

2008 Ford Mustang

2008 ENGINE Starting System - Mustang

2008 ENGINE

Starting System - Mustang

SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Maximum starting circuit voltage drop (engine at normal engine temperature)	0.5 volt
Normal engine cranking speed RPM	100-140 RPM
Starter motor no load current draw amperes	60-80 amps
Starter motor normal load current draw	130 amps
Starter motor maximum load current draw amperes	400 amps

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Starter motor bolts	25	18	-
Starter motor solenoid B+ terminal nut	12	-	106
Starter motor solenoid S-terminal nut	5	-	44

DESCRIPTION AND OPERATION

STARTING SYSTEM

Starting System - Starter Motor

The starter motor is a 12-volt unit that has the starter solenoid mounted on the drive end housing and functions as follows:

- The current flows through the solenoid energizing coil until the solenoid plunger is at the end of its travel.
- The plunger closes a set of contacts that bypass the energizing coil, letting the holding coil engage the starter drive and pass starting current to the starter motor.
- The motor is energized when the starter solenoid contacts are closed.
- The starter drive engages the flywheel ring gear and starts the engine.
- An overrunning clutch in the starter drive protects the starter motor from excessive speed when the engine starts.

Starting System - Starter Relay

The starter relay consists of:

- pull-in coil and contacts.

When the ignition switch is in the START position:

- the pull-in coil is activated and pulls the contacts together.
- current passes through the starter relay from the engine compartment Bussed Electrical Center (BEC) to the starter solenoid.

Starting System - Clutch Pedal Position (CPP) Switch

The Clutch Pedal Position (CPP) switch for:

- a manual transmission closes when the clutch pedal is depressed, completing the starting circuit.
- an automatic transmission is a jumper inserted in place of the CPP switch to complete the circuit.

Starter System - Operation

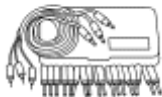
When the ignition switch is turned to the START position, the starter relay switches power to the starter solenoid causing the starter motor to engage as long as:

- the clutch pedal is depressed (manual transmission only).
- the digital Transmission Range (TR) sensor is in PARK or NEUTRAL (automatic transmission only).

DIAGNOSTIC TESTS

STARTING SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Flex Probe Kit	105-R025C or equivalent
 ST1138-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Principles of Operation

The starting system is electronically controlled by the Passive Anti-Theft System (PATS). PATS recognizes the correct electronically coded ignition key and signals the PCM to provide a ground for the starter relay. The energized relay provides voltage to the starter solenoid with the key in the START position, thereby allowing the starter motor to activate.

Inspection and Verification

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

NOTE: The anti-theft system must be functioning correctly before a logical starting system diagnosis can be carried out. Address anti-theft system concerns before continuing. Refer to ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) article.

- 1. Verify the customer concern by operating the starting system.
- 2. Visually inspect for obvious signs of mechanical and electrical damage. Refer to the following chart:

VISUAL INSPECTION CHART

Mechanical	Electrical
• Starter motor • Flexplate • Flywheel	• Battery • Smart Junction Box (SJB) fuse 21 (10A) • Bussed Electrical Center (BEC) fuse 4 (30A) • Anti-theft system • Damaged wiring harness • Loose or corroded connections

- 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

- 4. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

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5. If the scan tool does not communicate with the VCM:
 - check the VCM connection to the vehicle.
 - check the scan tool connection to the VCM.
 - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no power to the scan tool.
6. If the scan tool does not communicate with the vehicle:
 - verify the ignition key is in the ON position.
 - verify the scan tool operation with a known good vehicle.
 - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
 - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
 - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
9. If the DTCs retrieved are related to the concern, go to PCM DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Chart

PCM DTC CHART

DTC	Description	Action
P0705	Transmission Range (TR) Sensor Circuit Failure	Refer to the appropriate Automatic Transmission article for the procedure.
P0708	TR Sensor Circuit Failure	Refer to the appropriate Automatic Transmission article for the procedure.
P1260	Theft Detected, Vehicle Immobilized	REFER to the DTC Chart in <u>ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)</u> article. All other PCM DTCs, REFER to <u>Introduction - Gasoline Engines</u> article.
P1702	TR Sensor Circuit Failure	Refer to the appropriate Automatic Transmission article for the procedure.
P1705	TR circuit is not indicating PARK/NEUTRAL during self-test	Refer to the appropriate Automatic Transmission article for the procedure.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
	• Battery • Fuse	

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• The engine does not crank	• Starter relay • Starter motor • Ignition switch • PCM • Circuitry open • Digital Transmission Range (TR) sensor (automatic transmission only) • Clutch Pedal Position (CPP) switch (manual transmission only)	• Go to <u>Pinpoint Test A.</u>
• Unusual starter noise	• Starter motor mounting • Starter motor • Incorrect starter drive engagement • Damaged flexplate or flywheel ring gear teeth	• Go to <u>Pinpoint Test B.</u>
• The engine cranks slowly	• Battery • Starter motor	• CARRY OUT the Starter Motor - Ground Circuit component test.
• The starter spins but the engine does not crank	• Starter motor • Damaged flywheel or flexplate ring gear teeth	• INSPECT the starter motor mounting and engagement. REFER to <u>Starter Motor Drive Gear and Flywheel Ring Gear Inspection.</u> • INSPECT the flywheel or flexplate for damaged, missing or worn teeth. REPAIR as necessary.

Pinpoint Tests

Pinpoint Test A: The Engine Does Not Crank

Refer to appropriate SYSTEM WIRING DIAGRAM ARTICLE, Starting System for schematic and connector information.

Normal Operation

In normal operation, voltage from the Bussed Electrical Center (BEC) is supplied to the ignition switch through circuit 1050 (LG/PK). When the ignition switch is placed in the START position, voltage is supplied through circuit 1522 (DG) to the Smart Junction Box (SJB).

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For automatic transmission equipped vehicles, voltage is supplied from the SJB on circuit 32 (RD/LB) to the BEC, from the BEC power is supplied to the Transmission Range (TR) sensor through circuit 33 (WH/PK). In PARK or NEUTRAL, voltage is supplied from the TR sensor through circuit 33 (WH/PK) to the starter relay coil located in the BEC. The starter relay coil is supplied ground from the PCM through circuit 1419 (LG/YE).

