of the escape route~~; and

[…]

(2) At each non-over-wing emergency exit not required by CS 25.810(a) to have descent assisting means the illumination must be not less than 0.3 lux (0.03 foot candle) (measured normal to the direction of the incident light) on the ground surface with the landing gear extended where an evacuee is likely to make ~~his~~ first contact with the ground outside the cabin.

(h) The means required in CS 25.810 (a) (1) and (d) to assist the occupants in descending to the ground must be illuminated so that the erected assisting means is visible from the aeroplane. In addition:

(1) If the assisting means is illuminated by exterior emergency lighting, it must provide illumination of not less than 0.3 lux (0.03 foot candle) (measured normal to the direction of the incident light) at the ground end of the erected assisting means where an evacuee using the established escape route would normally make first contact with the ground, with the aeroplane in each of the attitudes corresponding to the collapse of one or more legs of the landing gear.

(2) If the emergency lighting illuminating the assisting means serves no other assisting means, is independent of the aeroplane's main emergency lighting system, and is automatically activated when the assisting means is erected, the lighting provisions:

(i) may not be adversely affected by stowage; and

(ii) must provide illumination of not less than 0.3 lux (0.03 foot candle) (measured normal to the direction of the incident light) at the ground end of the erected assisting means where an evacuee would normally make first contact with the ground, with the aeroplane in each of the attitudes corresponding to the collapse of one or more legs of the landing gear.

…

Amend CS 25.813 as follows:

CS 25.813 Emergency exit access and ease of operation
(See AMC to 25.807 and 25.813 and AMC 25.813(c))

Each required emergency exit must be accessible to the passengers and located where it will afford an effective means of evacuation. Emergency exit distribution must be as uniform as practical, taking passenger distribution into account; however, the size and location of exits on both sides of the cabin need not be symmetrical. If only one floor level exit per side is prescribed, and the aeroplane does not have a tail cone or ventral emergency exit, the floor level exit must be in the rearward part of the passenger compartment, unless another location affords a more effective means of passenger evacuation. Where more than one floor level exit per side is prescribed, at least one floor level exit per side must be located near each end of the cabin, except that this provision does not apply to combination cargo/passenger configuration. In addition -

(a) There must be a passageway leading from each the nearest main aisle to each Type A, Type B, Type C, Type I, or Type II emergency exit and between individual passenger areas. Each passageway leading to a Type A or type B exit must be unobstructed and at least 91 cm (36 inches) wide. Other Passageways and cross aisles between individual passenger areas and those leading to Type I, Type II, or Type C emergency exits must be unobstructed and at least 51 cm (20 inches) wide. Unless there are two or more main aisles, each Type A or B exit must be located so that there is passenger flow along the main aisle to that exit from both the forward and aft directions. If two or more main aisles are provided, there must be a unobstructed cross-aisles at least 51 cm (20 inches) wide leading directly to each passageway between main aisles. the exit and the nearest main aisle. There must be:

(1) A cross-aisle which leads directly to each passageway between the nearest main aisle and a Type A or B exit; and

(2) A cross-aisle which leads to the immediate vicinity of each passageway between the nearest main aisle and a Type C, Type I, Type II, or Type III exit; except that when two Type III exits are located within three passenger rows of each other, a single cross-aisle may be used if it leads to the vicinity between the passageways from the nearest main aisle to each exit.

(b) Adequate space to allow crew member(s) to assist in the evacuation of passengers must be provided as follows:

(1) Each assist space must be a rectangle on the floor, of sufficient size to enable a crew member, standing erect, to effectively assist evacuees. The assist space must not reduce the unobstructed width of the passageway below that required for the exit.

(2) For each Type A or Type B exit, assist space must be provided at each side of the exit regardless of whether an assisting means is required by the exit is covered by CS 25.810(a).

(3) For any other type exit that is covered by CS 25.810(a), space must at least be provided

at one side of the passageway. For each Type C, I or II exit installed in an aeroplane with seating for more than 80 passengers, an assist space must be provided at one side of the passageway regardless of whether an assisting means is required by CS 25.810(a).

(4) For each Type C, I or II exit, an assist space must be provided at one side of the passageway if an assisting means is required by CS 25.810(a).

(5) For any tail cone exit that qualifies for 25 additional passenger seats under the provisions of CS 25.807(g)(9)(ii), an assist space must be provided, if an assisting means is required by CS 25.810(a).

(6) There must be a handle, or handles, at each assist space, located to enable the crew member to steady himself or herself:

(i) While manually activating the assisting means (where applicable), and

(ii) While assisting passengers during an evacuation.

…

(e) No door may be installed in any partition between any passenger compartments seat that is occupiable for take-off and landing and any passenger emergency exit, such that the door crosses any egress path (including aisles, cross-aisles and passageways).

(f) If it is necessary to pass through a doorway separating any crew member seat (except those seats on the flight deck), occupiable for take-off and landing, the passenger cabin from other areas to reach any 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 when the door is subjected to the ultimate inertia forces, relative to the surrounding structure, listed in CS 25.561(b).

Amend CS 25.851 as follows:

CS 25.851 Fire extinguishers

(a) *Hand fire extinguishers*

(See AMC 25.851(a))

(1) …

(6) At least one of tThe required fire extinguishers located in the passenger compartment of an aeroplane with a passenger capacity of at least 31 and not more than 60, and at least two of the fire extinguishers located in the passenger compartment of an aeroplane with a passenger capacity of 61 or more must contain Halon 1211 (bromochlorodifluoromethane, CBrC1F2), or equivalent, as the an accepted extinguishing agent. The type of extinguishing agent used in any other extinguisher required by this paragraph must be that is appropriate for the kinds and classes of fires likely to occur where used.

…

(c) *Fire-extinguishing agents*
(See AMC 25.851(c))

(1) Fire classes against which fire-extinguishing agents may be employed are:

- Class A: Fires involving ordinary combustible materials, such as wood, cloth, paper, rubber and plastics;
- Class B: Fires involving flammable liquids, petroleum oils, greases, tars, oil base paints, lacquers, solvents, alcohols and flammable gases;
- Class C: Fires involving energised electrical equipment where the use of an extinguishing agent that is electrically non-conductive is important.

<u>Amend CS 25.853 as follows:</u>

CS 25.853 Compartment interiors
(See AMC 25.853)
…
(f) Smoking is not ~~to be~~ allowed in lavatories. If smoking is~~ to be~~ allowed in any ~~other compartment~~ area occupied by the crew or passengers, an adequate number of self-contained, removable ashtrays must be provided in designated smoking sections for all seated occupants.

<u>Amend CS 25.855 as follows:</u>

CS 25.855 Cargo or baggage compartments
(See AMC to CS 25.855 and 25.857)

For each cargo or baggage compartment ~~not occupied by crew or passengers~~, the following apply:
…

SUBPART E – POWERPLANT

<u>Amend CS 25.951(c) as follows:</u>

(c) Each fuel system must be capable of sustained operation throughout its flow and pressure range with fuel initially saturated with water at 26~~,~~.7ºC (80ºF) and having 0.20 cm^3 (0~~,~~.75 cc) of free water per 3.8 lit~~er~~res (US gallon) added and cooled to the most critical condition for icing likely to be encountered in operation.

<u>Amend CS 25.1197 as follows:</u>

CS 25.1197 Fire-extinguishing agents
(See AMC 25.1197.)

