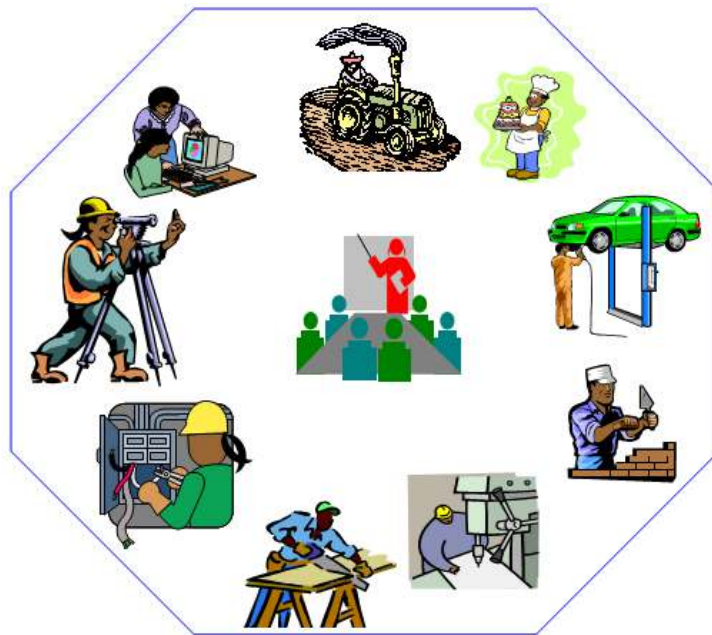


# Bamboo Product Processing

## Level I

Based on May 2011, Version 2 Occupational  
standards



**Module Title: - Producing bamboo furniture**

**LG Code: IND MAC2 M05 LO (1-5) LG (19-23)**

**TTLM Code: IND BPP1 TTLM 1121V1**

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**Addis Abeba, Ethiopia**

Page 1 of 94	Ministry of labor and skill Author/Copyright	TVET program title-producing bamboo furniture Level -1	Version -1 may 2021
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## Contents

LG #19 .....	4
LO#1-Prepare workstation.....	4
Instruction sheet .....	4
Information Sheet 1     Ensuring work area for safe work activity .....	5
Information Sheet 2 Reading and Interpreting drawing Checking and sorting parts for quality product.....	7
Self-Check.....	9
Written Test .....	9
Information Sheet 3 Checking and sorting parts for quality product.....	10
Self-Check.....	12
Written Test .....	12
Information Sheet 4 Checking and preparing fittings, fasteners, attachments and materials	13
Self-Check.....	17
Written Test .....	17
Information Sheet 5     Selecting and checking tools and equipment .....	18
LG #20 .....	21
LO #2- Prepare and Assemble component parts .....	21
Information Sheet 1     Preparing furniture component .....	22
Information Sheet 2     Producing joints .....	28
Information Sheet 4     Laying out and joining components using jigs .....	32
Information Sheet 4     Checking assembled frame components for compliance .....	34
Information Sheet 5     Cleaning and sanding furniture .....	35
Information sheet 1     Surface preparation .....	36
LG #21 .....	41
LO # 3- Split culms into weave strips .....	41
Instruction sheet : .....	41
Information sheet 1 .....	42
Selecting bamboo material.....	42
Self check #1 .....	45
Written test.....	45
Information sheet 4 .....	46
Dyeing weave strip.....	46
Color of the culm .....	46
Self check 1 .....	47
Written test.....	47
Operation sheet 1.....	48
Making the thin or thick slivers for making woven mat based products .....	48

LAP TEST .....	50
Performance Test .....	50
LO # 3- Split culms into weave strips .....	51
Instruction sheet 2 Marking, splitting, and sorting bamboo culm.....	51
Information sheet 3 Removing sharp edges of strip.....	52
LO # 4. Weave item.....	54
Instruction sheet .....	54
Information sheet 1 Selecting weaving design and material.....	55
Information sheet:- 2 Weaving item of given size .....	59
Operation sheet 1– techniques of producing weave products.....	64
Operation sheet 2– techniques of producing weave products.....	66
LAP TEST .....	68
Performance Test .....	68
Information Sheet 3- Checking quality standard of woven product .....	69
Information Sheet 2 Weaving item of given size.....	73
Information Sheet 4 quality standard of woven product Checking.....	74
Information Sheet 5 Storing weave product and strip.....	75
LO5. Apply finishing materials .....	76
Instruction sheet .....	76
Information Sheet 1 Surface preparation.....	77
Self-Check – 2.....	78
Written test.....	78
Operation Sheet 1-Techniques of surface preparation .....	79
Information Sheet 2 Preparing finishing materials .....	81
Information Sheet 1 Surface preparation.....	83
Self-Check – 2.....	84
Written test.....	84
Information Sheet 3 Applying finishing material and drying .....	85
Information Sheet 4 Cleaning work area and equipments .....	87
Reference Materials .....	91

## LG #19

## LO#1-Prepare workstation

### Instruction sheet

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

- Ensuring work area for safe work activity
- Reading and Interpreting drawing
- Checking and sorting parts for quality product
- Checking and preparing fittings, fasteners, attachments and materials
- Selecting and checking tools and equipment

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:

- Read and interpreted Plan and drawings in determine furniture style and joint type.
- Select and check the and apply appropriate tools work
- insure work activity

### Learning Instructions:

- Read the specific objectives of this Learning Guide.
- Follow the instructions described below.
- Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
- Accomplish the “Self-checks” which are placed following all information sheets.
- Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
- If you earned a satisfactory evaluation proceed to “Operation sheets
- Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
- If your performance is satisfactory proceed to the next learning guide,
- If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

## Information Sheet 1 Ensuring work area for safe work activity

### 1.1 Workplace Safety Procedures

The most important concept to remember is that you are responsible for your own safety and the safety of others. Most safety practices are common sense. Unfortunately, they can be forgotten or overlooked unless you make safe practices a habit or an instinct.

### 1.2 General Safety

By doing things right, you and your co-workers will commit yourselves to safety on the job and everyone will benefit. Accidents occur in many ways but most often can be traced back to one of two basic factors: ignorance or carelessness. You must always be concerned with your own safety and with the safety of others around you.

- **Following ways are a safe workplace and promote a strong safety culture.**

- ✓ Eliminate potential hazards. ...
- ✓ Make sure all workers are properly trained. ...
- ✓ Ensure workers have the proper equipment. ...
- ✓ Provide visual safety aids and messages. ...
- ✓ Create a safety committee – and hold monthly safety meetings. ...
- ✓ Make safety fun.
- ✓ Controlling the risks
- ✓ Accidents and Investigations
- ✓ Multi-employer workspaces
- ✓ Deciding who can help employers with their duties
- ✓ Consulting workers
- ✓ Providing training and information
- ✓ Providing supervision
- ✓ First aid Controlling the Risks

- **Risk assessments**

As part of managing the safety and health of the organization, the employer must identify the hazards and control the risks in their workplace. To do this they need to think about development of work organizations and working cultures in a direction with supports health and safety at work and in doing so also promotes a positive social climate and smooth operation and may enhance productivity of the undertakings

Page 5 of 94	Ministry of labor and skill Author/Copyright	TVET program title-producing bamboo furniture Level -1	Version -1 may 2021
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- **General safety precaution**

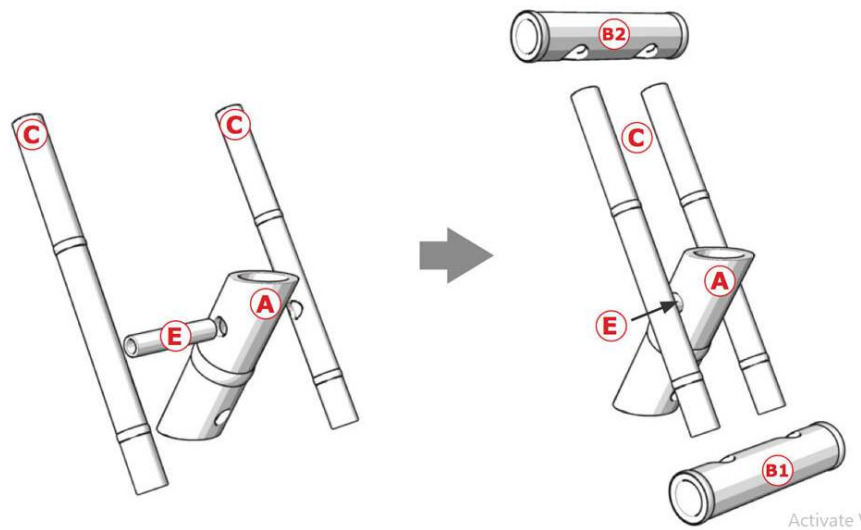
Safety: - is a caution to avoid accident. They are the cause of sharp and pointed tools. Developing safety working attitude and adopting safety methods are the surest way of avoiding unnecessary accidents and dangers in the work shop.

Never wear loose clothing, such as loose long sleeves, which can easily be caught in a revolving machine part. If you feel unwell, report to the teacher or the person in charge of first aid. Report

**Information Sheet 2 Reading and Interpreting drawing Checking and sorting parts for quality product**

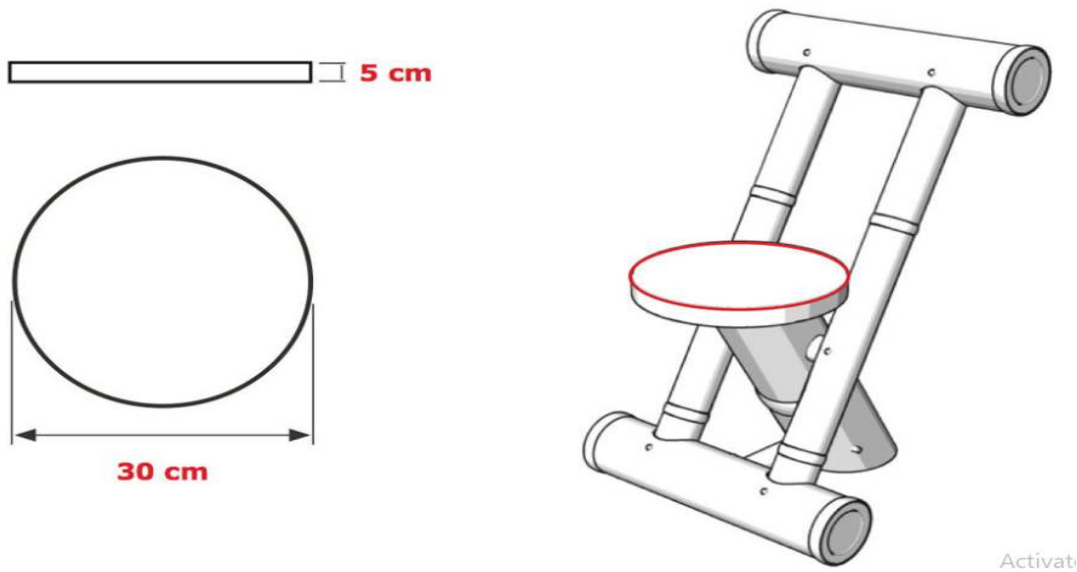
## 2.1 Introduction

The term **drawing** is used to describe the complete set of drawing produced by the designer, manufacturer, or fabricator that show the shape and detailed dimension and contain parts list, or bill of materials (BOM) and information needed for assembly of a product to be made based on its design.



**Figure 1 assembly drawing**

Working drawings and specifications are the primary working documents used by a contractor to bid and execute a project. Specifications are the written documents that go with the construction documents and describe the materials as well as the installation methods. They consist of precisely written documentation that describes a project to be constructed, supplementing drawings and forming part of the contract and describing qualities of materials, their methods of manufacture and installation into the project, workmanship and mode of construction, in addition to providing other information not shown in the drawings including description of the final result.



**Figure 2 3D and 2D drawings**

Working drawing describe every component in a more precise detail way that will enable them to be constructed and operated without errors, delays or other costly issues. The primary role or function of working drawings is to convert design data into finished part information /instructions and to clearly communicate that information to building industry, code officials, product manufacturers, suppliers and fabricators. It helps streamline the manufacturing process.



Self-Check	Written Test
------------	--------------

**Directions:**

Answer all the questions listed below.

- Before starting work, what action should you accomplish first?
  - Notify the supervisor
  - Inspect your tools
  - Insert hearing protection
  - Operate the tool on a test item
- Who should you notify for an unsafe condition?
  - Supervisor
  - Safety officer
  - Division officer
  - Commanding officer
- What equipment can you operate?
  - Any tool in the shop
  - Any tool in the portable toolbox
  - The tool type you are authorized to operate
  - The tools needed for maintenance only

**Note: Satisfactory rating - 3 points**

**Unsatisfactory - below 3 points**

**Answer Sheet**

Score = \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

- You can ask your teacher for the copy of the correct answers after you try by yourself.

