

# Automotive Technology 6<sup>th</sup> Edition

## Chapter 17 Preventative Maintenance

### Opening Your Class

KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	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.
<b>Motivate Learners</b>	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.
<b>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.</b>	Explain the chapter learning objectives to the students as listed: <ol style="list-style-type: none"> <li>1. Describe the steps to be followed when getting a vehicle ready for service.</li> <li>2. Explain the process to be followed in safety inspection, windshield wiper service, cabin filter replacement, and air filter inspection.</li> <li>3. Describe the brake fluid and engine oil inspection procedure.</li> <li>4. Explain the process of inspecting the cooling system.</li> <li>5. Explain how to check automatic transmission and power steering fluids.</li> <li>6. Describe how to check wheels and tires.</li> <li>7. Describe how to lubricate the chassis, check the differential and the manual transmission fluid, and perform under-vehicle inspection.</li> </ol>
<b>Establish the Mood or Climate</b>	Provide a <b><i>WELCOME</i></b> , Avoid put downs and bad jokes.
<b>Complete Essentials</b>	Restrooms, breaks, registration, tests, etc.
<b>Clarify and Establish Knowledge Base</b>	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 the 6<sup>th</sup> Edition Chapter Images found on Jim's web site @**












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	<p><b>1. SLIDE 1 Ch17 Preventative Maintenance</b></p>
	<p>Check for <b>ADDITIONAL VIDEOS &amp; ANIMATIONS</b>  @ <a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a>  <b>WEB SITE IS CONSTANTLY UPDATED</b></p>
	<p><a href="http://www.jameshalderman.com/automotive_principles.html">http://www.jameshalderman.com/automotive_principles.html</a>  <b>DOWNLOAD</b></p>
	<p><b>Crossword Puzzle (Microsoft Word) (PDF)</b>  <b>Word Search Puzzle (Microsoft Word) (PDF)</b>  <b>HOLD DISCUSSION ON IMPORTANCE OF PREVENTATIVE MAINTENANCE: DISCUSS IMPORTANCE OF PREVENTATIVE MAINTENANCE</b></p>
	<p><b>2. SLIDE 2 EXPLAIN</b> Figure 17-1 Before service begins, be sure to cover the seats, floor, and steering wheel with protective coverings.</p>
	<p><b>PREVENTATIVE MAINTENANCE VIDEOS</b>  <a href="http://www.youtube.com/watch?v=GH5qC7QC1_Q">http://www.youtube.com/watch?v=GH5qC7QC1_Q</a>  <a href="http://www.youtube.com/watch?v=NReBqiqzuhE">http://www.youtube.com/watch?v=NReBqiqzuhE</a></p>
	<p><b>HOLD DISCUSSION ON KEEPING INTERIOR CLEAN: DISCUSS STEPS TO PROTECT THE INTERIOR OF THE VEHICLE WHILE BEING SERVICED</b></p>
	<p><b>3. SLIDE 3 READ &amp; EXPLAIN</b> Figure 17-2 An exhaust system hose should be connected to the tailpipe(s) whenever the engine is being run indoors.</p>
	<p><b>4. SLIDE 4 EXPLAIN</b> 17-3 Installing a wiper blade insert into a wiper arm.</p>
	<p><b><u>EXPLAIN TECH TIP: Do No Harm</u></b>  <b>As stated in Hippocratic oath, a doctor agrees first to do no harm to patient during treatment. Technicians should also try to do no harm to vehicle while it is being serviced. Always ask, “Am I going to do any harm if I do this?” before you do it.</b></p>

