

WEARABLE ELECTRONIC DEVICES AND TECHNOLOGIES

– Electronic textile

- Test method for performance of heating products
- Heating temperature and power consumption



IEC TC124

2024. 06. 05

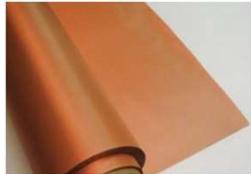
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Technology and Market

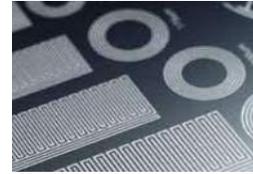
E-textile products



E-textile (woven)



E-textile (knit)



E-textile (printed)



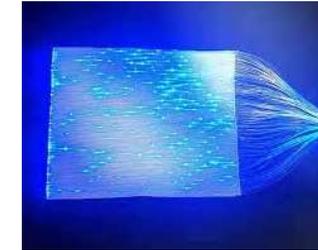
E-textile (embroidery)



Heating products

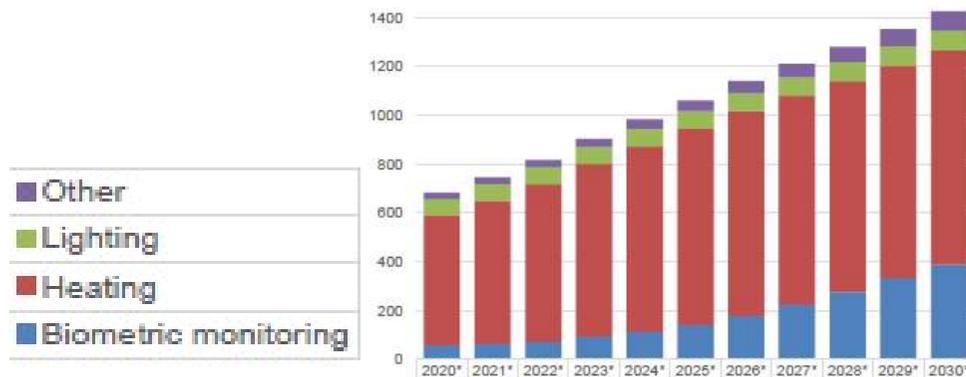


Biometric monitoring products



Lighting products

Market of e-textile products

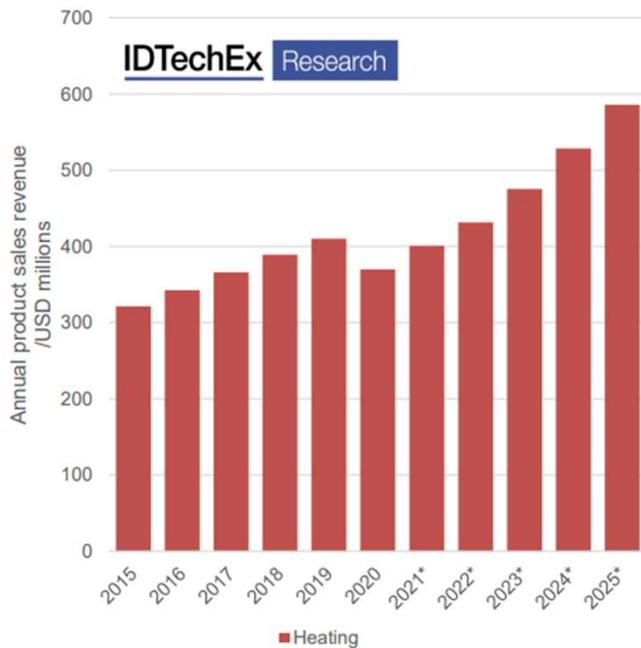


Heating products are the most popular type in the market of the e-textile products.