For manual transmission equipped vehicles, when the clutch pedal is depressed, the Clutch Pedal Position (CPP) supplies a ground to the PCM through circuit 92 (LB/YE). The starter relay coil is supplied ground from the PCM through circuit 1419 (LG/YE). Voltage is supplied to the starter relay coil located in the BEC through circuit 33 (WH/PK).

When the starter relay is energized, voltage supplied to the relay switch is sent to the starter motor solenoid through circuit 113 (YE/LB). Battery voltage is supplied to the starter motor through circuit 2037 (RD) at all times.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Battery
- Anti-theft system
- Starter relay
- Ignition switch
- Circuitry
- PCM

PINPOINT TEST A: THE ENGINE DOES NOT CRANK

A1 CHECK THE BATTERY

- Check the battery condition and charge. Refer to **BATTERY, MOUNTING AND CABLES** article.

- **Is the battery OK?**

YES : Go to A2.

NO : CHARGE or INSTALL a new battery. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A2 CHECK PCM FOR DTCs

- Using the DTCs retrieved in Inspection and Verification, check for PCM DTCs.
- **Were any PCM DTCs retrieved?**

YES : If PCM DTC P1260 is retrieved, REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. All other PCM DTCs, REFER to **Introduction - Gasoline Engines** article.

NO : For automatic transmission, go to A3. For manual transmission, go to A4.

A3 CHECK THE PCM AUTOMATIC TR SENSOR PID

- Connect the diagnostic tool.
- Key in ON position

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- Enter the following diagnostic mode on the diagnostic tool: DataLogger - PCM
- While observing the TR PID, place the vehicle in PARK and then NEUTRAL.
- **Does the PID match the gear selection?**

YES : Go to A5.

NO : Go to **AUTOMATIC TRANSAXLE/TRANSMISSION - 5R55S** article to diagnose the TR sensor.

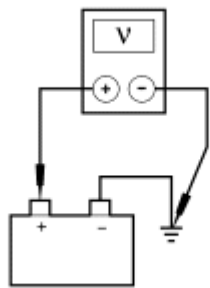
A4 CHECK THE PCM CLUTCH PEDAL AT OR NEAR BOTTOM OF TRAVEL (CPP_ BOT) PID

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - PCM
- While observing the CPP_ BOT) PID, fully disengage the clutch.
- **Does the PID change from NO to YES?**

YES : Go to A5.

NO : Go to A19.

A5 CHECK THE BATTERY GROUND CABLE



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Fig. 1: Checking Battery Ground Cable
Courtesy of FORD MOTOR CO.

- Measure the voltage between the positive battery post and the battery ground cable connection on the engine.
- **Is the voltage greater than 10 volts?**

NO : INSTALL a new battery ground cable. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

YES : Go to A6.

A6 CHECK THE STARTER MOTOR GROUND

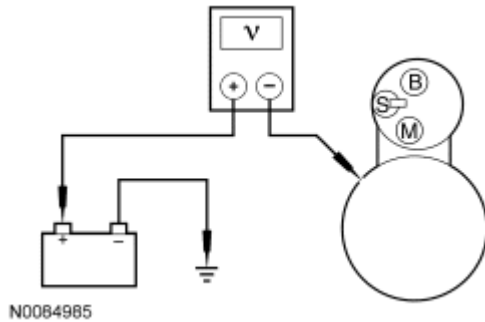


Fig. 2: Checking Starter Motor Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the positive battery post and the starter motor case.

- **Is the voltage greater than 10 volts?**

YES : Go to A7.

NO : CLEAN the starter motor mounting flange and make sure the starter motor is correctly mounted. TEST the system for normal operation.

A7 CHECK THE POWER SUPPLY TO THE STARTER MOTOR

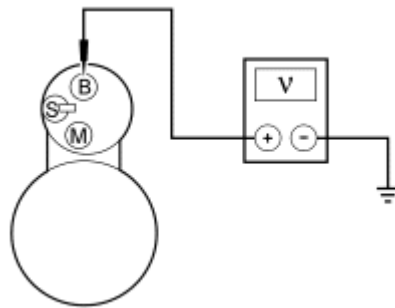


Fig. 3: Checking Power Supply To Starter Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between starter motor B-terminal and ground.

- **Is the voltage greater than 10 volts?**

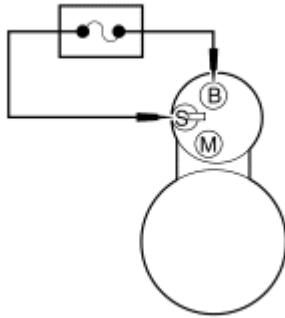
YES : Go to A8.

NO : INSTALL a new positive battery cable. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A8 CHECK THE STARTER MOTOR SOLENOID OPERATION

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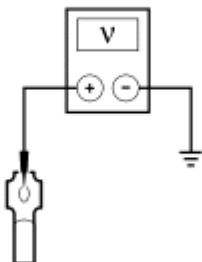
Fig. 4: Checking Starter Motor Solenoid Operation
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire to the B-terminal of the starter motor. Momentarily connect the other lead of the fused jumper wire to the starter motor S-terminal.
- **Did the starter motor engage and the engine crank?**
YES : Go to A9.
NO : INSTALL a new starter motor. REFER to **Starter Motor - 4.0L SOHC** or **Starter Motor - 4.6L (3V)** or **Starter Motor - 5.4L (4V)**. TEST the system for normal operation.

A9 CHECK THE START INPUT TO THE STARTER MOTOR

NOTE: Depress clutch pedal for manual transmission.

