GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW14310

Belt Assembly - Structural Loading

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 statically evaluate the structural performance of each component of the safety belt assembly.

1.1.1 This procedure is intended to evaluate each component of the safety belt assembly with respect to the static structural performance and propensity to cut webbing. Included in this procedure are static strength tests of the: retractor, buckle assembly, adjustable guideloop assembly, and the guideloop. The safety belt buckle release effort test consistent with FMVSS 209 requirements is also included. Dynamic structural performance of the safety belt assembly is comprehended primarily through barrier and sled tests.

1.2 Applicability. This procedure applies to all seat belt assemblies.

1.3 Remarks. This procedure requires that each component is checked for the propensity to cut webbing and its ultimate strength. As this procedure is written, the test engineer is required to load the component as specified, release the load, inspect the webbing for cuts and finally load the component to determine the ultimate strength. The supplier at his option may choose to perform the test as written or use either of the following variations.

a. Check the propensity to cut webbing as stated, but use new samples to determine the ultimate strength. Note this sequence will require double the test samples.

b. Load the component to its ultimate strength. Inspect the webbing for cuts and test per FMVSS 209 S5.1 (b) as required. Note if a sample of webbing fails to meet the stated requirements, a new set of samples must be tested for propensity to cut webbing as stated in this procedure.

2 References

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

2.1 External Standards/Specifications.

FMVSS 209

2.2 GM Standards/Specifications.

GMW14300 GMW14831

2.3 Additional References.

- American National Standard for Calibration, Calibration Laboratories and Measuring and Test Equipment – General Requirements
- GM Math File Log

3 Resources

3.1 Facilities. General Motors certified test lab.

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 equipment or equivalent is required.

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3.2.1 Seat belt assemblies or components to be tested.

3.2.2 Tensile test machine.

3.2.3 Appropriate mounting blocks for the designated test component to obtain the loading angles as specified.

3.2.4 Webbing grip(s) as defined by FMVSS 209 or equivalent – refer to Appendix A, Figure A1.

3.2.5 Loop load fixture per FMVSS 209 S5.3.

3.2.6 Hydraulic compensating cylinder three-point test machine, or equivalent.

3.2.7 Strip chart, graphic recorder or peak indicator.

Note: All equipment must be calibrated in accordance with American National Standard for Calibration, Calibration Laboratories and Measuring and Test Equipment – General Requirements.

3.3 Test Vehicle/Test Piece. Not applicable.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

3.7 Test Equipment. Unless otherwise specified elsewhere in this document, tests shall be conducted at local ambient pressure, relative humidity, and room temperature +23 °C ± 3 °C. Unless otherwise specified in this document, test condition tolerances shall be as stated in Table 1.

Table 1: Test Condition Tolerances

Temperature	± 3 °C
Length	± 0.1 m
Angle	± 1.0 Degree

4 Procedure

4.1 Preparation. See GMW14831.

4.2 Conditions. See GMW14831.

4.2.1 Environmental Conditions. Not applicable.

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. Deviations from the requirements of this standard shall be approved by GM engineering and documented in the GM Math File Log.

4.3 Instructions.

4.3.1 Safety Belt Retractor – Low Load Proof Test.

4.3.1.1 Install the webbing grip to the upper platen of the tensile test machine. Note, when testing a dual spool retractor, two grips must be installed as required to form the dynamic loading angles relative to the retractor (Figure A1 and Figure A2).

4.3.1.2 Install the mounting block and retractor to the lower platen of the tensile test machine such that the webbing forms the specified geometry relative to the retractor.

4.3.1.3 Attach the webbing to the grip such that 600 mm of the webbing remains on the spool(s).

4.3.1.4 Lock-up the retractor.

4.3.1.5 Apply a 2.0 kN tensile load to the webbing at a rate of 50 mm/minute to 100 mm/minute.

4.3.1.6 Remove the load from the retractor.

4.3.1.7 Retractor must meet all functional requirements after test. Vehicle sensitive retractors must be tested for static tilt angle and sensitivity (retractor acceleration and webbing acceleration) lock-up characteristics per standard GMW14300. Record the condition of the retractor.

4.3.1.8 If the ultimate strength of the retractor is desired, test the retractors per 4.3.2.

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4.3.1.9 Repeat 4.3.1.3 through 4.3.1.7 with the webbing fully extracted from the spool.

4.3.2 Retractor Ultimate Strength. For a retractor that incorporates Energy Management into the retractor, extend the webbing fully from spool.

For retractor angular loading, support the retractor from rotating with stops positioned along the sides of the retractor, refer to Figure A7.

4.3.2.1 Install the retractor to be tested as outlined in 4.3.1.1 through 4.3.1.4. It is permissible to use either the retractor tested in 4.3.1 Low Load Proof Test or a new retractor.