Technology and Market

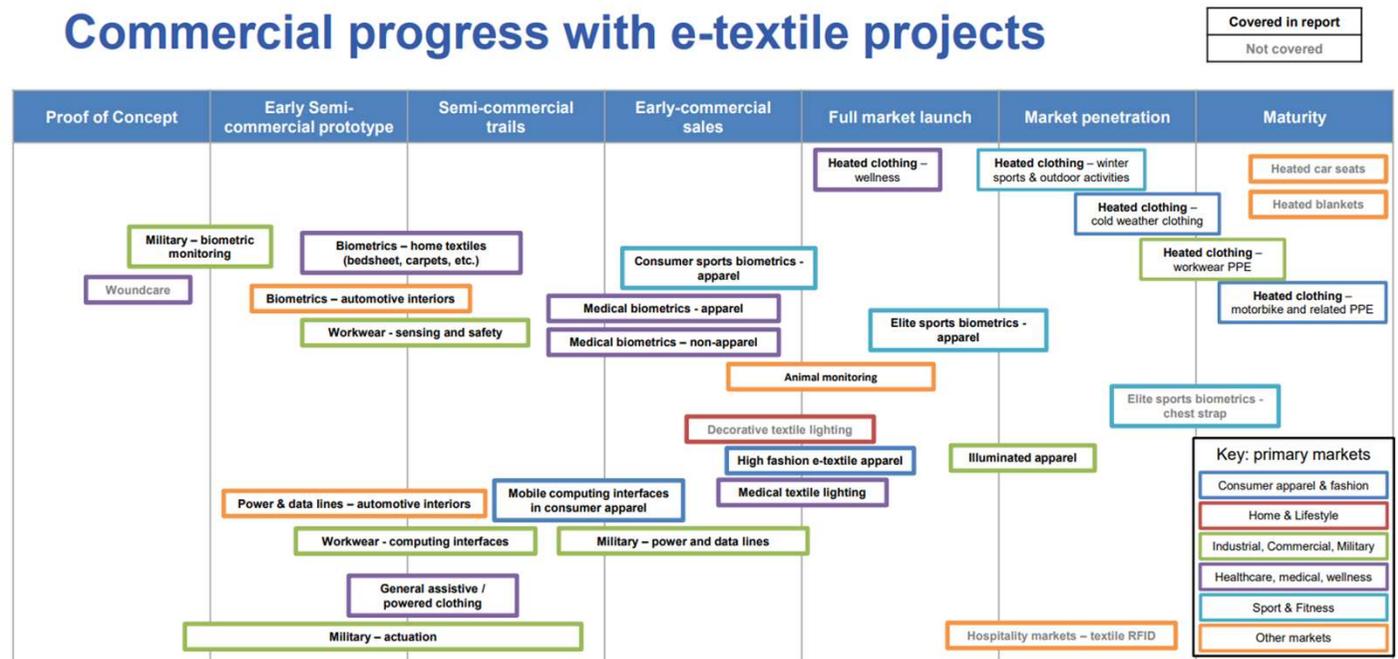
Market of heating textile products

Product sales revenue from e-textile products for heating



Resource: IDTechEx Research

Commercial progress with e-textile projects



Technology and Market

Wearable Electric Heating Textile Products

- Wearable heating textile products are used for activities in cold environments such as winter sports, military forces, covid-19 healthcare workers, and so on. Wearable heating products are mostly outer garments-such as jumpers and vests, and recently gloves, socks, and shoe insole are developed.



- Wearable heating products are made of e-textiles and conventional textiles. E-textiles produce heat and conventional textiles keep the generating heat from the cold environment.

Conventional textiles (garment)
: thermal insulation

Controller



E-textiles
: electric heating



Battery : power

Needs of New Standard

Major Performances of Wearable Electric Heating Products

- How warm it is? → Heating temperature
- How long does it work? → Power consumption (Energy)



< Example of a heating jacket >

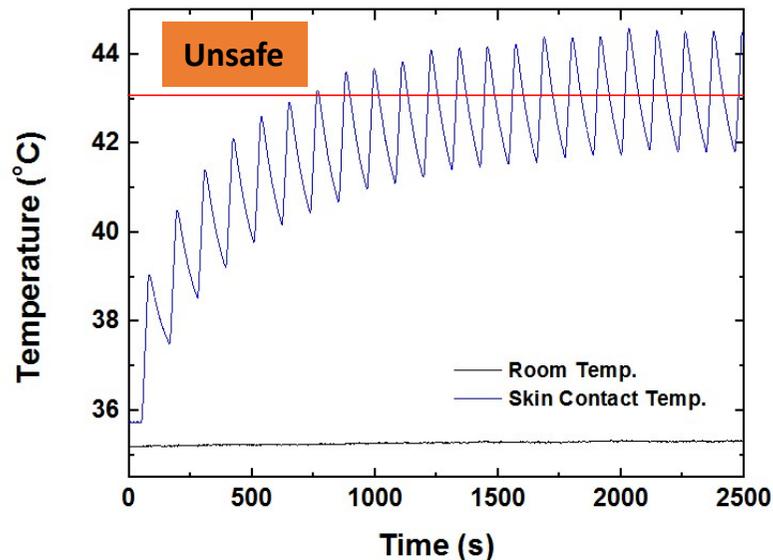
Needs of Performance Test Method for Wearable Electric Heating Products

- It is difficult to recognize or compare heating performance of products objectively, due to the **absence of a standard test method**.

Comparison of other Standards

IEC Standards

- IEC 60203-406-1 Wearable electronic devices and technologies – Part 406-1: Test method for measuring surface temperature of **wrist-worn wearable electronic devices** while in contact with human skin
- IEC 60335-2-17 Household and similar electrical appliances – Safety – Part 2-17: Particular requirements for blankets, pads, clothing and similar flexible heating appliances



- ✓ These standards are test methods for the **safety** of electronic devices.
 - Determination of the heating temperature
 - Measuring power consumption
- ✓ **Test condition** is not suitable for performance testing.
 - IEC 60203-406-1 : $(25 \pm 5)^\circ\text{C}$
 - IEC 60335-2-17 : $(20 \pm 5)^\circ\text{C}$

