Automotive Steering, Suspension, & Alignment 7th Ed

Chapter 3 Tires and Wheels

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Automotive Steering and Suspension Systems with Wheel Alignment and Drive Axles.** 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 learning objectives to students as listed on NEXT SLIDE. 1. Identify the parts of a tire. 2. Discuss tire sizes and ratings. 3. Describe tire selection considerations 4. Explain the construction and sizing of steel and alloy wheels and attaching hardware. 5. Demonstrate the correct lug nut tightening procedure and torque. This chapter will help you prepare for ASE Suspension and Steering (A4) certification test content area "E" (Wheel and Tire Diagnosis and Repair).
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.

NOTE: This lesson plan is based on Automotive Steering, Suspension, & Alignment 7th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com
LINK CHP 3: Chapter Images

ICONS	Chapter 3 Tires & Wheels
	**1. SLIDE 1 CH3 TIRES & WHEELS**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Videos**
 	**At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)**
	
	2. **SLIDE 2 EXPLAIN Figure 3-1 (a)** typical tire tread depth gauge. The center movable plunger is pushed down into the groove of the tire. 3. **SLIDE 3 EXPLAIN Figure 3-1 (b)** tread depth is read at the top edge of the sleeve. In this example, the tread depth is 6/32 in.
	**DEMONSTRATION: Show typical tread depth gauge. explain how to use it, SEE FIGURE 3-1**
 	**DISCUSSION: Ask the students to discuss other possible symptoms of bad or defective tires. Ask the students to discuss the importance of tread depth and to discuss why all tire manufacturers don't use the same standard depth.**
	**HANDS-ON TASK: Have the students use a tread depth gauge to measure tread depth. Ask them to read you the gauge and indicate depth of tread.**
	4. **SLIDE 4 EXPLAIN Figure 3-2** Wear indicators (wear bars) are strips of bald tread that show when tread depth is down **to 2/32 in**., legal limit in many states.

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	**DEMONSTRATION:** **Show the students examples of tires with wear bars, FIGURE 3-2**
	**DISCUSSION: Discuss whether there is a generally accepted practice regarding repair of tires with sidewall punctures. Discuss why it is necessary to replace a tire if the tire's bead is cut or damaged. Ask students to discuss which are stronger: bias-ply tires or radial-ply tires.**
	**HANDS-ON TASK: Using a tire crayon, have students circle wear bars on both new & used tires.**
	**5. SLIDE 5 EXPLAIN Figure 3-3** tire tread runs around the circumference of the tire, and its pattern helps maintain traction. The ribs provide grip, while the grooves direct any water on the road away from the surface. The sipes help the tire grip the road.
	6. SLIDE 6 EXPLAIN Figure 3-4 Hydroplaning can occur at speeds as low as 30 mph (48 km/h). If the water is deep enough and the tire tread cannot evacuate water through its grooves fast enough, the tire can be lifted off the road surface by a layer of water. Hydroplaning occurs at lower speeds as the tire becomes worn.
	**7. SLIDE 7 EXPLAIN Figure 3-5** Typical construction of a radial tire. Some tires have only one body ply, and some tires use more than two belt plies.
	8. SLIDE 8 EXPLAIN Figure 3-6 The major splice of a tire can often be seen and felt on the inside of the tire. The person who assembles (builds) the tire usually places a sticker near the major splice as a means of identification for quality control
	**DEMONSTRATION: Using both new and used tires, show the students the major Splice.**
	**DISCUSSION: Ask the students to discuss why damage to the inner liner will cause a flat tire.**
	**9. SLIDE 9 EXPLAIN Figure 3-7** Complete stage 1 (body plies, sidewall components, and beads) 2. Building drum expands in preparation to receive the belts and tread

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	3. Application of belt #1. 4. Application of belt #2. 5. Application of the tread 6.
	**10. SLIDE 10 EXPLAIN Figure 3-8** After the entire tire has been assembled into a completed "green" tire, it is placed into a tire-molding machine where the tire is molded into shape and the rubber is changed chemically by the heat. This nonreversible chemical reaction is called vulcanization
	**DISCUSSION: Ask the students to discuss problems that would develop by using a space-saving spare tire over an extended period of time.**
	**11. SLIDE 11 EXPLAIN Figure 3-9** Notice that the overall outside diameter of the tire remains almost the same and at the same time the aspect ratio is decreased and the rim diameter is increased.
	12. SLIDE 12 EXPLAIN Figure 3-10 (a) Tire size designation includes cross-sectional width and aspect ratio. (b) Cross-sectional view of a typical tire showing the terminology.
	**DEMONSTRATION: Show how to decode several tire sizes using service description. FIGURE 3-10**
	**HANDS-ON TASK: Have the students decode several tire sizes using service description. FIGURE 3-10**
	**When changing from an older tire measuring system to a newer system, speedometer calibration should be checked.**
	**DEMONSTRATION: show how to decode the Metric tire coding and explain it**
	**HANDS-ON TASK: Have students decode several metric tire sizes.**
	**13. SLIDE 13 EXPLAIN Figure 3-11** Typical sidewall markings for load index & speed rating following tire size.

