



Shoulder Belt Comfort Evaluation Part B: Belt Routing Procedure Section 2: Comfort Assessment with Human Test Subjects

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. This is a method of using human subjects to assess the shoulder belt routing that coincides with GMW14791 which utilizes anthropomorphic devices and to provide an alternate procedure for assessing shoulder belt routing when the equipment of GMW14791 is not available.

1.2 Applicability. All safety belt systems with shoulder belts.

1.3 Remarks. Like GMW14791, this procedure is used to assess belt routing comfort by measuring the proximity of the fastened shoulder belt to Belt Restraint Technical Committee (BRTC) approved reference landmarks established on test occupants. The reference landmarks and occupant sizes used in the two procedures are similar but the test occupants used in this procedure are humans. Since the measurements taken in this procedure are a simplified version of what is measured in GMW14791, the values obtained cannot be used to predict customer comfort complaints from the regression curves of GMW14791. The measurements obtained from this procedure will, however, give a good indication of the expected routing and can be used to subjectively predict an approximate degree of comfort.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14791

2.3 Additional References.

- Belt Restraint Technical Committee (BRTC) approved reference.
- University of Michigan Transportation Research Institute (UMTRI).
- Owner's Manual.

3 Resources

3.1 Facilities. Any location that is capable of accommodating a vehicle or test buck and has ambient lighting suitable for taking visual measurements and observations.

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 test equipment or equivalent is required.

3.2.1 Test Subjects. People who are subjectively considered normally proportioned, who meet the selection criteria of Appendix A, Table A1, and who are dressed in clothing which will not restrict shoulder belt movement (collarless, unpadding, etc.)

GM Confidential

© Copyright 2016 General Motors Company All Rights Reserved

July 2016

Page 1 of 8

3.2.2 Measuring equipment necessary to identify the reference landmarks on test subjects as follows.

3.2.2.1 Miscellaneous handheld linear millimeter scales, inclinometer, (2 to 3) mm graphic tape (light color), and small ≈ 10 mm diameter "stick-on" cross hair targets.

3.2.3 Test Vehicle. Vehicle or test buck with environment for which the belt system is intended (including seating characteristics, belt anchorage locations, and any components which may affect belt routing or tension).

3.2.4 Test Materials/Components. The safety belt system to be tested.

3.3 Test Vehicle/Test Piece. Not applicable.

3.4 Test Time.

Calendar time: 1 day

Test hours: 8 h

Coordination hours: 16 h

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

4 Procedure

4.1 Preparation.

4.1.1 Reference Landmark Identification. Establish the clavicle, neck, and shoulder reference landmarks on the appropriate side(s) of the selected test subject per 4.1.1.1 through 4.1.1.6 (see Figure A3).

4.1.1.1 Establish a Vertical Reference Line. With the test subject standing erect, subjectively locate and identify with graphic tape the median plane on the anterior surface of the test subject's upper torso between the base of the neck and the bottom of the chest.

4.1.1.2 Establish a Horizontal Reference Line. Locate the protrusion of the medial end of the test subject's clavicle bone on the chest (below the base of the neck near the median plane). Using graphic tape, subjectively place a horizontal reference line through the center of this point from the median plane to the arm (this line identifies the vertical height of the clavicle reference landmark and is used to locate the sagittal planes for identifying the neck and acromion reference landmarks).

4.1.1.3 On the horizontal reference line of 4.1.1.2 measure (and identify) from the median plane the appropriate lateral distances A, B, and C specified in Appendix A, Table A2 and Figure A3.

4.1.1.4 Locating the Clavicle Reference Landmark. Place a cross hair target on the horizontal reference line at lateral distance A.

4.1.1.5 Locating the Neck and Acromion Reference Landmarks. Subjectively identify the locations of the sagittal planes that pass through lateral distances B and C that are established on the horizontal reference line. Identify, with graphic tape, the surface location of these planes on the test subject shoulder.

4.1.1.6 With the test subject seated in the test vehicle, subjectively locate, and mark with cross hair targets, the highest points on the shoulder at the sagittal plane surface locations established in 4.1.1.5. These targets identify the neck and acromion references landmarks.

4.1.2 If the seat incorporates an adjustable seat back, place the seat back at the design seat back angle.

4.1.3 The following seat and safety belt related test condition represent the minimum that should be evaluated for each occupant size. Other seat and belt related conditions can be tested if deemed necessary.

4.1.3.1 Evaluating with the "Large" Male. Adjust the seat longitudinally to the full rear position. If applicable, adjust the seat vertically to the full down position.

4.1.3.2 Evaluating with the "Medium" Male. Adjust the seat longitudinally to the mid position. If applicable, adjust the seat vertically to the mid position.

4.1.3.3 Evaluating with the "Small" Female. Adjust the seat longitudinally to the full forward position. If applicable, adjust the seat vertically to the full up position.

4.1.3.4 If applicable, position the adjustable guideloop per the Owner's Manual (or intended Owner's Manual) instructions.

GM Confidential

© Copyright 2016 General Motors Company All Rights Reserved

July 2016

Page 2 of 8

Documents
Document Sharing Hub

4.1.3.5 If applicable, position adjustable headrests per the Owner's Manual (or the intended Owner's Manual) instructions.

4.2 Conditions.

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.

4.3 Instructions.

4.3.1 If applicable, position the seat bottom, headrest, and adjustable guideloop for the occupant size selected.

4.3.2 Instruct the test subjects to sit on the seat with the longitudinal center of their torso centered on the seat or between the lap belt anchors (whichever is most appropriate) and to fasten the seat belt.

4.3.3 Instruct the test subject to lean their upper torso forward and back (100 to 150) mm at the shoulder until the shoulder belt routing stabilizes. Encourage only longitudinal motion and an erect seating position.

4.3.4 With the test subject's torso against the seat back, measure and record the perpendicular distance from the inboard edge of the shoulder belt to the clavicle and neck reference landmarks and from the outboard edge of the shoulder belt to the acromion reference landmark. If the shoulder belt does not contact the shoulder, instruct the test subject to rotate forward until belt contact is made before taking measurements.

Note: For clavicle and neck reference landmarks, zero or a negative number indicates; "contact with the neck". For the acromion reference landmarks, zero or a negative number indicates; "loss of shoulder contact".

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. For clavicle and neck reference landmarks, identify the number as positive if the inboard edge of the belt is outboard of the target and as negative if it is inboard of the target. For the acromion reference landmark, identify the number as positive if the outboard edge of the belt is inboard of the target and as negative if it is outboard of the target.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary.

Anterior: Front of torso.

Clavicle and Acromion: Bones in the shoulder area of the human torso as shown in Figure A2.

Clavicle, Neck, and Acromion Reference Landmarks: BRTC approved landmarks established on the University of Michigan Transportation Research Institute (UMTRI) torsos to assess shoulder belt routing.

Deltoid: Muscle that covers the shoulder joint.

Medial: Extending toward the middle.

Median or Mid-Sagittal Plane: Plane that divides the human body into left/right halves as shown in Figure A1.

Sagittal Plane: Planes parallel to the median plane as shown in Figure A1.

UMTRI Torso: The torso section of the body forms (5th female, 50th male, and 95th male) developed by the UMTRI during its 1981 study of Anthropometry of Motor Vehicle Occupants.

GM Confidential

© Copyright 2016 General Motors Company All Rights Reserved

July 2016

Page 3 of 8



Documents

Document Sharing Hub