



Door Window System - Glass Scratch Durability

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 the potential for the door glass to be scratched as a result of dirt accumulation on the glass and in the belt seals during cycle testing of power or manual window systems.

1.2 Applicability. This procedure applies to all passenger cars and light duty trucks having conventional vertical dropping power or manual window systems.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW15081 GMW15938

2.3 Additional References.

- Global Subsystem Technical Specifications (GSSTS)
- GM Glass Cleaner Part Number 1050427
- Outer Belt Molding Component Technical Specifications (CTS)
- Vehicle Technical Specifications (VTS)

3 Resources

3.1 Facilities.

- Major Facility: GMNA Body Test Lab located within the Vehicle Performance Center (VPC) at the GM Technical Center in Warren, MI or a similarly equipped test facility.
- Minor Facility: For on-body testing, testing requires sufficient floor space and work area to perform this test. For off-body testing, testing requires a door cart or fixture capable of holding the test material in approximate design position.

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. The following list(s) include fixturing and instrumentation typically used by the GMNA Body Test Lab to perform this test. Other equipment may be substituted at the discretion of the testing facility as long as it provides the same data and/or data record, with equivalent accuracy as specified herein or by the requestor.

3.2.1 Fixturing.

3.2.1.1 If the door is not on a body, then it must be rigidly clamped to a fixture, such as a lab door cart, that can constrain it in approximate **design position**.

3.2.1.2 If testing a window system where the glass is allowed to drop completely out of view (i.e., below the beltline as seen on most front doors), a mechanical **stop** fixture (block, etc., attached to the window regulator

slide/carrier, etc.) must be made in order to keep the top edge of the glass from dropping below the beltline. The reasoning for this is that it is not desirable to have the belt seals wipe the glass scratch test material from the surface and off of the edge of the glass on the 1st down cycle after the test material has just been applied.

Note: For power window systems, rather than creating a mechanical stop, the GMNA Body Test Laboratory uses a proximity sensor that stops the glass in the desired down position when a piece of metallic tape on the glass passes in front of the sensor. If this method is chosen, then fixturing will be needed to secure the proximity sensors as shown in Figure A1.

Note: Do not place an object at the bottom of the door in order to stop glass down travel. This introduces non-typical external forces to the glass and may twist, bend, or misalign the window regulator while leaving no visual implications of this.

3.2.1.3 Manual window handle crank adapter, if testing a manual window system.

3.2.2 Instrumentation.

3.2.2.1 Still camera, or video camera to record test results throughout the test.

3.2.2.2 If testing power window systems, the GMNA Body Test Laboratory uses controllers (fabricated within the laboratory) that are dedicated to cycling power windows. Within each controller is a Programmable Logic Controller (PLC) that allows the user to cycle up to four windows at any given cycle frequency (i.e., 1 cycle per 45 s, 1 cycle per 90 s, etc.) and within the voltage range of 0 V to 20 V DC.

3.2.2.3 If testing manual window systems, the GMNA Body Test Laboratory uses controllers (fabricated with the laboratory) that are dedicated to cycling manual windows. An Alternating Current (AC) servo motor is used in conjunction with a manual window crank handle adapter in order to cycle the windows. The AC servo motor is set to provide a specified torque value to the manual crank handle as the glass reaches the full up position.

3.2.2.4 If proximity sensors are used to stop the glass at the desired down position, then one proximity sensor, including metallic tape, will be needed for each window system being tested (refer to Figure A1).

3.2.2.5 Weight scale to measure 15 g of glass scratch material per application.

3.2.3 Optional or Other Equipment.

3.2.3.1 Water spray bottle for moistening the glass and the test material (sand grit).

3.2.3.2 GM Glass Cleaner Part Number 1050427.

3.2.3.3 Glass Scratch Test Material.

3.2.3.3.1 Glass Scratch Recipe. Table 1 is the latest recipe used for the glass scratch test. This is a dry mix that is applied to the "wetted" glass surface. To create the recipe, filter each ingredient through a 1 mm sieve. Then mix the prescribed ingredients in the correct ratios by weight as shown in the table.

