U.S. Department
Of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: FLIGHTDECK INTRUSION RESISTANCE **Date:** 1/10/02 **Initiated by:** ANM-100 **AC No:** 25.795-1

1. PURPOSE. This advisory circular (AC) sets forth an acceptable means, but not the only means, of demonstrating compliance with the provisions of the airworthiness standards for transport category airplanes related to the airplane design for flightdeck (also referred to as the pilot compartment or cockpit) intrusion resistance. Intrusion resistance, in the context of this AC, refers to the ability to resist forced entry by a person who is not authorized by the pilot in command to enter the flightdeck. In addition, intrusion resistance includes the ability of the door to resist the introduction of a weapon into the flightdeck, even if the person cannot actually enter the flightdeck. Terms in this AC, such as "shall" or "must" are used only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described herein is used. While these guidelines are not mandatory, they are derived from Federal Aviation Administration (FAA) and industry experience in determining compliance with the pertinent regulations.

2. RELATED REGULATIONS. Sections 25.365, 25.771, 25.772, 25.777, 25.795, 25.809, and 25.853 of 14 CFR part 25, § 91.11 of 14 CFR part 91 and §§ 121.313 and 121.587 of 14 CFR part 121.

3. DEFINITIONS.

a. Bolt. A bar which, when actuated, is moved (or "thrown") either horizontally or vertically into a retaining member, such as a strike plate, to prevent a door from moving or opening.

b. Cylinder. The cylindrical subassembly of a lock, containing the cylinder core, tumbler mechanism and the keyway.

c. Door Assembly. For the purposes of this AC, a door assembly consists of the following parts: door (including any and all panels and mechanisms intended for decompression and/or egress purposes), hinges, locking or other devices, operation contacts (such as handles and knobs), miscellaneous hardware and closures, the frame (including the header and jamb structures plus the attachment to the surrounding airplane structure), and representative structure to which the frame attaches.

d. Jamb. The fixed vertical members of a doorframe to which the door is secured.

e. Jamb/Strike. The component of a door assembly that receives and secures the extended lock bolt. The strike and jamb, used together, are considered a single unit.

f. Jamb/Wall. The component of a door assembly to which a door is attached and secured by means of hinges. The hinges and jamb, used together, are considered a unit.

g. Latch (or Latch Bolt). A beveled, spring-actuated bolt.

h. Lock (or Lock Set). A keyed device (complete with cylinder, latch and/or an electrical, pneumatic or mechanical means of preventing normal operation, strike and trim such as knobs, levers, escutcheons, etc.) for securing a door in a closed position against forced entry.

i. Strike. A metal plate mounted to the doorjamb to receive and hold the latch bolt in order to secure the door to the jamb.

4. DISCUSSION.

a. Background.

(1) When a passenger(s) gains unauthorized entry to the flightdeck, the safety of the airplane and all aboard is at risk.

(2) The flightdeck door is subjected to several requirements that affect its construction. For example, §§ 121.313 and 121.587 require that there be a lockable door between the pilot and passenger compartments, and that the pilot-in-command must ensure that the door is closed and locked during flight.

(3) Section 25.772 also requires that the pilot compartment door have features that allow the crew to directly enter the passenger compartment from the flightdeck in the event that the door becomes jammed. If there are passenger exits in close proximity to the flightdeck, compliance with § 25.809 can be shown in which the flightdeck openable windows need not be openable from the outside. In this case, the door needs to facilitate entry by rescue personnel.

(4) In addition, many airplanes are designed to utilize the flightdeck door opening as a decompression pathway to demonstrate compliance with the requirements of § 25.365, and therefore the locks and/or other features may be designed to allow for extremely rapid opening times.

(5) Due to the fact that § 25.777 requires that the flight controls be designed for pilots from 5'-2" to 6'-3" in height, consideration must be given for these statures when considering compliance with the egress requirements of §§ 25.772 and 25.809.

