UDC 687.1:620.9:7.05
DOI https://doi.org/10.32782/uad.2025.5.12

Liuklian Nadiia Romanivna,
Postgraduate Student, Assistant at the Department of Art and Fashion Design
Kyiv National University of Technologies and Design
ORCID ID: 0000-0001-9598-8119
n.r.lyuklyan@gmail.com

Pashkevych Kalyna Livianivna,
Doctor of Technical Sciences, Professor,
Dean of the Faculty of Design
Kyiv National University of Technologies and Design
ORCID ID: 0000-0001-6760-3728
pashkevich.kl@knutd.edu.ua

IMPROVEMENT OF AESTHETIC AND ERGONOMIC INDICATORS IN HEATED CLOTHING BASED ON A COMPARATIVE ANALYSIS OF ANALOGUES

The article presents a comprehensive analysis of the practical experience in manufacturing heated clothing by various brands and examines their product range in detail. It focuses on technological aspects as well as aesthetic and ergonomic characteristics that influence consumer satisfaction. Comparative tables of foreign and Ukrainian analogues were created to evaluate features such as appearance, materials, fittings, and finishing, alongside functional and design characteristics including ease of use, heating efficiency, durability, and adaptability to different environmental conditions. This approach helped identify common features, differences, strengths, and weaknesses among existing products. Special attention is given to design solutions that improve comfort, user experience, and energy efficiency, including the placement of heating zones and intuitive control systems. In addition, the study considers factors such as weight distribution, flexibility, and compatibility with layering, which affect overall usability and comfort in various situations, from outdoor sports to everyday urban wear. Based on this analysis, ways to address the shortcomings of existing products are proposed, leading to the development of an improved prototype of a heated jacket. The new design combines modern aesthetic trends with enhanced ergonomic properties, ensuring better thermal protection, even heat distribution, and increased comfort during prolonged use. It also considers contemporary consumer preferences regarding style, versatility, and functionality, making the jacket practical, efficient, and visually appealing. Overall, the study provides a framework for combining functional performance, ergonomic improvements, and modern design in heated clothing, offering practical recommendations for future product development, material selection, and enhanced user satisfaction.

Key words: *heated clothing, smart technologies, smart textiles, innovations.*

Люклян Надія, Пашкевич Калина. УДОСКОНАЛЕННЯ ЕСТЕТИЧНИХ ТА ЕРГОНОМІЧНИХ ПОКАЗНИКІВ В ОДЯЗІ З ПІДГРІВОМ НА ОСНОВІ ПОРІВНЯЛЬНОГО АНАЛІЗУ АНАЛОГІВ

Стаття представляє комплексний аналіз практичного досвіду виробництва одягу з підігрівом різними брендами та детально досліджує їх асортимент продукції. Приділено увагу технологічним аспектам, а також естетичним і ергономічним характеристикам, які впливають на задоволення потреб споживача. Було створено порівняльні таблиці закордонних та українських аналогів для оцінки таких характеристик, як зовнішній вигляд, матеріали, фурнітура та обробка, а також функціональних і конструктивних параметрів, включно з легкістю використання, ефективністю обігріву, довговічністю та адаптивністю до різних умов експлуатації. Такий підхід дозволив виявити спільні риси, відмінності, переваги та недоліки існуючих продуктів. Особлива увага була приділена конструктивним рішенням, що підвищують комфорт, зручність використання та енергоефективність, зокрема розташуванню зон обігріву та інтуїтивному керуванню. Крім того, досліджено такі фактори, як розподіл ваги, гнучкість та сумісність з додатковими шарами одягу, що впливають на загальну зручність і комфорт у різних ситуаціях, від активного відпочинку на свіжому повітрі до повсякденного використання в місті. На основі проведеного аналізу запропоновано шляхи усунення недоліків існуючих аналогів,

що дозволило розробити покращений прототип виробу. Новий дизайн поєднує сучасні естетичні тенденції з покращеними ергономічними властивостями, забезпечує кращий тепловий захист, рівномірний розподіл тепла та підвищений комфорт під час тривалого використання. Він також враховує сучасні уподобання споживачів щодо стилю, універсальності та функціональності, роблячи куртку практичною, ефективною та привабливою. Загалом дослідження надає рамки для поєднання функціональної продуктивності, ергономічних удосконалень та сучасного дизайну у виробництві одягу з підігрівом, пропонуючи практичні рекомендації для подальшого розвитку продукції, вибору матеріалів та підвищення задоволеності користувачів..

