TEST REPORT

2021CN0700

DATE OF RECEPTION
28/07/2021

DATE TESTS
Starting: 28/07/2021
Ending: 21/09/2021

APPLICANT

KUNSHAN SUNSHINETEX NEW MATERIAL CO. LTD.
No. 417 Sanxiang Road
CN-215300 Kunshan
JIANGSU

IDENTIFICATION AND DESCRIPTION OF SAMPLES

REFERENCES
FABRIC POBFC3DY-1

According to information supplied by the customer:

Fabric reference: POBFC3DY-1
Composition and percentage: 98% Polyester and 2% Carbon and 60% Protex and 40% Cotton
Color: Fluo Yellow / Fluo Orange

TESTS CARRIED OUT

- PHOTOGRAPHY.
- PRE-TREATMENT FOR DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING.
- HEAT RESISTANCE.
- LIMITED FLAME SPREAD.
- DETERMINATION OF DIMENSIONAL CHANGE IN DOMESTIC WASHING AND DRYING.
- DETERMINATION OF BREAKING STRENGTH AND ELONGATION.
- DETERMINATION OF TEAR RESISTANCE.
- VERTICAL RESISTANCE.
- ELECTRIC ARC TEST.

Asociación de Investigación de la Industria Textil – C.I.F.: G03182870

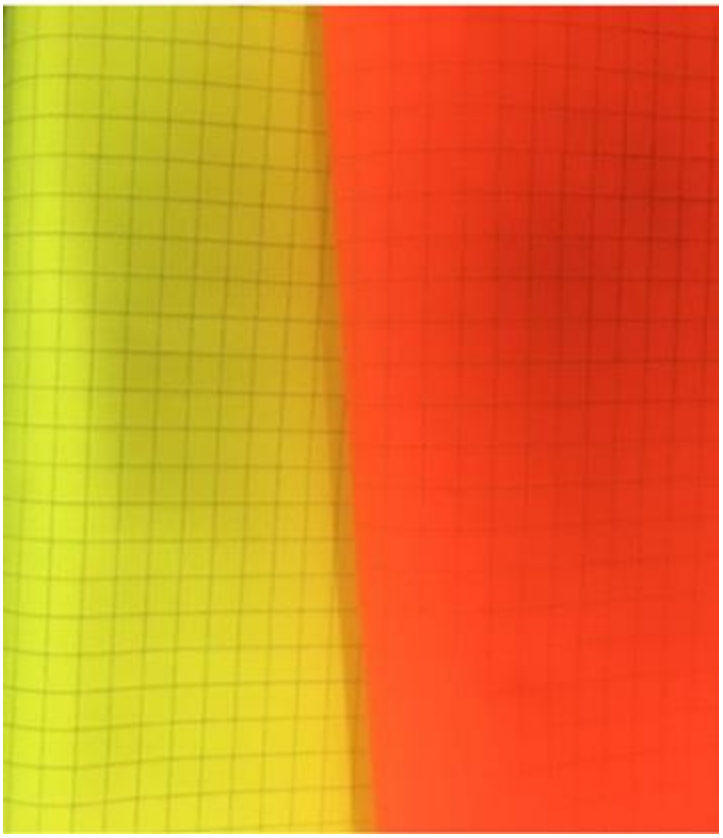
AITEX - Plaza Emilio Sala, 1 - E-03801 ALCOY (Alicante) SPAIN Tel.:+34 96 554 22 00 www.aitex.es info@aitex.es

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

ENAC ENSAYOS Nº12/LE025 Nº12/LE427

RESULTS

PHOTOGRAPHY



Reference

Fabric POBFC3DY-1

RESULTS

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

Standard
ISO 6330:2012

Standard deviation

Reference
Sample1 Fabric POBFC3DY-1

Units	1	2
Equipment	Wascator 13474E05	Wascator 13151E12
Dryer machine	JAMES HEAL 13475E05	ELECTROLUX 13426E12

Washing procedure 4N **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	0,950 Kg	1,000 Polyester	Wascator 13474E05
2	1,911 Kg		Wascator 13151E12

Start and finish date
11/08/2021 - 12/08/2021

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RESULTS

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

Standard
ISO 6330:2012

Standard deviation

Reference
Sample1 Fabric POBFC3DY-1

Units 1
Equipment Wascator 13370E12
Dryer machine ELECTROLUX 13426E12

Washing procedure 4N **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	0,020 Kg		1,900 Kg of Polyester	Wascator 13370E12

Start and finish date
11/08/2021 - 12/08/2021

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RESULTS

HEAT RESISTANCE

Standard
ISO 17493:2016

Apparatus
Air stove

Temperature
(180 ± 5) ºC

Length of the test
5 min (+0,15/-0) min

Deviation from the Standard

Pre-Treatment
5 washing cycles at 40ºC, according to standard EN ISO 6330:2012, method 4N and type F drying (tumble dry)

Tested material
Fluorescent orange woven fabric and white knitted fabric.

