

Hugh Hoagland Consulting, Inc.

ArcWear.com

Electric Arc Exposure Tests

Material System

Layer 1

8.0 oz/yd² 271 g/m² 2x1 LH Twill, 65% Modacrylic 35% N317

Style: 85917 - Protera 180

Color: Navy-10057Q

Actual Areal Density (AAD): 8.0 oz/yd² 271 g/m²

Layer 2

13 oz/yd² 440 g/m² Denim, 88% Cotton 12% Nylon

Style: S391 Indura Ultra Soft

Color: Blue

Actual Areal Density (AAD): 14.4 oz/yd² 488 g/m²

Report Number: 1102P87, Revision: 00

April, 2011

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

Electric Arc Exposure Report

ASTM F 1959/F 1959M-06 a^{ε1} Standard Test Method for Determining the Arc Rating of Materials for Clothing

General

At the request of info@arcwear.com, electric arc exposure tests were conducted on textile systems for info@arcwear.com. info@arcwear.com 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^{ε1} Standard Test Method for Determining the Arc Rating of Materials for Clothing.

Test samples

The test material was received in February, 2011. 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 E_i 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 arc testing website. Test data is accessible info@arcwear.com.

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

(ATPV) = 43.0 cal/cm²

Customer	
Layer 1	
Material design	8.0 oz/yd ² 271 g/m ² 2x1 LH Twill, 65% Modacrylic 35% N317
Style	85917 - Protera 180
Color	Navy-10057Q
Actual Areal Density (AAD) as tested	8.0 oz/yd ² 271 g/m ²
Layer 2	
Material design	13 oz/yd ² 440 g/m ² Denim, 88% Cotton 12% Nylon
Style	S391 Indura Ultra Soft
Color	Blue
Actual Areal Density (AAD) as tested	14.4 oz/yd ² 488 g/m ²

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

Requested by: V@ArcWear



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

ASTM F1959/F1959M-06a

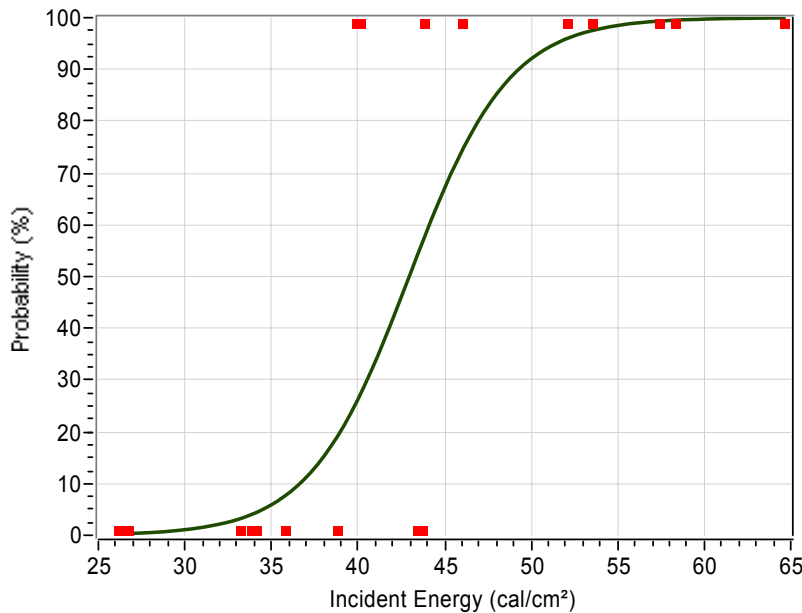
Standard Test Method for Determining the Arc Rating of Materials for Clothing



Client: X
 Y
 (Y)
 Y

Fabric: Two Layers, Style 85917 - Protera 180 8.0 oz/yd² 271 g/m² 2x1 LH Twill, 65% Modacrylic
Description: 35% N317, Navy10057Q, AAD 8.0 oz/yd² 271 g/m² over Style S391 Indura Ultra Soft 13 oz/yd² 440 g/m² Denim, 88% Cotton 12% Nylon, Blue, AAD 14.4 oz/yd² 488 g/m², ArcWear# 1102P87