### Information Sheet 3 Checking and sorting parts for quality product

#### 3.1 Quality product

During QC (quality control) inspection using a statistically-significant acceptance sampling method is better to achieve our goal. Without pulling samples randomly, you risk getting a report that doesn't fairly represent the quality of the entire product. Factory staff can actually hinder inspection accuracy if permitted to choose which units will be checked. Some may "cherry pick" samples or direct inspectors to check units they know will meet requirements from a specific area of the warehouse. But many importers don't know that their QC team also references a QC checklist to confirm how large of a random sample they need to pull.

Without knowing what sample size to check, a couple problems can occur:

Inspectors may check too many units, which will lengthen the time needed to inspect and may raise your costs if your inspector is billing you based on time; or Inspectors may check too few units, which limits transparency and raises the likelihood that defects and other product issues will go unnoticed. Any effective inspection checklist must include a point about what sample size to inspect, often based on the industry QC standard and Checking the product against specifications

**QC checklist typically covers product specifications such as:**

- Supplier and QC team will work out the testing equipment if they clarify what product tests they need. This often results in not having the necessary equipment available for testing on the inspection date.
- quality control checklist Outside inspectors often bring a few essential tools to product inspections to the factory, like calipers, a tape measure and a barcode scanner, among others. These tools are portable and applicable for most product inspections. quality control



**figer 3 quality cheking tools**

- we can also provide our QC team with CAD drawings, an approved sample and other reference materials to clarify product specifications. Your QC checklist should not only direct your inspector's attention to these, but also list any other specifications they should check during inspection.

Self-Check	Written Test
------------	--------------

**Directions:**

Answer all the questions listed below.

1. What is quality control?
2. Define QC.

**Note: Satisfactory rating - 3 points**

**Unsatisfactory - below 3 points**

**Answer Sheet**

Score = \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

- You can ask your teacher for the copy of the correct answers after you try by yourself.

## Information Sheet 4 Checking and preparing fittings, fasteners, attachments and materials

### 4.1. Fasteners

Fasteners are used to mechanically join two or more objects together, either permanently or non-permanently. There are many different types of fastener, each with their own purpose.

Fasteners can broadly be categorized as either Permanent or Non-Permanent. Permanent Fasteners, such as rivets and nails, are single-use fasteners that are designed to permanently join two materials or parts. Removing the fastener destroys it.

Non-Permanent fasteners, on the other hand are designed to allow for easy removal and re-use. Fasteners such as bolts and screws are commonly used in a number of industries and products as they allow for parts to be disassembled and re-assembled if required. Non-Permanent fasteners can be threaded (bolts, screws, etc.) or non-threaded (pins, retaining rings, etc.).

#### 4.1.1 Threaded Fasteners

Threaded fasteners are among the most commonly used for assembling components due to the ease in which they can be installed and uninstalled as needed. There are three main types of threaded fastener; Bolts, Screws and Studs.

- **Bolts** have a head on one end (this is usually a hex head) and are threaded on the other. They are generally used in conjunction with a nut (and sometimes a washer) to hold them in place.
- **Screws** are similar to bolts in that they have a head on one end and a thread on the other. Their key difference is that screws are usually used to screw into an internally threaded hole. There

are many different types of screws, such as Cap Screws, Machine Screws, and Woodscrews.

## Screw Head & Thread Type

- **Head Types**

- **Oval**

- Lower portion is countersunk and top is rounded.
    - Easier to remove & better looking than flathead screws.

- **Round**

- Used where the fastened piece is too thin to permit countersinking.
    - Also used on parts that may require a washer.

- **Flat**

- Used in applications where the head needs to be flush with the surface.
    - Slotted and Phillips type are available.

- **Thread Styles**

- **Fine-thread**

- Work best for hardwoods.



- **Studs** are threaded on both ends, and therefore have no head. They are used to join two components with internally threaded holes together.

Fastener threads are standardized to two major standards: ISO (Metric) and ANSI (Unified). Threads can also be right-handed or left-handed, depending on the application. However, the majority of common fasteners are right-hand threaded.

- **Glue**

Glue is any adhesive that is applied in liquid form and dries hard to hold materials together. Technically, true glues are made from organic compounds like animal collagen. However, many products marketed as glue are in fact synthetic adhesives made with polyvinyl acetate (PVA)

emulsions. These synthetic adhesives are also sometimes referred to as gums or cements.

## Yellow or Carpenter's Glue (*aliphatic resin*)

- For woodworking.
- "Refined" version of PVA.
- Packaged in squeeze bottles.
- Varieties typically come in yellow or brown.
- Begins to set within 15 minutes.
- Water-resistant nontoxic, nonflammable.
- More resistant to temperature and water than white glue.
- Work needs to be clamped for best results.
- Used for indoor and outdoor applications.



Other types of adhesives, including epoxy, caulk, and sealant, have many similarities with glue. However, they are created with specific jobs in mind and have specific additives that provide these task-specific qualities; glue is a more multi-purpose adhesive and thus has a more basic recipe.

### 4.2 Applying Glue.

If your glue joints have a tendency to fall apart, don't blame the glue. You must be doing something wrong, because modern woodworking glue will produce joints that are actually stronger than the wood itself. All you have to do is use the glue properly.

1. Make sure the joint fits together well. No glue will give much strength if the parts being glued are rough, warped or poorly cut. These keep the parts from fitting snugly.
2. Make sure the wood is clean. Glues rely on penetration to achieve full strength, but wax, dirt, grease, even natural resins in the wood can interfere with penetration. Wipe parts to be joined with a rag dampened with a strong solvent, such as lacquer thinner.
3. Avoid end-grain joints when possible. End grain is naturally weak, and it soaks up glue like a sponge, drawing it deep into the wood and out of the joint. The result is a dry, weak bond. If

you can't avoid an end-grain joint, reinforce the joint with cleats, nails, screws or dowels. Or use special joints that interlock to add strength.

4. Before gluing - thin the glue (use water for white glue or yellow carpenter's glue) about 50 percent.
5. Apply a coat of this thinned glue to the end grain and let it soak in for half an hour. Then apply full-strength glue and assemble the joint.



Self-Check	Written Test
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**Directions:**

Answer all the questions listed below.

1. What fastener?
2. List types of fastener?

**Note: Satisfactory rating - 3 points**

**Unsatisfactory - below 3 points**

**Answer Sheet**

Score = \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

- You can ask your teacher for the copy of the correct answers after you try by yourself.

## Information Sheet 5 Selecting and checking tools and equipment

### 5.1 Selecting and checking tools and equipment

Selecting the proper tool or piece of equipment for a particular job is an important step in maintaining a safe work place. Tools and equipment must be used in accordance with the manufacturer's designed or intended purpose.

- **Hand and Power Tools**

Employees will use proper tools suitable to the job being done. Only tools in good repair may be kept or used on the premises or on the job. Employee-owned tools must meet all safety requirements, whenever used for work. Guards must be in place when so designed.

- **Hand Tools**

Use the proper tool for the job. When possible, purchase tools with ergonomic features. The following guidelines apply to all tools and equipment, and to their operation.

- **Power tools**

Cutting tools must be kept sharp. It is the responsibility of the employee using the tool to keep the tool sharp. Exercise caution when using sharp cutting instruments, especially when encountering resistance. When possible, cut away from the body.

Hammers and other tools having separable handles must have the handle securely fastened to the tool.

Wrenches having jaw openings at right angles or less than 180 degrees to the handle must be placed on the nut with the jaw opening in the direction the handle is to move. Use the correct size wrench and test for slippage on the nut before exerting pressure. Do not use a piece of pipe or a "cheater" to extend the handle for leverage; use a larger wrench. Be aware of equipment torque specifications. Wrenches with cracked or spreading jaws must not be used. Damaged wrenches must be removed from service or repaired according to the manufacturers specifications.

The tips of screwdriver blades must be sharpened and properly dressed to fit screw slots. A screwdriver must not be used as a cutting tool.

Tools with heads that have mushroomed from repeated hammering must not be used. Remove such tools from service.

Power tools shall be equipped with on-off or constant pressure switch as designed.

Page 18 of 94	Ministry of labor and skill Author/Copyright	TVET program title-producing bamboo furniture Level -1	Version -1 may 2021
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- **Tool Storage**

Tools temporarily stored or laid aside on the job must be placed so as not to create a stumbling or falling hazard. They may not be left on ladders or in traffic areas. Tools with sharp edges must be covered or stored in such a way as to guard against a cutting hazard.

- **Electrical Powered Tools and Equipment**

Electric power-operated tools must either be of the approved double-insulated type or be grounded.

- **Electrical Power Cords**

All power cords must be of the three-conductor type with proper ground plug enclosed in common rubber waterproof sheaths.

- **Portable Electric Tools**

Electric cords supplying portable power tools must be rubber sheathed with adequate terminal connections, and must include a ground wire attached to the tool casing and to an outlet ground or other low resistance ground.

Portable electric power tools must be grounded. If double insulated tools are used, they must be distinctively marked.

Portable electric power tools with frayed or worn cords, missing ground prongs, or with loose or worn parts must be removed from service.

## 2 Assured Equipment Grounding Program (WAC 296-46B)

The purpose of this program is to establish procedures to test, identify hazards, and maintain (in safe operating condition), all cords, cord sets, plugs, and electrical equipment connected by a cord.

- **Equipment Grounding Program**

Cord sets equipped with do not need to be checked as a part of an assured equipment grounding program. Departments or employees who wish to avoid the process of having to inspect cord sets may do so by replacing them with equipped cord sets.

- **Daily Inspections**

The employee using the equipment will visually inspect each cord set, attachment cap, plug and receptacle of cord sets, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to damage before each days use. The employee will look for external defects, such as deformed or missing pins or insulation damage, and for indications of possible internal

damage. Equipment found damaged or defective must be removed from service and repaired or destroyed.

- **Test Procedures**

The following three tests shall be performed on cord sets or receptacles that are not a part of the permanent wiring of the building or structure and cord-connected and plug-connected equipment that is required to be grounded:

All equipment grounding conductors shall be tested for continuity and shall be electrically continuous. Power equipment must be used in a manner consistent with the manufacturer's recommendations. Supervisors must read and be completely familiar with the manufacturer's operating instructions and recommended safety procedures shall be taken out of service and reported to the supervisor. Small items shall be held with pliers to keep hands away from the wheel.

- **Drill Press**

A few safety precautions must be remembered while operating a drill press. Know your drill press. Read the owner's manual very carefully. Learn its applications and limitations, as well as the specific potential hazards peculiar to it. Always wear safety glasses or a face shield.

- **Power Cut off Saw**

Approved eye protection and ear protection must be worn when performing operations using a power cut off saw, or when working in close proximity to a power cut off saw or grinder.

## LG #20

## LO #2- Prepare and Assemble component parts

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

- Preparing furniture component
- Producing joints
- Laying out and joining components using jigs
- Checking assembled frame components for compliance
- Cleaning and sanding furniture

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:

- Prepare furniture component
- Produce joints
- Lay out and joining components using jigs
- Check assembled frame components for compliance
- Clean and sanding furniture

- Read the specific objectives of this Learning Guide.
- Follow the instructions described below.
- Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
- Accomplish the “Self-checks” which are placed following all information sheets.
- Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
- If you earned a satisfactory evaluation proceed to “Operation sheets
- Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
- If your performance is satisfactory proceed to the next learning guide,
- If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

## Information Sheet 1 Preparing furniture component

After processing, the culms are used for making furniture components.

- Leg poles
- Stool leg supports
- Mortise frame
- Bamboo or wooden plugs
- Surface supporting battens
- Bamboo nails
- Surface strips
- Concealing belt
- Flattened Bamboo surface Leg poles



1. Cut the required number of legs out of a single culm. Ensure that each leg pole has a node at one end for strength reasons.



2. Check if all the pieces are vertically upright and equal in length. Make both the cut ends perpendicular to the culm length.

