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## FINAL QUALITY CONTROL OF SHIRTS

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**ABSTRACT:** Final control is the last step of the shirt inspection system which performed before shipment. Thanks to the final control it is still possible to correct some mistakes in the shirts by their re-entering in the production process, and damaged products or those with irreparable defects can be classified into a lower class with a reduced price. In this paper, a final control of a total of 2790 men's and women's shirts in two apparel companies was made in order to determine the most common errors and, if it is possible, remove them. The errors that appear most often depend on the model, in women's shirts the most common error is an unevenly gathered ruffle, while in men's asymmetric pockets and bad position or damaged button.

**Keywords:** men's shirt, women's shirt, quality, control.

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## FINALNA KONTROLA KVALITETA KOŠULJA

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**APSTRAKT:** Završna kontrola je poslednji korak sistema kontrole košulje koji se vrši pre otpreme. Zahvaljujući završnoj kontroli još uvek je moguće ispraviti neke greške u košuljama njihovim ponovnim ulaskom u proces proizvodnje, a oštećeni proizvodi ili oni sa nepopravljivim nedostacima mogu se svrstati u nižu klasu uz sniženu cenu. U ovom radu izvršena je završna kontrola ukupno 2790 muških i ženskih košulja u dve konfekcijske firme kako bi se utvrdile najčešće greške i ako je moguće, otklonile. Greške koje se javljaju najčešće zavise od modela, kod ženskih košulja najčešća greška je neravnomerno skupljen volan, dok kod muških asimetrični džepovi i loš položaj ili oštećeno dugme.

**Ključne reči:** muška košulja, ženska košulja, kvalitet, kontrola.



## 1. INTRODUCTION

The term shirt was first used to name the simplest women's clothing. The shirt has been used in different form for thousands of years. Most of the time, the women's shirt was made from two rectangular pieces of material, which were joined along the shoulder and side seams. At first the shirt was collarless and sleeveless made from cotton, linen and silk. The more luxurious shirts were decorated. In the 19th century, the men's shirt got its present appearance. Until that time, shirts were only produced in white, and later other colors, including pink, began to be used. A shirt is a garment that is worn often and has close contact with the body. The material from which it is made should have a soft touch and be pleasant to wear. Woven as well as knitted materials are used to make the shirts [1,2].

90% of men's shirts are made of cotton fibers or their combination with other fibers, for example, with artificial or polyester fibers, which reduces the price of the product. The most common types of fabric for the production of shirts are: Popelin - canvas, smooth and soft texture of the fabric, Oxford - fabric made of thick (coarse) yarn in which the base is colored, while the core is white and Keeper or twill fabric in twill diagonal or weave, more often used for plain shirts, [3]. Some parts of the shirt, such as the collar, cuffs, pockets and buttons, have a great influence on the final appearance of a men's shirt. Also, the overall impression and quality of the shirt is influenced by the fabric from which the shirt is made.

## 2. FINISHING AND QUALITY CONTROL OF SHIRTS

Every step in the manufacturing process of men's shirts is vital to the overall quality of the final product. The finishing process of the shirts is extremely important, because their final appearance depends on it. In the technological process of finishing, various activities of finishing the garment are carried out in order to achieve a certain quality of the finished product that will satisfy the customer and that will ensure the building of a good image of the manufacturer on the market, [4]. The technological process of finishing consists of the following technological activities: preparation for the technological process of finishing, preparation of machines for the technological process of finishing, final ironing, sewing on buttons, thread cleaning, final control of the product, packaging and sending the product to the warehouse (warehouse) for finished products. Thanks to the final control it is still possible to correct some mistakes in the shirts by their re-entering in the production process, [5].

The quality of the shirt is the most important moment from the customer's point of view and much attention should be paid to the selection of suitable machines, devices and equipment that will provide the required quality. The final ironing plays a major role in the final appearance of the shirts and therefore in its attractiveness. Smaller apparel companies and fashion studios mostly use simple steam presses and tables for ironing of all parts of the clothes which extends the finishing time. Larger and modern companies are equipped with modern and productive machines and finishing devices, as well as with professional staff, [4]. Manufacturers of ironing equipment and machines are constantly working on the development of new possible solutions and ironing techniques. Their efforts are aimed at fully automating the machines with the possibility of precise programming of the ironing parameters. During the ironing, special attention is paid to the collar, cuffs and front parts

in the chest area. These are the parts that are visible after the shirt is folded for packing, [2].

