

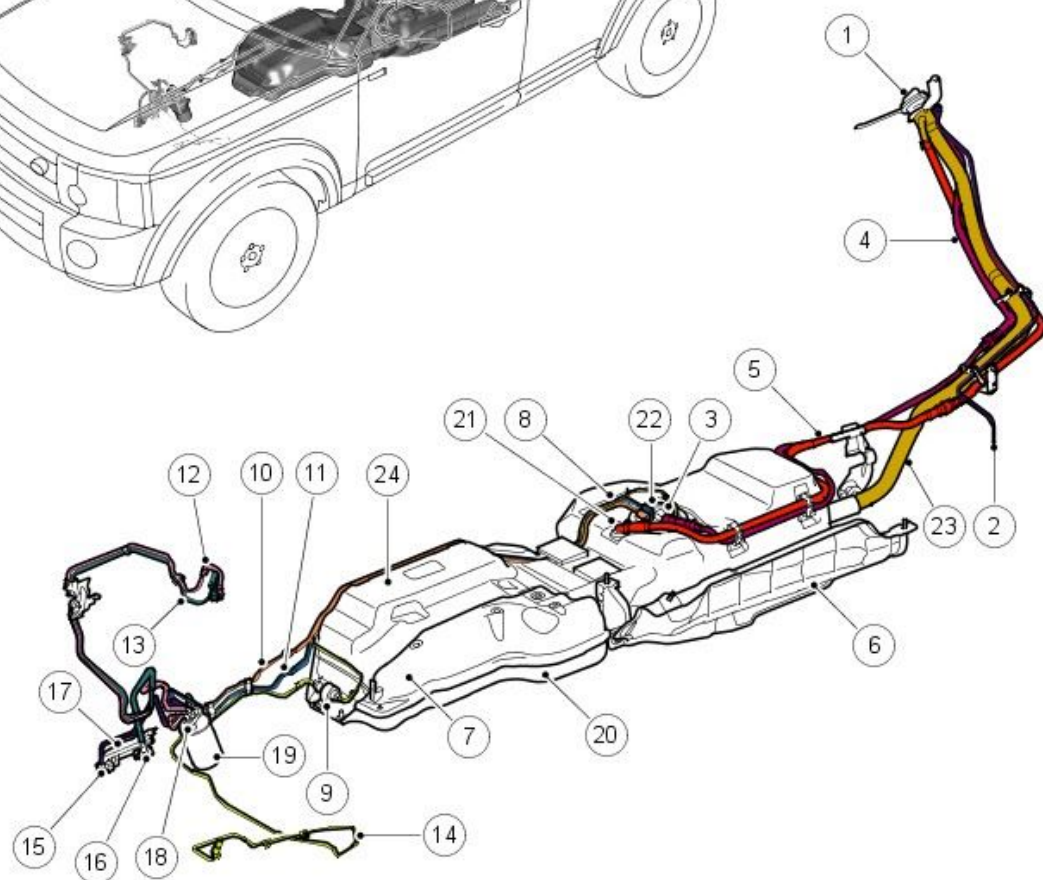
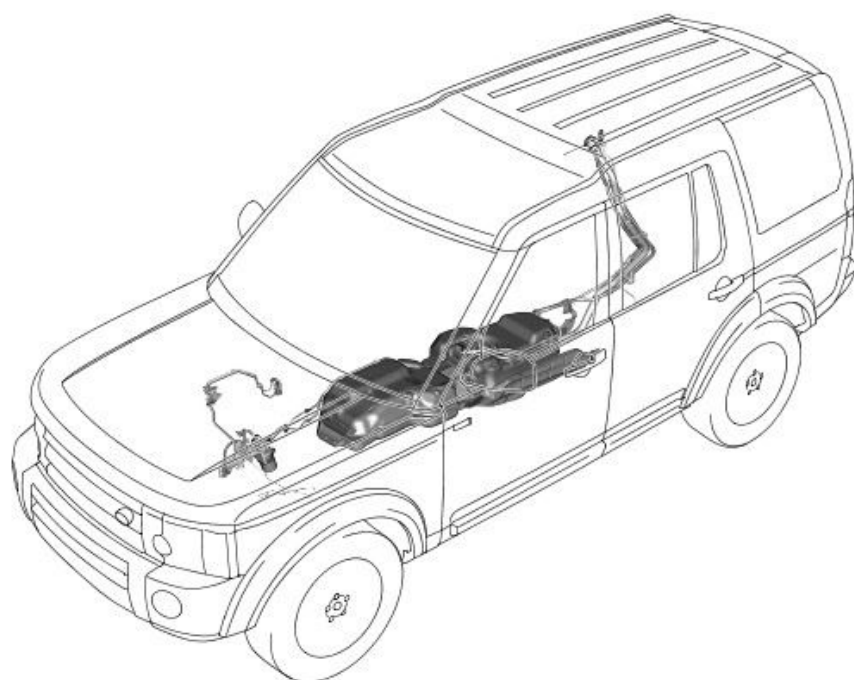
**Published: 11-May-2011**

