

# Automotive Technology 6<sup>th</sup> Edition

## Chapter 102 WHEEL BEARINGS & SERVICE

### Opening Your Class

KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	This Automotive Technology 6th text provides complete coverage of automotive components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and ASEEducation (NATEF) and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Case Studies, Videos, Animations, and ASEEducation (NATEF) Task Sheets.
<b>Motivate Learners</b>	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
<b>State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.</b>	<p>Explain learning objectives to students as listed below:</p> <ol style="list-style-type: none"> <li>1. Describe the types of antifriction bearings, bearing greases, and seals.</li> <li>2. Explain the diagnosis of defective wheel bearings.</li> <li>3. Describe wheel bearing service and sealed bearing replacement.</li> <li>4. Discuss rear drive axle classifications.</li> <li>5. Describe rear axle bearing and seal replacement.</li> <li>6. State the reasons for bearing failure.</li> <li>7. This chapter will help prepare for Suspension and Steering (A4) ASE certification test content area "C" (Related Suspension and Steering Service).</li> </ol>
<b>Establish the Mood or Climate</b>	Provide a <b>WELCOME</b> , Avoid put downs and bad jokes.
<b>Complete Essentials</b>	Restrooms, breaks, registration, tests, etc.
<b>Clarify and Establish Knowledge Base</b>	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

**NOTE: Lesson plan is based on 6<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**DOWNLOAD Chapter 102 Chapter Images: From [http://www.jameshalderman.com/automotive\\_principles.html](http://www.jameshalderman.com/automotive_principles.html)**

**NOTE: You can use Chapter Images or possibly Power Point files:**

## ICONS



**DEMO**

## Chapter 102 Wheel Bearings

### 1. SLIDE 1 CH102 Wheel Bearings

Check for **ADDITIONAL VIDEOS & ANIMATIONS**  
@ <http://www.jameshalderman.com/>  
**WEB SITE IS CONSTANTLY UPDATED**

[http://www.jameshalderman.com/automotive\\_principles.html](http://www.jameshalderman.com/automotive_principles.html)  
**DOWNLOAD**

**Crossword Puzzle (Microsoft Word) (PDF)**  
**Word Search Puzzle (Microsoft Word) (PDF)**

### Videos

### DISCUSS FREQUENTLY ASKED QUESTION:

2. **SLIDE 2 EXPLAIN Figure 102-1** Rolling contact bearings include (left to right) ball, roller, needle, and tapered roller.
3. **SLIDE 3 EXPLAIN Figure 102-2** Ball bearing point contact
4. **SLIDE 4 EXPLAIN Figure 102-3** Radial load is the vehicle weight pressing on the wheels.
5. **SLIDE 5 EXPLAIN Figure 102-4** Roller bearing line contact.
6. **SLIDE 6 EXPLAIN Figure 102-5** A tapered roller bearing will support a radial load and an axial load in only one direction.
7. **SLIDE 7 EXPLAIN Figure 102-6** Many tapered roller bearings use a plastic cage to retain the rollers.
8. **SLIDE 8 EXPLAIN Figure 102-7** Non-drive-wheel hub with inner and outer tapered roller bearings. By angling the inner and outer in opposite directions, axial (thrust) loads are supported in both directions.

**DEMONSTRATION: Show examples of ball bearings. What is their advantage over roller bearings, and where are ball bearings most often used on vehicles? Show students examples of**

## ICONS

## Chapter 102 Wheel Bearings



roller bearings. What is their advantage over ball bearings?

**DISCUSSION:** discuss role of antifriction bearings in reducing friction—allowing wheels to rotate while supporting the vehicle's weight. Have students name 4 types of antifriction bearings.

**DEMONSTRATION:** Show students examples of needle bearings. Where might needle bearings be used instead of roller bearings? Show students examples of tapered roller bearings. What about the design of these bearings makes them the most used automotive wheel bearing? Show students the placement of inner and outer wheel bearings. Why are the inner wheel bearings always larger?

**DISCUSSION:** Ask students to discuss difference between axial, or thrust, and radial loads and how tapered roller bearings accommodate both.

9. **SLIDE 9 EXPLAIN** Figure 102-8A Sealed bearing and hub assemblies are used on the front and rear wheels of many vehicles. A sealed wheel bearing that uses a double row of ball bearings. **8B** Sealed bearing and hub assemblies are used on the front and rear wheels of many vehicles. A sealed wheel bearing that uses two tapered roller bearings

10. **SLIDE 10 EXPLAIN** Figure 102-9 Sealed bearing and hub assemblies are serviced as a complete unit as shown. This assembly includes the wheel speed sensor.

