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DRAFT GLOBAL REGULATION ON SAFETY BELTS

1. SCOPE

This Regulation applies to safety belts and restraint systems for installation in:

- M1 and N1 vehicles (Europe)
- Passenger cars, trucks, buses, and multipurpose passenger vehicles with a GVWR of 4,535 kg (10,000 lb) or less, except for walk-in van-type trucks or vehicles designed to be sold exclusively to the US Postal Service (US).
- Passenger cars (Japan).

and intended for separate use, i.e. as individual equipment, by person occupying forward or rearward facing seats.

2. DEFINITIONS

2.1. Safety-belt (seat-belt, belt)

An arrangement of straps with a securing buckle, adjusting devices and attachments which is capable of being anchored to the interior of a power-driven vehicle and is designed to diminish the risk of injury to its wearer, in the event of collision or of abrupt deceleration of the vehicle, by limiting the mobility of the wearer' s body. Such an arrangement is generally referred to as a "belt assembly", which term also embraces any device for absorbing energy or for retracting the belt.

2.1.1. Lapbelt

A belt which passes across the front of the wearer' s pelvic region.

2.1.2. Diagonal belt

A belt which passes diagonally across the front of the chest from the hip to the opposite shoulder.

2.1.3. Three-point belt

Any belt which is essentially a combination of a lap belt and a diagonal strap.

2.1.4. Harness belt

A belt assembly comprising a lap belt and shoulder straps.

2.2. Strap

A flexible component designed to hold the body and to transmit stresses to the belt anchorages.

2.3. Buckle

A quick-release device enabling the wearer to be held by the belt. The buckle may incorporate the adjusting device, except in the case of a harness belt buckle.

2.4. Belt adjusting device

A device enabling the belt to be adjusted according to the requirements of the individual wearer and to the position of the seat. The adjusting device may be part of the buckle, or a retractor, or any other part of the safety belt.

2.5. Pretensioning device

An additional or integrated device which tightens the seat belt strap in order to reduce the slack of the belt.

2.6. "Airbag assembly"

means a device installed to supplement safety belts and restraint systems in power-driven vehicles, i. e. system which, in the event of a severe impact affecting the vehicle automatically deploys a flexible structure intended to limit, by compression of the gas contained within it, the gravity of the contacts of one or more parts of the body of an occupant of the vehicle with the interior of the passenger

compartment.

- 2.7. "Frontal airbag"**
means an airbag assembly intended to protect occupant(s) in the event of a frontal collision.
- 2.8. "Rearward-facing"**
means facing in the direction opposite to the normal direction of travel of the vehicle.
- 2.9. Attachments**
Parts of the belt assembly including the necessary securing components, which enable it to be attached to the belt anchorages.
- 2.10. Energy absorber**
Device designed to disperse energy independently of or jointly with the strap and forming part of a belt assembly.
- 2.11. Retractor**
Device to accommodate part or the whole of the strap of a safety belt.
- 2.11.1. **Automatically locking retractor.**
A retractor allowing extraction of the strap to the desired length and which, when the buckle is fastened, automatically adjusts the strap to the wearer. Further extraction of the strap is prevented without voluntary intervention by the wearer.
- 2.11.2. **Emergency locking retractor**
A retractor which during normal driving conditions does not restrict the freedom of movement by the wearer of the safety-belt. Such a device has length adjusting components which automatically adjust the strap to the wearer and a locking mechanism actuated in an emergency by:
- 2.11.2.1. deceleration of the vehicle or extraction of the strap from the retractor or other automatic means (single sensitivity); or
- 2.11.2.2. a combination of any of these factors (multiple sensitivity).
- 2.12. Belt adjustment device for height.**
A device enabling the position in height of the upper pillar loop of a belt to be adjusted according to the requirements of the individual wearer and the position of the seat. Such a device may be considered as a part of the belt or a part of the anchorage of the belt.
- 2.13. Belt anchorages.**
Parts of the vehicle structure or seat structure or any other part of the vehicle to which the safety-belt assemblies are to be secured.
- 2.14. Restraint system**
A system combining a seat affixed to the structure of the vehicle by appropriate means and a safety-belt for which at least one anchorage is located on the seat structure.
- 2.15. Seat**
A structure which may or may not be integral with the vehicle structure complete with trim, intended to seat one adult person. The term covers both an individual seat or part of a bench seat intended to seat one person.
- 2.16. Adjustment system of the seat**
The complete device by which the seat or its parts can be adjusted to a position suited to the morphology of the seated occupant; this device may, in particular, permit of:
- 2.16.1. longitudinal displacement;
- 2.16.2. vertical displacement;
- 2.16.3. angular displacement;

2.16.4. transverse displacement.

2.17. Seat anchorage

The system by which the seat assembly is secured to the vehicle structure, including the affected parts of the vehicle structure.

2.18. Locking system of the seat

A device ensuring that the seat and its parts are maintained in any position of use.

2.19. Enclosed buckle-release button

A buckle-release button such that it must not be possible to release the buckle using a sphere having a diameter of 40mm.

2.20. Non-enclosed buckle-release button

A buckle-release button such that it must be possible to release the buckle using a sphere having a diameter of 40mm.

3. SPECIFICATIONS

3.1. General Specifications

3.1.1. The belt or the restraint system shall be so designed and constructed that it is easily correctly installed and properly used by an occupant.

3.1.2. The straps of the belt shall not be liable to assume a dangerous configuration.

3.1.3. The use of materials with properties of polyamide 6 with respect to water retention is prohibited in all mechanical parts for which such a phenomenon is likely to have an adverse effect on their operation.

3.2. Rigid Parts

3.2.1. General

3.2.1.1. the rigid parts of the safety-belt, such as buckles, adjusting devices, attachments and the like, shall not have sharp edges liable to cause wear or breakage of the straps by chafing

3.2.1.2. a) Attachment hardware of a safety belt assembly after being subjected to the conditions specified in 4.1 shall be free of ferrous corrosion on significant surfaces except for permissible ferrous corrosion at peripheral edges or edges of holes on underfloor reinforcing plates and washers.
b) Surfaces of buckles, retractors and metallic parts, other than attachment hardware, of a safety belt assembly after subjection to the conditions specified in 4.1 shall be free of ferrous or non ferrous corrosion which may be transferred, either directly or by means of the strap, to the occupant or his clothing when the assembly is worn. After test, buckles shall meet the requirements of paragraphs 3.2.2.2 to 3.2.2.5 below.

3.2.1.3. The rigid items and parts made of plastics of a safety-belt which may become trapped under rigid parts of a moveable seat or in a door of that vehicle shall be subjected to the cold impact test specified in paragraph 4.4.2 below. After the test, if any visible cracks are present in any plastic cover or retainer of rigid item, the complete plastic part shall then be removed and the remaining assembly shall then be assessed against its continued security.
If the remaining assembly is still secure, or no visible cracks are present, it will then be further assessed against the test requirements specified in paragraphs 3.2.2., 3.2.3., and 3.5.

3.2.1.4. Plastic or other non metallic hardware parts of a safety belt assembly when subjected to the conditions specified in paragraph 4.4.4 below shall not warp or otherwise deteriorate to cause the assembly to operate improperly or fail to comply with applicable requirements of paragraphs 3.2 and 3.5.

3.2.2. Buckle

3.2.2.1. The buckle shall be so designed as to preclude any possibility of incorrect use. This means, inter alia, that it must not be possible for the buckle to be left in a partially-closed condition. The procedure for opening the buckle must be evident.

- 3.2.2.2. The buckle, even when not under tension, shall remain closed regardless of the position of the vehicle. It shall not be possible to release the buckle inadvertently, accidentally or with a force of less than 10 N.
The buckle shall be easy to use and to grasp; when it is not under tension and when under the tension specified in paragraph 4.7 below, it shall be capable of being released by the wearer with a single movement of one hand in one direction; in addition, in the case of belt assemblies intended to be used for the front outboard seats, except harness belts, it shall also be capable of being engaged by the wearer with a simple movement of one hand in one direction. The buckle shall be released by pressing either a button or a similar device. The surface to which this pressure is applied shall have the following dimensions, with the button in the actual release position and when projected into a plane perpendicular to the button's initial direction of motion: for enclosed buttons, an area of not less than 4.5cm² and a width of not less than 15mm; for non-enclosed buttons, an area of not less than 2.5cm² and a width of not less than 10mm. The buckle release area shall be coloured red. No other part of the buckle shall be of this colour.
- 3.2.2.3. The buckle when tested in accordance with paragraph 4.4.2 below shall operate normally.
- 3.2.2.4. The buckle shall be capable of withstanding repeated operation and, prior to the dynamic test specified in paragraph 4.6 shall undergo 5,000 opening and closing cycles under normal conditions of use. In the case of harness belt buckles, this test may be carried out without all the tongues being introduced.
- 3.2.2.5. The force required to open the buckle in the test as prescribed in paragraph 4.7 below shall not exceed 60 N.

3.2.3. Belt Adjusting Device

- 3.2.3.1. The belt after being put on by the wearer shall either adjust automatically to fit him or be such that the manual adjusting device shall be readily accessible to the seated wearer and shall be convenient and easy to use. It shall also allow the belt to be tightened with one hand to suit the wearer's body size and the position of the belt after being put on by the wearer, shall either adjust automatically vehicle seat.
- 3.2.3.2. Two samples of each belt adjusting device shall be tested in accordance with paragraph 4.2. The strap slip shall not exceed 25mm for each sample of adjusting device and the sum of shifts for all the adjusting devices shall not exceed 40mm.
- 3.2.3.3. When tested in accordance with paragraph 4.4.3., the force required to operate any manual adjusting device shall not exceed 50 N.

3.2.4. Retractors

Retractors shall be subjected to tests and shall fulfil the requirements specified below.

3.2.4.1. Automatically locking retractors

- 3.2.4.1.1. The strap of a safety belt assembly equipped with an automatically locking retractor shall not move more than 25mm between locking positions of the retractor.
- 3.2.4.1.2. The retracting force of the strap shall not be less than 1N when measured in the free length between the dummy and the retractor in accordance with paragraph 4.5.3. If the strap passes through a guide or pulley, the retracting force shall be measured in the free length between dummy and guide or pulley. If the assembly incorporates a device that, upon manual or automatic operation, prevents the strap from being completely retracted, such a device shall not be operated when these requirements are assessed.
- 3.2.4.1.3. A retractor used on a safety belt assembly after subjection to tests specified in paragraph 4.5.1. below shall meet the applicable requirements of paragraphs 3.2.4.1.1 and 3.2.4.1.2 above, except that the retracting force shall be not less than 50 percent of its original retracting force.

3.2.4.2. Emergency locking retractors.

- 3.2.4.2.1. An emergency locking retractor, when tested in accordance with paragraph 4.5.2 shall satisfy the conditions below:
- 3.2.4.2.1.1. The locking must have occurred when the deceleration of the vehicle reaches 0.45g¹ in the case of safety belts for passenger cars or 0.85g in the case of safety belts for light duty trucks.

¹ g = 9.81 m/s²

- 3.2.4.2.1.2. It must not lock for values of acceleration of the strap measured in the direction of the extraction of the strap of less than 0.8g.
- 3.2.4.2.1.3. It must not lock when its sensing device is tilted 15° or less in any direction from the installation position specified by its manufacturer.
- 3.2.4.2.1.4. It shall lock when its sensing device is tilted by more than 45° in any direction from the installation position with the exception of a rotation around the Y-axis of the vehicle specified by its manufacturer.
- 3.2.4.2.1.5. 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. However, this requirement needs not to be met in the case of retractor with multiple sensitivities, provided only one sensitivity is dependent on an external signal or power source and the failure of the signal or power source is indicated to the driver by optical and/or acoustical means.
- 3.2.4.2.2. When tested in accordance with paragraph 4.5.2. an emergency locking retractor with multiple sensitivity, including strap sensitivity, shall comply with the specified requirements and also lock up when strap acceleration measured in the direction of unreeling is not less than 3.5g.
- 3.2.4.2.3. In the case of the tests mentioned in paragraphs 3.2.4.2.1. and 3.2.4.2.2 above the amount of strap movement which may occur before the retractor locks shall not exceed 50mm starting at the length given in paragraph 4.5.2. In the case of the test mentioned in paragraph 3.2.4.2.1.2 above locking must not occur during the 50mm of strap movement starting at the length given in paragraph 4.5.2.
- 3.2.4.2.4. The retracting force of the strap shall not be less than 1N when measured in the free length between the dummy and the upper anchorage point according to the paragraph.4.5.3. If the strap passes through a guide or pulley, the retracting 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 a device shall not be operated when these requirements are assessed.
- 3.2.4.2.5. A retractor used on a safety belt assembly after subjection to tests specified in paragraph 4.5.1. below shall meet the applicable requirements of paragraphs 3.2.4.2.1, 3.2.4.2.2, 3.2.4.2.3 and 3.2.4.2.4 above, except that the retracting force shall be not less than 50 percent of its original retracting force.

