

# **WEAVING AND KNITTING OPERATION**

## **Level-II**

**Based on March 2022, Curriculum Version 1**



**Module Title:-Perform Knitting Operation**

**MODULE CODE : IND WKO2 M06 0322**

**NOMINAL DURATION : 65Hours**

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## Acronym

TTLM:- Teaching, Training and Learning Materials

SOPs:- Standard operating procedures

PPE:- Personal protective equipment

## Introduction to the module

Knitting is a method by which thread or yarn may be turned into cloth. Knitting consists of consecutive loops, called stitches. As each row progresses, a new loop is pulled through an existing loop. The active stitches are held on a needle until another loop can be passed through them. This process eventually results in a final product, often a garment. So as, to monitor and control the continuity in these production processes the following criteria's should be go behind: Follow up machine operation: Machine is checked during operation in accordance with the standard procedures, Reasons of machine stoppage are determined following standard operating procedures, Major machine faults are reported, Keep the machine and production area cleaned in accordance with OHS standard and practices, Follow –up proper function of air compressor and air conditioning systems

This module is designed to meet the industry requirement under the **weaving and knitting operations particularly** for the unit of competency **Performing Knitting Operations.**

### This module covers the units

- Set up and load machine
- Produce sample
- Operate and monitor
- Machine check product
- Readjust machine setting to meet requirements
- Complete knitting process
- Maintain records

### Learning Objective of the Module

- Set up and load machine
- Produce sample
- Operate and monitor machine.
- Check product quality
- Readjust machine setting to meet requirements
- Complete knitting process
- Maintain records

## Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” given at the end of each unit and
5. Read the identified reference book for Examples and exert

## Unit one: Set up and loading of knitting machine

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- OHS Practice
- Knitting machine classification
- Machine parts and components
- set up the knitting machine
- Yarn selection and preparation

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

- Understand OHS Practice
- Understand machine classification
- Understand Machine parts and components
- Set the knitting machine
- Prepare Yarn selection and preparation

### 1.1. OHS practices

Standard operating procedure Standard operating procedures (SOPs) are a set of instructions that have been developed to define or standardize the exact steps to perform specific tasks. These steps have been found to provide consistent, repeatable results regardless of who is performing the task. Controlling costs and assuring quality are keys to being successful in any business. SOPs help accomplish both of these objectives. In manufacturing, SOPs should be in-place for: Equipment startup and operation Equipment set up and change over Product assembly Inventory tracking Material ordering Material receiving Maintenance procedures Material processing (e.g., mixing, batching) Quality control

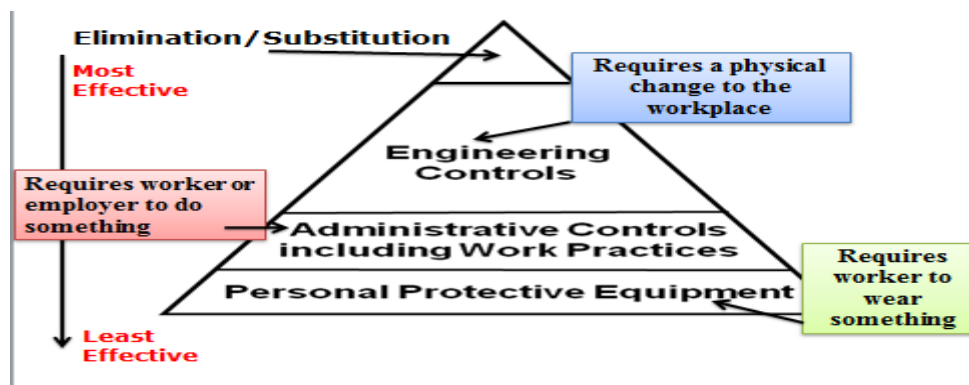


**Personal protective equipment (PPE)** PPE should only be used to protect workers as a last resort and in addition to other controls where it isn't reasonably practicable to fully control the dust by other means. Take care when choosing PPE and make sure that it is appropriate for the work. PPE should be used properly and maintained in good condition.

**Safe material handling** Material handling can be defined as: art and science of conveying, elevating, positioning, transporting, packaging and storing of materials Starting from the time, the raw material (such as fibers for spinning unit or yarns for weaving/ knitting unit and fabrics for wet processing or garmenting units) enters the mill gate and goes out of the mill gate in the form of finished products; it is handled at all stages within mill boundaries such as within and between raw material stores, various section of production department, machine to machine and finished product stores. A material may be handled even 50 times or more before it changes to finished product. It has been estimated that average material handling cost is roughly 10-30% of the total production cost depending upon product to process. By saving in the material handling cost, the cost of production can be reduced considerably. Material handling involves the movement of materials, manually or mechanically in batches or one item at a time within the plant. The movement may be horizontal, vertical or the combination of these two.

**Hazard control measures** Hierarchy of hazard control is a system used in industry to minimize or eliminate exposure to hazards. It is a widely accepted system promoted by numerous safety organizations. This concept is taught to managers in industry, to be promoted as standard practice in the workplace. Various illustrations are used to depict this system, most commonly a triangle.

The hazard controls in the hierarchy are, in order of decreasing effectiveness:



**Fig 1.1 hazard controls in the hierarchy**

**Elimination** Eliminating the hazard physically removing it is the most effective hazard control. For example, if employees must work high above the ground, the hazard can be eliminated by moving the piece they are working on to ground level to eliminate the need to work at heights.

**Engineering controls** The third most effective means of controlling hazards is engineered controls. These do not eliminate hazards, but rather isolate people from hazards. Capital costs of engineered controls tend to be higher than less effective controls in the hierarchy; however they may reduce future costs. For example, a crew might build a work platform rather than purchase, replace, and maintain fall arrest equipment. "Enclosure and isolation" creates a physical barrier between personnel and hazards, such as using remotely controlled equipment. Fume hoods can remove airborne contaminants as a means of engineered control

**Administrative controls** This sign warns people that there are explosives in Walker Lake, however it cannot prevent people from swimming in it. Administrative controls are changes to the way people work. Examples of administrative controls include procedure changes, employee training, and installation of signs and warning labels (such as those in the Workplace Hazardous Materials Information System). Administrative controls do not remove hazards, but limit or prevent people's exposure to the hazards, such as completing road construction at night when fewer people are driving.

**Personal protective equipment** Personal protective equipment (PPE) includes gloves, respirators, hard hats, safety glasses, high-visibility clothing, and safety footwear. PPE is the least effective means of controlling hazards because of the high potential for damage to render PPE ineffective. Additionally, some PPE, such as respirators, increase physiological effort to complete a task and, therefore, may require medical examinations to ensure workers can use the PPE without risking their health.

### **Housekeeping**

Management and keep up of facilities according to workplace procedures and standards.

Implementing housekeeping activities

- Cleaning schedule
- 5s and OHS practices
- Waste disposal
- Regular inspection

**Ergonomic arrangements of workplace** Ergonomics is a topic that affects us all; yet few of us have a good understanding of what the term actually means or realize how it affects us. Ergonomics is a science that focuses on designing a job for the worker. Ergonomically-designed job would ensure that a taller worker had enough space to safely perform his or her job, and also that a shorter worker could reach all of his or her tools and products without reaching beyond a comfortable and safe range. The opposite of this, and what typically happens in the workplace, is that a worker is forced to work within the confines of the job or workstation that is already existed.

### **Proper tools**

Tools should be appropriate for the specific tasks being performed. Your tools should allow you to keep your hands and wrists straight the position they would be in if they were hang in relaxed at your side. The workers should bend the tool not the wrist. The tool should fit comfortably into your hand. If the grip size is too large or too small, it will be uncomfortable and will increase the risk of injury. Tools should not have sharp edges, create contact stresses in your hand, or vibrate.

**Keep repetitive motion to minimum** Workstations or tasks can often be redesigned to reduce the number of repetitive motions that must be performed. Using power-driven screwdriver or tools with a ratchet device can reduce the number of twisting motions with the arm. To prevent ergonomic injuries workers should be encouraged to rotate tasks or take frequent, short breaks to stretch and relax muscles.

**Use safe lifting procedures** Avoid lifting objects that are too heavy. Use more than one person or a mechanical device to reduce the load. Your work station should not require you to lift objects above your head or twist your back while lifting. Keep the load close to your body and ensure that you have a good grip. Heavy and frequently lifted objects should be stored between knee and shoulder height not on the ground or above your head.

**Lubricate machines according to maintenance manual** Lubrication is a major item of expenditure in the maintenance of machinery, and it also represents the most important factor in protection of machinery from wear, corrosion and possible failure.

Wear may be defined as the undesired displacement or removal of surface material, although under some circumstances the initial stages of wear or mild wear which tends to smooth surfaces may be desirable for running in. In the knitting industry worn equipment can also be the cause of deterioration in product quality and in some specific instances a very small amount of wear in

knitting machinery can have a disproportionate effect. Some of the measures that can be taken to improve the quality of lubrication and reduce consumption of lubricants are outlined below:

**Read interpret and follow information on work.**

Depending on the machines used in the workplace:

- i. application of occupational safety and health procedures, including the use of first aid equipment and safe lifting practices;
- ii. yarn-jointing, either by hand to company standards, or by hand-held knotting or splicing devices;
- iii. stopping and starting knitting machines;
- iv. production examination for faults, and defects;
- v. correct yarn-paths for the machines being operated;
- vi. use of specific lubricants;
- vii. fault-correction, including fixing small and large press-offs by the methods appropriate to the category of machine;

## 1.2. Knitting machine classification

There are a lot of ways to classify knitting machines. Some sources have classified them according to its configuration such as either flat bed or circular. In other references, its function ;like for example, fabric knitting machines and garment length knitting machine indeed there are many different types of knitted fabrics In this module we have listed and classified these knitting machines as either weft knitting or warp knitting machine.

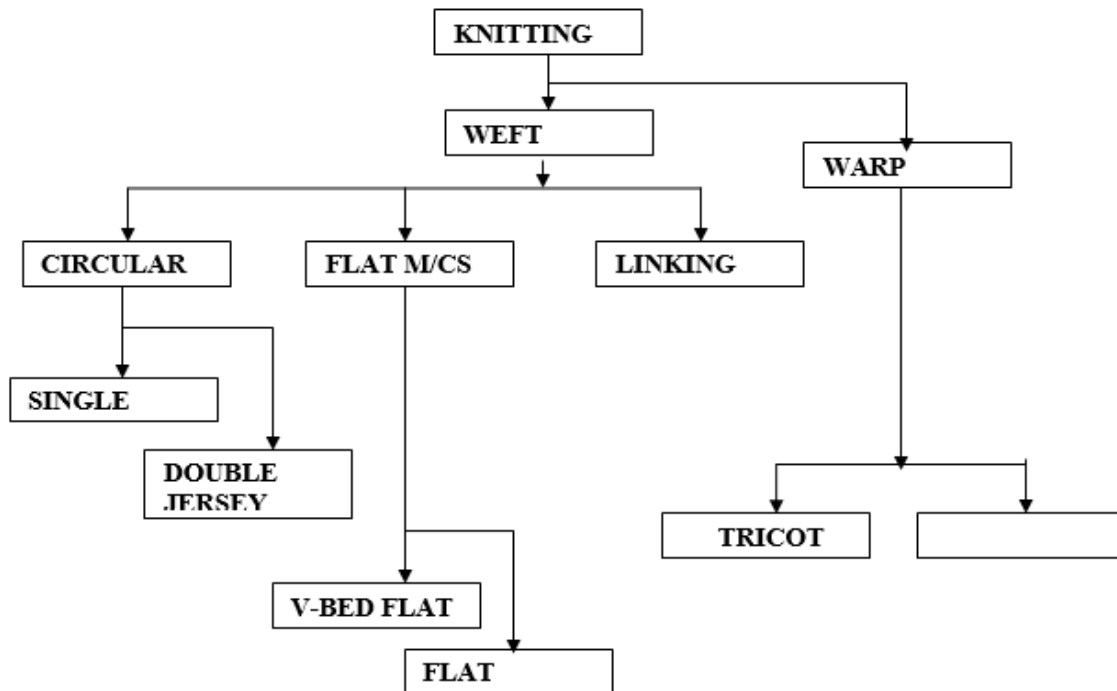


Figure 1. Knitting machine classification

### 1.1.1. Weft knitting machines

#### A. Straight bar frame machines

Have a vertical bar of bearded needles The needle movement is controlled by circular engineering cams The length of the machine is divided into a number of knitting heads ('sections') Each head is capable of knitting a separate fashion-shaped garment.



Fig.2 Straight bar frame machines

## B. Flat bed machines

Single and double bed machines Double bed has two stationary beds arranged in an inverted V formation or link to link. Latch needles slide in the tricks during the knitting action. Needle butt is controlled by the angular cams of a bi-directional cam system. They are two types 90 – 100° V bed machines 180° linked /link to link machines

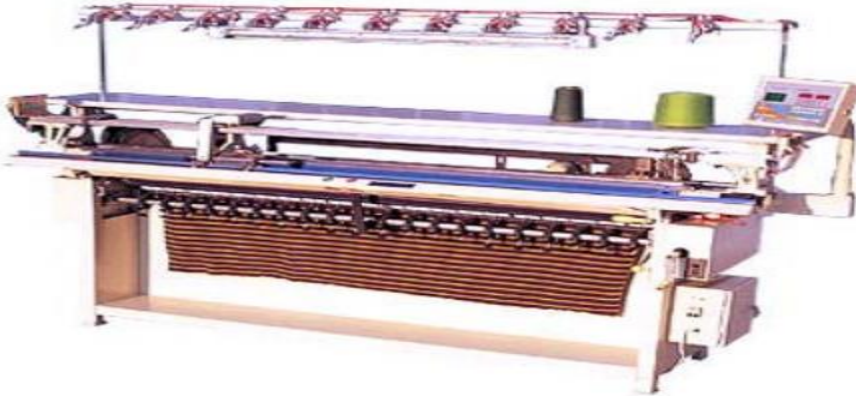


Fig. 3 Flat bed machines

## C. Circular knitting machines

Needle beds are arranged in circular cylinders and/or dials Include latch, bearded needle machinery knitting a wide range of fabric structures, garment and cylinder diameters Are most common type of machines

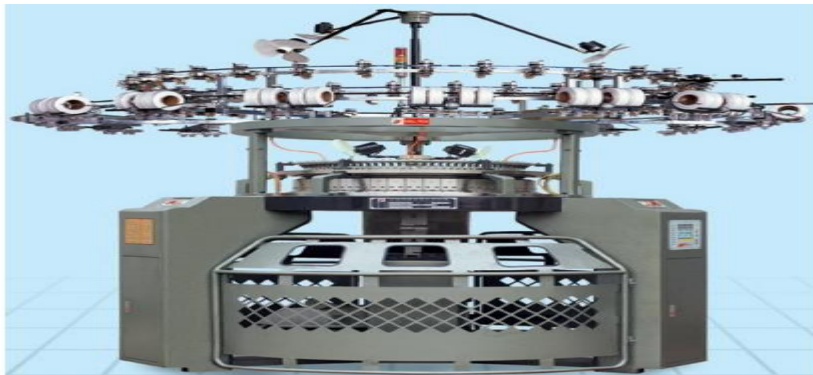


Fig.4 Circular knitting machines

### 1.1.2. Warp knitting

An additional element, guide is required to feed warp ends to the needles 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 Shagging and swinging of guide bars is



incorporated Warp knitted fabrics and weft knitted fabrics have different structures The warp beams



Fig.5 Warp knitting machine

Table 1.1 classification of knitting machines

• 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

## 1.3. Machine parts and components

### 1.3.1. Flat Bed Machine Part

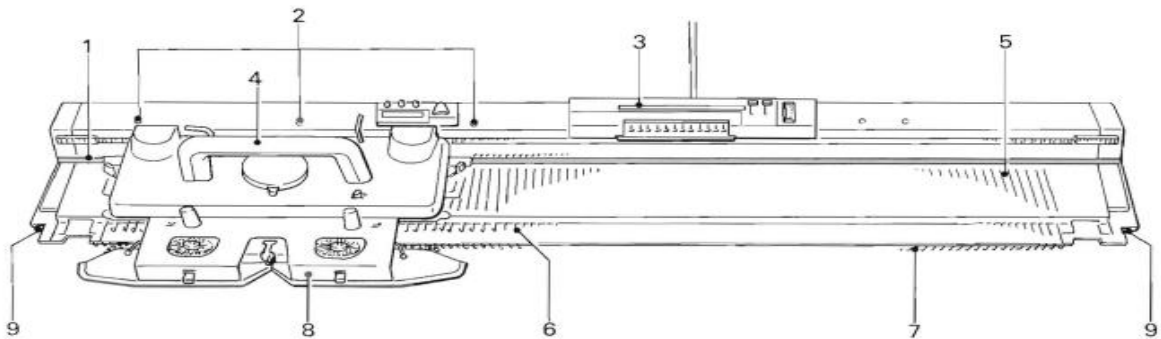


Fig.6 Flat Bed Machine Part

- |                                |                 |
|--------------------------------|-----------------|
| 1. Rail                        | 6. Latch Needle |
| 2. Knit Contour Securing Studs | 7. Sinker Post  |
| 3. Pattern Panel               | 8. Arm          |
| 4. Carriage                    | 9. Yarn Holders |
| 5. Needle Bed                  |                 |

### 1.3.2. circular knitting machine

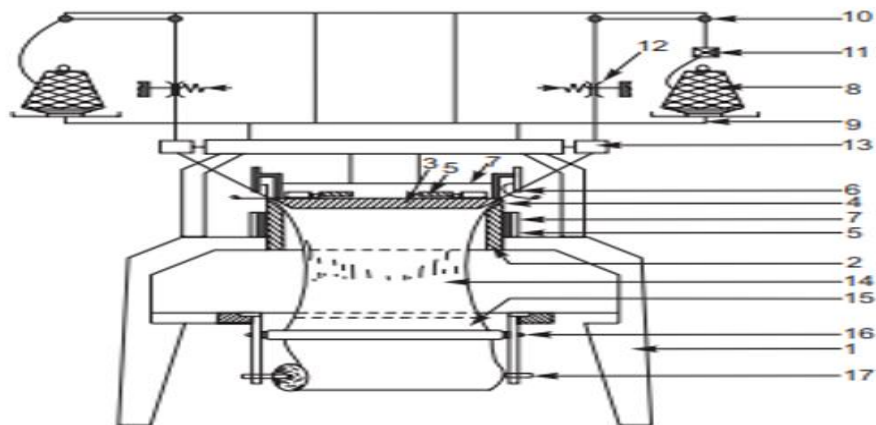


FIG.7 Circular Knitting Machine

- |             |                 |                   |
|-------------|-----------------|-------------------|
| 1. Legs     | 4. Needle       | 7. Cam            |
| 2. Cylinder | 5. Cam Parts    | 8. Supply Package |
| 3. Dial     | 6. Feeder guide | 9. Creel          |



