SUITCEYES

1 Jan 2018 - 31 Dec 2020

Smart, User-friendly, Interactive, Tactual, Cognition-Enhancer, that Yields Extended Sensosphere
Appropriating sensor technologies, machine learning, gamification and smart haptic interfaces

[D5.9]

Industrial Production Protocols

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 780814.

Dissemination level		
PU	PUBLIC, fully open, e.g. web	
CO	CONFIDENTIAL, restricted under conditions set out in Model Grant Agreement	
CI	CLASSIFIED, information as referred to in Commission Decision 2001/844/EC.	

Deliverable Type		
R	Document, report (excluding the periodic and final reports)	
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, etc.	
OTHER	Software, technical diagram, etc.	

Deliverable Details	
Deliverable number	D5.9
Part of WP	5
Lead organisation	HB
Lead member	Nils-Krister Persson

Revision History			
V#	**Date**	**Description / Reason of change**	**Author / Org.**
v0.1	25/09/2019	Structure proposal	Eva Lindell / HB
v0.2	09/12/2020	First draft for internal review	Nils-Krister Persson / HB
v0.3	17/12/2020	Second draft addressing review comments submitted to HB	Amelie Olesen, Li Guo, Nils-Krister Persson / HB
v0.4	18/12/2020	Final draft addressing PC and PMB reviewers' comments	AO, LG, NK/HB
v1.0	28/12/2020	Final draft submitted to the EU	Thomas Bebis / HB

Authors	
Partner	**Name(s)**
HB	Eva Lindell, Nils-Krister Persson, Amelie Olesen, Li Guo, Elisabeth Södergren

Contributors		
Partner	**Contribution type**	**Name**
ULeeds	Reviewer	Raymond Holt
Harpo	Reviewer	Joanna Starosta

Glossary	
Abbr. / Acronym	**Meaning**
HB	Hoegskolan I Boras / University of Borås
HIPI	Haptic intelligent, personalised interface
BOM	Bill of Material
F	Front
CF	Centerfront
B	Back
CB	Center back
vibr	Coin vibration motor
cyl	Cylindrical vibration motor
ela	Elastic
PM	Pattern mark (on pattern)
cam	Camera
CAD	Computer aided design

Table of Contents

Executive Summary

The deliverable D5.9 *Industrial Production Protocols (Report)* aims to bridge project results made in a research context with up-scaled manufacturing – which is what eventually leads to market and usage. For this, inspiration has been taken from a common concept within the textile and fashion industry, namely the *tech pack* which is a much employed tool, used for conveying information between designers and manufacturers in the textile supply chain. A full-fledged tech pack (in the form of an Excel file) for a vest with tactile communication means using vibro-tactile elements is presented. Included is also 3D scan work to show the positioning sensitivity of the elements and to give input to a customized, made-to-measure manufacturing process, which is shown feasible.

Introduction

The deliverable D5.9 *Industrial Production Protocols (Report)* aims to bridge small and lab scale results on the one side with industrial and production scale on the other. Contextualising this, it is an instance of the well-known gap between research and product innovation, i.e. introduction on a market. Without support for how to make a product, producfication, no company will be able to bring the research results to the market.

The deliverable contains two aspects hereof. First, the relatively new technique of 3D scanning is employed for getting measures from an individual from which a custom made, personalized garment could be carried out. This is in line with key words for the SUITCEYES project as a whole like customization and taken into account the variety of the target group and manufacturing aspects. 3D scanning could be seen as a first link in a value chain for production of future garments in general. Getting the measures of an individual is input to design programs such as Lectra (standard software within the textile community) for making garments. This is in turn input to CAD programs for (say) knitting machines in a knitting plant. Today it is possible to make what is called fully garments, i.e. complete knitted garments without any post-sewing process as the garment is made in one piece. Typically, this is done on flat knitting machines which have a wide ranged versatility. Still not everything can be done automatically - such as mounting electronics. Secondly, and the major part of D5.9, is the very description of making a vest from an industrial point of view. The knowledge developed during the SUITCEYES project for the sewing part at the lab and experimental scale is here condensated and filtered into a description at a large industrial scale. This is done in terms of what is denoted as a TechPack, which is state-of-the art in textile industry today.

Pre-study

A pre-study has been done to determine the best actuator placement location on the back. When integrating actuators into and onto the garment, one needs to consider not only the aesthetic and comfort aspects but also the human sensitivity to the tactile feedback. Proxemics (defined as a human's perception of self-size), weight distribution, postures, body movement are parameters to be considering. In this pre-study, we have focused on the human sensitivity related to the upper arm posture.

Method

When the actuators are placed on the body, especially in terms of a matrix form, it is crucial that the actuators keep at the place regardless of the body posture change and/or body movement. Messages, for instance the haptograms worked on elsewhere in the SUITCYES project, can be misperceived by the user when the position of the actuators changes. In this prestudy, five postures which can be easily repeated to evaluate the distance change to postures were selected (Figure 1). The test person then

had nine physical markers taped directly to the back. A reference marker was put in the middle of the test area at the backbone. Eight working markers where placed at different backmuscle parts, representing the areas most likely to distort by stretching. The markers were named as in Figure 2 and are grouped into two groups:

Markers 1 : left shoulder, right shoulder, lower back left and lower back right;

Markers 2: upper back left , upper back right, middle back left and middle back right.

3D body scanner (*Vitronic VITUSSMART LC*) has been used as a tool to register the movement of the markers generated by changing postures.

