



QUALITY ASSURANCE SPECIFICATIONS™

SFI SPECIFICATION 38.1

EFFECTIVE: MARCH 16, 2015*

PRODUCT: Head and Neck Restraint Systems

1.0 GENERAL INFORMATION

- 1.1 This SFI Specification establishes uniform test procedures and minimum standards for evaluating and determining performance capabilities for Head and Neck Restraint Systems 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 38.1" 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 a periodic basis thereafter. Any manufacturer may participate in the program by providing Head and Neck Restraint Systems that meet or exceed the SFI Specification 38.1 test standards, by complying with the requirements of the SFI Specification 38.1 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 Head and Neck Restraint Systems in compliance with all requirements of the SFI Specification 38.1 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 model number, part number and 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 **Head and Neck Restraint:** An active Head and Neck Restraint System is a protection ensemble providing an alternative load path which decreases both neck stress and head excursion during a vehicle impact without reliance on helmet impact into structures or nets.
- 2.2 **Separate Restraining Devices:**
 - A. Linkages attached to the helmet which transfer restraining loads directly to the helmet from the main device which is secured to the driver's shoulders, torso, etc. Methods for attachment of these linkages to the helmet and main device shall be prescribed by the manufacturer.
 - B. The main device shall be a mechanism held tightly to the driver's torso by seat belts or other strap systems such that the reactive load carrying components move directly with the torso and controls head, neck, and torso relative positions during forward or off-center impact situations.
- 2.3 **Reaction Linkage:** The means by which the head force necessary to limit displacement of the head with respect to the torso is reacted. Acceptable reaction linkages could include load paths to the torso or to the restraint webbing. Direct attachment to react loads to a fixed point or points on a vehicle structure or restraint webbing will not be acceptable because of the potential for torso displacements with respect to these points. Imposed loading by the reaction linkage to other areas of the body should be applied using approaches demonstrated to be practical without imposing risk of serious injury.

- 2.4 The Head and Neck Restraint System must be designed and manufactured to allow freedom of movement of head, torso, arms, etc., commensurate with operating a race vehicle under all race and associated conditions.
- 2.5 Adjustment and release mechanism(s) shall be accessible to both the user and to external personnel such that no additional motion is required, other than the release of the seat belts, to disengage the Head and Neck Restraint System during emergency situations.
- 2.6 All or any portion of the Head and Neck Restraint System pertaining to this specification shall remain as constructed by the original manufacturer and not modified.
- 2.7 Effective January 1, 2012, Head and Neck Restraint Systems shall be inspected for recertification every five years after the date of original certification. Product inspection, maintenance, and/or replacement procedure is per individual manufacturer. Inspection must be done by the original manufacturer only, and not their authorized resellers or dealers. When a unit is determined by the manufacturer to be acceptable for continued service and in compliance with the current version of the specification, the original manufacturer shall place on the product a new SFI 38.1 conformance label marked with the inspection date.

3.0 CONSTRUCTION

3.1 MATERIALS

The materials used in the construction of the Head and Neck Restraint System shall be resistant to the elements to which they are exposed in normal service. Besides environmental considerations such as heat and UV light, these elements include fluids used in and around motor vehicles that may come in contact with the restraint system. All metal rivets, bolts, buckles, adjusters, etc. shall be corrosion resistant and have sharp edges and burrs removed. The materials and design shall not promote combustion as defined by flame resistance testing herein.

4.0 MODEL CLASSIFICATION

Any variation of the original design, i.e. construction methods, materials, size and quantity of straps or links shall be considered a model change. Any change which affects the kinematic response of the user of the device, must be tested at the judgment of SFI. SFI will assemble a review panel through which manufacturers can present items of modification that they feel do not constitute additional testing.

5.0 TESTING

5.1 IMPACT PERFORMANCE

5.1.1 SAMPLES

Test samples shall be fully processed new Head and Neck Restraint Systems that are representative of devices currently being produced or to be produced. All necessary attachment and adjustment hardware along with instructions shall be supplied by the certifying manufacturer.

5.1.2 APPARATUS

- A. The system shall be tested using a 50th percentile male Hybrid III anthropomorphic test device (ATD) seated and restrained in a pan type seat assembly per Figure 1 and with a Nylon SFI Specification 16.1 six-point driver restraint system (to be supplied by SFI) mounted to a conventional race car style mounting frame without steering wheel and steering column. The driver restraint system shall be installed so that each shoulder belt is horizontal from the top of the Head and Neck Restraint Device system to the belt attachment point. The attachment points for the lap belts and anti-submarine belt (crotch strap) may not be altered in any way. Head side supports and supplemental head nets for the seat shall not be included. A full-face racing helmet weighing 3.0 lbs. (1.36 kg) minimum without face shield shall be fitted to the Hybrid III ATD to achieve a typical fit per the helmet manufacturer's instructions. If attachment of tethers or other devices to the helmet are required, drilling and attachment location, methods and hardware shall be per manufacturer's instructions.

