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LAND SEA AIR SPACE

TECHNICAL REPORT J4c

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MOTOR VEHICLE SEAT BELT ASSEMBLIES - SAE J4c

SAE Standard

Report of Motor Vehicle Seat Belt Committee approved November 1955 and last revised July 1965.

1. SCOPE

1.1 This SAE Standard provides for the following types of seat belt assemblies for use in motor vehicles, in order to minimize the risk of bodily harm in an accident:

Type 1 - Lap Belt for pelvic restraint.

Type 2 - Combination of pelvic and upper torso restraints.

(Type 2a - Shoulder belt - An upper torso restraint for use only in conjunction with a lap belt as a Type 2 seat belt assembly.)

Type 3 - Combination pelvic and upper torso restraint for persons weighing 50 lb (23 kg) or less and capable of sitting upright by themselves, that is children in the approximate age range of 8 months-6 years.

1.2 This standard specifies performance requirements, laboratory test procedures and minimal design requirements for seat belt assemblies when worn in the seated position.

2. DEFINITIONS

2.1 SEAT BELT ASSEMBLY - Consists of any strap, webbing, or similar device designed to secure a person in a motor vehicle with the intention of mitigating the results of a traffic accident, including all buckles or other fasteners, and all hardware designed for installing the assembly in a motor vehicle.

2.2 PELVIC RESTRAINT - A seat belt assembly or portion thereof intended to restrain movement of the pelvis.

2.3 UPPER TORSO RESTRAINT - A portion of a seat belt assembly intended to restrain movement of the chest and shoulder regions.

2.4 HARDWARE - Any metal or rigid plastic part of the seat belt assembly.

2.4.1 Buckle - A quick release connector which fastens a person in a seat belt assembly.

2.4.2 Attachment Hardware - Any or all hardware designed for securing the webbing of a seat belt assembly to a motor vehicle.

2.4.3 Adjustment Hardware - Any or all hardware designed for adjusting the size of a seat belt assembly to fit the user, including such hardware that may be integral with a buckle, attachment hardware, or retractor.

2.4.4 Retractor - A device for storing part or all of the webbing in a seat belt assembly.

2.4.4.1 Nonlocking Retractor - A retractor from which the webbing is extended to essentially its full length by a small external force, which provides no adjustment for assembly length, and which may or may not be capable of sustaining restraint forces at maximum webbing extension.

2.4.4.2 Automatic Locking Retractor - A retractor incorporating adjustment hardware by means of a positive self locking mechanism which is capable when locked of withstanding restraint forces.

2.4.4.3 Emergency Locking Retractor - A retractor incorporating adjustment hardware by means of a locking mechanism that is activated by vehicle acceleration, webbing movement relative to the vehicle, or other automatic action during an emergency and is capable when locked of withstanding restraint forces.

2.5 SEAT BACK RETAINER - The portion of some seat belt assemblies designed to restrict forward movement of a seat back.

2.6 WEBBING - A narrow fabric woven with continuous filling yarns and finished selvages.

2.7 STRAP - A narrow nonwoven material used in a seat belt assembly in place of webbing.

3. GENERAL REQUIREMENTS

3.1 SINGLE OCCUPANCY - A seat belt assembly shall be designed for use by one, and only one, person at any one time.

3.2 PELVIC RESTRAINT - A seat belt assembly shall provide pelvic restraint whether or not upper torso restraint is provided, and the pelvic restraint shall be designed to remain on the pelvis under all conditions, including collision or rollover of the motor vehicle. Pelvic restraint of a Type 2 seat belt assembly, that can be used without upper torso restraint, shall comply with requirement for Type 1 seat belt assembly in Sections 3-6 inclusive.

3.3 UPPER TORSO RESTRAINT - A Type 2 or Type 3 seat belt assembly shall provide upper torso restraint without shifting the pelvic restraint into the abdominal region. The upper torso restraint shall be designed to minimize vertical forces on the shoulders and spine. Hardware for upper torso restraint shall be so designed and located in the seat belt assembly that the possibility of injury to the occupant is minimized. A Type 2a shoulder belt shall comply with applicable requirements for a Type 2 seat belt assembly in Sections 3-6 inclusive.

3.4 HARDWARE - All hardware parts which contact, under normal usage, a person, clothing, or webbing shall be free from burrs and sharp edges.

3.5 RELEASE - A Type 1 or Type 2 seat belt assembly shall be provided with a buckle or buckles readily accessible to the occupant to permit his easy and rapid removal from the assembly. A Type 3 seat belt assembly shall be provided with a quickly recognizable and easily operated release arrangement, readily accessible to an adult. Buckle release mechanism shall be designed to minimize the possibility of accidental release.

3.6 ATTACHMENT HARDWARE - A seat belt assembly shall include all hardware necessary for installation in a motor vehicle in accordance with SAE J800a, Motor Vehicle Seat Belt Installation *, except that seat belt assemblies designed for installation in vehicles equipped with seat belt anchorages shall not require underfloor hardware. The hardware shall be designed to prevent attaching bolts and other parts becoming disengaged from the motor vehicle in services. Reinforcing plates or washers furnished for universal floor installations shall be steel, free from burrs and sharp edges on the peripheral edges adjacent to the vehicle, not less than 0.06 in. (1.5 mm) in thickness nor less than 4 sq in. (25 sq cm) in area. The distance between any edge of the plate and the edge of the bolt hole shall be at least 0.6 in. (15 mm) and any corner shall be rounded to a radius of not less than 0.25 in. (6 mm) or cut at a 45 deg angle along an hypotenuse not less than 0.25 in. (6 mm) in length.

