

# Course Outline

**Transportation**

**REVISED: August/2020**

**Job Title**

Automotive Technician

**Career Pathway:**

Systems Diagnostics and Service

**Industry Sector:**

Transportation

**O\*NET-SOC CODE:**

40-3023.02

**CBEDS Title:**

Automotive Specialty, Other Combinations

**CBEDS No.:**

5688

**79-60-70**

**Automotive Technician: Exhaust Emissions - 20-Hour Smog Licensing (Upgrade)**

**Credits: 0**

**Hours: 20**

**Course Description:**

This competency-based course meets the requirements for the BAR 20-Hour Update #1 for currently employed and licensed California State Smog Technicians. Instruction includes an introduction to ASM testing and diagnosis; oscilloscope testing and waveform pattern diagnosis; lab scope operation and analysis of fuel control sensors; use of the scan tool, DVOM, and lab scope; and different types of tests that can be used to determine the efficiency of the catalytic converter. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

**Prerequisites:**

Enrollment requires a California Smog Technician license, an 8.0 reading level as measured by the TABE D 9/10 and math skills equivalent to Math 2 (53-03-76).

**NOTE:** For Perkins purposes this course has been designated as a **capstone** course.

Students who successfully complete this course and pass the final examination will receive a certificate of completion. Students may bring in their smog application renewal to be stamped, verifying course completion.

This course can be repeated once a student receives a Certificate of Completion.



## **COURSE OUTLINE COMPETENCY-BASED COMPONENTS**

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

### **COURSE OUTLINE COMPONENTS**

### **LOCATION**

#### **GOALS AND PURPOSES**

Cover

The educational goals or purposes of every course are clearly stated, and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course and are written to be understandable by a prospective student.

#### **PERFORMANCE OBJECTIVES OR COMPETENCIES**

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Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and in competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction, and assessment in competency-based education are explicit, known, agreed upon, integrated, performance oriented, and adaptive.

**COURSE OUTLINE COMPETENCY-BASED COMPONENTS**  
**(continued)**

**COURSE OUTLINE COMPONENTS**

**LOCATION**

**INSTRUCTIONAL STRATEGIES**

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Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.

Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.

**UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT**

Cover

The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.

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Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.

**EVALUATION PROCEDURES**

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The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.

Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.

**REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT**

Cover

After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.

## ***ACKNOWLEDGMENTS***

Thanks to LUZ GRANADOS for developing and editing this curriculum. Acknowledgment is also given to ERICA ROSARIO for designing the original artwork for the course covers.

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# **CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS**

## ***Transportation Industry Sector Knowledge and Performance Anchor Standards***

### **1.0 Academics**

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Transportation academic alignment matrix for identification of standards.

### **2.0 Communications**

Acquire and accurately use Transportation sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

### **3.0 Career Planning and Management**

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

### **4.0 Technology**

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Transportation sector workplace environment.

### **5.0 Problem Solving and Critical Thinking**

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Transportation sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

### **6.0 Health and Safety**

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Transportation sector workplace environment.

### **7.0 Responsibility and Flexibility**

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Transportation sector workplace environment and community settings.

### **8.0 Ethics and Legal Responsibilities**

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

### **9.0 Leadership and Teamwork**

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization

### **10.0 Technical Knowledge and Skills**

Apply essential technical knowledge and skills common to all pathways in the Transportation sector, following procedures when carrying out experiments or performing technical tasks.

### **11.0 Demonstration and Application**

Demonstrate and apply the knowledge and skills contained in the Transportation anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

## ***Transportation Pathway Standards***

### **C. Systems Diagnostics and Service Pathway**

The Systems Diagnostics and Service pathway prepares students for postsecondary education and employment in the transportation industry, which includes but is not limited to motor vehicles, rail systems, marine applications, and small-engine and specialty equipment.

Sample occupations associated with this pathway:

- ◆ Service Technician/Maintenance Worker/Shop Foreman
- ◆ Technical Writer
- ◆ Dispatcher
- ◆ Engineer
- ◆ Investigator/Inspector

- C1.0 Demonstrate the practice of personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.
- C2.0 Practice the safe and appropriate use of tools, equipment, and work processes.
- C3.0 Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.
- C4.0 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.
- C5.0 Apply and understand appropriate business practices.
- C6.0 Demonstrate the application, operation, maintenance, and diagnosis of engines, including but not limited to two- and four-stroke and supporting subsystems.
- C7.0 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.
- C8.0 Demonstrate the function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with national industry standards.
- of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with portable national industry standards, such as the National Automotive Technicians Education Foundation.