(6) Considered a part of the airplane interior, the flightdeck doors must also meet the requirements of § 25.771 with regards to noise, light and odors and the flammability requirements of § 25.853.

(7) All of these requirements continue to apply and door assembly designs must consider their impacts.

b. Vulnerability. Due to considerations for the previously referenced regulations, the flightdeck door typically has been designed to prevent only unintentional and incidental entrance into the crew compartment and not that of a determined person. The loads required to overcome the locking mechanisms typically are much lower than what would be experienced through the action of kicking or ramming of the door assembly. Features of the door, such as hinges and locking mechanisms should not be easily overridden (e.g., insertion of a credit card or prying). The door knob is also susceptible to pulling force, and so should be designed to limit the ability of a person to exert high loads (e.g., by shape and the use of frangible features).

c. Tests.

(1) This AC applies to all types of flightdeck door designs (see Figure 1 for examples).

(2) The intent of the tests discussed in this AC is to demonstrate that a flightdeck door assembly will resist the unauthorized entrance of a person.

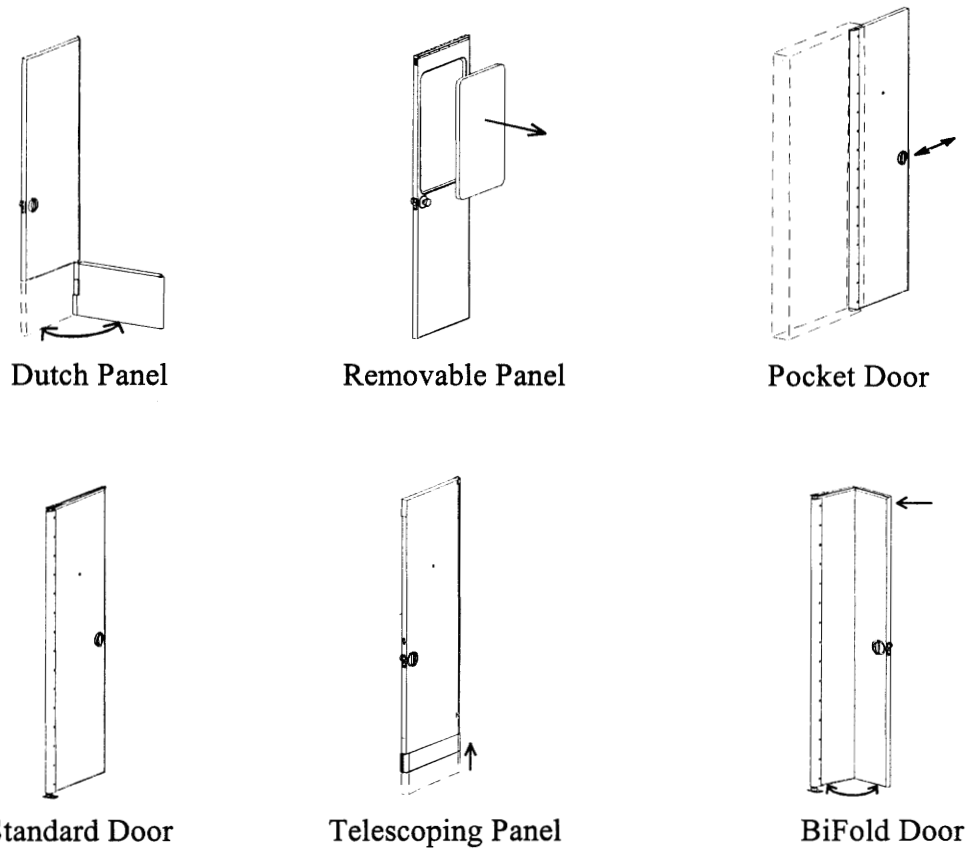


Figure1. Examples of Door Types and Features

(3) Although the door is intended to resist forced entry, it is recognized that the door is one element of several inflight security measures that work in conjunction with one another.

