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Find the Suitable Warp Tension to get the Best Resistance for Jacquard Fabric

Karnoub A[1]*, Kadi N[1], Azari Z[2] and Bakeer ES[1]

[1]*Faculty of Mechanical Engineering, University of Aleppo, Syrian Arab Republic*
[2]*Laboratory of Biomechanics, Polymers and Structures, France*

Abstract

Experimental studies were conducted on woven fabrics indicate that the yarn tension is the most important factor affects weaving performance and fabric property. This research has been examined the influence of fabric variables on warp tension, There are two advantages to applied the suitable tension on warp yarn, the first is to increase loom producing by decrease cutting of warp yarn, by suitable warp tension value. While the second is to improve the fabric quality by increase its resistance to tensile and friction. Chenille fabric was chosen for the test, because it is composed of a complex weave structures, on the other hand it is one of the most commonly used fabrics in the practical field. Four fabric variables have been studied on warp tension, which are (weft density, weft count, weft type and weave structure). Experimented mechanical properties are (vertical tensile resistance, horizontal tensile resistance and friction resistance). Research has been indicated that relationship between weft density with warp tension is an inverse relationship, while the relationship between weft count and weave float with warp tension is a direct relationship, and there is no effect of the weft type with warp tension. Finally, we have been concluded an equation for each previous relationship, by using those equatio† Ô– will get a fabric with best mechanical properties and high loom production.

Keywords: Warp tension; Cloth specifications; Fabric parameters; Jacquard fabric

Introduction

Textile industry is one of the advanced and important industries in the world as it is one of the oldest industries in which human work on it, where it evolved with the passage of time, especially in the last decade of the last century [1].

The industrial scientific progress achieved many accomplishments of modern innovation in all fields of industrial sectors, in particular the synthetic portion of which was plentiful, the sector has held the attention of many researchers and scientists and international companies specialized in this field [2]. The research and studies are still non-stop today to seek technical more sophisticated ways to reach the results that meet human needs and requirements [3].

Finding properties of stress-strain during the tensile test is the most common mechanical measurements, it is used to determine the specimen behavior when subject to axial tension load, it can get pregnancy cutter and elongation. The principle of the durability of the tensile test is very simple [4]. Where the piece stuck tested in two or more points and grabbing up the pieces. The deal tensile properties measured as a general rule a private laboratory and the results are considered absolute facts of a particular type or installation of the cloth results. Results are based on specimen dimensions and the type of fiber and place of fiber in addition to the weave structure of the cloth [5].

The strength of the cloth especially tensile durability is important mechanical properties for all users of fabric, like producers of fabrics, clothing makers, fashion designers and customers [6]. Rectangular Piece of cloth is tensile by suitable means until an outage occurs, then the power outage is determined and elongation at break, either through visual observation tools used for the measurement or through reading graphs automatic modern devices [7].

Fabrics tensile resistant is defined the maximum load the reality on the test specimen which causes elongation even breaking, it expressed in kg. Fabrics tensile resistant and its elongation is one of the main specifications of the fabric [8].

Customer who wants to buy a piece of cloth is not interested in how to get this piece but cares about their quality and appearance [9]. Warp tension is one of the most important variables that affect the quality and appearance of the cloth, when the yarn warp subject to changes in tensile strength values of the possible occurrence of breaks for strings and as a result drop cloth product and return the quality of the machine, this requires maintaining constant tension of the strings values throughout the textile session [10].

Warp tension is maintained by using warp and cloth organizations, it works to supply textile process with suitable length of the warp in conjunction with the loose warp process, the cloth organizations withdraw cloth with suitable length of woven fabric for constant tension and maintain of the weft density values [11].

Warp filaments are Exposed during the process of forming the cloth to the stresses and various deformities, as a result of direct friction with many parts of the machine, in addition to tensile forces and which are exposed during each cycle of the main axis of the loom cycles, and that these forces affect directly and mainly on the textile specifications cloth for the product [12]. In terms of phenotypic, through cohesion warp and weft yarns among themselves, and the density of warp and weft, the superficial weave structure [13]. Also these forces effect on the operation of the textile machine and productivity through interruptions that get in the warp weft [14].

***Corresponding author:** Amer Karnoub, Faculty of Mechanical Engineering, University of Aleppo, Syrian Arab Republic, Tel: 963934341385; E-mail: amerkarnoub@gmail.com

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These forces directly effect on the quality of the produced cloth [15], including cloth resistant of different strains and the most important of which fabric abrasion resistance, and resistance to tensile stresses in both direction of warp and weft, which exposed during use, through interlacement quality between warp and weft filaments with each other [16].

As well as the various forces affect the operation of the textile machine and its productivity through a number of interruptions that get in the warp yarns [17].

The tension resulting from a difference in delivery between warp beam and cloth beam, are not subject to any kind of previous forces, and it can change its values by loom sett [18].

Full tension force applied to the warp yarns follow the parameters of a woven fabric [19] are divided to three group, 1st are (density, types and count of warp yarns), 2nd are (density, types and count of weft yarns), 3rd is the method of entanglement between the warp and weft (weave structure).

While it is difficult to change the initial tension, it will be amended by changing the tension resulting from a difference in delivery between warp beam and cloth beam. This change will be against of each of the previous variables cloth [20].

