PROPOSED

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: FUSELAGE DOORS AND HATCHES	**Date:** DRAFT, Feb. 2003	**AC No:** 25.783-1X
	Initiated By: ANM-100	**Change:**

1. PURPOSE. This Advisory Circular (AC) describes an acceptable means for showing compliance with the requirements of § 25.783, "Fuselage doors," and other applicable sections of Title 14, Code of Federal Regulations (CFR), part 25. Part 25 contains the airworthiness standards applicable to transport category airplanes. The means of compliance described in this document provides guidance to supplement the engineering and operational judgment that must form the basis of any compliance findings about the structural and functional safety standards for fuselage doors and their operating systems.

2. APPLICABILITY

a. The guidance provided in this document is directed to airplane and engine manufacturers, modifiers, foreign regulatory authorities, and Federal Aviation Administration transport airplane type certification engineers and their designees.

b. Like all advisory circular material, this AC is not, in itself, mandatory, and does not constitute a regulation. It describes an acceptable means, but not the only means, for showing compliance with the requirements for transport category airplanes. Terms such as "shall" and "must" are used only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described in this document is used. While these guidelines are not mandatory, they are derived from extensive Federal Aviation Administration and industry experience in determining compliance with the relevant regulations.

c. This advisory circular does not change, create any additional, authorize changes in, or permit deviations from, regulatory requirements.

3. CANCELLATION. Advisory Circular 25.783-1, "Fuselage Doors, Hatches, and Exits," dated 12/10/86, is canceled.

4. RELATED DOCUMENTS.

a. **Title 14, Code of Federal Regulations (14 CFR), Part 25:**

Section	Title
25.571	Damage-tolerance and fatigue evaluation of structure
25.607	Fasteners
25.703	Takeoff warning system
25.783	Fuselage doors
25.809	Emergency exit arrangement
25.813	Emergency exit access

b. **FAA Advisory Circulars (AC):**

AC Number	Title	Date
20-71	Dual Locking Devices on Fasteners	12/8/70
25-17	Transport airplane Cabin Interiors Crashworthiness Handbook	7/15/91

5. DEFINITIONS. Inconsistent or inaccurate use of terms may lead to installing doors and hatches that do not fully meet the safety objectives of the regulations. To ensure that such installations fully comply with the regulations, the following definitions should be used when showing compliance with § 25.783:

a. **Door** includes all doors, hatches, openable windows, access panels, covers, etc., on the exterior of the fuselage that do not require the use of tools to open or close. This also includes each door or hatch through a pressure bulkhead, including any bulkhead that is specifically designed to function as a secondary bulkhead under the prescribed failure conditions of part 25 of the regulations.

b. **Initial opening movement** refers to that door movement, caused by operation of a handle or other door control mechanism, which is required to place the door in a position free of structure that would interfere with continued opening of the door.

c. **Inward** means having a directional component of movement that is inward with respect to the mean (pressure) plane of the body cutout.

d. **Closed** means the door has been placed within the doorframe in such a position that the latches can be operated to the "latched" condition.

e. **Fully closed** means the door is placed within the doorframe in the position it will occupy when the latches are in the latched condition.

e. **Latches** are movable mechanical elements that, when engaged, prevent the door from opening.

f. **Latched** means the latches are fully engaged with their structural counterparts and held in position by the latch operating mechanism.

g. **Latching mechanism** means the latch operating mechanism and the latches.

h. **Locks** are mechanical elements, in addition to the latch operating mechanism, that monitor the latch positions and, when engaged, prevent latches from becoming disengaged.

i. **Locked** means the locks are fully engaged.

j. **Locking system** means the lock operating system and the locks.

k. **Stops** are fixed structural elements on the door and doorframe that, when in contact, limit the directions in which the door is free to move.

l. **Exit** is a door designed to allow egress from the airplane.

m. **Emergency exit** is an exit designated for use in an emergency evacuation.

n. **Flight** refers to that period of time from the start of takeoff roll until the airplane comes to rest after landing.

o. **Door operator's station** is the location(s) where the door closing, latching, and locking operations are performed.

p. **Inadvertent action by persons** means an act committed without forethought, consideration, or consultation.

