

TEST REPORT

2021EP0973

DATE OF RECEPTION

24/03/2021

DATE TESTS

Starting: 24/03/2021

Ending: 17/06/2021

APPLICANT

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IDENTIFICATION AND DESCRIPTION OF SAMPLES

REFERENCES

LU-FRA WORKSUIT CLASS 2

TESTS CARRIED OUT

- PHOTOGRAPHY.
- ERGONOMICS.
- SIZING.
- SPECIFIC DESIGN REQUIREMENTS.
- PRE-TREATMENT FOR DOMESTIC WASHING AND DRYING PROCEDURES FOR TEXTILE TESTING.
- HEAT RESISTANCE.
- LIMITED FLAME SPREAD.
- SEAM STRENGTH RESISTANCE.
- DETERMINATION OF TEMPERATURE AND ENTHALPY OF MELTING.
- VERTICAL RESISTANCE.
- MASS PER UNIT AREA.
- DURABILITY OF MARKING.
- ELECTRIC ARC TEST.
- DETERMINATION OF RETROREFLECTIVE PHOTOMETRIC PERFORMANCE.

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



RESULTS

PHOTOGRAPHY



Reference ⁽¹⁾
LU-FRA WORKSUIT CLASS 2

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RESULTS

ERGONOMICS

Standard

EN ISO 13688:2013

Reference

LU-FRA WORKSUIT CLASS 2

Test date

17/06/2021

Remark

The ergonomics verification has been performed by physical dimensions commensurate with the size found.

According to the inspection of the garment, this fulfills ergonomics requirement.

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RESULTS

SIZING

Standard

EN ISO 13688:2013 Apdo. 6

Test uncertainty

The test uncertainty is $\pm 1\%$ of the measurand's value, for a coverage value of $K=2$ (95%)

Size

S

Reference		Bust girth (cm)	Arm height (cm)	Back height (cm)
LU-FRA CLASS 2	WORKSUIT	118,0	63,0	77,0

Size

S

Reference		Total height (cm)	Waist girth (cm)	Stretched waist (cm)
LU-FRA CLASS 2	WORKSUIT	109,0	82,0	98,0

Start and finish test date

07/05/2021 - 07/05/2021

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RESULTS

SPECIFIC DESIGN REQUIREMENTS

REFERENCE

LU-FRA WORKSUIT CLASS 2

STANDARD

EN ISO 13688:2013

DESIGN REQUIREMENTS

The protection clothing design makes easy its correct placement and wearing staying with no movement during the use period intended.	PASS
The design of the protective clothing applies elements from other protective or equipment clothing, which are used to create a comprehensive protective outfit.	PASS
The clothing has no rough, sharp or hard surfaces or edges that could damage or irritate the user.	PASS
The clothing is not enough narrow for causing flow blood restriction.	PASS
The clothing is not enough loose and heavy for interfering the user's movement.	PASS

Remark

N/A: Not applicable

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RESULTS

SPECIFIC DESIGN REQUIREMENTS

REFERENCE

LU-FRA WORKSUIT CLASS 2

STANDARD

EN ISO 11612:2015

DESIGN REQUIREMENTS

The garment sizing is in accordance with the requisites of the ISO 13688 guideline.	PASS
The garment is a two piece suit with a jacket and trouser that completely covers the upper and lower parts of the torso, neck, arms and legs.	PASS
The jacket is long enough to overlap the upper part of the trouser. This overlap is maintained when one standing wearer firstly fully extends both arms above the head and then bends over until the fingertips touch the ground.	PASS
The garment (jacket, trouser, hood, sleeve, apron or gaiter) is designed to protect specific parts of the body and to be used alongside other protective suits that completely cover the upper and lower parts of the torso, neck, arms and legs.	N/A
The pockets/inside pockets fulfil the requisites of the A and B limited flame spread tests given that they are made from the same material as the main material used on the garment.	PASS
All openings the pockets in garments shall be designed in such a way to prevent entry of heat, flame, or hot material. Front openings should be capable of being closed over the entire length by appropriate overlapping.	PASS
Trouser bottoms shall overlap the top of the footwear and this overlap should be maintained while walking and crawling.	PASS
It has quick-release fasteners.	PASS
The wrists, lower arms and ankles shall remain covered in an upright position.	PASS
The hard accessories connected to the outside of the garment do not reach the innermost layer of the clothing.	PASS

