

2015 NEW JERSEY ETEP PERFORMANCE STANDARD

The following course material is intended for adult education (i.e., the practicing in-service technician). Anyone beginning the emission technician training program without prior experience will need basic coursework not included in this outline.

All training programs approved by the State under the ETEP must, at a minimum, include 20% hands-on classroom experience. In addition, each section of the training program must include a final examination to insure that the technician has mastered the concepts covered in the training section.

Sections 1 through 4 – Electrical/Electronics and Engine Diagnosis/Repair

- A. Basic Electronics
 - 1. Demonstrate an understanding of the fundamentals of electricity.
 - 2. Identify volt as a unit of measurement and define voltage.
 - 3. Identify amp as a unit of measurement and define ampere/current.
 - 4. Identify ohm as a unit of measurement and define resistance.
 - 5. Use Ohm's Law to calculate voltage, amperage, and resistance in a circuit.
 - 6. Describe semiconductors.
 - 7. Identify the types of electrical measuring instruments and their applications.
 - 8. Select the proper meter and operating range to perform a specific measurement.
 - 9. Measure circuit voltages.
 - 10. Measure circuit amperages.
 - 11. Measure circuit resistance.
 - 12. Interpret the readings and obtain a correct analysis of conditions.
 - 13. Relate the importance of calibration of instruments within standard limits.
 - 14. Recognize a series circuit and describe how Ohm's Law applies.
 - 15. Recognize a parallel circuit and describe how Ohm's Law applies.
- B. Compression
 - 1. Describe how compression is produced and why it's important.
 - 2. Explain and diagnose compression related drivability problems.
 - 3. Describe what valve timing is and how it affects compression.
 - 4. Perform dynamic and static vacuum and compression tests.
 - 5. Diagnose and repair engine detonation.
 - 6. Discuss volumetric efficiency and the recent changes to improve volumetric efficiency.
- C. Ignition Theory and Testing
 - 1. State the importance of a properly working ignition system in relation to good vehicle performance, fuel economy, and emissions.
 - 2. Identify the operation and individual parts of a conventional (brief overview) and

- electronic ignition system (detailed discussion).
 - 3. Define the operation of circuits relating to the primary ignition system.
 - 4. Explain ignition dwell (coil saturation).
 - 5. Define the operation of circuits relating to the secondary ignition system.
 - 6. Explain spark plug performance, design, and service.
 - 7. Demonstrate simple individual testing procedures for ignition systems.
 - 8. Diagnose and repair ignition primary circuit malfunctions.
 - 9. Diagnose and repair ignition secondary circuit malfunctions.
 - 10. Test and explain results of ignition system triggering devices.
 - 11. Test and explain results of ignition coils.
 - 12. Diagnose ignition misfires.
 - 13. Diagnose ignition related diagnostic trouble codes.
- D. Air/Fuel Theory
- 1. Describe how the fuel control system works.
 - 2. Identify system components.
 - 3. Perform fuel pressure and volume tests.
 - 4. Perform injector balance tests.
 - 5. Describe the importance of the fuel control system as it relates to fuel economy and emissions.
- E. Emissions Theory and Diagnosis
- 1. Emission Control Systems
 - a. Recognize the process by which the emission system reduces air pollution from the automobile engine.
 - b. Recognize the purpose of each component in the emission system.
 - c. Recognize the function of each component in the emission system.
 - d. Explain how the conventional oxidation converter reduces hydrocarbon and carbon monoxide emissions.
 - e. Explain how the three way converter reduces oxides of nitrogen, hydrocarbons, and carbon monoxide exhaust emissions.
 - f. Explain how a converter failure can lead to poor emissions, driveability, and fuel economy.
 - 2. Exhaust Analysis
 - a. Identify which general problem areas could cause excessive HC emissions.
 - b. Identify which general problem areas could cause excessive CO emissions.
 - c. Explain other symptoms that may likely be present when a particular problem area is causing the excessive HC or CO emissions.
 - d. Explain the importance of referring to and following manufacturers' procedure for adjustments and service.
 - 3. Diagnosing Emissions Problems
 - a. Explain the functions of an infrared exhaust gas analyzer (I/R analyzer) as an inspection tool and efficient diagnostic tool.
 - b. Explain the causes and effects of analyzer sample system air leaks that

result in sample dilution, and demonstrate the ability to perform an integrity check.

- c. Demonstrate the proper procedure for probing both single and dual exhaust systems.
- d. Explain the need to follow the I/R analyzer manufacturer's recommended operating procedures in order to avoid the "ping-pong effect" and its impact on the service industry and the I/M program.
- e. Explain that other readings using a timing light, vacuum gauge, and oscilloscope can be used to supplement the I/R analyzer in initial diagnosis of the specific cause of excessive HC or CO emissions.
- f. Explain the limitations of present I/R analyzers in the inspection and control of emissions from catalytic converter, air pump equipped vehicles and computerized vehicles.