6. BACKGROUND.

a. There is a history of incidents and accidents in which doors, fitted in pressurized airplanes, have opened inadvertently during pressurized and unpressurized flight. Some of these inadvertent openings have resulted in fatal accidents. After one fatal accident that occurred in 1974, the FAA and industry representatives formed a design review team to examine the existing regulatory requirements for doors to determine if those regulations were adequate to ensure safety. The team's review and eventual recommendations led to the FAA issuing Amendment 25-54 to 14 CFR part 25 in 1980, which significantly improved the safety standards for doors installed on transport category airplanes. Included as part of Amendment 25-54 was § 25.783, "Doors," which provides the airworthiness standards for doors installed on transport category airplanes.

b. Although there have been minor revisions to § 25.783 following the issuance of Amendment 25-54, the safety standards for doors have remained essentially the same since 1980. Despite these improved standards, there have continued to be safety problems, especially for cargo doors. Cargo doors are often operated by people having little formal instruction in their operation. Sometimes the operator is required to carry out several actions in sequence to complete the door opening and closing operations. Failure to complete all actions in sequence during closure can have serious results. Service history shows that several incidents of doors opening during flight have been caused by the failure of the operator to complete the door closing, latching, and locking sequence. Other incidents have been attributable to incorrect adjustment of the door mechanism, or to failure of a vital part.

c. Experience also has shown that, in some cases, the flight deck indication system has not been reliable. In other instances, the door indication system indicated correctly, but the flightcrew, for unknown reasons, was not alerted to the unsafe condition. A reliable indication of door status on the flight deck is particularly important on airplanes used in operations where the flightcrew does not have an independent means readily available to verify that the doors are properly secured.

d. On some airplanes, large cargo doors form part of the basic fuselage structure, so that, unless the door is properly closed, latched, and locked, the basic airframe structure is unable to carry the design aerodynamic and inertial loads. Large cargo doors also have the potential for creating control problems when an open door acts as an aerodynamic surface. In such cases, failure to secure the door properly could have catastrophic results, even when the airplane is unpressurized.

e. After two accidents occurred in 1989 due to the failure of cargo doors on transport category airplanes, the Air Transport Association (ATA) of America initiated another study of the door design and operational issues. The ATA finished its study in 1991 and made recommendations to the FAA for improving the design standards of doors. The FAA considered those recommendations, as well as other recommendations from the National Transportation Safety Board, in developing the improved standards for doors adopted by Amendment 25-XXX.

7. CURRENT REQUIREMENTS - GENERAL.

a. Service history has shown that, to prevent doors from becoming a hazard by opening during flight, it is necessary to provide multiple layers of protection against failures, malfunctions, and human error. Section 25.783 addresses these multiple layers of protection by requiring:

- a latching system,
- a locking system,

- indication systems, and
- a pressure prevention means.

b. These features provide a high degree of tolerance to failures, malfunctions, and human error. Section 25.783 requires the latching system to be designed so that it is inherently or specifically restrained from being back-driven from the latches. Even so, the latches are designed to eliminate, as much as possible, all forces from the latch side that would tend to unlatch the latches. In addition to these features that prevent the latches from inadvertently opening, a separate locking system is required for doors that could be a hazard if they become unlatched. Despite these safety features, it could still be possible for the door operator to make errors in closing the door, or for mechanical failures to occur during or after closing. Therefore, an indicating system is required that will signal to the flightcrew if the door is not fully closed, latched, and locked. However, since it is still possible for the indication to be missed or unheeded, a separate system is required that prevents pressurization of the airplane to an unsafe level if the door is not fully closed, latched, and locked.

c. The material presented in paragraphs 8. through 15. of this AC restates the requirements of § 25.783 in italicized text and, immediately following, provides a discussion of acceptable compliance criteria.

8. GENERAL DESIGN CONSIDERATIONS.

a. ***Each door must have means to safeguard against opening in flight as a result of mechanical failure, or failure of each single structural element.***

(1) The applicant should consider failures when safeguarding the door against opening due to mechanical failure or the failure of a single structural element.

(2) Such failures include those caused by:

- wear;
- excessive backlash;
- excessive friction;
- jamming;
- incorrect assembly;
- incorrect adjustment;
- parts becoming loose, disconnected, or unfastened; and
- parts breaking, fracturing, bending, or flexing beyond the extent intended.

b. ***Each door that could be a hazard if it unlatches must be designed so that opening during pressurized and unpressurized flight from the fully closed, latched, and locked condition is extremely improbable. This must be shown by safety analysis.***

(1) All doors should incorporate features in the latching mechanism that provide a positive means to prevent the door from opening as a result of such things as:

- vibrations,
- structural loads and deflections,
- positive and negative pressure loads, positive and negative "g" loads, and
- aerodynamic loads.

