
LESSON 8 KNITTING AND BASIC KNITS

STRUCTURE

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8. KNITTING AND BASIC KNITS

One of the earliest methods of fabric construction was through interlacement of two sets of yarns in the warp and weft directions and was termed as weaving. It formed the subject matter of the previous lesson. This lesson deals with the process of knitting which apart from producing long lengths of fabrics can also produce ready-to-use knitted goods like sweaters, hosiery etc. it does this by intermeshing of loops. The third and final lesson of this unit, viz. Lesson 9 will deal with the production of non-wovens and braids.

8.0 Objectives

After going through this lesson, you will:

- Understand the process of knitting through interlooping of yarns.
- Be able to identify different types of knitted structures.
- Know about different types of knitting machines.
- Become acquainted with different stitches, which help to create different types of knitted fabric structures.

8.1 Introduction

Knitting is a technique of constructing textile structures by intermeshing loops of yarn which are formed with the help of needles. The earliest definite examples of the growth of knitting technology date back to the 15th century in Western Europe though it has been documented that amongst the first knitted goods to be made was a hand-knitted pair of socks found in Egypt in a mausoleum. The first knitting trade guild was started in Paris in 1527 and the first knitting machine was developed in 1589 by an Englishman named Rev. William Lee in which knitted fabrics 1 inch wide with 8 loops could be knitted.

The rapid growth of the man-made fibre industry had a very positive effect on the growth of machine-based knitting industry. The knitting characteristics of continuous multifilament yarns are superior compared to yarns spun from cotton or wool. This is because of the uniformity of their cross-sectional shape and size, absence of growth of lint and a high work of rupture (i.e. high toughness). These features allow high speed knitting machines to function without interruption. The use of textured multifilament yarns (which have properties of stretch and bulk) have resulted in superior fabrics and broadened the end-application base. Even yarns from man-made staple fibres, such as acrylics and other blends are easier to knit.

It is interesting to recall that in medieval times socks used to be made from woven materials till machine knitting created an economically viable fabric better

suiting to take up contours. However, a number of sizes had to be made. The introduction of crimped nylon yarn has changed the situation in that only two free-fitting sizes— one for adults and another for children— have to be made. The Indian knitting industry started using synthetics in the 1970s but it has picked up very fast.

The operating areas of the knitting industry can be considered as belonging to the following two categories: first, in the production of knitted goods in ready-to-use form, e.g., sweater, hosiery, undergarments, etc. and second, in the production of knitted fabrics, which can be used for making knitted goods by stitching, etc.

There are two ways in which knitting is done viz., weft knitting and warp knitting. Hand knitting process is an example of weft knitting, which can of course be done much faster by machine. In this process, work progresses width-wise or weft-wise in a back and forth cycle.

In each cycle, a new row of loops is formed called a course. The number of loops in each row is determined by the width of the fabric to be knitted. Each loop of the row gets built-up intermeshing with the loops of the preceding row. The vertical column of loops is called a *wale*. In Fig. 8.1 (left), the horizontal rows form courses out of which one course is highlighted. The figure on the right shows a number of wales in the form of columns with one wale being highlighted.

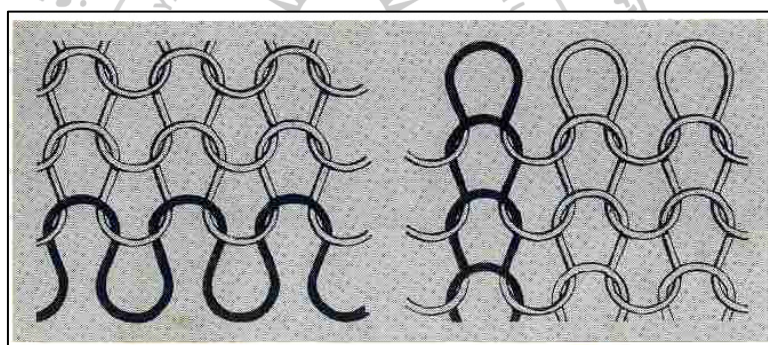


Fig. 8.1 A course (left) and a wale (right)

