EXCITING WORLD OF AUTOMOBILES

STUDENT WORKBOOK

Curriculum :AUTO-SRV *L2-NQ*^{2012}

Unit :AUTO-SRV *L2U2*

Automobile Service Tools

Vocational Learning Material for School

PSS Central Institute of Vocational Education

Bhopal

PREFACE

Improving the parity of esteem between the general academic education and vocational education, is the policy priority of the Government of India. The National Vocational Education Qualification Framework (NVEQF) developed by the Ministry of Human Resource Development (MHRD), Government of India, is a descriptive framework that provides a common reference for linking various qualifications. It will be used for setting common principles and guidelines for a nationally recognized qualification system covering Schools, Vocational Education and Training Institutions, Technical Education Institutions, Colleges and Universities. The NVEQF will act as a translation device to make qualifications more understandable to employers, students and institutions. It will promote transparency of qualifications and facilitate learner's mobility between different qualifications, thus encouraging lifelong learning. PSSCIVE has taken lead in development of learning material for the Automobile Sector for all level in collaboration with the Automobile Skill Development Corporation (ASDC).

The present material contains activity related to Level L-2 for the Automobile service sector. This will fulfill the needs of the students willing to learn activities relating to the Automobile Service Sector. Any student/ entrepreneur willing to start an Automobile Service Sector can acquire the desired competencies with the help of this book.

The book has been written by experts but reviewed by all the members of the group. I am grateful to the authors for the development of this book and to the members of the Working Group for their candid suggestions, during the development and review. Their names are given elsewhere.

I appreciate efforts put in the by Dr. Saurabh Prakash, as the Project Coordinator of the Working Group in planning and organizing Meetings which led to the final form of this title.

I shall be grateful to receive suggestions and observations from readers, which would help in bringing out a revised and improved version of this book.

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This student workbook was developed, with active involvement of Automobile Skill Development Council (ASDC) keeping in view the National Occupation Standard (NOS) for Service Technician L4 developed by ASDC.

This project for development of the student workbook was coordinated by the PSS Central Institute of Vocational Education, a constituent unit of National Council of Educational Research and Training, which is under Ministry of Human Resource Development, Government of India.

Student Details

Student Name: _____

Student Roll Number:_____

Batch Start Date: _____

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About this Workbook

This workbook is to assist students with completing the Auto Sector **L2U2-NQ2012** unit of competency: Automobile Service Tools. Students should peruse the workbook in class or in their own time.

This workbook contains sessions for imparting knowledge & skills on various aspects of the unit of competency. The workbook also includes information, exercises, and assessment activities to complete. The assessment plan has been included in the workbook to assist you in scheduling your time for completing the assignments. Each assessment activity is followed by a checklist for meeting the assessment criteria. The criteria will help you to ensure that you have fulfilled all of the assessment requirements to receive a 'competency' grading/Certification by ASDC.

Unit Information

Unit name: Automobile Service Tools
Unit code: Auto L2U2-NQ2012
Unit descriptor:

This unit provides introductory knowledge & skills covering **Automobile Service Tools** used by mechanic in auto sector. Students will be given a broad view of these service tools.

Resource Required:

- Notebooks, Pen, Pencil, Eraser, Computer, Open Source Software for making digital presentation, LCD projector. Sketches, pictures, animation and videos of service tools and its components. Posters for building awareness about these topics.
- **Nominal hours:** 40 hours

Elements and Performance Criteria

- Elements define the critical learning outcomes of a unit of competency.
- Performance criteria specify the level of performance required to demonstrate the achievement of the Competency Element.

Element of knowledge	Performance Criteria
Identify and handle general tools	1.1 Able to Identify general tools 1.2 Able to Handle the general tools
Identify and handle measuring tools	2.1 Able to Identify measuring tools 2.2 Able to handle measuring tools
Identify and handle electrical tools	3.1. Able to Identify electrical tools 3.2. Able to handle electrical tools
Identify and handle special tools	4.1 Able to Identify special tools 4.2 Able to handle special tools
Identify and handle service workshop equipment	5.1 Able to identify service workshop equipment 5.2 Able to handle service workshop equipment

Relevant Knowledge and Skills

1. Relevant Knowledge

Hand tools
Measuring Tools
Special tools,
Electrical tools,
Service workshop equipment

2. Skills

Able to handle tools used in service centre

Assessment Plan

Session No.	Assessment method	Due Date	Completion Date
1.	Fill in the Blanks		
2.	Fill in the Blanks		
3.	Fill in the Blanks		

Introduction

As you know that that we require tools and equipment for servicing of a vehicle. Tools and equipment are used for repair and maintenance of any vehicle. Tools are made of different material as per strength, work and use. It can be easily handled and operated by any mechanic. Every vehicle has tools for emergency work as spare parts. The important tools used in automobile shops are general, electrical, special type.