The warp tension plays the contradictory effect during weaving. On the one hand, warp tension provides the only means of holding or supporting the cloth fell in position during beat-up [21]. This is referred to as the supporting function. On the other hand, higher warp tension tends to increase the weaving resistance and can be said to oppose the entry of the new weft into the fabric [22]. This is referred to as the opposing function. To introduce the opposing function it would be necessary to express the coefficient of weaving resistance as a function of warp tension. There is a great deal of evidence that the supporting function is by far the more important [23].

By measuring the warp-end tension and the produced fabric properties, using FAST and air-permeability testers along the loom width, the effect of widthwise warp-end tension variation on fabric properties was determined [24].

From statistical analysis, fabric performance properties models were obtained. From which, variation in fabric properties due to variation of tension on warp-end during weaving process is evaluated. This could provide the fabric developer with beneficial tools to design with predetermined desired properties [25].

The Aim of the Research and its Importance

This research aims to identify fabric variables effect on warp tension, and presents equations to calculate a required warp tension for each variable, for getting a fabric with the best quality and the highest loom production.

When applying typical warp tension will get many benefits like reduce the warp yarn breaks caused by low or high tension leading to decrease loom stops, thereby increase productivity, on other hand to improve cloth specifications through increase cloth resistant to friction and tensile stresses and thus improve product quality.

Finally, all fabric looms of different development must contain special mechanism to apply tension on warp yarns to complete weaving process.

Materials and Methods of Search

The study and experiments were conducted on the loom model (GTM) from the production company (Picanol) Belgian, Figure 1, a loom capable of producing all type of fabrics, because it contains the Jacquard (a device to open the shed), which contains the 2688 controller yarn warp.

Warp tension was adjusted by a device to measure the tension, its model (I1901) of the production company (Schmidt) German (Figure 2).

Tested fabric is Chenille, because it is the most widely used, especially for the purposes of furniture upholstery. On the other hand, Chenille fabric enters the composition of many types of yarns in addition to the great variety of jacquard weave used to produce it.

Experiments on the specimens are three types:

Frictional resistance: by identifying the proportion of missing weight (%) of the specimen under a fixed number of frictions, on friction device (Martindale) (Figure 3).

Vertical tensile resistance toward warp: by identifying break force of specimen in [N], on tensile test device direction of warp.

Horizontal tensile resistance toward weft: by identifying break force of specimen in [N], on tensile test device direction of weft (Figure 4).

Figure 1: Picanol loom.

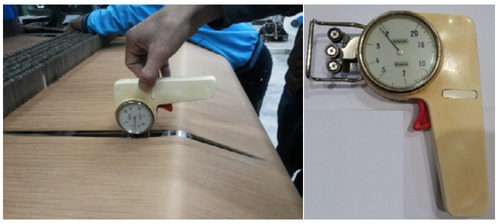

Figure 2: A device for measuring yarn tension.

Figure 3: A specimen before and after friction test.

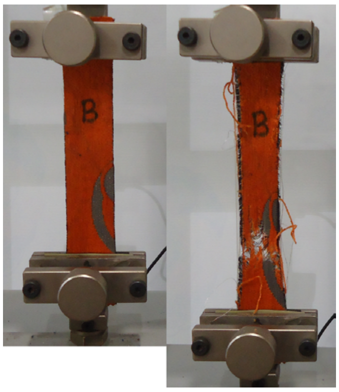

Figure 4: A specimen before and after tensile test.

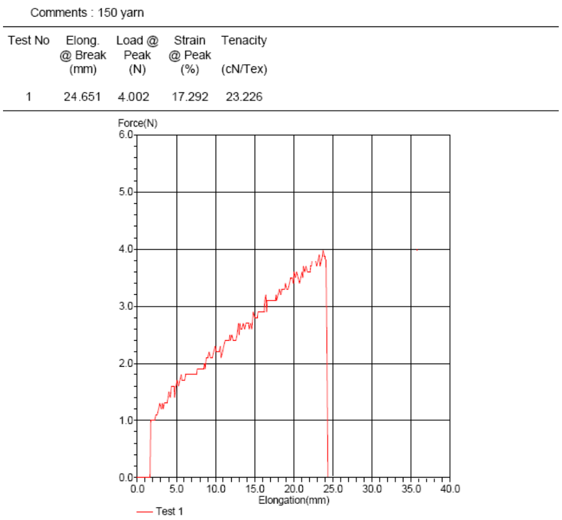

Figure 5: The tensile test for single warp yarn.

The best specimen breaks under the greatest value of tensile force, during testing the tensile strength. It loses the less weight during the friction resistance test. After taking several readings (10 readings) were taken as the value of its arithmetic average ratio.

To know the effect of each fabric parameter on warp tension, we will fix all fabric parameters except that parameter. Then we will change the value of tested parameter toward a range of warp tension value.

The range of warp tension depends on the type of warp yarn, while the type of warp yarn is polyester 150 den, and it breaks under 22.226 (cN/tex) as it cleared in Figure 5. Thereby we choose 12 up to 30 (cN/tex) for warp tension range, that's due to keep the yarn within elastic field.

Results and Discussion

Effect of weft density on warp tension

Fixed variables are: warp density is 66 yarn/cm, warp type is Polyester DTY, warp count is 60 Nm, weft primary type is Chenille polyester, auxiliary weft is polypropylene yarn (continues filaments), weft count for Chenille is 4 Nm and for polypropylene is 30 Nm, weave structure is complex one consists of Satin 1/23 for Chenille yarn and plain 1/1 for polypropylene yarn.

Four values of weft density have been selected for testing, (20-24-28-32) pick/cm, because the number of Chenille yarns per 1 cm are to be within a required field for jacquard fabric (5-6-7-8) pick/cm.

