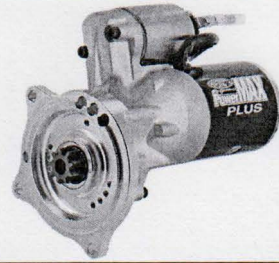




# Starter Dyno Sheet

**PASS**



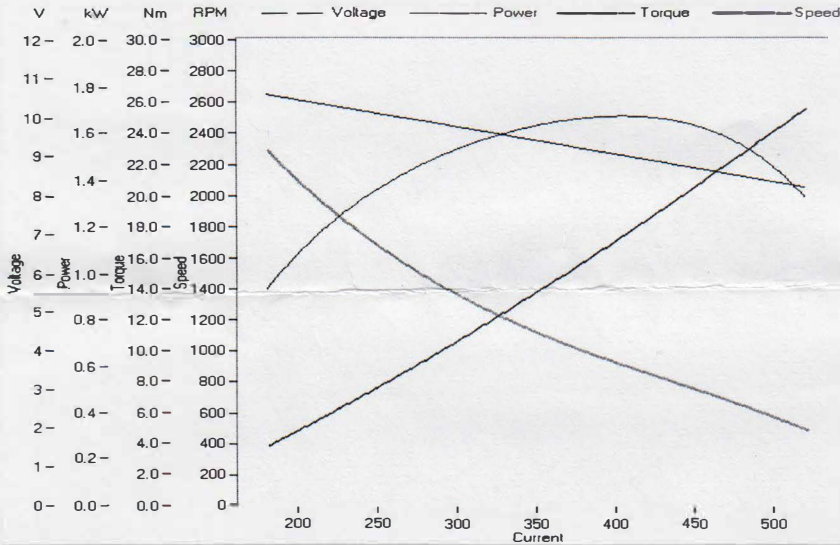
Performance result			Ratings		
Max Torque:	25.6	[Nm]	Rated Voltage:	12.0	[Volts]
Max Current	520	[Amps]	Rated Power:	1.4	[kW]
Max Power:	1.67	[kW]	Ground:	NEG	-
Speed @ Max Power	916	[RPM]	Pinion Teeth:	9	-
Current @ Max Power	404	[Amps]	Rotation:	CW	-
Torque @ Max Power	17.46	[Nm]	Simulated Battery:	642	CCA

P/N:	9002
Type:	
Model:	HITACHI
UPC:	

Commutator / Brush Ripple Patter

Ripple Current: 5 [Amps]  
Analyzed at: 1800 [RPM]

Performance curves by current



Free-run results

0.0	A @	0	RPM
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Solenoid results \* Compensated at Rated V

Pull Current: *	-	[Amps]
Hold Current: *	-	[Amps]
Voltage Drop (Max)	-	[Volts]
Close Test (Pull In):	-	-
Open Test:	-	-

Test	Speed [RPM]	Current [Amps]	Voltage [Volts]	Torque [Nm]	Power [Watts]	Trq. Const. [Nm/A]	Voltage Drop [Volts]
1	2298	181	10.59	3.92	943	0.0216	2.04
2	2000	210	10.40	5.42	1135	0.0258	2.04
3	1501	277	9.93	9.30	1461	0.0335	2.04
4	1002	382	9.17	16.02	1680	0.0419	2.04
5	776	444	8.75	20.22	1641	0.0455	2.04
6	674	471	8.55	22.06	1556	0.0468	2.04
7	499	520	8.20	25.60	1336	0.0492	2.04

We certify these results are within specifications!

# INSTALLATION INSTRUCTIONS

## FORD / AMC / JEEP / ULTRA TORQUE STARTERS

Part # 9002, 9000-3, 9000-4, 9000-5, 9000-6, 9000-13, 9000-14, 9000-15, 9000-16  
 9004-3, 9004-4, 9004-5, 9004-6, 9004-13, 9004-14, 9004-15, 9004-16  
 9403, 9404, 9405, 9406, 9413, 9415, 9416, 9453, 9454, 9455, 9456, 9463, 9465



**\* Proper mounting of 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 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 0.100" minimum from the back side of ring gear to the front edge of the teeth on 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.