Ключові слова: *одяг з підігрівом, смарттехнології, смарттекстиль, інновації.*

Introduction. In recent decades, innovations in various industries, including the fashion industry, have been rapidly introduced. Smart technologies in clothing is an innovative direction that combines modern technological solutions and textile materials to create smart clothing that can respond to changes in the environment and user needs [1]. One example of using smart technologies is heated clothing. Such products are made from materials that are integrated with carbon fibers, metal or film heating elements, as well as polymer materials. These elements ensure the maintenance of body heat in cold environmental conditions, and the heating temperature can be adjusted using special buttons or through mobile applications, which ensures special convenience and adaptability to the individual needs of the user [2].

The first heated clothing was developed by French scientists during the First World War, they made flight suits with electric heating, later the United States built its own prototypes based on these models. It was a revolutionary idea, but the execution left much to be desired. The military historian Sweeting, in his book [3], noted that the "electric suits" of 1918 consisted mainly of a wire "harness" attached to the suits and connected to copper heating pads on the knees, shoulders, etc. These suits were notoriously unreliable, and there was often a short circuit during the flight. After World War II, General Electric produced more sophisticated heated flight suits.

Heated clothing, most similar to modern prototypes, was invented in the mid-70s in the USA by Gordon Gerbing. By the 1980s, Gerbing was selling its gear for motorcycle rallies, where it proved extremely popular. Most of the early heated motorcycle clothing worked by connecting to the motorcycle itself [4]. But over the past decade, battery technology has improved significantly, and battery-powered equipment has evolved in tandem. So, in addition to its popularity in the motorcycle world, heated clothing is widely used by construction workers in cold climates, and is also gaining some popularity in the world of sports and everyday life.

In this way, the integration of advanced technologies into clothing design opens up new opportunities for creating an individual image of the consumer and expressing personal identity through fashion [5]. Research in the field of heated clothing is important from a practical and aesthetic point of view and contributes to the development of new technologies in the production of fabrics and materials, as well as improving the design and construction of clothing. This allows us to meet the needs of the modern consumer, who is looking for not only functionality, but also style. Innovative approaches to creating heated clothing open up broad prospects for the development of the fashion industry and providing users with a convenient, stylish and effective way to protect themselves from the cold.

Materials and methods. The work uses theoretical and empirical research methods. At the initial stage, an analysis of Internet sources was conducted to identify foreign and Ukrainian manufacturers of heated clothing. The official websites of manufacturers and their product range were analyzed to compile a complete list of available samples of heated jackets and vests for further research.

At the next stage, the method of comparing selected samples according to aesthetic and functional and design parameters was applied. The comparison included an assessment of appearance, materials, fittings, usability, and heating efficiency. Using the induction method, common and distinctive features of

heated clothing analogues were determined. This method also allowed us to determine the advantages and disadvantages of existing samples, according to such parameters as compliance with fashion trends, design functionality and usability.

At the final stage, the synthesis method was applied to develop an improved model of a heated jacket. Based on the identified shortcomings and existing problems, specific ways to solve them were proposed. The improved sample takes into account modern fashion trends, improves ergonomics and functionality, which will help to increase comfort and meet the needs of consumers.

Disscussion. The production of heated clothing is constantly evolving, reflecting the constant demand for innovative technologies in the field of fashion and textiles. Companies are actively improving their production processes, introducing new materials and design solutions to ensure high quality and user comfort. Below is information about manufacturing companies from the USA and European countries.

The Warming Store company (Philadelphia, USA) [6] produces heated clothing for the cold season. The brand's range includes: gloves, jackets (fig. 1), thermal underwear, heated socks, etc.

The international brand BERTSCHAT (Northampton, Great Britain) has more than 15 years of experience specializing in the sale of goods for winter sports athletes, construction workers, motorcyclists and police officers. The brand's range includes heated gloves, heated socks, heated insoles, heated clothing (fig. 2), cooling products and accessories [7].

Fig. 2. BERTSCHAT heated jacket (Northampton, United Kingdom)

Fieldsheer (San Marcos, USA) was the first company to develop jackets with built-in heating for motorcyclists back in 1978. The company is now innovating a lot and has a full supply chain, ranging from hardware research and development, battery design, cutting and sewing, and application development. The company's product range includes heated clothing (fig. 3, fig. 4) and products with a cooling effect in the hot season. Fieldsheer explores the integration of digital sensors optimized using the power supply algorithm [8, 9].

