



RCAR Low Speed Bumper Damageability Override/Underride

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 assess damage extent when a vehicle is impacted into the Research Council for Automobile Repairs (RCAR) Deformable Barrier at low speed for Override/Underride only.

1.2 Applicability. This standard applies to vehicles as deemed appropriate by the individual program.

1.3 Remarks. This standard is the test procedure to assess the ability of the bumper systems to protect a vehicle in low speed front and rear collisions. It is intended to provide the process and methodology for the assessment of low speed bumper impact damage which is consistent with the procedure used by the insurance industry, and consistent within GM across all vehicle lines.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- Research Council for Automobile Repairs (RCAR) Bumper Test; available at www.rcar.org.

3 Resources

3.1 Facilities. The test facility shall be in good working order and have valid calibration records.

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.

3.2.1 Bumper Barrier. The bumper barrier is pictured in Figure 1 and described in Appendix 1 of the RCAR test document, available at www.RCAR.org.

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Figure 1: RCAR Barrier Test Device

3.2.1.1 The bumper barrier shall be mounted to a wall such that when struck by a vehicle, the surface and its supporting structure must absorb no significant portion of the vehicle's kinetic energy.

3.2.1.2 The approach to the bumper barrier must be a horizontal surface that is large enough for the vehicle to attain a stable attitude and speed before impact, and will not restrict vehicle motion during the impact.

3.2.2 Other Equipment.

3.2.2.1 Speed Transducer. A fifth (5th) wheel tachometer generator, light trap, or equivalent.

3.2.2.2 Tire Pressure Gage.

3.2.2.3 Vehicle Scale.

Note: All instrumentation is to be calibrated as required. Record instrumentation details and date of calibration using the form in Appendix A, Data Sheet A1, unless the information is otherwise preserved in the testing laboratory records.

3.3 Test Vehicle/Test Piece. Components and vehicles used for this test must be representative of production.

3.4 Test Time.

Calendar time:	2 d
Test time:	4 h
Coordination time:	4 h
Damage Estimator:	8 h

3.5 Test Required Information. Bumper heights to ground for Nominal Curb Mass plus 1 passenger. Nominal curb mass with full tank of fuel.

3.6 Personnel/Skills. Test technician familiar with test facilities and equipment.

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4 Procedure

4.1 Preparation.

4.1.1 Vehicle Selection. A saleable vehicle is required for official (TIC) classification. However, a representative non-saleable vehicle may be used for development testing. The model, body style, etc. should be determined with the GM RCAR team. Record the vehicle identification on Appendix B, Data Sheet B1.

4.1.2 Vehicle Preparation. The following shall be performed on the vehicle before testing.

4.1.2.1 Body Inspection. Remove the front and rear bumper systems from the vehicle and inspect for damage in vehicle components that are not visible with the bumper system installed. Note any damage in Appendix B, Data Sheet B2.

4.1.2.2 Bumper System. The bumper system shall be assembled to the vehicle within production specifications. Assemble fasteners to torque specifications and record in Appendix B, Data Sheet B2.

4.1.2.3 Trailer hitches, unless integral to the bumper impact bar, and license plate brackets, are removed from the vehicle, and record removal in Appendix B, Data Sheet B3.

4.1.2.4 Optional equipment that is mounted to the bumper system may be removed at the test engineer's discretion. Optional equipment could be removed to test the worst case vehicle configuration, and record in Appendix B, Data Sheet B3.

4.1.2.5 Tires are inflated to the vehicle manufacturer's recommended pressure for the specified loading condition, and record in Appendix B, Data Sheet B4.

4.1.2.6 Weigh the vehicle and, if necessary, ballast to the model under consideration. The vehicle to be tested should be at the vehicle manufacturer's nominal curb weight plus the weight of fuel and additional test devices as stated. Add 80 kg mass to the driver's seat to simulate an occupant. Record the weight of the vehicle at each tire in Appendix B, Data Sheet B4.

4.1.2.7 All vehicle lights, sound system, wipers, and climate control to be off except for Daytime Running lamps.

4.1.2.8 Vehicle to be in **neutral** with the park brake released and the ignition switch in the **ON** position. The engine should not be running.

