AUTOMOTIVE MECHANICS

Level-I

Based on March 2022, Curriculum Version 1



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Acronyms

DMM = digital multi-meter

dc = current

ac = alternating current

DTC = diagnostic trouble code

Ppm = parts per million

PPE = Personal protective equipment

AMM = Analogue Multi meter

JHA = job hazard analysis

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).

Introduction to the Module

In automotive field, the Tools provide a general overview of different data tools and how they can be used. The information is presented in a straight forward, easy-to-understand manner through a series of exercises and case studies. Users of Plain & Simple Series learn how to select the right tool for the task at hand, collect the right data, interpret the data, and take appropriate action based on their findings.

This module covers the units: -

- Preparing work station
- Carrying-out measurements
- Using tools and equipment
- Maintaining tools and equipment

Learning Objective of the Module

- Make work station ready
- Carry-out measurements
- Use tools and equipment
- Maintain tools and equipment

Module Instruction

For effective use these 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 units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for Examples and exercise

Unit one: - Preparing work station

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

- Making workstation ready
- Following Procedures and workshop manuals
- Identifying tools and equipment
- Preparing testing devices for use
- Identifying and marking unsafe or faulty tools and equipment
- OHS relation to tools and equipment

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:

- To Make work station ready
- Follow Procedures and workshop manuals
- Identify tools and equipment
- Prepare test devices for use
- Identify and mark unsafe or faulty tools and equipment
- OHS relation to tools and equipment

1.1. Making workstation ready

1.1.1. Work Shop Safety

Safety means protecting yourself and others from possible danger and injuring in the shop, you are ' Safe' when you protect your eyes, your fingers, your hands all of yourself from danger as well as others.

- **Preparation of workshop helps as**
  - ✓ Keep environment well being
  - ✓ Identify the work and its implementing tools, equipment and materials
  - ✓ Decide the work procedure
  - ✓ Keep tools, equipment and resource prevent ourselves from injury
  - ✓ Done the work with quality
  - ✓ Workstation is readied for work activities.

1.1.2. C**lean equipment and tools**

- Part cleaning is a necessary step in most repair procedures. Cleaning automotive parts can be divided into three basic categories.
- Chemical cleaning relies primarily on some type of chemical action to remove dirt, grease, scale, paint, or rust.
- Abrasive cleaning relies on physical abrasion to clean the surface. This includes everything from a wire brush to glass bead blasting, airless steel shot blasting, abrasive tumbling, and vibratory cleaning. Chemical in-tank solution sonic cleaning might also be included here because it relies on the scrubbing action of ultrasonic sound waves to loosen surface contaminants.

Clean up procedures

- ✓ Clean up every time whenever you leave an area, including sweeping the floor.
- ✓ Clean and return all tools to where you got them.
- ✓ Use compressed air sparingly; never aim it at another person or use it to clean hair or clothes.
- ✓ Shut off and unplug machines when cleaning, repairing, or oiling.
- ✓ Never use a rag near moving machinery.
- ✓ Use a brush, hook, or a special tool to remove chips, shavings, scraps etc. from the work area. Never use the hands.

- ✓ Keep fingers clear of the point of operation of machines by using special tools or devices, such as, push sticks, hooks, pliers, etc.
- ✓ Keep the floor around machines clean, dry, and free from trip hazards. Do not allow chips to accumulate.

1.1.3. Hazards in the work shop

- ➢ Faulty work habits
- ➢ Misuse of equipment
- ➢ Misuse of hand tools

Select the work place depending on: -

- ➢ **Environmental condition**
  - ✓ Free from flammable things
  - ✓ Events around the work campus is closer together
  - ✓ Climatic condition
- ➢ **Working area events**

✓ The vehicle should perk on the level surface to repair the system

1.1.4. Maintain a safe workplace

- Once safe systems andprocedures are in place, theyneed to be maintained through an ongoingfocus on health and safety.

Maintain a safe work place by:-

- carryingout regular workplace inspections
- ensuringequipmentandtoolsaresafetouseandmaintained
- fixinghighrisksimmediately and others as soonas possible in order of level of risk
- discussingcommoninjuries,workpracticesandprocedureswithworkers
- keeping up-to-date knowledge of productlabels, Safety Data Sheets and manufacturer'sinstruction manuals
- havinganeasytousehazard,nearmissandinjury reporting process as well as reviewingincident reports.

1.1.5. Fire Prevention

- Store fuels properly
- Keep the shop doors open, will ventilation where fuel vapors can exit
- Wipe up the spilled fuel at once and keep the rags in a closed waste container
- Never smoke or light a cigarette around fuels. (Do not smoke in the workshops!)

- Fix leaking carburetors, fuel pumps fuel lone and fuel tank immediately
- Make fine extinguishers available in the workshop and know perfectly well how to use them in case of fire

1.1.6. Proper storage of tools and equipment

- The proper care and storage of tools and equipment's are not only the concern of the management but of the workers who use the equipment.



Figure.1.1 Proper storage of tools

Importance of proper storage of tools and equipment's

- It is important factor for safety and health as well as good business.
- Improves appearance of general-shop and construction areas.
- Reduce overall tool cost through maintenance.
- This also ensures that tools are in good repair at hand.
- It is important factor for safety and health as well as good business.
- Teaches workers principles of tool accountability.
- Each workers principles of tool accountability.

1.2. Following Procedures and workshop manuals

1.2.1. Identifying and accessing appropriate manuals as per job requirements.

There are different types of manuals according to their use as job requirements. These are

Manufacturer's specification manual

- Manufacturer's service manual or sometimes it's called a shop manual, are written by the automotive manufacturer for the technicians in their dealership**.**

- Shop manuals / service manuals are necessary to obtain the desired specification for specific job.
- It also provides drawings and photograph to show where and how to perform a certain procedure in a particular car you are working on. Special tools or instrument are listed and shown when they are required. Precautions were given to prevent injury and damage to the parts.



Fig .1.2 Typical Cover of a Service Manual

Diagnosing or troubleshooting information

Probably the most valuable type of service information comes from the troubleshooting or diagnosing guides. These are designed to help the technician save time in identifying and solving problems.

Procedure information

Procedure information gives the steps to follow in doing a repair job. The procedures are usually numbered in a step-by-step order.

Specification

Specifications are included as part of the service manual. Specifications are technical data, numbers, clearances and measurements used to diagnose and adjust automobile components.

Types of specifications

General Engine Specification– This specification identifies the size and style of the engine. They include cubic inch displacement, engine codes, fuel system settings, bore and stroke, horsepower, torque, compression ratio, and normal oil pressure.

Tune-Up specifications – This specification helps identify adjustments necessary for tune-up on the vehicle. This includes spark plug gap, firing order, degrees of ignition timings, fuel system settings and fuel pump pressure.

Capacity Specifications –This specification includes identifying the capacity of different fluids on the vehicle. This includes cooling capacity, number of quarts of oil, fuel tank size, transmission transaxle capacity, and rear axle capacity.

Overhaul and Maintenance Specifications–This includes distributor advance at different speeds, valve seat angles, valve stem clearance, piston measurements, ring end gaps, bearing clearances, shaft end play and many more. This specification help the technician determine how much wear has occurred.

Operational Specification – This specification tells how the vehicle is to operate, what type of oil to use, and so on. Some of them are found in the owner's manual. Other specification includes tire inflation, type of gasoline to use, tire size and general information for the operator of the vehicle.

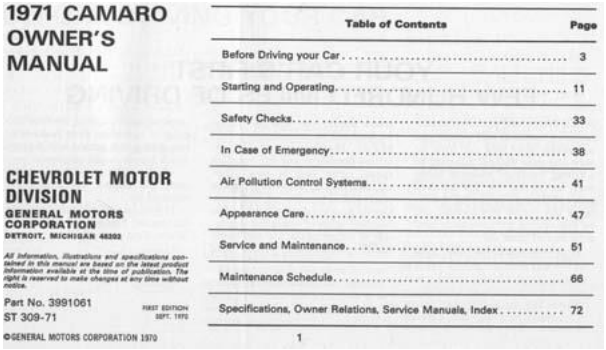
Torque Specification –Torque specifications are used for this purpose. This torque specification should be used in place of any standard bolt and nut torque specification.

Owner's manual

An **owner's manual** (also called an **instruction manual** or a **user guide**) is an instructional book that is supplied with almost all technologically advanced consumer products such as vehicles, home appliances and computer peripherals. Information contained in the owner's manual typically includes:

- ✓ **Safety instructions**; for liability reasons these can be extensive, often including warnings against performing operations that are ill-advised for product longevity or overall user safety reasons.
- ✓ **Assembly instructions**; for products that arrive in pieces for easier shipping.
- ✓ **Installation instructions**; for products that need to be installed in a home or workplace.
- ✓ **Setup instructions**; for devices that keep track of time or which maintain user accessible state.




1971 CAMARO
OWNER'S
MANUAL

CHEVROLET MOTOR
DIVISION
GENERAL MOTORS
CORPORATION
DETROIT, MICHIGAN 48202

Part No. 3991061
ST 309-71

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Fig.1. 3 a cover and a table of contents of a typical owner's manual

Repair manual

A repair manual is most often used by the technician at independent repair shops. This manual is called an aftermarket because it is published by independent publisher and not by the car manufacturer. Like the shop manual. This contains information on troubleshooting, specifications and step-by-step repair procedures.

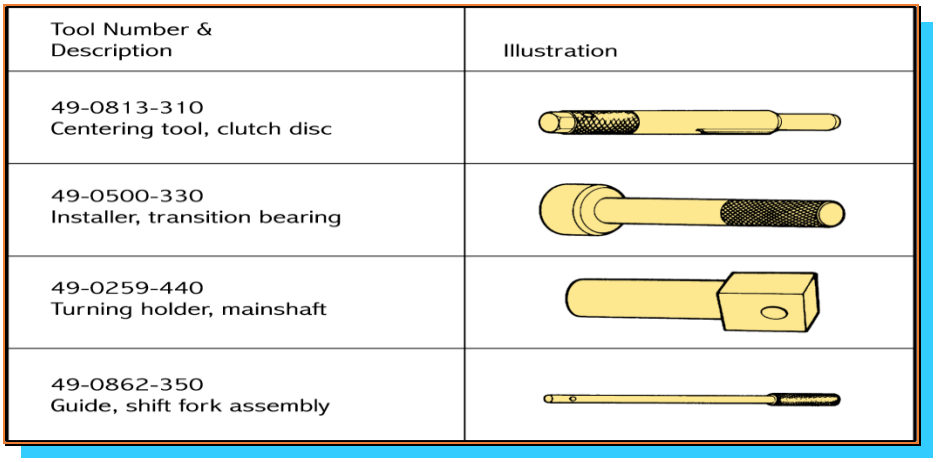


Fig 1.4. Illustrations of special tools needed for repair tasks are found in this section