3.7 ADJUSTMENT - A Type 1 or Type 2 seat belt assembly shall be capable of snug adjustment by the occupant by a means easily within his reach and easily operable without appreciable interference with the driving process, or shall be provided with an automatic locking or an emergency locking retractor. A Type 3 seat belt assembly shall be capable of snug adjustment to fit any child capable of sitting upright and weighing not more than 50 lb (23 kg) unless specifically labelled for use with a child in a smaller weight range.

3.8 SEAT BACK RETAINER - A Type 3 seat belt assembly designed for attachment to a seat back, or for use in a seat with a hinged back, shall include a seat back retainer unless such assembly is designed and labelled for use in specific models of motor vehicles, in which the vehicle manufacturer has provided other adequate restraint for the seat back.

3.9 WEBBING - The ends of webbing in a seat belt assembly shall be protected or treated to prevent ravelling. The end of webbing in a seat belt assembly having a metal-to-metal buckle, that is used by the occupant to adjust the size of the assembly, shall not pull out of the adjustment hardware at maximum size adjustment. Provision shall be made for essentially unimpeded movement of webbing routed between a seat back and seat cushion and attached to a retractor located behind the seat.

3.10 STRAP - A strap used in a seat belt assembly to sustain restraint forces shall comply with the requirements for webbing in Section 4, and if the strap is made from a rigid material it shall comply with applicable requirements in Sections 4-6.

3.11 MARKING - Each seat belt assembly shall be permanently and legibly marked or labelled with year of manufacture, model and name or trademark of manufacturer or distributor, or of importer if manufactured outside the United States. A model shall consist of a single combination of webbing having a specific type of fiber (nylon, polyester, or the like) weave and construction, and hardware having a specific design. Webbings of various colors may be included under the same model, but webbing of each color shall comply with the requirements for webbing in Section 4.

3.12 INSTALLATION INSTRUCTIONS - A seat belt assembly or retractor shall be accompanied by an instruction sheet providing sufficient information for installing the assembly in a motor vehicle except for a seat belt assembly or retractor installed in a motor vehicle by an automobile manufacturer. The installation instructions shall state whether the assembly is for universal installation or for installation only in specifically stated motor vehicles, and shall include at least those items in SAE J800a.

3.13 USAGE AND MAINTENANCE INSTRUCTIONS - A seat belt assembly or retractor shall be accompanied by written instructions for the proper use of the assembly, stressing particularly the importance of wearing the assembly snugly and properly located on the body, and for the maintenance of the assembly, including periodic inspection of all components. The instructions shall show the proper manner of threading webbing in the hardware of seat belt assemblies in which the webbing is not permanently fastened. Instructions for Type 2a shoulder belt shall include a warning that the shoulder belt is not to be used without a lap belt.

3.14 WORKMANSHIP - A seat belt assembly shall have good workmanship in accordance with good commercial practices.

4. REQUIREMENTS FOR WEBBING

4.1 WIDTH - The webbing in a seat belt assembly shall be not less than the following widths, when measured under conditions prescribed in paragraph 7.1:

Type 1 seat belt assembly - 1.8 in. (46 mm).

Type 2 seat belt assembly - 1.8 in. (46 mm).

Type 3 seat belt assembly - 0.9 in. (23 mm) for pelvic and upper torso restraint.

4.2 BREAKING STRENGTH - The webbing in a seat belt assembly shall have not less than the following breaking strengths when tested by the procedures specified in paragraph 7.2:

Type 1 seat belt assembly - 6000 lb (2720 kg)

Type 2 seat belt assembly - 5000 lb (2270 kg) for pelvic restraint; 4000 lb (1810 kg) for upper torso restraint.

Type 3 seat belt assembly - 1500 lb (680 kg) for pelvic and upper torso restraint; 4000 lb (1810 kg) for seat back retainer and for connection for pelvic and upper torso restraint to attachment hardware when assembly has single webbing connection; 3000 lb (1360 kg) for webbing connecting pelvic and upper torso restraint to attachment hardware when as-

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sembly has two or more webbing connections.

4.3 ELONGATION - The webbing in a seat belt assembly shall not extend to more than the following elongations when subjected to the specified forces in accordance with the procedures specified in paragraph 7.3:

Type 1 seat belt assembly - 20% at 2500 lb (1130 kg).

Type 2 seat belt assembly - 30% at 2500 lb (1130 kg) for pelvic restraint; 40% at 2500 lb (1130 kg) for upper torso restraint.

Type 3 seat belt assembly - 20% at 700 lb (320 kg) for webbing in pelvic and upper torso restraints; 25% at 2500 lb (1130 kg) for webbing in seat back retainer and for webbing connecting pelvic and upper torso restraints to attachment hardware when assembly has single webbing connection; 25% at 1800 lb (820 kg) for webbing connecting pelvic and upper torso restraints to attachment hardware when assembly has two or more webbing connections.

4.4 RESISTANCE TO ABRASION - The webbing in a seat belt assembly after being subjected to abrasion as specified in paragraph 7.4 shall have a breaking strength not less than 75% of the strength before abrasion when measured by the procedure specified in paragraph 7.2.