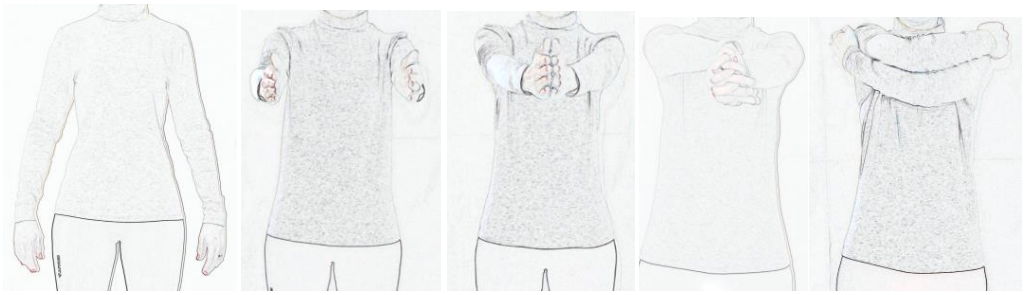


Figure 1. From left to right: Posture 1 - Relaxed standing with the arms hanging without touching the body; posture 2 - Relaxed standing with the hands and arms 90 degrees out from the body; posture 3 - Relaxed standing with the hands hold together 90 degrees out from the body; posture 4 - Relaxed standing with the hands rotated 180 degrees and then put together 90 degrees out from the body; and posture 5 - Relaxed standing with both arms bend. Hands tied to shoulders so that the elbows end up parallel to each other 90 degrees out from the body.

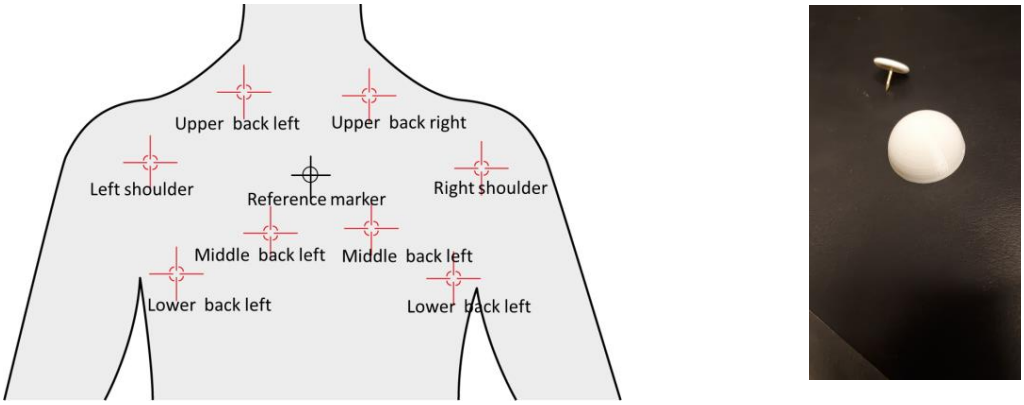


Figure 2. a) The markers placement; b) Markers used are highly reflective semi-spheres.

The scanning measures were taken with distances between the physical markers, both horizontal, vertical and from the reference marker to all of the markers, as seen in Figure 3.

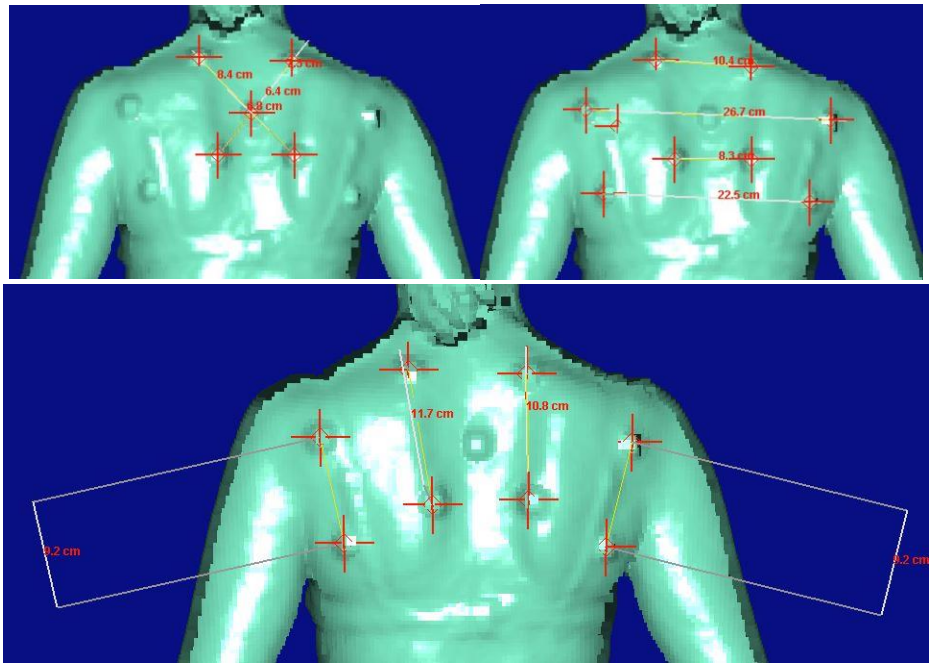


Figure 3. Center to center distance between makers and the ref. maker (top left); the horizontal distances (top right) and the vertical distances (bottom).

Results of the pre-study

The results are seen in Tables 1 and accompanying diagrams for different distances in Figure 4. In general, the scan and measurement result shown that the skin stretches even with relatively small position changes, but it also pulls together at the back when rising the arms.

Table 1 and Figure 4 present the center to center distances between the reference marker to all other makers in the five postures. As can be seen, marker group 1 (markers 1) changes more significant than that of the marker group 2 (markers 2), indicated that upper arm posture change has less impact medially than laterally.

Table 1. The center to center distances between ref. marker to all markers, grouped in two.

