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Evaporative Emissions -

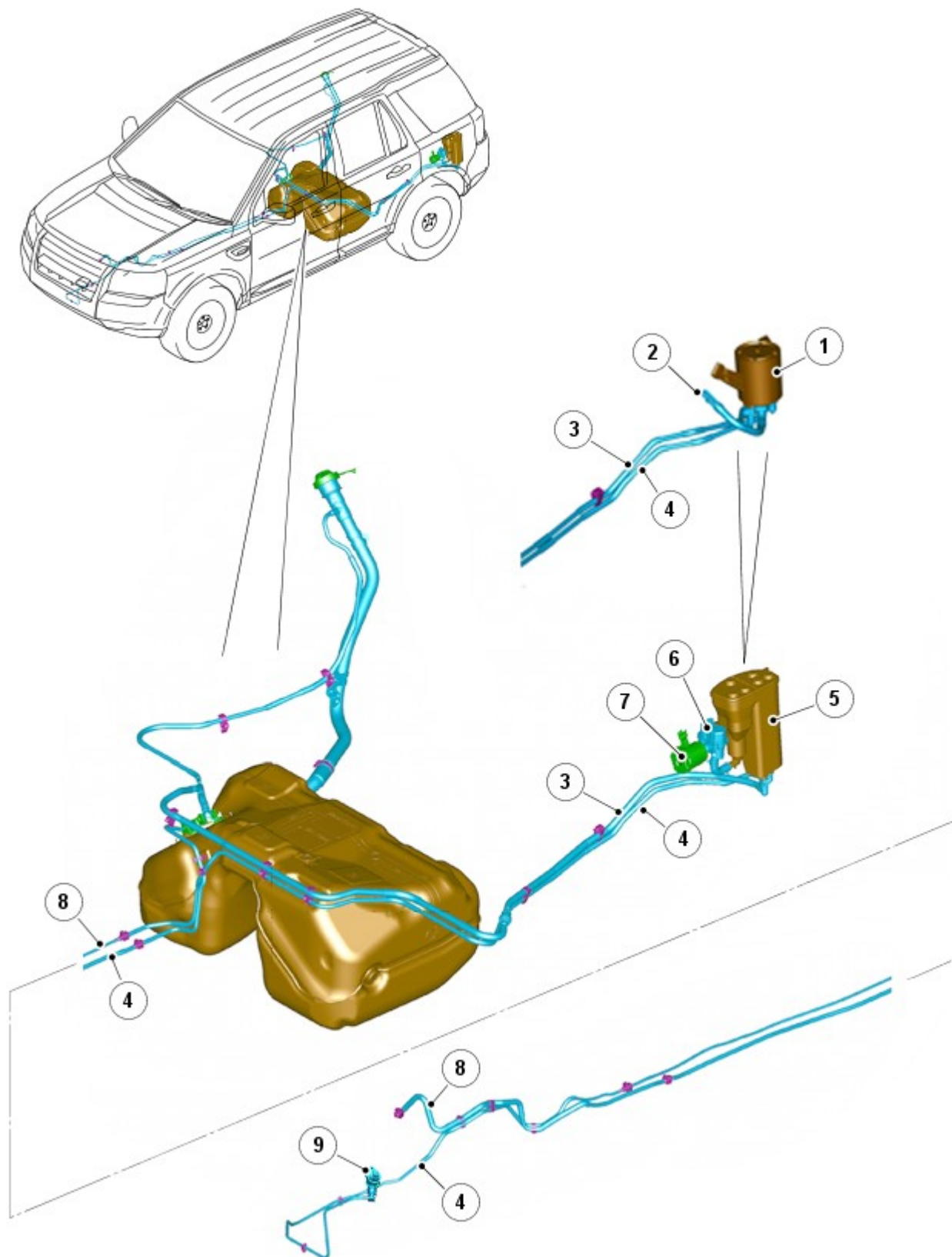
Torque Specifications

Description	Nm	lb-ft
Evaporative emissions canister bolts	10	7
Evaporative emissions canister pipe nuts	10	7
Fuel tank leakage monitoring pump filter	10	7
Fuel tank leakage monitoring pump	10	7