Remark

N/A: Not applicable

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RESULTS

SPECIFIC DESIGN REQUIREMENTS

REFERENCE

LU-FRA WORKSUIT CLASS 2

STANDARD

EN 1149-5:2018

DESIGN REQUIREMENTS

Electrostatic dissipative protective clothing shall permanently cover all non-complying materials during normal use (inclusive of bending and movements)	PASS
Garment shall provide proper fitting with sizing according to EN ISO 13688, and shall allow full body movement with all closures fastened according to manufacturer's instructions.	PASS
Conductive parts (slide fasteners, buttons, etc.) are permitted provided they are fully covered by the outermost electrostatic dissipative materials when in use.	PASS
Non-dissipative attachments to the outside of garments, such as labels, reflective stripes, etc., are permitted without length restriction providing they do not exceed 50 mm in width and are permanently attached to electrostatic dissipative materials. Non-dissipative attachments to the outside of garments greater in width than 50 mm shall be restricted to a maximum area of 10 000 mm ² , and shall be permanently attached to electrostatic dissipative materials.	PASS
Any hood that has a non-dissipative material that is exposed when the hood is not worn shall be capable of being removed or stowed within the garment such that non-dissipative materials are covered by dissipative materials.	N/A
Exposed cords shall not exceed 20 mm in width.	N/A
Attachments to the outside of garments greater in thickness, width or area than the specified limits are only permitted if test data are available to prove incendiary discharges cannot occur under worst case conditions. Users are recommended to take expert advice to select and conduct suitable testing and test conditions.	PASS
Attachment to the outside of garments shall be done in such a way that separation between the attached elements and the electrostatic dissipative material is avoided.	PASS

Remark

N/A: Not applicable

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RESULTS

SPECIFIC DESIGN REQUIREMENTS

REFERENCE

LU-FRA WORKSUIT CLASS 2

STANDARD

IEC 61482-2:2018

DESIGN REQUIREMENTS

The garment is designed to allow the user to carry out their work without being impeded in any way.	PASS
The garment has long sleeves to protect the upper part of the body to provide full coverage to the wrists.	PASS
The garment provides coverage up to the neck.	PASS
The trousers provide full coverage from the waist to the ankles.	PASS
The garment's fasteners are designed to open properly after having been accidentally exposed to an arc.	PASS
The threads, accessories and fasteners used to manufacture the garment do not add to the serious harm experienced by the user in the case of a temporary thermal explosion of an electric arc.	PASS
The metal accessories are allowed given that they are not exposed on the outside of the garment. The metals and/or parts connected to the outside of the garment do not reach the innermost layer of the clothing.	PASS
All the garment parts are made from materials that are resistant to an electric arc of the same characteristics used in the test, in accordance with the EN 61482-1-2:2014 APC 2 (7kA) test guideline.	PASS
The seam threads used when making the garments are inert, flame resistant fibres, which don't melt when tested at 260°C in accordance with the ISO 3146 guideline (heat resistance).	PASS
Whilst being used, the protective clothing conserves its arc thermal properties when it is cleaned by following the instructions.	PASS
The PPE, given that it is comprised of a set of protective clothing garments against arc heat, has been tested and fulfils the requirements of the guideline.	PASS

Remark

N/A: Not applicable

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RESULTS

SPECIFIC DESIGN REQUIREMENTS

REFERENCE:

LU-FRA WORKSUIT CLASS 2

STANDARD

EN 17353:2020

DESIGN REQUIREMENTS

Type B2 – Equipment for the limbs

To ensure 360° visibility, one or more devices shall be applied to each upper and/or each lower limb.	PASS
When retroreflective material is applied to a garment it shall also be positioned to achieve 360° visibility. The material shall be placed on the limbs so as to ensure a minimum width of 20mm encircling each limb.	PASS
Separate retroreflective elements may form part of an applied design in conjunction with the above.	PASS
Any gap in the lengthwise continuity of the retroreflective material shall not be greater than 50 mm, measured parallel to the direction of the material, and the total of such gaps shall not be greater than 50 mm around the limbs. Any offset not greater than the width of the material plus 5 mm is allowed.	PASS
In the case of B2 garments covering upper and lower limbs, the retroreflective material can be applied on the upper limbs only, on the lower limbs only or on both the upper and lower limbs. In the latter case, the minimum amount of Table 2 shall be used for upper limbs and also for the lower limbs.	PASS

