

Generator and Regulator -

General Specification

Item	Specification
Generator - 3.2L Petrol:	
Make/type	Bosch
Output	90/150 amps @25° C
Voltage control	Externally controlled by EMS using LIN protocol to communicate.
Voltage setpoint regulation	Controlled by software resident in EMS
Generator - 2.2L Diesel:	
Make/type	Bosch
Output - Standard	90/150 amps @25° C
Output - Optional	105/180 amps @ 25° C
Voltage Control	Externally controlled by EMS using LIN protocol to communicate.
Voltage Regulation	Controlled by software resident in EMS

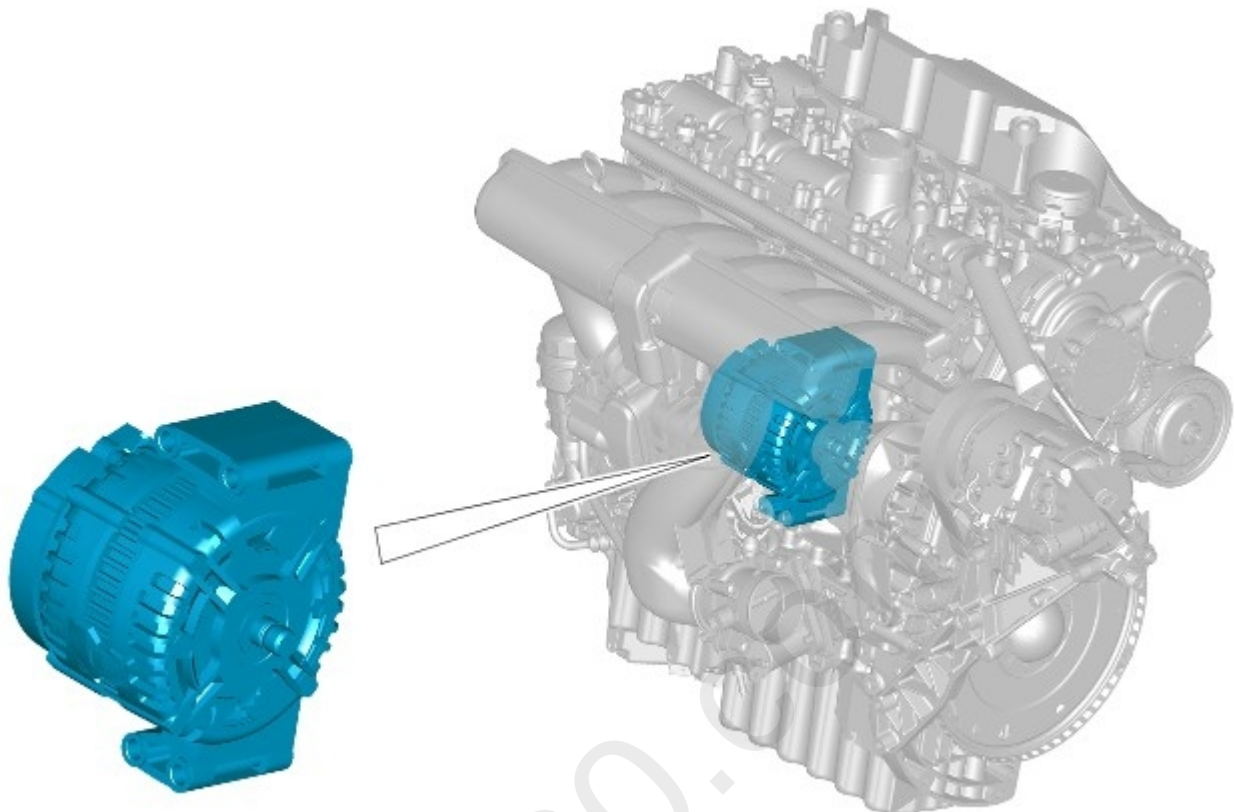
Torque Specifications

Description	Nm	lb-ft
Battery harness connection nut - 3.2L Petrol	12	9
battery cable to the generator nut - 2.2L Diesel	24	18
Drive belt idler pulley - 2.2L Diesel	48	35
Generator coupling	75	55
Generator bolts - 3.2L Petrol	24	18
Generator bolts - 2.2L Diesel	48	35

Generator and Regulator - GeneratorI6 3.2L Petrol

Description and Operation

COMPONENT LOCATION



E79505

OVERVIEW

The generator used on the Si6 obtains a direct drive from a shaft powered by the crankshaft; a coupling unit attaches the generator to the shaft. This direct drive arrangement improves the generator's durability by preventing side-loadings, caused by the tension of a drive belt, acting on the generator's rotor bearing.

