INTERNATIONAL JOURNAL OF ELECTRONICS, MECHANICAL AND MECHATRONICS ENGINEERING
Volume 1. Number.1 pp.(29-36)

FINAL PROCESS DEPENDENT DIMENSIONAL CHANGES OF DOUBLE KNIT FABRICS

Vedat ÖZYAZGAN

Istanbul Aydın University, Faculty of Engineering and Architecture,
Textile Engineering Department, Florya, Istanbul
E-mail: vedatozyazgan@aydin.edu.tr

Abstract: *In this paper Ne 30/1 cotton yarn obtained by using pure cotton fibers is employed. 1x1, 2x1 and 3x1 Rib fabrics were knitted with yarns at different gauges. During the knitting process, the tension was kept constant. In order to investigate the relaxation on the knitting process fabric samples were treated using three relaxation processes; dry, wet and full respectively. After each relaxation process, stitches dimensions were measured. As a result of these measurements, it is observed that as the relaxation increases the stitches length decreases while the stitches width increases. In rib knitting, As the fabric stretches increases the stitch length increases. As a result it is observed that as the stitch length increases, the width of the stitches increases linearly. In all rib fabrics, increase in the stitch density leads to an increase in the weight of the fabric.*

Key Words: Ribana fabrics, Relaxation, Knitting fabrics.

I. INTRODUCTION

Textile and apparel sector is the main source of success recently developing countries have showed during the export-led growth process. The great stance developed countries have attained in industrializing process was initiated the success gained in the textile and apparel products sector.

In recent years, increasingly dominated by economic policies, the "liberalism", as well as the effects on both developing and developed countries along with the "phenomenon of globalization", world trade has experienced great changes in every aspect. This area is experiencing the most significant change in the textile and international trade in apparel products. Since the 1980s, the world's textile and garment sector have achieved a great industry performance when compared with other branch of productions and trade.

While our country, during the early years of the Republic, was an importer of textile and garment, it has reached an exporter position in the textile sector since 1950 and the garment sector since 1970. In the1980's the textile sector started to gain a more importance in the export-oriented development model and today it has scored a significant breakthrough with a 38.4% of the total exports.

As all areas of manufacturing industry in the world started to make use of more technology, textile has showed that technology plays an important role in its sector by integrating electronically controlled knitting machines that enhances not only its quality but also its production efficiency. Production of the desired shape fabric can be controlled with the help of electronic knitting machines. Nowadays, the demand for high-quality product has increased and consumers have tended to higher quality products. Consequently, the "quality" term is placing a higher priority of the manufacturers' objectives. Manufacturing of knitted fabrics for the production of high quality fabrics with a smooth surface loops which make up the texture of the surface must have the same frequency and the same weight. For a quality fabric, as an output of the production, these factors during production must be kept under control of the manufacturer. Electronically-controlled knitting machines easily allow the manufacturer to control these stringent requirements on the fabrics. [1]

II. PRACTICAL PRINCIPLES OF RESEARCH

II.1.Research yarn properties

The selection of research material in the world and our country and our generation is widely used in the knitting industry is mainly made of cotton were selected. Yarns are available through the purchase of the sector. 100% cotton yarn during the selection and Ne 30 / 1 yarn chosen. The physical properties of yarns supplied by the International test methods have been identified.

The resulting numbers of yarns based on the standard tests to determine the TSE 244 has been tested as a result of what 29.26 the average yarn number is identified. [2]

The sample yarn elongation and strength test was performed according to the TSE 246 ISO 6939 the results of the test are given in table 1. [3]

Table 1 Sample yarns Elongation and Strength Test Results

Sample	Strenght of the yarn (gram)	Elongation of yarn (%)
1	245,6	3,68
2	256,4	3,53
3	260,4	3,87
4	265,8	3,66
Average	257,05	3,68

The number of sample test twist yarns are made according to the TSE 247 ISO 2061 the results of the test are given in table 2. [4]

Table 2 Number of Twist Yarns Sample

Test Results

Sample	Number of Twist Yarns (meter) T/M
1	822
2	776
3	810
4	826
Average	808,5

II.2.Knitting machine used in the study

Machine needles and knitting machine is selected as the research area has been noted to be clean. Before producing the sample passed through the machine required a general maintenance repair, adjustment is made, and lubricants. The machine running for a certain time before the production of samples of fabrics, providing parts of the heating of the sample minimized any errors that occur during production.

