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UN/ECE/WP29/GRSP INFORMAL GROUP

ON

DOOR LOCK
&
DOOR RETENTION COMPONENTS

2ND PROGRESS REPORT
(PRESENTED BY MR. GEORGE MOUCHAHOIR, CHAIRMAN OF THE INFORMAL GROUP)

TABLE OF CONTENTS

1. INTRODUCTION

During the 126th session of WP.29 of March 2002, the Executive Committee of the 1998 Global Agreement (1998 Agreement) adopted a Program of Work, which includes the development of a Global Technical Regulation (GTR) to address inadvertent door openings in crashes. The Executive Committee also charged the Working Party on Passive Safety (GRSP) to form an informal working group (working group) to discuss and evaluate relevant issues concerning requirements for door locks and door retention components to make recommendations regarding a potential GTR.

The United States of America volunteered to lead the group's efforts and develop a document detailing the recommended requirements for the GTR. The U.S. presented an informal document WP29/2003/6 in March 2003, formally proposing the work and highlighting the relevant issues to be addressed in the GTR.

The working group met to generally evaluate the likelihood of developing a door retention GTR on September 2nd and 3rd and on December 9th, in Paris, France and Geneva, Switzerland, respectively. A more thorough evaluation of the U.S. proposal was conducted on April 3rd and 4th in London, England, on July 23rd and 24th, 2003 in Paris, France, and on November 19th and 20th in Paris, France. A sixth meeting is scheduled for February, 2004.

A Preliminary Report was presented at the 33rd GRSP meeting (Informal document No. 5). This report summarizes the main issues discussed by the working party in evaluating the proposal to develop a draft global regulation on door lock and door retention components during the first three meetings of the group. It also provides an evaluation of the safety problems associated with door openings and a review of the existing international regulations.

This 2nd Progress Report discusses the status of prior issues raised in the Preliminary Report, as well as new issues raised during the drafting of the GTR at the July and November 2003 working group meetings. Attached to this report is the most current draft of the door lock and door component GTR, including all associated appendices.

2. PROGRESS ON DRAFTING OF A GTR

At the July 2003 meeting of the working group, a draft GTR was presented for discussion. Using this as a template, revisions were made. A second draft was circulated among the members of the working group prior to the November 2003 meeting and was discussed at that meeting. While not all issues have been resolved, no issues are sufficiently problematic to prevent the agreement on a draft regulation. Accordingly, the working group is generally on track for meeting the schedule presented in the last progress report. That schedule has been modified as follows:

Tasks	Dates
1st Progress Report to GRSP	June 2003
1st Progress Report to AC.3	June 2003
Preparation of 1st Draft GTR	July 2003
4th Informal group Meeting	July 2003
2nd Draft GTR	November 2003
5th Informal group Meeting	November 2003
2nd Progress Report/Draft GTR to GRSP	December 2003
6th Informal Group Meeting	February 2004
2nd Progress Report to AC.3	March 2004
3rd Progress Report/Adoption of Final Draft GTR by GRSP	May 2004
3rd Progress Report to AC.3	June 2004
Submittal of Final Draft GTR to AC.3	November 2004

3. DISCUSSION OF ISSUES ADDRESSED IN THE DRAFT GTR

The following discussions reflect the working group's identification of specific issues, as well as the group's evaluation of those issues.

A. Applicability

The application of a door retention component GTR will, to the extent possible, use the revised vehicle classification and definitions that the Working Party on General Safety (GRSG) Common Task Group has prepared.

Due to concerns over conducting the hinged side door system test on some vehicle doors, questions still remain as to what vehicles from these categories will be covered under the GTR. Among those desiring a GTR more limited in scope, it was proposed Category 1 and Category 2 vehicles greater than 3500 kg should be exempt from the GTR or could be added in the future after evaluating various door designs for these vehicles. Some of those arguing in favor of a more inclusive GTR noted that current U.S., Canadian, and Australian requirements already apply to all vehicles other than buses (M2 and M3 vehicles) and that the applicability of existing requirements to commercial trucks has not proven problematic for vehicle manufacturers. It was noted that the U.S. requirements, while regulating all vehicles other than buses, does exempt certain door designs that cannot realistically be expected to meet the requirements of the standard. One suggestion was to use this same approach that has been used in North America for about 30 years.

The working group requests guidance from the GRSP regarding the applicability of a door latch GTR to vehicles heavier than 3.5 kg.

B. New Definitions in Standard

The working group has revised, developed, and agreed to new definitions to better reflect the language in the draft GTR. Further work still needs to be accomplished in defining folding doors.

C. General Requirements

The working group agreed to recommend that the GTR should specify requirements for side and back doors, door retention components and door locks and to consider all

available research and testing done by various jurisdictions. New requirements and test procedures for hinged side and sliding doors proposed by North America for inclusion are being evaluated for consideration. Other requirements being evaluated include an inertial load dynamic test, load tests on latches in the direction orthogonal to the to parallel and perpendicular to the latch face, and limitations on circumstances under which rearward mounted door hinges would be allowed on hinged side doors.

1. Hinged Doors Issues

The U.S. and Canada have developed a series of new test procedures designed to better simulate real world door opening in crashes.

1.1. New hinged full door test requirements

These tests consist of lateral and longitudinal door-in-frame quasi-static (full door) tests in both longitudinal and lateral directions, independently from the door system. These procedures are designed to simulate various failures during crashes:

- The lateral full door test is designed to simulate latch failures in crashes that produce outwards forces on the door (i.e., through occupant loading or inertial loading) such as side crashes that result in vehicle spin and rollover. This procedure is intended to replace the current lateral tensile bench test.
- The longitudinal full door test is designed to simulate a collision in which the side of the vehicle is stretched, leading to the possibility that the striker could be torn from its mated latch (i.e., far side door in side impacts, and front and rear offset crashes on the opposite side door). This procedure is intended to replace the current longitudinal tensile bench test.

At present, most members do not support the adoption of full door tests into the GTR. Because of the current EU requirement for both the component tests and a door closure requirement in dynamic tests, there is some question among the members as to whether a full door test provides any additional value. One member has requested an analysis of how the full door test will improve safety (or the reduction in door openings) as compared to existing requirements. The U.S. plans to provide this analysis at the next meeting of the working group.

Other members of the working group have evaluated the contemplated test procedures. They have expressed several concerns that the new procedure will end up being unduly design restrictive and non-repeatable, given the limitations of the test frame. For example, it may be that multiple test frames would be required to ensure an appropriate "fit" between the door and the test frame. This is because placement of the test load relative to the latch mechanism may be sufficiently different to produce significantly different results, and because door specific holes must be drilled into the test frame. Additionally, the test frame may not adequately address new latch designs that may be mounted in non-traditional locations. Likewise, the procedure does not allow manufacturers the benefit of non-latch attachments that are

primarily used for side impact purposes but also may have a positive effect on door closure.

Those members voicing concerns over the new procedures have argued that conducting the proposed tests on a full vehicle rather than a test frame is impractical because not all loads can be applied to a closed door. However, it may be possible to cut the door frame and attach it to the test frame, although such an approach may not fully replicate the actual door-in-frame as installed in the vehicle since cutting the door frame may change its characteristics. Such an approach may address the fit between the latch and striker, as well as the physical characteristics of the door and the doorframe.

The primary concern with the proposed tests is whether they adequately address the instances of door failures in the real world or whether a dynamic or quasi-dynamic test (e.g., dynamic loading against the door interior) would be preferable. One member noted that he/she was concerned a static test inadequately tests door systems for real world conditions. He/she stated a dynamic requirement, where a dummy or other test form was propelled into the door, would be preferable to the static application of a load against the door, even if the statically-applied load were higher than the dynamically-applied load.

Because of the more encompassing concerns related to the full-door tests, there was little discussion over whether the trim should be removed or what would constitute "trim" if it were removed. A question was raised as to what exactly would be the point of the tests since the load direction would change with the application of force. It is unclear to what extent the removal of trim would limit the change in load direction.

While not rejecting the full door tests completely, the members have generally expressed serious concerns over these forms of tests being included into a GTR.

1.2. New Combination Component Test

The combination latch/striker component bench test is designed primarily to simulate the force conditions causing near side door openings in side impacts (longitudinal and lateral force loading).

The group discussed this combination test and one member has further evaluated the procedure. Some problems were noted in the test procedure that the group will attempt to resolve. There is also a request for justification of the recommended loads.

1.3. Rear mounted hinges

ECE R11 requires, with a limited exception, that hinges be located at the forward edge of hinged side doors, because of the difficulty in

closing a rear hinge door that is inadvertently opened while the vehicle is in motion. Some members of the group believe this requirement is too design restrictive. The working group agreed to recommend that all hinges be located on the forward edge of doors or otherwise, would be required to: make the interior door handles be inoperable, if vehicle speed is > [4 km/h], and require that a vehicle be equipped with a door telltale indicator, as would be required for sliding doors without a primary door latch.

1.4. Rear side door locks

Unlike the door lock and door retention component requirements in North America, ECE R11 does not have provisions for rear side door locks. Some of the working group members expressed concerns over including such requirements in the GTR, while others insisted that such requirements are necessary for the protection of children in the rear seat. In discussing this issue, several recommendations were made for inclusion in the GTR: i) a door that can be opened with a single movement of the door handle when the door is in a locked position must be fitted with a child safety lock, ii) automatic door locks that allow the driver to engage or disengage the child safety locks from the front seat would be acceptable, iii) doors that require some action other than the release of the door with a single movement of the door handle when the door is in a locked position may have child locks, but would not be required to have such locks; these doors could be required to have a manual door-lock release that would allow rear-seat passengers to open the door in the event of a crash. It was suggested that door lock requirements should be consistent with the ECE 94 and 95. The U.S. and Canada indicated that child locks are not regulated in the current North American standards, and that in any final recommendation, it is important that doors not be allowed to be opened from the interior with a single movement of the door handle when the door is locked. Accordingly, language is being drafted that may accommodate both egress in a post-crash environment and child safety under normal operating conditions.

The informal group will continue to discuss this item in order to reach a final resolution.

1.5 Rear glass tailgates

Some members commented that the North American standards restriction on latches or hinges attached to glazing is too restrictive, and that a less restrictive requirement, in terms of how much of the applicable door consists of glazing, seems appropriate. U.S. noted the point of the requirement was not to encourage "all glazing" doors, but rather an acknowledgement that these doors could not meet the strength requirements of FMVSS No. 206 and were exempted for practical reasons. The U.S. has agreed to review its requirement and better clarify what constitutes a door and what constitutes a window (i.e., hinges attached to a window fully incorporated into a latched tailgate).

