SFI FOUNDATION INC.™

QUALITY ASSURANCE SPECIFICATIONS™

SFI SPECIFICATION 32.1 EFFECTIVE: JUNE 26, 2020*

PRODUCT: Stock Car Fuel Cell Bladder

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 Fuel Cell Bladders 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 32.1" 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 Stock Car Fuel Cell Bladders that meet or exceed the SFI Specification 32.1 test standards, by complying with the requirements of the SFI Specification 32.1 program, and by signing a licensing agreement with the SFI Foundation, Inc.

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1.5 Compliance with this specification is entirely voluntary. However, when a manufacturer provides Stock Car Fuel Cell Bladders in compliance with all requirements of the SFI Specification 32.1 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 so they can be visually inspected after installation with the manufacturer's name, trademark or symbol, model, serial number, 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 Stock Car Fuel Cell Bladder: A flexible enclosure for fuel that is generally encased within a metal container or other appropriate structural material but which has the capability to undergo moderate crash loads while retaining integrity and resisting rupture.

2.2 Service Life: The service life of Stock Car Fuel Cell Bladders is five (5) years from the date of manufacture and must be replaced at or before that time.

2.3 Any Fuel Cell Bladder pertaining to this specification shall remain as constructed by the original manufacturer and not modified.

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3.0 CONSTRUCTION

3.1 Bladders shall be constructed of a square woven nylon, aramid or oriented polyethylene fiber woven fabric impregnated and coated with a fuel resistant elastomer on the inside and the outside. The fuel bladder must return to its general shape and size after deformation.

3.2 The fuel cell bladder shall be constructed such that it meets all minimum requirements of this specification.

3.3 All SFI Spec 32.1 fuel cell bladders must conform to the following specifications:

3.3.1 They must be capable of readily rearranging their shapes safely and must have a fuel resistant inner and outer surface.

3.3.2 They must be fit for the purposes intended as defined in Section 1.1 and shall be constructed in accordance with standard industry practices.

3.3.3 All fuel cell bladder openings shall be through metal fittings attached to the bladder. Rubber or fabric reinforced nipple fittings are prohibited.

3.3.4 All access covers shall be of materials that have an elongation and ultimate load-carrying capability equal to or greater than 2024-T4 aluminum in the .250 inch thickness.

4.0 MODEL CLASSIFICATION

Model designation is based on type of material, wall thickness and construction method and configuration, but not generally shape or size. Therefore, changes in shape, color and/or size do not constitute a model change unless those changes produce a required modification to wall thickness or construction method. Any other changes will be considered a model modification and will require revalidation testing.

5.0 TESTING

The fuel cell bladder product and material shall be subjected to the following tests:

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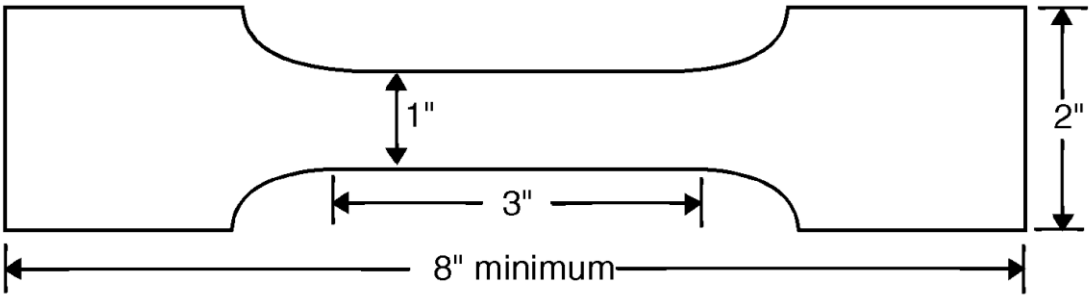
5.1 TENSILE STRENGTH

5.1.1 SAMPLES

Ten (10) samples cut from a production fuel cell bladder or roll goods per Figure 1 of this specification shall be conditioned at 73° ± 5°F and 50% ± 5% relative humidity for 24 hours prior to testing. No individual parallel fibers should be cut during sample preparation. The laboratory technician should not eliminate threads, thereby weakening the overall strength of the product and affecting the outcome of the test. If the bladder is not a constant thickness, the samples shall be obtained from the area of minimum wall thickness. Five (5) samples shall be cut parallel and five (5) samples shall be cut perpendicular to the strongest fabric warp threads direction.



