

TEST REPORT

2024ID0098

DATE OF RECEPTION

Date Format: dd/MM/yyyy 12/06/2024

DATE TESTS

Starting: 18/06/2024

Ending: 02/07/2024

APPLICANT

MADURA COATS PRIVATE LIMITED
46, Papavinasam Mills PostAmbasamudram,
Tirunelveli District
IN-627422 Tamil Nadu (TAMIL NADU)
India

Att. JITENDRA SHUKLA

IDENTIFICATION AND DESCRIPTION OF SAMPLES

Reference by AITEX	Reference by customer	AITEX sample description
2024ID0098-S01	FlamePro Standard FU50073	Fabric

TESTS CARRIED OUT

- PRE-TREATMENT FOR DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING.
- MASS PER UNIT AREA.

AITEX - Plaza Emilio Sala, 1 - E-03801 ALCOY (Alicante) SPAIN Tel.:+34 96 554 22 00 www.aitex.es info@aitex.es

Tests marked with * are not covered by ENAC accreditation



DESCRIPTION OF SAMPLES



Reference by AITEX: 2024ID0098-S01

Reference by customer:

FlamePro Standard FU50073

Information supplied by the customer

Style - FU50073

Colour Navy

Woven fabric

Fabric structure: Rip-Stop

Fiber content and percentages, Proprietary blend

Weight 240 g/m²

AITEX Subsamples	Subsample Description
2024ID0098-S01_P1	After 3 wash cycles / Fabric



EXECUTIVE SUMMARY

	Reference	Test/Standard	Result
ASTM F1506:22	2024ID0098-S01_P1	ELECTRIC ARC TEST (OPEN ARC) ASTM F1959/F1959M-23	ARC RATING (ATPV) = 11 CAL/CM ²



REQUIREMENT SUMMARY

ELECTRIC ARC TEST (OPEN ARC)

REQUIREMENT ACCORDING ASTM F1959/F1959M-23

Arc rating values below 10 cal/cm² shall be reported to the nearest 0.1 cal/cm², and arc rating values above 10 cal/cm² shall be reported to the nearest 1 cal/cm².

Arc Flash PPE category according to standard NFPA70E Edition 2021 Table 130.7 (C) (16) - Personal Protective Equipment (PPE)

PPE Category	Minimum Arc Rating (cal/cm ²)
1	4
2	8
3	25
4	40



RESULTS

PRE-TREATMENT FOR DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING

Standard

AATCC 135:2018

Standard deviation

Reference

Sample 1 2024ID0098-S01

Washing machine

Whirlpool

Washing temperatura

49 °C

Washing cycles

3

Washing procedure

IV

Dryer machine

Whirlpool

Drying procedure

(Aiii) Tumble Dry Permanent Press

Drying temperature

68 °C

Washing powder

AATC 1993 WOB

Start and finish date

18/06/2024 - 18/06/2024

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The test was carried out at laboratory located at Carretera Banyeres 10 - 03802 Alcoi, Alicante

Reference by AITEX	Reference by customer
2024ID0098-S01	FlamePro Standard FU50073



RESULTS

MASS PER UNIT AREA

Standard

ASTM D3776/3776M-20 (R2020) Option C

Conditioning date 18/06/2024 **Test date** 20/06/2024

Atmosphere for conditioning testing

Temperature (21±1) °C **Relative humidity** (65±2) %

Number of specimens

1

Dimensions of specimens

500 cm²

Reference

2024ID0098-S01

Mass per unit area (oz/yd ²)	Mass per unit area (g/m ²)
6,95	236

Remark

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The test was carried out at laboratory located at Carretera Banyeres 10 - 03802 Alcoi, Alicante

Reference by AITEX	Reference by customer
2024ID0098-S01	FlamePro Standard FU50073



RESULTS

MASS PER UNIT AREA

Standard

ASTM D3776/3776M-20 (R2020) Option C

Conditioning date 21/06/2024 **Test date** 24/06/2024

Atmosphere for conditioning testing

Temperature (21±1) °C **Relative humidity** (65±2) %

Number of specimens

1

Dimensions of specimens

500 cm²

Reference

2024ID0098-S01_P1

Mass per unit area (oz/yd ²)	Mass per unit area (g/m ²)
7,01	238

Remark

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The test was carried out at laboratory located at Carretera Banyeres 10 - 03802 Alcoi, Alicante

Reference by AITEX	Reference by customer
2024ID0098-S01_P1	After 3 wash cycles / <i>Fabric</i>



ELECTRIC ARC EXPOSURE TEST: DETERMINATION OF THE ARC RATING (ATPV OR E_{BT50}) OF FLAME RESISTANT MATERIALS FOR CLOTHING

Standard

ASTM F1959/F1959M-23

Reference

2024ID0098-S01_P1

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 sensors for each panel in each trial, plot of average responses from two monitor sensors.

Pictures after arc exposure.

Video.

Essential test data and test results are presented in the following pages as follows:

Arc rating: ATPV or E_{BT50} or both and plots of the burn injury probability (ATPV) or break open probability (E_{BT50}) or both versus E_i.

Heat attenuation factor (HAF) and plot of HAF on E_i.

Test specimen description and order of layer.

Distance from an arc center line to the panel surface.

Subjective evaluation.

Pictures after arc exposure.

Ignition probability value (if determined during testing).

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Test conditions	
Date test	02/07/2024 - 02/07/2024
Arc current	(8 ± 1) kA
Stainless steel electrodes, gap of the electrodes	(300 ± 5) mm
Distance between the electrodes and sample	(300 ± 5) mm
Fuse wire	0.5 mm
Number of samples tested	21
Starting and ending conditioning date	01/07/2024 - 02/07/2024
Conditioning	24 h; $21 \pm 2^\circ\text{C}$, $65 \pm 5\%$ HR.

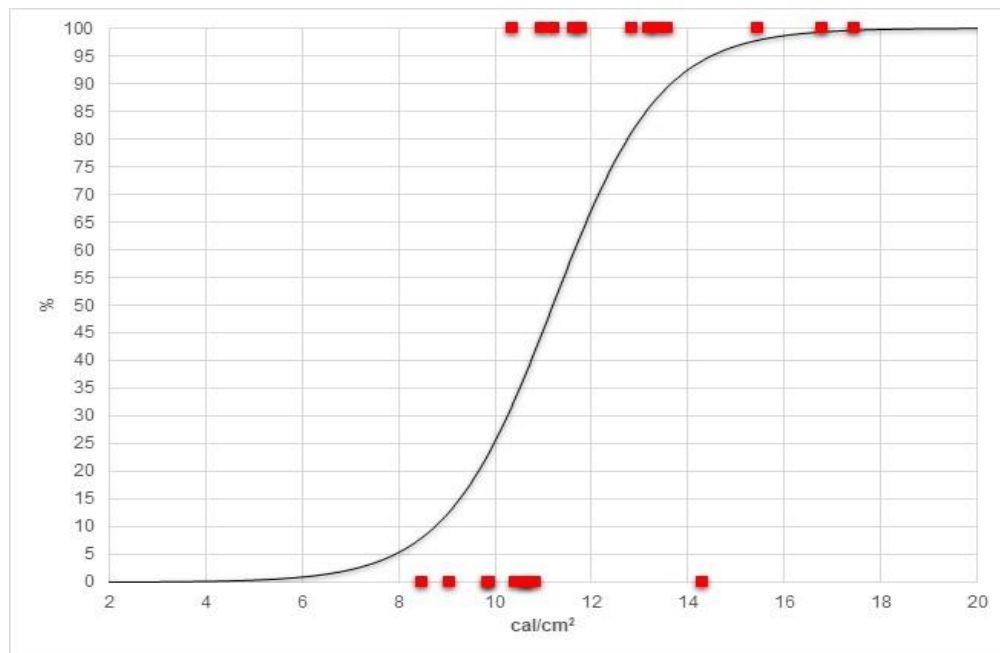
Measurement uncertainty $\pm 10\%$

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Determination of ATPV, 50% of Probability of 2nd degree burn