Table 3 circular knitting machine specifications are used in the production of knitted fabrics.

Table 3 Used in the production of knitted fabrics Knitting Machine Technical Features

Machine Brand	Terrot
Model	2003
Fine (E)	18
Diameter (Pus)	30
System number	62
Plate number	2
Needle number	2136

II.3.Research knitting fabrics features

Knitted fabrics under the names of our research, we examine the patterns of RIB 1x1 Rib, 2x1 and 3x1 Rib . Knitting technical drawings in Figure 1, 2 and 3 are given.

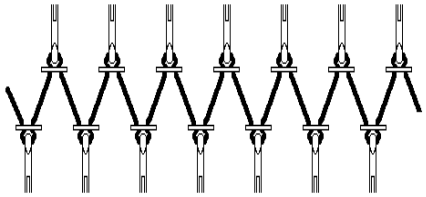

Fig. 1 1x1 Rib Technical Drawing

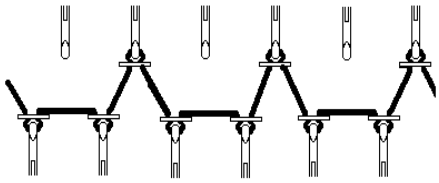

Fig. 2 2x1 Rib Technical Drawing

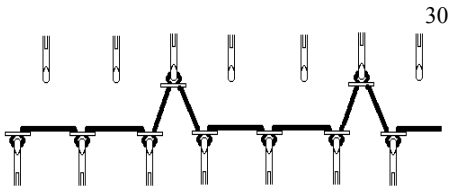

Fig. 3 3x1 Rib.Technical Drawing

II.3.1.The tests on the fabric

Fabrics of the research on the presentation of the tests and test equipment are shown below. These are:

II.3.2.Calculation of Loop Parameters

Knit fabrics are calculated in three different loop parameters. These parameters are:

a)The length of the loop yarn
b)Loop height
c)The width of the loop.

II.3.3.Loop Yarn Length

At the time of knitting yarn length per unit length, divided by the number of stitches in a loop at the time was the average length of yarn. During this test the yarn length measuring device used in the SDL 050 Hatra course. [5] The test device to be removed per unit length of yarn between the jaws hold standard weight at one end of yarn on the loop connecting thread Taxes be brought to a linear form by opening the length of the measured and calculated the length of the portion of the number of stitches. 5 pieces of each fabric sample from the sample of every 10 cases of all the comforting thread was removed from the calculation.

II.3.4 Loop Height

Calculation of the height of the Loop, about 1 cm away from the loop was carried out by measuring the number of rows.

II.3.5. Loop Width

Calculation of the loop width, 1 cm away from the loop was carried out by measuring the number of columns.

II.3.6.Finding m² of fabric weight

m²the weight of the fabric used to find M & S P65 standard. [6] The test was used for the sensitive balance and the template removal scissors. [7] m² weight of the fabric tension will be laid on a flat surface, without any wrinkles with the help of scissors and the template was an area of 100 cm². Then this delicate balance by weighing the sample result proportion 1 m²of fabric weight was calculated.

II.3.7. Fabric Thickness Determination

Fabric Thickness testing BS. 2544 is based. (8) R & B Fabric Thickness Testing Equipment (James H. Heal Co.. Ltd.) Done with. After the calibration samples 50x50 mm length were cut between the clamp jaws and sagged there. Then, the red lamp on the device until the jaws are closed, the lamp burned on the value of this transaction completed and the device is reading the fabric thickness.

Research in this test, all fabrics was subjected to relief operations.

