Hugh Hoagland Consulting, Inc.

ArcWear.com

Electric Arc Exposure Tests

For Therm-Equip

Blanket

BlastMat Four Layers Blanket, Size 56X60 inches, 20 attachment points with Kevlar straps,
Style TE5660 LightLine,
Layer 1: Shell: 10.3 oz/yd² Yellow Fabric
Layer 2: Insulation: 10.1 oz/yd² Yellow Fabric
Layer 3: Insulation: 10.1 oz/yd² Yellow Fabric
Layer 4: Shell: 9.0 oz/yd² Navy 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 *Imax* = 25.0 kA,
Breakopen Threshold Performance BTP = 267 kA*cycles

Customer	Therm-Equip
Blanket description	
Blanket design	BlastMat Four Layers Blanket, Size 56X60 inches, 20 attachment points with Kevlar straps
Style	Style TE5660 LightLine
Layer 1	Shell: 10.3 oz/yd² Yellow Fabric
Layer 2	Insulation: 10.1 oz/yd² Yellow Fabric
Layer 3	Insulation: 10.1 oz/yd² Yellow Fabric
Layer 4	Shell: 9.0 oz/yd² Navy 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 Four Layers Blanket, Size 56X60 inches, 20 attachment points with Kevlar straps
Style	Style TE5660 LightLine
Layer 1	Shell: 10.3 oz/yd² Yellow Fabric
Layer 2	Insulation: 10.1 oz/yd² Yellow Fabric
Layer 3	Insulation: 10.1 oz/yd² Yellow Fabric
Layer 4	Shell: 9.0 oz/yd² Navy 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.