(4) Features of the door (such as telescoping panels, Dutch panels, removable panels, etc. (see Figure 1)) designed to comply with or to aid in the compliance with decompression or egress requirements, do not require testing per this AC if their failure would not appreciably degrade the intrusion resistance offered by the flightdeck door. If this cannot be shown, testing will be required.

(5) With respect to intrusion resistance, the size and location of a removable panel are the key factors in determining whether or not it affords intrusion resistance. Panels that are small and are located at the extreme bottom or top of the door are typically less vulnerable to intrusion. An example of a design feature that could also address ballistic protection is shown in Figure 2.

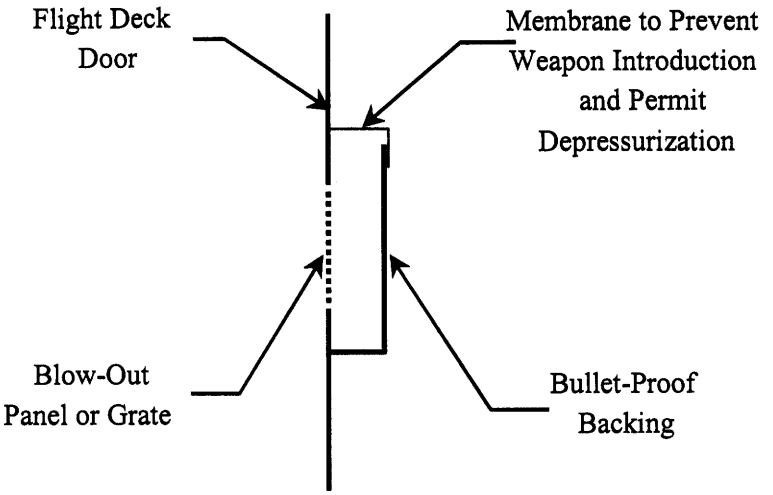


Figure 2. Example of a Protective Device for a Blow-Out Panel.

d. Standardized Test Procedures. The tests described are standardized procedures that are generally to be regarded as necessary to demonstrate compliance with the intrusion resistance requirement.

(1) National Institute of Law Enforcement and Criminal Justice (NILECJ) Standard 0306.00, released in May 1976, for the Physical Security of Door Assemblies and Components, was formulated by the Law Enforcement Standards Laboratory of the National Bureau of Standards under the sponsorship of the National Institute of Justice (NIJ), and was used as the basis for the development of this AC.

(2) The purpose of NILECJ-STD-0306.00 is to establish performance requirements and methods of test for the resistance of door assemblies and components to forced entry. The standard is primarily concerned with typical entry doors for residences and small businesses. However, while the standard does not address persons using skilled methods of entry, it does address the capability to frustrate determined persons from committing forced entry. To this end, portions of this standard and its test methods are applicable to this requirement.

(3) Portions of NILECJ-STD-0306.00 were excerpted for use regarding definitions, sampling, apparatus, procedures and test assembly. This standard contains

four levels of security. This AC uses the highest level identified in the standard as the basis for the tests described below but has significantly increased the demonstrated performance levels.

5. GENERAL TESTING CONSIDERATIONS. There are four basic types of testing that are relevant for the door, as noted in Table 1. These address resistance to impacts on the door, its locking bolt and hinge, and resistance to forcible opening by pulling on the doorknob or handle. A new specimen may be used for each of the four test conditions.