10. Top Stop motion

11. Anti-Snarl Device

12. Tensioned

13. Positive feeder

14. Knitted fabric

15. Fabric spreader

16. Fabric withdrawal

roller

17. Fabric winding roll

There three types of needles used for knitting: - latch needle, bearded needle and compound needle

1. Latch needle

b. Bearded needle

c. Compound needle

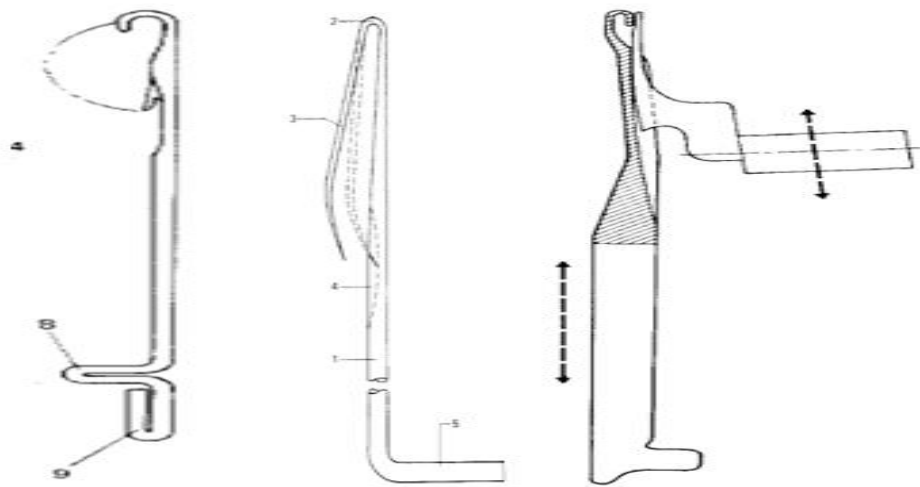


Fig.7 needles

In the past

- Tricot machines mainly employed *bearded needles* with a presser bar
- Raschels machines used *latch needles* with its blade.
- But now a days they also use compound needles
- Latch Needle operation

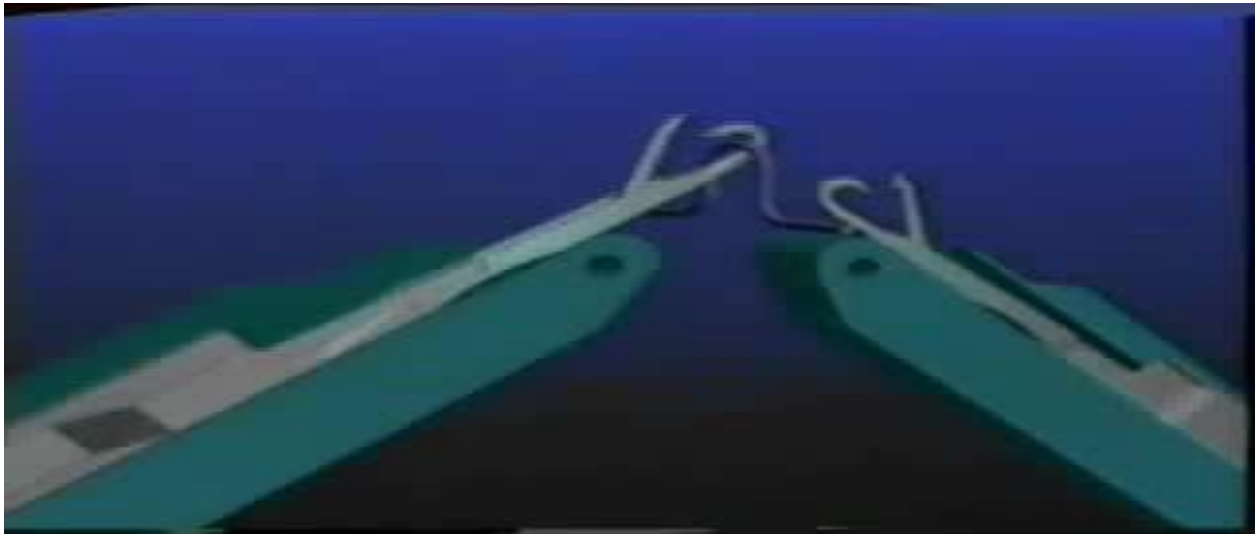


Fig.8 latch needle

### Basic operating Parts of knitting machines

1. Needle:- basic knitting element
2. Needle bed:- Bar/frame on which needles & jacks are arranged
3. Sinker:- for loop *formation, Holding-down, or Knocking-over*
4. Jack:- provides versatility of latch needle selection & movement
5. Positive feed devices:- device used to control yarn feeding rate
6. yarn carriage:- yarn feeding or may move the needle up & down
7. Cam:- converts the rotary drives→ reciprocating action
8. Pattern wheel:- to select and move individual elements/needles
9. Guide bar:- Bar on which thread guides are arranged in warp knitting
10. Thread guide:- guides and feed thread to needle in warp knitting Needle

## 1.4. Set up the knitting machine

### 1.4.1. CLEANING OF KNITTING MACHINES:

Following thumb rules should be followed: Fluff removal at least at the end of every shift. Removal of fly accumulation from cams at larger intervals. Occasional removal of paraffin from tension discs and yarn guide elements.

### 1.4.2. LUBRICATION

Lubrication is a major item of expenditure in the maintenance of machinery, and it also represents the most important factor in protection of machinery from wear, corrosion and possible failure. Wear may be defined as the undesired displacement or removal of surface material, although under some circumstances the initial stages of wear or mild wear which tends to smooth surfaces may be desirable for running in. In the knitting industry worn equipment can also be the cause of deterioration in product quality and in some specific instances a very small amount of wear in knitting machinery can have a disproportionate effect. Some of the measures that can be taken to improve the quality of lubrication and reduce consumption of lubricants are outlines below: The method and consumption of lubrication should be critically studied and suitable corrective measures taken to ensure proper lubrication and avoid wastage. The mill should prepare their own detailed lubrication schedules based on the recommendations of oil companies and machinery manufacturers. The lubricants should be stored at a specified centralized place in the stores, and in the department, in a clean and tidy place. The lubricants should be enclosed in a separate container. The lubrication points which have the same frequency should be grouped together and marked with distinctive colors for easy identification. It is of advantage to use separate containers for each grade of oil or grease so that contamination of one with the other does not take place.

### 1.4.3. CIRCULAR KNITTING MACHINES & THEIR SETTINGS

Machines should be installed on a horizontal floor & as far as possible without any vibrations. Bobbin carrier should be mounted in such a way that the yarn should not rub against the package. No deviations between yarn guide and knitting area. For basic knitted structures yarn tension should be low and constant. Yarn guide devices must be flawless, eyelets made of porcelain, without any furrows. Needles should be flawless (straight, latches, hooks) also if synthetic yarn is being used continuously then needles should be changed every 6 months. Shape of needles

(hooks) should be adapted to the gauge of the machine. Needle beds are subjected to high rate of wear & tear in cases of tight synthetic fabrics. Needle beds should be exactly centered towards one another. Fabric take offs and wind on tensions should be able to be individually set.

#### 1.4.4. AIR CONDITION IN KNITTING PLANT

Knitting section Should be air conditioned for less yarn breakage & less wear and tear of the machines; a relative humidity of 65 % and a temperature of 22 degree Celsius.

#### 1.4.5. CONTROL AND MONITORING SYSTEM

Modern circular knitting machines feature on-board computers (CPU) complete with a display and a keyboard to monitor and control the most important functions: Speed Number of machine revolutions (R.P.M) Working hours Causes of machine stops Detector of the yarn length fed into the machine On modern microprocessor-controlled machines, the LCD display (TOUCH SCREEN) is equipped with an alphanumeric keyboard for entering the operator's settings. The whole system is controlled by an electronic circuit which signals the status of the machine and the possible causes of machine stops by means of flashing lights. All the electronic control components are accommodated in a cubicle linked with the machine by special connectors. 68 Sometimes, together with these functions, the machine can also carry out needle selection procedures by retrieving the information saved on floppy disks or by means of a direct connection to a dedicated CAD system

### 1.5. Yarn selection and preparation

Knitting yarns come in so many fibers, weights, and textures that you may be overwhelmed when you first walk into a yarn shop. You can use the guide that follows to help choose yarns.

**NATURAL FIBERS** Yarns spun from animal fibers, like wool, alpaca, mohair, cashmere, and angora, are generally the warmest to wear and hold their shape well. Wool comes in a range of textures, from sturdy Shetlands to soft merinos. Alpaca is a sumptuous fiber with a lot of drape. Mohair is hairier than wool, and mohair-only garments have a fuzzy halo. Cashmere comes from goats and is buttery soft, but expensive. Angora, spun from rabbits, is also supple and fuzzy. Silk is warm, but not as elastic as wool. Garments knit in cotton, linen, bamboo, and hemp yarns are good for warm weather wear. These yarns, however, are less stretchy than wool. Sweaters knit in these fibers can lose their shape over time. Soft but strong, yarn made from soy has the look of

silk. **SYNTHETIC FIBERS** Synthetics include acrylic, nylon, and polyester. These yarns are human-made and often less expensive than natural fibers. Many are machine-washable.



**Fig.9 fibers**

**Yarn selection criteria** Spun yarn is made by twisting staple fibers together to make a cohesive thread, or "single. Twisting fibers into yarn in the process called spinning can be dated back to the Upper Paleolithic and yarn spinning was one of the very first processes to be industrialized. Spun yarns may contain a single type of fiber, or be a blend of various types. Combining synthetic fibers (which can have high strength, luster, and fire retardant qualities) with natural fibers (which have good water absorbency and skin comforting qualities) is very common. The most widely used blends are cotton-polyester and wool-acrylic fiber blends. Blends of different natural fibers are common too, especially with more expensive fibers such as alpaca, angora and cashmere.

Yarn is selected for different textiles based on the characteristics of the yarn fibers, such as warmth (wool), light weight (cotton or rayon), durability (nylon is added to sock yarn, for example), or softness (cashmere, alpaca).

Yarn is composed of twisted strands of fiber, which are known as plies when grouped together. These strands of yarn are twisted together (plied) in the opposite direction to make a thicker yarn. Depending on the direction of this final twist, the yarn will have either s twist or z twist. For a single ply yarn, the direction of the final twist is the same as its original twist. The twist direction of yarn can affect the final properties of the fabric, and combined use of the two twist directions can nullify skewing in knitted fabric.

**Filament yarn** Filament yarn consists of filament fibers (very long continuous fibers) either twisted together or only grouped together. Thicker monofilaments are typically used for industrial purposes rather than fabric production or decoration. Silk is a natural filament, and synthetic filament yarns are used to produce silk-like effects.

**Texturized yarns** Texturized yarns are made by a process of air texturizing filament yarns, which combines multiple filament yarns into a yarn with some of the characteristics of spun yarns.

**Yarn quality characteristics** Yarn is a long continuous length of interlocked fibers, suitable for use in the production of textiles, sewing, crocheting, knitting, weaving and rope making. Yarn can be made from any number of synthetic or natural fibers. The following are some quality characteristics of cotton yarn.

**Yarn count** (Yarn numbering): In spinning room, increased efficiency of operation and improved yarn quality are two major benefits to be derived from effective quality control throughout the preceding operations. The important features of yarn, which are evaluated to determine its quality, are yarn number (count), strength, twist, appearance and evenness. Common yarn numbering systems are cotton English system, Tex, Denier, Metric count, and Worsted system.

**Yarn strength:** Strength has been accepted by many, as one of the most vital characteristics of yarn. The factors which influence the yarn strength are: staple length of fiber- the longer the fiber the stronger is the yarn, fiber fineness- fine fiber gives greater yarn strength than coarse fibers, fiber strength, twist (as the twist value increase the strength of yarn also increase), and fiber length distribution in the yarn (variation in the distribution of fiber length will cause a variation in yarn strength).

**Twist of cotton yarn:** The cotton yarn twist is characterized by the number of twists or turns per meter of length and the directions of twist S-twist and Z-twist. Yarn twist needs continuous follow up during production process to minimize the variations.

**Hairiness of yarn:** These are protruding ends of single fibers or loops formed by separate fiber on the yarn surface. The presence of fiber ends or loops on the yarn surface is called hairiness or fluffiness. The yarn hairiness depends on the kind of fibers, the degree of their straightening, methods of spinning and twisting, and other factors.

**Yarn evenness:** A deviations in linear density of spinning products (sliver, roving, and yarn) or man-made filament yarns in some portions on one or other side from the mean value determine their unevenness in linear density.

**Cotton yarn tension:** The tension of yarn should be constant during production or process. There should be a standard value (limit) of yarn tension for each type and count of yarn. When the tension of yarn increase, internal deformation takes place and leads to breakage.

**Yarn abrasion:** at any stages of processing in the textile industry the fibers and yarns often rub against each other and against the surfaces of the machines working parts.



Fig 10 Quality characteristics of yarn

## Color

Yarn may be used un dyed, or may be color with natural or artificial dyes. Most yarns have a single uniform hue, but there is also a wide selection of variegated yarns:

- Heat hered or tweed: yarn with flecks of different colour fiber
- Ombre: variegated yarn with light and dark shades of a single hue
- Multicolored: variegated yarn with two or more distinct hues (a "parrot colour way" might have green, yellow and red)
- Self-striping: yarn dyed with lengths of color that will automatically create stripes in a knitted or crocheted object
- Marled: yarn made from strands of different-colored yarn twisted together, sometimes in closely related hues

## Measurements (Quantities)

Yarn quantities for handcrafts are usually measured and sold by weight in ounces or grams. Common sizes include 25 g, 50 g, and 100 g skeins. Some companies also primarily measure in ounces with common sizes being three-ounce, four-ounce, six-ounce, and eight-ounce skeins. Textile measurements are taken at a standard temperature and humidity, because fibers can



absorb moisture from the air. The actual length of the yarn contained in a ball or skein can vary due to the inherent heaviness of the fiber and the thickness of the strand; for instance, a 50 g skein of lace weight mohair may contain several hundred meters, while a 50 g skein of bulky wool may contain only 60 meters.

In Europe, textile engineers often use the unit tex, which is the weight in grams of a kilometer of yarn, or decitex, which is a finer measurement corresponding to the weight in grams of 10 km of yarn. Many other units have been used over time by different industries



## Self-Check 1

### Part I Instructions: Answer all the questions listed below.

1. What is the definition of knitting?
2. What is the difference between warp end weft knitting?
3. List weft knitted machine?
4. List warp knitted machine?

### PART II Multiple Choose

1. which one of the following is natural fiber?
  - A. nylon
  - B. polyester
  - C. wool
  - D. all
2. which one of the following is weft knitted machine
  - A. flat bed
  - B. tricot
  - C. Rachel
  - D. all
3. \_\_\_\_\_-is converts the rotary drives→ reciprocating action
  - A. cam
  - B. needle
  - C. Thread guide
  - D. none
4. Yarn supply for warp knitting is\_\_\_\_\_
  - A. Cone
  - B. Package
  - C. Beam
  - D. pirn
5. What type of needle is used for flat knitting machine?
  - A. Beard needle

- B. Latch needle
- C. Compound needle
- D. A&B

### PART III Matching

A

\_\_\_\_ 1 hook

\_\_\_\_ 2, butt

\_\_\_\_ 3.latch

\_\_\_\_ 4 shank

\_\_\_\_ 5.stem

B

A. Draw and retained the new loop

B, Carries the New Loop in the Rest Potion

C. Used To Reciprocate Motion

D. Situated In The Blade

E. between Steam and Hook

## Operation Sheet 1.1:

**Operation title:** yarn preparation for knitting operation

**Purpose:** To practice and demonstrate the knowledge and skill required in preparation of ----

**Instruction:** Use the given figure below (figure steps to prepare yarn . For this operation you have given 30 min and you are expected to provide the answer on the given table.

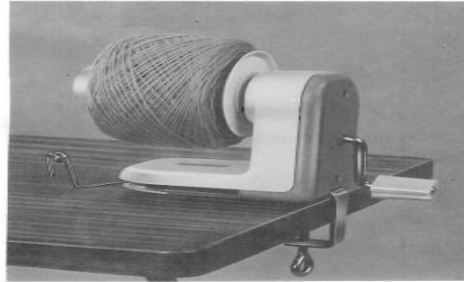


Fig 11 Con winder

### Tools and requirement:

1. Yarn.
2. Con winder

**Precautions:** Measure at least three times before recording the result on the given format

Procedures:

Open the hank of yarn or hand wound ball

Making yarn winding in ball form

LAP Test 1	Practical Demonstration
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 1 hours

Task 1: prepare work place and running knitting machines for operation

Task 2: prepare yarn for knitting

## Unit two: Produce sample

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Knitted structure and design
- Knitted fabric production

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

- Identifying Knitted structure and design
- Producing Knitted fabric sample
- Test, analyze and prepare samples

### 2.1. Knitted structure and design

#### 2.1.1. Type of fabric

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 interlooping. All three methods have evolved from hand-manipulated techniques through their application on primitive frames into sophisticated manufacturing operations on automated machinery.