…

SUBPART F - EQUIPMENT

<u>Amend CS 25.1305(a)(2) as follows:</u>

CS 25.1305 Powerplant instruments

…

(a)…

(2) ~~A fuel quantity indicator for each fuel tank~~

Fuel indication system(s) which:

(i) Provide(s) to the flight crew a full-time display of the total quantity of usable fuel on board;

(ii) Is (are) capable of indicating to the flight crew the quantity of usable fuel in each tank in accordance with CS 25.1337(b);

(iii) Provide(s) fuel quantity and availability information to the flight crew, including alerts, to indicate any fuel system condition (e.g. misconfiguration or failure) that, if not corrected, would result in no fuel being supplied to one or more engines. This includes:

(A) Abnormal fuel transfer between tanks;
(B) Trapped fuel;
(C) Fuel leaks including in the engines.

(iv) Provide(s) a low fuel level cockpit alert for any tank and/or collector cell that should not become depleted of fuel.

Each alert is such that:

(A) It is provided to the flight crew when the usable quantity of fuel in the tank concerned reaches the quantity required to operate the engine(s) for 30 minutes at cruise conditions;

(B) The alert and the fuel quantity indication for that tank are not adversely affected by the same single failure.

<u>**Amend CS 25.1445 as follows: delete the unwanted spaces in the title to read:**</u>

CS 25.1445 Equipment standards for the oxygen distributing system

<u>**Amend CS 25.1447 as follows:**</u>

CS 25.1447 Equipment standards for oxygen dispensing units

…
(c)…

(4) Portable oxygen equipment must be immediately available for each cabin crew member. The portable oxygen equipment must have the oxygen dispensing unit connected to the portable oxygen supply.

(See AMC 25.1447(c)(4).)

APPENDIX F

<u>**Amend Appendix F – Part II as follows:**</u>

Part II – Flammability of Seat Cushions

(a) Criteria for acceptance

…

(g) *Test procedures*. The flammability of each set of specimens must be tested as follows:

(1) …

(6) Expose the seat bottom cushion specimen to the burner flame for 2 minutes and then turn off the burner. Immediately swing the burner away from the test position. Terminate test 7 minutes after initiating cushion exposure to the flame by use of an appropriate gaseous extinguishing agent ~~(i.e. Halon or CO2)~~.

(7) …

Book 2

AMC – SUBPART D

Amend AMC 25.703 as follows:

…
3. Related material
a. Federal Aviation Administration and EASA Documents.
…
(7) EASA AMC 20-115() (Recognition of EUROCAE ED-12()/RTCA DO-178() Software Considerations for Airborne Systems and Equipment Certification)
…

b. Industry Documents.
…
(2) EUROCAE ED-14D/RTCA document DO-160D or latest version, Environmental Conditions and Test Procedures for Airborne Equipment; EUROCAE ED-12()/RTCA document DO-178() as recognized by EASA AMC 20-115(), Software Considerations in for Airborne Systems and Equipment Certification. RTCA documents can be obtained from the RTCA, One McPherson Square, Suite 500, 1425 K Street Northwest, Washington, D.C. 20005.
…

---

5. DISCUSSION
…
b. System Criticality.
…
(4) If such systems use digital electronic technology, a software Development Assurance lLevel (DAL) should be used, in accordance with the applicable version of EUROCAE ED-12()/RTCA document DO-178(), as recognized by AMC 20-115(), which is compatible with the system integrity determined by the AMC 25.1309 analysis.

Amend AMC 25.729 as follows:

AMC 25.729 Retracting mechanism
…
2. RELATED DOCUMENTS
…
e. I*ndustry Documents.*

(1) EUROCAE ED-14DG/RTCA, Inc., Document No. DO-160DG,

Environmental Conditions and Test Procedures for Airborne Equipment.
(2) ~~EUROCAE ED-12B/RTCA, Inc., Document No. DO-178B,~~ AMC 20-115, Software Considerations for Airborne Systems and Equipment Certification.

Amend AMC 25.735 as follows:

AMC 25.735
Brakes and Braking Systems Certification Tests and Analysis
…
2. RELATED REGULATORY MATERIAL AND COMPLEMENTARY DOCUMENTS
…
b. Complementary Documents
…
(ii) Advisory Circulars/Acceptable Means of Compliance
…
AMC 20-115~~()~~ ~~Recognition of EUROCAE ED-12()/RTCA DO-178()~~ Software Considerations for Airborne Systems and Equipment Certification
…
(vi) The European Organisation for Civil Aviation Equipment Documents
ED-14 ~~D~~G /RTCA DO-160 ~~D~~G Environmental Conditions and Test Procedures for Airborne Equipment. ~~Issued 29 July 1997~~
~~ED-12()/RTCA DO-178()~~ AMC 20-115 Software Considerations ~~in~~ for Airborne Systems and Equipment Certification~~, as recognized by AMC 20-115()~~

Amend AMC 25.803 as follows:

AMC 25.803
Emergency evacuation

Relevant part of the FAA Advisory Circular 25-17A Transport Airplane Cabin Interiors Crashworthiness Handbook, dated 05/18/09 and AC 25.803-1A Emergency Evacuation Demonstrations, dated ~~13/11/89~~ 03/12/12 are accepted by the Agency as providing acceptable means of compliance with CS 25.803.

Note: "relevant parts" means "the part of the AC 25-17A that addresses the applicable FAR/CS-25 paragraph".

<u>Amend AMC to 25.807 and 25.813 as follows:</u>

AMC ~~to~~ 25.807 ~~and 25.813~~
Emergency Exits ~~Access~~

The term 'unobstructed' should be interpreted as referring to the space between the adjacent wall(s) and/or seat(s), the seatback(s) being in the most adverse position, in vertical projection from floor-level to at least the prescribed minimum height of the exit.

Relevant part of the FAA Advisory Circular 25-17A Transport Airplane Cabin Interiors Crashworthiness Handbook, dated 05/18/09 is accepted by the Agency as providing acceptable means of compliance with CS 25.807.

Note: 'relevant parts' means 'the part of the AC 25-17A that addresses the applicable FAR/CS-25 paragraph'.

FAA Advisory Circular 25.807-1 'Uniform Distribution of Exits', dated 8/13/90 is accepted by the Agency as providing acceptable means of compliance with CS 25.807(e).

<u>Delete the existing AMC 25.807</u>

<u>Amend AMC to 25.807(d) as follows:</u>

AMC 25.807~~(d)~~(f)
Passenger Emergency Exits
…

<u>Create a new AMC 25.809 to read:</u>

AMC 25.809
Emergency exit arrangement

The requirement to provide a view of the outside in all ambient lighting conditions suggests the use of externally mounted lighting (although other means may be acceptable). In the landing gear collapsed cases, the rolling and pitching effects on the fuselage may redirect a fixed lamp's beam away from the area illuminated in the all landing gears extended condition. Furthermore, in the case of inflatable escape slides the toe end ground contact point will probably move in the opposite direction to that of the lamp beam.

In recognition of these effects, and in order to maintain reasonable demands on the complexity and power of external lighting equipment, the rule does not require the entire viewable area to be visible in all ambient lighting conditions. The only specific illumination requirement is for the likely areas of evacuee ground contact, with all landing gears extended, for passenger exits.

However, it is recommended that as large a field of view as is practicable should be provided, taking into account aspects such as fuselage curvature and door/window/hatch location, in order to provide the best chance to identify external evacuation hazards before exits are opened.

In the case of a flight crew emergency exit, a flight deck window as conventionally configured, used in conjunction with a suitably accessible and powerful portable illumination device (e.g. flashlight) will provide an acceptable means for viewing outside conditions.

Flight deck seats, consoles etc., as conventionally configured, are not considered to be obstructions in the meaning of this term in CS 25.809(a)(2) in the case where flight deck windows are the viewing means and the exit is an overhead hatch. Furthermore, it is considered that the distance between flight deck windows, as conventionally configured, and an overhead hatch is such that the criterion for the viewing means to be adjacent to the exit is satisfied.

