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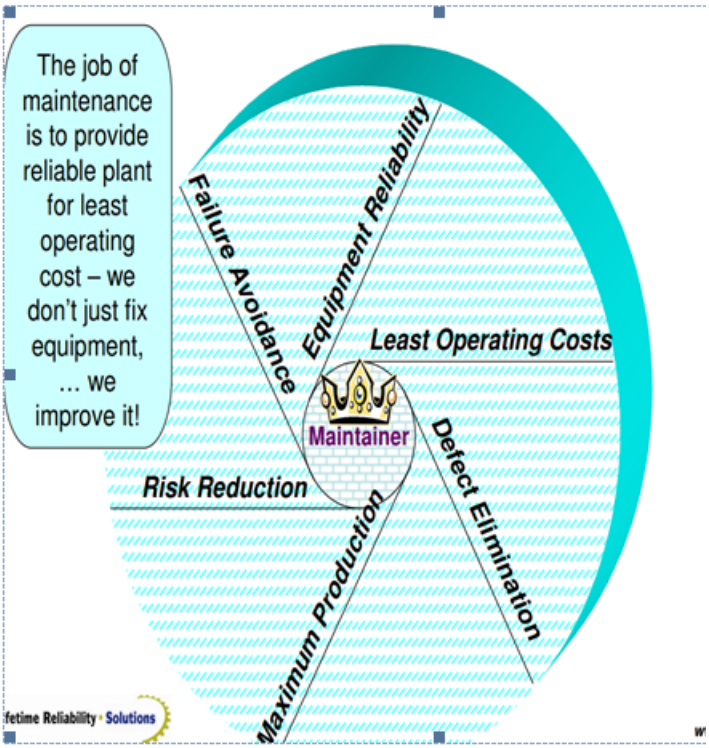
MINISTRY OF LABOR AND SKILLS

Ginning and Spinning Operation

LEVEL – II

Based on March, 2022, Curriculum Version 1



Module Title: - Performing Minor Maintenance

Module code: IND GSO2 M03 0322

Nominal duration: 40Hour

Prepared by: Ministry of Labour and Skill

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Acknowledgment

Ministry of Labor and Skills wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training and Learning Materials (TTLM).

Acronym

LAP: Learning Activity Performance

SOP: Standard Operating Procedure

OEM: Original equipment manufacturer

WHIMI: Workplace Hazardous Materials Information System

PPE: Personal protective equipment

RPE: Respiratory protective equipment

CMMS: Computerized Maintenance - Management System.

BIM: Building Information Modeling

KPIs: Key performance indicators

CBM: Embrace Condition-Based Maintenance

Introduction to the Module

The technical meaning of maintenance involves functional checks, servicing, repairing or replacing of necessary devices, equipment, and machinery, building infrastructure, and supporting utilities in industrial, business, and residential installations. Maintenance is a set of organized activities that are carried out in order to keep an item in its best operational condition with minimum cost acquired.

This module is designed to meet the industry requirement under the Ginning and Spinning Operation occupational standard, particularly for the unit of competency: **provide minor maintenance of production machines.**

This module covers the units:

- Operate machine and assess performance
- Minor machine fault,
- Clean and lubricate machine and
- Machine operation

Learning Objective of the Module

- Perform machine operate and assess
- Identify minor machine fault
- Clean and lubricate machine and
- Check out machine operation

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of module
4. Do the “LAP test” giver at the end of the module
5. Read the identified reference book for Examples and exercise

Unit one: Operate machine and assess performance

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

- Machine operation requirements
- Monitor machine operation
- Machine problem Identification and report

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

- Understand Start and stop Machine based on manufacturer requirements.
- Ensure correct procedures of Machine operation monitor to meet quality standard
- Identify and report problems of machine with quality standards

1.1 Introduction to Operate machine

Operating Machine means: controlling the working action of a machine and accepting responsibility for the observance of the manufacturing specifications of the process. This shall not be taken to mean the sole process of starting or stopping a machine. Cotton gin the meaning is cotton engine aim is a machine that quickly and easily separates cotton fibers from their seeds, enabling much greater productivity than manual cotton separation.

1.2 Machine operation requirements

- ✓ Types of Cotton Ginning machine:

Saw cotton ginning machine

Roller cotton ginning machine

Single roller ginning

Double roller ginning

Rot bar rotary knife roller ginning

Industrial Process of Cotton Ginning:

- At first, the cotton will go through dryers to reduce moisture content.
- Then the cotton is to go through cleaning equipment to remove foreign particles or materials.
- The cotton is than sent to the air conveyed to gin stands where revolving circular saws put the lint from the saw teeth by air blasts or by rotating brushes
- Then the cotton will compress in to 500 pounds weigh
- Then the bales of cotton are shipped to the textile spinning mill for further processes.
- A quality control team will monitor the overall process to ensure quality.
- Cotton ginning

1.2.1 Start and stop Machine according to manufacturer requirements.

- ✓ Start and stop any textile machinery in accordance with all safety, workplace standard operating procedures and manufacturer requirements.
- ✓ All textile machinery has its own manufacturing requirements, safety and standard operating procedures during starting and stopping the machine.
- ✓ Ginning and spinning machinery is starter and stopper in accordance with workplace standard operating procedures.

Guidelines for a sound repair program during the ginning season include:

● Make time during operation to clean during between shifts.

● Make time during or between shifts to perform inspections by competent employees trained to detect problems before they cause lengthy shutdowns.

● Perform preventive maintenance on a routine basis.

● shut down the gin (if possible) before making repairs.

● Lock out and tag out power before working on any machine, dissipate stored energy (e.g., capacitors, compressed air, or springs) and support anything that might fall.

● If the gin is shut down for a repair, have crew members not involved in the repair perform preventive maintenance elsewhere.

● Stock an adequate supply of common repair parts and materials.

● Repair the machine properly the first time.

● Maintain a log of downtime for all repairs and a log of all maintenance performed.

A dormant season repair program should enable the ginner to make repairs in an organized and thorough manner, thus minimizing in-season downtime.

Guidelines for a repair program during the dormant season include:

● Keep the gin clean and safe.

- Lock out and tag out power before working on any machine, dissipate stored energy (e.g., capacitors, compressed air or springs) and support anything that might fall.
- Consult the manufacturers' manuals or web sites for service intervals, adjustment settings, and detailed instructions.
- Spend the money to make repairs properly so that in-season downtime is minimized.
- Repair machinery that otherwise might not make it to the end of the next ginning season.
- Plan to have replacement parts and specialized repair tools(and rental equipment, if needed) on hand.

Start-up requirements

A machine should start only when its control device is moved intentionally. When it needs to be restarted after it stopped for some reason or when there is a significant change in working conditions. A machine can be restarted or configured using other devices than control elements only if does not create a hazardous situation. Starting, restarting and changing work conditions of automatically operated machines can take place without intervention. If a machine has multiple start switches and operators that might jeopardize each other, an additional element must be installed to eliminate the risk. If it is required for safety reasons that starting and/or stopping a machine must follow a certain sequence, appropriate devices must be fitted.

Stop requirements

All machines or machine parts in a system should be designed and constructed so that the stopping devices, including the emergency switch-off devices, stop the relevant machine and any other connected machine if their ongoing operation might be dangerous. Standard stop procedure each machine must have a control device that enables safe and complete shutdown. All operating areas must include a stopping device to switch off the entire machine or its moving parts, depending on the nature of the hazard, so that this machine is safe. The machine stopping function must take priority over start-up. If a machine and its moving parts and drives have stopped, it must be possible to switch off its power supply. Stopping during start-up In case it was necessary to switch off a machine during its start-up and the entire power supply cannot be disconnected, then the stopping process must be observable. Emergency stop all machines must be equipped with at least one emergency stop device for immediate switch-off to prevent a direct or a possible hazard. The exceptions are:

• If an emergency stop button does not reduce the risk due to long stopping time or it would not enable to use other necessary procedures to eliminate the hazard.

