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textile research institute



ENAC
ENSAYOS
N° 12 / LE025
N° 12 / LE427

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

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Att. Samit V. Chaudhari

**REPORT ISSUED BY THE RESEARCH ASSOCIATION OF THE TEXTILE
INDUSTRY, AITEX**

N° 2020ID0060

The test was carried out 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

HONEYWELL TECHNOLOGY SOLUTIONS LAB PVT LTD

Date of reception 24/08/2020

Date Test Starting: 24/08/2020
Ending: 31/08/2020

IDENTIFICATION AND DESCRIPTION OF SAMPLES

REFERENCES

Hood AS1200HAT-SPL + AFHOOD12

TESTS CARRIED OUT

- PHOTOGRAPHY.
- PRE-TREATMENT FOR DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING.
- ELECTRIC ARC EXPOSURE TEST: DETERMINATION OF THE ARC RATING FOR EYE OR FACE PROTECTIVE PRODUCTS.

PHOTOGRAPHY



Reference ⁽¹⁾
Hood AS1200HAT-SPL + AFHOOD12

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PHOTOGRAPHY



Reference ⁽¹⁾
Hood AS1200HAT-SPL + AFHOOD12

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

Standard

AATCC 135:2018

Standard deviation

Reference

Sample 1 Hood AS1200HAT-SPL + AFHOOD12

Washing machine

13046I12

Washing cycles

3

Washing procedure

IV

Dryer machine

Whirlpool 13098I12

Drying procedure

Aiii

Washing powder

AATCC 1993 WOB

Start and finish date

24/08/2020 - 25/08/2020

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ELECTRIC ARC EXPOSURE TEST: DETERMINATION OF THE ARC RATING FOR EYE OR FACE PROTECTIVE PRODUCTS

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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Standard

ASTM F2178 – 17

Test conditions	
Date test	28/08/2020
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	20

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Reference Hood AS1200HAT-SPL + AFHOOD12

Lens / Window description

Manufacturer Paulson Mfg.

Model AS1200SPL

Colour Grey

Thickness 0.06"

Material Polycarbonate

Hardhat Description

Manufacturer Honeywell Salisbury

Model SN10R03, Type I Class E

Material ---

Description of the tissue or joint tissue of capuz

Fabric system arc rating 12 cal/cm²

Arc rating test report number K-418406-1204P42

Number of layers 1

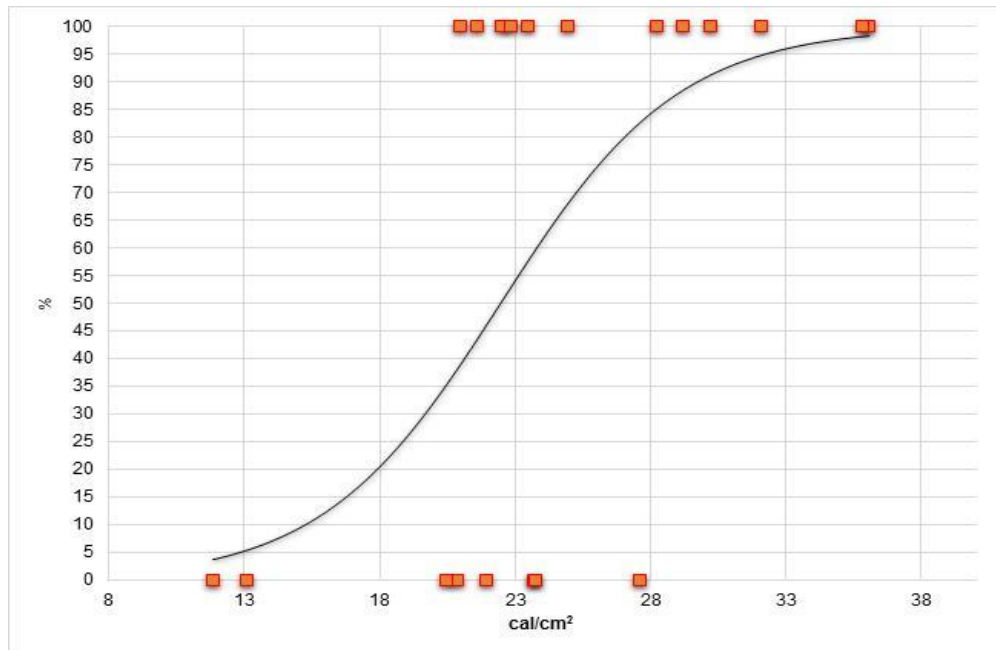
Description of fabric according to information provided by the customer

SSM, Style 1924.00, 6.5 oz/yd² 220 g/m² Interlock, 100%Cotton, Navy, AAD 7.1 oz/yd² 241 g/m², ArcWear# 1204P42

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

ATPV 22,4 cal/cm²



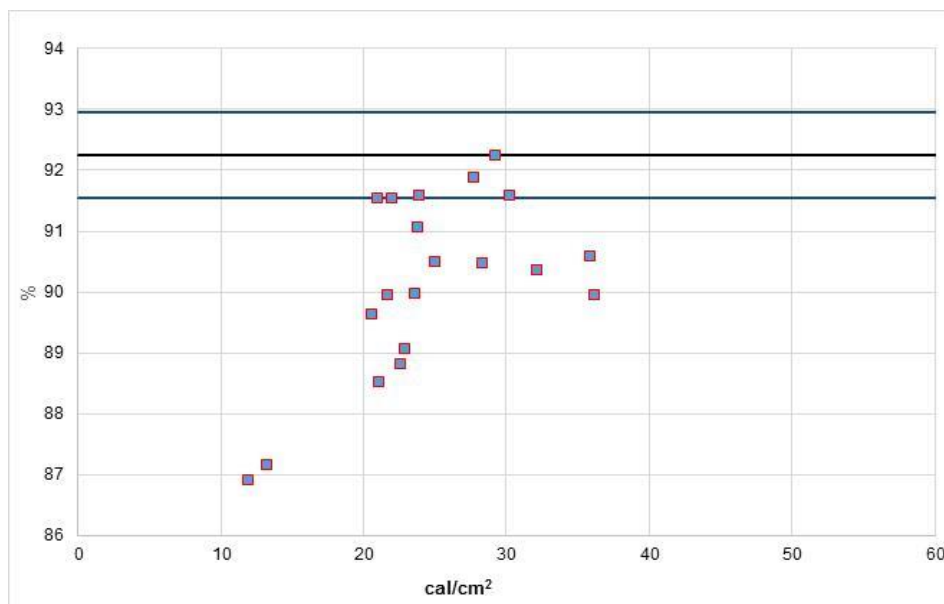
Probability%	5,0	10,0	20,0	30,0	40,0	50,0	60,0	70,0	80,0	95,0
E _i cal/cm ²	12,7	15,2	17,9	19,7	21,1	22,4	23,8	25,2	27,0	32,1

