



QUALITY ASSURANCE SPECIFICATIONS™

SFI SPECIFICATION 16.5

EFFECTIVE: DECEMBER 29, 2014*

PRODUCT: Stock Car Driver Restraint Assemblies

1.0 GENERAL INFORMATION

- 1.1 This SFI Specification establishes uniform test procedures and minimum standards for evaluating and determining performance capabilities for Stock Car Driver Restraint Assemblies used by individuals engaged in competitive motorsports.
- 1.2 The procedures, test evaluations and standards contained herein, are intended only as minimum guidelines for construction and evaluation of products. Certification that products meet such minimum standards is made by the product manufacturer and products are not certified, endorsed or approved by SFI under this program.
- 1.3 Use of the "This Manufacturer Certifies That This Product Meets SFI Specification 16.5" logo/designation, the authorized artwork style, or conventional lettering by a manufacturer, on a subject product, is intended only to indicate that the manufacturer of the product has represented that they have submitted the product to the recommended tests, with positive results, in compliance with the standards established herein.
- 1.4 This SFI Specification requires a demonstration that the product of a manufacturer meets or exceeds the requirements when the manufacturer enters the program; and on an annual basis thereafter. Any manufacturer may participate in the program by providing Stock Car Driver Restraint Assemblies that meet or exceed the SFI Specification 16.5 test standards, by complying with the requirements of the SFI Specification 16.5 program, and by signing a licensing agreement with the SFI Foundation, Inc.

- 1.5 Compliance with this specification is entirely voluntary. However, when a manufacturer provides Stock Car Driver Restraint Assemblies in compliance with all requirements of the SFI Specification 16.5 and enters into the licensing agreement with the SFI Foundation, Inc., they may certify that compliance with such standards is in accordance with the guidelines established herein.
- 1.6 Manufacturers wishing to participate in the program, in addition to the other requirements of this specification, must label each of their products with the manufacturer's name, trademark or symbol as well as the date of manufacture and part number/model number of the product.
- 1.7 No manufacturer may display the SFI logo/designation on their product unless the manufacturer has signed a licensing agreement with SFI and has successfully complied with all the requirements of this specification and the self-certification program.

2.0 DEFINITIONS

- 2.1 A Stock Car Driver Restraint Assembly is used to secure the user within a vehicle roll cage or cockpit structure with the objective of minimizing injury during accident conditions.
- 2.2 The useful life of a Stock Car Driver Restraint Assembly shall not exceed two years from the date of manufacture and must be replaced at or before that time.
- 2.3 Body Block: A device constructed of wood, metal or any other appropriate combination of materials which approximates the torso of an average size male and be adequately designed to withstand all Stock Car Driver Restraint Assembly test loads prescribed in this spec. The Body Block shall conform to all dimensions and descriptions, including the cloth covering, described in Figure 2 of this specification.
- 2.4 Any restraint assembly pertaining to this specification shall remain as constructed by the original manufacturer and shall not be modified or altered by anyone else.

3.0 CONSTRUCTION

3.1 DEFINITIONS, INCLUDING COMPONENT REQUIREMENTS (OTHER THAN WEBBING)

3.1.1 DRIVER RESTRAINT SYSTEM

An assembly which includes a lap belt, shoulder harnesses and anti-submarine belt(s) with the associated release mechanism, attachment, adjustment and mounting hardware.

3.1.2 LAP BELT

A belt assembly designed to restrain the pelvis. It includes the release buckle mechanism along with adjustment and attachment hardware.

3.1.3 SHOULDER HARNESSSES

Individual belts for each shoulder, designed to restrain the upper torso and shoulder area. The harness must be attached to the roll cage on the upper end and to the release buckle on the lower end with belt adjustments on the webbing in between. Sternum cross belts using metal or hard surface hardware are not permitted.

3.1.4 ANTI-SUBMARINE BELT(S)

A belt assembly designed to limit the forward motion of the pelvis while preventing the lap belt from riding up from the pelvis. The belt can be configured with a single forward-facing or vertical mount while attaching to the release buckle (5 point) or it can be mounted under the buttocks with individual belts passing up through the groin area and attaching to the release buckle (6 point) or passing through d-rings on the lap belt and attaching to the shoulder harness tabs (6 point, d-ring).