Remark

N/A: Not applicable

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RESULTS

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

Standard

ISO 6330:2012

Standard deviation

Reference

Sample1 LU-FRA WORKSUIT CLASS 2

Units	1	2	3	4	5
Equipment	Wascator 13337E12	Wascator 13492E12	Wascator 13474E05	Wascator 13474E05	Wascator 13096E12

Washing procedure 4N **Washing cycles** 5

Drying procedure

C (horizontal)

Washing powder

ECE detergent 98 + sodium perborate + TAED

Units	Dry mass of the samples	Counterweight mass	Equipment
1	2.10 Kg	---	Wascator 13337E12
2	1.74 Kg	0,30 Kg of Polyester	Wascator 13492E12
3	1.94 Kg	---	Wascator 13474E05
4	1.84 Kg	0,20 Kg of	Wascator 13474E05
5	2.06 Kg	---	Wascator 13096E12

Start and finish date

06/04/2021 - 08/04/2021

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RESULTS

HEAT RESISTANCE

Standard

ISO 17493:2016

Apparatus

Air stove

Temperature

(180 ± 5) °C

Length of the test

5 min (+0,15/-0) min

Deviation from the Standard

Pre-Treatment

5 washing cycles at 40°C, according to standard EN ISO 6330:2012, method 4N and type C drying (flat dry)

Tested material

Hardware: Plastic zipper with metallic cursor, elastic (jacket), plastic button, elastic trouser, hook and loop tape, reflective tape.

Reference

LU-FRA WORKSUIT CLASS 2

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RESULTS

Accessories				
Hardware	Flame	Melting	Separation	Hardware work correctly
Plastic zipper with metallic cursor	No	No	No	Yes
Elastic (Jacket)	No	No	No	Yes
Plastic button	No	No	No	Yes
Elastic trouser	No	No	No	Yes
Hook and loop tape	No	No	No	Yes
Reflective tape	No	No	No	---

Test uncertainty

The uncertainty of the assay of heat resistance is $\pm 12\%$ of the value measured, for a coverage factor of $K=2$ (95%)

PERFORMANCE LEVEL ACCORDING TO EN ISO 11612:2015 PASS

Requirements to meet according to EN ISO 11612:2015

No hardware/strip/seam shall ignite or melt

Closures opens

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RESULTS

LIMITED FLAME SPREAD

Standard

EN ISO 15025:2016 (Method B)

Apparatus

Equipment for determination of limited flame spread 13008IE12

Original and after pre-treatment test date

06/05/2021 - 06/05/2021

Conditioned

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

Original and after pre-treatment ambient conditions test

25,5°C and 42,2% RH - 25,3°C and 41,7% RH

Gas used

Propane gas

Deviation from the standard

Face exposed to the flame

Edge: Garment specimen

Tested material

Navy blue woven fabric (trouser).

Reference

LU-FRA WORKSUIT CLASS 2

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RESULTS

Pre-Treatment As received

Specimen	1	2	3
Flaming to top or either side edge	No	No	No
After flame time (s)	0	0	0
Afterglow time (s)	0	0	0
Loose waste	No	No	No
Inflammation of the filter paper detached from waste	No	No	No

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

Specimen	1	2	3
Flaming to top or either side edge	No	No	No
After flame time (s)	0	0	0
Afterglow time (s)	0	0	0
Loose waste	No	No	No
Inflammation of the filter paper detached from waste	No	No	No

Remark

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

PERFORMANCE LEVEL ACCORDING TO EN ISO 11612:2015 A2

Requirements to be met according to standard EN ISO 11612:2015

a) No specimen must ignite toward the top or toward the edges
b) No specimen shall give flaming or molten debris
c) The afterflame time is ≤ 2 s
d) The afterglow time is ≤ 2 s

///



RESULTS

LIMITED FLAME SPREAD

Standard

EN ISO 15025:2016 (Method B)

Apparatus

Equipment for determination of limited flame spread 13008IE12

Original and after pre-treatment test date

06/05/2021 - 06/05/2021

Conditioned

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

Original and after pre-treatment ambient conditions test

25,2°C and 40,3% RH - 25,3°C and 41,2% RH

Gas used

Propane gas

Deviation from the standard

Face exposed to the flame

Edge: Garment specimen

Tested material

Navy blue woven fabric (cuff).

