

Weaving and Knotting Operation

Level-II

Based on March, 2022, Curriculum Version I



Module Title: - Perform Drawing-in, Knotting and Weaving operations

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Acronyms

OHS	Occupational health and safety
PPE	Personal protective equipment
RPE	Respiratory protective equipment
EPI	Ends per inch
PPI	Pick per inch

Introduction to the Module

Drawing-in consists of threading the warp yarns through the drop wires, the healds and the reed the drawing-in process comes just after the preparation of the weaver's beam. The weaver's beam is obtained from sectional warping or sizing. The drawing-in process mainly consists of two processes. The first process is called drafting and the second process is called denting. It is mostly performed manually but in large scale textile industries, automatic drawing-in machines are used, where more productivity is required. When the drop wires with closed D are used, the ends are drawn through the D of drop wires before the heald eye. The drawing-in process is applied for the execution of a new fabric design on the loom. When the fabric design is repeated regularly, the warp tying (knotting) process is applied to change a weaver's beam. The tying process is done manually or with the help of the knotting machine.

This Module Covers the Units:

- Drawing-in operation
- Knotting operation
- Adjust Weaving loom
- Loom operation
- Maintain records

Learning Objective of the Module

- Perform the Drawing-in operation
- Perform knotting operation
- Setting up and supervise the weaving loom
- Performing the operation of a weaving loom
- Maintaining record and reporting activities

Module Instruction

For using the modules effectively, 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 exercise

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Unit One: Drawing-in operation

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

- Preparing work area
- Type of design and draft
- Setting drawing in machine
- Performing and controlling drawing-in process
- Minor and major machine faults
- Product quality standards

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:

- Preparing work area
- Identify Type of design and draft
- Set up drawing in machine
- Perform and controlling drawing-in process
- check Minor and major machine faults
- Check Product quality standards

1.1. Prepare work area

1.1.1 OHS practices

An Occupational health and safety is a manual handling operation takes place every time a load is moved or supported by a person's hands or arms, or by some other forms of bodily effort. It includes lifting, lowering, pushing, pulling and carrying the load. The definition of a load encompasses goods, baggage, humans and other living beings as well as an object that comprises or includes any living beings.

1.1.2. 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.

Coveralls of close-weave fabric (or suitable disposable ones) should be worn when handling dyestuffs.

Gloves and aprons may be needed for some jobs. These should be impermeable and either disposable or cleanable. They should be removed when not needed because they may be a continuing source of dust if contaminated. Workers should remove gloves and aprons in a way that does not contaminate skin or cloth.

Respiratory protective equipment (RPE) may be needed for short-duration jobs, such as filter changing. RPE should be carefully selected to provide adequate protection. It needs to be suitable for the wearer as well as for the task. Correct fitting is important and suppliers can help by offering face-fit testing. Beards and stubble growth prevent a good fit and facemask type respirators cannot be used in these circumstances. Where suitable for the wearer, disposable respirators giving protection against fine particulates.

1.2. Types of design and draft

Drafting in weaving means the number of heald shafts used to produce a given design and the order in which warp ends are threaded through the heald eyes of the heald shaft. The principle of drafting is that ends which work in different order require separate heald shafts.

1.2.1. Types of design and draft

Straight draft:

This draft is the simplest types of draft and from the basis of many others drafts. There each successive thread is drawn on each successive shaft. The first thread is drawn through the first heald shaft and the second through the second heald shafts and so on. So, the no. of heald shafts equals the no. of warp threads in a repeat.

Skip draft:

This draft is used in weaving the fabrics with a high density of warp threads. Here the number of heald shafts used is two or more times greater than the maximum number of heald shafts required this draft is used in plane weave fabrics.

Pointed draft /V- draft:

Point drafts are used for the weaves which are symmetrical about the center. This draft is produce in case of waved or diamond effects on fabric. In this system a straight draft is returned in the opposite direction .Here the first and last heald shafts of design contain only one end whereas the middle shafts contain warps.

Broken draft:

This draft may be considered as modified pointed draft. It is also a combination straight drafts of different direction of construction. In broken draft a break in continuation occurs where the warp thread revers its direction. This direction is reversed not on the last on first shaft as in pointed draft. The broken draft is applied for producing herring bone, twill, diaper designs etc.

Divided draft:

In this draft the heald shafts are divided in to two or more groups. For every group suitable draft is selected in pile weave two or more sets of warp thread are used. So, they require this type of draft. For example: The ground of warp thread of warp pile fabric are passed through the front heald shafts and pile warp thread are passed through the back heald shafts

Grouped draft:

This type of draft is used for producing cheek and stripe fabric, in which strips have different weaves or there combination

Curved draft:

This draft is applied fancy weave having large warp repeat with a view to reduce the number of heald shafts. There are irregular and actually cannot be classified.

1.3 Setting drawing in machine

Drawing-in consists of threading the warp yarns through the drop wires, the healds and the reed the drawing-in process comes just after the preparation of the weaver's beam. The weaver's beam is obtained from sectional warping or sizing.

1.3.1. Types of drawing machine

Depending on the styles of the produced fabrics and on the company's size, this operation can be carried out manual drawing in machine, and Automatic drawing-in machine.

Manual drawing in machine

This type of drawing in machine carried out manually by two female workers; operating in pairs (a time consuming activity which requires also skill and care).



Figure 1.3.1 Manual drawing in machine

Automatic drawing-in machine

Automatic drawing-in machine which carries out same functions as previous machine, however without needing the weaver's beam. In fact it is fed by a common cotton twine which it inserts among the various elements of the warp stop motion, of the harness and of the reed according to the program set up on the computer and under its control and supervision.