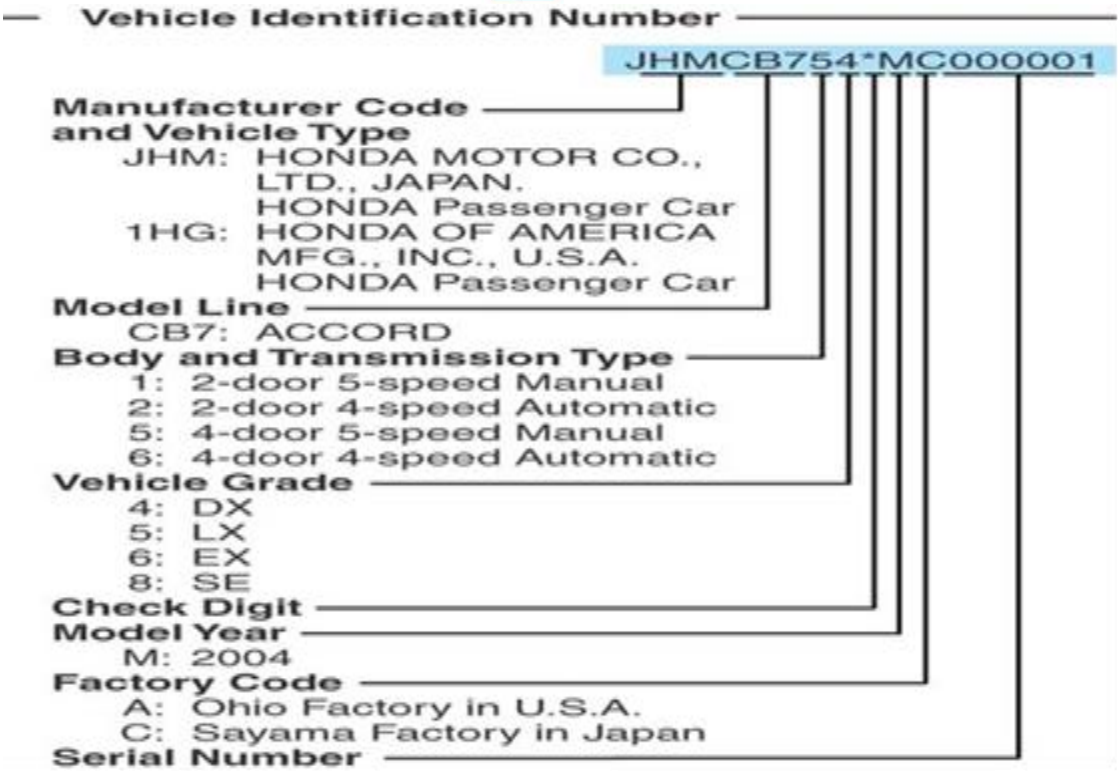
VIN (Vehicle Identification Number)

The official vehicle identification number is needed to identify the exact type of vehicle being worked on. The VIN is also used for title and registration purposes

Each VIN represents different data. The following information can be determined be reading the VIN.

- ✓ The country by which the vehicle was manufactured or the world manufacturer
- ✓ The corporation and division
- ✓ Model or series of the vehicle
- ✓ Model year
- ✓ Body style
- ✓ Check digit
- ✓ Engine type
- ✓ Factory or plant code
- ✓ Vehicle serial number

Example:-



Maintenance Procedure Manual

Procedure information gives the step by step to follow in doing a repair job. The procedures are usually numbered in a step-by-step order. Below is an example of step-by-step procedure to follow in replacing a cylinder head.

Example of Cylinder head

Replace

1. Raise and support front of vehicle, then drain cooling system and disconnect exhaust pipe from manifold.
2. Lower vehicle and remove oil dipstick tube and air cleaner.
3. Disconnect wire connectors and vacuum hoses from carburetor or TBI unit.
4. Remove EGR valve base plate from intake manifold, if applicable.
5. Disconnect heater hose from intake manifold, then remove AIR system discharge tube attaching bolt from intake manifold.
6. Remove ignition coil lower attaching bolt, then disconnect wiring from coil.
7. Disconnect all wiring from cylinder head and intake manifold, then remove engine upper support attaching bolt from engine strut.
8. Remove A/C compressor and position aside with refrigerant lines attached.

9. Remove alternator drive belt, then remove AIR pump bracket bolt from engine block, if equipped.
10. Disconnect throttle and throttle valve cables from throttle lever and intake manifold.
11. Disconnect upper radiator hose from cylinder head then disconnect AIR hose from tube assembly, if equipped.
12. Remove rocker arm cover, and then remove rocker arms and push rod.
13. Remove cylinder head attaching bolts then lift cylinder head and intake and exhaust manifold as an assembly from cylinder block.
14. Reverse procedure to install. Coat heads and threads of cylinder bolts with suitable sealing compound, then install bolts finger tight. Tighten cylinder head bolts in proper sequence.

Periodic maintenance Manual

- ✓ Performing inspection
  - block diagrams, flow charts, maintenance schedules
  - Changing brake parts,
  - Set back maintenance indicator, changing drive belt, Oil and Filter changes,
  - Battery maintenance, wheels Tyres, windshield wipers

1.3. Identifying tools and equipment

1.3.1. Hand tools

- ✓ open-end wrenches (spanners)

Used for loosening and tightening nuts and bolts.

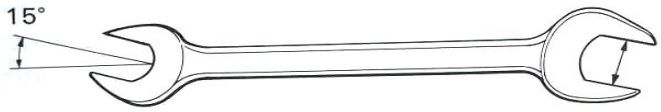


Fig1.5. Open-end wrenches (spanners)

- ✓ box-end wrenches (offset wrench)

Used for tightening and loosening nuts and bolts.

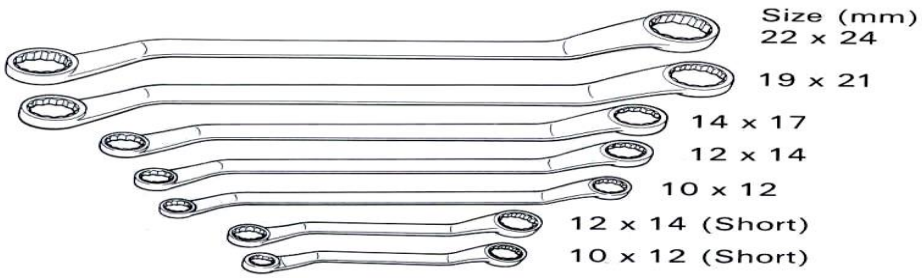


Fig1.6. Box-end wrenches (offset wrench)

Combination wrench wrench/spanners are for general use in areas where a socket and ratchet cannot be used.

The open end will be on either a 15-degree or 22.5-degree angle to the shank and the box end is offset 15 degrees to the shank.



Fig.1.7. combination wrenches

Adjustable wrench The jaw opening can be adjusted to properly fit nuts and bolts to loosen or tighten them.

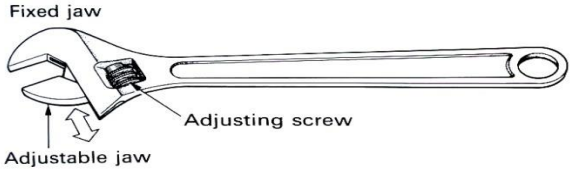


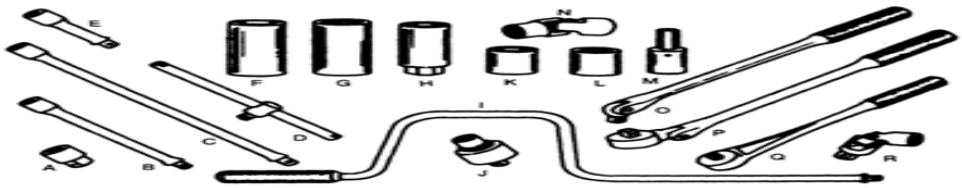
Fig1.8 Adjustable wrench

Allen key this key is made from hexagonal bar stock with a 90 degree bend in it.



Fig1.9. allen key

Socket wrench set the socket wrench is used in combination with different types of handles and extension bars for safe and speedy loosening and tightening in difficult positions.



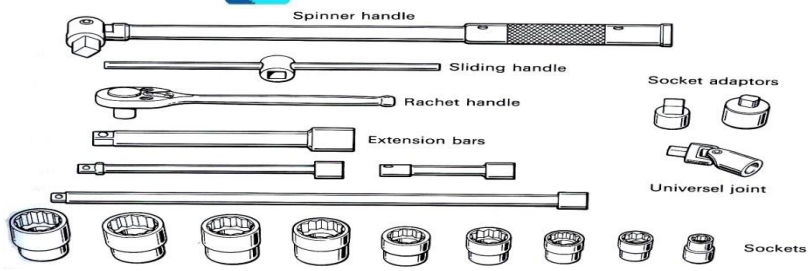


Fig1.10. Socket wrench set

a) Socket: - Use a socket wrench of an appropriate size, surround the nut or bolt completely.

b) Extension bar and Universal joint: **-** When a nut is deeply recessed and the handle cannot move freely, add an extension bar of suitable length.

- ✓ Use a Universal joint in places where the extension bar cannot be inserted straight.

c) Sliding Handle: **-** the handle pivot can be changed to alter leverage and adjust torque as needed.

d) Spinner Handle: - the handle can be extended to alter leverage and adjust torque as needed. The socket end has a universal joint and the handle may be raised up right to remove a nut or bolt more quickly.

e) Ratchet handle: **-** The Ratchet handle can be turned in one direction only but work can be done quickly without lifting the socket from the bolt or nut.

Spark plug wrench spark

plug wrenches are designed for fitting and removing spark plugs.

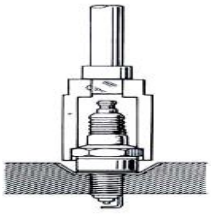


Fig1.11. Spark plug wrench

Screwdrivers: a screwdriver drives a variety of threaded fasteners used in the automotive industry. Each fastener requires a specific kind of screwdriver.

Flat screwdriver

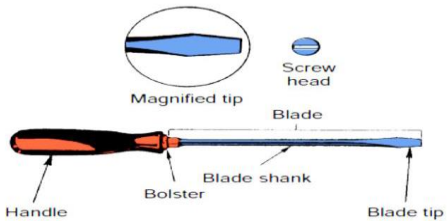


Fig Flat screwdriver

Phillips screwdriver

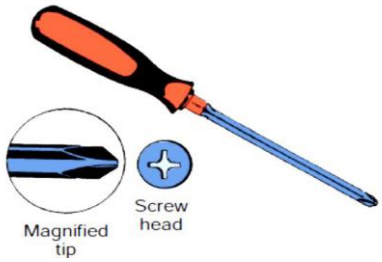


Fig Phillips screwdriver

Hammers are used for driving in parts. Several models of softheaded hammers are available for preventing damage to the part being struck.



Fig1.12.Hammers

Pliers there are various types of pliers for use in gripping and turning and cutting wire.

