



# QUALITY ASSURANCE SPECIFICATIONS™

SFI SPECIFICATION 20.1

EFFECTIVE: JULY 26, 2010\*

PRODUCT: Go-Kart Chest Protector (Youth Driver)

## 1.0 GENERAL INFORMATION

- 1.1 This SFI Specification establishes uniform test procedures and minimum standards for evaluating and determining performance capabilities for Chest Protectors (Youth Drivers) used by individuals engaged in competitive go-kart 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 20.1" 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 Chest Protectors that meet or exceed the SFI Specification 20.1 test standards, by complying with the requirements of the SFI Specification 20.1 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 Chest Protectors in compliance with all requirements of the SFI Specification 20.1 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 Chest Protector is a device to be worn by a go-kart driver while engaged in competitive motorsports and is intended to protect the driver from major chest injury due to impact with the vehicle steering wheel, steering column or other structure components in the event of a frontal crash or accident.
- 2.2 The Chest Protector is intended to attenuate point-type impact with the driver's upper torso to reduce blunt force trauma, chest deflection or penetration and viscous criterion values.
- 2.3 Viscous Criterion ( $V^*C$ ) is a method for predicting the severity of soft tissue injury which can occur in addition to the normally accepted blunt force or penetration type injury (SAE Report 861882, filtered at 60Hz, 180Hz or 600Hz, whichever frequency yields the most stable curve shape.)
- 2.4 The Chest Protector must allow free arm, body and head movement while being worn, but covering as much of the driver upper torso front portion as possible.
- 2.5 The Chest Protector main structure shall be a rigid one piece, continuous shell or multiple layers over a single shell with a contour intended to fit the appropriate age level chest shape (5-8 year old or 9-12 year old) and can be completely covered with padding for user comfort. The padding shall be the only portion of the product in contact with the user. The shell may contain holes of any quantity and shape if desired as long as the area of each hole is no greater than one (1) square inch.
- 2.6 Any Chest Protector pertaining to this specification shall remain as constructed by the original manufacturer and not modified.

- 2.7 Retention System: The complete assembly of straps, buckles and adjustment hardware intended to retain the Chest Protector securely in position during normal use and under severe "G" loads and crash conditions.
- 2.8 Additional devices to protect areas such as shoulder, arm, abdomen, etc. may be attached to the main Chest Protector shell by flexible straps or other methods but are not to be considered part of this specification.

### 3.0 CONSTRUCTION

#### 3.1 MATERIALS

The materials used in the construction of the Chest Protector shall be resistant to the elements to which they are exposed in normal service. Besides environmental considerations, these elements include fluids used in and around motor vehicles that may come in contact with the Chest Protector. All metal rivets, bolts, buckles, adjusters, etc. shall be corrosion resistant.

### 4.0 MODEL CLASSIFICATION

Any variation in materials, shell dimensions or contour, energy absorbing material type or quantity, if used, construction method or retention system shall be considered a model change.

### 5.0 TESTING

#### 5.1 IMPACT ATTENUATION AND DEFLECTION

##### 5.1.1 SAMPLES

Test sample(s) shall be fully processed new Chest Protector(s) 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. Additional protective devices per paragraph 2.8 of this specification shall be removed prior to testing.

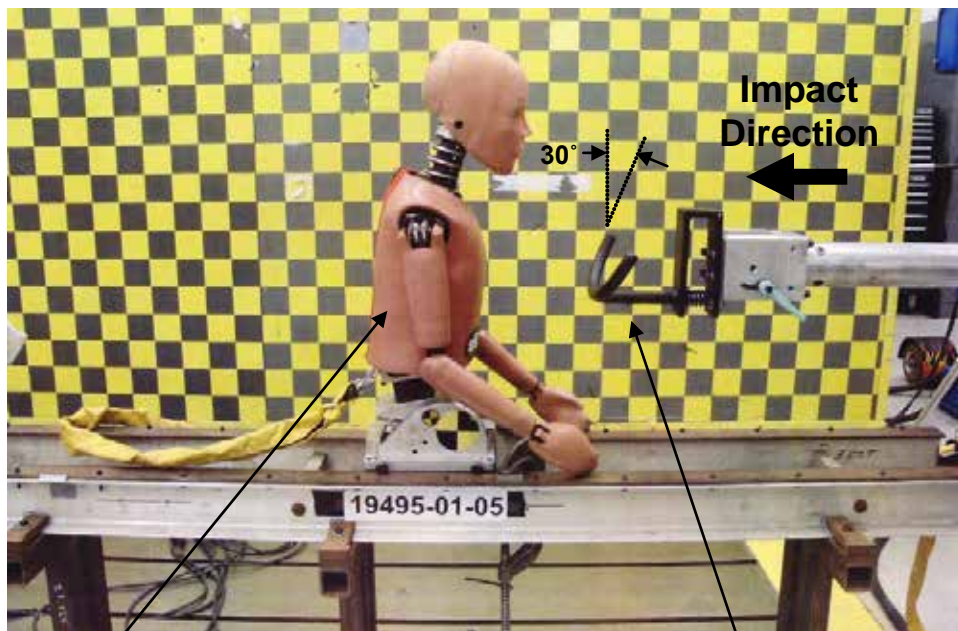
##### 5.1.2 APPARATUS

- A. Hybrid III Upper Torso 6 year old size for 5-8 year old certification or Hybrid III Upper Torso 10 year old size for 9-12 year old certification, instrumented test dummy per First Technology Safety Systems or equivalent which allows incorporation of the test sample Chest Protector.

