AMENDMENT NO. 1 / MAY 2002

TO

AIS-005 / 2000
Automotive Vehicles - Safety Belt Assemblies - Specifications.

1. ANNEXURE - III
Replace existing ANNEXURE - III by following ANNEXURE - III :

ANNEXURE-III

MINIMUM REQUIREMENT FOR SAFETY BELTS AND RETRACTORS FOR DIFFERENT CATEGORIES OF VEHICLES
(Para 4.1.2)

Vehicle Category as per IS:14272 Part I-1995	Front Row Outboard	All Other Seating Positions
M1, N1 and M2 < 3.5 ton GVW	3 Point belt with emergency locking retractor with single/ multiple sensitivity	2 Point or 3 Point belt with or without retractors
All Other Vehicles of M and N Category	2 Point or 3 Point belt with or without retractors	

PRINTED BY:
THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P. B. NO. 832. PUNE 411 004

ON BEHALF OF :
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE

SET-UP BY
MINISTRY OF ROAD TRANSPORT & HIGHWAYS
GOVERNMENT OF INDIA

May 2002

AIS-005/2000

AUTOMOTIVE INDUSTRY STANDARD

Automotive Vehicles - Safety Belt Assemblies - Specifications

PRINTED BY :
THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P.B. NO.832, PUNE 411 004

ON BEHALF OF :

AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE
UNDER
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE
SET-UP BY
MINISTRY OF ROAD TRANSPORT & HIGHWAYS
GOVERNMENT OF INDIA

September 2000

Status chart of the Standard to be used by the purchaser for updating the record

Sr. No.	Corr-igenda.	Amend-ment	Revision	Date	Remark	Misc.

General Remarks :

INTRODUCTION

The Automotive Industry Standards Committee (AISC) functions under the guidance of CMVR Technical Standing Committee. AISC is setup to assist the Automotive Industry as well as Government of India in the preparation of new standards and review of the existing standards. ARAI acts as the Secretariat for AISC.

Seats, seat belts, seat belt anchorages, etc., are safety critical items for the passenger in case of sudden acceleration/deceleration and accidents. Further, seats and their design, mounting, etc., constitute substantially to the ride comfort of the vehicle users. Presently there are no Indian standards or CMVR covering the seats and related items. AISC identified these as one of the priority items and a series of standards are being drafted by a Panel. This standard is one of them.

Seat belts have become mandatory fitment on front seats of M and N categories of vehicles from April 1994 in India. Even though there is a safety standard covering some of the requirements of safety belts, this is not in line with international requirements. Hence, it is necessary to have a comprehensive standard for safety belt. This standard fulfils the above requirement.

The Panel responsible for preparation of the standard is given in Annexure-XVI.

Annexure-XVII gives the list of the members of AISC.

****

INDEX OF ANNEXURES

Automotive Vehicles - Safety Belt Assemblies - Specifications

1. SCOPE

This Automotive Industry Safety Standard specifies the requirements of safety belt assemblies and restraint systems which are designed for installation in motor vehicles of category M and N and intended for separate use i.e. as indirect fittings by persons of adult built occupying forward and rearward facing seats.

2. REFERENCES

2.1 IS:14272 (Part 1):1995 – Automotive Vehicles – Types – Terminologies.

2.2 Draft AIS/015 – Automotive Industry Standard on Automotive Vehicles : Safety Belt Anchorages – Specifications.

2.3 IS:11939-1998 – Automotive Vehicles – Steering Control Systems – Impact Protection Requirements and Methods of Measurements

2.4 ISO:4582-1980 – Plastics – Determination of Change in Colour and Variations in Properties After Exposure to Day Light Under Glass, Natural Weathering or Artificial Light

2.5 ISO:6487-1987 - Road Vehicles - Measurement Techniques in Impact Test - Instrumentation.

2.6 ASTM D-573 “Test Method for Rubber – Deterioration in Air”

2.7 ASTM D-735 (replaced by D2000) “Classification System for Rubber Products in Auto Applications”.

2.8 ASTM D-736 (Discontinued) “Method of Test for Low Temperature Brittleness of Rubber and Rubber-like Materials”.

3. DEFINITIONS

For the purpose of this Standard:

3.1 **Safety Belt (Seat Belt, Belt)** means an arrangement of straps with a securing buckle, adjusting devices and attachments which are capable of being anchored to the interior of a motor vehicle and designed to diminish the risk of injury to the wearer in the event of collision or of abrupt deceleration of the vehicle, by limiting the mobility of the wearer’s body. Such an assembly is generally referred as a “belt assembly” a term also embracing any device for energy absorption or belt retraction. These may be of the following types :

3.1.1 **Two Point (lap) Belt** means a belt which passes across the front of the wearer's pelvic lap region and constructed so as to extend over the lap area from both extremities of the lap and fixed at 2 points (Ref. Fig.1 of Annexure-1). These are generally non-retracting type (static).

3.1.2 **Three Point Belt** means a belt which passes diagonally across the front of the chest from the hip to the opposite shoulder and intended to constrain the wearer's lap and upper body and constructed so that a continuous belt is fixed to a fitting at its one end and its other end, after passing over the passenger's shoulder and then across his chest, extends over his lap area after passing through slip guide and finally terminated at the fitting and supported at three points (Ref. Fig.2 of Annexure-1). These belts could be retracting type or non-retracting type (static).

3.1.3 **Harness Belt** means a belt which is essentially a combination of lap strap and diagonal strap across the shoulder and chest (Ref. Fig.3 of Annex.I).

3.2 **Strap/Webbing** means a flexible component designed to hold the body and transmit stresses to the belt anchorages.

3.3 **Buckle** means a quick release device enabling the wearer to be held by the belt. The buckles may be classified as any of the following four types :

3.3.1 **Flexible** means the buckle and the anchor point are connected by a flexible load bearing element, e.g. cable.

3.3.2 **Webbing** means the buckle head and the anchor point are connected by a webbing

3.3.3 **Rigid Stem** means the buckle head and the anchor point are connected by a load bearing steel plate.

3.3.4 **Others** means the buckle head and the anchor point are connected by any other element which is capable of bearing the load.

3.4 **Belt Adjusting** Device means a device enabling the belt to be adjusted to the requirement 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.

3.5 **Attachments** means parts of the belt assembly including the necessary securing components, which enable it to be attached to the belt anchorages.

3.6 **Energy Absorber** means a device designed to disperse energy independently of or jointly with the strap and forming part of a belt assembly.

3.7 **Retractor** means a device to accommodate part or the whole of the strap of a safety belt.

3.7.1 **Non Locking Retractor (Type 1)** means a retractor from which the strap is extracted to its full length by a small external force and which provides no adjustment for the length of the extracted strap.

3.7.2 **Manually Unlocking Retractor (Type 2)** means a retractor requiring manual operation of a device by the user to unlock the retractor in order to obtain the desired strap extraction which locks automatically when the said operation ceases.

3.7.3 **Automatically Locking Retractor (Type 3)** means a retractor allowing the 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 deliberate action by the wearer.

3.7.4 **Emergency/Locking Retractor (ELR) (Type 4)** means a retractor which during normal driving conditions does not restrict the freedom of movement by the wearer of the safety belt. It has a length adjusting capability which automatically adjust the strap to the wearer and a locking mechanism actuated in an emergency by:

3.7.4.1 deceleration of the vehicle (single sensitivity)

3.7.4.2 a combination of deceleration of the vehicle, movement of the webbing or any other automatic means (multiple sensitivity)

3.7.4.3 ELRs may be of simple locking or webbing clamp type.

3.7.5 **Emergency Locking Retractor with Higher Response Threshold (Type 4 N)** means a retractor of the type defined in para 2.7.4 but having special properties for use in vehicles of category M2, M3, N1, N2 and N3 as defined in IS:14272 (Part-1):1995.

3.7.6 **Belt Adjustment Device For Height** means 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. This may be considered as a part of the belt or the anchorage of the belt.

3.8 **Belt Anchorages** means parts of the vehicle or seat structure or any other part of the vehicle to which the safety belt assemblies are to be secured.

3.9 **Vehicle Type As Regards Safety Belts And Restraint Systems** means category of motor vehicles which do not differ in such essential respects as the dimensions, geometry and materials of the components of the vehicle or seat structure or any other part of the vehicle to which safety belts and restraint systems are attached.

3.10 **Restraint System means** a system consisting of 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.

3.11 **Seat** means 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 bench seat intended to seat one person.

3.11.1 **Front Passenger Seat** means any seat where the H Point measured in the foremost position of the seating position is in or in-front-of the vertical transverse plane through the driver's R Point.

3.12 **Group of Seats** means either a bench type seat or seats which are separable but side-by-side (i.e fixed so that the front seat anchorages of one of these seats are in line with the front or rear anchorages of the other or between the anchorages of the other seat) and seat one or more adults.

3.13 **Bench Seat** means a structure complete with trim, intended to seat at least two adults.

3.14 **Adjustment System of the Seat** means a 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 allow :

- Longitudinal displacement
- Vertical displacement
- Angular displacement

3.15 **Seat Anchorage** means the system by which the seat assembly is secured to the vehicle structure, including the affected parts of the vehicle structure.

3.16 **Seat Type** means a category of seats which do not differ in such essential aspects as :

- the structure, shape, dimensions and materials of the seat
- the type and dimensions of the adjustment system and locking systems
- the type and dimensions of the belt anchorages on the seat, the seat anchorage and the affected parts of the vehicle structure

3.17 **Displacement System of the Seat** means a device enabling the seat or one of its parts to be displaced angularly or longitudinally without a fixed intermediate position to facilitate passenger access.

3.18 **Locking System of the Seat** means a device ensuring that the seat and its parts are maintained in any position of use.

3.19 **Reference Zone** means the space between two vehicle longitudinal planes, 400 mm apart and symmetrical with reference to the H Point and defined by the rotation of the apparatus described in para 3.27 of Draft AIS/015, from vertical to horizontal. The apparatus will be positioned as described in the above standard and set to a maximum limit of 840 mm.

3.20 **Pre-Loading Device** means an additional or integrated device which tightens the strap in order to reduce the slack of the belt during a crash sequence.

3.21 **Recessed Buckle Release Button** means a device with which it is not possible to release the buckle using a sphere of having a diameter of 40 mm.

3.22 **Non-recessed Buckle Release Button** means a device with which it is possible to release the buckle using a sphere of having a diameter of 40 mm.

3.23 **Belt Type** means belts of different types, differing substantially from one another. The differences may be with reference to any of the following parameters such as :

3.23.1 Rigid parts (buckle, attachments, retractor, etc.)

3.23.2 The material, weave, dimensions of the straps. Colour variations alone will not be considered a type variation where it is demonstrated that the colour variation meets the requirements for straps.

3.23.3 The geometry of the belt assembly except where the geometry of the seat belt anchorage is within 50 mm distance sphere of an approved configuration.

3.23.4 Where the length of strap on an adjustable portion of a seat belt type does not vary by more 150 mm and/or the buckle side of a seat belt type does not vary by more than 50 mm of an approved type, the seat belt assembly shall be regarded as the same as the approved type.

4. GENERAL REQUIREMENTS

4.1 Specifications

4.1.1 The seat belt manufacturer/vehicle manufacturer should provide all the information required for carrying out the approval test as given in Annexure-2.

4.1.2 The minimum requirements for safety belt and retractors for different category of vehicles are given in Annexure-3.

4.1.3 The belt or the restraint system shall be so designed and constructed that, when correctly installed and properly used by an occupant, its satisfactory operation is assured and it reduces the risk of bodily injury in the event of an accident.

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

4.1.5 The belt after being put on the wearer, shall either adjust automatically to fit him or be such that the manual adjustment device shall be readily accessible to the seated wearer and convenient and easy to use. It should allow the belt to be tightened with one hand to suit the wearer body size in the position of the vehicle seat.

4.2 Belt Components Incorporating Rigid Parts

4.2.1 General

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

4.2.1.2 All parts of the belt assembly liable to be affected by corrosion shall be suitably protected against it. After undergoing the corrosion test prescribed in para 5.2, neither signs of deterioration likely to impair the proper functioning of the device nor any significant base metal corrosion shall be visible to the unaided eye of a qualified observer.

4.2.1.3 Rigid parts intended to absorb energy or to be subjected to or to transmit a load shall not be fragile.

4.2.1.4 The rigid items and parts made of plastics of a safety belt must be so located and installed that they are not liable during every day use of the vehicle, to become trapped under a moveable seat or in a door of that vehicle. If any of these items and parts do not comply with the above conditions, they shall be subjected to the test specified in paragraph 5.3.4. After the test, the part should have no disassociation nor fragmentation and should function normally. 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 para 4.2.2, 4.2.3 and 4.4.2.

4.2.2 Buckle

4.2.2.1 The buckle shall be so designed as to be easy to use and grasp and preclude any possibility of incorrect use. The buckle should not have any partial latch position. The procedure for opening the buckle must be evident. The parts of the buckle likely to be in contact with the body of the wearer shall present a section of not less than 20 cm^2 and at least 46 mm in width, measured in a plane situated at a maximum distance of 2.5 mm from the contact surface. In the case of harness belt buckles, the latter requirement shall be regarded as satisfied if the contact area of the buckle with the wearer's body is between 20 cm^2 and 40 cm^2.

4.2.2.2 The buckle, even when not under load, shall remain closed whatever be its position. It shall not be possible to release the buckle inadvertently, accidentally or with a force of less than 10 N. When it is not under load and when under a maximum load of 300 N, it shall be capable of being released by the wearer with a single simple movement of one hand in one direction. The buckle shall be released by pressing a button or activating a similar device. For the buckles with the recessed release button, the surface to which the force is applied shall have an area of not less than 4.5 cm^2 and a width of not less than 15 mm with the button in the actual release position and when projected into a plane perpendicular to the button's initial direction of motion. For non-recessed devices, the area should not be less than 2.5 cm^2 and a width not less than 10 mm. The buckle release area shall be colored red. No other externally visible parts of the buckle shall be of this colour. Direction/mode of operation "PRESS/PUSH/LIFT" shall be indicated on the buckle.

4.2.2.3 The buckle shall be capable of withstanding repeated operation and shall undergo 5000 opening and closing cycles under normal conditions of use prior to dynamic test as per para 5.6.2. In the case of harness belt buckles, the test may be carried out without all the tongues being introduced.

4.2.2.4 The buckle, when tested in accordance with 5.3.3, shall operate normally.

4.2.2.5 The buckle shall be tested for strength as prescribed in para 5.3.1 and 5.3.5, as appropriate. It must not break, be seriously distorted or become detached when subjected to the prescribed load.

4.2.2.6 In the case of buckles which incorporate a component common to the two assemblies, if the buckle of one assembly can be assembled in use with the mating part of that assembly with that of other assembly, the strength and release test as per para 5.6.2 and 5.6.3 shall also be carried out for both possible means of assembly.

4.2.3 Belt Adjustment Device

4.2.3.1 Two samples of each belt adjustment device shall be tested in accordance with the requirement of para 5.3.8. The strap slip shall not exceed 25 mm for each sample of adjusting device and the sum of shifts for all the adjusting devices shall not exceed 40 mm.

4.2.3.2 All the adjustment devices shall be tested for strength as prescribed in para 5.3.1 and 5.3.5 as appropriate. They must not break or become detached under the tension set up by the prescribed load.

4.2.3.3 When tested in accordance with para 5.3.6, the force required to operate any manually adjusting device shall not exceed 50 N.

4.2.4 Attachments and Belt Adjustment Devices for Height

The attachments shall be tested for strength as prescribed in para 5.3.1. and 5.3.2 as appropriate. Belt adjustment devices for height shall be tested for strength as prescribed in para 5.3.2 unless they have been tested as part of the vehicle anchorage systems as per Draft AIS/015. These parts must not break or become detached under the tension set up by the prescribed load.

4.2.5 Retractors

4.2.5.1 Retractors, other than non-loading ones, shall be subjected to tests and fulfil the requirements specified below, including the tests for strength prescribed in para 5.3.1 and 5.3.2.

4.2.5.2 Manually Unlocking Retractors

4.2.5.2.1 The strap of a safety belt assembly equipped with a manually unlocking retractor shall not move more than 25 mm between the locking positions of the retractor.

4.2.5.2.2 The strap of a safety belt assembly shall extract from a manually unlocking retractor within 6 mm of its maximum length when a tension between 14 N and 22 N is applied to the strap in the normal direction of pull.

4.2.5.2.3 The strap shall be withdrawn from the retractor and allowed to retract repeatedly by the method described in para 5.4.1 until 5000 cycles have been completed. The retractor shall then be subjected to the corrosion test given in para 5.2 and the dust resistance test given in para 5.4.3. It shall then satisfactorily complete a further 5000 cycles of withdrawal and retraction. After the above tests, the retractor shall operate correctly and still meet the requirement of para 4.2.5.2.1 and 4.2.5.2.2.

4.2.5.3 Automatically Locking Retractors

4.2.5.3.1 The strap of a safety belt assembly equipped with an automatically locking retractor shall not move more than 30 mm between the locking positions of the retractor. After a rearward movement by the wearer, the belt must either remain at its initial position or return to that position automatically on subsequent forward movements of the wearer.

4.2.5.3.2 If the retractor is part of a lap belt, the retracting force of the strap shall not be less than 7 N when measured in the free length between the manikin and the retractor in accordance with para 5.4.4. If the retractor is part of an upper torso restraint, the retracting force of the strap shall be between 2 N and 7 N when similarly measured. If the strap passes through a guide or pulley, the retracting force shall be measured in the free length between the manikin and guide or pulley. If the assembly incorporates a device which upon manual or automatic operation prevents the strap from being completely retracted, such a device shall not be operated when the retracting force is measured.

4.2.5.3.3 The strap shall be withdrawn from the retractor and allowed to retract repeatedly by the method described in para 5.4.1 until 5000 cycles of withdrawal and retraction have been completed. The retractor shall then be subjected to the corrosion test given in para 5.2 followed by dust resistance test prescribed in para 5.4.3. It shall then satisfactorily complete a further 5000 cycles. After the above tests, the retractor shall operate correctly and still meet the requirements of paragraphs 4.2.5.3.1 and 4.2.5.3.2.

4.2.5.4 Emergency Locking Retractor

4.2.5.4.1 An emergency locking retractor, when tested in accordance with para 5.4.2. shall satisfy the conditions below.

4.2.5.4.1.1 In the case of single sensitivity according to para 3.7.4.1, only the specifications regarding the deceleration of vehicle are valid.

4.2.5.4.1.2 The locking must have occurred when the deceleration of the vehicle reached 0.45 g in the case of Type 4 retractor or 0.85 g in the case of Type 4 N retractor.

4.2.5.4.1.3 It must not lock at at values of accelerations of the strap, measured in the direction of the unreeling less than 0.8 g in the case of Type 4 retractors or 1.0 g in the case of Type 4 N retractors.

4.2.5.4.1.4 In addition, it must not lock when the sensing device is tilted 12 degrees or less in any direction from the installation position specified by the manufacturer.

4.2.5.4.1.5 It shall lock when its sensing device is titled by more than 27 degrees in the case of Type 4 retractors or 40 degrees in the case of Type 4 N retractors in any direction from the installation position specified by the manufacturer.

