CIRCULAR 4/01-9-1

TEST PROCEDURES
ADR 4/01 - SEAT BELTS

“A Guide for Inspectors”

This Circular is relevant to the Third Edition of the
Australian Design Rules gazetted as
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  SCOPE</td>
<td>5</td>
</tr>
<tr>
<td>2  SELECTION OF TEST COMPONENTS</td>
<td>5</td>
</tr>
<tr>
<td>3  IDENTIFICATION OF TEST COMPONENTS</td>
<td>5</td>
</tr>
<tr>
<td>4  NUMBER OF TEST SEAT BELTS</td>
<td>5</td>
</tr>
<tr>
<td>5  TEST EQUIPMENT AND TEST PROCEDURES</td>
<td>6</td>
</tr>
<tr>
<td>6  ORDERS OF ACCURACY AND CALIBRATION</td>
<td>40</td>
</tr>
<tr>
<td>7  SUMMARY OF EVIDENCE REPORT</td>
<td>40</td>
</tr>
<tr>
<td>8  PROCEDURE FOR DESIGNS WITH CERTIFICATION TO ALTERNATIVE STANDARDS</td>
<td>40</td>
</tr>
<tr>
<td>9  REFERENCES</td>
<td>41</td>
</tr>
<tr>
<td>ANNEX A  Test Seat and Anchorages for the Dynamic Test.</td>
<td>42</td>
</tr>
<tr>
<td>ANNEX B  Component Boundary Location</td>
<td>43</td>
</tr>
<tr>
<td>ANNEX C  Dummy Dimensions</td>
<td>44</td>
</tr>
<tr>
<td>ANNEX D  Preparation and Conditioning of Test Specimens for Retractor Function (AS 2597 - 9, 1983)</td>
<td>45</td>
</tr>
<tr>
<td>ANNEX E  Apparatus to Test Locking of Type 4N Retractors.</td>
<td>48</td>
</tr>
</tbody>
</table>
1 SCOPE

This procedure, when read in conjunction with the Design Rule and other Circulars issued by the Administrator provides sufficient information to conduct and audit tests on Seat Belts to demonstrate compliance with Australian Design Rule 4/00 and 4/01. As ADRs 4/00 and 4/01 have identical test requirements, this circular applies to both ADRs.

The /01 Rule differs from the /00 Rule in applying/changing seat belt requirements to categories MD2, MD3, MD4, ME, NB2 and NC vehicles. It also deletes ECE 16/00 to 16/03 as acceptable “Alternative Standards”.

Test procedures from Australian Standards for tests referred to in the ADR have been included in this Circular by arrangement with Standards Australia. For convenience reference to the ADR and Australian Standard clause numbers are quoted in brackets against each appropriate Section of this procedure.

The equipment, orders of accuracy and step by step actions described in this procedure are drawn from the standards and recommended practices quoted in the ADR and Australian Standards and from accepted laboratory and testing practices. While conformance with this procedure is sufficient to demonstrate compliance with the ADR, other equipment, orders of accuracy and procedures may be used provided it can be shown that they demonstrate compliance with the ADR.

This ADR calls for tests which demonstrate that:

(i) The seat belt assembly meets certain fit and adjustment requirements.
(ii) The seat belt assembly and components meet certain strength and durability requirements.
(iii) The seat belt assembly shall withstand dynamic loads imposed by the specified test procedure.

This procedure is intended primarily as a guide for officers of the Australian Department of Transport and Communications or agents acting on behalf of the Administrator when they carry out audit inspections of test facilities or witness tests for compliance with the ADR. This and other circulars dealing with test procedures for ADRs may also be useful to vehicle manufacturers and testing organisations.

Nothing in this circular, however, absolves the manufacturer from complying with the requirements as specified in the ADR which always remains the primary reference.

2 SELECTION OF TEST COMPONENTS

This procedure applies to all seat belt assemblies in vehicles subject to the Design Rule. It includes static seat belts, lap/sash and lap belts and also emergency locking retractor (ELR) lap/sash belt systems.

3 IDENTIFICATION OF TEST COMPONENTS

All test seat belts and fittings, adjusters, sash guides and retractor assemblies shall be structurally representative of the design condition as reflected in the production drawings.

Further, for dynamic testing, the test facility must ensure that kinematically the mechanisms are representative of the design conditions.

If production parts are being tested they should be drawn from a batch which has passed normal quality assurance procedures. They should then be identified against the production drawings. If prototype parts are being tested they should be individually inspected on a component by component basis for both dimensional and material (composition, heat treatment and finish) compliance with the drawing.

In either case the revision or issue status of the drawing to which the assemblies have been checked must be stated on all test records.

Finally, a build record should be prepared showing the source and status of all material used for the test seat belt assemblies. The record should be of sufficient detail to completely identify the subject material.

4 NUMBER OF TEST SEAT BELTS

The tests required for each style of belt (static, ELR lap or lap/sash) should be studied so as to arrive at the number of seat belt assemblies to demonstrate Compliance with the ADR. Except where preconditioning of the seat belt assembly is required before conducting tests, the test assembly, comprising each component, and the welding, shall be dry, unused and not previously tested. Test pieces of webbing for determination of dry tensile breaking strength and elongation shall be taken from adjacent webbing or from the same roll of webbing.

5 TEST EQUIPMENT AND TEST PROCEDURES

5.1 Introduction
This Section describes the Equipment required and the test procedures each of the series of tests required to demonstrate compliance with ADR 4/01. In many cases the relevant Data from the Australian Standards has been reproduced by arrangement with Standards Australia. Where any part of the extracted Australian Standard is not relevant for ADR 4/01 it has had a line drawn through it. The Australian Standards used in this section are:

AS 2596-1983. Seat Belt Assemblies for Motor Vehicles
AS 1753 - 1983 Webbing for Restraining Devices for Occupants of Motor Vehicles
AS E35 Pt 1 and Pt 11 1970 have not been used in this circular

Index of Tests Required

<table>
<thead>
<tr>
<th>Seat Belt Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular</td>
</tr>
<tr>
<td>5.2</td>
</tr>
<tr>
<td>5.3</td>
</tr>
<tr>
<td>5.3.1</td>
</tr>
<tr>
<td>5.4</td>
</tr>
<tr>
<td>5.4.1</td>
</tr>
<tr>
<td>5.5</td>
</tr>
<tr>
<td>5.5.1</td>
</tr>
<tr>
<td>5.6</td>
</tr>
<tr>
<td>5.6.1</td>
</tr>
<tr>
<td>5.7</td>
</tr>
<tr>
<td>5.7.1</td>
</tr>
<tr>
<td>5.8</td>
</tr>
<tr>
<td>5.8.1</td>
</tr>
<tr>
<td>5.9</td>
</tr>
<tr>
<td>5.9.1</td>
</tr>
<tr>
<td>5.10</td>
</tr>
<tr>
<td>5.10.1</td>
</tr>
<tr>
<td>5.11</td>
</tr>
<tr>
<td>4.8</td>
</tr>
<tr>
<td>5.11.1</td>
</tr>
<tr>
<td>5.12</td>
</tr>
<tr>
<td>5.12.1</td>
</tr>
<tr>
<td>5.14</td>
</tr>
<tr>
<td>5.14.1</td>
</tr>
<tr>
<td>5.14.1.2</td>
</tr>
<tr>
<td>5.14.1.3</td>
</tr>
<tr>
<td>5.14.1.4</td>
</tr>
<tr>
<td>5.14.1.5</td>
</tr>
<tr>
<td>5.15</td>
</tr>
<tr>
<td>5.15.1</td>
</tr>
<tr>
<td>Clause</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>5.16</td>
</tr>
<tr>
<td>4.8.1</td>
</tr>
<tr>
<td>5.16.2</td>
</tr>
<tr>
<td>5.17</td>
</tr>
<tr>
<td>5.17.1</td>
</tr>
<tr>
<td>4.2.7</td>
</tr>
<tr>
<td>5.17.2</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>5.17.3</td>
</tr>
<tr>
<td>5.18</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>5.18.1</td>
</tr>
<tr>
<td>5.18.2</td>
</tr>
<tr>
<td>5.18.3</td>
</tr>
<tr>
<td>5.18.4</td>
</tr>
</tbody>
</table>
5.2 Dimensional Tests
These tests are usually conducted in the drawing office using full scale body layout drawings or computer aided drafting techniques. The equipment required comprises a 2-D manikin, see Circular 0-12-6, and normal drafting equipment.
Access to the vehicle manufacturer’s occupant package drawings is required to determine the location of the Seating Reference Point and the Seating Reference Plane. From this data, using conventional drafting techniques the component Boundary Location for the seat belt assembly can be determined.

5.2.2 COMPONENT BOUNDARY LOCATION

5.2.2.1 The lines shown in Amen B side elevation are established as follows:
5.2.2.2 Line A is a horizontal line 850 mm above the ‘Seating Reference Point’.
5.2.2.3 Line C is a horizontal line 680 mm above the ‘Seating Reference Point’.
5.2.2.4 Line D is a horizontal line 150 mm below the ‘Seating Reference Point’.
5.2.2.5 Line E is a horizontal line 75 mm below the ‘Seating Reference Point’.
5.2.2.6 Line FOS consists of 2 lines FO and OS and is constructed as follows:
5.2.2.6.1 Draw line FO parallel to the ‘Torso Reference Lines’ and intersecting Line G at Point O, such that the extension of Line FO passes through the most ‘Forward’ point on the ‘Seating Reference Locus’ and
5.2.2.6.2 Draw a vertical Line OS intersecting Line G at Point O;
5.2.2.7 Line KPS consists of 2 Lines KP and PS and is constructed as follows:
5.2.2.7.1 Draw Line KP parallel to and 100 mm ‘Rearward’ of Line FO (established above) intersecting Line OS at P; and
5.2.2.7.2 Line PS is coincident with Line OS,
5.2.2.8 Line G is a horizontal Line 380 mm above the ‘Seating Reference Point’, intersecting the Torso Reference Line at Point N; and
5.2.2.9 Line J is a horizontal Line 230 mm above the Seating Reference Point.
Section 5.3

AS 2597.3—1983

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TESTING SEAT BELTS

AS 2597.3
DETERMINATION OF FATIGUE RESISTANCE OF A FLEXIBLE MEMBER

1 SCOPE. This standard sets out a method for determining the effects of fatigue on flexible load-bearing members designed to bend and flex other than webbing complying with AS 1753.