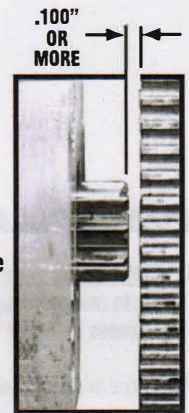


FIGURE 1

[3] **CHECK PINION ENGAGEMENT.** Pull pinion out to engage ring gear. This can be done by:

- Using a tool to pry the pinion out of the starter or connect 12 VDC 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 3 to 5 seconds at a time as the solenoid will overheat.

**[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. ]**

- Insert a wire gauge to check for proper clearance between the ring gear and starter pinion (see Figure 2). There should be a 0.020" to 0.035" clearance measured from the Valley of the starter pinion to the tip of the ring gear tooth. (NOTE: A #1 standard paper clip is usually about 0.035" in diameter and makes an easy tool.) Check clear-ance at least three places on the ring gear.

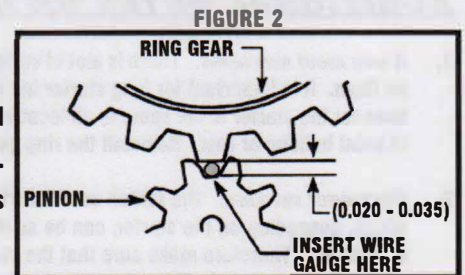


FIGURE 2

[4] **ATTACH BATTERY CABLE AND SWITCH WIRE.** The switch wire should be capable of handling 25A, typically a 12AWG 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 to the frame should be the same size as the starter cable. Also, a ground strap should be installed from the frame to the motor.

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

**CABLE RECOMMENDATIONS**

**[CONT'D ON REVERSE SIDE]**

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 Tech Email: tech@powermasterperformance.com

## ***INSTALLATION (CONT'D)***

- [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 pinion to ring gear engagement is too great. If the starter makes a high pitched whine after cranking as the button or key is released, the clearance is too small. 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 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 10.5V minimum while cranking].

**!CAUTION: NEVER OPERATE A STARTER MORE THAN 3 to 5 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 excessive starter pinion gear to ring gear clearance. The solution is to remove any shims between the starter and the engine block. If no shims are installed, then either shim under the outboard bolt only 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 [12 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.

## **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.
3. **CLOCKABLE STARTERS.** Some Powermaster starters are clockable meaning that the starter motor can be rotated in relation to the mounting block. Simply remove the socket cap bolts securing the mounting block to the front of the starter and rotate it to another setting.
4. **Heat Shields :** Heat is the enemy of any electrical device. Therefore, heat shields between the headers and starters are recommended to prolong the life of the starter.

