Welcome to Engine Repair
General Engine Diagnosis

Module 7

PPT a1 m7 Final

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Lesson 1: Oil/Fluid Leak Diagnosis

Introduction

♦ After completing this unit, the technician will demonstrate an understanding of oil leak diagnosis.

♦ The technician will also demonstrate the skills required to troubleshoot oil leak diagnosis and address customer concerns.
Objective

Describe the procedures to check for oil leaks and identify possible sources of oil leaks.
Notice

It is important to correctly identify the source of an oil leak. A power steering fluid leak or spillage can travel across the valley area of the engine and run out the weep hole, which is located at the back of the block.

Failure to correctly identify the source of an oil leak can lead to the incorrect or unnecessary replacement of components.
Engine Compartment Fluids

- Coolant
- Power steering fluid
- A/C PAG oil
- Transmission fluid
- Front axle lube
- Electrolyte
Sources/Causes of Oil Leaks

- High oil level
- High fluid pressure
- Plugged or malfunctioning filters or bypass valve
- PCV system malfunctions
Sources/Causes of Oil Leaks cont.

- Improperly tightened or damaged fasteners
- Incorrect or incorrectly installed sealers or gaskets
Leak Inspection Methods

- Visual Inspection Method
- Powder Method
- Black Light and Dye Method
Leak Checking
Lesson 2: Engine Mechanical Noises

Introduction

♦ After completing this unit, the technician will be able to apply concepts and procedures to diagnose engine mechanical concerns.
Objectives

- Identify the primary types of engine mechanical noise.
- Explain what engine noises sound like.
- Explain how engine noise can be affected by load.
- Identify the type of engine faults that can cause the various engine noises.
- Explain how engine noise can cause a misfire DTC.
Four Steps to Diagnosing Engine Noises

- Type of noise
- Determine the exact operating condition
- Determine the rate and location in the engine
- Compare sounds in other engines
Engine Noises

♦ Upper Engine or Valve Train: Tick

♦ Lower Engine: Knock
Valve Train/Upper Engine Ticking General Sources

- Camshaft(s)
- Lifters
- Pushrods
- Rocker arms
- Valve components
- Guides
- Carbon build up on valves
- Timing chain
- Balance shaft
Exercise
Directions: Place a check mark next to those items that will cause an upper engine ticking noise.

- Excessive piston pin clearance
- Loose spark plug
- Loose rocker arm
- Incorrect piston installation
- Excessive main bearing clearance
- Stuck lifter
Exercise - Review

Directions: Place a check mark next to those items that will cause an upper engine ticking noise.

- Excessive piston pin clearance
- Loose spark plug
- Loose rocker arm
- Incorrect piston installation
- Excessive main bearing clearance
- Stuck lifter
Question 1
You have an engine with a carbon concern. What GM recommended product can you use to remove the carbon without disassembling the engine?

A. Brake cleaner
B. Water injection
C. Propane
D. Top engine cleaner
Top Engine Cleaner
Damaged or loose belt can slip on pulleys, creating a noise.
Noise can change with engine speed.
Check for cracks, pilling, missing areas and component misalignment.
In some situations it can create what appears to be a bearing knock.
Generator bearing

- A damaged bearing will **whine** as the bearings move through races.
- Noise can change as **charging** load changes or as engine speed **increases**.
Flow through pump can generate noise during turning maneuvers.

Grounded hoses can transmit noises that are otherwise isolated.

Loose accessory mounts:

- Create noise when metal-to-metal contact changes with engine power pulses.
Primary Areas for Upper Engine Noise

- Upper valve train
- Timing chains
Question 2

We have a valve with damage on the stem tip, and lubrication is sufficient. What do you suspect could be the root cause?

