VEHICLE SERVICING AND REPAIRING

NTQF Level II

Learning Guide- #32

Unit of Competence: Remove, Inspect, and Refit Vehicle Wheel & Hub Assemblies

Module Title Removing, Inspecting, and Refitting Vehicle Wheel & Hub Assemblies

LG Code: **EIS VSR2 M09 LO2-LG-32**

TTLM Code: **EIS VSR2 TTLM 0919v1**

LO2: Remove and inspect wheel & hub assembly

Instruction Sheet	Remove and inspect wheel & hub assembly

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

- Remove wheel & hub assembly
- Inspection of wheel & hub assembly
- Report inspection findings

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, you will be able to –

- ❖ Wheel & hub assembly is removed according to workplace procedures and manufacturer and component supplier specifications and without causing damage to components or systems
- ❖ Inspection of wheel & hub assembly, mounting points and fittings for damage and wear is carried out.
- ❖ Inspection findings are reported according to workplace procedures, including recommendations for necessary repairs or adjustments

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 2 to 32.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” in page 13.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Remove wheel & hub assembly

Wheels and Tires

The wheels and tires on a vehicle may seem mundane, but since these provide the only contact point with the road, they actually are some of the most important parts of the car or truck. Tires not only support the weight of the vehicle, they absorb much of the road shock and are vital to how the vehicle handles and how well it stops. Wheels support the tires and connect them to the brakes, suspension, and steering systems. Wheel bearings provide smooth, easy movement of the wheels and tires as well as supporting the vehicle weight and cornering forces.

Purpose and Operation of Wheels and Tires

Wheels and tires do more than support the weight of the vehicle. Tires are the only contact with the road, so they affect how the car or truck steers, how it rides and handles bumps, and how effective the brakes are.

Tire Construction

Most modern passenger vehicles and light trucks use tubeless tires that do NOT have a separate inner tube. The tire and wheel form an airtight unit. Many commercial and construction vehicles use inner tubes, which are soft, thin, leak-proof rubber liners that fit inside the tire and wheel assemblies. However, in the last few years tubeless tires have been introduced to commercial and construction vehicles, reducing the need for tube type tires. Tires perform the following two basic functions:

- ✓ They must act as a soft cushion between the road and the metal wheel.
- ✓ They must provide adequate traction with the road surface.

Tires must transmit driving, braking, and cornering forces to the road in all types of weather. At the same time, they should resist puncture and wear. Although there are several tire designs, the six major parts of a tire are as follows:

a) **Tire beads** (two steel rings encased in rubber that holds the tire sidewalls against the wheel rim).
b) **Body plies** (rubberized fabric and cords wrapped around beads. forming the carcass or body of the tire).
c) **Tread** (outer surface of the tire that contacts the road surface).
d) **Sidewall** (outer surface of the tire extending from bead to tread; it contains tire information).

e) **Belts** (used to stiffen the tread and strengthen the plies; they lie between the tread and the inner plies).
f) **Liner** (a thin layer of rubber bonded to the inside of the plies: it provides a leak-proof membrane for tubeless tires).

There are many construction and design variations in tires. A different number of plies may be used and run at different angles. Also, many different materials may be used. The three types of tires found on late model vehicles are;

a) Bias-ply,

b) Belted bias, and

c) Radial

a) Bias-Ply Tire

A bias-ply tire is one of the oldest designs, and it does NOT use belts. The position of the cords in a bias-ply tire allows the body of the tire to flex easily. This design improves the cushioning action, which provides a smooth ride on rough roads. A bias-ply tire has the plies running at an angle from bead to bead (Figure 2-1). The cord angle is also reversed from ply to ply, forming a crisscross pattern. The tread is bonded directly to the top ply. A major disadvantage of a bias-ply tire is that the weakness of the plies and tread reduce traction at high speeds and increase rolling resistance.

b) Belted Bias Tire

A belted bias tire provides a smooth ride and good traction, and offers some reduction in rolling resistance over a bias-ply tire. The belted bias tire is a bias-ply tire with stabilizer belts added to increase tread stiffness. The belts and plies run at different angles. The belts do NOT run around to the sidewalls but lie only under the tread area. Two stabilizer belts and two or more plies are used to increase tire performance.

c) Radial Ply Tire

The radial ply tire has a very flexible sidewall, but a stiff tread (Figure 2-2). This design provides for a very stable footprint (shape and amount of tread touching the road surface) which improves safety, cornering, braking, and wear. The radial ply tire has plies running straight across from bead to bead with stabilizer belts directly beneath the tread. The belts can be made of steel, flexten, fiberglass, or other materials.

A major disadvantage of the radial ply tire is that it produces a harder ride at low speeds. The stiff tread does NOT give or flex as much on rough road surfaces.