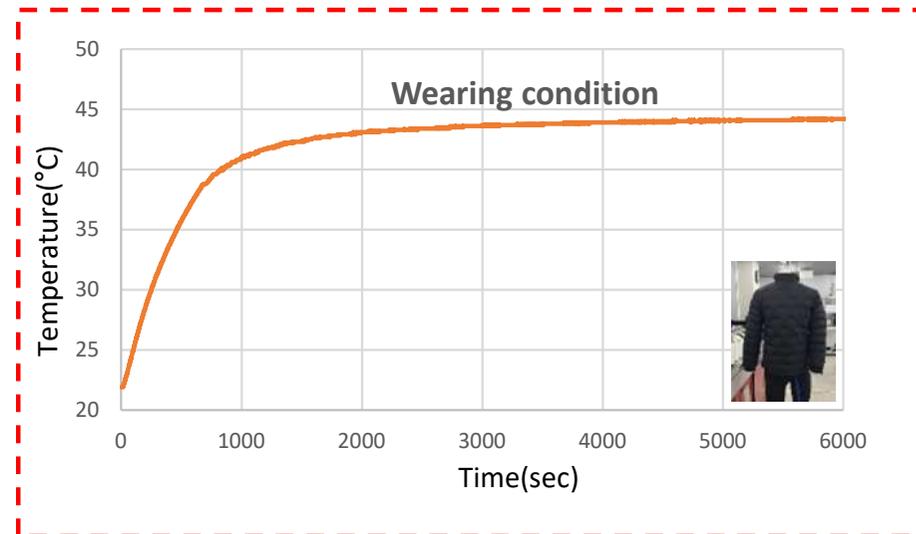
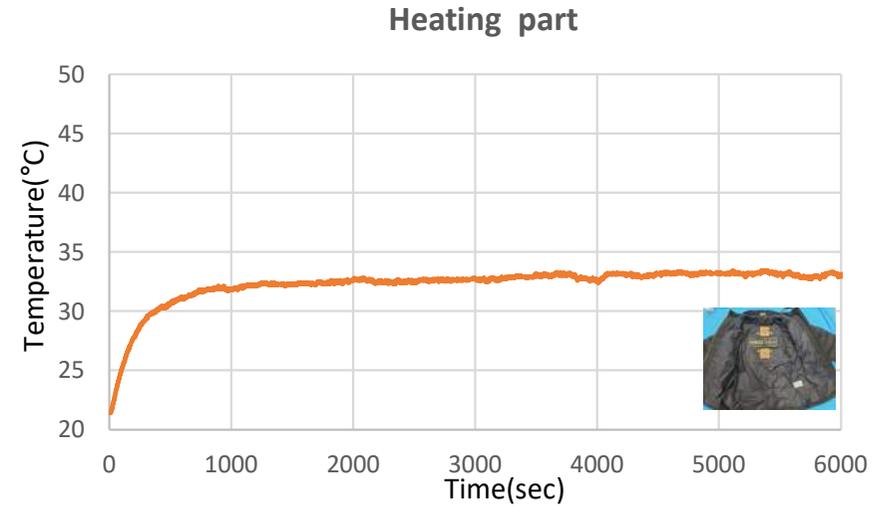
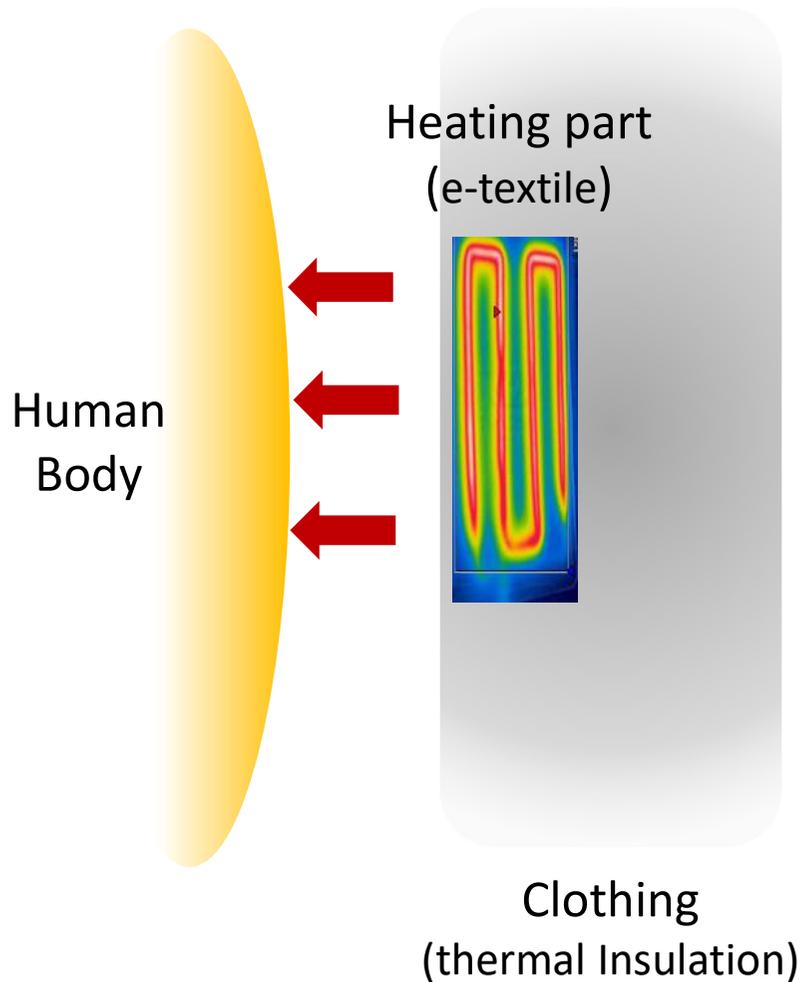
Comparison of other Standards