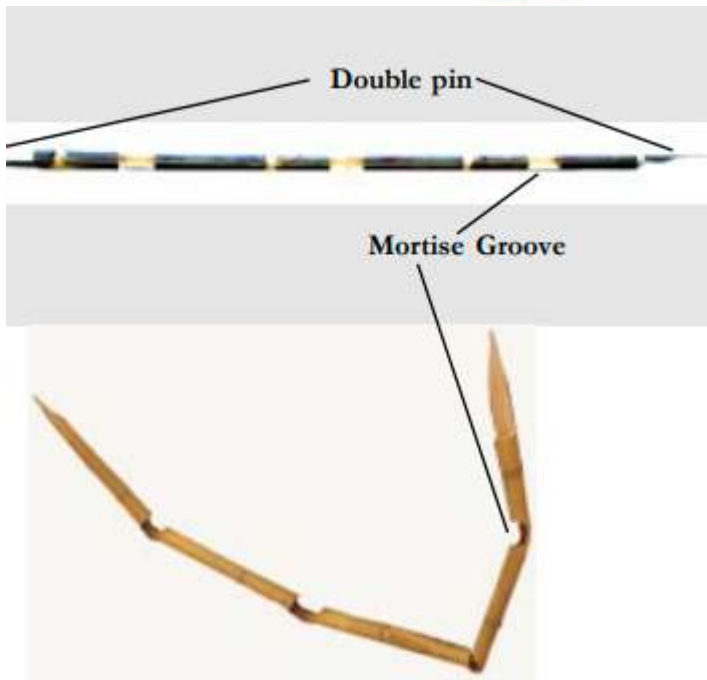


**Stool leg supports** For this component culms need to be sand-filled so they can be subjected to heat bending. Leg supports are added to the leg poles for extra strength. They are applied in between the leg poles. Apply heat bending\* to the culms and check constantly for the right fit. Leg poles are important components, as they support the entire furniture piece

Stool leg supports For this component culms need to be sand-filled so they can be subjected to heat bending. Leg supports are added to the leg poles for extra strength. They are applied in between the leg poles. Apply heat bending to the culms and check constantly for the right fit.

### **Bent Mortise**

A bent mortise is the basic element in Chinese style furniture making which ties the other components together and forms a strong framework.



### Steps to make the bent mortise:

- Determine the mortise groove length
- Mark reference lines on the culm
- Make a template stick
- Mark the culm
- Cut the mortise grooves
- Make the double pins
- Apply heat bending to bend the mortise



Cut on the overlap



Strip matches circumference

1. Cut a paper strip (1-2 cm wide) and fold it around the leg pole with overlap.
2. Make a cut parallel to the culm length on the overlap. The length of the obtained strip corresponds with the circumference of the leg. Step by step we will now adjust the length of the strip to the groove length, for each of the three types of bent mortise.

Triangular bent mortise with leg poles Groove length is 3a'

3 1 2

1/4 1/4



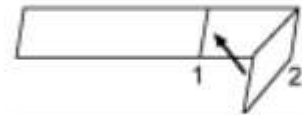
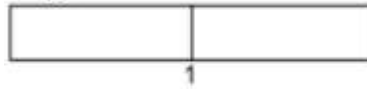
a a'



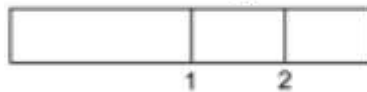
Start



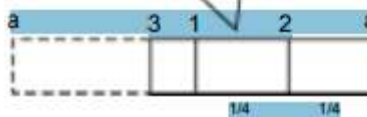
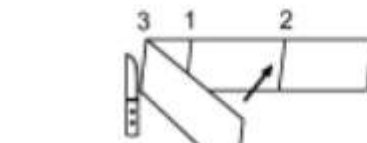
Step 1



Step 2



Step 3



Result

Calculations:

$$1(aa') - 1/4(2a') = 3/4 (a2)$$

$$3/4(a2) : 2 = 3/8 (a3)$$

$$1/2(a1) - 3/8(a3) = 1/8 (31)$$

$$1/8(31) + 1/4(12) + 1/4(2a') = 5/8(3a')$$

Inference: the required length of the strip is 5/8 th of the original strip.

Triangular bent mortise

The following steps are required:

Step 1

Fold the strip into half to make foldline 1.

Step 2

Fold the right half into two quarters to make foldline 2.

Step 3

Make the left end meet fold line 2 and cut through the new fold line 3.

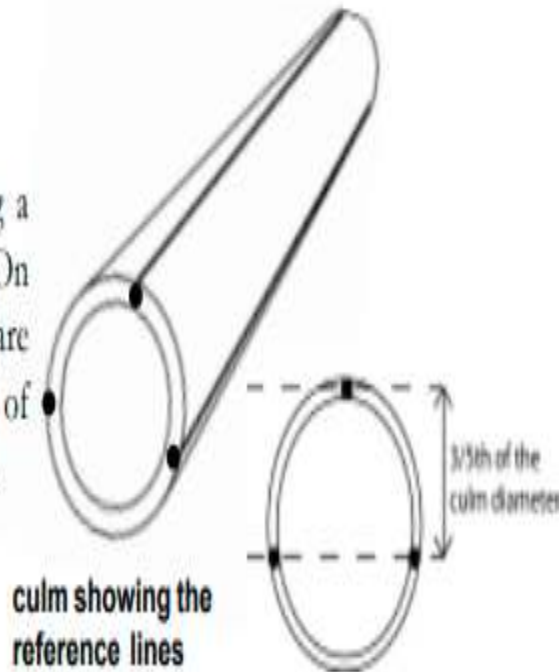
Result The longer part of the strip corresponds to the correct groove length of a triangular mortise.

Mark reference lines Mark a reference line by scraping a straight line along the culm length. On either

side of it, two parallel lines are marked, at a distance of two thirds of the culm diameter from the first one

## Mark reference lines

Mark a reference line by scraping a straight line along the culm length. On either side of it, two parallel lines are marked, at a distance of two thirds of the culm diameter from the first one.



## Make a template stick

Mark the groove length on a bamboo strip using the paper strip. The length of this template stick should be equal to the length of the groove plus the distance in-between two grooves.

Template stick



Marked grooves on the culm (triangular mortise)



## Mark the culm

Using this template stick, mark the culm along the central reference line. Make sure the mortise grooves do not lie on a node. The distance between two grooves should be marked on both ends of the culm.



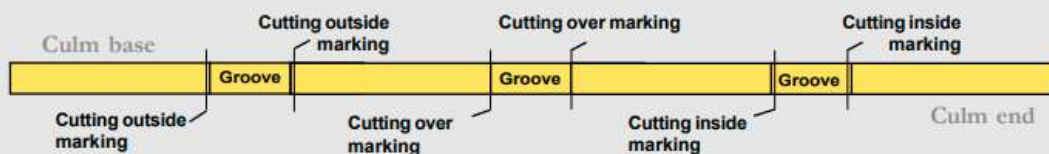
## Cut the grooves

1. Make a cut half the culm diameter on the groove markings. Cut just outside the marking at the culm base, cut just inside the marking at the culm end and cut exactly over the groove markings in the middle of the culm. This is done to neutralize the differences in wall thickness.

*Make sure the blade of the saw is perpendicular to the culm and the central reference line.*



### Cutting adjustments (view from above)



6

## Information Sheet 2 Producing joints

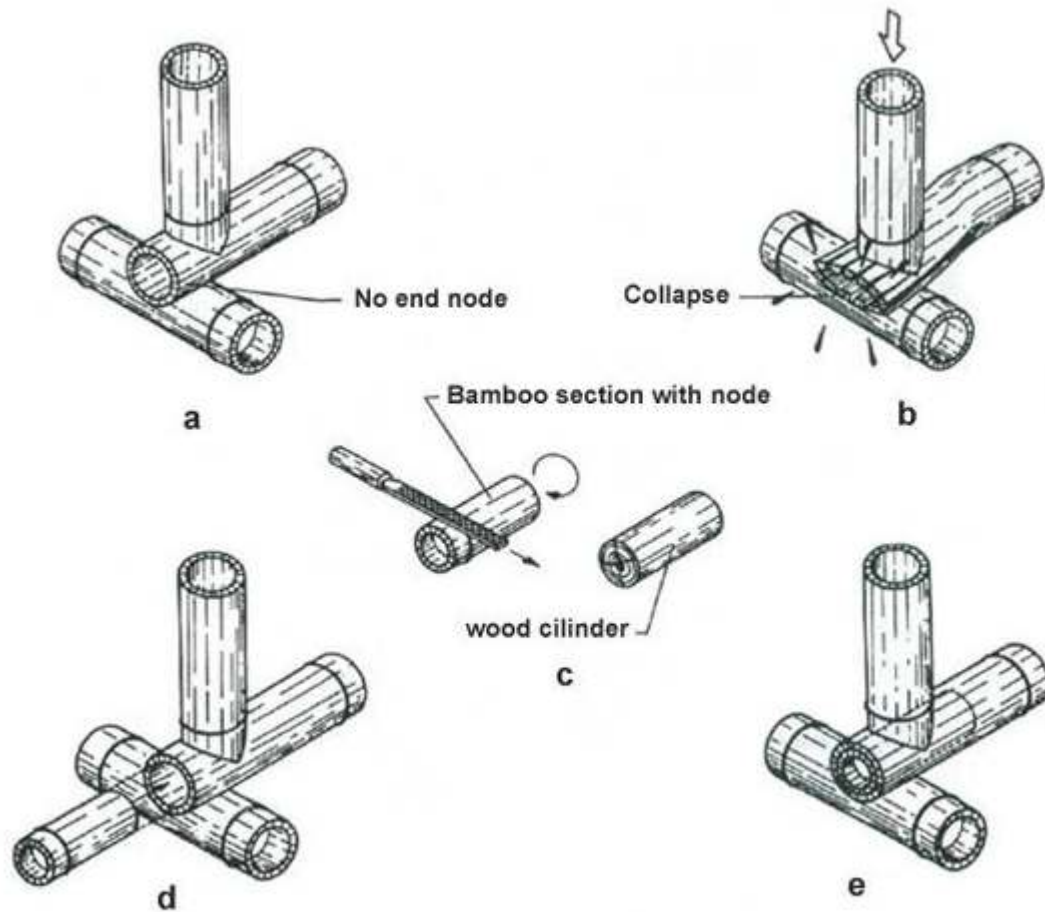
### 2.1 Introduction

Joinery is a part of wood and bamboo working that involves joining pieces of wood, bamboo or lumber, to produce more complex items. Some wood joints employ fasteners, bindings, or adhesives, while others use only wood elements. The characteristics of wooden joints - strength, flexibility, toughness, appearance, etc

Joint is junction of two or more members of bamboo pieces. Joinery, or the making of bamboo joints, is one of the principal functions of the carpenter and cabinetmaker. Bamboo, being a natural material, is not uniform in quality, and moisture, present in the culm during growth, is uneven in cut culm. Bamboo used for furniture is subject to movement caused by changes in its moisture content. Though such movement is frequently quite small and accurately predictable, it remains a critical consideration in joint design. Because bamboo has been used as a furniture and building material for centuries throughout the world, the designs of most joints were perfected hundreds of years ago and have changed little since that time.

### 2.2 Identifying components of joints

In bamboo joint work, using bamboo nodes is very important. Bamboo columns or better to have a node at both ends (or as close as possible towards the ends) it helps the joint having more strength.



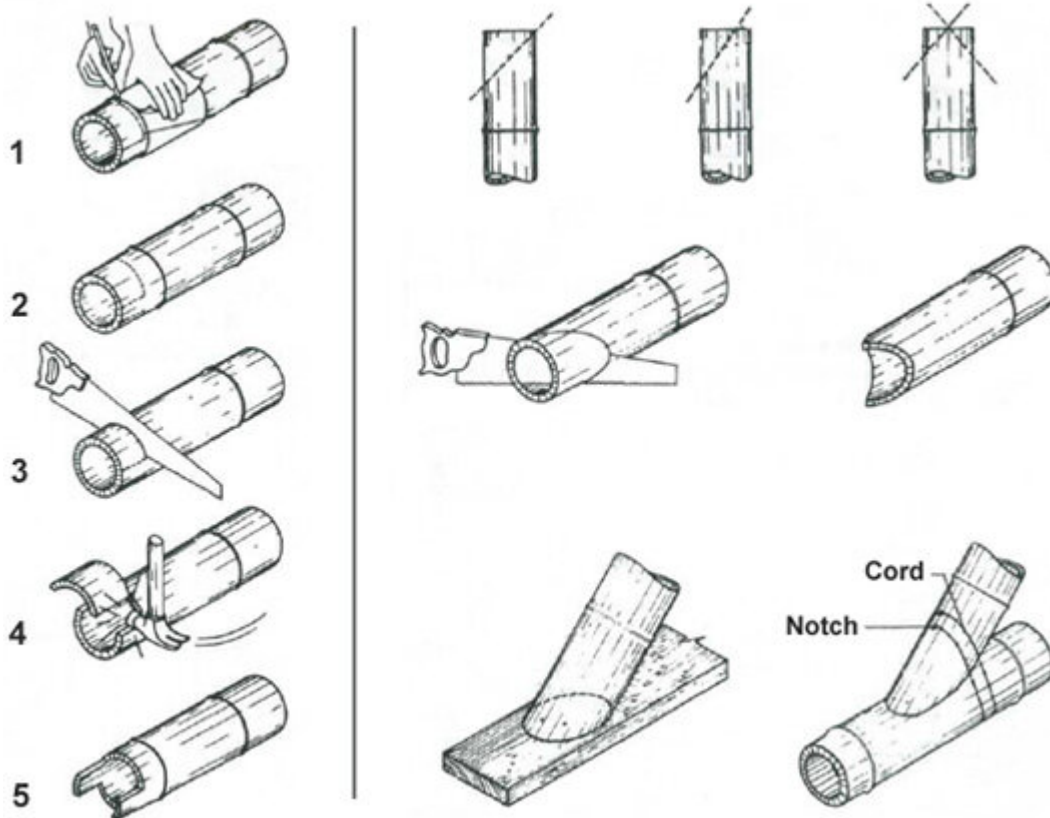
### ***Bamboo Cuts***

#### **Bamboo Cuts**

These are the most common cuts to use when making bamboo joints:

As you can see in the illustration below, making basic cuts in bamboo doesn't require expensive or heavy power tools, just a few traditional hand tools will work fine.



