Automotive Technology 6th Edition

Chapter 129 Drive Shafts and CV Joints Service

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. Explain how to diagnose and inspect a U-joint. 2. List the steps necessary to replace a U-joint. 3. Explain how to perform a measurement of the working angles of a U-joint. 4. Diagnose problems with CV joints and describe the service procedures for replacing CV joints. 5. This chapter will help prepare for Suspension and Steering (A4) ASE certification test content area "C" (Related 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

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http://www.jameshalderman.com/automotive_principles.html NOTE: You can use Chapter Images or possibly Power Point files:

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 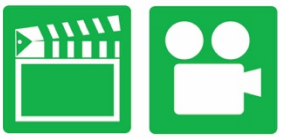   	**1. SLIDE 1 DRIVE SHAFTS & CV JOINTS SVC** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **http://www.jameshalderman.com/automotive_principles.html** **DOWNLOAD** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF** **Drive Axle (41 Links)** **Drive Shaft (27 Links)** **DISCUSS CASE STUDY: *SQUEAKING PICKUP TRUCK.* Owner of a pickup truck complained that a squeaking noise occurred while driving in reverse. THE "EEEE EEEE EEEE" sound increased in frequency as truck increased in speed, yet noise did not occur when driving Forward. Because there was no apparent looseness in u-joints, service technician at first thought that Problem was inside either transmission or rear axle. When driveshaft was removed to further investigate problem, it became obvious where noise was coming from. U-joint needle bearing had worn cross-shaft bearing surface of the u-joint. • SEE FIGURE 129–1. The noise occurred only in reverse because wear had occurred in forward direction, and therefore Only when torque was applied in opposite direction did needle bearing become bound up and start to make noise. A replacement u-joint solved squeaking noise in reverse.** **SUMMARY:**

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	• COMPLAINT—CUSTOMER COMPLAINED OF SQUEAKING SOUNDBUT ONLY WHILE DRIVING IN REVERSE. • CAUSE—WORN U-JOINT WAS FOUND TO BE THE CAUSE. • CORRECTION—WORN U-JOINT WAS REPLACED AND NOISE ISSUE WAS CORRECTED.
	2. SLIDE 2 EXPLAIN **FIGURE 129–1** Notice how the needle bearings have worn grooves, called Brinelling, into the bearing surface of the U-joint.
	3. SLIDE 3 EXPLAIN **FIGURE 129–2** All U-joints and spline collars equipped with grease fitting should be greased **4 X** a year as part of 4 regular lubrication service. 4. SLIDE 4 EXPLAIN **FIGURE 129–3** Many U-joints require special grease gun tool to reach grease fittings.
	**GM SERVICE TEXT OFTEN REFERS TO DRIVESHAFT AS A "PROPELLER SHAFT."**
	**DEMONSTRATION: SHOW PROPER WAY TO GREASE A U-JOINT. EXPLAIN THAT TOO MUCH GREASE WILL OPEN OR BREAK THE SEALS, LEAVING OPENINGS WHERE DIRT AND WATER CAN ENTER THE JOINT.**
	**DISCUSSION: DISCUSS IMPORTANCE OF PERIODIC GREASING & INSPECTING OF U-JOINTS**
	**HANDS-ON-TASK: HAVE YOUR STUDENTS GREASE A U-JOINT**
	5. SLIDE 5 EXPLAIN **FIGURE 129–4** Always mark the original location of U-joints before disassembly. 6. SLIDE 6 EXPLAIN **FIGURE 129–5** Two types of retaining methods that are commonly used at the rear U-joint at the differential.

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	**DISCUSSION: ASK THE STUDENTS TO DISCUSS IMPORTANCE OF MARKING U-JOINT COMPONENTS BEFORE DISASSEMBLY. ASK THE STUDENTS TO DISCUSS VARIOUS WAYS TO MARK U-JOINT ORIENTATION BEFORE DISASSEMBLY.** **WHEN CHECKING U-JOINTS IN THE VEHICLE, YOU MAY FIND IT HARD TO MOVE A WORN U-JOINT. A LITTLE PRESSURE WITH A PRYBAR CAN MAKE THE MOVEMENT MORE OBVIOUS.** 7. **SLIDE 7 EXPLAIN FIGURE 129–6** The best way to check any U-joint is to remove the driveshaft from the vehicle and move each joint in all directions.
  	**DEMONSTRATION: SHOW THE PROPER WAY TO REMOVE A DRIVESHAFT FROM A REAR WHEEL-DRIVE VEHICLE THAT DOESN'T CONTAIN A CENTER SUPPORT BEARING** **HANDS-ON-TASK: HAVE STUDENTS REMOVE A DRIVESHAFT FROM A RWD VEHICLE**
 	8. **SLIDE 8 EXPLAIN FIGURE 129–7** Typical U-joint that uses an outside snap ring. This style of joint bolts directly to the companion flange that is attached to the pinion gear in the differential. **HANDS-ON-TASK: HAVE THE STUDENTS REMOVE EXTERNAL AND AN INTERNAL CLIP FROM U-JOINT**
   	**IF A RETAINER CLIP IS DIFFICULT TO REMOVE, PUT PRESSURE ON JOINT TO MOVE CLIP OUT OF CONTACT WITH HOUSING.** **YOU CAN REMOVE NYLON RETAINERS BY CAREFULLY HEATING THE RETAINER AREA WITH TORCH. BE CAREFUL NOT TO GET BURNED BY THE SYNTHETIC MATERIAL AS IT COMES OUT** 9. **SLIDE 9 EXPLAIN FIGURE 129–8** A U-joint that is held together by nylon and usually requires that heat be applied to remove from the yoke. 10. **SLIDE 10 EXPLAIN FIGURE 129–9** Use a vise and two sockets to replace a U-joint. One socket fits over the

