

# Tech Tip®

## HOW TO TROUBLESHOOT YOUR STARTING SYSTEM

- ITEMS NEEDED:**
- Haynes Manual For Your Vehicle
  - Digital Volt-ohmmeter(DVOM)
  - Battery Hydrometer
  - Jumper Wires and Cables

Your vehicle's starting system is made up of many components which, when isolated, are really quite easy to diagnose and repair. An easy way to remember the system is to consider the battery as the power source the starter as the power consumer, and the other components as paths for the current to follow from the battery to the starter.

### 1 Starting system components

The starting system consists of the battery, battery cables, wiring, ignition switch, neutral safety switch, starter solenoid, and starter motor. All of these components can be individually checked to pinpoint starting problems. To prevent burns on your hands, always begin repairs with a cool engine. Starting system problems generally fall into the following two categories.

#### NO START ENGINE WILL NOT CRANK

1. If the vehicle has an automatic transmission, check to be sure the gear shift selector is in park.
2. Many vehicles with manual transmissions are equipped with a clutch pedal switch. Check to see if it is broken or has become detached from the clutch pedal.
3. Turn on the headlights. They should be at normal brightness, indicating the battery has an adequate charge. Dimness or no headlights indicates a weak or discharged battery.
4. Check to see if any lights or accessories were left on that may have run the battery down.
5. Inspect the battery cables and clamps. Look for corrosion at the terminal and where the cable enters the terminal (figure 1). On side post batteries, unbolt the terminal and examine the contact pads on the battery and cable ends. Clean all corrosion, tighten loose connections, and replace any deteriorated parts. We recommend the use of anti-corrosion pads or battery protectant spray to help minimize future corrosion. Inspect the wiring to the starter and/or solenoid. Some vehicles have a fender mounted solenoid; others have the solenoid mounted on the starter (Figure 2). Look for broken, burned, or loose wires and connections. Replace as needed.
6. Inspect the battery. If it has removable ventcaps, inspect each cell to be sure it is not frozen or low on fluid.
7. Remove the cell caps and make sure the fluid covers the battery plates. If it doesn't, add distilled water to raise the fluid level above the plates and level with the filler ring. If distilled water was added, fully charge the battery before checking the specific gravity of the fluid.
8. Using the battery hydrometer, check each cell for specific gravity (Figure 3). Insert the hydrometer into the first cell and draw out enough fluid to float the balls. Record the reading and replace the fluid. Go on to each cell in turn and repeat the procedure. The reading in each cell should be 1.250 or higher and should not vary more than 10% from any other given cell. If one or more cells have a low reading, charge the battery and retest. If the readings are still low, replace the battery.

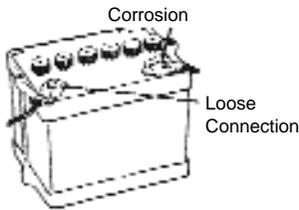


Figure 1

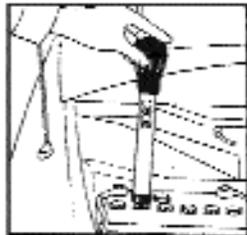


Figure 3

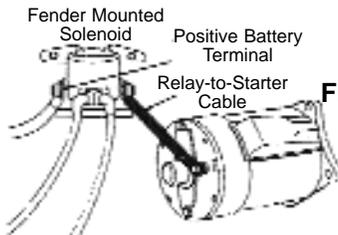


Figure 2

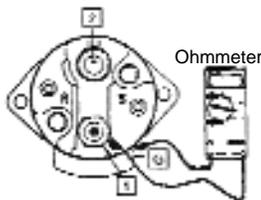


Figure 5-A

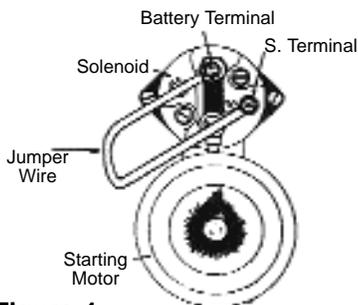


Figure 4

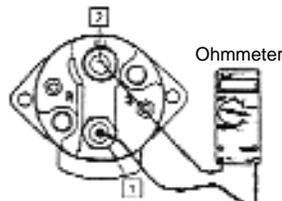


Figure 5-B

9. Next, by-pass the starter solenoid. This must be done on the vehicle.

#### A. Starter Mounted Solenoids.

To by-pass the starter solenoid, place the transmission in "park" or "neutral" and set the parking brake. Connect your jumper wire on the solenoid between the battery and "S" terminals (Figure 4). If engine cranks, the ignition or neutral safety switches may be at fault (see step 20). If no sound is heard, the solenoid is defective and must be replaced. A clicking sound indicates that the solenoid is operating properly, and the problem may lie in the starting motor itself.

To test the solenoid off the car you will need an ohmmeter. Set the meter to the lowest scale and connect one lead to the starter terminal "1" and the other to the metal housing "G" (Figure 5-A). The reading should be between .7 and .9 ohms. If you observe a lower reading than .7 ohms, the solenoid has a short circuit. If a reading higher than .9 ohms is observed, the solenoid has either loose internal connections or corrosion in the windings. In either case, the solenoid must be replaced. The test for a sticking internal contact that could cause the starter to stay engaged is simple. Connect one ohmmeter lead to the terminal marked (1) and the other lead to the terminal marked (2) (Figure 5-B). The reading should be infinity. If the reading indicates continuity, replace the solenoid.

