Published: May 30, 2006

Charging System

Generator testing

Charging system check

- Check battery is in good condition, with an open circuit voltage of at least 12.6 V. Recharge or substitute battery to carry out test.
- **1.** Check drive belt condition.
- **2.** Check battery connections are clean and tight.
- **3.** Check generator connections are clean and tight.
- **4.** Ensure there is no drain on battery from, for example, interior or exterior lamps.

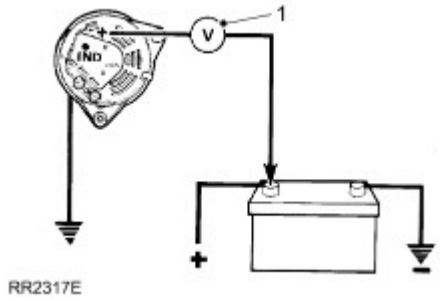
Generator test

Following instructions refer to use of suitable test equipment using a carbon pile rheostat.

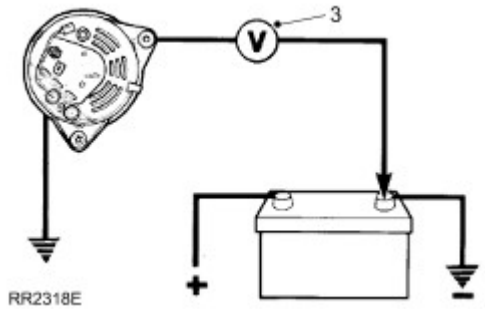
- Connect test equipment referring to manufacturer's instructions.
- Start engine and run at 3000 rev/min without accessory load.
- Rotate carbon pile load control to achieve greatest output (amps) without allowing voltage to fall below 12.0 V. A reading in amps, of generator output should be obtained.
- Run engine at 3000 rev/min, switch selector to regulator test, read voltmeter. A reading of 13.6 to 14.4 V should be obtained.
- Switch selector to diode/stator test, switch on headlamps to load generator. Raise engine speed to 3000 rev/min, read voltmeter, needle must be within 'OK' range.

Charging circuit resistance test

- Connect a low range voltmeter between generator terminal marked B+ and positive terminal of battery.



- **1.** Connect a low range voltmeter between generator terminal marked B+ and positive terminal of the battery.
- **2.** Switch on headlamps, start engine. Run engine at approximately 3000 rev/min. Note voltmeter reading.
- **3.** Transfer voltmeter connections to frame of generator and negative terminal of battery, and again note voltmeter reading.



- **4.** If reading exceeds 0.5 volt on positive side or 0.25 volt on negative side, there is a high resistance in charging circuit which must be traced and remedied.

Published: Feb 1, 2007

Specifications

Torque specifications

Description	Nm	lb-ft
Battery terminal nuts	5	4
Battery clamp nuts	9	7
Battery ground cable to transmission stud	30	22

Published: Jan 29, 2007

Battery Connect

WARNING: Batteries normally produce explosive gases which may cause personal injury, therefore do not allow lighted substances to come near the battery. When charging or working near the battery always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

WARNING: Batteries contain sulphuric acid, avoid contact with skin, eyes or clothing. Shield your face and protect your eyes when working near the battery to guard against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately for a minimum of 15 minutes and seek prompt medical attention. If swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

CAUTION: Make sure all electrical systems are OFF before connecting the battery ground cable. Failure to follow this instruction may result in damage to the vehicles electrical system.

1. Connect the battery ground cable.
   - Tighten the nut to 10 Nm (7 lb.ft).

2. Install the battery cover.
   - Secure with the clip.

3. Install LH front seat cushion.
Front Seat Cushion (78.10.12/99)

4. Enter the audio unit keycode and preset radio frequencies.

5. Reset the clock to the correct time.

Published: Sep 19, 2008

Battery Disconnect and Connect

WARNING: Batteries normally produce explosive gases which may cause personal injury, therefore do not allow lighted substances to come near the battery. When charging or working near the battery always shield your face and protect your eyes. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.