Reference marker to markers	Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	(cm)
Left shoulder	13,3	15,8	16,2	16,7	17	
Right shoulder	13,4	15,4	15,6	16,1	16	
Lower back left	14,2	15,3	15,4	16,1	15,7	
Lower back right	14,2	15,3	15,4	15,4	15,1	
Reference marker to markers	Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	
Upper back left	8,4	8,8	8,8	9	9,1	
Upper back right	7,5	7,7	7,8	7,9	7,8	
Middle back left	6,4	6,9	6,7	6,8	6,8	
Middle back right	6,8	7,3	7,1	7,3	7,1	

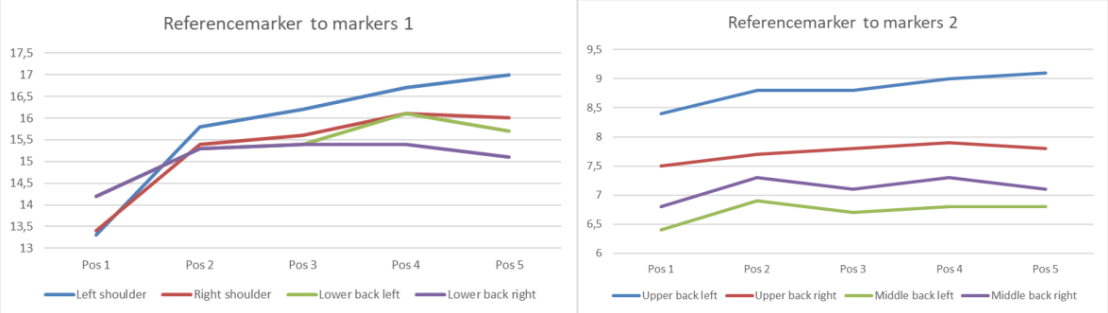


Figure 4. The center to center distances (in cm) between ref. marker to all markers 1 (left) and markers 2 (right).

In terms of changes in between each marker, one can see a similar trend in markers at the horizontal direction (Table 2). The shoulder to shoulder distance changes more significant than the middle back left to the middle back right, for example. On the other hand, less changes in the vertical direction for all markers at all postures were observed, which is due to that the five tested postures involved no horizontal stretch.

Table 2. Horizontal and vertical distances between markers.

Horizontal	Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	(cm)
Left shoulder-Right shoulder	26,7	30,9	31,7	31,8	30,7	
Middle back left-Middle back right	10,4	10,4	10,9	11,4	12,1	
Upper back left-Upper back right	8,3	11,4	11,6	11,3	11,3	
Lower back left-Lower back right	22,5	25,7	26,5	28	27,9	

Vertical	Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	(cm)
Left shoulder-Lower back left	9,2	9	9,1	9,5	9,4	
Upper back left-Middle back left	11,7	11,1	10,5	10,4	10,1	
Upper back right-Middle back right	10,8	10,3	10,2	10	9,2	
Right shoulder-Lower back right	9,2	9	8,9	9,3	9,7	

To conclude the prestudy, changing body posture will generate relative position changes of attached actuators, the changes induced by the five tested postures were more significant in the lateral sides

of the body than the medial part. This is true for both center to chenter distance and the distance in the horizontal direction, however, more postures need to be tested to evaluate the vertical position change, which will be done in a follow-up studyThe prestudy suggested in the design of the tactile vest gives that the actuators should be placed closer to the center of the back. However, the human resolution capability for tactile perception on the back should also be considered.

The HIPI Development Process

After having shown 3D scanning feasibility a production process for the haptic intelligent, personalised interface (HIPI) tactile vest could be mapped out (Figure 5). A 3D body scan is performed. This gives a set of measurement data. This is filtered and fed into state-of the art software for garment design (Lectra). The garment type is chosen, say a T-shirt, a vest, a dress. An adjustment phase is then performed. In an iterative manner a 3D fit simulation is performed digitally. Figure 6 shown the Lectra pattern design and 3D simulation interface (*3D Prototyping*). The use of 3D simulation enables the designers (HB), codesigner (ULeeds and HSO) and the users to simulate and visualize the HIPI models in 3D on a virtual mannequin, including the colors, size fit and the fabrics. Using the Lectra software pattern design is carried out. This could be either physically be printed out or, in this case, be kept in the digitally flow. The fabric is cut. A physical prototype is finally manufactured in the cut and sew process of textile industry.

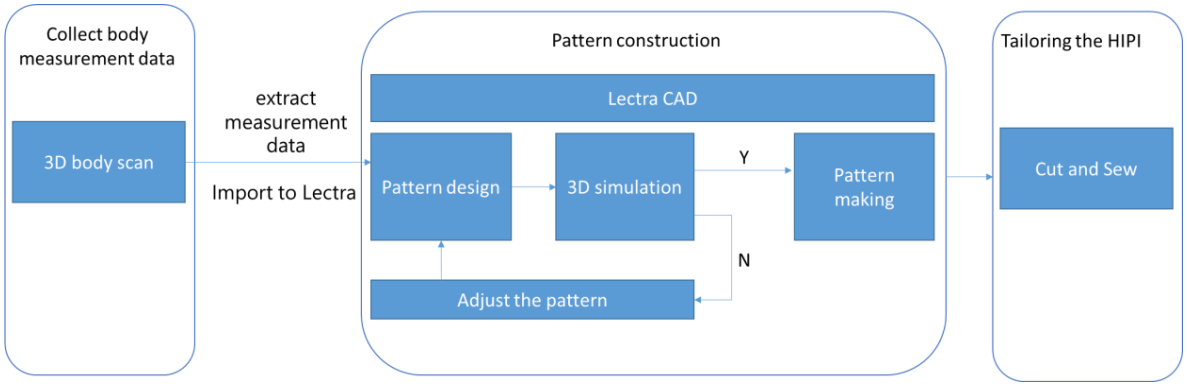


Figure 5. The HIPI development process flow: 3D body scan --> extract the measurement data --> adjust the measurement data in Lectra --> 3D simulation (with some iterations) --> pattern design --> pattern making --> production.