NOTE: This method is subject to development as experience in testing and normal usage is accumulated and assessed by SAA Committee AU/8, Adult Seat Belts.

2 PRINCIPLE. The member is held rigidly at the anchor fitting or at the end nearer to an anchor fitting, and the other end of the member is deflected to a specified angle from the rest position for a specified number of cycles and in a specified plane.

NOTE: This test is applicable to a sample member of the design dimensions, except that design qualification may be established on the shortest flexible section length for a family of members of which all features of the flexible members other than length are identical.

3 REFERENCED DOCUMENT. The following standard is referred to in this standard:

AS 1753 Webbing for Restraining Devices for Occupants of Motor Vehicles

4 APPARATUS. The following apparatus is required:

(a) A test rig which provides a rigid clamp for the anchor fitting end of the member, and a mechanism to deflect the unclamped end to an angle of not less than 30 degrees from the initial at-rest axis of the member. This angle is to be between the longitudinal axis of the unclamped end and the at-rest axis as shown in Fig. 1. The mechanism is not to apply any turning moment to the unclamped end other than may be necessary to maintain all motion in the selected plane. The mechanism is to be capable of applying 20,000 cycles to the member at a frequency within the range from 0.13 Hz up to and including 0.5 Hz.

(b) A means to count 20,000 cycles.

(c) A means to measure the tensile strength of a test specimen.

5 TEST SPECIMEN. A test specimen shall be an unused and not previously tested seat belt member or subassembly. If any swaging operation is to be carried out on the member, the test specimen shall have that operation completed.

6 PROCEDURE. The procedure shall be as follows:

(a) Determine the at-rest longitudinal axis of the test specimen.

(b) Determine the plane in which deflection is to be carried out. For a flexible member of circular cross-section, any plane passing through the longitudinal axis of the member may be used. For a flexible member of non-circular cross-sections, the plane shall pass through the longitudinal axis of the member and shall be that in which deflection imposes the greatest extreme fibre stress within the member, provided that the selected plane is also one in which the member is intended to deflect in normal use.

(c) Clamp the test specimen to the test rig in the selected plane. The rigidly clamped end is to be the anchor fitting end, or the end nearer to an anchor fitting.

(d) Attach the other end of the test specimen to the deflection mechanism, and set the mechanism to deflect to not less than 30 degrees from the initial at-rest axis, and return to the initial at-rest axis,
Section 5.3

5.3.1 Analysis of Test Results

Following the tests described above the flexible load bearing member shall be capable of sustaining a tensile load of 15 kN for a minimum of 30 seconds. (AS 2596 - Clause 7)
Section 5.4

AS 2597.4—1983

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TESTING SEAT BELTS

AS 2597.4

DETERMINATION OF POTENTIAL FOR INADVERTENT BUCKLE RELEASE

1 SCOPE. This standard sets out a method for determining the potential for release of the buckle through inadvertent contact with the release actuator.

2 PRINCIPLE. A flat surface is applied to the buckle in a defined manner. Operation of the release actuator by the flat surface is taken to indicate the design has potential for inadvertent buckle release.

3 APPARATUS. The following apparatus is required:
   (a) A test rig to support the buckle and to apply a nominal separation force to the latched components of the buckle.
       NOTE: The nominal force is not specified, and may be the separating force provided by a spring ejector incorporated in the buckle design, or by the weight of the separable component.
   (b) A test device incorporating a hard flat surface to be applied against the buckle in the line of action of the release actuator, and with the plane of the surface normal to the line of action. The flat surface shall be of sufficient size to extend in all directions beyond the perimeter of the release actuator to be tested.

4 TEST SPECIMEN. Test specimens shall be unused and not previously tested buckle components.

5 PROCEDURE. The procedure shall be as follows:
   (a) Position the test specimen in the test rig.
   (b) Determine the line of action of the release actuator.
   (c) Apply the test device against the buckle such that the flat surface is normal to the line of action of the release actuator, and attempt to operate the release actuator by means of the flat surface acting along the line of action of the release actuator.

6 REPORT. The report shall include the following:
   (a) Sufficient description to identify the buckle.
   (b) A statement that the release device was either actuated, or not actuated.
   (c) The number of this Australian standard, i.e., AS 2597.4.

5.4.1 Analysis of Test Results
The buckle shall not have a potential for inadvertent release by the vehicle occupants. A buckle shall be deemed not to have potential for inadvertent release by the vehicle occupants if, when tested in accordance with AS 2597.4 above, release is not caused. (AS 2596 - Clause 9b)
Section 5.5

1 SCOPE. This standard sets out the method for determining the forces required to draw webbing through an adjustment device to increase and decrease the size of fitment of a seat belt assembly.

2 REFERENCED DOCUMENT. The following standard is referred to in this standard:
   AS 2597   Methods of Testing Seat Belts
   2597.7 Determination of Locking Angle of Tilt-lock Adjustment Device.

3 PRINCIPLE. Webbing is drawn through the adjustment device at a nominated rate and with the adjustment device in the locked attitude and then at a nominated angle greater than the locked attitude.

4 APPARATUS. The following apparatus is required:
   (a) A clamp to hold the tilt-lock adjustment device, which permits webbing to be drawn through the adjustment device, and which permits the tilt-lock adjustment device to be rotated from a 'webbing fully unlocked' attitude to a locked attitude. The axis of rotation is to lie in the plane of the webbing and be normal to the length of the webbing.
   (b) A machine capable of drawing the webbing through the adjustment device at a rate of 500 ± 50 mm/min.
      The machine shall indicate the force being applied to the webbing to an accuracy of ± 1.0 N.
      (c) A means of establishing a reference line to the tilt-lock adjustment device.

5 TEST SPECIMEN. Test specimens shall be dry, unused, and not previously tested.

6 PREPARATION OF TEST SPECIMENS. With the adjustment device in an unlocked attitude, the webbing shall be drawn through the device to the limit of the webbing travel ten times in both directions.

7 PROCEDURE. The procedure shall be as follows:
   (a) Grip a portion of the seat belt assembly and apply a force of 90 N in a straight line through the tilt-lock adjustment device such that the adjustment device is permitted to assume its normal locking attitude. Apply a reference line to the tilt-lock device parallel to the line of force in the loaded webbing when viewed from the edge of the webbing.
   (b) Draw webbing through the device in a direction equivalent to that which makes the seat belt suit a larger person, so that sufficient webbing is available to obtain a result.
      NOTE: The minimum length of webbing should be determined by trial before the test.
   (c) Hold the adjustment device in the clamp and in the 'webbing locked' attitude.
   (d) Attach the webbing to the machine and draw the webbing through the adjustment device in a direction equivalent to that which makes the seat belt suit a smaller person, at a rate of 500 ± 50 mm/min.
   (e) After the first 25 mm of travel measure the force applied to the webbing.
   (f) Repeat steps (c), (d) and (e) but hold the adjustment device in an attitude not less than 5 degrees greater than the locking angle as determined in AS 2597.7 and draw the webbing through the device in the direction equivalent to making the belt suit a larger person.
5.5.1 Analysis of Results

The adjustment device shall not require an adjustment force greater than 50 N when tested above. (AS 2596, Clause 10e)
1 SCOPE. This standard sets out the method for determining the angle between the adjustment device base and the webbing connecting the anchorage device for the locked condition for a seat belt webbing adjustment mechanism.

2 PRINCIPLE. Tilt-lock adjustment devices operate by locking the webbing at certain relative angles to the webbing. A fully unlocked attitude is taken as a starting point, and the device is rotated until the clamping force is sufficient to prevent slippage of the webbing under an applied force. The tilt-lock actuating angle is then measured between the plane of base of the adjustment device and the plane of the webbing connecting the anchorage device.

3 APPARATUS. The following apparatus is required:
   (a) A clamp to hold the tilt-lock adjustment device, which permits the webbing to be drawn through the adjustment device with a progressively increasing force from zero to greater than 90 N, and which permits the tilt-lock adjustment device to be rotated from a ‘webbing fully unlocked’ condition through an angle sufficient to achieve the nominated locking condition. The axis of rotation is to lie in the plane of the webbing and be normal to the length of the webbing.
   (b) A machine capable of applying a progressively increasing force from zero to at least 90 N, to the webbing at a rate of withdrawal of 500 ± 50 mm/min.
       The machine shall include a device to indicate when a force of at least 90 N is applied to the webbing.
   (c) A means of applying a reference line to the tilt-lock device in the line of pull on the webbing.
   (d) A device to measure the angle in degrees between the base of the adjustment device when a force of 90 N is indicated, and the line of the pull on the webbing.

4 TEST SPECIMEN. Test specimens shall be dry, unused and not previously tested seat belt components.

5 PREPARATION OF TEST SPECIMENS. With the tilt-lock adjustment device in a fully unlock ed attitude, the webbing shall be drawn through the device to the limit of the webbing travel ten times in both directions.

6 PROCEDURE. The procedure shall be as follows:
   (a) Hold the tilt-lock adjustment device in the clamp and draw webbing through the device in a direction equivalent to that which makes the seat belt suit a smaller person, so that sufficient webbing is available to obtain a result.
       NOTE: The minimum length of webbing required should be determined by trial before the test.
   (b) Attach the webbing end to the machine and apply a small force sufficient to support the webbing.
   (c) Set the tilt-lock adjustment device to an attitude relative to the webbing in which the device is fully unlocked.
   (d) Draw the webbing through the tilt-lock adjustment device by means of the machine at a rate of 500 ± 50 mm/min.
Section 5.6

AS 2597.7—1983

2

At the same time gradually rotate the tilt-lock adjustment device until the tilt-lock adjustment device locks onto the webbing. Hold the angle of rotation at the locking angle, but allow the force in the webbing to increase to at least 90 N.

