

# The Relationship Between Stitch Length and Fabric Diameter (Open Width) of Single Jersey, 1 X 1 Rib and 1 X 1 Interlock

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**Abstract** -Knit fabric properties can be changed due to use of various count of yarn, type of yarn (ring, rotor, and compact), quality of yarn, stitch length / loop length, structural geometry, fiber composition of yarn etc. This study focused on the various stitch length effect of grey Single Jersey, 1x1 Rib, 1x1 Interlock knit structures. The increases value of stitch length, fabric width (Open Width) is decreased. This is due to when stitch length increases the loop is less bent than the tension impose upon it. As a result after relaxation, the loops go to their flexible bent position without altering stitch length / loop length. Diameter varies for single jersey, 1x1 ribs & 1x1 interlock for their different machine diameter. This study focused that for different parameter how knitted fabric diameter is increased on different diameter knitting machine. Finally, the authors established a relationship among the stitch length and fabric Diameter (Open width) for grey Single Jersey, 1x1 Rib, 1x1 Interlock knit structures.

**Key Words:** Stitch length, loop, Fabric Structure, fabric Dia, GSM.

## I. INTRODUCTION

Knitting is a method by which thread or yarn is turned into cloth or other fine crafts. Knitted fabric consists of consecutive rows of loops, called stitches. As each row progresses, a new loop is pulled through an existing loop. The active stitches are held on a needle until another loop can be passed through them. This process eventually results in a final product, often a garment. [1]

There are two major varieties of knitting: weft knitting and warp knitting. In the more common *weft knitting*, the wales are perpendicular to the course of the yarn. In warp knitting, the wales and courses run roughly parallel. In weft knitting, the entire fabric may be produced from a single yarn, by adding stitches to each wale in turn, moving across the fabric. By contrast, in warp knitting, one yarn is required for every wale. Effect of stitch length on knit fabric structure plays a vital role on its properties. What kind of properties of different knit structures will be regulated by various stitch length is the measurement of our project purpose. [6]

### A. Knitted loop & loop shape:

A kink of yarn that is intermeshed at its base i.e. when intermeshed two kink of yarn is called a knitted loop. A knitted loop is a basic part of knit fabric



Fig 1: Knitted loop

Technically a knitted loop consists of a needle loop & a sinker loop.

### B. Needle loop:

The loop is the simplest unit of knitted structure. It is formed by the top arc & the 2 legs of the weft knitted loop.

Needle loop = Top arc+ two legs



Fig 2: Needle loop

### C. Sinker Loop:

The yarn portion that connects two adjacent needle loops belonging in the same knitted course. Sinker loop is specially the portion of bottom arc.



Fig 3: Sinker loop

So, knitted loop = needle loop + sinker loop

Weft knitted structures, those used for hosiery, knitwear & underwear, have unique properties of form – fitting & elastic recovery based on the ability of knitted loops to change shape when subjected to tension. Unfortunately dimensional changes can also occur during production, or washing or wearing. At that time problems of shrinkage & size variation can cause customer dissatisfaction & increased production cost. [2]

### D. Loop Length / Stitch Length:

The length of yarn knitted into one stitch in a weft knitted fabric. Stitch length is theoretically a single length of yarn which includes one needle loop & half the length of yarn (half a sinker loop) between that needle loop & the adjacent needle loops on either side of it. Generally larger the stitch length more elastic & lighter the fabric & poorer its cover opacity & bursting strength. i.e.  $\text{Stitch Length} = \text{Length of one needle Loop} + \text{Length of two half of a sinker loop}$ . Generally stitch length is expressed in mm (millimeter). [5]

