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ANALYSIS OF TECHNOLOGICAL INDICATORS OF TWO-LAYER KNITTED FABRICS OF THE NEW STRUCTURE

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Abstract
In this article, 5 samples of two-layer knitted fabric with a new structure were woven on a Mayer knitting machine and its technological parameters were analyzed.

Keywords: Fabric, surface density, thickness, raw material, absolute volume, length, surface, polyester, front layer, back layer, yarn.

Several samples of knitted fabrics with a new structure were woven on a Mayer&Cie two-round needle knitting machine.

The technological parameters of the samples were determined experimentally on modern equipment installed in the testing laboratory of the Namanagan Institute of Engineering and Technology and the obtained samples are presented in Table 1.

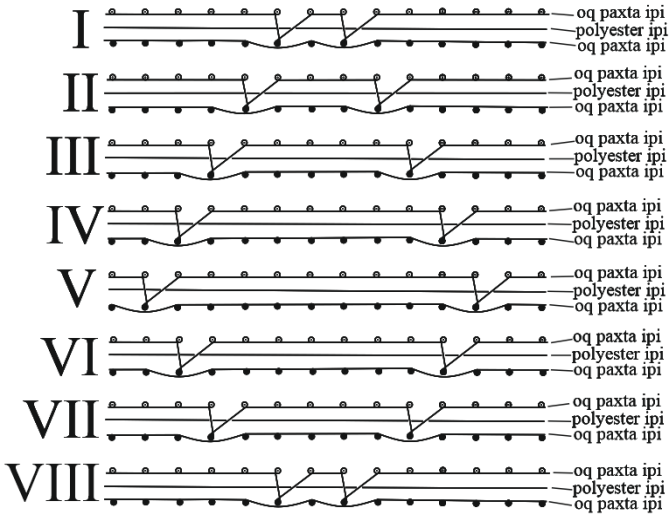
Samples differ from each other in the composition of raw materials, the axis of threads, the number of reports in the formation of patterns, as well as in the use of elements in different ways when combining layers.

The parameters describing the structure of the knitted fabric include: surface and volume density, width and length density (the number of loops per unit length), the length of the loop thread, the angle between the rows of loops and the columns of the loops, the thickness of the knitted fabric. A graphic record of the produced two-layer knitted fabric is presented in Figure 1 [1,2,3,4].

Table 1 Technological indicators of two-layer knitted fabric

Indicators		Options				
		I	II	III	IV	V
Type of thread, line density	Back layer	Cotton thread 20 teks	Polyester thread 17 teks	Hype thread 11/2 teks	Polyester thread 8 teks	Polyester thread 8 teks
	Front layer	Cotton thread 20 teks	Cotton thread 20 teks	Cotton thread 20 teks	Cotton thread 20 teks	Cotton thread 20 teks
	lean	Polyester thread 17 teks	Polyester thread 17 teks	Polyester thread 17 teks	Polyester thread 33 teks	Polyester thread 33 teks
Ring pitch A (mm)	Back layer	1,14	1,16	0,84	1,08	1
	Front layer	1,21	1,1	1,02	1	1,06
Ring row height B (mm)	Back layer	0,67	0,94	0,81	0,77	0,77
	Front layer	0,65	0,86	0,64	0,8	0,79
Horizontal density R_g (number of rings)	Back layer	44	43	56	46	50
	Front layer	41	45	49	50	47
Vertical density R_v (number of rings)	Back layer	74	53	61	65	65
	Front layer	77	58	78	64	63
Loop thread length L (mm)	Back layer	3,81	4,8	3,98	4	3,4
	Front layer	3,56	4,2	3,6	4	3,72
Knitted surface density Ms (gr/m^2)		238,8	187,9	283,9	283,5	307,3
Knitting thickness T (mm)		1,85	1,69	3,6	3,2	3,38
Bulk density δ (mg/sm^3)		129,08	111,18	78,86	88,59	90,91
Absolute volumetric relaxation Δδ (mg/sm^3)		-	17,9	50,22	40,49	38,17
Relative lightness θ, %		-	13,9	38,9	31,36	29,6