- **Woven fabrics:** yarns cross each other at right angles/interweave

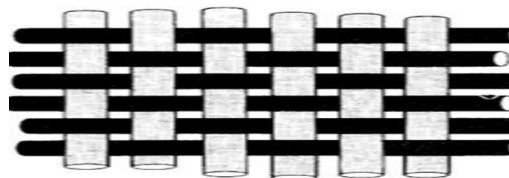


Fig.12 woven fabrics:

- **Knitted fabric:** yarn is made in to a series of intermeshed loops

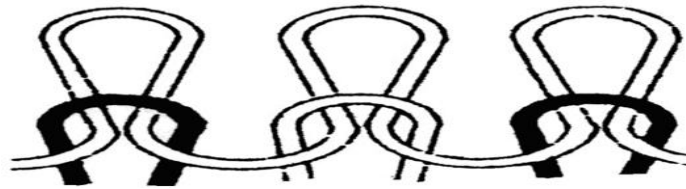


Fig.13 Knitted fabric

- **Braided fabrics:** yarns are intertwined, twisted or knotted

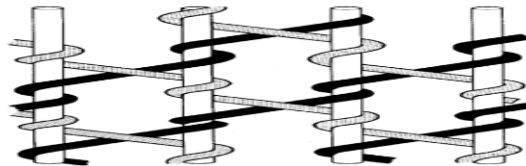


Fig.13 Braided fabrics

- **Non-woven:** fibers/filaments/yarns are bonded together

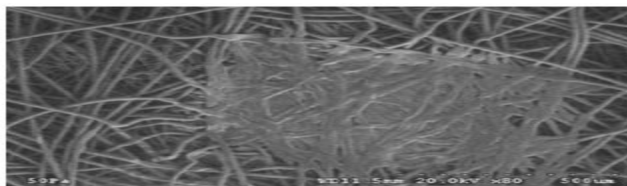


Fig.15 non –woven

### 2.1.2. The knitted loop structure

The knitted loop structure The knitted loop structure may not always be noticeable because of the effect of structural fineness, fabric distortion, additional pattern threads or the masking effect of finishing processes. However, unless the intermeshing of the loops is securely achieved by the needles receiving new loops of yarn into their hooks before the old loops are ‘cast-off’, and the ground structure is not fractured during finishing or wear, a breakdown or separation of the structure will result. The properties of a knitted structure are largely determined by the interdependence of each stitch to its neighbours on either side and above and below it. Knitted loops are arranged in rows, roughly equivalent to the weft and warp of woven structures. These are termed ‘courses’ and ‘Wales’ respectively



Fig.15 open and close loop

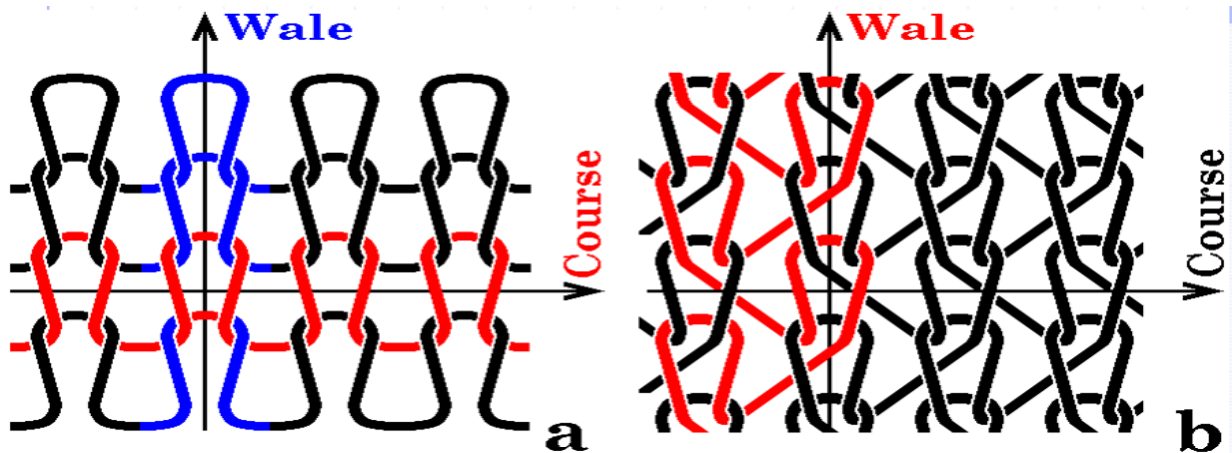


Figure 16 wale and course loop

### 2.1.3. Elements of Loop Structure Elements of knitting Wale:

Longitudinal series of loops Course: Transverse series of loops Loop: The basic knitted element  
Needle: The knitting element Sinker: The supporting element for knitting Feeder: The yarn feeding element Cylinder/Dial: The device to decide the needle movement

#### A. NEEDLE LOOP

Basic unit of knitted structure Under sufficient take-away tension, the loop become thinner and long It has head, legs and feet It has four contact points Foot of one loop is connected with the foot of the consecutive loop If the loops are the first course, the loops are not restricted/held at legs and foot rather it looks like tuck loops In warp knitting the feet may be open or closed at the base of the loop. But it is open in weft knitting

#### B. Sinker loop

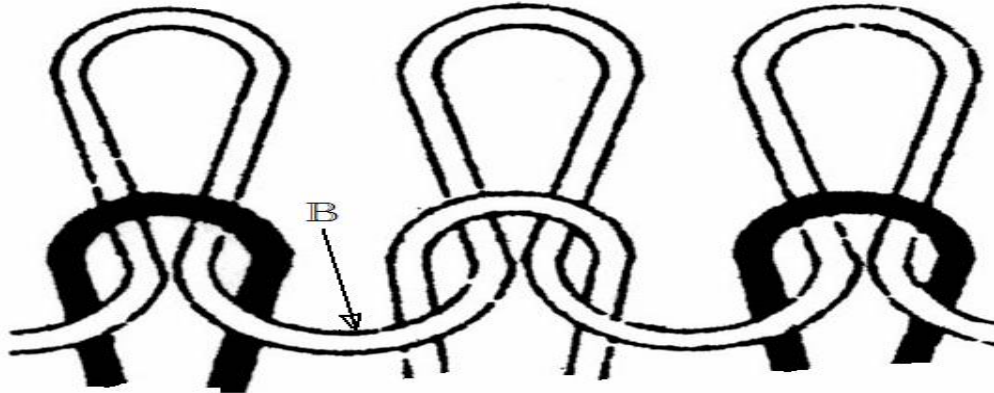


Fig.17 sinker loop

Sinker loop (B): is the feet of two successive needle loops in the on bearded needle machines, loop forming sinkers form the sinker loop But in latch needle it is formed automatically

### C. Warp knitted laps

Loops are termed '*laps*' in warp knitting because the warp guides lap their yarn around the needles in order to form the loop structure There are two types of laps overlap and under laps

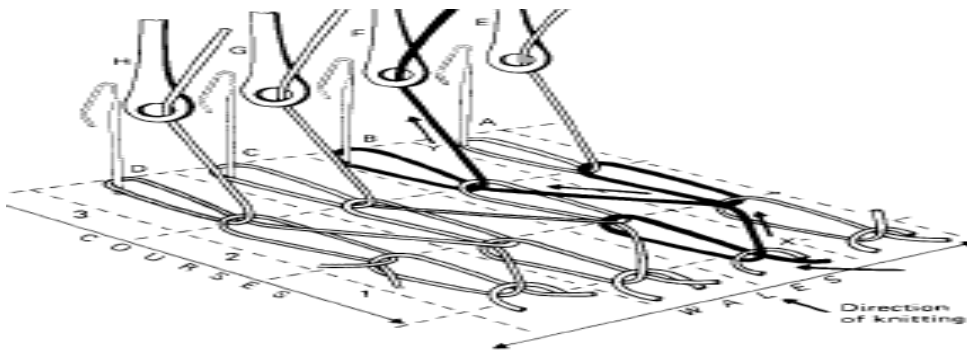


Fig.18 Closed lap and open lap

### Closed lap

When an under lap follows in the opposite direction to the overlap

### Open lap

When an under lap is in the same direction as the overlap or when under lap is omitted and an overlap is continued where the previous overlap is finished



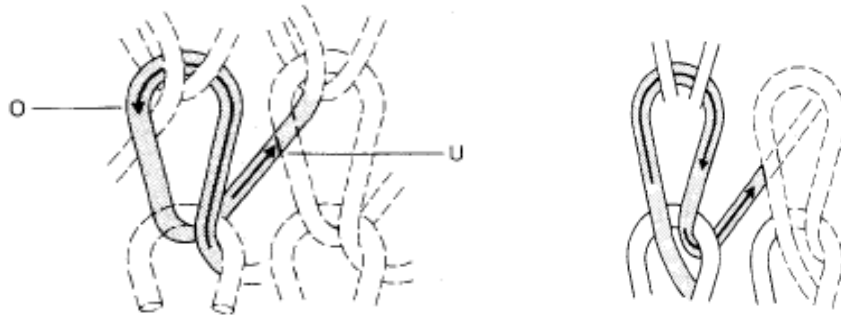


Fig.19 Closed lap and open lap

#### D. Wrapping

Wrapping is a method of producing vertically-orientated patterning with warp threads

It is done on a single jersey weft knitted base structure. Specially-controlled warp thread guides are used which make unidirectional warp knitted overlaps into selected needle hooks. If selected empty needle hooks rise to receive the warp yarn, pure wrapping or warp insertion is produced. If, however, wrapping takes place on needles, all of which already hold a ground yarn at that knitting cycle, embroidery plating or wrap striping is produced;

#### E. The knitted stitch

is the basic unit of intermeshing, consists of three or more intermeshed needle loops. The centre loop is drawn through the head of the lower loop and is intermeshed through its head by the loop above it. A needle loop's 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. Stitch length is a length of yarn which includes the needle loop or loop head + loop legs + half the sinker loop

The four intermeshing points of a loop (middle loop)

At— 1 and 2 at the head, where the next new loop will be drawn through by the needle

At 3 and 4 at the base, where the loop has intermeshed with the head of the previously formed loop.

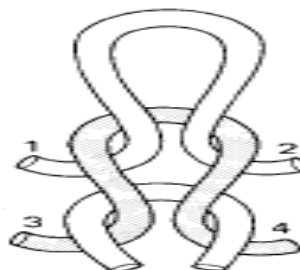


Fig.20 loop parts

**Face loop stitch** Shows the new loop coming towards the viewer as it passes through the previous loop. Called the right side hides sinker loops in weft knitting and the under laps in warp knitting loop arms are shown to the front but loop feet and loop head are shown to the back

**Reverse loop stitch** Shows the new loop meshing away from the viewer as it passes under the head of the old loop. Also called *left side* Show sinker loops in weft knitting and the under laps in warp knitting loop arms are shown to the back but loop feet and loop head are shown to the front

**Single faced structures** Needles are operating as a single set they move simultaneously in the same direction Adjacent needles face towards same direction one side of the fabric will be fully technical face while the other is technical back

**Double faced structures** When two sets of independently-controlled needles are employed or one of the two sets of needles face in the opposite direction to the other set. Each side of the fabric will have both technical face and technical back

**Double faced structures** When two sets of independently-controlled needles are employed or one of the two sets of needles face in the opposite direction to the other set. Each side of the fabric will have both technical face and technical back

#### F. Knitting notation

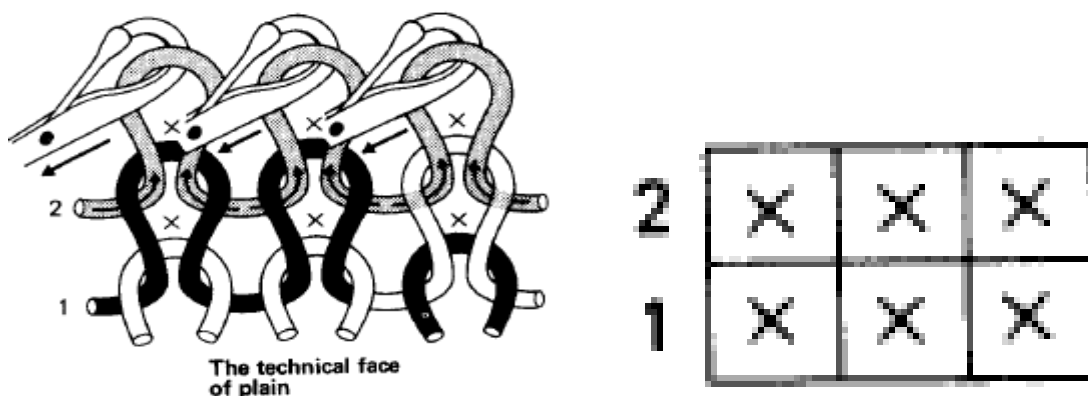
A symbolic representation of a knitting repeat sequence Use of point paper Point represents needle or a loop

Rows: → adjacent needles or the course produced by them.

columns:- a needle (single set of needles) or Wales

Point paper method Squared paper

An 'X' is placed in a square for a face loop



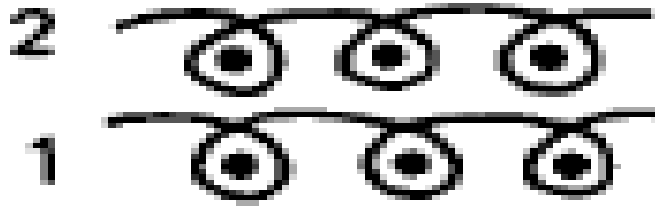
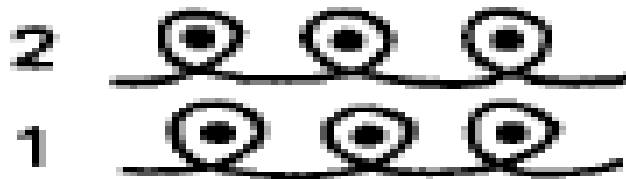
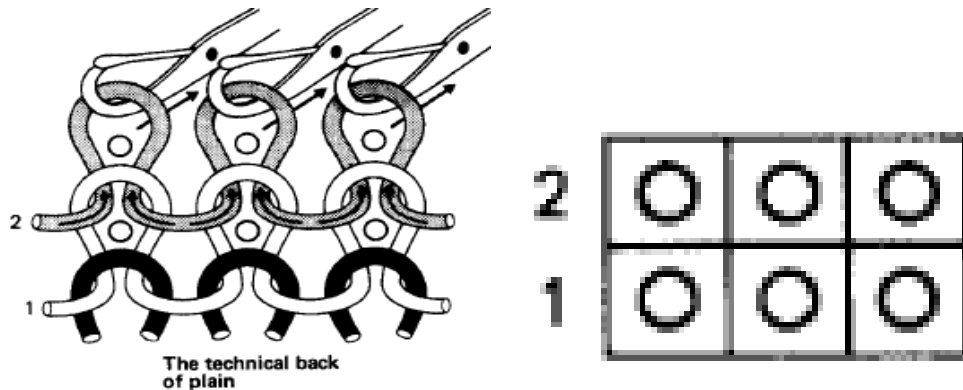


Figure 2.11 Technical face of the fabric

- An 'O' is placed for a reverse stitch



Technical back

Fig.21 Technical back of the fabric

#### 2.1.4. The four primary base weft knitted structure

plain, rib, interlock and purl Are the base structures from which all weft knitted fabrics and garments are derived Each is composed of a different combination of face and back stitches They can be made alone or in combination Examine the face and back stitch arrangement and unraveling state for each

##### A. Plain structure

Produced by single set of needles Single faced structure (one side is fully face and the other is back)

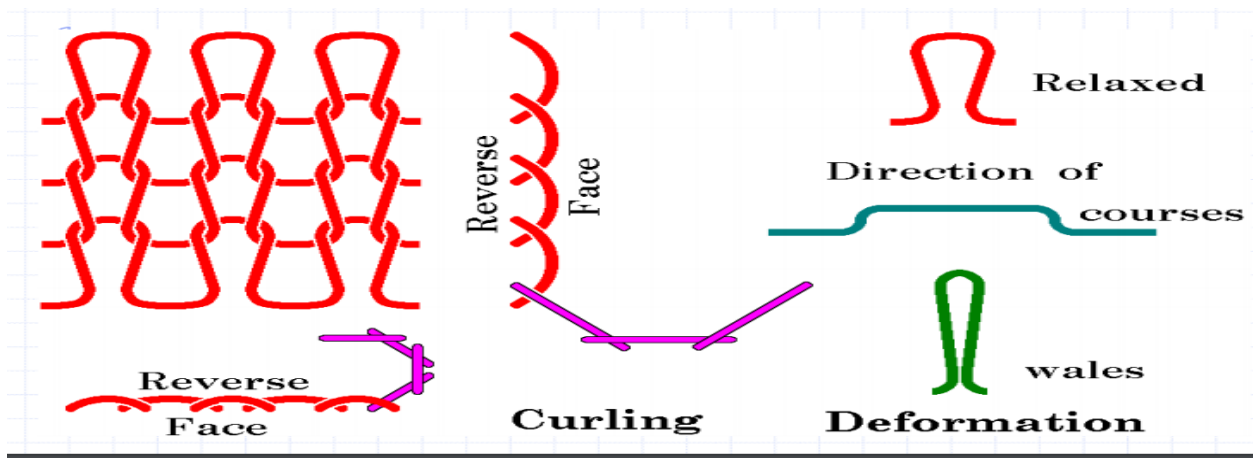
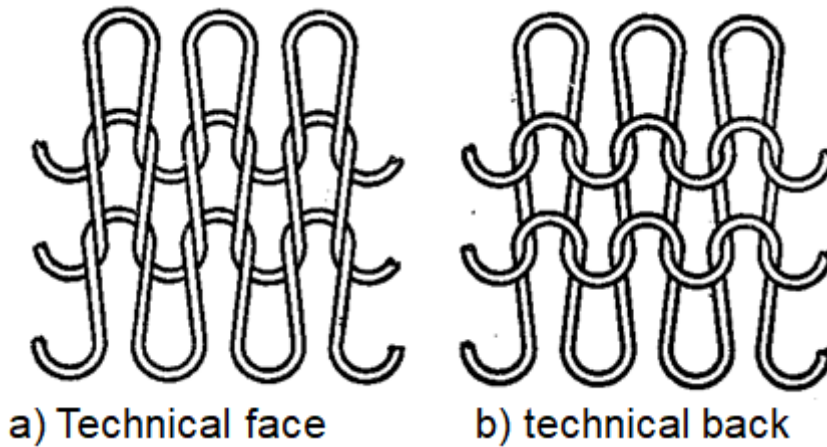
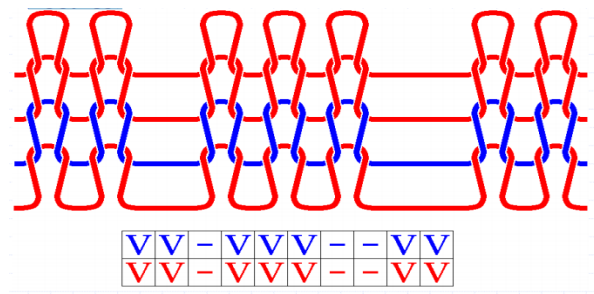


Fig. 22 \Plain structure

### B. B Rib Structure

Rib structures Topologically it corresponds with plain fabric, there are longer sinker loops in positions of missing needles: Two sets of needles operating in between each other /combination of Wales As a needle in one set forms face the needle in the other forms back of the same side 1x1



