# Study on Various Types of Knitted Fabrics That are Produced In Knitting Industry

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**ABSTRACT:** There are various types of knitted fabrics are produced in industries which are the derivatives of Single jersey, double Jersey fabric as well as basic structure of knitted fabric. But there are some other types of knitted fabrics which are produced in circular knitting machines by applying different cam arrangement & needle arrangement. This paper gives a new approach for knitted fabric design which is somewhat different from other thinking.
**KEYWORDS:** Single jersey, Double jersey, Cam arrangement, Needle arrangement.

## I.  INTRODUCTION

Knitting is the second most popular technique of fabric or garment formation by inter-looping one or one set of yarns. Continuous length of yarn is converted into vertically intermeshed loops either by hand or by machine in knitted fabric [1]. Knitted fabric can be classified into two main categories such as warp knitted fabric and weft knitted fabric. Due to higher production, lower cost and easy installment demand of weft knitted fabric increasing day by day. For the weft knitted fabric production, two main knitting machines are used such as flat bed knitting machine and circular knitting machine. But in worldwide, circular knitting machines are widely used because higher production and higher quality of fabric can be achieved [2]. On the basis of knitted stitches per minute against the capital cost of the machine, circular garment-length machines are generally more productive than flat bed machines for cut and sew knitwear. Prior to computer controls, the price/performance ratio was 1:3 in favor of body-width circular machines [3]. This paper is going to show the production of different types of designed knitted fabrics production technique through needle & cam arrangement.

## II.  MATERIALS & METHODS

**Fabric type: 2×2 rib:**



design

0 I  I 0 I  I 0 I I ⟹ **D/L**
1 1 0 1 1 0 1 1 0 ⟹ **C/L**

**Needle arrangement**

**I = needle, 0= drop needle, C/L =cylinder, D/L =  dial**

| Cam arrangement | |
| --- | --- |
| Dial | |
| K | K |
| K | K |
| | |
| Cylinder | |
| K | K |
| K | K |

Face side

Back side

The number of needles to make this design = 2/4×2πdg

**Fabric type: 4×2 rib:**

design

0 0 0 1 1 ⇒ **D/L**
1 1 1 1 0 ⇒ **C/L**
**Needle arrangement**

**I = needle, 0= drop needle, C/L =cylinder, D/L = dial**

| Cam arrangement | |
|---|---|
| Dial | |
| K | K |
| K | K |
| Cylinder | |
| K | K |
| K | K |

Face side          Back side

The number of needles to make this design = 4/6×2πdg

**Fabric type: 2×1 rib**

design

0 I 0 I 0 I ⇒ **D/L**
I I I I I I ⇒ **C/L**
**Needle arrangement**

**I = needle, 0= drop needle, C/L =cylinder, D/L = dial**

| Cam arrangement | |
|---|---|
| Dial | |
| K | K |
| K | K |
| cylinder | |
| K | K |
| K | K |

Face side          Back side

The number of needles to make this design = 2/3×2πdg

**Fabric type: 5×2 rib**

design

0 0 0 0 I I ⇒ **D/L**
I I I I I 0 ⇒ **C/L**
**Needle arrangement**
**I = needle, 0= drop needle, C/L =cylinder, D/L = dial**

| Cam arrangement | |
|---|---|
| Dial | |
| K | K |
| K | K |
| cylinder | |
| K | K |
| K | K |

Face side          Back side

The number of needles to make this design = 5/7×2πdg

**Fabric type: 6×3 rib**

design

0 0 0 0 0 I I I ⇒ **D/L**
I I I I I I 0 0 ⇒ **C/L**

**Needle arrangement**

**I = needle, 0= drop needle, C/L =cylinder, D/L = dial**

| Cam arrangement | |
|---|---|
| Dial | |
| K | K |
| K | K |
| cylinder | |
| K | K |

| Face side | Back side | K | K |
|-----------|-----------|---|---|
|           |           |   |   |