The Venture Heat brand (Venice Beach, USA) was founded in 2003, and in 2005 introduced the first vest with lithium-ion battery power, later released America's first battery heated gloves. Now the company has introduced many innovations, in particular, a series of clothing for pain relief using far-infrared heat therapy was developed, a waterproof heated diving suit was introduced, and previously developed heated products were improved and upgraded (fig. 5) [10].

Fig. 1. The Warming Store heated jacket (Philadelphia, USA)

Fig. 3. Fieldsheer heated vest (San Marcos, USA)

Fig. 4. Fieldsheer heated jacket (San Marcos, USA)

Fig. 5. Venture Heat heated jacket (Venice Beach, USA)

Despite all the difficulties, heated clothing is also produced in Ukraine. Domestic manufacturers adopt foreign experience and introduce advanced production technologies and methods to achieve the highest standards of quality and functionality of products. Below is information about Ukrainian companies engaged in the manufacture of heated clothing.

One example is the cooperation of the East Ukrainian technocluster (Kramatorsk, Ukraine) and the clothing company VELNA (Ukrayinsk, Ukraine), which in 2021 began to create "smart" clothing, namely a jacket (fig. 6) and a heated vest. In the future, the cooperation of the companies was supposed to expand, it was planned to create a different range of smart clothing – a hat, scarf, vest, T-shirt, shorts, etc., but the Russian invasion in 2022 suspended further developments and projects of companies in the field of smart technologies [11].

TM Shine (Kharkiv, Ukraine) [12] presents products of its own production, which are developed in accordance with DSTU and TU standards and have the appropriate quality certificates. The main activities of the Shine company are production and wholesale of various household items, namely: electric dryers for shoes of several types, heating pads, electric sheets, electric blankets, electric blankets for wraps and massage, heated clothing (fig. 7) et al.

TM Freever (Odesa, Ukraine) produces clothing and accessories for sports and outdoor activities. The company's product range includes ski suits, jackets, trousers; sports sweatshirts, vests, down jackets; jeans, shorts, T-shirts and heated clothing (fig. 8). In addition to basic items, a large selection of accessories is offered: buffs and hats; thermal socks and balaclavas; gloves and ski masks; helmets, bags and backpacks [13].

Fig. 6. Heated jacket by the East Ukrainian technocluster (Kramatorsk, Ukraine) and sewing company VELNA (Ukrayinsk, Ukraine)

Fig. 7. Shine heated vest (Kharkiv, Ukraine)

Fig. 8. Freever heated jacket (Odesa, Ukraine)

According to table 1 and table 2 it is possible to distinguish common and distinctive features of heated clothing from foreign and domestic manufacturers. ***Common features*** include designs and finishes that are designed for everyday use: a straight silhouette and sewn-in or raglan sleeves allow for freedom of movement; the central fastener provides quick unfastening and fastening; the color solution corresponds to the season; the top package of materials is made of raincoat fabrics that have water-repellent, windproof and dirt-repellent properties. The products use state-of-the-art technologies to provide comfort and warmth in cold weather, including heating panels integrated into fabrics in certain areas, heating temperature control buttons, USB cables and powerbank, etc.

Distinctive features of the analyzed clothing include**:**

– heating zones located in different areas, in the products of Ukrainian manufacturers mainly on the details of the back, and in foreign ones – on the details of the back, front halves, sleeves, collar and hood;

– systems for regulating the temperature of the heating zones, which are mounted in various parts of the front both on the top and the lining layer, as well as additional components for recharging, which are placed in external or internal pockets;

– the use of insulating materials and such details as: stand-up collar, hood, inner sleeve cuffs, drawstrings and pattes to adjust the tightness of the fit of the hood and sleeves to the body, etc. to provide additional protection against cold and wind in some products.

In general, based on the conducted comparative analysis, we can distinguish ***main advantages*** of analyzed clothing, namely: the presence of heating systems on the details of the back, shelves, sleeves, collar and hood; the use of insulation and additional details to retain heat and protect from wind: stand-up collar, inner cuffs of the sleeves, pattes/drawstrings on the details of the sleeves and at the bottom of the products, etc.

However, there also remains ***a number of certain disadvantages***, such as:

– design mismatch with modern trends;

– insufficient functionality of the design;

– inconvenient location of the pocket for the charging source.