### DISCUSS FREQUENTLY ASKED QUESTION:

#### What Do Different Grease Colors Mean?

**Nothing. According to grease manufacturers, grease is colored for identification, marketing, and for consistency of color reasons.**

- **Identification. color is often used to distinguish one type of grease from another within same company. Blue grease from one company may be totally different from blue grease produced or marketed by another company.**
- **Marketing. According to grease manufacturers, customers tend to be**

## ICONS

## Chapter 102 Wheel Bearings

attracted to a particular color of grease and associate that color with quality.

- **Consistency of color.** All greases are produced in batches, and color of finished product often varies from one batch to another. By adding color to grease, color can be made consistent. Always use the grease recommended for the service being performed.

**On non-drive tapered wheel bearings inner race must slide smoothly over the spindle.**



**DISCUSSION:** Ask students to discuss the National Lubricating Grease Institute (NLGI) grease penetration test. What is signified by low and high numbers? What do the quality ratings indicate? What types of grease would be used for the wheel bearings of cars students are working on? Grease is used on wheel bearings to reduce friction further. Ask students to discuss types of grease and the purpose of additives in them.

**SAFETY** *Smoking Can Kill You.* Some greases contain polymers such as Teflon® that turn to a deadly gas when burned. Always wash your hands thoroughly after handling grease that contains these ingredients before smoking. If some of grease is on cigarette paper and is burned, these polymers turn into nitrofluoric acid—a deadly toxin.

**EXPLAIN TECH TIP:** *Easy Wheel Bearing Looseness Test* Looseness in a front wheel bearing can allow the rotor to move whenever the front wheel hits a bump, forcing caliper piston in, which causes brake pedal to kick back and creates feeling that brakes are locking up. Loose wheel bearings are easily diagnosed by removing cover of master cylinder reservoir and *watching brake fluid as front wheels are turned left and right with steering wheel. If brake fluid moves while front wheels are being turned, caliper piston(s) are moving in and out,*

## ICONS

## Chapter 102 Wheel Bearings



**DEMO**



Education Foundation



**caused by loose wheel bearing(s).** If everything is OK, the brake fluid should not move. Loose wheel bearings can also cause brake pedal to sink due to movement of rotor, causing caliper piston to move. This sinking brake pedal is usually caused by a defective master cylinder. Before replacing a master cylinder, check wheel bearings.

11. SLIDE 11 **EXPLAIN** Figure 102-10 Typical lip seal with a garter spring.
12. SLIDE 12 **EXPLAIN** Figure 102-11 garter spring helps hold the sharp lip edge of the seal tight against the shaft.

**DEMONSTRATION:** Show students examples of a dynamic seal and the garter spring used to hold the lip of the seal in place

**DISCUSSION:** Ask students to talk about the purpose and function of seals, and discuss the difference between static and dynamic seals.

**DISCUSSION:** Ask students to discuss symptoms of defective bearings and how to diagnose the exact problem. Ask students to describe the sound of defective wheel bearings and discuss its cause. To determine location of a bearing noise drive vehicle along a high solid wall about six feet away with window open. Then drive by again going other way. The noise will echo off wall and help you to hear it.

**DISCUSSION:** Ask students to identify symptoms of a defective wheel bearing

**ON-VEHICLE ASE EDUCATION TASK:** Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action.

13. SLIDE 13 **EXPLAIN** Figure 102-12 Removing the grease cap with grease cap pliers.
14. SLIDE 14 **EXPLAIN** Figure 102-13 Using a seal puller to remove the grease seal.

## ICONS



## Chapter 102 Wheel Bearings

**DISCUSS CHART 102 -1 Wheel bearing inspection chart. Replace bearing if it has any of faults shown.**

**DEMONSTRATION: Show students how to remove an inner wheel bearing and grease seal. Show students how to use a wheel bearing race puller. Show students how to install a bearing race with a driver**

**DEMONSTRATION: Show students how to remove a wheel grease cap to access the outer wheel bearing. Show students how to do the wheel bearing looseness test. Ask them to describe some of problems that loose wheel bearings can cause.**

15. **SLIDE 15 EXPLAIN** Figure 102-14 Cleaning a wheel bearing with a parts brush and solvent.

