



COMMONWEALTH OF AUSTRALIA

AUSTRALIAN DESIGN RULE 4C
FOR
SEAT BELTS

As Endorsed by the
Australian Transport Advisory Council

The intention of this Australian Design Rule is to define standards for seat belts to restrain vehicle occupants under impact conditions and to facilitate fastening and correct adjustment.

The Australian Transport Advisory Council has recommended to Commonwealth, State and Territory Governments that all motor vehicles specified below shall be equipped with seat belts complying with Australian Design Rule 4C - Seat Belts.

VEHICLE CATEGORY	RULE AMENDMENT	
	MANUFACTURED ON OR AFTER	
	4C	4C.7.3(iii)*
Passenger Cars		
Forward Control Passenger Vehicles up to 8 seats	1 Jan 1985	
9 seats	1 Jan 1985#	
Other Passenger Cars	1 Jan 1976	1 Jan 1979
Passenger Car Derivatives	1 Jan 1976	1 Jan 1979
Multi-Purpose Passenger Cars	1 Jan 1976	1 Jan 1979
Omnibuses up to 3.5 tonnes GVM		
up to 12 seats	1 July 1983#	
over 12 seats	1 July 1983#	1 July 1983#
up to 4.5 tonnes GVM	N/A	N/A
over 4.5 tonnes GVM	N/A	N/A
Motorcycles	N/A	N/A
Mopeds	N/A	N/A
Specially Constructed Vehicles	N/A	N/A
Other Vehicles not listed above		
up to 4.5 tonnes GVM	1 July 1976	1 July 1978
over 4.5 tonnes GVM	N/A	N/A

Front Seats only (including the driver's seating position)

* After date shown, sub-clause 4C.7.3(iii) shall be superseded by sub-clause 4C.7.3(iv)

N/A - Not Applicable

GROSS VEHICLE MASS - Abbreviated to 'GVM'

The Australian Transport Advisory Council has also recommended to Commonwealth, State and Territory Governments that sub-clause 4C.4.7(ii) shall only become effective on 1 July 1977.

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AUSTRALIA

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- 4C.1 Definitions
- 4C.1.1 AS E35 Pt. 2 - means Australian Standard E35, Part 2 - 1970, 'Seat Belt Assemblies (including retractors) for Motor Vehicles', up to and including amendment No. 1.
- 4C.1.2 Accessible - a point on a seat belt component is considered to be accessible if either:
- (i) it is located above Line J; or
 - (ii) it is capable of being enclosed by a straight 100mm external diameter tube, a point of which extends to Line J and the centre line of which can intersect Line G at a point not more than 100mm forward nor more than 300mm rearward of Point O.
- 4C.1.3 Anchor Fitting - the terminal part of a seat belt assembly designed to be attached to the vehicle or seat.
- 4C.1.4 Automatic Length Adjusting and Locking Retractor - a retractor incorporating a self actuating mechanism which automatically locks the retractor at the webbing extension selected by the user.
- 4C.1.5 Buckle Component - means each one of the two parts of the buckle assembly designed to be latched to each other to complete the buckle assembly.
- 4C.1.6 Correctly fitted - means the design configuration of the seat belt assembly as installed in the vehicle using the anchorages and sash guide devices, and adjusted around the occupant of the seating position to eliminate slack, with the occupant seat such that his centre line lies in the seating reference plane of the seating position.
- 4C.1.7 Dry Breaking Strength - the tensile strength of a webbing strap conditioned in an atmosphere at $20 \pm 5^{\circ}\text{C}$ and relative humidity not more than 67%.
- 4C.1.8 Emergency Locking Retractor - a retractor incorporating a locking mechanism that is designed to lock under abnormal operating conditions.
- 4C.1.9 Final Torso Anchorage - an anchorage located in the vehicle to receive the anchor fitting of the upper torso strap of a lap-sash belt.
- 4C.1.10 Forward, Rearward (when referenced to a seat or seating reference point) - means the direction relative to that which an occupant faces when seated.

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- 4C.1.11 Functional Component - means a component essential to the satisfactory operation of the seat belt assembly and without which, the seat belt assembly would no longer meet the requirements of this Design Rule.
- 4C.1.12 Harness Belt - A seat belt assembly consisting of at least one strap designed to provide pelvic restraint and two or more torso straps designed to provide upper torso restraint.
- 4C.1.13 Lap Belt - A seat belt assembly designed to provide pelvic restraint only.
- 4C.1.14 Lap-Sash Belt - A seat belt assembly combining a lap strap designed to provide pelvic restraint, and a torso strap designed to provide upper torso restraint.
- 4C.1.15 Lap-Sash Point - means the point representing the intersection of the lap and torso straps of a lap-sash belt.
- 4C.1.16 Line 'X', Point 'Y' - a line or point of a family, established in Clause 4C.13 and represented in Figure 2, where 'X' and 'Y' represent a symbol listed in Clause 4C.13.
- 4C.1.17 Manual Adjusting Device - means a device other than a retractor designed to be operated by the wearer to adjust the length of a strap of a seat belt assembly.
- 4C.1.18 Sash Guide - A system of one or more devices which locates the torso strap of a lap-sash belt. Any device which alters the direction of the strap between the upper torso reference point and the final anchorage is a sash guide device. The anchor fitting at the final torso anchorage is always a sash guide device and may be the only sash guide device in the system.
- 4C.1.19 Seat Back Angle - The angle between the torso reference line and the vertical line through the seating reference point.
- 4C.1.20 Seat Belt Assembly - An arrangement of straps, anchor fittings, securing buckle, adjusting devices and at least one sash guide device, designed to restrain a motor vehicle occupant in the event of an impact. Devices for absorbing energy or for retracting the strap shall be considered as part of the seat belt assembly.
- 4C.1.21 Seating Reference Locus - The locus of a point fixed relative to the seat, which is coincident with the seating reference point when the seat back is at the design seat back angle and when the seat is in the rearmost driving or riding position, as the seat traverses over the riding or driving range of seat travel.

