Furniture Making Level - III

Based on September 2012, V5 OS and Dec, 2020 V1

Curriculum

Module Title: Bending and Forming Wooden

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Instruction sheet

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

- Observing workplace health and safety requirements
- Selecting & checking tools, machines and materials
- Determining furniture design, tolerances, process, materials &quantities
- Planning work sequence
- Determining & checking quality procedures at each stage of the process
- Selecting suitable work area for the task
- Completing drawings/set-outs for tasks where required
- Developing Cutting list components

Learning Instructions:

- Observe workplace health and safety requirements
- Select & checking tools, machines and materials
- Determine furniture design, tolerances, process, materials &quantities
- Plane work sequence
- Determine & checking quality procedures at each stage of the process

- select suitable work area for the task
- Complete drawings/set-outs for tasks where required
- Develop Cutting list components

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. 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.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. 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).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Information sheets” ,

Information Sheet-1	Observing workplace health and safety requirements

1.1 Observing workplace health and safety requirements

The Occupational Health and Safety Regulation (OHSR) contain legal requirements that must be met by all workplaces under the inspection of Work Safe.

The purpose of the OHSR is to promote occupational health and safety to protect workers and other persons present at workplaces from work-related risks to their health, safety, and well-being.

Work Safe is committed to the regular review of the requirements of the OHSR based on regulatory experience and changes in knowledge, technology, and work practices. All interested parties are invited to forward suggestions for improvement to Work Safe.

Note: The requirements of the Occupational Health and Safety Regulation are adopted under the authority of the *Workers Compensation Act* as amended from time to time.

How to organized OHSR

This section provides brief information about the core requirement of the OHSR.

The Core Requirements apply to all workplaces, include:

1. Definitions —A list of words used in the OHSR that have specific meanings.
2. Application — A description of how the OHSR is applied.
3. Rights and Responsibilities — Details about elements of a health and safety program, investigations and reports, workplace inspections, the right to refuse work and first aid.

4. General Conditions — Requirements for such aspects of workplace safety as building and equipment safety, emergency preparedness, preventing violence, working alone, ergonomics, illumination, indoor air quality, smoking.

Self-Check -1	**Written Test**

❖ Write Short answer the following question on the space provided. (10%)

1. What is the definition of work safety 2 points)

2. What is OHSR (3 points?)

Score=----------
Rating =----------
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Name ---------- date----------

Note: Satisfactory rating above 2.5 points Unsatisfactory-below 2.5 points

Answer sheet.

1. **----------**

2. ----------

Information sheet.2	Selecting & checking tools, machines and materials

2.1 Selecting & checking tools, machines and materials

Material selection is a step in the process of designing any physical object. In the context of product design, the main goal of material selection is to minimize cost while meeting product performance goals. Systematic selection of the best material for a given application begins with properties and costs of candidate materials. For example, a thermal blanket must have poor thermal conductivity in order to minimize heat transfer for a given temperature difference. It is essential that a designer should have a thorough knowledge of the properties of the materials and their behavior under working conditions. Some of the important characteristics of materials are :strength, durability, flexibility, weight, resistance to heat and corrosion, ability to cast, welded or hardened, machinability, electrical conductivity, etc.

A. Importance of strength

Wood has high strength-weight ratio Flexural rigidity in relation to the weight of the material, traceable to the nature of the cell wall material and its distribution as a system of thin-walled tubes, is one of the outstanding mechanical properties of wood. For instance, when is compared with low-carbon structural steel on an equal weight basis, even if the design stresses are reduced to allow for the presence of defects in wood, it is apparent that Douglas-fir is superior to steel in bending by a ratio of 2.6 to 1. The high flexural rigidity of wood is most effective in members in which the length is far in excess of depth of the cross section, such as in beams and long slender column

B. Importance of durability

Durability relates to the resistance of wood to organisms that cause decay. It can be expressed as; - The properties of wood to remain sound - Durability. - The measure of time

wood remains unaffected by the attack of fungi, insect and other wood destroying agents. - The time during which wood preserves its usefulness without special protection. Except for the heartwood of durable species, wood is not very resistant to attack by fungi or insects; the sapwood of all species is non-durable. 10/27/2010 Wood Drying and Preservatives; Objectives of Wood Preservatives: A large number of species have low natural durability, preservatives can increase 5 – 10 times of their normal life. To prolong the life of perishable timber. Causes of Non-Durability: The chief causes of non-durability are; a) Fungi: b) Insects: c) Animals: d) Mechanical wear and Tear:

C. Importance of flexibility

Dimensional changes that may take place as a result of rise in temperature are less significant in wood construction than they are in construction utilizing metal structural members. When heated, wood expands across the grain as much as or more than metals, but only little in the longitudinal direction, which is important in construction. Moreover, in wood, increase in dimensions with rise in Page 6 of 66 temperature is frequently balanced to a considerable degree by shrinkage caused by drying, with a corresponding increase in strength. There is no such compensating effect in metal structural members, which expand and lose strength progressively when heated.

Systematic selection for applications requiring multiple criteria is more complex. For example, a rod which should be stiff and light requires a material with high Young's modulus and low density.

2.2 **The suitable material for bending**

The following are suitable material for bending

1. Material with good grain condition with a little shake
2. High flexible in characteristic.
3. Use materials that are free of defects such as knots and checks.

A bad grain pattern made by the line of fibres in wood condition and a knot on the surface of the material are the factors that might cause the material to break. In term of material type, the broadleaf tree is more suitable to use than the conifer, and the tropical wood is hard to bend. Generally, a flexible material is easy to bend. Moreover, round shaped material makes a line contact with the bending strap cause a crack to occur easily. Elm, hackberry, oak, beech, ash, hickory, and walnut are some of the examples of materials that are easy to bend. For a tropical wood, rubber, taunt, teak etc. are comparatively easy to bend. Moreover, in some cases, same materials are different in the characteristic depends on their source, region etc. For that reason, there are many cases where we would not be able to decide whether the materials are easy to bend until we actually try to bend it. This different comes as a different at the curvature of the material. Moreover, it is said that the different among the same materials in term of weight and growth rate has a connection with the different in the aspect of the easiness to bend and the finishing 'R' condition of the material. What are the materials or tools help bend.

Self-Check -1	**Written Test**

Write answer the question listed below. (5%)

1. What is material selection? (2.5points)
2. List the condition for selecting martial? (2.5points**)**

Score= ----------
Rating=----------

Name ----------date ----------

Note: Satisfactory rating above–2.5points Unsatisfactory-below2.5 points

Answer sheet

1. **----------**

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2. **----------**

Information sheet.3	Determining furniture design, tolerances, process, materials &quantities

3.1 Determining furniture design, tolerances, process, materials &quantities.

Furniture designers study designs through sketches of ideas and quick initial modeling. In this activity explore ideas for furniture. Using craft materials (paper, cardboard, sticks, felt, glue, etc., design and construct pieces of furniture. Think of your scaled design as a model of furniture or the setting for a display. Make sketches of your ideas first to help you visualize what you would like to make. Create a room of miniature furniture.

Tolerance allocation is a design tool. It provides a rational basis for assigning tolerances to dimensions. Several algorithms are described in this paper for performing tolerance allocation, which is defined as the re-distribution of the “tolerance budget” within an assembly to reduce over-all cost of production, while meeting target levels for quality.

The task of placing +/- tolerances on each dimension of a furniture model or set and of little consequence.

There are several advanced tolerance techniques available to a designer to improve quality levels in assemblies. They are primarily operations which can be applied to an assembly distribution to reduce the number of rejected assemblies.

The three methods of tolerance are:

1. centering the Mean of the Assembly Distribution.
2. Upper or Lower Limit Justification
3. Reducing the Spread of the Distribution.

Examples of manufacturing material Process are;

Raw Materials The outer layers of plywood are known respectively as the face and the back. The face is the surface that is to be used or seen, while the back remains unused or hidden.

Plywood;-may be made from hardwoods, softwoods, or a combination of the two. Some common hardwoods include ash, maple, mahogany, oak, and teak. The most common softwood used to make plywood in the United States is Douglas fir, although several varieties of pine, cedar, spruce, and redwood are also used.

As logs are needed, they are picked up from the log decks by rubber-tired loaders and placed on a chain conveyor that brings them to the debarking machine.

Logs delivered to the log yard should be processed as soon as possible to minimize the degrade or determination caused by insect and fungi attack

Steaming of Logs for Veneer Production Before the veneer can be cut, the peeler blocks must be heated and soaked to soften the wood. The blocks may be steamed or immersed in hot water. This process takes 12-40 hours depending on the type of wood, the diameter of the block, and other factors.

Pressing the veneers are assembled together to form piles consisting of unglued, and glued veneers laid alternatively, with their grains mutually perpendicular. The assembled plywood panels may then be grouped together and pressed in a pre-press.

Hot Pressing Hot pressing is carried out in a hydraulic press incorporating multiple heated platens between which each individual panel assembly is subjected to heat and pressure.

Cold Pressing Cold pressing is carried out at room temperature with either mechanical (screw type) or hydraulic presses.

Particleboard; -is used as a generic term for any panel product that is made with wood particles. Of course, there is a great range of particle shapes and size used to make particleboards.

Self-Check -1	**Written Test**

Instruction: - Give short answer for the following question and answer the question on the space provided (10%)

1. What is tolerance?(5points)

2. Write the manufacturing process of materials? (5pts)

Score=----------
Rating =----------

Name ---------- date ----------

*Note:*Satisfactoryrating 5 and abovepoints Unsatisfactory-below5 points

Answer sheet.

1. ----------

   ----
2. ----------

Information sheet 4	**Planning work sequence**

4.1. Introduction to Planning work sequence

Planning is the act of researching, analyzing, anticipating and influencing change in our society. Planners are involved in making decisions about land use proposals and other types of developments. In making decisions, planners have to balance the needs of communities and the environment.

The purposes of planning a work sequence are:-

1. Eliminate unnecessary work
2. Ensure full use of machinery to prevent delays, and
3. Make the factory run more efficiently and economically.

It is also normal procedure to plan a machining sequence as part of the work sequence. A machining sequence should be planned to minimize handling. This will reduce the amount of time spent at each machine.

Planning the machine sequence also makes the assembler's job go more smoothly. They get the components as they are needed and are not held up waiting for particular pieces of the job.

Self-Check -1	Written Test

Instruction; - Write the answer TRUE or FALSE on the spaces provided.

----------1. Planning is the act of researching, analyzing, anticipating and influencing of society. 2.5points)

----------2.planning is one of a way to archive any goals. 2.5points)

Score= ----------
Rating =----------

Name ---------- date ----------

Note: Satisfactory rating 2.5 above points Unsatisfactorybelow2.5 points

Answer sheet

1. ----------

2. ----------

Information sheet 5	Determining & checking quality procedures at each stage of the process

5.1. Determining & checking quality procedures at each stage of the process

The process of continuous quality improvement in organizations requires the active use of management tools by organization managers in order to improve the quality of production. Nowadays, there are many quality management tools, so selecting the appropriate tools is not always easy.

One of the checking mechanisms and quality of tools are:-

1. Manual handling

Manual handling covers a wide range of activities including: lifting, pushing, and pulling, holding, restraining, throwing and carrying. It includes repetitive tasks such as packing, typing, assembling, cleaning and sorting, using hand-tools, operating machinery and equipment, and handling.

Good posture and lifting techniques can help reduce the risks, but research indicates that making changes to workplace design is the most effective way to prevent manual handling injury

2. Identifying workplace hazards

Some factors in the workplace may increase the risk of an injury occurring. These hazards can be identified in different ways:

A. Walk through the workplace and look for potential hazards.

B. Talk over risk factors with workers.

C. Check through injury records to help pinpoint recurring problems.

D. Regularly monitor and update risk identification.

A detailed process, including requirements for identifying hazardous manual handling and implementing risk controls, is available from Work Safe

Assessing the risks

Typical risk factors that can increase the risk of injury include:

I. Type of work – working in a fixed posture for a prolonged period of time.

II. Layout of the workspace – a cramped or poorly designed workspace can force people to assume awkward postures, such as bending or twisting.

III. Weight of an object – a heavy load may be difficult to lift and carry.

IV. Location of an object – heavy objects that have to be lifted awkwardly, for example above shoulder height or from below knee level.

V. 5 .Duration and frequency – increasing the number of times an object is handled or the length of time for which it is handled.

VI. 6 .Condition of an object – more effort may be required to manipulate badly designed or poorly maintained equipment.

VII. Loads – loads that are difficult to grasp, slippery or an awkward shape.

VIII. Handling a live person or animal – lifting or restraining a person or animal can cause sprains and other injuries.

4. Reducing or eliminating manual handling risks

After identifying workplace hazards you can do several things to control the risk of manual handling injuries. These tips can help reduce injury at home as well as at work. Safety suggestions include;-

A. **Change the task** – ask 'Does this task need to be carried out? If so, does it have to be done this way?'

B. **change the object** – for example, repack a heavy load into smaller parcels

C. **Change the workspace** – for example, use ergonomic furniture and make sure work benches are at optimum heights to limit bending or stretching

D. **Change the environmental conditions** – including heat, cold and vibration

E. **Use mechanical aids** – such as wheelbarrows, conveyor belts, cranes or forklifts

F. **Change the nature of the work** – for example, offer frequent breaks or the chance to do different tasks

G. **Offer proper training** – inexperienced workers are more likely to be injured.

Self-Check -1	Written Test

Write short answer for the following question on the space provided. (10%)

1. What is manual handling means? (2points)

2. ----------is a heavy load may be difficult to lift and carry**? (**3 points)

3. ----------is a Location of an object**? (**3points)

4. ----------is more effort may be required to manipulate badly designed or poorly maintained equipment? (4 points)

Score =----------
Rating =----------

Name ---------- date ----------

Note: Satisfactory rating 6 and above points Unsatisfactorybelow6 points

Answer sheet

1. ---------- **3. ----------**

2. ---------- **4. ----------**

Information sheet.6	Selecting suitable work area for bending

6.1 Selecting suitable work area for bending

Selecting suitable work area for bending is related to implement housekeeping activities.

Regular inspections are carried out in the work area according to workplace procedures and standards. Areas and cleaned and maintained in accordance with Occupational Health and Safety (OHS) and 5S procedures.

Disposal of waste and dangerous chemicals are checked in accordance with OHS regulations and organizational policies.

Effective housekeeping results are;-

- reduced handling to ease the flow of materials
- fewer tripping and slipping accidents in clutter-free and spill-free work areas
- decreased fire hazards
- lower worker exposures to hazardous substances (e.g. dusts,)
- better control of tools and materials, including inventory and supplies
- more efficient equipment cleanup and maintenance
- better hygienic conditions leading to improved health
- more effective use of space
- reduced property damage by improving preventive maintenance
- less janitorial work
- improved morale
- improved productivity (tools and materials will be easy to find)
- Prevent loss and waste of time
- Easy to find and pick up necessary items
- Ensure first come – first – served basis
- Make work flow smooth and ease

To **select suitable work area.**

Keeping of work shop clean & store the tools in proper place is to ensure our body & tools from the accidents of machine while working & breakage of tools respectively. The workshop is kept in different ways .Some of themes are:

- Work benches should be free &clean of clutter.
- Tools &equipment's should be safely stored.
- Keep the floor clean &clear.
- Immediately wipe of spilled liquids which can create a slippery surface.