The informal group will continue to discuss this item in order to reach a final recommendation.

2. Sliding Door Issues

The requirements and test procedures in both ECE R11 and the North American standards were discussed and the working group agreed to recommend the inclusion of the current requirements for the track and slide combinations of side sliding doors. Further, the group agreed to recommend adding the latch/striker system requirements of ECE R11. However, neither regulation had a detailed full vehicle sliding door test procedure that better simulates real world door openings in crashes.

2.1. Full vehicle test

The U.S. and Canada have jointly developed a new full vehicle sliding door test procedure to replace the existing door-in-frame test in the North American standards. The procedure specifies that the track and slide combination or other supporting means for each sliding door, while in the closed position, cannot separate from the door frame when lateral forces of 18 kN are applied. The total displacement of each of the loading devices is to be limited to 460 mm.

Everybody in the working group reacted favourably to the proposals and agreed to consider them in a GTR. It was suggested that the requirements for the new sliding door test parallel those currently in ECE R11, Section 5.4, which requires the track, sliding combination or other supports not separate under specified force loads. Also, it was recommended to consider a proposal to require these doors not separate from the doorframe more than 100 mm along any point along the perimeter. Some concerns were voiced as to the level of potential risk involved in measuring such a displacement requirement. The working group agreed to consider modifying the contemplated requirement to retain the original intent behind the requirement, while addressing any potential risk of injury to the test technicians.

2.2. Requirement for a telltale

The working group members agreed to require either a secondary latch or some type of visual indicator signalling the driver when a sliding door was not fully closed.

3. Addition of orthogonal force loading requirements for sliding and hinged doors

The working group has discussed the possibility of adding a force loading requirement in the direction orthogonal to the directions perpendicular and parallel to the latch face for hinged and sliding doors. All governing bodies expressing a view, support the inclusion of such a requirement, stating that the requirement is not burdensome and may prove beneficial in mitigating the risk

of door failures in rollover crashes. Industry representatives in the working party are opposed to such a requirement because they believe it may be difficult and may not address a real world safety problem. The working group will continue to discuss this item in order to reach a final conclusion.

4. Dynamic Requirements Issues

4.1. Dynamic inertial test procedure (optional to calculation)

The working group has agreed to recommend adopting the ECE R11 dynamic inertial test requirements to the GTR, as an option to the inertial calculation. In addition to the longitudinal and lateral tests, tests in the vertical direction are also being considered. The ECE test procedures were provided to the Ad Hoc committee and these are being validated by Canada. Testing is expected to be complete by the end of January 2004.

4.2. Door closure and door operability requirements following dynamic crash testing

Existing ECE standards with dynamic crash test components already require the door stay closed during dynamic crash tests. It is believed that it is unnecessary to repeat this requirement in the GTR. However, the working group believes it is appropriate to discuss in the preamble to the GTR that jurisdictions not party to the 1958 Agreement would adopt a corollary requirement as part of their crash test requirements.

The group likewise considered whether the GTR should require that at least one door per row be operable following crash testing (possible to exclude rear doors in rear impacts and side struck doors in side impact testing). Existing ECE standards with dynamic crash test components already have such a requirement. As with the requirement that doors stay closed during dynamic crash testing, the working group suggests discussing the adoption of such requirements by jurisdictions not party to the 1958 Agreement in the preamble to the GTR.

C. Other concerns

Questions were raised during group discussions as to whether to include in the GTR at this time other requirements, such as vehicle entrapment involving electric door, remote keyless entry systems, power assisted side and sliding door closure, and whether to include a "telltale indicator" for all doors. It was initially recommended that a door telltale indicator be required for each vehicle door to be activated when doors are partially or completely open. The group has tentatively concluded that such a requirement is only needed for doors without a secondary latch position (i.e., some sliding doors) and hinged side doors with rear mounted hinges that can operate independent of a mated hinged side door with front-mounted hinges.

4. COST EFFECTIVENESS ASSOCIATED WITH A GTR

The estimated cost of the new requirements, if adopted, would likely be minor. However, a full evaluation of the costs effectiveness associated with a GTR, will be provided once the working group completes its evaluation of the proposed test procedures.

5. REFERENCE DOCUMENTS USED BY THE WORKING GROUP

A list of informal documents used by this Informal group is listed and available on the UN/ECE website. In addition, test reports and other pertinent documents detailing the U.S. and Canada proposed test procedures are accessible from the **U.S. Department of Transportation Docket Management System (Docket No. NHTSA-1996-3705) Web access at http://dms.dot.gov/**

Number of Informal Document**	Title of Informal Document
TRANS/WP.29/GRSP/2001/1	Proposal for Draft Candidate GTR on Door Latches and Door Retention Components (OICA)
TRANS/WP.29/GRSP/2002/15	Comparison Between FMVSS No. 206 and ECE R11 (U.S.)
INF GR/DL/1/1	Agenda September 2002 Meeting
INF GR/DL/1/2	Summary of Lateral Full Door Test (U.S.)
INF GR/DL/1/3	Summary of Longitudinal Full Door Test (U.S.)
INF GR/DL/1/4	Summary of Combination Test (U.S.)
INF GR/DL/1/5	Summary of Transport Canada Sliding Door Test (Canada)
INF GR/DL/1/6	Transport Canada Test Reports (Canada)
INF GR/DL/2/1	Agenda December 2002 Meeting
INF GR/DL/2/2	Proposal for a Test Procedure Concerning the Resistance against Inertial Loads of Side Door Locks on Motor Vehicles (OICA)
INF GR/DL/2/3	Comparison of Locking Requirements in FMVSS 206 with ECE R11 (OICA)
INF GR/DL/3/1	Agenda April 2003 Meeting
INF GR/DL/3/2	Crash Data on US Door Ejection/Openings (U.S.)
INF GR/DL/3/3	Full Door and Combination Detailed Test Procedures (U.S.)
INF GR/DL/3/4	Dynamic Inertial Sled Test Pulse (France UTAC)
INF GR/DL/4/1	Agenda July 2003 Meeting
INF GR/DL/5/1	Agenda November 2003 Meeting
INF GR/DL/5/2	BMW Presentation, “Proposed Door Test Procedures - Hinged Side Doors”
INF GR/DL/5/3	Photos and acceleration plots of inertial loading in z-direction

** Informal Report (INF), GRSP Informal group (GR), Door Locks and Door Retention Components (DL), Meeting No., and Report Number

APPENDIX

Draft Global Technical Regulation on Door Locks and Door Components

Draft global technical regulation No.”X”

GLOBAL TECHNICAL REGULATION ON DOOR LOCKS AND DOOR RETENTION COMPONENTS

CONTENTS

page

Draft
Global Technical Regulation on
Door Locks and Door Retention Components

GLOBAL TECHNICAL REGULATION "X"

1. Scope and Purpose. This regulation specifies requirements for vehicle door locks and door retention components, including latches, hinges, and other supporting means, to minimize the likelihood of occupants being thrown from a vehicle as a result of impact.

2. Application. This regulation applies to the components on side or back doors and door retention components that lead directly into a compartment that contains one or more seating accommodations in Category 1 vehicles or Category 2 vehicles [<3,500 kg], as defined by [GTR 0].

3. Definitions.

Automatic Door Locking Device is a device that automatically engages the door locks when the vehicle is in motion and disengages the locks following a crash.
Auxiliary Door Latch is a latch, other than the primary door latch, fitted to a door or door system that is equipped with more than one latch.
Back Door is a door or door system on the back end of a motor vehicle through which passengers can enter or depart the vehicle, or cargo can be loaded or unloaded. It does not include:

(a) A trunk lid; or
(b) A door or window that is composed entirely of glazing material and whose latches and/or hinge systems are attached directly to the glazing material.

Door Closure Warning System is a system that will activate a visual signal located where it can be clearly seen by the driver when a door latch system is not in its fully latched position and while the vehicle ignition is activated.
Door Hinge System is the complete set of hinges on a door and its surrounding doorframe.
Door System is the door, latch, striker, hinges, sliding track combinations and other door retention components on a door and its surrounding doorframe. The door system of a double door includes both doors.
Double Door is a system of two doors where the front door or wing door opens first and connects to the rear door or bolted door, which opens second.
Fork-bolt is the part of the latch that engages and retains the striker when in a latched position.
Fork-bolt Opening is the direction opposite to that in which the striker enters to engage the fork-bolt.
Fully Latched Position is the coupling condition of the latch that retains the door in a completely closed position.
Latch is a mechanical device employed to position the door in a closed position relative to the vehicle body with provisions for controlled release (or operation).
Latch System consists, at a minimum, of a latch and a striker.
Primary Door Latch is a latch equipped with both a fully latched position and a secondary latched position.

Primary Door Latch System consists, at a minimum, of a primary door latch and a striker.
Secondary Latched Position refers to the coupling condition of the latch that retains the door in a partially closed position.
Side Front Door is a door that, in a side view, has 50 percent or more of its opening area forward of the rearmost point on the driver's seat back, when the seat back is adjusted to its most vertical and rearward position.
Side Rear Door is a door that, in a side view, has 50 percent or more of its opening area to the rear of the rearmost point on the driver's seat back, when the driver's seat is adjusted to its most vertical and rearward position.
Striker is a mechanical device with which the latch engages on the opposing member of the latch system.
Trunk Lid is a movable body panel that provides access from outside the vehicle to a space wholly partitioned from the occupant compartment by a permanently attached partition or fixed or fold-down seat back.

4. General Requirements

4.1 The requirements apply to all side and back doors and door components except for those on folding doors, roll-up doors, detachable doors, and doors that provide emergency egress.

4.2 Door Latches

4.2.1 Each hinged door system shall be equipped with at least one primary door latch.

4.2.2 Each sliding door system shall be equipped with either a:

a. A primary door latch, or
b. A latch system with a fully latched position and a door closure warning system.

5. Performance Requirements

5.1 Hinged doors

5.1.1 Load Test One. Each primary door latch system, when in the fully latched position, shall not separate when a load of 11,000 N is applied in the directions perpendicular to the face of the latch such that the latch and the striker anchorage are not compressed against each other. When in the secondary latched position, the primary latch system shall not separate when a load of 4,500 N is applied in the same direction when tested in accordance with 7.1.1.1.