ISO Standards and National Standards related heating textile

- ISO 16533 Textiles — Measurement of exothermic and endothermic properties of textiles under humidity change
 - ISO 18782 Textiles — Determination of dynamic hygroscopic heat generation
 - EN 16806-1 Textiles and textile products - Textiles containing phase change materials (PCM) - Part 1 : determination of the heat storage and release capacity
 - JIS L 1952-1 Textiles -- Determination of dynamic hygroscopic heat generation -- Part 1: Test method for maximum generated hygroscopic heat temperature measurement by humidification
 - JIS L 1926 Textiles -- Evaluation method of light absorption and heat generation
 - GB/T 29866 Textiles—Test method for heat generating by moisture absorption properties
 - GB/T 18319 Textiles—Test method for solar heat storage property
- ✓ These standards are test methods for textiles that generates **heat with environment change** such as humidity, temperature, and light irradiation. These are **not applied to e-textiles**.

Research for Standard Development

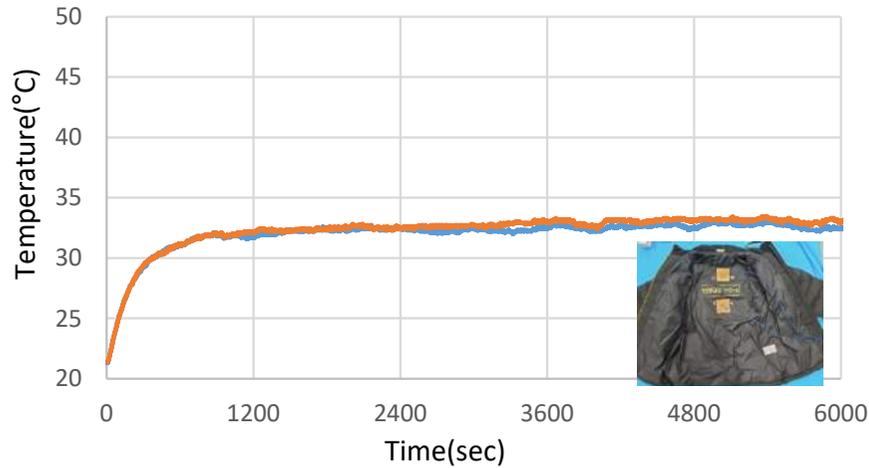
Research on heating temperature measuring method



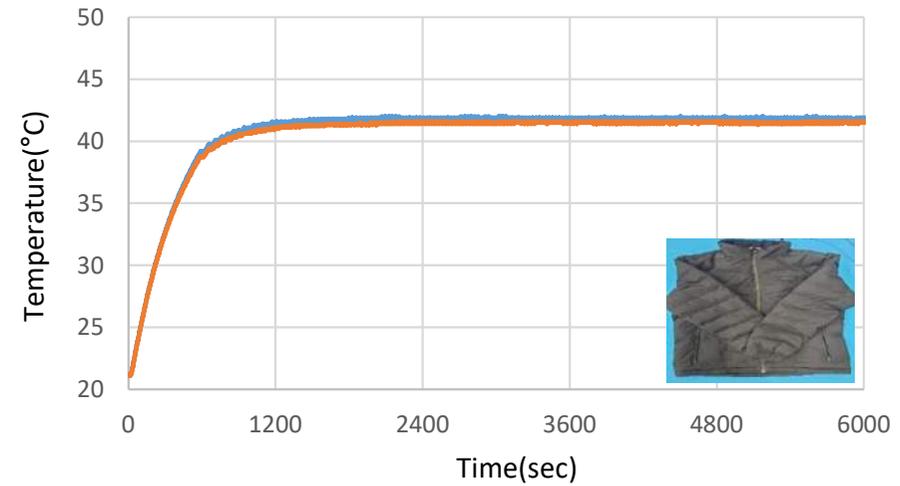
Research for Standard Development

■ Influence of thermal insulation (Covering area)