WARNING: Batteries contain sulphuric acid, avoid contact with skin, eyes or clothing. Shield your face and protect your eyes when working near the battery to guard against possible splashing of the acid solution. In case of acid contact with the skin or eyes, flush immediately for a minimum of 15 minutes and seek prompt medical attention. If swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

CAUTION: Make sure the engine is not running before disconnecting the battery ground cable. Failure to follow this instruction may result in damage to the vehicles electrical system.

NOTE:

This procedure should be used to disconnect the battery while carrying out repairs that refer to the battery being disconnected.

NOTE:

Before disconnecting the battery make sure that no data is required from the engine control module (ECM), as battery cable disconnection will erase any fault codes and idle/drive values held in the keep alive memory (KAM).

1. Obtain and record the audio unit keycode and preset radio frequencies.

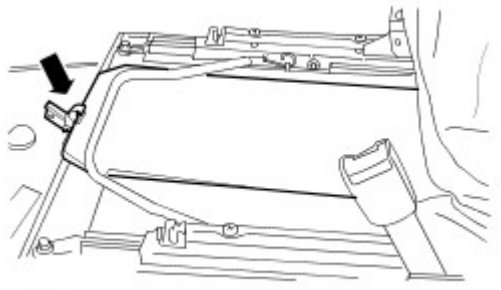
2. Remove the LH front seat cushion.
Front Seat Cushion (78.10.12/99)

3. **NOTE:**

RH illustration is shown, LH is similar.

Remove the battery cover.

- Release the clip.



E89791

4.

CAUTION: Failure to follow the procedure below could result in the alarm sounder self activating when the battery is disconnected.

Disconnect the battery ground cable.

- Loosen the nut.

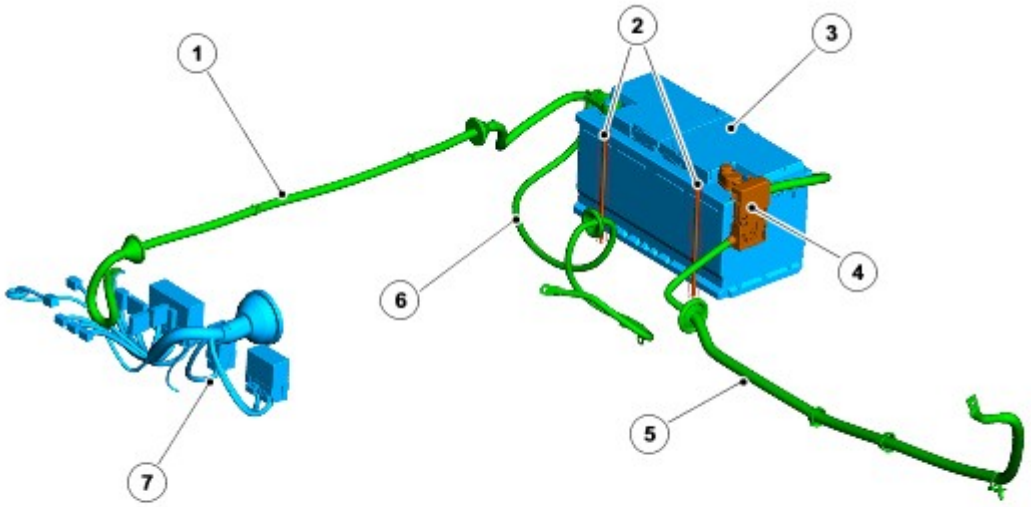
- Turn the ignition key to the run position.
- Turn the ignition key to the off position.
- Within 17 seconds of turning the ignition key to the off position, release the battery ground cable from the battery.

Published: May 22, 2007

Battery and Cables

COMPONENT LOCATION

Battery Junction Box



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Item	Part Number	Description
1		Power feed to BJB (battery junction box)
2		Battery clamps
3		Battery
4		Mega fuse
5		+VE battery cable
6		-VE battery cable
7		BJB (battery junction box)

OVERVIEW

The battery is mounted in a protective box, located under the LH seat. It sits in a tray and is secured with clamp plates and bolts.

The battery terminal posts allow for the battery cables to be connected with clamp type connections.