3.1.5 RELEASE BUCKLE

The latching mechanism attached to the lap belt must provide a common connection for the lap belt, shoulder harnesses and the anti-submarine belt(s) and must be designed with a quick and easy one-handed, gloved release of all belts in all conditions. Clear markings denoting the manufacturer and date of manufacture must be permanently marked on the hardware. It must have one (1) of two (2) release designs:

(A) Latch/Lever: Utilizes a lever opening away from the body in a right to left hand movement, parallel to the lap belt with a complete release of all belts. Lever must have a provision to prevent an unintentional release.

(B) Cam Lock: A circular handle or raised surface that turns in either direction for a motion of not less than 30 degrees before completely releasing all belts. A downward facing tab or toggle may be used, provided that its length does not extend more than ½ inch beyond the outer diameter of the release mechanism unless a provision to prevent unintentional rotation or release is provided. If a cam lock latching mechanism is used, it must be attached to either the lap belt or the shoulder harness.

3.1.6 ADJUSTMENT HARDWARE

Hardware used for adjusting the length of the individual belts. Roller adjusters may be used mid-belt on the shoulder harnesses and mid-belt on the right and left lap belts. Roller adjusters may also be directly attached to the release buckle or attachment tab with no webbing loop. If a roller type adjustment is not used, a 3-bar slider, threaded in accordance with the manufacturer's instructions, may be used near the attachment tab for length adjustment on either the left or right lap belt. All roller adjusters must use a tension spring as a part of the designed assembly if the belt uses the adjuster in mid-belt. Clear markings denoting the manufacturer and date of manufacture must be permanently marked on the hardware.

3.1.7 ATTACHMENT HARDWARE

Steel tabs using a minimum 3/8 inch diameter bolt hole to secure the belt mount locations. The belt material may be folded inward to pass through the mounting tab slot, which may be a minimum of two (2) inches wide. Wrap around type mounts may be used on shoulder harnesses that do not cross behind the driver and on anti-submarine belts but not on lap belts. Wrap around type mounts must terminate in a 3-bar slider attachment, threaded to manufacturer's instructions. Clip-on mounts and eyebolts attachment with safety pin provision may be used. Clear markings denoting manufacturer and date of manufacture must be permanently marked on the hardware.

3.1.8 PHYSICAL MEASUREMENT OF HARDWARE

- A. Hardware Edge Finish: All peripheral hardware edges that can contact the webbing must be free from burrs and sharp edges that may cause tearing of the webbing. All peripheral hardware edges must have a minimum radius of 0.025 inch. All other hardware edges must be free from burrs and sharp edges.
- B. Hardware Dimensions: Hardware thickness, slot lengths, widths, hole sizes and clearances on moving components must be measured and recorded.

3.2 DEFINITION - WEBBING

3.2.1 MATERIAL PROPERTIES

All restraint system webbing must be a woven narrow fabric manufactured with continuous filament yarns. The yarns used in the manufacture of the webbing shall be bright, high tenacity, light and heat resistant. Webbing must be produced of Nylon or Polyester yarns or a blend of both. The ends of the webbing must be protected or treated to prevent raveling. The free end of the lap belt must not freely pull out of the adjustment hardware when fully adjusted to the maximum length.

3.2.2 MINIMUM WIDTH

Lap, shoulder and anti-submarine belt webbing width must be 1-23/32 inches (1.72") minimum with a tolerance of -1/32 inch.

3.2.3 LABELS

All labels must be sewn on the webbing in an area that is not in contact with, and cannot come in contact with, any release buckle, adjustment hardware, attachment hardware or similar device.

4.0 MODEL CLASSIFICATION

Any variation of dimensions (except length of webbing), materials, construction, buckle type or associated hardware is considered a model change.

5.0 TESTING

Test samples shall be fully processed, new restraint assemblies which are representative of restraint assemblies currently produced or to be produced. All mounting hardware shall be tested with the corresponding restraint straps during the assembly testing. Webbing shall be tested for breaking strength and abrasion resistance for initial design validation of webbing, upon periodic revalidation of webbing when due, and upon any variation or change in webbing width and/or webbing type used by the manufacturer. It is not necessary to retest webbing in conjunction with each restraint assembly model submitted if there has been no variation made in webbing width or type and if webbing test certification reports are current. Any information not supplied herein shall be taken from Aerospace Standard "SAE AS 8043 – Torso Restraint Systems".

5.1 BREAKING STRENGTH - WEBBING

Test in accordance with SAE AS 8043 unless otherwise specified.

5.1.1 SAMPLES

One sample of each webbing width used in restraint assembly construction shall be tested. Adjusting, attachment or buckle hardware is not to be included in this test.

