SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J140 FEB2013

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Superseding J140 JUN1995

(R) Seat Belt Hardware Test Procedures

RATIONALE

SAE J140 defines the test procedures for abrasion testing of the webbing used in seat belt assemblies. SAE J141 defines the acceptance requirements for these tests. The testing and test sequences are similar but not identical to what is defined in FMVSS 209 and TP-209. The legal requirements for web abrasion have been the same for many years. No evidence has been presented of any field concerns arising from shortcomings in the FMVSS and TP requirements.

It is proposed to revise SAE J140 and SAE J141 to make them consistent with the FMVSS and TP regulations, with some small exceptions. These exceptions are the changes and clarifications proposed by the AORC to NHTSA in December of 2008. It is expected that NHTSA will adopt the AORC proposals eventually.

Also, it is proposed to add web abrasion requirements to SAE J140 and SAE J141 for seat belt systems that do not use a manual adjusting latchplates. The existing abrasion requirements of SAE J140 and SAE J141 only include systems with manual adjusting latchplates. These devices are not used in most seat belts today. It is proposed to adopt the hex bar abrasion requirements of FMVSS 209 for seat belts that do not include a manual adjustable latchplate. It is reasonable to require some degree of abrasion resistance for seat belt webbing. No evidence has been presented to show that the current FMVSS abrasion standard is inadequate.

A clarification has been added so that it is understood that the manual adjust latchplate tilt lock requirements do not apply to semi cinching latchplates or dynamically cinching latchplates. Semi cinching latchplates are intended to meet the child seat locking requirements of FMVSS 208 S7.1.1.5, which can be met without passing the tilt lock test. Dynamically locking latchplates are intended to improve performance in NCAP or other crash testing. The locking requirements of such devices are best defined by the vehicle manufacturer to optimize performance in the specific applications.

The section of SAE J140/1 about attachment hook retention was deleted. Attachment hooks have not been used in light vehicles for many years. Similarly the section on lift buckles was also removed for the same reason. Section 4.5.2 does refer to 'buckles of other types' so there is a requirement for any potential future buckle release design. Also, FMVSS 208 S7.2d) requires that buckles be activated by push buttons.

The sections on buckle compression have been harmonized with FMVSS 209.

The requirement for web resistance to microorganisms has been deleted. It was included in the chart in SAE140 4.1 but not defined. All web in current use is made of synthetic fiber and not subject to the microorganism requirements of FMVSS 209.

A section defining the light resistance was added to SAE J140 and SAE J141. Light resistance was already in the chart in SAE J140 4.1, but the requirements were not defined. The light resistance requirements were taken from the AORC proposal of December 2008.

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1. SCOPE

This SAE Recommended Practice describes test procedures for evaluating hardware used in motor vehicle seat belt assemblies. Related hardware performance requirements are described in SAE J141.

Test procedures and performance requirements for retractors will be covered in separate SAE Recommended Practices to be issued later.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM B 117 Method of Salt Spray (Fog) Testing

ASTM D 756 Service Conditions

ASTM E 4 Standard Methods of Load Verification of Test Machines

3. DEFINITIONS

See SAE J1803.

4. TEST PROCEDURE

4.1 General

All components shall be conditioned for 4 h under laboratory ambient conditions prior to conducting the test sequence outlined in Table 1.

TABLE 1 - TEST SEQUENCE

Test Method	SAE J140 Paragraph Ref.	Sequence of Tests Group 1	Sequence of Tests Group 2	Sequence of Tests Group 3	Sequence of Tests Group 4
Conditioning, General	4.1	1	1	1	1
Web width	6.1	2			
Web strength	6.2	3,5	3		
Web light resistance	6.3	4			
Corrosion	4.2		—	2	2
Temperature resistance	4.3		—	3	3
Hardware strength	4.4		—	4	
		—	—		—
Buckle release					
Loop test	4.6		—	8	5
	—		—	—	—
Compression	4.7		—	—	4
Buckle latch - cycle and false latch	4.8		—	7	—
Tilt lock	5.2			6	—
Adjustment	5.1			5	—
Abrasion - system	—	—	2	—	—

1. 3 assemblies to be tested in each group
2. Group 1 is webbing Tensile test 3 pieces without light exposure (1,2,3) and 3 pieces with light exposure (1,4,5)
3. Group 2 is webbing
4. Group 3 is hardware and assembly performance
5. Group 4 is buckle compression

