



Vehicle Washer System Capability 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 the dynamic wash performance of a windshield wiper/washer system on a specific vehicle design.

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 windshield wiper/washer system meets the intended static and dynamic wash performance requirements. 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).

2 References

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

2.1 External Standards/Specifications.

CMVSS 104

FMVSS 104

R (EU) 1008/2010

SAE J726

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- Subsystem Technical Specifications (SSTS)

3 Resources

3.1 Facilities. Climatic Wind Tunnel (CWT) OR Test track where vehicle can be driven up to 160 km/h (100 mph).

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 Full size layout of design wipe pattern.

3.2.2 Dry erase marker.

3.2.3 GM approved Glass Cleaner to assure water sheeting action (NOTE: may require more than one cleaning to achieve water sheeting action).

Recommended glass cleaners:

Trade Name:

Active Agents

a. CR Lawrence C0301 (or regional equivalent)

Cerium Oxide

b. ProStaff Keelobin (or regional equivalent)

Cerium Oxide

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c. BonAmi 1886 (or regional equivalent) Feldspar, Limestone, Citric acid, Corn Alcohol, Epsom salts, Xanthan Gum

d. Bar Keepers Friend Powder (or regional equivalent) Oxalic Acid Dihydrate

3.2.4 Test Mixture According to Commission Regulation (European Union). 92.5% by volume tap water (water not to exceed 205 ppm hardness), 5.0% by volume saturated salt and 2.5% by volume coarse grade test dust (as described in R (EU) 1008/2010, Annex V).

3.2.5 Test Mixture according to FMVSS 104 and CMVSS 104. 66.67% (2 parts) by volume tap water (water not to exceed 205 ppm hardness). As described in SAE J726, 33.33% (1 part) by volume fine grade test dust.

3.2.6 Polyester bristle paint brush with a 50 mm to 75 mm wide brushing surface. Use optional a spraying can or a paint roll.

3.2.7 Variable pressure wiper arms if available.

3.2.8 If necessary use an anemometer (wind meter) capable of 160°km/h $\pm$ 2 km/h (100 mph $\pm$ 1.3 mph).

3.2.9 Wiper arm attack angle gage.

3.2.10 Wiper arm tip force gage.

3.2.11 Stopwatch with seconds capability.

3.2.12 Pressure gage up to 500 kPa (72 psi) with minimum resolution of 3.44 kPa (0.5 psi).

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 It is suggested that different aimed nozzles be available during test in case of failure to meet requirements with design intent nozzles.

3.4 Test Time.

Calendar time: 1 d

Test time: 4 h

Coordination time: 2 h

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, nozzle aim, fluid pressure, etc., See Appendix A and C for Left Hand Drive (LHD) and Appendix B and D for Right Hand Drive (RHD).

3.6 Personnel/Skills. GM Validation and GM Design Engineer must be present during test. Supplier Engineer(s) (for wiper and/or washer systems) is also recommended but not required.

4 Procedure

4.1 Preparation.

4.1.1 Front end camouflage that is not adhesively bonded to vehicle needs to be removed for test. Approval is needed by Vehicle Performance Manager before this can be done.

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: Between +5 °C and +40 °C.
- Battery Voltage: 13.5 V $\pm$ 0.3 V.

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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 Connect pressure gage inline between nozzle closest to reservoir and its connecting hose. With vehicle engine running, operate pump for 5 s and record maximum pressure output during this time.

4.3.2 Connect pressure gage inline between nozzle furthest away from reservoir and its connecting hose. With vehicle engine running, operate pump for 5 s and record maximum pressure output during this time.

4.3.3 Measure the flow rate, when the engine is running. Connect both nozzles with original connection hose. Hold the nozzle in a measuring cup and spray 10 s. Insert the measurements in Data Sheet F1 in Appendix F.

4.3.4 Reinstall all vehicle components removed during vehicle preparation.

4.3.5 Fill reservoir with washer fluid either Isopropyl, Methyl-alcohol, or Ethanol-alcohol based depending on region, and activate washer system to make sure it is fully primed.

4.3.6 Measure the voltage for the battery and note it in Data Sheet F1 in Appendix F.

4.3.7 Remove existing wiper arms from vehicle and replace with known parts that are within design intent specifications OR adjustable tip force arms or arms that have tip force within the permissible range. Verify adjustable arm tip force and attack angles are set within the permissible range design intent specification on vehicle. Make adjustments as needed.

Note: Minimum or nominal tip force is preferred.

4.3.8 Install new set of wiper blades and place arms/blades in service up position.

4.3.9 Clean windshield and dry windshield surface with clean cloth.

4.4 Windshield Washer System Capability Test.

4.4.1 European Union (EU) Static Test.

4.4.1.1 Purpose. This test is to verify compliance with Commission Regulation R (EU) 1008/2010.

4.4.1.2 Test Equipment. Test mixture per 3.2.4 and application per 3.2.6.

4.4.1.3 Test Preparation. Clean windshield then apply test mixture per 3.2.4 by dipping brush into mud solution and brushing mixture on windshield or with spraying can. Start applying at vehicle centerline by brushing from bottom of windshield upwards and working outboard towards A-pillar. After creating two lines on windshield, immerse brush back into solution so mixture is applied as uniform as possible over entire wiping surface. Apply mud as uniform as possible over entire wiping surface and allow to dry.