(e) Stop the machine when a force of 90 N has been attained in the webbing.

(f) Measure the dihedral angle between the plane of the base of the adjustment device and the plane of the line of pull on the webbing.

7 REPORT. The report shall include the following:

(a) Sufficient description to identify the tilt-lock adjustment device and webbing.
(b) The angle measured in Clause 6 (f).
(c) The number of this Australian standard, i.e. AS 2597.7.

5.6.1 Analysis of Results

When tested as described above the tilt lock adjustment device shall lock at an angle of not less than 30 degrees and adjustment devices shall not require an adjustment force of greater than 50 N. (AS 2596 - Clause 10e)
5.7.1 Analysis of Results (Clause 4.3.3)

The free end device shall have complied with this clause if after being subjected to a force of 9 kN for > 30 seconds it did not pass through the anchor.
Section 5.8

1. AS 2597.1—1983

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TESTING SEAT BELTS

AS 2597.1

DETERMINATION OF WEBBING DURABILITY IN ADJUSTMENT DUTY

1 SCOPE. This standard sets out the method for determining the durability of seat belt webbing, including that intended for use in a tilt-lock type adjustment device, under simulated adjustment operations. The components for testing are all those with which the webbing makes rubbing contact except a sash guide used in conjunction with an emergency locking retractor.

2 REFERENCED DOCUMENTS. The following standards are referred to in this standard:
   AS 1753  Webbing for Restraining Devices for Occupants of Motor Vehicles
   AS 2596  Seat Belt Assemblies for Motor Vehicles.

3 DEFINITIONS. For the purpose of the standard, the definitions given in AS 2596 apply.

4 PRINCIPLE. Adjustment operations of a seat belt may result in abrasion between the webbing and other components. Abrasion may cause reduction of strength of the webbing, and the extent of abrasion will be influenced by the details of the components, the geometry of the system and the applied tensile force within the webbing. A test for adequate dry breaking tensile strength of the webbing is taken to indicate the suitability of the components with respect to abrasion caused by adjustment operations.

5 APPARATUS. The following apparatus is required:
   (a) A test rig in which the component can be held and the webbing can be pulled through the component in the nominated directions and with the nominated forces. Where the component is a tilt-lock adjuster, the apparatus shall facilitate rotation of the adjuster from a fully locked angle to at least a fully unlocked angle at each reversal of motion of the webbing, the axis of rotation being parallel to the plane of the webbing and normal to the longitudinal axis of the webbing.
   (b) A mechanism to oscillate the webbing through the device for a stroke of not less than 150 mm and not greater than 200 mm, while subjecting the stroked webbing to a tensile force of not less than 13 N at all times during the stroke.
   (c) A device to register the number of cycles completed, i.e. not less than 2500.
   (d) A device to apply a tensile force to the webbing of 14.7 kN or 75 percent of the dry tensile breaking strength, whichever is the greater.

   NOTE: Special jaws are necessary to prevent excessive slip of the webbing and breakage of the webbing at the grips.

6 TEST SPECIMEN. Test specimens comprising each component, and the webbing, shall be dry, unused, and not previously tested. Webbing specimens for determination of dry tensile breaking strength shall be from adjacent webbing.

7 PROCEDURE. The procedure shall be as follows:
   (a) Establish the dry tensile breaking strength of the webbing, being that determined in accordance with AS 1753 by test of webbing that was adjacent to the test specimen.
   (b) Mount the component in the test rig in accordance with Fig. 1, Fig. 2, or Fig. 3, as appropriate.
   (c) Apply a tensile force of not less than 13 N to the webbing.
   (d) Oscillate the webbing through the component for 2500 cycles. Where the component is an adjuster, the component shall be rotated between the two positions illustrated in Fig. 1 at the completion of each stroke. The stroke shall be greater than 150 mm and not greater than 200 mm.
Section 5.8

AS 2597.1—1983

(e) Remove the webbing and subject it to a tensile force (dry) of 14.7 kN, or 75 percent of the initial dry tensile breaking strength as determined in accordance with AS 1753, whichever is the greater.

8 REPORT. The report shall include the following:

(a) Sufficient description to identify the component and the webbing.
(b) The initial dry tensile breaking strength of the webbing.
(c) The force applied under Clause 7 (e).
(d) A statement that the dry tensile breaking strength of the webbing after 2500 cycles through the component was either less, or not less, than the greater of 14.7 kN and 75 percent of the initial dry tensile breaking strength.
(e) The number of this Australian standard, i.e. AS 2597.1.

5.8.1 Analysis of Results (ADR 4/01 Clause 4.5.1)

After the webbing and fittings have been subjected to the tests described in Section 7 above, the dry tensile strength of the webbing shall not be reduced to less than 14.7 kN or 75% of the ‘dry breaking strength’ established in section 7(a) above.
Section 5.8

3

AS 2597.1—1983

Fig. 1. POSITION FOR TEST OF ADJUSTER

NOTE: $F = 13$ N minimum force.

Fig. 2. WEBBING ANGLES FOR TEST OF BUCKLE

NOTE: $F = 13$ N minimum force.
Section 5.8

AS 2597.1—1983

4

Roller or adjuster

Strap

Relative motion between strap and free end restraint

Free end restraint

\[ F = 13 \text{ N minimum force} \]

Fig. 3. ARRANGEMENT FOR TEST OF FREE END RESTRAINT
Section 5.9

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TESTING SEAT BELTS

AS 2597.2

DETERMINATION OF WEBBING DURABILITY IN WITHDRAWING AND RETRACTING DUTY THROUGH A SASH GUIDE

1 SCOPE. This standard sets out the method for determining the durability of seat belt webbing passing through a sash guide system under simulated withdrawing and retracting operations.

2 REFERENCED DOCUMENTS. The following standards are referred to in this standard:
   AS 1753  Webbing for Restraining Devices for Occupants of Motor Vehicles
   AS 2596  Seat Belt Assemblies for Motor Vehicles

3 DEFINITIONS. For the purpose of this standard, the definitions given in AS 2596 apply.

4 PRINCIPLE. Withdrawing and retracting operations of a seat belt torso strap through a sash guide may result in abrasion of the webbing. Abrasion may cause reduction of strength of the webbing, and the extent of abrasion will be influenced by the details of the components and the geometry of the system. A test for adequate dry breaking tensile strength of the webbing is taken to indicate the suitability of the system with respect to abrasion caused by withdrawing and retracting operations.

5 APPARATUS. The following apparatus is required:
   (a) A test rig appropriate to the nominated application of the seat belt assembly as follows:
      (i) Nominated for a particular vehicle model or range of vehicle models — a test rig to simulate all webbing contact points between the retractor and the last contact point with any component before contact with the wearer within the sash guide system or as provided in the vehicle design.
      (ii) Others — a test rig to provide the strap and sash guide arrangement given in Fig. 1.
   (b) A mechanism to apply a reciprocating action to the webbing through a stroke of not less than 200 mm applied to the torso strap in directions given in Fig. 2. The frequency is to be not less than 0.2 Hz and not greater than 0.4 Hz.
   (c) A means of applying a tensile force not less than 18 N in all parts of the strap during the whole of the withdrawing and retracting strokes, but the tensile force is to be zero at one point in the cycle.
   (d) A device to register the number of cycles completed, i.e. not less than 50,000.
   (e) A device to apply a tensile force to the webbing of 14.7 kN or 75 percent of the dry tensile breaking strength, whichever is the greater.

   NOTE: Special jaws are necessary to prevent excessive slip of the webbing and breakage of the webbing at the grips.

6 TEST SPECIMEN. Test specimens comprising those parts of a seat belt assembly or part seat belt assembly that are liable to abrasion with the sash guide system shall be dry, unused, and not previously tested. Specimens for determination of dry tensile breaking strength shall be from adjacent webbing.

7 PROCEDURE. The procedure shall be as follows:
   (a) Establish the dry tensile breaking strength of the webbing being that determined in accordance with AS 1753, by test of webbing that was adjacent to the test specimen.
Section 5.9

AS 2597.2—1983

2

(b) Mount the part of the seat belt assembly to be tested, in the test rig in accordance with the following geometry, as appropriate:

(i) Where the seat belt assembly is designated for installation in a nominated vehicle model or range of vehicle models, or where testing a part seat belt, the relative orientation of the sash strap and sash guide system shall be that of the design configuration. Where the design permits the sash guide to pivot, the axis of rotation may be varied from the design axis by an angle not greater than 5 degrees. (See Fig. 1.)

(ii) Where the seat belt assembly is not designated for installation in a nominated vehicle model or range of vehicle models, the relative geometry of the sash strap and sash guide, and the point of application of the force $F$ shall conform to Fig. 2.

(c) Withdraw the webbing and allow it to retract in such a manner that the torso strap takes up the angles illustrated in Fig. 2 during each working stroke.

The tensile force in all parts of the test strap shall be not less than 18 N at all times during withdrawing and retracting, and shall be zero at one other point in the cycle. The working stroke shall be not less than 200 mm.

The webbing shall be withdrawn and allowed to retract 50 000 cycles, at a frequency of not less than 0.2 Hz and not greater than 0.4 Hz.

(d) Remove the webbing and subject it to a tensile force (dry) of 14.7 kN, or 75 percent of the initial dry tensile breaking strength as determined in accordance with AS 1753, whichever is the greater.

8 REPORT. The report shall include the following:

(a) Sufficient description to identify the component and the webbing.

(b) The initial dry tensile breaking strength of the webbing.

(c) The force applied under Clause 7 (d).

(d) A statement that the dry tensile breaking strength of the webbing after 50 000 retractor cycles was either less, or not less, than the greater of 14.7 kN and 75 percent of the initial dry tensile breaking strength.

(c) The number of this Australian standard, i.e. AS 2597.2.

5.9.1 Analysis of Results (ADR 4/01 Clause 4.5.2)

After the webbing, fittings, sash guide etc have been subjected to the tests described in section 7 above, the dry tensile strength of the webbing shall not be reduced to less than 14.7 kN or 75% of the ‘dry breaking strength’ established in section 7(a) above.
Section 5.9

Fig. 1. PERMITTED DEPARTURE FROM DESIGN AXIS FOR PIVOTING SASH GUIDE (DESIGN CONFIGURATION KNOWN)

NOTE: $F = 18$ N min. during working action.