Previous results in Tables 1-4 shown in Figures 5-8, to relent comparison with warp tension and fabric resistance.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
A 001	12	2202	1754	26%
A 002	15	2200	1801	29%
A 003	18	2104	1732	29%
A 004	21	2095	1677	29%
A 005	24	1783	1620	35%
A 006	27	1422	1475	32%
A 007	30	1046	1432	31%
A 008	33	597	1333	35%

Table 1: Results when weft density is 32 pick/cm.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
B 001	12	1943	1495	30%
B 002	15	2048	1621	30%
B 003	18	2111	1666	29%
B 004	21	2159	1732	27%
B 005	24	2089	1621	29%
B 006	27	1578	1538	29%
B 007	30	1250	1482	33%
B 008	33	789	1275	36%

Table 2: Results when weft density is 28pick/cm.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
C 001	12	1682	1199	59%
C 002	15	1759	1321	41%
C 003	18	1893	1379	39%
C 004	21	1954	1429	39%
C 005	24	2066	1475	38%
C 006	27	2110	1555	35%
C 007	30	2032	1696	40%
C 008	33	1789	1500	39%

Table 3: Results when weft density is 24 pick/cm.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
D 001	12	1386	1054	62%
D 002	15	1467	1118	62%
D 003	18	1532	1275	44%
D 004	21	1653	1410	41%
D 005	24	1688	1478	45%
D 006	27	1865	1502	44%
D 007	30	1909	1541	39%
D 008	33	1997	1551	44%

Table 4: Results when weft density is 20 pick/cm.

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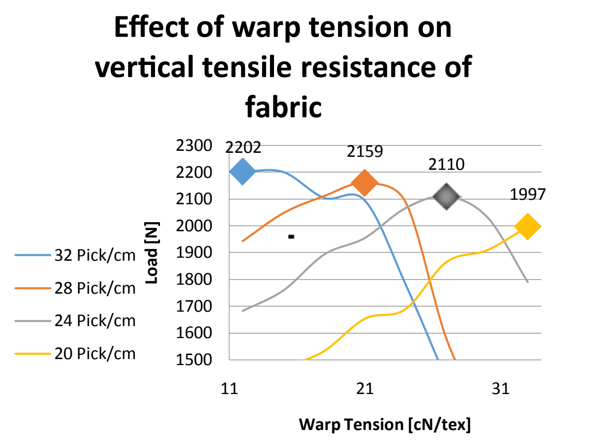

Figure 6: Relation between warp tension and vertical tensile strength, for several weft densities.

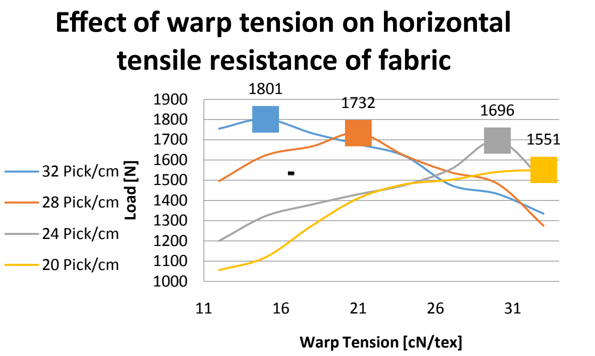

Figure 7: Relation between warp tension and horizontal tensile strength, for several weft density.

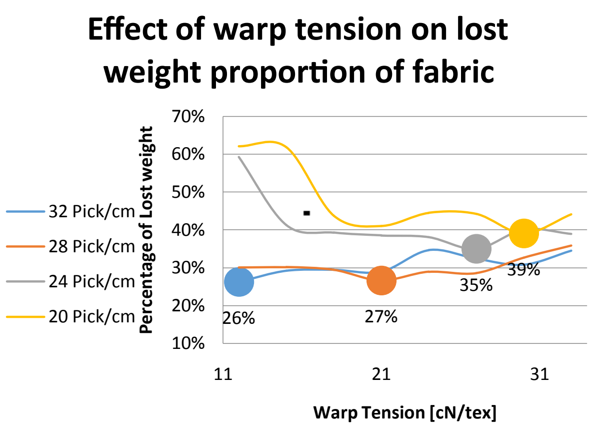

Figure 8: Relation between warp tension and lost weight due to friction, for several weft densities.

Characteristic points in previous figures mention to the best value of warp tension for the best of fabric properties, thereby characteristic points for each weft density are shown in Figure 9.

Figure 9, shows that the relationship between warp tension with weft density is an inverse relationship, and represents the equation as follows:

$$y = -1.7976x + 35.464. \quad (1)$$

Where y: refers to value of weft density, x: refers to warp tension [cN/tex], the correlation coefficient is $R^2 = 0.9808$.

In addition, we note that exposure of high warp tension on specimens with high weft densities lead to a quick collapse of those specimens under tensile test toward warp yarns. Moreover, exposure of low warp tension on specimens with low weft densities lead to a quick collapse of those specimens under friction test.

When weft density increases, number of intersections between warp and weft will increase. As it is known, increasing of intersections number between the warp and weft lead to increase the demand from the warp yarns because of the intersections that lead to an increase in the length of the yarn path, which is causing to increasing tension applied to the warp yarns. As a result we conclude, when weft density increase must reduce warp tension, this is shown by the results that we have obtained through experiments.

