

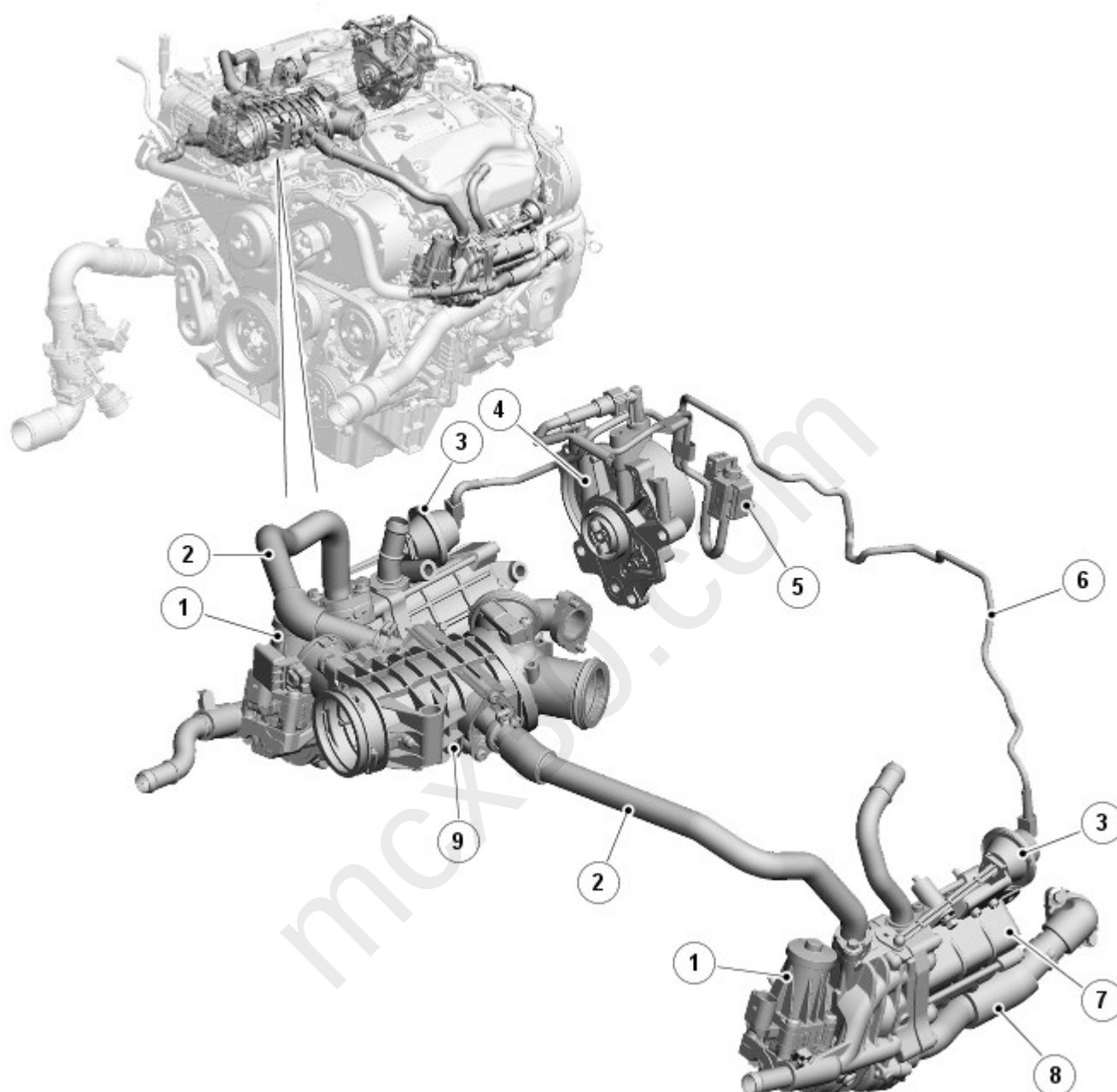
Engine Emission Control - TDV6 3.0L Diesel -

Description	Nm	lb-ft	lb-in
Exhaust gas recirculation (EGR) valve to cylinder head retaining bolts	10	7	89
EGR valve to EGR cooler retaining bolts	10	7	89
EGR valve tube to exhaust manifold retaining bolts	10	7	89
EGR valve cooler mounting bracket retaining bolt	10	7	89
EGR valve outlet tube to EGR valve retaining bolts	10	7	89
EGR valve outlet tube to timing cover retaining bolt	5	4	35

Engine Emission Control - TDV6 3.0L Diesel - Engine Emission Control - Component Location

Description and Operation

EGR (exhaust gas recirculation) Component Location

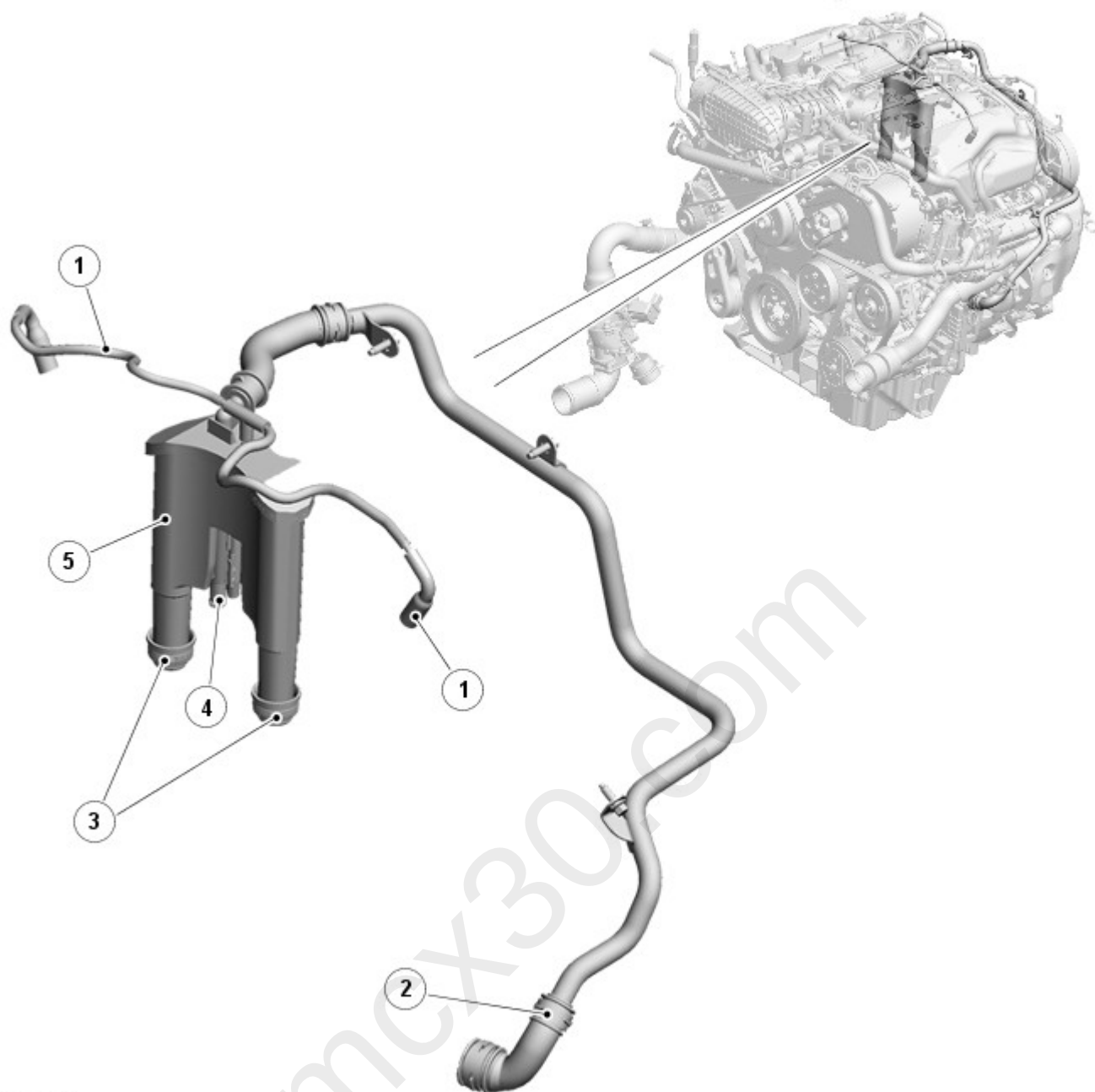


E121201

ItemDescription

1	EGR valve motor
2	EGR outlet pipe
3	By-pass valve vacuum actuator
4	Vacuum pump
5	Solenoid valve
6	Vacuum pipe (2 off)
7	EGR cooler
8	EGR inlet pipe from exhaust manifold
9	Throttle intake manifold

Crankcase Ventilation Component Location



E121202

ItemDescription

1	Cylinder ventilation scavenger hose (2 off)
2	Crankcase gas to air intake hose
3	Crankcase breather cylinder block connections
4	Oil drain to oil filter housing
5	Crankcase breather and oil separator

Engine Emission Control - TDV6 3.0L Diesel - Engine Emission Control -

Overview

Description and Operation

OVERVIEW

Exhaust Gas Recirculation (EGR) System

The [EGR \(exhaust gas recirculation\)](#) system is used to control the amount of exhaust gas being recirculated in order to reduce exhaust emissions and combustion noise. [EGR](#) is enabled when the engine is at normal operating temperature and under cruising conditions.

Crankcase Ventilation System

The crankcase ventilation system ensures that all gasses emitted from the crankcase when the engine is running are separated from any oil particles and recirculated via the clean air induction system.

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Engine Emission Control - TDV6 3.0L Diesel - Engine Emission Control - System Operation and Component Description

Description and Operation

System Operation

EXHAUST GAS RECIRCULATION (EGR) SYSTEM OPERATION

If small volumes of fuel are injected into a combustion chamber full of pure air, the effect is to create a very lean mixture. This burns at a high temperature, which in turn causes the excess oxygen in the mixture to combine with the naturally occurring nitrogen in the air to create nitrogen oxides (NOx), a noxious class of pollutants associated with acid rain. This is a particular problem for diesel engines at low to medium loads (as the engine has no throttle, the cylinder is replenished with a full charge of 'air' at every induction stroke). Exhaust gas is blended into the intake air charge to create the cylinder charge. As the exhaust gas effectively contains no oxygen, it prevents the formation of a very lean mixture, so lowering combustion temperatures and minimizing the formation of NOx.

At low engine speeds and loads, over 50 percent of the cylinder charge can be made up of recycled exhaust gas. This is routed directly from the exhaust manifold and passes through a gas-water heat exchanger before being supplied to the inlet manifold. The volume of exhaust gas added to the intake charge is regulated by an electronically controlled [EGR \(exhaust gas recirculation\)](#) valve, actuated according to precise engine speed and load by the engine management system.