ATPV points above	6
ATPV points 20%	11
ATPV points below	4
ATPV points mix zone	10

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Determination of HAF, confidence Intervals 95%

HAF	92,2 %
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% HAF value :	92,2
Upper Confidence Level %:	93,0
Lower Confidence Level %:	91,6
Points above:	0
Points below:	14
Points between:	6
Total Points:	20

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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	334,4	16,72	13,1	-0,19	87,2	N	N
1-C	334,4	16,72	11,8	-0,12	86,9	N	N
2-A	513,8	25,69	21,0	0,26	88,5	Y	N
2-C	513,8	25,69	20,8	-0,26	91,6	N	N
3-A	812,6	40,63	36,1	0,97	90,0	Y	N
3-C	812,6	40,63	35,8	1,07	90,6	Y	N
4-A	573,4	28,67	23,7	-0,03	91,1	N	N
4-C	573,4	28,67	22,0	-0,2	91,6	N	N
5-A	693,4	34,67	32,1	0,54	90,4	Y	N
5-C	693,4	34,67	29,2	0,08	92,2	Y	N
6-A	633	31,65	30,2	0,27	91,6	Y	N
6-C	633	31,65	27,6	-0,02	91,9	N	N
7-A	592,8	29,64	24,9	0,12	90,5	Y	N
7-C	592,8	29,64	21,6	0,09	90,0	Y	N
8-A	612,8	30,64	28,2	0,3	90,5	Y	N
8-C	612,8	30,64	22,5	0,3	88,8	Y	N
9-A	553	27,65	23,5	0,16	90,0	Y	N
9-C	553	27,65	23,8	-0,24	91,6	N	N
10-A	552,8	27,64	22,8	0,08	89,1	Y	N
10-C	552,8	27,64	20,4	-0,07	89,6	N	N

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Summary of measured energy and subjective evaluation:

Test	After flame	Ablation	Melting	Dripping	Charring	Embrittlement	Deformation
1-A	0	N	Y	N	Y	N	N
1-C	0	N	Y	N	Y	N	N
2-A	0	N	Y	N	Y	N	N
2-C	0	N	Y	N	Y	N	N
3-A	0	N	Y	N	Y	N	N
3-C	0	N	Y	N	Y	N	N
4-A	0	N	Y	N	Y	N	N
4-C	0	N	Y	N	Y	N	N
5-A	0	N	Y	N	Y	N	N
5-C	0	N	Y	N	Y	N	N
6-A	0	N	Y	N	Y	N	N
6-C	0	N	Y	N	Y	N	N
7-A	0	N	Y	N	Y	N	N
7-C	0	N	Y	N	Y	N	N
8-A	0	N	Y	N	Y	N	N
8-C	0	N	Y	N	Y	N	N
9-A	0	N	Y	N	Y	N	N
9-C	0	N	Y	N	Y	N	N
10-A	0	N	Y	N	Y	N	N
10-C	0	N	Y	N	Y	N	N

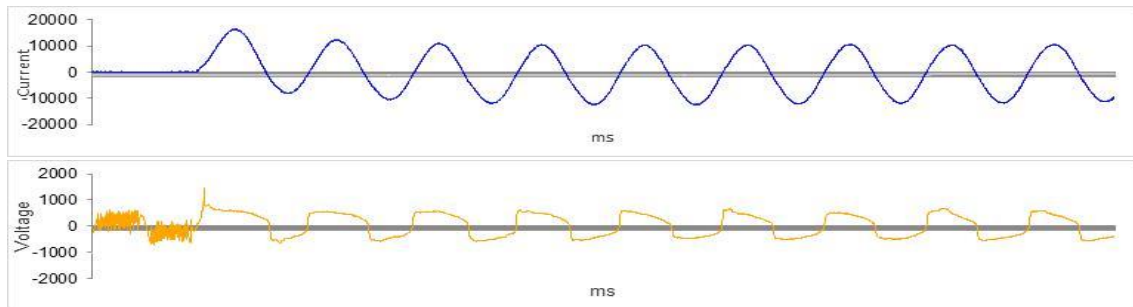
Y Yes N No

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Electrical current and response sensor response:

Calibration shot

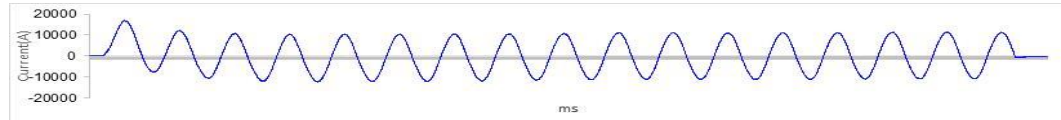
INITIAL CALIBRATION



Ei Panel A	7,1 cal/cm ²	Ei Panel B	7,2 cal/cm ²	Ei Panel C	cal/cm ²
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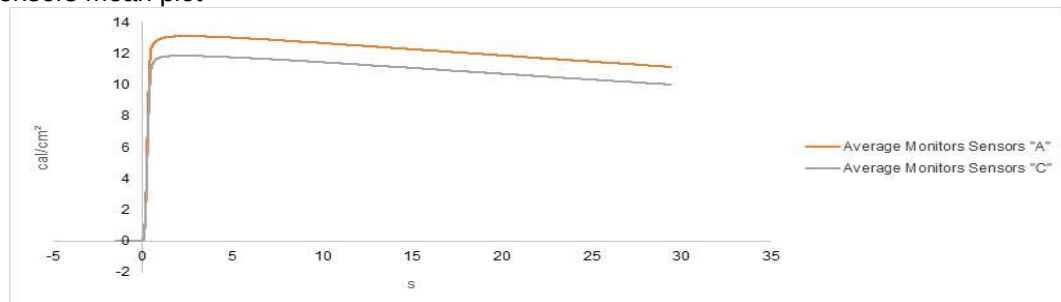
Shot 1
Current plot