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	<b>ON-VEHICLE TASK: HAVE STUDENTS DO A PRE-SERVICE WALK-AROUND ON A LAB VEHICLE TO NOTICE ANY BODY DAMAGE OR MISSING PARTS. THIS IS TYPICALLY DONE AT A DEALERSHIP SERVICE APPOINTMENT</b>
	<b>STUDENTS COMPLETE SAFETY INSPECTION</b>
	<b><u>DEMO</u> WIPER BLADE REPLACEMENT</b>
	<b>DO TASK SHEET 2 ON WIPER BLADE REPLACEMENT</b>
	5. <b>SLIDE 5 EXPLAIN</b> Figure 17-4 (a) windshield wiper fluid reservoir cap is usually labeled with a symbol showing a windshield washer.
	6. <b>SLIDE 6 EXPLAIN</b> Figure 17-4 (b) use only the recommended washer fluid. Never use antifreeze in the windshield washer reservoir.
	<b><u>WARNING: WINDSHIELD WASHER FLUID USUALLY CONTAINS METHANOL, A POISONOUS CHEMICAL THAT CAN CAUSE BLINDNESS IF INGESTED.</u></b>
	7. <b>SLIDE 7 EXPLAIN</b> Figure 17-5 cabin filter can be accessed either through the glove compartment or under the hood on most vehicles.
	8. <b>SLIDE 8 EXPLAIN</b> Figure 17-6 (a) typical dirty air filter.
	<b>HOST <u>DISCUSSION</u> ON CLEAN AIR FILTERS: DISCUSS IMPORTANCE OF A CLEAN AIR FILTER FOR ENGINE OPERATION</b>
	<b>COMPLETE <u>BELOW TASK SHEETS</u> SAFETY CHECK WINDSHIELD WIPER BLADE SERVICE</b>

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9. **SLIDE 9 EXPLAIN** Figure 17-6 (b) Always check the inlet passage leading to the air filter for debris that can reduce airflow to the engine.
10. **SLIDE 10 EXPLAIN** Figure 17-7 master cylinder with a transparent reservoir. The brake fluid level should be between the MAX and the MIN levels as marked on the reservoir.
11. **SLIDE 11 EXPLAIN** Figure 17-8 DOT 3 brake fluid. Always use fluid from a sealed container because brake fluid absorbs moisture from the air.

### **DISCUSS FREQUENTLY ASKED QUESTION:**

#### ***WHAT IS USED IN THE CLUTCH MASTER***

***CYLINDER? Vehicles equipped with a manual transmission often use hydraulically operated clutch. This type of clutch operation uses a master cylinder and a slave cylinder near the clutch assembly. When driver depresses clutch pedal, the hydraulic pressure created in master cylinder is transferred to slave cylinder, which moves and Actuates clutch. Most hydraulic clutches use dot 3 brake fluid. Check to see that level is between Maximum and minimum levels as shown by lines on reservoir. If low, check for leak in system, as it is not normal for brake fluid level to decrease over time.***

**HAVE STUDENTS RESEARCH INTERNET OR LRC TO FIND WHICH VEHICLES USE DOT 5 AND WHY**

12. **SLIDE 12 EXPLAIN** Figure 17-9 Brake fluid test strips are a convenient and easy-to-use method to determine if the brake fluid needs to be replaced.

**HOST DISCUSSION: BRAKE FLUID TYPES, DOT 3, ETC.**

**DEMONSTRATION BRAKE FLUID TEST STRIPS.**  
**DEMO BRAKE FLUID TEST STRIPS, IF YOU HAVE THEM.**

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**HAVE STUDENTS DO A BRAKE FLUID INSPECTION**  
**HAVE STUDENTS DO A VISUAL INSPECTION OF BRAKE FLUID**

13. SLIDE 13 **EXPLAIN** Figure 17-10 A typical oil level indicator (dipstick).

14. SLIDE 14 **EXPLAIN** Figure 17-11 oil level should be between the MAX and the MIN marks when the vehicle is on level ground and the oil has had time to drain into the oil pan.

