

Published: 11-May-2011

Engine Emission Control - TD4 2.2L Diesel -

Torque Specifications

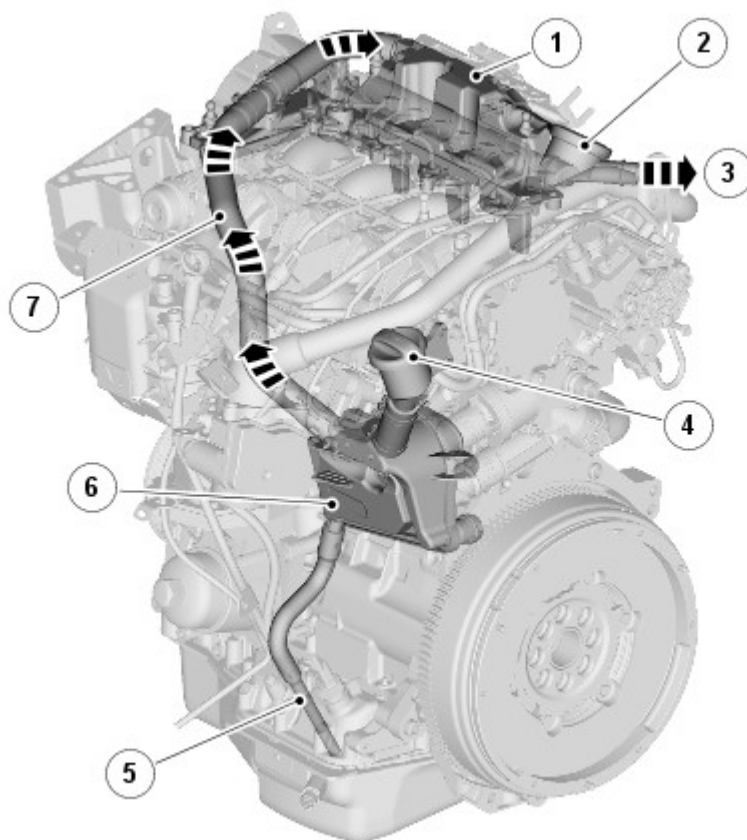
Description	Nm	lb-ft
Crankcase vent oil separator	9	7
Crankcase vent oil separator, wiring harness bracket.	10	7
Crankcase vent oil separator to cylinder block, bracket.		
M6	10	7
M8	25	18
EGR Cooler bolts	10	7
EGR Cooler cross-over pipe securing bolt	10	7
EGR Valve inlet tube bolts	10	7
EGR Valve outlet tube bolts	10	7
EGR Valve nuts	10	7
EGR Valve screws	6	4
Exhaust manifold heatshield	10	7
Fuel filter brackets	25	18
HO2S Wiring harness bracket	8	6
Intake manifold adaptor	6	4
Intake manifold adaptor, wiring harness bracket	10	7

Part Number

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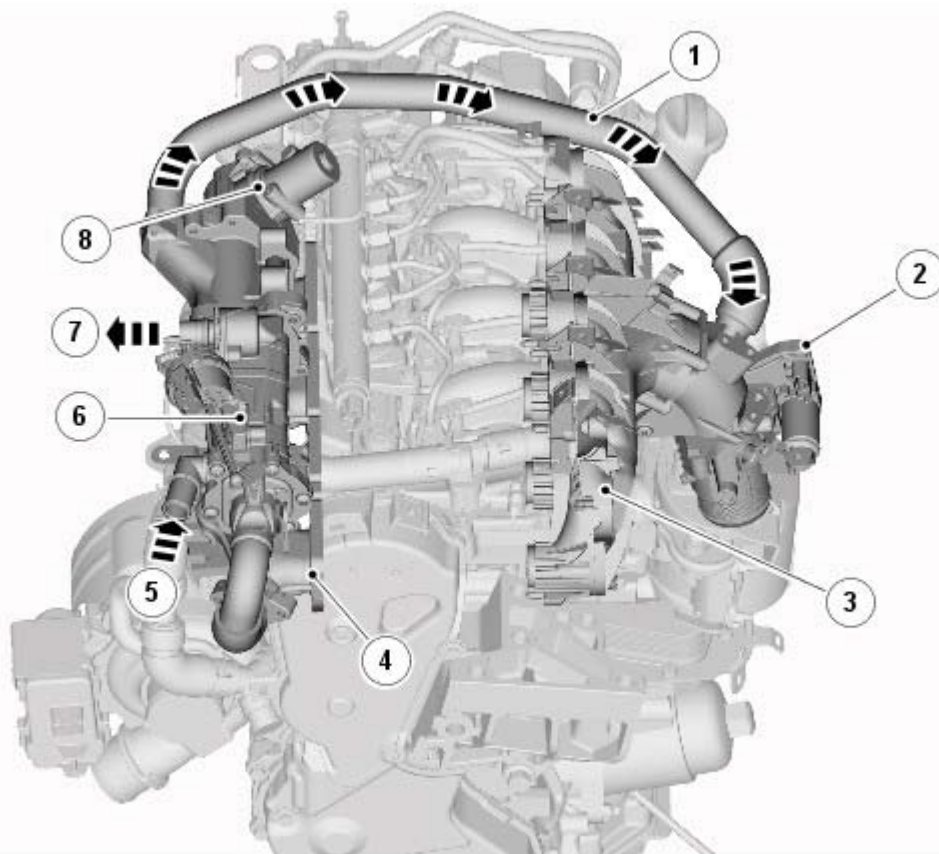
Engine Emission Control - TD4 2.2L Diesel - Engine Emission Control

Description and Operation

COMPONENT LOCATION

E134915

Item	Part Number	Description
1	-	Camshaft cover
2	-	Positive crankcase ventilation (PCV) valve
3	-	Crankcase gas vent to air intake duct
4	-	Oil filler cap
5	-	Oil return tube
6	-	Crankcase vent oil separator
7	-	Crankcase gas ventilation tube - showing flow direction



E137159

Item		Description
1		Exhaust gas transfer tube - showing flow direction
2		Throttle body
3		Intake manifold
4		Exhaust manifold
5		Coolant inlet
6		Exhaust gas recirculation (EGR) cooler
7		Coolant outlet
8		Exhaust gas recirculation (EGR) Valve and Actuator

OVERVIEW

Crankcase Ventilation System

To prevent the build-up of gases in the engine's crankcase, the crankcase gases are drawn into the oil separator where oil particles are removed from the gases. The oil is then drained down to the engine's oil pan and the gases are directed into the engine's air intake system.

Prior to the oil-free gases entering the air intake system, a positive crankcase ventilation (PCV) valve operates to minimize crankcase pressure variations caused by engine air demand and engine operating conditions.

Exhaust Gas Recirculation (EGR) System

Harmful nitrogen oxides (NO_x) a constituent of the exhaust gases, are formed by the reaction between oxygen and nitrogen at high temperatures. Reducing the engine's combustion temperature and therefore the amount of NO_x produced is achieved by recirculating a proportion of the exhaust gases. The recirculated exhaust gases replace some of the engine's intake air as this reduces the oxygen content within the cylinders and lowers the peak combustion temperature by several hundred degrees.

