

2005 Ford Focus ZX5 S

2005 ENGINE Starting System - Focus

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SPECIFICATIONS

TORQUE SPECIFICATIONS

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Description	Nm	lb-ft	lb-in
Starter motor bolt and stud bolts	25	18	-
Power steering pressure (PSP) tube retaining bracket nuts	13	10	-
Starter motor power connection	12	9	-
Starter solenoid connection	5	-	44

DESCRIPTION AND OPERATION

STARTING SYSTEM

The function of the starting system is to crank the engine at a speed fast enough to allow the engine to start. Heavy cables, connectors and switches are used in the system because of the large currents required. The starting system consists of a gear reduced starter motor, battery, remote control switch (ignition switch) and relay.

Vehicles equipped with an automatic transaxle have a transmission range sensor attached to the circuit, which prevents operation of the starter motor unless NEUTRAL or PARK are selected.

Vehicles equipped with a manual transaxle have a start inhibit switch in the starter control circuit, which prevents operation of the starter motor unless the clutch pedal is in the applied position.

The sequence of operation is as follows:

- Ignition switch in the start position III
- Starter relay activated
- Voltage provided to the starter motor solenoid
- Starter solenoid engages the drive pinion to the ring gear

- Starter solenoid switches the battery current to the starter motor
- System remains engaged until the ignition switch is released

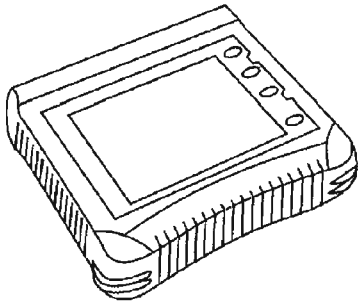
DIAGNOSIS AND TESTING

STARTING SYSTEM

Refer to **SYSTEM WIRING DIAGRAMS** for schematic and connector information.

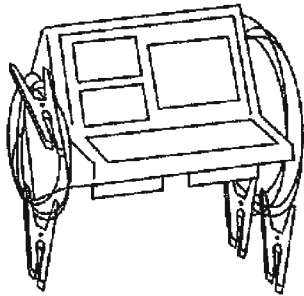
Special Tool(s)

SPECIAL TOOL DESCRIPTION



ST2332-A

73III Automotive Meter 105-R0057 or equivalent



ST1179-A

Alternator, Regulator, Battery and Starter Tester (ARBST) 010-00725 or equivalent

Inspection and Verification

WARNING: When working underhood in the vicinity of the starter motor, be aware that the heavy gauge battery input lead at the starter solenoid is "electrically hot" at all times. A protective cap or boot is provided over the terminal of this lead and must be reinstalled after repairing

WARNING: When working in the area of the starter motor, be careful to

avoid touching hot exhaust components.

NOTE: The anti-theft system must be functioning correctly before a logical starting system diagnosis can be carried out. Address anti-theft concerns before continuing.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
<ul style="list-style-type: none"> • Starter motor 	<ul style="list-style-type: none"> • Battery • Fuse(s) • Wiring harness • Starter relay • Loose or corroded connections • Anti-theft system • Starter switch (manual transaxle only)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom. GO to **SYMPTOM CHART**.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
<ul style="list-style-type: none"> • Engine does not crank but relay clicks 	<ul style="list-style-type: none"> • Battery. • Starter motor. • Relay. • Circuit. 	<ul style="list-style-type: none"> • GO to <u>PINPOINT TEST A</u>.
<ul style="list-style-type: none"> • Engine does not crank and relay does not click 	<ul style="list-style-type: none"> • Battery. • Open fuse. • Starter motor. • Ignition switch. 	<ul style="list-style-type: none"> • GO to <u>PINPOINT TEST B</u>.

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	<ul style="list-style-type: none">• Clutch pedal position (CPP) switch (manual transaxle only).• Circuitry.• Starter motor relay.	
<ul style="list-style-type: none">• Engine cranks slowly	<ul style="list-style-type: none">• Battery.• Starter motor.• Circuitry.	<ul style="list-style-type: none">• GO to <u>PINPOINT TEST C.</u>
<ul style="list-style-type: none">• Unusual starter motor noise	<ul style="list-style-type: none">• Starter motor.• Flywheel ring gear.	<ul style="list-style-type: none">• CHECK flywheel ring gear. REFER to <u>ENGINE SYSTEM-GENERAL INFORMATION</u> .• INSPECT the starter motor for alignment and cracked case. Make sure the mounting bolts are tightened. If necessary, INSTALL a new starter motor. REFER to <u>STARTER MOTOR.</u>
<ul style="list-style-type: none">• The starter spins but the engine does not crank	<ul style="list-style-type: none">• Starter motor.	<ul style="list-style-type: none">• INSPECT the flywheel ring gear for missing teeth. CHECK the <u>STARTER MOTOR</u> for correct mounting. If concern persists, INSTALL a new starter motor. REFER to <u>STARTER MOTOR.</u>

Pinpoint Tests

PINPOINT TEST A: THE ENGINE DOES NOT CRANK BUT THE RELAY CLICKS

A1 CHECK THE BATTERY

- Check the battery. Carry out the battery capacity test using a diagnostic tool.
- **Is the battery OK?**

Yes : GO to **A2.**

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

A2 CHECK THE STARTER RELAY

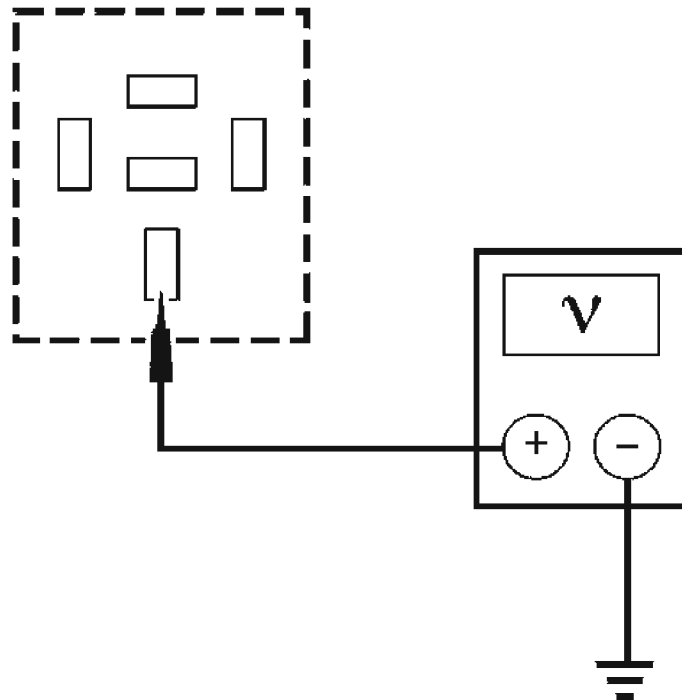
- Disconnect: Starter Relay.
- Carry out the ISO mini relay component test. Refer to the **COMPONENT TESTING** .
- **Is the relay OK?**

Yes : GO to **A3**.

