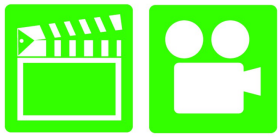
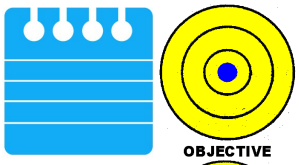
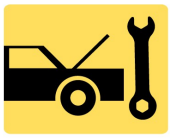
A8 Engine Performance 4th Edition

Chapter 21 Throttle Position (TP) Sensors

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 Engine Performance (A8) certification test content area "E" (Computerized Engine Controls Diagnosis and Repair). 2. Discuss how throttle position sensors work. 3. List the methods that can be used to test TP sensors. 4. Describe the symptoms of a failed TP sensor. 5. List how the operation of the TP sensor affects vehicle operation. 6. Discuss TP sensor rationality tests.
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	Ch21 Throttle Position (TP) Sensors
	**1. SLIDE 1 CH21 Throttle Position (TP) Sensors**
	**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 CH8 AEP_LO1**
	**3. SLIDE 3 EXPLAIN Figure 21-1** typical TP sensor mounted on the throttle plate of this port-injected engine. **4. SLIDES 4-5 EXPLAIN** Throttle Position Sensor Construction
	**DISCUSSION: PROVIDE THE STUDENTS WITH A WIRING DIAGRAM OF A TP CIRCUIT TO STUDY AND DISCUSS. WHAT IS THE FUNCTION OF EACH WIRE CONNECTED TO SENSOR?** **HANDS-ON TASK: HAVE STUDENTS LOCATE AND VISUALLY INSPECT A TP SENSOR FOR PROPER CONNECTION, ATTACHMENT, AND CONDITION.**
	**SOME TP SENSORS HAVE 4 WIRES. THE FOURTH WIRE IS COMMONLY A SWITCH CIRCUIT USED TO PROVIDE A SIGNAL THAT VEHICLE IS AT IDLE.**
	**SOME TP SENSORS GO BAD IN ONLY ONE SPOT—VEHICLES THAT ARE DRIVEN AT CONSTANT SPEEDS TEND TO WEAR THE TP IN ONE SPOT.**
	**ANIMATION: TP OPERATION WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A16_ANIMATION/CHAPTER55_FIG_55_11/INDEX.HTM
	**6. SLIDE 6 EXPLAIN Figure 21-2** The signal voltage from a throttle position increases as the throttle is opened because the wiper arm is closer to the 5-volt reference. At

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	idle, the resistance of the sensor winding effectively reduces the signal voltage output to the computer. 7. **SLIDES 7-8 EXPLAIN** TP Sensor Computer Input Functions
	**DISCUSSION: HAVE STUDENTS DISCUSS HOW TP SENSORS AFFECT AUTOMATIC TRANSMISSION FUNCTION. HOW COULD VARIOUS TP MALFUNCTIONS CAUSE ABNORMAL AUTOMATIC TRANSMISSION OPERATION?** **IF YOU FIND THAT TP SENSOR IS MISSING ITS VREF SIGNAL, CHECK OTHER SENSORS THAT OPERATE ON SAME VREF SIGNAL. IF OTHER SENSORS ARE ALSO MISSING THEIR VREF SIGNAL, THE PROBLEM MAY BE INSIDE THE COMPUTER.**
	
	9. **SLIDES 9-10 EXPLAIN** PCM Uses for the TP Sensor
	11. **SLIDES 11-12 EXPLAIN** Testing Throttle Position Sensor 13. **SLIDE 13 EXPLAIN Figure 21-3** A meter lead connected to a T-pin that was gently pushed along the signal wire of the TP sensor until the point of the pin touched the metal terminal inside the plastic connector. 14. **SLIDE 14 EXPLAIN Figure 21-4** typical waveform of a TP sensor signal as recorded on a DSO when the accelerator pedal was depressed with the ignition switch on (engine off). Clean transitions and the lack of any glitches in this waveform indicate a good sensor
	**DEMONSTRATION: SHOW HOW TO USE A DMM TO TEST TP SENSOR FOR PROPER OPERATION. BE SURE TO DEMONSTRATE PROPER TECHNIQUES THAT SHOULD BE USED TO PREVENT WIRE, TERMINAL, CONNECTOR DAMAGE FIGURE 21-5**
	15. **SLIDE 15 EXPLAIN FIGURE 21–5** Checking the 5-volt reference from the computer being applied to the TP sensor with the ignition switch on (engine off) 16. **SLIDE 16 EXPLAIN FIGURE 21–6** Checking voltage drop between TP sensor ground and good engine ground with ignition on (engine off). A reading of greater than 0.2 volt (200 mV) represents a bad computer ground.

