BASIC TEXTILE OPERATION

NTQF Level -1

Learning Guide -48

Unit of Competence: Prepare Yarn for Weaving and Knitting

Module Title: Preparing Yarn for Weaving and Knitting

LG Code: IND BTO1 M13 LO2-LG-48

TTLM Code: IND BTO1 TTLM 0919v1

LO2: Wind yarn or thread in the machine

Instruction Sheet	Learning Guide #48

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

- Performing winding
- Performing warping
- Performing sizing
- Performing drawing –in or tying in
- Performing waxing

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

- Set Leasing rod or other mechanisms according to specifications where necessary
- Thread (drawn in) Yarn onto the harness as per the drawing in plan
- Thread (drawn in) Yarn onto the machine as per the requirement
- Operate Machine according to OH&S practices.
- Monitor Operation and yarn in accordance with operational manual
- Repair Yarn breaks where necessary
- Correct and report Faults where necessary to meet specified requirements
- Report Major machine or product faults to the concerned person

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 26.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1”.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions.
7. Read the information written in the “Information Sheet 2”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
8. Accomplish the “Self-check 2”.
9. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 2).
10. If you earned a satisfactory evaluation proceed to “Information Sheet 3”. However, if your rating is unsatisfactory, see your teacher for further instructions.
11. Read the information written in the “Information Sheets 3”. And Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
12. Accomplish the “Self-check 3”.
13. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 3).
14. If you earned a satisfactory evaluation proceed to “information sheet 4”. However, if your rating is unsatisfactory, see your teacher for further instructions
15. Read the “information sheet 4” and try to understand the procedures discussed.
16. Accomplish the “Self-check 4”.

17. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 4).
18. If you earned a satisfactory evaluation proceed to “information sheet 5”. However, if your rating is unsatisfactory, see your teacher for further instructions.
19. Read the “information sheet 5” and try to understand the procedures discussed.
20. Accomplish the “Self-check 5”.
21. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 5).
22. Accomplish the “operation sheet 1”.
23. Accomplish the “operation sheet 2”.
24. Accomplish the “operation sheet 3”.
25. Accomplish the “operation sheet 4”.
26. Do the “LAP test” (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work. But if satisfactory you can proceed to other learning outcome.

Information Sheet-1	Perform winding

1.1. Types of winding

1.1.1. Warp winding

1.1.2. Weft winding

1.1.1. Warp winding

Warp yarn supplied by spinning mill is wound from the spinning cops on to winding packages convenient for warping process.

The Objectives of warp winding process are:

- Formation of suitable package for warping
- Checking and clearing the yarn from spinning defects

i. Technical Requirements of Winding Process

1. The physical and mechanical properties of the yarn should not be impaired

2. Package should be built to ensure easy running off during warping at high speed

3. The package should contain maximum length of yarn

4. The yarn ends should be tied with strong knots of correct structure easily passing at subsequent processing

5. The process should remove the objectionable fault

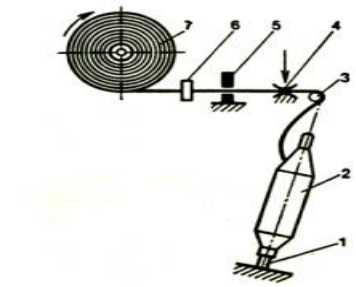
6. Yarn wastes must be as small as possible

7. The yarn tension should be regular and ensure constant winding condition

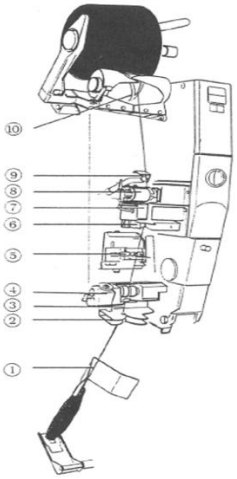
II. Basic Mechanisms of Warp Winding Process

The Basic mechanisms of warp winding process are:

- Unwinding
- Tensioning
- Yarn clearing
- Package built
- Lubrication



1. Package holder
2. Spinning cop
3. Guide rod
4. Tension device
5. Yarn clearer
6. Traverse
7. Package



(1) Balloon Controller
(2) Yarn Guide
(3) Pre-Clearer Guide
(4) Yarn Tensioner
(5) Splicer
(6) Electronic Clearer
(7) Cutting Device
(8) Waxing Unit
(9) Yarn Trap
(10) Grooved Drum

a. Un winding

When 75% of the package unwinds from the spinning cop, tension of yarn will be increased considerably. And hence the last layer of the yarn not able to form balloon since it licks around the package that results more yarn breakage at the bottom of the bobbin. Therefore, unwinding accelerator (anti-balloon device) should be used. The anti-balloon device decreases the tension by having more number of loops. So we can go for high unwinding speed.

b. Tensioning

The needs for tensioning are:

- It gives required winding density
- It gives suitable tension to the yarn
- It facilitates winding
- It aids to remove weak yarns

c. Yarn Clearing

Yarn clearer is a device which detects and removes yarn faults.