On the other hand, when warp tension increases the need of warp length will increase; because of increase in intersections occurring through high weft density will result in warp yarn straining significantly, and the loss of ductility and collapse of a large section of them before testing them. Leading to the quickly collapse of the specimen when tested under tensile test toward warp and under low tensile strength, as shown in Figure 10.

The results also showed that when the weft densities are low, the warp tension must be in high value, in order to compensation the shortfall in need of the warp length, resulting of the decline in the intersections between the warp and weft, to complete the process as required. If we assume the contrary case, that means decrease warp tension at low weft density. We will get specimens of cloth which does not have warp strength enough to fixing weft yarns in its place in fabric, which will negatively affect the amount of the specimen resistance to friction test and lost large amounts of weight.

Effect of weave structure on warp tension

Fixed variables are: warp density is 66 yarn/cm, warp type is Polyester DTY, warp count is 60 Nm, weft density is 20 pick/cm, weft primary type is Chenille polyester, auxiliary weft is polypropylene

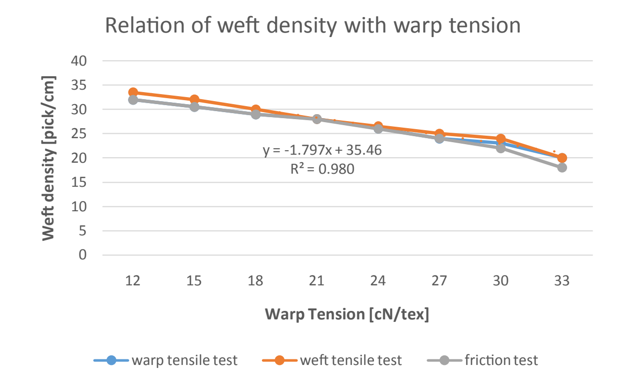

Figure 9: Relation between weft density and fabric properties after experiments.

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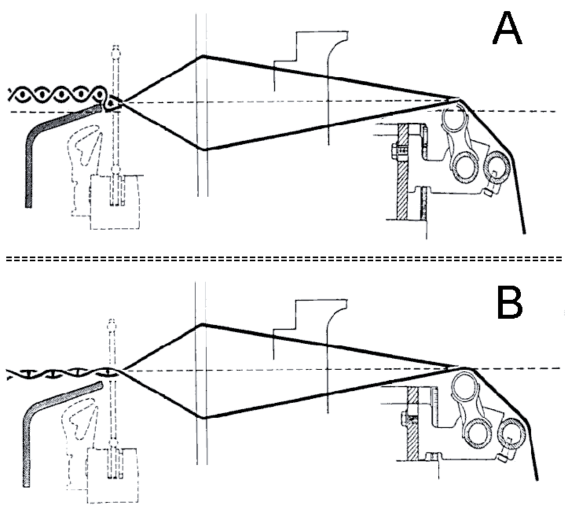

Figure 10: Relation between request warp length and weft density.

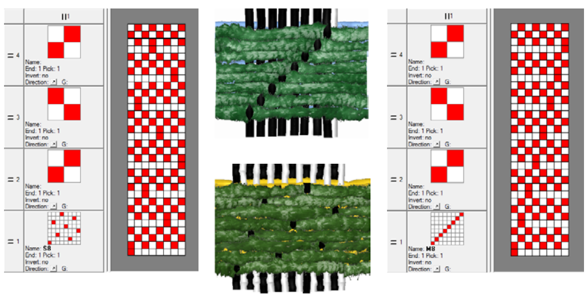

Figure 11: Deference between satin and twill weave.

yarn (continues filaments), weft count for Chenille is 4 Nm and for polypropylene is 30 Nm.

While, weave structure is complex one, consists of a simple weave for Chenille and simple weave for polypropylene. Because of the effect one is a Chenille weave, it will be change, and basic weave will be fixed. Selected weaves are (Satin 7/1, Satin 15/1, Satin 23/1) because it is more useful weaves in in the practical field. Deference between these in weave float only, because there is no deference between satin and twill in the effect on warp tension, because satin and twill just differs in distribution of warp and weft intersects points. As it shown in Figure 11.

Previous results in Tables 5-8, are shown in Figures 12-14, to relent comparison with warp tension and fabric resistance.

Characteristic points in previous figures mention to the best value of warp tension for the best of fabric properties, thereby characteristic points for each weave are shown in Figure 15.

Figure 15, shows that the relationship between warp tension with weave float is a direct relationship, and represents the equation as follows:

$$y = 2.8095x + 3.8571. \qquad (2)$$

Where y: refers to value of weave float, x: refers to warp tension [cN/tex], the correlation coefficient is R^2=0.9808.

To explain the previous result we must enumerate the number of intersections between warp and weft yarns by NedGraphics program. As the difference between the three weaves Satin (1/7-1/15-1/23) is only in Chenille weave, where assistance yarn weave is identical for all weaves as plain 1/1, the comparison is just between Chenille weave.

On the other hand the number of intersections must enumerate occurring in each of the three weaves within a unified measure of a weave paper, and the measurement of paper from complications of three weaves measurements (8-16-24). Correct measurement is 48 × 48, as is cleared in the Figure 16.