3.3. Straps.

3.3.1. General.

- 3.3.1.1. The characteristics of the straps shall be such as to ensure that their pressure on the wearer' s body is distributed as evenly as possible over their width and that they do not twist. They may have energy-absorbing and energy-dispersing capacities. The straps shall not become unravelled in use.
- 3.3.1.2. Straps used to perform the dynamic test requirements under paragraph 3.5 below will be tested according to 4.3.2. to determine the reference static breaking strengths at ambient temperature and hygrometry.

3.3.2. Strength after room-conditioning

- 3.3.2.1. In the case of the two straps samples conditioned in conformity with paragraph 4.3.1.1 the breaking load of the strap shall be determined as prescribed in paragraph 4.3.2. below. The difference between the breaking loads of the two samples shall not exceed 10% of the greater of the breaking loads measured.
- 3.3.2.2. The width of the strap under load of 980 N shall not be less than 46mm. This dimension shall be measured during the breaking strength test prescribed in paragraph 4.3.2. and without stopping the machine.

3.3.3. Strength after special conditioning

In the case of the two strap samples conditioned in conformity with one of the provisions of paragraph 4.3.1. (except 4.3.1.1.) below, the breaking load of the strap shall be not less than 75% of average of the loads determined in the test referred to in paragraph 3.3.2. The technical service conducting the tests may dispense with one or more of these tests if the composition of the material used or information already available renders the test or tests superfluous.

3.3.4. Strength after abrasion conditioning

The strap of a safety belt assembly, after being subjected to abrasion as specified in paragraph 4.3.1.5. below shall have a breaking strength of not less than 75 percent of the reference static breaking strength referred to in paragraph 3.3.1.2 above.

3.4. Pretensioning device

3.4.1. After being subjected to corrosion testing in accordance with paragraph 4.1, the pretensioning device (including the impact sensor connected to the device by the original plugs but without any current passing through them if the impact sensor is part of the pretensioning device) shall operate normally.

3.4.2. In the case of pyrotechnic pretensioning devices:

After being subjected to conditioning in accordance with paragraph 4.8, operation of the pretensioning device must not have been activated by temperature and the device shall operate normally

3.5. Belt assembly or restraint system

3.5.1. Dynamic test.

3.5.1.1. The belt assembly or restraint system shall be subject to a dynamic test in conformity either with paragraph 4.6.1 or with paragraph 4.6.2 below, at the choice of the manufacturer of the belt assembly or restraint system.

3.5.1.2. The dynamic test shall be performed on two belt assemblies which have not previously been under load, except in the case of belt assemblies forming part of restraint systems when the dynamic test shall be performed on the restraint systems intended for one group of seats which have not previously been under load. The buckles of the belt assemblies to be tested shall have met the requirements of paragraph 3. 2. 2. 4. above. In the case of safety-belts with retractors, the retractor shall have been subjected to the dust resistance test laid down in paragraph 4.5.1.; in addition, in the case of safety-belts or restraint systems equipped with a pretensioning device comprising pyrotechnic means, the device shall have been subjected to the conditioning specified in paragraph 4.8.1.

3.5.1.2.1. The belts shall have undergone the corrosion test described in paragraph 4.1., after which the buckles shall be subjected to 500 additional opening and closing cycles under normal conditions of use.

3.5.1.2.2. Safety-belts with retractors shall have been subjected either to the tests described in paragraph 3.2.4.1 or to those described in paragraph 3.2.4.2. If, however, a retractor has already been subjected to the corrosion test in accordance with the provisions of paragraph 3.5.1.2.1. above, this test need not be repeated.

3.5.1.2.3. In the case of a belt intended for use with a belt adjustment device for height, as defined in paragraph 2.12. above, the test shall be carried out with the device adjusted to the mid position. If the device does not have a mid position, the next highest adjustment position shall be used. However, if the belt adjustment device for height is constituted by the belt anchorage in accordance with the provisions of the Global Technical Regulation on anchorages, the provisions of § 4.6.1.1. below may apply.

3.5.1.2.4. In the case of safety-belts with pretensioning devices, the pretensioning devices shall be in operation for the purpose of these tests.

3.5.1.3. During this test, the following requirements shall be met :

No part of the belt assembly or a restraint system affecting the restraint of the occupant except parts of energy absorbing systems, shall break and no buckles or locking systems shall release or unlock after one of the test described in § 4.6 below

4. TEST METHODS

4.1. Corrosion test

Two safety belt assemblies shall be tested in accordance with ISO 9227: 1990- "Corrosion tests in

artificial atmospheres- Salt spray test". Any surface coating or material not intended for permanent retention on the metal parts during service life shall be removed prior to preparation of the test specimens for testing. The period of test shall be 48 hours for all attachment hardware at or near the floor, consisting of two periods of 23 hours exposure to salt spray followed by 1 hour drying and 24 hours for all other hardware, consisting of one period of 23 hours exposure to salt spray followed by 1 hour drying. In the spray cabinet, the parts from the two assemblies shall be mounted in the same orientation as in the intended vehicle application. If this orientation is not known the two assemblies shall be oriented differently, selecting those orientation most likely to develop corrosion on the larger areas. At the end of test, the belt assembly shall be washed thoroughly with water to remove the salt. After drying for at least 24 hours under standard laboratory conditions, attachment hardware shall be examined for ferrous corrosion on significant surfaces, that is, all surfaces that can be contacted by a sphere 19mm in diameter, and other hardware shall be examined for ferrous and non-ferrous corrosion which may be transferred, either directly or by means of the strap, to a person or his clothing during use of a seat belt assembly incorporating the hardware.

4.2. Microslip test (see Annex 1)

- 4.2.1.** The samples to be submitted to the micro-slip test shall be kept for a minimum of 24 hours in an atmosphere having a temperature of $20 \pm 5^\circ \text{C}$ and a relative humidity of $65 \pm 5\%$. The test shall be carried out at a temperature between 15 and 30°C .
- 4.2.2.** It shall be ensured that the free section of the adjusting device points either up or down on the test bench, as in the vehicle.
- 4.2.3.** A 50 N load shall be attached to the lower end of the section of strap. The other end shall be subjected to a back and forth motion, the total amplitude being 300 ± 20 mm (see figure).
- 4.2.4.** If there is a free end serving as reserve strap, it must in no way be fastened or clipped to the section under load.
- 4.2.5.** It shall be ensured that on the test bench the strap, in the slack position, descends in a concave curve from the adjusting device, as in the vehicle. The 50 N load applied on the test bench shall be guided vertically in such a way as to prevent the load swaying and the belt twisting. The attachment shall be fixed to the 50 N load as in the vehicle.
- 4.2.6.** Before the actual start of the test, a series of 20 cycles shall be completed so that the self-tightening system settles properly.
- 4.2.7.** 1, 000 cycles shall be completed at a frequency of 0.5 cycles per second, the total amplitude being 300 ± 20 mm. The 50 N load shall be applied only during the time corresponding to a shift of 100 ± 20 mm for each half period.

4.3. Conditioning of straps and breaking-strength test (static)

4.3.1. Conditioning of the strap for breaking strength test

Samples cut from the strap shall be conditioned as follows:

- 4.3.1.1.** Temperature-conditioning and hygrometrics
The strap shall be kept for at least 24 hours in an atmosphere having a temperature of $20 \pm 5^\circ \text{C}$ and a relative humidity of $65 \pm 5\%$. If the test is not carried out immediately after conditioning, the specimen shall be placed in a hermetically-closed receptacle until the test begins. The breaking load shall be determined within five minutes after removal of the strap from the conditioning atmosphere or from the receptacle.
- 4.3.1.2.** Light conditioning.
 - 4.3.1.2.1.** The provisions of Recommendation ISO 105-B02 (1999) shall apply. The strap shall be exposed to light for the time necessary to produce a contrast equal to grade 4 on the grey scale on Standard Blue Dye No. 7.
 - 4.3.1.2.2.** After exposure the strap, except for man-made fibres, shall be kept for a minimum of 24 hours in an atmosphere having a temperature of $20 \pm 5^\circ \text{C}$ and a relative humidity of $65 \pm 5\%$. If the test is not carried out immediately after conditioning the specimen shall be placed in a hermetically-closed receptacle until the test begins. The breaking load shall be determined within five minutes

after removal of the strap from the conditioning installation.

4.3.1.3. Cold conditioning.

4.3.1.3.1. The strap shall be kept for a minimum of 24 hours in an atmosphere having a temperature of $20 \pm 5^\circ \text{C}$ and a relative humidity of $65 \pm 5\%$.

4.3.1.3.2. The strap shall then be kept for one and a half hours on a plane surface in a low-temperature chamber in which the air temperature is $-30 \pm 5^\circ \text{C}$. It shall then be folded and the fold shall be loaded with a mass of 2 kg previously cooled to $-30 \pm 5^\circ \text{C}$. When the strap has been kept under load for 30 minutes in the same low-temperature chamber, the mass shall be removed and the breaking load shall be measured within 5 minutes after removal of the strap from the low-temperature chamber.

4.3.1.4. Heat-conditioning.

4.3.1.4.1. The strap shall be kept for three hours in a heating cabinet in an atmosphere having a temperature of $60 \pm 5^\circ \text{C}$ and a relative humidity of $65 \pm 5\%$.

4.3.1.4.2. The breaking load shall be determined within five minutes after removal of the strap from the heating cabinet.

4.3.1.5. Abrasion conditioning.

The strap from two safety belt assemblies shall be tested for resistance to abrasion by rubbing over the hexagon bar prescribed in Annex 2 in the following manner: The strap shall be mounted in the apparatus shown schematically in Annex 2. One end of the strap (A) shall be attached to a mass (B) of $2.35 \text{ kg} \pm 0.05 \text{ kg}$, except that a mass of $1.5 \text{ kg} \pm 0.05 \text{ kg}$ shall be used for strap in pelvic and upper torso restraints of a belt assembly used in a child restraint system. The strap shall be passed over the two new abrading edges of the hexagon bar (C) and the other end attached to an oscillating drum (D) which has a stroke of 330 mm. Suitable guides shall be used to prevent movement of the strap along the axis of hexagonal bar C. Drum D shall be oscillated for 5,000 strokes or 2,500 cycles at a rate of 60 ± 2 strokes per minute or 30 ± 1 cycles per minute. The abraded strap shall be conditioned as prescribed in paragraph 4.3.1.1. and tested for breaking strength by the procedure described in paragraph 4.3.2. The median values for the breaking strengths determined on abraded and unabraded specimens shall be used to calculate the percentage of breaking strength retained.

4.3.2. Determination of the referenced strength of straps (static test)

4.3.2.1. The test shall be carried out each time on two new samples of strap, of sufficient length, conditioned in conformity with the provisions of paragraph 4.3.1

4.3.2.2. Each strap shall be gripped between the clamps of a tensile-testing machine. The clamps shall be so designed as to avoid breakage of the strap at or near them. The speed of traverse shall be about 100 mm/ min. The free length of the specimen between the clamps of the machine at the start of the test shall be $200 \text{ mm} \pm 40 \text{ mm}$.

