

# Automotive Technology 5<sup>th</sup> Edition

## Chapter 82 Vehicle Emission Standards & Testing

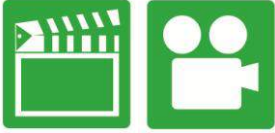
### Opening Your Class

KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	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.
<b>Motivate Learners</b>	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.
<b>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.</b>	Explain learning objectives to students as listed below: <ol style="list-style-type: none"> <li>1. Discuss emissions standards.</li> <li>2. Explain exhaust analysis testing procedures.</li> <li>3. Identify the reasons for excessive emissions of HC, CO, and NOx.</li> </ol>
<b>Establish the Mood or Climate</b>	Provide a <i><b>WELCOME</b></i> , Avoid put downs and bad jokes.
<b>Complete Essentials</b>	Restrooms, breaks, registration, tests, etc.
<b>Clarify and Establish Knowledge Base</b>	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 the 5<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 82: [ATE5 Chapter Images](#)**

## ICONS



## Ch82 Vehicle Emission Standards & Testing

### 1. SLIDE 1 CH82 VEHICLE EMISSION STANDARDS & TESTING

Check for ADDITIONAL VIDEOS & ANIMATIONS @  
<http://www.jameshalderman.com/>  
WEB SITE IS CONSTANTLY UPDATED

### Videos

2. SLIDE 2 EXPLAIN Figure 82-1 underhood decal showing that this Lexus RX-330 meets both national (Tier 2; BIN 5) and California LEV-II (ULEV) regulation standards.

**DISCUSSION:** Have the students talk about emissions. What are their impressions of emissions standards?

3. SLIDE 3 EXPLAIN Figure 82-2 label on a Toyota Camry hybrid shows the relative smog-producing emissions, but this does not include carbon dioxide (CO<sub>2</sub>), which may increase global warming.

**DISCUSSION:** Have the students talk about federal emissions standards. Explain that **Emission Control Systems (ECS) label** is under the hood of every vehicle produced for sale in the US & includes information about emissions systems installed when it was manufactured. What does higher tier number mean? **FIGURE 82-1 & 2** If a vehicle is damaged in a collision, the ECS label may not have been replaced during body repairs. If label is missing, the VIN must be used to determine year. A replacement ECS label can be obtained from dealer using the VIN.

**DISCUSSION:** Have the students discuss **3 main pollutants** for which vehicles are tested. How are the main pollutants produced? **CHART 82-1 & 2**

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**DISCUSSION:** discuss hydrocarbons, carbon monoxide, & oxides of Nitrogen. What are acceptable levels of each pollutant? What are units of measurement for properly tuned and running engine? What is meant by air pollution score (BIN)? **CHARTS 82-1 & 2**

**DISCUSSION:** Briefly review and discuss the role of catalytic converters in oxidizing hydrogen and carbon while reducing oxides of nitrogen. Why would a vehicle with a catalytic converter that is not functioning fail an emissions test?

4. **SLIDE 4 EXPLAIN** Figure 82-3 Photo of a sign taken at an emissions test facility.
5. **SLIDE 5 EXPLAIN** Figure 82-4 A vehicle being tested during an enhanced emission test.

**DISCUSSION:** Discuss differences between testing vehicle's emissions at different idle speeds vs. load test on dynamometer. How do emissions change as vehicle load increases? Discuss term loaded-mode testing. Students should understand that loaded mode testing requires vehicle to be **ON dynamometer**. How does dynamometer simulate real-world driving conditions in a testing environment?

### **FIGURES 82-3 & 4**

6. **SLIDE 6 EXPLAIN** Figure 82-5 Trace showing Inspection/Maintenance 240 test. Test duplicates an urban test loop around Los Angeles, California. First "hump" in curve represents vehicle being accelerated to about 20 mph, then driving up a small hill to about 30 mph and coming to a stop at 94 seconds. Then, the vehicle accelerates while climbing a hill and speeding up to about 50 mph during this second phase of the test.

**DISCUSSION:** discuss abbreviations **HC, CO, and NO<sub>x</sub>** and what these compounds are. How are **HC, CO & NO<sub>x</sub>** formed in the combustion chamber?

**DEMONSTRATION:** Using **5-GAS exhaust analyzer**, measure **HC, CO, and NO<sub>x</sub>** emissions on a vehicle simulating a two-speed idle test. Use the same vehicle and measure again, performing an ASM test to show students difference in emissions.

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**DISCUSSION:** Have the students discuss how and why emissions such as  $\text{NO}_x$  increase during **ASM** test compared to **TSI** tests. Why does  $\text{NO}_x$  increase as a result of a loaded engine? **FIGURE 82-5**

7. **SLIDE 7 EXPLAIN** Figure 82-6 A partial stream sampling exhaust probe being used to measure exhaust gases in parts per million (PPM) or percent (%).

**DEMONSTRATION:** While performing an emissions test, disconnect spark plug wire for short time. Show the students the increase emissions caused by misfiring cylinder. **FIGURE 82-6**

**DEMONSTRATION:** Disconnect fuel pressure regulator vacuum hose or ECT sensor to show how carbon monoxide (CO) readings can be increased during an emissions test. **FIGURE 82-6**

**DEMONSTRATION:** Demonstrate **USING** an **INFRARED THERMOMETER** what happens to the temperature of catalytic converter when a misfire or rich mixture is created. **FIGURE 82-6**

**DEMONSTRATION:** **Before- and after converter Emission readings** can be obtained by removing oxygen sensor and inserting 5-GAS analyzer probe into the sensor boss. Leave sensor connected while operating the engine and quickly record readings. Remove analyzer and insert it into the tailpipe after converter to illustrate operation of catalytic converter. **FIGURE 82-6**

8. **SLIDE 8 EXPLAIN** Figure 82-7 Exhaust emissions are very complex. When air-fuel mixture becomes richer, some exhaust emissions are reduced, while others increase.

**DISCUSSION:** Discuss the differences between **rich & lean exhaust**. What indicates that engine is operating correctly? **FIGURE 82-7**

**HANDS-ON TASK:** Prepare a vehicle to fail emissions test. Close electrodes on a spark plug. Students operate vehicle for an ASM emissions test. Ask students to explain failure and list causes for the high emissions. Grade them on their ability to identify ignition problems as cause of high HC

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**DEMONSTRATION:** Simulate a lean condition while analyzing a vehicle's emissions by disconnecting one or two injectors. Show drop in carbon monoxide and increase in oxygen.

**DISCUSSION:** Have the students talk about the emission readings of the vehicle in previous DEMO. Why is increase in oxygen & corresponding decrease in carbon monoxide a result of lean condition?

**DISCUSSION:** Have the students discuss how an exhaust leak can cause a false lean condition. How are low pressure pulses in exhaust system caused by the 4-stroke cycle drawing outside air past the oxygen sensor? **FIGURE 82-8**

**ON-VEHICLE NATEF TASK:** Prepare 4 or 5 Gas Analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action. **Page 256**

**DEMONSTRATION:** Advance ignition timing and/or disconnect EGR system on a vehicle prior to conducting an ASM emissions test. **Show students increase in NO<sub>x</sub>.**

**DISCUSSION:** Have the students talk about the increase in NO<sub>x</sub> in previous DEMONSTRATION. What are the potential causes?

**HANDS-ON TASK:** Have Students correct the condition that caused increase in NO<sub>x</sub> in vehicle used in demonstration & retest vehicle to see changes.

**Crossword Puzzle (Microsoft Word) (PDF)**  
**Word Search Puzzle (Microsoft Word) (PDF)**