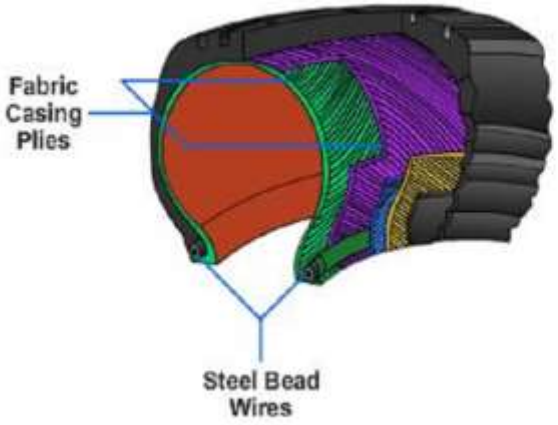


Figure2- 1— Bias ply tire

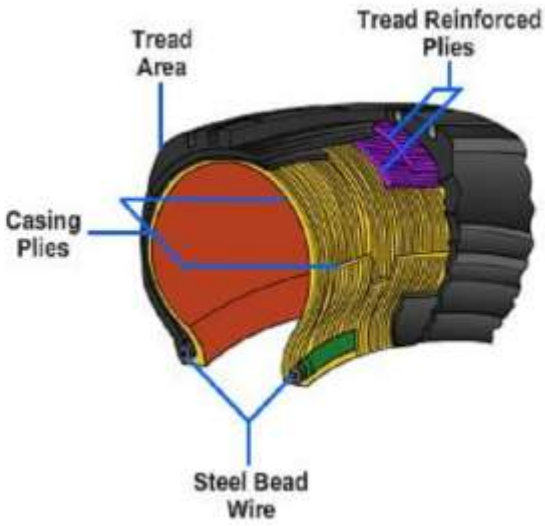


Figure2- 2— Radial tire

Tire Markings

There is important information on the sidewall of a tire. Typically, you will find Uniform Tire Quality Grading (UTQG) ratings for tread wear, traction, and temperature. You will also find the tire size, load index and speed rating, and inflation pressure. It is important that you understand these tire markings.

Tire Size

Tire size on the sidewall of a tire is given in a letter-number sequence. There are two common size designations (Table 2-1)—alphanumeric (conventional measuring system) and P-metric (metric measuring system). The alphanumeric tire size rating system, as shown in Table 2-1, uses letters and numbers to denote tire size in inches and load-carrying capacity in pounds. The letter G indicates the load and size relationship. Higher the letter, the larger the size and load-carrying capability of the tire. The letter R designates the radial design of the tire. The first number "78" is the aspect ratio, also known as height-to-width ratio. The last number "15" is the rim diameter in inches. The P-metric tire size identification system, as shown in Table 2-1, uses metric values and international standards. The letter P indicates a passenger vehicle (T means temporary and C means commercial). The first number "155" indicates the section width in millimeters measured from sidewall to sidewall. The second number "80" is the aspect ratio, also known as height-to-width ratio. The letter R indicates radial (B means bias belted, D means bias-ply construction).

Table 2-1 — Tire Size Designation Numbering System

Alpha-Numeric Tire Size (GR 78-15)				
G	R	78	15	
Load/Size Relationship	Radial Design	Height-to-Width Ratio	Rim or Wheel Diameter in Inches	
P-Metric Tire Size (P 155/80 R13)				
P	155	80	R	13
Type Tire (P=Passenger) (T=Temporary) (C=Commercial) (LT= Light Truck)	Section Width in Millimeters (155, 185, 195)	Height-to-Width Ratio in Percentage (70, 75, 80)	Tire Construction (R=Radial) (B=Bias Belted) (D=Diag. Bias)	Rim or Wheel Diameter in Inches

Maximum Inflation Pressure

The maximum inflation pressure, printed on the sidewall of a tire, is the highest air pressure that should be induced into the tire. The tire pressure is a “cold” pressure and should be checked in the morning before operating the vehicle.

In most parts of the world, fall and early winter months are the most critical times to check inflation pressures because the days are getting colder. And since air is a gas, it contracts when cooled. For every 10°F change in ambient temperature, the inflation pressure of a tire will change by 1 psi. It will go down with lower temperatures and up with higher temperatures. The typical difference between summer and winter temperatures is about 50°F, which results in a loss of 5 psi and will sacrifice handling, traction, durability, and safety.

Tire Grades

The Department of Transportation requires each manufacturer to grade its tires under the UTQG labeling system and establishes ratings for tread wear, traction, and temperature resistance (Figure 2-3). These tests are conducted independently by each

manufacturer following government guidelines to assign values that represent a comparison between the tested tire and a control tire. While traction and temperature resistance ratings are specific performance levels, the tread wear ratings are assigned by the manufacturers following field-testing

Figure2- 3 — Uniform tire quality grade system ratings on the sidewall of the tire

Tread wear receives a comparative rating based on wear rate of the tire in field-testing following a government-specified course. Tread wear is given as a number: 100, 120, or 130, for instance. The higher the number, the more resistant the tire is to wear. For example, a tire grade of 150 wears 1.5 times longer than a tire graded 100. Actual performance of the tire will vary significantly depending on conditions, driving habits, care, road characteristics, and climate.

Straight-a-head wet braking traction has been represented by a grade of A, B, or C with A being the highest. In 1997 a new top rating of "AA" was introduced to indicate even greater wet braking traction. Traction grades do NOT indicate wet cornering ability.

Temperature resistance is indicated by grades A, B. or C. This represents the resistance of the tire to heat generated by running at high speed. Grade C is the minimum level of performance for all passenger vehicle tires as set under Federal Motor Vehicle Safety Standards. This grade is established for a tire that is properly inflated and not overloaded.

Wheels

Wheels must have enough strength to carry the weight of the vehicle and withstand a wide range of speed and road conditions. Automobiles and light trucks are equipped with a single piece wheel. Larger vehicles have a lock ring (side ring) that allows for the easy removal of the tire from the wheel and, when in place, it provides a seat for one side of the inflated tire. See figure 2-4.

