

Hugh Hoagland Consulting, Inc.

**ArcWear.com**

Electric Arc Exposure Tests

For Work Protec SA

**Material System**

**8.3 oz/yd<sup>2</sup> 280 g/m Twill, 60% Modacrylic, 38% Cotton, 2% Antistatic**

**Style: Hi Prot 280®**

**Color: Navy**

**Actual Areal Density (AAD): 8.0 oz/yd<sup>2</sup> 271 g/m<sup>2</sup>**

**Report Number: 1202P25, Revision: 00**

February, 2012

Tests Conducted by Kinectrics High Current Laboratory  
Toronto, Ontario, Canada

# Electric Arc Exposure Report

## **ASTM F 1959/F 1959M-06 a<sup>ε1</sup> Standard Test Method for Determining the Arc Rating of Materials for Clothing**

### ***General***

At the request of Claudio Beniaminovich electric arc exposure tests were conducted on textile systems for Work Protec SA. Claudio Beniaminovich arranged with ArcWear.com to facilitate testing by the High Current Laboratory of Kinectrics in Toronto and to review test data.

The tests documented in this report were conducted in accordance with ASTM International Standard F 1959/F 1959M-06 a<sup>ε1</sup> Standard Test Method for Determining the Arc Rating of Materials for Clothing.

### ***Test samples***

The test material was received on January 30, 2012. The test material was washed 3 times and dried by ArcWear.com in accordance with requirements of the above standard. This is specified in the standard to allow for minimal shrinkage while removing contaminants from the material manufacturing process. Following the washing procedure, material was cut into panel test specimens.

### ***Test results***

The test program includes minimum of twenty individual panel arc trials. The following test data was recorded for each trial:

- arc exposure electrical conditions: arc trial number, RMS arc current, peak arc current, arc voltage, arc duration, energy dissipated in arc, plots of arc current and arc voltage
- temperature rise response from two monitor and two panel sensors for each panel in each trial, plot of average responses from two panel and two monitor sensors, plot of Incident energy distribution *Ei* from bare shot analysis
- photographs of exposed material panels
- video

Above mentioned test data is part of report and is available for download from [ArcWearOnline.com](http://ArcWearOnline.com) arc testing website. Test data is accessible only to and protected with Work Protec SA unique password.

Essential test data and test results are presented in the table below and on the attached data pages as follows:

- arc rating ATPV or EBT or both and plots of the burn injury probability (ATPV) or breakopen probability (EBT) or both versus  $E_i$
- test specimen description and order of layer
- distance from an arc center line to the panel surface
- subjective evaluation
- heat attenuation factor (HAF) and plot of HAF on  $E_i$
- ignition probability value (if determined during testing)

### **Rating**

Material system specified in the table below received Arc Rating as

**(EBT) = 5.9 cal/cm<sup>2</sup>**

Customer	Work Protec SA
Material design	8.3 oz/yd <sup>2</sup> 280 g/m Twill, 60% Modacrylic, 38% Cotton, 2% Antistatic
Style	Hi Prot 280®
Color	Navy
Actual Areal Density (AAD) as tested	8.0 oz/yd <sup>2</sup> 271 g/m <sup>2</sup>

The order of layering is numbered starting from the outer layer listed first.

Requested by: Claudio Beniaminovich

Approved by Hugh Hoagland  
Arcwear.com

*Neither Hugh Hoagland Consulting, Inc. dba/ArcWear, nor its affiliates, nor any person acting on behalf of any of them:*

- makes any warranty, express or implied, with respect to the use of any information, apparatus, method, or process disclosed in this report or that such use may not infringe privately owned rights; or*
- assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process disclosed in this report*

Report # K-418346-1202P25		<b>Test Report</b> Kinectrics Inc., 800 Kipling Avenue, Unit 2 Toronto, Ontario, Canada Tel: 416-207-6000, www.kinectrics.com	 KINECTRICS ISO 9001-2008
Samples Received: JAN 30, 2012	Samples Tested: FEB 17, 2012		