In the fabrics, loop lengths combine in the form of course lengths & it is there that influences fabric dimensions & other properties like weight, density, shrinkage, spirality etc. Variations in course length between one garment & another can produce horizontal barrenness & impair the appearance of the fabric. In the modern knitting machine, it needs to maintain a constant loop length at one feed & another on same machine is mandatory for continuing the constant loop length. Although a machine may be set to knit a specific stitch length, fluctuations in yarn or machine variable can affect yarn surface friction or yarn tension at the knitting point. As a result, the ratio of 'robbed back' to newly-drawn yarn changes & alters the size of the knitted loop. [3]

### E. Loop length measurement & control:

Conventionally loop length / stitch length was measured by measuring course length with the help of HTRA (Hosiery & Allied Trades Research Association) course length tester. But, This is time consuming, destructive of material & only provides informations after knitting, so control has become difficult.

In modern time, two types of meter may be employed to monitor yarn feed during knitting:

- i) Yarn length counters
  - ii) Yarn speed meters.
- i) Yarn length counters: This is simplest in construction, providing a reading of the amount of yarn fed in a certain time period. It is particularly suitable for attaching to a moving cam-box machine. After a specific number of machine revolutions, the machine is stopped to enable the yarn length reading to be taken; this is then divided by the number of knitting machine revolutions in order to obtain course length of that feed.
  - ii) Yarn speed meter: This may require calibrity & provides a direct reading of the rate of yarn feed, usually in meters per minute, whilst the machine is running. The meter may be hand-held & can be used on a revolving cylinder machine without need to stop it. To obtain the course length, it is necessary to divide the reading by the number of knitting machine revolutions per minute. [4]

## II. MATERIALS AND METHOD

### A. Materials

For identifying the actual fabric width of different fabric, the authors use the following materials.

TABLE I. YARN SPECIFICATION

Yarn	Yarn Count	Type	Stitch length	Country of Origin
Cotton	34 <sup>s</sup> , 40 <sup>s</sup> , 30 <sup>s</sup> , 26 <sup>s</sup> , 24 <sup>s</sup> .	Carded /Comb ed	2.00-4.00	India

TABLE II. FABRIC SPECIFICATION

Fabric type	GSM	Structure	Dia
Single Jersey	150	Normal	Open Width
1 X 1 Rib	170	D/J	
1 x 1 Interlock	190	D/J	

TABLE III. MACHINE SPECIFICATION

M/C Dia	M/C Type	M/C Gauge
38"-40"	Single jersey	24
	D/J (Interlock)	24
	D/J (Rib)	24

**B. Method:**

By using all the specification in different stitch length in (mm) for different fabric the authors got different results. The authors clearly observed that in different stitch length the single jersey, 1 x 1 ribs and 1 x1 interlock fabric get different dia. The authors got the fabric diameter in inch. For different machine diameter also a factor for fabric diameter. Here, the authors show different data table for different machine diameter also.

**III. RESULT AND DISCUSSION**

All the observations were performed on the machines which were smoothly running and without any kind of fabric faults. For different stitch length the authors finds different fabric width in inch for different fabric. Here, the authors use the same machine dia for identifying the actual fabric width. Here, the authors vary the stitch length for finding the width. Here, the authors observed that for same stitch length the fabric width has varied. In below, the experimental data table is given for showing the different fabric width.

TABLE IV. DATA FOR FABRIC WIDTH (MACHINE DIA: 38")

Observation no.	Stitch Length (in mm)	Fabric width in inch		
		Single Jersey	1*1 Rib	1*1 Interlock
1	2.50	76.8	80.5	84.9
2	2.60	76	79.5	84
3	2.70	75	79	83
4	2.74	74.8	78	82
5	2.78	74.3	77.6	80
6	2.85	73.9	77.3	79.6
7	3.05	73.1	76.8	78.7

TABLE V. DATA FOR FABRIC WIDTH (MACHINE DIA: 39")

Observation no.	Stitch Length (in mm)	Fabric width in inch		
		Single Jersey	1*1 Rib	1*1 Interlock
1	2.50	77.5	82.5	85.9
2	2.60	77	81.5	85
3	2.70	76	80	86
4	2.74	75.5	79	84
5	2.78	75	79.6	82
6	2.85	74.9	78.3	80.6
7	3.05	75.1	76.8	80.7

