BASIC TEXTILE OPERATION

NTQF Level -I-

Learning Guide -55

Unit of Competence: Operate knitting Machine

Module Title: Operating knitting machine

LG Code: **IND BTO1 M15 LO1-LG-55**

TTLM Code: **IND BTO1 M15 TTLM 09 19v1**

LO1: Assist in set-up and loading of Knitting machine

Instruction Sheet	Learning Guide #-55

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Introduction of knitting
- Cleaning the machines and workstation with OHS practices
- Lubricating machine components
- Adjusting knitting machine
- Elements of knitting machine
- Types of knitting technology
- Knitting product requirements
- Checking air-condition system
- Identifying yarns specification
- Loading yarns into the machine to specification

This guide will also assist you to attain the learning outcome stated in the cover page.
Specifically, upon completion of this Learning Guide, you will be able to:

- Introduction of knitting
- Clean the machines and workstation with OHS practices
- Lubricate machine components
- Adjust knitting machine
- Elements of knitting machine
- Types of knitting technology
- Knit product requirements
- Check air-condition system
- Identify yarns specification
- Load yarns into the machine to specification

Learning Instructions:

1. Read the specific objectives of this Learning Guide **-55-**
2. Follow the instructions described in number on page **–2-**
3. Read the information written in the “Information Sheets 1”, sheet 2, Sheet, sheet 4, sheet 5, Sheet 6, sheet 7, sheet 8, Sheet 9, sheet10 ,sheet 11, and sheet 12.on page, 3, 9, 12, 16, 26, 32, 36, 42, 48, 53, 58 and 62 respectively
4. Accomplish the “Self-check 1”**,** Self –check 2, Self –check 3, Self- check 4, Self –check 5, Self –check 6, Self- check 7, Self –check 8, Self –check 9, Self- check 10, Self –check 11, Sand Self- check 12, on page 7, 10, 14, 24, 30, 34, 4o, 46, 51, 56, 59 and 63 respectively
5. Ask from your **trainer’s** the key to correction (key answers) or you can request your **trainer’s** to correct your work.
6. If you earned a satisfactory evaluation proceed to **“Information Sheet**”. However, if your rating is unsatisfactory, see your **trainer’s** for further instructions or go back to Learning Activity #55.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

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Information Sheet-1	Introduction of knitting

1.1. Introduction to textile

Textile fabrics can be produced directly from webs of fibers by bonding, fusing or interlocking to make non-woven fabrics and felts, but their physical properties tend to restrict their potential end-usage. The mechanical manipulation of yarn into fabric is the most versatile method of manufacturing textile fabrics for a wide range of end- uses. There are three principal methods of mechanically manipulating yarn into textile fabrics: interweaving, intertwining and interloping. All three methods have evolved from hand-manipulated techniques through their application on primitive frames into sophisticated manufacturing operations on automated machinery. the word 'textile' a general term applied to any manufacture from fibers, filaments or yarns characterized by flexibility, fineness and high ratio of length to thickness.

1. **Interweaving**: is the intersection of two sets of straight threads, warp and weft, which cross and interweave at right angles to each other. Weaving is by far the oldest and most common method of producing continuous lengths of straight-edged fabric**.**

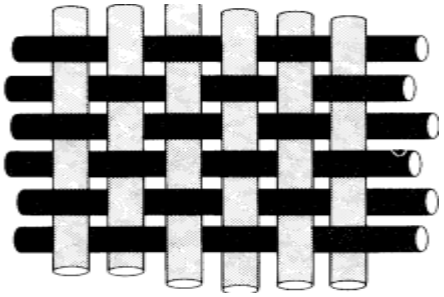

Fig.1.1 interweaving

2. **Intertwining and twisting** includes a number of techniques, such as braiding and knotting, where threads are caused to intertwine with each other at right angles or some other angle. These techniques tend to produce special constructions whose uses are limited to very specific purposes.

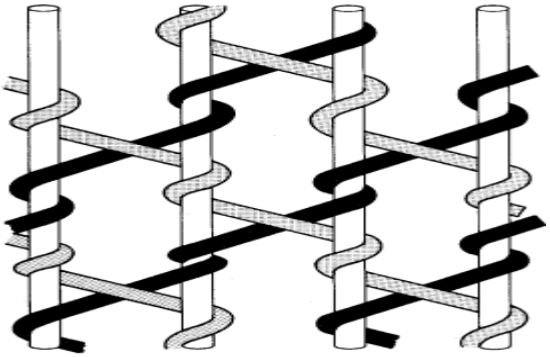

Fig.1.2 intertwining and twisting

3. I**nterloping**: consists of forming yarn(s) into loops, each of which is typically only released after a succeeding loop has been formed and intermeshed with it so that a secure ground

loop structure is achieved. The loops are also held together by the yarn passing from one to the next. (In the simplified illustration this effect is not illustrated.)

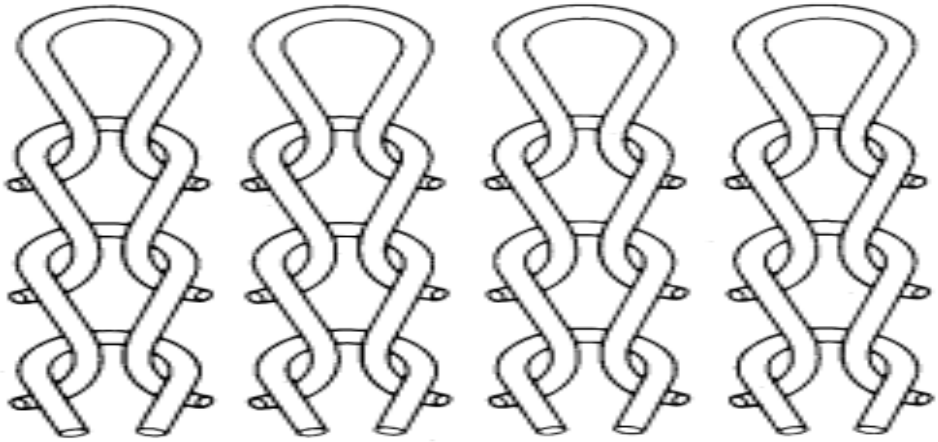

Fig.1.3 Interlooping

1.2. Definition of knitting

Textile fabrics can be produced directly from webs of fibers by bonding, fusing or interlocking to make non-woven fabrics and felts, but their physical properties tend to restrict their potential end-usage. The mechanical manipulation of yarn into fabric is the most versatile method of manufacturing textile fabrics for a wide range of end- uses. There are three principal methods of mechanically manipulating yarn into textile fabrics: interweaving, intertwining and interloping. All three methods have evolved from hand-manipulated techniques through their application on primitive frames into sophisticated manufacturing operations on automated machinery. the word ‘textile’ a general term applied to any manufacture from fibers, filaments or yarns characterized by flexibility, fineness and high ratio of length to thickness.

Knitting is the production of fabric by forming loops with yarn which are intermeshed of loops in a variety of ways to form the fabric. Knitting is the action of forming fabrics by the intermeshing of loops.

1.3. General terms and principles of knitting technology

1.2.1 Machine knitting

Knitted structures are progressively built-up from row after row of intermeshed loops. The newly-fed yarn is converted into a new loop in each needle hook. The needle then draws the new loop head first through the old (fabric) loop, which it has retained from the previous knitting cycle. The needles, at the same time, release,(cast-off or knock-over) the old loops so that they hang suspended by their heads from the feet of the new loops whose heads are still held in the hooks of the needles. A cohesive knitted loop structure is thus produced by a combination of the intermeshed needle loops and yarn that passes from needle loop to needle loop

1.2.2. A Course

A course is a predominantly horizontal row of needle loops (in an upright fabric as knitted) produced by adjacent needles during the same knitting cycle. (The last five words help to prevent confusion when describing complex weft knitted fabrics).

A course length: In weft knitted fabrics (with the exception of structures such as jacquard, intarsia and warp insertion),a course of loops is composed of a single length of yarn termed a course length. Weft knitted structures will un-rove from the course knitted last unless it is secured, for example, by binding-off.

Loop lengths combine in the form of course lengths and it is these that influence fabric dimensions and other properties, including weight. Variations in course length between one garment and another can produce size variations, whilst course length variations within structures can produce horizontal barrenness and impair the appearance of the fabric

A pattern row is a horizontal row of needle loops produced by adjacent needles in one needle bed. In plain weft knitted fabric this is identical to a course but in more complex fabrics a pattern row may be composed of two or more course lengths. In warp knitting, every loop in a course is usually composed of a separate yarn.

1.2.2 A Wale

A wale is a predominantly vertical column of intermeshed needle loops generally produced by the same needle knitting at successive (not necessarily all) knitting cycles. A wale commences as soon as an empty needle starts to knit.

When loop transfer occurs it is possible to transfer a wale of loops from one needle A to another B and to recommence knitting with the second needle, in which case more than one needle will have produced intermeshed loops in the same wale. (If needle B knits continuously, the wale knitted by needle A will merge into it). In warp knitting a wale can be produced from the same yarn if the same warp guide laps the same needle at successive knitting cycles.

Wales are connected together across the width of the fabric by sinker loops (weft knitting) or under laps (warp knitting). Wales show most clearly on the technical face and courses on the technical back of single needle bed fabric

1.2.3 Stitch density

Stitch density refers to the total number of loops in a measured area of fabric and not to the length of yarn in a loop (stitch length). It is the total number of needle loops in a given area (such as a square inch, or three square centimetres).The figure is obtained by counting the number of courses or pattern rows in one inch (or three centimetres) and the number of Wales in one inch (or three centimetres), then multiplying the number of courses by the number of Wales. (Using a measurement of three centimetres rather than one is preferable for accuracy in counting).

Stitch density gives a more accurate measurement than does a linear measurement of only courses or only Wales. Tension acting in one direction might produce a low reading for the courses and a high reading for the Wales; when they are multiplied together this effect is cancelled out. Pattern rows rather than courses may be counted when they are composed of a constant number of courses

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. write down the difference between course and wales in knitting manufacturing?(4 points)
2. what is the difference between knitting fabric formation with that of weaving fabric formation? (6 Points)

Note: **Satisfactory rating – 8 and above points** **Unsatisfactory - below 8 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ----------

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2. ----------

Information Sheet-2	Clean the machines and workstation with OHS practices

Occupational health and safety (OHS) relates to **health**, **safety**, and welfare issues in the workplace. OHS includes the laws, standards, and programs that are aimed at making the workplace better for workers, along with co-workers, family members, customers, and other stakeholders.

The main purpose of the act is to protect workers from health and safety hazards on the job. It sets out duties for all workplace parties and rights for workers. It establishes procedures for dealing with workplace hazards and provides for enforcement of the law where compliance has not been achieved voluntarily.