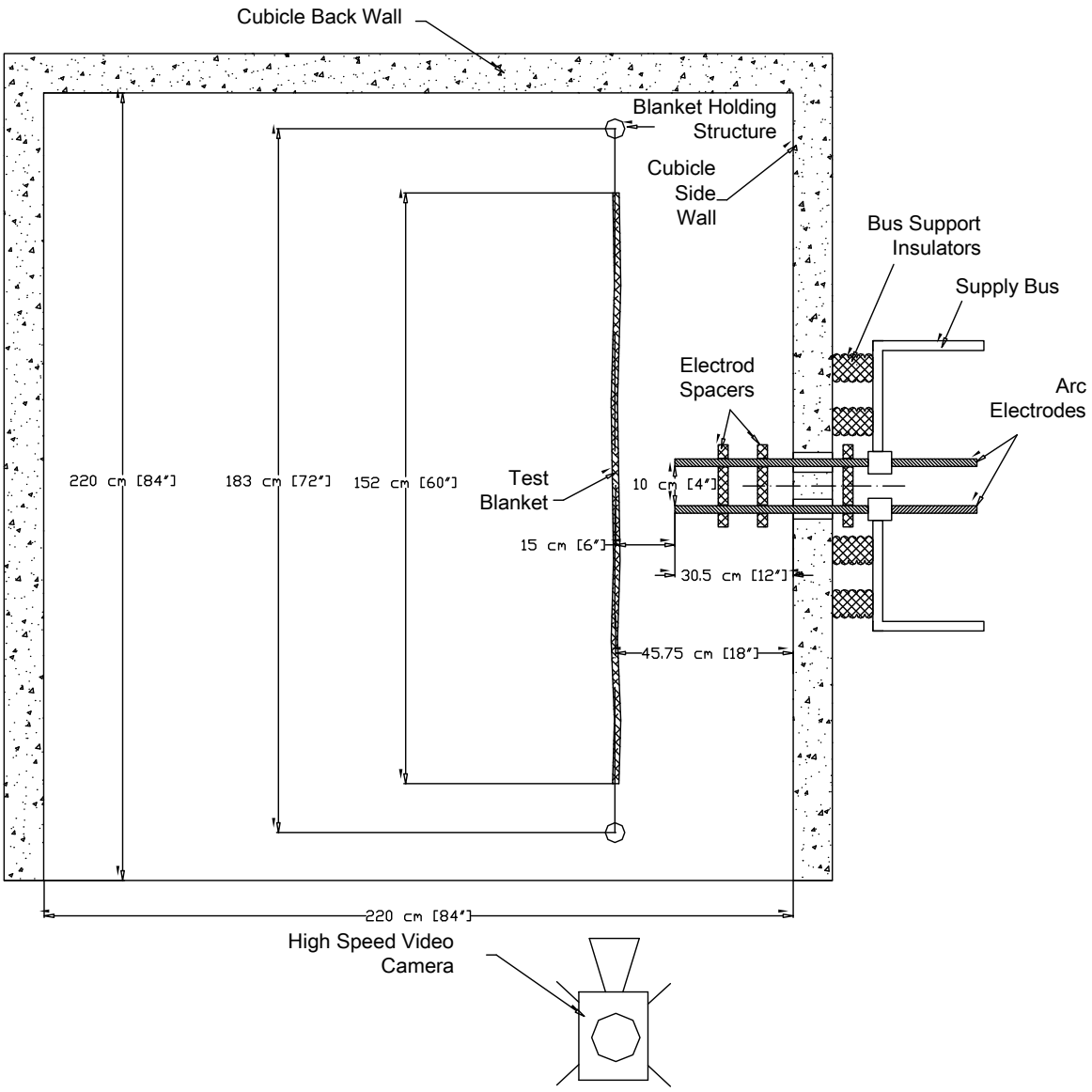


Figure 1

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	09-2629	09-2630	09-2631
Arc Current, kA	24.99	25.21	25.18
Arc duration, 60 Hz cycles	20	15	15
Break open	No	No	No
Number of cycles to breakopen	16.5	13.1	12.6
Ignition	No	No	No
Number of attachment points failed	0	0	0
Blanket stays attached and in vertical position	Yes	Yes	Yes
Afterflame, sec	29	26	27
Ten cycles rule	Passed	Passed	Passed
Breakopen Threshold Performance, BTP, kA*cycles	412	330	317
Average BTP for test level, kA *cycles	353		
Dripping	No	No	No
Melting	No	No	No



Trial	09-2633	09-2634	
Arc Current, kA	14.65	14.92	
Arc duration, 60 Hz cycles	25	33	
Break open	No	Yes	
Number of cycles to breakopen	>25	28	
Ignition	No	No	
Number of attachment points failed	0	0	
Blanket stays attached and in vertical position	Yes	Yes	
Afterflame, sec	11	23	
Ten cycles rule	Passed	Passed	
Breakopen Threshold Performance, kA*cycles	>366	418	
Average BTP for test level, kA *cycles	392		
Dripping	No	No	
Melting	No	No	

Trial	09-2640	09-2641	
Arc Current, kA	5.20	5.23	
Arc duration, 60 Hz cycles	90	65	
Break open	Yes	Yes	
Number of cycles to breakopen	50.4	52.1	
Ignition	No	No	
Number of attachment points failed	0	0	
Blanket stays attached and in vertical position	Yes	Yes	
Afterflame, sec	15	13	
Ten cycles rule	Passed	Passed	
Breakopen Threshold Performance, kA*cycles	262	272	