To reduce the temperature as well as increase the density of the inducted fuel charge, the recirculated exhaust gases are passed through the Exhaust Gas Recirculation (EGR) cooler. The EGR cooler utilizes coolant from the engine cooling system to reduce the exhaust gas temperature. Exhaust gases entering the EGR cooler reach temperatures of approximately 500C; the EGR cooler lowers the temperature of the gases, to 250-300C before they exit the cooler.

SYSTEM OPERATION

CRANKCASE VENTILATION SYSTEM OPERATION

Crankcase gasses are drawn into the oil separator unit from the crankcase and the oil pan by a vacuum created by a

connection into the air induction system.

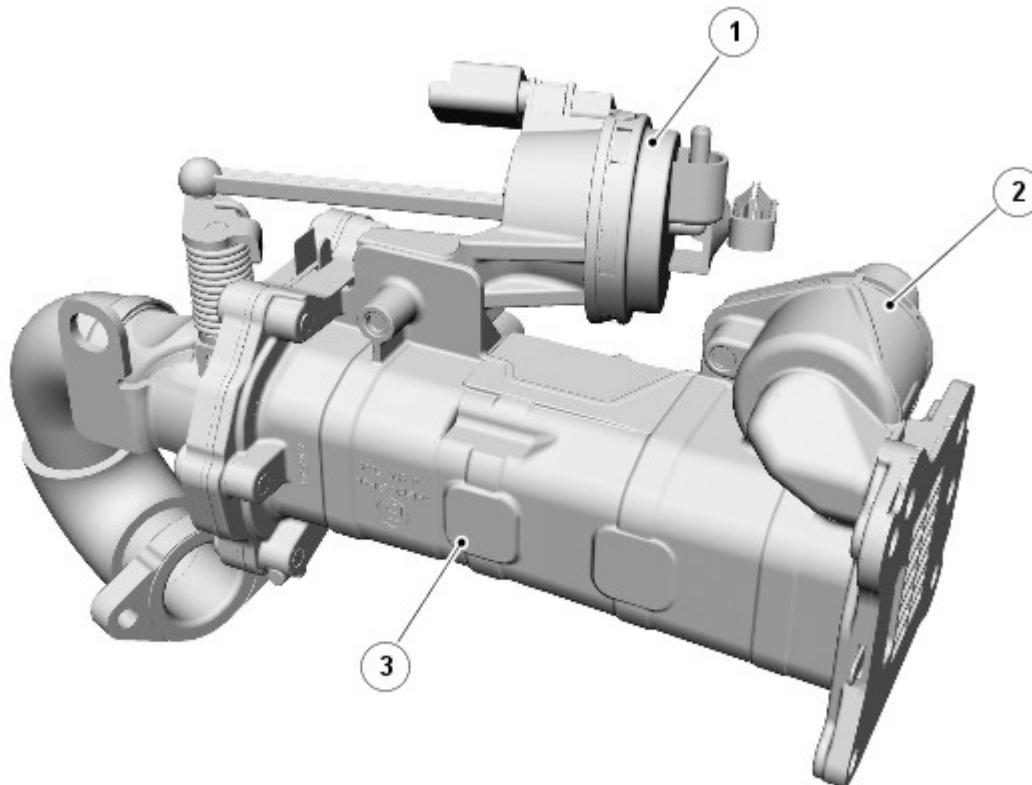
The crankcase gasses are circulated around the oil separator and through the camshaft cover where the gas and oil are separated. The gas is returned to the inlet side of the air induction system prior to the turbocharger. The collected oil is drained down to the sump.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

An electrically actuated valve, mounted on the outlet side of the EGR cooler and controlled by the [ECM \(engine control module\)](#), regulates the amount of exhaust gases recirculated into the air intake system. The [ECM](#) uses signals from various engine sensors and calculates a response based on the embedded software algorithm to control exhaust gas recirculation. The [ECM](#) transmits this control signal to the valve's actuator, which is closed-loop controlled with the mass air flow (MAF) sensor providing the feedback to the [ECM](#).

COMPONENT DESCRIPTION

Exhaust Gas Recirculation (EGR) Valve and Cooler Assembly



E131827

Item		Description
1		Actuator
2		Coolant outlet
3		Cooler

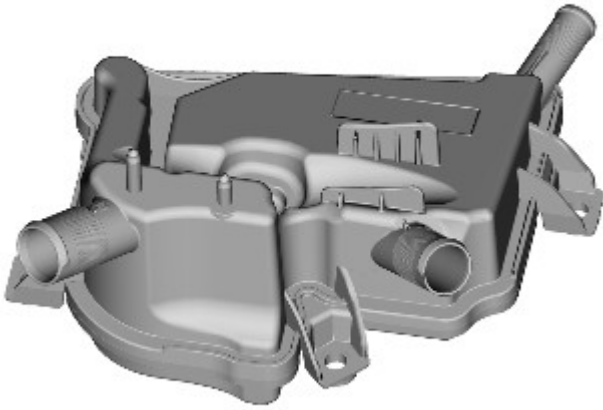
The EGR valve and cooler assembly is located on the RH side of the cylinder head above the exhaust manifold, and secured with 4 fixings. An inlet pipe connects the EGR cooler to the exhaust manifold. A gas transfer tube is routed across the engine and connects the EGR valve outlet to the intake manifold housing.

A pipe on the EGR cooler body connects to the climate control heater outlet hose, and provides the coolant supply to the EGR cooler. The EGR cooler outlet connects to the coolant rail, located on the RH side of the engine. The coolant rail is connected between the thermal control module and the coolant pump rear housing.

For additional information, refer to: [Engine Cooling](#) (303-03A Engine Cooling - I6 3.2L Petrol, Description and Operation).

The EGR is controlled by the ECM, and is enabled when the engine meets the correct operating temperatures and under cruising conditions.

Oil Separator



E135014

The crankcase ventilation oil separator is also connected to the oil filler tube, located at the rear LH side of the engine. Oil for replenishing the system passes through the oil separator and return hose, and into the oil pan. An oil baffle plate is installed in the oil pan housing to reduce oil aeration and splash.

Engine Emission Control - TD4 2.2L Diesel - Engine Emission Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the engine emission control systems, refer to the relevant Description and Operation section in the workshop manual.

REFER to: [Engine Emission Control](#) (303-08B Engine Emission Control - TD4 2.2L Diesel, 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 tested and/or the donor vehicle.

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

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> ● EGR valve ● EGR pipes/hoses ● Vacuum system ● Engine breather system 	<ul style="list-style-type: none"> ● Wiring harness ● Electrical connector(s) ● Fuses(s)

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 Cause	Action
Rough idle, lack of power under acceleration, excessive fuel consumption, excessive black smoke	<ul style="list-style-type: none"> ● EGR valve stuck 	Check EGR valve for correct operation. Check for related DTCs and refer to the DTC Index
Excessive engine blow-by/crankcase pressure	<ul style="list-style-type: none"> ● Engine breather system blocked/restricted ● Excessive engine wear 	Check engine breather system for blockage/restriction. Check for excessive engine wear REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).

DTC Index

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 five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE: When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM 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 DTCs 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.