Fig. 2. FORCES AND DIRECTION OF FORCES IN TORSO STRAP
5.10.1 Analysis of Results (ADR Clause 4.5.3)

The force required to operate the buckle spring shall not be reduced by more than 20% after being subjected to the tests described above. (AS 2596 Clause 10J)
Section 5.11

1 AS 2597.10—1983

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TESTING SEAT BELTS

AS 2597.10

DETERMINATION OF STATIC STRENGTH AND DUMMY DISPLACEMENT

1 SCOPE. This standard sets out the method for determining the static strength of a retractor, or seat belt assembly, or part seat belt. The method also includes determination of displacement of a test dummy under load, slippage of webbing, and buckle release actuation force.

2 REFERENCED DOCUMENTS. The following documents are referred to in this standard:

- AS 1180 Methods of Test for Hose Made from Elastomeric Materials
  - 1180.9A Hardness of Vulcanized Rubbers of Standard Hardness (35 to 85 IRHD)
  - 1180.9B Hardness of Vulcanized Rubbers of Low Hardness (10 to 35 IRHD)
- AS 2193 Methods for Calibration and Grading of Force-measuring Systems of Testing Machines
- AS 2596 Seat Belt Assemblies for Motor Vehicles
- SAE J941e (Mch 77) Recommended Practice for Motor Vehicle Driver's Eye Range

3 DEFINITIONS. For the purpose of this standard, the definitions given in AS 2596 and the following apply:

Buckle reference point. A point related to the buckle as follows:

(a) For the buckle of a lap-sash seat belt assembly — coincident with the lap-sash point.
(b) For the buckle of other types of seat belt assemblies — on the centreline of the strap and where the strap enters or attaches to the buckle half that does not incorporate the buckle release mechanism.

4 PRINCIPLE. Static tensile forces are induced in the seat belt components by forcing a test dummy against the seat belt straps. The seat belt assembly is to remain intact while the nominated force is attained and maintained for a nominated time. Buckle release is conducted at a reduced nominated force. The test dummy displacement is determined under the applied force and the slippage of webbing through components is measured after release of the force.

5 APPARATUS. The following apparatus is required:

(a) A test machine with provision for attaching the seat belt assembly by the seat belt anchors located as appropriate for the particular seat belt assembly.

NOTE: Figs 1, 2, 3 and 4 provide the centres for anchorage and sash guide locations where the vehicle geometry is not known, e.g. for general purpose seat belt assemblies. Where the vehicle geometry is known, the centres for anchor and sash guide locations are those of the vehicle. The actual anchor and sash guide locations are to lie within 50 mm radius spherical envelopes centred at the nominated locations, except that in the case of dispute the anchor and any sash guide locations shall be at the locations nominated by the vehicle manufacturer.

The test machine shall be of Grade B or better in accordance with AS 2193, and shall be capable of applying smoothly increasing and decreasing forces to the test dummy to a maximum force of 17.8 ± 0.4 kN, and at a rate of displacement of the dummy of between 60 mm/min and 100 mm/min, and shall be capable of maintaining the maximum force for not less than 30 s.

(b) A test dummy conforming to the dimensions given in Fig. 5.

(c) A test dummy frame, which may be a part of the test machine, and which prevents the test dummy from tilting during the test.

NOTE: Fig. 6 shows a typical test rig arrangement.
Section 5.11

AS 2597.10—1983

2

(d) A means of applying a force of 1.1 to 1.2 kN to the test dummy.
(e) A force-measuring device accurate to ± 4.5 N and capable of measuring within the range zero to 112 N, for measurement of the buckle release force under impact unloading conditions.

NOTE: Calibration may be carried out by burning through a string connecting calibration weights with the measuring device.
(f) Means of marking a reference point on the webbing at each component where slippage may occur, and a scale to measure, in millimetres, any slippage.
(g) Rubber pads to separate the test dummy from the buckle and, if appropriate, adjusters during testing and to protect the test dummy. Each pad is to be approximately 12 mm thick and not less than 100 mm x 100 mm, with a hardness of 30 to 50 IRHD as determined in accordance with AS 1180.9A or AS 1180.9B, as appropriate.

If excessive friction is present between the dummy and webbing, or the dummy and the pad, a material such as thin felt may be interposed to reduce the friction.

6 TEST SPECIMEN. The test specimens comprising a seat belt assembly or part seat belt and corresponding components shall be unused, dry, and not previously tested.

7 SETTING UP POSITIONS

7.1 Test Dummy. The test dummy shall be positioned so that the anchors can be disposed about the dummy as follows:

(a) For general purpose seat belt assemblies .......... in accordance with Fig. 1, Fig. 2, Fig. 3 or Fig. 4, as appropriate

(b) For original equipment and replacement seat belt assemblies .......... in accordance with information obtained from the vehicle manufacturer, or where that information is not available, in accordance with a derived position that will result in the centreline of the test dummy (in plan view) coinciding with the centre of the seat belt assembly to be occupied by the occupant. This test dummy derived position may be established by use of the seating reference plane (see Appendix C to AS 2596), which for the driver position makes reference to SAE J941e (Mch 77).

7.2 Anchoring. The anchors (including sash guide anchors) shall be positioned as follows:

(a) For general purpose seat belt assemblies .......... within 50 mm radius spherical envelopes centred on the anchor positions given in Fig. 1, Fig. 2, Fig. 3 or Fig. 4, as appropriate, where the strap length permits, except that in the case of dispute the anchor and any sash guide locations shall be at the locations nominated by the vehicle manufacturer. Where the strap length is not sufficient to permit the anchor location in accordance with Fig. 1, Fig. 2, Fig. 3 or Fig. 4, as appropriate, the following alternatives shall apply:

(i) Where the strap attached to that part of the buckle component incorporating the release mechanism is of insufficient length to allow anchoring at the location specified in Fig. 1, Fig. 2, Fig. 3 or Fig. 4, as appropriate, the anchor shall be positioned on a line passing through the centre of the buckle and the anchor location specified in Fig. 1, Fig. 2, Fig. 3 or Fig. 4, as appropriate.

(ii) Other anchors that cannot be positioned in accordance with Fig. 1, Fig. 2, Fig. 3 or Fig. 4, as appropriate, shall be positioned in the locations within the limits given in the fitting instructions that are most severe with respect to the test.

(b) For original equipment and replacement seat belt assemblies .......... within 50 mm radius spherical envelopes centred on the anchor positions of the vehicle or range of vehicle for which the seat belt assembly or part assembly is intended, except that in the case of dispute the anchor and any sash guide locations shall be at the locations nominated by the vehicle manufacturer.

7.3 Buckle. The reference point of the buckle shall be positioned as follows:

(a) For harness seat belt assemblies with a centre buckle .......... with the buckle at the front of the test dummy and the centre of the buckle within 25 mm of a longitudinal plane passing through the vertical axis of the test dummy.

(b) For lap-sash, lap, and other harness seat belt assemblies .......... with the buckle reference point at the side of the test dummy and 100 ± 25 mm from both the plane of the back of the test dummy and the plane of the base of the test dummy.

8 PROCEDURE. The procedure shall be as follows:

(a) With the seat belt assembly installed, place the protective rubber pad between the buckle and the test dummy. A protective pad may be placed between each adjuster and the test dummy where
contact between the adjuster and the test dummy may cause damage to the test dummy. Adjust the seat belt assembly to hold the test dummy tightly and to compress the protective rubber pads.

NOTE:
1. A material such as thin felt may be used to reduce friction between the rubber pad and the dummy.
2. It is necessary to lock any retractor to maintain the adjustment.

(b) Apply a static force of 1.1 kN to 1.2 kN to the test dummy and set the displacement reader to zero.
(c) Mark the webbing (on the unloaded side where possible) at each adjustment device and fitting where slip could occur, ensuring that the marks will not be obscured subsequent to slippage.
(d) Apply a smoothly increasing force so that the test dummy is displaced at 60 mm/min to 100 mm/min, to a maximum force of 17.8 ± 0.4 kN.
(e) Maintain the force of 17.8 ± 0.4 kN for not less than 30 s, and measure the test dummy displacement to an accuracy of ±13 mm during the last 10 s of that period.

NOTE: It is permissible to measure and record the test dummy displacement and corresponding force for the entire period of displacement.
(f) Smoothly reduce the force so that only the initial static force of (b) remains.
(g) At each adjustment device measure the slip that has occurred, to an accuracy of ±3 mm.
(h) Measure the force required to operate the buckle release actuation to an accuracy of ±4.5 N. The force is to be applied at a point and in a direction typical of the manner normally used by a wearer of that seat belt assembly.

9 REPORT. The report shall include the following:
(a) Sufficient description to identify the seat belt assembly or part seat belt assembly.
(b) The test dummy displacement to an accuracy of ±13 mm during the last 10 s of application of increasing force.
(c) The slip measured at each adjustment device, accurate to ±3 mm.
(d) The force to operate the buckle release actuation, accurate to ±4.5 N.
(e) The actual test location of anchors and sash guides, accurate to ±13 mm.
(f) The number of this Australian standard, i.e. AS 2597.10.

5.11.1 Analysis of Results (ADR Clause 4.6.2) (AS 2596 Clause 14.1)
After being subjected to the retractor durability test described in Annex D (AS 2597.9), the retractor shall be capable of locking and when locked, either:
: withstand a tensile load of not less than 9 kN applied to the Strap; or
: be capable of sustaining the static test force when tested as a seat belt assembly or part seat belt in accord with the procedures described above (Section 8) and the following
1 (a) The seat belt assembly shall not separate from itself or from any anchor.
(b) For lap belt assemblies the displacement of the test dummy shall not exceed 260 mm
(c) For other seat belt assemblies the displacement of the test dummy shall not exceed 180 mm.
(d) The slip of webbing through any single manual adjusting device shall not exceed 25 mm and total slip through all manual adjusting devices shall not exceed 50 mm.
(e) Buckle release force shall not exceed 112 N.
(f) When buckle components may be latched to each other in different ways, the seat belt assembly shall comply with the requirement (a) to (e) for each way of latching. (AS 2596 - Clause 14.1)
With the retractor unlocked it shall withstand a tensile force of not less than 9 kN applied to the strap.
For the purpose of this test the ‘Strap’ shall be fully withdrawn and locking mechanisms shall be rendered inoperative.
In the case where the retracting ‘Strap’ of a ‘Lap-Sash Belt’ is the torso ‘Strap’, the retraction force in the ‘Strap’ before and after the retractor has been subjected to the retractor durability test of Section 4.8, shall be not less than 2 N nor more than 10 N, under the conditions described in Section 5.13 Webbing Retraction Force (ADR Clause 4.6.2)
ALL DIMENSIONS IN MILLIMETRES

TOLERANCES ± 6 mm.