Evaporative Emissions - Evaporative Emissions

Description and Operation

COMPONENT LOCATION



E79501

Item	Part Number	Description
1	-	Evaporative emission canister - Rest Of World (ROW) derivative
2	-	Vent pipe and filter

3	Vapor pipe to evaporative emission canister
4	Vapor purge pipe to intake manifold
5	Evaporative emission canister - North American Specification (NAS) derivative
6	Fuel tank leakage monitoring pump
7	Fuel tank leakage monitoring pump filter
8	Fuel delivery pipe to engine
9	Evaporative emission canister purge valve

OVERVIEW

The evaporative emission (EVAP) control system reduces the level of hydrocarbons released into the atmosphere by fuel vapor venting from the fuel tank. The system comprises a charcoal canister, purge valve and interconnecting vent pipes and hoses.

Fuel vapor is generated by the fuel in the tank and the amount of vapor produced increases as the fuel heats up. Fuel vapor can flow freely to the charcoal canister via the tank venting system. The venting system consists of roll over valves and a liquid vapor separator mounted internally in the tank and then externally via a breather line. The breather line allows the fuel vapor to flow to the charcoal canister.

On NAS vehicles the vapor generated in the fuel tank during refueling flows without restriction to the charcoal canister.

On all vehicles except NAS, the vapor is restricted in its path to the charcoal canister but can flow freely during the refueling operation to atmosphere, via the filler opening.

The vapor passes into the charcoal canister where it is absorbed and stored by the charcoal. Because there is a limit to the amount of vapor the canister can contain, the fuel vapor is purged from the canister when the engine is running and burned in the engine.

PRINCIPLES OF OPERATION

Charcoal Canister

The charcoal canister contains a bed of activated charcoal or carbon. The charcoal is produced using special manufacturing techniques to treat the charcoal with oxygen. The oxygen treatment opens up millions of pores between the carbon atoms resulting in a highly porous charcoal with a very large effective surface area which is capable of absorbing large quantities of fuel vapor. Once treated the charcoal is known as 'activated' carbon or charcoal. The charcoal canister on NAS vehicles uses a higher grade charcoal to meet the requirements of the emission regulations.

On-board Refueling Vapor Recovery

To meet On-board Refueling Vapor Recovery (ORVR) requirements, the fuel tank and associated components are designed to minimize fuel vapor loss during refueling. This is achieved by preventing fuel vapor from the fuel tank venting directly to the atmosphere. Instead fuel vapor is directed into the Evaporative Emission (EVAP) canister where it is stored before being purged at intervals into the engine's intake manifold.

During vehicle refueling the narrow fuel-filler-tube below the fuel-dispenser nozzle region, provides a liquid seal against the escape of vapor. A check valve also located in the filler-tube opens to incoming fuel to prevent splash back.

As the fuel tank fills, fuel vapor is routed to the EVAP canister's charcoal filter, where it is absorbed by the charcoal's activated granules. The hydrocarbons from the fuel vapor are retained within the canister, allowing only purified air to be released to atmosphere through the canister's vent pipe. The hydrocarbons stored in the canister are purged at intervals into the engine for combustion.

The EVAP canister purge valve is located in the engine compartment. The Engine Control Module (ECM) operates the valve to purge fuel vapor from the EVAP canister into the engine for combustion. Purge rates (the extent that the purge valve opens) are determined by the engine operating conditions. The purge rates are adjusted to maintain vehicle driving characteristics and exhaust emissions at optimum levels. Engine operating conditions that affect the purge rate are:

- speed and load,
- engine coolant temperature,
- time from engine start-up,
- closed loop fueling

Owing to the limited storage-volume of the EVAP canister:

- NAS derivative - 2.5 liter
- ROW derivative - 0.7 liter

the charcoal filter is continually regenerated.

Regeneration is achieved when the engine is running, by drawing air through the EVAP canister, via the vent pipe, into the engine for combustion.