Yarn clearer can be grouped in to

I. Mechanical clearer

II. Electromechanical clearer

III. Electronic clearer

- Capacitance type
- Photoelectric type

d. Package Formation

During winding the yarn undergoes two motions. It is wound around the package by the package drive and it is given a lateral motion to cover the package by the traverse mechanism.

There are two ways to drive the yarn take up package.

I. Drum winder (by surface contact)

II. Spindle winder (by direct drive to the package spindle)

There three ways commonly in use to traverse the yarn to build-up the package.

I. Cam operation

ii. Rotary or Drum traverse

iii. Propeller or fun traverse

e. Yarn Lubrication

Lubricants are used for reduction of friction. A lubricant (wax) is applied for knitting yarn because the level of twist is low. In winding of warp yarn, lubricants are not used.

Warp winding faults and wastes

The most common defects which can occur in warp winding process are

(1) Cob webbing (stitch)

If the coil angle is too large, the coils on the package tend to slip out ward. Also if the yarn is not tensioned, it may cause slippage of coils and cause cob webbing.

(2) Hard edges

Ideally, only a small amount of yarn should be laid on the edges of package but a yarn cannot stop instantaneously and change its direction. Hence, there will be a small delay in the traverse motion which causes the yarn to be laid at the reversal

point. The difference in the package density from the edges to center would lead to uneven flow dye liquor.

(3) Slough off

During unwinding more than one coil get unwound, which is severe problem in the case of warping. So, we can use 2.5 or 3.0 crossing drum instead of 2.0 crossing drum.

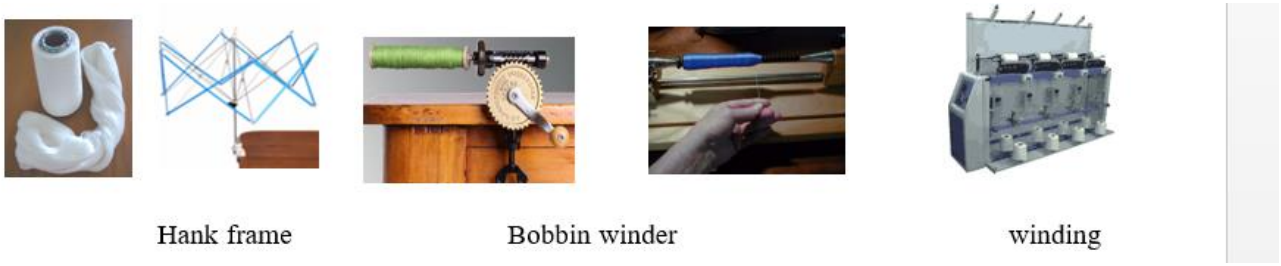
(4) Patterning

Patterning occurs when the coils on adjacent layers are superimposed on each other and seen as ridges on the package. Patterning occurs when the traverse ratio is exactly an integer. It causes shed variation during package dyeing and slough-off in warping.

(5) Irregular shape package

The result of improper operation of the winding mechanism.

♦ extremely loose or tight winding, poor yarn clearing, snarling's, Mixing of yarns, Greasy and dirty yarn, and Slack knots or knots with long tails are also among winding faults.



Hank frame Bobbin winder winding

Examples of manual winding

1.1.2. Weft winding

The whole process of weft yarn preparation for weaving consists of two operations

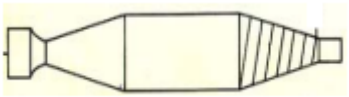
(I) Weft yarn rewinding

(ii) Humidification or Emulsifying

The objectives of weft preparation process is to supply the weft yarn packages with adequate shape, size and moisture for weaving besides improving the yarn properties by cleaning it from trashes and partially eliminating spinning faults.

a. Weft or Pirn winding process

It is a rewinding process which aids to supply a suitable package for shuttle loom. A pirn is a yarn package that is fitted to a shuttle in order to supply the weft at loom.



