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R 1231

SEAT BELT ASSEMBLIES FOR MOTORISTS

1st EDITION

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BRIEF HISTORY

The ISO Recommendation R 1231, *Seat belt assemblies for motorists,* was drawn up by Technical Committee ISO/TC 94, *Personal safety – Protective clothing and equipment,* the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1142, which was circulated to all the ISO Member Bodies for enquiry in January 1967, and was approved by the requisite majority of Member Bodies. However, after having examined some of the comments put forward, the Secretariat deemed it necessary to prepare a second Draft ISO Recommendation No. 1142, which was submitted to all ISO Member Bodies in September 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Austria	Hungary	Switzerland
Belgium	Israel	Turkey
Colombia	New Zealand	U.A.R.
Denmark	Norway	United Kingdom
France	Romania	U.S.A.
Germany	Spain	U.S.S.R.
Greece	Sweden	Yugoslavia

The following Member Bodies opposed the approval of the second Draft :

Australia
Italy
Japan
South Africa, Rep. of

This second Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

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SEAT BELT ASSEMBLIES FOR MOTORISTS

INTRODUCTION

The Technical Committee responsible for drafting this ISO Recommendation wishes to point out that some of the proposed tests have not been included. These tests, and in particular the dynamic test, call for investigations regarding their reproducibility and other features. It was considered inadvisable to delay the issue of an ISO Recommendation on this account in view of the fact that this ISO Recommendation includes the requirements necessary to ensure a reasonably safe seat belt, and indeed covers all those that were applied to seat belts until comparatively recently.

The tests to be added later are noted in clause 1.4.

1. SCOPE

1.1 This ISO Recommendation lays down the requirements and test methods for motorists' seat belts and harnesses for separate use, i.e. as individual equipment by adult occupants of motor vehicles, in order to minimize the risk of bodily harm in an accident.

1.2 Manufacturing requirements are specified for the materials used and for the finish of buckles and metal parts. The tests specified are restricted to the determination of the suitability of a belt or harness assembly and of its components.

1.3 The Recommendation does not cover requirements for the parts of the vehicle to which seat belt assemblies are anchored. (See ISO Recommendation R 1417, *Anchorages for seat belts.**)

1.4 Tests are given to ascertain compliance with the following requirements :

(*a*) tensile strength of the webbing or other material used for the straps;

(*b*) buckle slipping under load;

(*c*) buckle release load;

(*d*) the load-carrying capacity and elongation of the entire belt or harness assembly under static and/or dynamic** loading;

(*e*) variation in width of webbing under load;

(*f*) resistance to heat;

(*g*) resistance to cold;

(*h*) wet strength;

(*j*) resistance to light.

To be added later :

(*k*) resistance to ageing;

(*l*) resistance to abrasion.

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* At present Draft ISO Recommendation.

** To be added after completion of investigations.

2. DEFINITIONS

For the purposes of this ISO Recommendation the following terms and definitions apply (see also Figure 1).

2.1 Assemblies

2.1.1 *Seat belt or harness* (Safety belt or harness). An arrangement of straps, a buckle or buckles, and fittings firmly secured to the structure of a motor vehicle and designed to prevent or lessen injury to the wearer in the event of certain types of accident. It is referred to in the general sense as an "assembly".

2.1.2 *Lap belt or lap strap.* A seat belt, or part of an assembly, which passes across the pelvic region of the wearer.

2.1.3 *Diagonal belt or diagonal strap.* A seat belt, or part of an assembly, which passes diagonally across the chest from the hip to the opposite shoulder.

2.1.4 *Three-point belt.* An assembly comprising a lap belt and a diagonal belt anchored at three points.

2.1.5 *Harness.* An assembly comprising a lap belt and shoulder straps.

2.2 Components

2.2.1 *Shoulder straps.* That part (two straps) of an assembly which restrains the upper portion of the body of the wearer.

2.2.2 *Webbing.* The flexible strap used for body restraint, usually made of a textile material. When the term "webbing" is used in this ISO Recommendation it may cover any alternative materials used as straps.

2.2.3 *Adjusting device.* A device to permit the assembly to be adjusted to the requirements of the individual wearer. It may be part of the securing buckle.