Table 1. Test Methods for Door Assembly

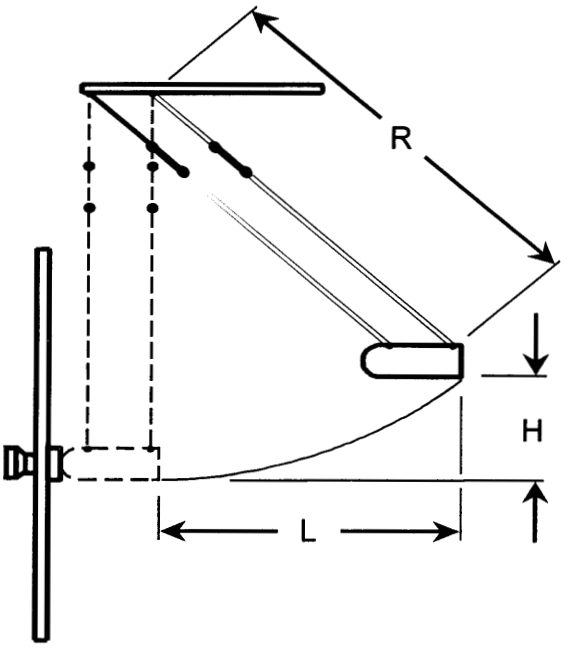
Test	Test Method	Measured Parameter	Requirement
Door Impact	6.d.1	Impact resistance of door	2 blows of 300 J (221.3 ft-lbf)
Bolt Impact	6.d.2	Impact resistance at bolt	2 blows of 300 J (221.3 ft-lbf)
Hinge Impact	6.d.3	Impact resistance at hinge	2 blows of 300 J (221.3 ft-lbf)
*Pulling	6.d.4	Pulling resistance at doorknob or handle	A tensile load of up to 250 lbs., or until handle no longer supports load.

* Doors that do not open in a conventional manner, that is, do not swing on hinges, such as pocket doors, should have the pulling force applied with respect to the opening direction of the door. In this case, the pocket door would require loading in a transverse direction. Such procedures should be agreed to with the Administrator.

6. TEXT METHODS.

a. Test Equipment.

(1) The door ram shall be a pendulum system with a steel weight of at least 45 kg (99.2 lb), capable of delivering horizontal impacts of at least 300 Joules (221.3 ft-lbf). Figure 3 illustrates the arrangement of this pendulum system in both the pre-release and impact position. The ram is a steel cylinder 15.2 cm (6 in) in diameter and 39.4 cm (15.5 in) long. The striking end of the weight shall be hemispherical and have a diameter of approximately 15.2 cm (6 in), as shown in Figure 3. The impact nose used in this equipment can be made from cast epoxy-polyamide resin. However, any durable impact resistant material is satisfactory. The suspension system for the door ram consists of four flexible steel cables providing a swing radius of 171 cm (5.61 ft), also shown in Figure 4. These cables are adjusted to equal length through turnbuckles such that the ram swings in a straight, true arc and are attached to a rigid frame that is adjusted to level.

