BASIC TEXTILE OPERATION

NTQF Level -1

Learning Guide -47

Unit of Competence: Prepare Yarn for Weaving and Knitting

Module Title: Preparing Yarn for Weaving and Knitting

LG Code: IND BTO1 M13 LO1-LG-47

TTLM Code: IND BTO1 TTLM 0919v1

LO1: Assist in set up machine and load yarn

Instruction Sheet	Learning Guide # 47

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

- Checking product specification
- Checking yarn batch or job
- Reporting non-conforming materials
- Loading yarn package

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:**

- Check Production specifications to identify requirements for yarn quantity, quality or color.
- Check Yarn batch or job to ensure conformity to specifications.
- Report Non-conforming materials to the concerned person
- Load Yarn package onto machine according to the specification procedure.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 17.
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)

Information Sheet-1	Checking product specification

1.1. Introduction to yarn

1.1.1. Spun yarn

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 eithers 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.

1.1.2. 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.

1.1.3. 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.

1.2. 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. 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.

1.2.1. **Yarn count (Yarn numbering):** Count is defined as the thinness or thickness of yarn. It is expressed by direct or indirect systems. The yarn count is a number giving a measure of the yarn linear density. The Linear density is defined as the mass per unit length.

Direct system: is expresses the count as the mass of a standard length. The mass is measured in grams and the specific length is either 1 km or 9 km. The direct system is expressed either by Tex or Denier.

Let M = Mass of the yarn sample at official regain in the unit of the system;

L = Length of the sample;

l = unit length of the system; then, the yarn number or count N of the sample is given by

$$N = \frac{M * l}{L}$$

Direct System

Count System	Unit of Mass	Unit of Length
Tex	Gram	One Kilometre
Denier	Gram	9000 metres

The units of mass and length of the two most commonly used direct systems are given in the above table.

Example:

The length of a skein or lea of a yarn sample is 100 metres and the mass of the sample is 1.60 grams.

Find:

A. Yarn count in Tex

B. Yarn count in Denier.

Solution:

A. Tex Number of the yarn sample is given by the formula

$$N = \frac{M * l}{L} \text{ .or } \frac{\text{Mass (gm)} * 1000}{\text{Length (m)}}$$

Here, N = Tex number or count

M = Mass of the yarn sample = 1.6 grams

l = Unit length of the system = 1 kilometre;

L = Length of the sample = 100 metres

N = 1.6gm * 1000m = **16 Tex.**

100m

B. Similarly, Denier Number of the sample is given by the formula

$$N = \frac{M * l}{L} \quad \text{or} \quad \frac{\text{Mass (gm)} * 9000}{\text{Length (m)}}$$

Where N = Denier number of count of the yarn sample;

M = Mass of the yarn sample = 1.6 grams

l = Unit length of the system = 9000 metres

L = Length of the sample = 100 metres

N = 1.6gm * 9000m = 1.6 *90 Denier = **144Denier**

100m

In tex system, multiples and sub multiples such as kilo tex (ktex), deci tex (dtex), milli tex (mtex) are also used to avoid usage of very big or very small numbers.

Tex system is the officially recognised yarn numbering system by International Standards Organisation (ISO) and is the official numbering system in SI Units.

Denier system is most commonly used in man-made fibre and silk industry.

Indirect system: This gives the length that weighs a standard mass. The standard mass is either 1 kg or 1 lb and the associated length is respectively, in meters or yards. This system is expressed by Metric (Nm) and English count (Ne).

Formulae

$$N_e = \frac{\text{Length (in Hanks)}}{\text{Mass (in pounds)}}$$

$$= \frac{\text{Length (in metres)} * 1.0936 * 453.6}{840 * \text{Mass (in grams)}}$$

$$N_m = \frac{\text{Length (in metres)}}{\text{Mass (in grams)}}.$$

The units of mass and length of the most commonly used indirect systems are given in the following table

Count System	Unit of Length	Unit of Mass	Abbreviation
Cotton (British/UK/ English)	Hank (of 840 yards)	Pound	N_e
Metric	Kilo metre	Kilo gram	N_m
Worsted	Hank (of 560 yards)	Pound	
Woollen (Yorkshire)	Skein (of 256 yards)	Pound	

Count Conversions

Quite frequently, it becomes necessary to convert the yarn count from one system to another system. This is usually and easily achieved with the help of conversion factors.

Denier count = 9 * Tex count

Tex count = 0.111 * Denier count

Tex * Ne = 590.5

Example

A lea of 120 hanks has a mass of 25 pounds. Calculate the English count of the yarn sample.