The generator has an output of 90/150 amps, and comprises a:

- stator,
- rotor,
- rectifier pack, and
- regulator

The stator consists of a flat core pack into which the stator wires are pressed. The rotor comprises a field winding, wound around an iron core and mounted on a shaft. The rotor is housed within the stator and is mounted on bearings to provide smooth running and support.

The rectifier converts the Alternating Current (AC) produced in the stator coils into Direct Current (DC), as required by the vehicle electrical system. The rectifier comprises 6 semi-conductor diodes mounted on a heat sink that dissipates the resultant heat.

The regulator provides a controlled variable voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the rectified and regulated DC current from the generator via a large diameter cable to the battery positive terminal. The second terminal provides the Local Interconnect Network (LIN) bus connection between the regulator and the Engine Control Module (ECM).

The regulator connects via the LIN bus to the ECM, and the ECM also connects via the high speed Controller Area Network (CAN) bus to the Central Junction Box (CJB). The CJB contains software maps that provide a mathematical model of battery electrolyte temperature, and constantly receives information from the ECM regarding the actual battery voltage. Based on the information received, the CJB then communicates via the high speed CAN bus to the ECM a predicted output voltage that is required from the regulator to effectively charge the battery.

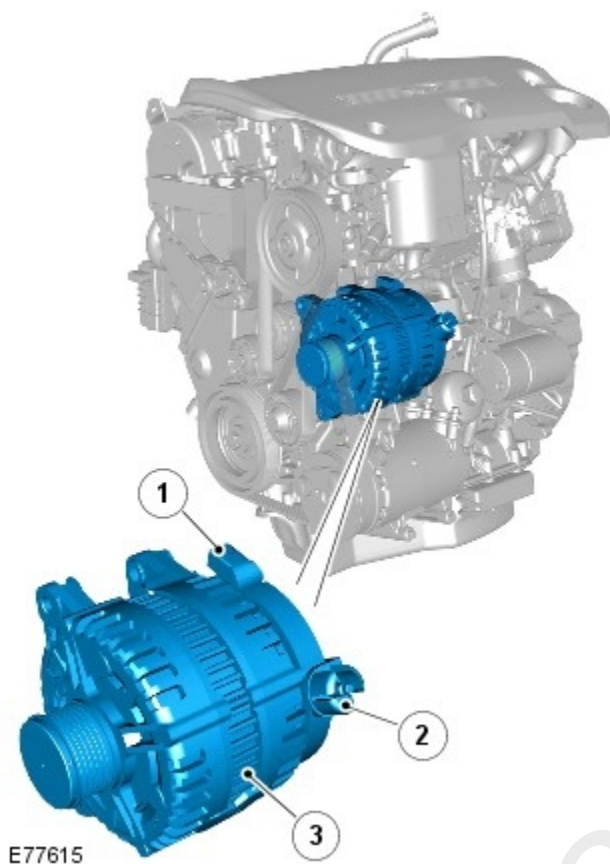
A corresponding message is then communicated by the ECM to the regulator via the LIN bus, to meet the output voltage determined by the CJB. This control cycle is repeated under a closed-loop condition.

The LIN bus is also used to communicate a fault in the wiring or the connections from the generator to the ECM. A fault code will be generated and stored in the ECM and if necessary, the charge warning indicator lamp will be displayed in the instrument cluster after a short delay. During engine starting the charge warning indicator lamp is illuminated in the instrument cluster when the ignition is energized, and will extinguish when the engine starts and the ECM detects a generator output voltage.

