



Quasi-Static Accelerated Test for Pull Handle/Cup Durability (CALT Methodology)

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. To determine the strength and durability of the pull handle/pull cup of the door trim. This standard applies the Calibrated Accelerated Life Test (CALT) methodology that allows time compression in life testing while retaining correlation in resulting life predictions.

Note: This test procedure utilizes Weibull analysis with use of an Acceleration Factor (AF).

1.2 Applicability. This document applies to door trim components that exhibit failures when subjected to a quasi-static load cycling. This test is used to uncover failure modes around the pull handle/pull cup such as pull handle/pull cup durability and fatigue.

1.3 Remarks. The failure modes identified in the test are incidents relative to the impact on the customer, such as cracking and loss of robustness and integrity. Further analysis is required to determine if the reliability and confidence has been met and the test was successful.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW8758

2.3 Additional References.

Door Trim CALT presentation

Quasi-Static CALT Test Spread Sheet

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.

3.2 Equipment.

3.2.1 Two (2) closed loop servo controllers model MTS 407 Servo Controller or similar.

3.2.2 Two (2) Schaevitze 15 cm (6 in) Alternating Current (AC) Linear Variable Differential Transformers (LVDT) or similar.

3.2.3 Two (2) five (5) port bi-directional flow control valves, normally closed, with a flow rate of air 170 Standard Liters Per Minute (SLPM) (6.0 Standard Cubic Feet Per Minute (SCFM)) such as the Enfield LS-V05 or similar.

3.2.4 Two (2) Sensotec 1000 N load cells or similar with same environmental rating.

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Documents

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3.2.5 Torque wrench for trim fasteners torque.

3.2.6 Cart or rack to stabilize door in the vehicle intent position.

3.3 Test Vehicle/Test Piece.

Note: Parts should arrive to the lab unassembled to ensure proper inspection before they are assembled and tested.

3.3.1 Trim parts.

3.3.2 Sheet metal door, one set.

3.3.3 Required fasteners.

3.3.4 A 5 cm (2 in) wide strap, with a length required to loop around door handle. For pull cup designs, use a pull device capable to absorb the inner angle variation of the pull cup (i.e., use a hook with a urethane splash with a minimum thickness of 5 mm and hardness < 60 shore A; another option is epoxy clay). Pull device's width of 5 cm. An example is provided in Figure 1.

Note: A 5 cm (2 in) wide strap or pull device is required to provide a soft grip and reduce point loading on the pull handle/pull cup.



Figure 1: Pull Device with Epoxy Clay to Absorb Pull Cup Angle Variation

3.4 Test Time.

Calendar time:	Approximately 5 days
Test hours:	Approximately 60 hours
Coordination hours:	16 hours

3.5 Test Required Information.

3.5.1 Process of assembly document or similar description for assembly of the trim pad and fasteners to the sheet metal.

3.5.2 Weight of complete door assembly, either provided by test requestor or to be weighed at the test facility.

3.6 Personnel/Skills. Test engineer or technician capable of setup and Weibull calculations.

4 Procedure

4.1 Preparation.

4.1.1 Setup and Fixturing. The CALT test will be performed on a door subsystem mounted vertically on a fixture as shown in Appendix A. The door should be fully trimmed and contain production intent material. The load cell (Figure A1 and Figure A2) should be calibrated before starting test. Typical door assemblies content include, but are not limited to:

- Fully dressed door metal-painted and baked (door will need to be mass representative including speakers and all hardware, i.e., lock rod, outside handle, wire harnesses, door side hinge, as well as window glass and trim)
- Handle brackets

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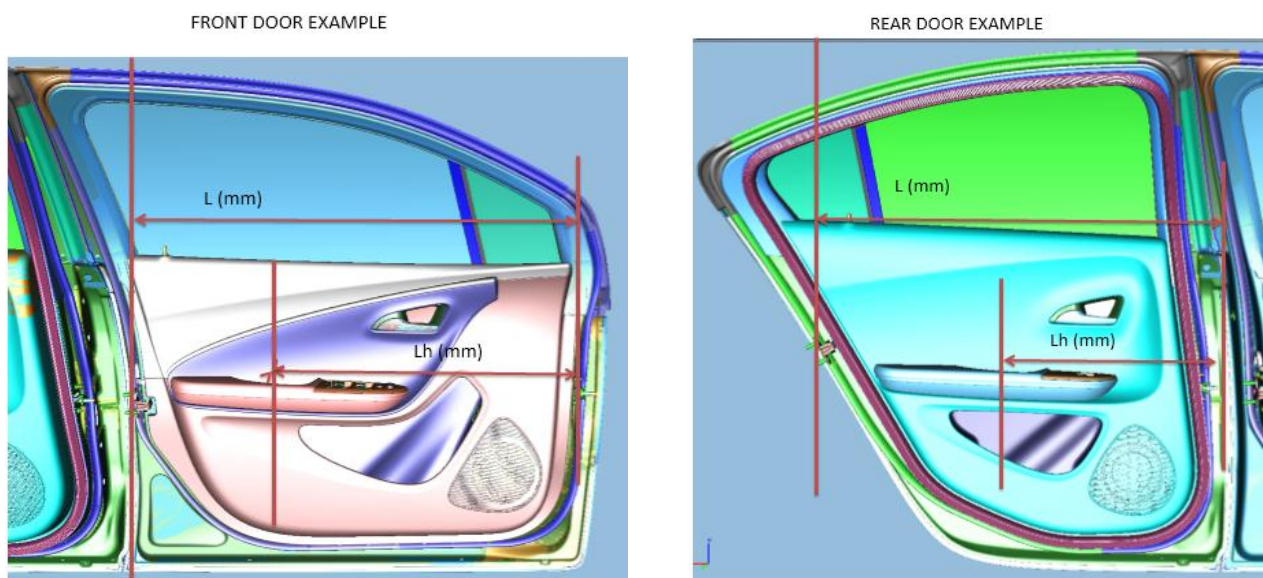
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- All fasteners (screws, birds beaks)
- Shark fin
- Screw covers
- Heaviest switch plate, bezel, and all clips
- Build instructions with torques
- Before installing door trim to sheet metal, inspect trim for good quality heat stakes
- Speaker grilles (if separately applied)
- Latches
- Inside Release Handle (ISRH)
- Push Nuts and J Nuts for metal
- Belt line seal, window regulators, window crank, lock knobs, appliques

4.1.1.1 In addition, there is some door trim assembly data that needs to be measured in order to calculate the reliability and confidence performance:

- Mass of fully trimmed door in the heaviest format (export mirrors, etc.) It is recommended to physically weigh the door trim assembly.
- Length of door ("L" = measured from the hinge to the door latch). The hinge reference is a projected line that is drawn from the upper hinge rod to the lower hinge rod. Then, draw a horizontal line from the latch to the projected hinge line to calculate "L".
- Length of hinge to middle of pull handle ("Lh"). Follow same criteria of "L" to calculate the "Lh", but now draw the line from the center of pull handle/pull cup to the projected hinge line.

4.1.1.2 For the "L" and "Lh" measurements, refer to the Figure 2. The measurements can be calculated through the math data.



Key: L = Measured from the hinge to the door latch, Lh = Length of hinge to middle of pull handle.

Figure 2: "L" and "Lh" Measurement Calculations

4.1.2 Sample Size Determination.

4.1.2.1 For optimal results the CALT methodology requires six (6) samples per unique design or unique door trim. However, this can lead to a requirement of too many samples (e.g., six (6) right front plus six (6) left front plus six (6) right rear plus six (6) left rear).

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