4C.1.22 Seating Reference Plane

4C.1.22.1 For a seat as described in Figure 1 of Clause 4C.11.1 - the vertical plane passing through the geometric centre of the seat, identified as BB on Figure 1 of Clause 4C.11.1.

4C.1.22.2 For seats intended for the vehicle:

- (i) Driver's position - the vertical longitudinal plane through the geometric centre of the eye ellipse defined and positioned as in Recommended Practices - SAE J941b (February 1969); SAE J941c (June 1972); SAE J941d (February 1975); SAE J941e (March 1977); SAE J941 (March 1981) - Motor Vehicle - Driver's Eye Range or in ISO 4513 - 1978 (E) - Road Vehicles - Visibility - Method for establishment of eye ellipses for driver's eye location, suitably handed for right hand steering, except that in case of seats designed for one seating position only, the reference plane may be the longitudinal plane through the geometric centre of the seat.
- (ii) Front outboard passenger position on a seat which also provides for the driver's seating position - the vertical plane parallel to the seating reference plane of the driver's seating position and equidistant from the centre of the vehicle.
- (iii) Seats designed for one seating position only - the vertical plane through the geometric centre of the seat, except that in the case of the front outboard passenger's position, the seating reference plane may be the vertical plane parallel to the seating reference plane of the driver's seating position and equidistant from the centre of the vehicle.
- (iv) Other seating positions - the plane nominated by the manufacturer provided that in the case of an outboard position on a transverse seat which is designed for two occupants only, the seating reference plane shall be at least 200mm from the vertical longitudinal plane through the centre of the vehicle and at least 200mm from the inner panel (or the line of the inner panel) when measured horizontally on a transverse line through the seating reference point.

*Amended February 1984

- 4C.1.23 Strap - A part of a seat belt assembly designed with flexure to facilitate correct and comfortable wearing.
- 4C.1.24 Test Seat Datum Point - means a point in relation to the seat described in Figure 1 of Clause 4C.11.1. When viewed in side elevation, it is located 120mm above and 115mm forward of the intersection of the planes of the seat base and the seat back.
- 4C.1.25 Torso Reference Line - A line parallel to the small of the two dimensional manikin's back and extending through the seating reference point when the seat back is adjusted to a required seat back angle. The two dimensional manikin is as specified in SAE J826a - Devices for Use in Defining and Measuring Vehicle Seating Accommodation, August 1970.
- 4C.1.26 Upper Torso Reference Point - An arbitrary point representing the last point of contact of a sash strap on a torso when the seat back is adjusted to the design seat back angle. It is located at a height of 530mm above the seating reference point measured along the torso reference line, 60mm forward of the torso reference line when measured normal to the torso reference line and 120mm from the seating reference plane when measured normal to the seating reference plane and towards the sash guide.
- 4C.1.27 5th percentile adult female - is a dummy whose dimensions comply with the appropriate dimensions in Table 1, or a person with dimensions which are less than the appropriate dimensions in Table 1.
- 4C.1.28 50th percentile 6 years old child - is a dummy whose dimensions comply with the appropriate dimensions in Table 1, or a person with dimensions which are less than the appropriate dimensions in Table 1.
- 4C.1.29 95th percentile adult male - is a dummy whose dimensions comply with the appropriate dimensions in Table 1, or a person with dimensions which are greater than the appropriate dimensions in Table 1.
- 4C.2 General Requirements
- 4C.2.1 Seat belts shall be fitted to each position for which anchorages are required in accordance with the Design Rule for seat belt anchorages, as appropriate at the date of manufacture of the vehicle.

- 4C.2.2 The type of seat belt assembly to be fitted shall be determined by the anchorage system required for that seating position in accordance with the Design Rule for seat belt anchorages. Except in the case of a four wheel drive vehicle, a lap-sash belt or harness belt shall:
- (a) when fitted to the driver's seating position, incorporate an emergency locking retractor; and
 - (b) when fitted to the other front outboard seating position, incorporate an emergency locking retractor or an automatic length adjusting and locking retractor.

4C.2.3 Removal of the seat belt assembly from the vehicle and separation of any functional components shall not be possible without the use of tools except in the case of:

- (i) the unlatching of the buckle components;
- (ii) a sash guide device which is both
 - (a) designed to separate from its supporting structure or fail to retain the strap upon application of the anchorage test loads of the Design Rule for seat belt anchorages; and
 - (b) for which more than one point of attachment to the vehicle is available to provide the occupant with a choice of sash strap positions relative to his shoulder;
- (iii) the torso strap of a lap-sash seat belt assembly fitted to an outboard seating position where the seat is designed to provide adjustment for conversion of occupant space to luggage or goods space and such seating position is not the driver's or front seat passenger's seating position or the seating position immediately to the rear thereof.

The provisions of paragraph (iii) above may apply notwithstanding the requirements of Clause 3 of Australian Standard E35 Pt. 1 - 1970, Seat Belt Assemblies for Motor Vehicles, as specified in Clause 4C.2.7 of this Design Rule.

- 4C.2.4 In the case where a lap-sash seat belt assembly is provided with a torso strap designed to be removed or separated from the seat belt assembly in accordance with the provisions of Clause 4C.2.3(iii), the requirements of this Design Rule shall apply to the seat belt assembly as:

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- (i) a lap-sash belt with the torso strap operative;
- (ii) a lap belt with the sash strap so removed or separated.