Self-Check -1	**Written Test**

Give short answer for the following question on the space provided? (5%)

1. what is work area for wood bending?(2.5pts)
2. what are the effective housekeeping results for bending ?(2.5pts)

Score= ----------
Rating =----------

Name---------- date ----------

*Note:*Satisfactoryrating 2.5 and abovepoints Unsatisfactorybelow2.5points

Answer sheet

1. ----------

2. ----------

Information sheet.7	Completing drawings/set-outs for tasks where required

7.1 Completing drawings/set-outs for tasks where required

Room Set-Up When considering how to arrange furniture in your event space, keep the overall purpose of the event in mind. Do you want guests to mix and mingle? Or is this a meeting where fostering dialogue is most important? Ask these kinds of questions as you decide how to set up your space. Once you have booked your venue, you can use a tool like the room Layout Planner to try out different arrangements for how furniture will look in the space.

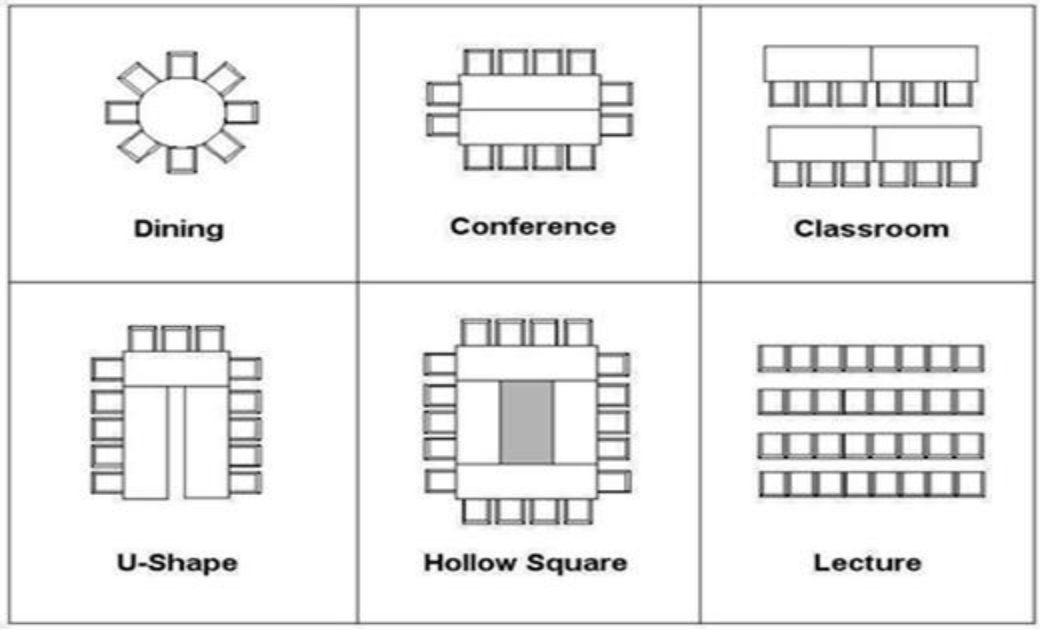

FIG.7.1 Room set-out

The following are the main ways of Room Set-Up

Design and décor

Design and décor elements create the atmosphere and ambiance of an event. Event design should be planned in advance, especially for large or complex events.

Think about the type of event, the audience, and your budget as you decide on your design and décor.

Some simple items that can upgrade the look of your event:

Floor;- add sounds to any space. For a limited budget or small event, take an approach to floral rather than purchasing finished arrangements from a florist. Groupings of individual succulents in small pots are cost effective, yet impactful. What department is hosting the event? Chemistry - use dyed water in beakers or tubes; Astronomy - place small telescopes with star confetti on your tables; Marine Science - a pile of sand and seashells is a simple option. You are only limited by your own creativity.

Lighting can create the right atmosphere for your event. Find out if there are easy ways to change the house lighting in your venue. For a more complex event discuss lighting options with your A/V Company.

Votive candles create warmth in a room even on a small budget. If your venue does not allow votive, battery-operated candles are a lovely substitute.

Print Materials can include menu cards, programs, place cards and table numbers. Print materials can be used to brand your event and communicate your message to guests. Get help with all of your printing needs right here on campus by visiting Document Solutions.

Linen Rentals can be requested on the Event Support Request Form along with tables and chairs; for more options in sizing and colors, contact an external vendor or speak with your caterer. Not sure what size you need? Check out this Linen Size Chart.

Self-Check -1	**Written Test**

Write short answer for the following question on the space provided?(5%)

1. write the definition of lighting?(2.5pts)
2. what is print materials?(2.5pts)

Score= ----------
Rating =----------

Name---------- date ----------

Note: Satisfactory rating above–2.5points Unsatisfactory-below2.5points

Answer sheet

1. **----------**

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2. **----------**

Information sheet.8	Developing Cutting list components

8.1 Developing Cutting list components

A cutting list, which can also be known as a material list, bill of materials, or schedule of materials is simply a listing of all the parts that will be required to construct a project.

This information can be derived from multiple sources: a measured or scaled drawing, a mocked-up project or an existing piece of furniture. Most cutting lists follow the convention of listing the. -Thickness first (T), the

-Width second (W) and the

- Length (L) third.
- For example – T x W x L

  = 18 X 70 X 1200

At a minimum, a cutting list describes every part in terms of its thickness, width and length. Those measurements include the length or width of a part's tendons.

The list provides exact measurements of the completed pieces. No additional material is included as a "safety net" or "just in case."

The list indicates how many of each part is required sometimes referred to as the quantity.

Cutting lists regularly name the parts as a means to describe their function (e.g. Upper Shelf, Drawer Front, Cleat, Apron, etc.).

Cutting lists can also include information about the joinery to be done to the pieces noted, and what type of wood or material they are to be made from. Without an accurate cutting list, you will lose efficiency and accuracy and be more likely to waste timber.

8.2 Obtaining, confirming and applying work instructions

A good cut list is basically an organized inventory and description of every piece needed to build a project. A complete and accurate list will help you to buy the right amount of lumber

in the right sizes. It also will help to ensure you don't forget any parts when you're planning your work.

A. Plans,

Start with a carefully made drawing of your project. I like to work with full-size layout drawings for the greatest precision, but a smaller-scale drawing also can work for generating a list.

I begin a list by filling in the names of the parts, the finished dimensions for each, and the number of parts needed (four table legs, for example).

Work out a cultist

B. Specifications,

Is part of the layout web page display. As you can see, the case sides get divided into pieces based on the width I set for the boards.

C. Quality requirements

A cutting list is a tabulated list showing information about the materials required for the job. It shows you things like: the kind of material needed for each part; how much to use; length; width and thickness of the material; and any special notes on what needs to be done. So to complete a cutting list you need to:

I. assess the specifications - consider what needs to be done

II. Identify the process to be used - this must include the materials and machining sequence to be used.

III. Complete the cutting list against specifications as outlined.

The cutting list really is a vital part of the communication process in the furniture factory. Together with the full size set out or shop rod, it gives each person involved all the information necessary to manufacture the project accurately.

D. Operational details

A chart that details the parts for your project will help you buy just the right amount of material and save money.

Determining job requirements:

A good cut list is basically an organized inventory and description of every piece needed to build a project. A complete and accurate list will help you to buy the right amount of lumber

in the right sizes. It also will help to ensure you don't forget any parts when you're planning your work.

Next, calculate the dimensions of the rough-cut pieces. Add 1 in. to all the lengths of the parts and 1⁄2 in. to the widths to ensure enough material in the rough-cut pieces to correct problems that arise during the milling process.

Lastly, be sure to list any special instructions. The notes here can refer to detailed cutting patterns, joinery, carving, or other issues.

E. **Calculate board feet to estimate cost**

Using the rough dimensions in your chart, you can calculate the board footage needed for each part. This calculation will help you to estimate your project's cost, but it won't tell you the length and width of the boards you should buy. For that you'll need to take your cultist to the lumberyard. To estimate your project's cost, multiply the various board-footage figures by the lumberyard's prices per board foot. ***Chalk out the parts.*** *Refer to your cut list to chalk out the parts on specific boards. On your cut list, check off the pieces you've selected. Be sure to restack any unwanted boards neatly when you're done.*

F. **Job specifications**,

The chart-style cut list described here contains all the information needed to estimate lumber costs and to guide selection of stock at the lumberyard. When you organize your list, make sure that it contains the finished and rough dimensions for each part in your project, and that it lays out the numbers logically for easy addition. **Work backward from finished dimensions.**

Start with a carefully made drawing of your project. I like to work with full-size layout drawings for the greatest precision, but a smaller-scale drawing also can work for generating a list.

G. Cutting list,

A cut list, also called a cultist or cutting list, is closely related to a bill of materials. In fact, many woodworkers treat them as one and the same. It's basically a list of all the parts required to build a woodworking project that contains a number for each part along with its thickness, width and length. After your cut list is complete, it can be used to lay out cutting lines.

H. Pick List

A shopping list for rough-cut lumber is known as a pick list. Each item on the list specifies a type or species of lumber, a nominal or rough thickness, and the number of board feet

Required. For estimating purposes, you might also want to include the cost information. Here is a sample pick list generated with the table.

No	Part	Qty	Thick	Width	Length	Lumber
1	Top	1	3/4	18 ½	26	4/4 Red Oak
2	Sides	2	3/4	18	37	4/4 Red Oak
3	Frame rail	4	3/4	1 ¼	24	4/4 Red Oak

Table 8.1 cutting list

I. Dimension

There is no strict rule for listing dimensions of length, width or height, but there are conventions typically followed. Generally, the bigger measurement is listed first, and so many times this ends up being the length or height. For instance, if someone is measuring a rectangle, the longer sides tend to be regarded as the length, which are then listed first before the width measurement.

8.3 Establishing job components and workplace procedures

at this point, you should have completed the design process and now have a scaled drawing in hand as well as a bill of materials and/or a cut list. You're ready to start putting that thing together! If you can still remember what you were building

Consider putting together a plan of procedure to guide you through the construction process

1. **Lay out sheet stock**. Consult your cutting diagram that was created by hand or with a sheet layout program. Use finished dimensions for the layout lines.
2. **Cut sheet stock**. Put a good plywood cutting blade on your table saw and go to town. If you have a lot of sheets to cut, this might be a good time to invest in a panel cutting saw!
3. **Select and lay out solid stock**. This is where your cut list comes in handy. Start with the largest pieces and work to the smallest, crossing items off the cut list as you go. Use chalk or a crayon as a marking tool. Lay out widths about 1/4″ wider and lengths about 1″-2″ longer than needed to account for stock removal during milling.
4. **Rough cut solid stock**. Allow extra width and length as noted above. This step will generally involve the radial arm saw for cross-cutting and the table saw or band saw for cutting to length.
5. **Square and glue up solid stock**. Mill the pieces as necessary to create fairly flat boards with good gluing surfaces. The glued-up pieces should still be a bit oversized.
6. **Mill solid stock to final dimensions**. This is where you put your arsenal of tools to work – the jointer, planer, table saw, radial-arm saw, chop saw, etc. The end result should be pieces that are flat, straight, square-cornered and cut to finished dimensions – with allowances made for joinery!
7. **Complete curved and irregularly-shaped parts**. The squared-up blanks for these parts were prepared in the previous step. For this step, you'll likely be using your band saw, jigsaw, sanders, and miscellaneous hand tools.
8. **Lay out and cut joints**. This is where the fun begins. We're talking mortises, tenones, tongues, grooves, rabbets, frogs, dovetails, half-laps, dowels, biscuits, You'll probably

spend a good bit of time making and setting up jigs – but this is what it's all about. Try to avoid getting saliva on the wood.

9. **Perform pre-assembly sanding**. It's usually much easier to sand boards before they're assembled. Note that the sanding process itself may represent a separate plan of procedure involving a specified sequence of sanding grits.

10. **Assemble and glue up**. For some projects, this will involve both a subassembly and a final assembly. Tools of the trade here include glue, hammers, and clamps, swearing, and praying.

11. **Perform post-assembly sanding**. This should be a quick once-over using the final sanding grit (grade 180-220). It's also a good time to touch up corners which tend to get banged up during assembly.

12. **Apply finish**. Depending on the complexity, finishing might warrant its own plan of procedure. For example: apply sanding sealer, apply base coat, sand after 24 hrs, apply 2nd coat, sand after 24 hrs., apply final coat, rub out after curing, apply paste wax

13. **Install hardware**. Hinges, locks, drawer pulls, knobs.Measuring work piece dimensions is relatively simple for machine operators but measuring work piece geometry which involves more complex comparisons of part shape to an ideal shape--is now also practical on the shop floor. The gaging equipment for doing this is coming down in price while becoming easier to use.

8.4 Prepare cutting list

Project: LOWER CASE UNIT

PARTS	FINISHED				ROUGH				
	No.	L	W	T	No.	L	W	T	
BOTTOM SIDE RAILS	4	36"	2½"	7/8	4	37"	3"	5/4	F
UPPER SIDE STILES	2	10"	4"	7/8	2	11"	4½"	5/4	
BOTTOM SIDE PANELS	2	24"	10"	¼	2	25"	10½"	¼	B
OUTER DOOR MOLDING	4	36"	1¼"	7/16"	1	37"	4"	1¼"	C

Table 8.2 cutting list

A cutting list derives from the plan. So you need a plan first, and only you can create that if you can either draw it on paper to scale or use CAD.

Cutting list and components lists are used to help you plan for and order materials required, they also help in working out the best use of materials available. Components lists can be generated easily in the Bill of Materials function.

Self-Check -1	Written Test

Give short answer for the following question on the space provided.

1. What is cutting list? (2points)
2. What is layout and cut joint? (2points)
3. What is assemble and glue up? (3points)
4. What is finishing? (3points)

Score =----------

Rating =----------

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Name ---------- date ----------

*Note:*Satisfactoryrating 5 and abovepoints Unsatisfactorybelow5points

Answer sheet

1. **----------**

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2. **----------**

3. **----------**

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4. **----------**

L G # 24	LO # 2- Complete bending and forming process

Instruction sheet

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

- Using tools, machines & equipment with manufacturers' specifications
- Inspecting materials visually for flaws and faults
- Sanding bending materials to remove exterior blemishes & faults
- Preparing & marking materials for bending
- Heating material in ovens with design/pattern bending requirements
- Bending & forming materials using appropriate process/method/techniques
- Checking manufactured components against set-outs for tolerances, fit & accuracy
- Identifying & checking products against plans/specifications
- Preparing product for final finish

Learning Instructions:

- Use tools, machines & equipment with manufacturers' specifications
- Inspected materials visually for flaws and faults
- Sanded bend materials to remove exterior blemishes & faults
- Prepare & mark materials for bending
- Heat material in ovens with design/pattern bending requirements
- Bend & form materials using appropriate process/method/techniques
- Check manufactured components against set-outs for tolerances, fit & accuracy

- Identify & check products against plans/specifications
- Prepare product for final finish

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.

2. 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.

3. Accomplish the “Self-checks” which are placed following all information sheets.

4. 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).

5. If you earned a satisfactory evaluation proceed to “Operation sheets

6. Perform “the Learning activity performance test” which is placed following “Information sheets” ,

Information sheet.1	Methods of wood bending

1.1 Methods of wood bending:

Thin layers of wood are easy to bend in to a variety of simple curves that is, surfaces that bend in only one plane.

Wood bending is an ancient craft that is of key importance in many industries today, especially in those that manufacture furniture, boats and ships, agricultural implements, tool handles, and sporting goods. Of the several methods commonly used to produce curved parts of wood. Yet commercial operations often sustain serious losses because of breakage during the bending operation or the fixing process that follows.