Average BTP for test level, kA *cycles	267		
Dripping	No	No	
Melting	No	No	

Conclusions

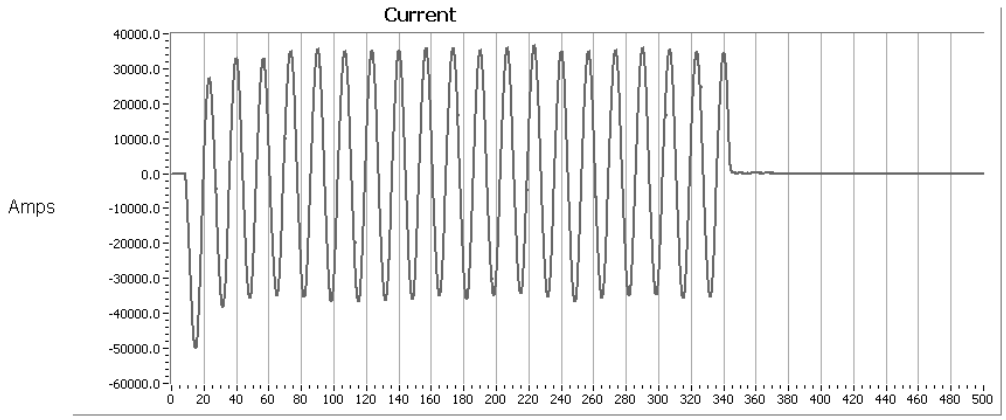
The Arc Protective Blanket under test described in the table material received the arc ratings below:

Customer	Therm-Equip
Blanket description	
Blanket design	BlastMat Four Layers Blanket, Size 56X60 inches, 20 attachment points with Kevlar straps
Style	Style TE5660 LightLine
Layer 1	Shell: 10.3 oz/yd² Yellow Fabric
Layer 2	Insulation: 10.1 oz/yd² Yellow Fabric
Layer 3	Insulation: 10.1 oz/yd² Yellow Fabric
Layer 4	Shell: 9.0 oz/yd² Navy Fabric

Maximum Arc Current *Imax* = 25.0 kA,
Breakopen Threshold Performance BTP = 267 kA*cycles

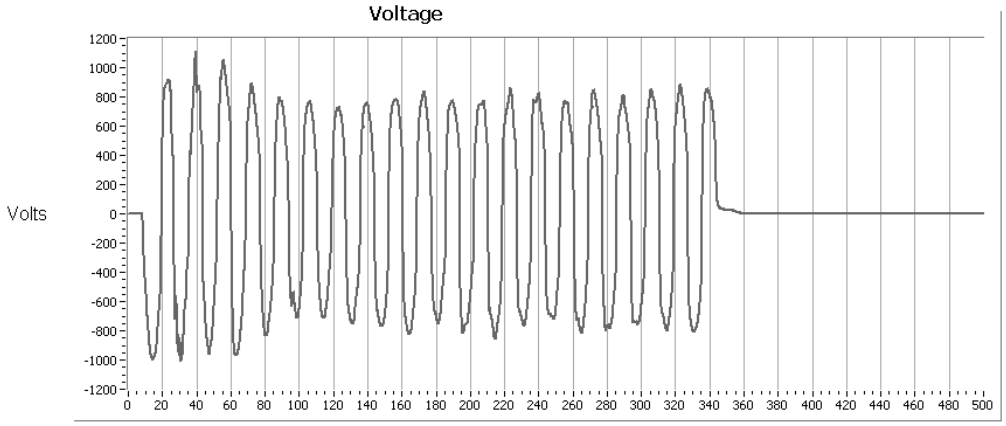
June 8, 2009	High Current Test Laboratory Kinectrics Inc. Test Sheet	KINECTRICS
Test # 09-2629		
WO#: K-418192		

Client:	Description:
ArcWear.com	**BlastMat 4 layer blanket, Style TE5660 Lightline, Size 56X60 inches, 20 Attachment points, 16 used, sn:08094**