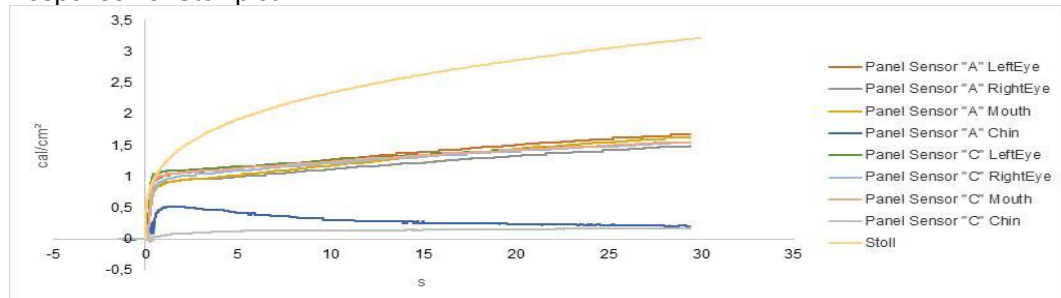
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

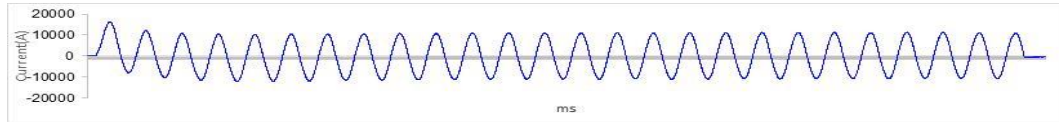


Current Total RMS (kA)	7,9	Current Peak (kA)	17,0	Arc Voltage (V)	1386,0
Duration (cycles nº)	16,7	Duration (ms)	334,4	Arc Energy (kJ)	1012,2
Arc Voltage (kJ)	416,1				

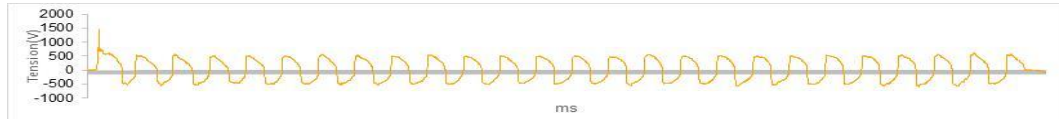
sensor response	PANEL A	PANEL C
Ei	13,11 cal/cm ²	11,84 cal/cm ²
SCD	-0,19 cal/cm ²	-0,12 cal/cm ²
HAF	87,17 %	86,92 %

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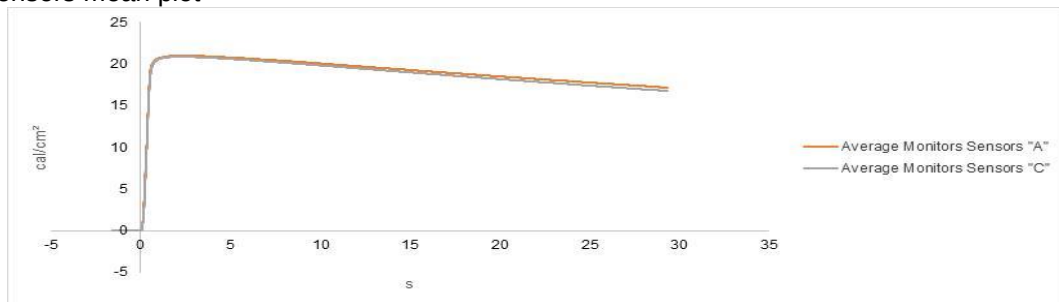
Shot 2
Current plot



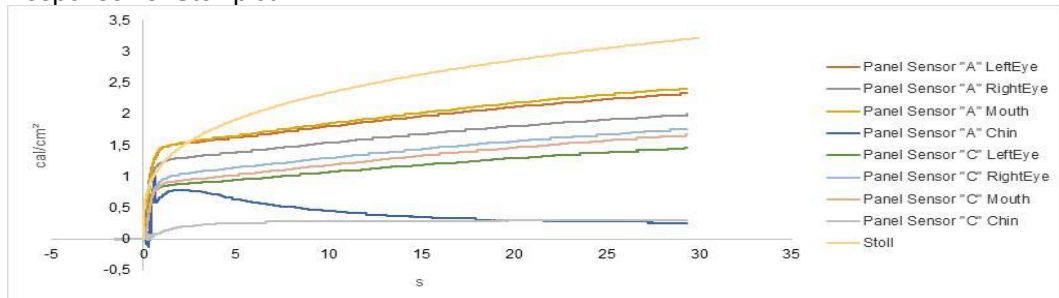
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

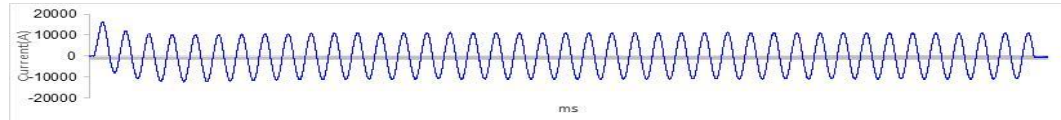


Current Total RMS (kA)	7,8	Current Peak (kA)	16,4	Arc Voltage (V)	1455,0
Duration (cycles nº)	25,7	Duration (ms)	513,7	Arc Energy (kJ)	1516,5
Arc Voltage (kJ)	407,8				

