GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW14311

Buckle/Latch Plate - Flatness, Release and Durability Tests, Adjustable Upper Guide Mechanism Release and Adjust Efforts

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 evaluate the seat belt buckle and latch plate assemblies with respect to latch plate flatness, inadvertent release, and partial engagement, potential for finger entrapment and release efforts.

1.2 Applicability. To all seat belt buckle and latch plate assemblies.

1.3 Remarks. This test procedure relates primarily to the seat belt buckle and latch plate at the component level and not to the installation or usage in a particular vehicle or body style.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14310 GMW14831

2.3 Additional References.

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

(ID) = This log is limited to internal use within General Motors and shall not be accessed outside this company. Contact the GM Lead Engineer for further instructions.

3 Resources

3.1 Facilities. GM 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.

3.2.1 Seat belt buckle and latch plate to be tested. (Samples may need to be attached to webbing for test purposes.)

3.2.2 Micrometers (0 mm to 25 mm).

3.2.3 Latch plate flatness acceptance gauges with a rectangular cross-sectional opening to accept the latch plate and a depth greater than or equal to the designed engagement with the buckle. Latch plate gauges are required from 0.130 mm greater than the minimum to 0.130 mm greater than the maximum allowed latch plate thickness in increments of 0.025 mm.

© Copyright 2016 General Motors Company All Rights Reserved

Documents Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: GMW-R GMW14311 2016

3.2.4 Cam-out fixture that is capable of holding buckle in specified position and inducing the "cam-out" loads as required. Fixture may be part of a tensile test machine.

3.2.5 Spherical ball bearing, 4 mm in diameter.

3.2.6 Force gauge with 100 N capacity.

3.2.7 Impact fixture capable of producing a 40G impact within 50 ms (Appendix A, Figure A2).

3.2.8 Accelerometer suitable for measuring 40G impact.

3.2.9 Chart recorder or equivalent data log device.

3.2.10 Cylinder with a 9.5 mm diameter with a spherical end of the same diameter.

3.2.11 Fixture to measure release effort with 13 N tension, (capable of holding buckle and latch plate with 13 N tension and supporting back of buckle).

3.2.12 Seat belt buckle cycling fixture.

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. Seat belt buckle and latch plate assemblies**.**

3.4 Test Time. Required timing to test to requirements.

3.5 Test Required Information. See 5.3.

3.6 Personnel/Skills. Test technician capable of testing to requirements.

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 Latch Plate Flatness Check.

Note: A total indicator reading may be substituted to determine latch plate flatness.

4.3.1.1 Measure (with micrometers) the thickness of the latch plate at a minimum of three locations within the area of buckle engagement. Select locations which are representative of the entire area, avoid edges of the part. Record the thickness.

4.3.1.2 Select the smallest gauge with a slot height at least 0.130 mm greater than the minimum part thickness determined in 4.3.1.1.

4.3.1.3 Insert the latch plate into the gauge slot. Acceptability is determined by free entry into the gauge (with no binding) for the entire area of the latch plate that enters the buckle. Record the results.

4.3.2 Buckle Release Effort with 13 N Tension.

4.3.2.1 Insert the latch plate into the buckle.

4.3.2.2 For end release buckles, support the attachment end such that a force on the buckles release button will result in a movement of the button and not the buckle.

4.3.2.3 Hang a 1.4 kg mass from the latch plate.

4.3.2.4 Measure the buckle release force by applying a force on the buckle in a manner and direction typical of those which would be employed by a seat belt occupant. For push-button-release buckles, the force shall be applied at least 3.2 mm from the edge of the push-button access opening of the buckle in a direction that produces maximum releasing effect.

Note: Steps 4.3.2.2 thru 4.3.2.4 may be accomplished by the use of an appropriate test fixture.

4.3.3 Post Loading Release Efforts.

Note: This test may be run in conjunction with standard GMW14310.

© Copyright 2016 General Motors Company All Rights Reserved

Documents
Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: GMW-R GMW14311 2016

4.3.3.1 Insert the latch plate into the buckle.

4.3.3.2 Attach the buckle latch assembly to the tensile test machine.

4.3.3.3 Load the assembly with a head separation rate of 50 mm/minute to 100 mm/minute until the specified load is reached.

4.3.3.4 Reduce the load to the specified load. (This can be achieved by hanging a mass from the assembly.)

4.3.3.5 For end release buckles, support the attachment end of the buckle such that a force on the buckles release button will result in a movement of the button and not the buckle.

4.3.3.6 Measure the buckle release force by applying a force on the buckle release button in a manner and direction typical of those which would be employed by a seat belt occupant. For push-button-release buckles, the force shall be applied at least 3.2 mm from the edge of the push-button access opening of the buckle in a direction that produces maximum releasing effect.

Note: 4.3.3.6 may be accomplished by the use of an appropriate test fixture.