The most common workplace hazards include safety hazards like slip-and-falls or electrical hazards. But there are also ergonomic workplace hazards, environmental, chemical and others

The most common hazards are from chemicals, fires, repetitive motion, electricity and fall related injuries. Keeping your employees safe can ensure a happier, more productive workplace. Build safety policies that address the specific hazards in your workplace

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is meant by OHS practices ? (10 points)

Note: **Satisfactory rating - 8 and above points** **Unsatisfactory - below 8 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ----------

Information Sheet-3	Lubricate machine components

3.1. Introduction

The ever increasing demand of knitted apparels has attracted attention in global market. In comparison to woven garment, around 50% of the clothing needs are met by the knitted goods. Needle, sinker cams, lubrication systems being the most important work elements for knitting machines, suffer permanent improvement to better satisfy the work conditions and the function they must answer, resulting in a higher quality of the knitted fabrics, the reduce of the production costs, the increase of the machine productivity by higher speeds and less downtime.
A circular knitting machine has difference external parts of to run the machine effectively. These parts are so important that without them it is impossible to run a machine. These parts also help to produce quality product and increase efficiency of the machine.

3.2. Lubricant:

Lubrication means to lubricate different metal parts to run the machine perfectly. The perfect lubrication of the knitting head is essential for an efficient knitting process. Lubrication is usually guaranteed by electronic atomizer pumps.

Lubricants are used for reduction of friction. The most important lubrication point are: knitting head of single faced knitting machines, **cylinders, needle cams , needles, sinker rings**, **sinker cams** and **sinker.**

3.2.1. Lubrication system:

Lubricator provides uniform lubrication to needles, cam tracks, sinker and other knitting machine components. The Lubrication system precisely maters a small amount of oil per pulse to ensure that oil is only distributed to the required.

3.2.2. advantages of lubrication system

- Uniform distribution of oil over the entire cylinder
- fewer oil spots on fabric
- individual lubrication programmers for needles and sinker
- Lower oil consumption thanks to precision metering
- Lower power costs due to savings in compressed air.
- Dry surfaces ensure less lint build-up
- Electronic monitoring of oil supply to lubrication points.
- Yearly oil consumption can be calculated accurately.

The specialized needle oils have been formulated not only to meet the exacting requirements of knitting machine technology, but also to be fully compatible with the yarns and the finishing

routes to which the knitted fabric is subjected. Oils contribute to the efficient running of the machinery and to the maximization of needle, sinker and cam life.

They are approved by many machine manufacturers.

- Excellent lubrication under critical conditions
- Excellent scour ability- readily scoured from fabric
- Powerful anti-wear performance
- Good high temperature stability
- Corrosion resistance
- Good storage stability
- Low friction
- Formulated to meet requirements

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the advantage of Lubricants for knitting machine?(5 Points)
2. what is the disadvantage of Lubricant for knitting machine?(5 Points)

Note: **Satisfactory rating – 8 and above points** **Unsatisfactory - below 8 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ---

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2. ---

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Information Sheet-4	Adjust knitting machine

4.1. Introduction

Machines without positive feed, the distance between the top of the needle head at knock-over and the loop-supporting belly of the sinker will determine the length of loop that is drawn. On single-cylinder machines, the sinkers are in a bed fixed to the head of the needle cylinder so that any raising or lowering of the cylinder will affect the loop length**.**

On electronically-controlled machines, this is achieved by step motors which are employed to raise and lower the stitch cams and also for introducing the stitch cams. This is particularly useful on tights machines for precisely placed spliced areas of elastane yarns to give selective comfort support whilst saving expensive yarn.

The angular position of the step motor-controlled stitch cam is adjusted to the speed requirements in different parts of the tights. A ten degree difference can enable an increase in speed by 130 rpm in that section of the tights.

On mechanically-controlled machines, levers scanning tracks on the control drum operate through adjustable set-screws to raise or lower the cylinder. Separate tracks on the drum may be responsible for adjustment of the loop length for the waste courses, toe, heel, panel, ankle and foot, graduated stiffening, etc. Graduated stiffening is operated from a rotary eccentric cam that is racked independently of the control shaft and allows the cylinder to be gradually lowered during the knitting of the calf, so that loops gradually become smaller and the leg tube is narrowed. On double-cylinder machines, loop length adjustment is achieved by adjusting the stitch cams and thus the needle height**.**

4.2. Weft knitting machine

When the needles are caused to act collectively, yarn feeding and loop formation will occur at each needle in succession across the needle bed during the same knitting cycle. All, or a number of, the needles (A, B, C, D) are supplied in turn with the same weft yarn during the same knitting cycle so that the yarn path (in the form of a course length) will follow a course of the fabric passing through each needle loop knitted from it (E,F,G,H).

Weft knitting is the more diverse, widely spread and larger of the two sectors, and accounts for approximately one quarter of the total yardage of apparel fabric compared with about one sixth for warp knitting. Weft knitting machines, particularly of the garment-length type, are attractive to small manufacturers because of their versatility, relatively low total capital costs, small floor

space requirements, quick pattern and machine changing facilities, and the potential for short production runs and low stock-holding requirements of yarn and fabric

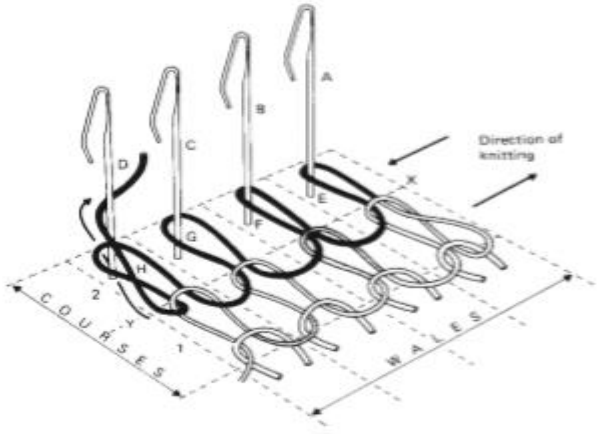

Fig. 1.4 weft knitting

4.3. Warp knitting machine

In a warp knitting machine there will be a simultaneous yarn-feeding and loop forming action occurring at every needle in the needle bar during the same knitting cycle .All needles (A, B, C, D) in the needle bar are simultaneously lapped by separate warp guides (E, F, G, H).As all needles receive their overlaps simultaneously, a guide under lapping from one needle to another will be passing from one knitting cycle or course to the next. Thus, the warp yarn passes from an overlap produced in one course to an overlap produced in the succeeding course (for example, guide F under lapping from needle B to needle A).

Warp knitted fabric is knitted at a constant continuous width, although it is possible to knit a large number of narrow width fabrics within a needle bed width, usually separating them after finishing. There is considerable potential for changing fabric properties during the finishing process, as well as during knitting.

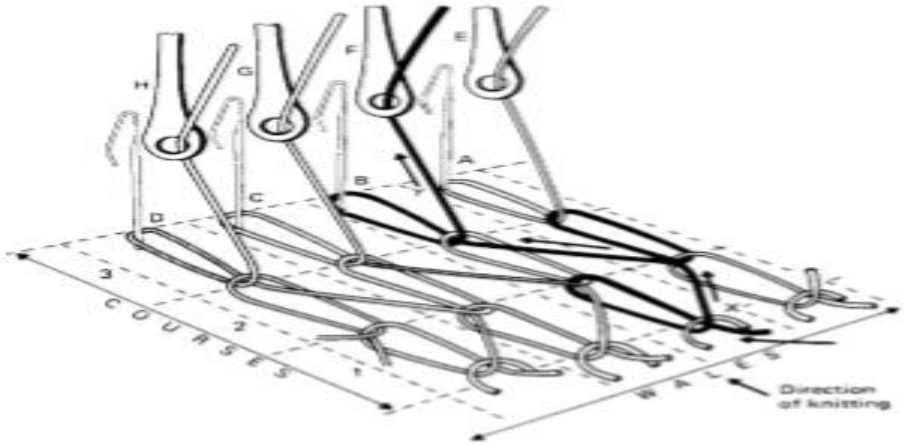

Fig. 1.5 warp knitting

It is also possible to produce length sequences such as scarves with fringed ends, articles produced on double needle bar based on the tubular knitting principle, and scalloped shaping of net designs by cutting around the outline after finishing.

4.4. Machine design

In warp knitting machines, all elements of the same type (needles or sinkers or guides of one guide bar) act as a single unit and are therefore fitted into, and controlled from, an element bar. Each guide in the same (conventional) guide bar requires the same warp-yarn feed rate and tension. This is most conveniently achieved by supplying a large number of parallel ends of warp yarn to the guide bar from a warp beam.

The shagging movement of the guide bars is controlled from one end of the machine. All these factors tend to restrict warp knitting machines to rectilinear frames and straight needle bars.

In weft knitting machines there are only a limited number of yarn feed positions, often requiring different rates of yarn feed, so these are supplied from yarn packages such as cones. Since the needles knit in serial formation, the weft knitting machine frame may be arranged with either a circular or a straight needle bed, depending upon end-use requirements

4.5. Productivity

Productivity is expressed in pattern rows per minute. In warp knitting this is the same as courses, but in weft knitting a pattern row may be composed of more than one course. In warp knitting, P = R * E, where R is the number of camshaft revolutions per minute and E is the machine efficiency. In weft knitting, P = F* R or T * (E/C), where F is the number of active yarn feeds, R or T the number of machine revolutions or cam-carriage traverses per minute, and C the number of courses or colours which comprise one pattern row

4.6. Basic mechanical principles of knitting technology

4.6.1. The sinker

The sinker is the second primary knitting element (the needle being the first). It is a thin metal plate with an individual or a collective action operating approximately at right angles from the hook side of the needle bed, between adjacent needles. It may perform one or more of the following functions; dependent upon the machine's knitting action and consequent sinker shape and movement:

- ❖ Loop formation
- ❖ Holding-down
- ❖ Knocking-over

4.6.2. The jack

The jack is a secondary weft knitting element which may be used to provide versatility of latch needle selection and movement. It is placed below and in the same trick as the needle and has its own operating butt and cam system.

4.6.3. Cams

All needles have a reciprocating action either en masse or serially (except on now obsolete bearded needle sinker wheel and loop wheel frames, where the circle of fixed bearded needles merely revolves). Cams are the devices which convert the rotary machine drive into a suitable reciprocating action for the needles and other elements. The cams are carefully profiled to produce precisely-timed movement and dwell periods and are of two types, engineering cams and knitting cams. The movements may be represented in the form of a time-displacement graph

4.7. The needle

The hooked metal needle is the principal knitting element of the knitting machine. Prior to yarn feeding, the needle is raised to clear the old loop from the hook and to receive the new loop above it on the needle stem. The new loop is then enclosed in the needle hook as the needle starts to descend. The hook then draws the new loop down through the old loop as the latter slides over the outside of the descending bridge of the closed hook. All needles must therefore have some method of closing the needle hook to retain the new loop and exclude the old loop.

