Furniture Making

Level II

Learning Guide #2

Unit of Competence: Perform Equipment Maintenance

Module Title: Performing Equipment Maintenance

LG Code: IND FMK2 M01 0919 LO2-LG-02

TTLM Code IND FMK2 M01 TTLM 0919V1

LO2: Carry out basic routine maintenance

Instruction Sheet	Learning Guide #2

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:

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 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” **in page -5, 14, 22 and 34** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, --Operation Sheet 14
6. Do the “LAP test” **in page – 23 and 35** (if you are ready).

Information Sheet-1	Personal protective equipment

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 jeweler 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: _____

Short Answer Questions

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
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^{o}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^{o}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.

<u>Function of Lubricant</u>

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.

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

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
  - 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 spoilt materials
- Direct loss of profit
- 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**

EQUIPMENT FILE

SPECIFICATIONS		LOCATION	
Name of Equipment		Building Number/Floor	
Brand		Department/Section	
Model			
Serial No./Machine No			
Date of Installation			
Technical Specifications			
Wattage			
Voltage input			
RPM			

SPARE PARTS SPECIFICATIONS

MAINTENANCE HISTORY

ACTIVITY	DATE	ACTIVITY	DATE

Maintenance Schedule

- a list allocating specific maintenance to a specific period
- List of planned maintenance tasks to be performed during a given time period, together with the expected start times and durations of each of these tasks.
- Schedules can apply to different time periods (eg. Daily Schedule, Weekly Schedule etc.)

MAINTENANCE SCHEDULE

Machine Name _____

Machine No./ Serial Number _____

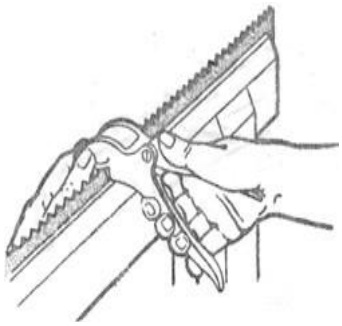
Date installed _____

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 (Thicknesser 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

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.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Sharpening of machine blades

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.

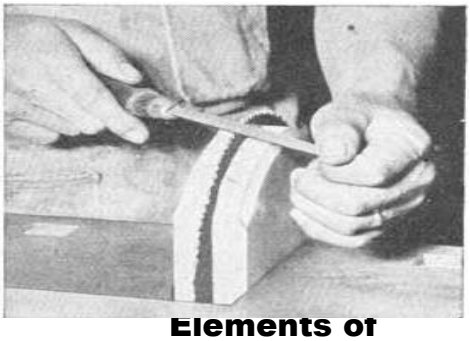
Note: arbor nut is loosened in the same direction that the saw blade rotates or by turning it in the direction the teeth are pointing

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

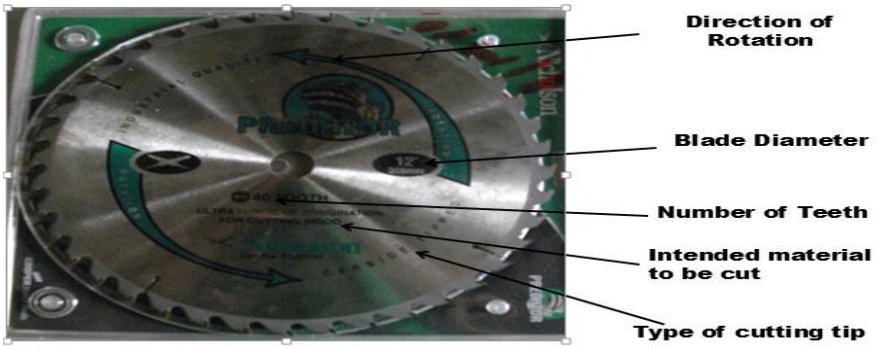
Steps 6- blades secured (clamp)

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



Operation Sheet 3	Sharpening a circular saw blade

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.

Operation Sheet 4	Replacing the circular saw blade

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

Operation Sheet 5	Changing Radial Arm Saw Blade

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

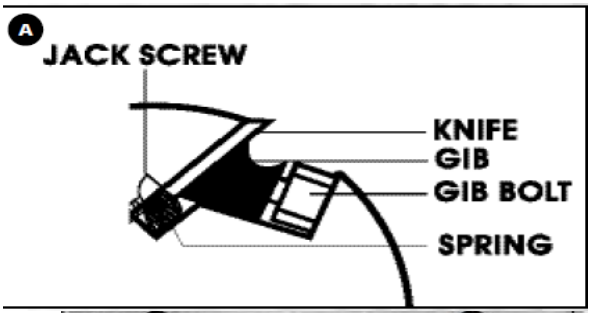
Attention!
Execute the following instructions exactly!
Always tighten the knife holder screws from the inside to the outside.