Figure2- 4 Vehicle wheels

A standard wheel consists of the RIM (outer lip that contacts the bead) and the SPIDER (center section that bolts to the vehicle hub). Normally the spider is welded to the rim. Common wheel designs are as follows:

a) Drop center
b) Semi-drop center
c) Safety Split

a) Drop Center Wheel

The drop center wheel is made in one piece and is commonly used on passenger vehicles because it allows for easier installation and removal of the tire (Figure 2-5). Bead seats are tapered to match a corresponding taper on the beads of the tire.

Figure2- 5 — Drop centre wheel

b) Semi-drop Center Wheel

The semi-drop center wheel has a shallow well, tapered-head seat to fit the taper of the beads of the tire (Figure 2-6). It also has a demountable flange or side ring which fits into a gutter on the outside of the rim, holding the tire in place.

Figure2- 6 — Semi-drop centre and a split wheel

c) Safety Wheel

A safety wheel is similar to the drop center wheel (Figure 2-7). The major difference is that the safety wheel has a slight hump at the edge of the bead ledge that holds the bead in place when the tire goes flat.

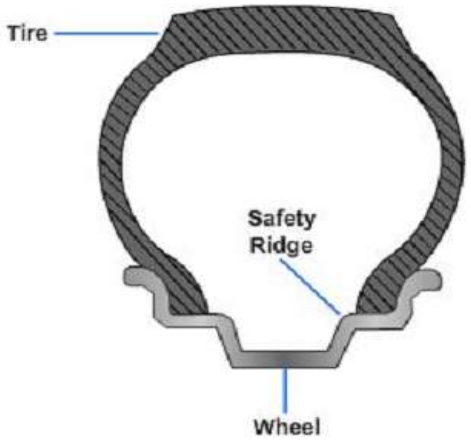


Figure2- 7— Safety wheel

Split Wheel (2 Piece Wheel)

A split wheel (rim) has a removable bead seat on one side of the rim (Figure 2-6). The seat is split to allow for its removal so tires can be easily changed. Some bead seats also require the use of a lock ring to retain the seat. These wheels are used on large commercial and military vehicles.

Lug Nuts, Studs, and Bolts

Lug nuts hold the wheel and tire assembly on the vehicle. They fasten onto special studs. The inner face of the lug nut is tapered to help center the wheel on the hub.

Lug studs are special studs that accept the lug nuts. The studs are pressed through the back of the hub or axle flange. A few vehicles use lug bolts instead of nuts. The bolts screw into threaded holes in the hub or axle flange.

Normally, the lug nuts and studs have right- hand threads (turn clockwise to tighten). When left-hand threads are used, the nut or stud will be marker with an "L." Metric threads will be identified with the letter M or the word Metric.

Wheel Bearings

To check the adjustment of the wheel bearings, raise the front of the vehicle. Grasp each front tire at the front and rear and push the wheel inward and outward. If any free play is noticed between the hub, rotor, and front spindle, adjust the wheel bearings.
Wheel bearings should be disassembled and serviced any time the hubs have been submerged in water. During normal operation the bearings get warm and when they are quickly cooled off by the splash of water, their lubricant breaks down and the bearings can be destroyed. Always replace the bearings if they are worn or damaged.
Another frequent cause of wheel bearing failure is the use of oversized tires mounted on wheels with substantial offset. These switch the load from the large inner bearing to the small outer wheel bearing, which was never intended to do much more than stabilize the wheel.

Wheel Bearing and Hub Assembly

Wheel bearings allow the wheel and tire assembly to turn freely around the spindle, in the steering knuckle, or in the bearing support. Wheel bearings are lubricated with heavy, high-temperature grease. This allows the bearing to operate with very little friction and wear.

The two basic wheel-bearing configurations are tapered roller or ball bearing types. The basic parts of a wheel bearing are as follows:

- **Outer race** (cup or cone pressed into the hub, steering knuckle, or bearing support).
- **Balls or rollers** (anti-friction elements that fit between the inner and outer races).
- **Inner race** (cup or cone that rests on the spindle or drive axle shaft).

There are two types of wheel bearing and hub assemblies: non-driving and driving. For example, the front wheels on a rear-wheel drive vehicle are non-driving.

Non-driving Wheel Assembly

The components of a non-driving wheel bearing and hub assembly (Figure 2-8) include the following:

- Spindle (a stationary shaft extending outward from the steering knuckle or suspension system to which the following components are attached).
- Wheel bearings (normally tapered roller bearings mounted on the spindle and in the wheel hub).
- Hub (outer housing that holds the brake disc, or drum, wheel, grease, and wheel bearing).
- Grease wheel (a seal that prevents loss of lubricant from the inner end of the spindle and hub).
- Safety washer (a flat washer that keeps the outer wheel bearing from rubbing on and possibly turning the adjusting nut).
- Spindle adjusting nut (a nut threaded on the end of the spindle for adjusting the wheel bearing).
- Nut locks (a thin, slotted nut that fits over the main spindle nut).
- Dust cap (a metal cap that fits over the outer end of the hub to keep grease in and dirt out of the bearings).

Since a non-driving wheel bearing and hub assembly does NOT transfer driving power, the spindle is stationary. The spindle simply extends outward and provides a mounting surface for the wheel bearings, hub, and wheel. With the vehicle moving, the wheel and hub spin on the wheel bearings and spindle. The hub simply freewheels.

