



Ethiopian TVET-System



Furniture Making L-II

Based on Sept. 2012G.C. Occupational standard

Module Title: Performing Equipment Maintenance

TTLM Code: IND FMK2 TTLM 0919V1

This module includes the following Learning Guides

LG01: Prepare for work

LG Code: IND FMK2 M01 LO1-LG-01

LG02: Carry out basic routine maintenance

LG Code: IND FMK2 M01 LO2-LG-02

LG03: Complete work

LG Code: IND FMK2 M01 LO3-LG-03



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

- 1.1. Tools and Equipment
- 1.2. Maintenance supplies
- 1.3. Basic routine maintenance
 - 1.3.1. Dismantling and assembling
 - 1.3.2. Testing and tightening
 - 1.3.3. Minor adjustments and repairs
 - 1.3.4. Routine servicing procedures
- 1.4. Identifying fault/unsafe machineries according to enterprise requirements
 - 1.4.1. Standard Operating Procedures (SOPs),
 - 1.4.2. Industry standards
 - 1.4.3. Production schedules
 - 1.4.4. Material Safety Data Sheets (MSDSs),
 - 1.4.5. Work notes and plans
 - 1.4.6. Product labels, manufacturers specifications,
 - 1.4.7. Operators' manuals, enterprise policies and procedures
- 1.5. OHS requirements
 - 1.5.1. Protective clothing and equipment
 - 1.5.2. Use of tools and equipment
 - 1.5.3. Workplace environment and safety
 - 1.5.4. Handling of materials
 - 1.5.5. Use of firefighting equipment
 - 1.5.6. Organizational first aid
 - 1.5.7. Hazard control and hazardous materials and substances
 - 1.5.8. Safe operating procedures



This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, **upon completion of this Learning Guide, you will be able to:**

- Identify Tools and supplies required to carry out basic routine maintenance tasks
- Identify Faulty or unsafe machinery and equipment for repair or replacement
- Identify OHS hazards in the workplace

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4, and Sheet 5”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3, Self-check 4 and Self-check 5” in page -7, 8, 12, 17, and 25 respectively.

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Information Sheet-1	Tools and Equipment
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Tools

- Tools can be divided into two main groups: hand tools and power tools.
- Hand tools are operated by the physical strength of the user.
- Power tools require an external source of power such as electricity or compressed air to operate.
- Each of these groups can also be divided into sub groups.

Tool and Equipment Safety Rules

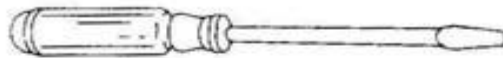
- Observe and follow Student Shop Rules as posted.
- Understand and follow manufacturer operating procedures.
- Inspect the tool for damage prior to use.
- Verify all guards are in place and adjusted properly.
- Do not bypass any safety devices.
- Only use the tool when it is secured to the floor via a pedestal or work bench.
- Always stay at the machine while it is running.
- Clean the tool after use.
- Report any malfunction or damage to the Shop Supervisor after tagging the tool “Out of Service, do not use”.
- Always disconnect the plug from the power source before making any adjustments, changing, or physically inspecting the blade.
- Never use another person as a substitute for a table extension or as additional support.
- Do not attempt to cut pieces of stock that are too small to easily hold with your hands. Use clamping devices and/or jig fixtures instead.
- Always stand with your face and body to one side of the saw blade when making cuts.
- Never make free-hand cuts by raising the work piece into the blade.
- Never feed the saw into the work piece at a rate faster than it can accept.
- Never pull the blade beyond the point necessary to make the cut as the back of the blade could lift the work piece and throw it over the fence.
- The saw must have a device installed which will automatically return the cutting head to the back of the track when released from any point of its travel.
- The saw must have a mechanical limit to prevent the cutting head from traveling beyond the front edge of the table.

Steps 1- select the right tool for the job

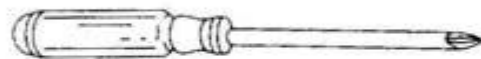
Steps 2- keep tools in good condition

Steps 3- use tools the correct way

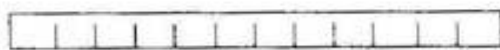
Steps 4- keep tools in a safe place



Medium screwdriver



#2 Phillips screwdriver



Straight edge



Adjustable wrench



Combination square



13mm Wrench

- Combination wrench
- Hex key
- Framing square
- Medium size flat blade screw driver

Drilling tools

- ⇒ Drilling tools are used in conjunction with drill bits to drill holes in material such as wood, steel and plastics.
- ⇒ There are other added features of pistol grip drills which make them more versatile, such as reverse rotation, torque settings making them useful as an electric screw driver and a hammer action setting.
- ⇒ All these features are available in a cordless drill.



Dial-gauge micrometer for knife alignment - # 30-050
Precision built, easy to adjust, mounted on enamel finished alloy steel. Designed to rest squarely on the cutter head for fast accurate knife alignment. Dial is easy to read and adjust.

Dust Collectors

- Dust collectors contribute to a cleaner more healthful workshop environment.
- We offer a wide selection of top quality dust collectors to suit all your shop needs

Grease Gun

A grease gun is used to apply grease or oil to car parts, machinery, tools, etc. through the grease nipple. A grease gun can inject grease into areas that are difficult to reach. Using a grease gun can be easy once you have taken it apart and loaded it. By doing this, you immediately see how the gun works and you are ready to use it with no further directions



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List hand and power tool safety? **(4points)**
2. What is the function of grease gun? **(2points)**

Note: Satisfactory rating – 6 points

Unsatisfactory - below 6 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



Information Sheet-2	Maintenance supplies
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Maintenance, Repair, and Operating supply items are supplies utilized in the production process that is not ultimately seen in the end products themselves. Maintenance, Repair, and Operating items may include:

- Gloves
- Safety equipment
- Industrial Equipment (valves, compressors, pumps)
- Consumables (cleaning, laboratory and office supplies)
- Plant upkeep supplies (lubrications, Gaskets, repair tools)

Lubrication is the process or technique of using a lubricant to reduce friction and wear in a contact between two surfaces.

Lubricants can be solids (such as Molybdenum disulfide MoS₂),^[1] solid/liquid dispersions (such as grease), liquids (such as oil or water), liquid-liquid dispersions or gases

Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List Maintenance supplies? (3 points)

Note: Satisfactory rating – 3 points

Unsatisfactory - below 3 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



Information Sheet-3

Basic routine maintenance

Performs routine maintenance on machine/ equipment such as lubricating, cleaning, oil, and checking parts etc...

Basic routine maintenance

- Checking/ cleaning machine parts
- Keep the saw clean
- Keep the blades sharp
- Clean and lubricate parts
- Adjust and inspect the parts
- Changing the motor brushes
- replacing the drive belt
- checking/ changing the friction wheel

General requirements for equipment maintenance include:

- Obtaining a copy of the maintenance schedule recommended by the manufacturer.
- Ensuring that maintenance is performed as required.
- Ensuring that the person(s) performing the maintenance are competent (e.g. licensed mechanic).
- Retaining records of maintenance/service conducted.
- Specifying who is responsible for overseeing equipment maintenance and where the records are kept.
- Set up a system for removal and tagging of damaged or defective tools and equipment.

1.3.1. Dismantling and assembling

Dismantling equipment

The main stages of dismantling are;

- Dismantling proper, taking the machine parts and in a strict sequence.
- Dismantling should commence with the removal of guards, protective devices, followed by disconnection of transmissions and withdrawal of belts, after which the machine is broken-down into its units in a definite order.
- Cleaning can be done by kerosene and petrol
- Cleaning, washing and wiping, drying the dismantled parts.

1.3.2. Testing and tightening

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All preparatory measures are carried out during the first stage;

- They include check of the quality of work performed on machine and its output, all inconveniences; weak spots in the machine during its operation and servicing are found out.
- Second stage of the preliminary operations, consists of the following measures;
 - 1) Removing all guards and protective arrangements of machine to facilitate access and inspection of moving and guiding parts of the machine. Removing or loosening flexible transmissions (belt, rope and chain drives etc.
 - 2) Inspecting and checking the condition and position of external rubbing parts subjected to impact loads and high stresses (tables, slides ,carriages, screws etc,)
 - 3) Inspecting and checking the tightness and rigidity of the fixed joints on the machine.
 - 4) Checking the radial and axial play of the movable joints.
 - 5) Checking the smoothness of travel and positions of all moving parts directly by hand or with levers.
 - 6) Checking the condition and action of locking and all fastening arrangements and also the starting, control and braking devices.
 - 7) Checking the foundation bolts.

1.3.3. Minor adjustments and repairs

- Repair means responding to the breakdown of equipment and undertaking work to correct the problem in order to return the equipment to a working condition.
- Before equipment can be repaired, you need to be aware that there is a problem! Therefore, there should be a clearly understood **system for reporting faults and breakdowns** and equipment users should be encouraged to report faults and breakdowns as soon as possible.
- **Simple repairs** can be done by the in-house or external **maintenance and repair team**.
- **More complex repairs** will be carried out by **specialized maintenance personnel**

Basic repair operations

The operations involved in woodworking machinery can be classified into 5 basic types;

- 1) Local tightening up of loosened worn parts.
- 2) Local fastening of worn, broken parts.
- 3) Partial adjustment of position, interconnection and interaction between individual parts of machine.
- 4) Partial restoration of broken parts.
- 5) Partial replacement of worn, broken or missing parts.

1.3.4. Routine servicing procedures

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- Different maintenances strategy is going to be formulated; there are many maintenance procedures that could be chosen, from sophisticated procedures to low level procedures.
- In reality there is a mix between different procedures due to the variety equipment in the plant and because of economic consequences the equipment causes if a scheduled stop occur.

A) **Operate to break down (unplanned corrective maintenance) (O.T.B.D)**

- ✓ If all maintenance jobs carried out in the plant are O.T.B.D, maintenance will result in low availability performance and high maintenance coast.
- ✓ Coast for down time will be extremely high.
- ✓ Maintenance is controlled by the unplanned demand for maintenance.
- ✓ Maintenance effectiveness is low; maintenance work is pressing and some- times dangerous due to the fact that safety procedures are often neglected.
- ✓ Sometime this maintenance procedure has to be practiced purposely because of economic or technical reasons.
- ✓ But only for equipment which this procedure has been decided for. If all maintenance are carried out are break down jobs, the maintenance strategy is completely wrong.

B) **Fixed time maintenance (F.T.M)**

- ✓ Fixed-time maintenance will result in less expensive maintenance and less down-time compared to operate to breakdown procedure.
- ✓ Fixed-time maintenance work is established for important machinery. Components whose life-time can be estimated are replaced or reconditioned.
- ✓ Preventive maintenance base only on the fixed-time maintenance procedure will not give the expected results since parts are having individual life time.
- ✓ Some parts will be replaced too often, and results in unnecessarily coast. Some parts will go breakdown and creates high down time costs.

C) **Condition-based maintenance, (C.B.M)**

- ✓ Condition-based maintenance will result in optimized availability and maintenance cost and is giving the best profitability.
- ✓ This maintenance procedure can be considered as just in time maintenance.
- ✓ Condition-monitoring of equipment while in operation will make possible planning corrective maintenance and a flexible maintenance planning coordinated with production planning production down-time due to e.g. changes of tools, changes of product etc., will be utilized for maintenance work.
- ✓ This maintenance procedure has resulted in extremely low down-time and high availability.

D) **Design out maintenance, (D.O.M.)**

- ✓ This maintenance procedure means that actions are taken to design out failures completely. The failure newer occurs again after the design out action has been taken.
- ✓ Follow up of carried out maintenance is crucial to be able to practice this procedure.
- ✓ It must be known what is going on with the equipment in the plant, if there are any repetitive failures and the reason there of.
- ✓ When a failure is designed out the need of maintenance will decrease and the availability performance arise?

