Advanced Engine Performance Diagnosis 6/E

Chapter 18 Mass Air Flow (MAF) Sensors

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references.
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. Describe the purpose and function of mass airflow (MAF) sensors. 2. List the methods that can be used to test MAF sensors. 3. Discuss the symptoms of a failed MAF sensor.
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: This lesson plan is based on Advanced Engine Performance Diagnosis 6/E Chapter Images found on Jim's web site @ www.jameshalderman.com
LINK CHP 18: Chapter Images

ICONS	Ch18 Mass Air Flow (MAF) Sensors
	**1. SLIDE 1 CH18 Mass Air Flow (MAF) Sensors**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE REGULARLY UPDATED** **Engine Controls (284 Links)**
	
	**At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)**
	
	**2. SLIDE 2 EXPLAIN Figure 18-1** A vane air flow (VAF) sensor.
	3. SLIDE 3 EXPLAIN Figure 18-2 typical air vane sensor with the cover removed. The movable arm contacts a carbon resistance path as the vane opens. Many air vane sensors also have contacts that close to supply voltage to the electric fuel pump as the air vane starts to open when engine is being cranked and air is being drawn into engine
	**DEMONSTRATION: SHOW STUDENTS A VANE AIRFLOW SENSOR. POINT OUT VANE, &, IF COVER IS REMOVED, LINK TO POTENTIOMETER** **FIGURE 18-1 & 2**
	**DISCUSS FREQUENTLY ASKED QUESTION**
	**DISCUSSION: DISCUSS VANE AIRFLOW SENSOR AND HOW IT WORKS. WHAT MIGHT HAPPEN IF THE SENSOR DIDN'T HAVE A DAMPENING CHAMBER DESIGNED INTO IT? FIGURE 18-1 & 2**

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	4. **SLIDE 4 EXPLAIN Figure 18-3** 5-wire mass air flow sensor consists of a metal foil sensing unit, an intake air temperature (IAT) sensor, & electronic module. 5. **SLIDE 5 EXPLAIN Figure 18-4** The sensing wire in a typical hot wire mass air flow sensor.
	**DEMONSTRATION: SHOW EXAMPLES OF HOT-FILM SENSORS. DISCUSS HOW THERMISTOR IS USED TO MEASURE AIR TEMPERATURE. THEN SHOW A HOT-WIRE SENSOR. DISCUSS PURPOSE OF BURN-OFF CIRCUIT. FIGURES 18-3 & 4**
	**DISCUSSION: DISCUSS TYPES OF MASS AIRFLOW SENSORS. HOW ARE HOT-FILM AND HOT-WIRE SENSORS SIMILAR? ARE THERE DIFFERENCES? FIGURES 18-3 & 4**
	**DISCUSSION: DISCUSS THE RESISTANCE OF THE HOT WIRE. DOES IT STAY THE SAME OR CHANGE AS AIR MOVES OVER IT? FIGURE 18-4**
	6. **SLIDE 6 EXPLAIN Figure 18-5** A Karman Vortex air flow sensor uses a triangle-shaped rod to create vortexes as the air flows through the sensor. The electronics in the sensor itself converts these vortexes to a digital square wave signal
	**DISCUSS REAL WORLD FIX PAGE 245**
	**DISCUSS FREQUENTLY ASKED QUESTION**
	**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 18-5**
	**ELECTRONIC PARTS, SENSOR WIRES, & THERMISTORS ARE SENSITIVE TO PROBING. BE CAREFUL NOT TO DROP THESE PARTS OR PROBE THEM WITH SCREWDRIVERS OR OTHER TOOLS.**

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	**DISCUSSION: HAVE STUDENTS DISCUSS HIGH-AUTHORITY & LOW-AUTHORITY SENSORS. CAN SAME SENSOR BE BOTH HIGH AND LOW? HAVE STUDENTS EXPLAIN THEIR RESPONSES.**
	7. **SLIDE 7 EXPLAIN Figure 18-6** Carefully check the hose between MAF sensor and the throttle body assembly for cracks or splits that could create extra (false) air into engine that is not measured by MAF
	**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. FIGURE 18-6**
	**DISCUSS FREQUENTLY ASKED QUESTION**
	**EXPLAIN TECH-TIP ON PAGE 247**
	**DISCUSS REAL WORLD FIX PAGE 248**
	**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?**
	**DEMONSTRATION: SHOW DATA STREAM READINGS ON A PROPERLY OPERATING MAF SENSOR.**
	**HANDS-ON TASK: USING A SCAN TOOL HAVE THE STUDENTS ACCESS THE MAF SENSOR DATA STREAM.**

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	ON-VEHICLE NATEF TASK: INSPECT AND TEST MAF SENSOR USING A GMM)/(DSO); PERFORM NECESSARY ACTION (P-1) PAGE 241