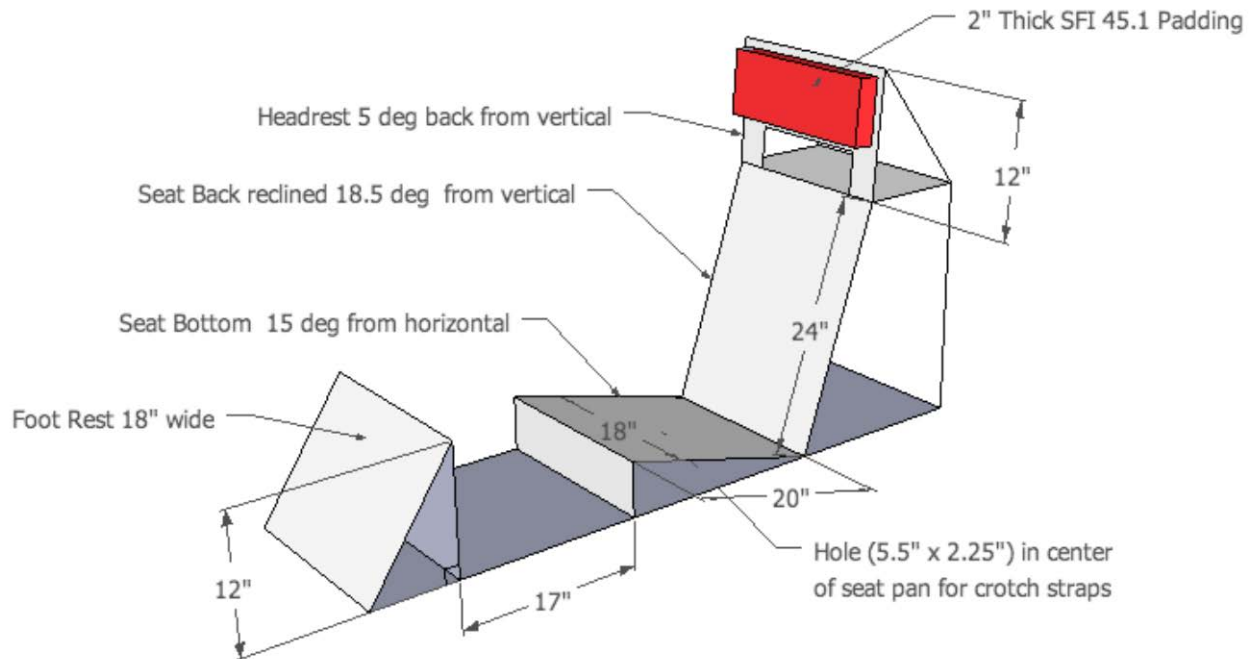


Figure 1

- B. Instrumentation in the Hybrid III ATD will be set up to read Upper Neck Tension and Compression Forces, and all data acquisitions necessary for calculating N_{ij} (per FMVSS 208.) The data from the upper neck transducers will be collected and filtered at SAE J211/1 Rev. March 95 channel frequency Class 600.
- C. A test sled (hydraulic or other) shall be capable of propelling the entire assembly in paragraph 5.1.2.A above in a manner to achieve a pulse contour per Figures 2A and 2B, producing a nominal 68G peak, 63 KPH (39.1 mph) velocity change.