4.2 Corrosion Resistance

Three seat belt assemblies shall be tested in accordance with American Society for Testing and Materials B117- 07a, “Standard Practice for Operating Salt Spray (Fog) Apparatus.” Any surface coating or material not intended for permanent retention on the metal parts during service life shall be removed prior to preparation of the test specimens for testing. In the salt spray test chamber, the parts from the three assemblies shall be positioned in an orientation as follows: Retractors will be hung by the webbing or positioned similar to “in-vehicle orientation” within the chamber. Buckles will be supported in a rack with the tongue slot facing upwards or positioned similar to “in vehicle orientation” within the chamber. The period of test shall be 50 continuous hours for all seat belt hardware. At the end of the test, the seat belt assembly shall be washed thoroughly with water to remove the salt. After drying for at least 24 hours under standard laboratory conditions specified in S5.1(a), attachment hardware shall be examined. Ferrous and nonferrous corrosion deposits are allowed for components normally behind trim or covered when installed in the vehicle provided they can not be transferred, either directly or by means of the webbing, to a person or their clothing during the use of a seat belt assembly incorporating the hardware. After testing, seat belt assemblies must meet all functional and strength requirements. Seat belt components in the passenger compartment normally handled while using the seat belt system shall be examined for ferrous corrosion on significant surfaces, that is, all surfaces that can be contacted by a sphere 19mm in diameter, and other hardware shall be examined for ferrous and nonferrous corrosion which may be transferred, either directly or by means of the webbing, to a person or his clothing during the use of a seat belt assembly incorporating the hardware.

4.3 Temperature Resistance

Three seat belt assemblies having plastic or non-metallic hardware or having retractors shall be subjected to the temperature resistance test and shall not warp or otherwise deteriorate to cause the assembly to operate improperly or fail to comply with applicable requirements of Section 4. Condition three specimens for 24 h at 23 ± 2 °C and 48%-67% relative humidity prior to beginning the temperature resistance test. Immediately after conditioning, expose the assemblies to a temperature of 80 ± 1 °C (176 ± 1.8 °F), for 24 hours, over water, in a circulating air type oven. Immediately following this 24 hour exposure perform an additional 24 hour exposure of dry heat at 80 ± 1 °C (176 ± 1.8 °F). Buckles shall be unlatched and retractors shall be fully retracted during conditioning and test. These parts shall then be used for all applicable tests in section 4.

4.4 Attachment Hardware

4.4.1 Pelvic Restraint

Attachment bolts or other substitute attachment means used to secure the pelvic restraint of a seat belt assembly to a motor vehicle shall be tested in a manner similar to that shown in Figure 1. The force shall be applied at an angle of 45 degrees to the axis of the bolt through attachment hardware from the seat belt assembly, or through a special fixture which simulates the loading applied by the attachment hardware. When bolts are used, the attachment hardware or simulated fixture shall be fastened by the bolt to the anchorage shown in Figure 1, which has the appropriate mating hole in a hardened steel plate of at least 10 mm in thickness. The bolt shall be tested when installed two full turns from the fully seated position Figure 1. The appropriate force required by SAE J141 shall be applied. The bolts or other attachment means from each of three seat belt assemblies shall be tested. Other attachment means shall be tested in a manner which simulates usage.