• Portable machines and/or manual machines. An emergency stop device must be:

• Equipped with identifiable, visible and easy-to-use controls.

• Able to stop and end dangerous processes as quickly as possible without introducing additional risks.

• The emergency switch-off device must be capable of executing or allowing the use of additional safety features, such as emergency lights or sound alarms. When an emergency switch-off device is activated, the command and the switch-off device have to stay active until the machine is reset. In case the switch-off device is activated, the system must sense that the stopping procedure was initiated. The emergency switch-off device should reset the system only when the appropriate procedure is used. Returning the switch off device to its original position should not restart the machine, but make it possible. The emergency stop function should always be usable and accessible, irrespective of the operating mode. The emergency switch-off device must complement other safety features, not replace them.

Figure 1 Buttons for Start and Stop Machine.

1.2.2 Basic machine maintenance and repair technique

Objectives & Benefits of maintenance

- ✓ Maximizing production or increasing facilities availability at the lowest cost and at the highest quality and safety standards.
- ✓ Minimizing energy usage.
- ✓ Optimizing the useful life of equipment.
- ✓ Providing reliable cost and budgetary control.
- ✓ Identifying and implementing cost reductions.
- ✓ Reducing breakdowns and emergency shutdowns.
- ✓ Optimizing resources utilization.
- ✓ Reducing downtime.

- ✓ Improving spares stock control.
- ✓ Improving equipment efficiency and reducing scrap rate.

What is machine maintenance?

Machine maintenance is the work that keeps mechanical assets running with minimal downtime.

Machine maintenance can include regularly scheduled service, routine checks, and both scheduled and emergency repairs. It also includes replacement or realignment of parts that are worn, damaged, or misaligned. Machine maintenance can be done either in advance of failure or after failure occurs.

Machine maintenance is critical at any plant or facility that uses mechanical assets. It helps organizations meet production schedules, minimize costly downtime, and lower the risk of workplace accidents and injuries.

Types of machine maintenance

There are 8 types of machine maintenance. Each one has its pros and cons (except reactive maintenance, which is all cons), and can be mixed and matched with assets to create a balanced maintenance program.

Reactive maintenance

Reactive maintenance refers to repairs done when a machine has already reached failure. Since it's unexpected, unplanned, and usually leads to rushed, emergency repairs, it's often called "fighting fires."

Routine maintenance

Routine maintenance consists of basic maintenance tasks, such as checking, testing, lubricating, and replacing worn or damaged parts on a planned and ongoing basis.

Corrective maintenance

Corrective maintenance is any work that gets assets back into proper working order, although it's most commonly associated with smaller, non-invasive tasks that fix a problem before a complete failure occurs.

Preventive maintenance

Preventive maintenance refers to any regularly scheduled machine maintenance intended to identify problems and repair them before failure occurs. Preventive maintenance can be split up into two predominant types: Time-based preventive maintenance and usage-based preventive maintenance.

Time-based preventive maintenance is tasks scheduled at a certain time interval, such as the last day of every month or every 10 days. Usage-based preventive maintenance is when

work is scheduled based on the operation of equipment, such as after 500 miles or 15 production cycles.

Condition-based maintenance

Condition-based maintenance depends on monitoring the actual condition of assets in order to perform maintenance when there is evidence of decreased performance or upcoming failure. This evidence can be obtained through inspection, performance data, or scheduled tests, and it can be gathered either on a regular basis or continuously, through the use of internal sensors.

Breakdown maintenance

It means that people waits until equipment fails and repair it. Such a thing could be used when the equipment failure does not significantly affect the operation or production or generate any significant loss other than repair cost.

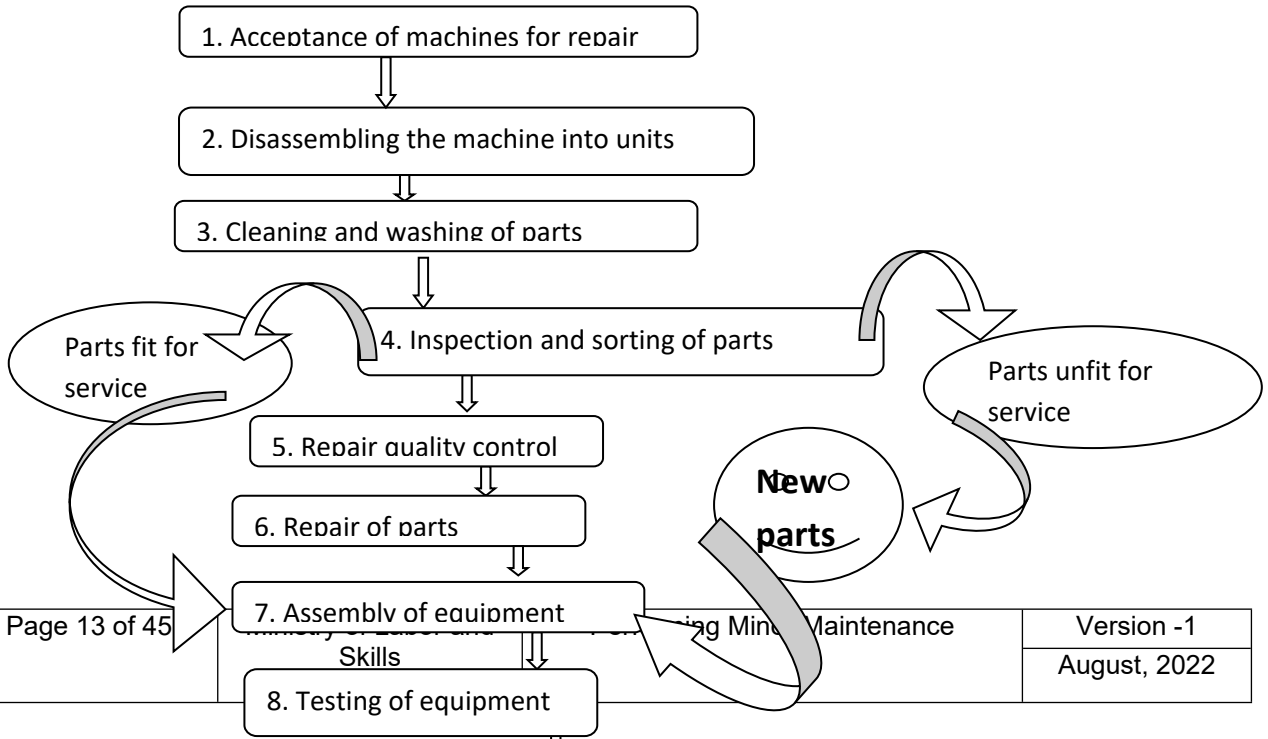
Predictive maintenance

Predictive maintenance builds on condition-based maintenance, using tools and sensors to track machinery performance in real-time. This enables the identification of potential problems so they can be corrected before failure occurs.

The 6 purpose of maintenance

Figure 2 purpose of maintenance

1.2.3 Acceptance and procedure of equipment repair system



1.3 Monitor machine operation

Machine monitoring is a systematic process of recording condition data from any machine with a goal to assess its performance and determine its health. Machine monitoring provides a reliable, consistent and high-quality stream of data to operators, maintainers, and engineers/designers

The data can be used in a variety of ways,

1. Data retrieval

Depending upon the complexity of the machine, the data collection process could range from simple observations made by a machine inspector up to a network of advanced sensors that automatically collect complex information about the subsystems and components of the machine.

A few other examples of data that can be recorded include,

Machine status:

Product attributes:

Quality data:

Reliability and availability data:

Maintainability data:

Energy consumption:

2. Data transfer

The magnitude of collected data can be overwhelming if not organized and stored in a secure place. To enable consistent interpretation and meaningful analysis, the real-time data has to be neatly and safely stored.