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	**DISCUSSION:** Ask the students whether using tires with suffix LT (Light Truck) is acceptable on passenger cars and/or SUVs.
	**DISCUSSION:** Ask students to discuss the advantages, if any, of using radial tires on an older automobile.
	**DISCUSSION:** Ask the students how changing the section height will affect the ride quality
	**14. SLIDE 14 EXPLAIN FIGURE 3–12** E.C.E. symbol on a sidewall of a tire. Notice the small -s at the end, indicating that the tire meets the "pass-by" noise limits.
	**DISCUSSION:** Ask the students why tires are manufactured with H-speed ratings of 130 mph or 210 km/h despite the fact that driving that fast would not only be unsafe but also illegal in most areas of the world.
	**DISCUSSION:** Ask the students to compare DOT standards & E.C.E. (Economic Commission for European Small "e") standards. Ask students to discuss whether US should have anti-noise standards similar to E.C.E pass-by noise limits.
	**15. SLIDE 15 EXPLAIN Figure 3-13** typical door placard used on a GM vehicle indicating recommended tire inflation. Note that information also includes tire size and speed rating of tire as well as recommended wheel size
	**DEMONSTRATION:** Show the students how to determine proper tire pressure by using the information on door placards.
	**HANDS-ON TASK:** Have students compare tire pressure recommendations of several automobiles by using the information on door placards.
	**16. SLIDE 16 EXPLAIN Figure 3-14** Conicity is a fault in the tire that can cause the vehicle to pull to one side due to the cone effect (shape) of the tire

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	**DEMONSTRATION:** Using a foam cup, show the students how a cone shape will cause a **pull**.
	17. **SLIDE 17 EXPLAIN Figure 3-15** Notice the angle of the belt material in this worn tire. The angle of the belt fabric can cause a "ply steer" or slight pulling force toward one side of the vehicle
	18. **SLIDE 18 EXPLAIN Figure 3-16** Slip angle is the angle between the direction the tire tread is heading and the direction it is pointed.
	**DISCUSSION:** Ask the students to discuss how tread depth and aspect ratio affect tire slip angle
	19. **SLIDE 19 EXPLAIN Figure 3-17** typical "Uniform Tire Quality Grading System" (UTQGS) ratings imprinted on the tire sidewall
	**DISCUSSION:** Ask the students to discuss whether people living in hot climates should purchase tires with **C Temperature** resistance rating.
	**DISCUSSION:** Ask the students to discuss whether a tire's tread wear rating number has any relationship to the price of the tire
	**Aligning a vehicle to correct for bad tire will cause pull to return when tires are rotated.**
	20. **SLIDE 20 EXPLAIN Figure 3-18** Typical DOT date code. This tire was built the sixth week of 2005.
	**DISCUSSION:** Ask the students to discuss how important DOT date code is when deciding to purchase a tire.
	**When installing aftermarket wheels using non-stock lug nuts, wire tie a set of stock lug nuts to the spare tire wheel**

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	**Many tire manufacturers require only returning the DOT code of the tire for claims on a warranty. This saves shipping cost.**
	**Be sure to include checking spare tire mounting hardware as part of a general service.**
	**21. SLIDE 21 EXPLAIN FIGURE 3–19** Cutaway of a run-flat tire showing the reinforced sidewalls and the required pressure sensor. **22. SLIDE 22 EXPLAIN FIGURE 3-20** A conventional tire on the left and a run-flat tire on right, showing what happens when there is no air in the tire
	**DISCUSSION: Ask the students to discuss the advantages and disadvantages of using run-flat tires.**
	**HANDS-ON TASK: Have the students use visual clues to identify run-flat tires on vehicles.**
	**23. SLIDE 23 EXPLAIN Figure 3-21** PAX run-flat tire system composed of 3 components: special asymmetrical wheel, urethane support ring, & special tire
	**24. SLIDE 24 EXPLAIN Figure 3-22** Tire Performance Criteria (TPC) specification number is imprinted on the sidewall of all tires used on GM vehicles from factory.
	**DEMONSTRATION: Show the students how to read and interpret the Tire Performance Criteria (TPC) specification number on a tire standard on a General Motors vehicle.**
	**HANDS-ON TASK: Have the students find TPC numbers on several tires on GM Lab or Personal Vehicle**
	**DISCUSSION: Have the students discuss why rolling resistance is a concern on hybrid vehicles.**