5.1.2 Load Test Two. Each primary door latch system, when in the fully latched position, shall not separate when a load of 9,000 N is applied in the direction of the fork-bolt opening and parallel to the face of the latch. When in the secondary latched position, the primary latch system shall not separate when a load of 4,500 N is applied in the same direction when tested in accordance with 7.1.1.1.

5.1.3 [Load Test Three. The primary door latch system shall not disengage from the fully latched position when a load of 9,000 N is applied in a direction orthogonal to the directions specified in 5.1.1 and 5.1.2 when tested in accordance with 7.1.1.1.]

5.1.4 [Inertia Load. The primary door latch shall not disengage from the fully latched position when an inertia load of 30g is applied to the door latch system, including the latch and its activation mechanism with the locking mechanism disengaged when tested in accordance with 7.1.1.2, in the directions specified in 5.1.1, 5.1.2, and [5.1.3].

5.1.5 Combination Force Application for Hinged Side Doors (except double doors). The primary door latch system, when in a simulated fixture and tested in accordance with 7.1.1.3, shall not separate from the fully latched position under simultaneous forces of [16,000 N] of longitudinal compressive force and 6,650 N of lateral tensile force when applied to the latch system.

5.1.6 Auxiliary Door Latches. Each auxiliary latch system shall be provided with a fully latched position and shall comply with the requirements specified in 5.1.1, 5.1.2, and 5.1.4.

5.1.7 Door Hinges.

5.1.7.1 Each door hinge system shall

a. Support the door,
b. Not separate when a longitudinal load of 11,000N is applied,
c. Not separate when a transverse load of 9,000 N is applied, and
d. [Not separate when a vertical load of 9,000 N is applied.]

5.1.7.2 All tests required by 5.1.7.1 are conducted in accordance with 7.1.2.

5.1.7.3 In the event that a single hinge within the hinge system is tested, the hinge must bear a load proportional to the total number of hinges in the hinge system.

5.1.7.4 On side doors with rear mounted hinges that can be operated independently of other doors,

a. The interior door handle shall be inoperative when the speed of the vehicle is greater than or equal to 4 km/h, and
b. A door closure warning system shall be provided for those doors.

5.1.8 [Hinged Side Door Systems (except for double doors)]

5.1.8.1 [Longitudinal Force Application. The door system, when mounted as part of the entire door in a simulated door frame, as specified in 7.1.3.1, shall not separate when simultaneous forces of 17,000 N of longitudinal tensile force and 1,000 N of lateral tensile force are applied to the entire door system in accordance with section 7.1.3.1.]

5.1.8.2 [Lateral Force Application. When the door system is mounted in a simulated doorframe, as specified in 7.1.3.2, the primary door latch system shall not separate when a lateral tensile force of 14,000 N is applied to the door near the door latch in accordance with 7.1.3.2.]

5.2 Sliding Side Doors

5.2.1 Load Test One. The door latch system, when in the fully latched position, shall not separate when a load of 11,000 N is applied in the direction perpendicular to the face of the latch when tested in accordance with 7.2.1.1.

5.2.2 Load Test Two. The door latch system, when in the fully latched position, shall not separate when a load of 9,000 N is applied in the direction of the fork-bolt opening and parallel to the face of the latch when tested in accordance with 7.2.1.1.

5.2.3 [Load Test Three. The primary door latch system, when in the fully latched position, shall not separate when a load of 9,000 N is applied in a direction orthogonal to the directions specified in 5.2.1 and 5.2.2.]

5.2.4 Inertia Load. Each door latch system shall not disengage from the fully latched position when an inertia load of 30g is applied to the door latch system, including the latch and its activation mechanism with the locking mechanism disengaged, in the directions specified in 5.2.1, 5.2.2,[and 5.2.3], and when tested in accordance with 7.2.1.2.

5.2.5 Door System.

5.2.5.1 The track and slide combination or other supporting means for each sliding door, while in the closed primary latched position, shall not separate from the door frame when a total force of 18,000 N along the vehicle transverse axis is applied to the door in accordance with 7.2.2.

5.2.5.2 The sliding door fails this requirement if any one of the following occurs:

5.2.5.2.1 The separation between any point on the door edge and the doorframe exceeds [100 mm], as measured by passing a [100 mm] diameter sphere completely through the gap between the door and the body of the vehicle.

5.2.5.2.2 Either ram reaches a total displacement of 460 mm.

5.3 Door Locks. Each door shall be equipped with a locking mechanism that has an operating means in the interior of the vehicle and lock release/engagement mechanism.

5.3.1 Side Front Door Locks. When the locking mechanism is engaged, the outside door handle or other outside latch release control shall be inoperative.

5.3.2 Side Rear Door Locks.

5.3.2.1 [When the locking mechanism is engaged, both the outside and inside door handles, or other latch release controls shall be inoperative.]

5.3.2.2 [For the rear door with an automatic door lock, when the locking mechanism is engaged both the outside and inside door handles and other latch release controls shall be inoperative. If the locks are disengaged, the doors will always automatically relock while the vehicle is in motion and if the locks are engaged will unlock automatically in the event of a crash.]

6 Test Conditions

(no general test conditions specified)

7 Test Procedure

7.1 Hinged Doors.

7.1.1 Door Latches.

7.1.1.1 Load Test One, Two, and [Three] Force Application. Compliance with 5.1.1, 5.1.2 and [5.1.3] is demonstrated in accordance with Appendix 1.

7.1.1.2 Inertia Force Application. Compliance with 5.1.4 is demonstrated in accordance with Appendix 2.

7.1.1.3 Combination Force Application. Compliance with 5.1.5 is demonstrated in accordance with Appendix 3.

7.1.2 Door Hinges. Compliance with 5.1.7 is demonstrated in accordance with Appendix 4. Hinged Side Door System.

7.1.2.1 Compliance with 5.1.8.1 is demonstrated in accordance with Appendix 5.

7.1.2.2 Compliance with 5.1.8.2 is demonstrated in accordance with Appendix 6.

7.2 Sliding Side Doors.

7.2.1 Door Latches.

7.2.1.1 Longitudinal, Lateral, [and Vertical] Force Application. Compliance with 5.2.1. 5.2.2, and [5.2.3] is demonstrated in accordance with Appendix 1.

7.2.1.2 Inertia Force Application. Compliance with 5.2.4 is demonstrated in accordance with Appendix 2.

7.2.2 Door System. Compliance with 5.2.5 is demonstrated in accordance with Appendix 7.

[Appendix 1 – Latch Test for Load Test One, Two, and [Three]Force Applications]

1. Purpose. These tests are intended to establish minimum performance requirements and test procedures for evaluating and testing passenger car side door latch systems for their ability to resist force load perpendicular to the latch face, in the direction of door opening and orthogonal two the first to directions (vertically), while in the fully and secondary latched positions. It is limited to tests that can be conducted on uniform test fixtures and equipment in commercially available laboratory test facilities.
2. Definitions.
   2.1. Latch—A mechanical device employed to position the door in a closed position relative to the vehicle body with provisions for controlled release (or operation).
   2.2. Basic latch components (nomenclature) are:
      2.2.1. Plate—The main body or frame for supporting working components, appendages, and transmitting or distributing loads to the door structure.
      2.2.2. Rotor (Or Bolt)—The rotating or sliding member of the latch, which engages and restrains the latch to the striker.
      2.2.3. Ratchet—A member of the latch connected to the rotor to provide an abutment or abutments which, when properly indexed, become engaged with a related pawl to inhibit motion of the rotor in one direction.
      2.2.4. Pawl—A member of the latch that can be caused to engage the abutments of the ratchet to inhibit relative motion between the two parts except in one direction.
      2.2.5. Striker—A mechanical device with which the latch engages on the opposing member of the latching system.
3. Basic Requirements
   3.1. Load Test One. The primary door latch and striker assembly, when in the fully latched position, shall not separate when a load of 11,000 N is applied in the directions perpendicular to the face of the latch such that the latch and the striker anchorage are not compressed against each other. When in the secondary latched position, the primary latch and striker assembly shall not separate when a load of 4,500 N is applied in the same directions.
   3.2. Load Test Two. The primary door latch and striker assembly, when in the fully latched position, shall not separate when a load of 9,000 N is applied in the directions of the fork-bolt opening and parallel to the face of the latch. When in the secondary latched position, the primary latch and striker assembly shall not separate when a load of 4,500 N is applied in the same directions.
   3.3. Load Test Three. The primary door latch and striker assembly shall not disengage from the fully latched position when a load of 9,000 N is applied in a direction orthogonal to the directions specified in 3.1 and 3.2.
4. Test Operation
   4.1. Load Test One
      4.1.1. Equipment. Tensile testing machine (see Figure 1).
      4.1.2. Procedures
      4.1.3. Fully Latched Position
         4.1.3.1. Attach the test fixture to the mounting provisions of the latch and striker. Align the direction of engagement parallel to the linkage of the fixture. Mount

fixture with latch and striker in fully latched position in the test machine so as to apply a load in the direction specified in 3.1.

4.1.3.2. Locate weights to apply an 890 N load tending to separate the latch and striker in the direction of the door opening.

4.1.3.3. Apply the test load at a rate not to exceed 5 mm/min until failure. Record maximum load.

4.1.4. Secondary Latched Position

4.1.4.1. Attach the test fixture to the mounting provisions of the latch and striker. Align the direction of engagement parallel to the linkage of the fixture. Mount fixture with latch and striker in secondary latched position in the test machine so as to apply a load in the direction specified in 3.1.

4.1.4.2. Locate weights to apply an 890 N load tending to separate the latch and striker in the direction of the door opening.

4.1.4.3. Apply the test load at a rate not to exceed 5 mm/min until failure. Record maximum load.

4.1.4.4. The test plate to which the door latch is mounted will have a striker cutout configuration similar to the environment in which the door latch will be mounted on normal vehicle doors.