Reference
Fabric POBFC3DY-1

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RESULTS

Fabric				
Flame	Melting	Direction	Shrink(-) / Elongation(+)	
No	No	Warp		-2,9 %
		Weft		-3,8 %
No	No	Warp		-3,2 %
		Weft		-3,6 %
No	No	Warp		-2,9 %
		Weft		-3,4 %

Remark

The uncertainty of the assay of Heat Resistance is ±12% of the value measured, for a coverage factor of K=2 [95%].

PERFORMANCE LEVEL ACCORDING TO IEC 61482-2:2018	PASS

Requirements to meet according to IEC 61482-2:2018, point 4.3.1

No layer can ignite
No layer can melt
No layer shrinks more than 5%

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RESULTS

LIMITED FLAME SPREAD

Standard
EN ISO 15025:2016 (Method A)

Apparatus
Equipment for determination of limited flame spread 13008IE12

Original and after pre-treatment test date
18/08/2021 - 18/08/2021

Conditioned
24h in indoor ambient conditions at (20 ± 2) ºC and (65 ± 5) % RH

Original and after pre-treatment ambient conditions test
22,5ºC and 56,1% RH - 22,5ºC and 58,1% RH

Gas used
Propane gas

Deviation from the standard

Face exposed to the flame
Outer surface

Tested material
Fluorescent orange woven fabric and white knitted fabric.

Test uncertainty
The uncertainty of the assay of limited flame spread is ±2% of the value measured, for a coverage factor of K=2 (95%).

Reference
Fabric POBFC3DY-1

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RESULTS

Pre-Treatment 5 washing cycles at 40ºC, according to standard EN ISO 6330:2012, method 4N and type F drying (tumble dry)

Specimen	1	2	3	4	5	6
Direction		Warp			Weft	
Flaming to top or either side edge	No	No	No	No	No	No
After flame time (s)	0	0	0	0	0	0
Afterglow time (s)	0	0	0	0	0	0
Melting	No	No	No	No	No	No
Loose waste	No	No	No	No	No	No
Inflammation of the filter paper detached from waste	No	No	No	No	No	No
Hole formation	No	No	No	No	No	No

PERFORMANCE LEVEL ACCORDING IEC 61482-2:2018	PASS

Requisites to be met according to IEC 61482-2:2018, point 4.3.3.2. Table 1 – Single-layer material

a) No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
b) No specimen shall give flaming or molten debris.
c) No specimen shall give hole formation of 5 mm or greater in any direction.
d) The afterglow time is ≤ 2 s
e) The afterflame time is ≤ 2 s

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RESULTS

DETERMINATION OF DIMENSIONAL CHANGE IN DOMESTIC WASHING AND DRYING

Standard
EN ISO 5077:2008

Standard deviation

Preparation, marking and measuring of fabric specimens according to EN ISO 3759:2011
Starting test date 10/08/2021 **Ending test date** 18/08/2021

Washing procedure
4N (T^a = 40 ± 3ºC; Total dry load test samples and the counterweight 2 ± 0.1 Kg) according to ISO 6330:2012

Used apparatus
Wascator type A-Horizontal drum, front loading (13474E05)

Detergent
98 ECE reference detergent without optical brightener.

Counterweight
Type III - 100% polyester

Number of washing cycles
5

Dryer type
A3

Procedure F – Tumble dry(13475E05)

Uncertainty of test (% of the measured value)
± 0.5 %

Tested material
Fluorescent orange woven fabric

Reference	Specimen	Direction	Dimensional change (%)
Fabric POBFC3DY-1	1	Warp	-1,5
		Weft	-0,5

REMARK
Negative dimensional change indicates shrinkage
Positive dimensional change indicates lengthening

REQUISITE
In accordance with the Standard IEC 61482-2:2018, the dimensional change of knitted fabrics shall not exceed ±5%, both in width Crosswise and in length Lengthwise.