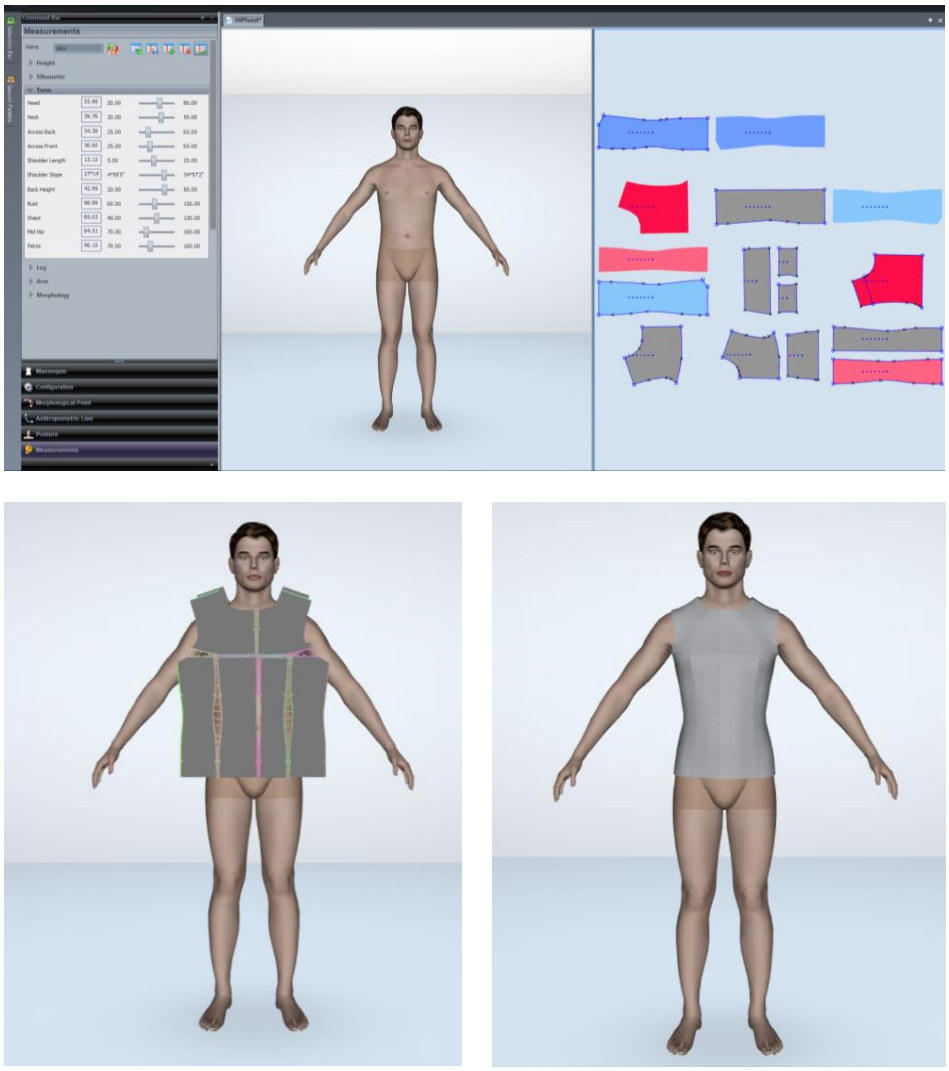


Figure 6. The Lectra 3D Prototyping interface - import the measurement data (top left); The pattern design and construction (top right) and the 3D simulation (bottom).

Tech Pack

The textile industry has a long history of distributed production, separating design and construction on one side, and manufacturing on the other. Given that the textile and fashion industry is a very global industry, the ability to correctly convey detailed information/specification of a product is of essence to be able to produce the thought garment with the intended result (Rita, 2016). Thus, specifications and detailed descriptions communicated between different actors along the textile supply chain have been developed and is much used. A special concept within the fashion community is what is called the technical package, in short, tech pack, It is the comprehensive specifications for a garment that is used throughout the manufacturing process of a garment. Other names for tech pack are specification pack, style file, dossier (Lee, 2018), product specification or product description (Eberle,2014).

It is a fundamental document in the manufacturing process and a tool of communication between buyers and suppliers (Lee, 2018). The purpose of a tech pack is to accomplish the following:

- Communicating specific product descriptions;
- Developing product consistency;
- Negotiating bids and contracts.

(R.E Glock p.102)

The importance of adequate specifications is crucial and can prevent many problems (Glock, 2005), including those of legal nature. Several components are needed such as technical sketches of a garment front- and back view, detail sketches, points of measure, grading rules, bill of material, labels and packing. Although companies have different kind of layouts and titles for the components, the content is still received likewise (Lee, 2018).

Throughout the manufacturing process a tech pack is often amended at one point. To achieve an intended result style changes might be carried out when garment prototypes are revised, for example measurement alterations for better fit or adding details to improve visual appearance. When a contract is signed a tech pack can no longer be changed and a supplier is obligated to deliver the garment as specified and at a certain cost (Glock, 2005).

A company can create internal tech pack standards that could be used for all/some of the manufactured garments. This not true not least of multinational large fashion companies. They could include often extremely detailed information such as packing information, placement of labels or stitches per inch (still much used instead of SI units) for frequently used seams. By doing this the appearance of several styles in a brand can be more unified and consistency can be achieved. Also, creating standardised tech packs facilitate for companies as great detailed specifications are very time consuming and require full commitment. Available information in the standard can then be omitted from the specific style tech pack, which saves time and improves garment consistency (Glock, 2005).

When it comes to contracts the tech pack has a central role, since it is a fundamental document between buyers and suppliers (Glock, 2005). Manufacturers use it as a means when making cost estimates for the buyer, and at the same time undertake the responsibility to deliver the thought garment at a certain price (Lee, 2018).

Tech pack components

Excel is a common environment for presenting and working with tech packs and is what is used here.