Every tool has specific work and it is used in that way, Proper tools should be used for better efficiency. Generally every tool has various size and shapes. Tools should be properly handled and kept in their position. Tools should be regularly cleaned and washed at specific duration.

In this Unit, you will develop an understanding of the tools such as general, electrical, special and workshop machine used at automobile workshop.

Session 1: Hand Tool
Relevant Knowledge

Hand Tool

A hand tool is a device for performing work on a material or servicing a two or four wheeler. The hand tools can be manually used employing force, or electrically powered, using electrical current.

Common tools used in servicing of a vehicle are as called as service tools like spanners, flies, pliers, grinders, drilling machine, oil and grease gun, hammer, mallet, screw drivers, wrench, chisel, pixes, hand hacksaw, Bench vice, Screw gauge, Vernier calipers, Multimeter, Caliper etc.

Fig: Hand Tools

Identification and handling of general tools

The important hand tools used in automobile repairing shops are spanners, files, pliers, grinders, drilling machine, oil and grease gun, hammer, mallet, screw drivers, wrench, chisel, pixes, hand hacksaw, Bench vice etc. The hand tools are used for repair, maintenance of automobile wheelers. If you visit to any automobile shops/ two wheeler service station, observe the hand tools used by the technician/mechanics. Details of important hand tools are given here.

Spanners

These are used to tighten and loosen nuts and bolts. These are made according to standard nut and bolt sizes. The Common spanners used are:
Ring Spanners: These are closed at both ends as they have full circular ring at ends. They do not slip and cause damage.

.

Fig: Ring Spanner close type

Fig: Open Ended Spanner

Combination Spanners

These are open at one end and close at other end.

Box Spanners

These are used to tighten nuts on drums of wheels. Sometimes they are also referred as wheel nut spanners. Figure shows different types of spanners used in motorcycle servicing and repairs.

Open-ended Spanners

These types of spanners are open from both side and used to tighten nut and bolts where low torque is required.

Files

The files are hand tools used to perform wide variety of metal removal, tasks like removing of sharp edges, smoothening of surfaces, shaping of jobs, finishing, producing intricate shapes etc. The file has five parts: tang, heel, face, edge and point or tip. The file has hardened teeth, when rubbed on the metal, perform cutting. Files are available in different shapes like hand, pillar, flat, square, three square, round, half round, knife edge, needle file are used as per job requirement.

Fig: File

Pliers

Pliers is used to hold small objects and either tighten or loosen parts into place. Pliers have several types which are all used by a mechanic in their work. Some pliers are also used for cutting work. The slip joint pliers are used for holding round and flat work pieces. Pliers are available in various shapes and sizes. Different types of pliers are shown here.

Fig: Different type of pliers

Bench Vice

The vice is work holding device use to hold the work for operation like sawing, filing, chipping, tapping, threading, bending of small jobs, fitting etc. The vice consists of a body and two jaws, one of which is fixed and other is moveable. These jaws are fitted

Fig: Bench wise

with hardened and serrated jaw plates for gripping the job. The size of the vice depends on the width of jaw.

Hand Hacksaw

The hand hacksaw is a hand tool to cut the metals, which include steel sections like rod, angle iron, channel sections, sheets, pipes etc. It can also be used to cut the bolt heads and nuts during repair if these are jammed and do not open with wrenches or spanners. It is a simple hand tool and consists of handle, frame, blade and adjusting wing nut.

Fig: Hack saw

Chisel

The chisels are hand tools for cutting, shearing and chipping of metals. The most widely used chisels are flat, cross cut, round nose and diamond point. The flat chisel is used to cut thin sheet metal, remove riveting heads, chip metal, split corroded nuts etc. Cross cut chisel narrow in width is used to cut key ways, narrow grooves, square corners and holes in sheet metal.

Fig: Chisel

Fig: Different type of screwdriver

Screw drivers

Screw drivers are tools often used by automobile mechanics to fit into screws and either tighten or loosen them into place. Screwdrivers have a distinct tip which fits into each screw. There are several different types of screwdrivers to fit each type of screw. This automotive tool actually has various types such as the Flat-head, Phillips, Robertson and hex which are all used by auto mechanics.