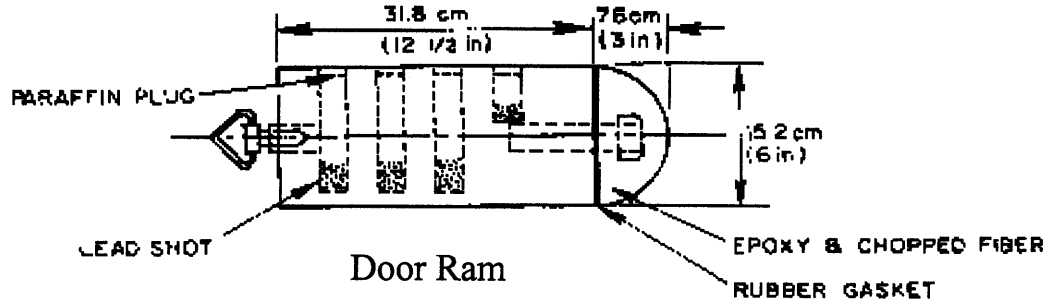


$$H = R - \sqrt{R^2 - L^2}$$

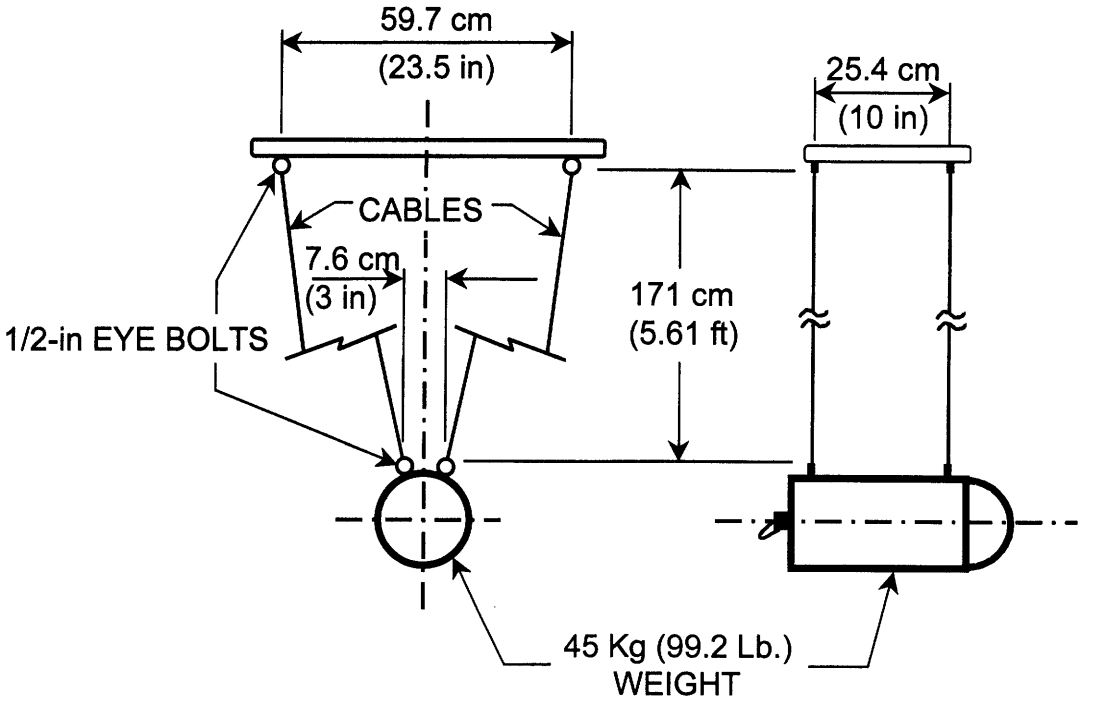
Figure 3. Door Ram Pendulum System

(2) It is convenient to clamp the pendulum system to the forks of a forklift truck, which allows rapid horizontal and vertical adjustment of the impact point of the ram. A winch and snap ring system may also be used to raise and pull back the door ram. The use of a calibrated elevation stand is a convenient means of quickly and reproducibly establishing the proper ram elevation for each required impact.

(3) The impact energy shall not be less than the prescribed value.



Door Ram



Suspension System

Figure 4. Door Ram and Suspension System

(4) The door handle pulling equipment shall be capable of attaching to the doorknob or handle and providing the required tension load without slippage. The equipment may be hydraulic or mechanical and must include a load cell, strain gauge or other calibrated load-measuring device.

b. Door Assembly Support Fixture. The fixture for door assembly tests shall consist of representative airplane framing members and representative wall structure, providing rigid, transverse restraint around the periphery of the assembly. The restraint provided by this fixture shall simulate the rigidity provided to a door assembly in the airplane by the ceiling, floor and walls. The test-panel fixture should not provide a significant increase in damping or energy absorption compared to the airplane configuration. That is, the fixture should not artificially contribute to the performance of the door. Figure 5 shows an example test fixture.

