



Government of India
Ministry of Textiles
Textiles Committee



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Chapter 1

BASICS OF TEXTILES

1.1. Textile Fibres:

Textile fiber is a material mainly made from natural or synthetic sources. This material will be converted into the making of textile yarns and fabrics; woven, knitted, nonwoven, and carpets. It may be in a form of a pliable hair like strand or as the smallest visible unit of textile production.

1.2. Yarn:

Yarn is a long continuous length of interlocked fibres, suitable for use in the production of textiles, sewing, crocheting, knitting, weaving, embroidery, or rope making.

1.2.1. Yarn Count:

Yarn count is the numerical expression of yarn, which defines its fineness or coarseness. (Linear density).

1.2.2. Yarn Count System:

Indirect system: English Count (Ne), Worsted Count etc.

i.e. Higher the yarn number, finer the yarn.

Direct System: Tex, Denier

i.e. Higher the yarn number, Coarser the yarn.

➤ **Note:** English (Ne) count system is commonly followed in India.

English Count: No. of Hanks of length 840 yds weighing in 1 pound

1 yds: 0.9144 mtr

1 lbs: 0.453 Kg

e.g. 40^sNe = 40 hanks of 840 yds weighs 1 lbs.

20^sNe = 20 hanks of 840 yds weighs 1 lbs.

1.3. What is Warp Knitting: Warp Knitting is a method of forming a fabric in which the loops are made in vertical way along the length of the fabric from each warp yarns and intermeshing of loops take place in a flat form of length wise basis.

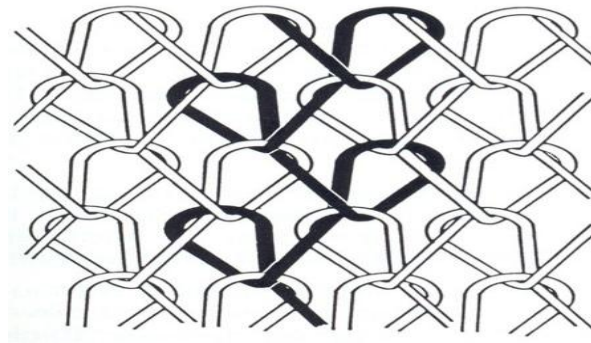


Figure: Warp Knitted Fabric Structure - Overall

The Under Lap: The under lap shog occurs across the side of the needles remote from the hooks, on the front of single bar and in the center of double bar needle machines, it supplies the yarn between one overlap and the next. So, under lap is a length of yarn in a warp knitted fabric that connects two overlaps in consecutive courses. Under laps as well as overlaps are essential in all warp knitted structures in order to join the wales of loops together, but they may be contributed by a different guide bar to those for the overlaps.

The overlap: The overlap is a shog usually across one needle hook by a warp guide which forms the warp yarn into the head of the loop. The swinging movement of the guide to the hook side and the return swing after the overlap produce the two side limbs or legs of the loop which has a very similar appearance on the face side of the fabric to a needle loop produced by weft knitting. So, overlap is a length of yarn in a warp knitted fabric that has been placed over the needle during loop formation.

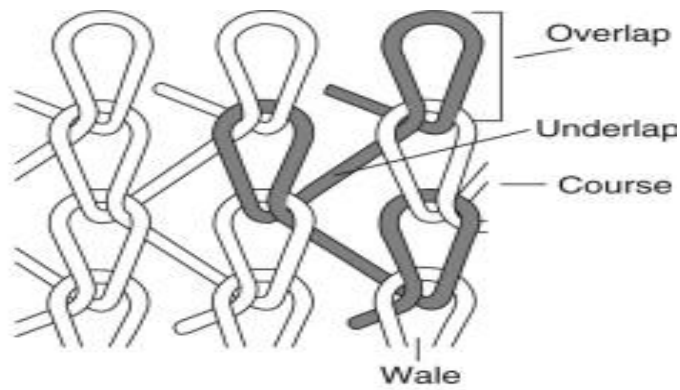


Figure: Warp Knitted Structure

- i. **Braiding:** in textiles, machine or hand method of interlacing three or more yarns or bias-cut cloth strips in such a way that they cross one another and are laid together in diagonal formation, forming a narrow strip of flat or tubular fabric. The word plaiting is generally applied when such materials as rope or straw are employed.



Figure: Braided Fabric

Chapter 2

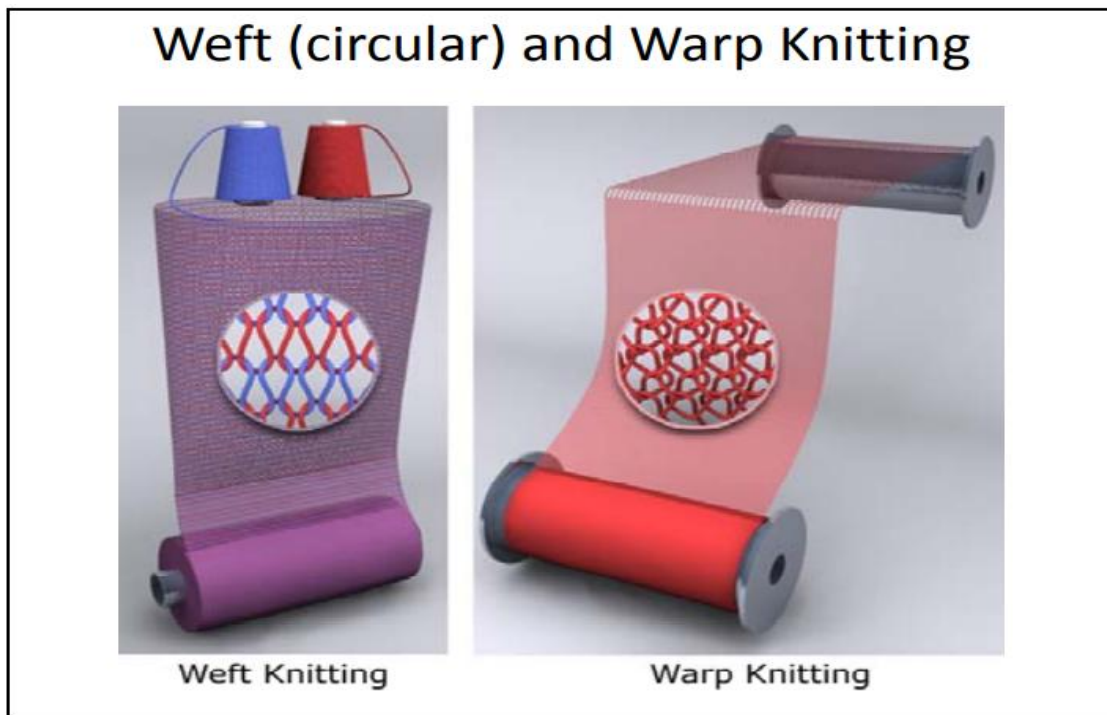
BASICS OF KNITTING

2.1. Basics of Knitting:

Knitting is the intermeshing or inter-looping of single yarn or single set of yarns to produce knitted fabric. Knitting is a process of manufacturing a fabric by intermeshing of loops of yarns.