4.3.2.2 Apply a tensile load at a rate of 50 mm/minute to 100 mm/minute until the specified load is reached.

4.3.2.3 Remove the tensile load and inspect for incipient damage to the hardware or webbing. Damaged webbing must be tested per FMVSS 209 S5.1 (b) and meet requirements per S4.4 (a) and (b).

4.3.2.4 Reapply the tensile load until the ultimate strength is reached and record all pertinent data.

4.3.2.5 Repeat 4.3.2.1 through 4.3.2.3 with a new retractor and the webbing extracted completely from the spool.

4.3.3 Guideloop Strength Test.

4.3.3.1 Install the webbing grip to the upper platen of the tensile test machine, see Figure A1.

4.3.3.2 Install the corresponding mounting fixture to the lower platen of the tensile test machine. Note that the fixture is to maintain the guideloop and retractor (a rigid anchor can be substituted for the retractor) such that the guideloop is loaded at the specified angles (see GMW14831 for setup angles, see Figure A3 for setup).

4.3.3.3 Install the guideloop to the mounting fixture using the proper bolt and tighten to the specified torque.

4.3.3.4 Thread the webbing through the guideloop and attach the webbing to the grip on the upper platen of the tensile test machine.

4.3.3.5 Manually lock the retractor and apply the specified load to the webbing at a rate of 50 mm/minute to 100 mm/minute.

4.3.3.6 Remove the load from the webbing and inspect for incipient damage to the guideloop or webbing. Damaged webbing must be tensile tested per FMVSS 209 S5.1 (b) and meet requirements per S4.4 (a) or (b).

4.3.3.7 Reapply the tensile load until the ultimate strength is reached and record all pertinent data.

4.3.4 Two Point Loop Load Test.

Note: Paragraph 4.3.4.1 applies to the loop load test setup for test samples that include the attaching anchor hardware; 4.3.4.2 applies to the loop load test setup for test samples that do not include attaching anchor hardware.

4.3.4.1 Setup for Test Samples with Attaching Anchor Hardware.

4.3.4.1.1 Install the corresponding adapters for the retractor and anchor hardware to the lower platen of the loop load machine such that the retractor and anchor hardware are loaded at the dynamic loading angle (Figure A4).

4.3.4.1.2 Place the webbing over the rollers of the upper platen with the buckle in a position so it does not touch the rollers. The buckle should be between the rollers or near a roller in one leg. (Figure A4).

4.3.4.1.3 Install the anchor hardware and retractor with the proper production bolts and tighten to the specified torque.

4.3.4.1.4 Adjust the length of the belt assembly to 1.3 m, from attaching bolt to attaching bolt.

4.3.4.1.5 Lock-up the spool of the retractor.

4.3.4.2 Setup for Test Samples without Attaching Anchor Hardware.

4.3.4.2.1 Install the webbing grips to the lower platen of the loop load machine.

4.3.4.2.2 Place the webbing over the rollers of the upper platen with the buckle in a position so it does not touch the rollers. The buckle should be between the rollers or near a roller in one leg. (Figure A4).

4.3.4.2.3 Attach the webbing to the webbing grips such that the webbing loop is 1.3 m long.

4.3.4.3 Apply a 244 N force to the loop to remove slack in the belt assembly.

4.3.4.4 Remove the force and adjust the heads of the loop load machine for and assembly loop between 1.20 m and 1.27 m. Record the initial head separation.

4.3.4.5 Adjust the length of the belt assembly to remove slack from the loop by the method that corresponds to the belt assembly being tested.

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4.3.4.5.1 Assembly loop with an adjustable latch plate: Apply a force of 89 N to 97 N to the free end of webbing.

4.3.4.5.2 Assembly loop with a retractor: Allow the retractor to retract the slack in the belt assembly loop and lock the spool if necessary.

4.3.4.5.3 Assembly loop without an adjustable latch plate or retractor: Remove slack by adjusting the webbing in the webbing grips.

4.3.4.6 Assemblies with adjustable latch plates: Mark the webbing across the back edge of the frame to determine webbing slippage.

4.3.4.7 Load the assembly with a head separation rate of 50 mm/minute to 100 mm/minute until the specified load is reached. Record the loop length under load.

4.3.4.8 Release the load to the specified level for post loading buckle release testing (can be achieved by a freely suspended mounting block of appropriate mass). Assemblies with adjustable latch plates: Mark the webbing across the back edge of the frame per 4.3.4.6. Measure the distance between the two marks and record this dimension as the slippage through the latch plate.