Wrenches

The wrenches are hand tools for tightening and loosening of nuts and bolts. The function of this automotive tool is to hold slippery or small nuts and bolts and either loosen or tighten it. There are two types of wrenches – adjustable and non-adjustable. The single end wrench is non-adjustable type and of which fits into one size of nut, bolt or head. The adjustable wrench is of adjustable type to fit into various sizes of nuts and bolts. These are useful particularly for loosening and tightening of odd size nuts and bolts.

Fig: Different type of wrenches (adjustable)

Hammers

The hammers are general purpose workshop hand tools used for straightening of sections, riveting, striking of nails, inserting the components by striking, inserting keyways and fitting by striking. The hammer consists of head made from hard and tampered steel and wooden handle. The head has a flat striking surface known as a face and the other end is called pein. The peins are of different shapes such as ball pein, cross pein and straight pein. The hammers made of hardened steel are known as engineers hammers and are usually used for working with steel components.

Fig: Hammer

Snips

The snips also called shears are used to cut sheet metals to the required shapes. The main parts of the snips are cutting blades which are hard and ground to sharp edge and handle.

Fig : Snip

Mallet

A mallet is a kind of hammer, usually of rubber or wood smaller. Mallets are used when a softer blow is called for than that delivered by a metal hammer. They are typically used to form sheet metal, since they don't leave marks, as well as for forcing tight-fitting parts together.

Fig : Mallet

Grease gun

A grease gun is a common workshop and garage tool used for lubrication. The purpose of the grease gun is to apply lubricant through an aperture to a specific point, usually on a grease fitting. The channels behind the grease nipple lead to where the lubrication is needed.

Fig : Grease gun

Grinding machine

It is also known as grinder. It is a type of machining using an abrasive wheel as the cutting tool. Grinding is used to finish work pieces which must show high surface quality (e.g., low surface roughness) and high accuracy of shape and dimension.

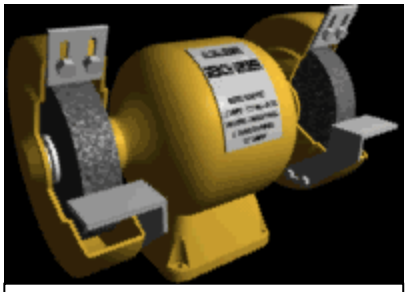

Fig: Grinding Machine

Drill bits

Drill bits are cutting tools used to create cylindrical holes. Bits are held in a tool called a drill, which rotates them and provides torque and axial force to create the hole. Specialized bits are also available for non-cylindrical-shaped holes.

Fig : Drill bits

Punch

A punch is a hard metal rod with a shaped tip at one end and a blunt butt end at the other, which is usually struck by a hammer. Punches are used to drive objects, such as nails, or to form an impression of the tip on a work piece. Decorative punches may also be used to create a pattern or even form an image.

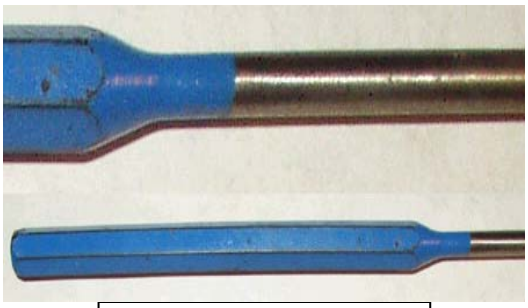

Fig: Punch

Wheel wrenches

These wrenches are designed for opening for wheels of vehicle. It helps a person to open wheel.

Fig: Wheel wrenches

Tool Box: Toolbox is box used for keeping all the tools. Box contains number of compartments in which different tools systematically.

Fig: Toolbox

Handling, Care & Maintenance of General Tools

General tools should be properly handled and a proper procedure should be adopted. Tools should be kept at proper place after use. Worn out tools should be replaced with new tools. Tools should be kept in the toolbox or display board. Tools should be handled properly. Correct procedure should be used for holding any tools, otherwise it may hurt worker or material. Proper safety procedure should be adopted. Proper dress should be wear by trainees during workshop practical.

