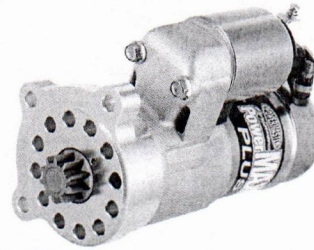




Starter Dyno Sheet

PASS



Performance result		
Max Torque:	21.9	[Nm]
Max Current	604	[Amps]
Max Power:	1.72	[kW]
Speed @ Max Power	989	[RPM]
Current @ Max Power	443	[Amps]
Torque @ Max Power	16.60	[Nm]

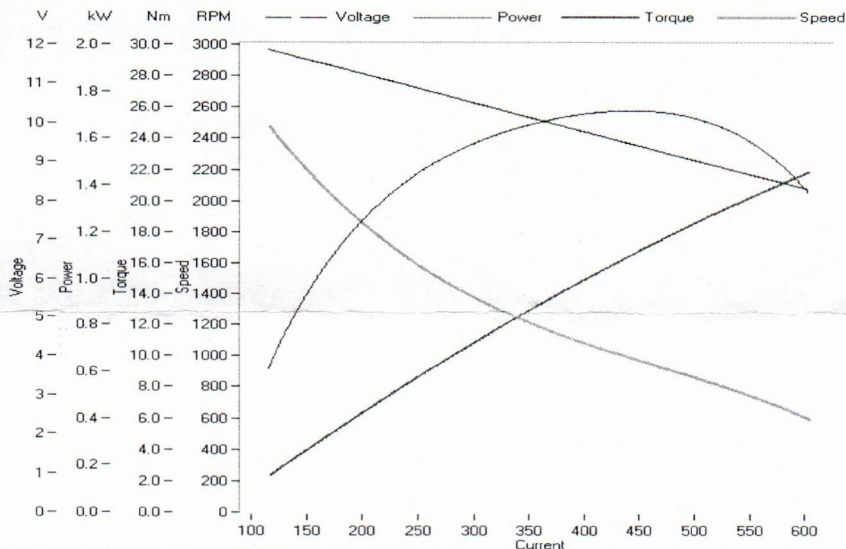
Ratings		
Rated Voltage:	12.0	[Volts]
Rated Power:	1.4	[kW]
Ground:	NEG	-
Pinion Teeth:	12	-
Rotation:	CW	-
Simulated Battery:	600	CCA

P/N:	9132
Type:	
Model:	HITACHI
UPC:	

Commutator / Brush Ripple Pattern

Ripple Current: 17 [Amps]
Analyzed at: 1500 [RPM]

Performance curves by current



Free-run results		
0.0	A @	0 RPM

Solenoid results * Compensated at Rated V		
Pull Current: *	31.38	[Amps]
Hold Current: *	17.57	[Amps]
Voltage Drop (Max)	0.00	[Volts]
Close Test (Pull In):	PASS	-
Open Test:	PASS	-

Test	Speed [RPM]	Current [Amps]	Voltage [Volts]	Torque [Nm]	Power [Watts]	Trq. Const. [Nm/A]	Voltage Drop [Volts]
1	2483	116	11.87	2.38	618	0.0205	0.00
2	2000	176	11.42	5.29	1108	0.0299	0.00
3	1501	270	10.73	9.62	1511	0.0355	0.00
4	1003	437	9.51	16.45	1727	0.0376	0.00
5	776	540	8.73	19.82	1609	0.0367	0.00
6	700	566	8.55	20.75	1520	0.0366	0.00
7	600	604	8.30	21.94	1378	0.0363	0.00

We certify these results are within specifications!

