



Roof Water Flow Static Capacity

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 measure the water flow required to overflow the roof water management systems such as gutters, ditches, drip rails, etc.

1.2 Applicability. All vehicles as defined in the VTS.

1.3 Remarks. The measurement, Roof Water Flow Static Capacity, is used to predict performance of roof water management systems while raining and/or while occupants get into and out of vehicles with water on the roof after rain, melted snow, dew, car wash, etc.

This procedure offers a simple method of measuring capacity of roof management systems to direct water away from the window/door area. This measurement will directly correlate with performance of roof management systems under actual customer conditions as stated previously.

This procedure is most effective when used in clay model stage. It can be used for development or validation.

This procedure is not intended for open sunroof water intrusion evaluation.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

Vehicle Technical Specification (VTS)

3 Resources

3.1 Facilities. The facility must have the following:

- Standard water hose supply outlet capable of 18.9 liters per minute (lpm) (5 gallons per minute (gpm)) flow.
- Water drainage.
- Level area.

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.

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3.2 Equipment.

3.2.1 Water flow meter capable of measuring 0 lpm to 18.9 lpm (0 gpm to 5 gpm) water flow through manifold assembly.

3.2.2 Roof Water Manifold Assembly as described in Appendix A, Figure A1.

3.2.3 Digital camera or equivalent (optional).

3.2.4 Brown Kraft-type paper or equivalent 150 g/m² (40 lb) to cover half of roof under test. This type of paper is typically used in packaging or masking. It keeps the roof surface texture uniform from test to test and eliminates surface variation such as clay versus painted steel and also diminishes the inertial effects of water coming from the manifold orifices.

3.2.5 Hose for delivering 18.9 lpm (5 gpm) of water with 16 mm (0.625 in) minimum inside diameter and 19 mm (0.75 in) outside diameter and fittings for moving water from facility to roof manifold.

3.3 Test Vehicle/Test Piece.

3.3.1 Test vehicle or buck representative of design intent. Test vehicle must have correct trim heights such that the vehicle attitude is correct since attitude may affect water runoff.

3.3.2 Clay model, buck or vehicle should include design intent level parts for any component that contributes to water management. These include:

- Roof trenches, weatherstrips, bumps, ditches, drip rails, feature lines, moldings, etc.
- Ditches or trough created between roof and door.

Note: Clay models may need to have door header area simulated to design intent.

3.4 Test Time.

Calendar time: 1 day

Test time: 4 hours

Coordination time: 1 hour

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Personnel familiar with the test procedure and setup.

4 Procedure

4.1 Preparation.

4.1.1 Place clay model, test buck or vehicle on level area in normal design attitude. Cut paper to follow contours of one half (left or right side) of roof. Keep paper away approximately 13 mm (0.5 in) from inboard edges of roof trenches/ditches, drip rails, roof edge, windshield and backlight glass.

4.1.2 Place brown paper on roof (see Appendix B, Figure B1). Thoroughly wet top side of paper so that paper is saturated. Smooth out any air bubbles or wrinkles.

Note: Large amounts of paper adjustment may be made by re-wetting paper so that it will float on roof surface.

4.1.3 Position manifold on roof.

4.1.3.1 Side Closure Positioning (see Appendix B, Figures B2 and B3).

4.1.3.1.1 Side-to-Side Positioning. On all vehicles, the manifold axis should be:

- Parallel to the vehicle fore-aft centerline.
- Approximately 30 cm (12 in) inboard from roof management features such as drip rails, trenches, ditches, etc.

4.1.3.1.2 Fore-Aft Positioning.

4.1.3.1.2.1 Two (2) Door Vehicles and Front Door of Multi-door Vehicles. Place the center orifice of the manifold centered between rear of the windshield and "B" pillar.

4.1.3.1.2.2 Rear Side Door of Multi-Door Vehicles and Rear Center Doors in Van Type Vehicles. Place manifold center orifice centered over the rear door opening (see Appendix B, Figures B4 and B5).

4.1.3.1.3 Set manifold angle so that water exits the manifold orifices at a 45 degree angle to the roof toward the door opening (see Appendix B, Figure B8).

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4.1.3.2 Rear Liftgate positioning (roof mounted) (see Appendix B, Figures B6 and B7).

4.1.3.2.1 Side-to-Side Positioning.

4.1.3.2.1.1 On All Vehicles, the Manifold Axis Should Be:

- Perpendicular to the fore-aft centerline.
- Centered on the roof in the cross-car direction.

4.1.3.2.1.2 Fore-Aft Positioning. At the crest of the roof, or the high point of the roof, to ensure all water flows rearward.

4.1.3.2.1.3 Set the manifold angle so water exits the manifold orifices at a 45 degree angle to the roof surface, facing the opening.