8.2 Weft knitting

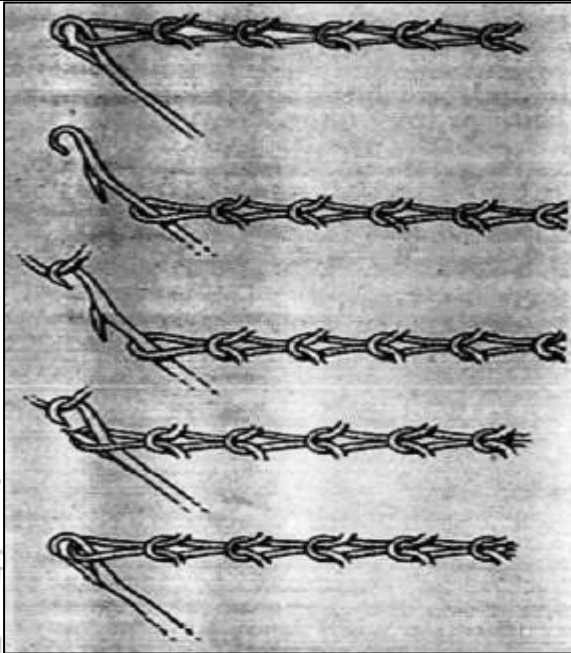
Weft knitted fabrics can be produced in either flat or tubular form. Weft knitted fabric is generally highly elastic and highly drapeable, two attributes, which make it suitable for a wide range of apparel applications. Weft knitted fabric is porous and comfortable both for outer garments and undergarments.

Four types of machines are available for weft knitting, viz.,

- i) Circular knitting machine,
- ii) Flat bed knitting machine,
- iii) Fully fashioned knitting machine, and
- iv) Hosiery knitting machine.

The circular knitting machine has a cylinder fitted with latch needles (the hooked needle and the thin strip of sinker separating two adjacent needles are fundamental elements of knitting machines). Synchronized timing cams fitting

inside the cylinder guide the movement of latch needles in loop formation. The formation of a stitch on a weft knitting machine with a latch needle is shown in Fig. 8.2.

<p><i>Stitch formation with a latch needle on a weft knitting machine, top to bottom:</i></p> <ol style="list-style-type: none"> i) The closed needle after drawing off a loop. ii) The needle latch opens as the finished loop slips over it onto the needle stem. iii) The thread caught and being drawn by the descending needle head. iv) The previously finished loop pushes the latch closing the needle head while the new loop is formed. v) The first loop slips over the needle head onto the newly formed loop. 	 <p style="text-align: center;">Fig. 8.2 Formation of a stitch with a needle</p>
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8.3 Warp knitting

In warp knitting, the work progresses length-wise, through the intermeshing of loops in the direction of wale. In this process, all the loops on the knitting needles in the column remain in the knitting mode. The main advantage of warp knitted cloth is that, unlike weft knitted fabric, it is not easy to *unravel*. However, these fabrics are not as stretchable as the weft knitted fabrics. An example of warp-knit structure is shown in Fig. 8.3.

Two types of warp-knitting machines are used:

- i) Tricot knitting machine, and
- ii) Raschel knitting machine.

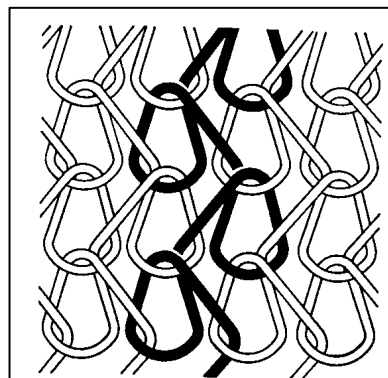


Fig. 8.3 A Warp-knit structure

Self-check Questions

1. Fill in the blanks:

- i) Knitting is the process of _____ of yarns.
- ii) The two types of knitting are _____ knitting and _____ knitting.

- iii) The vertical rows of loops formed during knitting are known as _____, while the loops created along the width of the fabric are termed _____.
- iv) _____ fabrics are more stretchable than the warp knitted fabrics
- v) _____ is a type of needle used in knitting machines.

Activity

1. Draw a diagram of warp knitted and weft knitted structures and label them.

8.4 Basic Knitted Structures

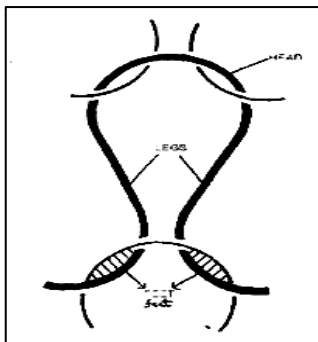


Fig. 8.4 The basic structure of stitch

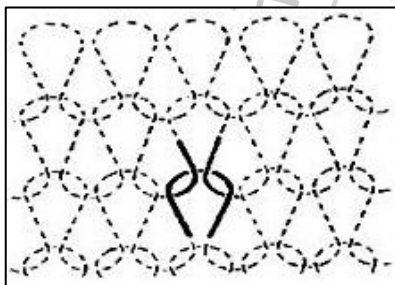
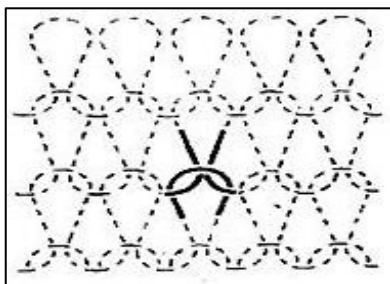


