Automotive Technology 6th Edition
Chapter 128 Drive Shafts and CV Joints
Opening Your Class

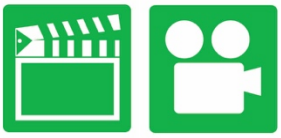
KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Technology 6th text provides complete coverage of automotive components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and ASEEducation (NATEF) and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Case Studies, Videos, Animations, and ASEEducation (NATEF) Task Sheets.
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. Describe driveshaft design and balance. 2. Describe the function and operation of U-joints. 3. Discuss the two types of CV joints and how they work. 4. This chapter will help prepare for Suspension and Steering (A4) ASE certification test content area "C" (Suspension and Steering Service).
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: Lesson plan is based on 6th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

DOWNLOAD Chapter 128 Chapter Images: From

http://www.jameshalderman.com/automotive_principles.html

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

ICONS	Ch128 Drive Shafts and CV Joints
	**1. SLIDE 1 DRIVE SHAFTS & CV JOINTS** **2. SLIDE 2 EXPLAIN FIGURE 128–1 Typical rear-wheel-drive powertrain arrangement. The engine is mounted longitudinal (lengthwise).** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **http://www.jameshalderman.com/automotive_principles.html** **DOWNLOAD** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF** **Drive Axle (41 Links)** **Drive Shaft (27 Links)** **RWD Driveshaft Operation** **RWD Drivetrain**
	
	
	
	
	**3. SLIDE 3 EXPLAIN FIGURE 128–2** On a rear wheel drive vehicle, the drive shaft transmits engine torque from the transmission to the rear axle assembly and drive wheels. On a front-wheel-drive vehicle drive shafts (also called axle shafts) transmit torque from the transaxle to each of the front drive wheels. **4. SLIDE 4 EXPLAIN FIGURE 128–3** Typical driveshaft (also called a propeller shaft). The driveshaft transfers engine power from the transmission to differential. **5. SLIDE 5 EXPLAIN FIGURE 128–4 This driveshaft was found to be dented during a visual inspection and has to be replaced.**
	**DISCUSS CASE STUDY:**
	**GM SERVICE TEXT OFTEN REFERS TO DRIVESHAFT AS A "PROPELLER SHAFT."**

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	6. SLIDE 6 EXPLAIN FIGURE 128–5 A center support bearing is used on many vehicles with long two-part driveshafts.. 7. SLIDE 7 EXPLAIN FIGURE 128–6 Some driveshafts use rubber between an inner and outer housing to absorb vibrations and shocks to the driveline.
	**DISCUSSION:** DISCUSS WHY SOME DRIVESHAFTS HAVE A CENTER SUPPORT BEARING.
	**DEMONSTRATION:** SHOW CENTER SUPPORT BEARING FOR A TWO-PIECE DRIVESHAFT.
	8. SLIDE 8 EXPLAIN FIGURE 128–7 simple universal joint (U-joint).
	9. SLIDE 9 EXPLAIN FIGURE 128–8 How the speed difference on the output of a typical U-joint varies with the speed and the angle of the U-joint. At the bottom of the chart, the input speed is a constant 1000 RPM, while the output speed varies from 900 to 1100 RPM when the angle difference in the joint is only 10°. At the top of the chart, the input speed is a constant 1000 RPM, yet the output speed varies from 700 to 1200 RPM when the angle difference in the joint is changed to 30°. 10. SLIDE 10 EXPLAIN FIGURE 128–9 The joint angle is the difference between angles of the joint.
	**DISCUSSION:** DISCUSS THE ADVANTAGES AND DISADVANTAGES OF ALUMINUM DRIVESHAFTS.
	**DEMONSTRATION:** SHOW DRIVESHAFT MADE OF STEEL AND ANOTHER ONE MADE OF ALUMINUM. SHOW THEM PARTS OF DRIVESHAFT, INCLUDING TUBE, SLIP YOKE, END YOKE, & BALANCE WEIGHTS.
	**DISCUSSION:** DISCUSS THE EFFECTS OF AN OUT-OF-BALANCE DRIVESHAFT. (EXAMPLES: DRIVER COMPLAINTS AND DAMAGE TO OTHER PARTS)

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	**DEMONSTRATION:** SHOW UNIVERSAL JOINTS ON BOTH ENDS OF A DRIVESHAFT LET IT ROTATE EVEN THOUGH THE TWO ENDS OF THE SHAFT ARE OUT OF ALIGNMENT.
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	**HANDS-ON-TASK & DISCUSSION:** HAVE THE STUDENTS USE INTERNET TO RESEARCH LIFE OF *GIROLAMO CARDANO*. DISCUSS HIS LIFE AND HIS INVENTION OF THE *CARDAN JOINT*, A TYPE OF UNIVERSAL JOINT IN A SHAFT THAT ENABLES THE JOINT TO ROTATE WHEN OUT OF ALIGNMENT.
	**SEARCH INTERNET:** STUDENTS USE INTERNET TO RESEARCH HOW A TORQUE TUBE SYSTEM WORKS. ASK THEM TO WRITE A REPORT DESCRIBING HOW A TORQUE TUBE DIFFERS FROM HOTCHKISS SYSTEM
	11. SLIDE 11 EXPLAIN FIGURE 128–10 The angle of this rear Cardan U-joint is noticeable. 12. SLIDE 12 EXPLAIN FIGURE 128–11 double-Cardan U-joint.
	**DISCUSS FREQUENTLY ASKED QUESTION:** ***What is a 1350-series U-joint?*** **Most universal joints are available in sizes to best match the torque that they transmit. The larger the u-joint, Higher the amount of torque. Most u-joints are sized and rated by series numbers. See the accompanying chart for series numbers and sizes.**
	**CV Joint**
	**DISCUSSION:** DISCUSS THE ADVANTAGE OF A CONSTANT VELOCITY JOINT