ATPV	11,21 cal/cm ²
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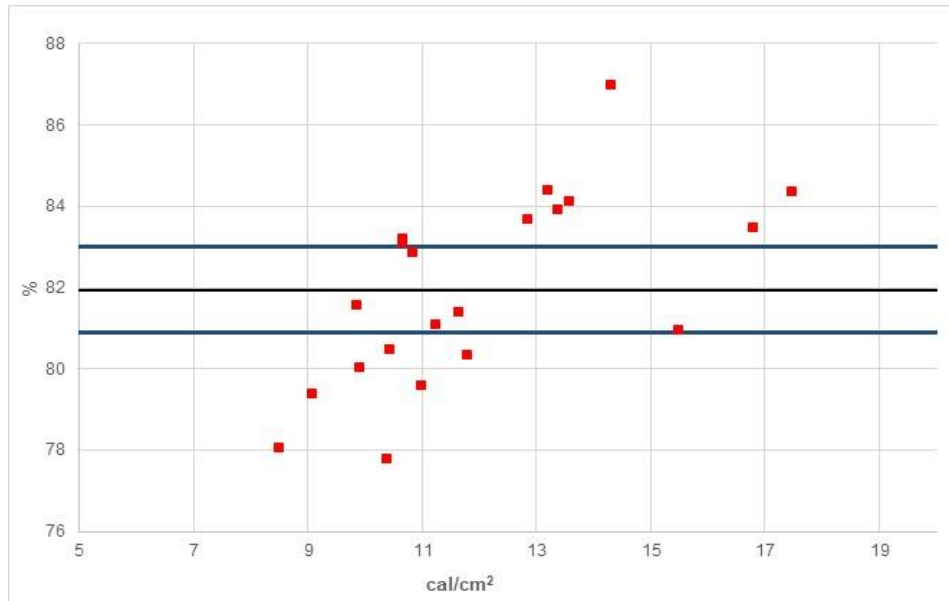
Mix zone points above	3
ATPV points 20%	14
Mix zone points below	4
Mix zone points mix zone	14

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Determination of HAF, confidence Intervals 95%

HAF	81,95 %
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% HAF value :	82,0
Upper Confidence Level %:	83,0
Lower Confidence Level %:	80,9
Points above:	9
Points below:	7
Points between:	5
Total Points:	21

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Summary of measured energy and subjective evaluation:

Test	Time (ms)	Cycles 50Hz	Ei cal/cm ²	SCD cal/cm ²	HAF %	Burn	Break Open
1-A	174	8,7	10,8	-0,19	82,9	N	N
1-B	174	8,7	9,9	-0,14	80,0	N	N
1-C	174	8,7	10,7	-0,15	83,1	N	N
2-A	313,8	15,69	17,5	1,03	84,4	Y	Y
2-B	313,8	15,69	15,5	1,32	81,0	Y	Y
2-C	313,8	15,69	16,8	1,26	83,5	Y	Y
3-A	223,6	11,18	13,4	0,16	83,9	Y	N
3-B	223,6	11,18	11,8	0,37	80,4	Y	N
3-C	223,6	11,18	11,0	0,19	79,6	Y	N
4-A	204	10,2	11,2	0,13	81,1	Y	N
4-B	204	10,2	10,6	-0,28	83,2	N	N
4-C	204	10,2	10,4	0,33	77,8	Y	N
5-A	173,8	8,69	12,8	0,16	83,7	Y	N
5-B	173,8	8,69	8,5	-0,27	78,1	N	N
5-C	173,8	8,69	9,1	-0,14	79,4	N	N
6-A	193,8	9,69	13,2	0,01	84,4	Y	N
6-B	193,8	9,69	9,8	-0,34	81,6	N	N
6-C	193,8	9,69	11,6	0,16	81,4	Y	N
7-A	204	10,2	14,3	-0,23	87,0	N	N
7-B	204	10,2	10,4	-0,07	80,5	N	N
7-C	204	10,2	13,6	0,24	84,1	Y	N

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**Summary of measured energy and subjective evaluation:**

Test	After flame (s)	Ablation	Melting	Dripping	Charring	Embrittlement
1-A	0	N	N	N	Y	Y
1-B	0	N	N	N	Y	Y
1-C	0	N	N	N	Y	Y
2-A	4,1	N	N	N	Y	Y
2-B	0	N	N	N	Y	Y
2-C	0	N	N	N	Y	Y
3-A	0	N	N	N	Y	Y
3-B	0	N	N	N	Y	Y
3-C	0	N	N	N	Y	Y
4-A	0	N	N	N	Y	Y
4-B	0	N	N	N	Y	Y
4-C	0	N	N	N	Y	Y
5-A	0	N	N	N	Y	Y
5-B	0	N	N	N	Y	Y
5-C	0	N	N	N	Y	Y
6-A	0	N	N	N	Y	Y
6-B	0	N	N	N	Y	Y
6-C	0	N	N	N	Y	Y
7-A	0	N	N	N	Y	Y
7-B	0	N	N	N	Y	Y
7-C	0	N	N	N	Y	Y

Y: Yes N: No

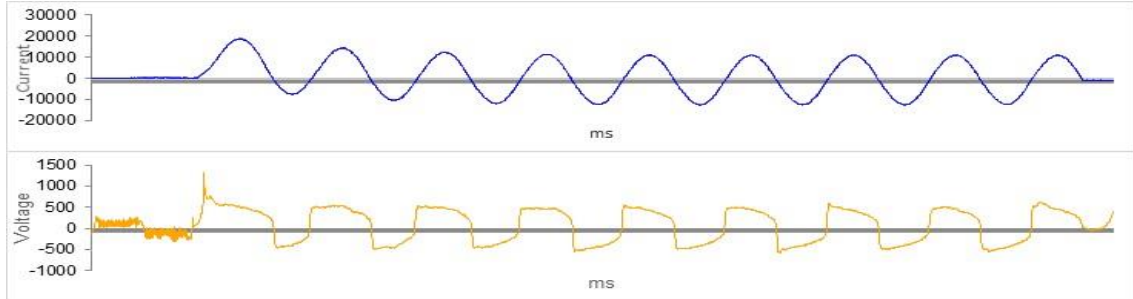
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Electrical current and response sensor response:

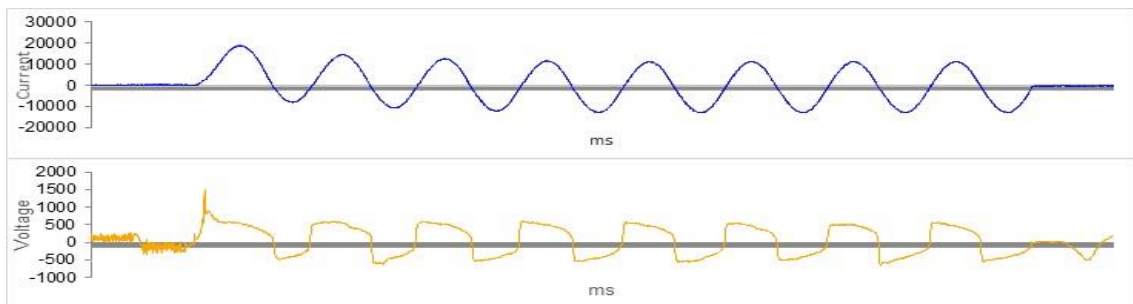
Calibration shot

INITIAL CALIBRATION



Ei Panel A	8,3 cal/cm ²	Ei Panel B	7,1 cal/cm ²	Ei Panel C	7,8 cal/cm ²
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FINAL CALIBRATION