The number of needles present in one inch is called machine gauge. It is denoted by G or E. e.g. 15 G - gauge machine means Its having 15 needles / inch

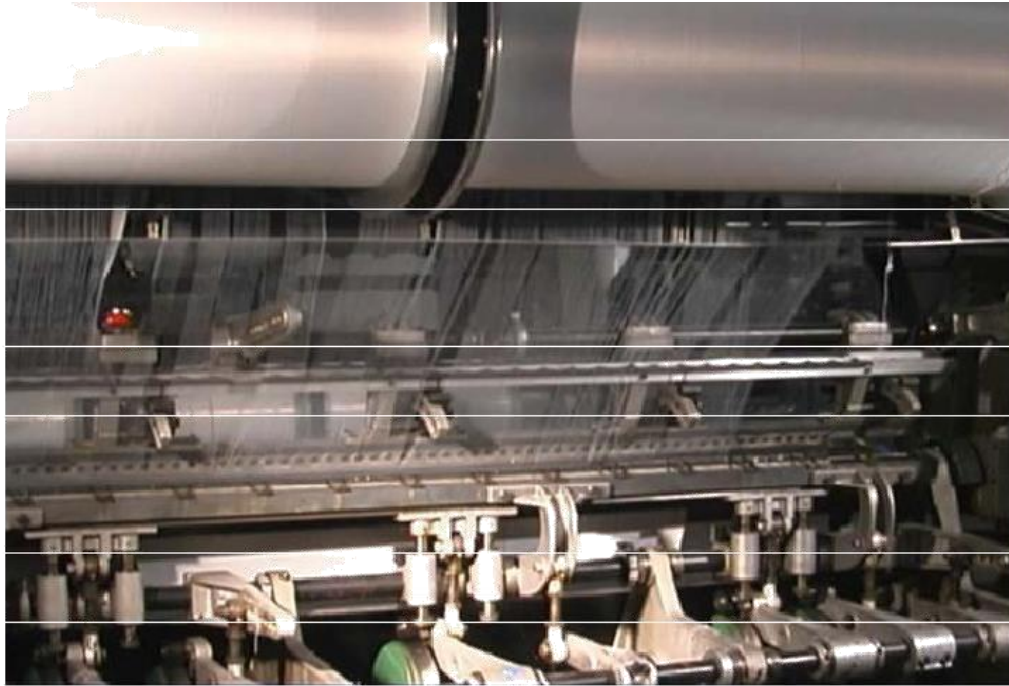
There are mainly two basic knit structures viz. **Weft knitting** and **Warp knitting** as detailed in the below table.



Warp Knits	Weft Knits
Tricot Knit	Plain Jersey Knit
Raschel Knit	Purl Knit
Crochet Knit	Rib Knit
Milanese Knit	Patterned Knits
	Double Knits

2.2. About Warp Knitting Machine Operations:

Warp knitting m/c is one kind of flatbed m/c. This m/c produces the knitted loops in wales direction. There are two major classes of warp knitting m/c. They are the 'Tricot' & the 'Raschel' warp knitting m/c. The 'Tricot' warp knitting m/c is also termed as automatic warp knitting of its function.



2.3. Warp Knitting Machine Parts:

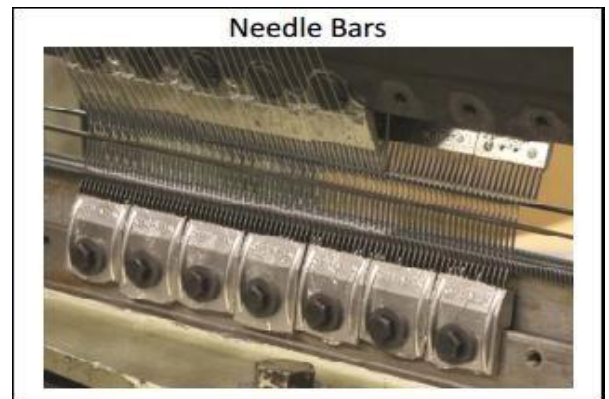
2.3.1. Guide Bars:

Guide bars are supplied with yarn from each warp beam shaft. All the yarns from one row or shaft of beams is typically threaded through one individual guide bar.



2.3.2. Needle Bars:

The needle bar is composed of leads containing needles. A sufficient number of leads will be attached to the needle bar to establish a certain fabric width. During machine operation, a needle bar will be rising to engage the yarns and then descends to form the yarn into knit loops.



2.3.3. Latch Needles:

The latch of the needle depends, for its knitting operation, on the yarn. The loop within the hook opens the latch when the needle rises to the clearing position and closes it when the needle descends for knockover. A broken yarn causes a needle to be void of yarn, and hence, the latch stays closed, so that no loops can be formed. Such a needle has to be opened manually in order to allow loop formation to resume.



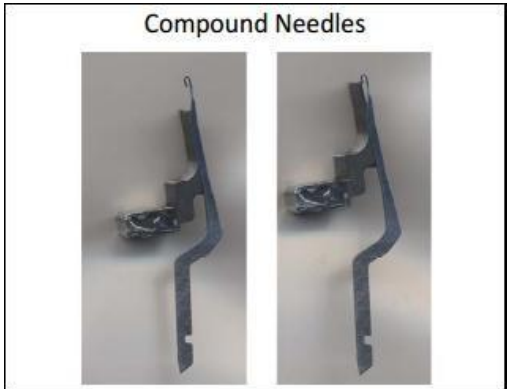
2.3.4. Bearded Needles:

The bearded needle has a stem, around which the needle loop is formed. The needle head is where the stem is turned into a hook to draw the new loop through the old loop. The beard is the curved downward continuation of the hook that is used to separate the trapped new loop inside from the old loop as it slides off the needle beard. The eye or groove of the needle

is cut in the stem to receive the tip point of the beard when it is pressed, thus enclosing the new loop.

