

Starting System - V6 4.0L Petrol -

Starter Motor

Item	Specification
Starter motor:	
Make	Denso
Type	RA - Pre-engaged
Voltage	12
Current consumption	1.8 kW

Torque Specifications

Description	Nm	lb-ft
* Starter motor positive terminal nut	10	7
Starter motor bolts	45	33
** Lower steering column universal joint retaining bolt	25	18
Upper suspension arm and brake line heat shield nuts and bolts	10	7



CAUTION: * Damage to the internal connections will occur if this torque is exceeded

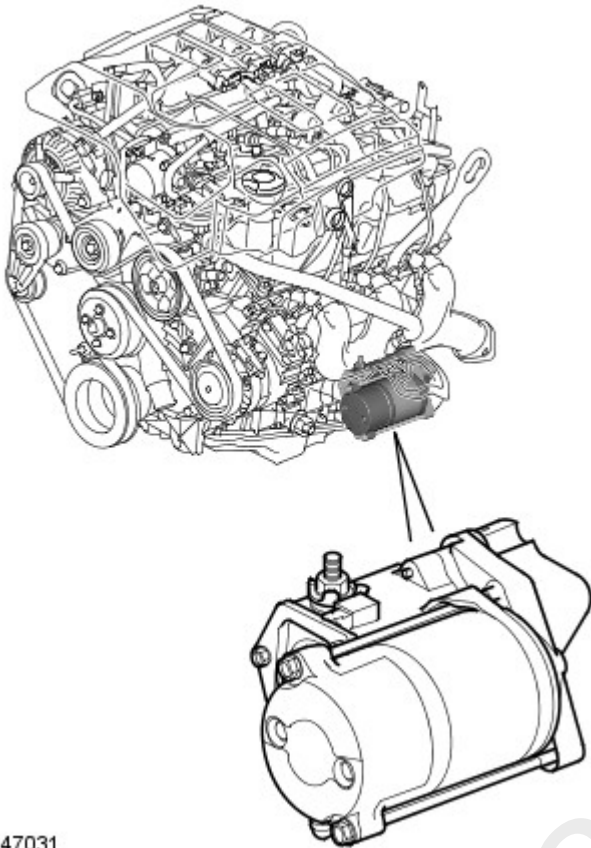
**** New patchlok bolt must be installed**

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Starting System - V6 4.0L Petrol - Starting System

Description and Operation

STARTER MOTOR



E47031

The starter motor is rated as a 1.8kW and is a Denso level three sealed unit. It is an RA type starter motor, which is of the offset design with the solenoid being directly behind the pinion to give a more positive engagement to the ring gear. The motor is geared directly to the pinion. Each starter motor is of the pre-engaged type and comprises of a series wound motor and an overrunning clutch. This starter incorporates labyrinth breathing tubes to help with sealing and drainage.

The starter solenoid is energised by a signal from the 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 with an anti-rotational device and secured with a nut.

The starter motor is located on the rear LH side of the engine block. The motor is secured to the block and protrudes through an aperture to drive the flywheel via a ring gear.

Starting System - V6 4.0L Petrol - Starting System

Diagnosis and Testing

Principles of Operation

For a detailed description of the starting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: [Starting System](#) (303-06C Starting System - V6 4.0L Petrol, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.

• **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

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

Visual Inspection

Mechanical	Electrical
● Gear selector lever cable adjustment (vehicles with automatic transmission) ● Starter motor ● Engine (turns freely)	● Battery ● Fuses ● Starter relay ● Wiring harness(es) ● Damaged, loose or corroded connectors ● Ignition switch ● Generator ● Transmission Control Module (TCM) ● Engine Control Module (ECM)

3. **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. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
The engine does not crank (starter motor does not turn)	● Gear selector not in P or N position (vehicles with automatic transmission) ● Battery ● Starter relay ● Invalid key code received by Central Junction Box (CJB) ● Harness/Connectors ● Starter motor ● Ignition switch ● Generator ● Transmission Control Module (TCM) ● Engine Control Module (ECM) ● Engine seized	Make sure the gear selector is in the P or N position and correctly adjusted. 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 for TCM and ECM DTCs. Check that the engine turns freely.
The engine does not crank (starter motor does turn)	● Starter motor installation ● Starter motor ● Flywheel/Drive plate ring gear	Check the starter motor installation (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 compressions.
Excessive starter motor noise	● Starter motor ● Flywheel/Drive plate ring gear ● Starter motor installation/casing	Check the starter motor installation (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

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: Engine Control Module \(PCM\) 4.0L V6](#) (100-00 General Information, Description and Operation).