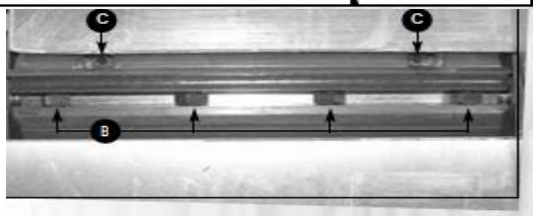
- Properly setting all three knives is essential to achieving accurate work results.
- Properly set knives will last longer and also keep their edge (sharpness) longer by equally sharing the cutting workload.
- You may use the supplied knife setting gauge to help you set the knives to the correct height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

Operation Sheet 6	Sharpening/changing the standard planer knives

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)** <u>To use the adjustment springs</u> to set the knife <u>height</u>: 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) <u>To use the Jack Screws to set the knife height</u>:
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.

Operation Sheet 7	**Sharpen the band saw blade**

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

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: _____

Short Answer Questions

LAP Test	Practical Demonstration

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 ach 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

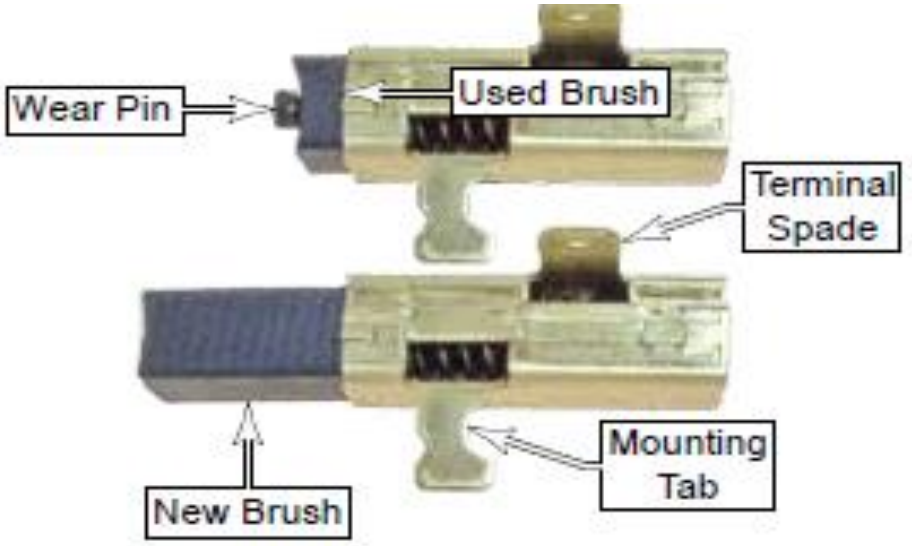
Dust and debris from some materials can be extremely abrasive and cause components within the saw to wear prematurely.

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

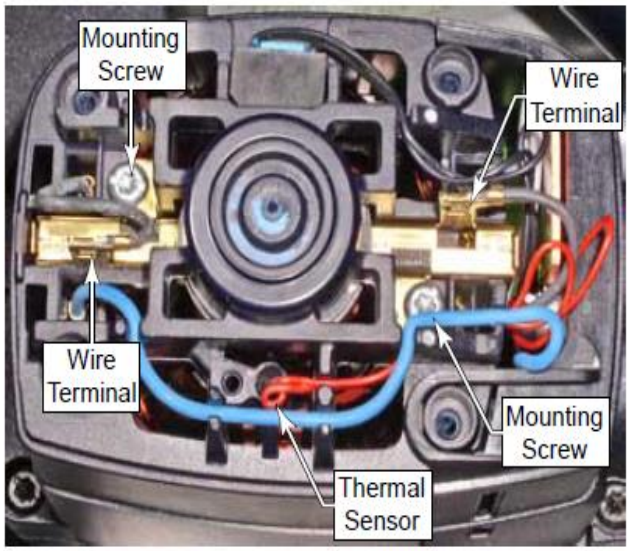
Procedure

1. Unplug the saw.
2. Remove the four screws that secure the access cover to the motor, and remove the cover.

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.

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.



Trouble shooting

Symptom	Possible Causes
Motor does not start	➢ 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	➢ 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	➢ 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

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.