2.2.4 *Securing buckle.* A buckle of quick release pattern but not capable of being opened unintentionally, which secures the wearer within the assembly. It may incorporate the adjusting device.

2.2.5 *Attachment fittings.* The parts of the assembly provided to attach it to the vehicle anchorages.

3. GENERAL REQUIREMENTS

3.1 Construction of an assembly

The assembly should be composed of the following :

(*a*) body restraining components;

(*b*) load carrying components which may be continuous with the body restraining components;

(*c*) attachment fittings, to secure the body restraining or load carrying components to the anchorages;

(*d*) means of adjusting the body restraining components to suit the individual wearer;

(*e*) means of securing the wearer within the body restraining components;

(*f*) means of quick release;

(*g*) additional parts to provide anchorage to the vehicle structure for attachment fittings, where such anchorages are not part of the vehicle structure.

3.2 Design requirements

3.2.1 The characteristics of the complete assembly should be compatible with its use in the interior of a motor vehicle. Every effort should be made in the design of the assembly to ensure that in case of collision no dangerous forces are exerted which could cause severe injury. It is of particular importance that the design characteristics should be such that during deceleration the force applied to the pelvic area is in a downward and rearward direction and that loads on the shoulder portion of the belt do not tend to pull the lap portion of the belt upwards.

3.2.2 Adjusting devices to be used when putting on the belt should be readily accessible to the wearer and the design of the belt should be such that, while there is no slipping under varying and repeated part loading, the belt is capable of easy adjustment.

3.2.3 The buckle or other release device should be so positioned that it can be released with each hand singly by the seated wearer, and also by any other person in case of emergency.

3.2.4 The design of any separable parts of an assembly should be such that either they cannot be put together incorrectly, or their connection other than as intended will not adversely affect their function.

CAUTIONARY NOTES

1. It is essential that when the assembly is installed the vehicle structure* together with any reinforcing plates supplied with the assembly should be strong enough to sustain the test load specified in clause 6.2, and should conform to ISO Recommendation R 1417, *Anchorages for seat belts***, for seat belt anchorage points. Data on tested anchorage installations should be sought from the vehicle manufacturer.
2. It is also essential that when an attachment fitting is provided for more than one seat belt or harness, its strength and the strength of its attachments to the vehicle anchorages should be sufficient to sustain the sum of the effects of the loads from all individual belts or harnesses.
3. For vehicles not provided with anchorages by the car manufacturer, either the installation of anchorages should follow the general lines of ISO Recommendation R 1417**, or the user should be recommended to obtain proper advice from the manufacturer or his qualified agent.

3.3 Requirements for provision of instructions

3.3.1 Written instructions, illustrated where necessary, and in the language of the country in which it is sold, should be supplied with each assembly to ensure that the purchaser knows the method of installation and attachment, and how to obtain the greatest benefit from the assembly. In these instructions should appear warnings against alterations and additions, and advice to the user to consult the manufacturer in case of doubt.

3.3.2 The manufacturer should also provide written instructions in the language of the country in which the sale is made to explain the method of operating the securing buckle and adjusting device and the cleaning of the assembly.

3.3.3 The testing authority should check that the above points are satisfactorily explained in the instructions.

4. REQUIREMENTS FOR WEBBING

4.1 Width

Under a load of 9800 N (1000 kgf) (2200 lbf), the width of the webbing should not be less than 46 mm ($1\frac{13}{16}$ in) except that the shoulder straps of a complete harness may have a minimum width of 43 mm ($1\frac{11}{16}$ in). The measurement is made during the assessment of the breaking load referred to in clause 4.2 and without stopping the machine.

4.2 Breaking load

The test pieces are selected, conditioned and tested in accordance with clause 7.1. The breaking load of the webbing is measured and should not be less than 14 700 N (1500 kgf) (3300 lbf).

4.3 Residual strength

When it is already known that the webbing satisfies one or more of the requirements given in clauses 4.3.1 to 4.3.4, the appropriate tests may be waived.

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* Unless the car seats are properly reinforced, the structure of a vehicle is not considered to include the car seats.

** At present Draft ISO Recommendation.

4.3.1 *Resistance to heat*

4.3.1.1 A test piece is cut from the same webbing as that from which test pieces were cut for assessment of breaking load in accordance with clause 4.2. The test piece should be kept in equilibrium with air for 3 hours at a temperature of 60 ± 5 °C and a relative humidity of 65 ± 5 %.