Rms (A) = 24990.5 Duration of fault in cycles = 20.1 Power = 212.00E+0

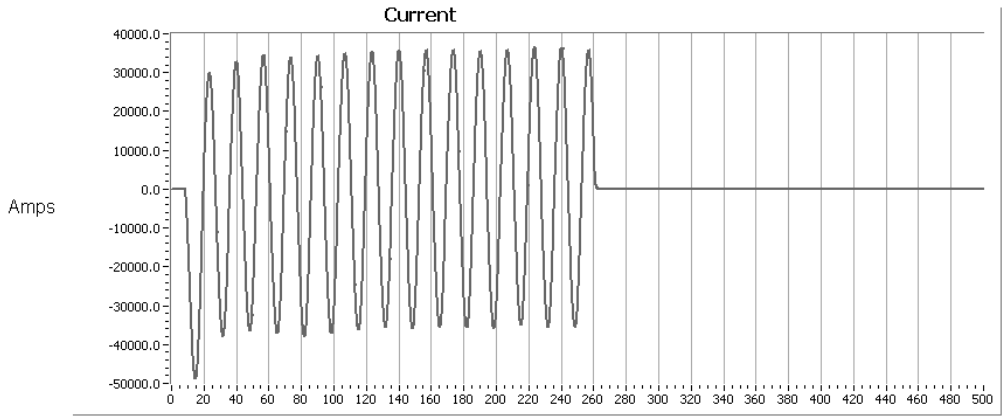
Peak, I pk (A) = 50030.5



Short circuit voltage (rms) = 669

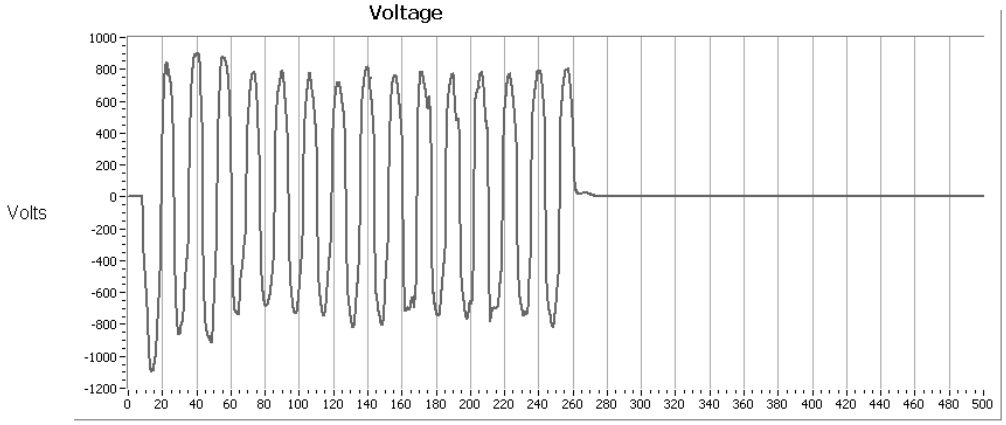
June 8, 2009	High Current Test Laboratory Kinectrics Inc. Test Sheet	KINECTRICS
Test # 09-2630		
WO#: K-418192		

Client:	Description:
ArcWear.com	**BlastMat 4 layer blanket, Style TE5660 Lightline, Size 56X60 inches, 20 Attachment points, 17 used, sn:08096**