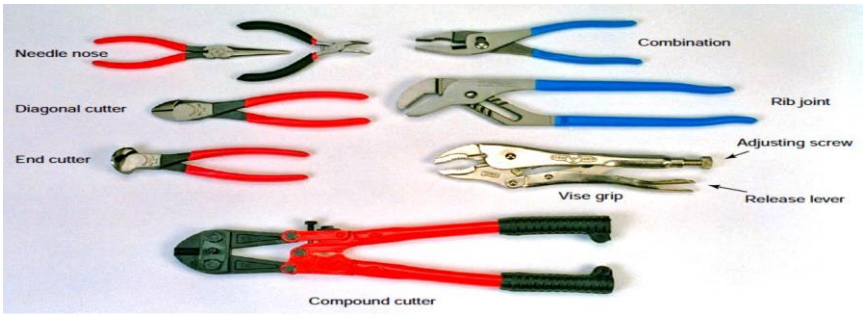


Fig 1.13. Pliers

Scraper **w**hen old gaskets are removed, the gasket scraper is used to clean the surface below the gasket.

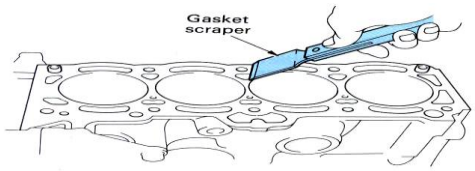


Fig 1.14. Scraper

Center punchs are used for marking the position for a drill hole and for making match marks so parts of similar shape can be reassembled in their original position.



Fig 1.15. Center punch and Punch mark

Pin punches used for knocking out rivets and pins.

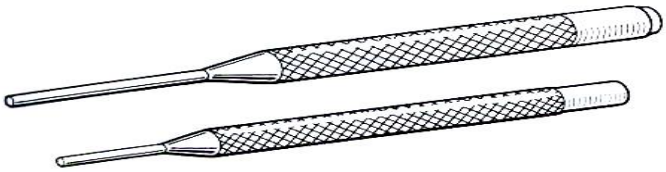


Fig 1.16. Pin punches

1.3.2. **Power Tools**

Electric hand drill it is used to drive drill bit so that holes can be drilled. The electric drill has an electric motor that drives the chuck. The chuck has jaws that can be opened and then closed to grip a drill bit.

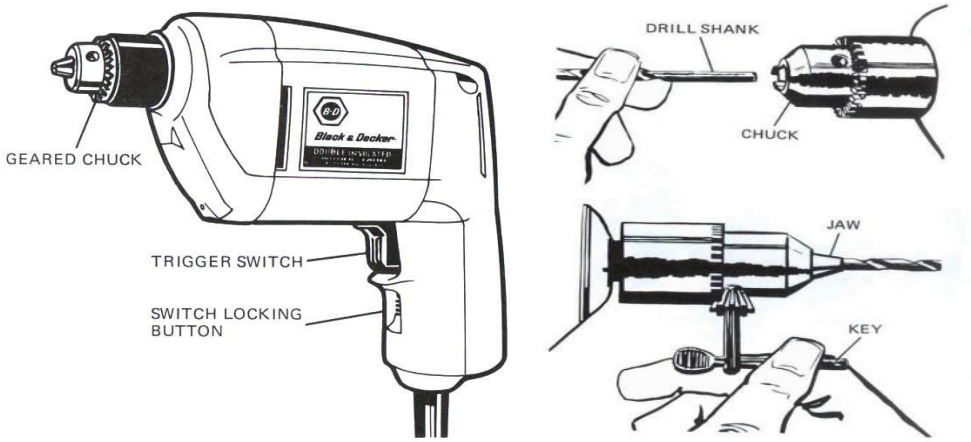


Figure1.17: Electric hand drill and chuck key

Electric grinders the grinder can be either bench mounted or portable. It may have a grinding wheel and wire wheel. If it has two grinding wheels, then one wheel is coarse and the other fine.

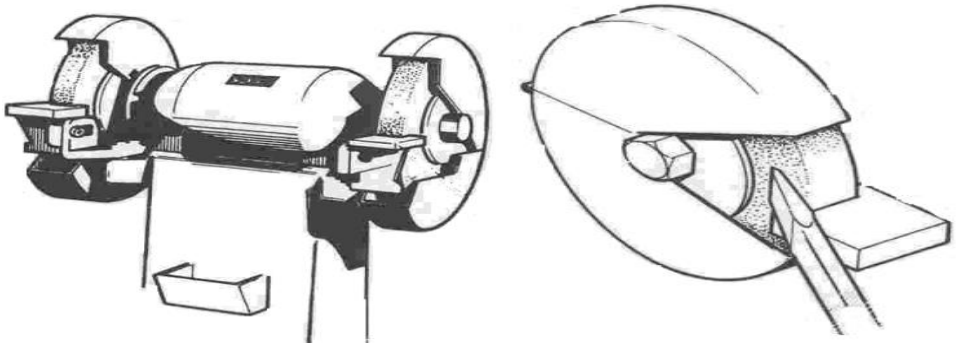


Figure1.18: Grinding wheel

Hand Jack the hand jack is compact tool for applying great force for lifting or straightening a bent part.

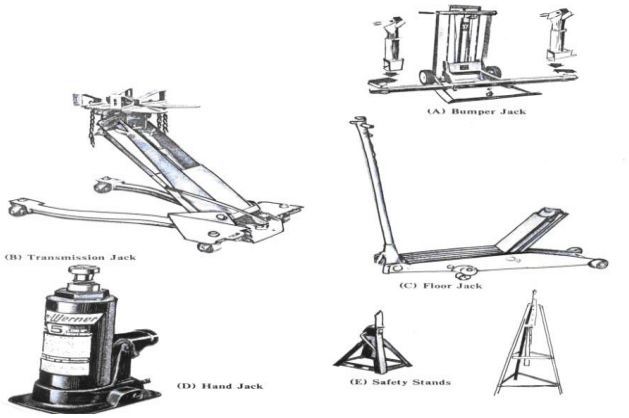


Figure1.19: Jacks and safety stand

1.4. Preparing testing devices for use

Stethoscope

A stethoscope is used to locate the source of engine and other noises. The stethoscope pickup is placed on the suspected component, and the stethoscope receptacles are placed in the technician's ears.

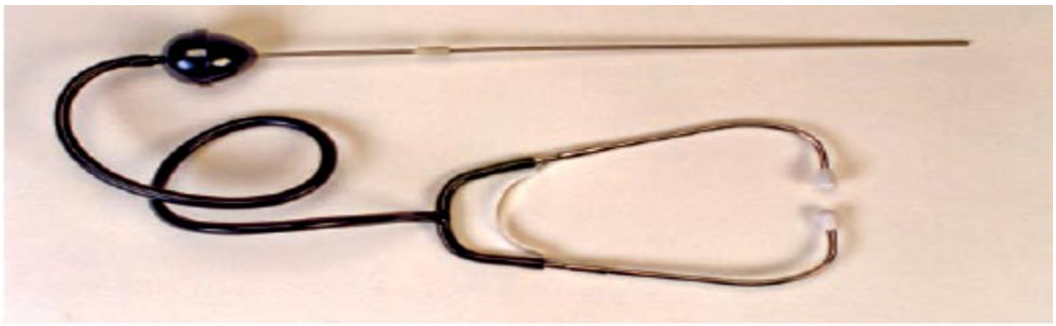


Fig1.20 Stethoscope

Circuit Tester circuit testers are used to check for voltage in an electrical circuit. A circuit tester commonly called a test-light.

A self-powered test-light is called a continuity tester. It is used on open circuits.

When the ground clip is attached to one end of the wire or circuit and the probe touched to the other end, the lamp will light if there is continuity in the circuit.

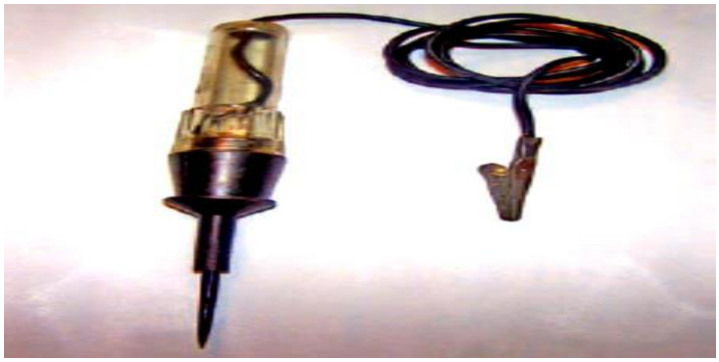


Fig1.21. Circuit Tester

Multi-meters a multi-meter is a must for diagnosing the individual components of an electrical system. A digital multi-meter (DMM) can measure volts, ohms, and low current such as direct current (dc) and alternating current (ac) amperes, diode continuity.



Fig1.22. Circuit Tester

Lab Scopes an oscilloscope or lab scope is a visual voltmeter. A lab scope converts electrical signals to a visual image representing voltage changes over a specific period of time.



Fig1.23Lab Scopes

Engine performance testing device tools

- ✓ **Hand-Held Engine Analyzer**

Hand-held Engine Analyzer supplies serial testing items, and meets serial testing demands, dual-track Width and duty cycle.



Fig1.24. Hand-Held Engine Analyzer

- ✓ **Scan Tools**

A scan tool is a microprocessor designed to communicate with the vehicle's computer, Connected to the computer through diagnostic connectors, a scan tool can access diagnostic trouble codes (DTCs), run tests to check system operations, and monitor the activity of the system. Trouble codes and test results are displayed on a screen or printed out on the scanner printer.



Fig1.25. Scan Tools

Engine Analyzer

With an engine analyzer, you can perform tests on the battery, starting system, charging system, primary and secondary ignition circuits, electronic control systems, fuel system, emissions system, and engine assembly.

The analyzer may compare the test results to the vehicle manufacturer's specifications. When the test series is completed, the analyzer prints a summary report. Many analyzers also provide diagnostic assistance for the problems indicated by their measurements.



Fig.1.26 Engine Analyzer

Fuel Pressure Gauge

A fuel pressure gauge is used to check the discharge pressure of fuel pumps, the regulated pressure of fuel injection systems, and injector pressure drop. This test can identify faulty pumps, regulators, or injectors and can identify restrictions present in the fuel delivery system. Restrictions are typically caused by a dirty fuel filter, collapsed hoses, or damaged fuel lines.



Fig.1.27 Fuel Pressure Gauge

Vacuum Gauge measuring intake manifold vacuum is another way to diagnose the condition of an engine. Manifold vacuum is tested with a vacuum gauge. Vacuum is formed on a piston's intake stroke. As the piston moves down, it lowers the pressure of the air in the cylinder if the cylinder is sealed.



Fig. 1.28 Fuel Pressure Gauge

Vacuum Pump the vacuum pump is also used to locate vacuum leaks by connecting the vacuum pump to a suspect vacuum hose or component and applying vacuum.

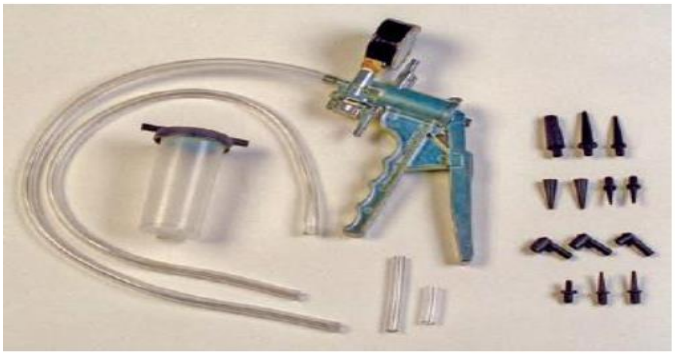


Fig. 1.29. Vacuum Pump

Tachometer is used to measure engine speed. Tachometers are connected to the ignition system to monitor ignition pulses, which are then converted to engine speed by the meter. Several types of inductive pickup tachometers that simplify rpm testing are available.