There is a long felt need for more reliable knowledge about:

(1) Criteria for selection of bending stock;

(2) Better methods of seasoning and plasticizing wood for bending;

(3) More efficient machines for the bending operation;

(4) Techniques for drying and fixing the bent part to the desired shape.

(5) The effect of bending on the strength properties of wood.

Such bending is done without treating the wood. In bending thick pieces of solid wood, however, softening with steam or hot water or plasticizing with chemicals is essential.

Stock can be selected with reasonable assurance that it will bend without undue breakage.

The principal precaution is avoidance of stock that contains strength-reducing defects. These defects are decay, cross grain, knots, shake, pith, surface checks, and brash wood. Even

wood containing incipient decay fails under slight tensile stress and cannot be compressed nearly so much as normal wood. Straight-grained wood is much less likely to fail during bending than cross-grained wood.

Below we discuss about the condition of material that is suitable with low possibility of failure to be used in bending.

1. Material with good grain condition.
2. High ductility in characteristic.

Use materials that are free of defects such as knots and checks.

A bad grain pattern made by the line of fibres in wood condition and a knot on the surface of the material are the factors that might cause the material to break. In term of material type, the broadleaf tree is more suitable to use than the conifer, and the tropic l wood is hard to bend. Generally, .

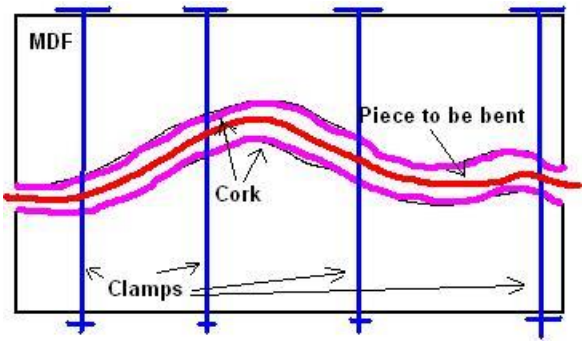

Fig.2.1MDF lay out

When the dowels are in place, you are ready to place your work piece into the jig and clamp it to the dowels as the blue marks indicate in the diagram below.

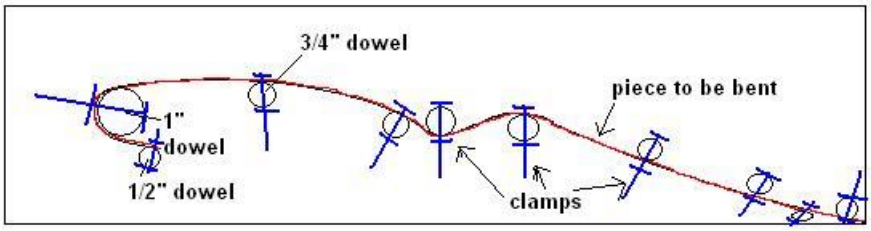

Fig. 2.2dowel lay out

Self-Check -1	Written Test

Give the following question for on the space provided?(5%)

1. What is wood bending?(2.5pts)
2. Write at list three long felt need for more reliable knowledge?(2.5pts)
3. Write the condition of material that is suitable with low possibility of failure to be used in bending;

Score =----------
Rating =----------

Name ---------- date ----------

Note: Satisfactory rating above– 2.5points Unsatisfactory–below 2.5points

Answer sheet

1. ----------

---

2. ---

Operation Sheet -1	Wood bending

Operation title: - Wood bending

Direction;-use the following steps for wood bending process.

STEEP1-Using the appropriate materials of wood bending process.

STEEP2-Use materials those are free of defects such as knots and checks

STEEP3- Identify Equipment, Tools and Materials**.**

STEEP4- Criteria for selection of bending stock.

STEEP5 -Use efficient machines for the bending operation.

STEEP6- Techniques for drying and fixing the bent part to the desired shape.

S**TEEP7**-A bad grain pattern made by the line of fibres in wood condition and a knot on the surface of the material are the factors that might cause the material to break.

STEEP8-Most forms and molds are easily made from MDF.

STEEP9-Then trace your shape on the form, and cut it with the band saw.

STEEP10-The place your work piece into the jig and clamp it to the dowels as the blue marks indicate in the diagram below.

LAP-TEST	WOOD BENDING PROSSES

Name---------- Date----------

Time started---------- Time finished----------

Instructions

1.)You are required to perform the following projects at to 8hrsfinish each exercise.

Task 1.preparing wood bending

2.1.1 Steam bending

Steam bending wood is probably the most widely used and accepted method of wood bending. It has been used for ages.

This type of bending is to apply a moisture and heat to the material using the steaming method. Here, steaming method itself can be divided into 2 type, low pressure and high-pressure method. The concept of device for the high-pressure method is same as a pressure pot used at home. Pressure between 3 to 7 atmospheres is applied during the steaming

process. Since the materials is steamed in a high temperature and high pressure condition, the process finish in a short time, and becomes easy to bend. For the low-pressure method at normal pressure, the method is same as a method of cooking using a steamer. The device used for low pressure steaming is simple and very suitable for a small quantity bending. Moreover, it has a high safety.

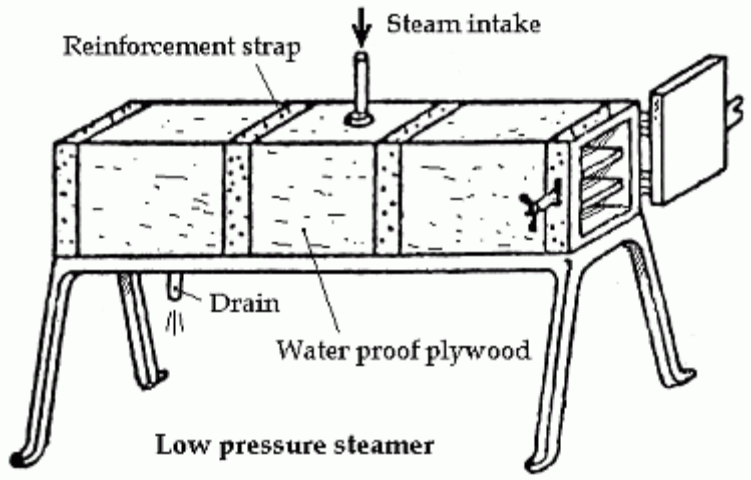

Fig.2.3steam bending one

To construct a steam box you will need.

I. Heat source to make to steam
II. A container to hold the water to be heated
III. A hose to connect the container to the steam box
IV. A box to hold the wood to be steamed
V. Various fittings, clamps, and screws to put the steam box together.

Steam bending can be quite a lengthy process depending on the thickness of the wood that you are bending. The general rule of time is about 1 hour for every inch of thickness being steamed. Use this as a starting point, and adjust your time as needed.

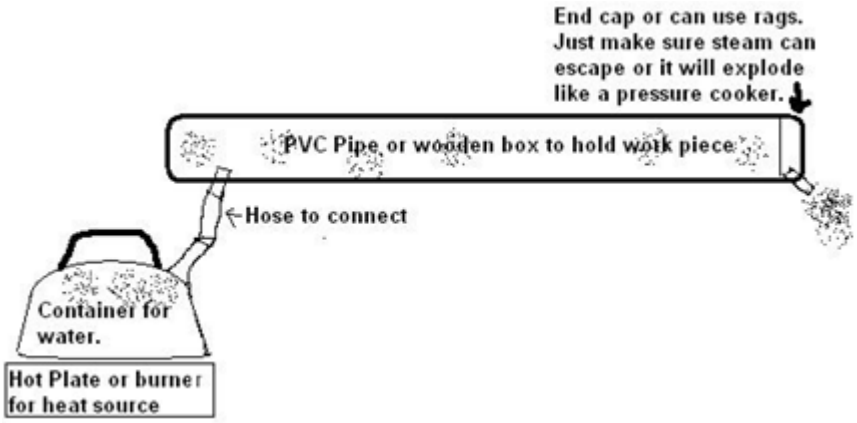

Fig.2.4 steam bending two

Steam has to be able to escape, or else the pressure will build and cause it to explode. But you want it to hold the steam enough to heat the wood and force water vapors into the wood. We use a wad of rags to plug the end of the box, and you can see the water dripping out of the end. If you use a PVC end cap, drill a hole or two in the end to allow the steam to release to pressure as it builds.

2.1.2 Lamination bending

In laminated bending the thin layer is chosen so that it would be easy to bend between 1mm to 5mm depends on its curvature. To bendwood with lamination you. need to use thin pieces of stock, longer than your final length needed animating wood to bend it is a fairly simple process. After you have your form or mold ready and all your thin stock ready, all you do is spread glue on the pieces and stack them together in the form and clamp. When the glue is dry you can dress the edges and trim to length.

Fig.2.5Lamination bending one

Clamp the laminated strips in the bending form, spacing the clamps every 3" dead center in the middle of each segment of the press. Drill 1"-diameter holes in the form to hold the top face of the clamps and automatically space them.

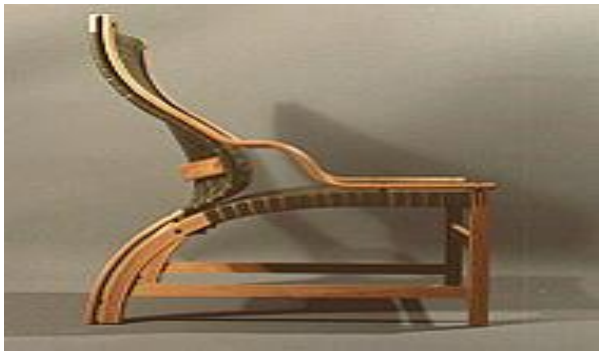

fig.2.6Lamination bending two

Different from a pure bending technique, the laminated bending technique keeps the 'R' shape of the product from straightening out when it is removed from the meld. It the strength.

Fig.2.7 Lamination bending three

When most of us hear the words “bending wood,” we think of steam bending. The wood is heated briefly in low-pressure steam to soften the lignin a glue-like protein that holds the cellulose fibers together. While the wood is still hot, it’s clamped into a bending form. The cellulose fibers telescope to conform to the curve, and the lignin cools to hold them in place. Or almost. In actual practice, the fibers never quite conform, and when you remove the wood from the bending form, there is a great deal of spring back — the wood loses some of its

curve. If the wood is not attached to the other parts in the project so as to hold the curve, it may continue to relax and it will spring back even more.

To cold-bend wood, first re- saw your stock into thin strips and plane it so the thickness is even. The thickness of the strips depends to a large extent on the radius

of the curve. The tighter the radius, the thinner the strips. I use this chart as a jumping-off point:

- 2″ to 4″ radius — 3/32″ thick
- 4″ to 8″ radius — 1/8″ thic
- 8″ to 12″ radius — 3/16″ thick
- 12″ radius or larger — 1/4″ thick

2.1.3 *Kerfs-cut bending*

The most popular method of bending wood without steaming is by kerning. Karting is in simple terms the act of cutting a series of kerfs cuts in a piece of wood in close Proximity, so the wood can be curved. What this method accomplishes is a reduction in stock thickness, while allowing room between the cuts so the wood can bend back on itself. The kerfs are usually only used on the inside of the bend. If you want to make a more complex curve, perhaps an S- shaped curve, you would cut the kerfs on theinside of each bend, then you would use a veneer you cover the entire piece. To bend wood with minimum loss of strength, proper kerf depth and spacing should be Determined using a simple test.

The depth of the kerfs and their spacing are the important factors and are variable. Deep kerfs, closely spaced, allow the sharpest bends It is important not to make the cuts too deep, resulting in the wood cracking completely through, or not deep enough so instead of bending, it snaps.

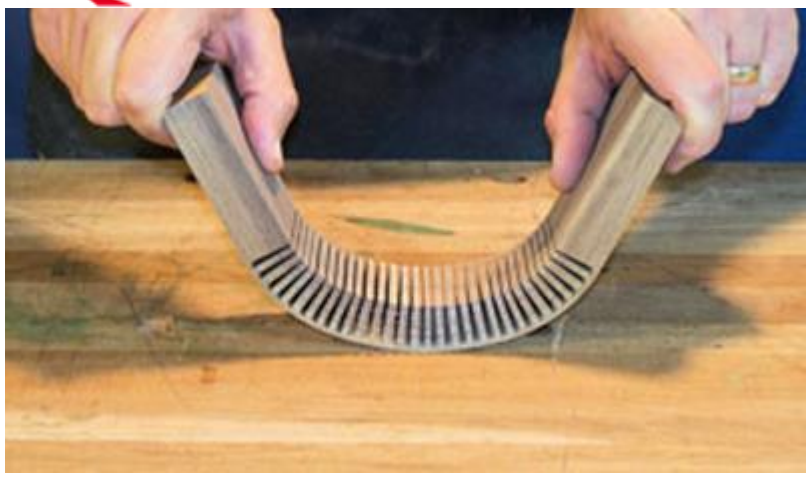

Fig.2.8***Kerfs-cut bending one***

1. The result is pretty spectacular

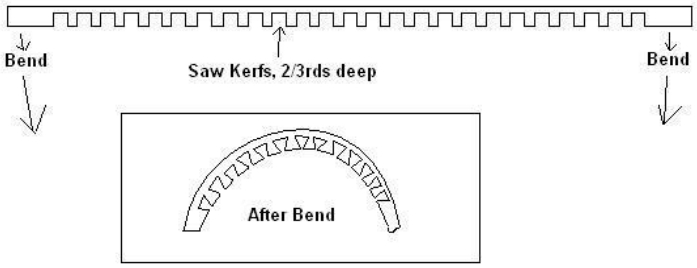

Fig.2.9 ***Kerfs-cut bending two***

To fix the kerning, use lots of glue. You can fill it, and if you want to disguise the kerning, use appropriate wood filler. It is a great technique, and is worth persevering with until you get one that is successful. If you are getting consistent failures, the chances are you are being too conservative on the depth of cut, and the outside of the curve is resisting the bend and fracturing.

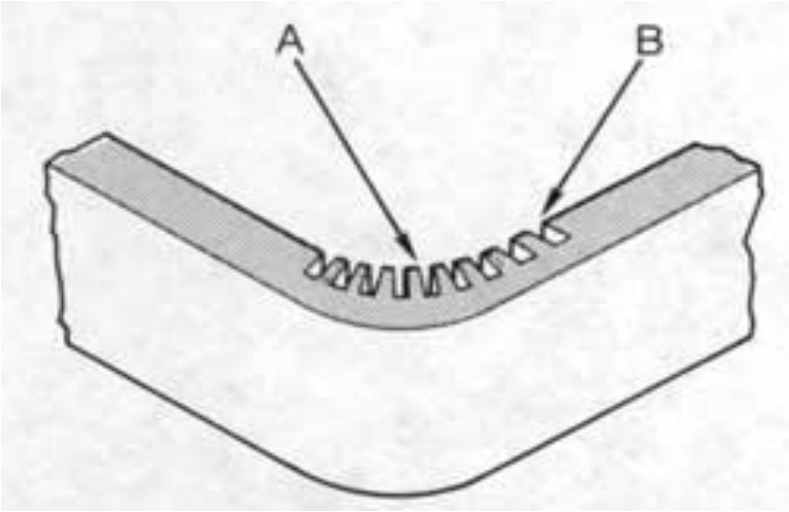

Fig .2.10***Kerfs-cut bending three***

The kerf spacing can be varied, depending on the sharpness of the bend. (A) The kerfs should be more closely spaced in the sharpest bend area. (B) Greater spacing is sufficient where bend begins to straighten.