Rms (A) = 25207.5 Duration of fault in cycles = 13.2 Power = 142.54E+0

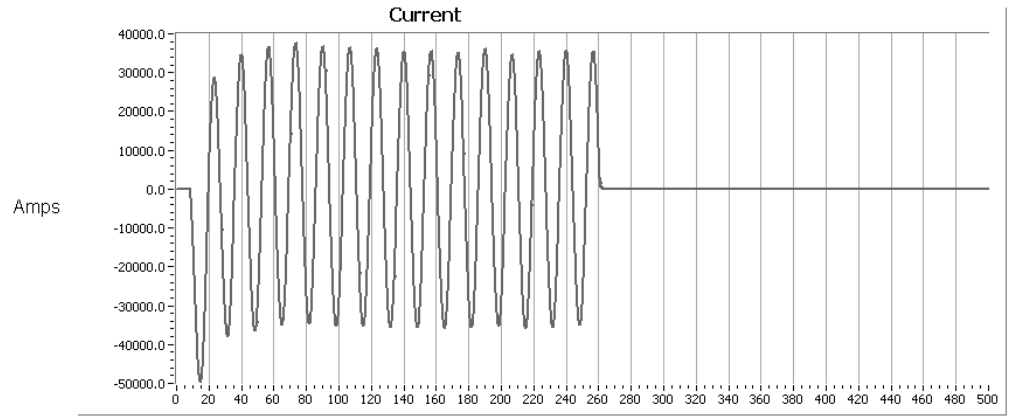
Peak, I pk (A) = 48772.8



Short circuit voltage (rms) = 640

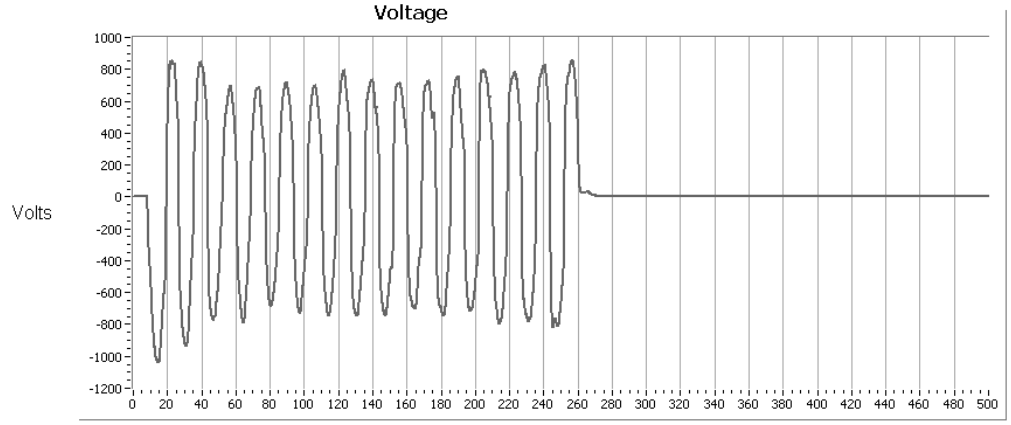
June 8, 2009	High Current Test Laboratory Kinectrics Inc. Test Sheet	KINECTRICS
Test # 09-2631		
WO#: K-418192		

Client:	Description:
ArcWear.com	**BlastMat 4 layer blanket, Style TE5660 Lightline, Size 56X60 inches, 20 Attachment points, 17 used, sn:09005**