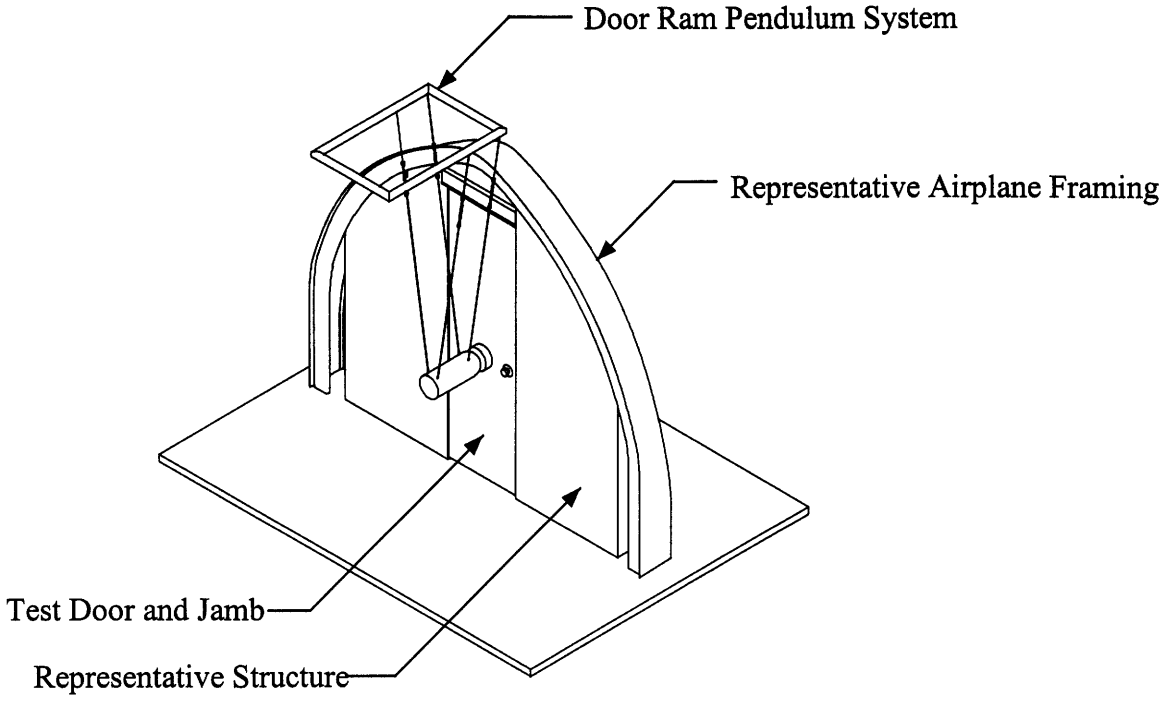


Figure 5. Door Assembly Support Fixture

c. Test Preparation. The door assembly shall consist of the door and doorknob or handle and all relevant components, such as locks, jambs, hinges, etc. Attach and orient this assembly to the Door Assembly Support Fixture as it will be installed in the airplane, with the door ram on the passenger cabin side.

(1) Ambient Test Conditions.

Ambient conditions of the test range will be maintained at:

Temperature: 21° C ± 2.9° C (70° F ± 5° F);
Relative humidity: 50% ± 20%

No additional environmental effects need be considered for the test.

(2) Test Specimens. The test specimens shall be manufactured using the materials and manufacturing processes used for production parts. A sufficient number of specimens will be provided to accomplish all tests. They will be conditioned to ambient conditions for at least 24 hours prior to testing unless the materials used are shown to be insensitive to variations in temperature and humidity.

d. Test Procedures.

(1) Door Impact Test.

(a) Prepare the test specimen in accordance with paragraph 6c and lock the door in the closed position. Set up the door ram pendulum weight (paragraph 6a(1)) so that its axis is horizontal and perpendicular to the face of the door at the point determined to be the most critical for door strength and distortion from impact, accounting for door design and load reaction points. If the door is of uniform construction, the impact point may be defined by the intersection of the vertical centerline of the door and a line from the center of the bolt at the door edge to the center of the mid-height hinge, or the mid point between hinges when the door is hung with two hinges, or horizontally across the door if the door is hung with a continuous hinge or integrated hinge pins. (See Figure 6).