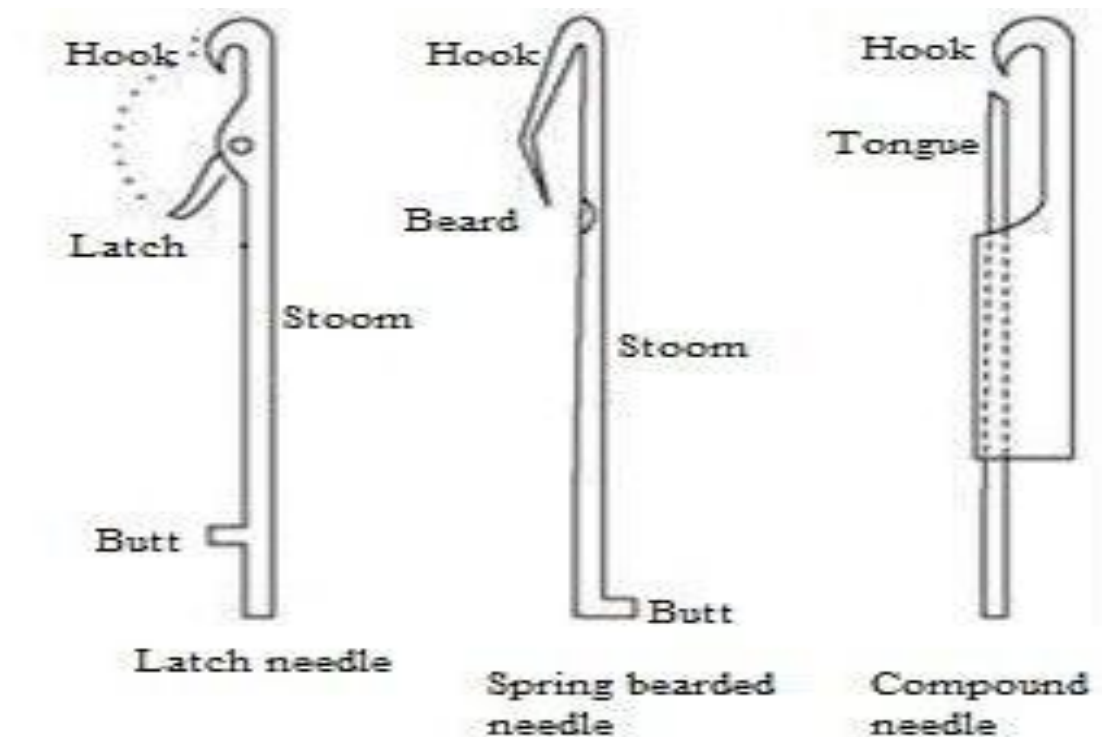
2.3.5. Compound Needles:

Compound needles consist of two separately controlled parts – the open hook and the sliding closing element. The two parts rise and fall as a single unit but, at the top of the rise, the hook moves faster to open the hook and at the start of the fall the hook descends faster to close the hook.



2.3.6. Compound Needles Type 2:

Some types of compound needles have the sliding element in a lead and they protrude through hollow stems in the needle hooks, which are also contained in leads.



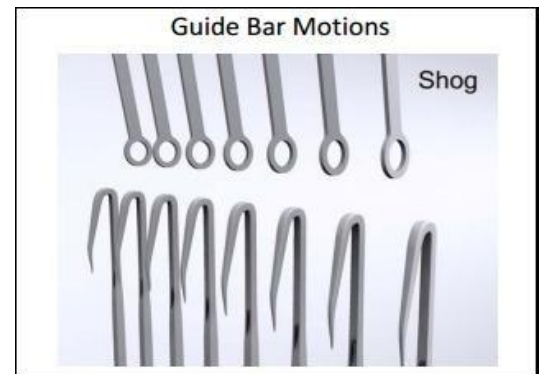
2.3.7. Hold Bar:

This is attached to the fixed needle bar and is used to hold the fabric as it leaves the needles.

The distance from fixed needle bar is adjusted according to the thickness of the fabric produced.

2.3.8. Guide Bar Motions:

The guides of the guide bar are required to execute a compound movement, composed of two separately derived motions. A swinging motion and a shogging movement act at right-angles to each other in order for their yarns to form overlap and underlap paths that combine as one yarn path around the needles.



