

## 2001 STARTING & CHARGING SYSTEMS

### Starters - Corvette

#### DESCRIPTION & OPERATION

**WARNING:** Vehicles are equipped with air bag supplemental restraint system. Before attempting any repairs involving steering column, instrument panel or related components, see **SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM** in appropriate **AIR BAG RESTRAINT SYSTEMS** article in **ACCESSORIES & EQUIPMENT**.

**CAUTION:** When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery.

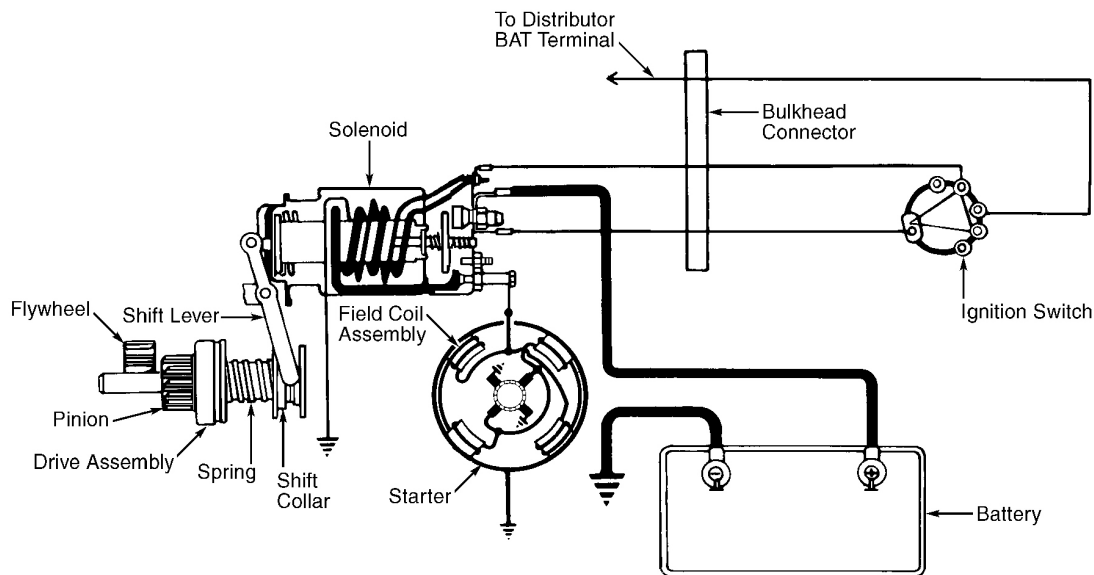
Corvette uses starter PG260 M which is serviceable only by complete replacement. Starter motor features pole pieces that are arranged around armature within starter housing. Drive housing encloses shift lever, shift lever mechanism, and solenoid plunger to protect them from exposure to ice, dirt, and other elements.

Models equipped with automatic transaxle utilize a Park/Neutral Position (PNP) switch or transaxle range switch incorporated within starter circuit to allow starter operation only when vehicle is in Park or Neutral. Models equipped with manual transaxle utilize a Clutch Pedal Position (CPP) switch incorporated within starter circuit to prevent starter operation with clutch pedal released, allowing starter operation only when clutch pedal is depressed. Moving ignition switch to START position sends battery voltage signal through PNP switch (A/T) or CPP switch (M/T) to theft deterrent relay and then to Body Control Module (BCM) for ground. BCM verifies it has received a valid theft password before energizing theft deterrent relay. Battery voltage signal is supplied to starter solenoid when theft deterrent relay is activated.

When voltage is applied to solenoid, voltage is applied to solenoid windings which causes movement of solenoid plunger and shift lever, causing drive pinion to engage flywheel and close solenoid switch contacts. See **Fig. 1** . When solenoid switch contacts close, starter motor energizes and cranks engine. As engine starts, pinion overrun clutch protects armature from excessive speed until ignition switch is opened and plunger return spring disengages pinion.

