

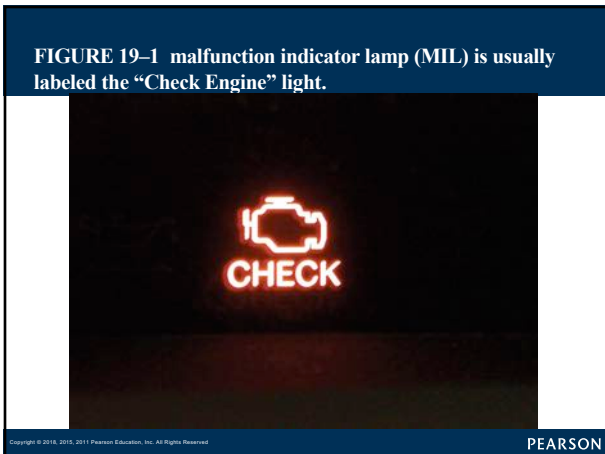
LEARNING OBJECTIVES (1 of 1)

19.1 Prepare for the Light Vehicle Diesel Engine (A9) ASE certification area “A” (General Diagnosis).

19.2 Understand the purpose and function of on-board diagnostics generation-II (OBD-II) systems.

19.3 Discuss the numbering designation of OBD-II diagnostic trouble codes.

19.4 Explain powertrain control module (PCM) tests and the modes of operation of OBD-II vehicles.

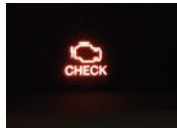


OBD-II

• OBD II Objectives

– CARB defines an OBD-II-equipped vehicle as:

- Detect component degradation
- Or faulty emission related system that
- Prevents compliance with federal emission standards
- Alert driver of needed emission-related repair
- Standardized DTCs & accept generic scan tool
- All new vehicles must pass Federal Test
- Procedure (FTP) for exhaust emissions



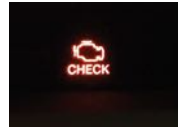
Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

CALIFORNIA OBD II (1 of 2)

• California On-board Diagnostic (OBD) Requirements

- for light duty vehicles & heavy-duty engines
- used in vehicles up to 14,000 lbs GVWR (medium-duty vehicles)
- Introduced in 2 steps:



Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

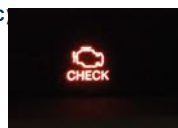
CALIFORNIA OBD II (2 of 2)

• STEP 1 – OBD I required OEMs to monitor

- Some of emission control components on all 1991
- Newer vehicles sold in California.

• STEP 2 – OBD II Since 1996 required new gasoline

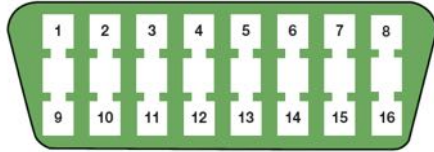
- Alternate fuel passenger cars and trucks sold in California
- All 1997 and newer diesel fueled passenger cars and trucks
- Required to meet OBD II-requirements
- Standardized diagnostic link connector (DLC)



Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

FIGURE 19-2 OBD-II diagnostic link connector (DLC) is located under the dash on most diesel vehicles. The pins are also standardized for most, but not all of the pin locations.



- Pin 2 - J1850 Bus+
- Pin 4 - Chassis Ground
- Pin 5 - Signal Ground
- Pin 6 - CAN High (J-2284)
- Pin 7 - ISO 9141-2 K Line
- Pin 10 - J1850 Bus
- Pin 14 - CAN Low (J-2284)
- Pin 15 - ISO 9141-2 L Line
- Pin 16 - Battery Power

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

What About the Emission Requirements for Heavy-Duty Diesel Engines?



FREQUENTLY ASKED QUESTION

- **California on-board diagnostic requirements** for heavy duty engines for vehicles with GVWR > 14,000 lb. have also been introduced in 2 stages, as follows:
- **STAGE 1 – Engine Manufacturer Diagnostic (EMD) system** — Starting with the 2007 model year, heavy-duty engines require a very basic diagnostic system referred to as an Engine Manufacturer Diagnostic (EMD) system.
- **STAGE 2 – HD OBD —Starting in 2010**, OBD requirements for heavy-duty engines started to be phased in and by **2013**, EMD systems were phased out. All heavy-duty engines offered for sale in California require OBD systems.

