AUTOMOTIVE MECHANICS
Level – I

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Acronym

TTLM ========= Teaching and Training Learning Material

TPMS========= Tire Pressure Monitoring System

Kpa========== Kilopascal

OHS========== Occupation Health and Safety

PPE ========== Personal Protective Equipment

WHS ========== Workplace Health and Safety

Introduction to the Module

In Automotive Mechanics filed; Carry out Service Tires and Wheel Balance helps during a tire mounting and balancing service, a service technician will remove the existing tires and wheels, spin the wheels using state-of-the-art tire balancing equipment then work to find any potential imbalance in the tires. Balancing your tires will help create a smoother ride and reduce tire wear.

Wheel balancing—also known as tire balancing—is the process of equalizing the weight of the combined tire and wheel assembly so that it spins smoothly at high speed. Balancing involves putting the wheel/tire assembly on a balancer, which centers the wheel and spins it to determine where the weights should go.

This module is designed to meet the industry requirement under the automotive mechanics occupational standard, particularly for the unit of competency: Carry out Service Tires and Wheel Balance

This module covers the units:

- Preparing to service tire and balance wheel
- Dismounting, check/test and remount on wheel
- Repairing tires and tubes
- performing tire/wheel balance
- Replacing and Prepare -wheel assembly for use or storage

Learning Objective of the Module

- Prepare
- Dismount
- Repair
- perform
- Replace

Module Instruction

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

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of 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 to service tire and balance wheel

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

- Fundamentals of automotive tire
- Tire construction and classification
- Tire Ratings and Designations
- WHS requirements and Procedures
- Identifying and Utilizing Proper Tools and equipment
- Sourcing and utilizing workshop manuals and Tire Placard

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:

- Identify tire construction and classification
- Identify tire Ratings and Designations
- Identify and Utilize Proper Tools and equipment
- Source and utilize workshop manuals and Tire Placard

1.1. Fundamentals of automotive tire

Pneumatic tires are the only means to transfer forces between the road and the vehicle. Tires are required to produce the forces necessary to control the vehicle, and hence, they are an important component of a vehicle. Figure 1.1 illustrates a cross section view of a tire on a rim to show the dimension parameters that are used to standard tires.

1.2. Tire construction and classification

Carcass (casing): The carcass is the frame work of the tire, It must be rigid enough to hold in the high pressure air, yet flexible enough to absorb load changes and impact. It consists of layer of tire cords bonded together with rubber. Tires are generally classified, according to the direction of the cords, into radial-ply and bias ply types.

Tread: The tread is an external rubber layer protecting the carcass from wears and external damage caused by the road surface. It is the part that directly contacts the road and generates the tractive resistance that transmits the vehicles driving and braking forces to the road. The tread pattern

consists of grooves molded into the tread surface, and is designed to help the tyre more effectively transmit these forces to the road.

Side Walls: The side walls are rubber layer that cover the sides of the tire and protect the carcass from external damage. The largest, most flexible tire constituents continuously flex under the loads applied during travel. They bear the manufacturer's name, tire size, and other information.

Breaker: The breaker, a fabric layer between the carcass and the tread, reinforces the adhesion between the two, while helping to attenuate the shocks passed from the road to carcass. Breakers are commonly used in bias ply tires.

Belt (rigid breaker): These are a type of breaker used in radial ply tires. Running like a hoop along the tire circumference between the carcass and the tread rubber, they hold the carcass securely in place.

Beads: To keep the tire from being thrown off the rim by the various forces acting on it. The free edges or sides of the layers are wound around strong steel wires called bead wires. The pressurized air inside the tire forces the beads out against the rims of the wheel and holds them securely in place. The beads are protected from damage caused by Chafing against the rim by hard strips of rubber called chafer strips.



Fig 1.1 tire construction

Three types of tire construction are in use. They are referred to as bias-ply, bias-belted, and radial-ply construction .The description for each construction type is derived from the method used to position the tire body cord plies in relation to the centerline of the tread.

Bias ply tires have fabric plies that run alternatively and form a crisscross design. The angle varies from 30 to 38 degrees with the centerline of the tire.

Belted bias ply tires are similar to bias ply tires, except that two or more belts run the circumference of the tire under the tread. This construction gives strength to the sidewall and greater stability to the tread.

Radial ply tires have body cords that extend from bead to bead at an angle of about 90 degrees or "radial'' to the circumferential centerline of the tire—plus two or more layers of relatively inflexible belts under the tread. The construction of various combinations of rayon, nylon, fiberglass, and steel gives greater strength to the tread area and flexibility to the sidewall. The belts restrict tread motion during contact with the road, thus improving tread life and traction. Radial ply tires also offer greater fuel economy, increased skid resistance, and more positive braking.

Classification by Hold Air

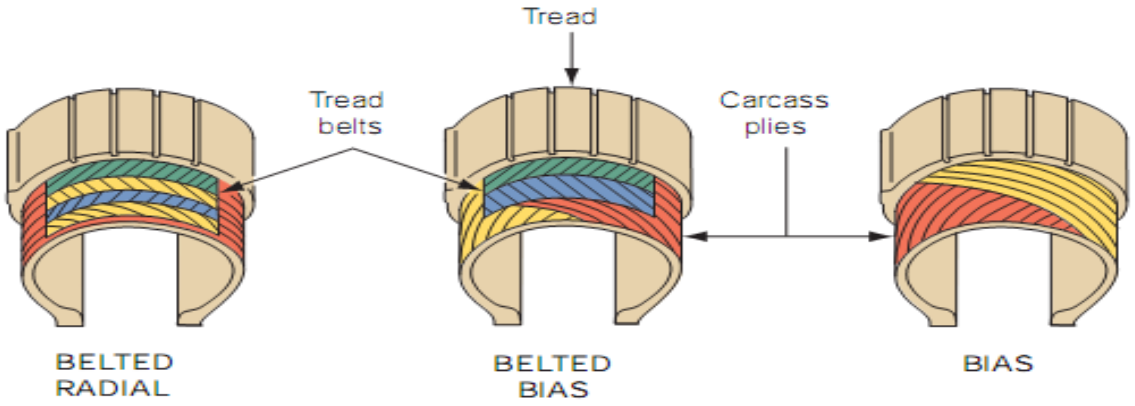


Fig 1.2

figure 0.1tire construction type

Tube tire

The tube tires are the tires which have a separate inner tube placed inside them. If tube tire is punctured then you are not able to drive the vehicle.



Tubeless tire

The tubeless tires are the tires which don't have a tube inside them. The tubeless tire doesn't mean it won't work



with a tube, it just means it doesn't have a tube. If the tubeless tire is punctured the tire never goes flat and it will still run for days.

Comparison between tube and tubeless tyre

Table 0-1comparetion table

Tube tyre	Tubeless tyre
A tube inside a tire would simply collapse in case of puncture and the air in the tyre goes out in no time.	Tubeless tyre retains air pressure and helps avoid sudden air loss in the case of a puncture.
Fuel Efficiency	
Tube tyres are not so fuel efficient when compared to tubeless tyres.	Tubeless tyres are more fuel efficient.
Weight	
Tube tyres weigh more because of the tube placed inside them.	Tubeless tyres are light weight because of no tube inside the tyre.
In case of puncture	
The tube in the tube tyres will explode suddenly in case of puncture causing loss of control of the vehicle which may result in accidents.	Tubeless tyres make driving safe and easy and there is no loss of control of the vehicle in case of puncture.
Repair Process	
The puncture repairing process of tube tyre involves a complicated process of removing the tyre from the vehicle and removing tube from the tyre, etc.	The puncture repairing process of a tubeless tyre can be done without removing the tyre and is very simple compared to a tubed tyre.
Cost of Tire	
The tube tyres are of less cost and are available in every size for every vehicle.	The tubeless tyres are costly and are not available for all types of vehicles.
Punctures	
The tube tyres are more prone to punctures because of the tubes placed in them.	The tubeless tyres are durable and last longer because of no tube is placed in them.
Repair Cost	

The tube tyre puncture repair cost is less when compared to that of the tubeless tyre.	The tubeless tyre puncture repair cost is very high and can be repaired instantly.

1.3. Tire Ratings and Designations

The construction of a tire depends on its application. Needless to say, there are many different tires. These differences are based on not only size, but their construction to meet intended driving conditions. There are also standards that tire manufacturers must meet to ensure that the tire will be safe, not wear rapidly, and offer good road isolation for the passengers in the vehicle. The uniqueness of each tire is represented by information given on the sidewall of every tire produced. In fact, everything you need to know about a tire is imprinted on the tire.

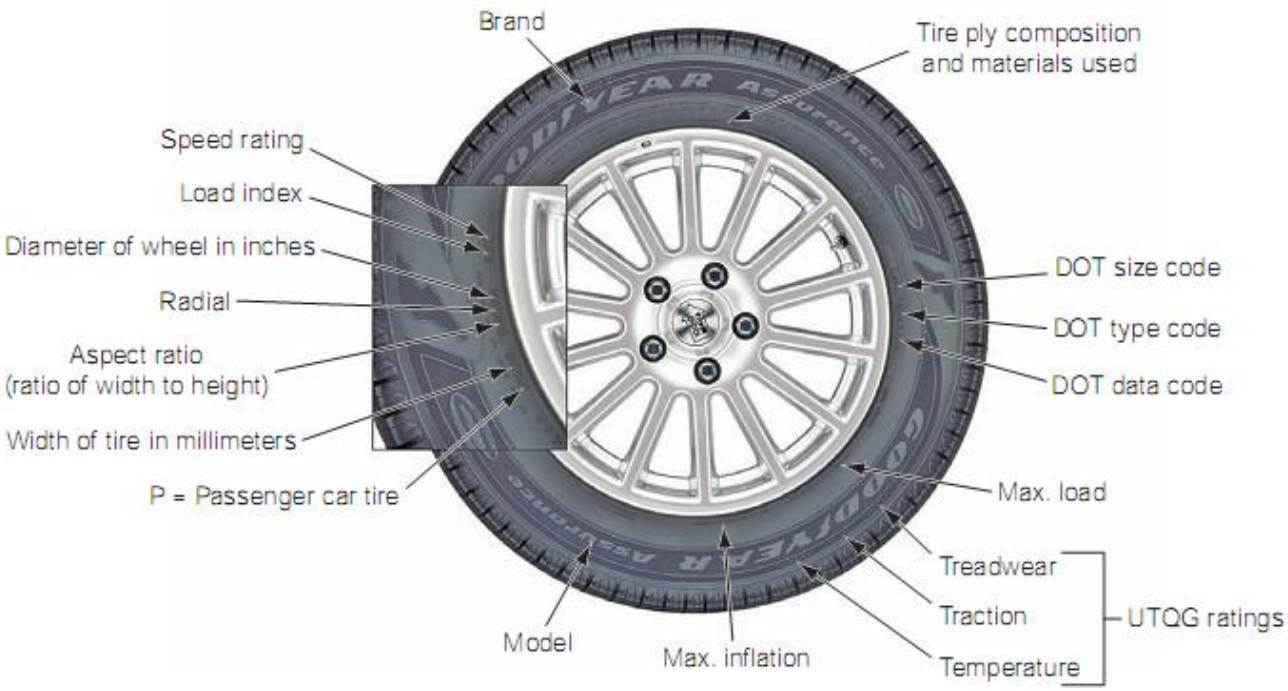


fig 1.3

figure 0.2tire rating indicator

1.3.1. Tire size information

The best way to describe and explain the information given on the sidewall of a tire is to look at an example. Look at the tire size designation of P215/65 R15 89H and see what it tells. On a P215/65 R15 89H tire,

The P represents the application of the tire; in this case P passenger car And If the tire had an “LT” designation, the tire would be for a light truck.

