Published: Jan 30, 2007

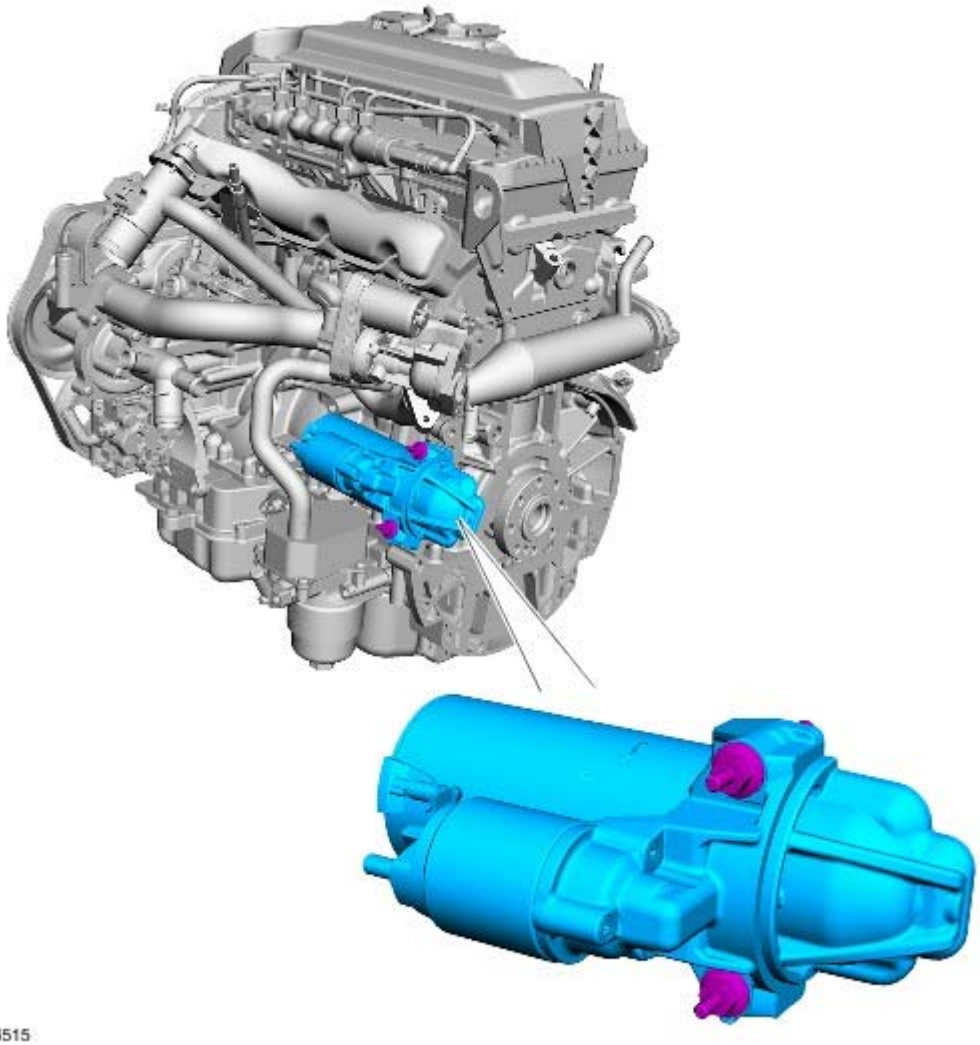
Specifications

Description	Nm	lb-ft
Starter motor bolts	35	26
Starter motor battery positive cable nut	12	9
Starter motor solenoid cable nut	8	6
Fuel line support bracket nut	8	6

Published: Jan 8, 2007

Starting System

COMPONENT LOCATION



E86515

OVERVIEW

The starter motor is rated as 2.0 kW and is of conventional design with the motor and drive pinion in line with the solenoid mounted above. It is of the pre-engaged type and comprises a series wound motor, an overrunning clutch and an integral solenoid. This starter incorporates a labyrinth in the front end nose casting to help with water management, sealing and drainage. The solenoid is sealed to stop water ingress and to alleviate cranking failures due to moisture.

The starter solenoid is energised by a signal from the Engine Control Module (ECM) when the ignition switch is moved to the crank position. When engine cranking is requested, the ECM checks that a valid key code has been received before granting the crank request. The power for starter operation is supplied on a substantial single cable connected direct from the battery positive terminal. The cable is connected to the solenoid via a copper threaded stud and secured with a nut.