Generator and Regulator - GeneratorTD4 2.2L Diesel

Description and Operation

COMPONENT LOCATION



Item	Part Number	Description
1	-	Local Interconnect Network (LIN) bus connection
2	-	Battery positive connection
3	-	Generator

OVERVIEW

A single self-exciting generator is located at the front of the engine on the Left-Hand (LH) side of the cylinder block. Two generators are available for the TD4 engine, dependent on vehicle specification. The generators are rated at 90/150 amps and 115/180 amps respectively. The larger rated generator is used on cold climate market vehicles installed with a heated front windshield and electric booster heater.

For additional information, refer to: [Electric Booster Heater](#) (412-02B Auxiliary Climate Control, Description and Operation).

The generator pulley incorporates a one-way clutch that reduces Noise, Vibration and Harshness (NVH), and improves the life of the accessory drive belt. The one-way clutch allows the belt to drive the pulley without slip occurring, but prevents the generator from driving the belt during transients in engine speed ('belt whip') due to the high rotational inertia of the generator internal components.

The generator comprises the following major components:

- Stator
- Rotor
- Rectifier pack
- Regulator.

The stator consists of a flat core pack into which the stator wires are pressed.

The rotor comprises a field winding, wound around an iron core and mounted on a shaft. The rotor is housed within the stator and mounted on bearings to provide smooth running and support, due to the side loading applied by the drive belt tension.

The rectifier comprises 6 semi-conductor diodes mounted on a heat sink. The heat sink dissipates the resultant heat created in the electrical conversion process. The rectifier converts the Alternating Current (AC) produced in the stator coils into Direct Current (DC) that is required by the vehicle electrical system.

The regulator provides a controlled variable voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the rectified and regulated DC current from the generator, via a large diameter cable to the battery positive terminal. The second terminal provides the LIN bus connection between the regulator and the Engine Control Module (ECM).

The regulator is connected via the LIN bus to the ECM, the ECM is also connected via the high speed Controller Area Network (CAN) bus to the Central Junction Box (CJB). The CJB contains software maps that provide a mathematical model of battery electrolyte temperature, and constantly receives information from the ECM regarding the actual battery voltage. Based on the information received, the CJB then communicates via the high speed CAN bus to the ECM a predicted output voltage that is required from the regulator to effectively charge the battery. A corresponding message is then communicated by the ECM to the regulator via the LIN bus, to meet the output voltage determined by the CJB. This control cycle is repeated under a closed-loop condition.

The LIN bus is also used to communicate a mechanical failure, or fault in the wiring and connections from the generator to the ECM. A Diagnostic Trouble Code (DTC) is stored in the ECM and if necessary, the charge warning indicator lamp is illuminated in the instrument cluster after a short delay.

During engine starting the charge warning indicator lamp is illuminated in the instrument cluster when the ignition is energized, and is extinguished when the engine starts and the ECM detects a generator output voltage.