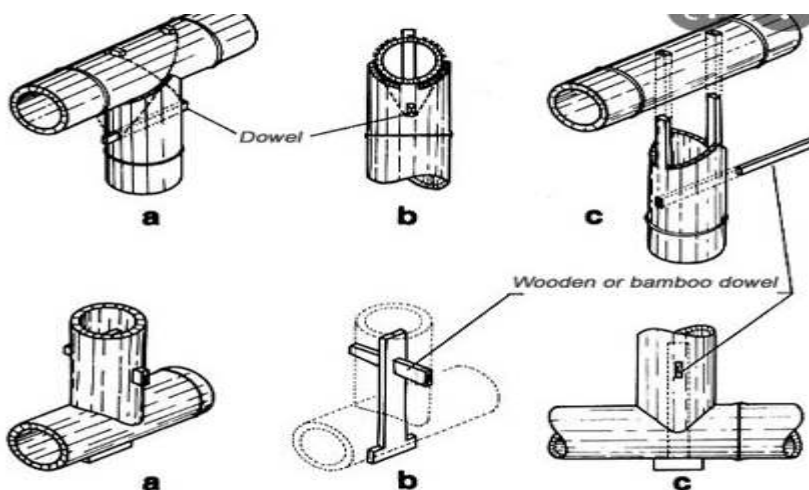


### 2.3 Types of bamboo joints

There are many types of bamboo joints in bamboo furniture making as well as bamboo construction.

The most common types of bamboo furniture joints are

- Joint with one or two ears
- Flap joint
- Bamboo joint with metal anchor
- Fish mouth joint.



Wooden or bamboo dawl figer

## 1Bamboo Joint and joinry technniques

### 1.3.1 Bent mortise

#### Bamboo Joinery Techniques

Making good and aesthetically pleasing bamboo joints is rather complicated because bamboo is hollow, tapered, has nodes at varying distances, and it is not perfectly circular. It is important to keep all these constraints in mind when designing a bamboo joint.

#### •General techniques for different kinds of joinery

- ☐ Mark a straight reference line on the entire length of component using straightened bamboo slat or meter tape or wooden ruler. Mark the locations of joinery using measuring tape and pencils by keeping the straight line as reference. Marking aids are vital in making accurate joinery, assembly and thereby standardized product.
- ☐ Depending on the design of the product and/or location of joinery, different methods or techniques are adopted
- ☐ Cutting. Cutting a piece of bamboo with a crosscut saw requires technique. It is best done on a device that holds the bamboo firmly while it is being cut. While the right hand pushes the saw back and forth, the left hand gradually turns the bamboo clockwise. Turning the bamboo counter-clockwise while it is being cut will damage the peel.

## Information Sheet 4 Laying out and joining components using jigs

### JIGS

It is a work holding device that holds, supports and locates the workpiece and guides the cutting tool for a specific operation. Jigs are usually fitted with hardened steel bushings for guiding or other cutting tools. A jig is a type of tool used to control the location and/or motion of another tool. A jig's primary purpose is to provide repeatability, accuracy, and interchangeability in the manufacturing of products. A device that does both functions (holding the work and guiding a tool) is called a jig. An example of a jig is when a key is duplicated, the original is used as a jig so the new key can have the same path as the old one

**FIXTURES** It is a work holding device that holds, supports and locates the workpiece for a specific operation but does not guide the cutting tool. It provides only a reference surface or a device. What makes a fixture unique is that each one is built to fit a particular part or shape. The main purpose of a fixture is to locate and in some cases hold a workpiece during either a machining operation or some other industrial process. A jig differs from a fixture in that it guides the tool to its correct position in addition to locating and supporting the workpiece.

Figure 2 jigs and fixtures

## How do jigs and fixtures differ

JIGS	FIXTURES
1. It is a work holding device that holds, supports and locates the workpiece and guides the cutting tool for a specific operation	1. It is a work holding device that holds, supports and locates the workpiece for a specific operation but does not guide the cutting tool
2. Jigs are not clamped to the drill press table unless large diameters to be drilled and there is a necessity to move the jig to bring one each bush directly under the drill.	2. Fixtures should be securely clamped to the table of the machine upon which the work is done.



JIGS	FIXTURES
3. The jigs are special tools particularly in drilling, reaming, tapping and boring operation.	3. Fixtures are specific tools used particularly in milling machine, shapers and slotting machine.
4. Gauge blocks are not necessary.	4. Gauge blocks may be provided for effective handling.
5. Lighter in construction.	5. Heavier in construction.

Figure 3 information

## Advantages of Jigs and Fixtures

### PRODUCTIVITY:

Jigs and fixtures increase the productivity by eliminating the individual marking, positioning and frequent checking. The operation time is also reduced due to increase in speed, feed and depth of cut because of high clamping rigidity.

### INTERCHANGEABILITY AND QUALITY:

Jigs and fixtures facilitate the production of articles in large quantities with high degree of accuracy, uniform quality and interchangeability at a competitive cost.

Activate Windows  
Go to Settings to activate Windows

Sl. No	Part Name	Material
1	Jig body	CI
2	Stud	MS
3	Drill/Bush	Gun metal
4	Pin	MS
5	Nut	MS

Figure 3 jig type

## Information Sheet 4 Checking assembled frame components for compliance

### 4.1 Introduction

Compliance permeates all activities in the design, construction, and the use of a built environment to ensure it is fit for purpose, constructed in accordance with the design brief, functional and cost-effective to run, safe to use, and sustainable to the environment throughout its service life.

The compliance checking process occurs constantly throughout all phases of a project lifecycle in the AECO (Architecture, Engineering, Construction, and Operation) domain affects all aspects of the lifecycle which is underpinned by codes and standards:

The planning and design aspects of a project must comply with, on one hand, the project brief and specifications, which stipulate the client's requirements and the manner in which the project should be executed, and, on the other hand, normative planning, resource, and land use provisions, as well as building design codes and standards.

The construction phase post-consenting is subject to health and safety provisions, contractual obligations, as well as satisfying consenting conditions, by-laws, and other regulatory constraints. Post construction, there are project hand-over procedures to follow, which lead on to facility and asset operations and maintenance requirements that continue to apply until the need to replace or renew an asset, which is also driven by safety, reliability, functional and performance objectives.

## Information Sheet 5 Cleaning and sanding furniture

### 5.1 Introduction

Whether you have decided to use a paint stripper or not you still need to sand down your wooden project prior to staining or painting. The reason you sand down a surface is to remove all of the old paint, topcoat, or stain while creating a smooth flat surface. After doing all this hard work, how do you clean wood after sanding?

The most effective way to clean wood after sanding is to brush all the dust off the wooden surface using a painters dust brush and then wipe the surface with a lint-free rag and mineral spirits. The mineral spirits will clean any grime or grease off of your surface making it ready for painting or staining. Also, the advantage of using mineral spirits when compared to water is that water swells wood, also known as a raised grain. It isn't necessarily a bad thing, but you should wait until the wood dries before applying anything over it. Mineral spirits will dry faster, because it evaporates quickly. Some methods for cleaning and reconditioning are:

## Information sheet 1 Surface preparation

### 5.1 Introduction

Surface preparation is the process of treating the surface of a substance in order to increase its adhesion to coatings. The single most important function that influences coating performance is the quality of surface preparation. This can be done mechanically or chemically. The surfaces most often prepared are:

Surface preparation is also known as grit blasting.

- Abrasion
- Over coating
- Reamalgamation
- Padding
- Patching

They are listed in order of increasing difficulty. Use the method that will require the least work to accomplish the desired result.

### 5.2 CLEANING AND WASHING

There is no best way to clean a finish. It depends on the kind of a water wash sparingly—water can loosen old glues.

- 1) Hot Wash: Add to each gallon of hot water:
- 2) tables poons gum turpentine
- 3) tablespoons boiled linseed oil



Figure 1 cleaning and washing materials

## FINISH SOLVENT

Shellac

and has its original finish, it's probably finished with shellac. Denatured alcohol

Lacquer Used on commercially made furniture because it dries so rapidly

Lacquer thinner Varnish Not usually found unless the piece was custom or handmade or previously refinished. Difficult to dissolve. Try lacquer thinner or commercial stripper. Penetrating Oils This finish will probably never need to be reamalgamated because it is so easily and effectively over coated. (See previous section.) Lacquer thinner or commercial stripper.

Use a pencil to mark all pieces with lines or symbols to facilitate their arrangement and assembly.

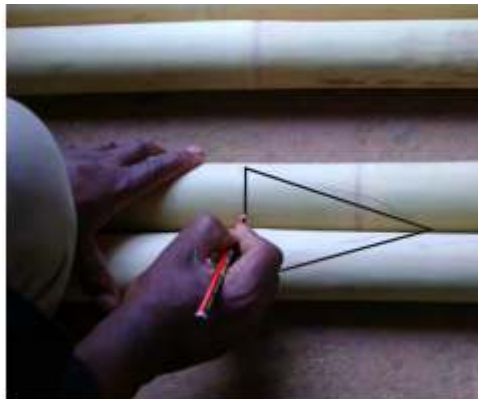
### STEP 1

- Never use a ball pen or soft tipped pen because the ink is very hard to remove.
- Be careful when using tools like mortise gauges, dividers or awls! Such tools can leave deep marks which are hard to remove

Make sure that the best .

### STEP 2

surfaces are facing outward so they are visible from the viewer's perspective.



Figier 2 marking method

### STEP 3

the spot to drill holes, make use of clear tape to cover the spot. This will prevent loose fibres from rising



Figure 2 marking method

#### STEP 4

- Make sure that work pieces are securely fastened while you work on them, especially while drilling holes.
- Use 2 clamps to fix the work pieces to the work bench. Support of clamps is useful to prevent the drill bit from slipping away and damaging the surface.
- Be careful not to damage the work pieces. Protect surfaces by using half round scrap wood.

In order to have a comfortable .

#### STEP 5

working environment make sure that clamp handles are positioned below the workbench and are out of the way.







## LG #21

## LO # 3- Split culms into weave strips

### Instruction sheet :

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

- Selecting bamboo material
- Marking, splitting, and sorting bamboo culm
- Removing sharp edges of strip
- Dying weave strip

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 materials based on design specifications
- Mark place on the top end of the culm, that lines up with the center of the knots on the node
- Mark culm into two longitudinal sections split and sort
- Remove sharp edges from the weaver strips using bench scraper/ L-scraper
- Dye weaver strips, if applicable, in line with standard operating procedures

### Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “operation sheet”.

## 1.1 Introduction

There are three basic weaving patterns. Namely:-

- **cross weaving pattern-** is the simplest, composed of vertical(warp) and horizontal(weft).
- **Netting-** is similar to cross patterns.
- **Hexagonal-** composed of three orientations of slivers.

Bamboo woven articles are made with various widths, thicknesses, lengths and sizes of bamboo splits made from bamboo culms, based on the design of the products. There are two kinds of bamboo splits used for weaving: bamboo threads and bamboo strips. As their names imply, the thickness and width of threads are approximately equal. Strips are much broader than they are thick.