Fuel Tank Leakage Monitoring

Fuel tank leakage monitoring is a legislative requirement for NAS vehicles. The monitoring system periodically checks the EVAP system and fuel tank for leaks when the ignition is off.

The monitoring system comprises the previously described components of the EVAP system with the following additional components:

- air pump, and
- dust filter

The pump is connected to the vent pipe of the EVAP canister and incorporates:

- a Positive Temperature Coefficient (PTC) heating element,
- change over valve, and
- a reference orifice

The pump is only operated when the ignition is 'off' and as controlled by the ECM. The ECM also monitors the pump operation and the change over valve for faults. The dust filter protects the pump from the ingress of moisture and foreign particles.

The fuel tank leakage monitoring test is performed if the following factors are present:

- the engine has been operating for at least 10 minutes and is now at rest,
- the fuel in the tank is between 15 and 85 percent volume,
- the ambient temperature is above 0°C (32°F) and less than 40°C (104°F),
- the engine has not been started for at least 3 hours prior to its last operation

The pump is operated to pressurize the fuel tank and the electrical current used to operate the pump is measured with the change-over valve in different states. A comparison of the current draw in each state indicates the degree of any fuel vapor leak; if appropriate the ECM records the appropriate Diagnostic Trouble Code (DTC).

Evaporative Emissions - Evaporative Emissions

Diagnosis and Testing

Principles of Operation

For a detailed description of the evaporative emissions system, refer to the relevant Description and Operation section in the workshop manual.

REFER to: [Evaporative Emissions](#) (303-13 Evaporative Emissions, 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"> Fuel filler cap and seal Fuel filler neck Diagnostic Monitoring of Tank Leakage (DMTL) fresh air filter (restriction, etc) Fuel tank (leaks, damage, etc) Fuel lines and joints, etc Carbon canister Purge valve DMTL pump module 	<ul style="list-style-type: none"> Fuses Connectors Harnesses Purge valve DMTL pump

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.
5. **NOTE:** On all vehicles equipped with Diagnostic Monitor Tank Leakage (DMTL), there is a requirement to blank off the ventilation port (large diameter stub pipe) of the DMTL module, to prevent mis-diagnosis when carrying out a smoke test.

Where K-Line, Vacutec or other proprietary smoke test equipment is available, it should be utilised to assist with Evaporative Emissions System leak diagnosis.

Symptom Chart

Symptom	Possible Cause	Action
Difficulty in filling fuel tank	<ul style="list-style-type: none"> Restriction in the vapor line between the fuel tank and the carbon canister outlet/atmospheric port 	Check for restrictions/damage, etc (see visual inspection)
Fuel smell	<ul style="list-style-type: none"> System leak Purge valve inoperative 	Check for leaks, check the purge valve operation. GO to Pinpoint Test A .
'Check Fuel Filler Cap' displayed on Message Center	<ul style="list-style-type: none"> Fuel filler cap missing/not tightened after refuelling 	Check the fuel filler cap and seal

DTC Index

NOTE: If the module is suspect and the vehicle remains under the manufacturer warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