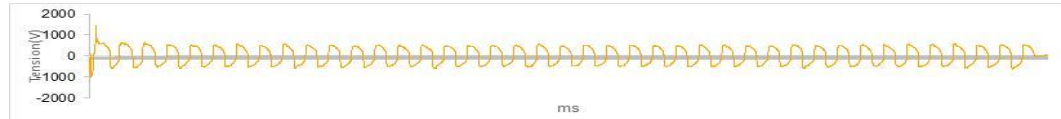
sensor response	PANEL A	PANEL C
Ei	20,98 cal/cm ²	20,85 cal/cm ²
SCD	0,26 cal/cm ²	-0,26 cal/cm ²
HAF	88,53 %	91,56 %

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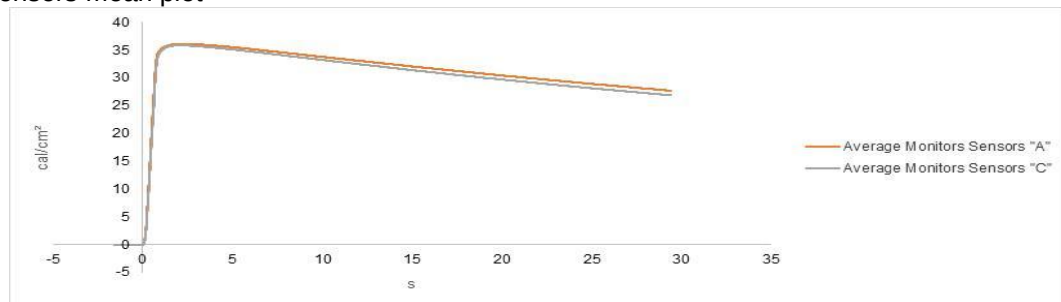
Shot 3
Current plot



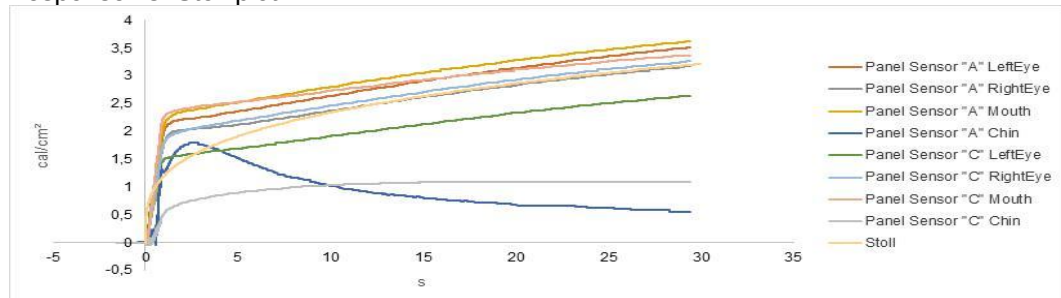
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

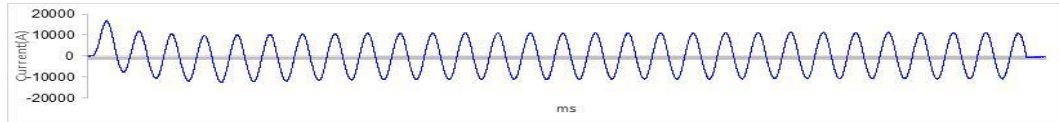


Current Total RMS (kA)	7,8	Current Peak (kA)	16,3	Arc Voltage (V)	1467,0
Duration (cycles nº)	40,6	Duration (ms)	812,6	Arc Energy (kJ)	2449,2
Arc Voltage (kJ)	416,7				

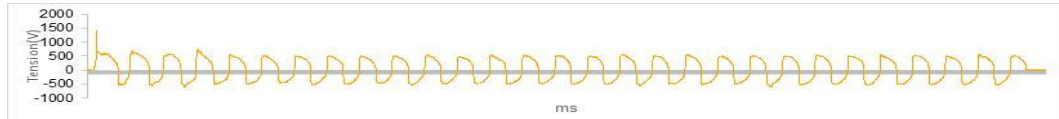
sensor response	PANEL A	PANEL C
Ei	36,07 cal/cm ²	35,83 cal/cm ²
SCD	0,97 cal/cm ²	1,07 cal/cm ²
HAF	89,96 %	90,60 %

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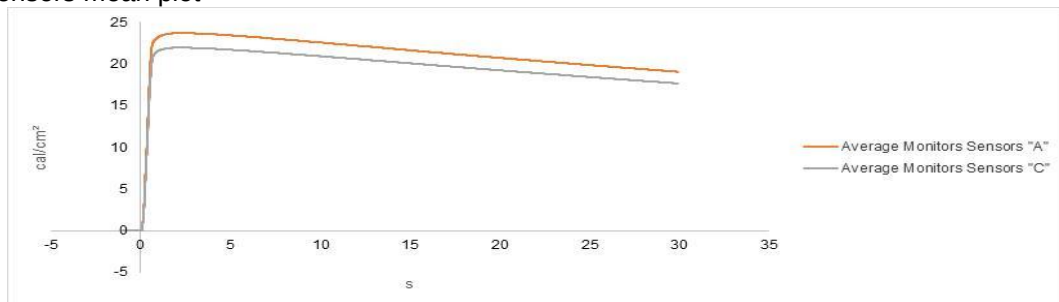
Shot 4
Current plot



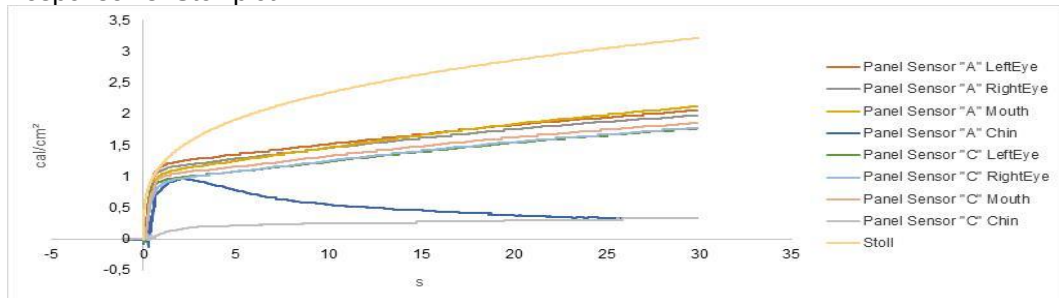
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