After enumerating the number of intersections occurring within each of the three weaves, the results can be clear within the Table 8.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
E 001	12	2240	1690	37%
E 002	15	2256	1677	35%
E 003	18	2222	1585	36%
E 004	21	2174	1502	40%
E 005	24	1832	1515	41%
E 006	27	1422	1414	44%
E 007	30	1200	1433	44%
E 008	33	943	1370	45%

Table 5: Results for 1/7 satin weave.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
F 001	12	1804	1290	63%
F 002	15	1877	1390	43%
F 003	18	1942	1433	36%
F 004	21	1955	1573	38%
F 005	24	2101	1467	41%
F 006	27	1784	1505	42%
F 007	30	1288	1347	44%
F 008	33	670	1260	42%

Table 6: Results for 1/15 satin weave.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
G 001	12	1386	1054	66%
G 002	15	1467	1118	63%
G 003	18	1532	1275	45%
G 004	21	1653	1410	45%
G 005	24	1688	1478	45%
G 006	27	1865	1502	40%
G 007	30	1909	1541	40%
G 008	33	1997	1551	45%

Table 7: Results for 1/23 satin weave.

Intersections No.	Float magnitude
12	8
6	16
4	24

Table 8: The amount of the number of intersections per show.

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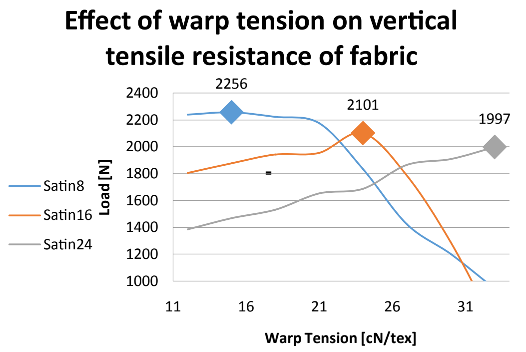

Figure 12: Relation between warp tension and vertical tensile strength, for several weaves.

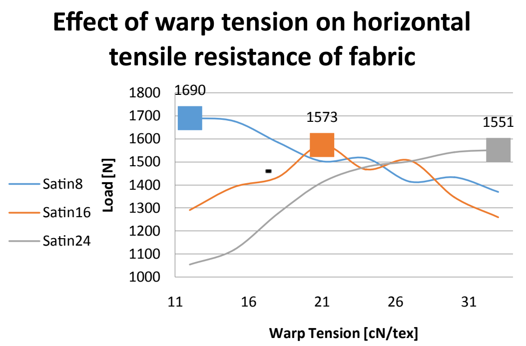

Figure 13: Relation between warp tension and horizontal tensile strength, for several weaves.

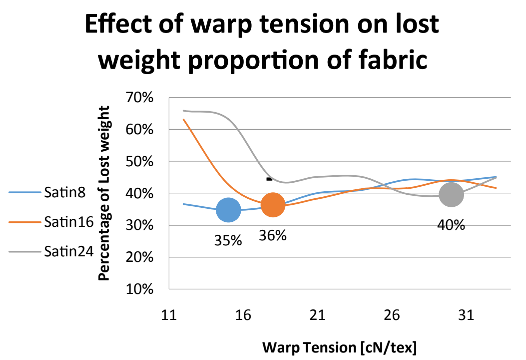

Figure 14: Relation between warp tension and lost weight due to friction, for several weaves.

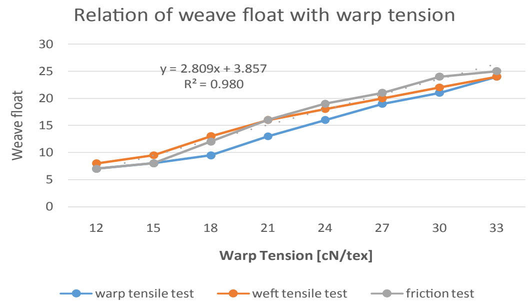

Figure 15: Relation between weave float and fabric properties after experiments.

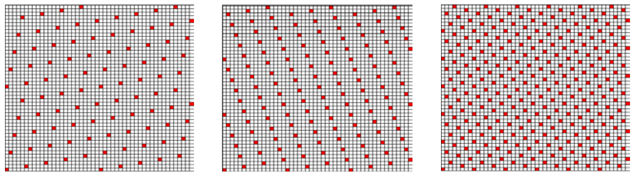

Figure 16: Comparison between three satins (8-16-24).

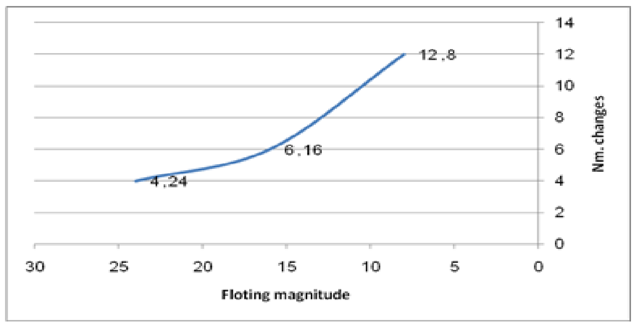

Figure 17: Relationship between number of intersections and float magnitude.

Figure 17, shows that relationship between number of intersections (changes) and the amount of float in weave is an inverse relationship.

As the number of intersections will increase that means the amount required from the yarn warp length will increase. This leads to increase tension that applied to the warp, and this explains the results we have obtained. It whenever the amount of float fell in a weave, whenever it is better to reduce the warp tension.

The length of the warp yarn needed to complete the process of weaving for Sateen 8 greater than the length required warp yarn for Sateen 16 greater than the length required for the warp yarn for Sateen 24. As it is shown in Figure 18.