DTC	Description	Possible Cause	Action
P040500	Exhaust Gas Recirculation Sensor A Circuit Low	<ul style="list-style-type: none"> ● EGR Valve position sensor voltage below lower limit 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P040600	Exhaust Gas Recirculation Sensor A Circuit High	<ul style="list-style-type: none"> ● EGR Valve position sensor voltage above upper limit 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
P042E00	Exhaust Gas Recirculation Control Stuck Open	<ul style="list-style-type: none"> EGR Valve stuck during normal engine running - attempt to unstick valve unsuccessful 	Check/clear EGR valve from obstruction/sticking
P042F00	Exhaust Gas Recirculation Control Stuck Closed	<ul style="list-style-type: none"> EGR Valve stuck during normal engine running - attempt to unstick valve unsuccessful EGR Valve stuck during after run tests 	Check/clear EGR valve from obstruction/sticking
P048900	Exhaust Gas Recirculation Control Circuit Low	<ul style="list-style-type: none"> EGR Valve position deviation - valve stuck open 	Check/clear EGR valve from obstruction/sticking
P049000	Exhaust Gas Recirculation Control Circuit High	<ul style="list-style-type: none"> EGR Valve position deviation - valve stuck closed 	Check/clear EGR valve from obstruction/sticking
P140200	Exhaust Gas Recirculation Metering Orifice Restricted	<ul style="list-style-type: none"> EGR valve closed position offset difference with first learning too large EGR valve closed position offset difference with previous learning too large 	Check/clear EGR valve from obstruction/sticking, clear DTC and re-test. If DTC remains, install new EGR valve
P148700	Exhaust Gas Recirculation Check Solenoid Circuit	<ul style="list-style-type: none"> EGR valve H-Bridge driver error 	Clear the DTC and re-test. If the DTC remains, install a new ECM
P154500	Exhaust Gas Recirculation High Side Control Circuit / Open	<ul style="list-style-type: none"> Exhaust gas recirculation control circuit 1 (positive) - open circuit Exhaust gas recirculation control circuit 2 (negative) - open circuit 	Refer to electrical circuit diagrams and check exhaust gas recirculation control circuit for open circuit
P154611	Exhaust Gas Recirculation High Side Control Circuit Low	<ul style="list-style-type: none"> Exhaust gas recirculation control circuit 1 (positive) - short to ground Exhaust gas recirculation control circuit 2 (negative) - short to ground 	Refer to electrical circuit diagrams and check exhaust gas recirculation control circuit for short to ground
P154712	Exhaust Gas Recirculation High Side Control Circuit High	<ul style="list-style-type: none"> Exhaust gas recirculation control circuit 1 (positive) - short to power Exhaust gas recirculation control circuit 2 (negative) - short to power 	Refer to electrical circuit diagrams and check exhaust gas recirculation control circuit for short to power

Engine Emission Control - TD4 2.2L Diesel - Exhaust Gas Recirculation (EGR) Valve

Removal and Installation

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Remove the EGR cooler.

Refer to: [Exhaust Gas Recirculation \(EGR\) Cooler](#) (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

Installation

1. Install the EGR cooler.

Refer to: [Exhaust Gas Recirculation \(EGR\) Cooler](#) (303-08B Engine Emission Control - TD4 2.2L Diesel, Removal and Installation).

Engine Emission Control - TD4 2.2L Diesel - Exhaust Gas Recirculation (EGR) Cooler

Removal and Installation

Removal

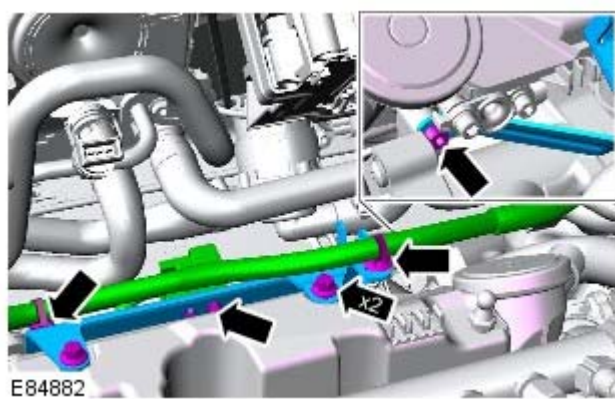
1. Remove the secondary bulkhead centre panel.

Refer to: [Secondary Bulkhead Center Panel - TD4 2.2L Diesel](#) (501-02 Front End Body Panels, Removal and Installation).

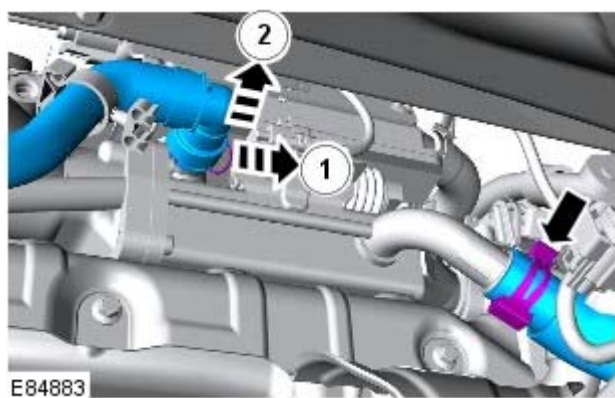
2. Remove the heated oxygen sensor (HO2S).

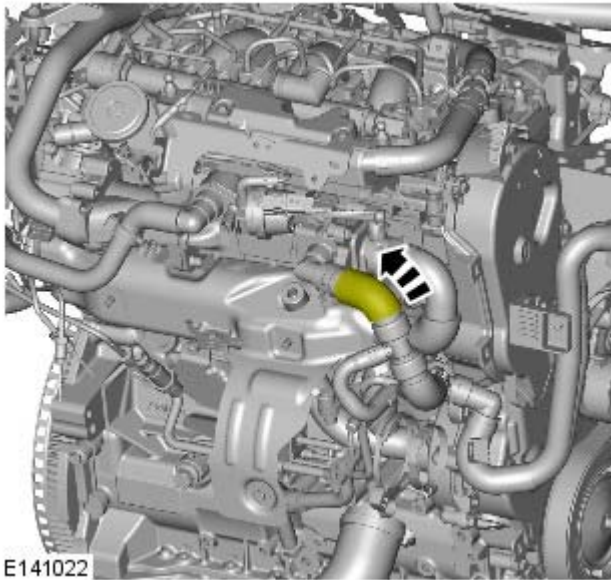
Refer to: [Heated Oxygen Sensor \(HO2S\)](#) (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).