- Disconnect: Starter Motor S-Terminal C197B



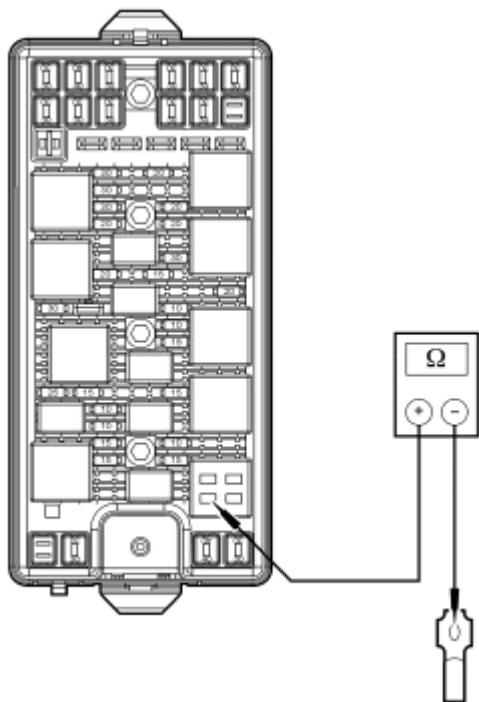
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Fig. 5: Checking Start Input To Starter Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between starter motor S-terminal connector C197B, circuit 113 (YE/LB), and ground, while holding the ignition switch in the START position.
- **Is the voltage greater than 10 volts in START?**
YES : CLEAN the starter motor S-terminal and connector. CHECK the wiring and the starter motor for a loose connection. TEST the system for normal operation.
NO : Go to A10.

A10 CHECK CIRCUIT 113 (YE/LB) FOR AN OPEN

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.



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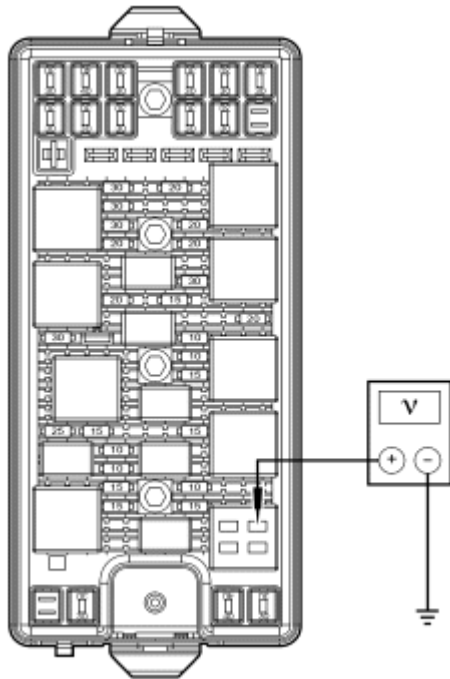
Fig. 6: Checking Circuit 113 (YE/LB) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between BEC starter relay, circuit 113 (YE/LB), and starter motor S-terminal connector C197B, circuit 113 (YE/LB).
- **Is the resistance less than 5 ohms?**

YES : Go to A11.

NO : REPAIR circuit 113 (YE/LB) for an open. TEST the system for normal operation.

A11 CHECK THE BATTERY SUPPLY TO THE STARTER RELAY



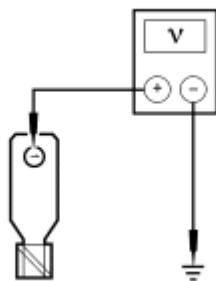
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Fig. 7: Checking Battery Supply To Starter Relay
Courtesy of FORD MOTOR CO.

- Measure the voltage between BEC starter relay, circuit 2037 (RD) and ground.
- **Is the voltage greater than 10 volts?**
YES : Go to A13.
NO : Go to A12.

A12 CHECK THE BATTERY SUPPLY TO THE BEC

- Disconnect: BEC Connector 1035E



N0060251

Fig. 8: Measuring Voltage Between BEC C1035E-1 & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between BEC C1035E-1, circuit 2037 (RD) and ground.
- **Is the voltage greater than 10 volts?**

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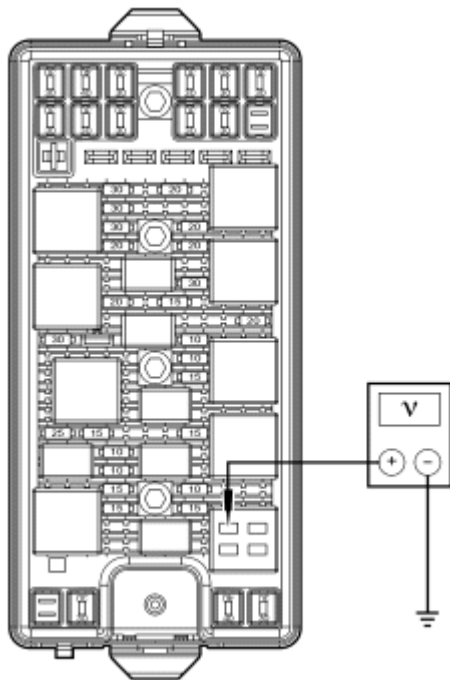
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YES : VERIFY BEC fuse 4 (30 A) is OK. If not OK, REFER to the appropriate SYSTEM WIRING DIAGRAM ARTICLE to identify the possible causes of the circuit short. If OK, REPLACE the BEC. TEST the system for normal operation.

NO : REPAIR circuit 2037 (RD) for an open. TEST the system for normal operation.

A13 CHECK THE START INPUT TO THE STARTER RELAY

- Disconnect: Starter Relay



N0014499

Fig. 9: Checking Start Input To Starter Relay
Courtesy of FORD MOTOR CO.

- Measure the voltage between BEC starter relay, circuit 33 (WH/PK) and ground, while holding the ignition switch in the START position.
- **Is the voltage greater than 10 volts?**

YES : Go to A17.

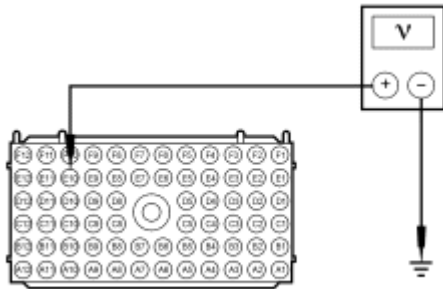
NO : Go to A14.

