

Glow Plug System - TDV6 3.0L Diesel -

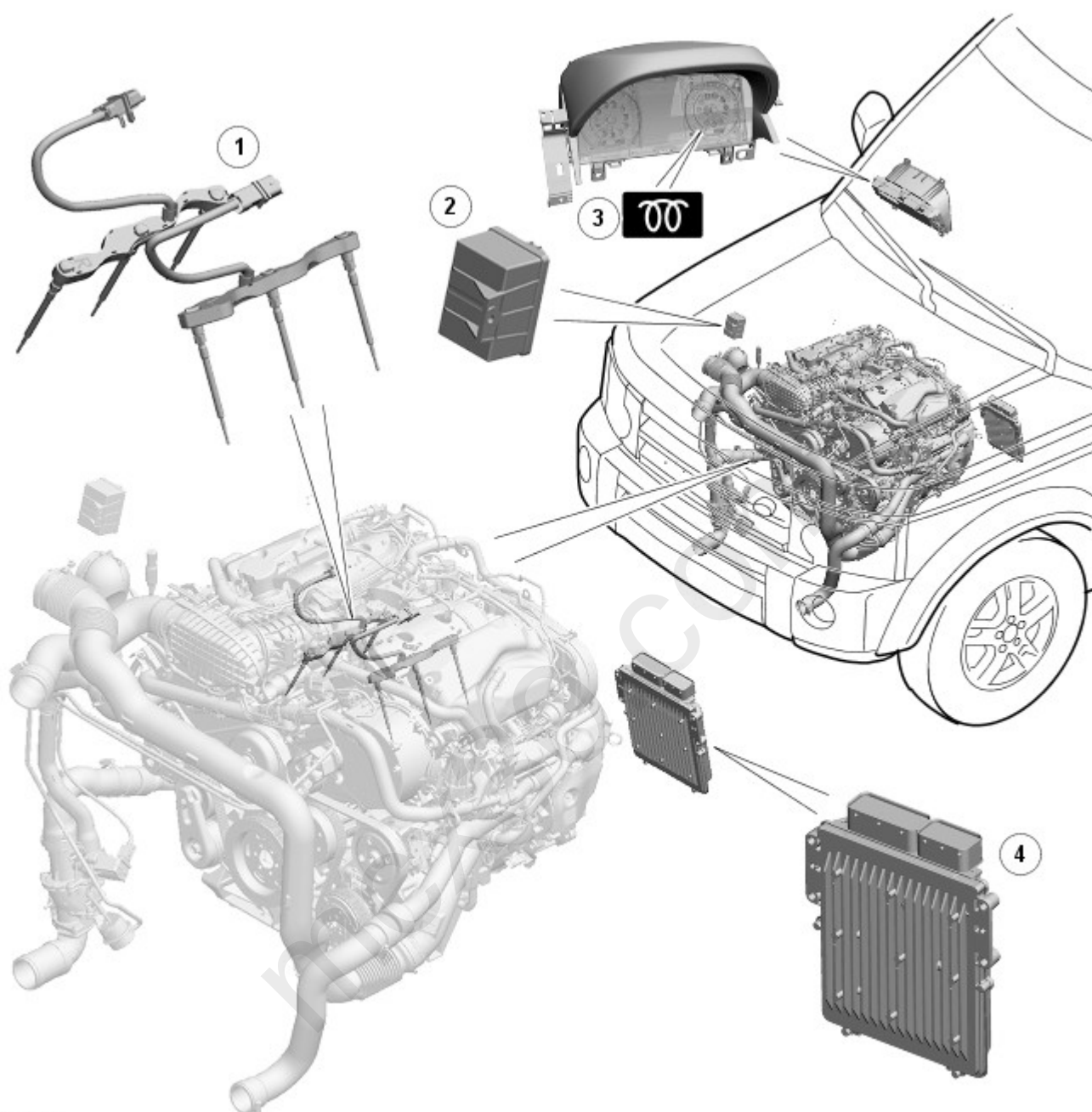
Description	Nm	lb-ft	lb-in
Glow plug	10	-	89

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Glow Plug System - TDV6 3.0L Diesel - Glow Plug System - Component

Location

Description and Operation



E117321

ItemDescription

1	Glow plugs
2	Glow plug module
3	Glow plug warning lamp
4	ECM (engine control module)

Glow Plug System - TDV6 3.0L Diesel - Glow Plug System - Overview

Description and Operation

OVERVIEW

The glow plug system includes a glow plug installed in the inlet side of each cylinder and a glow plug module. The glow plugs heat the combustion chambers before and during cranking, to aid cold starting, and after the engine starts to reduce emissions and engine noise when idling with a cold engine.