The pages of the techpack, see appendix I, can be described with:

- Side header – specifying general information about the style on all pages;
- Style overview – quick overview of style with sketches from all sides;
- Detail pages – specifying all garment details which are not included elsewhere;
- Pattern – all pattern pieces for the style;
- Garment Measurement Chart – points of measure and accepted tolerance values;
- Construction – shows how to assemble the garment, which machines are used and seam type;

- BOM – Bill of Material, states all materials needed to manufacture one garment unit of a specific style (Lee, 2018);

Even if far from the standard procedures in a clothing company, we have here also included the electronics. One alternative is to apply a platform philosophy for the design of the garment with different sensors and actuators for a given customer/garment type but here a general "all-included" description is presented. It has to be said that naturally only devoted textile companies to technical products would be able to handle any integration of electronics. Seams are central for any sewing partner which are finally described in the following.

Seams

Seams are of special importance for quality, sometimes for the brand. but also for the sewing company itself as it is the central part one is working with. Seams used in this style are the following.

Seam 514 is an over-edge chain stitch in the 500 class. It is a strong yet elastic seam (Colovic, 2015). It is a seam defined in standard ISO 4915 (Standards, 1995). Thread 1 and 2 are needle threads, a and b are looper threads (see figure 7).

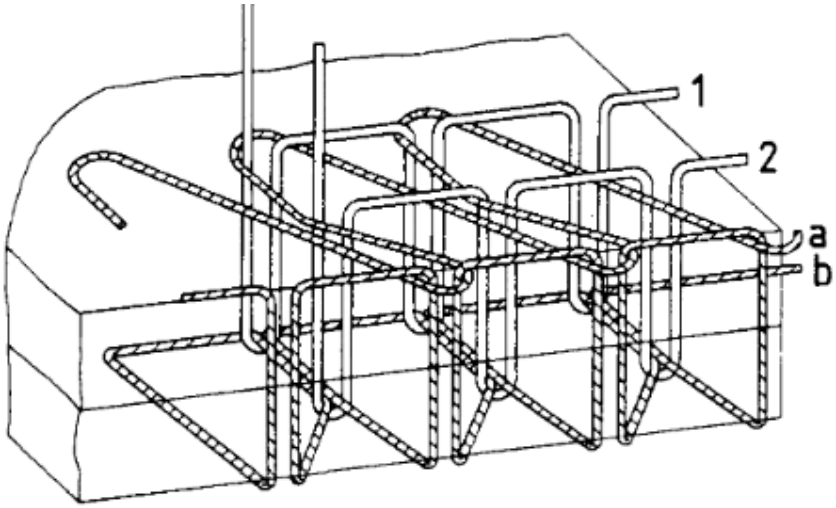


Figure 7. Seam diagram seam 514 from ISO 4915.

Seam 301 is the simplest seam with a needle thread and bobbin thread, defined in (Standards, 1995). See Figure 8 for seam diagram. Thread 1 is the needle thread and thread a is the bobbin thread.

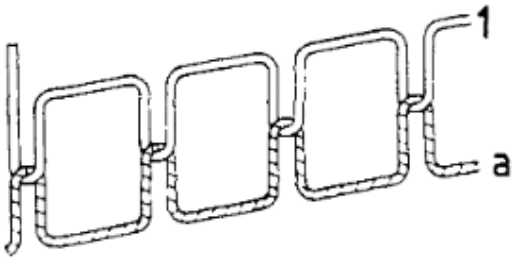


Figure 8. Seam 301 from ISO 4915.

Seam 401 is a two-thread chain stitch (Standards, 1995) that is suitable when elasticity is needed (Colovic, 2015). See seam diagram in Figure 9. Thread 1 is the needle thread, thread a is the bobbin thread.

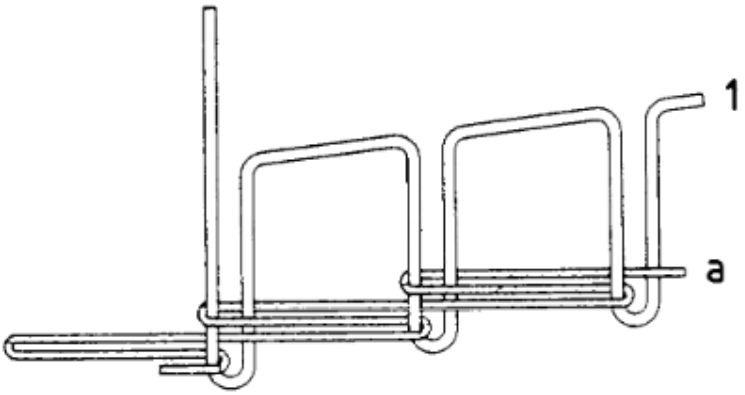


Figure 9. The 401 seam, from ISO 4915.

References

COLOVIC, G. 2015. Sewing, stitches and seams. *Garment Manufacturing Technology.* Woodhead Publishing.

EBERLE, H., RING, W. 2014. Clothing technology : ...from fibre to fashion.

Glock, R.E., Kunz, G. I. 2005. Apparel Manufacturing Sewn Product Analysis, New Jersey: Pearson Education.4, pp. 98-105.

LEE, J. A. S., C. 2018. *Technical Sourcebook for Apparel Designers*, New York: Fairchild Books.

RITA, A. A. M., S. 2016. Effectiveness of Technical Packages for the Apparel Production Process in the Global Apparel Industry. *IOSR Journal of Business and Management,* 18**,** 47-51. .

STANDARDS, S. I. F. 1995. SS-ISO 4915 Textiles - Stitch types - classification and terminology.

