



Windshield Defrost and Defog System Performance

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 determine if the defrosting and defogging system in a passenger car meets the requirements of:

1.1.1 Canada Motor Vehicle Safety Standard 103 (CMVSS 103) as amended in the Canadian Gazette.

1.1.2 Federal Motor Vehicle Safety Standard 103 (FMVSS 103) as amended in the Federal Register.

1.2 Applicability. This test specification applies only to passenger cars. Compliance of multipurpose vehicles, trucks, and buses is validated by review of applicable drawings and requires no testing.

1.3 Remarks. This internal procedure is intended to set standards for measuring compliance of GM vehicles to FMVSS 103/CMVSS 103; however, it is not intended to fully duplicate all aspects of the government FMVSS 103/CMVSS 103 as several optional methods are allowed and some parameters remain undefined in the federal document.

1.3.1 Air velocity shall be 8.0 ± 1.0 km/h. FMVSS 103 states 0 km/h to 3.2 km/h air velocity. Higher wind speed is more severe than stated in FMVSS 103 as the vehicle heater removes ice by warming the windshield and the ambient external air velocity removes heat from the warm windshield. A higher air velocity will remove more heat from the windshield, slow the warming of the glass and slow the melt of ice. The effect is similar to the term "wind chill" where cold weather feels colder when the wind is blowing due to additional heat loss.

2 References

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

2.1 External Standards/Specifications.

CMVSS 103	FMVSS 103	FMVSS 104	SAE J902 (1964)
CMVSS 104			

Note: The initial and historical 1964 version of SAE J902 must be referenced, NOT the latest version as the latest version does not contain the FMVSS 103 procedure requirement.

2.2 GM Standards/Specifications.

GMW15845

2.3 Additional References.

- Owner's Manual Instructions
- Vehicle Technical Specification (VTS)
- Windshield Pattern Control Drawing

3 Resources

3.1 Facilities. Cold chamber sufficiently large to contain the test vehicle and capable of maintaining temperature of $-18\text{ }^{\circ}\text{C} +0/-3\text{ }^{\circ}\text{C}$ ($0\text{ }^{\circ}\text{F} +0/-5\text{ }^{\circ}\text{F}$) during soak while circulating cold air at a wind speed of no more than 9 km/h (5 mph). The chamber need not provide for any room air change except that engine exhaust must be vented outside. Chamber may contain dynamometer equipment as indicated in 4.2.2.

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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 Battery charger (if needed, see 4.1.5).

3.2.2 Means, such as a wax pencil for recording the boundaries of the windshield areas deiced.

3.2.3 Engine tachometer.

3.2.4 Stopwatch or other timing device.

3.2.5 Thermometers or other temperature measuring devices. See GMW15845 for specific measurement requirements.

3.2.6 Device for measuring quantity of water required.

3.2.7 Spray gun for applying water to windshield; (Binks Model 62 Spray Gun, with fluid nozzle 66 and air nozzle 66SD, 66SF, or equivalent equipment).

3.2.8 Voltmeter.

3.2.9 Camera.

3.2.10 Cleaner to clean windows prior to test.

3.2.11 Distilled Water.

3.2.12 Vellum to transfer final test results from windshield.

3.2.13 Anemometer.

3.2.14 Windshield Pattern Control Drawing showing defined Areas A and C for specific vehicle under test as defined by CMVSS 104/FMVSS 104. (See Appendix A, Figure A1.)

3.2.15 Glazing surface plastic film, e.g., acetate, mylar, vellum, etc., overlay showing required reference lines. If the area of the deiced pattern is to be determined using the analytical balance method, the film must be uniform thickness and density.

3.2.16 Instrument to measure area of deiced pattern. This includes, but is not limited to, the following:

3.2.16.1 Graphic Computer – to commute the deiced area by digital analysis (eThermal includes an area tool).

3.2.16.2 Planimeter – to directly determine the deiced areas using geometry calculation.

3.2.16.3 Analytical Balance – to determine deiced area by weighing cutout tracings of marked areas and total areas.

Note: All instrumentation is to be calibrated as required; record instrumentation details and date of calibration on Data Sheet A1 (see Appendix A), unless the information is otherwise preserved in the testing facility records.