Create a new AMC 25.809(a)(3) to read:

AMC 25.809(a)(3)
Emergency exit arrangement

A subjective outside viewing test can be conducted to determine if the exterior viewing means and lighting system provide an adequate view/illumination to allow identification of possible hazards in the evacuee ground contact area. For this test, the viewing/lighting system will be deemed acceptable if an object (e.g., a traffic cone) placed in the viewing area is visible to the test witness looking through the emergency exit viewing means that is provided.

When a separate lighting system is installed that is only used to meet the requirements of CS 25.809(a), that system should be designed to meet the requirements of CS 25.812(k), for operation after having been subjected to the inertia forces listed in CS 25.561(b), and CS 25.812(l)(3), such that at least one exterior light on each side of the airplane remains operative after a single transverse separation.

Create a new AMC 25.813 to read:

AMC 25.813
Emergency Exit Access

The term 'unobstructed' should be interpreted as referring to the space between the adjacent wall(s) and/or seat(s), the seatback(s) being in the most adverse position, in vertical projection from floor-level to at least the prescribed minimum height of the exit.

For Assist Spaces, relevant part of the FAA Advisory Circular 25-17A Transport Airplane Cabin Interiors Crashworthiness Handbook, dated 05/18/09 is accepted by the Agency as providing acceptable means of compliance with CS 25.813(b).

Note: 'relevant parts' means 'the part of the AC 25-17A that addresses the applicable FAR/CS-25 paragraph'.

<u>Amend AMC to 25.851(a) as follows:</u>

AMC 25.851(a) Hand Fire Extinguishers
…

<u>Amend AMC to 25.851(a)(1) as follows:</u>

AMC 25.851(a)(1) Hand Fire Extinguishers
…

<u>Amend AMC to 25.851(a)(2) as follows:</u>

AMC 25.851(a)(2) Hand Fire Extinguishers

There should be at least one fire extinguisher suitable for ~~both flammable fluid and electrical equipment~~ Class B and C fires installed in each pilot's compartment. Additional extinguishers may …

Based on EU legislation[1], for new installations of hand fire extinguishers for which the certification application is submitted after 31 December 2014, Halon 1211, 1301 and Halon 2402 are unacceptable extinguishing agents.

The hand fire extinguishers and related agents listed in the FAA Advisory Circular AC 20-42D are considered acceptable by the Agency. See AMC 25.851(c) for more information on Halon alternatives.

NOTE: Dry chemical fire extinguishers …

<u>Amend AMC to 25.851(b) as follows:</u>

AMC 25.851(b) Built-in Fire Extinguishers for Cargo Compartments

1. <u>PURPOSE</u>

[1] Commission Regulation (EU) No 744/2010 of 18 August 2010 amending Regulation (EC) No 1005/2009 of the European Parliament and of the Council on substances that deplete the ozone layer, with regard to the critical uses of halon (OJ L 218, 19.8.2010, p. 2).

…

3. ~~RESERVED~~ BAN ON HALON 1301

Halon 1301 is no longer an acceptable extinguishing agent, based on EU Legislation[2], for cargo compartment fire extinction systems to be installed on aircraft types, for which type certification is requested after 31 December 2018. See AMC 25.851(c) for more information on Halon alternatives.

4. BACKGROUND ON CONCENTRATION OF HALON 1301

Minimal written guidance …

Cargo fire-extinguishing systems installed in aeroplanes ~~today~~ have primarily used **Halon** 1301 as the fire suppression agent. One widely used method to certify **Halon 1301** cargo …

Since **Halon 1301** is approximately five times heavier than air, it tends to stratify and settle after it is released into the cargo compartment. Also, due to temperature differences and ventilation patterns, in a ventilated compartment, **Halon 1301** will start to stratify shortly after discharge and the concentration level will decay faster in the upper locations of the compartment than in the lower locations. **Halon 1301** will also have a tendency to move aft due to any upward pitch or forward in any downward pitch of the aeroplane in flight. For some products the concentration levels of **Halon 1301** have been measured at various locations throughout …

Testing at the FAA Technical Center and other data from standardised fire-extinguishing evaluation tests indicate that the use of averaging techniques may not substantiate that there are adequate concentration levels of fire-extinguishing agent throughout the compartment to effectively suppress a cargo fire. If a cargo fire occurred, and was subsequently suppressed by **Halon 1301**, the core of the fire could remain hot for a period of time. If the local concentration of **Halon 1301** in the vicinity of the fire core dropped below three percent by volume and sufficient oxygen is available, re-ignition could occur. The FAA tests have shown that when the **Halon 1301** concentration level drops below three percent by volume and the cargo fire reignites, the convective stirring caused by the heat of the fire may be insufficient to raise the local concentration of **Halon** in the vicinity of the fire. Therefore, …

5. COMPARTMENT CLASSIFICATION

All cargo compartments …

a. A Class A compartment is …

---

[2] Commission Regulation (EU) No 744/2010 of 18 August 2010 amending Regulation (EC) No 1005/2009 of the European Parliament and of the Council on substances that deplete the ozone layer, with regard to the critical uses of halon (OJ L 218, 19.8.2010, p. 2).

(1) Typically, a Class A compartment is …

(2) Because a Class A compartment does not have a liner, it is *absolutely essential* that the compartment be small and located close enough to a crew member that any fire that might occur could be discovered and extinguished immediately. Without a liner to contain it, an undetected or uncontrolled fire could quickly become catastrophic by burning out of the compartment and spreading throughout the aeroplane. All portions of the compartment must be within arm's length of the crew member in order for any fire to be detected immediately and extinguished in a timely manner. Although there may be some exceptions, such as a 'U-Shaped' compartment for example, a Class A compartment greater than 1.42 cubic metres (50 cubic feet) in volume would not typically have the accessibility required by CS 25.857(a)(2) for fighting a fire.

b. …

6. FIRE-EXTINGUISHING OR SUPPRESSION SYSTEMS

…

7. TESTING VOLUMETRIC CONCENTRATION LEVELS

For the product it should be demonstrated that the cargo fire-extinguishing system provides adequate concentration levels of extinguishing agent to combat a fire anywhere where baggage and cargo is placed within the cargo compartment for the time duration required to land and evacuate the aeroplane. A combination of flight-testing and analysis may be used to comply with this requirement. If **Halon 1301** is used, an initial minimum concentration of five percent by volume is required to knock down a cargo fire. …

The fire-extinguishing agent concentration levels should be measured at sufficient vertical, horizontal, and longitudinal locations to ensure that sufficient resolution exists to …

The concentration levels …

…

Certification flight test demonstration is required for a 'dump' system … certification data must include analysis and/or data taken after landing at a time increment representative of the completion of an evacuation of all occupants.

Acceptable extinguishing agents, alternative to Halon and based on internationally recognised Minimum Performance Standards (MPS), like e.g. Report No. DOT/FAA/AR-00-28, Development of a Minimum Performance Standard for Aircraft Cargo Compartment Gaseous Fire Suppression Systems, dated September 2000, may be accepted by the Agency. In the absence of internationally accepted concentration levels, the Agency will initiate a

Certification Review Item addressing the use of an alternate fire-extinguishing agent.

If it is proposed for a product to use a fire-extinguishing agent other than Halon 1301, the Agency should be contacted. The EASA will initiate a Certification Review Item addressing the use of an alternate fire-extinguishing agent.