Fig.1.30 Tachometer

Timing Light timing light is used to check ignition timing. The timing light is connected to the battery terminals and has an inductive clamp that fits over the number 1 spark plug wire. While the engine is running, the timing light emits a beam of light each time the spark plug fires.



Fig.1.31Timing Light

Spark Tester Using test spark plugs is an easy way to determine if the ignition problem is caused by something in the primary or secondary circuit. The spark tester is inserted in the spark plug end of an ignition cable. When the engine is cranked, a spark should be seen from the tester to a ground.

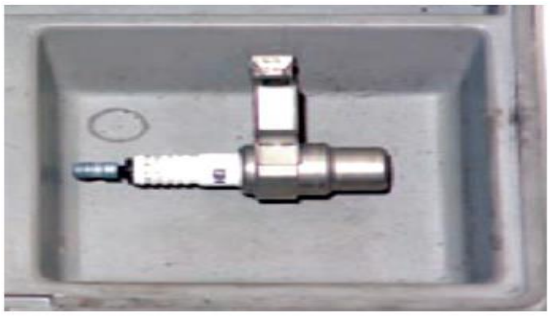


Fig.1.32Spark Tester

Exhaust Analyzers Exhaust analyzers measure the amount of HC and CO in the exhaust. HC is measured in parts per million (ppm) or grams per mile (g/mi) and CO is measured as a percent of the total exhaust.





Fig.1.34 Exhaust Analyzers

1.5. Identifying and marking unsafe or faulty tools and equipment

1.5.1. Basic general automotive workshop safety depending on tools and equipment

Power tool safety

Power tools are operated by an outside power source, such as electricity, compressed air, or hydraulic pressure.

Always respect the tool and its power source. Carelessness can result in serious injury. Also, always wear safety glasses when using power tools. Never try to use a tool beyond its stated capacity.



Electrical Tools safety

When using an electrically powered tool, make sure it is properly grounded. Check the wiring for insulation cracks, as well as bare wires, before using it. Also, when using electrical power tools never stand on a wet or damp floor.



Fig.1.35 Electrical Tools safety

Compressed Air Tools safety

Pneumatic tools must always be operated at the pressure recommended by the manufacturer.

Before using a pneumatic tool, check all hoses connections for leaks. Also check for airline damage.

Never use compressed air to clean the floor or workbench.

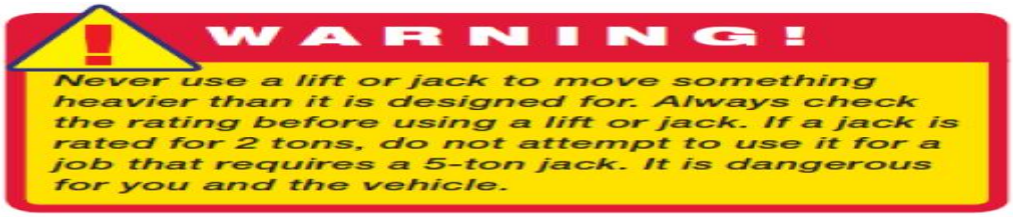
Never spin bearings with compressed air. If the bearing is damaged, one of the steel balls or rollers might fly out and cause serious injury.



Fig.1.36 Compressed Air Tools safety

Jack and Jack Stand Safety

- A vehicle can be raised off the ground by a hydraulic jack. A handle on the jack is moved up and down to raise part of a vehicle and a valve is turned to release the hydraulic pressure in the jack to lower the part.



Safety stands

Safety stands, also called **jack stands**, are supports of various heights that sit on the floor. They are placed under a sturdy chassis member, such as the frame or axle housing, to support the vehicle

Chain Hoist and Crane Safety

Heavy parts of the automobile, such as engines, are removed by using chain hoists or cranes. Another term for a chain hoist is chain fall. Cranes often are called cherry pickers.

To prevent serious injury, chain hoists and cranes must be properly attached to the parts being lifted. Always use bolts with enough strength to support the object being lifted.



Fig.1.37 Chain Hoist and Crane Safety

Cleaning Equipment Safety

Part cleaning is a necessary step in most repair procedures. Cleaning automotive parts can be divided into three basic categories.

Chemical cleaning relies primarily on some type of chemical action to remove dirt, grease, scale, paint, or rust.

Chemical cleaning equipment includes small parts washers, hot/cold tanks, pressure washers, spray washers, and salt baths.



Fig.1.38 Cleaning Equipment Safety

Electrical Safety

To prevent personal injury or damage to the vehicle, you should always take the necessary precautions before working.

Disconnect the negative or ground cable first, then disconnect the positive cable. Because electrical circuits require a ground to be complete, by removing the ground cable you eliminate the possibility of a circuit accidentally becoming completed.

When reconnecting the battery, connect the positive cable first, then the negative.



Fig. 1.39 Cleaning Equipment Safety

1.6. OHS relation to tools and equipment

Personal protective equipment (**PPE**) is protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection.

Protective equipment may be worn for job-related occupational safety and health purposes, as well as for sports and other recreational activities.

Identified/selected tools and equipment are checked for functionality and readied for use.

Eyes goggles

Hazards: chemical or metal splash, dust, projectiles, gas and vapor, radiation.

O**ptions**: safety spectacles, goggles, face shields, visors.



Safety Sign for EYES PROTECTION: *It emphasized to wear eye protection PPE such as safety spectacle, goggles, face shield or visors.*

Goggles

Fig.1.40 Eyes goggles

Head Helmet

Hazards: impact from falling or flying objects, risk of head bumping, hair entanglement.

Options: a range of helmets and bump caps.

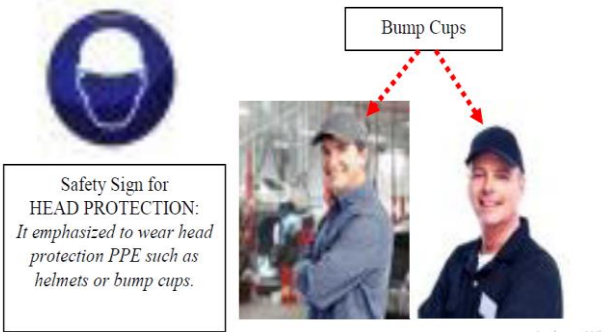


Fig.1.41 Head Helmet

Hazards: dust, vapor, gas, oxygen-deficient atmospheres.

Options: disposable filtering face piece or respirator, half or full-face respirators, air-fed helmets, breathing apparatus.

Protecting the body

Hazards: temperature extremes, adverse weather, chemical or metal splash, spray from pressure leaks or spray guns, impact or penetration, contaminated dust, excessive wear or entanglement of own clothing.

Options: conventional or disposable overalls, boiler suits, specialist protective clothing, that is chain-mail aprons, high-visibility clothing.

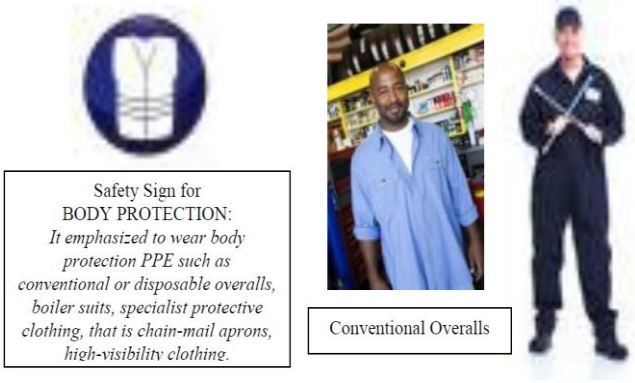


Fig.1.42 protecting the body

Hands and arms protection

Hazards: abrasion, temperature extremes, cuts and punctures, impact, chemicals, electric shock, skin infection, disease or contamination.

Options: gloves, gauntlets, mitts, wrist cuffs, armlets.



Safety Sign for HANDS/ARMS PROTECTION: *It emphasized to wear hands/arms protection PPE such as gloves, gauntlets, mitts, wrist cuffs, armlets.*



Gloves made of cotton or leather.

Fig. 1.43 Hands and arms protection

Feet and legs protection

Hazards: wet, electrostatic build-up, slipping, cuts and punctures, falling objects, metal and chemical splash, abrasion.

Options: safety boots and shoes with protective toe caps and penetration-resistant mid-sole, gaiters, leggings, spat.



Safety Sign for FEET/LEGS PROTECTION: *It emphasized to wear feet/legs protection PPE such as safety boots and shoes with protective toe caps and penetration-resistant mid-sole, gaiters,*



Safety boots or shoes with protective toe

Fig.1.44 Feet and legs protection

Self-check-1

Directions: Answer all the questions listed below.

1. What is safety? (3 mark)
2. What is PPE? (3 marks)
3. What are the conditions or depending while selecting a working area?
4. Write the types of specification and their use?
5. A good housekeeping program identifies and assigns responsibilities for the following?
6. What we do for power tool safety?
7. ----------are operated by an outside power source, such as electricity, compressed air, or hydraulic pressure.
8. A good housekeeping program identifies and assigns responsibilities for the following:

   A. clean up during the shift
   B. day-to-day cleanup
   C. waste disposal
   D. All

Operation sheet-1

OPERATION TITLE: -proper using tools and equipment's

PURPOSE: - in order to avoid/reduced personal injury or damaging of tools and equipment.

CONDITIONS OR SITUATIONS FOR THE OPERATIONS

- ✓ Safe working area
- ✓ Properly operated tools and equipment's
- ✓ Appropriate working cloths fit with the body

EQUIPMENT, TOOLS AND MATERIALS

- ✓ **Hand tools-** screw driver, wrenches, hammers etc.
- ✓ **Equipment's-** floor jack, hydraulic crane etc.
- ✓ **Special tools-** puller

PROCEDURE

- ✓ Prepare a tool and equipment for its intended purpose.
- ✓ Always use the correct size tool for the job you are doing.
- ✓ Pull a wrench rather than push it whenever possible.
- ✓ Keep all tools clean and replace them in a suitable box or cabinet.
- ✓ Always follow manufacturers' recommendations (you cannot remember everything!).
- ✓ Look after your tools and they will look after you.

PRECAUTIONS

- ✓ Wear working cloths which properly fit with your body
- ✓ Make working area hazard free
- ✓ Read and interpret manual which guide you
- ✓ how to use tools and equipment's
- ✓ Do not use a file or similar, without a handle
- ✓ Do not use a screwdriver as a pry bar.

Lap Test-1

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 2 hours.