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  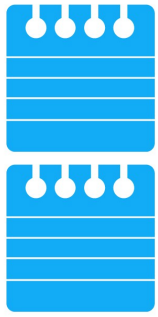 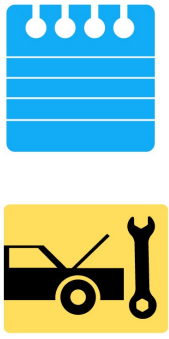    	**WHEN USING A DIGITAL VOLTMETER, BE SURE METER IS NOT AUTORANGING; OTHERWISE, WHEN THE METER SWITCHES RANGES, IT CAN EASILY BE MISTAKEN AS A GLITCH IN SENSOR.** **DEMONSTRATION: SHOW PROPER METHOD FOR ADJUSTING A TP SENSOR USING A VOLTMETER, DSO, OR SCAN TOOL** **ONLY EARLY MODEL TP SENSORS ARE ADJUSTABLE. CURRENT TP SENSORS ARE NOT ADJUSTABLE** **ON SOME OLDER VEHICLES, BASE IGNITION TIMING CANNOT BE SET UNLESS COMPUTER SEES AN IDLE SIGNAL FROM THE TP SENSOR. IT MAY BE NECESSARY TO ADJUST TP SENSOR AND/OR THROTTLE CABLE IN ORDER TO SET TIMING.** **HANDS-ON TASK: HAVE STUDENTS TEST A TP SENSOR FOR PROPER OPERATION USING A SCAN TOOL.** 17. **SLIDES 17-19 EXPLAIN** Testing Throttle Position Sensor USING DMM MIN/MAX FUNCTION 2. **SLIDE 2 EXPLAIN OBJECTIVE CH8 AEP_LO2** 3. **SLIDES 3-6 EXPLAIN** Testing TP Sensor Using a Scan Tool 2. **SLIDE 2 EXPLAIN OBJECTIVE CH8 AEP_LO3** 3. **SLIDES 3-4 EXPLAIN** TP Sensor Computer Input Functions: **REPEAT FIGURES 21-3 TO 21-6** 5. **SLIDES 5-6 EXPLAIN PCM Uses for the TP Sensor** 7. **SLIDES 7-8 EXPLAIN** Testing Throttle Position Sensor 9. **SLIDE 9 EXPLAIN Figure 21-3** meter lead connected to a T-pin that was gently pushed along the signal wire of the TP sensor until the point of the pin touched the metal terminal inside the plastic connector.

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	10. **SLIDE 10 EXPLAIN Figure 21-4** typical waveform of a TP sensor signal as recorded on a DSO when the accelerator pedal was depressed with the ignition switch on (engine off). Clean transitions and the lack of any glitches in this waveform indicate a good sensor
	11. **SLIDE 11 EXPLAIN FIGURE 21–5** Checking the 5-volt reference from the computer being applied to the TP sensor with the ignition switch on (engine off)
	12. **SLIDE 12 EXPLAIN FIGURE 21–6** Checking voltage drop between TP sensor ground and good engine ground with ignition on (engine off). A reading of greater than 0.2 volt (200 mV) represents a bad computer ground.
	**ON-VEHICLE NATEF TASK INSPECT AND TEST THROTTLE POSITION SENSOR USING A GMM)/ (DSO); PERFORM NECESSARY ACTION**
	**ON-VEHICLE NATEF TASK INSPECT & TEST PCM/ECM, ACTUATORS, & CIRCUITS USING GMM/DSO; PERFORM NECESSARY ACTION**
	2. SLIDE 2 EXPLAIN **OBJECTIVE CH8 AEP_LO4** 3. **SLIDE 3 EXPLAIN PCM Uses for the TP Sensor**