8. AEROPLANE TEST CONDITIONS FOR USE OF HALON 1301 IN CARGO COMPARTMENTS

Flight tests are required to …

9. EVALUATION OF ALTERNATE GASEOUS EXTINGUISHING/SUPPRESSION SYSTEMS AND
ALTERNATE AGENTS.

The Montreal Protocol, in existence since 1987, is an international agreement to phase out production of ozone-depleting substances, including halogenated hydrocarbons also known as Halon. The Montreal Protocol prohibits the manufacture or import of new Halon in all developed countries as of January 1, 1994, and will extend this prohibition to developing countries in the future. The US Environmental Protection Agency (EPA) has subsequently released a regulation banning the intentional release of Halons during repair, testing, and disposal of equipment containing Halons and during technician training. However, the EPA has provided the aviation industry an exemption from their ban on the intentional release of Halons in determining compliance with airworthiness standards. A European Regulation[3] governing substances that deplete the ozone layer has also been published and contains provisions that allow exemptions for critical uses of **Halon**, including fire-extinguishing in aviation. It should be noted that the EPA/EU exemption is predicated on the basis that there is currently no suitable alternate agent or system available for use on commercial transport category aeroplanes. It is the understanding of the EASA that once a suitable replacement extinguishing agent or system has been found then the EPA/EU will remove the exemption.

To date, FAA Technical Center testing of alternate gaseous extinguishing/suppression agents has not yielded any acceptable alternate **Halon** replacement agents for use in cargo compartments. For example, testing at the Technical Center utilising HFC-125 demonstrated the need for large concentrations of this agent that would carry weight penalty and toxicity concerns. The Technical Center will continue to pursue this line of research to identify alternate gaseous and liquid and other fire-extinguishing / suppression agent systems. Acceptable means of compliance for these immature systems are beyond the scope of this AMC. Future revisions to this AMC will be accomplished as soon as suitable standards are developed for these systems.

[3] Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer.

~~Should the EASA be approached with the intent of utilising for the product an alternate agent or alternate gaseous fire-extinguishing system in lieu of a **Halon 1301** system, then the recommended approach would be to perform testing on the product which meets the Minimum Performance Standards for that application as developed by the International **Halon** Replacement Working Group. The International **Halon** Replacement Working Group was established in October 1993. This group was tasked to work towards the development of minimum performance standards and test methodologies for non-**Halon** aircraft fire suppression agents/systems in cargo compartments, engine nacelles, hand held extinguishers, and lavatory trash receptacles. The International **Halon** Replacement Working Group has been expanded to include all system fire protection R&D for aircraft and now carries the name, International Aircraft Systems Fire Protection Working Group.~~

~~To ensure acceptable means of compliance, the following must be provided:~~

~~a. The test data and gaseous agent distribution profiles which meet the certification criteria as expressed below and in the Minimum Performance Standards as developed by FAA Technical Center as part of the International Halon Replacement program. (See paragraph 15 for the listing of the references.)~~

~~b. A system description document that includes a description of the distribution of the gaseous agent under the test conditions in the cargo compartment.~~

~~c. A detailed test plan.~~

~~d. Chemical data which describes the agent and any toxicity data.~~

~~9.1 Pre-Test Considerations:~~

~~a. An EASA accepted analyser (for example, Statham-derivative analyser) capable of measuring the agent distribution profile in the form of volumetric concentration is required.~~

~~b. An EASA accepted analyser (for example, Statham-derivative analyser) and associated hardware are configured for the particular application.~~

~~c. The fire suppression system should be completely conformed prior to the test.~~

~~d. The fire extinguisher bottle(s) should be serviced and prepared for the prescribed test(s).~~

~~9.2 Test Procedures:~~

~~a. Perform the prescribed distribution test in accordance with the test plan approved by the Agency. See Paragraph 7 for guidance on probe placement.~~

~~b. An EASA accepted analyser (for example, Statham-derivative analyser) should record the~~

distribution profile as volumetric concentration for the agent.

9.3 Test Result Evaluation:

a. Produce the data from the EASA accepted analyser (for example, Statham-derivative analyser) in graphical format. This format should be the volumetric concentration of the agent versus time. A specific percent volumetric initial concentration and a specific percent volumetric metered concentration for the length of the test duration as determined by previous testing conducted per the established minimum performance standards is required for airworthiness approval of cargo compartment systems.

b. Using the appropriate MPS evaluation criteria, evaluate the distribution profile of the agent for acceptable performance. The acceptability of the test data would be dependent upon the distribution profile and duration exhibited by each probe per (1) above and Paragraph 7 for cargo compartment fire-extinguishing systems

10. EVALUATION OF ALTERNATE LIQUID AGENT AND FIRE EXTINGUISHING/ SUPPRESSION SYSTEMS.

The FAA Technical Center has released a Technical Note that represents the latest Minimum Performance Standards (MPS) for a water spray system. However, as mentioned within the body of the report, additional developmental testing would be needed for the product and the FAA to be approached regarding certification of such a system. Additional testing would be required to demonstrate compliance with an Aerosol spray can fire threat. The Technical Center continues to perform research towards identifying alternate liquid and other fire-extinguishing / suppression systems. Acceptable means of compliance for these immature systems are beyond the scope of this AMC. Future revisions to this AMC will be accomplished as soon as suitable standards are developed for these systems.

If for the product it is proposed to use a liquid fire-extinguishing agent or system, the EASA should be contacted. The EASA will initiate a Certification Review Item addressing the use of an alternate fire-extinguishing agent or system.

119. USE OF SIMULANTS FOR CERTIFICATION TESTING

The aviation industry may continue to use **Halon** in cargo fire suppression applications in relation to new application for type certificate, until the end of 2018. as long as acceptable alternatives have not been identified and shown to provide an equivalent level of safety.

The EPA/EU is are allowing the aviation industry to use **Halon** to demonstrate system functionality as long as a simulant or alternate extinguishing agent or alternate fire-extinguishing system cannot be used in place of the **Halon** during system or equipment testing for technical reasons. It should be noted, however, that certain states continue to ban the release of **Halon** for testing. The FAA Technical Center and the International Aircraft Systems Fire Protection Working Group are concentrating efforts on evaluating alternative fire-extinguishing agents and the use of simulants during certification testing. The EASA plans to approve a simulant which can be used in place of **Halon 1301** during certification tests of aircraft fire-extinguishing systems to predict actual **Halon 1301** volumetric concentration levels. When approved, the use of a simulant will be the preferred method for demonstrating compliance.

As of the date of this AMC, no suitable simulant for cargo compartment gaseous fire-extinguishing systems has been identified. However, should the EASA be~~ing~~ approached with the intent to utilise for the product a simulant in lieu of a **Halon 1301** system or other gaseous fire-extinguishing system, then the recommended approach would be to perform testing which meets the Minimum Performance Standards for that application as developed by the International Aircraft Systems Fire Protection Working Group. To ensure successful acceptable means of compliance, the same information as outlined above in paragraph 7 should be provided.

A simulant is defined in this AMC as …

For the application the distribution of the simulant must be described as compared with **Halon 1301** under the following conditions:

a. Given the same filling conditions, the simulant is loaded into the fire extinguisher bottle based on an equivalent liquid fraction to the **Halon 1301** charge weight required. This is an equivalent statement to the mass of the simulant being a specific percentage of the **Halon** 1301 charge weight required.

b. The fire extinguisher bottle containing the simulant is pressurised with nitrogen in an identical manner required by the **Halon** 1301 charge weight.

c. The simulant is discharged into the test environment, i.e. cargo compartment.