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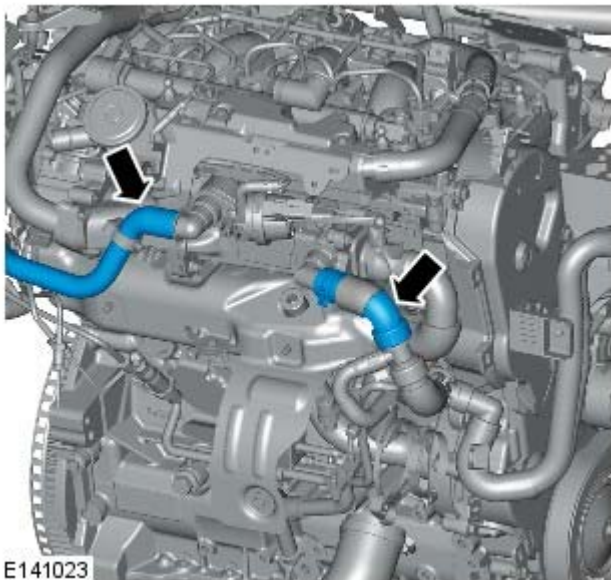


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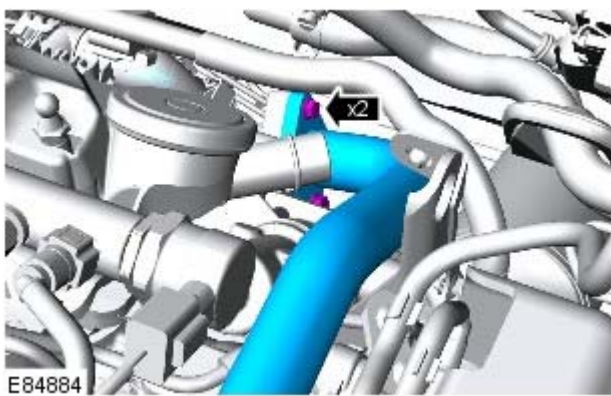




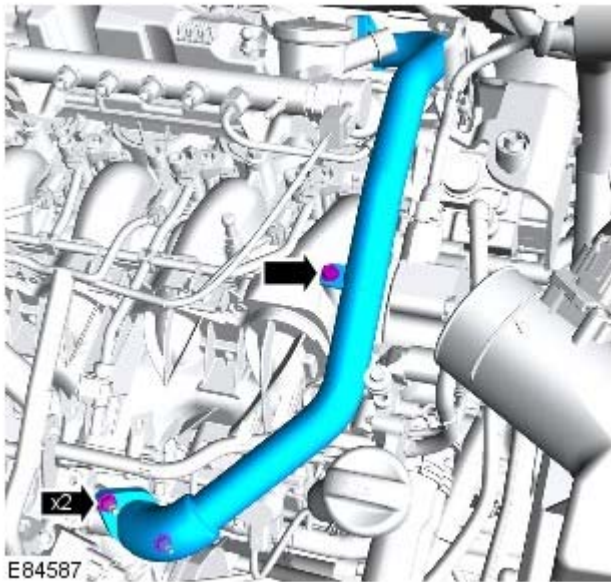
5. Displace heat shield as shown.



6. Clamp the coolant hoses in the locations shown to minimise coolant loss.



7.

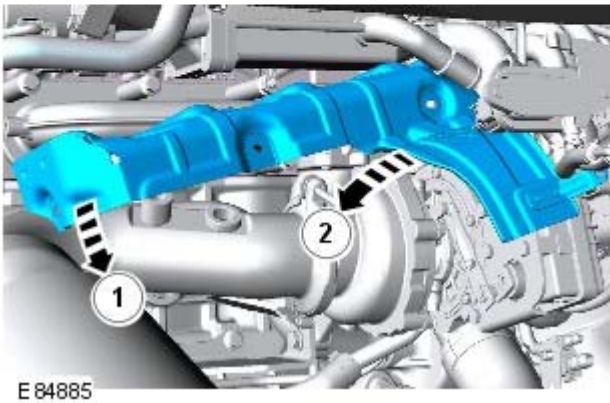
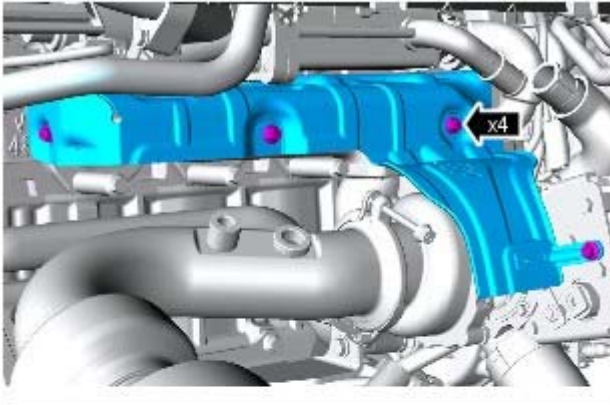


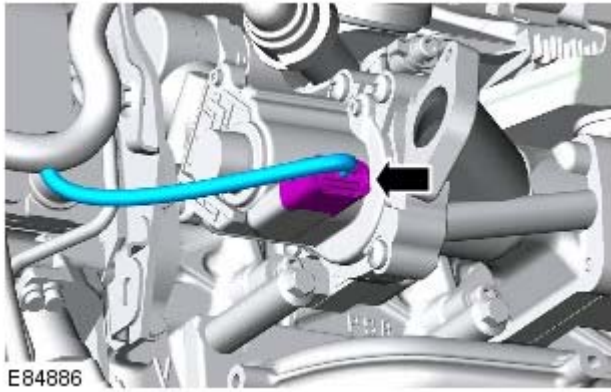
8. CAUTIONS:

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

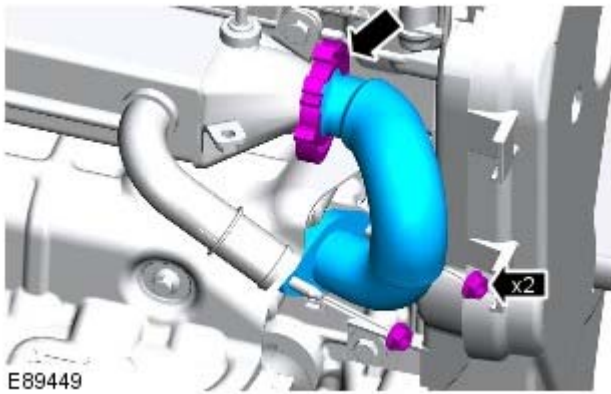
 Discard the component.

9.

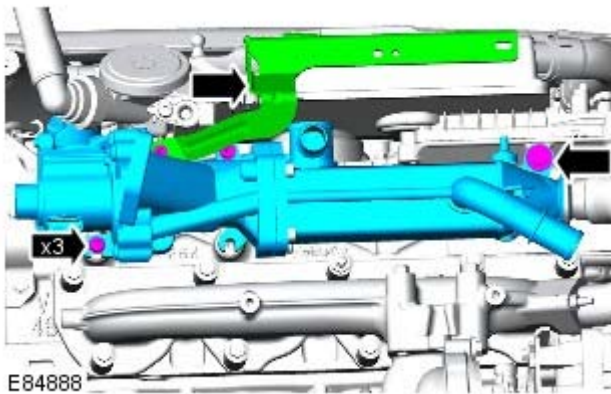




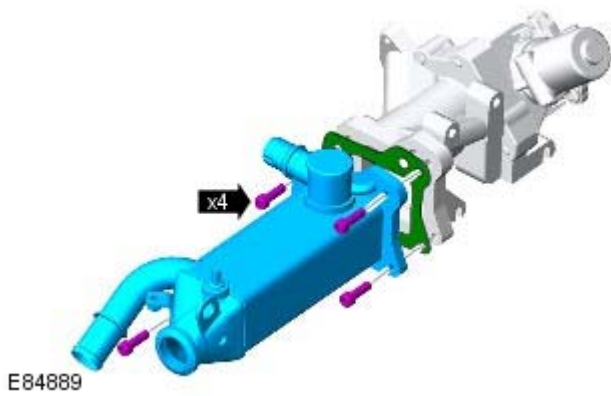
10.