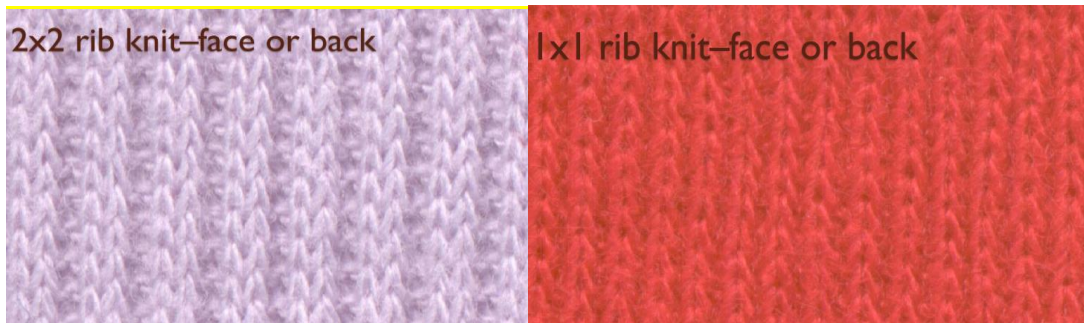


Fig.23 Rib Structure

### C. Interlock Structure

A double faced structure with change of directions (courses  $\leftrightarrow$  Wales) – greater longitudinal deformability, appearance as plain fabric from reverse side. Two sets of needle both sides are technical face In each set, needles work turn by turn

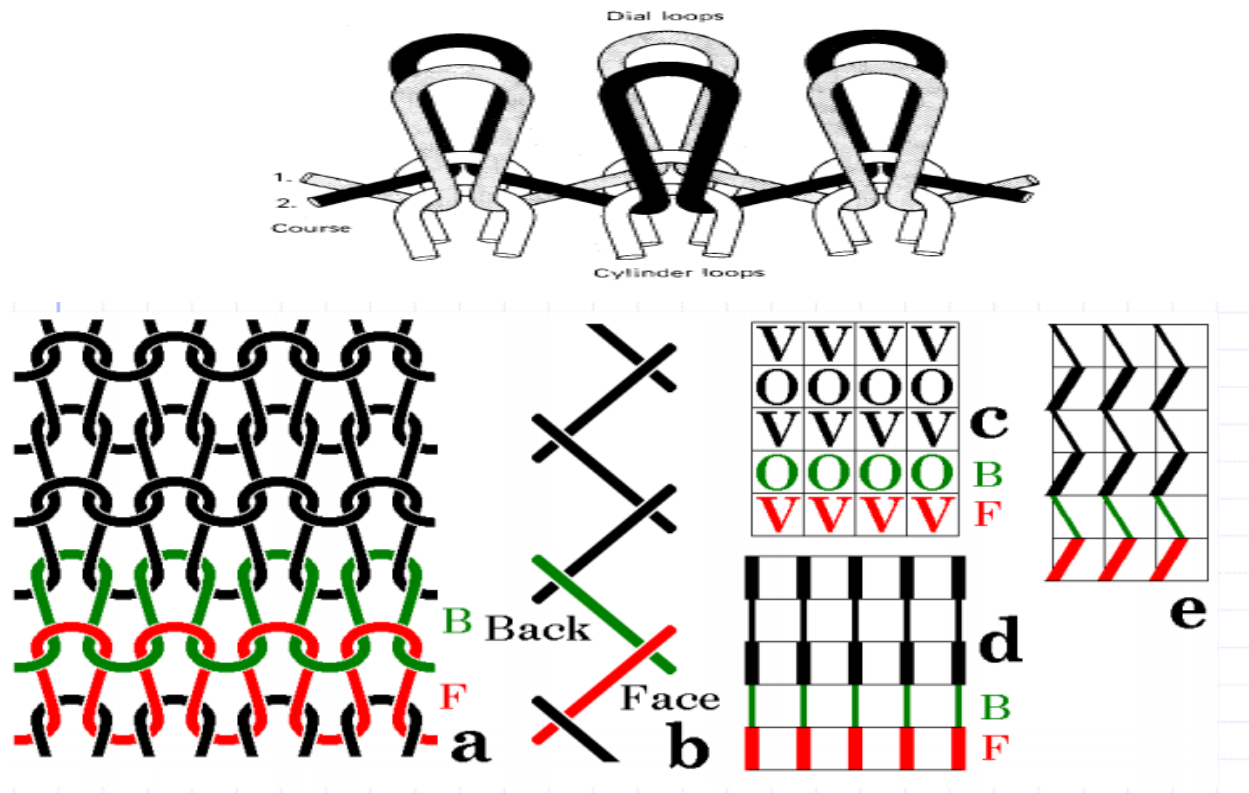




Fig.24 Interlock Structure

#### D. Purl structure

We get face and reverse stitches in a wale Can be formed by double faced needle or v-bed machine

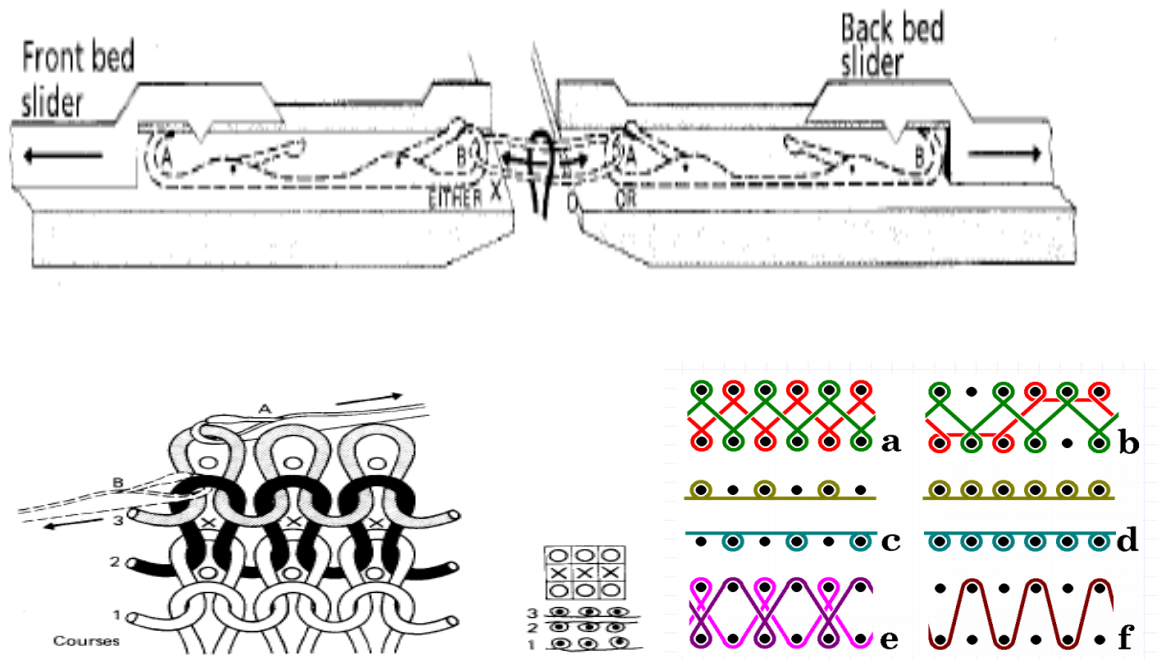


Fig. 25 Interlock Structure

#### 2.1.5. Different Types of Stitch Designs

**Knitted Loop:-** A loop that is held at its foot by previously formed loop head and holds the foot of newly formed loop by its head or when a needle receives a new loop and knocks over the old loop

**Knitted stitches:** Three or more intermeshed knitted loops

**The held loop** An old loop that the needle has retained for one or more knitting cycles.



Longer loop, takes two or more courses As the number of cycles for the needle to be held increase the tension on the yarn increases

#### A. The drop or press-off stitch

Result if a needle releases its old loop without receiving a new one

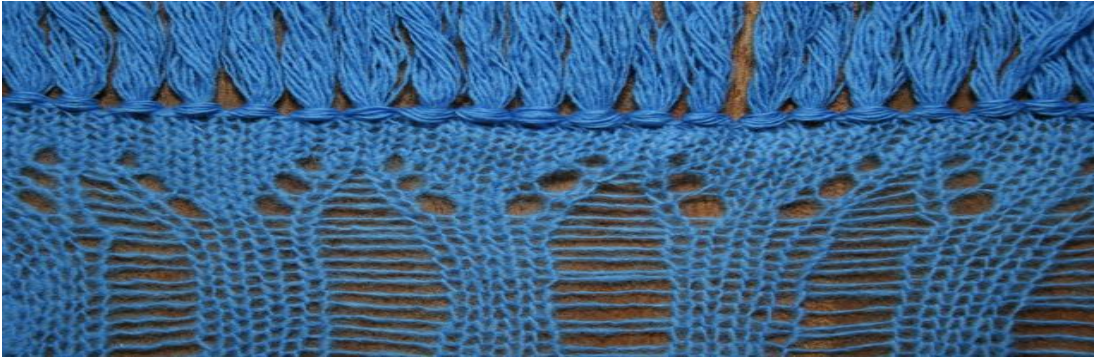


Fig 26 The drop or press-off stitch

#### B. The float stitch

Consists of a held loop, one or more float loops and knitted loops It is produced when a needle fails to receive the new yarn or the needle gets rest Under normal tensions max. Cycles for float is 4



Fig 27 The float stitch

### C. Tuck stitch

A floating thread is useful for hiding an unwanted colored yarn. The float loop assumes a u shape. It is floating on the technical back.



Fig 28 tuck stitch

## 2.2. Knitted fabric production

**Sinker** A thin metal plate with an individual or a collective action may perform one or more of the following functions; dependent upon the type of machines: Loop formation (C) Holding-down Knocking-over

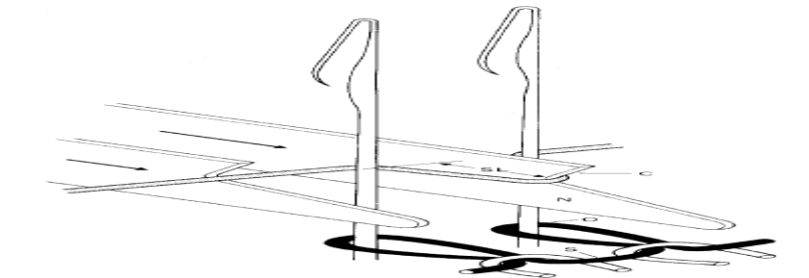


Fig 29 sinker

**Loop formation** On bearded needle weft knitting machines of the straight bar frame and sinker wheel type, the main function of the sinker is = loop formation. Latch needle, weft and warp knitting: the main function of the sinker is = Not loop formation.

- To hold down the old loops at a lower level on the needle stems than the new loops.
- To prevent the old loops from being lifted as the needles rise to clear them from their hooks.
- On tricot warp knitting machines and single bed weft knitting machines, a *slot*, *T*



- On raschel warp knitting machine the sole function of the sinker is a *web holder*
- Holding-down sinkers enable tighter structures, reduced minimum draw-off tension, higher speeds, knitting can be commenced on empty needles
- Holding-down sinkers are often unnecessary when knitting with two needle bed machines → the second bed restrains the fabric loops whilst the other set of needles moves.
- However, if single bed knitting or held loop structure is knitted, a form of holding-down element may still be required knock-over
- Upper surface or *belly* (B) supports the old loop (O) as the new loop (NL) is drawn through it.
- On Rachel warp knitting machines, many V-bed flats, and cylinder and dial circular machines, the verge or upper surface of the trick-plate serves as the knock-over surface.

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.

#### 2.2.1. The knitting action of the V-bed hand flat machine

The rest position The tops of the heads of the needles are level with the edge of the knock-over bits. The butts of the needles assume a straight line until contacting the raising cams R(R) because the leading stitch cams S and AS (L) are lifted to an inactive position. This action prevents needles from being unnecessarily lowered and a strain being placed on the old loops prior to the start-up of the knitting action.

**Clearing** The needle butts are lifted as they contact the leading edge of cams R (R), which raises the needles to ‘tucking in the hook’ height with the cams S (L) acting as guard cams. The needles are lifted to full clearing height as their butts pass over the top of cardigan cams C (R) and C (L).

**Yarn feeding** The yarn is fed as the needles descend under the control of guard cam (G). The required loop length is drawn by each needle as it descends the stitch cam S (R). To produce *synchronized knocking-over* of both needle beds simultaneously, the stitch cam S (R) in the front system is set lower than the auxiliary stitch cam AS (R), so that the AS (R) is rendered ineffective. If, however, *delayed timing of the knock-over* is employed, knock-over in the front bed will occur after knock-over in the back bed.

In this case, stitch cam S (R) is not set as low as (R) so that the depth setting of the AS (R) cam produces the knock-over action. Delayed timing is only normally used on gauges finer than On hand flat machines, the cams are often of the sinkable setting type so they can be set either:

**fully in action** out from the cam plate so that they act on every needle butt, **partly withdrawn** into the cam-plate so that they miss the low (short) butts, which pass undisturbed across their surface, or **fully with drawn** into the cam-plate so that all butts pass undisturbed across their surface. Two or more cam systems can be arranged in a single carriage = two or more feeders/travers. Split cams can be used on a bed straight bar frame Produces Underwear and knitwear popular gauges of 51 G and 60 G (needles/1.5inch) for stocking Today, outerwear straight bar frames with 16 knitting sections, each 32 or 34 inches wide, may be as long as 23.5 m The normal gauge range is from 9 to 33.

Table 2 Gauges

Gauges (G)	9	21	24	33
Yarn count (Ne)	2/10's	2/24's	2/28's	2/40's

Garment part	Bodies	Sleeve
Knitting section width	71 – 91cm	51 – 56 cm

### 2.2.2. Basic Mechanical Principles of Circular Knitting Technology

The circular knitting machine consists of three major sections Yarn supply knitting elements Fabric take down Yarn packages are mounted at the overhead creels and yarn are fed to knitting zone through yarn guides, stop motions and tensioners the knitting elements such as needles, sinkers, cylinder, dial, cams, feeders etc. are supported at the centre called as knitting zone. At the knitting zone, single knit plain machines are fitted with a cylinder and sinker ring, whereas the double knit machines have cylinder and dial. A fabric spreader gradually converts the tubular

fabric into a double layer folded fabric by preventing the formation of pleats or creases. The knitted fabric goes down inside the cylinder towards the centre of the machine, drawn into the take down device and finally collected on a roll winding mechanism

**FREE STANDING CREELS:** There are as many cams in the machine as there are number of feeds (cones/cheeses) in the creel. However as the number of cones/cheeses increases the ‘umbrella’ type of old creels are getting eliminated which are being replaced by a free standing creel. With these creels, yarn cones are made more readily assessable to the knitter for replacement. It permits larger size packages to be used. Also the lint problem from staple fiber yarns is reduced. Even number of stop motions on the machine is reduced. Creels up to 144 cones are now available.

**YARN FEEDING:** It is well known that the fundamental factor affecting the knitting quality is the length of yarn knitted into the fabric in one course. Hence, it is essential to feed the exact length of yarn from.

**POSITIVE FEEDER:** In this device, the yarn is interposed between the driving tape and the freely rotating feed wheels mounted on a ring along the circumference of the machine. There are as many rollers as the number of feeders on the machine. The speed of the yarn is therefore equal to the speed of the tape. The device is shown in Fig. The rate of yarn feed may be varied to change the quality of the fabric by varying the diameter of the driving wheel. The adjustment of stitch can setting is only for adjusting the input tension when the yarn is passage through the all the feeders to produce quality fabric. This is achieved by using positive yarn feeding device positive feed system. Because of the importance of this device, all the imported machines are fitted with positive feed.

**STORAGE FEEDER:** The positive feed system shall be used to knit structures that require a constant rate of yarn feed at all the feeders of the machine. When knitting jacquard design, this positive feed system cannot be used, because the yarn consumed at each feeder is different. Therefore, in this case it is desirable to feed the yarn at constant tension to the knitting elements. This is achieved by using storage feeder. In this system, the yarn is drawn from the cone and wound on to a small cylindrical drum. The required amount of yarn is unwound from this drum as the needles from the loops. A certain amount of yarn reserve is maintained in the drum, because of this arrangement yarn is delivered at a constant tension to the needles. This device is fitted with stop motions at the feed and delivery point and indicates any yarn break or slackness by red light indication and stop the machine

**STORAGE POSITIVE FEEDER:** The advantage of both storage and positive feed device has been combined and the storage positive feeder has been developed. In this device, the common belt drive to the individual pulley is maintained as in the positive feed device. In this device, the yarn is not nipped between the belt and feed wheel. The yarn is wrapped around a pulley that is mounted on the same shaft of the feed pulley. The pulley is so shaped that the yarn wraps does not get entangled or slip. The number of wraps can be varied to suit the condition. Stop motion are also provided at two feed and delivery point of this device to detect any yarn breakage.

**CYLINDER:** The cylinder is a steel cylinder bed having grooves/tricks/cuts on its outer periphery into which the needles are mounted. With reference to the tricks, the needles move vertically up and down by their butt being in contact with the cam track. The number of tricks per inch i.e., number of needles per inch decides the gauge of the machine. Machines are built as low as 4 NPI to as high as 32 NPI. Based on the machine gauge, the fineness of the yarn to be knitted can be varied. The diameter of the cylinder also varied based on the type and width of the fabric and a maximum of 75 cm diameter machines are available.

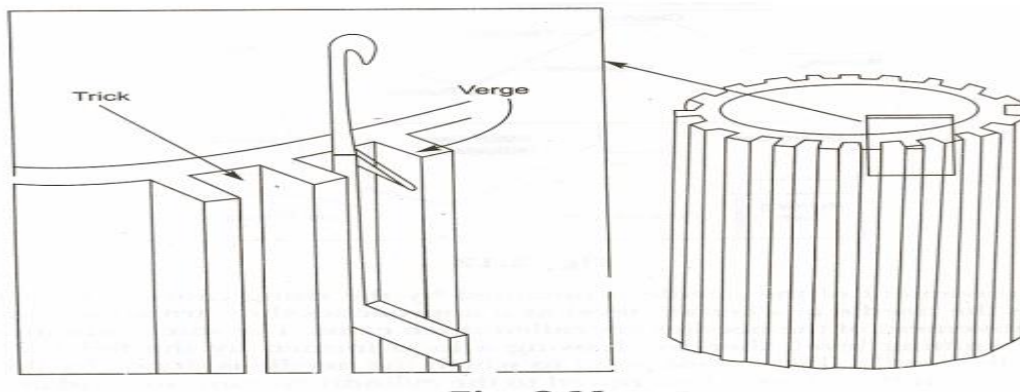


Fig 29 CYLINDER:

**DIAL:** Dial is the upper steel needle bed used in double knit machines. Into the grooves of the dial, the needles are mounted horizontally and are allowed to move radically in and out by their dial cams. The number of grooves per unit space conforms with the cylinder gauge in most of the cases

**CAMS:** The knitting cams are hardened steels and they are the assembly of different cam plates so that a track for butt can be arranged. Each needle movement is obtained by means of cams acting on the needle butts. The upward movement of the needle is obtained by the rising cams or clearing cams. The rising cam places the needle at a certain level as it approaches the yarn area. Cams controlling the downward movement of the needles are called stitch cams.