The battery positive terminal is fitted with a mega fuse, which is a 500 Amp device housed in a black fuse carrier, integral to the battery clamp. Power feed to the BJB (battery junction box) is taken from a tap on the battery clamp before the mega fuse.

In the event of a crash the mega fuse is designed to blow, this isolates the power from the generator and starter motor, but allows power to be delivered, via the CJB (central junction box) , to the rest of the vehicle.

The battery is a .

The battery is a H8, semi-sealed type. Each casing has a vent to allow for thermal expansion and to vent oxygen and hydrogen gases, which are produced under certain charging conditions.

When removing the battery, ensure the alarm is disarmed and the ignition is switched off. Always disconnect the

negative terminal first and then the positive. When refitting the battery, always fit the positive terminal first followed by the negative.

If the battery requires recharging, always use an approved constant current charger, designed for lead-calcium batteries. DO NOT use a fast charger, as permanent damage to the battery may occur.

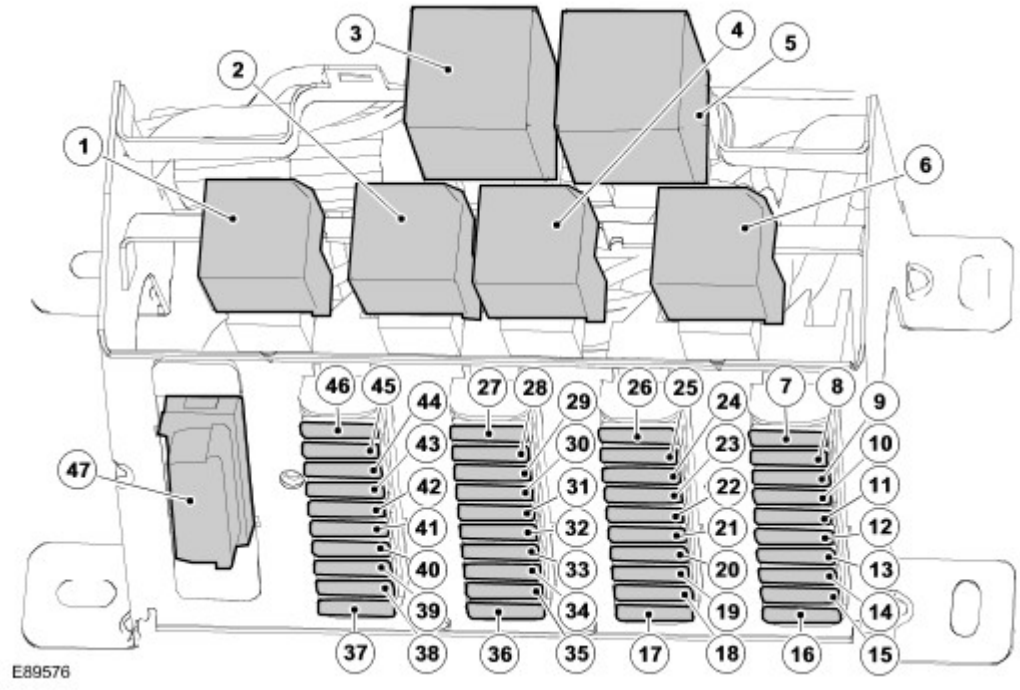
Starter Fuse

Incorporated in the cable between the battery and the starter motor/generator is a 500A mega fuse. The fuse is mounted adjacent the battery positive terminal and is integral with the cable assembly. In the event of fuse failure, the complete cable assembly must be replaced.

CENTRAL JUNCTION BOX

NOTE:

LH drive shown .



