Силовой агрегат — Топливная система

Land Rover Discovery Sport (L550) · Руководство по ремонту
Источник: lrdisc.com · разделов: 10

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Топливо система

Fuel System

- Fuel Filter (G1879979) / Removal and Installation
- Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Cooler (G1885493)
- Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Pump and Sensor Unit (G1779691)
- Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Tank (G1779692) / Removal and Installation
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- Fuel Tank and Lines - Ingenium i4 2.0l Diesel Diagnosis and Testing
- Fuel Tank Draining (G898063) / General Procedures

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Exhaust - Ingenium i4 2.0l Diesel Selective Catalyst Reduction / Diagnosis and TestingFuel Filter (G1879979) / Removal and Installation

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Топливо фильтр / снятие и установка

Fuel Filter (G1879979) / Removal and Installation

REMOVAL

WARNINGS:

- ***Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.***
- ***Avoid flames, sparks or lighted substances.***
- ***Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.***

CAUTION:

Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

NOTES:

- *Some variation in the illustrations may occur, but the essential information is always correct.*
- *Some components shown removed for clarity.*
- *Removal steps in this procedure may contain installation details.*

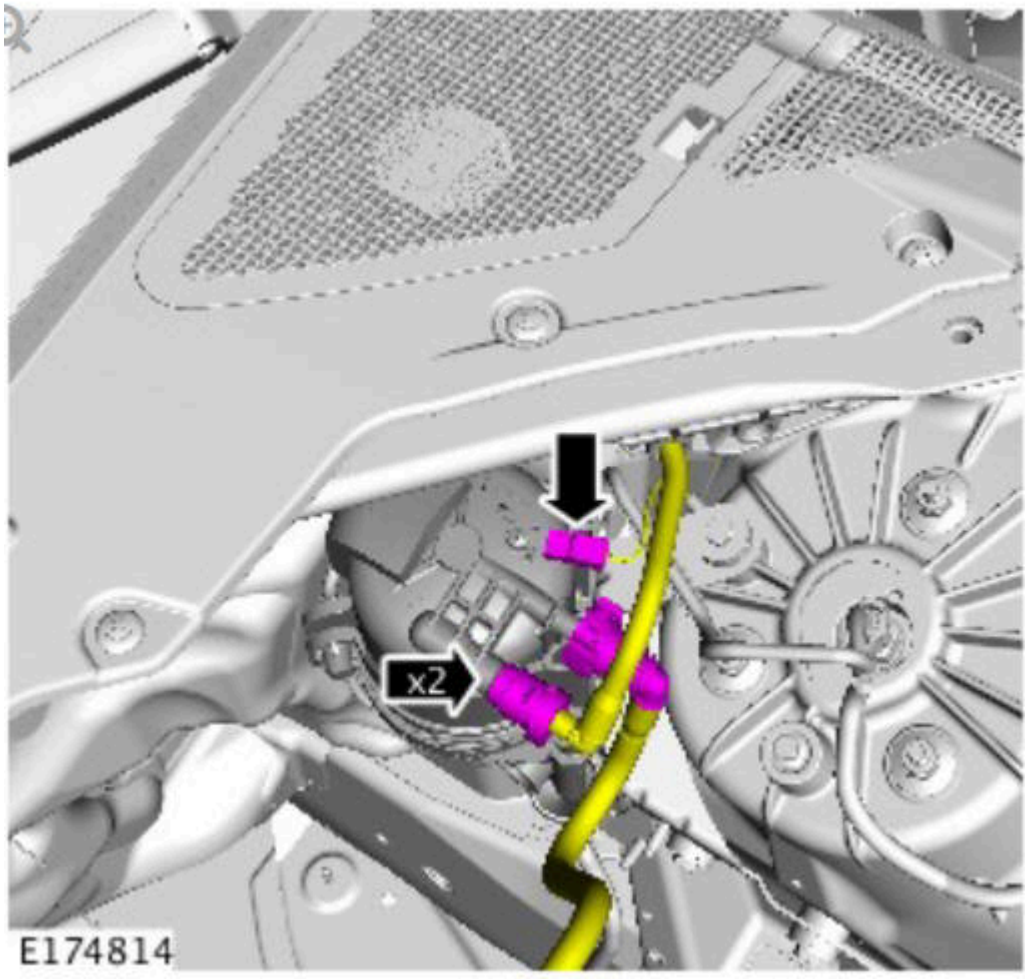
Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

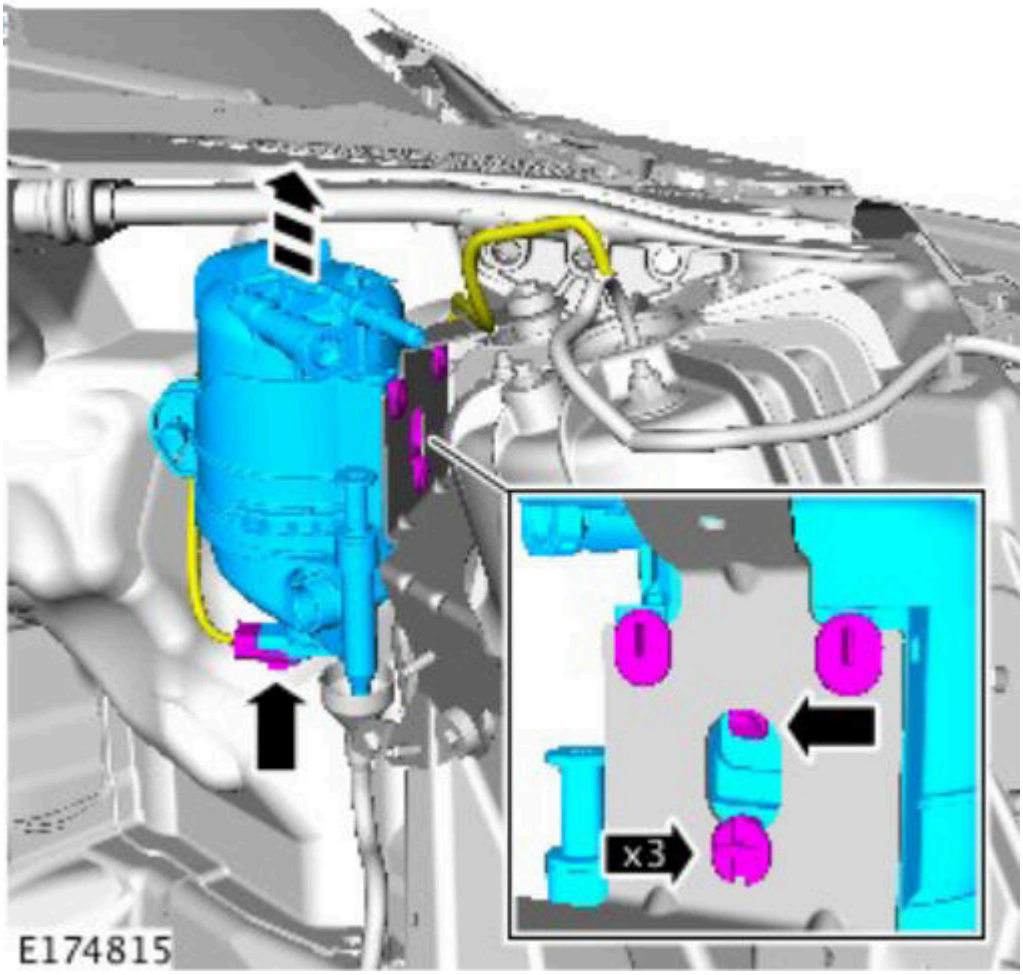
Disconnect the battery ground cable.

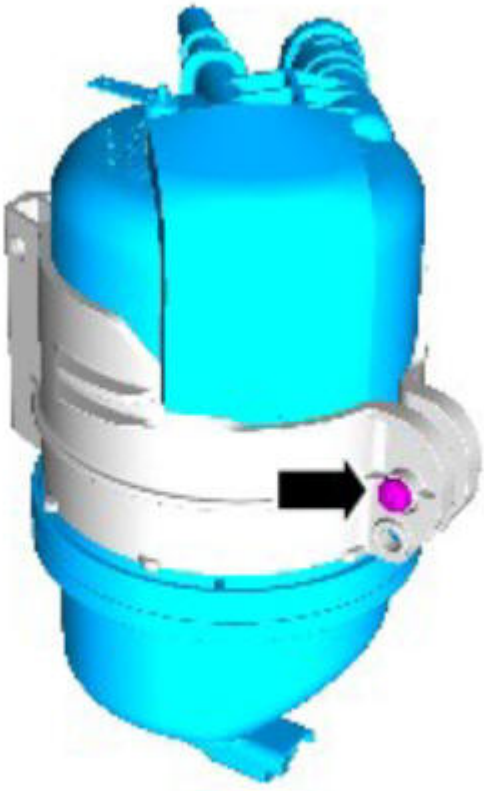
Refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

CAUTION:

Be prepared to collect escaping fuel.

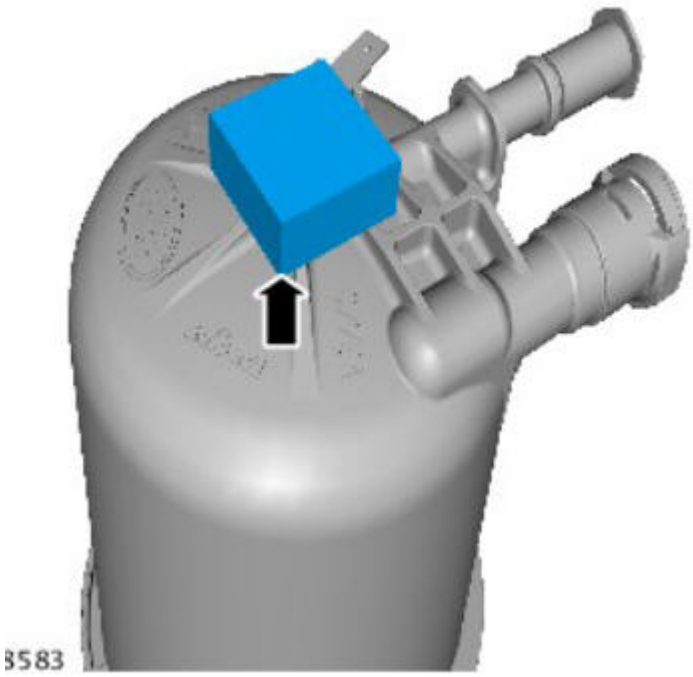






NOTE:

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



Remove and discard the fuel filter foam pad.

INSTALLATION

1. To install, reverse the removal procedure.
2. Refer to: Fuel System Bleeding - INGENIUM I4 2.0L Diesel (310-00 Fuel System - General Information, General Procedures).

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Fuel SystemFuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Cooler (G1885493)

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Топливный бак и магистрали - Ingenium i4 2.0l дизель топливо охладитель

Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Cooler (G1885493)

Removal

WARNINGS:

- ***Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.***
- ***Avoid flames, sparks or lighted substances.***
- ***Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.***

CAUTION:

Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean.

NOTES:

- *Some variation in the illustrations may occur, but the essential information is always correct.*
- *Some components shown removed for clarity.*
- *Removal steps in this procedure may contain installation details.*

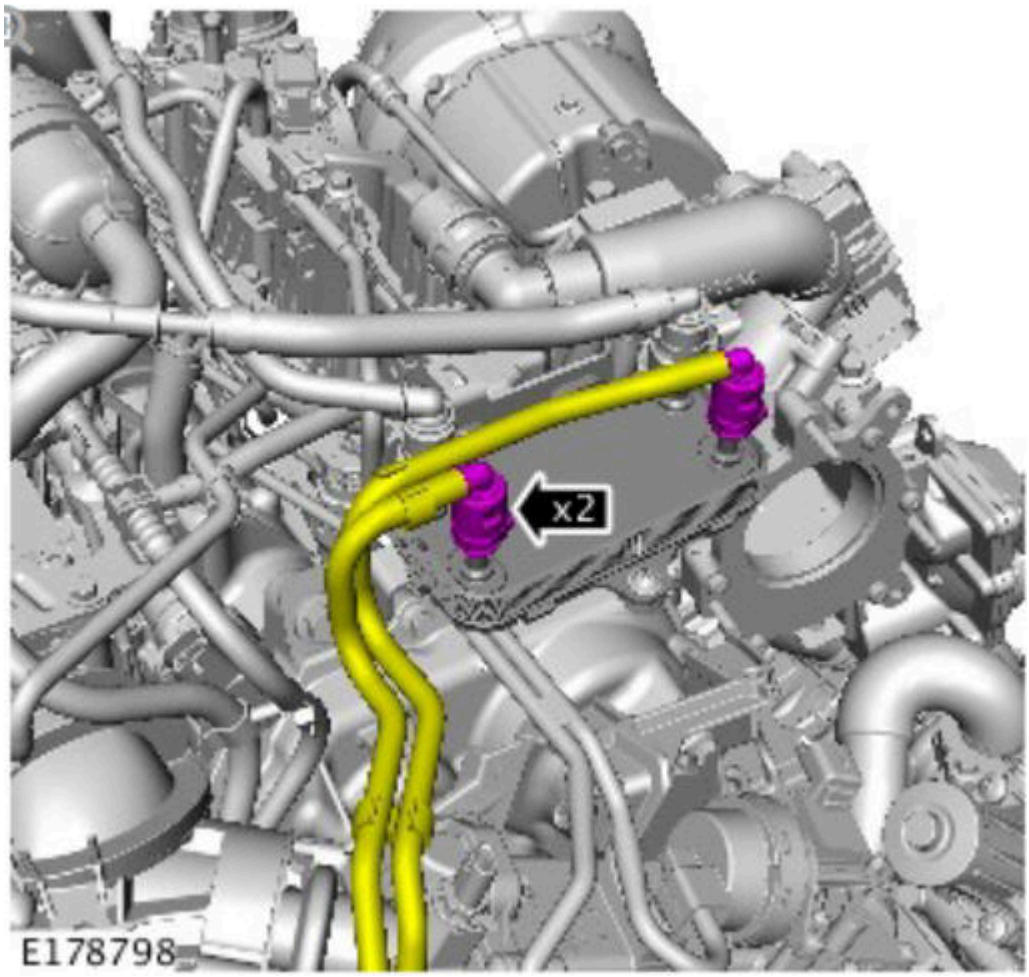
Disconnect the battery ground cable.

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

Refer to: Engine Cover - INGENIUM I4 2.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

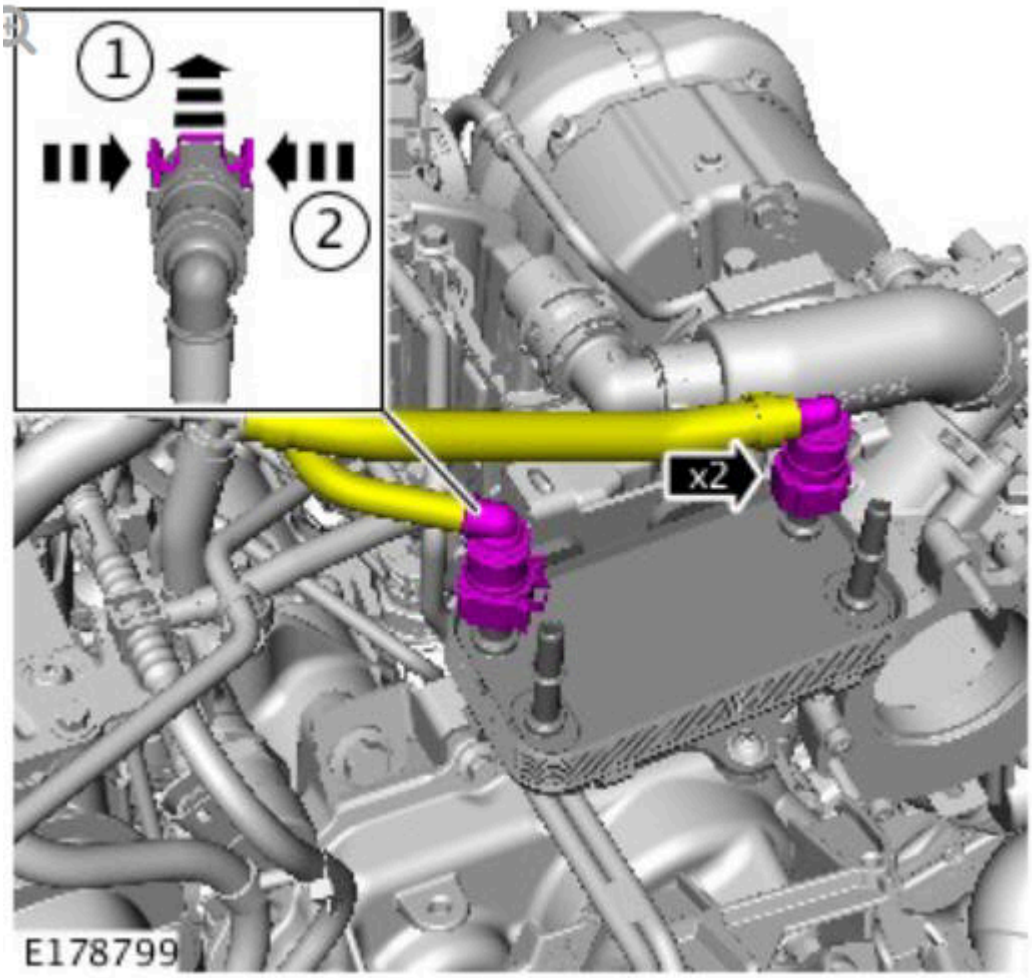
CAUTION:

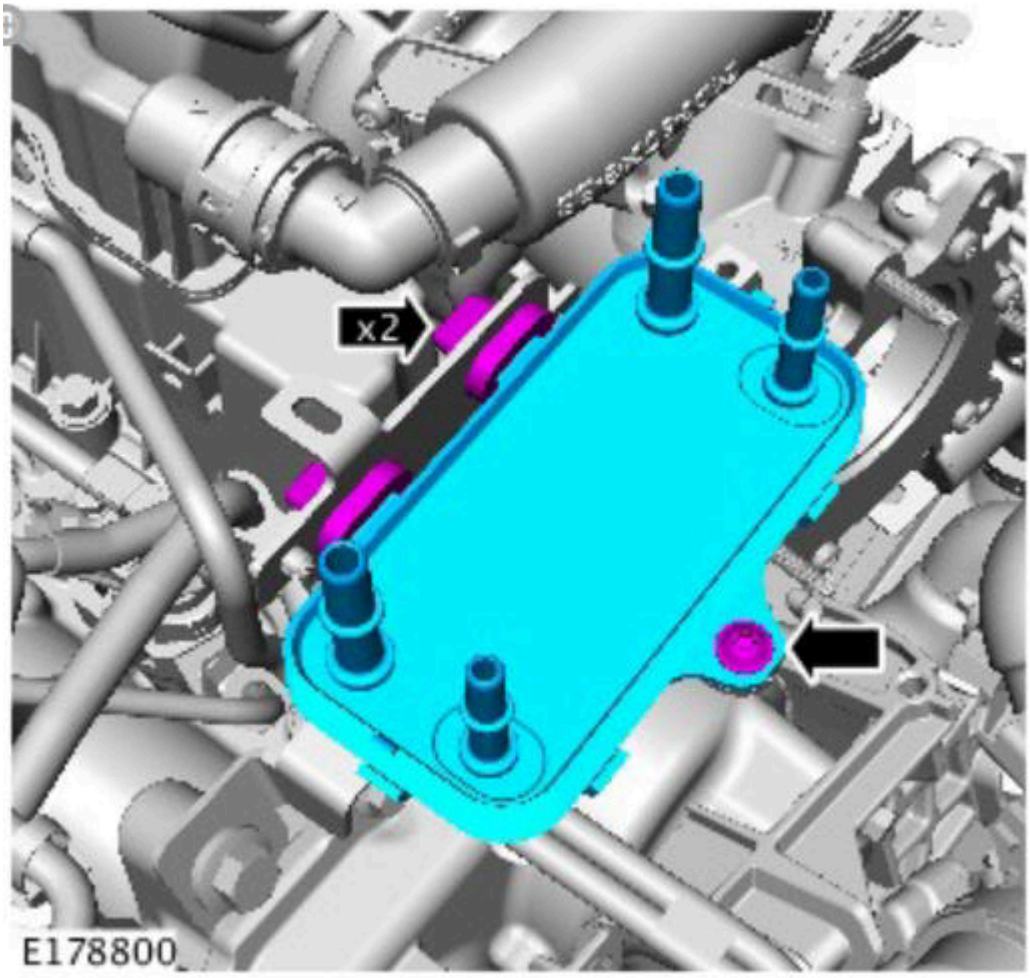
Be prepared to collect escaping coolant.



