CHAPTER 06

Machine Tool Maintenance

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Learning Objectives

- Students to understand the following maintenance of machine tools.
- To avoid the repair of machines, instruments, and machine parts.
- By using the maintenance tools, how to operate the machines.
- To increase the duration of life of the machines.

Seydhakka alla seyakkedum seydhakka
Seyyamai yaanum kedum. –Kural 466.

He will perish who does not what is not fit to do; and he also will perish who does not do what it is fit to do.

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DO YOU KNOW?

Spanner was invented by Solymen Merrick in 1835.

Solymen Merrick

6.1 Introduction

"Prevention is better than cure". With reference to this proverb, the task performed to make the machine tools work perfectly is called 'Maintenance'. This is achieved by ensuring that machine tools cutting tools and measuring instruments function properly without any fault.

6.2 Purpose of 'Maintenance'

The primary objective of the maintenance department is to ensure the machine tools, instruments, tools and accessories in good working condition. It is also necessary to ensure safety to both the machine tools and the operator. The accuracy and efficiency of the machine tools and the instruments are also to be maintained properly. By performing maintenance, we can avoid accidents inside the workshop and increase the production capacity.

All the machine tools are driven by electrical motors. It is necessary that the switches, fuse, the connections and other controls should be in order. Care should also be taken to keep in good conditions. The parts used for transmitting power from the motor – gears, chain drive, belt drive etc.

The rotating shafts of the machine tools are fitted with bearings and suitably supported by different types of brackets. As bearings are precision parts, we have to apply grease or any lubricating oil at recommended intervals to keep them in good operating conditions. The sliding parts of various machine tools should be maintained cleanly without any dirt on them. The metal chips should be cleaned at regular intervals.

The moving and rotating parts should be properly lubricated at the brackets where they are fitted.

The coolant pumps, filter elements, pipelines and valves should always be in good working condition.

The tools, accessories, special attachments and measuring instruments should be in good working conditions and be placed in their respective places.

6.3 Tear & Wear

Wear and tear

Due to continuous working of a machine tool and the nature of work performed on it, wear and tear is observed in the sliding parts of machine tools. As a result of this, the accuracy of the products is affected. In remedy, it is necessary to repair the said machine tools. The affected parts are to be replaced if necessary.

6.4 Backlash

Some slackness is observed in holding of parts, meshing gears or bolt and nut assembly. This slackness is known as backlash. If the amount of backlash is more in the case of mating gears, they should be replaced. The wear and tear on the gears should be observed once in a week time.

6.5 Lubrication

Rotating and sliding parts, which make contact with other parts, are subjected to wear due to friction. Viscous oil called lubricant is applied to these parts to avoid direct contact between them. The process of reducing friction is called lubrication.

Applying oil or grease to the axle shaft of the bullock cart and the cycle wheel, gearbox of automobiles, motor shafts of pumps, fans and sewing machine are some examples of lubrication.

Friction occurs as the shafts are rotating and the sliding parts moving on each other. It generates heat and the parts get damaged.

In order to keep the machine tools accurate and durable, it is necessary to apply lubricants between mating parts. It will reduce friction and wear is minimized.

Lubrication is the nerve centre of machine tool. As it is blood circulation for the human body, lubrication is for the machine tools.

6.6 The machine parts which need to be lubricated

1. Mechanisms of hydraulic systems
2. Guideways and sliding parts
3. Rotating shafts
4. Gear box
5. Feed Box
6. Speed changing mechanisms
7. Bearings

6.7 Purpose of of lubrication

1. Smooth functioning of sliding movable parts
2. To reduce friction and consequent wear
3. To remove burrs and dust
4. To reduce the heat generated due to friction
5. To prevent rust formation on precise parts
6. To provide cushioning effect to the load shocks
7. For hydraulic circuits to transmit power

6.8 Types of lubricants

The materials used for reducing wear between moving and sliding parts are called lubricants. Though there are many types of lubricants available, oil and grease are mostly used.

HPBMRM

Grease

Grease is manufactured with the ingredients of soap and mineral oils. Different types of grease are manufactured for specific applications under different commercial names. So, it is necessary to know the specific type of grease to be applied for the specific part.