**CBE**  
**Competency-Based Education**

**COMPETENCY-BASED COMPONENTS**

***for the Automotive Technician: Exhaust Emissions – 20-Hour Smog Licensing (Upgrade) Course***

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. ORIENTATION AND SAFETY</p> <p>Understand class procedures, recognize safety rules, and course requirements.</p> <p>(1 hour)</p>	<ol style="list-style-type: none"> <li>1. Describe class expectations.</li> <li>2. Describe class procedures and policies with regards to:               <ol style="list-style-type: none"> <li>a. attendance</li> <li>b. class participation</li> <li>c. requirements to earn certificate of completion/competency.</li> </ol> </li> <li>3. Describe benefits of updating and continuing Smog Technician Certification.</li> <li>4. Identify standard shop procedures and dynamometer safety.</li> <li>5. Describe shop safety rules and regulations.</li> <li>6. Pass the safety exam with 100% accuracy.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 5, 6, 7, 8, 12</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3 Career Planning and Management: 3.4 Health and Safety: 6.3, 6.5, 6.6, 6.7 Responsibility and Flexibility: 7.4, 7.7 Ethics and Legal Responsibilities: 8.4, 8.5</p> <p><b>CTE Pathways:</b> C1.3, C1.4</p>
<p>B. EMISSIONS FAILURES TESTING AND DIAGNOSTICS</p> <p>Understand Accelerated Simulation Mode (ASM) test procedures and differences between ASM testing and Bureau of Automotive Repair (BAR) 97 testing.</p>	<ol style="list-style-type: none"> <li>1. Describe the difference between a BAR 97, an ASM test and an Inspection/Maintenance (I/M) 240 test.</li> <li>2. Describe the procedure changes when performing a BAR 97 vs. an ASM Diagnostic Smog.</li> <li>3. Describe the procedures to pre-condition the vehicle.</li> <li>4. Describe an ASM failure diagnosis.</li> <li>5. Describe a diagnostic routine for identifying the root cause of a problem.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 5, 7, 8, 12</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3 Problem Solving and Critical Thinking: 5.1, 5.3 Ethics and Legal Responsibilities: 8.1, 8.2 Technical Knowledge and Skills: 10.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(2 Hours)		<b>CTE Pathways:</b> C2.1, C2.6, C6.4
<p>C. OSCILLOSCOPE TESTING AND WAVEFORM PATTERN DIAGNOSIS</p> <p>Understand how to use an oscilloscope to test and analyze computerized circuits and devices that might fail and cause an ASM emissions test failure.</p> <p>(5 Hours)</p>	<ol style="list-style-type: none"> <li>1. Describe and demonstrate the following: <ol style="list-style-type: none"> <li>a. use of a lab scope</li> <li>b. scales</li> <li>c. buttons</li> <li>d. scope screen</li> <li>e. operation of a lab scope</li> </ol> </li> <li>2. Demonstrate the lab scope testing of the five different types of sensors used on the automotive system: <ol style="list-style-type: none"> <li>a. frequency sensors</li> <li>b. variable reductor sensors</li> <li>c. digital sensors</li> <li>d. linear signals</li> <li>e. alternating current (AC) sensors.</li> </ol> </li> <li>3. Describe the different scales used on a lab scope.</li> <li>4. Demonstrate how to use the capture of snapshot feature of a digital lab scope, if possible, download a pattern into a computer.</li> <li>5. Describe how to analyze a waveform pattern.</li> <li>6. Describe different examples of failed sensors and how to analyze the fault in the waveform pattern.</li> <li>7. Demonstrate how different sensor failures show up on a lab scope pattern.</li> <li>8. Demonstrate a failure of sensors which resulted in a failure during an emissions test.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 4, 5, 7, 8, 12</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3 Technology: 4.4 Health and Safety: 6.6, 6.7 Responsibility and Flexibility: 7.5 Ethics and Legal Responsibilities: 8.1, 8.2 Ethics and Legal Responsibilities: 10.1 Demonstration and Application: 11.1</p> <p><b>CTE Pathways:</b> C2.1, C3.7, C6.3, C6.4</p>
<p>D. LAB SCOPE OPERATION AND ANALYSIS OF FUEL CONTROL SENSORS</p> <p>Understand how to test computerized circuits and devices.</p>	<ol style="list-style-type: none"> <li>1. Describe each of the five gasses and the emissions system that affects them.</li> <li>2. Describe the logic behind the computerized system diagnostic chart flow.</li> <li>3. Describe HC causes and diagnosis.</li> <li>4. Describe CO causes and diagnosis.</li> <li>5. Describe CO<sub>2</sub> causes and diagnosis.</li> <li>6. Describe O<sub>2</sub> causes and diagnosis.</li> <li>7. Describe NO<sub>x</sub> formation causes and diagnosis.</li> <li>8. Demonstrate how different system failures show up on a 5-gas.</li> <li>9. Demonstrate a failure of an emission system that raises HC and CO levels.</li> <li>10. Demonstrate NO<sub>x</sub> failures and what systems would fail causing high NO<sub>x</sub> readings.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 4, 5, 7, 8, 12</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3 Technology: 4.3 Problem Solving and Critical Thinking: 5.1 Ethics and Legal Responsibilities: 8.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)		Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.1  <b>CTE Pathways:</b> C2.1, C3.7, C6.3, C6.4
E. DIAGNOSING WITH TODAY'S TOOLS: THE SCAN TOOL, DVOM AND LAB SCOPE  Understand how to use a scan tool for computerized engine and control diagnosis. Understand the role of the scan tool and compare and contrast the differences between sensor diagnosis with a lab scope and a scan tool that is a filtered signal.	<ol style="list-style-type: none"> <li>1. Describe using a scan tool for codes and data analysis.</li> <li>2. Describe and demonstrate monitoring different signals with a scan tool and a lab scope. If possible, demonstrate the scan tool-graphing feature.</li> <li>3. Demonstrate the use of a DVOM in finding sensor faults including min/max, frequency, duty cycle and dwell.</li> <li>4. Demonstrate the use of scan tool to monitor computer inputs, outputs, and commands.</li> <li>5. Describe the effect of sensor failures on ASM testing.</li> </ol>	<b>Career Ready Practice:</b> 1, 2, 4, 5, 7, 8, 12  <b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3 Technology: 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.6 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.1  <b>CTE Pathways:</b> C2.1, C3.7, C6.3, C6.4
(3 Hours)		

