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INSURANCE OF KNITTED PRODUCTS QUALITY THROUGH THE ANALYSIS AND EVALUATION OF NON-QUALITY DURING ASSEMBLY BY STITCHING

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Abstract: *In a knitting factory, any acticity oriented toward evaluation, maintanence or improvement of products quality level is based on measuring and examining the product quality characteristics, in order to establish conformity to the quality specifications and/or naming the non-quality characteristics, thus noticing defects or fabrication deficiencies.*
The quality of the stitching operation has a particular influence on the finite product quality and is determined on side by the quality of knitted pieces, and on the other by insuring the correlation between the technological parameters of the stitching operation and the physico-mechanical characteristics of the knittings that are to be assembled through stitching.
Although the product execution processes comprise of manufacturing the elements and distinct subassemblies and their ulterior assembly, they present various difference dictated by the constructive particularities of the machine, as well as fabric characteristics.
Because of the multiple interactions between the material, yarn and working parts of the sawing machine, inadequacies in the technological discipline can result in negative effects on both the knitted and stitching thread as well as the machine. A part of these can be fixed by extra time consuming tasks (yarn breaks, stitching ruffling etc.), while other defects appear during the usage of the product cheapening it (stictch tearing by perforating the knitted on the stitching line, pilling effect, dimensional instability etc.).
This paper systematically presents, the main defects that may occur during the stitching operation of the products made out of circular knitted, as well as the causes that generate them along with preventive or corrective actions.

Key words: *qualiy, knitting, sewing, products, defects, insurance.*

1. INTRODUCTION

In a knitting factory quality insurance presents a management component as well as a technical one. The management component implies the construction of an evolved quality system and involvement of the whole personnel, while the technical componenets implies fitting of high technical level machines.

Along with all the other steps of the product fabrication process, confectioning is the phase in which textile fabric characteristics are improved and new product quality characteristics are obtained. As example:

- Esthetic of technological manufacturing;
- Aspect and behavior of the product;
- Novelty degree of the design;
- Correlation between life style and clothing;
- Dimensional correspondence;
- Dressing and undressing ease;
- Body covering degree;
- Fastening method.

2. GENERAL INFORMATION

Assembly operations, considering their prevalence, decisively influence the quality of the clothing products.

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Because of the multiple interactions between the material, yarn and working parts of the sawing machine, inadequacies in the technological discipline can result in negative effects on both the knitted and stitching thread as well as the machine. Part of these defects can be fixed by extra time consuming tasks (yarn breaks, stitching ruffling etc.), while the other part appear during the usage of the product cheapening it (stictch tearing by perforating the knitted on the stitching line, pilling effect, dimensional instability etc.).

In order to prevent these deficiencies, a good understanding of knitted proprieties and behavior during the manufacturing process is needed, thus creating the premises of product quality supervision.

2.1 Agents that influence the quality of stitching assembly

During knitted stitching, the working regime and a series of functional and technological parameteres have to be directly correlated with the physico-mechanical characteristics of the knitted that is to be assembled.

The agents that influence the quality of the sawing operation through representative characteristics are presented in table 1:

Table 1: *Influencing factors for the quality of the sawing operation*

No.	Quality influence factors	Groups of representative quality characteristics
1.	Type and characteristics of the textile	- structural characteristics (density, thickness); - physico-mechanical characteristics; - manufacturing characteristics;
2.	Seam type and structure	- number of stitchng threads; - stitching direction; - stitching type (visible/hidden); - interwining of the threads;
3.	Working parts characteristics	- needle type and characteristics (shape, count and surface preparation) [1, 4]; - transporter type (shape, height, and preparation of transporter teeth; amplitude differences in the transporter plates) [2,3]; - pressing pin type (shape, surface preparation);
4.	Seam thread type and characteristics	- fibrous composition; - torsion value and direction; - count; - designation (closing, covering, overlock) - elasticity; - physico-mechanical characteristics;
5.	Technical documentation characteristics	- technical and technological files; - assortement card; - standard design; - fabric samples;
6.	Caracteristicile asamblării Assembly characteristics	- number of layers; - layer height (thickness); - stitching direction; - stitching width;
7.	Stitching technological paramenters	- yarn tension; - seam pitch; - stitching speed;
8.	Human factor	- objective characteristics (education level); - subjective characteristics (motivation, fatigue level);

Fabrics quality destined for textile products confection, can be expressed through their manufacturing and fashioning capacity (transfer from plane to spacial shape).