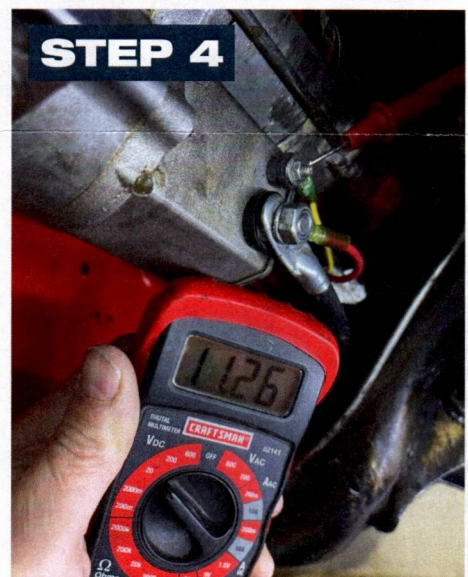
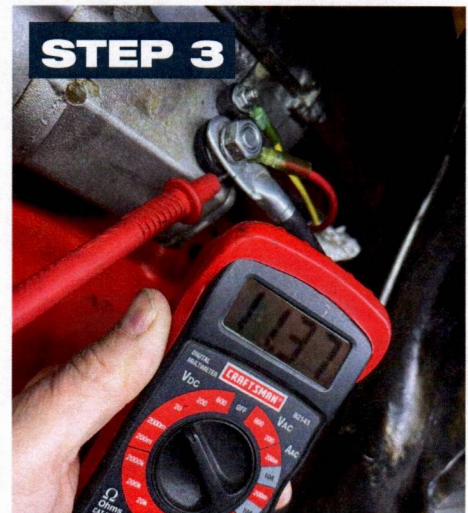


TECH BULLETIN

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.

Follow for a Tech Video





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.

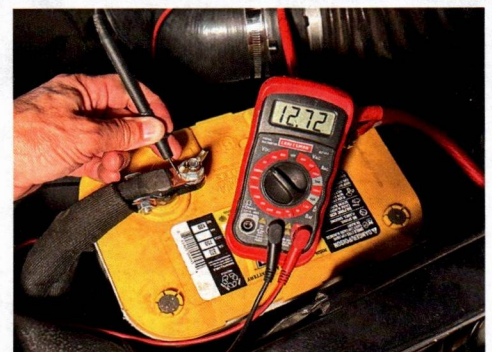
The good news is that these can easily be checked and remedied. Two things you'll need for the test – a volt meter and a friend to help.