4.2.5.4.2 An emergency locking retractor with multiple sensitivity when tested according to 5.4.2, including the strap sensitivity, shall comply with the specified requirements and also lock up when the strap acceleration measured in the direction of unreeling is not less than 2 g.

4.2.5.4.3 In each of the tests mentioned in para 4.2.5.4.1 and 4.2.5.4.2, the amount of strap movement which may occur before the retractor locks shall not exceed 50 mm starting at the length given in para 5.4.2.1. In the case of the test mentioned in para 4.2.5.4.1.2 above, locking must not occur during the 50 mm of strap movement starting at the length given in para 5.4.2.1.

4.2.5.4.4 If the retractor is part of the lap belt, the conditions specified in para 4.2.5.3.2 should be met.

4.2.5.4.5 The strap shall be withdrawn from the retractor and allowed to retract repeatedly by the method described in para 5.4.1 until 40,000 cycles have been completed. The retractor shall then be subjected to the corrosion test given para 5.2 and followed by the dust resistance test prescribed in para 5.4.3. It shall then satisfactorily complete a further 5,000 cycles of withdrawal and retraction after which it shall meet the requirements of para 4.2.5.4.1, 4.2.5.4.2, 4.2.5.4.3 and 4.2.5.4.4.

4.2.5.4.6 Pre - Loading Devices

4.2.5.4.6.1 After being submitted to the corrosion testing in accordance with para 5.2, the pre-loading device (including the impact sensor connected to the device by the original plugs but without any current passing through them) shall operate normally.

4.2.5.4.6.2 It shall be verified that inadvertent operation of the device does not involve any risk of bodily injury for the wearer.

4.2.5.4.6.3 In the case of pyrotechnic pre-loading devices, the operation of the pre-loading device must not have been activated by the temperature and the device shall operate normally after being submitted to the conditioning in accordance with para 5.3.7. Precautions shall be taken to prevent the hot gases expelled from igniting adjacent flammable materials.

4.3 Straps

4.3.1 General

4.3.1.1 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 even under load. They should have energy absorbing and dispersing capacities. The straps shall have finished salvages which shall not become unraveled in use.

4.3.1.2 The width of the straps under a load of 10 kN shall be not less than 46 mm. This dimension shall be measured during the breaking strength test prescribed in para 5.5.1 and without stopping the machine.

4.3.2 Strength after Room Conditioning

In the case of two straps samples conditioned in conformity with para 5.5.2.2, the breaking load of the strap, determined as prescribed in paragraph 5.5.1, shall be not less than 22.7 kN. The difference between the breaking loads of the two samples shall not exceed 10% of the greater value of the breaking loads measured.

4.3.3 Strength After Special Conditioning

In the case of two straps samples conditioned in conformity with one of the provisions of para 5.5.2.3 to 5.5.2.6, 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 4.3.2. The test agency 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(s) superfluous.

4.3.4 Strength after Abrasion Conditioning

4.3.4.1 For both samples conditioned in compliance with para 5.5.2.7, the breaking strength shall be assessed as prescribed in para 5.3.1 and 5.5.1. It must be at least equal to 75% of the average of the breaking strength determined during tests on unabraded straps and not less than the minimum load specified for the item being tested. The difference between breaking loads of the two samples must not exceed 20% of the highest measured breaking load. For Type 1 and Type 2 procedures, the breaking strength test shall be carried out on strap samples only according to para 5.5.1. For Type 3 procedure, the breaking strength test shall be carried out on the strap in combination with the metal component involved according to para 5.3.1.

4.3.4.2 The items to be subjected to the abrasion test procedure and the procedure(s) to be followed are indicated in the table below. A new sample shall be used for each procedure.

COMPONENT / PROCEDURE	TYPE 1	TYPE 2	TYPE 3
Attachment	-	-	X
Guide or Pulley	-	X	X
Buckle Loop	-	X	X
Adjusting Device	X	-	X
Parts Sewn to the Strap	-	-	X

4.3.5 Elongation

The elongation of the webbing shall be 20% or less when the webbing is tested by the method specified in para 5.5.3.

4.3.6 Energy Absorptivity

The work and work load ratio shall not be less than the values mentioned in table below when the webbing is tested by the method specified in para 5.5.4.

Type of Webbing	Work, Nm/m Length	Work Load Ratio
Lap Webbing	500	50
Continuous Webbing	800	55

4.4 Belt Assembly or Restraint Systems

4.4.1 Static Strength/Displacement Test on Seat Belt Assembly/Restraint Systems (not applicable for ELR Belt)

4.4.1.1 When tested in accordance with the provisions of para 5.6.1, the seat belt must sustain the maximum test load for the type of assembly for a minimum continuous period of 30 s. The test load shall then be reduced to 665 N ± 50 N. The force required to open the buckle in the test as prescribed in para 5.6.3 shall not exceed 60 N for button type buckle and 140 N for the lever type buckle of a two point or 3 point seat belt assembly.

4.4.1.2 The displacement shall be measured after the test load has been applied for a minimum continuous period of 30 s according to para 5.6.1 and this should not be more than 180 mm for two point and 250 mm for three point safety belt assemblies.

4.4.1.3 This requirement may be waived if the dynamic test requirement as per para 4.4.2 is met.

4.4.2 Dynamic Test

4.4.2.1 The belt assembly or restraint system shall be subjected to a dynamic test in conformity with para 5.6.2.

4.4.2.2 The dynamic test shall be performed on two assemblies which has not previously been under load.

4.4.2.3 The buckles of the belt assemblies to be tested shall have met the requirements of para 4.2.2.3. In the case of safety belts with retractors, the retractor shall have been subjected to the dust resistance test laid down in para 5.4.3.

4.4.2.4 In addition, in case of safety belts/restraint system equipped with a pre-loading device comprising pyrotechnic means, the device shall have been subjected to the conditioning specified in para 5.3.7.

4.4.2.5 The belts shall have undergone the corrosion test described in para 5.2, after which the buckle shall be subjected to 500 additional opening and closing cycles under normal conditions of use.

4.4.2.6 Safety belts with retractors shall have been subjected to the tests described in para 4.2.5.2, 4.2.5.3 or 4.2.5.4. If however, a retractor has already been subjected to the corrosion test as mentioned above, this test need not be repeated.

4.4.2.7 In the case of a belt intended for use with a belt adjustment device for height, the test shall be carried out with the device adjusted in the most unfavourable position(s) chosen by the test agency. However, if the belt adjustment device for height consists of the belt anchorage itself, as approved in accordance with the provisions of draft standard AIS-015, the test agency responsible may, at its discretion, apply the provisions of para 5.6.2.1.

4.4.2.8 In the case of a safety belt with pre loading device, one of the dynamic tests shall be carried out with the device in operation and the other with the device not in use. In the first case, the minimum displacements specified in para 4.4.2.9.2 may be reduced by half.

4.4.2.9 During this test, the following requirements shall be met.

4.4.2.9.1 No part of the belt assembly or a restraint system affecting the restraint of the occupant shall break and no buckles or locking system or displacement system shall release or unlock; and

4.4.2.9.2 The forward displacement of the manikin shall be between 80 mm and 200 mm at pelvic level in the case of lap belts. In the case of a harness belt, the minimum displacement specified for the pelvis may be reduced by half. In the case of other types of belts, the forward displacement shall be between 80 mm and 200 mm at the pelvic level and between 100 mm and 300 mm at torso level. These displacements are the displacements in relation to the measurement points shown in Fig.11 of Annexure-15.

4.4.2.10 In the case of a restraint system :

4.4.2.10.1 The movement of the torso reference point may exceed that specified in para 4.4.2.9.2 if it can be shown either by calculation or a further test that no part of the torso or the head of the manikin used in the dynamic test would have come into contact with any forward rigid part of the vehicle other than the chest with the steering assembly, if the later meets the requirements of IS:11939-1998 and provided the contact does not occur at a speed higher than 24 km/h. For this assessment the seat shall be considered to be in the position specified in para 5.6.2.5.

4.4.2.10.2 In vehicles where such devices are used, the displacement and locking systems enabling the occupants of all seats to leave the vehicle shall still be operable by hand after the dynamic test.

4.4.2.10.3 The force required to open the buckle in the test as prescribed in para 5.6.3 shall not exceed 60 N for button type buckle and 140 N for the lever type buckle of a two point or 3 point seat belt assembly.

5. TESTS

5.1 General

The number of samples required i.e. seven belts/restraint systems and thirteen straps and the tests to be carried out for approval of a type of belt or restraint system is given in Annexure - 4.

5.2 Corrosion Test

5.2.1 The complete safety belt assembly shall be subjected to salt spray (fog) testing in a test chamber as prescribed in Annexure-5. In the case of an assembly incorporating a retractor, the strap shall be unwound to full length less 300 mm ± 3 mm. Except for short interruptions that may be necessary, e.g., to check and replenish the salt solution, the exposure test shall proceed continuously for a period of fifty hours.

5.2.2 On completion of the test, the assembly shall be gently washed, in a clean running water in a temperature not higher than 38°C, to remove any salt deposit that may have formed and then allowed to dry at room temperature for 24 hours before inspection in accordance with para 4.2.1.2.

5.3 Static Test of Belt Components Incorporating Rigid Parts

5.3.1 The buckle and strap adjusting device must be connected to a tensile-testing machine by their normal attachments and a load of 10 kN must be applied. In the case of harness belts, the buckle shall be connected to the testing apparatus by the straps which are attached to the buckle and the tongue or two tongues located in an approximately symmetrical way to the geometric centre of the buckle. If the buckle or adjusting device is part of the attachment or of the common component of a three-point strap, the buckle or adjusting device must be tested together with the attachment in accordance with para 5.3.2 except in the case of retractors with a return pulley at the upper strap anchorage. In this case the test load must be 10 kN and the length of strap remaining on the reel at the moment of locking must be as close as possible to 450 mm.

5.3.2 The attachments and any belt adjustment devices for height shall be tested in the manner described in para 5.3.1 but load of 15 kN shall be applied in the least favourable conditions likely to occur in a vehicle in which the belt is correctly installed as per para 5.6.2.1. In the case of retractors, the test shall be performed with the strap completely unwound from the reel.

5.3.3 Two samples of the complete belt assembly shall be placed in a low-temperature chamber at –10 ± 1°C for two hours. Immediately after being removed from the chamber, the mating parts of the buckle shall then be locked together manually.

5.3.4 Two samples of the complete belt assembly shall be placed in a low-temperature chamber at a temperature of –10°C ± 1°C for two hours. All rigid items and parts made of plastic under test shall then be laid in turn on a flat rigid steel surface (which has been kept with the samples in the low temperature chamber), placed on the horizontal surface of a compact rigid block with a mass of at least 100 kg, within 30 seconds of their being removed from the low-temperature chamber. An 18 kg steel mass shall be allowed to fall under gravity from a height of 300 mm on to the test sample. The impact force 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 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.

5.3.5 Buckles having parts common to two safety belts shall be loaded in such a way as to simulate the conditions of use in a vehicle with the seats in the mid-position of their adjustment. The direction of application of the load shall be established in accordance with para 5.6.2.1. A load of 15 kN shall be applied simultaneously to each of the straps. Suitable apparatus for the above test is shown in Annexure-6.

5.3.6 When testing any manual adjusting device, the strap shall be drawn steadily through that device, having regard to normal conditions of use, at a rate of approximately 100 mm/s, and the maximum force shall be 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 adjusting device, the strap being cycled 10 times prior to measurement.

5.3.7 Additional Tests on Safety Belts with Pre-loading Devices – Conditioning

The pre-loading device may be separated from the safety belt to be tested and kept for 24 hours at a temperature of 60 ± 5°C. The temperature shall then be raised to 100 ± 5°C for two hours. Subsequently it shall be kept for 24 hours at a temperature of -30 ± 5°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.

5.3.8 Micro Slip Test

5.3.8.1 The samples to be submitted to the micro slip test shall be conditioned as per para 5.5.2.2. The test shall be carried out immediately after conditioning at a temperature between 15°C to 30°C.

5.3.8.2 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.

5.3.8.3 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 ad forth motion, the total amplitude being 300 ± 20 mm. A typical test arrangement is shown in Fig.1of Annexure-7.

5.3.8.4 If there is a free end serving as reserve strap, it must in no way be fastened or clipped to the section under load.

5.3.8.5 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.

5.3.8.6 Before the actual start of the test, a series of 20 cycles shall be completed so that the self tightening system settles properly.

5.3.8.7 1000 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.

5.4 Tests for Retractors

5.4.1 Durability of Retractor Mechanism

The strap shall be withdrawn and allowed to retract for the required number of cycles at a rate of not more than 30 cycles per minute. In the case of emergency locking retractors, a snatch to lock the retractor shall be introduced at each fifth cycle. The snatches shall occur in equal numbers at each of five different extractions, viz. 90, 80, 75, 70 and 65% of the total length of the strap remaining wound on the retractor. However, where more than 900mm is provided, the above percentages shall be related to the final 900 mm of strap which can be withdrawn from the retractor. A suitable apparatus is shown in Annexure-8.

5.4.2 Locking of Emergency Locking Retractors

5.4.2.1 The retractor shall be tested once for locking when 300 mm ± 3 mm of the strap remain wound on the retractor reel.

5.4.2.2 In the case of the retractor actuated by strap movement, the extraction shall be in the direction in which it normally occurs when the retractor is installed in a vehicle.

5.4.2.3 When retractors are being tested for sensitivity to vehicle deceleration they shall be tested at the above extraction along two mutually perpendicular axes, which are horizontal if the retractor is installed in a vehicle as specified by the safety belt manufacturers. One of these axes shall be in the direction chosen by the test agency to give the most adverse conditions with respect to actuation of the locking mechanism.

5.4.2.4 A suitable apparatus for the tests is described in Annexure-9. The design of any such test apparatus shall ensure that the required acceleration is given before the webbing is withdrawn out of the retractor by more than 5 mm and that the withdrawal takes place at an average rate of increase of acceleration is between 25 g/s and 150 g/s.

5.4.2.5 To check conformity with the requirements of paragraph 4.2.5.4.1.4 and 4.2.5.4.1.5, the retractor shall be mounted on a horizontal table and the table titled with a speed not exceeding 2 degrees per second until locking has occurred. The test shall be repeated with tilting in other directions to ensure that the requirements are fulfilled.

5.4.3 Dust Resistance

5.4.3.1. The retractor shall be positioned in a test chamber as described in Annexure-10. It shall be mounted with the same relative position as in the vehicle. The test chamber shall contain dust as specified in para 5.4.3.2. A length of 500 mm of the strap shall be extracted from the retractor and kept extracted, except that it shall be subjected ten complete cycles of retraction and withdrawal within one or two minutes after each agitation of the dust. For a period of five hours, the dust shall be agitated every twenty minutes for five seconds by compressed air free of oil and moisture at a gauge pressure of 550 kPa entering through an orifice 1.5 ± 0.1 mm in diameter.

5.4.3.2 The dust used in the test prescribed in para 5.4.3.1 shall consist of about 1 kg of dry quartz. The particle size distribution is as follows :

5.4.3.2.1 Passing 150 microns aperture, 10 microns wire diameter : 99-100%.
5.4.3.2.2 Passing 105 microns aperture 64 microns wire diameter : 76-86%.
5.4.3.2.3 Passing 75 microns aperture, 52 microns wire diameter : 60-70%

5.4.4 Retracting Force

The retracting force shall be measured with the safety belt assembly fitted to a manikin as per the dynamic test prescribed in para 5.6.2 as shown in Annexure-11. The strap tension shall be measured at the point of contact with (but just clear of) the manikin while the strap is being retracted at an approximate rate of 0.6 m/min.

5.5 Tests on Straps

5.5.1 Test of Breaking Strength of Strap (Static Test)

5.5.1.1 The test shall be carried out each time on two new samples of strap of sufficient length, conditioned in conformity with the appropriate provisions of para 5.5.2.

5.5.1.2 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 the point of contact with the clamps. 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 mm ± 40 mm. A recommended procedure for gripping the strap in tensile testing machine is shown in Annexure-12.

5.5.1.3 When the load reaches 10 kN, the width of the strap shall be measured without stopping the machine.

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

5.5.1.5 If the strap slips or breaks at the point of contact 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.

5.5.2 Conditioning of Straps

5.5.2.1 Samples cut from the strap given for testing as required by the test agency shall be conditioned :

- at room conditions as per para 5.5.2.2
- at special conditions as per para 5.5.2.3 to 5.5.2.7

5.5.2.2 Room Conditioning

The strap shall be kept for at least 24 hours in an atmosphere having temperature of 20°C ± 5°C and a relative humidity of 65 ± 5%. If the test is not carried out immediately after conditioning, the specimen shall be replaced 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.

5.5.2.3 Light Conditioning

The provision of recommendations of ISO/4582-1980 shall apply. The strap shall be exposed to light for the time necessary to produce a contrast equal to Grade 4 on the gray scale on Standard Blue Dye No.7. After exposure the strap shall be conditioned and tested for breaking load as per para 5.5.2.2.

5.5.2.4 Cold Conditioning

The strap shall be conditioned according to para 5.5.2.2. Then the strap shall be kept for 1.5 hours on a plane surface in a low temperature chamber in which the air temperature is kept at –30°C ± 5°C and kept under load for 30 minutes in the same low temperature chamber. Then the mass shall be removed and the breaking load shall be measured within five minutes after removal of the strap from the low temperature chamber.

5.5.2.5 Heat Conditioning

The strap shall be kept for 3 hours in a heating cabinet in an atmosphere having a temperature of 60°C ± 5°C at a relative humidity of 65 ± 5%. The breaking load shall be determined within five minutes after removal of the strap from the heating cabinet.

5.5.2.6 Exposure to Water

The strap shall be kept fully immersed for three hours in distilled water, at a temperature of 20 ± 5°C, to which a trace of wetting agent has been added. Any wetting agent suitable for the fibre under the test may be used. The breaking load shall be determined within ten minutes after removal of the strap from the water.

5.5.2.7 Abrasion Conditioning

5.5.2.7.1 The abrasion conditions will be performed on each and every device in which the strap is in contact with a rigid part of the belt. However, Type 1 abrasion test need not be carried out on the belt adjusting device where the micro slip test as per para 5.3.8 shows the strap slip less than half the specified amount. The setting on the test apparatus will approximately maintain the relative position of the strap and contact area. The samples shall be conditioned as per para 5.5.2.2. The ambient temperature during the abrasion procedure shall be between 15°C and 30°C.

5.5.2.7.2 The requirements for each abrasion procedure are listed in the table below. The shift given in the last column of this table represents the amplitude of a back and forth motion applied to the strap.

PROCEDURE	**LOAD, N**	**FREQUENCY, Hz**	**No. of Cycles**	**Shift, Mm**
Type 1	25	0.5	5000	300 ± 20
Type 2	5	0.5	45,000	300 ± 20
Type 3	5	0.5	45,000	---

5.5.2.7.3 Details of Procedures

5.5.2.7.3.1 Type 1

This procedure is for cases where the strap slides through an adjusting device. A vertical steady load of 25 N shall be maintained on one end of the strap, the other end of the strap shall be attached to a device giving the strap a horizontal back and forth motion. The adjusting device shall be placed on the horizontal strap so that the strap remains under load as shown in Fig.2 of Annexure-7. In the cases where the strap will not slide back and forth with 25 N load, the load may be increased upto 50 N to allow a back and forth motion.