CJB (central junction box) Relay Descriptions

Location	Description
1	Headlamp relay
2	Heated rear window relay
3	Wipers relay
4	Electric window lift relay
5	Indicator flasher relay
6	Alarm relay

CJB (central junction box) Fuse Descriptions

Name	Item Number	Rating (Amps)	Fuse color	Circuits protected
F8	16	10	Red	Alarm system
F9	15	15	Blue	Front wipers/wash
F10	14	10	Red	Rear wipers/wash
F11	13	10	Red	Anti-lock brakes

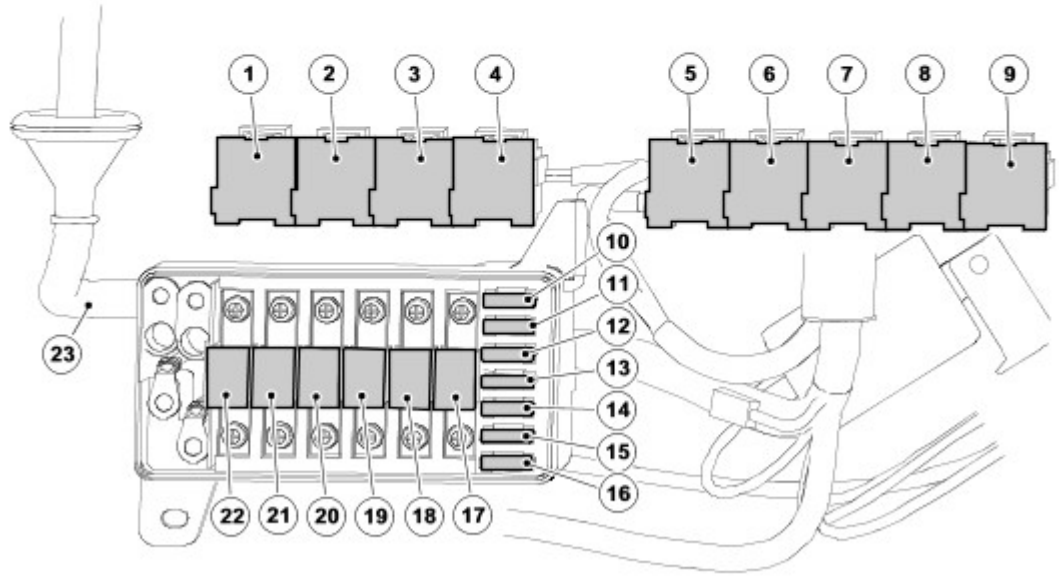
F12	12	10	Red	Speed transducer
F13	11	10	Red	Brake lamps
F14	10	10	Red	Reverse lamps
F15	9	5	Tan	Ignition
F16	8	-	-	Not used
F17	7	-	-	Not used
F18	17	10	Red	Side lamps (left)
F19	18	10	Red	Side lamps (right)
F20	19	10	Red	Illumination/clock illumination
F21	20	10	Red	Hazard switch
F22	21	10	Red	Headlamp dipped beam (right)
F23	22	10	Red	Headlamp dipped beam (left)
F24	23	10	Red	Headlamp main beam (right)
F25	24	10	Red	Headlamp main beam (left)
F26	25	10	Red	Rear fog lamps
F27	26	10	Red	Alarm sounder
F28	36	20	Yellow	Heated rear window
F29	35	20	Yellow	Cooling fan/A/C clutch link
F30	34	10	Red	Audio/clock/diagnostic socket
F31	33	15	Blue	Hazard switch
F32	32	-	-	Not used
F33	31	20	Yellow	Seat heater
F34	30	20	Yellow	Electric window (right)
F35	29	20	Yellow	Electric window (left)
F36	28	30	Green	Heated front screen
F37	27	30	Green	Spare fuse
F38	37	10	Red	Engine ECU/PCM
F39	38	5	Tan	Engine ECU/PCM
F40	39	-	-	Not used
F41	40	5	Tan	Engine ECU/PCM
F42	41	10	Red	Air conditioning switch
F43	42	20	Yellow	Cigar lighter
F44	43	5	Tan	Audio unit
F45	44	30	Green	Blower motor
F46	45	-	-	Not used
F47	46	-	-	Not used
Diagnostic socket	47	-	-	Diagnostic socket

The Central Junction box is located below and to one side of the steering column. The fuses are accessed by turning the fixing screws fully counterclockwise and removing the cover.

NOTE:

Some early 07MY vehicles have a handed CJB (central junction box) . The illustration above shows the LH (left-hand) drive variant fitted to all other vehicles. The early RH (right-hand) drive version is a mirror image of the standard LH (left-hand) drive CJB (central junction box) .