5.1.2 APPARATUS

A standard tensile test machine or equivalent shall be used. The machine shall be equipped with split drum grips (See Figure 1), having a diameter between 2-4 inches (50-100 mm). The test machine must be capable of applying a tensile load of 15,000 lbs (66.7 kN). The test machine must also be in calibration and traceable to the National Institute of Standards and Technology (NIST).

WEBBING GRIPS - SPLIT DRUM TYPE

A 25 to 50 mm (1 to 2 in.)

B A - 1.5 mm (0.06 in.)
(Dimension "A" minus web thickness)

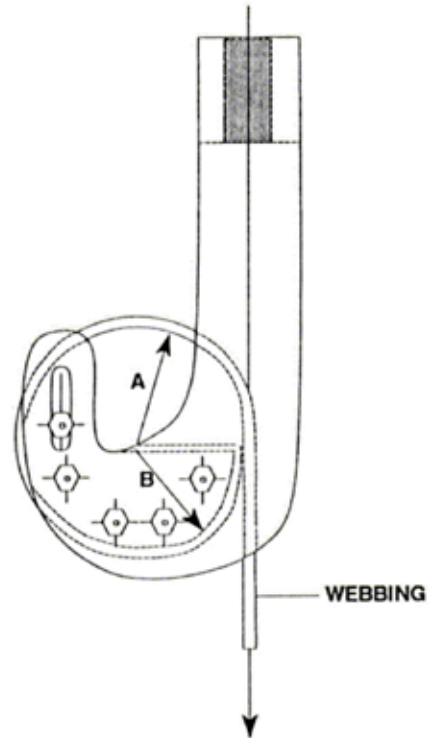


Figure 1
(Typical)

5.1.3 PROCEDURE

- A. At a separation rate of 2 to 4 inches per minute apply an initial preload of 45 to 55 lbs. (0.20 to 0.24kN) and then measure and mark a 5.0 ± 0.03 inch (12.7 ± 0.08 cm) gage length.
- B. At a separation rate of 2 to 4 inches (5.1 to 10.2cm) per minute, increase the tensile load to 2,500 lbs. (11.1kN) and hold at that level.
- C. Measure and record the gage length elongation within ± 0.03 inch (± 0.08 cm)
- D. Continue load application until webbing failure occurs and record the load at break.

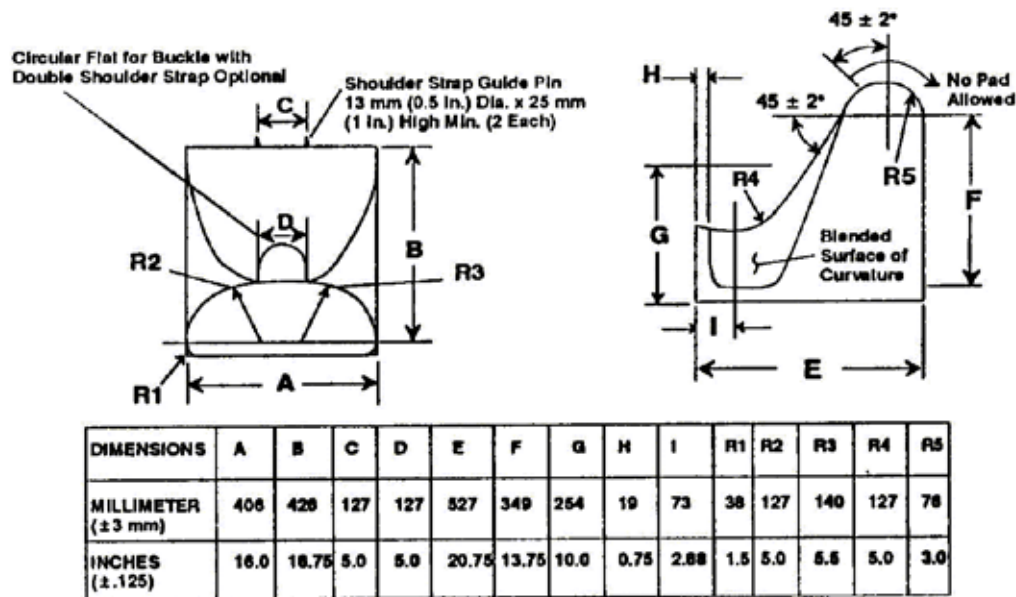
5.2 RESTRAINT ASSEMBLY TEST

5.2.1 SAMPLES

One sample of each model including all belts, all adjustment hardware, all release hardware, and all attachment hardware normally supplied with the specific model of harness assembly shall be tested.