Figure 1.3.1 Automatic drawing-in machine

- **Standard configuration:**

- ✓ Maximum beam width 230cm /400cm,
- ✓ there should have creel trolley with lifting device
- ✓ there should have warp yarn layer leasing
- ✓ heddle wire module with two guide rail
- ✓ Max. number of heald frames are 16

- **Drawing in:**
 - ✓ Maximum speed, 140picks/min
- **Reed:**
 - ✓ Count: between 20-100
 - ✓ Width: 230-400cm
 - ✓ Density: 20-350teeth/dm
 - ✓ height: 80-150mm
 - ✓ Dent height: 40-100mm
 - ✓ Reed type: flat, profile, and double reed
- **Drop wire:**
 - ✓ Thickness of drop wire:0.2-0.65
- **The control module:**
 - ✓ Power consumption: 3kw
 - ✓ Electrical protection: overload, short circuit protection

1.4 .Drawing-in processes

Drawing-in consists of threading the warp yarns through the drop wires, the healds and the reed the drawing-in process comes just after the preparation of the weaver's beam. The weaver's beam is obtained from sectional warping or sizing. The drawing-in process mainly consists of two processes. The first process is called drafting and the second process is called denting. It is mostly performed manually but in large scale textile industries, automatic drawing-in machines are used, where more productivity is required. When the drop wires with closed D are used, the ends are drawn through the D of drop wires before the heald eye. The drawing-in process is applied for the execution of a new fabric design on the loom. When the fabric design is repeated regularly, the warp tying (knotting) process is applied to change a weaver's beam. The tying process is done manually or with the help of the knotting machine

1.4.1. Drafting

A process of passing the end through the eye of heald wire or harness according to the draft (sequence of drafting the ends) is called drafting". When the drafting is performed manually, two persons do this job. The person who selects the ends and presents them for drawing is called the reacher. The person who draws the ends through the eye of heald wire with the help of a drawing hook is called a drawer.

1.4.2 Denting

When the drafting of the ends is completed, these ends are passed through the dent of the reed. We can say that “denting is the process of passing the ends through the dents of reed according to the denting order of the fabric to be woven”. It can be performed by a single person or two-person. In the case of two persons, one person selects the ends and presents them to the other person who passes these ends through the dents of the reed.

1.5. Minor and major machine faults

Misdraw (Colour): In woven fabrics the drawing of coloured yarns through the loom harness contrary to the colour pattern and/or design weave is termed as misdraw. In case of warp knits misdraw is the drawing of coloured yarns through the guide bars contrary to the pattern design.

Loom barre: Repetitive selvedge-to-selvedge unevenness in woven fabric usually attributed to a mechanical defect in the let-off or the take-up motion.

Knot: Knot is defined as a knob or lump formed by interlacing portions of one or more flexible strands or a quantity of yarn, or thread, which varies with the fibre; it consists of a set of coils. Control in pirn winding, the winding to binding coils ratio can solve this problem.

Reed mark: A crack between groups of warp ends, either continuous or at intervals, which can happen due to damaged reed or improper spacing of dents

Reed streak: A warp wise defect attributable to a bad reed like uneven reed space, bent reed wire, slant wire, damaged reed wire etc.

Warp streaks: Warp streaks are narrow, barre and dense stripes running along the warp direction. Main reasons are the variation in density of adjacent group of warp ends due to non-uniform dent spacing, wrong drawing-in, or count variations. Also, the variations in lustre, reflectance of dye pick-up of adjacent groups arising out of differences in raw materials, blend composition or yarn constructions contribute for streaks.

Reediness: These are very fine cracks or lines between groups of warp threads, caused due to excessive warp tension, late shedding, use of coarse reed with more number of ends per dent, bent reed wires, improper spacing of reed wires, wrong drawing, and insufficient troughing of shed, i.e. tension difference between top and bottom shed lines during beat up.

Double end: Two ends that weave as one. This happens because of migration of a broken end to the adjacent reed space along with the neighboring end

1.6. Product quality standards

To get the required quality weaver's beam, the following requirements of warping must be maintained:

- ✓ Here, weavers predetermined length should be observed.
- ✓ Wounded ends tension must be uniform here.
- ✓ Wounded ends beam density must be uniform.
- ✓ Weavers package surface must be cylindrical.
- ✓ Production rate should be high.
- ✓ During weavers, yarn should not be damaged.
- ✓ During weavers, yarn breakage should be as minimum as possible.
- ✓ Here, weavers beam should be free from all kinds of faults such as slack ends, cross ends, missing ends, damaged flanges, wild yarn etc.
- ✓ Weavers might not impair the mechanical and physical properties of yarn.

Self-check 1

Instruction: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: choose the correct answer

- Which one the following is odd?
 - Reed mark
 - Loom barre
 - Broken draft
 - Warp streaks
- Repetitive selvedge-to-selvedge unevenness in woven fabric usually attributed to a mechanical defect in the let-off or the take-up motion
 - Knot
 - Readiness
 - Double end
 - Drafting
- _____ is the simplest types of draft and from the basis of many others drafts
 - Grouped draft
 - Divided draft
 - Straight draft
 - None

Part II Matching

- | A | B |
|-------------------|---|
| 1. Drawing in | A. used for the weaves which are symmetrical about the center |
| 2. Straight draft | B. consists of threading the warp yarns through the drop wires, the healds and the reed |
| 3. Skip draft | C. the simplest types of draft and from the basis of many others drafts. |
| There each | |
| 4. Pointed draft | D. used in weaving the fabrics with a high density of warp threads |

Test III. Short Answer

- Write down the types of design draft? (6 Points)
- What are the difference between manual drawing in and automatic drawing in? (4 points)

3. Write the parameters of loom setting. (8 points)
4. Write at list four (4) minor and major machine faults

Operation Sheet 1

Operation Title: Perform drawing- in operation

Purpose: To insert the sized warp yarn on to the required parts of the weaving loom
And ready for the fabric production.

