



Horizontally Hinged Power Closures Cycle and Obstacle Durability Test – Component Level

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 this test is to evaluate power cycling, manual cycling, and obstacle durability of a power closures actuator.

1.2 Applicability. Passenger cars and multi-purpose vehicles with a rear power closures system.

1.3 Remarks. This procedure should be performed on a fixture that represents the mass, center of gravity (cg), and kinematics of the closure system or a partial vehicle body, Body in White (BIW).

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.

- Power Decklid Component Technical Specification (CTS)
- Power Liftgate Component Technical Specification (CTS)

3 Resources

3.1 Facilities. The facility should have all of the equipment listed in 3.2 and be capable of providing the conditions required in 4.2.

- **Laboratory Quality:** The test lab must be evaluated by GM Validation Engineer (VE), Test Engineer, and Design Engineer/Design Release Engineer (DE/DRE) to determine capability. All instrumentation must have a current calibration. Log books must be used to record dates, number of cycles, incidents, the results of the measurements and checks as defined in the CTS, and any other pertinent information.

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 Hardware.

3.2.1.1 Obstacle Simulation.

3.2.1.1.1 Information on how to simulate an obstacle can be found in the CTS.

3.2.1.1.2 Obstacle stiffness criteria are located in the CTS.

3.2.1.2 Test Rig/Fixture.

GM Confidential

© Copyright 2018 General Motors Company All Rights Reserved

March 2018

Page 1 of 8



Documents
Document Sharing Hub

- Fixture to simulate the closure, with the correct mass and cg as defined in the CTS.
- The fixture must also be capable of mounting the program specific latch, striker, actuator assembly, and counterbalance (if single sided actuator is used) to both the body and closure side of the fixture in the correct vehicle locations, per the math data.
- The seal load must also be included in the last few degrees of travel, see CTS for information.
- If a production controller is not available for Design Validation (DV) testing, a different latch may be utilized. GM VE and DE/DRE must agree with using the proposed latch.
- Test rig/fixture shall be capable of adjusting vehicle inclination to simulate up or down hill grades as stated in the Component Technical Specification, paragraph "Operating Environment Definition".
- Coordinate Measurement Machine (CMM) data must be taken at the following critical fixture locations and must be compared to math data: all ball studs, latch, striker, and hinge centerline.
- Mass and cg of fixture must be measured.

Note: Setup considerations should be made to design and engineer an interface between obstacles and test sample to prevent excessive local damage.

3.2.1.3 Secondary Obstacle Detection. Fixture must contain a means to rapidly reverse the direction of the fixture (from the closing direction to the opening direction) at the angle(s) specified in the CTS.

3.2.2 Instrumentation.

3.2.2.1 Inclinomater. Inclinomater, or other measurement device, used to measure the fixture angle during cycling. The angle should be measured throughout the entire durability test.

3.2.2.2 Serial Communication.

3.2.2.2.1 Design Validation (DV) Testing. It is preferred to use the production controller during DV durability testing. Production controller availability for DV testing will need to be verified on each program. When the production controller is not available, the supplier must have the capability to program their own test controllers per the design criteria of the production intent controller.

3.2.2.2.2 Product Validation (PV) Testing. Production controllers must be used.

3.2.2.3 Data Acquisition and Electronic Data Storage. Device or software used to monitor and record signals from the vehicle and instrumentation (see 4.3.2.3) at a minimum scan rate of 1000 samples per second with sufficient memory storage capacity (160 GB minimum). Data must be taken on all durability test samples and on each cycle. Cycle data must be saved every 100 cycles. In addition, when a fault is detected, the fault cycle along with the 10 previous cycles must be saved.

3.2.2.4 Test Controller. Applicable device, typically an Input/Output (I/O) controller, capable of automating the power actuation of the system as well as any applicable actuators.

3.2.2.5 Power Supply. Power supply capable of providing 9 V to 16 V and 50 A.

3.2.3 General Tools.

3.2.3.1 Torque Wrench. Capacity of $\approx 1.5\times$ the highest fastener torque referenced.

3.2.3.2 Force Gauge(s). Range of $1.5\times$ the specified requirements, or equivalent, for measuring operating efforts and static latch efforts.