A. Bent push rod
B. Worn valve guide
C. Worn cam lobe
D. Light carbon on the valve
Boroscope
Question 3

If you suspect that the timing chain is worn, how can you determine it without engine disassembly?
Lower Engine Knocking
General Sources

- Piston slap
- Main/rod bearing knock
- Piston pin knock
- Flywheel (loose or broken)
- Carbon in the combustion chamber
Pan Damage Can Cause:

- Pan contact with the suction screen
- Pickup tube damage
- Oil pump damage
- Engine block damage
Question 4
Which of the following could cause the engine to create a loud clunk noise during initial, moderate acceleration?

A. Broken engine mount
B. Loose generator mount
C. Mis-positioned power steering pump pulley
D. Leaking exhaust
Question 5

What diagnostic procedure can be used to verify and isolate a rod bearing concern?
Question 6

What is a simple contributor to many types of engine noise that can be easily checked?
Noise at Startup that Goes Away:

- Oil filter
- Damaged/faulty oil filter bypass valve
- Incorrect viscosity oil
- Worn crankshaft thrust bearing
- High valve lifter/SHLA leak down
Other Mechanical Checks

- Excessive timing chain wear
- Excessive camshaft end play
- Excessive crankshaft end play
- Proper installation of actuator assembly
Question 7

How can a damaged engine component cause a misfire DTC to set?
Lesson 3: Base Engine Misfire Test

Introduction

♦ After completing this unit, the technician will be able to apply concepts and procedures to diagnose base engine misfires.
Objectives

- Identify the cause of an engine misfire.
Diagnostic Scenario

Vehicle: 2002 Suburban

Customer Concern: MIL ON and engine noise - verified

Preliminary Diagnostics: No issues found

Diagnostic System Check: DTC P0300-Engine misfire detected
OBD System Check

♦ Steps 1 & 2: Checks ability of scan tool to power up & communicate

♦ Step 3: Checks engine start/idle

♦ Step 4: Checks for stored DTCs

♦ Step 5: Captures stored Powertrain DTC information
OBD System Check cont.

♦ Step 6: Does scan tool display U-type codes?

♦ Step 7: Does scan tool display DTC P0601, P0602, P0604 or P0606?

♦ Step 8: Does scan tool display DTC P0562, P0563, P1637 or P1638?
Tech 2 with DTC P0300

**DTC Info.**

P0300  Engine Misfire Detected

- **Last Test:** Failed
- **This Ignition:** Failed
  - MIL Requested
- **Since Cleared:** Passed & Failed
  - History
    - 1/1

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*Images of GM ASEP and ASEP logos at the bottom left corner.*
Question 8

What is the first thing you need to do for this DTC?

A. Use injector test lamp (noid lamp)
B. Perform power balance testing
C. Monitor misfire counters
D. Use J 26792/ST 125 Spark Tester
TECH 2 Misfire Counter
<table>
<thead>
<tr>
<th>Type of Misfire</th>
<th>Root Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Cylinder</td>
<td>Injector coil open</td>
</tr>
<tr>
<td></td>
<td>EGR stuck open</td>
</tr>
<tr>
<td></td>
<td>High/low fuel pressure</td>
</tr>
<tr>
<td></td>
<td>Bent push rod</td>
</tr>
<tr>
<td></td>
<td>Open ICM power or ground for Bank #1</td>
</tr>
<tr>
<td></td>
<td>Leaking injector</td>
</tr>
<tr>
<td></td>
<td>Timing chain stretch</td>
</tr>
</tbody>
</table>
5.3L Misfire Root Causes

**Type of Misfire**
- Single Cylinder

**Root Cause**
- Injector coil open
- EGR stuck open
- High/low fuel pressure
- Bent push rod
- Open ICM power or ground for Bank #1
- Leaking injector
- Timing chain stretch
Injector Test Lamp

- Test lamp checks the ability of the PCM to provide current to the fuel injector
# Base Engine Malfunctions

## Single Cylinder
- Weak valve spring
- Bent valve stem
- Piston with high carbon deposit

## Multiple Cylinder
- Plugged exhaust
- Head gasket
- Warped intake manifold
Lesson 4: Static Compression Test

Introduction

◆ After completing this unit, the technician will be able to apply concepts and procedures to diagnose engine mechanical concerns utilizing the static compression test.
Objectives