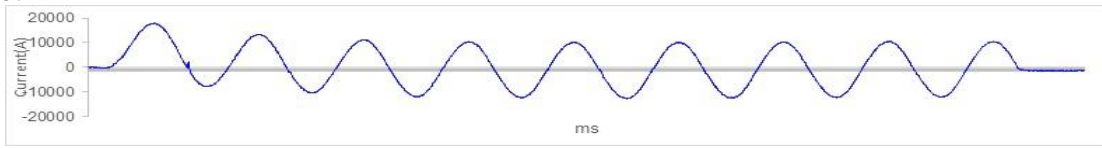
Ei Panel A	9,1 cal/cm ²	Ei Panel B	8,5 cal/cm ²	Ei Panel C	9,3 cal/cm ²
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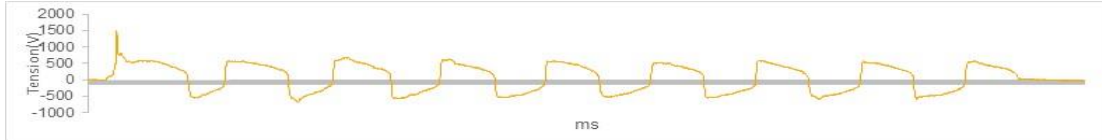


Shot 1

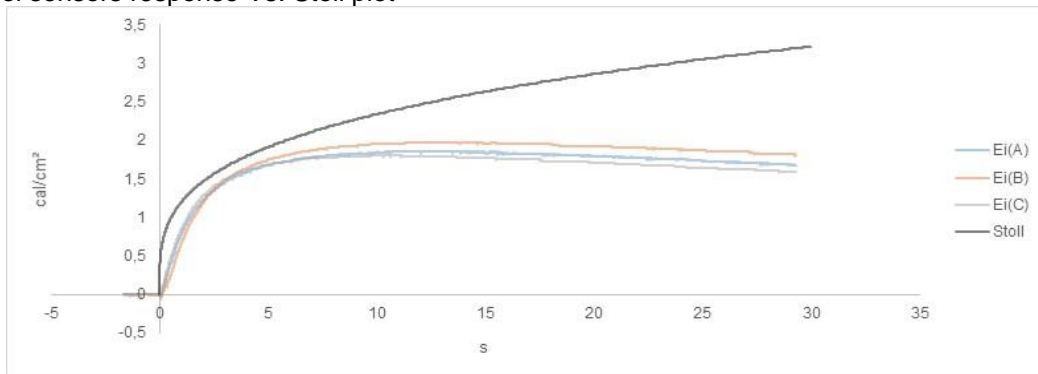
Current Plot



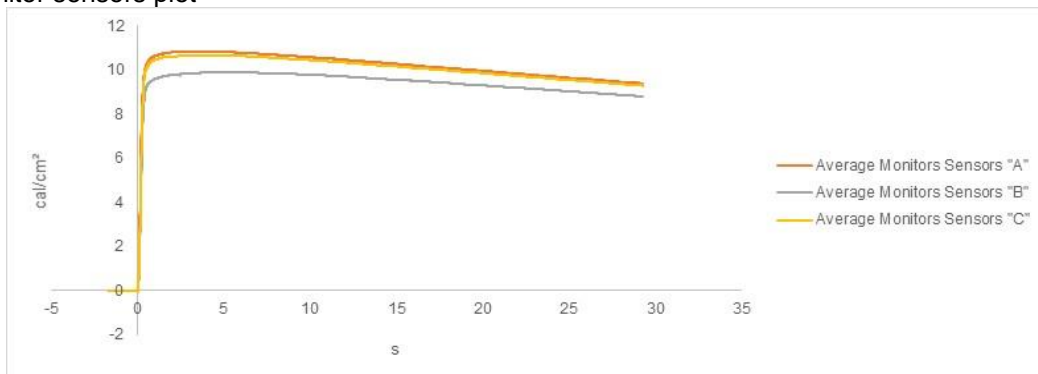
Voltage Plot



Average panel sensors response Vs. Stoll plot



Average monitor sensors plot

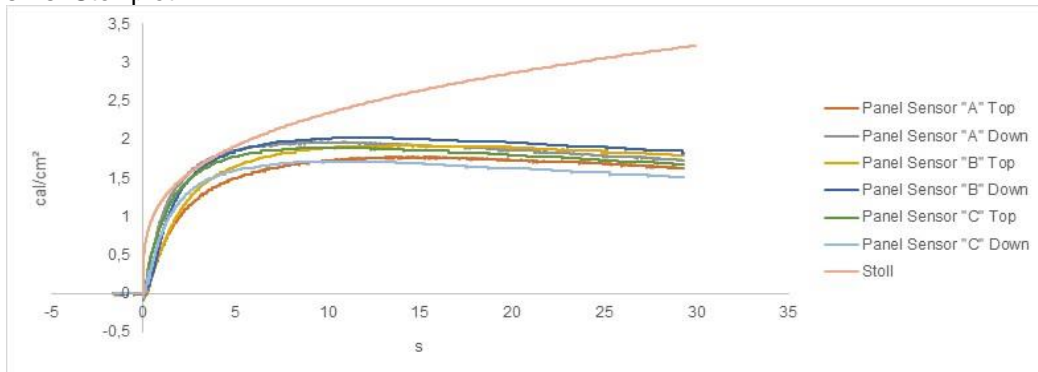


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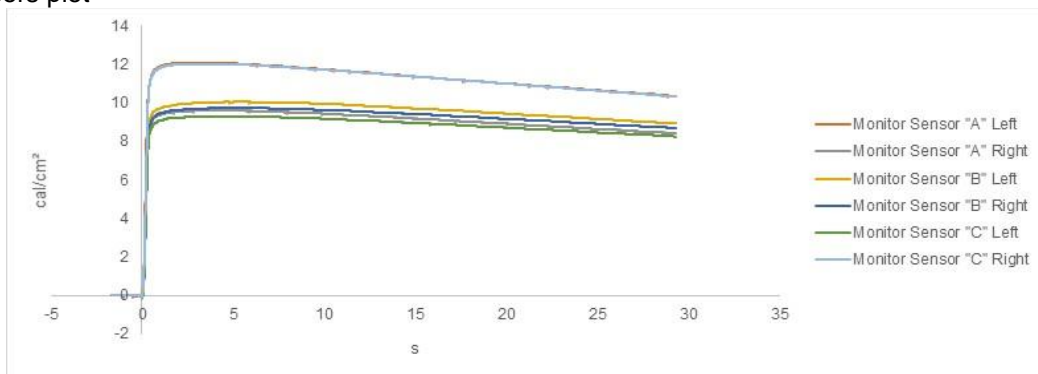


Shot 1

Panel sensors Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,5	Current Peak (kA)	17,8	Arc Voltage Peak(V)	1485,0
Duration (cycles n°)	8,7	Duration (ms)	174,0	Arc Energy (kJ)	548,7
Arc Voltage (V)	438,8				

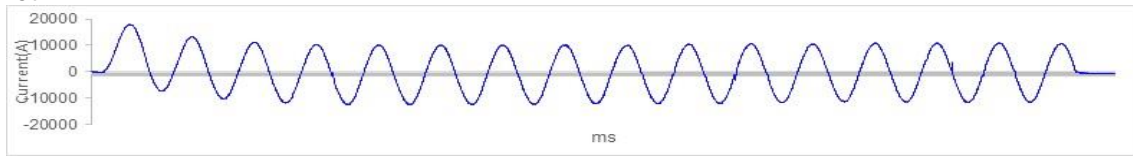
Sensor response	PANEL A	PANEL B	PANEL C
Ei	10,83 cal/cm ²	9,90 cal/cm ²	10,66 cal/cm ²
SCD	-0,19 cal/cm ²	-0,14 cal/cm ²	-0,15 cal/cm ²
HAF	82,88 %	80,05 %	83,11 %