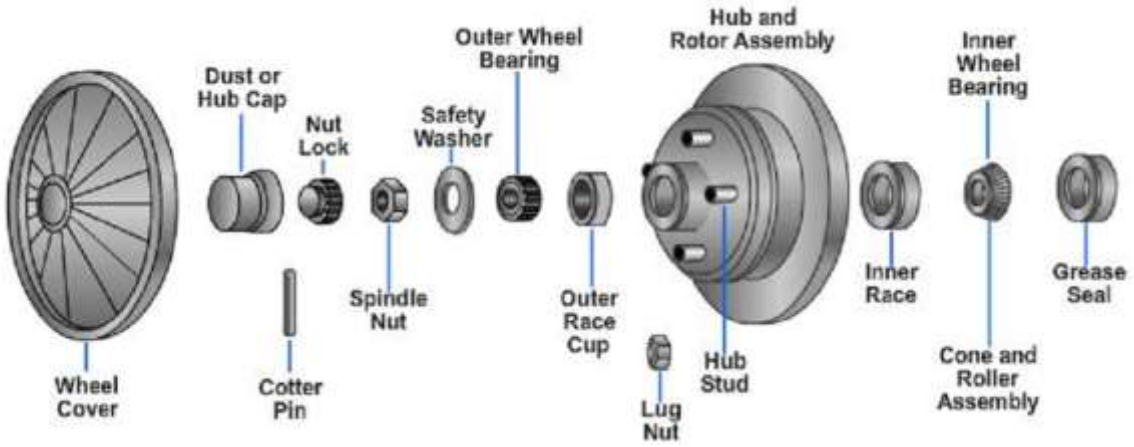


Figure2- 8 — View of a non-driving wheel bearing and hub assembly.

Driving Wheel Assembly

The components of a driving wheel bearing and hub assembly (Figure 2-9) includes the following:

- Outer drive axle (a stub axle shaft that extends through the wheel bearings and is splined to the hub).
- Wheel bearings (either ball or roller type bearings that allow the drive axle to turn in the steering knuckle or bearing support).
- Steering knuckle or bearing support (a suspension or steering component that holds the wheel bearings, axle stub, and hub).
- Drive hub (a mounting place for the wheel which transfers driving power from the stub axle to the wheel).
- Axle washer (a special washer that fits between the hub and locknut).
- Hub or axle locknut (a special nut that screws onto the end of the drive axle stub shaft to secure the hub and other parts of the assembly).
- Grease seal (prevents lubricant loss between the inside of the axle and the steering knuckle and bearing support).

The driving wheel bearing and hub assembly has bearings mounted in a stationary steering knuckle or bearing support. The drive axle fits through the center of the Bearings. The hub is splined to the axle shaft. Instead of a stationary spindle, the axle Shaft spins inside the stationary support. With the hub splined to the axle shaft, power is transferred to the wheels.

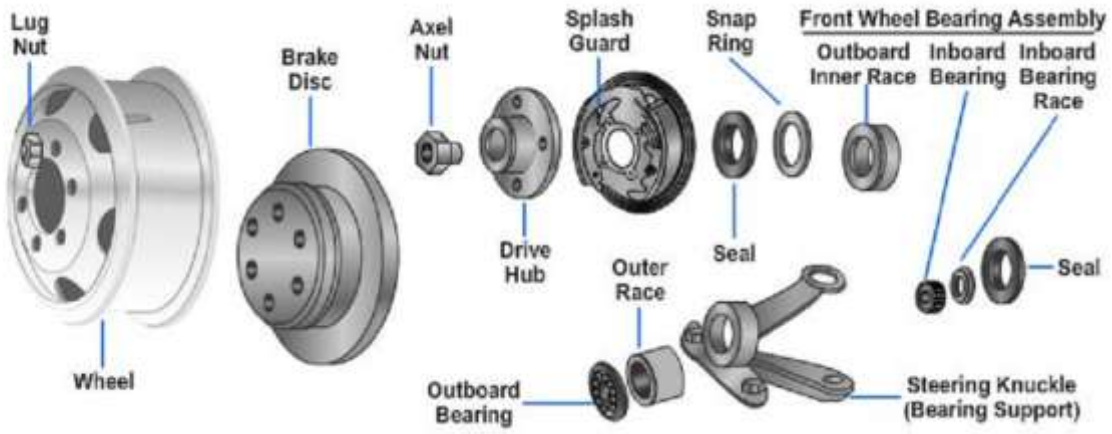


Figure2- 9 — View of a driving wheel bearing and hub assembly.

Bearing Lubrication - Grease

Grease should be replaced every 12,000 miles or 12 months. Prior to repacking bearings, all old grease should be removed from the wheel hub cavity and bearings. Bearings should be packed by machine if possible. If a machine is unavailable, packing by hand method is acceptable. The method to pack bearing cones is as follows:

1. Place a quantity of grease onto the palm of your hand.
2. Press a section of the widest end of bearing into the outer edge of the grease pile closest to the thumb forcing grease into the interior of the bearing between two adjacent rollers.
3. Repeat this while rotating the bearing from roller to roller.
4. Continue this process until you have the entire bearing completely filled with grease.
5. Before reinstalling, apply a light coat of grease onto the bearing cup mating surface.