The 215 in P215/65 R15 89H represents the width of the tire measured in millimeters from sidewall to sidewall. This tire width is 215 millimeters.

The 65 in P215/65 R15 89H indicates the aspect ratio or profile (series) of the tire

A tire's aspect ratio is the relationship of its cross-sectional height (from tread to bead) to its cross-sectional width (from sidewall to sidewall). In our example, the tire's height is equal to 65% of its width (the width equals 215 mm * 65% or 140 mm).

The aspect ratio determines a tire's performance characteristics. Higher aspect ratios provide a softer ride because they will deflect more over irregular surfaces and under heavy loads. Shorter sidewall heights demand stiffer sidewalls. Therefore, tires with a low aspect ratio have a harsher ride. However, they provide a larger contact area with the road and therefore better traction.

For a tire rated as P215/65 R15 89H the R represents the basic ply construction of the tire. This letter can be an "R" for radial construction, a "B" for belted-bias construction, or a "D" for bias ply ("bias" means the plies are set diagonally or at a slant).

The diameter of the wheel is indicated by the 15 after the R. The diameter of the wheel for this tire is 15 inches. Wheel diameter is the height of the wheel from one end to the other.

Following the size notation is the load and speed ratings. These are expressed by a number and a letter; in this case the ratings are given as 89H. The 89 is the load index and the H is the speed rating. The maximum load rating lists the maximum amount of weight the tire can carry at the recommended tire pressure. The load ratings for passenger car and light truck tires range from 70 to 110. Following are some examples of load ratings and the weight they represent:

71 =761 lb (345 kg)

79 =963 lb (437 kg)

89= 1,279 lb (580 kg)

99 = 1,709 lb (775 kg)

109 =2,271 lb (1,030 kg) so in our example, the tire can carry 1,279 lb (580 kg).

The speed rating indicates the maximum speed at which the tire should be used. In this case, the H means the tire has been tested to be safe at speeds up to 130 mph (210 km/h). The speed rating of a tire is really nothing more than an expression of how well the tire will withstand the temperatures of high speed. This does not necessarily mean that a high-speed rated tire will perform better at low speeds than a lower-rated tire.

In the below Table lists the various letters used to designate the speed rating of a tire and the maximum speed at which the tire was designed to safely operate. Driving a vehicle at speeds greater than the speed rating of the tires is risky. The heat generated can cause the tire to come apart. If this happens at high speeds, it will be close to impossible for the driver to maintain control of the vehicle.

Other Information

The sidewall of a tire also has a DOT safety code, tire identification or serial number, UTQG ratings, and maximum inflation values. The DOT code indicates that the tire has met all of the applicable safety standards established by the U.S. Department of Transportation (DOT). Next to the DOT code is a tire identification or serial number. This is a combination of numbers and letters that identify the tire manufacturer, where it was made, the tire design and size, and the week and year the tire was manufactured.

UTQG stands for Uniform Tire Quality Grading, a rating system developed by the DOT. This rating is comprised of three factors: tread wear, traction, and temperature resistance. All tires, except snow tires, have these ratings.

Tread Wear The tread wear grade is a rating based on a tire's wear rate when tested under controlled conditions on a specified government test track. Tread wear is listed as a number: The higher the number, the longer the tread will last. A rating of 100 is considered normal, whereas ratings lower than 100 mean poor tread wear. Ratings above 100 mean the tire has better-than-normal tread wear. These ratings should be used to compare the anticipated wear of tires from the same manufacturer and not to compare wear between manufacturers.

Traction Tire traction ratings are based on a tire's ability to stop on wet concrete and asphalt. It is not an indication of how well a tire will handle. The traction rating is given as AA, A, B, or C. A tire rated as C will provide less traction than one rated with an A.

Temperature Resistance This rating is an indication of how well a tire will dissipate heat and how it works when it is heated. The temperature rating applies only to a properly inflated tire that is not overloaded. Heat builds up when a tire is underinflated or overloaded. Temperature also increases with excessive speeds. Temperature resistance rating is given as A, B, or C. A rating of C means the tire is acceptable. A tire with an A temperature rating will be able to withstand high temperatures better than one rated B or C.

1.3.2. Maximum Cold Inflation pressure and Load

A tire's maximum inflation pressure is the highest "cold" inflation pressure that the tire is designed to contain. However the tire's maximum inflation pressure should only be used when called for on the vehicle's tire placard or in the vehicle's owner's manual For the reasons indicated above, It is also normal to experience "hot" tire pressures that are up to 5 to 6 psi above the tire's recommended "cold" pressure during the day if the vehicle is parked in the sun or has been extensively driven. Therefore, if the vehicle's recommended "cold" inflation pressures correspond with the tire's maximum inflation pressure, it will often appear that too much tire pressure is present. However, this

extra "hot" tire pressure is temporary and should NOT be bled off to return the tire pressure to within the maximum inflation pressure value branded on the tire.

If the "cold" tire pressure was correctly set initially, the temporary "hot" tire pressure will have returned to the tire's maximum inflation pressure when next measured in "cold" conditions.

A tire's "maximum inflation pressure" may be different than the assigned tire pressure used to rate the tire's "maximum load." For example, while a P-metric sized standard load tire's maximum load is rated at 35 psi, many P-metric sized standard load performance and touring tires are designed to contain up to 44 psi (and are branded on their sidewalls accordingly). This additional range of inflation pressure (in this case, between 36 and 44 psi) has been provided to accommodate any unique handling, high speed and/or rolling resistance requirements determined by the tire and vehicle manufacturers. These unique tire pressures will be identified on the vehicle placard or the vehicle's owner's manual.

The tire's maximum inflation pressure is indicated in relatively small-sized print branded near the tire's bead (adjacent to the wheel) indicating the appropriate value. Because tires are global products, their maximum inflation pressure is branded on the tire in kilopascals (kPa) and pounds per square inch (psi). These values can also be found in the industry's tire load & inflation charts.

Cold inflation pressure is the inflation pressure of tires before the car is driven and the tires (tyres) warmed up. Recommended cold inflation pressure is displayed on the owner's manual and on the placard (or sticker) attached to the vehicle door edge, pillar, glovebox door or fuel filler flap. 40% of passenger cars have at least one tyre under-inflated by 6 psi or more.[1] Drivers are encouraged to make sure their tires(tyres) are adequately inflated, as under inflated tires(tyres) can greatly reduce fuel economy, increase emissions, cause increased wear on the edges of the tread surface, and can lead to overheating and premature failure of the tire(tyre). Excessive pressure, on the other hand, will lead to impact-breaks, decreased braking performance, and cause increased wear on the center part of the tread surface.

Tire pressure is commonly measured in psi in the imperial and US customary systems, bar, which is deprecated but accepted for use with SI or the kilopascal (kPa), which is an SI unit

1.3.3. Managing Tire inflation pressure

The inflation pressure- This depends upon tyre size, tyre type, speed, and load. The inflation pressures are recommended by the vehicle manufacturer.

Under inflation causes the following defects.

- ✓ Uneven tread wear, more wear at the tyre sides.

- ✓ Lack of directional stability.
- ✓ Increased rolling resistance leading to increased fuel consumption.
- ✓ Excessive flexing of walls causes excessive build up.
- ✓ The valve may be ripped out due to tyre punch.

Over inflation causes the following defects

- ✓ Reduced tread contact area with the road surface. This results in rapid wear in the tread at the center.
- ✓ Reduced tyre grip.
- ✓ Reduced impact resistance.
- ✓ Increased vibrations resulting in uncomfortable ride.
- ✓ Increased stresses may cause tread separation and cracks in the sidewalls.

1.4. WHS requirements and Procedures

Workplace health and safety covers the concept of the health, safety and welfare of all persons who may be impacted by work activities in the workplace.

WHS is the term used to describe the laws and processes that help to protect employees from death and injury while at work.

Importance of WHS

Workplace health and safety protects works by setting standards for the workplace. It provides guidelines for lifting, for working with hazardous chemicals, protective equipment's like eye protection and ear protection and limits the number of hours a person can work at a particular job (preventing injury due to fatigue/stress).

WHS legislation is designed to protect workers from being injured on the job or suffering illness from unhealthy work environments. It encourages the workers to work together to resolve health and safety issues in the workplace.

Describes how to prevent or minimize a risk at your workplace. Regulations set out the standards you need to meet for specific hazards and risks, such as noise, machinery, and manual handling. They also set out the licenses you need for specific activities, the records you need to keep, and the reports you need to make.

A code of practice provides particular guides for people who have work health and safety duties. These codes give guidance on:

Provide minimum standards for health and safety

Effective ways to identify and manage ri**sks**

Provides practical guidance on how particular standards of health and safety can be achieved by using preferred method.

Policy is a written statement of organizations commitment to the Workplace Health and Safety of employees. The policy includes:

Encourage cooperation and consultation between managers and workers

Outline how WHS will be managed using a planned continuous improvement approach with an emphasis on hazard management

Outline roles and responsibilities for injury management be available to workers (and understood by them).