4.5 RESISTANCE TO LIGHT - The webbing in a seat belt assembly, after exposure to the light of a carbon arc and after testing by the procedure specified in paragraph 7.5 shall have a breaking strength not less than 60% of the strength before exposure to the carbon arc and shall have a color retention not less than No. 2 on the Geometric Gray Scale*.

4.6 RESISTANCE TO MICRO-ORGANISMS - The webbing in a seat belt assembly after being subjected to micro-organisms and tested by the procedure specified in paragraph 7.6 shall have a breaking strength not less than 85% of the strength before subjection to micro-organisms.

4.7 COLORFASTNESS TO CROCKING - The webbing in a seat belt assembly shall not transfer color to a crock cloth either wet or dry to a greater degree than Class 3 on the AATCC Chart for Measuring Transference of Color,* when tested by the procedure specified in paragraph 7.7.

4.8 COLORFASTNESS TO STAINING - The webbing in a seat belt assembly shall not stain to a greater degree than Class 3 on the AATCC Chart for Measuring Transference of Color when tested by the procedure specified in paragraph 7.8.

5. REQUIREMENTS FOR HARDWARE

5.1 CORROSION RESISTANCE - Hardware parts of a seat belt assembly, except buckles, after being subjected to the condition specified in paragraph 8.1, shall be free of red rust, except for permissible red rust at peripheral edges or edges of holes on underfloor reinforcing plates or washers. Buckle surface or other metallic parts which may come into contact with webbing, the occupant, or his clothing, when the belt is worn, shall be free of ferrous and nonferrous corrosion. Buckles and retractors shall conform to applicable requirements in paragraphs 5.7-5.11 inclusive.

5.2 TEMPERATURE RESISTANCE - Plastic, or other nonmetallic, hardware parts of a seat belt assembly, and all retractors, when subjected to the conditions specified in paragraph 8.2, shall not warp, or otherwise deteriorate, to cause the assembly to operate improperly or fail to comply with applicable requirements in Sections 5 and 6.

5.3 ATTACHMENT HARDWARE - Eye bolts, shoulder bolts, or other bolts used to secure the pelvic restraint of a seat belt assembly to a motor vehicle shall withstand a force of 5000 lb (2270 kg) when tested by the procedure specified in paragraph 8.3. A seat belt assembly, having single attachment hooks of the quick-disconnect type for connecting webbing to an eye bolt, shall be provided with a retaining latch or keeper which shall not move more than 0.08 in. (2 mm) in either the vertical or horizontal direction when tested by the procedure specified in paragraph 8.3.2.

5.4 BUCKLE RELEASE FORCE - The buckle of a Type 1 or Type 2 seat belt assembly shall release when a force of not more than 30 lb (14 kg) is applied, and the buckle of a Type 3 seat belt assembly shall release when a force of not more than 20 lb (9 kg) is applied as prescribed in paragraph 8.4.

5.5 ADJUSTMENT FORCE - The force required to decrease the size of a seat belt assembly shall not exceed 11 lb (5 kg) when measured by the procedure specified in paragraph 8.5.

5.6 TILT-LOCK ADJUSTMENT - The buckle of a seat belt assembly having tilt-lock adjustment shall lock the webbing when tested by the procedure specified in paragraph 8.6 at an angle of not less than 30 deg between the base of the buckle and the anchor webbing.

5.7 BUCKLE LATCH - The buckle latch of a seat belt assembly when tested by the procedure specified in paragraph 8.7, shall not fail, nor gall or wear to an extent that normal latching and unlatching are impaired, and a metal-to-metal buckle shall separate when in any position of partial engagement by a force of not more than 5 lb (2.3 kg).

5.8 NONLOCKING RETRACTOR - The webbing of a seat belt assembly shall extend from a nonlocking retractor within 0.25 in. (6 mm) of a maximum length when a tension of 3 lb (1.4 kg) is applied as prescribed in paragraph 8.8.

5.9 AUTOMATIC LOCKING RETRACTOR - The webbing of a seat belt assembly equipped with an automatic locking retractor shall not move more than 1 in. (2.5 cm) between locking positions of the retractor, and shall be retracted with a force of not less than 0.6 lb (0.27 kg) when measured by the procedure specified in paragraph 8.9.

5.10 EMERGENCY LOCKING RETRACTOR - An emergency locking retractor used on a Type 1 or Type 2 seat belt assembly shall lock before the webbing extends 1 in. (2.5 cm) when the retractor is subjected to an acceleration of 0.5 g (5 m/sec^2) and shall exert a retraction force of not less than 1.5 lb (0.7 kg) under zero acceleration when tested by the procedures specified in paragraph 8.10.

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5.11 PERFORMANCE OF RETRACTOR - A retractor used on a seat belt assembly after subjection to the tests specified in paragraph 8.11 shall comply with applicable requirements in paragraphs 5.8-5.10 and 6.1-6.3, except that the retraction force shall be not less than 50% of its original retraction force.

6. REQUIREMENTS FOR ASSEMBLY PERFORMANCE

6.1 TYPE 1 SEAT BELT ASSEMBLY - The complete seat belt assembly, including webbing, straps, buckles, adjustment and attachment hardware, and retractors, shall comply with the following requirements when tested by the procedures specified in paragraph 9.1:

6.1.1 The assembly loop shall withstand a force of not less than 5000 lb (2270 kg); that is, each structural component of the assembly shall withstand a force of not less than 2500 lb (1130 kg).

