Automotive Technology 6th Edition

Chapter 132 Vibration and Noise Diagnosis and Correction

Opening Your Class

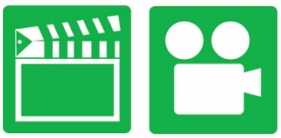
KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Technology 6th text provides complete coverage of automotive components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and ASEEducation (NATEF) and emphasizes a problem-solving approach. Chapter features 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. List the possible vehicle components that can cause a vibration or noise. 2. List the procedures for a test-drive and neutral run-up test for vibration/noise problems. 3. Explain the vibration speed ranges and how to determine the frequency of the vibration. 4. Explain how to check driveline angles and driveshaft runout. 5. Discuss the methods for measuring driveshaft U-joint phasing and balancing the driveshaft. 6. Diagnose and correct noise problems. 7. 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

DOWNLOAD Chapter 94 Chapter Images: From

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

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

ICONS	Ch132 Vibration & Noise Diagnosis Correction
     	**1. SLIDE 1 CH132 VIBRATION & NOISE DIAGNOSIS CORRECTION** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Drive Shaft (27 Links)** **DISCUSSION: HOST A DISCUSSION ON WHAT TO LOOK FOR DURING A ROAD TEST FOR A VIBRATION. WHICH SUSPENSIONS ARE MORE PRONE TO VIBRATIONS?** 2. SLIDE 2 EXPLAIN FIGURE 132–1 Many vehicles, especially those equipped with four-cylinder engines, use a dampener weight attached to exhaust system or differential, as shown, to dampen out certain frequency vibrations. 3. SLIDE 3 EXPLAIN FIGURE 132–2 The exhaust was found to be rubbing on frame rail during a visual inspection. Rubber exhaust system hangers are used to isolate noise and vibration from the exhaust system from entering the interior. These rubber supports can fail causing exhaust system to be out of proper location. It was found by looking for evidence of witness marks. 4. SLIDE 4 EXPLAIN FIGURE 132–3 A chart showing the typical vehicle and engine speeds at which various components will create a noise or vibration and under what conditions.
	**Discuss case study: *vibrating ford transmit connect.* Owner of a ford transit connect complained of a severe vibration at idle. Technician checked for any DTCS and any related TSB and found a TSB that the lower engine mount could be cause. Transmission mount was found to be cracked so this was also replaced. Vibration was still present.**

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	Thinking that engine mou7nts could be an issue technician found them to be clean without any leaks or cracks. Checking with other technicians on www.iatn. Net resulted in several responses that suggested that upper mount, being fluid (gel) filled has been found to be the cause or a vibration even if it is not leaking. Taking advice of other technicians who have solved a vibration by replacing upper mount, technician did replace it and this corrected vibration concern. Apparently failed engine mounts caused engine to vibrate because they were not in original position Where they were designed to dampen engine noise and vibrations. **Summary:** Complaint—owner complained of a vibration in the engine when at idle speed only Cause—defective engine mounts including the upper liquid filled mount was found to the root cause. Correction—all 3 engine (powertrain) mounts were replaced based on a TSB and a visual inspection
	GREATER ANGLE, GREATER CHANGE IN VELOCITY CAUSES TORQUE LOSSES DUE TO FRICTION, HEAT, & VIBRATION RESULTS IN WEAR SPEED DIFFERENCE ON OUTSET OF U-JOINT VARIES WITH SPEED BOTH U-JOINTS OPERATING AT ABOUT SAME ANGLE PREVENT EXCESSIVE DRIVE LINE VIBRATION. THE WORD CYCLE COMES FROM THE SAME ROOT AS THE WORD CIRCLE. A CIRCLE BEGINS AND ENDS AT THE SAME POINT, AS THUS, SO DOES A CYCLE. ALL VIBRATIONS CONSIST OF REPETITIVE CYCLES.