<b><u>Tested for</u></b> Hugh Hoagland ArcWear.com 502-333-0510 arcctestng@arcwear.com	<b><u>Contact information for item tested:</u></b> Claudio Beniaminovich Work Protec SA 5411 51972033 expoum@ciudad.com.ar
--	--

**Test item description**  
 Work Protec SA, Style Hi Prot 280@, 8.3 oz/yd<sup>2</sup> 280 g/m Twill, 60% Modacrilic, 38% Cotton, 2% Antistatic, Navy, AAD 8.0 oz/yd<sup>2</sup> 271 g/m<sup>2</sup>, ArcWear# 1202P25

**Reference Standard**  
 ASTM F1959/F1959M-06ae1  
 Standard Test Method for Determining Arc Thermal Performance of Textile Materials for Clothing by Electric Arc Exposure Method

<b><u>Test Parameters:</u></b>	Test current: 8 kA	Number of samples analysed: 21
	Distance to Fabric: 30 cm	
	Arc Gap: 30 cm	Incident Energy Range: 4 to 10 cal/cm <sup>2</sup>

---

**Arc Rating, Ebt = 5.9 Cal/cm<sup>2</sup>**  
**Heat Attenuation Factor, HAF = 75%**

---

**Summary**  
 The Arc Rating of this material is intended for use as part of a flame resistant garment for workers exposed to electric arcs. The material was tested by Kinectrics as received. The test result is applicable only to the Test Item, other material or color may have different protection level. Actual performance of the complete garment may vary depending on the final design and assembly of the garment. The Arc Rating was calculated based on the data obtained and analysed in accordance with the latest version of the applicable standards. The individual test sheets, graphs, photographs of the samples and video of every test are provided in digital format to the Client for review.

As of August 1, 2010, the arc testing performed to the above mentioned Standard is accredited by the Standards Council of Canada to conform to the requirements of CAN-P-4E (ISO/IEC 17025:2005) by QMI, a division of SAI Global and North America's leading QMS registrar. Adherence to this standard provides one of the strongest assurances of service quality available. As a minimum, since July 1998 all work at Kinectrics is performed to meet the requirements of ISO 9001.

Kinectrics Inc takes reasonable steps to ensure that all work performed shall meet the industry standards as set out in Kinectrics Inc.'s Quality Manual, and that all reports shall be reasonably free of errors, inaccuracies or omissions. KINECTRICS INC. DOES NOT MAKE ANY WARRANTY OR REPRESENTATION WHATSOEVER, EXPRESS OR IMPLIED, WITH RESPECT TO THE MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OF ANY INFORMATION CONTAINED IN THIS REPORT OR THE RESPECTIVE WORKS OR SERVICES SUPPLIED OR PERFORMED BY KINECTRICS INC. Kinectrics Inc. does not accept any liability for any damages, either directly, consequentially or otherwise resulting from the use of this report.

Note  
 - The test performed does not apply to electrical contact or electrical shock hazard.  
 - An unsigned copy of this report is an unofficial reporting of information. Report must be signed to validate test data and conform to quality standards.

Performed by:	Approved by:
Daniel Ferguson Station Operator High Current Laboratory Ph: 416-207-6000	Claude Maurice, Lab Manager Kinectrics, Inc. Toronto, ON Canada Ph: 416-207-6305 hcl@kinectrics.com