BATTERY JUNCTION BOX



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BJB (battery junction box) Relay Descriptions

Item Number	Description
1	ABS (anti-lock brake system) pump relay
2	Main relay
3	Starter relay
4	Glow plug relay
5	Aircon clutch relay
6	Aircon cooling fan relay
7	Aircon accessory relay
8	Heated front screen relay
9	Heated screen timer relay

BJB (battery junction box) Fuse Descriptions

Name	Item Number	Rating (Amps)	Fuse color	Circuits protected
F1	16	30	Green	Anti-lock braking
F2	15	20	Yellow	Accessory socket
F3	14	20	Yellow	Headlamp flash/horn
F4	13	20	Yellow	Not used
F5	12	30	Green	Main relay/ECM (engine control module)
F6	11	15	Blue	Alarm system

F7	10	20	Yellow	Alarm system

BJB (battery junction box) Link Fuse Descriptions

Item Number	Rating (Amps)	Fuse color	Circuits protected
22	100	Blue	Glow plug relay, fusible links 2,3 and 4, fuses 1,2 and 3 and fuse 36 in the CJB (central junction box)
21	60	Yellow	CJB (central junction box) Batt feed
20	60	Yellow	Window lift relay
19	30	Green	ABS (anti-lock brake system) return pump
18	60	Yellow	Ignition switch/starter relay
17	30	Green	Lighting switch
23	-	-	Main battery power feed

The Battery Junction Box is located under the right front seat and is accessed by removing the seat base.

Published: Feb 6, 2007

Battery (86.15.01)

Removal

1 . Remove LH front seat cushion.

2 . Release retaining clip and remove battery access cover.

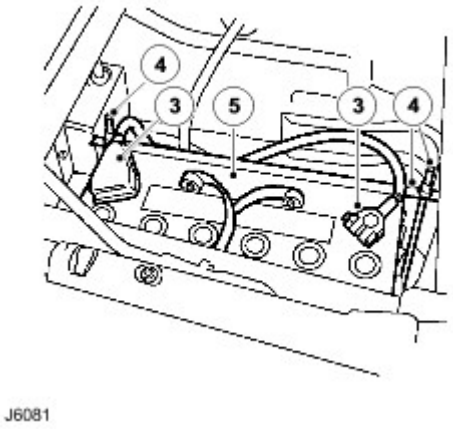
3 .

WARNING: During battery removal or before carrying out any repairs or maintenance to electrical components always disconnect negative lead first. If positive lead is disconnected with negative lead in place, accidental contact of a wrench to any grounded metal part could cause a severe spark, possibly resulting in personal injury. Upon installation of battery always connect positive lead first.

Disconnect both battery leads, negative first.

4 . Slacken securing nuts and move battery clamp, with 'J' bolts aside.

5 . Remove battery.



J6081

Installation

1 . **NOTE:**

Coat battery clamps and terminals with petroleum jelly before refitting.

Position battery and secure with clamp. Ensure 'J' bolts are hooked correctly under retaining brackets on base of battery box.

2 . Reconnect battery leads, positive lead first.

