

# SAFETY FIRST

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## FIRESUITS

Nomex® and CarbonX®

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### LEVEL OF PROTECTION

**Thermal Protective Performance** or **TPP** is the measurement of protection offered by a firesuit against both convective and radiant heat. The SFI Foundation uses TPP to determine firesuit ratings in accordance with SFI Specification 3.2A as a basis for safety as adopted by many Racing Sanctioning Bodies and Rules Committees.

The purpose of measuring TPP is to determine the length of time the person wearing the firesuit can be exposed to a heat source of approximately 1800°F before incurring skin blistering or second degree burns in laboratory conditions. Higher TPP ratings equate to better protection. The TPP method uses a 2cal/cm<sup>2</sup>-second heat flux (rate of heat transfer) to simulate the thermal behavior for four types of fuels: Nitro Methane, Methanol, High Octane Gasoline, and JP4 Jet Fuel.

### TPP versus 2<sup>nd</sup> Degree Burns

SFI Rating	TPP Value	Time to 2 <sup>nd</sup> Degree Burn	Typical Use
3.2A/1	6	3 Seconds	Single Layer Suit (Entry Level)
3.2A/5	19	9 Seconds	Double Layer Driving Suit
3.2A/10	38	19 Seconds	Land Speed Records
3.2A/15	60	30 Seconds	Top Fuel/Alcohol Drag Suit
3.2A/20	80	40 Seconds	Top Fuel/Alcohol Funny Car Suit

SFI Specification 3.2A requires the minimum TPP rating (2cal/cm<sup>2</sup> per second or approx. 1800°F) as defined above.

### TESTING

To better understand the performance of a firesuit, TPP is used as an indicator of protection. However, this factor must be balanced with the weight of the garment, the loft or resulting density of the materials and the ultimate comfort for the user. A thick, heavy, multi-layer suit is a very good insulator, but can be uncomfortable and may lead to heat stress under certain racing conditions.

We have selected several fabric types using Nomex® aramid and Kevlar® aramid fibers and CarbonX® based on the criteria above and submitted these to the SFI Foundation for SFI 3.2A Test Certification. The chart below outlines performance of the most common and practical firesuit constructions based on comfort, weight, protection, durability and cost.



**FIRESUIT  
PROTECTION**

**Thermal Protective Performance Testing per SFI Technical Bulletin 3.2A  
SFI 3.2A-5 Driving Suits (2 Layer--Most Common Use) and SFI 3.2A-20 Drag Suits (4 Layer)**

Style	Description	Outer Layer	Inner Layer	oz/yd <sup>2</sup>	Loft	TPP	Time to Burn (Seconds)
MTO-25	Future Suit	Knit Filament Nomex®	Nomex®	16	86	24	12
	CarbonX® Lining	“ “ “	CarbonX®	18	84	27	13_
MTO-20	Sateen	Sateen Nomex®	Nomex®	18	104	26	13
	CarbonX® Lining	“ “	CarbonX®	18	72	22	11
MTO-19	Woven Filament	Woven Filament Nomex®	Nomex®	13	68	19	9_
	CarbonX® Lining	“ “ “	CarbonX®	16	66	23	11_
CarbonX®	All CarbonX®	CarbonX® Twill	CarbonX®	21	93	26	13
Drag	Nomex®/Kevlar®	Knit Filament Nomex®	Nomex®/Kevlar® (3 Layers)	30	261	93	46_
Drag	CarbonX® Lining	Knit Filament Nomex®	CarbonX® (3 Layers)	32	292	84	42

**Five Fabric Types Used By Simpson:**

**Gabardine and Sateen Nomex® IIIA**—Traditional woven fabrics: 93% Nomex®, 5% Kevlar® and 2% Carbon.

**Filament Nomex®**—Type N104: 100% Nomex® Knit Future Suit (MTO-25) and Woven Filament (MTO-19).

**Nomex® Liners**—Type 462 Nomex® with Kevlar® and Carbon.

**CarbonX®**—Patented blend of O-Pan (Carbonized Fibers) with other aramid strengthening fibers.

**FLAMMABILITY**

While TPP measures the ability of a suit to insulate the driver from extreme heat, another factor to consider is how the suit reacts to direct flame. Although both Nomex® and CarbonX® have the ability to protect and insulate the driver from exposure to direct flame, they react very differently. When exposed to the flame, Nomex® thickens and forms a char that remains supple until the fabric cools, providing a barrier to the flame. CarbonX® displays much less visual distortion and will not shrink or char through its design.

**CONCLUSIONS**

The SFI tests shown in the chart show that Nomex® and CarbonX® provide excellent fire protection. At this point, we do not believe this data supports drawing hard conclusions about one versus the other on TPP.

Nomex® is a proven performer of over 30 years. During this time the qualities of the fiber and fabrics from it have continuously broadened and improved. There are staple, filament, knit and woven versions Nomex® and virtually any color is available. DuPont continues to invest in Nomex® product development.

CarbonX® is relatively new. As mentioned it visually reacts very differently to a direct flame when compared to Nomex®. Some drivers have reported liking its comfort next to the skin. It is limited to black or gray colors at least for now. We would expect that this newer fiber/fabric would continue to be developed by Chapman Innovations with more and better choices tomorrow than today.

More testing and learning about what the best combination of protection, comfort, weight, colors, durability and cost will give drivers more information to make even better choices in the future. Simpson is proud to offer both products for 2004.

**Since 1959...**

Simpson Performance Products has led the motorsports industry in safety innovation. We continually elevate safety standards through our dedication to development, refinement and testing. The Simpson Envelope of Safety reflects the highest standard of safety available.



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**Firesuit Sales: 888-872-SUIT**

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