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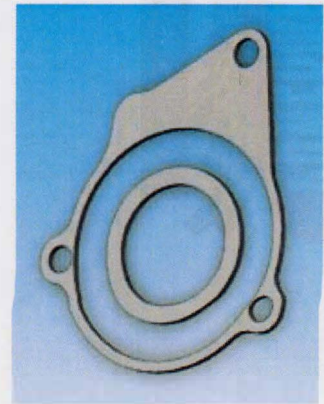
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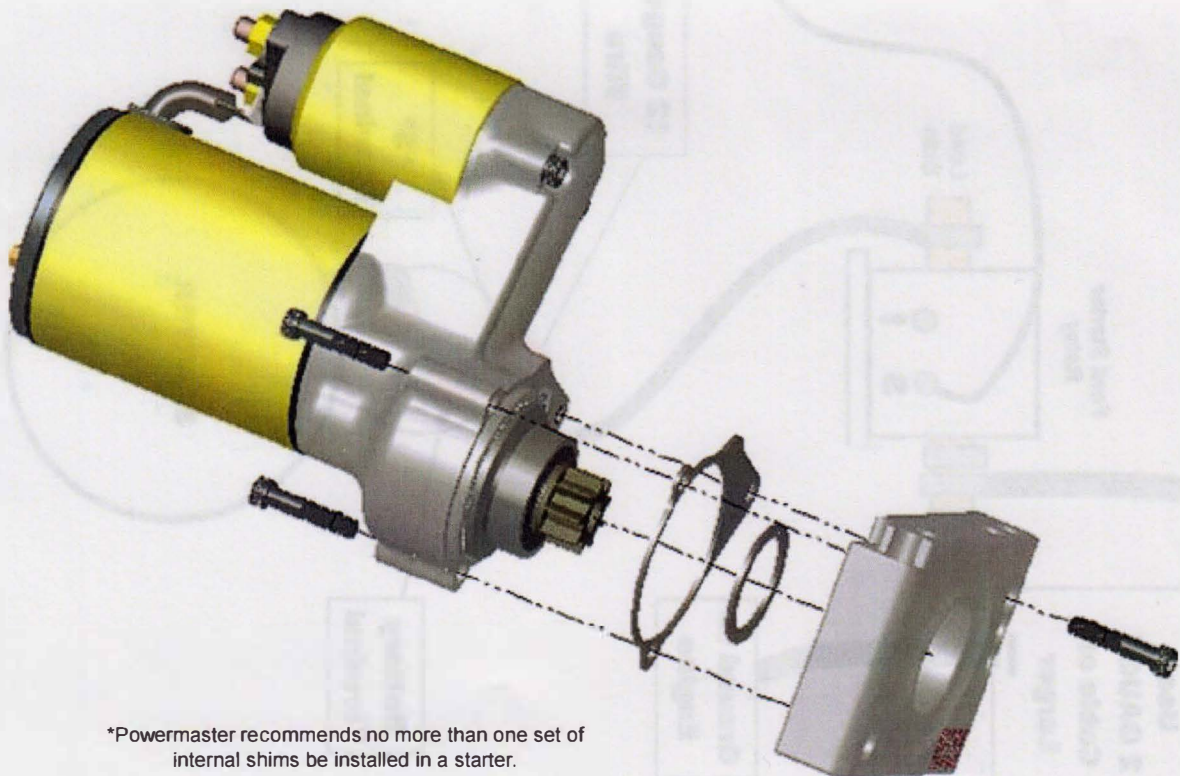
## INSTRUCTION SHEET

Ultratorque & Hitachi Style Starter-Internal Shim PN's 9400, 9403, 9404, 9405, 9406, 9410, 9415, 9416, 9426, 9497, 9498, 9000, 9004 & 9007

