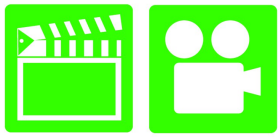
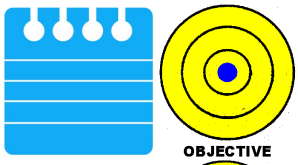
A8 Engine Performance 4th Edition

Chapter 29 Electronic Throttle Control System

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 ASE test content area "E" (Computerized Engine Controls Diagnosis and Repair). 2. Describe the purpose and function of an electronic throttle control (ETC) system. 3. Explain how an electronic throttle control system works. 4. List the parts of a typical electronic throttle control system. 5. Describe how to diagnose faults in an electronic throttle control system.
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	Ch29 Electronic Throttle Control System
	1. SLIDE 1 CH29 Electronic Throttle Control System
	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 CH29 AEP_LO1 3. SLIDES 3-5 EXPLAIN Electronic Throttle Control (ETC) System: Advantages of ETC
	ON-VEHICLE NATEF TASK: ELECTRONIC THROTTLE CONTROL IDENTIFICATION: RESEARCH SERVICE INFORMATION, SUCH AS ENGINE MANAGEMENT SYSTEM OPERATION, VEHICLE SERVICE HISTORY, AND TSBS
	Electronic Throttle Control
	6. SLIDE 6 EXPLAIN Electronic Throttle Control (ETC) System Parts Involved 7. SLIDE 7 EXPLAIN Figure 29-1 throttle pedal is connected to the accelerator pedal position (APP) sensor. The electronic throttle body includes a throttle position sensor to provide throttle angle feedback to the vehicle computer. Some systems use a Throttle Actuator Control (TAC) module to operate the throttle blade (plate)
	DEMONSTRATION: SHOW THE STUDENTS VEHICLE WITH AN ELECTRONIC THROTTLE CONTROL SYSTEM FIGURE 29-1. POINT OUT ITS COMPONENTS AND THE LACK OF A THROTTLE CABLE OR LINKAGE.

ICONS	Ch29 Electronic Throttle Control System
	8. SLIDE 8 EXPLAIN Normal Operation of ETC
OBJECTIVE	2. SLIDE 2 EXPLAIN OBJECTIVE CH29 AEP_LO2 3. SLIDES 3-5 EXPLAIN Normal Operation of the ETC System 6. SLIDE 6 EXPLAIN Figure 29-2 opening of throttle plate can be delayed as long as 30 milliseconds (0.030 sec.) to allow time for amount of fuel needed to catch up to opening of throttle plate
QUESTION	**DISCUSSION:** DISCUSS ELECTRONIC THROTTLE CONTROL SYSTEMS. WHAT ARE COMPONENTS OF AN ELECTRONIC THROTTLE CONTROL SYSTEM? HOW IS ACCELERATOR PEDAL POSITION SENSOR SIMILAR TO THROTTLE POSITION SENSOR? FIGURE 29-2
OBJECTIVE	2. SLIDE 2 EXPLAIN OBJECTIVE CH29 AEP_LO3 3. SLIDE 3 EXPLAIN Electronic Throttle Control (ETC) System Parts Involved 4. SLIDES 4-7 EXPLAIN Throttle Body Assembly 8. SLIDE 8 EXPLAIN FIGURE 29–4 default position for the throttle plate is in slightly open position. The servomotor then is used to close it for idle and open it during acceleration.
QUESTION	**DISCUSSION:** ASK THE STUDENTS TO DISCUSS THE NORMAL OPERATION OF ELECTRONIC THROTTLE CONTROL SYSTEM. HOW COULD THE LACK OF RAPID RESPONSE GIVE SOME DRIVERS A NEGATIVE OPINION OF ETC SYSTEM?
QUESTION	**DISCUSSION:** HAVE THE STUDENTS DISCUSS THE PRACTICE OF USING 2 OR 3 ACCELERATOR POSITION SENSORS. WHAT MIGHT HAPPEN IF ONE SENSOR FAILS?
QUESTION	**DISCUSSION:** DISCUSS THROTTLE BODY ASSEMBLY FIGURE 29-4 FOR ETC SYSTEM. HOW IS IT SAME AS & HOW DOES IT DIFFER FROM CONVENTIONAL SYSTEM?