(2) The means should be effective throughout the approved operating envelope of the airplane, including the unpressurized portions of flight.

(3) The applicant may conduct the safety assessment required by this regulation by qualitative or quantitative analysis, or a combination, as appropriate to the design. In evaluating a failure condition that results in total failure or inadvertent opening of the door, the applicant should consider all contributing events, including:

- failure of the door and door supporting structure,
- flexibility in structures and linkages,
- failure of the operating system,
- erroneous signals from the door indication systems, and
- likely errors in operating and maintaining the door.

c. ***Each element of each door operating system must be designed or, where impracticable, distinctly and permanently marked, to minimize the probability of incorrect assembly and adjustment that could result in a malfunction.***

(1) Experience has shown that the level of protection against mechanical failure can be significantly improved by careful attention to detail design. Therefore, the applicant should take the following points into account:

(a) To minimize the risk of incorrect assembly and adjustment, parts should be designed to prevent incorrect assembly if, as a result of such incorrect assembly, door functioning would be adversely affected. "Adverse effects" could be such things as preventing or impeding the opening of the door during an emergency, or reducing the capability of the door to remain closed. If such designs are impracticable and marking is used instead, the marking should remain clearly identifiable during service. In this respect, markings could be made using material such as permanent ink, provided it is resistant to typical solvents, lubricants, and other materials used in normal maintenance operations.

(b) To minimize the risk of the door operating mechanism being incorrectly adjusted in service, adjustment points that are intended for "in-service" use only should be clearly identified, and limited to a minimum number consistent with adequate adjustment capability. Any points provided solely to facilitate adjustment at the initial build and not intended for subsequent use, should be made non-adjustable after initial build, or should be highlighted in the maintenance manual as a part of the door mechanism that is not intended to be adjusted.

d. ***All sources of power that could initiate unlocking or unlatching of each door must be automatically isolated from the latching and locking systems prior to flight and it must not be possible to restore power to the door during flight.***

(1) For doors that use electrical, hydraulic, or pneumatic power to initiate unlocking or unlatching, those power sources must be automatically isolated from the latching and locking systems before flight. Additionally, it should not be possible to restore power to them during flight.

(2) It is particularly important for doors with powered latches or locks to have all power removed that could power these systems or that could energize control circuits to these systems in the event of electrical short circuits. This does not include power to the door indicating system, auxiliary securing devices (if installed), or other systems not related to door operation. Power to those systems should not be sufficient to cause unlocking or unlatching unless each failure condition that could result in energizing the latching and locking systems is extremely improbable.

e. ***Each removable bolt, screw, nut, pin, or other removable fastener must meet the locking requirements of § 25.607*** ["Fasteners"]. (Refer to FAA Advisory Circular 20-71, "Dual Locking Devices on Fasteners," dated 12/8/70, for guidance on complying with § 25.607.)

f. ***Certain doors, as specified by § 25.807(h), must also meet the applicable requirements of §§ 25.809 through 25.812 for emergency exits.***

9. OPENING BY PERSONS.

a. ***There must be a means to safeguard each door against opening during flight due to inadvertent action by persons.***

(1) The door should have inherent design features that achieve this objective. It is not considered acceptable to rely solely on cabin pressure to prevent inadvertent opening of doors during flight, because there have been instances where doors have opened during unpressurized flight, such as during landing.

(2) Therefore, all doors should incorporate features to prevent the door from being opened inadvertently by people on board the airplane.

b. ***In addition, design precautions must be taken to minimize the possibility for a person to open a door intentionally during flight. If these precautions include the use of auxiliary devices, those devices and their controlling systems must be designed so that:***

- ***no single failure will prevent more than one exit from being opened, and***
- ***failures that would prevent opening of the exit after landing are improbable.***

(1) The intentional opening of a door by people on board while the airplane is in flight should be considered. This rule is intended to protect the aircraft and passengers, but not necessarily the person who intentionally tries to open the door. Suitable design precautions should therefore be taken; however, the precautions should not compromise the ability to open an emergency exit in an emergency evacuation.