4.3.1.2 The test piece is subjected to the breaking load test within 5 minutes of removal from this environment.

4.3.1.3 The webbing should have retained at least 75 % of its original breaking load; its breaking load should not in any event be less than 14 700 N (1500 kgf) (3300 lbf).

4.3.2 *Resistance to cold*

4.3.2.1 A test piece is cut from the same webbing as that from which test pieces were cut for the assessment of breaking load in accordance with clause 4.2.

4.3.2.2 After conditioning in accordance with clause 7.1.3, the test piece should be stored for one and a half hours on a plane surface at an air temperature of − 30 ± 5 °C. It is then folded and the bend loaded with a weight of 2 kg (4 lb) which has been cooled to a temperature of − 30 °C. After an additional storage of 30 minutes in the same environment, the weight is removed and the breaking load test is applied to the specimen within 5 minutes of removal from the cold environment.

4.3.2.3 The webbing should have retained at least 75 % of its original breaking load; its breaking load should not in any event be less than 14 700 N (1500 kgf) (3300 lbf).

4.3.3 *Wet strength*

4.3.3.1 A test piece is cut from the same webbing from which test pieces were cut for the assessment of breaking load in accordance with clause 4.2.

4.3.3.2 The test piece is fully immersed for 3 hours in distilled water at 20 ± 5 °C with the addition of 1 g of a recognized wetting agent suitable for the fibre under test. If it is desired to specify the wetting agent in detail, this could be one which is an ethylene oxide condensate of alkyl phenol. The webbing is subjected to the breaking load test within 10 minutes of removal from the water.

4.3.3.3 The webbing should have retained at least 75 % of its original breaking load; its breaking load should not in any event be less than 14 700 N (1500 kgf) (3300 lbf).

4.3.4 *Resistance to light*

4.3.4.1 A test piece is cut from the same webbing from which test pieces were cut for the assessment of breaking load in accordance with clause 4.2.

4.3.4.2 The test piece is exposed to the light from a carbon arc in accordance with clause 7.4 for a period of 100 hours after which it is subjected to the breaking load test.

4.3.4.3 The webbing should have retained at least 75 % of its original breaking load; its breaking load should not in any event be less than 14 700 N (1500 kgf) (3300 lbf).

5. REQUIREMENTS FOR BUCKLES AND ATTACHMENT FITTINGS

5.1 Strength

5.1.1 All buckles and metal parts should comply with the appropriate test and other requirements applicable to them in the complete assembly. After being subjected to such tests, buckles should function satisfactorily.

5.1.2 The securing buckle should not break, seriously distort or disrupt under a load of less than 9800 N (1000 kgf) (2200 lbf).

5.1.3 The securing buckle should be capable of withstanding repeated operations and should be operated 5000 times before the assembly is tested statically in accordance with clause 6.2.

5.2 Design

5.2.1 The size and shape of the securing buckle should not be such as to cause undue pressure or injury to the wearer in an accident, and no width of the buckle should be less than the width of the strap wherever it is in contact with the wearer.

5.2.2 The securing buckle and any release device should not permit partial engagement that would allow it to open inopportunely. The buckle or other release device should be of the quick-release type.

5.3 Finish

5.3.1 All parts should be free from burrs and sharp edges.

5.3.2 All metal parts should be resistant to corrosion and, when tested in accordance with clause 7.3, no part should show significant signs of corrosion.

6. REQUIREMENTS FOR ASSEMBLY

6.1 Dynamic test

A dynamic test will be added later.

6.2 Static test

(Assembly working load)

6.2.1 After operating the securing buckle in accordance with clause 5.1.3, the static test is applied in accordance with clause 7.2 using a test load of 17 640 N (1800 kgf) (4000 lbf). On completion of the test, apart from permanent stretching of the webbing no part of the assembly should show failure, or fracture of the anchorage shackle or shackles, or shear pins etc., but on visual inspection very minor defects unlikely to affect the functioning of the assembly in normal use may be considered acceptable.

6.2.2 Any partial failure of the stitching should be checked by a repeat test on the same assembly. If the stitching does not then fail completely it should be accepted.

