

# Automotive Fuel and Emissions Control Systems 4/E





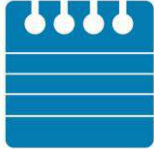









## Chapter 22 Electronic Throttle Control










### Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of <b>Automotive Fuel and Emissions Control Systems</b> . 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. <ol style="list-style-type: none"><li>1. Describe the purpose and function of electronic throttle control (ETC) systems.</li><li>2. Describe the operation of the throttle body assembly, accelerator pedal position (APP), and throttle position sensors.</li><li>3. Explain how to diagnose an electronic throttle control system.</li><li>4. Describe how to service an electronic throttle control (ETC) system.</li></ol>
Establish the Mood or Climate	Provide a <i>WELCOME</i> , 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: This lesson plan is based on Fuel & Emission Control 4<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 22: [Chapter Images](#)**

ICONS	Ch22 Electronic Throttle Control
             	<p><b>1. SLIDE 1 CH22 Electronic Throttle Control</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 REGULARLY UPDATED</b></p> <p><b><u>VIDEOS</u></b></p> <p>At the beginning of this class, you can download the crossword puzzle &amp; Word Search from the links below to familiarize your class with the terms in this chapter &amp; then discuss them</p> <p><b>Crossword Puzzle (<a href="#">Microsoft Word</a>) (PDF)</b></p> <p><b>Word Search Puzzle (<a href="#">Microsoft Word</a>) (PDF)</b></p> <p><b><u>ON-VEHICLE NATEF TASK: ELECTRONIC THROTTLE CONTROL IDENTIFICATION: RESEARCH SERVICE INFORMATION, SUCH AS ENGINE MANAGEMENT SYSTEM OPERATION, VEHICLE SERVICE HISTORY, AND TSBS</u></b></p> <p><b><u>Electronic Throttle Control</u></b></p> <p><b>2. SLIDE 2 EXPLAIN</b> Figure 22-1 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)</p> <p><b><u>DEMONSTRATION: SHOW THE STUDENTS VEHICLE WITH AN ELECTRONIC THROTTLE CONTROL SYSTEM FIGURE 22-1. POINT OUT ITS COMPONENTS AND THE LACK OF A THROTTLE CABLE OR LINKAGE.</u></b></p>

ICONS	Ch22 Electronic Throttle Control
	<p>3. SLIDE 3 EXPLAIN Figure 22-2 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</p>
 <p>QUESTION</p>	<p><b>DISCUSSION: DISCUSS ELECTRONIC THROTTLE CONTROL SYSTEMS. WHAT ARE COMPONENTS OF AN ELECTRONIC THROTTLE CONTROL SYSTEM? HOW IS <u>ACCELERATOR PEDAL POSITION SENSOR</u> SIMILAR TO <u>THROTTLE POSITION SENSOR</u>? <u>FIGURE 22-2</u></b></p>
	<p>4. SLIDE 4 EXPLAIN Figure 22-3 A typical accelerator pedal position (APP) sensor, showing two different output voltage signals that are used by the PCM to determine accelerator pedal position. Two (or three in some applications) are used as a double check because this is a safety-related sensor</p>
 <p>QUESTION</p>	<p><b>DISCUSSION: DISCUSS NORMAL OPERATION OF ELECTRONIC THROTTLE CONTROL SYSTEM. HOW COULD THE LACK OF RAPID RESPONSE GIVE SOME DRIVERS A NEGATIVE OPINION OF ETC SYSTEM?</b></p>
 <p>QUESTION</p>	<p><b>DISCUSSION: DISCUSS THE PRACTICE OF USING <u>2 OR 3 ACCELERATOR POSITION SENSORS</u>. WHAT MIGHT HAPPEN IF ONE SENSOR FAILS?</b></p>
	<p>5. SLIDE 5 EXPLAIN Figure 22-4 default position for throttle plate is in slightly open position. Servomotor then used to close it for idle &amp; open it during acceleration</p>
 <p>QUESTION</p>	<p><b>DISCUSSION: DISCUSS <u>THROTTLE BODY ASSEMBLY FIGURE 22-4</u> FOR ELECTRONIC THROTTLE CONTROL SYSTEM. HOW IS IT SAME AS &amp; HOW DOES IT DIFFER FROM CONVENTIONAL?</b></p>
	<p><b>HANDS-ON TASK: SHOW THROTTLE BODY FROM AN ETC SYSTEM. LET THEM <u>INSPECT THROTTLE BODY, FEEL SPRING TENSION, AND SEE SIZE OF DC ACTUATOR MOTOR.</u></b></p>
	<p>6. SLIDE 6 EXPLAIN Figure 22-5 (a) 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.</p>

**ICONS****Ch22 Electronic Throttle Control**

7. **SLIDE 7 EXPLAIN** Figure 22-6 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

**DISCUSS FREQUENTLY ASKED QUESTION**

**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 22-5 & 6**

8. **SLIDE 8 EXPLAIN** Figure 22-7 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 22-7**

**DISCUSS FREQUENTLY ASKED QUESTION**

9. **SLIDE 9 EXPLAIN** Figure 22-8 (a) A “reduced power” warning light indicates a fault with the electronic throttle control system on some GM vehicles.

10. **SLIDE 10 EXPLAIN** Figure 22-8 (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.

ICONS	Ch22 Electronic Throttle Control
-------	----------------------------------



**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 22-8**

11. **SLIDE 11 EXPLAIN** Figure 22-9 wrench symbol warning lamp on Ford. Symbol can also be green.
12. **SLIDE 12 EXPLAIN** Figure 22-10 symbol used on a Chrysler vehicle indicating fault with electronic throttle control.

**DISCUSS REAL WORLD FIX**




13. **SLIDE 3 EXPLAIN** FIGURE 22–11 The throttle plate stayed where it was moved, which indicates that there is a problem with the electronic throttle body control assembly.
14. **SLIDE 14 EXPLAIN** FIGURE 21–12 A corroded electronic throttle control assembly shown with the cover removed.

**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 22-9 & 10**

**EXPLAIN WARNING**

15. **SLIDE 15 EXPLAIN** FIGURE 22–13 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: HAVE STUDENTS DISCUSS VACUUM LEAKS AND HOW THEY AFFECT AN ENGINE. CAN ETC COMPENSATE FOR LEAKS AT ANY OTHER ENGINE SPEED BESIDES IDLE?**

ICONS	Ch22 Electronic Throttle Control
	<p><b><u>DISCUSSION:</u></b> HAVE THE STUDENTS DISCUSS THE PROCEDURE FOR <u>CLEANING</u> 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? <b><u>FIGURE 22-11</u></b></p>
	<p><b><u>DISCUSSION:</u></b> ASK THE STUDENTS TO DISCUSS THE REASON FOR <u>REMOVING THE KEY</u> WHEN SERVICING AN ELECTRONIC THROTTLE BODY. WHY SHOULD THEY NOT SPRAY CLEANER INTO THE THROTTLE BODY ASSEMBLY?</p>
	<p><b><u>SAFETY</u></b> EXPLAIN TO THE STUDENTS THAT DC MOTOR IS STRONG ENOUGH TO <u>SEVERELY CUT OR EVEN AMPUTATE</u> A FINGER IF INSERTED INTO A THROTTLE BODY WHEN ACTUATED. <b><u>KEY SHOULD BE REMOVED BEFORE ANY SERVICE IS ATTEMPTED.</u></b></p>