5.2.2 APPARATUS

A body block conforming to the dimensions and description defined in SAE AS 8043 shall be used (See Figure 2). The restraint assembly sample shall be installed on the body block as shown in Figure 3, incorporating all of the belt and harness attachment hardware at the belt extremities to be used as the mounting points to the loading device.



- NOTES:**
1. Surfaces of curvature may be padded with closed cell, non-resilient foam not exceeding one inch thick and density not less than 112 Kg/m³ (7 lbs./cu.ft.). Padding shall be loosely covered with two layers of synthetic cloth material.
 2. Unpadded surfaces in contact with safety belt webbing during testing shall have a smooth hard finish and shall be loosely covered with two layers of synthetic cloth material.

Figure 2

5.2.3 PROCEDURE

- A. Mark lap and shoulder belts at edge of adjusters before starting tests so that any slippage may be determined.
- B. Preload the lap belt (pelvic restraint portion) of the system to at least 3,000 lbs (13.3 kN), in balanced loop load, then load the upper anchorages of the shoulder harnesses (upper torso restraint) to 2,875 lbs each (5,750 lbs total). Increase the pelvic restraint load to achieve total loop load of 5,750 lbs after applying the upper torso restraint load.
- C. The anti-submarine strap shall be anchored horizontally from "lap" height to absorb any buckle movement loads (see Figure 3).
- D. Maintain the load for ten (10) seconds.
- E. Relieve all loads on the upper torso restraint, then reduce pelvic restraint loads to a balanced loop load of 250 lbs (1.1 kN). Maintain this load to measure and record the following:
 - 1. Webbing slippage through all manual adjusters.
 - 2. Depending on the type of buckle mechanism, the force, the torque or both, necessary to disengage the buckle. If more than one motion is required to open the mechanism, measure the exertion required for each motion. If the mechanism can be released in more than one direction, repeat this procedure for each direction.

Note: If a second or subsequent test on an individual buckle is outside exertion limits, another buckle may be used to test the other release direction(s) not previously tested (i.e. an individual buckle is only required to be within exertion limits for the first test to which it is subjected, but the design must be within exertion limits for each available release direction).

- F. Examine the webbing for cuts from the hardware.