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- ✓ When designing /procuring machinery, maintenance demands should be far more emphasized.
- ✓ To buy the cheapest equipment will very often result in high costs for maintenance, low availability and short technical life-time.
- ✓ High quality equipment is normally more expensive but will result in lower costs for maintenance, better availability performance and longer technical life-time.

E). Life-time extension, (L .T .E.):-

- ✓ Life-time extension shall always be in mind of maintenance people. If the life-time of parts can be extended by making some modification, renewal of material etc.,
- ✓ The demand for both preventive and corrective maintenance will decline. Follow up of maintenance carried out is essential to practice the L.T E. procedure.

F). Redundancy, (R.E. D.):

- ✓ Redundancy means that a spare machine or part is installed in parallel with the original.
- ✓ This means that the spare machine or part can be stated and connected to the production line, if the original one stops unforeseen.
- ✓ This procedure is very expensive to as it requires double function of equipment.
- ✓ If an unplanned stop create big losses or other consequences and is inevitable, the procedure must be practiced if it is economically.

Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are general requirements for equipment maintenance? **(2 points)**
2. List Routine servicing procedures? (3 points)
3. List Basic routine maintenance? (2 points)

Note: Satisfactory rating – 7 points Unsatisfactory - below 7 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



1.4.1. Standard Operating Procedures (SOPs),

- ❖ A **standard operating procedure**, or **SOP**, is a set of step-by-step instructions created by a business to help workers carry out routine operations.
- ❖ Their purpose is to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations.

Health and safety

- ❖ Procedures are extensively employed to assist with working safely.
- ❖ They are sometimes called safe work methods statements (SWMS).
- ❖ They are usually preceded by various methods of analyzing tasks or jobs to be performed in a workplace, including an approach called job safety analysis, in which hazards are identified and their control methods described.
- ❖ Procedures must be suited to the literacy levels of the user, and as part of this, the readability of procedures is important

1.4.2. Industry standards

- ❖ In manufacturing, a measure of excellence or a state of being free from defects, deficiencies and significant variations.
- ❖ It is brought about by strict and consistent commitment to certain standards that achieve uniformity of a product in order to satisfy specific customer or user requirements.

A **technical standard** is an established norm or requirement for a repeatable technical task. It is usually a formal document that establishes uniform engineering or technical criteria, methods, processes, and practices. In contrast, a custom, convention, company product, corporate standard, and so forth that becomes generally accepted and dominant is often called a de facto standard.

A technical standard may be developed privately or unilaterally, for example by a corporation, regulatory body, military, etc. Standards can also be developed by groups such as trade unions and trade associations. Standards organizations often have more diverse input and usually develop voluntary standards: these might become mandatory if adopted by a government (i.e., through legislation), business contract, etc.

The standardization process may be by edict or may involve the formal consensus^[1] of technical experts.



1.4.3. production schedules

Complete, thorough, and current documentation is essential to an effective maintenance program.

Whether you are performing preventive, predictive, or reliability-centered maintenance, keeping track of equipment condition and maintenance performed or planned is critical.

- Maintenance recommendations contained in this report should be used as the basis for establishing or refining a maintenance schedule.
- The maintenance recordkeeping system must be kept current so that a complete maintenance history of each piece of equipment is available at all times.
- This is important for planning and conducting an ongoing maintenance program and provides documentation needed for the Power.
- Regular maintenance and emergency maintenance must be well documented, as should special work done during overhauls and replacement.

1.4.4. Work notes and plans

Importance of taking notes

- **Taking notes helps you remember**
 - Unless you have the memory bank of a super computer, you need to take down notes to remember things.
 - Even if you're good at memorizing stuff, taking notes will relieve the mind of that extra task of recalling things at the office.
- Taking notes sharpens your focus
- Taking notes is your document of proof
- **Four Tips to Take Notes Effectively**
 - Use pen and paper
 - Learn shorthand
 - Just highlight the key points
 - Prepare a written report immediately after the work

Work notes and plans

Circular saw		
Maintenance	Time-frequents	Remark
General cleaning of the machine and around the machine	Daily	With compressed air and broom
Cleaning of the saw table	Daily	With compressed air
Cleaning of the motor area	Daily	With compressed air, broom or clothe
Observing the saw blade	Daily	Dull and damaged saw blade leads to unsafe operation of the circular saw and unclear saw cut
Changing of the saw blade	If dull or necessary	Dull and damaged saw blade leads to unsafe operation of the circular saw and unclear saw cut
Control of the adjustment of the riving knife	Daily	Incorrect adjustment of the riving knife leads to an unsafe operation of the circular saw
Control of v-belt tension	Weekly	If one belt is worn both belts have to be replaced
Creasing / oiling of the saw table	Four month	Thin film of oil or grease have to be applied to prevent rust
Greasing of the slide of sliding table	Two month	Saw dust will stick on the slide if too much greased



Thickness planner		
Maintenance	Time-frequents	Remark
General cleaning of the machine and around the machine	Daily	With compressed air and broom
Cleaning of the table	Daily	With compressed air
Cleaning of the cutter-block	Daily	With compressed air
Cleaning of the rubber rollers	Daily	With oil products, not acid products
Cleaning of the motor area	Daily	With compressed air, broom or clothe
Oiling of the feed chain of the feed rollers	Weekly	
Control of v-belt tension	Weekly	If one belt is worn both belts have to be replaced
Observing the cutting knives	Daily	If one cutting knife is dull all cutting knives have to be changed
Creasing / oiling of the work table	Four month	Thin film of oil or grease have to be applied to prevent rust

Surface planner		
Maintenance	Time-frequents	Remark
General cleaning of the machine and around the machine	Daily	With compressed air and broom
Cleaning of the in-feed and out-feed table	Daily	With compressed air
Cleaning of the cutter-block	Daily	With compressed air
Cleaning of the motor area	Daily	With compressed air, broom or clothe



Control of v-belt tension	Weekly	If one belt is worn both belts have to be replaced
Observing the cutting knives	Daily	If one cutting knife is dull all cutting knives have to be changed
Creasing / oiling of the work table	Four month	Thin film of oil or grease have to be applied to prevent rust

1.4.5. Product labels, manufacturers specifications,

- This information should form the basis of any inspection schedule. If this documentation isn't available it may be possible to get copies from the manufacturer or supplier or download information from the internet.
- Labels allow items to be identified and are often the first point of contact between the customer and the product.
- This is the primary function of labels, allowing for items to be differentiated even if they belong to the same brand.

1.4.6. Operators' manuals, enterprise policies and procedures

- **Manual** describes how to operate the machine properly and safely.
- Be sure to follow the safety tips and instructions stated in the manual
- Before beginning any work on the machine read and understand safety and the respective safety guidelines.
- The **operations manual** is the documentation by which an organization provides guidance for members and employees to perform their functions correctly and reasonably efficiently.
- It documents the approved standard procedures for performing operations safely to produce goods and provide services.
- ✓ The **policies and procedures** were explained in detail to each employee during their first week of employment with the company.
- ✓ Every company has different **policies and procedures**. Your first day you will be given a packet that outlines what the company expects as far as dress code, behaviors, time off and holidays.
- ✓ It is good to keep it on hand to reference when questions arise about what the company allows and doesn't allow.



Self-Check -4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is an operation manual? (2 points)

Note: Satisfactory rating – 2 points

Unsatisfactory - below 2 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



Information Sheet-4	OHS requirements
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1.5.1. Protective clothing and equipment

Woodworking workers exposes to a variety of hazards, including kickbacks, flying wood chips, noise, wood dust, and chemical hazards. Personal protective equipment (PPE) can help protect against these hazards

Personal Safety

- ⇒ **Stay alert.** Watch what you are doing, and use common sense when operating a power tool. Do not use a power tool while tired or under the influence of drugs, alcohol, or medication. A moment of inattention while operating power tools may result in serious personal injury.
- ⇒ **Dress properly.** Do not wear loose clothing or jewelry. Contain long hair. Keep your hair, clothing, and gloves away from moving parts. Loose clothes, jewelry, or long hair can be caught in moving parts.
- ⇒ **Avoid accidental starting.** Be sure the Power Switch is off before plugging in. Carrying power tools with your finger on the Power Switch, or plugging in power tools with the Power Switch on, invites accidents.
- ⇒ **Remove adjusting keys or wrenches before turning the power tool on.** A wrench or a key that is left attached to a rotating part of the power tool may result in personal injury.
- ⇒ **Do not overreach.** Keep proper footing and balance at all times. Proper footing and balance enables better control of the power tool in unexpected situations.
- ⇒ **Use safety equipment.** Always wear eye protection. Dust mask, non-skid safety shoes, hard hat, or hearing protection must be used for appropriate conditions.

1.5.2. Use of tools and equipment safety

Tool safety

- **Do not force the tool.** Use the correct tool for your application. The correct tool will do the job better and safer at the rate for which it is designed.
- **Do not use the power tool if the Power Switch does not turn it on or off.** Any tool that cannot be controlled with the Power Switch is dangerous and must be replaced.
- **Disconnect the Power Cord Plug from the power source before making any adjustments, changing accessories, or storing the tool.** Such preventive safety measures reduce the risk of starting the tool accidentally.
- **Store idle tools out of reach of children and other untrained persons.** Tools are dangerous in the hands of untrained users.
- **Maintain tools with care.** Keep cutting tools sharp and clean. Properly maintained tools with a sharp cutting edge are less likely to bind and are easier to control. Do not use a damaged tool. Tag damaged tools “Do not use” until repaired.

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- **Check for misalignment or binding of moving parts, breakage of parts, and any other condition that may affect the tool's operation.** If damaged, have the tool serviced before using. Many accidents are caused by poorly maintained tools.
- **Use only accessories that are recommended by the manufacturer for your model.** Accessories that may be suitable for one tool may become hazardous when used on another tool.

Woodworking tools can be dangerous if not used properly.

- Only use woodworking machines that you have been trained to use properly and safely.
- Read the owner's manual carefully.
- Make sure you understand instructions before attempting to use any tool or machine. Ask questions if you have any doubts about doing the work safely.

What safety procedures should you follow when using woodworking machines?

- Always wear safety glasses or goggles, or a face shield (with safety glasses or goggles).
- Wear dust masks when required.
- Wear hearing protection that is suitable for the level and frequency of the noise you are exposed to in the woodworking area. If you have trouble hearing someone speak from three feet away, the noise level from the machine is too high. Damage to hearing may occur.
- Use gloves to protect hands from splinters when handling wood but do not wear them near rotating blades and other machinery parts where the gloves can catch.
- Wear protective footwear when required.
- Make sure the guard is in position, is in good working condition, and guards the machine adequately before operating any equipment or machine. Check and adjust all other safety devices.
- Make sure the equipment is properly grounded before use.
- Check that keys and adjusting wrenches are removed from the machine before turning on the power.
- Inspect stock for nails, staples, loose knots or other defects before cutting, planing, routing or carrying out similar activities.
- Make sure that all machines have start and stop buttons within easy and convenient reach of an operator. Start buttons should be protected so that accidental contact will not start the machine. A collar around the button 3 to 6 mm (1/8 to 1/4 inch) above the button is recommended.
- Ensure that all cutting tools and blades are clean, sharp, and in good working order so that they will cut freely, not forced.
- Turn the power off and unplug the power cord (or lock out the power source) before inspecting, changing, cleaning, adjusting or repairing a blade or a machine. Also turn the power off when discussing the work.
- Use a "push stick" to push material into the cutting area. Jigs are also useful in keeping hands safe during cutting procedures. Keep hands out of the line of the cutting blade.
- Clamp down and secure all work pieces when drilling, sanding, cutting or milling.
- Use good lighting so that the work piece, cutting blades, and machine controls can be seen clearly. Position or shade lighting sources so they do not shine in the operator's eyes or cause any glare and reflections.