4C.2.5 Any single component of the seat belt assembly having a mass in excess of 75g other than a strap, anchor fitting or sash guide device shall be located in areas other than that areas forward of the torso reference line and between Line A and Line B when the assembly is correctly fitted for a 95th percentile adult male and a 50th percentile 6 year old child independently.

4C.2.6 Each seat belt assembly shall be permanently and legibly marked with at least the manufacturer's name or trade mark, date of manufacture by month and year, and identification code. The identification code shall be a number and/or symbol which uniquely identifies the seat belt assembly or sub-assembly design.

The same identification code may be used on two or more assembly or sub-assembly designs which are identical except for variations in strap length which do not exceed:

- (i) 25mm in the case of a strap which has a length critical to the correct location of the lap sash point; or
- (ii) 100mm in the case of other straps.

Furthermore, where a manufacturer, for 'in service' replacement purposes, provides for replacement of parts of a seat belt assembly rather than the assembly as a whole, each of the two sub-assemblies of the seat belt assembly which can be separated from each other by the normal unlatching process shall be permanently and legibly marked in accordance with the requirements of this Clause.

4C.2.7 Seat belt assemblies shall comply with Australian Standard E35 Pt. 1 - 1970, Seat Belt Assemblies for Motor Vehicles, up to and including amendments Nos. 3, 4, 5 and 7, but excluding:

- (i) Clause 1, 2, 7(vi), 8.1, 9.2, 9.3, Note 2 of 11.2, 12, 13, 14, 15, E3(ii)(b), E3(ii)(c), E3(iii), E3(iv), E3(v); and
- (ii) any amendments to other standards subsequent to the date when referenced in Australian Standard E35 Pt. 1 or its Amendments.

4C.2.8 Instructions for use of seat belt assemblies shall be included in the vehicle hand book, or otherwise supplied with the vehicle. These instructions shall include:

1. 'WARNING: Seat belts are designed to bear upon the bony structure of the body, and should be worn low across the front of the pelvis, or the pelvis, chest and shoulders, as applicable; wearing the lap section of the belt across the abdominal area must be avoided.

Seat belts should be adjusted as firmly as possible, consistent with comfort, to provide the protection for which they have been designed. A slack belt will greatly reduce the protection afforded to the wearer.

Care should be taken to avoid contamination of the webbing with polishes, oils and chemicals, and particularly battery acid. Cleaning may safely be carried out using mild soap and water. The belt should be replaced if webbing becomes frayed, contaminated or damaged.

It is essential to replace the entire assembly after it has been worn in a severe impact even if damage to the assembly is not obvious.

Belts should not be worn with straps twisted.

Each seat belt assembly must only be used by one occupant; it is dangerous to put a belt around a child being carried on the occupant's lap.'

2. In the case where a set belt assembly incorporates an automatic length adjusting and locking retractor or an emergency locking retractor
 - (a) the warning: 'No modifications or additions should be made by the user which will either prevent the seat belt adjusting devices from operating to remove slack, or prevent the seat belt assembly from being adjusted to remove slack'; and
 - (b) a description of the adjustments necessary to ensure that the lap and sash portions of the seat belt assembly fit as firmly as possible consistent with comfort; and
 - (c) instructions on the correct use of any device or devices included in the seat belt assembly which, upon manual or automatic operation, prevent the belt from being retracted.

4C.3 Adjustment Requirements

4C.3.1 Each seat belt assembly shall be so designed that with the adjustment provided, it shall be capable of being correctly fitted for:

- (i) in the case of the driver's seating position, a 5th percentile adult female with the seat in the rearmost driving position and a 95th percentile adult male with the seat in the foremost driving position;
- (ii) if installed at any other seating position, a 50th percentile 6 years old child with the seat in the rearmost riding position and a 95th percentile adult male with the seat in the foremost riding position.

Futhermore, in the case of the fittings to the 95th percentile adult male in (i) and (ii) above, the design shall provide for at least 75mm of additional strap in a lap belt and at least 75mm of additional strap in both the lap strap and any upper torso strap of a lap-sash belt or harness belt. The purpose of this Clause is to accommodate a stouter person than represented by the 95th percentile anthropometric dimensions.

4C.3.2 In the case of a seat belt assembly incorporating a manual adjusting device, the following requirements shall be met when the assembly is correctly fitted for a 95th percentile adult male and a 50th percentile 6 years old child independently, when the seat is in the most forward riding or driving positions:

- (i) For tightening, the adjustment shall be by a single action at an accessible point which lies between Line C and Line E and forward of Line FOS;
- (ii) For loosening, the entire adjusting device shall lie between Line C and Line D and forward of Line KPS and there shall be one point on the device which is accessible.

For the purpose of determining whether the point is 'accessible', the dummy or occupant may be removed.

- 4C.3.3 Any free end of a strap shall;
- (i) be designed so as to prevent it from passing through the adjuster under normal adjustment operations, and with the strap fully extended the strap/adjuster combination shall be capable of withstanding, for not less than 30 seconds a static tensile load of 9 kN applied to the load bearing end of strap with the adjuster restrained as in the vehicle; and
 - (ii) be restrained by a positive design feature to adopt a position against another strap.

Further, with the strap fully extended, there shall be not less than 25mm of material extending from the device to provide a grip for adjustment purposes. The material may either be attached to or form part of the free end of the strap.