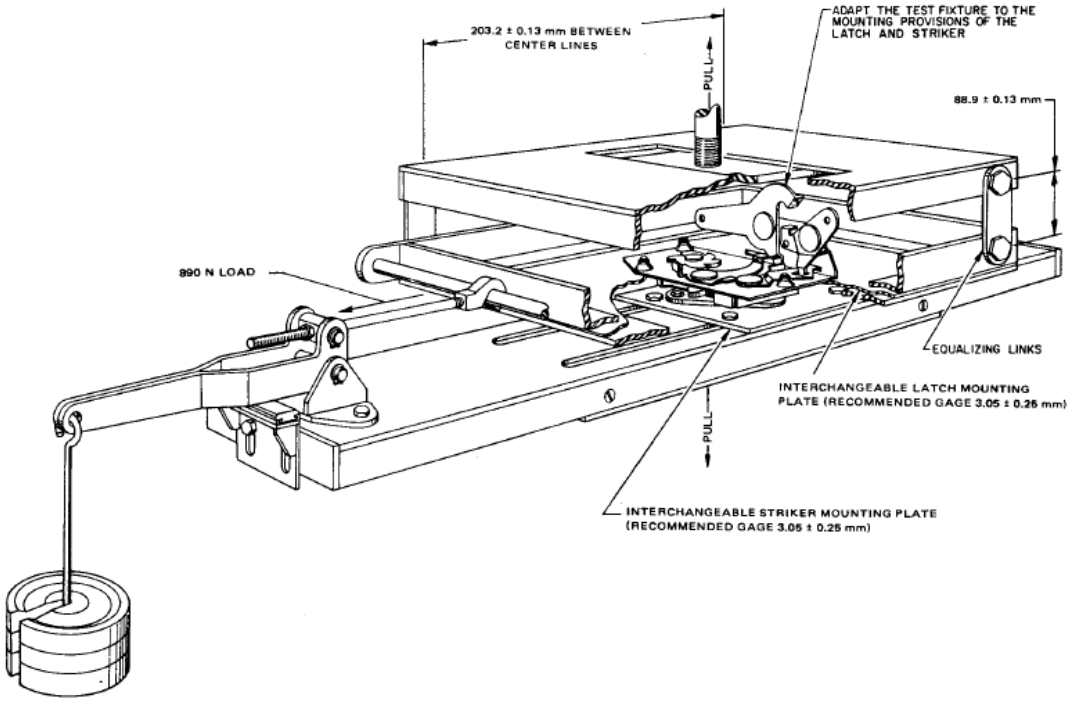


FIGURE 1—DOOR LATCH—STATIC LOAD TEST FIXTURE (LONGITUDINAL LOAD)

4.2. Load Test Two and Three

4.2.1. Equipment. Tensile testing machine (see Figure 2).

4.2.2. Procedures

4.2.3. Fully Latched Position

4.2.3.1. Adapt the test fixture to the mounting provisions of the latch and striker. Mount fixture with the latch and striker in fully latched position in the test machine so as to apply a load in the directions specified in 3.2 and 3.3.

4.2.3.2. Apply the test load at a rate not to exceed 5 mm/min until failure. Record the maximum load.

4.2.4. Secondary Latched Position

4.2.4.1. Adapt the test fixture to the mounting provisions of the latch and striker. Mount fixture with the latch and striker in secondary latched position in the test machine so as to apply a load in the directions specified in 3.2 and 3.3.

4.2.4.2. Apply the test load at a rate not to exceed 5 mm/min until failure. Record the maximum load.

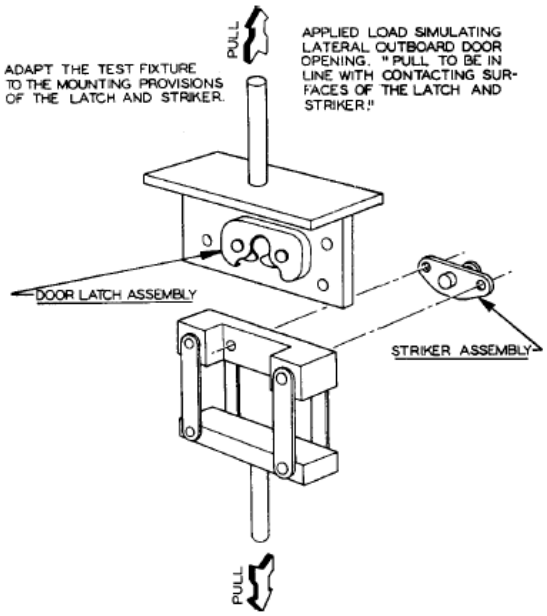


FIGURE 2—DOOR LATCH—STATIC LOAD FIXTURE (LATERAL LOAD)

[Appendix 2 – Inertial Test Procedures]

1. **Purpose**. To determine the ability of the vehicle latch system to resist inertia loading by means of a mathematical analysis of the component parts in their true car relationship or by evaluation using a dynamic sled test.

2. **Test Requirements.** A side or primary back door latch shall not disengage from the fully latched position when a longitudinal, transverse and vertical directions inertia load of 30g is applied to the door latch system (including the latch and its actuating mechanism with the locking mechanism disengaged) in the directions of the vehicle's longitudinal, transverse and vertical axis.[1] Validate the requirement using either by mathematical calculation or by a dynamic sled test (see Sections 3.1 and 3.2).

3. **Test Procedures**

3.1. **Option 1, Calculation Consideration**—Each component or subassembly can be calculated for its minimum inertia load resistance in a particular direction. Their combined resistance to the unlatching operation must assure that the door latch system (when properly assembled in the vehicle door) will remain latched when subjected to an inertia load of 30 g in any direction. Figure 1 is an example of the components and combinations of components to be considered.

3.2. **Option 2, Dynamic Sled Test** (allows for evaluation using full vehicle or door-on-sled)

3.2.1. Full Vehicle Sled Test

3.2.1.1. Test Equipment

3.2.1.1.1. An acceleration sled device

3.2.1.1.2. A sled gun

3.2.1.1.3. A vehicle or a vehicle body in white (i.e., vehicle frame, doors and other door retention components) including door(s), door latch(es), exterior door handles with mechanical latch operation, interior door opening lever and the locking device (to be attached to the sled device).

3.2.1.1.4. A device or means for recording door opening[2]

3.2.1.1.5. Equipment for measuring and recording accelerations.

3.2.1.2. Test Setup

3.2.1.2.1. Close the door and ensure that the latch is in the primary position

3.2.1.2.2. Mount the high speed camera to the exterior of each side and the back of the vehicle facing the doors

3.2.1.2.3. Ensure doors are shut in the primary latched position, tethered and unlocked

3.2.1.2.4. Attach the device for record door openings

3.2.1.2.5. Mount the full vehicle or vehicle body in white including the engine, transmissions, axles, exhaust, vehicle frame, and vehicle body may be rigidly secured to the vehicle and/or the device, and fluids, batteries and

[1] It is important to note that a failure of the inertial dynamic test only constitutes the latch system releasing from both the primary and secondary positions. Thus, a door system that fails in the primary latched position but retains the secondary position can still pass compliance.

[2] The purpose of this device is to record a door opening during that rebounds off the tether and closes again. Possible devices can include a high speed camera speed with a rate of 500 frames per second or higher or a marker stick which is placed 100 mm from the door end and used to visibly mark the door if an opening occurs.

unsecured components may be removed, in order to assure that all points on the crash pulse curve are within the corridor defined in Figure 1.

3.2.1.2.6. Longitudinal Setup. Orient the acceleration device in the direction of a frontal impact.

3.2.1.2.7. Lateral Setup. Orient the acceleration device in the direction of a side impact.

3.2.1.2.8. For vehicles that have unsymmetrical doors on each side, two tests will be conducted from each side of the vehicle

3.2.2. Door Deceleration Test

3.2.2.1.Test Equipment

3.2.2.1.1. The door assembly including all its door-retention and load-bearing components (i.e., latch, striker and hinges)

3.2.2.1.2. A buck to mount the door(s)

3.2.2.1.3. An acceleration device

3.2.2.1.4. A tether

3.2.2.1.5. A means for recording door opening [1]

3.2.2.1.6. Equipment for measuring and recording accelerations.

3.2.2.2. Test Setup

3.2.2.2.1. Ensure that the latch and striker are engaged in the primary position and that the door is tethered and unlocked

3.2.2.2.2. Mount the door assemblies either separately or combined to the buck. The doors should be mounted to correspond to their orientation in the vehicle and to the direction required for inertial load tests (see below)

3.2.2.2.3. Attach the device for recording door openings

3.2.2.2.4. Mount the buck to the acceleration sled

3.2.2.2.5. Longitudinal Setup. Orient the door subsystem(s) on the acceleration device in the direction of a frontal impact (the door(s) should be configured similar to their in-vehicle-position)

3.2.2.2.6. Lateral Setup. Orient the door subsystem(s) on the acceleration device in the direction of a side impact (the door(s) should be configured similar to their in-vehicle-position)

3.2.2.2.7. Vertical/Orthogonal (for back doors only). Orient the door subsystem(s) on the acceleration device in the direction of a side impact (the door(s) should be configured similar to their in-vehicle-position)

3.2.3. Test Operation

3.2.3.1. The test acceleration pulse corridor is defined in Table 1 and graphically shown in Figure 2.

3.2.3.2. Accelerate the test fixture to 30g's over a period of 16 to 20 ms and hold the acceleration within the pulse corridor (defined in Figure 1) for at least 20 ms in the following directions:

3.2.3.2.1. In both horizontal directions parallel to the vehicle longitudinal axis (positive and negative X-direction)

3.2.3.2.2. In both horizontal transverse directions (positive and negative Y-direction)

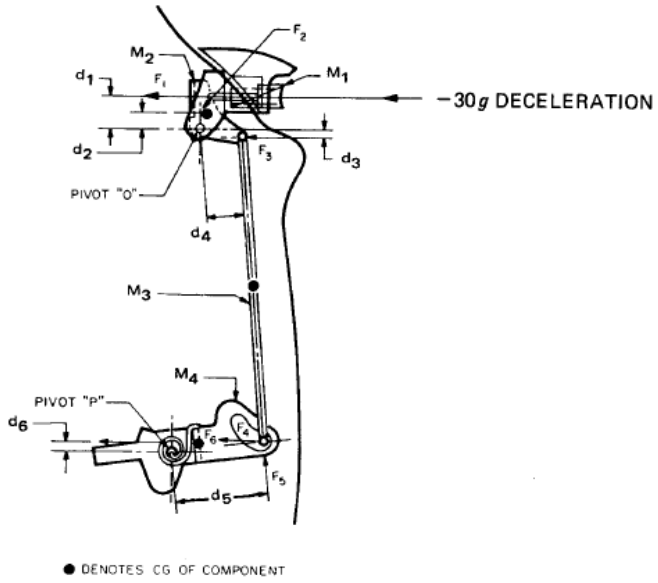
3.2.3.2.3. Table 1 and Figure 1 presents the pulse corridors for the acceleration of the test

