

**Hugh Hoagland Consulting, Inc.**

**ArcWear.com**

**Electric Arc Exposure Tests**

**For Therm-Equip**

**Blanket**

**BlastMat Seven Layers Blanket, Size 56X60 inches,  
Style TE5660 Standard,**

**Layer 1: Shell: 2.8 oz/yd<sup>2</sup> Yellow Fabric  
Layer 2: Insulation: 8.3 oz/yd<sup>2</sup> Yellow Fabric  
Layer 3: Insulation: 8.3 oz/yd<sup>2</sup> Yellow Fabric  
Layer 4: Insulation: 8.3 oz/yd<sup>2</sup> Yellow Fabric  
Layer 5: Insulation: 8.3 oz/yd<sup>2</sup> Yellow Fabric  
Layer 6: Insulation: 8.3 oz/yd<sup>2</sup> Yellow Fabric  
Layer 7: Shell: 2.8 oz/yd<sup>2</sup> Yellow Fabric**

June 2009

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

# Electric Arc Exposure Tests

Materials for use in Electric Arc

## Therm-Equip

### Certificate of Performance

This is to certify that the tests documented in this report were conducted at Kinectrics High Current Laboratory in accordance with ASTM International Standard Test Method F 2676 2009 Standard Test Method for Determining the Protective Performance of an Arc Protective Blanket for Electric Arc Hazards. The test samples were manufactured by the in accordance with the above standard.

Fabric system specified in the table below received arc rating as:

**Maximum Arc Current  $I_{max}$  = 40.0 kA,  
Breakopen Threshold Performance BTP = 400 kA\*cycles**

Customer	Therm-Equip
Blanket description	
Blanket design	BlastMat Seven Layers Blanket, Size 56X60 inches
Style	Style TE5660 Standard
Layer 1	Shell: 2.8 oz/yd <sup>2</sup> Yellow Fabric
Layer 2	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 3	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 4	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 5	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 6	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 7	Shell: 2.8 oz/yd <sup>2</sup> Yellow Fabric

Requested by: Mr. Victor Petrovic

Approved by Hugh Hoagland  
Hugh Hoagland Consulting, Inc.

## Therm-Equip

### Full Scale Testing of Arc Protective Blankets

#### ASTM F 2676 – 2009 Standard Test Method for Determining the Protective Performance of an Arc Protective Blanket for Electric Arc Hazards

##### Arc Tests at Kinectrics High Current Laboratory

At the request of Mr. Victor Petrovic, electric arc exposure tests were conducted on specimens of the Arc Protective Blankets for Therm-Equip. Mr. Victor Petrovic arranged with Hugh Hoagland Consulting, Inc. to conduct tests at the High Current Laboratory of Kinectrics in Toronto and review test data.

The Arc Protective Blankets were tested according to the ASTM F 2676 – 2009 Standard Test Method for Determining the Protective Performance of an Arc Protective Blanket for Electric Arc Hazards

#### Test Samples

The samples as tested are described in the Table below:

Customer	Therm-Equip
Blanket description	
Blanket design	BlastMat Seven Layers Blanket, Size 56X60 inches
Style	Style TE5660 Standard
Layer 1	Shell: 2.8 oz/yd <sup>2</sup> Yellow Fabric
Layer 2	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 3	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 4	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 5	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 6	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 7	Shell: 2.8 oz/yd <sup>2</sup> Yellow Fabric

## Test Method

### Test apparatus

ASTM F 2676 – 2009 Standard Test Method for Determining the Protective Performance of an Arc Protective Blanket for Electric Arc Hazards requires testing conducted in a high current laboratory with a controlled arc source.

This is a destructive test. In order to determine protective performance limits of the blanket, test specimens are intentionally forced to failure. In blanket testing failure is one of the following: break open, ignition or attachments failure.

Test apparatus is shown on Figure 1.

