SFI FOUNDATION INC.™

QUALITY ASSURANCE SPECIFICATIONS™

SFI SPECIFICATION 16.1 EFFECTIVE: FEBRUARY 26, 2014*

PRODUCT: 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 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 16.1" 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 Driver Restraint Assemblies that meet or exceed the SFI Specification 16.1 test standards, by complying with the requirements of the SFI Specification 16.1 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 Driver Restraint Assemblies in compliance with all requirements of the SFI Specification 16.1 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 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 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 Driver Restraint Assembly: An assembly that includes a lap belt, shoulder harnesses, anti-submarine strap and an optional cross strap with their associated attachment, adjustment and mounting hardware.

2.3 Lap Belt: A belt assembly intended to restrain movement of the pelvis. It includes a connection/release buckle along with adjustment and mounting hardware.

2.4 Shoulder harness: A belt assembly, one strap for each shoulder, intended to restrain movement of the upper torso and shoulder regions. It includes adjustment and mounting hardware. Optional cross strap can be used to hold the shoulder harnesses together and if the cross strap is in front of the driver it must be capable of being released in a single motion. A Y-type shoulder harness, i.e. both shoulder straps become a single strap with one attachment point, is not permitted. (Effective January 1, 2005)

2.5 Anti-Submarine Strap: A belt assembly intended to prevent slippage of the pelvic region forward from under the lap belt during any condition producing a forward pelvic load. This strap can have various configurations. It can have a single mounting, with the other end attached at the buckle (five point) or it can be mounted at both ends with the attachment to the buckle between them (six point).

2.6 Buckle: A connector which attaches the lap belt straps together. It also connects the anti-submarine and shoulder harness straps to the lap belt. It must have the capability for easy, quick release in an emergency situation. The buckle shall release the individual shoulder straps separately from the lap straps and the anti-submarine straps. The buckle may have any configuration that meets the requirements of the specification.

2.7 Latch/Lever: A type of buckle release mechanism that utilizes a lever that opens away from the body. It releases by pivoting in a plane parallel to the lap belt.

2.8 Turn/Push: A type of buckle release mechanism that utilizes a military parachute design where the mechanism is first turned, in one direction only, and then pushed toward the body to release.

2.9 Cam Lock: A type of buckle release mechanism that typically utilizes a circular handle and/or raised surface that turns in either direction to release.

2.10 Adjustment Hardware: The hardware used for adjusting the length of the individual straps to fit the user including such hardware that may be integral with a buckle or mounting hardware.

2.11 Mounting Hardware: The hardware used for securing the individual straps of the restraint assembly to the vehicle.

2.12 The useful life of the webbing in the straps shall not exceed two years and they must be replaced at or before that time. Only the original manufacturer can re-web an assembly prior to re-certifying.

2.13 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 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.

2.14 Any restraint assembly pertaining to this specification shall remain as constructed by the original manufacturer and shall not be modified or altered by any one else.

3.0 CONSTRUCTION

3.1 HARDWARE

All hardware which contacts the user, his clothing, or the strap webbing shall be free from burrs and sharp edges and shall be so designed and located in the assembly that the possibility of injury to the occupant shall be minimized.

3.1.1 BUCKLE RELEASE MECHANISM

A. The mechanism shall be designed to minimize the possibility of accidental release.

B. The mechanism shall be capable of being easily released regardless of body attitude (hanging inverted, on side, etc.).

C. The mechanism shall be a quick release connector with no more than two separate motions required to release the entire restraint assembly.

D. The mechanism shall be capable of being easily released in any of the release directions by an individual wearing driving gloves and not able to see the mechanism.

3.1.2 ADJUSTMENT HARDWARE

The driver restraint assembly shall be capable of snug adjustment by the user by means easily within his reach and easily operable without appreciable interference with the driving process. When ratchet adjusters are used, the webbing wrap around an installed spool must be less than 3 revolutions of the spool.

3.1.3 MOUNTING HARDWARE

The mounting hardware shall be designed to prevent attachment bolts and other securing parts from becoming inadvertently disengaged from the vehicle.

3.2 WEBBING

Webbing shall be narrow fabric, woven with continuous filling yarns and finished selvages. Nylon and Polyester are the current acceptable materials. The use of any other material must be reviewed by the committee for consideration. The anti-submarine strap can be commercial seat belt material. The ends of the webbing in a driver restraint assembly shall be protected or treated to prevent raveling. The end of the webbing in the lap belt assembly, having a metal to metal buckle, that is used

by the driver to adjust the size of the assembly, shall not pull out of the adjustment hardware at the maximum size adjustment.

3.3 MINIMUM WIDTHS

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

4.0 MODEL CLASSIFICATION

Any variation of dimensions (except length of webbing), materials, construction, buckle 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, as provided by the manufacturer, shall be tested with the corresponding restraint straps during the assembly testing. Any information not supplied herein shall be taken from Aerospace Standard "SAE AS 8043 - Torso Restraint Systems".