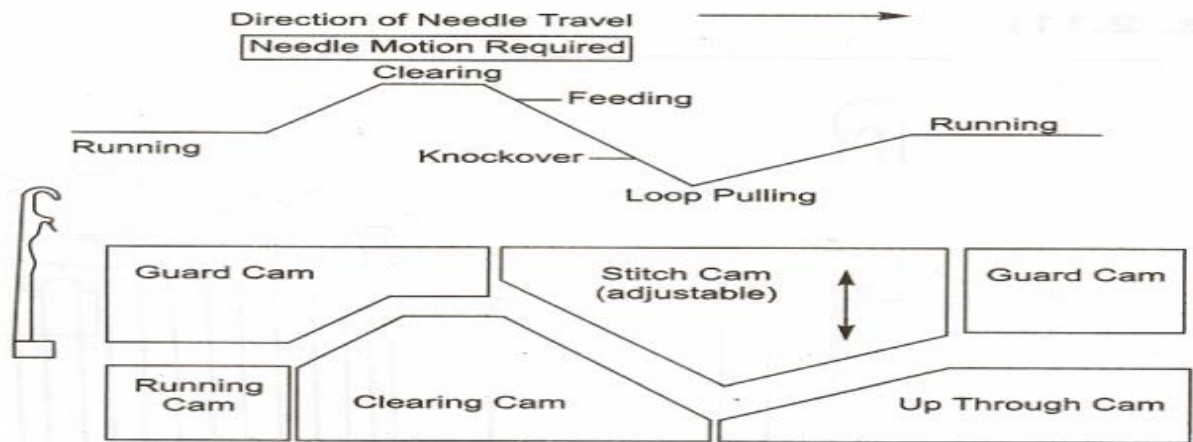


Fig 30 stitch cams.

The stitch cam draws the needle down below the knitting level, thereby drawing a loop formed by the fed yarn through the loop already on the needle. The lowest point to which the needle is drawn by the stitch cam is called the 'cast off' position. They are screwed to the cylindrical cam ring and are adjustable in vertical direction. If the stitch cam is raised, then shorter loop is drawn below the sinker level and a tighter fabric will result. With lowering of stitch cam, a reverse result is obtained. Guard cams keep the needle butts in their race-way. Running cams or (up throw cams) the needle butts at a low level until they meet the next rising cam.

**SINKERS OPERATION:** The held loop is positioned in the throat of the sinker when the sinker moves forward and the needle moves upward for clearing. The old loop is held by the throat and hence its movement along the needle is restricted. The sinker remains at its forward position when the needle attains its clearing position. The sinker retracts when the needle comes down after feeding. At this stage, due to sinkers retraction, fabric or held loop is eased out. Also the sinker belly supported the fabric or held loop and hence its movements along the needle is prevented. Sinker remains in backward position and the needle descends to its lowest position drawing the new loop through the old one. Before the needle ascends, the sinker moves forward to push the knitted fabric a little and to hold the old loop away from the head of the needle and to be in a position to control the fabric

**TAKE-UP MECHANISM:** This mechanism is bolted to the underside of the gear ring. The cloth is drawn from the sinkers between the two fluted rollers which exert a constant tension. Below the take-down is the cloth roll-up mechanism on the roller of which the knitted cloth is wound in a roll form.

## Self-check 2.

### Part I Short Answer

1. List four type of knitting structure?
2. Write about mechanism of flatbed knitting machine?
3. Mention parts of loop with diagram?
4. Draw technical face and back of knitted fabric?

### Part II Chose

1. Which one of the following is not part of loop
  - A. Head
  - B. Arm
  - C. Leg
  - D. all
2. which one of the following is types of knitted structure
  - A. Twill
  - B. Satin
  - C. Plain
  - D. twill
3. -----is method of fabric product by intermeshing of loop
  - A. Woven
  - B. Knitting
  - C. non-woven
  - D. breaded
4. Which of the following uses special needle
  - A. Plain
  - B. Rib
  - C. Interlock
  - D. Purl
5. Which of the following is not the function of sinker?
  - A. Knock-over

- B. Hold down
  - C. Loop formation
  - D. Intermeshing
6. Which one of the following is the heart of knitting?
- A. Cam
  - B. Sinker
  - C. Needle
  - D. Jack
7. Which of the following is the first to be produced?
- A. Latch needle
  - B. Beard needle
  - C. Compound needle
  - D. A&B
8. \_\_\_\_\_ is used to provide the versatility(flexibility) of latch needle selection and movement
- A. Sinker
  - B. Cam
  - C. Needle
  - D. Jack
9. The number of needles in one inch is\_\_\_\_\_
- A. Stitch density
  - B. Stitch lengt
  - C. Gauge
  - D. Needle arrangement
10. 10, The simplest rib structure is
- A. 2x2
  - B. 1x1
  - C. 1x2
  - D. 2x3
11. 11, in a knit, the length wise rows of stitches are called \_\_\_\_\_
- A. Course
  - B. Wales

- C. Warps
- D. none of the above

### Part III- Matching

- | <u>A</u>      | <u>B</u>   |
|---------------|--|
| 1. Cam        | A. Used For Knocking Over                          |
| 2. Sinker     | B. Fabric Density                                  |
| 3. Stich Dial | C. Used To Convert Rotation To Reciprocated Motion |
| 4. Inter Lock | D. Both Side Back Or Face                          |



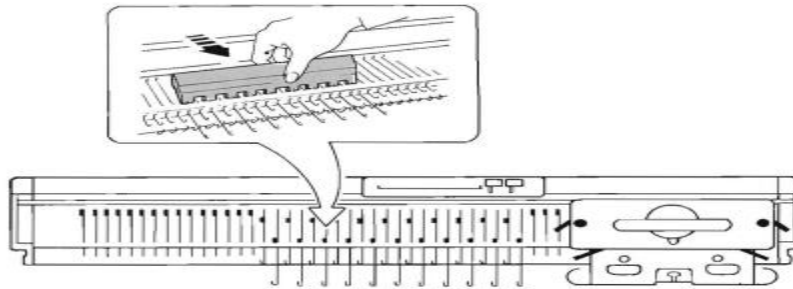
## Operation Sheet 2.1

**Purpose:** produce knitted sample

**Conditions or Situations for the Operations:** The operation process can be performed by following the procedure and steps.

**Equipment Tools and Materials:** For set up machines equipment and material needed are: - Safety tools like glove, goggle safety boot, yarn, flat bed machine and other equipment's.

Procedures:



**Fig 31. Needle selection**

**Step 1** Cast – on and knitting To cast- on push the required number of needles from A to D Position using— the straight side of the needle pusher. For practice, use 35 needles on both sides of center (0), 70 needles in total.

Set the carriage as follows

- Cam lever ----- 0
- Side Levers ----- I
- Russel Levers ----- II
- Weaving Knobs ----- 0

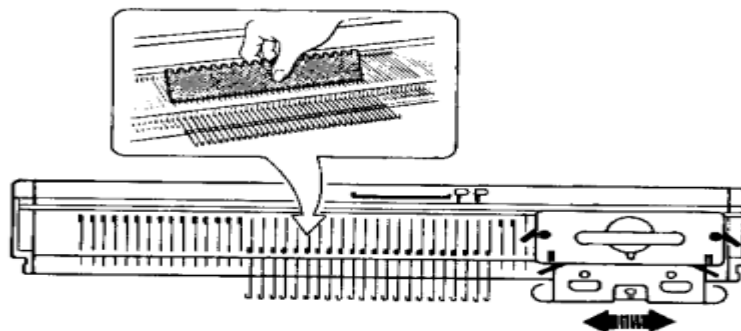


Fig. 32 all needle selection

Step 2 slowly move the carriage across the needles bed until it has passed all the needles

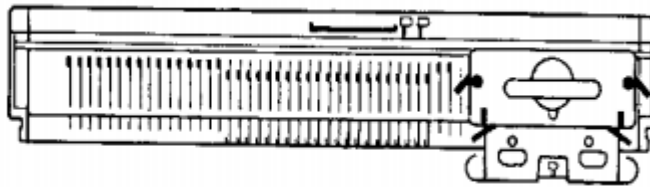


Fig. 33 movement of the carriage

Step 3 Using the 1/1 side of the needle pusher; push every alternate needle from B to D Position and set the weaving in to down position weaving knobs

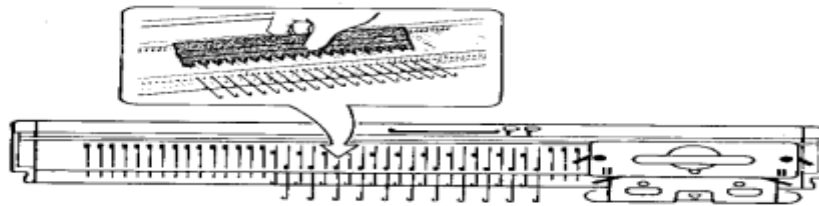


Fig.34 needle pusher

Step 4 Open the yarn feeder by moving the yarn feeder gate A to the left. Hold the yarn with both hands and slides it into the yarn feeder. Close the yarn feeder by moving the yarn feeder gate to the right.

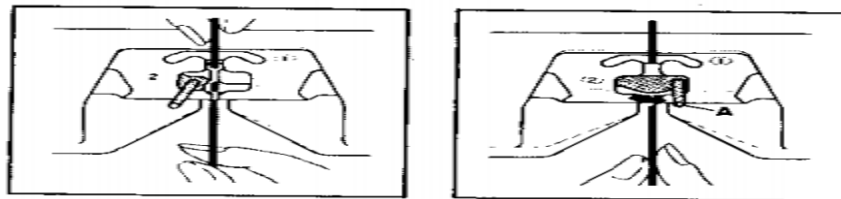


Fig. 35 yarn feeder

Step 6 Pull the yarn end from underneath the arm and lay it over all the needles in D position. Hold the yarn loosely at the left about 30 cm down from the needle bed. Eliminate slack yarn by pulling the yarn down at the back of the yarn rod until the Tension Spring is almost horizontal.

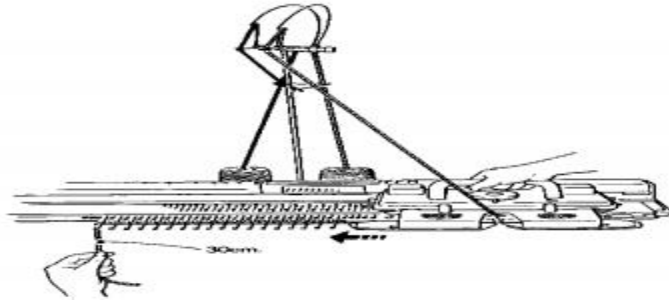


Fig 36. Tension spring

Step 7 Slowly move the carriage from right to left until it has passed all the needles to knit one row.

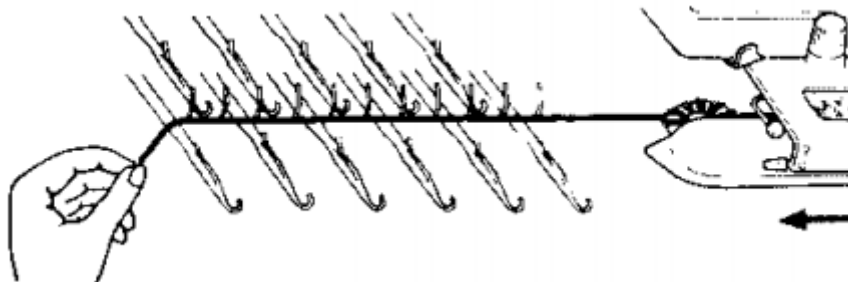


Fig 37 movement carriage

Step 8 Ensure that the arm has passed the last knitting needles by 2-3 cm. before beginning the next row. Continue to knit 2 – 3 rows cast – on has been finishes

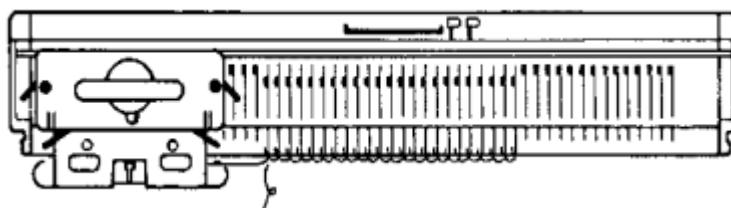


Fig 38 movement carriage

Step 9 Knitting stockinet Set the side levers at -V-- Weaving knobs at o. knit 4-5 rows Hang the claw weights at both edges of the knitting. Move the carriage from side to side to knit stockinet.

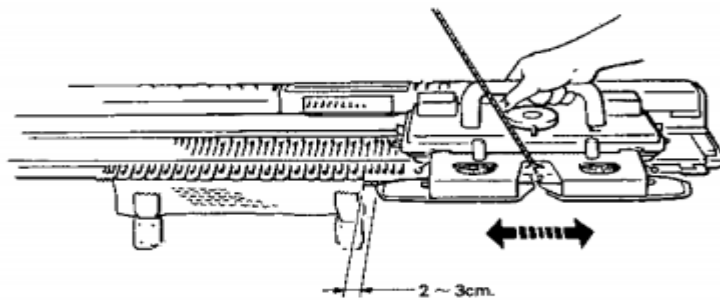


Fig 39 movement carriage

Step 10 Check point 2.1 Arm is attached to the carriage correctly.

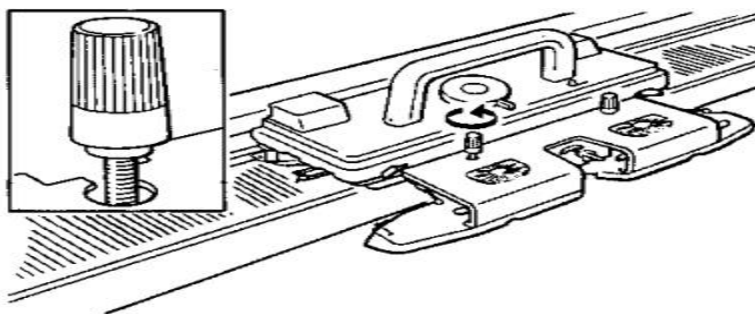


Fig 40 movement of carriage

Step 11 Yarn is threaded correctly through the auto tension and yarn feeder

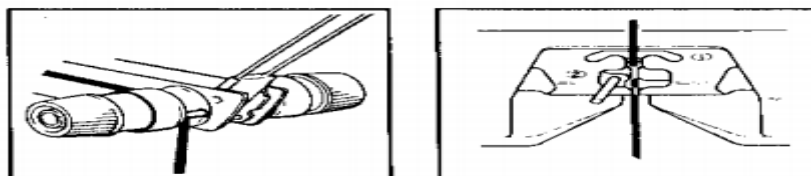


Fig 41 tension and yarn feeder

Step 12 Tension dial and stitch dial are set correctly



Fig. 42 Tension dial and stitch dial

Step 13 Yarn is wound correctly and Slack yarn is eliminated and Tension spring is almost horizontal.

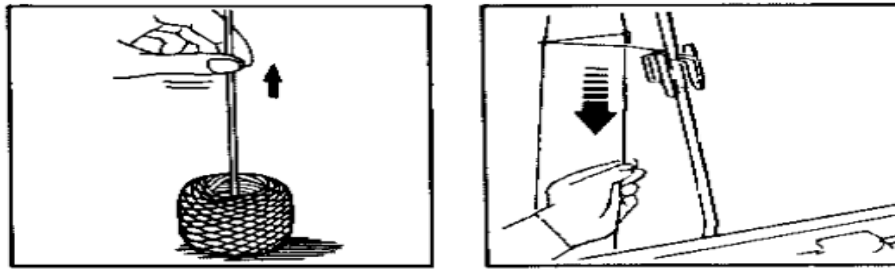


Fig. 43 yarn movement from con

Step 14 Arm has passed the last knitting needles by 2-3cm before knitting the next row

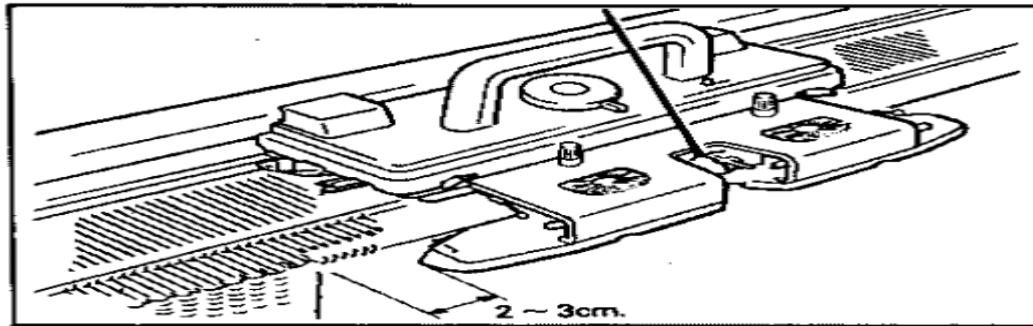


Fig. 44 Tension dial and stitch dial

## Lab test 2

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Time started: \_\_\_\_\_  
 Time finished: \_\_\_\_\_ Instructions: You are required to perform the following individually with the presence of your teacher.

Task 1: produced simple plain knitted fabric

Task 2: Identify fabric structure

### Unit three: Operate and monitor machine

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Operate and monitor knitting machine
- Minor Maintenance

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

- Set and operate machines
- Performing knitting machine operation
- Monitoring knitting machine
- Performing Minor Maintenance

### 3.1. Operate and monitor knitting machine

Monitoring offers constant oversight in your factory. An inspector is sent to the factory every day, providing daily reports on quality and production status. By receiving a daily report monitoring production quality, with detailed evidences, you have the information needed to make informed decisions and the response time to quickly adapt production and ensure the final goods meet your specifications. You receive a daily detailed report with systematic updates regarding production quality. Any variation to the knitting process needs to be investigated and corrected. Defects fall into this Category since when they appear repair is needed, which is time consuming and sometimes results in fabric rejection. Therefore monitoring is to be done starting from raw material selection, pre –processes, on process to final process and this intern resulted in ensuring the knitting production continuity.

