



Side Door Strength

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. To determine if the side doors of a passenger vehicle are consistent with the requirements of:

1.1.1 Federal Motor Vehicle Safety Standard FMVSS 214 as amended in the Federal Register.

1.1.2 Canada Motor Vehicle Safety Standard CMVSS 214 as published in the Canada Gazette.

1.1.3 Gulf States Standards GSO 38 and GSO 40.

1.1.4 Australia ADR 29.

1.1.5 Korea KMVSS 104.

1.2 Applicability.

1.2.1 All passenger cars, except as provided in 1.2.4.

1.2.2 Effective for at least 90% of multipurpose passenger vehicles, trucks and buses with a Gross Vehicle Weight Rating (GVWR) of 4545 kg or less, manufactured on or after September 1, 1993, and before September 1, 1994 (except as provided in section 1.2.4). See CMVSS 214, S9 and FMVSS 214, S9 for details.

1.2.3 Effective September 1, 1994, for all multipurpose passenger vehicles, trucks, and buses, with a GVWR of 4536 kg or less, except as provided in 1.2.4.

1.2.4 This specification is not applicable to walk-in vans or:

1.2.4.1 Any side door located so that no point on a 254 mm horizontal longitudinal line passing through and bisected by the H-Point of a manikin placed in any seat, with the seat adjusted to any position and the seat back adjusted to any position, as specified in Section S8.4 of the Federal Safety Standard, falls within the transverse, horizontal projection of the door's opening.

1.2.4.2 Any side door located so that no point on a 254 mm horizontal longitudinal line passing through and bisected by the H-Point of a manikin placed in any seat recommended by the manufacturer for installation in a location for which seat anchorage hardware is provided, with the seat adjusted to any position and the seat back adjusted as specified in section S8.3 of the Federal Safety Standard, falls within the transverse, horizontal projection of the door's opening.

1.2.4.3 Any side door located so that a portion of a seat, with the seat adjusted to any position and, the seat back adjusted as specified in Section S8.3 of the Federal Safety Standard, falls within the transverse. Horizontal projection of the door's opening, but a longitudinal vertical plane tangent to the outboard side of the seat cushion is more than 254 mm from the innermost point on the inside surface of the door at a height between the H-point and shoulder reference point (as shown in Figure 1 of CMVSS 210 and FMVSS 210), longitudinally between the front edge of the cushion with the seat adjusted to its forward-most position and the rear edge of the cushion with the seat adjusted to its rear-most position.

1.2.4.4 Any side door that is designed to be easily attached to or removed, (e.g., using simple hand tools such as pliers and/or a screw driver) from a motor vehicle manufactured for operation without doors.

1.2.4.5 On multipurpose passenger vehicles, trucks, and buses manufactured before September 1, 1994 and double side doors.

1.2.4.6 On multipurpose passenger vehicles, trucks, and buses manufactured before September 1, 1994, any doors without one (1) or more windows.

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1.2.4.7 On multipurpose passenger vehicles, trucks, and buses manufactured before September 1, 1994, any doors for which the ratio of the width of the lowest portion of the door to the width of the door at its widest point is not greater than 0.5. The width of the door is measured in a horizontal plane and on the outside surface of the door. The lowest portion of the door is that portion of the lower edge which is lowest to the ground and which is essentially horizontal.

1.3 Remarks.

1.3.1 CMVSS and FMVSS allow testing with or without seats (refer to CMVSS 214 paragraph 2 and FMVSS 214 S6.1 and S6.2). However, testing with seats requires that higher intermediate and peak loads are met. Gulf Standards and Australia require testing without seats. Thus, testing with seats results in higher load requirements and is not compatible with GSO 38, GSO 40, and ADR 29.

1.3.2 A week prior to scheduled testing, the Requesting Engineer will provide the testing facility a completed Test and Vehicle Review Form, (e.g., CG583 form for GMNA). This form is a final check for the requesting vehicle platform to ensure the intended material is tested and to provide necessary data for the test report.

