TECHNICAL SPECIFICATION

ISO/TS 3736-2

First edition
2022-08

Digital fitting — Service process —

Part 2:
Customized clothing online and offline

Habillage virtuel — Processus de service —

Partie 2: Habillement personnalisé en ligne et hors ligne

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 133, *Clothing sizing systems - size designation, size measurement methods and digital fittings*.

A list of all parts in the ISO/TS 3736 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The common practice of mass production and uniform consumption is changing and consumers' need for personalized goods and services such as customized clothing is growing and becoming a trend. New online technologies that use three-dimensional software, devices and automated production systems that support customization has played a major role in the expansion of the customized fashion market.

In the ubiquitous ready-to-wear fashion market, digital fitting technology can reduce exchanges and returns because the technology helps consumers choose a size among the existing sizes and provide recommendations that best fits their bodies.

In the ubiquitous customization fashion market, digital fitting technology is used in the process of pattern design, fit simulation, ordering and production, therefore it is more complicated than its application in the ready-to-wear market. Customization can be divided into two large categories, design-customization and size-customization (see 3.1), which requires more information from the customers.

In the ready-to-wear market a product already exists but in the customization market, there is no actual product, thus, digital fitting technologies, which enable visualization of the apparel, are essential before the production.

The customer provides the size and shape information using the virtual human body including information for the design and style required. The service provider takes this information and designs a pattern and virtual garment. The customer then tries on the virtual garment on their virtual human body and if satisfied, orders the product, which leads to production.

This document explains the details of this process.

Digital fitting — Service process —

Part 2:
Customized clothing online and offline

1   Scope

This document describes a service process applicable to the distribution of customized clothing using a virtual human body, virtual garment and fitting.

This document provides guidance to service providers, including online and offline retailers and 3D shopping platform developers to set up a service process for the distribution of customized clothing using a virtual human body, virtual garment and fitting.

This document does not specify software functions, algorithms and commercialization related to the simulation.

2   Normative references

There are no normative references in this document.

3   Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1   General terms

3.1.1
virtual human body
virtual human model for digital fitting of clothing sizing systems in the apparel industry, including information such as size, shape, cross section, body texture and skeletal structure

Note 1 to entry: Also called "fashion avatar". In computing, an avatar is the graphical representation of the user or the user's alter ego or character.

Note 2 to entry: The virtual human body is classified into two key types: virtual clone (or virtual shape, see ISO 18825-1:2016, 2.1.1.2.1) and virtual twin (or virtual size, see ISO 18825-1:2016, 2.1.1.2.2).

[SOURCE: ISO 18825-1:2016, 2.1.1.2, modified — "of clothing sizing systems" added to the definition.]

3.1.2
virtual garment
three-dimensional clothing in digital form that exists in virtual space

[SOURCE: ISO 18163:2016, 2.1.3, modified — Note to entry deleted.]

3.1.3
digital fitting
qualitative and/or quantitative evaluation of overall and/or specific simulation of garment fit through the analysis of the garment balance, gap between body and garment (which includes cross sections), heat map, surface wrinkles, etc.

Note 1 to entry: Digital fitting may be used for many different areas of application of virtual garments such as product development, marketing, etc.

[SOURCE: ISO 18163:2016, 2.1.5]

3.1.4
virtual garment simulation
creation and drape simulation of a virtual garment for a virtual human body using a virtual garment pattern, virtual sewing and bounding volume

[SOURCE: ISO 18163:2016, 2.1.4, modified — Note to entry deleted.]

3.1.5
customized clothing
garment produced after the order and production that meets the customers' required design (style, colour, material, and detail) and/or body shape and size information

3.1.5.1
design-customized clothing
garment that *customers* (3.2.2) can order by selecting design elements (e.g. style, colour, material, and details) in accordance with their preference

Note 1 to entry: It does not take into account the customer's body size or shape and the size of the clothing is the same as the ready-to-wear clothing size.

Note 2 to entry: to entry. See Figure 1.