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>F. CATALYTIC CONVERTER INSPECTION AND TESTING</p> <p>Understand the different types of tests that can be used to determine the efficiency of the catalytic converter.</p> <p>(3 Hours)</p>	<ol style="list-style-type: none"> <li>1. Explain catalytic converter system operation.</li> <li>2. Review the following: <ol style="list-style-type: none"> <li>a. closed loop fuel control</li> <li>b. integrator/block learn</li> <li>c. short term fuel trim analysis</li> <li>d. long term fuel trim analysis</li> </ol> </li> <li>3. Explain troubleshooting differences between closed loop-operation, open-loop operation, and limp-in fuel control.</li> <li>4. Demonstrate the temperature test of a catalytic converter.</li> <li>5. Demonstrate the propane enrichment test of the catalytic converter.</li> <li>6. Demonstrate the snap acceleration oxygen storage test on a catalytic converter.</li> <li>7. Demonstrate the analysis of a catalytic converter with a front and rear oxygen sensor.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 4, 5, 7, 8, 12</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3 Technology: 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.6 Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.1</p> <p><b>CTE Pathways:</b> C1.3, C2.1, C3.7, C5.6, 6.3, 6.4</p>
<p>G. FINAL EXAMINATION</p> <p>Complete final examination</p>	<ol style="list-style-type: none"> <li>1. Identify the parts and contents of a BAR's diagnostic flowchart worksheet.</li> <li>2. Describe and demonstrate the proper documentation of diagnostic information gathered using BAR's diagnostic flowchart worksheet.</li> <li>3. Describe and demonstrate the evaluation techniques for collected test data.</li> <li>4. Pass Bureau Automotive Repair (B.A.R) Final Exam</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 5, 7, 8, 12</p> <p><b>CTE Anchor:</b> Communications: 2.4 Career Planning and Management: 3.4 Problem Solving and Critical Thinking: 5.2, 5.3, 5.4 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1, 10.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(1 Hour)		<b>CTE Pathways:</b> C1.1, C1.3, C1.5

## ***SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES***

### **TEXTBOOKS**

Bureau of Automotive Repair. Clean Air Car Course Student Materials Set. Bureau of Automotive Repair, 2008.

Duffy, James E. Modern Automotive Technology, 7<sup>th</sup> Edition. Goodheart-Willcox Publishing, 2009.

Halderman, James D. and James Linder. Automotive Fuel and Emissions Control Systems. Prentice Hall, October 2008.

Horngren, Charles T. NATEF Correlated Task Sheets to Accompany Automotive Fuel and Emissions Control Systems. Prentice Hall Professional Technical Reference, November 2008.

Tomita, A. Emissions reduction: NOx/Sox Suppression. Elsevier Science and Technology Books. December 2008.

### **SUPPLEMENTAL BOOKS**

Bureau of Automotive Repair. Laws and Regulations Relating to Automotive Repair Dealers and Smog Check Stations. California Department of Consumer Affairs, Bureau of Automotive Repair, 2009.