TEST PROCEDURE

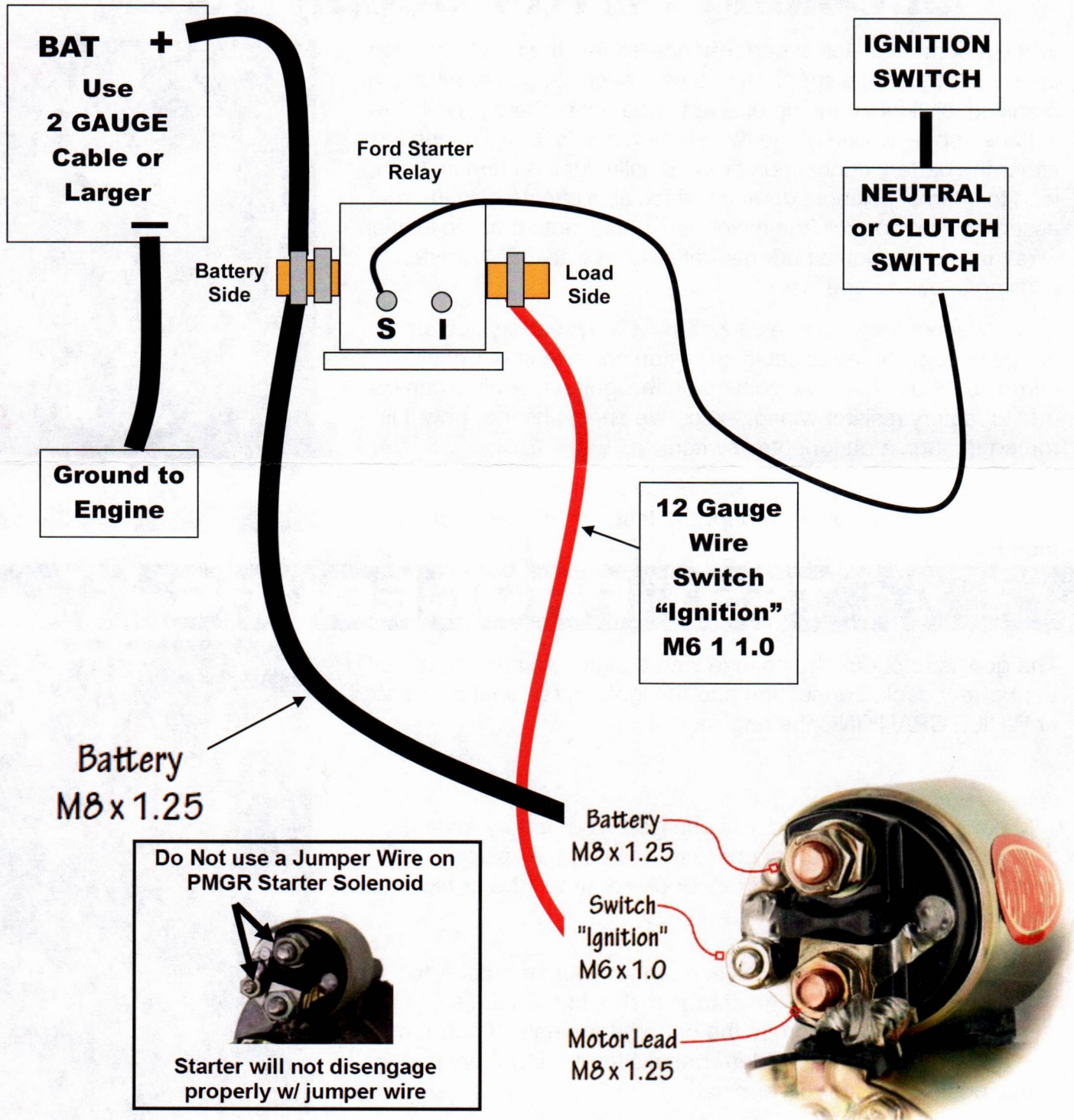
The goal is to check the voltage with a digital volt meter at BOTH, the battery cable connection and the ignition terminal of the starter WHILE CRANKING the engine.

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.





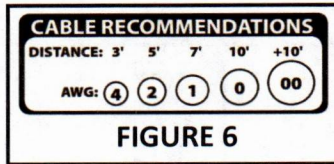
PMGR Starter & Relay Wiring



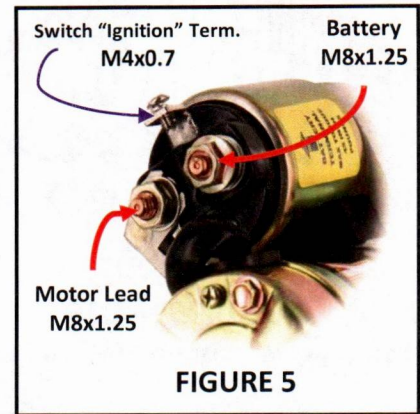
1833 Downs Drive, West Chicago, IL 60185

Tech Dept Phone# (630) 957-4019 Email : tech@powermasterperformance.com

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).



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 - 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 11.5V at the ignition switch post during cranking (voltage will normally be lower when the engine is hot), voltage lower than 11V 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 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	- Possible +/- tolerances in the bellhousing, crank flange, flexplate/flywheel - Incorrect starter for the flywheel being used	- Adjust starter by adding/removing inner shim - Check for tolerance issues in ring gear (Cracks, damage, etc) - Verify starter part number and application
- Starter stays engaged when releasing key switch	- Starter depth is incorrect for application - Starter wiring is incorrect (Jumper wire being used)	- Verify starter part number and application - Check starter depth (See Depth guide) - Verify starter wiring (See provided wiring diagram)



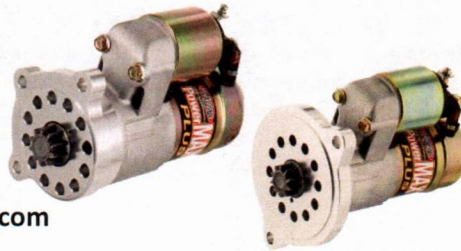
Starter Installation Instructions

9103, 9104, 9106, 9132

Tech Dept.