~~11~~9.1 Pre-Test Considerations:

a. …

c. The fire suppression system should be completely conformed for **Halon 1301**.

d. …

~~11~~9.2 Test Procedures:

a. …

~~11~~9.3 Test Result Evaluation:

a. …

b. Using the **Halon 1301** certification criteria, evaluate …

~~12~~10. ESTABLISHING DURATION FOR THE SUPPRESSION SYSTEM

The adequacy of the capacity of the 'built-in system' is understood to mean that there is sufficient quantity of agent to combat the fire anywhere where baggage and cargo is placed within the cargo compartment for the time duration required to land and evacuate the aeroplane. Current built-in cargo fire-extinguishing systems utilise **Halon 1301** as the fire-extinguishing agent. Protection is afforded as long as the minimum concentration levels in the cargo compartment do not drop below three percent by volume. The time for which a suppression system will maintain the minimum required concentration levels should be identified as a certificate limitation.

The designer of the product should work with the aircraft owner and the ~~civil aviation~~ competent authority providing operational approval to ensure that the cargo fire-extinguishing system provides the required protection time (i.e., proper sizing of the cargo fire-extinguishing system) for the specific route structure. The competent ~~civil aviation~~ authority may insist on some holding time to allow for weather and other possible delays, and may specify the speeds and altitudes used to calculate aeroplane diversion times based on one-engine-out considerations.

The competent ~~civil aviation~~ authority providing operational approval for the aeroplane determines …

~~13~~11. MANUAL CONSIDERATIONS

…

~~14~~12. PLACARDS AND MARKINGS IN CARGO COMPARTMENTS

…

~~15. REFERENCES.~~

~~a. Report No. FAA-RD-71-68, Fire-extinguishing Methods for New Passenger Cargo Aircraft, dated November 1971.~~

~~b. Civil Aviation Authority (CAA) Paper 91003, Cargo Bay Fire Suppression, dated March 1991.~~

~~c. Report No. DOT/FAA/AR-96/5, Evaluation of Large Class B Cargo Compartment's Fire Protection, dated June 1996.~~

~~d. Report No. DOT/FAA/AR-00-28, Development of a Minimum Performance Standard for Aircraft Cargo Compartment Gaseous Fire Suppression Systems, dated September 2000.~~

~~e Report No. DOT/FAA/AR-TN01/1, Water Spray as a Fire Suppression Agent for Aircraft Cargo Compartment Fires, dated March 2001.~~

APPENDIX 1: ANALYTICAL METHODS FOR DETERMINING **HALON 1301** CONCENTRATION LEVELS

…

Create a new AMC 25.851(c) as follows:

AMC 25.851(c) Alternative fire-extinguishing agents

1. General

The Montreal Protocol, in existence since 1987, is an international agreement to phase out production and use of ozone-depleting substances, including halogenated hydrocarbons also known as Halon. The Montreal Protocol prohibits the manufacture or import of new Halon in all developed countries as of 1 January, 1994. The US Environmental Protection Agency (EPA) has released a regulation banning the intentional release of Halons during repair, testing, and disposal of equipment containing Halons and during technician training. However, the EPA has provided the aviation industry an exemption from their ban on the intentional release of Halon in determining compliance with airworthiness standards. A European regulation[4] governing substances that deplete the ozone layer was also published, containing initial provisions for Halon phase-out, but also exemptions for critical uses of **Halon**, including fire-extinguishing in aviation. It should be noted that the exemptions were predicated on the basis that there were, at that time, no suitable alternate agents or systems available for use on commercial transport category aeroplanes.

'Cut-off' dates (i.e. Halon no longer acceptable in new applications for type certification) and 'end' dates (i.e. Halon no longer acceptable for use in aircraft) have been subsequently established by a new regulation in 2010[5], as presented in Table 4.1 below:

Table 4.1: 'Cut-off' and 'end' dates

[4] Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer.

[5] Commission Regulation (EU) No 744/2010 of 18 August 2010 amending Regulation (EC) No 1005/2009 of the European Parliament and of the Council on substances that deplete the ozone layer, with regard to the critical uses of halon (OJ L 218, 19.8.2010, p. 2).

Aircraft compartment	Type of extinguisher	Type of Halon	Dates	
			Cut-off	End
Inerting of fuel tanks	Fixed	1301 2402	31 December 2011	31 December 2040
Lavatory waste receptacles	Built-in	1301 1211 2402	31 December 2011	31 December 2020
Dry bays	Fixed	1301 1211 2402	31 December 2011	31 December 2040
Cabins and crew compartments	Hand (portable)	1211 2402	31 December 2014	31 December 2025
Propulsion systems and Auxiliary Power Units	Built-in	1301 1211 2402	31 December 2014	31 December 2040
Normally unoccupied cargo compartments	Built-in	1301 1211 2402	31 December 2018	31 December 2040

2 Lavatory extinguishing systems and agents

Historically, Halon 1301 has been the most widespread agent used in lavatory extinguishing (lavex) systems, to be used in the event of a Class A fire. Any alternative acceptable fire-extinguishing agent meeting the Minimum Performance Standards (MPS) laid down in Appendix D to Report DOT/FAA/AR-96/122 of February 1997, which includes the ability to extinguish a Class A fire and, in case of discharge, does not create an environment that exceeds the chemical agent's 'No Observable Adverse Effect Level' (NOAEL) will be acceptable. Research and testing have shown that there are suitable alternatives to Halon for built-in fire extinguishers in aircraft lavatories meeting the MPS for effectiveness, volume, weight and toxicology. Currently HFC-227ea or HFC-236fa are widely used on large aeroplanes and usually considered acceptable by EASA.

3 Hand fire extinguishers and agents

Historically, Halon 1211 has been the most widespread agent in handheld (portable) fire extinguishers to be used in aircraft compartments and cabins. Minimum Performance Standards (MPS) for the agents are laid down in Appendix A to Report DOT/FAA/AR-

01/37 of August 2002, while acceptable criteria to select the fire extinguishers containing said agents are laid down in the FAA Advisory Circular AC 20-42C. Version D of the same AC (published in 2011) would be preferred when the needed supporting guidance material has been released. Three agent alternatives to Halon are presently known meeting the MPS: HFC-227ea, HFC-236fa and HFC Blend B. However, these agents are significantly heavier and occupy a greater volume than Halon 1211. This may indirectly (i.e. additional weight of the fire extinguisher and additional weight of the structures supporting it) increase CO_2 emissions. Furthermore, some of these agents have also been identified as having a global warming potential much higher than Halon. Therefore, further research is underway to develop additional alternatives to Halon 1211 for hand fire extinguishers.

Should an applicant wish to propose, even before the end of 2014, any alternative agent for hand fire extinguishers meeting the mentioned MPS, the EASA will initiate a Certification Review Item addressing the use of such an alternate fire-extinguishing agent.

4 Fire protection of propulsion systems and APU

Historically, Halon 1301 has been the most widespread agent used in engine nacelles and APU installations to protect against Class B fires. The MPS for agents to be used in these compartments are particularly demanding because of the presence of fuel and other volatile fluids in close proximity to high temperature surfaces, not to mention the complex air flows and the extremely low temperatures and pressures surrounding the nacelles. Various alternatives are being developed (e.g. FK-5-1-12). The FAA has issued “Minimum Performance Standards (MPS) for Halon replacement in fire-extinguishing agents/systems of civil aircraft engine and APU compartments (MPSHRe rev03)” and intends to issue rev04.

Should an applicant wish to propose, even before the end of 2014, any alternative agent for Class B fire extinction in engine or APU compartments, even in the absence of a published MPS, the EASA will initiate a Certification Review Item addressing the use of such an alternate fire-extinguishing agent.

5 Fire protection of cargo compartments — Gaseous agents

MPS for cargo compartment fire suppression systems have already been published in the Report DOT/FAA/AR-00/28 of September 2000. However, to date there are no known and sufficiently developed alternatives to Halon 1301.