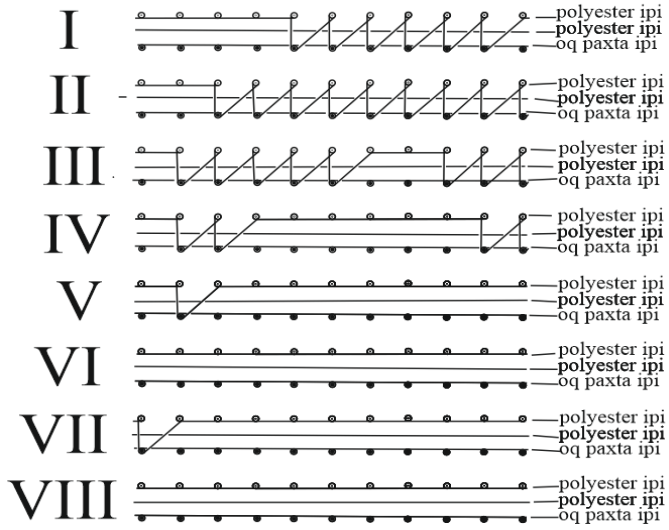
I option



Translation: Polyester thread - *Polyester ipi*

White cotton thread - *Oq paxta ipi*

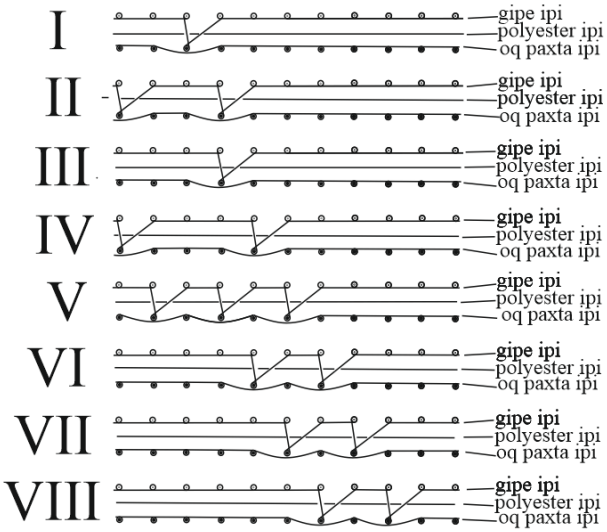
II option



Translation: Polyester thread - *Polyester ipi*

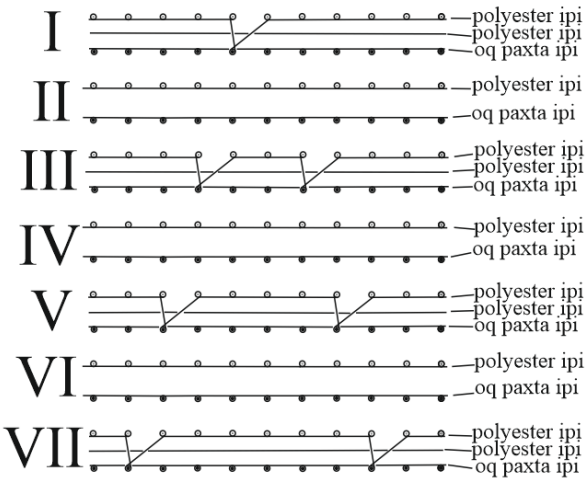
White cotton thread - *Oq paxta ipi*

III option



Translation: Polyester thread - *Polyester ipi*
White cotton thread - *Oq paxta ipi*
Hype thread- *Gipe ipi*