6.3 Maximum horizontal displacement

When tested in accordance with clause 6.2 the maximum forward displacement of the dummy during the application of the test load should not exceed 200 mm (8 in) at the lap for lap belts, and 300 mm (12 in) at chest level for all other assemblies.

6.4 Energy absorption

6.4.1 When it is not known whether the webbing is suitable for seat belts, a stress/strain curve on the assembly should be ascertained to confirm its suitability. This determination may be made on the static test apparatus when the initial load of the trolley should be 980 N (100 kgf) (220 lbf) and after the application of a load of 17 640 N (1800 kgf) (4000 lbf) it should be reduced to 980 N.

6.4.2 For all designs of assemblies the energy absorption derived from this curve should be not less than 800 N·m (80 kgf·m) (530 ft·lbf) at a load of 17 640 N (1800 kgf) (4000 lbf) and the irreversible proportionate energy should be not less than 50 %.

6.5 Slipping of webbing

During the application of the static test in clause 6.2, the total amount of slipping of the webbing through the buckles or adjusting devices is measured. This should not exceed 25 mm (1 in) for each buckle or adjusting device. The total amount of slipping in the assembly should not exceed 50 mm (2 in).

6.6 Securing buckle release

When the assembly is loaded to 685 ± 50 N (70 ± 5 kgf) (150 ± 10 lbf) the force required to release the securing buckle should not exceed 120 N (12 kgf) (27 lbf), and the operating device should withstand this force without distortion. The test is applied as in clause 7.2.4.

A buckle designed for push-button application of buckle release force shall have a minimum area of 4.5 cm^2 (0.7 in^2) with a minimum linear dimension of 10 mm (0.4 in) for applying the release force.

7. TEST METHODS

7.1 Tests for webbing breaking load

7.1.1 *Apparatus.* The test is carried out on a machine with an accuracy of ± 1 % and on a scale such that the breaking load is more than 20 % of the full capacity or scale reading. The machine may be either a constant rate of loading machine, the rate of loading being such that the time taken to reach the specified breaking load is 60 ± 10 seconds, or a constant rate of traverse machine with a rate of 100 mm (4 in) per minute.

7.1.2 *Sample.* The test sample consists of not fewer than three test pieces of sufficient length, cut from webbing which has not been previously stressed.

7.1.3 *Conditioning.* Test pieces are conditioned before testing for 24 hours in an atmosphere of 65 ± 2 % relative humidity, at a temperature of 20 ± 2 °C. If the test is not to be carried out immediately after conditioning, the test pieces should be placed in a tightly closed container until the start of the test.

7.1.4 *Procedure.* The test is started within 5 minutes of the removal of each test piece from the conditioning atmosphere or from the container. The piece is mounted between the grips of the machine so that its free length between the grips of the machine is $200^{+\,40}_{\ 0}$ mm ($8^{+\,1\frac{1}{2}}_{\ 0}$ in).

The machine is operated and the load is increased to that specified. If any test piece slips or breaks at either of the grips within 10 mm of the grips at a load less than the specified minimum breaking load, the result of that test is discarded and a further test piece is tested.

An example of a satisfactory grip is illustrated in Figure 4.

When the load is 9800 N (1000 kgf) (2200 lbf) the width of the webbing is measured without stopping the machine. The load is increased until the webbing breaks and this load is measured.

7.1.5 *Test report.* The width of the webbing at a load of 9800 N, and the breaking load, are reported.

7.2 Assembly test

7.2.1 *Apparatus.* A typical test rig is shown in Figure 2. The test load is applied to the dummy by using a fixed dummy suitably attached to a trolley guided to move in the direction of motion of a vehicle. The dummy is sufficiently rigid in construction not to be significantly deformed under the test load. Dimensions of the dummy are given in Figure 5.

7.2.2 *Sample.* The sample consists of at least two new and not previously loaded assemblies complete with all attachment fittings as provided by the supplier. The buckles should previously have been operated as described in clause 5.1.3.

7.2.3 *Preparation.* The assembly is erected on the test apparatus in accordance with Figure 3. If, however, the assembly is intended for a specific vehicle or specific types of vehicle, the relationship between the dummy and the anchorage points should be determined by the testing authority guided by the installation instructions supplied with the belt assembly.