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Shot 2

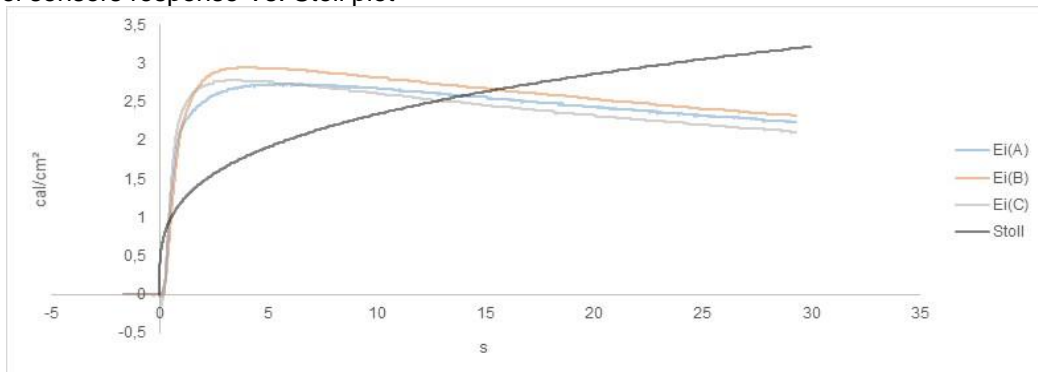
Current Plot



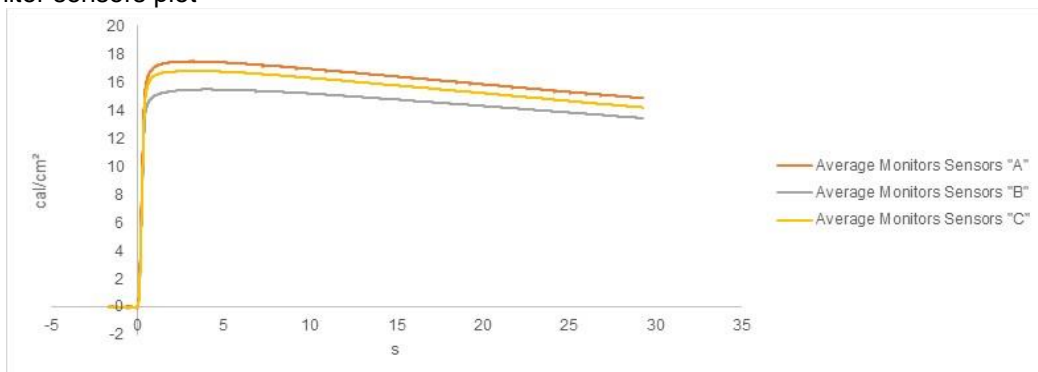
Voltage Plot



Average panel sensors response Vs. Stoll plot



Average monitor sensors plot

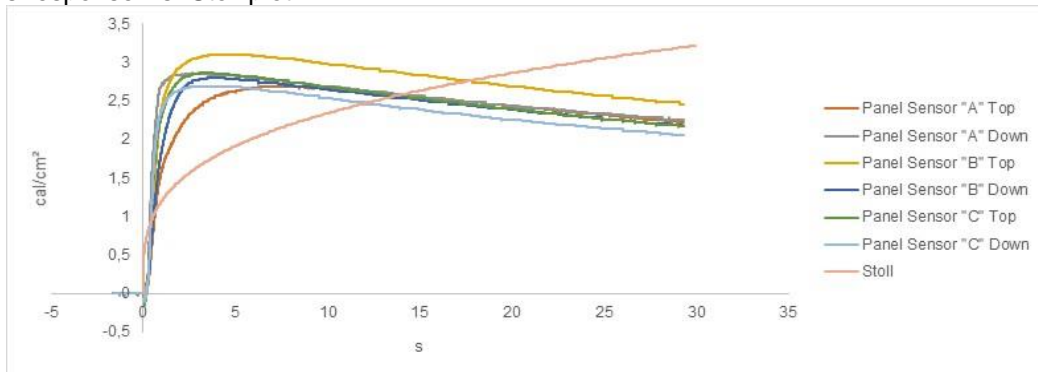


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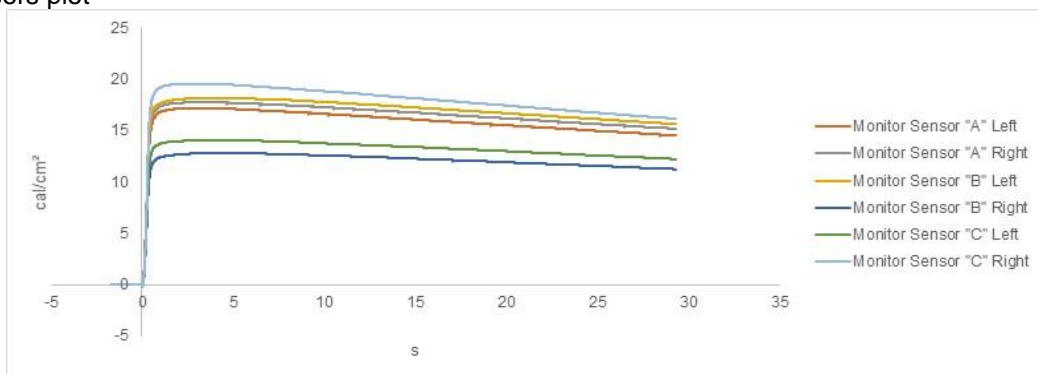


Shot 2

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,7	Current Peak (kA)	18,0	Arc Voltage Peak(V)	1500,0
Duration (cycles n°)	15,7	Duration (ms)	313,8	Arc Energy (kJ)	983,8
Arc Voltage (V)	442,9				

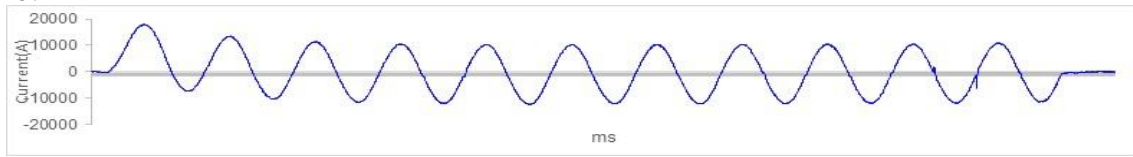
Sensor response	PANEL A	PANEL B	PANEL C
Ei	17,47 cal/cm ²	15,47 cal/cm ²	16,80 cal/cm ²
SCD	1,03 cal/cm ²	1,32 cal/cm ²	1,26 cal/cm ²
HAF	84,37 %	80,95 %	83,47 %