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Saw will not start	1. Saw not plugged in 2. Fuse blown or circuit breaker tripped 3. Cord damaged	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	1. Positive stop not adjusted correctly 2. Bevel angle pointer not set accurately	1. Check blade with square and adjust positive stop 2. Check blade with square and adjust to zero
Material pinched blade when ripping	1. Rip fence not aligned with blade 2. Warped wood, edge against fence is not straight	1. Check and align rip fence 2. Select another piece of wood
Material binds on splitter	1. Splitter not aligned correctly with blade	1. Check and align splitter with blade
Saw makes unsatisfactory cuts	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	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	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	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	1. Sawdust and dirt in raising and tilting mechanisms	1. Brush or blow out loose dust and dirt
Blade does not come up to speed	1. Extension cord too light or too long 2. Low house voltage	1. Replace with adequate size cord 2. Contact your electric company
Machine vibrates excessively	1. Saw not mounted securely to workbench 2. Stand not level 3. Damaged saw blade	1. Tighten all mounting hardware 2. Adjust stand level to floor 3. Replace blade
Does not make accurate 45° and 90° cross cuts	1. Miter gauge out of adjustment	1. Square miter gauge to 90°

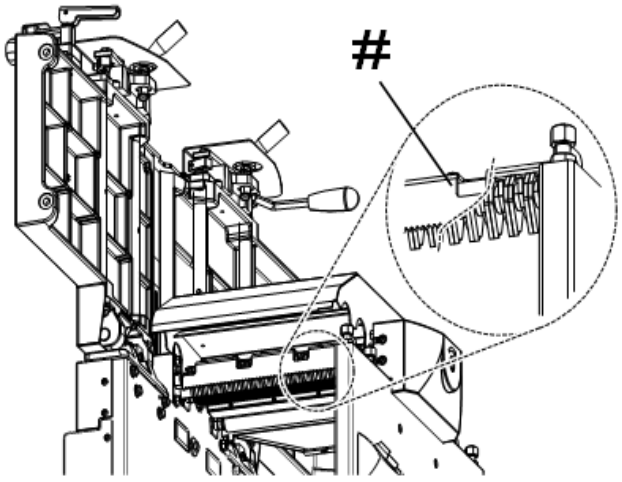
Jointer

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.

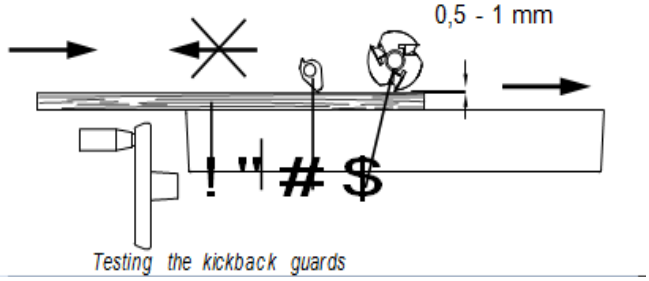
- Inspect/test the ON/OFF switch before each use. Do not operate the jointer with a

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



Testing the 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.

! 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

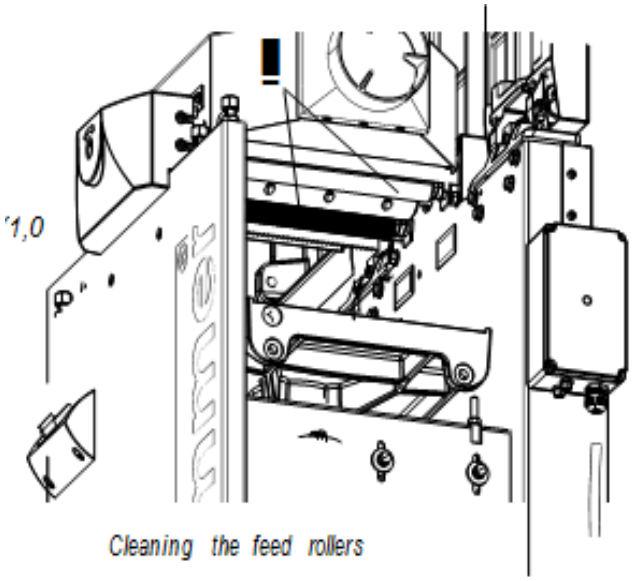
Steps 3- Check if functioning:

- 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

Cleaning the feed rollers



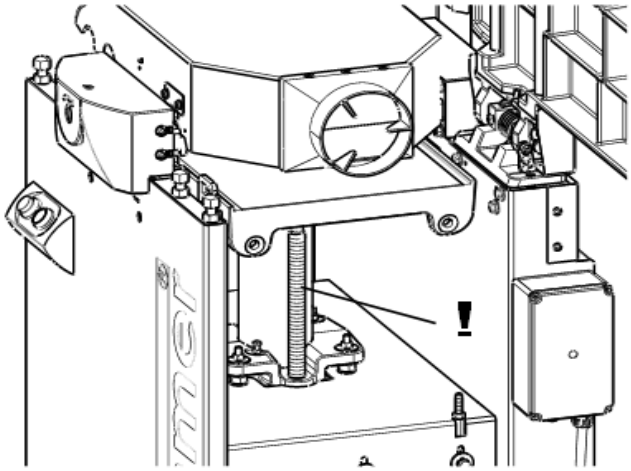
Cleaning the feed rollers

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)

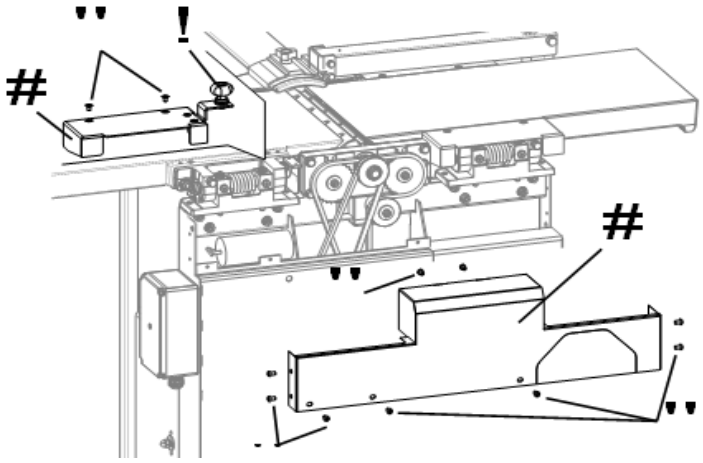


Lubricating the height spindle

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 thicknessing table all the way up
4. Clean the spindles and lubricate with regular machine grease.
5. Use the system handwheel to move the thicknessing table all the way down and then all the way back up again.
6. Clamp the clamping lever.

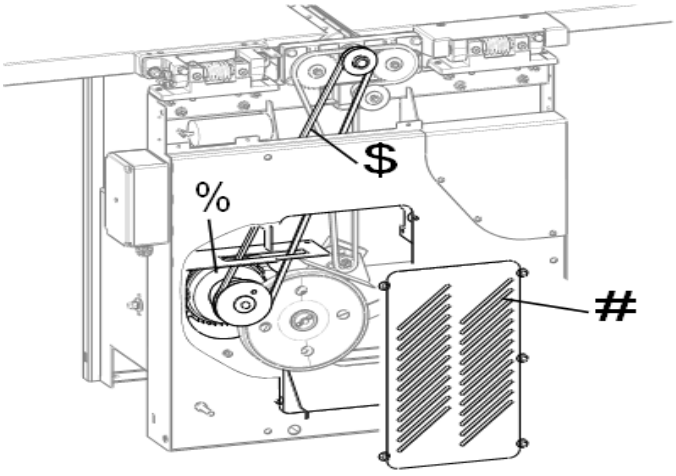
! Thicknesser table height spindle
Lubrication hole
Single-hand clamping lever

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

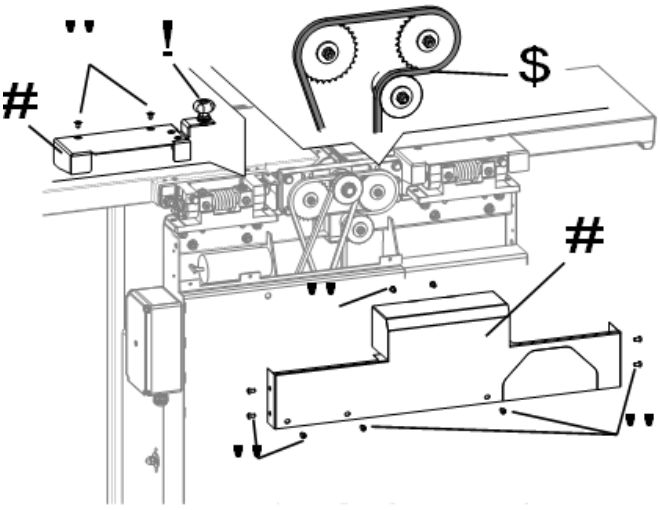
4. Loosen the nuts.
5. Remove the old drive belt

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)



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 *only* 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

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: _____

Short Answer Questions

LAP Test	Practical Demonstration

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.

OTHER 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