4.3.2.3. When the load reaches 9.8 kN, the width of the strap shall be measured without stopping the machine.

4.3.2.4. The tension shall be increased until the strap breaks, and the breaking load shall be noted.

4.3.2.5. If the strap slips or breaks at or within 10 mm of either of the clamps the test shall be invalid and a new test shall be carried out on another specimen.

4.4. Test of belt assembly components incorporating rigid parts.

4.4.1. Two samples of the complete belt assembly shall be placed in a refrigerated cabinet at $-10^\circ \pm 1^\circ \text{C}$ for two hours. The mating parts of the buckle shall be coupled together manually immediately after being removed from the refrigerated cabinet.

4.4.2. Two samples of complete belt assembly shall be placed in a refrigerated cabinet at $-10^\circ \text{C} \pm 1^\circ \text{C}$ for two hours. The rigid items and parts made of plastics under test shall then be laid in turn upon a flat rigid steel surface (which has been kept with the samples in the refrigerated cabinet) placed on the horizontal surface of a compact rigid block with a mass of at least 100 kg and within 30 seconds of being removed from the refrigerated cabinet, an 18 kg steel mass shall be allowed to fall under gravity through 300 mm

on to the test sample. The impact face of the 18 kg mass shall take the form of a convex surface with a hardness of at least 45 HRC having a transverse radius of 10 mm and a longitudinal radius of 150 mm placed along the centre line of the mass. One test sample shall be tested with the axis of the curved bar in line with the strap and the other sample shall be tested at 90° to the strap.

- 4.4.3.** When testing a manually adjusting device, the strap shall be drawn steadily through the adjusting device, having regard for the normal conditions of use, at a rate of approximately 100 mm/ s and the maximum force measured to the nearest 1 N after the first 25 mm of strap movement. The test shall be carried out in both directions of strap travel through the device, the strap being cycled 10 times prior to the measurement.
- 4.4.4.** Two safety belt assemblies having plastic or non-metallic hardware or having retractors shall be subjected to the conditions prescribed in Annex 9. The dimension and weight measurement shall be omitted. Buckles shall be unlatched and retractors shall be fully retracted during conditioning. The hardware parts after conditioning shall be used for all applicable tests in 3.2. and 3.5.

4.5. Additional tests for safety belts with retractors

4.5.1. Durability of retractor mechanism

After completion of the corrosion-resistance test described in paragraph 4.1., the strap shall be fully extended and allowed to dry for at least 24 hours under standard laboratory conditions specified in 4.3.1.1. The retractor shall be examined for ferrous and non-ferrous corrosion which may be transferred, either directly or by means of the strap, to a person or his clothing during use of a safety belt assembly incorporating the retractor, and for ferrous corrosion on significant surfaces if the retractor is part of the attachment hardware. The strap shall be withdrawn manually and allowed to retract for 25 cycles. The retractor shall be mounted in an apparatus capable of extending the strap fully, applying a force of 89 N at full extension, and allowing the strap to retract freely and completely. The strap shall be withdrawn from the retractor and allowed to retract repeatedly in this apparatus until 2,500 cycles are completed. The retractor and strap shall then be subjected to the temperature resistance test prescribed in Annex 9. The retractor shall be subjected to 2,500 additional cycles of strap withdrawal and retraction. Then, the retractor and strap shall be subjected to dust in a chamber similar to the one illustrated in Annex 4 containing about 0.9 kg of coarse grade dust conforming to the specification given in ISO 12103-1: 1997 - "Road vehicles - Test dust for filter evaluation - Part 1: Arizona test dust". The dust shall be agitated every 20 minutes for 5 seconds by compressed air, free of oil and moisture, at a gage pressure of 550 ±55 kPa entering through an orifice 1.5 ±0.1 mm in diameter. The strap shall be extended to the top of the chamber and kept extended at all times except that the strap shall be subjected to 10 cycles of complete retraction and extension within 1 to 2 minutes after each agitation of the dust. At the end of 5 hours, the assembly shall be removed from the chamber. The strap shall be fully withdrawn from the retractor manually and allowed to retract completely for 25 cycles. An automatic-locking retractor attached to pelvic restraint shall be subjected to 5,000 additional cycles of strap withdrawal and retraction. An emergency locking retractor attached to upper torso restraint shall be subjected to 45,000 additional cycles of strap withdrawal and retraction between 50 and 100 per cent extension. The locking mechanism of an emergency locking retractor shall be actuated at least 10,000 times within 50 to 100 percent extension of strap during the 50,000 cycles. At the end of test, compliance of the retractors with applicable requirements in 3.2.4.1. and 3.2.4.2. shall be determined. Two retractors shall be tested for performance.

4.5.2. Locking of emergency locking retractor

The retractor shall be tested once for locking when the strap has been unwound to full length less 300 ± 5mm.

- 4.5.2.1.** 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.
- 4.5.2.2.** When retractors are being tested for sensitivity to vehicle deceleration they shall be tested in the vehicle X and Y axis.
- 4.5.2.3.** A suitable apparatus for the tests specified in paragraph 4.5.2.1. above is described in annex 5 to this Regulation. The design of any such test apparatus shall ensure that the required acceleration is given before the strap is withdrawn out of the retractor by more than 5mm and that the withdrawal takes place at an average rate of increase of acceleration of at least 25g/s and not more than 150g/s.

- 4.5.2.4. To check conformity with the requirements of paragraphs 3.2.4.2.1.3. and 3.2.4.2.1.4., the retractor shall be mounted on a horizontal table and the table tilted with a speed not exceeding 2° per second until locking has occurred. The test shall be repeated with tilting in other directions to ensure that the requirements are fulfilled.
- 4.5.2.5. For a retractor sensitive to vehicle acceleration, the retractor shall be accelerated in the horizontal plane in two directions normal to each other, while the retractor drum's central axis is oriented at the angle at which it is installed in the vehicle.

4.5.3. Retracting forces

The retracting forces shall be measured with the safety-belt assembly fitted to a dummy as for the dynamic test prescribed in paragraph 4.6. 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 m/min.

Optionally, an angle of 45° inboard and 45° downward from the guide or pulley may be used in place of the dummy.

4.6. Dynamic test of belt assembly or of the restraint system

4.6.1. First method

- 4.6.1.1. The belt assembly shall be mounted on a trolley equipped with the seat and the anchorage defined in annex 6 to this Regulation. However, if the belt assembly is intended for a specific vehicle or for specific types of vehicle, the distances between the manikin and the anchorages shall be determined by the service conducting the tests, either in conformity with the instructions for fitting supplied with the belt or in conformity with the data supplied by the manufacturer of the vehicle. If the belt is equipped with a belt adjustment device for height such as defined in paragraph 2.12. above, the position of the device and the means of securing it shall be the same as those of the vehicle design.
- In that case, when the dynamic test has been carried out for a type of vehicle it needs not be repeated for other types of vehicles where each anchorage point is less than 50 mm distant from the corresponding anchorage point of the tested belt. Alternatively, manufacturers may determine hypothetical anchorage positions for testing in order to enclose the maximum number of real anchorage points.
- 4.6.1.1.1. In the case of a safety-belt or restraint system forming part of an assembly for which type approval is requested as a restraint system, the safety-belt shall be mounted on the part of the vehicle structure to which the restraint system is normally fitted and this part shall be rigidly attached to the test trolley in the way prescribed in paragraphs 4.6.1.1.2 to 4.6.1.1.5.
- In the case of a safety-belt or restraint system with pretensioning devices relying on component parts other than those incorporated in the belt assembly itself, the belt assembly shall be mounted in conjunction with the necessary additional vehicle parts on the test trolley in the manner prescribed in paragraphs 4.6.1.1.2. to 4.6.1.1.5.
- Alternatively, in the case where those devices cannot be tested on the test trolley, the manufacturer may demonstrate by a conventional frontal impact test at 50 km/h in conformity with the procedure ISO 3560 (1975) that the device complies with the requirements of the Regulation.
- 4.6.1.1.2. The method used to secure the vehicle during the test shall not be such as to strengthen the anchorages of the seats or safety-belts or to lessen the normal deformation of the structure. No forward part of the vehicle shall be present which by limiting the forward movement of the manikin excepting the foot, would reduce the load imposed on the restraint system during the test. The parts of the structure eliminated can be replaced by parts of equivalent strength provided they do not hinder the forward movement of the manikin.
- 4.6.1.1.3. A securing device shall be regarded as satisfactory if it produces no effect on an area extending over the whole width of the structure and if the vehicle or the structure is blocked or fixed in front at a distance of not less than 500 mm from the anchorage of the restraint system. At the rear the structure shall be secured at a sufficient distance rearwards of the anchorages to ensure that the requirements of paragraph 4.6.1.1.2 above are fulfilled.

- 4.6.1.1.4. The seats shall be fitted and shall be placed in the position for driving use chosen by the technical service conducting approval tests to give the most adverse conditions with respect to strength, compatible with installing the manikin in the vehicle. The positions of the seats shall be stated in the report. The seat back, if adjustable for inclination, shall be locked as specified by the manufacturer or, in the absence of any specification, to an actual seat back angle as near as possible to 25° in the case of vehicles of categories [M1 and N1] as near as possible to 15° in the case of vehicles of all other categories.
- 4.6.1.1.5. Any seating position that shares common structural seatbelt parts shall be tested simultaneously. The belt assembly shall be attached to the manikin as defined in annex 7 to this Regulation as follows: a board 25mm thick shall be placed between the back of the manikin and the seat back. The belt shall be firmly adjusted to the manikin. The board shall then be removed so that the entire length of its back is in contact with the seat back. A check shall be made to ensure that the mode of engagement of the two parts of the buckle entails no risk of reducing the reliability of locking.
- 4.6.1.2. The free ends of the straps shall extend sufficiently far beyond the adjusting devices to allow for slip.
- 4.6.1.3. The trolley shall then be so propelled that at the moment of impact its free running speed is 50 km/ h \pm 1 km/ h and the manikin remains stable. The stopping distance of the trolley shall be 40 cm \pm 5 cm. The trolley shall remain horizontal throughout deceleration. The deceleration of the trolley shall be achieved by using the apparatus described in annex 6 to this Regulation [or any other device giving equivalent results]. This apparatus shall comply with the performance specified in annex 8 to this Regulation.

4.6.2. Second Method

- 4.6.2.1. The belt assembly shall be mounted on a rigid fixture simulating the vehicle anchorage locations or on a reinforced partial vehicle body. The fixture shall be equipped with a representative vehicle seat or the seat as defined in annex 6 of this Regulation. The distances between the dummy and the anchorages shall be in conformity with the data supplied by the manufacturer of the vehicle. The seat belt anchorage fixture shall be mounted, at the choice of the manufacturer of the safety belt assembly or restraint system, on an acceleration sled or on a trolley as defined in annex 6 of this Regulation. If the vehicle is equipped with a belt adjustment device for height such as defined in paragraph 2.12. above, the position of the device and the means of securing it shall be the same as those of the vehicle design.
- 4.6.2.2. In the case of a safety belt or restraint system with pre-loading devices relying on component parts other than those incorporated in the belt assembly itself, the belt assembly shall be mounted in conjunction with the necessary additional vehicle parts.
- 4.6.2.3. No forward part of the fixture (or vehicle) shall be present, which by limiting the forward movement of the manikin, excepting the foot, could reduce the load imposed on the restraint system during the test.
- 4.6.2.4. The belt assembly shall be attached as defined in FMVSS 208 to a manikin as defined in § S7.1.4 of FMVSS 208, 95th percentile adult male. A check shall be made to ensure that the mode of engagement of the two parts of the buckle entails no risk of reducing the reliability of locking.
- 4.6.2.5. The fixture shall be propelled to simulate a 50⁺⁰_{-1.7} km/h vehicle crash with crash pulse as defined by full vehicle crash test into a rigid barrier. No measurements shall be taken.

4.7. Buckle-opening test

- 4.7.1. For this test, belt assemblies or restraint devices which have already undergone the dynamic test in conformity with paragraph 4.6 above shall be used.