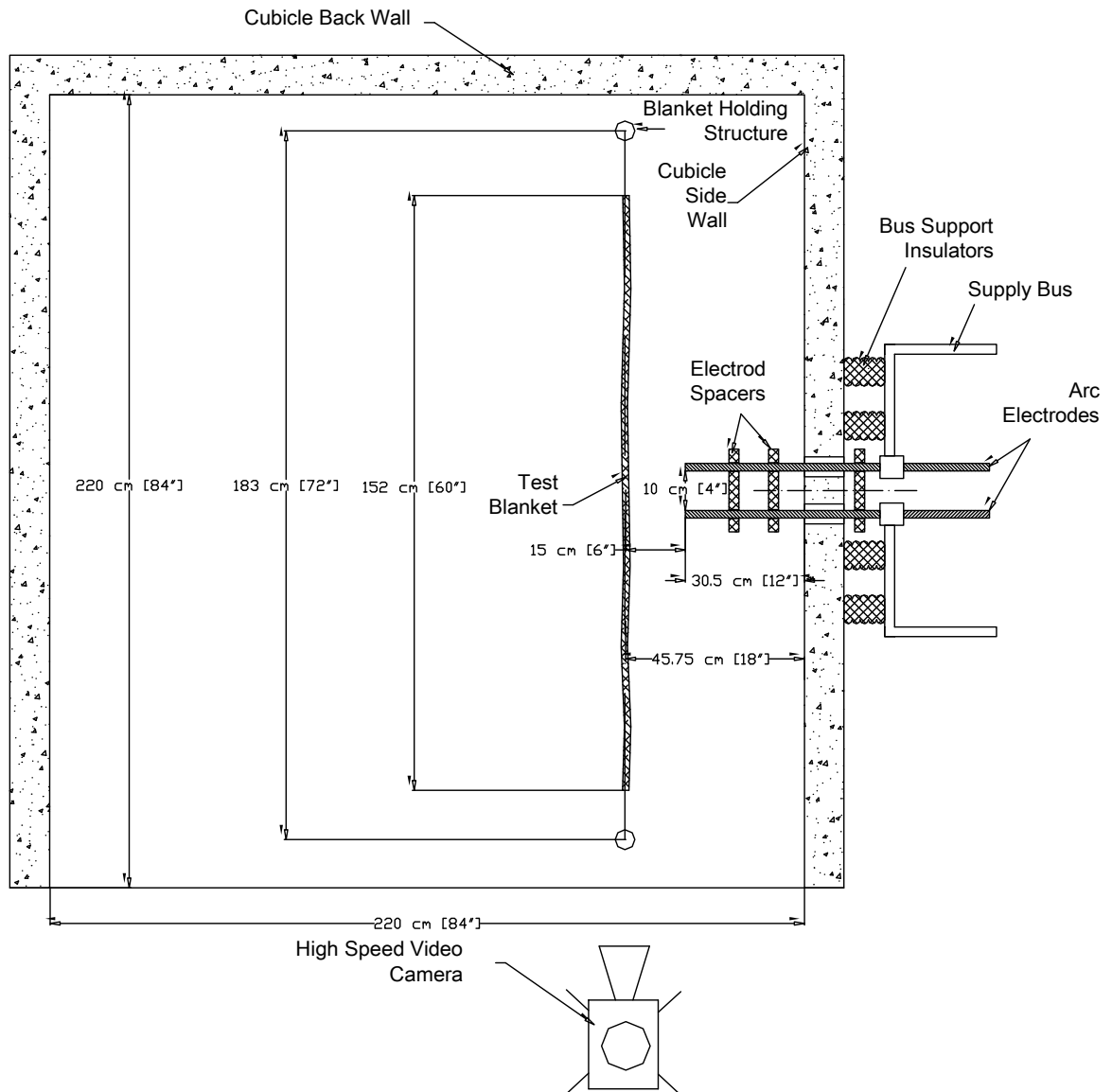


Figure 1

The Kinectrics High Current Laboratory uses a 100 MVA supply (100 million volt-amperes). This supply feeds the arc current to the arc electrodes.

Arc electrodes are enclosed within a test cubicle to utilize the effects of magnetic fields on the directionality of the arc. An Arc is intentionally directed towards test specimen.

A series of seven conclusive trials completes one test.

Following parameters are set, checked and recorded for each trial:

- arc current
- arc duration
- arc electrodes spacing
- distance between test specimen(s) and arc electrode

The peak current is controlled by closing phase angle of the 60 Hz supply source with accuracy of 0.01 cycles.

In addition to recorded data each trial is evaluated using visual observations.

## **Test Results**

The test program included seven arc trials.

Detailed arc current, arc voltage graphs and arc duration are shown on attached pages.

Test photographs and observations are shown in the Table below.

The arc voltage record, arc current record, arc duration, and arc energy are included on CD.

Each trial was videotaped using high speed and regular cameras. Video is included on CD.

CD is a part of this report.

Trial	09-2623	09-2624	09-2625
Arc Current, kA	39.68	40.27	40.45
Arc duration, 60 Hz cycles	20	10	15
Break open	No	No	No
Number of cycles to breakopen	>20	>10	>15
Ignition	Yes, on the arc side only	No	Yes, on the arc side only
Number of attachment points failed	0	0	0
Blanket stays attached and in vertical position	Yes	Yes	Yes
Afterflame, sec	Ignition	0	Ignition
Ten cycles rule	Passed	Passed	Passed

Breakopen Threshold Performance, BTP, kA*cycles	400	400	4000
Average BTP for test level, kA *cycles	400		
Dripping	No	No	No
Melting	No	No	No

