Modern Automotive Technology
Chapter 32
Starting System Testing & Repair
Learning Objectives

- Diagnose common starting system troubles
- Make orderly starting system tests
- R&R Starter
- Explain typical procedures for a starting motor rebuild
- Describe safety practices to follow when testing or repairing starting systems
1. A Single Click Sound (noise) is usually caused by the solenoid closing or the pinion gear contacting the flywheel gear.

2. A Discharged or Poorly Connected Battery can operate the lights but may not have enough power to operate the starting motor.
Basic Starting System

- Dead battery
- Poor cable connections
- Burned solenoid contacts
- Loose starter cable connection
- Ignition switch tumbler or actuator problems
- Ignition switch problems
- Loosened starter mounting bolts
- Bad or misadjusted neutral safety switch
A voltmeter is needed to verify battery condition.
3. A No-Crank condition happens when the engine crankshaft does not rotate when the ignition key is turned to the start position.

4. A Buzzing or Clicking Noise is caused by low current (amps) flow making the solenoid plunger rapidly kick in and out.
Load Test

Load Test to determine current draw (load)
5. A Slow-Crank condition occurs when the engine crankshaft rotates at speeds that are lower than normal.

6. A Voltage Drop Test quickly locates a part (or circuit) with higher-than-normal resistance.
Insulated Circuit Resistance Test

- **Insulated Circuit Resistance Test**
- **Insulated**
  (Positive/B+)
- **Circuit Resistance Test**
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7. A Bent Armature Shaft allows the armature to drag or rub on the field pole shoes.

8. A Starter Ground Circuit Test is used to check the circuit between the starting motor ground and the negative battery terminal.
Voltage Drop Test

Voltage Drop (Ground Circuit) Resistance Test

Starter ground circuit test

- Black lead to negative terminal
- Red lead to starter frame
- Coil grounded
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9. The Pinion Gear Clearance is the distance between pinion and drive end frame with pinion engaged.

10. Starter Shims are used to adjust the space between the pinion gear and the flywheel ring gear.
Starter Shims

Note starter shim location
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11. The Starter Current Draw test measures the number of amps used by starting system.

12. A Metallic Grinding Noise may be caused by broken flywheel teeth or pinion gear teeth wear.
# Starter Motor Current Draw

## Test Values

<table>
<thead>
<tr>
<th>ENGINE DISPLACEMENT</th>
<th>12-VOLT SYSTEM MAX. CURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most 4–6 Cylinders</td>
<td>125–175 Amps Max.</td>
</tr>
<tr>
<td>Under 300 C.I.D.</td>
<td>150–200 Amps Max.</td>
</tr>
<tr>
<td>Over 300 C.I.D.</td>
<td>175–250 Amps Max.</td>
</tr>
</tbody>
</table>

## Cranking Circuit Troubleshooting Chart

<table>
<thead>
<tr>
<th>Cranking Voltage</th>
<th>Cranking Amps</th>
<th>Possible Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage OK</td>
<td>Current OK</td>
<td>System OK</td>
</tr>
<tr>
<td>Voltage OK</td>
<td>Current Low Engine Cranks Slowly</td>
<td>Starter Circuit Connections Faulty</td>
</tr>
<tr>
<td>Voltage Low</td>
<td>Current Low Engine Cranks Slowly</td>
<td>Battery Low</td>
</tr>
<tr>
<td>Voltage Low</td>
<td>Current High</td>
<td>Starter Motor Faulty</td>
</tr>
</tbody>
</table>
Grinding noise may be caused by broken flywheel teeth or pinion gear teeth wear.
13. A Battery Cable Connection test is performed by connecting a voltmeter to the battery post and to the cable and measuring the voltage drop across the connections while cranking the engine.

14. To test for a Bad Starter Relay, check the voltage going into and coming out of the terminals.
15. A Humming Sound (Noise) is produced when the motor armature spins rapidly.
Battery Terminal Testing

Checking battery terminals for corrosion and high resistance
Solenoid Testing

Solenoid (Starter Relay) Testing

Check solenoid lug-to-cable connection

Check disc contact and terminal condition
Bench Testing
Starter Motor

- Starter Motor
- Basic starting system

Diagram showing various parts of a starter motor, including:
- Weak plunger return spring
- Worn plunger
- Bent engagement arm
- Cracked drive end frame bushing
- Worn pin
- Worn bushing
- Worn or damaged C-lock
- Bad clutch
- Worn pinion gear teeth
- Missing or worn armature
- Shorted or open armature
- Worn or dry end frame bushing
- Open or shorted field coil
- Loose through-bolts
- Worn brush
- Brush holder problems
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