Note: Cut 5 samples parallel to the warp and 5 samples perpendicular to the warp.

Alternate Shape:

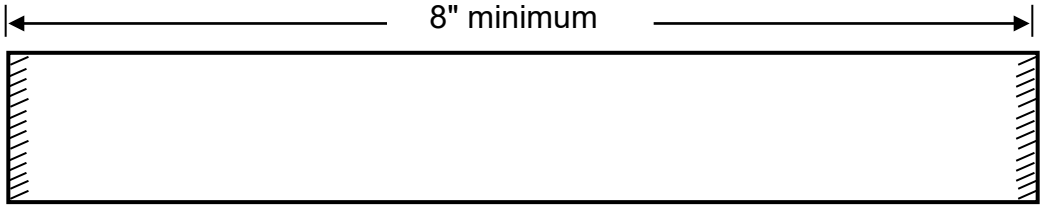


Figure 1
Tensile Test Material Sample Size and Shape

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5.1.2 APPARATUS

The testing machine, grip arrangement and associated measuring devices shall conform to paragraph 5.0 of ASTM D638 unless otherwise specified.

5.1.3 PROCEDURE

After conditioning, each sample shall be subjected to a tensile load at a rate of 12 inches per minute (± 0.5”) until separation occurs. All 10 load values at failure shall be recorded and the average value shall be specified as the fuel cell bladder wall tensile strength.

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5.2 TEAR STRENGTH

5.2.1 SAMPLES

Six (6) samples, 3” x 7”, shall be cut from a production fuel cell bladder or roll goods and including any locally thinned bladder material, if any, shall be conditioned at 73° ± 5°F and 50% ± 5% relative humidity for 24 hours prior to testing. Three (3) samples shall be cut parallel and three (3) samples shall be cut perpendicular to the strongest fabric warp threads direction.

5.2.2 APPARATUS

The testing machine and associated measuring devices shall conform to paragraph 5.0 of ASTM D638 unless otherwise specified. The metal test clips shall conform to Figures 2A and 2B of these SFI Specification requirements.

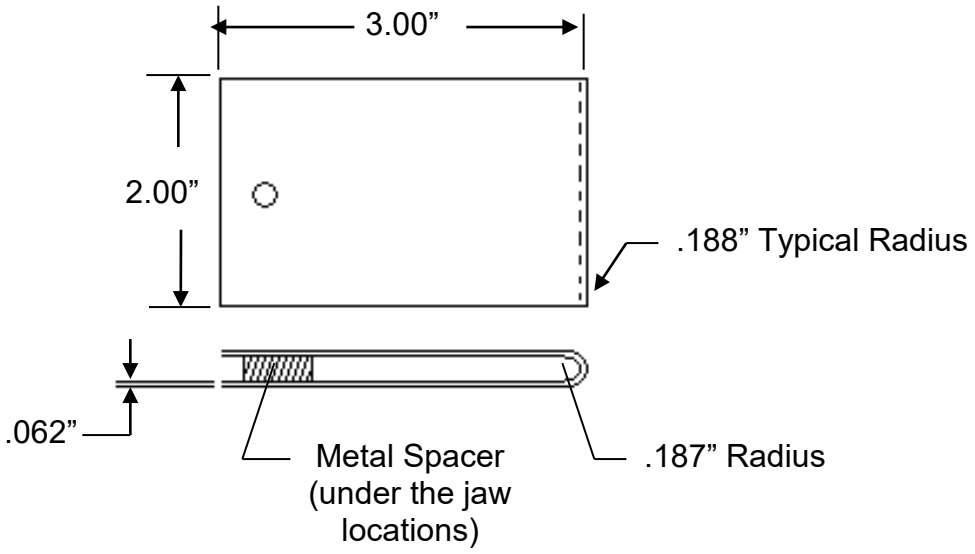

Figure 2A

Metal Test Clip
(2 required)