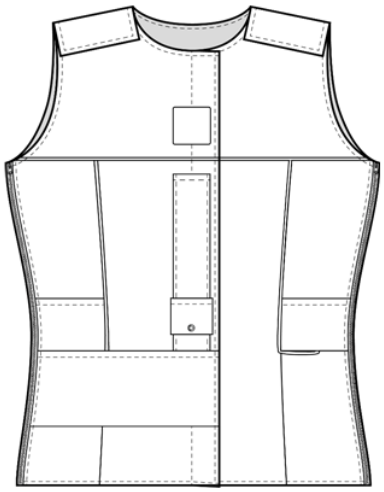
APPENDIX I: The HIPI Vest Tech pack

Style Overview

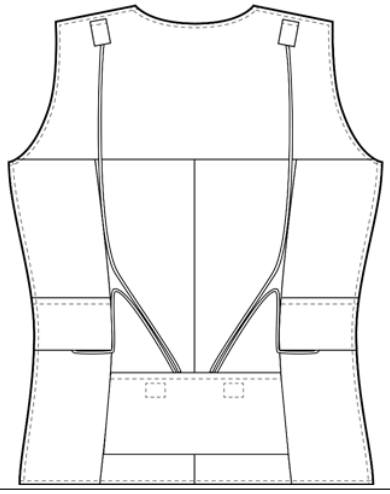
SUITCEYES

Prod. No.	GP_HIPI_2020	**Name**	HIPI Vest	**Date first send**	XX
Style	HIPI	**Fit type**	Tight Vest	**Date revised**	XX
Season	2020	**Brand**	SUITCEYES	**Status**	XX
Collection	SUITCEYES	**Size range**	One Size	**Fabrication**	XX

Garment front view



Garment back view



Smart garment for navigation and communication support with haptic feedback.

- Zipper closure front and zipper size adjustment in sides.
- Velcro size adjustment in shoulder seams
- 4 pocket for coin vibration motors (2 front, 2 back)
- 2 pockets for cylindrical vibration motors
- 2 pockets for controllers (1 front, 1 back)
- 1 camera mounting piece
- 1 wide wire channel for ribbon cable
- 9 piping wire channels (3 front, 4 back)

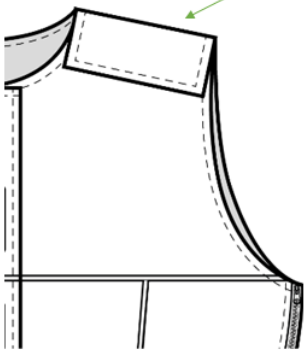
Page 1 of 12

Details 1/5

SUITCEYES

Prod. No.	GP_HIPI_2020	Name	HIPI Vest	Date first send	XX
Style	HIPI	Fit type	Tight Vest	Date revised	XX
Season	2020	Brand	SUITCEYES	Status	XX
Collection	SUITCEYES	Size range	One Size	Fabrication	XX

DETAIL - Velcro shoulder closure

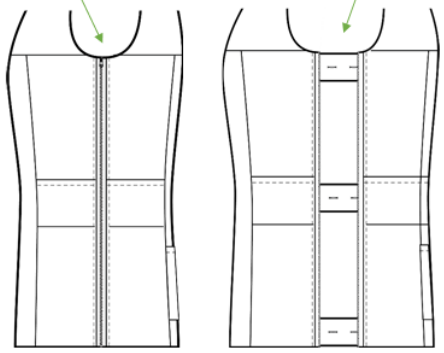


No shoulder seam, garment is closed over the shoulders with velcro that can be tighened (shortened) or loosened (lengthened) for size adjustment.

DETAIL - zipper side size adjustment

Zippers in sides closed (provides smaller size)

Zippers in sides opened (provides a larger size and adjustment)



Details 2/5

SUITCEYES

Prod. No.	GP_HIPI_2020	Name	HIPI Vest	Date first send	XX
Style	HIPI	Fit type	Tight Vest	Date revised	XX
Season	2020	Brand	SUITCEYES	Status	XX
Collection	SUITCEYES	Size range	One Size	Fabrication	XX

DETAIL - Cable management (inside garment)

Eyelets on the inside of the pocket guiding the wire from cylinder vibration motor to be on inside of garment to controller pocket

DETAIL - vibration motor placement in pocket

Extra elastic ribbon on inside of pocket to keep cylindrical vibration motor in place.

Details 3/5

SUITCEYES

Prod. No.	GP_HIPI_2020	Name	HIPI Vest	Date first send	XX
Style	HIPI	Fit type	Tight Vest	Date revised	XX
Season	2020	Brand	SUITCEYES	Status	XX
Collection	SUITCEYES	Size range	One Size	Fabrication	XX

Camera mounting piece on front. Tilted to compensate for angle on front chest.

Camera fastening with velcro.

Cable channel for ribbon cable, guides to cable to controller pocket.

Details 4/5

SUITCEYES

Prod. No.	GP_HIPI_2020	Name	HIPI Vest	Date first send	XX
Style	HIPI	Fit type	Tight Vest	Date revised	XX
Season	2020	Brand	SUITCEYES	Status	XX
Collection	SUITCEYES	Size range	One Size	Fabrication	XX

DETAIL - Back matrix vibration motor attatchment

Vibration motor placed next to pocket

Vibration motor placed inside pocket

DETAIL - Back matrix on garment

Adjustable velcro (loop) straps with vibration motors attached on velcro (hook) so the placement of the vibration motors can be adjusted in closeness in both horizontal and vertical direction.