The number of needles to make this design = 6/9×2πdg

**Fabric type: 3×3 rib**

| design | 0 0 I I I 0 0 I I I 0 0  **D/L** | **Cam arrangement** | |
|--------|-------------------------------|---------------------|--|
|        | I I I 0 0 I I I 0 0 I I I  **C/L** | Dial | |
|        | **Needle arrangement** | K | K |
|        | | K | K |
|        | **I = needle, 0= drop needle, C/L =cylinder, D/L = dial** | cylinder | |
|        | | K | K |
|        | | K | K |
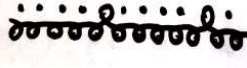
Face side     Back side

The number of needles to make this design = 3/6×2πdg

**Fabric type: 5×3 rib**

| design | 0 0 0 0 I I I 0 0 0 0 I I I  **D/L** | **Cam arrangement** | |
|--------|------------------------------------|---------------------|--|
|        | I I I I I 0 0 I I I I I 0 0  **C/L** | Dial | |
|        | **Needle arrangement** | K | K |
|        | | K | K |
|        | **I = needle, 0= drop needle, C/L =cylinder, D/L = dial** | cylinder | |
|        | | K | K |
|        | | K | K |

The number of needles to make this design = 5/8×2πdg

**Fabric type: 5×1 rib**

| design | 0 0 0 0 I 0 0 0 0 I 0 0 0  **D/L** | **Cam arrangement** | |
|--------|------------------------------------|---------------------|--|
|        | I I I I I I I I I I I I I I  **C/L** | Dial | |
|        | | K | K |
|        | **Needle arrangement** | k | k |
|        | **I = needle, 0= drop needle, C/L =cylinder, D/L = dial** | cylinder | |
|        | | K | K |
|        | | k | k |

Face side     Back side

The number of needles to make this design = 5/6×2πdg

**Fabric type: 8×7 rib**

**Design**

0 0 0 0 0 0 0 I I II I II
I I I II I I I I000000

**Needle arrangement**

**I = needle, 0= drop needle, C/L =cylinder, D/L = dial**

**Face side**     Back side

**Cam arrangement**

| Dial | | | |
|---|---|---|---|
| K | K | K | K |
| K | K | K | K |
| cylinder | | | |
| K | K | K | K |
| K | K | K | K |

The number of needles to make this design = 8/15×2πdg

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**Fabric type: 7×6 rib**

0 0 0 0 0 0 II I I II
II I II I I 00000
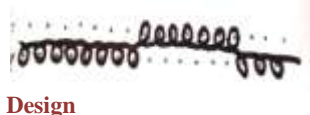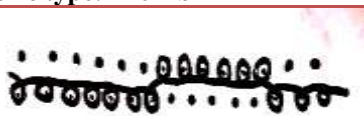**Needle arrangement**

**I = needle, 0= drop needle, C/L =cylinder, D/L = dial**

**Face side**     Back side

**Cam arrangement**

| Dial | |
|---|---|
| K | K |
| K | K |
| cylinder | |
| K | K |
| K | K |

The number of needles to make this design = 7/13×2πdg

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**Fabric type: 14×10 rib**
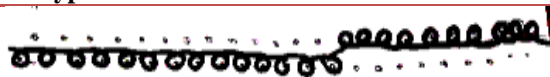
00 0000000000 0II I I I I I I I I ⇨ D/L
I I I I I I III I II II0000 00000 ⇨L

**Needle arrangement**
**I = needle, 0= drop needle, C/L =cylinder, D/L = dial**

The number of needles to make this design = 14/24×2πdg

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**Fabric type: 9×5 rib**

0 0 0 0 0 0 0 II II
I II I II I II000

**Needle arrangement**

**I = needle, 0= drop needle, C/L =cylinder,**
**D/L = dial**

**Design**

**Face side**     Back side

**Cam arrangement**

| Dial | |
|---|---|
| K | K |
| K | K |
| cylinder | |
| K | K |
| K | K |

The number of needles to make this design = 9/14×2πdg

## Fabric type: 8×2 rib

| | Cam arrangement |
|---|---|

**Design**

0 0 00 00 0 I I
I I I I I I I 0
**Needle arrangement**

I = needle, 0= drop needle, C/L =cylinder, D/L = dial

| dial | | |
|---|---|---|
| K | | K |
| K | | K |
| | cylinder | |
| K | | K |
| K | | K |