#### 3.1.1. Reducing Yarn breakage the yarn breakage

During knitting operation is to be controlled and minimized as much as possible so as to ensure production continuity. Some of the systems used to do so are the following the quality yarn is to

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be used for knitting with respect to customer specification. The yarn feeders (yarn guides) must not be rough; instead they are to be made smooth by using different methods. The winding density of the yarn package must be within the required standard. The knitting yarn package must be loaded, and the yarn must be threaded correctly which will be within the required yarn tension. The yarn is to be properly wound on to reserve feeder so as to keep continues production. The attention of the operators must be sensitive to the knitting activities. The healthy working condition (oiling, cleaning, maintained regularly, stop motion, ventilator and others) of the knitting machines is to be checked on the regular bases.

### **3.1.2. Cone replacement**

This is the situation which is observed when yarn package exchange, changing the finished cone with the new one as soon as possible must be in the way that it does not affect the production significantly. This is done by making the operators skill full in changing the cone.

### **3.1.3. Inspection of raw materials**

The inspection team from textile knitting section can perform a visual inspection of products as available at the beginning of the production cycle against a client's specification and Purchase Order specifications. The "Initial Production Check" when combined with a "Final Random Inspection" and any other on-line production checks, helps in taking corrective actions at an early stage of production cycle. The inspection team will send out intermediary reports to the client and keep them informed about the production progress relative to the delivery terms. There are mainly three tools at the disposal of buyers, to check on the quality of their suppliers' products. Each buyer should try to choose the solution(s) that best fit(s) her/his needs.

**Pre-production inspection** "Garbage in, garbage out": a factory usually cannot turn defective inputs (components, or raw materials) into good products. And the problems are much harder to detect once the materials are embedded in the final product. Thus, to decrease quality risks, the inputs can be inspected prior to production. Some samples can be taken randomly and checked visually (or sent to a laboratory for tests). Also, the buyer should clearly define what inputs are acceptable, before he gives any order. An experienced inspector can also examine the making of a prototype/sample, to make sure of two things: I. Has the factory understood the technical files? Do they know what product the client wants? 19 II. Has the development team clearly communicated the requirements to the manufacturing team? Is the equipment for mass production similar to that used for making prototypes? Usually, production has already started



when a pre-production inspection takes place. It allows the inspector to examine the process, and sometimes to check a few finished products. However, in this case, the factory might refuse to stop production (to avoid disruption of the lines), even though the inputs are not conforming or the process is not satisfactory. Generally speaking, pre-production inspections are adapted to customized and complex products. More standard items should be inspected during production

**During production inspection** should a buyer wait until the end of production, before doing an inspection In case products are defective, the following problems might arise: I. The factory has to rework (loss of time). II. If the products cannot be repaired, the factory should re-order components, and re-produce (which means long delays, and a financial loss for the factory). III. The supplier might refuse to repair or re-produce, particularly if the previously-agreed specifications are ambiguous. Typically, in an in-line inspection, the first products that got out of the line are inspected for conformity. If issues are raised at this stage, the factory can immediately take some corrective actions and avoid delays. Also, based on the production start date and the number of products already finished, the buyer can have a fair idea about the shipment schedule. A third advantage of in-line inspections is that the buyer knows where the goods are produced. Some suppliers show a factory to a buyer, and then sub-contract the production in another workshop (this happens every day in China) Note: some companies make a distinction between inspections performed at the beginning of production and inspections during production. 20 'During Production Check' allows evaluation of the average product quality during manufacturing. What it means is that third-party inspectors can either check the first finished products getting out of the line, or come in at a later stage and select samples from a larger pool of finished goods. In any case, in-process products are rarely checked. It takes a technician to reliably detect errors on unfinished products.

**Final random inspection** this is the most popular type of quality inspection for importers. It takes place once all the products are finished and ready for shipment. Note: A "packed product" is ready for shipment (i.e. in a closed export carton with full shipping marks). In many cases, the inspector accepts up to 20% of unpacked products per reference. This way, the inspection can often take place without delaying the shipment. The conformity of the products is checked against a list of criteria defined by the buyer (product quantity, workmanship, function, safety, aspect, and size, packing...). Buyers are advised to ask their inspectors to keep track of which cartons were opened. This way, a 2nd "spot" inspection can give an idea of how seriously the control was performed. Of the three inspections presented in this article, this is the only one



where the total quantity of products can be counted, and where samples of finished products can be drawn in a truly random manner--and thus be representative of the whole batch. As a result, the results of final inspections are more reliable. And some buyers assume that the inspectors should "guarantee" the quality of the whole order quantity, when the inspection is passed. Unfortunately, it is impossible for several reasons: I. After the inspection is done, and before shipment, many things can happen. A dishonest factory can ship a smaller quantity; substitute the content of the cartons, etc. There is a solution to avoid this: a container-loading supervision. II. An inspection result (pass/fail) is not 100% reliable: even a random sample might be better than the average products; the inspector might make a mistake; an inspector might get bribed by the supplier, etc. . An inspection fee (usually USD300 for one day) is totally out of proportion with the total value of the goods at stake.

#### 3.1.4. Identification, correction and reporting

Production faults any variation to the knitting process needs to be investigated and corrected. Defects fall into this category. Since when they appear, repair is needed, which is time consuming and sometimes results in fabric rejection? Fabric defect detection has been a long-felt need in the textile and apparel industry. Surveys carried out as early as 1975[1] show that inadequate or inaccurate inspection of fabrics has led to fabric defects being missed out, which has in turn had great effects on the quality and subsequent costs of the fabric finishing and garment manufacturing processes. Therefore the production faults are identified first clearly, if these faults can corrected by nearby concerned person thereby correction is done .if the fault are cannot be corrected by the nearby concerned person, and then it has to be reported to the concerned production man. Generally all the faults faced by the lower production person are to be reported all to the concerned person in detail.

### 3.2. Minor Maintenance

#### What is maintenance?

Maintenance is an action or actions to retain or restore the desired (required) state of as well as to asses and determine the actual state of technical means of a system.

The main objective or function of maintenance is to assure that plant or installations are available in a good or satisfactory condition for operation. Having well organized and properly performed

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maintenance one can expect the following out comings or benefits Before we go to the benefits let's briefly see what does well organized maintenance department has in it in order to facilitate successful work and expect the positive results.

- Good plan: - maintenance is a process which can be done well only when it is planed based on the existing facts of the organization.
- Well studied and balanced man power.
- Adequate maintenance tools and equipments.
- Error! Not a valid link. Time given for maintenance.
- Adequate space to do repair and maintenance work.
- Well equipped and systematically controlled maintenance store. ....etc

Organizing the above alone certainly doesn't mean we have done everything, rather the organization should properly operate and the plan be implemented to have the desired results. Many practical examples show that well equipped organizations having beautiful plans and schedules fail to enjoy the benefits of good maintenance. The benefits then are:-

- Increase in productivity of labor
- Increase in quality of products
- Minimize operation cost
- Less man power
- Less spare parts used
- Minimize power consumption
- Safe working condition

#### **Factors of evaluation for organizing good maintenance**

- The performance of maintenance can be judged by the condition of machinery as indicated by the following factors
- Performance: Machines must be capable of performing the function for which they are intended.
- Down time: Machine down time must be at an acceptable level
- Service life: Machine must provide a satisfactory return on investment before replacement become necessary.
- Efficiency : machine must operate at an acceptable level of efficiency

- **Safety :** Machines must operate safely and not dangerous for personnel
- **Environmental impact:** Machines must operate in a manner that is not detrimental ( harm full) to the environment or to adjacent plant or equipment.
- **Cost:** The cost of maintenance must be acceptable.

Maintenance is not only repair or planned preventive action but also improvement and modification of equipment.

The two major reasons to do modification are:

1. Continuous improvement of equipment operational or technological capacity.
2. Repeated and registered failure on particular part or parts of a machine. The procedure of decision for modification will be discussed later in corrective maintenance.

Modification includes:

- **Changing of materials** For example changing of steel made gear to cast iron made to get some advantage.
- **Changing of mechanisms:** changing of lap feeding system of the carding machine to chute feeding and/ or comb doffing to roller doffing system or gear transmission to belt transmission.
- **Changing of properties of materials** to increase their wear potential. This can be done by different treatments be it physical or mechanical to change the property of the same material. For example heat treatment.

### Different types of maintenance

Types of maintenance can be

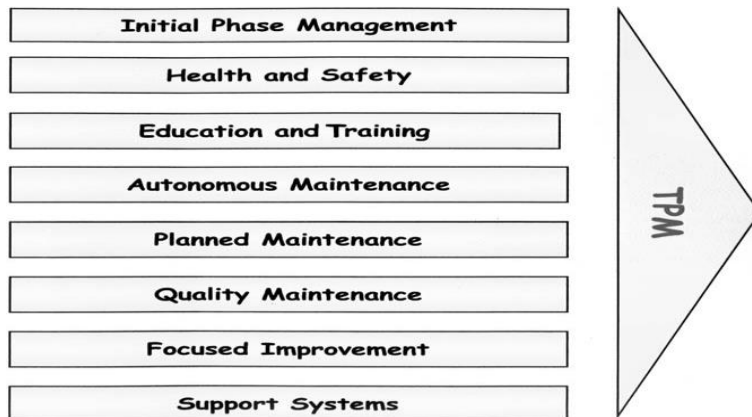
- Preventive
- Productive
- Predictive
- Break down
- Corrective

**Preventive maintenance** It is a daily maintenance ( cleaning, inspection, oiling and re-tightening ), design to keep the healthy condition of equipment and prevent failure through the prevention of deterioration, periodic inspection or equipment condition diagnosis, to measure deterioration. It is further divided into periodic maintenance and predictive maintenance. Just

like human life is extended by preventive medicine, the equipment service life can be prolonged by doing preventive maintenance.

**Productive maintenance** The goal of the productive maintenance program is to markedly increase production while, at the same time, increasing employee morale and job satisfaction.

For example the total productive maintenance tries to be based on various pillars they are:



**Predictive maintenance** This is a method in which the service life of important part is predicted based on inspection or diagnosis, in order to use the parts to the limit of their service life. Compared to periodic maintenance, predictive maintenance is condition based maintenance. It manages trend values, by measuring and analyzing data about deterioration and employs a surveillance system, designed to monitor conditions through an on-line system.

**Breakdown maintenance** It means that people waits until equipment fails and repair it. Such a thing could be used when the equipment failure does not significantly affect the operation or production or generate any significant loss other than repair cost.

**Corrective maintenance** It improves equipment and its components so that preventive maintenance can be carried out reliably. Equipment with design weakness must be redesigned to improve reliability or improving maintainability

The maintenance function is performed mainly in two ways.

- I. By prevention of break down.
- II. By the repair of break down.

### **Prevention of break down**

Prevention of break down holds the most important part of seccesful maintenance and can be achieved through two ways.

1. Routine servicing between scheduled works
2. periodic scheduled repair.

Generally the action included in prevention can be mentioned as follows: Preparation of plan for preventive maintenance adjusted to the specific requirements of the respective plant or installation. Preparation for execution (every thing required for the implementation) Execution Feed back which ultimately composes the machine history or log book.

### Self-check three

#### Part I- Short Answer

1. mention at least three type of maintenance type
2. define monitoring
3. write the benefits of good maintenance

#### Part II- Multiple Choice

1. ----- means that people waits until equipment fails and repair it
  - A. Preparation meaintenance
  - B. Predictive maintenance
  - C. Breakdown maintenance
  - D. all
2. \_\_\_\_\_ This is the most popular type of quality inspection for importers.
  - A. preventive inspection
  - B. Final random inspection
  - C. Pre-production inspection
  - D. All

#### Part III- Matching

A

B

- |               |   |
|---------------|---|
| 1. Preventive | A. preventive maintenance can be carried out reliably.            |
| 2. Productive | B. that people waits until equipment fails and repair             |
| 3. Predictiv  | C. maintenance ( cleaning, inspection, oiling and re-tightening), |
| 4. Break down | D. increasing employee morale and job satisfaction.               |
| 5. Corrective | E. based on inspection or diagnosis,                              |

## Operation sheet 3.1

**Operational title:** perform minor maintenance

**Purpose:** To correct the defect

**Conditions or Situations for the Operations:** The operation process can be performed by following the procedure and steps.

**Equipment Tools and Materials:** For set up machines equipment and material needed are: - Safety tools like glove, goggle safety boot, yarn, flat bed machine and other equipment's.

### Procedures:

To replace a damaged needle Needle with damaged latch or absent needle will cause incorrect knitting or dropped stitches. The needle latch "A" must move smoothly and lie flat over the hook "B".

Step 1 at each side of the needle Bed, you can see the Needle Retainer C". If the damaged needle IS at the left half of Needle Bed, place the Carnage at right side and using a pencil "O" push the Needle Retainer at its left plastic end. The Needle Retainer is then pushed out or the Needle Bed at the right end and you can pull it out of Needle Bed until the damaged needle lies free.

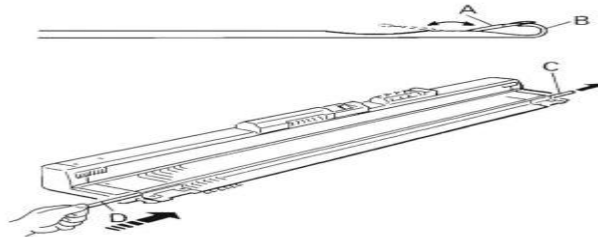


Fig. needle Bed

Step 2 Push the damaged need Close the latch "A" I.e. 10 0 position b will then com and press the hook "BX :rising lies hull "[" e out of the needle own. The shank "F": groove.

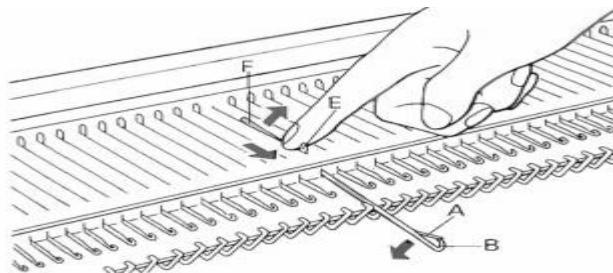


Fig. Close the latch

Step3 Lift up the needle by holding the butt and pull it to remove from the needle bed

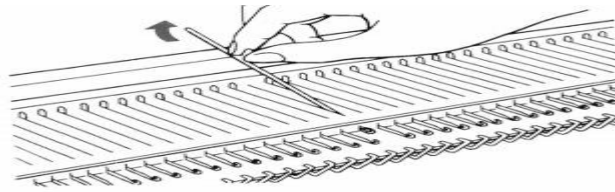
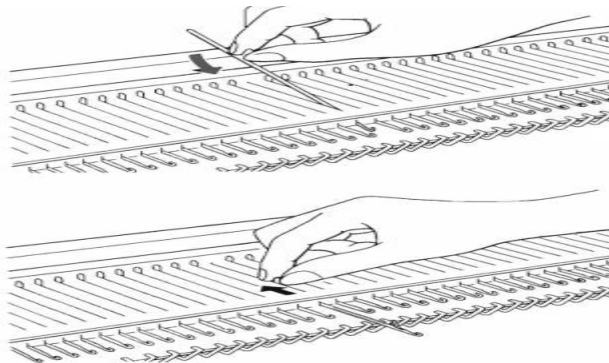
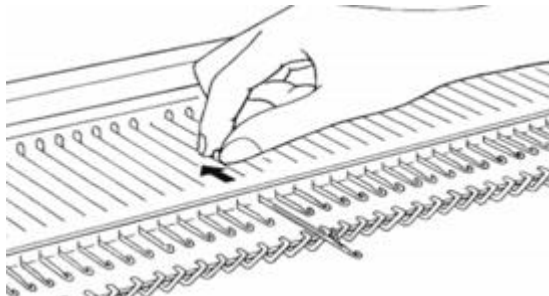


Fig. holding the butt

- To replace anew needle. Open it the latch and slide it I n to needle grove until the hook comes after the front opening of the needle bed
- To replace anew needle. Open it the latch and slide it I n to needle grove until the hook comes after the front opening of the needle bed



- Push the button back to A position by holding the butt



- Push the needle retainer back to needle bed

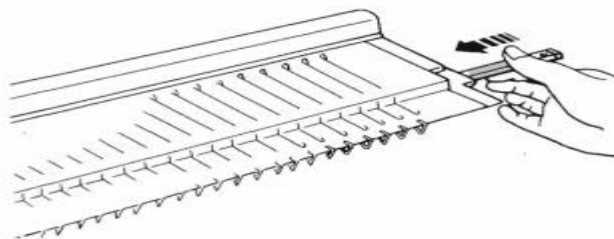
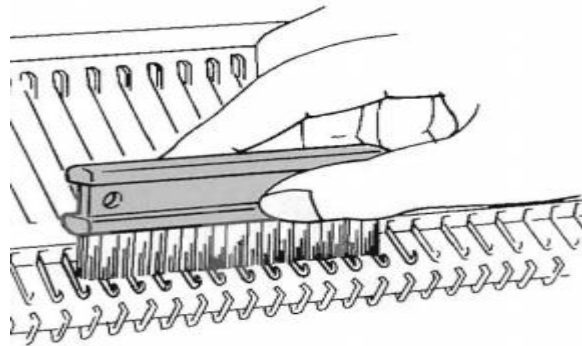


Fig. needle change



Step 4 To clean your knitting machine remove the carriage from the needle bed Needle bed remove all lint's using the cleaning brush



Step 5 Apply oil along the rail and front guide of the needle bed with an oil soft cloth. Wipe needle butts

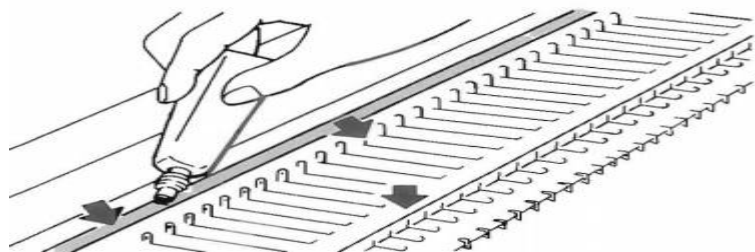


Fig apply oil

Step 6 Turn over the carriage and brush off all fluff and oil the side of the metal parts and slider and carriage pipe. Wipe the places indicated by the dotted line in the diagram with a piece of oil cloth. Mount the carriage on the needle bed

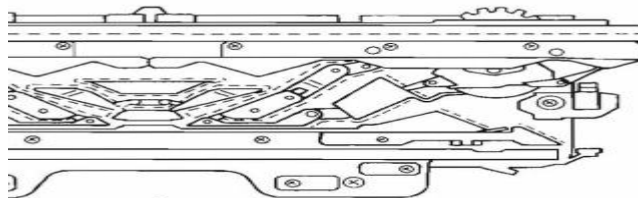


Fig. cam

Step 7 Replace the accessories in the accessory box. Remove the auto tension and arm from the knitter and pack them inside the top cover



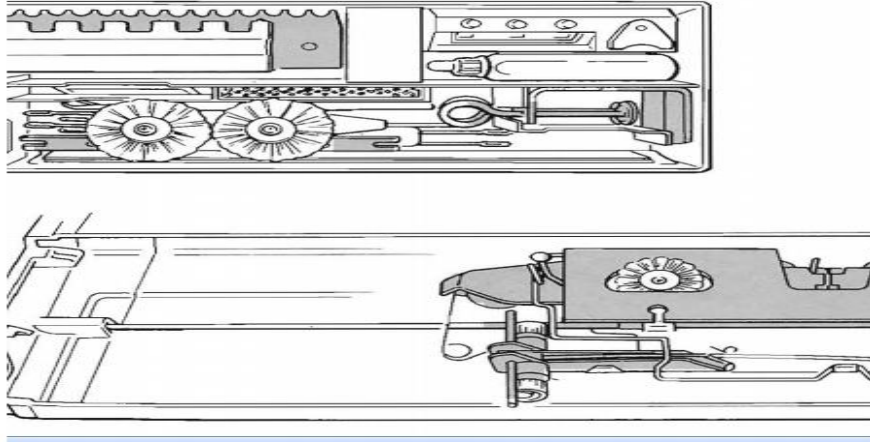


Fig. accessory box

### Lap test 3.1.

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Time started:

\_\_\_\_\_ Time finished: \_\_\_\_\_ Instructions: You are required to

perform the following individually with the presence of your teacher

Task 1.