**HANDS-ON TASK: Have students follow steps 1-21 to perform a non-drive wheel bearing inspection and replace and grease any defective bearings they find. Select a student to summarize the process and results for the class**

16. **SLIDE 16 EXPLAIN** Figure 102-15 A wheel bearing race puller.
17. **SLIDE 17 EXPLAIN** Figure 102-16 Installing a bearing race with a driver.
18. **SLIDE 18 EXPLAIN** Figure 102-17 Notice the new blue grease has been forced through the bearing.
19. **SLIDE 19 EXPLAIN** Figure 102-18 commonly used hand-operated bearing packer
20. **SLIDE 20 EXPLAIN** Figure 102-19 The wheel bearing is placed between two nylon cones and then a grease gun is used to inject grease into the center of the bearing.
21. **SLIDE 21 EXPLAIN** Figure 102-20 The wheel bearing adjustment procedure as specified for rear-wheel-drive vehicles. Always check service information for the exact specified procedure for the vehicle being serviced.
22. **SLIDE 22 EXPLAIN** Figure 102-21 A properly secured wheel bearing adjustment nut.

ICONS	Chapter 102 Wheel Bearings
	<p><b>HANDS-ON TASK:</b> Have students perform wheel bearing adjustment procedure for a rear-wheel drive vehicle by using a torque wrench. Have students repack a bearing with a bearing packer and with their hands</p>
	<p><b>ON-VEHICLE ASE EDUCATION TASK F1:</b> Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action.</p>
	
	<p><b>ON-VEHICLE ASE EDUCATION TASK F2:</b> Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings.</p>
	
	<p><b>ON-VEHICLE ASE EDUCATION NATEF TASK F8:</b> Inspect and replace wheel studs.</p>
	
	<p><b>ON-VEHICLE ASE EDUCATION TASK F6:</b> Replace wheel bearing and race.</p>
	
	<p><b>ON-VEHICLE ASE EDUCATION TASK F7:</b> Remove, reinstall, and/or replace sealed wheel bearing assembly.</p>
	
	<p>23. <b>SLIDE 23 EXPLAIN Figure 102-22</b> A rear wheel sealed bearing hub assembly.</p> <p>24. <b>SLIDE 24 EXPLAIN Figure 102-23</b> Removing the drive axle shaft hub nut. This nut is usually very tight and the drift (tapered) punch wedged into the cooling fins of the brake rotor keeps the hub from revolving when the nut is loosened. Never use an impact to remove or install a drive axle shaft hub nut because the hammering action can damage the bearing.</p>

## ICONS

## Chapter 102 Wheel Bearings



Education Foundation



25. **SLIDE 25 EXPLAIN Figure 102-24** A special puller makes the job of removing the hub bearing from the knuckle easy without damaging any component.

**ON-VEHICLE ASE EDUCATION TASK: Remove & install sealed wheel bearing assembly.**

26. **SLIDE 26 EXPLAIN Figure 102-25** A typical full-floating rear axle assembly.
27. **SLIDE 27 EXPLAIN FIGURE 102-26** three-quarter-floating rear axle.
28. **SLIDE 28 EXPLAIN Figure 102-27** semi-floating rear axle housing is the most commonly used in light rear-wheel-drive vehicles.
29. **SLIDE 29 EXPLAIN FIGURE 102-28** retainer plate-type rear axle bearing. Access to fasteners is through a hole in the axle flange.
30. **SLIDE 30 EXPLAIN Figure 102-29** SLIDE hammer-type axle puller can also be used.

**EXPLAIN TECH TIP: Brake Drum Slide Hammer Trick To remove axle from a vehicle equipped with a retainer plate-type rear axle, simply use brake drum as a slide hammer to remove axle from the axle housing. • SEE FIGURE 102-30. If brake drum does not provide enough force, a slide hammer can also be used to remove axle shaft.**

31. **SLIDE 31 EXPLAIN FIGURE 102-30** To remove axle from this vehicle equipped with a retainer-plate rear axle, the brake drum was placed back onto axle studs backward so that the drum itself can be used as a slide hammer to pull axle out of axle housing. A couple of pulls and the rear axle is pulled out of the axle housing.
32. **SLIDE 32 EXPLAIN FIGURE 102-31** To remove C-lock (clip), the lock bolt must be removed before pinion shaft is taken out.
33. **SLIDE 33 EXPLAIN FIGURE 102-32** axle must be pushed inward slightly to allow C-lock to be removed. After C-lock has been removed, axle can be easily pulled out of axle housing.
34. **SLIDE 34 EXPLAIN FIGURE 102-33** Using a hydraulic press to press an axle bearing from axle. When

## ICONS

## Chapter 102 Wheel Bearings



pressing a new bearing back onto axle, pressure should only be on inner bearing race to prevent damaging bearing.