WARNING:

Be prepared to collect escaping fuel.


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E178799



INSTALLATION

1. To install, reverse the removal procedure.
2. Refer to: Fuel System Bleeding - INGENIUM I4 2.0L Diesel (310-00 Fuel System - General Information, General Procedures).

Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Level Sensor (G1779690)

Removal

WARNINGS:

- ***Fuel may still be present in the fuel tank after draining.***
- ***Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.***
- ***Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.***
- ***The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.***
- ***Be prepared to collect escaping fuel.***

CAUTION:

Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

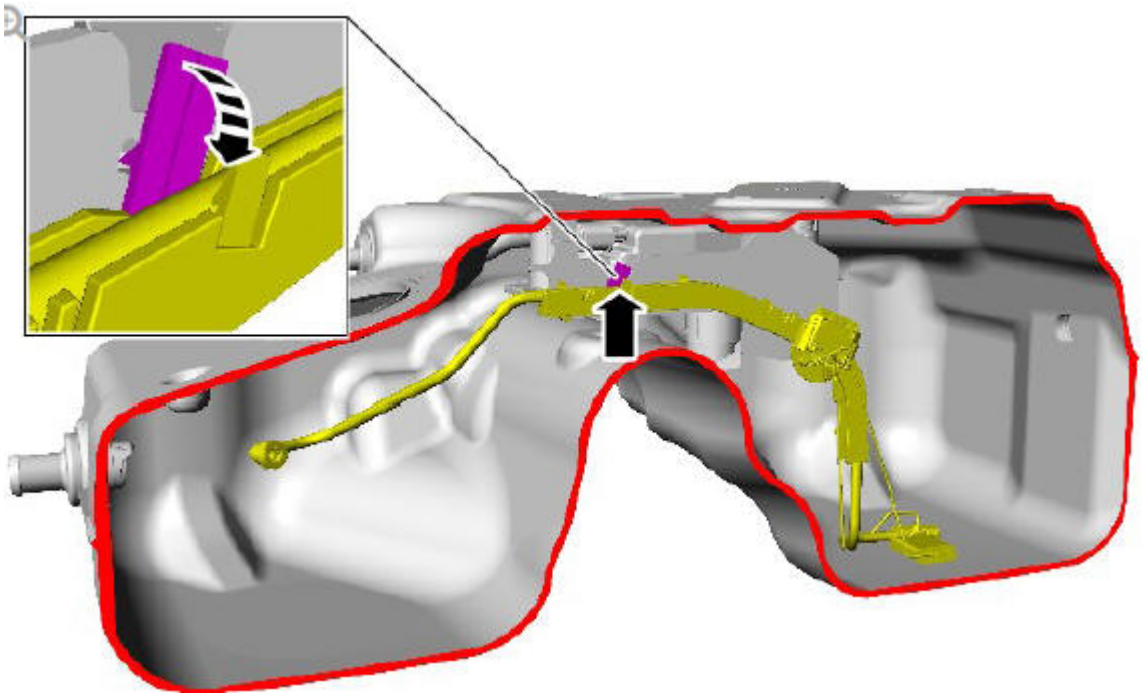
NOTES:

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- *Removal steps in this procedure may contain installation details.*

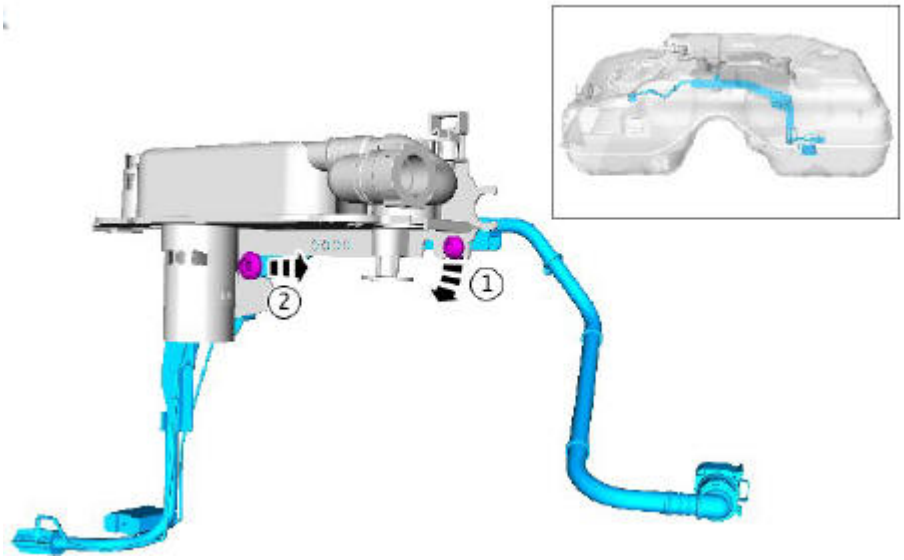
Refer to: Fuel Pump and Sender Unit (310-01A, Removal and Installation).

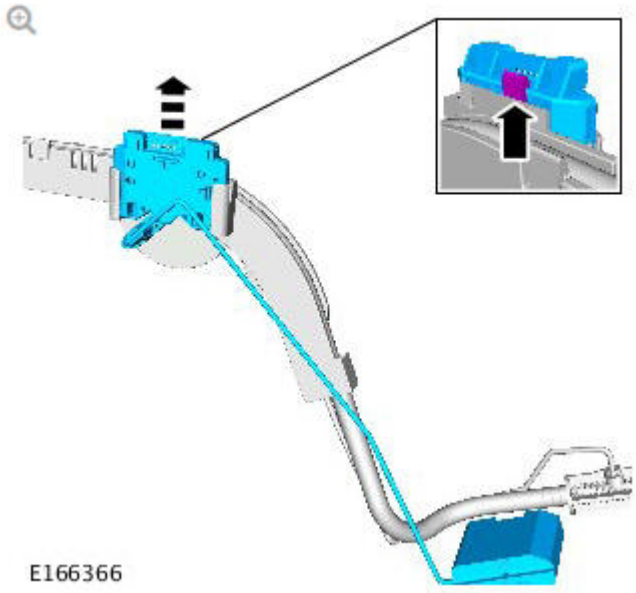
Refer to: Fuel Pump and Sender Unit (310-01B, Removal and Installation).



WARNING:

Be prepared to collect escaping fuel.





INSTALLATION

1. To install, reverse the removal procedure.

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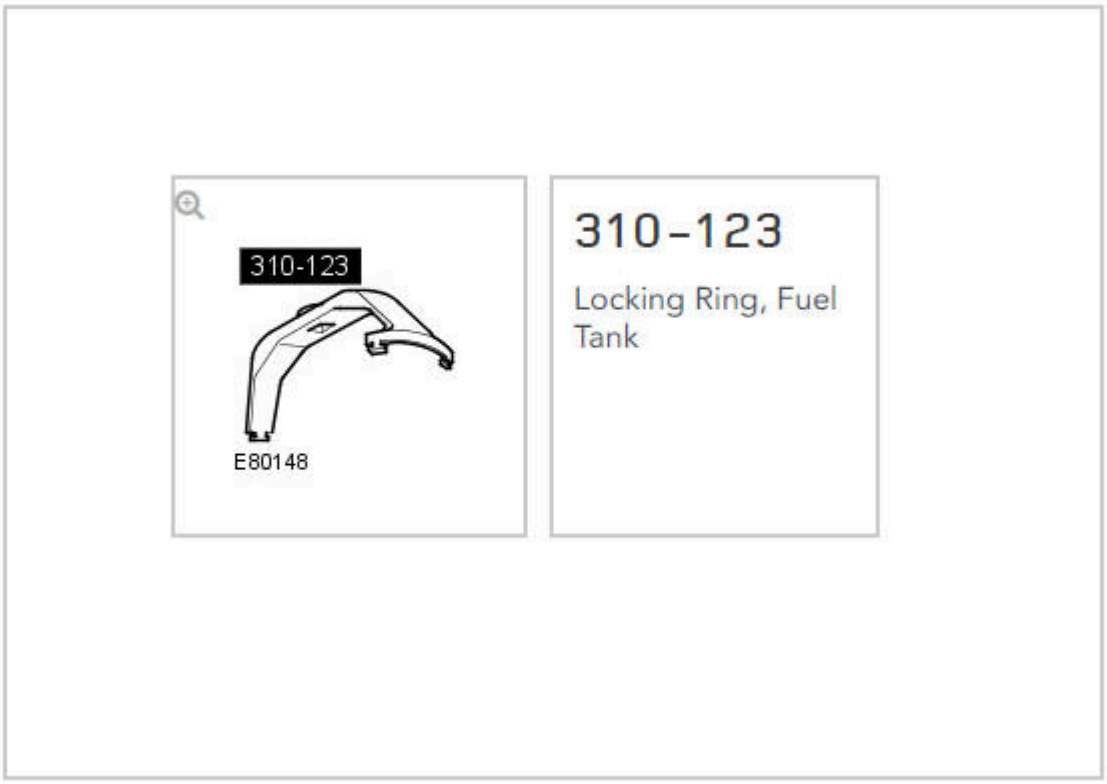
Fuel Filter (G1879979) / Removal and InstallationFuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Pump and Sensor Unit (G1779691)

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Топливный бак и магистрали - Ingenium i4 2.0l дизель топливо насос и датчик узел

Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Pump and Sensor Unit (G1779691)

SPECIAL TOOL(S)



REMOVAL

WARNINGS:

- ***After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.***
- ***This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.***
- ***The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.***
- ***Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.***
- ***If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.***
- ***Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.***

CAUTION:

Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

NOTES:

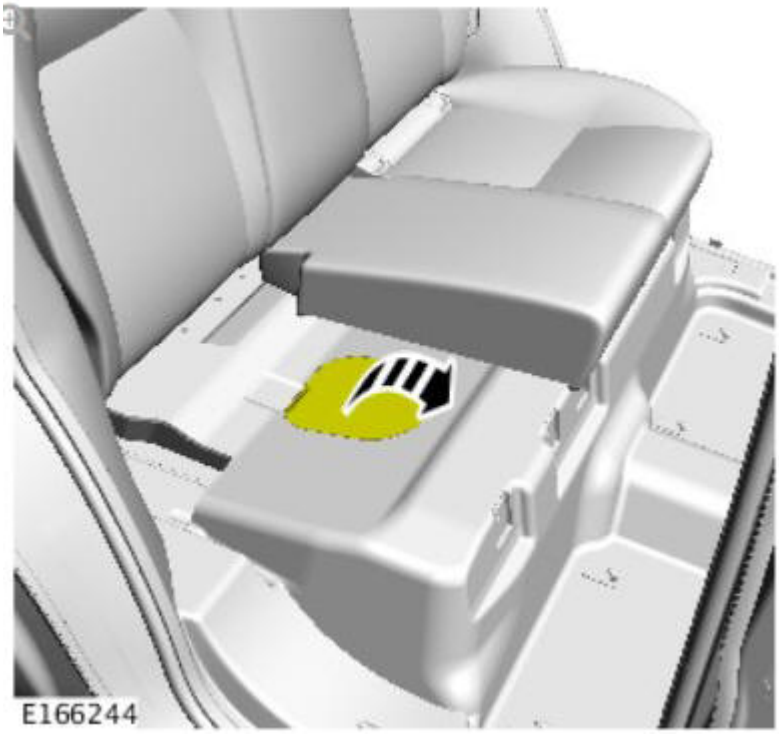
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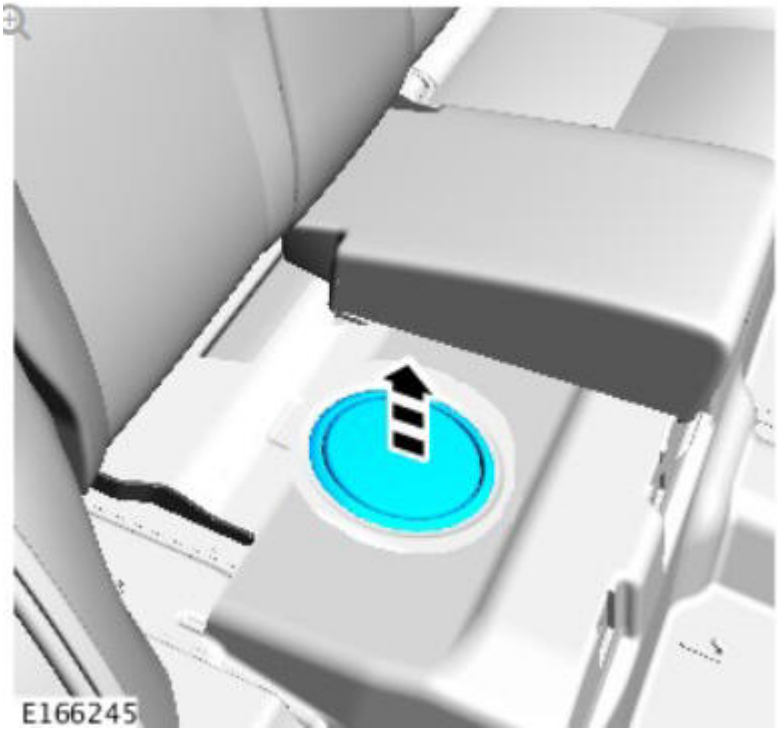
Refer to: Fuel System Pressure Release - GTDi 2.0L Petrol (310-00 Fuel System - General Information, General Procedures).

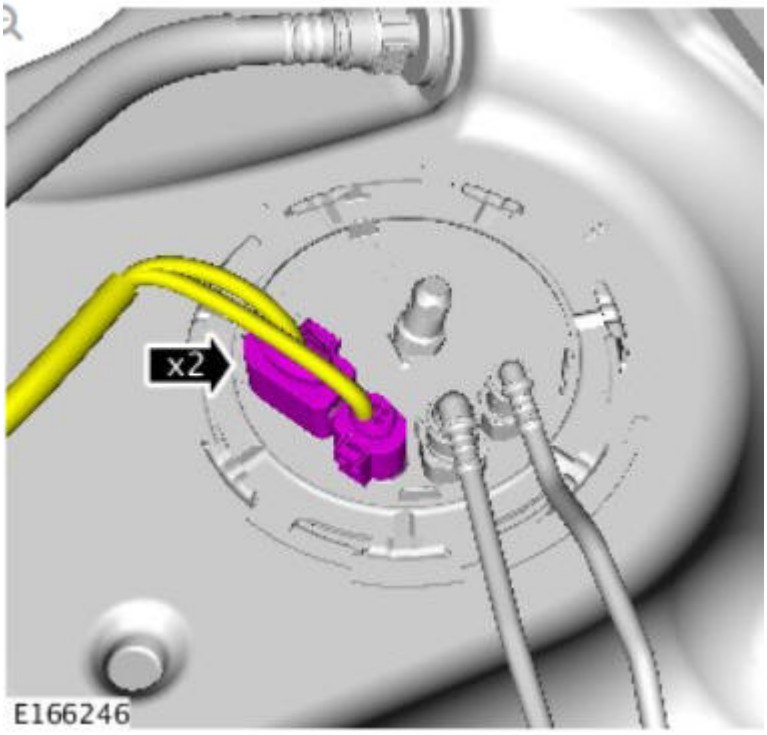
Refer to: Rear Seat (501-10 Seating, Removal and Installation).

