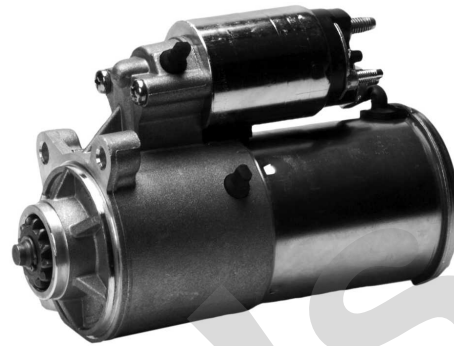


The Starting System



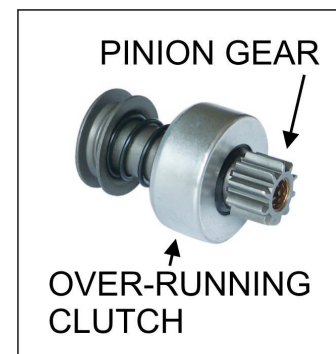
Like alternators and charging systems, starter motors and starting systems in modern automobiles are becoming smaller, lighter and more powerful. A starter motor of the same physical size, or smaller, than one used on a 1970's small-displacement four-cylinder engine, is now being used to crank a large eight-cylinder engine. Advances in permanent magnet technology have almost eliminated the need for field coils. Gear-reduction technologies have allowed the motor portion of the starter to shrink. Throttle body and fuel injection allow engines to start faster, causing less wear on the starter motor.

In spite of all these advances, starting system problems are often not diagnosed correctly. Once the ignition switch is turned to the crank position, the current must pass through the switch, the neutral safety switch (or clutch switch), any anti-theft system installed and finally to the switch terminal of the starter solenoid. Excessive resistance in any of these switches or the wiring will cause a "no start" situation. To make matters worse, the OE manufacturer will sometimes use a wire size that is barely adequate for the required amperage. The marginal capacity of the wire, with the combined resistance of the switches, will cause a chronic intermittent no-start situation. Improper diagnosis of a situation like this will cause repeated "warranty returns" until the installer finds and repairs the real cause of the problem.

Once the starter solenoid gets the proper amount of current:

1. The plunger is pulled into the solenoid.
2. The starter-drive pinion engages the ring gear.
3. The solenoid contacts close, and the starter begins to crank the engine.
4. When the engine starts and the key is released into the run position, the solenoid retracts the pinion from the ring gear.

The starter drive consists of a pinion gear and an over-running clutch. The clutch allows the pinion to slip if it begins turning faster than the starter motor. With age, the springs in the clutch will weaken, causing the clutch to slip when the engine is cranked. Eventually, the contact points in the solenoid will wear down. The brushes, bushings, bearings and machined surfaces in the starter all begin to wear. At this point, a replacement starter motor will be needed. Unless there is operator abuse or other failures in the vehicle systems, the starter motor should last for thousands of starts.



Typical Starter Drive

Testing Safety and Warnings

- Never disconnect the battery while the engine is running.
- Alternators are designed to maintain batteries, not recharge them from dead.
- Keep hands and test-leads away from belts, fans and other moving parts.
- Be sure belts are not worn and are adjusted properly.
- Start all tests with a fully charged battery.
- Clean and inspect all wires and connections.
- Be sure that all grounding surfaces are cleaned to bare metal.
- Verify that alternator amperage is adequate for the vehicle loads.
- Be sure all mounting fasteners are tight.
- Do not over tighten alternator or battery cable connections.
- Ensure automatic tensioners operate properly. The tension spring should not bind, and the pulley bearing should operate smoothly without excessive free play.
- Ensure the transmission is in park or neutral during all tests, and the parking brake is set.
- Disconnect the battery before removing the starter or alternator.
- When removing the alternator, always disconnect the voltage-regulator plug first and reconnect it last.
- Always disconnect battery negative before battery positive and install in reverse order.
- Never use a battery charger as a power supply to test a starter motor.
- When replacing a starter motor, always inspect the ring gear for worn or damaged teeth.
- Always clean the starter mounting-surface to ensure the starter mounts properly.
- Always ensure all starter or alternator mounting bolts are properly torqued.
- Clean and inspect all connections to the starter, solenoid, alternator and battery when removing and replacing cables.
- Use dielectric gel in all plug connections to avoid future corrosion and water penetration.
- Be sure to replace all original brackets, air ducts, etc to ensure proper support and cooling.
- Some applications require the electronic control module codes to be cleared and reset before a replacement alternator will operate properly. If the proper scan-tool is not available, this will require a trip to either the dealer or a well-equipped electrical shop.
- Always test and charge batteries in a well ventilated area. The gasses emitted by batteries are highly explosive.
- Always wear eye protection when working with a battery, and avoid getting the electrolyte on skin and clothing. The electrolyte is sulfuric acid and is highly corrosive.
- When working with active circuits, be careful to avoid accidentally grounding circuits or contacting wires and terminals with rings, watches or other jewelry. For example, contact from the battery terminal to a wrench and a ring on the hand could cause a short if the ring came into contact with the frame or fender.

Special Note

- The electronic control module may need to be reset using a scan-tool if the “Check Engine” light remains on after any repair.
- Be sure to supply the Vehicle Identification Number (VIN) and Accessory Number before replacing a starter or alternator.