Should the EASA be approached with the intent to utilise for the product an alternate agent or alternate gaseous fire-extinguishing system in lieu of a **Halon 1301** system, then the recommended approach would be to perform testing on the product which meets the Minimum Performance Standards for that application as developed by the International Halon Replacement Working Group. The International Halon Replacement Working Group was established in October 1993. This group was tasked to work towards the development of minimum performance standards and test methodologies for non-Halon aircraft fire suppression agents/systems in cargo compartments, engine nacelles, handheld extinguishers, and lavatory waste receptacles. The International Halon Replacement Working Group has been expanded to include all system fire protection R&D for aircraft and now carries the name 'International Aircraft Systems Fire Protection Working Group'.

To ensure acceptable means of compliance, the following must be provided:

a. The test data and gaseous agent distribution profiles which meet the certification criteria as expressed below and in the Minimum Performance Standards as developed by the FAA Technical Center as part of the International Halon Replacement programme. (See paragraph 7 for the listing of the references.)

b. A system description document that includes a description of the distribution of the gaseous agent under test conditions in the cargo compartment.

c. A detailed test plan.

d. Chemical data which describes the agent and any toxicity data.

5.1 Pre-test considerations:

a. An EASA accepted analyser (for example, Statham-derivative analyser) capable of measuring the agent distribution profile in the form of volumetric concentration is required.

b. An EASA accepted analyser (for example, Statham-derivative analyser) and associated hardware are configured for the particular application.

c. The fire suppression system should be completely conformed prior to the test.

d. The fire extinguisher bottle(s) should be serviced and prepared for the prescribed test(s).

5.2 Test procedures:

a. Perform the prescribed distribution test in accordance with the test plan approved by the Agency. (See Paragraph 7 in AMC 25.851(b) for guidance on probe placement.)

b. An EASA accepted analyser (for example, Statham-derivative analyser) should record the distribution profile as volumetric concentration for the agent.

5.3 Test result evaluation:

a. Produce the data from the EASA accepted analyser (for example, Statham-derivative analyser) in graphical format. This format should be the volumetric concentration of the agent versus time. A specific percentage of volumetric initial concentration and a specific percentage of volumetric metered concentration for the length of the test duration as determined by previous testing conducted per the established Minimum Performance

Standards are required for airworthiness approval of cargo compartment systems.

b. Using the appropriate MPS evaluation criteria, evaluate the distribution profile of the agent for acceptable performance. The acceptability of the test data would be dependent upon the distribution profile and duration exhibited by each probe per (1) above and Paragraph 7 for cargo compartment fire-extinguishing systems.

6. EVALUATION OF ALTERNATE LIQUID AGENT AND FIRE EXTINGUISHING/SUPPRESSION SYSTEMS

The FAA Technical Center has released a Technical Note (ref. f in paragraph 7 below) that represents the latest Minimum Performance Standards (MPS) for a water spray system. However, as mentioned within the body of the report, additional developmental testing would be needed for the product and the FAA to be approached regarding certification of such a system. Additional testing would be required to demonstrate compliance with an aerosol spray. The Technical Center continues to perform research towards identifying alternate liquid and other fire-extinguishing/suppression systems. Acceptable means of compliance for these immature systems are beyond the scope of this AMC. Future revisions of this AMC will be accomplished as soon as suitable standards are developed for these systems.

If it is proposed to use a liquid fire-extinguishing agent or system for the product, the EASA should be contacted. The EASA will initiate a Certification Review Item addressing the use of an alternate fire-extinguishing agent or system.

7. REFERENCES

a. Report No FAA-RD-71-68, Fire Extinguishing Methods for New Passenger Cargo Aircraft, dated November 1971.

b. UK Civil Aviation Authority (CAA) Paper 91003, Cargo Bay Fire Suppression, dated March 1991.

c. Report No DOT/FAA/AR-96/5, Evaluation of Large Class B Cargo Compartment’s Fire Protection, dated June 1996.

d. Report No DOT/FAA/AR-96/122, Development of a Minimum Performance Standard for Lavatory Trash Receptacle Automatic Fire Extinguishers, dated February 1997.

e. Report No DOT/FAA/AR-00-28, Development of a Minimum Performance Standard for Aircraft Cargo Compartment Gaseous Fire Suppression Systems, dated September 2000.

f. Report No DOT/FAA/AR-TN01/1, Water Spray as a Fire Suppression Agent for Aircraft Cargo Compartment Fires, dated March 2001.

g. Report No DOT/FAA/AR-01/37, Development of a Minimum Performance Standard for Hand-Held Fire Extinguishers as a Replacement for Halon 1211 on Civilian Transport Category Aircraft, dated August 2002.

h. 2010 Report of the UN Halons Technical Options Committee – 2010 Assessment

i. FAA Advisory Circular AC 20-42C, Hand Fire Extinguishers for use in Aircraft, dated 07 March 1984.

j. FAA Advisory Circular AC 20-42D, Hand Fire Extinguishers for use in Aircraft, dated 14 January 2011.

Amend AMC to CS 25.855 and 25.857 as follows:

AMC to CS 25.855 and 25.857 Cargo or baggage compartments

1. PURPOSE

…

2. RELATED DOCUMENTS

a. Certification Specifications

…

b. FAA Advisory Circulars (AC)

The following FAA Advisory Circulars are accepted by the Agency as providing acceptable means of compliance with CS 25.857:

AC 25-17, …

AC 20-42~~C~~D, Hand Fire Extinguishers for use in Aircraft

…

3 BACKGROUND

…

4. COMPARTMENT CLASSIFICATION

…

5. FIRE PROTECTION FEATURES

…

b. Access

(1) Class B. Class B compartments must provide sufficient accessibility …

(2) Class F. In the case of a Class F compartment, a means should be provided to control or extinguish a fire without a crew member entering the compartment.

… For **Halon 1301** fire-extinguishing agent, a minimum five percent concentration by volume at all points in the compartment is considered adequate for initial knock-down of a fire, and a three percent concentration by volume at all points in the compartment is considered the minimum for controlling a fire after it is knocked down. This option requires the use of a liner as stated in CS 25.855 (b).

…

c. Extinguishing agent

In order to effectively extinguish or control a fire in a Class B or F cargo or baggage compartment, sufficient fire-extinguishing agent must be allocated. Guidance on this topic ~~has been~~ is contained in the FAA AC 20-42~~C~~D. This guidance material is accepted by the Agency as addressing how to implement the provisions of CS 25.851(a) that require that at least one hand fire extinguisher be located in the pilot compartment, at least one readily accessible hand fire extinguisher be available for use in each Class A or Class B cargo/baggage compartment and in each accessible Class E or Class F cargo/baggage compartment, and one or more hand fire extinguishers be located in the passenger compartment for aeroplanes with a passenger seating capacity of 7 or more.

d. Fire control
…

6 PROCEDURES AND LIMITATIONS
…

7. AFM CONSIDERATIONS
…

AMC – SUBPART E

Amend AMC 25.1195(b) as follows:

AMC 25.1195(b) Fire Extinguisher Systems

Acceptable methods to establish the adequacy of the fire extinguisher system are laid down in Advisory Circular 20-100, with reference to Halon concentration levels. This AC is not applicable to extinguishing agents alternative to Halon.

Create a new AMC 25.1197 as follows:

AMC 25.1197 Fire-Extinguishing Agents

Halon 1301 is no longer an acceptable extinguishing agent, based on EU Law[6], for engine nacelle and APU fire extinction systems to be installed in aircraft types, for which type certification is requested after 31 December 2014. (See AMC 25.851(c) for more information on Halon alternatives.)