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

Refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

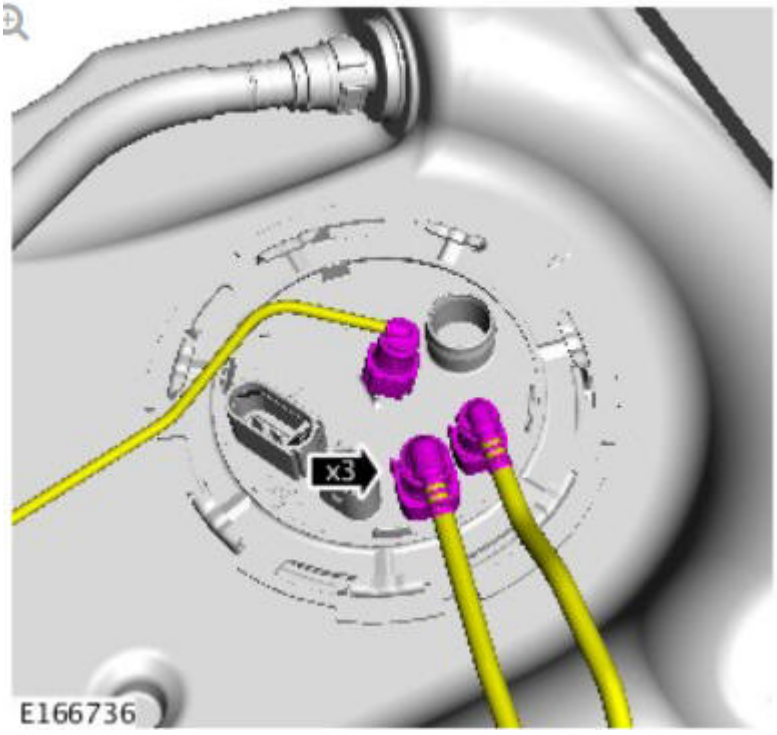


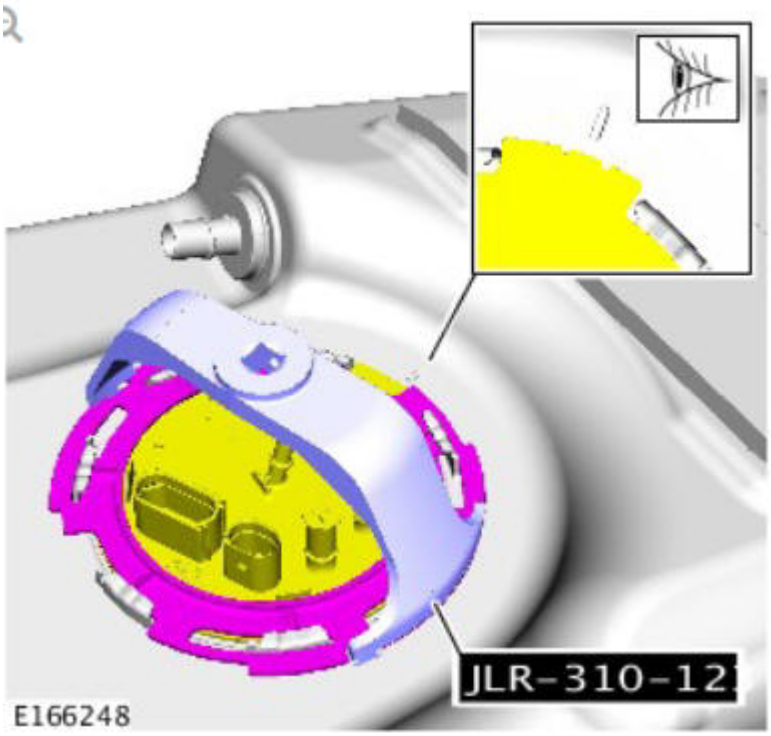




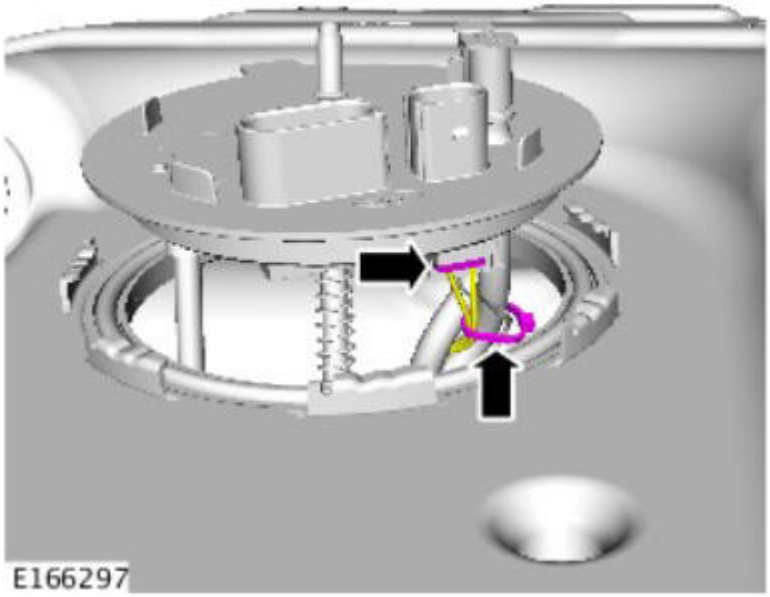
CAUTION:

Be prepared to collect escaping fuel.





Special Tool(s): 310-123

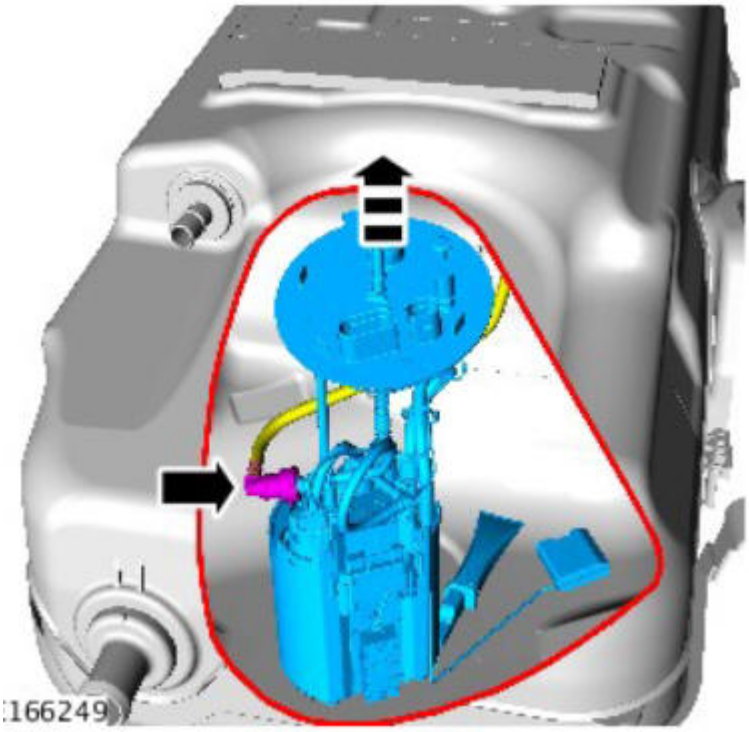


WARNING:

Be prepared to collect escaping fuel.

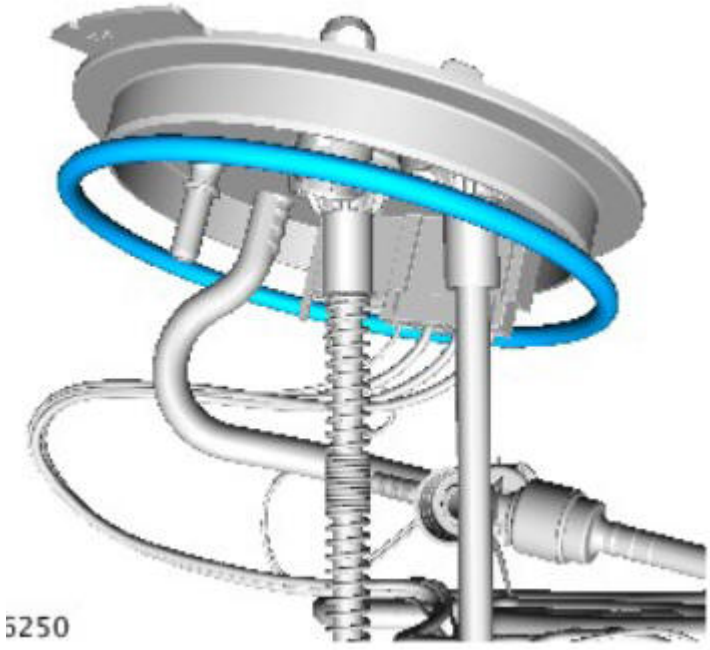
NOTE:

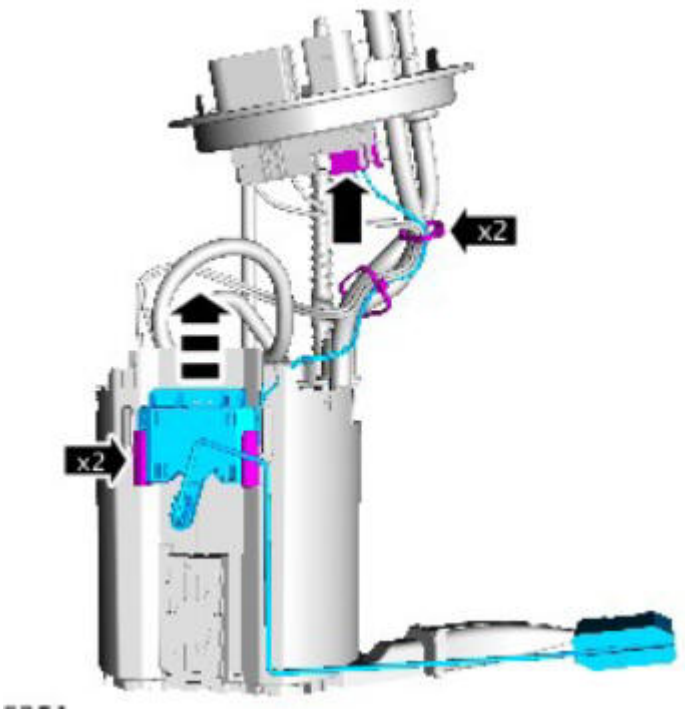
Note the orientation of the component prior to removal.



NOTES:

- *Discard the O-ring seal.*
- *Do not disassemble further if the component is removed for access only.*





INSTALLATION

CAUTIONS:

- **A new O-ring seal must be installed.**
- **Make sure the locking ring is correctly installed.**

To install, reverse the removal procedure.

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Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Cooler (G1885493)Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Tank (G1779692) / Removal and Installation

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Топливный бак и магистрали - Ingenium i4 2.0l дизель топливо бак / снятие и установка

Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Tank (G1779692) / Removal and Installation

GENERAL EQUIPMENT

Transmission jack

REMOVAL

WARNINGS:

- ***Fuel may still be present in the fuel tank after draining.***
- ***Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.***
- ***Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.***

- ***Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.***
- ***The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.***
- ***Be prepared to collect escaping fuel.***

CAUTION:

Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

NOTES:

- *Some variation in the illustrations may occur, but the essential information is always correct.*
- *Some components shown removed for clarity.*
- *Removal steps in this procedure may contain installation details.*

Refer to: Fuel System Pressure Release - GTDi 2.0L Petrol (310-00 Fuel System - General Information, General Procedures).

Disconnect the battery ground cable.

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

Refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

WARNING:

Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

Refer to: Driveshaft - TD4 2.2L Diesel, Vehicles With: Active Driveline/Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

Refer to: Driveshaft - TD4 2.2L Diesel, Vehicles Without: Active Driveline/Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

Refer to: Driveshaft - TD4 2.2L Diesel, Vehicles With: Active Driveline, Vehicles Without: Diesel Particulate Filter (DPF) (205-01 Driveshaft, Removal and Installation).

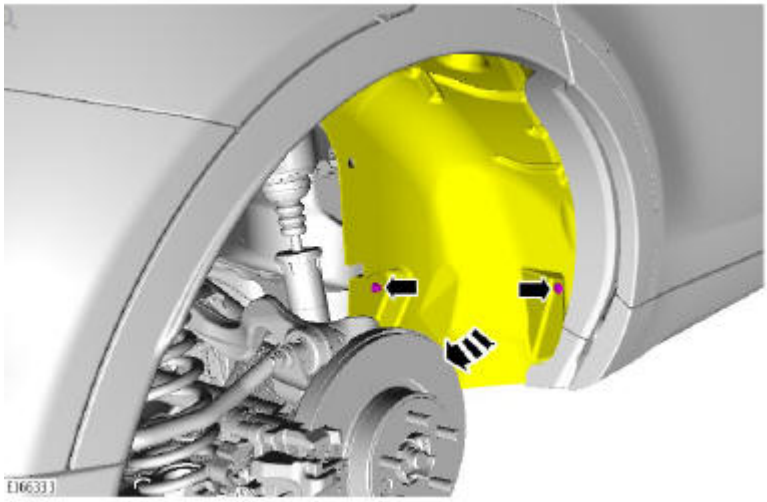
Refer to: Driveshaft - TD4 2.2L Diesel, Vehicles With: Diesel Particulate Filter (DPF), Vehicles Without: Active Driveline (205-01 Driveshaft, Removal and Installation).

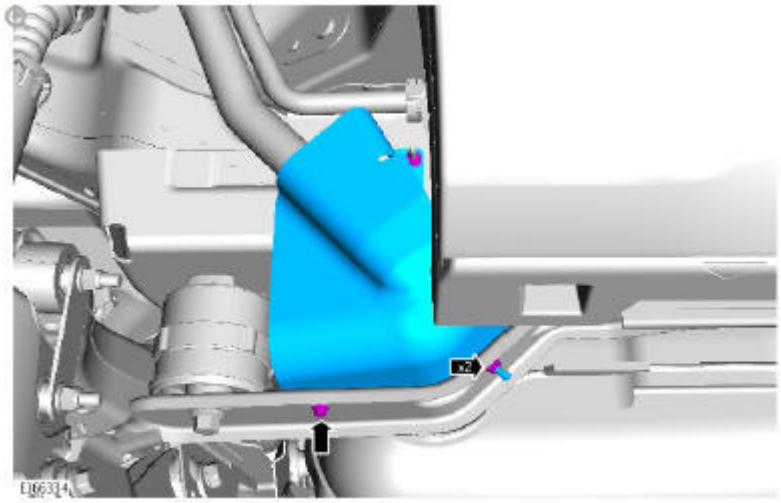
Refer to: Driveshaft - GTDi 2.0L Petrol, Vehicles Without: Active Driveline (205-01 Driveshaft, Removal and Installation).

Refer to: Driveshaft - GTDi 2.0L Petrol, Vehicles With: Active Driveline (205-01 Driveshaft, Removal and Installation).

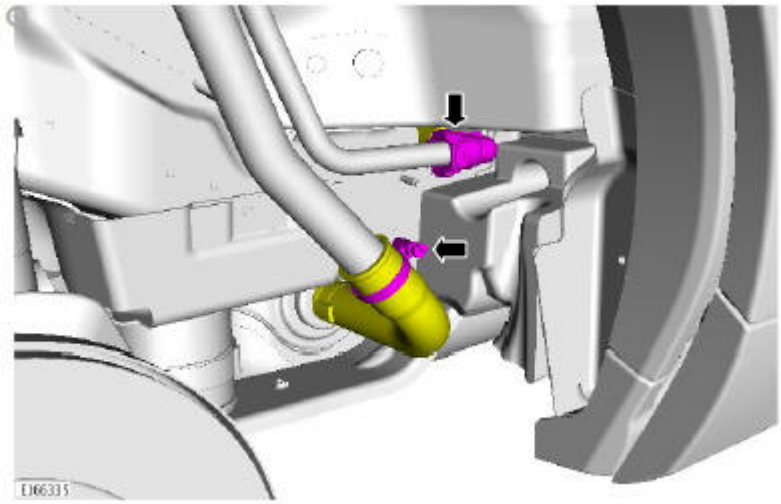
Remove the rear right wheel and tire.

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

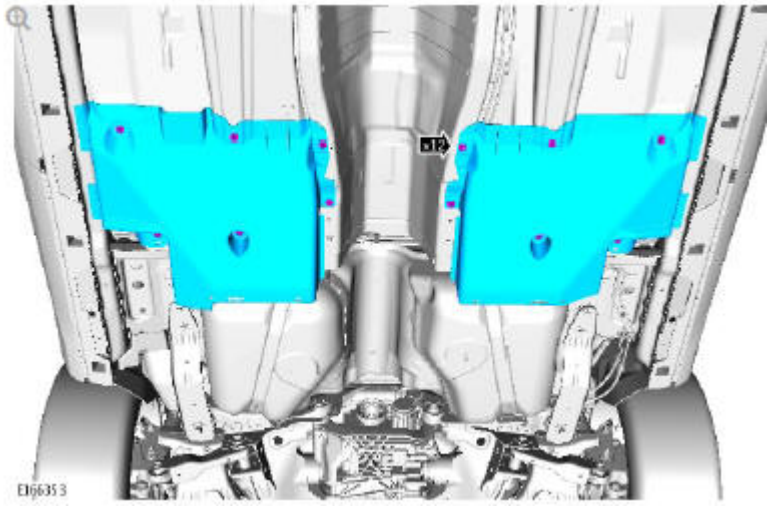




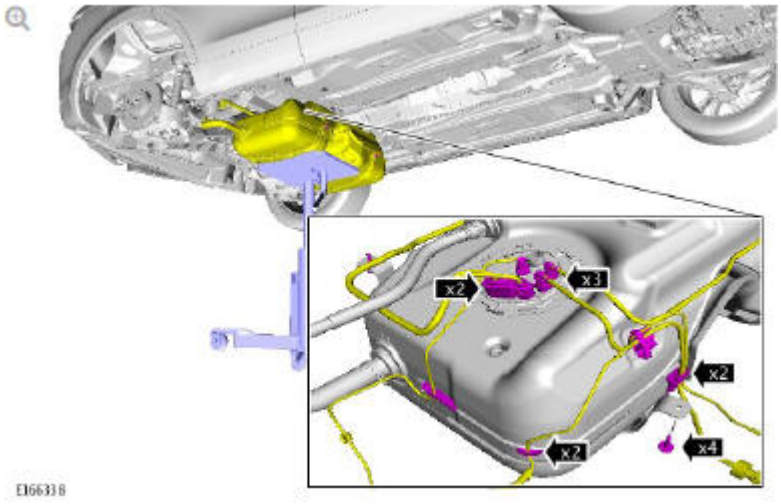
Torque: 7 Nm



Torque: 3.2 Nm



Torque: 5 Nm



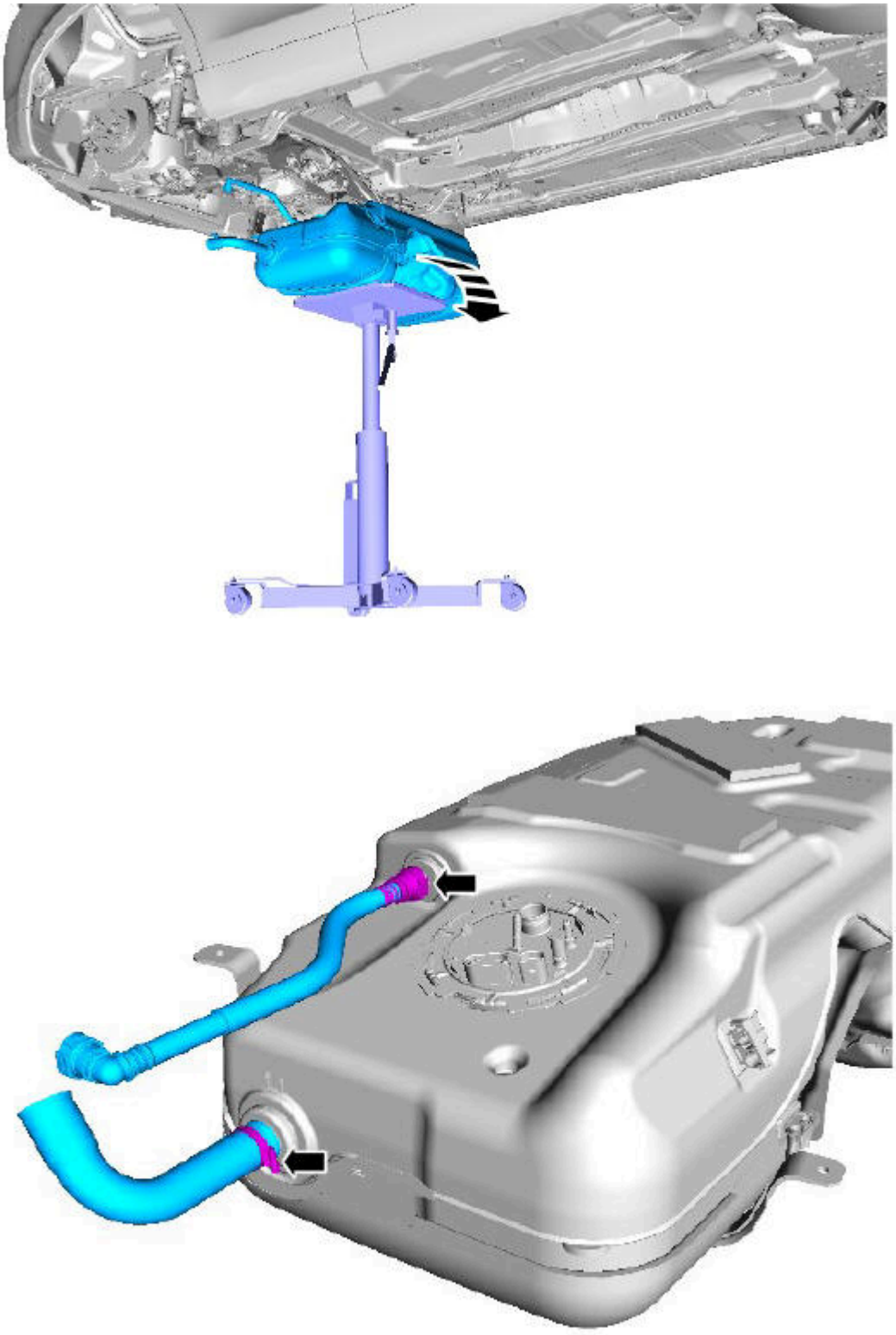
Lower the fuel tank to allow access to the fuel pump and sender unit connections.