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 electrical 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: 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
P044100	Evaporative emission system - incorrect purge flow	<ul style="list-style-type: none"> Evaporative emission canister vent restricted Canister to purge valve pipe damaged/restricted The purge valve is stuck in the open or closed position 	Check the condition and installation of the evaporative emission system. Check the operation of the purge valve. Install new components as necessary
P044200	Evaporative emission system leak detected (small leak)	<ul style="list-style-type: none"> The dynamic monitoring of tank leakage (DMTL) system has detected a small leak in the evaporative emission system 	Carry out a check of the fuel system integrity using local equipment (Vacutec/K-Line, etc). Rectify as necessary
P044400	Evaporative emission system purge control valve circuit open	<ul style="list-style-type: none"> Purge valve circuit: open circuit Purge valve failure 	Check the purge valve and circuits. Refer to the electrical guides. Install a new valve as necessary
P044700	Evaporative emission system vent control circuit open	<ul style="list-style-type: none"> Evaporative emission system change-over valve (COV) circuit(s): open circuit Evaporative emission system change-over valve (COV) circuit(s): short circuit to ground Evaporative emission system change-over valve (COV) failure 	Check the COV and circuits. Refer to the electrical guides. Install a new valve as necessary (the COV is incorporated into the fuel tank leakage monitoring pump)
P044800	Evaporative emission system vent control circuit shorted	<ul style="list-style-type: none"> Evaporative emission system change-over valve (COV) circuit(s): short circuit to power Evaporative emission system change-over valve (COV) failure 	Check the COV and circuits. Refer to the electrical guides. Install a new valve as necessary (the COV is incorporated into the fuel tank leakage monitoring pump)
P045500	Evaporative emission system leak detected (gross leak/no flow)	<ul style="list-style-type: none"> Fuel filler cap not fitted Fuel filler cap seal missing Evaporative emission system leak, canister, pipework, etc Evaporative emission system change-over valve (COV) failure 	Check the fuel filler cap and seal condition and fitment. Carry out a check of the fuel system integrity using local equipment (Vacutec/K-Line, etc). Rectify as necessary
P045800	Evaporative emission system purge control valve circuit low	<ul style="list-style-type: none"> Purge valve circuit: short circuit to ground Purge valve circuit: open circuit Purge valve failure 	Check the purge valve and circuits. Refer to the electrical guides. Install a new valve as necessary
P045900	Evaporative emission system purge control valve circuit high	<ul style="list-style-type: none"> Purge valve circuit: short circuit to power Purge valve failure 	Check the purge valve and circuits. Refer to the electrical guides. Install a new valve as necessary
P240100	Evaporative emission system leak detection pump control circuit low	<ul style="list-style-type: none"> Fuel tank leakage monitoring pump control circuit: short circuit to ground Fuel tank leakage monitoring pump control circuit: open circuit Fuel tank leakage monitoring pump failure 	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary
P240200	Evaporative emission system leak detection pump control circuit high	<ul style="list-style-type: none"> Fuel tank leakage monitoring pump control circuit: short circuit to power Fuel tank leakage monitoring pump failure 	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary
P240500	Evaporative emission system leak detection pump sense circuit low	<ul style="list-style-type: none"> Fuel tank leakage monitoring pump sense circuit: short circuit to ground Fuel tank leakage monitoring pump sense circuit: open circuit Fuel tank leakage monitoring pump failure 	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary
P240600	Evaporative emission system leak detection pump sense circuit high	<ul style="list-style-type: none"> Fuel tank leakage monitoring pump sense circuit: short circuit to power Fuel tank leakage monitoring pump failure 	Check the fuel tank leakage monitoring pump and circuits. Refer to the electrical guides. Install a new pump as necessary
PINPOINT TEST A : EVAPORATIVE SYSTEM INCORRECT PURGE FLOW			

Pinpoint Tests

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FUEL FILLER CAP INSTALLATION AND CONDITION OF CANISTER, PIPES AND CONNECTORS	
	1 Make sure that the fuel filler cap is correctly installed and tightened.
	2 Check the condition of the carbon canister.
	3 Check the condition of all accessible pipes and connectors in the vapor line.
	Are the canister and all pipes and connectors in good condition? Yes GO to A2. No REPAIR as necessary. CLEAR the DTC, test the system for normal operation.
A2: CHECK THAT THE PURGE VALVE IS OPERATING	
	1 Disconnect the vapor pipe from the inlet port of the evaporative purge valve.
	2 RUN the engine for 2 minutes, making sure that the engine reaches normal operating temperature.
	3 Check that the evaporative purge valve is operating, by touch or by sound (using a stethoscope, it will be possible to hear the valve operating).
	Is the valve operating? Yes CHECK for related DTCs. Refer to the DTC Index above. No CHECK for purge valve related DTCs and refer to DTC Index.

Evaporative Emissions - Evaporative Emission Canister


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).