## 1.2 Production of woven bamboo products

Bamboo has been rightly called as ‘wonder grasses due to its multifarious uses. No other plant material can provide a strong competition to bamboo due to its excellent properties and attributes which make it suitable for numerous end products/ purposes. Although bamboo is very strong and hard in its natural form, however when converted into a thin sliver, it can be very flexible owing to its strong fiber property. This special property has been exploited by the users from all over the world for many centuries. It requires special skills for bamboo-weaving that has opened multitude of employment generation activities



Figure 1: tall bamboos are appropriate for weaving

Although all the bamboo species can be used for weaving basket and mats, however some of them are very hard and some make very brittle slivers. Thin wall, longer nodes, smaller diameter bamboos can make better quality slivers for weaving. Mostly freshly harvested thin walled, long inter node type bamboos are good for weaving. The baskets made from thin flexible slivers are very sturdy.

Since times immemorial, bamboo has been woven to make various products like carry baskets, storages, containers, mats, fences, bridges etc. People have been weaving bamboo to make various products according to their requirements.

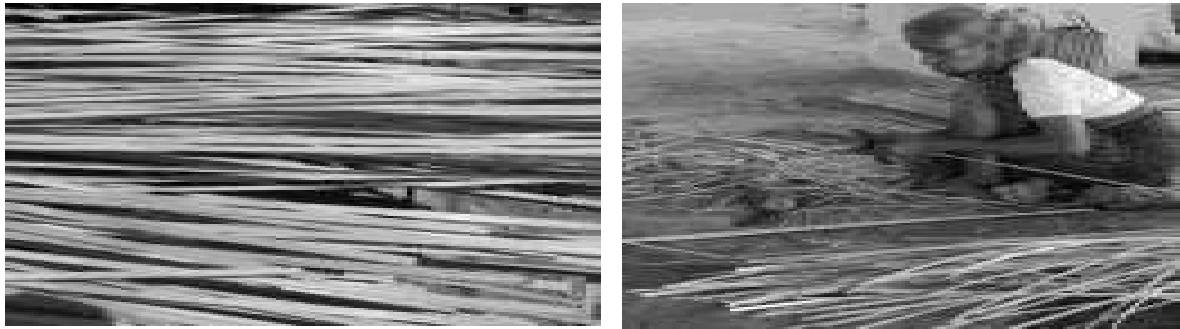


Figure 2: Preparing slats

### 1.3 Weaving process

- Making strips and threads

Strips and threads are the basic materials for weaving various bamboo crafts. Proper treatment of raw materials is a very important procedure that affects the final quality of the goods.

The processing techniques for making bamboo splits are briefly described below:

- Bamboo culms cross-cutting knot removal splitting
- Smoothing Width-sizing Stripping

The narrow tip of the culm and the stout bamboo rhizome are removed before the culms are cross cut to length. Remove the waxy epidermis and nodal flange: The waxy epidermis and nodal flange should remove from culm surface preferably on the day of cutting to guarantee the brightness and smoothness of the culms. The nodal flange is removed first and then traditional method is to lie the freshly cut bamboo in a flowing stream for several weeks to leach out the sap replacing it with water.

Another method is to stand the bamboo upright in drums of water for several days. The bamboo draws in the water and exudes the sap. Yet another method is to inject water under pressure into the end of the culms to force the sap out.

Untreated bamboo will, like any grass, not last long. For short term purposes such as scaffolding or buildings for temple ceremonies the bamboo is not treated and may only last 2 or 3 years. Good harvesting and treatment can extend the life up to as much as 20 or 30 years. Treatment provides protection against the natural enemies of bamboo, termites, powder borer, fungus and wet rot.

The structure of the bamboo swells and absorbs the preserving fluid. After treatment the bamboo cools down and dries out trapping the preserving chemical within the bamboo structure. The most commonly used chemical is a combination of borax and boric acid although some chemical companies are now supplying more sophisticated preserving agents.

A simpler and more commonly used method, though not as effective, is to stand the bamboo in drums and pour preserving fluid in at the top of the culm. The bamboo is left to soak for several days. Another method is to pressure inject the preserving fluid into one end of the bamboo forcing it right through the length of the culm.

Some people use more aggressive chemicals but great care should be taken. Deldrin and ddt are considered very nasty these days and should be avoided. Once treated the bamboo is dried slowly and evenly in the shade to avoid cracking in the outer skin. Care must be taken as the bamboo can split if it is dried too quickly. Air drying may take 6 to 12 weeks though this time can be reduced by slow kiln drying over 2 to 3 weeks. So if you want to go back to nature you too can live in a grass house and bamboo is the grass of choice.

Self check #1	Written test
---------------	--------------

Name..... ID..... Date.....

**Directions:** Answer all the questions listed below.

**Test I: Short Answer Questions** (10 points)

- Define the three weaving patterns?
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
- Why we called bamboo “wonder grass”?
- Who many days needed to avoid cracking in the outer skin of bamboo?
- What is the chemical used to preserving agents ?

You can ask you teacher for the copy of the correct answers.

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

## Color of the culm

Identifying the age of bamboo culms by their color is possible with new and young culms, but is increasingly difficult for older culms. Most of the bamboo when it is young has a distinctive sheen, which is typical for green, yellow and black bamboo varieties. Bamboos with green culms generally have a dark green color when they are 1 year old, but as the culms age, their color gradually fades and becomes murky. Thus, for aesthetic beauty, bamboos are dyed into vibrant colors.

Dyeing is a simple process that adds color to any cellulose material like cotton, jute, bamboo, or any other natural fiber. There are two types of dyes; one is the natural dye which is made from the flowers, leaves, barks, minerals etc. while the other is the chemical dye. Since bamboo is a natural and cellulose material and has an off white color, it can absorb color well and enhance the beauty of it. Preferably green or non-dried bamboos in sliver form are good for better absorption of dyes.

Self check 1	Written test
--------------	--------------

Name..... ID..... Date.....

**Directions:** Answer all the questions listed below.

**Test I: Short Answer Questions** (10 points)

1. Who we can identify ages of bamboo cuolms?
2. Write and explain the two types of bamboo dyeis ?

You can ask you teacher for the copy of the correct answers.

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



Operation sheet 1	Making the thin or thick slivers for making woven mat based products
----------------------	--

Operation title: Making the thin or thick slivers for making woven mat

### 1.1 Tools and Equipments needed:

- High land bamboo
- Wood glue
- Bench work
- Paint brush
- Paints
- water
- Machete/knife
- **Water container**

## 1.2 Procedure

The images shown below are the basic steps that need to be followed for making the thin or thick slivers for making baskets or woven mat based products.



Step 1: Cut the bamboo to the required size with the help of a hacksaw/handsaw



Step 2: Remove the skin with knife as shown in the figure.



Step 3: Split the bamboo into two halves



Step 4: Split this further to smaller width as required



Step 5: Split bamboo further for uniform width



Step 6: Split the bamboo parallelly between the outer layer and the inner layer as shown in the image.



Step 7: Bend the bamboo a little as shown in the image to control the split



Step 8: Keep the thin sliver between the knife and a wooden plank as shown and pull the sliver to clean it further

LAP TEST	Performance Test
----------	------------------

Name..... ID..... Date.....

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

**Instructions:** Given necessary workshop, tools and materials you are required to perform the following tasks within the specified **6hours**.

Task-1 Perform prepare bamboo nodes split it to slats.1hrs

Task-2 Perform put slats in water.2hrs

Task-3 Perform prepare slats to make woven mats.3hrs

**Instruction sheet 2 Marking, splitting, and sorting bamboo culm**

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

- Selecting bamboo material
- Marking, splitting, and sorting bamboo culm
- Removing sharp edges of strip
- Dying weave strip

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:

- Read and interpreted Plan and drawings in determine furniture style and joint type.
- Select and checked the and apply appropriate tools work
- Save work activity

**Learning Instructions:**

- Read the specific objectives of this Learning Guide.
- Follow the instructions described below.
- Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
- Accomplish the “Self-checks” which are placed following all information sheets.
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- Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
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- If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

## Information sheet 3 Removing sharp edges of strip

### 1. Introduction

The technical stages involved in manufacturing woven bamboo products are:

- Conception and design of handicrafts,
- Strip and split making
- Weaving skills
- Methods of colouring, preservation and protection against pests and relevant facilities.

Bamboo woven articles are made with various widths, thicknesses, lengths and sizes of bamboo splits made from bamboo culms, based on the design of the products. There are two kinds of bamboo splits used for weaving: bamboo threads and bamboo strips. As their names imply, the thickness and width of threads are approximately equal. Strips are much broader than they are thick.

### 2. Production of woven bamboo products

#### 2.1 Raw materials

Bamboo culms are hard and flexible but can easily be split lengthwise into strips and threads for weaving. Many different bamboo species can be used, but the best are those with long internodes such as *B. textilis* and *B. chungii*.

#### 2.2 Weaving process

##### 2.2.1 Making strips and threads

Strips and threads are the basic materials for weaving various bamboo crafts. Proper treatment of raw materials is a very important procedure that affects the final quality of the goods. The processing techniques for making bamboo splits are briefly described below:

Bamboo culms Cross-cutting Knot removal Splitting

Smoothing Width-sizing Stripping

- a. The narrow tip of the culm and the stout bamboo rhizome are removed before the culms are cross cut to length.
- b. Remove the waxy epidermis and nodal flange: The waxy epidermis and nodal flange should be removed from culm surface preferably on the day of cutting to guarantee the brightness and smoothness of the culms. The nodal flange is removed first and then

. A traditional method is to lie the freshly cut bamboo in a flowing stream for several weeks to leach out the sap replacing it with water.

Another method is to stand the bamboo upright in drums of water for several days. The bamboo draws in the water and exudes the sap.

Yet another method is to inject water under pressure into the end of the culms to force the sap out.

Untreated bamboo will, like any grass, not last long. For short term purposes such as scaffolding or buildings for temple ceremonies the bamboo is not treated and may only last 2 or 3 years. Good harvesting and treatment can extend the life up to as much as 20 or 30 years.

Treatment provides protection against the natural enemies of bamboo, termites, powder borer, fungus and wet rot.

The best treatment method for bamboo as recommended by the Gajah Mada University in Yogyakarta involves boiling it in a bath of preserving chemical for several hours (usually around 12 hours). The structure of the bamboo swells and absorbs the preserving fluid. After treatment the bamboo cools down and dries out trapping the preserving chemical within the bamboo structure. The most commonly used chemical is a combination of borax and boric acid although some chemical companies are now supplying more sophisticated preserving agents.

A simpler and more commonly used method, though not as effective, is to stand the bamboo in drums and pour preserving fluid in at the top of the culm. The bamboo is left to soak for several days.

Another method is to pressure inject the preserving fluid into one end of the bamboo forcing it right through the length of the culm.

Some people use more aggressive chemicals but great care should be taken. Deldrin and ddt are considered very nasty these days and should be avoided.

Once treated the bamboo is dried slowly and evenly in the shade to avoid cracking in the outer skin. Care must be taken as the bamboo can split if it is dried too quickly. Air drying may take 6 to 12 weeks though this time can be reduced by slow kiln drying over 2 to 3 weeks.

So if you want to go back to nature you too can live in a grass house and bamboo is the grass of choice.



**Instruction sheet**

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upoLO4. Weave item

- Selecting weaving design and material
- Weaving item of given size
- Ensuring woven product and repairing weave
- Checking quality standard of woven product
- Storing weave product and stripn completion of this learning guide, you will be able to:
- Read and interpreted Plan and drawings in determine furniture style and joint type.
- Select and checked the and apply appropriate tools work
- Save work activity

**Learning Instructions:**

- Read the specific objectives of this Learning Guide.
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### **1.1 Introduction**

The technical stages involved in manufacturing woven bamboo products are: • Conception and design of handicrafts,

- Strip and split making
- Weaving skills
- Methods of coloring, preservation and protection against pests and relevant facilities.

Bamboo woven articles are made with various widths, thicknesses, lengths and sizes of bamboo splits made from bamboo culms, based on the design of the products. There are two kinds of bamboo splits used for weaving: bamboo threads and bamboo strips. As their names imply, the thickness and width of threads are approximately equal. Strips are much broader than they are thick.

### **1.2 Raw materials**

Bamboo culms are hard and flexible but can easily be split lengthwise into strips and threads for weaving. Many different bamboo species can be used, but the best are those with long internodes

The main raw materials are bamboo culms. Auxiliary raw materials include dyes, bleaching agents and preservatives.

Bamboo culms are tough, flexible, straight, pressure-resistant, tension-resistant and corrosion-resistant. However, culms of different bamboo species, or of the same species of different ages, or under different site conditions, have different mechanical strengths.