Date:  
FEB 17, 2012

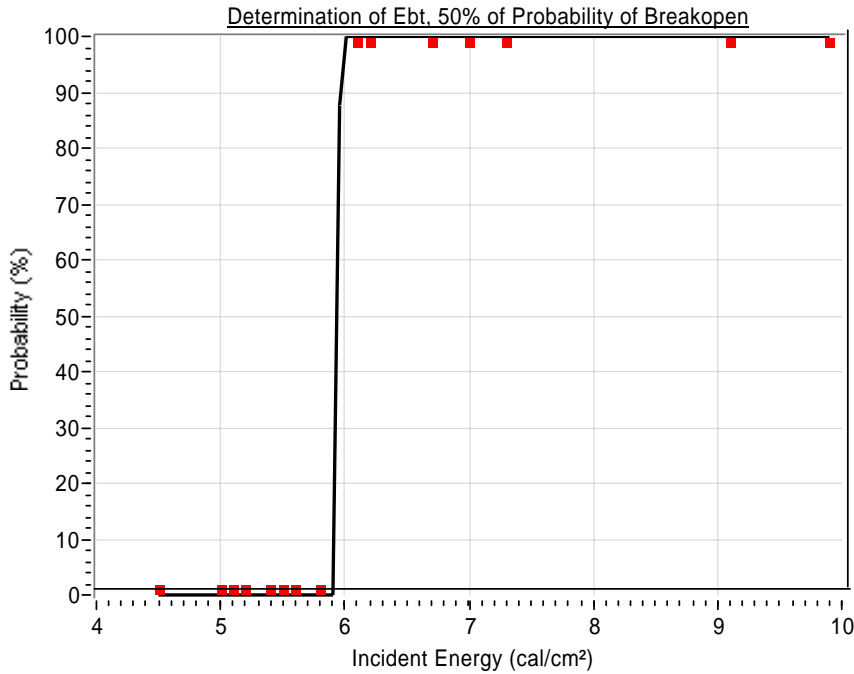
Report #  
K-418346-1202P25

Determination of Ebt by performing logistic regression on break-open observations as indicated in summary Table

Test Performed in accordance with : ASTM F1959/F1959M-06ae1



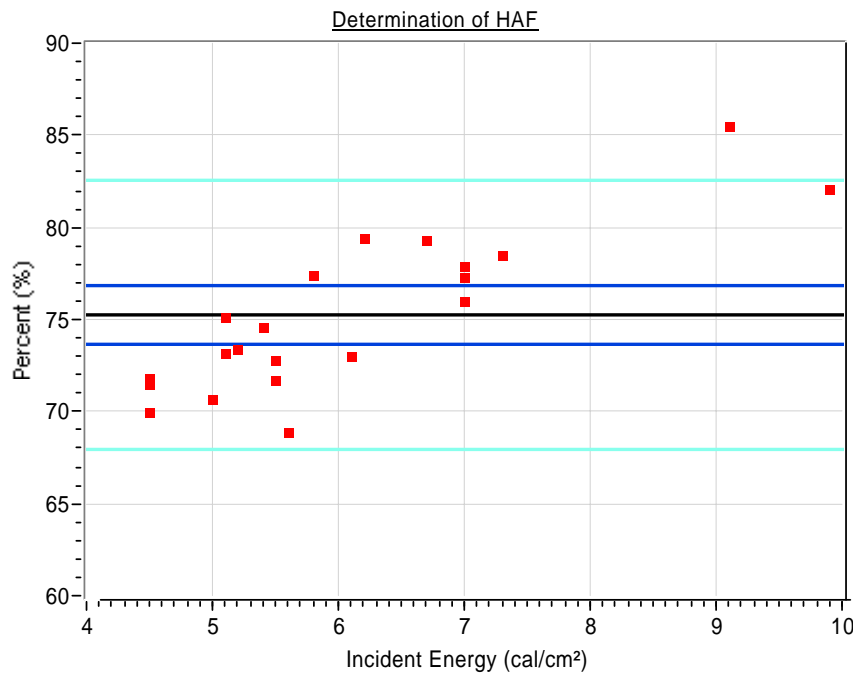
**Fabric** Work Protec SA, Style Hi Prot 280@, 8.3 oz/yd<sup>2</sup> 280 g/m Twill, 60% Modacrylic, 38% Cotton, 2% Antistatic,  
**Description:** Navy, AAD 8.0 oz/yd<sup>2</sup> 271 g/m<sup>2</sup>, ArcWear# 1202P25