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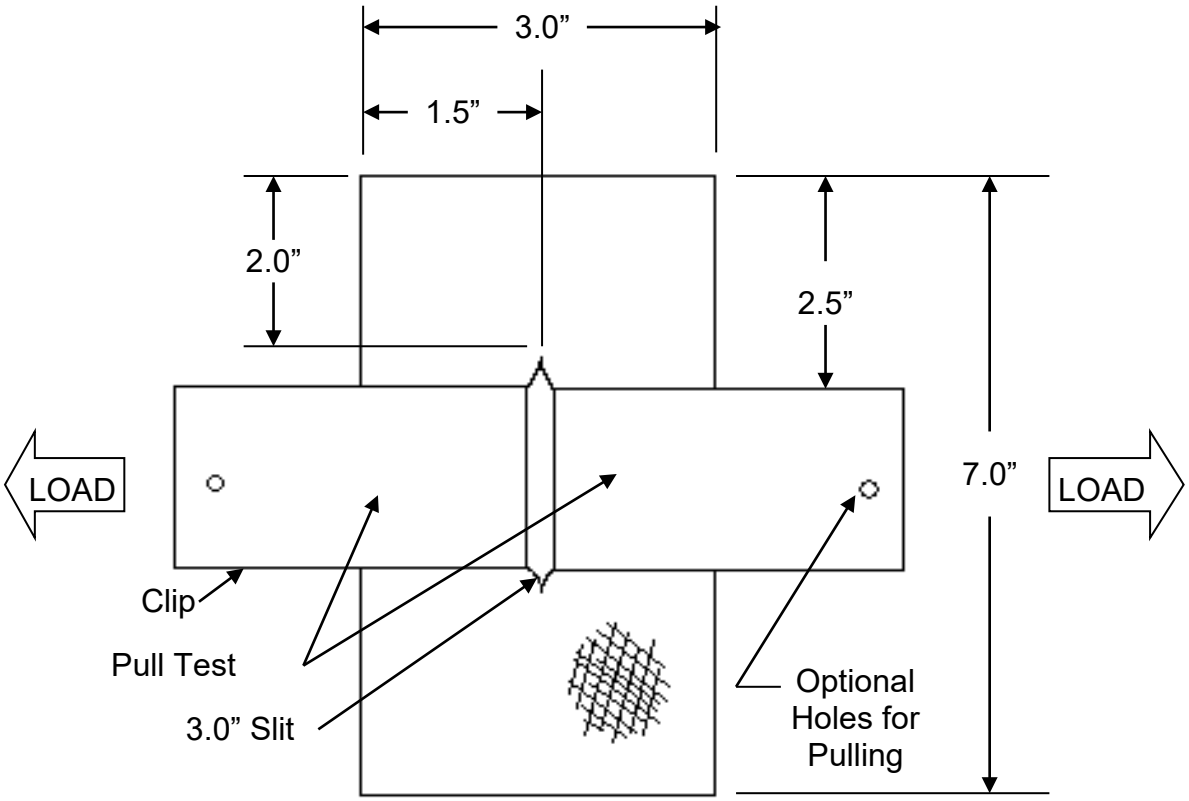

Figure 2B

Tear Strength Test Sample

Unless otherwise specified, tolerances: .xx” ± .06”
Dimensions: .xxx” ± .030”

5.2.3 PROCEDURE

After conditioning, each sample shall be subjected to jaw separation at a rate of 12 ± .5 inches per minute until complete separation takes place. Determine the average peak force required for separation of all 6 samples.

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5.3 PUNCTURE RESISTANCE

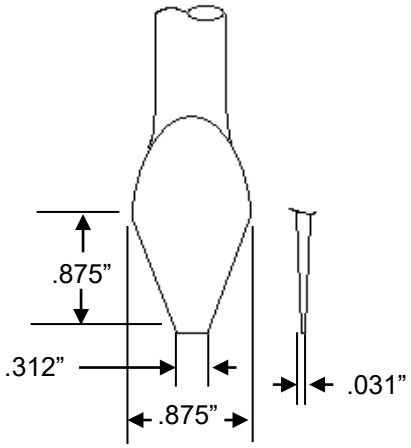
5.3.1 SAMPLES

Five (5) samples approximately 6.0 inches in diameter cut from a production fuel cell bladder (non-seamed or reinforced area) or roll goods shall be conditioned at 73° ± 5°F and 50% ± 5% relative humidity for 24 hours prior to testing. If the bladder is not a constant thickness, the samples shall be cut from the area of minimum wall thickness.