Procedures

A procedure prescribes actions that need to be executed as a sequence of activities, tasks, steps and processes that when undertaken produce the desired result or outcome. It should be developed to outline how the requirements of the policy will be met, so there may be procedures for:

- ✓ Hazard management
- ✓ Manual handling
- ✓ Hazardous substances
- ✓ Accident reporting and investigation
- ✓ Injury management

Use of tools

Use tools only for the purpose for which they are designed and within their capacity limits. Always seek instruction before using an unfamiliar tool or performing an unfamiliar procedure. When working with fasteners use only the correct type of tool and ensure it is a good fit. Use properly fitting screwdrivers. With nuts & bolts use spanners in the following order of priority: Ring spanner, socket spanner, open end spanner, adjustable spanner. Always use washers. When using spanners try to pull on them rather than push, with arm at 900 to the spanner. Look after tools, store them properly. Take extra care with measuring tools. Do not leave them lying about mixed up with general tools. Never sacrifice any tool for the sake of the job. Report any damaged tools and do not use until repaired or replaced. When using power tools ensure that the power tool has a current test tag fitted. Ensure that appropriate Personal Protective Equipment (PPE) is used. With power tools always wear safety glasses. If the machine makes loud noise wear hearing protection. If it creates dust wear respiratory protection etc. Dust extraction may be necessary Ensure that any safety features (such as safety guards) are fitted and used as intended. Exercise extreme caution with angle

grinders, circular saws or any other high speed power tool. Ensure rags or similar are kept well clear of rotating items such as drill bits, etc.

Equipment's

Qualified or suitably trained persons only to use.

Typical hazards associated with machinery and workshop areas include noise, vibration, dust & vapours, moving machine parts, heavy weights, sharps, possible flying metal fragments, compressed air, gases, solvents, chemicals and electricity. Due care should be exercised where these or any other hazards are present.

Ensure Safe Operating Procedure (SOP) has been developed for the particular machine. SOP's for standard workshop machines and some other workshop equipment (e.g. welding)

Ensure SOP for the particular machine is read prior to use and is complied with.

Use machinery only for the purpose it was designed and within its specified capacity limits.

Ensure all safety features are fitted and operable.

- ✓ Always use appropriate PPE (as specified in the Safe Operating Procedure).
- ✓ Never distract the attention of a person using machinery.
- ✓ Never use compressed air for cleaning machinery or clothing.
- ✓ Do not use rags or similar near rotating work pieces or machine parts.
- ✓ Report any damage to or faults with machinery. Do not use until repaired.

Personal protective equipment

How to protect or take care yourself in the workshop? Protecting yourself from injury is by wearing of personal protective equipment (PPE) and clothing. These are:

- ✓ Wearing eye glasses(goggles)
- ✓ Wearing ear protection
- ✓ Wearing cap head band or hairnet.
- ✓ Wearing proper clothing, shoes, and gloves.

1.4.1. Tire/wheel balance machine safety

Basic safety precautions should always be followed, including the following:

1. Read all instructions.

2. Do not operate equipment with a damaged power cord or if the equipment has been damaged - until it has been examined by a qualified authorized service technician.

3. If an extension cord is used, a cord with a current rating equal to or more than that of the machine should be used. Cords rated for less current than the equipment may overheat. Care should be taken to arrange the cord so that it will not be tripped over or pulled.

4. Always unplug equipment from electrical outlet when not in use. Never use the cord to pull the plug from the outlet. Grasp plug and pull to disconnect.

5. To reduce the risk of fire, do not operate equipment in the vicinity of open containers of flammable liquids (gasoline).

6. Keep hair, loose fitting clothing, fingers and all parts of the body away from moving parts.

7. Adequate ventilation should be provided when working on operating internal combustion engines.

8. To reduce the risk of electric shock, do not use on wet surfaces or expose to rain.

9. Do not hammer on or hit any part of the control panel with weight pliers.

10. Do not disable the hood safety interlock system or bypass the intended operation.

11. Do not allow unauthorized personnel to operate the equipment.

12. Use only as described in this manual. Use only manufacturer's recommended attachments.

13. Always securely tighten the wing nut before spinning the shaft.

14. a always wear safety glasses. Everyday eyeglasses only have impact resistant lenses, they are NOT safety glasses.

15. Balancer is for indoor use onl

1.4.2. Tire-Wheel Dismounting and Mounting machine safety

With the wheel off the vehicle, make a chalk mark or index mark across the tire and rim. Then you can reinstall the tire in the same position on the wheel.

To demount the tire, place the tire-and-wheel assembly on a tire changer. Remove the valve core and release the air from the tire. Remove any rim ¬mounted wheel weights. Follow the tire-changer operating instructions to remove the tire from the rim. A typical procedure is to position the bead breakers (top and bottom) and loosen both tire beads from the rim flanges.

Lubricate the inside of the wheel and the bead areas with nibbler lubricant. With the bottom tire bead in the wheel well place the tire iron under the top bead. Push the slot in the tire iron the rotating finger of the tire changer. Start the tire changer. As the finger rotates, the tire iron removes the top bead from the nm.

Again, lubricate the inside of the wheel along with the well and bead areas. Place the tire iron under the bottom bead and then onto the rotating finger. Hold the side of the tire opposite the tire iron in the wheel well. As the tire iron rotates. The bottom bead is raised up. This frees the tire from the rim.



figure 0.3safe tire removing

1.5. Identifying and Utilizing Proper Tools and equipment

Tools and Equipment's

- ✓ Hand Jack
- ✓ Tire wrench
- ✓ Crick
- ✓ Lever
- ✓ Hammer
- ✓ Flat and Philips screw driver,
- ✓ Tire remover

1.6. Sourcing and utilizing workshop manuals and Tire Placard

A car workshop manual can be of different types. Main ones are detailed below:

Factory Service Manuals: These car manuals are provided by the car manufacturing company itself. These are technical types of workshop manuals that are very useful in identifying in and outs of car maintenance information. These include service specifications, fluid capacity, torque value, diagnostic charts, instructions for repairs, maintenance timing prescriptions, etc. These also include other statistics relating to the exact model of your car.

Aftermarket Car Repair Manuals: These manuals are more inclined towards helping a layperson. They are not that technical, as they focus more on DIY guides for regular cleaning and maintenance jobs. The instructions given in them are easily understandable and doable by beginners and new car owners.

Apart from these two manual types, more specific manuals are also available, such as electrical manuals, unit repair manuals, wiring manuals, and manuals for particular components like transmission and engine.

Remember are required to have a Tire and Loading Information placard. Commonly found on the driver's doorjamb, these placards are a consistent reference that confirms important vehicle capacity and Original Equipment tire information

The placard must identify the number and location of seating positions along with the vehicle's total load capacity for its occupants and cargo. This vehicle-specific placard must also provide the Original Equipment tire sizes and the vehicle manufacturer's recommended cold tire pressures.

The rating for the combined weight of occupants and cargo is the maximum load the vehicle's tires, wheels, suspension and chassis were engineered to carry. Exceeding the listed weight will likely result in over working the vehicle and risking component wear or failure that can result in loss of control or an accident.

Self-check 1

Name: _____ ID No _____ Date: _____

Direction: Answer the following questions to test your knowledge pertaining to tire and its related function.

Describe about Types of Tires based on construction and holding air?

_____

_____

_____

Compare the tubed and tubeless tyre?

_____

_____

_____

List PPE?

_____

Operation sheet 1

Operation Title: Dismounting and mounting tire-wheel assembly

Instruction: mount and dismount the component safely and by its operation procedure

Purpose: to know about how to mount and dismount the tire from wheel

Required tools and equipment: -

Lever, Hammer, Flat and Philips screw driver, Tire remover

Procedures:

Step 1 Prepare tools and equipment

Step 2 Remove tire from the vehicle

Step 3 Dismount the tire from the wheel

Step 4 Clean

Step 5 Inspect

Step 6 Mount

Precautions: must wear ppe

LAP Test Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instruction I: Given necessary templates, tools and materials you are required to perform the following tasks within 3 hours.

Task 1: mount and dismount tire and wheel

2. UNIT TWO: Dismounting, check/test and remount on wheel

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

- Tire Care and tread pattern
- Removing tire from the Vehicle
- Tire-Wheel Assembly Dismounting and Mounting
- Checking/testing tire-wheel assembly
- Documentation and reporting results

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:

- Care tire tread pattern
- Remove tire from the vehicle
- Dismount and Mount Tire-Wheel Assembly
- Check/test tire-wheel assembly
- Document and report results

2.1. Tire Care and tread pattern

The tread pattern is made up of tread lugs and tread voids. The lugs are the sections of rubber that make contact with the road and voids are the spaces that are located between the lugs. Lugs are also called slots or blocks, and voids are also called grooves. The tire tread pattern of block-groove con-gurations a-ect the tire's traction and noise level Wide and straight grooves running circumferentially have a lower noise level and high lateral friction. More lateral grooves running from side to side increase traction and noise levels.

Tires need both circumferential and lateral grooves. The water on the road is compressed into the grooves by the vehicle's weight and is evacuated from the tire print region, providing better traction at the tire print contact. Without such grooves, the water would not be able to escape out to the side of the wheel. This would causes a thin layer of water to remain between the road and the tire, which causes a loss of friction with the road surface. Therefore, the grooves in the tread provide an escape path for water.

On a dry road, the tire treads reduce grip because they reduce the contact area between the rubber and the road. This is the reason for using treadles or slick tires at smooth and dry race tracks.

The mud-terrain tire pattern is characterized by large lugs and large voids. The large lugs provide large bites in poor traction conditions and the large voids allow the tire to clean itself by releasing and expelling the mud and dirt. The all-terrain tire pattern is characterized by smaller voids and lugs when compared to the mud terrain tire. A denser pattern of lugs and smaller voids make all-terrain tires quieter on the street. However,

2.2. Removing tire from the Vehicle

The overall aim of the learning module is to improve the quality of training and also servicing of tire and wheel the use of tyres for improvement of traffic safety.

This is an overview of the factors of a tyre maintenance quality or servicing quality consider when methods of tyre servicing for quality to meet the demanding needs of customer the 21st century.