- Identify the condition of the engine’s piston rings, valves and head gasket(s).
**Static Compression Test**

<table>
<thead>
<tr>
<th>Cylinder #1</th>
<th>155 psi</th>
<th>Cylinder #5</th>
<th>155 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder #2</td>
<td>160 psi</td>
<td>Cylinder #6</td>
<td>150 psi</td>
</tr>
<tr>
<td>Cylinder #3</td>
<td>160 psi</td>
<td>Cylinder #7</td>
<td>155 psi</td>
</tr>
<tr>
<td>Cylinder #4</td>
<td>155 psi</td>
<td>Cylinder #8</td>
<td>160 psi</td>
</tr>
</tbody>
</table>

70% of 160 = 112 psi
Question 9
Based on the results of this test, what would you do?

A. Run the test again, it was incorrectly performed
B. Replace leaking valves
C. Perform a cylinder leak down test
D. Perform running compression test
Lesson 5: Running Compression Test

Introduction

♦ After completing this unit, the technician will be able to apply concepts and procedures to diagnose engine mechanical concerns utilizing the running compression test.
Objectives

- Identify the engine’s ability to fill and evacuate the cylinder to produce the proper engine output during idle and loaded conditions.
# Running Compression Test

<table>
<thead>
<tr>
<th>Cylinder #1</th>
<th>Static</th>
<th>Running</th>
<th>Snap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>155 psi</td>
<td>75 psi</td>
<td>115 psi</td>
</tr>
<tr>
<td>Cylinder #3</td>
<td>160 psi</td>
<td>35 psi</td>
<td>50 psi</td>
</tr>
<tr>
<td>Cylinder #5</td>
<td>155 psi</td>
<td>80 psi</td>
<td>110 psi</td>
</tr>
</tbody>
</table>
Question 10

Based on the results of the running compression test, what would you inspect?
Lesson 6: Cylinder Leakage Test

Introduction

♦ After completing this unit, the technician will be able to apply concepts and procedures to diagnose engine mechanical concerns utilizing the cylinder leakage test.
Objectives

- The cylinder leakage test may be used in conjunction with the engine compression test to isolate the cause of leaking cylinders.
Cylinder Leakdown Tester
Cylinder Leakdown Tester
Static Compression Test

Cylinder #1 155 psi  Cylinder #5 105 psi
Cylinder #2 160 psi  Cylinder #6 150 psi
Cylinder #3 160 psi  Cylinder #7 155 psi
Cylinder #4 155 psi  Cylinder #8 160 psi

70% of 160 = 112 psi
Question 11
Based on the results of this test, what would you do?

A. Run the test again, it was incorrectly performed
B. Replace leaking valves
C. Perform a cylinder leak down test
D. Perform running compression test
Lesson 7: Restricted Exhaust Test

♦ Introduction

♦ After completing this unit, the technician will be able to apply concepts and procedures to diagnose engine mechanical concerns utilizing the restricted exhaust test.
Objectives

- Identify an engine mechanical concern related to a restricted exhaust system.
## Restricted Exhaust Diagnostic Chart

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Value(s)</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Did you verify the customers complaint?</td>
<td>--</td>
<td>Go to Step 2</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>Did you review the exhaust symptoms diagnostic information and perform the necessary inspections?</td>
<td>--</td>
<td>Go to Step 3</td>
<td>Go to Symptoms - Engine Exhaust</td>
</tr>
<tr>
<td>3</td>
<td>Is the vehicle equipped with a 6.6L diesel engine?</td>
<td>--</td>
<td>Go to Diagnostic Aids</td>
<td>Go to Step 4</td>
</tr>
</tbody>
</table>
| 4    | 1. Remove the AIR check valve or the HO2S that is in front of and closest to the catalytic converter. Refer to Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1 or Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1 in Engine Controls - 4.3L, Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1 or Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1 in Engine Controls - 4.8L, 5.3L, and 6.0L, Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1 or Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1 in Engine Controls - 8.1L.  
2. Install the J 35314-A/BT-8515/BT-8515A in place of the AIR check valve or HO2S sensor.  
3. Start the engine.  
4. Increase and monitor the engine speed at 2000 RPM.  
5. Observe the exhaust system back pressure reading on the gauge. Does the reading exceed the specified value? | 14 kPa (2 psi) | Go to Step 5 | Go to Step 8 |
### Restricted Exhaust Diagnostic Chart

