



Maximum allowable Rear Closure Effort Evaluation

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 standard defines the determination of the maximum allowable rear closure closing effort which is accepted by the customer. The closing effort is derived from a closing velocity which is determined in an expert evaluation. The determined closing velocity should be used as the maximum allowable closing velocity in the GCA.

1.2 Applicability. This standard applies to all passenger cars having manual rear closures and no power closures.

1.3 Remarks.

1.3.1 In order to determine the maximum but still acceptable closing effort by the customer, an expert subjective evaluation is necessary on at least 5 vehicles, taken from the same build phase. The rear closures should provide a reasonable range of closing efforts, so that the customer range is ascertainable. If the provided vehicles do not have the necessary range of closing efforts, the bumpers and/or striker of the rear closures shall be adjusted accordingly without considering the fit. Thus, the analysis of the expert questionnaires can provide the customer expectation of rear closure closing comfort.

In order to determine the closing effort, the effort shall be converted into velocity. The velocity shall be measured according to GMW15095. If a velocity meter is not applicable, due to the vehicle design, the alternative test according to GMW16842 shall be used instead.

1.3.2 The determination of the maximum from customer prospective accepted rear closure closing effort/velocity shall be performed in accordance with the customer requirement for a good closing behavior.

1.3.3 Due to a noticeable influence of the closing effort evaluation, it is important to:

- distinguish between “aged” and “green” seals
- consider air bind
- consider test temperature especially for rear closures with gas strut feature
- consider vehicle position (level, incline and decline)
- consider the customer closing behavior (closing in one single operation or pull-push method).
- consider the customer load application point

1.3.4 The detected results according this standard

- can be used for evaluation of the closing behavior in production (Assembly Plant, Audit)
- give a prediction if the customer requirement for a good closing behavior is fulfilled

2 References

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

2.1 External Standards/Specifications.

None

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2.2 GM Standards/Specifications.

GMW14264

GMW15095 (ID)

GMW16842

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the GM Lead Engineer for further instructions.

2.3 Additional References.

Vehicle Technical Specification (VTS) paragraph 3.2.5.8.d "External Closure Actuation Deck lid" and 3.2.5.8.f "External Closure Actuation Lift gate"

Subsystem Technical Specification (SSTS) "55.02.01 Lift gate" and "55.02.05 Deck lid".

3 Resources

3.1 Facilities.

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.

3.1.3 Test area with level surface and room temperature of $(+22 \pm 3) ^\circ\text{C}$.

3.2 Equipment.

3.2.1 Hardware.

3.2.1.1 Complete vehicles with all test relevant parts according design level.

3.2.2 Instrumentation.

3.2.2.1 Velocity meter.

3.2.2.2 Pressure scale.

3.3 Test Vehicle/Test Piece. A complete vehicle with all necessary components installed.

3.4 Test Time.

Calendar time: 3 days

Test hours: 6 h

Coordination hours: 2 days

3.5 Test Required Information. The requesting engineer is responsible to provide specifications appropriate to the particular vehicle line being tested (reference VTS/SSTS paragraph numbers if applicable; see 2.3).

Testing worst case scenarios may uncover some potential problems. Discuss with 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.

The following specifications or information are required to run this test:

3.5.1 The range of rear closure closing effort/velocity for the evaluation.

3.5.2 Door and window position.

3.5.3 Movable roof position.

3.5.4 HVAC condition.

3.5.5 Environmental conditions (especially for rear closures with gas strut feature).

3.5.6 Evaluation with "green" and "aged" seals.

3.5.7 Required time for the seal set from "green" to "aged" seal.

3.5.8 Vehicle level requirement (i.e., incline or decline).

Note: The angle of incline or decline may greatly affect the closing efforts of rear closures. Testing the inclined and declined condition simulates customer use when parked on a driveway with a slope or when parked on a hill.

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3.6 Personnel/Skills. Prior experience in setting up and running similar tests.

4 Procedure

4.1 Preparation.

4.1.1 Vehicle Setup.

4.1.1.1 Ensure that all vehicles are from the same build phase (IVER or PPV or MVBns or MVBs, etc.) due to possible tolerances and variations (no hodgepodge). Ensure that all rear closure components are properly assembled.

4.1.1.2 If applicable, ensure all seals have the same install time ("green" or "aged" seal).

4.1.1.3 The rear closures should provide a reasonable range of closing efforts, so that the customer range is ascertainable. If the provided vehicles don't have the necessary range of closing efforts, the bumpers and/or striker of the rear closures shall be adjusted accordingly without considering the fit.

4.1.1.4 Allow the vehicle to acclimate to the environmental conditions in the test area for an appropriate time to allow the vehicle systems to reach test room temperature before the closing assessment starts.

4.1.1.5 Install the velocity meter according GMW15095.

4.1.1.6 Turn ignition on and turn HVAC to Recirculation mode. After HVAC has achieved desired mode turn the ignition off.

4.1.1.7 Close all doors, all windows, moveable roofs and any other closures.

4.1.1.8 Perform basis measurement with the prepared vehicles according to Vehicle Data Sheet (Appendix A, A2).

4.2 Conditions.

4.2.1 Environmental Conditions. Unless otherwise specified in this document's text or by the requesting engineer, the test shall be performed at an ambient temperature of $(+22 \pm 3) ^\circ\text{C}$.

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.

4.2.2.1 Recommended Standard Test Conditions.

4.2.2.1.1 Range from "worse" (customer dissatisfaction) to "good" (customer satisfaction) -> engineering judgement.

4.2.2.1.2 All doors, windows and movable roof in closed position (worst case scenario).

4.2.2.1.3 Recirculation air mode on/outside air mode off.

4.2.2.1.4 Environmental condition: Workshop, $T = (+20 \pm 3) ^\circ\text{C}$

4.2.2.1.5 Evaluation with "aged" and "green" seals.

"Aged" seals → vehicle condition at time of delivery to customer

"Green" seals → vehicle condition at time of production

4.2.2.1.6 "Aged" seals → Rear closure panel in full latched condition for a minimum of 3 days

"Green" seals → Rear closure panel in full latched condition for less than 1 day

4.2.2.1.7 Vehicle parked in level condition.

4.3 Instructions.

4.3.1 Set Up Instructions.

4.3.1.1 Position the 5 prepared test vehicles with the different rear closure closing efforts on a level surface. Other incline angles may be tested if specified in 3.5.8. If required the vehicle angle shall be adjusted (uphill/downhill) using the jacks such that the vehicle incline is within 1° of the desired test condition.

4.3.1.2 Provide the questionnaires (Appendix A, A1) to the assessment group.

4.3.1.3 Keep rear closures always in closed position between every assessment due to influences of seal decompression (elastic rebound).

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