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Alternatives for Complying with NFPA 1971

BY WILLIAM J. GORAK

WHEN RELEASED, THE National Fire Protection Association (NFPA) 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2012 edition, will require ensemble manufacturers to comply with new testing requirements for potential burns under outer shell sleeve attachments including trim, patches, and logos. These burns are one of several types commonly referred to as stored energy (STE) burns. Each manufacturer will choose its own solutions to meet the requirements such as relocating patches, using porous trim, or increasing insulation in certain areas under outer shell attachments on sleeves.

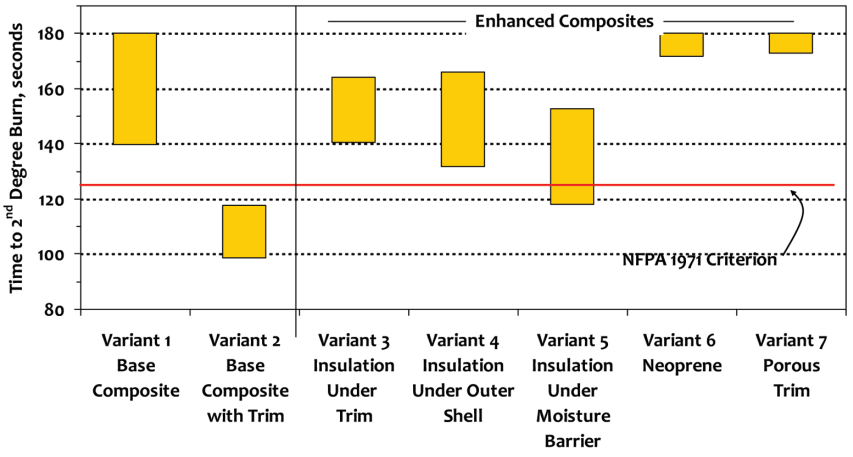
The NFPA has adopted American Society for Testing of Materials (ASTM) F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy of Firefighter Protective Clothing Systems*, to evaluate these types of burns. In 2009, W. L. Gore & Associates bought the first commercially available apparatus for this testing. Gore began investigating alternatives to satisfy both the end-users' concerns about subflashover burns and the ability of manufacturers to comply with the standard's new performance criteria. Using composites from NFPA 1971, 2007 edition-compliant garments as a basis, Gore tested various enhancements having dense, nonporous outer shell attachments.

To develop an STE test baseline, Gore worked with garment manufacturers to identify a range of commercially available turnout composites (i.e., outer shell, moisture barrier, and thermal liner combinations) that met the following specifications: outer shell composed of 7.5 oz/yd^2 of NOMEX®, Basofil®, PBI, or PBO fibers; CROSSTECH®, CROSSTECH® 3-layer, or GORE® RT7100 moisture barriers; single- or multiple-layer thermal liner of various weights; thermal protection performance values ranging from 36 to 51; and total heat loss values between 224 and 315.

To identify the time until second-degree burns (the required measurement for the new STE test), Gore examined seven composites with seven variants each, which follow: Variant 1—the base composite with no trim; Variant 2—the base composite with standard trim; Variant 3—Variant 2 with additional insulation between the trim and the outer shell; Variant 4—Variant 2 with additional insulation between the outer shell and the moisture barrier; Variant 5—Variant 2 with additional insulation between the moisture barrier and the thermal liner; Variant 6—Variant 2 with a nonporous, impermeable layer of neoprene added under the moisture barrier directly beneath the trim; and Variant 7—Variant 1 with a porous trim on the outer shell.

Figure 1.

ASTM F2371 range of results of predicted time to second-degree burn for each variant.



Gore tested the variants by following the ASTM F2371 method with the wet preconditioning option. As specified in the NFPA 1971 criteria, heat exposures were 120 seconds followed by 60 seconds of compression. If no burn was indicated in the test, the maximum value of 180 seconds was assigned as the result.

As seen in Figure 1, the base composite without trim (Variant 1) delivered better results than the same composite with standard trim (Variant 2). The difference in the time-to-burn between Variant 1 and Variant 2 showed the significant impact of standard trim as seen in other research. The testing also showed that each of the insulating enhancements (Variants 3-7) improved the time-to-burn for each composite with trim.

Adding an insulation layer directly under the trim (Variant 3) or between the outer shell and moisture barrier (Variant 4) met the NFPA 130-second minimum criterion; however, not all samples with the additional insulation layer between the moisture barrier and thermal liner (Variant 5) met the NFPA criteria, suggesting that not all composites using this configuration would pass NFPA 1971, 2012 edition certification.

Samples with the neoprene layer under the moisture barrier (Variant 6) and those with porous trim (Variant 7) performed best in these tests. The average values of these two variants as well as the lower end of the burn range were significantly above that of the base composite with standard trim, indicating that these constructions would easily meet the NFPA 1971 minimum requirements. In addition to providing good STE test results, the porous trim option (Variant 7) may simplify garment manufacturing by eliminating the need to align and secure additional layers under the outer shell attachments.

You may want to discuss Gore's study results and the options they identified with your manufacturer. ●

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