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Shot 3

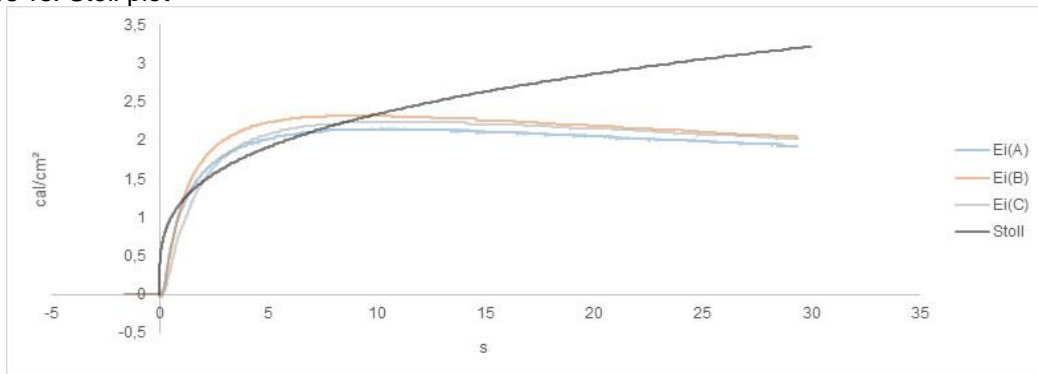
Current Plot



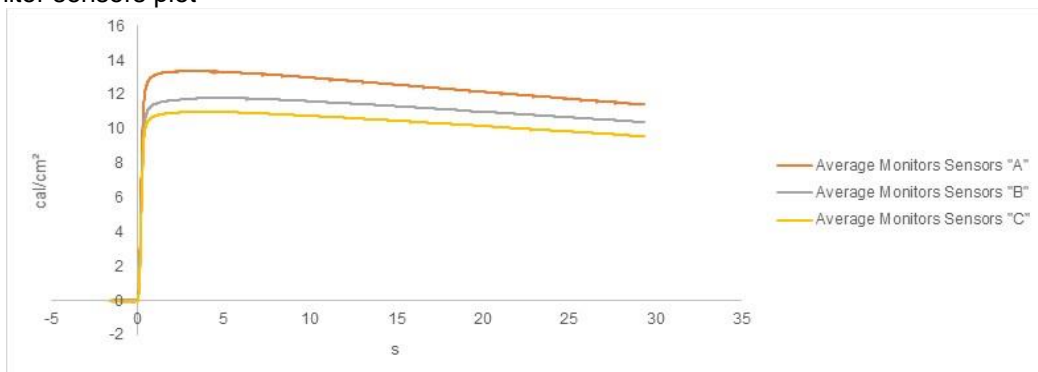
Voltage Plot



Panel sensors vs. Stoll plot



Average monitor sensors plot

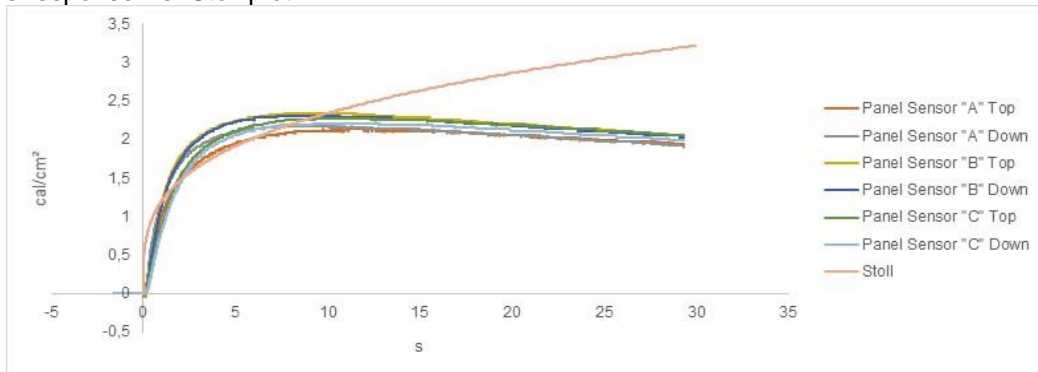


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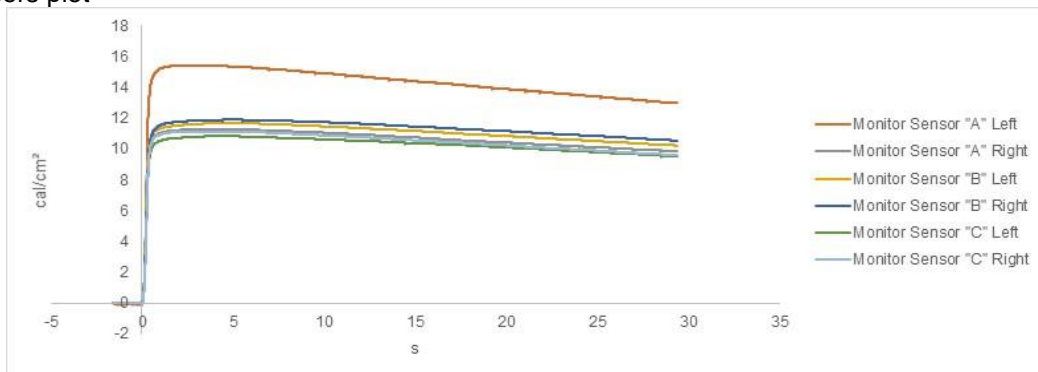


Shot 3

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,8	Current Peak (kA)	18,0	Arc Voltage Peak(V)	1446,0
Duration (cycles n°)	11,2	Duration (ms)	223,6	Arc Energy (kJ)	717,2
Arc Voltage (V)	443,6				

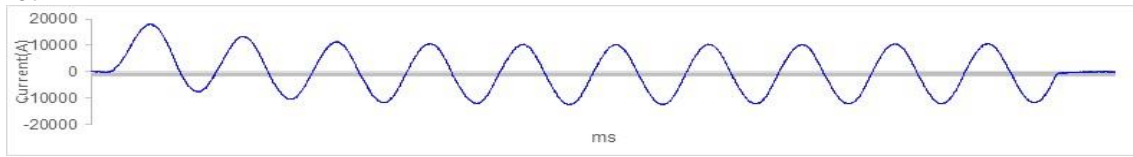
Sensor response	PANEL A	PANEL B	PANEL C
Ei	13,36 cal/cm ²	11,79 cal/cm ²	10,98 cal/cm ²
SCD	0,16 cal/cm ²	0,37 cal/cm ²	0,19 cal/cm ²
HAF	83,91 %	80,35 %	79,59 %

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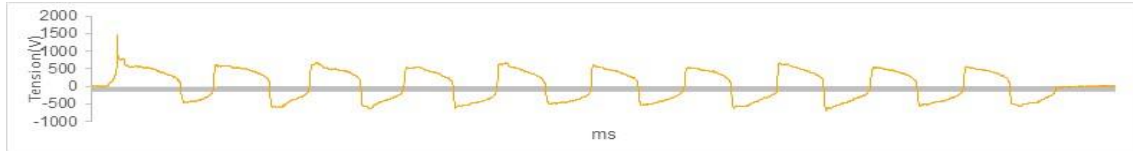