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Starting System - V6 4.0L Petrol - Starting System Vehicles With: Smart Key

Diagnosis and Testing

Principles of Operation

For a detailed description of the starting system, refer to the relevant Description and Operation section in the workshop manual.

REFER to: Starting System (303-06A, Description and Operation).

Inspection and Verification

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

Visual Inspection

Mechanical	Electrical
- Steering column - Brake pedal - Smart key - Steering Wheel	- Fuses - Harnesses and connectors - Warning lamp operation - Smart key operation - Engine start operation

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, check for Diagnostic Trouble Codes (DTC's) and refer to the DTC Index.



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle

• NOTE: If the control module or a 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 programme is in operation, prior to the installation of a new module/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 accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the digital multimeter 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 diagnostic trouble codes 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

Symptom Chart

Symptom - Message Displayed	Symptom - Possible Cause	Action
Smart key not found - Refer to handbook	Ignition mode fails to switch on	GO to Pinpoint Test A.
• NOTE: Back up start - 10MY onwards	Ignition mode fails to switch on	GO to Pinpoint Test B.
Smart key not found - Refer to handbook		
Press start and brake	Engine fails to crank	GO to Pinpoint Test C.
Steering column locked	Ignition switches off after 3 seconds	GO to Pinpoint Test D.
• NOTE: For diesel engines	Ambient temperatures below zero	GO to Pinpoint Test E.
Engine still not cranking		

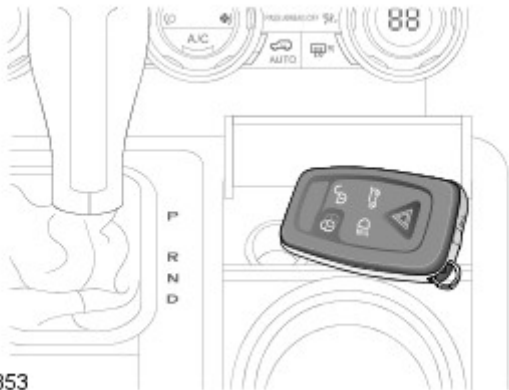
Pin Point Test

PINPOINT TEST A : SMART KEY NOT FOUND - REFER TO HANDBOOK

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: IGNITION MODE FAILS TO SWITCH ON	
• NOTE: In normal operation, pressing the start button for one second will cause the vehicle to enter the ignition mode. If the procedures below are followed the engine should crank	
• NOTE: For automatic transmission vehicles, ensure the brake pedal is depressed and the park or neutral selected	
• NOTE: For manual transmission vehicles ensure the clutch is fully depressed	
1	Ensure the smart Key is within the cabin area. Check the smart key is not close to any electrical devices e.g. Smart phones, laptops, laptop cases, games consoles and game console bags, briefcases, metal objects etc. All can affect the system performance and may block its communication with the vehicle. If the smart key battery low warning message has been displayed it is likely that the smart key battery has insufficient charge. Refer to section 'Back Up Start' for 10MY onwards

	Has the vehicle started? Yes No further action required No Check and install a new battery as required. Clear the DTC and retest. If the problem persists, contact dealer technical support
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PINPOINT TEST B : BACK UP START - 10MY ONWARDS - SMART KEY NOT FOUND - REFER TO HANDBOOK

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: IGNITION MODE FAILS TO SWITCH ON - NOTE: In normal operation, pressing the start button for one second will cause the vehicle to enter the ignition mode. If the procedures below are followed the engine should crank - NOTE: For automatic transmission vehicles, ensure the brake pedal is depressed and the park or neutral selected - NOTE: For manual transmission vehicles ensure the clutch is fully depressed	
 E138853	
 E138855	1 On pressing the start button, smart key not found. When this warning is displayed the smart key should be brought into close proximity with the immobilize antenna unit. For the location of the immobilize antenna unit, see illustration. Hold the key in the location and press the start button again. If this process fails the first time, try repositioning the key around the immobilize antenna unit location, repeat the sequence again
	Has the vehicle started? Yes No further action required No Contact dealer technical support

PINPOINT TEST C : PRESS START AND BRAKE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: ENGINE FAILS TO CRANK - NOTE: Conditions for starting in addition to pressing the start button are - NOTE: For automatic transmission vehicles, ensure the brake pedal is depressed and the park or neutral selected - NOTE: For manual transmission vehicles ensure the clutch is fully depressed - NOTE: If the engine can be heard to crank there is no fault with the smart key - NOTE: If the locking pin is still engaged, turn the steering wheel to overcome the side load - NOTE: Start authorisation defined as Ignition functions, Steering column lock engagement, Engine immobilize and smart key authorisation	
	1 Check that there is sufficient brake pressure, (Automatic transmission only). Attempt another start making sure that the brake pedal is pressed firmly so the message is no longer displayed. In certain conditions this may require a more effort than usual
	Has the vehicle started? Yes No further action required No Contact dealer technical support

