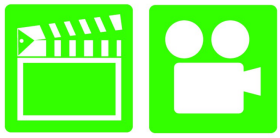
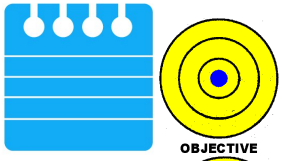
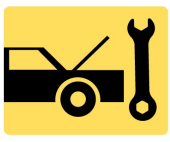
A8 Engine Performance 4th Edition

Chapter 12 Turbocharging and Supercharging

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Automotive Engine Performance.** 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 the chapter learning objectives to the students. 1. Prepare for Engine repair (A1) ASE certification test content area "D" (Lubrication and Cooling Systems Diagnosis and Repair). 2. Describe how coolant flows through an engine. 3. Discuss the operation of the thermostat. 4. Explain the purpose and function of the radiator pressure cap. 5. Describe the various types of antifreeze and how to recycle and discard used coolant. 6. Discuss how to diagnose cooling system problems.
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.

ICONS	Ch12 Turbocharging and Supercharging
	1. SLIDE 1 CH8 Turbocharging and Supercharging
	Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE REGULARLY UPDATED
	POWER POINTS DONE BY INDIVIDUAL LEARNING OBJECTIVES, SO THERE IS POWER POINT FILE FOR EACH LEARNING OBJECTIVE
	2. SLIDE 2 EXPLAIN OBJECTIVE CH12 AEP_LO1 3. SLIDES 3-5 EXPLAIN Airflow Requirements
	6. SLIDE 6 EXPLAIN Airflow Requirements: Volumetric Efficiency 7. SLIDE 7 EXPLAIN Figure 12-1 supercharger on a Ford V-8. 8. SLIDE 8 EXPLAIN Figure 12-2 turbocharger on a Toyota engine. 9. SLIDE 9 EXPLAIN Airflow Requirements: Engine Compression 10. SLIDE 10 EXPLAIN Figure 12-3 more air and fuel that can be packed in a cylinder, the greater the density of the air-fuel charge
	DEMONSTRATION: DEMONSTRATE AN ENGINE'S CHANGE IN VOLUMETRIC EFFICIENCY BY PERFORMING COMPRESSION TEST DURING CRANKING AND AT 2500 RPM. POINT OUT TO STUDENTS THAT THE HIGHER CYLINDER PRESSURE AT CRANKING SPEEDS IS DUE TO THE INCREASED TIME FOR AIR TO FLOW INTO CYLINDER. AT SLOWER SPEEDS THERE IS MORE TIME FOR AIR TO LEAK PAST RINGS
	DISCUSSION: ASK STUDENTS TO DISCUSS ADVANTAGES OF USING FORCED INDUCTION OVER INCREASED DISPLACEMENT

ICONS	Ch12 Turbocharging and Supercharging
   	**ON-VEHICLE TASK: NATEF TASK: RESEARCH VEHICLE INFORMATION** 2. SLIDE 2 EXPLAIN **OBJECTIVE CH12 AEP_LO2** 3. SLIDES 3-8 EXPLAIN **Supercharging Principles** 9. **SLIDE 9 EXPLAIN FIGURE 12–4** Atmospheric pressure decreases with increases in altitude. 10. **SLIDE 10 EXPLAIN** Supercharging Principles: Boost and Compression Ratios 11. **SLIDES 11-12 EXPLAIN** Superchargers 13. **SLIDE 13 EXPLAIN Figure 12-5** roots-type supercharger uses two lobes to force the air around the outside of the housing and into the intake manifold. 14. **SLIDE 14 EXPLAIN** Superchargers BOOST CONTROL 15. **SLIDE 15 EXPLAIN Figure 12-6** bypass actuator opens the bypass valve to control boost pressure 16. **SLIDE 16 EXPLAIN** Superchargers: Supercharger Boost Control 17. **SLIDE 17 EXPLAIN** Superchargers: Supercharger SERVICE.
 	**SUPERCHARGER WAS OPTIONAL EQUIPMENT ON 1957 FORDS. SOME MUSCLE CARS USED RAM AIR SCOOPS TO ACHIEVE SUPERCHARGING EFFECT BY CAPTURING HIGH PRESSURE OUTSIDE AIR.** **DEMONSTRATION: SHOW A SUPERCHARGER TO STUDENTS, POINTING OUT THE DRIVE PULLEY, INLET, OUTLET, AND BYPASS PASSAGE. CARE SHOULD BE TAKEN AROUND THE SUPERCHARGER DRIVE TO PREVENT INJURY. CLOTHING OR BODY PARTS CAN GET CAUGHT IN BELT.**
 	**DISCUSSION: HAVE STUDENTS DISCUSS WHY A NORMAL MANIFOLD ABSOLUTE PRESSURE SENSOR CAN'T BE USED ON A FORCED INDUCTION MOTOR.** **HANDS-ON TASK: HAVE YOUR STUDENTS CHECK A SUPERCHARGER'S OIL LEVEL.**