As part of the Test and Vehicle Review Form, (e.g., CG583 form for GMNA), the Requesting Engineer shall determine the desired distance the load device travels during the test. Consider the following when making a decision:

Option 1. Stop the load device at 457.2 mm of travel. The entire 457.2 mm load device travel may help identify ultimate strength, correlation to the CMVSS 214 and FMVSS 214 dynamic test, etc. This option may be appropriate for the initial test in a series or if only one (1) test will be run. This option is available for development and certification tests.

Option 2. Stopping the load device after both 304.8 mm of travel and peak load legal and platform requirements have been met, may:

- Reduce damage to test bodies scheduled for further testing.
- Reduce possible excessive loading to test fixture and equipment.

Option 2 is available for development and certification tests.

Option 3. Stopping the load device at any travel, other than those stated in Options 1 or 2, is appropriate only for developmental tests. For example, tests to only 152.4 mm of travel may be run if several design alternatives need to be evaluated at this initial crush distance. This option does not satisfy all three (3) CMVSS and FMVSS crush resistance measurement requirements.

1.3.3 This specification covers only the static portion of CMVSS 214 and FMVSS 214. The CMVSS 214 and FMVSS 214 sections relating to dynamic impact performance are in GMW15097.

Note: The following other documents referenced in this procedure include:

- GM Reference Manual for Legal Standards, CMVSS 210 and CMVSS 214 and FMVSS 210 and FMVSS 214. See Section 4.1.
- GMW15474.
- GM Worldwide Vehicle Regulation Manual. See 4.1.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ADR 29	FMVSS 210	GSO 40
CMVSS 210	FMVSS 214	KMVSS 104
CMVSS 214	GSO 38	NHTSA TP-214-s05

Note: NHTSA TP-214-s05 may be found here: <http://www.nhtsa.gov/Vehicle+Safety/Test+Procedures>

2.2 GM Standards/Specifications.

GMW15474 (ID)

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the GM Lead Engineer for further instructions.

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2.3 Additional References.

- CG583 Test and Vehicle Review, Global Document Management (GDM) Standard Forms and Templates
- CG2915 Pre-Test Checklist for Test Ready Properties in GDM Standard Forms and Templates
- GM Reference Manual for Legal Standards
- GM Worldwide Vehicle Regulations Manual

3 Resources

3.1 Facilities. Recognized General Motors body test facilities are the GMNA Structural Development Laboratory (SDL). (There may be additional test facilities in the other regions, but their proper names are not available at this time.)

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

Note: To better understand the necessary test equipment, read 4.1 and 4.3 for a description of what the test equipment must accomplish.

3.2.1 Test Fixture. A device that is capable of restraining a body or vehicle during testing.

3.2.2 Load Device. A rigid steel cylinder or semi cylinder measuring 304.8 mm in diameter with an edge radius of 12.7 mm. Length of the load device must be sufficient to attain a 12.7 mm minimum overlap with bottom edge of the door window opening. See Figure A1. However, it must not be of a length to cause contact with any structure above the bottom edge of the window opening during the test.

3.2.3 Actuator/Guide Mechanism. That is used to propel the load device a distance of 457.2 mm. The load device must be guided to prevent it from being rotated or displaced from its direction of travel. The load device travel rate must not exceed 12.7 mm/s. The test must be completed within 120 s.

The actuator should be set to allow the "no load" travel rate of the load device to be near the 12.7 mm/s limit. This will reduce the probability that the test is not completed within 120 s under load. The actuator may be either mechanical or hydraulic, and capable of generating force required to satisfy all test requirements (5.4.1 Legal Requirements).

3.2.4 Load Cell(s). A device to measure the force exerted on the door by the load device.

3.2.5 Load Device Displacement Transducer. A transducer that is capable of continuously measuring the displacement of the load device over a range of 457.2 mm.

3.2.6 Fixture Displacement Transducer. A transducer that is capable of continuously measuring the displacement of the rigid horizontal surface against the body rocker panel during test.

3.2.7 Signal Conditioner. A device used with the load cell and displacement transducers that produce a continuous, recordable signal proportional to the load and motion of the load device.