Rms (A) = 25176.8 Duration of fault in cycles = 15.1 Power = 163.54E+0

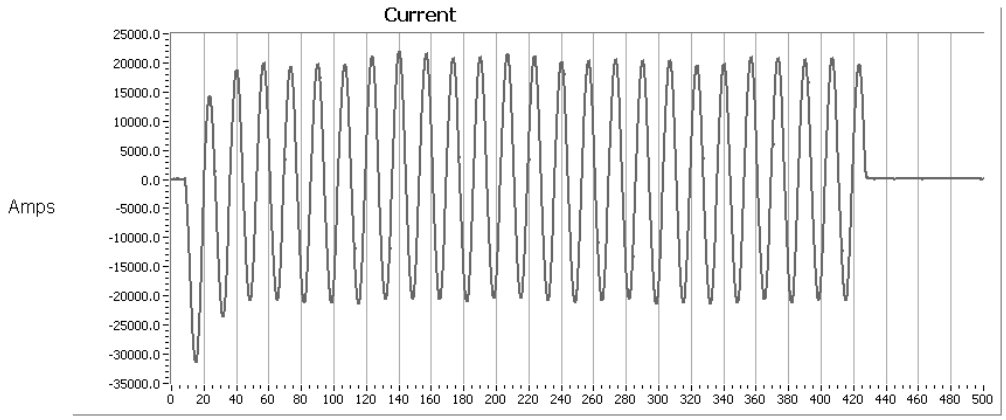
Peak, I pk (A) = 49617.5



Short circuit voltage (rms) = 618

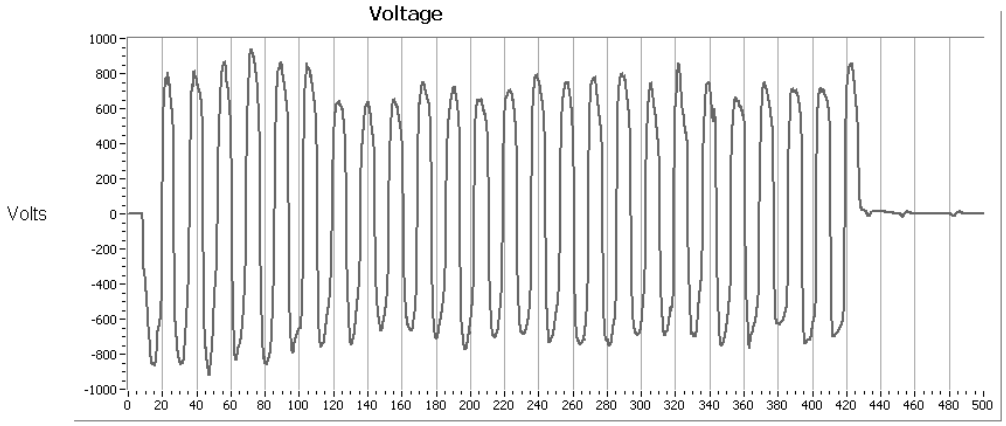
June 8, 2009	High Current Test Laboratory Kinectrics Inc. Test Sheet	KINECTRICS
Test # 09-2633		
WO#: K-418192		

Client:	Description:
ArcWear.com	**BlastMat 4 layers blanket, Style TE5660 LightLine, Size 56X60 inches, 20 Attachment points, 14 attachment points used , SN: 09004**



Rms (A) = 14651.5 Duration of fault in cycles = 25.1 Power = 91.38E+0

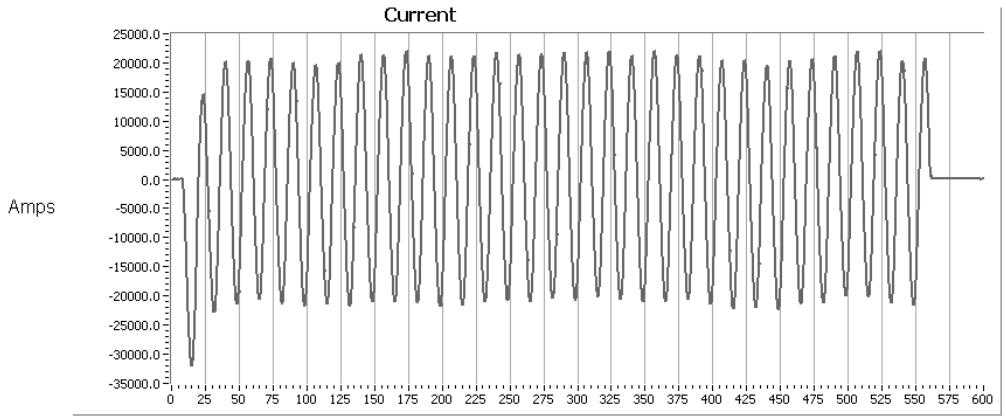
Peak, I pk (A) = 31362.0



Short circuit voltage (rms) = 626

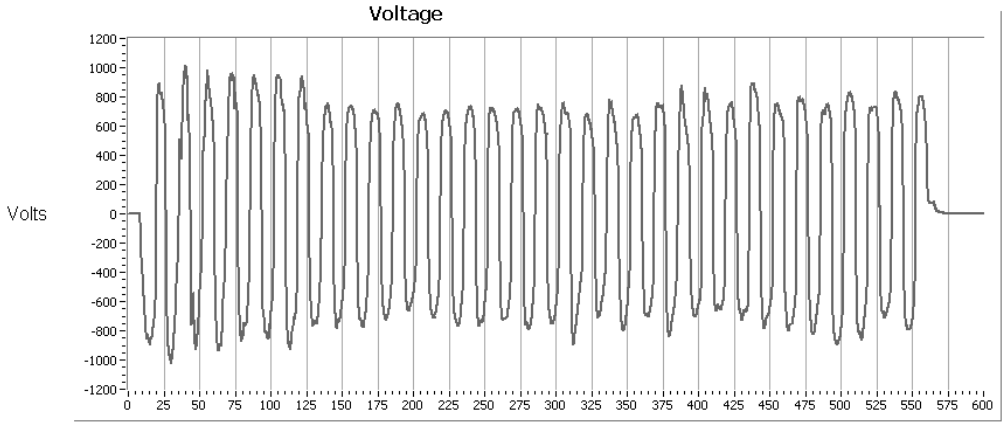
June 8, 2009	High Current Test Laboratory Kinectrics Inc. Test Sheet	KINECTRICS
Test # 09-2634		
WO#: K-418192		