Tyre servicing quality include:

Receiving and inspection of the tyer Removing and reinstalling the tyre and wheel to the vehicle Repairing and servicing of the tyre and wheel Report and document final results

The subject matter to be covered will include the tyre itself,servicing of tyre and wheel balancing how the needs and hence the servicing method different within the tyre size vary. The many servicing work shop conflicting needs placed on tyre tequinic by users of tyres and the range from which servicing skills can be selected are discussed. This review will also consider the tyre performance characteristics themselves, how they are measured and understood in terms of the technology of the tyre,. A few ideas for the future are explored.

PURPOSE OF TIRES

The friction (traction) between the tire and the road determines the handling characteristics of any vehicle. Think about this statement for a second. The compounding, construction, and condition of tires are some of the most important aspects of the steering, suspension, alignment, and braking systems of any vehicle. A vehicle that handles poorly or that pulls, darts, jumps, or steers “funny” may be suffering from defective or worn tires. Understanding the construction of a tire is important for the technician to be able to identify tire failure or vehicle handling problems.

FUNCTION OF TIRES

Tires are mounted on wheels that are bolted to the vehicle to provide the following:

Shock absorber action when driving over rough surfaces Friction (traction) between the wheels and the road All tires are assembled by hand from many different component parts consisting of various rubber compounds, steel, and various types of fabric material. Tires are also available in many different designs and sizes. Train yourself to look for possible trouble areas and keep your tires in the best possible condition. Remember, the tires are the car's only contact with the pavement, and you don't want to jeopardize that contact. A tire maintenance kit costs only a few dollars. Such a kit contains tire pressure and tread depth gauges. In today's age of self-service gasoline stations, it is important to be able to check tire pressures and wear patterns yourself.

Wheels

Wheels must be strong enough to support the vehicle and withstand the forces caused by normal operation. At the same time, they must be as light as possible, to help keep un-sprung weight to a minimum.



figure 2.1wheel

Wheels can be made from cast aluminum alloy or magnesium alloy. Alloy wheels are popular because of their appearance and because they are lighter than similar steel wheels. Aluminum is a better conductor of heat, so alloy wheels can dissipate heat from brakes and tyres more effectively than steel ones. Most wheels have ventilation holes in the flange, so air can circulate to the brakes. Most passenger car wheels are of well, or drop-center design. This design allows for tyre removal and fitting. The removal and fitting of tyres should be carried out according to manufactures instructions.

Types of Wheels

Passenger cars normally use rims which are of well based, or drop Centre design. The drop enter is used for mounting and demounting the tyre onto the rim. Wheels must be strong enough to carry the mass of the vehicle and withstand the forces that are generated during use. The wheel center must accurately locate the wheel rim centrally on the axle. It must also provide the required distance from the centerline of the wheel, to the face of the mounting flange.

This is called offset. Offset is important because it brings the tyre centerline into close alignment with the larger inner hub bearing and reduces load on the stub axle. This allows the inside of the wheel center to be shaped to provide space for the brake assembly, usually located inside the wheel. Ventilation slots allow air to circulate around the brakes. The rim must be accurately shaped and dimensioned and strong enough to support the tyre under the load of the vehicle and the forces generated by the motion of the vehicle. When inflated, the tyre is locked to the rim by tapering the bead seat towards the flange, or by safety ridges or humps, close to the flange. In the event of sudden deflation, or blow-out, safety ridges prevent the tyre moving down into the well. This helps maintain control of the vehicle while the brakes are applied. Well-based rims can also be used on heavy commercial vehicles for tubeless tyres.

2.3. Tire-Wheel Assembly Dismounting and Mounting

If a rim is dirty or corroded or if the tire is not centered on the rim, the tire bead may bind" on the rim and refuse to seat. Allowing air pressure to build within the assembly in an attempt to seat the bead is a dangerous practice. Inflation beyond 40 psi (275 kPa) may break the bead (or even the rim) with explosive force. This can cause serious injury to the person inflating the tire. Injuries caused by such explosions include severed fingers, broken arms, broken jaws, and severe facial lacerations. Be certain that the rim flanges and bead ledge (especially hump and radius) areas are smooth and clean. Remove any oxidized rubber, dried soap solution, rust, heavy paint, etc., with a wire brush.

Lubricate the tire beads, rim flanges, and bead ledge areas with a liberal amount of thin vegetable oil soap solution or with an approved rubber lubricant. Start the mounting procedure with the narrow bead ledge of the rim up at all times.

Be sure that the assembly is securely locked down on the mounting machine.

Use a tire mounting band. The use of a tire mounting band (or bead expander) is helpful when inflating tubeless tires. This device constricts the tread centerline of the tire, thereby helping to force the beads onto the bead seats of the rim. Follow these steps.When the tire is on the wheel, and before inflating, attach the bead expander around the center of the tread. Inflate the tire sufficiently [10 psi (69 kPa) or less] to move the tire beads out to contact bead seats of rim. Then, as a safety precaution, remove the expander. Never exceed 10 psi (69 kPa) pressure with the mounting band on the tire.

Increase air pressure, as needed, up to 40 psi (275 kPa) to seat the tire beads fully on the rim. Check for leakage and, if none, adjust air pressure to recommended pressure. Do not allow air pressure to exceed 40 psi (275 kPa) during the bead-seating process. If beads have not seated by the time pressure reaches 40 psi (275 kPa), deflate the assembly, reposition the tire on the rim, and re lubricate and re inflate it to recommended operating pressure. Make certain that the valve core is inserted in the valve stem. Worn valves should be replaced, using the valve designated by the manufacturer, since valves vary as to length and diameter . Valve caps should be screwed on finger-tight.

Use an extension gauge with clip-on chuck so that air pressure buildup can be closely watched and so that you can stand well back from the assembly during the seating process. Always follow manufacturer's recommended procedures for lug nut tightening sequence. Important wheel and tire service information that must be followed to service wheel-and-tire assemblies properly

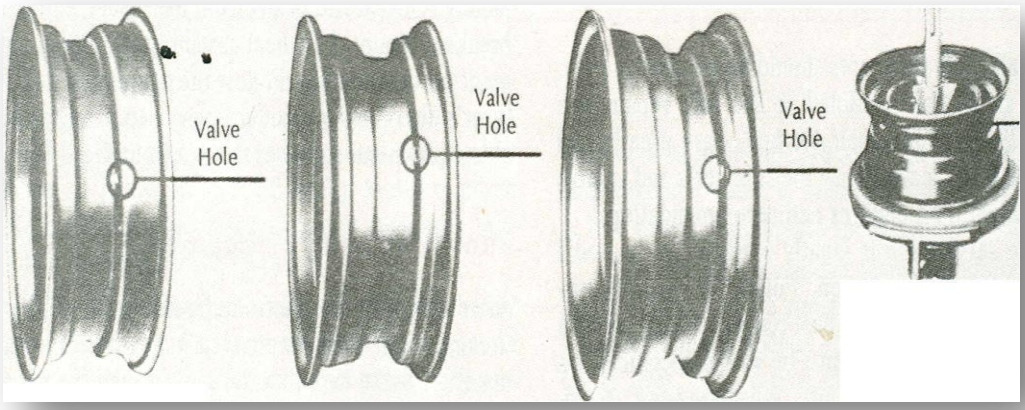


figure 2.2wheel hole indicator

2.3.1. Machine description

Machine, device, having a unique purpose, that augments or replaces human or animal effort for the accomplishment of physical tasks. This broad category encompasses such simple devices as the inclined plane, lever, wedge, wheel and axle, pulley, and screw (the so-called simple machines) as well as such complex mechanical systems as the modern automobile.

CLASSIFICATION OF MACHINES

1. Machines for generating mechanical energy
   - Converts other forms of energy into mechanical work

   Examples: Steam engines, Steam turbines, I. C. engines, gas turbines, water turbines etc
2. Machines for transmitting mechanical energy into other form of energy
   - Known as converting machines

   Examples: Electric generators, air or hydraulic pumps, etc.
3. Machines for utilizing mechanical energy in the performance of useful work.

Examples: Lathe, and other machine tools, etc.

The transmission and modification of energy within the machine require the inclusion of a number of parts (links or elements), which are so selected that they will produce the desired motion and carry with safety the forces to which they are subjected so that the machine can perform its task successfully.

A machine is a combination of components which can transmit power in a controlled manner and which is capable of performing useful work. A machine consists of a number of kinematic ally related links.

INPUT	MACHINE	OUTPUT
Mechanical Electrical Hydraulic Chemical or Nuclear	**Kinematic Arrangement of Links** - Rigid - Rigid-Hydraulic - Rigid-Pneumatic	Mechanical Electrical Hydraulic or Thermal
Force Velocity Energy/Time Power	A machine has moving parts, which must be constrained and controlled.	Force Velocity Energy/Time Power

2.3.2. Dismounting techniques

Implementing methods for the removal

Preparing Your Car for a Tire Change

- When a tire goes flat on the road, a driver has very little time to find a safe place to pull over and prepare for a change. The ideal surface would be flat, level and solid -- like a parking lot.
- The next consideration is parking as far away from traffic as possible. You definitely don't need the added danger of attempting to fix a flat tire while you're close to moving traffic. You risk being hit by an inattentive or reckless driver.
- The next step, once you've found a good spot, is to turn on the car's emergency flashers or hazard lights. Checking these lights to ensure they work properly should be a routine part of your regular car maintenance.
- With the flashers on, make sure the car can't roll once it's lifted. Apply the parking brake and shift the transmission into the "Park" position or in reverse gear if the car has a standard transmission. Now get out of the car and chock (block) the wheels. The wheel blocks can range from large roadside stones to specially designed wheel wedges. Anything that stops the car from rolling away will work. Place the blocks in front of the front tires if you're changing a rear tire and behind the rear tires if you're changing a front tire.
- Hopefully your regular automotive maintenance schedule has given you the opportunity to check the condition of the spare and tools. If not, now's the time to find out just how lucky (or unlucky) you are. Remove the jack and lug wrench from the car, as well as the spare tire.
- Again, regular auto maintenance would ensure these items are in good working order and condition. If not, well, it's time to call a tow truck. But if your spare tire and tools are ready to go, keep reading to find out what to do next.



Fig 2.3. lift a vehicle

2.3.3. Cleaning disassembled parts

Removal of multi piece rims from spoke wheels on chassis

Always be aware of the position, condition, and fit of side rings on multipiece (10.00 X 20 tube-type) rims. Visually inspect tires and rims; Cracks, severe corrosion or obvious poor fit should be rejected. Corrosion (rims, wheels, studs, nuts, clamps) that clearly will affect structural integrity should be repaired / replaced.