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**Fig. 1: Illustrating Typical Cranking Circuit**  
 Courtesy of GENERAL MOTORS CORP.

## COMPONENT LOCATIONS

### COMPONENT LOCATIONS

Component	Location
Battery	Underhood, Behind Right Wheelwell
Body Control Module	Right Side Footwell, Mounted To The Toe Board
Clutch Pedal Position Switch (M/T)	Mounted To Bracket Behind Clutch Pedal
Ignition Switch	Left Side Of Instrument Panel, Next To Radio
Instrument Panel Electrical Center	Below Right Side Of Instrument Panel, At Top Of Footwell
Park/Neutral Position Switch (A/T)	Left Side Of Transmission
Powertrain Control Module	Right Side Of Engine Compartment, Below Battery
Theft Deterrent Relay	Right Side Footwell, Mounted To The Toe Board, Above The Body Control Module
Underhood Junction Block	Right Side Of Engine Compartment, Forward Of Battery

## TROUBLE SHOOTING

**NOTE:** For information not covered in this article, see **TROUBLE SHOOTING** article in **GENERAL INFORMATION**.

Check IGN 2 (60-amp) fuse, STARTER (60-amp) fuse, and CRK (10-amp) fuse in instrument panel electrical center. Note condition and operation of SECURITY indicator light. If indicator stays on or flashes continuously, see appropriate ANTI-THEFT SYSTEMS article. Check starter solenoid terminals and battery grounds. Check for a broken or partially broken wire inside insulation, which could cause system malfunction but prove good in a continuity/voltage check with system disconnected. Ensure any aftermarket electronic equipment is properly installed. If fault is found, repair as necessary. If no fault is found, perform self-diagnostics. See **SELF-DIAGNOSTIC SYSTEM** .

## **ON-VEHICLE TESTING**

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**CAUTION:** When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery.

**NOTE:** Before making electrical checks, visually inspect all terminals for clean, tight connections. Ensure all starting system related fuses are okay. Ensure battery is in good condition prior to testing starting system. Ensure charging system is okay. See **GENERATORS & REGULATORS - CORVETTE** article.

## **BATTERY TESTING & INSPECTION**

**NOTE:** Manufacturer recommends using Battery Tester (J-42000) for testing battery. Follow instructions provided with tester.

1. Inspect battery for a cracked, broken or damaged case. If battery case is okay, go to next

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step. If battery case is not okay, go to step 18 .

2. Compare battery cold cranking amperage and reserve capacity rating to specifications. See **BATTERY SPECIFICATIONS** table. If battery meets or exceeds specifications, go to next step. If battery does not meet or exceed specifications, go to step 18 .

#### BATTERY SPECIFICATIONS

Application	Specification
5.7L (LS1 & LS6) Engine (GM P/N 19002277)	
Replacement Battery Number	75P-7YR
Cold Cranking Amps	500 Amps
Reserve Capacity Rating	80 Minutes

3. Turn ignition switch off. Attempt to rotate negative battery cable connector clockwise with light finger pressure. If negative connector rotates, go to next step. If negative connector does not rotate, go to step 5 .
4. Using an INCH lb. torque wrench, record torque value while loosening negative battery cable bolt. If torque is equal to or greater than 89 INCH lbs. (10 N.m), go to step 6 . If torque is less than 89 INCH lbs. (10 N.m), go to next step.
5. Disconnect negative battery cable and go to step 9 .
6. Disconnect negative battery cable. Inspect battery and cable terminals for corrosion and defects. Repair as necessary. Go to next step.
7. Attempt to rotate positive battery cable connector clockwise with light finger pressure. If battery cable rotates, go to next step. If battery cable does not rotate, go to step 9 .
8. Using an INCH lb. torque wrench, record torque value while loosening positive battery cable bolt. If torque is equal to or greater than 89 INCH lbs. (10 N.m), go to step 10 . If torque is less than 89 INCH lbs. (10 N.m), go to step 11 .
9. Disconnect positive battery cable and go to step 11 .
10. Disconnect positive battery cable. Inspect battery and cable terminals for corrosion and defects. Repair as necessary. Go to next step.
11. Clean and wire brush lead face of both battery terminals and metal contact surfaces on both

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cable connectors. Remove bolts from both battery cable connectors and inspect for corrosion and defects. Repair or replace as necessary. If battery and cables terminals are clean and in good condition, go to next step.