6.1.2 The assembly loop shall extend not more than 7 in. (18 cm) when subjected to a force of 5000 lb (2270 kg); that is, the length of the assembly between anchorages shall not increase more than 14 in. (36 cm).

6.1.3 Any webbing cut by the hardware during test shall have a breaking strength at the cut of not less than 4200 lb (1910 kg).

6.2 TYPE 2 SEAT BELT ASSEMBLY - The components of a Type 2 seat belt assembly including webbing, straps, buckles, adjustment hardware, and retractors shall comply with the following requirements when tested by the procedure specified in paragraph 9.2:

6.2.1 The structural components in the pelvic restraint shall withstand a force of not less than 2500 lb (1130 kg).

6.2.2 The structural components in the upper torso restraint shall withstand a force of not less than 1500 lb (680 kg).

6.2.3 The structural components in the assembly that are common to pelvic and upper torso restraints shall withstand a force of not less than 3000 lb (1360 kg).

6.2.4 The length of the pelvic restraint between anchorages shall not increase more than 20 in. (50 cm) when subjected to a force of 2500 lb (1130 kg).

6.2.5 The length of the upper torso restraint between anchorages shall not increase more than 20 in. (50 cm) when subjected to a force of 1500 lb (680 kg).

6.2.6 Any webbing cut by the hardware during test shall have a breaking strength of not less than 3500 lb (1590 kg) at a cut in webbing of the pelvic restraint, or not less than 2800 lb (1270 kg) at a cut in webbing of the upper torso restraint.

6.3 TYPE 3 SEAT BELT ASSEMBLY - The complete seat belt assembly, including webbing, straps, buckles, adjustment and attachment hardware, and retractors, shall comply with the following requirements when tested by the procedures specified in paragraph 9.3:

6.3.1 The complete assembly shall withstand a force of 2000 lb (900 kg).

6.3.2 The complete assembly shall extend not more than 12 in. (30 cm) when subjected to a force of 2000 lb (900 kg).

6.3.3 Any webbing cut by the hardware during test shall have a breaking strength of not less than 1050 lb (480 kg) at a cut in webbing of pelvic or upper torso restraints, or not less than 2800 lb (1270 kg) at a cut in webbing of seat back retainer, or in webbing connecting pelvic and upper torso restraint at attachment hardware.

7. WEBBING TEST PROCEDURES

7.1 WIDTH - The width of webbing from three seat belt assemblies shall be measured after conditioning for at least 24 hr in an atmosphere having a relative humidity between 48-67% and a temperature of 73.4 ± 3.6 F (23 ± 2 C). The tension on the webbing during measurement of width shall be not more than 5 lb (2 kg) for Type 1 or Type 3 seat belt assemblies and 2200 ± 100 lb (1000 ± 50 kg) for Type 2 seat belt assembly. The width of webbing in Type 2 seat belt assembly may be measured during the breaking strength test described in paragraph 7.2.

7.2 BREAKING STRENGTH - Webbing from three seat belt assemblies shall be conditioned in accordance with paragraph 7.1 and tested, by ASTM E 4-64T, Methods of Verification of Testing Machines (Tentative),* for breaking strength in a testing machine of suitable capacity verified

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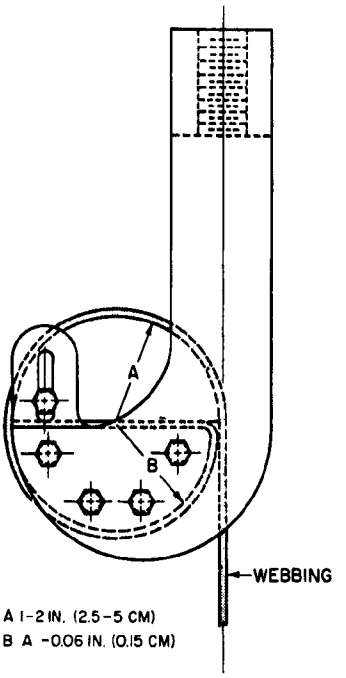

Fig. 1

to have an error of not more than 1% in the range of the breaking strength of the webbing. The machine shall be equipped with split drum grips illustrated in Fig. 1, having a diameter between 2-4 in. (5-10 cm). The rate of grip separation shall be between 2-4 in. (5-10 cm) per minute The distance between the centers of the grips at the start of the test shall be between 4-10 in. (10-25 cm). After placing the specimen in the grips, the webbing shall be stretched continuously at a uniform rate to failure. Each value shall be not less than the applicable breaking strength requirement in paragraph 4.2, but the median value shall be used in determining the retention of breaking strength in paragraphs 4.4-4.6.

7.3 ELONGATION - Elongation shall be measured during the breaking strength test described in paragraph 7.2 by the following procedure. A preload of 50 ± 5 lb (22.5 ± 2 kg) shall be placed on the webbing mounted in the grips of the testing machine, and the needle points of an extensometer, in which the points remain parallel during test, are inserted in the center of the specimen. Initially the points shall be set at a known distance between 4-8 in. (10-20 cm) apart. When the force on the webbing reaches the value specified in paragraph 4.3, the increase in separation of the points of the extensometer shall be measured and the per cent elongation shall be calculated to the nearest 0.5%. Each value shall be not more than the appropriate elongation requirement in paragraph 4.3.