Chock wheels; Jack vehicle; use axle stands if available.

Check the air pressure of both tires of a dual assembly with a pressure gage. Mark tire pressures on tire sidewalls.

Both tires of a dual wheel assembly must be completely deflated BEFORE loosening nuts for removal from the axle.

When deflating any tire, stand to the side; use a valve stem 'wrench' to remove valve core and deflate tire. Run a piece of wire into the valve stem to be sure there are no obstructions to deflation and that deflation is complete.

after both tires are completely deflated, begin to break lug nuts loose with a few turns of a socket wrench in a "star" or "crisscross" pattern. Do not remove lug nuts at this time; only loosen with a few turns.

Rim clamps work by "wedging" the rim; be sure a clamps are free before completely removing lug nuts. If a clamp is still wedged, gently tap it with a rubber mallet while lug nuts are still loosely attached; warning: do not use hard surface hammers.

Remove all lug nuts.

Carefully remove the rim(s) taking care not to damage stud threads.

Wipe mounting surfaces of rim to remove dirt and corrosion; use wire brush if needed; mounting surfaces should be smooth and clean.

2.3.4. Mounting techniques

Instructions for Mounting and Demounting Tires

Professionals should adhere to the following steps to demount and mount tires.

- ✓ Fully deflate the tire first. Remove the valve core and then take the entire tire and wheel assembly off the vehicle.
- ✓ Separate the top bead with a bead-breaking tool.
- ✓ Place the tire on a tire changer and lubricate the top bead. Then break the top bead and remove the top bead over the rim.

- ✓ Before mounting the tire on the rim, clean and inspect the rim. If there is any damage, such as breaks, bends or cracks, do not repair them. Heating a rim can compromise its functionality and cause mechanical failure.
- ✓ Remove the valve stem and install new o-rings, caps, cores and valves for each newly mounted tire. It is essential to ensure that there is no damage to the tire during this or any step.
- ✓ Make sure the inside is clean and dry. There should be no foreign materials or dirt inside the tire. Use a lubricant to prepare the tire for mounting.
- ✓ Place the tire on the wheel and put the tire bead over the rim.
- ✓ Install a new valve core.
- ✓ Inflate the tire per the vehicle specifications. The specifications are located in the driver's manual or the inside of the driver's side door jamb. Use an extension hose for air insertion. Never stand over a tire when inflating but stand back and away as far as you safely can.

2.4. Checking/testing tire-wheel assembly

2.4.1. Tire and tube

Check Tread Depth

Evaluate the tread depth of your tires to make sure you have enough traction to grip the road. The penny test is a simple way to do this. Just place a penny upside down in your tread. If you can see the top of Lincoln's head, it may be time for new tires.

Check Tire Pressure

Use a tire pressure gauge to make sure your tires are properly inflated and then fill your tires with air as needed. To check your pressure, remove the valve stem cap, press the gauge head evenly onto the valve stem, use firm pressure so that the hissing sound stops. Remove the gauge and read the pressure. Compare this to your vehicle's recommended inflation pressure. Always check your tires while they are cold (after sitting for at least 3 hours or before you've driven 1 mile at moderate speed). Never bleed pressure from a hot tire.

Check Tire Condition and Age In addition to tread depth and inflation pressure, you should also inspect your tires for any damage or conditions that would warrant their replacement. Look at the tread and sidewalls for any cuts, scrapes, punctures, bulges, bumps or cracks. If you see anything suspicious, have a tire service professional take a closer look.

You also want to keep an eye on your tire's age. Depending on how much you drive each year, your tire's tread may last for years but just because the tread is not worn out does not mean that your tires

don't need to be replaced. Bridgestone, following industry standards, recommends that tires be removed from service no more than ten (10) years after the date of manufacture.

To determine your tires age just look at the DOT stamping on the sidewall. At the end of the DOT stamping there will be a 4-digit number. This is the date code. The first two numbers are the week and the last two are the year. For example, 4617 would tell you that the tire was manufactured the 46th week of 2017

Emergency Tire Change Procedure

Step 1: Find a Safe Place to Park

Find a safe place to park. You will want to be on flat ground and ideally on a paved surface. Some roads have paved shoulders, sometimes called 'Breakdown Lanes'. If possible, it's best to avoid dirt or gravel. Soft ground may allow for an unsafe condition as the jack may sink under the focused weight of the vehicle. Ensure you are as far from active traffic as possible for safety.

Step 2: Hazard Lights Switch your Hazard Lights ON to warn others that your vehicle is disabled

Step 3: Put the Car in Park or NeutralOnce you are stopped, put the car in Park (P) or Neutral (N) if your vehicle has a manual transmission.

Step 4: Emergency Brake Apply the emergency brake. Two of the most common types of emergency brake applicators are the Emergency Foot Brake and the Emergency Hand Brake.

Step 5: Turn Off the Engine Turn the engine off. Most vehicles use a Keyed Ignition similar to the photo. Newer vehicles may have a Push Button Ignition.

Step 6: Analyze Tire Once your vehicle is safe for exit, proceed to exit the vehicle and analyze your suspected flat tire. If there are any defects noted, proceed to change the tire as indicated by the steps that follow.

Step 7: Place Cone or Flare From Emergency Kit If you do not own one already, it is highly recommended to have an Emergency Breakdown Kit. If you have one, it would be at this point that you'd want to place the emergency road flare, hazard triangle, or hazard cone out in the outer perimeter of your vehicle to indicate to other drivers that you are broken down and need space.

Step 8: Locate Your Spare Tire Locate your Spare Tire. Some vehicles have a spare located under the floor board in the trunk space while others, typically trucks and SUV's, will have the spare tire under the rear of the vehicle (see photo). Consult your owner's manual for instructions to release the spare tire if necessary.

Step: Locate Tire Change Tools Locate the Tire Change Tools that came with your vehicle. Depending on your vehicle make, they may be located in a number of places such as in the trunk along with the spare tire, behind the seat (often the case in a truck), or under the rear seat in many SUV's and extended cab trucks.

Step 10: Place Wheel Chocks If you carry Wheel Chocks in your vehicle, they should be placed under the front and rear of a tire on an axle of the vehicle which does NOT have a flat tire. This will be an added safety measure to prevent the vehicle from rolling during maintenance. It is highly recommended to use vehicle chocks when changing a tire on ground that is not level.

Step 11: Pry Off Cover If your wheels have a Plastic Cover over the steel rims, you will need to use a flat-tipped rod (such as a flat-tip screwdriver or maybe the back end of the lug nut wrench in some vehicles) to pry off the edge of the cover.

Step 12: Loosen the Lug Nuts Loosen the lug nuts. Only loosen each nut approximately ½ to 1 full turn counter-clockwise. This will make it easier to remove the tire in a later step.

caution: do not remove the lug nuts before the vehicle is jacked up in the air and the wheel and tire assembly are off the ground.

Step 13: Locate Jack Points Locate the jack points which will be indicated in the vehicle's owner's manual. The Hoist Adapter Contact Points in the diagram below are for small floor jacks and scissor jacks. The floor jack points are primarily for larger jacks and will primarily be used on solid axle vehicles that incorporate a differential gear box.

Step 14: Jack Up the Vehicle Jack the vehicle at the jack point closest to the tire which requires replacement. Raise the vehicle until the tire is approximately 2-4 inches off the ground (note that the vehicle may need to be jacked higher than this in order for the new, inflated tire to clear the ground upon installation).

Step 15: Remove Lug Nuts and Tire Remove the already loosened lug nuts completely and store in a convenient location nearby where you are working. They will be used to install the spare tire. You can now completely remove the tire and wheel assembly by pulling the tire toward you in a horizontal movement.

Step 16: Inspect and Note Damage Do a General Visual Inspection of the area that the wheel was attached to (Rotor/Drum, Brake Caliper, Brake Line, Wiring, etc.). The reason for this inspection is the fact that some tire blowouts can be semi-explosive and may cause component damage in the immediate areas around the tire. Any defects should be noted and a vehicle mechanic should be consulted prior to continued vehicle operation.

Step 17: Install Spare Tire Install the spare tire by clocking the wheel so the lugs are lined up with the wheel mounting holes. While holding the tire in place with one hand or your foot, install the Lug Nuts on the lugs by hand as tight as you can. Note that most lug nuts are tapered on one side. This tapered end goes on the lug first.

Step 18: Tighten Lug Nuts Snug the lug nuts with the lug nut wrench. Note that the wheel may want to turn from the force of the wrench turning the nut. Once this starts to happen, you've tightened the lug nut enough to lower the vehicle.

Step 19: Check Tire Pressure Check the spare tire's internal pressure. Most vehicles will not include a tire pressure gauge in their tire change kit.

Conventional tire pressure gauges are about the size of a pencil. They typically have metal exteriors with plastic rods that extend out when the device is pushed into the tire stem (Schrader Valve). if you attach the gauge to your tire and the rod extends to a large 3 and a small 4, then your reading is 34 PSI. Don't get confused by thinking that the gauge is giving you a measurement of 3.4 PSI.

a. If the tire pressure is within an acceptable range, reinstall the protective cap.

b. If the tire pressure is low, pump the tire with a compressed air source (may be found in an Emergency Breakdown Kit).

c. If the pressure is too high, reduce to an acceptable range by pushing on the pin in the center of the Schrader valve.

Step 20: Lower the Vehicle Lower the vehicle back to the ground using the vehicle jack. Remove the jack from under the vehicle and stow it in the completely retracted position for storage.

Step 21: Tighten Lug Nuts in Star Pattern

Tighten the lug nuts in a star pattern as indicated in most vehicle owner's manuals. The diagram shows the most common torque patterns. It is best practice to use a Torque Wrench to tighten the lug nuts. Lug nut torque values can be found in the vehicle owner's manual (typically between 90-160 pound-feet).

Step 22: Tire Change Is Complete

2.4.2. Wheel and rim

Clean the anti-rust with industrial alcohol or gasoline before adapter mounting to protect instalment precision. "0" on the adapter aims at "0"on the spindle, fasten with long bolts by six-angular spanner. (must be tightly for retesting precision).