PASS

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RESULTS

DETERMINATION OF BREAKING STRENGTH AND ELONGATION

Standard
EN ISO 13934-1:2013

Apparatus
INSTRON Dynamometer

Conditioning date 12/08/2021 **Test date** 17/09/2021

Atmosphere for conditioning testing
Temperature (20±2) ºC **Relative humidity** (65±4) %

Gauge length
Warp 200 mm. **Weft** 200 mm.

Test velocity
Warp 100 mm/min **Weft** 100 mm/min

Pretension
Warp 5 N **Weft** 5 N

Nº of specimens
Tested 5 for each direction **Rejected** 0
State of the specimens Conditioned

Previous treatment
5 washing cycles at 40ºC, according to standard EN ISO 6330:2012, method 4N and type F drying (tumble dry)

Reference
Fabric POBFC3DY-1

Direction	Maximum average load (N)	C.V. (%)	Average elongation (%)	C.V. (%)
Warp	820 740 810 790 760 820	4.8	21 20 20 20 21 20	4.0
Weft	670 650 600 620 680 480	13.0	20 20 18 19 20 15	11.0

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RESULTADOS / *RESULTS*

Remark

The relative expanded uncertainty of Tensile strength resistance is ±5% assay value of the measured, for a probability of coverage of 95%.

The test procedure described in the two versions of the Standard (EN ISO 13934-1:1999 and EN ISO 13934-1:2013) is the same.

REQUISITE ACCORDING TO STANDARD IEC 61482-2:2018

The woven or laminated outer material must have a tensile strength of at least 400 N for a weight greater than 220 g/m^2 or at least 250 N for a weight of 220 g/m^2 or less, in both directions

PASS

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RESULTS

DETERMINATION OF TEAR RESISTANCE

Standard
EN ISO 13937-2:2000

Apparatus
INSTRON Dynamometer

Conditioning date 13/08/2021 **Test date** 17/09/2021

Atmosphere for conditioning testing
Temperature (20±2) ºC **Relative humidity** (65±5) %

Nº of specimens
Tested 5 for each direction **Rejected** 0

The calculation of averages has been made
For electronic device

Previous treatment
5 washing cycles at 40ºC, according to standard EN ISO 6330:2012, method 4N and type F drying (tumble dry)

Reference
Fabric POBFC3DY-1

Tear	Average load (N)	C.V. (%)
Warp	41 40 38 38 36 38	4.8
Weft	27 29 24 26 25 25	7.3

Remark
The relative expanded uncertainty of Tear resistance is ±3.9% assay value of the measured, for a probability of coverage of 95%.

REQUISITE ACCORDING TO STANDARD IEC 61482-2:2018
The woven outer material shall have a tear resistance of at least 15 N for weight higher than 220 g/m^2 or at least 10 N for a weight of 220 g/m^2 or less, in both directions

PASS

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RESULTS

VERTICAL RESISTANCE

Standard
EN 1149-2:1997

Conditioned
24h in indoor ambient conditions at (23 ± 1) ºC and (25 ± 5) % RH according to standard EN 1149-5:2008

Ambient conditions test
23,0 ºC and 25,4

Radius of the inner electrode
50,4 mm

Inner radius of the outer electrode
69,2 mm

Outer radius of the outer electrode
89,0 mm

Contact pressure
2,25 kPa

Potential applied
100 V

Current measurement after
15 s

Test date
17/08/2021

Deviation from the standard

Tested material
Fluorescent orange woven fabric and white knitted fabric.

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RESULTS

Pre-Treatment

5 washing cycles at 40ºC, according to the standard ISO 6330:2012, method 4N, F drying (tumble dryer)

Reference

Fabric POBFC3DY-1

Specimen		Vertical Resistance (Ohm)
	1	$6,25 \cdot 10^{10}$
	2	$4,73 \cdot 10^{11}$
	3	$2,51 \cdot 10^{11}$
	4	$2,43 \cdot 10^{11}$
	5	$9,78 \cdot 10^{10}$
Classification value		$\mathbf{6,25 \cdot 10^{10}}$
Average (Ohm)		$\mathbf{2,25 \cdot 10^{11}}$

The uncertainty of the assay of Vertical Resistance is ±20% of the value measured, for a coverage factor of K=2 (95%)

ACCORDING TO STANDARD IEC 61482-2:2018 PASS

REQUIREMENT

According to the Standard IEC 61482-2:2018, point 4.3.2, the vertical resistance must be at least than $10^5\Omega$.