7.4 RESISTANCE TO ABRASION - The webbing from three seat belt assemblies shall be tested for resistance to abrasion by rubbing over the hexagon bar prescribed in Fig. 2 in the following manner. The webbing shall be mounted in the apparatus shown schematically in Fig. 2. One end of the webbing, A, shall be attached to a weight, B, which has a mass of 5.2 ± 0.1 lb (2.3 ± 0.05 kg) except that for Type 3 pelvic and upper torso restraint webbing a mass of 3.3 ± 0.1 lb (1.5 ± 0.05 kg) shall be used. The webbing shall be passed over two new abrading edges of the hexagon bar, C, and the other end attached to an oscillating drum, D, which has a stroke of 13 in. (33 cm). Suitable guides shall be used to prevent movement of the webbing along the axis of hexagonal bar, C. Drum D shall be oscillated for 5000 strokes (2500 cycles) at a rate of 60 ± 2 strokes (30 ± 1 cycles) per minute.

The abraded webbing shall be conditioned as prescribed in paragraph 7.1 and tested for breaking strength by the procedure described in paragraph 7.2. The median values for the breaking strengths determined on abraded and unabraded specimens shall be used to calculate the percentage of breaking strength retained.

7.5 RESISTANCE TO LIGHT - Three specimens of webbing at least 20 in. (50 cm) in length shall be suspended vertically on the inside of the specimen rack in a Type E carbon-arc light exposure apparatus described in ASTM E 42-64, Recommended Practice for Operation of Light and Water-Exposure Apparatus (Carbon-Arc Type) for Artificial Weathering Test., The apparatus shall be operated without water spray at an air temperature of 140 ± 3.6 F (60 ± 2C) measured at a point 1.0 ± 0.2 in. (2.5 ± 0.5 cm) outside the specimen rack and midway in the height. The temperature sensing element shall be shielded from radiation. The specimens shall be exposed to the light from the carbon-arc for 100 hr and then conditioned as prescribed in paragraph 7.1. The colorfastness of the exposed and conditioned specimens shall be determined on the AATCC Geometric Gray Scale. The breaking strength of the specimens shall be determined by the procedure prescribed in paragraph 7.2. The median values for the breaking strengths determined on exposed and unexposed specimens shall be used to calculate the percentage of breaking strength retained.

7.6 RESISTANCE TO MICROORGANISMS - Three specimens of webbing at least 20 in. (50 cm) in length shall be subjected successively to the procedures prescribed in Section 1C1 - Water Leaching, Section 1C2 - Volatilization, and Section 1B3 - Soil Burial Test of AATCC Tentative Test Method 30-1957T, Fungicides, Evaluation of Textiles; Mildew and Rot Resistance of Textiles.* After soil burial for a period of 2 weeks, the specimens shall be washed with water, dried and conditioned as prescribed in paragraph 7.1. The breaking strengths of the specimens shall be determined by the procedure prescribed in paragraph 7.2. The median values for the breaking strengths determined on exposed and unexposed specimens shall be used to calculate the percentage of breaking strength retained. NOTE: This test shall not be required on webbing made from material which is inherently resistant to microorganisms.

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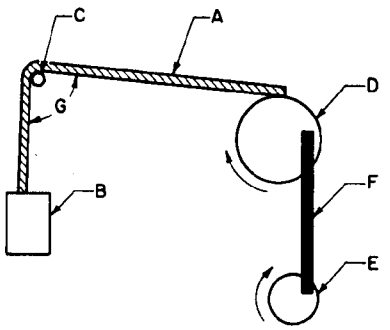

A - Webbing
B - Weight
C - Hexagonal rod
Steel, SAE 51416
Hardness, RB 97 - RB 101
Surface, cold drawn finish
Size, 0.250 ± 0.001 in. (6.35 ± 0.03 mm)
Radius on edges, 0.020 ± 0.004 in. (0.5 ± 0.1 mm)
D - Drum dia, 16 in. (40 cm)
E - Crank
F - Crank arm
G - Angle between webbing, 85 ± 2 deg

Fig. 2

7.7 COLORFASTNESS TO CROCKING - Webbing from three seat belt assemblies shall be tested by the procedure specified in AATCC Standard Test Method 8-1961, Colorfastness to Crocking (Rubbing).

7.8 COLORFASTNESS TO STAINING - Webbing from three seat belt assemblies shall be tested by the procedure specified in AATCC Standard Test Method 107-1962, Colorfastness to Water, with the following modifications: distilled water shall be used, perspiration tester shall be used, the drying time in paragraph 4 of the AATCC procedure shall be 4 hr, and the section entitled, "Evaluation Method for Staining (3)" shall be used to determine colorfastness on the AATCC Chart for Measuring Transference of Colors.

8. TEST PROCEDURES FOR HARDWARE

8.1 CORROSION RESISTANCE - All hardware from three seat belt assemblies shall be tested by ASTM B 117-64, Standard Method of Salt Spray (Fog) Testing. The period of test shall be 50 hr for all attachment hardware at or near the floor, consisting of two periods of 24 hr exposure to salt spray followed by 1 hr drying and 25 hr for all other hardware, consisting of one period of 24 hr exposure to salt spray followed by 1 hr drying. In the salt spray test chamber, the part from the three assemblies shall be oriented differently, selecting those orientations most likely to develop corrosion on the larger areas. At the end of the test, the hardware shall be washed with water to remove the salt. After drying, the hardware shall be examined for corrosion. Retractors shall be tested for corrosion resistance after 5000 cycles of operation as prescribed in paragraph 8.11.