CRANKCASE VENTILATION SYSTEM OPERATION

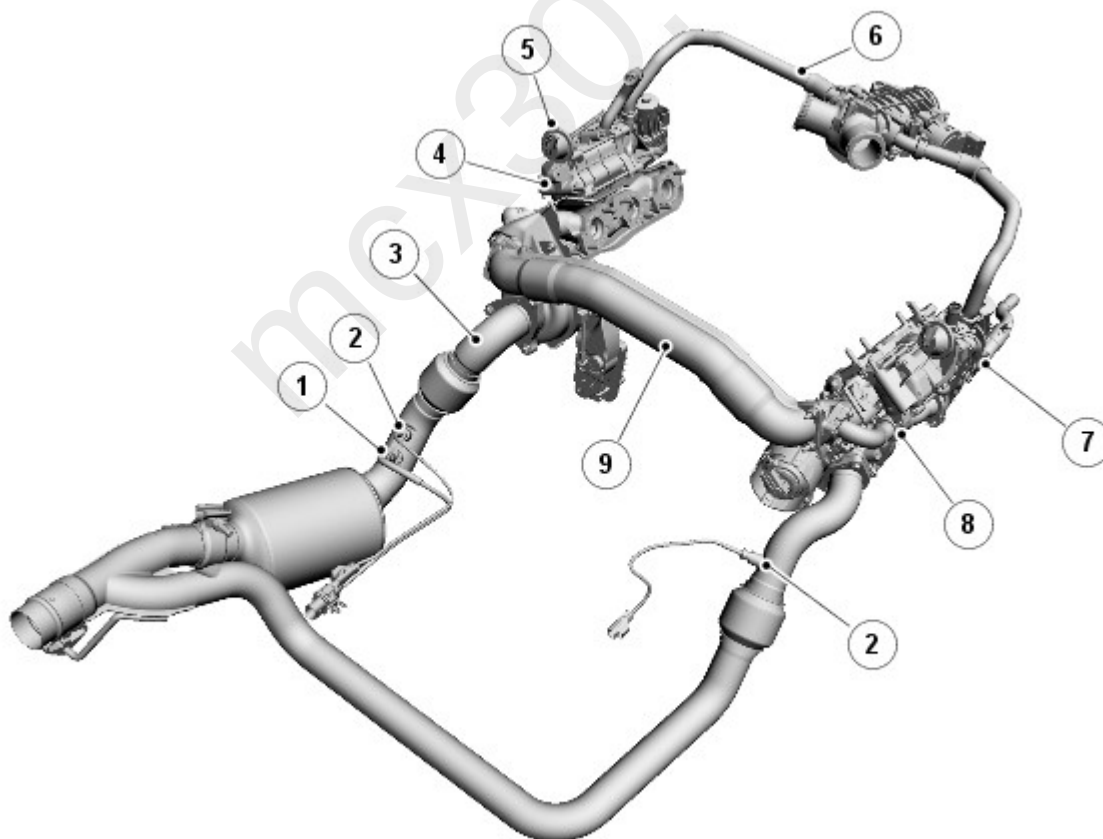
Crankcase gasses are drawn into the oil separator unit from the crankcase and the cylinder head covers (both banks) by a vacuum created by a connection into the air induction system.

The crankcase gasses are circulated around the oil separator where the gas and oil are separated. The gas is returned to the inlet side of the air induction system prior to the primary turbocharger. The collected oil is drained down to the sump via the oil cooler and filter housing on the cylinder block.

Component Description

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

EGR System Control Components



E121203

ItemDescription

1	Oxygen sensor
2	Exhaust gas temperature sensor LH (left-hand)
3	Exhaust pipe
4	EGR cooler
5	

By-pass valve vacuum actuator	EGR valve motor
6	EGR outlet pipe
7	EGR cooler and valve housing
8	EGR inlet pipe
9	Exhaust system cross-over pipe

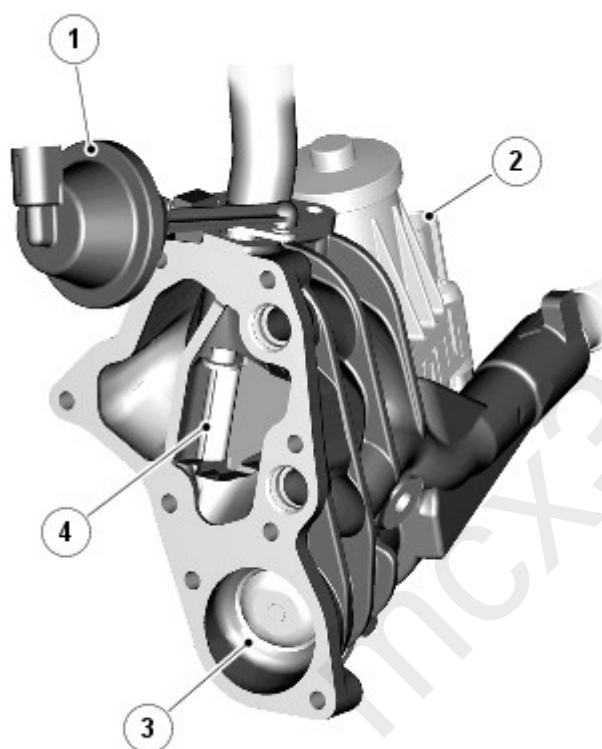
The [EGR](#) system comprises an [EGR](#) cooler and housing assembly which is bolted to the cylinder head, above the exhaust manifold. Each [EGR](#) assembly comprises an [EGR](#) cooler, a by-pass housing, a by-pass valve motor and a by-pass valve vacuum actuator.

A pipe is connected to the exhaust manifold and directs exhaust gasses into the by-pass housing. A second pipe from the by-pass housing connects to the throttle intake manifold and passes the cooled exhaust gasses into the intake manifold to mix with the clean air entering the engine from the air filter.

The [EGR](#) cooler is attached to the by-pass housing with a gasket and 5 screws. The by-pass housing has an engine coolant connection which allows coolant to flow from the engine oil cooler into the by-pass housing. Engine coolant flows from the by-pass housing into a water jacket within the cooler which in cools the exhaust gasses by heat transfer within the cooler. The engine coolant flows from the cooler through an outlet pipe and is passed back into the cooling system via the heater core.

The by-pass housing contains the [EGR](#) valve motor, the [EGR](#) valve and the by-pass valve.

By-pass Housing Components



E107585

Item Description

1	By-pass valve vacuum actuator
2	EGR valve motor
3	EGR valve
4	By-pass valve

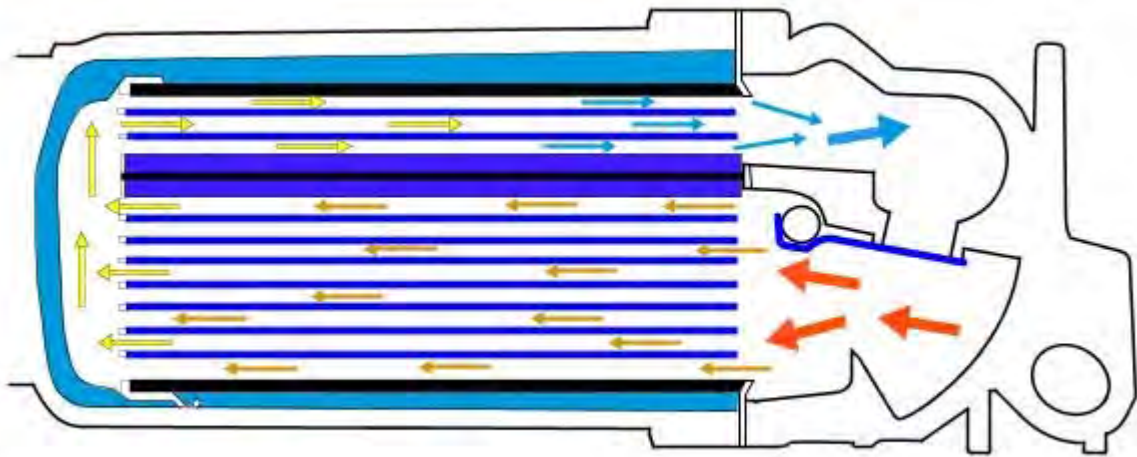
By-Pass Valve

The by-pass valve is a vacuum operated valve which directs the flow of exhaust gasses either through the [EGR](#) cooler or by-passes the cooler and directs the gasses directly to the intake manifold.

A vacuum actuator is located on a bracket attached to each [EGR](#) cooler. The actuator receives a vacuum which is produced by the vacuum pump located at the rear of the engine. The vacuum actuator is connected to the by-pass valve within the by-pass housing by a connecting rod.

The vacuum supply to the actuator is controlled by the [ECM \(engine control module\)](#). When by-pass control is required, the [ECM](#) energizes a vacuum solenoid valve which applies vacuum to the vacuum actuators. The vacuum causes the actuators to move the connecting rods in a linear direction. The linear movement of the rod is transferred to rotary movement of the by-pass valve within the by-pass housing.

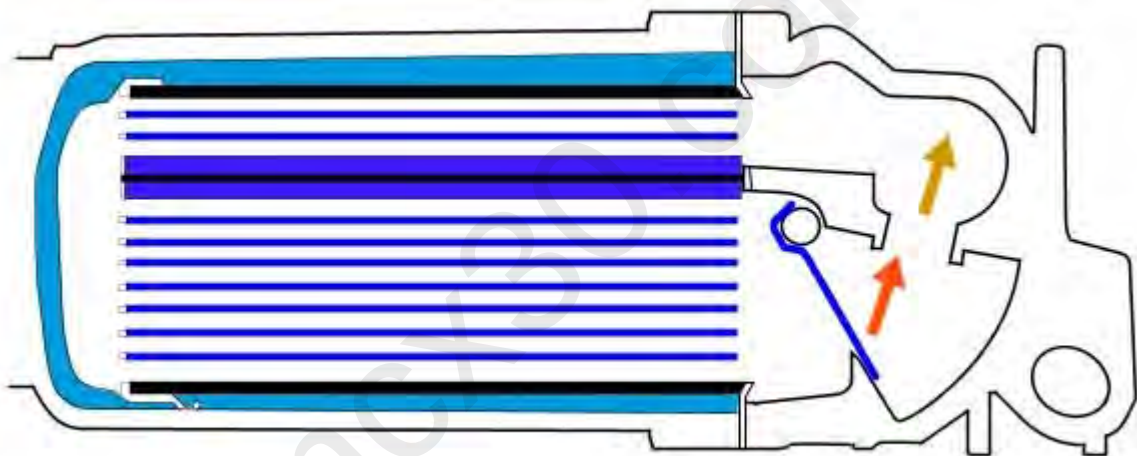
By-Pass Valve Closed



E112407

When the by-pass valve is closed, exhaust gasses are directed through the cooler before being passed to the intake manifold.

By-Pass Valve Open



E112408

When the by-pass valve is open, exhaust gasses are passed directly through the by-pass housing into the intake manifold with no cooling applied to the gasses.

EGR Valve

The [EGR](#) valve motor is located on the by-pass housing. A 5 pin connector provides the power, ground and [ECM](#) signal and feedback connections for the motor.

The motor is secured to the by-pass housing with 4 torx screws. A pinion gear on the motor spindle drives a geared rack which is connected to the [EGR](#) valve in the by-pass housing.

The motor is controlled by the [ECM](#) which provides power supply to operate the motor as required. A 5 Volt feedback signal is passed to the [ECM](#) which is used to establish motor position for precise control.

CRANKCASE VENTILATION

The crankcase ventilation system comprises an oil breather and separator. The breather receives crankcase directly from the crankcase and also from the cylinder heads.

The breather is connected to the top of the cylinder block with two seals. Two scavenge pipes located on the top of the breather are connected to the cylinder head covers. A breather pipe is connected from the top of the breather to the clean air intake hose at a point prior to the primary turbocharger.

Clean air being drawn into the engine when it is running creates a vacuum in the breather pipe. This vacuum in turn creates a vacuum in the oil breather and separator which draws gasses from the crankcase and cylinder heads into the breather. These gasses are circulated around the breather, allowing oil particles to be separated from the gas. The gasses are drawn into the breather pipe and are mixed with the clean air being drawn into the turbocharger.

The oil particles separated from the gasses accumulate in the oil separator and drain through a third connection at the bottom of the oil breather and separator, through a connection on the oil cooler housing to the oil pan.

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Engine Emission Control - TDV6 3.0L Diesel - Engine Emission Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the engine emission control system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-08B Engine Emission Control - TDV6 3.0L Diesel)

[Engine Emission Control](#) (Description and Operation),
[Engine Emission Control](#) (Description and Operation),
[Engine Emission Control](#) (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 or electrical damage.