Self-Check -1	Written Test

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

Sort answer

1. Write two point about the importance of wheel and tires
2. Write the two basic functions Tires perform.
3. List out the six major parts of a tire
4. What are the types of tires model vehicles explain them
5. What are the types of wheel

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

Answer Sheet

Score = _____

Rating: _____

Name _____ **ID NO**_ _____

Operation Sheet 1	Remove wheel & hub assembly

Tools and Materials:

- Hydraulic jack
- Block
- Stand
- Lugnut (cross wrench)

Steps and Procedures:

1. **Park your vehicle on a flat surface.** As with most types of auto maintenance, you'll want to take all necessary precautions when changing your vehicle's wheel bearings to ensure your safety. The worst thing that can happen when changing your wheel bearings is for your vehicle to suddenly shift or roll away. Before you begin, park your vehicle on a level surface. Put the vehicle in park (or, for manuals, 1st, reverse, or neutral) and be sure to put the parking brake up. See figure 2-10

- **Note:** Every vehicle is different. The instructions below are intended as a general set of guidelines and thus will not perfectly fit every vehicle. If you run into problems while attempting to change your wheel bearing or have doubts after you finish, it's very wise to enlist the help of a professional mechanic. Doing so can save time, prevent future headaches, and save money in the long run.

Figure2- 10 Park the vehicle on a flat surface

2. Use wheel chocks to secure wheels whose bearings you *aren't* replacing.

For added stability, it can be smart to use sturdy chocks to hold your vehicle's wheels in place. Obviously, you'll want to use chocks on the wheels you don't plan on modifying, as the wheels you *do* modify will be elevated off the ground. For example, you would place wheel chocks behind the rear tires if you are fixing a front wheel bearing and behind the front tires if you are working on a rear wheel. See figure 2-11.

Figure2- 11 Use wheel chocks to secure wheels

3 **Loosen the lug nuts and lift the wheel using a jack.** For proper access to the internal components of the wheel whose bearings you're replacing, you'll need to elevate the wheel. Luckily, most vehicles come with a jack for just this purpose. Before you lift the wheel, however, you may want to slightly loosen the lug nuts with a tire iron, as breaking their initial resistance is harder without the ground holding the wheel steady.(see figure 2-12) After this, carefully lift your wheel. If your vehicle doesn't come with a jack, you may need to buy a suitable jack at an auto supply store.

To prevent dangerous slippage, make sure that the vehicle is securely seated on the jack and that the jack is flush with the ground before attempting to lift the wheel. It's also important to make sure the jack touches the vehicle on a sturdy, metal piece of the undercarriage, rather than on fragile plastic molding, as the weight of the vehicle can damage the latter.

Most vehicles have jack points where the frame has extra support to lift the vehicle. It's best to check the owner’s manual to learn the best place to position your jack.

It is also extremely wise to use a safety jack stand for added support in the event the floor or scissor jack fails.

Figure2- 12 Loosen the lug nuts

4 Unscrew the lug nuts and remove the wheel. The lug nuts, which you should have already loosened, should come off easily. Remove these and put them in a safe place where you won't lose them. Next, remove the wheel itself. It should come freely. See figure 2-13.

- Some like to keep track of the lugnuts by removing the hubcap, turning it over, and using it as a sort of "plate" to contain them.

Figure2- 13 Unscrew the lug nuts and remove the wheel

5 Remove the brake caliper. Using a socket and a ratchet, remove the caliper's bolts. Then, remove the caliper itself using a screwdriver.

- When removing the caliper, be careful not to let it dangle freely, as this can damage the brake hose. Instead, hook it on a secure part of the undercarriage or use a short length of string to tie it in place. A bungee cord or bent wire hangers are two additional ways to secure the caliper. See figure 2-14.

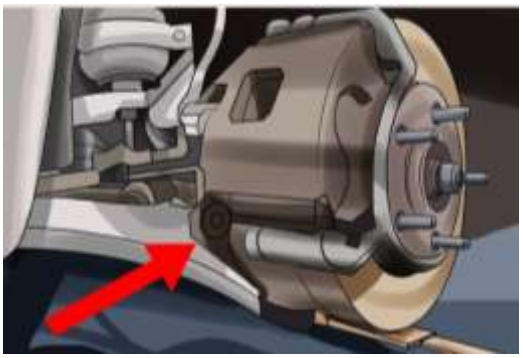


Figure2- 14 Remove the brake caliper

6 Remove the dust cover, cotter pin, and castle nut. (See figure 2-15.)In the center of the vehicle's exposed rotor should be a small metal or plastic cap called the dust cover which protects the components holding the rotor in place. Since you'll need to remove the rotor, the cap and the components it protects will have to go. Usually, the dust cover can be removed by gripping it with calipers and tapping the calipers with a hammer. Inside, you'll find the castle nut, usually secured with a cotter pin. Remove the cotter pin with pliers or wire cutters, then unscrew the castle nut and remove it (and its

washer). Be sure to keep these small but important parts somewhere that they won't be lost!

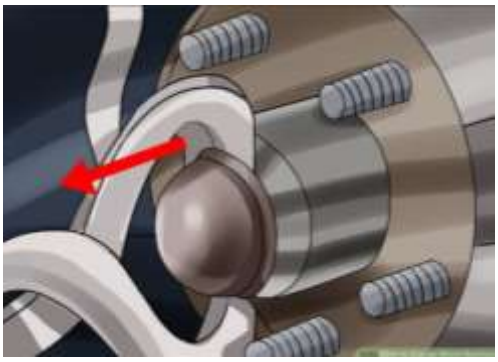


Figure2- 15 Remove the dust cover, cotter pin, and castle nut

7 Remove the rotor. Place your thumb securely on the peg in the middle of the rotor assembly. Firmly (but somewhat gently) bump the rotor itself with the palm of your other hand. The wheel's outer bearing should loosen or fall out. Remove the outer bearing. Finally, remove the rotor itself. See figure 2-16.

- If the rotor gets stuck, you can use a rubber mallet to hit it loose. This can, however, damage the rotor, so it's best to use a mallet only if you are not planning on reusing the same rotor.