4.1.3 Vehicle Inspection.

4.1.3.1 Photograph Vehicle. The vehicle shall be photographed in the pretest condition.

4.1.3.2 Vehicle Condition. The vehicle shall be inspected prior to testing. Components that are damaged should be assessed by the GM Validation engineer to determine if it will affect the test results. Replace components as necessary.

4.1.3.2.1 Exterior Vehicle Surfaces. Inspect the following exterior vehicle surfaces for damage such as dents, cracks, and breakage. Record specific information on the description of the damage size, extent, and location, on Appendix B, Data Sheet B5, and supporting photographs shall be taken.

4.1.3.2.1.1 Body Sheet Metal. Hoods, fenders, deck lid, and quarter panels, etc.

4.1.3.2.1.2 Lamps. Headlamps, and tail lamps, etc.

4.1.3.2.1.3 Bumper System. Fascia and visible impact bar, etc.

4.1.3.2.1.4 Grille.

4.1.3.2.1.5 Exhaust Tip.

4.1.3.2.2 Body Panel Gap Check. Measure gaps between body panels and record in Appendix B, Data Sheet B6.

4.1.3.2.3 Functional Checks.

4.1.3.2.3.1 Body Closures. Open and close the hood, doors, deck lid, tailgate and record functional operation on Appendix B, Data Sheet B7. Repair and replace components as necessary.

4.1.3.2.3.2 Lamps. Functional check the lamps and record results in Appendix B, Data Sheet B8. Repair or replace as necessary.

4.1.3.3 Vehicle Height Measurements.

4.1.3.3.1 Bumper Height. Measure and record the vehicle bumper heights as shown by the examples in Figure D1 and Figure D2 in Appendix D. Compare this vehicle measurement to the front and rear bumper ground

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lines from the nominal curb plus one passenger ground line located in the Ground Line math file and record in Appendix B, Data Sheet B9. The vehicle should be at the nominal ride height (± 8 mm).

4.2 Conditions.

4.2.1 Environmental Conditions. Minimum temperature of 16 °C.

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. The GM Design Release Engineer (DRE) and Subsystem Validation Engineer (SVE) must agree with any deviations.

4.3 Instructions.

4.3.1 Centerline Impacts. RCAR.

4.3.1.1 Barrier Position.

4.3.1.1.1 Plan View Position. Set the plan view position of the bumper barrier test fixture so the centerline of the fixture is aligned with the centerline of the vehicle. At impact, the centerline of the vehicle shall be aligned with the center of the bumper barrier.

4.3.1.1.2 Height. Set the bumper barrier height dimension to ground according to the data in Table 1 and as shown in Figure 2. If a non-saleable vehicle is used for a development test, adjust the height of the barrier to represent the worst case for over-ride or under-ride. Use Data Sheet B9 in Appendix B to calculate the required height adjustment. Using the ground line, build tolerance (± 8.0 mm) and bumper beam size, review the amount of overlap or underlap between the bumper test device and bumper beam. Select the configuration with the least amount of overlap/underlap and adjust the barrier height to that position (High or Low).