**Face side**       **Back side**

The number of needles to make this design = 8/10×2πdg

## Fabric type: 32×12 rib

| | Cam arrangement |
|---|---|

**Face side**

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 I I I I I I I II I I II
II I I I I II II I I I I I I III I I I I III II I I I IIII00000000000

**Needle arrangement**

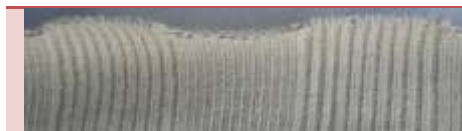I = needle, 0= drop needle, C/L =cylinder, D/L = dial

**Back side**

| dial | | |
|---|---|---|
| K | | K |
| K | | K |
| | cylinder | |
| K | | K |
| K | | K |

The number of needles to make this design = 32/44×2πdg

## Fabric type: waffle

| | Cam arrangement |
|---|---|

**Design**

I I I I
I I I I
**Needle arrangement**

I = needle, C/L =cylinder, D/L = dial

| Dial | | | | | |
|---|---|---|---|---|---|
| T | T | K | K | K | K |
| T | T | K | K | K | K |
| | | Cylinder | | | |
| K | K | K | T | T | K |
| K | K | K | T | T | K |

**Face side**       **Back side**

The number of needles to make this design = 2πdg

## Fabric type: variegated rib

| | Cam arrangement |
|---|---|

**Design**

0 0 0 I I 0 I I 0I I0 0 0 I I 0 0 0 0 0 0 0 I I I I
I I I I 0 I I 0 I I0 I I I I0 I I I I I I I II I00 0

| dial | |
|---|---|
| K | K |
| K | K |
| cylinder | |
| K | K |

| Needle arrangement | | |
|---|---|---|
| I = needle, 0= drop needle, C/L =cylinder, D/L = dial | K | K |

## Fabric type: variegated rib



**Face side**

| 0 I I 0 I I 0 I I 0 I I 0 I I I I I 0 I I 0 I I 0 I I 0 I I 0 I I I I I<br>I I 0 I I 0 I I 0 I I 0 I I 0 0 0 0 I I 0 I I 0 I I 0 I I 0 I I 0 0 0 I I | |
|---|---|
| I = needle, 0= drop needle, C/L =cylinder, D/L = dial | Back side |

## Fabric type: variegated rib
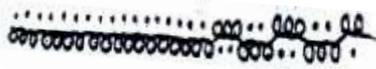


| | | Cam arrangement | |
|---|---|---|---|
| | | dial | |
| | | K | K |
| | | K | K |
| | Face back | cylinder | |
| 0 0 0 00 0 00 0 0 0 0 0 0 0 0 0 I I I 0 0 I I I<br>I II III III I II I II I II I II00 I III00 | | K | K |
| I = needle, 0= drop needle, C/L =cylinder,<br>D/L = dial | | K | K |
| | Back side | | |
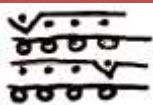
## Fabric type: Terry



| Needle type | | | Cam arrangement | | | |
|---|---|---|---|---|---|---|
| 1,2,2,3 | | | T | K | M | K |
| | | | M | K | M | K |
| | | | M | K | M | K |
| | | | M | K | T | K |

**Face side**   Back side

The number of needles to make this design = πdg

## Fabric type: Lacoste Terry
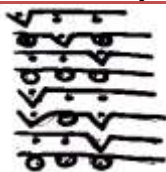


| Needle Type | | Cam arrangement | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1,2,3 | | T | K | M | K | T | T | M | K |
| | | M | T | M | K | M | K | M | K |
| | | M | K | T | K | M | T | T | K |

| Face side | Back side |

The number of needles to make this design = πdg

**Fabric type: single jersey cheese cloth**



| | Cam arrangement | | | | Needle arrangement |
|---|---|---|---|---|---|
| Face side | k | k | k | k | 1,2,2,1 |
| | k | k | k | M | |
| | k | k | k | M | |
| Back side | k | k | k | k | |