We have proposed possible solutions to these shortcomings. Taking into account fashion trends in shape and color can increase the level of applicability of products and match the everyday style.

With the help of replaceable elements (transformer), it is possible to expand the functionality of clothing and adapt it to different weather conditions and individual user needs.

By diversifying the functional pockets, as well as determining their correct location, it will contribute to creating a convenient and practical mechanism for carrying and storing additional devices, in particular charging sources.

Fig. 9 provides a technical sketch of the improved model of the heated jacket, as well as its color scheme in light and dark shades, which allows users to choose the most suitable option for different conditions of use and aesthetic preferences.

Table 1

Comparative table of heated products by aesthetic parameters

Analogs	Aesthetic parameters		
	general appearance	materials	accessories
Heated jacket (fig. 1). Manufacturer: The Warming Store (Philadelphia, USA)	medium voluminous shape, straight silhouette, black color	softshell top material; polyester lining with 4 heating zones	central zipper and pockets zippers; temperature control button; Powerbank Aheata 7V, USB cable
Heated jacket (fig.2). Manufacturer: BERTSCHAT (Northampton, United Kingdom)	medium voluminous shape, straight silhouette, horizontal division of front and back; black color	top material made of raincoat fabric; polyester lining with 5 heating zones; filler – synthepon	central zipper and pockets zippers; elastic hood cord; hood stoppers; Velcro fasteners on the sleeve pattes; temperature control button; power bank, USB cable
Heated vest (fig.3). Manufacturer: Fieldsheer (San Marcos, USA)	medium voluminous shape, straight silhouette, diagonal decorative and functional lines of separation of shelves and backs, light green color	upper material made of waterproof outer shell WaterpellTM; lining polyester with antistatic technology Zapsheer with 5 heating zones; filler – RDS premium duck down	central zipper and pockets zippers; temperature control button; power bank, USB cable
Heated jacket (fig.4). Manufacturer: Fieldsheer (San Marcos, USA)	medium voluminous shape, straight silhouette, light brown color	softshell top material; polyester lining with 6 heating zones	central zipper and pockets zippers; braided cord in the hood; hood stopper; temperature control button; power bank, USB cable; built-in Nightsheer LED flashlight.
Heated jacket (fig.5). Manufacturer: Venture Heat (Venice Beach, USA)	medium voluminous shape, straight silhouette, horizontal decorative and functional lines dividing the hem, back and sleeves, black color	top material is made of raincoat fabric; lining made of polyester material with 4 heating zones; filler – synthepon	central zipper and pockets zippers; temperature control button; power bank, USB cable
Heated jacket (fig. 6). Manufacturer: East Ukrainian technocluster (Kramatorsk, Ukraine) and SHP "VELNA" (Ukrayinsk, Ukraine)	medium voluminous shape, straight silhouette, horizontal decorative and functional lines of division of shelves, backs and sleeves, dark blue color	top material is made of raincoat fabric; lining made of raincoat fabric with 3 heating zones; filler – synthepon	central zipper and pockets zippers; elastic band of the sleeves; temperature control button; power bank, USB cable
Heated vest (fig.7). Manufacturer: TM "Shine" (Kharkiv, Ukraine)	medium voluminous shape, straight silhouette, diagonal decorative and functional lines of division of front, back, collar and hood, brown color	top material is made of raincoat fabric with polyurethane membrane; lining made using Omni-Heat technology with 2 heating zones; filler – biopolymer fiber synthetic down	central zipper and pockets zippers; temperature control button; power bank, USB cable
Heated jacket (fig.8). Manufacturer: TM "Freever" (Odesa, Ukraine)	medium voluminous shape, straight silhouette, dark blue color	top material made of raincoat fabric with wind and moisture resistant membrane; polyester lining with single heating zone; filler – holofiber	central zipper and pockets zippers; braided cord in the hood; buttons on the sleeves pattes; temperature control button; power bank, USB cable