4C.4 Buckle Requirements

- 4C.4.1 It shall not be possible to adjust a lap-sash belt so that when correctly fitted for a 5th percentile adult female, the lap sash point is less than 125mm in the case of seats with forward and rearward adjustment, or 175mm in the case of fixed seats, from the seating reference plane when measured along the centre line of the pelvic restraint section of the belt. This requirement shall be met with the seat in its foremost and rearmost driving or riding position and with the seat back at the design seat back angle.
- 4C.4.2 In cases where the buckle component of a lap-sash strap can be latched with part of an assembly intended for an adjacent seating position, the design shall be such that the requirements of Clause 4C.4.1 are met irrespective of the combination used.
- 4C.4.3 In cases where the buckle component of a seat belt assembly can be engaged either wholly or partially with the buckle component of a seat belt assembly intended for an adjacent seating position, the design shall be such that the seat belt assembly so formed shall comply with the requirements of Clause 11 of Australian Standard E35 Part 1 - 1970, Seat Belt Assemblies for Motor Vehicles, but excluding Note 2 of 11.2.
- This requirement shall apply irrespective of whether the wholly or partially engaged components will separate without operation of the unlatching device.

This requirement shall not apply in cases where seat belt assemblies fitted to adjacent seating positions are from the same manufacturer and have the same buckle design.

4C.4.4

In the case of a lap-sash belt incorporating a retractor, the design shall be such that in the full retracted position, the buckle component associated with the retracting strap must adopt a position that is either;

- (i) accessible; and
- (ii) within 300mm of both foremost and rearmost points on the seating reference locus when viewed in side elevation or within 300mm of Point O and Point N when viewed in side elevation; and
- (iii) within 400mm of the seating reference plane when viewed in plan;

or can be moved to a position which meets the requirements of (i), (ii) and (iii) above by a manual operation applied to the assembly at points which meet the requirements of (i), (ii) and (iii) above.

This requirement shall not apply to a seating position adjacent to an access door, where the seat must hinge or fold to permit access to another seating position.

4C.4.5

In the case of a vehicle with one front seating position only, or with two front seats, each providing for one seating position only, the buckle component on that part of a lap-sash belt which does not include the retracting strap, shall be supported by a rigid member which may pivot, or in such a manner that after being correctly fitted for a 95th percentile adult male with the seat in the foremost driving or riding position, unlatching of the buckle assembly and removal of the occupant from the seating position does not result in any point on the component moving downwards such that the vertical component of movement is more than 50mm.

When unlatched after the assembly has been correctly fitted for a 95th percentile adult male with the seat in the foremost driving or riding position and a 5th percentile adult female with the seat in the rearmost driving or riding position, independently, there shall be a point on the component which is;

- (i) accessible;

- (ii) within 300mm of both the foremost and rearmost points on the seating reference locus when viewed in side elevation; and
- (iii) within 150mm to 400mm of the seating reference plane when viewed in plan.

For the purpose of determining whether the point is accessible, the dummy or occupant may be removed.

4C.4.6 In the case of outboard seating positions not provided for in Clause 4C.4.5, the part of the assembly which does not include the strap designed to pass over the torso of the occupant, shall be so restrained by a positive design feature, that one point at least cannot pass rearward of the line of contact of the seat cushion with the seat back.

4C.4.7 In the case of assemblies fitted to;

- (i) outboard rear seating positions; and
- (ii) outboard front seating positions of vehicles fitted with seat belt assemblies not incorporating emergency locking retractors or automatic length adjusting and locking retractors.

The design shall provide for a stowage feature for the part of the assembly which includes the strap designed to pass over the pelvis or torso of the occupant, to facilitate that part of the assembly, when unlatched, being kept clear of the vehicle floor and the lower edge of the door opening.

4C.5 General Requirements for Seat Belt Components

4C.5.1 In all cases where the strap passes through another component, other than a sash guide used in conjunction with an emergency locking retractor, and there is relative movement between the strap and the component as a result of adjusting operations, the tensile strength of the webbing shall not be reduced to less than 14.7 kN or 75% of the dry breaking strength, whichever is the greater, after 2,500 cycles of relative movement under the following test conditions:

- (i) the tensile load in all parts of the test strap during the working stroke of the two strokes of each cycle shall be not less than 13N;
- (ii) the working stroke shall be not less than 150mm nor more than 200mm;

- (iii) the angle which the centre line of each end of the test strap makes with the component shall be not less critical to strap abrasion than that nominated by the vehicle manufacturer as representative of such an angle of the strap in use, when the assembly is correctly fitted for a 5th percentile adult female with the seat in the rearmost driving or riding position, except that in the case where the design provides for the centre lines of the straps to be separated when viewed normal to the plane of one strap, then such angle of separation in the test may be any angle greater than 25° , and the angle of separation of the centre lines of the straps when viewed in the plane of one strap may be any angle less than 10° .

4C.5.2

In the case of a lap-sash belt incorporating an emergency locking retractor where, during the wearing and retracting operations, there is relative movement between the retracting strap and the sash guide system other than the retractor itself the tensile strength of the webbing shall not be reduced to less than 14.7 kN or 75% of the dry breaking strength, whichever is the greater, after the retracting strap has been drawn through the sash guide system for 50,000 cycles under the following test conditions:

- (i) the tensile load in all parts of the test strap during the working stroke of the two stroke of each cycle shall be not less than 18N;
- (ii) the tensile load in the test strap at one point in the cycle shall be reduced to zero;
- (iii) the working stroke shall be not less than 200mm;
- (iv) the orientation of the test strap relative to the sash guide shall be such that:
- (a) the sash guide shall be in its design configuration except that, for sash guides designed to pivot, the angle of the axis of rotation may vary from its design configuration provided that such variation is not greater than 5° ;
- (b) the part of the test strap which simulates the strap passing from the sash guide to the next sash guide or to the retractor, shall be in the design configuration;

- (c) the part of the test strap which simulates the torso strap shall be pulled in a vertical plane not more than 45° to a longitudinal plane when viewed in plan, and the direction of pull in that plane shall vary over a range of not less than 65° during the working stroke of each cycle;
- (v) all sash guides for the one assembly shall be tested simultaneously.