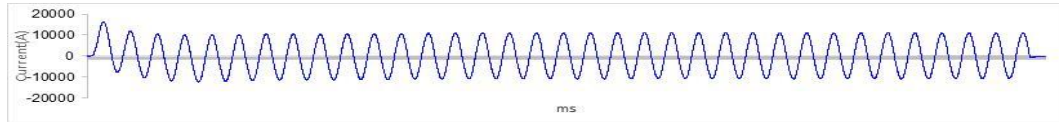


Current Total RMS (kA)	7,8	Current Peak (kA)	17,0	Arc Voltage (V)	1428,0
Duration (cycles nº)	28,7	Duration (ms)	573,4	Arc Energy (kJ)	1736,2
Arc Voltage (kJ)	418,6				

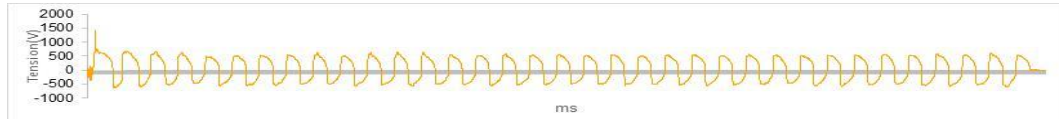
sensor response	PANEL A	PANEL C
Ei	23,69 cal/cm ²	21,95 cal/cm ²
SCD	-0,03 cal/cm ²	-0,20 cal/cm ²
HAF	91,07 %	91,56 %

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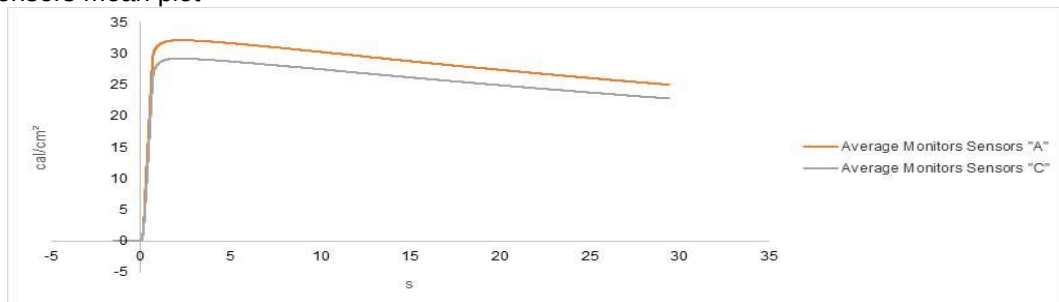
Shot 5
Current plot



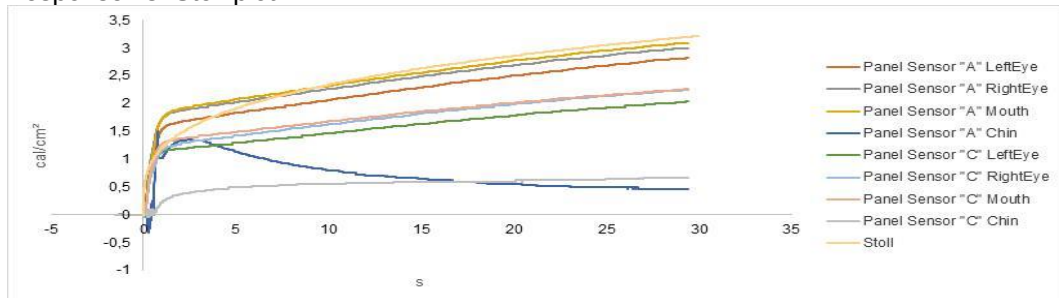
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

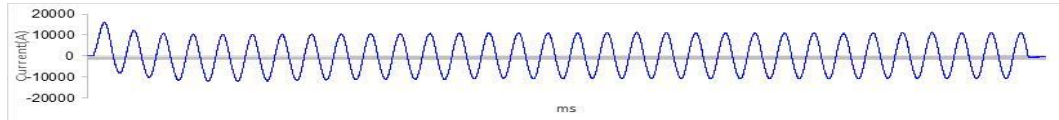


Current Total RMS (kA)	7,8	Current Peak (kA)	16,5	Arc Voltage (V)	1443,0
Duration (cycles nº)	34,7	Duration (ms)	693,4	Arc Energy (kJ)	2165,9
Arc Voltage (kJ)	434,1				

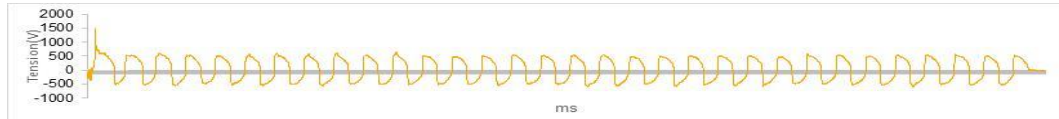
sensor response	PANEL A	PANEL C
Ei	32,11 cal/cm ²	29,17 cal/cm ²
SCD	0,54 cal/cm ²	0,08 cal/cm ²
HAF	90,37 %	92,25 %

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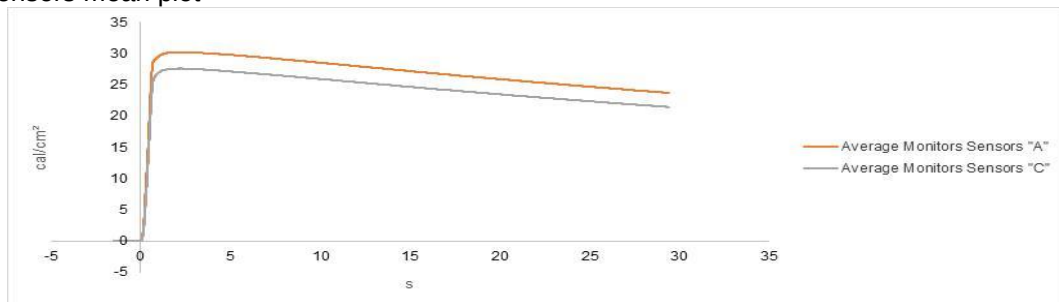
Shot 6
Current plot



