GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW16137

Wiper Blade Wind Lift Performance Test

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 procedure is to define and standardize the test methodology for validating windshield wiper blade wind lift performance on specific vehicle designs.

1.1.1 Wind lift occurs during dynamic vehicle speeds when the oncoming air stream contacts a wiper arm/blade and causes them to lose pressure on the windshield. Initial lift (blade does not wipe in one direction of wipe-cycle) and terminal lift (blade does not wipe in either direction of wipe-cycle) are to be evaluated.

1.2 Applicability. This document is applicable for all car, Multipurpose Passenger Vehicle (MPV), and truck models produced by GM.

1.3 Remarks. This procedure shall be used to ensure that wiper system meets the intended wind lift performance requirements in wiper Subsystem Technical Specification (SSTS). This is a living document and any suggestions or revisions will be reviewed and/or updated annually by the Windshield Wiper Global Subsystem Leadership Team (GSSLT). Supplier to use current approved five (5)-phase to be provided by GM Product Engineering.

2 References

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

2.1 External Standards/Specifications.

EEC 1008/2010

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- Five (5)-Phase Document
- GM Security Guidelines
- Part Number 9965864 Glass Cleaner
- Program SSTS
- Subsystem Technical Specification (SSTS)
- Vehicle Technical Specification

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 Wind tunnel facility with climatic capability and resources for achieving 210 km/h (130 mph) wind speed.

Note: If wind tunnel facility is not available in testing region, test track where vehicle can be driven up to 201 km/h (125 mph) is an alternative (see 4.4).

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3.2 Equipment.

3.2.1 Full size layout of design wipe pattern.

3.2.2 Dry erase marker.

3.2.3 GM approved Glass Cleaner (Part Number 9965864 Glass Cleaner) or equivalent (i.e., Bon Ami) to assure water sheeting action.

3.2.4 External water spray bar with nozzles capable of delivering a uniform spray pattern across the windshield surface.

3.2.5 Variable pressure wiper arms or a set of arms set to the minimum, nominal and maximum design pressure.

3.3 Test Vehicle/Test Piece.

3.3.1 All components/systems used in testing shall be within drawing specifications and have supporting data prior to start of test.

3.3.2 For conventional wiper blade designs, a minimum of three (3) samples per side are required to be validated.

3.3.3 For flat blade wiper designs, a minimum of 10 samples per side are required to be validated unless the flat blades can be set to maximum, minimum and nominal. Under this condition only three (3) flat blades are required. Pressure distribution plots are to be provided with all flat blade samples. Minimum pressure distribution blades must be identified and tested before start of test.

3.4 Test Time.

Calendar time:	1 day
Test hours:	8 hours
Coordination hours:	4 hours

3.5 Test Required Information.

3.5.1 Security protocol for the test vehicle must be followed per GM Security Guidelines.

3.5.2 Product related information, such as Model year, blade supplier, design level, part number, wiper arm tip force, attack angle, etc. See Appendix A for Left Hand Drive (LHD), and Appendix B for Right Hand Drive (RHD).

3.6 Personnel/Skills.

3.6.1 GM Validation and GM Design Engineer must be present during test. Supplier Engineer is also recommended but not required.

4 Procedure

4.1 Preparation.

4.1.1 After vehicle is placed in wind tunnel chamber, remove any front end camouflage that is not adhesively bonded to vehicle.

4.1.2 Place full size design pattern layout over windshield aligning blackout lines. From inside of vehicle, trace wipe pattern and wipe zones with dry erase marker.

4.1.3 Properly clean outside windshield surface with GM approved cleaner.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Unless otherwise specified:

- Ambient temperature: +23 °C ± 3 °C
- Battery Voltage: V_{NOM} - ± 0.3 V specified in the SSTS (defaults 13.5 V). Voltage reading shall be at motor terminals.

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. (See GM Validation and GM Design Engineers).

