Fundamentals of Knitting

To form a fabric by the intermeshing of loops of yarn.

**Weft Knitting**
Loops are formed by needles knitting the yarn across the width of the fabric. Each weft thread is fed at right angles to the direction of fabric formation.

**Warp Knitting**
Loops are formed by needles knitting a series of warp yarns fed parallel to the direction of fabric formation.

In warp knitting all needles knit simultaneously for all yarns, while in weft knitting the needles knit in sequence for each yarn.

**Figure 9-1 Weft (Circular) Knitting And Warp Knitting**

Consumer Acceptance
- Comfortable
- Pliable
- High extensibility
- Easy care properties
- Inexpensive
Apparel, home fashion, industrial
Productivity And Lead Time
Faster than woven
Shorter lead time, quick response Small lots
Body sizes, Full fashion
Use Of Fibers And Yarns
All fibers All yarns Low tensions/stress allow loop formation or entrapment
Capital Investment
Low initial cost
No expensive yarn preparation
Small area of floor space required
Few auxiliary machines needed for operation

**Figure 9-2 Weft Knitting**

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**Basic Weft Knitting Terminology**
Course
Wale
Course Count
Wale Count
Knit Loop Face Loop Back Loop Stitch
Tuck Loop
Float Loop
Yield
Course Length
Cut or Gauge
Gaiting
Timing
Dial Height
Back Loop
Stitch
Tuck Loop
Float Loop Yield

**Figure 9-3 Jersey Knit**

**Figure 9-4 1x1 Rib**
Basic Weft and Warp Knitting Terminology

A. Course - the row of loops or stitches running across the width of a fabric corresponding to filling of a woven fabric.
B. Wale - in knit fabrics, a column of loops running lengthwise the fabric.
C. Course Count - the number of courses in a knit fabric per unit length measure. For example: courses per inch.
D. Wale Count - the number of wales in a knit fabric per unit length. For example: wales per inch.
E. Knit Loop - a stitch in a fabric where the yarn is formed into a loop shape by the knitting elements. Knitting meshes or interlocks these loops to form a fabric.
F. Face Loop - a knitted loop formed on the cylinder needles on a knitted machine.
G. Back Loop - a knitted loop formed on the dial needles on a knitted machine.
H. Stitch - in knitting, a stitch is the loop geometry of a particular pattern repeat. It may be in the form of a knitted, a tuck or a float loop.
I. Tuck Loop - a knitted stitch when a needle receives a new yarn without losing its old loop.
J. Float Loop - a knitted stitch when a needle holds its old loop and does not receive a new yarn. It connects two loops on the same course but not in adjacent wales. Also called a miss-loop.
K. Yield - the amount of fabric delivered off a knitting machine in terms of its weight per unit length or area, or the number of linear units delivered per unit weight. For example, ounces per yard, or ounces per square yard or yards per pound.
L. Course Length - the amount of yarn used in forming all the knit-loops in one course of a knitted fabric. Also called run-in.
M. Cut or Gauge - the number of needles per inch in the circumference of the cylinder or dial of a knitting machine.
N. Gaiting - the spacing of the needles in the dial and the cylinder in relation to each other on rib and interlock machines. In rib knitting, the needles of the cylinder are between the needles of the dial. In interlock gaiting, the needles of the cylinder are directly opposed to the needles in the dial (opposed to each other).
O. Timing - the order the needles in the dial and cylinder go through the knitting cycle in relationship to one another. The cylinder needles that correspond to dial needles may go through the knitting cycle before or after the dial needles.
P. Dial Height - the distance between the bottom edge of the dial section on a knitting machine at its perimeter from the corresponding upper edge of the cylinder at its perimeter.
A. Tricot - a type of warp knitting in which spring bearded needles are normally used to make fine fabrics with usually one to three warps are used.
B. Raschel - a type of warp knitting in which plain and Jacquard fabrics can be made. Raschel fabrics are normally coarser than other types of warp knits, but a wide range of fabrics can be made. Raschel machines may have one or two sets of needles and up to thirty guide bars.
C. Guide Bar - the number of needles per linear inch of the needle bar. For most warp knits that refers to a one linear inch, but can be for two.
D. Guide Bar - a mechanism on a warp knitting machine which directs warp yarns to the knitting needles, and their movement is controlled so that patterns can be knit.
E. Needle Bar - a flat metal plate with slots (tricks) cut into it at regular intervals into which needles slide during the
knitting process.

F. Runner Length - in warp knitting the number of inches of yarn needed to knit one rack of fabric.
G. Rack - a warp knitting measure of 480 courses. Tricot fabric quality is judged by the number of inches per rack.
H. Inch Quality - a measure of quality of warp knit fabric, the number of inches of fabric per rack.
I. Full Set - a term that indicates that all guide eyes in a guide bar each have a yarn from the warp.
J. Part Set - a term that indicates that all guide eyes in a guide bar do not have a yarn from the warp.
K. Positive Feed - when the yarn is metered off the warp beam by a metering device.
L. Negative feed - when the yarn is pulled off the warp beam by the knitting action of the needles during the loop forming step.
M. Pattern Wheel - a cylinder or wheel upon which a pattern chain is placed which has links of different heights so as to move the guide bars throughout its pattern.

