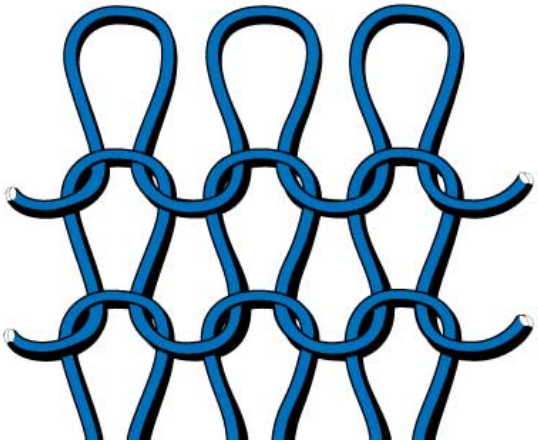
Knitting technology

Contents

Knitting-Interlooping

Knitting is the most common technique of inter-looping and is second only to weaving as a technique of constructing textile structures.

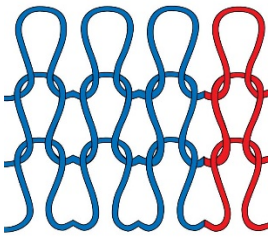
Construction of Knit Fabric



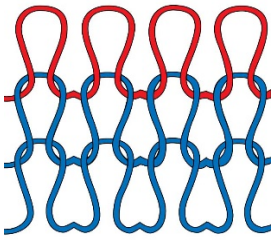
Weft and warp knitting

There are two major groups of knitting: **weft** and **warp** knitting.

In weft knitting, the wales are perpendicular to the course of yarn and the connected loops are in a weftwise or horizontal direction. Weft knitted fabric is commonly highly elastic and drapeable.



Wale



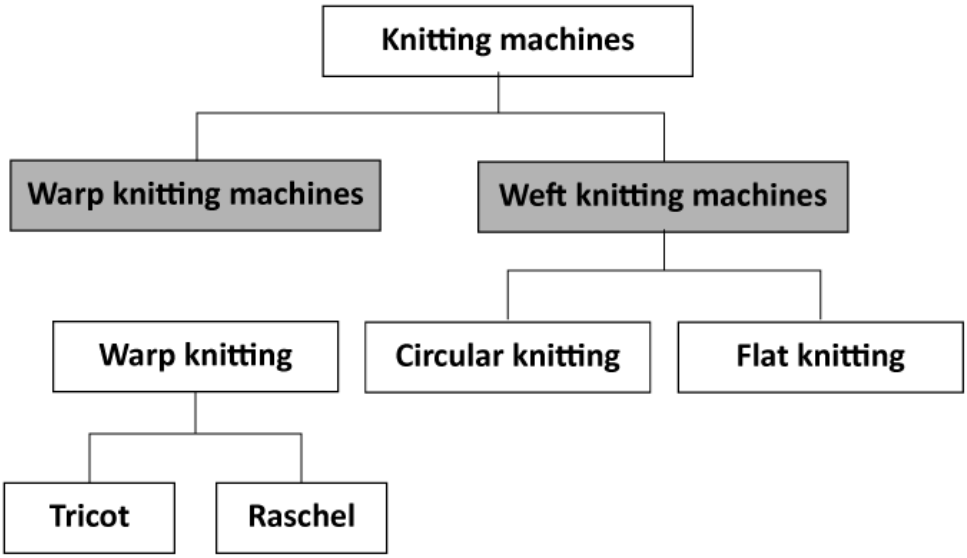
Coarse

What Binding has tuck inside?

- The yarn runs horizontally in the structure
- The yarns run vertically in the structure
- Always made on flat knitting machine
- Always made on circular knitting machine is the correct definition of weft-knitting?

Knitting machines

Knitting machines are classified into the following types:



Classification of knitting machines

Weft knitting machines

The weft knitting machinery may generally be classified as flats and circulars. This classification is based on their frame design and needle bed arrangement. Weft knitted fabrics can be created in either tubular or flat form.