Figure 1 — Example of a design-customized clothing (dress)

3.1.5.2
size-customized clothing
personalized service that modifies existing patterns or creates new patterns based on the size and shape of the customers' body

Note 1 to entry: It can include the function of design-customized clothing. Together, design and size customization corresponds to a Made-to-Measure (MTM) that selects and combines several body shapes and design elements.
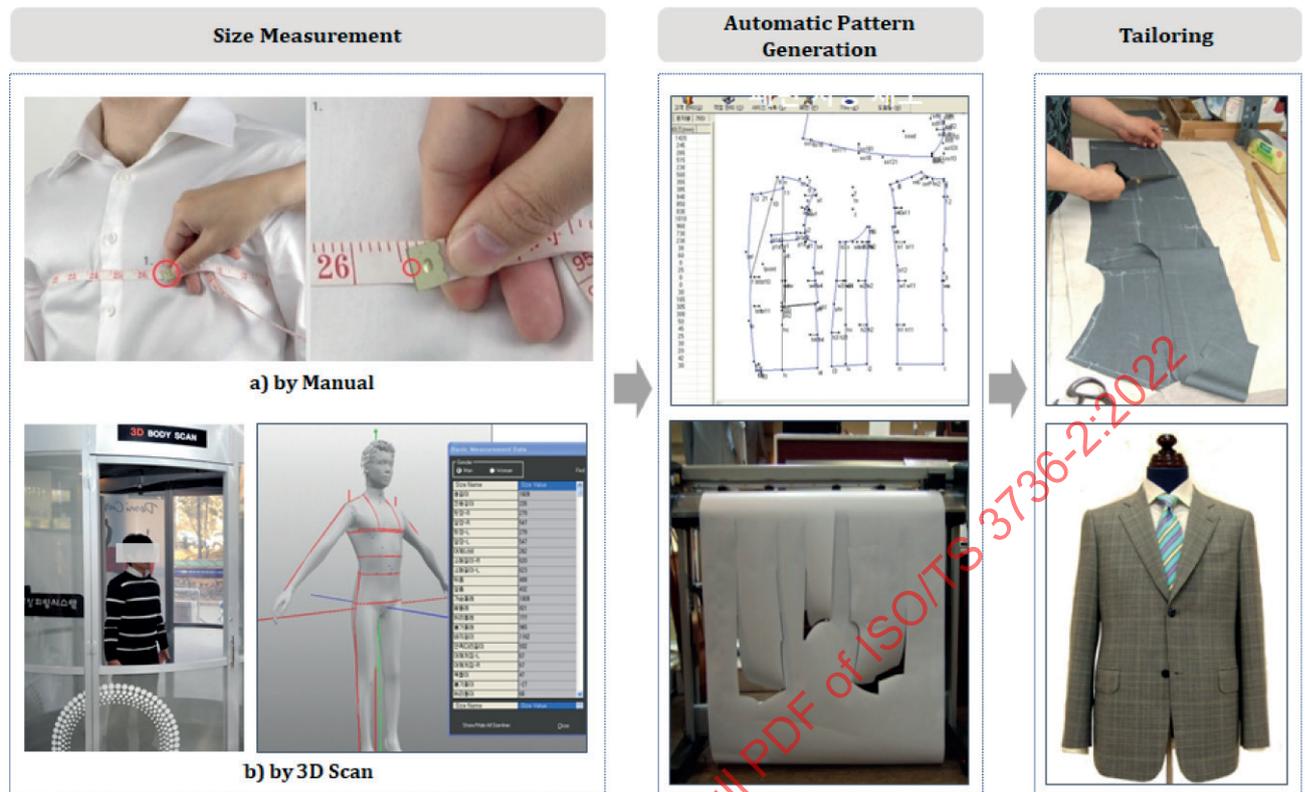
Note 2 to entry: See Figure 2.

