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REPORT ISSUED BY THE RESEARCH ASSOCIATION OF THE TEXTILE
INDUSTRY, AITEX
N° 2019EP3144

Tests marked with * are not included within the scope of the ENAC accreditation

1/29

The test was carried out at High Current Laboratory located at Polígono Industrial Fuente del Jarro. C/ Ciudad de Gibraltar, 5; 46988 - Paterna (Valencia); which property is shared at 50% between research institutes AITEX and ITE.

Applicant

ARITEKS BOYACILIK TICATET VE SANAYI AS

Date of reception

21/10/2019

Data tested

Starting: 22/10/2019

Ending: 11/11/2019

Identification of samples

- "FABRIC REF. Aramid D2 260-4845"

Test Carried out

- PRE-TREATMENT FOR DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING
- MASS PER UNIT AREA
- ELECTRIC ARC EXPOSURE TEST: DETERMINATION OF THE ARC RATING (ATPV or EBT50) OF FLAME RESISTANT MATERIALS FOR CLOTHING

RESULTS

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

Standard

ISO 6330:2012

Standard deviation

Reference

Sample1 FABRIC REF. Aramid D2 260-4845

Units

1

2

Equipment

Wascator 13337E12 Wascator 13470E05

Dryer machine

ELECTROLUX

JAMES HEAL

13427E12

13472E05

Washing procedure 3N **Washing cycles** 5

Drying procedure

F (tumble dryer)

Washing powder

ECE detergent 98 + sodium perborate + TAED

Units	Dry mass of the samples	Counterweight mass	Equipment
1	1.61 Kg	0,40 Kg of Polyester	Wascator 13337E12
2	2.10 Kg	---	Wascator 13470E05

Start and finish date

24/10/2019 - 24/10/2019

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RESULTS

MASS PER UNIT AREA

Standard

EN 12127:1997; pto. 8.3

Conditioning date

29/10/2019

Test date

04/11/2019

Atmosphere for conditioning and testing

Temperature (20±2) °C

Relative Humidity (65±4) %

Pre-treatment

5 cycles of washing at 30 °C, according ISO 6330:2012, method 3N and F drying

Reference	Mass per unit area (g/m ²)	CV (%)
FABRIC REF. Aramid D2 260-4845	336	0.44

///

RESULTS

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

Standard

IEC 61482-1-1:2009, panel test (Method A) - Obsolete

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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RESULTS

Test conditions	
Date test.	11/11/2019
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 pre-treatment date	24/10/2019 - 24/10/2019

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RESULTS

Reference FABRIC REF. Aramid D2 260-4845

Sample description according to the information supplied by the customer

Yellow woven fabric style FABRIC REF. Aramid D2 260-4845, 93% m-aramid 5%p-aramid 2% Carbon, 240-260 g/m².

Pre-treatment

5 washing cycles at 30°C, according to standard UNE-EN ISO 6330:2012, method 3N and type F drying

Washed sample weight before test

336 g/m²

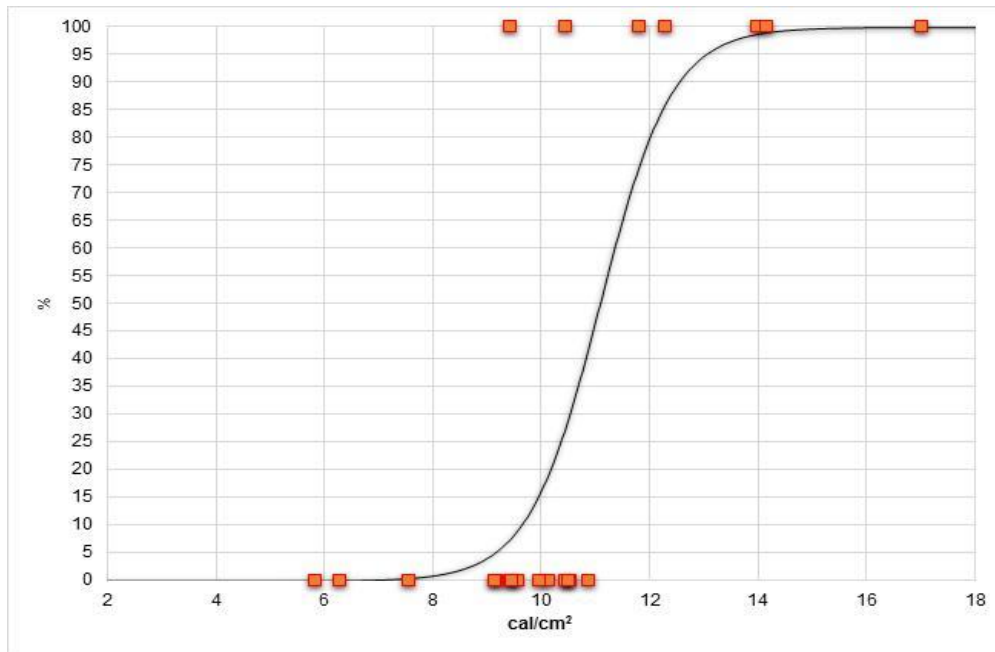
Deviation from the standard

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RESULTS

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

ATPV 11,1 cal/cm²



Probability %	5	10	20	30	40	50	60	70	80	95
E _i cal/cm ²	9,1	9,6	10,1	10,5	10,8	11,1	11,3	11,6	12,0	13,0

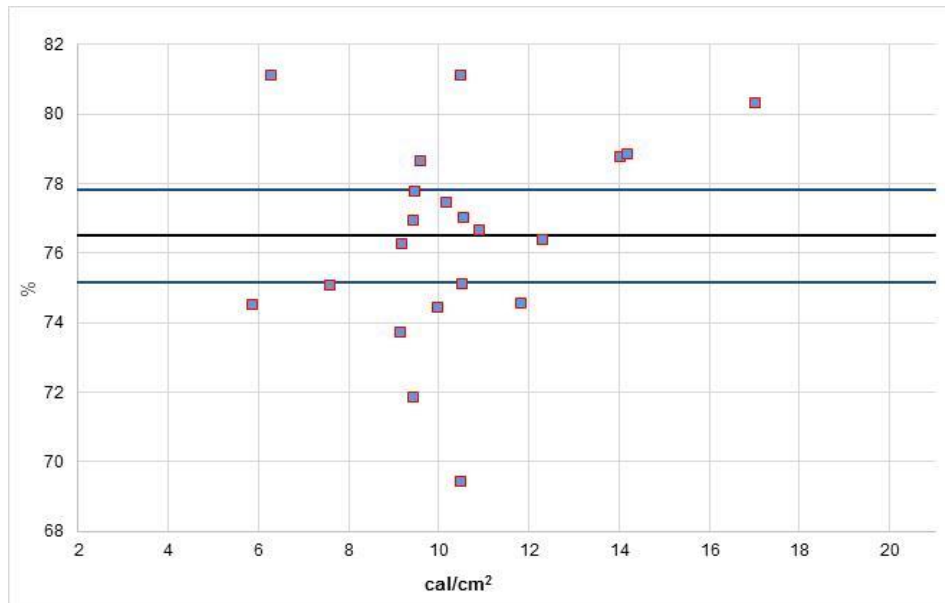
ATPV points above	5
ATPV points 20%	15
ATPV points below	5
ATPV points mix zone	11

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RESULTS

Determination of HAF, confidence Intervals 95%

HAF	76,5 %
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% HAF value :	76,5
Upper Confidence Level %:	77,8
Lower Confidence Level %:	75,2
Points above:	6
Points below:	8
Points between:	7
Total Points:	21

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RESULTS

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	214	10,7	10,1	-0,41	77,5	N	N
1-B	214	10,7	9,4	0,12	71,9	Y	N
1-C	214	10,7	10,4	-0,52	81,1	N	N
2-A	294,6	14,73	17,0	0,76	80,3	Y	N
2-B	294,6	14,73	11,8	0,43	74,6	Y	N
2-C	294,6	14,73	14,0	0,37	78,8	Y	N
3-A	194	9,7	9,4	-0,47	77,0	N	N
3-B	194	9,7	9,2	-0,37	76,3	N	N
3-C	194	9,7	9,6	-0,44	78,7	N	N
4-A	234,2	11,71	10,5	-0,18	77,0	N	N
4-B	234,2	11,71	10,4	0,67	69,5	Y	N
4-C	234,2	11,71	12,3	0,35	76,4	Y	N
5-A	134,8	6,74	7,6	-0,53	75,1	N	N
5-B	134,8	6,74	5,8	-0,56	74,5	N	N
5-C	134,8	6,74	6,3	-0,76	81,2	N	N
6-A	214,6	10,73	10,5	-0,06	75,2	N	N
6-B	214,6	10,73	10,0	-0,01	74,4	N	N
6-C	214,6	10,73	9,4	-0,46	77,8	N	N
7-A	234	11,7	14,2	0,39	78,9	Y	N
7-B	234	11,7	9,1	-0,03	73,7	N	N
7-C	234	11,7	10,9	-0,06	76,7	N	N