Solution:

$$Ne = \frac{L\ (Hank)}{Mass\ (Pound)} = 120/25 = \mathbf{4.8}$$

1.2.2. **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).

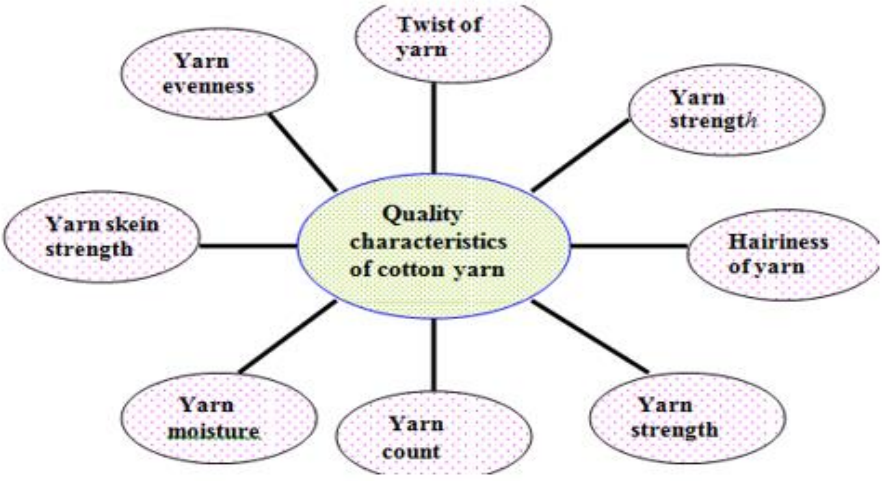
1.2.3. **Twist of cotton yarn:** The cotton yarn twist is characterized by the number of twists or turns per meter of length and the directions of twist S-twist and Z-twist. Yarn twist needs continuous follow up during production process to minimize the variations.

1.2.4. **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.

1.2.5. **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.

1.2.6. **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.

1.2.7. **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.



1.3. Color

Yarn may be used undyed, 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 color fiber

Ombre: variegated yarn with light and dark shades of a single hue

Multicolored: variegated yarn with two or more distinct hues (a "parrot color 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

Yarn comes in many colors

1.4. 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	**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 spun and filament yarn? (2 point)
2. Discuss about yarn quality characteristics. (3 point)
3. Mention the method to measure the quantities of yarn. (2 point)
4. Why we use different color yarn on fabric formation? (2 point)

Note: **Satisfactory rating - 9 points** **Unsatisfactory - below 9 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

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2. _____

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3. _____

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4. _____

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Information Sheet-2	Checking yarn batch or job

For similar product specification, the yarn batch must be same. So each batch has similar parameters. Unknowingly yarn batch may be mixed; this will affect the fabric appearance. In order to avoid such the yarn must be checked and approved.

Self-Check -2	Written Test

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

1. Why we report non-conforming material to the concerned personnel? (2 point)

Note: **Satisfactory rating - 2 points** **Unsatisfactory - below 2 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

