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INSURANCE OF KNITTED PRODUCTS QUALITY THROUGH THE ANALYSIS AND EVALUATION OF NON-QUALITY DURING THE OPERATIONS IN THE CUTTING ROOM

LUTIC Liliana

"Gh. Asachi" Technical University, Iasi, Romania, Knitting and Ready - Made Clothing Department, Faculty of Textile Leather and Industrial Management, 29 Dimitrie Mangeron Street, 700050, Iasi Romania

Corresponding author: Lutic Liliana, E-mail: llutic@tex.tuiasi.ro

***Abstract**: In a knitting- confection profile factory, any activity 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 (establishing defects and fabrication deficiencies. We can consider non-quality as complementary to quality, although a definitive distinction cannot always be made between the two categories or states.*
Cutting holds a key role in insuring shape precision and pieces dimensions, determining the quality of the confectioning process, its structure and manual stages frequency.
The quality of the cutting operation, appreciated through the precision and aspect of cut contours, existence and precision of markings, is directly reflected in the finite product's quality, which entails knowledge of cutting instrument - fabric interactions.
Incompliance of the technological regime during the operations in the cutting room can determine: incorrect marking, spreading, sectioning or cutting.
Non-quality of intermediate products obtained in the cutting department can be evaluated and controlled through defectologic control methods.
The De – Ca – Re method (defect-cause-remedy correlation), applied in this paper, allows establising the most important causes that generate defects, as well as preventive and corrective actions to eliminate these causes.
This paper systematically presents the main defects that may occur during operations in the cutting room, causes that generate these defects, along with their preventive and corrective actions.

***Key words:** quality, non-quality, defects, marking, spreading, cutting.*

1. INTRODUCTION

Non-quality respresents a discrepancy or constant global aberration or real quality effectively obtained, instead of desired quality [1, 2]. We can consider non-quality as complementary to quality, although a definitive distinction cannot always be made between the two categories or states.

The **non–quality** of products can be evaluated and controlled through defectologic control methods.

If the applied method has as objective discovering the places and ways in which defect occur, it has a pronounced analytical character. Instead, when the method targets evaluating the quality level of products or product batches, it has a control character.

Professional literature [1, 2, 3, 4, 5, 6, 7] proposes a series of defectologic methods, which serve the purpose of describing as closely as possible defects and determining the perturbatory factors and their importance, in order to find solution to prevent and diminish the defects, as well as establising corective methods and remedies.

The methods can be structured on one or multiple criteria of defects classification and are divided in: analytical methods and graphic methods.

The De – Ca – Re method (defect-cause-remedy correlation) allows establising the most important causes that generate defects, as well as preventive and corrective actions to eliminate these causes.

The corrective action [2] begins with problem detection and implies taking measures in order to eliminate or minimize the possibility of problem reccurence. The corrective method is applied to both machines by adjustements and maintenance and products by fixing defects.

The preventive actions [2] have the role to diminish the risk of defects or abnormalities occurance. These imply inspection of engineering documentation, implementing measures for good management of working places, machine equipment, instruments and materials for proper performance as well as fulfilling the conditions regarding transport, packaging and product storage.

2. GENERAL INFORMATION

Cutting holds a key role in insuring shape precision and pieces dimensions, determining the quality of the confectioning process, its structure and manual stages frequency.

The quality of the cutting operation, appreciated through the precision and aspect of cut contours [8], existence and precision of markings, is directly reflected in the finite product's quality, which entails knowledge of cutting instrument – fabric interactions.

Cutting quality is dependent to a series of factors from which we may mention [8]:

- contour complexity;
- number of product pieces;
- machine and cutting device characteristics;
- textile fabric and spread characteristics (thickness, fibrous composition of the knitted, surface aspect etc.);
- technical documentation quality;
- competence and attention of the executants.

Incompliance of the technological regime during the operations in the cutting room can determine:

- incorrect marking;
- defective spreading;
- incorrect sectioning;
- cutting with deficiencies.

3. APPLICATION OF DE – CA – RE METHOD FOR THE OPERATIONS TAKING PLACE IN THE CUTTING ROOM

By corroborating the professional literature and personal experience, the defect types that could be generated by deficiency in the cutting room operation were established, in correspondence with the causes of their occurance. Simultaneously were predicted the preventive methods and defect remedies.