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RESULTS

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	0	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

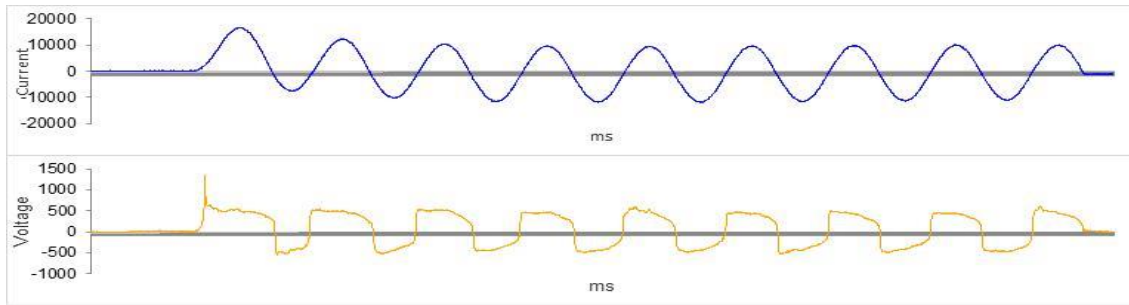
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RESULTS

Electrical current and response sensor response:

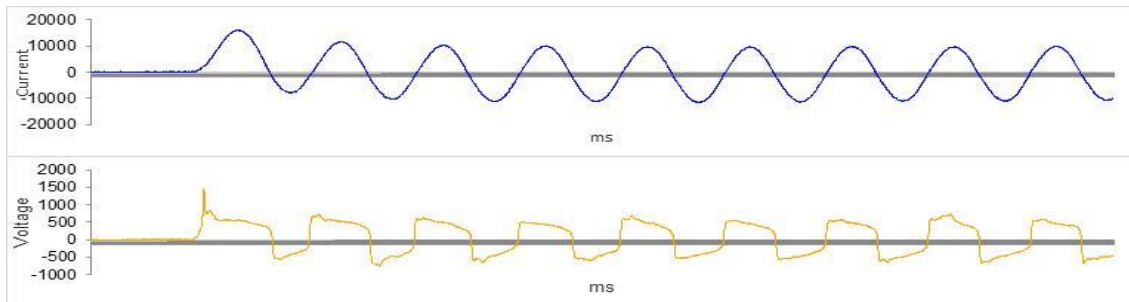
Calibration shot

INITIAL CALIBRATION



Ei Panel A	7,4 cal/cm ²	Ei Panel B	6,6 cal/cm ²	Ei Panel C	7,6 cal/cm ²
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FINAL CALIBRATION



Ei Panel A	9,3 cal/cm ²	Ei Panel B	10,5 cal/cm ²	Ei Panel C	8,8 cal/cm ²
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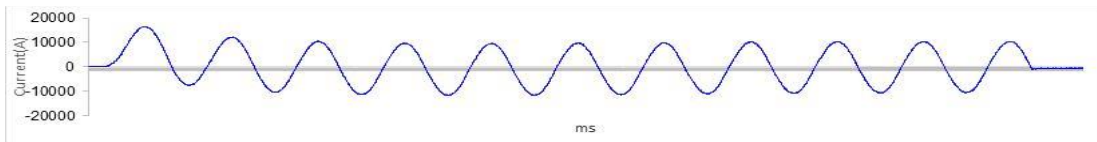
>>>

RESULTS

Electrical current and response sensor response:

Shot 1

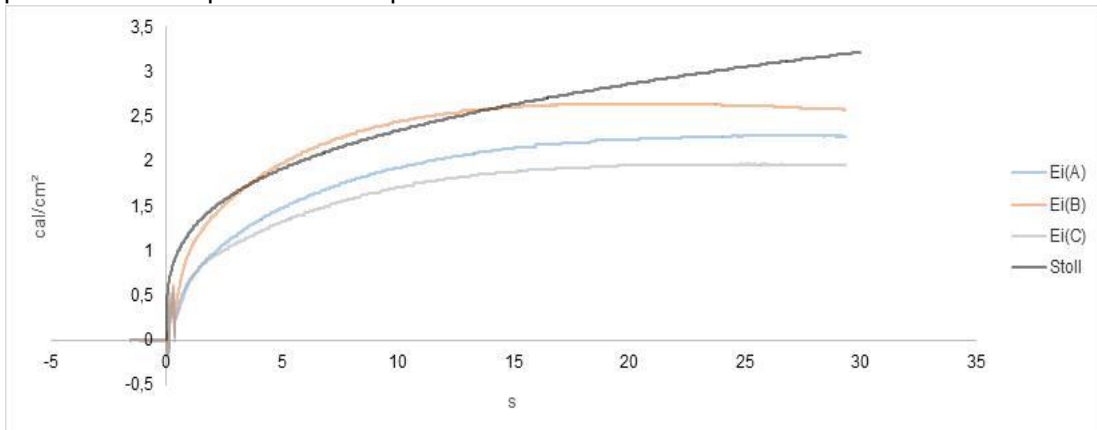
Current Plot



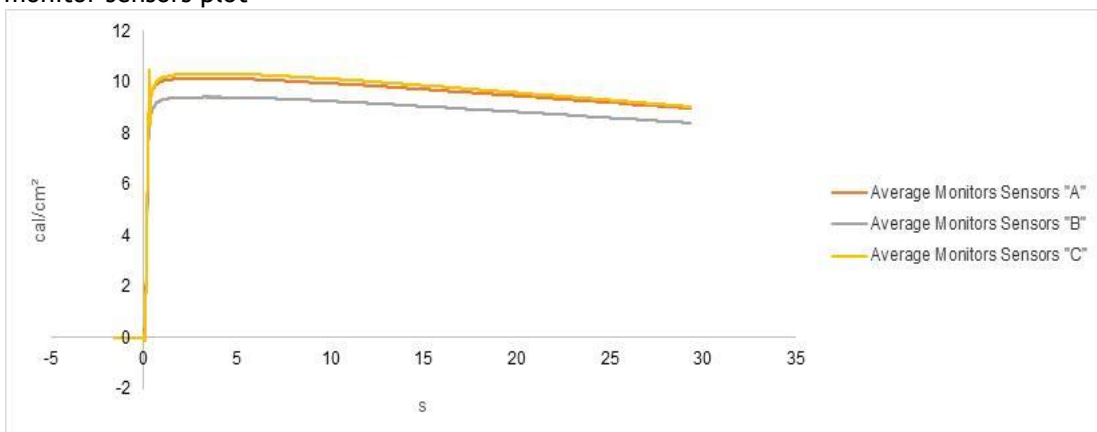
Voltage Plot



Average panel sensors response Vs. Stoll plot



Average monitor sensors plot



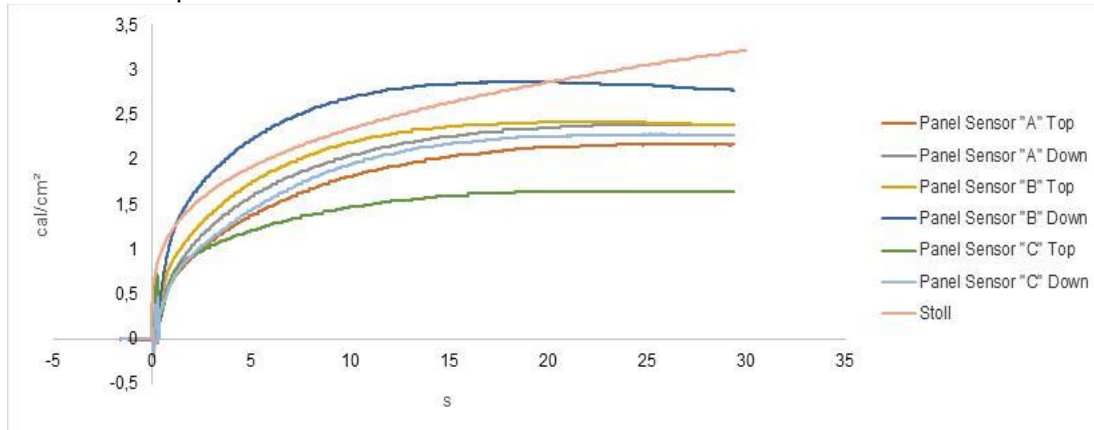
>>>

RESULTS

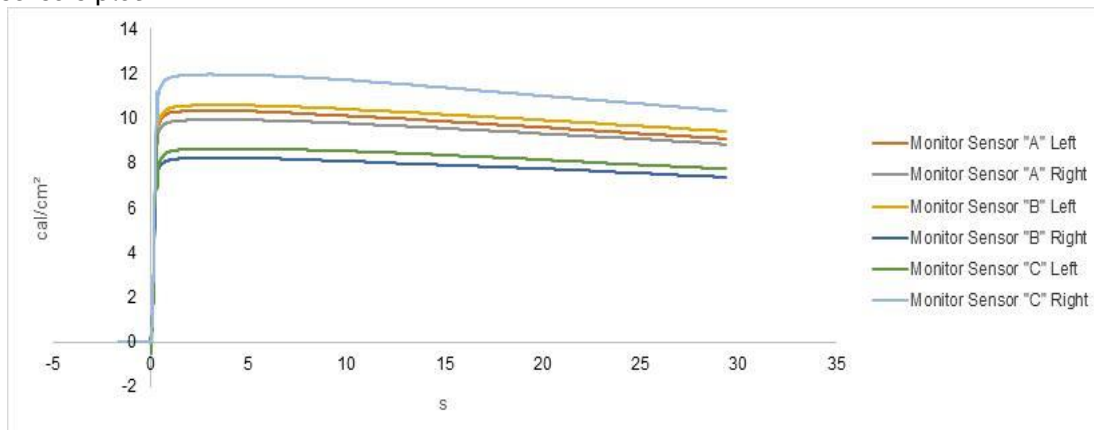
Electrical current and response sensor response:

Shot 1

Panel sensors Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,7	Current Peak (kA)	16,5	Arc Voltage (V)	1359,0
Duration (cycles n°)	10,7	Duration (ms)	214,1	Arc Energy (kJ)	577,9
Arc Voltage (kJ)	391,9				

sensor response	PANEL A	PANEL B	PANEL C
Ei	10,14 cal/cm ²	9,41 cal/cm ²	10,45 cal/cm ²
SCD	-0,41 cal/cm ²	0,12 cal/cm ²	-0,52 cal/cm ²
HAF	77,50 %	71,90 %	81,14 %

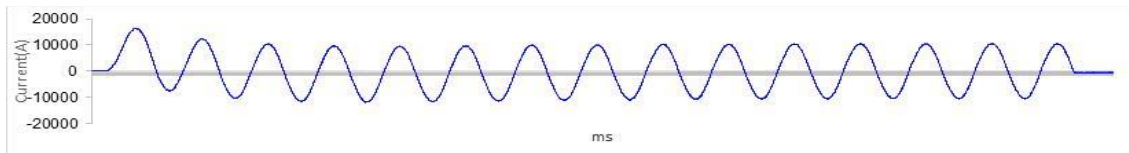
>>>

RESULTS

Electrical current and response sensor response:

Shot 2

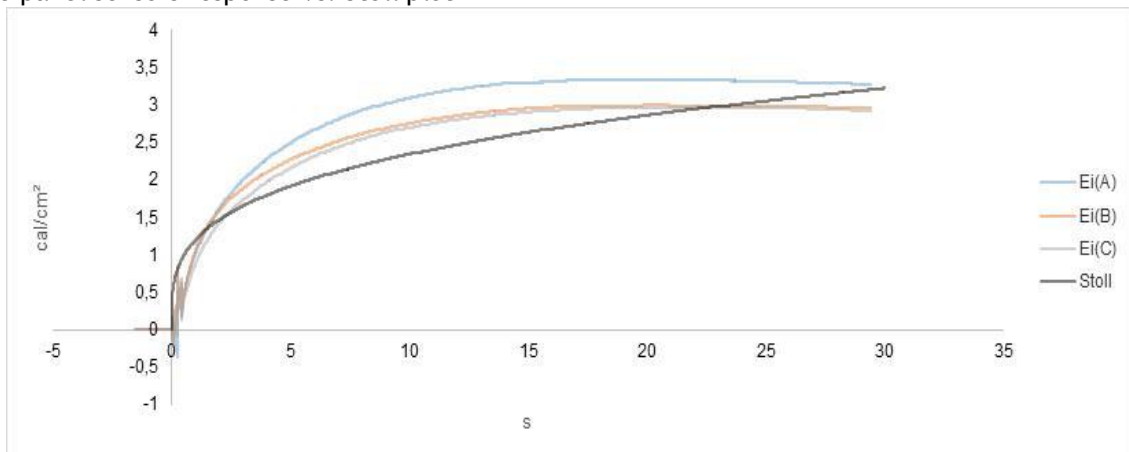
Current Plot



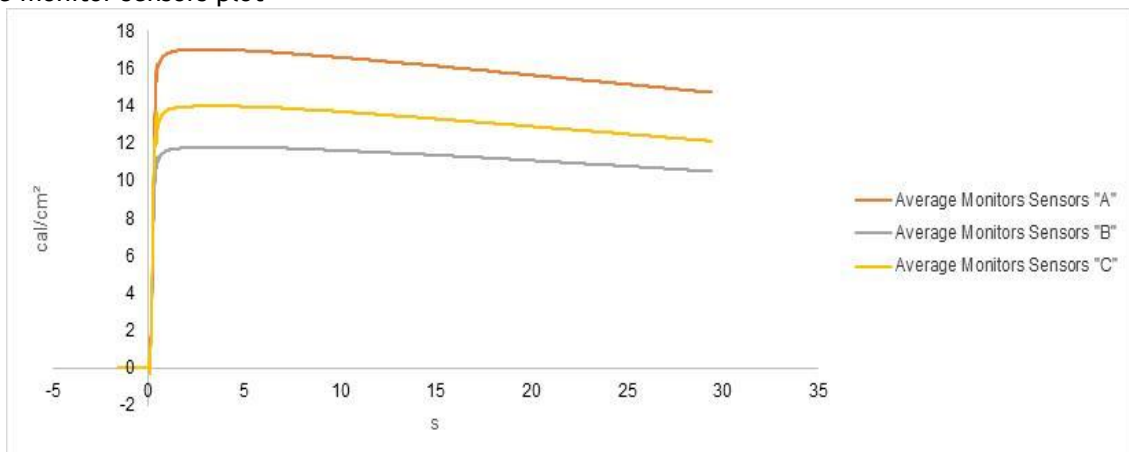
Voltage Plot



Average panel sensors response Vs. Stoll plot



Average monitor sensors plot



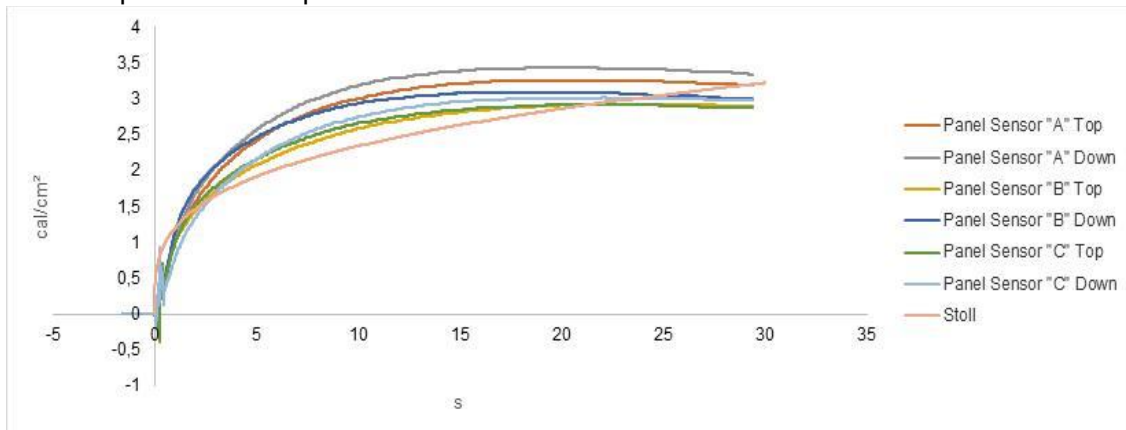
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RESULTS

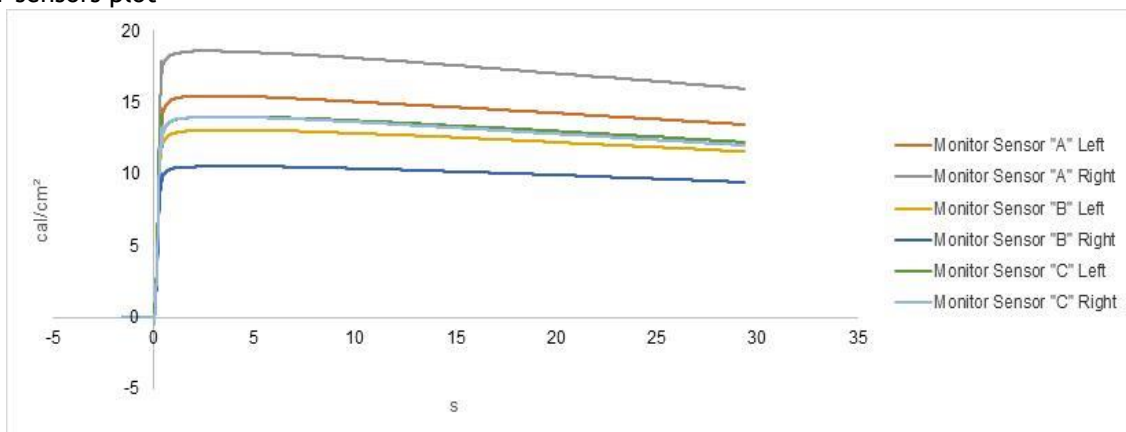
Electrical current and response sensor response:

Shot 2

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,6	Current Peak (kA)	16,5	Arc Voltage (V)	1446,0
Duration (cycles n°)	14,7	Duration (ms)	294,6	Arc Energy (kJ)	869,8
Arc Voltage (kJ)	425,5				

sensor response	PANEL A	PANEL B	PANEL C
Ei	17,01 cal/cm ²	11,80 cal/cm ²	13,99 cal/cm ²
SCD	0,76 cal/cm ²	0,43 cal/cm ²	0,37 cal/cm ²
HAF	80,34 %	74,57 %	78,79 %

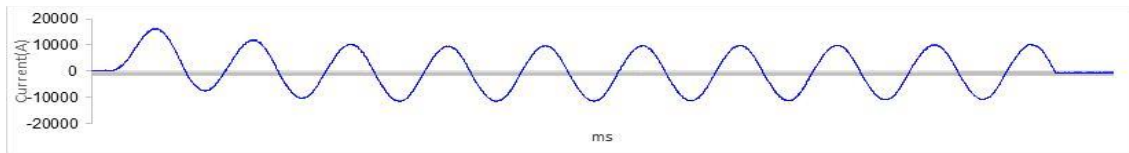
>>>

RESULTS

Electrical current and response sensor response:

Shot 3

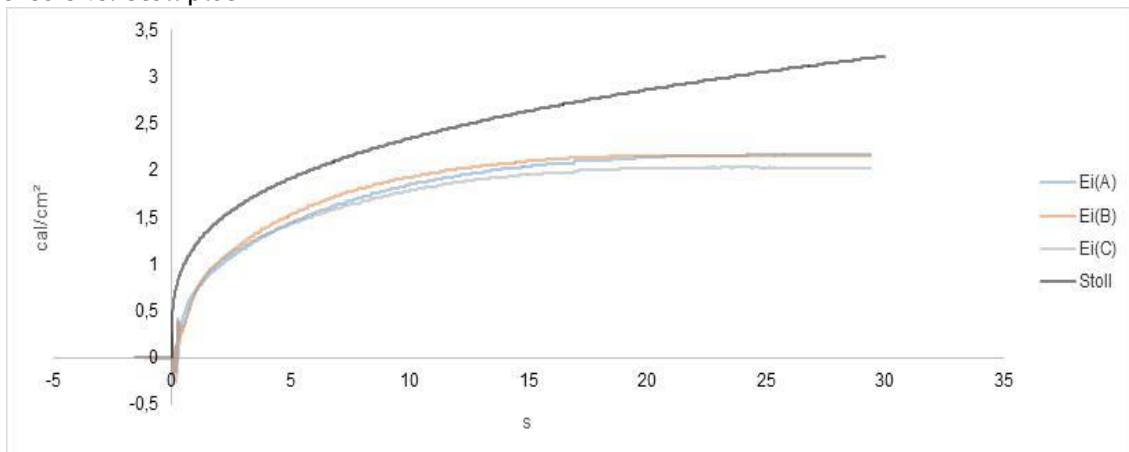
Current Plot



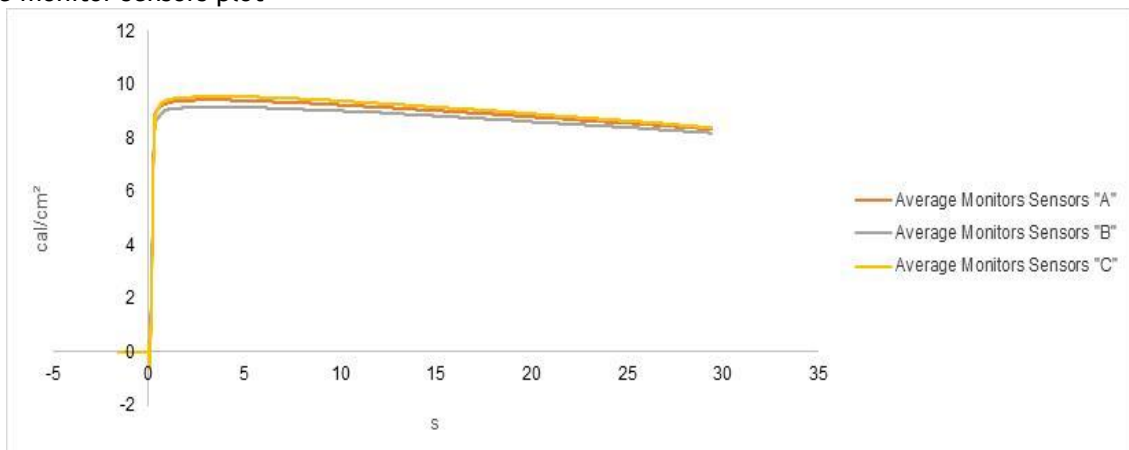
Voltage Plot



Panel sensors vs. Stoll plot



Average monitor sensors plot



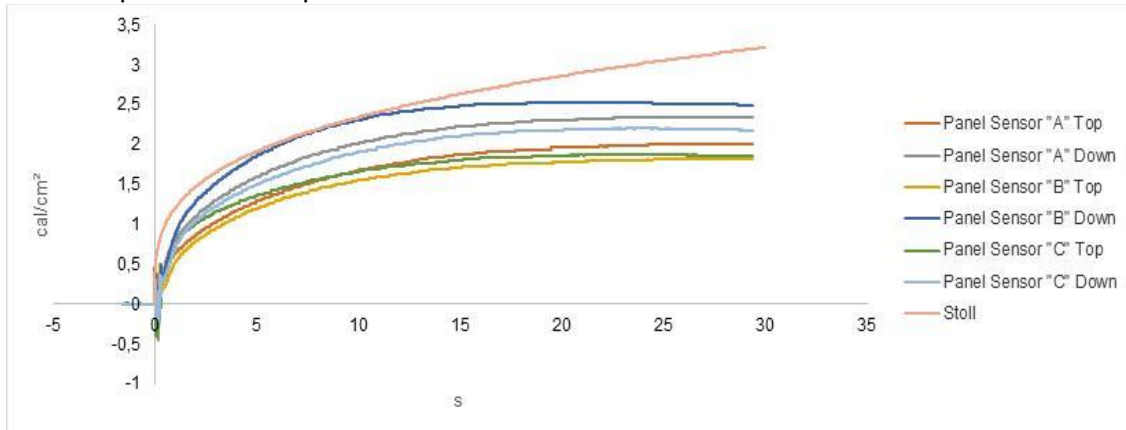
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RESULTS

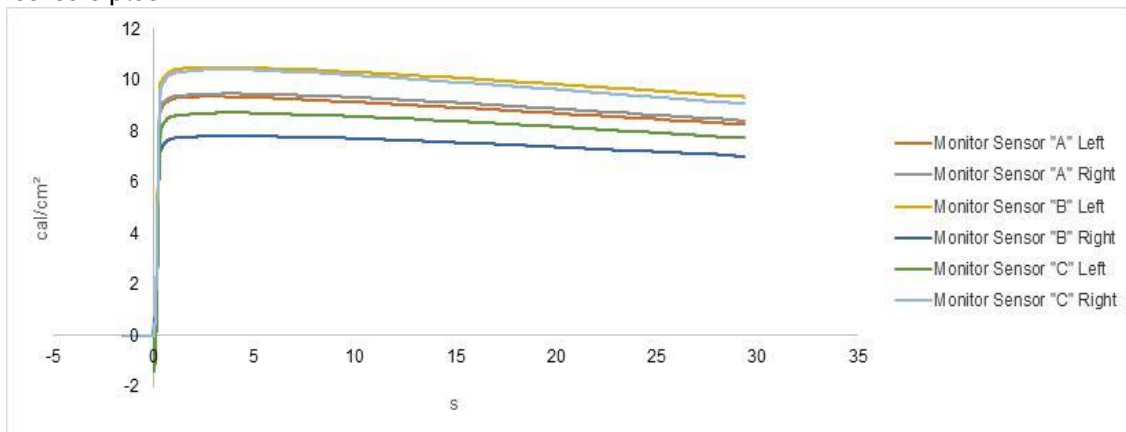
Electrical current and response sensor response:

Shot 3

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,7	Current Peak (kA)	16,3	Arc Voltage (V)	1470,0
Duration (cycles n°)	9,7	Duration (ms)	194,0	Arc Energy (kJ)	604,7
Arc Voltage (kJ)	448,2				

sensor response	PANEL A	PANEL B	PANEL C
Ei	9,41 cal/cm ²	9,16 cal/cm ²	9,56 cal/cm ²
SCD	-0,47 cal/cm ²	-0,37 cal/cm ²	-0,44 cal/cm ²
HAF	76,96 %	76,31 %	78,69 %