Chapter 3

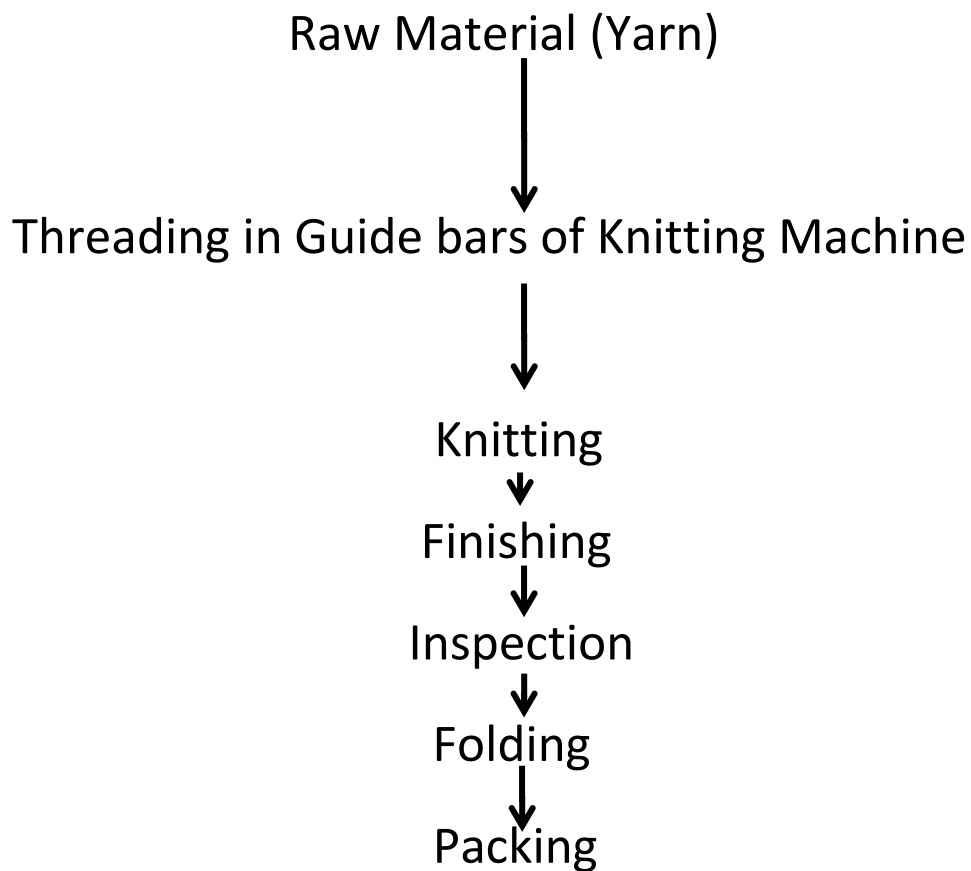
CROCHET KNITTING MACHINE

3.1. Crochet Knitting Machine:



3.2. Flow Chart of Crochet Knitting:

Flow Chart of Crochet Knitting



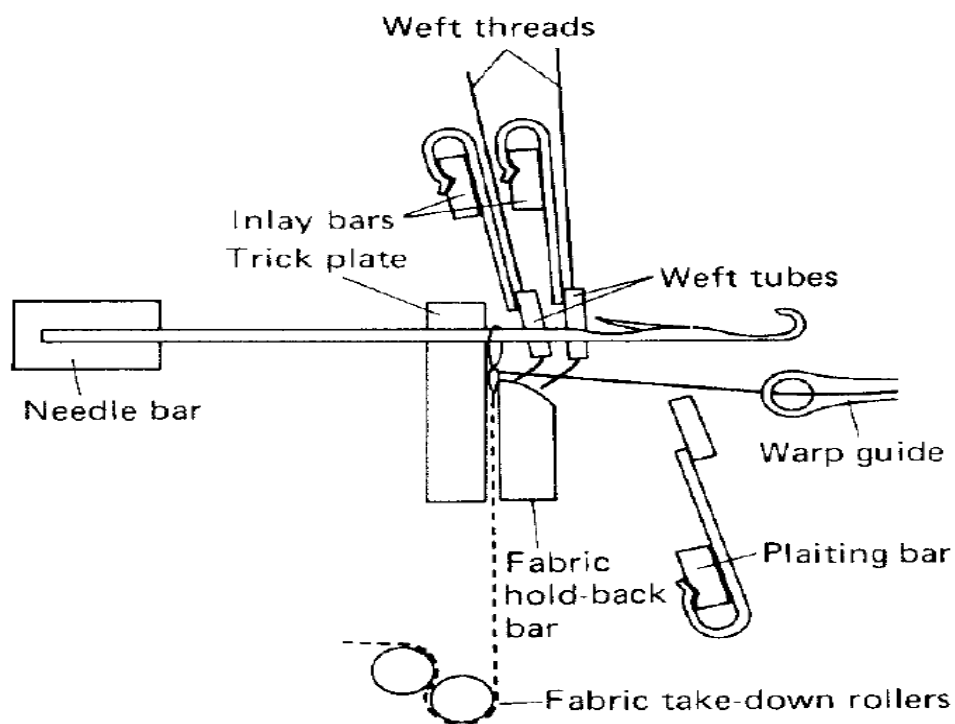
There are three main important machine parts in Crochet Warp Knitting Machine are:

1. Needle bar
2. Warp yarn guide bar
3. Laying-in bar

Name of the Bar	Required Motion
1. Needle bar	Traverse Motion
2. Warp yarn guide bar	Swinging & Shogging Motion
3. Laying-in bar	Shogging Motion

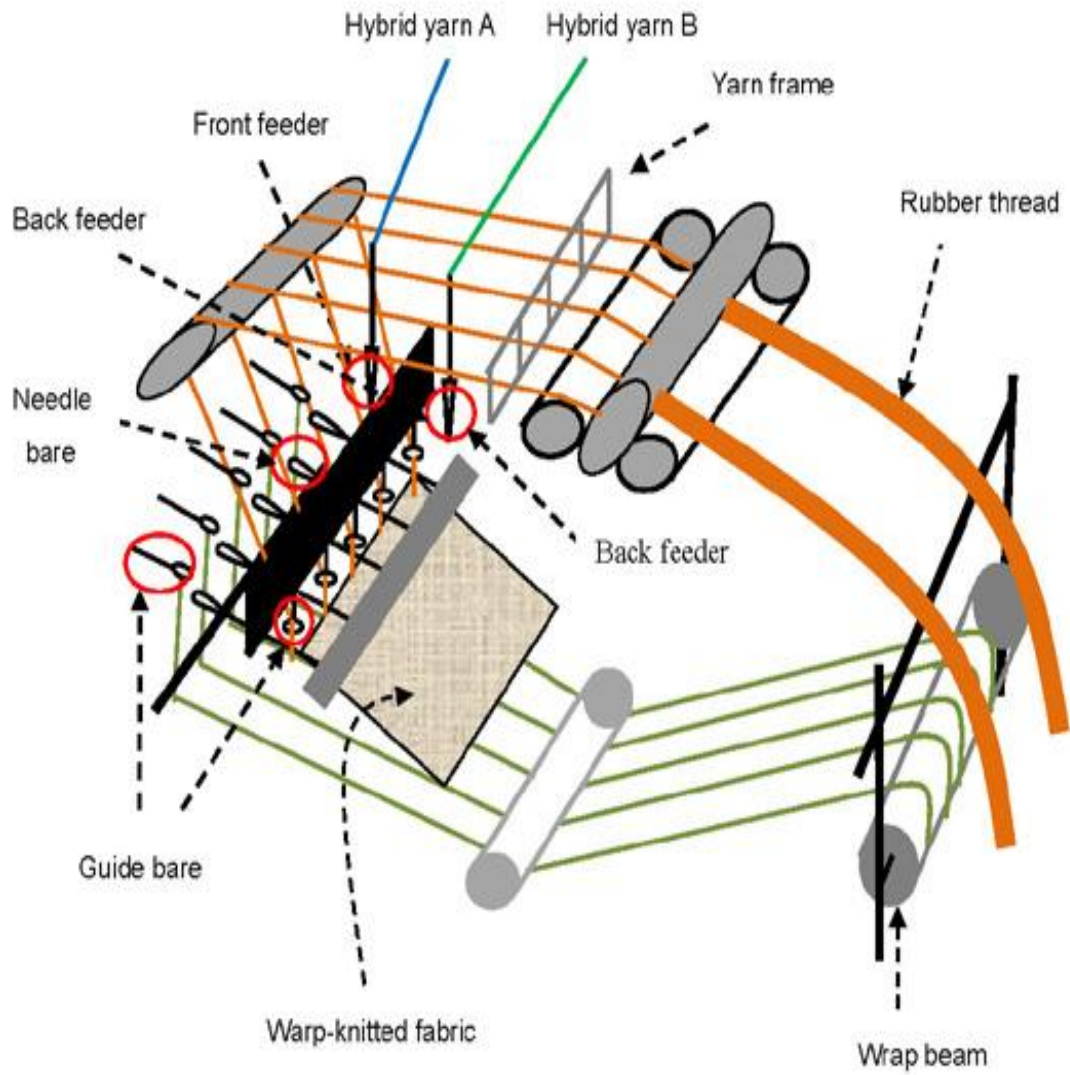
3.3. Machine Description:

Compound needle are used in the latest COMEZ m/cs. With the help of the pattern drum and the chain link the patterning is done. There warp if feeded with the help of beam. The yarns come through guide bar and through the needle the fabric is taken down and weft yarn is supplied from creel to the machine.