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	**25. SLIDE 25 EXPLAIN Figure 3-23** The size of the wheel is usually cast or stamped into the wheel. This wheel is 7 inches wide. The letter "J" refers to the contour of the bead seat area of the wheel.
	**26. SLIDE 26 EXPLAIN Figure 3-24** The wheel rim well provides a space for the tire to fit during mounting; the bead seat provides a tire-to-wheel sealing surface; the flange holds the beads in place.
	27. SLIDE 27 EXPLAIN Figure 3-25 cross section of a wheel showing part designations.
	28. SLIDE 28 EXPLAIN Figure 3-26 Offset is distance between centerline of wheel and wheel mounting surface
	29. SLIDE 29 EXPLAIN Figure 3-27 Back spacing (rear spacing) is the distance from the mounting pad to the edge of the rim. Most custom wheels use this measurement method to indicate the location of the mounting pad in relation to the rim
	**DEMONSTRATION: Show the students examples of several wheels and explain how to determine the size of wheel and the exact shape of flange area.**
	**DISCUSSION: Ask the students to discuss why the flange area shape and the angle that the rim drops down from the flange are important.**
	**HANDS-ON TASK: Have the students use sticky notes or masking tape to label the parts of the rim.**
	**30. SLIDE 30 EXPLAIN Figure 3-28** Bolt circle is the diameter of a circle that can be drawn through the center of each lug hole or stud. The bolt circle is sometimes referred to as PCD for pitch circle diameter
	31. SLIDE 31 EXPLAIN Figure 3-29 Measuring the bolt circle on a five lug wheel is difficult, but a quick and easy way includes measuring as shown to determine the approximate bolt circle of a five-lug wheel
	**Wheel Identification Bolt Pattern (View) (Download)**

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	**DEMONSTRATION:** Show the students how to use a tape measure to determine approximate bolt circle of a 5-lug wheel, **FIGURE 3-29**
	**HANDS-ON TASK:** Have the students use tape measures to determine the approximate bolt circles of five-lug wheels, **FIGURE 3-29**
	**Most tire shops have bolt circle templates. The templates have several bolt circles on them. This makes it faster to identify a bolt circle.**
	**32. SLIDE 32 EXPLAIN Figure 3-30** Measure center-to-center distance and compare the distance to the figures in the chart in the text to determine the diameter for a five-lug bolt circle **33. SLIDE 33 EXPLAIN FIGURE 3–31** A typical JWL symbol for the Japan Wheel Light Metal standard mark. **34. SLIDE 34 EXPLAIN Figure 3-32** (a) A rubber snap-in style tire valve assembly. (b) A metal clamp-type tire valve assembly used on most high pressure (over 60 PSI) tire applications such as is found on many trucks, RVs, and trailers. The internal Schrader valve threads into the valve itself and can be replaced individually, but most experts recommend replacing the entire valve assembly every time the tires are replaced to help prevent air loss.
	**Racers quote a 4:1 ratio gain in removing UNSPRUNG WEIGHT. As an example, removing 25 lb of unsprung weight would have the same effect on handling as removing 100 lb of sprung weight.**
	**35. SLIDE 35 EXPLAIN Figure 3-33** Various styles of lug nuts **36. SLIDE 36 EXPLAIN FIGURE 3.34A** typical knock-off-type wheel showing the large three prong wing nuts and the threads on the wheel hub **37. SLIDE 37 EXPLAIN FIGURE 3.34B** look-alike knock-off wheel that looks like a knock-off but uses lug nuts.
	**DEMONSTRATION:** Show the students various types of lug nuts and explain why there are different types. **FIGURE 3-33**

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	**DISCUSSION:** Ask the students to discuss why some OEMS use lug nuts and other manufacturers use lug bolts. **FIGURE 3-33**
	**HANDS-ON TASK:** Have the students inspect tires on an assigned vehicle.
	38. SLIDES 38-46 EXPLAIN OPTIONAL TIRE INSPECTION
	**ON-VEHICLE NATEF TASK:** Research applicable vehicle and service information, such as suspension and steering system operation, vehicle history, service precautions, & TSBs
	**SEARCH INTERNET** Have the students search the Internet to research the process of vulcanization. Ask them to prepare to report on vulcanization and its importance to the automotive industry during the next class.