5.5.2.7.3.2 Type 2

This is for cases where the strap changes direction once in passing through a rigid part. During this test, the angles which both strap ends make with each other shall be maintained as shown in Fig.3 of Annexure-7. A steady load of 5 N shall be maintained during the test. If the strap changes direction more than once in passing through a rigid part, a load of 5 N may be increased so as to achieve the prescribed strap movement of 300 mm through that rigid part.

5.5.2.7.3.3 Type 3

This is for cases where the strap is fixed to a rigid part of sewing or similar means. The total back and forth motion i.e. shift shall be 300 ± 20 mm and the 50 N load shall only be applied during the time corresponding to a shift of 100 ± 20 mm for each half period as shown in Fig.1 of Annexure-7.

5.5.3 Elongation Test

A test piece should be fixed on the tensile testing machine in the method described in para 5.5.1.2 and apply an initial load of 200 N, to strain the test piece with the clamps kept 200 ± 20 mm apart. Gauge marks of 200 mm distance within the clamp distance should be marked. The tension load should be applied at a rate of approximately 100 mm per min. When the load reaches 11.1 kN, the distance between the gauge marks should be measured. The elongation percentage shall be calculated.

5.5.4 Energy Absorptivity Test

A tension load upto 11.1 kN should be applied at an approximate rate of 100 mm/min on the test piece by the method specified in 5.5.1.2 and then decreased to the initial load of 200 N at the same rate. The load elongation diagram should be drawn (Ref. Annexure-13). The work load per unit elongation is obtained by dividing the work load area (ABD) produced by the tension load curve from the time of the initial load to that of the final load. The work load area (ABC) enclosed by the curve AB at the time of the tension and the curve BC at the time of removal are to be measured. The work load ratio representing the energy absorptivity is obtained from the following formula :

Work Load Ratio : ABC/ABD * 100%

5.6 Tests on Seat Belt Assemblies

5.6.1 Static Strength/Displacement Test of Seat Belt Assembly/Restraint Systems

5.6.1.1 The assembly shall be conditioned for room conditions as per para 5.5.2.2.

5.6.1.2 The test apparatus consists of two rollers of 100 mm dia, with its centre kept 300 mm apart and supported by roller bearings. The load is applied centrally to the rollers by a suitable loading block at the rate of about 100 mm/min. The belt assembly should be fixed in the same way as it is in the vehicle using the same fitments and bolts.

5.6.1.3 For seat belt equipped with non-locking retractor, the test shall be carried out with the fully extended condition of the webbing. For those equipped with automatic/emergency locking retractors, the test shall be made in the condition where the locking mechanism functions.

5.6.1.4 Two-Point Type

The test assembly should be mounted on to the testing apparatus as shown in Fig.1 of Annexure-14 with its loop length being about 1300 mm. In case the length is less than 1300 mm, the test should be carried out with the longest possible length. A tension load from 200 N to 22.7 kN should be applied at the specified rate. The component and its parts should be examined for any abnormalities and the vertical displacement of the rollers during the loading i.e. between 200 N and 22.7 kN should be noted.

5.6.1.5 Three-Point Type

The test is carried out in the same way as the two point belt except the layout is as per Fig.2 of Annexure-14.

5.6.1.6 The buckle opening test shall be continued with a load of 665 N ± 50 N on the assembly according to para 5.6.3.

5.6.2 Dynamic Test of Belt Assembly

5.6.2.1 The belt assembly shall be mounted on a trolley equipped with the seat and the anchorages defined in para 1, 2 and 3 and Fig.1 in Annexure-15. 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 test agency either in conformity with the fitting instructions supplied with the belt or in conformity with the data supplied by the manufacturer of the vehicle. In that case, when the dynamic test has been carried out for a type of vehicle, it need 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 anchorages points. If the belt is equipped with a belt adjustment device for height, the position of the device and its means of securing it shall be the same as those of the vehicle design.

5.6.2.2 In the case of a safety belt or restraint system forming part of an assembly for which 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 trolley as given in para 5.6.2.3.

5.6.2.3 The method used to secure the vehicle during the test shall not be such as to strengthen the anchorage of the seats or safety belts or to lessen the normal deformation of the structure. No forward movement of the vehicle shall be present which by limiting the forward movement of the manikin except the foot, would reduce the load imposed on the restraint system during the test. The discarded part of the structure can be replaced by parts of equivalent strength provided they do not hinder the forward movement of the manikin.

5.6.2.4 A securing device can be considered satisfactory if it produces no effect on the area extending over the whole width of the structure and if the vehicle or the structure is blocked or fixed 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 behind the anchorage to ensure that the requirements of the para 5.6.2.3 are fulfilled.

5.6.2.5 The seats shall be adjusted and placed in the position for driving use chosen by the test agency to give the most adverse conditions with respect to strength, consistent with the positioning of the manikin in the vehicle. The positions of the seats shall be stated in the report. If the seat back is adjustable, it 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 degrees in the case of vehicles of categories M1 and N1 and as near as possible to 15 degrees in the case of vehicles of all other categories.

5.6.2.6 For the assessment of the requirements in para 4.4.2.10.1, the seat shall be regarded as being in its most forward driving or travelling position appropriate to the dimensions of the manikin.

5.6.2.7 All the seats of the same group shall be tested simultaneously.

5.6.2.8 The seat belt assembly shall be attached to the manikin as described in para 5 and Fig.1 of Annexure-15. A board 25 mm thick shall be placed between the back of the manikin and the seat back. The belt shall be firmly fastened around the manikin. The board shall then be removed so that the whole 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.

5.6.2.9 The free ends of the straps shall extend sufficiently far beyond the adjusting devices to allow for slip.

5.6.2.10 The trolley shall then be so propelled that at the moment of impact, its free running speed is 50 km/h ± 1 km/h and the manikin remains stable. The stopping distance of the trolley shall be 400 mm ± 50 mm. The trolley shall remain horizontal throughout deceleration. The deceleration of the trolley shall be achieved by using the apparatus using deformable plastic tubes or any other device giving equivalent results. This apparatus shall comply with the performance specified in Fig.5 of Annexure-15.

5.6.2.11 The trolley speed immediately before impact and the maximum forward displacement of the manikin shall be measured.

5.6.2.12 After impact, the belt assembly or restraint system and its rigid parts shall be inspected visually, without opening the buckle, to determine whether there has been any failure or breakage. In the case of restraint systems, it shall also be ascertained, after the test, whether the parts of the vehicle structure which are attached to the trolley have undergone any visible permanent deformation. If there is any such deformation found, this shall be taken into account in any calculation made para 4.4.2..10.1.

5.6.2.13 The belt assembly shall be removed from the test trolley without the buckle being opened. The buckle opening test should be conducted according to para 5.6.3.

5.6.2.14 After the buckle opening test, the components of the belt assembly or of the restraint device 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.

5.6.3 Buckle Opening Test

5.6.3.1 For this test, belt assemblies or restraint devices which has already undergone the static strength/displacement test according to para 5.6.1 or dynamic test in conformity with para 5.6.2 shall be used.

5.6.3.2 In the case of samples subjected to static strength/displacement test, this test is continued as mentioned in 5.6.1.6.

5.6.3.3 In the case of samples subjected to dynamic test, a load shall be applied to the buckle by direct traction via the straps fixed to it so that all the straps are subjected to the force of 600/n N, where 'n' is the number of straps linked to the buckle when it is in a locked position and its minimum is deemed to be 2. 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.

5.6.3.4 The buckle opening force shall be applied 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 point of contact of the test equipment shall be spherical in form with a radius of 2.5 mm ± 0.1 mm. It shall have a polished metal surface. For lift cover buckles, the buckle opening force shall be applied by a spring balance or other measuring device in a manner and direction which are normal for opening the buckle. For lever type buckles a hole of 2.5 mm dia may be drilled through the buckle tab or lever on a centre line between 3.0 mm and 3.3 mm from its edge and a small loop of soft wire may be used on the connecting link between the buckle tab or lever and the force measuring device. The buckle opening force shall be measured and any failure of the buckle noted.

5.6.4 Additional Test for Pre-loading Device

The pre-loading force shall be measured in less than four seconds after the impact as close as possible to the contact point with the manikin on the free length of webbing between the manikin and the pre-loading device or sash guide, if any, the manikin having been replaced in its originally seated position if necessary.

5.7 Test Report

The test report shall record the results of all the tests in paragraph 5 above and in particular the trolley speed, the maximum forward displacement of the manikin, the position of the buckle, the buckle opening force, and any failure or breakage. If by virtue of para 5.6.2.1, the anchorage prescribed in para 3 and Fig.1 of Annexure-15 have not been respected, the test report shall describe how the belt assembly or the restraint system was installed and shall specify important angles and dimensions. The report shall also mention any distortion or breakage of the buckle that has occurred during the test. In the case of a restraint system, the test report shall also specify the manner of attaching the vehicle structure to the trolley, the position of the seats and the inclination of the seat backs. If the forward displacement of the manikin has exceeded the values prescribed in para 4.4.2.9.2, the report shall state whether the requirements in paragraph 4.4.2.10.1 are met.

6. SEAT BELT MARKING

6.1 Each seat belt assembly shall be marked at least with the information listed below to ensure correct usage and compliance to this regulation.

6.1.1 Manufacturer's name or trade mark.
6.1.2 Part No. of identification.
6.1.3 Batch number, month and year of manufacture.

7. CONFORMITY OF PRODUCTION

Any safety belt or restraint system approved under this standard shall be so manufactured as to conform to the approved by meeting the requirements set forth in para 4 and 5 above. In order to verify that the requirements of this standard are met, suitable controls of the production and its verification by carrying out the tests on randomly selected samples shall be carried out. The minimum frequency requirements are set out in Annexure-4. In order to reduce the number of types for COP, the locking mechanism is considered to be of two types with respect to mounting angle with reference to the vehicle axis system viz. less than 10° and more than 10°.

8. NOTE

This standard is based on ECE Regulation-16 "Safety Belts and Restraint Systems", 2000/3/EC "Motor Vehicle Safety Belts" and JIS:D-4604-1988 "Seat Belts for Automobiles".

****

Annex-I : Types of Seat Belt Assemblies

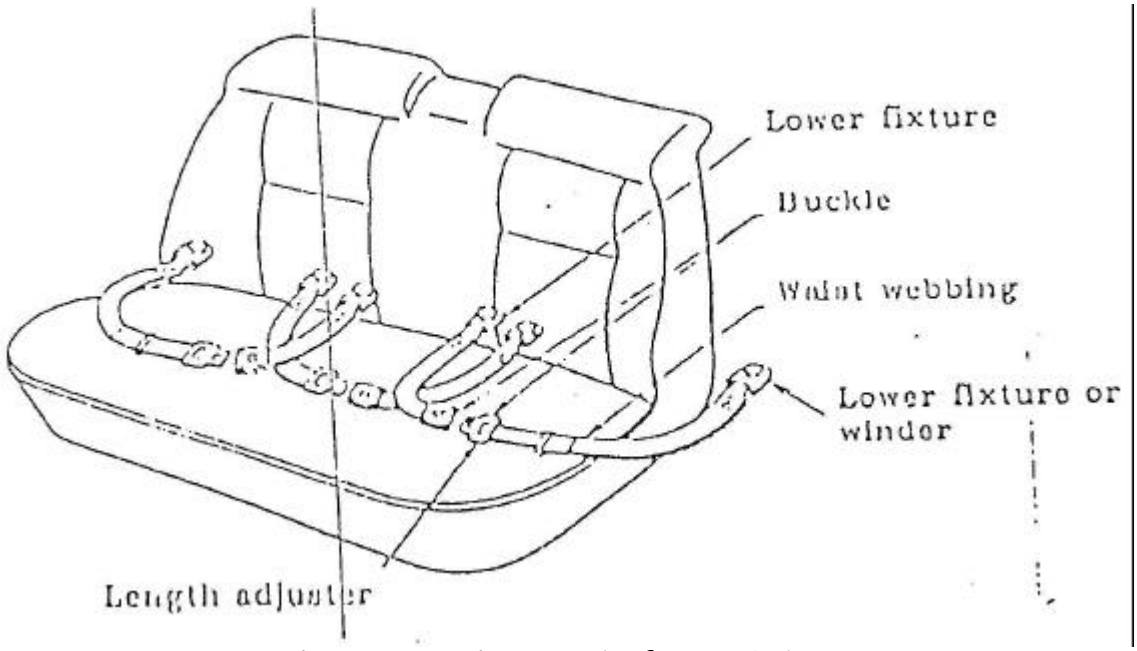


Fig.1 : Two-Point Type (Ref. Para. 3.1)

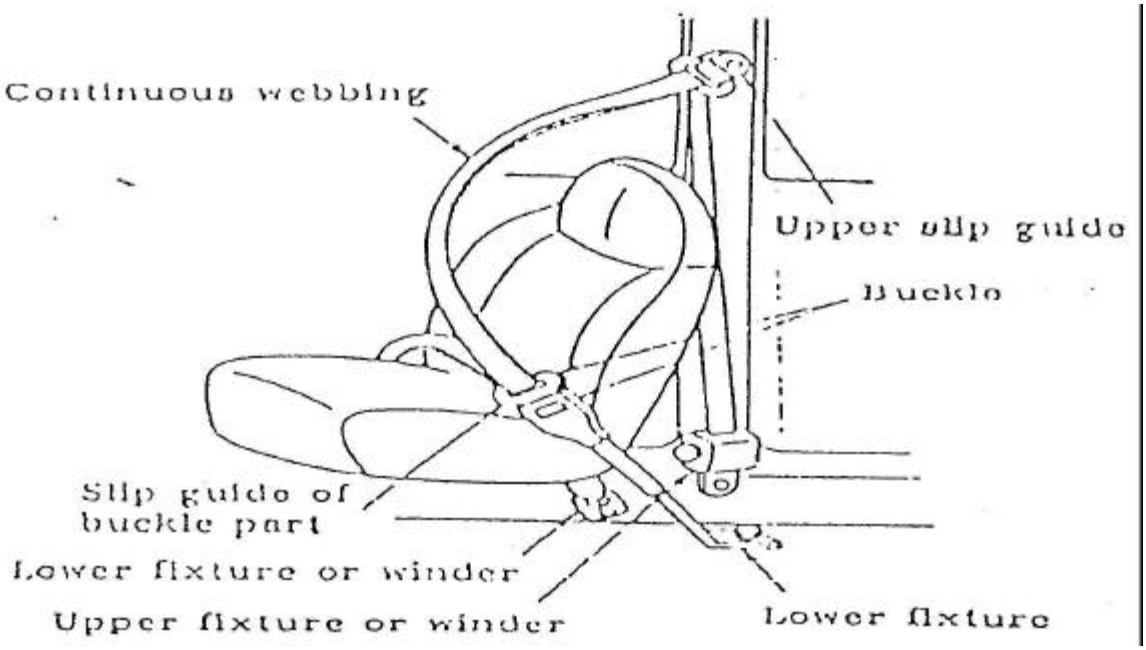


Fig.2 : Three-Point Type (Ref. Para. 3.1.2)

Annex-I : Types of Seat Belt Assemblies

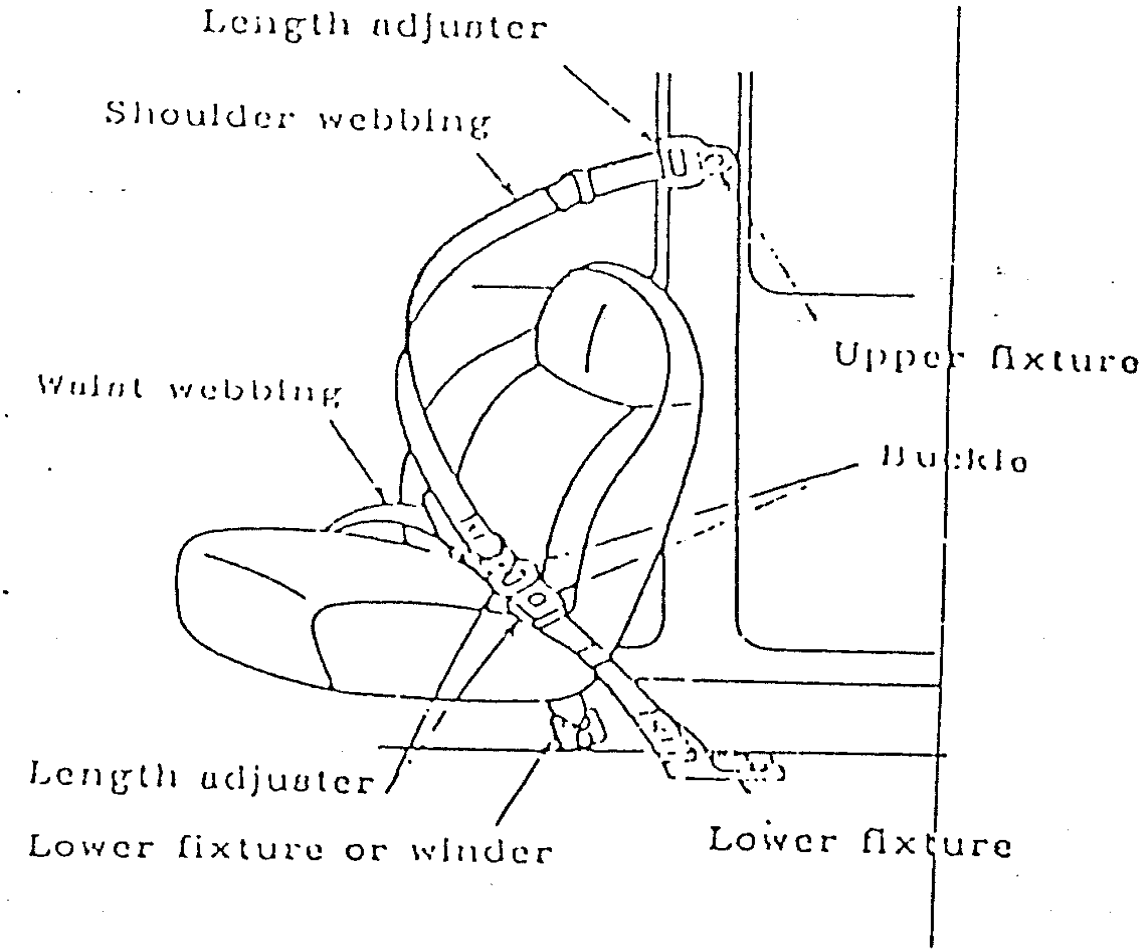


Fig.3 : Harness Type (Ref. Para. 3.1.3)

ANNEXURE-II

INFORMATION TO BE PROVIDED BY THE SAFETY BELT / VEHICLE MANUFACTURER FOR APPROVAL FOR SAFETY BELT/RESTRAINT SYSTEMS (Para 4.1.1)

1.0 GENERAL

1.1 Make (trade name of manufacturer):
1.2 Type and general commercial description (s):
1.3 Name and address of manufacturer:
1.4 Address (s) of assembly plant (s):