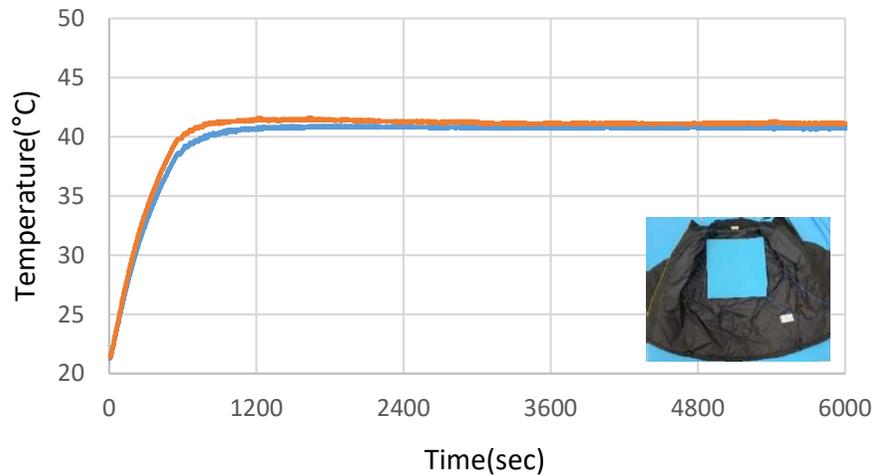
No insulation(opened)



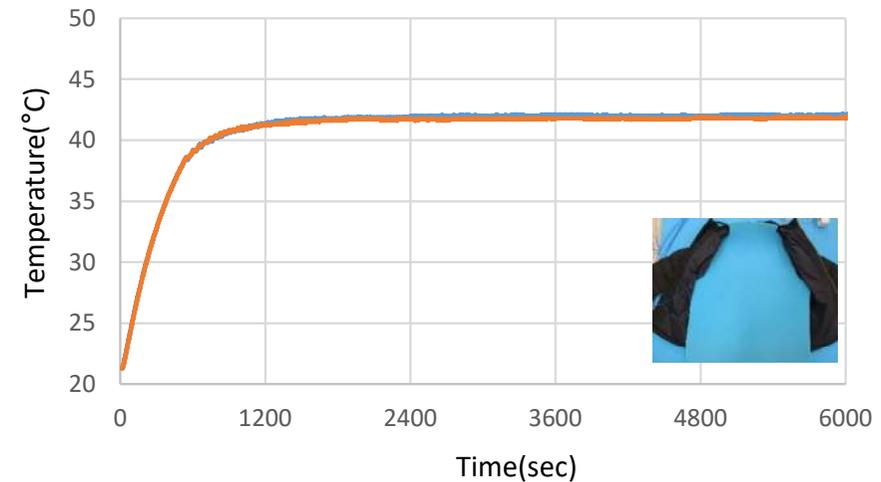
No insulation(closed)