Effect of weft type on warp tension

Fixed variables are: warp density is 66 yarn/cm, warp type is Polyester DTY, warp count is 60 Nm, weft density is 28 pick/cm, weft count for Chenille is 4 Nm and for polypropylene is 30 Nm, weave structure is a complex one consists of Satin 1/23 for Chenille yarn and plain 1/1 for polypropylene yarn.

Tested yarn types are (Acrylic, Polyester, Microfiber), because they are the most widely used in Chenille cloth.

Previous results in Tables 9-11 shown in Figures 19-21, to relent comparison with warp tension and fabric resistance.

Experiments' results indicate that it has not effect of weft type on warp tension.

Because change is for the weft type only, with fixed rest variables, we note that the best types of yarn are acrylic then polyester, followed by microfiber.

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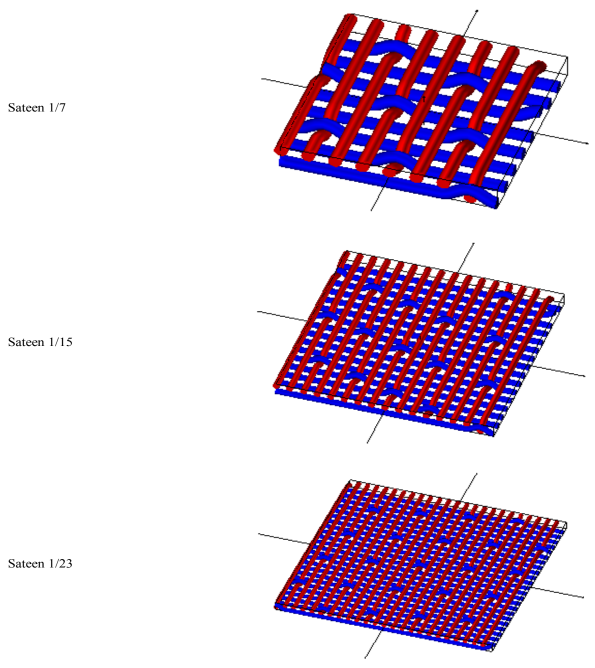

Figure 18: Cross-section for three tested weaves.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
H 001	12	1943	1495	53%
H 002	15	2048	1621	37%
H 003	18	2111	1666	31%
H 004	21	2159	1732	31%
H 005	24	2089	1621	35%
H 006	27	1578	1538	34%
H 007	30	1250	1482	33%
H 008	33	789	1275	34%

Table 9: Results for polyester chenille.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
I 001	12	1890	972	67%
I 002	15	1997	1054	53%
I 003	18	2076	1184	41%
I 004	21	2122	1322	39%
I 005	24	2043	1303	37%
I 006	27	1630	1253	38%
I 007	30	1104	1054	39%
I 008	33	707	899	45%

Table 10: Results for microfiber chenille.

There is no relationship between the weft type and required length of warp yarn or the number of intersections occurring between warp and weft.

According to fabric resistance (mechanical properties), acrylic is the best yarn followed polyester then microfiber, reason for this is due to the surface of the yarn capillary, where acrylic is characterized by a surface that is capable to cohesion with the filaments of warp yarn. It explains the high strength in both direction vertical and horizontal, addition large resistance to friction test.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
J 001	12	1864	1732	34%
J 002	15	2094	1771	27%
J 003	18	2143	1808	24%
J 004	21	2188	1967	25%
J 005	24	2221	1874	21%
J 006	27	2054	1854	23%
J 007	30	1584	1754	27%
J 008	33	1125	1666	28%

Table 11: Results for Acrylic chenille.

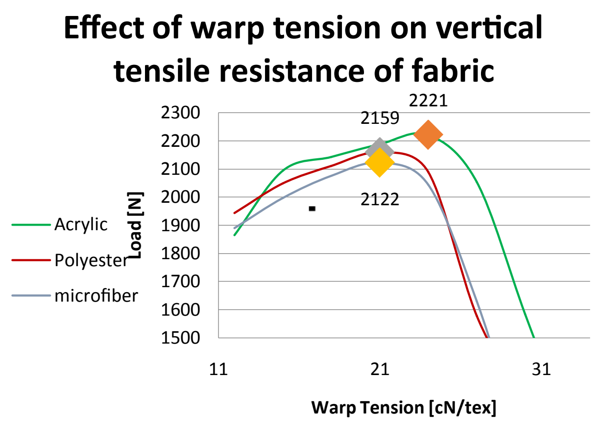

Figure 19: Relation between warp tension and vertical tensile strength, for several yarn types.

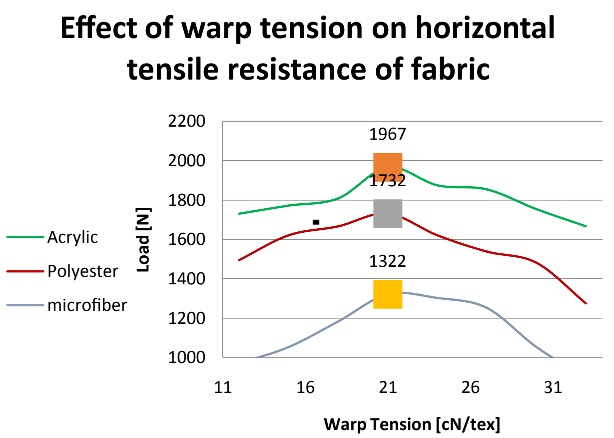

Figure 20: Relation between warp tension and horizontal tensile strength, for several yarn types.