Figure 2 — Example of a size-customized jacket

3.1.6
customized clothing shopping service using a virtual human body
process of a purchase decision without actually fitting on customized clothing in person but by a *virtual garment* (3.1.2) on a *virtual human body* (3.1.1) and checking *digital fitting* (3.1.3)

Note 1 to entry: A customized clothing shopping service using a virtual human body shortens the purchasing process, since it allows a customer to easily change designs or sizes and confirm the fit of customized clothing. It is a new distribution channel using IT technology, which allows for almost zero waste by personalized interaction between the buyer and the producer.

3.1.6.1
offline distribution channel
physical platform (place of distribution) that can provide *customized clothing shopping services using a virtual human body* (3.1.6)

Note 1 to entry: Physical platform such as a retail outlets should have a device that allows customers to select or input a design or size of clothing in real time, and to carry-out a digital fitting and a virtual garment simulation.

3.1.6.2
online distribution channel
online platform that can provide *customized clothing shopping services using a virtual human body* (3.1.6)

Note 1 to entry: Online platforms, such as the internet, mobile, digital and virtual shopping, should have a function that allows customers to select or input the design or size of clothing in real time, and to carry-out a digital fitting and virtual garment simulation.

3.2   Terms relating to users of distribution channels

3.2.1
platform service provider
organization with an *online distribution channel* ([3.1.6.2](#)) or *offline distribution channel* ([3.1.6.1](#)) and a database that can provide *customized clothing shopping services using a virtual human body* ([3.1.6](#))

Note 1 to entry: A platform that has a traditional clothing shopping system as well as a system that can show a digital fitting using a virtual human body and virtual garment. The platform is also able to save and manage the virtual human body and virtual garment.

Note 2 to entry: Virtual garments include details such as item features and size measurement data. The virtual human body to be used for virtual garment simulation includes data capable of creating a virtual twin.

Note 3 to entry: The platform for customized clothing shopping service is able to save and manage the elements for generating a virtual customized clothing sample (virtual fabric and a virtual garment pattern, see ISO 18163:2016, 2.1.1) and customized clothing property data (item, colour, material, detail, fit, and detailed size). In the case of a design-customized clothing shopping platform, it is able to change and apply the design elements of virtual customized clothing (style, colour, material, and detail). Shopping platforms of size-customized clothing are able to change and apply the size and pattern details of virtual customized clothing.

Note 4 to entry: The platform is able to save and manage database of customized clothing suppliers (e.g. raw material supplier, digital textile printing supplier, and sewing factory) and customized clothing designers for virtual garment simulation, ordering and production.

3.2.2
customer
user of the *online distribution channel* ([3.1.6.2](#)) or *offline distribution channel* ([3.1.6.1](#)) for *customized clothing shopping service using the virtual human body* ([3.1.6](#))

Note 1 to entry: Customers provide the body dimension information required by the platform service provider in case of size-customized clothing.

3.2.3
expert of customized clothing shopping service
human or artificial intelligence (AI) system that helps customers with customized clothing shopping service with knowledge of *customized clothing* ([3.1.5](#)) and with their experience as a customized clothing designer and/or patternmaker

Note 1 to entry: Experts of a platform service provider such as platform administrators and merchandisers have the understanding of virtual garment simulation and digital fitting and can coordinate the process of the customized clothing shopping service using the virtual human body

3.3   Terms relating to equipment for distribution channels

3.3.1
measurement equipment
device used for capturing three-dimensional body scans or body measurements for creating a *virtual human body* ([3.1.1](#))

Note 1 to entry: A three-dimensional body scanner or a smart tape measure can be used.

Note 2 to entry: It is an essential equipment in customized shopping service.

3.3.2
display device
equipment that visually shows the design or fit using a *digital fitting* ([3.1.1](#)) and *virtual garment simulation* ([3.1.4](#)).

Note 1 to entry: Smart/magic/virtual mirror, tablet, mobile phone, personal computer are some of the visual equipments used.

