



Tow Hook Load/Deflection Test

1 Scope

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 evaluate the structural integrity of the front tow hook and/or front tow hook mounting.

1.2 Foreword. This test procedure was derived from a previous "Tow Hook Yield" test that required the application of several loading conditions while measuring tow hook deflections. Since the sequential application of loads in different directions on a single sample led to incongruous results, the procedure was simplified to only address the straight-ahead condition and the most severe load condition as determined by Computer Aided Engineering (CAE) structural analysis.

CAE Guideline GMWA-20-05-017 is to be followed to determine the load case that causes the maximum tow hook deflection.

1.3 Applicability. This procedure is applicable to all trucks and vans equipped with a "vehicle retrieval hook", or similar device. This test does not satisfy the requirements of Directive European Union (EU) 77/389/European Economic Community (EEC), or Regulation European Union (R (EU)) No. 1005.

2 References

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

2.1 External Standards/Specifications.

EU 77/389/EEC R (EU) No. 1005

2.2 GM Standards/Specifications.

None

2.3 Additional References.

CAE Guideline GMWA 20-05-017

3 Resources

3.1 Facilities. A bedplate 2.4 m × 3 m and capable of withstanding the dynamic loading of the test specimen.

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 list(s) include test rig, fixtures, transducers, instrumentation, and controllers typically used by the General Motors North America Warren Structural Development Laboratory to perform this test. Other equipment may be substituted at the discretion of the local testing facility as long as it provides equivalent accuracy as specified herein or by the requestor. Any setup must be approved by the Tow Hook Bill of Material family owner and GM Validation Engineer.

3.2.1 Hydraulic Actuator. A linear hydraulic actuator with load capability higher than maximum test load.

3.2.2 Angle Stands. Angle stands to support the actuators in the required pull directions.

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3.2.3. Fixtures. Fixtures necessary to mount the test specimen and capable of withstanding the applied load.

Appendix B: Figure B1 and Figure B2 show typical test setup for indicated load conditions.

3.2.4 Rigid or Non-rigid Link. A clevis/pin to connect the actuator to tow hook. A cable, chain or strap may also be used to simulate the pulling device between the actuator and the tow hook.

3.2.5 Transducers/Load Cell. The test setup requires a load cell capable of measuring the applied force, and transducers to measure actuator linear displacement and tow hook displacements in the X, Y, and Z directions (reference Appendix A, Figure A1). Tow hook displacements are to be measured at a single location corresponding to a straight-ahead pull (Load Case No. 1 on Datasheet A2, Appendix A). Appendix B, Figure B3 shows the use of string potentiometers (pots) for measuring displacements, but any equivalent linear measuring device is acceptable.

3.2.6 Load/Displacement Recording Device. Use digital recording device.

3.3 Test Vehicle/Test Piece. The full vehicle or frame/body structure. This is a subsystem test for the tow hook and supporting structure. The responsible engineer shall decide which components are necessary to properly represent the tow hook supporting structure (frame/cradle, bumper beam, etc.), and should correspond with the vehicle content and constraints of the CAE simulation (See Appendix B, Figures B1 and B2).

This standard may also be used to measure clearances to surrounding components, such as bumpers and fascias. These tests may be run at the responsible engineer's discretion, and Load Cases No. 2 through No. 5 may be used for that purpose (see Appendix A, Datasheet A2).

Note: All instrumentation is to be calibrated as required. Record the instrumentation details and date of calibration, unless the information is otherwise preserved in the laboratory record.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable

3.6 Personnel/Skills. Not applicable

4 Procedure

4.1 Preparation.

4.1.1 Mount the tow hook to the vehicle or frame/body using appropriate fasteners torqued to minimum specification.

4.1.2 If testing a full vehicle, the tow hook supporting structure (frame/cradle/bumper) must be secured to the bedplate in order to avoid deflection of suspension bushings and springs.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable

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.

4.3.1 Record vehicle type, Maximum Gross Vehicle Weight Rating (GVWR), tow hook position, and most severe CAE Load Case in Appendix A, Datasheet A1. The position of the forward most point of the tow hook, in the X, Y, and Z directions (reference Appendix A, Figure A1) shall be measured relative to the bedplate.

4.3.2 Orient the hydraulic actuator in test direction beginning with the straight-ahead Load Case No. 1, and attach to the bedplate.

4.3.3 Attach the non-rigid link or clevis/pin between the actuator and the tow hook, such that the actuator does not push on the tow hook when the load is released.

4.3.4 Connect the load cell and recording equipment. Check transducing factor and calibrate to zero (0) point.

4.3.5 Increase the load slowly until the test load is achieved (see Appendix A, Datasheet A1). Hold the load for 5 s then return to zero. The actuator force versus deflection should be recorded for each load case along with the measured deflection (X, Y, Z) at the attachment point of the tow hook, and the maximum deflections entered on Appendix A, Datasheet A2.

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Note: All angles shown in Appendix A, Datasheet A2 are measured from the zero/no load/initial position of the tow hook attachment.

4.3.6 After release of the load, measure the permanent deformation in the X, Y and Z directions (See Appendix B, Figure B3) and record in Appendix A, Datasheet A2. After recording permanent deformations, reset the displacement transducers to zero.

4.3.7 Repeat 4.3.5 and 4.3.6 for the most severe CAE load case as identified in Appendix A, Datasheet A1. Other load cases may be run at the request of the design or test engineer in order to document deflections in any of other loading directions. If necessary, take photographs to document any visible permanent deformation.

Note: If a permanent deformation greater than 10 mm is measured for any load case, a new sample must be installed in order to complete any subsequent load cases.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. Not applicable.

6 Safety

This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

CAE	Computer Aided Engineering
EEC	European Economic Community
GVWR	Gross Vehicle Weight Rating
IVER	Integration Vehicle Engineering Release
No.	Number
Pot	Potentiometer
R EU	Regulation European Union

8 Coding System

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

Test to GMW16909

9 Release and Revisions

This standard was originated in January 2013. It was first approved by Global Chassis Structure Team in May 2013. It was first published in May 2013.

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1	MAY 2013	Initial publication.

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