6.9 Types of lubrication

The different types of lubrication are

1. Ring lubrication
2. Wick Lubrication
3. Splash Lubrication
4. Grease Lubrication

Ring Lubrication

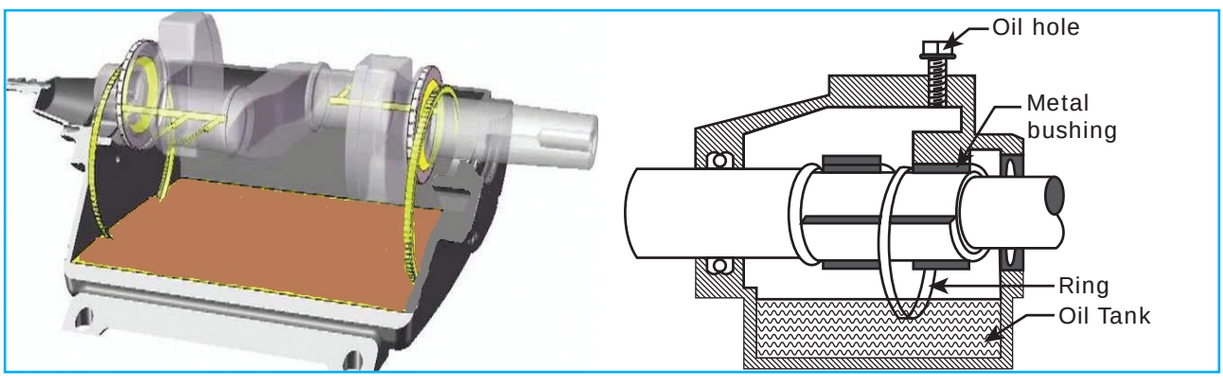
The method of lubrication involves a ring hanging from down the rotating shaft. The bottom portion of the ring is immersed in the oil container. When the shaft starts rotating, the ring also rotates. While the ring rotates, it carries a small amount of oil and the oil is spread into the bearing and the shaft.

Wick lubrication

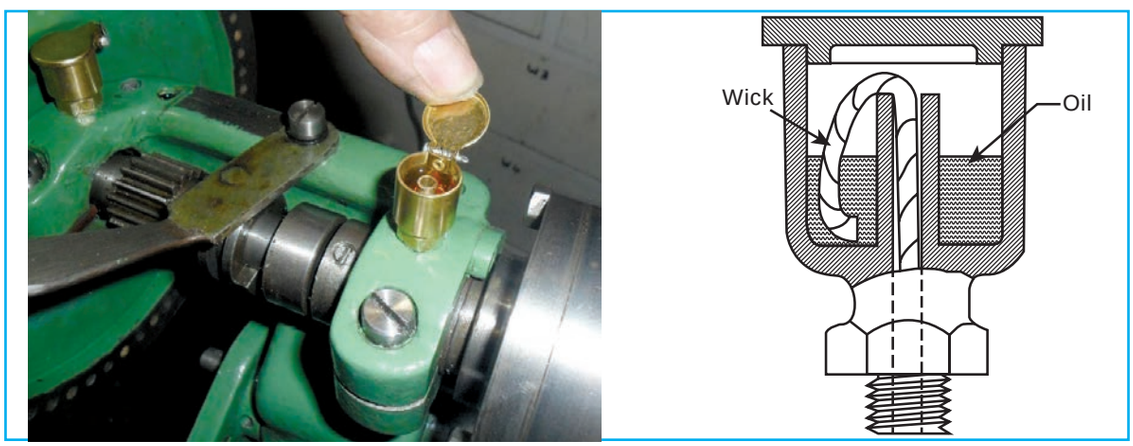
Wick lubrication is a method in which the wick along with a flexible thin piece of metal is used. A container having oil is placed above the bearing. The wick connects the container and the part to be lubricated. This lubrication enables the oil to flow from the container to the required place.