A small sized pirn accommodate longer length by using short conical traverse we can accommodate maximum possible length and minimize unwinding problems as in the case of cross winding and slough-off as in the case of parallel winding.

b. Moistening and Emulsifying of Weft yarn

Weft yarn being hygroscopic enough rapidly changes its moisture content when environment changes. Insufficient moisture on weft yarn results more breakages and slough-offs in weaving. With an increased moisture of weft, the cohesion between separate coils in the package increases and the yarn stiffness decreases. Moreover, the friction factor increases. As a result, curling and sloughing are reduced.

Thus, if the moisture is insufficient, prior to use on looms, the weft yarn must be artificially moistened.

Methods of yarn moistening

- ❖ keeping the yarn in chambers with relatively high air humidity
- ❖ Steaming the yarn in special kettles or apparatuses
- ❖ Application of special emulsions

Faults and wastes in Weft Winding

Faults can be due to troubles in some mechanisms of the automatic weft winders and carelessness on the part of operator.

The main faults in weft winding process are:

- Oversize or under size weft pirns
- Pirns of irregular shape due to improperly installed traverse after breakage elimination
- loose or over tight winding as a result of improperly set tension devices
- Improper knotting or overlaps which cause yarn breakage on the looms in weaving
- Pirns with yarns of different linear density and dirty pirns

Winding wastes are formed by ends remaining at breakage elimination, by winding-off spinning faults, and by the ends remaining on bobbins after incomplete yarn withdrawal.

Self-Check -1	Written Test

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

1. What are the difference b/n warp winding and weft winding? (2 point)
2. List the basic Mechanisms of Warp Winding Process. (2 point)
3. What are the two operations for weft yarn preparation for weaving? (2 point)
4. Describe the warp and weft winding faults and wastes. (2 point)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

_____

_____

2. _____

_____

_____

_____

_____

3. _____

_____

_____

_____

4. _____

_____

_____

Information Sheet-2	Perform warping

2.1. Introduction to warping

During warping a certain number of ends of a given length are wound in the warpers in to a warping beam. A beam consists of a large number of threads arranged in parallel order. The length of each thread is usually at least several thousand meters.

The main objective of warping process is to present a continuous length of yarn to the succeeding process with all ends continuously present and with the integrity and elasticity of the yarn as wound fully preserved.

2.2. Technical Requirements of the Process

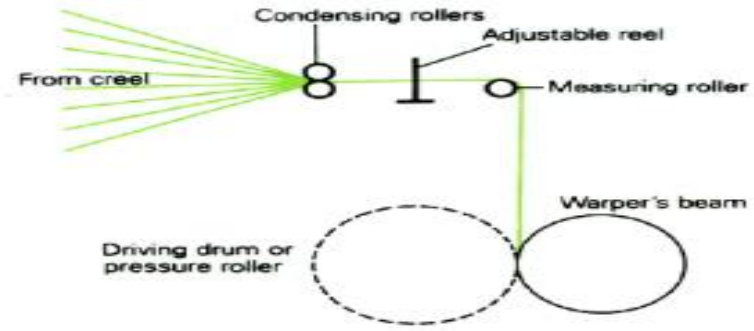
The warping process should met the following technical requirements

1. The tension of all wound ends must be uniform
2. Warping should not impair the physical and mechanical properties of the yarn
3. The density of the yarn throughout the package must be uniform as possible and its shape should be cylindrical
4. All ends should be of the same length
5. While the yarn end break or slough-off occurs, the beam must stop before 5 meter displacement
6. The production rate of warping should be as high as possible

2.3. Main parts of warping machine

The main parts of beam warping machine are

- **(i)** Creel
- **(ii)** Package drive mechanism
- **(iii)** Adjustable reed
- **(iv)** Measuring device