General Equipment: Transmission jack

Torque: 24 Nm

NOTE:

Do not disassemble further if component is removed for access only.

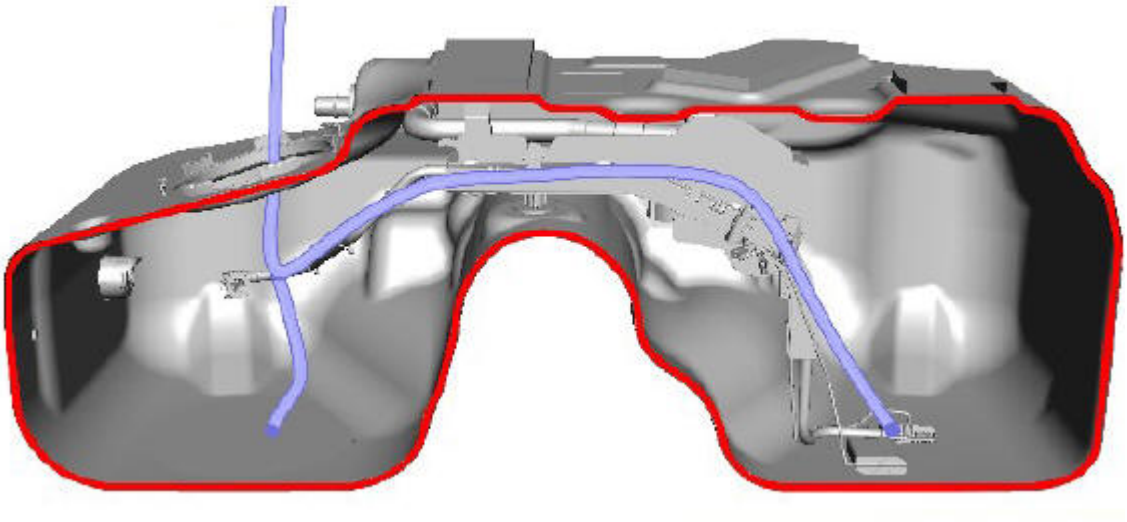


Torque: 3.2 Nm

Remove the fuel pump and sender unit.

Refer to: Fuel Pump and Sensor Unit (310-01B Fuel Tank and Lines - INGENIUM I4 2.0L Diesel, Removal and Installation).

Refer to: Fuel Pump and Sensor Unit (310-01B Fuel Tank and Lines - INGENIUM I4 2.0L Diesel, Removal and Installation).

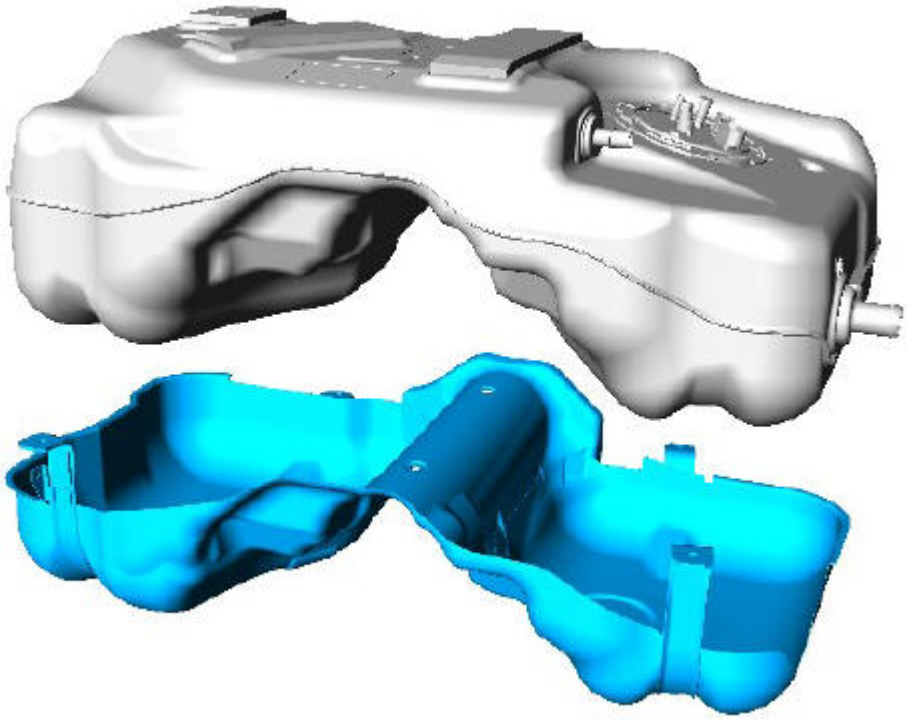


Recover the remaining fuel.

Remove the fuel level sender unit.

Refer to: Fuel Level Sensor (310-01B Fuel Tank and Lines - INGENIUM I4 2.0L Diesel, Removal and Installation).

Refer to: Fuel Level Sensor (310-01B Fuel Tank and Lines - INGENIUM I4 2.0L Diesel, Removal and Installation).



Installation

1. To install, reverse the removal procedure.

Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Tank Filler Pipe (G1779674)

Removal

WARNINGS:

After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.

This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.

Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

CAUTION:

Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

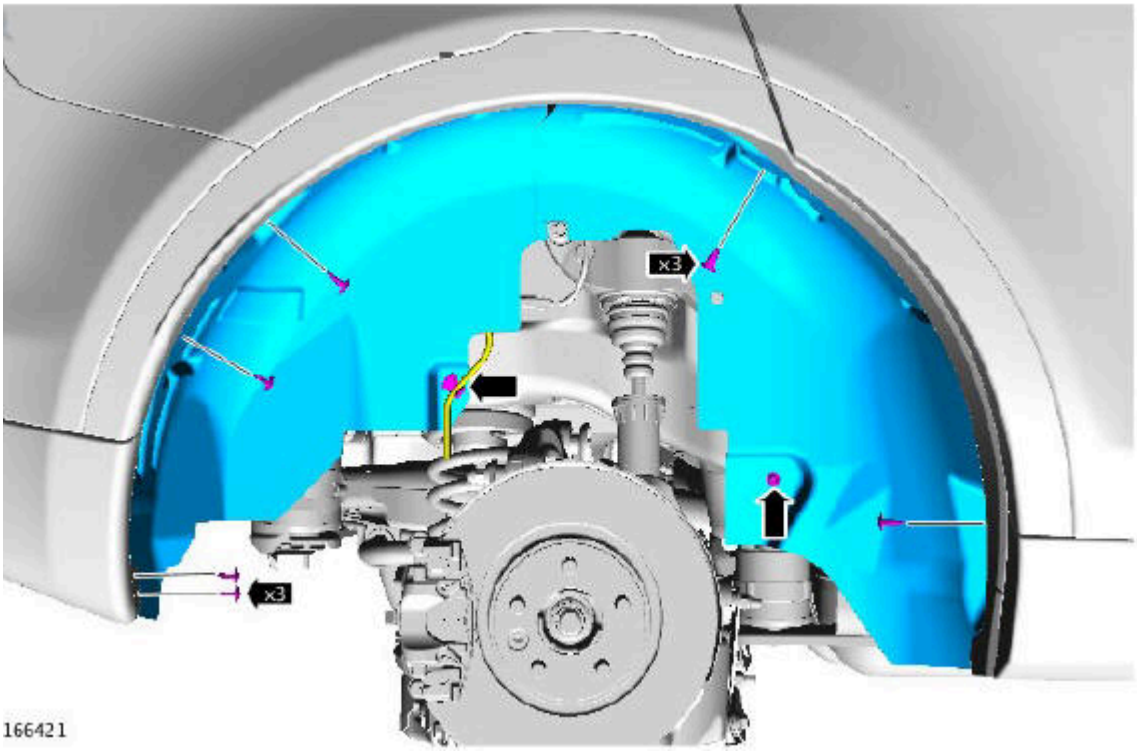
WARNING:

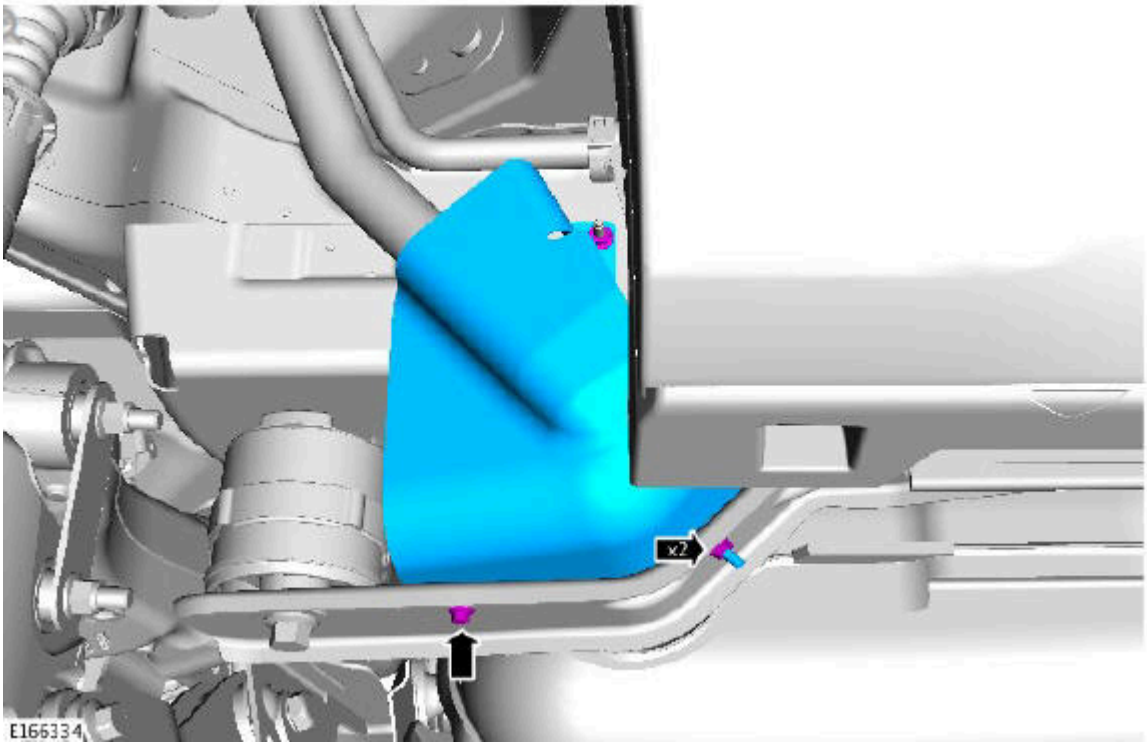
Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

Remove the rear right wheel and tire.

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

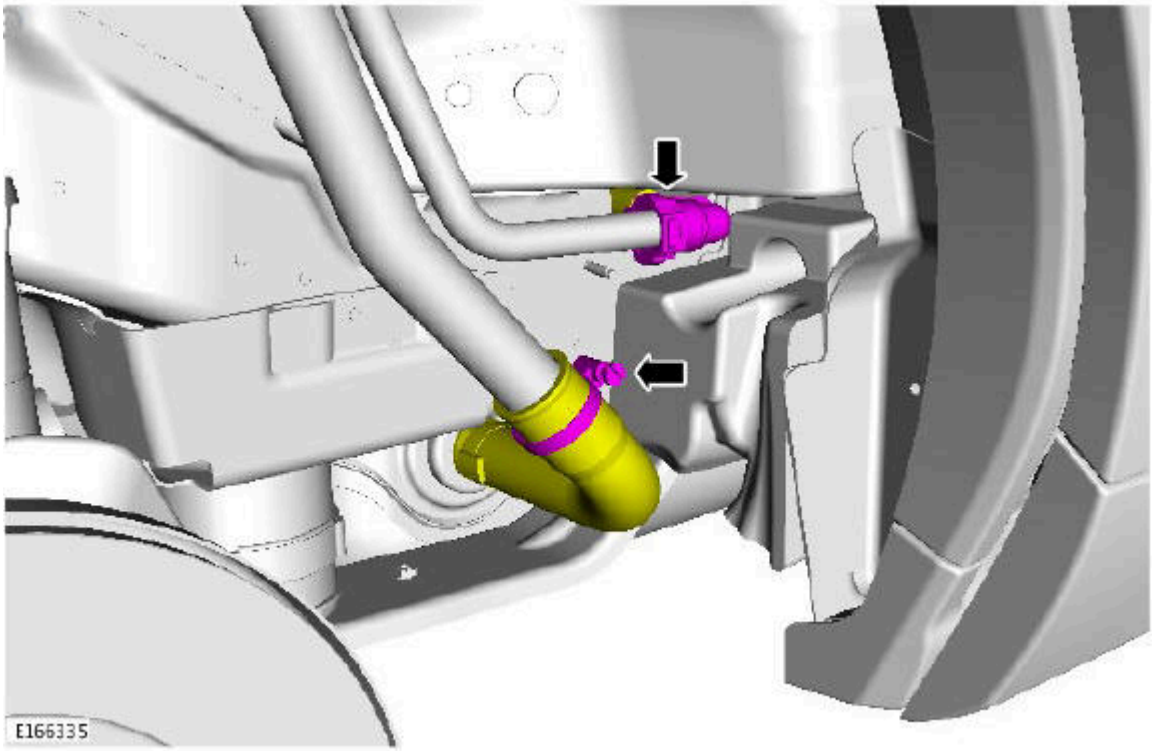




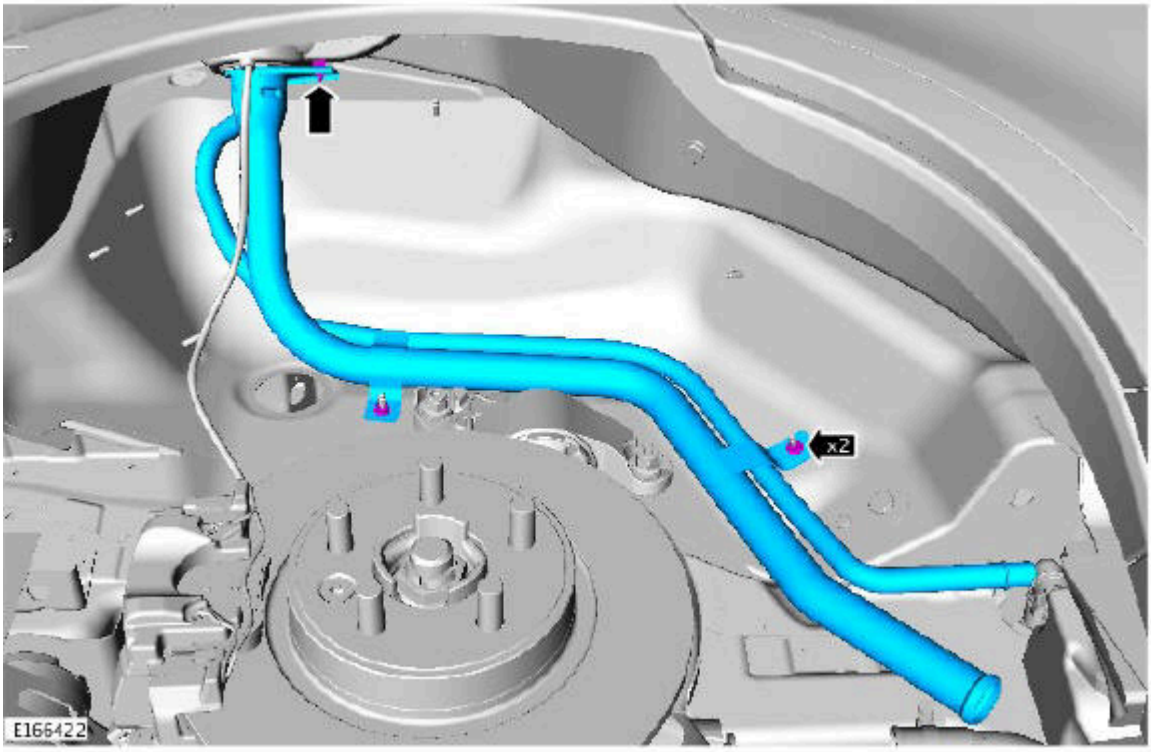
Torque: 7 Nm

WARNING:

<u>Be prepared to collect escaping fuel.</u>



Torque: 3.2 Nm



Torque: 7 Nm

INSTALLATION

1. To install, reverse the removal procedure.

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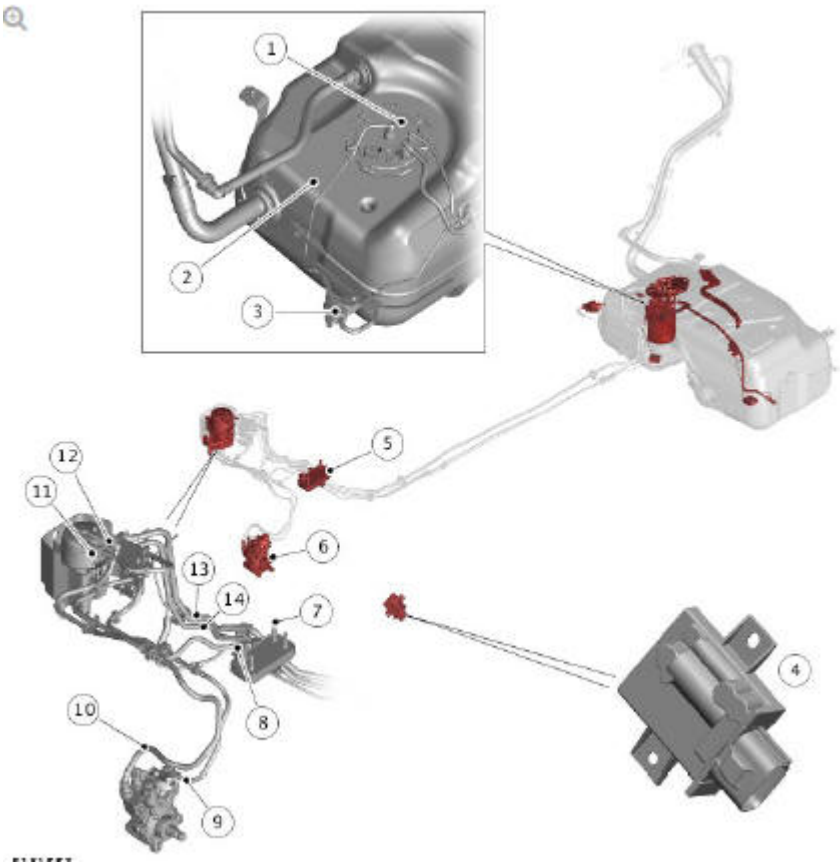
Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Pump and Sensor Unit (G1779691)Fuel Tank and Lines - Ingenium i4 2.0l Diesel / Description and Operation

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Топливный бак и магистрали - Ingenium i4 2.0l дизель / описание и работа

Fuel Tank and Lines - Ingenium i4 2.0l Diesel / Description and Operation

COMPONENT LOCATION - SHEET 1 OF 2



1. Fuel filler pipe connection
2. Fuel pump module
3. Fuel tank breather pipe
4. Vent tube
5. Support bracket
6. Fuel level sensor - 'B'
7. Fuel level sensor - 'A'
8. Line - fuel supply from Fuel Fired Booster Heater (FFBH) fuel pump (if equipped)
9. Line - fuel return
10. Line - fuel supply
11. Line - fuel supply from Fuel Fired Booster Heater (FFBH) fuel pump (if fitted)
12. Fuel Fired Booster Heater (FFBH) fuel pump (if equipped)

The fuel tank is manufactured using six-layer co-extruded blow-molding technology providing both high mechanical strength and complete emissions integrity. The fuel tank is mounted under the rear seat floorpan, forward of the rear suspension.

The fuel tank has a useable capacity of:

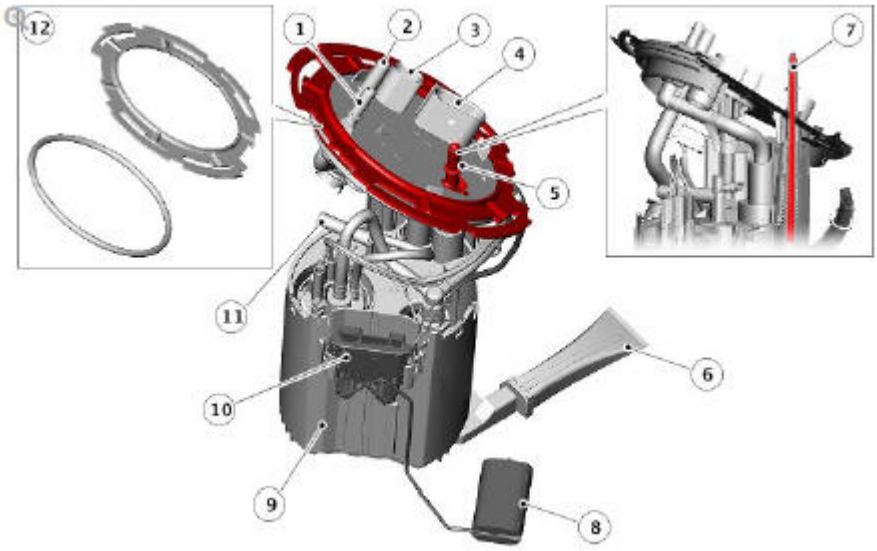
- 65 liters (17.17 gallons) (Vehicles fitted with EU5 engine)
- 54 liters (14.26 gallons) (Vehicles fitted with EU6 engine)

The LP fuel pump supplies fuel to the HP fuel pump mounted on the engine.

An internal bracket allows for the attachment of the left fuel pick-up and the fuel level sensor.

An internal breather hose is connected to a stub port passing through the fuel tank casing. An external pipe and hose connect this port to the top of the filler neck. This enables the fuel tank to be filled and controls the fuel cut off during filling. Fuel level inside the tank is monitored by two fuel level sensors.

FUEL PUMP MODULE



1. Fuel return connection
2. Fuel supply connection
3. Fuel level sensor electrical connector
4. Fuel pump electrical connector
5. Fuel Fired Booster Heater (FFBH) supply connection
6. Fuel inlet filter
7. Fuel Fired Booster Heater (FFBH) suction tube and seal (if equipped)
8. Fuel level sensor float
9. Swirl pot
10. Fuel level sensor - 'A'
11. Jet pump connection - left (passive) side of fuel tank
12. Locking ring and O-ring seal

The fuel pump module is located in the right side of the fuel tank. The fuel pump module flange is sealed to the fuel tank with an O-ring and secured with a locking ring.

The top flange of the fuel pump module assembly provides the internal and external interface for the tank electrical and fuel connections. The flange has external electrical connectors that are connected to the active and passive fuel level sensors, and the in-tank fuel pump.

The lower part of the fuel pump module forms the fuel swirl pot, and provides the location for the in-tank fuel pump and the two jet pumps. The swirl pot provides a constant reservoir of fuel for the LP fuel pump to supply the HP fuel pump.

The LP fuel pump ensures sufficient fuel is in the swirl pot to supply the engines HP fuel pump demands by supplying the fuel to power the jet pump venturis. The rapid flow of fuel through the venturi nozzle creates a depression which draws fuel back across the saddle from the left (passive) side of the fuel tank into the pump (active) side of the fuel tank. The second venturi draws fuel from the pump side of the fuel tank into the swirl pot.

Surplus fuel entering the fuel swirl pot overflows into the usable right side of the fuel tank.

For cold climate market vehicles fitted with a Fuel Fired Booster Heater (FFBH) and a FFBH fuel pump, the fuel pump module has a separate pipe connection for a fuel supply line which connects to the FFBH fuel pump. The FFBH fuel pump is mounted on the right side of the fuel tank exterior. This pipe connection is equipped with a sealed suction tube which draws fuel from the swirl pot. An additional fuel line connects the FFBH fuel pump to the FFBH fuel inlet.

FUEL LEVEL SENSORS

There are two fuel level sensors located inside the fuel tank. Fuel level sensor 'A' is attached to the swirl pot and monitors fuel level on the right side of the fuel tank. Fuel Level sensor 'B' is attached to the suction pipe carrier and monitors fuel level on the left side of the fuel tank.

Both level sensors are MAgnetic Passive Position Sensor (MAPPS) which provide a variable resistance to ground for the output from the fuel gauge.

FUEL FILLER PIPE AND BREATHER ASSEMBLY

The neck of the fuel filler pipe is positioned at the rear of the vehicle, above the rear right wheel. The filler pipe and cap is covered by a molded plastic fuel flap which is electrically locked when the vehicle is locked.

The filler cap is a conventional screw-in type which is secured to the vehicle with a lanyard. The cap has a locking mechanism which gives an audible click when the cap is correctly tightened.

The filler pipe is a stainless steel fabrication which is secured to the vehicle body with two brackets and nuts. A metal stub pipe, attached to the filler neck, provides for the attachment of the breather pipe.

A breather pipe is connected between the fuel filler neck and the fuel tank.

The breather pipe enables the fuel tank to be filled, allows for expansion of the fuel vapor and controls the fuel cut off during filling.

The fuel filler pipe attaches to a stub at the rear of the fuel tank which incorporates a check valve. The in-line check valve is mounted inside the fuel tank inlet stub, and is retained in the closed position by a spring. The check valve is only opened when the vehicle is refueled.

- Misfueling protection device
- Fuel Pump Driver Module

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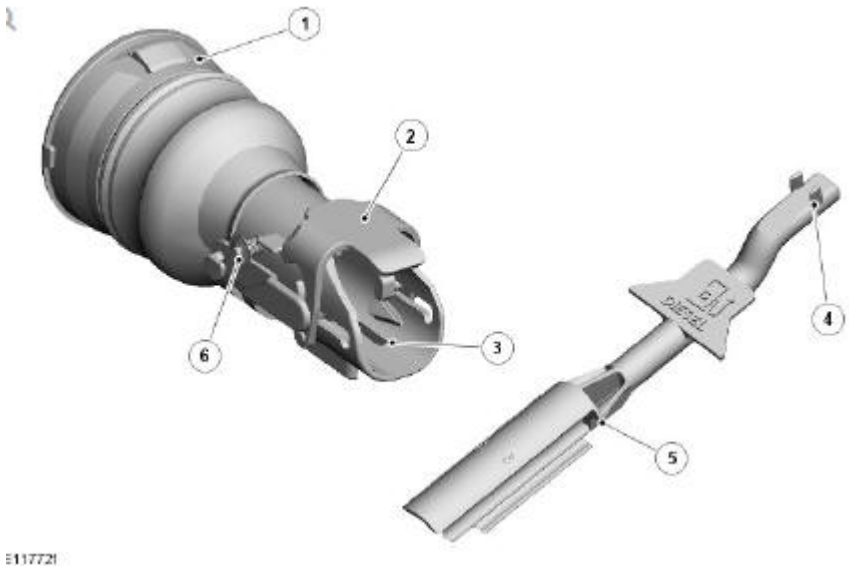
Fuel Tank and Lines - Ingenium i4 2.0l Diesel Fuel Tank (G1779692) / Removal and InstallationMisfueling protection device

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Misfueling protection device

Misfueling protection device

Passive Misfueling Protection Device System



1. Filler neck
2. Flap
3. Reset slots
4. Spigots
5. Reset tool
6. Spring

The passive misfueling protection device system comprises a mechanically operated flap which is triggered when the smaller diameter filler nozzle tube, used on petrol pumps, is inserted in the filler neck. The shut off flap is actuated and blocks the sensor port on the fuel pump nozzle, causing it to automatically switch off. The shut off flap is locked in this position by a latch mechanism, once it has been activated.

The tool is used to reset the misfueling protection device if triggered. The tool is inserted into the filler opening as far as possible with the spigots pointing upper most. Once the two spigots on the tool are located in the slots it can be pulled outwards, releasing a latch and allowing the shut off flap to be opened by its own spring pressure.

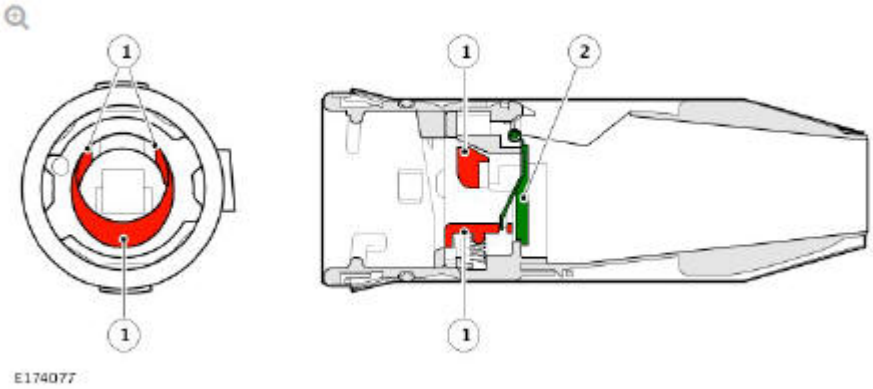
The shut off flap is colored yellow so that it is clearly visible within the entrance of the fuel filler pipe when activated, the shut off flap has a 'Handbook' symbol on it.

A 25 mm diameter diesel fuel pump nozzle will not activate the misfueling protection device because the nozzle stops against two molded lugs.

However, if a 21 mm diameter unleaded petrol pump nozzle is inserted into the housing, its smaller diameter allows it to pass the two molded lugs. The nozzle strikes two pins on the inside of the filler housing which move forward. This movement rotates the shut-off flap which is then held in place when the nozzle is removed by the latch mechanism.

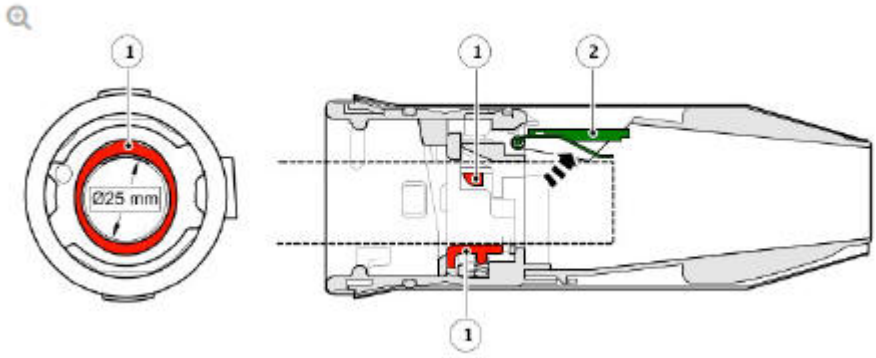
Active Misfueling Protection Device System

Normal State



1. Sensing tabs in normal state
2. Misfueling protection flap closed

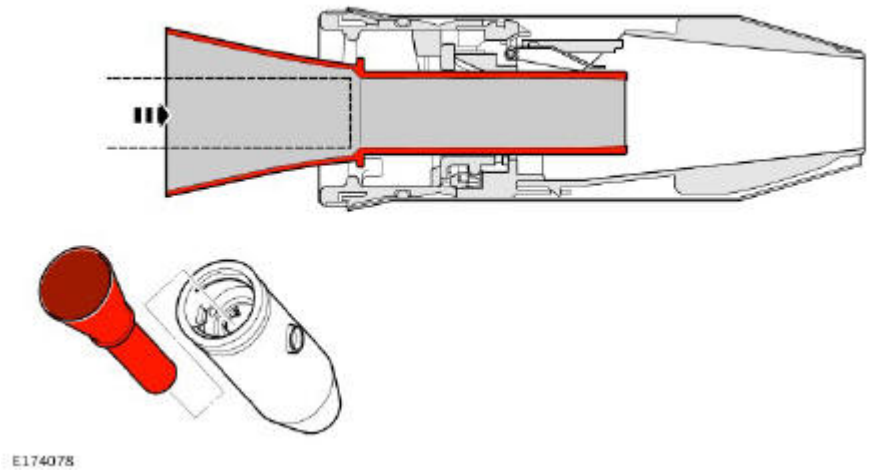
Open State



1. Sensing tabs in open state
2. Misfueling protection flap open

The misfueling protection device consists of a mechanically-operated flap and three fuel nozzle sensing tabs. When a 25 mm diameter diesel fuel filler nozzle tube is inserted into the fuel filler pipe, the three sensing tabs depress releasing the flap into the open position. If a smaller 21 mm diameter filler nozzle tube, used on unleaded petrol pumps, is inserted in the fuel filler pipe, the three sensing tabs will not depress and the flap will not release, so this blocks the fuel nozzle from entering the filler pipe.

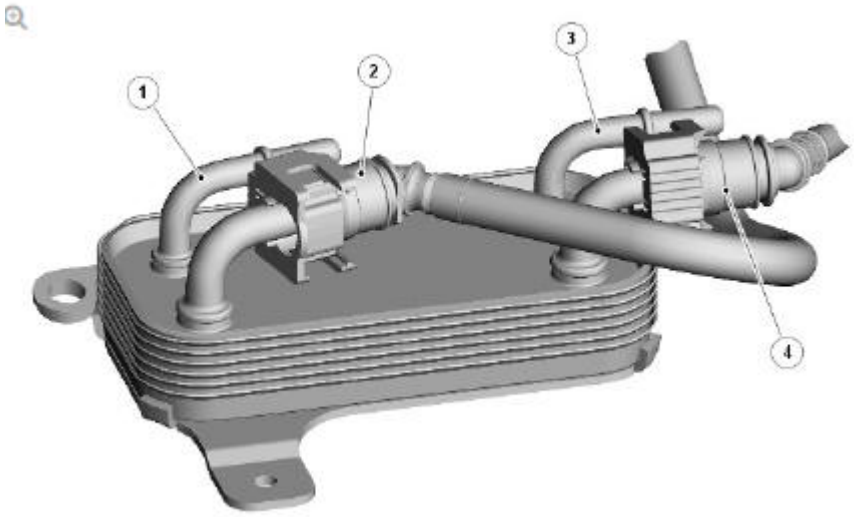
Adaptor Funnel



If the vehicle travels to a market where differentiation of fuel nozzle size or if the vehicle runs out of fuel and must be refilled at the road side using a reserve can, then an adaptor funnel is provided to allow the misfueling device to be temporarily overridden.

The adaptor funnel will be located either in the glovebox or in the luggage compartment alongside the tool kit.

FUEL COOLER



1. Coolant inlet connection
2. Fuel inlet connection
3. Coolant outlet connection
4. Fuel outlet connection

The LP fuel cooler is located in the engine compartment. The fuel cooler is connected to the engine cooling system.

The fuel cooler is designed to cool fuel returning from the HP pump before it is sent back to the fuel tank via the return line.

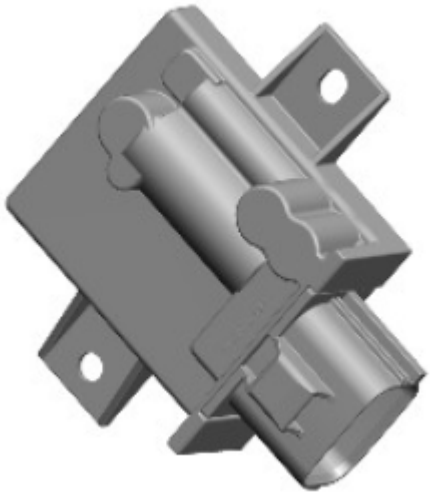
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Fuel Tank and Lines - Ingenium i4 2.0l Diesel / Description and OperationFuel Pump Driver Module

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Топливо насос водитель модуль

Fuel Pump Driver Module



The fuel pump operation is regulated by the FPDM which is controlled by the Powertrain Control Module (PCM). The FPDM regulates the flow and pressure supplied by controlling the operation of the Low Pressure (LP) fuel pump using a Pulse Width Modulation (PWM) output.

