



Vehicle Exterior Freeze Test

1 Scope

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 evaluate the effects of freezing water on exterior under hood and under body subsystems at a vehicle level.

1.2 Foreword. This new test procedure is in addition to any component or subsystem development at the System Management Team (SMT).

1.2.1 This audit consists of multiple water exposures followed by a freeze exposure. It is defined as follows:

1.2.1.1 Flooded Road Freeze: Comprehends driving in flooded road conditions and standing water followed by a freeze exposure. 10.0 cm X 40.0 km/h X 150 m followed by a 6 h to 12 h freeze at -12.0 °C.

1.2.1.2 Universal Water Test Booth (UWTB) With Under Body Spray Freeze: Comprehends exposure of the 8 minute Universal Water Test Booth followed by a 6 h to 12 h freeze at -12.0 °C.

1.3 Applicability. All vehicles

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14528

2.3 Additional References.

CG161 Camouflage Removal Approval

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 Water troughs.

3.1.4 Universal Water Test Booth.

3.1.5 Cold boxes capable of holding -12.0 °C.

3.2 Equipment.

3.2.1 Digital camera.

3.3 Test Vehicle/Test Piece. All vehicles must be integration level hardware (production design intent and materials) and saleable manufacturing validation level.

3.4 Test Time.

Calendar time: 5 days

Test hours: 40 hours

Coordination hours: 4 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Two trained personnel required to operate cold boxes.

4 Procedure

4.1 Preparation.

4.1.1 No vehicle camouflage can be installed on the vehicle.

4.1.2 Wash the vehicle in an automatic car wash with an under body spray.

4.1.3 Remove all ballast from the vehicle.

4.1.4 The camouflage removal approval (CG161) must be submitted and approved by the Vehicle Chief Engineer.

GM Confidential

© Copyright 2013 General Motors Company All Rights Reserved

March 2013

Page 1 of 5

4.1.5 All vehicles must be soaked dry at inside ambient temperature for 8 h to evaluate the pre-freeze column in the Appendix A checklists.

4.1.6 At end of dry soak, insure batteries are fully charged prior to water and freeze exposures.

4.1.7 Purge washer systems and fill with known specified concentration of solvent.

4.1.8 Fuel tank shall be set to $\frac{1}{2}$ full (minimum).

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Cold boxes must be set to -12.0°C for freeze exposure.

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 Flooded Road Freeze Exposure.

4.3.1.1 Dry soak vehicle in garage ambient conditions for a minimum of 8 h. Insure the 12 V battery is fully charged. Complete the pre-freeze dry ambient checklist in Appendix A, Checklist A1. Pre-chill cold soak chamber to -12°C

4.3.1.2 Set the Flooded Road facility depth to 10.0 cm.

4.3.1.3 Maintain 40.0 km/h vehicle speed while entering, driving through and exiting the Flooded Road Trough. In order to achieve optimum reproducibility, only moderate changes to the accelerator pedal position are permitted. Erratic (non constant) accelerator pedal operation shall be avoided to prevent uneven bow waves at the front of the vehicle.

4.3.1.4 Continue driving to obtain 150 m total exposure length. All passages containing a wake should have it moving in direction of the vehicle motion. The wake should be allowed to settle to cold (height of water = $x \pm 20$ mm).

4.3.1.5 Immediately proceed to the entrance of the Vehicle cold soak box.

4.3.1.6 Two personnel are required to be present when using the cold soak boxes.

4.3.1.7 Open the doors to the cold soak chamber, turn on the inside lights and back the vehicle into the box.

4.3.1.8 Lock all doors and make sure all windows, doors and roofs are closed. Place keys in a secure, accessible location outside of the vehicle.

4.3.1.9 Soak the vehicle at -12.0°C for 6 h to 12 h.

4.3.1.10 Attach the vehicle exhaust hose and route outside of cold chamber for static evaluation. Remove exhaust hose for dynamic evaluation. Assemble freeze exposure evaluators and completely fill out Appendix A, Checklist A1 for post-freeze conditions.

4.3.1.11 Park the vehicle in a dry warm garage with all doors and windows open to melt and dry the vehicle out.

4.3.1.12 Repeat steps 4.3.1.2 through 4.3.1.11 and only evaluate vehicle ability to start. Vehicle start evaluation must occur three (3) times.

4.3.2 Universal Water Test Booth Exposure.

4.3.2.1 Dry soak the vehicle in a garage with ambient conditions for a minimum of 8 h. Insure the 12 V battery is fully charged. Complete the pre-freeze dry ambient checklist in Appendix A, Checklist A2.

4.3.2.2 Back the test vehicle into the Universal Water Test Booth and position it per standard.

4.3.2.3 Operate the Universal Water Test Booth with under body spray for 8 minutes at 207 kPa (see GMW14528 for UWTB operation).

4.3.2.4 Immediately proceed to the entrance of the vehicle cold soak box.

4.3.2.5 Open the doors to the cold soak chamber, turn on the inside lights and back the vehicle into the box.

4.3.2.6 Lock all doors and make sure all windows, doors and roofs are closed. Place keys in secure, accessible location outside of the vehicle.

4.3.2.7 Soak the vehicle at -12.0°C for 6 h to 12 h.

4.3.2.8 Attach vehicle exhaust hose and route outside of cold chamber for static evaluation. Remove exhaust hose for dynamic evaluation. Assemble freeze exposure evaluators and completely fill out Appendix A, Checklist A2 for post-freeze conditions.

4.3.2.9 Park the vehicle in a dry warm garage with all doors and windows open to melt and dry the vehicle out.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. All agreed to performance issues must be documented in the Problem Reporting and Tracking System Plus (PRTS+).

5.3 Test Documentation. Completely fill out all Appendices with preexposure and postexposure data. Evaluation Reports must be written and

GM Confidential

© Copyright 2013 General Motors Company All Rights Reserved

March 2013

Page 2 of 5