A rim has two main parts: ange and spider. The ange or hub is the ring or shell on which the tire is mounted. The spider or centre section is the disc section that is attached to the hub. The rim width is

also called pan width and measured from inside to inside of the bead seats of the ange. Flange provides lateral support to the tire. A ange has two bead seats providing radial support to the tire. The well is the middle part between the bead seats with sucient depth and width to enable the tire beads to be mounted and demounted on the rim. The rim hole or valve aperture is the hole or slot in the rim that accommodates the valve for tire inflation.

The wheels on today's vehicles are made of steel, aluminium, or aluminium alloy (a combination of two or more metals). Steel wheels are the least expensive to produce, which is why they come as original equipment on many passenger cars and light trucks. The centre section includes the bolt circle, or mounting holes, and is used to attach the wheel to the vehicle. The flange is the outermost lip of the rim, and is the area typically used for attaching wheel (balancing) weights.

The rim is formed by rolling a strip of metal and then welding the two ends together. The interior section of the rim has a smaller diameter section called a drop centre. This area provides the means for removing and installing a tire, since the bead is not designed to stretch. During removal or installation, most of the tire bead is pushed into the drop centre so that the exposed portion can be pulled over the rim. The edges of the rim are flared to form the bead seats, which hold the tire and provide the airtight seal. Many rims include safety humps. These are small elevations on the inside of the bead seats. Safety humps help prevent the tire from falling into the drop centre during a blowout. This allows the driver to maintain better directional control of a vehicle running on one or more deflated tires.

2.4.3. TPM System

The purpose of the tire pressure monitoring system (TPMS) in your vehicle is to warn you that at least one or more tires are significantly under-inflated, possibly creating unsafe driving conditions. The TPMS low tire pressure indicator is a yellow symbol that illuminates on the dashboard instrument panel in the shape of a tire cross-section (that resembles a horseshoe) with an exclamation point.

2.4.4. Tire/Wheel Run out

Wheels that are bent or have excessive lateral run out or radial run out cause vibration (; 0.51-18) and balance problems. For example, too much radial run out of the front wheels will cause the front end of the vehicle to vibrate up and down. Sometimes repositioning the tire on the wheel reduces or eliminates excessive radial run out. A quick check of lateral run out and radial run out can be made using a safety stand. To measure lateral run out, position a dial indicator or run out gauge against the

wheel and the scrub rib of the tire. With the dial indicator in each position, rotate the wheel in both directions. The total indicator reading (; 0.5-17) shows the amount of lateral run out.

Tubeless tyres mounted on 3-piece and 5-piece Flat-Base rim types.

3-piece rim type:

- ✓ Rim base with fixed rear side ring
- ✓ Front side ring
- ✓ Locking ring

5-piece rim type:

- ✓ Rim base with loose side rings
- ✓ Front side ring
- ✓ Rear side ring
- ✓ Bead seat band
- ✓ Locking ring

2.5. Documentation and reporting results

Preparing the documents

Two basic questions need to be answered before documents can be prepared for repair work.

Are tradespeople available to execute the work?

Documents need to be tailored to the known skills of the tradespeople likely to be working on the project. You must find out what trades will be required and whether these skills are currently available in the marketplace. It is no good specifying tuck-pointing if tuck-pointers are not available. One solution is to ask tenderers to list recent projects, and nominate the staff who will be working on the project. Another is to ask them to do test panels as part of the selection process. If possible, discuss proposed works on site with experienced craftspeople before preparing the documents. Some types of repair work are relatively new and there are few skilled in doing them. In these cases, your documents should contain background information on the reasons for the repair technique, and detailed instructions on how to do it, and how it should look when finished. For example, desalination of stonework by applying a weak sacrificial plaster mix may need to be explained to tradespeople who otherwise may be reluctant to apply what appears to be a ‘poor mix’ that ‘won’t last long’. There is no substitute for a conservation architect to supervise the work, for an experienced project manager to coordinate the works and for reliable, experienced, specialist sub-contractors. Are materials available for the repair work?

The materials originally used on the building may no longer be obtainable. You will need to find out about replacement materials and their limitations and methods of application. For

example, is matching stone available? If so, the size of quarry blocks and correct methods of bedding, jointing and fixing may need to be discussed with an experienced banker mason. If not, rather than using new stone you may choose to repair with synthetic stone (a mixture of blended sand and epoxy resin). In this case, you need to know the consequences of using non-matching materials so that the new mix does not cause future damage to the surrounding stone.

Document with care

Poorly documented repair works could result in the work making matters worse rather than better. Documents should include a description of site conditions, such as potential noise problems, access times and work areas for the contractor and special protection of heritage fabric. Generally, the requirements of the occupants and the users of the building should be documented where they conflict with the contractor's work. Note that some work may need to be done "out of work hours".

Self-check 2

Name: _____ ID No _____ Date: _____

Direction: Answer the following questions to test your knowledge pertaining to tire and its related function.

Write and define the following question**?**

List the tool to check rim/wheel run out?

_____
_____
_____
_____

What are the two basic questions need to be answered before documents can be prepared for repair work?

_____
_____
_____
_____.

Operation sheet 2

Operation Title: Check rim/wheel run out.

Instruction: Check rim/wheel run out.

Purpose: to know about how to Check rim/wheel run out.

Required tools and equipment: -Lever, Hammer, Flat and Philips screw driver, Tire remover

Procedures:

Step 1 Prepare tools and equipment

Step 2 Remove tire from the vehicle

Step 3 Dismount the tire from the wheel

Step 4 Clean

Step 5 Inspect

Precautions: must wear ppe

Lap test 2

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instruction I: Given necessary templates, tools and materials you are required to perform the following tasks within 3 hours.

Task 1: Check rim/wheel run out.

3. UNIT THREE: Repairing tires and tubes

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

- legal regulations of tire repair
- Tire Repair Methods
- TPMS Service
- Possible damages of Tire-wheel assembly

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 tire Repair Methods
- Identify TPMS Service
- Identify possible damages of Tire-wheel assembly

3.1. Legal regulations of tire repair

There have been recent reports that certain repairs are "ILLEGAL" on tires operating in various countries or states in North America. We want to clarify statements of this type by explaining the following –

There are presently no Federal or State laws regarding repairs done to tires in the United States.

If repairs are restricted it is usually driven by the fleet or customer as a specification, which could be the outcome from a prior negative experience. If someone chooses not to run repaired tires on a steer axle, that is a fleet spec, not a law. If section repairs are not permitted on drive tires, it is a fleet spec, not a law.

3.2. Tire Repair Methods

Proper tire repair is an essential component of tire life cycle management. Utilizing a proper tire repair program from Tech can help to prolong the life of the tire casing by installing a permanent, worry-free repair. With experience in tire repair manufacturing dating back to 1939, Tech is dedicated to providing the highest quality tire repairs in the market. Tech repair units have been manufactured and tested to meet or exceed all industry requirements of new tires. You can be assured that when a tire is properly repaired with a Tech repair unit, it will be as safe as a new tire.

When tires are repaired properly, the tire's usable life is extended. This saves the owner of the tire money and reduces waste. If a tire is repaired improperly, it can result in an unsafe condition for both the technician installing the tire on the wheel and then the vehicle, and also for the driver of the vehicle. Improper repairs can lead to further loss of air pressure when the tire is in service, which can

result in premature tire failure, causing an accident which could lead to serious injuries or even deaths.

Failure to properly repair tire could cause sudden tire failure, resulting in serious injury or death. Carefully read and follow these instructions.

- ✓ After removing the tire from the rim probe repairable tire injuries in order to remove a nail or other damaging material. Make sure that the area around the injury is thoroughly dry. Scrape the damaged area with a sharp edged tool and buff. Take care not to damage the liner or expose any cords.
- ✓ Lubricate the injury by pushing the snout of the vulcanizing fluid can into the injury from both sides of the tire. Also pour vulcanizing fluid on the insertion tool and push it through with a twisting motion until it can be inserted and withdrawn easily.
- ✓ Using a head-type or headless straight plug slightly larger than the size of the injury, place it in the eye of the insertion tool. When a headless straight plug is used, always back it up with a patch. Wet both the plug and insertion tool with vulcanizing fluid. Always pour directly from the can so as not to contaminate the can's contents.
- ✓ While holding and stretching the long end of the plug, insert the plug into the injury from inside the tire. Hold and stretch the long end of the plug as it is forced into the injury until one end extends through it. Remove the insertion and cut off the plug -h inch above the surfaces. Do not pull on the plug while cutting.
- ✓ Do not wash previously prepared surface with solvent prior to application of vulcanizing fluid.

3.2.1. Plug Repair

How does a tire plug work?

A tire plug is a strip of leather covered in a rubber compound, which is inserted into the hole and typically seals on the inside of the tire.

When can you use a plug on a tire?

When choosing to plug or patch a tire, it often depends on the size of the hole and the location. Plugs are typically used after treading on a nail, screw or small puncture. Plugs are used on small holes away from the sidewall.

- ✓ Don’t plug your tire if it’s anywhere near the sidewall.
- ✓ Don’t plug your tire if it’s an irregularly shaped hole.

- ✓ Don't plug your tire if it's a large hole or thick nail.
- ✓ Don't plug your tire if you've run the tire while it was flat for more than a mile, as this can mean that the sidewalls are damaged.
- ✓ Don't plug your tire if there's a bubble or bulge in the rubber on the sidewall.
- ✓ Don't plug your tire if it's bordering another repair.
- ✓ Don't plug your tire unless you remove it from the wheel.



figure 3.1plug repair

3.2.2. Cold Patch Repair

When using a cold patch, carefully remove the backing from the patch. Center the patch base over the damaged area on which vulcanizing fluid has been spread and allowed to dry. Roll the patch down firmly with the roller tool, working from the center out.

3.2.3. Hot Patch Repair

When using a hot patch, cover the buffed area with a light coat of cement of the type specified for the patch and allow it to dry. Remove the backing from the patch. Center the patch over injury. Clamp-finger tighten only. Apply heat, cure, and allow to cool. Before remounting the tire, clean and de burr the rim carefully.

3.2.4. TPMS Service

The tire pressure monitoring system (TPMS) menu (shown in figure 17) displays all parameters that are used to define a TPMS sensor. The menu is divided into two sections:

• TPMS sensor model activation

– radio-buttons to activate/deactivate the sensor;

• **TPMS sensor position and mass**

– parameters defining the position and mass of the sensor;

The purpose of the tire pressure monitoring system (TPMS) in your vehicle is to warn you that at least one or more tires are significantly under-inflated, possibly creating unsafe driving conditions. The TPMS low tire pressure indicator is a yellow symbol that illuminates on the dashboard instrument panel in the shape of a tire cross-section (that resembles a horseshoe) with an exclamation point.