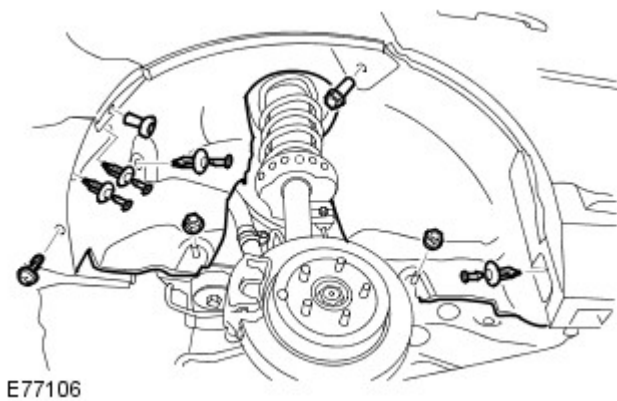
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

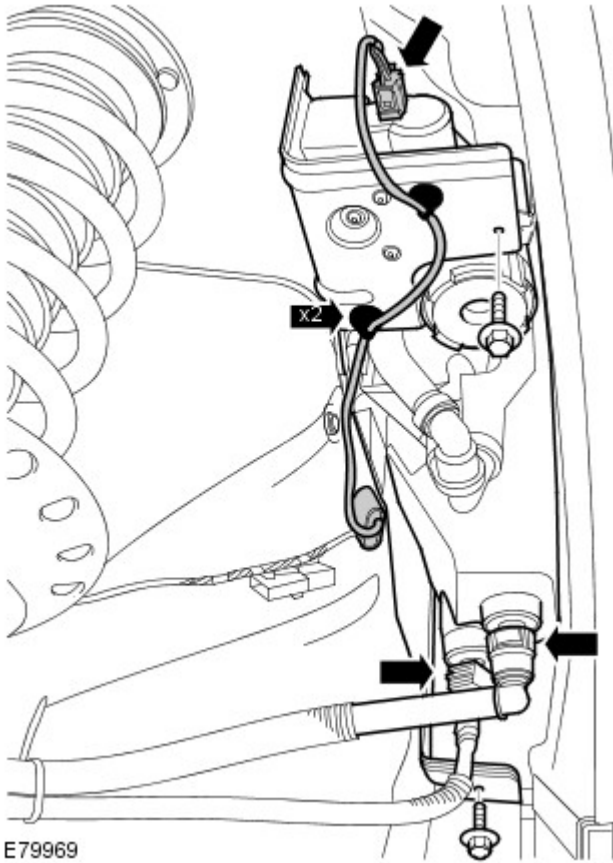
Raise and support the vehicle.

3. Remove the rear wheel.

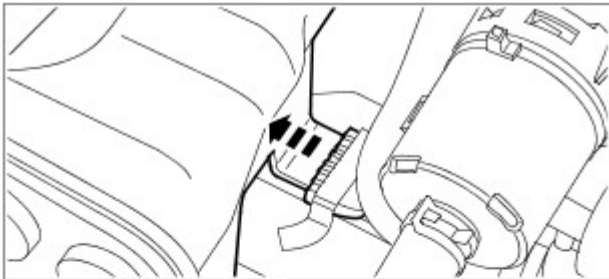
Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

- 4.

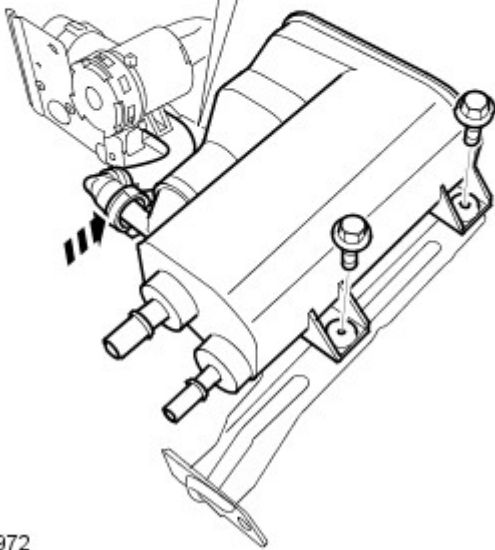




5. Torque: 10 Nm



6. Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.