4.3.3.7 Record the force to release the buckle.

4.3.4 Inadvertent Release; End Release Buckle.

4.3.4.1 Insert a latch plate into a buckle assembly.

4.3.4.2 Hold the buckle against a horizontal plane (i.e., table top). (If needed, attach a 1.4 kg weight to the latch plate webbing and allow this to hang off the edge of the table or work surface.)

4.3.4.3 Place a 40 mm spherical ball against the buckle release push button.

4.3.4.4 Apply a 50 N force against the 40 mm ball in any direction that may release the latch plate.

4.3.4.5 Record if the latch plate is released or ejected.

4.3.4.6 If latch plate releases during test, reinsert the latch plate into buckle assembly.

4.3.4.7 Hold the buckle against a secure surface (i.e., table top). (If needed, attach a 1.4 kg weight to the latch plate webbing and allow this to hang off the edge of the table or work surface.)

4.3.4.8 Depress the latch button 3 mm.

4.3.4.9 Record if the latch plate is released or ejected.

4.3.4.10 If the latch does not release, depress the latch button until the latch releases. Record distance button is depressed to release or eject latch.

4.3.5 Finger Entrapment.

4.3.5.1 Hold a buckle assembly in one hand; the 9.5 mm diameter tool with spherical end in the other hand.

4.3.5.2 With the spherical end of the tool, depress the buckle release button. Move the tool along the entire edge of the button and attempt to bind the tool between the push button and buckle assembly. Check all possible angles (tool relative to buckle) and positions of the push button that may cause bind or tool entrapment.

Note: A buckle is considered to bind either on itself or on the tool, if the operator can release his/her hold of the tool and cause the push button to remain partially or fully depressed. A buckle is considered to entrap the tool if the buckle holds or "grips" the tool.

4.3.6 Seat Belt Buckle Tests.

4.3.6.1 Seat Belt Buckle Durability Test.

4.3.6.1.1 Subject the buckle assembly to the common environmental conditioning.

4.3.6.1.2 Secure the buckle to the platform of the seat belt buckle cycling fixture.

4.3.6.1.3 Align the "button release" cylinder such that it is:

a. Perpendicular to the release button surface.

b. Contacts the center of the button.

4.3.6.1.4 Attach the latch plate to the mounting carriage of the insertion cylinder.

4.3.6.1.5 Adjust the "insertion" mounting carriage for proper alignment and travel for cycling the buckle.

4.3.6.1.6 Adjust the "button release" cylinder to apply the minimum force necessary to consistently release the latch plate from the buckle.

4.3.6.1.7 Reset the cycle counter to zero.

© Copyright 2016 General Motors Company All Rights Reserved

Documents
Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: GMW-R GMW14311 2016

4.3.6.1.8 Cycle the buckle assembly at a rate that does not induce failure due to heat buildup (approximately 10 cycles per minute to 20 cycles per minute). One cycle shall consist of inserting the latch plate to full engagement, depressing the button to release the latch mechanism, removing the latch plate from the buckle and releasing the button. The latch plate of end release buckles shall be ejected by the buckle and not removed by the fixture.

4.3.6.1.9 Operate to the specified number of cycles GMW14831

4.3.6.2 Seat Belt Buckle Duty Cycle Test.

4.3.6.2.1 Secure the buckle to the platform of the seat belt buckle cycling fixture.

4.3.6.2.2 Set up fixturing to allow buckle/latchplate cycling per Case 1 in Table 1. See Appendix B, Figure B1.

4.3.6.2.3 Reset the cycle counter to zero. Cycle the buckle assembly at a rate that does not induce failure due to heat buildup (approximately 10 cycles per minute to 20 cycles per minute). One cycle shall consist of the latch plate being inserted into or making contact with the buckle and complete with the latch plate disengaging from or when contact ends with the buckle.

4.3.6.2.4 Operate to the specified number of cycles in GMW14831.

4.3.6.2.5 Repeat steps 4.3.6.2.1 thru 4.3.6.2.4 for Case 2 thru Case 6 listed in Table 1.

Table 1: Buckle/Latchplate Cycling

Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Cycling the latch plate to contact the edge of the pushbutton and glide into latching action.	Cycle the latch plate to contact the edge of the pushbutton at a severe angle without performing any latching action.	Cycle the latch plate to contact the center of the pushbutton until the pushbutton bottoms out to the buckle base.	Start the latch plate where it loads and rubs against the pushbutton finger and performs a cam action.	Start the latch plate where it loads and rubs against the cover ramp and performs a cam action.	Cycle the latch plate to contact the latch guide leg and guide to latching.
(See Appendix B, Figure B1 thru Figure B6)					
Note: Contact angles depicted in Figure B1 thru Figure B6 will depend on specific hardware tested. Contact angles shall be approved by GM Engineering and documented in a Test/Evaluation Report					
See Figure B1	See Figure B2	See Figure B3	See Figure B4	See Figure B5	See Figure B6

4.3.7 Cam-Out Evaluation.

4.3.7.1 Set up the cam-out test fixture as appropriate for the particular equipment being used (See Appendix A, Figure A1). Mount the buckle "cam-out" fixture and webbing grips into opposing heads of the tensile testing machine (if applicable).