Figure2- 16 Remove the rotor.

8 Unscrew the hub bolts and remove the old hub. The wheel bearing is inside the hub, which is usually held in place with several bolts that screw in from behind. These bolts can be tricky to reach because they're tucked away in the undercarriage, so you may want to use a skinny socket wrench and/or a breaker bar to loosen and remove them. When you've removed the bolts, take the hub off of the axle. See figure 2-17.

- **Note** that if you've purchased a new hub assembly, at this point, you can install the new hub and put the wheel back together and you'll be finished. To install a new set of bearings inside the hub, read on.

Figure2- 17 Unscrew the hub bolts and remove the old hub

9 Disassemble the hub assembly. To gain access to the bearings, you'll need to take apart the hub. You'll probably need to use a wrench (and/or a hammer) to remove the end of the hub and any anti-lock brake wheel that may be part of your hub. Then, you may need to use a specialized "puller" tool to remove the central bolt. The bearing assembly should come apart easily. See figure 2-18.

Figure2- 18 Disassemble the hub assembly

10. Remove races and clean the knuckle. Removing the bearing assembly's races usually means physically breaking them with a grinder or hammer and chisel. Because of this, you'll want to have replacement races ready. After removing the races, it's a good idea to clean the inside of the bearing assembly around the knuckle. See figure 2-19.

- There's usually lots of grease and grime here, so have plenty of rags handy.

Figure2- 19 Remove races and cleans the knuckle

LAP Test 1	Practical Demonstration

Name: _____ Date: _____
Time started: _____ Time finished: _____
Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1:00 hour.

Task1. Remove wheel & hub assembly

Operation Sheet 2	Wheel bearing replacement

Wheel Bearing Replacement

Tools and equipment:

- Hydraulic jack
- Block
- Stand
- Lugnut (cross wrench)
- Mechanical Grease Packer,
- Dial Indicator

Description

Proper removal and installation helps avoid premature damage to the bearing and surrounding components. Below are the steps for replacing tapered single-row wheel bearings in passenger cars and light trucks.

Steps and Procedures:

1. Wheel End Disassembly

Follow the vehicle manufacturer's recommended procedure to remove the tire and wheel assembly, disk brake caliper, dust cap, cotter pin, adjusting nut and washers. Pull the rotor/hub assembly toward you to loosen the outer bearing cone assembly. Remove the outer bearing cone assembly. Pull the rotor/hub assembly off the spindle – the inner bearing cone assembly, inner cup, outer cup and seal will come with it. Use a seal puller to remove the seal, and then remove the inner bearing cone assembly from the rotor/hub. Discard the seal after removal. Use a cup driver or mild steel bar to remove the inner cup and the outer cup from the hub assembly. See figure 2-20.

Figure2- 20 Wheel end disassembly

2. Clean and Inspect Hubs and Spindles

Remove all old lubricant from the rotor/ hub assembly and spindle. Clean the rotor/hub assembly and spindle with kerosene or mineral spirits. Inspect the spindle for wear. Use a fine file, wire brush, emery cloth or honing stone to remove any debris, nicks or burrs. Follow the vehicle manufacturer's recommendation for permissible spindle wear. Apply a light grease coating on the cone seats to ease installation and prevent fretting. See figure 2-21.

Figure2- 21 Clean and Inspect Hubs and Spindles

3. Install cups

Use a cup driver or mild steel bar to drive the new inner cup and outer cup into the hub/rotor assembly until solidly seated against the hub shoulders. Be careful not to damage the cup surfaces. Never use a bearing cone assembly to drive a cup. See figure 2-22.

Figure2- 22 Install cups

4. Lubricate

Use a mechanical grease packer to pack the inner bearing cone assembly with grease. Place the bearing cone assembly, small end down, into the grease packer funnel. Plug the bore of the large end of the bearing cone assembly with the conical retainer. Firmly press down on the conical retainer. This forces the grease between the rollers, cage and cone. Smear excess grease on the outside of the bearing cone assembly. Pack grease between the inner and outer cups in the hub cavity. Also, liberally coat the hub cap inner wall. This layer combats moisture and retains the grease in the inner and outer bearing cone assemblies. See figure 2-23.

Figure2- 23 bearing Lubricate

5. Install Grease Seal

Replace the grease seal when it leaks or when bearings are being repacked or replaced. Install the inner bearing cone assembly in the hub, and then install the new seal. Make sure the seal lips are pointed in the right direction following the vehicle manufacturer's specification. Use the proper seal installation tool. See figure 2-24.

Figure2- 24 Install Grease Seal

6. Install Rotor/Hub Assembly

Be careful not to damage the seal against the spindle when sliding the rotor/hub assembly back over the spindle. After following Step 4, pack the outer bearing cone assembly with grease. Install the outer bearing cone assembly, washer and adjusting nut on the spindle. See figure 2-25.

Figure2- 25 Install Grease Seal

7. Bearing Adjustment

Use a torque wrench to tighten the adjusting nut to 50 ft. lbs. while turning the rotor. Back off the adjusting nut 1 full turn. Re-torque the nut to 10 ft. lbs. while turning the rotor. Next, back off the adjusting nut ¼ turn. Lock the nut with a new cotter pin. See figure 2-25.