The requirements of this Clause shall not apply to relative movement between the strap and the retractor, at the retractor.

4C.5.3 Buckle Fatigue Resistance

In the case where a spring is incorporated in the release mechanism of a buckle, the load required to operate the mechanism shall not be reduced by more than 20% after the mechanism has been subjected to 50,000 operations each involving a movement not less than 95% of the design movement for buckle release.

4C.6 Requirements for Retractors

4C.6.1 All retractors incorporated in seat belt assemblies shall comply with the requirements of Clause 4C.6.2 and either Clause 4C.6.3 or Clause 4C.6.4.

4C.6.2 General Requirements

4C.6.2.1 After being subjected to the durability requirements of Clause 4C.8, the retractor shall:

- (i) when locked, either
 - (a) withstand a tensile load of not less than 9 kN applied to the strap; or
 - (b) be subjected to the strength of assembly test of Clause 11.1 of Australian Standard E35 Pt 1 - 1970, as referenced in Clause 4C.2.7; and
- (ii) withstand a tensile load of not less than 9 kN applied to the strap. For the purposes of this test the strap shall be fully withdrawn and the locking mechanism shall be rendered inoperative.

- 4C.6.2.2 In cases 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 durability requirements of Clause 4C.8, shall be not less than 2N nor more than 10N, under the following test conditions:
- (i) the sash guide system and the retractor shall be in the design configuration. In the case of a sash guide with an adjustable sash guide, the retractor shall be capable of meeting the requirements of this Clause with the sash location point set in any position of adjustment;
 - (ii) the part of the test strap which simulates the torso strap shall be withdrawn through the sash guide system until it is within 430mm of its fully extended condition;
 - (iii) the strap shall be allowed to retract until a point on the strap is 450 ± 20 mm, measured along the strap, from its position when the strap is fully extended: it shall then be held stationary at this extension by a force applied in a downward direction at 20 degrees ± 10 degrees to the vertical in a vertical plane which is at 35 degrees ± 10 degrees to a longitudinal plane when viewed in plan, and shall not be withdrawn again until the retracting force has been determined;
 - (iv) the retraction force shall be measured in the test strap forward of the point where it would contact the first sash guide device after passing over the shoulder of the wearer;
 - (v) where the assembly incorporates a device that upon manual or automatic operation, prevents the belt from being completely retracted, such a device shall not be operating when this requirement is assessed.

4C.6.3 Automatic Length Adjusting and Locking Retractors

- 4C.6.3.1 The locking mechanism of an automatic length adjusting and locking retractor shall be designed to provide a locked position for at least every 30mm of strap extension, from the position when the seat belt assembly is correctly fitted for a 50th percentile 6 years old child, with the seat in the rearmost riding position.

4C.6.4 Emergency Locking Retractors

4C.6.4.1 Emergency locking retractors 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:

- (i) 30mm, when the strap is withdrawn to a point which is $150 \pm 5\text{mm}$ from the fully extended position; and
- (ii) 80mm, when the strap is withdrawn to points $450 \pm 5\text{mm}$ and $760 \pm 5\text{mm}$ 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 cases where the device is designed to lock when tilted to any angle in excess of 45° then the locking requirement need be met for longitudinal and transverse directions only.

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.

4C.6.4.2 Emergency locking retractors shall be designed in such a way that, when the strap is extended at an acceleration of not more than 20m/s^2 locking occurs within 25mm 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 extension by $150 \pm 5\text{mm}$, $450 \pm 5\text{mm}$ (if available), respectively.

4C.6.4.3 An emergency locking retractor shall be designed to lock automatically, or meet the requirements of Clauses 4C.6.4.1 and 4C.6.4.2 upon any single mechanical failure of a spring which is part of the locking mechanism.

4C.6.4.4 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.

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4C.6.4.5 The design of an emergency locking retractor shall ensure that it remains unlocked when the vehicle is tilted up to 120° longitudinally or transversely, from the horizontal.

4C.7 Dynamic Test Requirements

4C.7.1 Seat belt assemblies for forward facing seats shall not separate within themselves or from any anchorage, when tested in accordance with the dynamic test requirements of Clause 4C.9.

4C.7.2 Prior to the dynamic test, each seat belt assembly shall be subjected to the preconditioning requirements of:

- (i) Clause 4C.7.3(i), Clause 4C.7.3(ii) and either Clause 4C.7.3(iii) or Clause 4C.7.3(iv) in the case of all passenger cars, passenger car derivatives and multi-purpose passenger cars, manufactured on and after 1 January 1976, and all other vehicles manufactured on and after 1 July 1976 except motor cycles, omnibuses, specially constructed vehicles and vehicles exceeding 4.5 tonnes gross vehicle mass, and
- (ii) Clause 4C.7.3(i), Clause 4C.7.3(ii) and Clause 4C.7.3(iv) in the case of all passenger cars, passenger car derivatives and multi-purpose passenger cars, manufactured on and after 1 January 1979, and all other vehicles manufactured on and after 1 July 1978 except motorcycles, omnibuses, specially constructed vehicles and vehicles exceeding 4.5 tonnes gross vehicle mass.