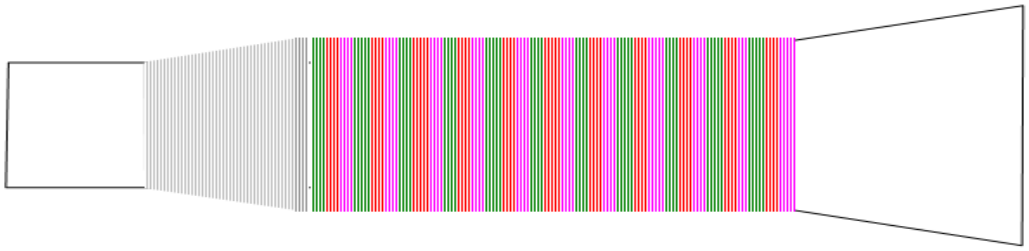
2.4. Types of warping machine

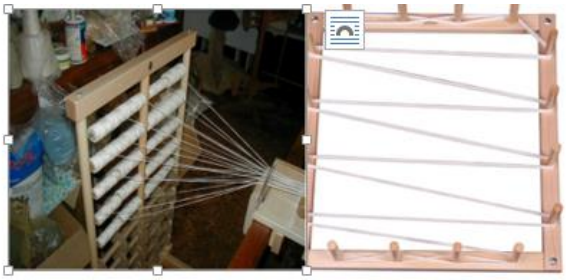
Depending up on the kind of yarn and the manufacturing process, warping machines can be grouped into two categories

1. Beam warping (High speed beaming) machine
2. Sectional warping (Horizontal mill warping) machine

1. **In beam warping process,** a part of known length of threads is wound on to a warping beam followed by their joining and winding on to the weavers beam. Moreover, it is used for the same colored yarns.

2. **In sectional warping process**, yarn ends are first wound in succession as sections on the warping drum and further these sections are simultaneously wound from the warping drum on to the weavers beam. Moreover, it is used for complicated colored pattern warp yarns.





2.5. Warping Defects and Wastes

Some of defects that may occur during warping are:

- **Lapped ends** which occur when the broken end is not tied to the end on the warping beam but wound around it. It can be the result of operative carelessness or disarrangements in the machine stop motion, when the yarn broken end is wound around the warping beam and the operative fails to find it.
- **Piecing** which is occurs when one broken end is pieced to another yarn end on the warping beam and due to operative carelessness.
- **Incorrect form of build** which is caused by non-uniform spreading of ends in the guide reed and its improper setting, incorrect shape of the warping drum or improper setting of supporting levers.
- **Slackness and non-uniform tension** which is caused by improper setting of tension devices or when the yarn escapes from under the washer.
- **Incorrect warping length** which is caused by incorrect setting or troubles in the counter, improper adjustment of measuring roller, non-uniform coating of measuring roller with felt, or when the felt is worn out.
- **Mixing up of wrong count** which is due to operative carelessness.

Warping wastes occur as a result of yarn losses at the elimination of breakages and at gaiting. In intermittent warping yarn losses are also caused by re-creeling. The amount of wastes depending upon the method of warping and the yarn count is from 0.02 to 0.15%.

Self-Check -2	Written Test

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

1. What are the objectives warping process? (2 point)
2. What are the technical Requirements of the warping Process? (2 point)
3. List and explain types of warping machine. (2 point)
4. Discuss warping Defects and Wastes. (2 point)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

_____

2. _____

_____

_____

3. _____

_____

_____

_____

_____

4. _____

_____

_____

_____

Information Sheet-3	Performing sizing

3.1. Introduction to sizing

During weaving process, the warp yarn is subjected to a considerable friction and the action of variable stretching forces. As the result, the yarn becomes damaged and single fibers are detached from it, which finally results end breakage.

3.2. The objectives of Sizing process are:

- To increase the smoothness of warp yarn by gluing the protrude fibers to the core by means of size Shed
- To apply a protective coating to the yarn to enable it so as to withstand complex stress in weaving machines meanwhile maintaining or enhancing its strength and elasticity
- To improve the weave ability of warp by reducing warp breakages in weaving

3.3. Requirements of Sizing Process Technical

The sizing process should suit the following provisions

I. The sized warp must be sufficiently strong, smooth, and elastic
II. The sizing process must ensure the applications of the required amount of size on the yarn
III. The tension of the yarn must be uniform throughout its length
IV. The package must have cylindrical shape, the necessary winding density and yarn length
V. Yarn stretch and loss in elongation should be within the admitted limit
VI. The process must be efficient, economical and ensure the production of high quality sized warp

3.4. Sizing Materials and Their Properties

The materials used for aqueous sizing may be conditionally classified in to the following groups

- Gum or Adhesives
- Chemical agent
- Softner
- Deliquescent
- Wetting and antifoaming agents
- Preservatives