5.1 BREAKING STRENGTH AND ELONGATION - WEBBING (CROSS STRAP OPTIONAL)

Test in accordance with paragraph 7.2 of SAE AS 8043 unless otherwise specified.

5.1.1 SAMPLES

One sample of each webbing width and one sample of each type of cross strap used in restraint assembly construction shall be tested for breaking strength. One sample of each webbing width used for shoulder harness and lap belts shall be tested for elongation. 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 11,500 lbs (51.1 kN). The test machine must also be in calibration and traceable to the National Institute of Standards and Technology (NIST).

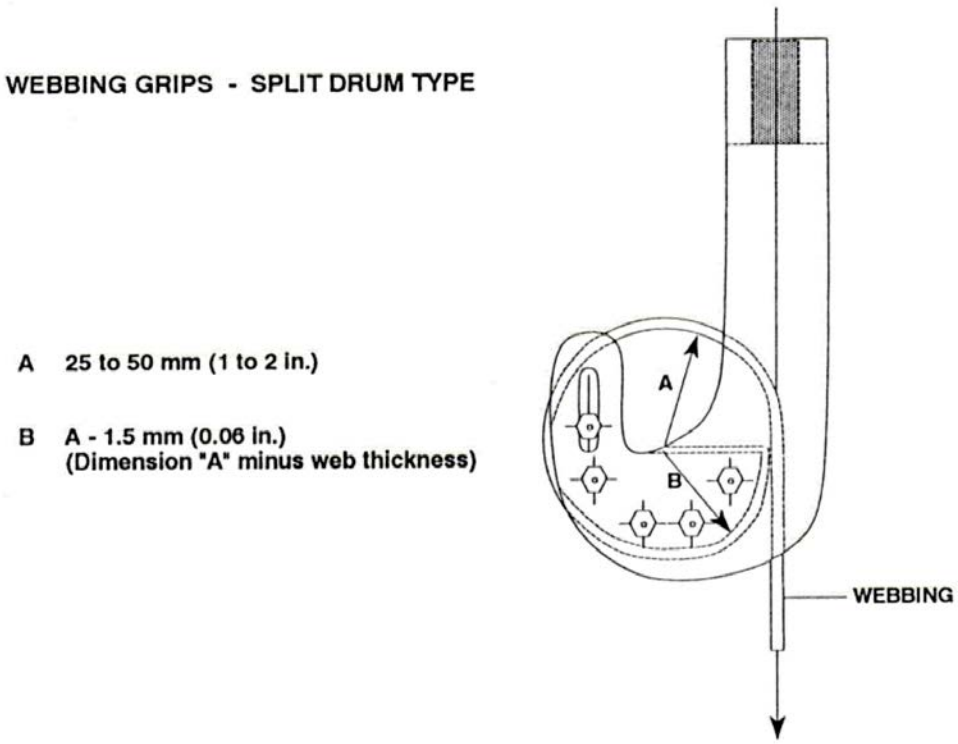


Figure 1
(Typical)

5.1.3 PROCEDURE

A. SHOULDER AND LAP BELT SAMPLES

1. Place the sample in the grips and apply an initial preload and hold to 45 to 55 lbs. (0.20 to 0.24kN).

2. Measure and mark a 5.0 ± 0.03 inch (12.7 ± 0.08cm) gage length near the center of the grip length.

3. 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.

4. Measure and record the gage length elongation within ± 0.03 inch (± 0.08cm)

5. Continue the load application until webbing failure occurs and record the load at break.

B. ANTI-SUBMARINE STRAP SAMPLE

1. Place the sample in the grips and apply an initial preload and hold to 45 to 55 lbs. (0.20 to 0.24kN).

2. Measure and mark a 5.0 ± 0.03 inch (12.7 ± 0.08cm) gage length near the center of the grip length.

3. At a separation rate of 2 to 4 inches (5.1 to 10.2cm) per minute, increase the tensile load to 1,500 lbs. (6.7kN) and hold at that level.

4. Measure and record the gage length elongation within ± 0.03 inch (± 0.08cm)

5. Continue the load application until webbing failure occurs and record the load at break.

C. CROSS STRAP (Optional)

1. After placing the cross strap sample in the grips, preload and hold to 45 to 55 lbs. (0.20 to 0.24kN).

2. No elongation values are required on cross strap.

3. Continue load application at a separation rate of 2 to 4 inches (5.1 to 10.2cm) per minute to 200 lbs. (0.9kN) and hold for ten (10) seconds and release the load.

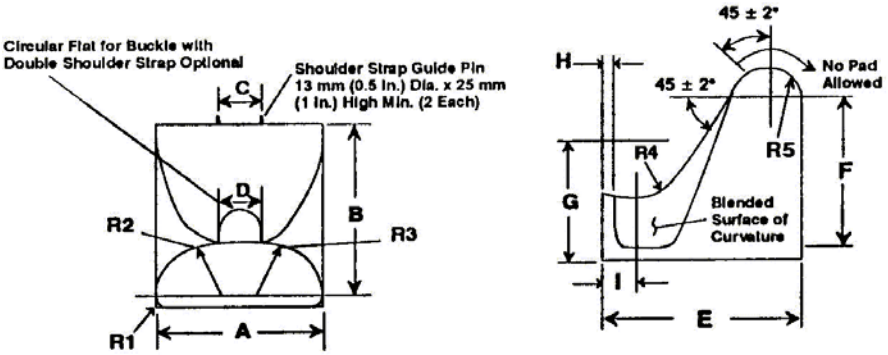
5.2 RESTRAINT ASSEMBLY TEST

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 or equivalent shall be used (See Figure 2) in conjunction with a loading device or devices which can produce 1.25 times the testing loads specified in Table 2 of this spec. 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.