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RESULTS

ELECTRIC ARC TEST

Standard	EN 61482-1-2: 2014 equivalent to IEC 61482-1-2: 2014
Principle of the Box test method	Determine the behaviour of materials against to thermal risk when exposed to heat energy from electric arc with specific characteristics Materials performance for this procedure is determined from the amount of the heat transmitted through the specimen and other thermal parameters
Sample type	Knitted fabric, orange colour with a weight does not provided by the customer

Test conditions	
Class	Class 2
Testing atmosphere	24,98 ºC 44,16 % RH
Test current I_{class} for class 2	7 kA ± 5%
Calibration test current	6830,05 A
Average direct exposure incident energy E_{io}	125,64 kJ/m^2
Arc duration	500 ms ± 5%
Average real arc duration	477,8 ms
Test voltage	400 V ± 5%
Average real test voltage	393,82 V
Average real Arc Energy W_{arc}	325,74 kJ

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RESULTS

ELECTRIC ARC TEST

Test conditions	
Gap between electrodes	(30 ± 1) mm
Distance between the electrodes and sample	(300 ± 5) mm

Electrodes type
Electrodes Cu/Al

Measurement uncertainty

Temperature	17% of the measured value in ºC
Equivalent energy	17% of the measured value in kJ/m^2
Time	± 0,390 s

Technician performing the test
David Lazaro

Person verifying the test report
Lucía Martinez

Pre-treatment
5 washing cycles at 40ºC, according to standard EN ISO 6330:2012, method 4N; and F drying

Pre-conditioning of the test specimens
24h. in indoor ambient conditions between (18-28)ºC and between (45-75)% RH

Starting and ending pre-conditioning date
24/08/2021 - 27/08/2021

Observation or deviation of the standard

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RESULTS

ELECTRIC ARC TEST

Testing date 27/08/2021
Reference Fabric POBFC3DY-1

VISUALLY OBTEINED DATA

Property	Measurement	Specimen 1
	Class	2
Burning time	Video	0,00 s
Hole formation >5mm	Visual	No
Melting through to the inner side	Visual	No
Embrittlement	Visual	No
Damage on the outside	Visual	No
Charring on the outside	Visual	Yes
Dripping	Visual	No
Shrinkage	Calculated	No

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RESULTS

ELECTRIC ARC TEST

Reference
Fabric POBFC3DY-1

COMPUTER OBTEINED DATA

Class 2	
Property	**Specimen 1**
Transmitted incident energy E_{it}	159,44 kJ/m^2
Time to delta peak temperature t_{max}	29,96 s
Delta peak temperature ΔT_p	28,88 ºC
Differences ΔEi of the transmitted energy values to the Stoll limit value at t_{max}	24,83 kJ/m^2
Maximum difference between the transmitted energy E_{it} to the Stoll energy E_{iSTOLL} in t_i (1)	37,14 kJ/m^2
Excess of the Stoll curve by the heat curve of the transmitted incident energy E_{it} (t)	Yes

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RESULTS

ELECTRIC ARC TEST

Remark

t_i is the time where the difference between the transmitted incident energy E_{it} and the Stoll Energy E_{iSTOLL} is maximum.

(1) Interpretation: In negative value, a higher difference implies a better behavior. In positive value, a less difference implies a better behavior, considering that the material fails the test.

Requirement for the standard compliance EN 61482-1-2:2014

a) Burning time ≤ 5 s.
b) No melting through to the inner side.
c) No hole bigger than max. 5 mm. in any direction in the innermost layer.
d) All four pairs of values (E_{it} - t_{max}) are below corresponding Stoll values, and all four heat curves E_{it} (t) of transmitted energy are at any moment of time “t” of the exposure period below Stoll curve.