Fig. 8.5 The technical back of a stitch (top) and the technical front of a stitch (bottom)



The knitted loops are bound only at the feet to the heads of the previous stitches. At the place where the legs transform into feet there are two points of contact with the previous stitch. These are defined as the binding points. Thus, a stitch has four binding points, i.e. two binding points at the head and two binding points at the feet of each stitch. Two binding points, therefore, build a binding unit. Thus, a stitch has a total of eight contact points, four binding points and two binding units.

A knitted fabric is technically upright when its courses run horizontally and its wales run vertically with the heads of the knitted loops oriented towards the top and the first course at the bottom of the fabric.

For a stitch, depending on the position of the legs at the binding points, a technical back and a technical front side is defined. If the feet of the stitches lie above the binding points, and accordingly the legs below, then this is the technical back of the stitch Fig. 8.5 (top) and it called the backstitch, purl stitch, garter stitch or reverse stitch.

If on the other hand, the bottom half-arcs are below and the legs above (Fig.8.5 bottom), then this is the technical front of the stitch. This is called the face4 stitch or plain stitch, stocking stitch, jersey stitch (USA) and flat stitch (USA). Intermeshing a yarn loop towards the technical face side of a fabric produces a face stitch.

8.5 Fabric Structures

The weft-knitted fabrics are broadly classified into two groups, namely

- i) *Single jersey*: Produced by using one set of needles. Plain weft-knitted structure and its derivatives fall in this group, and

- ii) *Double jersey*: Two sets of needles are used to produce this type of structure. Rib, interlock, purl and their derivatives belong to this group.

The structures mentioned above will be briefly described below.

8.5.1 Plain knitted fabrics

If a weft or warp knitted fabric has one side consisting only of face stitches, and the opposite side consisting of backstitches, then it is defined as a plain knitted fabric. It is also very frequently referred to as a single jersey fabric (single fabric). Plain knitted fabrics are produced by using one set of needles. As such all the stitches are meshed in one direction. These fabrics tend to roll at their edges. They roll from their technical back towards the technical front at the top and lower edges. They also roll from their technical front towards the technical back at their *selvedges*. The structure is extensible in both lateral and longitudinal directions, but the lateral extension is twice that of the longitudinal extension. The yarn loop pulled in the longitudinal direction would extend by half its length, while when pulled in the lateral direction it could extend by the entire length. The degree of recovery from stretch depends on the fibres and the construction of the yarn.

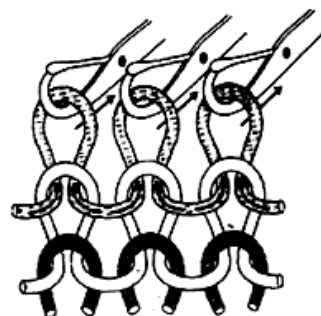


Fig.8.6 Plain knitted fabrics

8.5.2 Rib knitted fabrics

If on both sides of a relaxed weft or warp knitted fabrics only face stitches, *i.e.* the legs, are visible, then it is referred to as a rib knitted fabric and has been produced by meshing the stitches in neighboring wales in opposite directions. This is achieved by knitting with two needle systems, which are placed opposite to each other. As such these fabrics are also known as double jersey or double face fabrics. When the fabric is stretched widthwise, both sides of the fabric show alternately face and reverse stitches in each course. Once the fabric is released, it shrinks in its width, thus hiding the reverse stitches between the face stitches. These fabrics do not curl at their edges. The simplest rib structure is 1 x 1 rib.

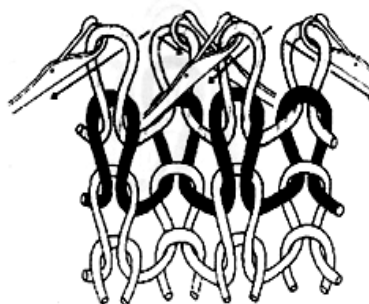


Fig.8.7 Rib knitted fabrics

The longitudinal extensibility of the rib structure equals that of a plain knitted structure. The geometry of the yarn path influences the elastic behavior of the knitted structures. The change of direction of the interlooping of the stitches of neighboring wales (cross-over points) results in the wales of a rib knitted structure closing up. This gives rib structures better elastic properties widthwise than other basic knitted structures. With rib structures in the lateral direction, extensions up to 140% can be achieved. Other construction of rib structures include 2 x 2 rib, where two wales of face stitches alternate with two wales of reverse stitches. As the number of wales in each rib increases, the elasticity decreases as the number of changeovers from reverse to front reduces.