! Knitting elements in a **crochet** machine [*Knitting International*].

Crochet machine



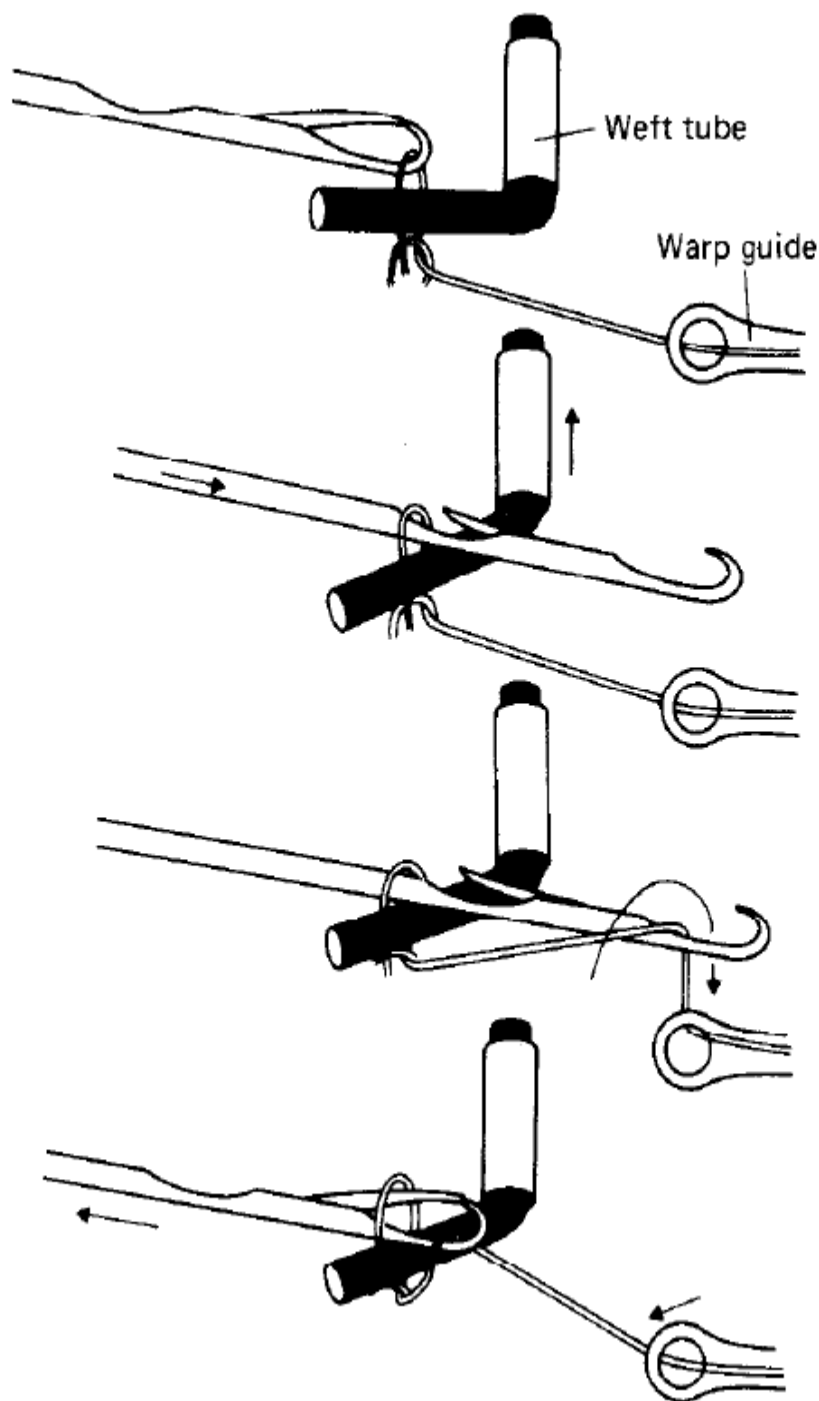
3.4. The Knitting Action of The Crochet Machine:

i. The inlay. Whilst the needle is withdrawn into its trick during knock-over of the previous warp overlap, the weft inlay tube is lowered. As it traverses in an under lap shog, the weft is laid below the level of the needle and on top of the warp thread that extends from its head to the warp guide.

ii. Clearing the warp overlap. The weft tube rises slightly on completion of its traverse movement to allow the needle to move out of its trick to clear its old warp overlap.

iii. The warp overlap wrap. The warp guide rises between the needles and automatically overlaps from the left, lowering itself again on the right side of its needle.

iv. Warp knock-over and underlap. The needle now retires into its trick to knock over the old overlap, whilst the warp guide is cammed under its needle to the start position for its next overlap, thus completing the closed lap pillar.