2.0 LIST OF VEHICLE(S) TO WHICH THE DEVICE IS INTENDED TO BE FITTED (If applicable)

3.0 DESCRIPTION OF THE DEVICE

3.1 Safety belt

3.1.1 Configuration of safety belt (two-point belt, three-point belt, static, automatic):
3.1.2 Details of webbing (material, weave, dimensions and colour):
3.1.3 Type of retractor and classify further in the case of emergency locking retractor – simple locking type, or webbing clamp type (Ref. Para 3.7).
3.1.4 Information on additional functions, if applicable:
3.1.5 Drawings of the rigid parts:
3.1.6 Type of buckle (Ref.3.3)
3.1.7 Diagram of the safety belt assembly enabling identification and location of the rigid parts:
3.1.8 Mounting instructions showing, inter-alia, the installation of the retractor and its sensing device:
3.1.9 If a belt adjustment device for height is present, state whether it is considered to be part of the belt:
3.1.10 In the case of a pre-loading device or system, a full technical description of the construction and function including any sensing device, describing the method of activation and any necessary method to avoid inadvertent activation:

3.2 Restraint system

3.2.1 Drawings of the relevant parts of the vehicle structure and any seat anchorage reinforcements:
3.2.2 Drawings of the seat, showing its structure, adjustment system and fixing components, with an indication of the materials used:
3.2.3 Drawing or photograph of the restraint system as installed:

4.0 DESCRIPTION OF THE VEHICLE

Photographs and/or drawings of a representative vehicle:

5.0 BODYWORK

5.1 Seats

5.1.1 Number:

5.1.2 Position and arrangement:

5.1.3 Characteristics: For seats non type-approved as components, description and drawings of:

5.1.3.1 the seats and their anchorages:

5.1.3.2 the adjustment system:

5.1.3.3 the displacement and locking systems:

5.1.3.4 the seat belt anchorages if incorporated in the seat structure:

5.2 Safety belts and/or other restraint systems

Number and position of safety belts and restraint systems and seats on which they can be used:

Row of Seat	**Location ***	**Type of seat belt**	**Variant (if applicable)**	**Belt adjustment device for height (indicate yes/no/optional)**
First row of seats	L			
	C			
	R			
Second row of seats (1)	F			
	M			
	B			
(1) The table may be extended as necessary for vehicles with more than two rows of seats or if there are more than three seats across the width of the vehicle. * (L = left-hand side, R = right-hand side, C = center)				

****

ANNEXURE-III

MINIMUM REQUIREMENT FOR SAFETY BELTS AND RETRACTORS FOR DIFFERENT CATEGORIES OF VEHICLES (Para 4.1.2)

Vehicle Category as per IS:14272 Part I-1995	Front Row		Centre (All Rows)	Rear Facing
	Out Board			
	Front	Other Than Front		
M1/N1 M2/N2 M3/N3	3 Point belt with emergency locking retractor with/single multiple sensitivity or 3 Point static. In the case of M3/N3 and M2 > 3.5 ton GVW, 2 Point is permitted if wind screen is outside the reference zone.	2 Point or 3 Point belt with or without retractor, (if provided).	2 Point with or without retractor, (if provided).	

ANNEXURE-4
Samples for the Tests and COP Frequency

Clauses	Test	Samples																			COP Frequency
		Belt or Restraint System							Straps												
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	9	10	11	12	13	
.3, 4.1.4, 4.1.5	Inspection of belt or restraint system	x																				1 in 2000
t Components Incorporating Rigid Parts																						
.1.1, 4.2.1.3, .1.4, 4.2.2.1,	Inspection	x	x	x	x	x	x	x														1 in 2000
.1.2, 5.2	Corrosion Resistance	x	x																			1 in 2000
.1.4, 5.3.4 (if	Low Temperature Impact Test	x	x																			1 in 10,000
.2.3	Durability of Buckle	x	x																			1 in 2000
.2.4, 5.3.3	Low Temperature Test on Buckle	x	x																			1 in 10,000
.2.6, 5.3.1, 5.3.5	Buckle Strength Test			x																		1 in 2000
.3.3, 5.3.6	Ease of Adjustment				x																	1 in 10,000
.3.1, 5.3.8	Micro Slip Test				x	x																1 in 10,000
.3.2, 5.3.1, 5.3.2, .5	Strength Test on Adjusting Device (when necessary on retractors)			x																		1 in 2000
.4, 5.3.1, 5.3.2	Strength Test on Attachments (when necessary on retractors)			x																		1 in 2000
ractors :																						
.5.2, 4.2.5.3, .5.4, 5.4	Retracting Force, Durability, Corrosion, Dust	x	x																			1 in 500
t Belt Assembly :																						
.2, 5.6.2, 5.6.3	Dynamic Test	x	x																			As per Table of Annex.4
.1, 5.6.1, 5.6.3	Static Strength/ Displacement Test						x	x														1 in 2000
.4, 5.5.2.7	Abrasion Test				x	x																
aps :																						
.1.2, 5.5.1	Testing of Strap Width								x	x												To follow the sampling procedure as per the quality plan approved for ISO:9000 the manufacture straps
ap Strength After : (5.5.1)																						
.2, 5.5.2.2	Room Conditioning								x	x												
.3, 5.5.2.3	Light Conditioning										x	x										
.3, 5.5.2.4	Low Temperature Conditioning												x	x								
.3, 5.5.2.5	Heat Conditioning														x	x						
.3, 5.5.2.6	Water Conditioning																x	x				
.5, 4.3.6, 5.5.3, .4	Elongation and Energy Absorptivity																		x	x		
	Retention of Strap Sample																				x	

Table - 1 of Annexure - 4
(Refer Para 7.0)

FREQUENCY OF DYNAMIC TEST

Production Rate/Annum	No. of Samples			Max. Interval Between Test
	Without Conditioning	With Conditioning	Total	
Up to 3,000	1	1	2	Once per year
3,001 to 15,000	3	2	5	--do--
15,001 to 30,000	5	3	8	--do
30,001 to 90,000	18	9	27	--do--
90,001 to 3,00,000	60	30	90	Once per two weeks
3,00,001 to 15,00,000	120	60	180	One per day
15,00,001 to 30,00,000	240	120	360	--do--
Above 30,00,000	480	240	720	--do--

****

ANNEXURE-V

TEST CHAMBER FOR CORROSION TEST
(Para 5.2)

1.0 TEST APPARATUS :

1.1 The apparatus shall consist of a mist chamber, a salt solution reservoir, supply of suitably conditioned compressed air, one or more atomizing nozzles, sample supports, provision of heating the chamber, and the necessary means of control. The size and detailed construction of the apparatus shall be optional provided that the test conditions are met.

1.2 It is important to ensure that drops of solution accumulated on the ceiling or cover of the chamber do not fall on test samples.

1.3 Drops of solution which fall from test samples shall not return to the reservoir for re-spraying.

1.4 The apparatus shall not be constructed of materials that will affect the corrosiveness of the mist.

2.0 LOCATION OF TEST SAMPLES IN THE MIST CABINET:

2.1 Samples except retractors, shall be supported or suspended between 15 degrees and 30 degrees from the vertical and preferably parallel to the principal direction of horizontal flow of mist through the chamber, based upon the dominant surface being tested

2.2 Retractors shall be supported or suspended so that the axes of the reel for storing the strap shall be normal to the principle direction of horizontal flow of mist through the chamber. The strap opening in the retractor shall also be facing in this principal direction.

2.3 Each sample shall be placed so as to permit free setting of mist on all samples.

2.4 Each sample shall be so placed to prevent salt solution from one sample dripping on to any other samples.

3.0 SALT SOLUTION:

3.1 The salt solution shall be prepared by dissolving 5 ± 1 parts by mass of sodium chloride in 95 parts of distilled water. The salt shall be sodium chloride substantially free of nickel and copper and containing on the dry basis not more than 0.1% of sodium iodide and not more than 0.3% of the total impurities.

3.2 The solution shall be such that when atomized at 35°C, the collected solution is in the pH range of 6.5 to 7.2.

4.0 AIR SUPPLY:

The compressed air supply to the nozzle for atomizing the salt solution shall be free of oil and dirt, and maintained at a pressure between 70 kPa and 180 kPa.

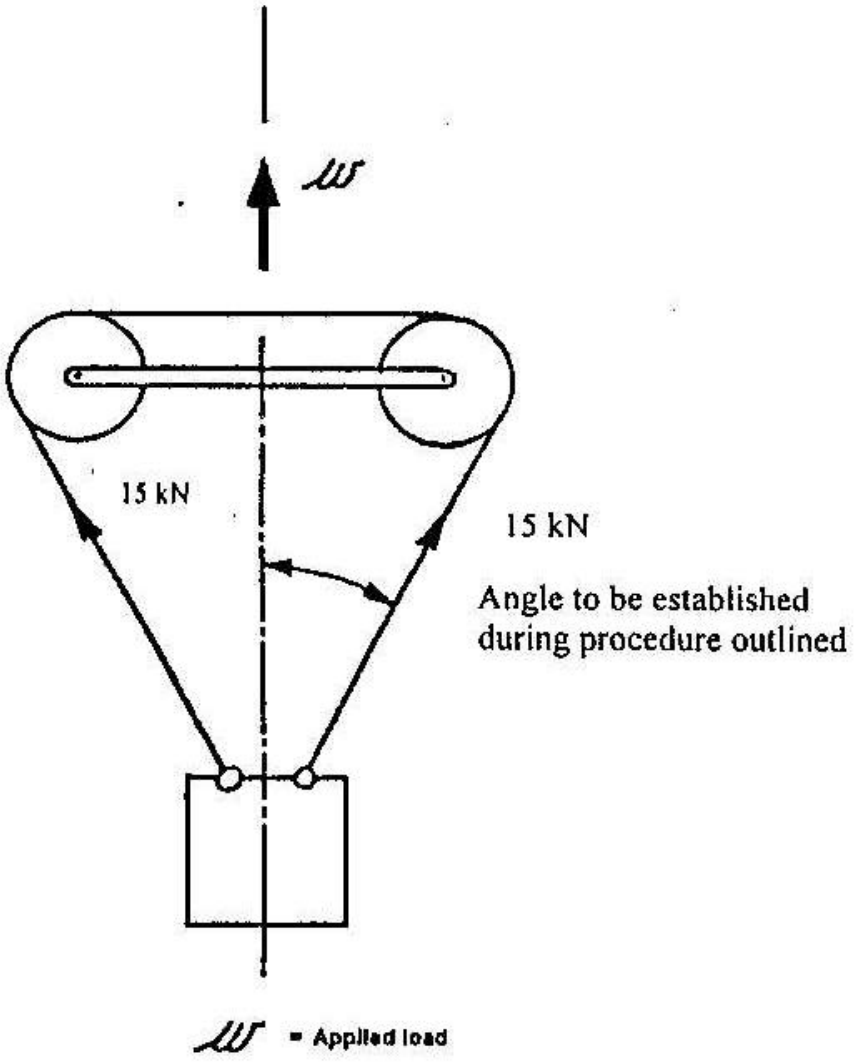
5.0 CONDITIONS IN THE MIST CHAMBER:

5.1 The exposure zone of the mist chamber shall be maintained at 35°C ± 5°C. At least two clean mist collectors shall be placed within the exposure zone to prevent drops of solution from the test samples or any other source from accumulating. The collectors shall be placed near the test samples, one as near as possible to the nozzles and the other as far away as possible from the nozzles. The mist shall be such that, for each 80 cm^2 of horizontal collecting area, an average of between 1.0 ml and 2.0 ml of solution per hour is collected in each collector when measured over at least 16 hours.

5.2 The nozzle or nozzles shall be directed or baffled in such a manner that the spray does not strike directly onto the test samples.

****

Annex-VI : Schematic of Dual Buckle Test (Ref. Para. 5.3.5)



Annex-VII : Abrasion and Micro Slip Test
(Ref. Para. 5.5.2.7.3.3 and 5.3.8.3)

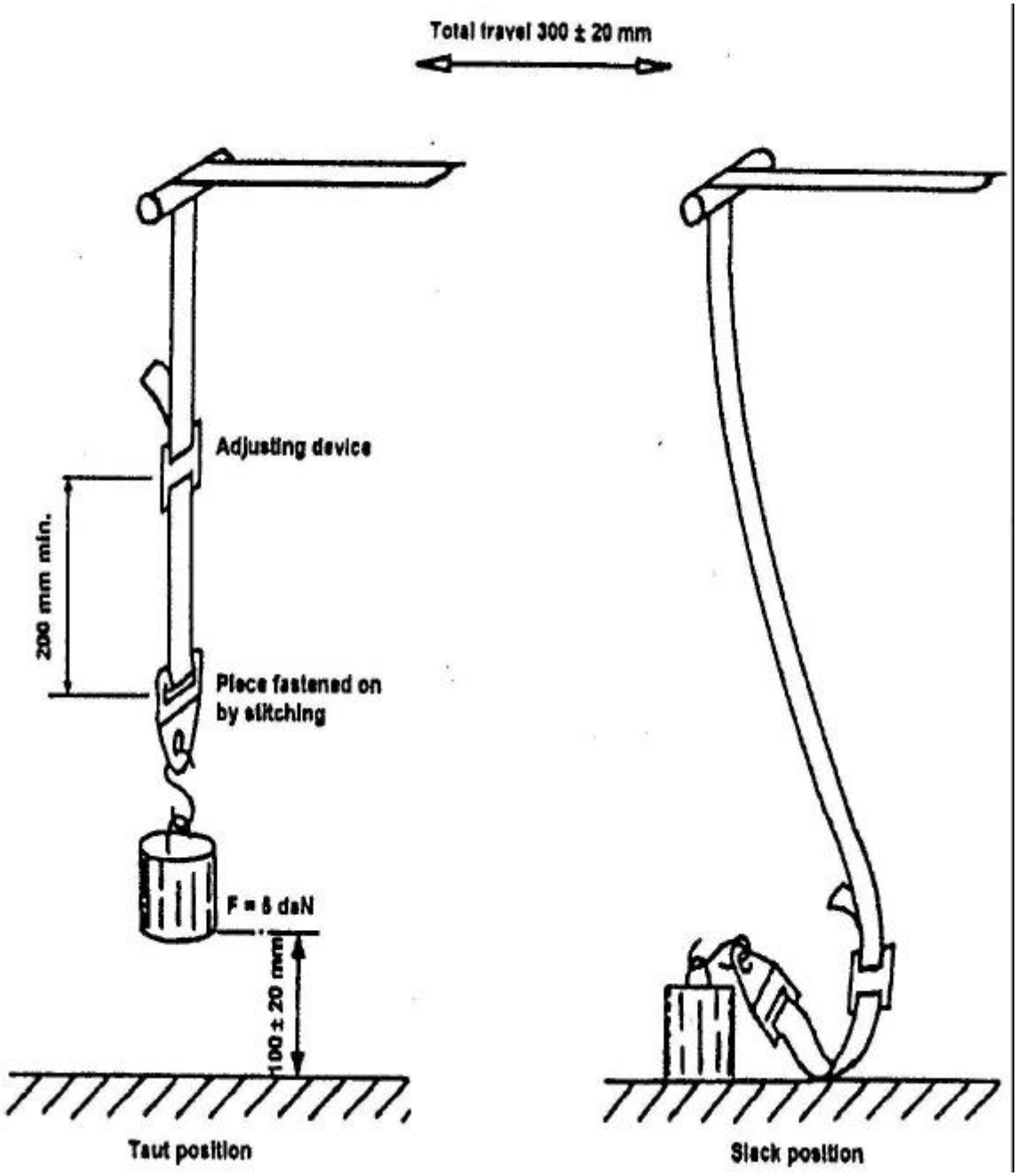


Fig.1

Annex-VII : Schematic of Abrasion and Micro Slip Test
(Ref. Para. 5.3.8 and 5.5.2.7.3)

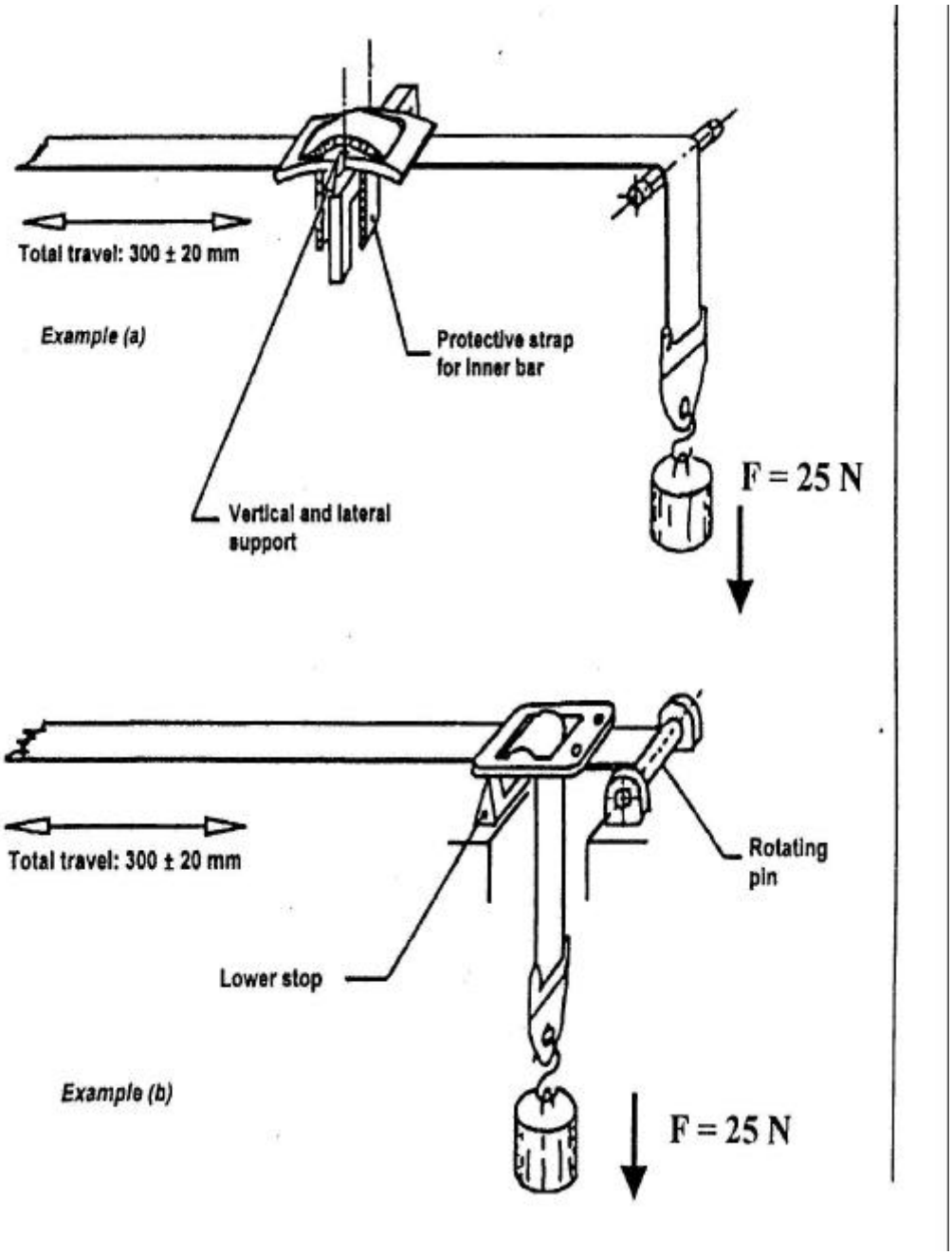


Fig.2 Type 1 Procedure Test (Ref. Para. 5.5.2.7.3.1)