Determination of ATPV, 50% Probability of 2nd Degree Burn

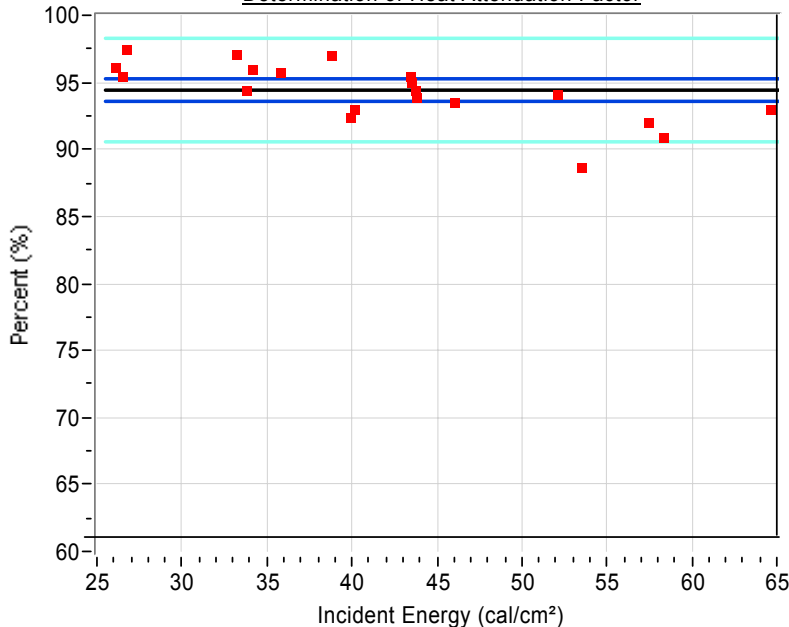


ATPV = 43.0 cal/cm²

Probability of Burn	E _i
5%	34.5
10%	36.6
20%	39.0
30%	40.5
40%	41.8
50%	43.0
60%	44.1
70%	45.4
80%	46.9
90%	49.3

- # Pts = 21
- # Pts above Stoll = 9
- # Pts Break-Open = 2
- # Pts always >STOLL = 7
- # Pts always <STOLL = 9
- # Pts within 20% = 10
- # Pts in mix zone = 5

Determination of Heat Attenuation Factor



HAF = 94.4 %

Confidence Intervals
 95% CI = 93.6 , 95.3

- Data pts
- Best Fit
- 95% CI
- 95% CI pts

Ref#: K-418310

Wed, Apr 20, 2011

ASTM F1959/F1959M-06a
Standard Test Method for Determining the Arc Rating of Materials for Clothing

Client: X
X
(X)
X



Fabric Description: Two Layers, Style 85917 - Protera 180 8.0 oz/yd² 271 g/m² 2x1 LH Twill, 65% Modacrylic 35% N317, Navy10057Q, AAD 8.0 oz/yd² 271 g/m² over Style S391 Indura Ultra Soft 13 oz/yd² 440 g/m² Denim, 88% Cotton 12% Nylon, Blue, AAD 14.4 oz/yd² 488 g/m², ArcWear# 1102P87

Test #	Panel	Test Current A	Cycles of 60Hz	Ei Cal/cm ²	SCD Cal/cm ²	HAF %	Break Open Y/N	Break Open Y/N	Ablation Y/N	After Flame sec.	Omit Y/N	Comment
1	K-418310-2129	A	8039	80.2	58.3	3.04	90.9	Yes	Y	-	1.5	No
2	K-418310-2129	B	8039	80.2	57.4	2.2	92.0	Yes	-	-	-	No
3	K-418310-2129	C	8039	80.2	64.6	2.3	93.0	Yes	Y	-	-	No
4	K-418310-2251	A	8126	65.2	52.1	0.25	94.1	Yes	-	-	-	No
5	K-418310-2251	B	8126	65.2	43.7	-0.4	94.4	No	-	-	-	No
6	K-418310-2251	C	8126	65.2	53.5	3.6	88.7	Yes	-	-	-	No
7	K-418310-2252	A	8106	60.2	43.5	-0.44	95.0	No	-	-	-	No
8	K-418310-2252	B	8106	60.2	43.4	-0.5	95.5	No	-	-	-	No
9	K-418310-2252	C	8106	60.2	46.0	0.3	93.5	Yes	-	-	-	No
10	K-418310-2253	A	8119	55.2	43.8	0.10	93.9	Yes	-	-	-	No
11	K-418310-2253	B	8119	55.2	38.8	-1.0	97.0	No	-	-	-	No
12	K-418310-2253	C	8119	55.2	39.9	0.3	92.4	Yes	-	-	-	No
13	K-418310-2254	A	8155	50.2	35.8	-0.80	95.8	No	-	-	-	No
14	K-418310-2254	B	8155	50.2	38.8	-1.1	97.0	No	-	-	-	No
15	K-418310-2254	C	8155	50.2	40.1	0.1	93.0	Yes	-	-	-	No
16	K-418310-2255	A	8154	45.2	34.1	-0.93	96.0	No	-	-	-	No
17	K-418310-2255	B	8154	45.2	33.2	-1.2	97.1	No	-	-	-	No
18	K-418310-2255	C	8154	45.2	33.8	-0.4	94.4	No	-	-	-	No
19	K-418310-2256	A	8184	35.2	26.1	-1.21	96.1	No	-	-	-	No
20	K-418310-2256	B	8184	35.2	26.5	-1.2	95.5	No	-	-	-	No
21	K-418310-2256	C	8184	35.2	26.7	-1.2	97.5	No	-	-	-	No
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
32												
33												
34												
35												
36												

Ref #: K-418310

Wed, Apr 20, 2011