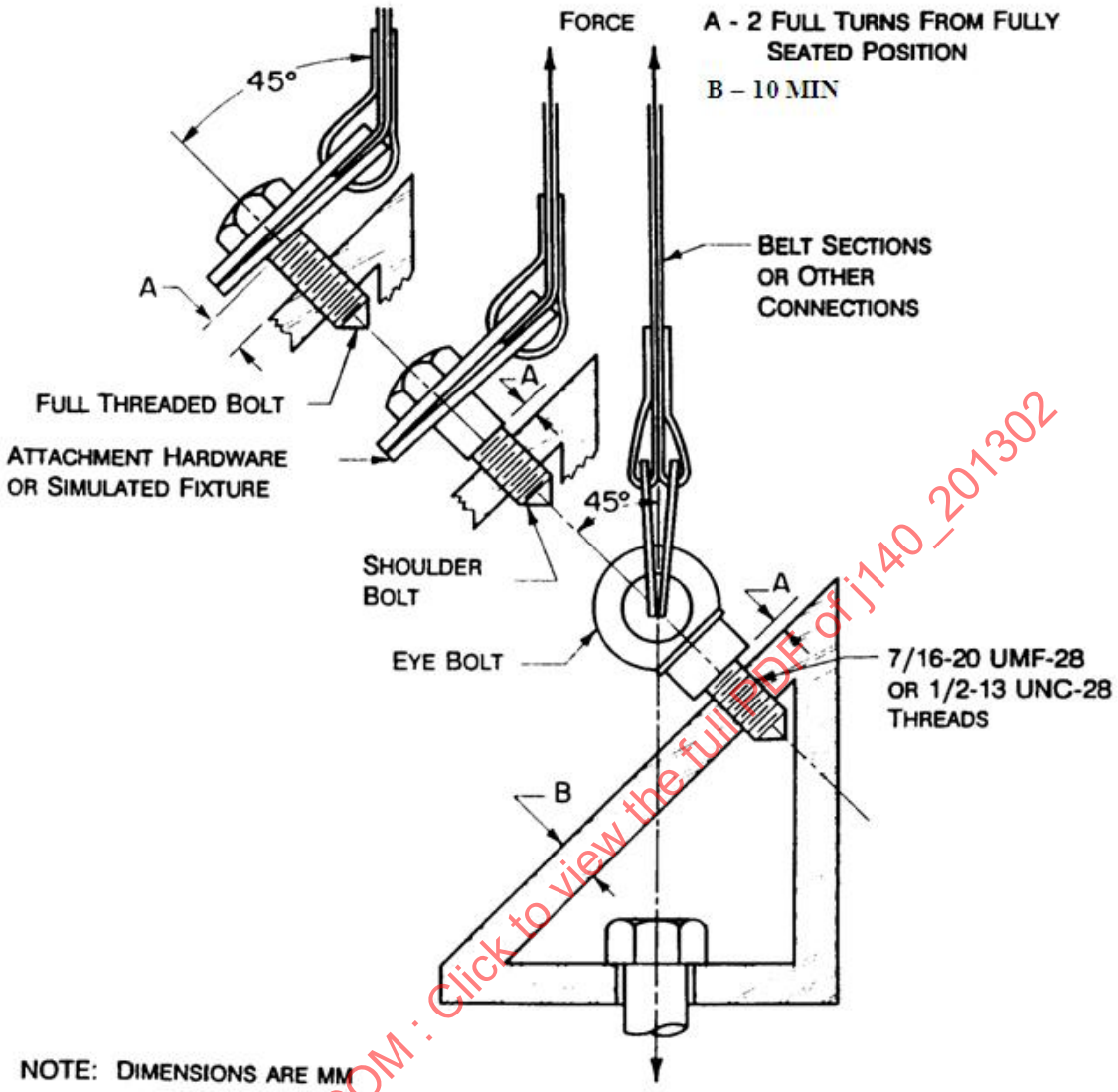


FIGURE 1 - ATTACHMENT HARDWARE TEST FIXTURE

4.4.2 Upper Torso Restraint

Attachment bolts or other attachment means used to secure the upper torso portion of a seat belt assembly to a motor vehicle shall be tested in a manner similar to that shown in Figure 1. The force shall be applied at an angle of 45 degrees to the axis of the fastener or bolt through attachment hardware from the seat belt assembly, or through a special fixture which simulates the loading applied by the attachment hardware as installed in the vehicle. The attachment hardware or simulated fixture shall be fastened by the bolt(s) or fastener(s) to the anchorage shown in Figure 1, which has the appropriate mating hole(s) or attachment(s) in a hardened steel plate of at least 10 mm in thickness. Bolt(s) shall be tested when installed two full turns from the fully seated position. The appropriate force required by SAE J141 shall be applied. Bolts and/or fasteners from each of three seat belt assemblies shall be tested.

4.5 Buckle Release

Three seat belt buckle assemblies shall be tested to determine buckle release force. After the force applicable to the seat belt assembly being tested in the procedure of Section 7 has been reached, the force shall be reduced and maintained at 665 N ± 44 N (equivalent to a tensile force of 334 ± 22 N at the buckle).