4 Service process

4.1 General

Figure 3 illustrates the processes of customized clothing shopping services using a virtual human body. The details of the service process are described in 4.2 to 4.9,
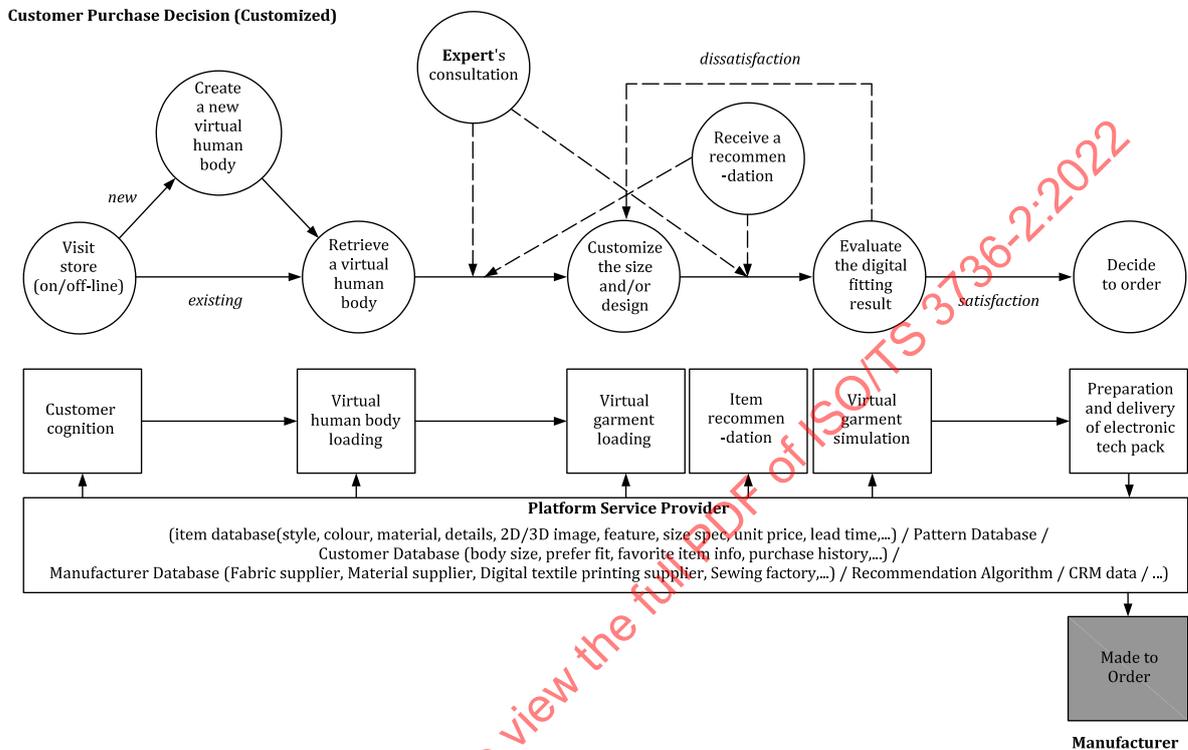

Figure 3 — Process of customized clothing shopping service using virtual human body

4.2 Platform service provider - Preparation phase

Platform service providers create a database as a preparation phase for service delivery of customized clothing online or offline. The database includes the customer-specific or representative virtual human body. It includes characteristics, dimensions and functions of clothing, but also property that can be customized (e.g. item, colour, material, detail, fitting display, detailed size and customizable area). Information for ordering and production of customized clothing includes raw material suppliers, digital textile printing suppliers and sewing factories. In addition, customized clothing designers, raw material costs, labour cost and time are included in the database.

4.3 Distribution channel visit

Customers visit an offline or online distribution channel that provides the customized clothing shopping service.

4.4 Creation or retrieval of a virtual human body

4.4.1 General

Customers create their own virtual human body, retrieve one they created and saved previously, or use a representative model similar to their own body to verify the fit of the desired customized clothing. The process of creating or retrieving a virtual human body is the same as the process described in ISO/TS 3736-1. However, essential processes and optional processes vary depending on design-

customized clothing or size-customized clothing. In the case of size-customized clothing shopping, platform service providers optionally require the customer's body shape information.