A14 CHECK THE START INPUT VOLTAGE TO THE BEC

- Disconnect: BEC C1035B

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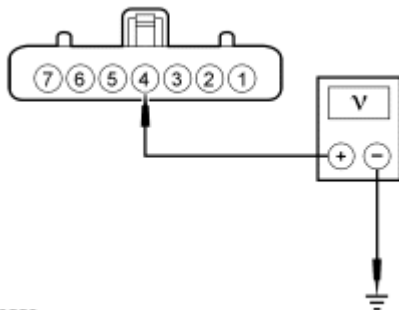
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Fig. 10: Measuring Voltage Between BEC C1035B-E10, Circuit 33 (WH/PK) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between BEC C1035B-E10, circuit 33 (WH/PK) and ground, while holding the ignition switch in the START position.
- **Is the voltage greater than 10 volts?**
YES : REPLACE the BEC. TEST the system for normal operation.
NO : Go to A15.

A15 CHECK THE POWER SUPPLY TO THE IGNITION SWITCH

- Disconnect: Ignition Switch C250



N0073559

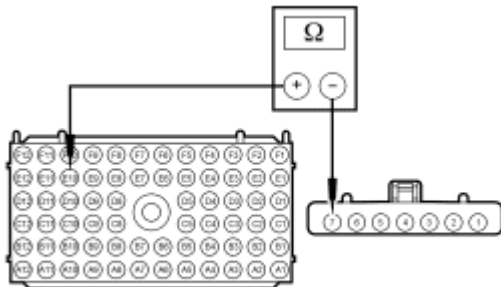
Fig. 11: Checking Power Supply To Ignition Switch
Courtesy of FORD MOTOR CO.

- Measure the voltage between ignition switch C250-4, circuit 1050 (LG/VT) and ground.
- **Is the voltage greater than 10 volts?**
YES : Go to A16.
NO : VERIFY BEC fuse 68 (20 A) is OK. If OK, REPAIR circuit 1050 (LG/VT) for an open. TEST the system for normal operation. If not OK, REFER to the appropriate SYSTEM WIRING DIAGRAM ARTICLE to identify the possible causes of the circuit short.

A16 CHECK CIRCUITS 1522 (DG) AND 33 (WH/PK) FOR AN OPEN

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Fig. 12: Measuring Resistance Between Ignition Switch C250-7, 1522 (DG) & C1035B-E10, 33 (WH/PK)

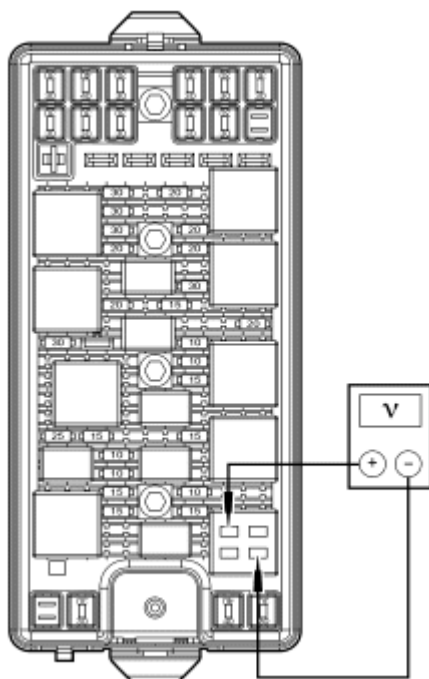
Courtesy of FORD MOTOR CO.

- Measure the resistance between ignition switch C250-7, circuit 1522 (DG) and BEC C1035B-E10, circuit 33 (WH/PK).
- **Is the resistance less than 5 ohms?**

YES : CARRY OUT the Ignition Switch Component Test. Refer to COMPONENT TESTING. INSTALL a new ignition switch. REFER to STEERING COLUMN SWITCHES article. TEST the system for normal operation.

NO : VERIFY Smart Junction Box (SJB) fuse 21 (10 A) is OK. If OK, REPAIR circuit 1522 (DG) or circuit 33 (WH/PK) for an open. TEST the system for normal operation. If not OK, REFER to the Wiring Diagram Manual to identify the possible causes of the circuit short.

A17 CHECK THE GROUND SIGNAL TO THE STARTER RELAY



N0014498

Fig. 13: Checking Starter Motor Relay Ground Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between BEC starter, circuit 1419 (LG/YE), and starter relay, circuit 33 (WH/PK), while holding the ignition switch in the START position, depress clutch pedal for manual transmission.
- **Is the voltage greater than 10 volts?**
YES : CARRY OUT the Starter Motor Relay Component Test. Refer to COMPONENT TESTING. INSTALL a new starter motor relay. TEST the system for normal operation.
NO : Go to A18.

A18 CHECK CIRCUIT 1419 (LG/YE) FOR AN OPEN

- Disconnect: PCM C175B

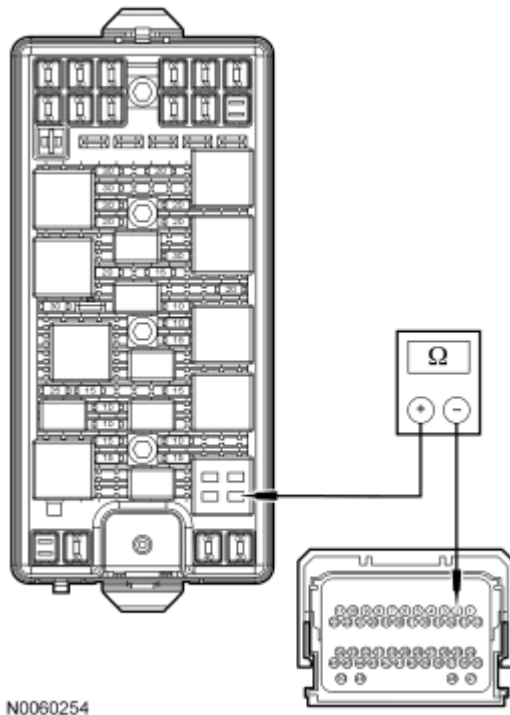


Fig. 14: Checking Circuit 1419 (LG/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between BEC starter relay pin 85, circuit 1419 (LG/YE) and PCM C175B-2, circuit 1419 (LG/YE).
- **Is the resistance less than 5 ohms?**
YES : INSTALL a new PCM. REFER to ELECTRONIC ENGINE CONTROLS article. TEST the system for normal operation.
NO : REPAIR circuit 1419 (LG/YE) for an open. TEST the system for normal operation.