- Water

1. Gum or Adhesives

   Gum is the base of the size as they coat the warp yarn with a film and impart smoothness by binding the protruding fibers to the yarn surface. Gums or Adhesives can be divided into three broad categories

   i. Natural starches such as potato, or wheat; Starch {C H O n ( ) 6 10 5} which is a complex carbohydrate and 'n' depends on the kind of starch can be used as natural gum. Some of them are Maize, potato, wheat … Starch (big granules) can be broken by hot water, chemical agent and steering.

$$(C_6H_{10}O_5)_n \xrightarrow{\textit{Hot water}} \{\text{Dextrin} + \text{Glucose}\}$$

   ii. Modified or etherized starches which have been modified to produce lower viscosity or reduced preparation time; and

   iii. Synthetic sizes such as polyvinyl alcohol (PVA), acrylic copolymers (poly acrylo-amides), and the sodium salt of carboxyl methyl cellulose (SCMC).

2. Chemical agents

It is used for splitting to a certain degree the macromolecules of starch. Eg. Chloramines Chloramines ensure a uniform splitting of starch granules without impairing its chemical structures.

3. Softeners

When splitting of starch is effected by means of acids or alkalies, a chemical modification of starch in to dextrin and glucose is possible which forms a hard rigid film on the yarn surface after sizing and makes the yarn stiff. Hence, to make the film somewhat flexible softners are used.

Some of the softeners in use are

- Vegetable and animal fats
- Glycerin
- Cotton seed oil
- Soap

4. Deliquescent

It can be used to increase the hygroscopic properties of sized yarn and for preserving the flexibility of starch film. It can be used rarely since constant moisture content is obtained byautomatic sizing regulators.

Eg. Common salt, Ca cl2, Glycerin

5. Wetting and Antifoaming agent

Foams are bubbles which can put-off size penetration inside the yarn and hence Antifoaming agents are used to prevent foam formation. The introduction of wetting agents improves the penetration of size between the fibers and to have a uniform penetration of sizing solution on the yarn surface. Eg. Silicones, Ethers, water insoluble alcohol ….

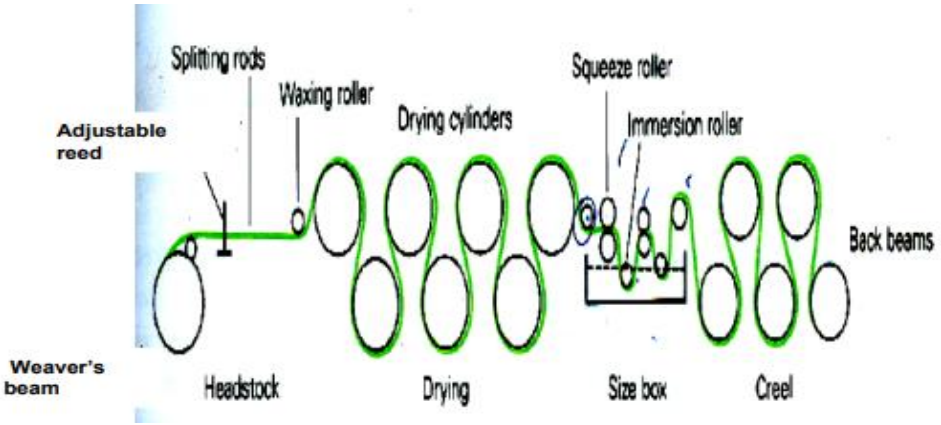
6. Preservatives

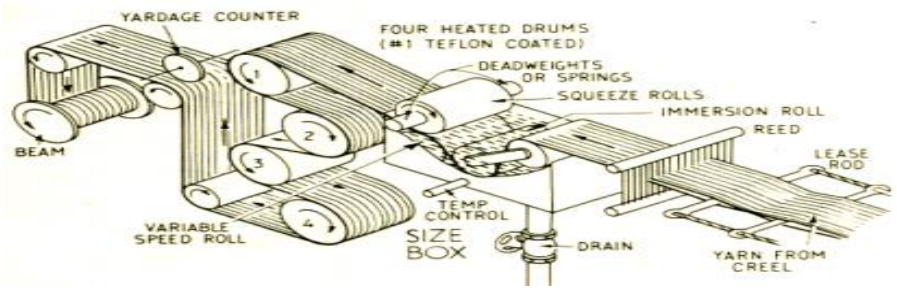
When the size warp or grey cloth is to be stored for a long period of time microorganisms can be developed and destroy the fabric. Antiseptics such as Sulphates of copper, phenol, boracic acid etc. are introduced in to the size to prevent the development of microorganisms.