Session 1: Hand Tools

Exercise: Assignment

1. List the general tools

S.No.	Name of tools

2. Prepare a poster showing tools used in automobiles.

Session 1: Hand Tools

Answer the following questions
(Use additional sheets of paper if necessary)

A. Fill in the blanks

1. Hammer is used for_____.
2. A grease gun is a _____ tool used for lubrication.
3. The wrenches are _____for tightening and loosening of nuts and bolts.
4. Pliers is used to _____ small objects and either_____ or loosen parts.

B. Tick the correct answer

1. Mallet is made of.
   A. Iron
   B. Wood
   C. Steel
   D. Aluminum

2. A spanner is used for
   A. tightening the bolt
   B. opening the nut
   C. cutting the nut
   D. folding the nut

3. Tool box is used for storing
   A. tools
   B. oil
   C. water
   D.spare parts

Session 1: Hand Tools

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for pollution control.

Part A

- Share importance of tools used in workshop.

Part B

- Discussed in class the following:
  What is meaning of hand tools?
  What are the different types of tools used in automobile?
  Differentiate between spanner and wrench, hammer and mallet?
  Name two popular tools used in as spare parts in motorcycle.
  Write the importance of tool box.

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to explain importance of hand tools		
Able to identify hand tools		

Session 2: Measuring Tools

Related Information

Measuring Tools

Measuring tools are important tools in automobile workshop. It helps mechanic to measure the sizes and dimensions of various components of automobile. Measuring tools are commonly used. Auto mechanic should know the use and handling of these tools. Important measuring tools are steel rule, caliper, multi meter, screw gauge, multi meter, hydrometer etc.

Steel ruler

A steel ruler is an instrument used in geometry, technical drawing, printing and engineering/building to measure distances and/or to rule straight lines. Metal is used for more durable rulers for use in the workshop.

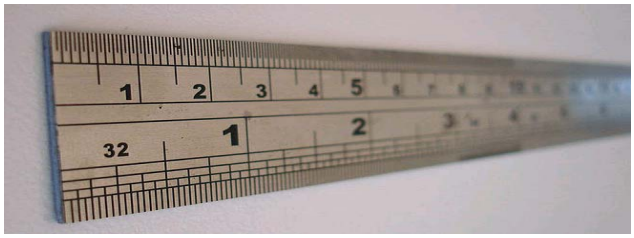

Fig : Steel Ruler

Caliper

A caliper is a device used to measure the distance between two opposing sides of an object. The tips of the caliper are adjusted to fit across the points to be measured, the caliper is then removed and the distance read by measuring between the tips with a measuring tool, such as a ruler. It is used in many fields such as mechanical engineering, metalworking, woodworking, science and medicine.

Fig : Outside Calipers

Fig : Inside Calipers

Screw gauge (Micro meter)

Screw gauge is a device incorporating a calibrated screw used widely for precise measurement of small distance. Micrometers are often, but not always, in the form of calipers. Micrometers use the principle of a screw to amplify small distances that are too small to measure directly into large rotations of the screw that are big enough to read from a scale.

Fig : Screw gauge

Screw gauge are used measuring tools. These tools give proper measurement. Proper handling and use is important in measuring any dimension.

Session 2: Measuring Tools

Exercise: Assignment

1. List the measuring tools

S.No.	Name of measuring tools

2. Prepare a poster of measuring tools used in automobile.

Session 2: Measuring Tools

Answer the following questions
(Use additional sheets of paper if necessary)

Fill in the blanks

1. Outside caliper is used for_____.
2. Scale measures is used for _____.
3. Screw gauge is a _____ incorporating a calibrated screw used widely for precise _____ of small distance.

Session 3: Measuring Tools

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for pollution control.

Part A

- Share importance of measuring tools

Part B

- Discussed in class the following:
- What are uses of measuring tools
- Why screw gauge is used?
- List the measuring tools used in automobile shop.
- Differentiate between outside calipers and inside calipers.

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to explain measuring tools		
Able to discuss about advantages and use of various measuring tools		

Session 3: Electrical Tools
Relevant Knowledge

Electrical tools are used for measuring and testing current, voltage etc. These tools are operated with battery or power. It helps mechanic to check and measuring the current, voltage of electrical component etc. Common electrical tools used are multi meter, ammeter, volt meter etc. Many electrical measuring tools are available in the workshop and same can be seen and discussed during the visit to a service centre of a vehicle.