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- Ensure that the floor space around the equipment is sufficient to enable you to machine the size of work piece being processed safely without bumping into other workers or equipment.
- Use extension tables or roller supports for large work-pieces. Supports should be placed on both sides (infeed and outfeed).
- Woodworking machines should be fitted with efficient and well-maintained local exhaust ventilation systems to remove sawdust or chips that are produced.
- Electric power cords should be above head level or in the floor in such a way that they are not tripping hazards.
- Keep work area free of clutter, clean, well swept, and well lit. Spills should be cleaned up immediately. Floor areas should be level and non-slip. Good housekeeping practices and workplace design will reduce the number of injuries and accidents from slips, trips, and falls.
- Keep the area free from water and moisture. Do not use electrical equipment outdoors in the rain.
- Always keep your attention on the work. For example, if you must talk to another person, turn off the equipment first.

1.5.3. Workplace environment and safety

What should you avoid when working with woodworking machines?

- Do not wear loose clothing, work gloves, neckties, rings, bracelets or other jewellery that can become entangled with moving parts.
- Avoid awkward operations and hand positions where a sudden slip could cause your hand to move into the cutting tool or blade.
- Do not stand directly behind stock that is being cut, planed, or jointed to avoid injury from kick-back.
- Do not remove sawdust or cuttings from the cutting head by hand while a machine is running. Use a stick or brush when the machine has stopped moving.
- Do not use [compressed air](#) to remove sawdust, turnings, etc. from machines or clothing.
- Do not leave machines running unattended (unless they are designed and intended to be operated while unattended). Do not leave a machine until the power off is turned off and the machine comes to a complete stop.
- Do not try to free a stalled blade before turning the power off.
- Do not distract or startle an operator while he or she is using woodworking equipment.
- Horse play should be prohibited. It can lead to injuries.

1.5.4. Materials handling

- Facility layout should encourage an even flow of materials and keep backtracking and crisscrossing to a minimum.
- Operators shouldn't have to stand in or near aisles.
- Arrange the machines so that the materials handled by the operator require minimum movement and changes of heights.
- This applies to both incoming supply and outgoing stock.

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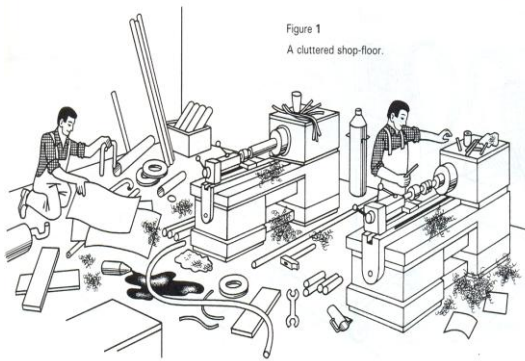


Figure 1
A cluttered shop-floor.

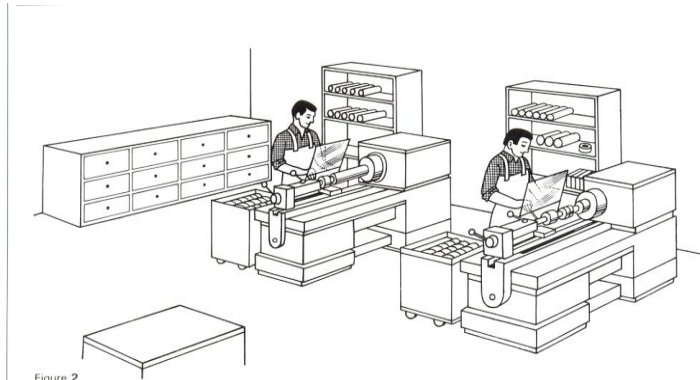


Figure 2
The same shop-floor after removal of all unnecessary items

1.5.5. Use of firefighting equipment

Classes of fires

- Class A Fires that occur in ordinary combustibles such as wood, rags, and rubbish
- Class B Fires that occur with flammable liquids such as gasoline, oil, grease, paints, and thinners
- Class C Fires that occur in or near electrical equipment such as motors, switchboards, and electrical wiring
- Class D Fires that occur with combustible metals such as magnesium

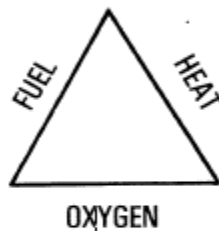
Components of the fire triangle

- Fuel any combustible material
- Heat enough to raise the fuel to its ignition temperature
- Oxygen--Necessary to sustain combustion

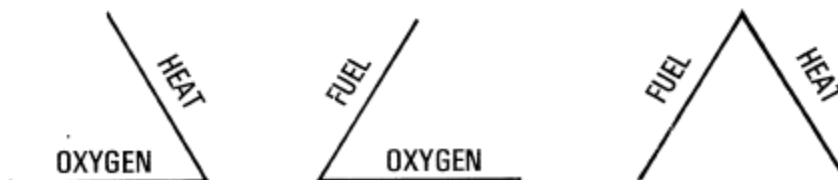
(NOTE: To produce fire these three elements are necessary and must be present at the same time. If any one of the three is missing, a fire cannot be started or, with the removal of any of them, the fire will be extinguished.)

The Fire Triangle

To produce fire, three things must be present at the same time.



If any one of the three is missing, a fire cannot be started or, with the removal of any one, the fire will be extinguished.



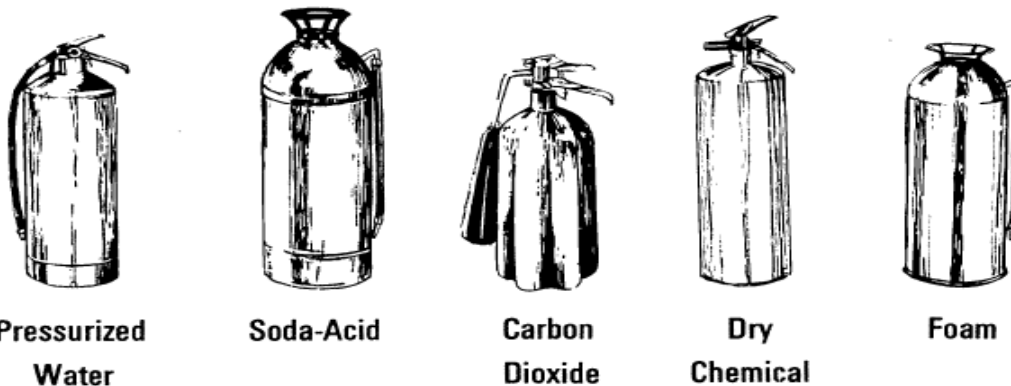
Types of fire extinguishers

- A. Pressurized water Operates usually by squeezing a handle or trigger; used on Class A fires

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- B. Soda acid Operates by turning extinguisher upside down; used on Class A fires
- C. Carbon dioxide (CO) Operates usually by squeezing handle or trigger; used on Class B and C fires
- D. Dry chemical--Operates usually by squeezing a handle, trigger, or lever; used on Class B, C, and D fires
(NOTE: On Class D fires, dry sand is as effective as any dry chemical other than Purple X. The cost of the Purple X chemical places it out of reach of most shops.)
- E. Foam Operates by turning extinguisher upside down; used on Class A and B fires

Types of Fire Extinguishers



1.5.6. Organizational first aid

- ⇒ Make sure that you know where the first aid box is so that you can use it at once in an emergency.
- ⇒ When an accident occurs, inform the person responsible for first aid immediately.
- ⇒ If someone receives an electric shock, switch off the power immediately and call for medical help.
- ⇒ If someone has severe bleeding from a cut, take a clean piece of cloth and press it on the cut. When the bleeding stops, take the pat away. Gently clean the wound outwards with cotton wool or a swap soaked in clean water. Gently dry around the wound with clean cotton wool and apply a plaster or bandage.

1.5.7. Hazard control and hazardous materials and substances

Types of Hazardous Wastes

1. Wastes that have common hazardous properties such as ignitability and reactivity.
2. Wastes that contain leachable toxic components

Risk control of general hazards

Effective machinery and equipment risk controls reflect some or all of the following characteristics:

- The hazard is controlled at its source



- Contact or access to the hazard is prevented
- Sturdy construction (correct materials with few points of potential failure)
- Fail-safe (failure of the control system to be effective will result in machinery shut-down)
- Tamper-proof design (as difficult as possible to bypass)
- Presents minimum impediment to machinery and equipment operator
- Easy to inspect and maintain
- Does not introduce further hazards through the risk control action.

Risk control of mechanical hazards

- Separation is a simple and effective machinery and equipment risk control and may be achieved by distance, barrier or time.
- Distance separation means a person cannot reach the hazard due to distance.
- Barrier separation means an effective barrier or guard denies access and controls ejection of parts, products or waste.
- Time separation means at the time of access, the machinery and/or equipment is disabled.

Risk control of non-mechanical hazards

The first step in selecting suitable and effective controls for non-mechanical hazards is to understand the nature of emissions that can be released by machinery and equipment in the workplace, where those emissions collect and the way they may cause harm

- Separating people from non-mechanical hazards is necessary where the emission cannot be controlled at the source through elimination or substitution.
- Guarding may also serve to mute noise emissions through application of sound absorbing materials.
- Oil leaks from machinery and/or equipment may present a serious slip hazard. By preventing oil leaks through routine maintenance, or containing leaking oil with a drip tray or through spill containment strategies, the risk the hazard presents is controlled.

1.5.8. Safe operating procedures

Pre-Operational Safety Checks

- ✓ Locate and ensure you are familiar with all machine operations and controls.
- ✓ Check workspaces and walkways to ensure no slip/trip hazards are present.
- ✓ Ensure all guards are fitted, secure and functional. Do not operate if guards are missing or faulty.
- ✓ Ensure all locks are securely tightened.
- ✓ Ensure table and work area is clear of all tools, off-cut timber and sawdust.
- ✓ Start the dust extraction unit before using the machine.

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**Self-Check -5****Written Test**

Name: _____

Date: _____

*Directions:* Answer all the questions listed below.

1. PPE
 2. Before Starting work
 3. During Work
 4. At Finish the Job
 5. machine safety
 6. workplace safety
 7. Maintain the equipment
 8. Post Warning
 9. Furnishings
 - 10, Protect Floor
- A, safe and healthy equipment
 - B, Remove rugs within one meter of work area.
 - C, Set up work area
 - D, sign and avoid warning
 - E, goggle
 - F, Clean up thoroughly
 - G, keep all tools clear of a work table
 - H, Find the causes of damage
 - I, free from dust and scratch
 - J, use proper hand tools to dismantle the machine



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

2.1. *Personal protective equipment*

2.1.1. Overalls

2.1.2. Gloves

2.1.3. Protective eyewear

2.1.4. Hearing protection

2.1.5. Safety **harness**

2.2. Basic servicing of machinery and equipment

2.2.1. Importance of manufacturer's specifications and manuals

2.2.2. Greasing and Lubricating

2.2.3 Saw tooth Setting

2.3. Sharpening of machine blades

2.4. Routine adjustments and repairs

2.4.1. Tightening of bolts and screws of the machines

2.4.2. Replacement of blades and bits

2.4.3. Cleaning, lubricating, basic repairs and adjustments.

2.5. Work according to OHS requirements.



This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, **upon completion of this Learning Guide, you will be able to:**

- Select, use and maintain Suitable personal protective equipment according to OHS requirements
- Perform Greasing, lubrication and other basic service
- Perform routine adjustments and repairs machinery

Learning Instructions:

5. Read the specific objectives of this Learning Guide.
6. Follow the instructions described below.
7. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
8. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in **page -5, 14, 22 and 34** respectively.
9. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, -- Operation Sheet 14
10. Do the “LAP test” in **page – 23 and 35** (if you are ready).