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Value (s)</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
| 5    | 1. Turn the engine off and place the ignition in the lock position.  
     2. Remove the J 35314-A/BT-8515/BT-8515A.  
     5. Install the J 35314-A/BT-8515/BT-8515A in place of the post HO2S sensor.  
     6. Start the engine.  
     7. Increase and monitor the engine speed at 2000 RPM.  
     8. Observe the exhaust system back pressure reading on the gauge.  
     Does the reading exceed the specified value?                                                                 | 14 kPa (2 psi) | Go to Step 6 | Go to Step 7 |

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Go to Step 6
Go to Step 7
Lesson 8: Vacuum Test

Introduction

♦ After completing this unit, the technician will be able to apply concepts and procedures to diagnose engine mechanical concerns utilizing the vacuum test.
Objectives

- Describe the procedure to check engine vacuum and identify the source(s) of incorrect vacuum readings.
## Vacuum Test Diagnostic Chart

<table>
<thead>
<tr>
<th>Readings</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Average, steady readings between 15–22 inches Hg</td>
<td>1. Normal</td>
</tr>
<tr>
<td>(normal readings for a 60° V6 engine may be lower, i.e., 12–16 inches Hg)</td>
<td></td>
</tr>
<tr>
<td>2. Low but steady, between 12 and 15 inches Hg</td>
<td>2. Leakage around piston rings, late ignition timing, or late valve timing</td>
</tr>
<tr>
<td>3. Needle fluctuates or drops between 1 and 2 inches Hg at Idle</td>
<td>3. Burned or leaking valve or spark plug in one of the cylinders is not firing</td>
</tr>
<tr>
<td>4. Irregular needle drop between 1 and 2 inches Hg</td>
<td>4. Sticking valve, intermittent spark plug misfire, or rich or lean air/fuel mixture</td>
</tr>
<tr>
<td>5. Normal at idle speed, but excessive vibrations at higher rpm</td>
<td>5. Weak valve springs; valves sticking in guides</td>
</tr>
<tr>
<td>6. Excessive vibrations at idle speed, but steadies at higher rpm</td>
<td>6. Worn valve guides</td>
</tr>
<tr>
<td>7. Excessive vibration at all rpm</td>
<td>7. Leaky head gasket</td>
</tr>
<tr>
<td>8. Needle oscillates slowly, or drifts, between 3 and 9 inches Hg lower than normal</td>
<td>8. Intake system leak</td>
</tr>
<tr>
<td>9. Normal at idle speed, but drops to near zero and rises to lower than normal</td>
<td>9. Restriction in exhaust system</td>
</tr>
</tbody>
</table>
Lesson 9: Oil Pressure Test

Introduction

♦ After completing this unit, the technician will be able to apply concepts and procedures to diagnose engine oil pressure concerns.
Objectives

- Describe the procedure to check oil pressure and identify the sources of low oil pressure.
Engine Oil Functions

- Provides lubrication
- Provides hydraulic pressure for component operation
- Cools moving components
- Provides sealing and cleaning
Initial Engine Oil Checks

- Check level
- Check condition
- Check vehicle gauge pressure
Engine Oil Pressure Test

♦ Preliminary inspections

♦ Connect gauge according to service procedures

♦ Compare gauge reading to service specifications
Oil Pressure Checking
Question 12

If the oil pressure is low, what would you check for?
Question 13

Before disassembling an engine to locate the source of low oil pressure, what should you do first?