III. TEST RESULTS AND EVALUATION

III.1. 1x1 Rib knitting loop length / frequency relationships

Table 4 Measured Loop Length 1x1 Rib Fabrics

	C (H1x1)	C (K1x1)	C (Y1x1)	C (YK1x1)
10	0,47	0,5	0,45	0,44
11	0,52	0,53	0,48	0,47
12	0,58	0,58	0,58	0,55
13	0,66	0,67	0,58	0,58
14	0,71	0,71	0,64	0,62

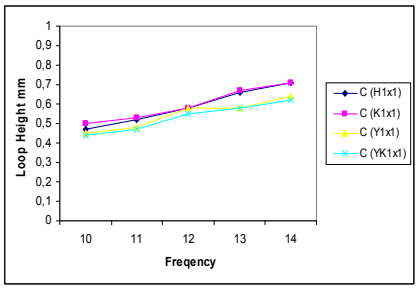

Fig. 4 1x1 Rib knitting the case of raw-dry-wet, and Full Relaxation Frequency / Loop Height Relationship

1x1 Rib knit fabrics as a result of the tests of raw, dry, wet, and examined the relationships change after washing. These values are in the light of a 10-scale value of 0.4 to 0.5 mm in the range of loop heights show that the distribution has emerged. Scale value of 0.5 mm levels run between 11 and washed, and from raw is understood that the overlap is seen. 12 beard value when working with fabrics on top of an optimization where the values observed and monitored. Scale value in the age of 14 when working with scissors and washed in values may occur and observed that the raw and dry leaves.

III.2. 2x1 Rib knitting loop length / frequency relationships

Table 5 Measured Loop Length 2x1 Rib Fabrics

	C (H2x1)	C (K2x1)	C (Y2x1)	C (YK2x1)
10	0,55	0,56	0,54	0,54
11	0,58	0,58	0,53	0,51
12	0,63	0,62	0,6	0,56
13	0,67	0,67	0,6	0,6
14	0,72	0,71	0,67	0,65

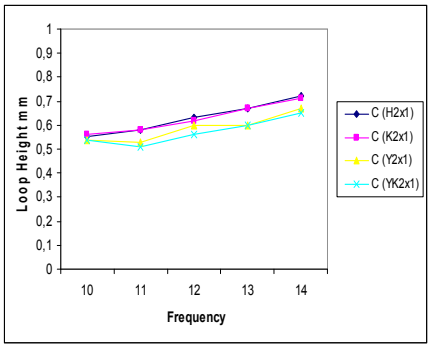

Fig.5. 2x1 Rib knitting the case of raw-dry-wet, and Full Relaxation Freq./LoopHeight relationship

2x1 rib knit fabric as a result of the tests of raw, dry, wet, and examined the relationships change after washing. Scale value of 0.54 to 0.56 mm in height of 10 knots in the light of these values is in the range and distribution was found. The age of 11 and washed in the spring by creating a scale of values was raw and dry leaves. Scale 12-13 and 14 years of age and looking raw and the exchange rate are left from wet.

III.3. 3x1 Rib knitting loop length / frequency relationships

Table 6 Measured Loop Length 3x1 Rib Fabrics

	C(H3x1)	CK3x1	CY3x1	C (YK3x1)
10	0,58	0,58	0,57	0,56
11	0,6	0,59	0,56	0,53
12	0,65	0,64	0,63	0,6
13	0,7	0,68	0,62	0,61
14	0,76	0,75	0,7	0,65

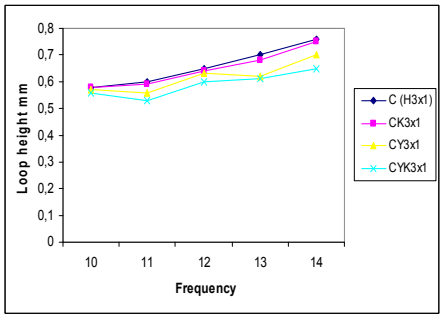

Figure 6 3x1 Rib knitting the case of raw-dry-wet, and Full Relaxation Frequency / Loop Height Relationship

3x1 Rib fabrics as a result of the tests of raw, dry, wet, and examined the relationships change after washing. These values are based on related scale in 10 raw, dry, wet and washed observed values overlap each other. Scale values are 11 and 12, were found close to each other. The values of the raw and dry Skala13 and 14 years of age by creating a pair of scissors and washed leaves were observed values.