11.  CAUTION: Discard the components.




12.



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

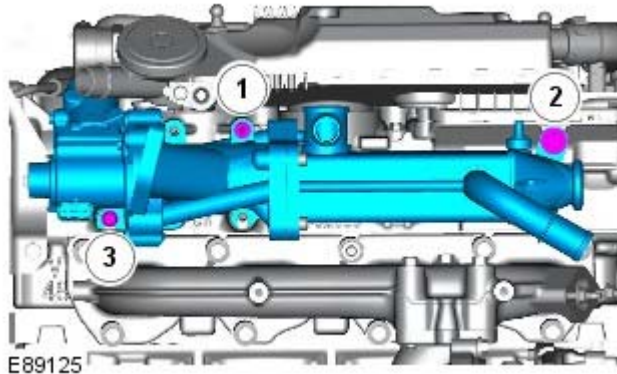
NOTE: Discard the gasket.

Installation

1.  **CAUTION:** Make sure that the component is clean, free of foreign material and lubricant.

Install the EGR valve.

Torque: 10 Nm



2.

- Install the EGR cooler.
- Install the nuts and bolt, but do not fully tighten at this stage.
- Tighten the nuts in the sequence shown.

Torque: 6 Nm

- Tighten the bolt in the sequence shown.

Torque: 10 Nm

3. Connect the EGR valve electrical connector.

4. Install the exhaust manifold heat shield.

Torque: 10 Nm

5. **CAUTIONS:**



Make sure that the component is clean, free of foreign material and lubricant.



Make sure that new components are installed.

Install the EGR cooler to exhaust manifold elbow.

Torque: 10 Nm

6. **CAUTIONS:**



Make sure that the component is clean, free of foreign material and lubricant.



Make sure that a new component is installed.

Install the cooler to inlet manifold EGR pipe.

Torque: 10 Nm

7. Connect the coolant hoses and secure with the clips.

8. Remove the coolant hose clamps.

9. Install the HO2S wiring harness bracket.

Torque: 8 Nm

10. Install the HO2S.

Refer to: [Heated Oxygen Sensor \(HO2S\)](#) (303-14B Electronic Engine Controls - TD4 2.2L Diesel, Removal and Installation).

11. Install the secondary bulkhead centre panel.

Refer to: [Secondary Bulkhead Center Panel - TD4 2.2L Diesel](#) (501-02 Front End Body Panels, Removal and Installation).

12. Check and top-up the coolant.

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Engine Emission Control - TD4 2.2L Diesel - Crankcase Vent Oil Separator

Removal and Installation

Removal

CAUTIONS:



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



Make sure that the area around the component is clean and free of foreign material.

1. Disconnect the battery ground cable.

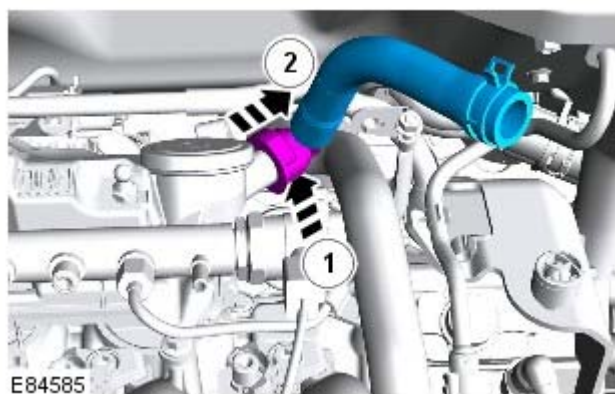
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

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

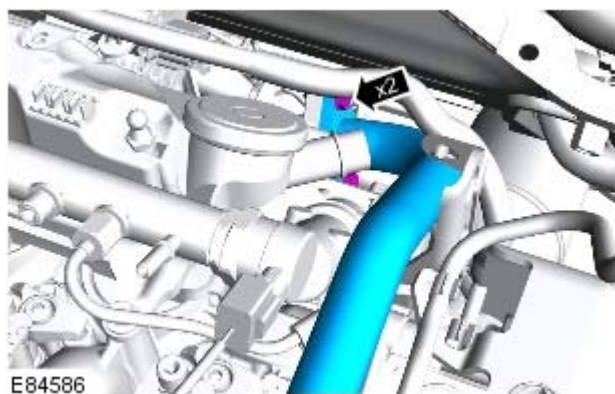
Raise and support the vehicle.

3. Remove the throttle body.

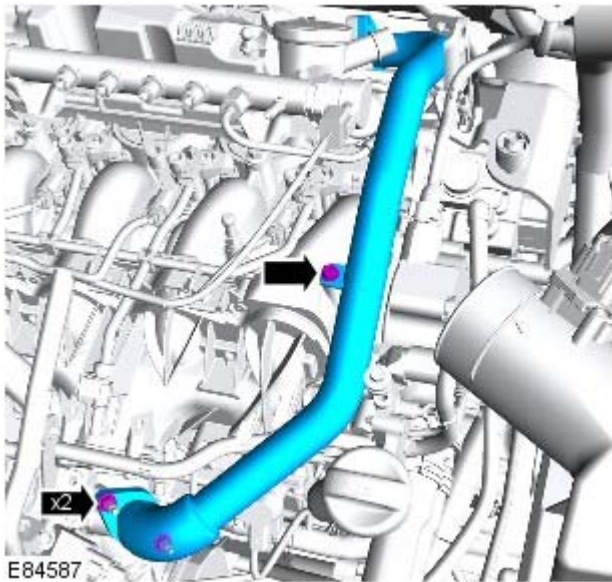
Refer to: [Throttle Body](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).



- 4.



- 5.



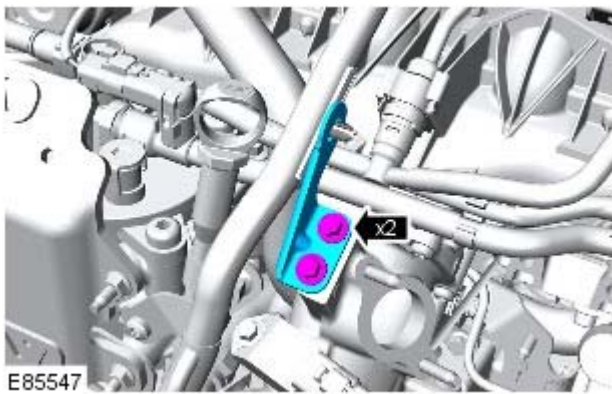
6. CAUTIONS:



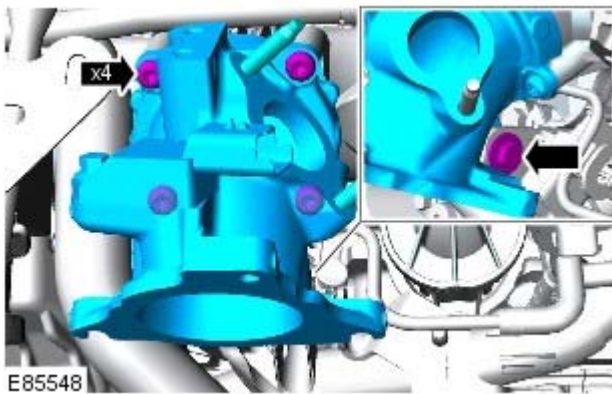
Discard the component.