Splash lubrication

The rotating part of the machine itself is made to be immersed in the oil



Ring Lubrication

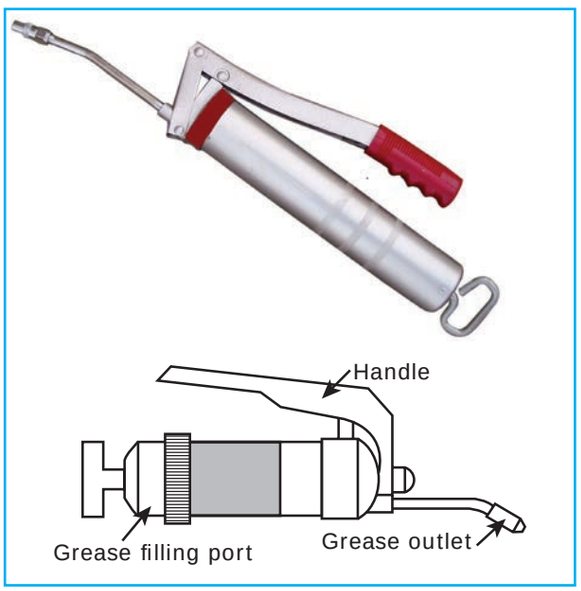


Wick Lubrication

container. When the part starts rotating, the oil is splashed and the moving parts are lubricated. Bearings are generally lubricated by this method. Little spoons are attached to the rotating parts to get more quantity of oil to the part to be lubricated.

Grease lubrication

Grease lubrication is done with the help of grease guns. Another way of doing it simply is so fill a container with grease and the container is connected to the parts to be lubricated by means of a small tube. When a screw is screwed into the container, a good amount of grease is taken to the required place.



Grease gun

Lubrication oil and grease are manufactured under several trade names by the Indian oil companies. Suitable lubricants are used for specific purposes.

6.10 Central maintenance department

The primary aim of maintenance department is to ensure the machine tools, instruments, tools and accessories in good working conditions. More maintenance attention is needed when the work load increases. If the machines are maintained properly, we can lookout for more production.

Separate maintenance department will be functioning in major machine shops and industries. Experienced engineers, supervisors, technicians will be working in this department. Separate equipments and instruments will be used in the department.

6.11 Types of maintenance

There are different types of maintenance and they are

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1. Routine maintenance
   a. Daily maintenance
   b. Weekly maintenance
2. Preventive maintenance
3. Breakdown maintenance
4. Capital repairs or Corrective maintenance

6.12 Routine maintenance

Routine maintenance is done to avoid unnecessary breakdown of machine tools. It involves regular works like cleaning and lubricating, making minor adjustments and doing small repair works.

It is important to chart out what are all to be done, daily, weekly and monthly.

6.13 Daily maintenance

1. Cleaning all the parts of the machine tool.

2. Lubricating the movable parts with grease and oil as per requirements.
3. To correct the machine tool to make it operate accurately.
4. To look at whether the coolant apply and auto lubricating equipments are working properly.
5. To remove the burrs cleanly.

6.14 Weekly maintenance

1. The measuring instruments, gauges and hand tools are checked and corrected if necessary.
2. The spare parts and integral parts of the machine tools should be cleaned.
3. The entire workshop premises should be maintained cleanly.
4. Grinding wheels of bench grinders and tool and cutter grinders should be dressed. The work rests of these machines should be adjusted properly.
5. The protective devices in the machine tool are checked whether they are properly fixed. And they are corrected if necessary.
6. The cables and electrical connections should be checked.
7. The position and working of belt, chain etc., are checked and adjusted.
8. Parts like gears, clutches and bearings are checked for their proper functioning.
9. The accuracy of precision measuring instruments are checked and corrected. They are also checked for zero error.

6.15 Preventive maintenance

In order to avoid sudden breakdown of machine tools and maintenance programme is charted out. This will ensure that there is no slip in the rate of production.

In case of any major breakdown to the machine tool, two types of losses are incurred to the management.

1. Direct losses 2. Indirect losses

- Direct loss is the expenditure incurred for repairing the machine tools and getting them back in action.
- Indirect losses happen by the loss of income for the disturbed production. The management has to pay the labourers their wages. It will also be earning a bad name due to non-deliverance of the products to its customers. So, it is necessary to plan the preventive maintenance program to avoid such losses.

Even if the machine tools are working in proper conditions, it is better to stop production once in a while to make the necessary repairs and adjustments. Certain parts should be replaced if necessary.