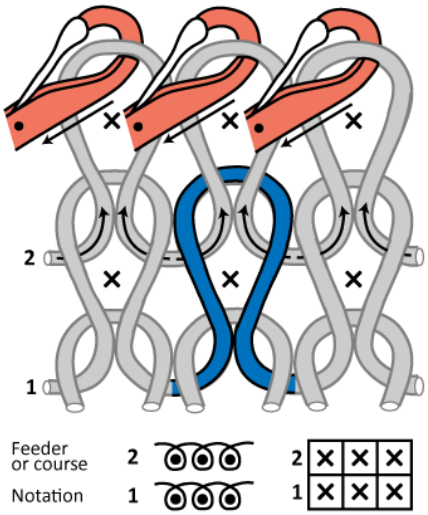
Circular knitting machine

Flat knitting machine

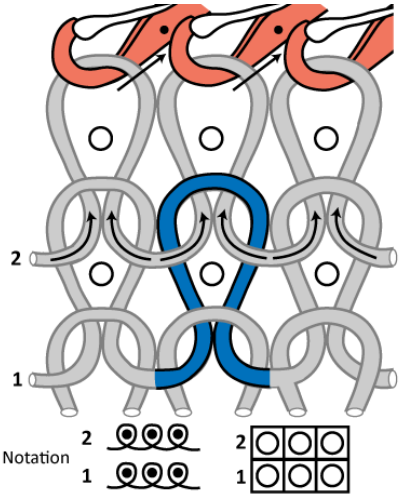
Weft knitted fabric structures

Plain, **rib**, **interlock** and **purl** are four primary structures from which all weft knitted fabrics are derived.

Plain is produced by using one set of needles, drawing the loops to only one side of the fabric.

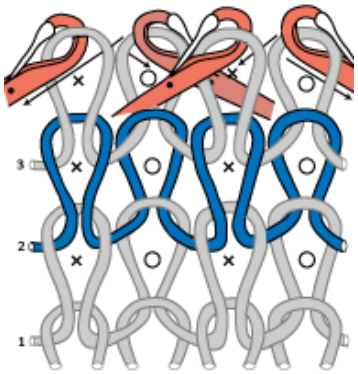


The technical face of plain weft knitted fabric.



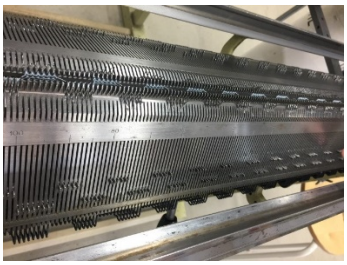
The technical back of plain weft knitted fabric.

Rib is produced by using two sets of needles operating in between each other so that wales of face loops and wales of reverse loops are knitted on each side of the fabric. Both face and back of fabric look exactly the same.



Face and reverse loop wales in 1 × 1 rib.


1 × 1 rib fabric


Flat weaving machine

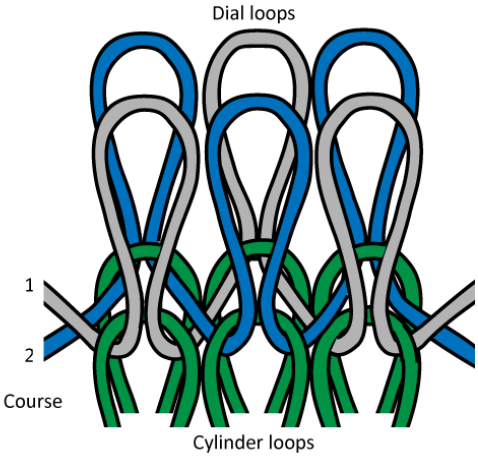

6 × 6 rib fabric

If you produced full rib fabric on a flat knitting machine, what do you achieve?

- A fabric with low weight and low stretch ability
- A fabric with a “bubble-effect”
- A fabric with high weight
- A fabric that is well stretched out and contracted back
- A fabric of the thinnest material that can be produced.

There is a lot of “rib-effect” with many transitions between the two needle beds.