7. Water

It is a solvent in the preparation of sizes. Only clean water without suspended admixtures and considerable amount of calcium or magnesium salts (hard water) should be used.

3.5. Sizing Machines





The main parts of sizing machine are:

- Creel for the accommodation of the warping beams
- Size box for impregnating the warp yarns in to a solution
- Drying section to remove excess moisture from the sized and squeezed warp ends
- Headstock where the stuck warp ends is separated, the pieces are marked and the yarn is wound on to the weavers beam.

3.6. Sizing Defect and Wastes

Some of the most common sizing defects are

- **Undersized yarn** which is due to improper size concentration, improper working squeeze roller, and dilution of size paste
- **Oversized yarn** caused by high size concentration due to non-splitting of starch granules, depth of immersion, and longer duration in size box
- **Sticky warp** due to improper drying, high speed sizing, and low drying temperature
- **Improper build of weavers beam** caused by improper spreading of ends in the adjustable reed, and improper functioning of compressing devices
- **Incorrect warp length** caused by disarrangement of measuring roller and marking mechanism
- **Non uniform size regain** due to irregular heating of size in the size box and non-uniform pressure on the squeeze roller
- **Crossed and lost ends** occur when the lease rods are set too far apart, when broken ends are improperly pieced-up

Self-Check -3	Written Test

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

1. What are the objectives of sizing? (2point)
2. What are sizing Materials and Their Properties in sizing process? (3 point)
3. What are main parts of sizing machine? (2point)
4. What are the sizing Defect and Wastes in sizing process? (3 point)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

_____

_____

2. _____

_____

_____

_____

3. _____

_____

_____

4. _____

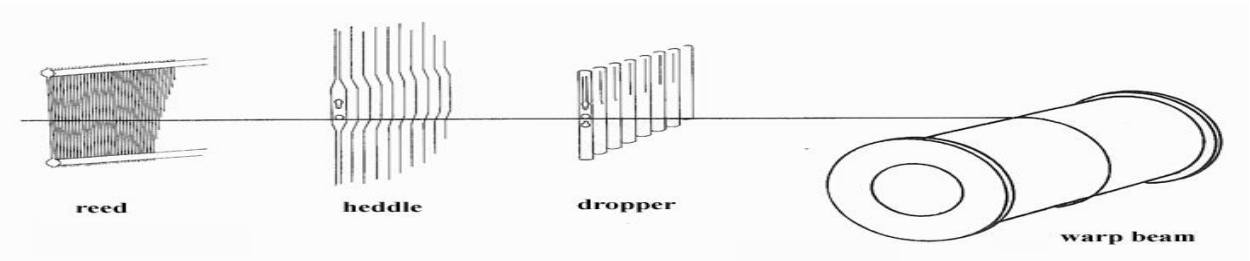
_____

_____

Information sheet 4	Performing drawing- in or tying- in

4.1. Drawing-in operations

Drawing-in is the entering of yarns from a new warp into the weaving elements of a weaving machine, namely drop wires, heddles and reed, when starting up a new fabric style.



The term drawing-in and warp tying refers to the operations involved in preparing the weaver's beam for the purpose of weaving fabrics on the loom. The drawing-in process primarily consists of drawing ends from the weaver's beam through heald eyes of different harnesses and then through the dents of a reed in the order that is determined by the design of the fabric.

If a beam is to be worked with warp stop motion on the loom, especially when using closed drop-pins, the ends have to be drawn through these pins before drawing them through the heald eyes and reed dents. Conventionally drawing-in is carried out manually by two persons- one, the reaches for selecting and presenting the ends from the beam, and the other, the drawer for pulling ends through the drop-pins, heald eyes and reed dents.

The main requirements of carrying out this process properly and efficiently are:

- The operator should be aware of the principles of drawing-in and be trained to do the job speedily because any mistakes or delays in carrying out the process would prove to be costly.
- The healds and reeds should be in good condition and of suitable specifications for ensuring that these are not the cause of warp breaks on the loom and of defects in the fabric.
- The drawing of the beam should be done properly to avoid cross ends on the beam.
- Suitable precautions should be taken to reduce the incidence of extra-ends and to compensate for the missing ends during the weaving of the loom.