12. Connect positive battery cable to battery and tighten bolt to 13 ft. lbs. (18 N.m). Go to next step.
13. Connect negative battery cable to battery and tighten bolt to 13 ft. lbs. (18 N.m). Go to next step.
14. Ensure all electrical loads are off. Follow manufacturers instructions and install Battery Tester (J-42000) to vehicle battery. Follow any instructions displayed on battery tester, EXCEPT add 100 to AGM battery's CCA rating when prompted to enter CCA into tester. DO NOT make this modification for other battery types. If battery tester passed battery, go to next step. If battery tester did not pass battery, go to step 16 .
15. Press CODE button on battery tester. Record displayed code on vehicle repair order for warranty purposes. Go to next step.
16. If J-42000 battery tester displayed result of GOOD-RECHARGE or CHARGE & RETEST, charge battery. If J-42000 battery tester did not display result of GOOD-RECHARGE or CHARGE & RETEST, go to next step.

**NOTE:** If battery was tested in the vehicle with battery cables connected, disconnect cables and install proper adapters. Repeat test according to tester instructions for testing out of the vehicle. Replace battery only if the second test shows a REPLACE or BAD CELL-REPLACE result. Use test code from second test.

17. Press CODE button on battery tester. Record displayed code on vehicle repair order for warranty purposes. Replace battery.
18. Replace battery.

## SELF-DIAGNOSTIC SYSTEM

**NOTE:** Diagnostic trouble code tests are written specifically for use with GM Tech I or Tech II scan tools. Generic scan tool can be used but may have limited functions. This article only covers the portion of those systems which relates to starting system diagnosis.

## ENGINE ELECTRICAL DIAGNOSTIC SYSTEM CHECK

1. Perform battery inspection test. See **BATTERY TESTING & INSPECTION** under ON-VEHICLE TESTING. If problem exists, repair as necessary. If problem does not exist, go to next step.
2. Connect scan tool to Data Link Connector (DLC). Turn ignition switch to RUN position. If scan tool powers up, go to next step. If scan tool does not power up, see **BODY CONTROL MODULES - CORVETTE** article in **ACCESSORIES & EQUIPMENT**.
3. Turn ignition switch to RUN position. Using scan tool, attempt communication with Body Control Module (BCM), Left Door Control Module (LDCM), Right Door Control Module (RDCM), Seat Control Module (SCM) and Powertrain Control Module (PCM) on class 2 serial data circuit. If scan tool communicates with all modules, go to next step. If scan tool does not communicate with any module, repair communications concern. See **BODY CONTROL MODULES - CORVETTE** article in **ACCESSORIES & EQUIPMENT**.
4. Using scan tool, select **DISPLAY DTCs** function for each module. Record all displayed DTCs, DTC status, and module which set the DTC. If scan tool displays any DTCs, go to next step. If scan tool does not display any DTCs, repair starting system by symptom. See **SYMPTOM INDEX** table under **SYSTEM TESTS**.
5. If scan tool displays DTCs which begin with "U", perform appropriate test. See **BODY CONTROL MODULES - CORVETTE** article in **ACCESSORIES & EQUIPMENT**. If scan tool does not display DTCs which begin with "U", go to next step.
6. If scan tool displays DTCs B1000, repair this DTC first. See **BODY CONTROL MODULES - CORVETTE** article in **ACCESSORIES & EQUIPMENT**. If scan tool does not display DTCs B1000, perform appropriate test. See **BODY CONTROL MODULES - CORVETTE** article in **ACCESSORIES & EQUIPMENT**.