No : INSTALL a new starter relay. TEST the system for normal operation.

A3 CHECK THE VOLTAGE TO THE STARTER RELAY CIRCUIT 30-BB9 (RD)

- Key in START position.
- Measure the voltage between starter relay socket pin 30, circuit 30-BB9 (RD) and ground.



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Fig. 1: Measuring Voltage Between Relay Pin And Ground
Courtesy of FORD MOTOR CO.

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

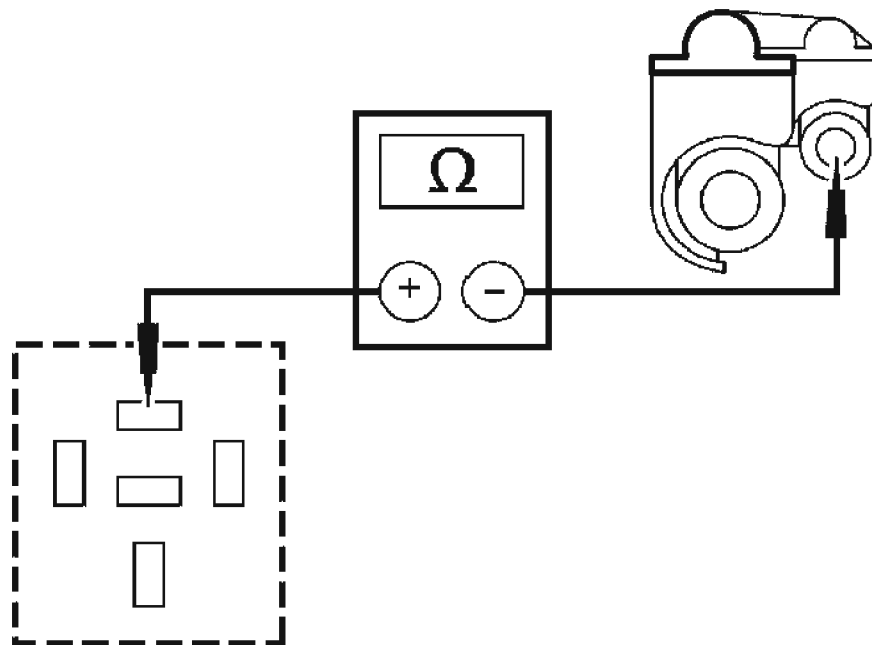
Yes : GO to **A4**.

No : REPAIR circuit 30-BB9 (RD) for an open. TEST the system for normal

operation.

A4 CHECK CIRCUIT 50-BB12 (GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Starter motor C197.
- Automatic transmission only: Place the vehicle in PARK.
- Measure the resistance between starter motor C197 pin 2, circuit 50-BB2 (BK) and starter relay socket pin 87, circuit 50-BB12 (GY).



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Fig. 2: Measuring Resistance Between Starter Motor C197 Pin 2, Circuit 50-BB2 (BK) And Starter Relay Socket Pin 87, Circuit 50-BB12 (GY)
Courtesy of FORD MOTOR CO.

- Is the resistance less than 5 ohms?

Yes : GO to **A5**.

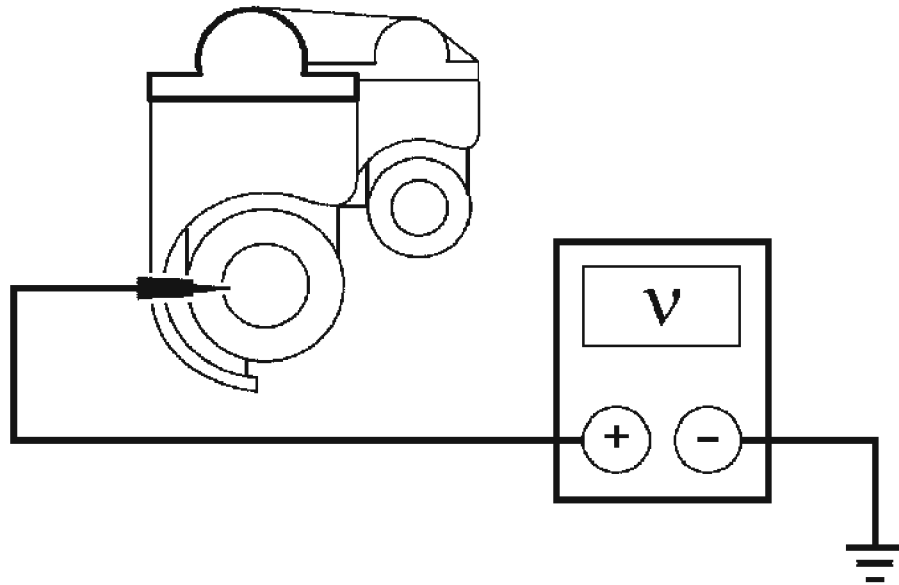
No : For manual transmission, REPAIR circuit 50-BB12 (GY)/50-BB2 (BK) for an open. TEST the system for normal operation.

For automatic transmission, GO to **A6**.

A5 CHECK THE STARTER MOTOR FEED

- Measure the voltage between starter motor pin C197 pin 1 circuit 30-BB10 (RD)

and ground.



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Fig. 3: Checking Starter Motor Feed
Courtesy of FORD MOTOR CO.

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

Yes : CLEAN and TIGHTEN all positive battery cable connections. TEST the system for normal operation. If the concern persists, INSTALL a new positive battery cable.

No : REPAIR circuit 30-BB10 (RD) for an open. TEST the system for normal operation.

A6 CHECK CIRCUIT 50-BB12 (GY)/50-BB14 (GY/RD) FOR AN OPEN

- Disconnect: TR Sensor C167.
- Measure the resistance between starter relay socket pin 87, circuit 50-BB12 (GY) and TR sensor C167 pin 6, circuit 50-BB14 (GY/RD).