Interlock - Originally derived from rib, this structure requires a special arrangement of needles. By knitting back-to-back in an alternate sequence of two sets the two courses of loops show wales of face loops on each side of the fabric exactly in line with each other, thus hiding the appearance of the reverse loops.

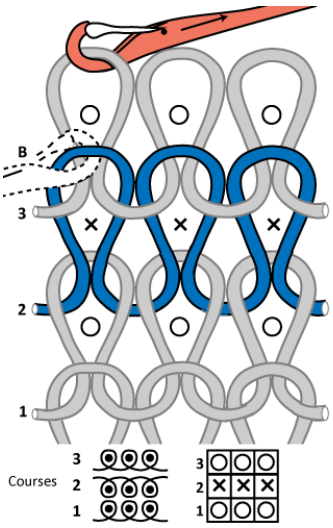


Interlock fabric structure

What is typical for the binding: Interlock?

- Low stretch out, low contracting back
- High elasticity
- Big risk for felting
- Shrinkage after washing
- Different look on the two sides

Purl is the only structure which has certain wales containing both face and reverse meshed loops.



Purl fabric structure

Circular knitting machine

Circular knitting machine are divided into single or double jersey according to whether the fabrics are knitted with one or two sets of needles (needle bed).

Circular knitting machine

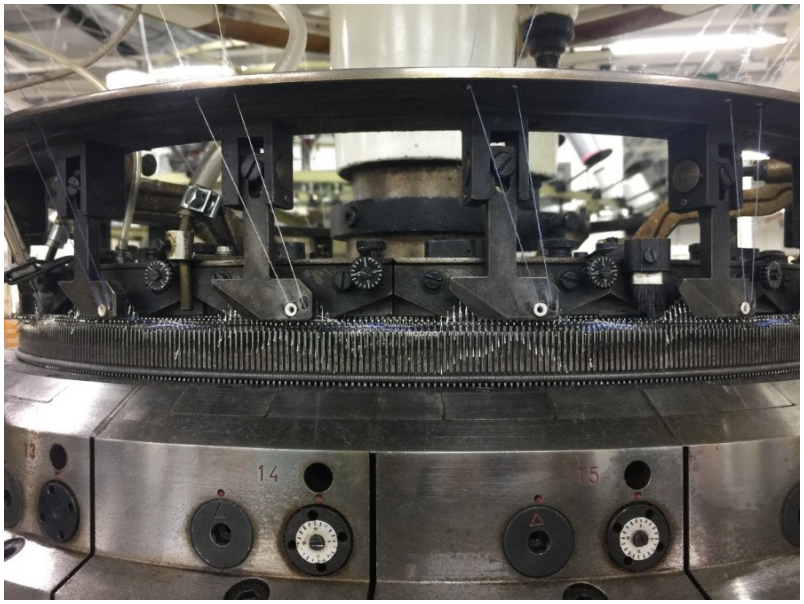
1. **Single jersey**: Weft knitted fabrics are produced by using one set of needles. Plain weft knitted structure and its derivatives belong to this group
2. **Double jersey**: Weft knitted fabrics are produced by using two sets of needles. Rib, interlock, purl and their derivatives fall in this group.

Spirality in knitted fabrics is a common problem mostly on goods made in one of the following machine types. Which one?

- Two beds circular knitting machine with mini jacquard
- Two beds circular knitting machine, interlock
- Two beds circular knitting machine, rib machine
- Flat Knitting Machine
- One needle bed, single jersey machine

Gauge of knitting machine

The number of needles available in one inch of the needle bed is defined as the gauge of the knitting machine. A machine with 10 gauge (E10) would be producing a thicker fabric compared to a machine with E20.