Bureau of Automotive Repair. Smog Check Inspection Procedures Manual. California Department of Consumer Affairs, Bureau of Automotive Repair, 2009.

Bureau of Automotive Repair. Write it Right Booklet: A Guide for Licensed Smog Check Stations. California Department of Consumer Affairs, Bureau of Automotive Repair, 2009.

### **RESOURCES**

Employer Advisory Board members

Foundation Standards

<http://www.cde.ca.gov/ci/ct/sf/documents/transportation.pdf>

Automotive Retailing Today (ART) 8400 Westpark Dr., MS 2, McLean, VA 22102. Phone: (703) 556-8578.

Automotive Service Councils of America

One Capitol Mall, Suite 320

Sacramento, CA 95814

[www.asca.com](http://www.asca.com)

Automotive Youth Educational Systems (AYES) 50 W. Big Beaver, Suite 145, Troy, MI 48084. Phone: (248) 526-1750. Fax: (248) 526-1751.

Field Representatives from the Bureau of Automotive Repair offices:

Culver City Branch	(310) 410-0024
South El Monte	(626) 575-6934
South El Monte HQ	(626) 350-6494
Valencia	(661) 702-6600

National Automobile Dealers Association (NADA) Public Relations Dept., 8400 Westpark Dr., McLean, VA 22102-3591. Phone: (703) 821-7000.

National Automotive Technicians Education Foundation (NATEF) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6650. Fax: (703) 669-6125.

[www.natef.org](http://www.natef.org)

[http://www.ed-foundation.org/html\\_pages/products\\_programs\\_services/natef\\_tools/non-structural\\_analysis/non-structural\\_analysis.shtml](http://www.ed-foundation.org/html_pages/products_programs_services/natef_tools/non-structural_analysis/non-structural_analysis.shtml)

National Institute for Automotive Service Excellence (ASE) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6600.

SkillsUSA P.O. Box 3000, Leesburg, VA 20177-0300. Phone: (703) 777-8810. Fax: (703) 777-8999.  
[www.skillsusa.org](http://www.skillsusa.org)

### **COMPETENCY CHECKLIST**

## ***TEACHING STRATEGIES and EVALUATION***

### **METHODS AND PROCEDURES**

- A. Lecture and discussion
- B. Demonstration
- C. Multi-media presentation

### **EVALUATION**

SECTION A – Orientation and Safety – Pass the safety test with 100% accuracy.

SECTION B – Emissions Failures Testing and Diagnostics – Pass all assignments and exams on emissions, failures, testing and diagnostics with a minimum score of 80% or higher.

SECTION C – Oscilloscope Testing and Waveform Pattern Diagnosis – Pass all assignments and exams on oscilloscope testing and waveform pattern diagnosis with a minimum score of 80% or higher.

SECTION D – Lab Scope Operation and Analysis of Fuel Control Sensors – Pass all assignments and exams on lab scope operation and analysis of fuel control sensors with a minimum score of 80% or higher.

SECTION E – Diagnosing with Today's Tools – Pass all assignments and exams on diagnosing with today's tools with a minimum score of 80% or higher.

SECTION F – Catalytic Converter Inspection and Testing – Pass all assignments and exams on catalytic converter inspection and testing with a minimum score of 80% or higher.

SECTION G – Final Examination – Pass all assignments and exams on final examination with a minimum score of 80% or higher.

## DEFINITIONS OF TERMS FOR A VEHICLE INSPECTION REPORT

**%CO<sub>2</sub>:** Carbon Dioxide is a colorless, odorless gas which is a byproduct of most combustion processes and of human respiration. It is the same gas found in soda pop. High levels of CO<sub>2</sub> in exhaust typically indicate greater engine efficiency; however, CO<sub>2</sub> is considered a greenhouse gas that may cause global warming. High or low levels of carbon dioxide emissions are not grounds for a vehicle failing the Smog Check; the measurement is meant as a diagnostic tool for technicians. CO<sub>2</sub> is measured in percent.

**%O<sub>2</sub>:** Oxygen is a colorless, odorless gas necessary for life on the planet and for engine combustion to occur. The atmosphere is comprised of approximately 21% oxygen. High levels of O<sub>2</sub> emissions can indicate a problem with the catalytic converter. High or low levels of O<sub>2</sub> emissions are not grounds for a vehicle failing the Smog Check; the measurement is meant as a diagnostic tool for technicians. O<sub>2</sub> is measured in percent.

**Air Injection:** Also known as the smog pump. Pumps air into the exhaust manifold to burn unburned fuels (hydrocarbons).