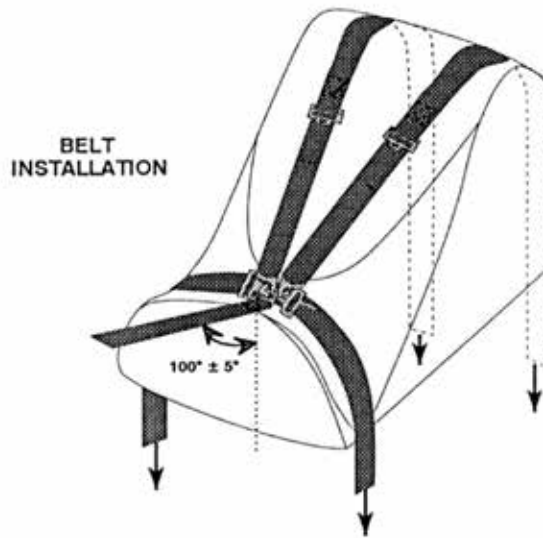


Figure 3

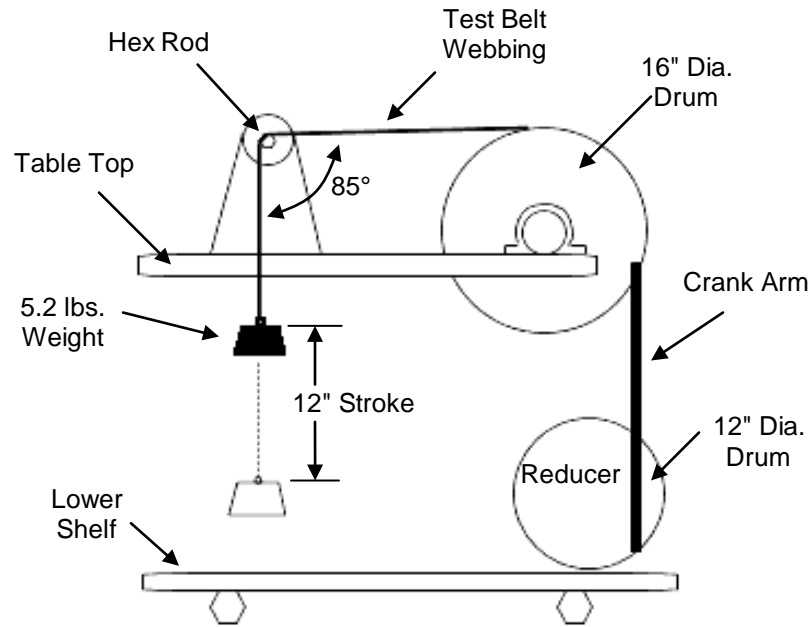
5.3 ABRASION RESISTANCE

5.3.1 SAMPLES

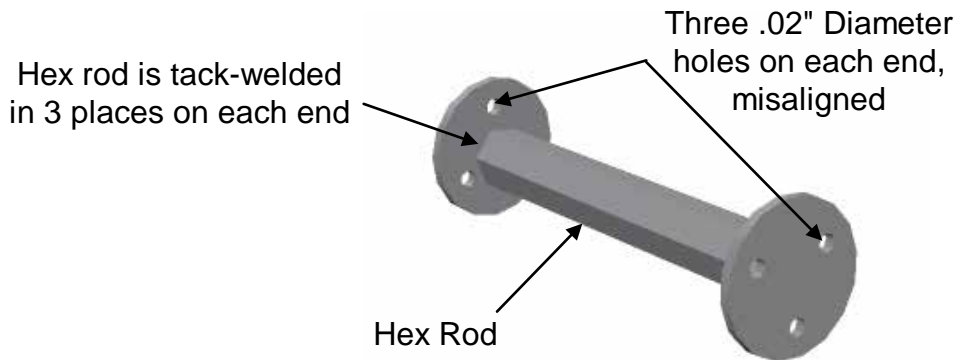
One sample of each webbing width and webbing type used in restraint assembly construction shall be tested. Adjusting, attachment or buckle hardware are not to be included in this test.

5.3.2 APPARATUS

An abrasion machine in conformance with Fed Test Method 5309 shall be used. It shall consist of a power driven, oscillating drum with an outside diameter of 16 inches (406 mm).



Abrasion Resistance Test Machine



Abrasion Test Hex Rod

5.3.3 PROCEDURE

One end of each specimen is attached to the drum and the other end passing over a hexagonal steel rod measuring $.250 \pm .001$ inch ($6.35 \pm .03$ mm) across opposite flat sides with a radius on the edges of $.020 \pm .008$ inch ($.5 \pm .2$ mm). The free end shall be attached to a weight of $2 \text{ lbs} \pm 2$ ounces ($.91 \text{ kg} \pm .06 \text{ kg}$) for specified breaking strengths under 1,000 lbs (4450N). For breaking strengths over 3,000 lbs (13,350N), the weight shall be $5.2 \text{ lbs} \pm 2$ ounces ($2.4 \pm .06 \text{ kg}$). During the test, the specimen oscillates over the hexagonal rod for a 12 ± 1 inches (305 ± 25 mm) traverse at the rate of 60 ± 2 strokes (30 ± 1 cycles) per minute for 5,000 strokes (2,500 cycles).

After conclusion of the 5,000 strokes, the specimen(s) shall be tested as described in paragraph 5.1 of specification, except there is no requirement to determine elongation.