Table 2

Comparative table of heated products by functional and design parameters

Analogs	Functional and design parameters	
	compliance with everyday use	**body heat support and wind protection**
Heated jacket (fig. 1). Manufacturer: The Warming Store (Philadelphia, USA)	provided by a straight silhouette, raglan sleeve, central fastening	provided by a stand-up collar; the presence of heating zones (carbon fiber fabric) on the parts of the lining at the top of the back, fronts and collar, with a button for adjusting the level of heat on the right front part at the bottom; pockets for storing the product's charging source
Heated jacket (fig.2). Manufacturer: BERTSCHAT (Northampton, United Kingdom)	provided by a straight silhouette, sewn-in sleeves, central fastening	provided by a hood with a stand, the front edge of which contains a drawstring with a cord to adjust the tightness of the fit to the face; pattes on the sleeves to adjust the tightness of the fit to the hands; details of the front, back, sleeve and hood sewn with insulation; the presence of heating zones (carbon fiber fabric) on the upper and lower back parts, on the front below, with a button for adjusting the heat level at the top of the lining of the left front part; side pockets on the front, an upper slit pocket on the left front part, inner lining pockets for storing the product's charging source.
Heated vest (fig.3). Manufacturer: Fieldsheer (San Marcos, USA)	provided by a straight silhouette and a central fastening	provided by a stand-up collar; details of the collar, front, back, stitched with insulation; the presence of heating zones (carbon fiber fabric) on the back parts at the top, on the upper and lower front parts, with a button for adjusting the heat level at the bottom of the right front part; side pockets for storing the product's charging source
Heated jacket (fig.4). Manufacturer: Fieldsheer (San Marcos, USA)	provided by a straight silhouette, sewn-in sleeves, central fastening	provided by a stand-up collar, a hood, the front edge of which contains a drawstring with a cord to adjust the tightness of the fit to the face; by the presence of heating zones (carbon fiber fabric) on the upper and lower back parts (waist area), at the top of the front, at the top of the sleeves; side pockets on the front, upper slit pocket on the left leg for storing the product's charging source
Heated jacket (fig.5). Manufacturer: Venture Heat (Venice Beach, USA)	provided by a straight silhouette, sewn-in sleeves, central fastening	provided by a hood with a stand, internal cuffs of the sleeves; details of the front, back, sleeves and hood, stitched with insulation; the presence of heating zones (carbon fiber fabric) on the details of the back, front and hood, with a button for adjusting the heat level at the bottom of the left front part; side pockets on the front parts, internal pockets on the lining of the front and back for storing the product's charging source; internal cuffs of the sleeves with a USB cable output for recharging
Heated jacket (fig. 6). Manufacturer: East Ukrainian technocluster (Kramatorsk, Ukraine) and SHP "VELNA" (Ukrayinsk, Ukraine)	provided by a straight silhouette, sewn-in sleeves, central fastening	provided by a stand-up collar, a drawstring at the bottom of the sleeves; internal cuffs of the sleeves; details of the collar, shelves, back, sleeves that are sewn with insulation; the presence of heating zones (carbon fiber fabric) on the lining details at the top of the back and shelves, with a button for adjusting the heat level on the lining of the left front part; pockets for storing the product's charging source
Heated vest (fig.7). Manufacturer: TM "Shine" (Kharkiv, Ukraine)	provided by a straight silhouette, sewn-in sleeves, central fastening	provided by a stand-up collar, removable hood; details of the collar, front, back, hood, stitched with insulation; the presence of heating zones (carbon fiber fabric) on the details of the back lining, with a button for adjusting the heat level at the top of the left front part; internal pockets in the lining for storing the product's charging source
Heated jacket (fig.8). Manufacturer: TM "Freever" (Odesa, Ukraine)	provided by a straight silhouette, sewn-in sleeves, central fastening	provided by a fixed hood with a stand, the front edge of which contains a drawstring with a cord to adjust the density of the fit to the face, internal cuffs of the sleeves, pattes on the sleeves to adjust the density of the fit to the hands; a drawstring at the bottom of the jacket; details of the front, back, sleeves and hood, stitched with insulation; the presence of heating zones (carbon fiber fabric) on the back details, with a button to adjust the heat level at the top of the left front part; patch pockets on the front to store the source of charging the product

a b

Fig. 9. Improved sample of a heated jacket: a-technical sketch; b – color scheme (light and dark shades)

Fig. 10 shows a technical drawing of the jacket with the designation of the main features of the model, where: 1 – heating systems; 2 – button for adjusting the heating temperature; 3 – pocket for storing the charging source; 4 – removable sleeves; 5 – removable hood with windbreaker; 6 – box plate; 7 – internal cuffs of the sleeves; 8– drawstring at the bottom of the product.