Evaporative Emissions - Evaporative Emission Canister Purge Valve

Removal and Installation

Removal

NOTE: Take care not to disconnect the purge line from the rear of the intake manifold, when removing the purge valve.

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

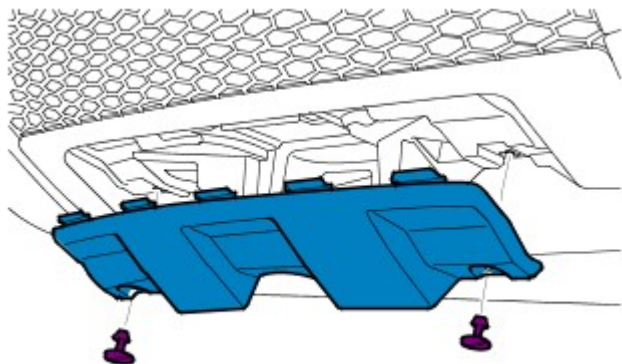
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the engine undershield.

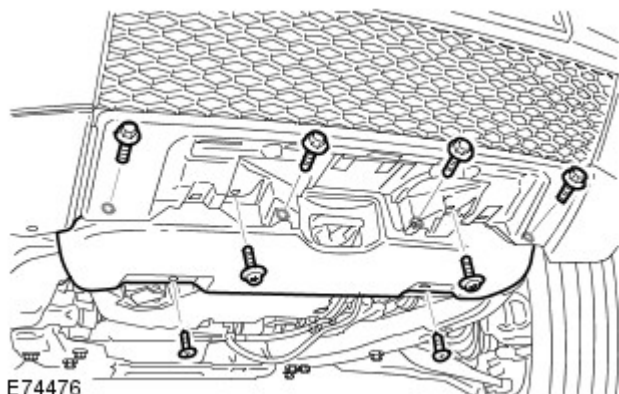
Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

3.



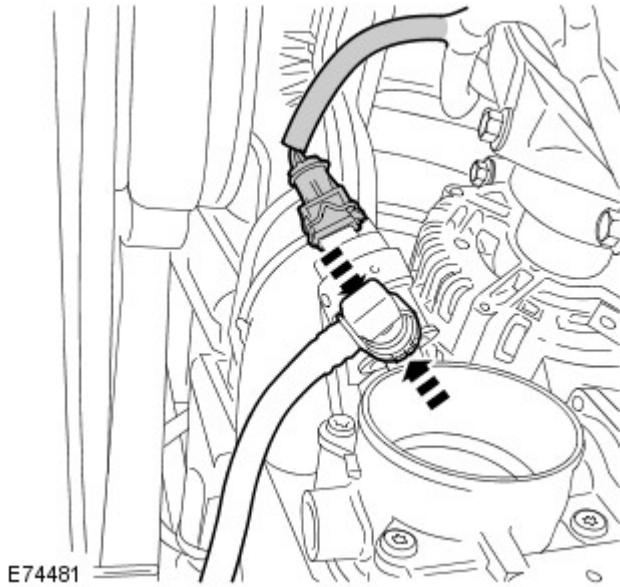
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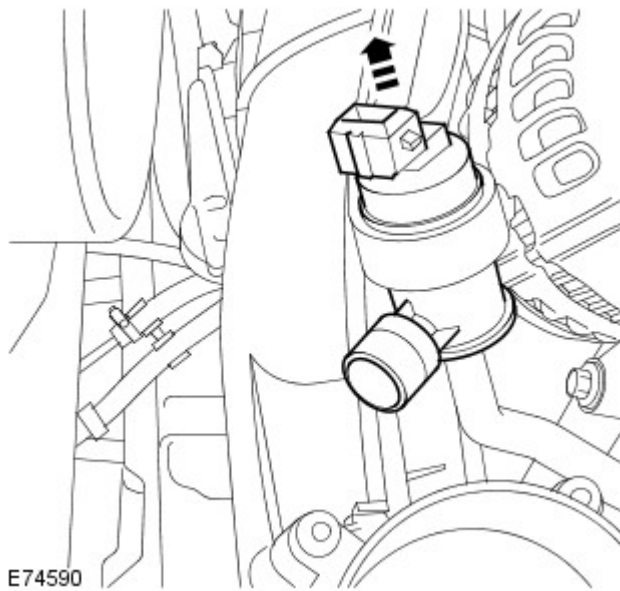


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5.