3.3 Test Vehicle/Test Piece.

3.3.1 Passenger car to be tested, equipped with windshield, defrost, and defog system components representative of design or test intent.

3.3.2 Vehicle battery is used to power all vehicle systems during testing.

3.4 Test Time. The following time should be allocated to each test:

3.4.1 Pre-Soak: Fourteen (14) h if there was a significant chamber temperature deviation from the previous test run.

3.4.2 Soak: Until engine coolant and lubricant (if applicable) has stabilized to $-18^{\circ}\text{C} +0/-3^{\circ}\text{C}$ for 2 h. Use seat rail temperature to indicate stabilization if the drive unit does not utilize engine coolant and lubricant.

3.4.3 Water Spray: Variable based on windshield area (approximately 10 minutes).

3.4.4 Ice Cure: At least 30 minutes after water spray but no more than 40 minutes.

3.4.5 Test: 40 minutes.

3.4.6 Testing must be conducted twice and averaged (see note after 4.3.3.10).

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3.5 Test Required Information. The area of test vehicle windshield is needed to calculate amount of water to be added to the spray gun. The vision areas of the windscreen is described in CMVSS 103/FMVSS 103 and CMVSS 104/FMVSS 104.

3.6 Personnel/Skills. One climatic wind tunnel operator and one test observer/recorder.

4 Procedure

4.1 Preparation.

4.1.1 On test vehicle, check all ducts and nozzles for location and fit.

4.1.2 Remove windshield wiper arms if wipers park on glazing surface.

4.1.3 Check all switches and controls for functional operation.

4.1.4 Check for proper thermostat and installation.

4.1.5 Verify all electrical systems are powered by the internal vehicle power supply and verify battery is at nominal state of charge. It is acceptable to charge the battery during first soak to improve vehicle starting.

4.1.6 Develop the following using the windshield pattern control drawing.

4.1.6.1 Develop Area D on drawing. (Area D is an area on the passenger's side equal to Area C and symmetric in shape and location to Area C with respect to the vehicle centerline). Record the drawing number, revision number and date of the drawing on the data sheet.

4.1.6.2 Prepare vellum for use in checking defrosted area by tracing Areas A, C and D from the windshield pattern control drawing onto the vellum sheet. (See Figure A1.)

4.1.7 Install instruments to record the following measurements:

4.1.7.1 Engine Speed.

4.1.7.2 Voltage across blower motor (meter must be temperature compensated if mounted in cold chamber).

4.1.7.3 Ambient air temperature and velocity at the furthest point forward of either;

a. at the forward most point of the vehicle or

b. a point 914 mm (36 in) from the base of the windshield.

The point of measurement shall be at a level halfway between the top and the bottom of the windshield, on the vehicle centerline.

4.1.7.4 Blower Voltage and Current.

4.1.7.5 Battery Voltage.

4.1.7.6 Engine oil temperature at bottom of dipstick per GMW15845 (if applicable).

4.1.7.7 Coolant temperature entering and leaving the heater unit, as close to the unit inlet and then outlet pipes as possible per GMW15845 (if applicable).

4.1.7.8 Left and right defroster discharge air temperature at a point 25 mm (1 in) below the plane of the defroster outlet opening per GMW15845.

4.1.7.9 Engine parameters diagnostic tool or some other device to control engine revolutions per minute (if applicable).

4.1.7.10 Engine coolant temperature at the thermostat pocket, below (upstream of) the engine thermostat per GMW15845 (if applicable).