NOTE: A reference test dummy is held by the Standards Association of Australia, and may be referred to for dimensions not provided by this figure.

Fig. 5. TEST DUMMY DIMENSIONS
NOTES:
1. Seat belt shown is lap-sash type belt. The arrangement is typical for other types.
2. Test dummy is to be guided or restrained to not tilt.
3. The test may be conducted with the force in a horizontal or vertical plane.

**Fig. 6. TYPICAL TEST RIG ARRANGEMENT**
Section 5.12

1

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TESTING SEAT BELTS

AS 2597.11

DETERMINATION OF WEBBING RETRACTION FORCE

1 SCOPE. This standard sets out a method for determining the webbing retracting force of a seat belt retractor.

2 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 2596  Seat Belt Assemblies for Motor Vehicles
AS 2597  Methods of Testing Seat Belts

2597.9 Preparation and Conditioning of Test Specimens for Retractor Function.

3 DEFINITIONS. For the purpose of this standard, the definitions given in AS 2596 apply.

4 PRINCIPLE. The retractor is installed as part of a seat belt assembly in a test rig to simulate the geometry in which it is normally used.

The force applied by the retractor is measured at a nominated position on the webbing, and in a nominated direction, and at a nominated webbing extension. The force is measured both before and after the retractor is subjected to conditioning to simulate dust exposure for durability testing in accordance with AS 2597.9. (Annex D of ADR 4/01

5 APPARATUS. The following apparatus is required:

(a) A test rig or vehicle to accommodate the seat belt assembly, or part assembly and corresponding parts, in the design configuration of the vehicle in which the assembly is intended to be installed, or a corresponding geometry.

(b) A device to apply and measure the force applied to the webbing to resist the retractor force.

6 TEST SPECIMEN. The test specimens comprising a seat belt assembly, or a part seat belt and the corresponding parts, shall be unused and not have been subjected to any test.

7 SETTING UP. The seat belt assembly shall be installed in the test rig as follows:

(a) For a seat belt assembly or part seat belt not designated for installation in a nominated vehicle model or range of vehicle models, the seat belt shall be set up so that the sash guide and retractor system are in the geometry given in Fig. 1.

(b) For a seat belt assembly or part seat belt designated for installation in a nominated vehicle model or range of vehicle models, the seat belt shall be set up so that the sash guide retractor system is in the design geometry of the vehicle, and where scope for variation exists, the most adverse geometry.

(c) Where the seat belt assembly incorporates a device that prevents the belt from being completely retracted upon manual or automatic operation of that device, the device shall be rendered inoperative for the test.

8 PROCEDURE. The procedure shall be as follows:

(a) With the seat assembly set up in accordance with Clause 7, withdraw the part of the test strap which simulates the torso strap through the sash guide system until 430 ± 20 mm of strap remains in the retractor.

NOTE: This position and the fully extended position should be determined and marked on the strap prior to the test.

(b) Allow the withdrawn strap to retract so that 450 ± 20 mm of strap is in the retractor. Hold the strap in this position by a static force. The force shall be applied in a downward direction at 20 ± 10
Section 5.12

AS 2597.11—1983

degrees to the vertical and in a vertical plane which is at $35 \pm 10$ degrees to a longitudinal plane of the vehicle when viewed in plan.

(c) Measure the retraction force in the test strap forward of the point where it would contact the first sash guide device after passing over the shoulder of a wearer.

(d) Condition the test specimen in accordance with AS 2597.9.

(e) Repeat steps (a), (b) and (c).

9 REPORT. The report shall include the following:

(a) Sufficient description to identify the seat belt assembly or part assembly.

(b) The retraction forces measured before and after durability testing.

(c) The number of this Australian standard, i.e. AS 2597.11.

Fig. 1. FORCES AND DIRECTION OF FORCES IN TORSO STRAP
(Right-hand installation only shown)

5.12.1 Analysis of Results (ADR 4.6.2.2) (AS 2596 Clause 11.3)
Retractor Force in the strap shall be between 2 kN and 10 kN before and after the test described above.

NOTE: This test is commonly carried out during the Retractor Durability Test referred to in Section 5.11
Section 5.13

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
METHODS OF TESTING SEAT BELTS

AS 2597.12
DETERMINATION OF RETRACTOR LOCKING UNDER ACCELERATION

1 SCOPE. This standard sets out methods for determining the locking response of a retractor under various conditions of accelerations of the webbing or the retractor as appropriate. Procedures for three conditions are provided.

2 REFERENCED DOCUMENTS. The following documents are referred to in this standard:
   AS 2596  Seat Belt Assemblies for Motor Vehicles
   AS 2597  Methods of Testing Seat Belts
   2597.9 Preparation and Conditioning of Test Specimens for Retractor Function
   SAE J211 (Jun 80) Recommended Practice for Instrumentation of Impact Tests

3 DEFINITIONS. For the purpose of this standard, the definitions given in AS 2596 apply.

4 PRINCIPLE. The strap or retractor is subjected to accelerations at various strap extensions and retractor modes. The extension occurring prior to locking under the influence of the applied acceleration is taken as response to acceleration. In two of the methods, the measured extensions are extrapolated to a theoretical extension at the fully extended length.

5 APPARATUS. The following apparatus is required:
   (a) A test rig to which the retractor is to be attached. For Procedures A and C, the test rig is to accelerate the strap directly relative to the retractor at 8 m/s² and 20 m/s² respectively. For Procedure B, the test rig is to accelerate the retractor at 5 m/s² in the longitudinal, transverse, and if applicable vertical mode, and in a positive and negative sense of acceleration. The acceleration to a maximum of 5 m/s² for Procedure B is to be attained in not less than 40 ms from start of application of acceleration to the retractor.
   (b) A means of measuring accelerations applied by the test rig. Instrumentation should be capable of complying with the requirements of SAE J211 (Jun 80) for Channel Class 60.
   (c) A means of setting reference positions for the strap extension relative to the fully extended position, these extensions being within 150 ± 5 mm, 450 ± 5 mm, and 750 ± 5 mm as applicable, of the fully extended position; 750 ± 5 mm applies to Procedures A and C, 760 ± 5 mm applies to Procedure B.
   (d) A means of measuring to an accuracy of ± 1 mm the extensions of strap that occur between application of acceleration and the retractor locking.

6 TEST SPECIMENS. Test specimens shall be dry, unused, and not previously tested assemblies of retractor and associated strap. Conditioning of each test specimen in accordance with AS 2597.9 is carried out after an initial testing and before a second testing.

7 PROCEDURE.
    7.1 Procedure A.
   (a) Attach the retractor to the test rig.
   (b) Fully extend the strap from the retractor, and mark the strap or otherwise establish points to indicate starting reference extensions on the strap 150 ± 5 mm, 450 ± 5 mm, and (if available) 750 ± 5 mm less than fully extended.
   (c) Attach the strap to the acceleration device, such that the acceleration will be applied to start at the selected reference extension (as established in (b) above).
AS 2597.12—1983

(d) Apply an acceleration to the strap of not more than 8 m/s² and sufficient to cause the device to lock.

(e) Measure the length of strap extended beyond the selected starting reference extension.

7.2 Procedure B.

(a) Attach the retractor to the test rig in the selected mode, i.e. for longitudinal, transverse, or (if applicable) vertical direction of acceleration.

(b) Fully extend the strap from the retractor, and mark the strap or otherwise establish points to indicate starting reference extensions on the strap 150 ± 5 mm, and (if available) 450 ± 5 mm and 760 ± 5 mm less than fully extended.

(c) Render inoperative any locking device actuated by strap acceleration which would otherwise affect the test result.

(d) Attach the strap to a fixed part of the test rig, such that the acceleration to the retractor will be applied at the selected reference extension (as established in (b) above).

(e) Apply an acceleration to the retractor of not more than 5 m/s² and sufficient to cause the device to lock.

(f) Measure the length of strap extended from the extension at first application of acceleration to the extension when locked.

(g) Repeat steps (d), (e) and (f) for all other starting reference extensions, and for all other applicable modes, and for positive and negative acceleration for each mode and starting reference extension.

(h) Condition the specimen in accordance with AS 2597.9.

(j) Repeat steps (a) to (g).

7.3 Procedure C. The procedure shall be as for Procedure A, except that the acceleration applied in step (d) shall be 20 m/s².

8 CALCULATION OF RESULTS (For Procedures A and C). The measured extensions before locking for each reference extension of 150 mm, 450 mm, and (if available) 750 mm shall be extrapolated to give a theoretical extension for the fully extended condition. If two results are measured, a straight line extrapolation shall be used. If three results are measured, extrapolation by the method of least squares is acceptable.

9 REPORT. The report shall include the following:

(a) Sufficient description to identify the retractor and webbing.

(b) The test acceleration, in metres per second per second.

(c) The measured extension before locking, in millimetres.

(d) For Procedure A or Procedure C, the extrapolated theoretical extension for the fully extended condition for the tests prior to and following conditioning, in millimetres.

For Procedure B, the measured extensions for each permutation of mode, sign of acceleration, and reference starting extension for the tests prior to and following conditioning, in millimetres.