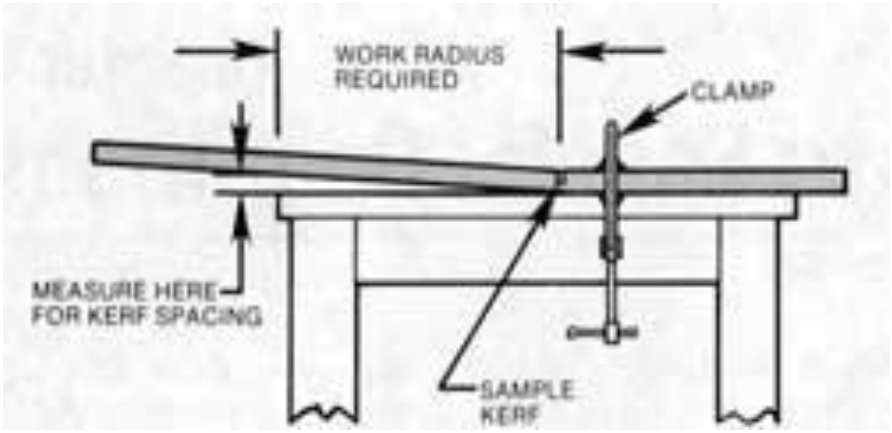

Fig.2.11***Kerfs-cut bending four***

Make this test to determine, at least as a start, the kerf depth and the spacing you need to make a particular bend. Click on image for larger view.

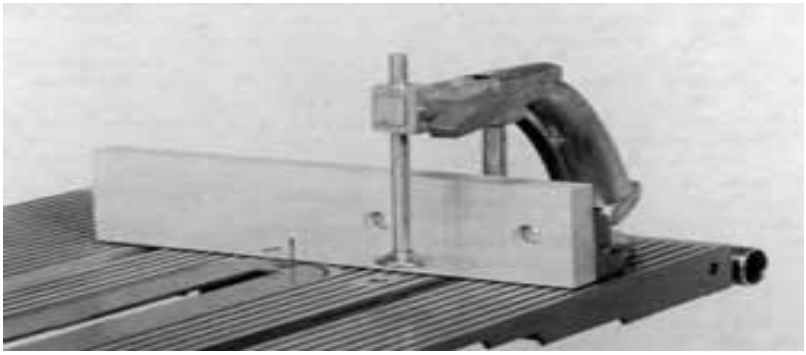

Fig.2.12 ***Kerfs-cut bending five***

Use a mitre gauge extension to make the kerf spacing guide. The distance from the pin (8d nail) to the slot automatically spaces the kersey placing the last kerf over the guide pin, the work is accurately positioned for the next.

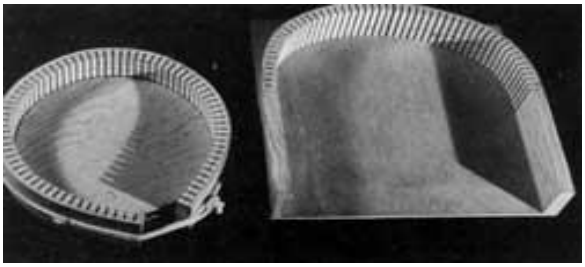

Fig.2.13 ***Kerfs-cut bending sixe***

A good amount of wood bending can be done by using the kerning technique. Kerfs can extend the full length of the work piece or be confined to an area.

Since work like this calls for a considerable number of kerfs correctly spaced, you should work with a kerf spacing guide like the one shown in. After you have secured the guide to the miter gauge, cut a saw slot through it and then drill a hole for a nail to serve as the guide pin, spacing it away from the slot a distance equal to the required kerf spacing. Make the first kerf with the work piece butted against the guide pin. The distance between the remaining cuts is automatically gauged by placing the last kerf over the guide pin. When the kerfs must be cut in a central area of the stock, make the first cut without using the guide.

You can form irregular curves if you do the kerning on both sides of the stock and/or vary the kerf spacing. When the kerning is exposed, veneers may be glued in place to conceal the cuts. If you're working on an outdoor project, coat the kerfs with waterproof glue before making the bend

. The formula use for determining how to kerf my panel or board is this:

1. Take the Outside Perimeter of the radius and subtract the Inside Perimeter. This gives the amount of frame to be removed.
2. Divide this amount by the thickness of the saw blade. This gives the number of saw cuts.

3. Last, divide the Outside Perimeter of the radius by the number of saw cuts. This gives the distance between saw cuts.

2.1.4 Microwaving wood.

As you can probably see by now, the smaller and thinner that a piece of wood is, the easier it is to manipulate. Therefore, bending small pieces of wood becomes a very simple process with the use of a microwave; the only modern technique mentioned in this article. For all intents and purposes, microwave bending is also steam bending but in a much quicker, more manageable way.

To generate steam when microwaving, wrap the wood in a piece of wet paper towel, place it in a microwave oven and microwave it on high. The exact amount of time needed to heat a piece of wood will vary depending on the size of the wood that you are bending, as well as the thickness of the wood so do experiment a little. Err on the side of caution until you are very comfortable with using this.

Some of the merits of using a microwave are as below.

1. Heating process can be done to the internal side in a short time.

2. Shortening the time needed for heating process.

3. Energy efficiency is high.

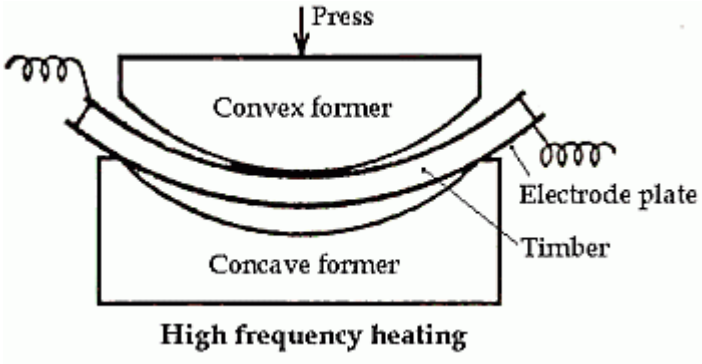

fig.2.13 microwaving wood

2.1.5 *Low pressure steaming*

Since low pressure steam boilers are typically used to maintain building heat, heating load is an important factor. A low pressure steam heating load does not involve a lot of instantaneous change to the load. The boiler should be sized to accommodate the worst foreseeable weather conditions while keeping in mind that the extreme conditions are rarely reached. All too often, boilers operate at loads that are a fraction of their rated capacity for the majority of the time they are in use. In order to prevent excessive cycling and fuel loss, the sizing and selection of the boiler should take seasonal variations into consideration.

2.1.5 Low Pressure Steam Boiler Applications

Low pressure steam boilers are often used in buildings and designed to supply heat to individual rooms through radiators. Buildings heated by low pressure steam boilers may include restaurants, hospitals, office buildings, and schools. These boilers can be used to heat the water supplied to bathrooms and the steam is used to supply heat throughout the building.

Lathrop Trotter is your source for steam boiler technology. We assist a wide range of businesses in increasing efficiency and lowing costs with high performance custom-designed and power solutions. Contact us to discuss your project needs! only have to be checked when they begin to break down.

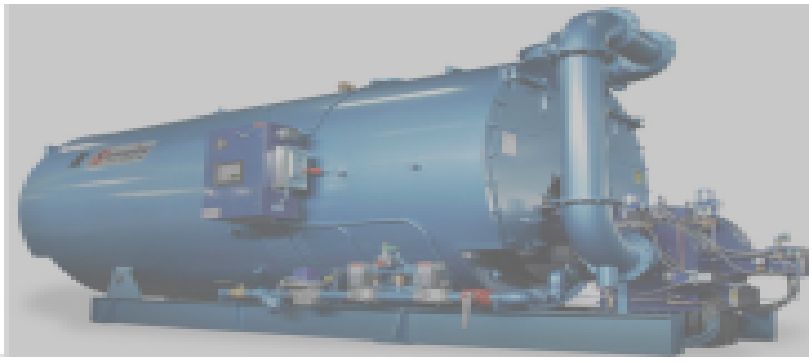

Fig.2.14*Low pressure steamin*

Self-Check -1	Written Test

Give short answer for the following equations listed below.(1o%)

1. 1, what is stem bending process?(2)
2. 2, draw the diagram of stem bending pictures.(1)
3. What is lamented bend?(1)
4. What is the purpose of clamps?(1)
5. What is could bending wood?(2)
6. what is kerfs-cut means?(1)
7. write panel kerf formula to bending wood?(1)
8. What is low presser steaming?.(1)

Score=----------
Rating=----------

Name---------- date----------

Note: Satisfactory rating 5 and above points Unsatisfactorybelow5points

Answer sheet

1. ----------
2. ----------
3. ----------
4. ----------

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5. ---

6. ---

7. ---

8. ---

Operation Sheet 2	identify work plane activity.

Operation title;-identify work plane activity.
Direction;-use the following steps for chair construction chair preparation.

STEEP1- Some of the instruments are pointed objects, observe standard safety of works.

STEEP2- Place the bending instruments in a safe location when in idle.

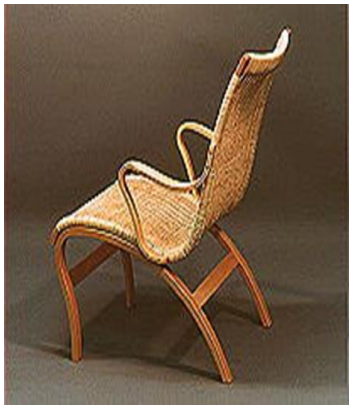
STEEP3- Observe proper posture of body in working area according to safety.

STEEP4- Guidelines to be control the quality of the materials.

STEEP3- Uniform wood bending prose's of each steep.

STEEP4- by using Proper stapes of works.

STEEP5- Observe the quality works of the project.



Lap-test	**Practical demonstration**

Name:_____

Date:_____

Time started:_____ Time _____

Instructions

1.)You are required to perform the following :projects at to 8hrsfinish each exercise.

Task1; preparing work plane activity.

Project WORK

Information sheet.2	*Using tools, machines & equipment with manufacturers' specifications*

Using tools, machines & equipment with manufacturers' specifications

1. Hand tools are used by every shop in Facilities Management. The uses of hand tools in industry are the cause of about seven to eight percent of all compensable injuries each year. These injuries often involve severe disabilities. The following are examples of hand tool injury and some probable causes:

    I. Loss of eye/vision - using striking tools without eye protection.

    II. Puncture wounds - using a screwdriver with a loose handle which causes the hand to slip.

    III. Severed fingers, tendons and arteries - using a dull knife requires so much force that your hand may slip down the blade.

    IV. Broken bones - using the wrong hammer for the job and smashing a finger.

    V. Contusions - using a small wrench for a big job and bruising.

2. Basic Rules for Hand tool Safety

    a. Safety is a state of mind. Always think when using a tool:

    a. Is it in good condition?

    b. Is it sized right for the job?

    c. Is it in the proper working condition?
    b. Every tool was designed to do a certain job. Use it for its intended purpose.

    c. Keep your tools in good condition: sharp, clean, oiled, dressed and not abused.

    d. Worn tools are dangerous. For example the teeth in a pipe wrench can slip if worn smooth, an adjustable wrench will slip if its jaws are sprung and hammer heads can fly off loose handles.

    e. Tools subject to impact (chisels, star drill, punches, etc.) tend to "mushroom". Keep them dressed (sharpened) to avoid flying spalls. Use tool holders.

f. Do not force tools beyond their capacity or use "cheaters" to increase their capacity.

g. Secure your work in a vise whenever possible. Never hold small work in your hand when using a screwdriver.

h. Chisels, screwdrivers or other pointed tools should never be carried in clothing pockets. Use tool belts designed for carrying tools.

i. Hammers should have heads ground properly. Should not have broken claws or handles. Check for loose handles. Always use proper size and weight for the job.

j. Cutting tools should be kept sharp to ensure good smooth cutting. Always use proper handles.

k. Drill Bits should be kept sharp, not dull, chipped, rounded, or tapered.

l. Screwdriver points should not be badly worn and handles should be in good condition. Use the proper size and type of screwdriver for the job.

m. Wrenches, if adjustable, must work freely and adjust properly. Gripping teeth or smooth jaws should not be worn. Always use the proper size for the job.

n. Always wear the PPE required for the job. Protect your eyes, hands, ears and other body parts. Keep clothing out of your work.

Select appropriate hand tools

The correct selection and use of hand tools will help you do the job safely ,and with a minimum expenditure /costs/ of time .When used incorrectly , a hand tool may be damaged ; but more importantly, you or someone else may be injured .It is to your advantage to learn to properly work with hand tools .

Tools are such a common part of our lives that it is difficult to remember that they may pose hazards. All tools are manufactured with safety in mind but, tragically, a serious accident often occurs before steps are taken to search out and avoid or eliminate tool-related hazards.

In the process of removing or avoiding the hazards, workers must learn to recognize the hazards associated with the different types of tools and the safety precautions necessary to prevent those hazards.

Machine is a high risk of accident from the use of woodworking machinery. In spite of improved safeguards, many people using these machines are injured each year. The facts show that injuries from these accidents are invariably more serious than those

caused by ordinary machinery and a great many of the victims suffer from permanent incapacity

The Provision and Use of Work Equipment Regulations, covers the use of work equipment in the workplace. The aim of this course is to train people in the skills and knowledge needed to achieve the standards of competency required to carry out the pre-use inspection and safe and correct use of the most popular types of woodworking machines in the workplace.

Manufacturing specifications is to define those measurement values which correspond to conforming items. That is, when the measurement falls within the manufacturing specifications we want to be able to say that the product is within the customer specifications. In the absence of measurement error we could achieve this objective by simply using the customer specifications as the manufacturing specifications. But when we have to make allowance for measurement error there will need to be some gap between the manufacturing specifications and the customer specifications

Self-Check -1	Written Test

- Write the answer for the following question on the space provided?(5%)

1. What is hand tools?(2.5pts)
2. What is manufacturing specifications?(2.5pts)

Score=----------
Rating=----------

Name---------- date----------

*Note:*Satisfactoryrating5 and abovepoints Unsatisfactorybelow5points

Answer sheet

1. ----------
2. ----------

Information sheet.3	*Inspecting materials visually for flaws and faults.*

3.1 *Inspecting materials visually for flaws and faults.*

Visual inspection of parts for clean lines that are not smooth, flat, and non-porous is often referred to as a gross cleanliness inspection protocol. In general, when these visual inspections are performed on such surfaces, they result in a high degree of cleanliness variability because these irregular surfaces are not well suited to direct visual inspection.

Visual inspection does not usually require special equipment; it is easily implemented provided that the inspector is experienced; and it is inexpensive. Visual inspection is a convenient method to inspect the appearance of rehabilitated structures in terms of global and local soundness, and can be performed routinely as a means of quality control and damage assessment.

Visual inspection is the fundamental inspection method for in-service inspections or during manufacturing to inspect any defect that is produced that may directly or indirectly influence the performance and integrity of the component. The most common types of defects found in composites are contamination, scratches, bump, flaking, lack of resin, stain, dent, impact damage on the surface.