**2005.0 Discovery 3, 310-01C**

# **Fuel Tank and Lines - TDV6 2.7L Diesel** (G421197)

DESCRIPTION AND OPERATION

Fuel Delivery System Component Location



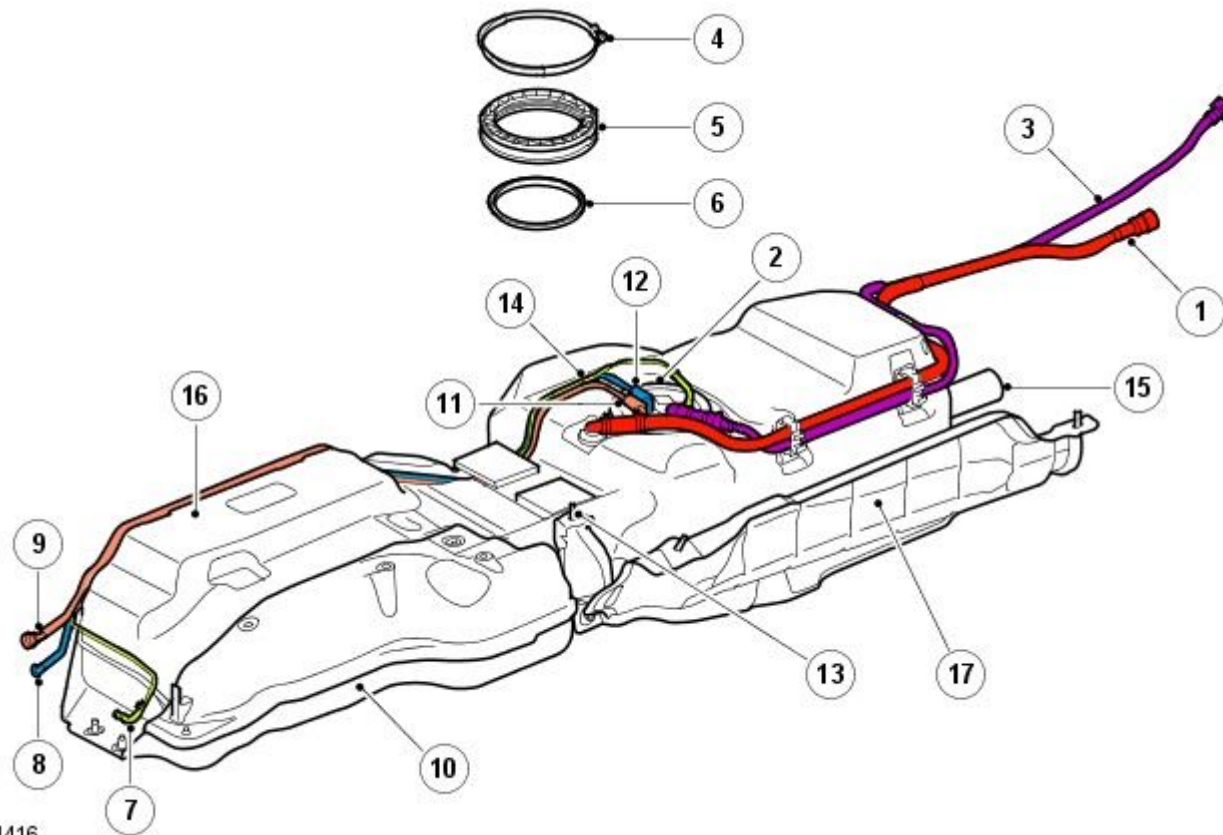
<b>Item</b>	<b>Description</b>
1	Filler cap and lanyard
2	Rear differential breather pipe
3	Fuel pump module assembly
4	Fuel tank vent pipe
5	Tank breather pipe
6	Heat shield
7	Cover
8	Pipe - Fuel Burning Heater (FBH) pump feed (if fitted)
9	FBH pump (if fitted)
10	Pipe - Pump to filter (fuel feed)
11	Pipe - Filter to pump module (fuel return)
12	Pipe - Filter to engine (fuel feed)
13	Pipe - Engine to fuel cooler (fuel return)
14	Pipe - FBH pump to FBH (if fitted)
15	Pipe - Fuel cooler to filter (fuel return)
16	Pipe - HP pump to fuel cooler (fuel return)
17	Fuel cooler
18	Fuel filter bracket
19	Fuel filter assembly
20	Cradle
21	Pipe - Fuel pump to filter (fuel feed)
22	Pipe - Filter to pump module (fuel return)
23	Fuel filler pipe
24	Fuel tank