Task 1 Follow Procedures and workshop manuals

Task 2 Identify tools and equipment

Task 3 Preparing testing devices how to use

Task 4 Identify and mark unsafe or faulty tools and equipment

Unit Two: Carrying-out measurements

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

- Selecting measuring tools
- Check and adjust measuring/testing devices
- Implementing appropriate measurements procedures
- Handling measuring instruments without damage
- Document result

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:

- Identify and Select measuring tools
- Check and adjust measuring/testing devices
- Understand Implement appropriate measurements procedures
- Properly Handle measuring instruments without damage
- Follow Documented result

2.1. Selecting measuring tools

2.1.1. Measuring tools

Rules The simplest tool for measuring linear distances is the steel scale, or rule. It can be marked off in both or either metric and/or inch.



Fig.2.1 **rulers**

Thickness Gauges Thickness gauges or "feeler" gauges are strips or blades of metal of various thicknesses. Thickness gauges are used to measure small distances such as the clearance between two parts. **For example,** to check the clearance between the rocker arm and valve stem in an engine.

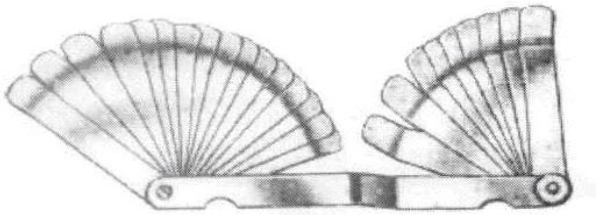
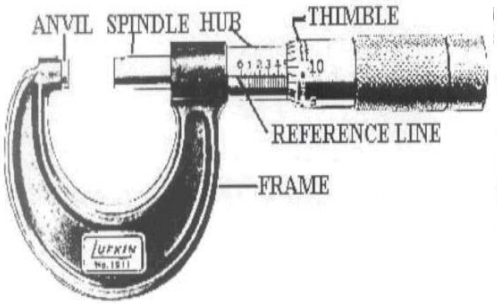


Figure 2.2 Thickness gauges

Micrometers the micrometer is a precision measuring tool that can measure thickness in hundredths of a millimeter (metric system) or in thousandths or ten-thousandths of an inch. There are three types, outside micrometers, inside micrometers and depth micrometers.

A. Outside Micrometers the outside micrometer is designed to measure the outside diameter of cylindrical forms and the thickness of materials. The standard sizes are 0-25mm, 25-50mm, 50-75mm, 75-100 and so on.



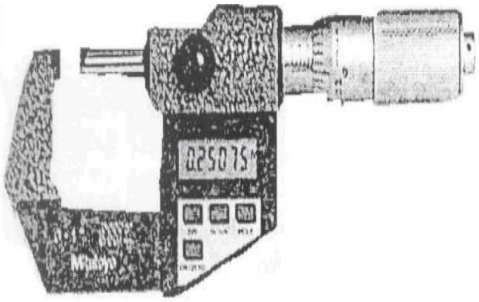
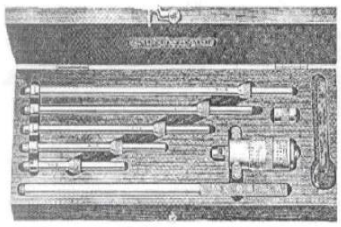


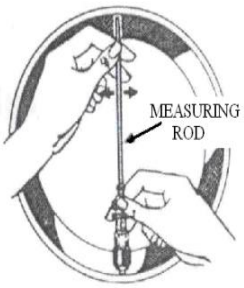
Figure 2.3 Parts of outside micrometer **Figure 2.4** Digital micrometer

Remember to always store micrometers in a clean, dry, safe place.

B. Inside Micrometer the inside micrometer is used for measuring the distance between two parallel surfaces and for measuring the inside diameter of cylinders.

To use this instrument, select a spindle that will just accommodate the inside of a cylinder or above when it is threaded to the thimble and sleeve. Read the measurement in the same way you read outside micrometer and add to this reading the size of the spindle.





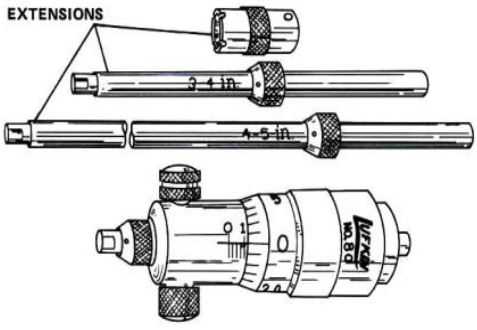


Figure 2.5 Inside micrometer set **Figure 2.6** Components of inside micrometers

C. Depth Micrometers depth micrometers, as the name implies, measures the depth of an object. There are also dial depth gauges. These dial depth gauges are useful in checking end play and run out on a large number of parts

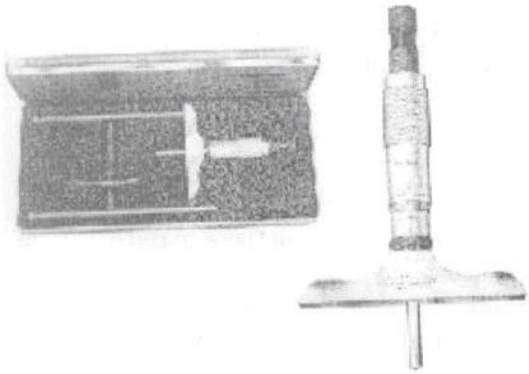


Figure 2.6 Depth micrometers

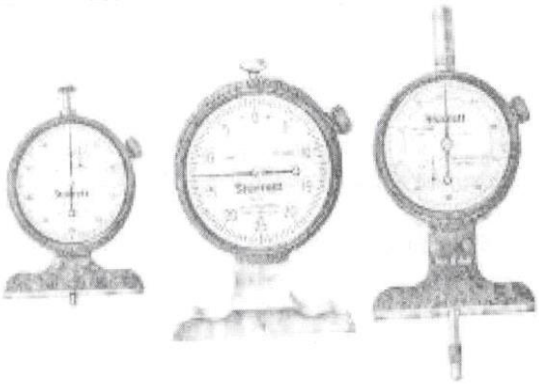


Figure 2.6 Dial depth gauges

Dial Indicator

The dial indicator is a gauge that uses a dial face and a needle to register measurements. The dial indicator can be used for checking the run-out, out of round and taper condition of the cylinder walls in an engine, to measure an endplay in shafts or gears, the amount of run out of a flywheel and numerous other measurements.

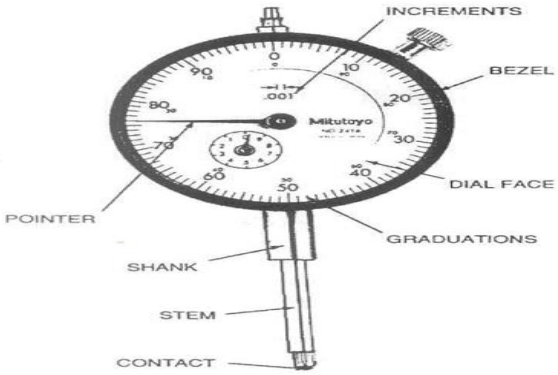


Figure 2.7 Dial indicator

Vernier Caliper Mostly, the vernier caliper is more convenient than the mike. The vernier caliper can take inside, outside, and depth measurements to within hundredths or thousandths of a millimeter or thousandths of an inch.

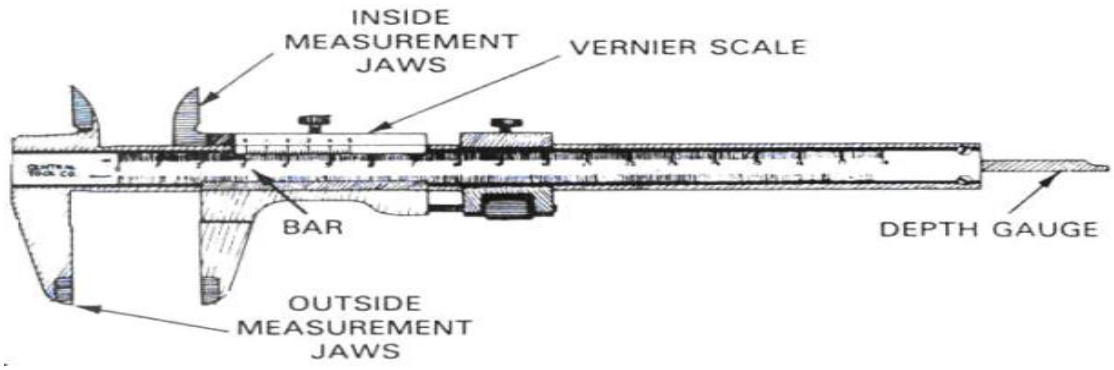


Figure 2.8 Vernier Caliper

Telescopic Gauge telescopic gauge is measuring the inside diameter of a hole or a bore and consists of two spring loaded telescoping members and a locking handle. In use, the gauge is placed in the hole or bore with the handle parallel to the sides of the bore.

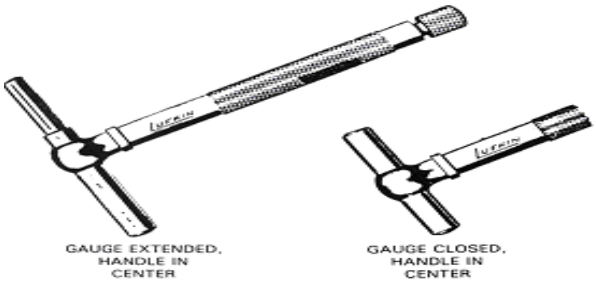


Figure 2.9 Telescopic gauge

Plastic-gauge Plastic gage is used to determine clearances. To measure bearing clearance, place a piece of Plastic gage along the width of the bearing cap. Install the bearing cap with the Plastic gage between the bearing and the journal and tighten the cap to the proper torque value.

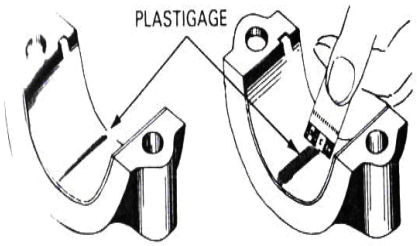


Figure 2.10 Plastic gage

2.2. Check and adjust measuring/testing devices

Measuring Tools

a. Steel rule and tape rule:

- ✓ Measuring tools of 1 mm graduation mainly used for coarse measurements at easily accessible measuring points with the tool always to be placed at right angles to the locating edge.

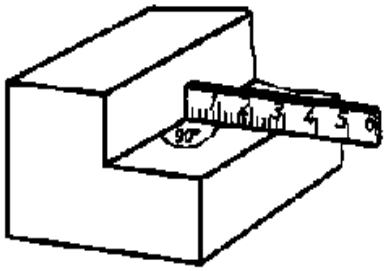


Figure 2.11 Location of the steel rule

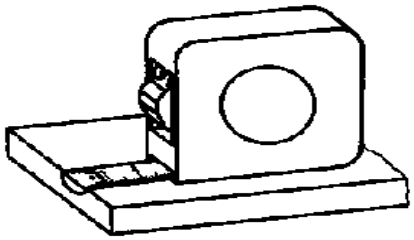


Figure 2.12 Location of the tape rule

b. Depth gauge:

- ✓ Special instrument of 1/10 nun measuring accuracy for depth measurements of slots, shoulders and bore holes.
- ✓ Depths of bore holes are always measured at the border (never in the center!)!