Effect of weft count on warp tension

Fixed variables are: warp density is 66 yarn/cm, warp type is Polyester DTY, warp count is 60 Nm, weft density is 28 pick/cm, weft primary type is Chenille polyester and auxiliary weft is polypropylene

Citation: Karnoub A, Kadi N, Azari Z, Bakeer ES (2015) Find the Suitable Warp Tension to get the Best Resistance for Jacquard Fabric. J Textile Sci Eng 5: 222. doi:10.4172/2165-8064.1000222

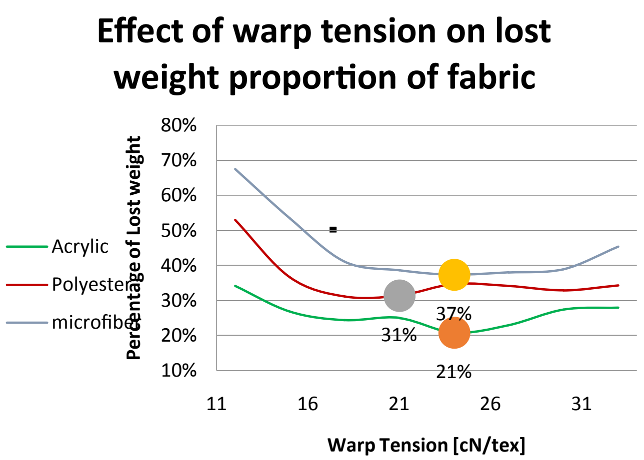

Figure 21: Relation between warp tension and lost weight due to friction, for several yarn types.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
K 001	12	2189	1788	26%
K 002	15	2212	1717	27%
K 003	18	1976	1712	29%
K 004	21	1743	1640	29%
K 005	24	1643	1549	31%
K 006	27	1128	1438	31%
K 007	30	786	1390	32%
K 008	33	539	1316	34%

Table 12: Results for 4 Nm count.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
L 001	12	1639	953	51%
L 002	15	1888	1129	46%
L 003	18	2041	1249	44%
L 004	21	2144	1313	38%
L 005	24	2089	1386	44%
L 006	27	1459	1202	47%
L 007	30	1140	1005	48%
L 008	33	711	943	48%

Table 13: Results for 6 Nm count.

yarn (continues filaments), weave structure is a complex one consists of Satin 1/23 for Chenille yarn and plain 1/1 for polypropylene yarn.

While count of primary tested yarn (Chenille) are: (4 Nm - 6 Nm - 8 Nm), because it have a wide useful. While count of auxiliary yarn often be 30 Nm steadily.

Previous results in Tables 12-14 shown in Figures 22- 24 to relent comparison with warp tension and fabric resistance.

Characteristic points in previous figures mention to the best value of warp tension for the best of fabric properties, thereby characteristic points for each weave are shown in Figure 25.

Figure 25, shows that the relationship between warp tension with weft count is a direct relationship, and represents the equation as follows:

$$y = 0.568x + 3.5679 \quad (3)$$

Where y: refers to value of weft count, x: refers to warp tension [cN/tex], the correlation coefficient is $R^2 = 0.9946$.

Specimen	Warp tension (cN/tex)	Vertical tensile strength (N)	Horizontal tensile strength (N)	Lost weight due to friction (%)
M 001	12	1424	547	71%
M 002	15	1479	611	62%
M 003	18	1643	638	62%
M 004	21	1763	793	60%
M 005	24	1777	875	56%
M 006	27	1843	922	50%
M 007	30	1919	983	50%
M 008	33	1980	1011	59%

Table 14: Results for 8 Nm count.

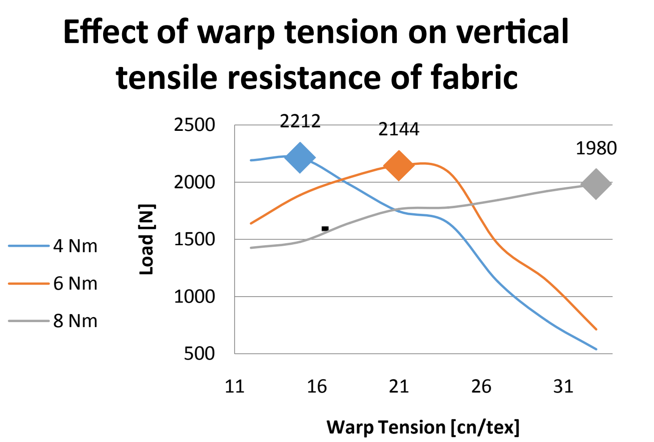

Figure 22: Relation between warp tension and vertical tensile strength, for several yarn counts.

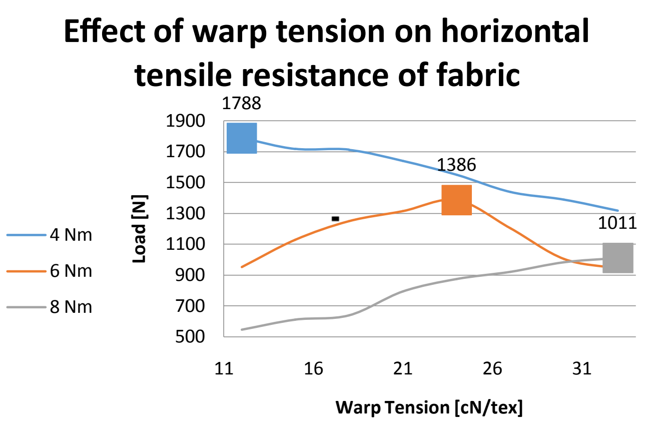

Figure 23: Relation between warp tension and horizontal tensile strength, for several yarn counts.