DIMENSIONS	A	B	C	D	E	F	G	H	I	R1	R2	R3	R4	R5
MILLIMETER (±3 mm)	406	426	127	127	527	349	254	19	73	38	127	140	127	76
INCHES (±.125)	16.0	16.75	5.0	5.0	20.75	13.75	10.0	0.75	2.88	1.5	5.0	5.5	5.0	3.0

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/m^3 (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

Table 2

Harness Type	Shoulder Belt Load		Lap Belt Load	
	lb.	kN	lb.	kN
16.1	5750	25.58	5750	25.58

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 3000 lbs (13.3 kN), in balanced loop load, then load the upper anchorages of the shoulder harnesses (upper torso restraint) per Table 2, dividing the load equally between both. Increase the pelvic restraint load per Table 2 to achieve total loop load 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.

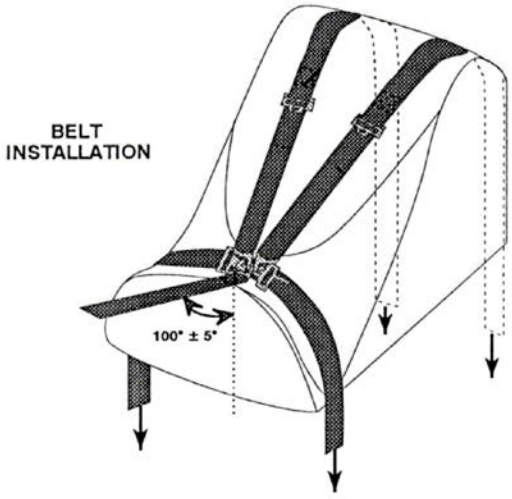


Figure 3

6.0 PROOF OF COMPLIANCE

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 BREAKING STRENGTH AND ELONGATION - WEBBING (CROSS STRAP OPTIONAL)

The elongation of the Lap/Shoulder Belt webbing sample(s) measured at 2,500 lbs. (11.1kN) and of the Anti-Submarine Belt webbing sample(s) measured at 1,500 lbs. (6.7kN) must be 5% to 20%. No elongation values are required for the optional cross strap.

The breaking strength of all webbing samples tested per paragraph 5.1.3 shall be greater than or equal to the minimum values in Table 3 below.

Table 3

Harness Type	Lap/Shoulder Belt Load		Anti-Submarine Strap Load		Cross Strap Load	
	Lb.	kN	lb.	kN	lb.	kN
16.1	6300	28	1500	6.7	200	.9

6.1.2 RESTRAINT ASSEMBLY TEST

A. Each assembly shall endure the test load 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 4 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 4

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
Turn/Push	Minimum	15	1.69	30	133.44
	Maximum	25	2.82	90	400.32
Cam Lock	Minimum	25	2.82	N/A	N/A
	Maximum	65	7.34	N/A	N/A

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 model designation.

7.1.7 Component name and description.

7.1.8 Photograph of the submitted restraint assembly.

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 16.1 Program, the manufacturer must submit to SFI all information delineated in the Proof of Compliance section. This information shall be provided for each Driver Restraint Assembly 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 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 model 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 month period following the date of the initial design validation test for each model of 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 Driver Restraint Assemblies for sale with the representation that their product meets the SFI Specification 16.1. 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 conformance label is a patch. One patch shall be sewn onto the left strap of the lap belt assembly, one onto the left strap of the shoulder harness assembly and one onto the anti-submarine strap. The patch issued by SFI is preprinted to indicate the month and year of certification expiration per Paragraph 2.12 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 16.1" 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 16.1, 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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*	Original Issue:	October 8, 1986
	Edited:	July 10, 1989
	Revised:	February 15, 1990
	Revised:	February 14, 1992
	Revised:	February 18, 1994
	Revised:	December 1, 1995
	Reviewed:	December 4, 1997
	Reviewed:	November 19, 1999
	Reviewed:	November 30, 2001
	Revised:	March 23, 2004
	Edited:	June 8, 2004
	Revised:	February 9, 2006
	Reviewed:	December 7, 2007
	Revised:	May 1, 2008
	Reviewed:	December 11, 2009
	Reviewed:	December 2, 2011
	Revised:	February 26, 2014
	Reviewed:	December 11, 2015
	Edited:	December 1, 2016
	Reviewed:	December 8, 2017
	Reviewed:	December 13, 2019
	Edited:	March 26, 2020