(e) The number of this Australian standard, i.e. AS 2597.12.
5.14 Determination of Retractor Locking

5.14.1 Analysis of Test Results (ADR 4/01 Clause 4.6.4.1)

5.14.1.1 Acceleration of emergency locking dual sensitive locking retractor (AS2596 - Clause 11.6.3 and AS2597.12 Procedure B) Section 5.13.

When the emergency locking retractor is tested by Procedure B AS2597.12 above it:

- shall lock when the retractor and any associated devices to sense acceleration are accelerated at not more than 5m/s\(^2\), the peak acceleration being attained in not less than 40 milliseconds
- Furthermore with a point on the external ‘Strap’ fixed the locking device shall limit ‘Strap’ movement, measured from the time of application of the acceleration, to not more than:
  - 30 mm, when the ‘Strap’ is withdrawn to a point which is 150 5 mm from the fully extended position; and
  - 80 mm, when the ‘Strap’ is withdrawn to points 450 5 mm and 760 5 mm from the fully extended position, if the ‘Seat Belt Assembly’ includes sufficient ‘Strap’ to attain these extensions.
- This requirement shall be met under positive and negative acceleration in longitudinal, transverse and vertical directions, except that in case where the device is designed to lock when tilted to any angle in excess of 45 degrees then the locking requirement need be met for longitudinal and transverse directions only.

NOTE Sensing of acceleration to meet the requirements of this Clause shall not be dependent upon rate of withdrawal of ‘Strap’ from the retractor. In demonstrating this requirement, any device dependent for sensing of acceleration on withdrawal of ‘Strap’ from the retractor may be rendered inoperative. (ADR Clause 4.6.4.1)

5.14.1.2 Acceleration of the Strap (ADR Clause 4.6.4.1) when the Emergency Locking Retractors is tested by Procedure C (AS2597.12) above and the ‘Strap’ is extended at an acceleration of not more than 20 m/s\(^2\) locking shall occur within 25 mm of ‘Strap’ extension. This requirement shall be met at an extrapolated point representing full extension based on test results achieved at points of extension which are less than the full extensions by 150 5 mm, 450 5 mm, and 750 5 mm (if available), respectively. (ADR Clause 4.6.4.2)

5.14.1.3 Mechanical Failure of Retractor Mechanism.

An ‘Emergency Locking Retractor’ shall be designed to lock automatically, or meet the requirements of section 5.14.1.1 and 5.14.1.2 above upon any single mechanical failure of a spring which part of the locking mechanism (ADR Clause 4.6.4.3) (AS2596 Clause 11.4)

5.14.1.4 Signal or Power Failure

In cases where the operation of retractor depends on an external signal or power source, the design shall ensure that the retractor locks automatically upon failure or interruption of that signal or power source (ADR Clause 4.6.4.4)(AS2596 Clause 11.4)

5.14.1.5 Tilt of Emergency Locking Retractor

The design on an ‘Emergency Locking Retractor’ shall ensure that it remains unlocked when the vehicle is tilted up to 12 degrees, longitudinally or transversely, from the horizontal. (Clause 4.6.4.5) (AS2596 11.6.3 (c)).
1 SCOPE. This standard sets out the method for determining the dynamic performance of a seat belt assembly.

2 REFERENCED DOCUMENTS. The following documents are referred to in this standard:
   AS 1753  Webbing for Restraining Devices for Occupants of Motor Vehicles
   SAE J211 (Jun 80) Recommended Practice for Instrumentation of Impact Tests

3 PRINCIPLE. The seat belt assembly is subjected to dynamic forces required to cause a nominated deceleration of a dummy of specified characteristic.

4 APPARATUS. The following apparatus is required:
   (a) A means to apply a force of not less than 1.8 kN for a period of not less than 10 s to the buckle through the end of a 20 mm maximum diameter rigid bar radiused to 150 mm maximum at the end.
   (b) A means to subject the buckle assembly to 20 000 unlatching operations with a tensile force of not less than 20 N applied during each unlatching operation.
   (c) A test rig of mass not less than 380 kg, and which consists of either of the following:
      (i) A trolley, test seat, foot rest, and structure for providing seat belt anchoring, conforming to the dimensions given in Fig. 1. The seat base surface shall not have energy-absorbing characteristics, and shall be smooth where contact is made with the dummy.
      (ii) A trolley and a vehicle body shell complete with a representative seat which is adjusted to the rearmost seat position, the vehicle body shell and representative seat being appropriate for the vehicle for which the seat belt assembly or part assembly is designated.
   (d) A dummy of mass 74 ± 2 kg, and of a design which complies with calibration requirement given in Clause 7.2.
   (e) A spacer of flexible but substantially incompressible material not less than 25 mm thick, and at least as wide and as long as the back of the dummy. This spacer is required only for testing of seat belts that do not incorporate retractor.
      NOTE: Plywood is an acceptable material for the spacer when used with the test rig specified in (c)(i), but not with the test rig specified in (c)(ii).
   (f) A means of subjecting the seat belt assembly to successive environments in accordance with Clause 6 (c).
   (g) A means of measuring deceleration of the test rig for calibration purposes. Instrumentation should be capable of complying with the requirements of SAE J211 (Jun 80) for Channel Class 60.

5 TEST SPECIMEN. Test specimens shall be dry, unused, and not previously tested seat belt assemblies. Where a part seat belt is to be tested, the part shall be combined with a corresponding part to make a complete assembly.

6 PREPARATION OF TEST SPECIMEN. The seat belt components nominated shall be subjected to all of the following operations:
   (a) A buckle or adjusting device which is normally free to take up a position in a door opening or under a pivoting seat shall be placed on a flat surface in its most stable attitude and subjected to a force of not less than 1.8 kN for a period of not less than 10 s. The force shall be applied through the end of a rigid bar of not more than 20 mm diameter with the end formed into an arc of radius of
Section 5.15

not more than 150 mm, with the bar in line with the strap when viewed in plan, and the test shall be repeated with the bar normal to the direction of the strap when viewed in plan.

NOTE: This requirement is to apply to the general purpose seat belt, and to all other seat belts unless it can be shown that the buckle or adjusting device is not free to take up a position in a door opening or under a pivoting seat.

(b) The buckle assembly shall be subjected to not less than 20 000 unlatching operations. During each unlatching operation, a tensile force of not less than 20 N shall be applied to the assembly.

(c) Where the seat belt assembly incorporates non-metallic parts (other than webbing), the entire assembly (including the webbing) shall be subjected to successive exposures to environments as follows:

(i) Phase 1. In an enclosure at 80°C containing an uncovered water surface, for not less than 24 h.

(ii) Phase 2. In environment at not more than 23°C, for not less than 15 min.

(iii) Phase 3. In an environment that attains not less than 100°C within 80 min of commencement of the phase, for not less than 6 h.

(iv) Phase 4. In an environment that attains not more than 0°C within 20 min of commencement of the phase, for not less than 6 h.

(v) Phase 5. In an environment at not more than 23°C, for not less than 15 min, and if desired up to a maximum of the residual of a 24 h period.

(vi) Phases 6 to 11. Repeat Phases 3 to 5 twice in succession.

7 CALIBRATION OF APPARATUS.

7.1 Test Rig. The test rig shall be calibrated at intervals not exceeding 50 test operations, and prior to the first test operation following any maintenance. The calibration shall be carried out with a rigid body of mass 74 ± 2 kg rigidly attached to the test rig in place of the dummy. The deceleration shall be measured in the vicinity of the lap anchorage position, and shall be a forward deceleration of between 235 m/s² and 335 m/s² achieved within 30 ms of start of deceleration for a velocity of 13.6 m/s nominal. The deceleration shall remain substantially within the range 235 m/s² to 335 m/s² for not less than 20 ms, but deceleration values outside that range that occur for periods of less than 1 ms may be disregarded.

7.2 Dummy. The dummy shall be calibrated at intervals not exceeding 50 test operations, and prior to the first test operation following any maintenance. The calibration shall be carried out in a calibrated test rig. The dummy shall be restrained by separate lap and sash straps, each of which uses webbing known to have an elongation of not less than 12 percent when subjected to a tensile force of 11 kN in accordance with Appendix B of AS 1753. All slack in the lap and sash straps shall be taken up. Anchorage shall be located in accordance with Fig. 1.

The test rig shall be fired with settings identical with those used in calibration of the test rig prior to every test and—

(a) the sum of the peak restraining forces in each length of sash strap at a point not in contact with the dummy shall be not less than 10 kN; and

(b) the sum of the peak restraining forces in each length of lap strap at a point not in contact with the dummy shall be not less than 10 kN.

8 SETTING UP POSITIONS.

8.1 Test Dummy. The test dummy shall be positioned so that the anchors can be arranged about the dummy as follows:

(a) For general purpose seat belt assemblies in accordance with Fig. 2, Fig. 3, Fig. 4 or Fig. 5, as appropriate.

(b) For original equipment and replacement seat belt assemblies in accordance with information obtained from the vehicle manufacturer, or where that information is not available, in accordance with a derived position that will result in the centreline of the test dummy (in plan view) coinciding with the centre of the seat belt assembly to be occupied by the occupant. This test dummy derived position may be established by use of the seating reference plane.

8.2 Anchors. The anchors (including sash guide anchors) shall be positioned as follows:

(a) For general purpose seat belt assemblies within 100 mm radius spherical envelopes centred on the anchor positions given in Fig. 2, Fig. 3, Fig. 4 or Fig. 5, as appropriate, where the strap length permits. Where the strap length is not sufficient to permit the anchor location in accordance with Fig. 2, Fig. 3, Fig. 4 or Fig. 5, as appropriate, the following alternatives shall apply:
Section 5.15

5.15.1 Analysis of Results (Clause 4.7)

After the Seat Belt Assemblies for the front facing Seats has been subjected to the preconditioning and dynamic tests described above they shall not separate within themselves or from any Anchorage. (ADR Clause 4.7.1)

The buckle components shall be capable of manual release after the dynamic test. (AS 2596 Clause 14.2)
Fig. 1. DIMENSIONS FOR TEST SEAT AND ANCHORS
(Right-hand installation only shown)

ALL DIMENSIONS IN MILLIMETRES
5.16 Corrosion Resistance of Metal Parts

5.16.1 Procedure
Metal parts or coated metal parts shall be exposed to the ASTM B117 salt spray test for 50 hours

5.16.2 Analysis of Results
After washing away deposited salt and any corrosion products the metal or coated metal parts shall show no significant evidence of base metal corrosion or of blistering of the coating and shall be operational.