## SYSTEM TESTS

**WARNING:** Vehicles are equipped with air bag supplemental restraint system. Before attempting any repairs involving steering column, instrument panel or related components, see **SERVICE PRECAUTIONS** and **DISABLING & ACTIVATING AIR BAG SYSTEM** in appropriate **AIR BAG RESTRAINT SYSTEMS** article in **ACCESSORIES & EQUIPMENT**.

**CAUTION:** When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery.



**NOTE:** The following tests assume that engine and battery are operating normally and are at operating temperature, battery is charged, there are no engine problems that would cause a no-start condition, and no diagnostic trouble codes are present.

**SYMPTOM INDEX**

Symptom	Perform Test
Starter Solenoid Does Not Click	<u><b>A</b></u>
Starter Solenoid Clicks, Engine Does Not Crank	<u><b>B</b></u>
Engine Cranks Slowly	<u><b>C</b></u>
Starter Noise Diagnosis	<u><b>D</b></u>

**TEST A: STARTER SOLENOID DOES NOT CLICK**

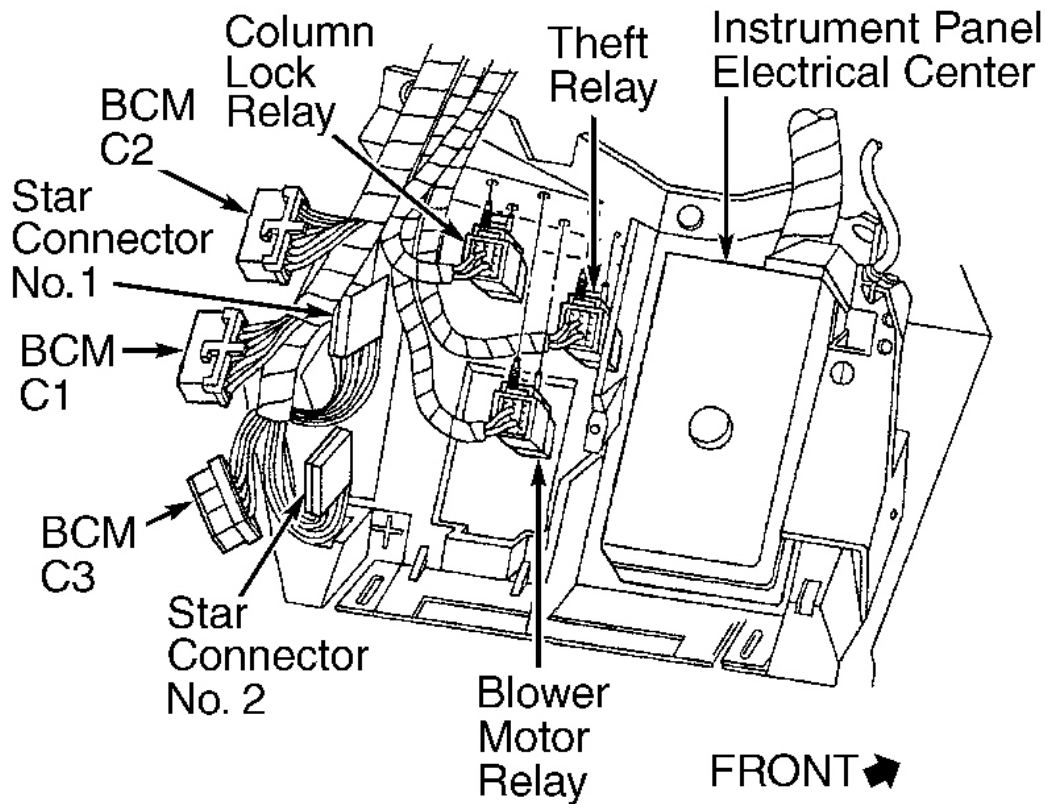
1. If diagnostic system check was not performed, go to **ENGINE ELECTRICAL DIAGNOSTIC SYSTEM CHECK** under SELF-DIAGNOSTIC SYSTEM. If diagnostic system check was performed, go to next step.
2. Turn ignition switch to START position. If engine cranks, problem is intermittent. Check wiring and connections. If engine does not crank, go to next step.
3. Turn ignition switch to START position. If theft deterrent relay clicks, go to step 7 . If theft deterrent relay does not click, go to next step.
4. Remove theft deterrent relay. Theft deterrent relay is located on right side footwell, mounted to the toe board, above the Body Control Module (BCM). See **Fig. 2** . Connect a test light between ground and theft deterrent relay coil voltage supply circuit (Yellow wire) at theft deterrent relay harness connector. Ensure transmission is in Park (A/T) or clutch pedal is depressed (M/T). Turn ignition switch to START position. If test light illuminates, go to next step. If test light does not illuminate, leave test light connected and go to step 6 .
5. Connect a test light between voltage supply circuit (Yellow wire) and control circuit (Yellow/Black wire) at theft deterrent relay harness connector. Ensure transmission is in Park (A/T) or clutch pedal is depressed (M/T). Turn ignition switch to START position. If test light illuminates, go to step 13 . If test light does not illuminate, go to step 10 .
6. Turn ignition switch to LOCK position. Disconnect Park Neutral Position (PNP) switch (A/T) or Clutch Pedal Position (CPP) switch (M/T). Turn ignition switch to RUN position. Connect a 10-amp fused jumper between Purple wire terminal and Yellow wire terminal at PNP switch (A/T) or CPP switch (M/T). Turn ignition switch to START position. If test light illuminates, go to step 14 . If test light does not illuminate, go to step 11 .
7. Turn ignition switch to LOCK position. Remove theft deterrent relay. Theft deterrent relay