Instruction: Based on the given number of ends (400 warp ends), perform the warp drawing-in operation on to the required parts of the weaving machine. You have given 3 hours to perform the task.

Equipment, Tools and Materials: To perform drawing in process use equipment and material needed are:-

- Drawing in machine
- Cotton sized yarns
- Weavers beam (warped)
- Metal hook
- Reed hook
- Scissor
- Automatic splicer

Precautions: Don't forget to insert the drawing-in operation by flowing the straight draft for obtaining the required final weave design.

Procedures:

- follow OHS practices
- Set up and adjust weaver's beam
- Prepare the thread ends for drawing
- Select suitable reed for predetermined width of the fabric
- Use the required design
- Drawn in or draft the warp yarns through the heald wires
- Fix the warp ends on reed frame (with clamp)

- Complete operation and reporting

Conditions or situations for the operations: The operation process can be performed by following safety precautions and the procedure and steps illustrated on the course unit 1 above.

Quality criteria: Check the performance of inserted input yarns on the required machine parts of the weaving loom based on the production standards and requirements.

LAP Test 1

Name _____ Date _____

Time started _____ Time finished _____

Instructions:- Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 3 hr.

Task 1: Unload the used empty beam & Load the new full weaver's Beam on the weaving loom.

Task 2: Pass the input yarns through the lease rods and drawing-in their ends through drop wire, heald eye and reed dent.

Task 3: check the quality of the drawing process

Unit Two: Knotting operation

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

- Preparation of knotting operation
- Knotting of warp yarn
- Knotting faults

This guide 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:

- Select yarn type
- Identify Type of knotting
- Perform knotting process
- Identify and repair knotting faults

2.1. Preparation of knotting operation

Warp knotting is the process of tying the warp sheets at the time of beam change. For tying of two warp sheets it takes some time and effect on loss of loom efficiency so that this time should be optimum. There are certain activities that are used to prepare warp threads for weaving operation regards knotting of the warp sheet. These are preparing warp sheets for knotting, loading and dressing of the warp sheets, brushing of the sheets and knotting machine setting.



Figure 2.1: warp knotting

Types of knotting operation

The ends of the old warp beam are cut and the ends of the new warp beam are tied to the corresponding ends of the old beam which is called warp knotting process. There are two types of warp knotting operations.

- Manually warp knotting
- Automatic warp knotting

Manually warp knotting

In manual warp knotting more number of workers were required as compare to automatic. In case manual knotting the tie use made by hand, So that it contains so much time and also quality of knot varies from worker to worker in term of size of knot, length of the tail end.

Automatically warp knotting:

Automatic warp knotting is reducing the down time in knotting operation. In this process are use automatic knotting machine, so that this process are improve the quality of knot, less worker requirement etc.

Warp knotting operation generally used in the following four manners

- **Sheet to sheet warp knotting operation:** sheet to sheet warp knotting operation is same count and same qualities are running in loom is mainly use this warp knotting operation.

- **Lease to lease warp knotting operation:** Lease to lease warp knotting operation is mainly use same color pattern are tying operation. It avoided the cross end in color pattern warp sheet.
- **Sheet to lease warp knotting operation:** sheet to lease warp knotting is mainly use in same number of end in two qualities. There for tying is plain pattern to color pattern.
- **Lease to sheet warp knotting operation:** sheet to lease warp knotting is mainly use in same number of end in tow quality. There for tying is color pattern to plain pattern

Loading and unloading of beams

When we want to knot broken ends or new yarns from existing yarn we must be follow the following procedures.

- ✓ Load and unload beams
- ✓ Start and stop machines
- ✓ Perform leasing/ Yarn is prepared for knotting using leases/
- ✓ Yarn is knotted using knotting machine or manual knotting techniques.
- ✓ Broken yarn is identified and repaired.

The warp knotting is completed in two steps:

- **Dressing of warp sheet**



Figure 2.2: Dressing of warp sheet

2.2. Knotting of warp yarn

Tying-in/knot is used when a fabric is being mass produced. The tail end of the warp from the exhausted weaver's beam is tied to the beginning of the new warp. Therefore, if every end on the new beam is tied to its corresponding end on the old beam, the drawing-in process can be omitted. Following the tying-in process, all knots are pulled through the drop wires, heddles and the reed. The loom is now ready for operation.

Types and techniques of yarn knotting/ tying-in

Different types of knots:

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- **Dog knot:** tying of dogs knot is simple and quick but it is bulkier than weavers and fisherman's knot. It is only suitable for creeling and these knots will not be incorporated into the fabric.
- **Fisherman's knot:** it is most popular but it is not at all convenient to lie by hand. They have a diameter 3-4 times that of parents yarn and are popular for filament, cotton, woolen, worsted and blends.
- **Warp machine knot:** Warp knotting Machine Warp knotting machines, in conjunction with TPF3 tying frames, are high-performance warp tying machine for universal use. This machine guarantees maximum efficiency during the warp change process for every weaving mill. Optimum tying quality and adaptability to all yarn types lead to minimum down times on the weaving machine.
- **Reef knot:** The reef knot can be considered an unsafe knot when human life depends on it. If used to tie two ends of any rope or cord together this knot will spill easily when any of the ends are tugged. The knot will spill into reversed half hitches and will then continue to slip resulting in the two joined ends coming apart.

Weaver's knot

The weavers knot has a number of variations which for ease of classification are called weavers knot. The method of tying each knot is similar and they are usually started with both strands to be joined held in the left hand. The knot is then worked with the right hand to bring it into shape.