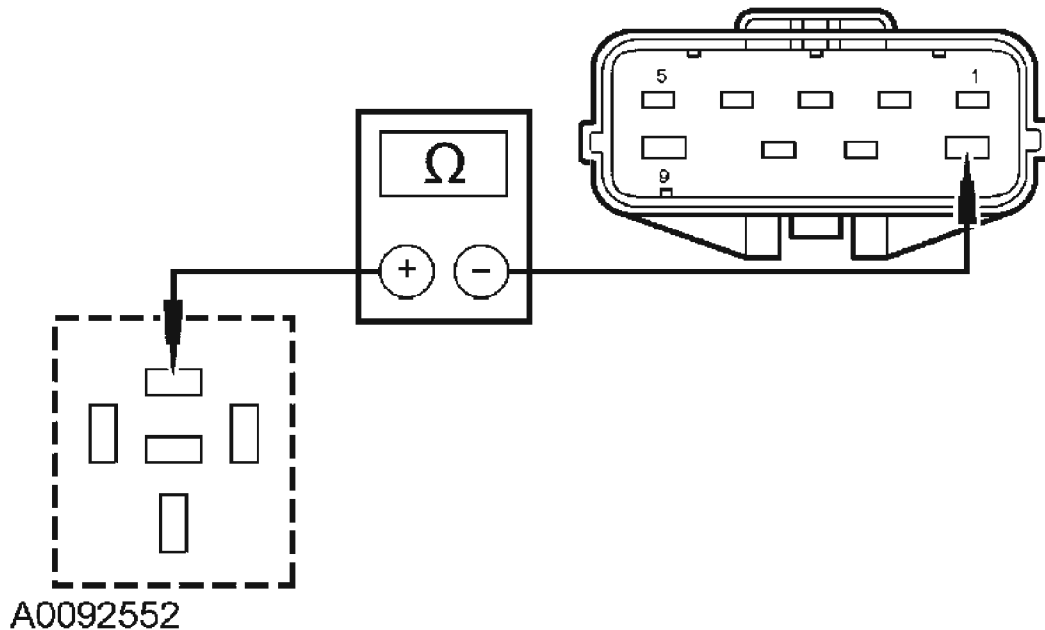


Fig. 4: Measuring Resistance Between Starter Relay Socket Pin 87, Circuit 50-BB12 (GY) And TR Sensor C167 Pin 6, Circuit 50-BB14 (GY/RD)
 Courtesy of FORD MOTOR CO.

- Is the resistance less than 5 ohms?

Yes : GO to **A7**.

No : REPAIR circuit 50-BB12 (GY)/50-BB14 (GY/RD) for an open. TEST the system for normal operation.

A7 CHECK CIRCUIT 50-BB12 (GY)/50-BB2 (BK) FOR AN OPEN

- Measure the resistance between starter motor C197 pin 2, circuit 50-BB2 (BK) and TR sensor C167 pin 9, circuit 50-BB12 (GY)

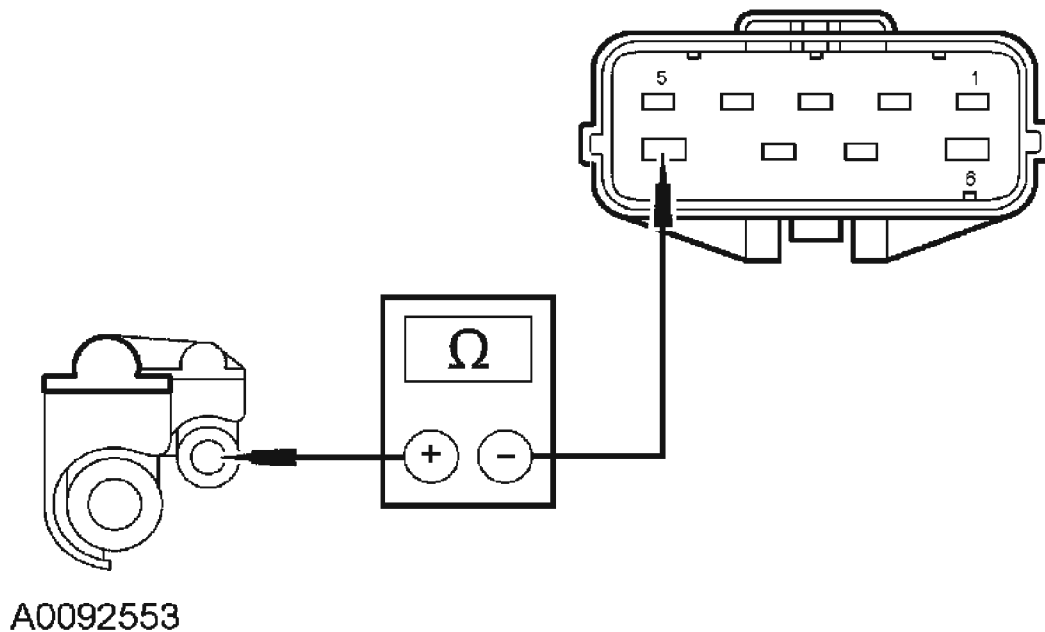


Fig. 5: Measuring Resistance Between Starter Motor C197 Pin 2, Circuit 50-BB2 (BK) And TR Sensor C167 Pin 9, Circuit 50-BB12 (GY)
Courtesy of FORD MOTOR CO.

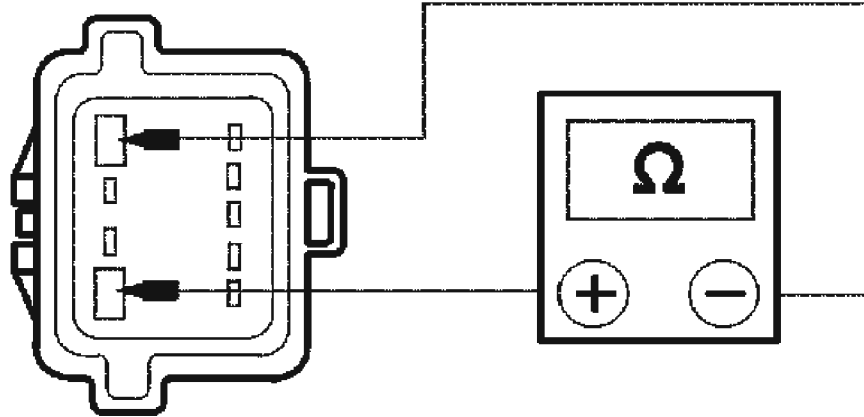
- Is the resistance less than 5 ohms?