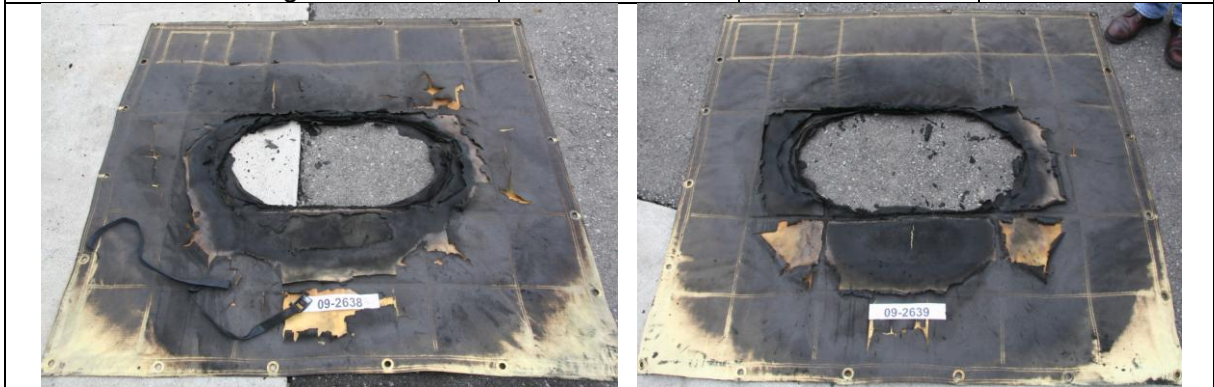


Trial	09-2627	09-2628	
Arc Current, kA	24.58	24.58	
Arc duration, 60 Hz cycles	20	20	
Break open	No	No	
Number of cycles to breakopen	>20	>20	
Ignition	No	No	
Number of attachment points failed	0	0	
Blanket stays attached and in vertical position	Yes	Yes	
Afterflame, sec	9	14	
Ten cycles rule	Passed	Passed	
Breakopen Threshold Performance, kA*cycles	>480	>480	
Average BTP for test level, kA *cycles	480		
Dripping	No	No	
Melting	No	No	



Trial	09-2638	09-2639	
Arc Current, kA	5.20	5.22	
Arc duration, 60 Hz cycles	120	120	
Break open	Yes	Yes	

Number of cycles to breakopen	110	101	
Ignition	No	No	
Number of attachment points failed	0	0	
Blanket stays attached and in vertical position	Yes	Yes	
Afterflame, sec	No video, <30	23	
Ten cycles rule	Passed	Passed	
Breakopen Threshold Performance, kA*cycles	572	527	
Average BTP for test level, kA *cycles	549.5		
Dripping	No	No	
Melting	No	No	



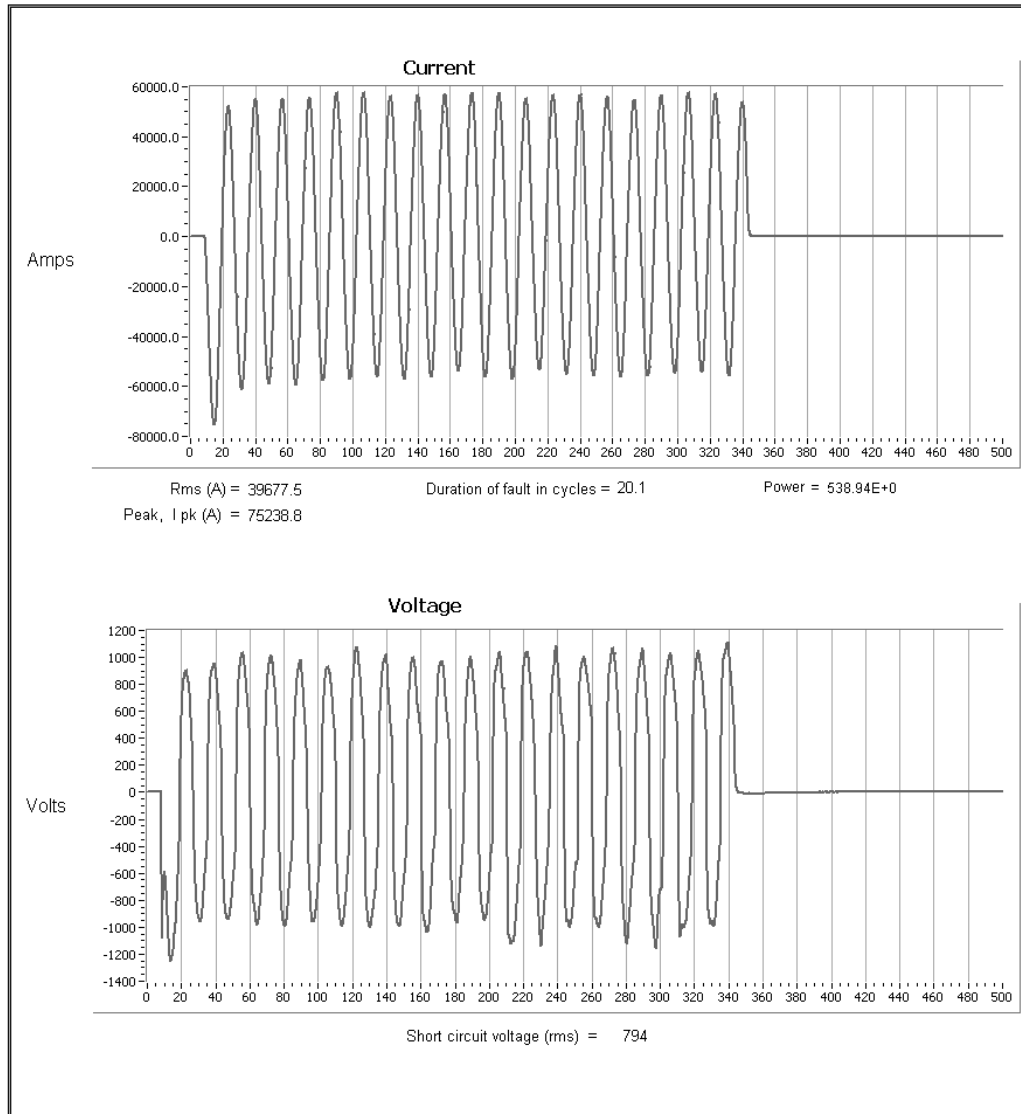
### Conclusions

The Arc Protective Blanket under test described in the table material received the arc ratings below:

Customer	Therm-Equip
Blanket description	
Blanket design	BlastMat Seven Layers Blanket, Size 56X60 inches
Style	Style TE5660 Standard
Layer 1	Shell: 2.8 oz/yd <sup>2</sup> Yellow Fabric
Layer 2	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 3	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 4	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 5	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 6	Insulation: 8.3 oz/yd <sup>2</sup> Yellow Fabric
Layer 7	Shell: 2.8 oz/yd <sup>2</sup> Yellow Fabric


**Maximum Arc Current  $I_{max}$  = 40.0 kA,  
Breakopen Threshold Performance BTP = 400 kA\*cycles**

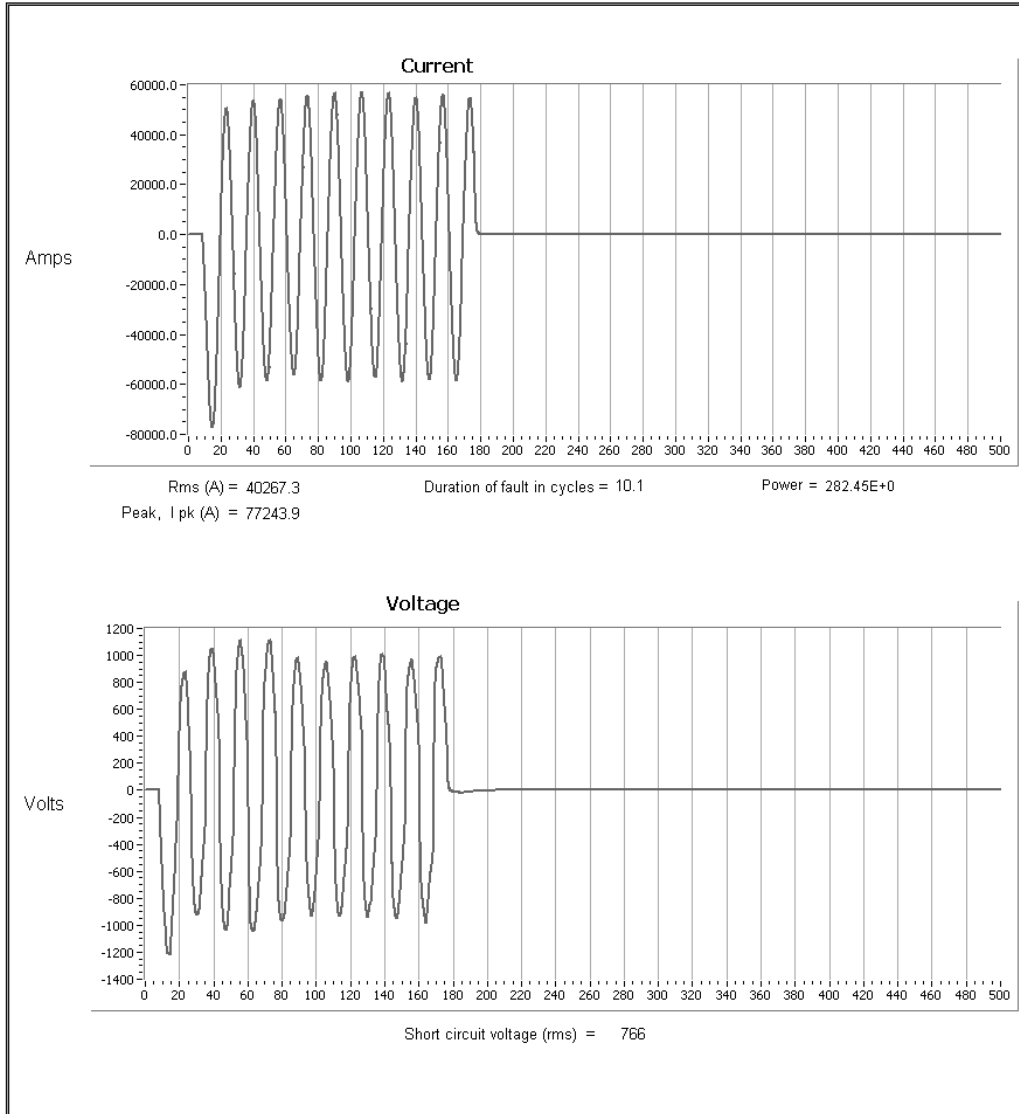
June 8, 2009	<b>High Current Test Laboratory</b> <b>Kinectrics Inc.</b> <b>Test Sheet</b>	 <b>KINECTRICS</b>
Test # 09-2623		
WO#: K-418192		
Client: ArcWear.com	Description: BlastMat 7 layers blanket, Style TE5660 Standard, Size 56X60 inches, 20 Attachment points, 14 used, sn:09007	



PRIVATE INFORMATION, This test data shall not be disclosed or distributed without permission of the client.