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

DIAGNOSTIC EXECUTIVE AND TASK MANAGER

- PCM incorporates a special segment of software
- Ford/ GM: called **Diagnostic Executive**
- Chrysler: called **Task Manager**
- Software designed to manage operation
 - Of all OBD-II monitors by controlling
 - Sequence of steps necessary
 - To execute diagnostic tests and monitors

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

MONITORS (1 of 3)

- **Organized testing specific part of system**
- **Simply test computer performs**
 - To evaluate components & systems.
- **Component or system failure detected**
 - Monitor running, DTC stored
 - **MIL** illuminated by second trip

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

MONITORS (2 of 3)

- **TRIP: Page 224 of text**
- **WARM-UP CYCLE Page 224 of text**
- **MIL CONDITION: OFF Page 224 of text**
 - ON STEADY
 - FLASHING
 - OFF

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

MONITORS (3 of 3)

- **Trips are Criteria**
 - Used to turn MIL off
 - Most scan tools display this information
 - Under “Trip Counter.”
 - 3 trips must occur
 - To extinguish MIL

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

QUESTION 1

- What is a trip?

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

ANSWER 1

- Trip is defined as a key-on condition that contains the necessary conditions for a particular test to be performed followed by a key-off. These conditions are called the enable criteria.

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

DIAGNOSTIC TROUBLE CODES (1 of 6)

- Scan tool is required to retrieve DTCs: **Page 224**
 - From an OBD-II vehicle.
- Every OBD-II scan tool will be able to read all
- **SAE GENERIC** DTCs from any vehicle.

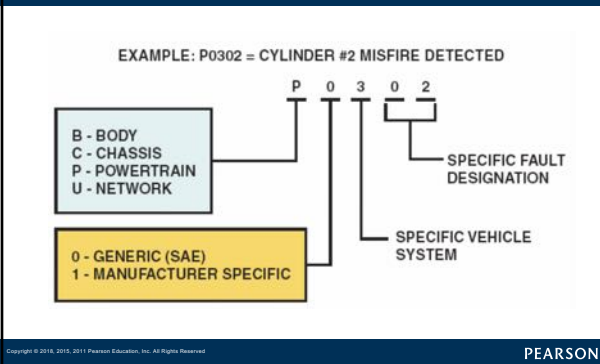
Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

FIGURE 19–3 scan tool screen capture showing warm-up cycles and distance travelled since diagnostic trouble code (DTC) was cleared.

Malfunction Indicator Lamp (MIL)		
Open Test Status		
Engine Oil Pressure Control Solenoid Valve Control Circuit	OK	
High Voltage Test Status		
Engine Oil Pressure Control Test Counter	0	Counts
Vehicle Speed Sensor	0	mph
Warm-Ups Since DTC Cleared	89	Counts
Warm-Ups without Emission Malfunctions	89	Counts
Warm-Ups without Non-Emission Malfunctions	89	Counts
Distance Since DTC Cleared	1308	miles
Engine Run Time	00:15:06	

FIGURE 19–4 OBD-II DTC identification format.



DIAGNOSTIC TROUBLE CODES (2 of 6)

- Pxxx codes—
 - Powertrain DTCS (engine, transmission related faults)
- Bxxx codes—
 - Body DTCS (accessories, interior-related faults)
- Cxxx codes—
 - Chassis DTCS (suspension and steering related faults)
- Uxxx codes—
 - Network DTCS (module communication related faults)

DIAGNOSTIC TROUBLE CODES (3 of 6)

• **Number In 100TH Position Indicates**

- Specific vehicle system/subgroup failed for
 - P0xxx- and P1xxx-type codes
 - P0100—Air metering and fuel system fault
 - P0200—Fuel system (fuel injector only) fault
 - P0300—Ignition system or misfire fault
 - P0400—Emission control system fault
 - P0500—Idle speed control, vehicle speed (VS) sensor fault
 - P0600—Computer output circuit (relay, solenoid, etc.)
 - P0700—Transaxle, transmission faults

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

DIAGNOSTIC TROUBLE CODES (4 of 6)

• **DTC Types: Not all same importance**

- Computer will only turn on MIL
 - For emissions-related DTC
 - Type A Codes Emission-related
 - Type B Codes stored
 - MIL on during 2nd consecutive trip
 - Type C & D Codes
 - Non-emission-related diagnostic tests

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

QUESTION 2

What is the difference between a type A and type B OBD-II DTC?