3. Data analysis

Once the data is collected and stored, it has to be analyzed to derive meaningful insights. The analysis is often performed automatically by predictive algorithms. They are written to

analyze the incoming data and compare it with baseline and historical information to estimate future performance.

Benefits of machine monitoring systems

There are many benefits of sampling and understanding machine performance and condition data:

- Improved response time:
- Inventory and resource optimization.
- Refined maintenance schedules:
- Automatic data collection: Manual
- Precise operations: Improved machine performance:
- Machine replacement and renewal decisions

Steps for implementing a machine monitoring system

1. Identify your requirements
2. Define the process
3. Prototype a solution
4. Verify and validate
5. Deploy at full scale

The success and profitability of a ginning operation is determined by the effectiveness of its machinery maintenance program. A comprehensive gin maintenance program impacts safety, fiber quality, daily and annual volume, downtime, energy costs, and maintenance costs (material and labor).

A good gin maintenance program involves continual documentation, communication, and planning. Each employee must communicate the needs and benefits of the program. The office worker compiling the repair and downtime data, the gin crew performing the preventive maintenance and cleaning the gin, the ginner troubleshooting problems and operating the gin, the superintendent troubleshooting problems and planning repairs, and the gin manager overseeing the entire operation while satisfying the customers' needs of timely, quality ginning, all must become part of the gin repair process.

A comprehensive gin maintenance program has four basic components:

1. A sound maintenance philosophy
2. Problem and repair documentation and guidelines
3. A dormant season repair program
4. A preventive maintenance and in-season repair program.

Guidelines for a sound repair program during the ginning season include the following:

1. Keep the gin clean and safe.

2. Perform inspections by competent employees trained in detecting problems before they cause lengthy shutdowns.

3. Perform preventive maintenance (P.M.) on a routine basis.

4. Shut down the gin (if possible) before making repairs.

5. Take time to think about how to do the repair safely.

6. Have the crew perform P.M. work elsewhere if the gin is shut down for a repair.

7. Have an adequate supply of parts on hand for repairs.

8. Repair machinery properly the first time.

9. Maintain a log of downtime for all repairs and a log of maintenance performed.

Guidelines for a repair program during the dormant season include the following:

1. Keep the gin clean and safe (lock out power to a machine before working on it).

2. Follow the manufacturer's specifications when repairing machinery.

3. Spend the money to make repairs properly so that seasonal downtime is reduced.

4. Repair machinery that might otherwise not make it through the season.

5. Plan ahead to have repair tools and parts on hand.

The success of a ginning operation is determined by how efficiently the cotton is ginned. The gin should be properly repaired and ready to operate at maximum efficiency with minimum downtime. The basic principle of P.M. is the reduction of downtime through the scheduling of routine maintenance and repairs. Preventive maintenance will reduce repair costs while increasing daily production. Repair costs are reduced by doing small repairs on the machinery before larger problems occur as other components are impacted.

The larger problems require more downtime and cause more expensive repairs. Preventive maintenance should be scheduled once during each operating shift. After the initial training period, the ginner will be able to concentrate on specific repair problems needing specialized attention. If a problem is discovered during the P.M. period, the problem should be corrected immediately. If the parts or necessary pieces of equipment are not available to repair the machinery immediately, the parts should be ordered and the repair scheduled for the next P.M. period. P.M. is an ongoing process, and the procedures to be followed depend partly on the period of gin operation.

1.4 Identify and report problems of machine with quality standards

There are certain objectives of machine problem identification:

(I) Prevention of future failure events

(ii) Assurance of safety, reliability, and maintainability of machineries

Cotton-gin repairs are in the interest of both cotton growers and ginners, since they are important in economy of operation and in preserving the inherent quality of the seed cotton and frequently afford opportunities to modernize the ginning establishment.

Better quality of the ginned products, increased capacity, improved performance of the ginning outfit, and lower cost of operation are among the benefits resulting from the prompt repair and adequate maintenance of the ginning equipment by problem identification. Thus, for example, losses in the monetary value of the ginned lint from brushes in poor condition have averaged from 80 cents on short-staple to as much as $1.50 on damp long-staple cottons. Replacing worn brushes has decreased ginning time 7 to 10 percent. Losses from air-blast nozzles improperly adjusted have averaged as much as $1 a bale on long-staple cotton ginned in a moist condition. Losses to the farmer from ginning with gin saws in poor condition have averaged $2 a bale with long-staple cottons and at the same time ginning was 25 percent slower than it would have been if the saws had been in good condition.

An overhaul of gin saws was needed in more than one-fourth of the 500 representative gins surveyed by the laboratory in 1940. When making these needed repairs is a good time to make changes necessary to speed up slow saw cylinders. This can be done to advantage in the older gins operating their saws at or below 500 revolutions per minute and which constitute approximately 45 percent of the gins in the Cotton Belt. Similarly, repair and maintenance of conveyors and distributors in many cases may lead to steps for providing pure seed- handling systems. At present, only a small percentage of all cotton gins in the United States are so equipped. Check-ups on shafting, bearings, and drives opened the way to brush repairs needed in over one-third of the gins and rib repairs in almost one-third of the gins inspected.

In repairing gins, a good plan is to systematically check all important elements of ginning along the route over which the cotton passes.

Checking Pneumatic Cotton-Handling Equipment

For delivering seed cotton to storage bins, well planned piping and Robert-type fans utilize only 10 horsepower from either a motor or internal-combustion engine. Suction piping to such a fan should not be larger than 11% or 12 inches in diameter, with a round-nose telescoping pipe for effective introduction of seed cotton into the air line, and the discharge piping from the fan should be 1 inch smaller in diameter. Overhead swing pipes from central pivots or series of outlets give delivery to a maximum number of bins with minimum valuing. For removal of seed cotton from storage, the suction piping may be either overhead or under the floor; but in any case, it should be kept in first-class condition and all unused openings madoairtight with good covers. Economical pneumatic cotton-handling equipment comprises

relatively small pipe, simplicity of layout, and use of the Robert-type fan or the improved cone-type Robert fan developed by the United

COTTON-GIN MAINTENANCE

The entire system should be as nearly airtight as possible.' These fans may be combined with drying systems for delivery of seed cotton to the gins by various methods, with or without suction separators; or installed to use old separators of different kinds by conversion from suction to blow-box units, retaining the vacuum wheel, if any to act as dust seals. For conventional separator systems, suction and seed-blow piping in three- or four-stand outfits should not exceed about 10 1: inches in diameter.

To save power and simplify the ginning equipment, belt distributors are now being frequently replaced with screw-conveyor distributors.

In the repair of existing belt distributors the alignment of the distributor box is very important to prevent fires and undue wear of the pulleys, and special care is needed to prevent distributor-belt spikes from becoming loose and dropping off into the machinery.

Bearings need periodical repacking and testing for wear. Trash conveyors from feeders should be shortened and simplified as much as possible. Driers require inspections to keep their radiators and cotton passages in good condition with smooth surfaces, tight joints, and freedom from choke in screens.

Reporting for identified machine problems

Fault Reporting is a maintenance concept that increases operational availability and that reduces operating cost through three mechanisms.

- Reduce labor-intensive diagnostic evaluation
- Eliminate diagnostic testing down-time
- Provide notification to management for degraded operation

Maintenance requires three actions.

- Fault discovery
- Fault isolation
- Fault recovery

Self-check-1

Test-I Choose

Instruction: choose the best answer for the give choice. You have given 1 Minute for each question. Each question carries Point.