3.2.3.3. Then decelerate the device over a period of 20 to 40 ms.

3.2.3.4. When the test is complete, verify whether that the door latch(es) are still in either the primary or secondary latched position. Perform the following validation test:

3.2.3.4.1. Apply a horizontal (±5 degrees) force of 250 N perpendicular to the longitudinal centerline of the vehicle in the door opening direction. The force shall be applied at a point on the door that is 5 cm (±1 cm (0.4 in)) below the vertical center of the exterior door handle and in the same vertical lateral plane as the center of the exterior door handle. The door shall not open from the secondary latched position

3.2.3.4.2. Ensure that the door did not open and close during the test.



Given: Door Latch System Subjected to 30 *g* Deceleration
Average Push-Button Spring Output Force = 4.5 N
Pawl Spring Output Torque = 0.45 N-m
a = 30 *g* (m/s^2)
F = *ma* = 30 *mg* = 294.2 * *m*

M_1 = 0.0163 kg	d_1 = 31.50 mm
M_2 = 0.0227 kg	d_2 = 10.67 mm
M_3 = 0.0122 kg	d_3 = 4.83 mm
M_4 = 0.0422 kg	d_4 = 31.50 mm
	d_5 = 37.60 mm
	d_6 = 1.91 mm

$F_1 = M_1a$ - (avg. spring output) = (0.0163 x 294.2) - 4.5 = 0.30 N

$F_2 = M_2a = 0.0227 \times 294.2 = 6.68$ N

$F_3 = \frac{M_3a}{2} = (0.0122/2) \times 294.2 = 1.80$ N

$\Sigma M_o = F_1 \times d_1 + F_2d_2 - F_3d_3 = 0.30 \times 31.5 + 6.68 \times 10.67 - 1.80 \times 4.83 = 72.0$ N-mm

$F_5 = \frac{M_o}{d_4} = \frac{72.0}{31.50} = 2.30$ N

$F_6 = M_4a = 0.0422 \times 294.2 = 12.42$ N

ΣMp = (pawl spring output) - $\left(\frac{F_5 \times d_5 + F_6 \times d_6}{1000}\right) = 0.45 - \left(\frac{2.30 \times 37.60 + 12.42 \times 1.91}{1000}\right) = 0.34$ N-m

EQUATIONS

SYMBOL	DEFINITION
m	Mass
a	Acceleration
g	Gravitational Acceleration
d	Distance to Pivot
F	Force
M	Moment About a Point

METRIC UNITS

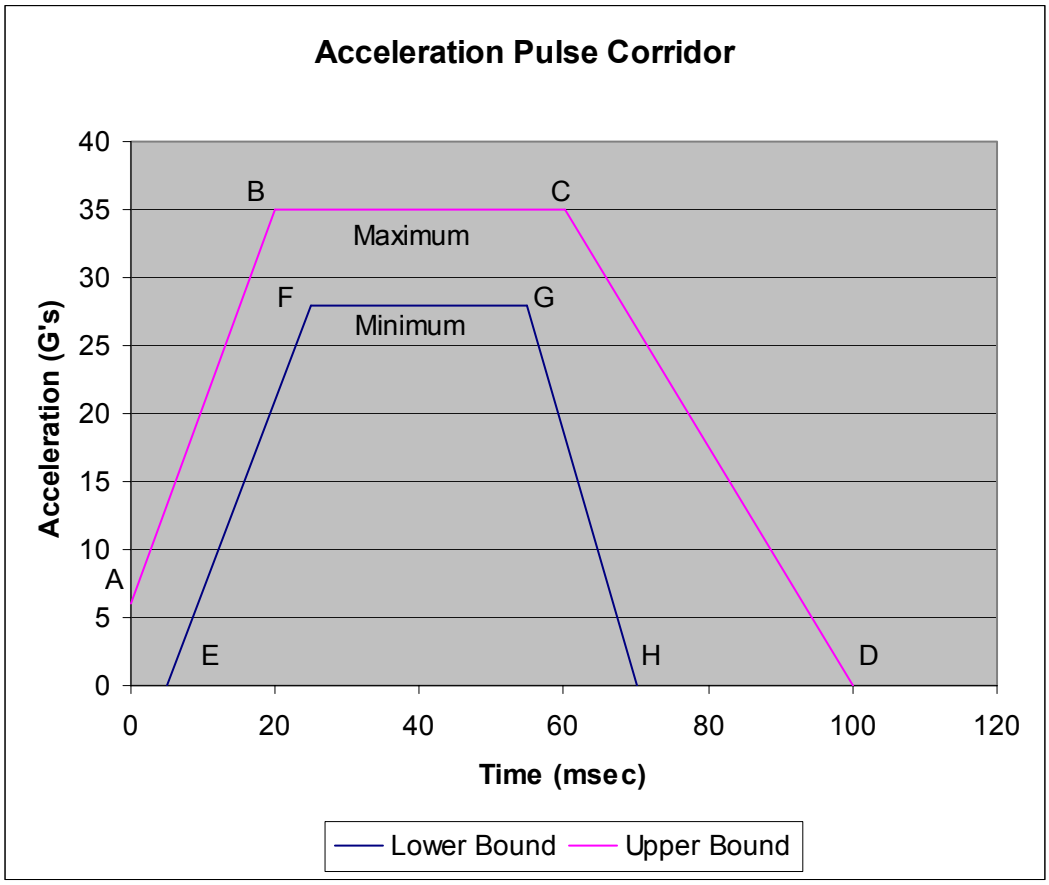
SYMBOL	DEFINITION
kg	Kilogram
m/s^2	Meter per second squared
m/s^2	9.806 650 Meter per second squared
mm	Millimeter
N	Newton
N-m	Newton Meter (preferred)
N-mm	(Newton-Millimeter)

Figure 1 – Inertial Loading – Sample Calculation

Table 1 - Sled Pulse Corridor

Upper Bound			Lower Bound		
Point	Time	Acceleration	Point	Time	Acceleration
A	0	6	E	5	0
B	20	35	F	25	28
C	60	35	G	55	28
D	100	0	H	70	0

Figure 2 – Sled Pulse



[Appendix 3
Combination Loading Test]

Test Equipment
The test equipment consists of:

1. A simulated test device. A ½ inch thick aluminum plate is prepared for mounting the latch mechanism. This involves cutting a notch in the plate so that the striker and longitudinal shaft can apply load to the latch mechanism with interfering with the aluminum plate. Holes must be drilled and tapped into the plate to allow mounting of the latch mechanism, and the striker attached to the loading device. An illustration of the device is shown in Figure 1.
2. One latching system, which includes latch and striker

1 Pre-test Conditions

1. The trolley with the latch is positioned and the longitudinal ram is run down to engage the striker with the latch in the primary latched position.
2. Movement of the latch is constrained in a direction along the vehicle's transverse axis

2 Test Procedure

1. The transverse ram loads the latch to 6,650 N and maintains this load throughout the course of the test.
2. When the transverse load of 6,650 N is reached, the longitudinal ram applies a 16,000 N compressive load on the latch at a displacement rate of 1.0 cm/min.
3. After reaching the longitudinal load of 16,000N, compliance is achieved by maintaining the load and not separating for at least 10 seconds

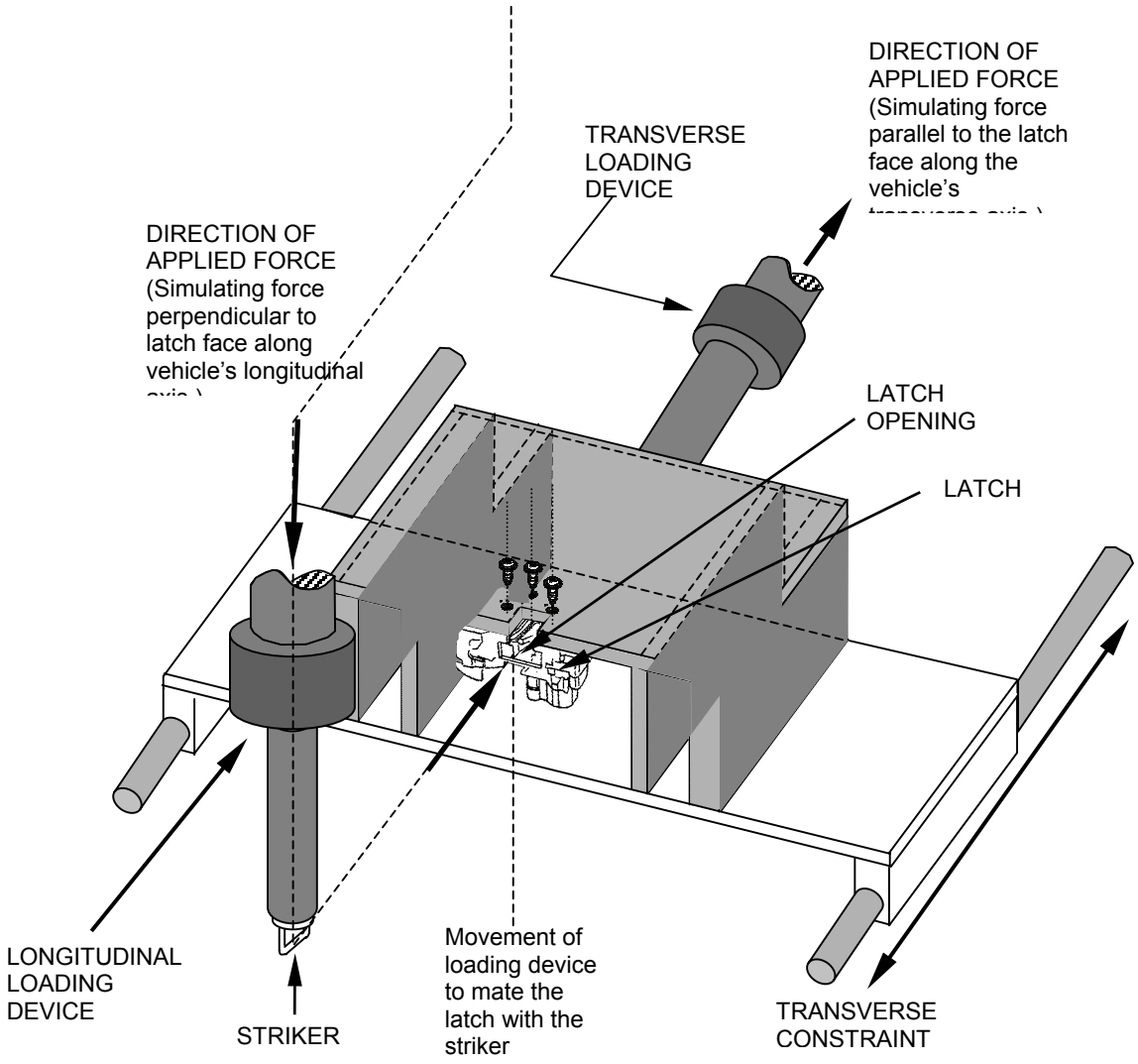


FIGURE 1 – Combination Loading Test
(Note, Figure being updated)

(Procedure

[Appendix 4 – Hinge Test Procedure]

1. **Purpose**. These test are conducted to determine the ability of the vehicle hinge system to withstand a test load in the longitudinal and lateral vehicle direction.