4.1.3.3 Rear Liftgate Positioning - Liftgate Mounted. See Appendix B, Figures B9 and B10.

4.1.3.3.1 Side-to-Side Positioning.

4.1.3.3.1.1 On All Vehicles, the Manifold Axis Should Be:

- Perpendicular to the fore-aft centerline.
- Centered on the liftgate in the cross-car direction.

4.1.3.3.1.2 Fore to Aft Positioning. At the crest of the liftgate, or the high point of the liftgate, to ensure all water flows toward the center high-mounted safety light (CHMSL)/appliqué.

4.1.3.3.1.3 Set the manifold angle so water exits the manifold orifices at a 45 degree angle to the liftgate surface, toward the CHMSL/appliqué (see Appendix B, Figure B11).

4.2 Conditions.

4.2.1 Environmental Conditions. Ambient temperatures shall be above freezing.

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 Side Closure Test.

4.3.1.1 The door should be closed with the window down 5 cm (2 in) from the top of glass run channel, if applicable.

4.3.1.2 With manifold properly positioned over the door, slowly increase water flow rate to manifold assembly allowing water flow at drip rails, ditches and other roof features. Allow water flow to stabilize between flow increases.

4.3.1.3 Record the following:

- Flow rate when the water stream first enters the passenger compartment, or if using a buck/clay model, when the water stream first contacts the side glass.
- Location and path of water entry.
- Take photos of these area(s) and the water management features (optional).

4.3.1.4 Repeat flow rate measurement process in 4.3.1.2 and 4.3.1.3 for a total of three (3) times. Average the three (3) flow rates. This average flow rate is the open window Roof Water Flow Static Capacity.

4.3.1.5 Open the door and repeat steps 4.3.1.2 and 4.3.1.3, if required.

4.3.1.6 Repeat flow rate measurement process (with door open) in 4.3.1.2 and 4.3.1.3 for a total of three (3) times. Average the three (3) flow rates. This average flow rate is the open door Roof Water Flow Static Capacity.

4.3.2 Rear Liftgate Test.

4.3.2.1 Liftgate should be in the full open position.

4.3.2.2 With manifold properly positioned on the roof over the liftgate opening, slowly increase the water flow rate to the manifold assembly allowing the water to flow towards the drip rails, ditches and other roof features. Allow the water flow to stabilize between flow increases.

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4.3.2.3 Record the following:

- Flow rate when the water stream first enters the passenger compartment.
- Location and path of water entry.
- Take photos of these area(s) and the water management features (optional).

4.3.2.4 Repeat flow rate measurement process in 4.3.2.2 and 4.3.2.3 for a total of three (3) times. Average the three (3) flow rates. This average flow rate is the open liftgate Roof Water Flow Static Capacity.

4.3.3 External Mounted CHMSL/Appliqué Test.

4.3.3.1 Liftgate should be in the full open position.

4.3.3.2 Position manifold properly on the liftgate. (Manifold should be relatively centered side-to-side and at the fore-aft crest.) Slowly increase the water flow rate to 7.6 lpm (2 gpm) allowing the water to flow towards the CHMSL/Appliqué.

4.3.3.3 Record the following:

- Observe whether the water is prevented from entering the passenger compartment. Verify that no water is flowing between the CHMSL/appliqué and glass and dripping into the passenger compartment.
- Location and path of water entry (if any).
- Take photos of these area(s) (optional).

5 Data

5.1 Calculations. Average flow rate is calculated on the Roof Water Flow Static Capacity Data Sheet (see Appendix C, Data Sheet C1, pages 1 thru 4) included in this procedure.

5.2 Interpretation of Results. The requesting engineer is responsible for interpretation of results.

5.3 Test Documentation. Data is to be recorded on Roof Water Flow Static Capacity Sheets (see Appendix C, Data Sheet C1, pages 1 thru 4) included in this procedure.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary.

Roof Water Flow Static Capacity: Water flow rate required to overflow roof gutters, ditches, drip rails, etc., and enter the passenger compartment as measured in this procedure.

Water Management: To direct or control the flow of water away from the passenger or rear compartment when opening or closing doors, rear compartment, windows, etc.

7.2 Acronyms, Abbreviations, and Symbols.

Cal.	Calibration
CHMSL	Center High Mounted Safety Light
gpm	gallons per minute
lpm	liters per minute
N&V	Noise and Vibration
VPO	Vehicle Performance Owner

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8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW15258

9 Release and Revisions

This standard was originated in March 2006. It was first approved by the Global Vehicle Sealing Team in April 2006. It was first published in April 2006.

Issue	Publication Date	Description (Organization)
1	APR 2006	Initial publication.
2	DEC 2011	Updated to support the five year refresh process. (Noise and Vibration)
3	OCT 2016	Revised to current template. (Global N&V VPO Team – Sealing/Contaminants)

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