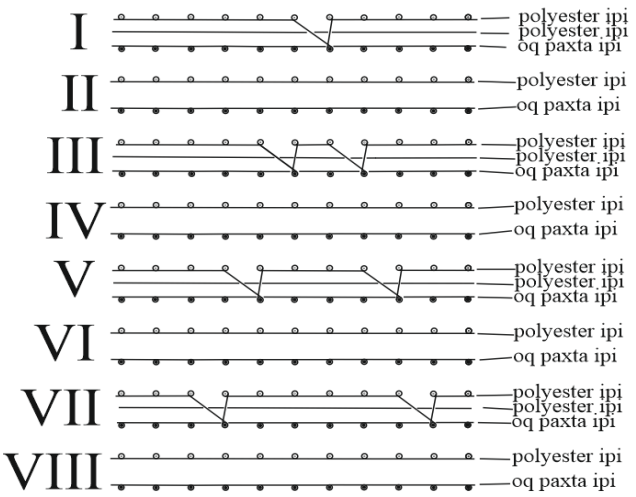
IV option



Translation: Polyester thread - *Polyester ipi*

White cotton thread - *Oq paxta ipi*

V option



Translation: Polyester thread - *Polyester ipi*

White cotton thread - *Oq paxta ipi*

Figure 1. Graphic notation of two-layer ribbed knit fabric.

The samples of two-layer knitted fabrics were obtained using polyester, cotton yarn and hype yarn.

A graphic record of the proposed knitted fabrics is presented in Fig. 1 and a photo is presented in Fig. 2.

I option II option

III option IV option

V option

Figure 2. Photo of two-layer rib knit fabric.

Among our samples, the highest volume density was recorded in our sample of option I, its value is 129.08 mg/sm^3. Our sample of option I is 38.17 mg/sm^3 more than the indicator of our sample of option IV. The lowest indicator was observed in our sample of variant III. Its value was 78.86 mg/sm^3. Volume density indicators of the samples are presented in Table 1 and Figure 3 [5,6,7].

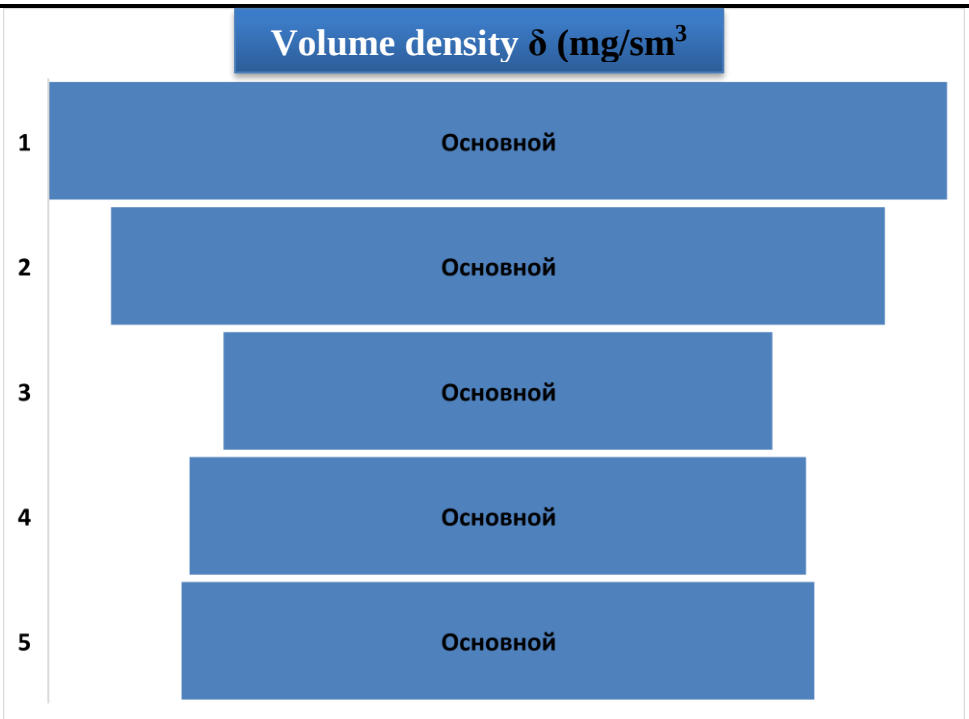


Figure 3. Changes in volume density of samples.

The bulk density of two-layer knitted fabric with surface density Ms= 187.9 g/m^2 and thickness T=1.69 mm is 111.18 mg/cm^3, Ms= 238.8 g/m^2 and the bulk density of the basic knitted fabric (option I) with surface density and T= 1.85 mm thickness was 129.08 mg/cm^3 (Table 1). An increase in the density of the knitted fabric leads to an increase in its surface density and thickness [8,9].