F. Input Strategies and Sensor Testing

- 1. Identify major components of the system's electrical sensor inputs.
- 2. List the major components in the order of system operation.
- 3. Describe the operation of the major components.
- 4. Identify features common to major components.
- 5. Diagnose system failures.
- 6. Perform diagnostic testing procedures on components.

G. Output Devices and Component Testing

- 1. Identify the fuel metering controls used on fuel injected engines.
- 2. Diagnose and repair idle speed control systems.
- 3. Explain the various types of each control system.

H. Computerized Fuel Management System Operation

- 1. State the effects of a system malfunction on computer controlled engines.
- 2. Identify sensor substitution.
- 3. Identify sensors responsible for determining base pulse width.
- 4. Identify sensors responsible for modifying pulse width.
- 5. Identify different operating strategies.

Section 5 – OBDI and OBDII

A. History of OBD

- 1. Explain the history of vehicle emissions.
- 2. Describe the evolution of OBD systems.
- 3. Explain how and why OBD regulation began.

B. Basic OBD Parameters and Strategies

- 1. Demonstrate basic OBD strategies.
- 2. Explain how input sensors function.
- 3. Explain Engine Control Module (ECM) output functions.
- 4. Describe parameters for setting codes.

- C. History of OBDII System
 - 1. Describe the basic OBDII regulations.
 - 2. Explain why OBDII was mandated.
 - 3. Explain the need for standardization.
- D. Comparison of OBD to OBDII Systems
 - 1. Explain the difference between OBD and OBDII.
 - 2. Describe the primary operating differences between the early OBD and OBDII systems.
 - 3. Explain the difference in diagnostics between the two systems.
- E. Continuous Monitors
 - 1. Explain the reason for continuous monitors.
 - 2. Explain the different continuous monitors used.
 - 3. Describe the criteria used to satisfy each continuous monitor.
 - 4. Describe conditions that will effect continuous monitors operations.
- F. Non-continuous Monitors
 - 1. Explain the reason for non-continuous monitors.
 - 2. Explain the different non-continuous monitors used.
 - 3. Describe the criteria used to satisfy each non-continuous monitor.
- G. MIL Strategy and DTCs
 - 1. Describe the difference between the check engine light and the Malfunction Indicator Lamp (MIL).
 - 2. Describe the 4 different operating strategies of the Malfunction Indicator Lamp.
 - 3. Explain the difference between a Type A and Type B code.
 - 4. Describe the diagnostic procedure of the PCM to set DTCs.
 - 5. Demonstrate the ability to interpret DTCs.
 - 6. Explain and demonstrate how DTCs are cleared.
- H. Scan Tools
 - 1. Explain and demonstrate the use of scan tools.
 - 2. Describe the progression of the scan tool from 1980 to present.
 - 3. Explain the Society of Automotive Engineers (SAE) requirements for OBDII scan tools.
 - 4. Explain the difference between Original Equipment Manufacturers (OEM) and generic scan tool data.
 - 5. Demonstrate the use of Freeze Frame Data.
 - 6. Describe the use of bi-directional control.
- I. OBD II Diagnostic Check
 - 1. Explain the progression of On-Board Diagnostics.
 - 2. Explain OBDII and how it relates to the Clean Air Act and Enhanced I/M.
 - 3. Describe and demonstrate how to perform the On-Board Diagnostic Check.

Section 6 – Diagnosing and Repairing OBDII Monitoring Failures

- A.-F. OBDII Monitors – Misfire, Fuel Control, Evaporative System, Exhaust Gas Recirculation (EGR) System, Oxygen Sensor, Catalyst Efficiency
1. Describe in detail the operating strategies for each of the monitors.
 2. Identify the components in each system.
 3. Explain the likely causes of monitor failures.
 4. Discuss the benefits of using a strategy-based troubleshooting process to efficiently locate and repair malfunctions.
 5. Describe (and demonstrate when possible) individual component test procedures.
 6. Discuss Mode \$06 and how it can be used to verify repair efficiency.