**DISCUSS FREQUENTLY ASKED QUESTION:**

***CAN I SWITCH FROM SYNTHETIC OIL TO***

***REGULAR OIL? Yes. All oil is miscible, meaning that it can be readily mixed.***

**Therefore, synthetic oil can be used one time**

**And then regular mineral oil used the next**

**time. Most important, however, is that the oil**

**be changed at intervals that are never longer**

**than specified by the vehicle manufacturer.**

**DISCUSS CHART 17-1 Difference Between**

**“Normal” And “Severe” Use Specified By**

**Many Vehicle Manufacturers.**

**HANDS-ON TASK ASE EDUCATION TASK**

**ENGINE OIL DIPSTICK TEST**

**DISCUSS FREQUENTLY ASKED QUESTION:**

***HOW DOES AN OIL LIFE MONITOR WORK?***

**While some vehicle manufacturers, such as**

**Mercedes, use a sensor to measure oil**

**temperature and acidity, most vehicle oil**

**change monitors function three ways:**

1. **Vehicle mileage. This is the most commonly used vehicle service monitoring system. When a certain number of miles has occurred since it**

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was reset, control (usually the powertrain control module will turn on a dash light that states maintenance is required.

2. **Oil life computer program.** A computer program called an algorithm, or series of mathematical calculations used to determine life of oil. For example, when the oil change warning light is reset, the oil life is reset to 100%. Then PCM tracks the number of engine starts, outside temperature, when engine was started (based on intake air temperature [IAT] sensor input), & number of miles traveled. Because long drives are easier on engine oil than short stop-and go driving, PCM deducts numbers faster during this condition.
3. **Oil condition sensor.** This sensor measures the dielectric properties of the oil, which changes when exposed to water, soot, ash, and glycol in the oil. A computer program takes information from sensor about changes of dielectric property of oil to determine when to light “change oil” lamp.

15. SLIDE 15 **EXPLAIN** Figure 17-12 Visually check level and color of coolant in coolant recovery or surge tank.



### DISCUSS FREQUENTLY ASKED QUESTION:

#### ***What is the Magnuson-Moss Act?***

The Magnuson-Moss Act, passed into law in 1975, allows the use of non-original equipment replacement Parts during the service or repair of a vehicle without losing The factory warranty. This means that any oil or air filter,

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Spark plug, or other service part can be used, unless the Vehicle manufacturer furnishes these parts for free during the warranty period. The vehicle manufacturer cannot deny paying a Warranty claim for a fault unless replacement part is proved to be the cause of the condition needed to be covered by the warranty. Therefore, it is up to the business owner, service Manager, or technician to determine if the replacement Part is of good quality. While this is very difficult or impossible, unless defects are obviously visible, the best solution is to use the OEM

**HAVE STUDENTS DO A VISUAL CHECK OF COOLANT AND REPORT CONDITION: HAVE STUDENTS DO A VISUAL INSPECTION OF COOLANT**

**WARNING:** Remove the pressure cap only on a cold engine as coolant will boil when pressure is released. This occurs because the coolant temperature is above the boiling point, but it does not boil due to the pressure. When the pressure is released, all of the hot coolant immediately boils and expands outward from the opening where the cap was installed. The resulting geyser of boiling hot coolant can cause severe burns or even death.

16. SLIDE 16 **EXPLAIN** Figure 17-13 (a) refractometer is used to measure the freezing point of coolant. A drop of coolant is added to a viewing screen, lid is closed, and then held up to the light to view display on tool.
17. SLIDE 17 **EXPLAIN** Figure 17-13 (b) use of tests strips is a convenient and cost-effective method to check coolant condition and freezing temperature.

**DEMONSTRATE REFRACTOMETER OR TEST STRIPS**

18. SLIDE 18 **EXPLAIN** Figure 17-14 Used coolant should be stored in a leak-proof container until it can be recycled or disposed of according to local, state, or

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federal laws. Storage barrel is placed inside another container to catch any coolant that may spill out  
**HOLD DISCUSSION ON RECYCLING ANTI-FREEZE**

19. SLIDE 19 **EXPLAIN** Figure 17-15 Using hand-operated pressure tester. Do not exceed the pressure rating of the radiator cap when pressurizing the system. This vehicle had a leaking upper radiator that only leaked when the system was pressurized