B. Any mechanism (pendulum, drop tower, compressed air or hydraulic gun, etc.) capable of propelling a steering wheel or Replica at an instrumented Hybrid III Upper Torso test dummy at an impact velocity per Table 1 with the accompanying requirements as shown (Figure 1).

Table 1			
Hybrid III Dummy(3) Age (Yrs.)	Total Stationary(2) Mass Weight	Impact Velocity	Total Moving Mass Weight(1)
6 yr	50 ± 5 lb. (22.7 ± 3 kg)	22 ± 2 ft/sec. (6.7 ± 0.6 m/sec.)	50 ± 5 lb. (22.7 ± 3 kg)
10 yr	60 ± 5 lb. (27.24 ± 3 kg)	29 ± 3 ft/sec. (8.84 ± 0.8 m/sec.)	50 ± 5 lb. (22.7 ± 3 kg)

- (1) Includes trolley (if used) and steering wheel or Replica assembly
- (2) The dummy torso shall include arms, neck and head
- (3) All weights are without chest protector attached



Hybrid III Upper Torso Dummy

Steering Wheel or Replica Fixture Assembly

**Figure 1**  
**Impact Set Up**

\*For exact contact point, see Paragraph 5.1.3

- C. Hardware and software shall be capable of measuring and recording maximum impact deflection and velocity of the sternum center utilizing instrumentation incorporated in the test dummy.
- D. The stationary dummy torso shall be mounted to allow free rotation about the "waist" location at impact in the axial or "X" direction.
- E. The center of the steering wheel or Replica shall be limited to a maximum travel after impact of 0.50 inches (1.27 cm).
- F. The steering wheel (if used) shall be a new "Grant Custom Steering Wheel" manufactured by Grant Products International, Glendale, CA, Part No. 151-14 for each test. The impact point on the wheel rim shall be at the spoke opposite the center of the longest rim span.
- G. If a steering wheel Replica assembly is used, a fixture which reproduces the spring constant at impact of the actual steering wheel must be utilized ( $k = 370 \text{ lb/in.} \pm 20\%$ ).

#### 5.1.3 TEST SET UP

- A. Before certification test (or group of certification tests), to establish repeatability of test set up and precise contact point of impact on the test dummy, baseline tests must be run following Procedure 5.1.4 C (without chest protector) until a Viscous Criteria (V\*C) value of 1.1 to 1.3 m/sec is obtained using the calculation method per Paragraph 2.3 of this specification.
- B. The contact point location used to achieve the V\*C above shall be recorded within  $\pm 0.030$  inch and that value shall be used to perform the test procedure for the certification testing in Paragraph 5.1.4 below.

#### 5.1.4 PROCEDURE

- A. The Chest Protector sample shall be attached to the appropriate size Hybrid III test dummy using all straps, buckles, adjusters, etc. supplied with the test sample and using the attachment methods prescribed by the manufacturer (without supplemental devices per paragraph 2.8 of this specification.)
- B. The entire steering wheel or Replica assembly shall be propelled in such a manner that it strikes the Chest Protector (See Figure 1) at an impact velocity per Table 1 depending on which size is being certified.
- C. For certification purposes, a minimum of two (2) tests are required utilizing the same new chest protector for both tests. Both test results must meet all requirements of paragraph 6.1.1 of this spec using the cut off point of 240 milliseconds.

#### 6.0 PROOF OF COMPLIANCE

Chest Protector 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 ATTENUATION AND DEFLECTION (measured on the Hybrid III test dummy)

- A. Maximum velocity of chest deformation shall not exceed 27.9 ft/sec. (8.5 m/sec.)
- B. The Chest Protector shall not become separated from the test dummy and the attachment straps and hardware shall not be broken. Some permanent deformation of components is allowed as long as the test sample remains located on the impact side of the dummy after the test.
- C. Viscous Criteria (V\*C) shall be not greater than 1.0 m/sec maximum, calculated per paragraph 2.3 of this specification.

- D. Cracks no longer than 0.125 inch (0.32 cm) in the shell are allowed emanating from vent holes, rivet holes, buckle and other hardware holes but no pieces of any size may be dislodged.

## 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.

### 7.2 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 20.1 Program, the manufacturer must submit to SFI all information delineated in the Proof of Compliance section. This information shall be provided for each Chest Protector 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 Chest Protector 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 Chest Protector for sale with the representation that their product meets the SFI Specification 20.1. 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" label for the Chest Protector. Each certified Chest Protector shall be affixed with the appropriate label (20.1/1 for 5-8 year old size and 20.1/2 for 9-12 year olds.) On all types, 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 20.1" 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 20.1 Chest Protector must demonstrate full compliance with the requirements of this specification within ninety (90) days of the latest effective date.

---

*	Original Issue:	December 9, 2004
	Edited:	February 24, 2005
	Edited:	April 15, 2005
	Revised:	May 25, 2005
	Edited:	March 24, 2006
	Reviewed:	December 15, 2006
	Reviewed:	December 12, 2009
	Revised:	July 26, 2010
	Reviewed:	December 9, 2011
	Edited:	December 9, 2011
	Reviewed:	December 12, 2013
	Reviewed:	December 10, 2015