- ✓ It has very less slippage.
- ✓ Weaver's knot is specially used in cotton threads.
- ✓ Weaver's knots are a vital part of the textile industry. Without them all traditional woven materials would undone.

Knotting Machine Main Parts and their Working

Following are the main parts of knotting machine and their working is also given below:

Advance motion assembly:

The knotting machine is set on the racks of tying frame for warp tying. The upper and lower advance motion feelers control the correct positioning i.e. the forward movement of knotting machine in relation to warp sheet. If there is no thread from the top warp sheet below the upper advance motion feeler, the tying machine moves towards the top warp sheet.

- **Thread retainers:**

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There are two thread retainers in knotting machine. The function of the thread retainers is to prevent two warp ends of one warp sheet from being fed to the tying elements at the same time.

- **Tensioners and Thread pressers:**

The tensioners and thread pressers lay the warp ends parallel to one another and hold them tight for the separation needle. This ensures that the separation needle separates only one warp end of a warp sheet at a time.

- **Thread Feelers:**

The thread feeler spring enables the two thread feelers to check whether a thread has been separated by each of the separation needles. If only one thread has been separated, then the thread feelers disable the feeder.

- **Thread Feeler Spring:**

The thread feeler spring might have to be adapted to accommodate the yarn stock being used. The following springs are available:

- ✓ Z286773 00001 for very fine yarn types
- ✓ Z286773 00002 for medium count type yarn
- ✓ Z286773 00003 for coarse yarn types

- **Separation Needles:**

The two separation needles separate the first warp end from the upper and lower warp sheets and position these two warp ends in the vicinity of the feeder point, which assumes the warp ends from the separation needles and transfer them to the thread clamps. It uses the needle table to select the two separation needles in keeping with the warp material being tied.

- **Needle Retainer:**

The needle retainer acts as a stop for separation needle. It prevents the separation needle from advancing too quickly to the warp sheet before the warp end to be separated is grasped tight by the tensioners and yarn pressers.

- **Needle Penetration Depth:**

As separation needle moves inward, warp end is pushed underneath feeder point by the hook of the separation needle and then assumed by the feeder point. The needle retainers have to be adjusted properly before the needle penetration depth can be adjusted.

- **Lease tubes:**

The lease tube tubes alternatively lay the warp ends to be separated open by virtue of their pivoting movement, the warp ends being tied out of the lease. At the same time they push the

warp ends which have not been laid open towards the warp sheet. To this end, the lease bands forming the lease in the warp sheet have to be drawn in through lease tubes.

- **Thread Clamps:**

The two thread clamps assumes the warp ends from feeder. Each warp end is held separately by the clamping jaws of the thread clasper, cut off by scissors positioned behind the clamps, and assume by the knotter. Once the knotter has taken hold of the upper thread, the upper thread clamp opens and releases the warp end. The same procedure is repeated for the lower warp end.

- **Scissors:**

As the warp ends are held by the thread clamps, the warp end is cut by the top scissor and bottom scissor. A pair of scissors consists of one fixed scissor blade with 4 cutting edges and one moveable scissor blade with 2 cutting edges. When warp ends are no longer being properly cut then the scissor blades are replaced.

- **Extractor Disc:**

The extractor disc removes the cut thread ends from vicinity of the separating elements. To check the extractor disc, the tying machine has to be on the tying frame with tendered warps.

- **Knotter**

The knotter assumes the thread pair from the thread clamps, wraps the warp ends around the needle sleeve in the process forming the knot loop followed by depositing them on the hook of the knotter needle. Various knotters can be used, depending on the properties of the yarn being used and the respective tying machine model.

- **Knotter Needle:**

The knotter needle assumes the warp ends from the knotter and pulls them into the hole of the needle sleeve. By doing so the warp ends are held tight for tying. The extent to which the knot is tightened depends on the flexure of the knotter needle. The greater the flexure, the tighter the knot and vice versa.

- **Thread catcher:** The thread catcher takes hold of the warp end of the lower and upper warp sheet.

Push Needle: The push needle pushes the knot loop off the needle sleeve.

Knot extractor: The knot extractor pulls the two warp ends to the rear, while the push needle pushes the knot loop off the needle sleeve. As a result, the knot is tightened and the warp ends are pulled out of 5 the needle sleeve. This is done by the knot extractor arranging the knots in rows on the knot carrier cord



Figure 2.3: Modern knotting machine

2.3. Knotting the warp yarn

- **Beam unloading & Loading:** Unload the exhausted warp beam in loom and cleaning, oiling of loom. There for load the new warp beam in loom.
- **Frame loading:** After loading the new warp beam are loading the warp knotting frame in parallel to loom.
- **Dressing of warp sheet:** After frame loading the dressing of the beam should be done properly to avoid cross end in new & old warp sheet.
- **Knotting of warp sheet:** After completion of dressing of warp sheet process are tying the new warp sheet and old warp sheet. The tying of warp sheet is end to end tied
- **Frame unloading:** After completion of warp knotting process are removing the tension plate in warp knotting frame, knotting machine and knotting frame.
- **Knotting passing:** After compilation of frame unloading the next process is passing the knot in drop- Pin, heald wire and reed for manually running for loom

2.4. Knotting Faults

Reporting or addressing machine or product faults

The product fault reports can be based on the following effects.

- Efficiency
- Yarn
- Warping
- Sizing
- Weaving
- Inspection

These Reports can be obtained in

- Hour wise

- Shift wise
- Day wise

Interpretation: after getting the reports we can compare the reports Shift wise, Operator wise, Machine wise. We can also judge the loom performance according to reports obtained from that loom.