1. Performing minor maintenance

## Unit four: Check product quality

This unit is developed to provide you the necessary information regarding the following content coverage and topic

- Testing product quality parameter's
- Knitted Product Fault

This unit will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

Identify Knitted Product Fault

Identify Machine element fault

Identify Raw material fault

Identify Operators fault

Testing product quality parameter's

### 4.4. Testing product quality parameter's

Quality is the main ingredient in a product that delights the customer either by meeting or exceeding his expectations. Quality can be defined as a combination of the characteristics or properties of a product that make the product.

Nowadays, where ever you go it seems that you are always hearing the word 'quality' especially in relation to the requirements of 'ISO9000' but even though these have become everyday words, they are often misused, misquoted and misunderstood. But why is this? Well, normally you will find that when most people talk about the quality of an object, they are talking about its excellence, perfection and/or value. In reality, of course, they should be taking about how much it meets its designed purpose and comes up to the manufacturer's or suppliers' original specifications.

## QUALITY SYSTEM MANUAL

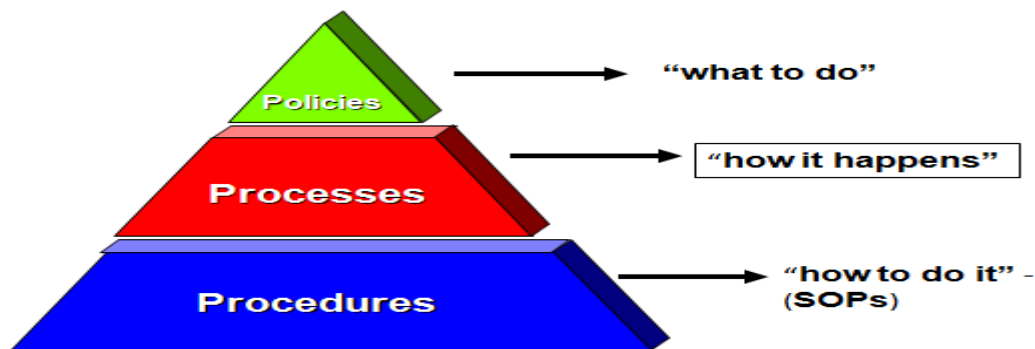


Fig 45 quality system manual

### 4.1.1. Determination of Knitted fabric construction, Course length, Stitch density and Fabric count

#### A. Construction

Easier to identify than woven fabrics Knitted fabric structure fall into 4 general categories:

- weft knit fabrics without Wales
- weft knit fabrics with Wales on one side( made with one set of knitting needles)
- weft knit fabrics with Wales on both sides( made with two set of needle )
- Warp knit fabrics (Wales on one side) Heavier warp knit – Rachel fabrics

#### B. Course length

If the fabric has been knitted on a flat machine, a thread is removed from a full width of fabric. If it has been knitted on a circular machine the fabric sample is slit along its length, opened out and a thread removed from the full width of the sample. The straightened length of the thread is then measured using a course length tester. This allows long length of yarn to be measured under sufficient tension to remove crimp created by the loop distortions.

#### C. Stitch length

First the course length is measured as described above. If only a small sample of fabric is available a procedure similar to that for determining linear density is used. Two parallel slits are cut in the fabric at a convenient distance apart length of thread is removed from b/n the slits and its straightened length measured using a course length tester. The stitch length is then calculated:

**Stitch length = (course length)/No. of loops in fabric width**

Or

**Stitch length = (straightened length)/No. of loops in thread**

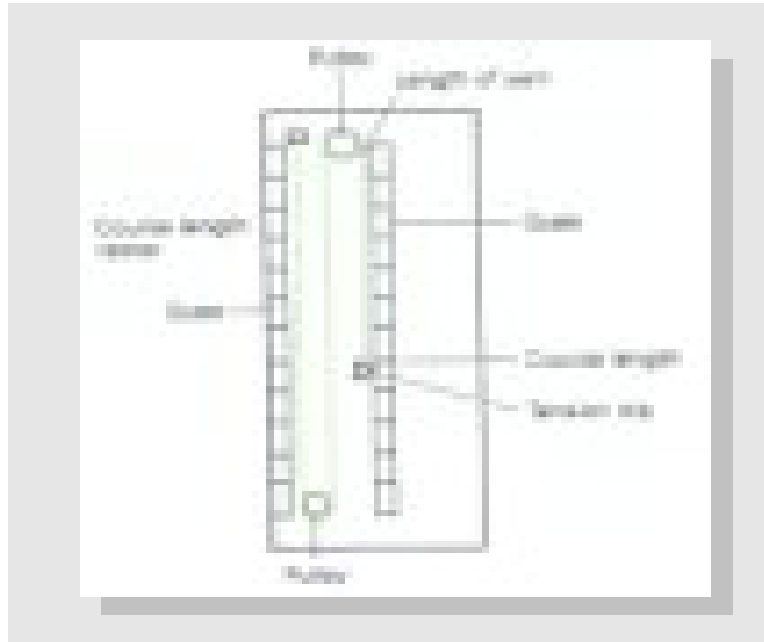


Figure 46 determination of course length

#### D. Knitted FABRIC COUNT

Determination using ASTM Procedure Part D 3887 -80

Fabric lies flat without tension ,and free of folds or wrinkles are very important with knits For fabrics with more than 25 courses / Wales per inch ,the recommendation is to determine the number of loops “ in a space not less than 5 centimeters (2 inches “ at 5 different locations in the laboratory sample”. For fabrics with fewer than 25 Wales /courses per inch, the count should be across a 10 centimeter or 4 inch width. **Report:** In both results are reported per inch and averages should be rounded to the nearest 0.1 course or wale. In general the number of Wales per inch in knit fabric dependents on the cut (needles per inch at knitting machine) & crosswise tension exerted on the fabric after knitting. Course counts depend greatly on the yarn tension and amount of yarn fed during knitting the number of Wales per inch is rough the same as or somewhat higher than the cut.

#### 4.1.2. Fabric Dimension

##### a) Length

It may be necessary to measure the length of a large piece of fabric in order to know how much has been produced by the manufacturer or how much has been delivered to a customer. The strains imposed during manufacturing and processing may affect the length of a fabric and some recovery may occur during storage. Before measurement are made the fabric should be unrolled and stored without tension, preferably in a standard atmosphere. The fabric is paced on a large table under minimum tension and folded so that it contains no creases, starting one end marks are made on the selvage every five meters, using a meter rule as a measure. The end portion is measured to the nearest ten millimeters and the total length is calculated.

$$l = 5N + fm$$

Where; l= total length

N= number of marks

f= length of end section

**NB:** Devices are available for rapid measurement of length. The fabric is passed continuously through rollers which grip the selvage causing the rollers to rotate and operate a length meter.

#### B Width

It is important to know, if the width of a fabric is correct so that when it is made into garments the patterns will fit across the width without too much waste. Some finishing processes change the width of the machine state (grey) fabric .The fabric is placed at full width on a large table so it is free from creases. The width is measured using a meter rule ,at ten places spaced equally the piece ,taking care not to stretch the fabric.

#### c) Thickness

Specimen fabric are placed b/n two small flat plates (feet)and the distance between the plate is measured. A small pressure is applied to flatten the surface fibers .The pressure applied depends on the type of fabric under test. There are also different standard pressure foot areas for different types of fabric (thin fabrics: small are; thick fabrics: large area), with modern instrument the feet are initially set wide apart. The specimen is placed b/n them and the distance gradually decreased, so increasing the pressure on the specimen. When the pressure reaches preset value a light a light switch on. The thickness at this pressure is measured by the dial gauge operated by moving foot. The gauge is sensitive to 0.001milimetrs.

#### d/ mass per unit area

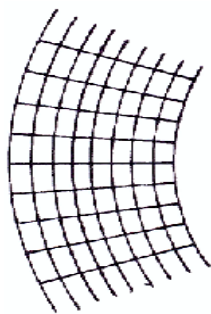
As absorbed moisture affects both mass and dimensions,it is important to precondition samples and carry out measurements in a standard atmosphere. Mass per unit area is expressed in grams

per square meter ( $\text{gm}^{-2}$ ), but it is not necessary to measure square meter of fabric. A relatively small specimen is cut-out, usually 10x10 centimeters, with aid of template circular cutters are also available which cut out –the same area ( $10\text{cm} \times 10\text{cm} = 100 \text{ cm}^2$ ), then the specimen is weighed accurately. Using this area of specimen:

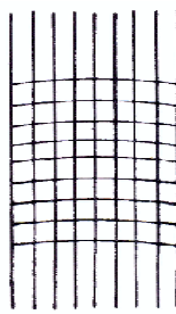
$$\text{mass per unit area} = \text{specimen mass(g)} \times 100 (\text{gm}^{-2})$$

Bowing( knitting)- a fault in knitted fabric consisting of curvature of the fabric courses, imposed during knitting or subsequent operations.

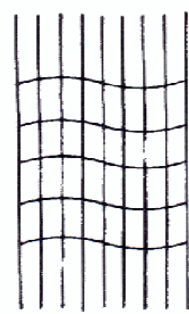
Bow/skew( weaving) –Curvature of the warp or weft in the cloth. The cloth is said to be warp or weft –bowed according to which the set of threads is curved



a) warp bow



b) weft bow



c) double bow

Figure 47 bow

Course spiralis (weft knitting)-The inclination of courses from the horizontal, i.e. across the fabric, caused by multiple feeds on a circular knitting machine. Fabrics made on circular knitting machine have an inclination of the courses to the Wales. This should not be confused with spiraled.

## 4.2. Knitted Product Fault

### 4.2.1. Assess product faults and non-conformity

Knitting machine is widely used throughout the knitting industry to produce fabric. It has been designed and manufactured for mass production of knitted fabrics. The special properties of knitted fabrics, especially fine fabrics made by the circular knitting process. Among them huge positive this knitting machine also has some problems and limitations. Many faults and defects occurred during knitting. These faults and defects are given below

**Needle line:** - lengthwise streak in knitted goods caused by improper alignment of a needle or its incorrect spacing cause the needle lines. This is caused by needle movement due to a tight fit in its slot or a defective sinke

#### 4.2.2. Machine element and operator fault

##### Defects from Machine Setting Defects from Knitting Equipment

Some defects come from first time machine for a new style or faulty machine set up. The main defects that occur from the machine setup are listed below.

- Unevenness
- Brocken ends
- Lycra out
- Missing yarn
- Hole
- Fabric press
- Spiraled
- Brocken stitch
- Needle line
- Sinker mark
- Drop stitch



Fig 48 Defects from Machine Setting

**Needle line:** - lengthwise streak in knitted goods caused by improper alignment of a needle or its incorrect spacing cause the needle lines. This is caused by needle movement due to a tight fit in its slot or a defective sinker

**Barre:** - is an unintentional repetitive visual pattern of continuous bars and stripes usually parallel to the filling of woven fabric or to the courses of circular knitted fabric. Mixing of yarns of different lots or counts variation, color variation, yarn linear density variation, yarn twist variation, yarn hairiness variation, knitting tension variation, improper mixing of cotton from different origin, improper mixing of cotton from different varieties and improper mixing of cotton grown in different seasons, difference in tension between the feed packages, yarns/filaments of different elongation properties fed without proper control of tensions,

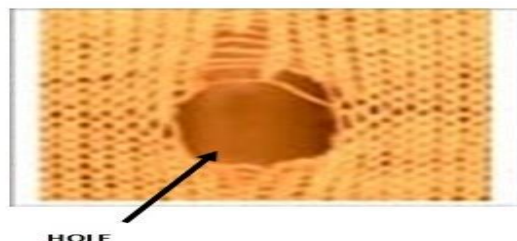


improper stitching cam setting, uneven take down pull, over stretching of fabrics and exposing of cones to sunlight of a long time are the main causes of barre attributed to knitting operation. Barre can be caused by physical, optical or dye differences in the yarns, geometric differences in the fabric structure or by any combination of these differences



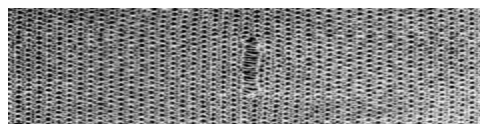
**Fig 49 barrier fault**

**Holes in fabric:** - is the result of a broken yarn at a specific needle feed so that knitting cannot occur. Fluff accumulation on the knitting creel if fall on the needle zone, or the knots and slabs if present in the yarn are the main reasons for holes in the fabric. Yarn imperfections in which one or several yarns are sufficiently damaged to create an opening also contribute to this problem. A good and clean working area is very essential. The blowing or suction fans can be provided to prevent fluff accumulation on the cones, yarn and the knitting area.



**Fig 50 hole in fabric**

**Dropped stitch:** - Defect in knitted fabric; recurrent openings in one or more wales of a length of knitted fabric because the stitches did not knit.



**Fig 51 dropped stitch**

Drop Stitches (Holes) Drop Stitches are randomly appearing small or big holes of the, same or different size, which appear as defects, in the Knitted fabric

**Causes:**

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High Yarn Tension Yarn Overfeed or Underfeed High Fabric Take Down Tension

Obstructions in the yarn passage, due to the clogging of eyelets, yarn guides & tension discs, with wax & fluff etc. Defects like; Slubs, Naps, Knots etc.

Incorrect gap between the Dial & Cylinder rings.



**Fig. 51 drop stitches**

### **Remedies:**

Ensure uniform yarn tension on all the feeders, with a Tension Meter. Rate of yarn feed should be strictly regulated, as per the required Stitch Length.

The fabric tube should be just like a fully inflated balloon, not too tight or too slack. Eyelets & the Yarn Guides, should not have, any fibers, fluff & wax etc. stuck in them. The yarn being used, should have no imperfections, like; Slabs, Naps& big knots etc

The gap between the Cylinder & the Dial should, be correctly adjusted, as per the knitted loop size.

### **Streakiness**

**Causes:** Yarn slippage on the IRO Pulley, due to the yarn slipping in & out from underneath the IRO Belt, due to a tilted IRO Pulley. Worn out IRO belts, yarn guides & eyelets etc. Faulty winding of the yarn packages Yarn running out of the belt, on the IRO Pulley.

**Remedies:** Ensure very smooth, clean & obstruction free passage of the yarn, through the eyelets, yarn & tension discs etc. No cuts or rough surfaces, in the Porcelain Eyelets, Yarn Guides & the Yarn Feeder holes etc. Flawless winding of the, Yarn Package (The yarn coils should unwind smoothly, without any obstruction) The yarn should be running under the IRO belt, between the belt & around the IRO pulley.

### **Contaminations**

**Causes:** Presence of dead fibers & other foreign materials, such as; dyed fibers, husk & synthetic fibers etc. Dead Fibers appear in the fabric, as a result of the, presence of excessive immature Cotton fibers, in the Cotton fiber crop Dead fibers do not pick up color during Dyeing. Presence of the foreign materials, in the, staple fiber mixing (Kitty, Husk, Broken Seeds, dyed fibers & fibers like Poly Propylene, Polyester, Viscose etc)Dyed & other types of fibers flying from the

adjacent Knitting machines cling, to the yarn being used for knitting & get, embedded in the Grey Fabric.

**Remedies:** Use rich fiber mixing for the yarns, to be used for Knitting, in order to have less dead fibers, appearing in the fabric. Rigid control measures in the Blow Room, to prevent the mixing of foreign matters in the Cotton mixing. Segregate the Spinning & Knitting Machines, with Plastic Curtains or Mosquito Nets, to prevent the fibers flying from the neighboring machines, from getting embedded in the yarn / fabric.

Needle Lines

**Causes:** Bent Latches, Needle Hooks & Needle stems Tight Needles in the grooves

Wrong Needle selection (Wrong sequence of needles, put in the Cylinder or Dial)

**Remedies:** Inspect the grey fabric on the knitting machine for any Needle lines. Replace all the defective needles having, bent latches, hooks or stems. Remove the fibers accumulated in, the Needle tricks (grooves). Replace any bent Needles, running tight in the tricks. Check the Needle filling sequence in the Cylinder / Dial grooves (tricks).

**Sinker Lines**

**Causes:** Bent or Worn out Sinkers Sinkers being tight in, the Sinker Ring grooves

**Remedies:** Replace, all the worn out or bent sinkers, causing Sinker lines in the fabric.

Sinker lines are very fine & feeble vertical lines, appearing in the fabric. Remove the fibers, clogging the Sinker tricks (Grooves)

**Oil Lines**

**Causes:** Fibers & fluff accumulated in the needle tricks, which remain soaked with oil.

Excessive oiling of the, needle beds.