The material for certain bamboo woven products should be selected in accordance with the design requirements. For delicate products bamboos with flexible compact culms, and long internodes that split well should be selected. This is important due to the ease with which the thin bamboo strips breakdown at the node.

Additionally, green-yellow bamboo culms growing exposed to the sun should be selected due to their pliability, greater flexibility and strong stretch resistance, while bamboo culms growing in the shade lose these properties, although they are usually larger.

Culms should be straight, free of mechanical damage, insect damage and disease. Because there are various bamboo species with different processing characteristics distributed widely in the world, the selection of

bamboo species with culms of suitable ages will depend on local bamboo resources and quality requirements for products.

The auxiliary raw materials in common use are as follows:

- The dyes are: direct dyes, electropositive and acid dyes;
- The bleaching agents are: hydrogen peroxide, sodium hydroxide, sodium silicate, oxalic acid, and sodium sulfite.
- The preservatives are: alum, boric acid, sodium borate, and sodium fluoride.

### **1.3 Making strips and threads**

Strips and threads are the basic materials for weaving various bamboo crafts. Proper treatment of raw materials is a very important procedure that affects the final quality of the goods. The processing techniques for making bamboo splits are briefly described below:

- The narrow tip of the culm and the stout bamboo rhizome are removed before the culms are cross cut to length.
- Remove the waxy epidermis and nodal flange: The waxy epidermis and nodal flange should remove from culm surface preferably on the day of cutting to guarantee the brightness and smoothness of the culms. The nodal flange is removed first and then the culms are fixed to a frame and the waxy epidermis removed by scraping gently and evenly with a sharp knife, without damaging the surface appearance.
- There are two procedures for splitting bamboo culms. The first involves marking out lines 2~3cm apart, and then splitting into pieces with a knife. The other method is to split the culms in half longitudinally and then further split them into sections based on size of splits required. Attention should be paid to ensuring smooth passage of the knife through the nodes. This operation can be carried out manually or on a machine. Bamboo splits should be put on frames in the open air and dried under the sun with the green skinside upward. The air-drying process continues until the bamboo skin turns light yellow or yellowish white. To retain their natural beauty the bamboo splits should not be exposed to rain.
- Production of bamboo strips and threads: Split bamboo parts vertically along the radius of the cross section into bamboo strips. Bamboo strips can then be cut into bamboo threads according to the requirements for the final products. All the bamboo strips should be of same width and same thickness and each strip should be of equal width and thickness throughout its length.
- Strips must be straight and smooth.

### **1.4 Weaving methods**

Bamboo threads are mostly used for making articles such as baskets, boxes, bottles, jars and dolls. All these goods are woven from their base upwards. After the base is finished the weaving continues spirally upwards. Bamboo strips are used for making bamboo mats and curtains. These types of goods are usually woven from the middle outwards to the borders and corners.

### 1.5 Types of Weaving Techniques

Weaving can be closed or open depending on the purpose of the basket to be done. There are 3 types namely plain weave, diagonal weave and cross warp or hexagonal weave.

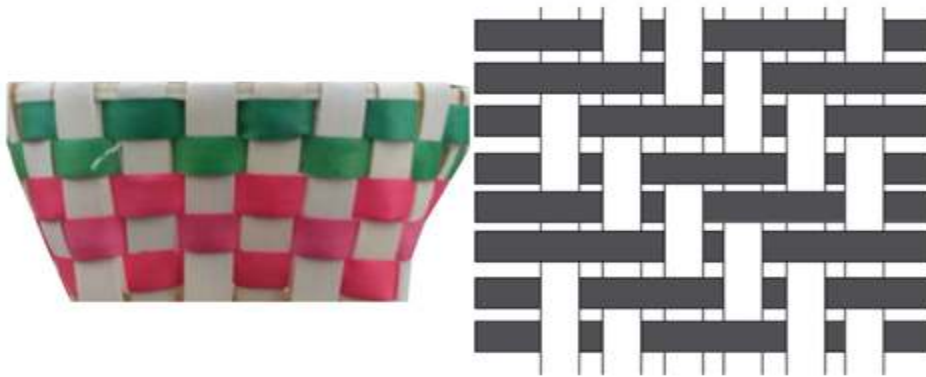


Figure: 1 Left: Checker weave-plain; Right: Checker weavediagonal



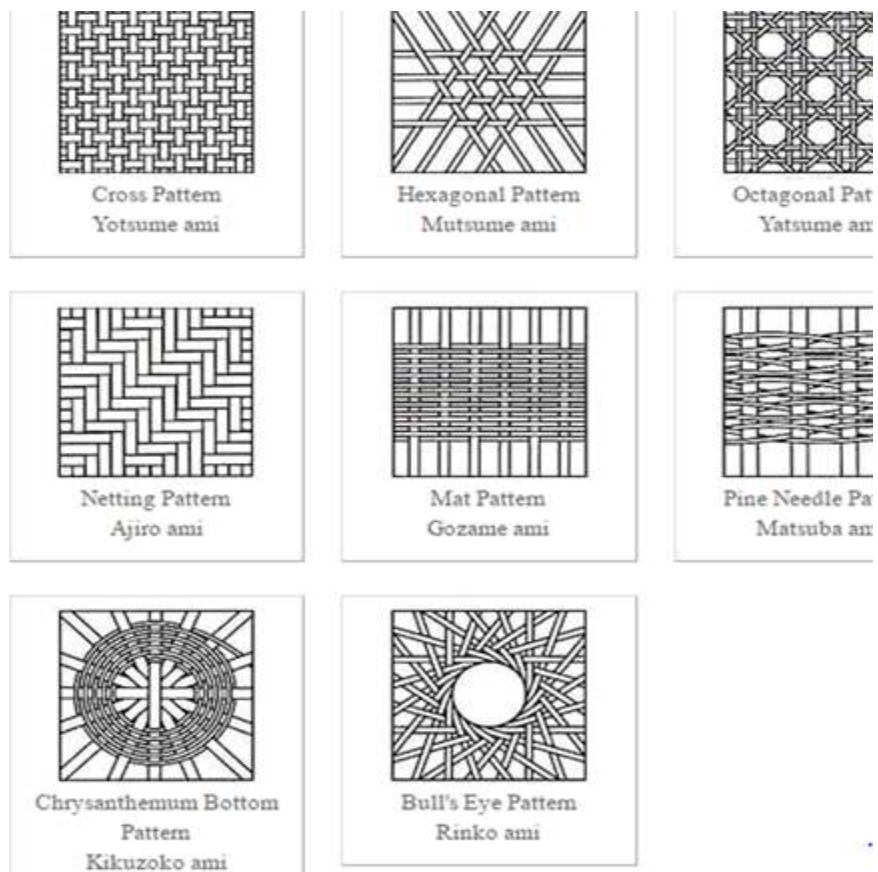


Figure: 3 weaving design

## **Information sheet:- 2 Weaving item of given size**

### **2.1 Process, materials and sizes**

The process of weaving basket using bamboo strips as a primary material.

- The properties of the bamboo such as strength, durability, and flexibility facilitated the easy weaving of the basket. The greenish strips are flexible enough for weaving.
- Regardless of the size, the number of strips measures 18–24 cm can start the weaving process, what matters is the length of the strips that complete the basket's rim.
- The sizes of basket vary according to purpose; small-sized basket has a 26–28 cm base, 16 cm high and the diameter of its opening is 33–35 cm.
- The medium-sized basket has a base diameter of 29–30 cm, its height is 30 cm and the diameter of the opening is 57.5 cm.
- Large sizes of basket have a base diameter of 62 cm, a height of 35 cm and the opening diameter is 78.5 cm.
- Smaller basket stores fruits, vegetables, and bread. The smaller size is ideal in transporting goods in short distances carried by hand.
- The larger basket stores bigger fruits like melons and coconuts for transport by a truck. It is an ideal size to carry goods in long distances as it allows the larger quantity of goods or items stored inside.
- Medium sizes of basket also use either big or small items, depending on its capacity.
- The mat can be made to any size and in any color combinations.

### **2.2 Basic Terminology: Warp and Weft**

Warp and weft are two basic terms used for weaving in general.

- Warp is the set of parallel bamboo strips that provide a basis for weaving patterns. In plane bamboo weaving, the warp strips are positioned vertically on the workbench
- The weft is made up of the bamboo strips that are inserted perpendicularly under and over the warp to create a design. In plane bamboo weaving the weft strips are positioned horizontally on the workbench

### **2.3 Color of Woven Bamboo Patterns**

Weaving dots into patterns is the basic technique for plane bamboo weaving. This weaving technique involves combining 2 colors (light and dark) of bamboo strips along the warp and weft of the bamboo strips.

This weaving technique involves combining 2 colors (light and dark) of bamboo strips along the warp and weft of the bamboo strips.

This weaving technique involves combining 2 colors (light and dark) of bamboo strips along the warp and weft of the bamboo strips.

There are 8 color shades used in the dot pattern weaving:

- Black
- Light gray
- Middle gray
- Dark gray
- White
- Light Black
- Middle black and
- Dark black.

There are 4 common weaving methods, namely:-

- vertical weaving method,
- multi angle weaving method,
- round weaving method,
- cross weaving method and other.

Each of these 4 weaving methods has their unique weaving patterns. Also, with years of practice, craftsmen have developed their own methods and techniques of weaving too.

## **2.4 Design process of making basketry pattern**

Details of Implementation

- Information gathering
- Creative idea generation
- Design refining
- Material preparation
- Pattern weaving
- Patent proposing
- 3D pattern modeling as showed in a diagram below.

Resources and information collection were initially conducted either through primary or secondary sources as much as possible in order to develop for preliminary design.

Conceptual idea was drafted freely in line with imagination inspired by either nature or manmade matters. Draft papers were demonstrated as bamboo stripes to create conceptual works.

Design refinement is the step aiming to craft basketry works to be more functional and more attractive in terms of stability of the pattern, characteristics, colours, and other elements.

Preparing materials means to select types of bamboo in order to be compatible with each type of basketworks. Mostly, Hear-Bamboo is frequently used due to its flexibility to cut and to form. All bamboo stripes are normally boiled and colour died with salts for 20 minutes; then they are naturally dried.

2D weaving patterns are basic design process for making basketry by considering details of beauty.



To protect intellectual property by proposing patent of fresh combining pattern of basketry works which are key contributions from this research which are benefits for both researcher and local artisan group.

3D weaving products and dissemination which can be seen either in demonstration of design practice or in terms of publications.

Combinations between dot, line, color, shapes, and other art components can be compatible with weaving techniques to express local pattern by integrating with each pattern. Based on the study, patterns can be categorised into two groups which are line patterns in vertical, horizontal, Zig-Zag, and curve and shape patterns in square such as rectangular, rhombus, pentagon, hexagon, and octagon



Figure: Weaving pattern was patented as product design.

About this figure, the pattern is applied to use with 35 cm. long and 35 diameter vase. This pattern consists of flower design in square



Figure: Weaving pattern was patented as product design.

About this figure, the pattern is applied to use with 34 cm. long and 10 diameter vase. This pattern possesses characteristic of vane that slantingly weaves



Figure: Weaving pattern was patented as product design.

Figure: Weaving pattern was patented as product design. About this figure, the pattern is applied to use with 34 cm. long and 10 diameter vase. This pattern possesses characteristic of rhombus design in vertically alternate with ellipse design



Figure: Weaving pattern was patented as product design.

About this figure, the pattern is applied to use with 25 cm. long and 35 diameter basket. This pattern possesses characteristics of square design which alternately lies.



Figure: Weaving pattern was patented as product design.

About this figure, the pattern is applied to use with 18 cm. long and 20 diameter basket with handle. This pattern possesses characteristics of symmetry pattern.

## 2.5 Lampshade Making

The lamp shades made using various materials are very common in today's market. Bamboo has also been one of the prime materials used for making lamp shades.

Various weaves learned in the previous chapter can be used to make various types of lamp shade. The flat mat or weaving around a cylindrical or square object etc... can create various shaped lamp shades.

Here we are exploring the technique of hexagonal weaving on a cylinder to make a lamp shade. One needs to take a cylindrical object of any diameter according to the size of lamp shade required. Make thin slivers of around 3-4mm width and dyed in one color and use natural shade as combination with the color.

## 2.6 Other Woven Products

In the same fashion, multiple woven products can be made by weaving. Also, the products can be further modified by stitching, etc.

Some examples have been mentioned below. These can be created by the methods that have been described in the previous chapters.



A tray with woven mat and bamboo frame around



Baskets of woven mat and stitched with fabric.



Gift pack of woven mat and stitched with fabric.



A basket of woven mat and stitched with fabric.