Shot 4

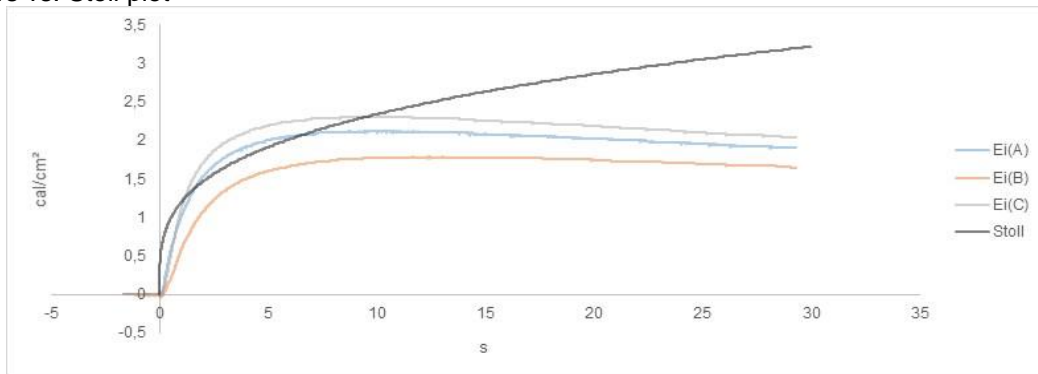
Current Plot



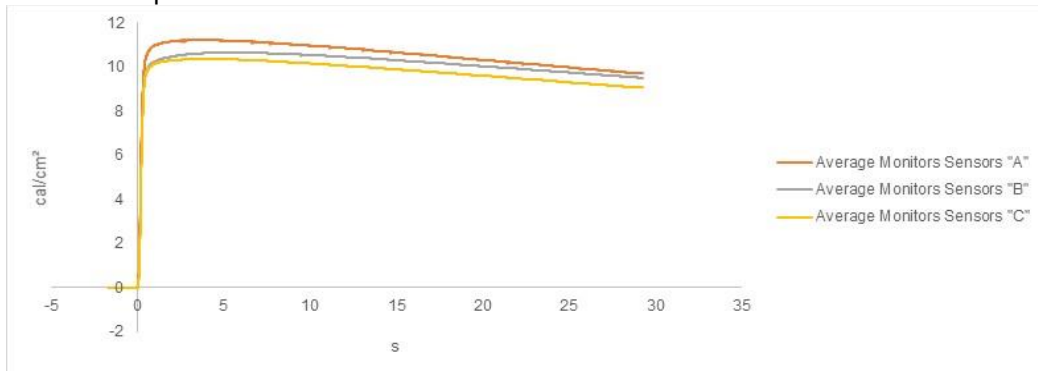
Voltage Plot



Panel sensors vs. Stoll plot



Average monitor sensors plot

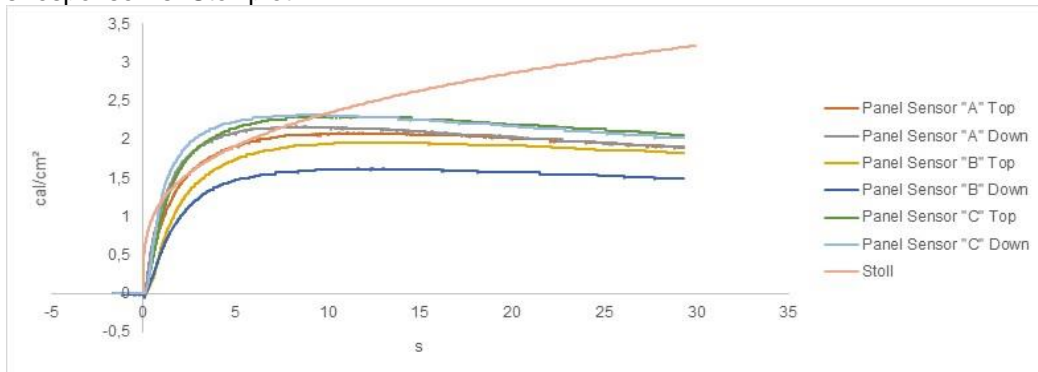


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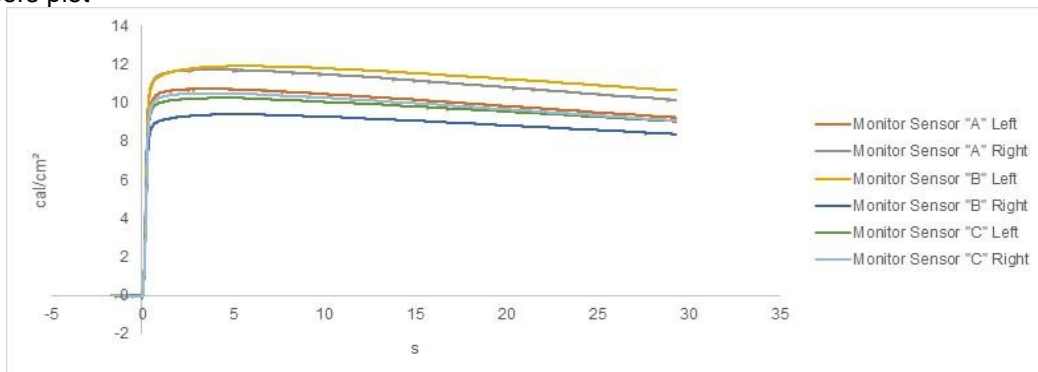


Shot 4

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,8	Current Peak (kA)	18,2	Arc Voltage Peak(V)	1458,0
Duration (cycles n°)	10,2	Duration (ms)	204,0	Arc Energy (kJ)	649,4
Arc Voltage (V)	443,2				

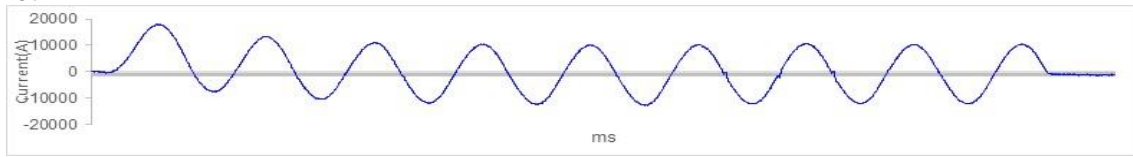
Sensor response	PANEL A	PANEL B	PANEL C
Ei	11,22 cal/cm ²	10,65 cal/cm ²	10,37 cal/cm ²
SCD	0,13 cal/cm ²	-0,28 cal/cm ²	0,33 cal/cm ²
HAF	81,09 %	83,21 %	77,80 %

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Shot 5

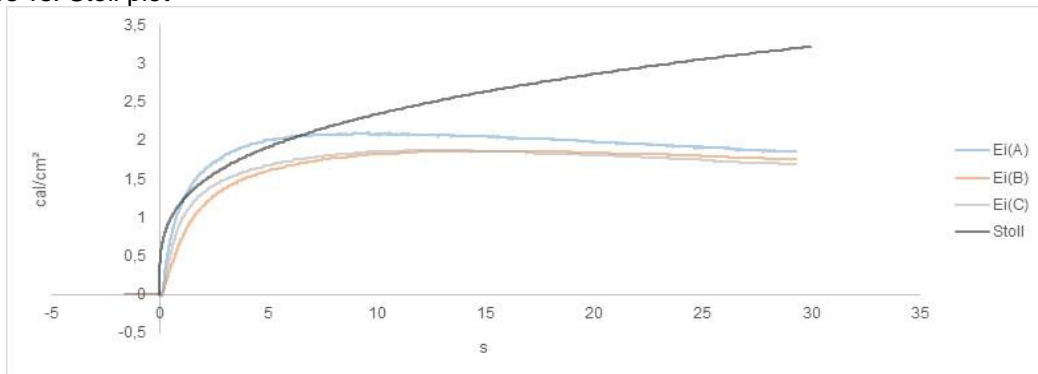
Current Plot



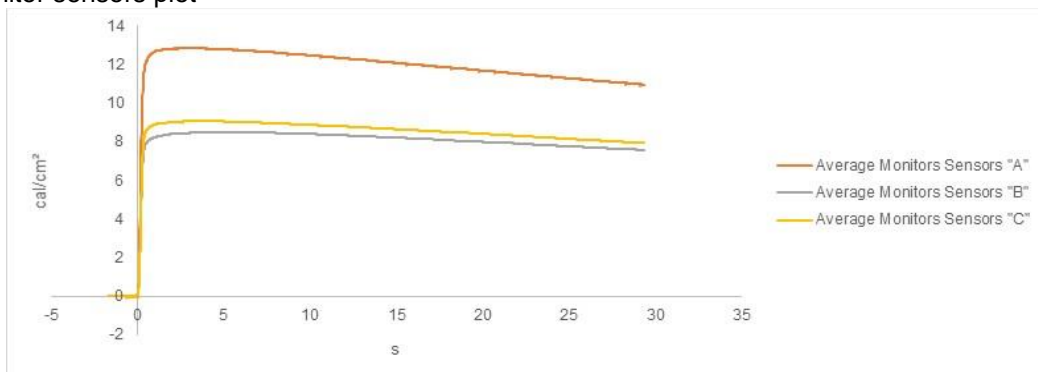
Voltage Plot



Panel sensors vs. Stoll plot



Average monitor sensors plot

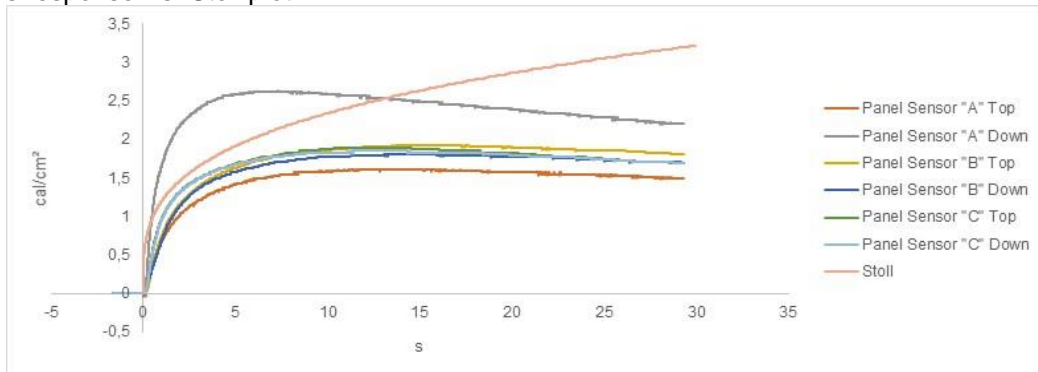


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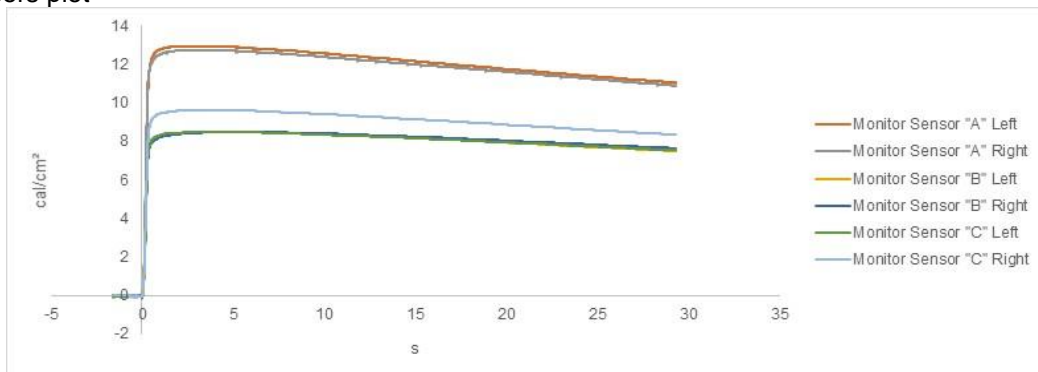