Client:	Description:
ArcWear.com	**BlastMat 4 layers blanket, Style TE5660 LightLine, Size 56X60 inches, 20 Attachment points, 14 attachment points used , SN: 09003**



Rms (A) = 14922.4 Duration of fault in cycles = 33.1 Power = 123.89E+0

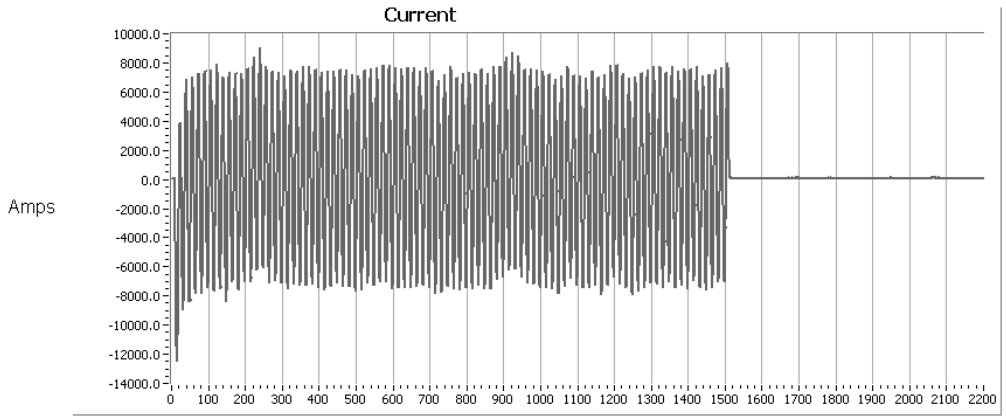
Peak, I pk (A) = 31904.0



Short circuit voltage (rms) = 667

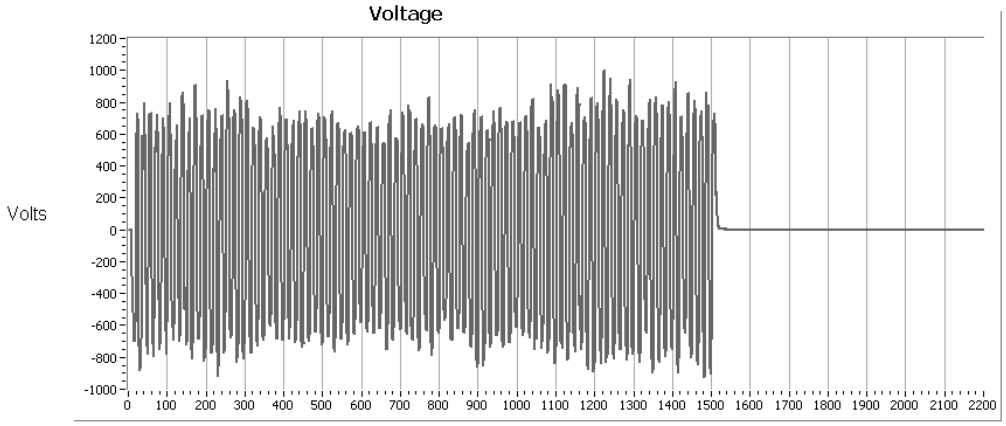
June 8, 2009	High Current Test Laboratory Kinectrics Inc. Test Sheet	KINECTRICS
Test # 09-2640		
WO#: K-418192		