4.4.2   Creation of design-customized clothing

In case of design-customized clothing shopping, the customer creates a virtual human body or retrieves a representative virtual human body. In this case, it is not necessary to create a virtual human body that contains body dimension information, since the garment is not size-customized clothing tailored to the customer's body. In design-customized clothing service, the main purpose of the virtual human body is to enable the customer to virtually check the garment fit and drape. In addition, the customer can retrieve a representative virtual human body and modify its specific size to their body size.

4.4.3   Creation of size-customized clothing

In case of size-customized clothing shopping, the customer creates a virtual human body. The customer creates or retrieves a saved virtual human body that includes the specific body size dimensions required by the platform service provider to make size-customized clothing. These measurements include height, weight, bust girth, chest girth, waist girth, hip girth, inside leg height and other relevant body dimensions. The customer acquires their body dimensions through manual or automatic measurement by using measurement equipment or a measuring tool. At an offline distribution channel, the customer can get help from a shopping expert. During online shopping, the customer can take a picture of their body with a 3D smart technology and use it to create a virtual human body (See Figure 5).

Platform service providers create a virtual human body using the virtual human body creation function or retrieve representative virtual human body types saved in the platform database and project it on a display device along with physical information and sectional information.

Operators (mm, inch)
Stature (1883.7,74.2)
Leg Length (944.4,37.2)
Shoulder Width (402.1,15.8)
Arm Length (574.4,22.6)
Neck (340.2,13.4)
Upper Arm (322.7,12.7)
Lower Arm (273.7,10.8)
Bust (960.9,37.8)
Waist (748.5,29.5)
Abdomen (828.5,32.6)
Hip (934.1,36.8)
Midthigh (533.1,21.0)
Knee (348.9,13.7)
Calf (376.8,14.8)

Figure 4 — Example of creation of virtual human body including body dimension information for size-customized clothing
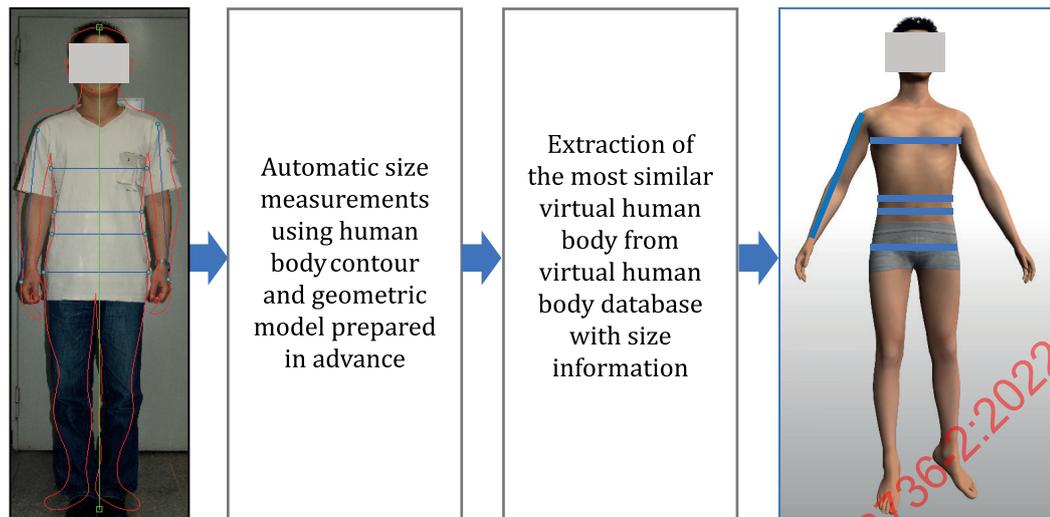
Figure 5 — Example of creation of virtual human body using 3D-capable smartphone

4.5 Selection and modification of customized clothing item (including virtual garment creation and virtual garment simulation)

4.5.1 General

Customers select the design, preferred fit, and customization areas. Customers select design options such as style, colour, material and detail for customized clothing on their own, or through a consultation with a shopping expert of the customized clothing shopping service using virtual human body.