4C.7.3 Dynamic Test Preconditioning

- (i) Any buckle component or manual adjusting device which can take up a position in a door opening, or under a pivoting seat, shall be placed on a flat surface in its most stable position and subjected to a force of not less than 1.8 kN for a period of not less than 10 seconds. The force shall be applied through a rigid bar of diameter not more than 20mm formed to an arc of radius not more than 150mm, 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;

- (ii) The buckle assembly shall be subjected to not less than 20,000 unlatching operations. During each unlatching operation a tensile load of not less than 20N shall be applied to the assembly;
- (iii) Seat belt assemblies containing non-metallic components other than webbing strap shall be exposed, in an enclosed space and over a water surface for a period of not less than 24 hours at an environmental temperature not less than 80°C, followed by exposure in an oven for a period of not less than 24 hours at an environmental temperature of not less than 100°C;
- (iv) Each seat belt assembly which contains non-metallic material (other than a webbing strap) shall be exposed to an environment over a water surface within a closed space, the environment having a temperature of not less than 80°C, for a continuous period of not less than 24 hours and then cooled in an environment having a temperature not exceeding 23°C. The cooling period shall immediately be followed by three consecutive 24 hour cycles with each cycle comprising the following consecutive sequences:
 - (a) an environment having a temperature of not less than 100°C shall be maintained for a continuous period of 6 hours and this environment shall be attained within 80 minutes of commencement of the cycle; then
 - (b) an environment having a temperature of not more than 0°C shall be maintained for a continuous period of 6 hours and this environment shall be attained within 20 minutes; then
 - (c) an environment having a temperature of not more than 23°C shall be maintained during the remainder of the 24 hour cycle.

4C.8 Retractor Durability Test

4C.8.1 The seat belt assembly shall be conditioned by the procedure specified in Standard Method of Salt Spray (Fog) Testing, ASTM designation: B117-64, published by the American Society for Testing and Materials. The period of conditioning shall be not less than 50 hours.

4C.8.2 At the end of the conditioning procedure specified in Clause 4C.8.1 the seat belt assembly may be washed thoroughly with water to remove the salt. If washed, the webbing shall be fully extended and allowed to dry for at least 24 hours in an atmosphere having a relative humidity of not less than 48% nor more than 67% and a temperature of not less than 21°C nor more than 25°C. The webbing shall then be withdrawn manually and allowed to retract for 25 cycles.

4C.8.3 Following the procedure specified in Clause 4C.8.2, the retractor shall be subjected to the following:

- (i) in the case of automatic length adjusting and locking retractors, the strap shall be withdrawn from the retractor and allowed to retract repeatedly by the method described in Appendix A of AS E35 Pt. 2 for not less than 5000 cycles after which the retractor, including the strap wound upon the reel, shall be subjected to application of dust as described in Appendix C of AS E35 Pt. 2. The strap shall then be subjected to at least 5,000 cycles of withdrawal and retraction. The locking mechanism shall be functional at the completion of the test;
- (ii) in the case of emergency locking retractors, the strap shall be withdrawn from the retractor and allowed to retract repeatedly by the method described in Appendix A of AS E35 Pt. 2 for not less than 45,000 cycles after which the retractor, including the strap wound upon the reel shall be subjected to the application of dust as described in Appendix C of AS E35 Pt. 2. The strap shall then be subjected to at least 5,000 cycles of withdrawal and retraction.

4C.9 Dynamic Testing Procedure

4C.9.1 The test rig shall have a mass of not less than 380 kg and shall meet the requirements of Clause 4C.12 for test rig calibration. It shall comprise either:

- (i) a trolley and seat as specified in Clause 4C.11.1 and Clause 4C.11.2 for dummy calibration, and with anchorages and sash guide devices within 100mm of their design positions when the test seat datum point is assumed to coincide with the seating reference point; or
- (ii) a trolley and a vehicle body shell complete with a representative seat adjusted to the rearmost driving or riding position.

4C.9.2 A dummy meeting the requirements of Clause 4C.10 shall be placed in the appropriate seating position so that its centre line lies in the seating reference plane and such that it is restrained by the seat belt assembly as follows:

- (i) in the case of seat belt assemblies incorporating retractors, the belt shall be manually adjusted around the dummy to eliminate slack;
- (ii) in the case of other seat belt assemblies, a spacer of flexible but substantially incompressible material not less than 25mm thick and at least as wide and as long as the dummy's back shall be placed behind the back of the dummy. The assembly shall be adjusted to eliminate slack and the spacer then removed. The dummy shall be re-positioned so that its back is in contact with the seat back.

4C.9.3 The rig shall be operated in a manner identical in all rational respects to that specified in Clause 4C.12.1 for rig calibration except that in this case the dummy replaces the inert mass.

4C.10 Test Dummy Requirements

4C.10.1 The dummy shall have a mass of 74 ± 2 kg.

4C.10.2 When tested in accordance with the requirements of Clause 4C.11 for dummy calibration, the test dummy shall give rise to seat belt assembly loads such that the sum of the peak restraining forces in each length of the sash strap which is not in contact with the dummy, is not less than 10kN, and also that the sum of the peak restraining forces in each length of the lap strap which is not in contact with the dummy is not less than 10kN.

4C.11 Dummy Calibration

4C.11.1 The test rig shall have a mass of not less than 380kg and shall meet the requirements of Clause 4C.12 for test rig calibration. It shall comprise a trolley, test seat, foot rest, and structure for providing seat belt anchorages, meeting the dimensional requirements indicated in Figure 1.

4C.11.2 The seat base surface shall not be designed with energy absorbing characteristics and shall present a smooth surface for the dummy.