Figure 2A

NASCAR Pulse
Velocity

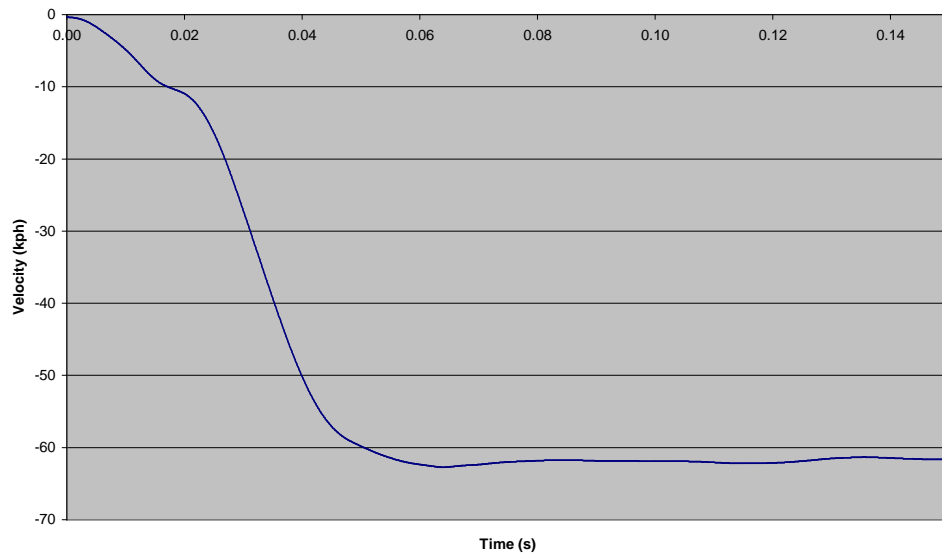
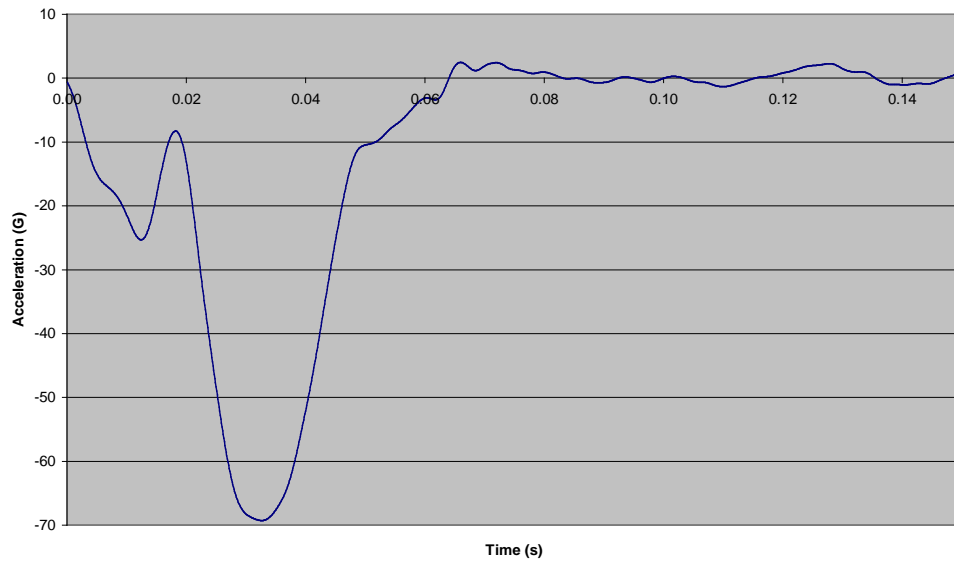


Figure 2B

NASCAR Pulse
Acceleration



- D. If it becomes desirable to utilize an alternative lab rather than IMMI/CAPE or to employ a different ATD than the Hybrid III, then test procedures and requirements may need to be reevaluated at the discretion of SFI.

5.1.3 PROCEDURE

- A. The Head and Neck Restraint System shall be assembled per the manufacturer's instructions to the 50th percentile male Hybrid III test device (ATD) and the ATD then shall be seated and restrained in the seat and mounting frame with the full face helmet fitted, all as described in paragraph 5.1.2.A of this specification. This complete assembly shall be mounted on the test sled.
- B. The test sled shall be propelled to produce the racing acceleration pulse (Figures 2A and 2B) at a nominal 68G peak, 63 KPH (39.1 mph) velocity change. For initial design validation, two (2) frontal tests and one (1) 30° right frontal test will be required. The results of both frontal tests and the 30° right frontal test must meet the requirements of paragraph 6.1.1. For periodic revalidation, one (1) frontal test and one (1) 30° right frontal test will be required. The results of the frontal test and the 30° right frontal test must meet the requirements of paragraph 6.1.1.
- C. The data recorded in the test shall be analyzed for the first 80 milliseconds of the test and then analyzed at 120 milliseconds of the test.

5.2 HEAD AND NECK RESTRAINT DEVICE SURFACE FLAME RESISTANCE

The test shall be conducted at an ambient temperature between 10°C (50°F) and 30°C (86°F).

5.2.1 SAMPLES

One Head and Neck Restraint System sample at ambient temperature shall be tested.

5.2.2 APPARATUS

A. THERMAL LOAD

The thermal load shall be applied by a gas Bunsen burner, with an inside diameter of 0.4 inch (9.5mm).

B. TIMING DEVICE

A timing device with an accuracy of ± 0.5 seconds shall be used to measure combustion rates.

C. FIXTURE

A fixture shall be used to support the Head and Neck Restraint System sample.

5.2.3 PROCEDURE

The Bunsen burner flame height shall be adjusted to 1.5 inches (38mm) and positioned perpendicular to the head and neck restraint device surface in at a site chosen by the test laboratory. The device surface shall be subjected to the thermal load at a distance of 0.75 inch (19mm) from the surface of the component to the center of Bunsen burner nozzle for a period of 15 ± 1 seconds and immediately removed. Measurement of the after-flame time shall start simultaneously with the removal of the flame. The after-flame time is the time the sample continues to flame after the burner flame is shut off.