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Information Sheet-1	Personal protective equipment
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Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Hearing protection may be required.



Sturdy footwear must be worn at all times in work areas.



Close fitting/protective clothing must be worn.



Rings and jewelry must not be worn.

Safety instructions



Warning! Risk of injury! Improper maintenance can cause serious injury or damage. For this reason, this work may only be carried out by authorized, trained personnel who are familiar with how to operate the Machine and in strict observance of all safety instructions.

- Before beginning any maintenance work on the machine, switch it off and secure it against accidentally being switched on again.
- Keep the work area orderly and clean Components and tools that are not put in their correct place or put away may be the cause of accidents!
- Ensure that there is sufficient space to work around the machine
- Following the maintenance work, reinstall the guards and check that they are functioning properly.



Self-Check -1	Written Test
----------------------	---------------------

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

1. List Personal protective equipment? (2 points)
2. What are safety instructions in maintenance work? (2 points)

Note: Satisfactory rating – 4 points

Unsatisfactory - below 4 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



Information Sheet-2	Basic servicing of machinery and equipment
----------------------------	---

2.2.1. Importance of manufacturer’s specifications and manuals

- This information should form the basis of any maintenance schedule.
- The maintenance activities and frequencies advised in manufacturers/suppliers manuals should always be followed unless risk assessment of the particular circumstances of use indicates a different approach would be more appropriate.
- For example maintenance activities are usually based on the amount of use a piece of equipment is used. If equipment in a workshop is used a lot less frequently than indicated in the user manual some maintenance activities could be less frequent.
- If this documentation isn’t available it may be possible to get copies from the manufacturer or supplier or download information from the internet. If doing the latter it is important to use a reliable source.

2.2.2. Lubrication of Machines

- The purpose of lubrication of machine parts is to reduce friction heating and loss of power.
- Lubrication also provides the most efficient utilization of a machine but also extends service life.
- Efficient operation of machinery largely depends not the lubricant, Selected but also on its method of application.
- Lubricants formerly were applied by hand, but modern Machinery requires exact method that can be precisely controlled.
- For most machinery, different methods of lubrication and types of lubricant must be employed for different parts.
- Lubrication should ensure perfect lubrication in the range of speeds, loads and temperatures specified for a given mechanism.

The selection of lubrication by

- I. Geometry of contacting bodies
- II. Material and finish of mating surfaces
- III. Lubricate change and refreshment periods
- IV. Degree contamination of the environment

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- V. Operating temperatures
- VI. Speed of rotation

- It has been found that oil has better lubricating properties than greases and with this reason power losses are less due to friction with oils.
- Greases are more suitable for antic friction bearings and other mating parts of most units in wood working machines.
- The use of lubricating greases does not require complicated sealing devices and provides comparatively long service of the unit without changing of the lubricant, good protection of the bearings against external influences, etc.

The condition under which the use of lubricating grease is in effective are:-

- A). High temperature (above 70°C)
- B). Below freezing (low temperature) at which grease solidifies, and increases the internal friction.
- C). Maximum ease of movement for instance in case of measuring instruments, meters etc.
- D). When units cannot be dismantled for completely recuing the lubricant.
- If the bearing are to operate at high temperatures (over 70°C) liquid lubricants (oil) will have to be used ;
- Oil and grease are equally good for bearing working low and average peripheral speeds (up to 1-5m/sec).
- Low viscosity oils are recommended for bearings operating at speeds above 10.000 rpm.
- Thicker lubricants are used for bearing working at low speeds.
- The load on bearing is also of great importance in the choice of lubricant.
- Bearing with considerable loads be lubricated with oils of a higher viscosity than bearing operating under normal and small loads.
- At the temperature rises the viscosity of oil / greases decreases. Therefore a lubricant which is satisfactory at normal temperatures may prove unsuitable at very low or high temperatures.

Function of Lubricant

The functions of lubricant are the following:-

- To minimize mechanical friction
- Reduce the rate of wear
- Prevent dust and corrosion of the polished surfaces of the bearing.
- Dissipate some of the bearing heat and
- Act as partial seal, to prevent dirt from entering around the shaft.

The ideal lubrication for a sleeve bearing is one in which it is possible to maintain a state of fluid friction between contact body(surfaces) of the metal such a condition can exist only with high speeds and loads.

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Maintenance

- Work that is done regularly to keep equipment, buildings and grounds in good condition and working order
- All actions necessary for retaining an item, or restoring to it, a serviceable condition, include servicing, repair, modification, overhaul, inspection and condition verification
- Increase availability of a system
- Keep system's equipment in working order

Objectives of maintenance

General Objective

To maintain the optimum condition of physical facilities at acceptable levels and minimum costs to satisfy the expected demands of programs and activities

Specific Objectives

1. To extend the useful life of assets.
2. To assure the optimum availability and operational readiness of installed equipment.
3. To obtain the maximum possible return of investments.
4. To ensure the safety of personnel using the facilities.

Purpose of Maintenance

- Attempt to maximize performance of production equipment efficiently and regularly
- Prevent breakdown or failures
- Minimize production loss from failures
- Increase reliability of the operating systems

Principle Objectives in Maintenance

- To achieve product quality and customer satisfaction through adjusted and serviced equipment
- Maximize useful life of equipment
- Keep equipment safe and prevent safety hazards
- Minimize frequency and severity of interruptions
- Maximize production capacity – through high utilization of facility

Problems in Maintenance

- Lack of management attention to maintenance
- Little participation by accounting in analyzing and reporting costs
- Difficulties in applying quantitative analysis
- Difficulties in obtaining time and cost estimates for maintenance works
- Difficulties in measuring performance

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Problems Exist Due To:

- Failure to develop written objectives and policy
- Inadequate budgetary control
- Inadequate control procedures for work order, service requests etc.
- Infrequent use of standards
- To control maintenance work
- Absence of cost reports to aid maintenance planning and control system

Maintenance Costs

- Cost to replace or repair
- Losses of output
- Delayed shipment
- Scrap and rework

Maintenance Program

- a comprehensive list of maintenance and its incidence
- Long-term plan, covering all aspects of maintenance management which sets the direction for maintenance management, and contains firm action plans for achieving a desired future state for the maintenance function.

Run-to-Failure

- No Scheduled Maintenance - an Equipment Maintenance Strategy, where no routine maintenance tasks are performed on the equipment.
- The only maintenance performed on the equipment is Corrective Maintenance, and then only after the equipment has suffered a failure.
- Also described as a No Scheduled Maintenance strategy

Types of Maintenance

- Maintenance may be classified into four categories:
- (some authors prefer three categories- scheduled and preventive maintenances are merged)
 - Scheduled maintenance
 - Preventive maintenance
 - Predictive (Condition-based) maintenance
 - Corrective or Breakdown maintenance

Scheduled Maintenance

- Scheduled maintenance is a stitch-in-time procedure and incorporates

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- inspection
- lubrication
- repair and overhaul of equipment's
- If neglected can result in breakdown
- Generally followed for:
 - overhauling of machines
 - changing of heavy equipment oils
 - Cleaning of water and other tanks etc.

Preventive Maintenance

- Principle – “Prevention is better than cure”
- Procedure - Stitch-in-time
- It locates weak spots of machinery and equipment's
- provides them periodic/scheduled inspections and minor repairs to reduce the danger of unanticipated breakdown
- Schedule of planned maintenance actions aimed at the prevention of breakdowns and failures
- Primary goal-Preserve and enhance equipment reliability
- Anything that increases life of equipment, and helps it runs more efficiently
- Preventive maintenance should be performed on most equipment as recommended by the Manufacturer
- Examples
 - Oil changes
 - Greasing
 - Changing filters
 - Belt tightening



Benefits of Preventive maintenance

- ✓ Increases life of equipment
- ✓ Reduces failures and breakdowns
- ✓ Reduces costly down time
- ✓ Decreases cost of replacement

Predictive Maintenance

- Techniques that help determine the condition of in-service equipment in order to predict when maintenance should be performed





- Primary goal – Minimize disruption of normal system operations, while allowing for **budgeted, scheduled** repairs
- Predictive maintenance identifies trends and provides historical data
- Predictive Maintenance shows condition of in-service equipment, and predicts when corrective maintenance should be performed
- Example
 - Vibration Analysis
 - Infrared Thermography
 - Oil Analysis
 - Visual Inspections

Benefits of Predictive Maintenance

- ✓ Provides increased operational life
- ✓ Results in decrease of downtime
- ✓ Allows for *scheduled* downtime
- ✓ Allows for money to be budgeted for repairs
- ✓ Lowers need for extensive parts inventory
- ✓ DOE reports
- ❖ an estimated 8-12% cost savings
- ❖ Reduction in maintenance costs – 25-30%
- ❖ • Elimination of breakdowns – 70-75%
- ❖ • Reduction of downtime- 35-45%
- ❖ • Increase in production – 20-25%

Corrective Maintenance

- Corrective or Breakdown maintenance implies that repairs are made after the equipment is failed and cannot perform its normal function anymore
- Repair of equipment/machinery in order to bring it back to original operating condition.
- Important reminders
 - ✓ Use original OEM parts
 - ✓ Install per manufacturer’s specs
 - ✓ Don’t take shortcuts
 - ✓ Do it right

Disadvantages of Corrective Maintenance

- Breakdown generally occurs inappropriate times leading to poor and hurried maintenance
- Excessive delay in production & reduces output
- Faster plant deterioration
- Increases chances of accidents and less safety for both workers and machines
- More spoiled materials
- Direct loss of profit

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- Cannot be employed for equipment's regulated by statutory provisions e.g. cranes, lift and hoists etc..

Equipment File

- To ensure a quick and smooth planning of maintenance activities as well as the actual repair job, it is advisable to maintain an equipment file for all equipment, used in the plant.
- The following data should be included:

1. Specification

- Name of equipment
- Brand
- Model
- Date of installation
- Serial number
- Capacity
- Speed
- Load

2. Location

- Building
- Floor
- Department/Section

3. Spare part specifications

- Bearing
- Sealant
- Lubricant
- Drive
- Coupling

4. History of Preventive Maintenance Activities and Repair Activities

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MAINTENANCE SCHEDULE

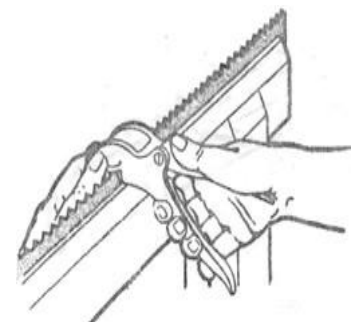
Machine Name		
Machine No./ Serial Number		
Date installed		

Interval	Component	Task to accomplish
Daily	Machine	Remove dust and shavings
	Table surfaces	Remove dust and shavings
	Planer fence	Remove dust and shavings
	Dust extractor	Check for defects
	Kickback guards	Check if functioning, if necessary remove any resin residue
Monthly OR: approx. Every 40 operating hours	Dust extractor	Check efficiency
	Drive belt	Check, if necessary: readjust the tension or replace
	Feed rollers	Remove any resin residue
	Height spindle (Thickneser table)	Control and lubrication (if required)
	Height spindle (Mortising table)	Control and lubrication (if required)
	Guides (Mortising table)	Clean
Every 6 months	Chain (Gearbox)	Check and lubricate if necessary
	Friction wheel (Gearbox)	Check and exchange if necessary
Poorly planed surface	System planer knives	Check and if necessary reverse or replace
	Standard planer knives	Check and if necessary, sharpen or replace

2.2.3 Saw tooth Setting

Correctly set teeth will cut a kerf just enough to give clearance to the blade. The kerf need be no more than 1 ½ times the thickness of the saw blade. Only the height of each tooth is set and the setting tool is called a saw set.