Insulation A

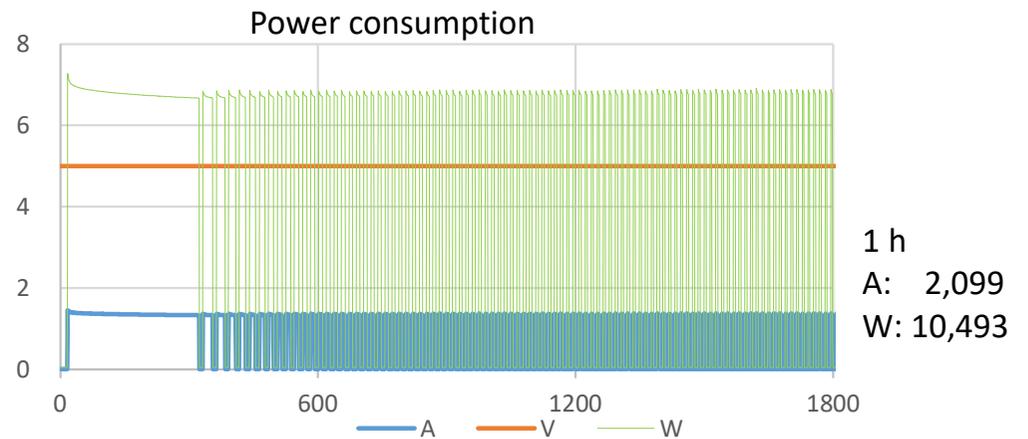
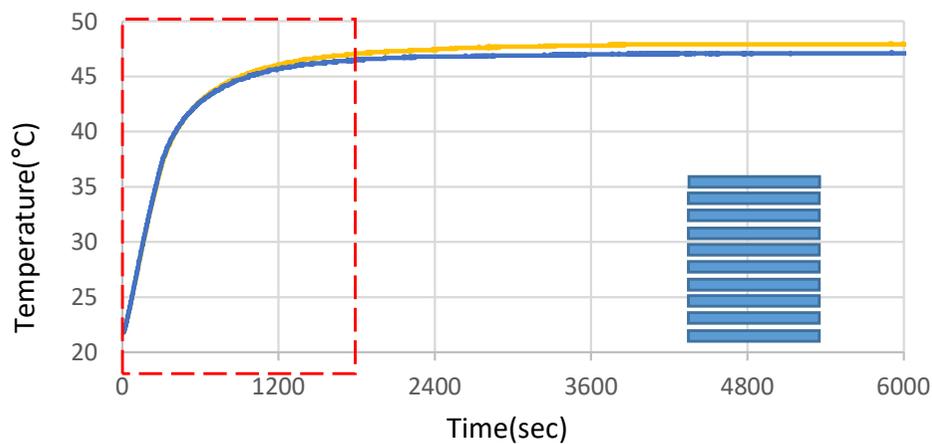
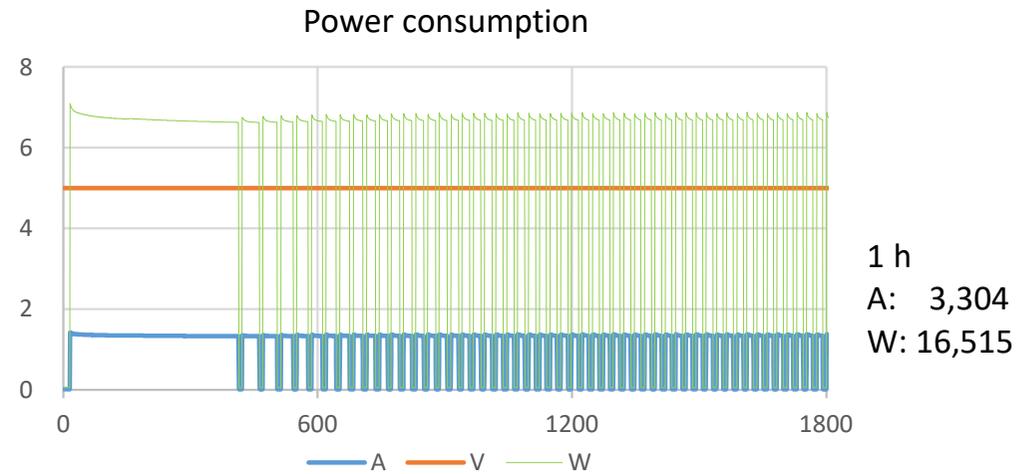
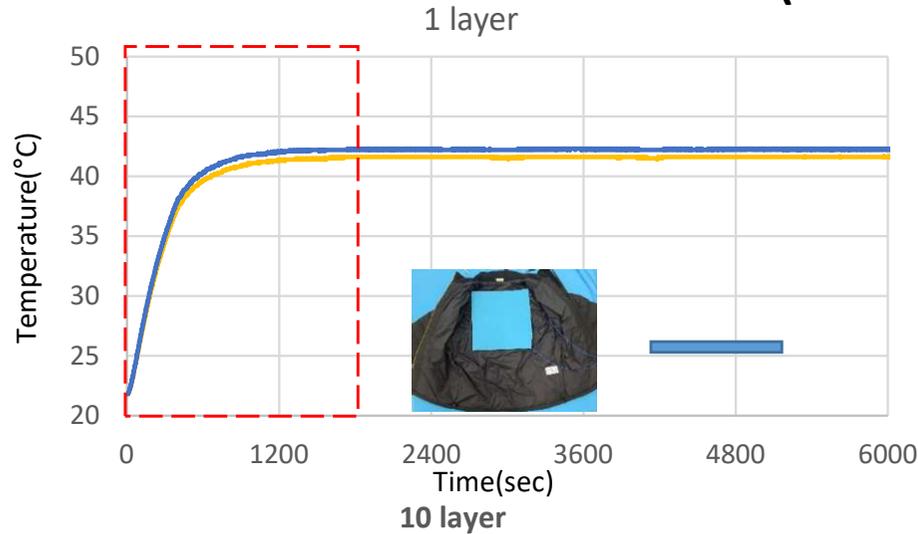


Insulation B



Research for Standard Development

■ Influence of thermal insulation (Insulation thickness)



- ✓ Cover thermal insulation for testing could influence surface temperature and power consumption.
- ✓ Also, it means that the heat retention property of the garment could influence the performance

IEC 63517 Test methods for performance of heating products

Standard Development

Date	Content	
2022.05	Presentation for pre-PWI	
2022.07	Questionnaire on the creation of a PWI	
2022.09	Approval to create a PWI	
2022.11	Starting the project as a candidate for joint ISO/IEC in mode 5.	
2022.02	Consensus about Joint working Group between IEC TC124 and ISO TC38 WG32	
2023.03	NP ballot in both IEC TC124 and ISO TC 38 (approved)	
2023.10	JWG6 approved in IEC TC124 plenary meeting	
2023.11	JWG6 approved in ISO TC38 plenary meeting	
2024.03	Starting CD consultation (- 6/21)	

IEC 63517 Test methods for performance of heating products

- Title

- WEARABLE ELECTRONIC DEVICES AND TECHNOLOGIES

- Test method for performance of heating products – Part 1: Heating temperature and power consumption

- Scope

- This document specifies a test method for the determination of heating performances of wearable electrical heating textile products.
- Wearable heating textile products are made of e-textiles parts including a portable battery for electric heating and conventional textiles parts for garments.
- This document includes the test procedure for the heating temperature and power consumption of wearable heating garments such as jackets, vests, etc. This document is not applied to heating gloves and footwears.
- This document does not assess the safety and security of heating products. The Information on thermal safety limits for heating products is addressed in IEC 62368-1 and IEC 60335-2-17. The performance and safety of portable battery is not included.