**AVE:** The average emissions for vehicles in the same Emissions Standards Category (ESC). ESCs are based on model year and whether the vehicle is a passenger car or a light-, medium-, or heavy-duty truck. The average emissions reading is meant as a guidepost for technicians when repairing vehicles that fail a Smog Check; it has no effect on the pass/fail result of the emissions test.

**Acceleration Simulation Mode (ASM):** This is the test type for vehicles operated on a dynamometer (treadmill like device) which simulates actual driving conditions.

**Bureau of Automotive Repair (BAR):** Part of the California Department of Consumer Affairs, the Bureau of Automotive Repair (BAR) is a consumer protection agency focused exclusively on automotive repair issues. BAR licenses auto repair dealers, Smog Check stations, and Smog Check technicians. BAR administers the Smog Check program, as required by law. BAR investigates complaints from consumers about auto repair establishments and recovers millions of dollars for consumers each year. BAR is completely separate from the Department of Motor Vehicles and the Air Resources Board.

**Catalytic Converter:** Located between the exhaust manifold and the muffler, this device uses precious metals as a catalyst to turn hydrocarbons, carbon monoxide, oxygen, and oxides of nitrogen into carbon dioxide and water vapor.

**Certification:** Indicates whether your vehicle was manufactured to meet United States Environmental Protection Agency or more stringent California emissions standards.

**Carbon Monoxide (CO%):** Carbon Monoxide is a colorless, odorless gas that is fatal to many life forms in moderate concentrations. CO emissions are often the byproduct of an overly rich fuel mixture. Unhealthy levels of CO emissions result in a vehicle failing its Smog Check. CO is measured in percent.

**Consumer Assistance Program (CAP):** The Consumer Assistance Program is available at participating Gold Shield stations for motorists who need financial assistance (up to \$500) making repairs to their vehicle when it fails a biennial (every other year) Smog Check. [Click here](#) to learn more about the Consumer Assistance Program and to obtain an application.

**Cylinders:** The number of combustion cylinders in the engine (usually 4, 6, or 8).

**Directed Vehicle:** In order to comply with state law, the California Department of Consumer Affairs/Bureau of Automotive Repair (DCA/BAR) directs a portion of the vehicles registered in Enhanced Smog Check Areas to Test-Only

and Gold Shield stations. These vehicles are called Directed Vehicles. Enhanced Areas are those parts of the state with "serious," "severe," or "extreme" ozone pollution problems.

**DMV ID Number:** A number used to locate the electronic smog certificate in the event it is electronically misfiled.

**EGR Functional:** During the Smog Check inspection, the technician performs a functional test of the EGR system per the vehicle manufacturer's instructions. This ensures the EGR system is operating as designed.

**EGR Visual:** As part of the Smog Check inspection, the technician performs a visual inspection of all emission components the vehicle is equipped with, including the EGR system. The technician visually inspects the EGR valve and associated plumbing for defects or modifications. The technician will either pass or fail the fuel cap visual test based on observations made during the test.

**Emissions Control System (ECS):** The Emissions Control System is any of a number of separate emissions control components which, together, reduce the level of pollutants emitted from a vehicle.

**Emissions Inspection System (EIS):** The EIS can be defined as the complete BAR97 system, the analyzer, dynamometer, and peripheral devices.

**Emission Standards Category (ESC):** ESCs are the pass/ fail emission level cut points for a specific class of vehicles. For example, 1975 through 1978 trucks with a Gross Vehicle Weight Rating (GVWR) over 8500 pounds would have the same cut points, therefore, they are in the same ESC.

**Emissions Test:** The third of the three vital parts of the California Smog Check. This is where the emissions analyzer tests actual emissions from your vehicle, as measured at the tailpipe. Only the emissions test can label a car a [Gross Polluter](#). Emissions measured include Carbon Monoxide (CO), Carbon Dioxide (CO<sub>2</sub>), Hydrocarbons (HC) and Oxygen (O<sub>2</sub>). In California's most polluted urban areas (Enhanced Areas), the emissions test also measures levels of oxides of nitrogen (NO<sub>x</sub>).

**Engine Size:** Measured in displacement of either cubic inches, cubic centimeters, or cubic liters.

**Evaporative Emission Control System (EVAP):** The EVAP system prevents raw gasoline from escaping the vehicle and evaporating into the atmosphere. As part of the inspection, the technician visually inspects the EVAP system and associated plumbing for defects or modifications. The technician will either pass or fail the EVAP system based on observations made during the test.