(2) The applicant should consider the following precautions:

(a) For doors in pressurized compartments: It should not normally be possible to open the door when the compartment differential pressure is above 2 psi. The ability to open the door will depend on the door operating mechanism and the handle design, location, and operating force. Operating forces in excess of 300 pounds should be considered sufficient to prevent the door from being opened. During approach, takeoff, and landing, when compartment differential pressure is lower, intentional opening may be possible; however, these phases are brief and all passengers are expected to be seated with seat belts fastened.

(b) For doors that cannot meet the guidance of paragraph 9.b.(2)(a), above, and for doors in non-pressurized airplanes: The use of auxiliary devices (for example, a speed-activated or barometrically-activated means) to safeguard the door from opening should be considered. The need for such auxiliary devices should depend upon the consequences to the airplane and other occupants if the door is opened in flight.

(c) If auxiliary devices are installed on emergency exits: The failure of an auxiliary device should normally result in an unsecured position of the device. Failures of the device that would prevent opening of the exit after landing should be improbable.

10. PRESSURIZATION PREVENTION MEANS.

a. ***There must be a provision to prevent pressurization of the airplane to an unsafe level if any door subject to pressurization is not fully closed, latched, and locked. The provision must be designed to function after any single failure, or after any combination of failures not shown to be extremely improbable.***

(1) The provisions for preventing pressurization must monitor the closed, latched, and locked condition of the door. If more than one lock system is used, each lock system must be monitored. Examples of such provisions are vent panels and pressurization inhibiting circuits. Pressurization to an unsafe level is considered to be prevented when the compartment differential pressure is kept below 1/2 psi. These systems are not intended to function to depressurize the airplane once the fully closed, latched, and locked condition is established and pressurization is initiated.

(2) If a vent panel is used, it should be designed so that, in normal operation or with a single failure in the operating linkage, the vent panel cannot be closed until the door is latched and locked. The vent panel linkage should monitor the position of each door lock.

(3) If automatic control of the cabin pressurization system is used as a means to prevent pressurization, the control system should monitor each lock. Because inadvertent depressurization at altitude can be hazardous to the occupants, this control system should be considered in showing compliance with the applicable pressurization system reliability requirements. Normally, such systems should be automatically disconnected from the airplane's pressurization system after the airplane is airborne, provided no prior unsafe condition was detected.

(4) It should not be possible to override the pressurization prevention system unless a procedure is defined in the Master Minimum Equipment List (MMEL) that confirms a fully closed, latched, and locked condition. In order to prevent the override procedure from becoming routine, the override condition should not be achievable by actions solely on the flight deck, and should be automatically reset at each door operational cycle.

b. ***Doors that meet the conditions described in § 25.783(h) are not required to have a dedicated pressurization prevention means if, from every possible position of the door, it will remain open to the extent that it prevents pressurization or safely close and latch as pressurization takes place. This must also be shown with each single failure and malfunction, except that:***

- ***with failures or malfunctions in the latching mechanism, it need not latch after closing, and***
- ***with jamming as a result of mechanical failure or blocking debris, the door need not close and latch if it can be shown that the pressurization loads on the jammed door or mechanism would not result in an unsafe condition.***

(1) As specified in § 25.783(d)(7), each door for which unlatching would not result in a hazard is not required to have a locking mechanism. Those doors also may not be required to have a dedicated pressurization prevention means.

(2) However, this should be determined by demonstrating that an unsafe level of pressurization cannot be achieved for each position that the door may take during closure, including those positions that may result from single failures or jams.

(a) Excluding jamming and excluding failures and malfunctions in the latching system, for every possible position of the door, it must either remain open to the extent that it prevents pressurization, or safely close and latch as pressurization takes place.

(b) With single failures of the latching system or malfunctions in the latching system the door may not necessarily be capable of latching, but it should either remain open to the extent that it prevents pressurization, or safely move to the closed position as pressurization takes place. And

(c) With jamming as a result of mechanical failure in the latching system or blocking debris, the pressurization loads on the jammed door or mechanism may not result in damage to the door or airframe that could be detrimental to safe flight (both the immediate flight or future flights). In this regard, consideration should be given to jams or non-frangible debris that could hold the door open just enough to still allow pressurization, and then break loose in flight after full pressurization is reached.

11. LATCHING AND LOCKING

a. ***There must be a provision to latch each door.***

(1) The definitions of latches and locks are redefined as of Amendment 25-xxx, particularly with regard to mechanical and structural elements of inward-opening plug doors. In this regard, fixed stops are not considered latches. The movable elements that hold the door in position relative to the fixed stops are considered latches. These movable elements prevent the door from opening and will support some loads in certain flight conditions, particularly when the airplane is unpressurized.

