GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW14958

Dynamic Exterior Vehicle Snow Ingestion 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. Evaluate vehicle performance while driving in a snow storm or in the snow cloud of preceding vehicles.

1.2 Foreword. This procedure consists of a Road test and a Lab Test. Either one may be used to develop/validate vehicle performance.

Snow especially in the raw air duct of an Air Cleaner Box can lead to power loss, a defect of the turbo charger or a stalled engine.

Snow in the electrical components, mechanical actuators, belt drive system and EPV (Electro Pneumatic Valves) could cause big disturbances and drivability problems.

1.3 Applicability. Applicable to all vehicle developments, front end modifications, use of new engines and when making modifications to the engine compartment. Particular focus should be on any modifications in the area of induction snorkel inlet and also when making modifications on electrical components, mechanical actuators, belt drive system and EPVs.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14264

2.3 Additional References.

- CG161 Camouflage Removal Authorization Form
- Climatic Wind Tunnel (CWT) Snow Making Test Procedure

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 Snow covered circular track that can be driven on at constant speed 70 km/h.

3.1.4 Climatic Wind Tunnel with Dynamometer.

3.2 Equipment/Test Material.

3.2.1 Road Test.

3.2.1.1 Lead vehicle with trailer pulling device to create a snow drag. To improve the effect of swirling snow a height adjustable frame with four to five vertical rubber plates that lightly scratch the surface of the snow can be fitted behind the vehicle (on the trailer pulling device). The lead vehicle and all test vehicles should be equipped with a priority vehicle light to make it more visible.

3.2.1.2 Three (3) radio sets with headsets and roof antenna that can be tuned to each other.

3.2.1.3 Measuring computer for recording temperatures and pressure ratios in the induction system and the output signal from the MAF (Mass Air Flow) Sensor.

3.2.1.4 Digital camera for photo documentation.

3.2.1.5 Video system with watertight, external miniature camera heads.

3.2.1.6 Radar system (if available) to display the distance to the vehicle in front.

3.2.1.7 Sufficient quantity of dry filter elements.

3.2.1.8 Suitable tools.

3.2.1.9 Thermometer.

3.2.2 Lab Test.

3.2.2.1 Tech-II to monitor Diagnostic Trouble Codes (DTC).

3.2.2.2 Digital camera to document results.

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3.2.2.3 Three (3) replacement engine air filters.

3.2.2.4 Suitable tools for inspection.

3.3 Test Vehicle/Test Piece.

3.3.1 All testing shall be completed on Integration level vehicles or equivalent with Production intent design parts with Production intent material properties.

The test vehicle shall be fitted with all the production front end features (bumper, grille, front openings) and all the components in the engine compartment affecting flow, such as engine encapsulation, cooling module, etc.

Note: Derivatives such as sports versions, special vehicles, etc., shall be tested separately.

3.3.2 It is especially important that the complete air induction system is properly positioned, correctly fastened and free from leaks.

Dimensions and distance of any deflector to the snorkel inlet shall be documented on the data sheet.

3.3.3 All vehicles participating in the test shall be fitted with radio sets with roof antenna and headsets.

3.4 Test Time.

Calendar time:	3 days
Test Distance:	50 km to 150 km
Coordination hours:	8 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. A driver for the lead vehicle and a driver for the test vehicle.

4 Procedure

4.1 Preparation – (Road Test).

4.1.1 Before the first test run, the gear or the driving position in which the highest engine speed is achieved within a speed range of 1800 rpm to 3000 rpm at a speed of 70 km/h shall be ascertained.

4.1.2 Check all electrical connections, actuators and shields for correct seating.

4.1.3 Measure and record vehicle data on data sheet.

4.1.4 Check and clear Diagnostic Trouble Codes and record on data sheet.

4.1.5 Remove front (forward of "A" pillar) camouflage. (Requires written permission from vehicle team and CG161 form).

4.1.6 Document vehicle configuration with digital photos of the following views: (front, side, rear, ¾ front, ¾ rear, underbody front, underbody rear, induction inlet, Secondary Air Injection (SAI), underhood, transmission vent, and any other critical components).

4.2 Conditions.

4.2.1 Environmental Conditions. This test shall only be performed if the snow condition on the circular track produces a satisfactory effect of swirling snow (see Appendix A "Subjective evaluation of degree of swirling snow" in the data sheet and Figures A3 and A4).

Note: The ideal snow conditions in the wind tunnel are created at -14 °C. Follow the Climatic Wind Tunnel Snow Making Procedure for equipment setup, water/air temperature and water/air pressure requirements for creating ideal snow conditions in the environmental chamber. Refer to regional specific snow production process and Appendix A, Figures A1 and A2.

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 - (Road Test).

4.3.1 Determination of distance "**a**" from the vehicle in front, depending on the degree of swirling snow.

4.3.1.1 Subjective Evaluation of Degree of Swirling Snow (Tested From Grade 3):

Table 1: Subjective Evaluation Rating Scale

Grade	Degree of Swirling
1	Insufficient Whirling up
2	Slight Whirling up
3	Satisfactory Whirling up
4	Good Whirling up
5	Very Good Whirling up

4.3.1.2 Distance "**a**" depending on the degree of swirling snow:

- a_3 = 15 ± 5 m **(at Grade 3)**
- a_4 = 25 ± 5 m **(at Grade 4)**
- a_5 = 35 ± 5 m **(at Grade 5)**

4.3.1.3 Maintain the distance from the vehicle in front using a radar system to measure distance.

If the degree of swirling snow varies, the distance shall be adjusted accordingly.

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