6.



7. Remove the clip.

Installation

1. To install, reverse the removal procedure.

Evaporative Emissions - Fuel Tank Leakage Monitoring Pump Filter


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).

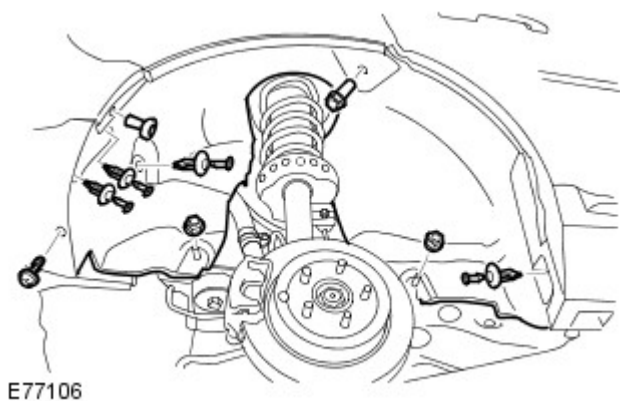
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

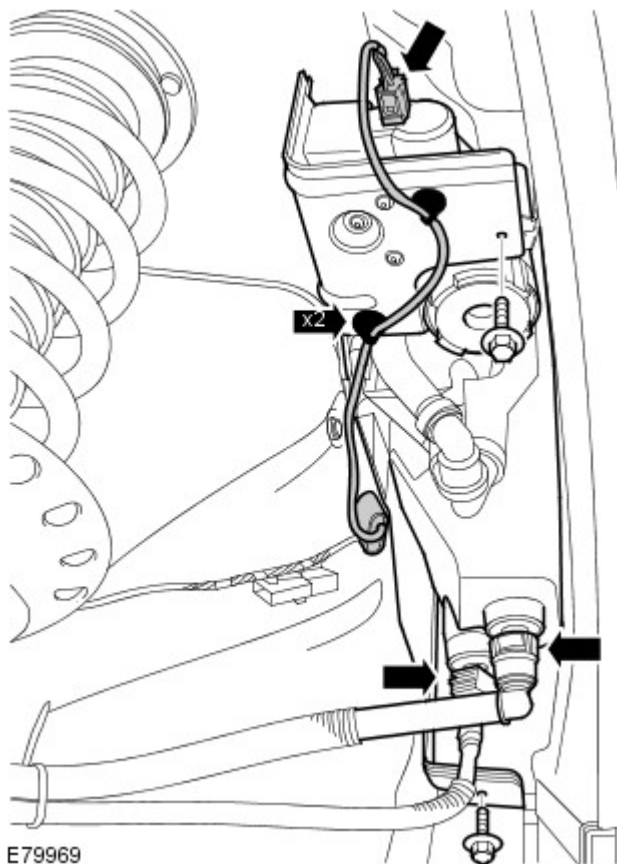
Raise and support the vehicle.

3. Remove the rear wheel.

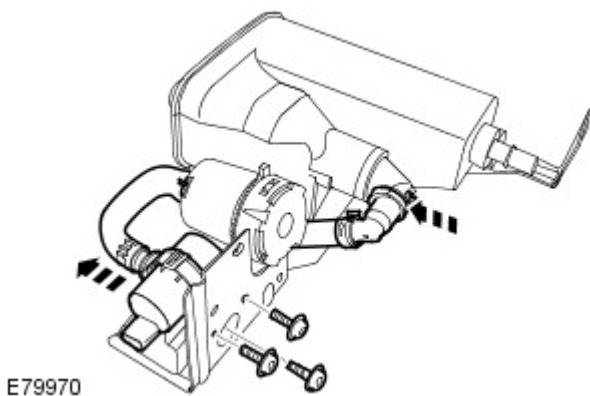
Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

- 4.