The absolute volumetric relief, when compared to the base tissue, consists of:

$\Delta\delta = \delta_b - \delta = 129{,}08 - 111{,}18 = 17{,}9$ mg/sm^3 (1)

where: $\Delta\delta$ - absolute volume relief, mg/sm^3;

δ_b – volume density of base tissue mg/sm^3;

δ– is the bulk density of the experimental tissue in mg/sm^3.

The indicators of relative relief are as follows (Fig. 3):

$$\theta = \left(\frac{\delta}{\delta_б}\right) \times 100 = \left(\frac{17{,}9}{129{,}08}\right) \times 100 = 17{,}9\ \% \quad (2)$$

The volume density of the base knitted fabric with surface density Ms= 283.9 g/m^2 and T = 3.6 mm thickness in option III is 143.05 mg/sm^3, while the density of the base knitted fabric (I option) volume density is equal to 78.86 mg/sm^3.

The absolute volumetric relief, when compared to the base tissue, consists of:

$\Delta\delta = \delta_b - \delta = 129{,}08 - 78{,}86 = 50{,}22$ mg/ sm^3 (3)

Relative relief consists of (Fig. 4):

$$\theta = (\frac{\delta}{\delta_б}) \text{ x100} = 38{,}9\ \% \quad (4)$$

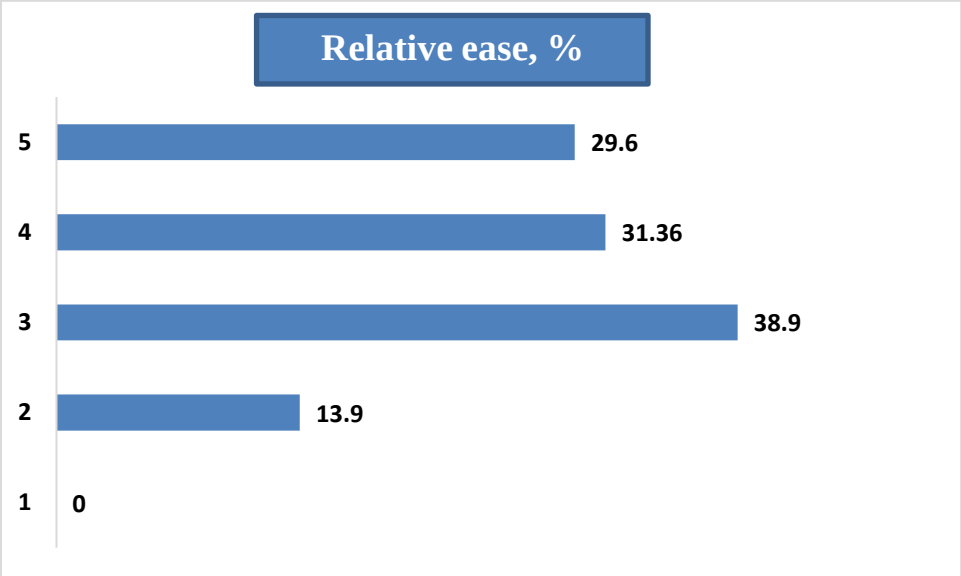


Figure 4. Indicator of relative lightness of two-layer ribbed knitted fabrics.

In conclusion, it can be said that the volume density indicates the amount of raw materials used in the material, the change of the thread texture in the two-layer warp knitted fabric, the change of the pattern type, the order of giving the warp thread to it, the type of elements used in combining the layers affect its density is enough.

Among our samples, the volume density of our sample of option III was higher than the other samples. The reason for this is that in our example of variant III, the shape of the pattern is exaggerated into a hollow and the thread of the yarn is dropped in each row. Therefore, the increase in the value of the ratio of the pore-forming pattern and the increase in the texture of the warp thread in the two-layer knitted fabric increases the thickness of the fabric and leads to a decrease in the volume density. As a result, the amount of raw materials used for the fabric decreased.

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