A19 CHECK CIRCUIT 92 (LB/YE) FOR AN OPEN

- Disconnect: PCM C175B and CPP Switch C257

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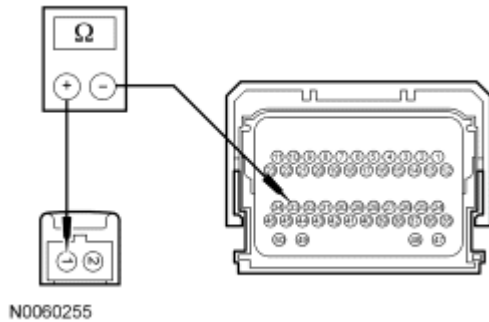


Fig. 15: Measuring Resistance Between CPP Switch C257-1, Circuit 92 (LB/YE) & PCM C175B-33

Courtesy of FORD MOTOR CO.

- Measure the resistance between CPP switch C257-1, circuit 92 (LB/YE) and PCM C175B-33, circuit 92 (LB/YE).

- **Is the resistance less than 5 ohms?**

YES : Go to A20.

NO : REPAIR circuit 92 (LB/YE) for an open. TEST the system for normal operation.

A20 CHECK CIRCUIT 1205 (BK) FOR AN OPEN

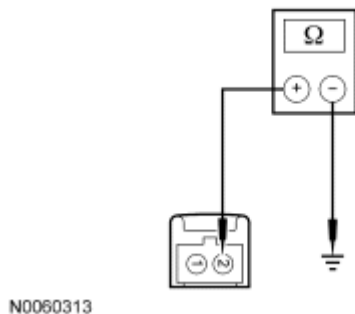


Fig. 16: Measuring Resistance Between CPP Switch C257-2 & Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between CPP switch C257-2, circuit 1205 (BK) and ground.

- **Is the resistance less than 5 ohms?**

YES : Go to A21.

NO : REPAIR circuit 1205 (BK) for an open. TEST the system for normal operation.

A21 CHECK CPP SWITCH

- Connect: CPP Switch C257

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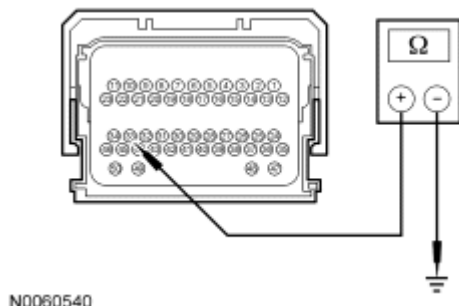


Fig. 17: Measuring Resistance Between PCM C175B-33, Circuit 92 (LB/YE) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM C175B-33, circuit 92 (LB/YE) and ground, while depressing the clutch pedal.
- **Is the resistance less than 5 ohms?**
YES : Go to A22.
NO : INSTALL a new CPP switch. REFER to **ELECTRONIC ENGINE CONTROLS** article.
TEST the system for normal operation.

A22 CHECK CIRCUIT 1419 (LG/YE) FOR AN OPEN

- Disconnect: PCM C175B

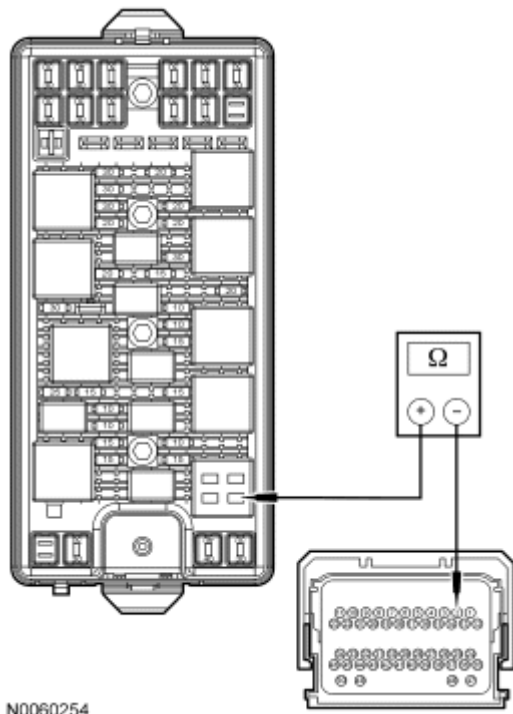


Fig. 18: Checking Circuit 1419 (LG/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between BEC starter relay, circuit 1419 (LG/YE) and PCM C175-2, circuit 1419 (LG/YE).
- **Is the resistance less than 5 ohms?**
YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS** article. TEST the system for normal operation.
NO : REPAIR circuit 1419 (LG/YE) for an open. TEST the system for normal operation.

Pinpoint Test B: Unusual Starter Noise

This pinpoint test is intended to diagnose the following:

- Starter motor
- Ring gear

PINPOINT TEST B: UNUSUAL STARTER NOISE**B1 CHECK THE STARTER MOUNTING**

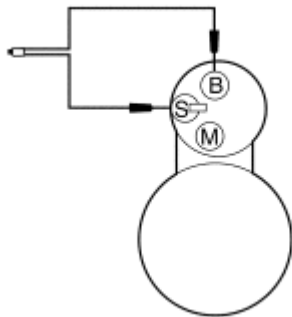
- Inspect the starter mounting bolts and brackets for looseness.
- **Is the starter motor mounted correctly?**

YES : Go to B2.

NO : INSTALL the starter motor correctly. REFER to **Starter Motor - 4.0L SOHC**, **Starter Motor - 4.6L (3V)** or **Starter Motor - 5.4L (4V)**. TEST the system for normal operation.

B2 CHECK FOR ENGINE NOISE

- Key in OFF position.



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Fig. 19: Inspecting Starter Motor
Courtesy of FORD MOTOR CO.

- Connect a remote starter switch between the starter solenoid B and S terminals.
- Engage the starter motor and verify the noise is due to the starter operation.
- **Is the noise due to the starter motor engagement?**

YES : Go to B3.

NO : REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article to continue

diagnosis.