Fruit basket made using basket weaving technique

Figure: Multiple woven products

### **1.1 Techniques of producing fish mouth joint**

- Tools and Equipment

- Bolo/Matchete or knife
- Cross cut saw
- Measuring tape
- Caliper
- Work bench
- Shaver and sizer
- Bamboo splitting knife
- Scissors
- Pliers with rubber grip

### **1.2 Procedures/steps/Techniques**

- Weave basket

Step 1: Wear proper personal protective equipment's

Step 2: Use broad slivers and arrange as shown

Step 3: Take two narrow slivers and weave them in an up and down pattern, passing through the broad sliver arrangement in a circular fashion

Step 4: Continue weaving up and down as shown



Step 2: Take two narrow slivers and weave them in an up and down pattern, passing through the broad sliver arrangement in a circular fashion



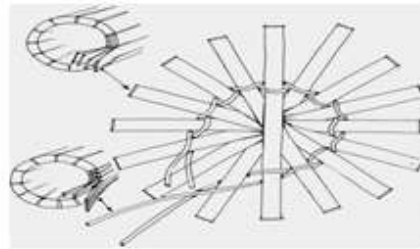
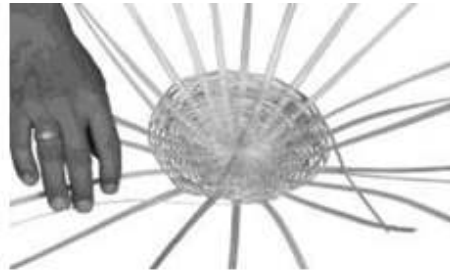
Step 3: Continue weaving up and down as shown.



Step 4: Slowly start building a 'bowl' shape by pushing the weaved circular section below and bending the broad sliver to make it a gradual vertical curve



Step 5: The 'bowl' shape can be slowly made by pushing the weaved section below with your fingers



Details of basket weaving structure.

Step 6: Continue the weaving until desired height. Color sliver can be used too according to choice



## Operation sheet 2– techniques of producing weave products

### 2.1 Weave mat

**Step 1: Wear proper personal protective equipment's**

**Step 2: With the help of a scale, the slivers can be placed at equal intervals**



Step 2: At right angles, insert a sliver in an up and down manner

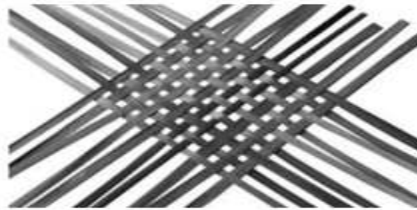
Step 3: Keep inserting more slivers at right angles in the same manner



Step 4: Both the sets of slivers are placed at equal intervals (depending on the pattern/design of the weave)



Step 5: The slivers can be added according to the desired size of the mat



### 1.2.3 Mat Weave 2 (Cross weaving pattern)



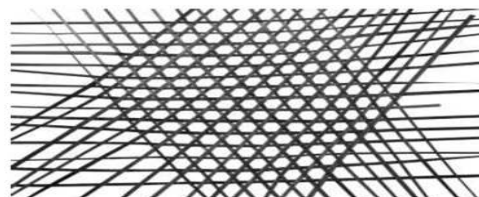
Step 1



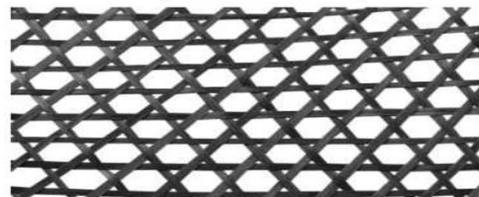
Step 2



Step 3



Step 4



Step 5

## 2.1 Make Lampshade

### 1.2.6 Make Lampshade

Step 1: Wear proper personal protective equipment's

Step 2: Weave the slivers in such a manner that they create a hexagon in the center



Step 3: Keep adding the slivers on all the sides of hexagon by inter locking the slivers up and down.



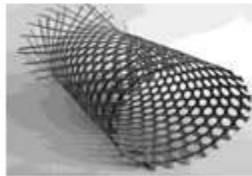
Step 4: Cover a cylinder shaped object with a paper.



Step 5: Place the mat on the cylinder and start weaving around it.



Step 6: Continue the weaving around the cylinder



Step 7: Once the weaving is complete, remove the cylinder and trim the edges of the woven cylindrical shape made of bamboo slivers. Use adhesive to stick the trimmed edges.



Step 8: Use thicker sliver inside and outside and bend



Step 9: Apply adhesive on both the inside and outside rims



Step 10 The final lamp shade

LAP TEST	Performance Test
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Name..... ID.....

Date.....

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

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within **16** hour. The project is expected from each student to do it.

Task: 1 Perform basket weave

Task: 2 Perform mat weave

Task: 3 Make lampshades



### Information Sheet 3- Checking quality standard of woven product

#### 3.1 Introduction

Anyone who wants to produce top quality woven goods in high volume, and wants to stay competitive in the bidding for orders, must first and foremost have their planning and organization under control. An additional criterion is thorough familiarity with the entire production process, from bamboo culm to woven product, to ensure that woven production is profitable.

A requirement of optimum production in the weave is careful planning. It is at the planning stage that process parameters, sequences of operations and working conditions are defined, all of which are relevant to profitability.

#### 3.2 Quality Standards

A quality standard is a detail of the requirements, specifications, the various guidelines and characteristics to be able to meet its quality by the product in order to meet the purpose of the product, process or the service.

In case if a company fails to meet its quality standards, it may end up losing the trust of the customer and henceforth its market share.

#### 3.3 Importance of Quality Standards

A product is said to be of quality if it is free from any manufacturing defect deficiency or significant variation. In order to do so certain specific standards need to be set so that uniformity is achieved in the entire set of products being manufactured. The quality standards defined should be such that the features and specifications offered by the product should be capable to meet the implied need of the product.



Figure 1 .Importance of Quality Standards

### 3.4 Advantages of Quality Standards

Advantages of having quality standards in a manufacturing company are:

1. It helps save costs & improves productivity.
2. Increases customer satisfaction with high quality products & services.
3. Sets minimums standards of quality for processes, products & services.
4. Maintaining quality standards increases safety of workers.
5. Good communication enables smooth flow of operations & avoid mistake repetition.

## Information Sheet 4- Storing weave product and strip.

### 1. Introduction

The technical stages involved in manufacturing woven bamboo products are:

- Conception and design of handicrafts,
- Strip and split making
- Weaving skills
- Methods of colouring, preservation and protection against pests and relevant facilities.

Bamboo woven articles are made with various widths, thicknesses, lengths and sizes of bamboo splits made from bamboo culms, based on the design of the products. There are two kinds of bamboo splits used for weaving: bamboo threads and bamboo strips. As their names imply, the thickness and width of threads are approximately equal. Strips are much broader than they are thick.

. Production of woven bamboo products

#### 1.1 Raw materials

Bamboo culms are hard and flexible but can easily be split lengthwise into strips and threads for weaving. Many different bamboo species can be used, but the best are those with long internodes such as *B. textilis* and *B. chungii*.

#### 1.2 Weaving process

Strips and threads are the basic materials for weaving various bamboo crafts. Proper treatment of raw materials is a very important procedure that affects the final quality of the goods. The processing techniques for making bamboo splits are briefly described below: Bamboo culms Cross-cutting Knot removal Splitting

Smoothing Width-sizing Stripping

- The narrow tip of the culm and the stout bamboo rhizome are removed before the culms are cross cut to length.
- Remove the waxy epidermis and nodal flange: The waxy epidermis and nodal flange should be removed from culm surface preferably on the day of cutting to guarantee the brightness and smoothness of the culms. The nodal flange is removed first and then the culms are fixed to a frame and the waxy epidermis removed by scraping gently and

- **Evenly with a sharp knife, without damaging the surface appearance.**

There are two procedures for splitting bamboo culms. The first involves marking out lines apart, and then splitting into pieces with a knife.

The other method is to split the culms in half longitudinally and then further split them into sections based on size of splits.

This operation can be carried out manually or on a machine.

Bamboo splits should be put on frames in the open air and dried under the sun with the green skinside upward. The air-drying process continues until the bamboo skin turns light yellow or yellowish white. To retain their natural beauty the bamboo splits should not be exposed to rain.

- **Production of bamboo strips and threads:** Split bamboo parts vertically along the cross section into bamboo strips. Bamboo strips can then be cut into bamboo threads according to the requirements for the final products. All the bamboo strips should be of same width and same thickness and each strip should be of equal width and thickness throughout its length.

- **Strips must be straight and smooth.**

### 1.3 Weaving methods

Bamboo threads are mostly used for making articles such as baskets, boxes, bottles, jars and dolls. All these goods are woven from their base upwards. After the base is finished the weaving continues spirally upwards. Bamboo strips are used for making bamboo mats and curtains. These types of goods are usually woven from the middle outwards to the borders and corners.

### 1.4 Comprehensive input requirements

Bamboo is traditionally used in rural areas for weaving products or handicrafts. Manual crosscutting, splitting and slivering of bamboo culms is normally done by men with various tools like knives. Women, disabled or infirm people usually work as weavers. It is possible for people to weave products such as mats and baskets after short-term training. Much more experience and higher levels of skill are required to weave superior quality handicrafts and these can only be learnt from master craftsmen apprenticeship scheme.

## Information Sheet 2 Weaving item of given size

### 1.Introduction

‘weaving’ is mostly used for the process of interlacing yarns on a loom to form a woven fabric, it is actually a series of processes which convert yarn into fabric which is suitable for tailoring. The processing steps are as follows:

- Winding and clearing
- Weft winding
- Warping
- Sizing and other applications
- Entering and knotting
- Loom operation
- Finishing
- Inspection and measuring.

The first five operations are those that prepare the yarns for weaving, the main theme of this lecture. Subsequent lectures discuss weaving technologies and the structure, quality and performance of woven fabrics.

The selection of suitable yarns and the preparation of yarn for weaving have a considerable influence on weaving efficiency. Yarn breakage at the loom must be minimised and this is only possible if (a) the yarn is of uniform quality, (b) it is wound onto a suitable package in the best possible way, and (c) the yarn is suitably treated before use. These requirements apply to varying extents with warp and weft yarn.

## Information Sheet 4 quality standard of woven product Checking

### 1. Introduction

- **WOVEN BAMBOO PRODUCTS**

Woven bamboo products are produced from thin strips of bamboo. There are a wide variety of such products and they have been closely associated with the development of civilisations in bamboo growing regions of the world for many millennia. The products may be primarily intended for agricultural use, such as baskets for vegetables or animals and winnowing trays for cereals, or they may be household products such as baskets, trays, jars, cases, lampshades, fans and mats.

## Information Sheet 5 Storing weave product and strip

### 5.1 Introduction

How do I establish a woven bamboo products unit?

A woven bamboo products unit can be established very cheaply. If splitting is land, raw materials and labour. The unit can be established at any scale, from a single person enterprise to a community cooperative.

Proper links to markets and feedback on market demands are very important, and continued innovation and development of new product designs will help maintain sustainability of the enterprise. The main raw materials are bamboo culms. Auxiliary raw materials include dyes, bleaching agents and preservatives bamboo culms are tough, flexible, straight, pressure-resistant, tension-resistant and different ages, or under different site conditions, have different mechanical strengths.

The material for certain bamboo woven products should be selected in accordance with design requirements. long internodes that split well should be selected. This is important due to the ease with which thin bamboo strips breakdown at the node. Additionally, green-yellow bamboo culms growing exposed to the sun should be selected due to their pliability, greater flexibility and strong stretch resistance, while bamboo culms growing in the shade loose these properties, although they are usually larger culms should be straight, free of mechanical damage, insect damage and disease. They should be cut on cloudy days in summer. Harvesting on sunny days should be avoided if possible.

The culm skin should not be damaged while harvesting and transporting. Because there are various bamboo species with different processing characteristics distributed widely in the world, the selection of bamboo species with culms of suitable ages will depend on local bamboo resources and quality requirements for products.

## LG# 23

## LO5. Apply finishing materials

### Instruction sheet

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

- Surface preparation
- Preparing finishing materials
- Applying finishing material and drying
- Cleaning work area and equipment's

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 materials and design based on specifications
- Woven products are ensured to meet the specified requirements in terms of size and shape
- Weaves are tightly ensured and repaired if necessary
- Products are checked in line with company quality standards.
- Store weaver strips and product in a cool environment

### Learning Instructions:

- Read the specific objectives of this Learning Guide.
- Follow the instructions described below.
- Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
- Accomplish the “Self-checks” which are placed following all information sheets.
- Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the
- If you earned a satisfactory evaluation proceed to “Operation sheets
- Perform “the Learning activity performance test” which is placed following “Operation
- If your performance is satisfactory proceed to the next learning guide,
- If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.