However, before you report a defective product, it will help in processing and investigating your concerns if you can also provide the following information:

- Reasons you consider the product to be defective
- Details of any injuries or harm resulting from the defect
- A description of the defect with, where relevant, measurements.
- Photographs of the product and the defect, if available
- Details of the markings / information on the product or accompanying documentation.
- Full contact details of the manufacturer, any supplier(s) and date of supply
- Although this is a lot of information, much of this must be obtained before a report defective product.

Self-Check – 2

Instruction: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer

- Which one of the following is a type of knots?
 - Dog knot
 - Fisherman's knot
 - Reef knot
 - All
- _____ is the process of tying the warp sheets at the time of beam change
 - Push Needle
 - dressing of warps
 - Warp knotting
 - None
- ___ is only suitable for creeling and these knots will not be incorporated into the fabric.
 - Lease tubes
 - Reef knot
 - Fisherman's knot
 - Dog knot

Part II Matching

A

B

- | | |
|----------------------------|--|
| 1. Knotting | A. Reducing the down time in knotting operation |
| 2. Automatic warp knotting | B. number of workers were required |
| 3. Manual warp knotting | C. The process of tying the warp sheet the time of beam change |

Part III Short Answer Questions:

- What is meant Splice? (4 points)
- What are the types of weaver's knot? (5 points)
- Write the difference between manual and Automatic warp knotting (5 points)
- Write down the knotting fault (4 points)
- What is knotting? (3 points)

Operation Sheet 2.1

Operation Title: Perform knotting operation

Purpose: To carry-out the tying of the full beam sized warp yarn with the previous last warp end which is already found (drawn) through the weaving parts on the back rest by using hand splicer or automatic knotting machine.

Instruction: Based on the given operational steps, perform the warp knotting/tying operation of the new ends of the full beam with the previous warp ends. You have given 3 hours to perform the task.

Equipment, Tools and Materials: To knot the two warp ends the following equipment and material needed are:-

- Drawing in machine
- Full beam cotton sized yarns
- Metal hook and brush
- Reed hook
- Scissor
- Tying in splicer machine
- Automatic splicer

Precautions: Don't forget to knot the two warp ends by using appropriate knotting device/ machine for achieving the expected result. The operation should be performed by considering the safety rules and regulations.

Procedures

1. Read the course unit well
2. Apply OHS practices
3. Unloading & Loading Beam
4. Knotting of warp sheet
5. Adjusting the new warp yarn tension within the machine parts
6. Complete operation and reporting

Conditions or situations for the operations: The operation process can be performed by following safety precautions and following its sequential procedure and steps illustrated on the course.

Quality criteria: Check the quality and performance of knotted yarns on the required machine parts of the weaving loom based on the production requirements.

LAP Test 2

Name _____ Date _____

Time started _____ Time finished _____

Instructions: Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 3 hr.

Task 1: Unload the used empty beam & Load the new full weaver's Beam on the weaving loom.

Task 2: by unraveling the full weavers beam knot the input new yarn ends with the warp end which is already found on the weaving loom.

Task 3: check the quality of the knotting process.



Unit Three: Adjust Weaving loom

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

- Product specifications
- Setting up of weaving loom
- Loom operation
- Workplace instructions
- Electronic process monitoring

This guide 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:

- Interpret Product specifications
- Setting up of weaving loom
- Operate Loom operation
- Follow workplace instructions
- Perform the electronic processes monitoring

3.1. Product specifications

The loom setting is checked according to the product requirements. The product requirements include the following parameters.

- **Color/weave relationship**

The use of colored warp and weft yarns combined with the weave structures permit the development of striking patterns. For a given pattern with multi-color, a color can be strategically placed in the pattern by merely using the binary system of warp and weft interlacing. The desired color of a yarn appears when the yarn is over the crossing yarns for a desired length and small or large area if several yarns are used. Moreover, numerous mixtures of colors to produce other colors can be obtained from few colors of the warp and weft yarns through proper weave interlacing.

- **Tension**

Tension in the yarn is measured using of the tension devices, the operator sets the tension in the yarn to the required level by using means that are known as tension generators or compensators or simply tensioning device.

- **Size/width**

How to work out the total width of the warp

The shrinkage/take-up is usually assumed to be 10% of the width of the woven piece but this can vary by a large amount depending on the yarn, structure and finishing. Sampling will give you a more accurate number. It is often easier to work out the calculations in cm and then convert to Meter by dividing by 100 at the end.

As a working example:

Total number of picks:

8 PPC (Pick per centimeter)

200cm length of woven piece

10% of 200cm = 20cm shrinkage/take-up

Total width of warp:

50cm wide woven sample

10% of 50 = 5cm shrinkage/take-up

- **Weight**

Fabric weight (w_c) is the weight of yarn per square meter in a woven fabric which is the sum of the weight of the warp (W_1) and the weight of the weft (W_2).

✓ W_c Total length of yarn in one square meter x mass per unit length of yarn.

- ✓ Where total length of yarn= total threads per meter x length of each thread
= 1meter + crimp allowance
- ✓ Total fabric weight per square m = $W_1 + w_2 \text{ gm}^{-2}$
- ✓ Weight per piece = $(W_1 + W_2) \times \text{piece length} \times \text{piece width g.}$
- ✓ Total weight per square meter = warp weight per square meter x weft per square meter
- ✓ Piece weight = total weight per meter x piece length x piece width kg or g

- **Ends per inch (EPI)**

Ends per inch (EPI) are commonly used by weavers who must use the number of ends per inch in order to pick the right reed to weave with.

- **PPI**

Pick Per Inches. A pick is a single weft thread, hence the term. In general, the higher the picks per inch, the finer the fabric. A single thread of the weft, crossing the warp, is called a pick.

- **Cover factor**

Cover factor indicates the extent to which the area of a fabric is covered by one set of threads. For any fabric, there are two cover factors: the warp cover factor and the weft cover factor. The cloth cover factor is obtained by adding the weft cover factor to the warp cover.