The platform service provider creates a virtual design or virtual garment pattern of the customer's choice or both (see Figure 6 and Figure 7) and virtually sew in real time (see Figure 8) to be converted into a virtual garment. When the customer makes a customized clothing selection, the matching pattern is selected from the pattern database of the platform service provider (see Figure 7a). If patterns need to be created or modified according to the customer's size information, they are automatically generated by size grade-rule from the rule-based pattern (see Figure 7b). The methods applied depend on the provider. When the created or modified patterns are automatically placed around the virtual human body, the virtual sewing lines are automatically set and sewn (see Figure 8). The platform service provider displays the virtual garment simulation of the customized clothing on the virtual human body on a display device (see Figure 9).
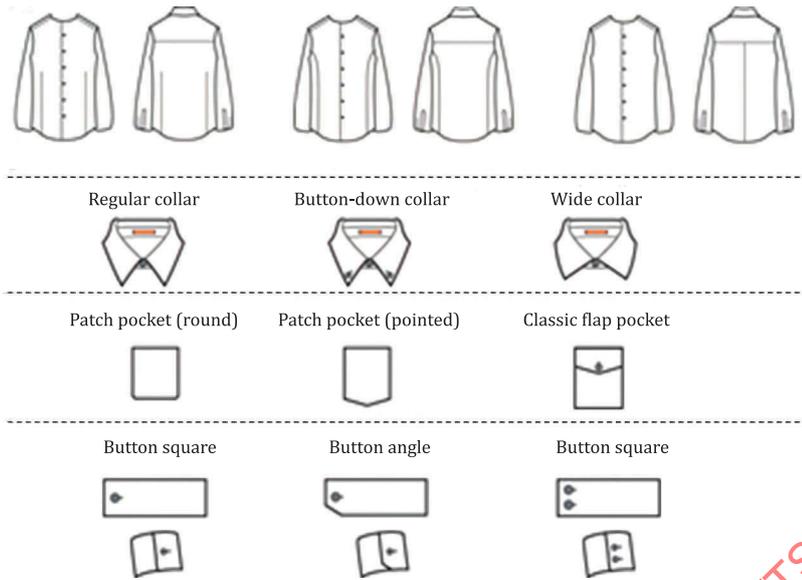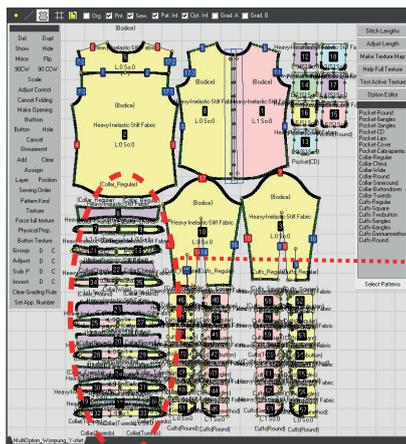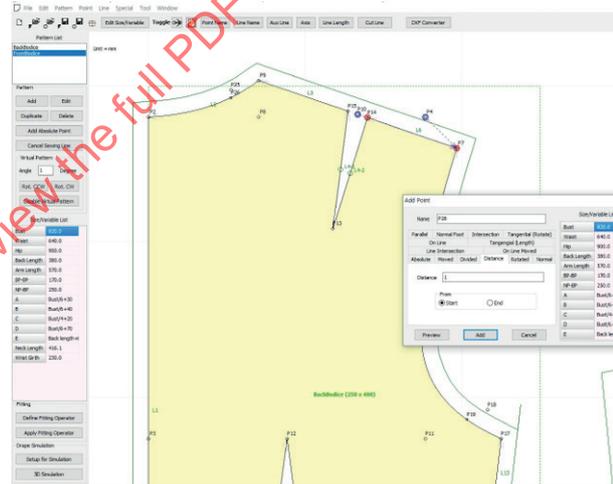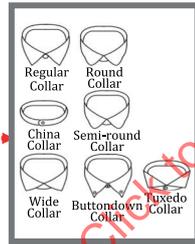
Figure 6 — Example of customer selection for men's shirts