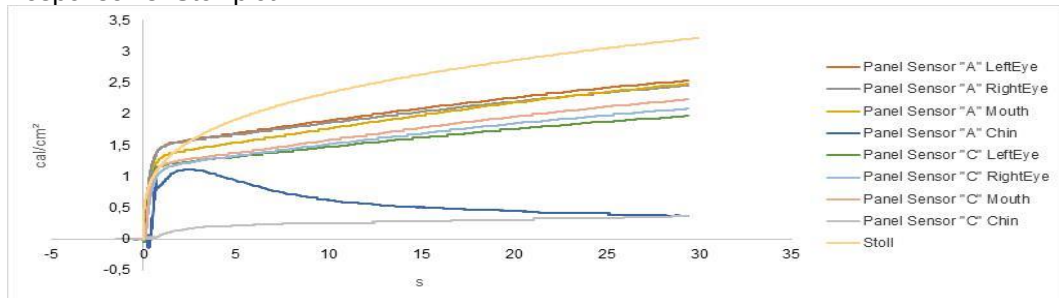
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

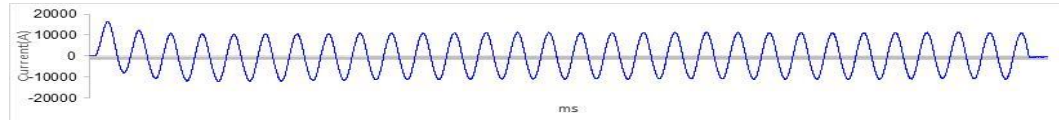


Current Total RMS (kA)	7,8	Current Peak (kA)	16,2	Arc Voltage (V)	1479,0
Duration (cycles nº)	31,6	Duration (ms)	633,1	Arc Energy (kJ)	1906,2
Arc Voltage (kJ)	419,9				

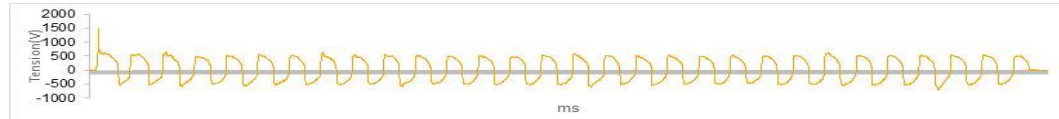
sensor response	PANEL A	PANEL C
Ei	30,20 cal/cm ²	27,59 cal/cm ²
SCD	0,27 cal/cm ²	-0,02 cal/cm ²
HAF	91,60 %	91,90 %

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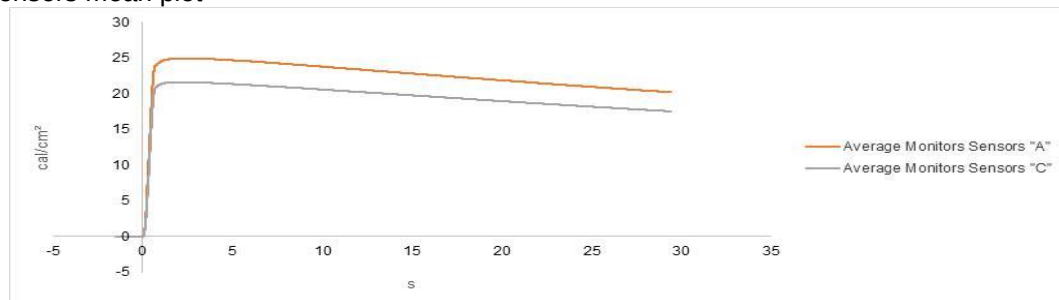
Shot 7
Current plot



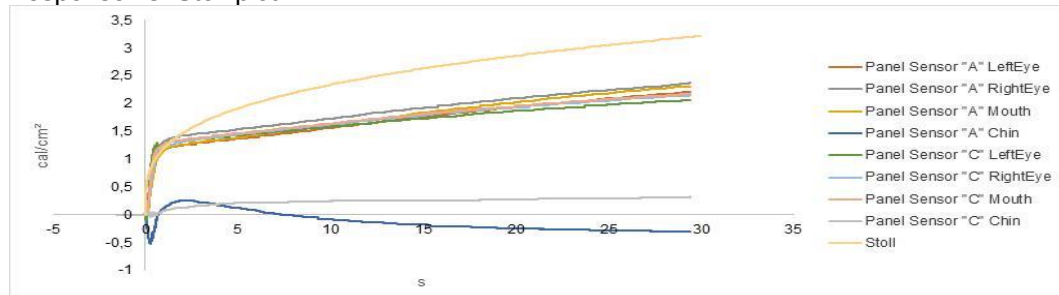
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

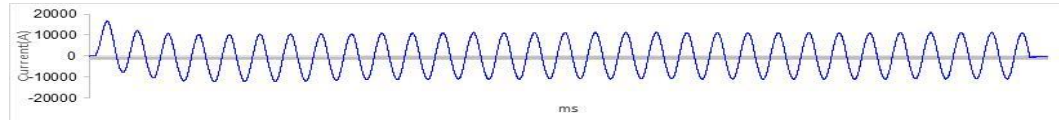


Current Total RMS (kA)	7,9	Current Peak (kA)	16,5	Arc Voltage (V)	1488,0
Duration (cycles nº)	29,6	Duration (ms)	592,8	Arc Energy (kJ)	1826,2
Arc Voltage (kJ)	423,9				