1. Maintenance require four action

   A true B false

2. It means that people waits until equipment fails and repair it.

A. Breakdown maintenance B. Predictive maintenance

C. Condition-based maintenance D. all

3. Which one is Cotton Ginning Machine?

A. Saw cotton ginning machine B. Single roller ginning

C. Roller cotton ginning machine D. all E. none

Test II: short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has Points.

1. What is Machine operation?
2. Write down at least five objective and benefit of maintenance
3. What is the difference between preventive and corrective maintenance?

Part III: long answer writing

Direction: Give **long** answer to the following questions. Time allotted for each item is 5 minute and each question carry point.

1. What is the difference between start up requirement and stop requirement
2. Write the types and purpose of maintenance
3. Guidelines for a sound repair program during the ginning
4. What are the important elements of ginning need checking
5. Show the acceptance repairing process of machine

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

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

Unit Two: Minor machine fault,

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

- Minor machine and associated equipment and tool faults
- Identification and documentation of major machine or product faults
- Machine maintenance records and other documentation

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

- Analysis minor machine and associated equipment and tool faults.
- Identify and document major machine or product faults
- Records and document at minor machine maintenance fault

2.1. Introduction

Machine fault problems are broad sources of high maintenance cost and unwanted downtime across the industries. The prime objective of maintenance department is to keep machinery and plant equipment in good operating condition that prevents failure and production loss. If the department organizes a predictive maintenance program, this goal as well as cost benefits can be achieved, while accurate information at the right time is a crucial aspect of a maintenance regimen. Machine fault identification can be done with different methodologies as vibration signature analysis, lubricant signature analysis, noise signature analysis, and temperature monitoring, with the use of appropriate sensors, different signal conditioning, and analyzing instruments.

2.2. Minor machine and associated equipment and tool faults Identification

Condition monitoring is taken to mean the use of advanced technologies in order to determine equipment condition, and to predict potential failure. It includes, but is not limited to, technologies such as

Visual inspection, visual monitoring can sometimes provide a direct indication of the machine's condition without the need for further analysis

Vibration measurement and analysis, Vibration signals are the most versatile parameters in ma-chine condition monitoring techniques.

Temperature monitoring, Temperature monitoring consists of measuring of the operational temperature and the temperature of component surfaces.

Acoustic emission analysis, Acoustic emission refers to the generation of transient waves during the rapid release of energy from localized sources within a material.

Noise analysis, Noise signals are utilized for condition monitoring because noise signals measured at regions in proximity to the external surface of machines can contain vital information about the internal processes, and can provide valuable information about a machine's running condition.

Oil analysis /Wear debris analysis, Examination of the oil, any particle it has carried with it, allows monitoring of the machine on load rat shutdown.

Nondestructive testing the principle of nondestructive testing (NDT) is to be able to use the components or structure after examination. The inspection should not affect the item involved, and must there-fore, be nondestructive.

A minor fault is likely to be able to be fixed or repaired. *Minor Fault* means a fault that requires minimal capital equipment such as blown substation LV fuse, jumper cut, blown aerial fuse etc.; Mino Fault. A failure or function degradation of any part of Game (and/or its integration with the Ladbrokes System), that is not a Material Fault and which constitutes non-compliance with the Specification and/or which impacts on a Customer's experience of the Game;

Machine problem/fault identification can be done with different methodologies

- Vibration signature analysis method
- Lubricant signature analysis method
- Noise signature analysis method
- Temperature monitoring method with the use of appropriate sensors, different signal conditioning, and analyzing instruments.

Vibration signature analysis Techniques for machine fault identification is the most popular among other techniques.

Vibration monitoring is based on the principle that all the system produces vibration. When a machine is operating properly, the vibration is small and constant, however, when faults develop and some of the dynamic process in the machine changes, there will be changes in vibration spectrum observed.

Modern manufacturing plants are highly complex. Failure of process equipment's and instrumentation increased the operating costs and resulted in loss of production. Undetected or uncorrected malfunctions can induce failures in related equipment's and, in extreme cases, can lead to catastrophic accidents. Early fault detection in machines can save millions of dollars on emergency maintenance and production-loss cost.

Necessity of Machine Fault Identification

Machine fault can be defined as any change in a machinery part or component which makes it unable to perform its function satisfactorily or it can be defined as the termination of availability of an item to perform its intended function. The familiar stages before the final fault are incipient fault, distress, deterioration, and damage; all of them eventually make the part or component unreliable or unsafe for continued use

What Is the Solution to Equipment Failure?

Equipment can be unpredictable, and failure happens. People make mistakes, parts get old, and sometimes preventive maintenance is just the one thing too many in an already busy day. But by ensuring adequate operator training, running preventive or condition-based maintenance at the right time, and working towards a better overall culture, you'll have a much better shot at keeping your equipment running in tip-top shape.

Here are a few tips to prevent or minimize equipment failure:

- Provide Adequate Operator Training:
- Develop an Effective PM Strategy:
- Perform Regular Inspections
- Embrace Condition-Based Maintenance (CBM):
- Invest in Maintenance Management Software

Equipment purpose built and general test or inspection equipment related to the particular requirements:

- Balance,
- Strength tester
- Hank maker,
- Oster tester

- Micronaire value tester
- Fibro test

Ginning machine part

- Feeder system
- bale press
- Gin stand
- air and drying system
- Seed cotton cleaners
- Lint cleaner
- Battery condenser

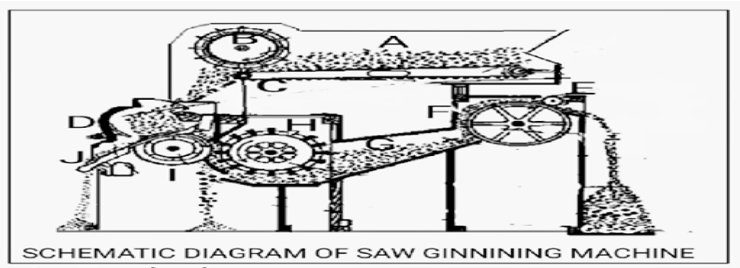


Figure 3 saw ginning machine diagram

Pre-spinning machine

- Bale pucker
- opener
- blender
- card
- roving frame
- comber
- draw frame (breaker and finisher)
- lap former

Spinning Machines

- Rotor spinning (open end)
- ring spinning (ring frame)
- Friction spinning and others spinning wheel

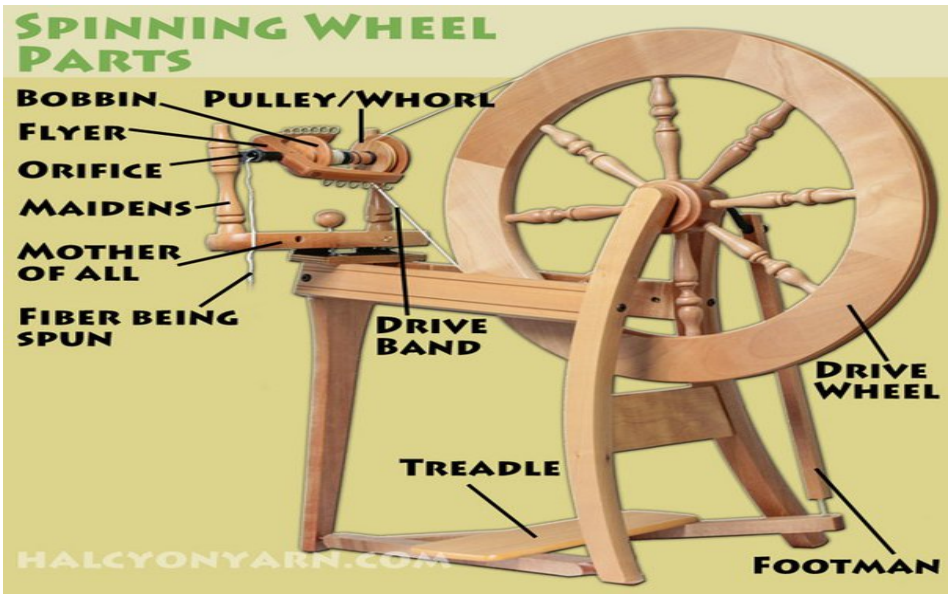


Figure 4 spinning wheel parts diagram

Post-spinning Machines

- Winding machine
- assembly winding (plying)
- Twister
- Yarn steamer
- Hank reeling machine