Yes : GO to **A8**.

No : REPAIR circuit 50-BB12 (GY)/50-BB14 (GY/RD) for an open. TEST the system for normal operation.

A8 CHECK THE OPERATION OF TRANSMISSION RANGE (TR) SENSOR

- Measure the resistance between the TR sensor C167 pin 6, and pin 9 component side in PARK and NEUTRAL.



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Fig. 6: Measuring Resistance Between TR Sensor C167 Pin 6, And Pin 9 Component Side In PARK And NEUTRAL
Courtesy of FORD MOTOR CO.

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

Yes : INSTALL a new starter motor. TEST the system for normal operation.

No : ADJUST the TR sensor. If the concern persists, INSTALL a new TR sensor.

PINPOINT TEST B: THE ENGINE DOES NOT CRANK AND THE RELAY DOES NOT CLICK

B1 CHECK THE CONDITION OF THE PATS SYSTEM

- Observe the PATS warning indicator.
- **Does the indicator flash when attempting to start the vehicle?**

Yes : REFER to ANTI-THEFT - PERIMETER or ANTI-THEFT - PATS to diagnose the PATS DTCs.

No : GO to **B2**.

B2 CHECK THE BATTERY

- Check the battery. Carry out the battery capacity test using a diagnostic tool.
- **Is the battery OK?**

Yes : GO to **B3**.

No : INSTALL a new battery. For additional information, refer to BATTERY, MOUNTING AND CABLES . TEST the system for normal

operation.

B3 CHECK THE SWITCHED POWER TO THE STARTER RELAY

- Key in ON position.
- Measure the voltage between starter relay socket pin 87, circuit 30-BB9 (RD) and ground.

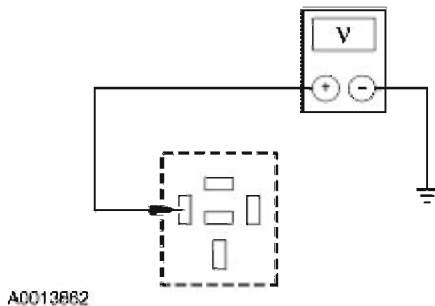


Fig. 7: Checking Relay Coil Supply Voltage
Courtesy of FORD MOTOR CO.

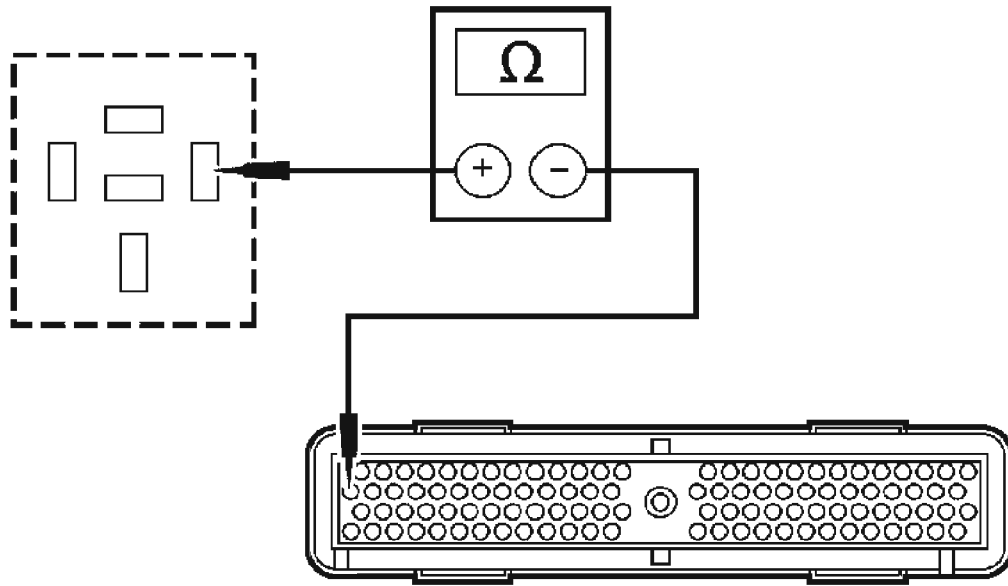
- Is the voltage greater than 10 volts?

Yes : For automatic transaxle, GO to **B4**. For manual transaxle, GO to **B5**.

No : GO to **B7**.

B4 CHECK CIRCUIT 31S-BB16 (BK/RD) (AUTOMATIC TRANSAXLE ONLY)

- Key in OFF position.
- Disconnect: PCM C175.
- Measure the resistance between starter relay pin 86, circuit 31S-BB16 (BK/RD) and PCM C175 pin 27, circuit 315-BB16 (BK/RD).



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Fig. 8: Measuring Resistance Between Starter Relay Pin 86, Circuit 31S-BB16 (BK/RD) And PCM C175 Pin 27, Circuit 315-BB16 (BK/RD)
Courtesy of FORD MOTOR CO.

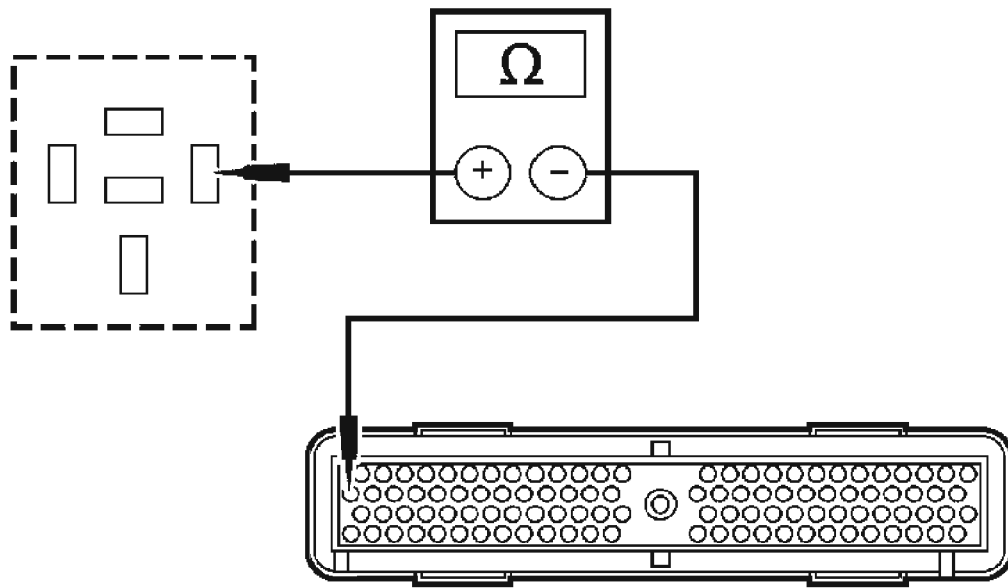
• **Is the resistance less than 5 ohms?**

Yes : CARRY OUT the relay component test on the starter relay. If the relay tests as good, INSTALL a new PCM. TEST the system for normal operation.