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	bearing cup and the other fits on the bearing to press-fit the cups from the crosspiece. **EXPLAIN TECH TIP: Use Tape to Be Safe** **When removing a driveshaft, use tape to prevent rear U-joint caps from falling off. If the caps fall off the U-joint, all of the needle bearings will fall out and scatter over the floor. • SEE FIGURE 129–10.**
	**11. SLIDE 11 EXPLAIN FIGURE 129–10** Taping the U-joint to prevent the caps from coming off
	**DEMONSTRATION: SHOW HOW TO REMOVE A U-JOINT WITH A VISE**
	**DEMONSTRATION: SHOW HOW TO REMOVE A U-JOINT FROM A DRIVESHAFT BY USING A SPECIAL U-JOINT PRESS**
	**HANDS-ON-TASK: HAVE STUDENTS R&R A U-JOINT USING THE VISE OR PRESS METHOD**
	**WHEN REPLACING U-JOINT, GREASE ZERK FITTING SHOULD FACE THE SHAFT.**
	**12. SLIDE 12 EXPLAIN FIGURE 129–11** A special tool being used to press apart a U-joint that is retained by injected plastic. Heat from a propane torch may be necessary to soften the plastic to avoid exerting too much force on the U-joint. **13. SLIDE 13 EXPLAIN FIGURE 129–12** Removing the worn cross from the yoke. **14. SLIDE 14 EXPLAIN FIGURE 129–13** When installing a new U joint, position the grease fitting on the inboard side (toward the driveshaft tube) and in alignment with the grease fitting of the U-joint at the other end.
	**NOTE: PROCESS OF BALANCING A DRIVESHAFT IS NOT USED VERY MUCH TODAY BUT IT MAY HELP IN SOME VIBRATION CASES**

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 	**HANDS-ON-TASK HAVE STUDENTS LOCATE SERVICE INFORMATION TO BALANCE DRIVESHAFT THEN BALANCE DRIVESAFT ON A LAB VEHICLE** 15. **SLIDE 15 EXPLAIN FIGURE 129–14** The working angle of most U-joints should be at least 1/2 degree (to permit the needle bearing to rotate in the U-joints) and should not exceed 3 degrees or a vibration can occur in the driveshaft, especially at higher speeds. The difference between the front and rear working angles should be within 1/2 degree of each other. 16. **SLIDE 16 EXPLAIN FIGURE 129–15** An inclinometer with a magnetic base is being used to measure the angle of the driveshaft at the rear U-joint. 17. **SLIDE 17 EXPLAIN FIGURE 129–16** Placing a tapered metal wedge between the rear leaf spring and the rear axle pedestal to correct rear U-joint working angles.
	**DEMONSTRATION: SHOW HOW TO FIND DRIVESHAFT ANGLE.**
	**DEMONSTRATION: SHOW HOW TO USE AN INCLINOMETER TO MEASURE THE ANGLE OF DRIVESHAFT.**
 	**HANDS-ON-TASK: HAVE STUDENTS PRACTICE CHECKING DRIVE SHAFT ANGLES & USE INTERNET TO RESEARCH U.S. PATENT 2,010,899** 18. **SLIDE 18 EXPLAIN FIGURE 129–17** A transmission oil pan gasket leak allowed automatic transmission fluid (ATF) to saturate the rear transmission mount rubber, causing it to collapse. After replacing the defective mount, proper driveshaft angles were restored and the driveline vibration was corrected.
	**EXPLAIN TECH TIP: *Quick and Easy Backlash Test*** **Whenever a driveline clunk is being diagnosed, one possible cause is excessive backlash (clearance) between ring gear teeth and differential pinion teeth in the differential. Another common cause of excessive differential backlash is too much clearance between differential carrier pinion teeth**