Visual Inspection

Mechanical	Electrical
● Engine breather system ● Oil separator ● Exhaust gas recirculation pipes/hoses (check for cracks) ● EGR valve(s) ● EGR cooler(s) ● Vacuum system	● Fuse(s) ● Wiring harness ● Loose or corroded electrical connector(s) ● Intake air shut off throttle ● Exhaust gas recirculation (EGR) valve(s) ● 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
Difficult to start	● Exhaust gas recirculation (EGR) valve stuck open	Check the Exhaust gas recirculation (EGR) valve.
Poor/Erratic idle		
Lack of power when accelerating	● Exhaust gas recirculation (EGR) valve stuck open ● Breather system disconnected/restricted/blocked	Check the Exhaust gas recirculation (EGR) valve. Check the engine breather system. Check the oil separator. Check for Exhaust gas recirculation (EGR) DTCs.
Engine stops/stalls		
Excessive fuel consumption		
Excessive black smoke		
Excessive emissions	● Exhaust gas recirculation (EGR) valve stuck open ● Exhaust gas recirculation (EGR) not operating ● Breather system restricted/blocked	Check the engine breather hoses. Check the oil separator.
Excessive blow-by		
Engine oil leaks	● Breather system restricted/blocked	Check the engine breather hoses. Check the oil separator.

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).

Engine Emission Control - TDV6 3.0L Diesel - Crankcase Vent Oil Separator

Removal and Installation

Removal

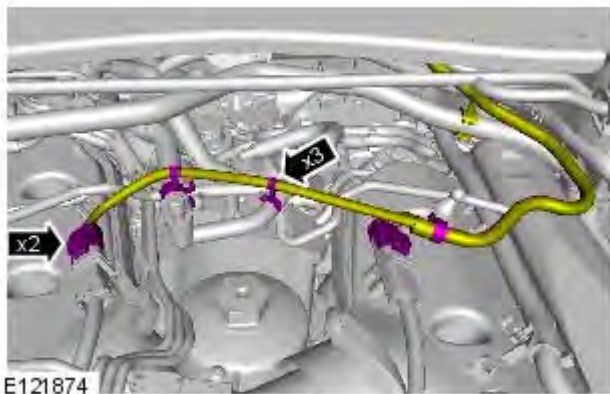
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
- NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

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

2. Refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornammentation, Removal and Installation).

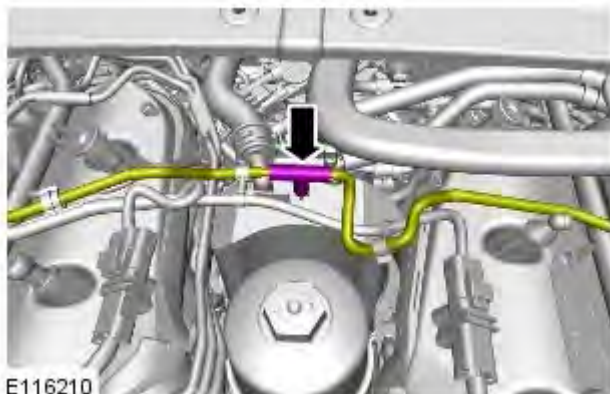
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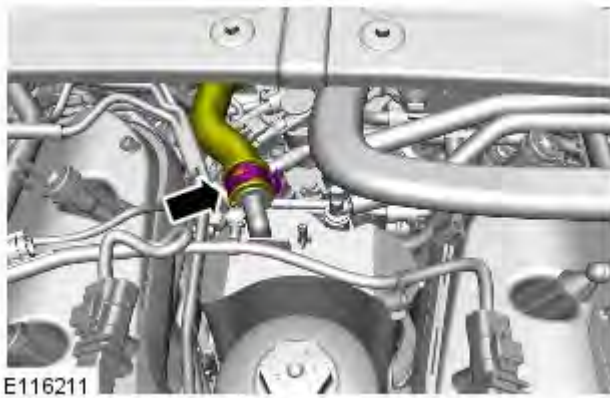


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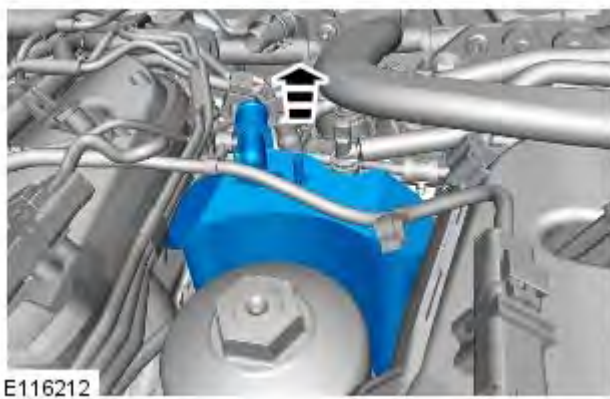


5.





6.



7. 7. CAUTIONS:



Make sure that all openings are sealed.



Lubricate the O-ring seals with clean engine oil.

Installation

1. To install, reverse the removal procedure.

Engine Emission Control - TDV6 3.0L Diesel - Exhaust Gas Recirculation (EGR) Valve LH

Removal and Installation

Removal

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

All vehicles

1. Disconnect the battery ground cable.

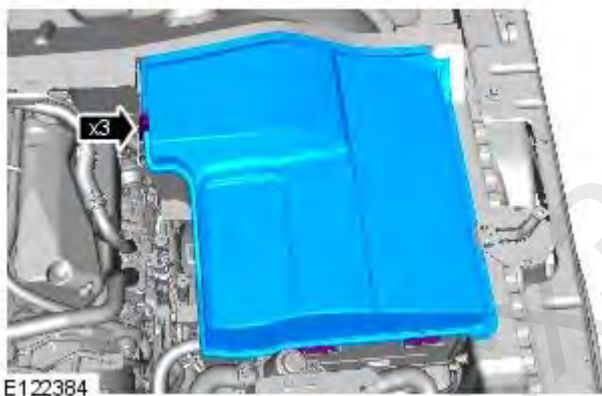
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

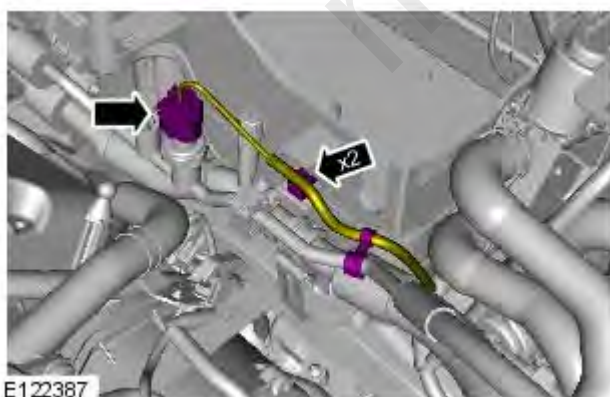
3. Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - TDV6 3.0L Diesel, General Procedures).

4. Refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

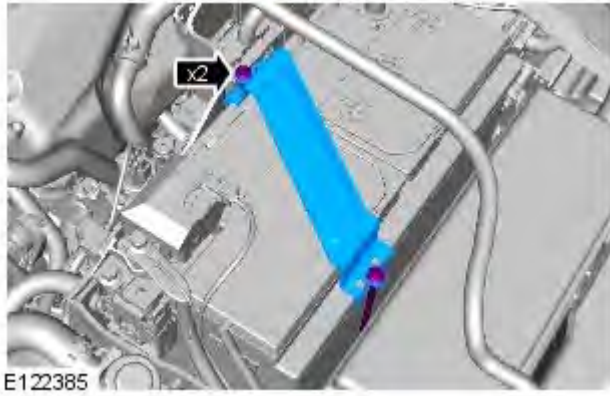
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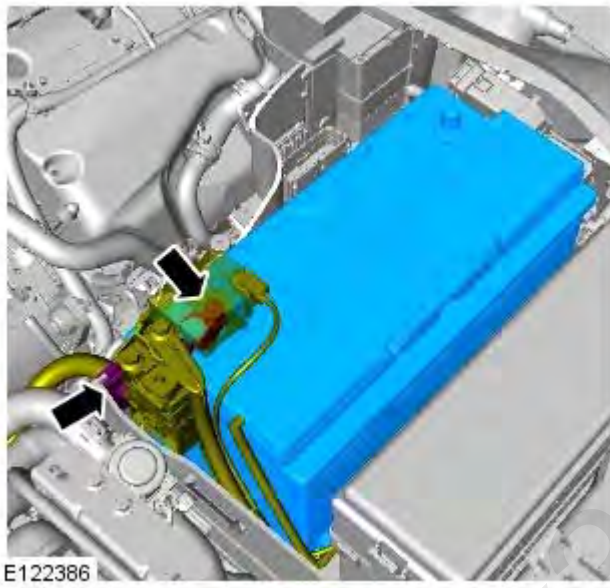
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Right-hand drive vehicles



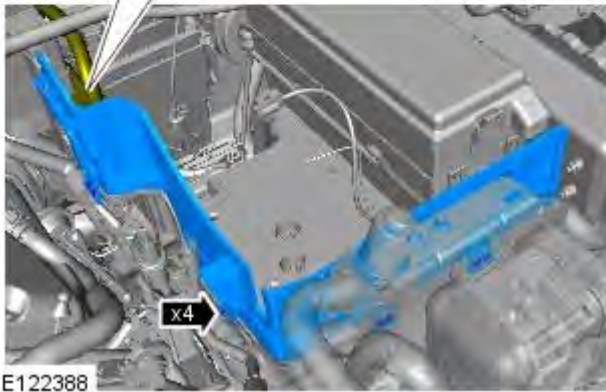
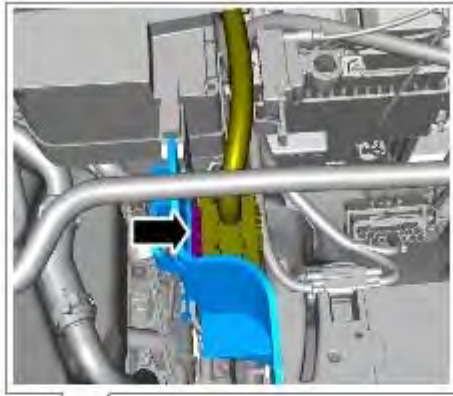
7. Torque: 10 Nm



8. Torque: 10 Nm

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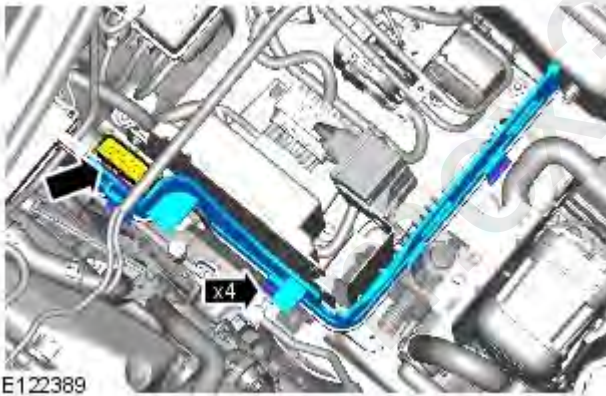
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E122388

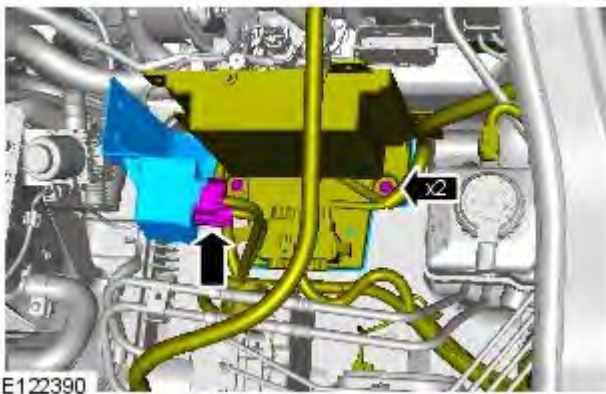
Left-hand drive vehicles

10.