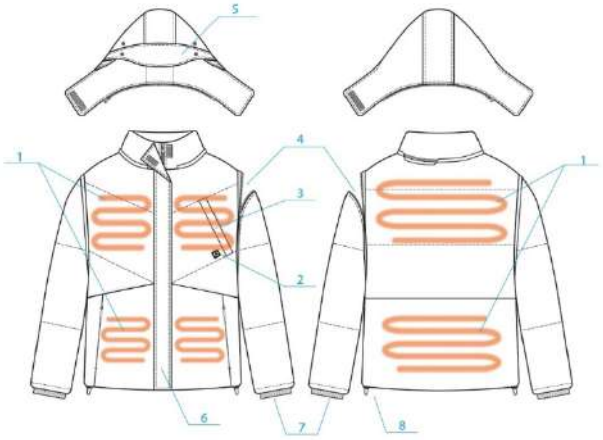

Fig. 10. Technical drawing of an improved heated jacket with the designation of the main places of design features

Conclusions. As a result of the analysis of practical experience in the manufacture of heated clothing by manufacturing companies, it was revealed that this industry is constantly developing, reflecting the constant demand for innovative technologies. Comparative analysis showed that foreign and Ukrainian analogues have common features, such as: conformity of design and decoration to everyday use, top materials made of fabrics with water-repellent, windproof and dirt-repellent properties, availability of heating systems; as well as distinguishing features: the location of heating zones and temperature control systems in different areas of the product, the presence of additional materials and elements for heat retention and protection from the wind. Due to this, a number of main advantages and certain disadvantages of analogues were singled out, such as: design inconsistency with modern trends, insufficient functionality of the design, inconvenient location of the pocket for the charging source. Based on this, possible solutions to these shortcomings are provided, namely: taking into account fashion trends in shape and color, using replaceable elements and functional pockets. An improved model of a heated jacket is proposed, which includes the experience of previous developments and improves their shortcomings. This approach to the development of a new model will help to improve customer satisfaction and increase market competitiveness.

Bibliography:

1. Tang S., Stylios G. K. An overview of smart technologies for clothing design and engineering. *International Journal of Clothing Science and Technology*. 2006. №18(2). P. 108–128.

2. Repon M. R., Mikučionienė D. Progress in flexible electronic textile for heating application: A critical review. *Materials.* 2021. №14(21). P. 6540.

3. Sweeting C. G. Combat flying clothing: Army Air Forces clothing during World war II. *Smithsonian Institution Press.* 1984.

4. Knibbs K. My Quest to Survive Quarantine – in Heated Clothes. Wired. 2021. URL: https://www.wired.com/story/cold-wfh-heated-clothes/ (дата звернення: 20.08.2025)

5. Scataglini S., Moorhead A. P., Feletti F. A systematic review of smart clothing in sports: Possible applications to extreme sports. *Muscles, Ligaments and Tendons Journal*. 2020. №10(2). P. 333–342.
6. Aheata 7V Men's Battery Heated Jacket. The Warming Store : webpage. URL: https://www.thewarmingstore.com/aheata-mens-7v-heated-jacket.html (дата звернення: 20.08.2025)
7. Heated Soft Shell Jacket | Men – USB. BERTSCHAT : webpage. URL: https://www.bertschat.co.uk/collections/heated-clothes/products/heated-soft-shell-jacket-men?variant=40100541399245 (дата звернення: 20.08.2025)
8. Crest Heated Down Vest Men's. Fieldsheer : webpage. URL: https://fieldsheerca.com/collections/mens-heated-clothing/products/crest-heated-down-vest-men (дата звернення: 20.08.2025)
9. Tundra Jacket Men's. Fieldsheer : webpage. URL: https://fieldsheerca.com/collections/mens-heated-clothing/products/crest-heated-down-vest-men (дата звернення: 20.08.2025)
10. Men's MAX 26W Heated Down Jacket with HeatSync. Venture Heat : webpage. URL: https://www.ventureheat.com/products/mens-12v-bt8710?variant=42977790787809 (дата звернення: 20.08.2025)
11. Starovoyt O. Куртка та жилет з *підігрівом*: на *Донеччині розпочали виготовляти «розумний» одяг*. Vseosvita : webpage. 2021. URL: https://vseosvita.ua/news/kurtka-ta-zhylet-z-pidihrivom-na-donechchyni-rozpochaly-vyhotovliaty-rozumnyi-odiah-46037.html (дата звернення: 20.08.2025)
12. Жилет з підігрівом TM Shine хакі. Elektrogrelka : webpage. URL: https://elektrogrelka.com/ua/p1134256959-zhilet-podogrevom-shine.html (дата звернення: 20.08.2025)
13. Чоловіча куртка з підігрівом: огляд популярної моделі від бренду Freever. Freever : webpage. URL: https://freever.ua/obzor/muzhskaya-kurtka-s-podogrevom?gclid=CjwKCAjwreW2BhBhEiwAavLwfJMa7ZU5fsMwOrUQr0WUH_3tYTCBAX_0T8hoOmaSkuOAHg04UEiQTRoCrSoQAvD_BwE (дата звернення: 20.08.2025)