The FPDM is powered by a supply from the fuel pump relay in the Rear Junction Box (RJB). The LP fuel pump relay is energized on opening the driver's door, pressing the start button only or pressing the start button and the footbrake (which initiates engine cranking). The FPDM supplies power to the LP fuel pump, and adjusts the power to control the speed of the LP fuel pump and the pressure and flow in the fuel delivery line.

A PWM signal from the PCM tells the FPDM the required speed for the LP fuel pump. The on time of the PWM signal represents half the LP fuel pump speed, for example; if the PWM signal has an on time of 50 %, the FPDM drives the pump at 100 %.

The FPDM will only energize the LP fuel pump if it receives a valid PWM signal, with an on time of between 4 % and 50 %. To switch the LP fuel pump off, the PCM transmits a PWM signal with an on time of 75 %.

The output pressure from the LP fuel pump will change with changes of engine demand and fuel temperature. The PCM calibrates the engine and fuel demands then sends a PWM signal to the FPDM to adjust the speed of the LP fuel pump as necessary.

If the PCM does not detect pressure in the fuel delivery line, it stops, or refuses to start the engine and stores the appropriate Diagnostic Trouble Code (DTC).

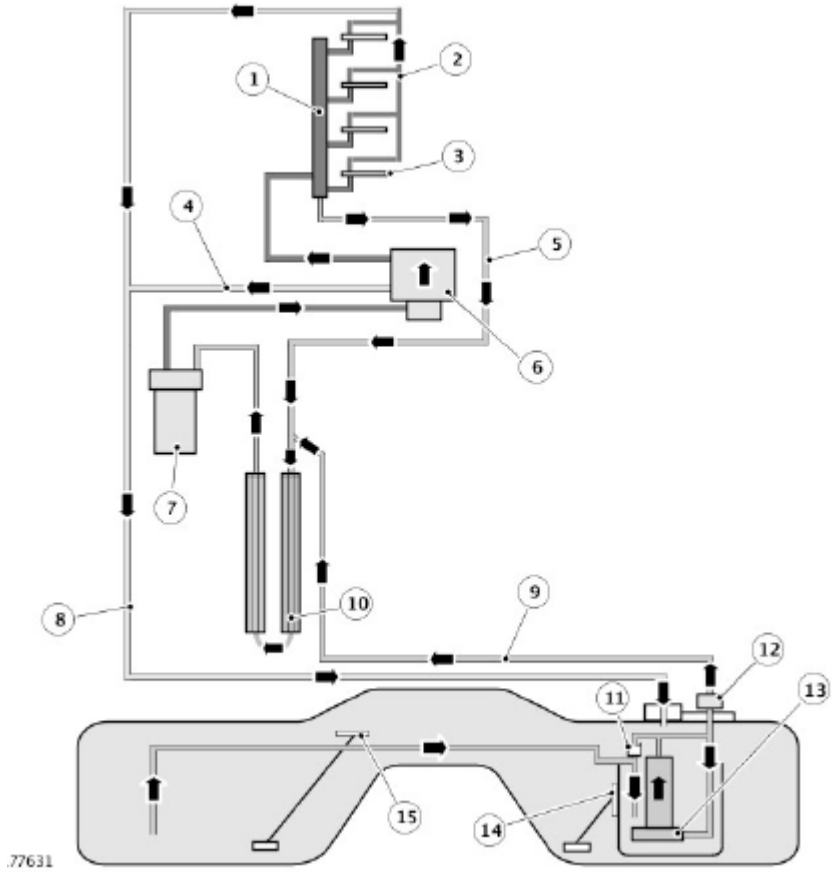
The PCM receives a monitoring signal from the FPDM. Any DTCs produced by the FPDM are stored by the PCM.

DTCs can be retrieved from the PCM using an approved diagnostic system.

The FPDM itself cannot be interrogated by the approved diagnostic system.

OPERATION

Fuel System Flow Schematic



1. Fuel rail
2. Injector leak-off return line
3. Fuel injector (4 off)
4. High Pressure (HP) fuel pump return line
5. Fuel rail return line
6. HP fuel pump (engine mounted)
7. Fuel filter assembly
8. Fuel return/air bleed pipe
9. Low pressure (LP) delivery pipe
10. Fuel cooler
11. Jet pump
12. Pressure regulator
13. Fuel pump module
14. Active fuel level sensor 'A'
15. Passive fuel level sensor 'B'

The Low Pressure (LP) fuel pump operation is regulated by the Fuel Pump Driver Module (FPDM), which is controlled by the Powertrain Control Module (PCM). The FPDM regulates the fuel flow and pressure delivered to the engine mounted High Pressure (HP) fuel pump by controlling the operation of the LP fuel pump using a Pulse Width Modulation (PWM) output.

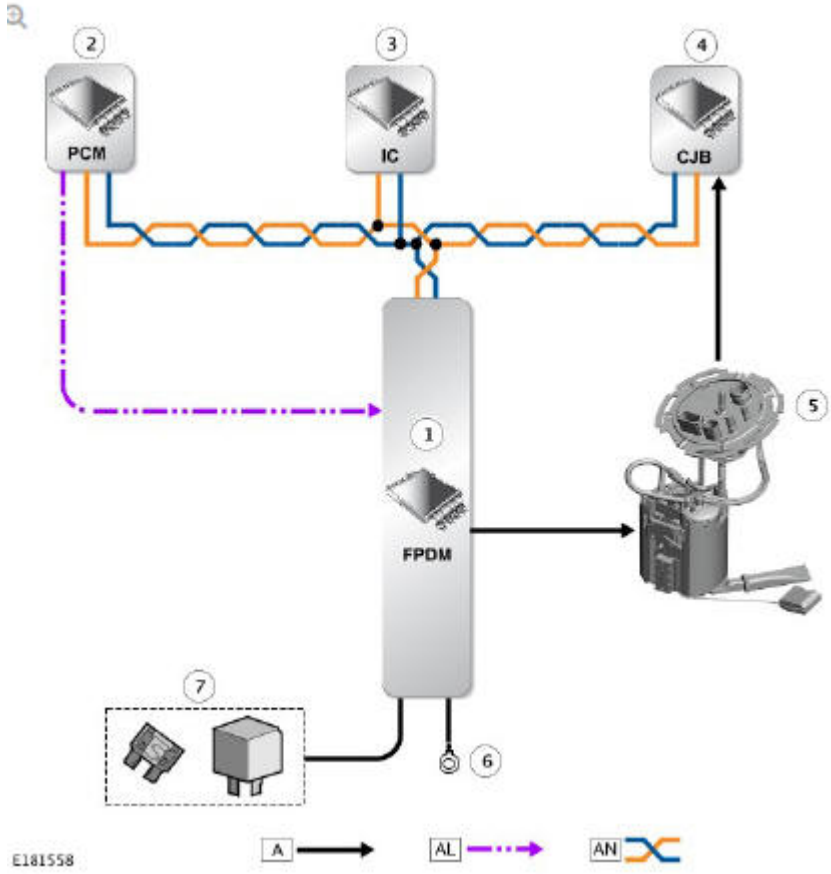
The FPDM has a power supply connection from the Battery Junction Box (BJB) via the LP fuel pump relay. The LP fuel pump relay is controlled by the Central Junction Box (CJB) and it is active when the ignition is switched on (power mode 6).

Inside the fuel tank there are two fuel level sensors; 'A' and 'B', which output signals to the CJB for fuel tank fuel level. This information is processed by the CJB and passed to the Instrument Cluster (IC) to display the remaining fuel level and low fuel warning.

INPUT/OUTPUT DIAGRAM

NOTE:

A = Hardwired; AL = PWM (Pulse Width Modulation); AN = High Speed (HS) Controller Area Network (CAN) powertrain systems bus



1. Fuel Pump Driver Module (FPDM)
2. Powertrain Control Module (PCM)
3. Instrument Cluster (IC)
4. Central Junction Box (CJB)
5. Fuel Pump Module
6. Ground
7. Power supply

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Misfueling protection deviceFuel Tank and Lines - Ingenium i4 2.0l Diesel Diagnosis and Testing

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Топливный бак и магистрали - Ingenium i4 2.0l дизель диагностика и проверка

Fuel Tank and Lines - Ingenium i4 2.0l Diesel Diagnosis and Testing

PRINCIPLE OF OPERATION

For a detailed description of the fuel tank and lines system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (310-01B Fuel Tank and Lines - INGENIUM I4 2.0L Diesel)

Fuel Tank and Lines (Description and Operation), Specifications (Specifications), Fuel Pump and Sensor Unit (Removal and Installation).

INSPECTION AND VERIFICATION

WARNINGS:

- ***Do NOT carry out any work on the fuel system with the engine running. The fuel pressure within the system can be as high as 2200 bar (31,908 lb/in²). Failure to follow this instruction may result in personal injury.***
- ***Eye protection must be worn at all times when working on or near any fuel related components. Failure to follow this instruction may result in personal injury.***
- ***This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury.***
- ***After carrying out repairs, the fuel system must be checked visually for leaks. This should be done after the engine has been run, but with the engine switched OFF. Failure to follow this instruction may result in personal injury.***
- ***If taken internally, DO NOT induce vomiting. Seek immediate medical attention. Failure to follow this instruction may result in personal injury.***
- ***If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention. Failure to follow this instruction may result in personal injury.***
- ***Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.***

  Failure to follow this instruction may result in personal injury.

CAUTIONS:

- **Before disconnecting any part of the system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into the fuel system. Failure to follow this instruction may result in damage to the vehicle.**
- **It is essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in damage to the vehicle.**
- **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.

NOTES:

- *Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.*
- *When measuring fuel sender resistance values with a multimeter, it is critical to use the correct multimeter setting. The multimeter should not be on the 'Auto' setting and must be set to 'Manual'.*

  This will help prevent incorrect diagnosis and unnecessary replacement of fuel senders. If the multimeter range is set at 'Auto' then, during a sweep of the sender from 50 Ohms to 998 Ohms, the multimeter has to change its measurement range. For approximately 1 second, during the range switch over point, the multimeter display indicates an open circuit. This can lead to a misdiagnosis of a fuel sender fault.

1. Verify the customer concern

2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

MECHANICAL	ELECTRICAL
■ Low/contaminated fuel ■ Fuel supply/return line(s) ■ Fuel tank and filler pipe ■ Fuel leak(s) ■ Fuel filler cap ■ Fuel filter ■ Push connect fittings ■ Fuel pump	■ Fuses ■ Links ■ Relays ■ Fuel Pump Driver Module (FPDM) ■ Fuel pump module ■ Sensor(s) ■ Engine control module (ECM) ■ Rear Junction Box (RJB) ■ Restraints Control Module (RCM)

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 proceed to the DTC Index

SYMPTOM CHART

SYMPTOM	POSSIBLE CAUSES	ACTION
Fuel gauge reading too low	■ Instrument Cluster (IC) is not configured correctly ■ Fuel pump module flange electrical connector short circuit to ground due to frayed, melted wires/connectors or corroded connector pins ■ Fuel level sensor short circuit to ground, low resistance ■ Fuel level sensor float arm	■ GO to Pinpoint Test A.

	broken or bent ■ Fuel level sensor failure	
Fuel gauge reading too high	■ Instrument Cluster (IC) is not configured correctly ■ Fuel pump module flange electrical connectors short circuit to power due to melted wires/connectors or corroded connector pins ■ Corroded electrical harness connections between low pressure fuel pump and Central Junction Box (CJB) ■ Corroded electrical harness connections between Body Control Module (BCM) and Engine Control Module (ECM) or Instrument Cluster (IC) ■ Fuel level sensor circuit short to ground ■ Fuel level sensor failure ■ Fuel level sensor float arm jammed in the up position	■ GO to Pinpoint Test A.
Fuel gauge intermittent or inconsistent	■ Fuel level sensor poor ground connection, open circuit to power, high resistance ■ Fuel pump module electrical connector open circuit to power due to frayed, melted wires/connectors or corroded connector pins ■ Fuel pump module flange pins not projecting sufficiently to ensure electrical contact ■ Harness electrical connectors not correctly located, disconnected, damaged or pins backed out	■ GO to Pinpoint Test B.
Engine cranks but will not start or malfunction	■ Fuel tank empty ■ Fuel tank active side empty ■ Passive suction pipe	■ GO to Pinpoint Test C.

indicator lamp illuminated	disconnected from the fuel pump module passive jet connection or kinked suction tube line ■ Fuel filter restricted/blocked ■ Passive side jet pump blocked ■ Engine mounted fuel filter connector wear/leak ■ Open circuit between low pressure fuel pump module and low pressure fuel pump ■ Short circuit between low pressure fuel pump module and low pressure fuel pump ■ Low pressure fuel pump blockage due to debris ■ Low pressure fuel pump electrical control module inoperative ■ Fuel pump inoperative ■ Fuel supply pipe detached/restricted/blocked ■ In-tank fuel pipes detached from low pressure fuel pump or flange ■ Fuel inlet filter blockage (In-tank)	
Engine Malfunction, Stalls or Cut off	■ Fuel tank empty ■ Fuel tank active side empty ■ Passive suction pipe disconnected from the fuel pump module passive jet connection or kinked suction tube line ■ Engine mounted fuel filter restricted/blocked ■ Engine mounted fuel filter connector wear/leak ■ Passive side jet pump blocked ■ Open circuit between low pressure fuel pump module and low pressure fuel pump	■ GO to Pinpoint Test C.

	▪ Short circuit between low pressure fuel pump module and low pressure fuel pump ▪ Low pressure fuel pump blockage due to debris ▪ Low pressure fuel pump, Fuel Pump Driver Module (FPDM) inoperative ▪ Fuel pump pressure relief valve jammed open or leaking ▪ Fuel pump module pressure regulating valve jammed open or leaking ▪ Debris blocking engine High Pressure (HP) fuel pump inlet ▪ Fuel pump check valve leaking ▪ Fuel pump inoperative ▪ Fuel supply pipe detached/restricted/blocked ▪ In-tank fuel supply pipes detached from low pressure fuel pump or flange ▪ Fuel inlet filter blockage (In-tank)	
Engine misses under load	▪ Fuel tank empty ▪ Fuel pump pressure relief valve jammed open or leaking ▪ Fuel pump module pressure regulating valve jammed open or leaking ▪ Debris blocking engine High Pressure (HP) fuel pump inlet ▪ Engine mounted Fuel filter restricted/blocked ▪ Fuel supply pipe detached/restricted/blocked	▪ GO to Pinpoint Test D.
Engine doesn't rev up	▪ Engine mounted fuel filter restricted/blocked ▪ Fuel supply pipe detached/restricted/blocked	▪ GO to Pinpoint Test D.

	▪ In-tank fuel filter restricted/blocked ▪ Fuel pump pressure relief valve jammed open or leaking ▪ Fuel pump module pressure regulating valve jammed open or leaking ▪ Debris blocking engine High Pressure (HP) fuel pump inlet	
Low pressure fuel pump noise during idle and normal driving conditions	▪ The noise is not an error state. This is normal operation of the low pressure fuel pump	▪ Noise from the low pressure fuel pump is normal and will reduce considerably after 15 miles (24 kilometers) of use
Water in fuel above allowed threshold	▪ Water in fuel ▪ Water in fuel sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance ▪ Water in fuel sensor failure	▪ Using the manufacturer approved diagnostic system, check for water in fuel related DTCs and repair as necessary. Refer to the relevant DTC index
Fuel leak from fuel tank	▪ Fuel supply pipe detached from fuel pump flange ▪ Fuel pump cover locking ring and O-ring seal not fitted properly ▪ Leak from vapour/breather pipe connection incorrectly installed within the fuel pump module	▪ Check fuel delivery line and fuel return line for any leakage due to de-latching or pipe damage ▪ Check if the fuel pump locking ring and O-ring seal is fitted properly

SYMPTOM:

Fuel gauge reading too low

POSSIBLE CAUSES:

- Instrument Cluster (IC) is not configured correctly
- Fuel pump module flange electrical connector short circuit to ground due to frayed, melted wires/connectors or corroded connector pins
- Fuel level sensor short circuit to ground, low resistance
- Fuel level sensor float arm broken or bent Fuel level sensor failure

ACTION:

- GO to Pinpoint Test A.

SYMPTOM:

Fuel gauge reading too high

POSSIBLE CAUSES:

- Instrument Cluster (IC) is not configured correctly

- Fuel pump module flange electrical connectors short circuit to power due to melted wires/connectors or corroded connector pins
- Corroded electrical harness connections between low pressure fuel pump and Central Junction Box (CJB)
- Corroded electrical harness connections between Body Control Module (BCM) and Engine Control Module (ECM) or Instrument Cluster (IC)
- Fuel level sensor circuit short to ground
- Fuel level sensor failure
- Fuel level sensor float arm jammed in the up position

ACTION:

- GO to Pinpoint Test A.

SYMPTOM:

Fuel gauge intermittent or inconsistent

POSSIBLE CAUSES:

- Fuel level sensor poor ground connection, open circuit to power, high resistance
- Fuel pump module electrical connector open circuit to power due to frayed, melted wires/connectors or corroded connector pins
- Fuel pump module flange pins not projecting sufficiently to ensure electrical contact
- Harness electrical connectors not correctly located, disconnected, damaged or pins backed out

ACTION:

- GO to Pinpoint Test B.

SYMPTOM:

Engine cranks but will not start or malfunction indicator lamp illuminated

POSSIBLE CAUSES:

- Fuel tank empty
- Fuel tank active side empty
- Passive suction pipe disconnected from the fuel pump module passive jet connection or kinked suction tube line
- Fuel filter restricted/blocked
- Passive side jet pump blocked
- Engine mounted fuel filter connector wear/leak
- Open circuit between low pressure fuel pump module and low pressure fuel pump
- Short circuit between low pressure fuel pump module and low pressure fuel pump
- Low pressure fuel pump blockage due to debris
- Low pressure fuel pump electrical control module inoperative
- Fuel pump inoperative
- Fuel supply pipe detached/restricted/blocked
- In-tank fuel pipes detached from low pressure fuel pump or flange
- Fuel inlet filter blockage (Intank)

ACTION:

- GO to Pinpoint Test C.

SYMPTOM:

Engine Malfunction, Stalls or Cut off

POSSIBLE CAUSES:

- Fuel tank empty
- Fuel tank active side empty
- Passive suction pipe disconnected from the fuel pump module passive jet connection or kinked suction tube line
- Engine mounted fuel filter restricted/blocked
- Engine mounted fuel filter connector wear/leak
- Passive side jet pump blocked Open circuit between low pressure fuel pump module and low pressure fuel pump
- Short circuit between low pressure fuel pump module and low pressure fuel pump
- Low pressure fuel pump blockage due to debris
- Low pressure fuel pump, Fuel Pump Driver Module (FPDM) inoperative
- Fuel pump pressure relief valve jammed open or leaking
- Fuel pump module pressure regulating valve jammed open or leaking
- Debris blocking engine High Pressure (HP) fuel pump inlet
- Fuel pump check valve leaking
- Fuel pump inoperative
- Fuel supply pipe detached/restricted/blocked
- In-tank fuel supply pipes detached from low pressure fuel pump or flange
- Fuel inlet filter blockage (Intank)

ACTION:

- GO to Pinpoint Test C.