8.2 TEMPERATURE RESISTANCE - Three seat belt assemblies having plastic or nonmetallic hardware or having retractors shall be subjected to the conditions prescribed in Procedure IV of ASTM D 756-56, Standard Methods of Test for Resistance of Plastics to Accelerated Service Conditions. The dimension and weight measurements shall be omitted. Buckles shall be unlatched and retractors shall be fully retracted during conditioning. The hardware parts after conditioning shall be used for all applicable tests in Sections 5 and 6.

8.3 ATTACHMENT HARDWARE -

8.3.1 Attachment Bolts - Attachment bolts used to secure the pelvic restraint of a seat belt assembly to a motor vehicle shall be tested in the following manner: to one head of a testing machine described in paragraph 7.2, two belt sections shall be attached. At the free end of each belt section, attachment hardware from the seat belt assembly (that is, sister hooks, and so on) shall be attached. The attachment hardware shall be fastened by the bolt in a fixture on the other head of the testing machine as shown in Fig. 3, which has a standard 7/16 -20 - UNF - 2B threaded hole in a hardened steel plate at least 0.4 in. (1 cm) in thickness; the axis of this threaded hole forms a 45 deg angle with the line of pull of the belt sections. The bolt shall be 0.2 in. (5 mm) from its fully seated position with the attachment hardware from the two belt sections attached. A force of 5000 lb (2270 kg) shall be applied. A bolt from each of three seat belt assemblies shall be tested.

8.3.2 Single Attachment Hooks - Single attachment hooks for connecting webbing to an eye bolt shall be tested in the following manner: the hook shall be held rigidly so that the retainer latch or keeper, with cotter pin or other locking device in place, is in a horizontal position as shown in Fig. 4. A force of 150 ± 2 lb (68 ± 1 kg) shall be applied vertically as near as possible to the free end of the retainer latch, and the movement of the latch by this force at the point of

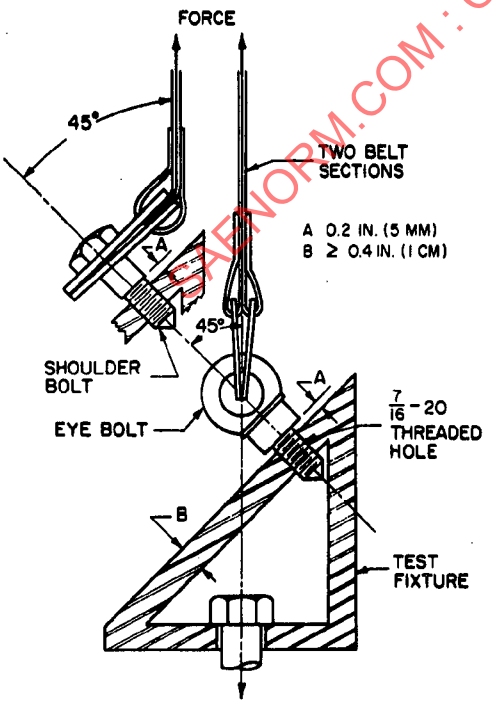

Fig. 3

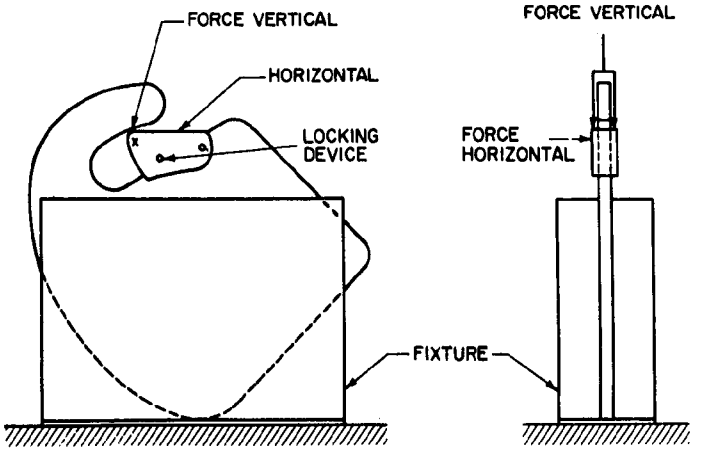

Fig. 4 - Single attachment hook

application shall be measured. The vertical force shall be released, and a force of 150 ± 2 lb (68 ± 1 kg) shall be applied horizontally as near as possible to the free end of the retainer latch. The movement of the latch by this force at the point of load application shall be measured. Alternatively, the hook may be held in other positions, provided the forces and the movements of the latch are measured at the points indicated in Fig. 4.