3.5.Operations Involved In Warp Knitting Machine:

- Receive and correctly interpret working instructions.
- Obtain the required resources and check that resources are sufficient and meet specification
- Protect resources from damage and contamination
- Ensure equipment is ready for use
- Take appropriate action when resources and equipment do not meet requirements
- Arrange resources and equipment to ensure efficient operations
- Certify correct sett loaded before warp drawn and to correctly draw ends in ensure that the creel, machine and any other equipment are clean and ready for use
- Ensure the correct yarn is selected
- Remove any existing yarn on the creel
- Plan the creel in sections according to the number of guide bars being used
- Thread the correct number of bobbins in the order specified for each guide bar
- Draw the warps in the correct order to the correct set of rollers and thread following the specified warp path
- Thread the guide bars in accordance with the pattern specified
- Ensure correct engage of section/tape is achieved
- Ensure new beam is efficiently loaded on to loom
- Keep the work area clean and safe throughout operations
- Prepare the area to ensure efficiency during the next stage of work operations
- Carry out any other required preparation activities
- Identify problems address them within the limits of own responsibility
- Inform the relevant person of problems encountered
- Complete and store accurate records and documentation

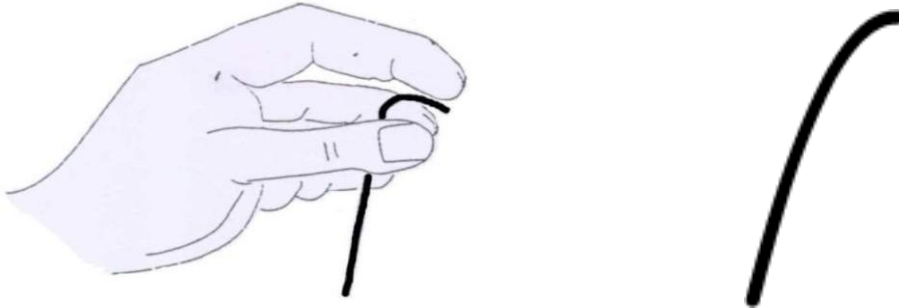
3.6. Role of Operator:

- Use suitable creel.
- Ensure the creel is vibration free.
- Ensure that the electronic stop motion working properly.
- Ensure the signal lamp indicate the yarn breakage (rowwise).
- Ensure that yarn tension uniformly maintained & centrally adjustable between creel & warping machine by set up of load cell system.
- To ensure yarn tension can be set as the requirements of various yarn count & types.
- Fluff removed by air blowing nozzles on the disc on every tensioner.
- Preference for cone creel capacity.
- Unwind the yarn from cone.
- Ensure proper knotting to draw the yarn through the guide, guide rollers and pass it through the stop motion, guide bar in delivery zone.
- Ensure proper functioning of knitting machine post knotting.
- Collect the wastes collected during knotting and store the waste at respective waste box.
- Segregate the reusable wastes and weigh and record them in a register.
- Ensure standard knotting procedure is adopted and quality of knotting is as per standards
- Ensure minimum time is taken for knotting the yarn.
- Ensure safety while carrying out knotting activity.
- Verify the quality of knotting done in the yarn.
- Ensure yarn tension in the creeling section is appropriate
- Ensure proper functioning of the machine.
- Collect the empty cones from creel and replace with full cone.
- Ensure whether the beam is ready for take off by viewing the details in display panel or by manual.
- Keep the empty beam ready for replacement.
- Keep the empty beam near the machine in manual take-off.
- Ensure beam take off is carried out properly.
- Move the beam roll to knitting storage area.
- Ensure the machine is properly restarted after take-off.

3.7. WeaversKnot:

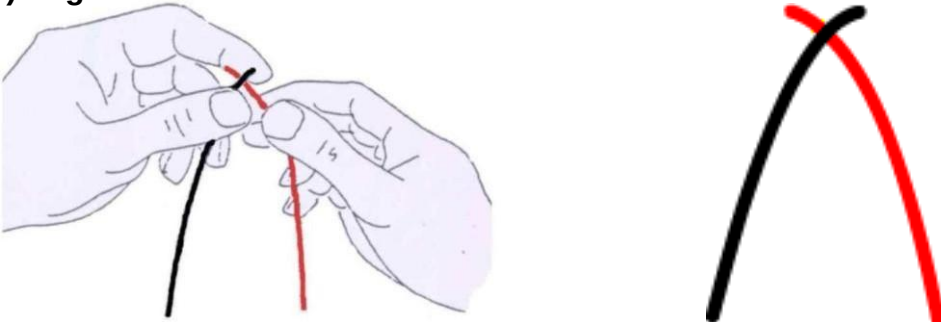
The following illustration explains the procedure for putting weavers knot.

1.



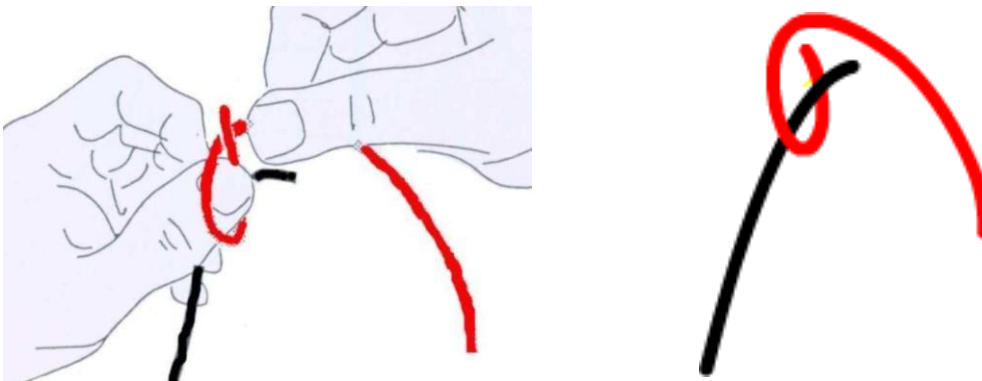
Pick up the broken end 6 mm from its end with the left hand thumb and second (middle) finger.

2.



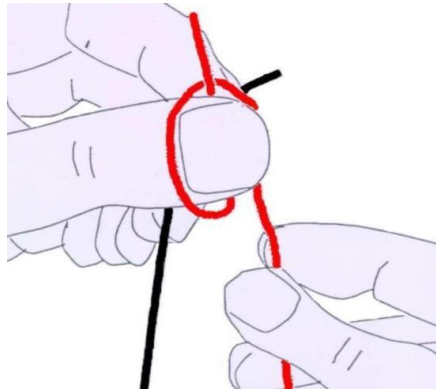
Then tie thread is then placed under the broken end by the right hand.

3.



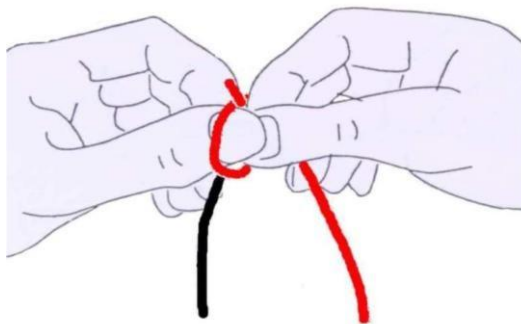
A loop is made with the tie thread around the left hand thumbnail, and tie thread passed behind the tie thread end.

4.



