A5 BRAKES 6th Edition

Chapter 9 Wheel Bearings and Service

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Automotive Brakes.** It correlates material to task lists specified by ASE and NATEF.
Motivate Learners	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.
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.	Explain the chapter learning objectives to the students. 1. Discuss the need for brake bleeding. 2. Describe the manual bleeding procedure. 3. Discuss how to gravity bleed the hydraulic brake system. 4. Discuss how to pressure bleed the hydraulic brake system. 5. Describe how to flush the hydraulic system.
Establish the Mood or Climate	Provide a *WELCOME,* Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	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.

ICONS	Ch09 Wheel Bearings and Service
  	**1. SLIDE 1 WHEEL BEARINGS & SERVICE** **2. SLIDES 2-3 EXPLAIN OBJECTIVES** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **4. SLIDE 4 EXPLAIN Figure 9-1** Rolling contact bearings include (left to right) ball, roller, needle, and tapered roller. **5. SLIDE 5 EXPLAIN Figure 9-2** Ball bearing point contact **6. SLIDES 6-7 EXPLAIN** Antifriction Bearings **8. SLIDE 8 EXPLAIN FIGURE 9-3** Radial load is the vehicle weight pressing on wheels. The thrust load occurs as chassis components exert a side force during cornering. **9. SLIDE 9 EXPLAIN Figure 9-4** Roller bearing line contact. **10. SLIDE 10 EXPLAIN Figure 9-5** A tapered roller bearing will support a radial load and an axial load in only one direction. **11. SLIDE 11 EXPLAIN Figure 9-6** Many tapered roller bearings use a plastic cage to retain the rollers. **12. SLIDES 12-13 EXPLAIN Antifriction Bearings** **14. SLIDE 14 EXPLAIN Figure 9-7** 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, & WHERE ARE BALL BEARINGS MOST OFTEN USED ON VEHICLES? SHOW EXAMPLES OF ROLLER BEARINGS. WHAT IS THEIR ADVANTAGE OVER BALL BEARINGS?**
	**DISCUSSION: ASK STUDENTS TO DISCUSS THE ROLE OF ANTIFRICTION BEARINGS IN REDUCING FRICTION—ALLOWING WHEELS TO ROTATE WHILE SUPPORTING VEHICLE'S WEIGHT. HAVE STUDENTS NAME 4 TYPES OF ANTIFRICTION BEARINGS.**
	**DEMONSTRATION: SHOW EXAMPLES OF NEEDLE BEARINGS. WHERE MIGHT NEEDLE BEARINGS BE USED INSTEAD OF ROLLER BEARINGS? SHOW STUDENTS EXAMPLES OF TAPERED ROLLER**

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	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.**
	**15. SLIDES 15-18 EXPLAIN** Antifriction Bearings **19. SLIDE 19 EXPLAIN Figure 9-8** Sealed bearing and hub assemblies are used on the front and rear wheels of many vehicles. **20. SLIDE 20 EXPLAIN Figure 9-9** Sealed bearing and hub assemblies are serviced as a complete unit as shown. This assembly includes the wheel speed sensor.
	**ON NON-DRIVE TAPERED WHEEL BEARINGS INNER RACE MUST SLIDE SMOOTHLY OVER THE SPINDLE.**
	**21. SLIDES 21-23 EXPLAIN** Bearing Greases
	**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.**
	**24. SLIDES 24-25 EXPLAIN** Seals **26. SLIDE 26 EXPLAIN Figure 9-10** Typical lip seal with a garter spring & **EXPLAIN Figure 9-11** garter spring helps hold sharp lip edge of the seal tight against shaft.

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	**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.
	27. **SLIDES 27-29** EXPLAIN Bearing Diagnosis
	**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 NATEF TASK** DIAGNOSE WHEEL BEARING NOISES, WHEEL SHIMMY, AND VIBRATION CONCERNS; DETERMINE NECESSARY ACTION.
	30. **SLIDE 30** EXPLAIN **Figure 9-12** Removing the grease cap with grease cap pliers & EXPLAIN **Figure 9-13** Using a seal puller to remove the grease seal.
	**DEMONSTRATION:** SHOW HOW TO REMOVE INNER WHEEL BEARING & GREASE SEAL. SHOW HOW TO USE WHEEL BEARING RACE PULLER. SHOW HOW TO INSTALL BEARING RACE
	**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

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	THEM TO DESCRIBE SOME OF PROBLEMS THAT LOOSE WHEEL BEARINGS CAN CAUSE.
	31. **SLIDE 31** EXPLAIN **Figure 9-14** Cleaning a wheel bearing with a parts brush and solvent & EXPLAIN **Figure 9-15** A wheel bearing race puller.
	**HANDS-ON TASK: HAVE STUDENTS FOLLOW STEPS 1-21 ON PAGE 140 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**
	32. **SLIDE 32** EXPLAIN **Figure 9-16** Installing a bearing race with a driver & EXPLAIN **Figure 9-17** Notice the new blue grease has been forced through the bearing. 33. **SLIDE 33** EXPLAIN **Figure 9-18** commonly used hand-operated bearing packer &EXPLAIN **Figure 98-19** 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. 34. **SLIDE 34** EXPLAIN **Figure 9-20** wheel bearing adjustment procedure as specified for rear-wheel-drive vehicles. Always check service information for exact specified procedure for vehicle being serviced & EXPLAIN **Figure 9-21** properly secured wheel bearing adjustment nut.
	**HANDS-ON TASK: HAVE STUDENTS PERFORM WHEEL BEARING ADJUSTMENT PROCEDURE FOR REAR-WHEEL DRIVE VEHICLE BY USING A TORQUE WRENCH. HAVE STUDENTS REPACK A BEARING WITH BEARING PACKER AND WITH THEIR HANDS**
	**ON-VEHICLE NATEF TASK REMOVE, CLEAN, INSPECT, REPACK, AND INSTALL WHEEL BEARINGS.**
	**ON-VEHICLE NATEF TASK REPLACE WHEEL BEARING AND RACE.**