Details 5/5

Prod. No.	GP_HIPI_2020	**Name**	HIPI Vest	**Date first send**	XX
Style	HIPI	**Fit type**	Tight Vest	**Date revised**	XX
Season	2020	**Brand**	SUITCEYES	**Status**	XX
Collection	SUITCEYES	**Size range**	One Size	**Fabrication**	XX

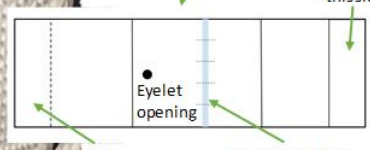
Size adjustment side

The smaller size of the vest is acchieved when the zippers in the sides are closed

The larger size of the vest is acchieved when the zippers in the sides are opened

Extra pocket for cylindrical vibration motor if needed for correct placement

Velcro (loop) this side



Velcro (hook) other side

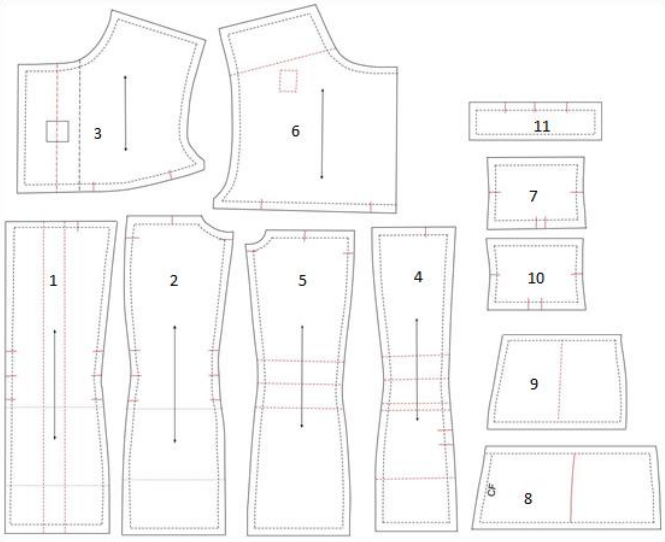
Elastic ribbon for keep in vibration motor in place

Pattern Pieces

Prod. No.	GP_HIPI_2020	**Name**	HIPI Vest	**Date first send**	XX
Style	HIPI	**Fit type**	Tight Vest	**Date revised**	XX
Season	2020	**Brand**	SUITCEYES	**Status**	XX
Collection	SUITCEYES	**Size range**	One Size	**Fabrication**	XX

Pattern piece no.	Pattern piece name	Material	Cut
1	Center front panel	Main fabric	2
2	Side front panel	Main fabric	2
3	Front yoke	Main fabric	2
4	Center back panel	Main fabric	2
5	Side back panel	Main fabric	2
6	Back yoke	Main fabric	2
7	F vibr. pocket	Pocketing	2
8	F controller pocket	Main fabric	1
9	Back contr. Pocket	Main fabric	1
10	Back vibr. Pocket	Pocketing	2
11	Extra pockets	Pocketing	2

Measure	Additional cutting		
3 x 2 cm	Top cyl. Pocket	Pocketing	2
16 cm	Elastic ribbon sides	4 cm wide elastic	4
See pp	Ela. ribbon (pockets)	0,5 cm wide elastic	6
5x5x2 cm	Cam. mounting piece	Foam (tilt height)	1
7 x 25 cm	Ribbon cable guide	Pocketing	1
PM	Front shoulder velcro	Velcro (hook)	2
PM	Back shoulder velcro	Velcro (loop)	2
7x40 cm	Stripes back matrix	Velcro (loop)	8

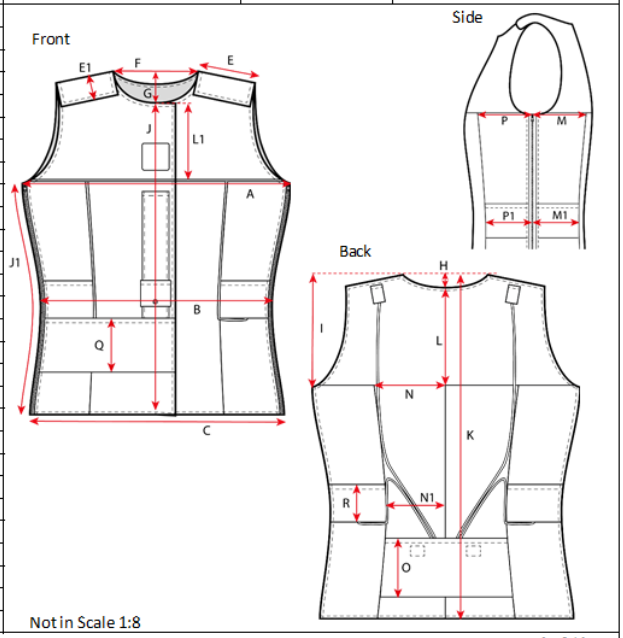


Garment Measurement Chart

SUITCEYES

Prod. No.	GP_HIPI_2020	Name	HIPI Vest	Date first send	XX
Style	HIPI	Fit type	Tight Vest	Date revised	XX
Season	2020	Brand	SUITCEYES	Status	XX
Collection	SUITCEYES	Size range	One Size	Fabrication	XX

Code	Measures (CM)	One Size	Tol. + / -
A	Chest *	49,5	2
A1	Chest at widest *	63,5	2
B	Waist *	40	2
B1	Waist at widest *	54	2
C	Hip *	48	2
C1	Hip at widest *	62	2
D	Side adjustment at widest	14	0,5
E	Shoulder width	11	0,5
E1	Shoulder overlap	5,5	1
F	Neck width	16,5	1
G	Front neck drop	6,5	1
H	Back neck drop	3	1
I	Armhole drop	21,5	1
J	Front Zip length	57	0
J1	Side Zip length	40	0
K	Length Back fr. HPS	63,5	2
L	Yoke height CB	18	1
L1	Yoke height CF	15	1
M	Back side panel - Top	13,5	1
M1	Back side panel - Waist	10,5	1
N	Back panel width - Top	9,5	1
N1	Back panel width - Waist	7	1
O	Back pocket height	12	1
P	Front side panel - Top	12,5	1
P1	Front side panel - Waist	10	1
Q	Front pocket height	10	1
R	Waist pockets height	7	1