AMC – SUBPART F

Create a new AMC 25.1305(a)(2) as follows:

AMC 25.1305(a)(2)

Fuel indication system(s)

0. Related references

AMC 25-11 Electronic Flight Deck Displays

1. Purpose

This AMC provides guidance and means of compliance for demonstrating compliance with CS 25.1305(a)(2) when designing a fuel indication system(s).

2. General objective

a. The primary function of fuel indication system(s) is indicating the usable fuel quantity on board an aircraft. Additionally, the fuel indication system(s) provide(s) any alert and information to the flight crew to assist them in the task of managing the fuel quantity on board.

[6] Commission Regulation (EU) No 744/2010 of 18 August 2010 amending Regulation (EC) No 1005/2009 of the European Parliament and of the Council on substances that deplete the ozone layer, with regard to the critical uses of halon (OJ L 218, 19.8.2010, p. 2).

b. Service experience indicates that scenarios leading to impending fuel starvation of one or more engines have developed into an unsafe system operating condition. Therefore, such scenarios have to be identified and, as required per CS 25.1309(c), appropriate information should be provided to the flight crew to enable them to take corrective action.

This information, including alerts, is provided in a timely manner so that any unsafe fuel starvation situation can be avoided.

c. The fuel indication system(s) alerts as a minimum inform the flight crew of:

- any abnormal fuel transfer;
- a trapped fuel situation;
- the existence of a fuel leak;
- a low fuel level situation.

For each alert, corrective actions are made available to the flight crew. This should include for instance:

- procedure(s) to identify and isolate the fuel leak;
- procedure(s) to correct the abnormal fuel transfer and/or to manage the trapped fuel situation;
- diversion procedure or the instruction to land as soon as possible;
- any required procedure to avoid additional hazard (for instance: fuel coming into contact with wheel brakes during landing when a fuel leak is not isolated; exceeding centre of gravity or fuel imbalance limits).

3. Usable fuel quantity

a. The total usable fuel quantity is considered essential information. Operational regulations require the flight crew to regularly check the remaining total usable fuel quantity. This quantity is then evaluated when comparing the actual quantity of fuel used to the planned fuel consumption, and to ensure that sufficient fuel is available to complete the flight with the required fuel reserve. The total usable fuel quantity is therefore displayed full-time and it is easily and directly readable by the flight crew.

b. As required per CS 25.1337(b), there is a means to indicate to the flight crew the usable fuel quantity in each fuel tank. It is considered acceptable that these individual tank quantities be only displayed when required. This may be displayed either at pilot discretion (on demand) or automatically as determined to support operational procedures associated with fuel system alerts.

4. Abnormal fuel transfer between tanks

The fuel indication system(s) provide(s) any alert and information enabling identification of abnormal fuel transfer between tanks.

Abnormal fuel transfer between tanks is a fuel transfer that - if no corrective action is taken - can lead to no fuel becoming available to an engine and/or fuel imbalance. This may result either from a fuel management system failure or from inappropriate flight crew action.

5. Trapped fuel

The fuel indication system(s) provide(s) any alert and information enabling identification of trapped fuel situations.

Trapped fuel means any fuel quantity (above the unusable fuel quantity) gauged by the FQIS that cannot be supplied to the engine.

For instance, failure of an isolation valve in an auxiliary tank, failure of a transfer pump, fuel pipe failure inside a tank could result in trapped fuel. Also, inappropriate selection of fuel system configuration by the flight crew has to be considered.

6. Fuel leaks

The fuel indication system(s) provide(s), as early as practical, any alert and information enabling the crew to identify a fuel leak.

Fuel leaks can be caused by a loss of integrity of the fuel system (for instance, fuel pipes failures, leakage of connections) and result in fuel being drained overboard the aircraft.

The fuel leaks analysis will identify all foreseeable leakage sources from the aircraft fuel tank(s) to the engine fuel nozzles. For the engines, it means that the effects of leaks upstream and downstream of the engine fuel flow meter have to be considered.

The leak detection may be performed by monitoring and comparing several sources of information (for instance fuel flows, fuel used computation, usable fuel quantities per tank(s) and total usable fuel on board before take-off).

7. Low fuel level alert

a. The fuel indication system(s) trigger(s) an alert in case of low fuel level. The low fuel level cockpit alert is applicable to any tank or collector cell that is not expected to be depleted in flight because otherwise this situation would lead to an engine fuel starvation. Fuel tanks that may normally be depleted during flight do not require a low fuel level alert.

b. The alert is triggered when the quantity of usable fuel in the tank concerned reaches the quantity required to operate an engine for 30 minutes with the aircraft operated in optimum cruise conditions. When defining the 30 minutes under optimum cruise conditions the applicant will consider the mission profile for which the aircraft is designed.

c. The safety analysis in accordance with CS 25.1309 (b) and (c) includes as a minimum the following failure scenarios:

- Erroneous high fuel quantity indication system (FQIS) readings;
- Loss of FQIS gauging information.

No single failure of the FQIS (including total loss of FQIS power supply) or total loss of the primary basic FQIS information will lead to the fuel low level alert not being correctly triggered.

Amend AMC to 25.1309 as follows:

AMC 25.1309
System Design and Analysis

…

3. RELATED DOCUMENTS

…

a. Advisory Circulars, Acceptable Means of Compliance

…

(3) AMC 20-115~~()~~ ~~Recognition of EUROCAE ED-12()/RTCA DO-178()~~ Software Considerations for Airborne Systems and Equipment Certification

b. Industry documents

(1) RTCA, Inc., Document No. DO-160 ~~D~~G /EUROCAE ED-14 ~~D~~G, Environmental Conditions and Test Procedures for Airborne Equipment.

~~(2) RTCA, Inc., Document No. DO-178()/EUROCAE ED-12(), Software Considerations in Airborne Systems and Equipment Certification, as recognized by AMC 20-115().~~

(~~3~~2) Society of Automotive Engineers (SAE) Aerospace Recommended Practice (ARP) 4754A/EUROCAE ED-79A, Guidelines for development of civil aircraft and systems.