IEC 63517 Test methods for performance of heating products

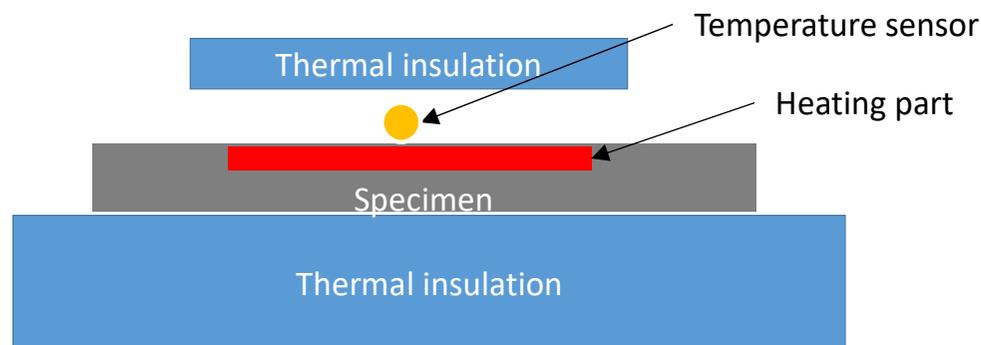
- Test specimens

- Conditioning

- The specimens shall be stored for at least 24 h in standard atmosphere conditions: $(20,0 \pm 2,0) ^\circ\text{C}$ and $(65,0 \pm 5,0) \% \text{RH}$ in accordance with ISO 139:2005.

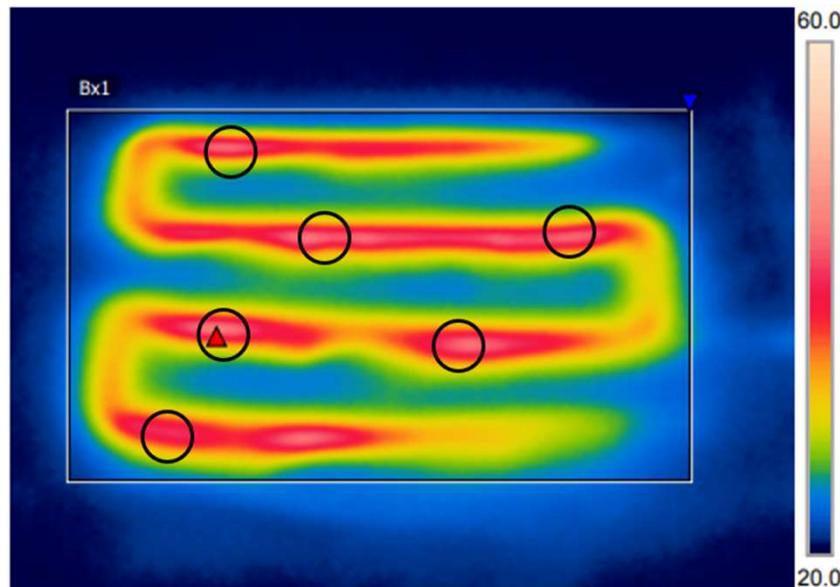
- Preparation of test

- Check the specimens as described in the manufacturer-provided user manual and connect with an electric power supply instead of the manufacturer-provided battery.
- The test specimen is placed on a sheet of thermal insulation with the heated area in contact with the wearer's body up.
- The size of the thermal insulation is such that the edges extend at least 50 mm beyond the outline of the test specimen.



IEC 63517 Test methods for performance of heating products

- Test procedure
 - Selection of measuring points
 - The test specimen is operated for at least 10 min and then observed by an Infrared camera. The number and size of the heating areas in the whole product are checked with thermography. The temperature measuring points to be selected are the 6 hottest points of the observed heating area determined with the IR thermography. Measuring points shall be apart at least by 15 mm.



IEC 63517 Test methods for performance of heating products

- Test specimens

- Environmental conditions

- The tests are carried out in standard atmosphere conditions: $(20,0 \pm 2,0)$ °C and $(65,0 \pm 4,0)$ % RH in accordance with ISO 139:2005.

- Heating Temperature

- The thermometers to measure temperature are attached at the selected measuring points. Each thermometer with copper disk is fixed by means of thin adhesive tape to not place between the test specimen and the thermometer.
- The test specimen is covered with a sheet of thermal insulation. The cover sheet has a thickness of (7 ± 1) mm. The size of the cover sheet is such that the edges extend at least 20 mm beyond the outline of the heating area of the test specimen.
- Check the temperature of specimens is constant at the environment temperature $(20,0 \pm 2,0)$ °C.
- Turn on the heating device of the test specimen and measure the temperature of each measuring point at intervals of at least 1 min.
- The measurement duration is at least 2 h. The temperature is checked at (10 ± 1) min, (30 ± 1) min, $1 \text{ h} \pm 1 \text{ min}$ and $2 \text{ h} \pm 1 \text{ min}$.
- Calculate the average maximum and minimum value of the measured values from 6 measuring points.