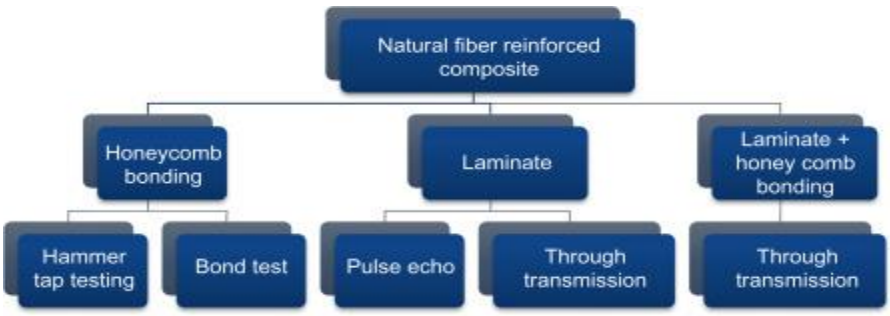


Fig. 3.1 Visual Inspection

Visual inspection of the property may be conducted by the mold abatement contractor, third-party consultant “Guidelines on Assessmentand Remediation of Fungi in Indoor Environments. Ventilation systems should also be visually checked, particularly for damp filters but also for damp conditions elsewhere in the system and for overall

cleanliness. Ceiling tiles, gypsum wallboard wallpaper, cardboard, paper, and other cellulosic surfaces should be given careful attention during a visual inspection.

Self-Check -1	**Written Test**

Choose the best answer for the following question.(5%)

1. ----------is a parts of clean lines that are not smooth, flat, and non-porous?(2.5points)

A. Defect process.

B. Visual inspection.

C. low power magnifying glasses

2. ---------*Are*the most common types of defects found in composites are?(2.5points)

A. contamination,

B. scratches

C. flaking

D. all

Score=----------

Rating=----------

Name---------- date ----------

*Note:*Satisfactoryrating 2.5 and abovepoints Unsatisfactory-below2.5points

Answer sheet

1. ----------

2. ----------

Information sheet.4	*Sanding bending materials to remove exterior blemishes & faults.*

4.1 Sanding bending materials to remove exterior blemishes & faults.

Proper sanding creates the best finishes, whether you're working with wood and learn how to choose the right sandpaper for your work.

Power-sanding products remove material quickly and efficiently. They're a good choice for getting rid of blemishes and for shaping and leveling wood. Power sanding is an effective method of preparing metal surfaces for paint. Sandpaper for power sanding comes in sheets, discs and belts designed to fit specific power tools. Some tools also accept sheets cut to size.

Hand-sanding products give you a lighter touch for woodworking and finishing. You have better control and can sand areas that a power sander can't reach. With proper technique, the scratches align with the wood grain and are less visible. Hand sand wood as final preparation for finishes and between finish coats**.** The grit number of a sanding product indicates the size of the abrasive particles. The lower the number, the larger the abrasive particles; they remove more material but create more noticeable scratches

Types of sand paper materials and each grade

A. .Great numbers from 36 to 100 are good for removing material and work well with power sanders. Applications include:

1. Stripping away finishes, such as paint or varnish

2. Removing rust on metals or flaws in wood

3. Leveling and shaping wood

B. Great numbers from 100 to 180 perform well with both hand sanding and power sanding, preparing bare surfaces for finishes. This range is good for

1. Smoothing work pieces
2. Removing scratches
3. Final preparation for finishing

C. Great c numbers from 180 to 320 work for finishing. Hand sanding is good for these applications are;-

1. Removing raised wood grain fibers
2. Scuffing between finish coats

D. Putty knife/Paint scraper

Scraping is usually accomplished with either a putty knife or a paint scraper, or both. Putty knives range in width from one to six inches and have a beveled edge. A putty knife is used in a pushing motion going under the paint and working from an area of loose paint toward the edge where the paint is still firmly adhered and, in effect, “beveling" the remaining layers so that as smooth a transition as possible is made between damaged and undamaged areas.

E. Mildew Cause of condition

Mildew is caused by fungi feeding on nutrients contained in the paint film or on dirt adhering to any surface. Because moisture is the single most important factor in its growth, mildew tends to thrive in areas where dampness and lack of sunshine are problems such as window sills.

Because mildew can only exist in shady, warm, moist areas, attention should be given to altering the environment that is conducive to fungal growth.

Self-Check -1	Written Test

Fill in the blank **for the following question for on the space provided?(10%)**

1. ----------is a- products remove material quickly and efficiently. wood.(3pts)
2. ----------is products give you a lighter touch for woodworking and finishing.(3pts)
3. -------- is usually accomplished with either a putty knife or a paint, or both.(4pts)

Score=
Rating=

Name ---------- date ----------

*Note:*Satisfactoryrating above–5points Unsatisfactory-below5points

Answer sheet

1. **----------**
2. **----------**
3. **----------**

Information sheet 5	*Preparing & marking materials for bending*

5.1 Preparing & marking materials for bending

Geometric tools are those that are used for measuring, marking out, and testing of a job of various stages.

Measuring: - is the process of estimating length mass, relative to a unit of measurement,

Marking out: - are putting/placing lines, circles, points and arcs before measurement.

Transferring: - measurements from the rule/scale to apply on the work pieces.

Testing: - is a method of transferring and checking degree.

Leveling: - a method of checking a vertical and horizontal

Gauges: Gauges are instruments used to check that an item meets standard **measurement**s. They are also used to mark critical dimensions, such as length and thickness

- Geometric tools are calcified in to three categories
  - I. Measuring tool
  - II. Measuring and marking tools
  - III. Measuring testing and leveling tools

5.2 Measuring tools

4. **Flexible measures;-**Retractable steel tape measures, often referred to as spring tapes, are available in a variety of lengths. They are useful for setting out large areas or marking long lengths of timber and other materials. They have a hook at right angles at the start of the tape to hold over the edge of the material. On better tapes this should slide,

5. **Zigzag rule (folding rule)**: collapsible joined poke rule. sliding metal or wood extension in to the first segment in to assist depth and side measure

   These rules are made from wood, aluminum or steel. They fold up to a handy size of approximately 100.mm, 200 mm and 300mm long.

6. **Self-adhesive bench tap**: that is amounted to a work surface or the front edge of the work bench. handy for checking dimension while work is progress
7. **Hook rule**: usually scaled both directions. This rule at one end facilitates accurate outside measures from the edge. in side measures can be taken from the straight end
8. **Bench Steel rule** : is a rigid rule in a various length from 6inch to 1 yard : this rule is available with either English or metric scale .ideal for lay out work and as a straight edge ,
9. Extension rule : is zigzag rule ,which made up of flexi able like radio antenna it is used to accurate measure length or width,

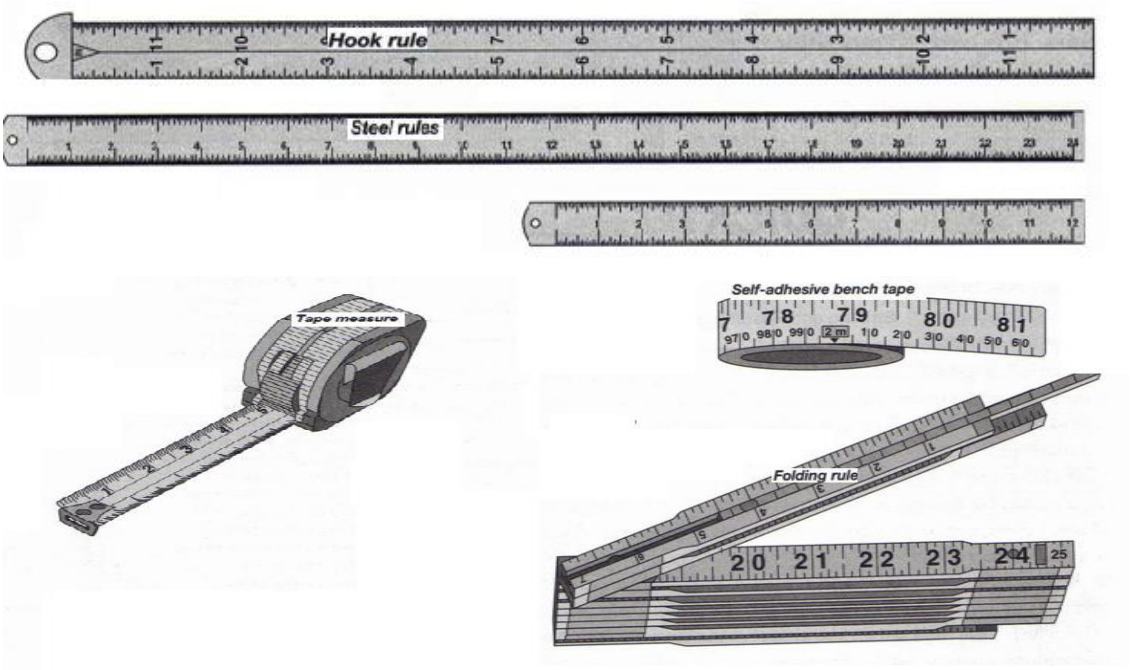


FIG. 5.1ameasuring tool

5.3 Measuring , marking and scraping tools

1. Pencils

Pencils are an important part of a tool kit. They can be used for marking out exact measurements, both across and along the grain.

2. **Marking gauge:-** A marking gauge is used for marking lines parallel to the edge or end of the wood. The parts of a marking gauge include stem, stock, spur (or point) and thumbscrew. A marking gauge has only one spur or point.
3. **Mortise gauge**. **-** A mortise gauge is used for marking the double lines required when setting out mortise and ten on joints, hence the name. It has one fixed and one adjustable spur or point.
4. **Cutting gauge:** The cutting gauge is very similar to the marking gauge, but has a blade in place of the spur. This is used to cut deep lines in the timber, particularly across the grain, to give a clean, precise cut**.**
5. **Marking knife: -** is made up of tool steel with one end angled and beveled. the cutting edge is used for marking a cut line across the shoulders of joints such as tenons, and trenches to guide sawing or chiseling. the cut line is drown in conjunction with a try square and must be squire (at 90^0) with the face edge
6. **Compasses:** - is a metal (steel) tool in a form of a pair of dividers its main application is for setting out arcs and circles and a work piece or job.
7. **Trammel point**: is a large compass which have adjustable legs and used to scribing large circle arcs and curve.
8. **Calipers and dividers:** Calipers and dividers enable accurate checking of widths and gaps. They can have a simple friction joint or knurled rod and thread. The latter are more accurate for repetitive work, as the width setting can be

maintained.Calipers are designed for either internal or external gaps. Although some come with a graduated scale, it is usually better to check measurements against a steel rule 

Fig.5.1b in said& outside caliper

9. **Scratch awe**: is a sharp point tool which used to making straight hole for drill .screw or nail. it also precision than a pencil for scribing lay out line,
10. **chalk line** : used to making a long straight line : the straight line is held out over the surface and snapped with helper or fix end of string to surface with a nail.
11. **Pounce wheel**: is used for transferring paper paten in to work pieces (in to wood surface). The teeth perforate paper and score mark on a wood.
12. **Dovetail square** : is made up wood or metal .which is used to outline dovetail joint by angle 80^0
13. **carpentary square** : is a large try aquare.most of atime which is commonly ued for checking and marking $90^0$for long arm .
14. **center punch** : is made up of hard metal which is used to makinga straght hole for nail and screw on a pices of wood and meta ,

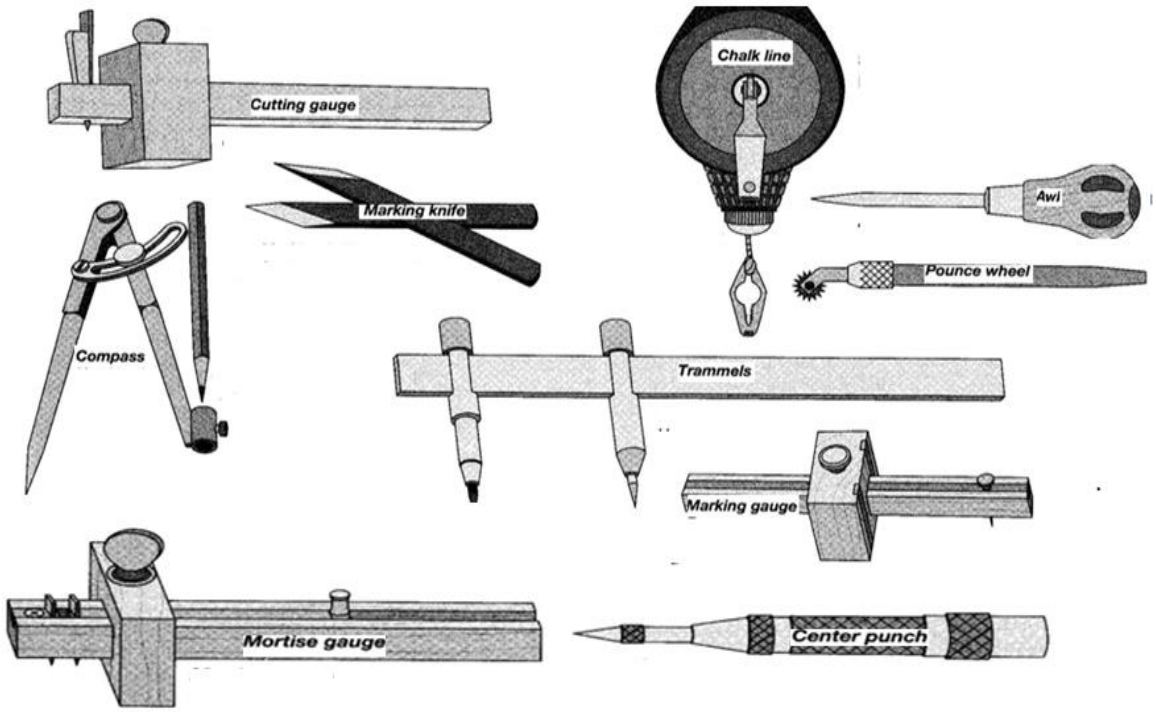


Fig. 5.1c marking tool

Self-Check -1	Written Test

Choose and write the letter of the correct answer on the space provided?(5%)

1. --------is the process of estimating length mass, relative to a unit of measurement,(2.5pts)

A. marking out

B. measuring

C. testing

D. all

2. ---------which one of the following is marking tool. (2.5pts)

A. compass

B. marking gauge

C. pencil

D. all

Score=
Rating=

Name ---------- date ----------

*Note:*Satisfactoryrating above–2.5points unsatisfactorybelow2.5points

Answer sheet

1. ----------

2. ----------

Information sheet.6	*Heating material in ovens with design/pattern bending requirements.*

6.1 Heating material in ovens with design/pattern bending requirements.

The thermo forming could be taken literally to include any process which uses heat to create a 3D form - Blacksmithing for example.

Online includes as Thermoforming all processes in which Thermoplastics are heated to create products with a particular emphasis on methods of molding flat sheet materials.