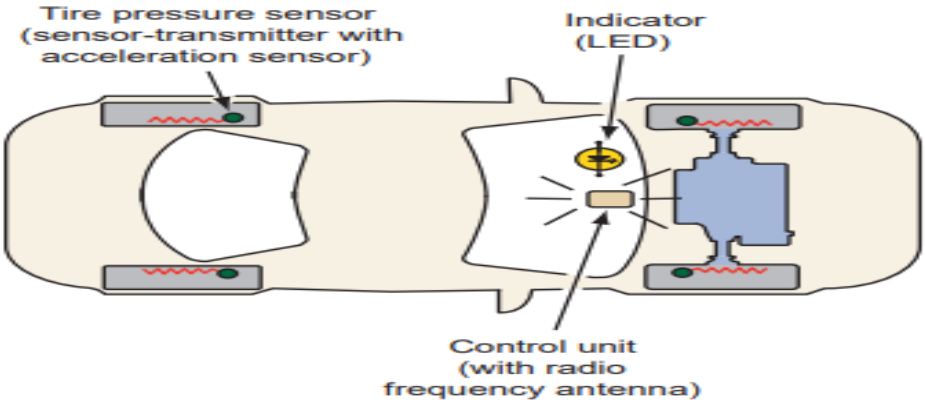


figure 3.2location of TPM

3.3. Possible damages of Tire-wheel assembly

Tires can become damaged for a variety of reasons, and it can happen without the driver being immediately aware there's a problem. The most common types of damage are punctures, cuts, impacts, cracks, bulges and irregular wear. In this section, we'll explain the signs and symptoms to help you diagnose the issue, plus some useful tips on how to prevent them

Self-Check 3

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I. If the statement is correct say true if the statement is incorrect say false

1. Plug and patch is the types of tire repair method
2. There is no difference b/n patching and plugging

3. Rim and wheel the same function.

Part II. Write short answer

1. Define wheel, rim, tire and tire plug?

_____

_____

_____

_____

2. What is TPMS?

_____

_____

_____

Operation sheet 3

Operation Title: Remove tire/rim from the wheel.

Instruction: Remove tire/rim from the wheel.

Purpose: to know about how to Remove tire/rim from the wheel.

Required tools and equipment: -Lever, Hammer, Flat and philips scriw driver, Tire remover

Procedures:

Step 1 Prepare tools and equipment

Step 2 Remove tire from the vehicle

Step 3 Dismount the tire from the wheel

Step 4 Clean

Step 5 Inspect

Step 6 Mount

Precautions: must wear ppe

Lap test 3

Name: _____ Date: _____

Time started: _____ Time finished: _____

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

Task 1: To remove tire/rim from the wheel.

4. Unit Four: Performing tire/wheel balance

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

- Computer storage system of machine
- Inspect rims for damage and wear.
- Performing static and dynamic wheel balance

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 computer storage system of machine
- Inspect rims for damage and wear.
- Perform static and dynamic wheel balance

4.1. Computer storage system of machine

Storage Basics

• Storage is a term used for the components of a digital device designed to hold data permanently.

• A data storage system has two main components: a storage medium and a storage device – Storage medium – the hard drives, CDs, DVDs, flash drives, solid state drives, and memory cards that contains data – Storage device – the mechanical apparatus that records and retrieves data from a storage medium

Each storage technology has its advantages and disadvantages, so review its durability, dependability, speed, capacity, and cost before buying.

4.2. Inspect rims for damage and wear.

When Should Rims Be Replaced? Any time that your rims are compromised, cannot hold air, or cause braking and handling problems mean that they need to be replaced. A worn or broken rim could cause a sudden blowout even if the leak seems slow or the crack appears minorDriving on damaged tires is dangerous. A damaged tire can suddenly fail causing serious personal injury or death. Have your tires regularly inspected by a qualified tire service professional.

What are the different types of tire wear?

To help interpret your tire tread here is a short guide on the five most common types wear pattern

1. Patch wear
2. Centre wear
3. Edge wear
4. Cupping wear

5. Inner/outer wear

General Guidelines

Scrap rims for the following reasons:

- ✓ Bent in any area (flange, disc, inner rim, outer rim, etc.)
- ✓ Cracked in any area, no matter how small
- ✓ Out-of-round regardless of degree (inner or outer rim)
- ✓ Subjected to high heat or direct fire
- ✓ Leaking due to cause other than: -

  O-ring - Valve (CTIS or Fill Valve) - Incorrect assembly

- ✓ •Stripped threaded holes - Fill valve - CTIS valve attachment

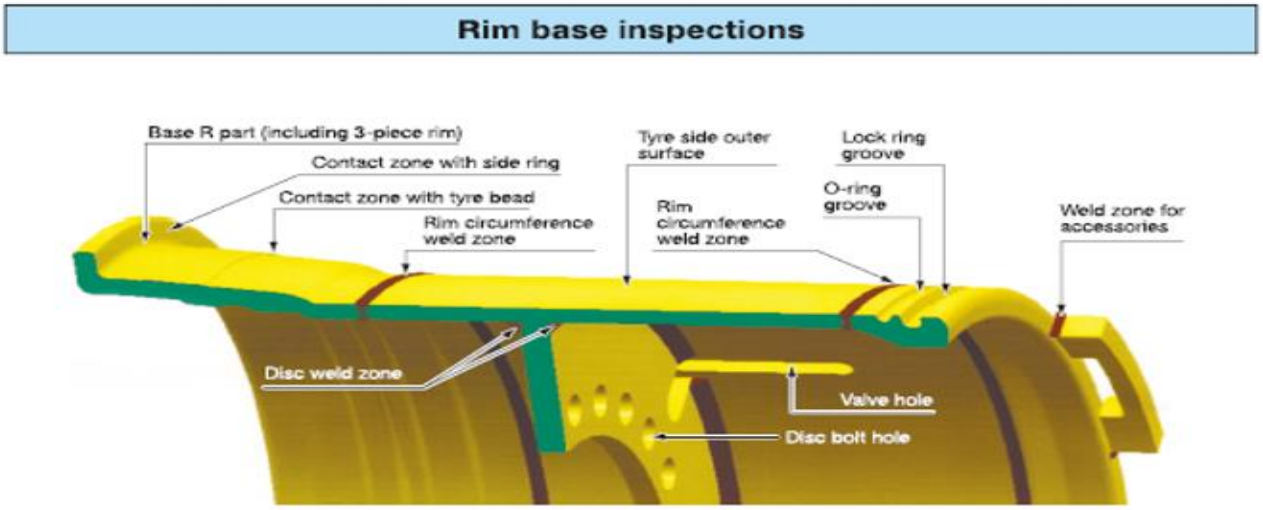


figure 4.1rim components

4.3. Performing static and dynamic wheel balance

Tire/Wheel Balance

Proper wheel alignment allows the tires to roll straight without excessive tread wear. The wheels can go out of alignment from striking raised objects or potholes. Misalignment subjects the tires to uneven and/or irregular wear. An out-of-balance condition can also cause increased wear on the ball joints, as well as deterioration of shock absorbers and other suspenssion components. If an inspection show uneven or irregular tire wear, wheel alignment and balance service is a must. Wheel balancing distributes weights along the wheel rim, which counteract heavy spots in the wheels and tires and allow them to roll smoothly without vibration. The wheel weights are adhered to the wheel or are clipped over the edge of the wheel's rim. There are two types of wheel imbalance: static and dynamic.

A. Static Balance

Static balance is the equal distribution of weight around the wheel. Wheels that are statically unbalanced cause a bouncing action called wheel tramp.

B. Dynamic Balance

Dynamic balance is the equal distribution of weight on each side of the centerline. When the balanced tire spins, there is no tendency for the assembly to move from side to side. Wheels that are dynamically unbalanced can cause wheel shimmy and a wear pattern

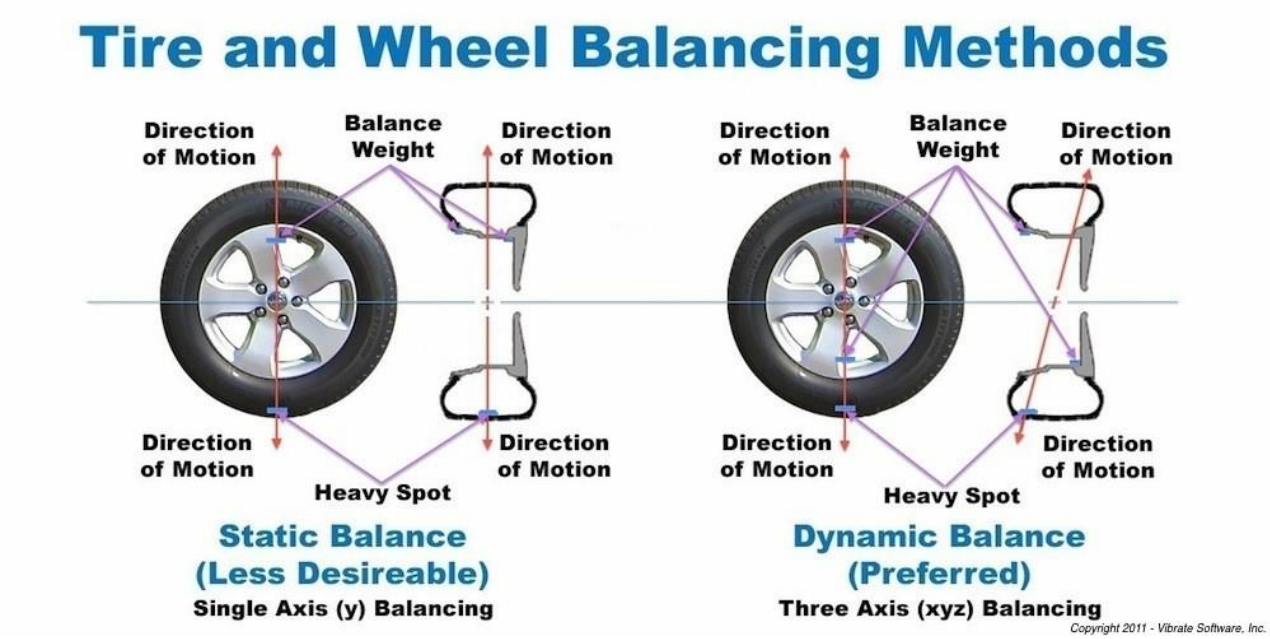


figure 4.2 tire and wheel balancing method

Steps for Balancing a Tire/Wheel Assembly

Depending on the equipment you have, tire/wheel assemblies are balanced in a number of ways. The steps are outlined as follows if you are using one of the more modern, automated machines, like the Coats 1250. These instructions are not meant to cover every balancing situation.