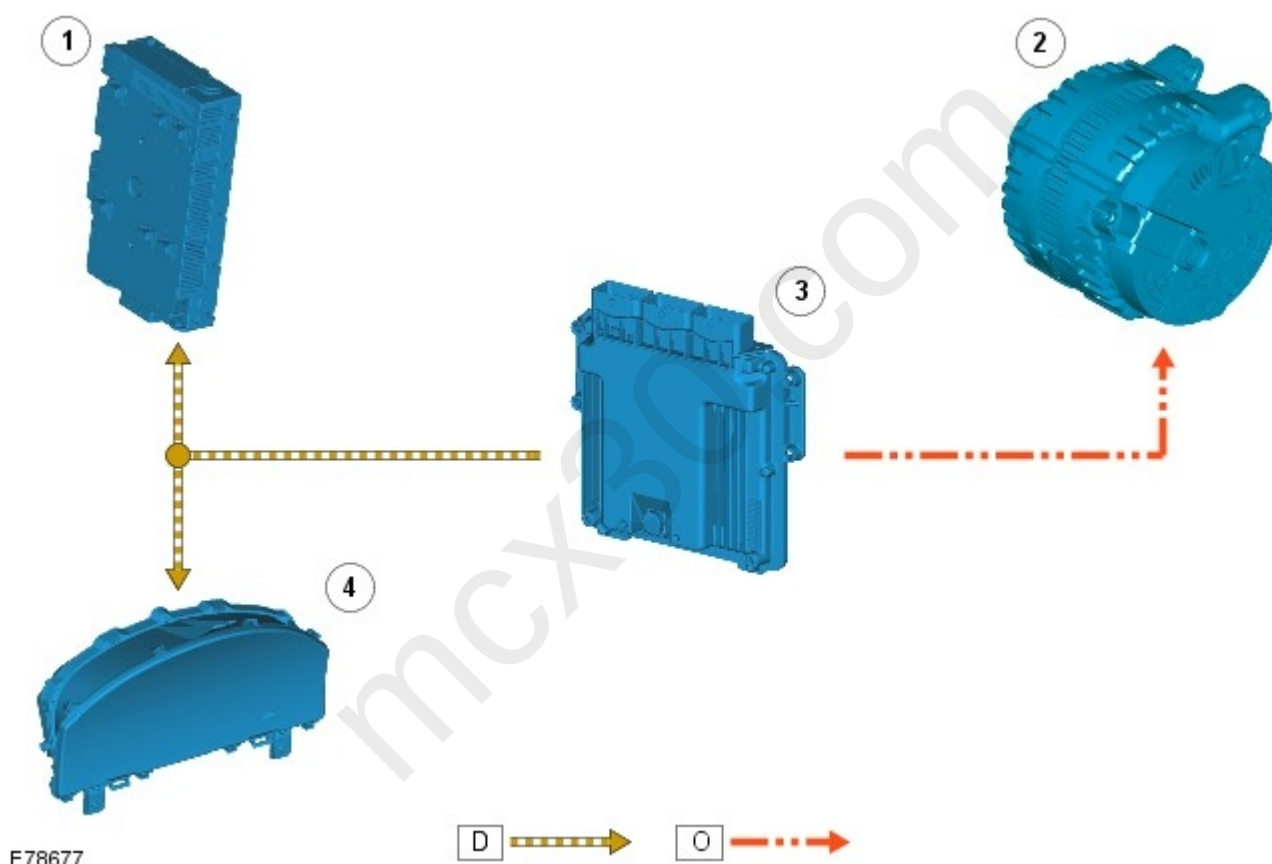
Stop/Start Vehicles - From 2010 MY

Due to the additional loads a higher rated 180 amp generator is used on Stop/Start vehicles.

For additional information, refer to: [Starting System](#) (303-06C Starting System - TD4 2.2L Diesel, Vehicles Built From: 01-03-2009, Description and Operation).

CONTROL DIAGRAM

- NOTE: **D** = High speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1	-	CJB
2	-	Generator
3	-	ECM
4	-	Instrument cluster

Generator and Regulator - Generator

Diagnosis and Testing

For additional information.

REFER to: Charging System (414-00, Diagnosis and Testing).

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Generator and Regulator - GeneratorI6 3.2L Petrol

Removal and Installation

Special Tool(s)

 303-1255 E81974	303-1255 Installer, Generator dowels
 303-1278 E83825	303-1278 Aligner, Timing Cover
 ES21205	303-502 Socket, Flywheel Bolt

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Disconnect the battery ground cable.

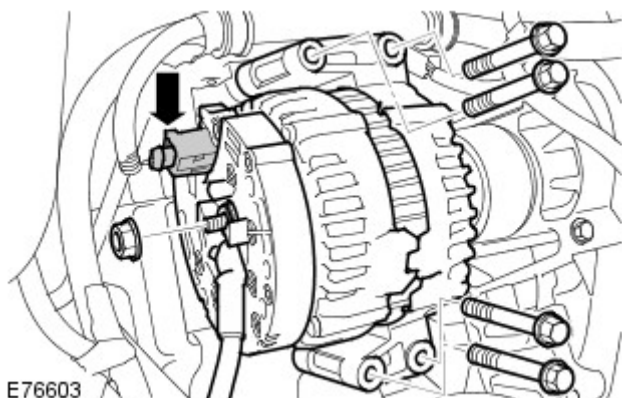
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