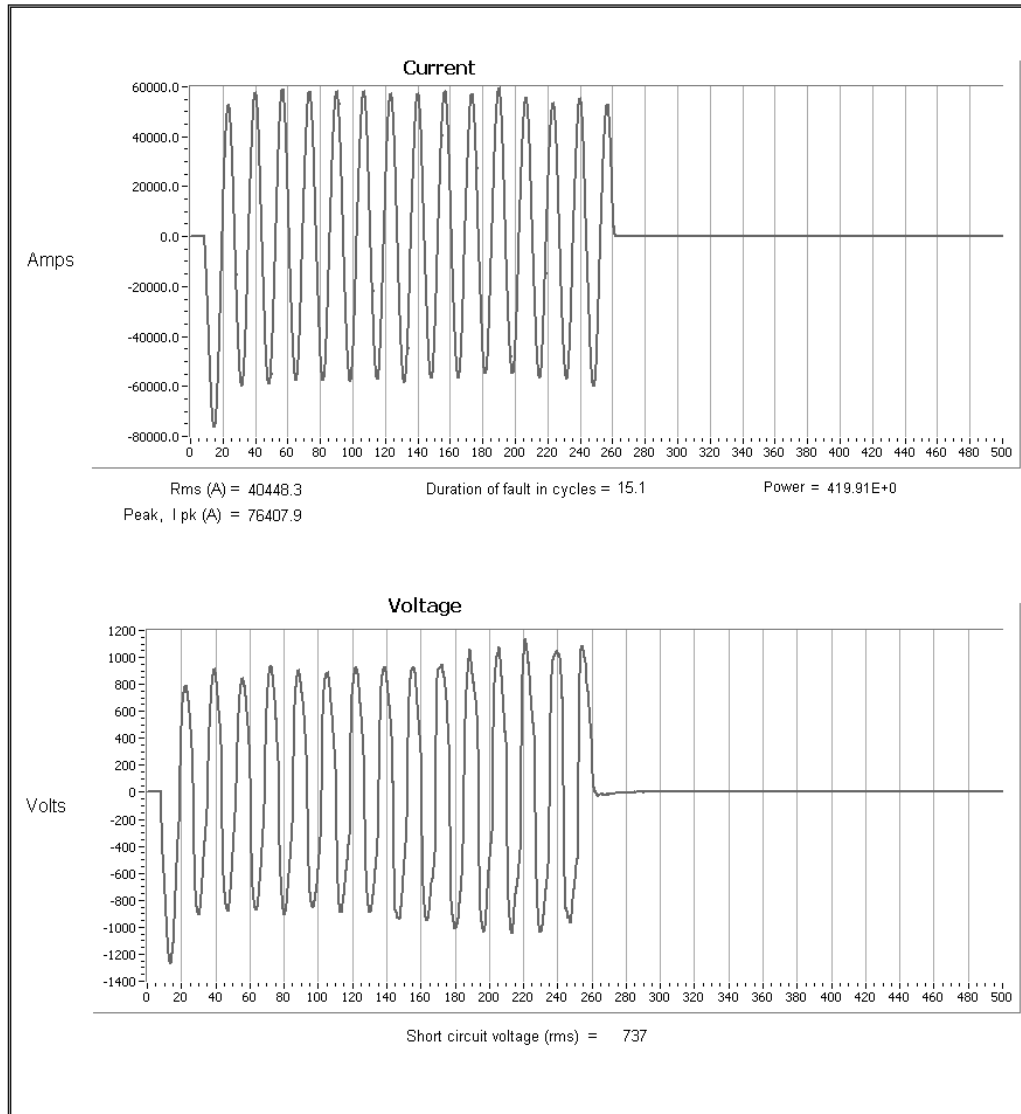


June 8, 2009	<b>High Current Test Laboratory</b> <b>Kinectrics Inc.</b> <b>Test Sheet</b>	 <b>KINECTRICS</b>
Test # 09-2624		
WO#: K-418192		
Client: ArcWear.com	Description: <b>BlastMat 7 layers blanket, Style TE5660 Standard, Size 56X60 inches,                  20 Attachment points, 14 used, sn:09006</b>	