The number of needles to make this design = πdg

**Fabric type: Interlock pique**



| | Cam arrangement | | | | Needle type |
|---|---|---|---|---|---|
| Face side | K | M | K | M | 1,1,2,3 |
| | K | M | K | M | |
| | M | K | T | K | |
| Back side | T | K | M | K | |

The number of needles to make this design = πdg

**Fabric type: fleece**



| Needle type | Cam arrangement | | |
|---|---|---|---|
| 1,2,2,2 | | | |
| | K | K | K |
| | K | K | K |
| | K | K | K |

| Face side | Back side |

The number of needles to make this design = πdg

**Variation of needle arrangement in case of same rib design.**



**4×2 rib design**

0 0 0 I I 0 0 0 I I
I I I I 0 I I I I 0

**This type of needle arrangement is used while using coarser yarn. Example: 12's to 20's yarn, 30's+20d Lycra. But the number of needle as remain unchanged (4/6×2πdg)**

0 0 0 0 I I 0 0 0 0 I I
I I I I 0 0 I I I I 0 0

This type of needle arrangement is used while using finer yarn. Example: 24's to 42's yarn. But the number of needle as remain unchanged (4/6×2πdg)

## III. RESULTS & DISCUSSION

Various types of knitted design can be made by arranging needle in different way. In case of rib design cam arrangement remains same but the variation of needle arrangement. In this case yarn count is responsible for needle arrangement. In indirect yarn numbering system, yarn fineness is proportional to count. For coarser count, yarns require much space between needle-cam than finer count yarn. so, change of needle arrangement to produce same design in case of rib fabric(double jersey). At variegated rib design where varied & enamors face & back loops are required to complete one course according to design requirement only change of needle arrangement & cam arrangement remain unchanged. At waffle rib design as combination of knit & tuck loop is required to complete one course, so different cam arrangement is required. In case of cheese cloth (single jersey) after every three feeder mixed yarn (Lycra +polyester) is supplied through fourth feeder to make shrinkage effect. In fleece fabric, three feeder is required to make course repeat (1st feeder input finer yarn, 2nd feeder input coarser yarn than 1st one, 3rd feeder input polyester yarn of direct yarn count system also most coarser yarn among three finally form 3 thread fleece). Here for two thread fleece 1st two feeders use same count yarn but 3rd one is coarser one. Interlock pique is another type single jersey fabric design which is produced only by applying cam arrangement.

Formula for number of needle,

1. single jersey circular machine = $\pi DG$
2. double jersey rib machine = a/a+b $\times 2\pi DG$ here, $\pi$ = 3.14, D = machine diameter, G = machine gauge, a = needle b = drop needle

Example:

For 3×2 rib, no of needle = 3/3+2 × $2\pi DG$ ,where a = 3, b = 2

## IV. CONCLUSION

Needle & cam are important factors for any particular structure and also for calculation of production. Appropriate approach of machine settings may need to be use for calculation of production mathematically. The values which are used in the production calculation have influences on the production of knit fabric. On the other hand, yarn quality and fabric quality also influenced the knit fabric production. All the values can be constant without total No. of active needle present in the machine. If design of fabric needed to be changed, No. of needles must be dropped and production fabric decreases. Production of fabric has directly influenced the cost of fabric. Higher the fabric production means lower of cost and *vice versa*.

## REFERENCES

[1]. Ray, S.C. (2011) Fundamentals and Advances in Knitting Technology. Woodhead Publishing India Pvt. Limited, New Delhi.
[2]. Belal, E.S.A. (2006) Understanding Textile for a Merchandiser. BMN Publication, Dhaka.
[3]. Spancer, D.J. (2001) Knitting Technology. Woodhead Publishing Limited, Cambridge.