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RESULTS

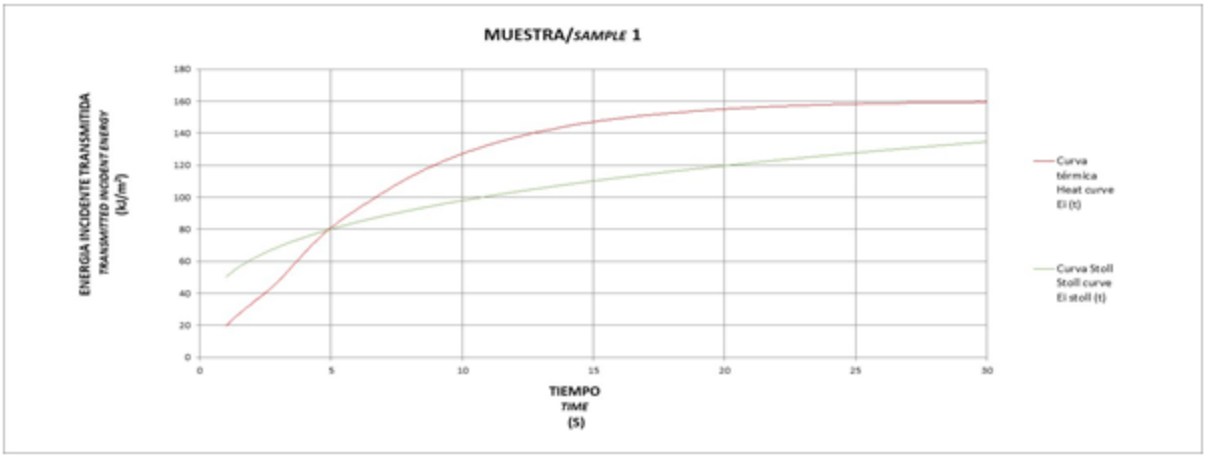
ELECTRIC ARC TEST

STOLL CURVES

Specimen 1

Reference

1- Fabric POBFC3DY-1



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RESULTS

ELECTRIC ARC TEST

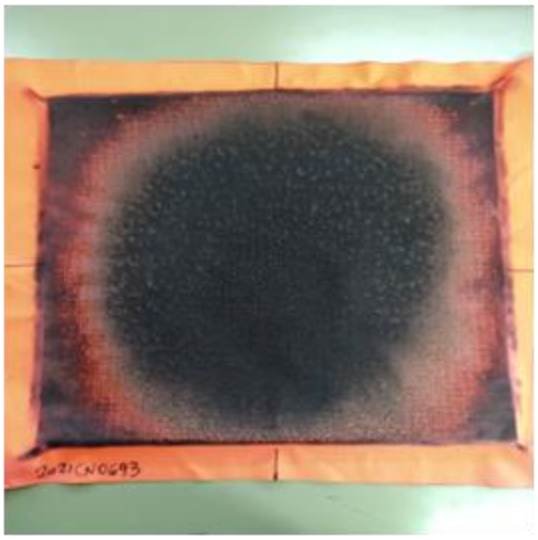
Reference

Fabric POBFC3DY-1

Original material



Tested material



Remark

The electric arc test is performed in: Cr. Villaviciosa de Odón a Móstoles (M-856) Km. 1,5 Móstoles 28935.

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RESULTS

ELECTRIC ARC TEST

Standard	EN 61482-1-2: 2014 equivalent to IEC 61482-1-2: 2014
Principle of the Box test method	Determine the behaviour of materials against to thermal risk when exposed to heat energy from electric arc with specific characteristics Materials performance for this procedure is determined from the amount of the heat transmitted through the specimen and other thermal parameters
Sample type	Knitted fabric, orange colour with a weight does not provided by the customer

Test conditions	
Class	Class 1
Testing atmosphere	24,98 ºC 44,16 % RH
Test current I_{class} for class 1	4 kA ± 5%
Calibration test current	4019,85 A
Average direct exposure incident energy E_{io}	125,64 kJ/m^2
Arc duration	500 ms ± 5%
Average real arc duration	478,1 ms
Test voltage	400 V ± 5%
Average real test voltage	388,73 V
Average real Arc Energy W_{arc}	172,21 kJ

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RESULTS

ELECTRIC ARC TEST

Test conditions	
Gap between electrodes	(30 ± 1) mm
Distance between the electrodes and sample	(300 ± 5) mm

Electrodes type
Electrodes Cu/Al

Measurement uncertainty

Temperature	17% of the measured value in ºC
Equivalent energy	17% of the measured value in kJ/m^2
Time	± 0,390 s