8.4 BUCKLE RELEASE FORCE - Three seat belt assemblies shall be tested to determine compliance with the maximum buckle release force requirements, following the assembly test in Section 9. After subjection to the force applicable for the assembly being tested, the force shall be reduced and maintained at 150 ± 10 lb (68 ± 4 kg) on the assembly loop of a Type 1 seat belt assembly, 75 ± 5 lb (34 ± 2 kg) on the components of a Type 2 seat belt assembly, or 45 ± 5 lb (20 ± 2 kg) on a Type 3 seat belt assembly. The buckle release force shall be measured by applying a force on the buckle in the manner and direction typical of that which would be employed by a seat belt occupant. For lever release buckles, the force shall be applied on the centerline of the buckle lever or finger tab in such direction as to produce maximum releasing effect. A hole 0.1 in. (2.5 mm) in diameter may be drilled through the buckle tab or lever on the centerline between 0.12-0.13 in. (3.0-3.3 mm) from its edge, and a small loop of soft wire may be used as the connecting link between the buckle tab or lever and the force measuring device.

8.5 ADJUSTMENT FORCE - Three seat belt assemblies shall be tested for adjustment force on the webbing at the buckle or other manual adjusting device, normally used to adjust the size of the assembly. With no load on the anchor end, the webbing shall be drawn through the adjusting device at a rate of 20 ± 2 in. (50 ± 5 cm) per minute and the maximum force shall be measured to the nearest 0.25 lb (0.1 kg) after the first 1 in. (25 mm) of webbing movement. The webbing shall be precycled 10 times prior to measurement.

8.6 TILT-LOCK ADJUSTMENT - This test shall be made on buckles or other manual adjusting devices having tilt-lock adjustment, normally used to adjust the size of the assembly. Three buckles or devices shall be tested. The base of the adjustment mechanism and the anchor end of the webbing shall be oriented in planes normal to each other. The webbing shall be drawn through the adjustment mechanism in a direction to increase belt length at a rate of 20 ± 2 in. (50 ± 5 cm) per minute, while the plane of the base is slowly rotated in a direction to lock the webbing. Rotation shall be stopped when the webbing locks, but the pull on the webbing shall be continued until there is a resistance of at least 20 lb (9 kg). The locking angle between the anchor end of the webbing and the base of the adjustment mechanism shall then be measured to the nearest degree. The webbing shall be precycled 10 times prior to measurement.

8.7 BUCKLE LATCH - The buckles from three seat belt assemblies shall be fully opened and closed at least 10 times. Then the buckle shall be clamped or firmly held against a flat surface so as to permit normal movement of buckle parts, but with the metal mating plate (metal-to-metal buckles) or webbing end (metal-to-webbing buckles) withdrawn from the buckle. The release mechanism shall be moved 200 times through the maximum possible travel against its stop with a force of 30 ± 3 lb (14 ± 1 kg) at a rate not to exceed 30 cpm. The buckle shall be examined to determine compliance with the performance requirements of paragraph 5.7. A metal-to-metal buckle shall be examined to determine whether partial engagement is possible by means of any technique representative of actual use. If partial engagement is possible, the maximum force of separation when in such partial engagement shall be determined.

8.8 NONLOCKING RETRACTOR - After the retractor is cycled 10 times by full extension and retraction of the webbing, the retractor and webbing shall be suspended vertically and a force of 4 lb (1.8 kg) shall be applied to extend the webbing from the retractor. The force shall be reduced to 3 lb (1.4 kg). The residual extension of the webbing shall be measured by manual rotation of the retractor drum or by disengaging the retraction mechanism. Measurements shall be made on three retractors.

8.9 AUTOMATIC LOCKING RETRACTOR - Three retractors shall be tested in a manner to permit the retraction forces to be determined exclusive of the gravitational forces on hardware or webbing being retracted. The webbing shall be fully extended from the retractor. While the webbing is being retracted the average force of retraction within ±2 in. (5 cm) of 75% extension (25% retraction) shall be determined and the webbing movement between adjacent locking segments shall be measured in the same region of extension.

8.10 EMERGENCY LOCKING RETRACTORS - Three retractors shall be tested in a manner to permit the retraction forces to be determined exclusive of the gravitational forces on the hardware or webbing being retracted. The webbing shall be fully extended from the retractor. While the webbing is being retracted the average force of retraction within ±2 in. (5 cm) of 75% extension (25% retraction) shall be determined. The retractor shall be subjected to an acceleration of 0.5 g (5 m/sec^2) within a period of 50 msec while the webbing is at 75% extension and the webbing movement before locking shall be measured under each of the following conditions: for a retractor sensitive to the rate of webbing withdrawal, the retractor shall be accelerated in the direction of webbing withdrawal while oriented horizontally and at angles of 45, 90, 135, and 180 deg to the horizontal plane; for a retractor sensitive to vehicle acceleration, the retractor shall be accelerated in three directions normal to each other while oriented horizontally and at angles of 45, 90, 135, and 180 deg to the horizontal plane, unless the retractor locks by gravitational force when tilted in any direction to an angle of 45 deg or more.

8.11 PERFORMANCE OF RETRACTORS - After completion of the temperature resistance test described in paragraph 8.2, the retractor shall be mounted in an apparatus capable of extending the webbing fully, applying a force of 20 lb (9 kg) at full extension, and allowing the webbing to retract freely and completely. The webbing shall be withdrawn from the retractor and allowed to retract repeatedly in this

apparatus until 5000 cycles are completed. The retractor and webbing shall then be subjected to the corrosion test prescribed in paragraph 8.1. After the corrosion test, the webbing shall be extended fully and allowed to dry at least 16 hr under standard laboratory conditions specified in paragraph 7.1. The performance of the retractor after the corrosion test shall be determined by withdrawing the webbing manually and allowing the webbing to retract for 25 cycles.