4C.11.3 The dummy shall be restrained by separate lap and sash belts, each of which comprises load bearing material having an elongation of not less than 12% when subjected to a load of 11kN. The method of test of elongation shall be determined by the method described in Appendix B of Australian Standard E47 - 1971, Webbing for Restraining Devices for Occupants of Motor Vehicles, except that the specimen shall be loaded to 11 kN in lieu of the load specified in the Australian Standard.

4C.11.4 The lap and sash belts shall be adjusted to eliminate slack.

4C.11.5 The rig shall be operated in a manner identical in all operational respects to that specified in Clause 4C.12.2 for rig calibration except that in this case the dummy replaces the inert mass.

4C.12 Test Rig Calibration

4C.12.1 In the case of calibration prior to seat belt testing, the test rig, to which a mass of 74 ± 2 kg is rigidly attached, when subjected to a velocity change of not less than 49 km/h, shall achieve within 30 milliseconds a forward deceleration measured in the vicinity of a lap anchorage of at least 235 m/s^2 and shall maintain this deceleration, except for periods of less than 1 millisecond, for not less than 20 milliseconds.

- 4C.12.2 In the case of calibration prior to proving the dummy, the test rig, to which a mass of 74 ± 2 kg is rigidly attached, when subjected to a velocity change of not less than 49 km/h, shall achieve within 30 milliseconds, a forward deceleration measured in the vicinity of a lap anchorage, within the range 235 m/s^2 to 335 m/s^2 and shall maintain this deceleration, except for periods of less than 1 millisecond, for not less than 20 milliseconds.
- 4C.13 Component Boundary Location - The lines shown in Figure 2 in side elevation are established as follows:
- (i) Line A is a horizontal line 850mm above the seating reference point.
 - (ii) Line B is a horizontal line 330mm above the seating reference point.
 - (iii) Line C is a horizontal line 680mm above the seating reference point.
 - (iv) Line D is a horizontal line 150mm below the seating reference point.
 - (v) Line E is a horizontal line 75mm below the seating reference point.
 - (vi) Line FOS consists of two lines FO and OS and is constructed as follows:
 - (a) Draw line FO parallel to the torso reference line 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.
 - (b) Draw a vertical line OS intersecting Line G at Point O.
 - (vii) Line KPS consists of two lines KP and PS and is constructed as follows:
 - (a) Draw line KP parallel to and 100mm rearward of line FO (established above) intersecting line OS at P.
 - (b) Line PS is coincident with line OS.
 - (viii) Line G is a horizontal line 380mm above the seating reference point, intersecting the torso reference line at Point N.
 - (ix) Line J is a horizontal line 230mm above the seating reference point.