5.4 ROLLER ADJUSTER MICRO-SLIP TEST

5.4.1 SAMPLES

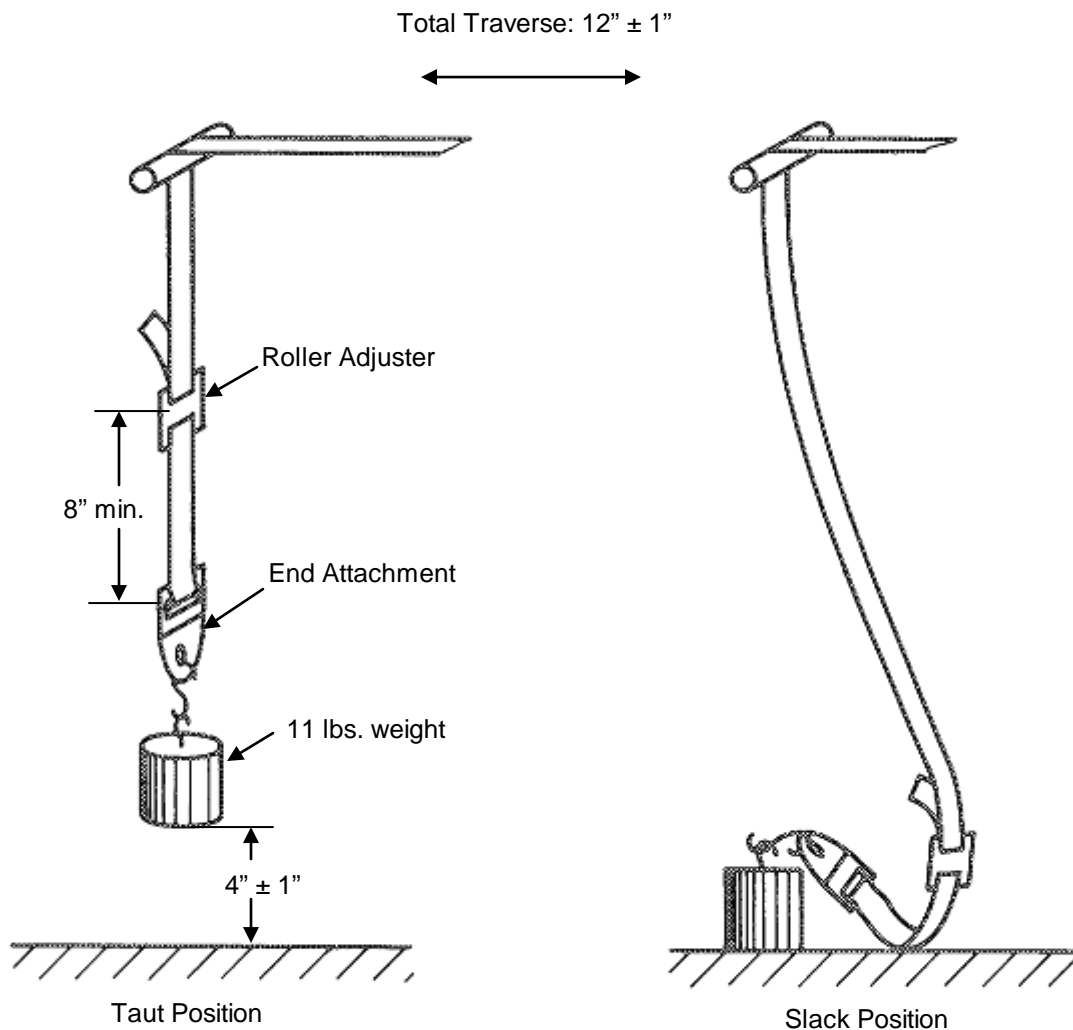
Two samples of each type of roller adjustment hardware used in the assembly shall be tested. Each test sample shall consist of a single strap of seatbelt webbing with the roller adjuster in the middle of the strap, and an end attachment hardware piece at one end of the strap. The roller adjuster shall be a minimum of 8 inches (200 mm) from the end attachment.

5.4.2 APPARATUS

The abrasion resistance test fixture described in Paragraph 5.4.2 above shall be used for the micro-slip test.

5.4.3 PROCEDURE

- A. Attach the free end of the entire webbing test strap to the drum fixture, with an 11 lbs. weight hooked to the lower end attachment as shown in the figure below. The free end of the webbing coming from the roller adjuster shall in no way be attached or clipped to the section under load.
- B. Before the actual start of the test, a series of 20 cycles shall be completed so that the self-tightening system settles properly.
- C. Mark the webbing strap at the edge of the adjuster before starting the actual test so that any slippage may be determined.
- D. Begin the test by raising and lowering the test load so the test sample goes from taut to slack. The sample shall oscillate in this manner for a 12 ± 1 inches (305 ± 25 mm) total traverse at the rate of 60 ± 2 strokes (30 ± 1 cycles) per minute for 2,000 strokes (1,000 cycles). The 11 lbs. load shall be raised 4 ± 1 inches (100 ± 25 mm) for each cycle.
- E. After conclusion of the 2,000 strokes, measure and record any slippage of the webbing strap between the roller adjuster and the end attachment.



Roller Adjuster Micro Slip Test

6.0 PROOF OF COMPLIANCE

Stock Car Driver Restraint Assembly manufacturers are required to provide the following information to enroll in this program:

6.1 TEST RESULTS

Test results shall be documented in a test report.