4.5.1 For push button buckles, the release force shall be measured at the point of maximum mechanical advantage, but no closer than 3.0 mm from the edge of the release button opening.

4.5.2 For buckles of other types, the release force shall be applied in a manner so as to simulate usage.

4.6 Buckle Compression

The buckle of a Type 1 or Type 2 seat belt assembly shall be subjected to a specified compressive force of 1776 N ± 90 N applied anywhere on the longitudinal centerline of the buckle and anywhere along lines at approximately 60 degrees to this centerline, with the point of intersection of these lines centered over the release mechanism. The force shall be applied through a cylindrical bar 19 mm in diameter, at least 100 mm long, and curved to a radius of 150 mm). The bar shall be placed with the longitudinal centerline of the bar directly above the lines through the longitudinal centerline of the buckle and at 60 degrees to it Figure 2. Buckles from these seat belt assemblies shall be tested to determine compliance with section 4.6 of SAE J141

4.6.1 The buckle and latch plate shall be assembled and a tensile force of 333 N ± 22 N shall be applied to the connected assembly during the application of the compressive force.

4.6.2 The latch plate shall be disengaged from the buckle and the compressive force applied to the buckle again.

4.7 Buckle Latch Operation

4.7.1 The buckles from three seat belt assemblies shall be fully latched with their latch plates and unlatched at least 10 times. Then each buckle, with the latch plate withdrawn from the buckle, shall be clamped or firmly held against a solid surface so as to permit normal movement of buckle parts without movement of the buckle assembly. The release mechanism shall be moved 200 times through the maximum possible travel against its stop with a force of 133 N ± 13 N at a rate not to exceed 30 cpm, actuating the mechanism in a manner which simulates actual usage. After completion of this portion of the test, the latchplate shall be inserted and released for 10,000 cycles. The release force shall be of just sufficient magnitude to assure full travel to the stop, the performance of each buckle shall then be evaluated with respect to 4.7 of SAE J141.