is located on right side footwell, mounted to the toe board, above the Body Control Module (BCM). See **Fig. 2** . Connect a test light between theft deterrent relay positive battery voltage circuit (Red wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 18 .

8. Connect a 30-amp fused jumper between theft deterrent relay positive battery voltage circuit (Red wire) and starter solenoid voltage supply circuit (Purple wire) at theft deterrent relay harness connector. If engine cranks, go to step 13 . If engine does not crank, go to next step.
9. If fuse in 30-amp jumper is blown, go to step 19 . If fuse in 30-amp jumper does not blow, go to step 12 .
10. Check for an open or high resistance in Yellow/Black wire between theft deterrent relay and Body Control Module (BCM). BCM is located on right side footwell, mounted to the toe board. See **Fig. 2** . If problem exists, repair as necessary, then go to step 25 . If problem does not exist, go to step 15 .
11. Check for an open or high resistance in Purple wire between PNP switch (A/T) or CPP switch (M/T), and ignition switch. Check for an open or high resistance in Yellow wire between PNP switch or CPP switch, and theft deterrent relay. If problem exist, repair as necessary and go to step 25 . If problem does not exist, go to step 16 .
12. Check for an open or high resistance in Purple wire between theft deterrent relay and starter. If problem exist, repair as necessary and go to step 25 . If problem does not exist, go to step 17 .
13. Inspect theft deterrent relay for poor connections. If problem exists, repair as necessary and go to step 25 . If problem does not exist, go to step 20 .
14. Inspect PNP switch harness connector (A/T) or CPP switch harness connector (M/T) for poor connections. If problem exists, repair as necessary and go to step 25 . If problem does not exist, go to step 21 .
15. Inspect BCM harness connector for poor connections. If problem exists, repair as necessary and go to step 25 . If problem does not exist, go to step 22 .
16. Inspect ignition switch harness connector for poor connections. If problem exists, repair as necessary and go to step 25 . If problem does not exist, go to step 23 .
17. Inspect starter solenoid for poor connections. If problem exists, repair as necessary and go to step 25 . If problem does not exist, go to step 24 .
18. Repair open or high resistance in Red wire between theft deterrent relay and instrument panel fuse box. See POWER DISTRIBUTION article in WIRING DIAGRAMS. After repairs, go to step 25 .
19. Repair short to ground in Purple wire between theft deterrent relay and starter. After repairs, go to step 25 .