3.3 Test Vehicle/Test Piece. See 3.2.1.2 for fixture information. Actuator and counterbalance (if included in design) test properties must be to the design level indicated in the Analysis, Development, Validation Plan and Report (ADVP&R) and must be approved by the GM VE and DE/DRE prior to the start of test. The number of test samples will be defined by GM in the ADVP&R.

3.4 Test Time. Testing must be completed by the milestones shown in the ADVP&R. This may require testing 24 h a day, 7 d a week. Soak time of 4 h minimum is required when the test is moved into a new environment prior to the start of testing. The cycle rates are given in the CTS. If this cycle rate needs to be adjusted, the new cycle rate must be agreed to by the GM VE and DE/DRE.

3.5 Test Required Information. The following information is required to run this test and is available in the CTS and ADVP&R:

3.5.1 Durability Cycle Requirement.

3.5.1.1 The total number of cycles of the closure panel per life and the number of lives.

GM Confidential

© Copyright 2018 General Motors Company All Rights Reserved

3.5.1.2 The total number of closure panel samples required for testing.

3.5.1.3 The durability cycle definition.

3.5.1.4 Garage Height (where applicable).

3.5.1.5 Environments (temperature and humidity) that must be included during test. Deviations to the order in which the environments in the CTS cycle durability table are run can be considered. Deviations must be approved by the GM VE and DE/DRE.

3.5.2 Measurements and Checks.

3.5.2.1 Criteria for measurements and checks, as well as frequency of when to take the checks, are located in the CTS. See Appendix A.

3.5.2.2 Fastener torques.

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 success. This test cannot be run by an individual that has never previously performed this type of testing.

4 Procedure

4.1 Preparation.

4.1.1 A review of the fixture design and capability must occur between the supplier and the GM VE and DE/DRE prior to constructing the test fixture. This review is mandatory and GM must approve the fixture before construction is started.

4.1.2 Prior to start of test, a mandatory pre-test inspection and approval must take place with the supplier and the GM VE and DE/DRE. This inspection and approval must include running a few cycles of the test property on the fixture and reviewing all measured data to make sure everything is working correctly. This must occur on each fixture if multiple fixtures will be used. The CMM, mass, and cg measured data from 3.2.1.2 must also be reviewed. The supplier engineer for the test must provide a pre-test approval form. This form will provide approvals for proper test setup, representative product content, and test buck attributes.

4.1.2.1 The supplier and the GM VE and DE/DRE shall inspect the test items to ensure all material is at correct design level. Deviations shall be noted on the approval form.

4.1.2.2 Any deviations from the CTS requirements or the requirements of this standard must have the agreement of the GM VE and DE/DRE. Such deviations shall be noted on the approval form and in test certificates, reports, etc.

4.1.3 Typical signatures on the approval form include: GM VE, DE/DRE, supplier Test Engineer and other GM System Management Team (SMT) Engineers as required. GM DE/DRE signatures should include both the mechanical and electrical (Electronic Control Unit (ECU)/software) aspect of the power system, as well as any other components whose parts are being validated with this test, such as the counterbalance when a single sided actuator is used. Testing may not start until all required approvals are complete.

4.2 Conditions.

4.2.1 Environmental Conditions. Testing is typically performed at ambient, hot, humid, and cold conditions. Refer to the Program Specific CTS for specific environmental conditions to be used in this test. Deviations to the order in which the environments in the CTS cycle durability table are run can be considered. Deviations must be approved by the GM VE and DE/DRE.

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. Such deviations shall be approved by the GM VE and DE/DRE noted on the approval form and in test certificates, reports, etc.

4.3 Instructions.

4.3.1 Initial Inspection.

4.3.1.1 Inspect test material for any cracks, dents, or other issues. Inspect the areas around the latch, striker, counterbalance attachments, hinge attachments, and power drive unit attachments for metal deformation and cracks. (These areas will be reviewed during testing and post-test for any subsequent damage.) Document any variation/deviation from design intent.

GM Confidential

© Copyright 2018 General Motors Company All Rights Reserved

March 2018

Page 3 of 8

Documents
Document Sharing Hub