4.7.2 A 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.

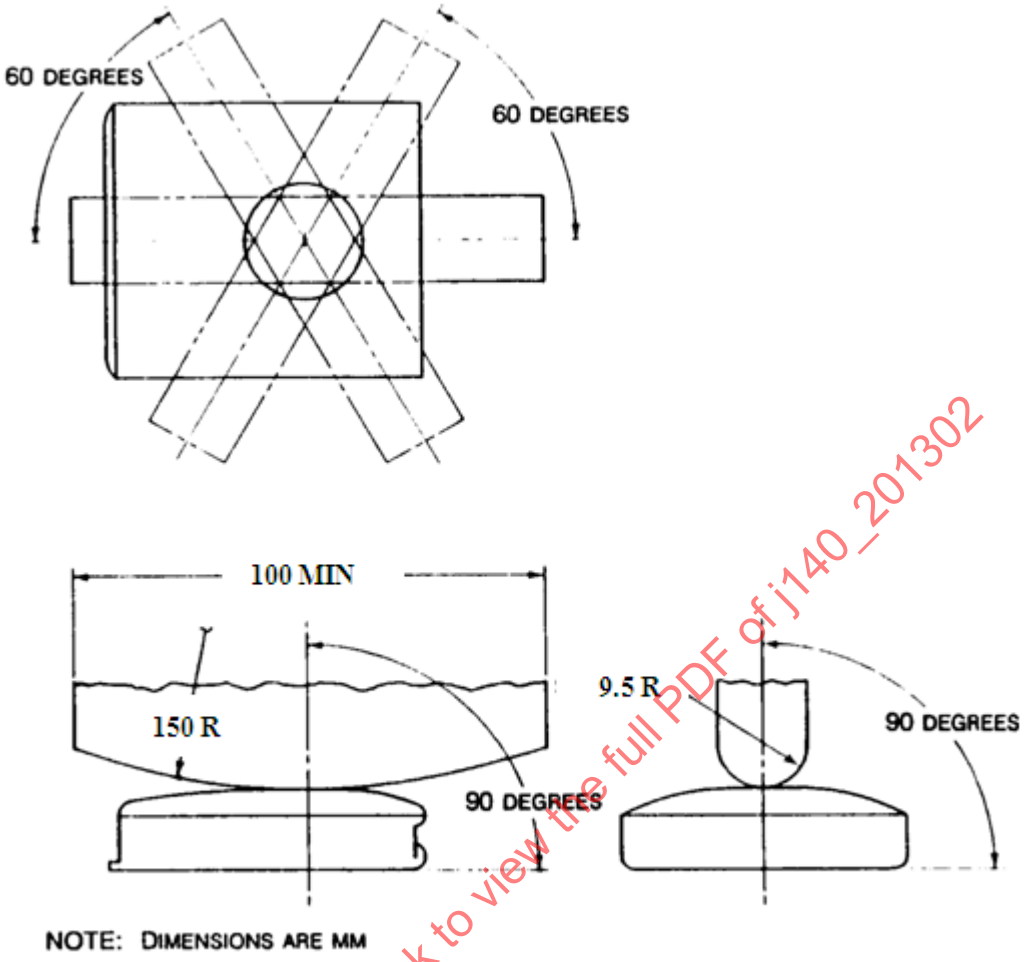


FIGURE 2 - BUCKLE COMPRESSION

5. SYSTEM TEST PROCEDURES RELATED TO HARDWARE

5.1 Adjustment Force

Three buckles or other manual adjusting devices normally used to adjust the length of the assembly shall be tested. This test shall be conducted within 1 h after conditioning under laboratory ambient conditions. With no load on the anchor end, the webbing shall be drawn through the adjusting device at a rate of 500 mm ± 50 mm per minute and the maximum force shall be measured to the nearest 1 N after the first 25 mm of webbing movement. The webbing shall be precycled 10 times prior to measurement.

5.2 Tilt-Lock Adjustment

This test shall be conducted on locking latchplates used on two point seat belt assemblies with the webbing intended for use in the latchplate. Three locking latchplates shall be tested after the adjustment force test. The webbing shall be precycled 10 times prior to measurement. The base of the latchplate and the anchor end of the webbing shall be oriented in planes normal to one another with the webbing vertical as in Figure 3. The latchplate base shall be horizontal at the start of the test. The webbing shall be drawn through the locking latchplate so as to increase belt length at a rate of 500 mm ± 50 mm (per minute, while the plane of the base is slowly rotated in a direction so as 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 89 N). The locking angle between the anchor end of the webbing and the base of the locking latchplate shall then be measured to the nearest degree. .

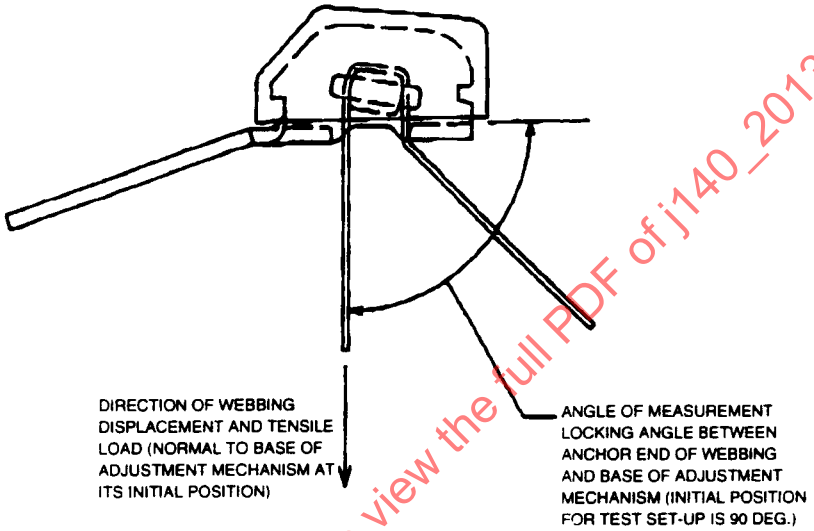


FIGURE 3 - TILT-LOCK ADJUSTMENT

5.3 Abrasion

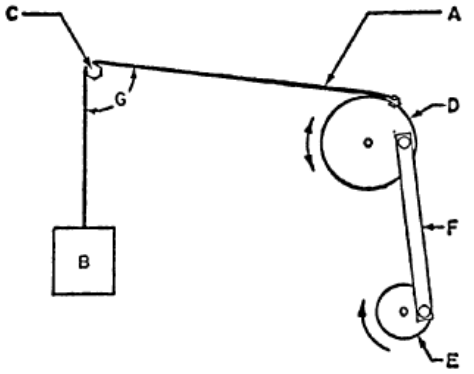
5.3.1 Abrasion for Type 2 Seat Belt Assemblies