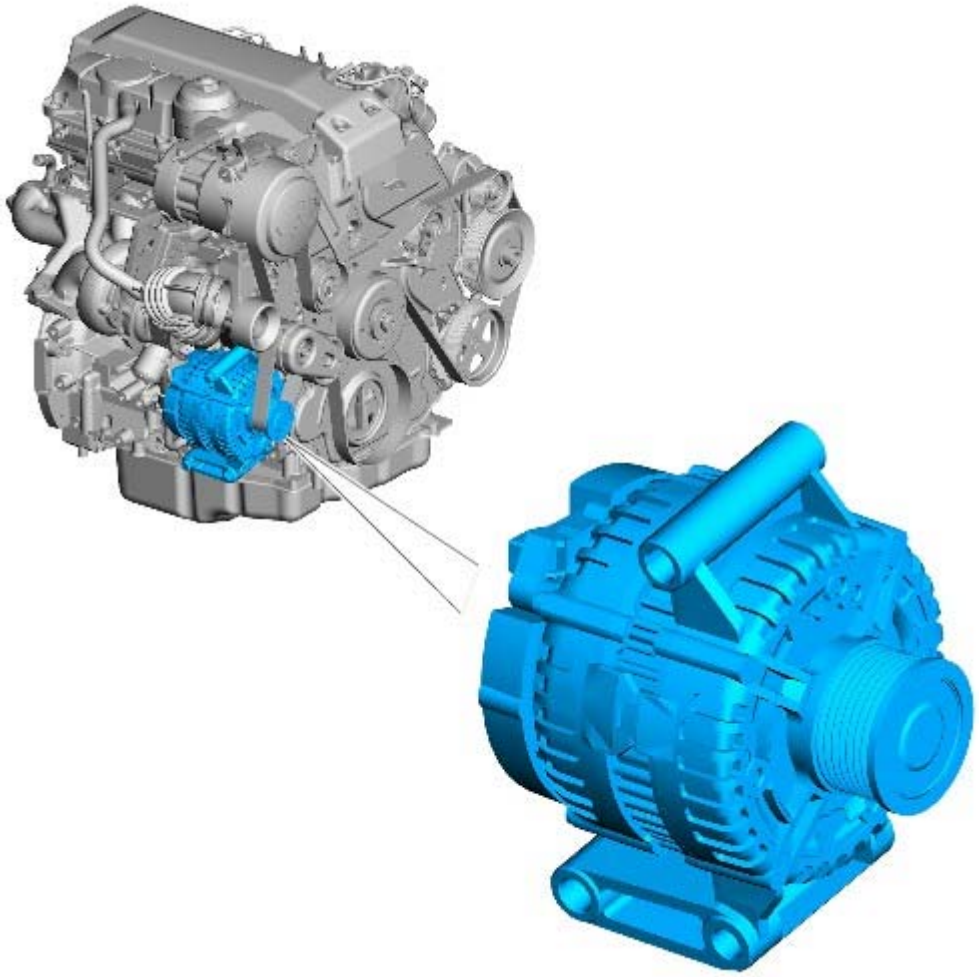
3 . Install battery access cover.

4 . Install seat cushion.

Published: Nov 2, 2006

Generator - 2.4L Duratorq-TDCi (Puma) Diesel

COMPONENT LOCATION



E85648

OVERVIEW

The generator is located at the front RH side of the engine. The generator has an output of 85/150 Amps and is manufactured by Denso. An eight-ribbed polyvee belt drives the generator pulley, which in turn is driven from the engine crankshaft pulley.

The generator pulley incorporates a one-way clutch mechanism, which allows the pulley to free wheel, reducing the amount of inertia applied to the engine during deceleration (coast). The generator comprises a stator, a rotor, a rectifier pack and a regulator.

The generator is connected to ground via its mountings.

The rotor comprises a field winding, wound around an iron core and mounted on a shaft. The iron core has extensions at each end, which form North and South poles as current flows through the field winding. The rotor is located inside the stator and is mounted on bearings for smooth running and to support the rotor due to the high side loading applied by the drive belt tension.

The stator has three sets of coils made from copper wire. The three coil windings are connected in a 'star' connection, where one end of the winding is connected to the other two windings. The output current is supplied from the opposite end of each winding. Rotation of the rotor causes ac current to be produced in the coils.

The rectifier converts the ac current produced in the stator coils into dc (rectified) current required by the vehicle

electrical system. The rectifier comprises semi-conductor diodes mounted on a heatsink to dissipate heat. An equal number of the diodes are on the negative and positive side. An additional diode in the regulator controls feedback through the battery voltage signal line. The rectifier also prevents current flow from the battery to the generator when the output voltage is less than the battery voltage.

The 'smart' regulator controls the output voltage from the generator to protect the battery; at low temperatures battery charge acceptance is very poor so the voltage needs to be high to maximise any re-chargeability, but at high temperatures the charge voltage must be restricted to prevent excessive gassing with consequent water loss. The Engine Management System (EMS), which controls the regulator, will calculate the voltage set point required for the ensuing conditions. The 'traditional' regulator controls voltage against generator temperature, which means the battery temperature will lag a long way behind so there will be significant periods of operation when battery charging is compromised. With this system, the EMS can set the voltage by inferring the battery temperature from information received from it's various sensors, hence voltage will accurately follow the battery's needs.