**Exhaust:** Usually either single (one pipe) or dual (two pipes).

**Exhaust Gas Recirculation (EGR):** The vehicle's Exhaust Gas Recirculation system reroutes exhaust gases back through the intake manifold to lower engine temperatures and, in so doing, reduces [NO<sub>x</sub>](#) emissions. The EGR functional test is part of the two-speed idle (TSI) [test](#), but is not necessary for the ASM (BAR-97) [test](#) because that equipment tests for NO<sub>x</sub>.

**Fail:** The level of harmful emissions from this vehicle, on this portion of the test, exceeds the range of what is reasonable for this model/engine combination, and is contributing to unhealthy air in California.

**Fuelpipe Restrictor:** A functional test of the fuel pipe restrictor is performed only on vehicles being initially registered in California. If the fuel pipe restrictor is oversized due to tampering, then the fuel pipe restrictor functional test fails.

**Fuel EVAP Functional:** A functional test of the evaporative emission control system is under development by the Bureau. Until the test is implemented, the technician will enter "non applicable" into the analyzer for this test.

**Fuel Cap Integrity Test:** Tests whether gasoline fumes can leak out from your tank around the cap. Gasoline fumes contain high levels of harmful pollutants, including benzene, a known carcinogen. Studies by the United States Environmental Protection Agency show that around 30 percent of all the emissions from a vehicle are in the form of fuel evaporation, usually from the fuel tank.

**Fuel Cap Visual Test:** As part of a Smog Check inspection, the technician visually inspects the fuel tank cap for defects, (i.e. cracked or deteriorated rubber seal). The technician will either pass or fail the fuel cap visual test based on observations made during the test.

**Fuel Evaporative Controls:** Also known as the charcoal canister, this system stops vapors from the carburetor bowl and the gas tank from evaporating into the atmosphere.

**Fuel Type:** Only vehicles fueled by gasoline, natural gas, and propane are currently included in the Smog Check program. Light-duty diesel vehicles are excluded.

**Functional Inspection:** The second of the three vital parts of the California Smog Check. The functional check ensures the correct vehicle timing and [EGR System](#) function. The engine malfunction light is also part of the functional inspection. Emissions system defects identified during the functional inspection are considered unhealthy for the air and result in an overall Smog Check failure.

**Gold Shield Dealer:** The Gold Shield Dealer station sub-type is a new car dealer in a Basic or Change of Ownership area and has the ability to smog enhanced area cars that are to be sold in their program area.

**Gold Shield Station:** The Gold Shield Station type has met certain performance criteria and performs [CAP](#) repairs. As of late 2007, Gold Shield stations are authorized to perform initial inspections on Directed Vehicles.

**GP:** The emissions level, or "cut point," at which a vehicle fails as a [Gross Polluter](#). The emissions of a gross polluter are typically at least twice as high as those of an ordinary failing vehicle. Repairs on a Gross Polluter must be verified at a Test-Only or Gold Shield station. (Click here for Test-Only or Gold Shield [station listings](#)).

**Gross Polluter:** The emissions levels, or "cut points," established for the highest-polluting vehicles. The emissions of a Gross Polluter are typically at least twice as high as those of an ordinary failing vehicle. Repairs on a Gross Polluter must be verified at a Test-Only or Gold Shield station. (Click here for Test-Only or Gold Shield [station listings](#)).

**Gross Vehicle Weight Rating (GVWR):** Gross Vehicle Weight Rating is the weight of the vehicle plus the maximum load it is designed to carry. This differs from the vehicle's [Test Weight](#).

**Hydrocarbons (HC) (PPM):** Hydrocarbons are the component of fuels that produce energy. HC emissions from a vehicle are basically unburned fuel. High levels of HC emissions indicate incomplete fuel combustion, either the result of a misfire or of low engine compression. Unhealthy levels of HC emissions result in a vehicle failing its Smog Check. Hydrocarbons are measured in parts per million (PPM).

**Ignition Timing:** The timing of the spark relative to the operation of the valves and the placement of the piston in the cylinder. BTDC stands for "before top dead center" a reference to a mark on the main pulley on the front of the engine. For most engines, when the timing is set to 0 degrees TDC, the number one piston will fire at the very top of the stroke. For vehicles where the manufacturer specifies a timing setting, the Smog Check inspection allows plus or minus three degrees from that setting. For vehicles where the manufacturer specifies a timing range, the vehicle must be within that timing range. Advanced timing is when the spark fires before the piston has reached the top of the stroke. Retarded timing is when the spark fires after the piston has reached the top

**Inspection Reason:** Either biennial (in conjunction with a DMV registration renewal notice), change of ownership (selling a car), or initial (first time registered in California).

**License:** The California license plate number on your vehicle. This field is left blank when there is no license plate on the vehicle.