Faults in Ginning Process of Cotton

Gin-cut fiber	Crushed seeds
Neps formation	Too much wastage

2.3. Identification and documentation of major machine or product faults

Machine fault diagnosis

Machine fault diagnosis is a field of mechanical engineering concerned with finding faults arising in machines. A particularly well developed part of it applies specifically to rotating machinery, one of the most common types encountered. To identify the most probable faults leading to failure, many methods are used for data collection, including vibration monitoring, thermal imaging, oil particle analysis, etc. The results of this analysis are used in a root cause failure analysis in order to determine the original cause of the fault. Diagnosing the bearing's damaged state is not enough for precision maintenance purposes. The root cause needs to be identified and remedied. If this is not done, the replacement bearing will soon wear out for the same reason and the machine will suffer more damage, remaining dangerous. Of course, the cause may also be visible as a result of the spectral analysis undertaken at the data-collection stage, but this may not always be the case.

Cotton-gin repairs are in the interest of both cotton growers and ginners, since they are important in economy of operation and in preserving the inherent quality of the seed cotton and frequently afford opportunities to modernize the ginning establishment.

Better quality of the ginned products, increased capacity, improved performance of the ginning outfit, and lower cost of operation are among the benefits resulting from the prompt repair and adequate maintenance of the ginning equipment.

When making these needed repairs is a good time to make changes necessary to speed up slow saw cylinders. This can be done to advantage in the older gins operating their saws at or below 500 revolutions per minute and which constitute approximately 45 percent of the gins in the Cotton Belt. Similarly, repair and maintenance of conveyors and distributors in many cases may lead to steps for providing pure seed- handling systems. Check-ups on shafting,

bearings, and drives opened the way to brush repairs needed in over one-third of the gins and rib repairs in almost one-third of the gins inspected.

In repairing gins, a good plan is to systematically check all important elements of ginning along the route over which the cotton passes.

- checking pneumatic cotton-handling equipment
- cotton-gin maintenance
- inspecting drying, cleaning, and feeding equipment

The 4 Causes of machine and Equipment Failure/fault

1. **Aging Equipment**

According to the 2019 Plant Engineering Maintenance Study, aging equipment is the leading cause of equipment failure, accounting for 40 percent of unplanned downtime in plants.

Assets that consistently run year after year require more frequent repairs over time. Unfortunately, this natural deterioration translates to more money spent on parts, shipment fees, and production interruptions. It also requires technicians to shift from practicing preventive maintenance (PM) to reactive maintenance more frequently.

2. **Operator Error**

Another common cause of equipment failure is operator error. Both fortunately and unfortunately, human beings aren't machines! Consequently, we sometimes make mistakes due to fatigue or forgetfulness. Most plants prepare machine operators to properly run complex pieces of equipment with educational training, accessible standard operating procedures (SOPs), and clear communication channels. However, it's not unheard of for workers to occasionally work on unfamiliar machines when filling in for others.

For example, maybe the machine operator who typically runs the machine had to take care of an emergency. As a result, someone asked an untrained worker to temporarily step in. Not only could the worker's lack of specialized knowledge result in an equipment breakdown, but it could also cause an accident.

3. **Lack of Preventive Maintenance**

There's a reason why world-class maintenance programs predominantly practice preventive maintenance: it works to decrease downtime! Studies suggest PM programs can reduce

equipment failure by as much as 45 percent. Ultimately, organizations that solely practice run-to-failure miss out on solving minor issues before they become big problems.

4. **Over-Maintenance**

On the other hand, performing too much maintenance can also be detrimental. Though less common, over-maintenance can speed up an asset's depreciation. Constantly taking apart and reconfiguring equipment components can disrupt even the most stable systems, causing them to become less effective.

2.4. Machine maintenance records and other documentation

Maintenance records are written notes that provide documentation about the upkeep of a certain piece of equipment. Maintenance documentation is any record containing information that you might need to complete maintenance tasks and inspections. It tells you what you have, shows you how to maintain it, and has records of all your past work. Maintenance documentation is your collection of records that help you complete maintenance work. It's how you know what you have, how to look after it, and what work you completed so far. So, the first category can include asset serial numbers, images, CAD and BIM files, warranties, insurance policies, and information on your maintenance team, including certificates and trade seals. For the second, you have SOPs, preventive maintenance schedules, checklists, and manuals. In the third, there are closed-out work orders, reports, and KPIs. All of this information is vital to your operations, and you can think of it collectively as a map that shows you where you've been, where you are now, and how to get to your goals. To ensure your documents are both safe and accessible, you need a modern CMMS solution. Because everything lives in a central database and your provider takes care of all the back-ups and updates, you never have to worry about losing or losing access to your maintenance documentation.

In this situation, the maintenance documentation includes:

Maintenance request Assigned work order Equipment manual Equipment warranty Completed work order. Each piece of documentation plays an important role in the process. Without it, the maintenance lead wouldn't know there was a problem, the tech wouldn't have known how to fix it, and later, no one knows what the tech did.

What are the different types of maintenance documentation?

Although there are many types, they all tend to fall into one of three broad categories: what you have, what you do and how you do it and what you did.

What you have

Here, you can include documents that describe your assets and equipment, including: Serial numbers CAD and BIM files Schematics Images Warranties Insurance policies You can also include here all the documents that tell you who you have in the maintenance team, including certificates for training and trade-specific seals.

What you do, how you do it

Here, you have all the documents that explain how to look after your assets, including: Original equipment manufacturer (OEM) manuals Checklists for inspections Step-by-step instructions Standard operating procedures (SOPs) General policies and procedures Preventive maintenance schedules Because safety is so important, it can be its own subcategory, and include: Safety-specific policies and procedures Lock out/tag out policies Workplace Hazardous Materials Information System (WHIMIS) OSHA documentation Depending on your location, you might also add workers' compensation documents.

What you did

And here, it's all the documents related to the work completed by the maintenance team as well as any third-party vendors. You can include: Maintenance requests Work orders Maintenance metrics Key performance indicators Reports Work orders have many documents inside them, including notes and images created by the technician.

Why is maintenance documentation important?

Passing audits often comes down to how well you can answer these questions:

Do you have a process in place? Did the team follow your processes? If they followed them, when did they do the work? If you have SOPs and the team is following them, when's the last time you updated them?

Now that we know what it is and why it's important, we can answer the next question:

What's the best way to keep it safe and make it accessible?

Self check-2

Test-I Matching

Instruction: select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

A	B
----1 minor fault	A. Operator Error
--- 2 bale pucker	B. Ginning machine part
----3. Crushed seeds	C. Faults in Ginning Process
----4. Causes of Equipment fault	D. able to be fixed or repaired
----5. Seed cotton cleaners	E. Pre-spinning machine
	F. spinning wheel

Test II: short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has 5Points.

4. Define maintenance records and documentation?
5. Describe tips to prevent or minimize equipment failure?
6. Write Necessity of Machine Fault Identification?
7. Define Machine fault diagnosis

Part III: Long answer writing

Direction: Give long answer to the following questions. Time allotted for each item is 2mniut and each question carry 4 point.

6. What are the different types of maintenance documentation?
7. Briefly discuss Causes of machine and Equipment Failure/fault?
8. Write the prime objective of maintenance and consequence of Machine fault problems?
9. Discuss briefly minor machine and associated equipment faults Identification?