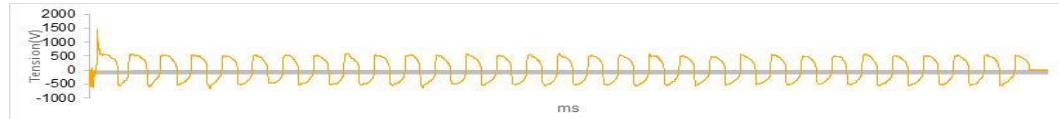
sensor response	PANEL A	PANEL C
Ei	24,93 cal/cm ²	21,62 cal/cm ²
SCD	0,12 cal/cm ²	0,09 cal/cm ²
HAF	90,51 %	89,97 %

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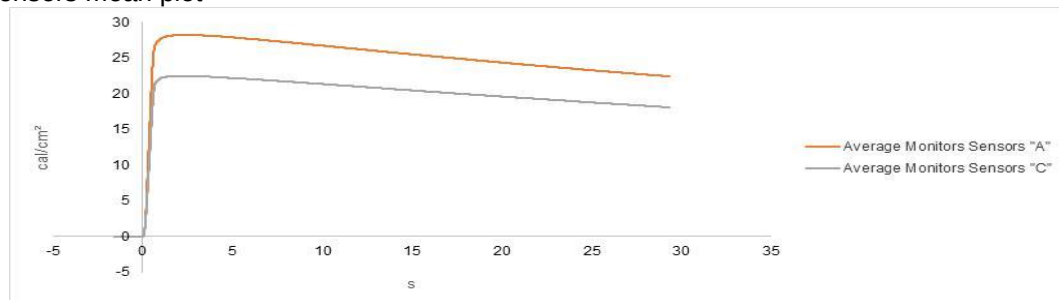
Shot 8
Current plot



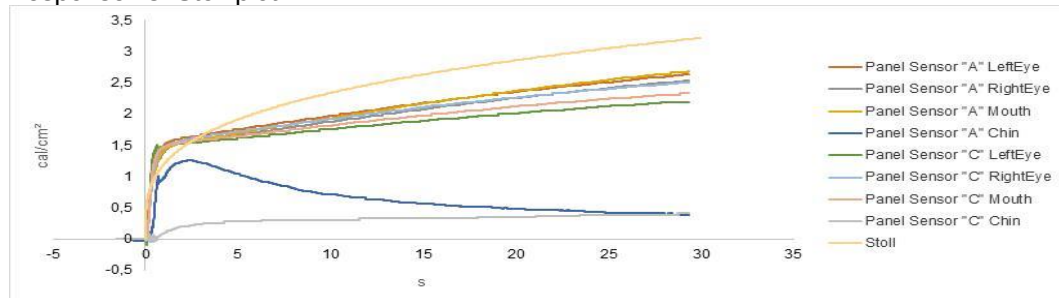
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

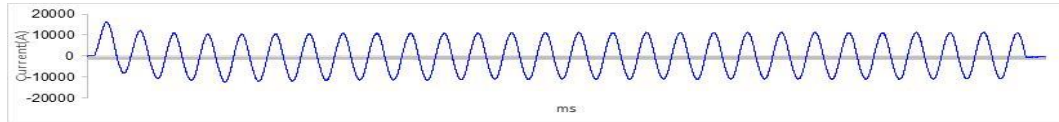


Current Total RMS (kA)	7,8	Current Peak (kA)	16,6	Arc Voltage (V)	1446,0
Duration (cycles nº)	30,6	Duration (ms)	612,8	Arc Energy (kJ)	1912,0
Arc Voltage (kJ)	429,7				

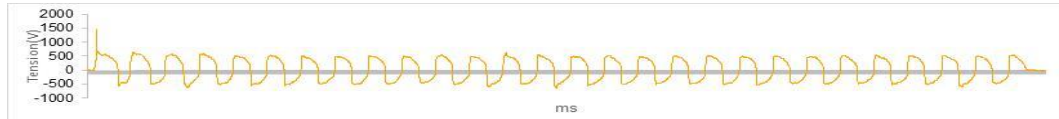
sensor response	PANEL A	PANEL C
Ei	28,21 cal/cm ²	22,49 cal/cm ²
SCD	0,30 cal/cm ²	0,30 cal/cm ²
HAF	90,49 %	88,83 %

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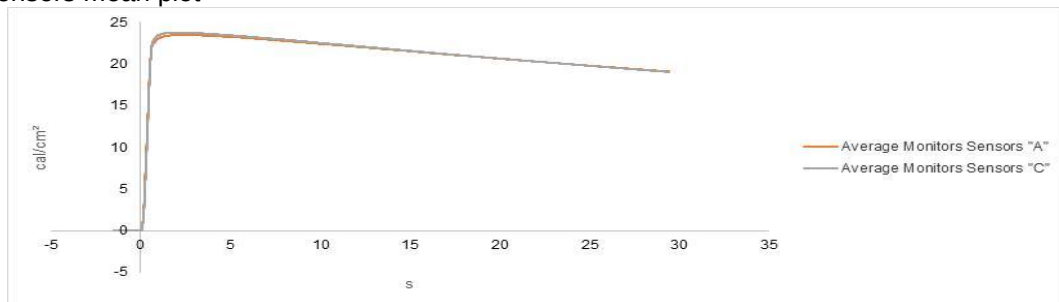
Shot 9
Current plot



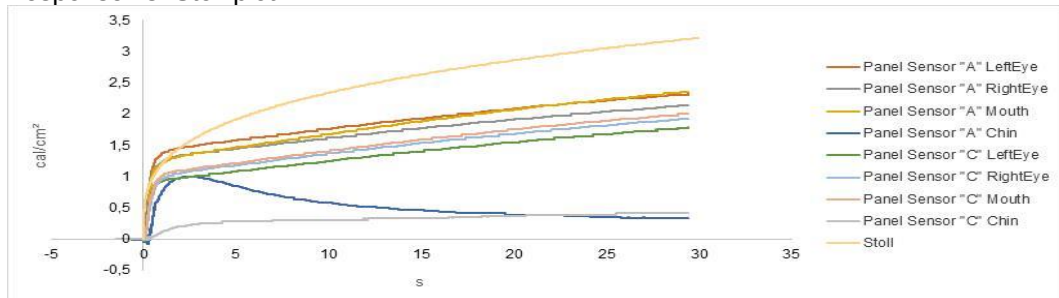
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

