



Windshield and Backlight – Static Stress Test – Strain Gage Method

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 the static stress test is to determine the induced strain on the windshield or backlight due to types of adhesion materials, windshield supporting methods, installation residual stress, windshield molding installation, and/or body opening build variations.

1.2 Applicability. This procedure applies to all passenger cars and light duty trucks. While written specifically for windshields and backlights, it may also be used to evaluate various other stationary glass installations.

1.3 Remarks. This procedure is used to determine/develop a windshield/backlight installation fit and installation process having minimum localized stresses. It is also used to resolve field problems of glass cracking by determining the root cause and resulting fixes.

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.

- Master Process Documents (MPD)
- Service Manuals
- Subsystem Technical Specification (SSTS)
- Vehicle Technical Specification (VTS)

3 Resources

3.1 Facilities. GMNA Body Test Lab, or similarly equipped test facility.

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 requester.

3.2.1 Fixturing.

3.2.1.1 Glass Checking Fixture. Glass checking fixture for the vehicle windshield being tested (fixture is obtained from glass manufacturer).

3.2.1.2 Miscellaneous Tools.

- Windshield removal and installation tools, such as suction cup handlers, knives or cutters, etc.

- Adhesive caulking gun (manual or pneumatic).
- Foam padding low density 0.635 cm (0.25 in).

3.2.2 Instrumentation.

3.2.2.1 Strain Gages. Enough strain gages to satisfy the layout diagram (3.5.3) for each windshield to be strain gaged (typically twelve per windshield).

3.2.2.2 Signal Amplifiers/Conditioners. An appropriate number of signal amplifiers/conditioners, equal to the number of strain gages used.

3.2.2.3 Data Recording. Data recording and/or charting equipment such as computers, strip chart recorders, etc.

Note: All instrumentation is to be calibrated as required. Record instrumentation details and date of calibration on Data Sheet A1 unless the information is otherwise preserved in the testing laboratory records or corporate archives.

3.3 Test Vehicle/Test Piece.

3.3.1 Test Material.

3.3.1.1 A dimensionally certified **design intent** test buck or a non-drivable vehicle for a **Static Only Test**.

3.3.1.2 Minimum of two (2) windshields (the second windshield serves as a backup to minimize delay, should the first one break during installation).

3.3.1.3 Acoustical strips, windshield spacers, windshield moldings, cowl screens, adhesive, primer, and anything else needed to install a windshield. It is recommended that the test parts/assembly be dimensionally certified before testing is started.

3.4 Test Time.

Calendar time:	3 d
Test hours:	12 h
Coordination hours:	36 h

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

Note: These time estimates are approximate averages. They may vary considerably depending on early component failures (and subsequent availability of replacement parts), testing to varying multiple of cycle lives, varying requirements for frequency of environmental test conditions, scheduling problems for test facilities, test equipment malfunctions, scheduling of overtime and or multiple shifts, scheduling of "witnesses" for tests, actual readiness of test samples upon receipt, unique or additional requests for test details, running multiple samples (times shown are for one system), etc. These times consider preparation and other downtime, actual test, and analysis of data in capturing a total calendar time. Report writing, approval, processing, etc., are not part of this time.

Technician Resource: 24 Man Hours

Engineer Resource: 12 Man Hours

3.5 Test Required Information. The following specifications or information are required to run this test:

3.5.1 Desired windshield fit, spacers, moldings, installation process, etc.

3.5.2 Frequency of strain measurements during adhesive cure.

3.5.3 A diagram depicting the desired layout of the gages on the windshield. This should be provided by the requesting engineer. Typically, the gages should be placed at anticipated points of stress, such as points where the cowl screen, windshield moldings, side molding, or other items are attached.

3.5.4 A diagram depicting the body position angle of the windshield.

3.5.5 Any deviations or exceptions to the contour and size limitations already marked on the checking fixture.

3.5.6 If dynamic testing is to be performed on the test material.

3.6 Personnel/Skills. Prior experience in setting up and running similar tests and experience in the use of the referenced test equipment are critical to achieving the estimated times shown in 3.4. Prior experience in windshield removal and installation and strain gage installation are mandatory.

4 Procedure

4.1 Preparation.

4.1.1 Sample Inspection. The test and requesting engineers should inspect the test items to ensure all material listed in Section 3.3 is of correct design level and assembled properly. Thoroughly inspect the windshield test samples for possible flaws (chips, scratches, etc.) which might increase the likelihood of cracking.

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).

Note: Take proper safety precautions during testing because of the possibility of glass breakage (safety glasses and gloves). Do not apply any tape to the windshield (to minimize spread of broken glass fragments) as it may affect the stiffness.

4.1.2.1 Carefully remove all windshield trim and hardware. These items may be required for the installation of the test sample.

4.1.2.2 Remove the existing windshield from the test vehicle (exercise due care and wear proper hand and eye protective equipment, since the removal process often results in the breakage of the windshield). Remove all adhesive (urethane) from the windshield and the body flanges, and prepare the vehicle for manual installation of the strain gaged windshield.

4.1.2.3 Place the windshield test sample(s) on the glass checking fixture and visually verify its contour and size are within the limits (as specified on the fixture or as supplied by the requesting engineer).

4.1.2.4 Install strain gages on the test windshield according to the layout diagram (3.5.3).

4.1.2.5 Place strips of 0.635 cm (0.25 in) low density foam around the perimeter of the windshield opening area of the glass checking fixture. This will provide a soft flexible surface upon which the windshield can rest and minimize stress that might be induced by less than perfect nesting into the body opening area.

4.1.2.6 Align the glass checking fixture to match the vehicle body position windshield angle (3.5.4).

4.1.2.7 Place the strain gaged test windshield on the glass checking fixture (on top of the foam), connect the instrumentation, and zero out the strain gages. Once zeroed, and while still connected to all the instrumentation, the windshield should be removed from the checking fixture and "reinstalled" on the checking fixture a minimum of three (3) times to ensure that the zero readings are stable. If stability cannot be achieved, determine the cause and resolve before continuing.

Note: If no checking fixture is available, rest the windshield approximately vertical on its widest edge to obtain zero readings.

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). Unless otherwise noted, these conditions are typically 22 °C ± 3 °C (72 °F ± 5 °F), relative humidity of 40% + 20%, and atmospheric pressure equivalent to the local barometric pressure (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.

4.3.1.1 If testing for the stress caused by spacers of various sizes, locations and durometer, body build variations, glazing materials, different durometer acoustical strips, or different cowl screen designs, develop a matrix of tests for each desired combination and dry run these tests first, without the use of an adhesive.

4.3.1.2 After completing a data sheet for each test variant, analyze and select the combination that exhibits the least stress and proceed to 4.3.2.

4.3.2 Test Operation Instructions.

4.3.2.1 For installation induced stress, assemble the windshield per the MPD/Service Manual with all the appropriate hardware and place the windshield in the body opening. Perform at least three (3) dry runs of this procedure, checking that the windshield is correctly nested into the proper plane. Record the strain gage readings during each dry run to ensure that the readings are fairly stable, with very little deviation.