



# Starter Installation Instructions

## 9100, 9109, 9112

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### Included Parts:

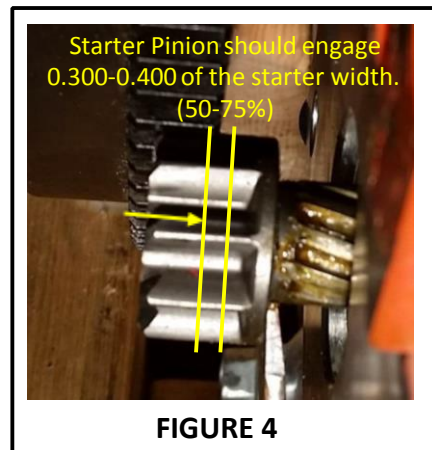
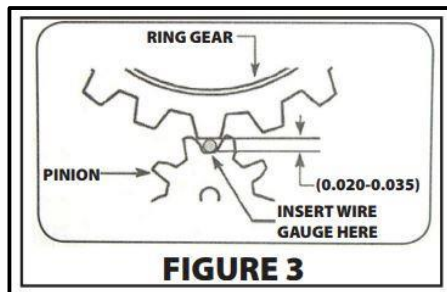
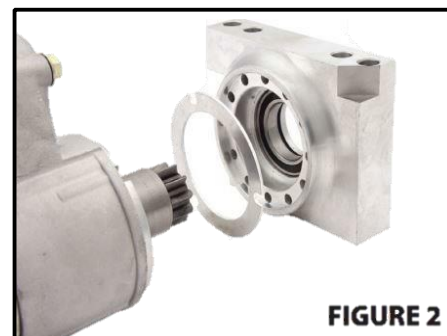
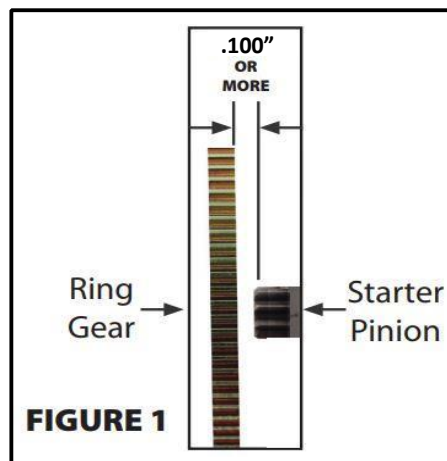
- |                       |                                       |
|-----------------------|---------------------------------------|
| 1- Starter            | 1- Block Shim Kit                     |
| 1- Bolt Kit           | 1- Inner Shim (Pre-installed on 9100) |
| 1- Starter Dyno sheet |                                       |

### WARNING: Disconnect Battery (-) Before Proceeding.

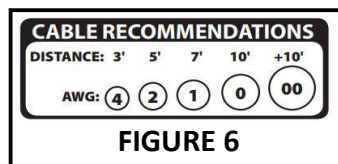
- 1) GROUNDING:** Make sure engine mounting points are free from paint, oil, and debris (Wire brush if necessary). Keep in mind mounting bolts DO NOT provide adequate grounding.
- 2) FITMENT:** Check starter for clearance against oil pan and exhaust. If you encounter any interference re-clock the starter by removing the 3 hex head bolts. The starter can now be reattached in any combination of the 11 mounting holes (Figure2) and retightened to 50 in/lbs. You can now install the provided starter mounting bolts and torque to 32 ft/lbs. We do not recommend heat wraps on our starters, however a custom heat shield with air gap between unit and exhaust is optional.
- 3) PINION CLEARANCE:** There should be a minimum of .100" clearance between the pinion gear and ring gear (Figure1). This distance can be larger than .100" as long as the starter pinion engages properly. Proper engagement is when the pinion gear is engaged 50-75% of the ring gear width (Figure 4). If your engagement is too shallow, you can remove the preinstalled inner shim (See Figure 2). This will allow the pinion gear to engage 0.065 deeper.
- 4) GEAR MESH:** Carefully engage the starter pinion into the ring gear by either prying the gear out or supplying 12V to only the ignition post of the solenoid (Do not hold this voltage more than 10 seconds at a time). This clearance should be 0.020-0.035 (Figure 3), if the gear mesh is too tight install supplied block shims one at a time until desired clearance is achieved. NOTE: The starter gear may stay engaged until the engine fires, DO NOT add shims in response to this. In some cases the gear mesh may be too loose without shims installed, in these cases the starter mounting block can be machined accordingly until correct tolerance is achieved.