a) Selected matching pattern from the pattern database

b) Rule-based pattern generation from customer's size information

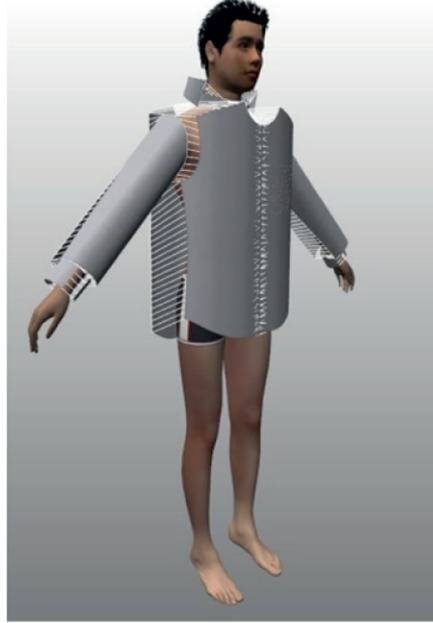**Figure 7 — Example of a generation of virtual pattern for men's shirt**

Figure 8 — Example of a virtual sewing for men's shirt

Figure 9 — Example of a virtual garment simulation for men's shirts

4.5.2 Design-customized clothing process

Customers change the design elements, such as style, material, colour and details of an item as required. When a customer changes a design element, the visual representation of the garment will vary depending on the garment fit. Variations in print or pattern size can occur depending on the material's elasticity, therefore, it is recommended to change the design element after virtually placing the selected item on the virtual human body. Through this process, the customer can virtually fit the customized clothing and verify whether it is correct.

4.5.3 Size-customized clothing process

Upon selecting a basic item that customers want to customize, they order the customized clothing of preference that acceptably fits their body type by using the virtual human body based on their body measurements. When customizing, the customer can select the fit style that the customer prefers, such as tight, normal or loose, and/or include design customization. At this time, the customer can change the size of the item, including fit and design detail size, by selecting the item to be resized. Since visual confirmation is important, the selected item can be resized after it has been virtually fitted on the virtual human body. Through this process, the customers virtually fit the customized clothing and check whether the selected customized clothing fits their virtual human body.

4.6 Evaluation of the digital fitting result

4.6.1 Evaluation of customized clothing's design and digital fitting results

Evaluation on the customized clothing's design and fit (digital fitting) results is carried out at the same level as the digital fitting results of the ready-to-wear clothing, which used the virtual human body (refer to the ISO 20947 series).

Platform service providers or experts of customized clothing shopping service analyse the virtual garment simulation and digital fitting results and suggest modifications.

When required, platform service providers help customers in making purchasing decisions by presenting the production cost, labour cost and production location of the selected customized clothing ordered, along with the order-to-delivery time.

4.6.2 Customer's purchase decision based on digital fitting

Customers confirm the result of the virtual garment simulation and digital fitting, and then determine the next step.

— If satisfied, customers decide to make a purchase.

— If dissatisfied, customers change the design or resize it.

Platform service providers or experts of the customized clothing shopping service recommend design or fit for each customer depending on the level of technology.

4.7 Digital fitting item change

Repeat steps 4.5 and 4.6.

Customers modify the design or size of the existing item and then evaluate the result of the digital fitting.

4.8 Purchase decision

Customers decide to purchase if they are satisfied with the result of the virtual garment simulation and digital fitting.

4.9 Preparation and delivery of electronic data pack

Platform service providers digitize and save information in the data pack, which includes the master pattern, pattern gradings, pattern marker makings, raw materials, design, size information, sewing instructions, the label and accessories, etc. of the customized clothing selected by the customer. This information is to be provided to the manufacturer for customized production. Figure 10 shows an example of an electronic data pack for customized men's shirts.