B3 CHECK FOR UNUSUAL WEAR

- Remove the starter motor.
- Inspect the flywheel/flexplate ring gear for damaged or worn teeth. Refer to **ENGINE - 4.0L SOHC** article, **ENGINE - 4.6L (3V)** article or **ENGINE - 5.4L (4V)** article.
- **Is the noise due to ring gear tooth damage?**

YES : INSTALL a new flywheel/flexplate ring gear. REFER to **ENGINE - 4.0L SOHC** article, **ENGINE - 4.6L (3V)** article or **ENGINE - 5.4L (4V)** article. EXAMINE the starter pinion teeth. If damaged, INSTALL a new starter motor. REFER to **Starter Motor - 4.0L SOHC**, **Starter Motor - 4.6L (3V)** or **Starter Motor - 5.4L (4V)** TEST the system for normal operation.

NO : INSTALL a new starter motor. REFER to **Starter Motor - 4.0L SOHC**, **Starter Motor - 4.6L (3V)** or **Starter Motor - 5.4L (4V)** TEST the system for normal operation.

Component Tests

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

Always make the 73III Automotive Meter connections at the component terminal rather than at the wiring end connector. Making a connection at the wiring end connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and the component.

Starter Motor - Motor Feed Circuit

1. Make sure the battery is fully charged; carry out a Battery Condition Test. Refer to **BATTERY, MOUNTING AND CABLES** article.
2. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.
3. Connect the 73III Automotive Meter positive lead to the battery positive (+) post. Connect the negative lead to the starter solenoid M-terminal.

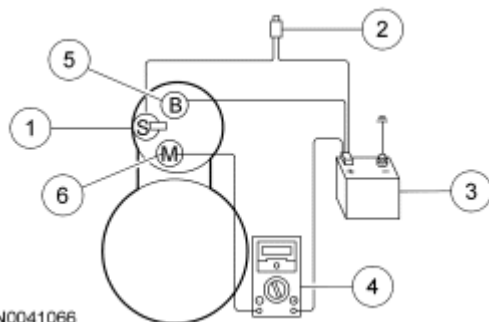


Fig. 20: Motor Feed Circuit

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Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	S-terminal
2	-	Remote starter switch
3	10653	Battery
4	-	73III Automotive Meter
5	-	B-terminal
6	-	M-terminal

- Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.
- If the voltage reading is 0.5 volt or less, go to the Starter Motor - Ground Circuit component test.
- If the voltage reading is greater than 0.5 volt, this is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Move the 73III Automotive Meter negative lead to the starter solenoid B-terminal and repeat the test. If the voltage reading at the B-terminal is lower than 0.5 volt, the concern is either in the connections at the starter solenoid or in the solenoid contacts.

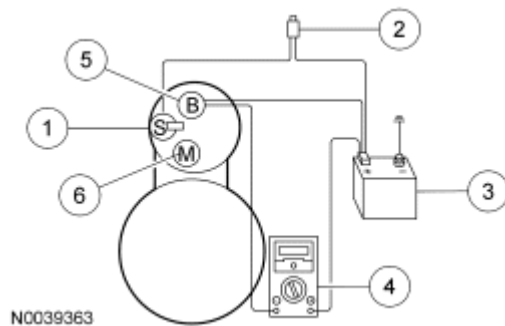


Fig. 21: Identifying S,M,B-Terminal, 73III Automotive Meter, Battery & Remote Starter Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	S-terminal
2	-	Remote starter switch
3	10653	Battery
4	-	73III Automotive Meter
5	-	B-terminal
6	-	M-terminal

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6	-	M-terminal
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7. Remove the cables from solenoid B-, S- and M-terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6. If the voltage drop reading is still greater than 0.5 volt when checked at the M-terminal or less than 0.5 volt when checked at the B-terminal, the concern is in the solenoid contacts. Install a new starter motor.
8. If the voltage reading taken at the solenoid B-terminal is still greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is either in the positive (+) battery cable connection or in the positive battery cable itself.
9. Clean the positive (+) battery cable connection. If this does not solve the problem, install a new positive battery cable.

Starter Motor - Ground Circuit

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. Check the voltage drop in the ground circuit as follows:

1. Connect the 73III Automotive Meter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative (-) battery terminal.
2. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.2 volt or less.
3. If the voltage drop is more than 0.2 volt, clean the negative cable connections at the battery, the body ground connections and the starter ground connection. Retest.
4. If the voltage drop is greater than 0.2 volt, install a new cable. If the voltage reading is less than 0.2 volt and the engine still cranks slowly, install a new starter motor. Refer to **Starter Motor - 4.0L SOHC**, **Starter Motor - 4.6L (3V)** or **Starter Motor - 5.4L (4V)**.

GENERAL PROCEDURES

STARTER MOTOR DRIVE GEAR AND FLYWHEEL RING GEAR INSPECTION

1. Remove the starter motor. For additional information, refer to **Starter Motor - 4.0L SOHC** or **Starter Motor - 4.6L (3V)** or **Starter Motor - 5.4L (4V)**.
2. Check the wear patterns on the starter drive gear and the flywheel/flexplate ring gear. If the wear pattern is normal, install the starter motor. For additional information, refer to **Starter Motor - 4.0L SOHC** or **Starter Motor - 4.6L (3V)** or **Starter Motor - 5.4L (4V)**.

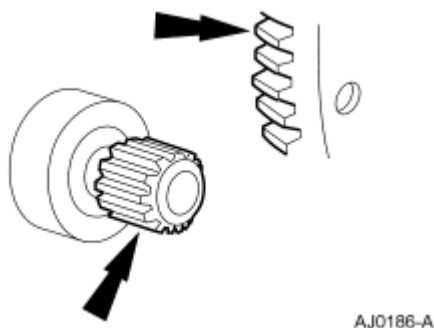


Fig. 22: Checking Wear Patterns On Starter Drive Gear & Flywheel Ring Gear
Courtesy of FORD MOTOR CO.

3. If the starter drive gear and the flywheel/flexplate ring gear are not fully meshing and both of the gears are scored or damaged, install a new starter motor. For additional information, refer to **Starter Motor - 4.0L SOHC** or **Starter Motor - 4.6L (3V)** or **Starter Motor - 5.4L (4V)**.

