



Pickup Box/Rear Pillar Stiffness and 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. The purpose of the test is to determine vehicle pickup box rear pillar stiffness and strength when being statically loaded.

1.2 Applicability. This procedure applies to pickup trucks which have a truck bed.

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.

CG583 Form: Located in Standard Forms and Templates in GM Global Document Management (GDM) database.

Regulatory Documents: As of the issue/revision date for this procedure, there were no known, current, federal, state or local legal requirements that apply to, or affect, the contents of this procedure.

Subsystem Technical Specifications (SSTS): Reference Subsystem Technical Specifications. These include 50.03.01 Pickup Box Body Structure.

Paragraph titles include:

- Box Performance
- Rear Pillar Stiffness and Strength

3 Resources

3.1 Facilities.

- Major Facility: An equipped facility capable of meeting test requirements.
- Minor Facility: A suitable bedplate for secure anchoring of body or vehicle and test equipment.

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 A suitable bedplate to hold a test buck or vehicle and allow it to secure properly.

3.2.2 Two (2) pieces 125 mm x 125 mm plate for local loading.

3.2.3 A suitable source to apply a controlled load (hydraulic actuator, pneumatic actuator, weights, etc.)

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3.2.4 A set of suitable supports and cross beam to anchor the load bearing source.

3.2.5 A suitable load bearing device or substitute that will measure the controlled weight or load.

3.2.6 Measuring device to measure displacement.

3.2.7 Blocks or dynamometer pedestals to isolate the suspension if a vehicle is used for this procedure.

3.2.8 If actuators are used for test, use a hand-held level to locate the actuator straight vertically.

3.3 Test Vehicle/Test Piece.

3.3.1 Body or vehicle with box and without the endgate, hinges, weatherstrip (if applicable), lock, strikers and handles. It is recommended that the body be subjected to the production-intent assembly and paint process to ensure representative strength characteristics. It is also recommended that the test parts/assembly be dimensionally certified before testing is started.

3.4 Test Time.

Calendar time: 3 d

Test hours: 18 h

Coordination hours: 30 h

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested. Reference Subsystem Technical Specifications (SSTS) paragraph numbers, if applicable.

3.5.1 The following information is required to run this test.

3.5.1.1 Condition of the body reviewed and approved.

3.5.1.2 Subsystem Technical Specification (SSTS) requirements of the Box Performance load.

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

4 Procedure

4.1 Preparation.

Required: The CG583 form must be completed and all responsible engineers must approve the test setup by signature on the form.

4.2 Conditions.

4.2.1 Environmental Conditions. This test is performed at ambient condition only.

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 Setup Instructions. Isolate the pickup box and frame or vehicle body from the suspension so that the vehicle or box will not move when the pickup box is statically loaded. See Figures A1 and A2.

4.3.2 Set up displacement gauges on the two locations on the pickup box. See Figure A2.

4.3.3 Set up actuator to be parallel to the floor and located on the pickup box approximately where the latches are located. See Figures A1 and A2.

4.3.3.1 Pre-load. Apply the pre-load from the actuator to 100 N. Reset the force/deflection equipment to start from zero (0).

4.3.4 Pickup Box Rear Pillar Stiffness and Strength.

4.3.4.1 Locate the actuator between the upper corners of the pickup box without the endgate. See Figure A3 for details.

4.3.4.2 Apply a load outward specified in the SSTS in increments until the following occurs:

Note: Attention is required at rear sill where a buckle effect may occur.

- The maximum permanent set specified by the SSTS is reached.
- A buckle effect occurs at the rear sill.

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4.3.4.3 Once loading is complete, check pickup box for cracks and deformation.

4.3.5 Pickup Box Stiffness and Strength. Note the maximum displacement and permanent set measured up to the maximum permanent set specified by the SSTs.

5 Data

5.1 Calculations.

Compute the stiffness using the following formula:

$$Stiffness \left[\frac{N \cdot m}{degrees} \right] = \frac{(AF_1 - AF_p)}{(AD_1 - AD_p)}$$

Where:

$AF_1 (N \cdot m)$ = Actuator Moment at 1st Load Point = Actuator Load₁ (N) x "YY" (m)

$AF_p (N \cdot m)$ = Actuator Moment at Preload = Actuator Load_p (N) x "YY" (m)

"YY" (m) = Distance of Actuator above Platform (m)

AD_1 (degrees) = Angular Deflection at 1st Load Point

$$AD_1 [degrees] = \text{Arctan} \frac{\text{Measured Deflection}_1 [mm]}{"ZZ" [mm]} \times \frac{180}{\pi}$$

AD_p (degrees) = Angular Deflection at Preload

$$AD_p [degrees] = \text{Arctan} \frac{\text{Measured Deflection}_p [mm]}{"ZZ" [mm]} \times \frac{180}{\pi}$$

Where:

"ZZ" (mm) = Distance of Measurement Point above Platform (mm)

Stiffness to be measured at a load of approximately 400 N·m to 500 N·m

Strength (N·m)

Permanent Set = Arctan (Displacement/"ZZ") x 180/π

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. Data sheet is provided in Table A1.

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.

Preload: A specified load applied to the Pickup box Rear Pillar prior to the full incremental loading. This preload is used to assure contact between the load application adapter and body.

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