(2) For all doors, § 25.783(d)(2) requires that the latching system employ a securing means other than the locking system. The separate locking system may not be necessary for certain inward-opening plug doors [see § 25.783(d)(7)].

b. ***The latches and their operating mechanism must be designed so that, under all airplane flight and ground loading conditions, with the door latched, there is no force or torque tending to unlatch the latches. In addition, the latching system must include a means to secure the latches in the latched position. This means must be independent of the locking system.***

(1) The latches of doors for which the initial opening movement is outward are typically subject to vibrations; structural loads and deflections; positive and negative pressure loads; positive and negative "g" loads; aerodynamic loads; etc. The latches of

doors for which the initial opening movement is inward typically share some of these same types of loads with fixed stops.

(2) The design of the latch should be such that, with the latch disconnected from its operating mechanism, the net reaction forces on the latch should not tend to unlatch the latch during both pressurized and unpressurized flight throughout the approved flight envelope. The effects of possible friction in resisting the forces on the latch should be ignored when considering reaction forces tending to unlatch the door. The effects of distortion of the latch and corresponding structural attachments should be taken into account in this determination. Any latch element for which "g" loads could result in an unlatching force should be designed to minimize such forces.

(3) Even though the principal back-driving forces should be eliminated by design, it is recognized that there may still be ratcheting forces that could progressively move the latches to the unlatched position. Therefore, each latch should be positively secured in the latched position by its operating mechanism, which should be effective throughout the approved flight envelope. The location of the operating system securing means will depend on the rigidity of the system and the tendency for any forces (such as ratcheting) at one latch to unlatch other latches.

(4) Overcenter features in the latching mechanism are considered to be an acceptable securing means, provided that an effective retaining feature that functions automatically to prevent back-driving is incorporated. If the design of the latch is such that it could be subject to ratcheting loads that might tend to unlatch it, the securing means should be adequate to resist such loads.

(5) In those designs that use the latch to operate an electrical switch, any back-driving effect of the switch on the latch is permissible, provided that the extent of any possible movement of the switch:

- is insufficient to unlatch it, and
- will not result in the latch being subjected to any other force or torque tending to unlatch it.

(6) The latch securing means must be independent of the locking means. However, the latching and locking functions may be fulfilled by a single operating means, provided that it is not possible to back-drive the locks via the latch mechanism when the door is locked.

c. ***Each door subject to pressurization, and for which the initial opening movement is not inward, must:***

- ***have an individual lock for each latch,***
- ***have the lock located as close as practicable to the latch, and***

- ***be designed so that, during pressurized flight, no single failure in the locking system would prevent the locks from restraining the latches as necessary to secure the door.***

(1) To safeguard doors subject to pressurization and for which the initial opening movement is not inward, each latch must have an individual lock. The lock should directly lock the latch. In this regard, the lock should be located directly at the latch to ensure that, in the event of a single failure in the latch operating mechanism, the lock would continue to restrain the latch in the latched position. Even in those cases where the lock cannot be located directly at the latch, the same objective should be achieved. In some cases, a pair of integrally-connected latches may be treated as a single latch with respect to the requirement for a lock, provided that:

(a) the lock reliably monitors the position of at least one of the load-carrying elements of the latch; and

(b) with any one latch element missing, the airplane can meet the full requirements of part 25 as they apply to the unfailed airplane; and

(c) with the pair disengaged, the airplane can achieve safe flight and landing, and meet the damage tolerance requirements of § 25.571 ("Damage-tolerance and fatigue evaluation of structure").

(2) In some designs, more latches are provided than necessary to meet the minimum design requirements. The single failure requirement for the locking system is intended to ensure that the number and combination of latches necessary to secure the door will remain restrained by the locking mechanism. Only those latches needed to meet the minimum design requirements need to remain restrained after the single failure.

(3) In meeting this requirement, the indirect locking provided through the latch system by the locks at other latches may be considered. In this case, the locking system and the latching system between the locked latch and the unlocked latch should be designed to withstand the maximum design loads discussed below in paragraph 11.g. of this AC, below, as appropriate to pressurized flight.

d. ***Each door for which the initial opening movement is inward, and unlatching of the door could result in a hazard, must have a locking means to prevent the latches from becoming disengaged. The locking means must ensure sufficient latching to prevent opening of the door even with a single failure of the latching mechanism.***

(1) On these doors, the locking means should monitor the latch securing means, but need not directly monitor and lock each latch. Additionally, the locking means could be located such that all latches are locked by locking the latching mechanism.

