



Closure Panel - Striker Loads

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 measures the resultant loads that occur between a closure panel's latch and striker, with the glass in various positions (if applicable), and at different slam velocities (if applicable). This load information is used by the Computer Aided Engineering (CAE) group as input to CAE door slam durability and lock pillar fatigue models. This load information is also used for developmental testing of components and/or subsystems as well as being leveraged when attempting to understand durability test results during any given closure panel subsystem durability test.

1.2 Applicability. This procedure applies to all passenger cars, light duty trucks, and medium duty trucks having closure panel strikers.

1.3 Remarks. This procedure can be conducted on any level of experimental, prototype, or production material as long as the material represents the intended design from a mass, functional, and dimensional standpoint.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14269

GMW15938

GMW16155

GMW16156

2.3 Additional References.

The numbers listed here refer to engineering drawings for Strain-Gaged Striker Load Transducers. These drawings are kept in the Teamcenter PTK2 Truck Group database. Contact the GM Lead Engineer for further instructions.

Note: Expertise for the design, construction, gaging, and calibration of strain gaged strikers resides within the Structural Development Laboratories organization and supporting strain-gage laboratory activity (Department D0440). Contact the GM Lead Engineer for further instructions.

Side Closures:

TLF19396: GEN0/GEN1 Striker Base (Offset Hole Pattern)

TLF20011: GEN0/GEN1 Striker Strap

TLF20012: GEN0/GEN1 Striker Base (Inline Hole Pattern)

TLF20013: GEN0/GEN1 Striker Post/Wire

TLF22150: Wire for Gen 2 Striker

TLF22153: Base Plate for Gen 2 Striker

TLA00304: Competitive Vehicle Strain-Gage Striker Assembly Drawing

Front Compartment:

None

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Rear Compartment:

TLA00390: GEN I CCC Decklid Striker Assembly

TLA00473: Gen II Liftgate Striker Assembly

TLF21443: Common Base-plate Drawing for the GEN I Global Liftgate Strain-Gage Striker Assembly

TLF21444: Aveo Liftgate Striker

3 Resources

3.1 Facilities. Major Facility – General Motors North America (GMNA) Body Test Laboratory or similarly equipped test facility.

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 equipment list includes test fixtures and instrumentation typically used by the GMNA Body Test Laboratory 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 Test Fixture. Not applicable.

3.2.2 Instrumentation.

3.2.2.1 Torque wrench(es) within the range(s) of the torque(s) required to perform any closure panel moves/adjustments, component installations, striker installation, etc.

3.2.2.2 Velocity measuring instrumentation to measure the closure panel's slam velocity.

3.2.2.3 Calibrated energy input device for ensuring repeatable closing speeds; refer to test procedures GMW14269 Door System Slam Energy Determination, GMW16155 Hood System Slam Durability, and GMW16156 Horizontally Hinged Rear Closures System Slam Durability.

Example: For side door closures, a "slam cannon" is used to ensure consistent door closing speeds. The alternative to an energy input device is the "trial-and-error" method, which may require several slams in order to capture a slam event at the desired closing velocity.

3.2.2.4 Strain-Gaged Striker Load Transducer, capable of measuring the latch/striker interaction loads in the desired directions. Figure 1 shows an example of a Side Closure Transducer that records loads in both the lateral (cross-car) and vertical (up/down) directions. This striker is assembled from three drawing numbers listed in 2.3 (TLF20011, TLF20012, TLF20013), see other drawing numbers as required (TLF19396, TLF22153, TLF22150, TLA00304, TLA00390, TLA00473, TLF21443, TLF21444) in 2.3.

Note: This striker has been designed such that the lateral and vertical loads measured are not sensitive to where contact is made to the striker in the fore/aft position along the length of the striker post (i.e., 250 N applied near the base of the striker post versus 250 N applied at the end of the striker post/strap will both read 250 N because of how the striker is designed to transfer load through the strain-gaged base). See Figure 1.

Note: Strain gaging a production striker and using this to record striker loads should not be done due to issues with both load linearity and repeatability.

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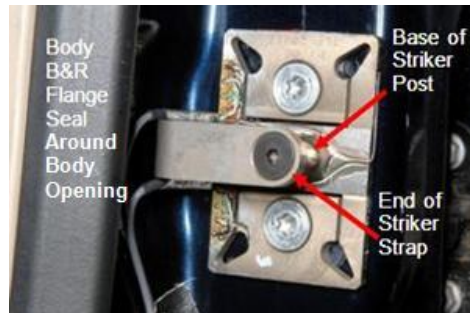


Figure 1: Side Closure Global Striker Load Transducer Mounted to a Left Front Door B-Pillar

3.2.2.5 Data acquisition system for recording the two (2) channels of loads from the striker transducer (e.g., lateral and vertical for side closures). Specific requirements for this equipment are as follows:

Sample Rate: 2048 data points per second.