Shot 5

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,5	Current Peak (kA)	17,9	Arc Voltage Peak(V)	1446,0
Duration (cycles n°)	8,7	Duration (ms)	173,8	Arc Energy (kJ)	582,2
Arc Voltage (V)	468,3				

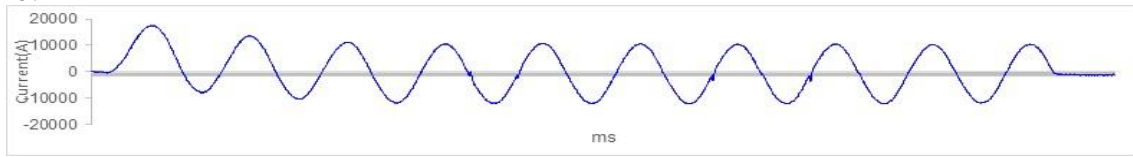
Sensor response	PANEL A	PANEL B	PANEL C
Ei	12,84 cal/cm ²	8,49 cal/cm ²	9,07 cal/cm ²
SCD	0,16 cal/cm ²	-0,27 cal/cm ²	-0,14 cal/cm ²
HAF	83,68 %	78,07 %	79,40 %

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Shot 6

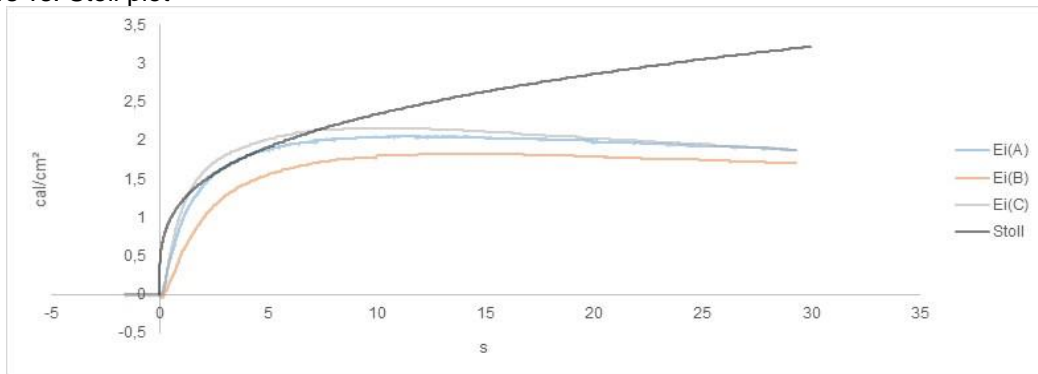
Current Plot



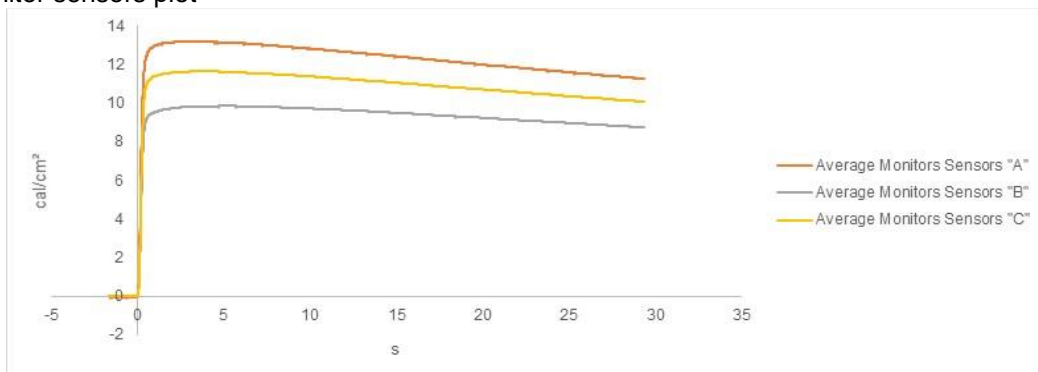
Voltage Plot



Panel sensors vs. Stoll plot



Average monitor sensors plot

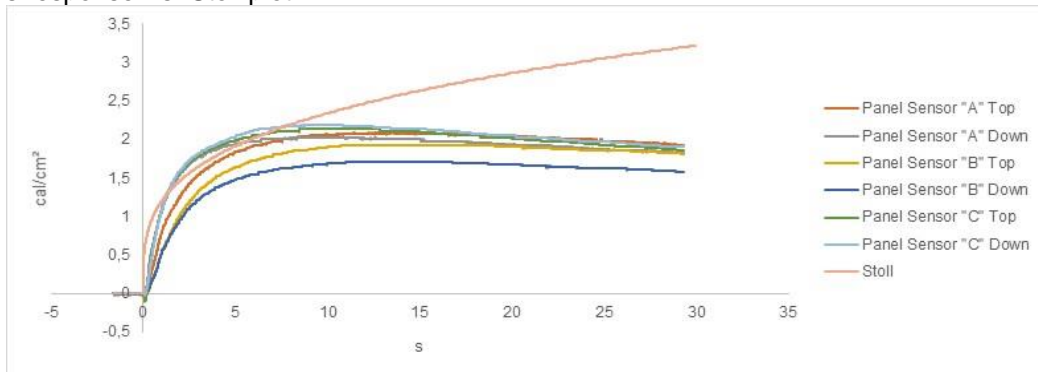


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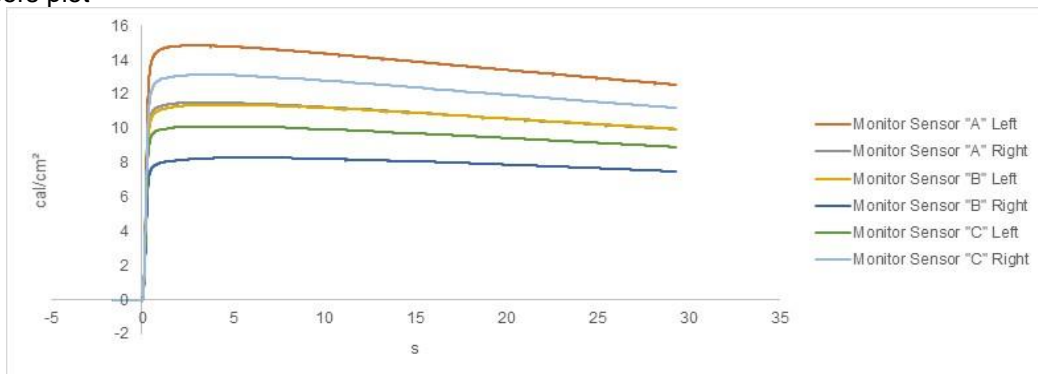


Shot 6

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,5	Current Peak (kA)	17,5	Arc Voltage Peak(V)	1500,0
Duration (cycles n°)	9,7	Duration (ms)	193,8	Arc Energy (kJ)	651,4
Arc Voltage (V)	474,3				