4.7.2. The belt assembly shall be removed from the test trolley without the buckle being opened. A load shall be applied to the buckle by direct traction via the straps tied to it so that all the straps are subjected to the force of 600 N/n.
It is understood that n is the number of straps linked to the buckle when it is in a locked position. In the case where the buckle is connected to a rigid part, the load shall be applied at the same angle as the one formed by the buckle and the rigid end during the dynamic test. A load shall be applied at a speed of 400 ± 20 mm/min to the geometric centre of the buckle-release button along a fixed axis running parallel to the initial direction of motion of the button. During the application of the force needed to open the buckle, the buckle shall be held by a rigid support. The load quoted above shall not exceed the limit indicated in paragraph 3.2.2.5. above. The point of contact of the test equipment shall be spherical in form with a radius of $2.5 \text{ mm} \pm 0.1 \text{ mm}$. It shall have a polished metal surface.

4.7.3. The buckle-opening force shall be measured and any failure of the buckle noted.

4.7.4. After the buckle-opening test, the components of the belt assembly or of the restraint device which have undergone the tests prescribed in paragraph 4.6 above shall be inspected and the extent of the damage sustained by the belt assembly or restraint device during the dynamic test shall be recorded in the test report.

4.8. Additional test on safety belts with pretensioning devices

4.8.1. Conditioning

The pretensioning device may be separated from the safety belt to be tested and kept for 24 hours at a temperature of $60^\circ \pm 5^\circ\text{C}$. The temperature shall then be raised to $100^\circ \pm 5^\circ\text{C}$ for two hours. Subsequently it shall be kept for 24 hours at a temperature of $-30^\circ \pm 5^\circ\text{C}$. After being removed from conditioning, the device shall warm up to ambient temperature. If it has been separated it shall be fitted again to the safety belt.

4.9. Use of Samples Submitted for Approval of a Type of Belt or Restraint System (See Annex 10 to this Regulation)

4.9.1. Two belts or restraint systems are required for the buckle inspection, the low-temperature buckle test, the low-temperature test described in Paragraph 4.4.2 below where necessary, the buckle durability test, the belt corrosion test, the temperature resistance test, the retractor operating tests, the dynamic test and the buckle-opening test after the dynamic test. One of these two samples shall be used for the inspection of the belt or restraint system.

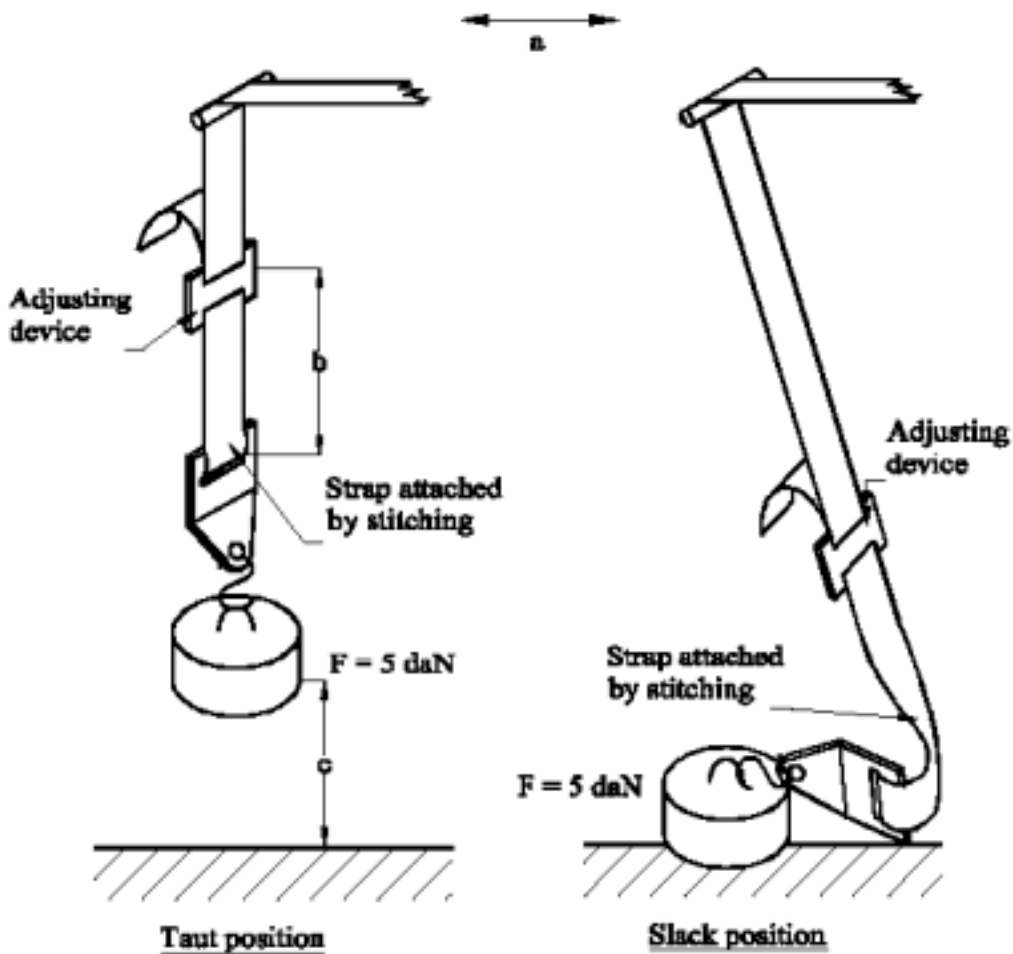
4.9.2. Two belts or restraint systems are required for the inspection of the buckle, the micro-slip test. The belt adjusting device operating test shall be conducted on one of these two samples.

4.9.3. The sample of strap shall be used for testing the breaking strength of the strap. Part of this sample shall be preserved so long as the approval remains valid

ANNEX 1

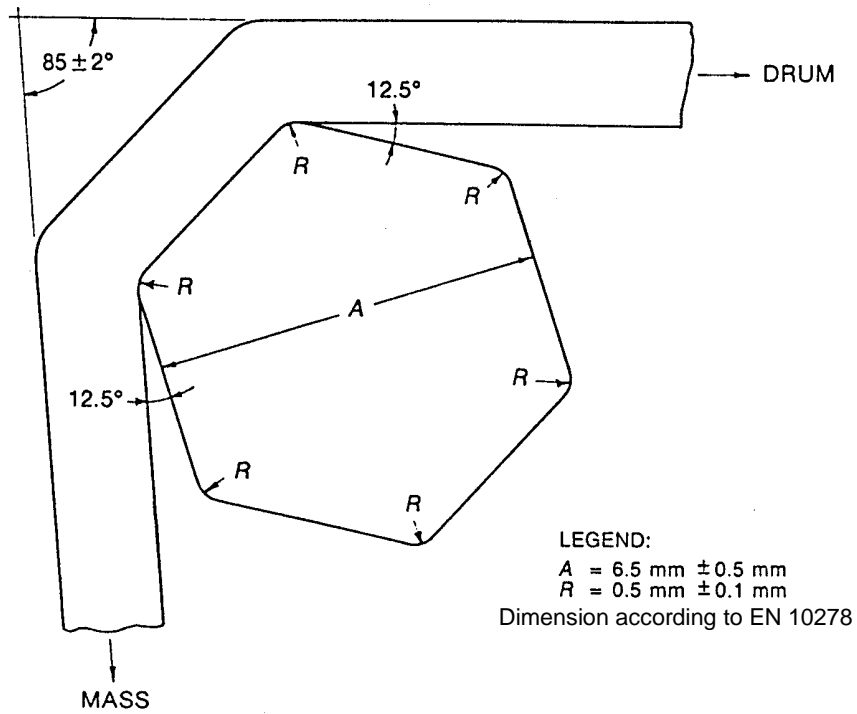
MICRO SLIP TEST

Dimensions	mm	Tolerance (± mm)
Total travel (a)	300	20
Adjusting device (b)	200	-
Ground distance ©	100	20



The load of 5daN on the testing device shall be vertically guided in such a way as to avoid load-swing and winding of the strap.
The attaching device shall be fixed to the load of 5 daN in the same manner as in a vehicle.

ANNEX 2
Abrasion Conditioning



Hexagon Bar:
Material: X12CrS13 according to EN 10088 or SAE 51416
Hardness: 91 to 101 HRB

Figure 1 Webbing and Bar Geometry

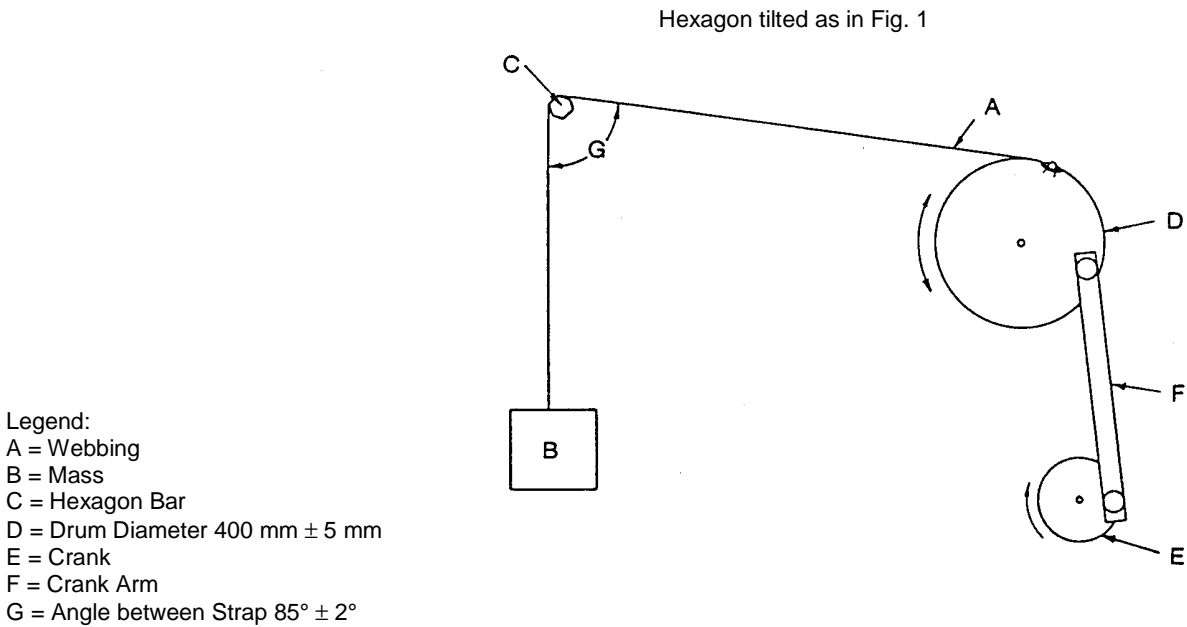
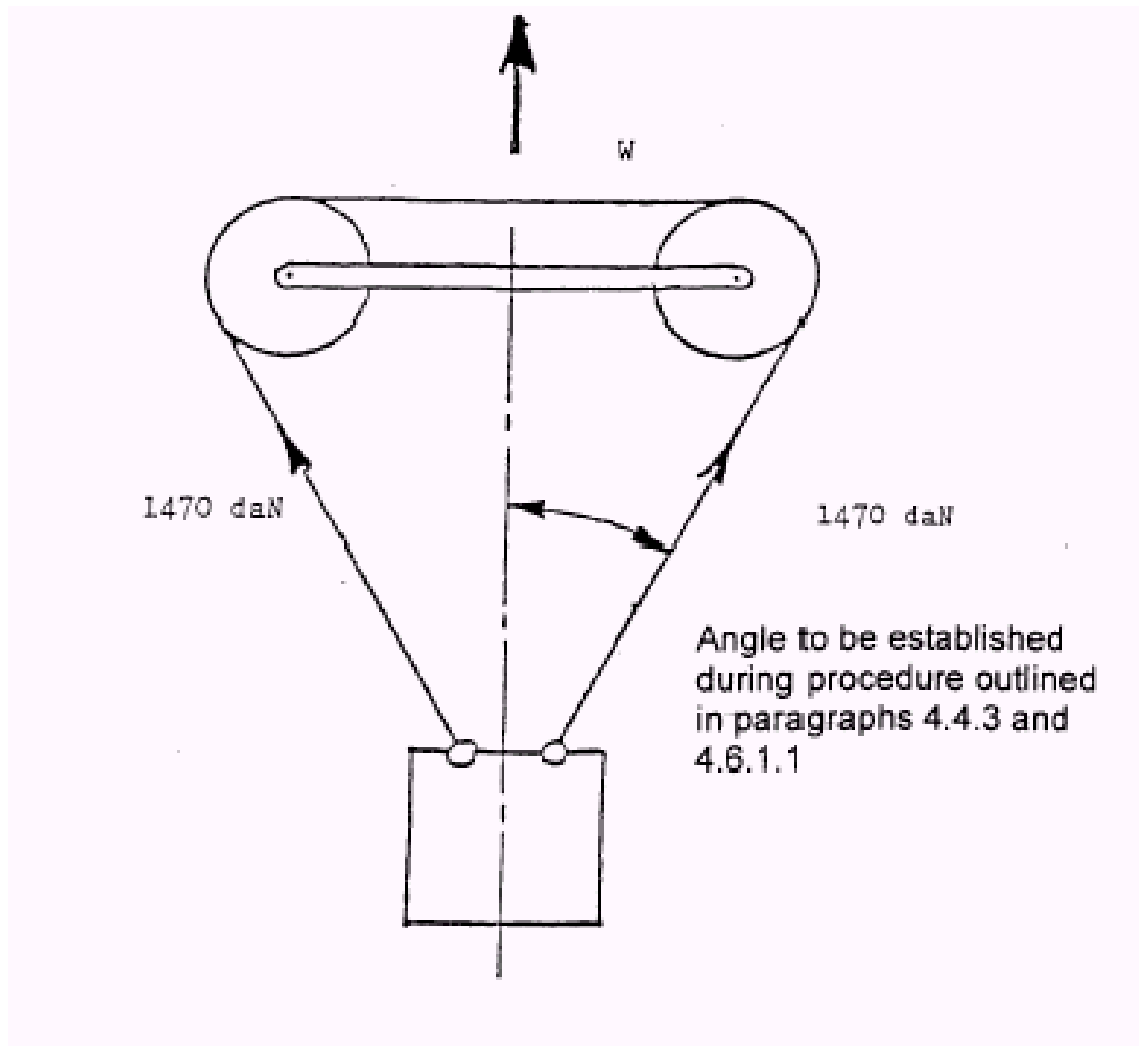