3.2.8 Recorders.

3.2.8.1 A device that will record load vs. displacement of the load device continuously for the entire crush distance of 457.2 mm.

3.2.8.2 A device that will record displacement vs. time of the load device continuously for the entire crush distance of 457.2 mm.

3.2.9 Computer (Optional). A device that will record and store the test data for future reference or original reproduction. The device can be used to determine Crush Resistance and the Device Load Rate.

3.2.10 Video Recording Equipment (Optional).

3.2.11 Camera 35 mm or Equivalent.

3.2.12 Additional recorders and data acquisition equipment (optional).

3.2.13 Torque Wrench.

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Note: All instrumentation is to be calibrated as required; record instrumentation details and date of calibration on Data Sheet A1 Instrument Calibration, unless the information is otherwise preserved in the testing laboratory records.

3.3 Test Vehicle/Test Piece. See Pre-Test Checklist for Test Ready Properties in GDM under document number CG2915.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Test personnel should thoroughly understand the test equipment and procedure being used to conduct the test.

3.7 Development/Validation Items. Test Materials/Components.

3.7.1 A body or vehicle equipped with all glass (optional, but preferred). If testing a sedan, the adjacent door on the test side shall be closed and locked to support the B-Pillar. Additional door hardware and trim are not required at this location.

The test door shall be selected by the responsible engineer if right hand (RH) and left hand (LH) doors or body structure are not symmetrical. Remember when making a selection that all makes/models of a platform must be validated. Consideration must be given to the design and option content if only one (1) make is to be tested. Option content impacts vehicle weight which establishes test requirements. The selected test door shall include glass, hardware, (i.e., locks, module back plate, etc.) primary seal and worst case body side moldings. A body side molding offering the smallest resistance to an applied load is considered worst case, (e.g., deep, hollow moldings). If a test door body side molding is the initial load device contact point, and it is not available, the ram initial position must simulate its presence with an air gap to ensure a worst case condition.

3.7.2 The body must have the test-side seats removed unless using the “test with seats” option (refer to CMVSS 214 paragraph 2 and FMVSS 214 S6.2). See 1.2.1 for options.

3.7.3 The standard lab practice is to remove the steering wheel, instrument panel, outboard rocker mounted seat belt retractors and door inner trim panel to ensure a worst case test condition and test to test correlation.

Note: Verify and document that the test material is correct by having the appropriate engineers “sign off” on a Test and Vehicle Review Form, (e.g., CG583 form for GMNA).

4 Procedure

4.1 Preparation.

4.1.1 Inspect test equipment for calibration and proper operation. Note that each calibration should include a system verification which includes loading the ram near its top, bottom, and middle points with a reference load cell and comparing the systems output to the reference. This is to ensure that the test rig is working properly as a system.

4.1.2 Visually inspect entire body and test door with special attention to the body side frame and door opening. Structural damage in these areas is typically not acceptable. Record data on Data Sheet A2 whether seats are removed. Report any missing major body components such as windshield, decklid, liftgate, backlite, etc.

Note: Structural damage incurred on a non-test side, due to previous testing, may be accepted at the judgment of the responsible engineer. Document significant damage on Data Sheet A2.

4.1.3 Check test-side door systems for proper operation. The movable windows should be operable without binding. The doors should open/close and lock/unlock properly. Set the door torques, noted on Test and Vehicle Review Form, (e.g., CG583 form for GMNA), to the nominal specifications.

4.1.4 Completely close and lock all test-side window(s) and door(s).

4.1.5 If testing with seats, see CMVSS 214 paragraph 2 and FMVSS 214 S6.2.

4.1.6 Scribe a horizontal line from a rear door to the quarter panel at the door lock height (Figure A2). This line is to measure the relative movement between the door and body structure, which may be caused when tying the body down to the fixture in 4.1.8. Alignment is evaluated in 4.1.10.

4.1.7 Determination of Load Device Location.

4.1.7.1 Draw a horizontal line on the outer surface of the door 127 mm above the lowest point of the door. If a molding is the lowest point of the door and it is not permanently affixed; remove it for the purpose of making the

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