1. Secure the saw in the saw vice with the blade well exposed
2. Adjust the beveled anvil to the required amount of set for the saw
3. Start from the toe; identify the first tooth set away from you
4. Locate the hammer on that tooth and set it, using a firm, even pressure
5. Set each alternate tooth on that side
6. Turn the saw around and repeat the setting procedure on the unset teeth





Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. list importance of manufacturer's specifications and manuals (2 points)
2. Types of Maintenance? (2 points)
3. Describe the functions of lubricant? (2 points)
4. What are Principle Objectives in Maintenance? (2 points)

Note: Satisfactory rating – 8 points

Unsatisfactory - below 8 points

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

Name: _____

Date: _____



Sharpening: One of the most important skills a woodworker can acquire is the ability to sharpen tools easily and well. Working with hand tools can be a frustrating experience unless you have sharp tools. The goal of this lesson is, with a minimum of equipment, is for you to be able to produce razor sharp cutting edges on any tool blade consistently.

Sharpening hand saw procedure

The operation of sharpening, **Joining, setting & filing**

Jointing: - is known as topping is the process of running a file along the top the projecting teeth of the saw until they equal of the teeth of height.

Setting: - the process of bending adjacent teeth of a saw the opposite side by saw setting tools.

Filing: - is the process of sharpening knife proper angle

Portable Circular Saw

Keep the Saw blades Sharp

Using a dull saw blade can be extremely dangerous and provide poor cut quality.

- Never attempt to sharpen a saw blade manually.
- Special equipment is necessary to properly sharpen a circular saw blade. An improperly sharpened saw blade can injure the operator, destroy the saw, and damage the work piece.
- The saw blades should be sharpened regularly, and only by a qualified sharpening service.
- Improper grinding of the carbide teeth of a saw blade can result in serious injury to the saw operator.

Adjust and Inspect the Saw

To ensure the saw is in proper working order, periodically inspect the operation of the saw and ensure it is properly adjusted.

- Observe the function of the saw during normal operation.
- Unusual sounds are indicative of pending problems.
- A reduction in the cut quality indicates the saw is either improperly adjusted or not functioning properly.
- A reduction in cutting power or speed may indicate a dull blade or a motor problem.
- If any of the safety devices on the saw are inoperable or disabled, immediately stop using the saw and have it serviced.
- Periodically inspect the wear bars for the guide rail cams for wear.

Operation Sheet 2	circular saw remove blades
-------------------	----------------------------

circular saw blades

To remove the blade:-

Steps 1- Disconnect the power

Steps 2- Remove the throat plate

Steps 3- Select a wrench that fits the arbor nut.

Steps 4- Loosen the arbor nut.

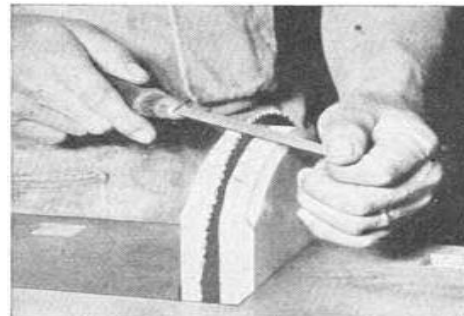
Note: arbor nut is loosened in the same direction that the saw blade rotates or by turning it in the direction the teeth are pointing

Steps 5- Remove the nut, collar and the blade.

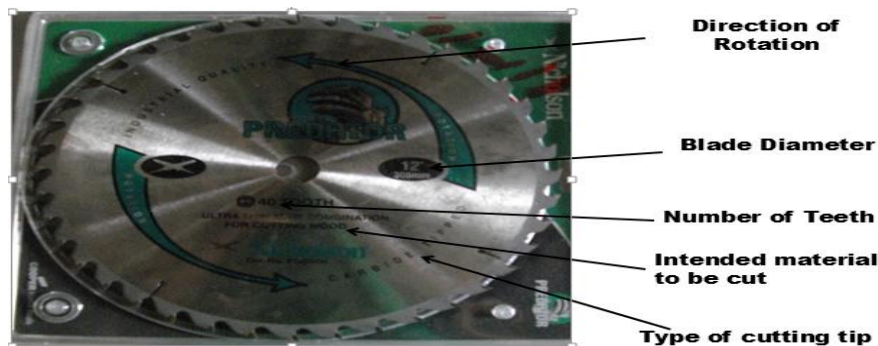
Steps 6- blades secured (clamp)

Steps 7- Sharpe the blades by portable grinder

Process	Type of Blade
Cross Cutting	Cross cut, Combination
Miter Cutting	Cross cut, Combination
Bevel Cutting	Cross cut, Combination
Dadoing	Dado Head



Elements of Circular Saw Blades





Sharpening a circular saw blade is something that should be done to maintain the life of the saw blade for many years. To sharpen circular saw blade follow the following steps:-

Step One: Remove the Blade:-

- Remove the blade from a circular saw.
- This generally requires the use of an open-ended box wrench, although newer models may have other blade releases.

Step Two: Secure the Blade down:-

- Secure the blade in a vice grip.
- The blade facing up with the teeth is towards us.
- It need to also be aware not to tighten the vice grip too hard or it will warp the metal that holds the teeth.

Step Three: Make the Marks:-

- Make a mark at the top most point of the blade so that will be aware of when it has gone all the way around the blade (and thus prevent double sharpening).

Step Four: Pay Attention to the Bevels:-

- Since the bevels appear on every other blade, skip one blade and go to the next beveled edge.
- Repeat this process until you get around the entire blade, applying the same number of strokes that you did with the first blade.

Step Five: Repeat on Other Side:-

- Turn the blade over when it has gone all the way around the blade, sharpening every other point.
- This will know when it done because it will come back to the chalk mark.
- On the other side of the blade, put another chalk mark and do the something as we did to the first side, starting with the top most point with a beveled edge.



Replacing the circular saw blades:

The following are the steps to be followed for replacing the circular saw blades.

Steps:

1. To replace the circular saw blades, reverse the procedures for removing
2. Make sure that the teeth of the blades point toward the operator
3. Replace the collar and tighten the nut securely.

Note: the arbor nut is tightened against, or opposite, the rotation of loosening during operation.

4. Rotate the blade by hand to make sure that it is running clear.
5. Replace the plate or metal insert

Changing Radial Arm Saw Blade

Steps 1- Shut off main power switch or disconnect from wall plug.

Steps 2- Select the proper type blade for the job.

Steps 3- Remove the saw guard, arbor nut and arbor collars. Remove the blade.

Steps 4- Replace inside arbor collar with recessed face toward the blade.

Steps 5- Place the saw blade on the arbor so the teeth point in the direction of rotation.

Steps 6- Replace arbor collar and tighten the arbor nut.

Steps 7- Before replacing the guard, check the squareness of the saw blade. If out of adjustment, consult the operator's manual for alignment procedures.



Sharpening/changing the standard planer knives



Attention!

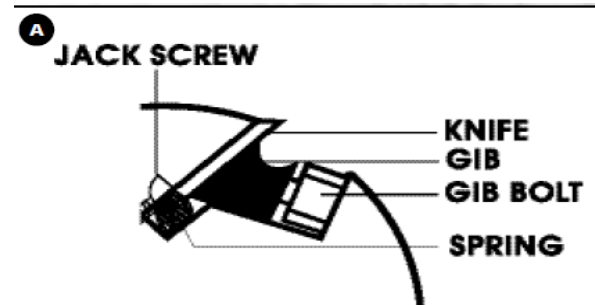
Execute the following instructions exactly!

Always tighten the knife holder screws from the inside to the outside.

- Properly setting all three knives is essential to achieving accurate work results.
- Properly set knives will last longer and also keep their edge (sharpness) longer by equally sharing the cutting workload.
- You may use the supplied knife setting gauge to help you set the knives to the correct height whenever re-setting or changing knives.

Note: If you prefer you may also find other “aftermarket” gauges, jigs or knife setting tools that are to your liking – ask your local tool distributor for information on any such tools that may be available in your market.

The cutter head on this unit is supplied with both adjustment springs and jack screws **A** providing you with two options for setting the knives. We suggest you try each method at least once or twice and decide for yourself which method works best and fastest for you.



1. Turn off and disconnect the machine from the power source.
2. To give you unimpeded access to the cutter head and knives, remove the cutter guard and lower the tables as far as they go.
3. Remove the fence to have access to the upper pulley and turn it by hand to rotate the cutter head to access one of the knives.
4. Loosen (but don't remove) all the gib bolts **B** start in the center and alternate sides (If replacing an old or damaged knife, loosen the bolts until the knife can be removed and install a new sharpened knife). Then position the gauge over the selected knife **D**.



5. **a) To use the adjustment springs to set the knife height:** Push the knife down with the gauge so that the edge of the knife is touching the center reference pads on the gauge **E**. Hold the gauge down and tighten the bolts **B** to secure the knife in place. Repeat for the 2 other knives.

b) To use the Jack Screws to set the knife height:

Use an Allen key to turn the screws **C** to raise or lower the knife as needed until the ideal position - both sets of feet of the gauge sitting flush on the cutter head and the knife barely touching the center reference pads on the gauge **E** - has been achieved. Repeat for the 2 other knives.

6. Re-check the height setting on all the knives and re-set if necessary.
7. Reset the tables and replace the fence and blade guard.



IMPORTANT! After changing or resetting the knives, the out-feed (left) table height must be re-adjusted to match the new height of the knives. Follow the instructions in section

☞ Sharpening band saw blade

A band saw's job is cutting lumber, metal or meat with bone, so the abuse on the blade is great. Sharpen a band saw when, become aware of it is no longer giving a smooth cut or it becomes difficult to cut the material.

Steps 1- Wear safety goggles and ear plugs when you sharpen a band saw blade.

Steps 2- Remove the blade from the band saw. Follow the manufacturer's instructions.

Steps 3- Mark the blade, where to begin and stop when it sharpens a band saw blade.

Steps 4- Adjust the grinding parameter controls and double check the teeth per inch and gullet depth setting.

Steps 5- Set the grinding wheel depth and angle adjustment. Make sure the grinding wheel makes proper contact with the blade.

Steps 6- Prepared to turn the machine off when the entire blade completes the sharpening process if it doesn't turn off automatically. Remove the blade from the grinding machine and put it on the band saw.



Band saw sharpening machines

Causes for band saw blade breakage

The following factors are responsible for blade breakage.

- 1) Use of defective blade caused from improper punching. Filing or welding
- 2) Vibration of the upper wheel and uneven tension caused by frame.
- 3) Wheels out of balance. This causes uneven blade tension.
- 4) Too light a blade for work.
- 5) Twisting blade in the guides.
- 6) Sawing with a dull blade.
- 7) Improper tooth spacing for the work.
- 8) Blade running through worn guides.
- 9) Too much blade pressure on the guide thrust wheel.
- 10) Blade too tight in the guides.
- 11) Uneven blade off thickness.
- 12) Blade under excessive tension.
- 13) Throwing blade off the wheels.
- 14) Teeth not uniform in length.
- 15) Blade weaving or running back and forth across the face of the wheel.



Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are procedures for Sharpening hand saw? (2 points)

Note: Satisfactory rating – 2points

Unsatisfactory - below 2 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 8 hours.