6.1.1 SHOULDER HARNESS CONSTRUCTION

Sternum cross belts, if used on the shoulder harness, shall not be metal or hard surface hardware.

6.1.2 RELEASE BUCKLE CONSTRUCTION

Identification markings denoting the manufacturer and date of manufacture shall be permanently marked on the hardware and recorded in the test report.

- A. The Latch/Lever, if used, shall open from right to left and completely release all belts. The Lever shall have a provision to prevent unintentional release of the latch and belts.
- B. The Cam Lock, if used, shall turn at least 30° before releasing the belts. If a tab or toggle is used, it shall face downward. If a tab or toggle is greater than 0.5" in length, then it shall have a provision to prevent unintentional release.

6.1.3 ADJUSTMENT HARDWARE CONSTRUCTION

The test report shall indicate the type of lap belt adjustment hardware used. If roller adjusters are used on the shoulder harnesses, they shall be located mid-belt and utilize tension springs. Identification markings denoting the manufacturer and date of manufacture shall be permanently marked on the hardware and recorded in the test report.

6.1.4 ATTACHMENT HARDWARE CONSTRUCTION

Lap belts shall not utilize wrap-around type mounts. Wrap-around type mounts on shoulder belts shall terminate in 3-bar slider attachments. Identification markings denoting the manufacturer and date of manufacture shall be permanently marked on the hardware and recorded in the test report.

6.1.5 PHYSICAL MEASUREMENT

All peripheral hardware edges in contact with webbing shall be free from burrs and sharp edges. All peripheral hardware edges shall have a minimum radius of 0.025". All other hardware edges shall be free from burrs and sharp edges.

6.1.6 WEBBING

- A. Material Properties: Webbing shall be produced of Nylon or Polyester yarns, or a blend of both. Webbing ends shall be protected or treated to prevent raveling. The free end of the lap belt shall not freely pull out of the adjustment hardware when fully adjusted to the maximum length.
- B. Minimum Width: Webbing shall be considered acceptable if it meets the minimum widths required in paragraph 3.2.2.

6.1.7 LABELS

All labels sewn on the webbing shall not be in contact with any release buckle, adjustment hardware, attachment hardware, or similar device.

6.1.8 BREAKING STRENGTH/ELONGATION - WEBBING

The breaking strength of webbing samples tested per paragraph 5.1.3 shall be greater than or equal to 7,000 lbs (31.1 kN). The elongation of the webbing sample(s) measured at 2,500 lbs. (11.1kN) must be 4% to 20%.

6.1.9 RESTRAINT ASSEMBLY TEST

- A. Each assembly shall endure the total test load of 11,500 lbs without breakage or failure. The metal components shall have no permanent deformation which will result in malfunctioning of the belt assembly.
- B. The total slippage through any manual adjuster and/or release mechanism shall not exceed one (1) inch (2.54 cm).
- C. Depending on the type of buckle, the mechanism shall disengage within the range of values given in Table 2 for each available release direction. If more than one buckle is used to qualify a design, each individual buckle tested must be within exertion limits for the first test to which it is subjected (i.e. a buckle design shall be rejected if an individual buckle fails to release within the exertion limits on the first test regardless of the release direction). Abbreviations used: inch pounds {in-lb}, newton meters {N-m} and not applicable {n/a}.

Table 2					
Buckle Type	Range	Torque		Force	
		IN-LB	N-M	LB	N
Latch/Lever	Minimum	N/A	N/A	6	26.69
	Maximum	N/A	N/A	60	266.88
Cam Lock	Minimum	25	2.82	N/A	N/A
	Maximum	65	7.34	N/A	N/A

6.1.10 ABRASION RESISTANCE

After completion of the procedure in Section 5.4 Abrasion Resistance, the specimen(s) will be tested for breaking strength in a manner similar to Section 5.1 above. The breaking strength of the webbing after abrasion shall not be less than 3,750 lbs.

6.1.11 ROLLER ADJUSTER MICRO-SLIP TEST

Any webbing slippage between the roller adjuster and the end attachment shall not exceed 1 inch (25 mm).