3.1 Application of De – Ca – Re method for the marking operation

In the industry, two types of marking are used:

- with outlines manually arranged on the first spread layer, according to the marking outline;
- by automatic drawing of the marker on a special paper that is placed on the first layer of the spread.

In order to perform the manual marking the following documentation is necessary:

- ✓ miniature outline of the markers needed for a certain product;
- ✓ demand (colours and sizes combination);
- ✓ assortement file (samples for all types of fabrics that are part of the product);
- ✓ outline sets for all the sizes that are to be marked on different types of fabrics that are part of the product;
- ✓ useful width of the fabric and other informations that contain positioning restrictions of the outlines.

The quality of manual marking is determined by the experience and proffesional training of the operator, and the necessary time for this operation is quite long.

In this case we may encounter errors caused by:

- positioning the outline without taking into consideration the nominal direction of the fabric;
- incomplete marking (pieces missing);
- usage of used outlines.

When using real scale outlines on special paper, the intervention of the operator is limited to gluing the paper on the surface of the spread. This way is reduced the risk of human errors, that generate inadequacies.

In table 1, the De – Ca – Re method is used for the marking operation.

Table 1: *De – Ca – Re method for the marking operation*

Types of defects cause by the marking operation	Causes	Preventive or remedial actions
Product pieces assimetry	Incompliance to the nominal direction of the stitch column in the knitted when placing the marker	Respecting the direction of the stitch column and the technological conditions at marking
Differences in aspect (nuance) between the product pieces	Incompliance of the placing direction of the product piece markers in the case of terry, fleecy or printed knitted etc. Incompliance to the direction of the spread layers	Correct placement of the markers in correlation with the light reflective patter of the knitted structure Respecting the direction of the spread layers
Incomplete marking of all the product pieces	Technological indiscipline *Observation*: In this case the omitted pieces will be cut separately which will result in : • additional fabric consumption; • additional working time; • increase of production costs; • possible nuance differences between pieces.	Respecting the technological regime

Observation: The outlines must be carried out on knitted with minimum width, in order to avoid dimensional variation of the pieces.

3.2 Application of De – Ca – Re method for the spreading operation

The conditions that must be applied during this operation are:

- the length of the spread is determined by the length of the marker (equal or multiple of it);
- the width of the spread is determined by the width of the textile fabric;
- the number of spread layers depends on the characteristics of the fabric, scale of demand and technical solution adopted for the cutting.

Besides the geometrical characteristics, when making the spread we must also take into consideration the distribution of the material according to the demand's characteristics.

The characteristics of the material deteremine the optimum solution chosen for the spreading operation. For example:

- for the spreading of highly elastic materials (especially knitted) manual spreading is usually used; in the case or automatic spreading, there must be the possibility of adjusting the tension for successive layers of material;
- in the case of material with high sliding factor, the height of the spread must be smaller, and the fixation of the layers with clamps is mandatory; we can utilize spreading tables fitted with pneumatic installation;
- for thicker material spreads with fewer layers will be made;
- on uni circular knittings continuous spreading is preffered without cutting the edges;
- for fleecy textiles or fur imitation is recommended to cut the edges of spread layers and to place them front-up (so that the operator can track defects on this side).

In table 2 the De – Ca – Re method is applied to the spreading operation.

Table 2: *De-Ca-Re method for the spreading operation*

Defects cause by spreading	Causes	Preventive actions or remedies
Dimensions variation of the product pieces	Inadequate correlation between the marker dimensions and spread layers dimensions	Correspondence between the markers dimensions and spread layers dimensions
	Tensed placing of the spread layers - leading to spread contraction	Respecting the correct tension for the material
	Incorrect alignment of the spread edges (non-compliance to the perpendicularity of the longitude side of the spread on the working table) [9]	Ensuring the perfect allignement on one of the longitude edges of the spread so that eventual width variations of the spread layers will be restricted to one edge that could be sectioned.
	Not fixing the spread layers on the extremities that may cause relative position movement The edge of the spread is thicker that the middle – which implies difficulties of the marking and cutting operation because of these (rolled or fleecy edges)	Usage of clamps or other attachment methods for the spread layers Removal of the edges

Observations:

- ✓ Not conforming to the spreading conditions (alignment of spread layers, correct tensioning of the spread layers, attachment of the extremities) determines great loses of material (knitted);
- ✓ Critical defects in the knitted (that are inadmissible in any quality class) will be removed from the spread;
- ✓ The height of the spread depends on the thickness, surface aspect and friction coefficient of the knitted; the maximum admitted height of the spread must not exceed 12 cm.