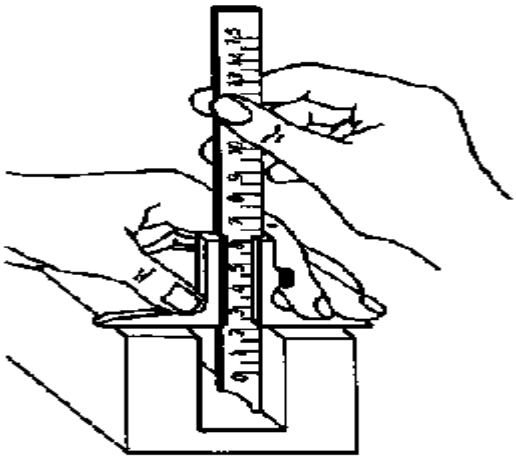


Figure.2.14 measuring of a slot depth by means of the depth gauge

c. Outside micrometer:

- ✓ Instrument of 1/100 mm measuring accuracy for precision measurement of outside measures in certain measuring ranges.

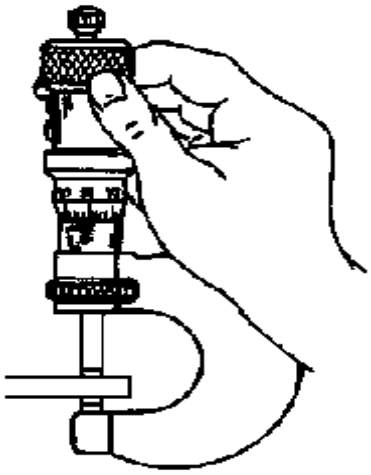


Figure 59. Measuring by means of the outside micrometer

d. Dial gauge:

- ✓ Special instrument of 1/100 mm measuring accuracy for precision measurement in differential and concentricity measurements in batch production.

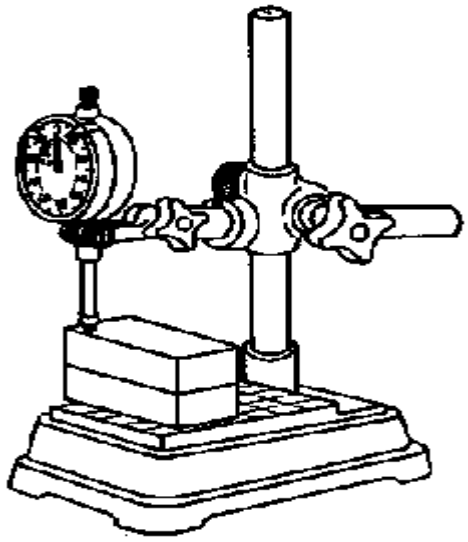


Figure 2.15 Use of the dial gauge in differential measurements

e. Universal bevel protractor:

- ✓ Instrument for measurement of angles from 0 to 360 degrees with 1-degree graduation, with Vernier providing for a reading accuracy of 1/12 degree - suitable for precision measurements.

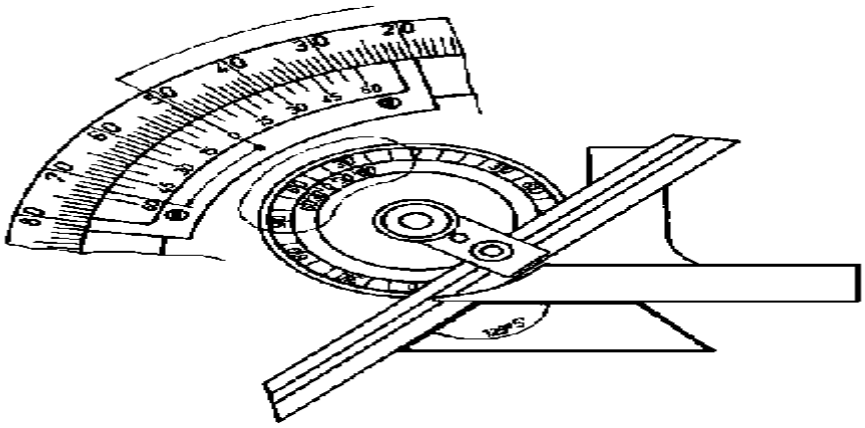


Figure 2.16 Universal bevel protractors

Testing with measuring tools (measuring):

- ✓ Lengths and angles of any object are determined (measured) by comparison with a measuring instrument where the exact value measured can be read on a scale

Testing Tools

a. **Size gauges Size** gauges are used to determine sizes or to check whether any dimensions of parts are within admissible limits.

The answer may be:

Yes - the size is within the admissible range.

No - the size is smaller than required.

No - the size is bigger than required.

If the answer is "no", it is to be decided whether (reworking) corrections of the part are possible.

b. **Caliper:** Instrument with movable legs for outside and inside testing which are set to the size of the work piece or setting of which is done by means of a measuring instrument before use.

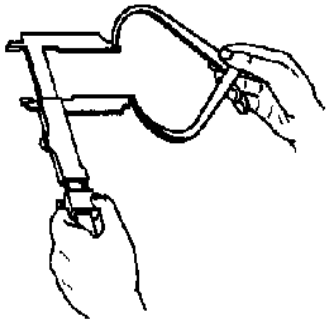


Figure 2.17 Outside calipering

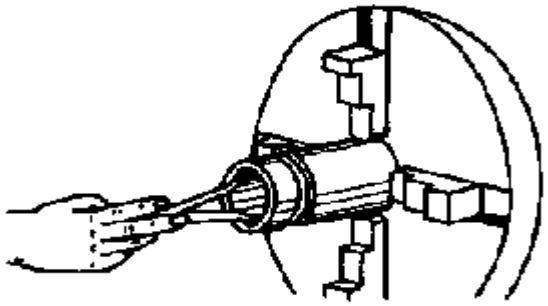


Figure 2.18 Inside calipering

c. Thickness gauge:

- Instrument which consists of several leaves of different thicknesses (0.05 to 0.1 mm increments) and is used to determine the size of narrow clearances by inserting a leaf into the clearance.

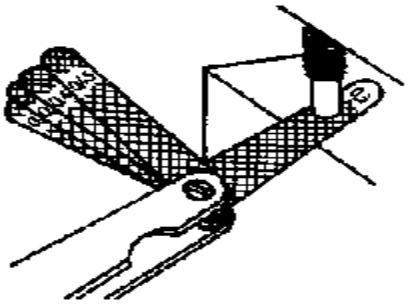


Figure 2.19 Clearance testing by means of a thickness gauge

Testing with testing tools (gauging):

- Deviations in size or shape of any object are determined (tested) by comparison with a gauge.
- This will answer the question as to whether the deviations are within or beyond admissible ranges (tolerance ranges) only. There is no need to know the exact value.

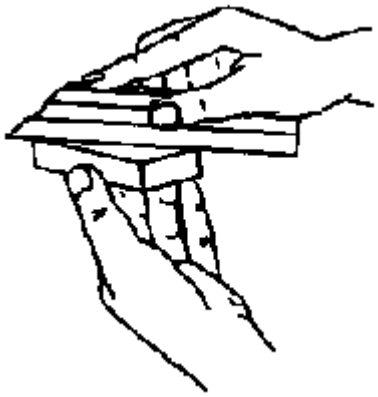


Figure2.20 Testing

1.3. Implementing appropriate measurements procedures

1.3.1. Handling measuring instruments without damage

- Proper lubrication of measuring instruments will prevent damage due to corrosion and oxidation.
- Precision measuring should be lightly oiled after each use and excess oil should be removed from metal surface with a clean, dry cloth.

Faults at the measuring instrument (damage):

- ✓ Check any measuring instrument for serviceability before use (slide vernier caliper into zero position and compare scale and vernier;
- ✓ Check for external damage.
- ✓ Inaccuracies of measuring instruments may also be the result of too wide manufacturing tolerances or maladjustments!

Faults caused by wrong use:

- The measuring instrument is to be used for the proper purpose and range of accuracy.
- Too big measuring forces (deflections), oblique location or location on faces or edges not cleaned or burred may result in wrong values measured. Moreover, reading errors may be a consequence of inadequate lighting or wrong conversion of the indicated values.

Faults caused by environmental conditions:

- Measuring instruments and work pieces are subject to heat expansion and low-temperature contraction.
- This may lead to different measuring results for the same object measured. To have a comparative value, measuring and testing tools are mostly adjusted at 20° Celsius.

1.3.2. Document result

Documentation is a set of documents provided on paper, or online, or on digital or analog media, such as audio tape or CDs.

Follow these three general principles to develop records and documents:

- ✓ Keep it short and simple. Use bullet points and flow diagrams instead of long sentences and lengthy paragraphs.
- ✓ Clarity is important. Step-by-step instructions are easily understood.
- ✓ Use a standardized, consistent format. Although different programs may need different documents and records, using a similar approach will help staff learn quickly.

Self-check-2

Part 1. Give the best answer for the following questions (1point)

1. Define and explain about the following measuring tools?

A. Rule
B. Micrometer
C. VerniercaIiper
D. Dial gauge
E. Plastic-gauge

2. What is the misuse of equipment the hazard encounter in the workshop?
3. What is documentation?
4. While maintenance makes sure the equipment is?

Operation sheet 2.1

OPERATION TITLE: - Carry-out measurements

PURPOSE: - implement appropriate measurement procedure check and adjust measuring/testing devices.

CONDITIONS OR SITUATIONS FOR THE OPERATIONS

- ✓ Safe working area
- ✓ Properly operated measuring tools
- ✓ Selecting measurements tools

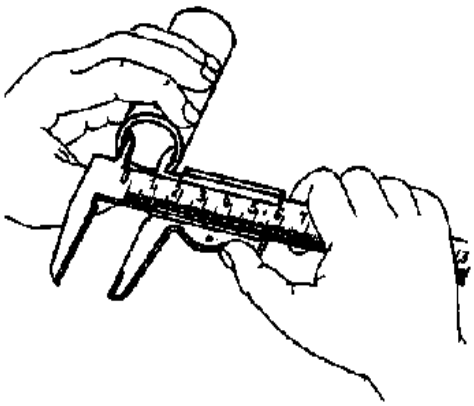
EQUIPMENT, TOOLS AND MATERIALS

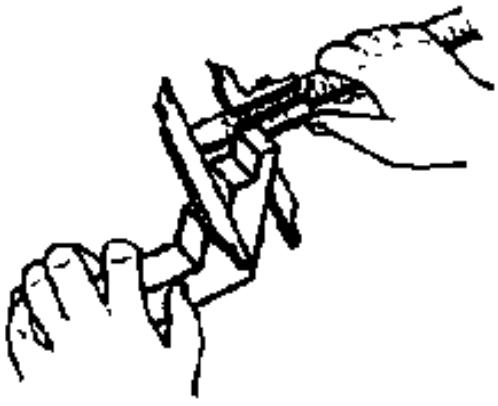
- ✓ **Measuring tools –** steel rule, micrometer, Dial gauge, etc.
- ✓ **Testing tools-** caliper, thickness gauge etc.