Reference

LU-FRA WORKSUIT CLASS 2

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RESULTS

Pre-Treatment As received

Specimen	1	2	3
Flaming to top or either side edge	No	No	No
After flame time (s)	0	0	0
Afterglow time (s)	0	0	0
Loose waste	No	No	No
Inflammation of the filter paper detached from waste	No	No	No

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

Specimen	1	2	3
Flaming to top or either side edge	No	No	No
After flame time (s)	0	0	0
Afterglow time (s)	0	0	0
Loose waste	No	No	No
Inflammation of the filter paper detached from waste	No	No	No

Remark

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

PERFORMANCE LEVEL ACCORDING TO EN ISO 11612:2015 A2

Requirements to be met according to standard EN ISO 11612:2015

- | |
|---|
| a) No specimen must ignite toward the top or toward the edges |
| b) No specimen shall give flaming or molten debris |
| c) The afterflame time is ≤ 2 s |
| d) The afterglow time is ≤ 2 s |

///



RESULTS

LIMITED FLAME SPREAD

Standard

EN ISO 15025:2016 (Method A)

Apparatus

Equipment for determination of limited flame spread 13008IE12

After pre-treatment test date

06/05/2021

Conditioned

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

Ambient conditions test

24,7°C and 39,8% RH

Gas used

Propane gas

Deviation from the standard

Face exposed to the flame

Surfaces: Outer

Tested material

Seams.

Reference

LU-FRA WORKSUIT CLASS 2

----->>>



RESULTS

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

Specimen	1	2	3
Flaming to top or either side edge	No	No	No
Post- After flame (s)	0	0	0
Afterglow time (s)	0	0	0
Melting	No	No	No
Loose waste	No	No	No
Inflammation of the filter paper detached from waste	No	No	No
Seams separation	No	No	No

Remark

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

PERFORMANCE LEVEL ACCORDING TO EN ISO 11612:2015 A1

Requirements to be met according to standard EN ISO 11612:2015

a) No specimen must ignite toward the top or toward the edges
b) No specimen shall give hole formation of 5 mm or greater in any direction
c) No specimen shall give flaming or molten debris
d) The afterflame time shall be ≤ 2 s
e) The afterglow time shall be ≤ 2 s
f) Seams do not separate

///



RESULTS

LIMITED FLAME SPREAD

Standard

EN ISO 15025:2016 (Method B)

Apparatus

Equipment for determination of limited flame spread 13008IE12

After pre-treatment test date

06/05/2021

Conditioned

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

Ambient conditions test

24,7°C and 39,8% RH

Gas used

Propane gas

Deviation from the standard

Face exposed to the flame

Edge: Garment specimen

Tested material

Seams.

Reference

LU-FRA WORKSUIT CLASS 2

----->>>



RESULTS

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

Specimen	1	2	3
Flaming to top or either side edge	No	No	No
Post- After flame (s)	0	0	0
Afterglow time (s)	0	0	0
Melting	No	No	No
Loose waste	No	No	No
Inflammation of the filter paper detached from waste	No	No	No
Seams separation	No	No	No

Remark

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

PERFORMANCE LEVEL ACCORDING TO EN ISO 11612:2015 A2

Requirements to be met according to standard EN ISO 11612:2015

a) No specimen must ignite toward the top or toward the edges
b) No specimen shall give hole formation of 5 mm or greater in any direction
c) No specimen shall give flaming or molten debris
d) The afterflame time shall be ≤ 2 s
e) The afterglow time shall be ≤ 2 s
f) Seams do not separate

///



RESULTS

LIMITED FLAME SPREAD

Standard

EN ISO 15025:2016 (Method A)

Apparatus

Equipment for determination of limited flame spread 13008IE12

After pre-treatment test date

06/05/2021

Conditioned

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

Ambient conditions test

24,6°C and 39,1% RH

Gas used

Propane gas

Deviation from the standard

Face exposed to the flame

Surface: Outer

Tested material

Hardware: Plastic zipper with metallic cursor, elastic (jacket).