5. Torque: 10 Nm



6.

Installation

1. To install, reverse the removal procedure.

Evaporative Emissions - Fuel Tank Leakage Monitoring Pump


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).

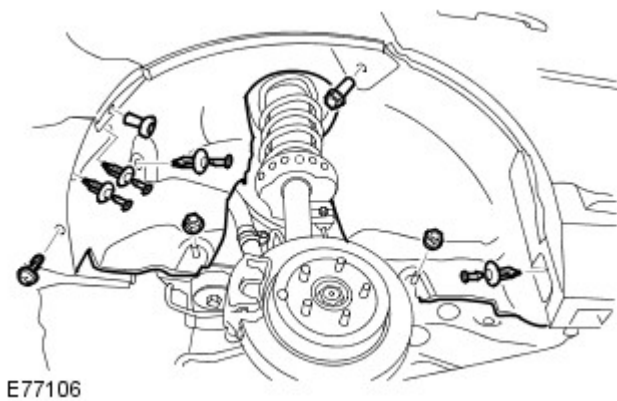
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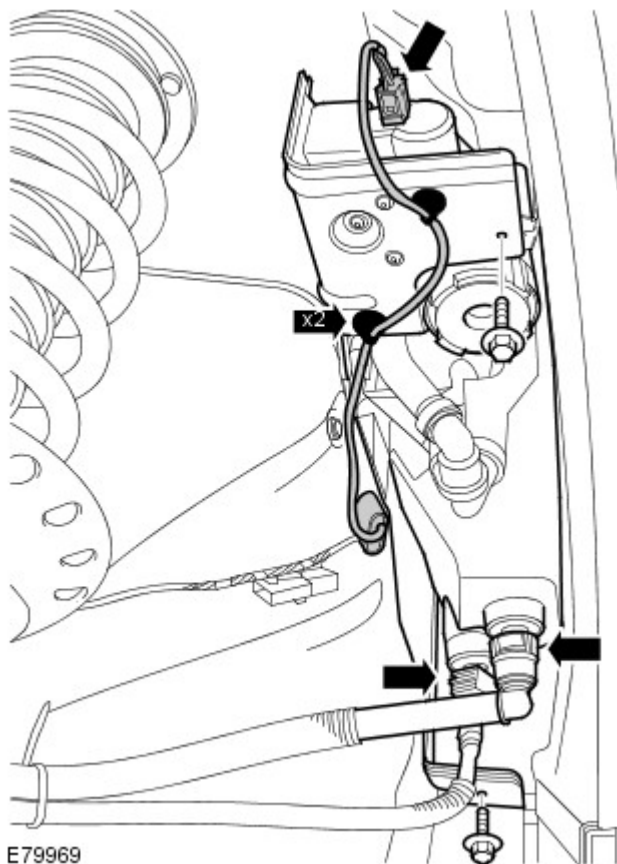
Raise and support the vehicle.

3. Remove the rear wheel.

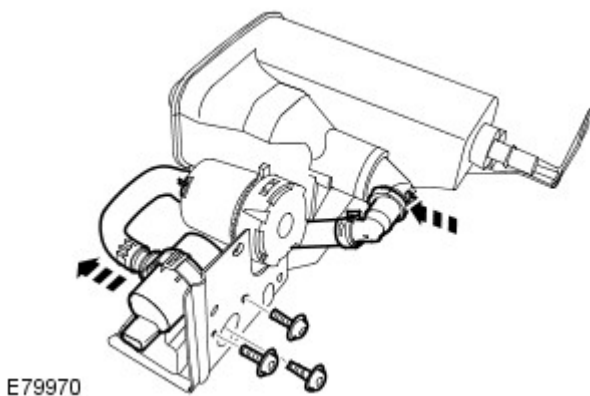
Refer to: [Wheel and Tire](#) (204-04 Wheels and Tires, Removal and Installation).

4. **NOTE:** Right-hand shown, left-hand similar.





5. Torque: 10 Nm



6. Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.