20. Replace theft deterrent relay. After repairs, go to step 25 .
21. Replace PNP switch (A/T) or CPP switch (M/T). After repairs, go to step 25 .
22. Replace BCM. After replacement, reprogram PCM. See BODY CONTROL MODULES - CORVETTE article in ACCESSORIES & EQUIPMENT. After repairs, go to step 25 .
23. Replace ignition switch. See appropriate STEERING COLUMN SWITCHES article in ACCESSORIES & EQUIPMENT. After repairs, go to step 25 .
24. Replace starter. See **STARTER** under REMOVAL & INSTALLATION. After repairs, go to next step.
25. Operate system for which symptom occurred. If condition was found and corrected, system is okay. If condition was not found, go to step 2 .



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**Fig. 2: Locating Theft Deterrent Relay**  
 Courtesy of GENERAL MOTORS CORP.

**TEST B: STARTER SOLENOID CLICKS, ENGINE DOES NOT CRANK**

1. If diagnostic system check was not performed, go to **ENGINE ELECTRICAL DIAGNOSTIC SYSTEM CHECK** under SELF-DIAGNOSTIC SYSTEM. If diagnostic system check was performed, go to next step.
2. Turn ignition switch to START position. If starter solenoid clicks, go to next step. If starter solenoid does not click, go to **TEST A: STARTER SOLENOID DOES NOT CLICK** .
3. Inspect engine and drive belt system for mechanical binding. If engine moves freely, go to next step. If engine does not move freely, repair as necessary. See appropriate article in ENGINES.
4. Check for an open or high resistance in battery positive cable between underhood fuse block and starter. If problem exist, repair cable as necessary and go to step 8 . If problem does not exist, go to next step.
5. Check for high resistance in starter ground circuit between battery and starter. If problem exists, repair circuit as necessary and go to step 8 . If problem does not exist, go to next step.
6. Inspect starter for poor connections. If problem exists, repair as necessary and go to step 8 . If problem does not exist, go to next step.
7. Replace starter motor. See **STARTER** under REMOVAL & INSTALLATION. After repairs, go to next step.
8. Retest system to verify repair. If conditions were found and corrected, system is okay. If condition was not found, go to step 2 .

**TEST C: ENGINE CRANKS SLOWLY**

1. Ensure battery is in good condition. See **BATTERY TESTING & INSPECTION** under ON-VEHICLE TESTING. If problem exists, repair as necessary. If problem does not exist, go to next step.
2. Inspect wiring system for damage or poor connections at starter motor, starter solenoid, battery and all grounds. If problem exists, repair as necessary. If problem does not exist, go to next step.
3. Inspect engine and belt drive system for mechanical binding. If engine moves freely, go to next step. If engine does not move freely, repair as necessary.
4. Replace starter motor. See **STARTER** under REMOVAL & INSTALLATION.

**TEST D: STARTER NOISE DIAGNOSIS**

**CAUTION: Never operate starter for periods of more than 15 seconds. Excessive cranking can cause starter to overheat. Allow**