4.8. The basic knitting action of a needle

The basic action of a needle except for the manner in which the hook is closed the knitting action is similar for all needles. The arrows indicate the relative movement of the loops along the needles.

1. The needle is in the rest position, with the previously formed loop (a) held on its stem and covered by the hook.
2. The loop is cleared from the needle hook to a lower position on the needle stem.
3. The new yarn (b) is fed to the needle hook at a higher position on the needle stem than the position of the previous (‘old’) loop.
4. The yarn is formed into a ‘new’ loop.
5. The hook is closed, enclosing the new loop and excluding and landing the old loop onto the outside of the closed hook.
6. The new loop (b) is drawn through the head of the old loop (a).Simultaneously the old loop slides off the closed hook of the needle and is cast-off or knocked-over.
7. The old loop now hangs from the feet of the fully formed new loop and the knitting cycle starts again.

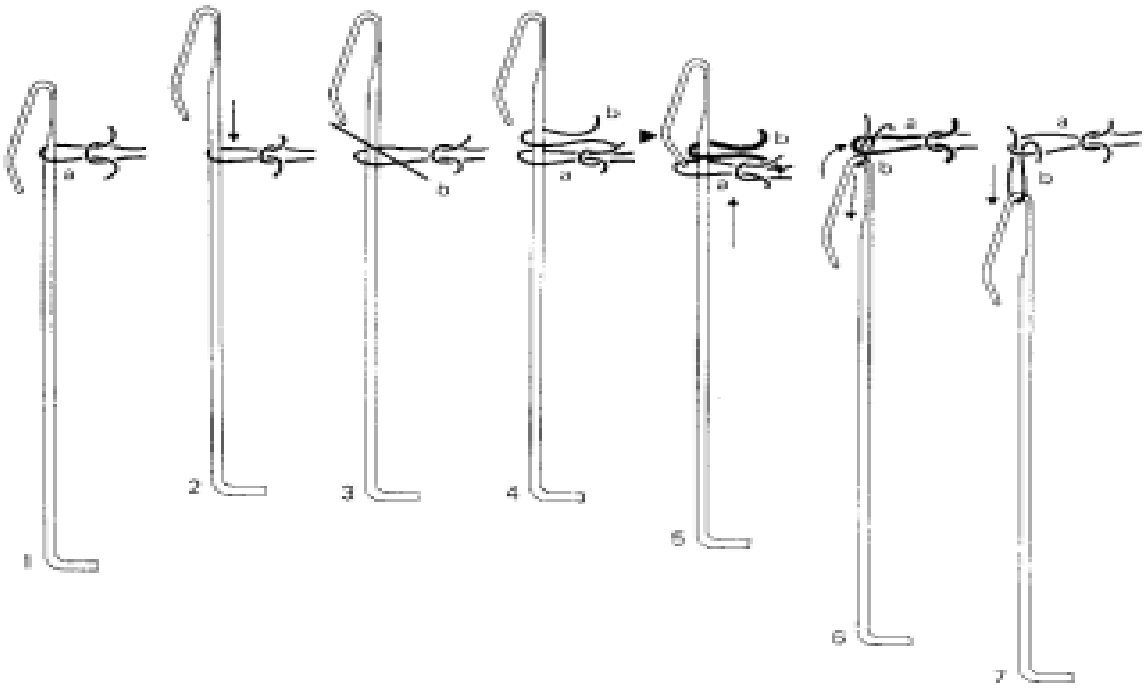

Fig. 1.6 Basic knitting action of needle

4.8.1. The bearded needle

The bearded or spring needle was the first type of needle to be produced. It is the cheapest and simplest type to manufacture as it is made from a single piece of metal, in machine gauges as fine as 60 needles per inch, with the needles being pillared to ensure accurate needle spacing**.**

The bearded needle is essentially a frame needle, the needles being fixed to move collectively with the straight needle bar or being attached to a circular frame and revolving with it**.**

When bearded needles are reciprocated in their bed, the action is a collective one because of the problems of individual pressing and needle movement. The serial action of weft knitting is thus achieved by other loop-forming and controlling knitting elements that form the yarn into new loops and May (on sinker wheel and loop wheel frames) move the loops along the needle stems. A knitting section occupies a considerable amount of space on bearded needle circular machines, thus limiting productivity. Selective beard pressing facilities used to be provided on some weft and warp knitting machines.

a. The main parts of the bearded needle

1. The stem, around which the needle loop is formed.
2. The head, where the stem is turned into a hook to draw the new loop through the old loop.
3. The beard, which is the curved downwards continuation of the hook that is used to separate the trapped new loop inside from the old loop as it slides off the needle beard.

4. The eye, or groove, cut in the stem to receive the pointed tip of the beard when it is pressed, thus enclosing the new loop.
5. The shank, which may be bent for individual location in the machine or cast with others in a metal ‘lead’

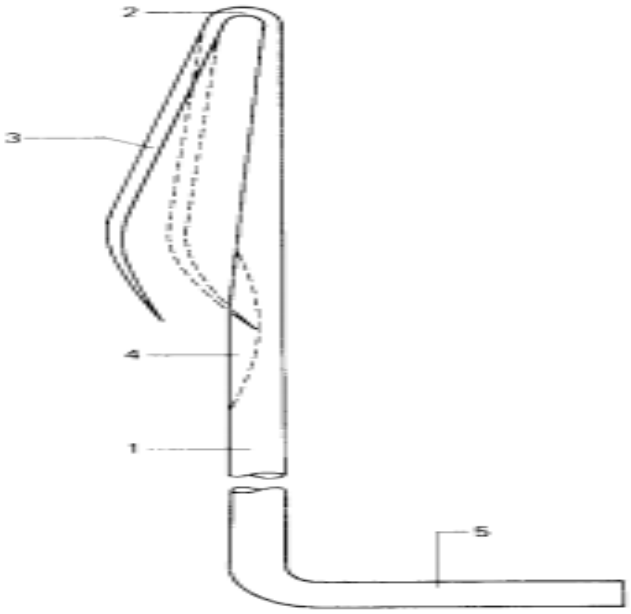

Fig. 1.7 Main parts of the bearded needle

b. The knitting action of the bearded needle

Depending upon the machine, the needles are set vertically or horizontally. The needle has the disadvantage of requiring a pressing edge to close the bearded hook and enclose the new loop. The presser may be in the form of a bar, blade, verge or wheel, with either the presser or the needle remaining stationary whilst the other element moves towards it. Another feature of bearded needle knitting is that individual loop formation has to be achieved by a loop forming element. This leads to a more complicated knitting action but also provides for a more gentle and careful loop formation

4.8.2. The latch needle

The latch needle was a more expensive and intricate needle to manufacture than the bearded needle. It was more prone to making needle lines as it slides in its trick, particularly if the latch was damaged or there was dirt in the trick. However, the latch needle was quickly employed by the newly emerging American knitting machine industry, whilst British companies preferred the bearded needle. The latter believed the bearded needle, which could be more precisely manufactured, had a knitting action which produced a better quality knitted structure.

a. The knitting action of the latch needle

1. **The rest position**: The head of the needle hook is level with the top of the verge of the trick. The loop formed at the previous feeder is in the closed hook. It is prevented from rising as the needle rises, by holding-down sinkers or web holders that move forward between the needles to hold down the sinker loops.
2. **Latch opening**: As the needle butt passes up the incline of the clearing cam, the old loop, which is held down by the sinker, slides inside the hook and contacts the latch, turning and opening it:
3. **Clearing height**: When the needle reaches the top of the cam, the old loop is cleared from the hook and latch spoon on to the stem. At this point the feeder guide plate acts as a guard to prevent the latch from closing the empty hook.
4. **Yarn feeding and latch closing**: The needle starts to descend the stitch cam so that its latch is below the verge, with the old loop moving under it. At this point the new yarn is fed through a hole in the feeder guide to the descending needle hook, as there is no danger of the yarn being fed below the latch. The old loop contacts the underside of the latch, causing it to close on to the hook.
5. **Knocking-over and loop length formation**: As the head of the needle descends below the top of the trick, the old loop slides off the needle and the new loop is drawn through it. The continued descent of the needle draws the loop length, which is approximately twice the distance the head of the needle descends, below the surface of the sinker or trick-plate supporting the sinker loop. The distance is determined by the depth setting of the stitch cam, which can be adjusted

b. The latch needle has nine main features

1. The hook, which draws and retains the new loop.

2. The slot or saw cut, which receives the latch-blade (not illustrated).

3. The cheeks or slot walls, which are either punched or riveted to fulcrum the latch blade (not illustrated).

4. The rivet, which may be plain or threaded. This has been dispensed with on most plate metal needles, by pinching in the slot walls to retain the latch blade.

5. The latch-blade, which locates the latch in the needle

6. The latch spoon, which is an extension of the blade, and bridges the gap between the hook and the stem covering the hook when closed, as shown in broken lines.

7. The stem, which carries the loop in the clearing or rest position.

8. The butt, who enables the needle to be reciprocated when contacted by cam profiles on either side of it forming a track. Double-ended purl type needles have a hook at

each end; whilst one hook knits, the inactive hook is controlled as a butt by a cam-reciprocated element called a slider.

9. The tail, which is an extension below the butt, giving additional support to the needle and keeping the needle in its trick.