SYMPTOM:

Engine misses under load

POSSIBLE CAUSES:

- Fuel tank empty
- Fuel pump pressure relief valve jammed open or leaking
- Fuel pump module pressure regulating valve jammed open or leaking
- Debris blocking engine High Pressure (HP) fuel pump inlet
- Engine mounted Fuel filter restricted/blocked
- Fuel supply pipe detached/restricted/blocked

ACTION:

GO to Pinpoint Test D.

SYMPTOM:

Engine doesn't rev up

POSSIBLE CAUSES:

- Engine mounted fuel filter restricted/blocked
- Fuel supply pipe detached/restricted/blocked
- In-tank fuel filter restricted/blocked
- Fuel pump pressure relief valve jammed open or leaking
- Fuel pump module pressure regulating valve jammed open or leaking
- Debris blocking engine High Pressure (HP) fuel pump inlet

ACTION:

- GO to Pinpoint Test D.

SYMPTOM:

Low pressure fuel pump noise during idle and normal driving conditions

POSSIBLE CAUSES:

- The noise is not an error state.

  This is normal operation of the low pressure fuel pump

ACTION:

- Noise from the low pressure fuel pump is normal and will reduce considerably after 15 miles (24 kilometers) of use

SYMPTOM:

Water in fuel above allowed threshold

POSSIBLE CAUSES:

- Water in fuel
- Water in fuel sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance
- Water in fuel sensor failure

ACTION:

- Using the manufacturer approved diagnostic system, check for water in fuel related DTCs and repair as necessary.

  Refer to the relevant DTC index

SYMPTOM:

Fuel leak from fuel tank

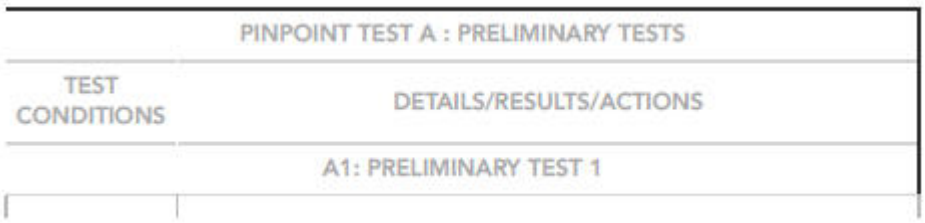
POSSIBLE CAUSES:

- Fuel supply pipe detached from fuel pump flange
- Fuel pump cover locking ring and O-ring seal not fitted properly
- Leak from vapour/breather pipe connection incorrectly installed within the fuel pump module

ACTION:

- Check fuel delivery line and fuel return line for any leakage due to de-latching or pipe damage
- Check if the fuel pump locking ring and O-ring seal is fitted properly

PINPOINT TESTS



	1 Check that the fuel gauge indicates that there is some fuel in the fuel tank. Add fuel if necessary
	2 Using the manufacturer approved diagnostic system, check datalogger signals - Fuel Level Sensor pump/active/A (0xD908) - and - Fuel Level Sensor eject/passive/B (0xD907)
	3 Make a note of the values of each sensor
	Are both datalogger signals between 0.37V and 3.02V? **Yes** GO to A2. **No** GO to Pinpoint Test B.

A2: PRELIMINARY TEST 2

	1 Re-configure the Instrument Cluster (IC) with the latest level software
	Is the fuel gauge reading correctly now? **Yes** Repair complete **No** GO to A3.

A3: PRELIMINARY TEST 3

	1 Using the manufacturer approved diagnostic system, check datalogger signals - Fuel Level Sensor pump/active/A (0xD908) - and - Fuel Level Sensor eject/passive/B (0xD907).
	Is the passive fuel level value greater than the active fuel level value? **Yes** GO to A4. **No** GO to Pinpoint Test B.

A4: PRELIMINARY TEST 4

	1 Remove the fuel pump module flange (to allow access to the crossover pipe inside the fuel tank). (Refer to: Fuel Tank and Lines (310-01B Fuel Tank and Lines - INGENIUM I4 2.0L Diesel, Removal and installation, Fuel pump and sender unit)
	2 Check the integrity of the crossover pipe, disconnected / damaged / kinked passive suction pipe, passive jet pump blocked, pickup filter mesh blocked
	Is there a fault with the crossover pipe, passive suction pipe, jet pump and pickup filter mesh? **Yes** Repair as necessary **No** GO to Pinpoint Test B.

NOTE:

Two ohmmeters are required for this test.

NOTE:

If the measurement range of the ohmmeter is set to 'automatic', the ohmmeter will briefly display 'open circuit' when the range changes.

This does not indicate a fault with the component. To prevent incorrect diagnosis, always set the measurement range to 'manual'.

PINPOINT TEST B : FUEL LEVEL SENSOR TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	B1: FUEL LEVEL SENSOR TEST 1
	1 Locate the fuel pump module flange electrical connectors. (Refer to: Fuel Tank and Lines (310-01B Fuel Tank and Lines - INGENIUM I4 2.0L Diesel, Removal and installation, Fuel pump and sender unit)
	2 Disconnect and reconnect the fuel level sensor electrical connector three times
	Did the datalogger signals change between 0.37V and 3.02V each time the connector was disconnected and reconnected? **Yes** Poor connection in the fuel pump electrical connector or harness side electrical connector due to damaged/corroded connector pins or pin receptacles. If the bad connection is on the harness side connector or the wiring before fuel pump module flange, replace the wiring or connector. If the bad connection is on the fuel pump module flange connector, install a new fuel pump module flange (Refer to: Fuel Tank and Lines (310-01B Fuel Tank and Lines - INGENIUM I4 2.0L Diesel, Removal and installation, Fuel pump and sender unit) **No** GO to B2.
	B2: FUEL LEVEL SENSOR TEST 2
	1 Disconnect the fuel level sensor electrical connector from the fuel pump module flange
	2 Check if all the fuel pump module flange pins are projecting sufficiently to ensure electrical contact. Each pin is required to be

	11.6mm from the top of the connector molding
	3 Check if the harness electrical connectors are correctly located, not disconnected, damaged or pins are backed out
	Is there any evident fault in the flange electrical connector pins or harness electrical connector? **Yes** Repair as necessary **No** **GO to B3.**

B3: FUEL LEVEL SENSOR TEST 3

	1 Connect an ohmmeter to the passive fuel level sensor (B) terminals in the fuel pump module flange connector (Pins 2 PASSIVE + and 4 PASSIVE -)
	2 Measure the resistance of the passive fuel level sensor (B)
	3 Connect an ohmmeter to the active fuel level sensor (A) terminals in the fuel pump module flange connector (Pins 5 ACTIVE + and 3 ACTIVE -)
	4 Measure the resistance of the active fuel level sensor (A)
	5 Make a note of the resistance values
	Is the measured resistance of the passive fuel level sensor (B) between 51.1Ω and 992.1Ω? Is the measured resistance of the active fuel level sensor (A) between 51.1Ω and 527.4Ω? **Yes** Refer to: Electrical information (Electrical wiring diagram, Fuel tank and fuel line) and check the fuel level sensor circuit Central Junction Box (CJB) to fuel pump module flange and CJB to Instrument Cluster (IC) for short circuit to ground, short circuit to power, open circuit, high resistance. Re-configure the IC with the latest level software. Re-configure the CJB **No** **GO to B4.**

B4: FUEL LEVEL SENSOR TEST 4

	1 Disconnect the battery. (Refer to: Electrical/Battery and charging system (414 Battery and charging systems, mounting and cables, Removal and Installation, Battery)
	2 Disconnect the battery support unit
	3 Remove the fuel pump module flange (to allow access to the connector on the underside of the fuel pump module flange. (Refer to: Fuel tank and lines (310-01C: Fuel Tank and Lines – INGENIUM I4 2.0L Diesel/Removal and installation/ Fuel Pump and sender unit)
	4 Connect an ohmmeter to the passive fuel level sensor (B) terminals in

	the fuel pump module flange connector (Pins 2 PASSIVE + and 4 PASSIVE -)
	5 Connect an ohmmeter to the active fuel level sensor (A) terminals in the fuel pump module flange connector (Pins 5 ACTIVE + and 3 ACTIVE -)
	6 Measure the resistance of the passive fuel level sensor (B)
	7 Measure the resistance of the active fuel level sensor (A)
	8 Disconnect and reconnect the fuel pump module lower fuel level electrical connector three times
	
	9 Check if there is any evidence of frayed, melted wires/connectors or corroded connector pins
	Did the measured resistance value of the passive fuel level sensor (B) change between 51.1Ω and 992.1Ω each time the connector was disconnected and reconnected? Did the measured resistance value of the active fuel level sensor (A) change between 51.1Ω and 527.4Ω each time the connector was disconnected and reconnected? **Yes** Poor connection in the fuel pump module electrical connector due to damage/corrosion of the terminals. Install a new low pressure fuel pump. (Refer to: Fuel tank and lines (310-01B: Fuel Tank and Lines – INGENIUM I4 2.0L Diesel/Removal and installation/ Fuel Pump and sender unit) **No** **GO to B5.**

B5: FUEL LEVEL SENSOR TEST 5

	1 Disconnect both the active (A) and passive (B) fuel level electrical connector from the underside of the fuel pump module
	
	2 Measure the resistance of the passive fuel level sensor (B)
	3 Measure the resistance of the active fuel level sensor (A)
	Is the measured resistance of the passive fuel level sensor (B) between 51.1Ω and 992.1Ω? Is the measured resistance of the active fuel level sensor (A) between 51.1Ω and 527.4Ω? **Yes** Poor connection in the fuel pump flange electrical connector due to

	damage/corrosion of the terminals. Install a new low pressure fuel pump. (Refer to: Fuel tank and lines (310-01B: Fuel Tank and Lines – INGENIUM I4 2.0L Diesel/Removal and installation/ Fuel Pump and sender unit) **No** GO to B6.

B6: FUEL LEVEL SENSOR TEST 6	
	1 Remove the suspect fuel level sensor
	2 Connect an ohmmeter to the fuel level sensor terminals
	3 Move the fuel level sensor arm through its full range and monitor the measured resistance
	Is the measured resistance for the passive fuel level sensor (B) between 51.1Ω and 992.1Ω? Is the measured resistance for the active fuel level sensor (A) between 51.1Ω and 527.4Ω? **Yes** Passive fuel level sensor (B) Check the fuel level sensor float arm for breakage or bends. Replace the passive fuel level sensor (B). Active fuel level sensor (A) Check the fuel level sensor float arm for breakage or bends. Replace the active fuel level sensor (A) **No** Passive fuel level sensor (B) Fuel level sensor internal failure. Install a new passive fuel level sensor (B). Active fuel level sensor (A) Fuel level sensor internal failure. Install a new active fuel level sensor (A)

NOTE:

This test should be carried out by turning the ignition ON.

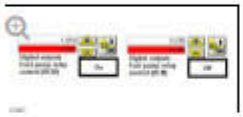
PINPOINT TEST C : LOW PRESSURE FUEL PUMP TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK LOW PRESSURE FUEL PUMP ACTIVITY	
	1 Remove the lower rear seat cushion. Refer to Rear Seat (501-10 Seating, Removal and Installation)
	2 Use an assistant to cycle the ignition status between On and Off to operate the low pressure pump. Ensure the engine remains off
	3 Listen for a humming sound from the fuel pump for a couple of seconds
	Can the fuel pump be heard running? **Yes**

	GO to C4. **No** GO to C2.

C2: CHECKING LOW PRESSURE FUEL PUMP FUSE

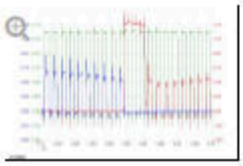
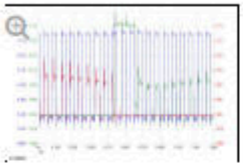
	1 Locate the fuel pump fuse in the Rear Junction Box (RJB)
	2 Check the fuel pump fuse
	has the fuel pump fuse blown? **Yes** Refer to the electric circuit diagrams and check the fuel pump circuit for short circuit to power or short circuit to ground. Repair circuit as necessary. Install a new fuse and retest **No** GO to C3.

C3: CHECKING LOW PRESSURE FUEL PUMP RELAY

	1 Using the manufacturer approved diagnostic system, find the datalogger signal for the fuel pump relay control button. Use this button to switch the fuel pump relay ON and OFF
	
	Can the fuel pump relay be heard clicking each time it is turned ON and OFF **Yes** GO to C4. **No** Check the ampere rate of the relay. Check the fuel pump relay circuit for short circuit to ground. Repair as necessary and retest if the relay is not functioning, if the ampere rate of the relay is different replace it with a 70A relay

C4: LOW PRESSURE FUEL PUMP VOLTAGE DROP TEST

	1 Go back to the fuel pump
	2 Use the manufacturer approved oscilloscope
	3 Connect the oscilloscope to the low pressure fuel pump connector (C4E515 - 3)
	4 Turn the ignition ON and record the outcome

	
	
	Are the voltage values constantly oscillating between 0V and 13.5V in each of the phases as shown in the above figures? **Yes** GO to Pinpoint Test **D.** **No** GO to C5.

C5: LOW PRESSURE FUEL PUMP RESISTANCE TEST 1

	1 Disconnect the electrical connector on top of the fuel pump flange
	2 Use the manufacturer approved oscilloscope
	3 Check the resistance between terminal 1 and 2, 1 and 3, 2 and 3 of the low pressure fuel pump using an ohmmeter
	4 Check if there is any evidence of frayed, melted wires/connectors or corroded connector pins
	Is there any open or short circuit in the fuel pump connector or internal circuit? (Expected resistance value in the specified terminals is 0.5Ω) **Yes** Low pressure fuel pump internal failure. Replace low pressure fuel pump **No** GO to C6.

C6: LOW PRESSURE FUEL PUMP RESISTANCE TEST 2

	1 Reconnect the electrical connector on top of the fuel pump module flange
	2 Locate the Fuel Pump Driver Module (FPDM)
	3 Disconnect the electrical connector of the FPDM

	4 Use the manufacturer approved ohmmeter
	5 Check the resistance between terminal 1 and 2, 1 and 5, 2 and 5 of the FPDM harness side connector using an ohmmeter
	Is there any open or short circuit in the wiring harness between FPDM and Low pressure fuel pump? (Expected resistance value in the specified terminals is 1Ω) **Yes** Repair the suspected wiring harness as required. (Refer to: Electrical Distribution (Electrical, 418-02: Electrical Distribution, Wiring Harnesses, Description and Operation) **No** GO to C7.

C7: LOW PRESSURE FUEL PUMP GROUND CIRCUIT CHECK

	1 Get a long wire lead that can reach the fuel pump and attach it to the -VE terminal of the battery
	2 Use the manufacturers approved multimeter
	3 Attach the -VE lead of the multimeter to the long wire lead which is attached to the battery –VE terminal
	4 Attach the +VE lead of the multimeter to the -VE terminal of the Fuel Pump Driver module (FPDM) (Terminal 8)
	5 Set the multimeter to VDC
	6 Turn the ignition key ON
	7 Measure the voltage
	Is the voltage drop >1V? **Yes** Check the ground connection of the FPDM and Repair as required. (Refer to: Electrical Distribution (Electrical, 418-02: Electrical Distribution, Wiring Harnesses, Description and Operation) **No** GO to C8.

C8: LOW PRESSURE FUEL PUMP VOLTAGE DROP TEST IN THE +VE CIRCUIT

	1 Get a long wire lead that can reach the Fuel pump Driver Module (FPDM) and attach it to the +VE terminal of the battery
	2 Attach the +VE lead of the multimeter to the long wire lead which is attached to the battery

	3 Attach the -VE terminal of the multimeter to the +VE terminal of the Fuel Pump Driver Module (FPDM) (Connector harness side: terminal 4)
	4 Set the multimeter to VDC
	5 Turn the ignition key ON
	6 Measure the voltage
	Is the voltage drop >1V? **Yes** Check connector C31A, C31B (if fitted) and the wire between fuse box and FPDM, replace or repair them as necessary **No** GO to Pinpoint Test E.

WARNING:

This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury

NOTE:

This procedure involves disconnection of fuel lines. Place suitable absorbent material around the fuel line to be disconnected, to absorb any spillage when connecting the fuel pressure gauge.

NOTE:

This procedure involves disconnection of fuel lines. Place suitable absorbent material around the fuel line to be disconnected, to absorb any spillage when connecting the fuel pressure gauge.

PINPOINT TEST D : LOW PRESSURE FUEL LINE PRESSURE TESTS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	D1: LOW PRESSURE FUEL LINE PRESSURE TEST 1
	1 Make sure the vehicle is in Park and apply the parking brake
	2 Set ignition status to OFF
	3 Disconnect the fuel supply line from the low pressure fuel pump fuel supply connection
	
	4 Connect the manufacturers approved fuel pressure gauge in the fuel supply connection on top of the low pressure fuel pump flange. Remove the absorbent material and dispose of safely
	5 Set ignition status to ON
	6 Record the fuel pressure reading
	Is the fuel pressure >4.5bar? **Yes** GO to D2. **No** Remove the fuel pump module flange (to allow access to the fuel lines on the underside of the fuel pump module flange. (Refer to: Fuel tank and lines (310-01B: Fuel Tank and Lines – INGENIUM I4 2.0L Diesel/Removal and installation/ Fuel Pump and sender unit). Inspect low pressure fuel pump internal fuel lines from any leakage, blockage or de-latching. Inspect in-tank fuel filter from blockage. Check if the pump pressure relief valve is jammed open or leaking, Fuel pump module pressure regulating valve jammed open or leaking. Repair as required. If no fault found, GO to Pinpoint Test F.
	D2: LOW PRESSURE FUEL LINE PRESSURE TEST 2
	1 Reconnect the fuel supply line to the low pressure fuel pump fuel supply connection
	2 Disconnect the low pressure fuel supply line from the fuel filter
	3 Connect the manufacturers approved fuel pressure gauge in the fuel line between low pressure fuel pump and fuel filter. Remove the absorbent material and dispose of safely
	4 Set ignition status to ON
	5 Record the fuel pressure reading
	Is the fuel pressure >4.4bar?