Condition 3 seat belt assemblies per 4.1. The webbing from these assemblies shall be tested for resistance to abrasion by rubbing over the hexagon bar prescribed in Figure 4 in the following manner: The webbing shall be mounted in the apparatus shown schematically in Figure 4. One end of the webbing (A) shall be attached to a mass (B) of 2.35 kg ± .05 kg. The webbing shall be passed over the two new abrading edges of the hexagon bar (C) and the other end attached to an oscillating drum (D) which has a stroke of 330 mm. Suitable guides shall be used to prevent movement of the webbing along the axis of hexagonal bar C. Drum D shall be oscillated for 5,000 strokes or 2,500 cycles at a rate of 60 2 strokes per minute or 30 ± 1 cycles per minute. The abraded webbing shall be conditioned as prescribed in paragraph (a) of this section and tested for breaking strength by the procedure described in paragraph (b) of this section. The median values for the breaking strengths determined on abraded specimens shall be used to calculate the breaking strength retained.

5.3.2 Abrasion for Type 1 Seat Belt Assemblies

The webbing used in two point locking latchplate assemblies shall be tested for resistance to webbing abrasion by the adjust latchplate. The webbing of the assembly to be used in this test shall be conditioned per section 4.1. The webbing shall be pulled back and forth through the manual adjusting device as shown schematically in Figure 5. The anchor end of the webbing (A) shall be attached to a mass (B) of 1.4 kg. If the mass of 1.4kg should prove insufficient to pull the webbing through the adjuster on the lengthening stroke, it is allowable to clamp the webbing to the abrasion cycling drum such that the drum pulls the webbing through the adjuster at a 90 degree angle. A roller can be used to maintain the 90 degree angle if required. See Figure 6.

The webbing shall pass through the buckle (C), and the other end (D) shall be attached to a reciprocating device so that the webbing forms an angle of 8 degrees with the hinge stop (E). The reciprocating device shall be operated for 2,500 cycles at a rate of 18 cycles per minute with a stroke length of 203 mm. The abraded webbing shall be tested for breaking strength by the procedure described in paragraph S5.1(b).



A – WEBBING
B – WEIGHT
C – HEXAGONAL ROD
STEEL – SAE 51416
ROCKWELL HARDNESS – B-97 TO B-101
SURFACE – COLD DRAWN FINISH
SIZE – 0.250 ± 0.001 INCH OR
6.35 ± 0.03 MILLIMETER
RADIUS ON EDGES – 0.020 ± 0.004 INCH OR
0.5 ± 0.1 MILLIMETER
D – DRUM DIAMETER – 16 INCHES OR
40 CENTIMETERS
E – CRANK
F – CRANK ARM
G – ANGLE BETWEEN WEBBING – 85 ± 2 DEGS.