6.16 Breakdown maintenance

Even after enforcing routine maintenance and preventive maintenance, there are chances that some machine parts may fail due to some reason or other. In order to bring back the machine to its original working condition, some minor or major repairs are needed to be done. This type of maintenance is known as breakdown maintenance.

6.17 Capital Repairs (or) Corrective maintenance

Even if the machine is functioning properly, it is necessary to halt the functioning of the machine to do some major repair once in a year. To do that, the machines parts are to be dissembled completely and worn out parts are replaced. Some parts of the

machine may be in a condition that they need to be replaced soon. To correct all such difficulties, the machine is stopped from functioning to do all and every repairs to bring back the machine to accurate machining conditions. This called as capital repairs (or) corrective maintenance .

6.18 Planned maintenance programme

The main objective of planned maintenance programme is to increase the production by keeping the machine tools always ready in good condition. It is done by keeping the machine tools to perform all the activities correctly with the required accuracy at desired speed with full safety protection.

The planned maintenance programme is to be prepared and executed as follows.

1. When a new machine tool arrives to the machine shop or the existing machine tools are to be replaced, it is required to install the machine tools properly, level and align them correctly and connect them to the electrical terminals safely.
2. If errors are found in the dimensional accuracy, the errors should be recorded and analysed whether the machine is in bad condition.
3. It is necessary to plan and get ready the materials, spares and tools required for the maintenance in advance so that the maintenance work is carried out in time.
4. The operators and supervisors should know the importance of the cutting speed, feed data of the machine tools.
5. Emergency repair works should be done without any delay in the case of breakdown of any of the machine tools.
6. The machine should be overhauled if the working efficiency of the machine tool goes below a particular level.
7. If the machine tools become very old and not performing to the desired level, it has to be dismantled completely and worn out parts should be replaced to bring it to the normal working condition.
8. The following details should be prepared and made as charts the layout plan of the shop, the size and specification of the machine tools and the parts to be lubricated. The manuals and the list of spare parts of all the machine tools are also to be kept ready.
9. Annual budget for the maintenance work should be prepared atleast six month or once in year in advance.

6.19 Instruments needed for maintenance

1. Steel rule
2. Try-square
3. Calipers
4. Micrometer
5. Vernier calipers
6. Gauges
7. Vise
8. Files
9. Tap & Die
10. Screw gauges
11. Spanner set
12. Hammers
13. Screw drivers
14. Wrenches
15. Hacksaw frame & blades
16. Lubricating devices
17. Emery sheets
18. Scraper

ACTIVITIES

1. Students to visit the industry and workshops nearby school, to observe how to maintenance of machines and tools.
2. To give exercises to tabulate the tools and instruments for different types of machines.

Questions

Part I.

Choose the correct option 1 Mark

1. Maintenance done once in a year is known as
   a. Routine maintenance
   b. Preventive maintenance
   c. Breakdown maintenance
   d. Corrective maintenance

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2. Daily maintenance is
   a. Routine maintenance
   b. Preventive maintenance
   c. Breakdown maintenance
   d. Corrective maintenance
3. Maintenance of belt, bearing and chain is
   a. Daily maintenance
   b. Weekly maintenance
   c. Preventive maintenance
   d. Corrective maintenance

Part II.

Answer the following questions in one or two sentences 3 Marks

4. Define "Maintenance".
5. What is the objective of maintenance?
6. What do you mean by "wear"?
7. Define backlash.
8. What is lubrication?
9. Name the different types of lubrication.
10. What are the types of maintenance?

Part III.

Answer the following questions in about a page 5 Marks

11. Explain the "Lubrication".
12. What are the parts to be lubricated?
13. Explain "Ring Lubrication" with a diagram.
14. Explain wick lubrication with a neat sketch.
15. Explain splash lubrication.
16. Sketch and explain "Grease Lubrication".
17. Explain Routine Maintenance
18. Explain corrective maintenance.

Part IV.

Answer the following Questions in detail. 10 Marks

19. Explain any two types of lubrication with diagram.
20. Explain "Preventive maintenance".
21. Explain "Breakdown maintenance".
22. Explain "Planned maintenance program".