Chapter 46

Advanced Diagnosis  Learning Objectives

- Use advanced diagnostic tools to troubleshoot difficult problems
- Use a scan tool to find problems
- Explain the principles of a lab scope
- Evaluate ignition system operation
- Explain when and how to use an engine analyzer
Strategy-Based Diagnostics

- Verify customer concern
- Preliminary checks: visual, operational, and hints
- Perform published diagnostic system checks
- Check for bulletins

1. Stored DTC(s)
   - Follow published DTC diagnostics
2. Symptom, no DTC(s)
   - Follow published symptom diagnostics
3. No published diagnostics
   - Analyze & develop diagnostics or call technical assistance
4. Intermittent
   - See diagnostic details

5. Operating as designed
   - Customer misunderstanding of system: Refer customer to management or zone
   - Product problem: call technical assistance

6. Isolate the root cause?
   - No Reexamine the concern
   - Yes Repair & verify fix
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Advanced Diagnosis

1. Also called a multimeter, a DVOM is commonly used to check the condition of numerous electrical, engine-related components.

2. An DYNAMOMETER is used to measure the power output and performance of an engine.
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Engine Performance

Using a DVOM to Diagnosis an Electrical System Problem

Digital Volt/Ohmmeter
Test Leads
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Engine Performance

A General Guideline is: This Reading Should Usually be Between $500$ to $1500$ OHMS
A General Guideline is: This Reading Should Usually be \textit{Less Than 1 OHM}.

To check primary resistance, connect ohmmeter between B+ terminal and the pin corresponding to the coil in question.
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3. An OSCILLOSCOPE displays voltages in relation to time.

4. A CYLINDER POWER BALANCE TESTER will determine if a cylinder is firing properly and producing power.
Oscilloscope

- Displays voltages in relation to time
- Produces a line on a cathode ray tube or liquid crystal screen
Oscilloscope Screen

A. 25,000 volt scale
B. 50,000 volt scale
C. Time scale milliseconds
D. Time scale degrees
Cylinder Balance Test

Each analyzer button will short and disable one cylinder
5. A VACCUM PUMP is capable of producing a supply vacuum for operating and testing vacuum devices.

6. An EXHAUST GAS ANALYZER measures the chemical content and amount of pollution in the vehicle's exhaust.
Hand Vacuum Pump

Used to check vacuum-actuated devices and vacuum diaphragms
Dynamometer

Using a five-gas analyzer with a dynamometer
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Advanced Diagnosis

7. A SCAN TOOL is incorporated into analyzers for retrieving trouble codes and circuit operating values.

8. A VACUUM GAUGE measures negative air pressure produced by the engine, fuel pump, vacuum pump, and other components.
Using a Scanner
Vacuum Gauge Diagnosis

Normal engine reading
Vacuum gauge should have reading of 18-22 inches of vacuum. The needle should remain steady.

Burned or leaky valves
Burned valve will cause pointer to drop every time burned valve opens.

Weak valve springs
Vacuum will be normal at idle but pointer will fluctuate excessively at higher speeds.

Worn valve guides
If pointer fluctuates excessively at idle but steadies at higher speeds, valves may be worn allowing air to upset fuel mixture.

Choked muffler
Vacuum will slowly drop to zero when engine speed is high.

Intake manifold air leak
If pointer is down 3 to 9 inches from normal at idle, throttle valve is not closing or intake gaskets are leaking.

Carburetor or fuel injection problem
A poor air-fuel mixture at idle can cause needle to slowly drift back and forth.

Sticking valves
A sticking valve will cause pointer to drop intermittently.
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9. A DWELL METER will detect point misadjustment and other problems.

10. When adjusting fuel injection or ignition timing, a TACHOMETER is used to measure engine speed in rpm.
### Analyzer

Digital Display

**Cranking tests**

<table>
<thead>
<tr>
<th>CRANKING/PINPOINT TESTS</th>
<th>HOLD</th>
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<tbody>
<tr>
<td>210 RPM</td>
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<tr>
<td>ENGINE</td>
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<tr>
<td>CURRENT</td>
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<tr>
<td>BATTERY</td>
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<tr>
<td>DIST RES</td>
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<tr>
<td>DWELL</td>
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<tr>
<td>TIMING</td>
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<tr>
<td>HC</td>
<td>610</td>
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<tr>
<td>VACUUM</td>
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<tr>
<td>RESISTANCE</td>
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**ENGINE KILL**

8 CYL TEMP 19°C TDC 9.5°

**Running tests**

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<th>2385</th>
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<th>520</th>
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<tr>
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<tr>
<td>Dwell %</td>
<td>70.7</td>
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<tr>
<td>TIMING DEG</td>
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<td>HC PPM</td>
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<tr>
<td>CO %</td>
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<tr>
<td>AMPS A</td>
<td>22.3</td>
<td>32.4</td>
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<td>VOLTAGE V</td>
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<td>14.2</td>
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<tr>
<td>VACUUM &quot;HG&quot;</td>
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<td>14.6</td>
<td>4.5</td>
</tr>
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</table>

8 CYL TEMP 19°C TDC 00.0°
Long Pulse Width = Rich Fuel Mixture

What Causes a “Rich” Mixture?
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Engine Performance

Short Pulse Width = Lean Fuel Mixture

What Causes a “Lean” Mixture?
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