III.4. 1x1 Rib knitting loop width / frequency relationships

Table 7 Measured Loop Widths 1x1 Rib Fabrics

	WH1	WK1x1	WY1x1	W(YK1x1)
10	0,83	0,83	0,8	0,78
11	1	0,99	1	1,02
12	1,24	1,22	1,22	1,25
13	1,5	1,47	1,38	1,4
14	1,56	1,55	1,6	1,65

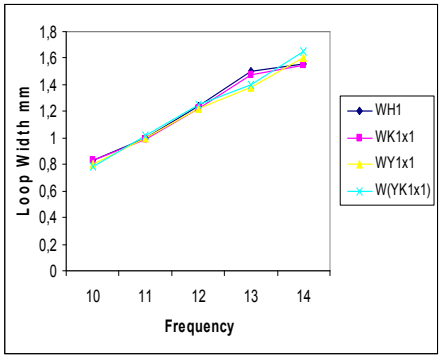

Fig. 7 1x1 Rib knitting the case of raw-dry-wet, and Full Relaxation Frequency / Loop width Relationship

1x1 Rib fabrics as a result of the tests of raw, dry, wet, and examined the relationships change after washing. In the range of 0.78 to 0.83 mm, the width of the loop in the light of these values is skala'10 and distribution was found. Looking at the values overlapped with each other is seen to 11 scale.. Scale 12 also shows a distribution of values is seen at. Scale 13 is seen in the raw and dry values separated by wet and washed. Scale 14 in raw, dry and wet values are close to each other, washed the value is high.

III.5. 2x1 Rib knitting loop width / frequency relationships

Table 8 Measured Loop Widths 2x1 Rib Fabrics

	WH2	WK2x1	WY2x1	W(YK2x1)
10	0,58	0,57	0,56	0,55
11	0,62	0,6	0,6	0,62
12	0,67	0,65	0,65	0,69
13	0,8	0,77	0,75	0,8
14	0,9	0,89	0,91	1

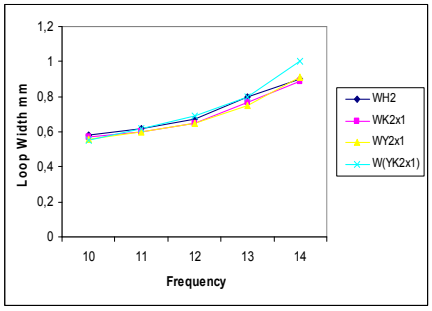

Fig. 8 2x1 Rib knitting the case of raw-dry-wet, and Full Relaxation Frequency / Loop width Relationship

2x1 Rib fabrics as a result of the tests of raw, dry, wet, and after washing were changes. Scale from 10 to 11-12-13 from the values is very close to each other. Scale 14 below shows the raw-dry and wet values overlap each other. After washing the raw-value was found on dry and wet values.

III.6. 3x1 Rib knitting loop width / frequency relationships

Table 9 Measured Loop Widths 3x1 Rib Fabrics

	WH3	WK3x1	WY3x1	W(YK3x1)
10	0,88	0,87	0,85	0,83
11	0,93	0,91	0,92	0,92
12	1,05	1,02	1,02	1,02
13	1,12	1,06	1,02	1,06
14	1,16	1,12	1,12	1,16

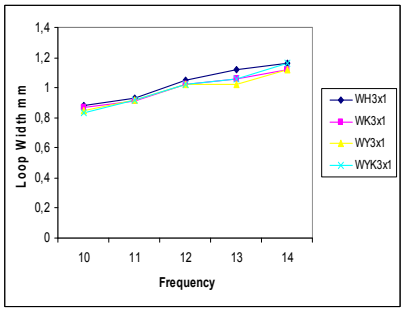

Fig. 9 3x1 Rib knitting the case of raw-dry-wet, and Full Relaxation Frequency / Loop width Relationship

3x1 Rib fabrics as a result of the tests of raw, dry, wet, and after washing were changes. From 10 -11 to 12 scale and observed values overlap each other. Scale value of 13 high-dry-wet and washed raw observed values overlap each other. Scale is seen in 14 of all the values overlap each other.