**DEMO COOLING SYSTEM PRESSURE TEST.**  
**DEMO how to pressure test a cooling system**

**HANDS-ON ASE EDUCATION TASK**  
**COOLING SYSTEM INSPECTION (A1-D-3) PAGE 34**

20. SLIDE 20 **EXPLAIN** Figure 17-16 Hose clamps come in a variety of shapes and designs.

21. SLIDE 21 **EXPLAIN** Figure 17-17 typical automatic transmission dipstick.

**EXPLAIN TECH TIP: The Cut-and-Peel Trick**

**It is often difficult to remove a radiator or heater hose from the fittings on the radiator or heater core. To avoid possible damage to expensive radiator or heater cores, do not pull or twist the hose to remove it. Simply use a utility knife and slit the hose lengthwise and then use your finger to peel the hose off of the radiator or heater core. Although this procedure will not work if the hose is to be reused, it is a real time saver when it comes to replacing old hoses. Sometimes using an angled pick that is dulled at the end will do a good job breaking the hose free.**

**ATF FLUID COLOR DISCUSSION**  
**DISCUSSION ON BROWN OR PINK COLORED AT**

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DEMO



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**DEMONSTRATION: PREPARE UNLABELED CLEAR JARS OF ANTI-FREEZE, ATF, ENGINE OIL, & POWER STEERING FLUID, & GASOLINE. HAVE STUDENTS IDENTIFY THESE FLUID BY COLOR & SMELL**

22. SLIDE 22 EXPLAIN Figure 17-18 Most vehicles use a combination filler cap and level indicator (dipstick) that shows the level of power steering fluid in the reservoir.

### **HANDS-ON ASE EDUCATION TASK** **STUDENTS DO FLUIDS CHECK**





#### **EXPLAIN TECH TIP: *The Paper Towel Test***

New ATF will penetrate a paper towel better than used oxidized ATF. To compare old fluid with new, place three drops of new fluid on a paper towel and three drops of used ATF on the paper towel about 3 inches from the first sample. Wait for 30 minutes. The new ATF will have expanded (penetrated through the paper towel) much farther than the old, oxidized fluid. This test can be used to convince a customer that the ATF should be changed according to the vehicle manufacturer's recommended interval even though, to the naked eye, the fluid looks okay.

23. SLIDE 23 EXPLAIN FIGURE 17.19 A special tool is useful when installing a new accessory drive belt.
24. SLIDE 24 EXPLAIN FIGURE 17.20 A typical worn serpentine accessory drive belt.
25. SLIDE 25 EXPLAIN FIGURE 17-21 If the wear gauge can be moved side to side, then the belt is worn and should be replaced. It is almost impossible to check a serpentine belt made from EPDM for wear visually without using a wear gauge.
26. SLIDE 26 EXPLAIN FIGURE 17.22 A spring-loaded accessory drive belt tensioner.

#### **EXPLAIN TECH TIP: *Water Spray Trick***

Lower-than-normal alternator output could be the result of a loose or slipping drive belt. All belts (V and serpentine multigroove) use an interference

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   	<p>angle between the angle of the Vs of the belt and the angle of the Vs on the pulley. Over time, this interference angle is worn off the edges of V of the belt. As a result, the belt may start to slip and make a squealing sound, even if tensioned properly. A fast method to determine if the noise is from the belt is to spray water from a squirt bottle at the belt with the engine running. <b>If belt noise stops, but returns when the belt dries out, cause is often called chirp and is due to pulley <i>misalignment</i>. If the belt noise gets louder when sprayed with water, the cause is often called squeal and is caused by low belt tension.</b></p> <p><b><u>HANDS-ON ASE EDUCATION TASK</u></b>  <b><u>ACC DRIVE BELT INSPECTION</u></b></p> <p>27. SLIDE 27 EXPLAIN FIGURE 17.23 The specified tire inflation pressure is printed on a placard on the driver's door or doorpost.</p> <p>28. SLIDE 28 EXPLAIN FIGURE 17.24 An electronic tire pressure gauge is usually more accurate than a mechanical "pencil type" gauge and more likely to provide consistent pressure readings.</p> <p><b><u>EXPLAIN TECH TIP: <i>Two Quick Checks</i></u></b>  <b>If the vehicle is hoisted on a frame-contact lift, perform two quick checks:</b></p> <ol style="list-style-type: none"> <li>1. Spin each tire to check that the brakes are not dragging. You should be able to turn all four wheels by hand if the parking brake is off and the transmission is in neutral.</li> <li>1. When spinning tire, look over top of tire to check if it is round. An improperly mounted tire or a tire that is out-of-round due to a fault in the tire can be detected by watching for the outside of tire to move up and down as it is being rotated.</li> </ol>