4.3 Instructions.

4.3.1 Wind Tunnel – Preferred Method. Remove existing wiper arms from vehicle and replace with adjustable tip force arms. Verify arm tip force and attack angles are set to nominal design intent specifications. If needed, make adjustments.

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4.3.2 Install first set of wiper blade test samples.

4.3.3 Set water spray bar, with nozzles, height to be level with leading edge of vehicle hood surface and place approximately 1 m in front of vehicle. See Appendix C for picture.

4.3.4 Place occupant in the driver seat of vehicle and set tunnel speed for 112 km/h (70 mph) with water spray on. Water should lightly mist windshield so the wipe pattern is visible for a few seconds after the wipers are cycled. Depending on the vehicle geometry, it may be necessary to adjust the water spray volume to achieve necessary misting. Excess water will limit wipe pattern visibility and make it difficult to identify missed wipe areas during evaluation.

Note: Spray volume may need tuning at higher speeds. Make adjustments as necessary.

4.3.5 With evaluators in the vehicle, set tunnel speed to 128 km/h (80 mph) with water spray on. Set wipers on low speed and look for missed wipe areas throughout the wiping pattern. These will typically appear as localized blurred area >10 mm diameter as shown in Figure 1.

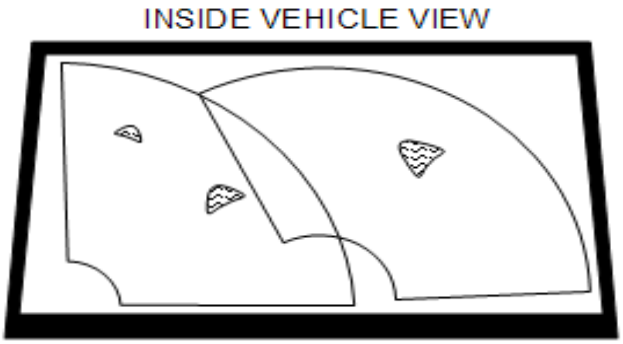

Figure 1: Unwiped Areas

Note: Light blade chatter is not considered a defect or failure during evaluation.

4.3.6 Increase tunnel speeds in 8 km/h (5 mph) increments until initial wind lift is determined on each wiper blade. Document speed on data recording sheet.

4.3.7 Continue increasing tunnel speeds by 8 km/h (5 mph) increments until terminal wind lift is demonstrated on each blade. If blade does not experience wind lift up to 209 km/h (130 mph), the test results shall be recorded and testing stopped. Check SSTS or Vehicle Technical Specifications (VTS) for program specific $V_{MAX.}$

4.3.8 Repeat 4.3.5 and 4.3.6 using additional test samples.

4.3.9 Reduce arm tip force to minimal tolerance tip force called out on drawing. Verify attack angle is set at nominal.

4.3.10 Repeat 4.3.5 and 4.3.6 with minimal tip force arms on all test samples.

4.3.11 When testing is complete, remove dry erase wipe pattern, reinstall original wiper arms/blades, and put vehicle camouflage back on vehicle.

4.4 Instructions for Test Track. Only if wind tunnel is not available, for development and for European Economic Community (EEC) Testing.

4.4.1 Remove existing wiper arms from vehicle and replace with adjustable tip force arms. Verify arm tip force and attack angles are set to nominal design intent specifications. If needed, make adjustments.

4.4.2 Install first set of wiper blade test samples. Make sure the washer reservoir is full with the appropriate test fluid.

4.4.3 Place occupant in the driver seat of vehicle and drive to the test track. Start the test when you have reached a speed of 112 km/h (70 mph) with washer on. Washer fluid should lightly mist windshield so the wipe pattern is visible for a few seconds after the wipers are cycled. Excess water will limit wipe pattern visibility and make it difficult to identify missed wipe areas during evaluation.

Note: Spray volume may need tuning at higher speeds. Make adjustments as necessary.

Note: An external washer source can be used instead of using the washer system for two reasons;

a. The fluid capacity is very limited.

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