



Door Beam Bending Strength Test

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. This procedure is used to determine the energy absorption characteristics of door beams for comparative analysis.

1.2 Applicability. This procedure applies to all passenger cars, light duty trucks, and medium duty trucks having door beams or similar applications which use beams as part of their structure.

1.3 Remarks. This procedure is related to static FMVSS 214 testing (reference GMW15140) and uses similar terminology and techniques.

2 References

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

2.1 External Standards/Specifications.

FMVSS 214

2.2 GM Standards/Specifications.

GMW15140

2.3 Additional References.

- CG190 GM Evaluation Report Template
- SSTS - 55.01.01, Front Side Door SSTS
- SSTS - 55.01.02, Rear Side Door SSTS
- VTS - 3.2.1.3, Crash Worthiness and Occupant Protection

3 Resources

3.1 Facilities.

Major Facility: The facility should have all of the equipment listed in 3.2 and be capable of providing the conditions required in 4.2.

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: The following includes fixturing and instrumentation typically used to perform this test. Other equipment may be substituted at the discretion of the testing facility as long as it provides the same data and/or data record with equivalent accuracy as specified herein or by the requestor.

3.2.1 Fixturing. See Figure A1 and Figure A2 in Appendix A.

3.2.1.1 Test machine with 44.5 kN (10 000 lb) minimum capacity with the ability to record both load and displacement data.

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3.2.1.2 Two (2) test block supports. These fixtures allow the beam ends to move only in the direction of the beam's axis. They also incorporate springs to provide resistance to the allowed movement.

3.2.1.3 Steel semi-circular loading ram with 304.8 mm (12 in) diameter face and a minimum length of 400 mm.

3.2.1.4 Safety anchor cable or seat belt webbing for the beam, 3.175 mm x 50.8 mm x 914.4 mm ($\frac{1}{8}$ in x 2 in x 36 in) long.

3.2.2 Instrumentation.

3.2.2.1 Camera for setup photographs, if desired.

3.2.2.2 Data acquisition device that will record load and displacement of the load device vs. time continuously for a minimum of 152.4 mm (6 in). The data acquisition device should sample at a minimum of 100 points per second.

3.2.2.3 Load transducers 44.5 kN (10 000 lb) minimum capacity to measure the force exerted on the test piece by the load device and the forces exerted on each test block support by the fixture's springs.

3.2.2.4 Displacement transducers capable of continuously measuring the displacement of the load device over a range of 457.2 mm (18 in) and the displacement of each of the fixture's test block supports.

3.2.2.5 Signal conditioners used with the load cells and displacement transducers capable of producing a continuous, recordable signal proportional to the load and motion of the load device.

3.2.2.6 A computer (optional) or equivalent device capable of recording and storing the test data for future reference or original reproduction. This device can also be used to determine crush resistances and the load device load/travel rate.

3.3 Test Vehicle/Test Piece. There are two types of sample side door impact beams (long and short) to be used for the test. Long beams have a length of 900 mm or greater, while the length of short beams is less than 900 mm.

It is recommended that the test parts/assembly be dimensionally certified before testing is started. If beams include thermal setting adhesives; then the test part(s) must go through the production Electrophoretic Priming Operation (ELPO) and paint bake process prior to testing.

3.4 Test Time. The following is an estimate on the amount of time (work hours) needed to perform this procedure.

Note: These time estimates are approximate averages. Actual times vary considerably depending on early component failures (and subsequent availability of replacement parts), testing to varying multiples of cycle lives, varying requirements for frequency of environmental test conditions, scheduling problems for test facilities, test equipment malfunctions, scheduling of overtime and/or multiple shifts, scheduling of "witnesses" for tests, actual readiness of test samples upon receipt, unique or additional requests for detailed test information, running multiple samples (times shown are for one system), etc.

These times consider preparation and other downtime, actual test, and analysis of data in capturing a total calendar time. Report writing, approval, processing, etc., are not part of these times.

Calendar time:	1 d
Test hours:	0.5 h
Coordination hours:	4 h

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested (see 2.3).