**DO NOT SHIM YOUR STARTER TO SOUND!**

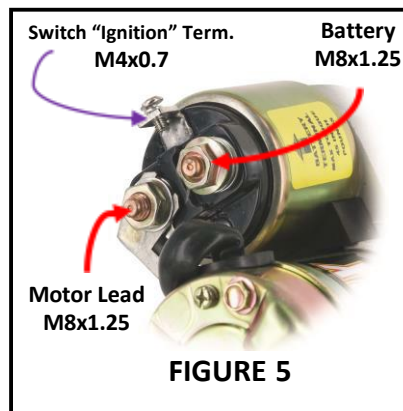
**Continued on back**



- 5) **WIRING CONNECTIONS:** Ensure power cable is sufficient size and in good condition (See Figure 6). Attach battery cable and starter ignition wire to corresponding post on solenoid (Figure 5). **NOTE:** These starters do not have a post for the "R Terminal" connection. If you are using an electronic ignition, this post is normally not needed. If you are using the factory type points ignition, a diode can be added to the starter to function this circuit (PM Part number #600)



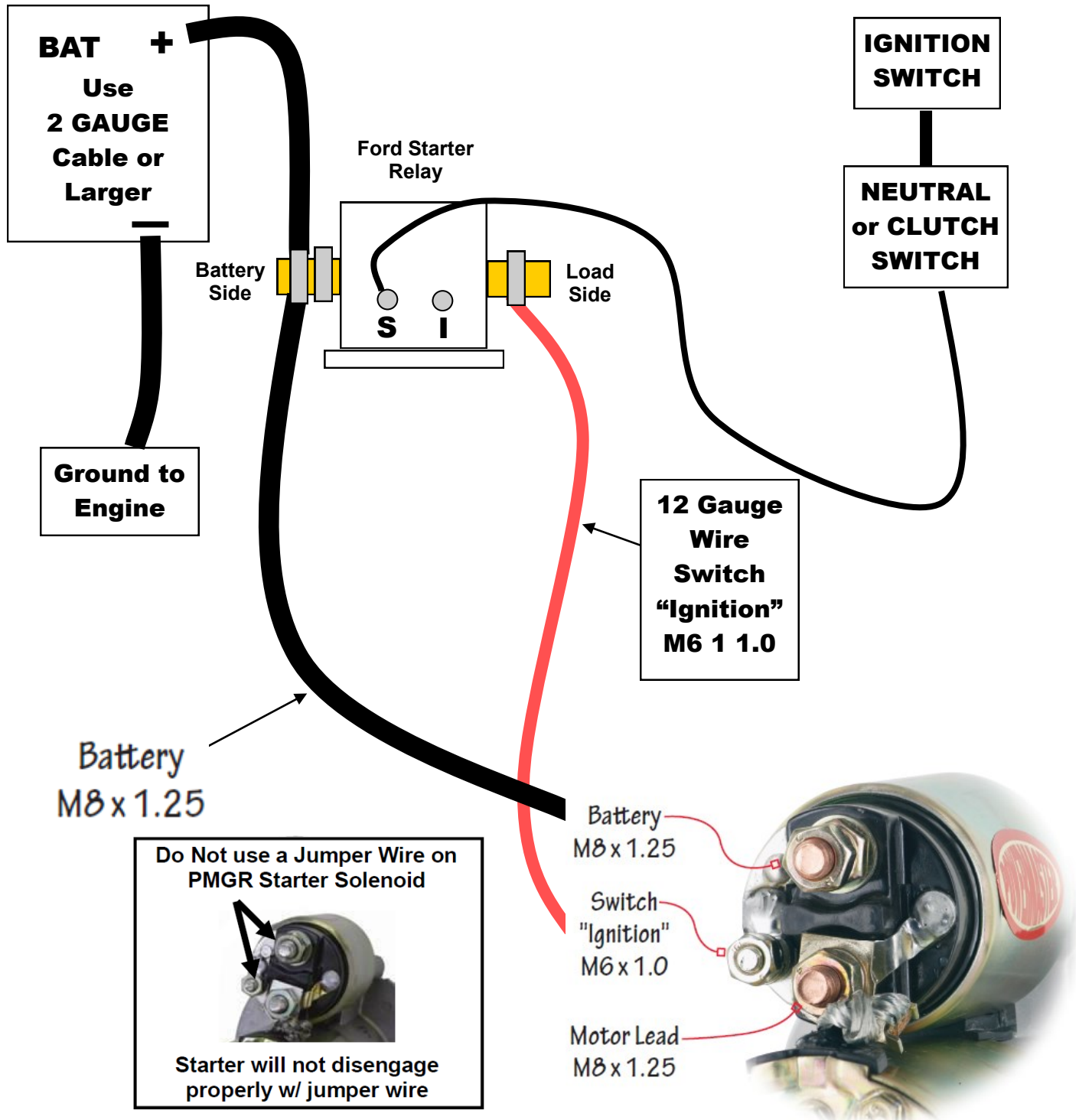
**DO NOT use Jumper Wire:** These starters are Perm Magnet and will not function with a jumper wire installed. You can use a remote solenoid if desired, however you will need both the ign. and batt wires routed back to the remote solenoid. (See Website for optional wiring diagram)