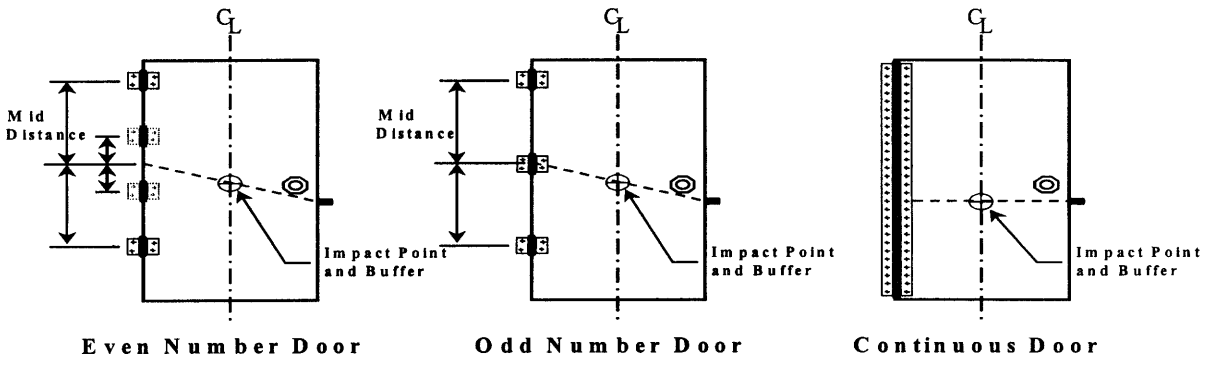


Figure 6. Door Impact Test Location for Different Hinge Configurations (Uniform Door Design)

(b) Attach to the door, centered on the impact point, an impact buffer with a diameter no greater than 15.2 cm (6 in) and a thickness no greater than 5 cm (2 in). The recommended buffer material is a 25.6 Kg / m^3 (1.6 Lb / ft^3) rigid, cellular, polystyrene thermal insulation (ASTM Standard Specification C578-00 Type IV). Other buffer materials may be used provided they have similar response characteristics in terms of energy losses, peak impact loads and rise times. Position the door ram such that its striking nose just touches the surface of the buffer when at rest. Pull back the pendulum weight to a drop height (H) of 68 cm (2.23 ft) and horizontal swing distance (L) of 136.5 cm (4.48 ft) to produce the required energy of 300 Joules (221.3 ft-lbf) and release. Subject the same test specimen to two impacts, attaching a new buffer for each impact. This test procedure assumes consistent structure throughout the door panel. Any significant detail variations may require further substantiation.

(2) Bolt Impact Test.

(a) Prepare the test specimen in accordance with paragraph 6c and lock the door in the closed position. Set up the door ram pendulum weight (paragraph 6a(1)) so that its axis is horizontal and perpendicular to the face of the door at the point 8.9 cm (3.5 in) from the door edge and horizontally in line with the door bolt. If the doorknob interferes with the impact point, the impact point may be moved vertically above or below the doorknob, whichever is closer to the bolt. (See Figure 7).

(b) Attach to the door, centered on the impact point, an impact buffer with specifications provided in paragraph 6d(1)(b) and perform the impact tests also specified in that paragraph.