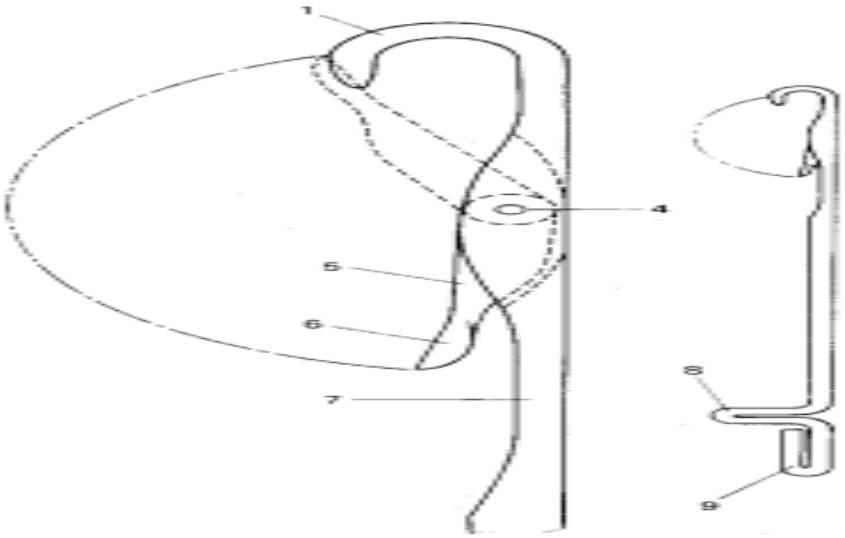

Fig. 1.8 Main features of the latch needle

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. **what are the basic knitting action of a needle?(5 Points)**
2. what is the difference between weft knitting with that of warp knitting? (10 points)

Note: **Satisfactory rating – 12 and above points** **Unsatisfactory - below 12 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ----------

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2. ----------

Information Sheet-5	Elements of knitting loop structure

5.1. The needle loop

The needle loop is the basic unit of knitted structure. When tension in the fabric is balanced and there is sufficient take-away tension during knitting, it is an upright noose formed in the needle hook. It consists of a head (H) and two side limbs or legs (L). At the base of each leg is a foot (F), which meshes through the head of the loop formed at the previous knitting cycle, usually by that needle. The yarn passes from the foot of one loop into the foot and leg of the next loop formed by it. (NB: If the loop is the first loop knitted on that needle, its feet and legs will not be restricted and it will open out to give the appearance of a tuck loop. If the loops are knitted on a flat machine with a pressing down device and no take-down tension, the loops will be more rounded and will tend to incline due to the traversing movement of the presser.) In warp knitting the feet may be open or closed at the base of the loop. In the latter case, the yarn guide has passed across the back of the needle across whose hook it has previously formed a loop.

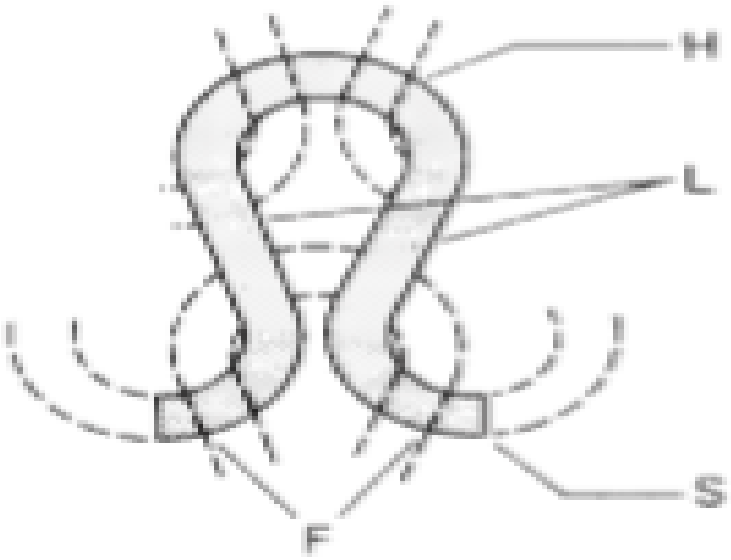

Fig.1.9 Intermeshing points of a needle loop

In weft knitting, the feet are normally open because the yarn continues to be supplied in one direction (except at the selvedges of straight knitting machines).Exceptionally, closed loops have occasionally been produced in the past on the bearded needle sinker wheel machine, by twisting a loop over as it is transferred to another needle which closes onto the back of the needle so that, as the loop is cast-off, it twists over itself

5.2. The sinker loop

The sinker loop (**S in the figure above**) is the piece of yarn that joins one weft knitted needle loop to the next. On bearded needle weft knitting machines, loop-forming sinkers form the sinker loops in succession between the needles hence the origin of the term sinker loop. On latch needle weft knitting machines, however, the sinker loops are automatically formed as the needles, in succession, draw their new loops. Sinker loops show on the opposite side of the fabric to the needle loops because the needle loop is drawn onto the opposite side from which the yarn was originally fed. The terms ‘sinker loop’ and ‘needle loop’ are convenient descriptive terms but their precise limits within the same loop length are impossible to exactly define.

5.3. The over lap

The overlap is shag, usually across one needle hook, by a warp guide (at the back of a single needle bar machine) which forms the warp yarn into the head of a needle loop. Every needle on a conventional warp knitting machine must receive an overlapped loop from at least one guide at every knitting cycle; otherwise it will press-off the fabric. The swinging movement of the guide to the hook side and the return swing after the overlap, produce the two side limbs of the loop which give a similar appearance on the face side of warp knitted fabric to a weft knitted needle loop.

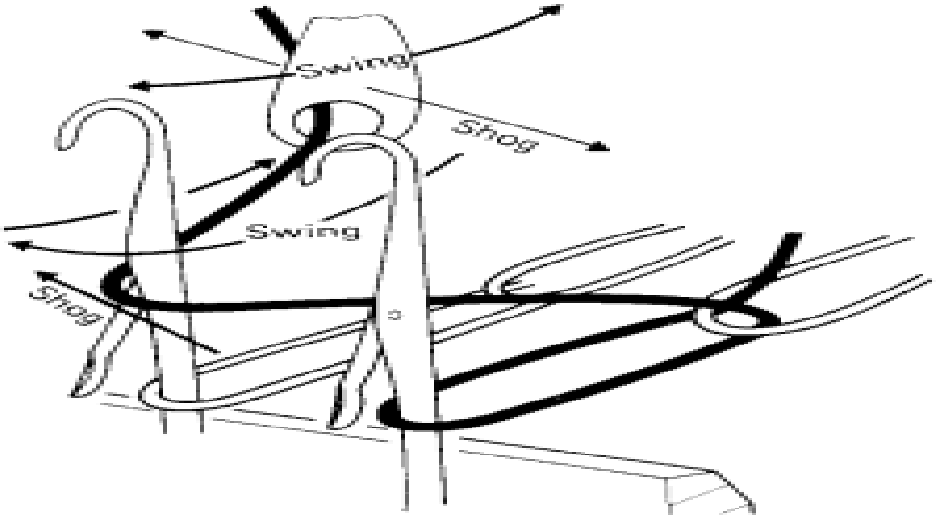

Fig.1.10 Loop forming by warp quid’s

5.4. The under lap

The under lap shag occurs across the side of the needles remote from the hooks on the front of single-needle bar, and in the centre of double-needle bar, warp knitting machines. It supplies the warp yarn between one overlap and the next. The under lap shog generally ranges from 0 to 3 needle spaces, but it might be 14 needle spaces or more depending upon the design of the machine and the fabric structure. Under laps as well as overlaps are essential in warp knitted

structures in order to join the Wales of loops together but they may be contributed by different guide bars

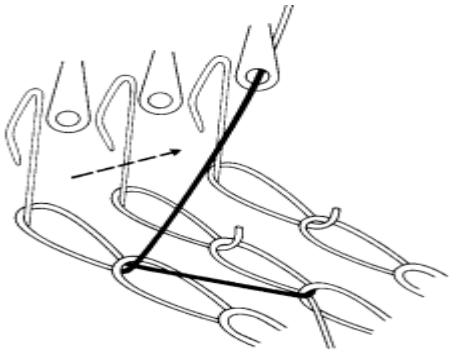

Fig.1.11 the under lap shagging

5.5. The closed lap

A closed lap is produced when a subsequent under lap shags in the opposite direction to the preceding overlap, thus lapping the same yarn around the back as well as around the front of the needle.

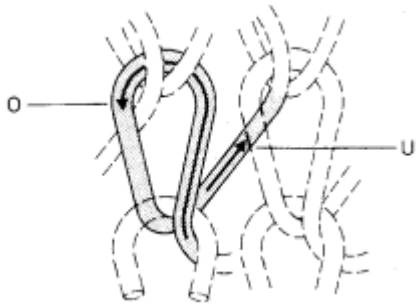

Fig.1.12 The closed lap

5.6. The open lap

An open lap is produced either when a subsequent under lap is in the same direction as the preceding overlap or an under lap is omitted so that the overlap of the next knitting cycle commences in the needle space where the previous overlap finished. Closed laps are heavier, more compact, more opaque, and less extensible than open laps produced from the same yarn at a comparable knitting quality

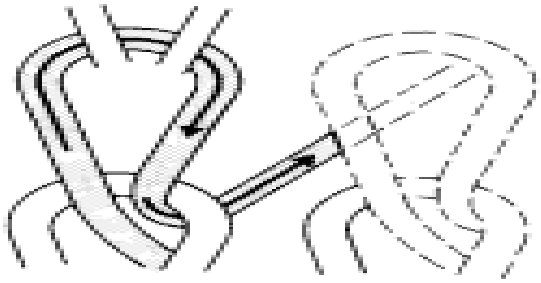

Fig.1.13 the open Lap

5.7. The knitted stitch

The knitted stitch: is the basic unit of intermeshing. It usually consists of three or more intermeshed needle loops. The centre loop has been drawn through the head of the lower previously-formed loop and is, in turn, intermeshed through its head by the loop above it. **The repeat unit of a stitch:** is the minimum repeat of intermeshed loops that can be placed adjoining other repeat units in order to build up an unbroken sequence in width and depth.

A needle loop: only has its characteristic appearance because its legs are prevented from spreading outwards by being intermeshed through the head of the loop below it. If there is no previous loop to mesh through, the legs of the new loop will spread outwards. The term stitch is unfortunately sometimes used to refer to a single needle loop.

Stitch length: is a length of yarn which includes the needle loop and half the sinker loop on either side of it. Generally, the larger the stitch length, the more extensible and lighter the fabric and the poorer the cover, opacity and bursting strength.

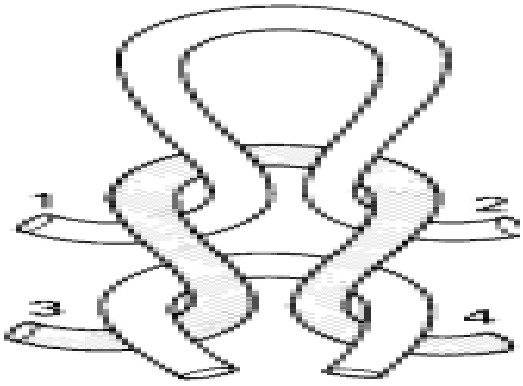

Fig.1.14 the knitted stitch

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is meant by needle loop? (10 points)
2. what is meant by sinker loop? (10 points)

Note: **Satisfactory rating – 15 and above points** **Unsatisfactory - below 15 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ----------

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2. ----------

Information Sheet-6	Types of knitting technology

6.1. Weft knitting

Weft knitting is the most common type of knitting; it is the process of making a fabric by forming a series of connected loops in a horizontal or filling –wise direction; produced on both flat and circular knitting machines.