Filter: Nyquist Filter set to 80% of Nyquist Frequency (i.e., 40% of sample rate).

Note: Nyquist filtering is a standard data acquisition practice that prevents aliasing (unrealistic recording of data) and, in the process, "smooths" the data by reducing the noise on the recording (Figure 2). Nyquist frequency is one-half the sample rate.



Figure 2: Example of "Smooth" versus "Non-Smooth" Data

3.3 Test Vehicle/Test Piece.

3.3.1 Test Material.

3.3.1.1 A body or vehicle complete with the closure system to be tested. All associated hardware such as weatherstrips, trim, and any other components associated with the system are required for this test. It is recommended that the test parts/assembly be dimensionally certified before testing is started. Reference the appropriate procedures and expertise when making any door, hood, or decklid adjustments.

3.3.1.2 For side closures, new body secondary and door primary (if applicable) seals are required (see 4.1.2.3). These additional seals have been documented in the Learning Analysis Development Validation (LADV) Plan to ensure they are available for the test.

3.3.1.3 For front/mid/rear closure panel testing, obtain new seals for those seals that act as the main interface between the closure panel and the body.

3.3.1.4 For competitive vehicle testing, it is expected that new seals will be obtained, typically ordered through a local dealership.

3.4 Test Time. This is an estimate of the amount of time (man-hours and facility hours) needed to perform this procedure.

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

One (1) closure panel (coupe: door, hood, or decklid).

Calendar time:	6 days
Test hours:	5 hours
Coordination hours:	4 hours

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Two (2) closure panels (sedan: one (1) front and one (1) rear door).

Calendar time:	6 days
Test hours:	8 hours
Coordination hours:	4 hours

Note: Strain gage striker development is not included in this timing and needs to be considered at least 3 to 4 months ahead of testing to meet the test timing. When designing a striker, keep the base concept the same as the current strain gaged striker designs, and only change the striker "wire/strap" to what is needed. Contacting the subject matter experts for strain gage striker design is encouraged (see 2.3).

Note: Depending on the striker design on the body/vehicle being tested, the striker mounting hole pattern may not match an existing strain-gaged striker base. In these cases, a base can be made with the mounting holes repositioned, but needs to follow the same overall design concept as it pertains to the "teardrop" shaped holes at the corners, the "relief" cuts, and the concept of where to place the strain-gages (refer to Figure 1). Once again, contacting the experts is recommended.

Note: If the original striker assembly has an integral pop-up spring for simplicity, this feature will not be included on the striker transducer. This will have minimal impact on the measured loads.

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested. Information required to run this test:

3.5.1 Nominal seal margin, and the tolerance. Example: 11.3 mm $\pm$ 2 mm.

3.5.2 If applicable, the by-design over-slam bumper clearance to the body surface when panel is at the nominal seal margin value.

3.5.3 Fastener torques for striker, latch, etc.

3.5.4 Slam Velocity. Example: Typical durability slam velocity for Side Closures is 1.5 m/s for doors $\leq$ 1.25 m in length, and 1.3 m/s for doors $>$ 1.25 m in length.

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

4 Procedure

4.1 Preparation.

Note: Prior experience in setting up and running similar tests and the use of the referenced test equipment will minimize the potential for accidents and injuries.

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

4.1.2 Sample Preparation.

Note: It is known that variation in the seal margin for a closure panel has a significant effect on the striker load values (see Figure B2 in Appendix B). Because of this, striker loads need to be measured in a methodical way, starting with the wide seal margin value (worst case scenario), then the nominal condition, followed by the minimum seal margin condition. For Side Closures, striker loads at the minimum seal margin (least case scenario for both impact and rebound loads) have been eliminated from this procedure.

4.1.2.1 For the closure panel being tested, remove the existing seal(s) and the original striker. Set the closure to the wide seal margin in the body opening. This may involve loosening hinges, etc., so the closure panel can move freely. Clamping spacer blocks of the desired seal margin thickness to the body's seal flange is an easy way to position the closure panel to the exact seal margin value (see Figure 3). Tighten hinge and strain-gage striker fasteners once closure panel is in position. Proper striker position is achieved at the latch end of the closure panel when it just touches the spacer block as it reaches the full primary latched position. (See GMW15938).

Note: If spacers of the proper seal margin thickness are not available, then the best alternative is to make some; or use clay as an alternative. Clay requires an iterative process, however, of setting the striker cross-car position, closing the panel, measuring the clay thickness, and repeating striker moves until the desired seal margin value is achieved.

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