Task 1: Sharpening/changing Changing Radial Arm Saw Blade and Circular saw

Task 2: Sharpening/changing the standard planer knives



Information Sheet-4	Routine adjustments and repairs
----------------------------	--

- ⇒ Routine maintenance is the simplest but very essential form of maintenance system.
- ⇒ Earlier the routine maintenance was considered about preventing failures.
- ⇒ Today routine maintenance is being considered about avoiding, reducing or eliminating the consequences of failures.
- ⇒ As the name each implies, it means carrying out minor maintenance jobs at regular intervals. It involves jobs such as ‘cleaning, lubrication, inspection and minor adjustments pressure, flow, tightness and tightening of loose parts etc. It also includes inspection of bearings, V-belts, couplings, jointing, foundation bolts, earthlings and protective covers etc.
- ⇒ The small and critical defects, observed during such inspection, are rectified immediately and bigger jobs are planned for rectification during next available shutdown. Such maintenance is essential for effective scheduled preventive maintenance.
- ⇒ Carrying out planned jobs regularly in simple cyclic schedule is very essential in routine maintenance. Such schedules are simple (like check, clean, lubricate, tighten, adjust etc..

Portable Circular Saw

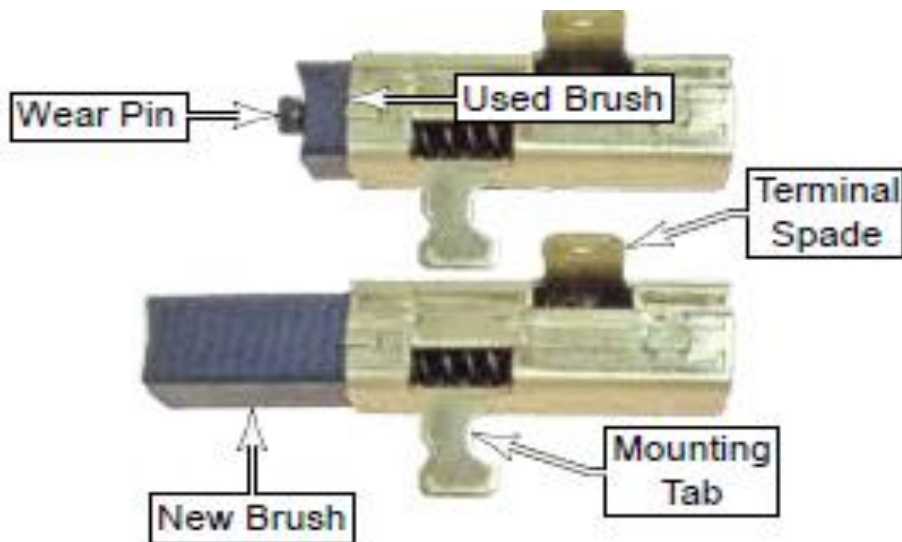
Dust and debris from some materials can be extremely abrasive and cause components within the saw to wear prematurely.

It is important to keep moving parts cleared of abrasive dusts.

- As a general rule, keep the saw clean of all dust and debris. Even soft-wood dust can be abrasive over time.
- Examine all moving parts for dust and debris.
- Keep the bevel hinges clean of dust using compressed air or cotton swabs. If the hinges wear due to abrasive particles, the saw will not perform optimally.
- Keep the blade area and dust extraction port clean of debris. Debris can cause wear and reduce the effectiveness of the dust extraction system.
- Periodically remove the blade cover, the blade, and the inboard arbor flange; and clean any built up debris from the inside of the saw.

Changing the Motor Brushes

- The motor brushes are graphite bars that provide an electrical connection between the motor controller and the rotating armature.
- When the brushes have worn past their useful length, spring loaded wear pins are exposed that separate the brush from the armature contacts.
- This disables the motor to prevent damage. For a shorter break-in period without excessive arcing, new brushes have ribs that quickly form to the curve of the armature.

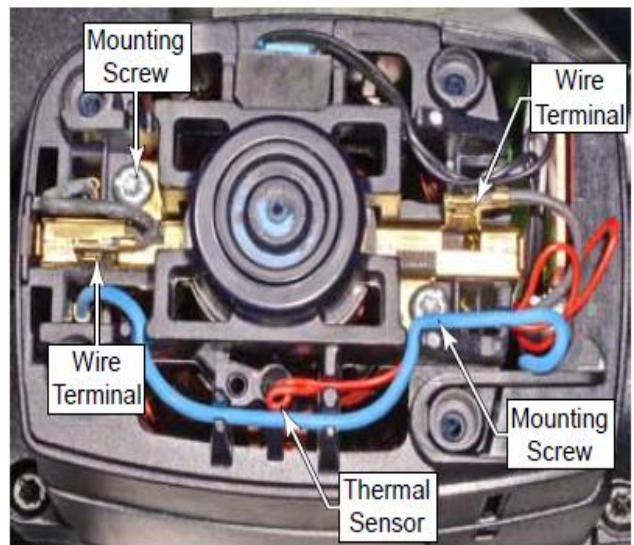


CAUTION! Make sure the power cord is unplugged before beginning this procedure.

Operation Sheet 8	Changing the Motor Brushes
--------------------------	-----------------------------------

Procedure

1. Unplug the saw.
2. Remove the four screws that secure the access cover to the motor, and remove the cover.
4. Remove the screw that secures each brush to the motor housing. Be careful not to drop the screws into the motor.
5. Carefully lift the brushes up to remove them.
6. Insert the new brushes into the motor, and reassemble the saw by reversing the previous steps.



3. Lift the 2 wire connectors off the terminals on the brushes.



NOTICE: Take care to not pull on the red wires for the thermal sensor, or you may pull the sensor out of its pocket. The sensor is embedded in a thermally conductive paste.



Trouble shooting

Symptom	Possible Causes
Motor does not start	<ul style="list-style-type: none"> ➤ Check that the cord is properly plugged into an outlet. ➤ Make sure the Plug-it connector is properly inserted and fully tightened. ➤ Make sure the outlet has power. Check the circuit breaker or try another outlet. ➤ The auxiliary outlet on the dust extractor has power only when the selector is at Auto. ➤ Inspect the power cord (including extension cords) for damage or missing prongs. ➤ The motor brushes may have worn and need replacement.
The saw makes wavy cuts	<ul style="list-style-type: none"> ➤ Make sure the guide rail gap cams are properly adjusted. ➤ Inspect the blade for damage. ➤ Make sure the sole plate is not rocking on the guide rail. ➤ Keep the blade depth consistent during the cut; don't raise and lower the blade.
Saw cuts are burning	<ul style="list-style-type: none"> ➤ Make sure to use the correct blade for the material. ➤ Make sure the blade is sharp. ➤ Make sure the blade is installed correctly (not turning backward). ➤ Reduce the motor speed. ➤ If possible, increase the blade depth. ➤ Increase your feed speed.

Operation Sheet 9	Maintaining or lubricating table saw
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Table Saw

For your own safety, turn the switch OFF and remove the switch key.

Remove the plug from the power source outlet before maintaining or lubricating your saw.

Steps 1- Clean out all sawdust that has accumulated inside the saw cabinet and the motor.

Steps 2- Polish the saw table with an automotive wax to keep it clean and to make it easier to slide the work piece.

Steps 3- Clean cutting blades with pitch and gum remover.

Steps 4- A worn, cut, or damaged power cord should be replaced immediately.

Steps 5- All electrical or mechanical repairs should be attempted only by a trained repair technician.

Contact the nearest Sears Service Center for service.

Use only identical replacement parts. Any other parts may create a hazard.

Steps 6- Use liquid dish washing detergent and water to clean all plastic parts.

NOTE: Certain cleaning chemicals can damage plastic parts.

Steps 7- Avoid use of the following cleaning chemicals or solvents; ammonia and household detergents containing ammonia.

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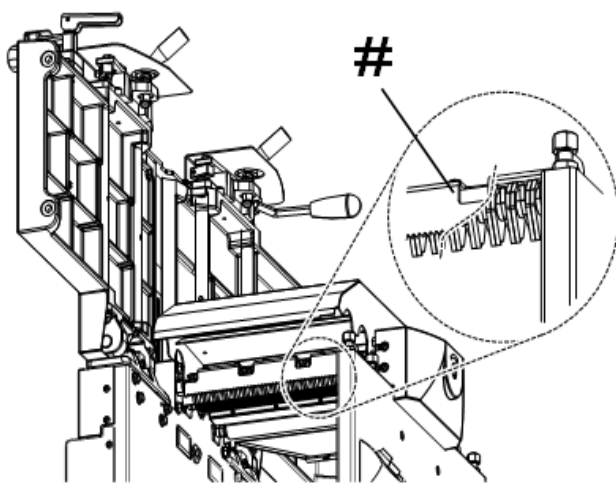
SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Saw will not start	<ol style="list-style-type: none"> 1. Saw not plugged in 2. Fuse blown or circuit breaker tripped 3. Cord damaged 	<ol style="list-style-type: none"> 1. Plug in saw 2. Replace fuse or reset circuit breaker 3. Have cord replaced by a Sears Service Center
Does not make accurate 45° and 90° rip cuts	<ol style="list-style-type: none"> 1. Positive stop not adjusted correctly 2. Bevel angle pointer not set accurately 	<ol style="list-style-type: none"> 1. Check blade with square and adjust positive stop 2. Check blade with square and adjust to zero
Material pinched blade when ripping	<ol style="list-style-type: none"> 1. Rip fence not aligned with blade 2. Warped wood, edge against fence is not straight 	<ol style="list-style-type: none"> 1. Check and align rip fence 2. Select another piece of wood
Material binds on splitter	<ol style="list-style-type: none"> 1. Splitter not aligned correctly with blade 	<ol style="list-style-type: none"> 1. Check and align splitter with blade
Saw makes unsatisfactory cuts	<ol style="list-style-type: none"> 1. Dull blade 2. Blade mounted backwards 3. Gum or pitch on blade 4. Incorrect blade for work being done 5. Gum or pitch on blade causing erratic feed 	<ol style="list-style-type: none"> 1. Replace blade 2. Blade teeth must face forward 3. Remove blade and clean with turpentine and coarse steel wool 4. Change the blade 5. Clean table with turpentine and steel wool
Material kicked back from blade	<ol style="list-style-type: none"> 1. Rip fence out of adjustment 2. Splitter not aligned with blade 3. Feeding stock without rip fence 4. Dull blade 5. Operator is letting go of material before it is past saw blade 6. Miter angle lock handle is not tight 	<ol style="list-style-type: none"> 1. Align rip fence with miter gauge slot 2. Align splitter with blade 3. Install and use rip fence 4. Replace Blade 5. Push material all the way past saw blade before releasing work 6. Tighten handle
Blade does not raise or tilt freely	<ol style="list-style-type: none"> 1. Sawdust and dirt in raising and tilting mechanisms 	<ol style="list-style-type: none"> 1. Brush or blow out loose dust and dirt
Blade does not come up to speed	<ol style="list-style-type: none"> 1. Extension cord too light or too long 2. Low house voltage 	<ol style="list-style-type: none"> 1. Replace with adequate size cord 2. Contact your electric company
Machine vibrates excessively	<ol style="list-style-type: none"> 1. Saw not mounted securely to workbench 2. Stand not level 3. Damaged saw blade 	<ol style="list-style-type: none"> 1. Tighten all mounting hardware 2. Adjust stand level to floor 3. Replace blade
Does not make accurate 45° and 90° cross cuts	<ol style="list-style-type: none"> 1. Miter gauge out of adjustment 	<ol style="list-style-type: none"> 1. Square miter gauge to 90°

Jointer

To prolong the service life of your jointer and to maintain optimum performance the following basic maintenance procedures should be practiced and become part of your shop routine.