No : REPAIR circuit 31S-BB16 (BK/RD). TEST system for normal operation.

B5 CHECK CIRCUIT 31S-BB16 (BK/RD) FOR OPEN

- Key in OFF position.
- Disconnect: PCM C175.
- Depress the clutch pedal.
- Measure the resistance between starter relay pin 86, circuit 31S-BB16 (BK/RD) and PCM C175 pin 27, circuit 315-BB16 (BK/RD).



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Fig. 9: Measuring Resistance Between Starter Relay Pin 86, Circuit 31S-BB16 (BK/RD) And PCM C175 Pin 27, Circuit 315-BB16 (BK/RD)
Courtesy of FORD MOTOR CO.

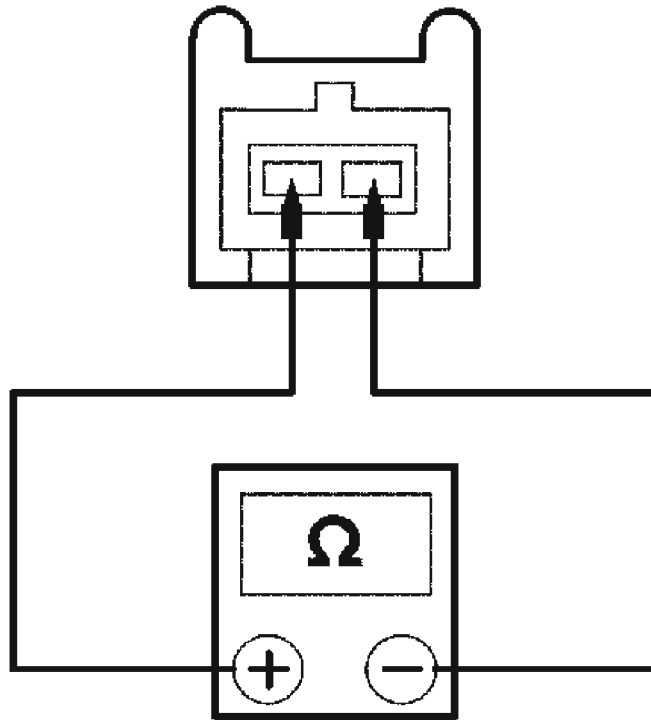
- **Is the resistance less than 5 ohms?**

Yes : CARRY OUT the relay component test on the starter relay. If the relay tests as good, INSTALL a new PCM. TEST the system for normal operation.

No : GO to **B6**.

**B6 CHECK THE STARTER SWITCH FOR CORRECT OPERATION
(MANUAL TRANSAXLE ONLY)**

- Disconnect: C2195 Starter Switch.
- Measure the resistance between starter switch C2195 pin 1 and pin 2.



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Fig. 10: Measuring Resistance Between Starter Switch C2195 Pin 1 And Pin 2

Courtesy of FORD MOTOR CO.

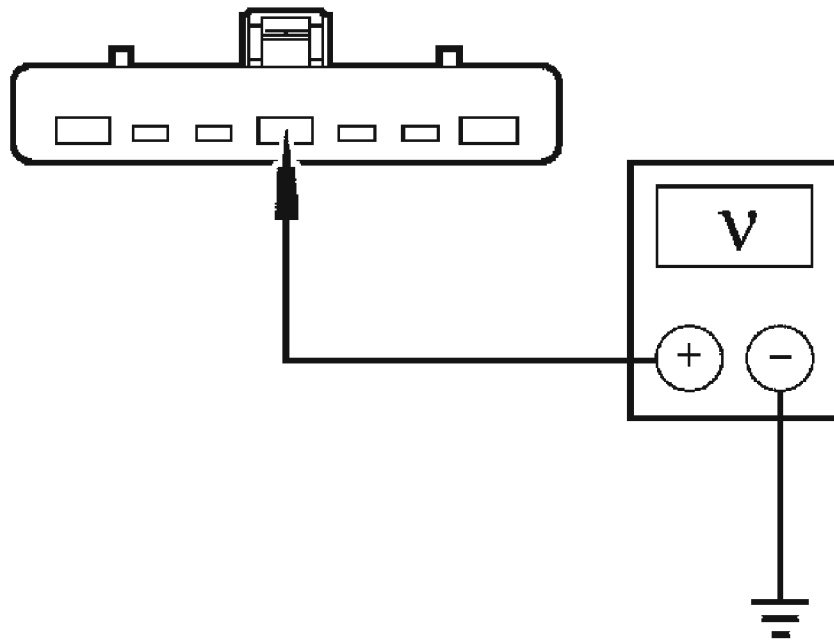
- **Is the resistance less than 5 ohms with the clutch pedal depressed and greater than 10,000 ohms with the clutch pedal released?**

Yes : REPAIR circuit 31S-BB16 (BK/RD). TEST the system for normal operation.

No : INSTALL a new starter switch. TEST the system for normal operation.

B7 CHECK THE VOLTAGE TO IGNITION SWITCH CIRCUIT 30-BB9 (RD)

- Disconnect: Ignition Switch C250.
- Measure the voltage between ignition switch C250 pin 4, circuit 30-BB9 (RD), harness side and ground.



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Fig. 11: Measuring Voltage Between Ignition Switch C250 Pin 4, Circuit 30-BB9 (RD), Harness Side And Ground
Courtesy of FORD MOTOR CO.