Needle gauge of knitting machine

A one needle-bed circular knitting machine has gauge E28. The number of needles in the machine is 2638. What is the perimeter of the machine needle cylinder? (1 inch = 2.54cm)

- 239 cm
- 315 cm

- 215 cm
- 115 cm
- 195 cm

Feedback: **2638 / 28 = 94.2 inch**

94.2 x 2.54 = 239 cm

A flat knitting machine has 632 needles in the front needle bed. Needle bed width is 2 meters. What is the knitting machine gauge? (1 inch = 2.54cm)

- E8
- E14
- E6
- E12

Feedback: **2 meter = 200 cm = 79 inch**

(200 / 2.54 = 79)

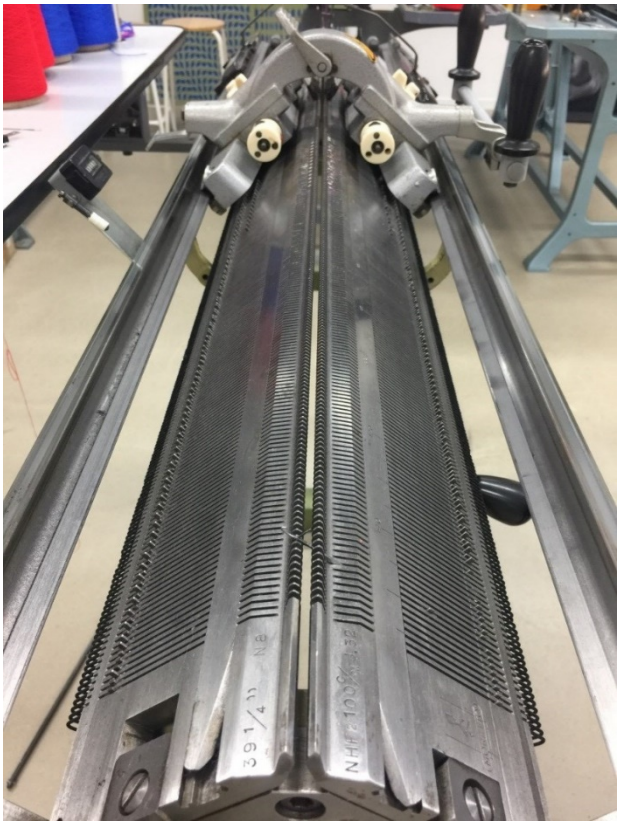
632 / 79 = 8 needle in one inch = E8

What is the reason of producing a fabric with gauge E28 in circular knitting machine?

- It is not possible to build that small gauge in flat knitting machine.
- Loops are small and you need many feeders.
- You need the possibility of bed-racking
- Flat knitting production would be cheaper if used.
- Jacquard-knitting is simpler to handle in
- circular-knitting.

Feedback: **In order to get a relevant production, E28 must be produced in the machine with many feeders. Ex flat knitting has max 4 feeders.**

Flat knitting machines



Hand driven flat knitting machine

Please visit the online version of this resource to watch the videos contained in this page.

Products produced on flat knitting machines:

- Sweaters ex roundneck, v-neck
- Cardigans
- Headwear ex ski-caps
- Scarfs
- Skirts

The advantages of flat knitting:

- Many pattern possibilities
- Produce Cut & sew
- Produce Fully fashion
- Produce Integral knitting
- Produce complete garment

Flat knitting production

The manufacturing process of flat knitted garments can be divided in four different production methods:

Cut & sew production method

Knitting > Steaming > Cutting > Sewing > Steaming 2 > Ready garment

Fully fashion production method

Knitting > Steaming > Sewing > Steaming 2 > Ready garment

Integral knitting production method

Knitting > Steaming > steaming 2 > Ready garment

Complete garment production method

- Advantages
  - No cutting
  - No sewing
  - No waste of material
- Disadvantages
  - Longer time for knitting

- Problem with sizes

What technique is the most economical regarding yarn supply in knitwear?

- Fully fashion
- Complete Garment
- Double-knitting with linking
- Cut and sew
- Integral technique

Feedback: **There is no waste of yarn using the complete garment production method.**

Basic structures in flat knitting machine

Introduction

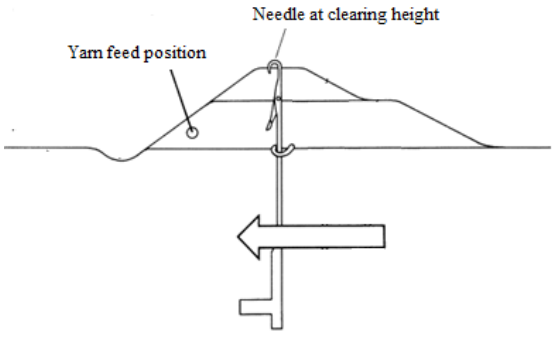
The latch needle is capable of being lifted to one of three stitch positions to create a knit, a tuck or a miss stitch.