Care should be taken to lock a cam type buckle only with the force of its spring; it should not be forced or allowed to snap down. If a metal-to-metal buckle is used, it should be checked to see that there is no danger of latching the two parts together in a manner resulting in reduced strength or reduced holding ability.

If the design allows, any free end of webbing should extend beyond any appropriate adjusting device by an adequate amount to accommodate slipping.

The webbing should be marked on the unloaded side of each buckle or metal part in the assembly.

7.2.4 *Procedure.* The test load is applied to the dummy horizontally in such a manner that the centre of gravity of the dummy moves horizontally and in a direction parallel to the movement of the test rig trolley, and at such a rate as to cause a trolley movement of 100 mm (4 in) per minute from no load to full load. The maximum forward displacement of the dummy at the lap for lap belts and at chest level for all other assemblies is measured.

The load is reduced to 685 ± 50 N (70 ± 5 kgf) (150 ± 10 lbf) and, while maintaining this load, a force should be applied by a spring balance or other load measuring device to the buckle in a manner and direction typical of that which would normally be employed to open it. For instance, for lever release buckles the force may be applied on the centre line of the buckle lever or finger tab, 3 mm ($\frac{1}{8}$ in) from its edge and in such direction as to produce maximum releasing effect. The buckle release load is measured.

NOTE. – Other equivalent and correct methods of determining the maximum buckle release force are acceptable.

7.2.5 *Test report.* The following should be reported :

(*a*) any damage to the assembly;

(*b*) the amount of slipping of webbing at each buckle and adjusting device;

(*c*) the force required to release the securing buckle when the assembly is under reduced load;

(*d*) the maximum forward displacement of the dummy at the lap for lap belts, and at chest level for all other assemblies;

(*e*) energy absorption and irreversible proportionate energy (if required).

7.3 Corrosion test

7.3.1 *Procedure.* Metal parts are placed in a boiling solution of sodium chloride (10 % m/m) for 15 minutes. They are then immediately dropped into a similar solution at ambient temperature and without wiping off are left to dry at ambient temperature for 24 hours.

7.3.2 *Test report.* Metal parts are examined visually and any sign of corrosion is reported.

7.4 Test for resistance to light

7.4.1 *Apparatus*

7.4.1.1 *Open flame carbon arc* with the following characteristics :

(*a*)	supply voltage :	208 to 250 V
(*b*)	arc voltage :	48 to 52 V
(*c*)	arc current :	58 to 62 A a.c. or d.c.
(*d*)	upper carbon electrode :	22.2 mm ($\frac{7}{8}$ in) × 305 mm (12 in) copper coated sunshine
(*e*)	lower carbon electrode :	12.7 mm ($\frac{1}{2}$ in) × 305 mm (12 in) copper coated sunshine

7.4.1.2 *Flat panes of optical heat resistant glass* with cut-off at 255 nm (2550 Å) with an increase in transmission to 91 % at 360 nm (3600 Å), interposed between the test pieces and the carbon arc.

7.4.1.3 *Test piece rack*, 958 mm (37 $\frac{3}{4}$ in) in diameter with a speed of rotation of one revolution per minute.

7.4.1.4 *Means for maintaining the air temperature at 60 ± 2 °C* at a point 25 ± 5 mm (1 ± 0.2 in) outside the specimen rack and midway in height. The temperature sensing element is shielded from radiation.

7.4.2 *Procedure.* The webbing is suspended vertically on the inside of the specimen rack above and below the horizontal centre line of the radiation source. The apparatus is operated at one revolution per minute at a temperature of 60 ± 2 °C, and the webbing is exposed to the light of the carbon arc for 100 hours.

In order to provide uniform exposure conditions over their surface, the positions of the test specimens are changed daily by rotating the specimen position in the drum or rack in four steps, employed in the same sequence, from upper to lower specimen row and inverted in both specimens rows.

NOTE. – The flat panes of glass should be replaced after 2000 hours of use, or when pronounced discolouration develops, whichever occurs first. Panes should be cleaned each day by washing with detergent and water. It is also recommended that half the panes be replaced after each 1000 hours of operation.

After 100 hours exposure the test samples are conditioned as in clause 7.1.3 and subjected to the breaking load test given in clause 7.1.4.

7.4.3 *Test report.* The breaking load of the webbing is reported.