PINPOINT TEST D : STEERING COLUMN LOCKED

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: IGNITION SWITCHES OFF AFTER 3 SECONDS	
• NOTE: Conditions for starting in addition to pressing the start button are	
• NOTE: For automatic transmission vehicles, ensure the brake pedal is depressed and the park or neutral selected	
• NOTE: For manual transmission vehicles ensure the clutch is fully depressed	
• NOTE: If the engine can be heard to crank there is no fault with the smart key	
• NOTE: If the locking pin is still engaged, turn the steering wheel to overcome the side load	
• NOTE: Start authorisation defined as Ignition functions, Steering column lock engagement, Engine immobilize and smart key authorisation	
	1 Unlock the vehicle using the key fob, within 3 minutes of unlocking ensure the steering wheel can rotate freely. Perform a further lock and unlock check and attempt to start vehicle. If the steering 'column locked' message is still displayed, Lock the vehicle with the key fob and ensure the column is locked (If installed) by turning the steering wheel. Then unlock the vehicle ensuring the column Steering wheel can turn freely. Now perform another start attempt
	Did the engine start? Yes No further action required No Contact dealer technical support

PINPOINT TEST E : ENGINE STILL NOT CRANKING	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: AMBIENT TEMPERATURES BELOW ZERO	
	1 Hold the start button down for at least 4 seconds while starting the vehicle 2 Switch the ignition on, wet the windscreen and activate the wipers. when the wipers are in operation press the start button, If the wipers stop, the Engine is allowed to start
	Did the engine start? Yes No further action required No Contact dealer technical support

Starting System - V6 4.0L Petrol - Starter Motor

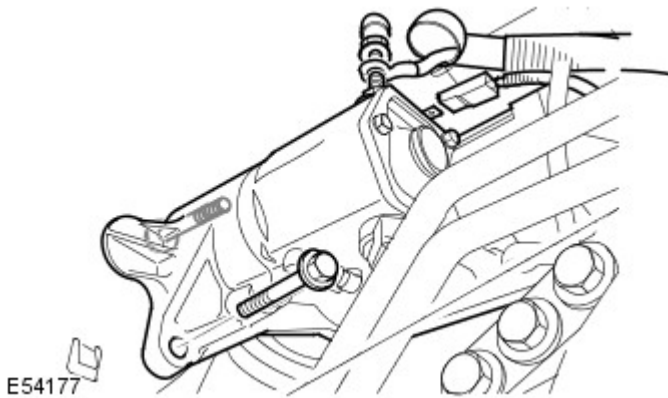
Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
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.
3. Remove the exhaust system.
For additional information, refer to: [Exhaust System](#) (309-00C Exhaust System - V6 4.0L Petrol, Removal and Installation).
4. Remove the starter motor.

- Remove the 2 bolts.
- Remove the terminal upper cover.
- Remove the terminal lower cover.
- Remove the nut.
- Disconnect the 2 electrical connectors.



Installation

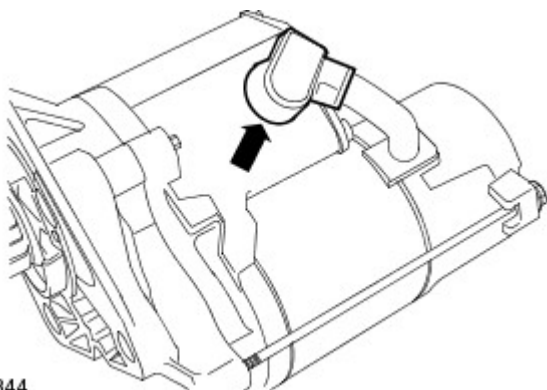
1. Install the starter motor.
 - Clean the component mating faces.
 - Connect the electrical connectors.
 - Tighten the nut to 10 Nm (7 lb.ft).
 - Install the terminal lower cover.
 - Install the terminal upper cover.
 - Tighten the bolts to 45 Nm (33 lb.ft).
2. Install the exhaust system.
For additional information, refer to: [Exhaust System](#) (309-00C Exhaust System - V6 4.0L Petrol, Removal and Installation).
3. Connect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Starting System - V6 4.0L Petrol - Starter Solenoid