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	**ON-VEHICLE NATEF TASK INSPECT AND REPLACE WHEEL STUDS.**
	**35. SLIDES 35-36 EXPLAIN** Sealed Bearing Replacement **37. SLIDE 37 EXPLAIN Figure 9-22** A rear wheel sealed bearing hub assembly. **38. SLIDE 38 EXPLAIN Figure 9-23** 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. **39. SLIDE 39 EXPLAIN Figure 9-24** A special puller makes the job of removing the hub bearing from the knuckle easy without damaging any component.
	**ON-VEHICLE NATEF TASK REMOVE & INSTALL SEALED WHEEL BEARING ASSEMBLY.**
	**40. SLIDE 40 EXPLAIN Figure 9-25** A typical full-floating rear axle assembly. **41. SLIDE 41 EXPLAIN Figure 9-26** semi-floating rear axle housing is the most commonly used in light rear-wheel-drive vehicles & **EXPLAIN Figure 9-27** A retainer plate-type rear axle bearing. Access to the fasteners is through a hole in the axle flange.
	**VIDEO: 1 MINUTE: REAR AXLE SEALS WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=REAR%20AXLE%20SEALS&CLIP=PANDC/CHET/2012/AUTOMOTIVE/A5-B2.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/XML/A5-B2.ADB.XML
	**42. SLIDES 42-44 EXPLAIN** Rear Axle Bearing and Seal Replacement **45. SLIDE 45 EXPLAIN Figure 9-28** slide hammer-type axle puller can also be used.
	**47. SLIDE 47 EXPLAIN Figure 9-30** To remove the axle from this vehicle equipped with a retainer-plate rear axle, the brake drum was placed back onto the axle studs backward so that the drum itself can be used as a slide hammer to pull the axle out of the axle housing. A couple

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  	of pulls and the rear axle is pulled out of the axle housing **48. SLIDES 48-49** EXPLAIN Rear Axle Bearing and Seal Replacement **50. SLIDE 50** EXPLAIN **Figure 9-31** To remove the C-lock (clip), the lock bolt has to be moved before the pinion shaft. **51. SLIDE 51** EXPLAIN **Figure 9-32** The axle must be pushed inward slightly to allow the C-lock to be removed. After the C-lock has been removed, the axle can be easily pulled out of the axle housing. **52. SLIDE 52** EXPLAIN **Figure 9-33** Using a hydraulic press to press an axle bearing from the axle. When pressing a new bearing back onto the axle, pressure should only be on the inner bearing race to prevent damaging the bearing. **53. SLIDE 53** EXPLAIN **Figure 9-34** Removing an axle seal using the axle shaft as the tool **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 STUDENTS HOW TO DO 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.** **54. SLIDE 54** EXPLAIN **Figure 9-35** This is a normally worn bearing. If it does not have too much play, it can be reused. **55. SLIDE 55** EXPLAIN **Figure 9-36 (a)** When corrosion etches into the surface of a roller or race, the bearing should be discarded. **(b)** If light corrosion stains can be removed with an oil-soaked cloth, bearing can be reused. **56. SLIDE 56** EXPLAIN **Figure 9-37** (a) When just the end of a roller is scored, it is because of excessive preload. Discard the bearing. (b) This is a more advanced case of pitting. Under load, it will rapidly lead to spalling. **57. SLIDE 57** EXPLAIN **Figure 9-38** (a) Always check for faint grooves in the race. This bearing should not be reused. (b) Grooves like these are often matched by grooves in the race (above). Discard the bearing.

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	58. **SLIDE 58 EXPLAIN Figure 9-39** (a) Regular patterns of etching in the race are from corrosion. This bearing should be replaced. (b) Light pitting comes from contaminants being pressed into race. Discard bearing 59. **SLIDE 59 EXPLAIN Figure 9-40** (a) This bearing is worn unevenly. Notice the stripes. It should not be reused. (b) Any damage that causes low spots in the metal renders the bearing useless. 60. **SLIDE 60 EXPLAIN Figure 9-41** (a) In this more advanced case of pitting, you can see how race has been damaged. (b) Discoloration is a result of overheating. Even a lightly burned bearing should be replaced. 61. **SLIDE 16 EXPLAIN Figure 9-42** (a) Pitting eventually leads to spalling, a condition where the metal falls away in large chunks. (b) In this spalled roller, the metal has actually begun to flake away from the surface 62. **SLIDE 62 EXPLAIN Figure 9-43** These dents resulted from the rollers "hammering" against the race, a condition called brinelling **63. SLIDES 63-71 EXPLAIN REAR AXLE BEARING REPLACEMENT** **71 SLIDES 72-76 EXPLAIN SUMMARY**
	**HOMEWORK: HAVE STUDENTS RESEARCH WORK OF JOHN HARRISON, AN ENGLISH CLOCKMAKER WHO INVENTED THE FIRST PRACTICAL CAGED ROLLER BEARING IN THE MID-1740S.**