III.7. 1x1 Rib knitting loop yarn length / frequency relationships

Table 10 Loop Yarn length measured 1x1 Rib Fabrics

	LH1	LK1x1	LY1x1	L(YK1x1)
10	130	128	128	128
11	133	132	132	132
12	137	135	135	135
13	142	141	141	141
14	149	148	149	148

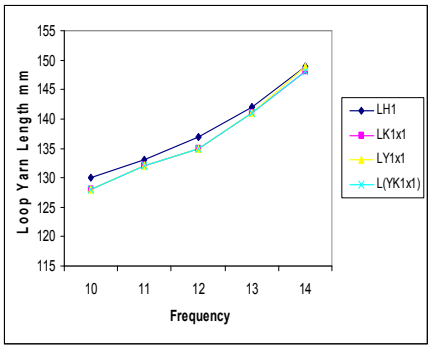

Fig. 10 1x1 Rib knitting the case of raw-dry-wet, and Full Relaxation Frequency / Loop yarn length Relationship

1x1 Rib fabrics as a result of the tests of raw, dry, wet, and after washing were changes. From 10 to 11- to 12 scale dry, wet, and washed the values are separated by the values in the raw. Scale 13 and 14 In terms of raw, dry, wet and washed observed values overlap each other.

III.8. 2x1 Rib knitting loop yarn length / frequency relationships

Table 11 Loop Yarn length measured 2x1 Rib Fabrics

	LH2	LK2x1	LY2x1	L(YK2x1)
10	168	165	165	165
11	170	168	168	168
12	174	173	173	173
13	178	176	176	176
14	180	179	179	179

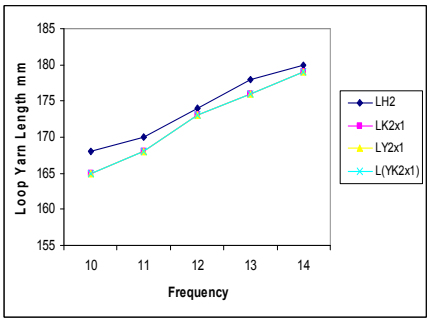

Fig. 11 2x1 Rib knitting the case of raw-dry-wet, and Full Relaxation Frequency / Loop yarn length Relationship

2x1 Rib fabrics as a result of the tests of raw, dry, wet, and after washing were changes. Looking at the values of all scale values are raw, dry-wet and washed the values are separated.

III.9. 3x1 Rib knitting loop yarn length / frequency relationships

Table 12 Loop Yarn length measured 3x1 Rib Fabrics

	LH3	LK3x1	LY3x1	L(YK3x1)
10	170	169	169	169
11	172	170	170	170
12	173	171	171	171
13	175	172	172	172
14	177	175	175	175

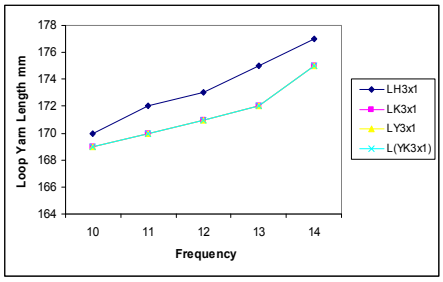

Fig. 12 3x1 Rib knitting the case of raw-dry-wet, and Full Relaxation Frequency / Loop yarn length Relationship

3x1 Rib fabrics as a result of the tests of raw, dry, wet, and after washing were changes. Looking at all the scale values in dry wet and washed raw values overlap each other were separated values.

Table 13 Regression equations of 1x1 Rib loop length/frequency according to different relaxation cases

State of Relaxation	Regression Equation between s-c	Correlation coefficient
Raw	c = 0,062 s + 0,402	0,9938
Dry	c = 0,056 s + 0,43	0,9715
Wet	c = 0,048 s + 0,402	0,932
Washed	c = 0,047 s + 0,391	0,974

Table 14 Regression equations of 2x1 Rib loop length/frequency according to different relaxation cases

State of Relaxation	Regression equation between s-c	Correlation coefficient
Raw	c = 0,043 s + 0,501	0,9941
Dry	c = 0,039 s + 0,511	0,9826
Wet	c = 0,033 s + 0,489	0,8588
Washed	c = 0,031 s + 0,479	0,8089

Table 15 Regression equations of 3x1 Rib loop length/frequency according to different relaxation cases

State of Relaxation	Regression equation between s-c	Correlation coefficient
Raw	c = 0,046 s + 0,52	0,976
Dry	c = 0,043 s + 0,519	0,9492
Wet	c = 0,032 s + 0,52	0,8179
Washed	c = 0,026 s + 0,512	0,786

Table 16 Regression equations of 1x1 Rib loop width/frequency according to different relaxation cases