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

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

Unit Three: Clean and lubricate machine

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

- Machine cleaning

3.1 Introduction

- Lubricating machine

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

- Apply machine cleanse
- **Schedules machine lubricate**

The cotton ginning industry, like other processing industries, has many hazards. While the industry has been active in hazard reduction and safety education, gin safety remains a major concern. The reasons for the concern include the high frequency of accidents and workers' compensation claims, the large number of lost work days, and the severity of the accidents.

3.2. Machine cleaning

3.2.1 OHS practice

- **Manual handling**

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

- **Personal protective equipment (PPE)**

PPE should only be used to protect workers as a last resort and in addition to other controls where it isn't reasonably practicable to fully control the dust by other means. Take care when choosing PPE and make sure that it is appropriate for the work. PPE should be used properly and maintained in good condition.

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

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

Respiratory protective equipment (RPE) may be needed for short-duration jobs, such as filter changing. RPE should be carefully selected to provide adequate protection. It needs to be suitable for the wearer as well as for the task. Correct fitting is important and suppliers can

help by offering face-fit testing. Beards and stubble growth prevent a good fit and facemask type respirators cannot be used in these circumstances. Where suitable for the wearer, disposable respirators giving protection against fine particulates.

Standard operating procedures

Standard operating procedures (SOPs) are a set of instructions that have been developed to define or standardize the exact steps to perform specific tasks. These steps have been found to provide consistent, repeatable results regardless of who is performing the task. Controlling costs and assuring quality are keys to being successful in any business. SOPs help accomplish both of these objectives.

In manufacturing, SOPs should be in-place for:

- Equipment startup and operation
- Equipment set up and change over
- Product assembly
- Inventory tracking
- Material ordering
- Material receiving
- Maintenance procedures
- Material processing (e.g., mixing, batching)
- Quality control
- Any business or process step that needs to be controlled

❖ **Housekeeping**

- **Containers -** use robust containers with a closable lid for storage. However, repeated removal and replacement of container lids and opening and closing of bags can also generate more dust. Plan to dispose of containers safely. Bags especially can cause problems and are best placed into disposal sacks at the workstation, under LEV. Also plan how you will deal with damaged containers and how to dispose of unwanted dyes.
- Areas where dyes are handled should be easy to clean, with walls and floors that are sound and smooth. Rounded corners are easier to clean. Shelving and workbenches should be easy to clean too or else covered with impervious, disposable covering. They should have a lip to retain spills.

- Cleaning and dealing with spillages - dry vacuum cleaning, using a piped system or a type H industrial vacuum cleaner, is best for larger dry spillages and most cleaning tasks. Wet vacuuming or other wet cleaning methods may be appropriate in some situations or for smaller spillages. Don't use brushes or brooms or compressed air, as these will simply spread the dust into the air.

Ergonomic arrangements of work places

Definitions of ergonomics

- ✓ Ergonomics is a means of improving working conditions and reducing illness at work
- ✓ Ergonomics attempts to 'Fit the Job to the Man' rather than 'Fit the Man to the Job'
- ✓ Ergonomics is concerned with the design of systems in which people carry out work
- ✓ Ergonomics optimizes Efficiency, Health, Safety and Comfort of people through better designs of products and work places

Basic aims of ergonomics

Efficiency in purposeful activity

To achieve desired result without

- ✓ Waste
- ✓ Error
- ✓ Damage to persons

Working situation in harmony with the activities of the worker

Hazard identification

The Plant Regulations require employers not to depend solely on the use of administrative controls (e.g. training, safety procedures, safety signs, supervision) or personal protective equipment (e.g. safety gloves, safety glasses) to control risk unless the following are not practicable measures:

- ► Substituting the machine with one which has a lower level of risk; or
- ► Use of engineering controls to change the physical characteristics of the machine to eliminate or reduce risk; or
- ► Isolation of the machine from people.

The Plant Regulations require employers to consult with the relevant health and safety representative when undertaking hazard identification, risk assessment and risk control processes.

Employers should also involve machine operators, people who carry out inspection, maintenance, repair, service and cleaning of machines in those processes. They are valuable

source of information on hazards and measures for controlling risks because of their day to day experience.

Hazard identification

Work Safe Victoria's publication "Plant Hazard Checklist" can be used to identify hazards associated with machines for use in your workplace. This is available from Work Safe publications.

To help identify areas of the machine which can cause injury or illness, look for:

Mechanical hazards:

- ✓ "drawing in" points
- ✓ impact and crushing areas
- ✓ abrasion areas
- ✓ flying particles

Non-Mechanical hazards:

- ➢ electrical shocks and burns
- ➢ chemical burns, toxicity, flammability
- ➢ noise, vibration
- ➢ radiation
- ➢ biological hazards, viral mist, dust, fumes

Assessing Risks

Once the potentially dangerous areas of the machine are identified, the risk (likelihood of injury or illness) associated with those areas should be assessed by considering: whether any person (workers and visitors) would be exposed to those areas during installation, commissioning, erection, operation, inspection, maintenance, repair, service and cleaning of the machine; what existing measures are in place to protect the health and safety of people who may be exposed; and how adequate the existing measures are for protecting the health and safety of people who may be exposed.

Controlling Risks

If there is a likelihood of injury or illness associated with certain areas of the machine when all existing control measures are considered, the Plant Regulations require employers to eliminate or reduce the risk so far as is practicable by adopting the hierarchy of control as outlined in the Background section.

Provision of appropriate guarding for danger areas of a machine is a form of engineering control designed to:

- ✓ prevent access to the danger areas of the machine; or

- ✓ contain flying particles generated from the materials which the machine processes; or
- ✓ contain work pieces ejecting or disintegration of machine parts

Environmental practices

Environmental practice is critical issues in all manufacturing and service provider companies. Now a day in order to build sustainable and conductive environment textile sectors play a great roles by reducing pollutant chemicals and waste products/materials

Environmentally friendly means: not harmful to the environment. Eco-friendly is a term usually used for not harmful to the environment – used especially about products, we always try to use eco-friendly cleaning products. Eco-friendly coffins made from news papers

The worldwide production of textiles needs to focus more strongly on the areas of sustainability and environmental protection in future. Transparency, staff training and the regular recording of environmental data are important prerequisites for sparing the environment and achieving financial success at the same time.

3.1.2 Cleaning and washing of parts.

• After they have been disassembled the parts are cleaned and if required washed. Large- size parts (stands, Frame. Works) are cleaned with hand and mechanized brushes or by blowing with compressed air or by means of an industrial type vacuum cleaner.

• Interior threads in these parts are cleaned with a brass wire bent as a loop with loose pointed ends.

• Cleaning of small parts by scrapers, hooks, and rags is inefficient and of low quality.

In this case it is more expedient to use special cleaning devices and brushes.

• Steel and cast iron parts are cleaned by metal brushes of low carbon steel wire, while for brass parts brushes of brass wire are to be used.

• Brushes of fiber cord or other synthetic materials are used for cleaning the parts from burrs and small rust as well as for eliminating dirt remained after washing.

• The cleaning efficiency may be two or three times increased by using an electric polishing machine with an induction high- frequency motor which is provided with a metal brush.

• using an electric polishing machine the impurities are destroyed by electric discharge and mechanical action of the brush.

Washing procedure

Washing and cleaning of parts should be carried out in special solutions. The parts are placed on a grate of a bath or pan.

1. Washed in kerosene or immersed in soap solution. (25 g of soap per liter of water)
2. Treated for several hours in a solution containing 45% kerosene, 35% of turpentine and 20% industrial ammonium hydroxide
3. Washed with clean kerosene and wiped with cotton rag.