Section 7 – Light-Duty Diesel Vehicle Technologies and Testing

- A. Diesel Engine Operation
1. Explain diesel engine operation.
 2. Discuss how diesel engines create and control combustion.
 3. Describe diesel engine combustion systems (pre-chambers, swirl chambers, and direct ignition).
- B. Diesel Emissions
1. Explain the advantages and disadvantages of diesel emissions.
 2. Describe pollutants from diesel engines.
 3. Discuss the formulation of particulate matter.
 4. Identify the health effects of diesel emissions.
 5. Describe the diesel combustion and the formation of emissions.
- C. Designing for Power, Fuel Economy and Low Emissions
1. Explain how improving the power means increasing the flow.
 2. Discuss methods of improving fuel economy and minimizing emissions.
 3. Describe fuel management systems (mechanical and electronic-Introduction)
 4. Describe emission reduction technologies (Exhaust Gas Recirculation, Catalysts, Traps and Catalysts, Traps and Post-Combustion Technologies)
- D. Electronic Control of Diesel Engines
1. Provide an overview of the four basic ECMS functions.
 2. Describe heavy duty diesel engine performance basics.
 3. Discuss basic heavy duty diesel engine performance diagnostics.
 4. Briefly identify types of sensors and actuators used on diesel engine applications (thermistors, variable capacitance, potentiometers, signal generating sensors).
 5. Describe the controllers and control techniques.
- E. Understanding and Using Scan Data
1. Discuss communicating with the diesel engine controller.
 2. Describe diagnostic connectors.
 3. Explain and demonstrate (if possible) using scan data.
 4. Identify diagnostic codes (MID, SID, PID, FMI fault code descriptions).

- F. Diesel Smoke Diagnostics
 - 1. Discuss the root cause and conditions affecting diesel smoke diagnostics (blue smoke, white smoke, black smoke, and gray smoke).
- G. Diesel Emission Diagnostics
 - 1. Describe basic preventative maintenance and emissions checks.
 - 2. Discuss (and demonstrate when possible) the typical emission testing techniques and standards.
 - 3. Describe (and demonstrate when possible) using an opacity meter.
 - 4. Review recommended maintenance needs.
- H. Diesel Component Diagnosis
 - 1. Explain the common Fuel Injection diagnosis procedures.
 - 2. Discuss testing fuel pumps.
 - 3. Describe Turbochargers/Intercoolers diagnosis.
 - 4. Discuss (and demonstrate when possible) EGR systems diagnosis (HPL EGR, LPL EGR, Hybrid EGR, Fast-acting EGR systems).
 - 5. Explain catalysts and traps:
 - Diesel Oxidation Catalysts.
 - Selective Catalytic Reduction.
 - Lean NOx Catalyst.
 - NOx Absorbers.
 - Commercial Catalyst Technologies.
 - Deactivation of Diesel Catalyst.
 - Diesel Filter Regeneration.
 - Wall-Flow Monoliths.
 - Ceramic Fibers and Cartridges.
 - Catalyzed Diesel Filters.
 - CRT Filter.
 - Filters with Fuel Additives.
 - Electronically Regenerated Filters.
 - Filters with Fuel Burners.
 - Crankcase Ventilation Systems.

Section 8 – Advanced Gasoline System Technologies (16 Hours)

A. Variable Valve Timing (VVT), Variable Cam Timing (VCT), and Variable Cam Lift Systems and Diagnosis

- 1. Why VVT and VCT systems?
- 2. Advantages and disadvantages of VVT/VCT
- 3. Variable Valve Timing with Electronic Lift Control (VTEC, iVTEC, and VTEC-E systems)
- 4. VANOS and DOUBLE VANOS Variable Cam Timing Systems
- 5. Valve Overlap / Retarded and Advanced Valve Timing
- 6. Valve Timing Solenoids / Oil Pressure Actuation
- 7. Oil Contamination and the effect on VVT/VCT systems
- 8. Camshaft Actuators and VCT Phasers