5.3 TETHER FLAME RESISTANCE

The test shall be conducted at an ambient temperature between 10°C (50°F) and 30°C (86°F).

5.3.1 SAMPLES

One Head and Neck Restraint tether sample at ambient temperature shall be tested.

5.3.2 APPARATUS

A. THERMAL LOAD

The thermal load shall be applied by a gas Bunsen burner, with an inside diameter of 0.4 inch (9.5mm).

B. TIMING DEVICE

A timing device with an accuracy of ± 0.5 seconds shall be used to measure combustion rates.

C. FIXTURE

The test must be conducted in a draft free horizontal cabinet in accordance with Federal Test Method Standard 191 Model 5906 or equivalent.

5.3.3 PROCEDURE

The tether sample shall be mounted horizontally in the test cabinet. The Bunsen burner flame height shall be adjusted to 1.5 inches (38mm) and located in the test cabinet so that the Bunsen burner nozzle is positioned below one end of the tether sample as shown in Figure 3. The tether shall be subjected to the thermal load at a distance of 0.75 inch (19mm) from center of Bunsen burner nozzle to the center of the bottom edge of the tether for a period of 15 ± 1 seconds and immediately removed. Measurement of the speed of combustion shall start simultaneously with the removal of the flame.

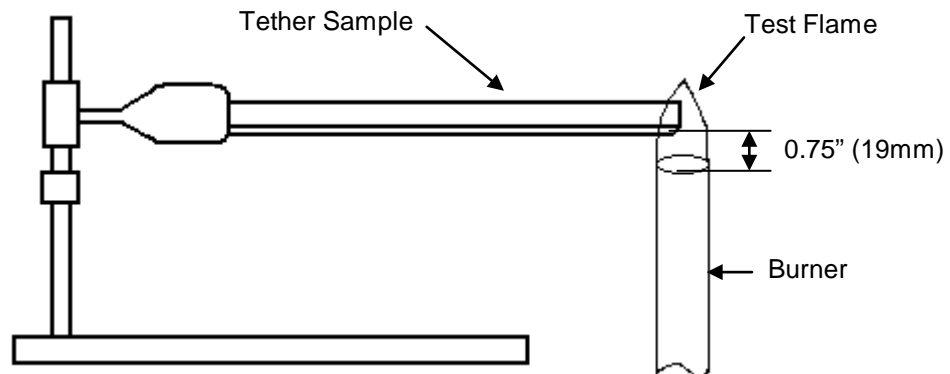


Figure 3
Test Flame Fixture Inside Test Cabinet

6.0 PROOF OF COMPLIANCE

Head and Neck Restraint System certifying 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 IMPACT PERFORMANCE FOR EACH TEST (procured from Hybrid III test device).

0 to 80 milliseconds:

Maximum Upper Neck Tension	2,500N (562 lbs)
Maximum Upper Neck Compression	2,500N (562 lbs)
Maximum Value of NIJ	1.0

80 to 120 milliseconds:

Maximum Upper Neck Tension	3,200N (719 lbs)
Maximum Upper Neck Compression	3,200N (719 lbs)
Maximum Value of NIJ	1.0

If in the judgment of the SFI, breakage during certification testing presents a threat to the occupant in actual use, the device will be considered to have failed the test, even if otherwise passing results have been achieved.

6.1.2 HEAD AND NECK RESTRAINT DEVICE SURFACE FLAME RESISTANCE

When the surface is tested per paragraph 5.2.3, the after-flame time, or time to self-extinguish, shall be within 10 seconds.

6.1.3 TETHER FLAME RESISTANCE

The speed of combustion of the tether per paragraph 5.3.3 shall be less than or equal to 3 inches/minute (77mm/minute).

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, model designation and part number.
- 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 38.1 Program, the manufacturer must submit to SFI all information delineated in the Proof of Compliance section. This information shall be provided for each Head and Neck Restraint System 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.

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 Head and Neck Restraint System 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 Head and Neck Restraint System for sale with the representation that their product meets the SFI Specification 38.1. 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 “punch-out” sticker or label for the Head and Neck Restraint System. The label shall be punched with the month and year of manufacture and be placed on the outside surface. The month and year of manufacture shall be punched in each label with a 1/8" hole punch.

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 38.1" 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 38.1 Head and Neck Restraint System must demonstrate full compliance with the requirements of this specification within ninety (90) days of the latest effective date.

*	Original Issue:	October 25, 2004
	Reviewed:	December 11, 2004
	Revised:	July 19, 2007
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