3. Remove the intake manifold.

Refer to: [Intake Manifold](#) (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

4. Disconnect the generator harness.

5. Remove the generator.

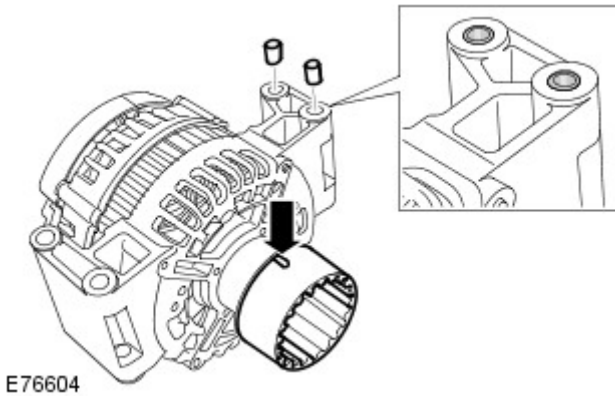


6. **6.**  **CAUTION:** Mark the components to aid installation.

Remove the coupling.

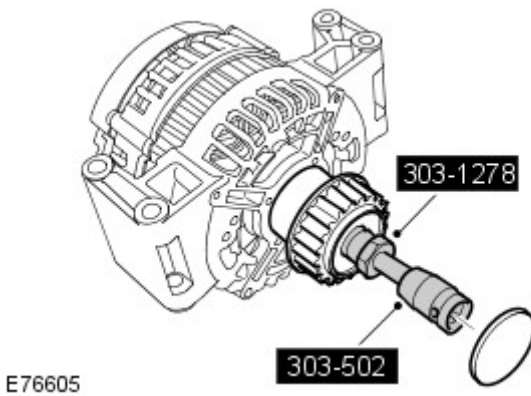
7. **7.** **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the dowels.



8. Remove the generator coupling.

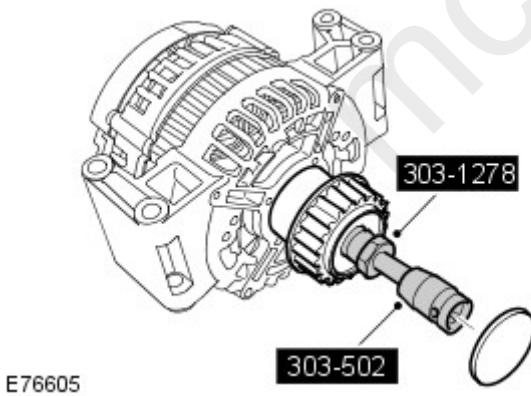
Special Tool(s): [303-1278](#), [303-502](#)



Installation

1. Install the generator coupling.

Torque: 75 Nm

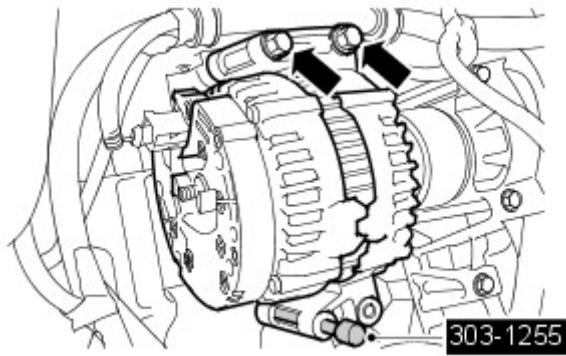


2. Install the locating dowels flush with the generator casing.

3. **3.** **NOTE:** Make sure that the installation marks are aligned.

Install the coupling.

4. Locate the generator and install and lightly tighten the upper bolts.



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5. Using the special tool, install the dowels to align the generator.

Special Tool(s): [303-1255](#)

6. Tighten the generator bolts.

Torque: 24 Nm

7. Connect the generator harness and tighten the nut.

Torque: 12 Nm

8. Install the intake manifold.

Refer to: [Intake Manifold](#) (303-01A Engine - I6 3.2L Petrol, Removal and Installation).

9. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Generator and Regulator - GeneratorTD4 2.2L Diesel

Removal and Installation

Removal

1. Remove the cover and disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the fuel filter.

Refer to: [Fuel Filter](#) (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).