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	13. SLIDE 13 EXPLAIN FIGURE 128–12 constant velocity (CV) joint can operate at high angles without a change in velocity (speed) because the joint design results in equal angles between input and output.
	14. SLIDE 14 EXPLAIN FIGURE 128–13 A Rzeppa fixed joint. This type of CV joint is commonly used at the wheel side of the drive axle shaft. This joint can operate at high angles to compensate for suspension travel and steering angle changes.
	15. SLIDE 15 EXPLAIN FIGURE 128–14 protective CV joint boot has been torn away on this vehicle and all of the grease has been thrown outward onto brake and suspension parts. The driver of this vehicle noticed a "clicking" noise, especially when turning.
	16. SLIDE 16 EXPLAIN FIGURE 128–15 A tripod fixed joint. This type of joint is found on some Japanese vehicles. If the joint wears out, it is to be replaced with an entire drive axle shaft assembly.
	**DEMONSTRATION: SHOW OUTER CV JOINT. SHOW THEM THE MAIN COMPONENTS OF THE JOINT**
	**HANDS-ON-TASK HAVE THE STUDENTS IDENTIFY THE MAJOR COMPONENTS OF THE CV JOINT ASSEMBLY**
	17. SLIDE 17 EXPLAIN 128–16 The fixed outer joint is required to move in all directions because the wheels must turn for steering as well as move up and down during suspension movement. The inner joint has to be able to not only move up and down but also plunge in and out as the suspension moves up and down
	18. SLIDE 18 EXPLAIN FIGURE. 128–17 Unequal-length driveshafts result in unequal drive axle shaft angles to the front drive wheels. This unequal angle side to side often results in a steering of the vehicle during acceleration called torque steer. By using an intermediate shaft, both drive axles are the same angle and the torque steer effect is reduced.
	**DISCUSS FREQUENTLY ASKED QUESTION: *WHAT IS THAT WEIGHT FOR ON THE DRIVE AXLE SHAFT?* Some drive axle shafts are**

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	equipped with what looks like a balance weight. • see **FIGURE 128–18**. It is actually a dampener weight used to dampen out certain drive line vibrations. The weight is not used on all vehicles and may or may not appear on the same vehicle depending on engine, transmission, and other options. The service technician should always try to replace a defective or worn drive axle shaft with the exact replacement. When replacing an Entire drive axle shaft, the technician should always follow the OEM instructions regarding either transferring or not transferring the weight to the new shaft.
	19. SLIDE 19 EXPLAIN **FIGURE 128–18** A typical drive axle shaft with dampener weight.
	**DEMONSTRATION:** SHOW OUTER CV JOINT AND DEMONSTRATE HOW IT TRANSMITS TORQUE EQUALLY TO THE DRIVE WHEELS AT ANGLES UP TO 40 DEGREES.
	**DEMONSTRATION:** SHOW INNER CV JOINT. SHOW HOW THE INNER (PLUNGE) CV JOINT CAN MOVE IN AND OUT, UNLIKE THE OUTER (FIXED) CV JOINT.
 	**DISCUSSION:** DISCUSS THE DIFFERENCE BETWEEN INNER AND OUTER CV JOINTS. WHAT IS THE MAJOR DIFFERENCE?
	20. SLIDE 2 EXPLAIN FIGURE 128–19 A tripod joint is also called a tripot, tripode, or tulip design.
	21. SLIDE 21 EXPLAIN 128–20 A cross-groove plunge joint is used on many German front-wheel-drive vehicles and as both inner and outer joints on the rear of vehicles that use an independent-type rear suspension. 22. SLIDE 22 EXPLAIN 128–21 Double-offset ball-type plunge joint.

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	23. SLIDE 23 EXPLAIN 128–22 Many outer CV joints include the tone wheel for wheel speed sensor used by the anti-lock and stability control systems. **EXPLAIN TECH TIP*: CV Joint Boots Are in a Hot Place.* While outer CV boots move when front wheels are steered, inner boots are also subjected to possible damage because they are often near exhaust system where the high temperatures can damage boot material. Then, if there is an engine oil leak, engine oil could harm the CV boot too. Try to fix all leaks to help prevent premature CV boot failure. • SEE FIGURE128–23.**
 	24. SLIDE 24 EXPLAIN **FIGURE 128–23** Many CV joints are close to the exhaust system where they are exposed to higher than normal temperatures. 5. SLIDE 5 EXPLAIN FIGURE 9–5 A center support bearing is used on many vehicles with long two-part driveshafts. 6. SLIDE 6 EXPLAIN FIGURE 9–6 Some driveshafts use rubber between an inner and outer housing to absorb vibrations and shocks to the driveline.