2. Definitions

2.1. Hinge System—That system used to position the door relative to the body structure and control the path of the door swing for passenger ingress and egress.

2.2. Hinge Assembly—That portion of the hinge assembly comprised of a pair of pivotally interconnected hinge members.

2.3. Hinge Components

2.3.1. Door Member—That portion of the hinge assembly normally affixed to the door structure and constituting the swinging member.

2.3.2. Body Member—That portion of the hinge assembly normally affixed to the body structure and constituting the fixed member.

2.3.3. Hinge Pin—That portion of the hinge assembly normally interconnecting the body and door members and establishing the swing axis.

3. Basic Requirements

3.1. Longitudinal Load—A vehicle passenger door hinge system, when tested as prescribed under test procedure in 5.1, must be capable of withstanding an ultimate longitudinal load of 11,000 N.

3.2. Transverse Load—A vehicle passenger door hinge system, when tested in accordance with the test procedures in 5.2, must be capable of withstanding an ultimate transverse load of 9,000 N.

4. Test Procedure

4.1. Multiple Hinge Evaluation

4.1.1. Longitudinal Load Test

4.1.1.1. Equipment

4.1.1.1.1. Tensile testing machine.

4.1.1.1.2. A typical static test fixture is illustrated in Figure 1.

4.1.1.2. Procedure.

4.1.1.2.1. Attach a test fixture to the mounting provision of the hinge system. Hinge attitude must simulate vehicle position (door fully closed) relative to the hinge centerline. For test purposes, the distance between the extreme ends of one hinge in the system to the extreme end of another hinge in the system is to be set at 406 mm. The load is to be applied equidistant between the linear center of the engaged portions of the hinge pin and through the centerline of the hinge pin in the longitudinal vehicle direction.

4.1.1.2.2. Apply the test load at a rate not to exceed 50 mm/min until failure. Failure to consist of separation of either hinge. Record maximum load.

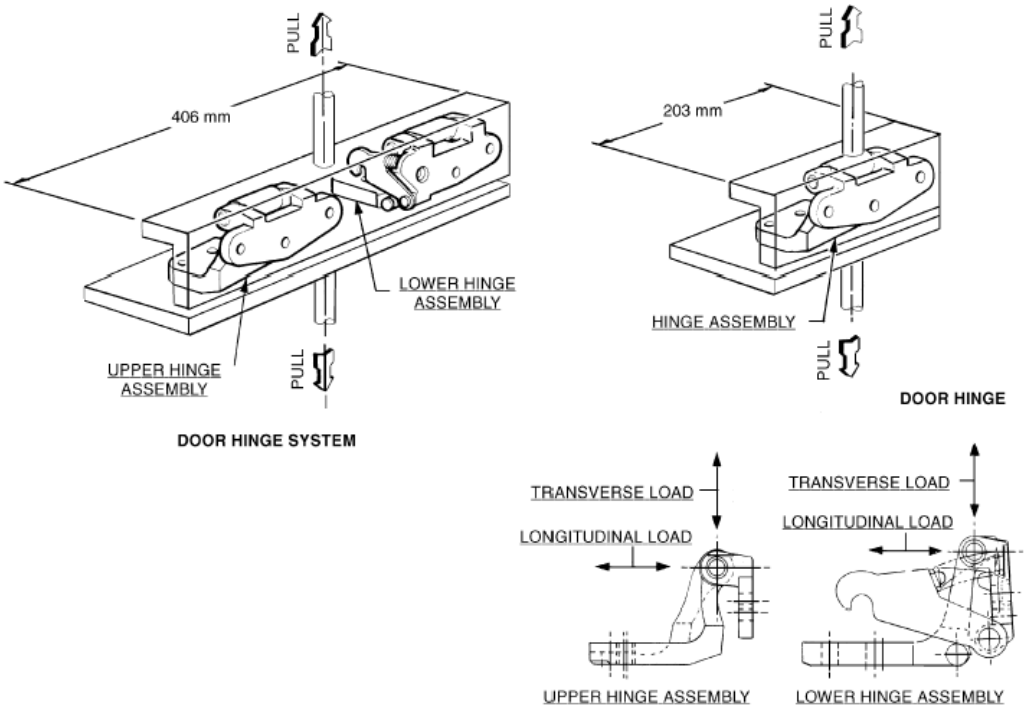


FIGURE 1—STATIC LOAD FIXTURES (TRANSVERSE LOAD)

4.1.2. Transverse Load Test

4.1.2.1.Equipment

4.1.2.1.1. Tensile testing machine.

4.1.2.1.2. A typical static test fixture is illustrated in Figure 1.

4.1.2.2. Procedure

4.1.2.3. Attach the test fixture to the mounting provisions of the vehicle hinge system. Hinge attitude must simulate vehicle position (door fully closed) relative to the hinge centerline. For test purposes, the distance between the extreme ends of one hinge in the system to the extreme opposite end of another hinge in the system is to be set at 406 mm. The load is to be applied equidistant between the linear center of the engaged portions of the hinge pins and through the centerline of the hinge pin in the transverse vehicle direction.

4.1.2.4. Apply the test load at a rate not to exceed 50 mm/min until failure. Failure to consist of separation of either hinge. Record maximum load.

4.2. **Single Hinge Evaluation.** In some circumstances, it may be necessary to conduct evaluations of individual hinges in a hinge system. In such cases, the results for an individual hinge, when tested in accordance with the procedures below, shall be such as to indicate that system requirements in 3.1 and 3.2 are met. (For example, an individual hinge in a two-hinge system must be capable of withstanding 50% of the load requirements of the total system.)

4.2.1. Test Procedures

4.2.1.1. Longitudinal Load—Attach a test fixture to the mounting provision of the hinge. Hinge attitude must simulate the vehicle position (door fully closed) relative to the hinge centerline. For test purposes, the load is to be applied equidistant between the linear center of the engaged portions of the hinge pin and through the centerline of the hinge pin in the longitudinal vehicle direction. Apply the test load at a rate not to exceed 50 mm/min until failure (failure to consist of separation of either hinge). Record maximum load.

4.2.1.2. Transverse Load—Attach the test fixture to the mounting provision of the vehicle hinge. Hinge attitude must simulate the vehicle position (door fully closed) relative to the hinge centerline. For test purposes, the load is to be applied equidistant between the linear center of the engaged positions of the hinge pin and through the centerline of the hinge pin in the transverse vehicle direction. Apply the test load at a rate not to exceed 50 mm/min until failure (failure to consist of separation of either hinge). Record maximum load.

[Appendix 5
Longitudinal Full Door Test]

1. Test Equipment

The test equipment consists of:

1. Two linear hydraulic actuators (hydraulic rams).
2. Two load cells with the load capacity to withstand shear loading that may be occurring
3. Two linear string potentiometers
4. A servo controller

2. Test Setup

The door is mounted to a section of 3/8-inch thick angle iron (approximately 5 foot long) mounted vertically to a support fixture. The support fixture has horizontal slots milled into the mounting plate while the angle iron has vertical slots milled into one face of the section. These slots allow for the adjustment of the vertical and horizontal positions as well as the roll angle of the door. An illustration of the device is shown in Figure 1.

The door is mounted to the post using the door hinges. Holes are drilled as needed into the flange of the angle iron to accommodate the door hinges. The pitch angle of the door is determined by where the hinges are mounted on this "door post". The pitch angle is adjusted so that the latch is oriented vertically (within $\pm$ 5 degrees).

This procedure will typically require that a unique set of boltholes be drilled in the angle iron "door post" for each model of door to be tested. The goal is to attach the door to a rigid mount so that, as far as feasible, the loading conditions on the various doors to be kept constant and to ensure that displacement and failure would occur at the door latch. By using specifically drilled holes matched to an appropriate bolt size and using a 3/8" thick piece of metal in which a shear load is applied to hold the door, there should be minimal movement or distortion of the door due to potential slippage of the mounting points or deformation of the mounting structure.

The longitudinal actuator consists of a 3-inch diameter hydraulic ram with a 25,000-pound load cell mounted along the load axis. A steel shaft with the striker is threaded into the end of the load cell. A string potentiometer is used to measure displacement of the actuator.

The longitudinal actuator is adjusted so that the striker is aligned with the door latch and normal operation of the door latch is possible (the door opens and latches normally). For the test, the door is closed so that the door latch engages the striker as designed. The door is left unlocked and the "security" lock is not engaged.

The lateral actuator consists of a 3-inch diameter hydraulic ram with a 25,000-pound load cell mounted along the load axis. A steel shaft with a 3x5 inch loading plate is threaded into the end of this load cell. The loading plate is aligned with the inner edge of the latch opening. During testing, the door tends to exhibit some lateral distortion due to deformation in the hinges or in the body of the door. As a result the loading point of the lateral actuator tends to move or "slip" forward in relation to the latch. If precautions are not taken, then in some extreme cases, this

movement can allow the loading plate to slip off of the structural components of the inner door and push directly against the linkage rods connecting the door latch to the latch handles causing premature latch activation. The 225-pound lateral load is applied to help identify a definite failure of the door latch, as the door will tend to spring open when the latch fails.