PROCEDURE

- ✓ Inspect/test the vehicle accordance with manufacturer procedure
- ✓ Record/ capture the problem with the necessary information
- ✓ Order the recorded problems in accordance with their damaging area
- ✓ Report to the assigned person for these problems
- ✓ Maintain damaging parts according to maintenance procedure
- ✓ Preparing reports have no error/discrepancy
- ✓ Check any measuring instrument for serviceability before use
- ✓ Check for external damage.

For Examples checking/Testing VerniercaIiper





1. Clean the legs and check the tool for accuracy.
2. Clean the objects to be measured
3. Check for external damage.
4. Inaccuracies of measuring instruments may also be the result of too wide manufacturing tolerances or maladjustments!
5. Slide the movable leg close to the surface.
6. Lock it with the lock screw to the bar.
7. Be certain that the legs are parallel to the object to be measured and do not force the legs together.
8. Adjust the leg with adequate force so that the object just sits between the two legs.
9. Check any measuring instrument for serviceability before use (slide vernier caliper into zero position and compare scale and vernier;

PRECAUTIONS

- ✓ Handling measuring instruments without damage.
- ✓ Always follow manufacturers' recommendations
- ✓ Read and interpret manual which guide you
- ✓ Do not use Improper measuring tools

Lap Test-2

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, workshop, carry out measuring tools you are required to perform the following tasks within 2 hours.

Task 1 identifies and selects measuring tools

Task 2 Check and adjust measuring/testing devices

Unit Three: Using tools and equipment

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

- Tools and equipment
- Electrical measuring device.
- Use and observe Personal Protective Equipment (PPE)
- Handling tools and equipment
- Reporting malfunctions, unplanned or unusual events

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:

- Identify Tools and equipment
- Follow Electrical measuring device.
- Use and observe Personal Protective Equipment (PPE)
- Handling tools and equipment
- Reporting malfunctions, unplanned or unusual events

3.1 Tools and equipment

3.1.1 Hand tools

Hand tools are used very often throughout work to loosen and tighten bolts, screws and parts; apply impact to or mark something for adjustment or replacement etc.

3.1.2 Generic Mechanic Tools set

The screwdriver handle can meet batch head (a word cross T word plum blossom socket head hex extension roduniversal joint can receive bending bar).

The socket using high-quality chrome vanadium steel 50 bv30 cold-press forming, torque 50% higher than that of carbon steel, use inferior smooth surface processing, good rust prevention.

For example: -



3.1.3 Power tools

Power tools are tools driven by compressed air, electricity, or pressurized liquid. They make many repair operations easier and quicker.

Large shop tools, such as floor jacks, parts cleaning tanks, and steam cleaners, are called shop equipment.

3.1.4 Measuring and testing Tools

a. Measuring tools

Measuring tools are sensitive instruments of surface hardened steel provided with scales of different degree of accuracy. Simple measuring tools are mainly used in single-part production and maintenance work.

b. Testing tools

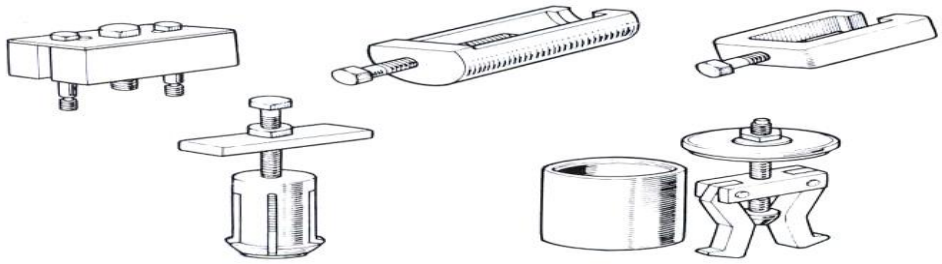
Testing tools (gauges) are sensitive instruments of surface hardened steel without any graduation. The measure is represented by their shape or size or setting.

3.1.5 SPECIAL SERVICES TOOLS (SST'S)

Ordinary hand tools cannot be used for all jobs they sometimes damage parts, or take too much time to do something. Special service tools, often referred to as SSTs, are designed to correct these drawbacks.

There are a large variety of SSTs to be used selectivity according to the type of the vehicle and work.

For example: - pullers



3.1.6 Equipment

Equipment means passenger cars, trucks (including trailers for trucks), minivans, on-the-road vehicles, construction and heavy duty agricultural equipment, motor homes, or other wheeled vehicles comparable to the foregoing, but not including "Non-Automotive Equipment."

3.2 Electrical measuring device

An Electrical measuring device combines several measurements functions in one unit.

For example:

- ✓ Current is measured by Ammeter.
- ✓ Voltage is measured by Voltmeter.
- ✓ Resistance is measured by Ohmmeter.

Multi meter: - electronic instrument having ability to measure current, voltage, Resistance, conductance.

Types of Multi meter: - Analogue multi meter and Digital multi meter

- ✓ Analogue Multi meter (AMM) is a multi-purpose electronic testing device. ϖ It is capable to measure voltage, current, and resistance.
- ✓ A digital multi meter is an electronic instrument which is used to measure electrical parameters. A DMM can measure AC/DC voltage , AC/DC current ,Resistance, Continuity test , Diode check

How to measure Voltage by Multi meter (voltmeter): -

- ✓ Connect the multi meter to a circuit. Put the black probe in the common terminal and the red probe in the terminal marked for measuring volts and ohms.
- ✓ Set the multi meter it for the voltage you're measuring. You can measure volts DC (direct current), millivolts DC or volts AC (alternating current).
- ✓ Measure AC voltage by placing the probes across the component.
- ✓ It's not necessary to observe polarity. Observe polarity when measuring DC voltage or mill voltage. Place the black probe on the negative side of the component and the red probe on the positive side.
- ✓ Read the display, taking care to note the units.

How to measure current by using multi meter (Ammeter):

- ✓ Choose either the terminal marked for measuring 10 amps or the one marked for measuring 300 milliamps (mA). If you're unsure of the current, start in the 10 amp terminal until you're sure the current is less than 300 milliamps.
- ✓ Set the multi meter to measure current. This may be represented by the letter A.
- ✓ Turn off power to the circuit.
- ✓ Break the circuit. To measure current, you must place the multi meter in series with the circuit. Place the probes on either side of the break, observing polarity (black probe on negative side, red probe on positive side.)
- ✓ Turn the power on. The current will run through the circuit, up the red probe and through the multi meter, then out the black probe and into the circuit.
- ✓ Read the display, remembering whether you are measuring amps or milliamps. You can use the touch-hold feature if desired.

How to measure Resistance by Multi meter (Ohmmeter):

- ✓ Connect the multi meter to the circuit. Insert the black probe into the common terminal and the red probe into the terminal marked for measuring volts and ohms. The terminal may also be marked for testing diodes.
- ✓ Twist the selector knob to set the multi meter to measure resistance. This may be represented by the Greek letter Omega, which stands for ohms, the unit of measurement for resistance.
- ✓ Turn off power to the circuit.
- ✓ Remove the resistor you want to measure. If you leave the resistor in the circuit you may not get an accurate reading.
- ✓ Touch the tips of the probes to each side of the resistor.
- ✓ Read the display, taking care to note the units. A reading of 10 may indicate 10 ohms, 10 kilo-ohms or 10 mega-ohms.



3.3. Use and observe Personal Protective Equipment

Personal protective equipment includes those prescribed under legislation/ regulations/codesof practice and workplace policies and practices. Safe operating procedures include the conduct ofoperational risk assessment and treatments associated with workplace organization.

The goals of occupational safety and health programs include fostering a safe and healthy work environment. OSH may also protect co-workers, family members, employers, customers, and many others who might be affected by the workplace environment. Occupational safety and healthcan be important for moral, legal, and financial reasons.

Personal protective equipment (PPE) Selection

PPE selection should be based on a job hazard analysis (JHA), which includes evaluation ofhazards, specific tasks, procedures and work practices, in consultation with area supervision as needed.This PPE selection guidance is not intended to be a comprehensive resource on PPE.

1. Eye Protection
2. Hand Protection
3. Skin and Body Protection
4. Foot and Leg Protection

3.4. Handling tools and equipment

Handling of hand tools the responsibility of each employee to make frequent inspections of tools and other equipment used to make sure such tools and equipment are in good physical condition.

Pointed tools shall never be carried edged or point up in a worker's packet.

Some of the commondefects in tools and equipment that shall be eliminated to prevent accidents are the following:

- ✓ Handles which are cracked, split, broken or loose, in hammers, shovels, sledges, axes,etc.
- ✓ Mushroom heads on chisels, impact drill, etc.
- ✓ Wrenches that fit poorly, open-end wrenches, and adjustable wrenches with spread jaws,or pipe wrenches that do not hold.
- ✓ Ladders having broken or loose rungs or cracked side pieces.
- ✓ Ladders with no rubber shoes.
- ✓ Rubber protective devices having cracked, cut, or otherwise defective, rubber.

Pipe wrench jaws; - must be clean before being used. Shims must never be used to make a wrenchfit.

Cutting and digging tools; - are the safest to use when they are kept sharp and in good condition.

Tools and equipment; - shall be kept in proper operating condition and usedonly for the purpose for which they were designed

3.5. Reporting malfunctions, unplanned or unusual events

Problem reporting procedures

- ✓ Inspect/test the vehicle accordance with manufacturer procedure
- ✓ Record/ capture the problem with the necessary information
- ✓ Order the recorded problems in accordance with their damaging area
- ✓ Report to the assigned person for these problems
- ✓ Maintain damaging parts according to maintenance procedure
- ✓ Preparing reports have no error/discrepancy.

Faulty work habits

- ✓ Smoking around fuel and solvents
- ✓ Incorrect handling of paint, thinners, solvent
- ✓ Blocking exits. A block exit could mean serious injury or even death during an emergency case such as fire.

Misuse of equipment's

- ✓ Incorrect safety guarding of moving machinery
- ✓ Misuse of flexible electric cords or worn cords. When used through holes the May cause fire

- ✓ Improperly stored composed gas cylinders
- ✓ Using hand held electric tools improperly grounded

Misuse of hand tools

- ✓ Keeping hand tools dirty and in poor conditions
- ✓ Improper storing of hand tools
- ✓ Using defective hand tools
- ✓ Keeping sharp tools in pockets

Self-check-3

Instructions: Read the following questions and choose the best answer (6 points each)

1. The goals of occupational safety and health programs are
   A. Increases the emergency in the workplace
   B. fostering a safe and healthy work environment
   C. leads poor handling of material
   D. none

2. ----------includes those prescribed under legislation/ regulations/codes of practice and workplace policies and practices.
   A. Personal protective equipment **C.** Equipment
   B. Tool **D**. All

3. ----------can be important for moral, legal, and financial reasons.
   A. OHS **C.** PPE
   B. Occupational health and safety D. A&B

4. ----------is a set of documents provided on paper, or online, or on digital or analog media, such as audio tape or CDs. Increases the emergency in the workplace
   A. Equipment **C.** leads poor handling of material
   B. Documentation **D.** none

5. which of the following are Problem reporting procedures includes are,
   A. Report to the assigned person for these problems
   B. Maintain damaging parts according to maintenance procedure
   C. Preparing reports have no error/discrepancy
   D. All

Operation sheet-3.1

OPERATION TITLE: -use tools and equipment

PURPOSE: - properly use tools and equipment

CONDITIONS OR SITUATIONS FOR THE OPERATIONS

- ✓ Safe working area
- ✓ Properly apply tools and equipment
- ✓ Identify tools and equipment

EQUIPMENT, TOOLS AND MATERIALS

Tools – Hand tools, Generic Mechanic Tools set, Power tools etc. .