E122389

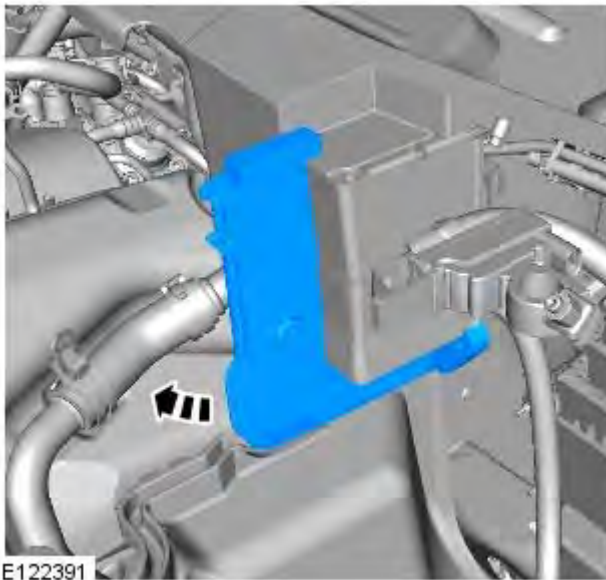
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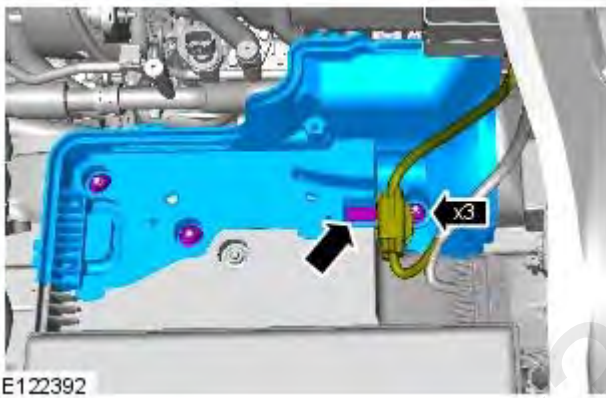
E122390

All vehicles

12.



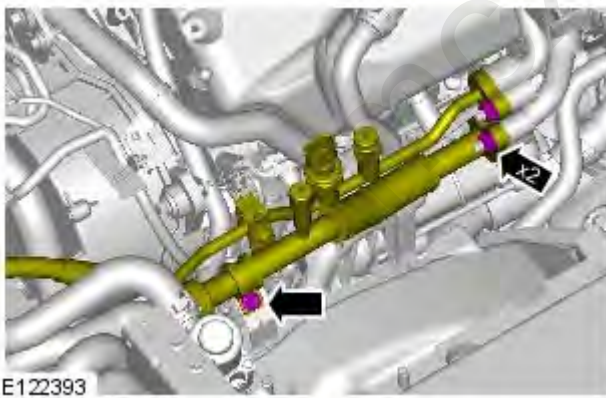
13. Torque: 12 Nm

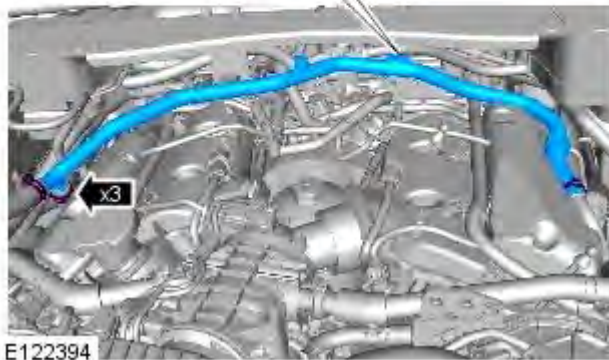


14. **14.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

- NOTE: Install new O-ring seals.

Torque: 10 Nm



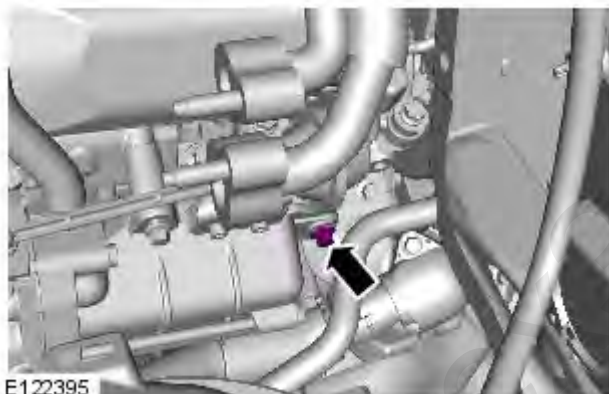


E122394

15. **15.**  **CAUTION:** Make sure that all openings are sealed.

Torque: 10 Nm

16. Refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube LH](#) (303-08B Engine Emission Control - TDV6 3.0L Diesel, Removal and Installation).



E122395

17. *Torque:* 10 Nm



E122396

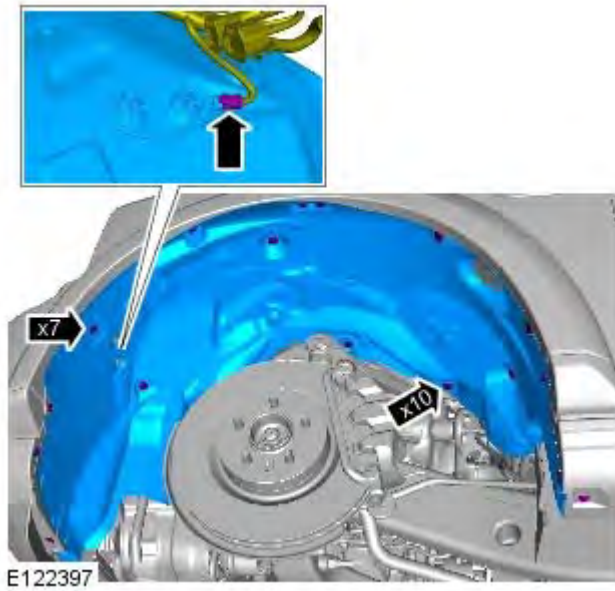
18. *Torque:* 9 Nm

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

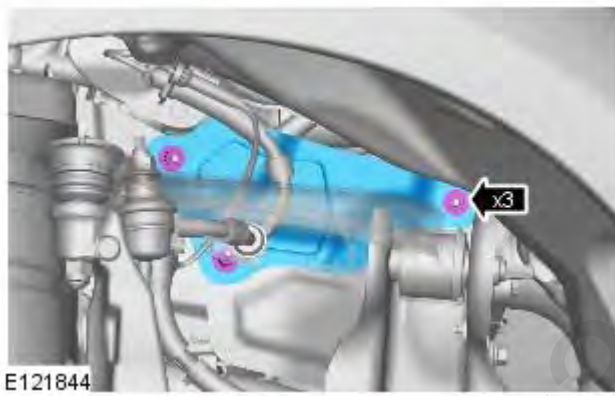
Raise and support the vehicle.

20. Remove the LH front wheel and tire.

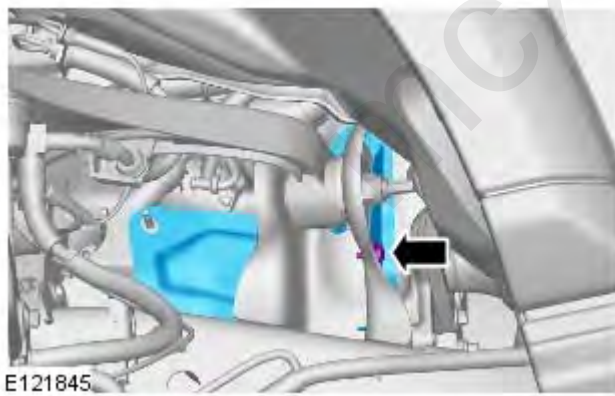
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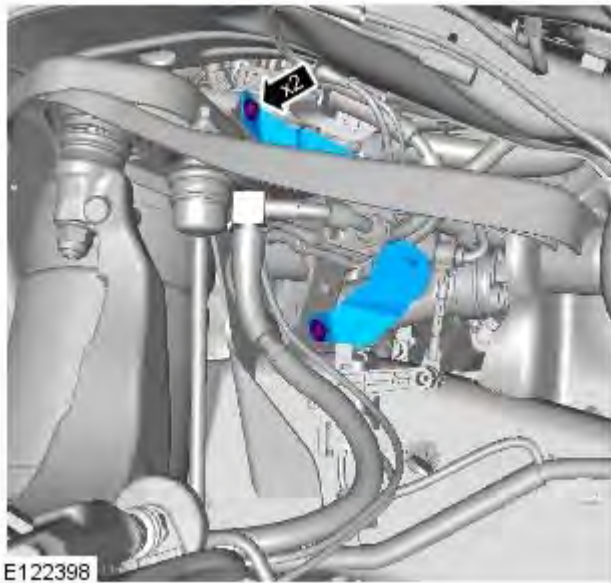


22. Torque: 9 Nm

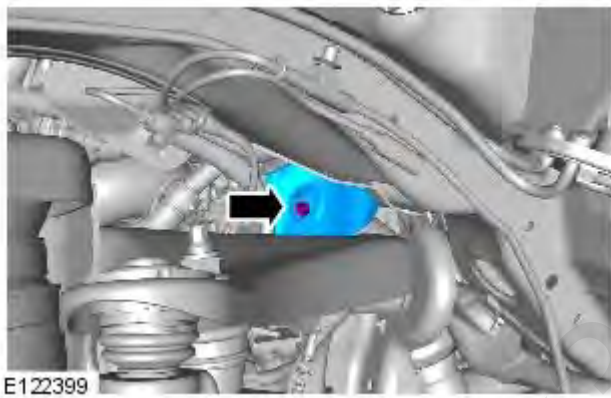


23. Torque: 9 Nm

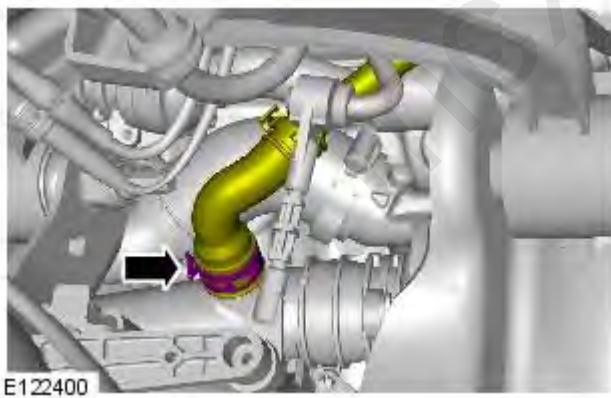




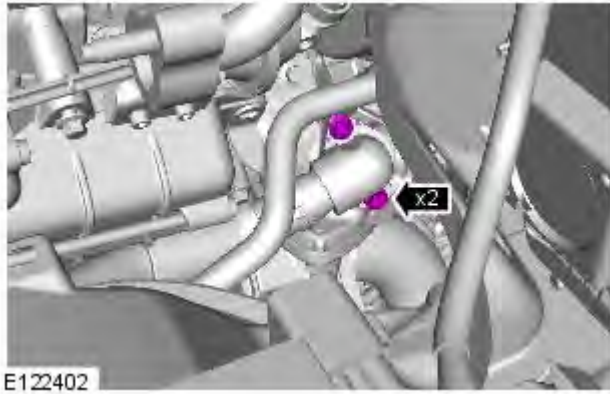
24. Torque: 9 Nm



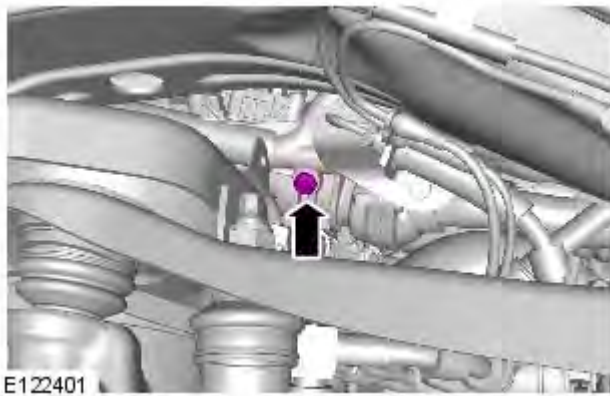
25. Torque: 9 Nm



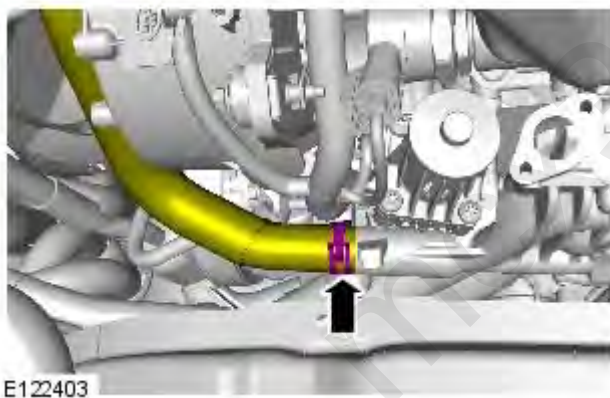
26. **26.**  CAUTION: Make sure that all openings are sealed.