3.2. Setting up weaving loom

A loom is a device used to weave cloth and tapestry. The basic purpose of any loom is to hold the warp threads under tension to facilitate the interweaving of the weft threads. The precise shape of the loom and its mechanics may vary, but the basic function is the same.

Weaving is done by intersecting the longitudinal threads, the warp, i.e. "that which is thrown across", with the transverse threads, the weft, i.e. "that which is woven".

Types of weaving loom

- **Table Looms**

Table looms are smaller and more portable than floor looms but more complex than the other small looms in this list. They are made to be used on top of a table or on a stand. While you can get a table loom that has more than 8 shafts, the most common types have either 4 or 8.



Figure 3.1 Table loom

- **Projectile weaving loom:**

Projectiles with small and large Grippers for the majority of commercial yarns. Recently a company introduced K 3 as synthetic (Carbon Composite) projectile which has been used for economic production of very delicate fabrics.

The picking and the projectile units are separated from the moving sley. The Sley (Projectile track) carries the Reed and Gripper Guides. The gripper projectile, made of the fine steel 90 mm The weft is drawn directly from a large stationary cross wound package with or without accumulator. The gripper projectile is picked across the warp shed at the very high speed, the picking energy being derived from the energy stored in the metal torsion bar which is twisted at predetermined amount and released to give the projectile at high rate of acceleration. Picking always takes place from one side but several projectiles are working on conveyor chain located underneath the warp shed.



Figure 3.2: Projectile weaving loom

- **Rapier (Flexible & Rigid) loom:**

Rigid Rapier Looms for Technical Fabrics like Glass, Aramid, and Carbon (3 K to 50 K) Varieties. Warp preparation is being carried out on Sectional Warping and Texmer Direct Creel to Loom. We are developing prototypes of Leno Fabric, Glass Rovings, HDPE fabrics, PPGL Matrix, PP Filter Fabrics, Jute, Ceramic Insulation Fabrics, etc. in different weaves on Dornier Rigid Rapier looms. We are running three width of 300 Tex Glass Roving together to take advantage in production of wider, width weaving machine



Figure 3.3; Rapier (Flexible & Rigid) loom

- **Water Jet weaving loom:**

Water jet looms were used in early 80's for economic and bulk production of Polyester Sarees and Dress Materials, Shirting, etc. Mostly water jet looms were manufactured from Japan. These looms are suitable for medium to fine Denier Polyester yarns while Cotton and Viscose weaving was not possible with commercial acceptance

- **Air Jet Weaving loom:**

A successful weaving technology for medium to coarse cotton and spun yarns with the mechanism of air jet picking was introduced by Max Paboo of Sweden in 1958. A leno selvedge with a fringe of about 1/8 inch or 0.33 cm length is produced during weaving. These looms have been installed in large numbers due to high RPM and better productivity controls with the help of Microprocessor based controls..



Figure 3.4.: Air Jet Weaving Machine

3.3. Loom operation

Shedding

It is raising and lowering of warp yarns by the harnesses to make an opening for the weft yarns to pass through.

Picking

It is the actual process of placing the weft yarns in the shed. This is done using a device known as 'shuttle'. It has a metal strip in which bobbin or pin is inserted.

Beating

Sometimes called beating in or beating up, consists of evenly packing the filling yarns into position in the fabric. It gives a compact construction to the fabric.

Taking up and letting off:

It involves taking up the newly manufactured fabric onto the cloth beam and letting off or releasing yarn from the warp beam. The operation maintains uniform distance and tension from warp beam to harness to completed cloth.

3.4. Work instructions

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Weaving loom work instruction

- ✓ Fasten the warp onto the loom
- ✓ Prepare the weft yarn
- ✓ Insert your shed stick into the warp thread
- ✓ Create a basic weaving pattern
- ✓ Push each new row of weft thread down
- ✓ Keep an even tension
- ✓ Add colors and textures with additional weft materials.

The loom setting is checked according to the product requirements. The product requirements include the following parameters.

Color/weave relationship

The use of colored warp and weft yarns combined with the weave structures permit the development of striking patterns. For a given pattern with multi-color, a color can be strategically placed in the pattern by merely using the binary system of warp and weft interlacing. The desired color of a yarn appears when the yarn is over the crossing yarns for a desired length and small or large area if several yarns are used. Moreover, numerous mixtures of colors to produce other colors can be obtained from few colors of the warp and weft yarns through proper weave interlacing.

- **Tension**

Tension in the yarn is measured using of the tension devices, the operator sets the tension in the yarn to the required level by using means that are known as tension generators or compensators or simply tensioning device.

- **Size/width**

- ✓ **How to work out the total width of the warp**

$$\text{Width of woven piece (m)} + \text{shrinkage/take - up (m)} = \text{Total width of warp (m)}$$

The shrinkage/take-up is usually assumed to be 10% of the width of the woven piece but this can vary by a large amount depending on the yarn, structure and finishing. Sampling will give you a more accurate number. It is often easier to work out the calculations in cm and then convert to Meter by dividing by 100 at the end.

As a working example:

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Total number of picks:

8 PPC (Pick per centimeter)

200cm length of woven piece

10% of 200cm = 20cm shrinkage/take-up

$$8 \times (200 + 20) = 1760 \text{ picks}$$

Total width of warp:

50cm wide woven sample

10% of 50 = 5cm shrinkage/take-up

$$50 + 5 = 55\text{cm} (0.55\text{m})$$

$$1760 \times 0.55 = 968\text{m of yarn needed for the warp}$$

• Weight

Fabric weight (w_c) is the weight of yarn per square meter in a woven fabric which is the sum of the weight of the warp (W_1) and the weight of the weft (W_2).