References:

1. Tang, S., & Stylios, G. K. (2006). An overview of smart technologies for clothing design and engineering. *International Journal of Clothing Science and Technology*. №18(2). P. 108–128.
2. Repon, M. R., & Mikučionienė, D. (2021). Progress in flexible electronic textile for heating application: A critical review. *Materials.* №14(21). P. 6540.
3. Sweeting, C. G. (1984). Combat flying clothing: Army Air Forces clothing during World war II. *Smithsonian Institution Press*.
4. Knibbs, K. (2021). My Quest to Survive Quarantine – in Heated Clothes. Wired. Retrieved from: https://www.wired.com/story/cold-wfh-heated-clothes/ (last accessed: 20.08.2025).
5. Scataglini, S., Moorhead, A. P., & Feletti, F. (2020). A systematic review of smart clothing in sports: Possible applications to extreme sports. *Muscles, Ligaments and Tendons Journal*. №10(2). P. 333–342.
6. Aheata 7V Men's Battery Heated Jacket. The Warming Store : webpage. Retrieved from: https://www.thewarmingstore.com/aheata-mens-7v-heated-jacket.html (last accessed: 20.08.2025)
7. Heated Soft Shell Jacket | Men – USB. BERTSCHAT : webpage. Retrieved from: https://www.bertschat.co.uk/collections/heated-clothes/products/heated-soft-shell-jacket-men?variant=40100541399245 (last accessed: 20.08.2025)
8. Crest Heated Down Vest Men's. Fieldsheer : webpage. Retrieved from: https://fieldsheerca.com/collections/mens-heated-clothing/products/crest-heated-down-vest-men (last accessed: 20.08.2025)
9. Tundra Jacket Men's. Fieldsheer : webpage. Retrieved from: https://fieldsheerca.com/collections/mens-heated-clothing/products/crest-heated-down-vest-men (last accessed: 20.08.2025)
10. Men's MAX 26W Heated Down Jacket with HeatSync. Venture Heat : webpage. URL: https://www.ventureheat.com/products/mens-12v-bt8710?variant=42977790787809 (last accessed: 20.08.2025)
11. Starovoyt O. (2021). Kurtka ta zhylet z pidihrivom: na Donechchyni rozpochaly vyhotovliaty "rozumnyi" odiah [Heated jacket and vest: production of "smart" clothing has begun in Donetsk region]. *Vseosvita* : webpage. Retrieved from: https://vseosvita.ua/news/kurtka-ta-zhylet-z-pidihrivom-na-donechchyni-rozpochaly-vyhotovliaty-rozumnyi-odiah-46037.html (last accessed: 20.08.2025) [in Ukrainian].
12. Zhilet z pidihrevom TM Shine khaki [Shine Heated Vest Khaki]. Elektrogrelka : webpage. Retrieved from: https://elektrogrelka.com/ua/p1134256959-zhilet-podogrevom-shine.html (last accessed: 20.08.2025) [in Ukrainian].
13. Cholovicha kurtka z pidihrevom: ohliad populiarnoi modeli vid brendu Freever [Men's heated jacket: a review of the popular model from the Freever brand]. Freever : webpage. Retrieved from: https://freever.ua/obzor/muzhskaya-kurtka-s-podogrevom?gclid=CjwKCAjwreW2BhBhEiwAavLwfJMa7ZU5fsMwOrUQr0WUH_3tYTCBAX_0T8hoOmaSkuOAHg04UEiQTRoCrSoQAvD_BwE (last accessed: 20.08.2025) [in Ukrainian].

Стаття надійшла: 07.10.2025
Прийнято: 23.10.2025
Опубліковано: 28.11.2025