3. Pre-test Conditions

1. The door is mounted to the angle iron such that the door is positioned vertically in the roll axis and the door around the latch is positioned vertically along the pitch axis. The internal padding/insulations/ decorative panels are removed from the door before testing.
2. The longitudinal actuator, with the striker mounted in line with the load cell, is positioned at the correct height and placement to fully engage the door latch.
3. The door is "shut", in such a manner as to fully engage the door latch with the striker.
4. The door is not locked and the security lock is not engaged.
5. The lateral ram with the 3"x5" loading plate is run up to the door at the latch point. The outer edge of the loading plate is placed as close to the latch as possible without jeopardy of accidentally interfering with the movement of the striker or the fork bolt of the latch during the test. Typically this means aligning the outer edge of the loading plate with the inner edge of the latch opening.

4. Test Procedure

1. The lateral ram loads the door/latch assembly to 1,000 N and maintains this load throughout the course of the test.
2. After reaching the lateral load of 1,000 N, the longitudinal ram moves the striker away from the latch, causing tension at the interface, at a rate of 2 cm per minute until a force of 17,000 N
3. After reaching the longitudinal load of 17,000N, compliance is achieved by maintaining the loads and not separating for at least 10 seconds

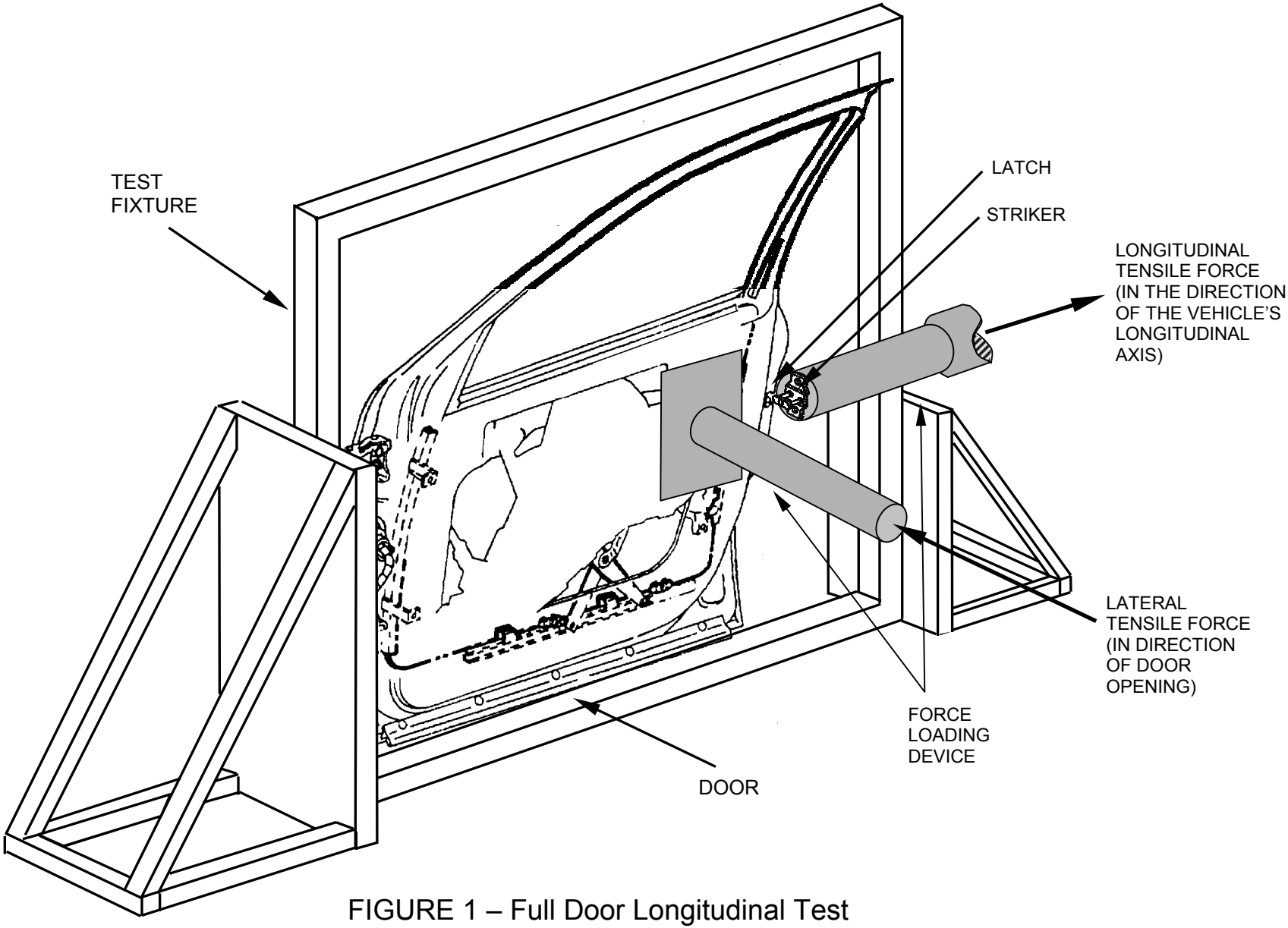


FIGURE 1 – Full Door Longitudinal Test Procedure
(Note, Figure being updated)

[Appendix 6
Lateral Full Door Test]

Test Equipment
The test equipment consists of:

1. Two linear hydraulic actuators (hydraulic rams).
2. Two load cells with the load capacity to withstand shear loading that may be occurring
3. Two linear string potentiometers
4. A servo controller

1. Test Setup

The door is held rigidly in place while the striker, attached to a linear actuator (hydraulic ram), loads the latch assembly in tension (in the direction of door opening).

The door is mounted to the angle iron of the door pillar in the same manner as outlined for the longitudinal full door test (see Figure 1). The motion of the door is restrained by a 250mm x 588mm loading plate rigidly mounted to prevent rotational movement of the door about it's hinges or lateral movement due to loading from the actuator. The striker is securely attached to a metal fixture that is installed in line with the load cell to the hydraulic actuator. Place the loading plate approximately 1 inch from the forward edge of the latch opening.[3]

2. Pre-Test Conditions

1. The door is mounted to the angle iron such that the door is positioned vertically in the roll axis and the door around the latch is positioned vertically in the pitch axis. The internal decorative panels are removed from the door before testing.
2. The "lateral" actuator, with the striker, is adjusted to the correct height and position in relation to the door.
3. The door is "shut", in such a manner as to fully engage the door latch with the striker.
4. The loading plate is positioned approximately one inch forward of the latch opening. This loading point is marked on the door and documented for future reference.
5. The door is unlocked (the security lock is not engaged).

3. Test Procedure

1. The ram is retracted at a constant displacement rate of 2.0 cm/min applying a lateral tensile force of 14,000 N to the door near the door latch.
2. After reaching the lateral load of 14,000N, compliance is achieved by maintaining the load and not separating for at least 10 seconds

[3] The fore and aft (longitudinal) placement of the loading pad has a potentially significant effect on the interactive door/door latch response. The closer the loading plate is positioned to the latch, the less effect deformation, mounting points, etc. of the door has on the test results, thus eliminating the need for a full door test.

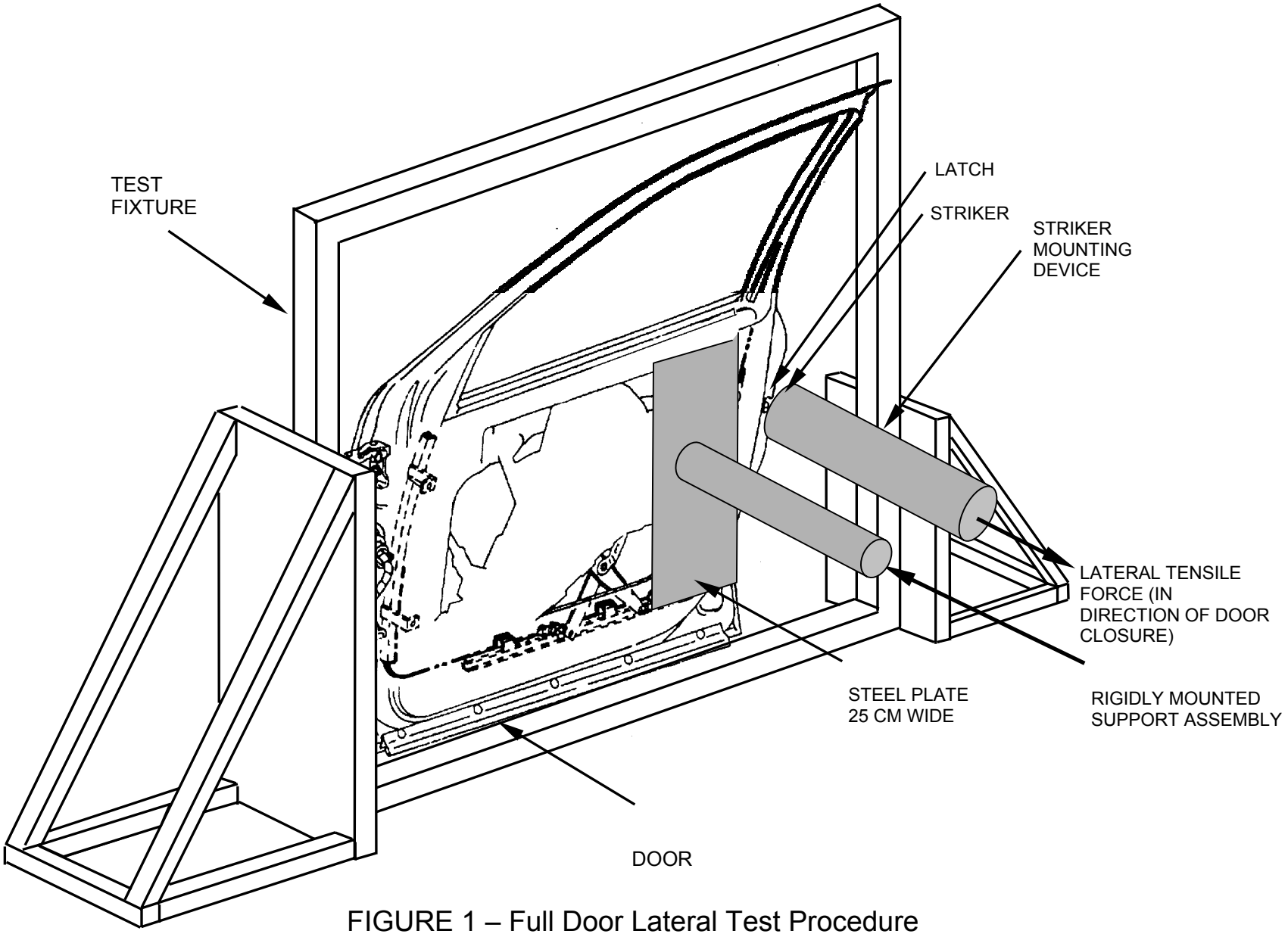


FIGURE 1 – Full Door Lateral Test Procedure
(Note, Figure being updated)