#### **GENERAL**

The major components of the TdV6 fuel system comprise a fuel tank, a fuel pump module, a fuel filter, a fuel cooler, a fuel filler pipe and cap assembly and two fuel level sensors.

The TdV6 fuel system is a high pressure common rail system. This system uses an engine mounted and driven high pressure pump to deliver a uniform level of pressure to the common fuel rail which supplies all fuel injectors. For additional information, refer to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 2.7L Diesel, Description and Operation).

## FUEL TANK ASSEMBLY



E44416

Item	Description
1	Tank breather pipe
2	Fuel pump module assembly
3	Vent pipe

<b>Item</b>	<b>Description</b>
4	Pump module clamp
5	Pump module collar
6	Pump module seal
7	FBH pump feed pipe (if fitted)
8	Pipe - Fuel return
9	Pipe - Fuel feed
10	Cradle
11	Fuel feed pipe connection
12	Fuel return pipe connection
13	Mounting bolt (6 off)
14	FBH feed pipe connection (if fitted)
15	Fuel filler hose
16	Fuel tank
17	Heat shield

The fuel tank is located on the right hand side of the vehicle, between the transmission and the right hand chassis longitudinal. The tank is located on a mounting cradle which secures the whole fuel tank assembly to the vehicle. The tank has a useable capacity of 82.0 liters (18 gallons).

The cradle is attached to the chassis with six screws. When the cradle is attached to the chassis, the tank is positively secured via foam pads which bear against the central chassis cross beam. A protective cover is fitted to the front right hand corner of the tank and provides additional protection.

The fuel tank is manufactured from moulded plastic which is a minimum of 3 mm thick. The tank is a sealed unit with the only internal access being via the pump module flange aperture on the top of the tank.

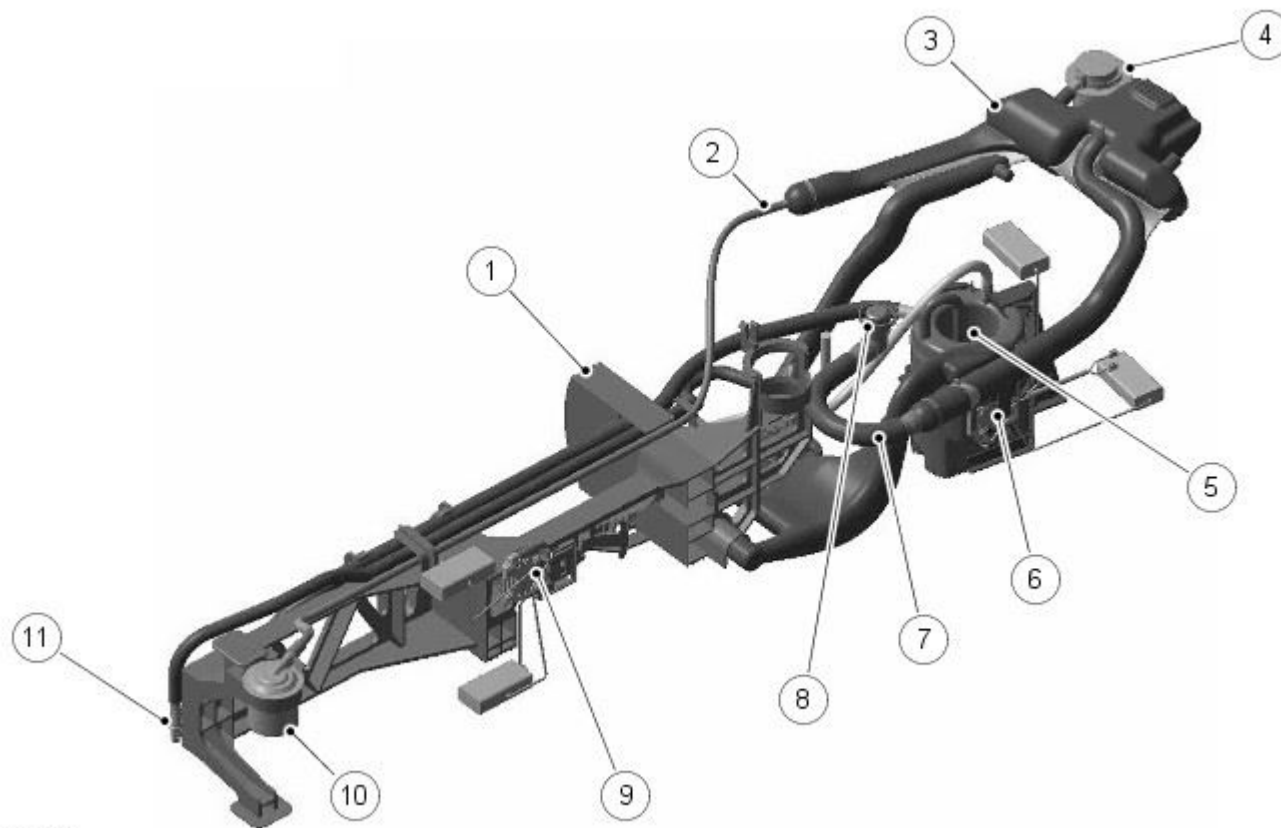
The flange assembly comprises a pump module flange which contains all external pipe and electrical connections for the tank internal components, a collar and a clamp. The flange is fitted with a seal which locates in the tank aperture. An arrow on the flange must be aligned between two moulded lines on the tank, adjacent to the pump module flange aperture, to obtain the correct orientation of the flange. The collar is located over the flange and is secured with the clamp.