There are several garment quality control procedures, and optimally these should be taken at various stages of the production, including pre-production level, during- and post-production levels, to check the quality of a garment. Quality control of finished garments is an inspection before the merchandise are shipped to the customer and is done when at least 80% of the order has been packed for shipping. This process helps to detect any defects and reduces the risk of complaints from customers. The inspection process typically includes: visually inspecting the garment for any flaws visible to the human eye finished product, checking the labeling, and counting the items in the production lot [6, 7]. Controllers who perform the final inspection are usually employees of the factory that produced the shirts, but they can also be employees of the buyer. This second variant is becoming more common among clothing factories that produce clothing intended for foreign markets, [8].



**Figure 1:** Men's shirt packaging elements (a) and packaged shirt appearance  
Source: [9].

At the end the shirt is folded and packed in a polyethylene bag. In order to get a better sales appearance when folding the shirt, an elastic band is placed under the collar. In the front part, under both ends of the collar, a specially tailored collar holder is placed, caught by the button. Both parts are important to keep the collar straight and smooth. To bend the shirt, it is necessary to use sewing pins. The shirts of a high quality are packed in special boxes (Figure 1), [9].

### 3. EXPERIMENTAL

#### 3.1. Result and discussion

In the practical part of the paper, the final quality control of three models of women's shirt in MK Angelo and three models of men's shirt in MK Grand Tex was performed. The practical part was carried out during 2023, in the period from May to July. The results obtained are given in Table 1, 2, 3, 4, 5 and 6 (a document named the final control protocol). In the case of the women's shirt - Akkonrad melange/classic fit (Table 1), out of a total of 1000 checked pieces, 925 are without errors, that is, 7.5% of the shirts have errors.

In this order, there was a need for only one repair, which is also one of the most difficult. Out of a total of 1000 pieces, 48 new collars were cut due to an unevenly gathered ruffle. Due to the errors, the following corrections were made:

- 5 repairs to the positions of the elastic band.
- 8 repairs for omitted bias tape
- 12 pieces returned from final ironing of the bias tape.

In the case of the women's shirt - Akkarsten flannel check shirt (Table 2) from the order S4255, the number controlled pieces is 280. 256 are good pieces, while 24 pieces with mistakes were found. This means that errors occur in 8.6% of the shirts. The most common mistake is again an unevenly gathered ruffle.

**Table 1:** Final control of the women's shirt, S4951

Company: Angelo Order: S4951 Model: Women's shirt-Akkonrad melange/classic fit	
Total pieces controlled	1000
Good pieces	925
Pieces with mistakes	75
Unevenly gathered ruffle	48
Outer stitch of the sleeve	/
Sewing on the elastic	5
Bad position or damaged label	/
Button holes: poorly made	/
Bad position or damaged button	/
Omitted bias tape	8
Hem of the shirt	1
Final ironing of the bias tape	12
Adjustment	/
Other common mistakes	/

**Table 2:** Final control of the women's shirt, S4255

Company: Angelo Order: S4255 Model: Women's shirt-Akkarsten flannel check shirt	
Total pieces controlled	280
Good pieces	256
Pieces with mistakes	24
Unevenly gathered ruffle	22
Folde of the back	3
Button hole repair	5
Bad position or damaged label	/
Button holes: poorly made	/
Bad position or damaged button	/
Omitted cuff	8
Slit on sleeve	12
Final ironing of the bias tape	12
Adjustment	/
Other common mistakes	/

Due to the errors, the following corrections were made:

- 5 repairs to buttonholes on the right front part,
- 8 omitted cuffs,
- 12 repairs to the sleeve slit,
- 3 repairs of the folde on the back (it was not nicely centered in the middle)

For the Madewan women's shirt (with 2 pockets, 2 pocket flaps, 2 shoulder epaulets and 2 sleeve epaulets) from order S4545 (Table 3), a total of 400 pieces were controlled, of which 322 were error-free, and 78, i.e. 19.5%, had errors. The most common mistake with this model is the outer stitch on the sleeve.