7.0 TEST REPORTS

A separate test report, or set of test reports if required, shall be submitted for each product model. If more than one test facility is required to complete all necessary tests, then a separate test report shall be submitted from each one. A test report shall be submitted for each component, if tested separately. The test facility shall assign a unique number to each test report. This number along with the report date and page number shall appear on each page. Each test report shall include:

7.1 RELEVANT INFORMATION

- 7.1.1 Manufacturer's name, contact name, address and telephone number.
- 7.1.2 Name, address and telephone number of the test facility.
- 7.1.3 Name and signature of the responsible test supervisor.
- 7.1.4 Actual date of the test.
- 7.1.5 Specification number and effective date.
- 7.1.6 Product name, description and part number/model number designation.
- 7.1.7 Component name and description.

7.2 TESTS

Each test conducted shall be listed showing the test name, apparatus used, procedure used and test results obtained along with any other appropriate information.

7.3 AUTHENTICATION

Test reports shall be authenticated and stamped by a Professional Engineer who is registered in the state in which the testing is conducted. If necessary, SFI may allow an equivalent entity to provide authentication.

8.0 INITIAL DESIGN VALIDATION

To receive initial recognition from SFI as a participant in the SFI Specification 16.5 Program, the manufacturer must submit to SFI all information delineated in the Proof of Compliance section. This information shall be provided for each Stock Car Driver Restraint Assembly part number/model offered by the applicant that is to be included in the program. Any change in design, materials and/or methods of manufacturing not specifically excluded is considered a part number/model change and, therefore, requires initial design validation.

Note: A model certification is based on the successful test results submitted for restraint assemblies with all offered mounting configurations. A restraint assembly variation shall not be considered certified under this part number/model number if it is later produced with a different mounting configuration unless it is also successfully tested.

9.0 PERIODIC REVALIDATION

Test reports with successful test results must be submitted to SFI at least once every 24 months following the date of the initial design validation test for each part number/model of Stock Car Driver Restraint Assembly manufactured by the participant. If multiple test reports are required to obtain all test results, then the earliest test date shall be used to determine when the periodic revalidation reports are due. Also, SFI shall retain the option to conduct random audit reviews. SFI shall purchase the product on a commercial basis and test for compliance to the specification. The submitting manufacturer shall reimburse SFI for all audit costs.

10.0 CERTIFICATION OF COMPLIANCE

Upon demonstration of successful compliance with all the requirements of the specification and the self-certification program and upon entering the licensing agreement with SFI, the manufacturer may advertise, present and offer the Stock Car Driver Restraint Assemblies for sale with the representation that their product meets the SFI Specification 16.5. Continuing certification is contingent upon the following additional considerations: (1) the product shall be resubmitted for testing following any change in design, materials and/or methods of manufacturing not specifically excluded, and (2) periodic revalidation test reports are submitted when due to SFI.

11.0 CONFORMANCE LABELS

The SFI conformance label is a label, purchased from SFI. One label shall be sewn onto each separate piece of the Driver Restraint Assembly. A separate piece is defined as the full length of the strap from the buckle to the anchor attachment. There shall be one label sewn onto each strap of the lap belt assembly (left and right), one label sewn onto each strap of the shoulder harness assembly (left and right) and one label sewn onto the anti-submarine strap assembly. The patch issued by SFI is preprinted to indicate the month and year of certification expiration per Paragraph 2.2 of this specification.

12.0 DECERTIFICATION

Participating manufacturers are subject to decertification when not in compliance with the requirements of this program or when their products are not in compliance with the requirements of this specification. Decertification will provide SFI the right to effect any and all remedies which are available to SFI in the licensing agreement.

13.0 APPEAL PROCEDURE

In the event of decertification, the manufacturer is entitled to an appeal of the decision of SFI. Requests for appeal must be received by SFI no later than thirty days following

receipt of the notice of decertification. Appeals of such decisions will be heard at the next meeting of the Board of Directors of SFI.

14.0 STATEMENT OF LIMITATIONS

Testing procedures and/or standards contained in this specification are intended for use only as a guide in determining compliance with the minimum performance requirements as defined herein. The granting and assignment of the "This Manufacturer Certifies That This Product Meets SFI Specification 16.5" logo/designation is in no way an endorsement or certification of product performance or reliability by SFI. SFI, its officers, directors and/or members assume no responsibility, legal or otherwise, for failure or malfunctions of a product under this program.

15.0 COSTS

All costs involved in this program will be absorbed by the submitting manufacturer.

16.0 COMPLIANCE PERIOD

As this specification is revised to reflect changes in technology and/or field conditions, to remain current, participating manufacturers in the SFI Specification 16.5, Stock Car Driver Restraint Assembly Program must demonstrate full compliance with the requirements of this specification within ninety (90) days of the latest effective date.

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