Three step needle selection

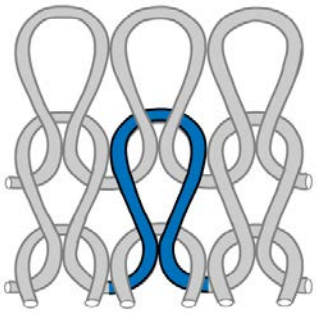
Latch needle

Knit stitch

In order to produce a Knit stitch, the needle has to rise all the way up so that the old loop inside the needle hook is cleared of latch area and the new loop would be taken through the previous loop.



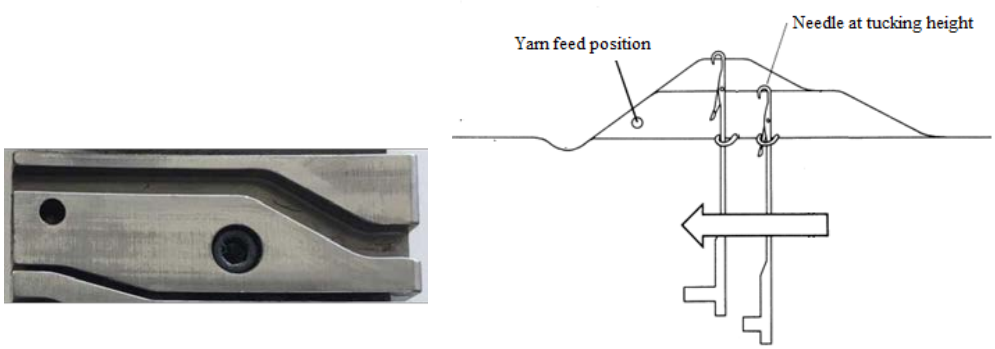
Knit cam and needle position



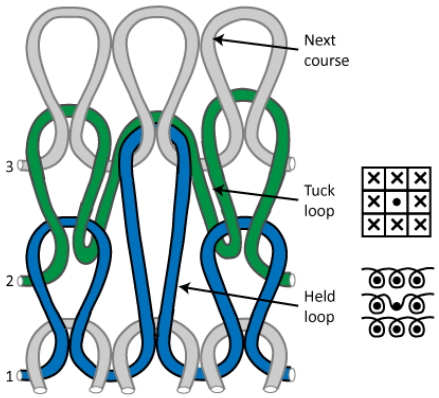
Knitted stitch fabric

Tuck stitch

In order to create a tuck stitch, the needle has to rise half way to take a new loop without casting off the old one. The resulting stitch consists a tuck loop and a held loop being intermeshed in the same course.



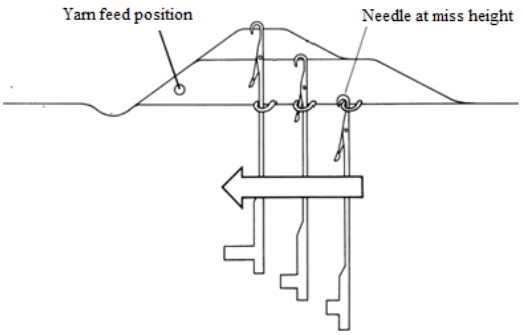
Tuck cam and needle position



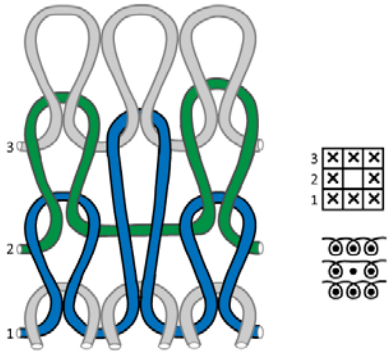
Technical face of tuck stitch fabric

Miss stitch

To create a miss stitch, one or more needles are deactivated therefore the needle misses the knitting and no loop is formed.