9. The Importance of proper Timing Belt /Timing Chain Installation
 10. Lab scope Testing for Camshaft and Crankshaft Sensor Synchronization
 11. Interpreting DATA PIDS, including Cam Error and Camshaft Degrees
 12. VVT/VCT Diagnostic Trouble Code Diagnosis
 13. Electrical vs. Mechanical Failure Diagnosis
 14. VVT/VCT System Service and Repair
 15. CASE STUDIES: Common Failures and Diagnosis
- B. In-Vehicle Communication Network & Data Bus Diagnosis, Including CAN Network Diagnosis
1. Advantages of a Multiplex Bus Network
 2. Types of Vehicle Network Systems
 3. Understanding Module to Module Communications and how they talk
 4. Rules of Serial Data
 5. How many modules do I have on the bus?
 6. Scan Tool Diagnosis on the Network; Global vs. VIN Specific
 7. Diagnostic network testing: Voltmeter vs. Labscope vs. Scan Tool
 8. Diagnosing "no communication" I/M Failures
 9. Differential vs. Standard ground Diagnostic Results
 10. Diagnosing Shorted vs. Open Bus Circuits
 11. Universal Asynchronous Receive and Transmit (UART), Class 2 Data line, Local Area Network (LAN), Serial Communication Protocol (SCP), Bosch K-LINE Data Network, Chrysler Collision Detection (CCD), Serial Communication Interface (SCI), Programmable Communication Interface (PCI) and CAN systems
 12. High Speed vs. Low Speed CAN and their applications
 13. Diagnosing Babbling vs. Disturbed Nodes
 14. Vehicle Network repair, including twisted pairs
 15. CASE STUDIES: Common Failures and Diagnosis
- C. Gasoline Direct Injection (GDI) System Testing and Diagnosis
1. Advantages of GDI Stratified / Homogeneous Fuel Charging Gasoline Direct Injection (GDI) • Spark Ignition Direct Injection (SIDI) • Fuel Stratified Injection (FSI) • Turbo Fuel Stratified Injection (TFSI) • Direct Injection Spark Ignition (DISI) • Gasoline Turbo Direct Injection (GTDI) • High Precision Injection (HPI) • High Pressure Direct Injection (HPDI)
 2. Homogeneous stratified mode / Homogeneous lean mode / Homogeneous knock protection mode / Stratified catalyst heating mode
 3. Low Pressure Fuel Delivery Systems
 4. High Pressure Fuel Delivery Systems
 5. High and Low Pressure System Sensors and Wiring
 6. High Pressure Pump Control Solenoids
 7. Fuel Pump Control Modules
 8. PCM Control of Fuel Pressure
 9. Fuel Rail Pressure Regulator (FRPR) Wiring by vehicle manufacturer
 10. Cam Lobe Designs for High Pressure Fuel GDI Injector Designs and Failure Diagnosis

11. GDI Injector Special Service Procedures
12. SCAN DATA PIDS for GDI systems
13. GDI Intake Valve Deposits
14. CASE STUDIES: Common Failures and Diagnosis

Section 9 – Advanced Light-Duty Diesel Vehicle Technologies (8 Hours)

- A. Enhanced Diesel Emission Controls including SCR, DEF, DPF and DOC
 1. Advantages of current generation Diesel Emission Controls
 2. Diesel Particulate Filters (DPF) Operation and Testing
 3. Diesel Particulate Filters (DPF) Pressure Sensors
 4. Diesel Particulate Filters (DPF) Exhaust Gas Temperature Sensors
 5. Passive and Active Regeneration
 6. Diesel Particulate Filters (DPF) Servicing and Cleaning
 7. Hydrocarbon Injectors
 8. Throttle Valves for Regeneration
 9. Diesel Oxidizing Converters (DOC)
 10. Diesel Exhaust Fluid (DEF) Testing
 11. Special Diesel Exhaust Fluid (DEF) service issues: creep, pressure pump, pressure sensors
 12. Diesel Exhaust Fluid (DEF) Dosing Injectors
 13. Selective Catalyst Reduction (SCR)
 14. NOx Sensor Operation and Testing
 15. CASE STUDIES: Common Failures and Diagnosis
- B. Enhanced Diesel Turbo Charging including Variable Geometry Turbos
 1. Diesel Air Management Systems and Turbocharging
 2. Variable Geometry Turbo (VGT) Operation and Testing
 3. VGT Control Solenoids
 4. EBP (Exhaust Gas Backpressure Sensors)
 5. VGT Vane Positions Sensors
 6. Sliding Ring Turbochargers
 7. MAP and MAF Sensors for Diesel applications
 8. EGR Air Control Valves and Coolers
 9. Operation and Testing New Generation Diesel Fuel Injectors
 10. Programming Diesel Fuel Injectors
 11. CASE STUDIES: Common Failures and Diagnosis
- C. Enhanced Common Rail System Design and Diagnosis
 1. Updates Cummins 6.7 High Pressure Common Rail System
 2. New Generation Sprinter V6 Common Rail Diesel
 3. Updates Ford 6.7 Power Stroke Diesel
 4. New Generation GM Duramax Systems
 5. Diesel Car Technology VW/Audi TDI/Mercedes/BMW/Jeep Systems

Section 10 – HYBRID Vehicle System Technology, Safety, and Repair **(8 Hours)**

- A. Hybrid Vehicle Theory and Operation
 - 1. Hybrid Vehicle Theory, Operation, Regenerative Braking, & Atkinson Cycle
 - 2. Hybrid Batteries and Battery Control Modules
 - 3. Hybrid Drive Systems, Series. vs. Parallel

- B. Hybrid Vehicle Safety
 - 1. Hybrid High Voltage System Safety
 - 2. High Voltage Starter and Generator
 - 3. High Voltage Batteries and Cables

- C. Hybrid Vehicle Service
 - 1 Hybrid Vehicle Maintenance and Service

- D.. Hybrid Vehicle Testing and Diagnosis
 - 1 Scan Tool Diagnosis
 - 2 Inverter Converter Testing and Diagnosis
 - 3 Smart Key Systems
 - 4 CASE STUDIES: Common Failures and Diagnosis