3.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

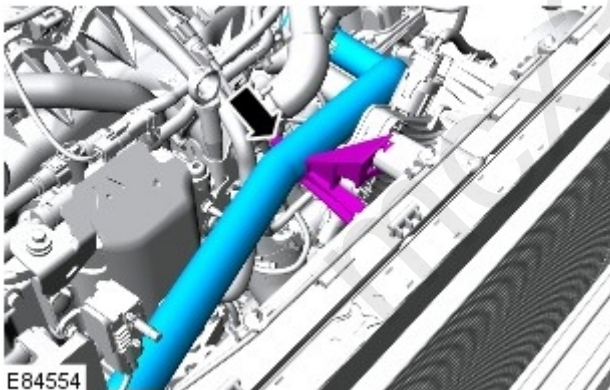
4. Remove the engine undershield.

Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

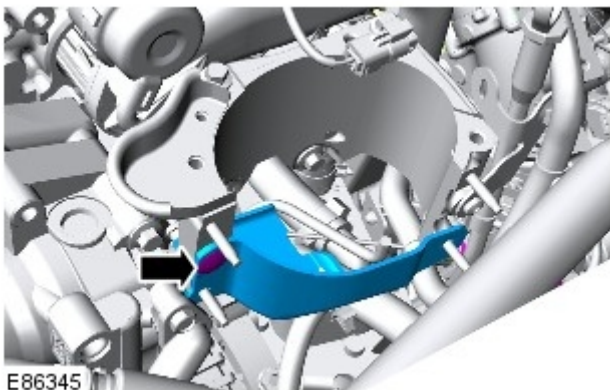
5. Remove the accessory drive belt.

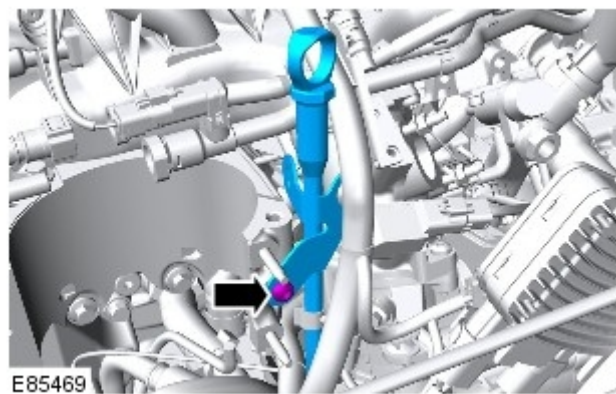
Refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

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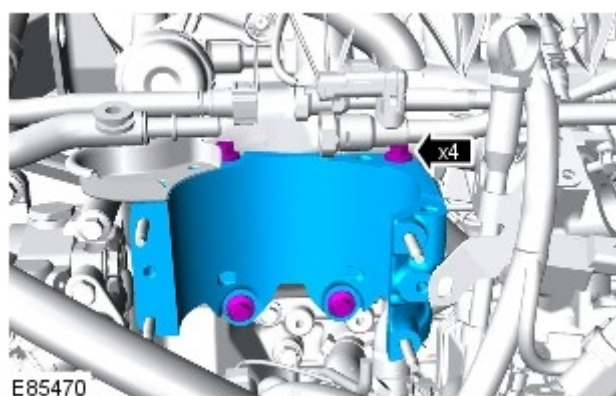


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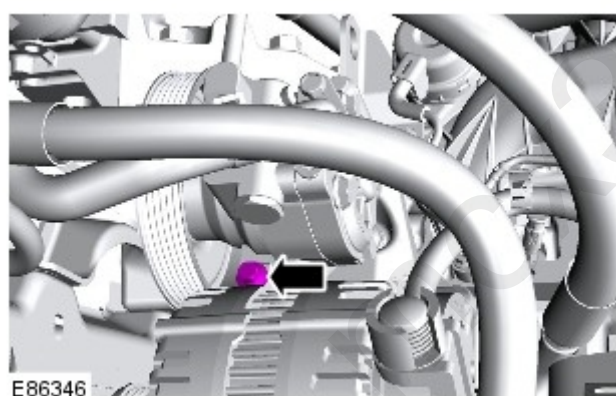