Technician performing the test
David Lazaro

Person verifying the test report
Lucía Martinez

Pre-treatment
5 washing cycles at 40ºC, according to standard EN ISO 6330:2012, method 4N; and F drying

Pre-conditioning of the test specimens
24h. in indoor ambient conditions between (18-28)ºC and between (45-75)% RH

Starting and ending pre-conditioning date
24/08/2021 - 27/08/2021

Observation or deviation of the standard

>>>

RESULTS

ELECTRIC ARC TEST

Testing date 27/08/2021
Reference Fabric POBFC3DY-1

VISUALLY OBTEINED DATA

Property	Measurement	Specimen 1	Specimen 2	Specimen 3	Specimen 4
	Class	1	1	1	1
Burning time	Video	0,00 s	0,00 s	0,00 s	0,00 s
Hole formation >5mm	Visual	No	No	No	No
Melting through to the inner side	Visual	No	No	No	No
Embrittlement	Visual	No	No	No	No
Damage on the outside	Visual	No	No	No	No
Charring on the outside	Visual	Yes	Yes	Yes	Yes
Dripping	Visual	No	No	No	No
Shrinkage	Calculated	No	No	No	No

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RESULTS

ELECTRIC ARC TEST

Reference
Fabric POBFC3DY-1

COMPUTER OBTEINED DATA

Class 1				
Property	**Specimen 1**	**Specimen 2**	**Specimen 3**	**Specimen 4**
Transmitted incident energy E_{it}	50,77 kJ/m^2	54,79 kJ/m^2	62,28 kJ/m^2	53,26 kJ/m^2
Time to delta peak temperature t_{max}	29,83 s	29,96 s	29,96 s	29,96 s
Delta peak temperature ΔT_p	9,20 ºC	9,92 ºC	11,28 ºC	9,65 ºC
Differences ΔEi of the transmitted energy values to the Stoll limit value at t_{max}	-83,67 kJ/m^2	-79,82 kJ/m^2	-72,33 kJ/m^2	-81,35 kJ/m^2
Maximum difference between the transmitted energy E_{it} to the Stoll energy E_{iSTOLL} in t_i (1)	-42,78 kJ/m^2	-41,35 kJ/m^2	-41,74 kJ/m^2	-42,44 kJ/m^2
Excess of the Stoll curve by the heat curve of the transmitted incident energy E_{it} (t)	No	No	No	No

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RESULTS

ELECTRIC ARC TEST

Remark

t_i is the time where the difference between the transmitted incident energy E_{it} and the Stoll Energy E_{iSTOLL} is maximum.

(1) Interpretation: In negative value, a higher difference implies a better behavior. In positive value, a less difference implies a better behavior, considering that the material fails the test.

IN ACCORDANCE WITH THE ACEPTANCE CRITERIA ACCORDING TO EN 61482-1-2:2014, FOR CLASS 1

PASS

Requirement for the standard compliance EN 61482-1-2:2014

a) Burning time ≤ 5 s.
b) No melting through to the inner side.
c) No hole bigger than max. 5 mm. in any direction in the innermost layer.
d) All four pairs of values (E_{it} - t_{max}) are below corresponding Stoll values, and all four heat curves E_{it} (t) of transmitted energy are at any moment of time “t” of the exposure period below Stoll curve.