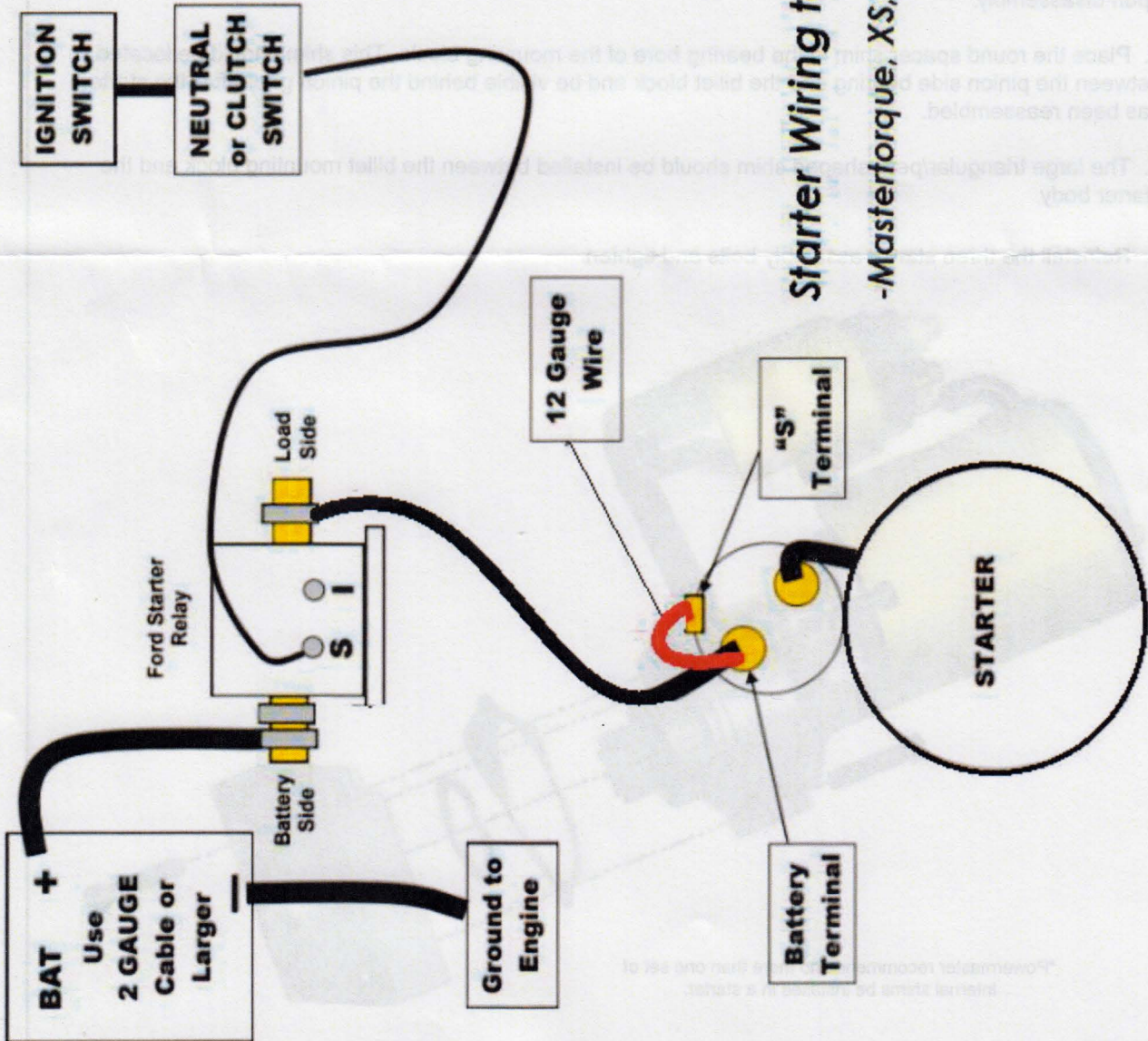
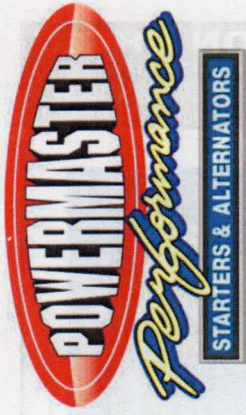
After the starter has been installed, there should be 1/16" (0.062) minimum between the engine side of the ring gear and the front edge of the teeth on the starter pinion gear. Check this distance with the ring gear in at least three different positions. If the distance is too little, shims can be installed inside the starter, which will pull the pinion into the starter an additional 1/16" (0.062). This will result in additional clearance between the pinion and the ring gear.



1. Remove the three socket head bolts that hold the billet mounting block to the starter-assembly. One bolt is located on the pinion gear side of the block, and two are located near the starter side of the block.
2. Remove the mounting block from the starter by pulling on both ends of the block, while pressing the pinion gear with both thumbs. Observe where all internal parts are located upon disassembly.
3. Place the round spacer shim in the bearing bore of the mounting block. This shim should be located between the pinion side bearing and the billet block and be visible behind the pinion gear after the starter has been reassembled.
5. The large triangular/pear shaped shim should be installed between the billet mounting block and the starter body.
6. Reinstall the three starter-assembly bolts and tighten.



\*Powermaster recommends no more than one set of internal shims be installed in a starter.



## Starter Wiring to Remote Solenoid

-Masterforque, XS, Ultra, 9000 Series

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