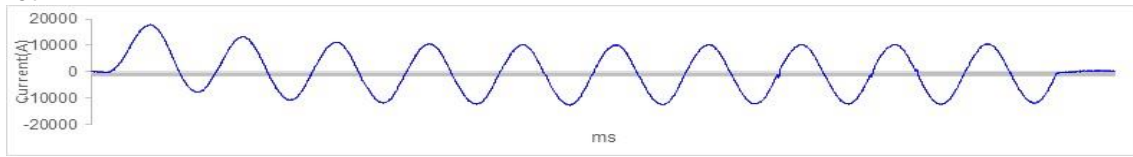
Sensor response	PANEL A	PANEL B	PANEL C
Ei	13,19 cal/cm ²	9,85 cal/cm ²	11,63 cal/cm ²
SCD	0,01 cal/cm ²	-0,34 cal/cm ²	0,16 cal/cm ²
HAF	84,42 %	81,57 %	81,41 %

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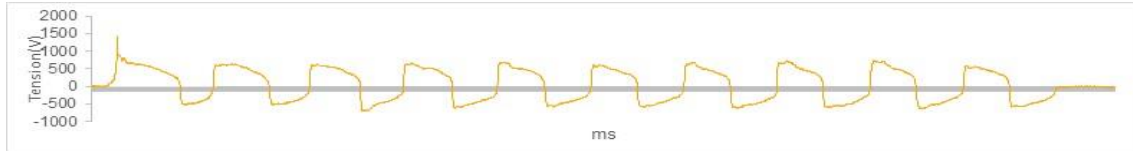


Shot 7

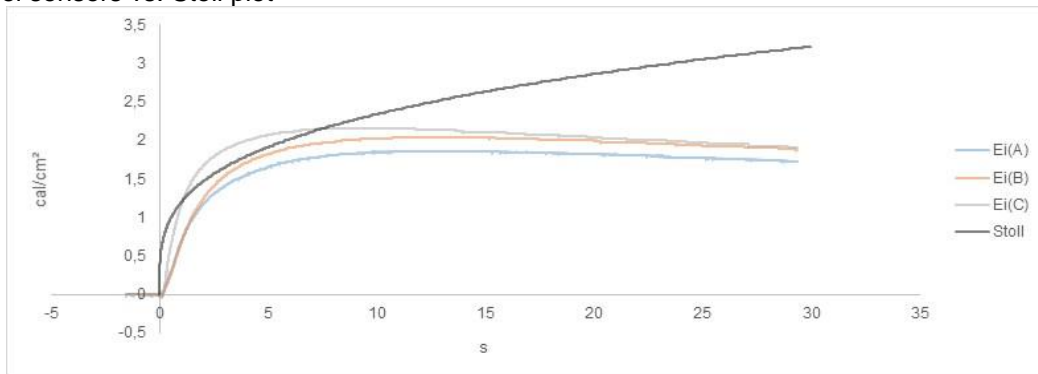
Current Plot



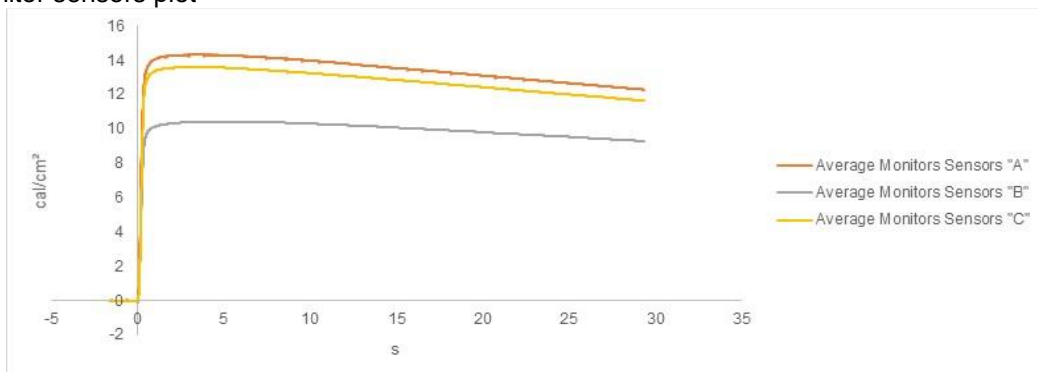
Voltage Plot



Average panel sensors vs. Stoll plot



Average monitor sensors plot

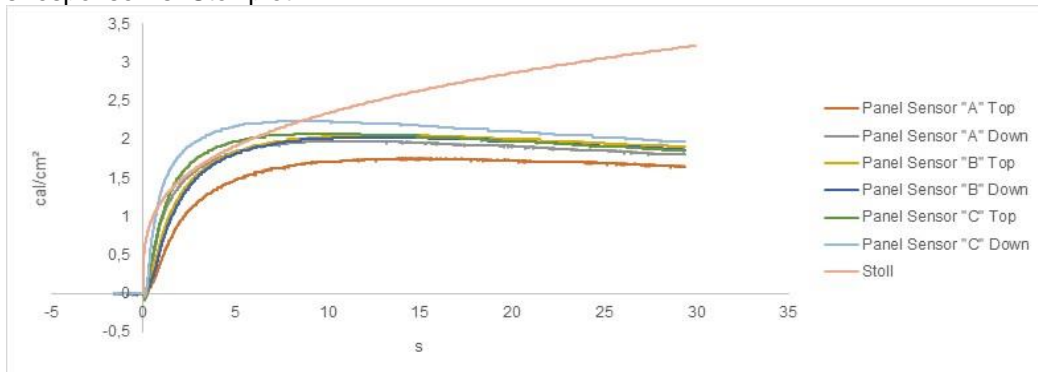


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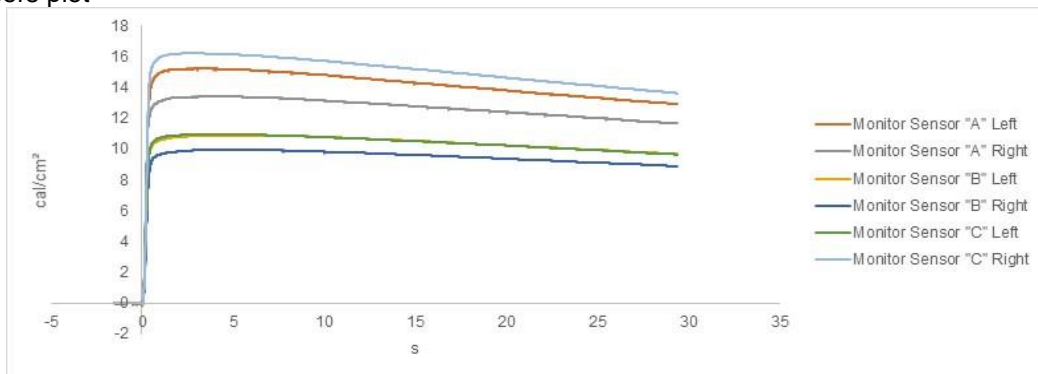


Shot 7

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,9	Current Peak (kA)	17,8	Arc Voltage Peak(V)	1440,0
Duration (cycles n°)	10,2	Duration (ms)	204,0	Arc Energy (kJ)	707,5
Arc Voltage (V)	482,2				

Sensor response	PANEL A	PANEL B	PANEL C
Ei	14,31 cal/cm ²	10,43 cal/cm ²	13,58 cal/cm ²
SCD	-0,23 cal/cm ²	-0,07 cal/cm ²	0,24 cal/cm ²
HAF	86,99 %	80,49 %	84,13 %

>>>



Tested material pictures:

Original



Shot 1



Shot 2



Shot 3



Shot 4



Shot 5



Shot 6



Shot 7



>>>

**Summary of results:**

ATPV	11,21 cal/cm ²
HAF	81,95 %

FABRIC TESTED ACCORDING TO THE STANDARD ASTM F1959/F1959M-23

ARC RATING (ATPV)

11 cal/cm²

Remark

The test was carried out at: AITEX - Electric open arc laboratory, located at Polígono Industrial Fuente del Jarro. C/ Ciudad de Gibraltar, 5; 46988 – Paterna (Valencia)

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**Lucia Martinez**

Head (

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Date: 03/07/2024 12:52:54

Digitally Signed by: ISABEL LLOPIS LUMBRERAS -

NIF: 21678551Q

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