State of Relaxation	Regression equation between s-w	Correlation coefficient
Raw	w = 0,196 s + 0,638	0,9732
Dry	w = 0,192 s + 0,636	0,9802
Wet	w = 0,198 s + 0,606	0,9981
Washed	w = 0,212 s + 0,584	0,9948

Table 17 Regression equations of 2x1 Rib loop width/frequency according to different relaxation cases

State of Relaxation	Regression equation between s-w	Correlation coefficient
Raw	w = 0,082 s + 0,468	0,9508
Dry	w = 0,081 s + 0,453	0,933
Wet	w = 0,085 s + 0,439	0,9201
Washed	w = 0,108 s + 0,408	0,9416

Table 18 Regression equations of 3x1 Rib loop width/frequency according to different relaxation cases

State of Relaxation	Regression equation between s-w	Correlation coefficient
Raw	w = 0,075 s + 0,803	0,9718
Dry	w = 0,065 s + 0,801	0,9753
Wet	w = 0,064 s + 0,794	0,9499
Washed	w = 0,080 s + 0,758	0,9864

Table 19 Regression equations of 1x1 Rib loop yarn length/frequency according to different relaxation cases

State of Relaxation	Regression equation between s-l	Correlation coefficient
Raw	l = 4,7 s + 124,1	0,974
Dry	l = 4,9 s + 122,1	0,9729
Wet	l = 5,1 s + 121,7	0,9633
Washed	l = 4,9 s + 122,1	0,9729

Table 20 Regression equations of 2x1 Rib loop yarn length/frequency according to different relaxation cases

State of Relaxation	Regression equation between s-l	Correlation coefficient
Raw	l = 3,2 s + 164,4	0,9846
Dry	l = 3,6 s + 161,4	0,9908
Wet	l = 3,6 s + 161,4	0,9908
Washed	l = 3,6 s + 161,4	0,9908

Table 21 Regression equations of 3x1 Rib loop yarn length/frequency according to different relaxation cases

State of Relaxation	Regression equation between s-l	Correlation coefficient
Raw	l = 1,7 s + 168,3	0,9897
Dry	l = 1,4 s + 167,2	0,9245
Wet	l = 1,4 s + 167,2	0,9245
Washed	l = 1,4 s + 167,2	0,9245

Conclusion

Research results can be grouped as follows.

Variations in the found k values depend on the mesh type, tissue extraction and the frequency . K with fixed values of this error margins should be considered in the calculations.

As the relaxation increases the loop height decreases and hence the loop width increases. The reason for this is that as the forces applied to the fabric during knitting results in a high and thin loop that tend to shorten and become wider during the relaxation process.

In rib fabrics, as the cloth pulled more an increase in height of the loop is observed. On the contrary, as the loop density increases, a decrease in the loop height is noticed.

As the knitting fabric density decreases the loop height and width are observed to increase and hence the total weight of the fabric is decreased.

The loop width increases linearly with increasing the length of the yarn loop.

In the full relaxation case, shrinkage of the rib fabric width is observed as a result of an increase in the amount of pulling.

In all Rib fabrics, the total weight is observed to be proportional to the loop density. The total weight is observed to attain the highest level at full of relaxation.

1x1 Rib fabrics thickness is observed to increase with relaxation. On the contrary, the thickness of other fabrics tends to decreases with relaxation. A result of relaxation process Decreases observed in other fabrics. This change in the 1x1 Rib fabric loop is due to the topology of the connecting points of the fabrics that affects contraction.

REFERENCES

[1] İşgören, E.: "Geometric characteristics of the single jersey structured fabrics made of Turkish cotton", *Ph.D. thesis,* Marmara university Applied Science Institue, Istanbul, Turkey, (1993)
[2] TSE 244.: "Determination of yarn count" Institue of Turkish Standards, Ankara, Turkey, (1989).
[3] TSE 246.: "Elongation at break yarns" Institue of Turkish Standards, Ankara,Turkey, (1989).
[4] TSE 247.: "Identification number of twist yarns" Institue of Turkish Standards, Ankara, Turkey, (1989).
[5] SDL-050 Hatra paint course measuring device user guide., Shirley Devolopments Limited, England, (1989)
[6] M&S-P65 Finding weight of fabric meter square.
[7] SDL-239 Fabric weighing machine User Guide, Shirley Devolopments Limited, England, (1989).
[8] BS 2544 Measuring fabric thickness.