## Information Sheet 1      Surface preparation

### 1. Introduction

To demonstrate the principles and techniques for the preparation of surfaces and finishing of round pole bamboo products, we shall focus on a fairly simple product, namely, a three layer shelf.

More complex bamboo products can later be made by applying the methods explained in the following pages.

Self-Check – 2	Written test
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Name..... ID..... Date.....

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

**Test I: Short Answer Questions**

1. List at list 5 finishing tools and materials

## Operation Sheet 1-Techniques of surface preparation

### 1.1 Techniques of surface preparation

#### 1.1.1 Tools and equipments

Tools & Materials:	
<ul style="list-style-type: none"> <li>- Scrubbing pad</li> <li>- Big knife</li> <li>- Sanding paper (P80, P120, P180, P240)</li> <li>- Saw</li> <li>- Measuring tape</li> <li>- Pencil</li> <li>- Rubber eraser</li> <li>- Clamps</li> <li>- Ropes</li> <li>- Chisel</li> <li>- Drilling machine</li> </ul>	<ul style="list-style-type: none"> <li>- Drill bits</li> <li>- Hole saw</li> <li>- Half round file (fine)</li> <li>- Half round file (rough)</li> <li>- PVAC glue (incl. brush)</li> <li>- Leather strips (for decorative binding)</li> <li>- Mitre Box</li> <li>- Contact glue (for leather)</li> <li>- Clear (transparent) Tape</li> </ul>

#### 1.1.2 Procedures/Steps/Techniques

##### STEP 1

##### • Select treated bamboo culms

according to the cutting list and final

use. All parts that will be exposed to view need to have an excellent surface, i.e.,

without marks, stains, or defects. If some materials have noticeable defects, find a way of hiding them by positioning the pieces so that they are not visible.



## STEP 2

- Carefully scrape off the outer skin of the bamboo using a knife.

## STEP 3

- When scraping the outer skin, position the knife at approximately 90° relative to the culm. This facilitates the scraping process and minimizes the risk of damaging the culm with deep cuts.



## STEP 4

- Clean the recessive areas of the nodes using a half round fine file



## Information Sheet 2 Preparing finishing materials

### SANDING

#### GENERAL INFORMATION:

- Sanding is actually a cutting process. The abrasive particles of sandpaper work like tiny cutters that remove small amounts of material from surfaces.

When sandpaper is used for finishing bamboo products, the overall effect is the smoothening of the surface.

The process involves using various grits of sandpaper, starting with rough paper and gradually to the finer ones.

- Using only very coarse sandpaper will leave sanding marks that lower the quality of the product.
- Start sanding with 80 grit sandpaper to remove the marks that were made from scratching outer skin with knives and cleaning the nodes with the half round file.
- Continue sanding all surfaces with 120 grit sandpaper until all the sanding scratches created by the 80 grit have been removed.
- The next step is to sand the surface with grit 150 and finally with 180 grit paper.
- Do not skip a grit number in your sanding procedure. To produce a smooth surface you need to be systematic by gradually using finer grits of sandpaper. Otherwise it will be very difficult to eliminate rough spots.
- Use a damp sponge to wipe the surface. This will raise loose fibers, which will cause problems when finish (e.g. varnish) is applied. After the surface has dried, use a sanding block and sand all areas again with 180 grit paper grit size of sandpaper:
- The grit size determines the relative diameter of each abrasive particle.
- The grit number is printed at the back of the sandpaper sheet.
- The larger the grit size, the finer or smaller the particle size. For example, a grit size of P220 grit is finer than P100.
- The larger the particles, the faster the abrasives will remove the material. They also leave deeper scratches on the surface.
- Small particles produce a smoother surface. But if you sand the bamboo at a slower rate you might not be able to remove deep scratches.



Grits for abrasives used for bamboo and wood working:

- P40 to P800 abrasive paper are usually available in hardware stores.
- P40 is too rough for normal woodwork especially for hand work.
- P60 is commonly used on wide-belt sanders for very rough sanding.
- P80 is recommended as a starting size for handwork with bamboo material (Use of an orbital sanding machine only with this grit size.)
- P80 up to P180 is used for basic sanding of raw material.
- P180 up to P400 is used for the fine sanding of finishes.
- P600 to P1200 is only used for polishing high gloss surfaces



## Information Sheet 1      Surface preparation

### 1.1 Introduction

To demonstrate the principles and techniques for the preparation of Preparing finishing materials surfaces and finishing bamboo tooles and materiyales, fairly simple product, namely, a three layer shelf. Preparing finishing materials More complex bamboo products can later be made by applying the methods explained in the following pages.

**Self-Check – 2**

**Written test**

1.1.1 Techniques of surface preparation Preparing finishing materials

Name..... ID..... Date.....

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

**Test I: Short Answer Questions**

1. List at list 5 finishing tools and materials

- The compressed air flows through the air inlet to the air valve. The air valve will be opened by pressing the trigger. When the trigger is pressed the fluid pin retracts and the finish (lacquer) is sprayed out as a mixture of air and lacquer.
- The fluid and the air flow are regulated by valve screws. The valve screws can be adjusted to regulate the pattern of spraying. Always do a test before you start spraying the product.
- For the different viscosities of your finishes you have to change the fluid tip of the spray gun. Consult the product information about the recommended nozzle spray size.
- Properly clean the spray gun after each use. Cleaning is done by spraying pure thinner. Release the pressure and clean the gun with a rag damped in thinner.
- Always follow the safety instructions when you spray lacquer!

Wear goggles, gloves and a face mask.

- An exhaust system is required when spraying otherwise the overspray will destroy your newly finished surface.



### Information Sheet 3 Applying finishing material and drying

#### 1.introduction

Finishing involves colouring, varnishing or oiling by means of brushing or spraying.

- **BLEACHING:** removes the natural color of bamboo. Use hydrogen peroxide which is a chemical product. It is advisable to wear gloves, goggles and a face mask when working with chemicals.
- **STAINING:** creates color through the use of pigments that are dissolved in a liquid. When the stain is applied, the colored pigment remains on the bamboo surface. Pigments for staining are available in powdered form or premixed.
- **SPECIAL LAYERS**

There are special products which are available in different colours that can be applied as a finishing touch before applying the final lacquer coat:

- **GRAIN FILLER:** Is used to create a level surface on bamboo by filling up holes or surface imperfections. You need it for a closed-grain finish. Rub the filler on the bamboo in circular strokes and remove the excess filler with a coarse cloth. Let it harden and sand it slightly with fine grade paper in the direction of the grain.
- **SANDING SEALER:** A barrier of finish designed to seal the substrate and/or increase the adhesion of the next coat. For the clear finish use a sealer; for the pigmented finish a primer is recommended.
- **FINISHING**

The most suitable finishes for bamboo are evaporative lacquers which are pigment based. These include:

#### NITROCELLULOSE LACQUER:

Very popular finish; dries extremely quickly; forms a hard and very brittle surface, not absolutely scratch resistant. Durable but only moderately resistant to water, chemicals and heat. The

finish is clear but will get yellowish after some years.

Not environmentally friendly, flammable. Wear goggles, gloves and face mask during use.

**WATER-BASED LACQUER:** Thinning solvent is mainly water therefore more environmentally friendly, not flammable. It is easy to use but takes longer to dry. The durability is good, it is also more or less resistant against solvents.

### **VARNISHING USING A BRUSH**

- Check room conditions. Make sure it is a dust free area with good lighting and with a ventilation & exhaust system.
- Spread the varnish as thinly as possible by applying it with the brush moderately to avoid running.
- Pay attention especially to all connections and joints to ensure that there is no excess varnish that may drip.
- After applying the varnish leave the room in order to avoid dust generation.
- Check the surface after it has dried completely.
- The drying time will depend on the type of varnish.
- If too many dust particles remain on the surface repeat the sanding process and paint it again.

### **APPLYING A FINISH BY SPRAYING**

- Spraying lacquers must be applied with a motorized spray gun and a compressor. For small jobs, lacquer can be applied with aerosol spray cans.
- Pressurized air is used to spray the liquid finish and distribute it in very fine particles on a surface.

## Information Sheet 4 Cleaning work area and equipments

### 4. Cleaning and storing tools and equipment

#### 4.1 Clean, Inspect and Care for Tools

Make it a habit to clean tools after each use before you return them to storage. Wipe them down with a rag or old towel and be sure they are free of dust, grease and debris before you put them into their proper places. This is also an opportunity to look for any damage or defect





## 2.1 Tagging and reporting defective equipment

If you find that tool is defective and that you are not qualified or assigned to repair follow the procedures:-

1. Obtain defective or out of service tag card designated for defective tools
2. Fill out defective or out of service tag. Wire the tag to the equipment around the shut off button
3. The trainer will log out of service tag in to the maintenance records and the tool will be repaired or replaced.
4. If repaired the trainer will have repair made and the tool returned back to production and remove out of service tag.

By taking proper care of tools, you'll ensure that they'll remain in good working order and will be ready for use when you need them.

Figure 2 tool storage

The cleaning of your work area must be carried out on a regular basis

Effective housekeeping can help control or eliminate workplace hazards. ... Housekeeping is not just cleanliness. It includes keeping work areas neat and orderly, maintaining halls and floors free of slip and trip hazards, and removing of waste materials.



Regardless of where you choose to store your tools, there are a few basic tool storage ideas and tips to keep in mind before you put them away.

- Follow the instructions. Some manufacturers will have specific instructions for how to store tools, so consult your manual first and foremost. It's important to follow these instructions, especially for larger power tools like saws or drills, so they remain in good working condition

- Clean them off. Tools should be cleaned each time you use them. Wipe them down with a damp rag or towel to get rid of any dirt, dust, grease or debris. Make sure garden tools are free of mud and grime. Everything should be completely dry before placing it in storage to avoid rust developing.

- Use original cases. Power tools usually come in hard, plastic cases, and it's recommended to keep these cases for storage whenever possible. These cases will keep your power tools in storage safe from extreme conditions, plus all the parts can be stored right alongside them in the case. No more lost power cords or chargers!

- Store in a safe, dry place. Along with having the right containers, another way to protect your tools is to ensure that area you're storing them in is safe and dry. Water or humidity can cause damage to tools, especially power tools.

- Go vertical. Tools should never be stored on the ground. Invest in some shelving for smaller tools, or hang pegboard along your workbench or on a wall in your garage. You'll be able to hang things like

wrenches, hammers, box cutters, garden equipment and many other tools so they'll be easy to access at any time.

10 ways to make your equipment last longer

- Read the User Guide. ...
- Use the Correct Equipment For The Job. ...
- Know Your Machinery. ...
- Inspect Regularly. ...
- Carry Out Regular Maintenance, Using a Schedule. ...
- Replace Parts When Needed. ...
- Clean After Use. ...
- Repair and Refurbish, Rather Than Replace.

How should wood waste be stored?

Waste collecting bins are pile-up stations of different sizes, shapes, and materials that help to reduce the spread of litter. The different types of waste collecting containers are localized containers, centralized bins stations, waste transfer carts or transfer balers, and waste yard dumpsters. Localized containers also called desk-side bins and are individual refuse bins whose purpose is to increase efficiency in the correct handling of waste. For example, they are a close point to throw minor personal trash such as papers. They encourage people to keep their garbage organized, thus promoting the recycling of wood waste. The second category is centralized bin stations or high traffic containers. These are placed in strategic points and are the recipients of waste assembled from the localized containers. Most furniture workshops have these bins in their hallways and corridors for storing wood waste from personal employees' work stations. The third type is the waste transfer carts, also known as utility carts. Their primary purpose is to receive refuse from centralized stations and move or cut them if it is a transfer baler. They are big containers that carry more waste and are economical compared to buying numerous high traffic containers. The refuse yard dumpster is the last designated point that stores large amounts of waste. They are mostly huge and receive tones of wood waste from transfer balers.

Collecting and storing cut-offs, unused and scrap materials



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### WEB ADDRESSES

<https://www.youtube.com/watch?v=PAqApqMQ6NM>

<https://www.youtube.com/watch?v=9n7SllrZ5cw>

<https://www.youtube.com/watch?v=saexnVWd6GQ&t=39s>

<https://www.youtube.com/watch?v=BcGAUDKVIyA&t=56s>

<https://www.youtube.com/watch?v=BSiHovIRLRO&t=185s>

<https://www.youtube.com/watch?v=H3UC4XRvGaQ>

<https://www.youtube.com/watch?v=0tweQ5DPy5A>

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