Multi meter

A multi meter or a multi tester, also known as a VOM (Volt-Ohm meter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multi meter may include features such as the ability to measure voltage, current and resistance. A multi meter can be a hand-held device useful for basic fault finding and field service work or a bench instrument which can measure to a very high degree of accuracy. They can be used to troubleshoot electrical problems in a wide array of industrial and household devices such as electronic equipment, motor controls, domestic appliances, power supplies, and wiring systems.

Fig: 17 Multi meter

Tachometer

A tachometer is an instrument that measures the working speed of an engine. It is mostly used to measure engine speeds of road vehicles in revolutions per minute. The word comes from two Greek words; tachos, "speed" and metron, "to measure". The engine speed is displayed on the tachometer on a calibrated analogue dial.

Hydrometer

A hydrometer is an instrument used to measure the specific gravity (or relative density) of liquids; that is, the ratio of the density of the liquid to the density of water.

A hydrometer is usually made of glass and consists of a cylindrical stem and a bulb weighted with mercury or lead shot to make it float upright. The liquid to be tested is poured into a tall container, often a graduated cylinder, and the hydrometer is gently lowered into the liquid until it floats freely. The point at which the surface of the liquid touches the stem of the hydrometer is noted. Hydrometers usually contain a scale.

Fig: 18 Hydrometer

Session 3: Electrical Tools

Exercise: Assignment

1. List the electrical tools

S.No.	Name of Electrical tools

2. Observe and identify two types of electrical tools in service centre and draw their diagrams

Session 3: Electrical Tools

Answer the following questions
(Use additional sheets of paper if necessary)

A. Fill in the blanks

1. A multi meter or a multi tester, also known as a_____.
2. Tachometer is used for_____.
3. A hydrometer is usually made of_____.

B. Tick the correct answer

Multimeter is used for measuring
a. Speed
b. Current
c. Distance
d. height

Session 3: Electrical Tools

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for tools.

Part A

- Share importance of measuring tools.

Part B

- Discussed in class the following:
    1. Role of electrical measuring tools
    2. Distinguish between hydrometer and ammeter
    3. Handling and operation of a multimeter

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to Identify electrical measuring tools		
Able to handle and operate multimeter		

Session 4: Special Tools
Related Knowledge

Every vehicle has large number of parts which are used in assembling the vehicle. During disassembly of these parts are operated by special tools. Special tools are important tools used for special purpose. These tools are special in nature and does the special purpose work. Use of these tools makes work easy and save time. These tools are costly and available in authorized service centre.

With the use of special tools, the life of parts increases and damage is reduced. These tools are designed for special work. Handlings of these tools are important. Proper care should be taken while operating and handling these tools.

During visit to the garages student should see and observe the functioning of tools

Some of common special tools are Universal holder, socket wenches, flywheel puller, tappet cover wrench, Pierce plier, piston slide base, socket, front, fork oil seal driver, driver outer, ball race driver, tappet cover wrench.etc**.** We will discuss some special tools here.

Universal clutch holding tool: This universal clutch holding tool is tool for holding the compressor clutch when removing or installing the center nut.

Torque wrench: A torque wrench is a tool used to precisely apply a specific torque to a fastener such as a nut or bolt. It is usually in the form of a socket wrench with special internal mechanisms.

Tappet Wrench: A wrench having parallel jaws at fixed separation (often on both ends of the handle)

Flywheel puller: A proper flywheel puller is the only correct and safe way to remove a flywheel from engine. Without using the recommended tool, there are chances of damaging the flywheel which could lead to a potential reliability issue.

Fig 19: Flywheel puller

Session 4: Special Tool

Exercise : Assignment

1. List the reasons for using special tools

S.No.	List of reasons

2. Prepare a poster showing figure of special tools.

Session 4: Special Tools

Answer the following questions
(Use additional sheets of paper if necessary)

A. Fill in the blanks

1. Special tools is used for _____
2. Hydrometer is used for measuring _____.
3. Hammer and mallet is used for _____ .
4. Tools help mechanic in _____ of two wheeler.
5. Multimeter is used for measuring _____, _____ and _____

Session 4: Special Tools

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for special tools.

Part A

- Share importance of special tools

Part B

- Discussed in class the following:
  - Write the importance of special tools.
  - Why hydrometer is used?
  - List the special tools used in automobile sector.
  - Write the purpose of torque wrench used

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to explain special tools		
Able to discuss about advantages and use of various special tools		

Session 5: Service Workshop Equipment

Related Knowledge

Modern service workshop deploy important workshop machine for handling and servicing of a vehicle. These machines make work very systematic and comfortable to mechanic. Common equipment fitted in the workshops are Two Post lift, Air compressor, Wheel balancer, Bench vice, Work tables, Bench grinder, Oil draining & filling equipment, Cooling system tester, BC clamp meter, Coolant tester, Battery & charging system tester (Megatronics), Diagnostic tool (genesis Evo), Pneumatic tools and many other tools. We will be discussing some equipment here. Whenever you visit any service centre, kindly see the working of these machines.