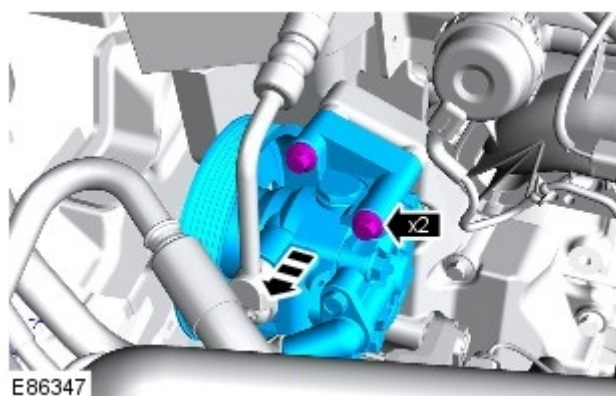
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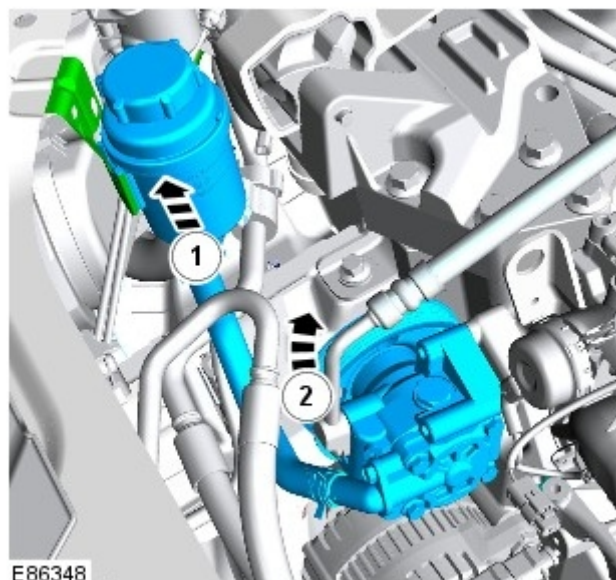
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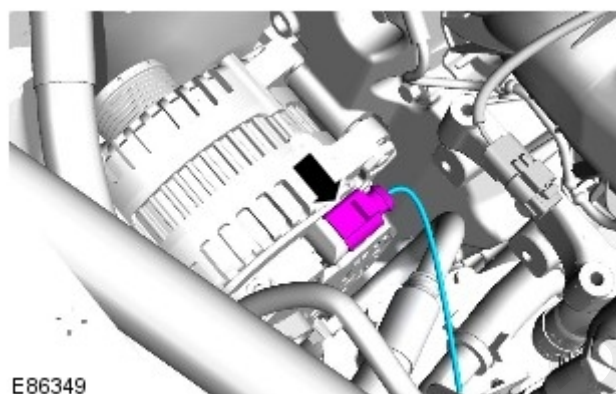
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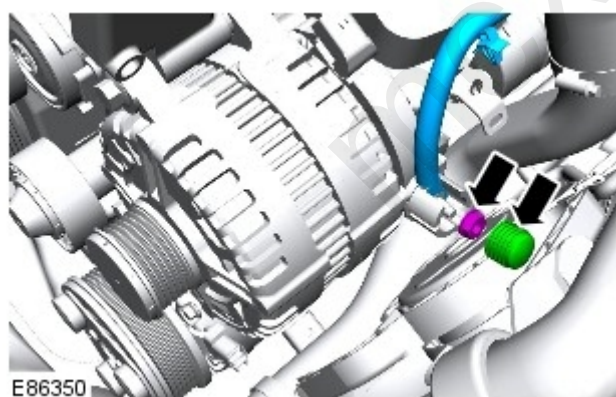
11. Release the power steering pump.