The flange has a six pin external connector which provides for electrical connections for the level sensors and the fuel pump. This connector is wired to three push fit connectors on the underside of the flange. Two quick release connectors provide for the connection of the fuel feed and return pipes and the vent pipes. The fuel return connection contains a non return valve which prevents fuel escaping from the connection in the event of a vehicle roll over and the pipe becoming detached. On vehicles with a fuel burning heater, a third connection provides the connection for the fuel feed supply to the fuel burning heater.

A tank carrier assembly is attached inside the tank and is used to locate the internal tank components. The carrier provides location for the fuel pump module, the front level sensor, the Roll Over Valves (ROVs) and the front jet pump.

The fuel pump module contains a number of components. The module comprises the fuel pump, the rear fuel level sensor, the rear jet pump, the pump inlet filter and the fuel pressure regulator which is mounted in a manifold which is attached on the carrier. Only the pump module assembly and the fuel level sensors are available as serviceable components, the individual assembly components are not available separately.

## **Fuel Tank Internal Components**



E50100

Item	Description
1	Carrier assembly
2	Front ROV corrugated tube
3	Liquid Vapor Separator (LVS)
4	Rear Roll Over Valve (ROV)
5	Fuel pump module
6	Rear fuel level sensor

<b>Item</b>	<b>Description</b>
7	Tank breather corrugated tube
8	Tank breather connection
9	Front fuel level sensor
10	Front ROV
11	Front jet pump

The TdV6 vent system is different to the system used on the petrol models. The TdV6 vent system comprises:

- two Roll Over Valves (ROV)
- one Liquid Vapor Separator (LVS)
- breather spout.

The vent system is mounted on the fuel tank internal carrier which is assembled outside of the tank and inserted into the tank during the blow moulding process. None of the internal tank venting components are serviceable.

The rear ROV is mounted in the rear right hand corner of the fuel tank. It is mounted directly onto the LVS with a rubber grommet and secured with a clip.

The front ROV is located in the front left hand corner of the tank. It is attached by a moulded clip to the main beam of the carrier. The ROV is connected to the LVS by a corrugated tube.

Both ROVs vent directly into the LVS. Any liquid fuel is separated from the vapor in the LVS and drains back into the tank via the front ROV.

The LVS vent outlet is connected to the underside of the tank flange. The vent line is then routed from the flange to atmosphere at the top of the filler neck. This line allows for pressure and vacuum relief during normal tank operation. It also allows air to enter the tank as fuel is used.

The main purpose of the tank breather connection is to control the fill volume of the tank. During filling, vapor exits the fuel tank via the breather connection and the breather tube to the filler neck. When the tank reaches its full level, the liquid fuel closes off the breather connection by filling it with fuel. The closure of the breather connection causes the back pressure in the tank to increase, which in turn causes the pump filling nozzle to turn off.