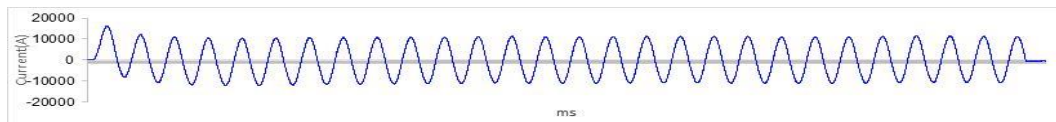


Current Total RMS (kA)	7,9	Current Peak (kA)	16,3	Arc Voltage (V)	1449,0
Duration (cycles nº)	27,6	Duration (ms)	553,0	Arc Energy (kJ)	1674,1
Arc Voltage (kJ)	415,0				

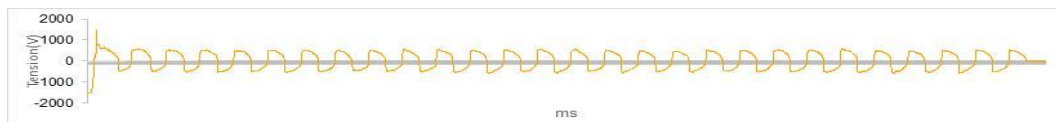
sensor response	PANEL A	PANEL C
Ei	23,47 cal/cm ²	23,77 cal/cm ²
SCD	0,16 cal/cm ²	-0,24 cal/cm ²
HAF	89,98 %	91,60 %

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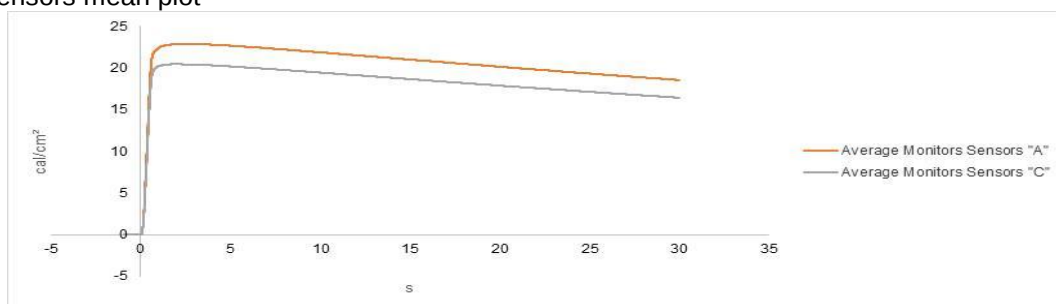
Shot 10
Current plot



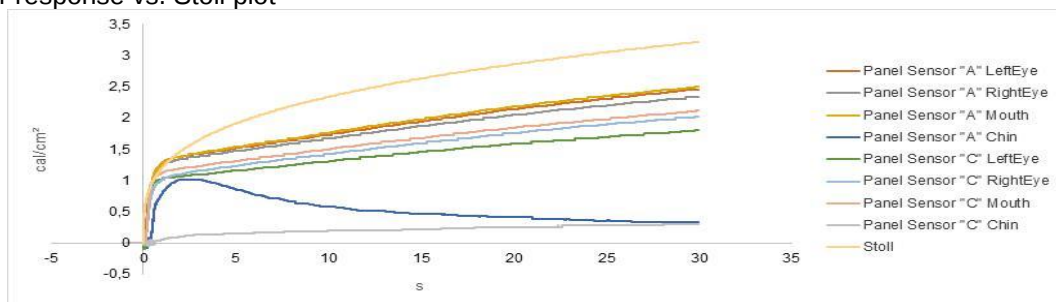
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot



Current Total RMS (kA)	7,9	Current Peak (kA)	16,3	Arc Voltage (V)	1524,0
Duration (cycles nº)	27,6	Duration (ms)	552,8	Arc Energy (kJ)	1677,4
Arc Voltage (kJ)	416,9				

sensor response	PANEL A	PANEL C
Ei	22,85 cal/cm ²	20,45 cal/cm ²
SCD	0,08 cal/cm ²	-0,07 cal/cm ²
HAF	89,07 %	89,65 %

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Tested material pictures:

Original



Shot 1



Shot 2



Shot 3



Shot 4



Shot 5



Shot 6



Shot 7



Shot 8



Shot 9



Shot 10



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Summary of results:

ARC RATING (ATPV)	22,4 cal/cm ²
HAF	92,2 %

Arc Flash PPE category according to standard NFPA70E Edition 2018 Table 130.7 (C) (16) - Personal Protective Equipment (PPE)

PPE Category	Minimum Arc Rating (cal/cm²)
1	4
2	8
3	25
4	40

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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.
- 2.- AITEX shall not be liable in any case of misuse of the test materials nor for undue interpretation or use of this document
- 3.- The Offer and / or Order to which the applicant gives approval through signature and seal, constitutes the Legally Executable Agreement in which AITEX is responsible for safeguarding and guaranteeing the absolute confidentiality of the management of all the information obtained or created during the performance of the contracted activities.
- 4.- In the eventuality of discrepancies between reports, a check to settle the same will be carried out in the head offices of AITEX. Also, the applicants undertake to notify AITEX of any complaint received by them as a result of the report, exempting this Centre from all liability if such is not done, the periods of conservation of the samples being taken into account.
- 5.- AITEX is not responsible for the information provided by customers, which is reflected in the Report, and may affect the validity of the results.
- 6.- AITEX will provide at the request of the person concerned, the treatment of complaints procedure.
- 7.- AITEX is not responsible for an inadequate state of the sample received that could compromise the validity of the results, expressing such circumstance, in the test reports.
- 8.- AITEX may include in its reports, analyses, results, etc., any other evaluation which it considers necessary, even when it has not been specifically requested.
- 9.- When a Declaration of Conformity is requested, if not indicated otherwise, the decision rule will be applied according to ILAC-G8 & ISO 10576-1, in case of ambiguity, or indeterminacy
- 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