Reference

LU-FRA WORKSUIT CLASS 2

>>>



RESULTS

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

Hardware	Plastic zipper with metallic cursor			Elastic (jacket)		
	No	No	No	No	No	No
Flaming to top or either side edge	No	No	No	No	No	No
Post- After flame (s)	0	0	0	0	0	0
Afterglow time (s)	0	0	0	0	0	0
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
Closures can be opened	Yes	Yes	Yes	---	---	---

Remark

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

PERFORMANCE LEVEL ACCORDING TO EN ISO 11612:2015 A1

Requirements to be met according to standard EN ISO 11612:2015

a) No specimen shall give flaming to top or either side edge
b) No specimen shall give hole formation in any layer of 5 mm or greater in any direction.
c) No specimen shall give flaming or molten debris
d) The afterflame time is ≤ 2 s
e) The afterglow time is ≤ 2 s
f) Closures can be opened

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RESULTS

LIMITED FLAME SPREAD

Standard

EN ISO 15025:2016 (Method A)

Apparatus

Equipment for determination of limited flame spread 13008IE12

After pre-treatment test date

15/04/2021

Conditioned

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

Ambient conditions test

23,2°C and 40,4% RH

Gas used

Propane gas

Deviation from the standard

Face exposed to the flame

Surface: Outer

Tested material

Hardware: Plastic button, elastic trouser.

Reference

LU-FRA WORKSUIT CLASS 2

>>>



RESULTS

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

Hardware	Plastic button			Elastic trouser		
	No	No	No	No	No	No
Flaming to top or either side edge	No	No	No	No	No	No
Post- After flame (s)	0	0	0	0	0	0
Afterglow time (s)	0	0	0	0	0	0
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
Closures can be opened	Yes	Yes	Yes	---	---	---

Remark

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

PERFORMANCE LEVEL ACCORDING TO EN ISO 11612:2015 A1

Requirements to be met according to standard EN ISO 11612:2015

a) No specimen shall give flaming to top or either side edge
b) No specimen shall give hole formation in any layer of 5 mm or greater in any direction.
c) No specimen shall give flaming or molten debris
d) The afterflame time is ≤ 2 s
e) The afterglow time is ≤ 2 s
f) Closures can be opened

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RESULTS

LIMITED FLAME SPREAD

Standard

EN ISO 15025:2016 (Method A)

Apparatus

Equipment for determination of limited flame spread 13008IE12

After pre-treatment test date

6/05/2021

Conditioned

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

Ambient conditions test

24,5°C and 39,6% RH

Gas used

Propane gas

Deviation from the standard

Face exposed to the flame

Surface: Outer

Tested material

Hardware: Hook and loop tape, reflective tape.

Reference

LU-FRA WORKSUIT CLASS 2

>>>



RESULTS

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

Hardware	Hook and loop tape			Reflective tape		
	No	No	No	No	No	No
Flaming to top or either side edge	No	No	No	No	No	No
Post- After flame (s)	0	0	0	0	0	0
Afterglow time (s)	0	0	0	0	0	0
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
Closures can be opened	Yes	Yes	Yes	---	---	---

Remark

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

PERFORMANCE LEVEL ACCORDING TO EN ISO 11612:2015 A1

Requirements to be met according to standard EN ISO 11612:2015

a) No specimen shall give flaming to top or either side edge
b) No specimen shall give hole formation in any layer of 5 mm or greater in any direction.
c) No specimen shall give flaming or molten debris
d) The afterflame time is ≤ 2 s
e) The afterglow time is ≤ 2 s
f) Closures can be opened

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RESULTS

SEAM STRENGTH RESISTANCE

Standard

EN ISO 13935-2:2014

Apparatus

INSTRON Dynamometer

Conditioning date

09/04/2021

Test date

10/05/2021

Gauge length

100 mm

Atmosphere for conditioning testing
Temperature (20±2) °C

Relative humidity

(65±4) %

Number of specimens

Tested

5

Rejected

0

The break of the seam is produced for:

Broken sewing threads

Previous treatment

5 washing cycles at 40°C, according to standard EN ISO 6330:2012, method 4N and type C drying (flat dry)

Reference

LU-FRA WORKSUIT CLASS 2

Average resistance (N)	C.V.(%)
202,66	
195,68	
212,22 214,67	8,41
242,19	
220,61	

Remarks

The relative expanded uncertainty of Seams resistance is ± 6% assay value of the measured, for a probability of coverage of 95%.

REQUISITE ACCORDING TO STANDARD EN ISO 11612:2015

The external material must resist a breaking load ≥ 225 N.