**Ebt = 5.9 cal/cm<sup>2</sup>**

Probability	Ei
5%	5.9
10%	5.9
20%	5.9
30%	5.9
40%	5.9
50%	5.9
60%	5.9
70%	5.9
80%	6.0
90%	6.0

# Pts = 21  
 # Pts above Stoll = 1  
 # Pts Break-Open = 9  
 # Pts above mix zone = 9  
 # Pts below mix zone = 12  
 # Pts within 20% = 15  
 # Pts in mix zone = 0



**HAF = 75 %**

Confidence Intervals  
 95% CI = 73.4 , 76.6

Data pts

Best Fit

95% CI

95% CI pts

Date:  
FEB 17, 2012

Report #  
K-418346-1202P25

### Summary Table

Test Performed in accordance with : ASTM F1959/F1959M-06ae1



**Fabric Description:** Work Protec SA, Style Hi Prot 280®, 8.3 oz/yd<sup>2</sup> 280 g/m Twill, 60% Modacriliic, 38% Cotton, 2% Antistatic, Navy, AAD 8.0 oz/yd<sup>2</sup> 271 g/m<sup>2</sup>, ArcWear# 1202P25

#### Summary of measured energy and observations

	Test #	Panel	Test Current A	Cycles of 60Hz	Ei Cal/cm <sup>2</sup>	SCD Cal/cm <sup>2</sup>	HAF %	Burn Y/N	Break Open Y/N	Ablation Y/N	After Flame sec.	Omit Y/N	Comment
1	K-418346-1302	A	8295	10.2	7.3	-0.59	78.5	No	Y	-	-	No	
2	K-418346-1302	B	8295	10.2	9.9	0.2	82.1	Yes	Y	-	-	No	
3	K-418346-1302	C	8295	10.2	9.1	-0.3	85.5	No	Y	-	-	No	
4	K-418346-1303	A	8479	6.2	5.8	-0.88	77.4	No	-	-	-	No	
5	K-418346-1303	B	8479	6.2	5.1	-0.8	75.1	No	-	-	-	No	
6	K-418346-1303	C	8479	6.2	6.2	-0.8	79.4	No	Y	-	-	No	
7	K-418346-1304	A	8597	5.2	4.5	-0.86	70.0	No	-	-	-	No	
8	K-418346-1304	B	8597	5.2	4.5	-0.9	71.8	No	-	-	-	No	
9	K-418346-1304	C	8597	5.2	4.5	-0.9	71.5	No	-	-	-	No	
10	K-418346-1305	A	8558	5.7	5.1	-0.88	73.2	No	-	-	-	No	
11	K-418346-1305	B	8558	5.7	5.2	-0.9	73.4	No	-	-	-	No	
12	K-418346-1305	C	8558	5.7	5.5	-0.9	72.8	No	-	-	-	No	
13	K-418346-1306	A	8489	6.7	5.0	-0.85	70.7	No	-	-	-	No	
14	K-418346-1306	B	8489	6.7	6.1	-0.8	73.0	No	Y	-	-	No	
15	K-418346-1306	C	8489	6.7	5.4	-0.9	74.6	No	-	-	-	No	
16	K-418346-1307	A	8475	7.2	7.0	-0.34	77.9	No	Y	-	-	No	
17	K-418346-1307	B	8475	7.2	7.0	-0.7	76.0	No	Y	-	-	No	
18	K-418346-1307	C	8475	7.2	5.6	-0.7	68.9	No	-	-	-	No	
19	K-418346-1308	A	8462	7.2	6.7	-0.52	79.3	No	Y	-	-	No	
20	K-418346-1308	B	8462	7.2	5.5	-0.8	71.7	No	-	-	-	No	
21	K-418346-1308	C	8462	7.2	7.0	-0.6	77.3	No	Y	-	-	No	
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													