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RESULTS

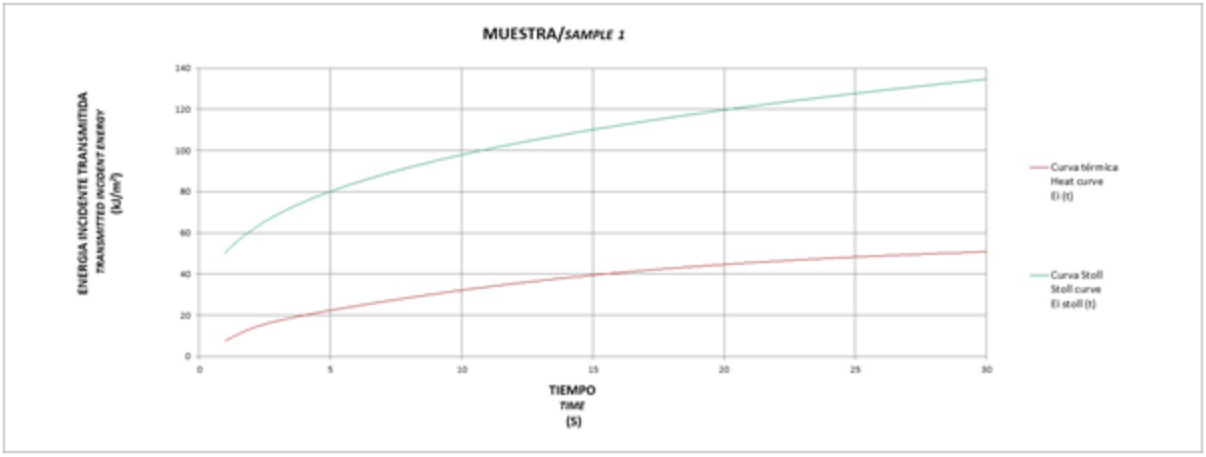
ELECTRIC ARC TEST

STOLL CURVES

Specimen 1

Reference

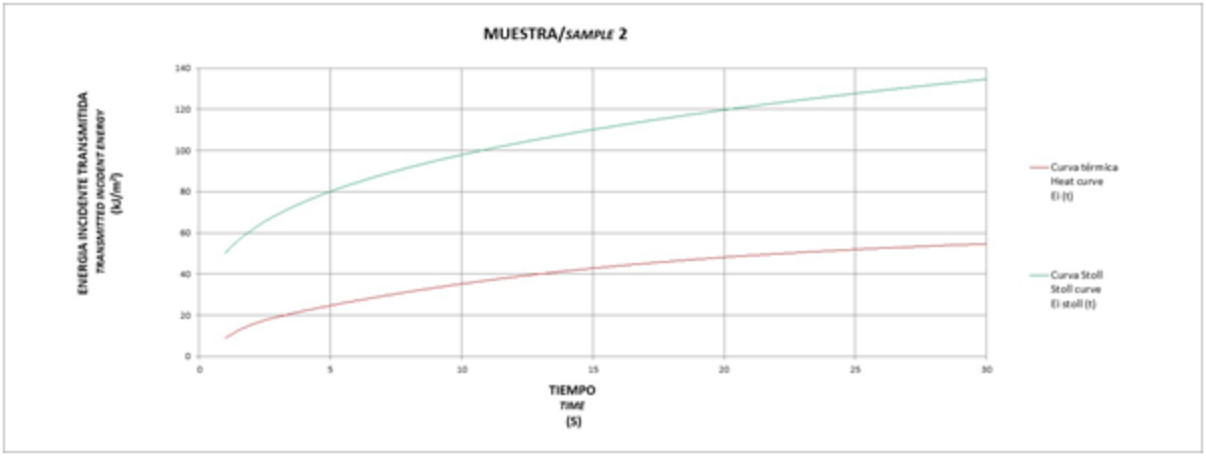
1- Fabric POBFC3DY-1



Specimen 2

Reference

2- Fabric POBFC3DY-1



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RESULTS

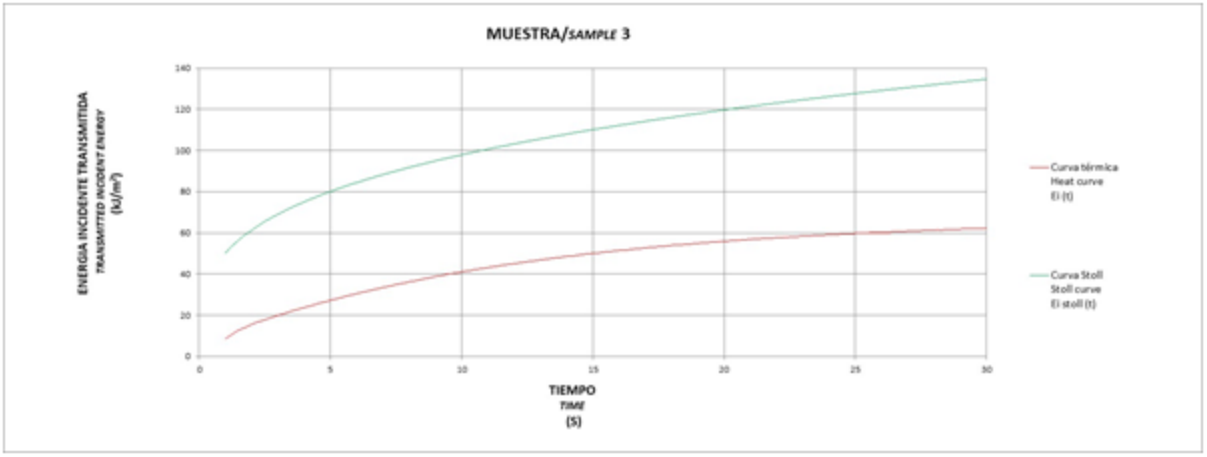
ELECTRIC ARC TEST

STOLL CURVES

Specimen 3

Reference

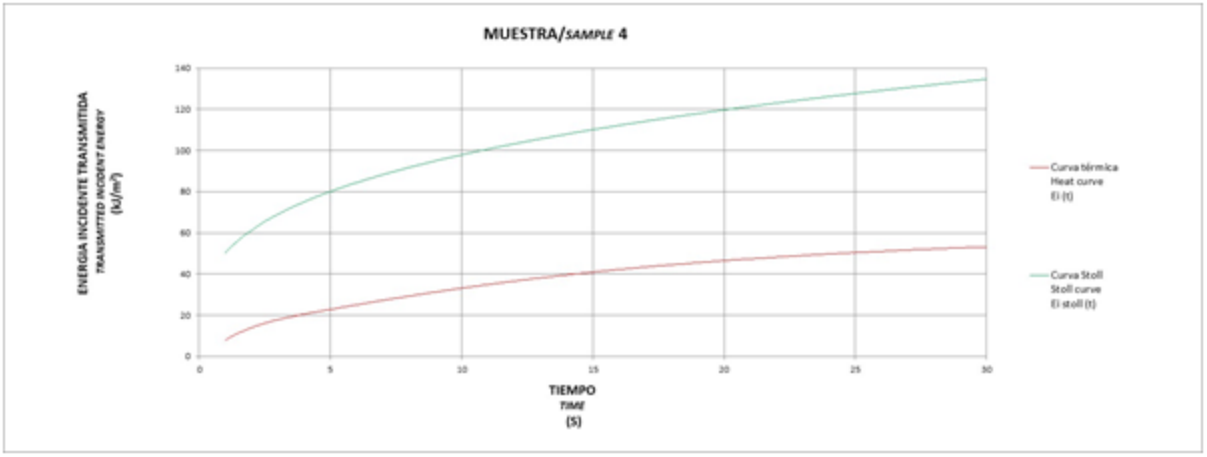
3- Fabric POBFC3DY-1



Specimen 4

Reference

4- Fabric POBFC3DY-1



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RESULTS