5.17 Test on Seat Belt Webbing

Tests to determine the compliance of the webbing used in seat belts shall be carried out in accordance with Australian Standard 1753-1983 ‘Webbing for Restraining Devices for Occupants of Motor Vehicles’.

Refer to this standard for webbing requirements and test procedures.

Tests concerned are
5.17.1 Light Degradation Resistance AS 1753 Clause 11.2.11.3 (ADR Clause 4.2.7)
5.17.2 Webbing Strength
- Dry Breaking Load
  AS 1753 Clause 6 (ADR Clause 4.2.7)
- Wet Breaking Load
  AS1753 Clause 10 (ADR Clause 4.2.7)
5.17.3 Load/Elongation of Webbing
  AS 1753, (ADR Clause 4.2.7)
For calibration of the dummy used on the sled for the dynamic test on a seat belt assembly, webbing is used to restrain the dummy and must meet the following properties
- Elongation of not less than 12% when subjected to a load of 11 kN using the test procedure specified in Appendix ‘B’ of AS 1753-1983
  (ADR Clause 4.11.3) (Section 5.15 Dynamic Test)
5.18.2 Locking of Type 4 N Retractors
5.18.2.1 Testing Equipment
A suitable apparatus for the tests for locking of Type 4N Retractors is described in Annex E. The design of any such test apparatus shall ensure that the required acceleration is given at an average rate of increase of acceleration at least 25 g per second
5.18.2.2 Test Procedure
5.18.2.2.1 The retractor shall be tested once for locking when the strap has been unwound to full length less 300 3 mm
5.18.2.2.2 In the case of a retractor actuated by strap movement, the extraction shall be in the direction in which it normally occurs when the retractor is installed in a vehicle
5.18.2.2.3 When retractors are being tested for sensitivity to vehicle deceleration they shall be tested at the above extraction along two perpendicular axes, which are horizontal if the retractor is installed in a vehicle as specified by the safety belt manufacturer. When this position is not specified, the test facility shall consult the safety belt manufacturer.
5.18.2.2.4 To check conformity with the requirements for locking of the retractor when tilted the retractor shall be mounted on a horizontal table and the table tilted with an angular speed not exceeding 2 degrees per second until locking has occurred. The test shall be repeated with tilting in other directions to ensure that the requirements are fulfilled.
5.18.2.2.5 The retracting force shall be measured with the safety belt assembly fitted to dummy as for the dynamic test described in Section 5.18.4. The strap tension shall be measured at the point of contact with (but just clear of) the dummy while the strap is being retracted at the approximate rate of 0.6 metres per minute.
5.18.2.3 Analysis of Test Results.
Following the tests described above, the Type 4 N Retractor Assembly shall meet the following conditions.
5.18.2.3.1 The Retractor locking must have occurred when the deceleration of the vehicle reaches 0.85 g
5.18.2.3.2 The retractor must not lock for values of acceleration of the strap measured in the direction of the extraction of the strap of less than 1.0 g
5.18.2.3.3 The retractor must not lock when its sensing device is tilted 12 degrees or less in any direction from the installation position specified by its manufacturer and
5.18.2.3.4 It shall lock when its sensing device is tilted by more than 40 degrees in any direction from the installation position specified by its manufacturer.
5.18.2.3.5 In cases where the operation of a retractor depends on an external signal or power source, the design shall ensure that the retractor locks automatically upon failure or interruption of that signal or power source.
5.18.2.3.6 A retractor with multiple sensitivity must satisfy the requirements above, when tested in accordance with Section 5.18.2.2. In addition if one of the sensitivities relates to strap extraction, locking must have occurred at a strap acceleration equal to or more than 2.0g measured along the line of the extraction of the strap
5.18.2.3.7 In the case of the requirements described above the amount of strap movement which may occur before the retractor locks shall not exceed 50 mm starting at the full length less 500 50 mm. In the case of the test mentioned in Section 5.18.2.3.2 above locking must not occur during the 50 mm of strap movement starting at the full length less 500 5 mm (Section 5.18.2.1.1)
5.18.2.3.8 If the retractor is part of a lap belt, the retracting force of the strap shall not be less then when measured in the free length between the dummy and the retractor in accordance with Section 5.18.2.5. If the retractor is part of an upper torso restraint, the retracting force of the strap shall be not less than 2 N and not more than 7 N when similarly measured. If the strap passes through a guide or pulley the retractor force shall be measured in the free length between the dummy and the guide or pulley. If the assembly incorporates a device that upon manual or automatic operation prevents the strap from being completely retracted, such as device
shall not be operated when these requirements are assessed.

5.18.3 Durability of Retractor Mechanism (ADR Appendix A Clause 7.6)
5.18.3.1 Test Equipment. The apparatus for carrying out the durability of the retractor is shown in Figure 2 of Annex D
5.18.3.2. Test Procedure, Conditioning
5.18.3.2.1 The strap shall be withdrawn and allowed to retract for the required of cycles (40,000 cycles) at a rate of not more than 30 cycles per minute. In the case of ‘Type 4N Retractors’ a snatch to lock the retractor shall be introduced at each fifth cycle. The snatches shall occur in equal numbers at each of five different extractions, namely, 90, 80, 75, 70 and 65 per cent of the total strap remaining wound on the retractor. However, where more than 900 mm is provide the above percentages shall be related to the final 900 mm of strap which can be withdrawn from the retractor.
5.18.3.2.2 The retractor shall then be subjected to the corrosion tests described in Annex D (AS 2597.9), Preparation and Conditioning of Test Specimen for Retractor Function, Section 6.
5.18.3.3 Following the corrosion test the retractor shall then be subjected to the test for dust resistance. The apparatus and dust is described in Annex D Section 5(C)(d)

5.18.4 Dynamic Tests (Clause 4.4.7)
Dynamic tests on the seat belt/retractor assembly shall be carried out in accordance with Section 5.15 (AS 2597.13, Determination of Dynamic Performance) including the Dynamic Preconditioning and Retractor Durability Test. (Clause 4.7.3 and Clause 4.8)
5.18.4.1 Procedure Dust Test
The retractor shall be positioned in the test chamber as described in Annex D. It shall be mounted in an orientation similar to that in which it is mounted in the vehicle. A length of 500 mm of the strap shall be extracted from the retractor and kept extracted, except that it shall be subject to ten complete cycles of retraction and withdrawal within one or two minutes after each agitation of the dust. For a period of five hours, the dust shall be agitated every twenty minutes for five seconds by compressed air, free of oil and moisture at a gauge pressure of $5.5 \times 10^5 + 0.5 \times 10^5 \text{ Pa}$ entering through an orifice $1.5 \times 0.1 \text{ mm}$ in diameter.
5.18.4.2 The retractor shall then satisfactorily complete a further 5,000 cycle (making 45,000 in all)

5.18.5 Analysis of Tests Following Conditioning
5.18.5.1 Following the above conditioning the retractor shall operate correctly and still meet the requirements described in Sections 5.18.2.3 after testing to the procedure described in Section 5.18.2.2
5.18.7 Dynamic Tests (Clause 4.4.7)
Dynamic tests on the seat belt/retractor assembly shall be carried out in accordance with Section 5.15 (AS2597.13, Determination of Dynamic Performance) including the Dynamic Preconditioning and Retractor Durability Test (Clause 4.7.3 and Clause 4.8)

6 ORDER OF ACCURACY AND CALIBRATION
6.1 Order of Accuracy. Except where specified in the ADR or referred documents, the following order of accuracy is considered to be commercially achievable and should be taken as a guide. Instrumentation of lesser accuracy is acceptable provided it is taken into account in determining the certainty of results.
The time measurements should be determined within 1%. The order of accuracy of load measurement may vary, depending on the system employed. In all cases, however, the tests must be conducted with the load reading equaling the calculated load plus maximum instrument error. A typical instrument system for load measurement would have an order of accuracy of 5%.
Deflection measurements should be made within 3 mm.
6.2 Calibration. Routine calibration of load cells, electronic elements and recording equipment is to be carried out in accordance with Circular 0-12-3.
Prior to each series of tests it is desirable that the complete load measuring system be calibrated against a known standard, e.g. deadweight, universal testing machine or transfer calibration system at a number of points.
6.3 Reporting Results. The results of each test are to be recorded in a complete internal report giving a full description of material tested, equipment used, results and order of accuracy. For submission to the Administrator the determined results for loads, deflected position and distortion, are to be recorded together with the internal report number in the appropriate section of the Summary of Evidence Report. See Section 7.

7 SUMMARY OF EVIDENCE REPORT
The Summary of Evidence Report SE 4/00 is the only document to be sent to the Administrator for demonstration of compliance to ADR 4/00 or 4/01. The original test report identification number, the location of the test report, the test facility identification number and the determined results are to be recorded in the appropriate place in the SE 4/00 form for each relevant clause of the ADR.

8 PROCEDURE FOR DESIGNS WITH CERTIFICATION TO ALTERNATIVE STANDARDS
For ADR 4/00
8.1 The technical requirements of ECE R 16/00 to R 16/04 “Safety Belts” shall be deemed to be equivalent to the technical requirements of ADR 4/00 provided that
8.1.1 For ADR Clauses 4.14 to 4.16 for vehicle categories MD3, MD4, ME, NB2 and NC non-locking retractors shall not be employed; and
8.1.2 The Light Degradation Resistance of the Australian Standard 1753 Clause 11.2 and 11.3 and the dust and
preconditioning (before any dynamic testing) requirements of AS2597.9 are met:
8.1.3 The free end requirements of Clauses 4.3.3.2 or 4.16.2 of ADR 4/00 are met (Clause 4.17.1)

For ADR 4/01
8.2 The technical requirements of ECE R 16/04 “Safety Belts” shall be deemed to be equivalent to the technical requirements of ADR 4/01, provided that
8.2.1 For ADR Clauses 4.14 to 4.16 for vehicle categories MD3, MD4, ME, NB2, and NC non-locking retractors shall not be employed;
8.2.2 The Light Degradation Resistance of the Australian Standard 1753 Clauses 11.2 and 11.3 and the dust and preconditioning (before any dynamic testing) requirements of AS2597.9 are met; and
8.2.3 The free end requirements of Clauses 4.3.3.2 or 4.16.2 of ADR 4/01 are met.
8.3 Seat Belts Assemblies for vehicle category MD3, MD4, ME, NB2 and NC meeting the requirements of Federal Motor Vehicle Safety Standard No 209, “Seat Belt Assemblies” current as at 13 December 1979 are acceptable except that the use of non-locking retractors as defined in that Standard shall not be allowed; (Clause 4.14.2.4)
8.4 Where a Standards Association of Australia (SAA) approval mark and license is held for manufacture of seat belts to the relevant Australian Standards, relevant parts noted on the form SE 4/00 shall be completed.