Two Post lift:

It is used for lifting an automobile vehicle and to carry out the work under the chassis. It consists of two columns and screws are fitted in each column. Similarly four post lift is also used in workshop.

Fig : Two Post lift

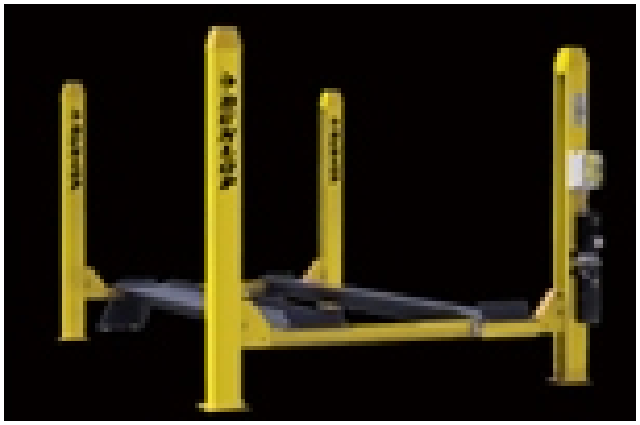

Fig : Four Post lift

Air compressor

This is the machine which is used to increase the pressure of air by reducing its volume.

Fig : Air compressor

Generally air compressors have been categorized in two types:

- Rotary Screw Air Compressors
- Reciprocating Air Compressors

Rotary Screw Air Compressors

The rotary screw air compressor has become the most popular source of compressed air for industrial applications.

Reciprocating Air Compressors

Designed for heavy shop or industrial use, Ingersoll Rand Two Stage electric air compressors provide the quality and performance that are ideal for most applications and users, including: automotive service and body shops, fleet maintenance, machine shops, production and manufacturing lines, car washes, maintenance/repair shops and farms.

Wheel balancer

Wheel balancing helps in minimizing tire vibration and bounce. By wheel balancing traction, steering control improves and life of tires increases. Automatic wheel balancer is designed for the tyre shop and workshop. It is very simple and easy to operate.

Fig : Wheel balancer

Pneumatic wrenches

Pneumatic wrenches that is made from premium quality raw material. This type of wrenches are used for accuracy and easy operations, mostly in workshops, power plants, mining & cement industries, railways industries, fertilizers/chemicals and so on. These are used where accurate torque is required on a nut and bolt. These wrenches are operated electrically.

Fig : Pneumatic wrenches

Session 5: Service Workshop Equipment

Exercise : Assignment

1. List the reasons for using workshop equipment

S.No.	List of reasons

2. Prepare a poster showing uses of workshop equipment.

Session 5: Service Workshop Equipment

Answer the following questions
(Use additional sheets of paper if necessary)

Fill in the blanks

1. Pneumatic wrench is used for_____.
2. Two Post lift help mechanic to work under _____.
3. Wheel balancer work for _____

Session 5: Service Workshop Equipment
Answer the following questions
Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for Service Workshop Equipment

Part A

Share importance of Service Workshop Equipment

Part B

Discussed in class the following:

- Why is necessary to go to Service Workshop?
- Important Service Workshop Equipment used in workshop.
- Differentiate between pneumatic and common manual wrench.
- Differentiate between Rotary and reciprocating compressor

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to explain Service Workshop Equipment		
Able to discuss about Service Workshop Equipment		

Suggested Reading

Books

Title	Author	Publisher
Automobile Engineering Vol I	Kirpal Singh	Standard Publishers
Automobile Engineering, Vol II	Kirpal Singh	Standard Publishers
Text Book of Automobile Engineering	Rajput R K,	Laxmi Publications
Automobile Engineering	R. K. Singal	S. K. Kataria and Sons
Automobile Engineering Theory	Kapil Dev	Computech Publications
Automobile Engineering,	K. M. Moeed	S. K. Kataria and Sons
Automobile Engineering	GBS Narang	Khanna Publisher Delhi
Automotive Mechanic	SSrinivasan	TATA MacgraHill Pub.New Delhi

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