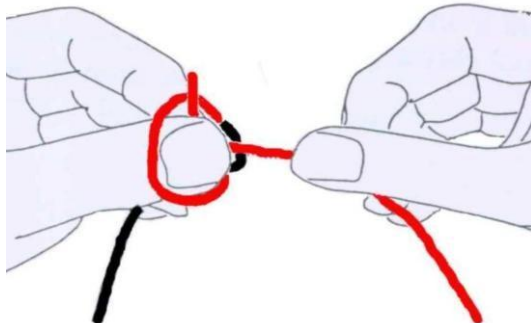
The first finger of the left hand is moved down against the thumb to hold the loop in position on the thumb.

5.



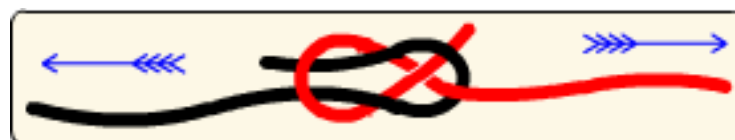
Right hand thumb is used to push the tail formed by the broken end, under the left hand thumb.

6



To form the knot, the right hand pulls the tie thread, while the left hand holds the knot stationary. There should be no pulling by the left hand.

7



Chapter 4

KNITTED FABRIC DEFECTS

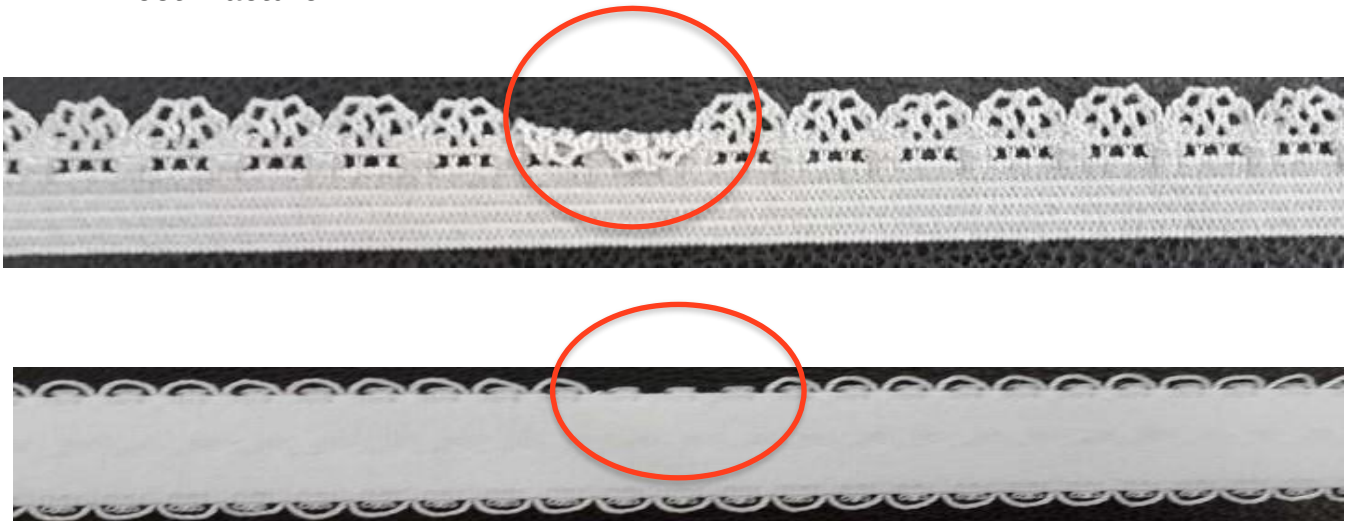
4.1. Knitting Defects Causes and Remedies:

4.1.1. Cockling:



This only detected in the final testing phases. The elastic has to be redesigned from scratch.

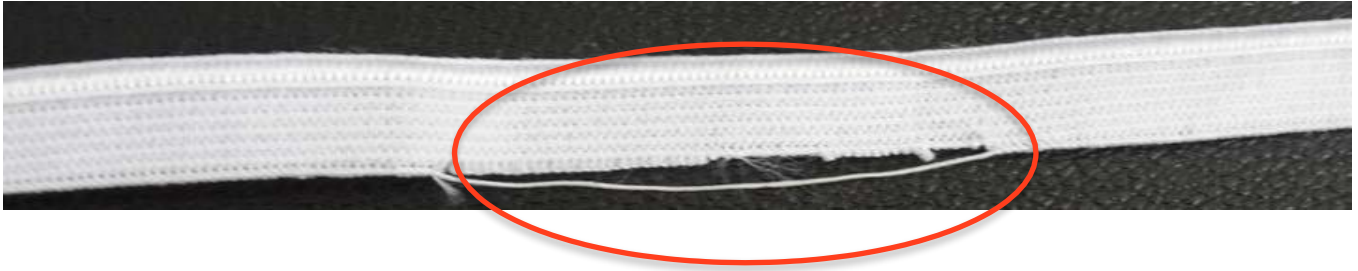
4.1.2. Picot Fracture:



Storage conditions and due to the process error.

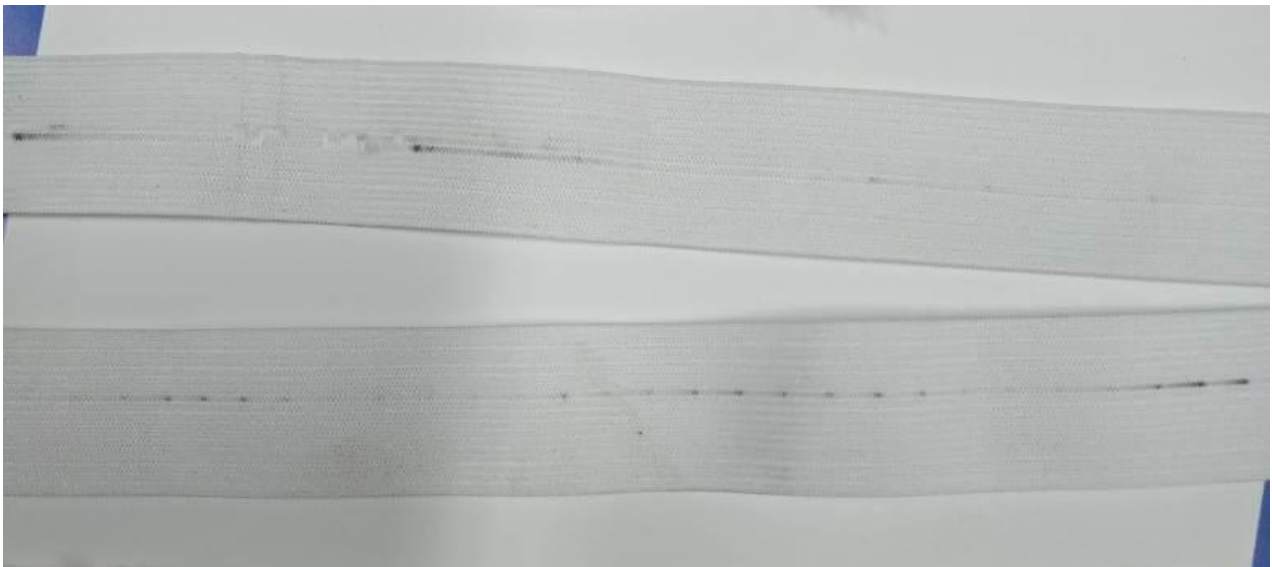
Solution: The pattern and yarn requirements should be reviewed and fixed composition.