In the cases above the relevant parts of form SE 4/00 shall be completed

9 REFERENCES

ADR References

ADR Definitions
ADR 3/00 - Seat Anchorages
ADR 4/00 - Seat Belts
ADR 4/01 - Seat Belts
ADR 5/01/02 - Anchorages for Seat Belts and Child Restraints
Australian Standards
AS E35-1970 Pt 1 and Pt 2 - Seat Belt Assemblies for Motor Vehicles
AS 2596-1983 - Seat Belt Assemblies
AS 1753-1983 - Webbing for Restraining Devices for Occupants of Motor Vehicles
AS E47-1971 - Webbing for restraining Devices for Occupants of Motor Vehicles
AS 2597-1983 - Methods of Testing Seat Belts

Circulars
Circular 0-12-2 - General Requirements for Testing Facilities
Circular 0-12-3 - General Requirements for Calibration of Test Equipment and Instrumentation
Circular 0-12-6 - Devices for use in Defining and Measuring Motor Vehicle Seating Accommodation
Circular 0-12-7 - Motor Vehicle Driver’s Eye Range

Other References
ASTM B 117 - 1964 Salt spray (fog) Testing
FMVSS 209 - December 13 1979 - Seat Belt Assemblies
ECE R 16/00 to 16/04 - Safety Belts
ECE R 14/02 Safety Belt Anchorages
ANNEX A
TEST SEAT AND ANCHORAGES
FOR THE DYNAMIC TEST

TEST SEAT DATUM POINT

DIMENSIONS IN mm
AB = SEAT BASE SURFACE
BB = SEATING REFERENCE PLANE

VIEW A
ANNEX B

COMPONENT BOUNDARY LOCATION

[Diagram showing lines and seating reference points with labels such as "LINE A", "LINE B", "LINE C", "LINE D", "LINE E", "LINE F", "Line G", "Line J", "Seating Reference Locus", and "Seating Reference Point." There is an arrow labeled "Forward" indicating direction.]
### ANNEX C

#### DUMMY DIMENSIONS

<table>
<thead>
<tr>
<th></th>
<th>‘95th Percentile Adult Male’</th>
<th>‘5th Percentile Adult Female’</th>
<th>‘50th Percentile 6 Years Old Child’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>97.5 ± 5 kg</td>
<td>46 ± 5 kg</td>
<td>21.4 ± 3 kg</td>
</tr>
<tr>
<td>Erect sitting height</td>
<td>965 mm</td>
<td>785 mm</td>
<td>645 mm</td>
</tr>
<tr>
<td>Hip breadth (sitting)</td>
<td>415 mm</td>
<td>325 mm</td>
<td>215 mm</td>
</tr>
<tr>
<td>Hip circumference (sitting)</td>
<td>1200 mm</td>
<td>925 mm</td>
<td>605 mm</td>
</tr>
<tr>
<td>Waist circumference (sitting)</td>
<td>1080 mm</td>
<td>600 mm</td>
<td>530 mm</td>
</tr>
<tr>
<td>Chest depth</td>
<td>265 mm</td>
<td>190 mm</td>
<td>160 mm</td>
</tr>
<tr>
<td>Chest circumference</td>
<td>1130 mm</td>
<td>775 mm (nipple)</td>
<td>595 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>755 mm (upper)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>675 mm (lower)</td>
<td></td>
</tr>
<tr>
<td>Shoulder height</td>
<td>680 mm</td>
<td>520 mm</td>
<td>415 mm</td>
</tr>
</tbody>
</table>

### Tolerance on all length dimensions ±5 percent.
ANNEX D

1 AS 2597.9—1983

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TESTING SEAT BELTS

AS 2597.9
PREPARATION AND CONDITIONING OF TEST SPECIMENS FOR RETRACTOR FUNCTION

1 SCOPE. This standard sets out the method for conditioning a seat belt retractor prior to testing for retractor function.

NOTE: This method for conditioning is referred to in AS 2597.11 and AS 2597.12.

2 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 1152 Test Sieves
AS 2596 Seat Belt Assemblies for Motor Vehicles
ASTM B 117 Method of Salt Spray (Fog) Testing

4 PRINCIPLE. The seat belt assembly is conditioned by exposure to a specified salt spray, and may be rinsed and dried. It is then operated at a range of locking positions for a nominated number of cycles. A further conditioning by exposure to dust is then carried out, followed by more operations at a range of locking positions.

5 APPARATUS AND MATERIALS. The following apparatus and materials are required:

(a) Equipment to apply salt spray (fog) testing in accordance with ASTM B 117.

(b) Equipment to provide an environment having a temperature between 21°C and 25°C and a relative humidity between 48 percent and 67 percent, for at least 24 h.

(c) Approximately 1 kg of dry quartz dust of the following particle size distribution:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Test Sieve Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>99 percent</td>
<td>150 μm</td>
</tr>
<tr>
<td>76 percent</td>
<td>106 μm</td>
</tr>
<tr>
<td>60 percent</td>
<td>75 μm</td>
</tr>
</tbody>
</table>

(d) A dust test apparatus capable of exposing the retractor to the dust caused by an air blast for 5 ± 1 s every 70 ± 1 min over a period of 5 h. A suitable apparatus is illustrated in Fig. 1, but other apparatus may be used if shown to be equivalent. The apparatus shall permit withdrawing and retracting of the webbing during dust exposure.

(e) A machine to hold the retractor and to withdraw and release the webbing for a total of 50,000 cycles at a frequency not exceeding 0.5 Hz. During withdrawing of the webbing on every fifth cycle, the retractor locking mechanism is to be actuated so that the webbing is locked at a predetermined extension. These extensions are to be 90, 80, 75, 70 and 65 percent of the maximum extension, or where the maximum extension exceeds 0.9 m are to be those percentages of the 0.9 m of webbing nearest the core of the retractor. A suitable apparatus is illustrated in Fig. 2 but other apparatus may be used if shown to be equivalent.

6 PREPARATION OF TEST SPECIMEN. The test specimen shall be prepared in the following manner:

Subject the retractor to the salt spray (fog) testing in accordance with ASTM B 117 for not less than 50 h, except that the washing procedure given in Clause 11 therein may be omitted or varied by washing thoroughly with water to remove salt. The drying procedure of the method (if necessary) is exposure of the withdrawn webbing to an atmosphere of between 21°C and 25°C and a relative humidity of
between 48 percent and 67 percent for at least 24 h. Then manually fully extend the webbing and allow it to retract for 25 cycles.

7 PROCEDURE. The procedure shall be as follows:
(a) Attach the seat belt retractor and connected webbing to the test apparatus.
(b) Withdraw the webbing and allow it to retract for 45 000 cycles at a frequency not exceeding 0.5 Hz. At each fifth withdrawal, operate the retractor locking mechanism so that webbing withdrawal is limited.
During the 45 000 cycles, the limited withdrawals shall be arranged to be 1800 cycles of each of the following: 90, 80, 75, 70 and 60 percent of the maximum extension, or where the maximum extension exceeds 0.9 m the percentages shall be of 0.9 m.
(c) At the completion of 45 000 cycles of testing, subject the retractor and connected webbing to dust exposure for a period of 5 h. The dust shall be agitated by an air blast for 5 ± 1 s at a gauge pressure of 550 ± 55 kPa every 20 ± 1 min. Within 2 min of the air blast, the webbing shall be fully withdrawn from the retractor and allowed to fully retract for 10 cycles.
(d) Re-attach the test specimen to the test apparatus and apply a further 5000 cycles at a frequency not exceeding 0.5 Hz in the same manner as given in Clause 7 (b). This will result in a further 200 cycles of each of the nominated extensions.
ANNEX D

3

ID 500 mm

Retractor positions

Cycling attachment

500 mm

Retractor

250 mm

Dust
(approx. 1 kg)

Orifice $\phi$ 1.5 $\pm$ 0.1 mm

Valve

Air supply
(Oil and moisture free)
550 $\pm$ 50 kPa

Fig. 1. DUST EXPOSURE APPARATUS

Fig. 2. SUITABLE APPARATUS FOR WITHDRAWING AND RELEASING WEBBING

COPYRIGHT

TO TEST DURABILITY OF RETRACCTOR MECHANISM
ANNEX E

DIAGRAM OF AN APPARATUS TO TEST LOCKING OF EMERGENCY LOCKING ‘TYPE 4N RETRACTORS’

A suitable apparatus is illustrated in the figure and consists of a motor-driven cam, the follower of which is attached by wires to a small trolley mounted on a track. The cam design and motor speed combination is such as to give the required acceleration at a rate of increase of acceleration as specified in Section 5.18.3 of the Annex and the stroke is arranged to be in excess of the maximum permitted webbing movement before locking.

On the trolley a carrier is mounted which can be swiveled to enable the retractor to be mounted in varying positions relative to the direction of movement of the trolley.

When testing retractors for sensitivity to strap movement the retractor is mounted on a suitable fixed bracket and the strap is attached to the trolley.

When carrying out the above tests any brackets, etc shall be incorporated in the test installation to simulate as closely as possible the intended installation in a vehicle.

Additional brackets, etc may be required to simulate the installation as intended in the vehicle.