For instance washing steel and cast iron is used alkaline solution heated to 70-800C and having the following composition (g / liter):

Sodium hydroxide	10
Soda ash	7.5
Sodium phosphate	13
Soap	2

4. Parts are rinsed with hot water to avoid corrosion and to eliminate the remaining alkali. Washing of small parts in mass production is carried out in tanks and tubes of different design using kerosene or other washing liquids.

3.3. Lubricating machine

3.2.1 Principles of lubrication

Whenever the surfaces of two bodies are in contact, the force of friction will resist relative motion between them. The operation of almost all industrial equipment relies on the relative motion of separate machine elements and lubrication is necessary to overcome the effects of the friction forces. To lubricate means 'to make smooth and slippery', and thus the application of a lubricant helps to reduce the effect of friction. Friction causes energy to be wasted in the form of heat and causes the rubbing surfaces to wear. The introduction of a lubricant separates the surfaces in contact and thus reduces the effects of friction although friction can never be entirely eliminated.

The basic purposes of lubrication are to:

- Reduce friction
- Reduce wear
- Dampen shock

- Cool moving elements
- Prevent corrosion
- Seal out dirt

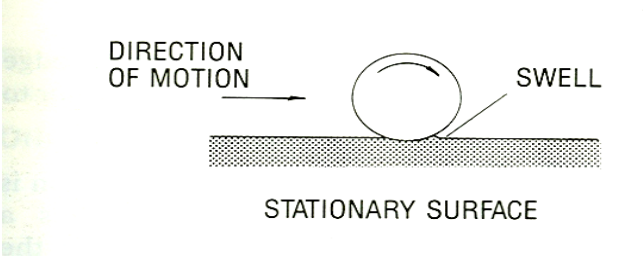


Figure 5 Rolling friction.

3.3.2 Lubricant selection

The selection of a lubricant is determined by the following factors:

Load: The load on the bearing will determine the pressure that the lubricant will have to work against.

Speed: As operating speeds increase the lubricated surfaces will tend to wear faster.

Temperature: The operating temperature may affect the properties of the lubricant.

Environment: The lubricant may be required to cope with the presence of water or corrosive materials. Lubricant selection should normally be left to those who are expert in the field. However, as a general rule it is worth remembering that for plain journal bearings:.

- ✓ For light loads and high speeds - use a lubricant of low viscosity; and.
- ✓ For high loads and low speeds - use a lubricant of high viscosity.

The decision of whether to use oil or grease as the lubricant will depend on the operating conditions. The following comparative advantages should be taken into account:

Oil: provides cooling; feeds more easily and can be fed from a central supply; washes away dirt can also lubricate other elements such as gears absorb less torque

Grease: allows simpler bearing designs; provides better sealing against dirt; is easier to contain and seal allows longer periods without attention.

3.3.3. Methods of application

The golden rule of lubrication is said to be: 'Good lubrication depends on the right lubricant being available in the right quantity at the right time.' For this to be achieved the technician must be aware of a number of basic principles governing the application of lubricants.

- ✓ Cleanliness is vital. Lubricating equipment must be kept free of dirt and other contaminants.
- ✓ Lubricants are not necessarily interchangeable and as a general rule should not be mixed. Before changing lubricant the equipment should be cleaned out.

- ✓ An excess of lubricant, especially grease, will cause excessive heat to build up and eventual breakdown of the lubricant.
- ✓ Lubricant filters or strainers should always be changed at the recommended time.
- ✓ The selection of lubricant for a particular application should be left to qualified personnel if possible.
- ✓ Inadequate lubrication can often be identified by the operating condition of a bearing, especially its temperature. As a general rule, if a bearing is too hot to hold a hand on it, then lubrication may be inadequate and should be investigated.
- ✓ Lubricants are potentially hazardous materials and should be stored with regard to safety and effect on the environment.

There are four basic methods by which lubricants can be applied and these are selected according to design criteria and the particular demands of the equipment.

Manual application: Whether the lubricant is liquid, semi-solid or solid, the simplest method of application is by hand. An oil can may be used for liquid lubricant, a grease gun for grease and a brush or spray gun for solid lubricant.

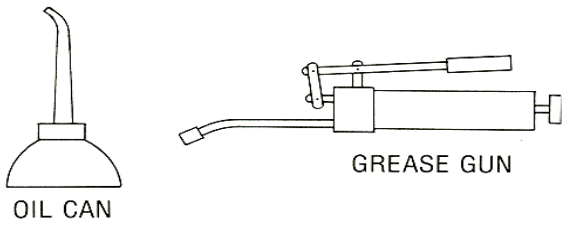


Figure 6 Equipment for manual application of lubricant

Gravity

This method is only suitable for liquid lubricants are is sometimes referred to as drip-feed oiling. There are various types of drip-feed oilers and they usually include some method of feed regulation.

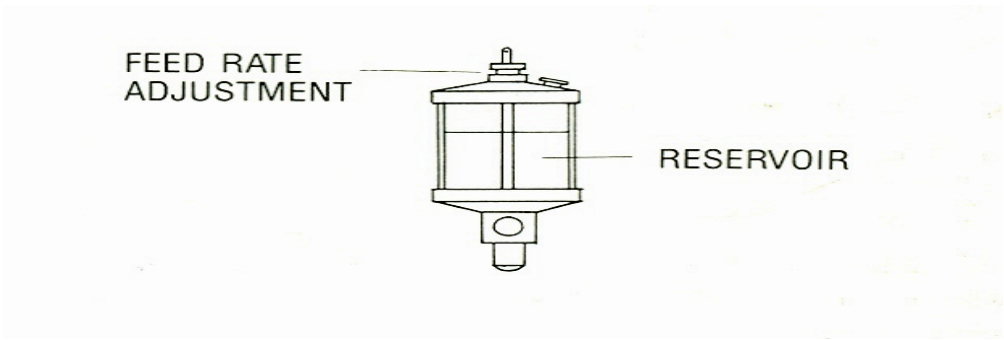


Figure 7 Drip-feed oiler.

Splash lubrication

Splash lubrication relies on the component requiring lubrication being partially immersed in an oil sump so that they pick up oil as they rotate. The oil picked up in the process may also be deposited on the shaft bearings and other components. A variation on this method is the ring-type oiler which uses steel or brass ring which rotates with the shaft and picks up oil which it deposits on the upper surface of the shaft. Examples of these methods are shown

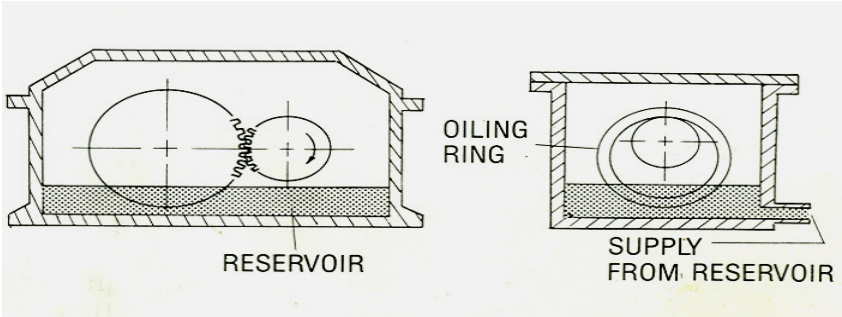


Figure 8 Splash lubrication methods.

Pressure lubrication

Many industrial applications, especially where loads are heavy and operating speeds are high, require a pressurized system to ensure that art adequate supply of lubricant can be maintained. This usually takes the form of a circulating system such as that shown in Fig. 5-11.