4.3.4.9 To measure Post Loading Buckle Release Efforts, applying a force on the buckle in a manner and direction typical of those which would be employed by a safety belt occupant. For push-button-release buckles, the force shall be applied at a minimum of 3.2 mm from the edge of the push-button access opening of the buckle in a direction that produces maximum releasing effort.

4.3.4.10 Record the effort to release the buckle.

4.3.4.11 Inspect for incipient damage to the hardware or webbing. Damaged webbing must be tensile tested per FMVSS 209 S5.1 (b) and meet requirements per S4.4 (a) or (b).

4.3.4.12 Buckle the belt assembly and reapply the tensile load until the ultimate load is reached.

4.3.4.13 Record the ultimate load and failure mode.

4.3.4.14 If the safety belt assembly has a buckle in which the latch plate is capable of inverted insertion, one assembly shall be tested with the latch plate inverted.

4.3.5 Three Point Static Strength Test.

Note: This test procedure is intended for those buckle assemblies that are specified to be tested with a 60 degree fixed angle between the outboard lap anchor belt and the shoulder belt.

4.3.5.1 Actuate the test machine to move the lock bar drums to the full up position.

4.3.5.2 If the latch-plate and buckle are not attached to webbing, thread a piece of webbing 1 m through the latch plate and buckle slots until equal lengths obtained.

4.3.5.3 Place the webbing through the corresponding guides and over the rollers.

4.3.5.4 Adjust the webbing on the buckle leg to a length of 75 mm ± 10 mm from the axis of the roller to the slot in the buckle (Figure A5).

4.3.5.5 Loop the ends of the webbing through the lock bar drum (Figure A5) and insert the knurled lock-bar into the drum.

4.3.5.6 Remove the slack from the webbing and adjust the position of the buckle such that the webbing from the outboard lap anchor and the shoulder belt form an angle of 60 degrees.

4.3.5.7 Apply the specified load to the assembly.

4.3.5.8 Remove the load from the assembly and inspect for incipient damage to the hardware or webbing. Damaged webbing must be tensile tested per FMVSS 209 S5.1 (b) and meet requirements per S4.4 (a) or (b).

4.3.5.9 If the webbing is not damaged, reapply the load until failure occurs.

4.3.5.10 Record the ultimate load and failure mode.

4.3.6 Three Point Static Strength Test.

Note: This test procedure is intended for those buckle assemblies that are specified to be tested with an angle different than 60 degrees between the outboard lap anchor belt and the shoulder belt.

4.3.6.1 Install the webbing grip to the upper platen of the tensile test machine.

4.3.6.2 Install the corresponding fixture to the lower platen of the tensile test machine (Figure A6).

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4.3.6.3 Place the buckle assembly webbing ends through the appropriate webbing jaws. The assembly is to be adjusted such that the angle between the lap and shoulder strap and the angle between the lap and buckle end is at the specified angle (Figure A6). Note these angles will change during the pull test.

4.3.6.4 Load the assembly until the specified load is reached.

4.3.6.5 Remove the load from the assembly and inspect for incipient damage to the hardware or webbing. Damaged webbing must be tensile tested per FMVSS 209 S5.1 (b) and meet requirements per S4.4 (a) or (b).

4.3.6.6 If the webbing is not damaged, reapply the load until failure occurs.

4.3.6.7 Record the ultimate load and failure mode.

4.3.7 Adjustable Guideloop Mechanism Strength Test.

4.3.7.1 Install the webbing grip to the upper platen of the tensile test machine.

4.3.7.2 Install the adjustable guideloop mechanism mounting fixture to the lower platen of the tensile test machine. Note that the fixture is to maintain the adjustable guideloop mechanism and retractor (a rigid anchor can be substituted for the retractor) such that the adjustable guideloop mechanism is loaded at the specified angles (Figure A8).

4.3.7.3 Install the adjustable guideloop mechanism to the mounting fixture using the proper bolt and tighten to the specified torque.

4.3.7.4 Thread the webbing through the guideloop and attach the webbing to the grip on the upper platen of the tensile test machine.

4.3.7.5 Manually lock the retractor and apply the specified load to the webbing at a rate of 50 mm/minute to 100 mm/minute.

4.3.7.6 Remove the load from the webbing and inspect the adjustable guideloop mechanism for permanent deformation. Record any permanent deformation.

4.3.7.7 Reapply the tensile load until the ultimate strength is reached and record ultimate load.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. Not applicable.

6 Safety

This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

7 Notes

7.1 Glossary.

Dynamic Loading Angle: The angle that is formed between the loaded webbing and the seat belt component during the impact of the barrier test. This angle is measured from the high speed film of a barrier or sled test, usually with a 95th percentile male dummy.

7.2 Acronyms, Abbreviations, and Symbols.

GSSLT Global Subsystem Leadership Team

8 Coding System

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

Test to GMW14310

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