_____

_____

_____

Information Sheet-3	Reporting non-conforming materials

3.1. **Nonconformity:** the nonfulfillment of a specified requirement

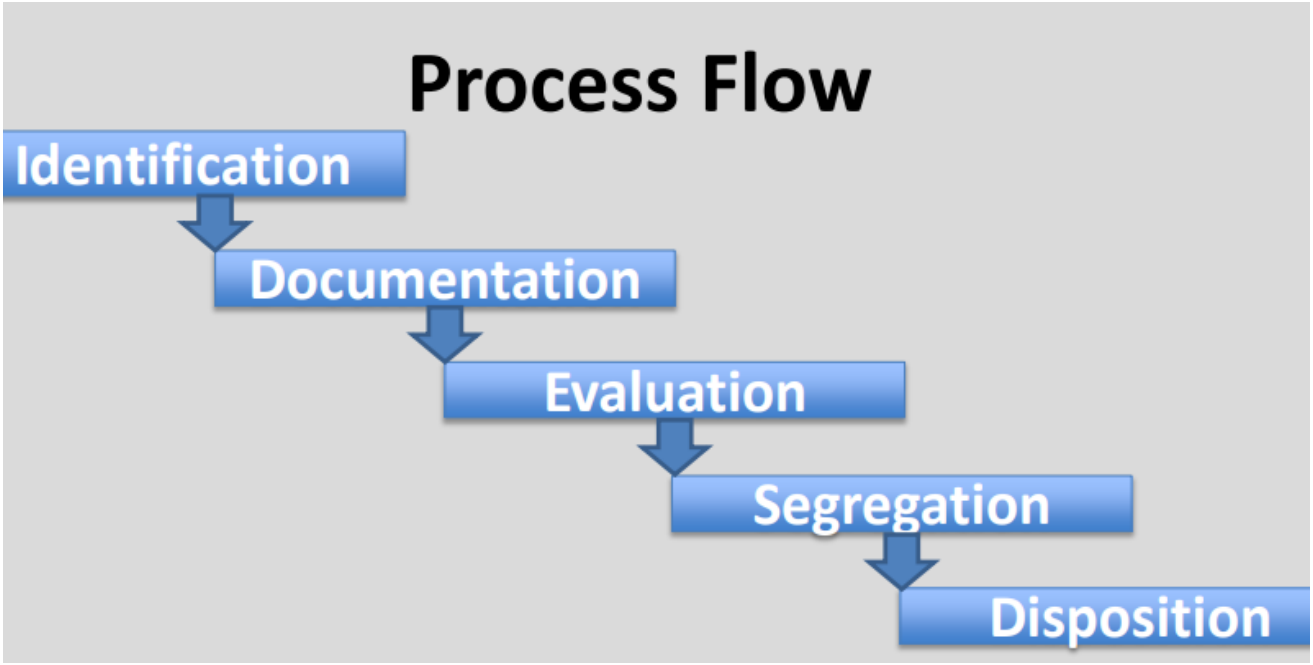
3.2. **Non- conformances**

- ✓ Nonconforming Product is product that does not fulfill its specified requirements
- ✓ Nonconformance's can occur in both product and process
- ✓ Nonconforming processes can lead to nonconforming product.

3.3. Nonconforming Product - Regulation

"Each manufacturer shall establish and maintain procedures to control product that does not conform to specified requirements…."

"….The procedures shall address the identification, documentation, evaluation, segregation, and disposition of nonconforming product."



3.3.1. Identification

Sources of Nonconforming Product

• Received components/material that fail incoming inspection

Example

- ✓ Specification: 6 +/- 1 inch
- ✓ Inspection result: 8 inch
- ✓ This is nonconforming product

• Products/components that fail inspection or test during manufacturing

Example

- ✓ Temperature range: 300 ± 10° F

- ✓ Temperature set on bonding machine: 280° F
- ✓ This is nonconforming process:

- Product returned to manufacturer with defects

Example

- ✓ If a catheter is supposed to fit inside a 6 French guide and during procedure it does not fit.
- ✓ Handled within the complaint system*
- ✓ *not within the scope of this talk

3.3.2. Documentation

- Form that identifies the material, the problem, evaluation, segregation, the investigation (if any), disposition and signatures
- Standard operating procedure (SOP)
- Work Instruction (WI)

3.3.3. Evaluation

... The evaluation of nonconformance shall include a determination of the need for an investigation and notification of the persons or organizations responsible for the nonconformance. The evaluation and any investigation shall be documented.

5.3.4. Segregation

You must segregate non-conforming product to ensure it is not released.

Examples

- ✓ Locked Cages
- ✓ Digital Controls
- ✓ Separate Area

3.3.4. Disposition

Each manufacturer shall establish and maintain procedures that define the responsibility for review and the authority for the disposition of nonconforming product. The procedures shall set forth the review and disposition process.

Typical Nonconforming Product in Dispositions

- Scrap
  - ✓ Where you decide not to use the product
  - ✓ destroy
- Downgrade
  - ✓ Reverting back to a safe and effective older version when there is a problem with an upgrade
- Use as Is

- ✓ Use the Nonconformance as is when it does not affect the safety and effectiveness of the final product

• Rework

Each manufacturer shall establish and maintain procedures for rework, to include retesting and reevaluation of the nonconforming product after rework to ensure that the product meets its current approved specifications.

Self-Check -3	**Written Test**

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

1. Why we report non-conforming material to the concerned personnel? (2 point)

Note: **Satisfactory rating - 2 points** **Unsatisfactory - below 2 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

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_____

_____

Information Sheet-4	Loading yarn package

3.1. Yarn package preparation

Yarn preparation is done to furnish the fabric making unit with a fault free yarn, wound on to the most suitable and effective supply package.

Factors that must be considered during yarn preparation

- Package shape
- Package density and weight
- Yarn length on the package
- Package identification
- Yarn fault
- Frictional characteristics of the yarn

There are two types of yarn preparation equipment's: Single end winders, which produce packages such as cones, and multi-end winders, which produce packages such as beams.

Yarn

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 factors that must be considered during yarn preparation? (4 point)

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

2. _____

_____

_____

_____

3. _____

_____

_____

_____

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