4.1.3. Needle Problem:



- Coming loose of the warp yarns, or due to breakdown of the needle.
- Solution: The warp yarn control and needle exchange.

4.1.4. Oil Stains:



Oil stains on the warp / weft yarn

Solution: Keep all the parts, in the yarn passage clean & carry out regular cleaning of the machine

4.1.5. Broken Needle:



Causes: faulty needle or breakage of needle due to wear & tear

Remedies: If any broken needle is noticed immediately has to replace & machine need to be taken under regular maintenance as per Schedule

4.1.6. Cleaning and Waste Disposal:

- Clean the wastes around the machine.
- Segregate the wastes collected and deposit at the waste bins.
- Remove the defect in cones / chasses.
- Use proper tools for cleaning as instructed by superiors.
- Carry out cleaning activities in creeling zone, knitting zone, and fabric zone.
- Ensure the yarn paths, eyelets, knitting heads, machines, and working environment are clean and free of contamination in accordance with workplace procedures.
- Ensure safety while carrying out cleaning.
- Ensure the wastes collected are deposited in the respective waste box.
- Ensure knitting machine area is clean.

Chapter 5

INSTRUCTIONS DURING SHIFT CHANGE OVER

5.1. Shift Interchange Taking Charge of Shift:

- Reach at least 10 - 15 minutes early to the workplace.
- Bring the necessary operational tools to the department.
- Discuss with the previous shift operator and collect the information regarding the count, process, issues faced in quality, current fabric production followed in the department.
- Ensure the proper functioning of machine and problems if any should be reported to the supervisor and maintenance in-charge.
- Discuss about the current order quantity and balance quantity.
- Discuss about the new order fabric details and quantity.
- Discuss about the department cleanliness.

5.2. Handing Over at Shift End:

- Clean the machine and department before handing over the shift.
- Hand over the necessary operational tools if any.
- Discuss with the next shift operator and give the information regarding the count, gsm, loop length, process, issues faced in quality, and current fabric production followed in the knitting department.
- Discuss about current order running for which company.
- Note the production details for the current shift.
- Ensure the proper functioning of machine and problems if any should be reported to the supervisor and maintenance in-charge.
- Should discuss with next operator about the current order.
- Quality, quantity and balance quantity.
- Discuss about the new order fabric details and quantity.
- Discuss about the department cleanliness.

Chapter 6

IMPORTANCE OF HEALTH AND SAFETY

6.1. Health and Safety Instructions:

- ❖ To minimize exposure to hazardous chemicals appropriate personal protective equipment, such as Hand Gloves, Safety Glasses, Gum Boots, Masks, Head cap, etc., should be used.
- ❖ Never handle chemicals with bare hands
- ❖ Training should be provided on handling of solvents and other harmful chemicals, and how to deal with accidental spills, contact with skin and eyes, and ingestion of chemicals.
- ❖ Report any service malfunctions in the machine that cannot be rectified to the supervisor.
- ❖ Store materials and equipment at their designated places.
- ❖ Minimize health and safety risks to self and others due to own actions.
- ❖ Monitor the workplace and work processes for potential risks.
- ❖ Do not carry any metallic parts during machine running as there are chances of fire and damage to machine parts.
- ❖ Take action based on instructions in the event of fire, emergencies or accidents, participate in mock drills/ evacuation procedures organized at the workplace as per organization procedures.
- ❖ Hazardous waste must be disposed of properly in accordance with manufacturer's guidelines (MSDS) and national policies.
- ❖ Exit passageways and stair cases must never be blocked with obstacles and all stairs should have hand rails.
- ❖ Employees should be given access to safe drinking water as well as a clean area for meals.
- ❖ Emergency exit doors should never be locked.
- ❖ Proper lighting and ventilation need to be ensured and machinery must be well maintained to avoid accidents.

- ❖ Sufficient fire extinguishers should be made available and signs should be placed in prominent places so that people are aware of their presence.
- ❖ There should also be signs saying “No Food and Drink’ in areas such as the laboratory, store room and factory floor, and any other areas where it is not safe to consume food.
- ❖ Hazardous chemicals should be clearly marked in an appropriate language and with clear symbols that people have to be trained to recognize and understand.
- ❖ Signs should be placed near inflammable substances stating that it is not permitted to smoke or have open fires.

6.2. Safety Precautions :

- ❖ Always clean the machine before each and every production
- ❖ Check the machine conveyor path for any tools/ any objects before starting the machine.
- ❖ Do not touch the moving parts while machine in running condition.
- ❖ Avoid frequent handling of face mask until necessary.
- ❖ During cleaning ensure the machine is in off condition.
- ❖ Do not run the machine with choking material/face mask.
- ❖ Don't run the machine with the ultrasonic horn in high temperature.
- ❖ Avoid touching the belt or moving parts while running.
- ❖ Wear gloves, shoes, ear plug, face mask, caps and aprons during machine operation.
- ❖ Do not blow the air while machine is running.
- ❖ Avoid frequent handling of sanitary napkins until necessary.
- ❖ During cleaning to ensure the machine is turned off.
- ❖ Do not run the machine with choking material/napkin.
- ❖ Keep the SAP container remains close always.
- ❖ During cleaning the machine remove the SAP and Raw materials from the machine.
- ❖ Use the emergency exit to get outside from the work place immediately when the conditions are going out of control.
- ❖ Use the correct type of fire extinguisher based on the fire type by the trained person.



Figure: Proper usage of Personal protective equipment

Figure: Emergency exit sign



Figure: Fire extinguishing equipment used in the industry



Safety Gloves Safety Shoes