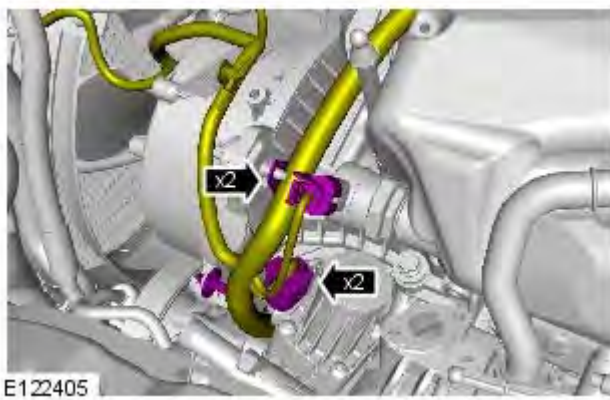
27. Torque: 10 Nm



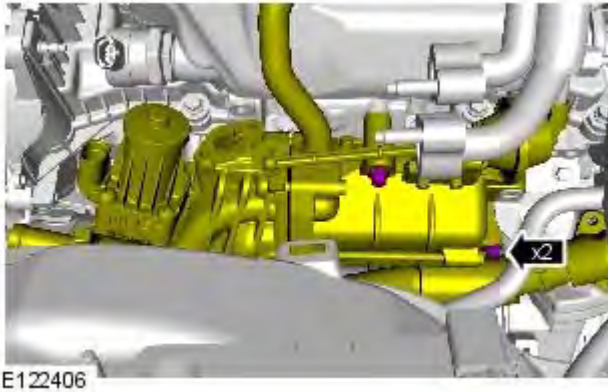
28. Torque: 10 Nm



29. **29.**  CAUTION: Make sure that all openings are sealed.

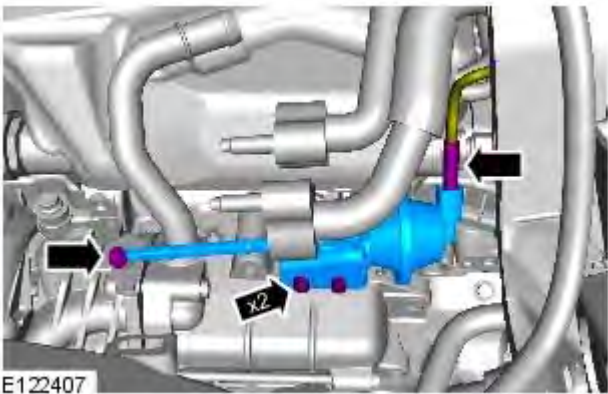


30.



31. **31.**  **CAUTION:** Make sure that all openings are sealed.

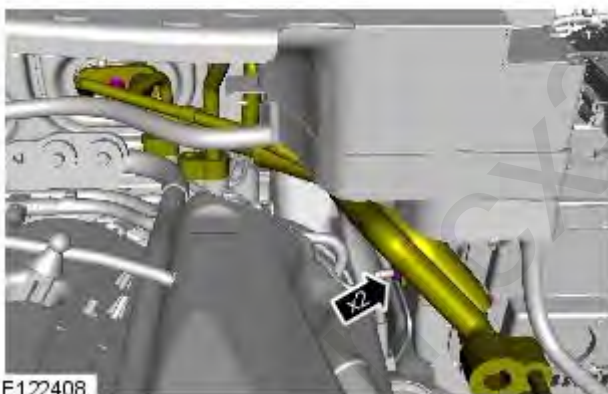
Torque: 10 Nm



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

- **NOTE:** An audible click is heard when the ball joint is fully latched.

Torque: 8 Nm

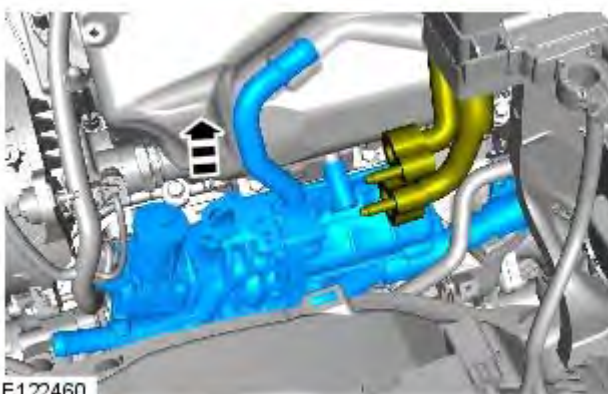


33. **33.** **CAUTIONS:**

-  Install new o-ring seals

-  Make sure that all openings are sealed. Use new blanking caps.

Torque: 6 Nm



- 34.

Installation

1. To install, reverse the removal procedure.

2. If a new unit is installed, configure using the approved diagnostic tool.

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Engine Emission Control - TDV6 3.0L Diesel - Exhaust Gas Recirculation (EGR) Valve RH

Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

All vehicles

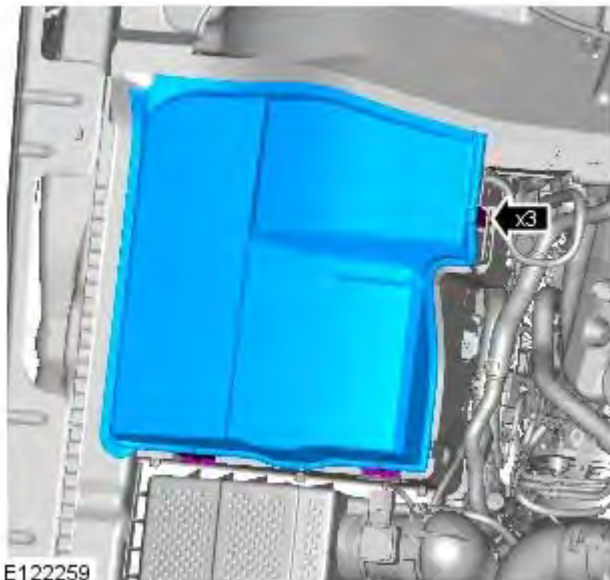
1. Disconnect the battery ground cable.

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

2. Refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03B Engine Cooling - TDV6 3.0L Diesel, General Procedures).

3. Refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornammentation, Removal and Installation).

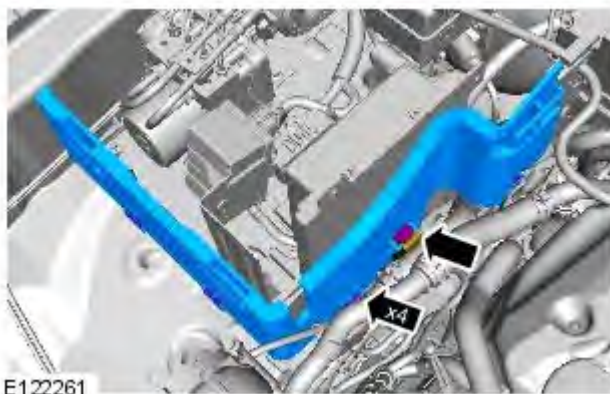
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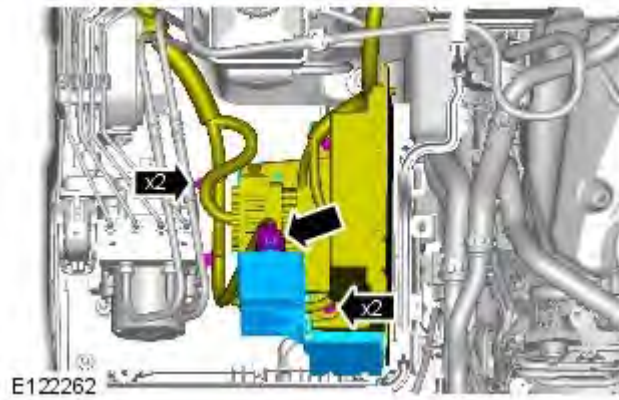


5. Refer to: [Air Cleaner](#) (303-12B Intake Air Distribution and Filtering - TDV6 3.0L Diesel, Removal and Installation).

Right-hand drive vehicles

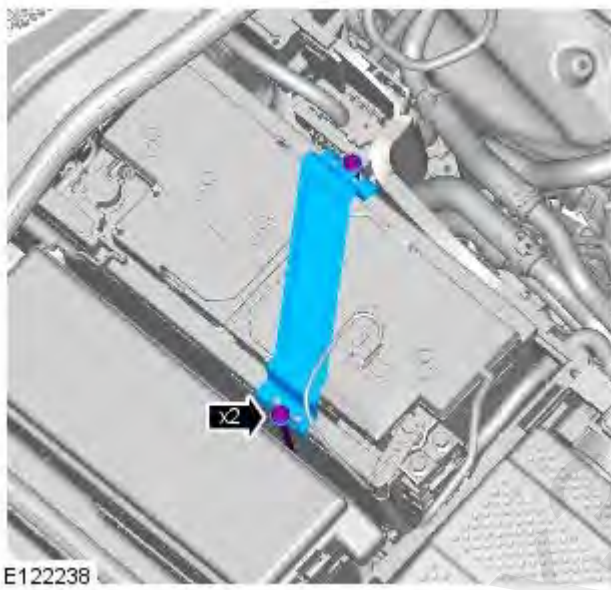
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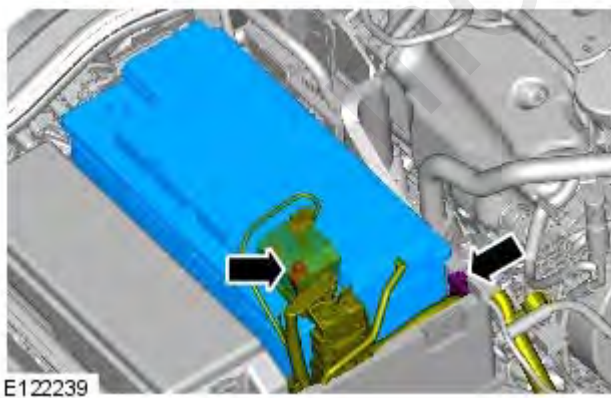