4.3.7.2 Mount the buckle to the cam-out fixture at a fixed angle of 30 degree relative to the direction of load to be applied (see Appendix A, Figure A1).

4.3.7.3 Latch the buckle assembly and secure the webbing to the webbing grips.

4.3.7.4 Apply the maximum specified load at a rate of 50 mm per minute to 100 mm per minute. Continue to apply the load until failure or three times the specification is reached. Record the results.

4.3.8 Break Edge Loading.

4.3.8.1 Set up the test fixture to apply a load at 30 degree as appropriate for the particular buckle attachment. Buckle attached with a rigid strap, refer to Appendix A, Figure A3 and buckles attached with webbing or cable, refer to Appendix A, Figure A4.

4.3.8.2 Position the 3.2 mm break edge along the buckle surface as specified (i.e., laterally in line with the tip of the inserted latch, or ± 20 mm vertically along the buckle from tip of the inserted latch). The break edge should

© Copyright 2016 General Motors Company All Rights Reserved

Documents
Document Sharing Hub
Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: GMW-R GMW14311 2016

be the only surface supporting the buckle from lateral movement. The break edge is to extend the width of the buckle.

4.3.8.3 Apply the specified load at a rate of 50 mm/minimum to 100 mm/minimum. Continue to apply the load until failure. Record results.

4.3.9 Side Impact; End Release Buckle.

4.3.9.1 Mount the buckle with an engaged latch plate on the end of the pendulum head with the inside surface of the buckle (relative to an occupant) facing away from the pendulum head (see Appendix A, Figure A2).

4.3.9.2 Calibrate the oscilloscope and accelerometer to measure a 40G impact.

4.3.9.3 Install the accelerometer on the pendulum head such that the sensitive axis of the accelerometer is parallel to the direction of impact.

4.3.9.4 Rotate the arm to the point where a 40G impact will be obtained within 50 ms.

4.3.9.5 Release the arm.

4.3.9.6 Verify that a 40G impact was achieved and record if the latch plate was released or ejected.

4.3.9.7 Remount the buckle with the engaged latch plate on the end of the pendulum head but with the inside surface of the buckle (relative to the occupant) facing **towards** the pendulum head (see Appendix A, Figure A2).

4.3.9.8 Repeat 4.3.9.4 to 4.3.9.6.

4.3.10 Buckle Housing Separation; End Release Buckle.

4.3.10.1 Lateral Separation. Mount the buckle to a fixture capable of allowing a lateral force to be applied to the cover that would separate the cover from the buckle assembly (i.e., split the cover open, see Appendix A, Figure A5).

4.3.10.2 Apply the specified load to the cover in the lateral direction relative to the buckle. Record if the cover separates.

4.3.10.3 Continue to apply load until separation or other failure occurs. Record load.

4.3.10.4 Longitudinal Separation. Mount the buckle to a fixture capable of allowing a force to be applied to the cover that would separate the cover from the buckle assembly (see Appendix A, Figure A6).

4.3.10.5 Apply the specified load to the buckle housing in the direction toward the buckle attachment. Record if the cover separates from the assembly.

4.3.10.6 Continue to apply load until separation or other failure occurs. Record load.

4.3.11 Adjustable Guideloop (AGL) Mechanism Release Forces.

4.3.11.1 With 600 mm of webbing stowed on the spool, mount the belt assembly to a fixture such that the webbing exits the guideloop at an angle of 45 degree inboard of the AGL adjustment axis, and 45 degree foreword of the AGL adjustment axis. The retractor side belt segment is parallel to the AGL adjustment axis. Note that the actuator of a vehicle sensitive retractor may need to be "blocked out".

4.3.11.2 Adjust the mechanism to the top-most position.

4.3.11.3 Apply a load, on the release mechanism, at a rate of 12 mm/minute. Apply the load parallel to the Adjustable Guideloop Mechanism rail's adjustment axis in the downward direction. Apply the load until the mechanism is delatched (see Appendix A, Figure A7).

4.3.11.4 Record the maximum load applied to delatch the mechanism.

4.3.11.5 Adjust the mechanism to the lowest position.

4.3.11.6 Repeat 4.3.11.3 to 4.3.11.4 applying in an upward direction.

4.3.12 Adjustable Guideloop Mechanism Adjust Forces.

4.3.12.1 Mount the belt assembly to a fixture as described in 4.3.11.1.

4.3.12.2 Adjust the mechanism to the bottom-most position.

4.3.12.3 Disable the locking mechanism if the mechanism locks in position when moved upward.

4.3.12.4 Apply an upward load, to the mechanism, at a rate of 12 mm/minute parallel to the Adjustable Guideloop Mechanism rail's adjustment axis until the mechanism reaches the up-most position (see Appendix A, Figure A7).

4.3.12.5 Record the maximum load applied in the upward direction.

© Copyright 2016 General Motors Company All Rights Reserved

Documents
Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: GMW-R GMW14311 2016