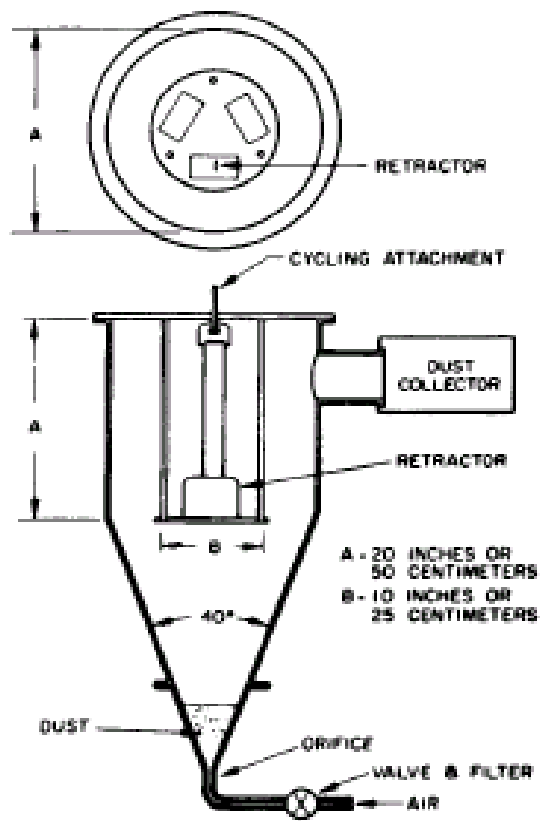
Figure 2 Diagrammatic Arrangement of Suitable Test Machine

ANNEX 3
DUAL BUCKLE TEST.



W = applied load

ANNEX 4
DUST CHAMBER



ANNEX 5

DIAGRAM OF AN APPARATUS TO TEST LOCKING OF EMERGENCY LOCKING RETRACTORS

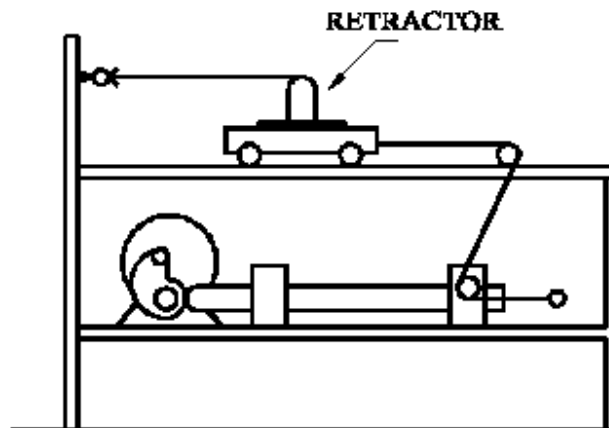
A suitable apparatus is illustrated in the figure and consists of a motor-driven cam, the follower of which is attached by wires to a small trolley mounted on a track. The cam design and motor speed combination is such as to give the required acceleration at a rate of increase of acceleration as specified in paragraph 4.5.2.2. of this Regulation 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 swivelled 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. supplied by the manufacturer or his accredited representative shall be incorporated in the test installation to simulate as closely as possible the intended installation in a vehicle.

Any additional brackets, etc. that may be required to simulate the installation as intended in the vehicle shall be provided by the manufacturer or his accredited representative.



The use of an alternative test apparatus that provide the required acceleration and rate of acceleration increase as specified in paragraph 4.5.2.2. of this Regulation is acceptable.

ANNEX 6

DESCRIPTION OF TROLLEY, SEAT, ANCHORAGES AND STOPPING DEVICE

1. TROLLEY

For tests on safety-belts the trolley, carrying the seat only, shall have a mass of 400 + 20 kg. For tests on restraint systems the trolley with the attached vehicle structure shall have a mass of 800 kg. However, if necessary, the total mass of the trolley and vehicle structure may be increased by increments of 200 kg. In no case shall the total mass differ from the nominal value by more than ± 40 kg.

2. SEAT

Except in the case of tests on restraint systems, the seat shall be of rigid construction and present a smooth surface. The particulars given in figure 1 to this annex shall be respected, care being taken that no metal part can come into contact with the belt.

3. ANCHORAGES

- 3.1. In the case of a belt equipped with a belt adjustment device for height as defined in paragraph 2.11.4 of this Regulation, this device shall be secured either to a rigid frame, or to a part of the vehicle on which it is normally mounted which shall be securely fixed on the test trolley.
- 3.2. The anchorages shall be positioned as shown in figure 1. The marks which correspond to the arrangement of the anchorages show where the ends of the belt are to be connected to the trolley or to the load transducer, as the case may be. The anchorages for normal use are the points A, B and K if the strap length between the upper edge of the buckle and the hole for attachment of the strap support is not more than 250 mm. Otherwise, the points A1 and B1 shall be used. The tolerance on the position of the anchorage points is such that each anchorage point shall be situated at most at 50 mm from corresponding points A, B and K indicated in figure 1 or A1, B1 and K, as the case may be.
- 3.3. The structure carrying the anchorages shall be rigid. The upper anchorage must not be displaced by more than 0.2 mm in the longitudinal direction when a load of 98 daN is applied to it in that direction. The trolley shall be so constructed that no permanent deformation shall occur in the parts bearing the anchorages during the test.
- 3.4. If a fourth anchorage is necessary to attach the retractor, this anchorage:
Shall be located in the vertical longitudinal plane passing through K;

Shall enable the retractor to be tilted to the angle prescribed by the manufacturer;

Shall be located on the arc of a circle with radius $KB1 = 790$ mm if the length between the upper strap guide and the strap outlet at the retractor is not less than 540 mm or, in all other cases, on the arc of a circle with centre K and radius 350 mm.

4. STOPPING DEVICE

4.1. The device consists of two identical absorbers mounted in parallel, except in the case of restraint systems when four absorbers shall be used for a nominal mass of 800 kg. If necessary, an additional absorber shall be used for each 200 kg increase of nominal mass. Each absorber comprises:

an outer casing formed from a steel tube;

a polyurethane energy-absorber tube;

a polished-steel olive-shaped knob penetrating into the absorber; and

a shaft and an impact plate.

4.2. The dimensions of the various parts of this absorber are shown in the diagrams reproduced in figures 2, 3 and 4.

4.3. The characteristics of the absorbing material are given in table 1 of this annex. Immediately before each test the tubes shall be conditioned at a temperature between 15° and 25 °C for at least 12 hours without being used. During the dynamic testing of safety-belts or restraint systems, the stopping device shall be at the same temperature as during the calibration test, with a tolerance of ± 2 °C. The requirements to be met by the stopping device are given in annex 8 to this Regulation. Any other device giving equivalent results may be used.

Table 1

CHARACTERISTICS OF THE ABSORBING MATERIAL
(ASTM Method D 735 unless otherwise stated)

Shore hardness A: 95 ± 2 at 20 ± 5 °C temperature

Breaking strength: $R_o > 343 \text{ daN/cm}^2$

Minimum elongation: $A_o > 400$ per cent

Module at 100 per cent elongation: $> 108 \text{ daN/cm}^2$

at 300 per cent elongation: $> 235 \text{ daN/cm}^2$

Low-temperature brittleness (ASTM Method D 736):

5 hours at -55 °C

Compression set (Method B):

22 hours at 70 °C < 45 per cent

Density at 25 °C: between 1.05 and 1.10

Ageing in air (ASTM Method D 573)

- 70 hours at 100 °C - Shore-A-hardness: max variation ± 3
- breaking strength: decrease < 10 per cent of R_o
- elongation: decrease < 10 per cent of A_o
- mass: decrease < 1 per cent

Immersion in oil (ASTM Method No. 1 Oil):

- 70 hours at 100 °C - Shore-A-hardness: max variation ± 4
- breaking strength: decrease < 15 per cent of R_o
- elongation: decrease < 10 per cent of A_o
- volume: swelling < 5 per cent

Immersion in oil (ASTM Method No. 3 Oil):

- 70 hours at 100 °C - breaking strength: decrease < 15 per cent of R_o
- elongation: decrease < 15 per cent of A_o
- volume: swelling < 20 per cent

Immersion in distilled water:

- 1 week at 70 °C - decrease < 35 per cent of R_o
- elongation: increase < 20 per cent of A_o .