Electrical measuring device- Voltmeter (Multi-meters), oscilloscope

PROCEDURE

- ✓ identifying different tools and equipment
- ✓ Using tools and equipment according to tasks undertaken
- ✓ observing all safety procedures in using tools and equipment
- ✓ handling tools and equipment without damage reporting malfunctions, unplanned or unusual events

PRECAUTIONS

- ✓ Properly use tool and equipment without damage.
- ✓ Always follow manufacturers' recommendations
- ✓ Read and interpret manual which guide you

Lap Test-3

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, workshop, carry out measuring tools you are required to perform the following tasks within 2 hours.

Task 1 Use properly tools and equipment

Task 2 identify Electrical measuring device.

Task 3 Use and observe Personal Protective Equipment (PPE)

Task 4 Handling tools and equipment

Task 5 Reporting malfunctions, unplanned or unusual events

Unit Four: Maintaining tools and equipment

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

- Undertake Routine maintenance
- Clean equipment and tools
- Store tools and equipment safely

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:

- Follow Undertaking Routine maintenance
- Applying Cleanup equipment and tools
- Properly Store tools and equipment safely

4.1. Undertake Routine maintenance

A maintenance strategy includes procedures as well as corrective and preventive maintenance Inspections ensure that measuring/testing device**,** tools and equipment are operating correctly.

- ✓ **Corrective maintenance (cm)** restores the function of a failed device and allows it to be put back in to service.
- ✓ **Preventive maintenance** (pm) aims to extend the life of the tools/equipment and reduce failure rates.

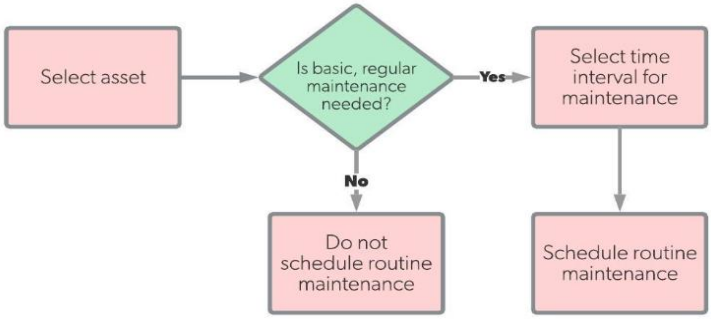
Preventive maintenance is the systematic care and protection of tools, equipment, machines and vehicles in order to keep them in a safe, usable condition limit downtime and extend productivity. The successful maintenance program is:

- well organized and scheduled,
- controls hazards,
- defines operational procedures, and
- Trains key personnel.

Routine maintenance is the upkeep practices that an organization performs on a regular basis with an eye towards preventing harm to workers and large-scale, expensive repairs.

also called planned maintenance, often involves scheduling, at which time machines, including computer systems, or other assets are examined, updated or tuned up. This scheduled effort may require ordering spare parts or running diagnostics. Regular maintenance like this avoids catastrophic breakdowns in equipment and allays the greater costs associated with those repairs. Additionally, these precautions enhance worker safety, especially for those operating the equipment in question.

Routine maintenance workflow



Typical examples of routine maintenance include:

- ✓ Lubricating, cleaning, or adjusting machinery
- ✓ Inspecting equipment to ensure proper operation and safety
- ✓ Replacing parts that show deterioration
- ✓ Checking, testing, and maintaining safety equipment, such as safety barriers, fire extinguishers, or alarm systems
- ✓ Checking for and replacing damaged signage or utilities, like light bulbs
- ✓ General workplace maintenance, such as cleaning floors, replacing HVAC filters, and washing windows, trash removal, and landscaping.

Advantages of routine maintenance

There are several advantages to performing routine maintenance at your facility.

- ✓ Routine maintenance can decrease downtime and lengthen the lifespan of equipment when used in conjunction with a well-planned preventive maintenance program.
- ✓ Regular routine maintenance can reduce the need for reactive maintenance.
- ✓ Routine maintenance helps assets and equipment working in optimal conditions, leading to fewer failures, better productivity, higher profitability, and improved safety.

4.1.1. Cleaning

Tools get dirty that's a given whether they are hand tools, power tools, or especially gardening tools, your tools are bound to get some dirt, grime, soot, rust, and even oil on them. Here's everything you need to know on how to clean your tools, so they can keep working hard for you without losing their luster.



Here is what you'll need to better clean your tools:

- ✓ Dish soap to tackle oil and grease
- ✓ Large bucket for hot water and dish soap solution

- ✓ Scrubber, scrub brush, or steel wool to further clean away any dirt
- ✓ Cloth to wipe down your tools

Hand Tool Cleaning Directions

- ✓ Add a teaspoon of soap to a gallon of hot water.
- ✓ With a dishrag or sponge, scrub away the grease and oil (do not soak hand tools*).
- ✓ When clean, thoroughly rinse them under running water and dry them with a towel right away.

4.1.2. Lubricating

Lubrication equipment is essential since machine parts often need a constant supply of lubricating fluids such as oil and grease, and lubrication equipment can provide this at the proper temperature, viscosity, flow rate and pressure.

Lubrication equipment, such as **chain oilers**, air lubricators and grease pumps, are useful in a wide range of industries including: packaging, for the lubrication of packaging machinery and equipment; pulp and paper, for the lubrication of printing equipment; food and beverage, to lubricate processing and packaging equipment; mining, for the lubrication of stationary and mobile mining equipment; and automotive, for the lubrication of power transmission and other parts.

4.1.3. Tightening

- ✓ A tool with loose parts will not function properly and may cause injuries.
- ✓ Gripping tools such as a plier is an example that needs tightening. A plier's rivet must be well tightened to be able to grip properly.
- ✓ Lubricants must also be applied after tightening to reduce the friction.
- ✓ Driving tools' handles must also be tightened to reduce hand strain when turning. A loosely connected handle will make it almost impossible to use it.

4.1.4. Simple tool repairs

In doing simple repair of tools, make sure that you are knowledgeable in doing so. Repairing tools without sufficient skills may result to further damage or inflict injuries to the fixer. Small repairs like tightening, sharpening and changing of handles may not require special skills to do.

4.1.5. Hand sharpening

Sharpening is the process of removing metal. For rapid metal removal, use a stone, natural or man-made, that consists of comparatively coarse abrasive particles or grains. The coarse

abrasives leave a rough edge; so, after using a “coarse” stone, follow with a second stone having very fine abrasive particles or grit.

The process of sharpening any tool consists of restoring the original cutting edge(s) by removing a little metal.

4.1.6. Adjustment

Making adjustments on manufacturing equipment isn't a task that should be taken lightly. Adjustments are an ordinary part of daily work routines and if they are handled properly, can result in higher rates of productivity and efficiency.

In additional to regular inspections, owners and managers should identify standards for adjustments that occur at specific points in the manufacturing process, including the following equipment adjustment events.

4.2. Clean equipment and tools

- ✓ Part cleaning is a necessary step in most repair procedures.
- ✓ Cleaning automotive parts can be divided into three basic categories.
- ✓ Chemical cleaning relies primarily on some type of chemical action to remove dirt, grease, scale, paint, or rust.



Clean up procedures

- ✓ Clean up every time whenever you leave an area, including sweeping the floor.
- ✓ Clean and return all tools to where you got them.
- ✓ Use compressed air sparingly; never aim it at another person or use it to clean hair or clothes.
- ✓ Shut off and unplug machines when cleaning, repairing, or oiling.
- ✓ Never use a rag near moving machinery.
- ✓ Use a brush, hook, or a special tool to remove chips, shavings, scraps etc. from the work area. Never use the hands.

- ✓ Keep fingers clear of the point of operation of machines by using special tools or devices, such as, push sticks, hooks, pliers, etc.
- ✓ Keep the floor around machines clean, dry, and free from trip hazards. Do not allow chips to accumulate.
- ✓ Mop up spills immediately and put a chair or cone over them if they are wet enough to cause someone to slip.

4.3. Storage of tools and equipment

- ✓ The proper care and storage of tools and equipment's are not only the concern of the management but of the workers who use the equipment.
- ✓ Good organization of stored materials is essential for overcoming material storage problems whether on a temporary or permanent basis.



Importance of proper storage of tools and equipment's

- ✓ It is important factor for safety and health as well as good business.
- ✓ Improves appearance of general-shop and construction areas.
- ✓ Reduce overall tool cost through maintenance.
- ✓ This also ensures that tools are in good repair at hand.
- ✓ It is important factor for safety and health as well as good business.
- ✓ Teaches workers principles of tool accountability.
- ✓ Each workers principles of tool accountability.

Self-check 4

Directions: Answer all the questions listed below (each 2 points).

1. storing tools and equipment's in the follows are

A. Have a designated place for each kind of tools.

B. Label the storage cabinet or place correctly.

C. Store them near the point of use.

D. All

2. ----------is the systematic care and protection of tools, equipment, machines and vehicles in order to keep them in a safe, usable condition limit downtime and extend productivity

A. Preventive maintenance **C.** Scheduled maintenance

B. Corrective maintenance **D.** All

3. the following is Importance of proper storage of tools and equipment's

A. Improves appearance of general-shop and construction areas.

B. Reduce overall tool cost through maintenance.

C. This also ensures that tools are in good repair at hand.

D. All

4. Routine maintenance, also called----------.

A. planned maintenance **C.** Corrective maintenance

B. Preventive maintenance **D.** All

Operation sheet-4.1

OPERATION TITLE: - Maintain tools and equipment

PURPOSE: - To undertaking routine maintenance of tools and equipment in safely in appropriate

CONDITIONS OR SITUATIONS FOR THE OPERATIONS

- ✓ Safe working area
- ✓ Maintain tools and equipment

PROCEDURE

- ✓ undertaking routine maintenance of tools and equipment
- ✓ cleaning equipment and tools
- ✓ storing tools and equipment safely in appropriate

PRECAUTIONS

- ✓ Properly use tool and equipment without damage.
- ✓ Always follow manufacturers' recommendations
- ✓ Read and interpret manual which guide you.

Lap Test-4

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, workshop, maintain tool and equipment you are required to perform the following tasks within 2 hours.

Task 1 maintain tool and equipment

Task 2 identify Electrical measuring device.

Task 3 Clean equipment and tools

Task 4 Store tools and equipment safely

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