Annex-VII : Abrasion and Micro Slip Test

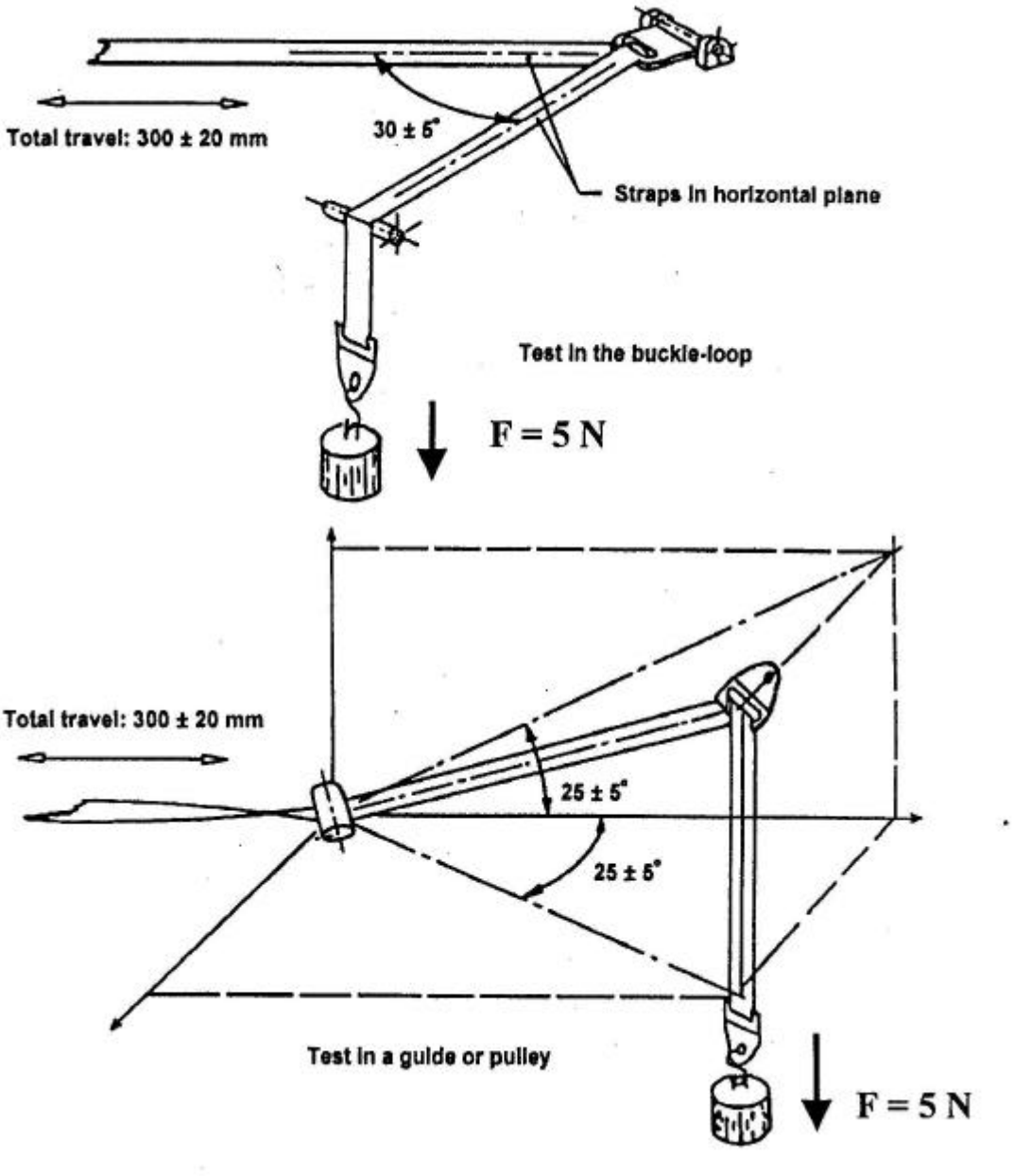
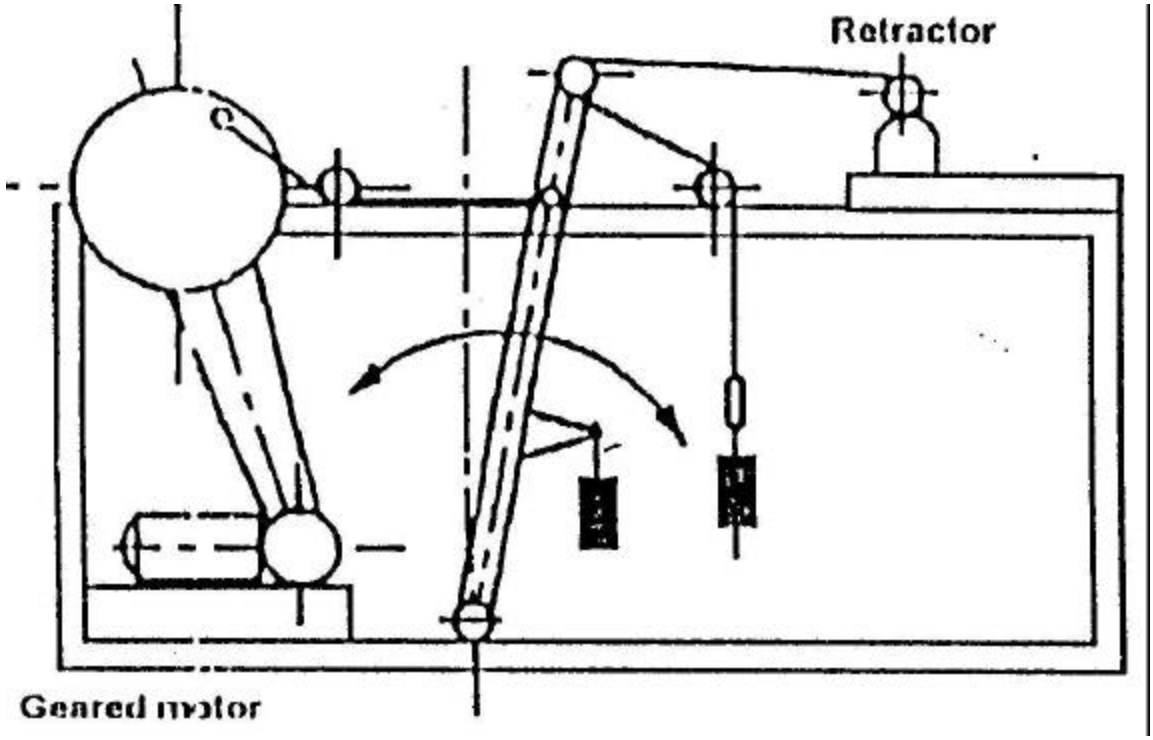


Fig.3 Type 2 Procedure Test (Ref. Para. 5.5.2.7.3.2)

Annex-VIII : Typical Apparatus to Test Durability of Retractor Mechanism
(Ref. Para. 5.4.1)



ANNEXURE-IX

TYPICAL APPARATUS TO TEST LOCKING OF EMERGENCY LOCKING RETRACTORS (Para 5.4.2.4)

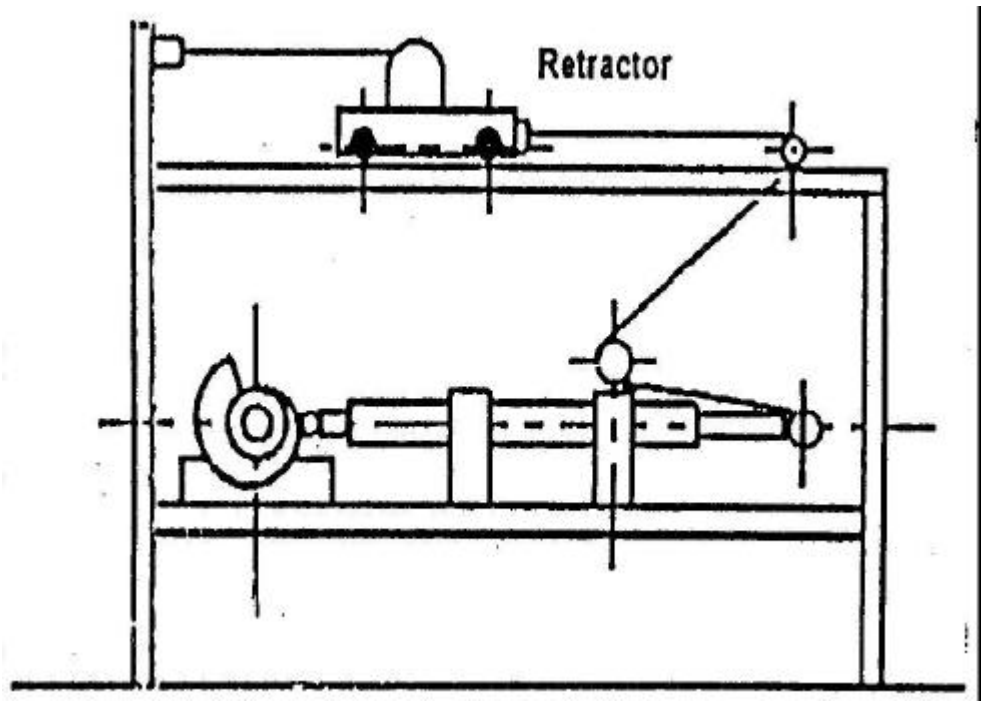
1.0 A suitable apparatus is illustrated in the figure given below. This consists of a motor-driven cam, the follower of which is attached by wires to a small trolley mounted on a track. The cam follower incorporates a 'lost-motion' device which absorbs any movement should the reel lock before the full stroke of the follower is completed. 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 5.4.2.4 and the stroke is arranged to be in excess of the maximum permitted strap movement before locking.

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

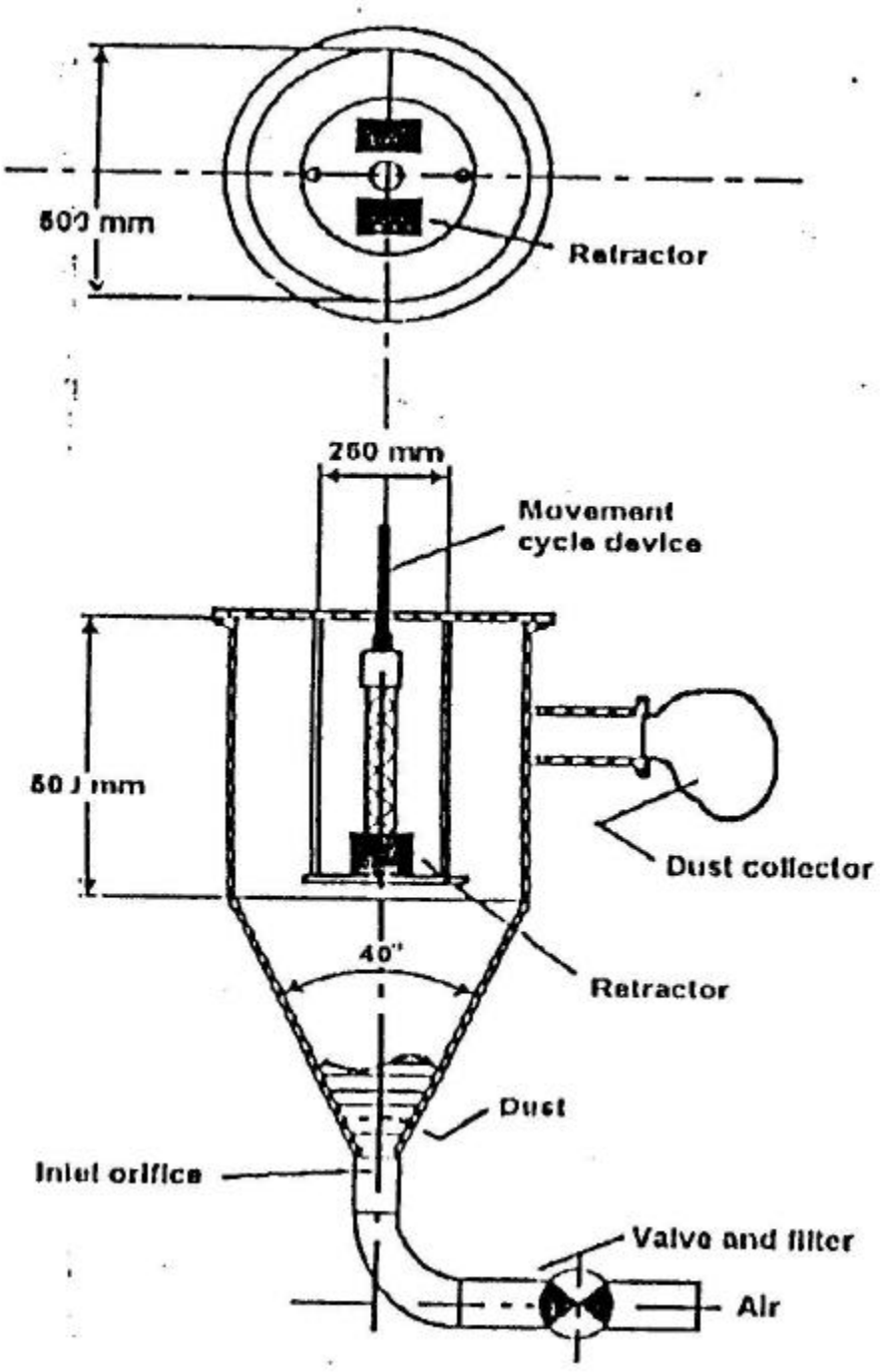
3.0 When testing retractors for sensitivity to strap movement, the retractor is mounted on a suitable fixed bracket and the strap is attached to the trolley.

4.0 When carrying out the above tests, any brackets, etc., supplied by the manufacturer or by his representative shall be incorporated in the test installation to simulate as closely as possible the intended installation in a vehicle.

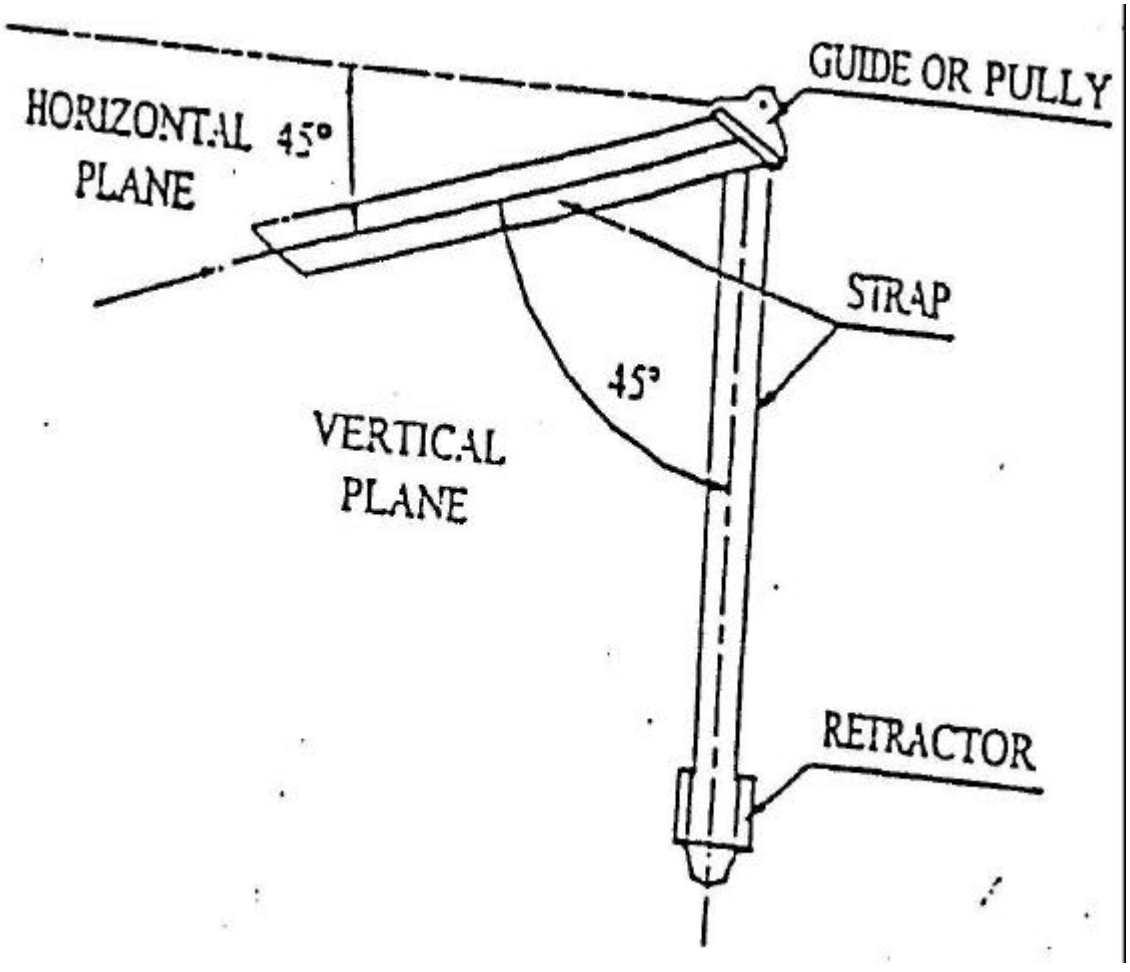
5.0 Any additional brackets, etc., that may be required to simulate the installation as intended in a vehicle shall be provided by the manufacturer or by his representative.