✓ W_c Total length of yarn in one square meter \times mass per unit length of yarn.

✓ Where total length of yarn = total threads per meter \times length of each thread

$$\circ = 1\text{meter} + \text{crimp allowance}$$

✓ Total fabric weight per square m = $W_1 + w_2\text{gm}^{-2}$

✓ Weight per piece = $(W_1 + W_2) \times \text{piece length} \times \text{piece width g.}$

✓ Total weight per square meter = warp weight per square meter \times weft per square meter

✓ Piece weight = total weight per meter \times piece length \times piece width kg or g

Ends per inch (EPI)

Ends per inch (EPI) are commonly used by weavers who must use the number of ends per inch in order to pick the right reed to weave with.

• PPI

Pick Per Inches. A pick is a single weft thread, hence the term. In general, the higher the picks per inch, the finer the fabric. A single thread of the weft, crossing the warp, is called a pick

• Cover factor

Cover factor indicates the extent to which the area of a fabric is covered by one set of threads. For any fabric, there are two cover factors: the warp cover factor and the weft cover factor. The cloth cover factor is obtained by adding the weft cover factor to the warp cover.

Table 1: Comparison of fabrics with identical warp and weft cover factors woven with yarns of different linear densities (SI units)

Cloth	Threads per cm		Linear density		Cover factor		Weight	thickness
	n ₁	n ₂	N ₁	N ₂	K ₁	K ₂	(g/m ²)	Mm
A	24	24	25	25	12	12	130	0.28
B	12	12	100	100	12	12	260	0.56
C	6	6	400	400	12	12	520	1.12

- **Crimp:**

Crimp refers to the amount of bending that is done by a thread as it interlaces with the threads that are lying in the opposite direction of the fabric.

- **Selvedge:**

The length wise running edges of woven fabric are known as selvages. It prevents unraveling of warp yarns. Three kinds of selvages can be formed:

✓ **Tucked selvages:**

A special hooked needle driven by a cam produces, after cutting, the insertion of the protruding thread end into the subsequent shed, thus forming a stronger edge.

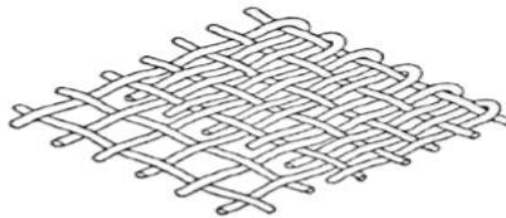


Figure 3.5: Tucked selvages

✓ **Leno selvages:**

These selvages are obtained by binding the wefts with strong additional threads working in gauze weave and by eliminating through cutting the protruding weft ends.

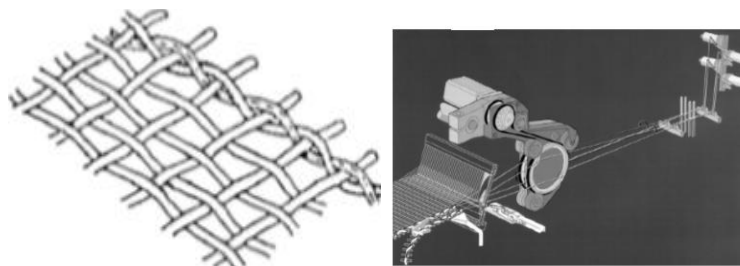


Figure 2: Leno selvages

✓ **Fused selvages**

These are obtained by pressing a hot mechanical element on the fabric edge; this method can be applied on fabrics in man-made fibers.

✓ **Devices for center selvages:**

All these three systems allow the formation also of centre or "split" selvages, when several lengths of cloth are woven on the same machine.



Figure: Devices for center selvage formation in a projectile weaving machine

3.5. Electronic process monitoring

Modern electronic control Systems in weaving machines

- **Electronic Take Up and Let Off:**

The take-up is used to keep the required thread density in the fabric and wind the fabric on the cloth roll and let off release the required amount of warp. The electronic system provides important time saving the required pick density is electronically set (no pick wheels are required to change pick density). The accuracy of settings makes it easy to adjust the pick density of the fabric for optimum fabric weight and minimum yarn consumption. The take up and let off are driven by separate motors.

- **Let-off and take-up motions:** are identical in construction, each motion utilizes a resolver as the measuring system, connected together with the sensor to a control circuit. Electronic fabric take-up and warp let-off is not only controlling and reacting, but also acting with regard to the future. Absolute sensors measure the warp tension – independently of the position of back-rest roller and mechanical element motion – keeping it constant, even when weaving with splitted warp beams. The accuracy of warp beam settings on the display amounts to 1 cN/end with a filling density resolution of 0.01 picks/cm. Exactly reproducible values for filling density, machine speed, warp tension and contraction support start-mark prevention.

Self Check-3

Test 1: Choose the best answer

- Which one of the following is correct about Weaving loom work instruction?
 - Prepare the weft yarn
 - Create a basic weaving pattern
 - Fasten the warp onto the loom
 - All
- _____ is raising and lowering of warp yarns by the harnesses to make an opening for the weft yarns to pass through
 - Picking
 - Beating
 - Shedding
 - Let off
- Which one of the following is odd?
 - Shedding
 - Picking
 - Beating
 - Table Loom
- Consists of evenly packing the filling yarns into position in the fabric
 - PPI
 - Crimp
 - Cover factor
 - None

Part II Matching

- | <u>A</u> | <u>B</u> |
|------------------|--|
| 1. Let- off | A. PPI |
| 2. Take-up | B. EPI |
| 3. Pick per inch | C. The newly manufactured fabric onto the cloth beam |
| 4. Ends per inch | D. Releasing yarn from the warp beam |

Test II: Short answer

- What is the difference between Let-off and take-up motions?
- Write weaving loom motions?