The main characteristics of the materials that influence quality are: thickness, elasticity degree, compaction degree, mass, dimensional stability, fibrous compositions, electrostatic charge.

Depending on these fabric characteristics their designation is chosen, machine type and technological parameter of the termic adhesion operation, stitching and finishing operations.

The choice of material in close connection with:

- ✓ product type (underclothes, exterior wear, night clothes, sports wear etc.);
- ✓ position of the product compared to the body (with support on the shoulders, with support on the waistline);
- ✓ place in case of multiple layers of clothing (base material, backing, lining etc.).

Not correlating the fabric characteristics with technological and functional stitching parameters, will lead to inconformities or defects in the stitched joints.

In table 2, a series of fabric characteristics that influence the esthetic of the stitching are presented, as well as concrete solutions.

Table 2: *Factors that influence the esthetic of the stitching*

Material characteristics	Fabric groups on which the influence is significant	Influenced quality indicator	Quality insurance method
Thickness	All textiles	Esthetic: - raise the seam - the uniformity of the seam	Adjusting the presser foot pressure Adjusting the hight of transporter teeth over the needle plate Adjusting the sewing tension
Density	Knitted or weave	Esthetic: - wrinkled seam - raise the seam	Correlating the needle count with the fabric structure Choosing the stitching type in correlation to the fabric structure
Elasticity	Knitted or fabrics made out of high elasticity threads	Esthetic: - wrinkled seam	Choosing a stitching thread with a similar fibrous composition to the knitted yarns Choosing the correct type of stitching
Friction coefficient	Silk-like knitted, knitted made out of synthetic yarns	Esthetic	Correct adjustement of the seam pitch Correct adjustement of the sewing tension Correct choice of the stitching thread Appropriate constructive design of the stencils
Electrostatic charge	Fabrics with high content of synthetic yarns	Esthetic: - uneven transport caused by fabric adherence to the working pieces of the sawing machine	Antistatic treatment of the material Air ionization in the production departement

3. DE-CA-RE FILE FOR THE SAWING OPERATION OF PRODUCTS MADE OUT OF CIRCULAR KNITTED

Studies and practical experience proved that from the standing point of their importance and frequency, defects that may occur during the sawing operation of the knitted are various. Some of them are presented in table 3, as De-Ca-Re files:

Table 3: *Correlation defect-causes-preventive actions or remedies*

Defects during the stiching process	Causes	Preventive actions or remedies
1. Perforation of the knitted on the seam line followed or not by stitch unwinding[1, 5]	**Yarn breaking in the stitch when pierced by the needle determined by:**	Utilising round headed needles, of corresponding count to the knitted
	-low sliding capacity of the stitch yarn, at the needle penetration moment	Respecting the environment conditions in the confection section (for a 65% air humidity, material humidity is approximately 7.2%)
	- utilising a wrong needle, as counting, form or surface state, with the knitted structure	Brushup of external needle surface Correct dimension of the needle plate eyelet (reccomended eyelet of about 1,6 -1,8 mm)
	- needle heating because the high stitching speed	Respecting the admitted stitching speed Cooling of the needle (needle treatment with lubricants)
2. Interrupted seam	**Breaking of the sewing thread and formation of breaked seam pitches because:**	Insuring the correct yarn- needle track
	- uncompliance to the yarn track	
	- non-correlation between sewing thread and stitching type with the knitted characteristics	Choosing the thread and stitching type in correlation with the knitted characteristics
	- surface wear of the yarn conductive organs	Polishing or replacement of worn out or flawed parts
	- melting or breaking of the stitching thread because of high temperature of the needle at high stitching speeds	Reduction of the stitching speed
	-inadequate adjustement of thread tension	Optimal adjustement of sewing tension
3. Inadequate look of the stitching and interweaving (relative displacement of the layers)	**Irregular feed of the material layers because of:** - amplitude differences in the motion of the plates with transporter teeth	Correct adjustement of the plates with transporter teeth
	-utilisation of the wrong presser foot	Using a Teflon or special presser foot
	- incorrect adjustement of the pressure exerted by the presser foot in correlation with the knitted characteristics	Correct pressure adjustement of the presser foot according to the knitted characteristics
	- elongation of the knitted material during stitching	
4. Incorrect interlacing of the threads (in a simple seam)	Inadequate tension of the yarn (tension too low)	Respecting the technological parameters of the sewing
	Out of sync movement of the stitching formation organs (needle, greifer, transpoter)	Correct movement adjustement of the stitching formation organs
5. Knitted wrinklin during sewing	Stitching yarn overly stressed Inadequacy of the seam pitch with the knitted characteristics	Respecting the technological parameters (yarn tension, and seam pitch in correlation with the knitted structure)
	Amplitude difference of the conveyor teeth plates	Correct adjustemenet of the conveyor
	Wearing of the conveyor	Replacement of the flawed sewing organs
6. Raising of the knitted stitch on the seam line	Using the incorrect count needles or inadequate to the knitted thickness	Insuring the correlation between the needle count and the knitted count
	Uneven needle suface or conveyor teeth surface	Smoothing of the external needle surface

Defects during the stiching process	Causes	Preventive actions or remedies
7. Melting of the yarns of the knitted on the seam line (in the case of syntethic fiber knittings)	Excessive heating of the needle because of the high stitching speed	Keeping the maximum admitted speed
8. Deflection from the stitching line	Techonological indiscipline	Respecting the technological discipline
9. Inclination of one the piece during stitching	Irregular stitching	
	Wrong pairing of pieces (different characteristics and dimensions of pieces)	
10. Different nuance between the piece of the same product	Knitting defect on the surface of pieces of the product (stripes on stitches or rows, irregular density etc.)	Caring out an adequate reception of the knitted, anterior to the sawing operation
	Dyeing or imprinting defects and wrong pairing of the pieces when forming packages (at the assortment of components after the sawing operation)	
11. Differences between the simetrical pieces of the same product (sides, sleeves, pockets, welts etc.)	Contraction of the pieces after sawing because of uneven tensing of the spread layers	Respecting the spreading and sawing conditions
	Technological indiscipline at sawing: - unemployment of sawing stencils and /or control stencils in the making	Keeping the technological discipline during product confection
12. Not keeping the simetrical gradient and shoulder length in the same product	Technological discipline Not keeping the technological indicators during the confection process	Keeping the technological indicators during the confection process
13. Pocket asimetry	Indisciplină tehnologică Technological indiscipline	
14. Stitching skew from the outline		
15. Pattern asimetry on the paired pieces (sides, pockets, flaps)	Sawing defect	
	Technological indiscipline during making	
16. Buttonholes incorrectly done	Inadequate adjustement of the machine	Adjusting the mechanisms of the sawing machine
17. Incorrect placement of the buttons in comparison to the buttonholes	Technological indiscipline	Keeping the technological discipline
18. Inconcordance between Button dimensions and buttonholes lenghts		
19. Misplaced buttonholes compared to pieces sides and uneven spaces between them		
20. Oil smears and/or dirth	Incorrect maintanence of the sawing machines associated with technological indiscipline	

4. CONCLUSIONS

The quality of the stitching operation has a particular influence on the product and is determined by a multitude of factors, punctually presented in this paper.

Contructive particularities of the machines, technological parameters of the stitching operation, knitted characteristics, behavior during the processing, as well as the correlations between these factors are of crucial importance. Only knowing these can we prevent stitching deficiencies, creating at the same time the premise for supervising process quality.

This paper systematically presents the main shortcomings observed during the stitching operation of knitted products, the causes and their prevention method or their remedies.

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