## Fuel Pump Module

The fuel pump is attached to the carrier and is located at the bottom of the swirl pot. The pump and the fuel level sensors are connected to the external electrical connector via the connectors on the underside of the fuel pump module flange.

The pump module has a rated flow of 70 liters/hour (18.5 US gallons/hour) at a voltage of 12.3V and an output pressure of 0.5 bar (7.25 lbf/in<sup>2</sup>).

The fuel pump is energised by the fuel pump relay which is located in the battery junction box. The relay is controlled by the engine control module and energises the relay at all times when the ignition switch is in ignition position II.

A filter is attached to pump inlet port at the bottom of the pump. The filter has a 'winged' section which is located vertically at the side of the pump to ensure that a portion of the filter is off the base of the swirl pot, to prevent premature blocking of the filter. The filter has two sections, a normal filter and a by-pass filter. The normal filter is a 31 micron fine mesh filter with a surface area of 70 cm<sup>2</sup> (10.8 in<sup>2</sup>). The by-pass filter is a 300 micron coarse mesh filter which is closed in normal conditions and has a surface area of 4 cm<sup>2</sup> (0.62 in<sup>2</sup>). In cold conditions, 'waxing' of the fuel can occur which can restrict fuel passing through the fine mesh filter. If this occurs, the by-pass opens allowing fuel to pass through the coarse mesh filter.

The top face of the fuel pump module has three pipe connections. One connection is the fuel pump outlet connection which feeds into the manifold. A second connection allows fuel at pump outlet pressure to flow back through the pump module housing from the manifold to the rear jet pump. The third connection allows fuel from the pressure regulator to return to the swirlpot when the regulator has opened due to excessive pump output pressure.

## Fuel Level Sensors

The sensor is a Magnetic Passive Position Sensor (MAPPS) which provides a variable resistance to earth for the output from the fuel gauge. The sensor is sealed from the fuel preventing contamination of the contacts, increasing reliability. The front and rear fuel level sensors are connected to the external electrical connector on the flange via the connectors on the underside of the fuel pump module flange.

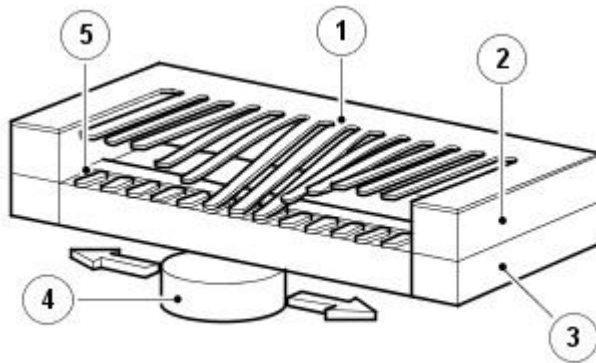
The front sensor is attached to the front of the carrier and is accessible via the fuel pump flange aperture. The rear sensor is attached to the side of the swirl pot and is also accessible via the flange aperture.

NOTE:

When a service replacement tank is ordered the tank is supplied with the front level sensor fitted.

The sensor comprises a series of 51 film resistors mounted in an arc on a ceramic surface. The resistors are wired in series with individual contacts. A soft magnetic foil with 51 flexible contacts is mounted a small distance above the film resistors. A magnet, located below the ceramic surface, is attached to the sender unit float arm. As the float arm moves the magnet follows the same arc as the film resistors. The magnet pulls the flexible contacts onto the opposite film resistor contacts forming an electrical circuit.

Sensor Operating Principle



E44417

Item	Description
1	Magnetic foil
2	Spacer
3	Ceramic surface
4	Magnet
5	Resistance film



The film resistors are arranged in a linear arc with resistance ranging from 51.2 to 992.11 Ohms. The electrical output signal is output proportional to the amount of fuel in the tank and the position of the float arm. The measured resistance is processed by the instrument pack to implement an anti-slosh function. This monitors the signal and updates the fuel gauge pointer position at regular intervals, preventing constant pointer movement caused by fuel movement in the tank due to cornering or braking.

A warning lamp is incorporated in the instrument cluster and illuminates when the fuel level is at or below 10 liters (2.64 US gallons).

The fuel level sender signal is converted into a CAN message by the instrument pack as a direct interpretation of the fuel tank contents in liters.