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

ANSWER 2

Type A Codes Emission-related
Type B Codes stored
MIL on during 2nd consecutive trip

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

DIAGNOSTIC TROUBLE CODES (5 of 6)

- **Pending DTC: Page 225**
 - Set when operating conditions are met
 - Component or circuit is not within normal range
 - Conditions have not yet been met to set A DTC.
 - Set fault detected on 1ST fault of two-trip failure

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

DIAGNOSTIC TROUBLE CODES (6 of 6)

- **Permanent DTC Page 225**
 - Stored in memory, cannot be erased with
 - Scan tools or by disconnecting battery
 - Only erased by OBD system itself
 - Erased by OBD system itself in 1 of 2 ways:
 - Scan tool "code clear" has not been received, permanent DTC will be erased at same time MIL turns off
 - If scan tool "code clear" taken place (codes cleared after repairing fault), permanent DTC will not be erased until the monitor has run at least once

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

OBD II FREEZE FRAME (1 of 2)

• **Freeze Frame**

- OBD II requires PCM to take "snapshot" or freeze-frame
- OF data at instant emission-related DTC is set
- Scan tool required to retrieve this data.

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

OBD II FREEZE FRAME (2 of 2)

• **OBD-II FREEZE-FRAME: Pages 225-226**

- Calculated load value
- Engine speed (RPM)
- Short-term and long-term fuel trim percent
- Fuel system pressure (on some vehicles)
- Vehicle speed (mph)
- Engine coolant temperature
- Intake manifold pressure
- Closed-open-loop status
- Fault code that triggered freeze-frame

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

PCM TESTS

- **Rationality Test Page 226 of text**
- **Functionality Test**
- **Electrical Test**

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

GLOBAL OBD II (1 of 6)

- **Global OBD II**, also called **Generic OBD II**
 - Standardized format of on-board diagnostics
 - Following SAE standard J1962.
- **Global OBD II**
 - Designed for engineers
 - When OBD II was first introduced
 - **Not intended to be used by technicians.**

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

GLOBAL OBD II (2 of 6)

- All OBD-II vehicles must be able to display data
- ON global (generic) scan tool under 9 modes
- These modes include:
 - **MODE ONE** Current powertrain data (parameter identification display or **PID**)
 - **MODE TWO** Freeze-frame data
 - **MODE THREE** Diagnostic trouble codes

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

GLOBAL OBD II (3 of 6)

- **MODE FOUR** Clear and reset diagnostic trouble codes (DTCs), freeze-frame data, and readiness status monitors for non-continuous monitors only
- **MODE FIVE** Oxygen sensor monitor test results
- **MODE SIX** Onboard monitoring of test results for noncontinuous monitored systems
- **MODE SEVEN** Onboard monitoring of test results for continuously monitored systems
- **MODE EIGHT** Bidirectional control of onboard systems
- **MODE NINE** Module identification

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

FIGURE 19-5 global OBD II can be accessed from the main menu on all factory-level aftermarket and some original equipment scan tools.



GLOBAL OBD II (5 of 6)

• Advantages of Global OBD II

- Use global information before looking
- At factory side of PCM
- Because OBD II requires data displayed is raw
- Not substituted value
 - IF ECT sensor were to become unplugged:
 - Global OBD-II scan tool would show about -40°.
 - On factory or factory-level enhanced scan tool
 - Data may read 177°, which is replacement or substituted value

Copyright © 2010, 2015, 2011 Pearson Education, Inc. All Rights Reserved. PEARSON

GLOBAL OBD II (6 of 6)

• Disadvantages of Global OBD II

- Does not display all of data
- Information NOT sorted by area
- Factory Scan tool data includes all of data
- Can be viewed in specific "data packets:"
 - Misfire Data
 - Sensor Data
 - Exhaust Aftertreatment Data

Copyright © 2010, 2015, 2011 Pearson Education, Inc. All Rights Reserved. PEARSON

Summary (1 of 2)

- An instrument panel warning lamp able to alert the driver of certain control system failure is called a malfunction indicator lamp (MIL).
- All 1997 and newer diesel fueled passenger cars and trucks are also required to meet OBD-II requirements.
- A monitor is an organized method of testing a specific part of the system. Monitors are tests that the computer performs to evaluate components and systems.

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON

Summary (2 of 2)

- If the MIL is on, retrieve the DTC and follow the manufacturer's recommended procedure to find the root cause of the problem.
- Permanent diagnostic trouble codes (DTCs) are stored in memory and cannot be erased with scan tools (generic, aftermarket, or manufacturer-specific) or by disconnecting the battery.
- OBD-II vehicles use common global (generic) DTCs.

Copyright © 2018, 2015, 2011 Pearson Education, Inc. All Rights Reserved.

PEARSON