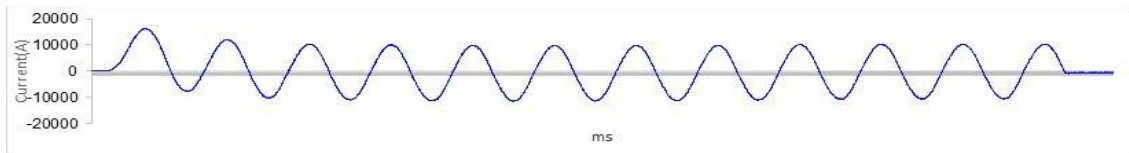
>>>

RESULTS

Electrical current and response sensor response:

Shot 4

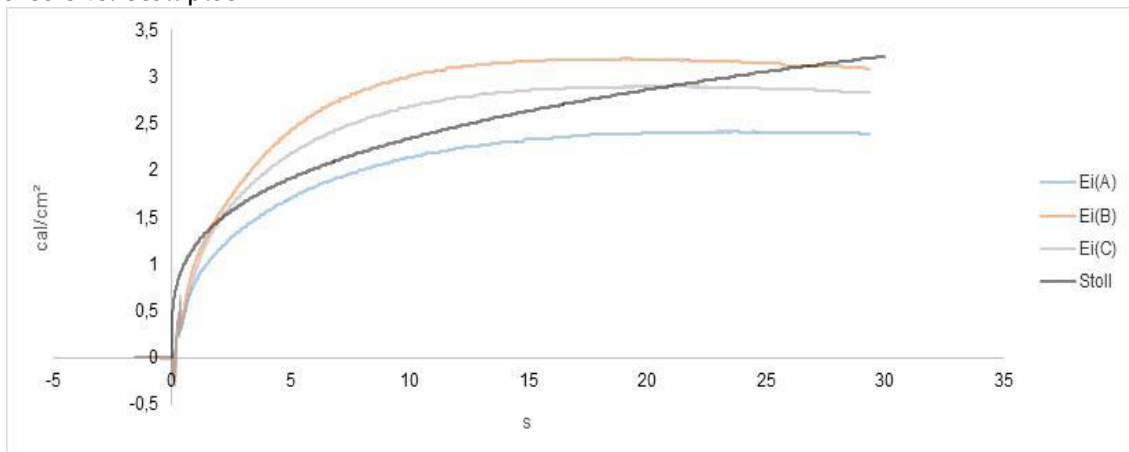
Current Plot



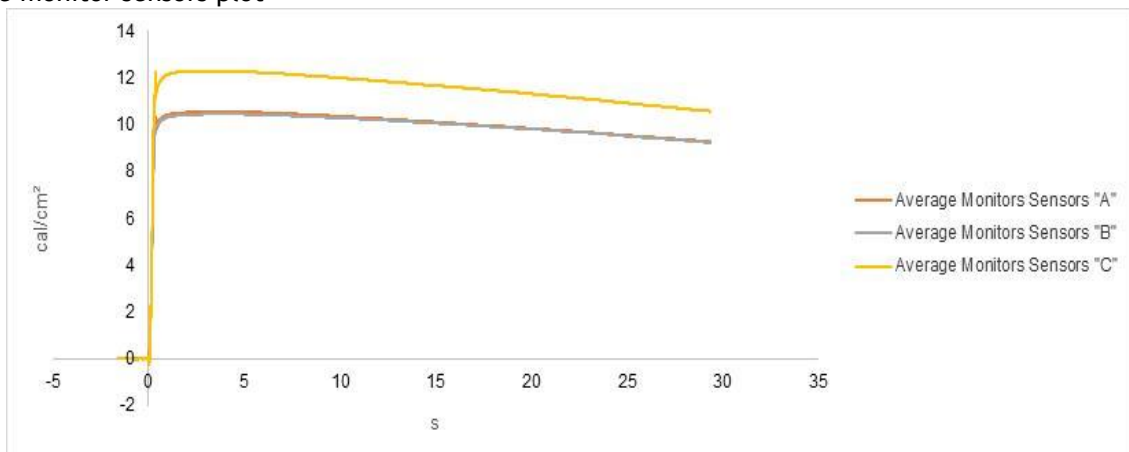
Voltage Plot



Panel sensors vs. Stoll plot



Average monitor sensors plot



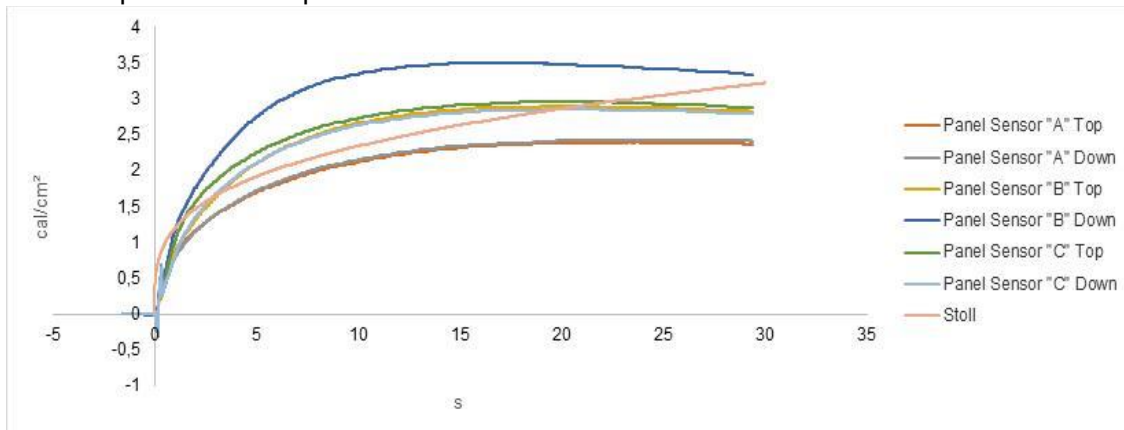
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RESULTS

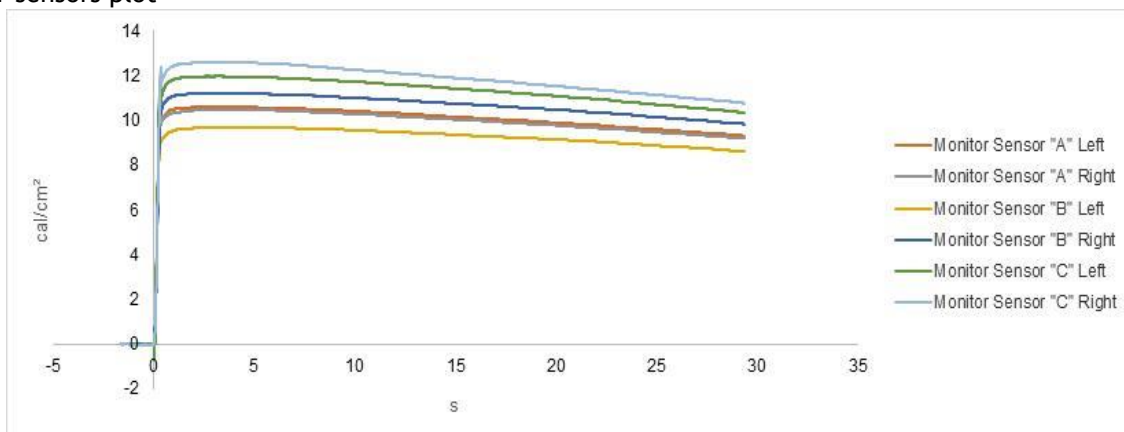
Electrical current and response sensor response:

Shot 4

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,6	Current Peak (kA)	16,3	Arc Voltage (V)	1341,0
Duration (cycles n°)	11,7	Duration (ms)	234,2	Arc Energy (kJ)	683,0
Arc Voltage (kJ)	420,1				

sensor response	PANEL A	PANEL B	PANEL C
Ei	10,54 cal/cm ²	10,45 cal/cm ²	12,29 cal/cm ²
SCD	-0,18 cal/cm ²	0,67 cal/cm ²	0,35 cal/cm ²
HAF	77,05 %	69,46 %	76,40 %

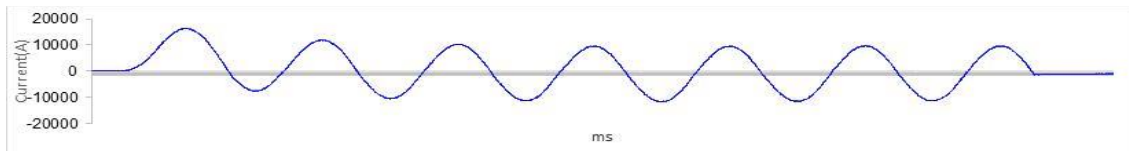
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RESULTS