7. Torque: 10 Nm

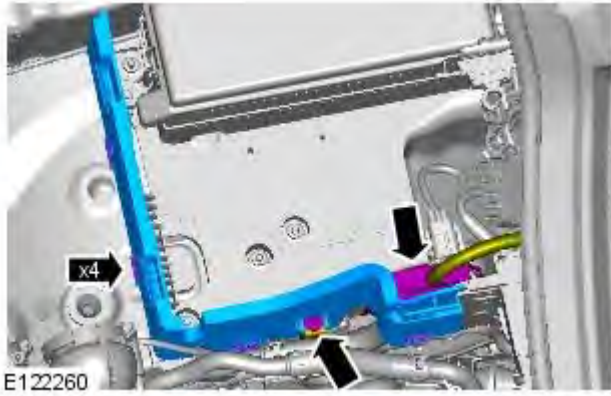
Left-hand drive vehicles



8. Torque: 10 Nm

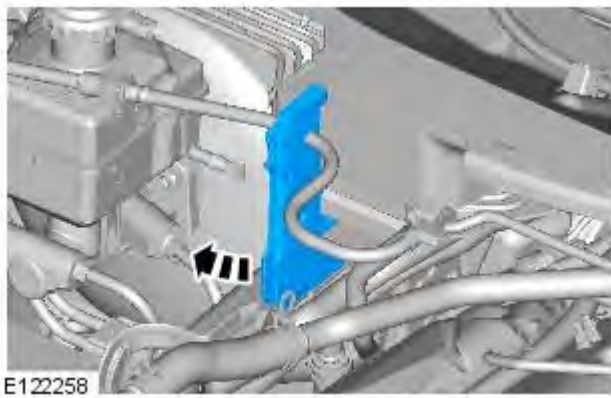


9. Torque: 10 Nm

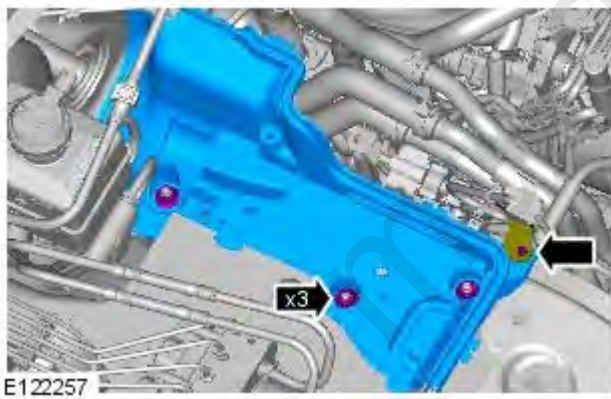


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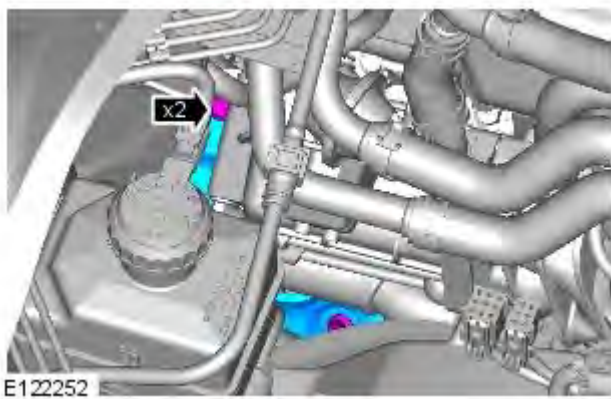
All vehicles



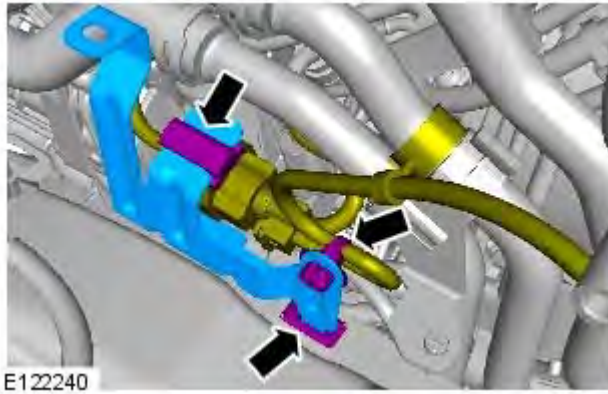
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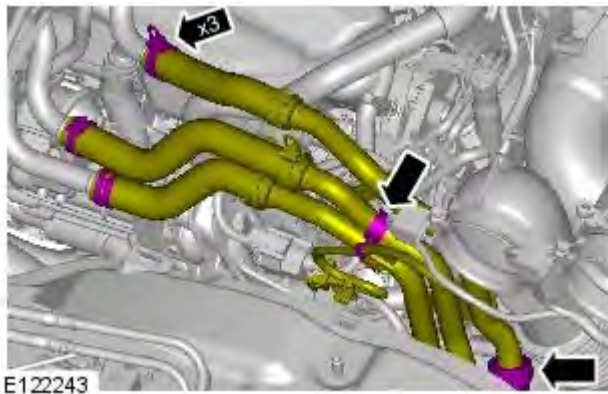
12. Torque: 12 Nm



13. Torque: 9 Nm

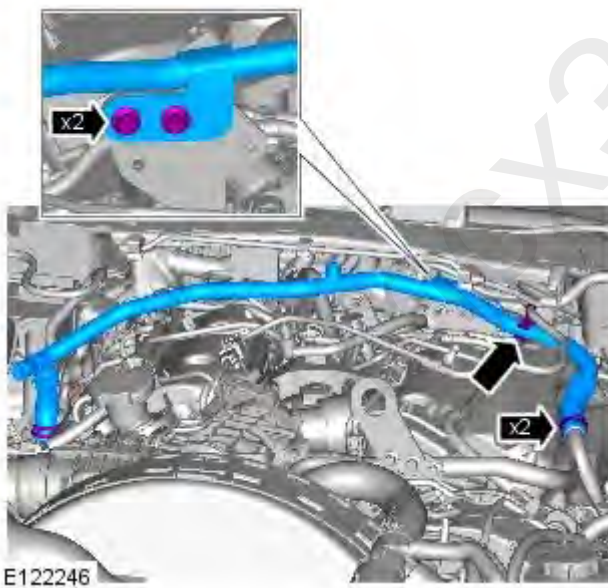


14.



15. **15. CAUTIONS:**

-  Be prepared to collect escaping fluids.
-  Make sure that all openings are sealed.



16. **16.**  **CAUTION:** Make sure that all openings are sealed.

Torque: 10 Nm

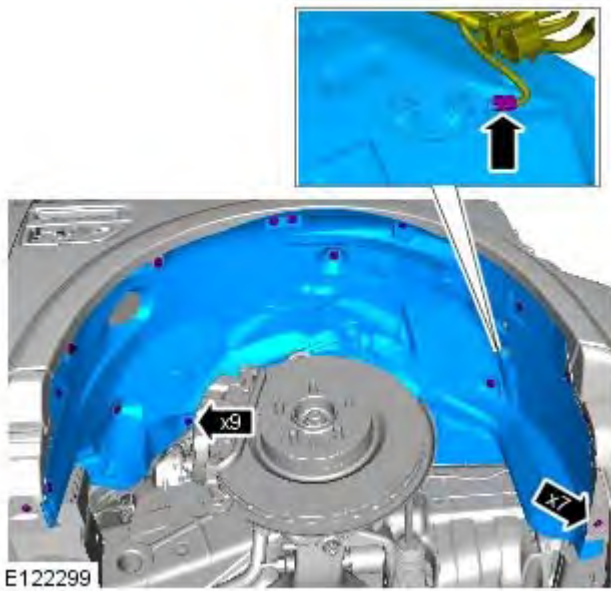
17. Refer to: [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube RH](#) (303-08B Engine Emission Control - TDV6 3.0L Diesel, Removal and Installation).

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

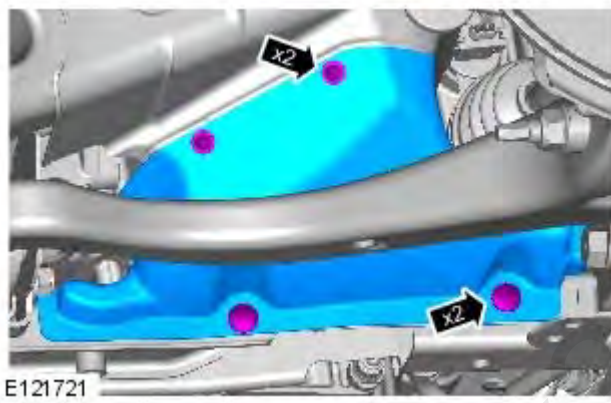
Raise and support the vehicle.

19. Remove the RH front wheel and tire.

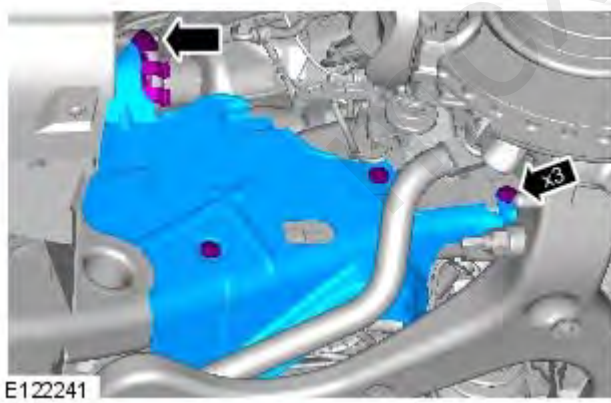
20.

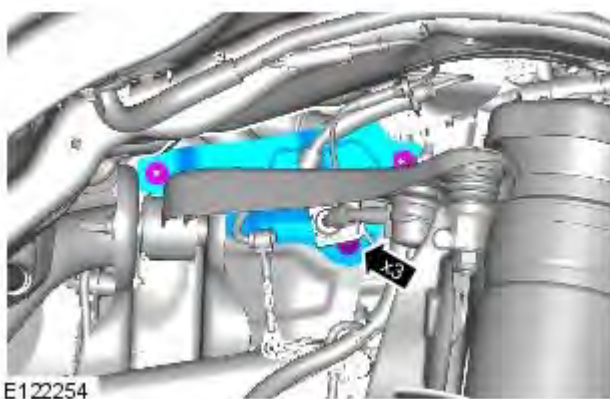


21.

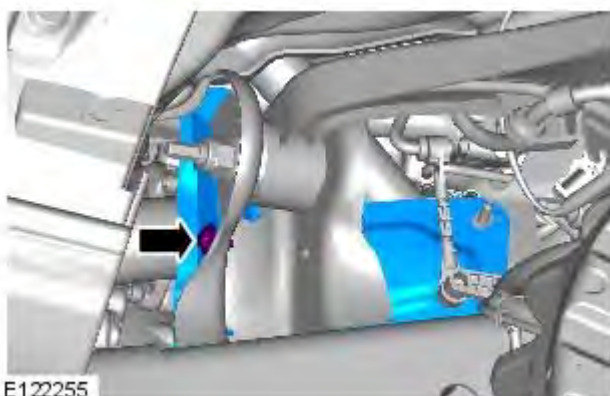


22.