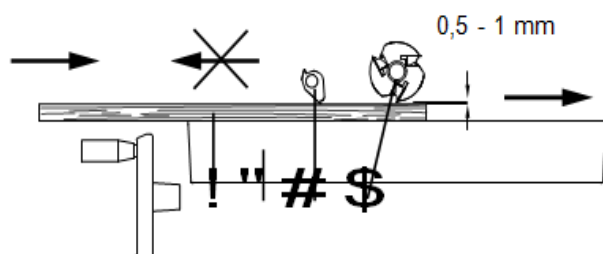
- Inspect/test the ON/OFF switch before each use. Do not operate the jointer with a damaged switch; replay a damaged switch immediately.

- Keep the machine as well as the in-feed out-feed tables clean and free of saw dust, woodchips, pitch or glue. Vacuum or brush off any loose debris and wipe down the machine and the tables occasionally with a damp rag.
- An occasional light coating of paste wax can help protect the tables' surface and reduce work piece friction. Ask your local distributor for suggestions on aftermarket surface cleaners, protectant and dry lubricants based on what is readily available in your area.
- Avoid using silicon based products that may affect or react with wood finishing products such as oil, solvent or water-based stains, varnishes and lacquers.
- Periodically inspect the power cord and plug for damage. To minimize the risk of electric shock or fire, never operate the planer with a damaged power cord or plug. Replace a damaged power cord or plug at the first visible signs of damage.
- All bearings are sealed and permanently lubricated and no further lubrication is required. The fence assembly and table ways also should not be lubricated. If you should encounter a "sticking" problem, simply disassemble and clear away any obstructions from the ways.



Kickback guards

- Regularly inspect jointed work pieces for signs of knife damage or wear and replace damaged or worn knives immediately.
- Inspect the belt regularly – To avoid potentially costly downtime, consider keeping a spare replacement belt on hand for use if needed. Belts that show visible signs of wear such as cracks or fraying at the edges should be replaced immediately.



Testing the kickback guards

- ! Planed board
- Thicknesser table
- # Kickback guards
- \$ Cutterblock

Operation Sheet 10	Checking/cleaning the kickback guards
---------------------------	--

Steps 1- Before beginning any maintenance work on the machine, switch it off and secure it against accidentally being switched on again

Steps 2- Check if functioning: the kickback guards must fall back after having been lifted

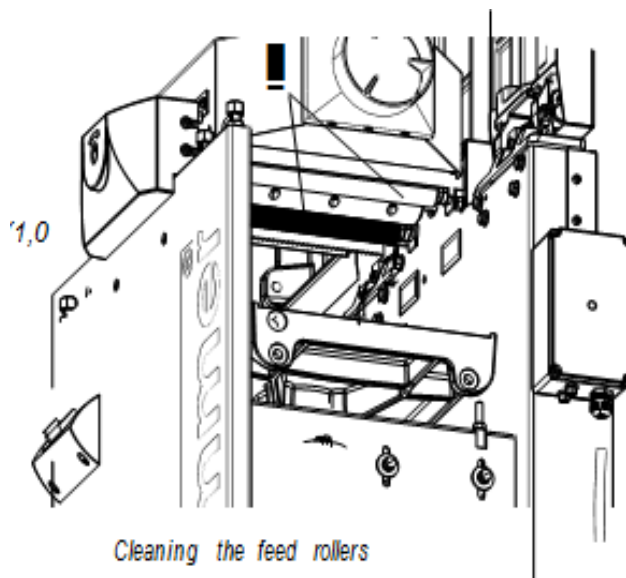
Steps 3- Check if functioning:

- Push a planned board into the machine
- Adjust the height of the thickness table so that there is 0.5 to 1 mm gap between the board and the cutter block's circle of cut
- It should not be possible to pull the board out of the machine
- Push the board out of the machine.

Steps 4- Remove any resin residue from table, kickback guards and cutter block.

Operation Sheet 11	Cleaning the feed rollers
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Cleaning the feed rollers

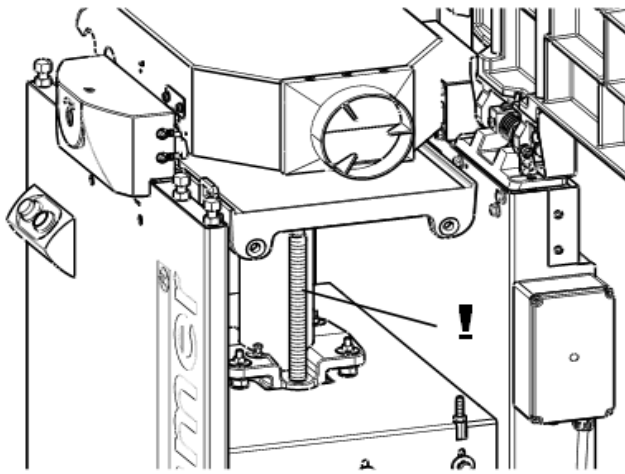


Steps 1- Before beginning any maintenance work on the machine switch it off and secure it against accidentally being switched on again

Steps 2- Remove any resin residue on the feed rollers:

! Feed rollers

Operation Sheet 12	Greasing the height spindle (thicknesser planing table)
---------------------------	--



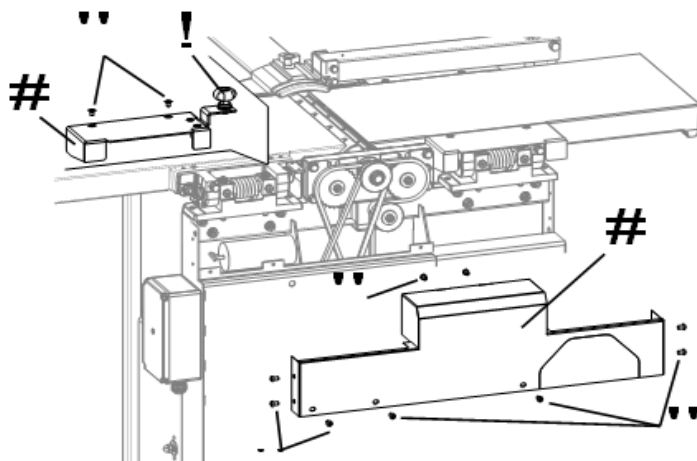
Lubricating the height spindle

1. Before beginning any maintenance work on the machine, switch it off and secure it against accidentally being switched on again.
2. Loosen the clamping lever.
3. Use the system handwheel to move the thickening table all the way up
4. Clean the spindles and lubricate with regular machine grease.
5. Use the system handwheel to move the thickening table all the way down and then all the way back up again.
6. Clamp the clamping lever.

! Thicknesser table height spindle
 ! Lubrication hole

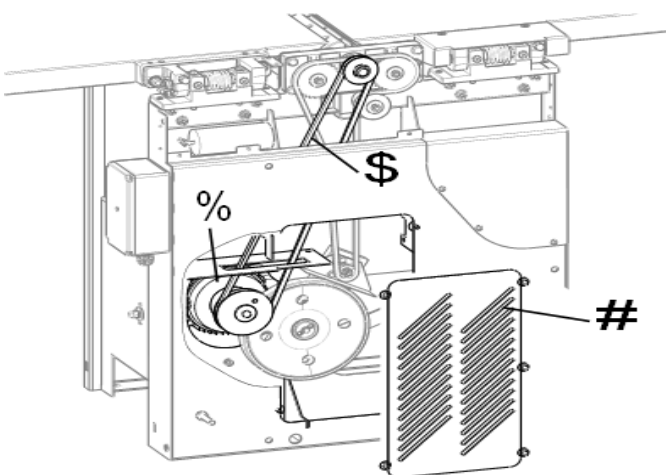
Single-hand clamping lever

Operation Sheet 13	Replacing the drive belt
---------------------------	---------------------------------



1. Before beginning any maintenance work on the machine, switch it off and secure it against accidentally being switched on again.
2. Set the gear lever to the "0" setting
Remove the thumb nut
Dismantle the planer fence
3. Loosen the screw and take off the covering lid.

! Thumb nut
 ! Screws
 # Cover



Retensioning the drive belt

4. Loosen the nuts.
5. Remove the old drive belt
6. Hook the new drive belt into place:
 - First hook the belt onto the drive motor (if necessary, open the gearbox cover)
 - Pull up the drive motor with the drive belt
 - Hook the drive belt onto the cutterblock
7. Use the belt-tensioning screw to tension the drive belt.
8. Tighten the nuts
9. Fit and screw the covering lid back on

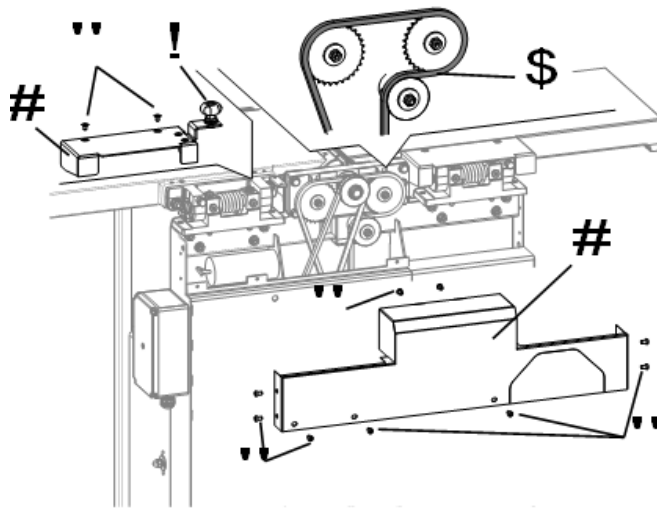
Gearbox cover
 \$ Drive belt
 % Drive motor



Attention! Risk of material damage!

Do not over-tension the drive belt!. Turn the belt-tensioning screw only until the drive belt is sufficiently tensioned to transmit power effectively.

Operation Sheet 14	Checking/greasing the chain (transmission)
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Checking/greasing the chain (transmission)

1. Before beginning any maintenance work on the machine, switch it off and secure it against accidentally being switched on again.
2. Set the gear lever to the "0" setting
Remove the thumb nut
Dismantle the planer fence
3. Loosen the screw and take off the covering lid.
4. Check the chain and lubricate with regular machine grease if necessary.
5. Fit and screw the covering lid back on

- ! Thumb nut
- Screws
- # Cover
- \$ Chain

Faults, causes and repairs

Fault	Cause	Repair
Machine does not start	Main switch at setting „0“	Check switch position
	Planer tables and/or vacuum hood incorrectly positioned (Safety break switch is not activated)	Close planer tables properly and position the vacuum hood correctly
Squeaking noises when starting up	Insufficient tension (Drive belt)	Retensioning the drive belt
The joint is not true (extremely splayed or open joint)	Receiver-side of the planer table is misaligned	Adjusting the joint Replace the planer knives*1)
	Planer knives are worn out	Replace the planer knives*1)
When surface planing, workpiece stops at the receiver-side of the planer table	Receiver-side of the planer table is too high in relation to the circle of cut	Adjusting the joint Replace the planer knives*1)
„Straight cut“ at the end of the workpiece when surface planing	Receiver-side of the planer table is too low in relation to the circle of cut	Adjusting the joint Replace the planer knives*1)
The planer fence angle is not correct	Angle setting misadjusted	Correcting the angle of the planing fence

Woodturning Lathe

- Clean and oil the lathe bed so that headstock, tailstock and tool rest base will slide easily. Clean any rust spots that may develop on the bed with a commercial rust remove
- Use compressed air to blow out the interior of the headstock, in order to keep sawdust and chips from accumulating on belts and sheaves. Also blow off debris that accumulates in the motor fan and around inverter. **Do not disassemble inverter to clean!**
- Frequently clean out the Morse tapers on both headstock and tailstock.