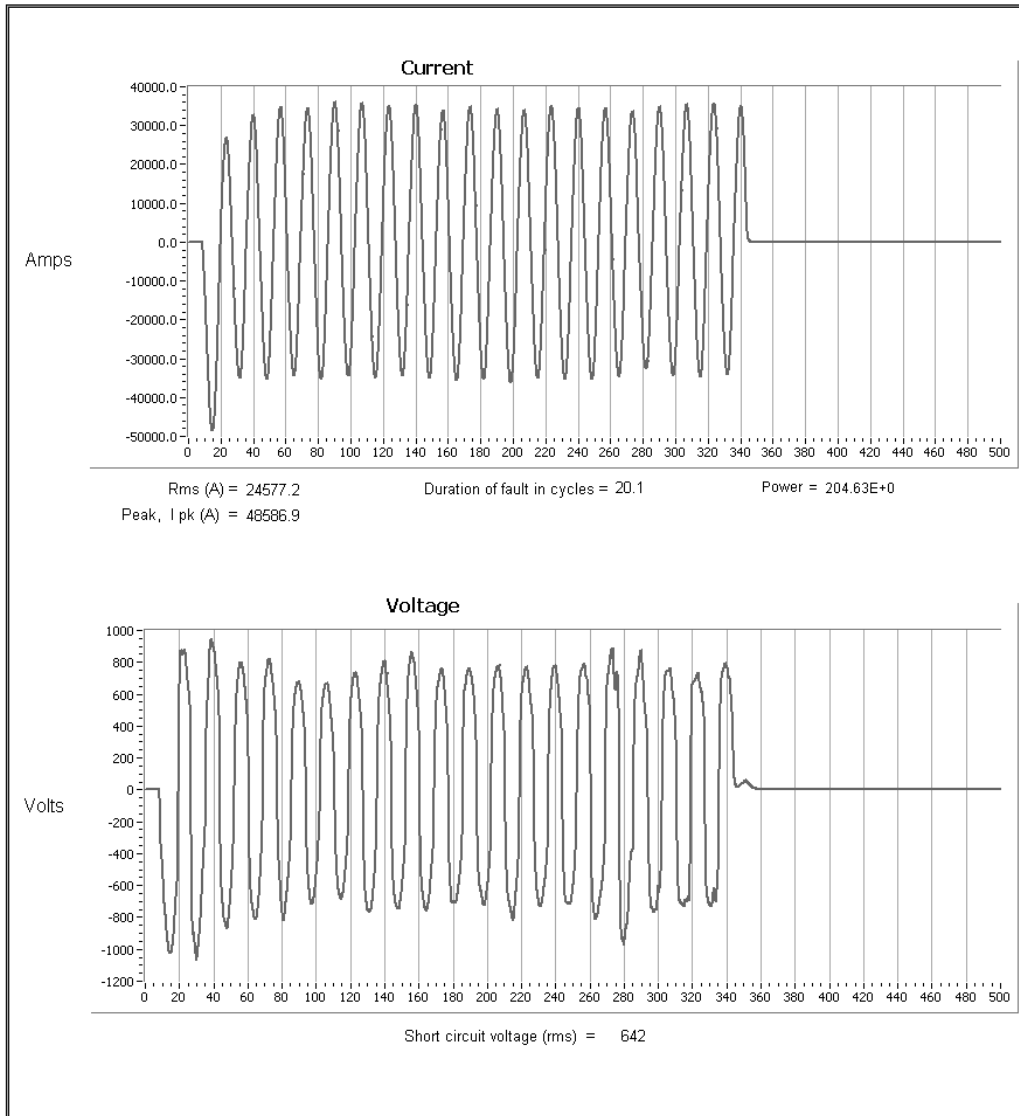
PRIVATE INFORMATION, This test data shall not be disclosed or distributed without permission of the client.

June 8, 2009	<b>High Current Test Laboratory</b> <b>Kinectrics Inc.</b> <b>Test Sheet</b>	 <b>KINECTRICS</b>
Test # 09-2625		
WO#: K-418192		
Client: ArcWear.com	Description: BlastMat 7 layers blanket, Style TE5660 Standard, Size 56X60 inches, 20 Attachment points, 20 used, sn:09011	



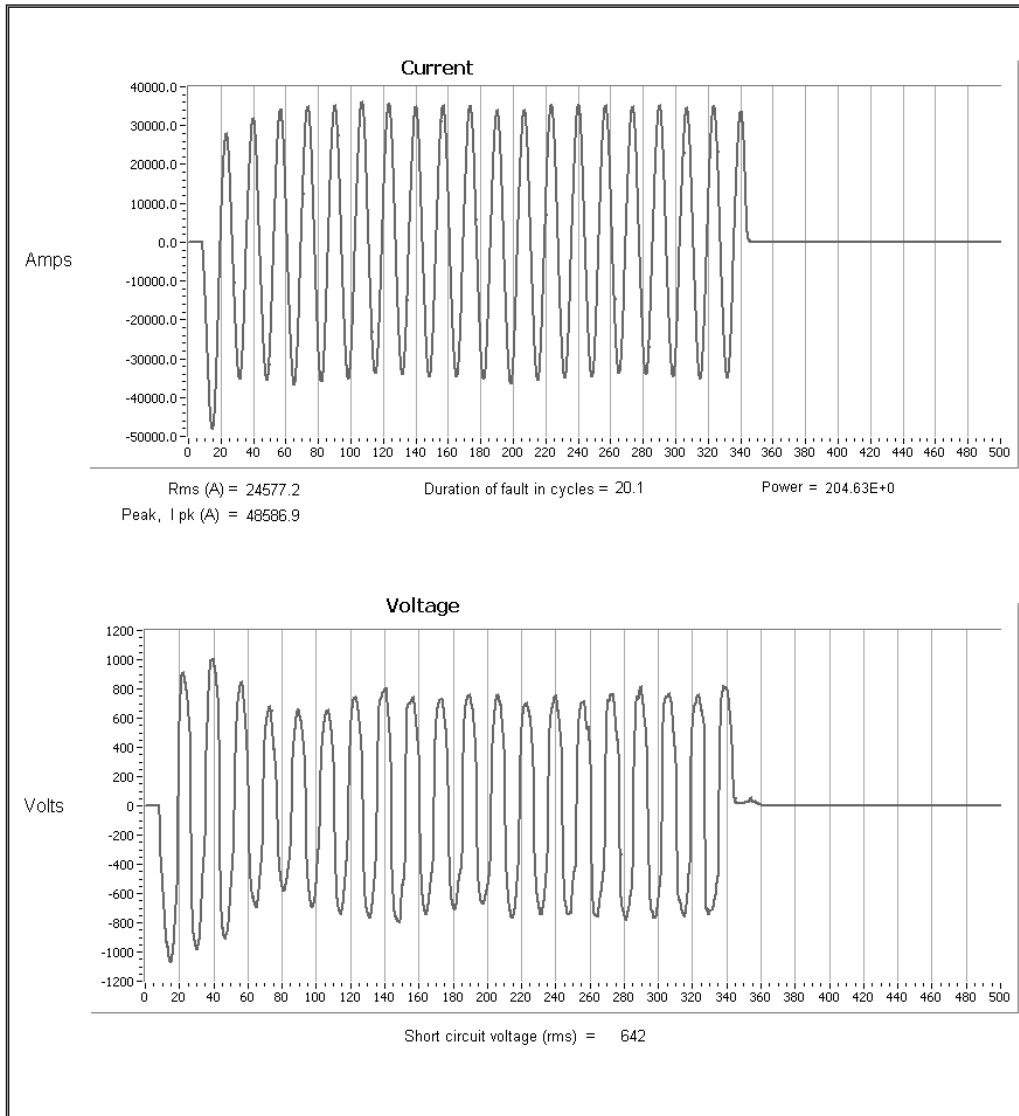
PRIVATE INFORMATION, This test data shall not be disclosed or distributed without permission of the client.