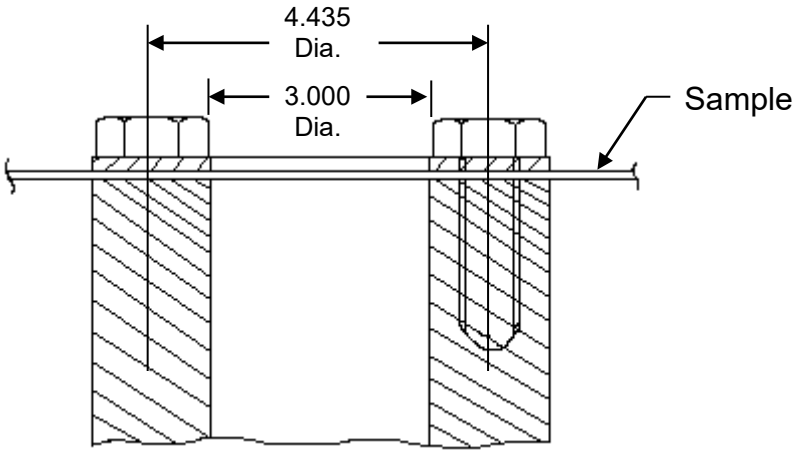
5.3.2 APPARATUS

The piercing instrument and sample holder shall conform to Figure 3 of this Specification (Figure 3 of MIL-T-6396). A minimum of four (4) bolts will be used to hold the sample in the holder.

Figure 3



End of Piercing Instrument



Sample Holder

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5.3.3 PROCEDURE

Five samples shall be used; two from one yarn direction parallel to the piercing instrument, two from the other yarn direction parallel to the piercing instrument and one with the yarn direction at approximately 45° to the piercing instrument. The piercing instrument shall be applied to the side of the sample which would represent the exterior surface of the fuel bladder. The force shall be applied at 12 ± .5 inches per minute and recorded.

5.4 SEAM STRENGTH

5.4.1 SAMPLES

Five (5) samples cut from a production fuel cell bladder containing a minimum overlap seam per Figure 4 of this specification, aligned perpendicular to the fabric warp yarns and shall be conditioned at 73° ± 5°F and 50% ± 5% relative humidity for 24 hours prior to testing.

5.4.2 APPARTUS

Same as in paragraph 5.1.2 above. Jaw location shall be a minimum of 1.50 inches from edges of seam as shown in Figure 6 and in the 2.00 inch width of the dog bone type sample.

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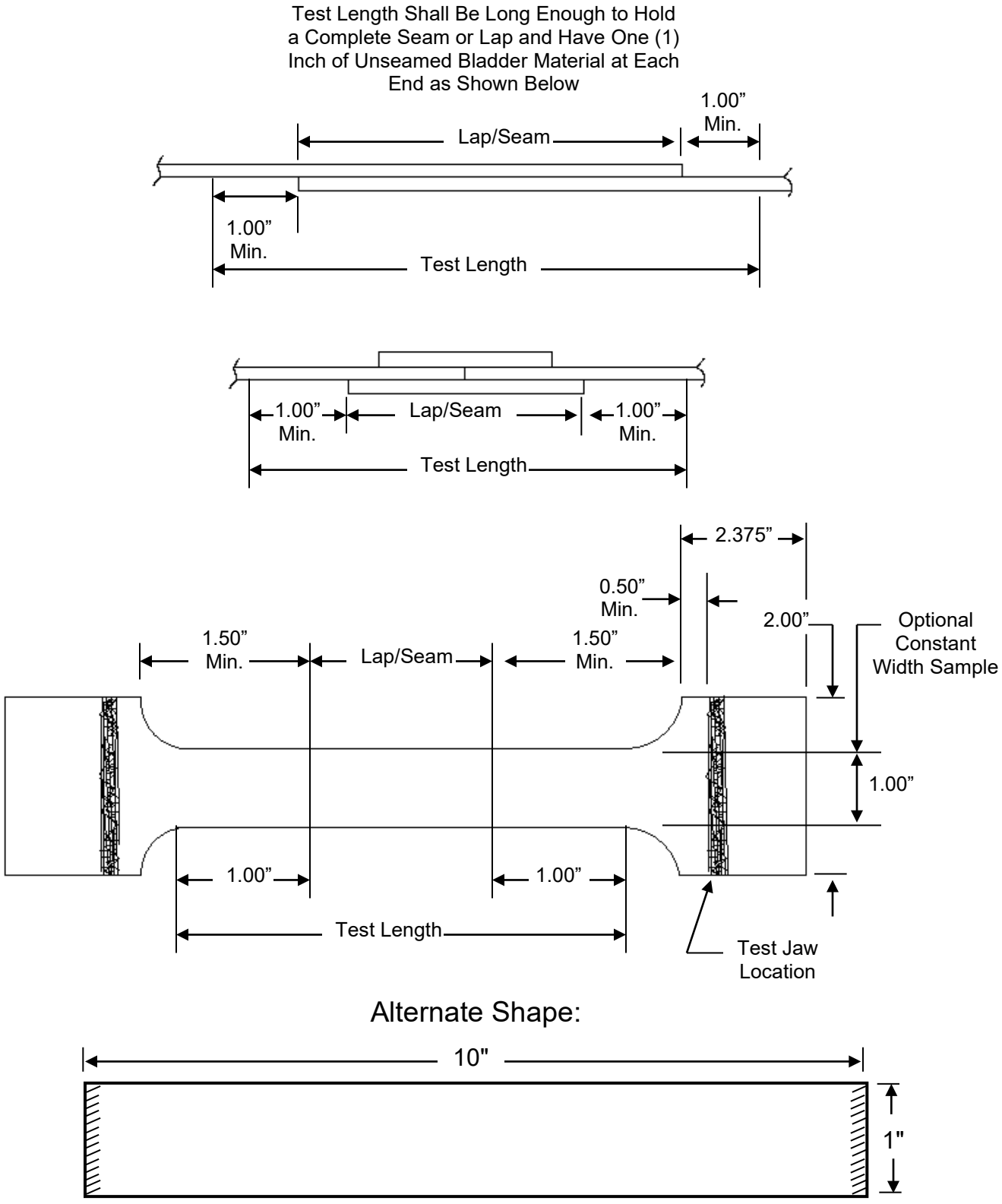