If necessary, install a new flywheel/flexplate. For additional information, refer to **ENGINE - 4.0L SOHC** article or **ENGINE - 4.6L (3V)** article or **ENGINE - 5.4L (4V)** article.

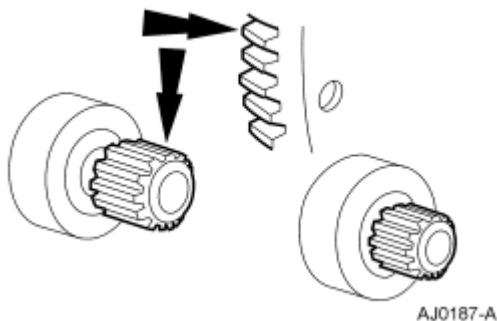


Fig. 23: Checking Wear Patterns On Starter Drive Gear & Flywheel Ring Gear
Courtesy of FORD MOTOR CO.

REMOVAL AND INSTALLATION

STARTER MOTOR - 4.0L SOHC

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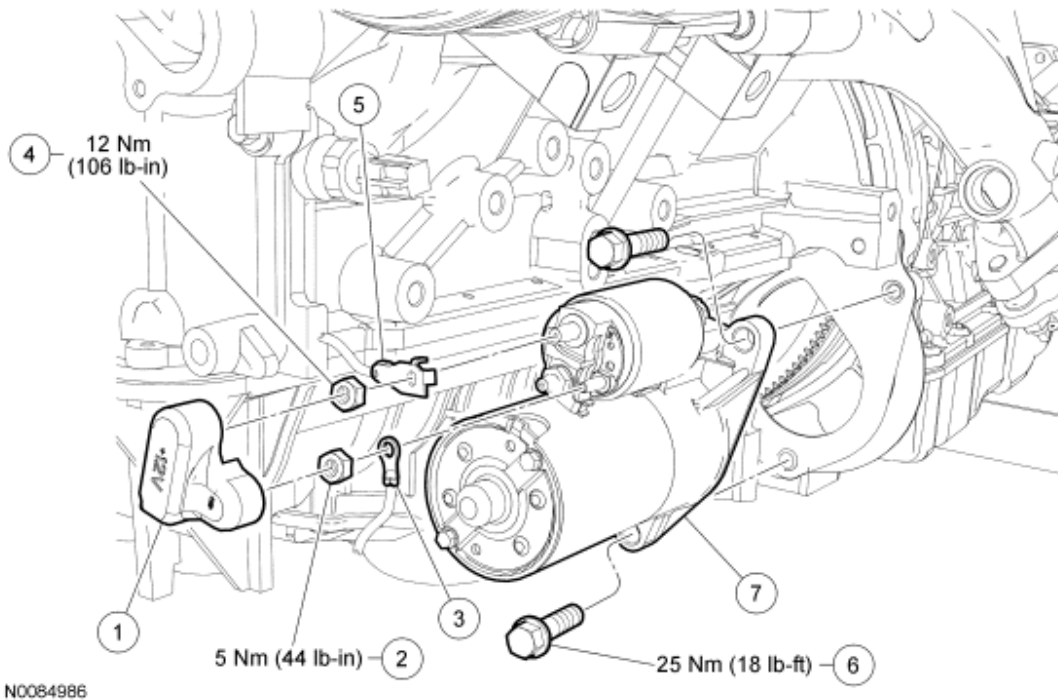


Fig. 24: Exploded View Of Starter Motor With Torque Specifications - 4.0L SOHC
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	11N087	Starter solenoid terminal cover
2	W705790	Starter solenoid S-terminal nut
3	14463	Starter solenoid S-terminal eyelet
4	N805403	Starter solenoid B+ terminal nut
5	14463	Starter solenoid B+ terminal eyelet
6	W709781	Starter motor mounting bolt (2 required)
7	11000	Starter motor

REMOVAL

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

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3. Remove the starter solenoid terminal cover.
4. Remove the 2 starter solenoid terminal nuts and position aside the wires.
5. Remove the 2 bolts and the starter motor.

INSTALLATION

NOTE: To make sure of correct starter installation, the upper bolt must be tightened first.

NOTE: Clean the starter motor mounting flange and mating surface of the starter motor to make sure there is a correct ground connection.

1. Position the starter motor and install the 2 bolts finger-tight.
 - Tighten the upper bolt to 25 Nm (18 lb-ft).
 - Tighten the lower bolt to 25 Nm (18 lb-ft).
2. Install the wires and the 2 starter solenoid terminal nuts.
 - Tighten the starter solenoid B+ terminal nut to 12 Nm (106 lb-in).
 - Tighten the starter solenoid S-terminal nut to 5 Nm (44 lb-in).
3. Install the starter solenoid terminal cover.
4. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

STARTER MOTOR - 4.6L (3V)

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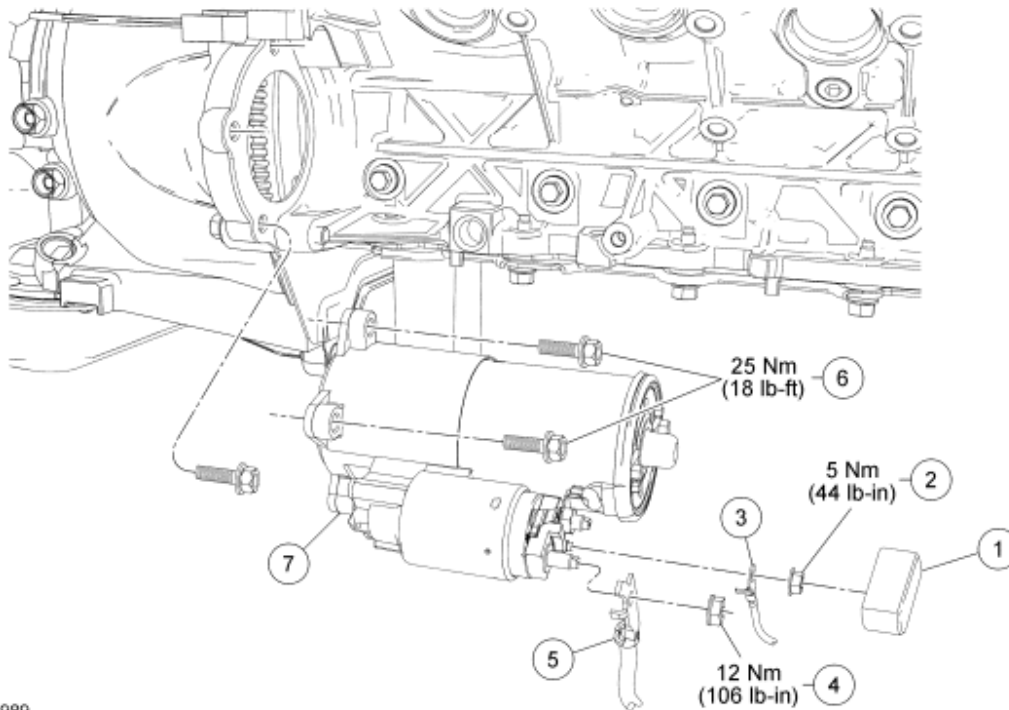