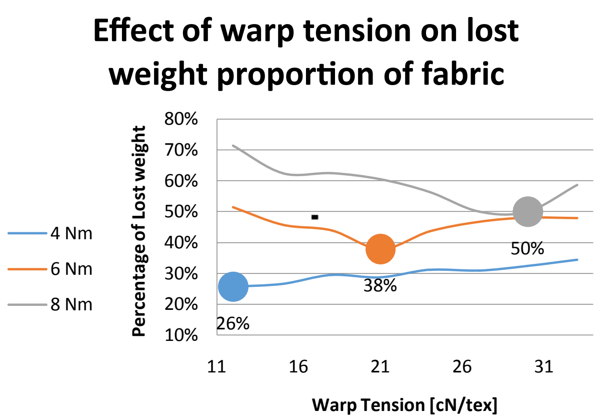

Figure 24: Relation between warp tension and lost weight due to friction, for several yarn counts.

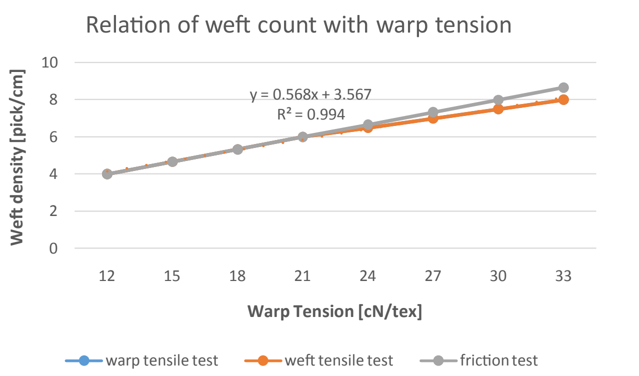

Figure 25: Relation between weft count and fabric properties after experiments.

Decrease the weft count will increase the yarn diameter, then will require a larger length of warp to complete the weaving process, thus increase warp tension, which requires to decrease the tension applied to the warp yarns.

Figure 26, identifies three cross-sections of tested yarns for several count, with fixed weave structure. Figure shows that required warp length to complete overlap with weft yarn increases when the weft diameter increases. Note that the red color is weft yarn while the green color is the warp yarn.

Conclusion

There is an important effect for warp tension on fabric resistance (mechanical properties) like friction resistance, vertical tensile resistance and horizontal tensile resistance. In some cases, warp tension must be in high value, but in other cases, it must be in low value, it depends on fabric variables like weft and warp density, weft and warp count, weft and warp type, finally weave structure.

We conclude the following results:

- Relationship between weft density and warp tension is an inverse relationship, as followed equation:

$D_e = -1.7976T_a + 35.464.$ (4)

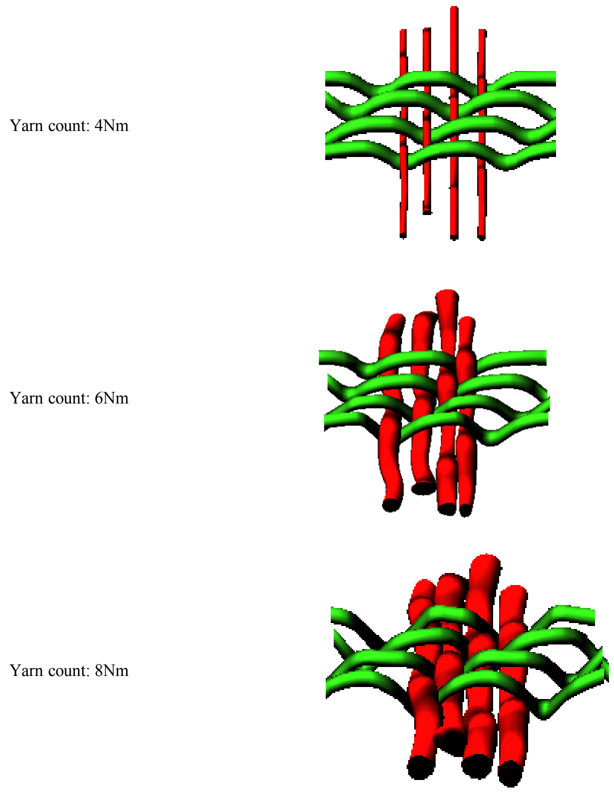

Figure 26: Cross-section for three tested yarns for same weave.

Where D_e: weft density [pick/cm], T_a: warp tension [cN/tex].

- Relationship between weave float and warp tension is an direct relationship, as followed equation:

$W_f = 2.8095T_a + 3.8571$ .. (5)

Where W_f: weft density [pick/cm], T_a: warp tension [cN/tex].

- Relationship between weft count and warp tension is an direct relationship, as followed equation:

$W_f = 0.568T_a + 3.5679$ .. (6)

Where W_f: weft density [pick/cm], T_a: warp tension [cN/tex].

- There is no effect of weft type on warp tension.

By using Equations 4-6, fabric will be in the best mechanical properties, because high warp tension leads to low tensile resistance, and low warp tension leads to low friction resistance.

On other hand, using Equations 4-6 loom production will be in the highest produce, because high warp tension leads to cut warp yarns then stop the loom, also low warp tension leads to enlacement between warp yarns and stop the loom.

Thereby using previous equations, we will get typical value of warp tension.

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