A. Press Molding

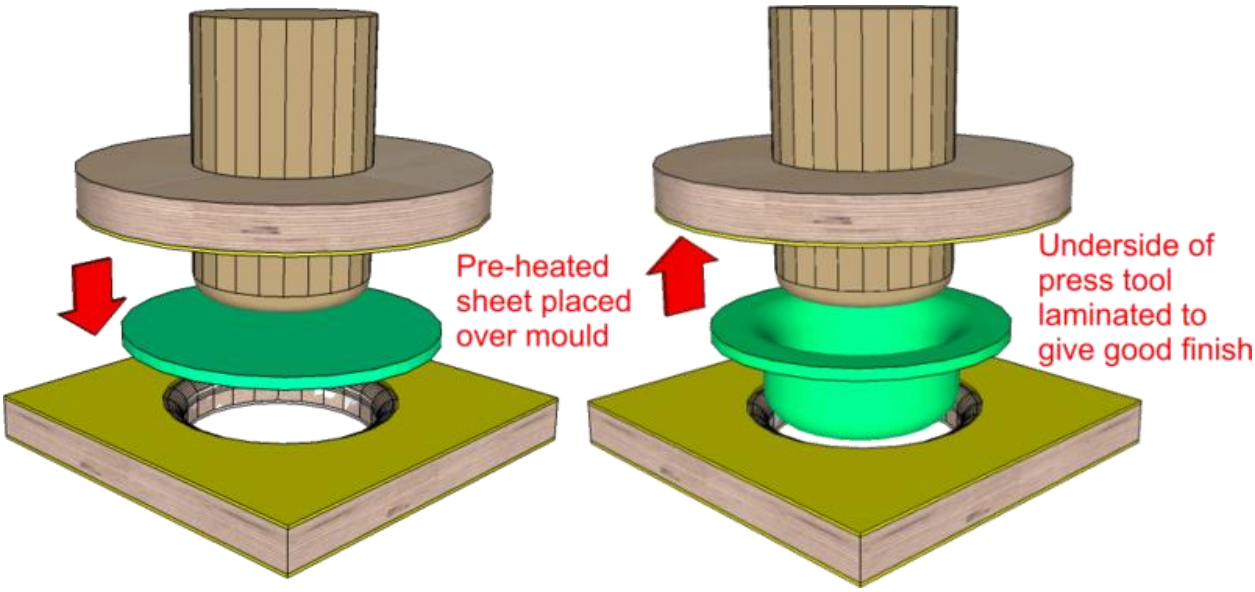


Fig.6.1apress molding one

- The sheet of Acrylic can be heated in the plastics oven set at between 1350C to 1750C (275°F to 350°F) then placed over a mold shape and pressed into it as shown - the two parts of the mold should be made with an allowance between them to accommodate the thickness of plastics sheet used.

Molding plates can be Laminated with ‘Formica’ or similar and have well rounded corners to ensure the surface finish of the Acrylic is not unduly marked as pressure is applied.

Small pieces can be heated by careful use of a Hot Air Gun which is continuously moved over the surface until the Acrylic becomes suitably Malleable - experiment to find the right temperature and be careful not to overheat the plastics : this will cause bubbling and eventual melting.

B. Drape molding

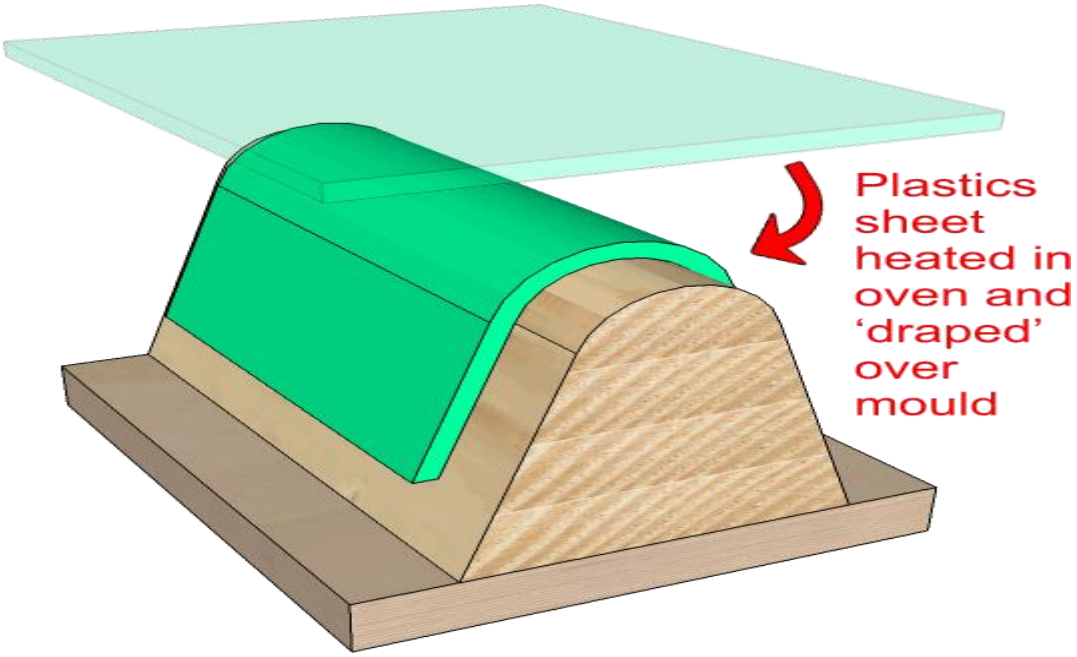


Fig.6.1bdrape molding

The sheet of Acrylic can be heated in the plastics oven as above or small pieces heated with a Hot Air Gun - experiment to find the right temperature and be careful not to overheat the plastics: this will cause bubbling and eventual melting.

Use oven gloves or similar when handling the hot Acrylic sheet and simply ‘drape’ it over a pre-prepared mold.

Minor adjustments can be made throughout using a Hot Air Gun to maintain molding temperature and an extended mounding time can be achieved if the mold is first pre-heated.

C. Blow Molding

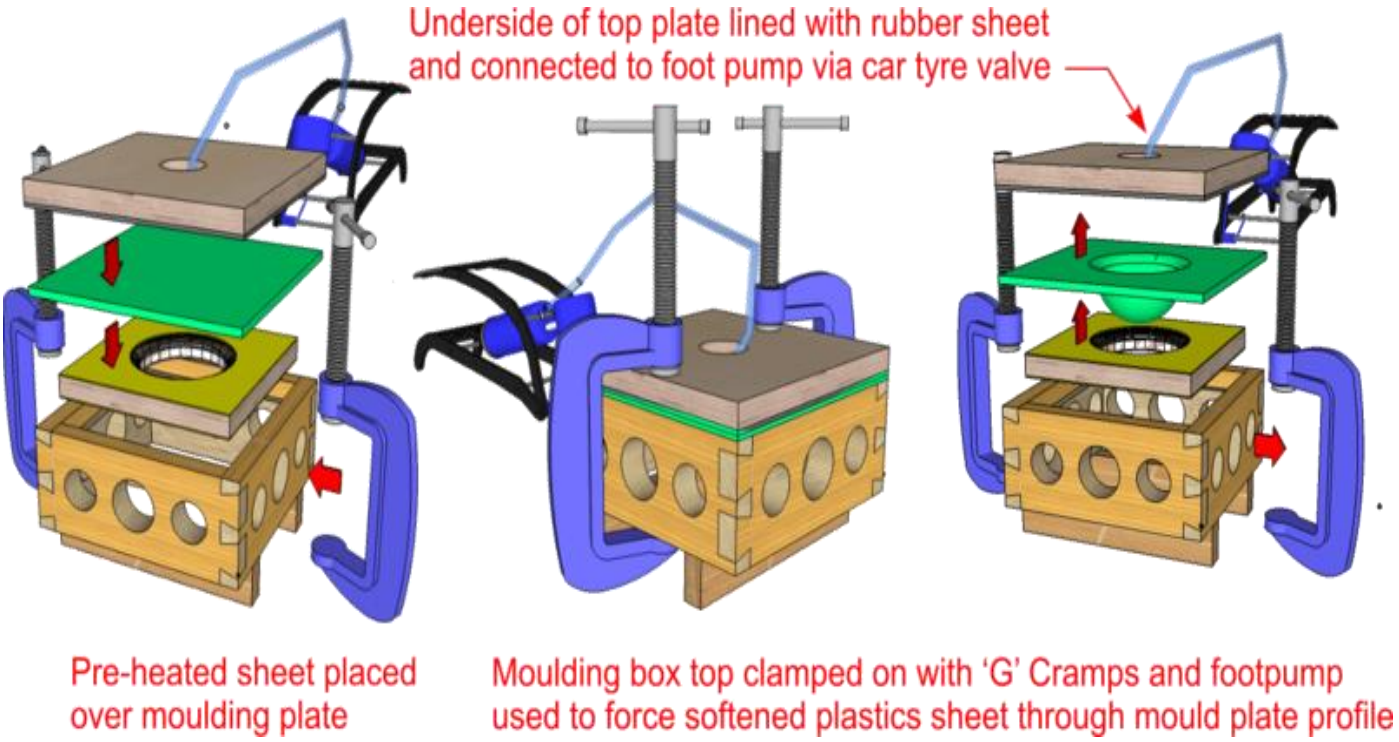


Fig.6.1c blow molding one

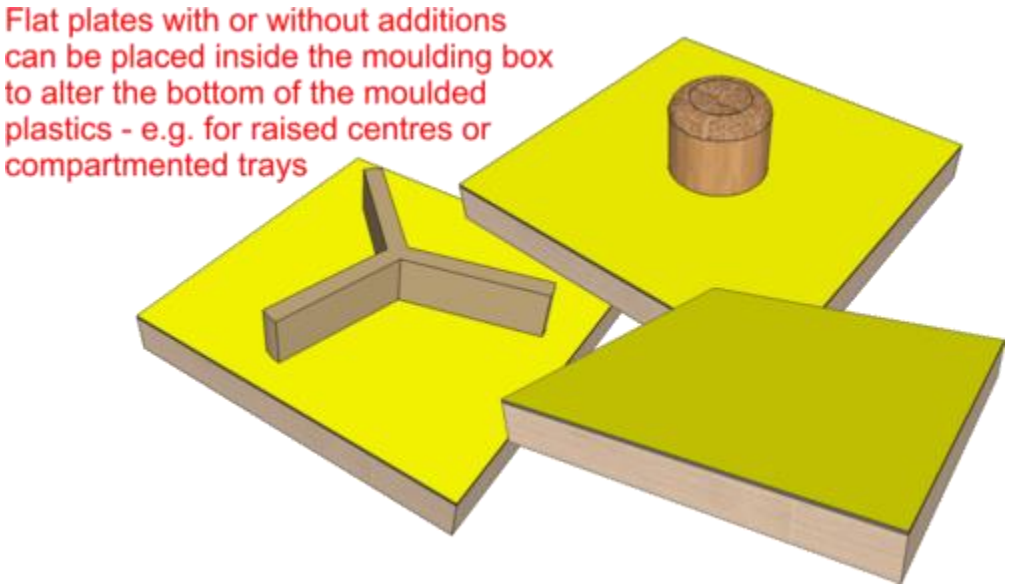


Fig.6.1d blow molding two

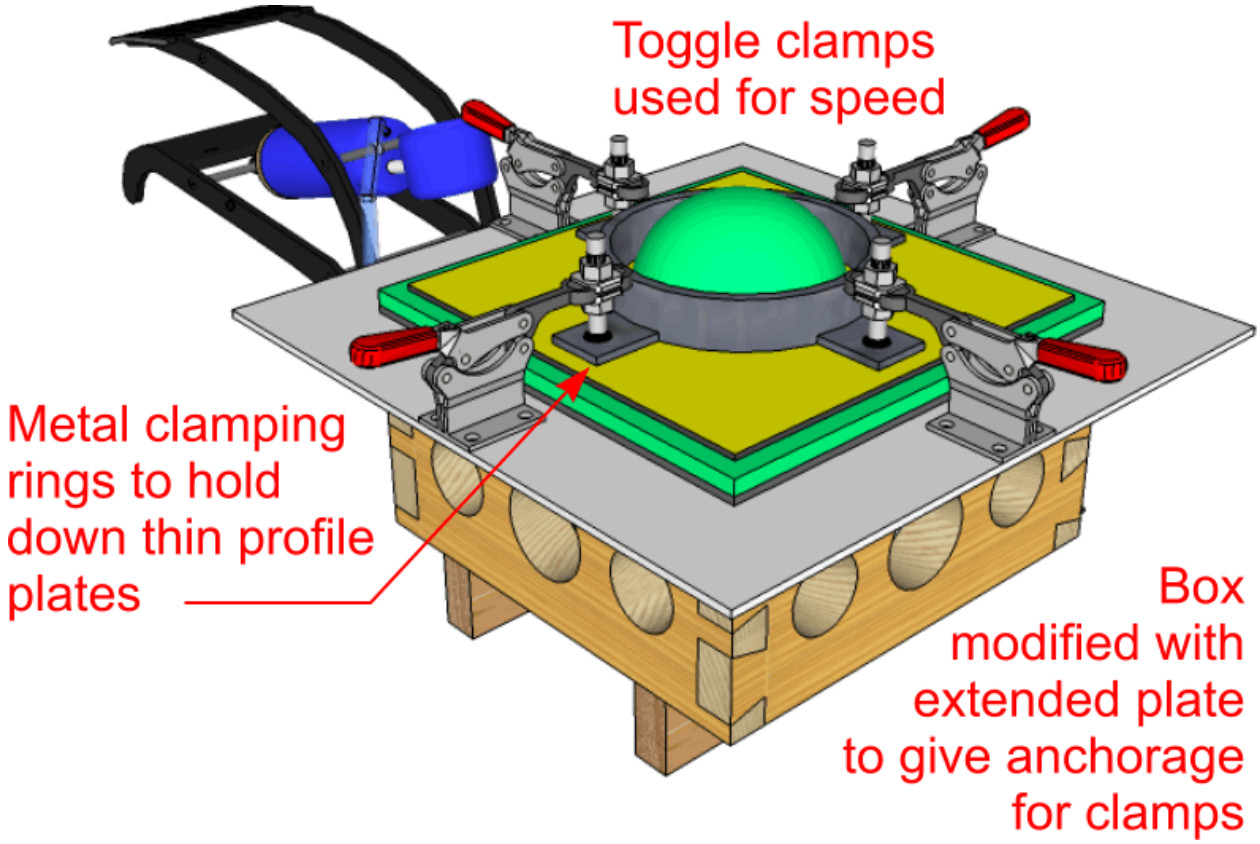


Fig.6.1e blow molding three

D. Line Bending

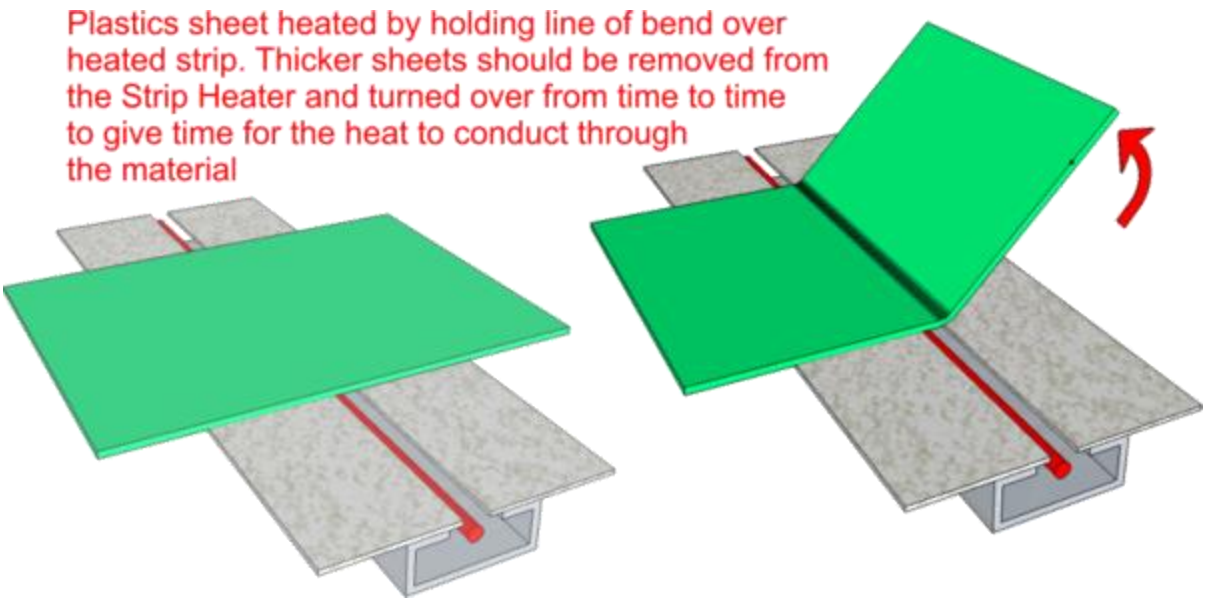


Fig.6.1f line molding

As the name implies, a Strip Heater is a heating source which is shielded in such a way that only a narrow strip is exposed. In modern Strip Heaters the heat source is usually a length of Chrome Wire but older machines may use a Infra-red Element.