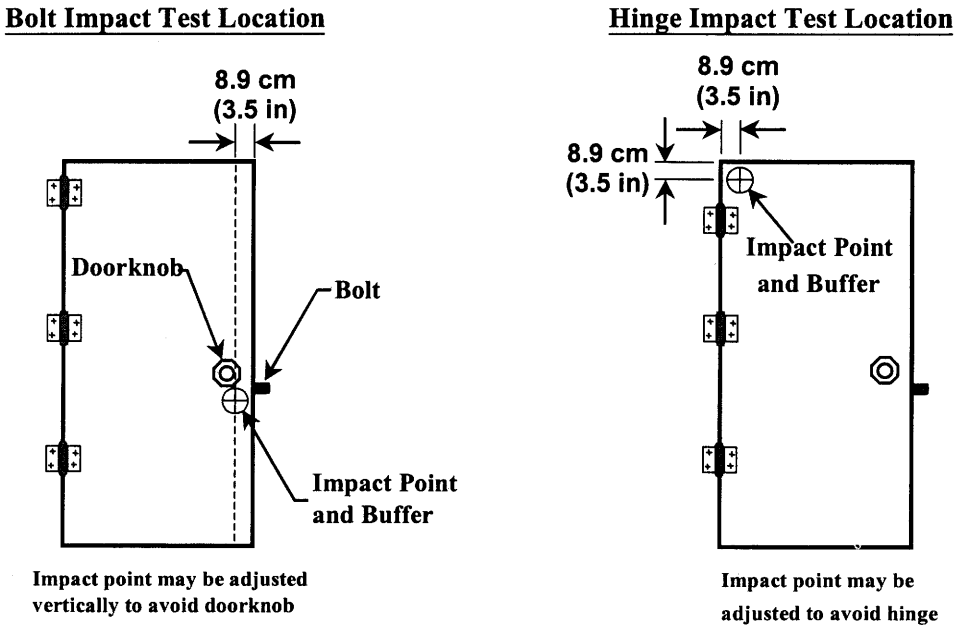


Figure 7. Impact Test Locations for Doorknob and Hinge

(3) Hinge Test.

(a) Prepare the test specimen in accordance with paragraph 6c and lock the door in the closed position. Set up the door ram pendulum weight (paragraph 6a(1)) so that its axis is horizontal and perpendicular to the face of the door at the point 8.9 cm (3.5 in) down from the top door edge and 8.9 cm (3.5 in) in from the vertical door edge containing the door hinge (Figure 6). If the hinge interferes, the impact point may be moved as agreed to with the administrator.

(b) Attach to the door, centered on the impact point, an impact buffer with specifications provided in paragraph 6d(1)(b) and perform the impact tests also specified in that paragraph.

(4) Pull Test.

(a) Prepare the test specimen in accordance with paragraph 6c and lock the door in the closed position. Attach the tension-loading device (paragraph 6a(4)) to a rigid support in front of the handle or knob on the cabin side of the door and align the pulling axis to match the initial door opening direction. Attach the tension loading device to the handle or doorknob by means which will require minimum alteration of the doorknob or handle (i.e., friction devices, drilling holes, cutting slots, etc.) ensuring that it will not slip during the test.

(b) Apply a minimum tensile load of 250 pounds to the knob or handle for three seconds or until the knob or handle separates from the door, whichever occurs sooner. Where design features would not permit a 250-pound tensile load to be applied by a person, an artificial method of applying the load may be necessary.

7. PASS/FAIL CRITERIA. The door assembly fails a test if:

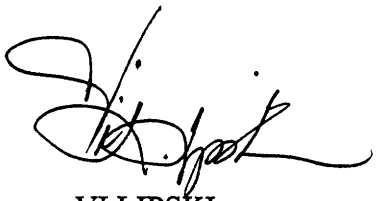
a. The door is forced open by any of the test impacts to the door, bolt or hinge area, or from the tensile load applied to the knob or handle.

b. A person can easily enter, relatively unimpeded, from the outside even though it might not be possible to open the door. For example, through removable panels on the door, or gaps formed as a result of the impacts.

c. The failure of the door handle enables the door to be opened, including use of small tools such as pocket knives, nail files or keys.

d. A method for determining acceptability under paragraphs 7a and b, is to apply a constant 100 lbs. load on the door in the direction of the flightdeck while making the assessments.

8. DESIGN VARIATION. Variations in design will not necessarily require testing if it can be shown by rational, comparative analysis that the new design will meet the pass/fail criteria.



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