June 8, 2009	<b>High Current Test Laboratory</b> <b>Kinectrics Inc.</b> <b>Test Sheet</b>	 <b>KINECTRICS</b>
Test # 09-2627		
WO#: K-418192		
Client: ArcWear.com	Description: BlastMat 7 layers blanket, Style TE5660 Standard, Size 56X60 inches, 20 Attachment points, 20 used, sn:09009	




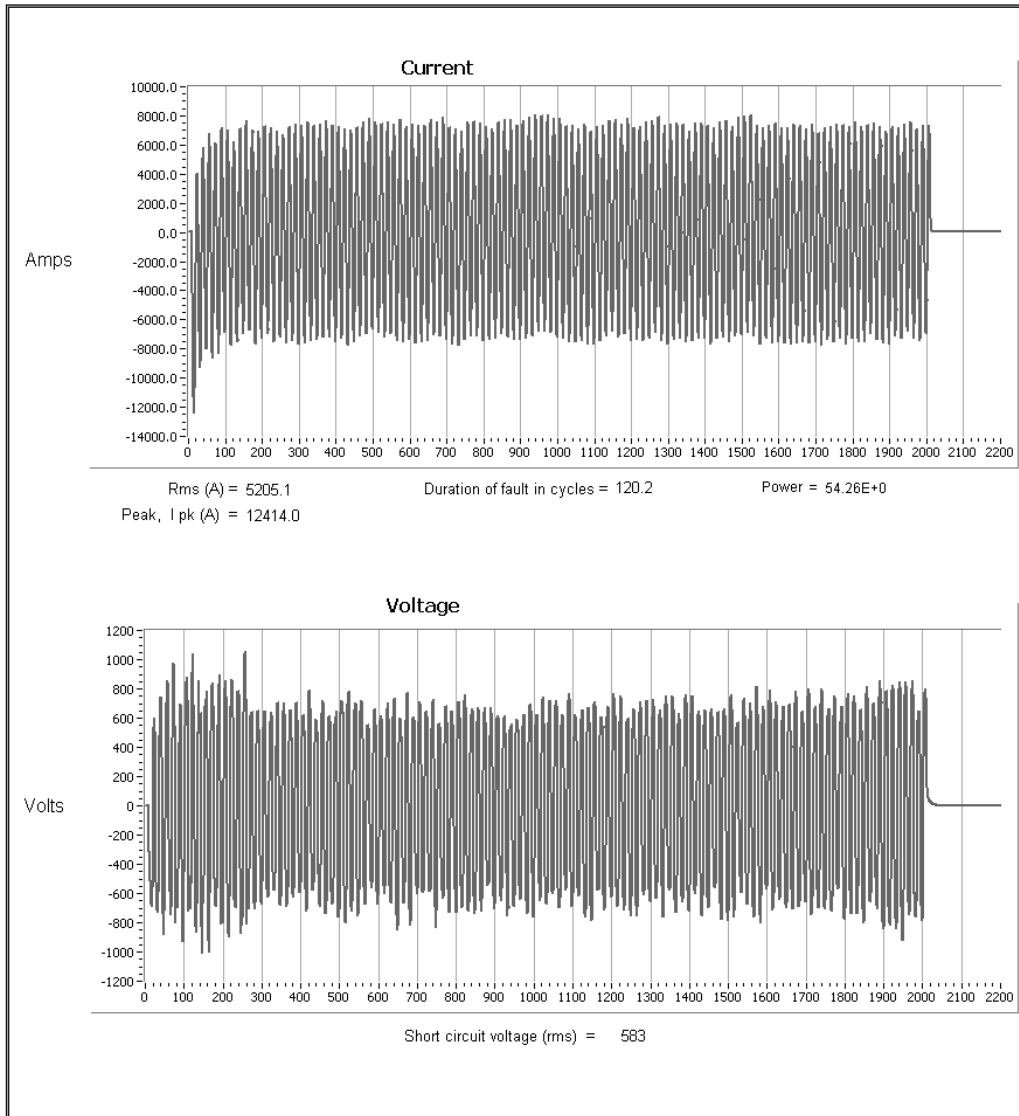
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June 8, 2009	<h2>High Current Test Laboratory</h2> <h3>Kinectrics Inc.</h3> <h3>Test Sheet</h3>	 <b>KINECTRICS</b>
Test # 09-2628		
WO#: K-418192		
Client: ArcWear.com	Description: BlastMat 7 layers blanket, Style TE5660 Standard, Size 56X60 inches, 20 Attachment points, 20 used, sn:09014	