4.2. **Common defects in drawing-in**

1. **Cross ends-** To minimize the incidence of cross ends on the beam during weaving, the ends presented for drawing in or warp tying should be made to be parallel and in their respective positions as in the beam. Proper dressing of ends is, therefore, of great importance.
2. **Extra Ends-** some ends are generally cast out during drawing-in/warp tying to compensate for long missing ends on the weaver's beam whether to leave these ends or not should be governed by the method of cutting lappers at sizing.

   If the lappers are cut and mended only after completion of a weaver's beam, there is no need of leaving extra-ends at drawing-in or warp tying. If however, the lappers are cut no sooner these are detected, the same ends should not be withdrawn or not taken for tying.

Self-Check -4	Written Test

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

1. What are the main objectives of drawing in? (3 point)
2. What are the common defects in drawing-in? (3 point)

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

_____

_____

2. _____

_____

_____

_____

Information sheet 5	Performing waxing or lubrication

5.1. Objectives of yarn lubrication

The main aim of yarn lubrication is to reduce yarn friction. Added advantages include:

1. Reduced abrasion effects on guide surfaces and needles - this is important with hard synthetics (PA, PE)
2. Dissipation of static charges - this is important with 100% synthetic yarns
3. Better cohesion of the filaments
4. Improved yarn pliability. Due to lubrication, yarn becomes softer and more pliable offering less resistance to the loop formation

Lubrication In knitting, the yarns are threaded around numerous guides and into the needles and tension builds up in the yarn due to friction between the yarn and the guides and needles. Frictional forces opposing yarn motion can cause excessive yarn breakage in knitting. Yarn lubrication to reduce these forces is an important part of the preparation of knitting yarns. Paraffin wax is often used for this purpose and is normally applied by means of wax rings during the winding process. Proper waxing ensures that a constant yarn tension is maintained throughout the knitting process. It is recommended that the average wax take-up should be around 2 grams per kilometer of yarn. The final yarn packages are now ready to be loaded onto the knitting machine. Unlike the time consuming and labor intensive steps involved in bringing the warp yarns into a weaving loom, the loading process for knitting is relatively simple and quick. No all knitting yarns are waxed before leaving the spinning plant. This is because if the storage conditions are too warm, the wax can melt and penetrate into the yarn, thus significantly reducing its effectiveness.

Self-Check -5	Written Test

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

1. What are the objectives waxing of yarn? (3 point)
2. What are the methods for lubrication of yarn? (3 point)

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

_____

_____

2. _____

_____

_____

_____

_____

Operation Sheet 1	Perform winding

Method of Warp Winding Process

Step 1- Load the spinning cope yarn package on the winding machine

Step 2- Unwinding the spinning yarn from the cope

Step 3- provide tension to the yarn

Step 4- implement Yarn clearing

Step 5- accomplish package built

Step 6- if necessary apply Lubrication

Operation Sheet 2	Perform sizing

Procedures for warping process

Step 1- load the cone on the warping creel

Step 2- condense the yarn

Step 3- split the yarn into individuals

Step 4- measure the length the yarn

Step 5- wound the yarn on the warp beam

Operation Sheet 3	Perform sizing

Procedures for sizing

Step 1- preparation of sizing paste

Step 2- load the warping beam on the sizing creel

Step 3- immerse the warp yarn by the sizing solution

Step 4- squeeze the warp yarn

Step 5- dry the warp yarn

Step 6- if necessary waxing the yarn

Step 7- split the yarn into individuals

Step 8- winding the warp yarn on the weaver beam

Operation Sheet-4	Perform drawing- in

Techniques for drawing -in

Step 1- load the weaver beam on the weaving machine

Step 2- draw the yarn into the drop wire

Step 3- draw the yarn into heald eye according the design

Step 4- draw the yarn into the dents of the reed

Step 5- tie the yarn onto the take up roller

.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1. Carry out winding

Task 2. Carry out warping

Task 3. Carry out sizing

Task 4. Carry out Drawing- in

List of Reference Materials

1. Handbook of technical textiles edited by a r horrocks and s c anand
2. Textile Sizing (Goswami-2004), by BHUVENESH C. GOSWAMI Clemson University Clemson, South Carolina, U.S.A.
3. Textile dictionary by Celanese Acetate Three Park Avenue New York, NY 10016
4. Reference books of textile technologies By Giovanni Castelli, Salvatore Maietta, Giuseppe Sigrisi, Ivo Matteo Slaviero
5. Cotton: Science and technology Edited by S. Gordon and Y-L. Hsieh