Note: Do not clean excess solution away from base of windshield or under blades.

Note: A fan blowing air across exterior windshield surface will reduce time for solution to dry. Do **NOT** use vehicle defroster.

4.4.1.4 Make sure vehicle is in garage or in a wind-blocked location and start engine. With engine at idle, activate washer switch for three wipe/wash cycles and disengage switch. Turn off engine after wipers finish their designated post dry-wipe cycles.

Note: GM wiper systems use low speed during wipe/wash cycles.

4.4.1.5 Test Requirement. Evaluate wash-wipe performance on windshield by measuring and recording any unwiped areas on Data Sheet A1 thru Data Sheet D1 in Appendix A thru Appendix D.

4.4.2 European Union Dynamic Test.

4.4.2.1 Purpose. This test is to verify compliance with R (EU) 1008/2010.

4.4.2.2 Test Equipment. Test mixture per 3.2.4 and application per 3.2.6.

4.4.2.3 Test Preparation. Clean windshield then apply test mixture per 3.2.4 by dipping brush into mud solution and brushing mixture on windshield or with spraying can. Start applying at vehicle centerline by brushing from bottom of windshield upwards and working outboard towards A-pillar. After creating two lines on windshield, immerse brush back into solution so mixture is applied as uniform as possible over entire wiping surface. Apply mud as uniform as possible over entire wiping surface.

Note: A fan blowing air across exterior windshield surface will reduce time for solution to dry. Do **NOT** use vehicle defroster. Do not clean wipe excess solution away from base of windshield or under blades.

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4.4.2.4 After solution is dry, carefully drive vehicle to test track and locate a vehicle preparation area. Remove all front end camouflage from vehicle that may interrupt airflow across windshield surface and place inside vehicle cargo area.

Note: It is acceptable to remove mud from a small area (~250 mm x 100 mm) so the driver can see. This clearing shall not be done when testing in a wind tunnel.

4.4.2.5 Start driving on test track and steadily climb to 120 km/h (75 mph) and have passenger hold the anemometer outside the window next to rear view mirror. Increase vehicle speed until 160 km/h (100 mph) wind speed is measured on Anemometer.

4.4.2.6 While at desired speed, activate washer, switch for three wipe/wash cycles and then disengage switch. Maintain vehicle speed until after wipers finish their designated post dry-wipe cycles.

4.4.2.7 Decrease vehicle speed and locate a vehicle preparation area where cleaning performance can be reviewed. Evaluate wash-wipe performance on windshield by measuring and recording any unwiped areas on data sheet in Appendix A and C or B and D. If possible take pictures after every test. The speed shall be clearly noticeable.

4.4.2.8 Repeat paragraphs 4.4.2.3 thru 4.4.2.7 to reconfirm dynamic performance.

4.4.2.9 Before leaving test track area, put vehicle camouflage back on vehicle.

4.4.3 Motor Vehicle Safety Standard (MVSS) Static Test.

4.4.3.1 Purpose. This test is to verify compliance with CMVSS 104 and FMVSS 104.

4.4.3.2 Test Equipment. Test mixture per 3.2.5 and application method per 3.2.6.

4.4.3.3 Test Preparation. Clean windshield then apply test mixture per 3.2.5 by dipping brush into mud solution and brushing mixture on windshield or with spraying can. Start applying at vehicle centerline by brushing from bottom of windshield upwards and working outboard towards A-pillar. After creating two lines on windshield, immerse brush back into solution so mixture is applied as uniform as possible over entire wiping surface. Apply mud as uniform as possible over entire wiping surface.

Note: A fan blowing air across exterior windshield surface will reduce time for solution to dry. Do NOT use vehicle defroster. You may clear mud from under the blades.

4.4.3.4 Make sure vehicle is in garage or in a wind-blocked location and start engine.

4.4.3.5 Test Procedure. With engine at idle, activate washer switch for three wipe/wash cycles and disengage switch. Turn off engine after wipers finish their designated post dry-wipe cycles.

4.4.3.6 Test Requirement. Evaluate wash-wipe performance on windshield by measuring and recording any unwiped areas on Data Sheet A1 thru Data Sheet D1 in Appendix A thru Appendix D.

4.4.4 MVSS Dynamic Test.

4.4.4.1 Purpose. This test is to verify compliance with CMVSS 104 and FMVSS 104.

4.4.4.2 Test Equipment. Test mixture per 3.2.5 and application method per 3.2.6.

4.4.4.3 Test Preparation. Clean windshield then apply test mixture per 3.2.5 by dipping brush into mud solution and brushing mixture on windshield or with spraying can. Start applying at vehicle centerline by brushing from bottom of windshield upwards and working outboard towards A-pillar. After creating two lines on windshield, immerse brush back into solution so mixture is applied as uniform as possible over entire wiping surface. Apply mud as uniform as possible over entire wiping surface.