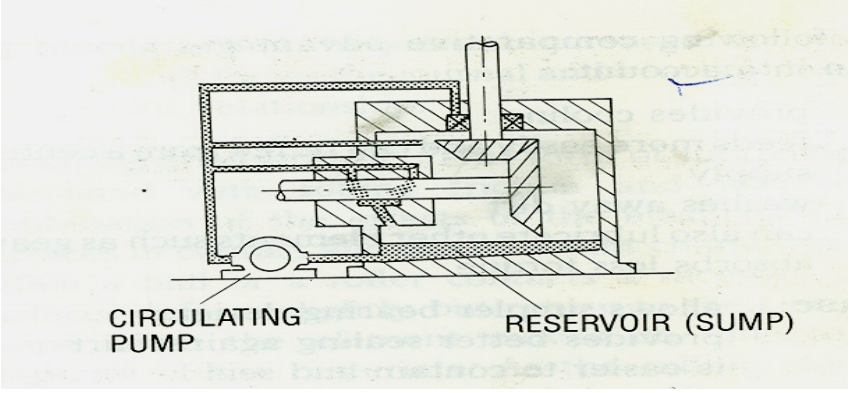


Figure 9 Circulating system of lubrication.

3.3.4 Characteristics and properties

There are four basic types of lubricant:

- liquid
- semi-solid or plastic
- solid
- gaseous

And they can be classified according to their source:

- ❖ animal
- ❖ vegetable
- ❖ mineral

Self-check-3

Test-I Matching

Instruction: select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

A	B
----1 Mechanical hazards:	G. liquid
--- 2 source lubricant	H. PPE
----3. Non-Mechanical hazards:	A. mineral
----4. types of lubricant	D impact and crushing areas
	A. chemical burns, toxicity, flammability

Test II: short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has 5Points.

8. Define ergonomics and describe aims of ergonomics?
9. In manufacturing, SOPs should be in-place for what?
10. Write the difference b/n Assessing Risks and Controlling Risks?
11. List the purposes of lubrication

Part III: long answer writing

Direction: Give long answer to the following questions. Time allotted for each item is 5mniut and each question carry 4 point.

10. What is the OHS practice?
11. Briefly discuss selection of a lubricant is determined by the factors
12. Explain basic methods by which lubricants can be applied

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

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

Operation Sheet 3	Perform Minor Maintenance

Techniques for Cleaning and Lubricating Machine operation

EQUIPMENT TOOLS AND MATERIALS:

To perform machine setting use equipment and material needed are:-

Visual inspection photo

Cotton yarns

PROCEDURE: Includes

-Read the information sheet well

-Apply OHS practices

-Follow the steps for the preparation of work station

-Follow standard operating procedures -

-Prepare work station according to specification and manufacturer requirement.

-clean the area and handle the waste properly

Use of proper OHS materials

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

LAP Test 3	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 30 minutes.

Task 1: clean the machine properly

Task 2: select the oil according to machine specifications

Task 3: Apply the oil on the machine

Task 5: complete the oiling process

Unit Four: Check machine operation

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

- Machine maintenance schedule
- Checking machine operation

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

- Check machine maintenance schedule
- Ensure correct machine operation

4.1. Machine maintenance schedule

PLANNING & SCHEDULING OF MAINTENANCE WORK:

Basic requirements of organizing planning and scheduling of maintenance work are:

To the extent possible a separate and a capable person should handle the planning and scheduling work and he would report to the In-charge of the Maintenance Department. He should be responsible for co-coordinating the

a) Schedule of maintenance personnel

b) Spare parts stock control, and

c) Shutdown or breakdown time control

This person will assist Maintenance In-charge in evolving the maintenance methods, develop and improve them, development of new maintenance tools and materials. He will also assist the 5 maintenance engineering and management

In-charge in establishing 'time' for various work which will be the basis for working out the maintenance schedules.

Maintenance In-charge will have the full responsibility for the work of the maintenance department. He should report only to the top manager of the establishment. The planning and scheduling person has the basic responsibility for determining the job priorities, ensuring that required tools and materials are available and written schedules of jobs are prepared and distributed.

The person holding the charge of maintenance planning should be the same level as that of the in-charge of production departments to be effective. His understanding of various maintenance methods, crafts and shop services is important.

SOURCES OF SCHEDULING DATA:

1. Repair note is the primary source of information for scheduling purpose.

2. Maintenance Methods and time estimates, evolved earlier for various maintenance works, will give information regarding the various trades and the work-load involved.

3. Load schedule and the progress report of the various maintenance crews will give information with respect to their availability.

4. Special Material for maintenance and Spare Parts records in the stores will be the source of information as to their availability.

5. Plant Production schedule is the source of information as to the time when the equipment could be available for maintenance work and necessary servicing.

TYPES OF SCHEDULES:

The size of the maintenance organization and the complexity of the plant's maintenance functions will determine the types and frequency of schedules. In general, however, there are three principal classes of schedules which should be used regardless of the plant size. They are:

1. The preventive maintenance master overhaul and inspection schedule.
2. The daily man assignment schedule.
3. The area maintenance schedule.

4.2. Checking machine operation

Inspecting Drying, Cleaning, and Feeding Equipment

On all overhead machinery it is important to keep supports and fastenings tight. The general condition of screens, as well as the clearance between them and the cylinders should be observed. When they are too close to the cylinders, the seed cotton is likely to be machined. If too far away, they may produce roping and rolling of the cotton. With green, damp, or wet cotton, introducing hot air into overhead cleaners makes for better cleaning and fewer repairs. Extractor saws may get bent and broken by foreign matter, such as rocks and sticks. Each periodic inspection is a good time to straighten and realign the extractor teeth and put them into good shape. (See the illustration on the cover page.) All of the mechanism governing the rates of feed of seed cotton, extractor feeders, and other feeding equipment should also be inspected and kept in repair.

Factors of evaluation for organizing good maintenance

The performance of maintenance can be judged by the condition of machinery as indicated by the following factors

1. **Performance**: Machines must be capable of performing the function for which they are intended.

2. **Down time**: Machine down time must be at an acceptable level
3. **Service life**: Machine must provide a satisfactory return on investment before replacement become necessary.
4. **Efficiency** : machine must operate at an acceptable level of efficiency
5. **Safety :** Machines must operate safely and not dangerous for personnel
6. **Environmental impact**: Machines must operate in a manner that is not detrimental (harm full) to the environment or to adjacent plant or equipment.
7. **Cost:** The cost of maintenance must be acceptable.

Maintenance is not only repair or planned preventive action but also improvement and modification of equipment.

The two major reasons to do modification are:

1. Continuous improvement of equipment operational or technological capacity.
2. Repeated and registered failure on particular part or parts of a machine. The procedure of decision for modification will be discussed later in corrective maintenance.

Modification includes:

- Changing of materials For example changing of steel made gear to cast iron made to get some advantage
- Changing of mechanisms: changing of lap feeding system of the carding machine to chute feeding and/ or comb doffing to roller doffing system or gear transmission to belt transmission.
- Changing of properties of materials to increase their wear potential.

This can be done by different treatments be it physical or mechanical to change the property of the same material. For example heat treatment.

The factors of evaluation maintenance choice depend on:

- ✓ Efficient operation
- ✓ Effectiveness
- ✓ Profitability
- ✓ Low cost

Self-check-4

Test I: short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has 5Points.

1. Write factors of maintenance performance evaluation?
2. List the sources of scheduling data

Part II: long answer writing

Direction: Give long answer to the following questions. Time allotted for each item is 5mniut and each question carry 4 point.

3. Briefly discuss major reasons to do modification and which includes?
4. List types of schedules and if it is possible explain it

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

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

Operation Sheet 4	Perform Minor Maintenance

Techniques for Monitoring and assessing Machine operation

Step 1- Visualize the machine for inspections

Step 2- Measure vibration of the machine

Step 3- Monitor the temperature of machines

Step 4- Measure noise signals of the machine

Step 5-Measure motor current signals of machines

LAP Test 4	**Practical Demonstration**

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 6-12 hours.

Task 1: Operate saw ginning machine

Task 2: Monitor Machine operations