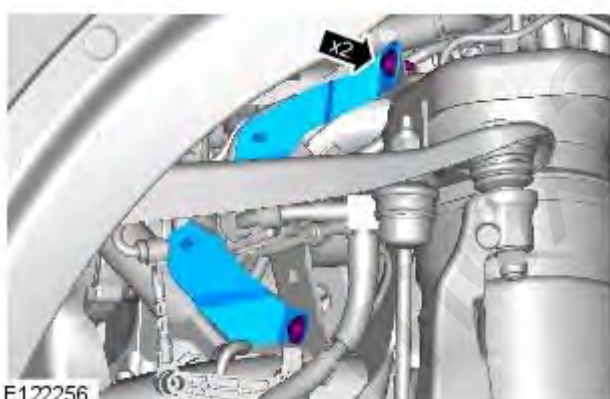




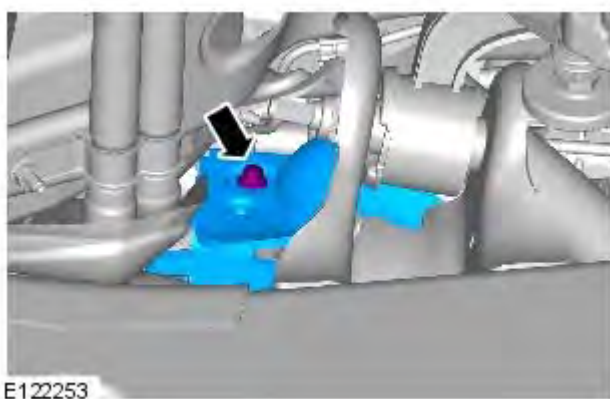
23. Torque: 9 Nm



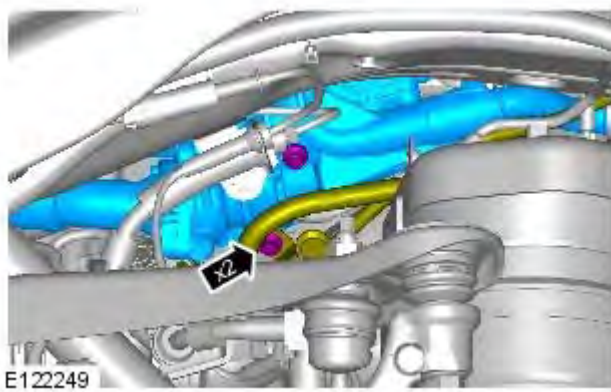
24. Torque: 9 Nm



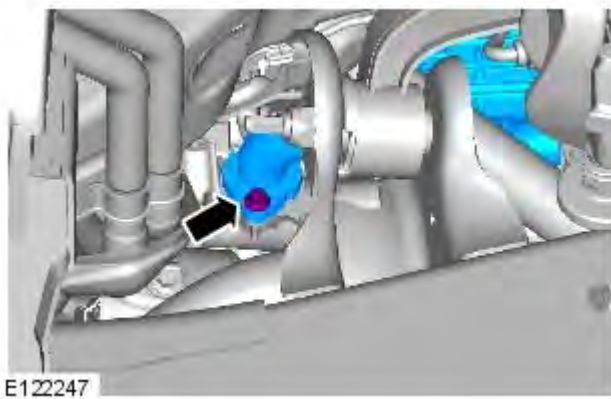
25. Torque: 9 Nm



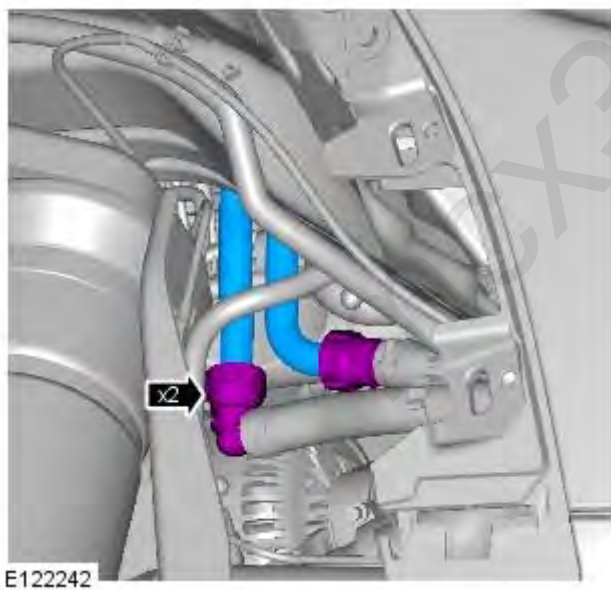
26. Torque: 9 Nm



27. Torque: 10 Nm



28. Torque: 10 Nm



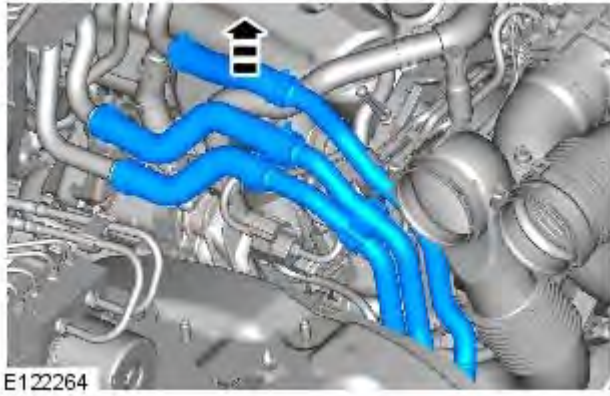
29. **29. CAUTIONS:**



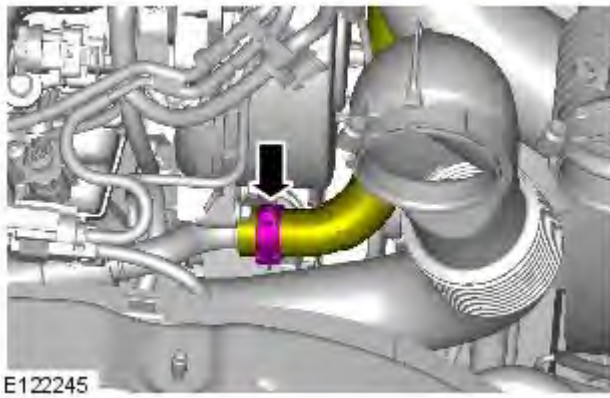
Be prepared to collect escaping fluids.



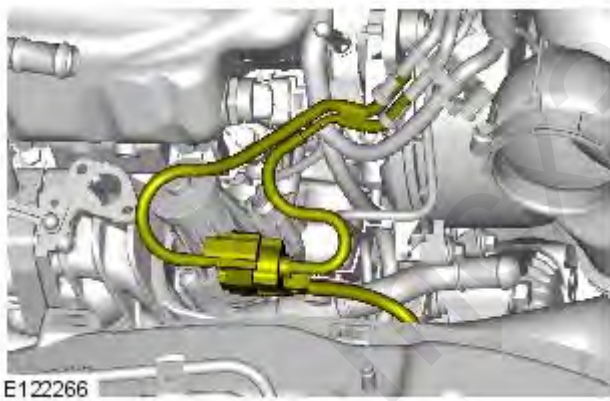
Make sure that all openings are sealed.



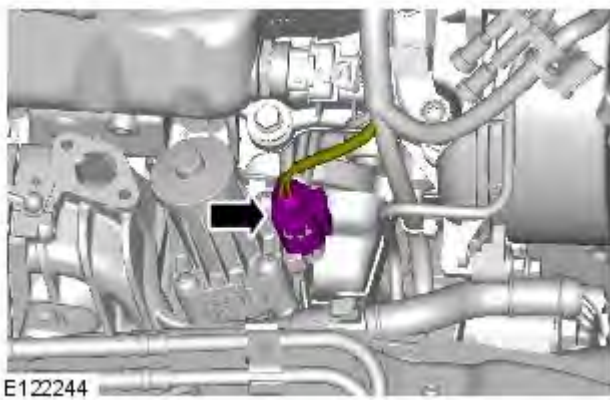
30.



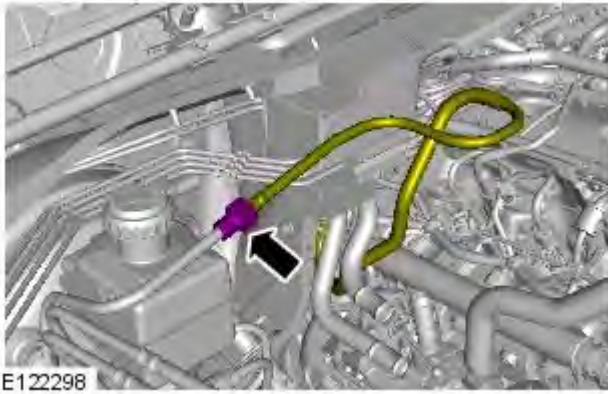
31. **31.**  **CAUTION:** Make sure that all openings are sealed.



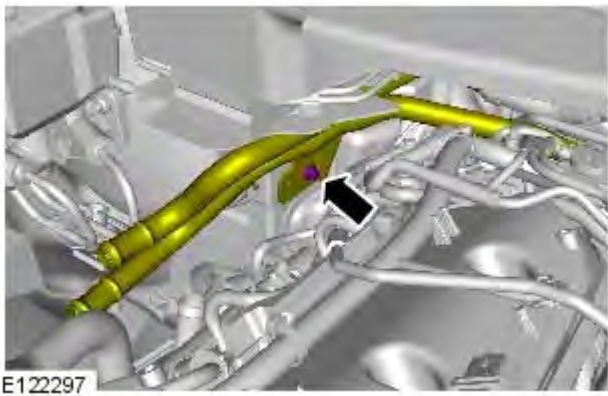
32.



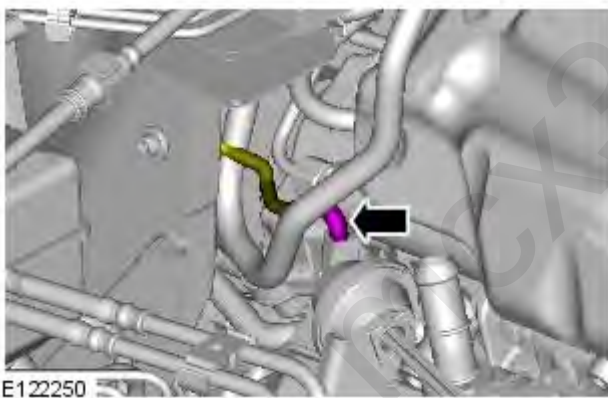
33.



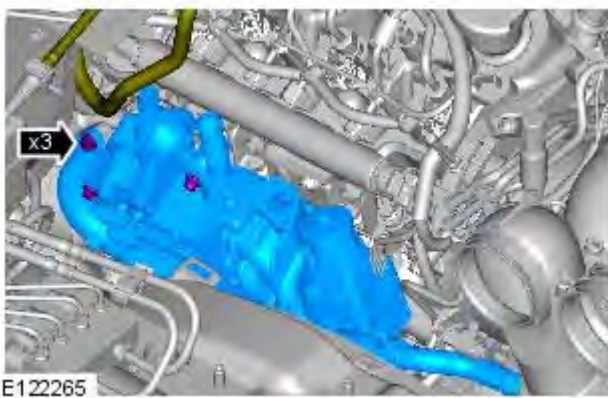
34. **34.**  **CAUTION:** Make sure that all openings are sealed.



35. *Torque:* 10 Nm



- 36.



37. **37.**  **CAUTION:** Make sure that all openings are sealed.

- **NOTE:** Install a new gasket.

Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

2. If a new unit is installed, configure using the approved diagnostic tool.

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Engine Emission Control - TDV6 3.0L Diesel - Exhaust Gas Recirculation (EGR) Valve Outlet Tube LH

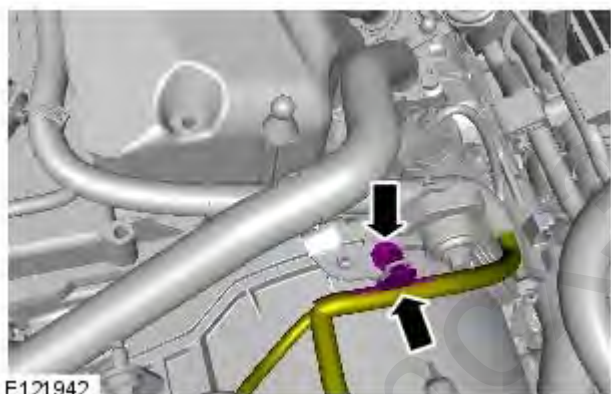
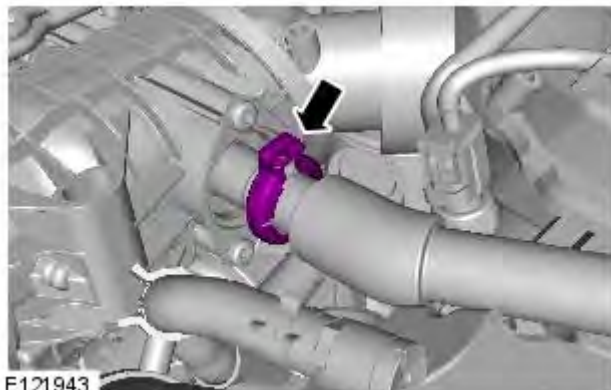
Removal and Installation

Removal

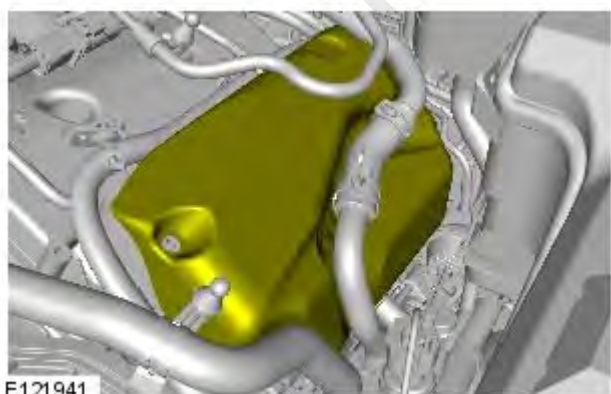
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

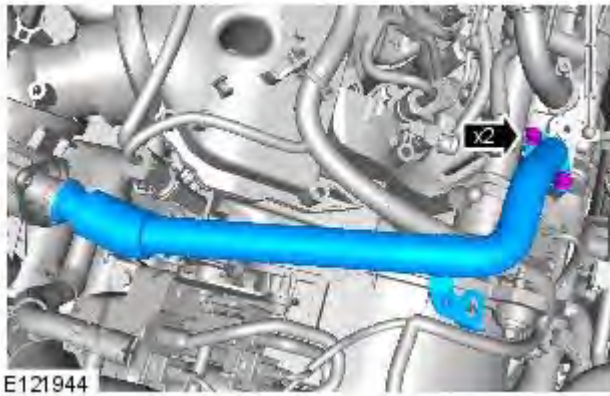
2. **2.** NOTE: Discard the retaining clips.