The glow plugs are connected for each bank by a common harness which is connected into the main engine harness. The harness for each bank connects into a connector block which attaches to each of the glow plugs for that bank. The glow plugs are connected directly to the glow plug module which is controlled by glow plug software contained within the [ECM \(engine control module\)](#).

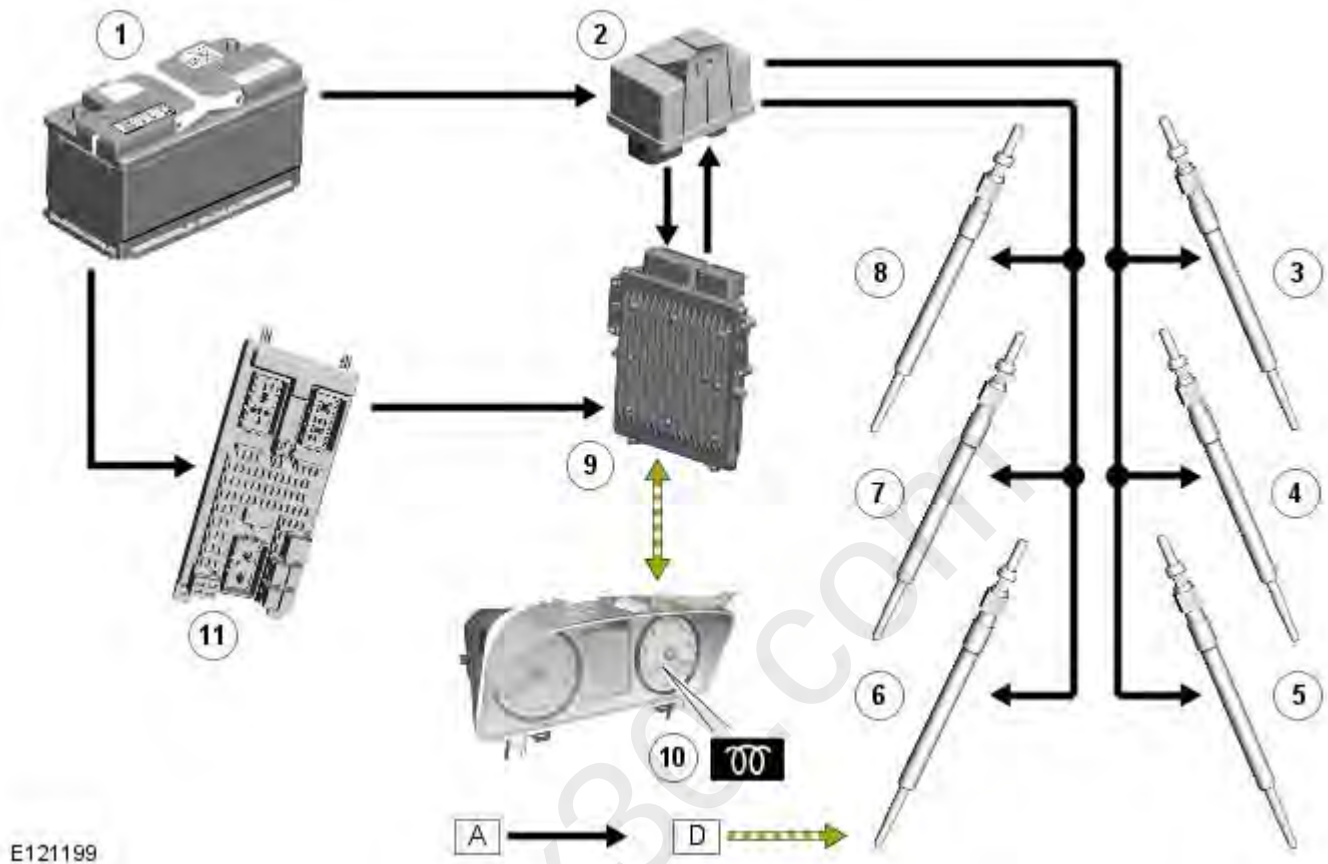
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Glow Plug System - TDV6 3.0L Diesel - Glow Plug System - System Operation and Component Description