(2) With any single failure in the latching mechanism, the means must still lock a sufficient number of latches to ensure that the door remains safely latched.

e. ***Each door for which unlatching would not result in a hazard is not required to have a locking mechanism.*** (See paragraph 15. of this AC, below, for a description of the kinds of doors for which unlatching is considered not to result in a safety hazard.)

f. ***It must not be possible to position the lock in the locked position if the latch and the latching mechanism are not in the latched position.***

(1) The lock should be an effective monitor of the position of the latch such that, if any latch is unlatched, the complete locking system cannot be moved to the locked position.

(2) Although an overcenter feature may be an adequate means of securing the latching mechanism, it is not considered to be the locking means for the latches.

g. ***It must not be possible to unlatch the latches with the locks in the locked position. Locks must be designed to withstand the limit loads resulting from --***

- ***the maximum operator effort when the latches are operated manually;***
- ***the powered latch actuators, if installed; and***
- ***the relative motion between the latch and the structural counterpart.***

(1) Although the locks are not the primary means of keeping the latches engaged, they must have sufficient strength to withstand any loads likely to be imposed during all approved modes of door operation.

(2) The operating handle loads on manually-operated doors should be based on a rational human factors evaluation. However, handle forces in excess of 300 pounds need not be considered.

(3) The loads imposed by the normal powered latch actuators are generally predictable; however, loads imposed by alternate drive systems are not. For this reason, the locks should have sufficient strength to react to the stall forces of the latch drive system.

(4) Load-limiting devices should be installed in any alternative drive system for the latches in order to protect the latches and the locks from overload conditions.

(5) If the design of the latch is such that it could be subject to ratcheting loads that might tend to unlatch it, the locks should be adequate to resist such loads with the latch operating system disconnected from the latch.

12. WARNING, CAUTION, AND ADVISORY INDICATIONS.

a. ***There must be a positive means to indicate at the operator's station for each door that all required operations to close, latch, and lock the door have been completed.***

(1) To minimize the probability of incomplete door operations, it should be possible to perform all operations for each door at one station. If there is more than one operator's station for a single door, appropriate indications should be provided at each station.

(2) The positive means to indicate at the door operator's station that all required operations have been completed are such things as final handle positions or indicating lights.

b. ***There must be a positive means clearly visible from the operator station for each door to indicate if the door is not fully closed, latched, and locked for each door that could be a hazard if unlatched.***

(1) A single indication that directly monitors the door in the closed, latched, and locked conditions should be provided, unless the door operator has a visual indication that the door is fully closed, latched, and locked. This indication should be obvious to the door operator.

(2) For example, a vent door or indicator light that monitors the door locks and is located at the door operator's station may be sufficient.

c. ***There must be a visual means on the flight deck to signal the pilots if any door is not fully closed, latched, and locked. The means must be designed such that any failure or combination of failures that would result in an erroneous closed, latched, and locked indication is improbable for —***

- ***each door that is subject to pressurization and for which the initial opening movement is not inward, or***
- ***each door that could be a hazard if unlatched.***

(1) The visual means may be a simple amber light or it may need to be a red warning light tied to the master warning system, depending on the criticality of the door.

(2) The door closed, latched, and locked functions must be monitored, but only one indicator is needed to signal that the door is in the closed, latched, and locked condition.

(3) Indications should be reliable to ensure that they remain credible. The probability of erroneous closed, latched, and locked indication must be at least 10^{-5}:

- for each door subject to pressurization and for which the initial opening movement is not inward; and

- for each door that could be a hazard if unlatched.

d. ***There must be an aural warning to the pilots prior to or during the initial portion of takeoff roll if any door is not fully closed, latched, and locked, and its opening would prevent safe takeoff and return to landing.***

(1) Where an unlatched door could open and prevent a safe takeoff and return to landing, a more conspicuous aural warning is needed in addition to the visual indication. It is intended that this system should function in a manner similar to the takeoff configuration warning systems required by § 25.703 ("Takeoff warning system"). The visual display for these doors may be either a red light or a display on the master warning system.

(2) Examples of doors requiring these aural warnings are:

- doors for which the structural integrity of the fuselage would be compromised if the door is not fully closed, latched, and locked; or

- doors that, if open, would prevent rotation or interfere with controllability to an unacceptable level.