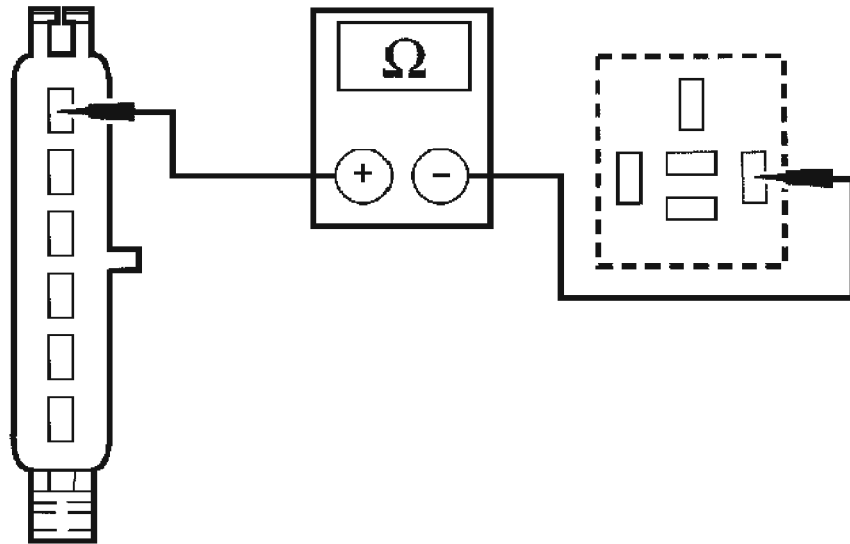
- Is the voltage greater than 10 volts?

Yes : GO to **B8**.

No : REPAIR circuit 30-BB9 (RD) for an open. TEST the system for normal operation. If the problem persists, REPAIR or INSTALL a new battery junction box.

B8 CHECK CIRCUIT 50-BB16 (GY/BK) FOR AN OPEN

- Measure the resistance between ignition switch C250 pin 7 circuit 50-BB16 (GY/BK) and starter relay pin 85.



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Fig. 12: Measuring Resistance Between Ignition Switch C250 Pin 7 Circuit 50-BB16 (GY/BK) And Starter Relay Pin 85
 Courtesy of FORD MOTOR CO.

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

Yes : INSTALL a new ignition switch. TEST the system for normal operation.

No : REPAIR circuit 50-BB16 (GY/BK) for an open. TEST the system for normal operation.

PINPOINT TEST C: THE ENGINE CRANKS SLOWLY

C1 CHECK THE STARTER MOTOR LOAD

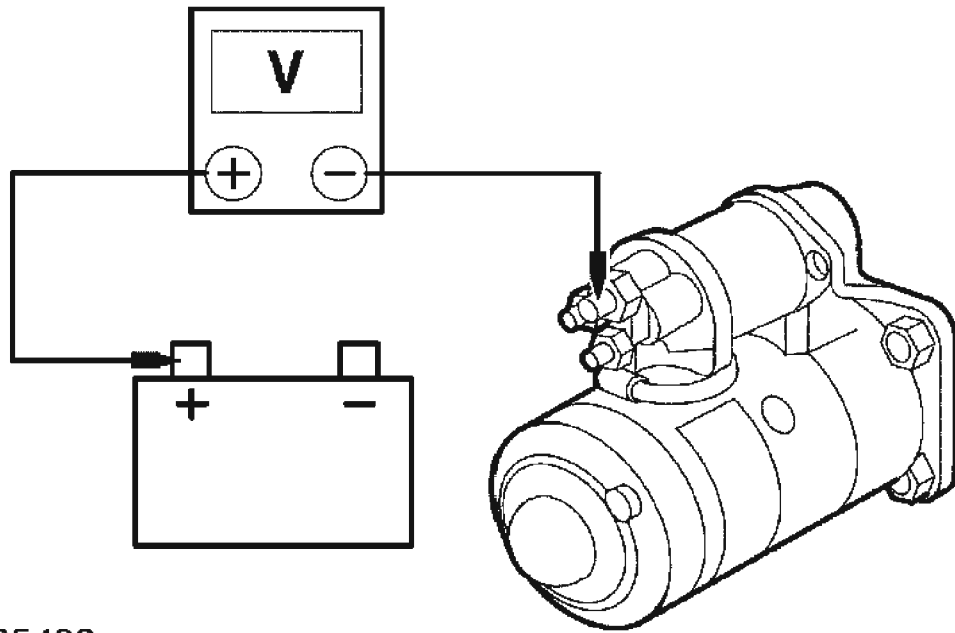
- Carry out the starter motor load test on the starter motor. Refer to **STARTER MOTOR - LOAD TEST**.
- **Is the starter motor OK?**

Yes : GO to **C2**.

No : INSTALL a new starter motor. REFER to **STARTER MOTOR**.

C2 CHECK FOR A VOLTAGE DROP

- Measure the voltage between starter motor pin 30, component side and the positive battery terminal with the ignition switch in position III.



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Fig. 13: Measuring Voltage Between Starter Motor Pin 30, Component Side And Positive Battery Terminal With Ignition Switch In Position III
Courtesy of FORD MOTOR CO.

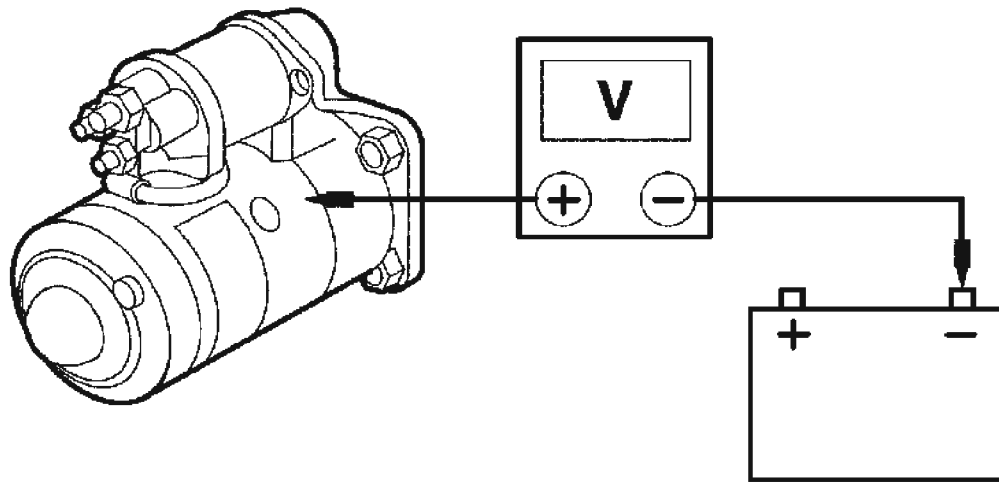
- Is the voltage less than 0.5 volt?