Description and Operation

Control Diagram

• NOTE: **A** = Hardwired; **D** = High Speed CAN (controller area network)



E121199

Item Description

1	Battery
2	Glow plug module
3	Glow plug
4	Glow plug
5	Glow plug
6	Glow plug
7	Glow plug
8	Glow plug
9	ECM (engine control module)
10	Instrument cluster (glow plug warning indicator)
11	CJB (central junction box)

System Operation

System Operation

There are three phases of glow plug heating:

- Pre heating
- Crank heating
- Post heating

The **ECM** determines the heating times from the **ECT (engine coolant temperature)**. The lower the engine coolant temperature, the longer the heating times.

When the ignition is switched to power mode 9, the **ECM** calculates any required heating times and, if heating is required, energizes the glow plug relays in the **CJB**. When pre heating is required, the **ECM** also sends a message to the instrument cluster, on the high speed **CAN**, to request illumination of the glow plug indicator. The glow plug indicator remains illuminated for the duration of the pre heating phase, or until the ignition is switched to crank, whichever occurs first. If required, the **ECM** keeps the glow plug relays energized during cranking and for the duration of any post heating phase.

The [ECM](#) monitors the drive circuit of the glow plug relay for plausibility of operation, continuity, and short and open circuits. If a fault is detected, the [ECM](#) stores a related fault code.

Pre Heating

Pre-heat is the length of time the glow plugs operate prior to engine cranking. The [ECM](#) controls the pre-heat time based on [ECT](#) sensor output and barometric pressure. If the [ECT](#) sensor fails, the [ECM](#) will use a predefined temperature as a default value. The pre-heat duration is extended if the coolant temperature is low.

The [ECM](#) receives the corresponding temperature signal from the [ECT](#) sensor.

The preheating period is dependent on the temperature signal (low temperature = longer preheating period).

The driver is informed that preheating is in operation by the glow plug indicator light in the instrument cluster coming on. The preheating times become longer as the coolant temperature falls.

The [BARO \(barometric pressure\)](#) also has an influence on activation and deactivation of the glow plugs in the event of large altitude differences.

Crank Heating

Crank heating is carried out at every start where the coolant temperature is below the predefined threshold of 20°C. Crank heating begins if the engine speed exceeds 80 rpm for longer than 50ms, or the starter is active for longer than 4 sec. If the coolant temperature sensor is defective, a default temperature of 0°C is used.

Post Heating

Post heat is the length of time the glow plugs operate after the engine starts. The [ECM](#) controls the post heating time based on [ECT](#) sensor output. The post heat phase reduces engine noise, improves idle quality and reduces hydrocarbon emissions.

Preheating is followed by the post heating phase once the engine has started. The post heating phase depends upon how the vehicle is driven.

In addition to [ECT](#), [BARO](#) and engine speed, the injected fuel quantity is significant in this context. For example, if the injected fuel quantity is less than 70 mg per piston stroke and the coolant temperature is below -20°C, post heating is performed.

Component Description

Glow Plug

The ceramic sheathed element glow plugs are made from a heat-resistant, electrically conductive ceramic material. The ceramic sheathed-element glow plugs outer layer is heated directly and is self regulating. The self regulation allows the resistance of the sheathed element to automatically increase as the heat increases preventing the glow plug from overheating. In addition, during the heating process and under the control of the glow plug relay, the glow plugs can be operated above their nominal voltages. This permits heat-up speeds of 1000°C per second. The sheathed-element glow plugs reach a maximum glow temperature of 1300°C and can hold a temperature of 1150°C for several minutes after the first-start glow or at intervening times.

Each cylinder bank has a separate harness connecting the three glow plugs. The harness connects into the engine wiring harness and each harness has a connector block which attaches to each of the glow plugs for that bank.

The glow plug module receives a battery voltage feed via a 250A fusible and a 60A fuse in the engine compartment fusebox. Operation of the glow plug module is controlled by the [ECM](#), which also controls the illumination of the glow plug indicator in the instrument cluster.