The starter motor is located on the rear LH side of the engine block and protrudes through a recess to drive the flywheel via a ring gear. The motor is secured to the cylinder block by 2 bolts.

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Starting System

Overview

For information on the operation of the system:
Starting System

Inspection and Verification

1 . Verify the customer concern.

2 . Visually inspect for obvious signs of mechanical or electrical damage.

Mechanical	Electrical
• Starter motor • Engine (turns freely)	• Battery • Fuses Fuse link 5, fuse box under seat Megafuse • Starter relay • Wiring harness(es) • Damaged, loose or corroded connectors • Ignition switch • Generator • Engine control module (ECM)

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 . Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the symptom chart or DTC index.

Make sure that all DTCs are cleared following rectification.

Make sure that all DTCs are cleared following rectification.

Symptom Chart

Symptom	Possible causes	Action
The engine does not crank (starter motor does **not** turn)	• Battery • Starter relay Output circuit: high resistance Output circuit: short circuit to power • Invalid key code received by immobilizer • Harness/connectors • Starter motor • Ignition switch • Generator • Engine seized	Check the battery condition and state of charge. Check for DTCs indicating an immobilizer fault. Check the starter motor relay, ignition switch and generator circuits. Refer to the electrical guides. Check that the engine turns freely.
The engine does not crank (starter motor **does** turn)	• Starter motor fitment • Starter motor • Flywheel/drive plate ring gear	Check the starter motor fitment (fasteners tight, starter motor square to engine, etc.). Check the flywheel/drive plate ring gear teeth for damage, foreign objects, etc.
Engine cranks too slowly	• Battery • Harness/connectors • Starter motor • Oil grade	Check the battery condition and state of charge. Check the starter motor circuits. Refer to the electrical guides. Check the engine oil grade and condition.
Engine cranks too fast	• Low engine compression	Check the engine condition and compressions.
Excessive starter motor noise	• Starter motor • Flywheel/drive plate ring gear • Starter motor fitment/casing	Check the starter motor fitment (fasteners tight, motor square to engine, etc.). Check the starter motor casing condition. Check the flywheel/drive plate ring gear teeth for damage, foreign objects, etc.

DTC Index

NOTE:

If a control module or component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval program is in operation, before the replacement of a component.

NOTE:

Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

NOTE:

For a full list of engine control module (ECM) DTCs:

Electronic Engine Controls

DTC	Description	Possible causes	Action
P061512	Starter relay circuit - circuit short to battery	• Starter relay circuit: short circuit to power	Check the starter relay circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs and test for normal operation.
P061514	Starter relay circuit - circuit short to ground or open	• Starter relay circuit: short circuit to ground • Starter relay circuit: open circuit	
P160231	Immobilizer/engine control module (ECM) communication error – no signal	• Alarm (immobilizer) - instrument cluster circuit: short circuit to ground • Alarm (immobilizer) - instrument cluster circuit: short circuit to power • Alarm (immobilizer) - instrument cluster circuit: open circuit • Engine control module (ECM) fault • Instrument cluster fault	Check for related DTCs. Rectify as necessary. Clear the DTCs and test for normal operation. Check the alarm (immobilizer) circuits. Refer to the electrical guides. Rectify as necessary. Clear the DTCs and test for normal operation. Refer to the warranty policy and procedures manual if a module is suspect.

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Starter Motor (86.60.01)

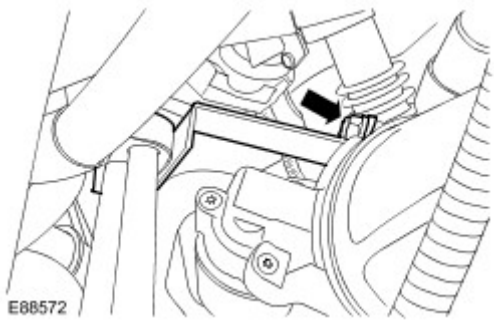
Removal

1 . Disconnect the battery ground cable.
For additional information, refer to Battery Disconnect and Connect

2 .
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

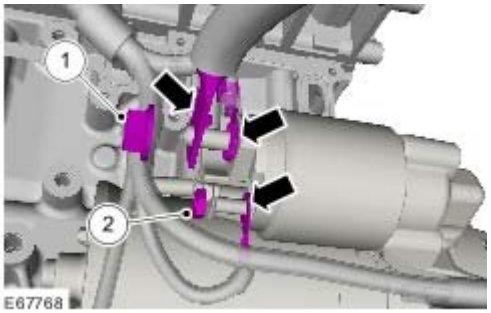
Raise and support the vehicle.
For additional information, refer to Lifting

3 . Remove the fuel line support bracket.
Remove the nut.