8.5.3 Purl knitted fabrics

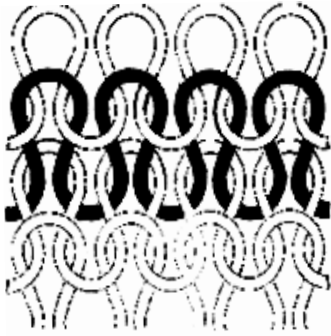


Fig.8.8 Purl knitted fabrics

If on both sides of a relaxed weft knitted fabric only reverse stitches are visible, then this is defined as a purl knitted fabric. Generally, weft-knitting machines are used to produce these fabrics. Purl fabrics are produced by meshing the stitches in neighboring courses in opposite directions by using special latch needles with two needle hooks. When the fabric is stretched lengthwise, then the face stitches are visible. The fabric shrinks more in the direction of wales, and once it is released, it relaxes to

hide the face stitches between the courses.

The inter-looping of the stitches of neighboring courses in opposite directions results in the courses of a purl knitted structure closing up. The structure, therefore, has a large longitudinal extensibility which is largely elastic.

8.5.4 Interlock knitted fabrics

These could be considered as combination of two rib knitted structures. The reverse stitches of one rib knitted structure are covered by the face stitches of the second rib knitted structure. On both sides of the fabric, therefore, only face stitches are visible, and it is difficult to detect the reverse stitches even when the fabric is stretched widthwise.

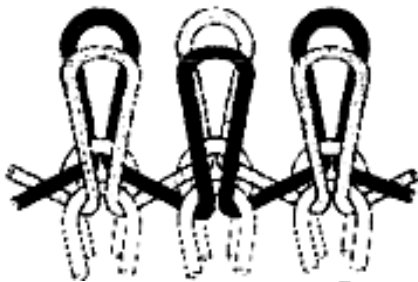


Fig.8.9 Interlock knitted fabrics

The geometry of the yarn path influences the elastic behavior of the knitted fabrics. The change of direction of the meshing of the stitches in neighboring wales results in the wales of a rib knitted fabric closing up-giving it better elastic properties widthwise over other basic knitted structure. The meshing of the stitches in neighboring courses in opposite directions results in the courses of a purl knitted fabric

closing up. Thus they could be stretched lengthwise more than the other knitted structures. The combination of two rib knitted structures in the interlock structure gives very little or no room at all for the wales or courses to close up, and therefore the interlock fabrics shows very poor elastic properties in both directions.

The warp-knitted fabrics are generally classified according to the number of guide bars as well as lapping plan employed. Warp knitting is generally carried out with one set of needles, although two sets of needles are found on some *Raschel machines* for production of special kinds of fabrics such as cut plush.

Self-check Questions

2. Name the two different types of weft knitted fabrics.
3. List the different types of knitted structures
4. What is single Jersey fabric?

Activity

2. Draw a diagram showing the structure of basic stitch and label it.
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8.6 Assignments

8.6.1 Class assignments

- i) Get some wool and knitting needles. Do some knitting practice on the different types of knits - plain, rib and purl.

8.6.2 Home assignments

- i) Collect different types of knitted fabrics, paste them on a chart paper, identify and label them.

8.7 Summing up

In this lesson, the basics of knitting and knitted structures are discussed. The knitting process is carried out either by weft knitting or by warp knitting. These two types of knitting and the various knitted structures formed are described and the various types of knitted structures are briefly discussed.

8.8 Possible Answers to Self-check Questions

1. Fill in the blanks
 - i) interlooping
 - ii) warp & weft
 - iii) wales, courses
 - iv) weft knitted.
 - v) latch needle
2. single jersey, double jersey
3. Plainknit Ribknit, Purlknit, Interlock knit.
4. Single jersey fabric is a type of weft knitted fabric produced with the help of single set of needles.

8.9 Terminal Questions

1. What do you understand by knitting?
2. What is a course in knitting?
3. What is a Wale in knitting?
4. What is a back loop?

5. What is a face loop?
6. What is a weft knitted fabric?
7. What is a warp knitted fabric?
8. What is a single Jersey fabric?

8.10 References and Suggested Further Reading

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4. Internet Websites:
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 - iii) www.amann-online.de

8.11 Glossary

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|--------------------|---------------------------------|
| 1. Ravel | To remove |
| 2. Synchronized | Set to happen at the same time |
| 3. Interlocking | To lock together |
| 4. Raschel machine | A type of Warp knitting machine |