**Make:** The vehicle manufacturer's brand name.

**MAX:** The maximum allowable emissions for the particular make, model, and year of vehicle. Vehicles with emissions that exceed this level, or "cut point," fail the emissions portion of the Smog Check. There are separate cut points for vehicles failing at ordinary vs. [Gross Polluter](#) levels.

**MEAS:** The amount of each specific pollutant measured during the emissions test of the vehicle.

**Model:** The vehicle manufacturer's model name.

**Model-Year:** The vehicle manufacturer's model year for your vehicle. Not necessarily the year the vehicle was built.

**NO (PPM):** Oxides of nitrogen (more commonly called NOx) are odorless gases that help form smog and give smog its characteristic brown color. NO is produced when temperatures in the combustion chambers exceed 2500 degrees Fahrenheit. Excessive engine temperatures could be caused by a lean fuel mixture, by retarded timing, by carbon buildup inside the combustion chamber, or by a malfunctioning engine cooling system. The function of the [EGR System](#) is to reduce NO. Unhealthy levels of NO emissions result in a vehicle failing its Smog Check. NO is measured in parts per million (PPM).

**Odometer:** The number of miles on your vehicle as reported by the technician based on his or her reading of your vehicle's odometer.

**Oxygen Sensor:** A device located in the exhaust manifold or exhaust pipe which compares the level of oxygen in the ambient air to the level of oxygen in the exhaust stream and sends a signal to the vehicle's onboard computer, which adjusts the fuel mix accordingly.

**Parts Per Million (PPM):** This is a unit of measurement for both Oxides of Nitrogen and Hydrocarbons which are measured by the BAR97 emissions analyzer.

**Pass:** The level of harmful emissions from this vehicle, on this portion of the test, is within the range of what is reasonable for this model/engine combination. Thank you for doing your part to improve our air quality to healthy levels in California.

**Positive Crankcase Ventilation (PCV):** Positive Crankcase Ventilation removes gases blown around the pistons and rings from the engine crankcase and reroutes them through the intake manifold to be burnt again.

**Regular Test and Repair:** The Regular Test and Repair Station type performs inspections and repairs all types of vehicles. This station type does not have the ability to certify directed (Test Only) vehicles or vehicles with emissions in the [gross polluter](#) range.

**Revolutions Per Minute (RPM):** Revolutions per minute is a measurement of engine speed. Engine turning speed typically does not correspond to the speed of the vehicle.

**RepairTech Name / Number:** The name of the licensed Smog Check technician who repaired the vehicle, if applicable or known.

**Smog Check Certificate Number:** This is the number of the electronic certificate sent to the Department of Motor Vehicles (DMV) which allows the owner to complete his or her registration. The Vehicle Inspection Report is proof of the vehicle passing a Smog Check.

**Software Version / EIS Number:** The BAR-certified version of the software that the emissions analyzer unit used during the test, and the unique identification number for the analyzer unit.

**State:** The state where the vehicle is registered.

**Station Number:** The license number of the Smog Check station where the test was performed.

**System Malfunction Light:** Also known as the "check engine light," this early warning signal in the vehicle cabin indicates engine problems. Such problems could cause serious performance or engine problems for the vehicle if not checked and repaired and could lead to excessive amounts of pollution being emitted during certain driving conditions which may not be detected during a Smog Check.

**Technician Name / Number:** The name of the licensed Smog Check technician who performed the test, and his/her individual license number.

**Test:** The Acceleration Simulation Mode (BAR-97) test measures vehicle emissions levels at 15 mph and 25 mph with driving conditions simulated by the dynamometer, a treadmill-like device. The two-speed idle (TSI or BAR-90) test measures the emissions levels of a stationary vehicle at two engine idle speeds.

**Test Only:** The Test Only station type has the ability to test and certify all vehicles, though it cannot perform any repairs.

**Test Weight:** The actual weight of your vehicle as measured during the Smog Check.

**Thermostatic Air Cleaner:** Draws warm air into a cold engine to help fuel vaporize before burning. This system is important before the engine warms up, to improve cold drivability and cold-engine emissions reductions.

**Transmission:** Either manual (3-, 4-, 5-, or 6-speed) or automatic.

**Type:** Vehicles eligible for the Smog Check program include passenger cars, light-duty trucks, and heavy-duty trucks.

**Vacuum Lines to Sensors/Switches:** A visual inspection of the vacuum lines to the sensors and switches in all the emission control systems on the vehicle is performed. The technician will either pass or fail these components based on observations made during the test.