Complex products may be modeled in card first to check which order to complete the bends or folds. Bending Jigs can be made to ensure folds are completed accurately and held in position until the material cools.

E. Vacuum Forming

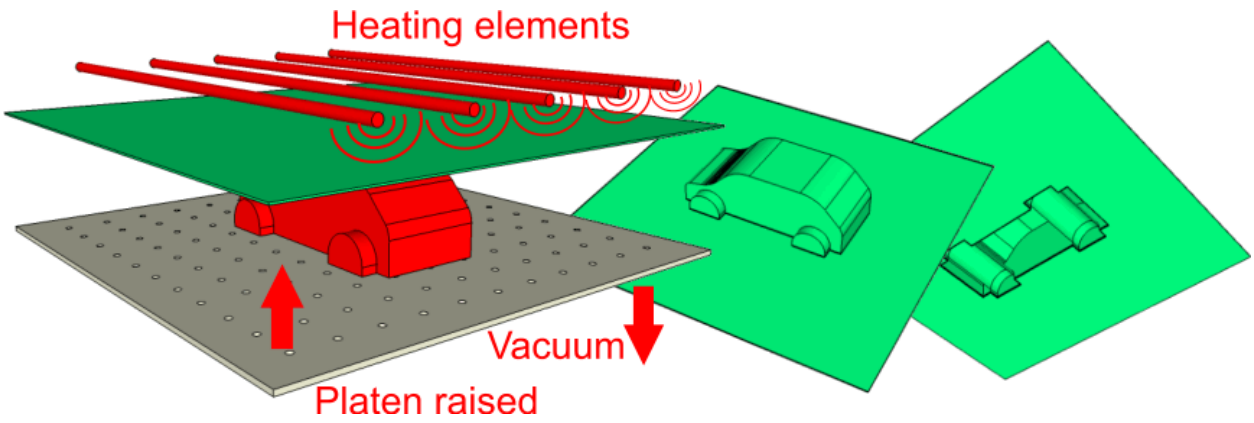


Fig.6.1g vacuum forming

Vacuum Forming is a process, in which a sheet of relatively thin Thermoplastics e.g. 1mm to 3mm thick is heated, stretched over a mold and then sucked down on to it by a vacuum.

The mold can be made by any material which will withstand the heat of the plastics and the force of the vacuum (e.g. wood or plaster). Molds should be created such that any vertical surfaces have a slight taper or draft to ensure they can be withdrawn after mounding. They should be well finished and brushing on Talcum Powder or using Silicone Spray will aid their release use only if the inside of the finished mounding is not to be painted - paint does not stick to silicone!. Molds which have recesses should be made hollow with bleed holes drilled into them to help the vacuum draw the plastics.

Self-Check -1	Written Test

I. Give short answer for the following question and write the answer on the space provided.

1. what is press molding? (1points)

2. What is drape molding? (1points)

3. What is line bending? (1points)

4. what is vacuum forming? (2points)

Score=----------
Rating=----------

Name ---------- date ----------

*Note:*Satisfactoryratingabove–2.5points Unsatisfactory-below 2.5points

Answer sheet

1. ----------
2. ----------
3. ----------

4. ----------

Information sheet 7	Bending & forming materials using appropriate process/method/techniques

7.1Bending & forming materials using appropriate process/method/techniques

Bending& forming is widely applied in the forming of wood bending parts which featured high forming efficiency good quality time saving and reducing the processing cost of the parts.

Such techniques will increase the cost of parts processing due to the use of forming tooling. The increase of human activates will results in unstable parts.it also reduces the matching efficiency of the parts.

Bending process are;-This paper mainly focuses on discussing size calculation, bending tool selection, process aanalysis of typical parts, common problems and solution in the bending process.

Selection of bending tooling are;- Selection of bending tools;-how tochoose the right tool in the bending processing a key problem.

To bending tool is divided in to the top tool and bottom tool namely punch and die.

The press bark punch and die are chosen according to the thickness and the bending size of the parts in order to avoid deformation caused by the collision between bending parts and punch die.

The straight punch is mainly used for bending the parts with the thickness. The small gooseneck punch is used for bending the *U* shape parts with shallow depth, the gooseneck punch mainly used to bend *U*shape parts with deep depth the hammering punch is mainly used to the parts.

Methods of wood bending include;

a. **steam box method**;-Steam bending can be quite a lengthy process depending on the thickness of the wood that you are bending.

b. **lamination method**;- In laminated bending the thin layer is chosen so that it would be easy to bend between 1mm to 5mm depends on its curvature.

c. **kerfs-cutting method**;-

of bending wood without steaming is by kerning. Kurting is in simple terms the act of cutting a series of kerfs cuts in a piece of wood.

method bending method answers related references although most projects involving wood use straight boards, some require bent wood. Bent wood can add uniqueness and flair to a project. There are several different methods that can be used, each with its advantages and disadvantages. Experiment with different techniques so that you find out which ones suit your particular project.

1.Set up your steam box. The steam box can be a wooden box that you construct to hold the wood to be bent, or it can be a piece of PVC or other kind of pipe. The box needs to have a hole through which you can pump in the steam. It also needs an exit hole so the steam pressure doesn't blow up the box.

For best results, set up the exit hole so that it's turned toward the ground. This will allow the pressure inside the steam box to push the water out of your box.

Self-Check -1	Written Test

Fill in the blank space answer for the following question.(5%)

1. --------- Steam bending can be quite a lengthy process depending on the thickness of the wood that you are bending.(2.5pts)

2. ------- In laminated bending the thin layer is chosen so that it would be easy to bend between 1mm to 5mm depends on its curvature.(2.spts)

Score=----------
Rating=----------

Name ---------- date ----------

*Note:*Satisfactoryrating2.5 abovepoints Unsatisfactorybelow 2.5points

Answer sheet

Information sheet 8	*Checking manufactured components against set-outs for tolerances, fit & accuracy*

8.1 Checking manufactured components against set-outs for tolerances, fit & accuracy

Tolerance and fits ;-The calculations for easy option of fits of machine parts and determination of their dimensional tolerances and deviations. Using this tool the following tasks can be solved:

1. Selection of suitable fits of machine parts according to the international standard ISO.
2. Determination of dimensional tolerances and deviations of machine parts according to the international standard ISO.
3. Selection of preferred fits of machine parts and determination of their dimensional tolerances and deviations.
4. Determination of non-prescribed limit deviations of linear and angular dimensions according to ISO.
5. Automatic design of a fit for the given clearance or fit interference respectively.

Basic item

It is necessary that the dimensions, shape and mutual position of surfaces of individual parts of mechanical engineering products are kept within a certain accuracy to achieve their correct and reliable functioning. Routine production processes do not allow maintenance or measurement of the given geometrical properties with absolute

accuracy. Actual surfaces of the produced parts therefore differ from ideal surfaces prescribed in drawings.

Deviations of actual surfaces are divided into four groups to enable assessment, prescription and checking of the permitted inaccuracy during production:

- Dimensional deviations
- Shape deviations
- Position deviations
- Surface roughness deviations

This includes the first group and can be used to determine dimensional tolerances and deviations of machine parts.

As mentioned above, it is principally impossible to produce machine parts with absolute dimensional accuracy. In fact, it is not necessary or useful. It is quite sufficient that the actual dimension of the part is found between two limit dimensions and a deviation is kept with production to ensure correct functioning of engineering products. The required level of accuracy of production of the given part is then given by the dimensional tolerance which is prescribed in the drawing. The production accuracy is prescribed with regards to the functionality of the product and to the economy of production as well.

A coupling of two parts creates a fit whose functional character is determined by differences of their dimensions before their coupling.

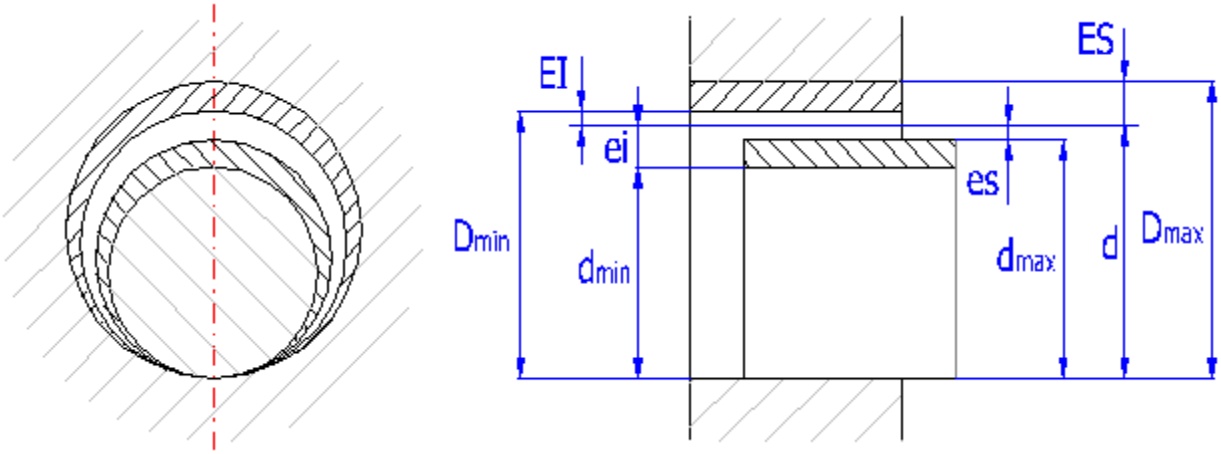


Fig.8.1a tolerance & fit

Where:

d=D ... basic size

Dam , Din ... limits of size for the hole

dam , din ... limits of size for the shaft

ES ... hole upper deviation

EI ... hole lower deviation

es ... shaft upper deviation

ei ... shaft lower deviation

Depending on the mutual position of tolerance zones of the coupled parts, 3 types of fit can be distinguished:

A. Clearance fit

B. Transition fit

C. Interference fit

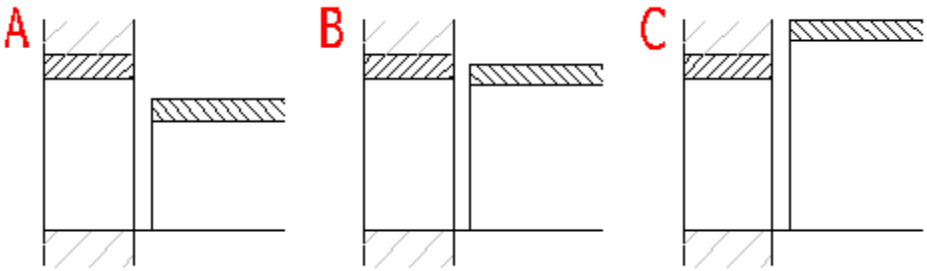


Fig 8.1b tolerance & fit

Self-Check -1	**Written Test**

Write answer for the following question.(5%)

1.What is tolerance and fits?(2.5pts)

2. writethe mutual position of tolerance zones of the coupled parts, 3 types of fit can be distinguished?(2.5pts)

Score=----------
Rating=----------

Name ---------- date ----------

*Note:*Satisfactoryrating 2.5 abovepoints Unsatisfactory –below2.5points

Answer sheet

1. ----------
   ----
2. ----------

Information sheet 9	*Identifying & checking products against plans/specifications*

9.1 *Identifying & checking products against plans/specifications.*

Methods of identifying & checking products are;-

functional specification A functional specification or sometimes *functional specifications* is a formal document used to describe in detail for developers a product's intended capabilities, appearance, and interactions with users. The functional specification is a kind of guideline and continuing reference point as the developers write the programming code. For a sense of where the functional specification fits into the development process, here are a typical series of steps in developing a product:

Requirements. This is a formal statement of what the product planners informed by their knowledge of the market place and specific input from existing or potential customers

believe is needed for a new product or a new version of an existing product. Requirements are usually expressed in terms of narrative statements and in a relatively general way.

Objectives .are written by product designers in response to the Requirements. They describe in a more specific way what the product will look like.

Design change requests. Throughout the development process, as the need for change to the functional specification is recognized, a formal change is described in a design change request.

User documentation is the documents except the logic specification are used as source material for the technical manuals and online information such as help pages that are prepared for the product's users.

The final product. Ideally, the final product is a complete implementation of the functional specification and design change requests, some of which may result from formal testing and beta testing.

The cycle is then repeated for the next version of the product, beginning with a new Requirements statement, which ideally uses feedback from customers about the current product to determine what customers need or want next.

Self-Check -1	Written Test

Choose and write the letter of the correct answer on the space provided?(5%)

1. --------- are written by product designers in response to the Requirements. They describe in a more specific way what the product will look like?

A .Final product

B. Objectives

C. User documentation

2. ---------- is the documents except the logic specification are used as source material for the technical manuals?

A. objectives

B. final product

C. user documentation

Score=----------
Rating=----------

Name ---------- date ----------

*Note:*Satisfactoryrating above–2.5points Unsatisfactory –below2.5points.

Answer sheet

1. ----------
2. ----------

Information sheet.10	**Preparing *product for final finish***

10.1 preparing *product for final finish*

Wood is a lovely material and is shown off at its best with a good finish. In the context of a car, that will probably mean an oil-based varnish of some sort, as it is resistant to water. This is as important inside the car as outside. Atmospheric damp and splashes of rain will mark many finishes such as French polish, Danish oil, etc.

We show you a simple method of doing this and talk through some other options along the way. The tutorial includes a lesson on, how to apply varnishes and other two part wood treatments, how to prepare wood for refurbishment and also how to deal with damage and staining.

Final white wood sanding is the most important step in finishing for satisfactory results. Poor finish quality, rework, and missed expectations are in most cases a direct result of improper final whitewood sanding preparation.

There are three commonly used methods to prepare the surface of the wood as a final step before finishing: wide belt sanding, random orbit sanding and brush sanding.

From a lean perspective, brush sanders will reduce rework, lower sanding preparation labor, and lower material costs. In addition, correct brush sanding technology will return profitability on investment quicker than most any other investment in finishing. Most wood manufacturing shops with $7 million to $10 million in sales and up should see a return on the investment in less than one year, but not more than three years from purchase.

Benefits of Brush Sanding

Brush sanding will remove the following defects: knife marks above 14 per inch; dried marks and surface defects; excessive fiber raise; and blending of cross scratch and swirl marks.