The system has been designed as a low-voltage glow system. At 7 volts, the nominal voltage of the sheathed-element glow plugs is significantly lower than the 12 volts of the main electrical circuit. The electronic glow plug module matches the voltage to the sheathed-element glow plugs and controls their glow temperature precisely to the specific requirements of the engine. This produces the optimum glow temperature even when the main circuit voltage is interrupted during engine starting. The lower power consumption of the ceramic glow plugs and their time-staggered activation reduce to a minimum the peak load on the main circuit during the cold start and immediate post-start periods.

In the event of glow plug failure, the engine may be difficult to start and excessive smoke emissions may be observed after starting.

Glow Plug System - TDV6 3.0L Diesel - Glow Plug System

Diagnosis and Testing

Principles of Operation

For a detailed description of the glow plug system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-07D Glow Plug System - TDV6 3.0L Diesel)

[Glow Plug System](#) (Description and Operation),

[Glow Plug System](#) (Description and Operation),

[Glow Plug System](#) (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. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection

Electrical
• Glow plug lamp • Fuses • Glow plug relays • Engine management control relay • Wiring harness(es) • Electrical connector(s) • Glow plug(s) • 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. 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
Poor starting (extreme weather conditions)	• Glow plugs inoperative/inefficient • Fuel temperature too low	Check the glow plug harnesses at the glow plugs and at the connection to the main harness. Refer to the electrical guides. Check for glow plug DTCs. The fuel system recycles fuel until operating temperature is reached to reduce this possibility.
High cold-engine emissions	• After-glow phase inoperative	Check the glow plug harnesses at the glow plugs and at the connection to the main harness. Refer to the electrical guides. Check for glow plug DTCs. After-glow is designed to function at engine temperatures below 50 degrees C (122 degrees F), and below 2,500 rpm.
High cold-engine noise, vibration or harshness	• After-glow phase inoperative	Check the glow plug harnesses at the glow plugs and at the connection to the main harness. Refer to the electrical guides. Check for glow plug DTCs. After-glow is designed to function at engine temperatures below 50 degrees C (122 degrees F), and below 2,500 rpm.

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) 3.0L TdV6 (100-00, Description and Operation).

Glow Plug System - TDV6 3.0L Diesel - Glow Plugs

Removal and Installation

Removal

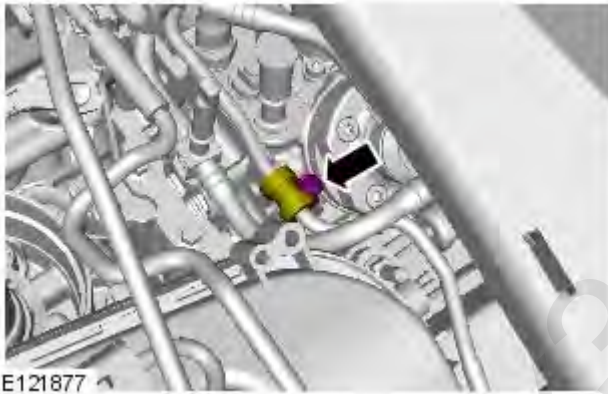
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

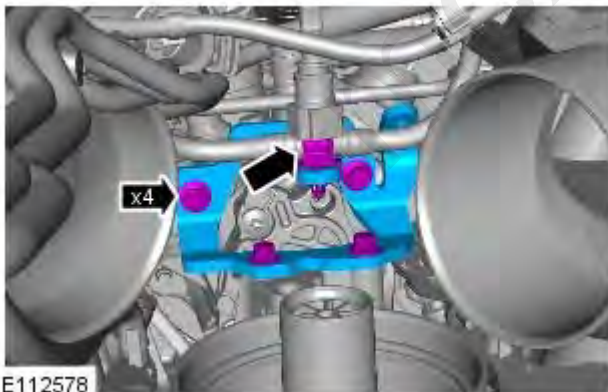
Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

2. Refer to: [Intake Air Shutoff Throttle](#) (303-04C Fuel Charging and Controls - TDV6 3.0L Diesel, Removal and Installation).
3. Refer to: [Crankcase Vent Oil Separator](#) (303-08B Engine Emission Control - TDV6 3.0L Diesel, Removal and Installation).
4. Refer to: [Oil Filter Element](#) (303-01B Engine - TDV6 3.0L Diesel, Removal and Installation).

5.