FIGURE 4 – HEX BAR ABRASION

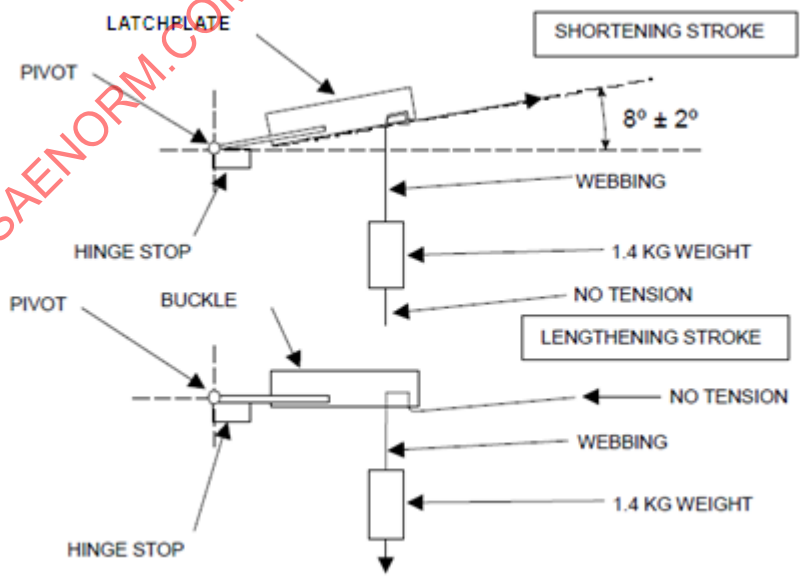


FIGURE 5 – LATCHPLATE ABRASION

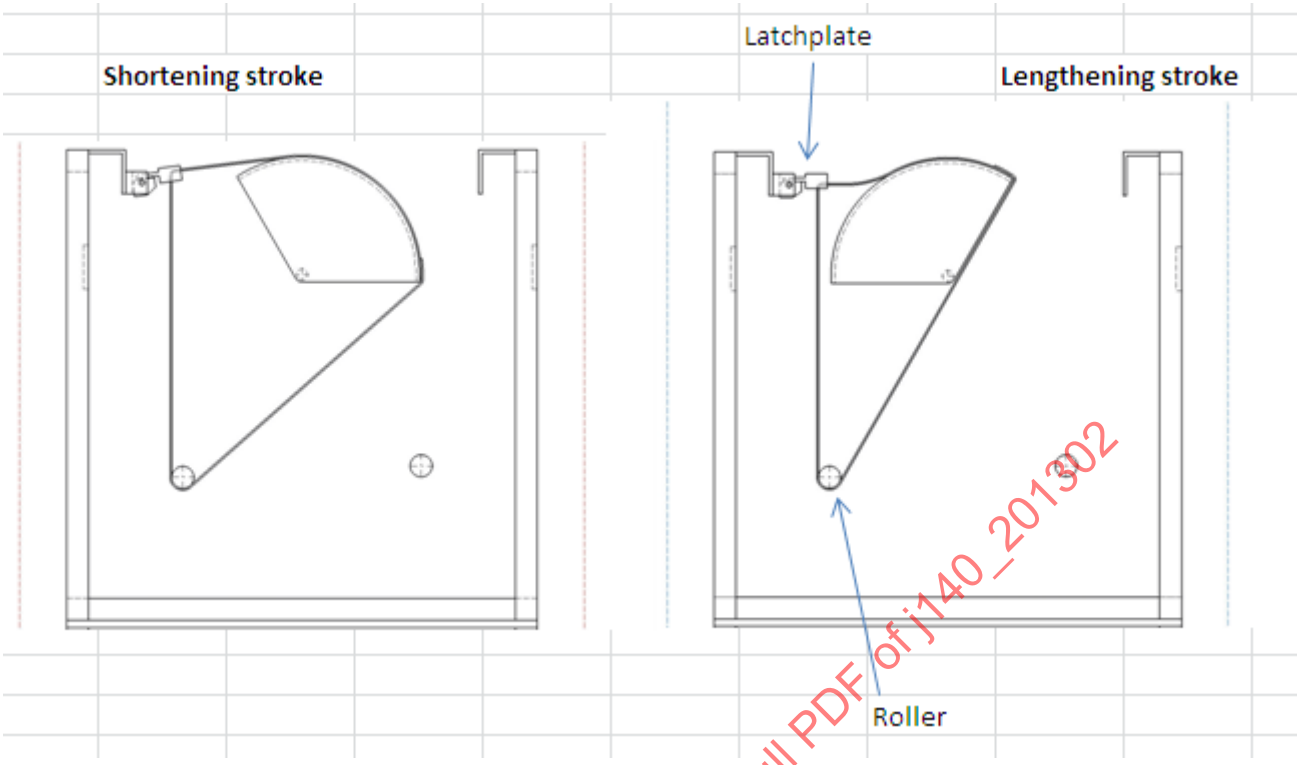


FIGURE 6 - ALTERNATIVE LATCHPLATE ABRASION TEST

6. WEBBING BREAKING STRENGTH

6.1 Web Width Test

Webbing from three seat belt assemblies shall be conditioned in accordance with 4.1 and tested for breaking strength in a testing machine of capacity verified to have an error of not more than 1% in the range of the breaking strength of the webbing in accordance with ASTM E 4-82.

The machine shall be equipped with split drum grips illustrated in Figure 7, having a diameter between 50 and 100 mm. The rate of grip separation shall be between 50 and 100 mm/m. The distance between the centers of the grips at the start of the test shall be between 100 and 250 mm. After placing the specimen in the grips, the webbing shall be stretched continuously at a uniform rate to a load of 9800 ± 450 N. The width shall then be measured and shall not be less than the minimum specified in 6.2 of SAE J141.