3.3 Application of De-Ca-Re method for the sectioning and cutting operations

Taking into consideration the destructive effect, cutting the textile fabrics is particularly important for product quality. The shapes of pieces obtained through cutting, as well as outline aspect have a significant influence on esthetic, ergonomic and availability functions of products and respectively technological manufacturing esthetic.

Cutting has implications on specific consumption and occupies up to 25% of the time allotted for making a clothing product.

Cutting of textile fabrics usually contains two stages:

- sectioning of the spread;
- cutting of the pieces from the spread.

Sectioning the spread is realised with the help of mobile machines with circular knife (with disc) or vertical knife. When cutting pieces of high complexity are recommended mobile machines with vertical knifes.

Piece cutting is traditionally executed with fixed machines with continuous cutting blade. The cutting blade only moves in one direction – vertically while the executants moves the spread in the cutting zone.

The quality of cut pieces depends on their complexity, characteristics of the cutting blade and the degree of competence and skill of the executant.

The cutting operation of pieces from the spread was perfected by the emergence of automatic cutting systems. Their usage is justified by the integral automatization of all documentation execution stages, spreading and cutting of the pieces.

In table 3 the De – Ca – Re method is applied to sectioning and practical cutting operations (cutting according to outline).

Table 3: *De – Ca – Re method for sectioning and outline cutting operations*

Defects caused by sectioning and cutting	Causes	Preventive actions or remedies
Pieces with uneven contour lines	Incorrect handling of the mobile sectioning machines and incorrect handling of spread sections	Respecting the technological discipline
	Imprecise following of the outline contour, or not using outlines for cutting	
	Incorrect tension of the cutting band on the fixed cutting machine, caused by not correlating it to the fabric characteristics of spread height	Correct tensioning of the cutting band Respecting the optimal height of the spread
Inesthetics look of cutting lines of pieces contour	The cutting band of the fixed cutting machines isn't sharpened	Respecting the sharpening angle of the cutting band during the entire cutting
Control markings of inadequate dimensions	Imprecise guidance of the spread section in front of the cutting band	Respecting the technological discipline
	Incorrect documentation (used markers or markers incorrectly placed)	Replacing the incorrect (used) markers

The quality control of cut pieces is realized with control outlines, verifying for each piece, its integrity and markers position. Shape or dimensions abnormalities depend on the complexity of the contour lines. For uni knittings, the permitted aberrance is bigger, while for striped knittings they are minimal or void. For all textile materials, the maximum permitted aberrance from the nominal direction is 20 mm. [9].

In regards to pieces integrity is worth mentioning that defects tracking is necessary, assessing their gravity and eventually recutting of the pieces that present main defects of the knitted structure (highly frequent missed stitches, unrepared holes, unevenly distributed stripes) or critical cutting defects (dimensional variations above the admitted limits).

Observation: Before introducing the knitted in the fabrication line, it must be verified on the control ramp in order to appreciate its quality and registering knitting defects.

4. CONCLUSIONS

The quality of the operations taking place in the cutting room hold an essential role in insuring shapre precision and dimensions of cut pieces, determining the quality of the confection process and its structure, as well as the quality of the finite product.

The accuracy and correctitude of the cutting operation in its entirety, is appreciated through the precision degree and aspect of the cut contours, the existence and precision of markers and other important aspects that are directly reflected in the quality of the finite product.

The multitude of factors that influence these operations are punctually presented in this paper, this knowledge allowing the prevention of cutting defects and creating the premises that grant control over the process quality and implicitly product quality.

This paper systematically presents the main defects that may occur during operations in the cutting room of knitted products, causes that generate these defects, along with their preventive and corrective actions.

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