Table 1: Glass Scratch Recipe and the Material Accessibility

Material	Amount	Supplier	Address	Contact Phone
Fire Clay	900 g	A P Green		(734) 287-2150
Cinders	900 g	Oerther Brothers Excavating Company	3500 North Monroe St. Monroe, MI 48162	(734) 241-0766
Play Sand	900 g	DPW Milford Proving Grounds	Powder Valley Rd. Milford, MI	(248) 685-5000
Block Mix	1080 g	Stoneco Ottawa Lake Quarry	7555 Whiteford Lake Rd. Ottawa Lake, MI 49267	(734) 854-2262

3.3 Test Vehicle/Test Piece.

3.3.1 Test Material. It is recommended that a complete door system be provided for this test. Discuss with the requesting engineer whether or not the interior trim pad needs to be present during the test. Some trim pads exert force on the inner belt seals that may cause a tighter fit between the glass and the belt seals. Some trim pads also come with the inner belt seal as Part Of Assembly (POA). A body or some fixture that represents the body will be necessary, if testing a frameless glass system, since it is difficult to represent factors such as door

overcrown. The body seals that interface with the glass, etc., without a body or fixture that represents the body. It is recommended that the test parts/assembly be dimensionally certified before testing is started (see 4.1.1.1).

3.4 Test Time. The following is an estimate of the amount of time (work-hours) needed to perform this procedure.

Note: These times consider preparation time, actual test time, and analysis of data in capturing a total calendar time. Report writing, proper approval(s), processing, etc., are not part of these times.

Calendar time:	3 d
Test hours:	3 h
Coordination hours:	14 h

For each additional door, add 1 h for Technical resource and 2 h for Engineer resource. The calendar duration remains unchanged up to four doors.

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested (refer to VTS/SSTS paragraph numbers, if applicable).

Testing worst case scenarios may uncover some potential problems. Discuss with the requesting engineer, if testing should include some worst case scenarios. Depending on which test is being performed and which level of parts or systems are being tested, consider if any of the following may apply: tolerance stack-ups, build variations, misalignment, minimum/maximum fastener torque(s), lubrication, environmental extremes, location of customer representative load application, symmetry (Left Hand vs. Right Hand), color, mold, die source, etc.

3.5.1 The following specifications or information are required to run this test.

3.5.1.1 Power Window Test Voltage. Table 2 provides the test voltages to use when testing on a full vehicle or when testing a door system that is not on a full vehicle. For full vehicle testing where the system uses the vehicle's battery as its power source, the battery voltage value is specified for the engine-on condition. For testing off-body, the voltage is also based on the engine-running condition, but the voltage is controlled at the window regulator motor terminals, not at a battery. These values have been agreed to by the Window Regulator Global Subsystem Leadership Team (GSSLT) in March 2007.

Table 2: Test Voltage Values

Condition	Voltage
Full Vehicle (Engine On)	13.5 V Running at the battery terminals
Off-Body (Engine On)	Constant Voltage of 12.5 V Running maintained at the window regulator connector

3.5.1.2 Number of Durability Cycles. Unless otherwise specified, this test has traditionally been performed for one (1) life of cycles, not three (3) lives. It is easier to perform A to B comparisons between two (2) pieces of glass after one (1) life, rather than attempting to compare potentially hundreds of additional scratches during the 2nd and 3rd lives. The total number of glass scratch cycles required is found in the Global Subsystem Technical Specifications (GSSTS) document, in the glass scratch requirement section.

3.5.1.3 Stall torque, if testing manual window systems.

3.6 Personnel/Skills. Prior experience in setting up and running similar tests and experience in the use of the referenced test equipment is critical to achieving the estimated times shown in 3.4 Test Time.