Symptom	Possible Cause	Correction *
Motor fails to develop full power.	Power line overloaded.	Correct overload condition.
	Undersized wires in supply system, or extension cord is too long.	Increase supply wire size.
	Low voltage.	Request voltage check from power company and correct low voltage condition.
	Worn motor.	Replace motor.
Motor or spindle stalls or will not start.	Excessive cut.	Reduce depth of cut.
	Worn or broken belt.	Replace belt.
	Improper cooling of motor.	Blow out sawdust from motor housing fan.
	Worn spindle bearings.	Replace bearings.
	Worn motor.	Replace motor.
Excessive vibration or noises.	Workpiece warped, out of round, has major flaw, was improperly prepared for turning.	Correct problem by planing or sawing workpiece, or discard entirely and use new workpiece.
	Spindle rotation too fast.	Reduce speed.
	Worn spindle bearings.	Replace spindle bearings.
	Drive belt misaligned or worn.	Align belt. Replace if worn.
	Motor mount bolts are loose.	Tighten bolts.
	Lathe on uneven surface.	Adjust leveling feet.
Tools tend to grab or dig in.	Dull tools.	Keep tools sharp.
	Tool rest set too low.	Reposition tool rest height.
	Tool rest set too far from workpiece.	Reposition tool rest closer to workpiece.
	Improper tool being used.	Use correct tool for operation.
Headstock moves when applying pressure with Tailstock.	Locking handle not tight.	Tighten handle.
	Excessive pressure being applied by tailstock.	Slide headstock to left end, lock firmly, then apply pressure to workpiece with tailstock. Apply <i>only</i> sufficient force with tailstock to hold workpiece securely in place.
Tailstock moves when applying pressure.	Cam lock nut needs adjusting.	Tighten cam lock nut.
	Excessive pressure being applied by tailstock. (Note: The screw action of the tailstock is capable of applying excessive pressure to workpiece and headstock. Apply only sufficient force by tailstock to hold workpiece securely in place. Excessive pressure can cause damage to machine.)	Slide tailstock to right side of lathe against the stop. Move headstock into position and apply pressure to workpiece with tailstock.
	Lathe bed and tailstock mating surfaces are greasy or oily.	Remove tailstock and clean surfaces with a cleaner/degreaser. Re-apply light coat of oil to lathe bed surface.



Self-Check -4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define what is Routine maintenance? (3 points)

Note: Satisfactory rating – 3 points

Unsatisfactory - below 3 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 15 hours.

Task 1: Identify personal protective equipment, select, use and maintain according to OHS requirements.

Task 2: Use operator’s manual/manufacturers specifications and supervisor's instructions for Greasing, lubrication and other basic servicing of machinery and equipment

Task 3: Perform routine adjustments and repairs machinery and equipment according to operators' manual/manufacturers’ specifications and supervisors instructions

Task 4: Work is conduct according to OHS requirements and completed to supervisor's satisfaction.



Instruction Sheet	LG03: Complete work
--------------------------	----------------------------

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

- 3.1. Steps in proper storing of tools
- 3.2. Collect, treat and dispose or recycle waste
- 3.3. Clean and maintain work area
- 3.4. Maintenance reporting procedure
 - 3.4.1. Reports on faulty, Malfunctions, faults, and damaged tools
 - 3.4.2. Reports on waste to be treated, disposed or recycled

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

- Conduct and complete the work according to OHS requirements
- Treat and dispose or recycle wastes from maintenance activities with OHS
- Report malfunctions, faults, wear or damage tools to the supervisor
- Clean and maintain work area according to OHS

Learning Instructions:

11. Read the specific objectives of this Learning Guide.
12. Follow the instructions described below.
13. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
14. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in **page -4, 6, 8 and 13** respectively.
15. Do the “LAP test” in **page – 14** (if you are ready).



Information Sheet-1	Cleaning, returning and storing tools according to manufacturer's specifications
----------------------------	---

Cleaning maintenance is the cleaning of equipment's, components, working tools, hands tool or working gloves and workplace etc. Before taking repairs, during and after repairs is of main importance, but is often not given due consideration.

Cleaning of components is, normally, assisted by kerosene, petrol, carbon-tetra-chloride (CTC) and many other solvents.

Storing tools and equipment

Tools and equipment should be safely stored according to workplace Procedures. Generally, this will mean returning items to their allocated place.

This could include shadow boards, cabinets, cupboards, power tool cases, cutter blocks, drill bit containers, benches or storage racks. Tools and equipment must be put away so that they can be easily located and accessed

Completing basic routine maintenance activities:-

- ☞ Execute regular maintenance activities according to scheduled plan.
- ☞ Maintenance procedures are followed in accordance with the manufacturers Manual and organizational policies.
- ☞ Complex faults or repair requirements outside area of competence are reported for specialist assistance in accordance with organizational procedures.
- ☞ responds to failed or unsafe equipment
- ☞ Maintenance and repair activities are documented and reported according to Organizational policies.



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

- List completing basic routine maintenance activities (4 points)

Note: Satisfactory rating – 4 points

Unsatisfactory - below 4 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



The *proper handling* of the things we throw away in a manner that does not harm anyone or anything, be it human, animals or the environment.

Waste: - Unwanted material or substance produced by human activities, which are usually referred to as rubbish, trash, garbage or junk.

Types of Wastes

- Solid
- Liquid
- Gaseous

Proper handling: - includes the collection, transport, processing, recycling or disposal of waste materials produced by human activity in order to reduce their negative effect on the environment.

Waste Reduction: - the prevention of waste material.

3R Reuse, Reduce & Recycle

Methods of Reusing and Reducing

1. Reuse of second-hand products
2. Repairing broken items instead of buying new
3. Designing products to be refillable or reusable
4. Encouraging consumers to avoid using disposable products
5. Designing products that use less material to achieve the same purpose



Self-Check -2	Written Test
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Information Sheet-3	cleaning and maintaining working area according to OHS
---------------------	--

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

1. List types of Wastes? (2 points)
2. What are the Methods of Reusing and Reducing? (2 points)

Note: Satisfactory rating – 5 points

Unsatisfactory - below 5 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



➤ **Cleaning the work area**

Safe work practices should be followed at all times. A clean work area is an important part of having a safe work environment. On completion of each job

The assembly area should be cleaned, this includes the removal of all waste material, the floor cleaned (swept/vacuumed) if necessary and all tools and equipment returned to their allocated storage area.

➤ **Cleaning up**

When all the parts are assembled, your work area needs to be cleaned ready for the next job.

In this section we will look at:

- ☞ cleaning the work area
- ☞ cleaning and maintenance of equipment
- ☞ waste disposal
- ☞ Storing tools and equipment.

Clean work shop site/area

- ⇒ Always clean the work shop after done/ work.
- ⇒ Separate workshops e.g.- finishing machine, assembling, main store, and office & class room.
- ⇒ Remove out wastage raw material in the container.
- ⇒ After using equipment & tools clean with sponge, rage, oil, turpentine & greases.

Implement Housekeeping Activities

- ☞ Regular inspections 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.

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Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Describe the benefit cleaning and maintaining working area?

Note: Satisfactory rating – 3 points

Unsatisfactory - below 3 and 4 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



3.4.1. Reporting malfunctions, faults, wear or damaged tools

On completion of each job it is important that all the equipment you have used be cleaned and checked for serviceability before being stored.

That Equipment is faulty or damaged should be tagged and reported to supervisor or appropriate person. A suitable logging system should be used to identify Equipment or materials that need to be serviced, repaired, removed, replaced or considered unsafe.

Maintenance records should include the following information:

- Name and model of equipment.
- Where equipment is usually kept.
- Unique identifier.
- Each task on the maintenance schedule.
- Frequency of each task.
- What is involved in each task.
- Result of maintenance and any actions resulting from the maintenance.
- Sign off by the person carrying out the maintenance.



Example of inspection sheet for a week of daily inspections of a single piece of workshop equipment

Equipment			Frequency													
Model			Serial number		Location											
Name of inspector			Period of inspections		Any issues found?					Yes		No				
Checklist			Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
Check 1	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Check 2	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Check 3	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
...continue to enter checks required to ensure the equipment is safe to use.	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Signature																
Comments (please date and initial comments)					Actions (please date and initial actions)											

3.4.1. Reports on waste to be treated, disposed or recycled

Waste Disposal and Recycling

1. Be responsible for cleaning up workstations, tools and the shops.
 2. Sort waste by category as required using approved containers.
 3. Sort recyclable liquids and solids into proper approved storage container.
- Dust collection is best accomplished at the source-at the point of operation of the equipment, if feasible. For many pieces of equipment, well-designed ducts and vacuum hoods can collect most of the dust generated before it even reaches the operator.
 - Very fine dust that manages to escape point-of-source collection can be captured from above by general exhaust points located along the ceiling.
 - These control technologies are effective for most equipment, excepting machines that commonly produce the very finest dust or large quantities of dust.
 - Good housekeeping extends to periodic hand cleaning of your entire facility, as some dust will other Safety Hazards of Woodworking escape from even the best exhaust system and will eventually accumulate on rafters and other out-of-the-way spots. Also, it is extremely



important to inspect and clean your exhaust ventilation system on a regular basis to maintain maximum efficiency.

- Ensure the proper use and storage of flammable materials, such as paints, finishes, adhesives, and solvents.
- Segregate tasks particularly prone to fire and explosion hazards, such as spray painting, welding, and use of powder-actuated nail guns.
- Train employees to recognize, avoid, and correct potentially hazardous conditions and behaviors. Train employees so that they are acquainted with the special equipment and aspects of building design related to dealing with fires and explosions.
- Control ignition sources. This involves using electrical systems rated for the projected use and protected by appropriate circuit breakers, grounding all equipment prone to accumulating static electrical charges, grounding entire buildings against the possibility of lightning strikes, and controlling and banning smoking in and around the workplace..
- Never permit blow-down of accumulated dust with compressed air. Blowing dust with compressed air will create the very type of dust cloud that presents the greatest explosion hazard.
- Provide continuous local exhaust ventilation on all woodworking machines. The local exhaust systems must have a suitable collector. Dust collection systems must be located.
- Segregate combustible and flammable materials such as lumber stock and chemical solvents from each other and from ignition sources.
- Ensure that you use equipment with a hazard classification appropriately rated for your work environment

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Weekly Inspection Report

Completed by:		Site:		
Accompanied by:		Date:		Last inspection:
Item	Comment	Area	Contractor	Action taken
1. Housekeeping				
2. Storage				
3. PPE				
4. Fire protection				
5. Electrical				
6. Lighting				
7. Machine guards				
8. Material handling				
9. Ventilation				
Copies provided to:				



Self-Check -4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are Maintenance records should include?

Note: Satisfactory rating – 3 points

Unsatisfactory - below 3 and 4 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

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

Task 1: Conduct and complete the work according to OHS requirements

Task 2: Treat and dispose or recycle wastes from maintenance activities with OHS

Task 3: Report malfunctions, faults, wear or damage tools to the supervisor

Task 4: Clean and maintain work area according to OHS



REFERENCES

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- Woodworkers' Guide to Sharpening, by John English, Fox Chapel Publishing, 2008
- Illustrated Guide to Sharpening, by Thomas Lie-Nielsen, Taunton Press, 2004
- Sharpening, by Nick Engler, Rodale Press, 1994
- The Complete Guide to Sharpening, by Leonard Lee, Taunton Press, 1995
- How To Sharpen Every Blade in Your Woodshop, by Don Geary, Betterway Book machinery component maintenance and repair

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