Fig. 25: Exploded View Of Starter Motor With Torque Specifications - 4.6L (3V)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	11N087	Starter solenoid terminal cover
2	W705790	Starter solenoid S-terminal nut
3	14463	Starter solenoid S-terminal eyelet
4	N805403	Starter solenoid B+ terminal nut
5	14463	Starter solenoid B+ terminal eyelet
6	W500310	Starter motor mounting bolts (3 required)
7	11000	Starter motor

REMOVAL

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

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3. Remove the starter solenoid terminal cover.
4. Remove the 2 starter solenoid terminal nuts and position aside the wires.
5. Remove the 3 bolts and the starter motor.

INSTALLATION

NOTE: To make sure of correct starter installation, the upper bolt must be tightened first.

NOTE: Clean the starter motor mounting flange and mating surface of the starter motor to make sure there is a correct ground connection.

1. Position the starter motor and install the 3 bolts finger-tight.
 - Tighten the upper bolt to 25 Nm (18 lb-ft).
 - Tighten the 2 lower bolts to 25 Nm (18 lb-ft).
2. Install the wires and the 2 starter solenoid terminal nuts.
 - Tighten the starter solenoid B+ terminal nut to 12 Nm (106 lb-in).
 - Tighten the starter solenoid S-terminal nut to 5 Nm (44 lb-in).
3. Install the starter solenoid terminal cover.
4. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

STARTER MOTOR - 5.4L (4V)

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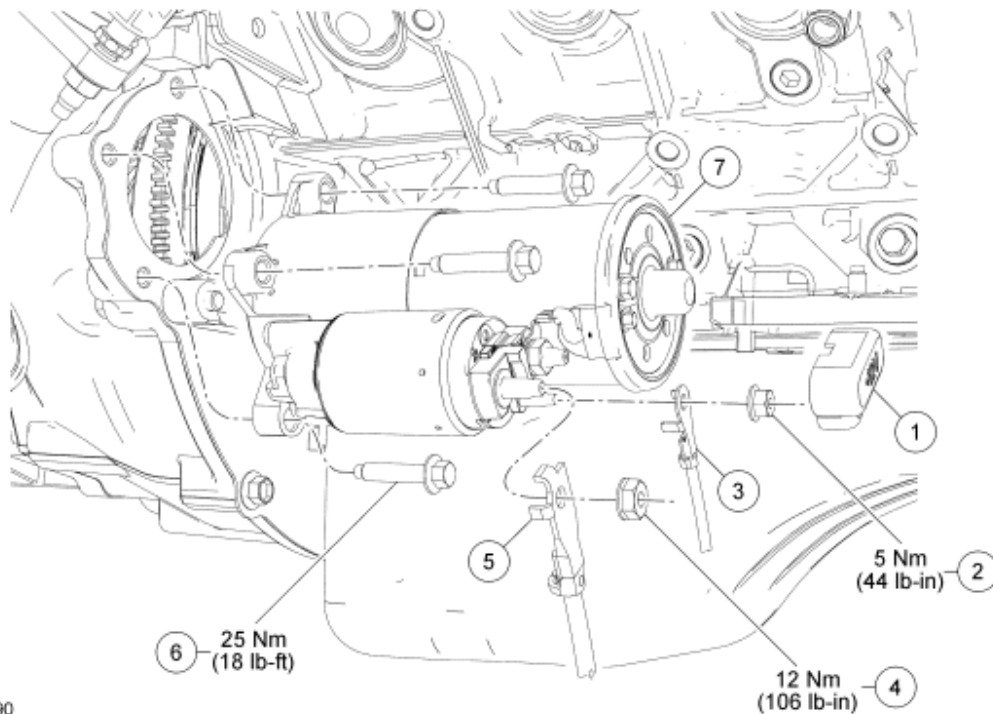


Fig. 26: Exploded View Of Starter Motor With Torque Specifications - 5.4L (4V)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	11N087	Starter solenoid terminal cover
2	W705790	Starter solenoid S-terminal nut
3	14463	Starter solenoid S-terminal eyelet
4	N805403	Starter solenoid B+ terminal nut
5	14463	Starter solenoid B+ terminal eyelet
6	W500310	Starter motor mounting bolt (3 required)
7	11000	Starter motor

REMOVAL

WARNING: Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

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3. Remove the starter solenoid terminal cover.
4. Remove the 2 starter solenoid terminal nuts and position aside the wires.
5. Remove the 3 bolts and the starter motor.

INSTALLATION

NOTE: To make sure of correct starter installation, the upper bolt must be tightened first.

NOTE: Clean the starter motor mounting flange and mating surface of the starter motor to make sure there is a correct ground connection.

1. Position the starter motor and install the 3 bolts finger-tight.
 - Tighten the upper bolt to 25 Nm (18 lb-ft).
 - Tighten the 2 lower bolts to 25 Nm (18 lb-ft).
2. Install the wires and the 2 starter solenoid terminal nuts.
 - Tighten the starter solenoid B+ terminal nut to 12 Nm (106 lb-in).
 - Tighten the starter solenoid S-terminal nut to 5 Nm (44 lb-in).
3. Install the starter solenoid terminal cover.
4. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.