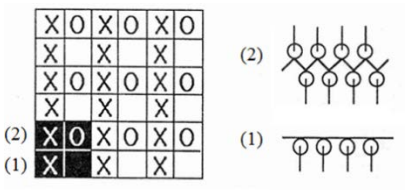
Miss cam and needle position



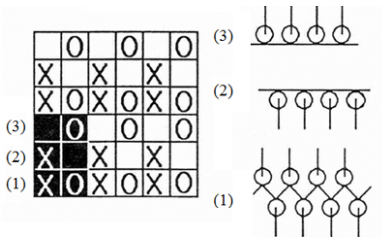
Technical face of float stitch

Combinations of Knit and Miss

Some of the basic fabric structures are created by combining miss and knit stitches being called milano structures.



Half Milano



Full Milano

Half Milano fabric has a repeat on how many feeders?

- 2
- 4

- 6
- 8
- 10

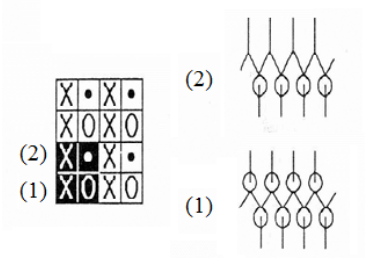
Feedback: **The binding consists of two courses**

- Binding Half Milan has the following typical characteristics?
- High stretchability, high elasticity.
- Low extensibility, good elasticity.
- Low length and width shrinkage after washing
- High risk of distortion after washing.
- Risk of felting, low extensibility.

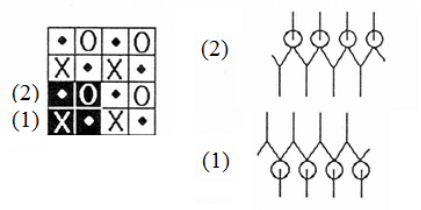
Feedback: **The binding is a combination of (1)-full rib and (2)-plain fabric, so you get half result of each binding.**

Combinations of Knit and Tuck

ome of the basic fabric structures are created by combining tuck and knit stitches being called cardigan structures.



Half-cardigan



Full cardigan

You are producing tuck-binding or full-cardigan. What do you achieve?

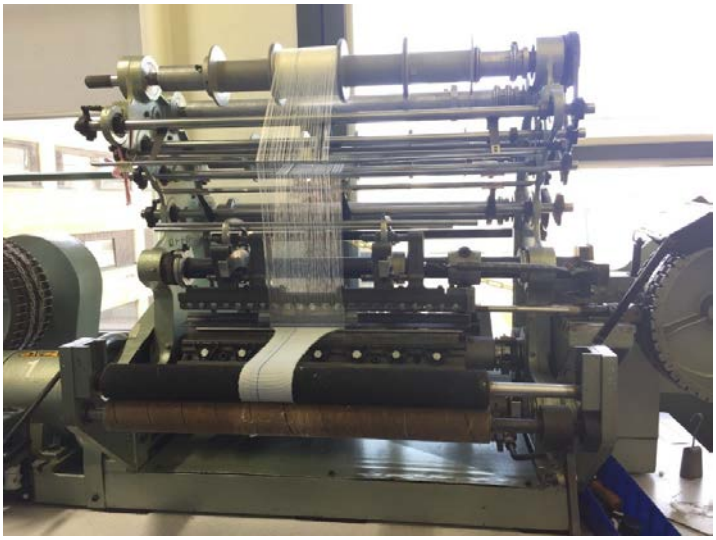
- Low weight and low stretch
- Stiff handle
- High stretch and low contract back

- High weight
- Thin thickness

Feedback: **Tuck has no rib-effect, the yarn is lying in loose bows, so it doesn´t return to the origin.**

Warp knitting

Warp knitting systems are broadly classified into Tricot and Raschel machines. There are some fundamental differences between these two machines:



Warp knitting machine

Warp knitting machine

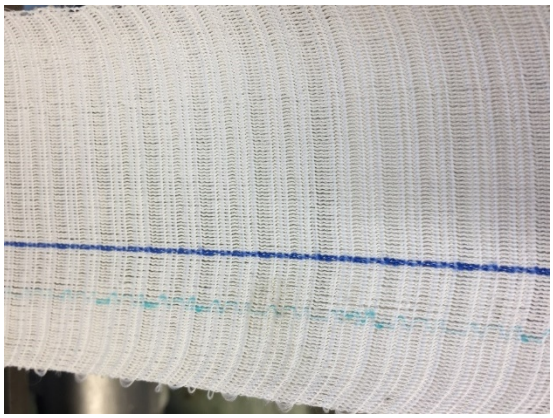
Tricot machines:

- High speed machines (max 3500 courses/min)
- Compound needles
- Clothing, technical textiles, home textiles

Raschel machines:

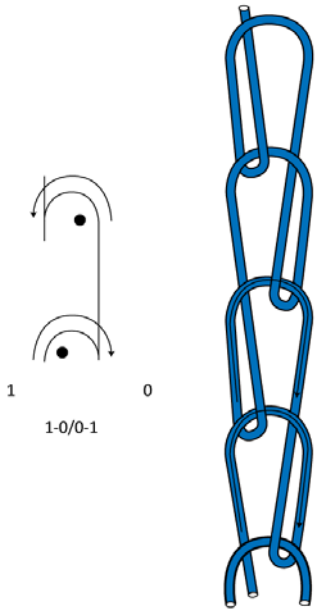
- High pattern possibilities
- Compound or latch needles
- Clothing, technical textiles, home textiles

Warp knitted fabric



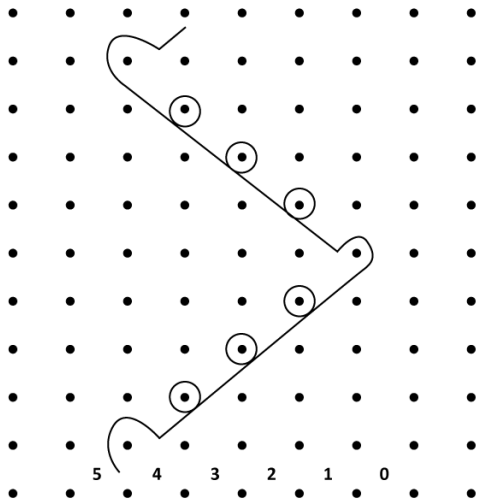
Ground structures in warp knitting

1. Pillar stitch or plain stitch:
    - In a pillar stitch, the over and underlappings are always carried out across the same needle and each needle knits a chain of stitches. Therefore there are no lateral connections with neighbouring courses and no fabric is created. This stitch is commonly used with other lapping movements to form a fabric.



Pillar stitch

2. Tricot lapping or 1 X 1:
    - Tricot is the simplest of these movements, creating overlaps in alternate wales at alternate courses with just one thread which is crossed between adjacent wales.
3. Cord lap or 2 X 1:
    - Two threads will cross between wales with a 2 X 1
4. Satin lap or 3 X 1:
    - Three threads will cross between wales with a 3 X 1
5. Velvet lap or 3 X 1:
    - Four threads will cross between wales with a 4 X 1
6. Atlas lapping
    - In the atlas construction the laps are continued in the same direction over minimum of two consecutive courses and then return to the starting point in the opposite direction.



Summary

You should now be able to:

- Describe the knitting process by warp and weft knitting
- Describe the formation of Knit, Tuck and Miss stitches
- Describe the basics of knitting and various knitted structures formed
- Draw the lapping movements for a given loop diagrams

Further reading

- Mazza, C., Zonda, P. (2002). *Reference Book for Knitting* Fondazione Acimit.
- Spencer, D. J. (2001). *Knitting Technology A Comprehensive Handbook and Practical Guide*. Burlington: Burlington : Elsevier Science.