Removal and Installation

Removal

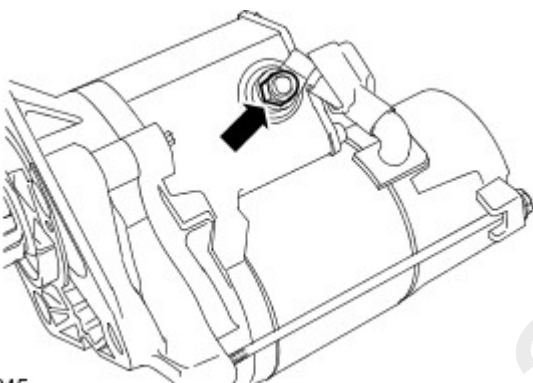
1. Remove the starter motor.
For additional information, refer to: [Starter Motor](#) (303-06C Starting System - V6 4.0L Petrol, Removal and Installation).
2. Release the starter motor terminal cover.



E92344

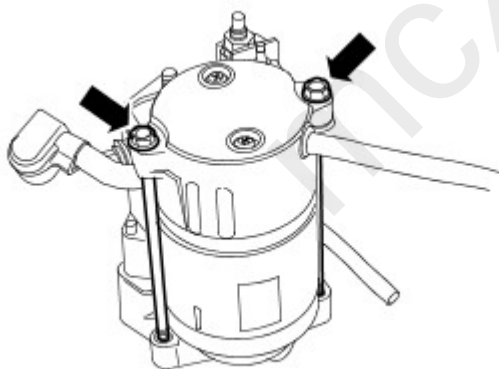
3. Release the starter motor terminal.

- Remove the nut.



E92345

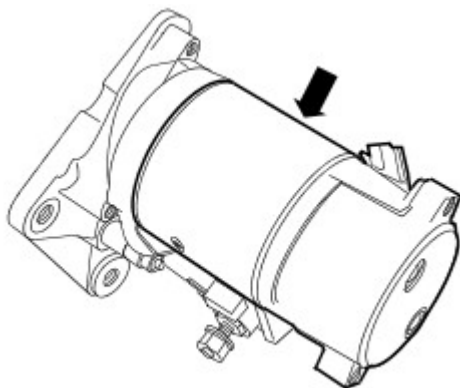
4. Remove the starter motor bolts.



E92220

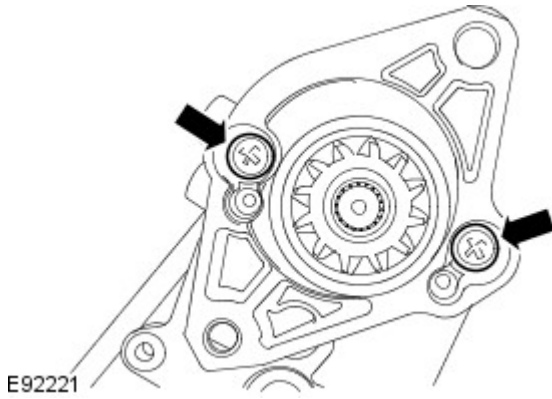
5.  **CAUTION:** Make sure the starter motor armature remains located inside the motor housing.

Remove the starter motor from the gear housing.



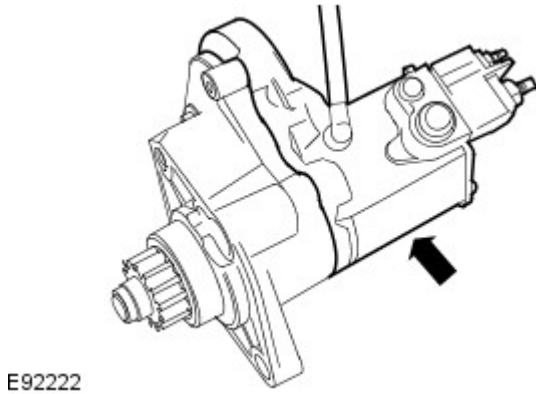
E92346

6. Remove the starter solenoid screws.



7.  **CAUTION:** Make sure the gears and bearings remain located in the gear housing.

Remove the starter solenoid.



Installation

1.  **CAUTION:** Make sure the gears and bearings remain located in the gear housing.

Fit the starter solenoid to the gear housing.

2. Fit the starter solenoid screws.

- Tighten to 10 Nm (7 lb.ft).

3. Install the starter motor to the gear housing.

4. Install the starter motor bolts.

- Tighten to 10 Nm (7 lb.ft).

5. Secure the starter motor terminal.

- Tighten the nut to 5 Nm (4 lb.ft).

6. Secure the starter motor terminal cover.

7. Install the starter motor.

For additional information, refer to: [Starter Motor](#) (303-06C Starting System - V6 4.0L Petrol, Removal and Installation).