FIGURE 2
STOPPING DEVICE

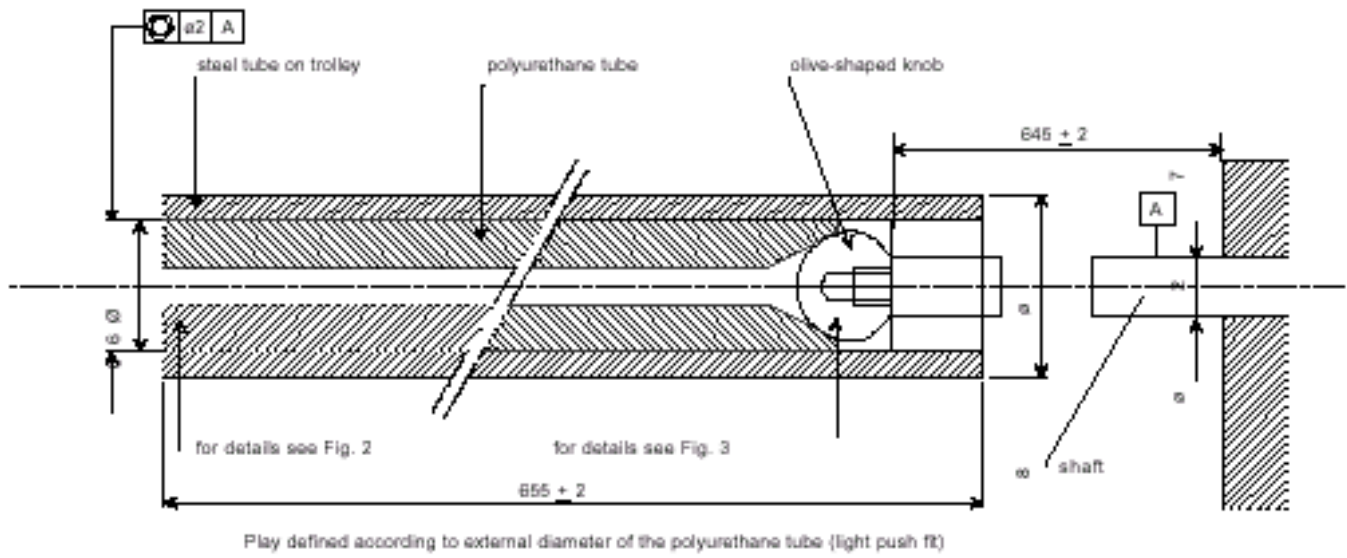
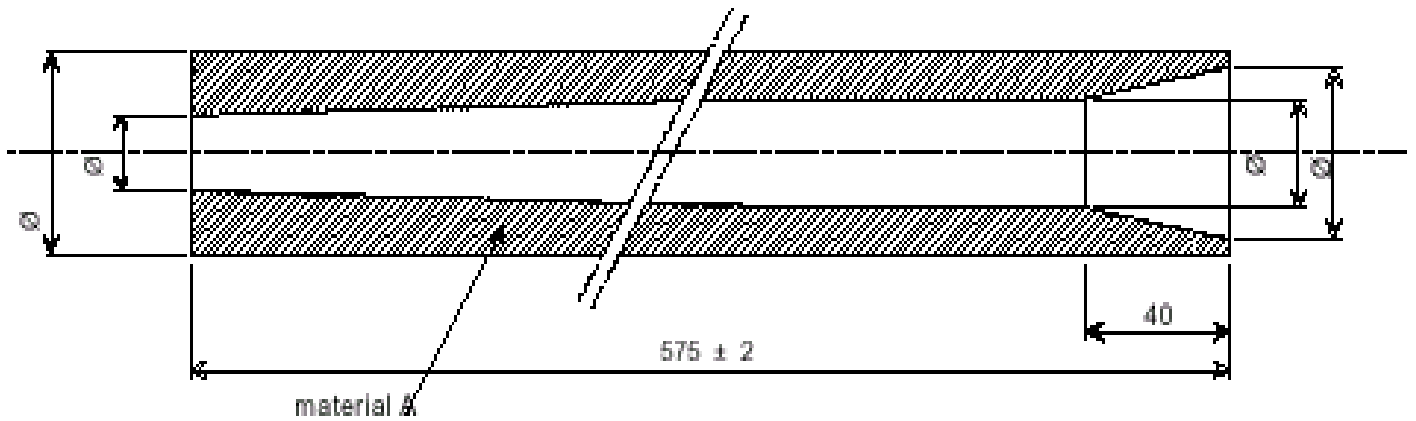


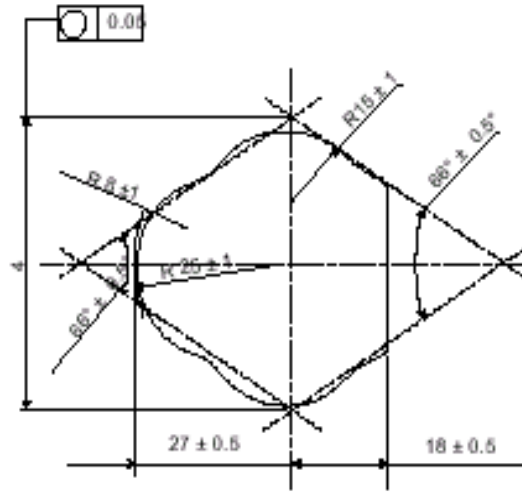
FIGURE 3
STOPPING DEVICE
(Polyurethane tube)



Surface finish $\sqrt{1.2}$
of mandrell

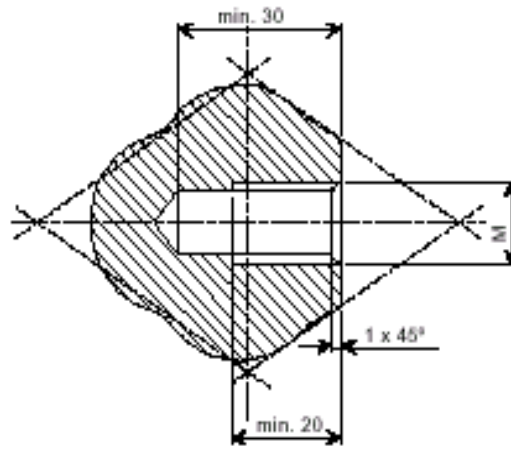
Interference tolerance ± 0.2
All dimensions in mm

FIGURE 4
 STOPPING DEVICE
 (Olive-shaped knob)



* This dimension can vary between 43 and 49 mm
 Dimensions in mm

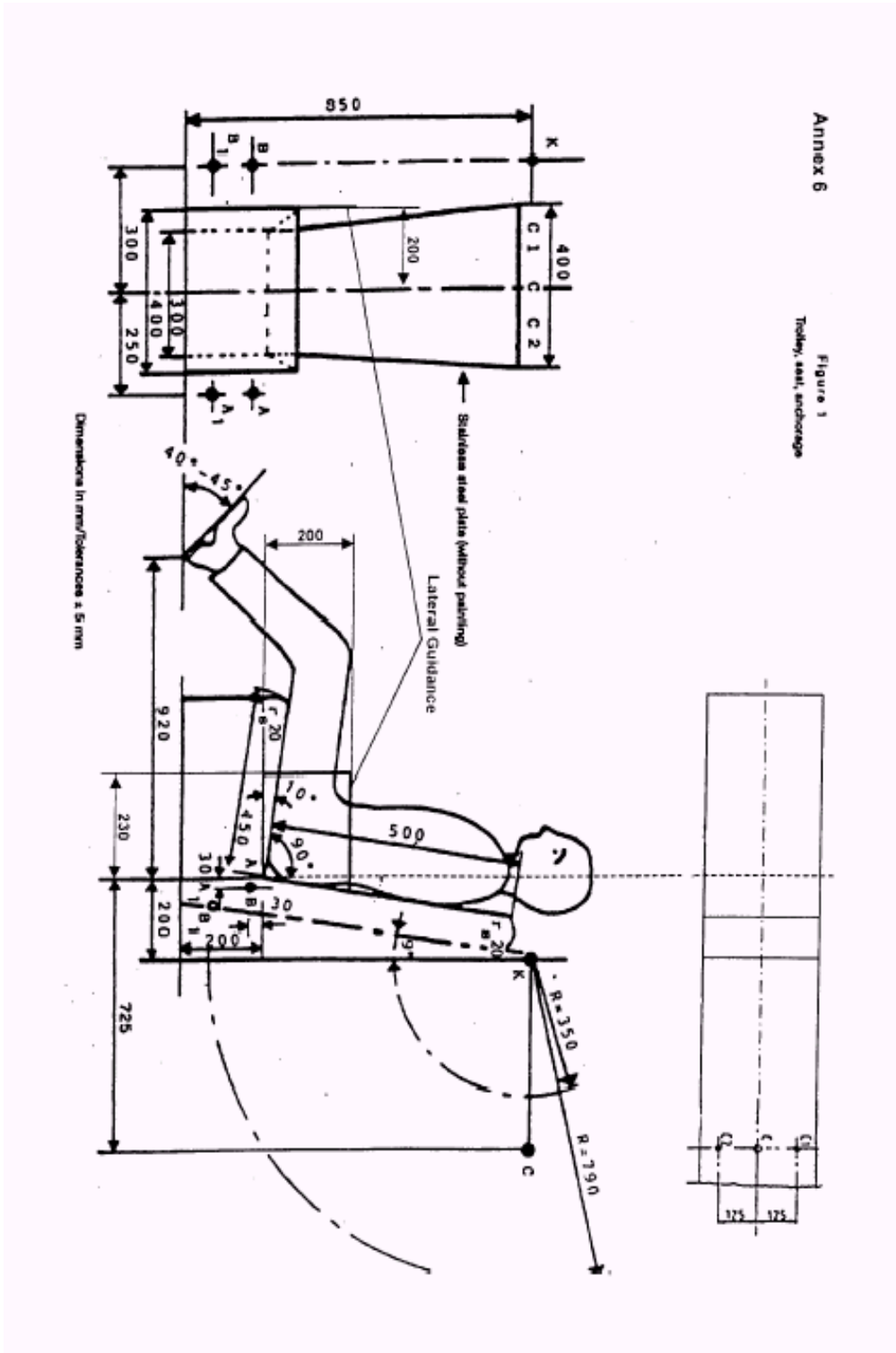
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Dimensions in mm

ANNEX 6

Figure 1
Trolley, seat, anchorage



Dimension in mm/tolerances ± 5 mm

ANNEX 7

DESCRIPTION OF MANIKIN

1. Specifications of the manikin

1.1. General

The main characteristics of the manikin are illustrated in the following figures and tables:

Figure 1 Side view of head, neck and torso;

Figure 2 Front view of head, neck and torso;

Figure 3 Side view of hip, thighs and lower leg;

Figure 4 Front view of hip, thighs and lower leg;

Figure 5 Principal dimensions;

Figure 6 Manikin in sitting position, showing:

location of the centre of gravity;
location of points at which displacement shall be measured; and
shoulder height.

Table 1 References, names, materials and principal dimensions of components of the manikin; and

Table 2 Masses of head, neck, torso, thighs and lower leg.

1.2. Description of the manikin

1.2.1. Structure of the lower leg (see Figures 3 and 4)

The structure of the lower leg consists of three components:

a sole plate (30);

a shin tube (29); and

a knee tube (26).

The knee tube has two lugs which limit the movement of the lower leg in relation to the thigh.

The lower leg can be rotated rearwards 120° from the straight position.

Structure of the thigh (see Figures 3 and 4)

The structure of the thigh consists of three components:

- knee tube (22);
- a thigh bar (21); and
- a hip tube (20).

Movement of the knee is limited by two cut-outs in the knee tube (22) which engage with the lugs of the lower leg.

1.2.2. Structure of the thigh (see figures 3 and 4)

The structure of the thigh consists of three components

- knee tube (22)
- a thigh bar (21); and
- a hip tube (20)

Movement of the knee is limited by two cut-outs in the knee tube (22) which engage with the lugs of the lower leg.

1.2.3. Structure of the torso (see Figures 1 and 2)

The structure of the torso consists of:

- a hip tube (2);
- a roller chain (4);
- ribs (6) and (7);
- a sternum (8); and
- chain attachments (3) and at parts (7) and (8).

1.2.4. Neck (see Figures 1 and 2)

The neck consists of seven polyurethane discs (9). The stiffness of the neck can be adjusted by means of a chain tensioner.

1.2.5. Head (see Figures 1 and 2)

The head (15) itself is hollow; the polyurethane form is reinforced by steel plate (17). The chain tensioner by which the neck can be adjusted consists of a polyamide block (10), a tubular spacer (11), and tensioning members (12) and (13). The head can

be turned about the Atlas-Axis joint, which consists of the adjuster assembly (14) and (18), the spacer (16), and polyamide block (10).

1.2.6. Knee joint (see Figure 4)

The lower leg and thighs are connected by a tube (27) and a tensioner (28).

1.2.7. Hip joint (see Figure 4)

The thighs and torso are connected by a tube (23), friction plates (24), and tensioner assembly (25).

1.2.8. Polyurethane

Type: PU 123 CH Compound

Hardness: 50-60 Shore A

1.2.9. Overalls

The manikin is covered by a special overall (see table 1).