NO PASS

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RESULTS

DETERMINATION OF TEMPERATURE AND ENTHALPY OF MELTING

Standard

ISO 11357-1:2016

ISO 11357-3:2018

ApparatusDifferential scanning calorimeter DSC 3+/METTLER of heat flow rate with aluminum crucible 40 μ l**Calibration**

Calibration type Simple

Procedure

Standard reference materials: Indium de 99,99999 % purity, 4,80 mg

Zinc de 99,99998% de purity, 2,80 mg

Tin de 99,99998% de purity, 6,00 mg

Test conditionsGas: N₂ Grade: 99,99% Flow rate: 50ml/min**Previous conditioning**According standard EN 20139-1993 (20 \pm 2 $^{\circ}$ C y 65 \pm 4%HR)**Number of specimens:**

1

Temperaturas programFirst heating cycle from 20 to 300 $^{\circ}$ C at 20 $^{\circ}$ C/minIsotherm at 300 $^{\circ}$ C,5 minutesCooling cycle at 20 $^{\circ}$ C/min until 20 $^{\circ}$ CSecond heating cycle from 20 to 300 $^{\circ}$ C at 20 $^{\circ}$ C/min

>>>



RESULTS

DETERMINATION OF TEMPERATURE AND ENTHALPY OF MELTING

Start date test

07/04/2021

End date test

08/04/2021

Results

Reference	Heat of fusion
LU-FRA WORKSUIT CLASS 2 (Sewing thread)	NO MELT

Requisite

According standard IEC 61482-2:2018 (points 4.2 and 5.2.5), sewing thread utilized in the construction of garments shall be made of an inherently flame-resistant fibre and shall not melt when tested according to ISO 3146 Method B at a temperature of $260\text{ °C} \pm 5\text{ °C}$.

PASS



RESULTS

VERTICAL RESISTANCE

Standard

EN 1149-2:1997

Conditioned

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

Ambient conditions test

23,0 °C and 27,1 % RH

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

19/04/2021

Deviation from the standard

Tested material

Navy blue woven fabric.

—————>>>



RESULTS

Pre-Treatment

5 washing cycles at 40°C, according to standard EN ISO 6330:2012, method 4N and type C drying (flat dry)

Reference

LU-FRA WORKSUIT CLASS 2

Specimen	Vertical Resistance (Ohm)
1	$3,21 \cdot 10^6$
2	$1,75 \cdot 10^6$
3	$2,53 \cdot 10^6$
4	$3,09 \cdot 10^6$
5	$6,53 \cdot 10^6$
Classification value	$1,75 \cdot 10^6$
Average (Ohm)	$3,42 \cdot 10^6$

The uncertainty of the assay of Vertical Resistance is $\pm 20\%$ 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

MASS PER UNIT AREA

Standard

EN 12127:1997; pto. 8.3

Conditioning date 06/05/2021 **Test date** 12/04/2021

Atmosphere for conditioning testing

Temperature (20±2) °C **Relative humidity** (65±2) %

Fabric type

Woven fabric

State of the specimens

Original

Reference	Mass per unit area (g/m ²)	CV (%)
LU-FRA WORKSUIT CLASS 2	255	0,6

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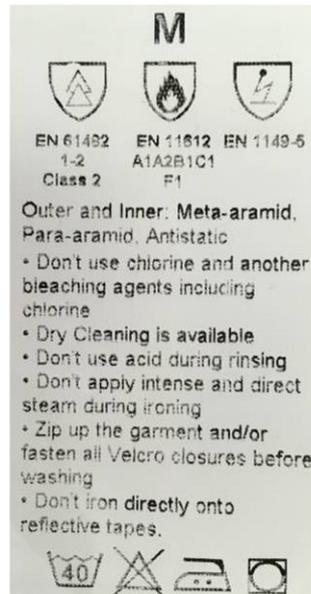
RESULTS

Durability of marking

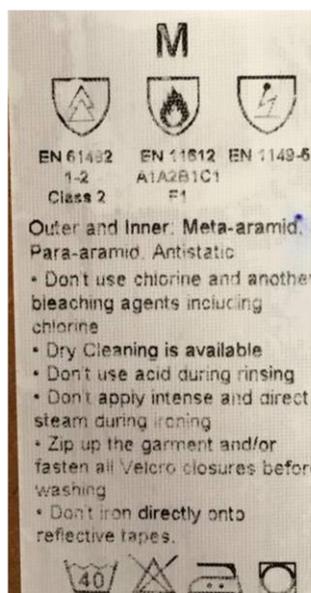
Standard

ENAC_IEC 61482-2:2018

Original:



After rubbing for 15 seconds with a lint-free cloth soaked in water and then rubbing for 15 seconds with a lint-free cloth soaked in isopropanol:





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 Jacket: Woven fabric, grey colour with a weight does not provided by the customer + woven fabric, grey colour with a weight does not provided by the customer

Test conditions	
Class	Class 2
Testing atmosphere	25,50 °C 45,10 % RH
Test current I_{class} for class 2	7 kA \pm 5%
Calibration test current	6778,9 A
Average direct exposure incident energy E_{io}	414,34 kJ/m ²
Arc duration	500 ms \pm 5%
Real arc duration	477,6 ms.
Test voltage	400 V \pm 5%
Real test voltage	393,87 V
Real arc energy W_{arc}	326,48 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

Time ± 0,301 s.

Technician performing the test

David Lazaro

Person verifying the test report

Lucía Martínez

Pre-treatment

4 washing cycles at 40°C, according to standard ISO 6330:2012, method 4N; and C drying

Pre-conditioning of the test specimens

24h. in indoor ambient conditions between (18-28) °C and between (45-75) % RH

Starting and ending pre-conditioning date

15/06/2021 - 16/06/2021

Observation or deviation of the standard

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RESULTS

ELECTRIC ARC TEST

Testing date 16/06/2021
Reference LU-FRA WORKSUIT CLASS 2

VISUALLY OBTAINED DATA

Property	Measurement	Specimen 1
	Class	2
Burning time	Video	0,00 s
Hole formation >5mm. on external layer	Visual	No
Hole formation >5mm. on internal layer	Visual	No
Melting through to the inner side	Visual	No
Embrittlement	Visual	Yes
Damage on the outside	Visual	No
Charring on the outside	Visual	Yes
Dripping	Visual	No
Shrinkage	Calculated	No
Behavior of accessories with the garment	Visual	Agreed

>>>



RESULTS

ELECTRIC ARC TEST

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

PASS

CATEGORY OF ARC THERMAL PROTECTION ACCORDING TO IEC 61482-2:2018 ⁽²⁾APC 2

Remark

⁽²⁾Arc Protection Class

The arc protection class is characterized by the test energy level of arc exposure (arc energy and incident energy)

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) After exposure, fasteners shall be functional. Accessories shall have no negative influence on the results of the burning time, melting and hole formation. |

>>>



RESULTS

ELECTRIC ARC TEST

Reference

LU-FRA WORKSUIT CLASS 2

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

DETERMINATION OF RETROREFLECTIVE PHOTOMETRIC PERFORMANCE

Standard

CIE 54:1982 modified by EN 1150:1999 section 7.3

Apparatus

Optronik rms 10 retroreflectometer 13320E06

Light lamp

CIE standard Illuminant A

Measurement distance

A=15 m

B= 16 m

To determine the retroreflection coefficient is considered

$\epsilon_1 = 0^\circ$ vertical retroreflective strips

$\epsilon_2 = 90^\circ$ Horizontal retroreflective strips.

Deviation from the Standard

Test was carried out as result verification only at Observation / Entrance angles $12' / 5^\circ$

—————>>>



RESULTS

DETERMINATION OF RETROREFLECTIVE PHOTOMETRIC PERFORMANCE

Reference	LU-FRA WORKSUIT CLASS 2
Sample size	100 cm ²
Measurement distance	A
Date test	05/05/2021

Observation angle Entrance angle	Position	Test results (cd/lx·m ²)
12' / 5°	ε1 = 0° vertical	506,3
12' / 5°	ε2 = 90° horizontal	510,9

Remark:

The uncertainty of the assay of retroreflective photometric performance is $\pm 2\%$ of the value measured, for a coverage factor of K=2 (95%).

Minimum coefficient of retroreflection in cd/(lx m²) for separate performance retroreflective material according to section 6.1 of standard EN 1150:1999

Observation angle	Entrance angle			
	5°	20°	30°	40°
12'	250	220	135	50
20'	120	100	75	30
1°	25	15	12	10
1°30'	10	7	5	4

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Lucia Martinez
Head of PPE and Ballistics department

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