- 3.

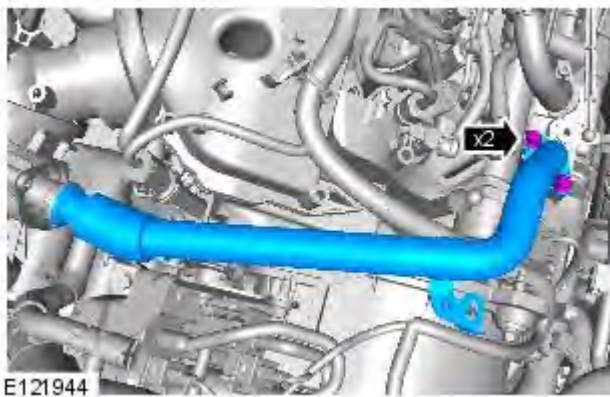


- 4.

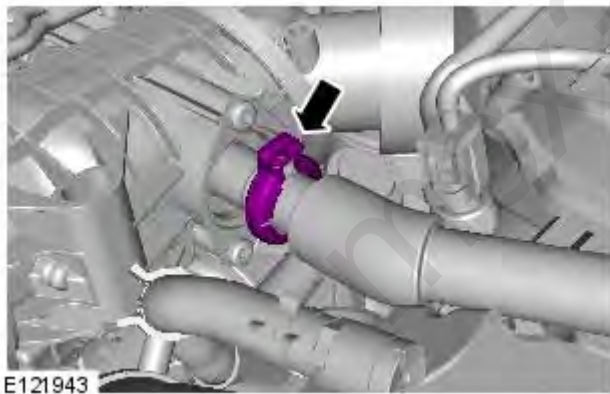


5. **CAUTION:** Make sure that all openings are sealed.
 - **NOTE:** Discard the gasket.

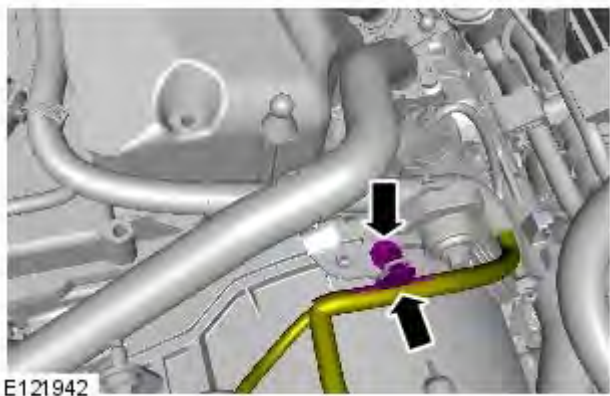
Installation



1. **CAUTION:** Only tighten the bolts finger-tight at this stage.
 - **NOTE:** Install a new gasket.



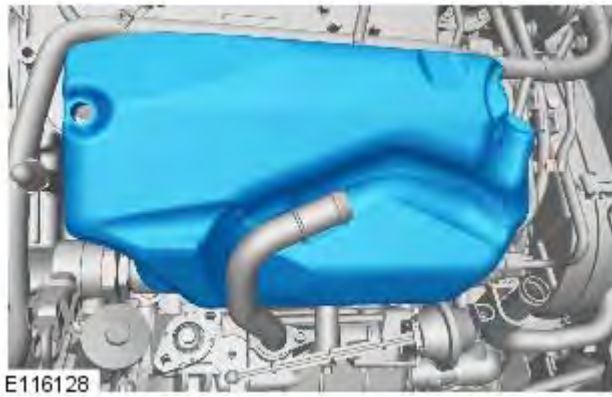
2. **CAUTION:** Install a new clamp. Close the clamp to the first audible click by hand. Making sure that the clamp is in a central position to the joint, close to the second audible click using a suitable tool.



3. **Torque:** 5 Nm



4. Torque: 10 Nm



5.

6. Refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Engine Emission Control - TDV6 3.0L Diesel - Exhaust Gas Recirculation (EGR) Valve Outlet Tube RH

Removal and Installation

Removal

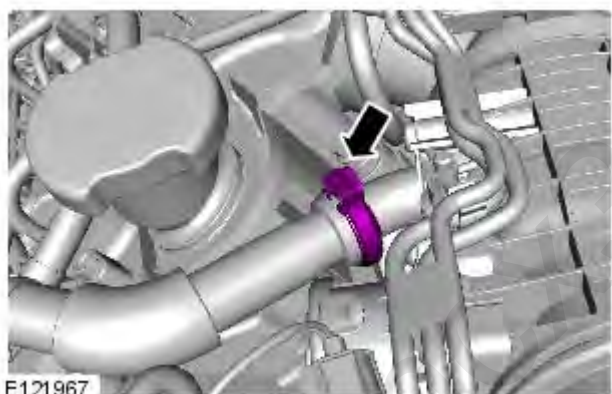
- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

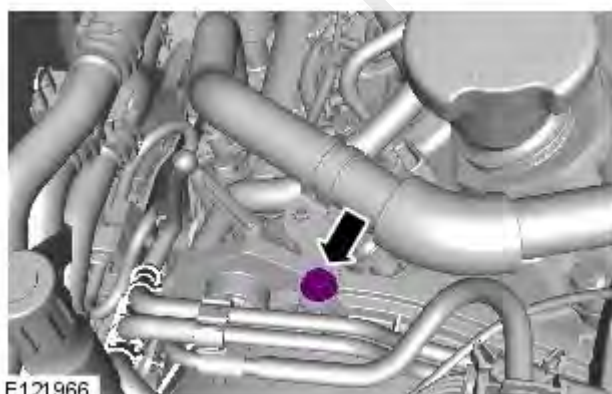
2.

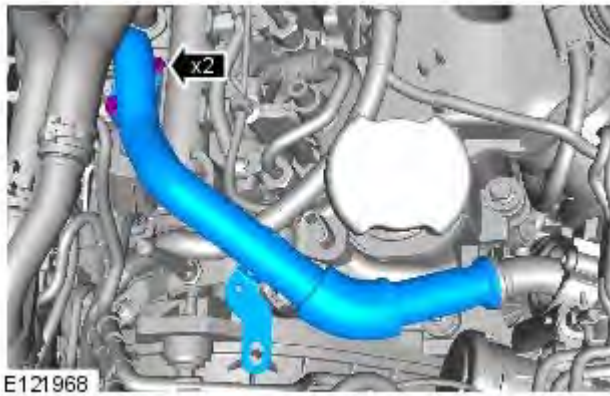


3. **3.** NOTE: Discard the retaining clips.



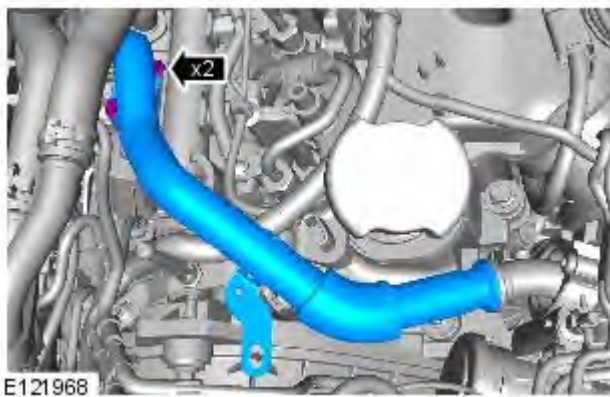
4.



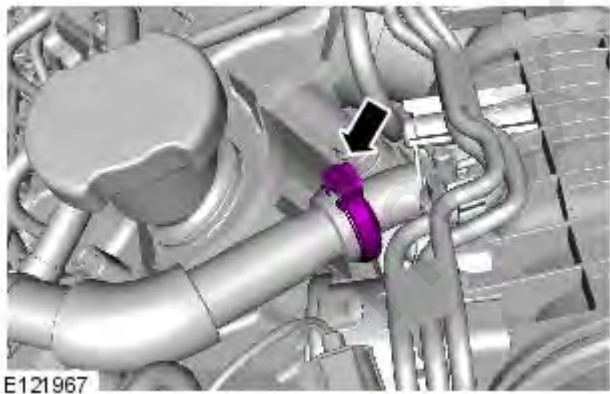


5.  **CAUTION:** Make sure that all openings are sealed.
 - **NOTE:** Discard the gasket.

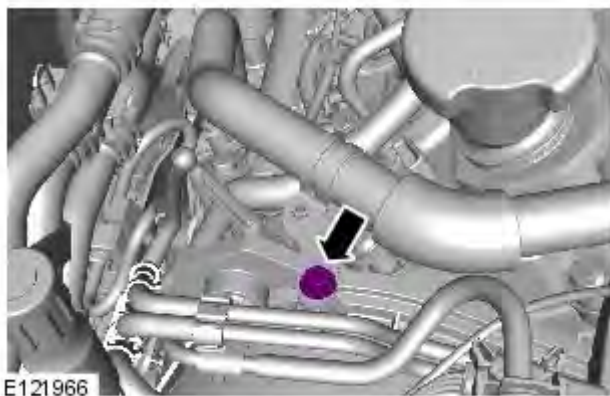
Installation



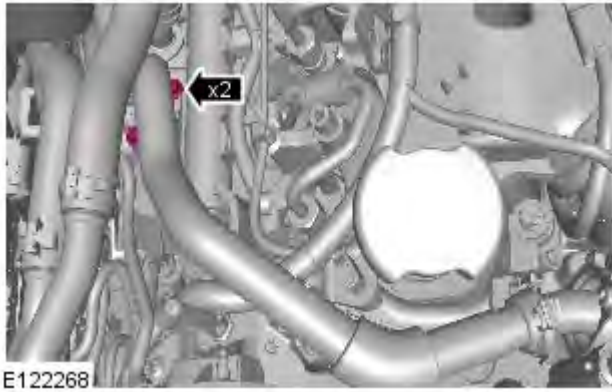
1.  **CAUTION:** Only tighten the bolts finger-tight at this stage.
 - **NOTE:** Install a new gasket.



2.  **CAUTION:** Install a new clamp. Close the clamp to the first audible click by hand. Making sure that the clamp is in a central position to the joint, close to the second audible click using a suitable tool.



3. **Torque:** 5 Nm



4. Torque: 10 Nm



5.

6. Refer to: [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).