Yes : GO to **C3**.

No : CLEAN and TIGHTEN all positive battery cable connections. TEST the system for normal operation. If the concern persists, INSTALL a new positive battery cable.

C3 CHECK FOR A GROUND CONNECTION

- Measure the voltage between the starter motor case and battery negative terminal with the ignition switch in position III.



A0065540

Fig. 14: Measuring Voltage Between Starter Motor Case And Battery Negative Terminal With Ignition Switch In Position III
Courtesy of FORD MOTOR CO.

- **Is the voltage less than 0.5 volt?**

Yes : DIAGNOSE the battery and charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** .

No : CLEAN and TIGHTEN all negative battery cable connections, starter motor mounting and body to engine ground strap. TEST the system for normal operation. If the concern persists, INSTALL a new negative battery cable.

Component Tests

Starter Motor - Load Test

NOTE: **The batteries must be fully charged before carrying out a starter load test.**

1. Set the parking brake and shift the transmission into the NEUTRAL position.
2. Connect the Alternator, Regulator, Battery and Starter Tester (ARBST). Follow the manufacturer's supplied instructions.
3. Connect a remote starter switch across the starter relay S-terminal and the battery positive terminal post.
4. Turn the ignition switch to the RUN position.
5. Crank the engine and record the voltmeter reading.

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6. Turn the carbon pile control knob until the voltmeter indicates the same reading recorded during cranking the engine. Record the ammeter reading.
7. Compare the ammeter reading with specifications.

Starter Motor - No-Load Test

1. Connect a fully charged battery to the starter.
2. Connect the Alternator, Regulator, Battery and Starter Tester (ARBST) as illustrated.
3. Connect a remote starter switch between the starter solenoid Terminal S and the positive battery terminal post.
4. Press the remote starter switch. The pinion should shift to the crank position and the motor should run smoothly.
5. While the starter motor is running, record the voltmeter and ammeter readings.
6. The voltage reading should be greater than 11.0 volts and the amperage should be no more than 170 amps.

Starter Motor - Motor Feed Circuit Voltage Drop Test

1. This test is carried out to determine if slow cranking is caused by high resistance in the starter motor circuit wiring.
2. The voltage drop test can only be carried out with the starter motor on the vehicle.
3. Disconnect the fuel pump electrical connector.
4. Connect the positive lead of the 73 Digital Multimeter to the battery positive (+) post, and the negative lead to the starter solenoid M-terminal.
5. Connect a remote starter switch between the starter solenoid S-terminal and the positive battery terminal post.
6. Press the remote starter switch and record the voltage reading.
7. The voltage reading should be 0.5 volt or less. A reading higher than 0.5 volt indicates high resistance.
8. Repeat the test on the starter solenoid B-terminal.
9. If the readings are higher than 0.5 volt, remove the wiring from the starter solenoid.
10. Clean and inspect each wire connector and the starter solenoid terminals.
11. Install the wires onto the starter solenoid and retest.
12. If the reading at the starter solenoid M-terminal is still higher than 0.5 volt or the reading at the B-terminal is lower, carry out the Starter Solenoid Component Test. If no change is noted, install a new positive battery cable lead.

Starter Motor - Motor Ground Circuit Voltage Drop Test

NOTE: A slow cranking condition can also be caused by high resistance in the ground circuit.

1. Disconnect the wiring from the fuel pump electrical connector.
2. Connect the Digital Volt-Ohmmeter positive lead to the starter motor housing.
3. Connect the Digital Volt-Ohmmeter negative lead to the battery negative (-) terminal.
4. Connect a remote starter switch between the starter solenoid S-terminal and the positive battery terminal post.
5. Press the remote starter switch and record the voltage reading.
6. The voltage reading should be 0.2 volt or less. If the voltage reading is higher, remove and clean the negative cable connections at the battery, starter motor and the body.
7. Retest the system. If readings are still higher than 0.2 volt, test each individual negative cable.

REMOVAL AND INSTALLATION

STARTER MOTOR

Removal and Installation

WARNING: When carrying out underhood work in the vicinity of the starter motor, be aware that the heavy gauge battery input lead at the starter solenoid is "electrically hot" at all times. A protective cap or boot is provided over the terminal of this lead and must be reinstalled after servicing.

WARNING: When working in the area of the starter motor, be careful to avoid touching hot exhaust components.

1. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES**.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING**.
3. Remove the terminal nuts and disconnect the wiring.

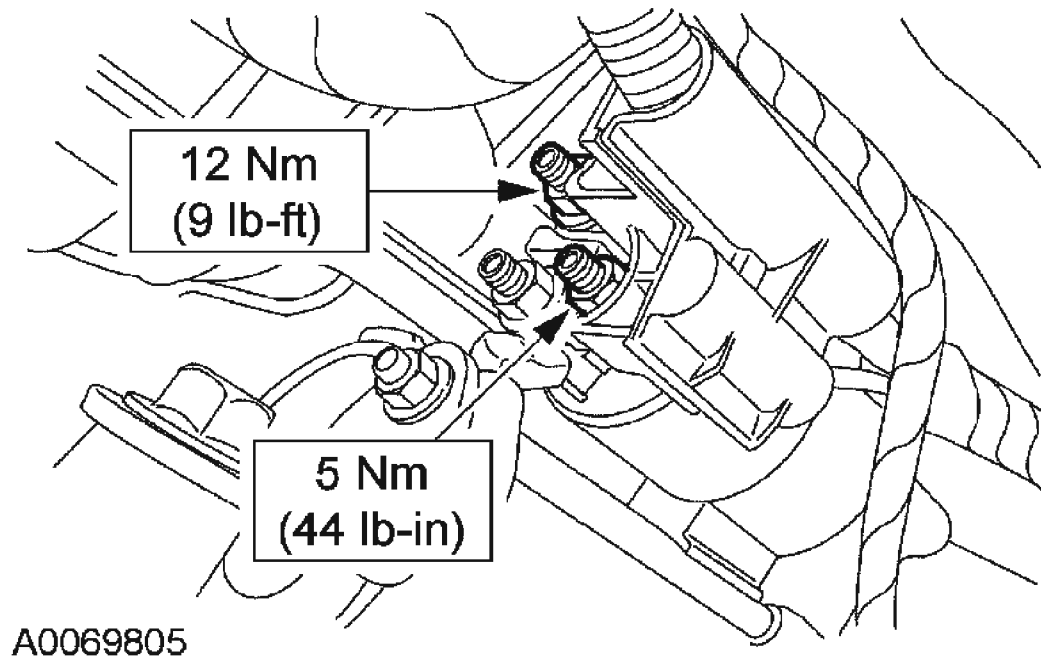


Fig. 15: Removing Starter Motor Terminal Nuts
Courtesy of FORD MOTOR CO.