TABLE VI. DATA FOR FABRIC WIDTH (MACHINE DIA: 40")

Observation no.	Stitch Length (in mm)	Fabric width in inch		
		Single Jersey	1*1 Rib	1*1 Interlock
1	2.50	78	83.5	86.9
2	2.60	79	82.5	87
3	2.70	77	82	86
4	2.74	76.5	84	85
5	2.78	77	80.6	84
6	2.85	75.9	80.3	83.6
7	3.05	77.1	78.8	84.7

**A. Observation no1:**

Here, from table no. 4 the authors observed that When the machine dia is 38" and stitch length (2.50 mm) the fabric width of single jersey is (76.8 inch) comparatively lower than 1 x1 rib (80.5 inch) and the fabric width of 1 x1 rib (80.5 inch) is comparatively lower than 1 x1 interlock (84.9 inch).

**B. Observation no 2:**

Here, from table no.4 the authors observed that when the machine dia 38" and stitch length (2.60 mm) the fabric width of single jersey is (76 inch) comparatively lower than 1 x1 rib (79.5 inch) and the fabric width of 1 x1 rib (79.5 inch) is comparatively lower than 1 x1 interlock (84 inch).

After analyzing all the observation the authors finally observed that, with increasing the stitch length fabric width (Open) is decreasing for all type of fabrics. In below a comparison graph are given:

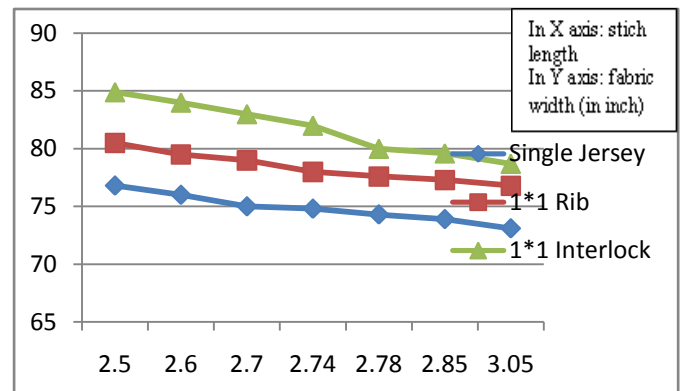


Fig 4: Graph of Fabric width

On the other hand from table number 4, 5, 6, the authors observed that when the machine dia is increasing the fabric of different fabric also increasing.

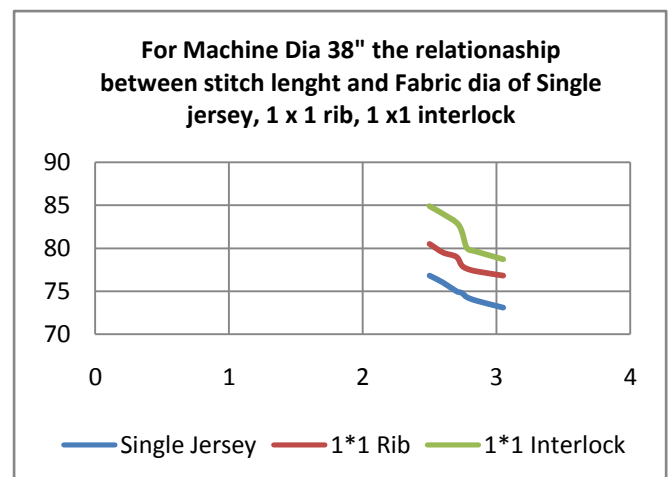


Figure 5: The relationship between stitch length and fabric dia of single jersey, 1 x 1 ribs and 1 x 1 interlock (For Machine Dia 38")