The loops are formed across the width of the fabric, and each weft thread is fed, more or less, at right angles to the direction in which the fabric is produced. It is possible to knit with only one cone of yarn, though production demands have resulted in weft knitting machines being manufactured with up to 192 cones (feeders).

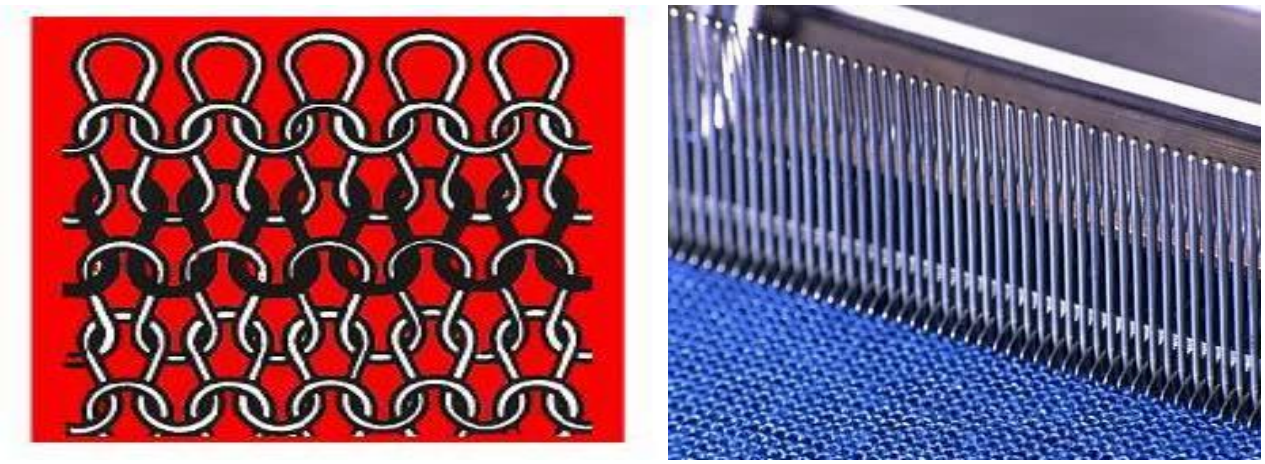

Fig.1.15 weft knitting structure

6.2. Warp knitting

Warp knitting is the process of making a fabric in which the loops form in a vertical or warp wise direction; the yarn is prepared as warp on beams with one or more yarns for each needle. The fabric has a flatter, closer, less elastic knit than weft knit and is very often run resistant.In warp knitting; loops of yarn are interlaced vertically down the length of the fabric. Each needle in the knitting width must be fed with at least one yarn at every course.

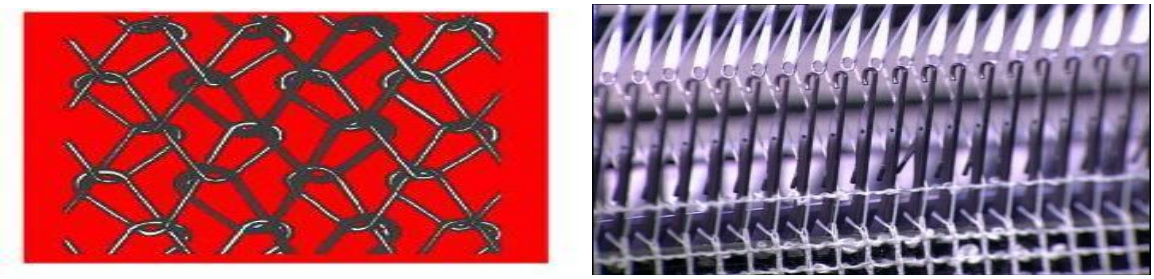

Fig.1.16 warp knitting structure

6.3. Table1.1 Comparison of wet and warp knitting

Weft	Warp
➢ The loops are formed across the width of the fabric	➢ The loops are formed vertically down to the length of the fabric
➢ Possible to knit with ONE thread	➢ Warp beam is used
➢ Staple and filament yarns can be used successfully	➢ Filament yarns can be worked successfully
➢ Latch needle is used mostly	➢ Latch, bearded or compound needles are used
➢ Less dimensional stability	➢ More dimensional stability
➢ Speed reduce with design change in cams	➢ Change in pattern does not affect the speed of m/c
➢ Fabric quality is not consistent	➢ Fabric quality is consistent
➢ Loops are not uniform	➢ Loops are uniform
➢ Stretch in both direction	➢ Stretch in widthwise direction

6.4. Warp knitting process

- A beam of warp (many warp ends) is feed for knitting process.
- Knitting of ends is done along the length of the fabric, movement of ends is perpendicular to course direction
- An additional element, guide is required to feed warp ends to the needles
- The warp yarns, after forming loops in one course, pass into the following course, and therefore the number of loops formed in the course is the same as the number of yarns in the warp

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is warp knitting? (10 Points)
2. What is weft knitting? (10 points)

Note: **Satisfactory rating –16 and above points** **Unsatisfactory - below 16 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ----------

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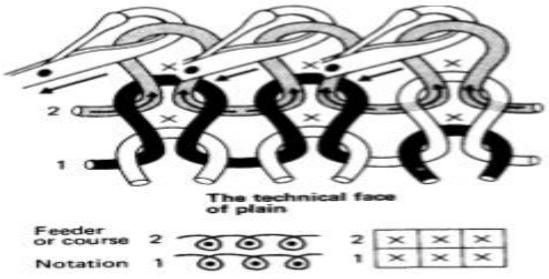
2. ----------

7.1. Introduction

Four primary structures **plain, rib, interlock and purls** are the base structures from which all weft knitted fabrics and garments are derived. Each is composed of a different combination of face and reverses meshed stitches, knitted on a particular arrangement of needle beds. Each primary structure may exist alone, in a modify form with stitches other than normal cleared loops, or in combination with another primary structure in a garment-length sequence

7.1.1. Plain

Plain is produced by the needles knitting as a single set, drawing the loops away from the technical back and towards the technical face side of the fabric. Plain is the base structure of ladies' hosiery, fully fashioned knitwear and single-jersey fabrics. The term 'plain knit' may be used instead of just 'plain', particularly when the structure has a surface design. Its technical face is smooth; with the side limbs of the needle loops having the appearance of columns of V's in the Wales. These are useful as basic units of design when knitting with different colored yarns. On the technical back, the heads of the needle loops and the bases of the sinker loops form columns of interlocking semi-circles whose appearance is sometimes emphasized by knitting alternate courses in different colored yarns. Plain can be un-roved from the course knitted last by pulling the needle loops through from the technical back, or from the course knitted first by pulling the sinker loops through from the technical face side. Loops can be prevented from un-roving by binding-off. If the yarn breaks, needle loops successively un-mesh down a Wale and sinker loops un-mesh up a wale; this structural breakdown is termed laddering. Laddering is particularly prevalent in ladies' hosiery, where loops of fine smooth filaments are in a tensioned state; to reduce this tendency, certain ladder-resist structures have been devised. The tendency of the cut edges of plain fabric to un-rove.



The technical face of plain weft knitted

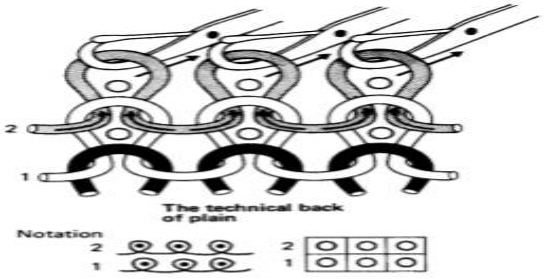


Fig.1.18 The technical back of weft knitted

Fig.1.17

7.1.2. Rib

Rib requires two sets of needles operating in between each other so that Wales of face stitches and Wales of reverse stitches are knitted on each side of the fabric**.** The simplest rib fabric is 1

x1 ribs. Who used a second set of needles to pick up and knit the sinker loops of the 1st set. It is now normally knitted with two sets of latch needles.

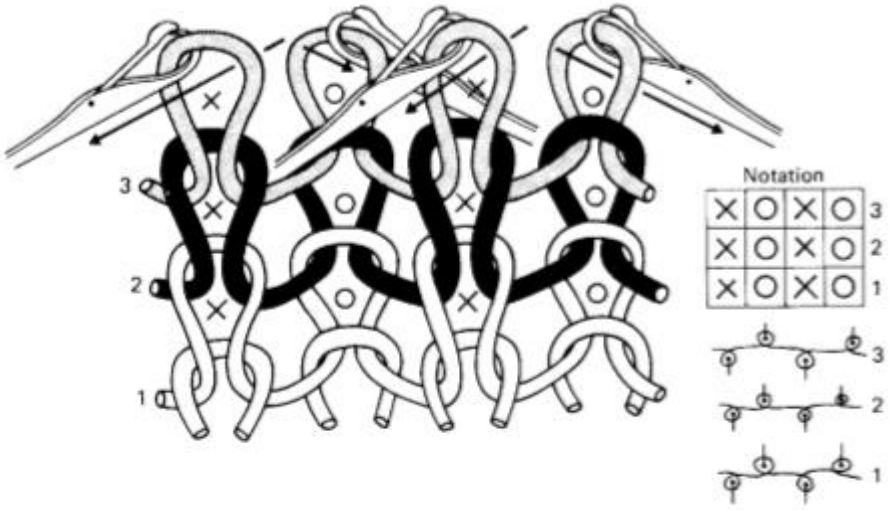


Fig.1.19 Face and reverse loop Wales in 1 * 1 ribs

Rib has a vertical cord appearance because the face loop Wales tend to move over and in front of the reverse loop Wales. As the face loops show a reverse loop intermeshing on the other side, 1 * 1 rib has the appearance of the technical face of plain fabric on both sides until stretched to reveal the reverse loop Wales in between. 1*1 ribs is production of by two sets of needles being alternately set or gated between each other. Relaxed 1*1 rib is theoretically twice the thickness and half the width of an equivalent plain fabric, but it has twice as much width-wise recoverable stretch. In practice, 1*1 rib normally relaxes by approximately 30 per cent compared with its knitting width. 1*1 rib is balanced by alternate Wales of face loops on each side; it therefore lays flat without curl when cut. It is a more expensive fabric to produce than plain and is a heavier structure; the rib machine also requires finer yarn than a similar gauge plain machine. Like all weft-knitted fabrics, it can be un-roved from the end knitted last by drawing the free loop heads through to the back of each stitch. It can be distinguished from plain by the fact that the loops of certain wales are withdrawn in one direction and the others in the opposite direction, whereas the loops of plain are always withdrawn in the same direction, from the technical face to the technical back**.**

7.1.3. Purl

Purl is the only structure having certain Wales containing both face and reverses meshed loops. A garment-length sequence, such as a ribbed half-hose, is defined as purl, whereas smaller sections of its length may consist of plain and rib sections.