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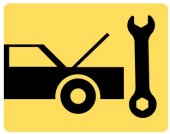
	18. **SLIDES 18-19 EXPLAIN Turbochargers** 20. **SLIDE 20 EXPLAIN FIGURE 12–7** A turbocharger uses some of the heat energy that would normally be wasted. 21. **SLIDE 21 EXPLAIN Figure 12-8** turbine wheel is turned by the expanding exhaust gases. 22. **SLIDES 22-24 EXPLAIN** Turbochargers: Turbocharger Design and Operation 25. **SLIDE 25 EXPLAIN FIGURE 12–9** The exhaust drives the turbine wheel on the left, which is connected to the impeller wheel on the right through a shaft. The bushings that support the shaft are lubricated with engine oil under pressure. 26. **SLIDES 26-27 EXPLAIN** Turbochargers: Turbocharger Size and Response Time
 	2. SLIDE 2 EXPLAIN **OBJECTIVE CH12 AEP_LO3** 3. SLIDES 3-5 EXPLAIN BOOST CONTROL
	**A TURBOCHARGED ENGINE CAN HAVE HORSEPOWER OF A LARGER ENGINE BUT WITH BETTER GAS MILEAGE**
	**DEMONSTRATION: SHOW YOUR STUDENTS A TURBOCHARGER AND POINT OUT THE TURBINE, COMPRESSOR, WASTEGATE, AND LUBRICATION PASSAGES.**
	**DISCUSSION: ASK YOUR STUDENTS TO COMPARE THE POWER CURVE OF TURBOCHARGERS TO THAT OF SUPERCHARGERS AND DISCUSS HOW THIS AFFECTS VEHICLE PERFORMANCE.**
	**HANDS-ON TASK: GIVE STUDENTS AN EXPLODED VIEW DIAGRAM OF A TURBOCHARGER AND HAVE THEM USE SERVICE INFORMATION TO LABEL ALL COMPONENTS.**
	6. **SLIDE 6 EXPLAIN Figure 12-10** unit on top of this Subaru that looks like a radiator is the intercooler, which cools the air after it has been compressed by the turbocharger. 7. **SLIDES 7-8 EXPLAIN** Boost Control: Wastegate 9. **SLIDE 9 EXPLAIN Figure 12-11** wastegate is used on

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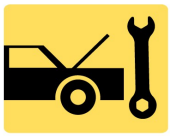
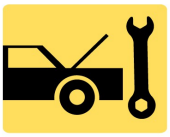
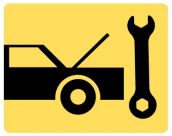
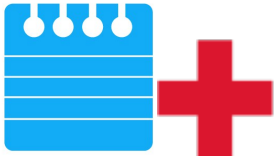
	many turbocharged engines to control maximum boost pressure. The wastegate is controlled by a computer-controlled valve.
	**HANDS-ON TASK: HAVE STUDENTS MEASURE BOOST AT VARIOUS RPM RANGES USING A PRESSURE GAUGE OR A SCAN TOOL**
	10. **SLIDES 10-12 EXPLAIN** Boost Control Relief Valves 13. **SLIDE 13 EXPLAIN Figure 12-12** blow-off valve is used in some turbocharged systems to relieve boost pressure during deceleration. 14. **SLIDE 14 EXPLAIN Figure 12-13** dual turbocharger system installed on a small block Chevrolet V-8 engine.
	**RELIEF VALVES ALSO PREVENT COMPRESSOR SURGING THAT CAN HURT PERFORMANCE AND DAMAGE TURBOCHARGER.**
	**DISCUSSION: ASK YOUR STUDENTS TO DISCUSS WHY THEY MIGHT USE A BOV WHEN A CBV IS MUCH LESS OBTRUSIVE**
 	**ON-VEHICLE TASK: NATEF TASK: TEST OPERATION OF TURBOCHARGER SUPERCHARGER SYSTEMS; DETERMINE NECESSARY ACTION.**
	**HANDS-ON TASK: HAVE STUDENTS FIND TURBOCHARGER ENDPLAY SPECIFICATIONS IN ON-LINE SERVICE INFORMATION.**
 	2. SLIDE 2 EXPLAIN **OBJECTIVE CH12 AEP_LO4** 3. **SLIDES 3-4 EXPLAIN** Turbocharger Failures
	**DISCUSSION: ASK YOUR STUDENTS TO DISCUSS THE ADVANTAGES AND DISADVANTAGES OF USING NITROUS OXIDE INSTEAD OF SUPERCHARGER OR TURBOCHARGER**
	**SAFETY NOTE: DELIBERATE INHALATION OF NITROUS OXIDE CAN HAVE SERIOUS HEALTH CONSEQUENCES BY DEPRIVING BRAIN OF OXYGEN.**