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## REFERENCES

- [1] Knitting Technology (3<sup>rd</sup> edition) - David J. Spencer Chapter: 22, Page: 274
- [2] MUNDEN, D. L. HATRA Research Report No. 9, April-1959, PP.54
- [3] C. D. Kane, U. J. Patil & P. Sudhakar - D.K.T.E.'s Textile Engineering Institute [ Chalkaranji 416115, India ]
- [4] Parmer, M.S, An unconventional way to incorporate comfort in knitted fabrics, Indian J. Fibre textile Res. 24, 41-44 (1999)
- [5] Binternagel, T, New Potential in Downstream processing of COM4 yarns, Melliand 6, 198 (2000), PP.50
- [6] Anand S. C., some properties of single jersey weft knitted fabrics, Melliand 6, 43 (2000), PP.44-85
- [7] Munden n D. L. The Geometry & Dimensional properties of plain knitted fabrics, J. Textile Inst.448 1959, PP.77-94

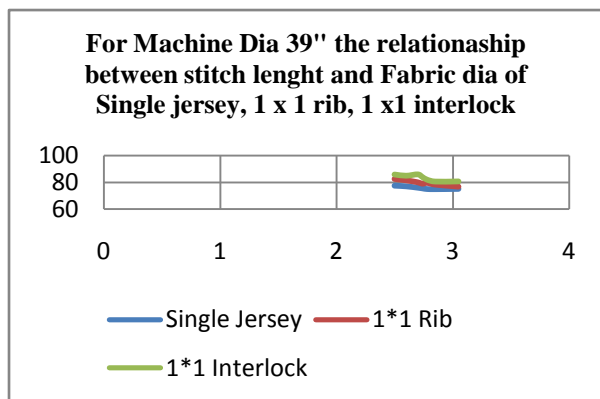


Figure 6: The relationship between stitch length and fabric dia of single jersey, 1 x 1 ribs and 1 x 1 interlock (For Machine Dia 39")

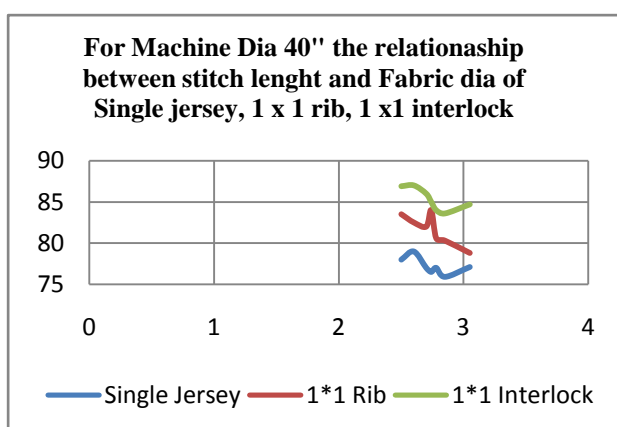


Figure 7: The relationship between stitch length and fabric diameter of single jersey, 1 x 1 ribs and 1 x 1 interlock (For Machine Diameter 40")

## CONCLUSIONS

Stitch/Loop length is the fundamental unit which controls all the properties of weft knitted fabrics. Mainly stitch length & knit structure affects all the dimensional, comfort, handle & other properties. We only worked by taking single jersey, plain (1x1) rib, plain(1x1) interlock; But stitch length also plays a great roll on their derivatives such as lacoste, pique etc. As the knit density / stitch density increased tensile properties of finished fabric ready for end use. From the analysis, we can get idea about grey stage of knit fabrics, that source will show better performance for the summer inner wear & some for winter outerwear. Due to stable structure, we can see that plain interlock possess the best dimensional stability against any changes. [6] We can also see that 1x1 rib has an elastic & elongation properties without the use of lycra which will give it a preference in specific purpose. After all, it can be decided that very low stitch length is not also good. For a uniform comfort, handle & tensile properties in the fabric