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	Clamp a yardstick to edge of a table, leaving about 50 cm (20 in) hanging over edge of table. Pull down on the edge of stick and release while observing the movement of stick. The motion of stick occurs in repetitive cycles. The cycle begins at midpoint, continues through the lowest extreme of travel, then back past midpoint, through upper extreme of travel, and back to midpoint where cycle begins again. The cycle occurs over and over again at same rate, or frequency. In this case, about 10 cycles in one minute. If we measure frequency to reflect the number of complete cycles that yardstick made in one minute, the measure would be 10 cycles x 60 seconds = 600 cycles per minute (CPM).
	5. SLIDE 5 EXPLAIN FIGURE 132–4 Vibration created at one point is easily transferred to passenger compartment. MacPherson strut suspensions are more sensitive to tire imbalance than SLA-type suspensions.
	**RWD Driveshaft Operation**
	**DISCUSS CASE STUDY: *S-10 PICKUP TRUCK FRAME NOISE.*** **S-10 pickup truck with loud squeaking noise, especially when turning left. Technicians attempted to solve problem and replaced shock absorbers, ball joints, and control arm bushings without solving problem. Problem was finally discovered to be starter motor hitting frame. A measurement of new vehicles indicated that clearance between starter motor and the frame was about 1/8 inch (0.125 inch) (0.3 cm)! The sagging of engine mount and weight transfer of engine during cornering caused starter motor to rub up against frame. Noise was transmitted through frame throughout vehicle and made source of noise**
	Summary
	Complaint—owner complained of a loud squeaking noise.

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	**Cause—starter was found to be hitting the frame due to a collapsed engine mount. Correction—both engine mounts were replaced, which proved to be root cause.** **EXPLAIN TECH TIP: *Duct Tape Trick*** **A clicking noise heard at low speeds from the wheels is a common noise complaint. This noise is usually most noticeable while driving with windows lowered. This type of noise is caused by loose disc brake pads or noisy wheel covers. To confirm exactly what is causing the noise, simply remove the wheel covers and drive the vehicle. If clicking noise is still present, check the brakes and wheels for faults. If noise is gone with the wheel covers removed, use duct tape over inner edge of wheel covers before installing them onto the wheels. The duct tape will cushion and dampen the wheel cover and help reduce noise. The sharp prongs of the wheel cover used to grip the wheel will pierce through the duct tape and still help retain wheel covers.**
	6. SLIDE 10 EXPLAIN FIGURE 132–5 Hertz means cycles per second. If six cycles occur in one second, then the frequency is 6 Hz. The amplitude refers to total movement of the vibrating component.
	7. SLIDE 7 EXPLAIN FIGURE 132–6 Every time the end of a clamped yardstick moves up and down, it is one cycle. The number of cycles divided by time equals frequency. If the yardstick moves up and down 10 times (10 cycles) in two seconds, the frequency is 5 Hertz (10 ÷ 2 = 5).
	8. SLIDE 8 EXPLAIN FIGURE 132–7 Determining rolling circumference of a tire.
	9. SLIDE 9 EXPLAIN FIGURE 132–8 An electronic vibration analyzer..
	**DISCUSS CASE STUDY: *Vibrating Van*** **After engine was replaced in a rear-wheel-drive van, a vibration that felt like an engine miss was noticed by driver. Because vibration was**

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	not noticed before engine was replaced, problem was thought to be engine-related. Many tests failed to find anything wrong with the engine. Even ignition distributor was replaced, along with electronic ignition module, on suspicion that an ignition misfire was the cause. After hours of troubleshooting, a collapsed transmission mount was discovered. After replacing the transmission mount, "engine miss" and vibration were eliminated. The collapsed mount caused driveshaft U-joint angles to be unequal, which caused vibration. **Summary:** Complaint—Owner complained of a vibration during acceleration only that was believed to be an ignition misfire. Cause—transmission mount was found to have collapsed which affected the drive shaft angles. Correction—transmission mount was replaced which restored the proper drive shaft angles.
	10. SLIDE 10 EXPLAIN FIGURE 132–9 Properly balancing all wheels and tires solves most low-frequency vibrations.
	**DEMONSTRATION: SHOW HOW TO BALANCE A DRIVESHAFT USING HOSE CLAMPS**
 	**DISCUSSION: DISCUSS THE EFFECTS OF AN OUT-OF-BALANCE DRIVESHAFT. (EXAMPLES: DRIVER COMPLAINTS AND DAMAGE TO OTHER PARTS)**
	**ASEEDUCATION TASK: HAVE THE STUDENTS' COMPLETE NATEF TASK SHEET: CHECK BALANCE AND PHASING; MEASURE DRIVE SHAFT ANGLES.**
Education Foundation	