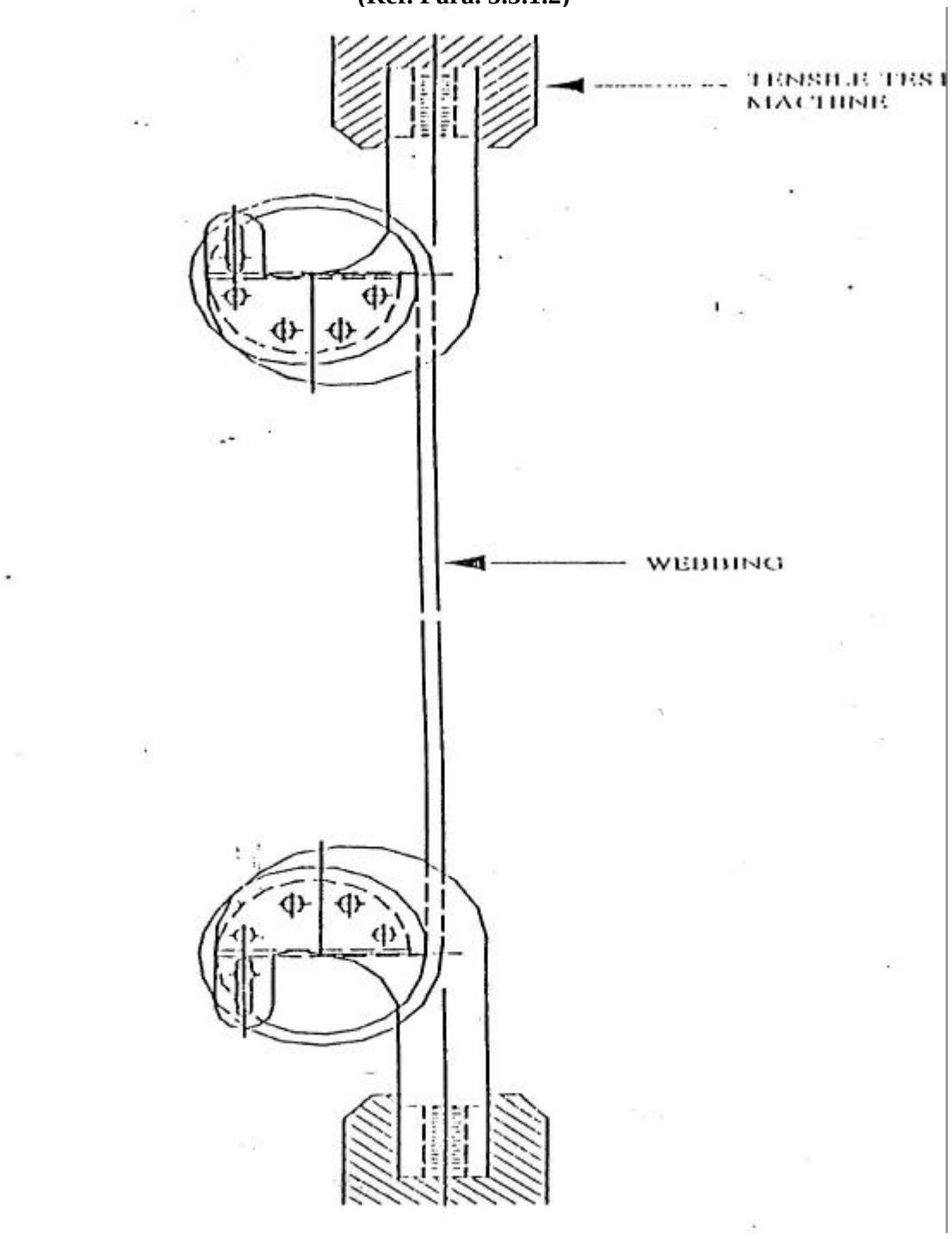
Annex-X : Typical Apparatus to Test the Dust Resistance to Retractors
(Ref. Para. 5.4.3.1)



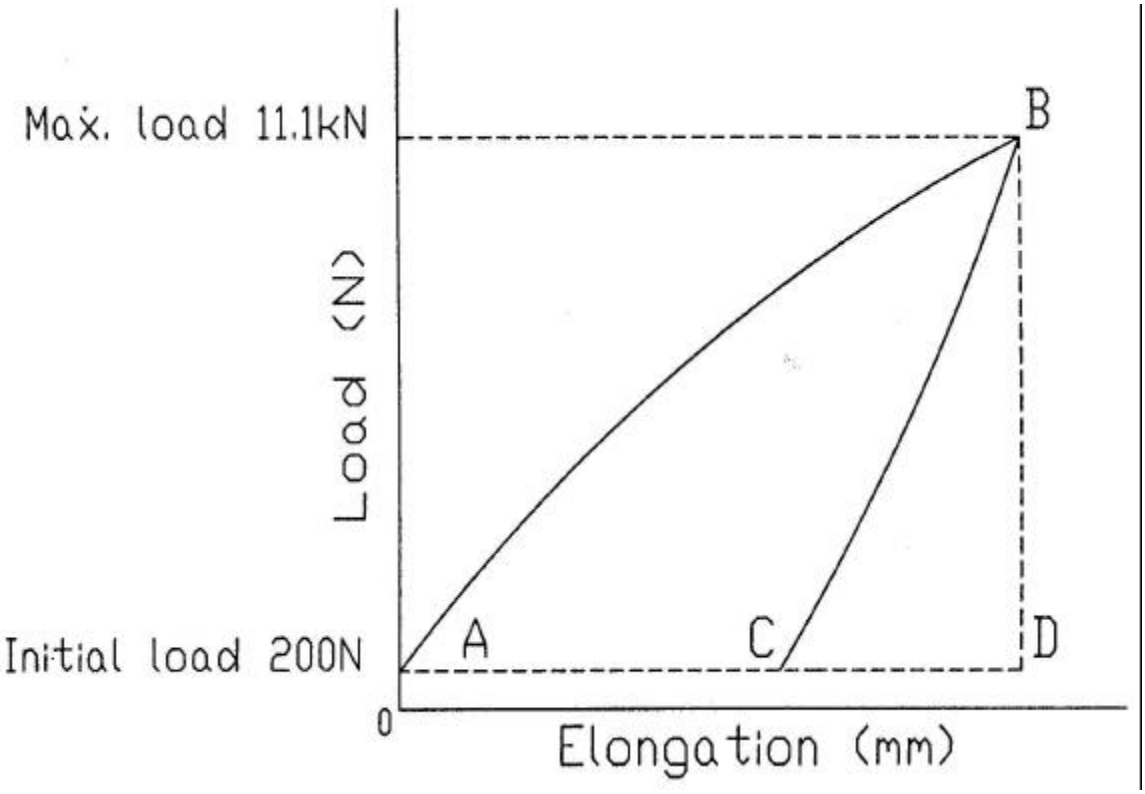
Annex-XI : Retraction Force Measurement - Schematic
(Ref. Para. 5.4.4)



Annex-XII : Typical Setup for Gripping the Strap in Tensile Testing Machine
(Ref. Para. 5.5.1.2)



Annex-XIII : Energy Absorptivity Pot
(Ref. Para. 5.5.4)



Work Load Ratio = $\frac{ABC}{ABD}$ X 100 %

Annex-XIV : Static Strength/Displacement of Seat Belt Assembly/Restraint System

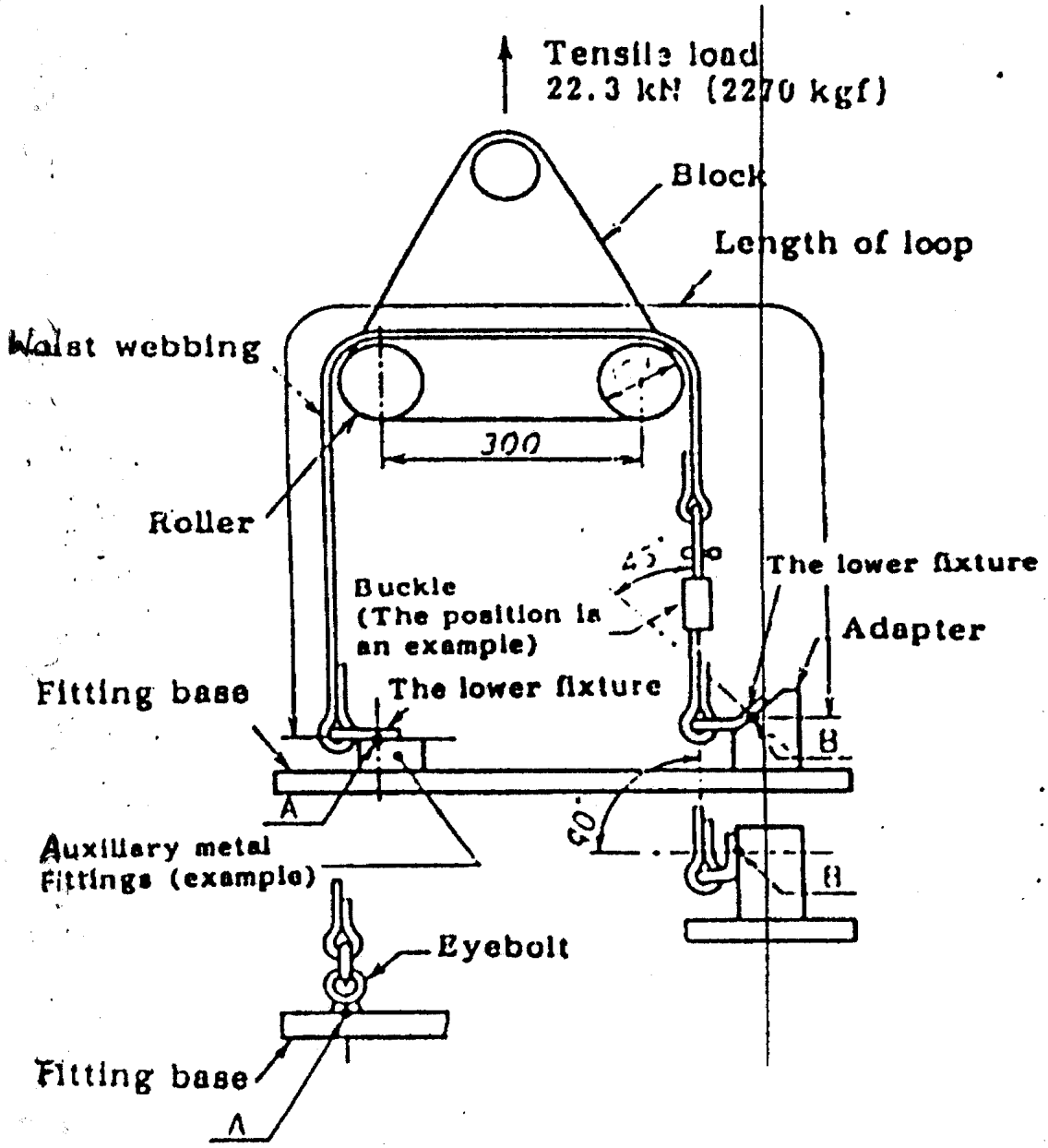


Fig.1 : Setup for Two Point Type

Annex-XIV : Static Strength/Displacement of Seat Belt Assembly/Restraint System

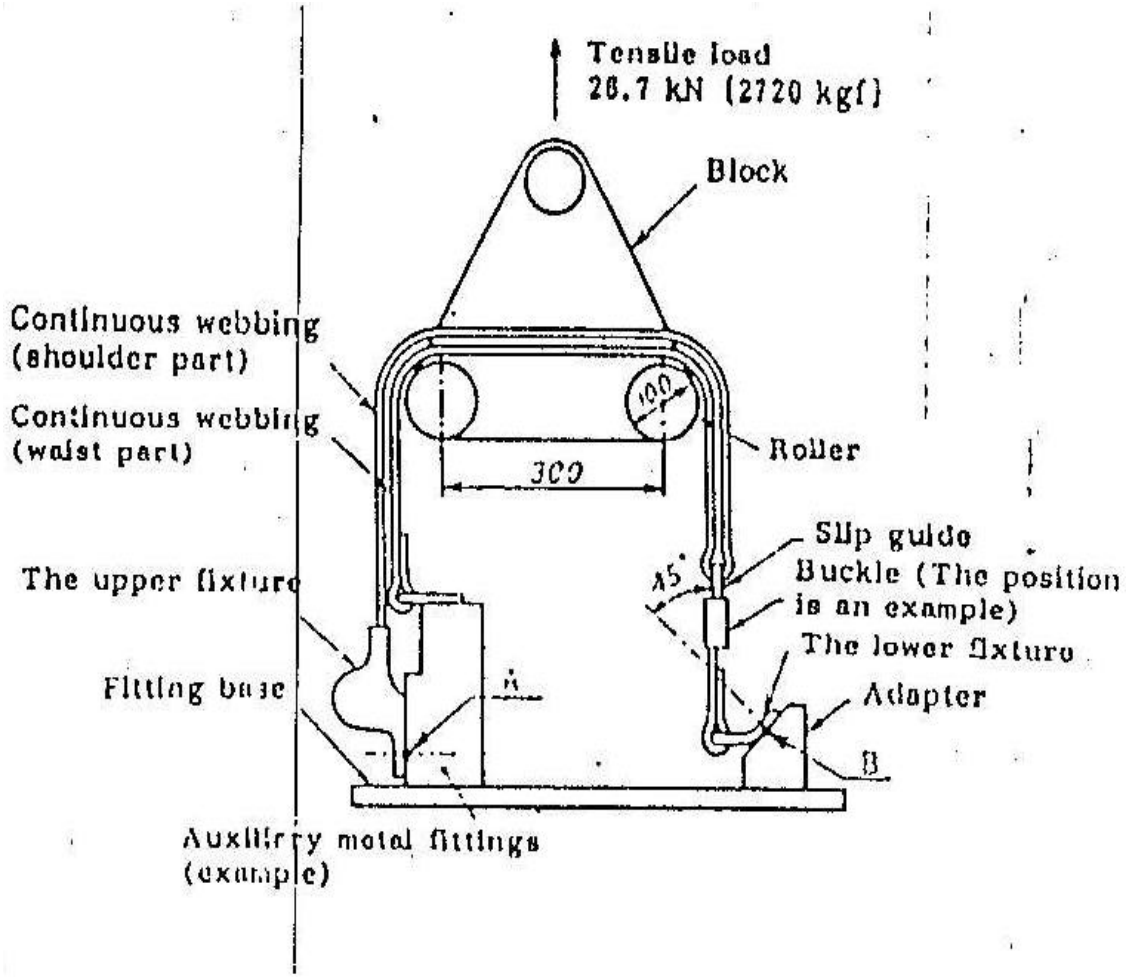


Fig.2 : Setup for Three Point Type

ANNEXURE-XV

DESCRIPTION OF TROLLEY, SEAT, ANCHORAGES, STOPPING DEVICE AND MANIKIN FOR DYNAMIC TEST (Para 5.6.2)

1. TROLLEY

The trolley carrying the seat only for tests on safety belts, shall have a mass of 400 ± 20 kg. For tests on restraint systems, the trolley, with the vehicle structure attached, 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

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

3. ANCHORAGES

3.1 The anchorages shall be positioned as shown in Figure 1. The circular 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 hole for the attachment of the strap support is not more than 250 mm. Otherwise, the Points A_1 and B_1 shall be used. 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 1 kN 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.

3.2 The tolerance on the position of the anchorage points is such that each anchorage point shall be situated at the most at 50 mm from corresponding Points A, B and K indicated in Figure 1, or A_1, B_1 and K_1 as the case may be.

3.3 If a fourth anchorage is necessary in order to attach the retractor, this anchorage shall :

- be located in the vertical longitudinal plane passing through K_1
- enable the retractor to be tilted to the angle prescribed by the manufacturer,

- be located on the arc of a circle with center K and 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 center K and radius 350 mm.

3.4 In the case of a belt equipped with a belt adjustment device for height, this 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.

4. STOPPING DEVICE

4.1 This 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 increases of nominal mass.

4.2 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,
- a shaft and an impact plate.

4.3 The dimensions of the various parts of this energy absorber are shown in Figures 2, 3 and 4. The characteristic values of the energy-absorbing material are given below. Immediately before each test, the tubes must be conditioned at a temperature of between 15 ^{o}C and 25^{o}C for at least 12 hours without being used. The temperature of the stopping device during the dynamic testing of safety belts and restraint systems must be the same as during the calibration test to within ± 2^{o}C.

4.4 Characteristic Values Of The Energy-Absorbing Material (ASTM method D 735 unless otherwise stated)

4.4.1	Shore hardness A:	95 ± 2 at 20 ± 5^{o}C
4.4.2	Breaking strength:	$R_o \geq 343$ daN/cm^2
4.4.3	Minimum elongation:	$A_o \geq 400\%$
4.4.4	Modulus:	at 100% elongation: ≥ 108 daN/ cm^2 at 300% elongation: ≥ 235 daN/ cm^2
4.4.5	Low-temperature brittleness (ASTM method D 736):	five hours at –55^{o}C
4.4.6	Compression set (method B):	22 hours at 70 ^{o}C ≤ 45%

4.4.7	Density at 25 °C	:	1, 05 to 1, 10
4.4.8	Ageing in air (ASTM method D 573):		
4.4.9	70 hours at 100 °C- shore hardness A:		maximum variation ± 3
	- breaking strength:		decrease < 10% of R_o
	- elongation:		decrease < 10% of A_o
	- mass:		decrease < 1%
4.4.10	Immersion in fluids		
4.4.10.1	Immersion in oil (ASTM method No. 1 Oil):		
	70 hours at 100 °C- shore hardness A:		maximum variation ± 4
	- breaking strength:		decrease < 15% of R_o
	- elongation:		decrease < 10% of A_o
	- volume:		swelling < 5%
4.4.10.2	Immersion in oil (ASTM method No.3 Oil):		
	70 hours at 100 °C	- breaking strength:	decrease < 15% of R_o
		- elongation:	decrease < 10% of A_o
		- volume:	swelling < 5%
4.4.10.3	Immersion in distilled water:		
	one week at 70°C	- breaking strength:	decrease < 35% of R_o
		- elongation:	decrease < 20% of A_o

4.5 The requirements relating to the stopping device are given para 4.6 below. Any other device giving equivalent results is acceptable.

4.6 Trolley deceleration requirements:

4.6.1 The deceleration curve of the trolley weighted with inert masses to produce a total of 455 kg ± 20 kg for safety belt tests and 910 kg ± 40 kg for restraint system tests, where the nominal mass of the trolley and vehicle structure is 800 kg, must remain within the hatched area in Fig.5. 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 shall be added per increment. In no case shall the total mass of the trolley, the vehicle structure and the inert masses differ from the nominal value for calibration tests by more than ± 40 kg. The stopping distance during calibration of the trolley shall be 400 ± 20 mm and the speed of the trolley shall be 50 ± 1 km/h.

4.6.2 In both the above cases the measurement equipment shall have a response which is substantially flat up to 60 Hz with a roll off at 100 Hz in accordance with Recommendation ISO R 6487/1980. Mechanical resonances associated with transducer mounting should not distort readout data. Consideration should be given to the effect of cable length and temperature on frequency response.

5.0 MANIKIN

5.1 Specifications Of The Manikin

5.1.1 General

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

Figure 6: side view of head, neck and torso;

Figure 7: front view of head, neck and torso;

Figure 8: side view of hip, thighs and lower leg;

Figure 9: front view of hip, thighs and lower leg;

Figure 10: principal dimensions;

Figure 11: manikin in sitting position, showing:

- location of the center of gravity,
- location of points at which displacement shall be measured,
- shoulder height;

Table1: mass of head, neck, torso, thigh and lower leg

Table 2: references, names, materials and principle dimensions of the components of the manikin.

5.1.2 Description of the manikin

5.1.2.1 Lower Leg Structure (see Figures 8 and 9)

The lower leg structure consists of three components:

- a sole plate (30),
- a shin tube (29),
- a knee tube (26).

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

The lower leg can rotate rearwards about 120^{o} from the straight position.

5.1.2.2 Thigh Structure (see Figures 8 and 9)

The thigh structure consists of three components:

- a knee tube (22),
- a thigh bar (21),
- 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 leg.

5.1.2.3 Torso Structure (see Figure 6 and 7)

The torso structure consists of the following components:

- a hip tube (2),
- a roller chain (4),
- ribs (6) and (7),
- a sternum (8),
- chain attachments (3 and, partly, 7 and 8).

5.1.2.4 Neck (see Figures 6 and 7)

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

5.1.2.5 Head (see Figures 6 and 7)

The head (15) is hollow; the polyurethane is reinforced by steel bands (17). The chain tensioner which enables the neck to be adjusted consists of a polyamide block (10), a tubular spacer (11) and a tensioning component (12 and 13). The head can rotate at the joint between the first and second cervical vertebrae (the atlas-axis joint), which consists of an adjuster assembly (14 and 18), a spacer (16) and a polyamide block (10).