ELECTRIC ARC TEST

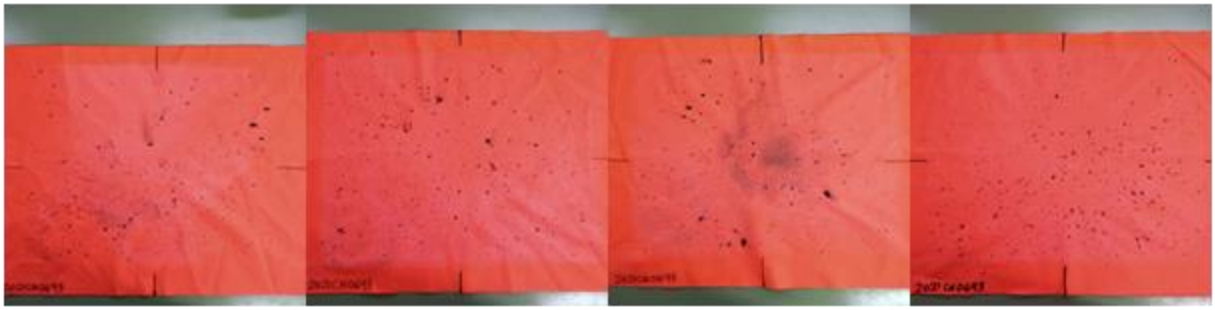
Reference

Fabric POBFC3DY-1

Original material



Tested material



Remark

The electric arc test is performed in: Cr. Villaviciosa de Odón a Móstoles (M-856) Km. 1,5 Móstoles 28935.

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Lucia Martinez
Head of PPE and Ballistics department

Digitally signed by ISABEL LLOPIS LUMBRERAS - NIF:21678551Q
Date: 2021.10.06 16:45:19 +02:00
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Location: Alcoy

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