**Remedies:** Fibers, accumulated in the needle tricks, cause the oil to seep into the Fabric.

Some lubricating oils are not washable & cannot be removed during Scouring. Oil lines appear in the fabric, in the lengthwise direction, even after dyeing. Remove all the Needles & the Sinkers of the machine, periodically. Clean the grooves of the Cylinder & Dial of the machine thoroughly, with petrol. Blow the grooves of the Cylinder, Dial & Sinker ring, with dry air after cleaning

## Surface Hairiness & Piling

**Causes** Abrasion due to the contact with rough surface Excessive surface hairiness caused, due to the abrasive tumbling action (Fabric friction in the Tumble Dryer) Rough Dyeing process & abrasive machine surfaces (Soft Flow Machine tubes, Tumble Dryer drum etc.) Reprocessing of the fabric is, also a major cause of piling.

**Remedies:** Avoid using the Tumble Dryer. (Control shrinkage by maximum fabric relaxation & over feed in the processing) Regularly inspect the fabric contact points on all the machines, for any rough & sharp surfaces. (Rectify, if found rough) Avoid repeated reprocessing of the fabrics. Use anti pilling chemical treatments for the fabrics, prone to pilling.

## Bowing

Bowing appears as, rows of courses or yarn dyed stripes, forming a bow shape, along the fabric width

**Causes:** Uneven distribution of tensions, across the fabric width while, dyeing or finishing the fabric.

**Remedies** Bowing can be corrected, by reprocessing the fabric feeding it from the opposite end.

A special machine (MAHLO) is also available for, correcting the bowing in the knitted fabrics

The main defects that occur from yarn are listed below.

- Thick and thin
- Slub
- Hairiness
- Knots
- Excessive weak and hard yarn
- Spun in fly
- Kitties
- Mix yarn
- Oily slub
- Loose yarn
- Slough off
- Unevenness
- Lot mixing
- Splice

## Barrines

**Causes:** High Yarn Tension Count Variation Mixing of the yarn lots Package hardness variation

**Remedies:** Ensure uniform Yarn Tension on all the feeders. The average Count variation in the lot, should not be more than  $\pm 0.3$  Ensure that the yarn being used for Knitting is of the same Lot

/ Merge no. Ensure that the hardness of, all the yarn packages, is uniform, using a hardness tester.

### Snarls

Snarls appear on the fabric surface, in the form of big loops of yarn getting twisted, due to the high twist in the yarn (Unbalanced twist yarn).

**Causes:** High, twist in the, yarn. Hosiery yarns are soft twisted. High, twist in the yarn, is the cause of snarling.(Snarls cause, fabric defects & needle breakages)

**Remedies:** Ensure using Hosiery Yarns, of the recommended T.P.M. only.(Hold a few inches of the yarn in both the hands, in the form of a ‘U’.The yarn has a balanced twist, if it doesn’t tend to rotate or turn, in the form of a snarl.(Such yarn can be used for Hosiery applications

### 4. Defects from Dyeing

Most of the important defect come from the dyeing process. The main defects that occur from dyeing are listed below.

- Dull shade
- Poor color fastness
- Shade variation
- Color bleeding
- Crease mark
- Softener mark
- Rope mark
- Crocking
- Narre
- Tonal variation
- Colorfaddin

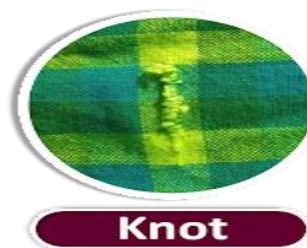


Fig 52 Defects From Dyeing

## 5. Defects from Finishing

Some defect comes from dyeing finishing process. The main defects that occur from dyeing are listed below.

- Bowing
- Servility
- High shrinkage
- GSM variation
- Tonal variation
- Skewing or bias
- Loose thread
- Fold mark
- Squeezer mark
- Water mark
- Pinhole
- Pilling
- Inadequate pressing

## Self-check -4

### Part I- Short Answer

1 How do you manage quality in knitting operation?

2 list at list four defect come from the dyeing process

### Part I- Matching

A

1. \_\_\_ Defects from Dyeing
2. \_\_\_ Defects from Finishing
3. \_\_\_ Defects from Machine Setting
4. \_\_\_ Defect occur from yarn

B

- A. Water mark
- B. Color bleeding
- C. Hole
- D. Hairiness



## Unit five : Readjust machine setting to meet requirements

This unit is developed to provide you the necessary information regarding the following content coverage and topic

- Machine maintenance and repair techniques

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

- Maintain Machine maintenance and repair techniques

## 5.1. Machine maintenance and repair techniques

The idea behind manufacturing specifications is to define those measurement values which correspond to conforming items. That is, when the measurement falls within the manufacturing specifications we want to be able to say that the product is within the customer specifications. In the absence of measurement error we could achieve this objective by simply using the customer specifications as the manufacturing specifications. But when we have to make allowance for measurement error there will need to be some gap between the manufacturing specifications and the customer specifications. How to determine the size of the gap,  $D$ , and the kind of statements that we can make about the product is the topic of this paper.

### 5.1.1. Readjust machine settings to meet requirements

The idea behind manufacturing specifications is to define those measurement values which correspond to conforming items. That is, when the measurement falls within the manufacturing specifications we want to be able to say that the product is within the customer specifications. In the absence of measurement error we could achieve this objective by simply using the customer specifications as the manufacturing specifications. But when we have to make allowance for measurement error there will need to be some gap between the manufacturing specifications and the customer specifications. How to determine the size of the gap,  $D$ , and the kind of statements that we can make about the product is the topic of this paper. Of product lifecycle management.

Specification (technical standard)

There are different types of specifications, which generally are mostly types of documents, forms or orders or relates to information in databases. The word specification is defined as "to state explicitly or in detail" or "to be specific". A specification may refer to a type of technical standard. Using a word "specification" without additional information to what kind of specification you refer to is confusing and considered bad practice within systems engineering.

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Using a word "specification" without additional information to what kind of specification you refer to is confusing and considered bad practice within systems engineering.

Technical specification as described in this article. A "in-service" or "maintained as" specification, specifies the conditions of a system or object after years of operation, including the effects of wear and maintenance (configuration changes). Specifications may also refer to technical standards, which may be developed by any of various kinds of organizations, both public and private. Example organization types include a corporation, a consortium (a small group of corporations), a trade association (an industry-wide group of corporations), a national government (including its military, regulatory agencies, and national laboratories and institutes), a professional association (society), a purpose-made standards organization such as ISO, or vendor-neutral developed generic requirements. It is common for one organization to refer to (reference, call out, cite) the standards of another. Voluntary standards may become mandatory if adopted by a government or business contract.

In engineering, manufacturing, and business, it is vital for suppliers, purchasers, and users of materials, products, or services to understand and agree upon all requirements. A specification is a type of a standard which is often referenced by a contract or procurement document. It provides the necessary details about the specific requirements.

Specifications may be written by government agencies, standards organizations (ASTM, ISO, CEN, DoD, etc.), trade associations, corporations, and others.

A product specification does not necessarily prove a product to be correct or useful. An item might be verified to comply with a specification or stamped with a specification number: This does not, by itself, indicate that the item is fit for any particular use. The people who use the item (engineers, trade unions, etc.) or specify the item (building codes, government, industry, etc.) have the responsibility to consider the choice of available specifications, specify the correct one, enforce compliance, and use the item correctly. Validation of suitability is necessary.

Sometimes a guide or a standard operating procedure is available to help write and format a good specification. A specification might include: Descriptive title,

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number, identifier, etc. of the specification Date of last effective revision and revision designation A logo or trademark to indicate the document copyright, ownership and origin

However errors due to file name encoding incompatibilities have always existed, due to a lack of minimum set of common specification between software hoped to be inter- operable between various file system drivers, operating systems, network protocols, and thousands of software packages.

### Self-Check 5

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## Part I- Short Answer

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

1. Define the word specification?
2. What is product specification?
3. What is the importance/needs/ of specification in manufacturing industries?

## Unit six : Complete knitting process

This unit is developed to provide you the necessary information regarding the following content coverage and topic

- . product doffing mechanism
- packaging and labeling

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

- .check product doffing mechanism
- Perform packaging and labeling
- .perform product dispatching
- Perform House keeping

### 6.1. Doffing the product

When the knitting machines fabric can become full ensure that they are wound till the required length and width

- Check the package is fully wound to the predetermined specification and start doffing.
- If the required length is not achieved, fix the cone on the machine and continue the process to achieve the required weight and then doff the cone.
- If excess area is observed, take it for rewinding to reduce the area to the desired level as instructed by supervisor.
- Follow the instructions of supervisor/Jobber to stop the machine for doffing or doff the package while the machine is running..
- Keep the hard waste removed during doffing in separate waste collection boxes.

#### 6.1.1. Sorting waste

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At the end of any operation cleaning the work area is very important to ensure the work environment is maintained in a safe and productive manner by applying kaizen and 5 S procedures.

- Collect the wastes at regular intervals as instructed by shift in charge
- Collect the waste from the centralized waste collection systems when it is full
- Collect the hard wastes from waste collection box
- Make sure that the yarn and fabric wastes are falling in respective waste collection bags.  
Clean all the half needle and damaged cops in the particular shift itself.
- Ensure safety while carrying out cleaning activities.
- Clean the wastes in the alley around the spinning Machine area.
- Transport the wastes to the designated place
- Keep the waste category wise and avoid mix-up
- Transfer the wastes to waste go down & Weigh the wastes and record in register.

#### **6.1.2. Clean the machines**

Machine should be cleaned before and after use according to the standard for quality product and specification.

Clean the different mechanisms in the machine at the scheduled interval as instructed.

- Periodically clean the parts like drum brush as instructed
- Ensure the waxing discs are clean.
- Keep the wastes in waste bags, piercer bags, or in needle.
- Clean the waste accumulation from different parts of the machine from time to time. Use proper tools for cleaning.



## 6.2. Packaging and labeling

### 6.2.1. Packaging definition

Knitting packaging is the procedure of wrapping, compressing, filling or creating of goods for the purpose of protection too their appropriate handling. This is the concluding procedure inward the production knitted, which prepares the finished trade for delivery to the customer. It is an of import part of the knitted fabric manufacturing process. Packaging refers to the container that carries a product. Two basic objectives of packaging are preventing whatever impairment to the production during shipping too enhancing the features of the production to the consumer for a sale of it.

Packaging has 2 major functions:

- Distribution
- Merchandising

The primary purpose of distribution packaging is packaging the garment inward a agency that it allows the garment manufacturers to carry the garment at a minimum toll too inward the shortest fourth dimension to the retailer or purchaser, without deteriorating the character of the product. The merchandising business office deals amongst showcasing the garment production inward a agency that it stimulates consumer wishing for purchasing the detail product.

### Requirement

The plastic bags are almost commonly used for knitted fabric packing either at the completion of production or when they construct it at the finished goods stores. Apparel such every bit shirts too underwear is usually bagged too boxed right away later concluding inspection too enters the stores inward pre packed form. Other hanging knitted fabric woven fabric and other garment are usually bagged when they learn into the stores. The packed garment boxes are sealed past times contact adhesive newspaper

### 6.2.2. Labeling

**Definition:** Labeling is a part of branding and enables product identification. It is printed information that is bonded to the product for recognition and provides detailed information about the product. Customers make the decision easily at the point of purchase seeing the labeling of the product. Labels must comply with the legal obligations.

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## Types of Labeling

There are different types of labels:



**Brand label:** It plays an important role in labeling as it gives information about the brand. It can be removable or non-removable.

**Descriptive label:** It specifies product usage.

**Grade label:** It describes the aspect and features of the product.

Common label has a specific purpose and carries some kind of information

### Brand or Main Label:

Main labels indicate a Brand name or Brand Logo of the company that sources and sells clothes. Brand labels play a big role to customers as because customers only know the brand and they buy the brand. A brand level is associated with the product quality, durability and feel good factor. Like, we go buy Levis jeans and Tommy Hilfiger for shirts and Polo shirts, Zara for dresses etc.

### Size Label:

Size label defines a specific set of measurements of the human body. Sizes labels may be printed only a later to denote a specific size. The customer knows which size fits them well. When a customer goes for shopping, s/he picks garment according to his/her size that fit him/her well.

### Care Label:

This label includes wash care and ironing instruction. For details of wash care instructions refer fabric. Fiber contents are also included in care labels. i.e. 40% Poly and 60% Cotton Country of Origin: Name of the country that manufactured the particular product is also written on care label. Like, Made in India, Made in Italy.

### **Batch Mark Label:**

A label that indicates which sewing line or batch had made the particular garment. This label normally is not asked by buyers or brands. Few garment manufacturers add this label to the internal quality inspection process and rectify which line had made the garment and which checker had checked the same. This label is normally attached at side seam under wash care label.

### **Special Label:**

100% Cotton, Organic Cotton is an example of such special labels. Special labels normally attached to draw customer attention at the time of purchasing

### **Knitted fabric Labeling Requirement**

- Material contents
- Country of origin
- Manufacturer details
- Care instruction of the Garments

### **Important of labeling**

#### **• Functions of Labeling:**

The different functions of labeling are as follows

1. Defines the product and its contents
2. Recognition of product
3. Assorting of products
4. Assists promotion of products
5. In compliance with the law

### **Importance of labeling**

1. Labeling is significant as it fetches customers' attention to purchase the product because of visual appeal.
2. It promotes the sale of the product as it can make or break the sale of a product.
3. Labeling is an important factor in the sale of a product. It helps in grading and provides information required by the law.

## Self-check-6

### Test-I Matching

Instruction: select the correct answer for the give choice

A	B
-----1. Functions of Labeling	A. use for coats, blazer, pants
-----2. Functions of packaging	B. Attractiveness
-----3. Brand or Main Label	C. Use Shirt, sportswear, trouser
-----4. Flat pack	D. Assorting of products
-----5. Hanger pack	Material contents
-----6. knitted fabric Labeling Requirement	E. indicate a Brand name or Brand Logo of the company

### Test II: short Answer writing

**Instruction:** write short answer for the given question.

1. Mention function of garment packaging and labeling?
2. Explain types of knitted labeling and their uses?
3. What are **Packing List Documents in textile Sector?**
4. List at least 5 Information provided inward packing carton boxes.

### Test III: Multiple choices

**Instruction:** select the correct answer from the given choices. You are provided 3 minute for each question and each point has 5Points.

1. ----- is **bonded to the product for recognition and provides detailed information about the product.**

A. Packaging      B. Labeling      C. Folding      D. sewing

2. ----- defines a specific set of measurements size the human body.

A. Care Label      B. Size Label      C. Main Label      D. Special Label

## Unit seven : Maintain records

This unit is developed to provide you the necessary information regarding the following content coverage and topic

- Develop Product check list
- Record and report

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

Developing Product check list

Recoding and reporting

- Prepare Develop Product check list
- Check Record and report

### 7.1. Develop Product check list

Documentation is a set of documents provided on paper, or online, or on digital or analog media, such as audio tape. Examples are user guides, white papers, on-line help, quick-reference guides. It is becoming less common to see paper (hard-copy) documentation. Documentation is distributed via websites, software products, and other on-line applications. Professionals educated in this field are termed document lists. This field changed its name to information science in 1968, but some uses of the term documentation still exists and there have been efforts to reintroduce the term

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documentation as a field of study.

Procedures and techniques of documentation the procedures of documentation vary from one sector, or one type, to another. In general, these may involve document drafting, formatting, submitting, reviewing, approving, distributing, reposting and tracking, etc., and are convened by associated SOPs in a regulatory industry. Documentation should be easy to read and understand. If it's too long and too wordy, it may be misunderstood or ignored. Clear, Short, Familiar words should be used to a maximum of 15 words to a sentence. Only gender hyper neutral word should be used and cultural biases should be avoided. Procedures should be numbered when they are to be performed

Producing documentation Technical writers and corporate communicators are professionals whose field and work is documentation. Ideally, technical writers have a background in both the subject matter and also in writing and managing content (information architecture). Technical writers more commonly collaborate with subject matter experts (SMEs), such as engineers, medical professionals, or other types of clients to define and then create content (documentation) that meets the user's needs. Corporate communications includes other types of written documentation that is required for most companies. IDENTIFY RECORDS

In every workplace you are required to identify and keep records. The records that you are required to keep will be determined by your job tasks. This workbook will discuss and provide examples and formative assessments for a range of commonly used records such as physical records, preparing and processing basic financial transactions, establishing and maintaining a cashbook and reconciling and preparing invoices. In businesses, in the rural and regional sectors of Australia, the industry sectors can be quite varied. However the record keeping and administration requirements have many common factors related to the:

- Types of records
- Legislative requirement
- Ethical standards

Technology and equipment used both the physical and financial records of the

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business are vital for planning purposes, meeting legislative requirements and the efficient operation of the business on a daily basis. By having a better understanding of what records to keep and how to keep records, you will gain the skills and knowledge to participate in your workplace more efficiently and effectively. You cannot rely on your memory, so you need to record your physical and financial transactions. Through this process we are able to:

The 4 basic rules for record keeping are:

- Useful — don't waste your time keeping records you will never use.
- Easy to use — Simple and neat to encourage you to use the system.
- Accurate — Bad records can lead to poor decisions.
- Compulsory — These are the records you are required to keep by

Documentation gives substance to a workplace's activities not only for legal matters, audits, or disputes, but also for rules and regulations. It keeps our center running systematically and ethically. It would be very difficult for employees, and supervisors remember everything on a daily basis. When we document it removes, doubt, confusion, and misquoted information. There are several key reasons we should always document in the workplace Documentation establishes patterns of behavior. When you document all conflicts with employee, you establish a pattern of behavior. Your record of incidents, meetings and confrontations serves as an indication of the nature of the employee's relationship with management. If you eventually are forced to terminate the employee, you have a history of the employee's behavior and this will support your action. There will be times you have to have difficult conversations with your staff, based on the documentation you keep on them. Documentation leads to better decision making. The process of having to stop and document conflicts helps slow the process down and gives the manager time to consider what actions are appropriate. When you document and process what has happened, helps the manager see the problem more objectively. In addition, the manager can review the dispute and make level head recommendations. Documentation can prevent a lawsuit. Documentation also gives us the ability to have another account of a situation, other than verbal. If it's not in writing, it didn't happen" Documentation can help win

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a lawsuit. Courts expect documentation, and your detailed accounts will show the court that you are professional and have given thought to the disciplinary actions you have taken. This kind of evidence can sway a judge in your favor. Documentation is a very powerful tool that each of us should use daily. When you are in a pressured situation and can't document at that time, it will be in your best interest to write down key notes at your earliest.

## Self-Check-7 Written Test

Answer all the questions listed below.

1. What is documentation?
2. What is the important of documentation?
3. What are the procedures of documentation?
4. Who needs to access the records?
5. Why do I keep the records and how do I need to use the records in future?
6. How long do I need to retain records?

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