IEC 63517 Test methods for performance of heating products

- Test specimens

- Power consumption

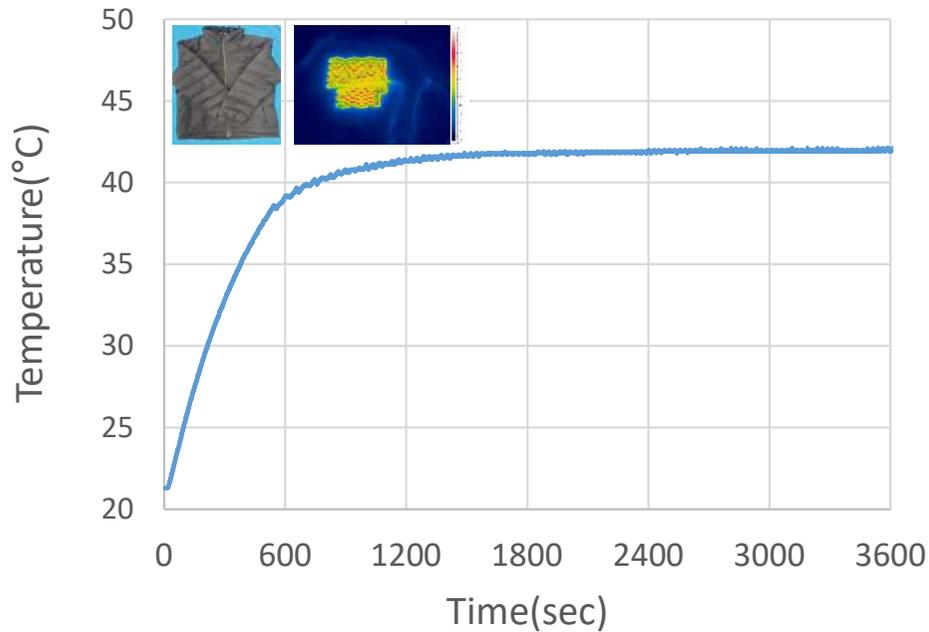
- The procedure for power consumption may be conducted that of heating temperature simultaneously.
- The measurement duration is at least 2 h. Power consumption of heating is calculated from starting time to (10 ± 1) min, (30 ± 1) min, $1 \text{ h} \pm 1 \text{ min}$ and $2 \text{ h} \pm 1 \text{ min}$.
- The test specimen is turned off and cooled down. Repeat the test twice.
- The power consumption of heating is determined as the average value of the three tests. The results are expressed in whole-number units.



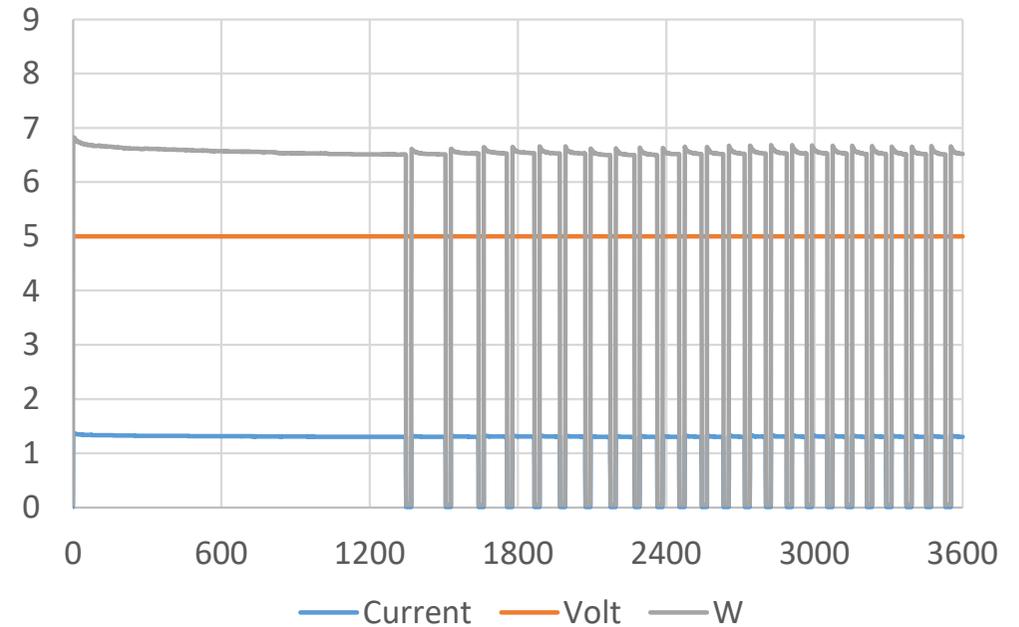
IEC 63517 Test methods for performance of heating products

- Test results

- Heating temperature



- Power consumption





Thank You for your attention.

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