[Appendix 7
Sliding Side Door
Full Door Test]

1. General Provisions.
   1.1. Tests are conducted using a full vehicle or a vehicle in white with the sliding door and its retention components.
   1.2. The test is conducted using two force application devices capable of applying the outward lateral forces specified in 5.2.4. The force application system shall consist of two plates, two load cells capable of measuring the applied force specified in 5.2.4, two linear displacement measurement devices, and equipment for recording the applied force and displacement rate. The test setup is shown in Figure 1.
2. Test Setup
   2.1.1. Remove all interior trim and decorative components from the sliding door assembly.
   2.1.2. Remove seats and any interior components that may interfere with the mounting and operation of the test equipment.
   2.1.3. Mount the force application devices and associated support structure to the floor of the test vehicle.
   2.1.4. Determine the forward and aft edge of the sliding door, or its adjoining vehicle structure, that contains a latch/striker.
   2.1.5. For any tested door edge that contains one latch/striker, the following set-up procedures are used:
      2.1.5.1. The force application plate is 150 mm in length and 50 mm in width.
      2.1.5.2. Place the force application device and force application plate against the door so that the applied force is horizontal and normal to the vehicle's longitudinal centerline, and vertically centered on the door-mounted portion of the latch/striker.
      2.1.5.3. The force application plate is positioned as close to the edge of the door as possible. It is not necessary for the force application plate to be vertical.
   2.1.6. For any tested door edge that contains more than one latch/striker, the following set-up procedures are used:
      2.1.6.1. The force application plate is 300 mm in length and 50 mm in width.
      2.1.6.2. Place the force application device and force application plate against the door so that the applied force is horizontal and normal to the vehicle's longitudinal centerline, and vertically centered on a point mid-way between the outermost edges of the latch strikers.
      2.1.6.3. The force application plate is positioned as close to the edge of the door as possible. It is not necessary for the force application plate to vertical.
   2.1.7. For any tested door edge that does not contain at least one latch/striker, the following set-up procedures are used:
      2.1.7.1. The force application plate is 300 mm in length and 50 mm in width.
      2.1.7.2. Place the force application device and force application plate against the door so that the applied force is horizontal and normal to

the vehicle's longitudinal centerline, and vertically centered on a point mid-way along the length of the door edge ensuring that the loading device avoids contact with the window glazing.

2.1.7.3. The force application plate is positioned as close to the edge of the door as possible. It is not necessary for the force application plate to be vertical.

2.1.8. The door is unlocked. No extra fixtures or components may be welded or affixed to the sliding side door or any of its components.

3. Test Procedure

3.1. Close the sliding door, ensuring that all door retention components are fully and properly engaged.

3.2. Place the load application structure so that the force application plates are in contact with the interior of the sliding door.

3.3. Move both force application devices at a rate of 5 mm per minute until a force of 9,000 N is achieved on each ram or until the ram displaces 460 mm from their initial position.

3.4. If one of the force application devices reaches the target force of 9,000 N prior to the other, maintain the 9,000 N force with that force application device until the second force application device reaches the 9,000 N force or 460 mm of displacement.

3.5. Once the combined target force of 18,000 N is achieved, hold the force minimum of 10 seconds.

4. Test Equipment

The test equipment consists of:

1. A vehicle structure, complete with sliding doors assembly and all door-retention and load-bearing components.
2. Two loading devices, or rams, capable of applying the outward transverse load requirements
3. Two load cells of sufficient capacity to measure the applied load
4. Two linear displacement measurement devices required for measuring ram displacement during the test. [Note: Deflection measurements are necessary if the load is to be applied at a constant displacement rate, or if maximum displacement is a criterion.]
5. Equipment for measuring and recording the applied load and the ram displacement rate.

5. Pre-test Setup

1. Remove all interior trim and decorative components from the sliding door assembly.
2. Remove seats and any interior components, which may interfere with the mounting and operation of test equipment.
3. The rams and associated support structure are mounted rigidly to the floor of the test vehicle.
4. The load application structure shall consist of two loading plates.
5. Determine the forward and aft edge of the sliding door (or its adjoining vehicle structure), which contains a compliant latch/striker. The door edge

containing such a latch/striker, and the opposite door edge, are to be tested. If adjacent door edges contain a compliant latch/striker, either side, and its opposite, may be tested.

6. For forward and aft door edge to be tested that contains exactly one compliant latch/striker, the following set-up procedures are to be used:
    a. The loading plate shall be 152 millimeters (6 inches) in length and 51 millimeters (2 inches) in width.
    b. Locate the loading device and loading plate such that the applied load will be horizontal, normal to the vehicle's longitudinal centerline, and centered on the door-mounted portion of the compliant latch/striker. Any non-compliant door retention components on this door edge are to be ignored in this set-up.
    c. The loading plate should be positioned as close to the edge of the door as possible. It is not necessary for the loading plate to be vertical.
7. For any door edge to be tested that contains more than one compliant latch/striker, the following set-up procedures are to be used:
    a. The loading plate shall be 304 millimeters (12 inches) in length and 51 millimeters (2 inches) in width.
    b. Locate the loading device and loading plate such that the applied load will be horizontal, normal to the vehicle's longitudinal centerline, and centered on a point mid-way between the outermost compliant latch/strikers. Any non-compliant door retention components on this door edge are to be ignored in this set-up.
    c. The loading plate should be positioned as close to the edge of the door as possible. It is not necessary for the loading plate to be vertical.
8. For any door edge to be tested that does not contain at least compliant latch/striker, or that contains only non-compliant door retention components, the following set-up procedures are to be used:
    a. The loading plate shall be 304 millimeters (12 inches) in length and 51 millimeters (2 inches) in width.

6. Test Procedure

1. After the sliding door is closed, and the load application structure is placed so that the force application plates are in contact with the interior of the sliding door, both force application devices are moved at a rate of 5 mm per minute until a force of 9,000 N is achieved on each ram or until the rams displace 460 mm from their initial position.
2. If one of the force application devices reaches the target force of 9,000 N prior to the other, 9,000 N force is maintained with that force application device until the second force application device reaches the 9,000 N force or 460 mm of displacement. After reaching the combined target force of 18,000 N, compliance is achieved by maintaining the load and not separating for at least 10 seconds

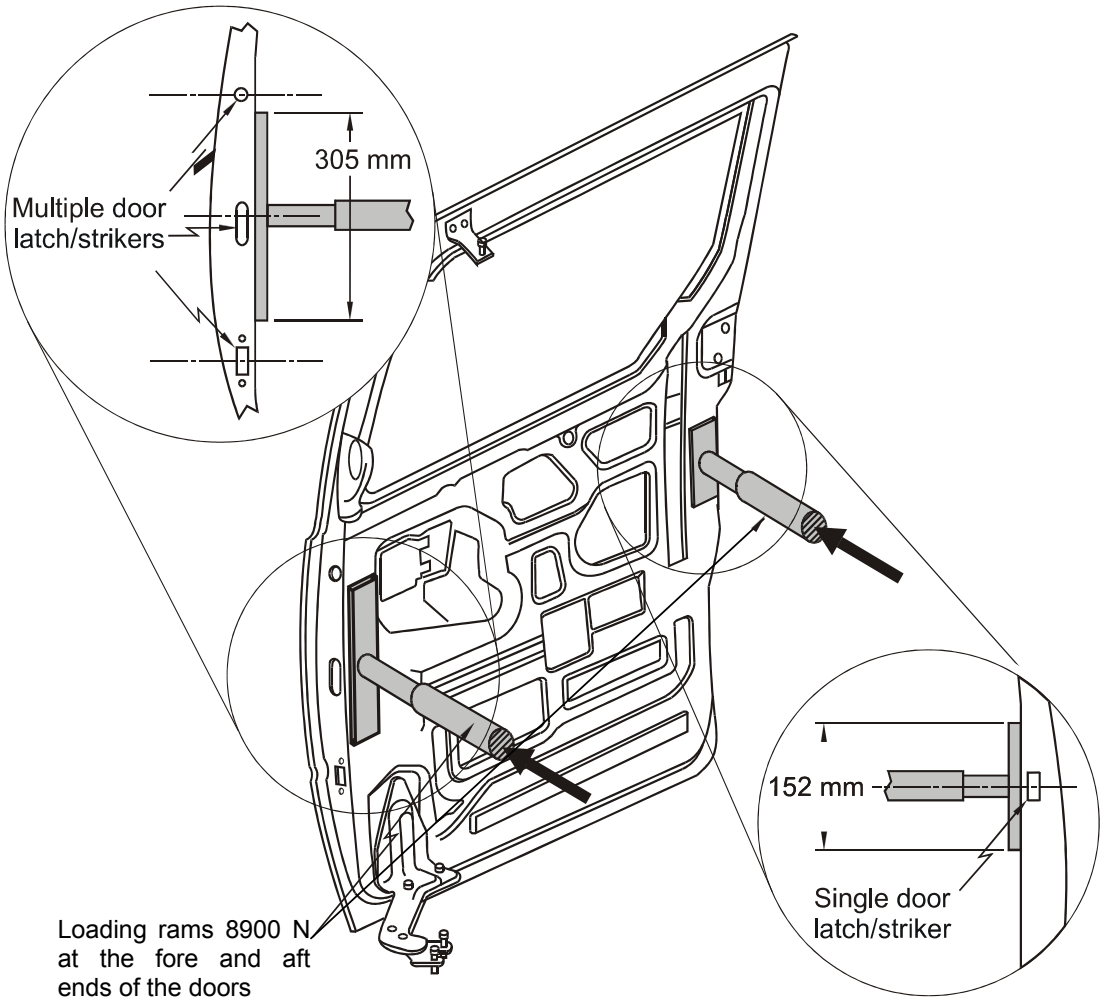


FIGURE 4 – Sliding Door Full Vehicle Test Procedure
(Note: Sliding door is shown separated from the vehicle.)