The following corrections were made:

- 12 side seam repairs,
- 28 corrections on the outer stitch on the sleeve,
- 16 corrections on the pocket folds due to different widths,
- 7 repairs of the outer stitch of the yoke on the plates on the back,
- 15 corrections on the shoulder epaulet button.

**Table 3:** Final control of the woman's shirt, 4545

Company: Angelo	
Order: S4545	
Model: Women's shirt-Madewan	
Total pieces controlled	400
Good pieces	322
Pieces with mistakes	78
Unevenly gathered ruffle	/
Outer stitch of the sleeve	28
Side seam	12
Bad position or damaged label	/
Outer stitch of the yoke	7
Bad position or damaged button on the epaulet	15
Omitted bias tape	/
Folde of the pocket	16
Final ironing of the bias tape	/
Adjustment	/
Other common mistakes	/

**Table 4:** Final control of the man's shirt, S2890

Company: Grand Tex	
Order: S2890	
Model: Men's shirt-Cypres	
Total pieces controlled	300
Good pieces	257
Pieces with mistakes	43
Unremoved thread	5
Outer stitch of the sleeve	/
Sewing on the elastic	/
Bad position or damaged label	/
Button Holes: poorly made	/
Bad position or damaged button	21
Unequal shoulder width	17
Hem of the shirt	/
Final ironing of the bias tape	/
Adjustment	/
Other common mistakes	/

In addition, the protocols of the final control of the man's shirts are given. Out of a total of 300 controlled shirts from the Cypres model (Table4), 257 pieces are without errors, that is, 14.3% have some error or errors. The most common error is a bad button position or a damaged button.

The following corrections were made:

- 21 pieces returned for finishing due to defective buttons,
- 13 repairs returned for finishing due to unremoved threads,
- 17 repairs for uneven shoulder width.

Table 5 shows the data of the final control of the man's shirt model Ihcensev2 from the S5482 work order. Of the 100 controlled pieces, 66 are without error, while 34 or 34% have some mistake. The most common mistake is asymmetric darts.

The following corrections were made:

- 14 repairs for asymmetric darts
- 10 repairs for button holes sloppy stitched
- 8 repairs for too small pockets

Two shirts were with stains, a specific mistake which can not be simply corrected. These shirts will be disassembled and re-tailored.

**Table 5:** Final control of the men's shirt, S5482

Company: Grand Tex Order: S5482 Model: Men's shirt-Ihcensev2	
Total pieces controlled	100
Good pieces	66
Pieces with mistakes	30
Outer stitch of the sleeve	/
Sewing on the elastic	/
Pocket too small	8
Poorly made button holes	/
Bad position or damaged button	/
Button holes sloppy stitched	10
Stains (blemishes)	2
Final ironing of the bias tape	/
Asymmetric darts	14
Other common mistakes	/

**Table 6:** Final control of the man's shirt, S3487

Company: Grand Tex Order: S3487 Model: Men's shirt-V8Granstgrey	
Total pieces controlled	700
Good pieces	646
Pieces with mistakes	54
Unevenly made collar	11
Shoulder seam uneven	19
Sewing on the elastic	/
Bad position or damaged label	/
Poorly made button holes	/
Bad position or damaged button	/
Omitted bias tape	/
Sleeve hem	4
Asymmetric pockets	20
Adjustment	/
Other common mistakes	/

Table 6 shows the protocol final control of the man's shirt model V8GranstGrey from the S3487 work order. Of the 700 pieces 646 are without error, while 7.7% have some error.

In this case the most common mistake is asymmetric pockets.

The following corrections were made:

- 20 repairs for asymmetric pockets,
- 19 repairs for uneven shoulder seam,
- 11 repairs for unevenly made collar,
- 4 repairs for sleeve hem.

#### 4. CONCLUSION

From the results of the final control of women's shirts (1680 pieces from three work orders) in one apparel company, it can be noted that the most common errors are: unevenly folded ruffle (in the first two models) and outer stitch on the sleeve in the third model. In men's



shirts, 1110 pieces from three work orders were controlled. Although the percentage of shirts with an error is very high, a very large percentage of the errors that occur will be simply corrected. The most common mistakes were bad button position or a damaged button, asymmetrical darts and asymmetrical pockets. Most of them can be eliminated by re-entering of the shirts in the production process, and damaged products or those with irreparable defects can be classified in a lower class with a reduced price.

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