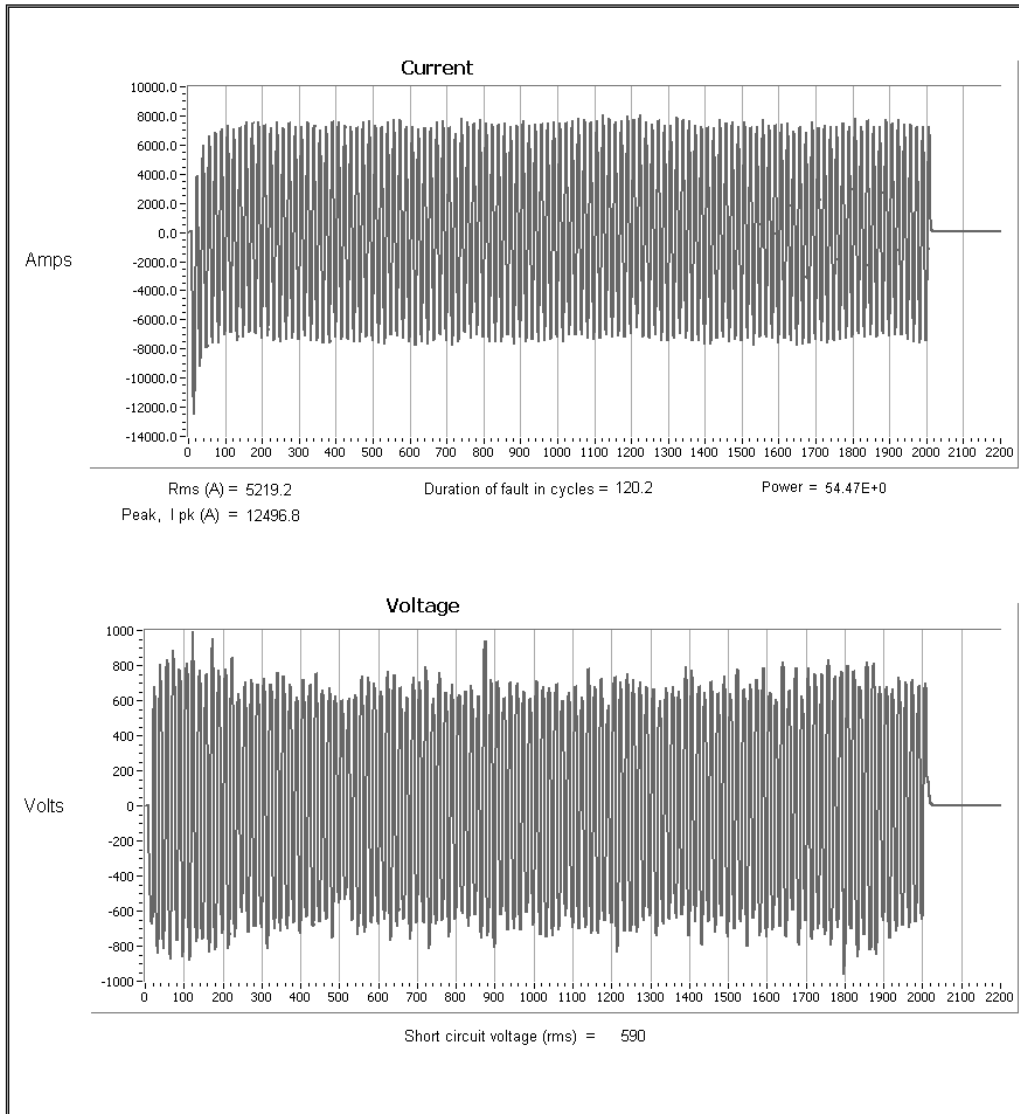
PRIVATE INFORMATION, This test data shall not be disclosed or distributed without permission of the client.

June 8, 2009	<b>High Current Test Laboratory</b> <b>Kinectrics Inc.</b> <b>Test Sheet</b>	 <b>KINECTRICS</b>
Test # 09-2638		
WO#: K-418192		
Client: ArcWear.com	Description: <b>BlastMat 7 layers blanket, Style TE5660 Standard, Size 56X60 inches,                  20 Attachment points, 16 points used, SN 09013</b>	



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June 8, 2009	<b>High Current Test Laboratory</b> <b>Kinectrics Inc.</b> <b>Test Sheet</b>	 <b>KINECTRICS</b>
Test # 09-2639		
WO#: K-418192		
Client: ArcWear.com	Description: BlastMat 7 layers blanket, Style TE5660 Standard, Size 56X60 inches, 20 Attachment points, 16 points used, SN 09012	



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