2. Correction devices

2.1. General

In order to calibrate the manikin to certain values and its total mass, the mass distribution are adjusted by the use of six correction steel masses of 1 kg each, which can be mounted at the hip joint. Six polyurethane weights each of 1 kg mass can be mounted in the back of the torso.

3. Cushion

A cushion must be positioned between the chest of the manikin and the overall. This cushion shall be made of polyethylene foam of the following specification:

Hardness: 7-10 shore A

Thickness: 25 mm + 5

It shall be replaceable.

4. Adjustment of the joints

4.1. General

In order to achieve reproducible results, it is necessary to specify and control the friction at each joint.

4.2. Knee joint

Tighten the knee joint.

Set the thigh and lower leg vertical.

Rotate the lower leg through 30°.

Gradually slacken the tensioner (28) until the lower leg starts to fall under its own mass.

Lock the tensioner in this position.

4.3. Hip joint

Tighten the hip joint.

Place the thigh in a horizontal position and the torso in a vertical position.

Rotate the torso in a forward direction until the angle between the torso and the thigh is 60°.

Gradually slacken the tensioner until the torso starts to fall under its own mass.

Lock the tensioner in this position.

4.4. Atlas-Axis joint

Adjust the Atlas-Axis joint so that it just resists its own weight in the fore and aft directions.

4.5. Neck

The neck can be adjusted by means of the chain tensioner (13).

When the neck is adjusted, the upper end of the tensioner shall displace between 4-6 cm when subjected to a horizontal load of 10 daN.

TABLE 1

Reference number	Name	Material	Dimensions
1	Body material	Polyurethane	--
2	Hip tube	Steel	76 x 70 x 100 mm
3	Chain attachments	Steel	25 x 10 x 70 mm
4	Roller chain	Steel	3/4
5	Shoulder plate	Polyurethane	--
6	Rolled section	Steel	30 x 30 x 3 x 250 mm
7	Ribs	Perforated steel plate	400 x 85 x 1.5 mm
8	Sternum	Perforated steel plate	250 x 90 x 1.5 mm
9	Discs (six)	Polyurethane	\varnothing 90 x 20 mm \varnothing 80 x 20 mm \varnothing 75 x 20 mm \varnothing 70 x 20 mm \varnothing 65 x 20 mm \varnothing 60 x 20 mm
10	Block	Polyamide	60 x 60 x 25 mm
11	Tubular spacer	Steel	40 x 40 x 2 x 50 mm
12	Tensioning bolt	Steel	M16 x 90 mm
13	Tensioner nut	Steel	M16
14	Tensioner for Atlas-Axis joint	Steel	\varnothing 12 x 130 mm (M12)
15	Head	Polyurethane	--
16	Tubular spacer	Steel	\varnothing 18 x 13 x 17 mm
17	Reinforcement plate	Steel	30 x 3 x 500 mm
18	Tensioner nut	Steel	M12
19	Thighs	Polyurethane	--
20	Hip tube	Steel	76 x 70 x 80 mm
21	Thigh bar	Steel	30 x 30 x 440 mm

Reference number	Name	Material	Dimensions
22	Knee tube	Steel	52 x 46 x 40 mm
23	Hip connection tube	Steel	70 x 64 x 250 mm
24	Friction plates (four)	Steel	160 x 75 x 1 mm
25	Tensioner assembly	Steel	M12 x 320 mm+
			Plates and nuts
26	Knee tube	Steel	52 x 46 x 160 mm
27	Knee connection tube	Steel	44 x 39 x 190 mm
28	Tensioner plate	Steel	ø 70 x 4 mm
29	Shin tube	Steel	50 x 50 x 2 x 460 mm
30	Sole plate	Steel	100 x 170 x 3 mm
31	Torso correction mass (six)	Polyurethane	Each mass 1 kg
32	Cushion	Polystyrene foam	350 x 250 x 25 mm
33	Overall	Cotton and polyamide straps	--
34	Hip correction masses (six)	Steel	Each mass 1 kg

Table 2

Components of manikin	Mass in kg
Head and neck	4.6 ± 0.3
Torso and arms	40.3 ± 1.0
Thighs	16.2 ± 0.5
Lower leg and foot	9.0 ± 0.5
Total mass including correction weights	75.5 ± 1.0