3. Write types of weaving loom?
4. What are the difference between EPI and PPI?

Operation Sheet 3

Operation Title: **Adjust Weaving loom**

Purpose: To carry-out the tying of the full beam sized warp yarn with the previous last warp end which is already found (drawn) through the weaving parts on the back rest by using hand splicer or automatic knotting machine.

Instruction: Based on the given operational steps, operate weaving loom. This operation helps to trainees know how to knot operate weaving loom and steps and procedures.

The operation steps as follow

Equipment, Tools and Materials: • To perform operate weaving loom use equipment and material needed are:-

- Hydraulic beam shifting device
- Knotting machine
- Cotton yarns
- Weavers beam (warped)
- Weaving loom

Precautions: The operation can be performed by following occupational health and safety rule. Use of proper OHS materials

- Operational workplace activities
- Hazardous, controlled or exposed conditions
- Work may be conducted in small to large scale enterprises and may involve individual and team activities.

- Procedures in doing the task:
- Read the information sheet well and Apply OHS practices
 - Unloading the empty weavers beam and loading in new beam
 - Set the knotting frame and Fix the brush and clamp
 - Pull and dressing the end with help of comb brush
 - Fix the end in knotting frame (with clamp)
 - Fix the clamp on end and Set the Knotter on stand
 - Start the warp knotting operation
 - After complete knotting, start operating weaving loom.
 - Perform recording

Conditions or The operation process can be performed by following the procedure and situations for the steps illustrated on the information sheet operations:

Quality criteria: Perform weaving operation based on the production requirements.

Lap Test-3

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 2 hour.

Project Name: Weaving Loom

Task-1 Operate weaving loom

Task-2 Report machine faults used appropriate form.

Unit Four: Loom Operation

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

- Duties and Responsibility of supervisor

This guide 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:

- Understanding the Duties and Responsibilities of a supervisor

4.1. Duties and Responsibility of supervisor

A supervisor oversees the day-to-day performance of employees. Depending on the company, a supervisor may manage a team, a shift or an entire department

Job description the loom supervisor is a job role in weaving department. The responsibility of Loom supervisor is to ensure production of knotted carpets as per specified quality and productivity level as per prescribed timelines while maintaining cohesive team of weavers performing with commitment.

Responsibilities

- Oversee efficiency of operational processes.
- Participate in strategic planning and goal-setting for various business functions, including IT and customer support.
- Analyze business requirements and customer needs.
- Research methods to improve operations and reduce costs

Tufted Weaving Supervisor: Tufted Weaving Supervisor is overall head of tufted weaving section responsible for monitoring and execution of production planning schedule for production and quality of tufted carpet and its delivery to subsequent customer department

Brief Job Description: The Tufted Weaving Supervisor is a job role in Weaving department. The responsibility of supervisor is to ensure production of tufted carpets as per specified quality and productivity level while maintaining cohesive team of Tufting gun operators performing with commitment. He also ensures keeping in order the safety and security of workplace and working in compliance with organization policies and practices.

Personal Attributes: The supervisor (jamadar) should be keen, vigilant, good eyesight, patient and investigative. He should be free from defects of colour vision. Agile, cooperative, available and responsive to needs of people seeking technical/professional assistance.

Self check-4

Test4. Short answer

1. What is the responsibility of loom operation?
2. Write importance of supervisor?

Unit five: Maintain records

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

- Preparing and recording reports

This guide 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:

- Report are prepared based on the works done
- Record are maintained as per the requirement for future reference and use

1.5. Preparing and recording reports

What is recording and documentation

Documentation is a set of documents provided on paper, or online, or on digital or analog media, such as audio tape or CDs. 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 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 requirements
 - Ethical standards
 - Technology and equipment used
- Both the physical and financial records of the 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:

- satisfy various legal requirements
 - assist in preparation of tax returns
 - to help management identify areas where efficiencies can be introduced
 - enable management to monitor business, exercise control and make informed decisions
 - use information from the past to plan for the future
- It is important when considering implementing recording systems that they are simple, easy to use, effective and suit the business.

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 law e.g. financial records for tax returns.

The importance of documentation in the workplace

Many of us have heard the saying” If it's not in writing, it didn't happen. But how many of us follow through with what this really means.

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.

- **Why you should document**

Documentation provides a written account of activities as they happen. It stands as written proof that something was done or said.

Documentation also gives us the ability to have another account of a situation, other than verbal.

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.

How to Maintain Employee Records

Keeping employee records accurate and up to date is essential for your business, especially when considering all the state and federal filing requirements for employee taxes. Otherwise, you'll have a hard time filling out all the necessary forms and providing quarterly detail on your employees and your payroll.

The detailed individual records you keep on each employee should include this basic information, most of which is collected or determined as part of the hiring process:

- ✓ Name, address, phone number, and Social Security number
 - ✓ Department or division within the company
 - ✓ Start date with the company
 - ✓ Pay rate
 - ✓ Pay period (weekly, biweekly, semimonthly, or monthly)
 - ✓ Whether hourly or salaried
- **Filing systems:** Every business has filing to do and invariably multiple staff within the business need to be able to easily access information that is being filed. It is important to everyone in your workplace that you are diligent about your filing responsibilities and properly follow the designated systems. There are three main areas applicable to the majority of workplace filing systems:
 - ✓ business records for financial management
 - ✓ technical information for physical management
 - ✓ personal information for OHS, employment, human resource management

There are many different filing systems that can be adopted including:

- ✓ Alphabetic
- ✓ numeric
- ✓ subject

Self-Check – 5

Instruction: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Part I: Short answer

1. What is documentation? (5)
2. What is the important of documentation? (5)
3. What are the procedures of documentation? (5)

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