



# GM Starter Installation Instructions

## XS and Mastertorque Series

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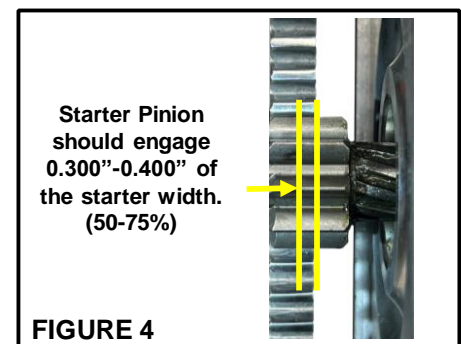
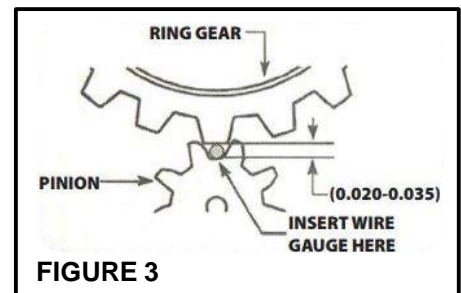
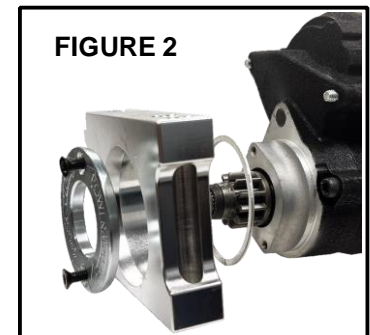
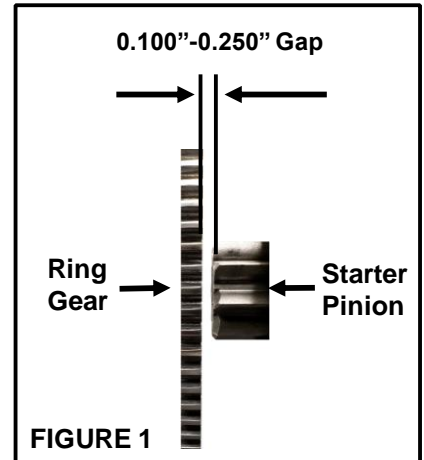


### Included Parts:

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

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

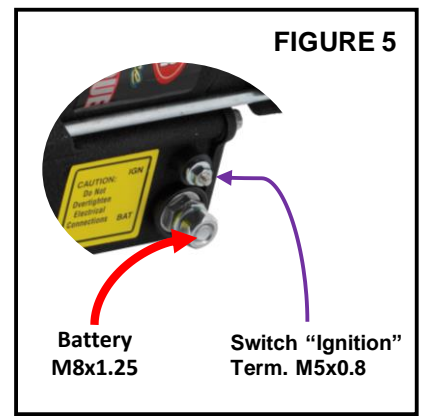
- GROUNDING:** Make sure engine mounting points are free from paint, oil, and debris (**Wire brush if necessary**). Keep in mind mounting bolts DO NOT provide adequate grounding.
- FITMENT:** Check starter for clearance against oil pan and exhaust. If adjustment is needed loosen the two T25 screws on the front of the starter. The starter can now be rotated 360 degrees for clearance (Figure 2) and retightened to 50 in/lbs (Wrist tight with hand tools) with a dab of blue Loctite. You can now install the provided starter mounting bolts and torque to 32 ft/lbs. Note: Use of a starter heat wrap is not recommended and will void your warranty. However, a metal heat shield with air gap between unit and exhaust is optional.
- PINION CLEARANCE:** The starter pinion gear should have between .100" and .250" "Air Gap" between the teeth and ring gear (Figure 1). If this gap is too loose you can remove the supplied inner shim to move the starter closer to the ring gear (Figure 2). If this distance is too close additional shimming may be needed. Proper engagement is when the starter gear is engaged 1/4" to 3/8" into the ring gear (Figure 4).
- GEAR MESH:** Carefully engage the starter pinion into the ring gear by either prying the gear out or supplying 12V to only the ign terminal of the solenoid (Do not hold this voltage more than 10 seconds at a time). Use a paperclip or pin gauge to check the clearance between the two gears (Figure 3). This clearance should be between .020-.035", if the gear mesh is too tight install the supplied block shims one at a time until desired clearance is achieved. NOTE: Even when shimmed correctly 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 (Common on aftermarket engine blocks)



**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)



**Remote Solenoids:** These units can be used with Ford style remote solenoids. When using this setup you will install a jumper wire between the ign and batt post of the starter. Make sure this wire is at least 12 gauge wire and crimped correctly. Drilling two holes in a piece of copper strap also works great for this.

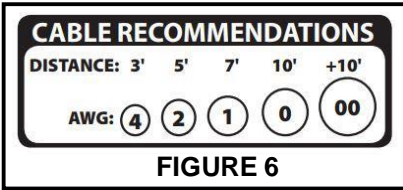


FIGURE 6

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 - Starter only cranks intermittently - Starter drive jumps in and out during cranking - Starter drive grinds on engagement - 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 11V at the ignition switch post during cranking (voltage will normally be lower when the engine is hot), voltage lower than this 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 - Increase wire gauge on ign circuit - Check for voltage drop across neutral safety/ign switch - Check for loose crimps or connections
- Starter drags or cranks slowly	This can be caused by a few different issues. - Poor starter grounding - Improper cable sizing - Low battery voltage - Battery doesn't hold voltage under load - Initial engine timing set to high	- Clean mounting surface and/or add ground strap - Increase starter battery cable gauge - Load test battery to verify condition - Consider start retard box to step down timing
- Starter drive is too close to ring gear	This can be due to the +/- tolerances in the engine block, crank flange, flexplate/flywheel. These tolerances can stack against each other and cause an alignment issues.	- Adjust starter by adding/removing inner shim - Check for tolerance issues in ring gear (Cracks, damage, etc) - Verify ring is flush with crank flange



# 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.



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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