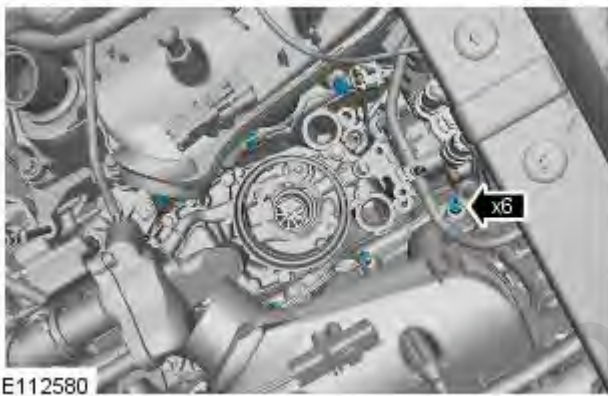


6.



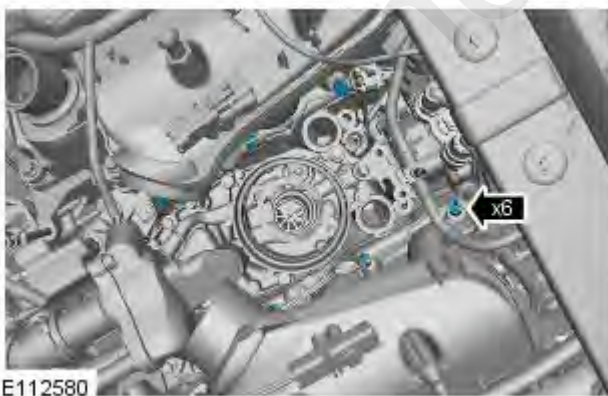


7.  **CAUTION:** Take extra care not to damage the component.



8.

Installation



1. **1. CAUTIONS:**

 Take extra care when handling the component.

 Fixings must be started by hand to avoid damaging threads.

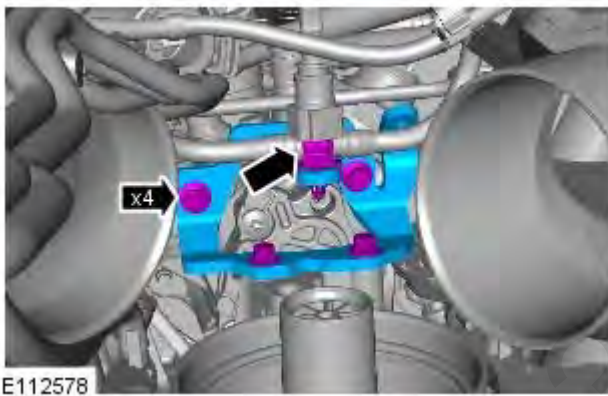
 If accidentally dropped or knocked install a new module.

 Make sure the engine is cold before this procedure is carried out. Failure to follow this instruction may result in damage to the vehicle.

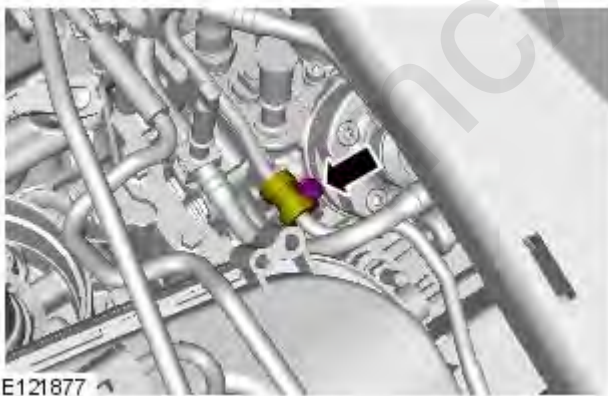
Torque: 10 Nm



2.  **CAUTION:** Take extra care not to damage the component.



3. Torque: 10 Nm



4. Torque: 10 Nm

5. Refer to: [Oil Filter Element](#) (303-01B Engine - TDV6 3.0L Diesel, Removal and Installation).
6. Refer to: [Crankcase Vent Oil Separator](#) (303-08B Engine Emission Control - TDV6 3.0L Diesel, Removal and Installation).
7. Refer to: [Intake Air Shutoff Throttle](#) (303-04C Fuel Charging and Controls - TDV6 3.0L Diesel, Removal and Installation).
8. Connect the battery ground cable.

Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables,

Specifications).

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