**Vehicle Identification Number (VIN):** Your vehicle's unique identification number, usually 17 digits but sometimes less. Typically found on the top of the dash just inside the windshield on the driver's side, or on a plate/sticker in the driver's side door jamb. The BAR code on your DMV registration renewal also contains this number. Contact the DMV if the VIN on your vehicle does not match the VIN on your registration form.

**Visual Inspection:** The first of the three vital parts of the California Smog Check. The visual inspection checks for missing, disconnected, or visibly damaged emissions-system components, including the catalytic converter, the thermostatic air cleaner, the heat riser, and the smog pump. Emissions system defects identified during the visual inspection are considered unhealthy for the air and result in an overall Smog Check failure.

**VLT Record #:** Your vehicle's record on the Bureau of Automotive Repair's Vehicle Lookup Table (VLT). The table contains specific information for each vehicle model and engine combination available. Information from the VLT regarding your vehicle's weight and aerodynamic resistance allows the Smog Check emissions analyzer to correctly set the resistance on the dynamometer (a treadmill-like device used to test vehicles in the smoggiest urban areas of the state).

**Wiring to Sensors/Switches:** A visual inspection of the wiring to the sensors and switches in all the emission control systems on the vehicle is performed. The technician will either pass or fail these components based on observations made during the test.

## ***Standards for Career Ready Practice***

### **1. Apply appropriate technical skills and academic knowledge.**

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education. They make connections between abstract concepts with real-world applications and recognize the value of academic preparation for solving problems, communicating with others, calculating measures, and performing other work-related practices.

### **2. Communicate clearly, effectively, and with reason.**

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, using written, verbal, electronic, and/or visual methods. They are skilled at interacting with others: they are active listeners who speak clearly and with purpose, and they are comfortable with terminology that is common to workplace environments. Career-ready individuals consider the audience for their communication and prepare accordingly to ensure the desired outcome.

### **3. Develop an education and career plan aligned with personal goals.**

Career-ready individuals take personal ownership of their educational and career goals and manage their individual plan to attain these goals. They recognize the value of each step in the educational and experiential process, and they understand that nearly all career paths require ongoing education and experience to adapt to practices, procedures, and expectations of an ever-changing work environment. They seek counselors, mentors, and other experts to assist in the planning and execution of education and career plans.

### **4. Apply technology to enhance productivity.**

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology. They understand the inherent risks—personal and organizational—of technology applications, and they take actions to prevent or mitigate these risks.

### **5. Utilize critical thinking to make sense of problems and persevere in solving them**

Career-ready individuals recognize problems in the workplace, understand the nature of the problems, and devise effective plans to solve the problems. They thoughtfully investigate the root cause of a problem prior to introducing solutions. They carefully consider options to solve a problem and, once agreed upon, follow through to ensure the problem is resolved.

### **6. Practice personal health and understand financial literacy.**

Career-ready individuals understand the relationship between personal health and workplace performance. They contribute to their personal well-being through a healthy diet, regular exercise, and mental health activities. Career-ready individuals also understand that financial literacy leads to a secure future that enables career success.

### **7. Act as a responsible citizen in the workplace and the community.**

Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are aware of the impacts of their decisions on others and the environment around them, and they think about the short-term and long-term consequences of their actions. They are reliable and consistent in going beyond minimum expectations and in participating in activities that serve the greater good.

**8. Model integrity, ethical leadership, and effective management.**

Career-ready individuals consistently act in ways that align with personal and community-held ideals and principles. They employ ethical behaviors and actions that positively influence others. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they recognize the short-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.

**9. Work productively in teams while integrating cultural and global competence.**

Career-ready individuals contribute positively to every team, as both team leaders and team members. To avoid barriers to productive and positive interaction, they apply an awareness of cultural differences. They interact effectively and sensitively with all members of the team and find ways to increase the engagement and contribution of other members.

**10. Demonstrate creativity and innovation.**

Career-ready individuals recommend ideas that solve problems in new and different ways and contribute to the improvement of the organization. They consider unconventional ideas and suggestions by others as solutions to issues, tasks, or problems. They discern which ideas and suggestions may have the greatest value. They seek new methods, practices, and ideas from a variety of sources and apply those ideas to their own workplace practices.

**11. Employ valid and reliable research strategies.**

Career-ready individuals employ research practices to plan and carry out investigations, create solutions, and keep abreast of the most current findings related to workplace environments and practices. They use a reliable research process to search for new information and confirm the validity of sources when considering the use and adoption of external information or practices.

**12. Understand the environmental, societal, and economic impacts of decisions.**

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact other people, organizations, the workplace, and the environment. They are aware of and utilize new technologies, understandings, procedures, and materials and adhere to regulations affecting the nature of their work. They are cognizant of impacts on the social condition, environment, workplace, and profitability of the organization.

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### Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.

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