Purl was originally spelt ‘pearl’ and was so named because of its similar appearance to pearl droplets. Purl structures have one or more Wales which contain both face and reverse loops. This can be achieved with double-ended latch needles or by rib loop transfer from one bed to

the other, combined with needle bed racking. The semi-circles of the needle and sinker loops produced by the reverse loop intermeshing tend to be prominent on both sides of the structure and this has led to the term ‘links-links’ being generally applied to purl fabrics and machines.

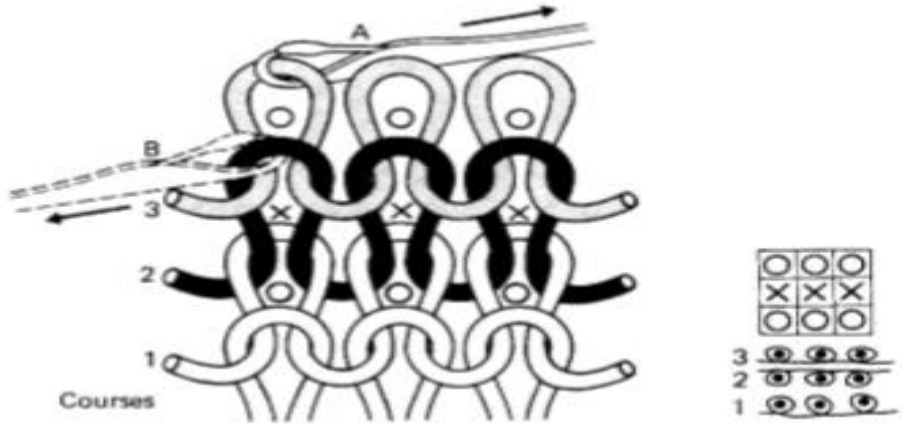


Fig.1.20 Purl fabric structures

7.1.4. Interlock

Interlock was originally derived from rib but requires a special arrangement of needles knitting back-to-back in an alternate sequence of two sets, so that 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 was extended for 20 years, underwear manufacturers found the needles expensive, especially on the larger 20 inch (51cm) diameter model. Suitable hosiery twist cotton yarn only became available in 1925, and the first stationary cam-box machine appeared in 1930.
Originally, interlock was knitted almost solely in cotton on 20 gauge (needles per inch) machines for under wear, a typical weight being 5oz per square yard (170g per square meter) using 1/40’s s cotton, but from the 1950s onwards, 18 gauge machines were developed for knitting double-jersey for semi-tailored suiting because the open-width fabric could be Finished on existing equipment. As the machines became more versatile in their capabilities, the range of structures became greater. Interlock has the technical face of plain fabric on both sides, but its smooth surface cannot be stretched out to reveal the reverse meshed loop Wales because the Wales on each side are exactly opposite to each other and are locked together Each interlock pattern row (often termed an ‘interlock course’) requires two feeder courses, each with a separate yarn that knits on separate alternate needles, producing two half-gauge 1*1 rib courses whose sinker loops cross over each other. It is a balanced, smooth, stable structure that lays flat without curl. Like 1 * 1 ribs, it will not un-rove from the end knitted first, but it is thicker, heavier and narrower than rib of equivalent gauge, and requires a finer, better, more expensive yarn. As only alternate needles knit at a feeder, interlock machines can be produced

in finer gauges than rib, with less danger of press-offs. Interlock knitting is, however, more of a problem than rib knitting, because productivity is half, fewer feeders can be accommodated, and there are finer tolerances.

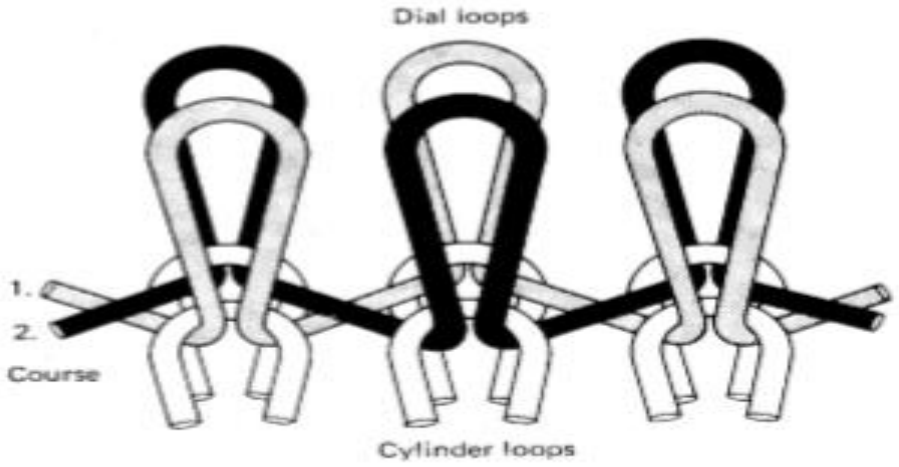


Fig.1.21 Interlock fabric structure

When two different-colored yarns are used, horizontal stripes are produced if the same color is knitted at two consecutive feeders and vertical stripes if odd feeders knit one color and even feeders knit the other color. The number of interlock pattern rows per inch is often double the machine gauge in needles per inch. The interlock structure is the only weft knitted base not normally used for individual needle selection designs, because of the problems of cylinder and dial needle collision.

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Draw the plain fabric structure? (3 points)
2. Write the difference between rib and satin fabric structure? (7 points)

Note: **Satisfactory rating –8 and above points** **Unsatisfactory - below 8 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Question

1. ----------

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2. ----------

Information Sheet-8	Knit product requirements

8.1. Color

Color is one of the five ingredients of fashion, the other four being style, silhouette, texture and pattern. Ornamentation for design purposes may be introduced at the fiber, yarn, or dyeing and finishing stage, as well as at the knitting stage. Apart from different colors, it may take the form of sculptured or surface interest. In fiber form it may include a variation of fiber diameter, length, cross-section, dye uptake, shrinkage, or elastic properties.

In yarn form it can include fancy twist and novelty yarns, as well as the combined use of yarns produced by different spinning or texturing processes. The dyeing process, which provides the possibility of differential and cross-dyeing of fabrics composed of more than one type of fiber, may occur at any point in manufacturing from fiber to finished article. At the knitting stage, apart from stitches for surface interest and other functional purposes, four techniques may, if required, be employed to produce designs in colored stitches. These are horizontal striping, intarsia, plating, and individual jacquard stitch selection.

Fig. 1.22 Rib jacquard machine with three –way selection and four –color stripes

8.2. Pattern:

Patterns are produced in weft knitted structures either in the form of selected colors for face stitches or surface relief patterns based on a choice of different types of stitch. The height to which a latch needle is lifted in its trick determines which stitch will be knitted.

If all needle butts are in the same position on the needle stems and they pass over the same cam profile, a plain fabric will be knitted, with all stitches having the same intermeshed loop structure. Patterning is therefore determined by selection of needle butts for example, either to pass onto a raising cam to knit or to miss the cam profile and not be lifted.

The width of the pattern in Wales is determined by how many needles can be selected separately, independently of each other. The pattern depth in courses is dependent upon the number of feeds with selection facilities and whether the selection can be changed during knitting.

Simple patterning and quick rib changes (during garment-length knitting) can be achieved in a limited width repeat when element butts are at one of a range of lengths or positions associated with particular raising cam arrangements.

The cam arrangement and element butt repeat set-out will determine the pattern area. Popular simple methods employ different butt lengths and cam thicknesses and/or different butt positions and cam tracks.

8.3. Size

Strapping machine needle bed widths tend to range from about 14 to 50 cm (5.5–20inches); hand-operated garment-width machines range from about 80 to 120 cm (31–47 inches); power-driven automatic garment length machines range approximately in width from about 66 cm to 240 cm (26–95 inches).

Wider ‘blanket width’ machines are approximately 244 cm (96 inches) wide, to knit unshaped garment pieces for cut-and-sew knitwear. Narrow bed ‘compact’ machines are approximately 127 cm (50 inches) wide for fashion shaped knitwear. For integral garment knitting, the approximate width is 183 cm (72 inches)

8.4. Stitch gauge

Machines the gauge is usually expressed as diameter and total number of needles. A 4 inch x400 needle single-cylinder ladies’ seamless hosiery machine will have 400 needles to knit plain. (NB: the number of needles may be slightly more or less than 400 in order to fit a particular mesh structural repeat exactly around the leg)

A 4 inch x 200 needle cylinder and dial machine will have 200 cylinder needles and 100 dial needles. Every second cylinder needle is gated in line with a dial needle and can only knit as 200 cylinder needles in plain structures. For 1x1 rib, the 100 dial needles knit in co-operation with the alternate 100 cylinder needles.

A 4 inch x 200 needle double-cylinder machine will have a total of 200 needles to knit plain stitches in the bottom cylinder, or, when arranged for 1 x 1 rib, will have 100 needles knitting plain in the bottom cylinder and 100 needles knitting rib in the top cylinder. As well as the machine gauge, the needle gauge, i.e. thickness and size of needle hook, is also a consideration

Flat machines are normally gauged on the English system (E) of needles per inch (npi). The Metric system, which is based on the distance in tenths of a millimeter from the centre of one needle to the next, is rarely used. The latter is a direct system, with a higher gauge number indicating a coarser gauge the opposite of the English system.

Generally, flat machine gauges range from E 5 to E 14, with the main gauges being 5, 7 and 10, but there are machines as coarse as fine as E 18 or even finer now being built.

NB: All flat machines can be half-gauged by removing every alternate needle; thus, an E 10 gauge machine will become an E 5 gauge. Also, different needle hook sizes are available, and gauge conversion by changing needle beds is possible.

8.5. Tension

Tension has significant effects on a knitted garment. The first and most obvious is size. Knitters use something called a tension square or swatch to determine what tension they are knitting. Tension will also affect the feel of the knitted fabric: how thick it is, whether the Tension has significant effects on a knitted garment. The first and most obvious is size. Knitters use something called a tension square or swatch to determine what tension they are knitting. Tension will also affect the feel of the knitted fabric: how thick it is, whether the stitches are loose or dense, how the fabric hangs and drapes

8.6. sock knitting

In the sock knitting machine is a cylinder with slots for needles. Latches on these needles do the knitting as each needle passes through the cam shell path. To make socks on a knitting machine, set up a bonnet or webbing on the middle of the machine to make the needle move continuously.