The regulator has transistors, which rapidly switch on and off to regulate the voltage output according to the voltage sensed internally. The regulator also provides a PWM signal output to the ECM, which uses the signal to adjust the idle speed under varying electrical loads.

Initially, the ignition switch supply provides an excitation current to the rotor at low generator speeds via brushes, which contact slip rings at the end of the rotor shaft. As the generator speed increases the generator becomes self-exciting.

The charge warning lamp function is transmitted to the EMS and then on to the Controller Area Network (CAN) bus to the instrument cluster.

LOAD MANAGEMENT SYSTEM

The load management system comprises software resident in the Automatic Temperature Control (ATC) module .For additional information, refer to:Control Components (412-04 Control Components, Description and Operation). Its purpose is to protect battery state-of-charge during abnormal usage of the vehicle. The system will request the Media Orientated System Transport (MOST) ring and the air suspension to go into 'power save' mode, and will modulate features such as seat heating and screen heating to prevent the battery being dragged down to a point where the car becomes un-operational. A 'WARNING - LOW BATTERY' message will be displayed in the message center.

Published: Jan 31, 2007

Generator (86.10.02)

Removal

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

2 . Remove the accessory drive belt.
For additional information, refer to Accessory Drive Belt (86.10.03)

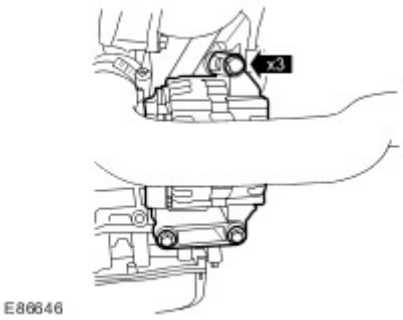
3 . Remove the air cleaner outlet pipe.
For additional information, refer to Air Cleaner Outlet Pipe

4 . **NOTE:**

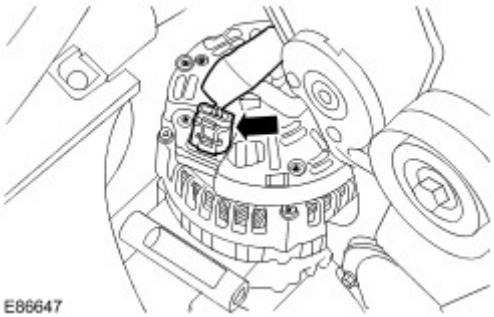
The generator upper bolt can only be removed when the generator has been released from the accessory drive component bracket.

Release the generator.

- Remove the 3 bolts.

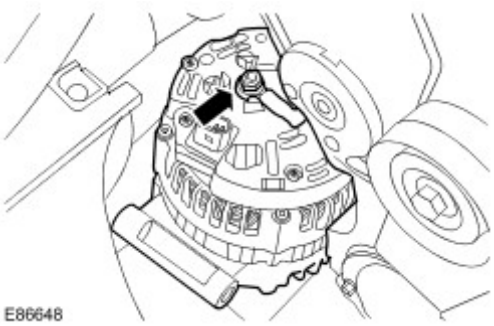


5 . Disconnect the generator electrical connector.



6 . Remove the generator.

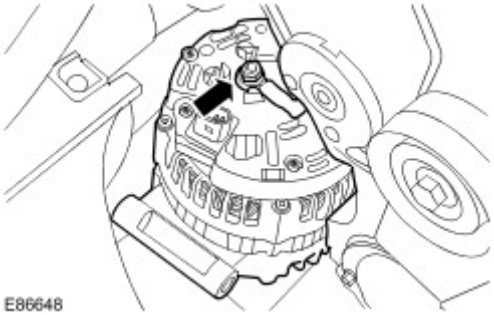
- Remove the battery positive cable nut.
- Release the battery positive cable.



Installation

1 . To install, reverse the removal procedure.

2 . Tighten to 8 Nm (6 lb.ft).



3 . Tighten to 48 Nm (35 lb.ft).