The retractor and webbing shall then be subjected to dust in a chamber similar to one illustrated in Fig. 5 containing about 2 lb (0.9 kg) of coarse grade dust conforming to the specification given in SAE J726a. The dust shall be agitated every 20 minutes for 5 sec by compressed air, free of oil and moisture, at a gage pressure of 80 ± 8 lb/in.^{2} (5.6 ± 0.6 kg/cm^2) entering through an orifice 0.060 ± 0.004 in. (1.5 ± 0.1 mm) in diameter.

The webbing shall be extended to the top of the chamber and kept extended at all times, except that the webbing shall be subjected to 10 cycles of complete retraction and extension within one to two minutes after each agitation of the dust. At the end of 5 hr, the assembly shall be removed from the chamber and the retractor functional performance shall be determined by withdrawing the full length of webbing manually and allowing the webbing to retract for 25 cycles.

Nonlocking and automatic locking retractors shall be subjected to 5000 additional cycles of webbing withdrawal and retraction, and emergency locking retractors shall be subjected to 45,000 additional cycles of webbing withdrawal and retraction as previously described. The locking mechanism of an emergency locking retractor shall be actuated about 10,000 times during the 50,000 cycles. At the end of test, compliance of the retractors with applicable requirements in paragraphs 5.8-5.10 shall be determined. Three retractors shall be tested for performance.

9. TEST PROCEDURES FOR ASSEMBLY PERFORMANCE

9.1 TYPE 1 SEAT BELT ASSEMBLY - Three complete seat belt assemblies including webbing, straps, buckles, adjustment and attachment hardware, and retractors, arranged in the form of a loop as shown in Fig. 6, shall be tested in the following manner:

9.1.1 The testing machine shall conform to the requirements specified in paragraph 7.2. A double-roller block shall be attached to one head of the testing machine. This block shall consist of 2 rollers 4 in. (10 cm) in diameter and sufficiently long so that no part of the seat belt assembly touches parts of the block other than the rollers during test. The rollers shall be mounted on antifriction bearings and spaced 12 in. (30 cm) between centers, and shall have sufficient capacity so that there is no brinelling, bending, or other distortion of parts which may affect the results. An anchorage bar shall be fastened to the other head of the testing machine.

9.1.2 The attachment hardware furnished with the seat belt assembly shall be attached to the anchorage bar. The anchor points shall be spaced so that the webbing is parallel in the two sides of the loop. The attaching bolt shall be parallel, or at an angle of 45 or 90 deg, to the webbing, whichever results in the greatest angle between webbing and attachment hardware, except that eye bolts shall be vertical, and attaching bolts of a seat belt assembly designed for use in specific models of motor vehicles shall

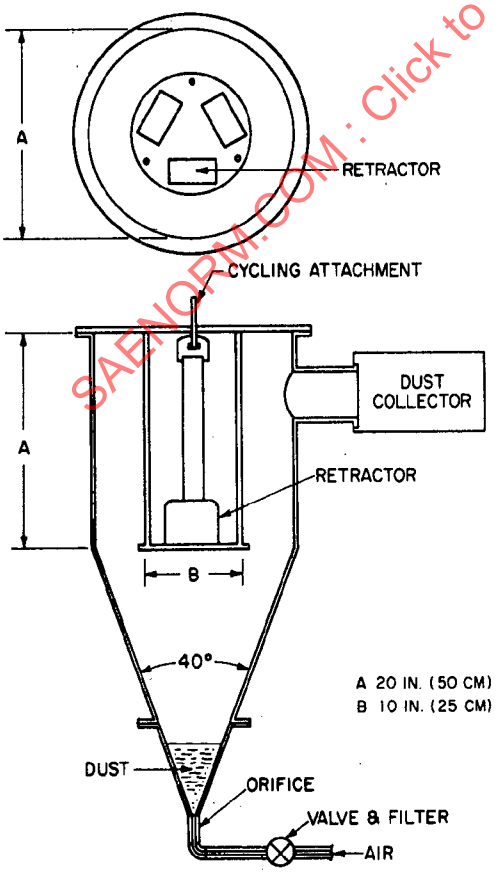

Fig. 5

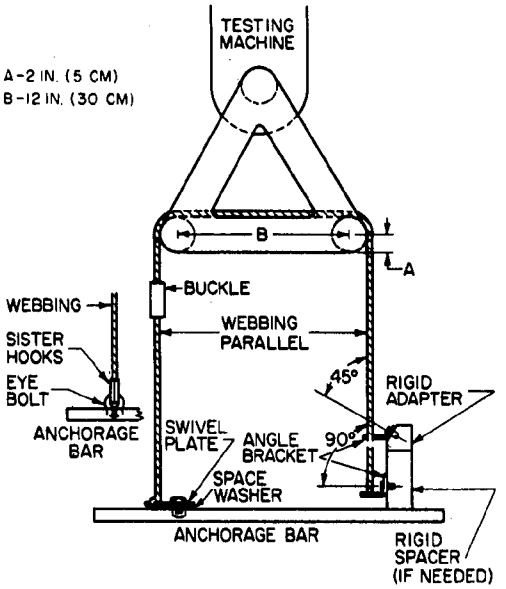

Fig. 6