5.1.2.6 Knee Joint (see Figure 9)

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

5.1.2.7 Hip Joint (see Figure 9)

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

5.1.2.8 Polyurethane

Type : PU 123 CH compound

Hardness : 50 to 60 shore A

5.1.2.9 Overall

The manikin is covered by a special overall.

5.2 CORRECTION OF THE MASS

In order to calibrate the manikin to certain values and its total mass, the mass distribution must be adjusted by means of six correction weights of 1 kg each which can be fitted to the hip joint. Six other polyurethane weights of 1 kg each can be fitted to the back of the torso.

5.3 Cushion

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

- hardness: 7 to 10 shore A
- thickness: 25 ± 5 mm.

It shall be replaceable.

5.4 Adjustment of the Joints

5.4.1 General

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

5.4.2 Knee joint:

tighten the knee joint;

set the thigh and lower leg vertical;

rotate the lower leg through 30^{o};

gradually slacken the tensioner until the lower leg starts to fall under its own weight;

lock the tensioner in this position.

5.4.3 Hip joints:

increase the rigidity of the hip joints for the purpose of adjustment;

place the thighs in horizontal position and the torso in a vertical position;

rotate the torso towards until it forms an angle of 60^{o} with the thighs;

gradually slacken the tensioner until the torso starts to fall under its own weight;

lock the tensioner in this position.

5.4.4 Atlas-axis joint:

adjust the atlas-axis joint so that it just resists its own weight;

lock the tensioner in this position.

5.4.5 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 be displaced between 40 and 60 mm when subjected to horizontal load of 100 N.

TABLE 1

Components of manikin	Mass in kilograms
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

TABLE 2

Reference Number	Name	Material	Dimensions (in mm)
1	Body Material	Polyurethane	--
2	Hip tub	Steel	76 x 70 x 100
3	Chain-attachments	Steel	25 x 10 x 70
4	Roller chain	Steel	0.75
5	Shoulder plate	Polyurethane	--
6	Rolled section	Steel	30 x 30 x 3 x 250
7	Ribs	Perforated Steel plate	400 x 85 x 1.5
8	Sternum	Perforated Steel plate	250 x 90 x 1.5
9	Discs (six)	Polyurethane	90 dia x 20 80 dia x 20 75 dia x 20 70 dia x 20 65 dia x 20 60 dia x 20
10	Block	Polyamide	60 x 60 x 25
11	Tubular spacer	steel	40 x 40 x 2 x 50
12	Tensioning bolt	steel	M16 x 90
13	Tensioner nut	steel	M16
14	Tensioner for atlas axis joint	steel	12 dia x 130
15	Head	polyurethane	--
16	Tubular spacer	steel	18 dia x 13 x 17
17	Reinforced plate	steel	30 x 3 x 500
18	Tensioner nut	steel	M12
19	Thighs	polyurethane	--
20	Hip tube	steel	76 x 70 x 80
21	Thigh bar	steel	30 x 30 x 440
22	Knee tube	steel	52 x 46 x 40
23	Hip connection tube	steel	70 x 64 x 250
24	Friction plates (four)	steel	160 x 75 x 1
25	Tensioner assembly	steel	M12 x 320 Plates and nuts
26	Knee tube	steel	52 x 46 x 160
27	Knee connection tube	steel	44 x 39 x 190
28	Tensioner plate	steel	70 dia x 4
29	Shin tube	steel	50 x 50 x 2 x 460
30	Sole plate	steel	100 x 170 x 3
31	Torso correction mass (six)	polyurethane	Each mass 1 kg
32	Cushion	polystyrene foam	350 x 250 x 25
33	Overall	cotton and polyamide straps	--
34	Hip correction masses (six)	steel	Each mass 1 k

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test

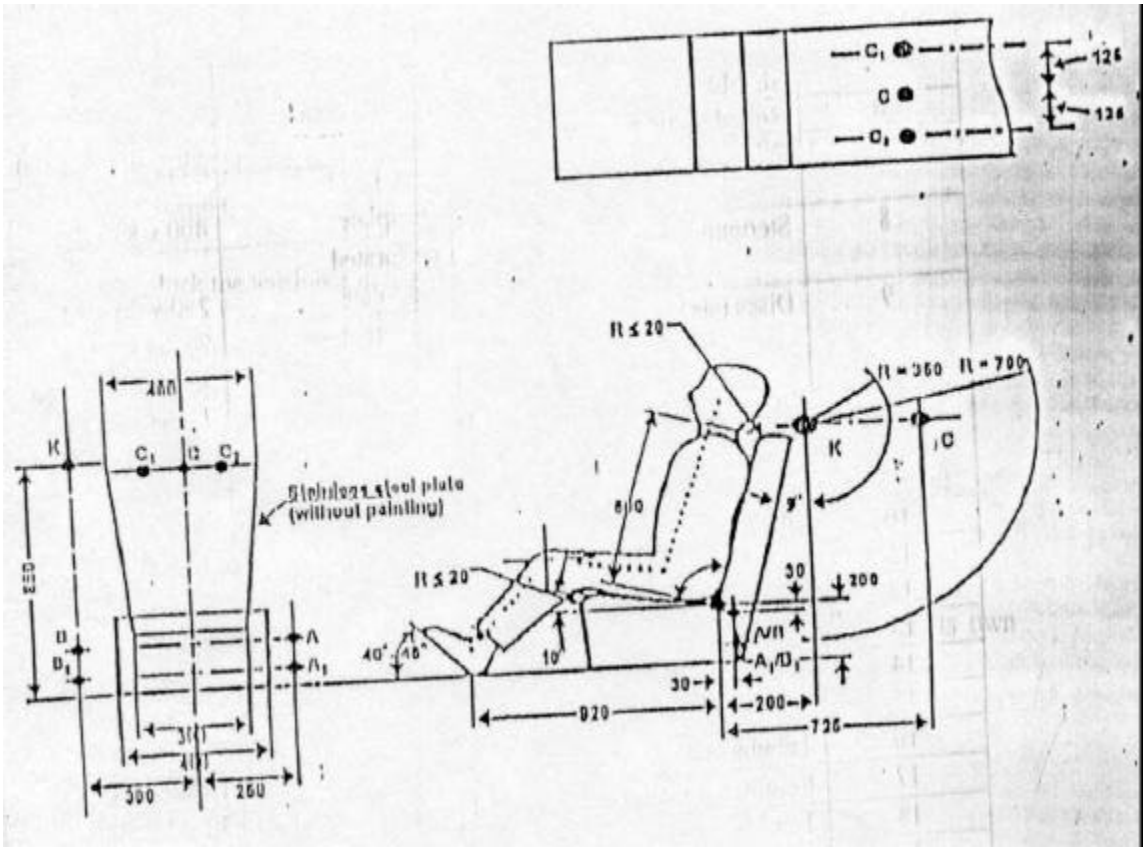


Fig.1 : Trolley, Seat, Anchorage
(Ref. Para. 5.6.2.1 and 5.6.2.8.5.7)

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test

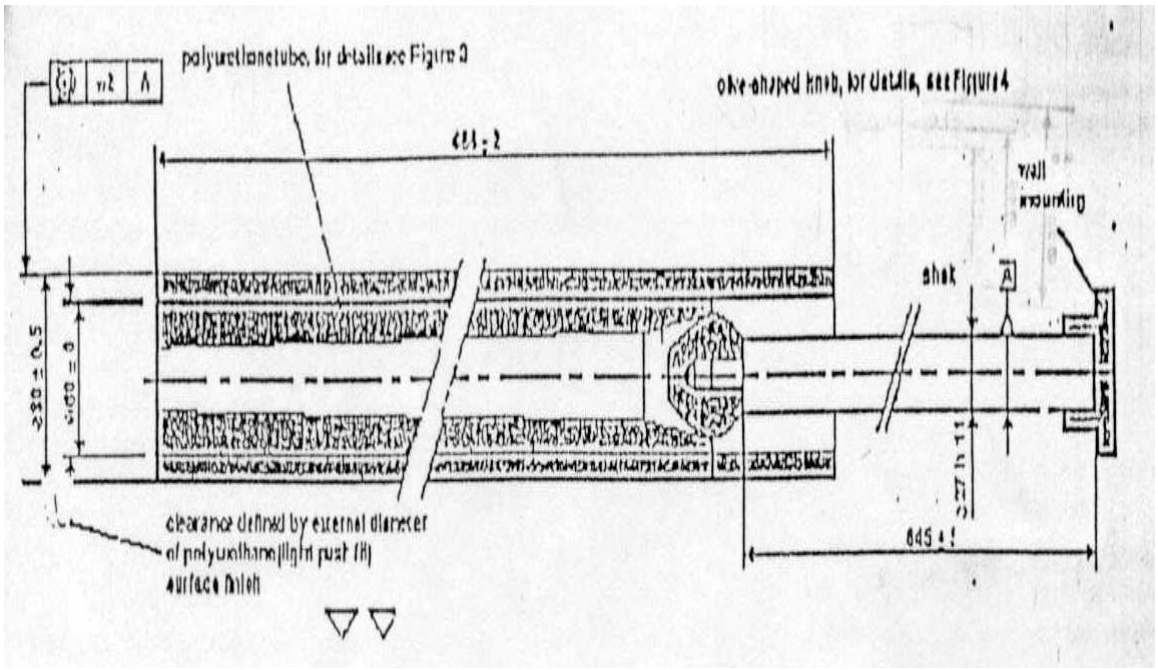


Fig.2 : Stopping Device
(Ref. Annexure 15 Para. 4.3)

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test

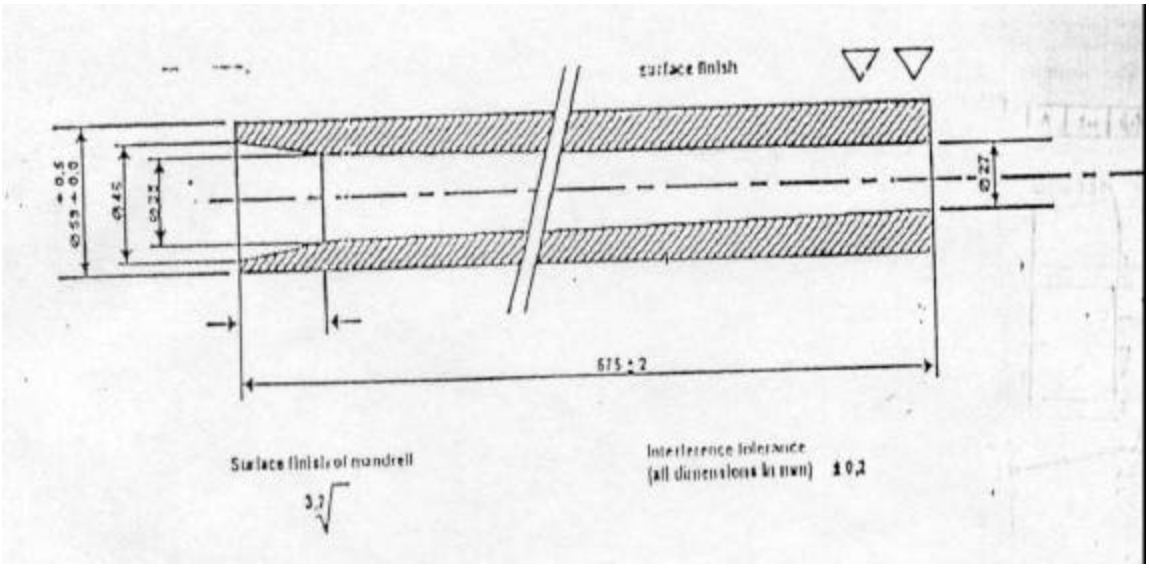


Fig.3 : Stopping Device (polyurethane tube)
(Ref. Annexure 15 Para. 4.3)

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test

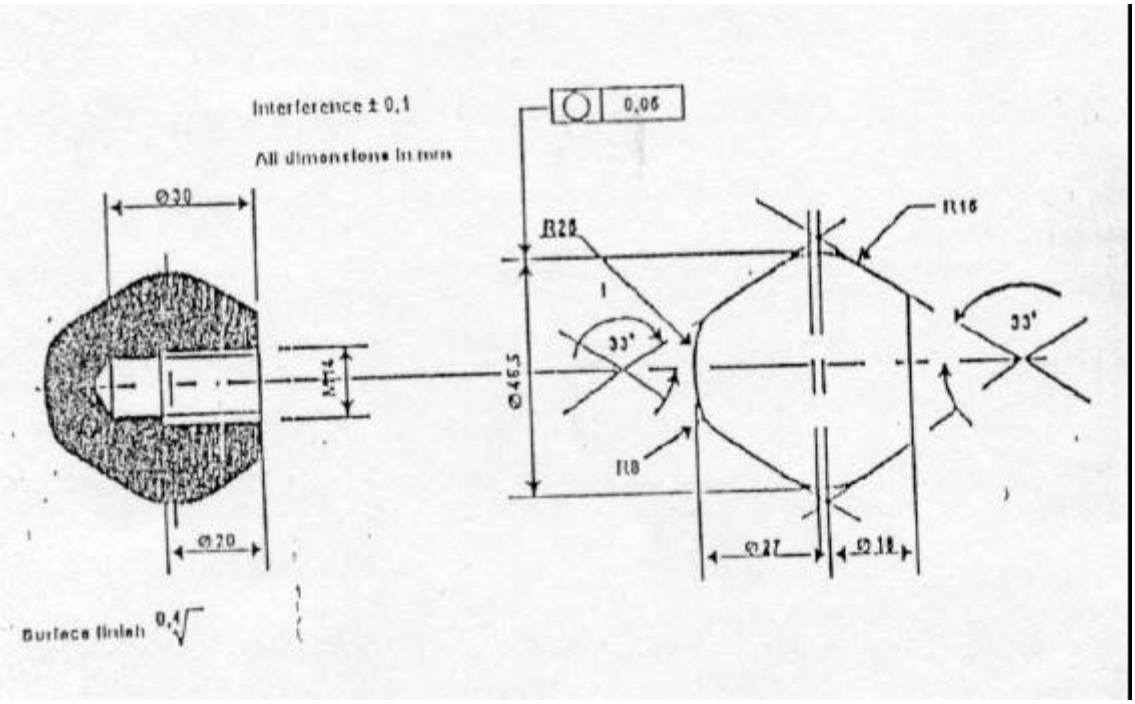
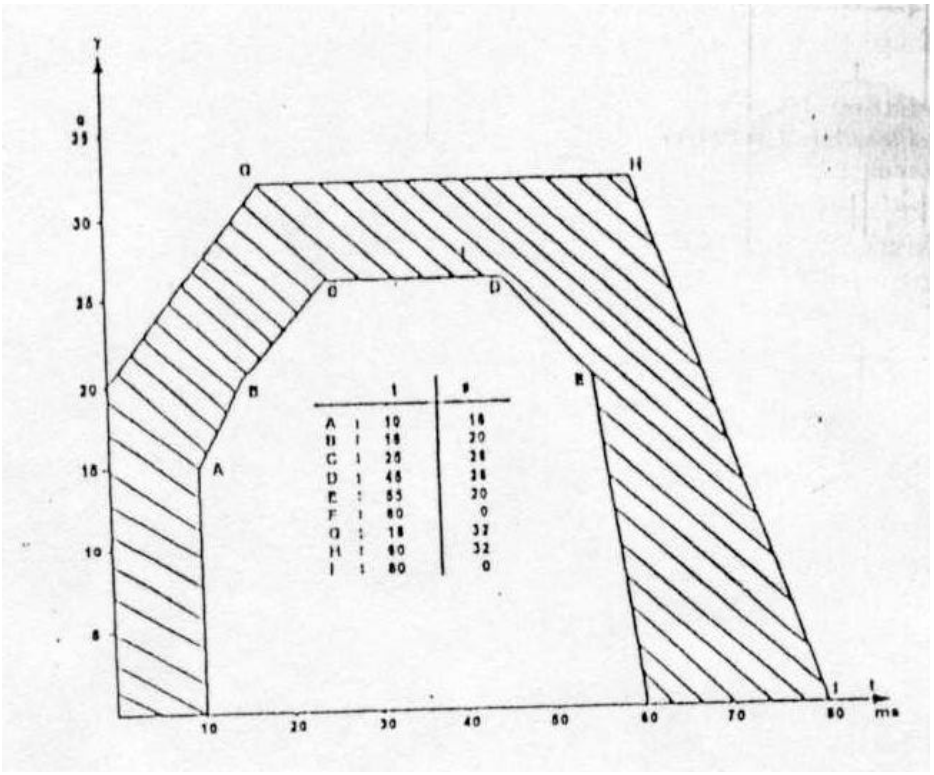


Fig.4 : Stopping Device (olive-shaped knob)
(Ref. Annexure 15 Para. 4.3)

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test



	t	g
A	10	15
B	15	20
C	25	26
D	45	26
E	55	20
F	60	0
G	18	32
H	60	32
I	80	0

Fig.5 : Description of the Curve of Trolley Deceleration According to the Time (Ref. Para. 5.6.2.10)

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test

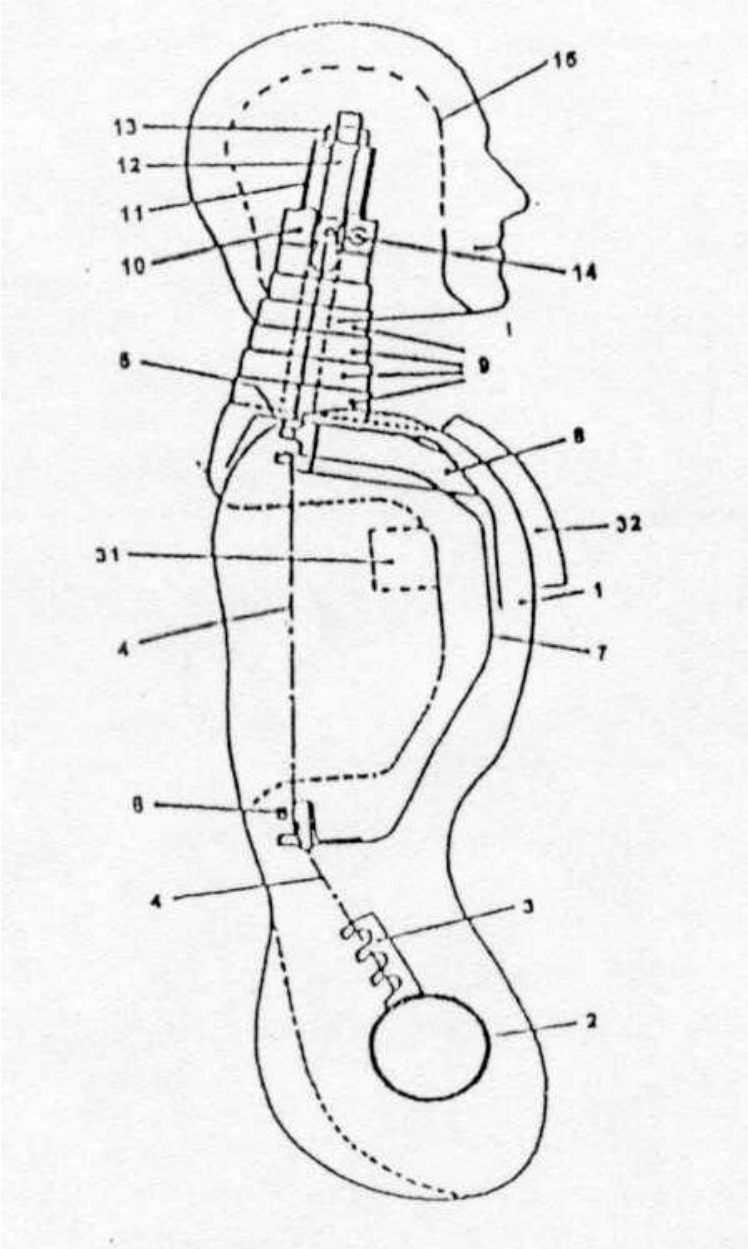


Fig.6 : Manikin - Side View of Head, Neck and Torso
(Ref. Annexure 15 Para. 5.1.1)