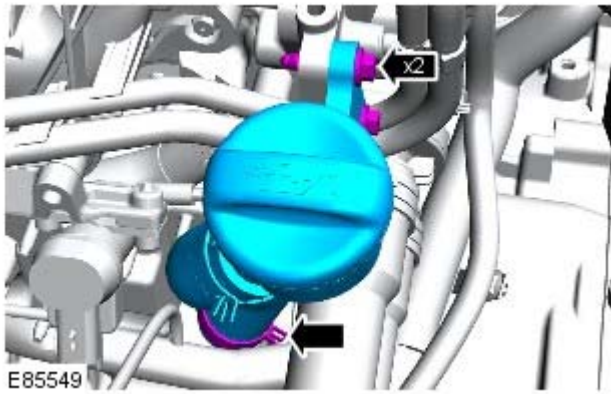
Make sure that all openings are sealed.



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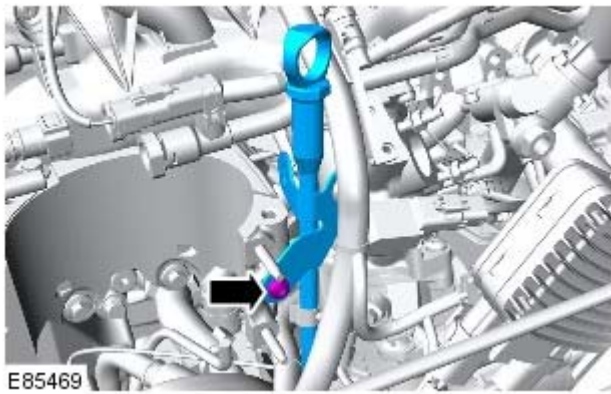
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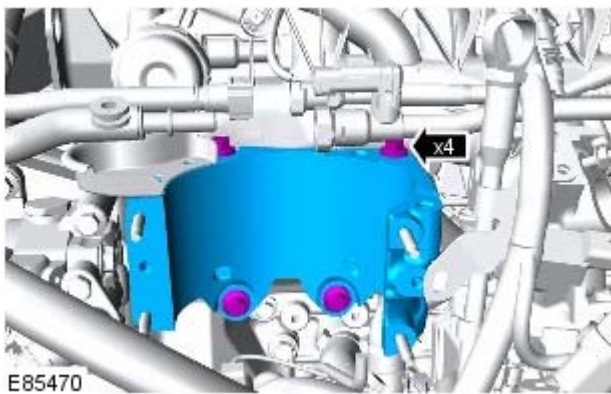
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10. Remove the fuel filter.

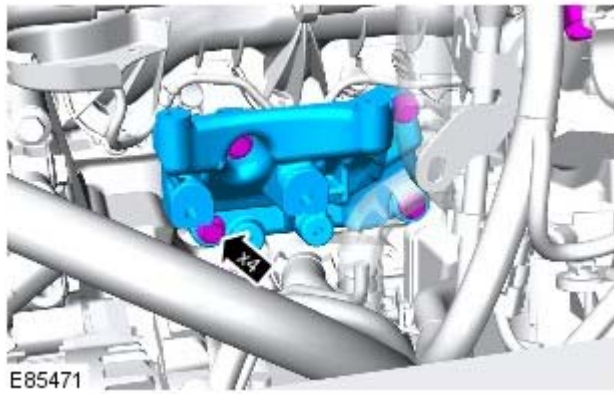
Refer to: [Fuel Filter](#) (310-01B Fuel Tank and Lines - TD4 2.2L Diesel, Removal and Installation).



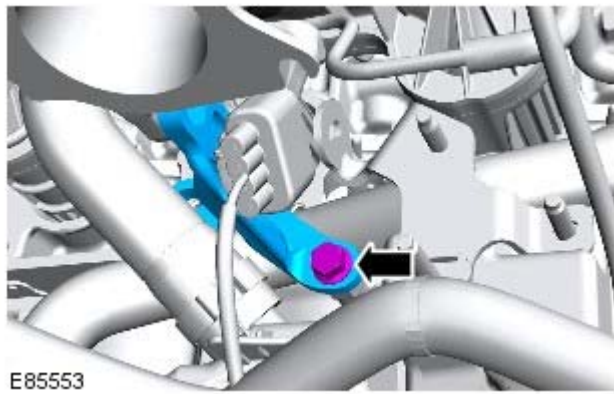
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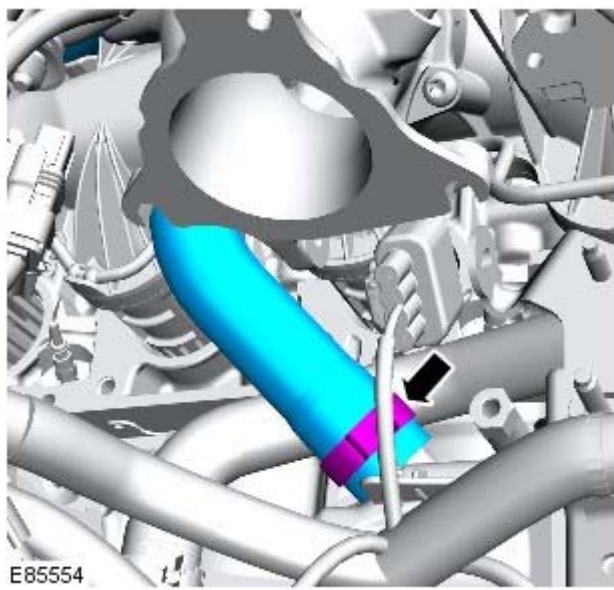
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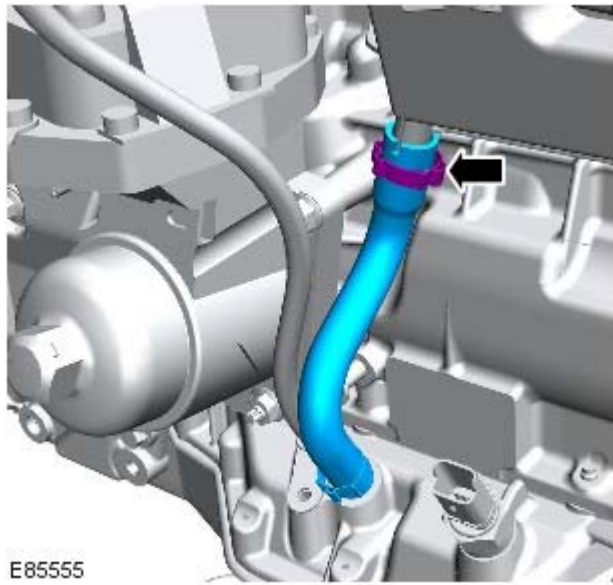
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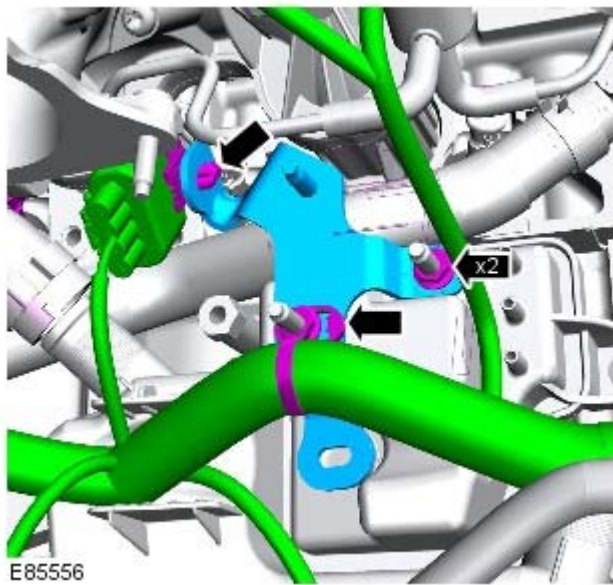
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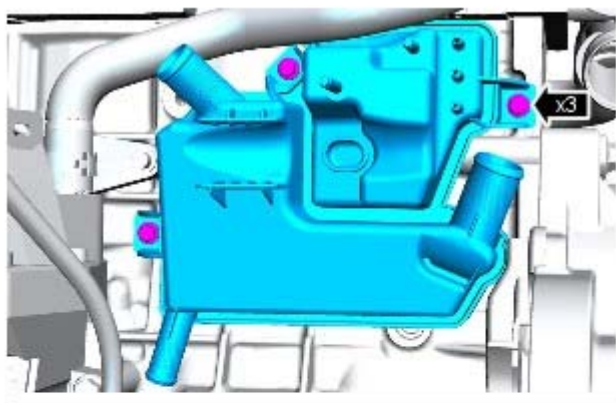