13. VISUAL INSPECTION PROVISION.

a. ***Each door for which unlatching could be a hazard must have a provision for direct visual inspection to determine, without ambiguity, if the door is fully closed, latched, and locked. The provision must be permanent and discernible under operational lighting conditions, or by means of a flashlight or equivalent light source.***

(1) A provision is necessary for direct visual inspection of the closed position of the door and the status of each of the latches and locks, because dispatch of an airplane may be permitted in some circumstances when a flight deck or other remote indication of an unsafe door remains after all door closing, latching, and locking operations have been completed. Because the visual indication is used in these circumstances to determine whether to permit flight with a remote indication of an unsafe door, the visual indication should have a higher level of integrity than, and be independent of, the remote indication.

(2) The provisions should:

(a) allow direct viewing of the position of the locks to show, without ambiguity, whether or not each latch is latched and each lock is in the locked position. For doors that do not have a lock for each latch, direct viewing of the position of the latches may be necessary for determining that all the latches are latched. Indirect

viewing, such as by optical devices or indicator flags, may be acceptable, provided that there is no failure mode that could allow a false latched or locked indication.

(b) preclude false indication of the status of the latches and locks as a result of changes in the viewing angle. The status should be obvious without the need for any deductive processes by the person making the assessment.

(c) be of a robust design so that, following correct rigging, no unscheduled adjustment is required. Furthermore, the design should be resistant to unauthorized adjustment.

(d) preclude mis-assembly that could result in a false latched and locked indication.

(2) If markings are used to assist the identification of the status of the latches and locks, such markings must include permanent physical features to ensure that the markings will remain accurately positioned.

(3) Although the visual means should be unambiguous in itself, placards and instructions may be necessary to interpret the status of the latches and locks.

(4) If optical devices or windows are used to view the latches and locks, it should be demonstrated that they provide a clear view and are not subject to fogging, being obstructed from dislodged material, or giving a false indication of the position of each latch and lock. Such optical devices and window materials should be resistant to scratching, crazing, and any other damage from all materials and fluids commonly used in the operation and cleaning of airplanes.

14. CERTAIN MAINTENANCE DOORS, REMOVABLE EMERGENCY EXITS, AND ACCESS PANELS.

a. ***Some doors not normally opened except for maintenance purposes or emergency evacuation and some access panels need not comply with certain paragraphs of § 25.783 as follows:***

- ***Access panels that are not subject to cabin pressurization and would not be a hazard if open during flight need not comply with § 25.783(a) through (f), but must have a means to prevent inadvertent opening during flight.***
- ***Inward-opening removable emergency exits that are not normally removed, except for maintenance purposes or emergency evacuation, and flight deck-openable windows need not comply with § 25.783(c) and (f).***
- ***Maintenance doors that meet the conditions of § 25.783(h), and for which a placard is provided limiting use to maintenance access, need not comply with § 25.783(c) and (f).***

15. DOORS THAT ARE NOT A HAZARD.

a. Section 25.783 recognizes four categories of doors:

- Doors whose initial opening is not inward, and are presumed to be hazardous if they become unlatched.
- Doors whose initial opening is inward, and could be a hazard if they become unlatched.
- Doors whose initial opening is inward, and would not be a hazard if they become unlatched.
- Small access panels outside pressurized compartments whose opening is of little or no consequence to safety.

b. Section 25.783(h) describes those attributes that are essential before a door in the normal (unfailed) condition can be considered not to be a hazard during flight.

16. STRUCTURAL REQUIREMENTS.

a. The door structure, including its mechanical features (such as hinges, stops, and latches) that can be subjected to airframe loading conditions, must be designed either to the damage-tolerance requirements of § 25.571 (Amendment 25-45 or later), or to the earlier fail-safe requirements, depending on the certification basis of the airplane.

b. In assessing the extent of damage under § 25.571 and § 25.783, the applicant should give consideration to single element failures in the primary door structure, such as:

- frames,
- stringers,
- intercostals,
- latches,
- hinges,
- stops, and
- stop supports.

c. The skin panels on doors that must comply with § 25.571, Amendment 25-45 or later, should be designed to be damage-tolerant, with a high probability of detecting any crack before the crack causes door failure or cabin depressurization. The obvious partial failure criteria or the damage-tolerance criteria may be used for the design of skin panels on doors with an earlier certification basis.