| Troubleshooting                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Problem                                                                                                                                                                                                      | Cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Solution                                                                                                                                                                                 |
| - My new starter has more/less teeth than my OE unit                                                                                                                                                         | We specifically engineer each starter block to work with the specified ring gear. This means depending on the starter used a 9,10,11 tooth gear may all fit the same application.                                                                                                                                                                                                                                                                                                                             | - You're good to go!                                                                                                                                                                     |
| - Starter clicks when hot or cold<br>- Starter only cranks intermittently<br>- Starter drive jumps in and out during cranking<br>- Starter drive grinds on engagement<br>- Starter hangs up on disengagement | This is typically caused by low voltage from the ignition circuit (ignition switch, neutral safety/clutch switch, remote mounted solenoid if equipped). The starter must have a minimum of 10V at the ignition switch post during cranking (voltage will normally be lower when the engine is hot), voltage lower than 10.5V will cause premature solenoid failure and intermittent cranking. Ignition circuit voltage is independent of the battery and can even occur with even the best battery installed. | - Check starter grounding<br>- Increase wire gauge on ign circuit<br>- Check for voltage drop across neutral safety/ign switch<br>- Check for loose crimps or connections                |
| - Starter drags or cranks slowly                                                                                                                                                                             | This can be caused by few different issues.<br>- Poor starter grounding<br>- Improper cable sizing<br>- Low battery voltage<br>- Battery doesn't hold voltage under load<br>- Initial engine timing set to high                                                                                                                                                                                                                                                                                               | - Clean mounting surface and/or add ground strap<br>- Increase starter battery cable gauge<br>- Load test battery to verify condition<br>- Consider start retard box to step down timing |
| - Starter drive is too close to ring gear                                                                                                                                                                    | This is due to the +/- tolerances in the engine block, crank flange, flexplate/flywheel. Due to core shifts in OE engine blocks, previously unknown issues may become present.                                                                                                                                                                                                                                                                                                                                | - Adjust starter by adding/removing inner shim<br>- Check for tolerance issues in ring gear (Cracks, damage, etc)<br>- Verify ring is flush with crank flange                            |



# PMGR Starter & Relay Wiring



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# TECH BULLETIN

## Checking Starter Supply Voltage

When it comes to starter performance issues, the most common cause is low voltage supply. If you're experiencing intermittent cranking, clicking, grinding or erratic operation, there is likely low voltage supply to one of the two starter circuits. Low voltage at either the battery connection or the smaller ignition terminal can lead to internal solenoid damage which also affects the clutch assembly that controls the pinion gear. Also, note that the ignition wire may go through a park/neutral switch or an OEM resistor causing a low voltage issue.

Low voltage supply can be caused by a weak battery, too small gauge of cable, internal cable corrosion and even poor quality crimps on the cable. Low voltage on the ignition terminal can be due to factory resistor wiring, excessive engine heat or how it is routed through a park/neutral switch.

The good news is that these can easily be checked and remedied. Two things you'll need for the test – a volt meter and a friend to help.



## TEST PROCEDURE

The goal is to check the voltage with a digital volt meter at BOTH, the battery cable connection and the ignition terminal of the starter WHILE CRANKING the engine.

1. Make sure the battery is fully charged. The battery must be at least 12.6 volts before checking the voltage values at the starter terminals. If the battery does not read 12.6 or higher, charge it or replace it.
2. With the battery at full charge, connect your volt meter to the battery terminal of the starter. It should read the same at the starter as it did across the battery terminals. If not, there is an issue within the cable/terminals from the battery positive post to the starter terminal.





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3. If the voltage is the same at the battery as the starter, have your partner crank the engine for about 3-5 seconds and note the voltage on the battery terminal of the starter while cranking. It should stay above 11 volts.
4. Next, connect your volt meter to the small terminal of the starter (ignition) and to ground. Have your partner crank the starter for 3-5 seconds and note the voltage. It should also be over 11 volts.

## ***If less than 11 volts:***

1. For block mounted starters, ensure the engine block mount is clean of all paint. This is the ground source for hundreds of amps being used by the starter. A poor ground will affect the voltage values and performance of the starter.
2. Inspect the wiring. Original cables need to be replaced. Corrosion can build up inside an older cable which you'll never see. Also, the gauge may be too small to carry the current and voltage needed for a high torque starter. We recommend a high quality, multi-strand copper wire and remember that trunk mounted batteries require heavier gauge cables. You can't go too big on the battery cable!
3. Inspect the ring lug/terminals. Use the proper ring lugs and ensure they are crimped to the bare wire strands – not the insulation!



**If you have any questions about checking the starter supply voltage or other starter concerns, please contact our tech team at 630-957-4019.**

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