Before a tire can be balanced, it must be concentrically seated. You can determine this by measuring the distance between the molded rib on the lower sidewall of the tire and the edge of the wheel's rim flange. The tire must be deflated and reseated if the distance between the two points is greater than 2/32-inch.

After ensuring that the beads have reseated properly, the tire should be inflated to the recommended pressure.

- Turn your machine OFF then ON, which resets the balancer. The machine wakes up using standard clip-on wheel weight locations.

- Remove stones/rocks or other debris from tread and any weights already attached to the wheel. During this process you also should remove any mud, dirt or snow on the inside of the wheel and make sure that the mounting surface of the wheel is completely clean of debris.
- Mount a tire/wheel assembly on a balancer that will use standard clip-on wheel weights. Use the most appropriate mounting method. Technicians should be careful to avoid back injury and should seek assistance when lifting a heavy tire/wheel assembly onto a balancing shaft.
- There are three main mounting methods. They include:
  - ✓ Back Cone – Most original equipment and steel wheels can be mounted properly using this method. The wheel is centered on a cone from the inner side of the wheel.
  - ✓ Front Cone – A wheel should be centered by the outer side of the hub only when the inner surface will not provide an accurate surface to center on.
  - ✓ Pin-Plate – An alternate method of securing and aligning an assembly on a balancing machine is the pin-plate method. A pin-plate is added instead of a pressure cup.
- Enter A & D wheel dimensions using offset arm.

  Before a wheel can be balanced, wheel dimensions must be entered into the computer on your unit. These include:

  A = Offset – The distance measured from the balancer (“0” on offset arm) to inner plane of the wheel rim (inner weight location).

  W = Width – The width of the wheel at the rim flanges, measured with calipers.

  D = Diameter – The diameter of the wheel as indicated on the tire.
- For automatic measurement, pull the offset arm out to the wheel, hold it still at clip-on weight position against the wheel flange and wait for a “beep.” Return the arm to home position.
- Enter the wheel width dimension. Use plastic calipers to measure wheel width for manual entry. Press the W key. Use the keypad to enter width value (between 2 and 20 inches.) Lower the hood for automatic measurement.

Note the value entry of the W dimension.

- Lower the hood. The wheel will spin and unbalances are measured and displayed. The corrective weight amount appears in the weight display window for inboard and outboard weight locations.
- Raise the hood after the tire stops rotating. Make sure that the wheel has stopped before raising the hood.

- Inboard center bar blinks. If an inboard corrective weight is not required, the wheel will stop at the outboard corrective weight location and you can go to Step 13.
- Attach inboard corrective weight. Attach specified weight amount at top-dead-center on the inside flange of the wheel. *NOTE: Wheel weight suppliers often will supply a rim flange contour gauge to help technicians select the correct clip-on weight for the wheel.*
- Press NEXT, causing the wheel to rotate.
- The outboard center bar will blink.
- Attach outboard corrective weights. Attach specified weight amount at the top-dead-center on the outside flange of the wheel.
- Lower the hood to respin the tire/wheel and check balance. The weight readings should now be 0.00.

Self-check 4

Name: _____ ID No _____ Date: _____

Direction: Answer the following questions to test your knowledge pertaining to tire and its related function.

1. Dismount and dismount the rin from the tire

   _____

   _____

   _____

   _____

   _____

2. Explain types of wheel imbalance?

   _____

   _____

   _____

   _____

5. Unit Five: Replace and Prepare -wheel assembly for use or storage

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

- Post repair inspection and functionality check
- Tire Rotation technique
- Tire Recycling
- Machine handling
- Processing job card and documentation

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

- Repair documentation is completed
- Inspect is made to ensure work is to workplace expectations
- Process Job card is in accordance with workplace procedures.

5.1. Post repair inspection and functionality check

Evaluation and maintenance of your tires is important to their performance and the service they provide to you. Over time and/or through use, the condition of a tire can change from exposure to everyday road conditions, the environment, damaging events such as punctures, and other external factors.

Driving on damaged tires is dangerous. A damaged tire can suddenly fail causing serious personal injury or death. Have your tires regularly inspected by a qualified tire service professional.

You should visually inspect your tires on a regular basis throughout their life, and you should have your tires periodically evaluated by a qualified tire service professional when your vehicle is serviced such as routine maintenance intervals, oil changes, and tire rotations. In particular, note the following tips for spotting tire damage:

• After striking anything unusual in the roadway, have a qualified tire service professional demount the tire and inspect it for damage.

A damaged tire may not show any visible signs of harm. Yet, the tire may suddenly fail without warning, a day, a week, or even months later.

• Inspect your tires for cuts, cracks, splits or bruises in the tread and sidewall areas. Bumps or bulges may indicate a separation within the tire body. If you see damage or unusual condition, have your tire inspected by a qualified tire service professional. It may be necessary to have it removed from the wheel for a complete inspection.

• Inspect your tires for adequate tread depth. When the tire is worn to the built-in indicators at 2/32 inch (1.6 mm) or less tread groove depth, or the tire cord or fabric is exposed, the tire is dangerously worn and must be replaced immediately.

• Inspect your tires for uneven wear. Wear on one side of the tread or flat spots in the tread may indicate a problem with the tire or vehicle. Consult a qualified tire service professional.

• Inspect your wheels also. If you have a bent or cracked wheel, it must be replaced.

• Don't forget to check the spare tire

5.2. Tire Rotation technique

The purpose of tire rotation is to minimize irregular or uneven wear caused by maintaining a tire in one rotation direction and one position over an extended period. Rotate tires as recommended by the vehicle manufacturer or every 5,000 miles (8,000 km). Individual tire pressures must be checked after rotation and adjusted to the vehicle manufacturer's recommendation for the tire's new location on the vehicle. Vehicle alignment should be checked if irregular wear is evident. For vehicles with a "temporary use" spare tire, follow the vehicle manufacturer's recommended pattern for rotation.

5.3. Tire Recycling

The recycling of scrap tires may be defined under two different categories:

i) Using the scrap tires as whole or mechanically modified shapes (in crumps or shredded), and ii) Chemical decomposition or separation of scrap tire contents into different materials.

Recycling as-is or after mechanical process has the advantages of directly using scrap tires without major investment. For example, scrap tires can be directly used as boat bumpers at marinas to protect ships from scratching or hitting at the side of wharf (Fig. 3). Similarly, old tires can be placed side by side in half tire shifted pattern for slope stability or under roads for improved stability (Mechanical Concrete). Ripped tire pieces in large chunks can be directly used as light weight infill material at embankments. Drainage around building foundations, erosion control for rainwater runoff barriers, wetland establishment, crash barriers at sides of race tracks are other uses of scrap tires without much modification.

5.4. Machine handling

Procedure moving the machine

In case the machine is to be moved from one area to another, proceed as follows:

- Disconnect the machine from the electric supply.
- Remove all objects that may fall during the relocation and create a hazard.
- Do not use metal ropes to lift the machine.
- Slide the machine on the forks of a forklift.
- Hold the machine as depicted.

5.5. Processing job card and documentation

The concept of "job-cards" to clearly define the work the Panel intends to undertake and to ensure that there is sufficient information on context, justification, milestones and clear deliverables for all work items of the Panel in order to facilitate monitoring and reporting. These job cards will serve as a basis for the Facilitation work programme. It is proposed that the Facilitation (FAL) Panel regularly review and complete job-cards linked to the work programme of the Facilitation Section that will outline the tasks to be carried out by the Panel under its terms of reference.

A. Preparing the documents

Two basic questions need to be answered before documents can be prepared for repair work.

- **Are tradespeople available to execute the work?**

Documents need to be tailored to the known skills of the tradespeople likely to be working on the project. You must find out what trades will be required and whether these skills are currently available in the marketplace. It is no good specifying tuck-pointing if tuck-pointers are not available. One solution is to ask tenderers to list recent projects, and nominate the staff who will be working on the project. Another is to ask them to do test panels as part of the selection process. If possible, discuss proposed works on site with experienced craftspeople before preparing the documents. Some types of repair work are relatively new and there are few skilled in doing them. In these cases, your documents should contain background information on the reasons for the repair technique, and detailed instructions on how to do it, and how it should look when finished. For example, desalination of stonework by applying a weak sacrificial plaster mix may need to be explained to tradespeople who otherwise may be reluctant to apply what appears to be a 'poor mix' that 'won't last long'. There is no substitute for a conservation architect to supervise the work, for an experienced project manager to coordinate the works and for reliable, experienced, specialist sub-contractors.

- **Are materials available for the repair work?**

The materials originally used on the building may no longer be obtainable. You will need to find out about replacement materials and their limitations and methods of application. For example, is

matching stone available? If so, the size of quarry blocks and correct methods of bedding, jointing and fixing may need to be discussed with an experienced banker mason. If not, rather than using new stone you may choose to repair with synthetic stone (a mixture of blended sand and epoxy resin). In this case, you need to know the consequences of using non-matching materials so that the new mix does not cause future damage to the surrounding stone.

Document with care

Poorly documented repair works could result in the work making matters worse rather than better. Documents should include a description of site conditions, such as potential noise problems, access times and work areas for the contractor and special protection of heritage fabric. Generally, the requirements of the occupants and the users of the building should be documented where they conflict with the contractor's work. Note that some work may need to be done "out of work hours.

Self-check 5

Name: _____ ID No _____ Date: _____

Direction: Answer the following questions to test your knowledge pertaining to tire and its related function.

I. Write the following question

1. Write the two different categories of tire recycling?

_____

_____

_____

2. List moving machine procedure?

_____

_____

_____

_____

Reference

1. Automotive tool and equipment text book
2. Books
3. Web Addresses (Putting Links