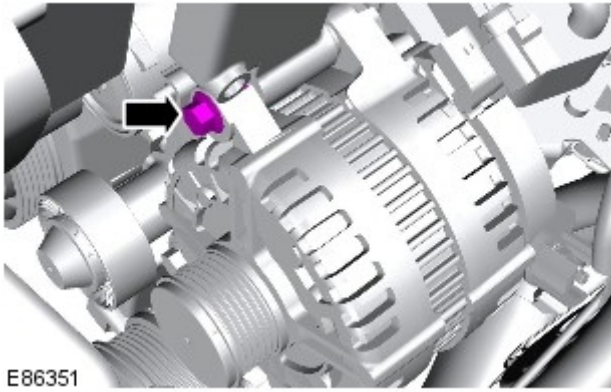
12. **12.**  **WARNING:** Power steering fluid is extremely flammable. Make sure that power steering fluid is not spilt over the engine and that the power steering fluid reservoir cap is sealed.



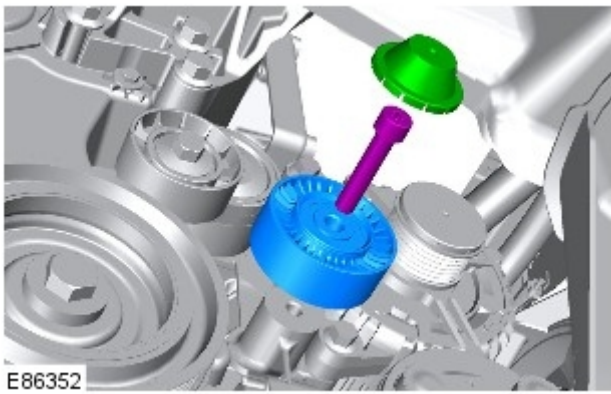
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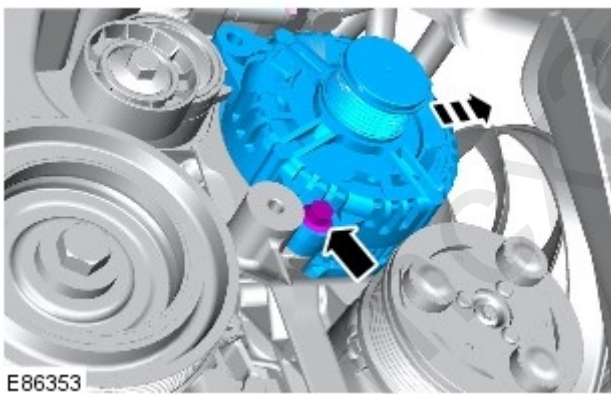
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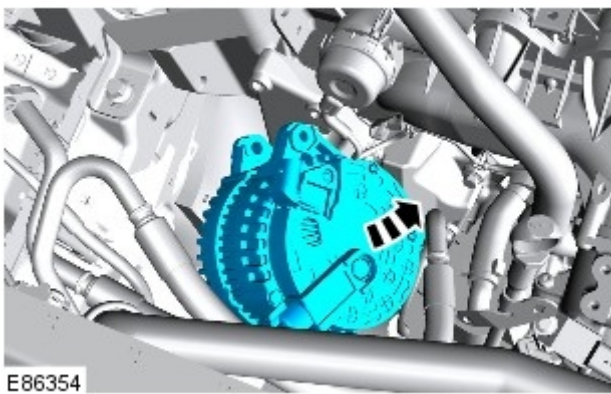
15.



16. **16.**  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.



17.



18.

Installation

1.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Install the generator.

2. Install the 2 generator bolts.

Torque: 48 Nm

3. Install the accessory drive belt idler pulley.

Torque: 48 Nm

4. Install the accessory drive belt idler pulley dust cap.

5. Connect the generator electrical connector.

6. Connect the battery cable to the generator.

Torque: 24 Nm

7. Attach the power steering fluid reservoir.

8.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Install the power steering pump.

Torque: 24 Nm

9. Install the fuel filter support bracket.

Torque: 20 Nm

10. Attach the oil level indicator tube to the fuel filter support bracket.

Torque: 10 Nm

11. Install the inner fuel filter shield.

12. Secure the coolant top hose.

13. Install the accessory drive belt.

Refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - TD4 2.2L Diesel, Removal and Installation).

14. Install the engine undershield.

Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

15. Install the fuel filter.

Refer to: [Fuel Filter](#) (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).