(630) 957-4019

Tech@powermasterperformance.com

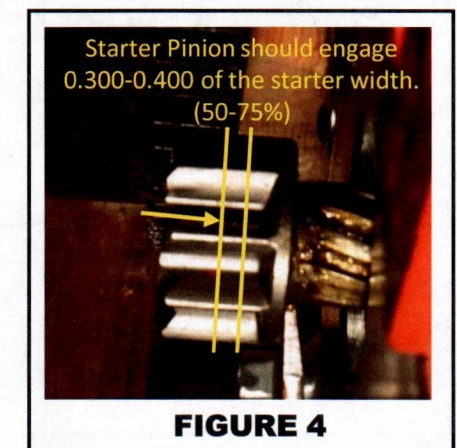
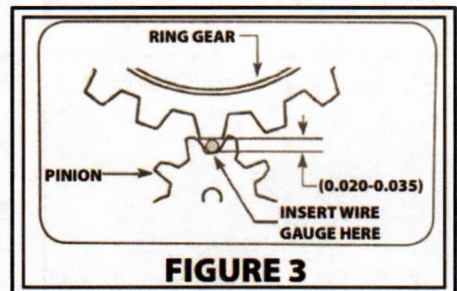
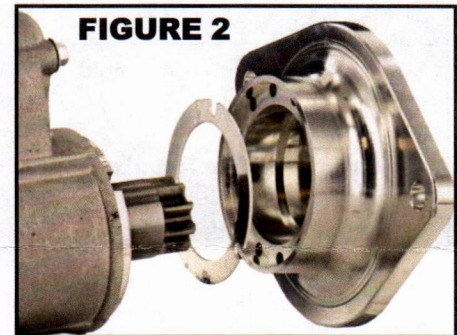
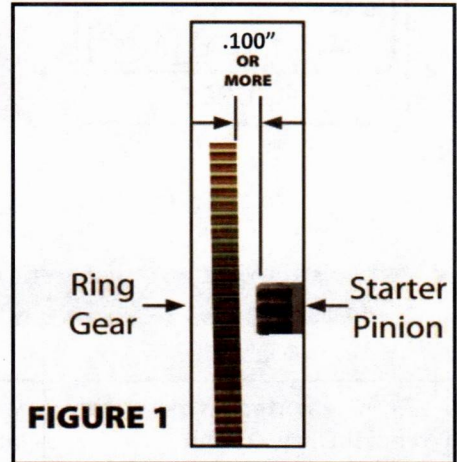


Included Parts:

1- Starter 1- Inner Shim (Pre-installed) 1- Starter Dyno sheet

WARNING: Disconnect Battery (-) Before Proceeding.

- 1) **GROUNDING:** Make sure starter 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 12 mounting holes (Figure2) and retightened to 50 in/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 can 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. (See Ford starter depth guide for more info)
- 4) **GEAR MESH:** This is normally not adjustable on a flange mounted starters since these starters pilot into the register plate to set the alignment. This plate MUST be installed between the engine and transmission or both depth and mesh will be adversely effected. An easy way to check this is adding paint to the starter gear to provide a wear pattern reference, this will typically be 0.020-0.035". In cases where this spec is out of range always check the flexplate/flywheel condition and tolerance. Note: Always check the bellhousing indexing when using a manual transmission, this will alter the starter alignment and may cause binding and premature wear.



DO NOT SHIM YOUR STARTER TO SOUND!

Continued on back