4.1.7.11 Seat rail temperature per GMW15845 (if not equipped with engine coolant and lubricant).

4.1.8 Operate the Drive Unit to confirm instrumentation is functioning properly, vehicle revolutions per minute is controlled, cooling system is free of air bubbles (thermo-cycle to purge air and assure a full system), thermostat calibration is within specification, and coolant remains at the prescribed level (if applicable).

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Tunnel Preconditioning. If there is a significant temperature deviation between test runs, the cold chamber shall be preconditioned for at least 14 h at -18 °C +0/-3 °C (0 °F +0/-5 °F). Room air change is not required.

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4.2.1.2 Test Temperature -18 °C +0/-3 °C.

4.2.1.3 The chamber air is to be directed at the front of the vehicle and parallel to its longitudinal axis at approximately 8 km/h (5 mph), unless otherwise directed.

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.

4.2.2.1 Drive Unit Load and Speed (to obtain normal vehicle operating temperatures).

4.2.2.1.1 Conventional Powertrain Vehicles. Test vehicle shall be operated at 40 km/h +0/-3 km/h (25 mph) at road load drive wheel conditions per Table 1 or in neutral with engine speed not to exceed 1500 min⁻¹ (rpm) + 50 min⁻¹ (rpm). A conventional powertrain vehicle is defined as a non-electric drive mechanism. The engine load and speed requirement preceding is defined in FVMSS 103 section 4.3, area (2), option (ii).

Note: Wind speed to remain at 8 km/h during test. See 1.3.1.

Note: Testing in neutral gear required only permissible in a facility without a dynamometer.

Note: Test weight = curb weight + one (1) passenger.

Table 1: Gear Steps or Drive Positions

	Speed	
Transmission	40 km/h	Idle
Manual	3	Neutral
Automatic Transmission (AT)	Highest Drive Gear	Highest Drive Gear

4.2.2.1.2 Electric Vehicles (or Other Vehicles with Electric Windshield Defrost). Test to be run in neutral with any electric drive motor off. The battery system should be at full charge prior to test.

4.2.2.1.3 Hybrid Electric Vehicles. The test should be run per 4.2.2.1.1 with the powertrain control logic per manufacturer's specification at -18 °C. The battery system should be at full charge prior to test.

4.3 Instructions.

4.3.1 Soak. Install test vehicle in cold chamber and soak until engine coolant and engine oil temperatures (or seat rail if applicable) are stabilized at 18 °C +0/-3 °C (0 °F +0/-5 °F) for 10 h with the drive unit hood open and the vehicle inoperative. Take a photograph of the primary windshield defroster outlet grill from outside the vehicle using a centerline windshield location and filling the viewfinder with the complete defroster grill while insuring the camera focus on the grill vanes. **Note:** This defrost grill camera view location and focus will be used in a photograph in 4.3.3.7.

4.3.2 Windshield Icing.

4.3.2.1 Cause formation of ice as follows:

4.3.2.1.1 Determine the required amount of water to be added to the spray gun. The amount of water is dependent on the amount of glazed area and is 0.05 cm³ of water per centimeter cubed (cm²) of glazed surface. Record the water quantity to be added into the spray gun on Data Sheet A2 (see Appendix A). Apply the water, measured by means of a graduated container, using equipment specified in 3.2.

4.3.2.1.2 Spray gun shall maintain 345 kPa (50 psi) of air pressure during application.

4.3.2.1.3 Hold spray nozzle perpendicular to and 20 cm to 25 cm (8 in to 10 in) from the glazed surface. Wind speed shall be 0 km/h ± 3 km/h during spray gun operation.

4.3.2.1.4 Stroke side to side evenly in horizontal overlapping layers, the full width of the windshield from top to bottom of the glazed surface. Each full pass of the windscreen should take 2 s to 3 s. Alternate with vertical top to bottom strokes from one side to the other. This sequence is repeated until all the liquid is applied.

4.3.2.2 At completion of the icing process, soak vehicle for not less than 30 minutes and not more than 40 minutes. Remove vehicle from battery charger or electrical outlet (if used) during this soak and for the remainder of the test.

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