Figure 4
Seam Samples, Size and Shape

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5.4.3. PROCEDURE

After conditioning, each sample shall be subjected to a tensile load at a rate of 12 ± .5 inches per minute until separation or breakage occurs. All 5 of the load values at failure shall be recorded and the average value shall be specified as the seam strength.

6.0 PROOF OF COMPLIANCE

Stock Car Fuel Cell Bladder 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 TENSILE STRENGTH

Tensile strength values in pounds per inch of width shall be reported for all 10 samples tested but the average value shall not be less than 2,000 lbs/in.

6.1.2 TEAR STRENGTH

All 6 values of separation force in pounds shall be reported but no value under 700 pounds shall be acceptable. The average value (above 700 pounds) shall be established as "Tear Resistance."

6.1.3 PUNCTURE RESISTANCE

All 5 values of puncture load as measured per paragraph 5.3.3 shall be reported but no value under 400 lbs. shall be acceptable. The minimum value above 400 lbs. shall be established as "Puncture Resistance."

6.1.4 SEAM STRENGTH

All 5 values of the seam strength shall be reported in pounds-per-inch of width but the average value shall not be less than 2000 lbs/in.

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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 model, 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 SFI Specification 32.1 number and effective date.

7.1.6 Product name, description and model designation.

7.1.7 Component name and description.

7.1.8 Photographs of the submitted fuel cell bladder or samples.

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.

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8.0 INITIAL DESIGN VALIDATION

To receive initial recognition from SFI as a participant in the SFI Specification 32.1 Program, the manufacturer must agree that the product to be tested will be obtained on a commercial basis through an outlet in the normal stream of commerce or from roll goods. This information shall be provided for each Stock Car Fuel Cell Bladder 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 Stock Car Fuel Cell Bladder 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.

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 Fuel Cell Bladders for sale with the representation that their product meets the SFI Specification 32.1. 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.

The manufacturer is required to keep all top drawings, copies of test reports, and all other engineering records which define the specific product under safe keeping and in its possession, available for inspection by SFI, for not less than fifteen (15) years after approval is granted, or for five (5) years after the last fuel cell bladder is manufactured.

11.0 CONFORMANCE LABELS

The conformance label is a sticker. The serialized sticker shall be placed on the exterior surface, near the access flange ***in a location easily readable by technical inspectors***. The Stock Car Fuel Cell Bladder type, date of manufacturer and sticker serial number shall be permanently marked on the unit. The permanent markings shall not be affected by fuels used in the cell. The serial number should appear on the customer invoice to aid in identification and tracking.

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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 32.1" 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 32.1, Stock Car Fuel Cell Bladder, Program must demonstrate full compliance with the requirements of this specification within ninety (90) days of the latest effective date.

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	Reviewed:	December 1, 2012
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