

## Installation Instructions for 10001-04, 10020-22 & 10040 GM Starters

**IMPORTANT:** Properly mounting the starter is important because this determines whether the starter pinion will engage properly with the ring gear. When the starter is positioned correctly, the starter pinion will engage the ring gear without binding and there will be no chance of starter pinion and/or ring gear damage.

### INSTALLATION:

- 1) Mount Starter.** Make sure the mounting surface of the engine block is smooth, flat and free of paint buildup. Torque starter mounting bolts to engine manufacturer's specifications, typically 32 ft.-lbs.
- 2) Check Pinion Clearance.** There should be 0.060" - 0.140" clearance from the face of ring gear to the front face of the starter pinion. Check in at least three locations on the ring gear (see Figure 1). If not in spec, verify that the ring gear is properly mounted and does not have excessive runout. The included shims can be installed between the starter mounting block and the starter's center support to increase this distance.
- 3) Check Pinion Engagement.** Pull pinion out to engage ring gear. This can be done by:
  - 1) Using a tool to pry the pinion out of the starter, or 2) Connect 12VDC to the "Switch" terminal ONLY (DO NOT connect battery cable to "BAT" terminal on the starter solenoid). This engages the solenoid, but does not spin the starter. CAUTION: Do not leave the solenoid engaged like this for more than 30 seconds at a time as the solenoid will overheat.

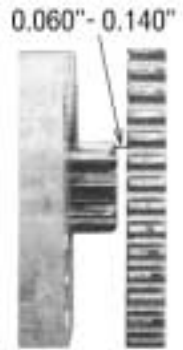
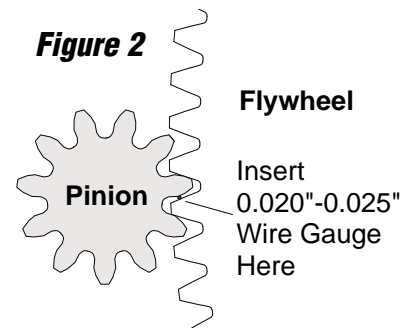


Figure 1

PLEASE NOTE: After releasing the solenoid, the pinion may STAY ENGAGED in the ring gear until the engine is started. This is normal for gear reduction starters and does NOT require shimming to correct.)

- 3) Insert a wire gauge to check for proper backlash between the ring gear and starter pinion (see Figure 2). There should be a 0.020" to 0.025" clearance measured from the flank of the starter pinion to the flank of the ring gear tooth. Check clearance at least three places on the ring gear. If the clearance is too small, add one shim at a time between the starter and engine block to bring it into specifications. In many installs, no shims are necessary.



- 4) Attach Battery Cable and Switch Wire.** The switch wire should be capable of handling 50A intermittent and 10A continuous, typically a 14AWG wire. The battery cable must be the proper size for the length of the cable (see chart). All connections should be clean and tight and terminals should be soldered if possible. The ground cable is important and the best ground path is direct to the engine block. With steel frame vehicles, the ground path can be to the frame. This round cable should be the same size as the starter positive cable. Also, a ground strap should be installed from the frame to the motor. If the original solenoid had a connection to the "R" terminal (ballast resistor bypass), this wire can usually be eliminated. (See explanation #4 on the reverse side.)

DISTANCE	3'	5'	7'	10'	+10'
AWG	4	2	1	0	00

- 5) Operate Starter.** It should operate quietly. Any loud grinding noises must be corrected. If the starter makes a high pitched whine during cranking the center distance from the pinion to the ring gear may be too great. If the starter makes a high pitched whine after cranking as the button or key is released, the center distance from the pinion to the ring gear may be too small. Add a shim. The cables and connectors themselves should be checked for voltage drop with a voltmeter. To check any wire or cable for voltage drop, connect one side of the voltmeter to one end of the cable and the other side of the voltmeter to the other end. OPERATE THE CIRCUIT and simultaneously measure the volt drop. It should be 0.5VDC or less. High voltage drops indicate a bad connector or undersized cable. The ground circuit can be checked

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in the same manner. Measure input voltage by connecting the positive probe of a voltmeter to the "MOTOR" terminal of the solenoid and connecting the negative to the starter housing (should be 9.0V minimum while cranking).

**CAUTION: Never operate a starter more than 30 seconds at a time without allowing time to cool (at least 2 minutes). Overheating will damage the starter.**

### COMMON QUESTIONS

- 1) Why do the teeth on the starter pinion wear off prematurely?** This is caused by pinion and ring gear not being in the proper position to each other. Many things can contribute to this including excessive center distance between to pinion and ring gear, excessive pinion runout in the starter clutch, or excessive runout in the ring gear itself. The solution is to remove any shims between the starter and the engine block and check the clutch assembly in the starter. If no shims are installed, then either shim under the outboard bolt only to roll the pinion toward the ring gear or machine excess material from the mounting surface of the starter.
- 2) Why does the starter crank slowly?** This condition can be caused by several things. The most common cause is excessively low input voltage, which can be caused by undersized starter cables, high resistance or defective batteries, high resistance battery disconnect switches or poor connectors. If the input voltage to the starter is satisfactory (9 volts or higher), then a second possible cause could be an underpowered starter. It is important that the starter have the torque characteristics to handle the load of the engine. If the engine turns too slow, it may require a higher torque starter.
- 3) Can I use a remote solenoid?** Yes. Connect the battery cable from the remote solenoid to the starter in the normal way. Using a small jumper wire (14 gauge), connect the starter's ignition switch terminal to the starter's battery connection.
- 4) What do I do with the wire that connected to the "R" terminal on the original starter (on part nos. 10001-03, 10020-22 and 10040)?** In vehicles originally equipped with a breaker point ignition, the wiring harnesses "R" circuit was a ballast resistor bypass. This terminal is "no connection" when the starter is at rest and is +12VDC while cranking. This circuit provided +12VDC to the ignition coil during cranking for easier engine starting. Cars that do not have a ballast resistor (ie: HEI, MSD or other aftermarket ignition systems) should not need this connection. In most cases this wire will be eliminated. However, cars equipped with a ballast resistor (ie: Breaker Point or Mallory Unilite) may need this harness. If the engine has no ignition during cranking, then the wiring of the coil is going to require an "R" terminal signal. To accomplish this, install an "R" Terminal Diode Kit, part number 555-10038, sold separately.



### ADDITIONAL NOTES ON INSTALLATION

- 1) A note about ring gears.** There is a lot of variation in the quality of the flexplates/flywheels on the market today and in the ring gears that are installed on them. It is important for long starter life that the ring gear be round and true. Check the ring gear in at least six places verifying that the clearance for the starter is the same in all locations. If not, remove the ring gear and make sure the mounting surface of the crankshaft is clean and free of paint buildup or rust. Reinstall the ring gear and properly torque the mounting bolts. If this does not correct the problem, replace the ring gear.
- 2) Disconnect switches.** The switch used for a battery disconnect is very important. All of the starter current will go across this switch during cranking; which, depending on the starter, can be as high as 700A! After the engine is running, all of the current from the alternator will be running across this switch. Therefore, make sure that the switch that is being used can handle these amounts of current. Switches are rated in intermittent amps and continuous amps. The intermittent rating should match or exceed the amount the starter will pull, and the continuous rating should match or exceed the amount the alternator can produce. Using a switch that is too small will result in voltage loss and possible switch failure.



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