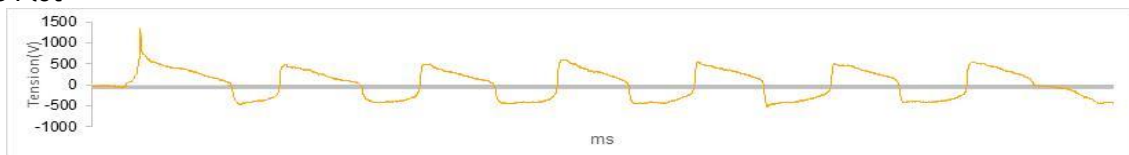
Electrical current and response sensor response:

Shot 5

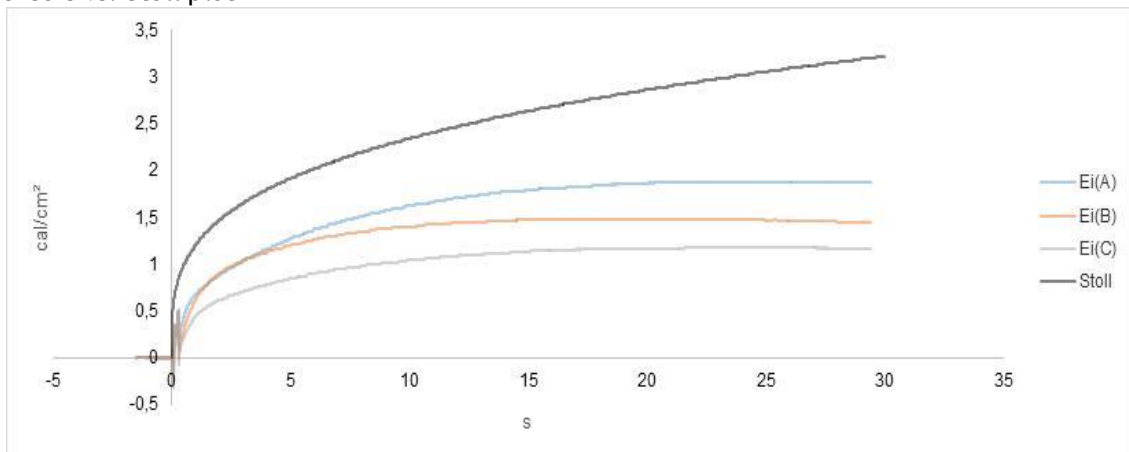
Current Plot



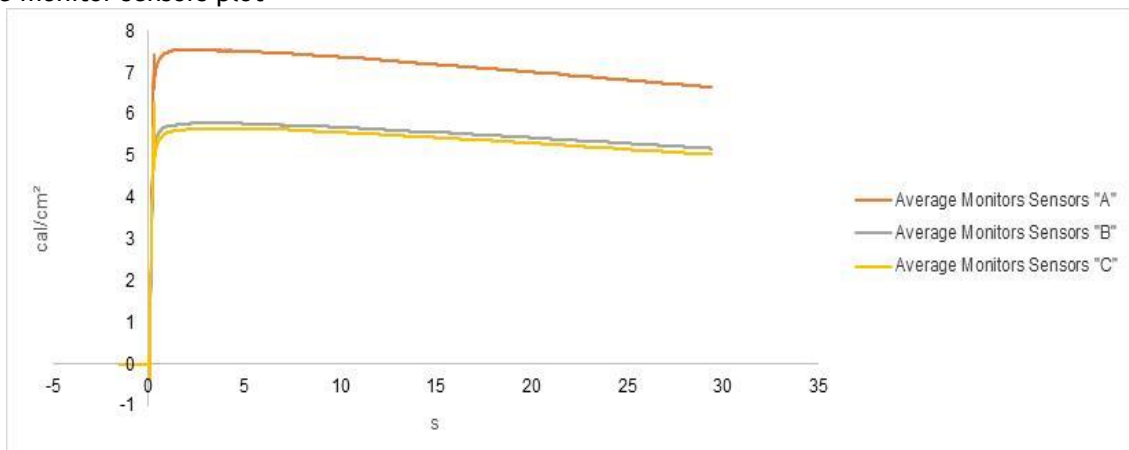
Voltage Plot



Panel sensors vs. Stoll plot



Average monitor sensors plot



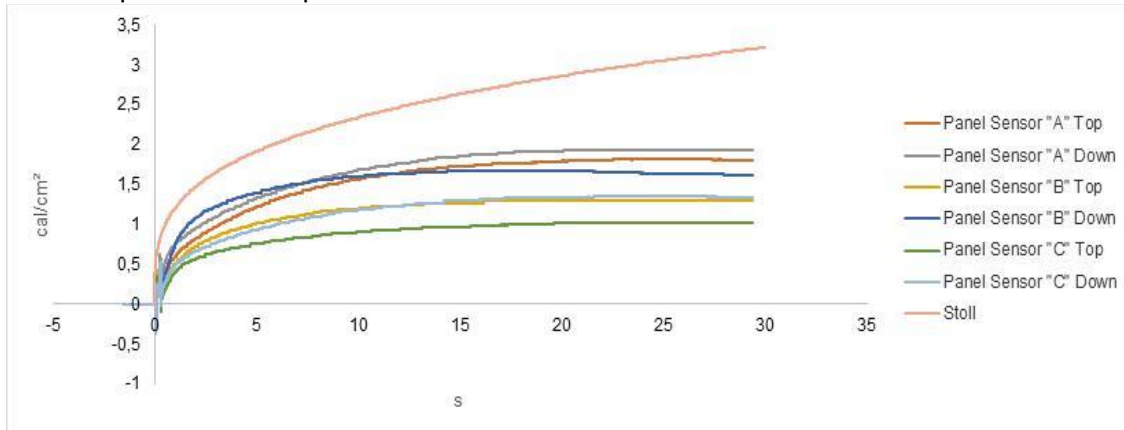
>>>

RESULTS

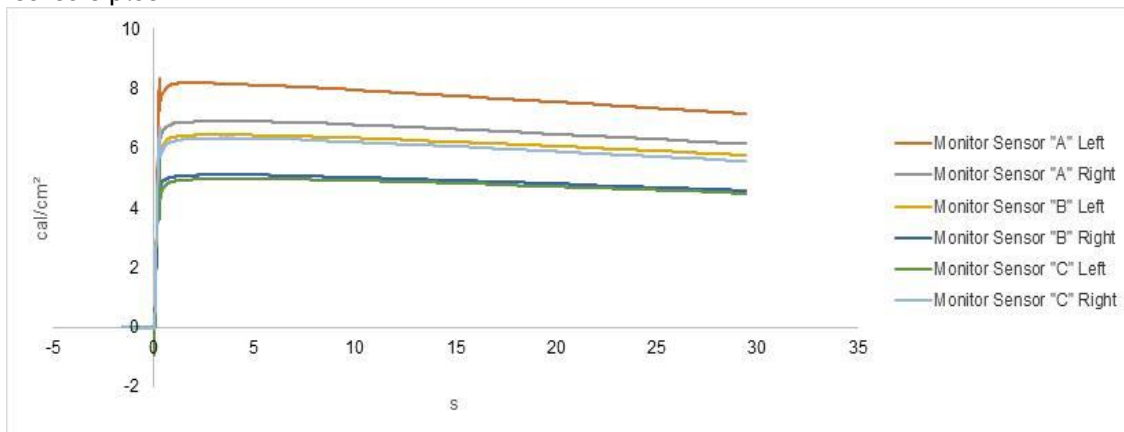
Electrical current and response sensor response:

Shot 5

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,8	Current Peak (kA)	16,3	Arc Voltage (V)	1350,0
Duration (cycles n°)	6,7	Duration (ms)	134,7	Arc Energy (kJ)	320,0
Arc Voltage (kJ)	358,3				

sensor response	PANEL A	PANEL B	PANEL C
Ei	7,55 cal/cm ²	5,83 cal/cm ²	6,27 cal/cm ²
SCD	-0,53 cal/cm ²	-0,56 cal/cm ²	-0,76 cal/cm ²
HAF	75,11 %	74,53 %	81,15 %

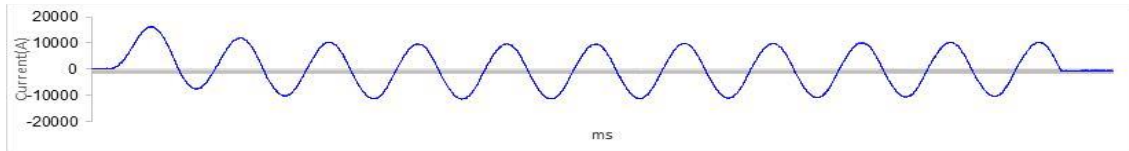
>>>

RESULTS

Electrical current and response sensor response:

Shot 6

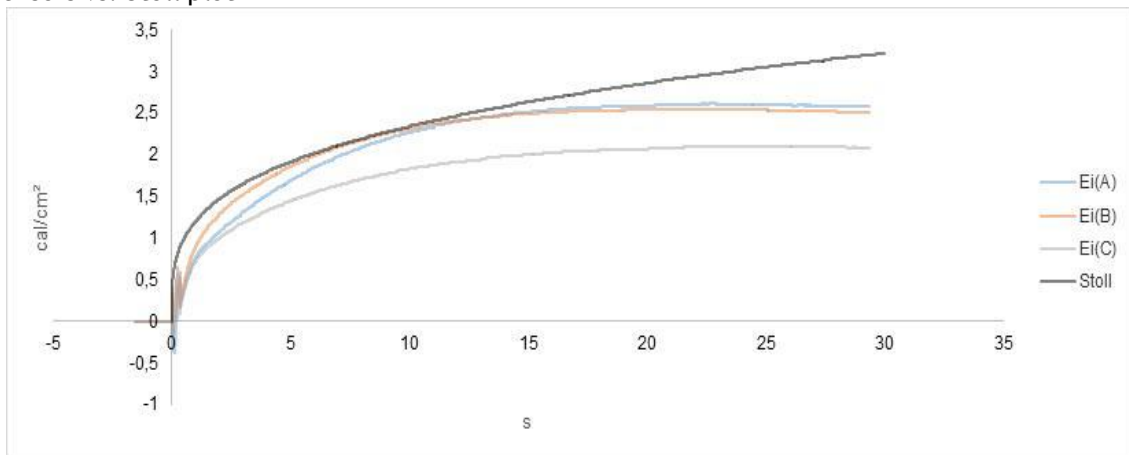
Current Plot



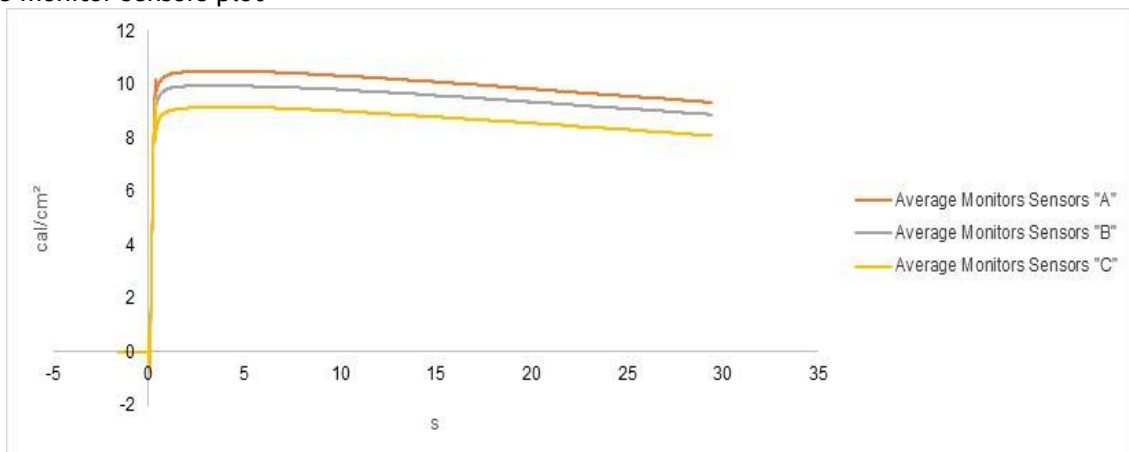
Voltage Plot



Panel sensors vs. Stoll plot



Average monitor sensors plot



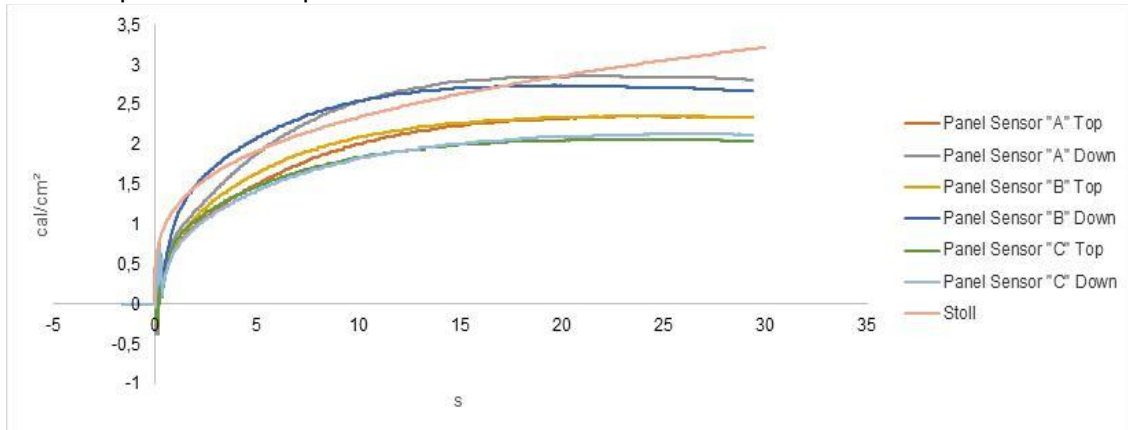
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RESULTS

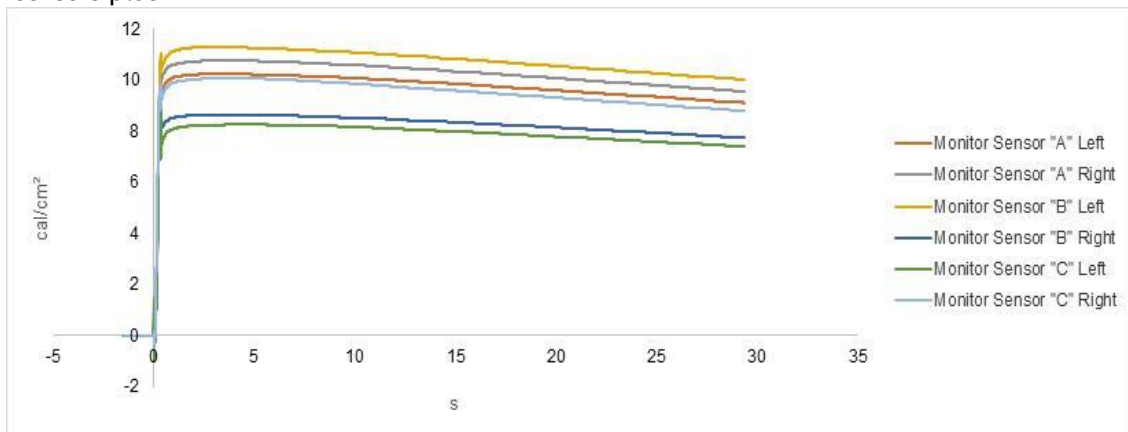
Electrical current and response sensor response:

Shot 6

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,6	Current Peak (kA)	16,3	Arc Voltage (V)	1428,0
Duration (cycles n°)	10,7	Duration (ms)	214,7	Arc Energy (kJ)	665,4
Arc Voltage (kJ)	447,4				

Sensor response	PANEL A	PANEL B	PANEL C
Ei	10,50 cal/cm ²	9,96 cal/cm ²	9,45 cal/cm ²
SCD	-0,06 cal/cm ²	-0,01 cal/cm ²	-0,46 cal/cm ²
HAF	75,15 %	74,45 %	77,82 %

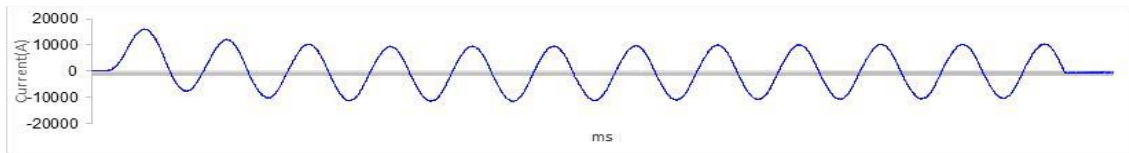
>>>

RESULTS

Electrical current and response sensor response:

Shot 7

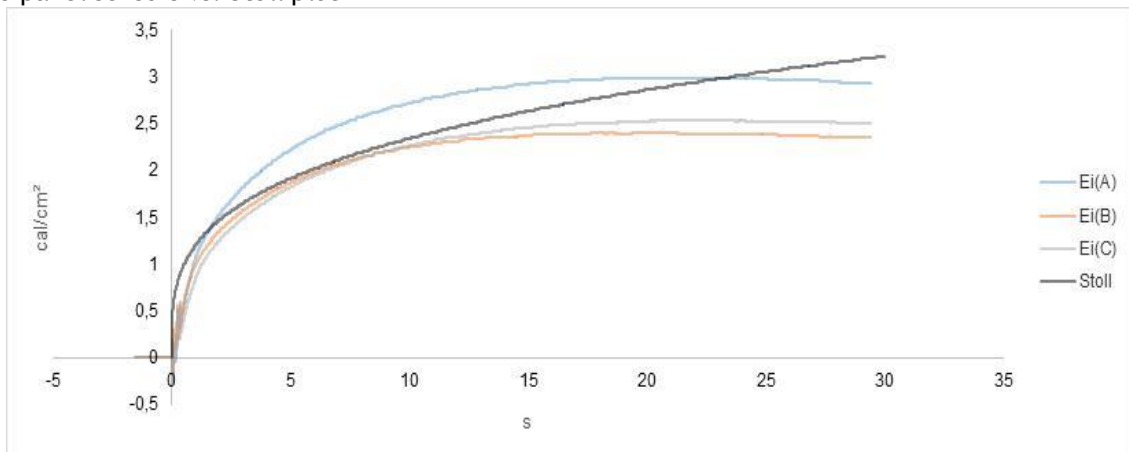
Current Plot



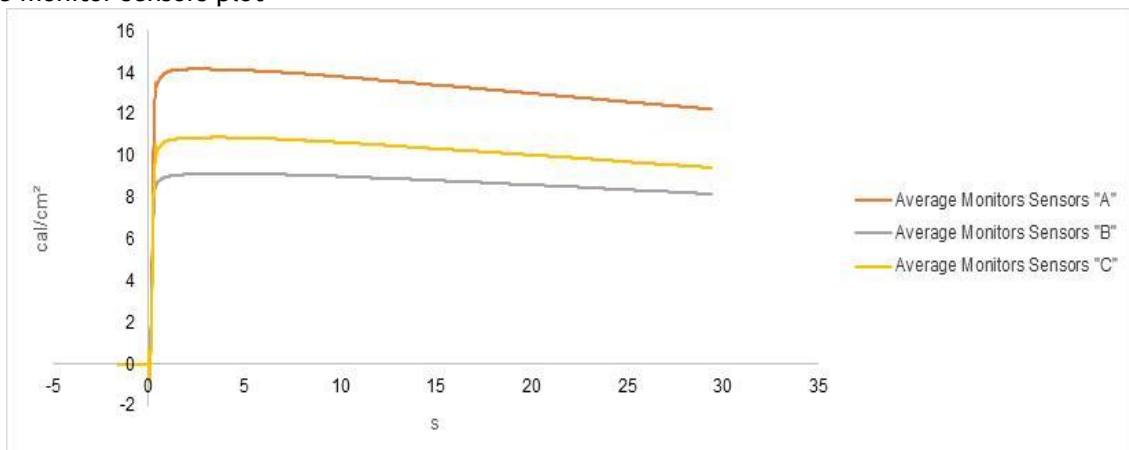
Voltage Plot



Average panel sensors vs. Stoll plot



Average monitor sensors plot



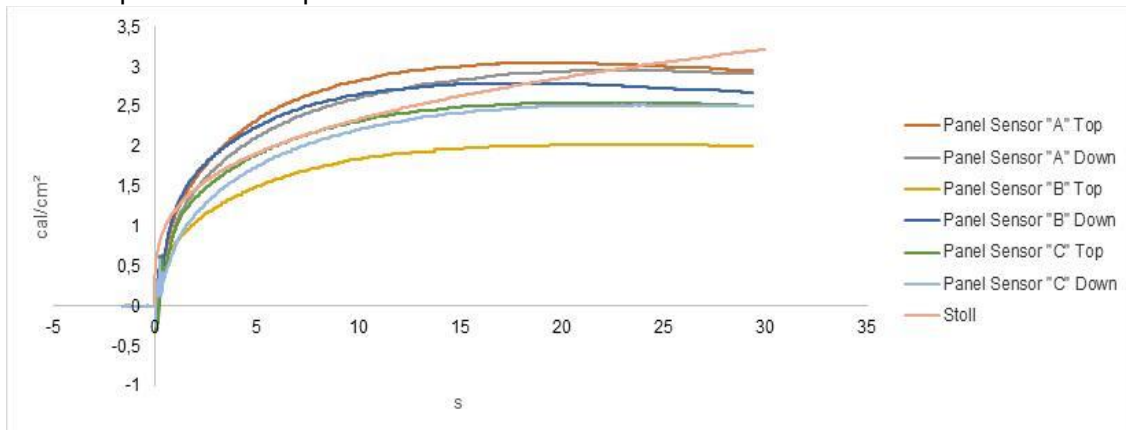
>>>

RESULTS

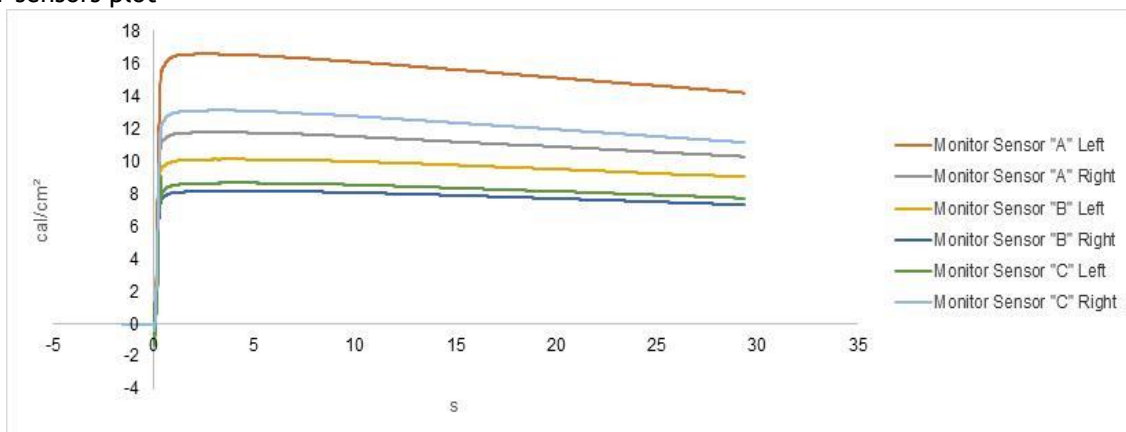
Electrical current and response sensor response:

Shot 7

Panel sensors response Vs. Stoll plot



Monitor sensors plot



Current Total RMS (kA)	7,6	Current Peak (kA)	16,2	Arc Voltage (V)	1440,0
Duration (cycles n°)	11,7	Duration (ms)	234,1	Arc Energy (kJ)	711,8
Arc Voltage (kJ)	446,4				

sensor response	PANEL A	PANEL B	PANEL C
Ei	14,16 cal/cm ²	9,14 cal/cm ²	10,88 cal/cm ²
SCD	0,39 cal/cm ²	-0,03 cal/cm ²	-0,06 cal/cm ²
HAF	78,87 %	73,74 %	76,69 %

>>>

RESULTS

Tested material pictures:

Original

Shot 1

Shot 2



Shot 3

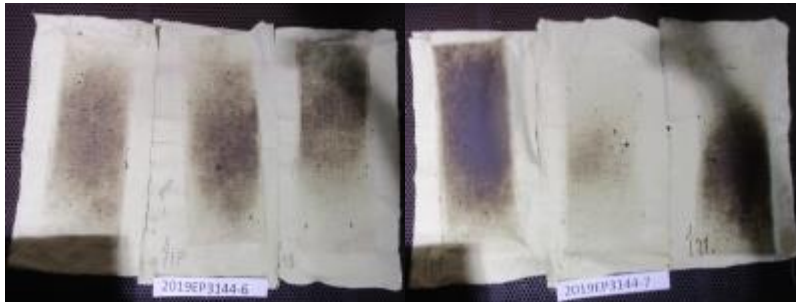
Shot 4

Shot 5



Shot 6

Shot 7



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RESULTS

Summary of results:

ATPV	11,1 cal/cm ²
HAF	76,5 %

FABRIC TESTED ACCORDING TO THE STANDARD IEC 61482-1-1:2009, panel test (Method A) - Obsolete

ARC RATING (ATPV)

11,1 cal/cm²

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Lucia Martinez
Head of PPE and Ballistics department

LIABILITY CLAUSES

- 1.- AITEX is liable only for the results of the methods of analysis used, as expressed in the report and referring exclusively to the materials or samples indicated in the same which are in its possession, the professional and legal liability of the Centre being limited to these. Unless otherwise stated, the samples were freely chosen and sent by the applicant.
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- 10.- The uncertainties of tests, which are made explicit in the Results Report, have been estimated for a $k = 2$ (95% probability of coverage). If not informed, they are available to the client in AITEX.
- 11.- The original materials and rests of samples, not subject to test, will be retained in AITEX during the twelve months following the issuance of the report, so that any check or claim which, in his case, wanted to make the applicant, should be exercised within the period indicated.
- 12.- This report may only be sent or delivered by hand to the applicant or to a person duly authorised by the same.
- 13.- The results of the tests and the statement of compliance with the specification in this report refer only to the test sample as it has been analyzed / tested and not the sample / item which has taken the test sample.
- 14.- The client must attend at all times, to the dates of the realization of the tests.
- 15.- According to Resolution EA (33) 31, the test reports must include the unique identification of the sample, and any brand or label of the manufacturer may be added. It is not allowed to re-issue test reports of untested sample names (references), they can only be re-issued for error correction or inclusion of omitted data that were already available at the time of the test. The laboratory can not assume responsibility for declaring that the product with the new trade name / trademark is strictly identical to the one originally tested; This responsibility belongs to the client.

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