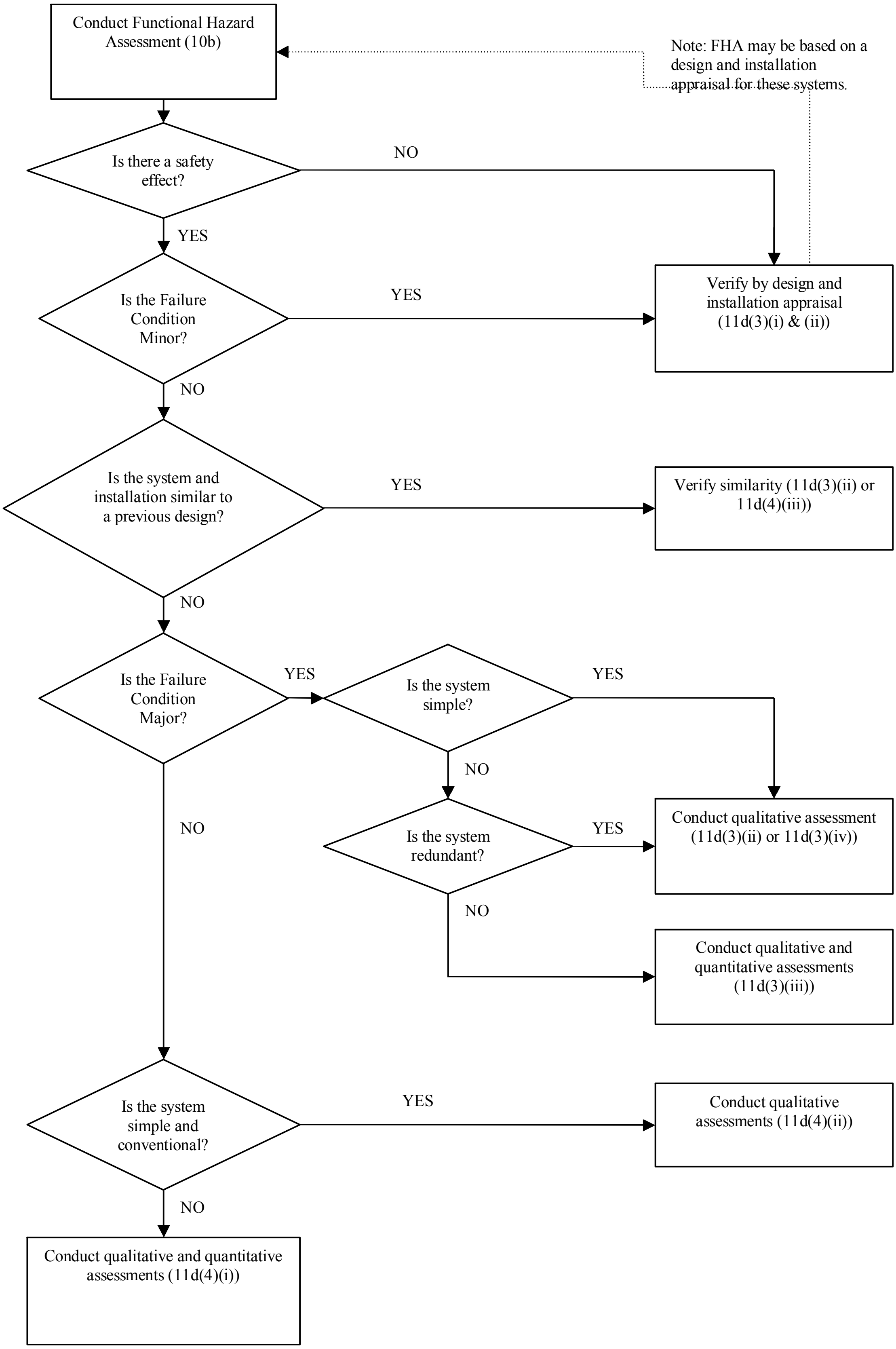
(~~4~~3) Society of Automotive Engineers (SAE) Aerospace Recommended Practice (ARP) 4761, Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment.

…

Replace the content of Figure A2-2 'Depth of Analysis Flowchart' that has been affected by conversion from Word to PDF. The following figure replaces Figure A2-2 'Depth of Analysis Flowchart' on page 2-F-62 of CS-25 Amendment 11:

…

Figure A2-2: Depth of Analysis Flowchart


Conduct Functional Hazard Assessment (10b)
Note: FHA may be based on a design and installation appraisal for these systems.
Is there a safety effect?
NO
YES
Is the Failure Condition Minor?
YES
Verify by design and installation appraisal (11d(3)(i) & (ii))
NO
Is the system and installation similar to a previous design?
YES
Verify similarity (11d(3)(ii) or 11d(4)(iii))
NO
Is the Failure Condition Major?
YES
Is the system simple?
YES
NO
Is the system redundant?
YES
Conduct qualitative assessment (11d(3)(ii) or 11d(3)(iv))
NO
Conduct qualitative and quantitative assessments (11d(3)(iii))
NO
Is the system simple and conventional?
YES
Conduct qualitative assessments (11d(4)(ii))
NO
Conduct qualitative and quantitative assessments (11d(4)(i))

Amend AMC to 25.1322, page 2-F-88 of CS-25 Amendment 11, as follows:

…

CS 25.1517~~(3)~~	Rough air speed, V_{RA}

Amend AMC to 25.1329 as follows:

AMC No. 1 to CS 25.1329
Flight Guidance System

…
3. Related advisory material
…

AMC 20-115~~B~~	~~Recognition of EUROCAE ED-12B / RTCA DO-178B~~ Software Considerations for Airborne Systems and Equipment Certification

…

4. Related documents
…

~~RTCA DO-178B/ EUROCAE ED-12B~~	~~Software Considerations in Airborne Systems and Equipment~~
RTCA DO-160 ~~D~~G / EUROCAE ED-14 ~~D~~G	Environmental Conditions and Test Procedures for Airborne Equipment

…

Amend AMC to 25.1435 as follows:

AMC 25.1435
Hydraulic Systems - Design, Test, Analysis and Certification

…
2.

(b)

(vi) The European Organisation for Civil Aviation Equipment Documents ED-14 ~~D~~G /RTCA DO-160 ~~D~~G, Environmental Conditions and Test Procedures for Airborne Equipment

3.

(a)

(5)
…
For further guidance on environmental testing, suitable references include, but are not limited to, Military Standard, MIL-STD-810 "Environmental Test Methods and Engineering Guidelines", The European Organisation for Civil Aviation Equipment Document ED-14 DG "Environmental Conditions and Test Procedures for Airborne Equipment" or International Organisation for Standardisation Document No. ISO 7137 "Environmental Conditions and Test Procedures for Airborne Equipment.
…

AMC – SUBPART G

Amend AMC 25.1581, Appendix 1 as follows:

AMC 25.1581, APPENDIX 1 COMPUTERISED AEROPLANE FLIGHT MANUAL

6. SOFTWARE INTEGRITY, DEVELOPMENT AND DOCUMENTATION REQUIREMENTS
…
b. *Software Development*. The integrity of the software components of the computerised AFM is achieved through the software development processes used.

(1) The applicant should propose the software development process in the plan for software aspects of certification. The application should document the methods, parameters and allowable range of conditions contained in the computerised AFM. The results obtained from the computerised AFM should be shown to meet all applicable CS-25 requirements. This compliance may be shown using substantiation documentation, demonstrations, or other means mutually agreed to by the Agency and the applicant. The software development process described in AMC 20-115() (~~Recognition of EUROCAE ED-12()/RTCA DO-178()~~Software Considerations for Airborne Systems and Equipment Certification) is valid, in general, for developing either airborne or ground based software. It represents one acceptable approach, but not the only acceptable approach, for developing software for the computerised AFM. Some of the specific guidance provided in AMC 20-115(), however, may not apply to the computerised AFM.
…

GENERAL
ACCEPTABLE MEANS OF COMPLIANCE – AMC

AMC 25-11
Electronic Flight Deck Displays
…

CHAPTER 4
SAFETY ASPECTS OF ELECTRONIC DISPLAY SYSTEMS
…

21. General

…

e. System Safety Guidelines

…

(9) For those systems that integrate windowing architecture into the display system, a means should be provided to control the information shown on the displays, such that the integrity of the display system as a whole will not be adversely impacted by anomalies in the functions being integrated. This means of controlling the display of information, called window manager in this AMC, should be developed to the software assurance level at least as high as the highest integrity function of any window. For example, a window manager should be level "A" if the information displayed in any window is level "A" (see ~~EUROCAE ED-12B~~ AMC 20-115 Software Considerations for Airborne Systems and Equipment Certification). SAE ARP 4754A/EUROCAE ED-79A, Guidelines for development of civil aircraft and systems, provides a recommended practice for system development assurance.

…

Appendix 1
Primary Flight Information

…

1.2 Continued Function of Primary Flight Information (Including Standby) in Conditions of Unusual Attitudes or in Rapid Manoeuvres

…

In showing compliance with the specifications of CS 25.1301(a~~d~~), CS 25.1309(a), CS 25.1309 (b), and CS 25.1309 (c), ~~and CS 25.1309 (d)~~…