Automotive Technology 6th Edition
Chapter 76 MAP/BARO 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 a result of attending this session or class.	Explain learning objectives to students as listed below: 1. Discuss the variations in pressure that can occur within an engine. 2. Discuss how MAP sensors work. 3. Discuss the PCM uses for the MAP sensor. 4. Describe how the BARO sensor is used to test altitude. 5. List the methods for testing MAP sensors and describe the symptoms of a failed MAP sensor. 6. 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

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

ICONS	Chapter 76 MAP/BARO Sensors

1. SLIDE 1 Chapter 74 MAP/BARO Sensors

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DISCUSS FREQUENTLY ASKED QUESTION:

2. **SLIDE 2** EXPLAIN **FIGURE 76–1** (a) As an engine is accelerated under a load, the engine vacuum drops. This drop in vacuum is actually an increase in absolute pressure in the intake manifold. A MAP sensor senses all pressures greater than that of a perfect vacuum. (b) The relationship between absolute pressure, vacuum, and gauge pressure.

DISCUSSION: Have the students discuss intake manifold pressure. How and why does throttle angle affect intake manifold vacuum? Discuss the difference between PSIG & PSIA. How is a perfect vacuum indicated in gauge pressure? How is atmospheric pressure, or barometric pressure, indicated in absolute pressure? FIGURE 76-1

DISCUSSION: Have the students discuss the difference between MAP, BARO, & BMAP sensors. Is there any advantage to using separate MAP & BARO sensors?

3. **SLIDE 3** EXPLAIN **FIGURE 76–2** MAP sensor compares the absolute pressure in the intake manifold to a perfect vacuum. The deflection of the silicon chip is converted to a an absolute pressure reading by the electronics in the sensor itself.

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DEMONSTRATION: Show what a **MAP** sensor looks like and discuss where it can be found on most vehicles.

DISCUSSION: Have the students compare and contrast different types of pressure sensors (silicon diaphragm, capacitor capsule, & ceramic disc). Which is most commonly used design for a MAP sensor?

4. **SLIDE 4 EXPLAIN FIGURE 76–3** A typical MAP sensor installed in the intake manifold.

DISCUSSION: Have the students discuss frequency. What is frequency? How is it measured?

HANDS-ON TASK: Have the students use a DMM to monitor MAP sensor frequency.
FIGURE 76-3

5. **SLIDE 5 EXPLAIN FIGURE 76–4** Shown is the electronic circuit inside a ceramic disc MAP sensor used on many Chrysler engines. The black areas are carbon resistors that are applied to the ceramic, and lasers are used to cut lines into these resistors during testing to achieve proper operating calibration.

DUSCUSS CHARTS 76-1 & 76-2

EXPLAIN TECH TIP: ***If It's Green, It's a Signal Wire***
Ford-built vehicles usually use a green wire as the signal wire back to computer from sensors. It may not be a solid green, but if there is green somewhere on the wire, then it is signal wire. The other wires are the power and ground wires to the sensor.

DEMONSTRATION: Show the students how to use a DSO to monitor MAP sensor frequency. Show them how frequency changes with changes in engine load.

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6. **SLIDE 6 EXPLAIN FIGURE 76–5** Altitude affects the MAP sensor voltage.

EXPLAIN TECH TIP: *Use the MAP Sensor as a Vacuum Gauge:* MAP sensor measures pressure inside intake manifold compared with absolute zero (perfect vacuum). For example, an idling engine that has 20 inches of mercury (inch Hg) of vacuum has a lower pressure inside intake manifold than when engine is under a load and vacuum is at 10 inch Hg. A decrease in engine vacuum results in an increase in manifold pressure. A normal engine should produce between 17 and 21 inch Hg at idle. Comparing vacuum reading with voltage reading output of MAP sensor indicates that reading should be between 1.62 and 0.88 volt. Therefore, a DMM, scan tool, or scope can be used to measure MAP sensor voltage and be used instead of a vacuum gauge.

NOTE: This chart was developed by testing a MAP sensor at a location about 600 feet above sea level. For best results, a chart based on your altitude should be made by applying a known vacuum, and reading the voltage of a known-good MAP sensor. Vacuum usually drops about 1 inch per 1,000 feet of altitude.

DISCUSSION: Have students discuss EGR system operation. How could a leaking EGR pintle affect MAP sensor readings?

DUSCUSS CHARTS 76-3 & 76-4

7. **SLIDE 7 EXPLAIN FIGURE 76–6** When checking a MAP sensor, first verify that sensor is receiving a 5-volt reference voltage then check for output (signal) voltage.

DISCUSS CASE STUDY: *Case Of No Start Lexus*
The owner of a Lexus IS250 had the car towed to a shop as a no-start. The technician

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	discovered that "check engine" light would not come on even with key on, engine off (KOEO). A scan tool would not communicate either. Checking the resources on www.iatn.net, technician read of a similar case where fuel pressure sensor was shorted which disabled all serial data communications. The technician disconnected fuel pressure sensor located on the backside of engine and communications were restored and engine started. Fuel pressure senor is similar in construction to a MAP/BARO sensor where it uses a five volt reference voltage from PCM and a signal plus a ground. It was apparently five volt reference that was shorted to ground that caused fault to occur. The fuel pressure sensor was replaced the returned to happy owner.
	Summary: • Complaint—vehicle owner stated that the engine would not start. • Cause—shorted fuel pressure sensor was found as per a previous similar case. • Correction—fuel pressure sensor was replaced and this corrected the serial data fault that caused no-start condition
QUESTION	**DISCUSSION:** Have the students discuss how intake manifold vacuum leaks affect MAP sensor readings. How might this problem impact fuel economy and emissions?
	Older GM products that used MAP & BARO sensors used different color connectors to help technicians tell one sensor from other.
QUESTION	**DISCUSSION:** Have the students discuss what a BARO sensor detects. How does a reduction in barometric pressure affect engine operation?

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	HANDS-ON TASK: **Have the students use a scan tool to monitor MAP sensor operation.**
	8. **SLIDE 8** **EXPLAIN** Figure 76-7 hand-operated vacuum pump
	EXPLAIN TECH TIP: ***Visual Check of the MAP Sensor TROUBLE CODES*** **A defective vacuum hose to a MAP sensor can cause a variety of driveability problems, including poor fuel economy, hesitation, stalling, and rough idle. A small air leak (vacuum leak) around the sensor can cause these symptoms and often sets a trouble code in the vehicle computer. When checking the MAP sensor, if anything comes out of the sensor itself, it should be replaced. This includes water, gasoline, or any other substance.**
	DEMONSTRATION: **Use a vacuum pump hooked up to MAP sensor & scan tool to show students how changes in engine load (manifold vacuum) affect pulse width (air-fuel mixture).** **FIGURE 76-7**
	DISCUSSION: **Have the students discuss how increases and decreases in fuel rail pressure affect injector pulse width. Why does this happen?**
	ON-VEHICLE TASK: **Inspect and test** **MAP Sensor** **using a GMM)/(DSO); perform necessary action.**