4 Procedure

4.1 Preparation.

4.1.1 Sample Inspection.

4.1.1.1 The Lead Door System, Lead Glass Guidance, and Lead Weatherstrip Engineers should inspect the test items to insure that all material listed in 3.3 is of the correct design level and assembled properly.

Note: As noted in the GSSTS, it is critical that the physical evaluation of the glass seal interface per the outer belt molding Component Technical Specifications (CTS) is performed - and results reviewed - prior to starting this subsystem test.

4.1.1.2 Because this is a glass scratch test, clean the glass and identify all defects and any scratches prior to starting the test. Record any scratches on Data Sheet A2 or any alternative data sheet(s) that will record the equivalent data. It may also be helpful to take pictures to record scratches.

4.1.2 Sample Preparation. This test is normally run on the test subject in an **as received** condition. If it is requested to be run in a specifically adjusted condition, follow the applicable procedure(s).

4.1.2.1 If performing this test on a body, adjust the door positioning, as necessary, in accordance with the Door System Door Alignment to Body Determination test procedure (GMW15938) to ensure that the door has the proper fit and flushness to the body.

4.1.2.2 Trim pad removal and re-assembly may be necessary in order to install wiring to the window regulator motor when testing on doors that are not on a full vehicle.

4.1.2.3 Outer Belt opening measurements should be taken prior to running the glass scratch test. All measurements should be taken with the glass, regulator, run channel, applique(s), and any below belt guides installed; inner and outer belts removed. The measurement is from the inside of the outer belt flange to the outside of the glass in the following locations and glass positions:

- a. With the glass 50 mm $\pm$ 10 mm down as measured from its full up position, measure 75 mm from the forward edge of the glass, at the center of the glass, and 75 mm from the rearward edge of the glass.
- b. With the glass edge 50 mm $\pm$ 10 mm above the door belt at the center of glass, measure all of the locations possible from Step a.

Record this data on the Data Sheet A2 or equivalent.

4.1.3 Facilities and/or Equipment Preparation. Record the instrumentation calibration information on Data Sheet A3: Instrument Calibration or an equivalent document.

4.2 Conditions.

4.2.1 Environmental Conditions. Unless otherwise specified in this document's text or by the requesting engineer, the typical environmental conditions for this test are the temperature, humidity, and pressure at the major test facility (3.1.1). Unless otherwise noted, these conditions are typically 22 °C $\pm$ 3 °C (72 °F $\pm$ 5 °F), relative humidity of 40% $\pm$ 20%, and atmospheric pressure equivalent to the local barometric pressure (which is variable during any given day and from day-to-day).

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 Setup Instructions. It may be desirable to place a drop-cloth (or equivalent) under the test sample for cleanliness purposes.

4.3.1.1 If necessary, make any alterations to the window regulators of the doors being tested (refer to 3.2.1.2). Specifically, make any adjustments that will maximize the glass surface area that can be tested (refer to Figure A2 for how to determine the glass surface area under test).

4.3.1.2 For power window systems, set the supply power to the proper voltage as provided in Table 2. If testing a manual window system, adjust the servo motor to produce the specified torque value when the glass reaches a stall condition (i.e., full up).

4.3.1.3 Cycle the window system through at least five (5) full cycles to ensure proper operation, proper glass travel, and proper seating of all system components. Note any irregular sounds or erratic operation indicating a potential problem with assembly or design, and verify any observations with the requesting engineer.

Note: If needed, stall time has been established to be 0.75 s, as it is representative of the human response time to release the power window button at the full up/down stall positions.

See GMW15081 Door Window System (Power and Manual) Performance/Stall Test, for further discussion on power window voltage issues.

4.3.2 Test Operation Instructions.

4.3.2.1 Using the spray bottle, mist the outer surface of the glass with water. Mist only needs to be applied to the area of the glass that is being evaluated.

4.3.2.2 Measure out 15 g (approximately 1 teaspoon) of glass scratch material and uniformly apply it to the misted outer surface of the glass, within the area that is being evaluated. The mist on the glass should cause the material to stick to the glass.