Module 16: General Engine Diagnosis

Terms and Definitions

- Aeration is foaming caused by air mixing with a liquid, such as oil or fuel.
- Dynamometer is a device that measures the engine power output by applying a load to the engine.
- Diagnostic data link (DDL) allows shop test equipment to “plug into” the electronic control module (ECM).
- Electronic control module (ECM) is a computer that processes information from engine sensors and controls the fuel injector solenoid.
- Electronic unit injector uses an ECM-controlled, injector-mounted electric solenoid to control the amount and timing of the injected fuel.
- Infrared thermometer is an instrument that measures temperatures up to 500°F (260°C).
- Magnahelic gauge is a sensitive instrument that measures small differences in pressure or vacuum.
- Manometer is a device that measures positive or negative pressure (vacuum).
  - Note: A manometer may use a column of water or mercury (Hg) for making measurements.
- Mercury manometers are typically used in high heat applications such as exhaust manifolds.
- Personality module contains customer-specified information concerning engine performance.
- Pyrometer is a device that measures high exhaust temperatures (usually over 300°F (149°C)).
- Snapshot is ECM recordings at the time and operating parameters when a fault occurs.
- Symptom is an indication of a mechanical or electrical/electronic problem.
- Tachometer is a device that measures engine speed.
- Troubleshooting is a process using test instruments to locate and diagnose the cause of failure.

Evaluating Engine Performance

- Surveying the operator is the best source of information.
- Visually inspect the vehicle.
  - Fluid levels
  - Fluid condition
  - Component condition
- Test the performance of the vehicle.
  - Without a dynamometer
  - With a dynamometer
- Use computer diagnostic abilities to test the vehicle.
  - On-board system self-tests
  - Hand-held testers
- Locate symptom(s) in the manufacturer’s troubleshooting chart.
  - With a symptom
  - With a trouble code

Benefits of Operator Questionnaire

- Provides direct communication between the operator and technician
- Assists the technician in troubleshooting, especially when no fault codes are available
- Eliminates wasted technician time by providing specific information
Major Checkpoints in a Visual Inspection

**Cooling system**
- Levels
- Condition (supplemental coolant additive level)
- Maintenance history
- Leaks (radiator/hoses/pump)

**Lubricating system**
- Level
- Condition (sample)
- Maintenance history
- Leaks

**Fuel system**
- Fuel level
- Condition (sample)
- Leaks
- Hoses/clamps
- Wiring harnesses/connectors

**Electrical system**
- Belts
- Connections (clean and tight/corroded)
- Wiring harnesses/connectors
- Battery electrolyte level
- Charging system

**Air intake system**
- Filter(s)
- Ducting/hoses
- Clamps/joints
- Turbocharger

**Exhaust system**
- Pipes
- Connections
- Muffler
- Turbocharger

Major Performance Checkpoints

**Cooling system**
- Pressure test the radiator/cap.
- Check for bubbles/flow at the operating temperatures.

**Lubrication system**
- Pressure check with a shop gauge
- Temperature check (sump)

**Fuel system**
- Pressure check
- Flow (amount in a given time)

**Electrical system**
- Voltage
- Current

**Air intake system**
- Restriction level (vacuum)
- Pressure test the intercooler core.

**Exhaust system**
- Restriction (back pressure)
- Turbocharger noise

Performance Test Made With the Engine on a Dynamometer

**Engine power output**
- Horsepower
- Torque

**Exhaust smoke analysis**
- Blue—Excess lubrication oil in the combustion chamber
- Black—Incomplete combustion of fuel
- White—Noncombustion of fuel

**Fuel consumption**
**Crankcase blow-by**

**Air intake system**
- Restriction
- Boost pressure

**Exhaust system**
- Back pressure
- Temperature

**Lubrication system**
- Pressure
- Temperature
Functions of Engine Computer Fault Detection

- Sensing abnormal operation
  - The ECM detects abnormal input from the sensors.
  - The ECM determines the extent of variation.
  - If engine-threatening, the ECM limits the engine speed and power output.
- Communicating with the driver
  - Warning light

Communicating with the driver

- Warning buzzer (optional)
- Power loss as the ECM begins to derate/rampdown

Communicating with the technician

- Fault code stored in memory
- Snapshot data

Engine Computer Fault Code Storage

- Inactive fault code
  - The “Check Engine” light illuminates while the problem exists.
  - The fault code is stored in memory.
  - The fault code is erased by a computer command.
- Active fault code
  - The “Check Engine” light comes on and stays on.
  - The fault code is stored in memory.

Engine Computer Fault Code Retrieval

- Hand-held communication tool
  - Connects to the DDL
  - Shows any fault stored in memory
  - Initiates a diagnostic sequence for the ECM to check all electronic components
  - Allows the technician to see the sensor output and actuator response
- Personal computer (PC) with a translator device
  - The translator connects to the DDL, and the PC connects to the translator.
  - Shows the fault codes
  - Shows the snapshot parameters on screen
  - Allows the technician to reprogram the PROM (or EEPROM) with new parameters (some systems)

The “Check Engine” light

- The fault code is erased by a computer command.
- Snapshot data
  - The fault code is stored in memory.
  - The ECM records the time (in engine hours).
  - The ECM records the engine operating conditions for a short time before and after the fault occurred.

SAE Code Identifiers

- Each fault code uses three, three-digit number groups to describe the problem. An example would be: 128 s110 04.
  - The first three-digit number group is the message identifier (MID) that identifies which microprocessor is broadcasting the code.
  - The second three-digit number group is either the parameter identifier (PID) or the subsystem identifier (SID).
  - The PID gives a numerical value in degrees, volts, or psi.
  - The SID identifies the part that is malfunctioning.
  - The third three-digit number group is the fault mode identifier (FMI) that identifies what is wrong with the sensor signal and indicates whether the problem relates to the current flow or voltage.