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29. SLIDE 29 EXPLAIN FIGURE 17.25 The method most often recommended is modified X method.
30. SLIDE 30 EXPLAIN FIGURE 17.26A A torque absorbing adaptor commonly called a “torque stick” is being used to tighten lug nuts.
31. SLIDE 31 EXPLAIN FIGURE 17.26B A color-coded assortment of torque sticks.

### **EXPLAIN TECH TIP: *Check for Wheel Lock Key***

**Many vehicles have wheel locks that require a special key to remove. The wise technician should always ask the customer or service writer about wheel locks before pulling the vehicle into the shop or before the vehicle is hoisted.**

### **DISCUSS FREQUENTLY ASKED QUESTION: *WHEN IS “SECOND CLICK” HEARD?***

**A student service technician was observed applying a lot of force to a clicker-type torque wrench attached to a wheel lug nut. When the instructor asked what he was doing, student replied that he was turning the lug nut tighter until he heard a second click from the torque wrench. This was confusing to the instructor until the student explained that he had heard a second click of torque wrench during the demonstration. The instructor at once realized that student had heard a click when proper torque was achieved, plus another click when the force on the torque wrench was released. No harm occurred to the vehicle because all of lug nuts were reinstalled and properly torqued. The Instructor learned that a more complete explanation for use of click-type torque wrenches was needed.**

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### HANDS-ON ASE EDUCATION TASK TIRE ROTATION

32. SLIDE 32 **EXPLAIN** FIGURE 17.27 A hand-operated grease gun is being used to lubricate the steering component through a grease fitting.

**EXPLAIN TECH TIP: Watch Out for Vents that Look Like Grease Fittings:** Watch for what looks like a grease (Zerk) fitting but is somewhat smaller, as this may be a vent, such as found on a late-model Dodge Caravan on the ball joints. If the grease gun does not fit on it, do not be tempted to remove and replace with a grease fitting.




33. SLIDE 33 **EXPLAIN** FIGURE 17.28 Most vehicle manufacturers recommend the use of grease meeting the NLGI #2 and “GC” for wheel bearings and “LB” for chassis lubrication.

34. SLIDE 34 **EXPLAIN** FIGURE 17.29 This differential assembly has been leaking fluid.

**EXPLAIN TECH TIP: Check the Fill Plug before Draining a Transmission:** Experienced technicians have learned that it is wise to check that the fill plug can be removed before draining manual transmission or transfer case through the drain plug. If the fill plug cannot be removed, then the fluid should not be drained until the problem is resolved. Once the fluid has been drained, there is no option but to do whatever it takes to get the fill plug open. This process is often difficult and may result in having to replace the entire assembly. • **SEE FIGURE 17-30.**

35. SLIDE 35 **EXPLAIN** FIGURE 17.30 Always ensure that fill plug can be accessed and removed *before* draining the fluid from a manual transmission.

36. SLIDE 36 **EXPLAIN** FIGURE 17.31 broken coil spring was found during under vehicle inspection.

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  	<p>37. SLIDE 37 <b>EXPLAIN</b> FIGURE 17.32 This corroded muffler was found during a visual inspection, but was not detected by driver because it was relatively quiet.</p> <p>38. SLIDE 38 <b>EXPLAIN</b> FIGURE 17–33 Diesel exhaust fluid (DEF) is available in containers or in bulk.</p> <p><b>COMPLETE ASE EDUCATION TASK SHEETS LUBRICATION SERVICE, CHECKING DEF FLUID.</b></p> <p><b><u>HOMEWORK</u> RESEARCH INTERNET FOR LOCAL, STATE, AND FEDERAL LAWS REGARDING RECYCLING OF COOLANT</b></p>