A. Test the operation of the vehicle oil pressure gauge
B. Look for DTCs
C. Inspect for oil leaks
D. Check the operation of the gauge on another vehicle
Question 14

Where are some of the primary spots that you should check for leaks?
Lesson 10: Engine Speed-Related Vibrations

Introduction

♦ After completing this unit, the technician will be able to apply concepts and procedures to diagnose engine speed-related vibrations.
Objectives

- Describe Engine Speed-Related Vibration Firing Frequencies.
Isolating Vibrations

<table>
<thead>
<tr>
<th></th>
<th>First Order Any Engine</th>
<th>Firing Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RPM</td>
<td>Hz</td>
</tr>
<tr>
<td>Shake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>500</td>
<td>8.3</td>
</tr>
<tr>
<td>750</td>
<td>750</td>
<td>12.5</td>
</tr>
<tr>
<td>1000</td>
<td>1000</td>
<td>16.6</td>
</tr>
<tr>
<td>1500</td>
<td>1500</td>
<td>25</td>
</tr>
<tr>
<td>Roughness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>2000</td>
<td>33.3</td>
</tr>
<tr>
<td>2500</td>
<td>2500</td>
<td>41.6</td>
</tr>
<tr>
<td>Buzz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3000</td>
<td>3000</td>
<td>50</td>
</tr>
<tr>
<td>3500</td>
<td>3500</td>
<td>58.3</td>
</tr>
<tr>
<td>4000</td>
<td>4000</td>
<td>66.6</td>
</tr>
</tbody>
</table>

*Engine Order Vibration Chart*
Speed-Related Vibrations

- Tire Inspection
  - Slow Acceleration Test
    - Downshift Test
    - Neutral Coast-Down Test

Speed-Related Vibrations
Speed-Related Vibrations (Continued)

Engine Speed-Related Vibrations

- Downshift Test
- Neutral Run-Up Test
- Brake Torque Test
Summary

- Identify types, causes and appropriate diagnostic strategies of engine mechanical noise
- Identify and diagnose engine misfire concerns
Thank you for attending

General Engine Diagnosis

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Question 1

Valve train noises occur at _____ speed of the engine.

A. 1/4  
B. 1/2  
C. 3/4  
D. the same
Question 2

During which of the following engine operating conditions will carbon build up cause a noise concern?

A. Cold engine operation
B. Engine overheating conditions
C. Normal operating temperatures
D. All engine operating conditions
Question 3

Top engine cleaner is the recommended GM cleaner for which of the following conditions?

A. Leaking oil seals
B. Carbon build up
C. Coolant system leaks
D. Defective head gasket
Question 4

When removing carbon build up, the top engine cleaner should be allowed to work inside the engine how long before starting the engine to remove cleaner?

A. At least 5 minutes
B. At least 10 minutes
C. At least 15 minutes
D. At least 20 minutes
Question 5

Which of the following noises would usually be associated with a balance shaft concern?

A. Detonation/rattle noise
B. Whine
C. Knock
D. Growl
Question 6

A damaged flywheel will usually create a knock noise during which of the following conditions?

A. Acceleration
B. Deceleration
C. Wide open throttle
D. Part throttle cruise
Question 7

Which of the following is a cause of low oil pressure?

A. High engine RPM
B. Broken piston oil ring
C. Plugged oil pump pickup screen
D. Oil pan leak
Question 8

The injector test lamp tests which of the following?

A. The mechanical side of the injector
B. The fuel pump
C. The fuel pressure regulator
D. The PCM and harness
Question 9

During a static compression test, no cylinder should be lower than _____ of the highest cylinder.

A. 60%
B. 70%
C. 80%
D. 90%
Question 10

When checking the Camshaft Position Actuator movement, how much movement should there be?

A. 5-8mm
B. 10-11 mm
C. 14-15 mm
D. 17-18 mm