4. Remove the nuts and detach the power steering pressure (PSP) tube brackets from the stud bolts.

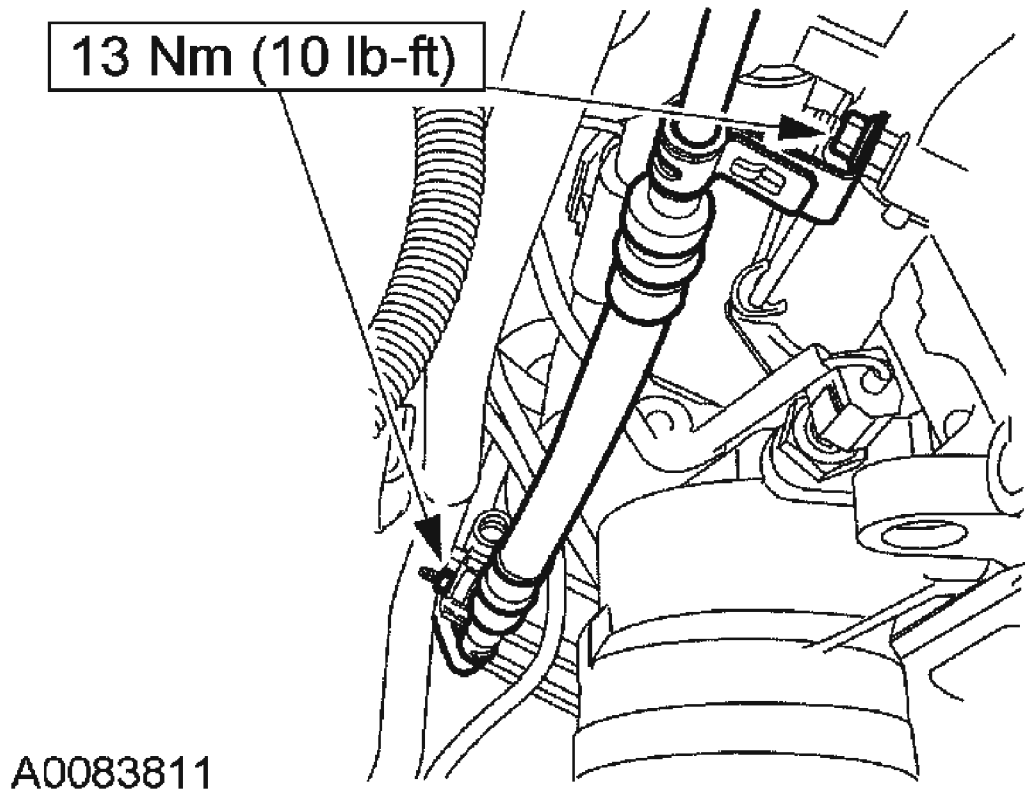


Fig. 16: Detaching Power Steering Pressure Tube Brackets From Stud Bolts
Courtesy of FORD MOTOR CO.

5. Remove the 3 starter motor bolts and the starter motor.
 - To install, start the upper and lower starter motor bolts finger-tight.
 - Tighten the upper bolt to 25 Nm (18 lb-ft).
 - Tighten the lower bolt to 25 Nm (18 lb-ft).

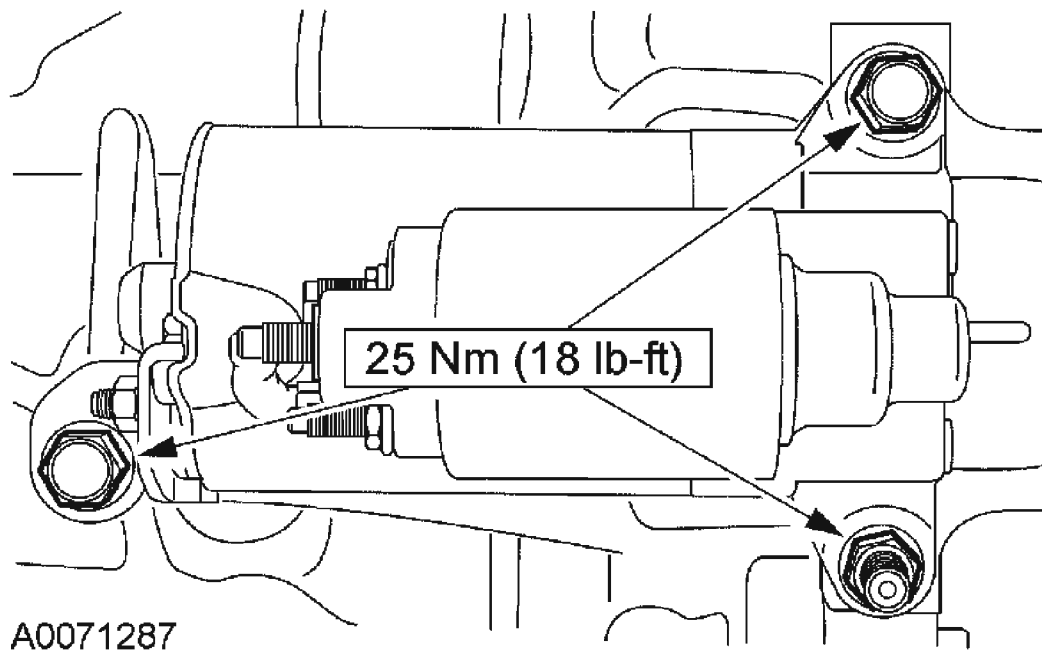


Fig. 17: Removing 3 Starter Motor Bolts And Starter Motor
Courtesy of FORD MOTOR CO.

6. To install, reverse the removal procedure.