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	**HANDS-ON-TASK HAVE STUDENTS LOCATE SERVICE INFORMATION TO BALANCE DRIVESHAFT THEN BALANCE DRIVESAFT ON A LAB VEHICLE**
	11. SLIDE 11 EXPLAIN FIGURE 132–10 An out-of-balance tire showing scallops or bald spots around the tire. Even if correctly balanced, this cupped tire would create a vibration. 12. SLIDE 12 EXPLAIN FIGURE 132–11 Another cause of a vibration that is often blamed on wheels or tires is a bent bearing hub. Use a dial indicator to check the flange for runout. 13. SLIDE 13 EXPLAIN FIGURE 132–12 Checking a drive shaft for runout using a magnetic mounted dial indicator.
	**EXPLAIN TECH TIP: *Squeaks and Rattles*** **Many squeaks and rattles commonly heard on any vehicle can be corrected by tightening all bolts and nuts you can see. Raise the hood and tighten all fender bolts. Tighten all radiator support and bumper brackets. Open the doors and tighten all hinge and body bolts. An even more thorough job can be done by hoisting vehicle and tightening all under-vehicle fasteners, including inner fender bolts, exhaust hangers, shock mounts, and heat shields. It is amazing how much this quiets vehicle, especially on older models. It also makes vehicle feel more solid with far less flex in body, especially when traveling over railroad crossings or rough roads.**
	14. SLIDE 14 EXPLAIN **FIGURE 132–13 When checking the balance of a driveshaft, make reference marks around the shaft so that the location of the unbalance may be viewed when using a strobe light.**
	15. SLIDE 15 EXPLAIN **FIGURE 132–14 Using a strobe balancer to check for driveline vibration requires that an extension be used on magnetic sensor. Tall safety stands are used to support rear axle to keep driveshaft angles same as when vehicle is on road.**

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	16. SLIDE 16 EXPLAIN **FIGURE 132–15 Typical procedure to balance a driveshaft using hose clamps.**
	**DISCUSS CASE STUDY: *EVERYTHING IS OK UNTIL I HIT A BUMP SEE PAGE 1671*** **SUMMARY:** • **Complaint—owner complained of vibration but only after hitting a bump in road.** • **Cause—rack-and-pinion steering had excessive looseness in both inner and outer tie rods.** • **Correction—steering gear assembly was replaced and problem was corrected.**
	17. SLIDE 17 EXPLAIN FIGURE 132–16 Two clamps were required to balance this front driveshaft of a 4WD vehicle. Be careful when using hose clamps so that ends of clamps do not interfere with body or other parts of the vehicle
	18. SLIDE 18 EXPLAIN FIGURE 132–17 Tire wear caused by improper alignment or driving habits, such as high-speed cornering, can create tire noise. Notice the feather-edged outer tread blocks.
	19. SLIDE 19 EXPLAIN FIGURE 132–18 This bearing was found on a vehicle that had been stored over winter. This corroded bearing produced a lot of noise and had to be replaced
	**DISCUSS FREQUENTLY ASKED QUESTION:** ***WHAT ARE "CHASSIS EARS"?*** **Chassis ears is brand name for a tool that uses microphones that can be attached to parts under vehicle** **And transmit noise to a receiver.** **Receiver can be tuned so that a technician can listen to one microphone**

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	at time while someone else is driving. This tool makes finding The source of a noise easier. • SEE FIGURE 132–19.
	20. SLIDE 20 EXPLAIN **FIGURE 132–19** Chassis ear microphones attached to various suspension components using the integral clamps. The sound is transmitted wirelessly to receiver inside the vehicle where an assistant technician can listen for noises while the vehicle is being driven.
	**EXPLAIN TECH TIP:** ***RAP It.*** **Many technicians who service transmissions and differentials frequently replace all bearings in the differential when there is a noise complaint. While this at first may seem to be overkill, these technicians have learned that one defective bearing may put particles in the lubricant, often causing destruction of all the other bearings. This practice has been called RAP (replace all parts), and in the case of differentials, RAP may not be such a bad idea.**
	**DISCUSS CASE STUDY** ***ENGINE NOISE*** **SUMMARY: SEE PAGE 1673** • **Complaint—owner complained of a loud engine noise.** • **Cause—alternator bracket was loose causing noise due to a broken bracket bolt.** • **Correction—alternator bracket bolt was replaced and proper alternator belt tension was restored and noise was eliminated.**