6.2 Web Tensile Test

Webbing from three seat belt assemblies shall be conditioned in accordance with 4.1 and tested for breaking strength in a testing machine of capacity verified to have an error of not more than 1% in the range of the breaking strength of the webbing in accordance with ASTM E 4-82.

The machine shall be equipped with split drum grips illustrated in Figure 7, having a diameter between 50 and 100 mm The rate of grip separation shall be between 50 and 100 mm/m The distance between the centers of the grips at the start of the test shall be between 100 and 250 mm 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 6.1 of SAE J141.

6.3 Web Light Resistance

Webbing at least 508 mm in length from three seat belt assemblies shall be exposed to the light of a xenon arc lamp according to the method described in Textiles – Tests for Colour Fastness – Colour fastness to artificial light: Xenon arc fading lamp test, ISO 105-B02 (1978) published by the International Organization for Standardization, for the time necessary to produce a contrast equal to grade 4 on the grey scale on Standard Blue Dye No. 7.

The webbing shall then be tested for tensile strength per 6.2 above. The minimum value shall not be less than as specified in section 6.1 of SAE J141

7. TEST PROCEDURES FOR ASSEMBLY PERFORMANCE

7.1 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 Figure 7, shall be tested in the following manner:

7.1.1 The testing machine shall conform to the requirements specified in Section 6. A double roller block shall be attached to one head of the testing machine. The block shall consist of 2 rollers, 100 mm (4.0 in) in diameter, and sufficiently long so that no part of the seat belt assembly touches parts of the block other than the rollers during the test. The rollers shall be mounted on antifriction bearings and spaced 300 mm (12.0 in) between centers, and shall have sufficient capacity so that there is no brinnelling, 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.

7.1.2 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 to the two sides of the loop. The attaching bolt shall be parallel, or at an angle of 45 or 90 degrees 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 be installed to produce the maximum angle in use indicated by the installation instructions.

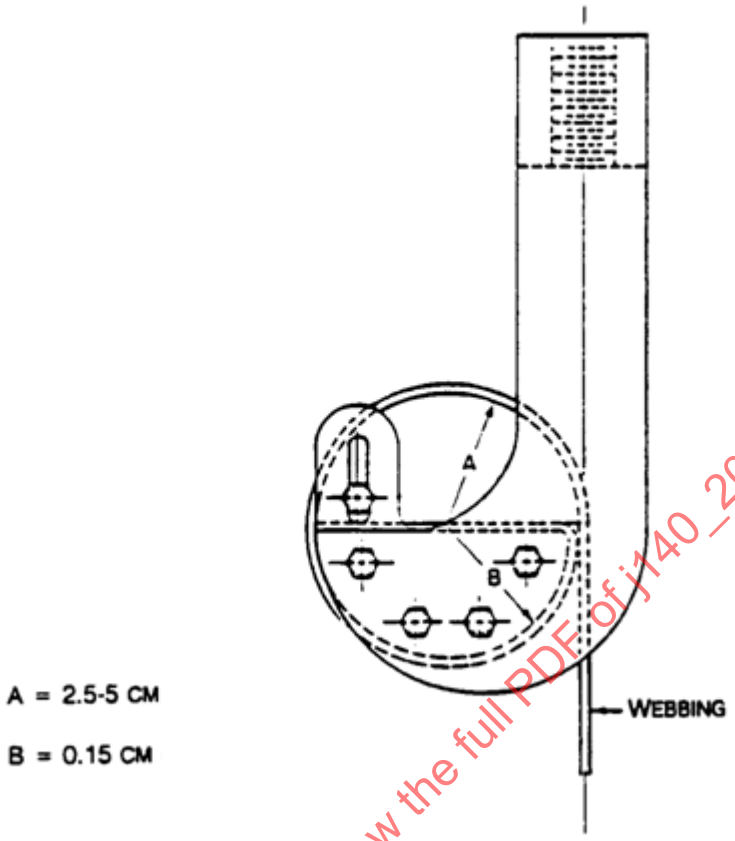


FIGURE 7 - WEBBING BREAKING STRENGTH