Note: A fan blowing air across exterior windshield surface will reduce time for solution to dry. Do NOT use vehicle defroster. Do not clean wipe excess solution away from base of windshield.

4.4.4.4 Test Procedure. After solution is dry, carefully drive vehicle to test track and locate a vehicle preparation area. Remove all front end camouflage from vehicle that may interrupt airflow across windshield surface and place inside vehicle cargo area.

Note: It is acceptable to remove mud from a small area (~250 mm x 100 mm) so the driver can see. This shall not be done when testing in a wind tunnel.

4.4.4.5 Start driving on test track and steadily climb to 120 km/h (75 mph) and have passenger hold the anemometer outside the window next to rear view mirror. Increase vehicle speed until 160 km/h (100 mph) wind speed is measured on Anemometer.

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4.4.4.6 While at desired speed, activate washer switch for three wipe/wash cycles and then disengage switch. Maintain vehicle speed until after wipers finish their designated post dry-wipe cycles.

4.4.4.7 Decrease vehicle speed and locate a vehicle preparation area where cleaning performance can be reviewed. Evaluate wash-wipe performance on windshield by measuring and recording any unwiped areas on data sheet in Appendix A thru D. Take pictures after every test.

4.4.4.8 Test Requirement. Evaluate wash-wipe performance on windshield by measuring and recording any unwiped areas on Data Sheet A1 thru Data Sheet D1 in Appendix A thru Appendix D.

4.4.4.9 Repeat paragraphs 4.4.4.3 thru 4.4.4.8 to reconfirm dynamic performance.

4.4.4.10 Before leaving test track area, put vehicle camouflage back on vehicle.

4.4.4.11 When testing is complete, remove dry erase wipe pattern and reinstall original wiper arms/blades.

4.5 Rear Washer System Capability Test.

4.5.1 European Union Static Test.

4.5.1.1 Purpose. This test is to verify compliance with SSTS.

4.5.1.2 Test Equipment. Test mixture per 3.2.4 and application method per 3.2.6.

4.5.1.3 Test Preparation. Clean backlight then apply test mixture per 3.2.4 by dipping brush into mud solution and brushing mixture on backlight or with spraying can. Start applying at vehicle centerline by brushing from bottom of backlight upwards and working outboard towards rear edge of vehicle. After creating two lines on backlight, immerse brush back into solution so mixture is applied as uniform as possible over entire wiping surface.

Note: A fan blowing air across exterior backlight surface will reduce time for solution to dry.

4.5.1.4 Make sure vehicle is in garage or in a wind-blocked location and start engine.

4.5.1.5 Test Procedure. With engine at idle, activate washer switch for three wipe/wash cycles and disengage switch. Turn off engine after wipers finish their designated post dry-wipe cycles.

4.5.1.6 Test Requirement. Evaluate wash-wipe performance on windshield by measuring and recording any unwiped areas on Data Sheet G1 thru Data Sheet H1 in Appendix G thru Appendix H.

4.5.2 European Union Dynamic Test.

4.5.2.1 Purpose. This test is to verify compliance with SSTS.

4.5.2.2 Test Equipment. Test mixture per 3.2.4 and application method per 3.2.6.

4.5.2.3 Test Preparation. Clean backlight then apply test mixture per 3.2.4 by dipping brush into mud solution and brushing mixture on backlight or with spraying can. Start applying at vehicle centerline by brushing from bottom of backlight upwards and working outboard towards A-pillar. After creating two lines on windshield, immerse brush back into solution so mixture is applied as uniform as possible over entire wiping surface.

4.5.2.4 Test Procedure. After solution is dry, carefully drive vehicle to test track and locate a vehicle preparation area. Remove all camouflage from the rear of the vehicle and spoiler that may interrupt airflow across the backlight surface and place inside vehicle cargo area.

4.5.2.5 Start driving on test track and steadily climb to 100 km/h (62 mph) and have passenger hold the anemometer outside the window next to rear view mirror. Increase vehicle speed until 128 km/h (80 mph) wind speed is measured on Anemometer.

4.5.2.6 While at desired speed, activate washer switch for three wipe/wash cycles and then disengage switch. Maintain vehicle speed until after wipers finish their designated post dry-wipe cycles.

4.5.2.7 Decrease vehicle speed and locate a vehicle preparation area where cleaning performance can be reviewed. Evaluate wash-wipe performance on backlight by measuring and recording any unwiped areas on data sheets in Appendix A-D. Take pictures after every test.

4.5.2.8 Before leaving test track area, put vehicle camouflage back on vehicle.

4.5.2.9 Test Requirement. Evaluate wash-wipe performance on windshield by measuring and recording any unwiped areas on Data Sheet G1 thru Data Sheet H1 in Appendix G thru Appendix H.

Note: A fan blowing air across exterior backlight surface will reduce time for solution to dry.

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