**DISCUSSION:** Ask students to talk about **C-lock rear axles.** What type of bearing is used with this axle? How do you lubricate axle bearing? How do you remove this type of axle to service bearings?

**DEMONSTRATION:** Show drum slide hammer trick to remove an axle from a vehicle equipped with a retainer-plate rear axle. Show students how to safely remove lock bolt from carrier. Care must be taken to not break bolt in carrier.

**EXPLAIN TECH TIP:** *Touch the Spring When Checking for Bearing Noise* Wheel bearing noises are often hard to pin down because noise can be transmitted throughout the vehicle. Whenever diagnosing a possible defective wheel bearing, use one hand to grasp the spring while using the other hand to rotate the wheel. The roughness of a defective wheel bearing is detected by feeling vibration in coil spring. • SEE FIGURE 102-36.

35. SLIDE 35 **EXPLAIN** Figure 102-34 This is a normally worn bearing. If it does not have too much play, it can be reused.
36. SLIDE 36 **EXPLAIN** Figure 102-35 A bearing/hub assembly that shows the reluctor (tone wheel) teeth used by wheel speed sensor..
37. SLIDE 37 **EXPLAIN** Figure 102-36 To detect a possible defective wheel bearing, grasp the coil spring then rotate the rotor

**DISCUSS CASE STUDY:** *The Noisy Lexus*  
A customer complained that a noise was heard from the rear of Lexus RX350 SUV. During test drive, the service technician did notice a slight noise and thought it might be due to a tire. Driving over various types of road surfaces *did not change level or pitch (frequency) of noise indicating that noise was due to a bearing rather than a tire.* As a double check that a tire was not issue, the technician rotated tires

## ICONS

## Chapter 102 Wheel Bearings

placing front tires in the rear and rear tires on the front. Another test drive resulted in the same results. The technician then recommended that Right rear wheel bearing (bearing hub assembly) be replaced and customer agreed to estimate. When hub bearing was removed and checked for any roughness, the technician did not feel or hear any noise from the old bearing. However, once new bearing was replaced noise was gone during a test drive.

### Summary:

- **Complaint**—Customer complained of a noise from right rear of SUV.
- **Cause**—Defective wheel bearing.
- **Correction**—Replacing right rear bearing/hub assembly fixed the noise concern.

**EXPLAIN TECH TIP: *Double-check the Bearing Part Number*** Most wheel bearing/hub assemblies include tone wheel (reluctor ring), which is used by wheel speed sensor for use by electronic brake control unit for electronic stability control and antilock brake operation. The number of notches or teeth on the bearing hub can and do vary. If the incorrect bearing is installed, it can cause amber ABS warning lamp to come on and a wheel speed sensor diagnostic trouble code to be set. • **SEE FIGURE 102-37.**

37. SLIDE 37 **EXPLAIN FIGURE 102-37** A bearing/hub assembly that shows the reluctor (tone wheel) teeth used by the wheel speed sensor.

### **EXPLAIN TECH TIP: *“Bearing Overload”***

It is not uncommon for vehicles to be overloaded. This is particularly common with pickup trucks and vans. Whenever there is a heavy load, axle bearings must support the entire weight of vehicle, including



## ICONS

## Chapter 102 Wheel Bearings

its cargo. If a bump is hit while driving with a heavy load, balls of a ball bearing or the rollers of a roller bearing can make an indent in race of bearing. This dent or imprint is called brinelling, named after Johann A. Brinell, a Swedish engineer who developed a process of testing for surface hardness by pressing a hard ball with a standard force into a sample material to be tested. Once this imprint is made, the bearing will make noise whenever roller or ball rolls over indent. Continued use causes wear to occur on all of balls or rollers and eventual failure. While this may take months to fail, the cause of the bearing failure is often overloading of the vehicle. Avoid shock loads and overloading for safety and for longer vehicle life.

**38. SLIDES 38-47 EXPLAIN REAR AXLE BEARING REPLACEMENT**