	Yes GO to D3. **No** Inspect low pressure fuel line between low pressure fuel pump and engine mounted fuel filter. Repair as required

D3: LOW PRESSURE FUEL LINE TEST 3	
	1 Disconnect the pipe which connects the fuel filter and High Pressure (HP) fuel pump from the fuel filter
	2 Connect the manufacturers approved fuel pressure gauge between the fuel filter and the pipe to HP fuel pump
	3 Set ignition status to ON
	4 Record the fuel pressure reading
	Is the fuel pressure >4.3bar? **Yes** GO to D4. **No** Faulty fuel filter. Replace fuel filter

D4: LOW PRESSURE FUEL LINE TEST 4	
	1 Disconnect the fuel supply pipe from the High Pressure (HP) fuel pump
	2 Connect the manufacturers approved fuel pressure gauge in the fuel line between the fuel supply pipe and the HP fuel pump
	3 Set ignition status to ON
	4 Record the fuel pressure reading
	Is the fuel pressure >4.3bar? **Yes** Check HP fuel pump inlet strainer for any blockage due to debris. If no fault found, GO to Pinpoint Test E. **No** Check the fuel line between the high pressure fuel pump and fuel filter. Replace or repair fuel line as necessary and retest

PINPOINT TEST E : ENGINE MANAGEMENT SYSTEM TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: ENGINE MANAGEMENT SYSTEM TEST 1	
	1 Using the manufacturer approved diagnostic system, check the engine control module for engine management system related DTCs

	Are any engine management system DTCs set? **Yes** Refer to the relevant DTC index and perform the relevant corrective actions **No** GO to Pinpoint Test **F**.

PINPOINT TEST F : FUEL TANK CHECK	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: FUEL TANK CHECK	
	1 Check for the presence of fuel in the active side of the fuel tank
	Is fuel present in the active side of the fuel tank? **Yes** Fuel pump internal failure. Install a new low pressure fuel pump. (310-01B: Fuel Tank and Lines – INGENIUM I4 2.0L Diesel/Removal and installation/ Fuel Pump and sender unit) **No** Check the integrity of the crossover pipe and repair as necessary. If the actual fuel level is inconsistent with the fuel level sensor datalogger signals GO to Pinpoint Test **B**.

MIS - FUELLING ISSUES / ACCIDENTALLY FILLING THE FUEL TANK WITH GASOLINE INSTEAD OF DIESEL

NOTES:

- *The customer MUST be informed prior to vehicle hand-over of the consequences of adding gasoline to the fuel tank instead of diesel.*
- *The cost of this repair work is not Jaguar Land Rover's responsibility. If the customer does not have all of the appropriate work carried out, warranty may be refused on all affected components.*
- *If the customer refuses the advised repair or wants a lower level repair than advised, the vehicle must be added to the Restricted Warranty Register.*
- *Vehicle mis-fuelling will not result in a formal warranty restriction if the approved repair has been completed.*
- *The symptom charts below describe the four possible scenarios of a customer incorrectly fuelling a diesel engine vehicle with gasoline. When customers report a mis-fuel, allow them to fully explain exactly what took place before advising the necessary repair.*
- *The procedures listed below are for guidance only. The relevant sections of TOPIx must be referred to for all detailed procedures and replacement of parts.*
- *Purge operation of the low pressure fuel pumps on the following vehicle lines is activated when the drivers door is opened: Jaguar XE, Jaguar XF, Jaguar F-Pace. For all other vehicle lines, the purge operation of the low pressure fuel pumps is activated when the ignition is switched on.*

Mis-fuelling Procedure 1

SYMPTOM	POSSIBLE CAUSES	ACTION
Mis-fuelling issue. The diesel fuel tank has been filled with gasoline	The vehicle has been incorrectly fuelled and the ignition switch has **NOT** been switched to **ON**	▪ 1. Referring to the relevant section in the workshop manual, drain the fuel tank

		▪ 2. Remove the fuel tank assembly ▪ 3. Remove the primary fuel pump/sender module and in-tank transfer pipe. Invert the pump/sender module to drain excess fuel ▪ 4. Remove all traces of residual fuel within the fuel tank using clean absorbent cloth/paper ▪ 5. Flush the pump/sender module and in tank transfer pipe with clean diesel ▪ 6. Reassemble the pump/sender module and in tank transfer pipe to the fuel tank and install to the vehicle ▪ 7. Fully fill the fuel tank with clean diesel ▪ 8. Road test the vehicle for at least 10 miles/16Km ▪ 9. Return the vehicle to the customer

Mis-fuelling Procedure 2

SYMPTOM	POSSIBLE CAUSES	ACTION
Mis-fuelling issue. The diesel fuel tank has been filled with gasoline	The vehicle has been incorrectly fuelled and the ignition switch has been switched to the **ON** position	▪ 1. Referring to the relevant section in the workshop manual, drain the fuel tank ▪ 2. Remove the fuel pump module and fuel level sensor ▪ 3. Remove all traces of residual fuel within the fuel tank using clean absorbent cloth/paper ▪ 4. Invert the fuel pump module and fuel level sensor to remove all traces of residual fuel ▪ 5. Remove the fuel filter and discard ▪ 6. Disconnect the fuel feed to the high-pressure fuel pump ▪ 7. Flush all the fuel lines with

		clean diesel ▪ 8. Reassemble the fuel pump module and fuel level sensor to the fuel tank ▪ 9. Install a new fuel filter ▪ 10. Fully fill the fuel tank with clean diesel ▪ 11. Road test the vehicle for at least 10 miles/16Km, checking for normal engine operation and no stored DTC'S ▪ 12. Return the vehicle to the customer

Mis-fuelling Procedure 3

SYMPTOM	POSSIBLE CAUSES	ACTION
Mis-fuelling issue. The diesel fuel tank has been filled with gasoline	The vehicle has run for less than two minutes	▪ 1. Referring to the relevant section in the workshop manual, drain the fuel tank ▪ 2. The residual fuel from all removed parts needs to be checked for metal particles using a magnet ▪ 3. Remove the fuel pump module and fuel level sensor ▪ 4. Remove all traces of residual fuel within the fuel tank using clean absorbent cloth/paper ▪ 5. Invert the fuel pump module and fuel level sensor to remove all traces of residual fuel ▪ 6. Remove the fuel filter and discard ▪ 7. Disconnect the fuel feed to the high-pressure fuel pump ▪ 8. Flush all the fuel lines with clean diesel ▪ 9. If no metal particles are detected, go to step 11 ▪ 10. If metal particles are present, go to procedure 4 and carry out step 3 to step 8

		▪ 11. Reassemble the fuel pump module and fuel level sensor to the fuel tank ▪ 12. Install a new fuel filter ▪ 13. Fully fill the fuel tank with clean diesel ▪ 14. Road test the vehicle for at least 10 miles/16Km, checking for normal engine operation and no DTC'S ▪ 15. Return the vehicle to the customer

Mis-fuelling Procedure 4

SYMPTOM	POSSIBLE CAUSES	ACTION
Mis-fuelling issue. The diesel fuel tank has been filled with gasoline	The vehicle has been driven until it stops or over two minutes. The entire fuel system will need reworking	▪ 1. Referring to the relevant section in the workshop manual, drain the fuel tank ▪ 2. Clean and flush all the low pressure fuel pipes ▪ 3. Replace the fuel filter ▪ 4. Replace the high pressure fuel pump ▪ 5. Replace all the high pressure fuel pipes ▪ 6. Replace the diverter pipe and both fuel rails ▪ 7. Replace the fuel cooler ▪ 8. Replace all the fuel injectors ▪ 9. Remove the fuel pump module and fuel level sensor ▪ 10. Remove all the traces of residual fuel within the fuel tank using clean absorbent cloth/paper ▪ 11. Invert the fuel pump module and fuel level sensor to remove all the traces of residual fuel ▪ 12. Reassemble the fuel pump module and fuel level sensor to the fuel tank ▪ 13. Fully fill the fuel tank with clean diesel
		▪ 14. Road test the vehicle for at least 10 miles/16Km, checking for normal engine operation and that no stored diagnostic trouble codes are logged ▪ 15. Return the vehicle to the customer

FUEL GAUGE , RESISTANCE , VOLTAGE AND FUEL TANK LEVEL COMPARISON CHART

Use the chart to determine fuel tank fuel volume versus fuel gauge reading to determine the fuel level symptom and fault.

NOTES:

- *The vehicle must be parked on a level surface to obtain an accurate fuel level gauge reading.*
- *The actual values may vary, according to the quantity of fuel in the left and right sides of the fuel tank.*
- *An accurate fuel level gauge reading requires 3 to 5 minutes for levels to stabilise.*

Volume, Resistance and Voltage Values

GAUGE READING	FILL VOLUME (L)	FUEL SENDER 2 (0X61B8) - RIGHT SIDE		FUEL SENDER 1 (0X61B7) - LEFT SIDE	
		RESISTANCE (Ω)	CAN COUNT (TOLERANCE ± 10)	RESISTANCE (Ω)	CAN COUNT (TOLERANCE ± 10)
	0	52	75	51	74
	2	60	86	51	74
	4	76	107	51	74
	6	86	119	51	74

	8	121	160	51	74
	10	151	191	51	74
Empty	12	183	223	51	74
	14	205	244	51	74
	16	242	276	51	74
	18	283	308	51	74
	20	327	340	51	74
¼	22	358	361	51	74
	24	408	392	51	74
	26	445	414	51	74
	28	446	436	51	74
	30	446	436	51	74
	32	446	436	59	85
	34	446	436	75	106
	36	445	425	101	148
	38	486	436	170	159
	40	486	446	140	170
½	42	486	446	160	201
	44	460	425	192	223
	46	486	446	204	243
	48	552	457	204	243
	50	626	489	204	243
	52	654	521	228	254
	54	654	521	241	275
	56	654	521	254	286
¾	58	654	521	281	307
	60	684	531	296	318
	62	707	531	326	339
	64	727	541	357	350
	66	737	562	373	370
Full	67	803	563	407	391
Maximum Fill	Maximum Fill	911	594	425	402

DTC INDEX

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. Diagnostic Trouble Code (DTC Index - INGENIUM I4 2.0L Diesel, DTC: Engine Control Module (ECM) B10A2-07 to P034B-76

Fuel Tank and Lines - Ingenium i4 2.0l Diesel Specifications

Capacity

ITEM	LITERS
Fuel tank capacity	59 (usable)

General Specifications

ITEM	SPECIFICATIONS
Fuel system	Electronic - returnless
Fuel tank	Multi layer plastic
Fuel pump	Dual stage electric - submersible - located in fuel tank
Fuel filter	Located in the fuel tank - if the fuel filter becomes blocked a new fuel pump and sender unit must be installed
Fuel tank sender units	Two - active and passive - passive sender unit is attached to the removable retaining bracket and the active sender unit is attached to the fuel pump swirl pot
System pressure	4.5 bar - 65.3 lbf/in2
Starting pressure	6.3 bar - 91.4 lbf/in2

Torque Specifications

DESCRIPTION	NM	LB-FT	LB-IN
Fuel tank internal bracket retaining bolt	7	-	62
Fuel tank filler pipe retaining nuts	9	-	80
Fuel tank filler pipe hose clamp	3.5	-	31
Fuel tank shield retaining bolts	45	33	-
Fuel tank shield to fuel tank bolt	10	7	-

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Fuel Pump Driver ModuleFuel Tank Draining (G898063) / General Procedures

ne

Топливо бак слив / общие процедуры

Fuel Tank Draining (G898063) / General Procedures

WARNINGS:

- ***Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.***
- ***Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.***
- ***Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.***
- ***The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.***

CAUTION:

Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

NOTE:

It is possible that up to 2 litres of fuel may be left in the tank after draining.

1. Open the fuel filler door and remove the cap.
2. Disconnect the battery ground cable. Refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).
3. Connect the fuel tank drain equipment ground cable to the vehicle.

WARNING:

Fuel may still be present in the fuel tank after draining.

Remove the fuel from the fuel tank, via the filler neck, using the fuel tank draining equipment. Follow the manufacturer's operating instructions.

To install, reverse the removal procedure.

General Information Diesel Filter Water Drain-off (G1450064) General Procedures

DRAINING

WARNINGS:

- ***Avoid flames, sparks or lighted substances.***
- ***Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.***

CAUTION:

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

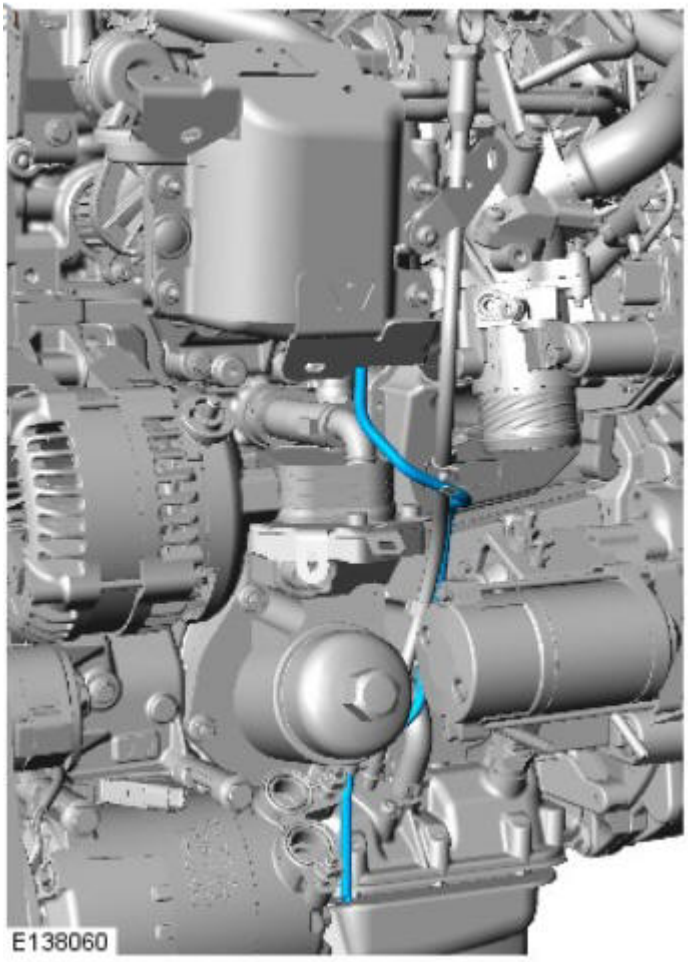
Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

WARNING:

Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

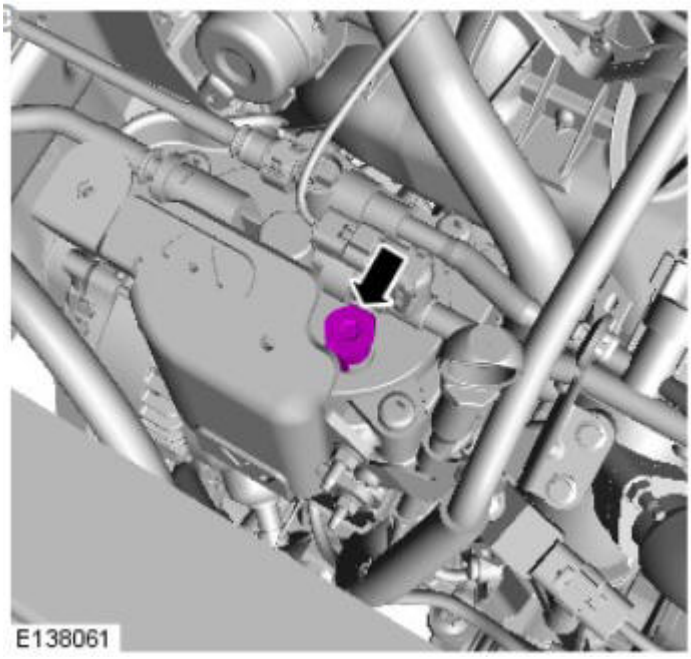
Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



Position a container to collect the fluid.

CAUTION:

Make sure that all fluid is drained from the fuel filter.



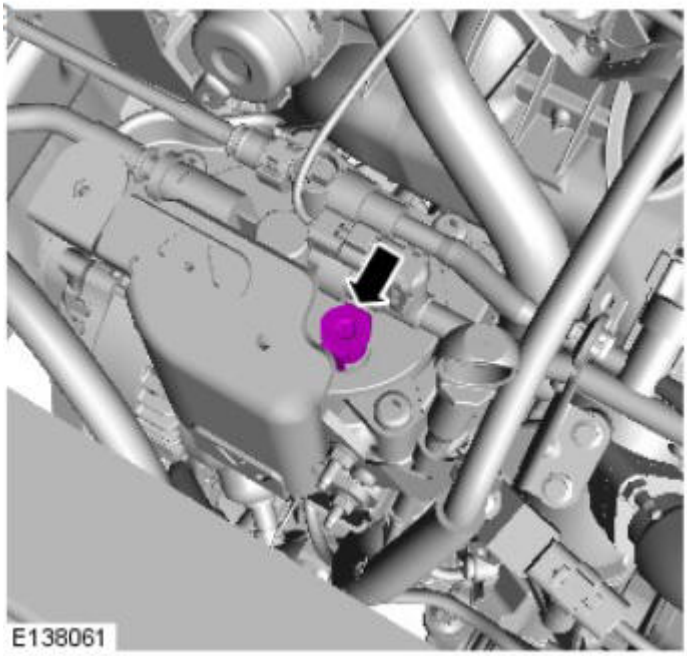
FILLING

WARNINGS:

- ***Avoid flames, sparks or lighted substances.***
- ***Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.***

CAUTION:

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



Remove the container.

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

Refer to: Engine Cover - TD4 2.2L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Refer to: Fuel System Bleeding - TD4 2.2L Diesel (310-00 Fuel System - General Information, General Procedures).

General Information Fuel System Bleeding - Ingenium i4 2.0l Diesel (G1801385) General Procedures

WARNING:

After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.

NOTE:

This procedure is necessary if any low-pressure fuel system components are removed or replaced. These include the fuel filter, fuel lines, fuel tank or fuel cooler.

CAUTION:

Do not start the engine.

1. Set the ignition to the ON position.
2. Wait for 65 seconds.
3. Set the ignition to the OFF position.
4. Repeat the above steps 2 more times.

Start the engine and idle for 60 seconds

General Information Specifications

Capacities

ITEM	TOTAL LITERS	USABLE LITERS
Fuel tank capacity - vehicles with 2.2L Duratorq Td4	60	57
Fuel tank capacity - vehicles with 2.0L GTDi	70.5	68.5
Fuel tank capacity - when fuel gauge indicates empty - vehicles with 2.2L Duratorq Td4	6	3
Fuel tank capacity - when fuel gauge indicates empty - vehicles with 2.0L GTDi	6	4
Reserve capacity - when fuel gauge indicates empty - vehicles with 2.2L Duratorq Td4	3	3
Reserve capacity - when fuel gauge indicates empty - vehicles with 2.0L GTDi	4	2

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Fuel Tank and Lines - Ingenium i4 2.0l Diesel Diagnosis and TestingManual Transmission Transaxle and Clutch

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