FIGURE 1

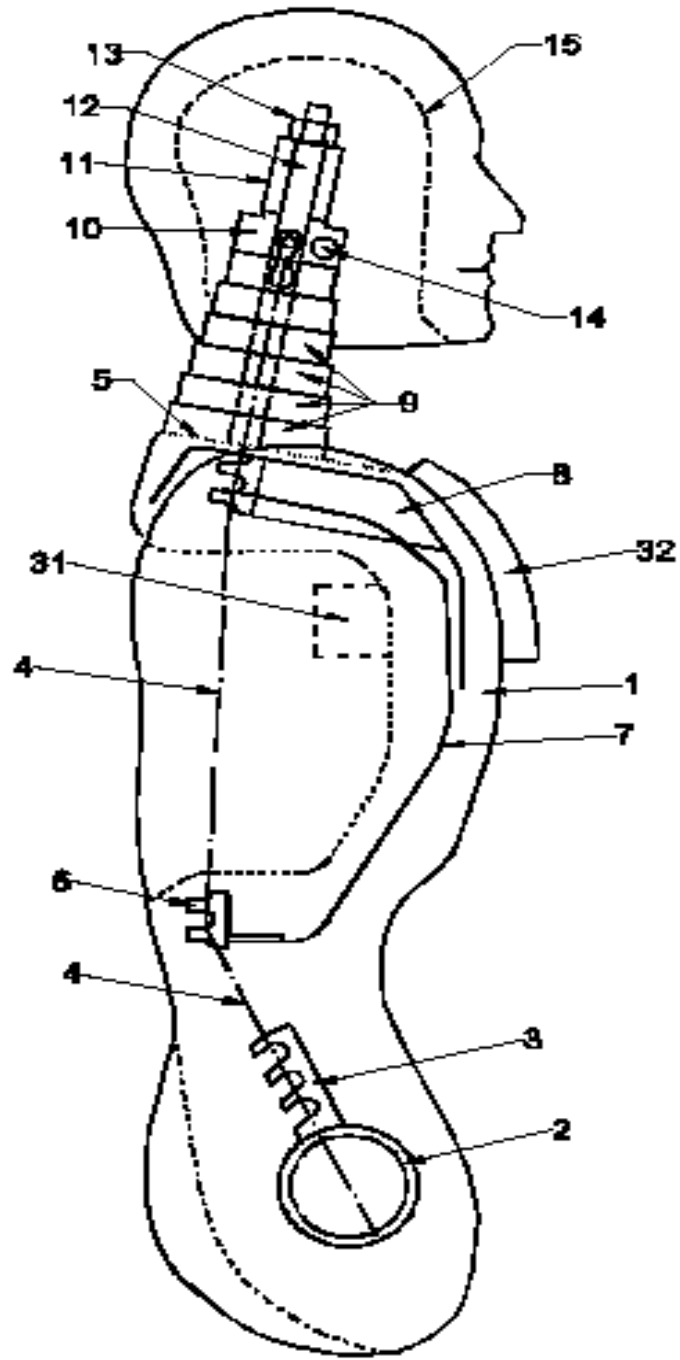


FIGURE 2

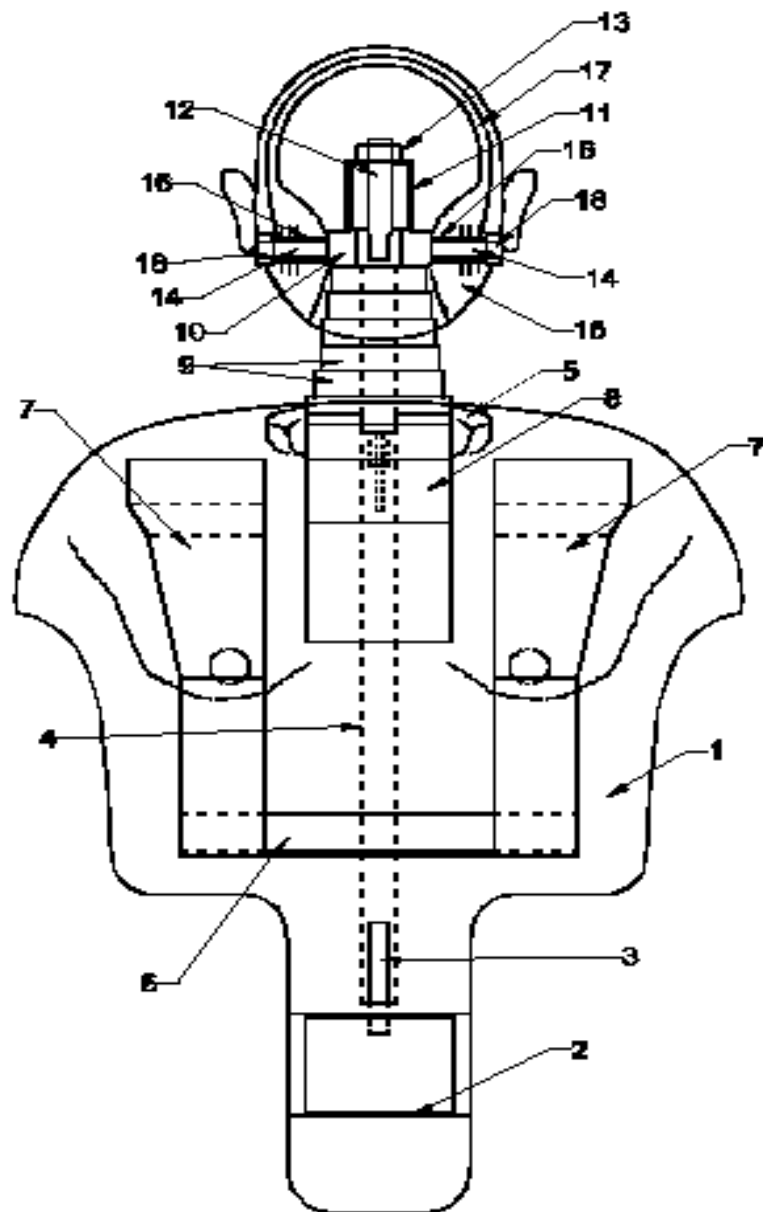


FIGURE 3

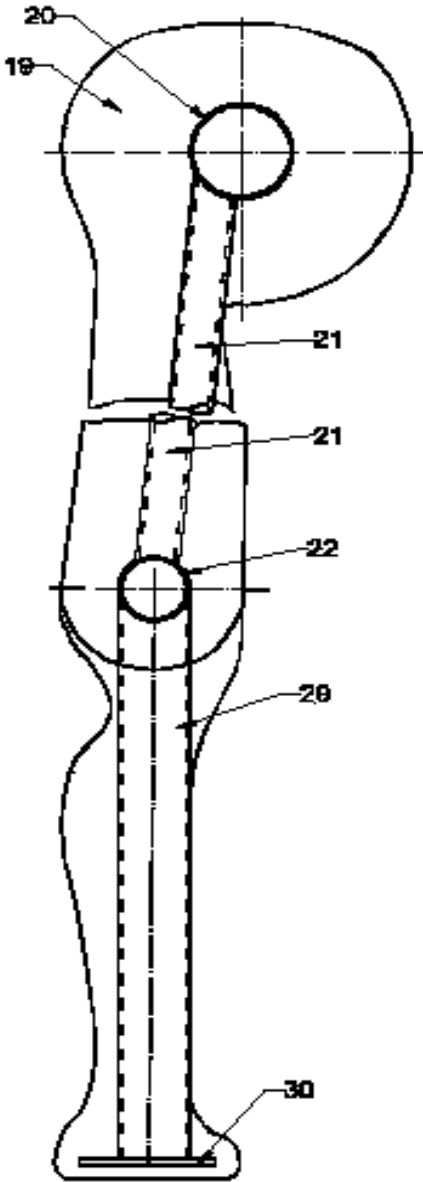


FIGURE 4

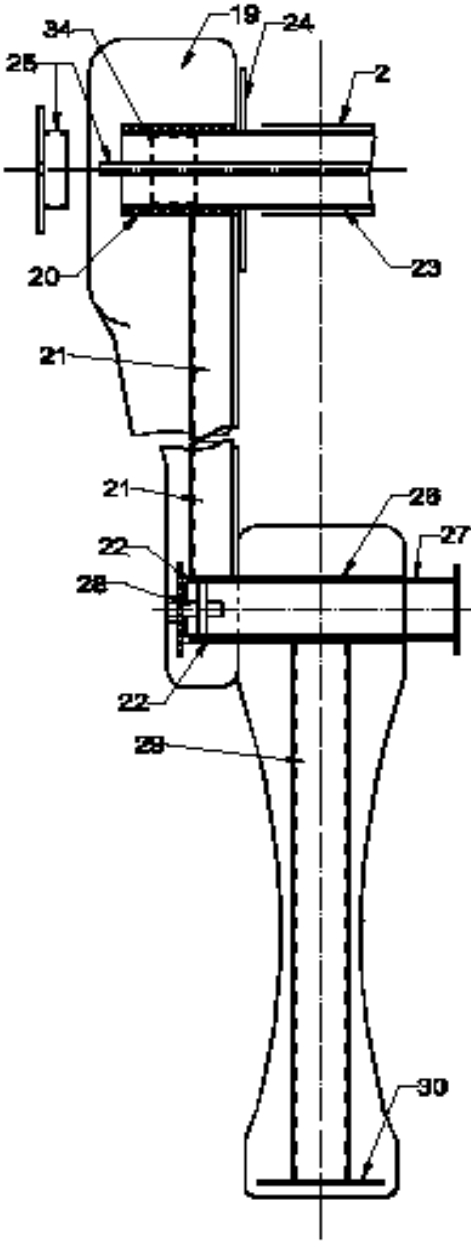


FIGURE 5

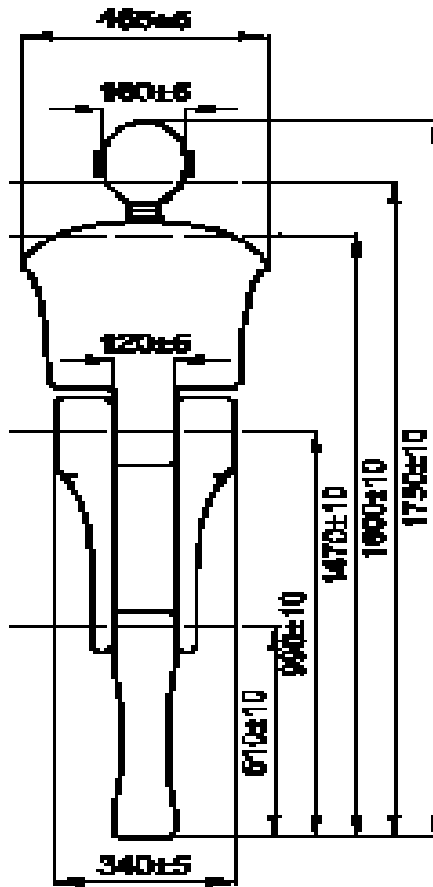
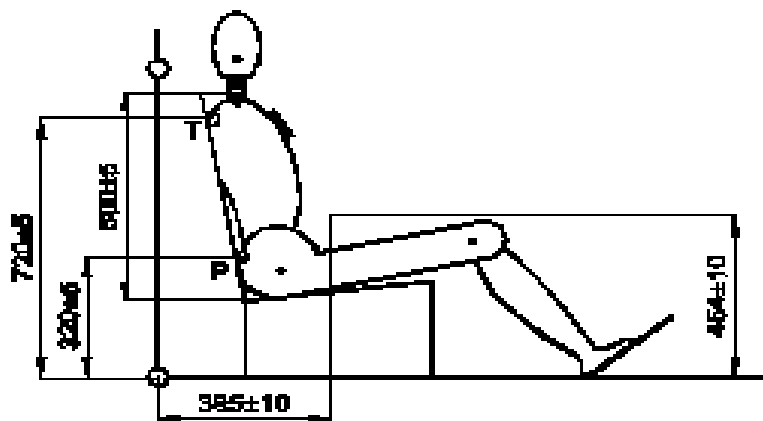


FIGURE 6



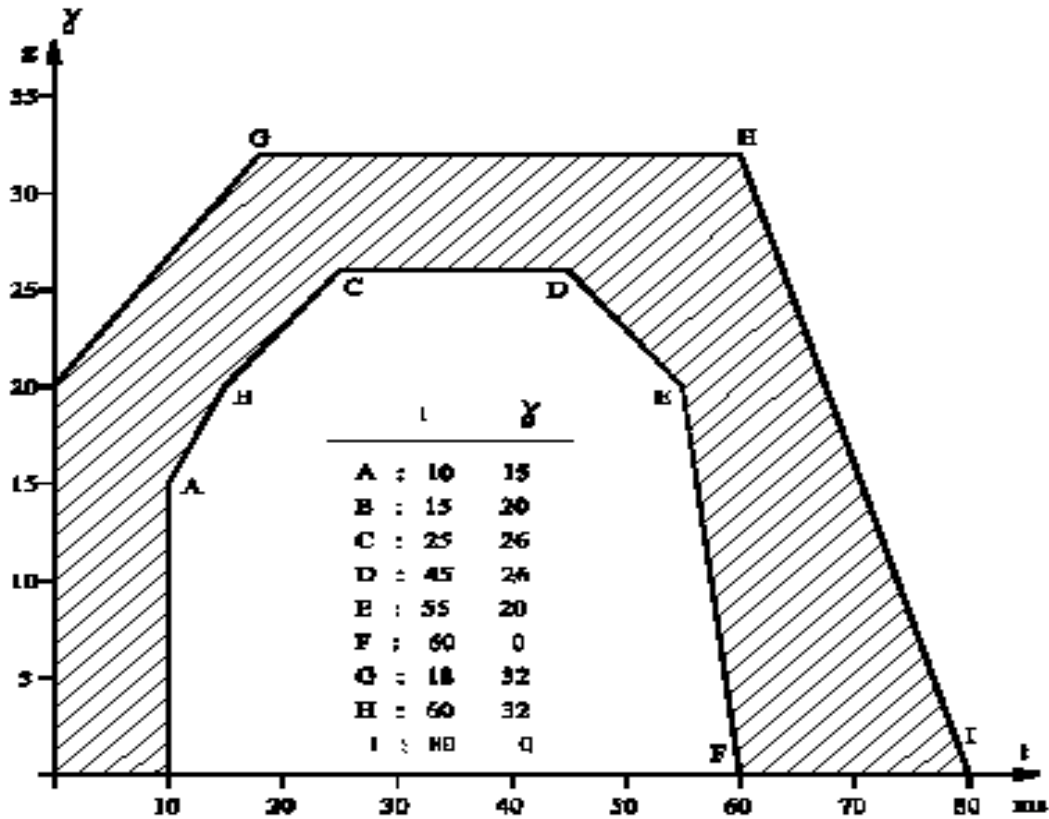
Dimensions in mm

- G: centre of gravity
- T: torso reference point (at the rear on the centre line of the manikin)
- P: pelvis reference point (at the rear on the centre line of the manikin)

ANNEX 8

DESCRIPTION OF CURVE OF TROLLEY' S DECELERATION AS FUNCTION OF TIME

(Curve for testing stopping devices)



The deceleration curve of the trolley weighted with inert mass to produce a total mass of 455 kg + 20 kg for safety-belt tests and 910 + 40 kg for restraining system tests where the nominal mass of the trolley and vehicle structure is 800 kg must remain within the hatched area above. If necessary, the nominal mass of the trolley and attached vehicle structure can be increased by increments of 200 kg, in which case, an additional inert mass of 28 kg per increment shall be added. In no case shall the total mass of the trolley and vehicle structure and inert masses differ from the nominal value for calibration tests by more than + 40 kg. During calibration of the stopping device, the speed of the trolley shall be 50 km/h + 1 km/h and the stopping distance shall be 40 cm + 2 cm. In both the above cases the calibration and measuring procedures shall correspond to those defined in the International Standard ISO 6487:1987; the measuring equipment shall correspond to the specification of a data channel with a channel frequency class (CFC) 60.

ANNEX 9

1. Scope

This procedure is provided for exposing plastics to combinations of extreme humidity and temperature that will accelerate the changes taking place in the materials kept in sheltered spaces not subject to humidity and temperature variation.

2. Apparatus

2.1 Oven

A circulating-air oven capable of maintaining the required temperature of test within $\pm 1^{\circ}\text{C}$ (1.8°F).

2.2 Containers

Noncorroding containers with a shelf to support the test specimen above the solution used for maintaining the required humidity. the container shall be tightly sealed except for a small capillary which permits release of vapour pressure that might otherwise lift the top off the container.

2.3 Desiccator

A clean, dry, uncharged desiccator or equivalent closed container in which to bring test specimens to room temperature.

2.4 Cold Box

A cold box capable of maintaining the required temperature of test within $\pm 3^{\circ}\text{C}$ (5.4°F).

3. Procedure

3.1 The test cycle shall be as follows:

24 h at 80°C (176°F) over water, followed by
24 h at 80°C (176°F) in the oven.

3.2 Expose the specimen for 24h in the shelf of a container maintained at $80 \pm 1^{\circ}\text{C}$ ($176 \pm 1.8^{\circ}\text{F}$) in the oven, and containing distilled water to maintain a humid atmosphere.

3.3 Remove the specimen from the container, place it in the uncharged desiccator, and bring to ambient temperature

3.4 Within 2h after the completion of the operation described in 3.3, expose the specimen for 24h in the oven at $80 \pm 1^{\circ}\text{C}$ ($176 \pm 1.8^{\circ}\text{F}$).

3.5 Place the specimen in the uncharged desiccator, and bring to room temperature.

ANNEX 10

PARAGRAPH	TEST	SAMPLES														
		Belt or Restraint System No.				Strap No.										
		1	2	3	4	1	2	3	4	5	6	7	8	9	10	11
3.1.1/3.1.2/3.2.1.1/ 3.2.2/ 3.2.3/3.2.3.1/ 3.3.1.1	Inspection of belt or restraint system	X														
3.2.2.1/3.2.2.2	Inspection of buckle	X	X	X	X											
3.2.2.3/4.4.2	Low-temperature test on buckle	X	X													
3.2.1.3/4.4.2	Low-temperature impact test on rigid parts	X	X													
3.2.3.2	Ease of adjustment			X												
	Conditioning/testing of belt or restraint systems before dynamic test :															
3.2.2.4	Durability of buckle	X	X													
3.2.1.2/4.1	Corrosion resistance of rigid parts	X	X													
3.2.1.4/4.4.4	Temperature resistance	X	X													
	Conditioning of retractors :															
3.2.4.1.1/ 3.2.4.2.1/ 3.2.4.2.3/ 4.5.2	Locking threshold	X	X													
3.2.4.1.2/ 3.2.4.2.4/4.5.3	Retracting force	X	X													
3.2.4.1.3/ 3.2.4.2.5 / 4.5.1	Durability	X	X													
3.2.1.2/4.1	Corrosion	X	X													
4.5.1	Dust	X	X													
3.3.2.2/4.3.2.3	Testing of strap width					X	X									
	Strap strenght test after :															
3.3.2.1/4.3.1.1/4.3.2	Room conditioning					X	X									
3.3.3/4.3.1.2/ 4.3.2	Light conditioning							X	X							
3.3.3/4.3.1.3/ 4.3.2	Low-temperature conditioning								X	X						
3.3.3/4.3.1.4/ 4.3.2	Heat-conditioning										X	X				
3.2.3.2/4.2/ 3.2.3.3/4.4.4	Micro-slip test / length adjuster			X	X											
3.3.4/4.3.1.5	Abrasion test												X	X		
3.5.1/4.6	Dynamic test	X	X													
3.2.2.5/3.2.2.7/ 4.7	Buckle-opening test	X	X													