**Effects Of Tucks And Floats On Knitted Fabrics**

**Tuck Loop**
- Makes the fabric wider
- Makes the fabric thicker
- Makes the fabric slightly less extensible

**Float Loop**
- Makes the fabric narrower
- Makes the fabric thinner
- Makes the fabric much less extensible
Weft Knitting Notation

Verbal
1 x 1 Rib - Fabric made with face loops and back loops alternating in same course but not same wale. Made on dial and cylinder machine with rib gaffing.

2 x 2 Rib

Machine Requirements
A rib machine.
Only one came race and one type of needle for the cylinder dial. Rib gaiting

Needle Setout
Needles not knitting must be removed from the machine Needle Selection
All at every feed

Fabric Properties
A one feed repeat.

Same appearance on both sides. Good crosswise extensibility.
Interlock
Machine Requirements
An interlock or eightlock machine.
Long and short needles in both the cylinder and dial. Interlock gaiting and usually delayed timing.
Needle Setout
Needles alternately arranged long and short in the cylinder and dial. Needle Selection
Dial Needles Cylinder Needles
Knit short Knit short
Knit long Knit long
Fabric Properties
A two feed repeat.
Same appearance on both sides. Tight and stable construction. Does not curl.

Ponte Di Roma
Machine Requirements
An eightlock machine.
Long and short needles in both the cylinder and dial. Interlock gaiting (Rib gaiting can also be used) and usually delayed timing.

Needle Setout
Needles alternately arranged long and short in the cylinder and dial. Needle Selection
Dial Needles Cylinder Needles,
Knit short Knit short
Knit long Knit long
Miss all Knit all
Knit all Miss all

Fabric Properties
A four feed repeat.
Same appearance on both sides. Tight and stable construction. Does not curl.

Figure 9-23

Figure 9-24 'V Bed Rib'

Properties Of Weft Knits
Stretch and recovery Wrinkle Recovery Thickness
Air Permeability
Shrinkage
Snagging
Figure 9-26 Diagram Of A Typical Tricot Machine: The Front Is At Right

Warp Knitting
L. Basic Warp Terminology
A. Tricot
B. Rachel
C. Gauge
D. Guide Bar
E. Needle Bar
F. Runner Length
G. Rack
H. Inch Quality
I. Full Set
J. Part Set
K. Positive Feed
L. Negative Feed M. Pattern Wheel

II. Basic Warp Knit Actions
A. Spring Beard Needle
B. Latch Needle
C. Compound Needle

III. Design Variables
A. Yarn Characteristics
B. Threading
C. Underlap Length and Position
D. Number of Bars
E. Fabric Enhancement

IV. Fabric Classifications
A. One Bar
B. Two Bar
C. Three Bar
D. Multiple Bar

V. Warp Knitted Fabric Notation
A. Verbal
B. Graphic
C. Numerical
D. Diagrammatic

Comparison Of Latch Needle and Spring Beard Needle
Latch Needle Spring Beard Needle,
Latched Not latched
Self-closing To be closed
Forms loop Requires help to form loop
Expensive Cheaper
Coarser Finer
Low needles per inch More needles per inch

Figure 9-29 Lapping Movements

Figure 9-30 Tricot Machine Knitting Action

Overlap Feed

Overlap Movement

Note:
Standard Two Bar Fabrics
Tricot Jersey (Full Tricot)
Front Bar 1-2/1-0/
Back Bar 1-0/1-2/
Locknit
Front Bar 2-3/1-0/
Back Bar 1-0/1-2/
Reverse Locknit
Front Bar 1-2/1-0/
Back Bar 1-0/2-3/
Loop Raised
Front Bar 1-0/3-4/
Back Bar 1-0/2-3/
Sharkskin
Front Bar 1-0/1-2/
Back Bar 3-4/1-0/
Satin
Front Bar 3-4/1-0/
Back Bar 1-0/1-2/
OR
Front Bar 4-5/1-0/
Back Bar 1-0/1-2/
Queenscord
Front Bar 1-0/0-1/
Back Bar 3-4/1-0/
OR
Front Bar 1-0/0-1/
Back Bar 4-5/1-0/

Diagram of a Simple Raschel Crochet Knit

Figure 9-33 Diagram Of A Knitted Net
Figure 9-34 Diagram Showing Laying In Yarn to Form Designs: Some guide bars are left empty.

Characteristics Of Warp Knit Fabrics
Extremely versatile in pattern effects with yarn Rigid to elastic
Cannot be raveled
Good air and water permeability
Good crease resistance
Good drapability
Good dimensional stability
Good Strength