16.




17.

18.



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Installation

1.  **CAUTION:** A new O-ring seal is to be installed.
Install the crankcase vent oil separator.

Torque: 10 Nm
2. Install the crankcase vent oil separator, wiring harness bracket.

Torque: 10 Nm
3. **NOTE:** Install new retaining clips.
Connect the crankcase vent hoses.
4. Install the crankcase vent oil separator to cylinder block, bracket.

Torque:
M6 10 Nm
M8 25 Nm
5. Install the fuel filter brackets.

Torque: 25 Nm
6. Attach the oil level indicator tube.

Torque: 10 Nm

7. Install the fuel filter.

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

8. **NOTE:** Install a new retaining clip.

Install the engine oil filler tube.

Torque: 10 Nm

9. Install the intake manifold adaptor.

Torque: 6 Nm

10. Install the intake manifold adaptor, wiring harness bracket.

Torque: 10 Nm

11. **CAUTIONS:**



"Make sure that a new component is installed. "



Make sure that the mating faces are clean and free of foreign material.

Install the EGR pipe.

Torque: 10 Nm

12. Install the breather line.

13. Install the throttle body.

Refer to: [Throttle Body](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

14. Connect the battery ground cable.

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

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Engine Emission Control - TD4 2.2L Diesel - Valve Cover Vent Oil Separator

Removal and Installation

Removal

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).

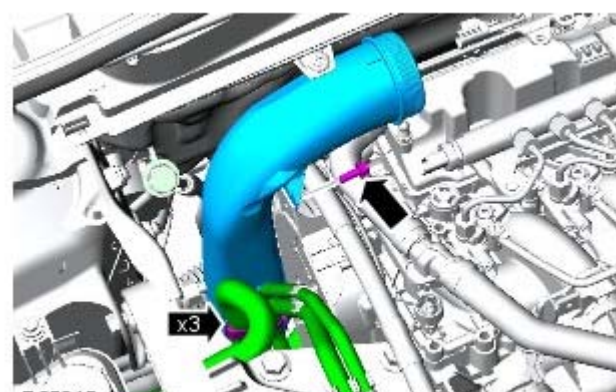
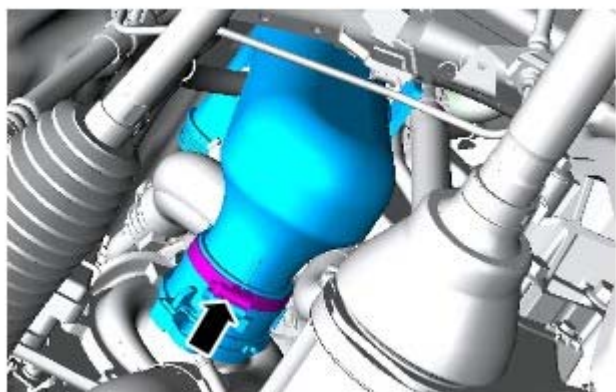
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

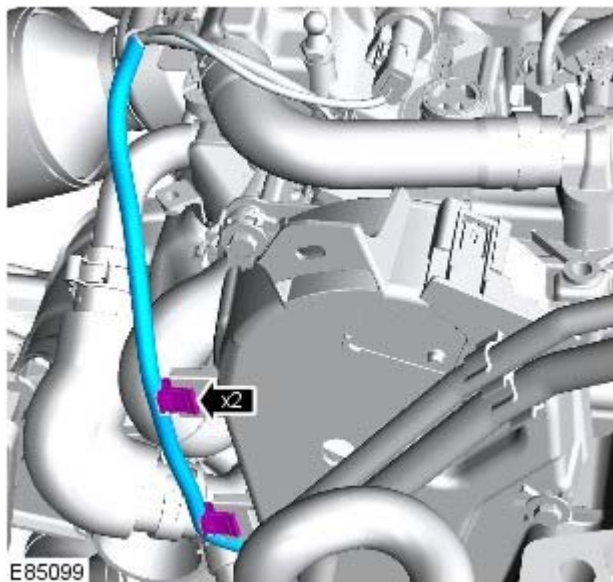
3. Remove the fuel rail.

Refer to: [Fuel Rail](#) (303-04B Fuel Charging and Controls - TD4 2.2L Diesel, Removal and Installation).