Socks can be created from a wide variety of materials, such as cotton, wool, nylon, acrylic, polyester, olefins (such as polypropylene), or spandex. To get an increased level of softness other materials that might be used during the process can be silk, bamboo, linen, cashmere, or mohair.

Most time we wear socks to keep our feet warm or as a fun fashion statement. Wearing socks can prevent foot health issues from forming. Along with your hands and armpits, your feet are one of the areas of your body that sweat the most. It is imperative that you keep your feet dry to prevent the growth of bacteria

Socks making process in socks making factory is quite complicated, first you have to design the socks, draw the pattern with socks knitting software and send it to the socks machine. Dye and acquire the raw socks yarn, set it on the machine. Start knitting - it usually takes a few minutes to knit one sock.

8.7. Full garment

Knit to shape, or fully fashioned knitwear, where individual garment pieces are indeed knitted to shape and then sewn or linked together, cut and sew knitwear is produced from a roll of knitted fabric. This roll has to be laid up and cut in a similar manner to woven fabric

Self-Check -8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is meant by stitch gauge? (5 points)
2. What is meant by pattern? (5 points)

Note: **Satisfactory rating –8 and above points** **Unsatisfactory - below 8 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ---

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2. ---

Information Sheet-9	Check air-condition system

9.1. Introduction

Air-conditioning is that process used to create and maintain certain temperature, relative humidity and air purity conditions in indoor spaces. This process is typically applied to maintain a level of personal comfort.

It's also used in industrial applications to ensure correct operation of equipment or machinery that need to operate in specific environmental conditions or alternatively to be able to carry out certain industrial processes, such as welding, which produce considerable amounts of heat that needs to be disposed of in some manner.

An air-conditioning system must be effective regardless of outside climatic conditions and involves control over four fundamental variables: air temperature, humidity, movement and quality. The distinction between industrial and personal comfort applications is not always clear cut. Industrial air-conditioning usually requires better precision as regards temperature and humidity control. Some application also demands a high degree of filtering and removal of contaminants.

Comfort air-conditioning on the other hand, as well as needing to satisfy personal temperature-humidity requirements, also involves other fields such as architectural design, weather forecasting, energy consumption and sound emissions to recreate the ideal conditions for human psycho physiological well-being. The main process underlying air-conditioning is the exchange of heat and water vapor between the indoor and outdoor environments and the people inside the air-conditioned space.

9.1.1. The principal appliances used in home and industrial air-conditioning are:

- Packaged, split or multi-split air-conditioners for home use;
- Air handling units for medium/large spaces;
- Rooftop units, air handling units for small spaces;
- Shelter units, air-conditioner for telephone exchanges;
- Close control units, precision cooling units for servers or telecoms equipment;
- Fan coils systems using chilled water circuits and terminal units for air-conditioning buildings

These differ significantly in terms of size, complexity and cooling capacity, which may range from several hundred watts into the megawatts, components and in general which of the main air-conditioning functions are implemented, i.e.:

- Cooling of air or water;
- Heating of air or water;
- Air dehumidification;
- Air humidification;
- Air filtering/purification;
- Mixing of air indoor/outside air; Ventilation

The ventilation, filtering, mixing and often heating functions are managed using relatively simple dedicated components, respectively fans, filters, dampers and electric heaters or

boilers, while the principle and more complex functions are managed by likewise complex systems such as refrigerant circuits and humidifiers.

Special mention also needs to be made of the solution commonly used to deliver cooling capacity that exploits the evaporation of a fluid inside a circuit placed in contact with the environment being cooled. The principles underlying this technology are again quite complex.

This process is done through the 5 steps such as the evaporator, compressor, condenser, expansion valve, Refrigerant. An air conditioner is able to cool a building because it removes heat from indoor air and transfers to outdoor air.

9.1.2. Different levels of air conditioning

- **Partial Cooling**: air conditioning equipment that provides partial control of the temperature and none of moisture. For instance, the rooms are cooled, but the fresh air is introduced without having been cooled and dried. In such cases also, the installed cooling capacity of the AC system may be insufficient for all circumstances, as a result the internal air cannot be kept at a constant temperature.
- **Total Cooling**: system provides full temperature control and includes the provision of the minimum rate of ventilation air changes required for hygienic purposes at an adequate temperature. This type of equipment allows a degree of dehumidification consequent to the cooling effect–it is a very frequent level of comfort today.
- **Total Air Conditioning**: which includes full control of temperature and humidity as well as provision of the minimum ventilation rate required for hygienic purposes but is not capable of attaining air purity conditions for specific IAQ (Indoor Air Quality) levels.
- **Advanced Air Conditioning**: These systems are particularly applied in hospitals or clean rooms in the electronic industry.
- **Provide heating**: reversible systems can supply cooling and heating in winter and summer or, for some system types, cooling and heating at the same time to different zones
- **Provide controlled ventilation**: the ventilation is integrated with the A/C system and the overall system introduces the fresh air and treats it. Heat and cool recovery from the extracted air is possible.

Self-Check -9	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the difference levels of air conditioner? (10 Points)

Note: **Satisfactory rating –8 and above points** **Unsatisfactory - below 8 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ---

Information Sheet-10	Check function of the machine

10.1.Flat knitting machine

A flat knitting machine is a two-bed machine. The most important mechanical features of a flat knitting machine are the supporting frame, the yarn feeding system, a transmission system, a fabric take-down motion, a central programming unit, and a needle-bed racking system. The flat knitting machine is a two-bed machine. The most important mechanical features of a flat knitting machine are:

- The supporting frame
- The yarn feeding system
- Two needle-beds made up of flat grooved plates
- A carriage provided with cam-locks for needle control
- A transmission system
- A fabric take-down motion
- A central programming unit
- A needle-bed racking system

The two flat beds can be:

a. Inclined by 90°-100° with respect to one another, with a staggered arrangement of the grooves accommodating latch needles or compound needles. The two flat beds are the “front needle-bed” (indicating the needle-bed closer to the operator) and the “rear needle-bed” (indicating the farther).
b. Both are arranged on a horizontal plane (at 180°) with the grooves, which are positioned opposite to each other. Double hook needles slide inside the grooves; these needles are moved by special sliders, which can transfer the stitches to the front bed – or to the rear bed for links-links or purl knitting processes – according to the type of patterns

10.2.Circular knitting machine

Definition of *circular knitting machine*: a machine with needles and yarn feeds arranged in a circle for knitting fabrics, hosiery, sweaters, and underwear

Circular knitting or knitting in the round is a form of knitting that creates a seamless or tube. Machines also produce circular knitting; double bed machines can be set up to knit on the front bed in one direction then the back bed on the return, creating a knitted tube.

Circular knit fabric has a gauge of 12 to 22. The higher the gauge is, the thinner the fabric. Flat knit is made with a machine that knits the fabric in sheets (or flat) and the gauge is 2 to 10 works with circular knit fabrics.

In textile knitting sector, knitting process is classified into two, where one is warp knitting and another one is weft knitting. A circular knitting machine is a device which is used to produce weft knitted fabrics in a semi or fully automated fashion. This article is presented a details discussion on circular knitting machine with its machine parts, machine types, applications