The requesting engineer should identify the appropriate Designing Engineer (DE). The appropriate DE should provide the location of Point "K" and the details of how the beam ends are to be fastened to the Test Blocks.

Testing worst case scenarios may uncover some potential problems. Discuss with the requesting engineer if testing should include some worst case scenarios. Depending on which test is being performed and which level of parts or systems is being tested, consider if any of the following may apply: tolerance stack-ups, build variations, misalignment, minimum/maximum fastener torque(s), lubrication, environmental extremes, location of customer representative load application, symmetry (left hand vs. right hand), color, mold or die source, etc.

3.6 Personnel/Skills. Prior experience in setting up and running similar tests and experience in the use of the reference test equipment is critical to achieving the estimated times shown in 3.4.

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4 Procedure

4.1 Preparation.

4.1.1 Sample Inspection. The test and requesting engineers should inspect the test items to insure all material listed in 3.3 is of correct design level and assembled properly.

4.1.2 Sample Preparation. This test is normally run on the test subject in an as-received condition. If it is requested to be run in a specifically adjusted condition, follow the applicable procedure(s).

4.1.3 Facilities and/or Equipment Preparation. Record the instrumentation calibration information using CG190 GM Evaluation Report Template or an equivalent document.

4.2 Conditions.

4.2.1 Environmental Conditions. Unless otherwise specified in this document's text or by the requesting engineer, the typical environmental conditions for this test are the temperature, humidity and pressure at the major test facility described in 3.1. Unless otherwise noted, these conditions are typically $22^{\circ}\text{C} \pm 3^{\circ}\text{C}$, relative humidity of $40\% \pm 20\%$, and atmospheric pressure equivalent to the local barometric pressure (which is variable during any given day and from day to day).

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions. Note: Unless this test is being performed on a competitive vehicle, analysis data should be available for the test being performed. For correlation purposes, communication between test and analysis personnel must take place to ensure that the loading conditions, restraints, and measurement locations are consistent between the test and analysis procedures.

4.3.1 Setup Instructions.

4.3.1.1 Fabricate two beam support fixtures as depicted in Figure A1.

4.3.1.2 Fabricate front and rear test blocks to mimic the beam to inner panel overlap distance (support length of beam) as depicted in Figure A2 (will be provided by DE).

4.3.1.3 Using distance (R) (supplied by DE), mark Point (K) on the test sample as depicted on Figure A3.

4.3.1.4 Mount the 304.8 mm (12 in) diameter semi-circular ram to the upper platen (free rotation of ram head required).

4.3.1.5 The axial springs shall be attached to the vertical walls of the base (as shown in Figure A1) such that the springs are in line with a spring rate of 250 N/mm and both are constrained to translate only in the X direction (along the axis of the beam) as depicted in Figure A2.

4.3.1.6 Place the test sample on the test blocks and ensure Point (K) aligns with that of the upper platen ram centerline as depicted in Figure A2.

4.3.1.7 If beam is welded to the inner panel by design, drill 8 mm diameter holes through each weld location of the test sample.

4.3.1.8 Fix the ends of the beam to the test blocks in the location of each production intent weld using M8 bolt (11514766) with torque of $22\text{ Nm} \pm 3\text{ Nm}$ or the equivalent, or if beam is bolted to the inner panel by design, use production intent bolt.

4.3.2 Test Operation Instructions.

4.3.2.1 Take setup photographs if desired.

4.3.2.2 Turn on allied electronics at least 1 h before actual test.

4.3.2.3 Ensure that all transducers and data acquisition equipment are operating correctly.

4.3.2.4 Turn on all applicable actuator/guide mechanism propelling equipment.

4.3.2.5 Adjust the cylindrical face of the load device until it is 5 mm (air gap) from the test sample.

4.3.2.6 Zero the displacement and load transducers.

4.3.2.7 Activate all applicable recording equipment.

4.3.2.8 Using the load device, apply a load to the outer surface of the test sample in an inboard direction at a maximum of 12.7 mm/s (0.5 in/s).

4.3.2.9 Apply the load until the load device has

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