FIG. 1
TEST SEAT & ANCHORAGES

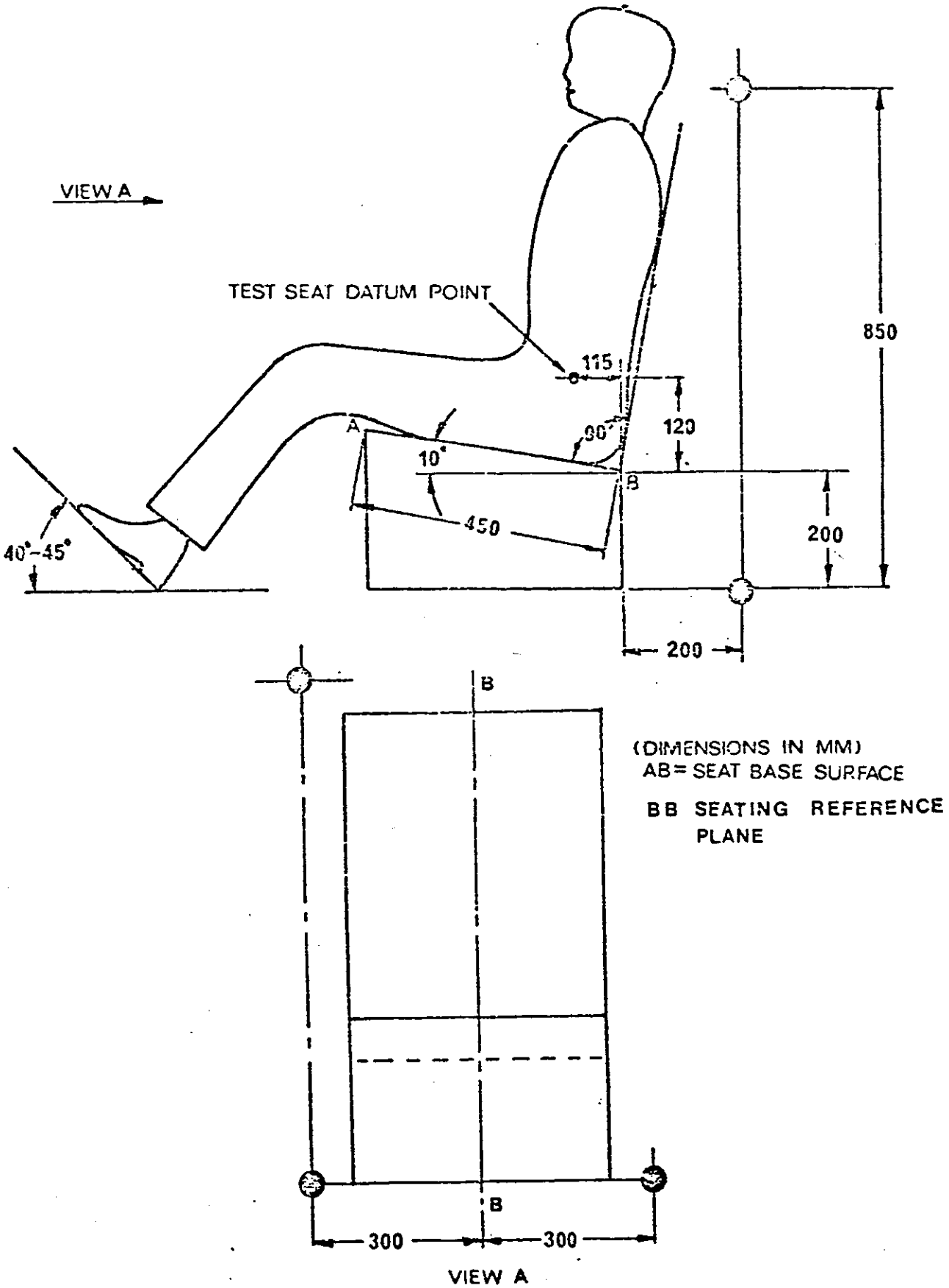
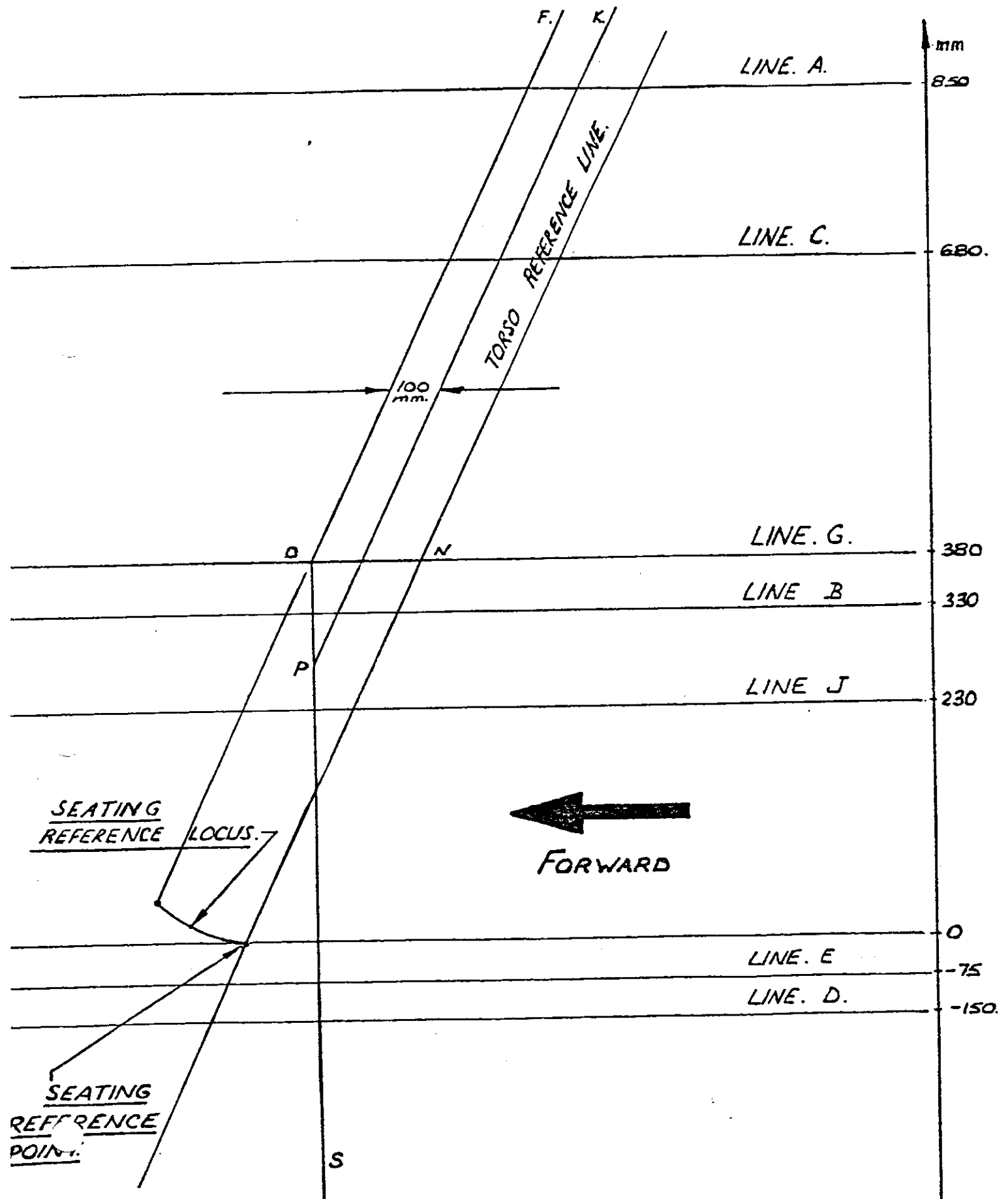


FIG. 2
COMPONENT BOUNDARY LOCATION



AUSTRALIAN DESIGN RULE NO. 4C - SEAT BELTS

TABLE 1 - DUMMY DIMENSIONS

	95th Percentile Adult Male	5th Percentile Adult Female	50th Percentile 6 yr. old child
Weight	97.5 \pm 5 kg	46 \pm 5 kg	21.4 \pm 3 kg
Erect sitting height	965 mm	785 mm	645 mm
Hip breadth (sitting)	415 mm	325 mm	215 mm
Hip circumference (sitting)	1.2 m	925 mm	605 mm
Waist circumference (sitting)	1.08 m	600 mm	530 mm
Chest depth	265 mm	190 mm	160 mm
Chest Circumference	1.13 m	775 mm (nipple) 755 mm (upper) 675 mm (lower)	595 mm
Shoulder height	680 mm	520 mm	415 mm
Tolerance on all length dimensions \pm 5%			