Table 1: Barrier Positions

	Height
Front Centerline Impact	455 mm
Rear Centerline Impact	405 mm

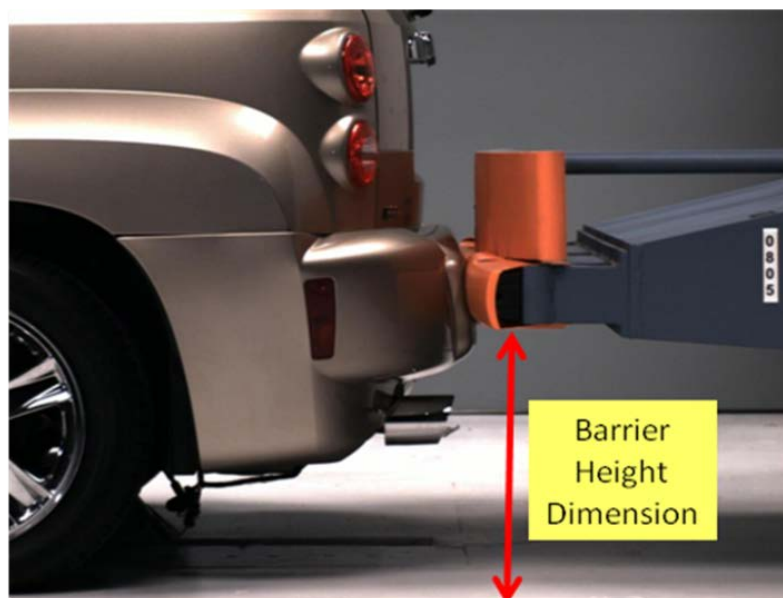


Figure 2: Barrier Height Dimension

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4.3.1.2 Front Impact. Propel the vehicle longitudinally forward into the barrier test fixture at a speed of 10.5 km/h (6.5 mph) into the barrier test fixture. Record impact speed, bumper system deflections, and barrier loads on Appendix C, Data Sheet C1.

4.3.1.3 Rear Impact. Propel the vehicle longitudinally rearward into the barrier test fixture at a speed of 10.5 km/h (6.5 mph) into the barrier test fixture. Record impact speed, bumper system deflections, and barrier loads on Appendix C, Data Sheet C1.

4.3.1.4 Posttest Functional Checks.

4.3.1.4.1 Body Closures. Open and close the hood, doors, deck lid, tailgate and record functional operation on Appendix C, Data Sheet C2.

4.3.1.4.2 Lamps. Functional check the lamps and record results on Appendix C, Data Sheet C3.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Review the results with the GM Customer Care and Aftersales Representative (CCA). The VTS may also include a target damage list.

5.3 Test Documentation.

5.3.1 Instrument Calibration. Instrument calibration is to be recorded on Appendix A, Data Sheet A1.

5.3.2 Pretest Inspection. Record the pretest preparation on Appendix B, Data Sheets B1 through B9.

5.3.3 Posttest Inspection. Record posttest inspection data on Appendix C, Data Sheets C1 through C4.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary.

Maximum Curb Mass: The mass of a vehicle that has 100% of the option content. All fluid containers are full. It does not include any passengers or luggage.

Optional Equipment: Equipment that requires an option code to be built in the vehicle.

7.2 Acronyms, Abbreviations, and Symbols.

CCA	Customer Care and Aftersales
CHMSL	Center High Mounted Stop Lamp
DRE	Design Release Engineer
GSSLT	Global Subsystem Leadership Team
RCAR	Research Council for Automobile Repairs
SVE	Subsystem Validation Engineer
VIN	Vehicle Identification Number

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW15378

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9 Release and Revisions

This standard was originated in June 2006. It was first approved by the Bumper System Global Subsystem Leadership in December 2006. It was first published in March 2007.

Issue	Publication Date	Description (Organization)
1	MAR 2007	Initial publication.
2	AUG 2008	Added RCAR European Test Requirements. Added Appendix C, Post Test Inspection. Added web sites to 2.3 Additional References. Added Figures 2, 3, and 4. Modified 5.3, Test Documentation.
3	SEP 2013	5 Year Refresh. • Updated IIHS and RCAR document references. • Updated IIHS/RCAR Barrier Test Device picture per Bumper Test and Rating Protocol. • Updated Corner Impacts as requirement for RCAR per RCAR Bumper Test and Rating Protocol. (Bumper, Fascia and Grilles Global Subsystem Leadership Team)
4	JUN 2018	5 year refresh. (Bumper, Fascia and Grilles Global Subsystem Leadership Team (GSSLT))

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Appendix A

Data Sheet A1: Instrument Calibration

Record Number _____

When the instrument calibration is not preserved in the testing laboratory record, include Appendix A, Data Sheet A1 with the test report.

Test Date _____

	Instrument Description	Instrument Number	Calibration Date	Next Calibration Due Date
1.	Barrier Recorder			
2.	Vehicle Weight Scale – Number 1			
3.	Vehicle Weight Scale – Number 2			
4.	Vehicle Weight Scale – Number 3			
5.	Vehicle Weight Scale – Number 4			
6.	Speed Transducer			

Recorded by: _____

(Signature)

Date: _____

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