Automotive Technology 6th Edition
Chapter 77 MASS AIR FLOW SENSORS
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	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.
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 result of attending this session or class.	Explain learning objectives to students as listed below: 1. Discuss how MAF sensors work and describe the types of MAF sensors. 2. Discuss the PCM uses for the MAF sensor. 3. List the methods that can be used to test MAF sensors. 4. This chapter will help prepare for Engine Repair (A8) ASE Certification test content area "E" (Computerized Engine Controls Diagnosis and Repair).
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.

NOTE: Lesson plan is based on 6th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

DOWNLOAD Chapter 77 Chapter Images: From

http://www.jameshalderman.com/automotive_principles.html

NOTE: You can use Chapter Images or possibly Power Point files:

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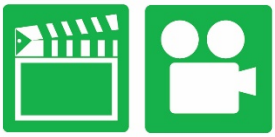
	**1. SLIDE 1 Chapter 75 Mass Air Flow Sensors** **2. SLIDE 2 EXPLAIN FIGURE 77–1** This five-wire mass air flow sensor consists of a metal foil sensing unit, an intake air temperature (IAT) sensor, and electronic module. **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **http://www.jameshalderman.com/automotive_principles.html** **DOWNLOAD** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF** **Videos**
	
	
	
	**3. SLIDE 3 EXPLAIN FIGURE 77–2** The sensing wire in a typical hot wire mass air flow sensor..
	**DEMONSTRATION: Show students a vane airflow sensor. Point out vane, &, if cover is removed, link to potentiometer**
	**DISCUSSION: Have the students discuss vane airflow sensor and how it works. What might happen if the sensor didn't have a dampening chamber designed into it?**
	**DISCUSS CASE STUDY: *Dirty MAF Sensor Story*** **The owner of a Buick Park Avenue equipped with a 3,800 V-6 engine complained that engine would hesitate during acceleration, showed lack of power, and seemed to surge or miss at times. A visual inspection found everything to be like new, including a new air filter. There were no DTCs. A look at scan data showed airflow to be within recommended 3 to 7 grams per second. A check of the frequency output showed the problem. Idle frequency · 2.177 kHz (2,177 Hz) Normal frequency at idle speed**

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  	**should be 2.37 to 2.52 kHz. Cleaning the hot wire of the MAF sensor restored proper operation. The sensor wire was covered with what looked like fine fibers, possibly from replacement air filter.** **Summary:** • **Complaint—Customer stated that the engine hesitated when accelerating.** • **Cause—Tests confirmed that MAF sensor was operating correctly, but the frequency output at idle was not within normal range.** • **Correction—Cleaning the MAF sensor restored proper operation of the sensor and the engine now accelerates normally** **DISCUSS CHART 77-1 Chart showing the amount of air entering the engine in grams per second compared to the sensor output voltage.** **DISCUSSION: Have the students talk about the difference in voltage readings and grams per second listed in the Chart 77-1. Why should OEM specifications always be used in diagnosing mass air flow sensors?** **DISCUSS FREQUENTLY ASKED QUESTION:** ***What Is Meant by a "High-Authority Sensor"?*** **A high-authority sensor is a sensor that has a major influence over the amount of fuel being delivered to the engine. For example, at engine start-up, the engine coolant temperature (ECT) sensor is a high-authority sensor and oxygen sensor (O2S) is a low-authority sensor. However, as the engine reaches operating temperature, oxygen sensor becomes a high-authority sensor and can greatly affect the amount of fuel being supplied to engine. reaches closed-loop operation)**

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	4. **SLIDE 4 EXPLAIN FIGURE 77–3** Karman Vortex air flow sensor uses a triangle-shaped rod to create vortexes as air flows through sensor. The electronics in sensor itself converts these vortexes to a digital square wave signal.
	**DISCUSSION: Have the students talk about Karman Vortex Sensors. What is design factor that makes them operate? Discuss ultrasonic and the pressure-type Karman Vortex sensors. What is the difference in their operation? What is similar in their operation? FIGURE 77-3**
	**DISCUSS FREQUENTLY ASKED QUESTION: What Is False Air? Airflow sensors and mass airflow (MAF) sensors are designed to measure all the air entering engine. If an air inlet hose was loose or had a hole, extra air could enter engine without being measured. This extra air is often called false air. • SEE FIGURE 77–4. NOTE: If the engine runs well in reverse, yet runs terrible in any forward gear, carefully look at inlet hose for air leaks that open when engine torque moves the engine slightly on its mounts.**
	5. **SLIDE 5 EXPLAIN FIGURE 77–4** Carefully check hose between MAF sensor and throttle plate for cracks or splits that could create extra (false) air into engine that is not measured by MAF sensor.
	**DEMONSTRATION: Show examples of hot-film sensors. Discuss how thermistor is used to measure air temperature. Then show students a hot-wire sensor. Discuss purpose of burn-off circuit.**
	**DISCUSSION: Have the students talk about types of mass airflow sensors. How are hot-film and hot-wire sensors similar? Are there differences?**
	**DISCUSSION: Have the students discuss the resistance of the hot wire. Does it stay the same or change as air moves over it?**
	6. **SLIDE 6 EXPLAIN FIGURE 77–5** scope display showing a normal Chevrolet Equinox MAF sensor at idle speed. the frequency is 2,600 Hertz (2.6kHz).

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	**Electronic parts, sensor wires, & thermistors are very sensitive to impact and probing. Be careful not to drop these parts or probe them with screwdrivers or other tools.**
	**DISCUSSION: Have students discuss high-authority & low-authority sensors. Can same sensor be both high and low? Have students explain their responses.**
	**Cracked or loose air inlet tube, or snorkel, can admit unmetered (false) air & cause driveability problems. PCM calculates fuel injector pulse width based on mass air flow reading. Any leaks will give false readings.**
	**DISCUSSION: Have the students talk about different ways of testing MAFs. Is a tap test result always accurate?**
	**DISCUSSION: Have the students discuss MAF sensor contamination. Is it possible to clean a contaminated MAF sensor?**
	**EXPLAIN TECH TIP: *The Unplug It Test:* If a sensor is defective, yet produces a signal to the computer, computer often accepts the reading and makes required changes in fuel delivery and spark advance. If, however, sensor is not reading correctly, the computer processes this wrong information and performs an action, assuming that information being supplied is accurate. "If in doubt, take it out." If engine operates better with a sensor unplugged, then suspect that the sensor is defective. A sensor that is not supplying correct information is said to be skewed. The computer does not set a DTC this condition because computer can often not detect that sensor is supplying wrong information.**
	**DEMONSTRATION: Show data stream readings on a properly operating MAF sensor.**

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  	**HANDS-ON TASK:** Using a scan tool have the students access the **MAF sensor DATA STREAM**. **ON-VEHICLE ASEEDUCATION TASK:** Inspect and test **MAF Sensor** using a GMM)/(DSO); perform necessary action.