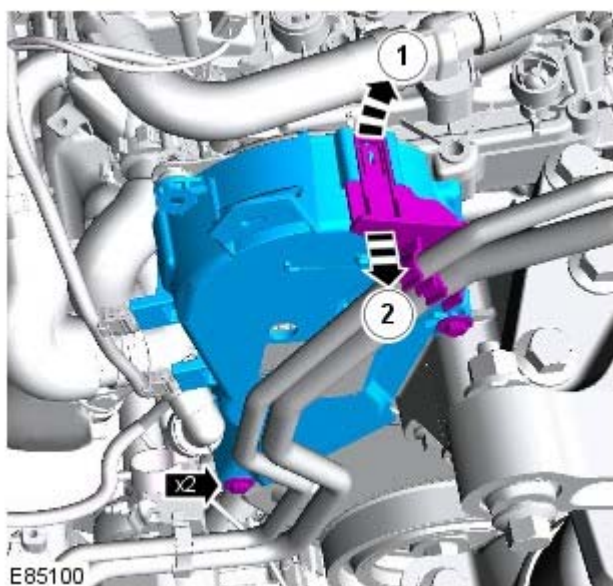
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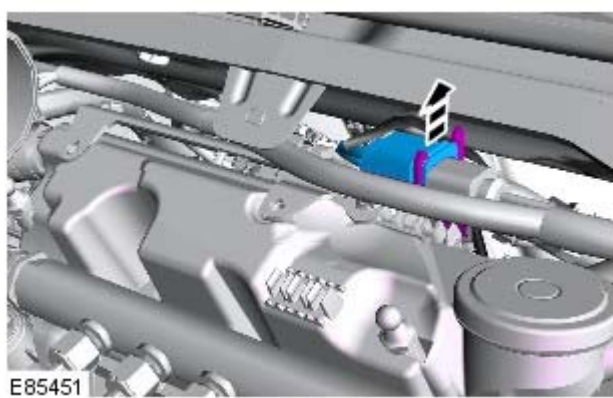
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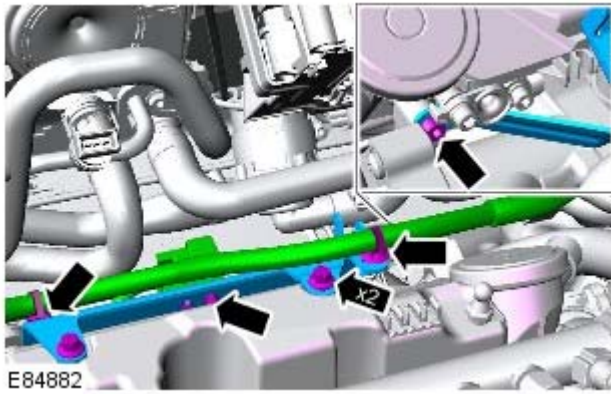


6. Torque: 6 Nm

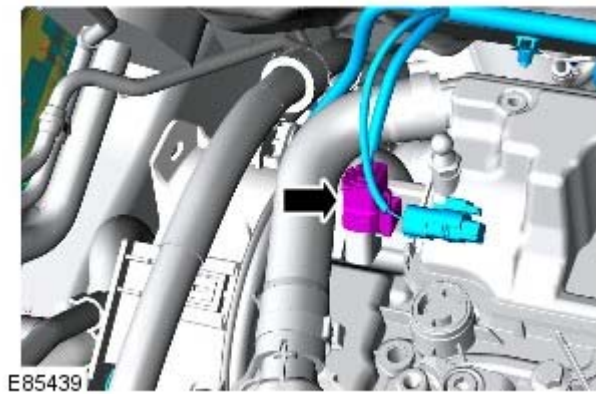


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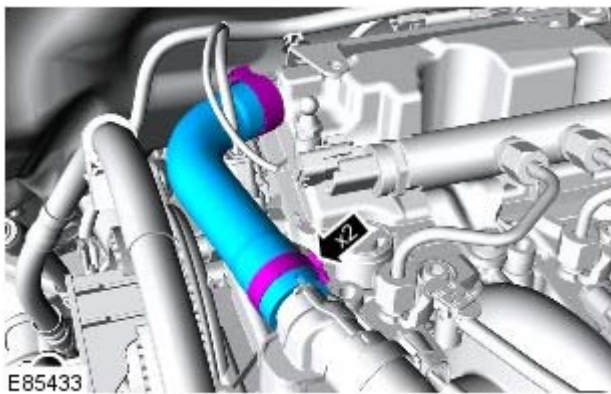




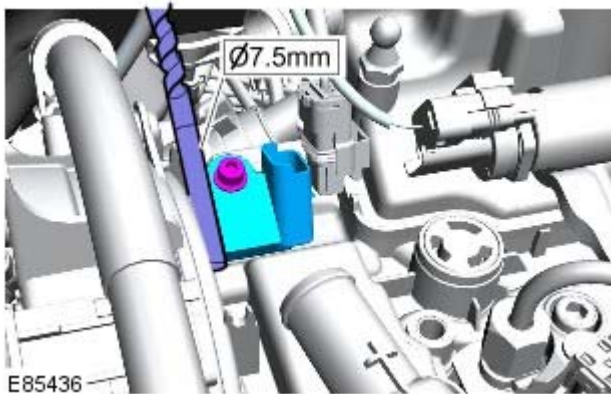
8. Torque: 8 Nm




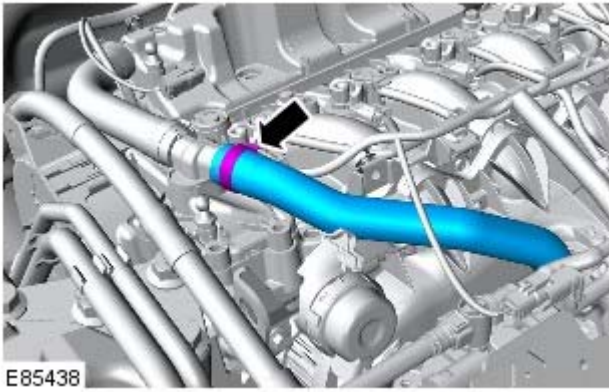
9.



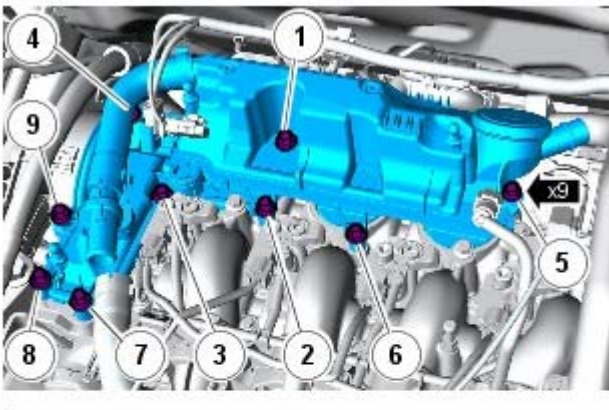
10. Remove and discard the hose clips.



11.  **CAUTION:** Incorrect installation of the camshaft position (CMP) sensor could result in engine damage.
- Insert a 7.5 mm diameter drill between the valve cover and the CMP sensor as shown, to achieve the correct alignment of the CMP sensor.
 - Torque: 4 Nm



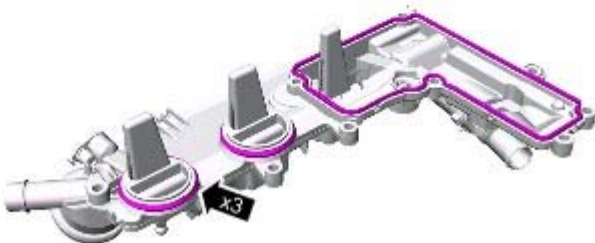
12. Remove and discard the hose clip.



13.  **CAUTION:** Tighten the bolts in the sequence shown.


NOTE: Remove and discard the O-ring seals.

Torque: 9 Nm



E 85440

Installation

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

To install, reverse the removal procedure.