Figure2- 26 Bearing adjustment

8. Check Bearing Adjustment

Use a dial indicator to measure endplay. Mount the indicator base as close to the center of the hub/rotor as possible. With the indicator tip against the end of the spindle, set the indicator at zero. Grasp the rotor at three o'clock and nine o'clock. Push the rotor in while oscillating and read the dial indicator. Pull the rotor out while oscillating and read the dial indicator again. The bearing end-play is equal to the total indicator movement, which should be between 0.001" and 0.005." If not, repeat steps 7 and 8. Reinstall all components as the vehicle manufacturer recommends. See figure 2-27.

Figure2- 27 Check Bearing Adjustment

LAP Test 2	Practical Demonstration

Name: _____ Date: _____
Time started: _____ Time finished: _____
Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1:30 hour.

Task1. Wheel bearing replacement

Information Sheet-2	Report inspection findings

Report inspection findings

Perform the following procedure for each wheel end on the trailer.

1. Wear safe eye protection.
2. Park the trailer on a level surface. Use a jack to raise the trailer until all the trailer tires are off the ground. Place safety stands under the trailer frame or axles. Do not use a jack to support the trailer.
3. Rotate the wheel assembly to check for signs of unusual resistance or roughness from the bearing. Listen for a low-pitched grinding sound as you rotate the assembly. Use care to determine whether sounds heard are coming from the bearing and not from the brake components or dust cover. If unusual resistance or noise is detected: Replace the hub. Refer to Replace the Hub for correct procedures.
4. Grasp the tire and wheel-end assembly at the 12 and six o'clock positions. Check for vertical and horizontal movement. With your hands, apply approximately 50 lb (23 kg) of force to the assembly. You should not feel or see any looseness or movement. Figure 2-28. If you feel or see movement at the tire circumference: Proceed to the Detailed Hub Inspection procedure. If no movement is detected: Proceed to the Quick Clamp Load and Inspection procedure.

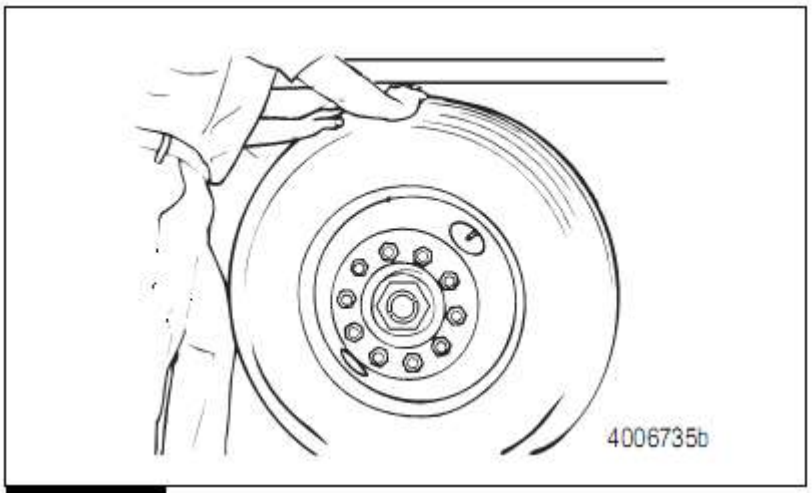


Figure2- 28 tire and wheel-end assembly

Troubleshooting

Tire problems usually show up as vibrations, abnormal wear patterns, abnormal noises, steering wheel pull, and other similar symptoms. In some cases, you may need to

operate the vehicle to verify the problem. Make sure that symptoms are NOT being caused by steering, suspension, or front-wheel alignment problems.

When inspecting tires, you should look closely at the outer sidewall; tread area, and inner sidewall for bulges, splits, cracks, chunking, cupping, and other abnormal wear or damage. If problems are found before repairing or replacing the tire, determine what caused the failure.

a. Tire Impact Damage

Tire impact damage or road damage includes tears, punctures, cuts, and other physical injuries. Depending upon the severity of the damage, the tire must either be repaired or replaced.

b. Tire Wear Patterns

Tire wear patterns can be studied to determine the cause of abnormal tread wear. By inspecting the tread wear, you can determine what parts should be serviced, repaired, or replaced. Common tread wear patterns are as follows (Figure 2-29):

i. Feathering is caused by erratic scrubbing against the surface of the road when the tire is in need of toe-in or toe-out alignment correction (Figure 2-29, View A).

ii. Over inflation causes fast center line wear in bias and bias belted tires (Figure 2-29, View B). In this case, the center of the tread has more contact with the road and wears faster than the outer area of the tread.

iii. Under inflation causes the outer tread areas (shoulders) of the tire to have more contact with the road; therefore, they wear faster than the center area of the tread (Figure 2-29, View C).

iv. One-side wear is caused by excessive camber, which means that the tire is leaning too much to the inside or outside (Figure 2-29, View D). This places all the work on one side of the tire, resulting in excessive wear.

v. Cupping is caused by several problems, such as imbalanced wheels, faulty shock absorbers, faulty ball joints, or a combination of these troubles (Figure 2-29, View E).