Not in Scale 1:8

*Girth measurements are half measures

Construction

SUITCEYES

Prod. No.	GP_HIPI_2020	Name	HIPI Vest	Date first send	XX
Style	HIPI	Fit type	Tight Vest	Date revised	XX
Season	2020	Brand	SUITCEYES	Status	XX
Collection	SUITCEYES	Size range	One Size	Fabrication	XX

Textile Components

Area	Description	Join stitches	Seam finishes	Top Stitch	Machine	Comments
All edges	Hem	Single-needle Lockstitch	5-thread overlock	5 mm from edge	Lockstitch / Overedge	
Front and back - panels and yoke	Join	Single-needle Lockstitch	5-thread overlock	-	Lockstitch / Overedge	
Zipper - front and sides	Join and Topstitch	Single-needle Lockstitch	5-thread overlock	5 mm from edge	Lockstitch / Overedge	
Button sides	Four-hole button	-	-	-	Button sewing machine	
Buttonhole on Elastic	Buttonhole	-	-	-	Buttonhole machine	
Shoulder and front closure	Attach velcro	Single-needle Lockstitch	-	edge	Lockstitch	
Pockets	Fold and Topstitch	Single-needle Lockstitch	-	edge	Lockstitch	
Elastic	Attch	Single-needle Lockstitch	-	-	Lockstitch	
Ribbon cable channel - front	Fold and Topstitch	Single-needle Lockstitch	-	5 mm from edge	Lockstitch	
Piping wire channels - front and back	Join / Topstitch	Single-needle Lockstitch	-	- / edge	Lockstitch	

Bill of Material 1/3

SUITCEYES

Prod. No.	GP_HIPI_2020	Name	HIPI Vest	Date first send	XX
Style	HIPI	Fit type	Tight Vest	Date revised	XX
Season	2020	Brand	SUITCEYES	Status	XX
Collection	SUITCEYES	Size range	One Size	Fabrication	XX

TEXTILE COMPONENTS

Item	Content	Placement	Supplier	Width/weight/size	Colour	Finish	QTY
Interlock jersey	100% Polyester	Front and back yoke, front and back pieces		145 cm,	Grey	Pre coloured	80 cm
Velcro (loop)	100% Polyester	Back shoulder & stripes, CF closure + extra pieces		145 cm	Black		100 cm
Pocket fabric	100% Polyester	F, B, and top vibr. pocket		145 cm	White	Pre coloured	25 cm
TRIMMINGS							
Velcro (hook)	100% Polyester	Front shoulder, camera mounting piece		2,5 cm (on roll)	Black		80 cm
Zipper - one way	100% Plastic	Front closure, left & right side		55 cm	Grey		1 pcs
Zipper - one way	100% Plastic			40 cm	Grey		2 pcs
Eyelets	100% Brass	F, B vibr. Pocket, extra pockets		0,5 cm dia	Brass		6 pcs
Thread	100% Polyester	All over			DTM		-
Elastic ribbon	10% Elastane 90% Polyester	Left and right side		4 cm	Black		64 cm
Elastic ribbon	10% Elastane 90% Polyester	Pockets		0,5 cm	White		-
Foam		Cam. mounting piece		2 cm			5x5 cm
Piping with conductive wire	Casing: 100% Polyester	Front and back body		0,3 cm	Green		-

Bill of Material 2/3

SUITCEYES

Prod. No.	GP_HIPI_2020	Name	HIPI Vest	Date first send	XX
Style	HIPI	Fit type	Tight Vest	Date revised	XX
Season	2020	Brand	SUITCEYES	Status	XX
Collection	SUITCEYES	Size range	One Size	Fabrication	XX

ELECTRONIC COMPONENTS

Item	Component	Part number	Placement	Supplier	Width/size	QTY
JST PH, 2 Way, 1 Row, Str. PCB Head.	Controller	B2B-PH-SM4-TB(LF)(SN)	Back pocket	RS Components Ltd		8
JST PHR Female Connector Housing, 2mm Pitch, 2 Way, 1 Row	Controller	PHR-2	Back pocket	RS Components Ltd		8
JST PH, 4 Way, 1 Row, Straight PCB Header	Controller	B4B-PH-SM4-TB(LF)(SN)	Back pocket	RS Components Ltd		7
JST PHR Female Connector Housing, 2mm Pitch, 4 Way, 1 Row	Controller	PHR-4	Back pocket			7
JST PH, 8 Way, 1 Row, Straight PCB Header	Controller	B8B-PH-SM4-TB(LF)(SN)	Back pocket	RS Components Ltd		4
JST PHR Female Connector Housing, 2mm Pitch, 8 Way, 1 Row	Controller	PHR-8	Back pocket			4

Bill of Material 3/3

SUITCEYES

Prod. No.	GP_HIPI_2020	Name	HIPI Vest	Date first send	XX
Style	HIPI	Fit type	Tight Vest	Date revised	XX
Season	2020	Brand	SUITCEYES	Status	XX
Collection	SUITCEYES	Size range	One Size	Fabrication	XX

ELECTRONIC COMPONENTS

Item	Component	Part number	Placement	Supplier	weight/width/size	QTY
JST PH Female Crimp Terminal Contact 24AWG BPH-002T-P0.5S	Controller	BPH-002T-P0.5S	Overall	RS Components Ltd		44
JST GH Female Crimp Terminal Contact 26AWG	Controller	SSHL-002T-P0.2	Overall	RS Components Ltd		32
HC-SR04	Ultrasonic sensor		Front	Amazon		7
LilyPad Vibe Board	Actuator		Back matrix panel	Sparkfun		16
Vibration Motor	Actuator Vibration Motor -	Model No. 307-103	Front and back side, Top Shoulders	Precision Microdiver		8
Ribbon cable	Cable		Center front under camera	RS Components Ltd	50 mm	30 cm
Arduino Mega 2560 Rev3 MCU Development Board A000067	Controller	715-4084	Front pocket	RS Components Ltd		1
AAEON UP board	Controller		Front pocket			1