#### B. Ford and AMC Fender-mounted Starter Relay

On Ford and AMC vehicles with a fender mounted starter relay, begin by removing the wire attached to the "S" terminal. Connect a jumper wire from this terminal to the positive battery terminal on the relay (Figure 6). If engine now cranks, the problem is in the wiring, ignition, or neutral safety switches. If engine still will not crank, connect a heavy jumper cable between the positive and starter terminals on the relay (Figure 7) If the engine now cranks, the relay is defective and must be replaced. If it still doesn't crank, the starter may be at fault.

Fender mounted starter solenoids can also be tested off the car using an ohmmeter. With the ohmmeter set at the lowest scale, connect the ohmmeter leads to the "S" terminal and the grounded case (Figure 8). The reading should be between 3.4 and 4.5 ohms. If you get a reading lower than 43.4 ohms, the solenoid has shorted windings. If a reading higher than 4.5 ohms is observed, the solenoid either has a bad internal winding connection or corrosion in the windings. This occurs if the solenoid has been on the vehicle for a long time. Next, check to be sure the contact disc inside the solenoid is not stuck to the battery or starter terminals. Referring to the dotted line in Figure 8, connect the ohmmeter leads to the large terminals labeled "From Battery" and "To Starter" (Figure 8). The meter should show an open circuit or infinity reading. If it does not, the contact disc is stuck in the cranking position. If the solenoid fails any of the above tests, replace it.

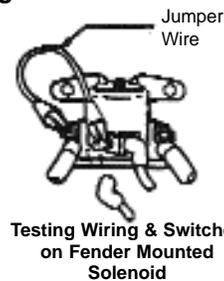
#### C. Chrysler Relays

Chrysler vehicles use a relay to transfer power to the starter instead of the solenoid. On Chrysler vehicles, the relay can be found either on the firewall or the inner fender. To test, connect a Jumper wire between the positive battery and solenoid terminals on the relay (Figure 9). If the engine cranks, the relay is defective and must be replaced. If the engine still fails to crank, then the starter may be defective.

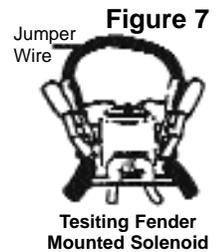
10. If no sound is heard when the key is turned to "start" and the battery and cables are okay, the ignition switch and neutral safety switch should be checked. To check the neutral safety switch, locate the two wires going to the switch (Figures 10-11). The switch may be mounted on the steering column, in the center console on some floor shift models and on others, it is threaded into the transmission. Unplug the wires from the switch and connect your jumper wire between the two wires. Turn the ignition switch to start and if the engine now cranks, the neutral safety switch is defective and must be replaced. For specific testing procedures on your vehicle, please contact a detailed repair manual.

Note: Ignition switches rarely fail only in the "start" mode. Check the ignition switch after all other components have been ruled out.

Figure 6



Testing Wiring & Switches on Fender Mounted Solenoid



Testing Fender Mounted Solenoid

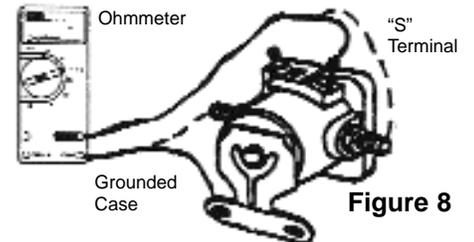


Figure 8

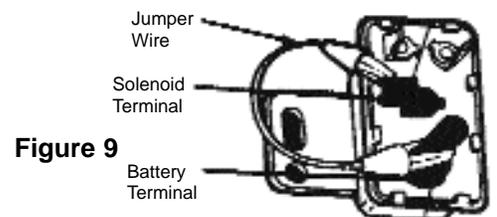
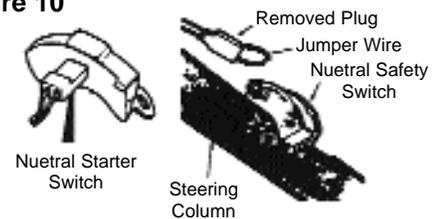


Figure 9

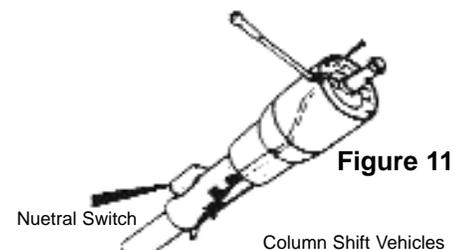
Figure 10



Neutral Starter Switch

Steering Column

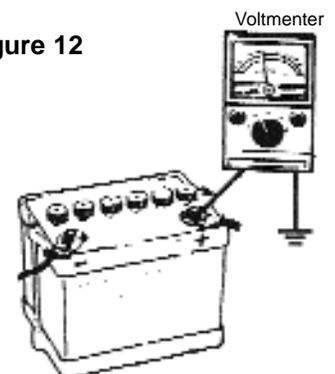
Figure 11



Neutral Switch

Column Shift Vehicles

Figure 12



## 2

### HARD START ENGINE CRANKS TOO SLOW

1. Follow instructions contained in 3 through 7 above.

2. Perform a cranking test. If the engine turns over, a voltmeter can be used to check the cranking voltage available from the battery. First, disable the ignition system by grounding the coil high tension lead or by disconnecting the battery wire at the distributor cap on GM HEI systems. Set the voltmeter to 20 volt scale. Attach the black lead of the voltmeter to a good engine ground. Connect the red lead to the positive battery terminal (Figure 12). Now turn ignition switch to "run" and check the meter reading. The meter should read at least 12.5 volts. Next crank the engine for 15 seconds while observing the meter reading. The voltage should not drop below 9.5 volts. If the voltage stays above 9.5 volts, the battery has sufficient power. If the voltage drops below 9.5 volts, remove the starter and bring it to your Auto Store. They'll be glad to test your battery or starter for free.