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	and side gear teeth. A quick test to check backlash involves three easy steps: **STEP 1 Hoist vehicle on a frame contact lift, allowing drive wheels to be rotated.** **STEP 2 Have an assistant hold one drive wheel and the driveshaft to keep them from turning.** **STEP 3 Move the other drive wheel, observing how far tire can rotate. This is amount of backlash in differential; it should be less than 1 inch (25 mm) of movement measured at tire. If the tire can move more than 1 inch (25 mm), then differential should be inspected for wear and parts should be replaced as necessary. If tire moves less than 1 inch (25 mm), then the backlash between the ring gear and pinion is probably not the cause of the noise.**
	19. **SLIDE 19 EXPLAIN FIGURE 129–18** The hub nut must be removed before the hub bearing assembly or drive axle shaft can be removed from the vehicle**.**
	20. **SLIDE 20 EXPLAIN FIGURE 129–19** Many knuckles are attached to the ball joint on the lower control arm by a pinch bolt.
	21. **SLIDE 21 EXPLAIN FIGURE 129–20** preferred method for separating the tie rod end from steering knuckle is to use a puller such as the one shown. A "pickle-fork"-type tool should be used only if tie rod is going to be replaced. A pickle-fork-type tool can damage or tear the rubber grease boot. Striking the tie rod end with a hammer while holding another hammer behind the joint to shock and break the taper from steering knuckle can also be used. 22. **SLIDE 22 EXPLAIN FIGURE 129–21** Many drive axles are retained by prevailing torque nut that must not be reused. Prevailing torque nuts are slightly deformed or contain a plastic insert that holds the nut tight (retains the torque) to the shaft without loosening. 23. **SLIDE 23 EXPLAIN FIGURE 129–22 A special General Motors tool is being used to separate the drive axle shaft from the wheel hub bearing.** 24. **SLIDE 24 EXPLAIN FIGURE 129–23 Most inner CV joints can be separated from transaxle with a prybar.**

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	**EXPLAIN TECH TIP: *Spline Bind Cure.* Driveline "clunk" often occurs in rear-wheel-drive vehicles when shifting between drive and reverse or when accelerating from a stop. Often the cause of this noise is excessive clearance in differential. Another cause is called spline bind, where changing rear pinion angle creates a binding in spline when rear springs change in height. For example, when a pickup truck stops, weight transfers toward front and unloads rear springs. The front of differential noses downward and forward as rear springs unload. When driver accelerates forward, the rear of the truck squats downward, causing drive shaft to be pulled rearward when the front of differential rotates upward. This upward movement on the spline often causes the spline to bind and make a loud clunk when the bind is finally released. The method recommended by vehicle manufacturers to eliminate this noise is to follow these steps:** 1. **Remove driveshaft.** 2. **Clean splines on both driveshaft yoke and transmission output shaft.** 3. **Remove any burrs on splines with a small metal file (remove all filings).** 4. **Apply a high-temperature grease to the spline teeth of yoke. Apply grease to each spline, but do not fill splines. Synthetic chassis grease is preferred because of its high temperature resistance.** 5. **Reinstall driveshaft.**
	25. **SLIDE 25 EXPLAIN FIGURE 129–24** When removing a drive axle shaft assembly, use care to avoid pulling the plunge joint apart. 26. **SLIDE 26 EXPLAIN FIGURE 129–25** If other service work requires that just one end of the drive axle shaft be disconnected from the vehicle, be sure that the free end is supported to prevent damage to the protective boots or allowing the joint to separate.

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	27. **SLIDE 27 EXPLAIN FIGURE 129–26** With a scribe, mark the location of the boots before removal. Replacement boots must be in same location 28. **SLIDE 28 EXPLAIN FIGURE 129–27** Most CV joints use a snap ring to retain the joint on drive axle shaft. 29. **SLIDE 29 EXPLAIN FIGURE 129–28** After releasing the snap ring, most CV joints can be tapped off the shaft using a brass or shot-filled plastic (deadblow) hammer**.** 30. **SLIDE 30 EXPLAIN FIGURE 129–29** Typical outer CV joint after removing the boot and joint from drive axle shaft. This joint was removed from vehicle because a torn boot was found. After disassembly and cleaning, this joint was found to be OK and was put back into service. Even though grease looks terrible, there was enough grease in joint to provide lubrication to prevent any wear from occurring**.** 31. **SLIDE 31 EXPLAIN FIGURE 129–30** cage of this Rzeppa-type CV joint is being carefully inspected before being reassembled. 32. **SLIDE 32 EXPLAIN FIGURE 129–31** Be sure to use all of the grease supplied with replacement joint or boot kit. Use only the grease supplied and do not use substitute grease. 33. **SLIDE 33 EXPLAIN FIGURE 129–32** punch being used to keep the rotor from rotating while torquing the axle shaft spindle nut.
	**DISCUSS CASE STUDY: *VIBRATING BUICK*** **The owner of a front-wheel-drive Buick complained that it vibrated during acceleration only. The vehicle would also pull toward one side during acceleration. An inspection discovered a worn (cracked) engine mount. After replacing mount, cv joint angles were restored and both Vibration and the pulling to one side during acceleration Were solved. • SEE FIGURE 129–33.** **SUMMARY:**

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	• **Complaint—owner complained about a vibration and pull to one side during acceleration.** • **Cause—defective engine mount which caused CV joint angles to be unequal causing the vibration and pulling during acceleration.** • **Correction—engine mount was replaced and customer concern was solved.** **34. SLIDE 34 EXPLAIN FIGURE 129–33** engine had to be raised higher to get new (non-collapsed) engine mount installed