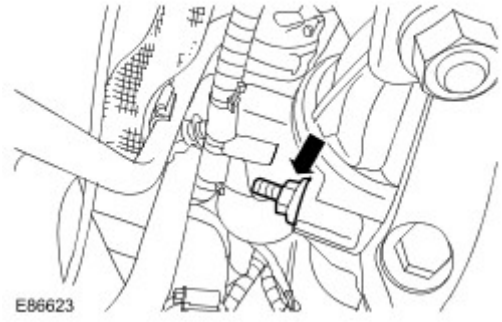


4 . Release the starter motor wiring harness clip.

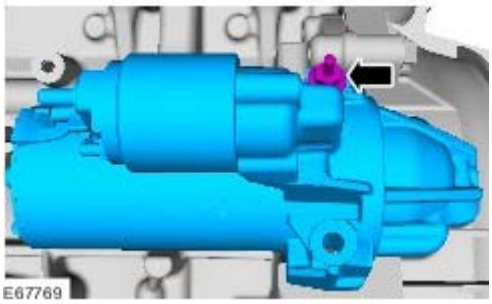
5 . Release the 2 battery positive cables and the switch lead from the starter motor solenoid.
1) Remove the battery positive cable nut.
2) Release the starter motor switch lead nut.



6 . Remove the starter motor lower bolt.



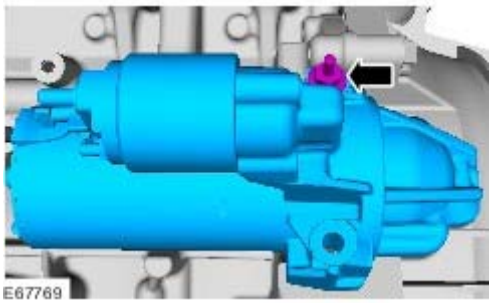
7 . Remove the starter motor.



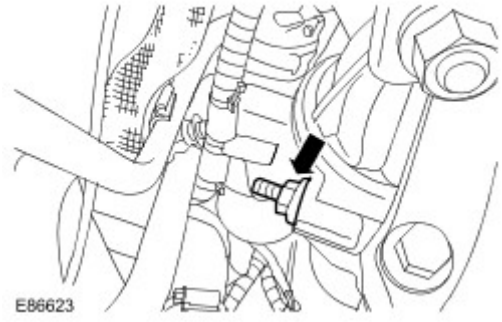
Installation

1 . Install the starter motor.

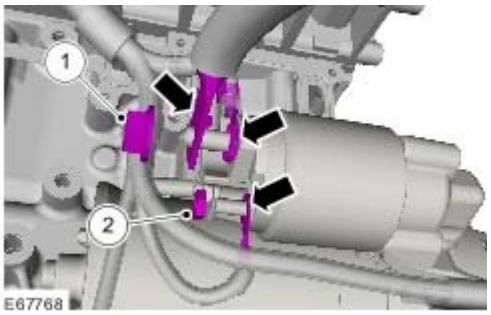
Tighten to 35 Nm (26 lb.ft).



2 . Tighten to 35 Nm (26 lb.ft).

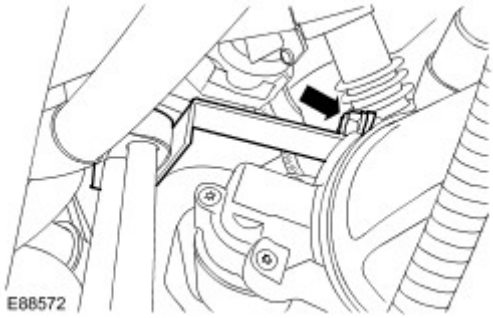


3 . Secure the 2 battery positive cables and the switch lead to the starter motor solenoid.
1) Tighten to 12 Nm (9 lb.ft).
2) Tighten to 8 Nm (6 lb.ft).



4 . Secure the starter motor wiring harness clip.

5 . Install the fuel line support bracket.
Tighten to 8 Nm (6 lb.ft).



6 . Connect the battery ground cable.
For additional information, refer to Battery Connect