**starter to cool for at least 2 minutes after each time operated.**

**NOTE: Always check flywheel ring gear for signs of damage.**

1. If diagnostic system check was not performed, go to **ENGINE ELECTRICAL DIAGNOSTIC SYSTEM CHECK** under SELF-DIAGNOSTIC SYSTEM. If diagnostic system check was performed, go to next step.
2. Start engine. If starter operates normally, problem is intermittent. Check wiring and connections. If starter does not operate normally, go to next step.
3. Start engine while observing noise from starter motor. If a loud, siren-like "whoop" sound is heard after engine starts (while starter is still held in engaged position), go to step 6 . If a loud, siren-like "whoop" sound is not heard after engine starts (while starter is still held in engaged position), go to next step.
4. If a "rumble", "growl", or "knock" is heard as starter is coasting down to a stop after starting engine, go to step 7 . If a "rumble", "growl", or "knock" is not heard as starter is coasting down to a stop after starting engine, go to next step.
5. If a high-pitched whine is heard after engine cranks and starts normally, go to step 8 . If a high-pitched whine is not heard after engine cranks and starts normally, go to step 7 .
6. Inspect flywheel ring gear for chipped gear teeth, missing gear teeth and milled teeth. If flywheel is bent or has damaged teeth, go to step 9 . If flywheel is okay, go to step 10 .
7. Remove starter motor. See **STARTER** under REMOVAL & INSTALLATION. Inspect starter motor bushings and clutch gear. If clutch gear has chipped or milled teeth, or worn bushings, go to step 10 . If clutch gear is okay, go to step 9 .

**NOTE: Flywheel runout may make this noise appear to be intermittent.**

8. Shim starter away from flywheel by adding shims between starter motor and engine block one at a time. Go to step 11 .
9. Replace flywheel. After repairs, go to step 11 .
10. Replace starter motor. See **STARTER** under REMOVAL & INSTALLATION.
11. Retest system to verify repair. If conditions were found and corrected, system is okay. If condition was not found, go to step 3 .

## **BENCH TESTING**

Information is not available from manufacturer.

## REMOVAL & INSTALLATION

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**NOTE:** Vehicles are designed for starter mounting without shims. A single shim or double shims may have been added to correct a noise or engagement condition. When installing starter, any previously installed shims should be replaced in original location to ensure proper pinion to flywheel clearance.

### STARTER

#### Removal

1. Disconnect negative battery cable. Raise and support vehicle. Disconnect heated oxygen sensor connectors. Remove exhaust pipe-to-exhaust manifold retaining nuts. Remove intermediate exhaust pipe-to-rear exhaust pipe retaining bolts. Remove front and rear exhaust hanger bolts as necessary. Remove intermediate exhaust pipe assembly. Remove catalytic converter.
2. Remove positive battery cable nut. Remove positive battery cable terminal and engine harness leads from solenoid. Remove starter solenoid "S" terminal nut. Remove Purple wire lead and washer from solenoid. Support starter motor. Remove starter motor bolts and starter motor.

#### Installation

1. Position starter motor to block. Install starter motor bolts.

**NOTE:** Orient Purple lead wire to 10 o'clock position when installing.

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**Orient Gray harness lead to 6 o'clock position and Rust harness lead to 7 o'clock position.**

2. Install starter motor "S" terminal washer and Purple lead wire. Install starter motor "S" terminal nut. Install Gray and Rust harness leads to solenoid. Install positive battery cable terminal to solenoid. Install positive battery cable nut.
3. Install catalytic converter. Connect negative battery cable. Tighten bolts and nuts to specification. See **TORQUE SPECIFICATIONS** .

### OVERHAUL

**NOTE: Starter assembly is not serviceable and should be replaced as complete unit.**

### TORQUE SPECIFICATIONS

#### TORQUE SPECIFICATIONS

<b>Application</b>	<b>Ft. Lbs. (N.m)</b>
Exhaust Manifold Nuts	15 (20)
Exhaust Muffler Bolts	37 (50)
Exhaust Pipe Brace Bolts	37 (50)
Exhaust Pipe Hanger Bolts	37 (50)
Negative Battery Cable-To-Battery Bolt	11 (15)
Oxygen Sensors	30 (41)
Positive Battery Cable-To-Starter Motor Stud Nut	11 (15)
Starter Mounting Bolts	37 (50)
	<b>INCH Lbs. (N.m)</b>
Positive Battery Cable-To-Solenoid Nut	89 (10)
Solenoid "S" Terminal Nut	35 (4)

### WIRING DIAGRAMS

**2001 Chevrolet Corvette**

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**2001 Chevrolet Corvette**

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**Fig. 3: Starting System Wiring Diagram (Corvette)**