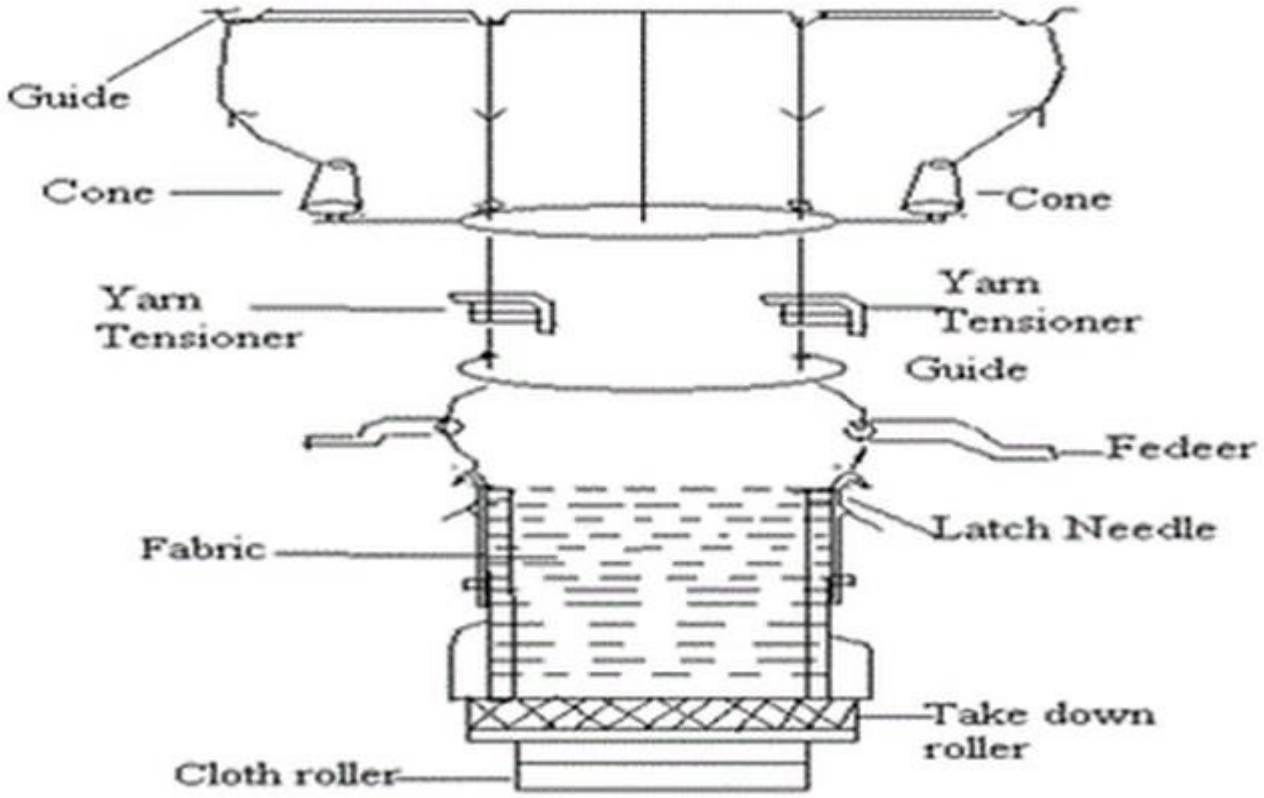


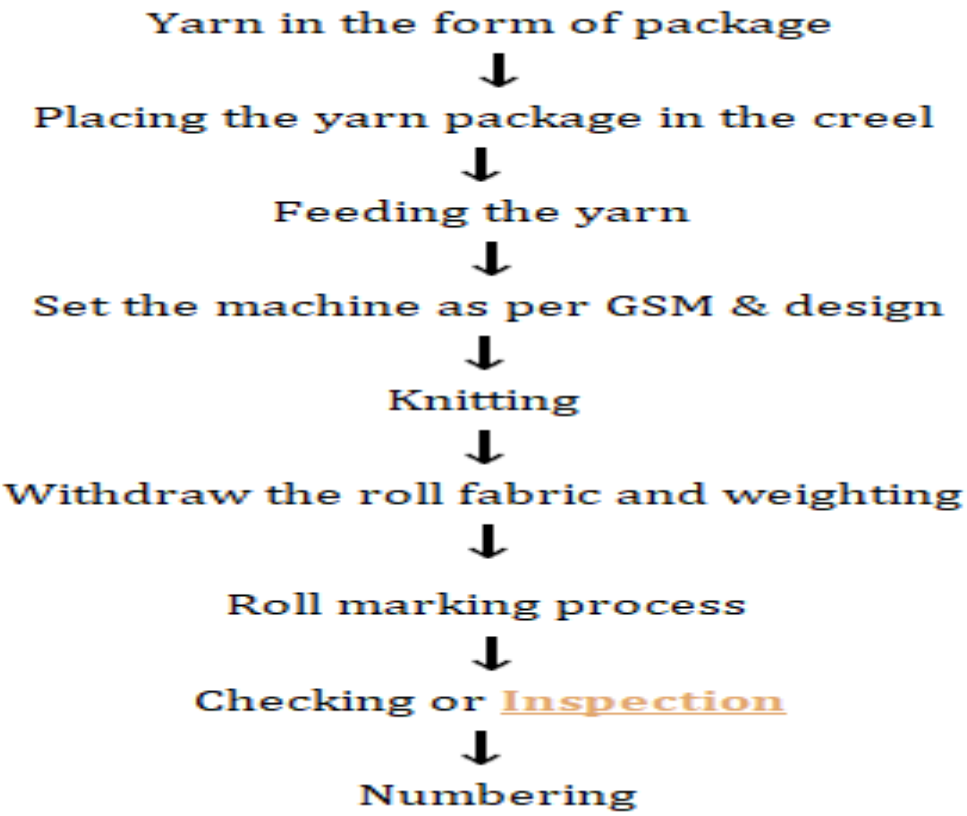
Fig: Circular knitting machine parts

10.2.1. **Main Parts of Circular Knitting Machine:**

Major parts of a circular knitting machine are listed in the following

1. Legs,
2. Cylinder,
3. Dial,
4. Needle,
5. Cam Parts,
6. Feeder guide,
7. Cam,
8. Supply Package
9. Creel,
10. Top Stop motion,
11. Anti Snarl Device,
12. Tensioner,
13. Positive feeder,
14. Knitted fabric,
15. Fabric spreader,
16. Fabric withdrawal roller
17. Fabric winding roll

10.3. Process Flow Chart of Circular Knitting Machine:



Self-Check -10	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. write the correct process fellow of knitting fabricating process ?(10 points)

Note: **Satisfactory rating – 5 and above points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ---

Information Sheet-11	Identify yarns specification

11.1. Introduction

A yarn count number indicates the linear density (yarn diameter or fineness) to which that particular yarn has been spun. An important consideration in choosing a yarn count is the machine gauge which defines the spacing of the needles in the needle bed (usually as needles per inch). The finer the machine gauge, the finer the required yarn count. Choice of yarn count is also restricted by the type of knitting machine employed and the knitting construction.

The count, in turn, influences the cost, weight, opacity, handle and drapability of the resultant structure. In staple spun yarns tend to be comparatively more expensive the finer their count because finer fibers and a more exacting spinning process are necessary in order to prevent the yarn from showing an irregular appearance. A number of differently based count numbering systems are still currently in use. Historically, most systems are associated with particular yarn-spinning systems. A yarn spun on the worsted system from acrylic fibers may be given a worsted count number.

The worsted count system is of the indirect type based on length per fixed unit mass, i.e. the higher the count number, the finer the yarn. The weight is fixed (1 lb) and the length unit (number of 560-yard hanks) varies. A 1/24's worsted yarn (24 x 560-yard hanks weighing 1 lb) will be twice the cross-sectional area of a 1/48's worsted yarn (48 x 560-yard hanks weighing 1 lb).

The designation 2/24's worsted indicates that the yarn contains two ends of 1/24's so that the resultant count is twice the cross-sectional area (24/2 =12's). he denier system is used in continuous filament silk spinning, and when the silk throwsters began to process textured synthetic continuous filament yarns, these nylon and polyester yarns were given denier count numbers.

The denier system is of the direct type based on mass per fixed unit length, i.e. the lower the number, the finer the yarn. The length unit is fixed (9000 meters) and the weight unit (in grams) is variable. A 70 denier yarn (9000 meters weigh 70 g) will be twice as fine as a 140 denier yarn (9000 meters weigh 140 g). A 2/70 denier yarn will give a resultant count of 140 denier.

The tex system was introduced as a universal system to replace all the existing systems. As tex sometimes produces a count number having a decimal point, it has been found more satisfactory to multiply the count number by 10 to give a deci-tex number. The tex system has not been universally accepted, particularly for spun yarns, and on the continent of Europe the metric system is used for these yarns. In common commercial practice has been followed, with decitex being used for filament yarn counts and the metric system for spun

staple yarn counts. The main count systems, with their continental abbreviations, are as follows:

11.1.2. Indirect Systems

- **Bradford Worsted System** (NeK) – the number of 560-yard hanks that weigh 1 lb (453.6 g).
- **English Woollen System** (NeW) (Yorkshire Skeins) – the number of 256-yard hanks that weigh 1 lb.
- **English Cotton System** (NeB) – the number of 840-yard hanks that weigh 1 lb
- **Continental Metric System** (Nm) (Cotton System) – the number of 1000-metre hanks that weigh 1000 g (1 kg).

11.1.2. Direct Systems

- **Denier System** (Td) – the weight in grams of 9000 meters.
- **Tex System** (Tt) – the weight in grams of 1000 meters.
- **Decitex System** (dtex) – the weight in grams of 10 000 meters.

Self-Check -11	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. what is yarn fabrication process for knitting manufacturing? (8points)

Note: **Satisfactory rating – 6 and above points** **Unsatisfactory - below 6points**

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ---

Information Sheet-12	Loading yarns into the machine to specification

12.1 Definition of knitting

It is the process of producing fabric by transforming continuous stands of yarn into a series of interlocking loops, where each raw of such loops hanging from the one immediately preceding it.

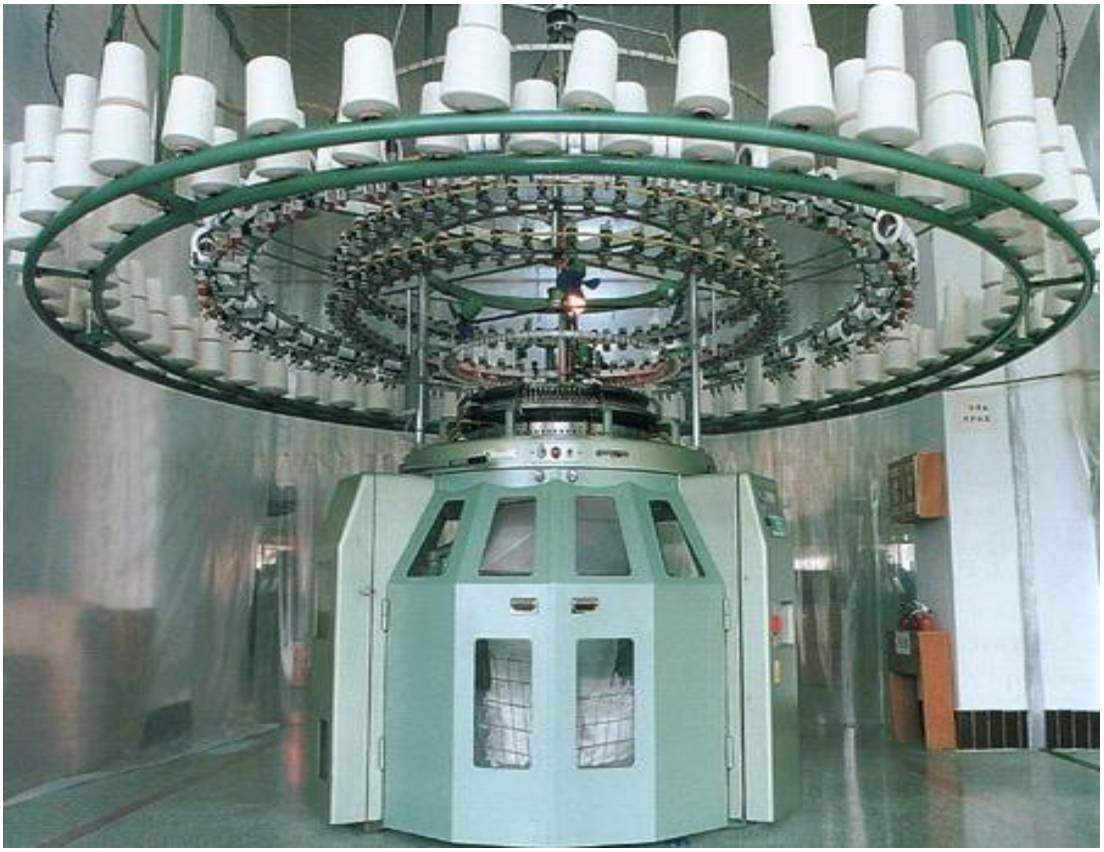


Fig.1.23 Circular knitting machine used in knit fabric production

It should be noted here that, interloping consists of forming yarns into loops. Each of which is typically only released after a succeeding loop has been formed and inter-meshed with it. It is the most used method interloping and is second choice only to weaving as the process of manufacturing textile products.

Self-Check -12	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. write down yarn loading process on the knitting machine creel?(10 Points)

Note: **Satisfactory rating – 8 and above points** **Unsatisfactory - below 8 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. ----------

List of Reference Materials

1. briars,a., Cyril Hurd Memorial Lecture, (2000), April, Leicester Text. Inst. Leicester, UK.
2. haigh,d., Dyeing and finishing of knitted goods,Hos.Trade J., (1970), Leicester, UK, 147 pp.

3. Gibbon,j.e., Crimplene: profile of a yarn’s problems and successes,Hos. Trade J., (1965), Sept., 110–12.
4. Law,i.m., Crimplene: a fibre legend,Knit.Int., (1981), June, 78–81.