Client:	Description:
ArcWear.com	**BlastMat 4 layers blanket, Style TE5660 LightLine, Size 56X60 inches, 20 Attachment points, 14 points used, SN 09002**



Rms (A) = 5204.5 Duration of fault in cycles = 50.3 Power = 23.35E+0

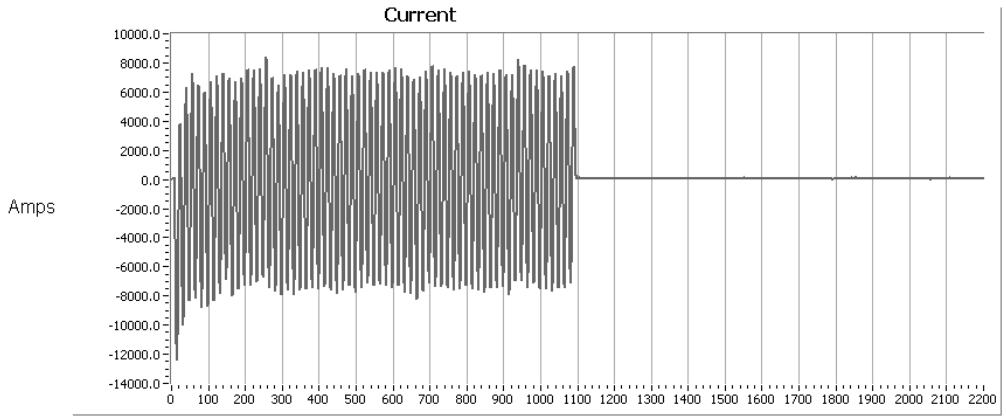
Peak, I pk (A) = 12497.0



Short circuit voltage (rms) = 577

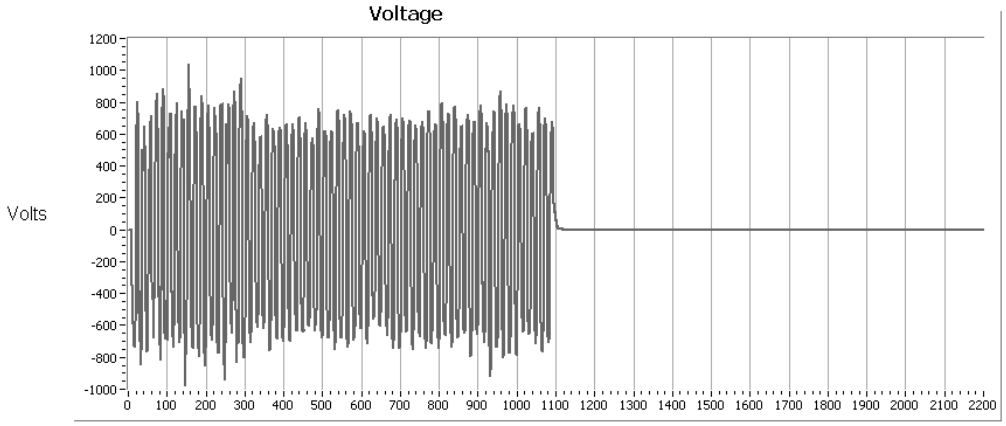
June 8, 2009	High Current Test Laboratory Kinectrics Inc. Test Sheet	KINECTRICS
Test # 09-2641		
WO#: K-418192		

Client:	Description:
ArcWear.com	**BlastMat 4 layers blanket, Style TE5660 LightLine, Size 56X60 inches, 20 Attachment points, 14 points used, SN 09002**



Rms (A) = 5227.6 Duration of fault in cycles = 40.1 Power = 18.83E+0

Peak, I pk (A) = 12354.8



Short circuit voltage (rms) = 579