However, brush sanding cannot remove the following defects: large indentations and defects; glue; chatter marks; and heavy cross scratch on uneven joints.

Long abrasive strips will do a much more effective sanding job than short abrasives. Longer abrasive media will allow the strips to bend and sand along the surface of the strip rather than on the tip of the abrasive strip.

Narrow abrasive strips work best for non-aggressive sealer sanding. Wide abrasive strips provide a more aggressive sanding action to remove deep defects.

It is important to insure that all abrasives be broken in before placing them into production. This will ensure an invisible scratch pattern and provide a scratch profile that will allow the stain to develop to the correct color.

.Proper sanding preparation before finishing is the true secret for success for profitability and finish quality.

Self-Check -1	Written Test

Write short answer for the following question on the space provided.(10%)

1. ---------is a lovely material and is shown off at its best with a good finish? (3points)

2. ---------is the most important step in finishing for satisfactory results? (3points)

3. **--------**will remove the following defects: knife marks above 14 pried marks and surface defects? (4points)

Score=----------
Rating=----------

Name ---------- date ----------

Note:**Satisfactoryrating5 and above points** **Unsatisfactory-below5points**

Answer sheet

1. **----------**
2. **----------**
3. **----------**

Operation Sheet -1	**Identify types of molding**

Operation title: prepare types of molding

Direction;- use the following producers for bending method.

STEEP1-Using the appropriate materials of wood bending process.

STEEP2-Use materials those are free of defects such as knots and checks

STEEP3- Identify Equipment, Tools and Materials**.**

STEEP4- Criteria for selection of bending stock.

STEEP5 -Use efficient machines for the bending operation.

STEEP6- Techniques for drying and fixing the bent part to the desired shape.

S**TEEP7**-A bad grain pattern made by the line of fibres in wood condition and a knot on the surface of the material are the factors that might cause the material to break.

STEEP8-Most forms and molds are easily made from MDF.

STEEP9-Then trace your shape on the form, and cut it with the band saw.

STEEP10-The place your work piece into the jig and clamp it to the dowels as the blue marks indicate in the diagram below.

The procedures of Heating material in ovens with design/pattern bending requirements includes are / types of molding.

- **Press molding**
- **Drape molding**
- **Blow molding**
- **Line molding**
- **Vacuum forming**

Instructions

1.)You are required to perform the following: bending types for each exercise you have given 8 hours.

Taske1. Prepare types of molding

L G # 25	**LO #3- Finalize operation**

Instruction sheet

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

- Tagging and reporting faulty and/or defective equipment
- Cleaning, maintaining & storing hand& power tools
- Collecting and storing off-cuts and unused materials
- Dealing with waste and scrap materials following workplace procedures

Learning Instructions:

- Tag and reporting faulty and/or defective equipment
- Clean maintaining & storing hand& power tools
- Collect and storing off-cuts and unused materials

• Deal with waste and scrap materials following workplace procedures
Read the specific objectives of this Learning Guide. **7.** Follow the instructions described below. **8.** 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. **9.** Accomplish the “Self-checks” which are placed following all information sheets. **10.** 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). **11.** If you earned a satisfactory evaluation proceed to “Operation sheets **12.** Perform “the Learning activity performance test” which is placed following “Information sheets” ,

Information Sheet-1	***Tagging and reporting faulty and/or defective equipment***

1.1 *Tagging and reporting faulty and/or defective equipment*

In keeping with the Winnipeg Regional Health Authority commitment to providing a safe and healthy workplace as noted in the ‘Workplace Safety and Health’ policy the following Operational Procedure has been developed to ensure that.

1. When any equipment, tool, machine or personal aide is considered to have a Safety defect, taking the defective item out of service and tagging it with an Appropriate tag such as, "Do Not Start or Do Not Use Tag"” prevents the Defective item from being used and potentially injuring an employee or damaging the facility.

2. If an investigation of a serious accident, incident, injury, or near miss that Includes defective equipment is required, consideration must be given to Ensuring that the equipment is not disturbed nor compromised until the Investigation is complete.
3. Equipment is deemed unsafe shall not be used until repaired or replaced by a qualified person.
4. This operational procedure is also designed to ensure, that when followed, the minimum requirements of Manitoba Workplace Safety and Health legislation is complied with and where possible exceeded.

Any person undergoing training or serving an apprenticeships at an education Institution or at any other place.

Director: means the person administratively responsible for the department or unit.

Director includes heads of departments.

OESH: means the Occupational and Environmental Safety and Health Unit.

Qualified Persons: as defined by the facility site program.

Operational procedure

Each facility site program will ensure that a system is in place that includes the following:

When any equipment, tool, machine or personal aide that has caused an injury or near miss due to a defect, take the item out of service and tagging it with an Appropriate tag such as, "Do Not Start or Do Not Use Tag".

When any equipment, tool, machine or personal aide is considered to create a Potential hazard, ensure it is taken out of service and tagging it with an appropriate tag such as, “Do Not Start or Do Not Use Tag”.

Name of machine are;-A. radial arm saw machine

B. circular saw machine

C. jointer machine

D. Thickens planner machine

Name of tools are;

- ✓ Try-square
- ✓ Tap rule
- ✓ Claw hammer
- ✓ Chisel
- ✓ Mallet
- ✓ Ripsaw
- ✓ Compass

Name of equipment's are;-

- ✓ A. electric portable sander
- ✓ electric hand drill
- ✓ electric jig saw
- ✓ electric router

Persona aide. Ensure documentation is maintained.

Safety shoos

- ✓ mask
- ✓ Easy Goggle
- ✓ Glove
- ✓ Ear protection

Ensure compliance with all aspects of the regulations. The department director is responsible for ensuring that their area of responsibility complies with all aspects of the regulations and this operational procedure.

Manager shall designate a person responsible for tagging out equipment.

Contact qualified persons to initiate the repair process and indicate an urgent Status because of a safety related occurrence.

Self-Check -1	Written Test

Write *true* if the statement is correct and *false* if the statement is in correct.(5%)

---------- 1. Equipment is deemed unsafe shall not be used until repaired or replaced by a qualified person?(2.5points)

----------2. OESH means the Occupational and Environmental Safety and Health Unit.?(2.5points)

SCORE=----------
RATING=----------

Name ---------- date ----------

Note: Satisfactoryrating above–2.5points Unsatisfactory below 2.5points

Answer sheet 1. ----------

2. ----------

Information Sheet-2	***Cleaning, maintaining & storing hand& power tools***

2.1 *Cleaning, maintaining & storing hand& power tool*

Cleaning are carried out in the work area according to workplace procedures and standards.

Areas and amenities are cleaned and maintained in accordance with Occupational Health and Safety (OHS) and 5S procedures.

Disposal of waste and dangerous chemicals are checked in accordance with OHS regulations and organizational policies.

Effective housekeeping results are;

- reduced handling to ease the flow of materials

- fewer tripping and slipping accidents in clutter-free and spill-free work areas

. Five basic safety rules can help prevent hazards associated with the use of hand and power tools:

A. Keep all tools in good condition with regular maintenance.
B. Use the right tool for the job.
C. Examine each tool for damage before use and do not use
D. damaged tools.
E. Operate tools according to the manufacturers'

The following sections identify various types of hand and power tools and their potential hazards. The greatest hazards posed by hand tools result from misuse and improper maintenance. .Some examples include the following:

If a chisel is used as a screwdriver, the tip of the chisel may break and fly off, hitting the user or other employees.

If a wooden handle on a tool, such as a hammer or an axe, is loose, splintered, or cracked, the head of the tool may fly off and strike the user or other employees.

If the jaws of a wrench are sprung, the wrench might slip.

If impact tools such as chisels, wedges, or drift pins have mushroomed heads, the

heads might shatter on impact, sending sharp fragments flying toward the user or other employees.

.Appropriate personal protective equipment such as safety goggles and gloves must be worn to protect against hazards that may be encountered while using.

A. hand tools.

.Workplace floors shall be kept as clean and dry as possible to prevent accidental slips with or around dangerous hand tools.

.The wooden handles of tools must not be splintered. Iron or steel hand tools may produce sparks that can be an ignition source around flammable substances.

- ✓ Set the tool down before energizing (plugging-in) the tool.
- ✓ Never carry a tool by the cord or hose.
- ✓ Never yank the cord or the hose to disconnect it from the receptacle.
- ✓ Keep cords and hoses away from heat, oil, and sharp edges.
- ✓ Disconnect tools when not using them, before servicing and cleaning the m, and when changing accessories such as blades, bits, and cutters.
- ✓ Keep all people not involved with the work at a safe distance from the work area.
- ✓ Secure work with clamps or a vise, freeing both hands to operate the tool.
- ✓ Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool.
- ✓ Maintain tools with care; keep them sharp and clean for best performance.
- ✓ Follow instructions in the user's manual for lubricating and changing accessories.
- ✓ Be sure to keep good footing and maintain good balance when operating.

B. power tools.¬ Wear proper apparel for the task. Loose clothing, ties, or jewelry can become .caught in moving parts.

- ✓ Remove all damaged portable electric tools from use and tag them:

C. Safety Guards

The exposed moving parts of power tools need to be safeguarded. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other moving parts of equipment must be guarded. Machine guards, as appropriate, must be provided to protect the operator and others from the following:

i. Point of operation.
ii. Rotating parts.
iii. Flying chips and sparks'

safety guards must never be removed when a tool is being used. Portable circular saws having a blade greater than 2 inches in diameter must be equipped at all times with guards. An upper guard must cover the entire blade of the saw. A retractable lower guard must cover the teeth of the saw, except where it makes contact with the work

material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work material.

Operating Controls and Switches

The following hand-held power tools must be equipped with either a positive “on-off” control switch, a constant pressure switch, or a “lock-on” control: disc sanders, grinders, platen sanders, routers, planers, laminate trimmers, nibblers and shears. Its recommended that the constant-pressure control switch be regarded as the preferred device. Other hand-held power tools such as circular saws, chain saws, and percussion tools with no means of holding accessories securely must be equipped with a constant-pressure switch.

D. **Types of Power Tools**

The types of power tools are determined by their power source:

- ✓ Hand Manual
- ✓ Electric
- ✓ Liquid Fuel
- ✓ Hydraulic
- ✓ Powder-Actuated

I. Hand Manual Tools

Hand manual tools need no external power source. Hand manual tools include a broad range of tools from extremely simple to more complex, such as:

- ✓ Hammer
- ✓ Saws
- ✓ Screwdrivers
- ✓ Shovels and Spades
- ✓ Bull-floats
- ✓ Levels
- ✓ Pry Bars

- ✓ Scissors/Sheers/Knives

II. Electric;-

A. electric jig saw.

B .Electric sander

C. Electric sander

III. Liquid fuel;-

A. machine oil

B. machine grass

C. coolants

IV. Hydraulic;-

A. electric presser machine

B. CNC. Machine

Self-Check -1	Written Test

Write short answer the following question?(10%)

1. write Five basic safety rules can help prevent hazards associated with the use of hand and power tools?(2points)
2. list must be provided to protect the operator and others from the following?(2points)
3. Explain Types of Power Tools?(2points)
4. write Hand manual tools include a broad range of tools from extremely simple to more complex?(2points)
5. write types of power tools are determined by their power **source?(2points)**

Score=----------
Rating=----------

Name---------- date----------

***Note:*Satisfactoryrating above–5points** **Unsatisfactory–below-5points**

Answer sheet

1. ---------- **4. ----------**

2. ---------- **5. ----------**

3. ----------

Information Sheet-3	*Collecting and storing off-cuts and unused materials*

3.1 Collecting and storing off-cuts and unused materials

To reduce waste we must use standard sizes and plan ahead to reduce off-cuts any time. use off site prefabrication if possible as this is likely to reduce waste on site try to only order the amount you need for the job make arrangements to sell back or return unused materials to your supplier get deliveries to match work stages to avoid storage on site longer than needed make sure materials are delivered, handled and stored properly to avoid damage buy materials with less packaging talk to suppliers about reducing packaging waste, and ask if they can take back packaging.

To reuse materials

arrange storage space on or off site where you can store unused materials for reuse collect offcuts of timber and plasterboard and half bricks and blocks for reuse – let all staff know that these are available use bulk bags to segregate waste and leftover materials for reuse coordinate trades so that leftover materials from one job can be used on the next don’t throw away materials like fi trues and fi things.

To recycle more waste

segregate wastes – and keep hazardous wastes out of mixed waste skips – reduce waste gate fees and increase the value of materials send your mixed waste skip to a Materials Recovery Facility (MRF) instead of a landfill site – the gate fees are often the same use waste contactors who will recycle your waste keep a check on waste markets, like wood, metals,& aggregates try to use suppliers who use recyclable packaging– many will also take your packaging waste away and recycle it for you.

Self-Check -1	Written Test

write short answer for the following question?(5%)

1. How to reduce waste?(2.5point)
2. What is segregate wastes means?(2.5pts)

Score=----------
Rating=----------

Name---------- date----------

*Note:*Satisfactoryrating above–2.5points Unsatisfactory–below-2.5points

Answer sheet

1. ----------

2. ----------

Information Sheet-4	**Dealing with waste and scrap materials following workplace procedures.**

4.1Dealing with waste and scrap materials following workplace procedures

The following are steeps of waste and scrap materials .

A. Purpose

Generates solid and liquid waste as part of normal daily facility operations and academic operations. A determination is conducted on all waste to identify the proper **disposal routes for the protection of the environment and compliance to Federal, State, and local regulation.**

B. **Scope**

This Waste Disposal Management Plan (WDMP) addresses the disposal of regulated and non-regulated waste generated and disposed by Within this plan is guidance on the process to determine the storage and disposal requirements of all waste generated on campus.

C. Limitations

This plan is not intended to address the safe handling of chemicals in laboratories as required under this plan intended to define the requirements for employees expose Plan and Asbestos Management Plan under a separate cover which addresses the safe handling of laboratory chemical and building asbestos material, respectively.

D. Locations

Copies of the Waste Disposal Management Plan are located in the Office of Facilities Services.

E. Responsibilities

- It is the responsibility of all employees, students, and contractors working on handle, store, and dispose of hazard waste, universal waste, bio-hazardous waste, and regulated non-hazardous waste in a manner that

is in compliance with all applicable sta and federal regulations.

the department should provide the following minimum information on the work order request: type of hazardous material, quantity, source of generation, and the building and room that the waste is stored.

.Facilities Services shall create a work order and enter it into the system for

Processing by appropriate division Housekeeping. Housekeeping will process work order and schedule pickup up waste materials from department.

F. Hazardous Waste Generator Status

- ✓ Perform and maintain waste determinations.
- ✓ Comply with Department of Transportation (DOT) regulations.
- ✓ Comply with Universal Waste rules or manage the waste as hazardous.
- ✓ Comply with Used Oil requirements.

By utilizing several of the practices required by a Small Quantity Generator of hazardous waste,

- ✓ Place the waste in appropriate containers. Establish and document emergency preparedness procedures and contingency plans Conduct annual training Perform inspections.

G. Waste Minimization Program

Top management support Characterization of waste generation and waste management costs Periodic waste minimization assessments Cost allocation system Encourage Technology transfer Program implementation and evaluation.

Self-Check -1	Written Test

Write for the following questions on the space provided.(5%)

1. What is purpose?(2.5pts)

2. What is location?(2.5pts)

Score=----------
Rating=----------

Name---------- date----------

Note: Satisfactory rating above–2.5points Unsatisfactory–below-2.5points

Answer sheet

1. ----------

2. ----------

Participant Name

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