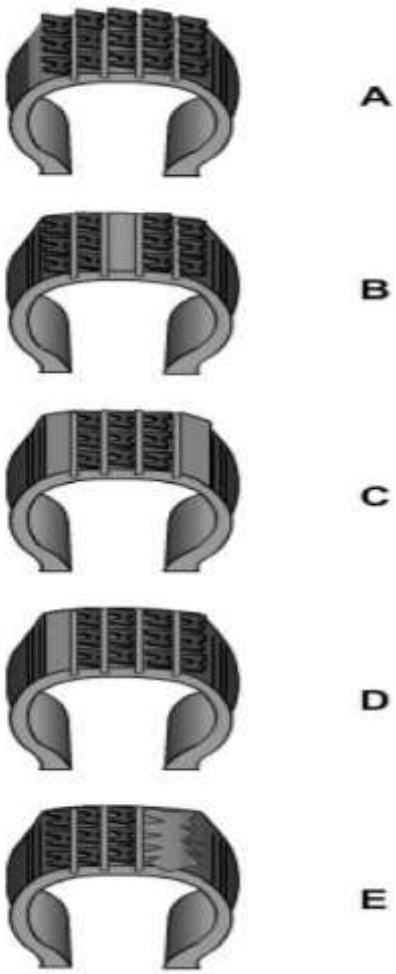


Figure2- 29 Tire Wear Patterns

c.Tire Inflation Problems

The correct tire inflation pressure is important to the service life of the tire. Proper inflation is required to ensure that the tread of the tire fully contacts the

road surface. This condition allows for even wear Figure 2-29.Tire wears patterns. Across the tread, therefore resulting in increased tire life and improved handling and safety. Tire over inflation causes the center area of the tread to wear quickly. The high pressure causes the body of the tire to stretch outward, pushing the center of the tread against the road surface. This action lifts the outer edges of the tread off the road. An overinflated tire produces a rough or hard ride. It is also more prone to impact damage.

Tire under inflation is a very common and destructive problem. This condition wears the outer edges of the tread (shoulders) because low pressure allows the sidewalls of the tire to flex, which builds up heat during operation.

The center of the tread flexes upward and does not touch the surface of the road. Under inflation will cause rapid tread wear, loss of fuel economy, and possibly ply separation (plies tear away from each other).

Uneven tire inflation pressure can cause steering wheel pull. For example, when a vehicle that has the left front tire underinflated and the right front tire properly inflated, the vehicle has a tendency to pull to the left. The low air pressure in the left tire has more rolling resistance. This action tends to pull the steering wheel away from the normally inflated tire.

d. Tire Vibration Problems

When one of the front tires is vibrating, it can be felt in the steering wheel. When one of the rear tires is vibrating, the vibration can be felt in the center and rear of the vehicle.

Tire vibration can be attributed to several problems, such as out-of-balance condition, ply separation, tire run out, a bent wheel, or tie cupping.

e. Tire and Wheel-Bearing Noise

Tire noise usually shows up as a whine due to abnormal tread wear or a thumping sound caused by ply separation. Tire replacement is required to correct these problems.

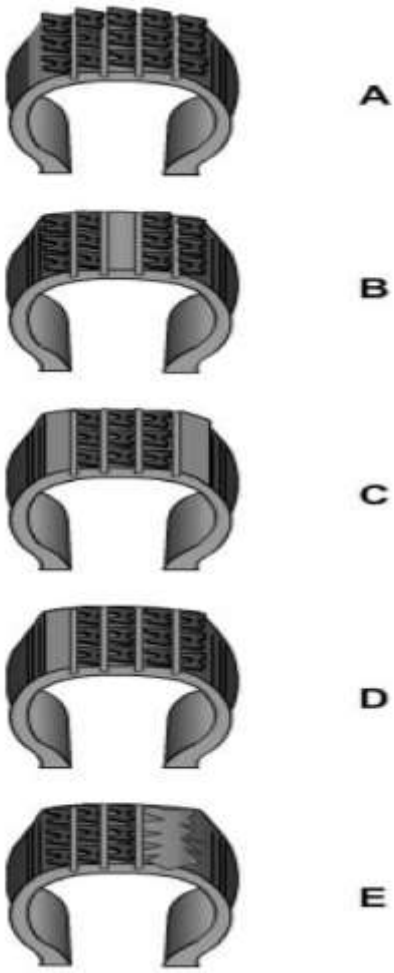
Wheel-bearing noise is produced by dry, worn wheel bearings. The bearing will make a steady humming type sound. This is due to the rollers or balls being damaged from lack of lubrication and being no longer smooth. To check for a worn wheel bearing, raise and secure the vehicle, and rotate the tire by hand. Feel and listen carefully for bearing roughness. Also, wiggle the tire back and forth to check for bearing looseness. It may be necessary to disassemble the wheel bearing to verify the problem.

Self-Check -2	Written Test

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

Sort answer

1. Write Perform procedure for each wheel end on the trailer
2. Detail Explain Common tread wear patterns from the below Figure :



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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

List of Reference Materials

1- Crawfords Guide to Beginners Auto Maintenance & Repair (www.CrawfordsAutoService.com)

2- Using a Fire Extinguisher From OSHA Webpage: (http://www.osha.gov/SLTC/etools/evacuation/portable_use.html#Using)

3- ↑ https://www.safework.nsw.gov.au/safety-alerts/safety-alerts/uncontrolled-movement-of-vehicles

4- ↑ https://checkers-safety.com/chocking-procedures/

5- ↑ https://www.2carpros.com/articles/wheel-removal-and-re-installation

6- ↑ https://www.2carpros.com/articles/wheel-removal-and-re-installation

7- ↑ http://cf.linnbenton.edu/eit/app/mackd/web.cfm?pgID=7739

8- ↑ http://www.safebraking.com/top-ten-brake-job-mistakes-pads-rotors-calipers/

9- ↑ http://www.boatus.com/magazine/trailering/2013/october/repacking-or-replacing-your-trailer-tire-bearings.asp

10-↑ https://www.2carpros.com/articles/how-to-replace-front-wheel-bearings-and-seals

11-↑ http://knowhow.napaonline.com/dirty-jobs-pack-wheel-bearing/