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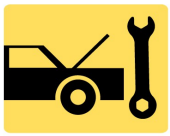
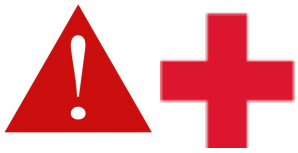
	**HANDS-ON TASK: SHOW ETC THROTTLE BODY. LET THEM INSPECT THROTTLE BODY, FEEL SPRING TENSION, SEE SIZE OF DC ACTUATOR MOTOR.**
	9. **SLIDE 9 EXPLAIN Figure 29-5 (a)** An H-bridge circuit is used to control the direction of the DC electric motor of the electronic throttle control unit **(b)** To reverse the direction of operation, the polarity of the current through the motor is reversed.
	10. **SLIDE 10 EXPLAIN Figure 29-6** Schematic of a typical electronic throttle control (ETC) system. Note that terminal #5 is always pulse-width modulated and that terminal #3 is always constant, but both power and ground are switched to change the direction of the motor
	**DISCUSSION: DISCUSS HOW PCM DRIVES THROTTLE BLADE OPEN OR CLOSED FROM DEFAULT POSITION. WHY IS A DEFAULT POSITION NEEDED? TALK ABOUT THE USE OF 2 THROTTLE POSITION SENSORS IN THE THROTTLE BODY. WHAT HAPPENS IF ONE FAILS? ASK STUDENTS TO DISCUSS H-BRIDGE CIRCUIT USED TO ACTUATE THROTTLE. CAN THEY THINK OF OTHER MOTORS (E.G., WINDOW MOTOR, SEAT MOTOR) THAT OPERATE ON SAME PRINCIPLE? FIG 29-5 & 6**
	11. **SLIDES 11-13 EXPLAIN** Throttle Position (TP) Sensor 14. **SLIDE 14 EXPLAIN Figure 29-7** The two TP sensors used on the throttle body of an electronic throttle body assembly produce opposite voltage signals as the throttle is opened. The total voltage of both combined at any throttle plate position is 5 volts
	**DISCUSSION: HAVE THE STUDENTS DISCUSS NEED TO CALIBRATE A REPLACEMENT ACCELERATOR PEDAL POSITION SENSOR. WHY DO THEY THINK CALIBRATION SHOULD BE DONE? FIGURE 29-7**
	15. **SLIDE 15 EXPLAIN** Throttle Position (TP) Sensor: Hall-Effect TP Sensors

ICONS	Ch29 Electronic Throttle Control System
	2. SLIDE 2 EXPLAIN OBJECTIVE CH29 AEP_LO4 3. SLIDE 3 EXPLAIN Diagnosis of Electronic Throttle Control Systems 4. SLIDE 4 EXPLAIN Figure 28-8 (a) A "reduced power" warning light indicates a fault with the electronic throttle control system on some GM vehicles. (b) symbol showing an engine with an arrow pointing down is used on some GM vehicles to indicate a fault with the electronic throttle control system.
	**DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE "LIMP HOME" OR LIMP-IN MODE SITUATION. WHY IS LIMP HOME MODE ALSO CALLED FAIL-SAFE SYSTEM?**
	**DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE DIFFERENCES AMONG OEMS IN SYMBOLS OR WARNING LAMPS THEY USE TO INDICATE A PROBLEM WITH ELECTRONIC THROTTLE CONTROL SYSTEM. DO THESE DIFFERENCES CAUSE PROBLEMS? FIGURE 29-8**
	5. SLIDE 5 EXPLAIN Figure 29-9 wrench symbol warning lamp on Ford. Symbol can also be green. 6. SLIDE 6 EXPLAIN Figure 29-10 symbol used on a Chrysler vehicle indicating fault with electronic throttle control.
	**DISCUSSION: DISCUSS WRENCH & LIGHTNING BOLT SYMBOLS USED BY FORD & CHRYSLER. DO THEY THINK THESE SYMBOLS GET MORE ATTENTION FROM DRIVER THAN CHECK ENGINE LAMP DOES? FIGURES 29-9 & 10**
	7. SLIDE 7 EXPLAIN FIGURE 29–11 throttle plate stayed where it was moved, which indicates that there is a problem with electronic throttle body control assembly. 8. SLIDE 8 EXPLAIN FIGURE 29–12 corroded electronic throttle control assembly shown with cover removed.
	9. SLIDE 9-10 EXPLAIN ETC Throttle Follower Test

ICONS	Ch29 Electronic Throttle Control System
	**DISCUSSION:** DISCUSS VACUUM LEAKS AND HOW THEY AFFECT AN ENGINE. CAN ETC COMPENSATE FOR LEAKS AT ANY OTHER ENGINE SPEED BESIDES IDLE?
	**DISCUSSION:** DISCUSS THE PROCEDURE FOR CLEANING AN ELECTRONIC THROTTLE CONTROL SYSTEM THROTTLE BODY. IS THIS A NEW PROCEDURE? THEN HAVE STUDENTS TALK ABOUT PROCEDURE FOR A THROTTLE BODY WITH A WARNING LABEL THAT SAYS "DO NOT CLEAN." WHAT WOULD THEY DO IF THIS THROTTLE BODY WERE DIRTY? FIGURE 29-11
	2. SLIDE 2 EXPLAIN OBJECTIVE CH29 AEP_LO5 3. SLIDE 3 EXPLAIN Servicing Electronic Throttle Systems 4. SLIDE 4 EXPLAIN FIGURE 29–13 Notice the small motor gear on the left drives a larger plastic gear (black), which then drives the small gear in mesh with the section of a gear attached to the throttle plate. This results in a huge torque increase from the small motor and helps explain why it could be dangerous to insert a finger into the throttle body assembly
	**DISCUSSION:** ASK THE STUDENTS TO DISCUSS THE REASON FOR REMOVING THE KEY WHEN SERVICING AN ELECTRONIC THROTTLE BODY. WHY SHOULD THEY NOT SPRAY CLEANER INTO THE THROTTLE BODY ASSEMBLY?
	**SAFETY** EXPLAIN TO THE STUDENTS THAT DC MOTOR IS STRONG ENOUGH TO SEVERELY CUT OR EVEN AMPUTATE A FINGER IF INSERTED INTO A THROTTLE BODY WHEN ACTUATED. KEY SHOULD BE REMOVED BEFORE ANY SERVICE IS ATTEMPTED.