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test

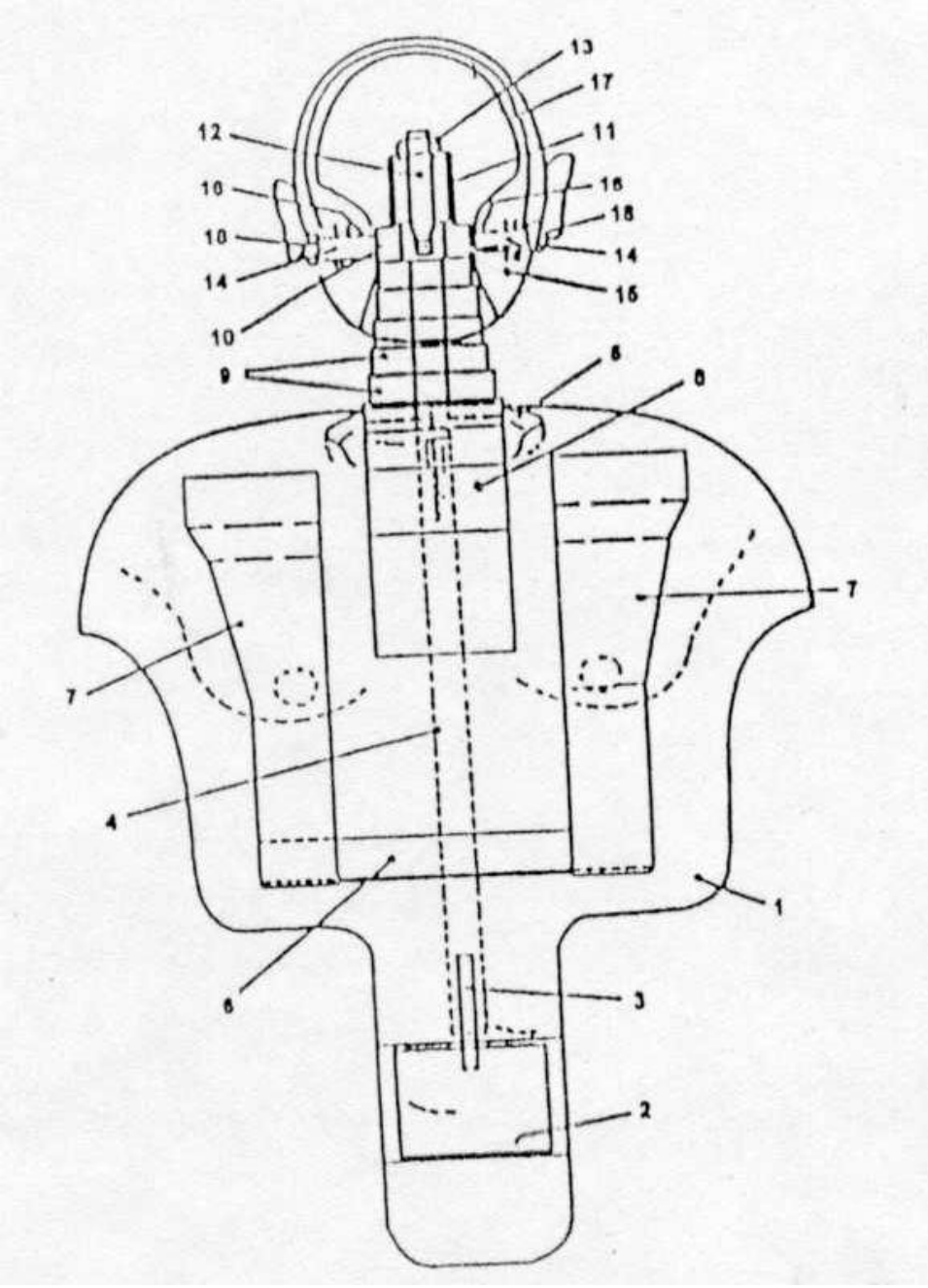


Fig.7 : Manikin - Front View of Head, Neck and Torso
(Ref. Annexure 15 Para. 5.1.1)

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test

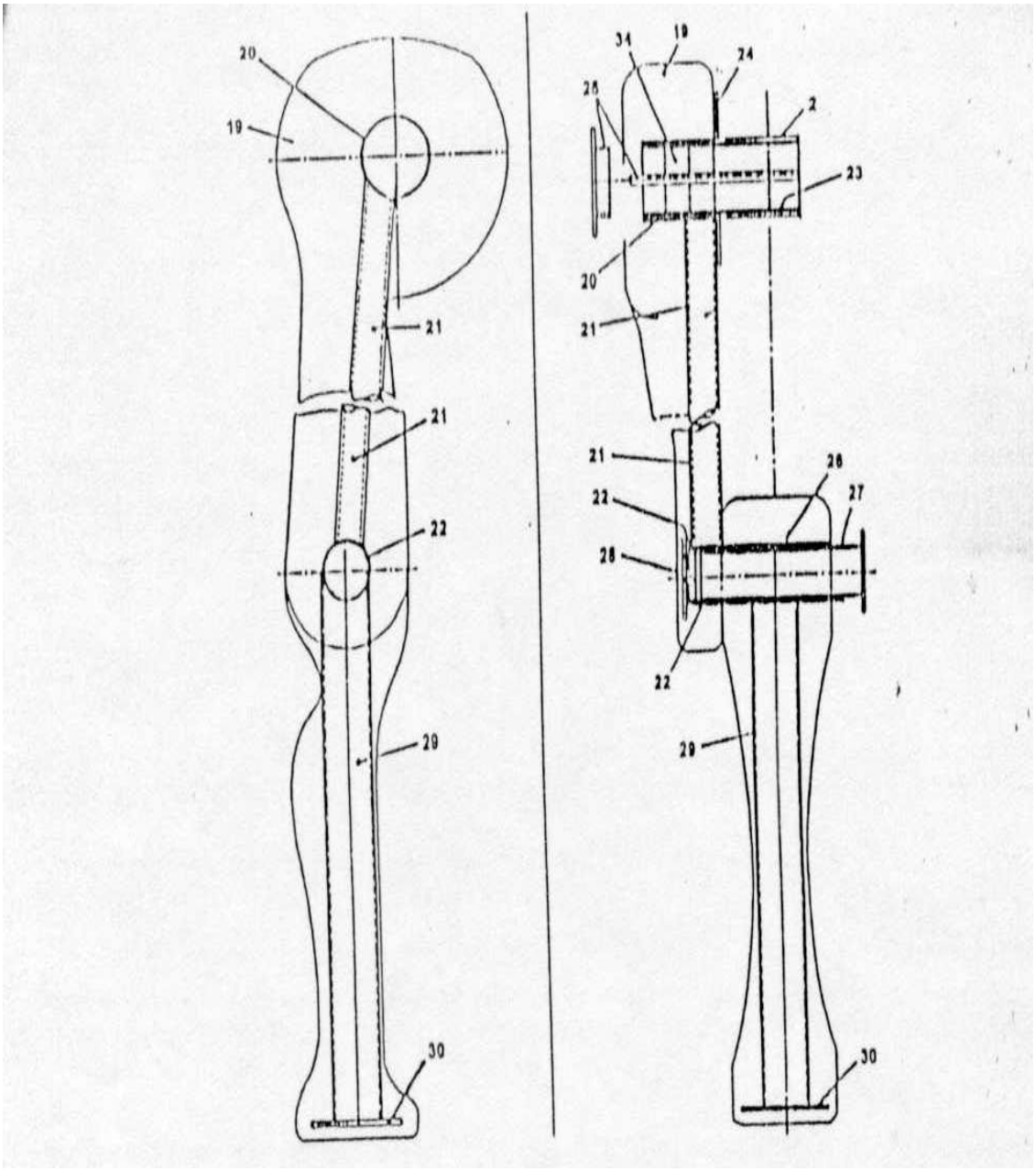


Fig.8 : Manikin - Side View of Hip, Thighs and Lower Leg

Fig.9 : Manikin - Front View of Hip, Thighs and Lower Leg

(Ref. Annexure 15 Para. 5.1.1)

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test

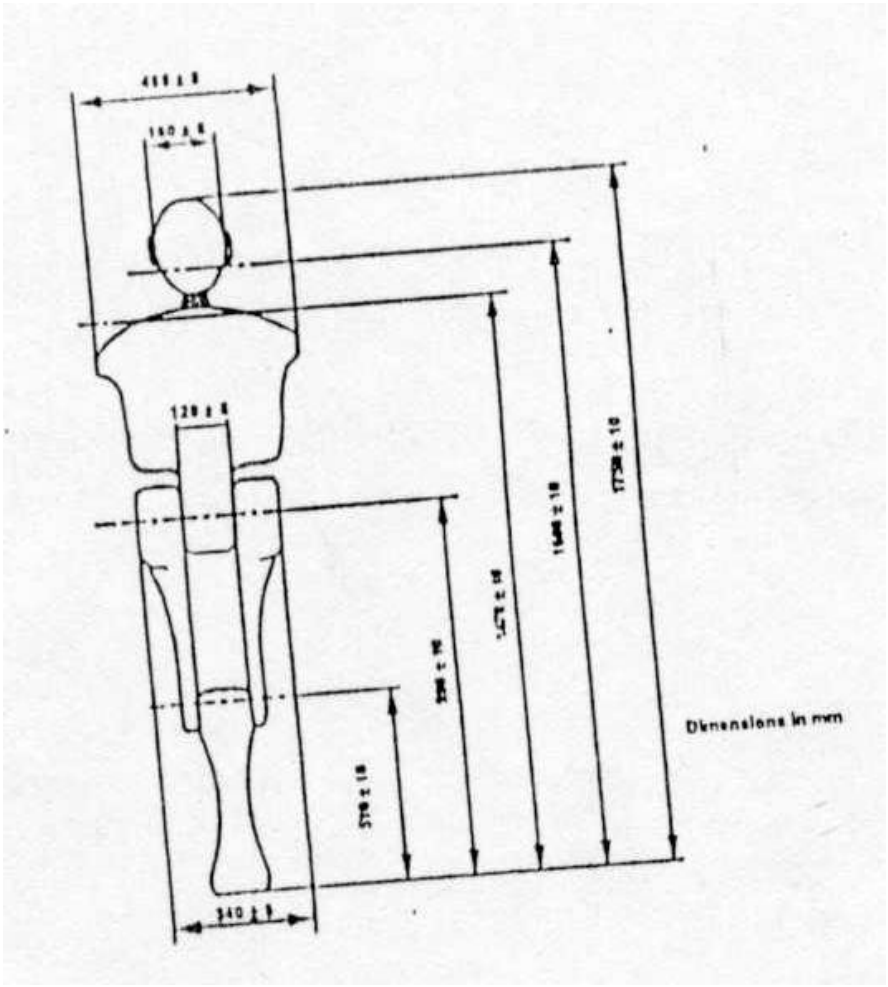
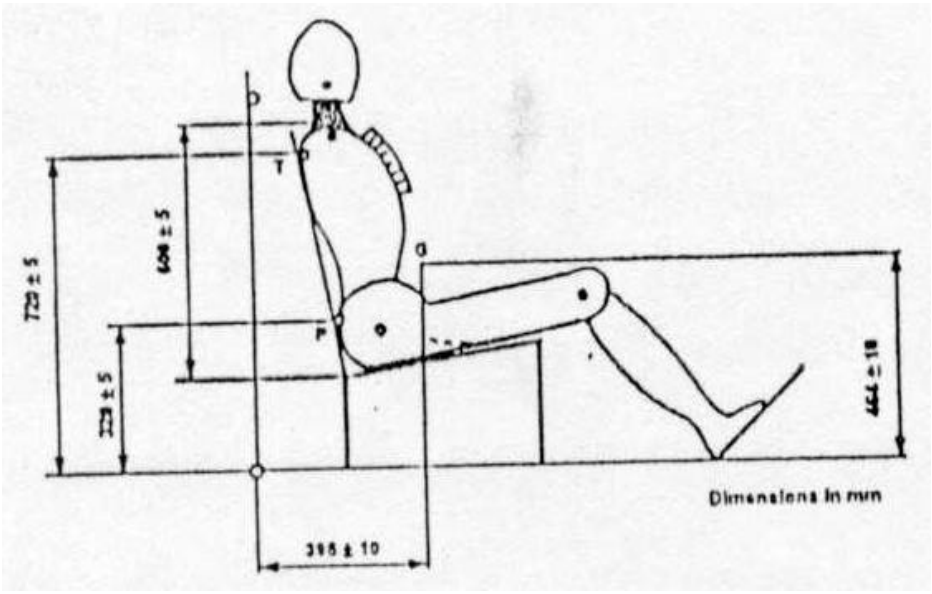


Fig.10 : Manikin - Principle Dimensions
(Ref. Annexure 15 Para. 5.1.1)

Annex-XV : Description of Trolley, Seat Anchorages, Stopping Device and Manikin for Dynamic Test



Manikin seated in a position shown in Figure 1
G = Centre of gravity
T = Torso measurement point (located at the centre line of the manikin)
P = Pelvis measurement point (located at the back on the centre line of the manikin)

Fig.11 : Manikin in Seated Position
(Ref. Annexure 15 Para. 5.1.1)

ANNEXURE-XVI

LIST OF MEMBERS OF "PANEL ON SAFETY BELTS"

01	Dr.P.D.Singhal Asst. General Manager Tata Engg. & Locomotive Co. Ltd. Pimpri **Pune - 411 018**	- Convenor	FAX : 7472308 E-Mail : pds12076@telco.co.in
02	Mr.I.V.Rao General Manager Maruti Udyog Ltd. Palam-Gurgaon Road **Gurgaon - 122 015**		FAX : 0124-341304 E-Mail : spurush@mul.co.in
03	Mr.S.Pal Scientist 'C' Vehicle Research & Devpt. Establishment P.O.Vahannagar **Ahmednagar - 414 006**		FAX : 0241-341410 E-Mail : root@dvrde.ren.nic.in
04	Mr.Z.A.Mujawar Dy. General Manager - Veh. & Comp. Testing Mahindra & Mahindra Ltd. 89, MIDC, Satpur **Nashik - 422 007**		FAX : 0253-352302 E-Mail : mujawar.zia@mahindra.co.in
05	Mr.G. P. Bannerji Executive Officer Automotive Component Manufacturers of India 203-205, Kirti Deep Building Nangal Raya Business Centre **New Delhi - 110 046**		FAX : 011-5593189 E-Mail : acma@vsnl.com
06	Mr.Subodh Kumar Scientist 'E' director.cirt@gems.vsnl.net.in Central Institute of Road Transport Bhosari **Pune - 411 026**		FAX : 795426 E-Mail :
07	Mr.V.Raghu Sr. Executive Vice President Autoliv IFB India Ltd. 16, Visveswaraiah Indl. Estate 1st Main Road, Off. Whitefield Road **Bangalore - 560 048**		FAX : 080-8517651 E-Mail : aiil@bgl.vsnl.net.in

08	Dr.A.R.Gulati Director (Transport Engg.) Bureau of Indian Standards Manak Bhavan 9, Bahadur Shah Zafar Marg **New Delhi - 110 002**	FAX : 011-3239399 E-Mail : bisind@del2.vsnl.net.in
09	Mr.S.M.Iqbal President TRW Rane Occupant Restraints Ltd. 48 KM, G.S.T.Road (NH 45) **Singaperumal Koil - 603 204** TAMIL NADU	FAX : 04114-464429 E-Mail : trwrane@vsnl.com
10	Mr.K.P.V.Babu Manager - Technical Abhishek Auto Industries Ltd. 380-381, Udyog Vihar, Phase-IV **Gurgaon - 122 015**	FAX : 0124-343419
11	Mr.Ramesh Gavnekar Asst. Manager (Auto Parts) Goradia Forge Ltd. Seat Belt Division 366, S.V.P.Road, Prarthana Samaj **Mumbai - 400 004**	
12	Mr.Sandip Khuilar Jai Bharat Allied Signal Ltd. Plot No.133, Sector 24 **Faridabad - 121 005**	
13	Mr.Michael Pereira Bond Safety Belts Bhaktavar, Ground Floor Opp. Colaba Post Office **Mumbai - 400 005**	
14	Mr.G.S.Kashyab Industrial Adviser Office of the Devpt. Commissioner Dept. of SSI, Agro & Rural Industries Ministry of Industry 7th Floor, Nirman Bhavan, M.A.Marg **New Delhi - 110 011**	FAX : 011-3017277

****

Annexure: XVII

(See Introduction)

COMMITTEE COMPOSITION

Automotive Industry Standards Committee

Chairman	Representing
Shri. B. Bhanot	Director The Automotive Research Association of India, Pune.
Members	
Shri. V.C. Mathur	Department of Heavy Industry, Ministry of Industries & Public Enterprises, New Delhi.
Shri. J. R. Kapoor	Ministry of Surface Transport, New Delhi.
Shri. G. S. Kashyab Shri. M.K. Bhat (Alternate)	Office of the Development Commissioner Small Scale Industries, Ministry of Industry, New Delhi.
Shri. A. R. Gulati	Bureau of Indian Standards, N. Delhi.
Shri. R. C. Sethi Shri. N. Karuppaiah (Alternate)	Vehicle Research & Development Establishment, Ahmednagar.
Shri. S. R. Tapade Shri. P. C. Barjatia (Alternate)	Central Institute of Road Transport, Pune.
Dr. P. D. Singhal	Society of Indian Automobile Manufacturers.
Shri. T. M. Balaraman	Society of Indian Automobile Manufacturers.
Shri. I. V. Rao	Society of Indian Automobile Manufacturers.
Shri. Z. A. Mujawar (Alternate)	Society of Indian Automobile Manufacturers.
Shri. Vivek Adyanthaya (Alternate)	Society of Indian Automobile Manufacturers.
Shri. U. K. Kini (Alternate)	Society of Indian Automobile Manufacturers.
Shri. T. C. Gopalan	Tractor Manufacturers Association, New Delhi.
Shri. Klaus Goehring	Automotive Components Manufacturers Association.
Shri. G. P. Banerji	Automotive Components Manufacturers Association

Member Secretary
Mrs. Rashmi Urdhwareshe,
Sr. Assistant Director
The Automotive Research Association of India, Pune