



*Final Report for:*

***Elven Technologies***

***Rancho Cordova, CA***

***Thermal Protective Performance Testing***

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## Disclaimer

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This technical report is prepared consistent with the terms and purposes of the Project Form agreement between Elven Technologies (the “Company”) and Rochester Institute of Technology (RIT) on behalf of the Golisano Institute for Sustainability (GIS) dated November 7, 2022. This report is the product of work conducted by RIT for a project entitled, “TPP Testing.” All conclusions herein are subject to the warranty, indemnification, and liability limitations, and other provisions, described in the Project Form agreement executed by RIT and Elven Technologies (the “Parties”).

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## **A. Executive Summary**

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The Golisano Institute for Sustainability (GIS) at Rochester Institute of Technology (RIT) conducted a project entitled, “Thermal Protective Performance (TPP) Testing” for Elven Technologies.

For this project, GIS tested 5 samples of multilayer material supplied by Elven Technologies following ASTM F2700 as a guideline for thermal protective performance testing. Some portions of ASTM F2700 were not followed as the samples being tested did not conform to and/or need some of the standard requirements (e.g. Sections 8.2 Laundering Samples, 8.3.1 removing the seams for the samples or 8.4 for conditioning of samples)

The results of the work performed include the heat transfer performance value for each sample tested, the average heat transfer performance value for the 5 specimens tested, images of the samples pre and post testing, and the observations captured during and post testing inspection as directed in Appendix X2 of ASTM F2700.

## **B. Summary of Work Performed**

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Samples were tested as received from Elven Technologies with no alteration, laundering or conditioning. The exact composition and nature of the samples received were not disclosed to GIS, but they were multilayer samples which indicated that they should be tested in the restrained condition for TPP testing as recommended in ASTM F2700.

The testing was completed using a Thermetrics Model 403 Thermal Protective Performance Tester. The system was verified, prior to testing, to have a calibrated exposure energy of 83.301 kW/m<sup>2</sup> (1.99 cal/cm<sup>2</sup>s), within the limits of ASTM F2700 ( $84 \pm 2$  kW/m<sup>2</sup> |  $2 \pm 0.05$  cal/cm<sup>2</sup>s).

The samples were labeled 1 through 5 in an arbitrary fashion and photographed prior to testing. Each sample was then placed in the specimen holder of the thermal protective performance tester with the sensor assembly in contact with the back of the specimen. The specimen was then exposed to the radiant and flame energy per ASTM F2700. During the exposure the samples were observed for indications of ignition and following the exposure the heat transfer performance value for each sample was reported. Post testing ratings for breakopen, melting, dripping, charring, embrittlement, shrinkage and sticking, per Appendix X2 of ASTM F2700, were determined and the samples were photographed.

## C. Results

### 1. Heat Transfer Performance Values

Sample	Heat Transfer Performance Value	
	J/cm <sup>2</sup>	cal/cm <sup>2</sup>
1	804.10	192.06
2	847.53	202.43
3	702.03	167.68
4	787.55	188.10
5	769.89	183.89
Average	782.2	186.8

### 2. Sample Images

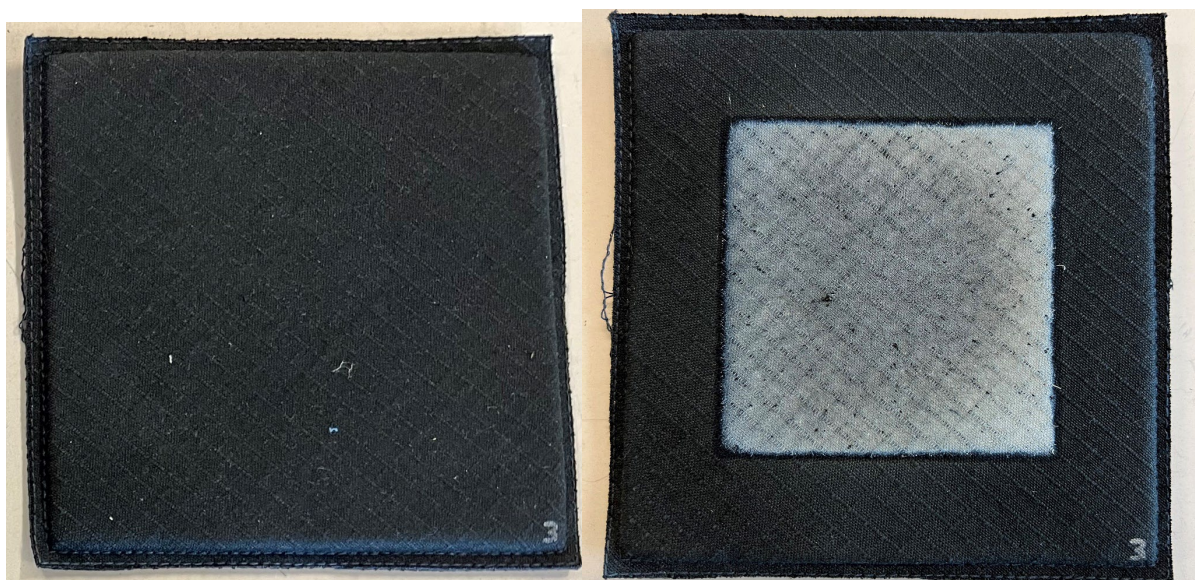


Figure 1: Sample 1 Pretest (Left) and Post Test (Right)





**Figure 2: Sample 2 Pretest (Left) and Post Test (Right)**



**Figure 3: Sample 3 Pretest (Left) and Post Test (Right)**





**Figure 4: Sample 4 Pretest (Left) and Post Test (Right)**



**Figure 5: Sample 5 Pretest (Left) and Post Test (Right)**

3. ASTM F2700 Annex X2 Observations

Sample	Ignition	Breakopen	Melting	Dripping	Charring	Embrittlement	Shrinkage	Sticking
1	2 - Slight Smoke	None	None	None	None	2 - slight, specimen starts to harden	None	None
2	2 - Slight Smoke	None	None	None	None	2 - slight, specimen starts to harden	None	None
3	2 - Slight Smoke	None	None	None	None	2 - slight, specimen starts to harden	None	None
4	2 - Slight Smoke	None	None	None	None	2 - slight, specimen starts to harden	None	None
5	2 - Slight Smoke	None	None	None	None	2 - slight, specimen starts to harden	None	None