#### Front Fuel Level Sensor Resistance/Fuel Gauge Read out Table

NOTE:

These figures are with the vehicle on level ground. Sensor readings will differ with varying vehicle inclinations.

Sender Unit Resistance, Ohms	Nominal Gauge Reading
51.2	Empty
67	Low fuel level illumination (17L)
281	Half full
872	Full

#### Rear Fuel Level Sensor Resistance/Fuel Gauge Read out Table

NOTE:

These figures are with the vehicle on level ground. Sensor readings will differ with varying vehicle inclinations.

Sender Unit Resistance, Ohms	Nominal Gauge Reading
75	Empty
150	Low fuel level illumination (17L)
267	Half full
768	Full

## Fuel Pressure Regulator

The fuel pressure regulator is located in the manifold inside the fuel tank. The regulator controls the fuel pressure in the feed pipe to the HP injection pump. If the pump outlet pressure becomes too high, the regulator controls the fuel pressure in the feed pipe by allowing some fuel to return to the swirl pot.

The regulator is subject to pump output pressure and controls the pressure of the fuel delivered to the HP injection pump to a maximum of 0.5 bar (7.25 lbf/in<sup>2</sup>). At pressures above this figure, the regulator opens, decaying the pressure supplied to the HP injection pump by allowing fuel to flow back into the swirl pot. The primary reason for the regulator is to protect the HP fuel injection pump from high fuel input pressures from the LP fuel pump if a high voltage condition occurs.

## **Swirl Pot**

The swirl pot is located at the rear of the fuel tank and provides for the attachment or location of most of the fuel pump assembly components.

The swirl pot acts as a fuel reserve, providing a constant supply of fuel to the fuel pump irrespective of fuel quantity or vehicle attitude. When the vehicle is level the swirl pot contains approximately 400 cm<sup>3</sup> (24.4 in<sup>3</sup>) of fuel when the engine is running. The two jet pumps ensure that fuel is constantly supplied to the swirl pot to provide a sufficient fuel supply for the pump.

A one way valve is located in the base of the swirl pot. The valve allows fuel from the tank to enter the swirl pot, but prevents it from escaping.

## **Jet Pumps**

The fuel system incorporates two jet pumps. The front jet pump is located on the carrier near the front of the fuel tank. The rear jet pump is located in the swirl pot below the fuel pump. Both jet pumps operate on a venturi effect created by fuel at pump output pressure passing through the jet pump. This draws additional fuel from the tank through ports in the jet pump body, delivering additional fuel to the swirl pot.

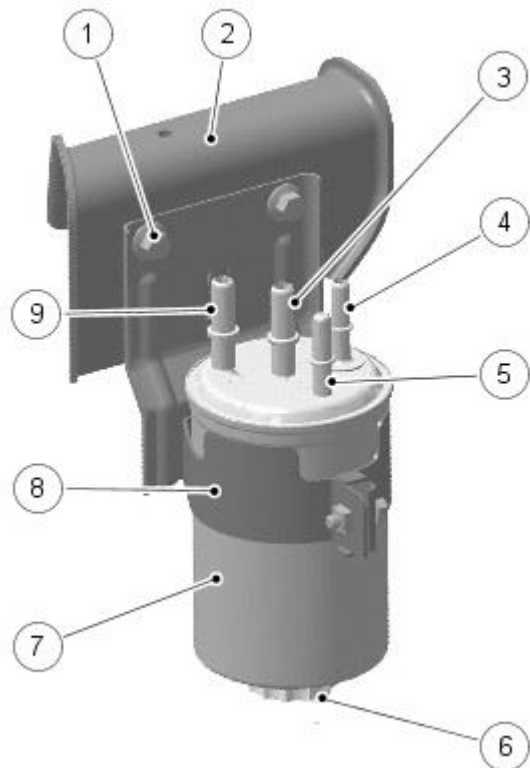
The front jet pump is mainly used when the vehicle is driving downhill. The jet pump is connected via a pipe from the fuel manifold and receives fuel at pump output pressure. Because of its location at the front of the tank, it collects fuel from the front of the tank and transfers it into the swirl pot, ensuring a constant supply of fuel to the pump. The jet pump has a jet nozzle of 1 mm diameter.

The rear jet pump operates at pump output pressure and delivers some of the fuel from the rear of the tank back into the swirl pot.

## Roll Over Valves (ROVs)

Two ROVs are located on the carrier and are connected via pipes to a liquid vapour separator. The separator, which is also attached to the carrier, is connected via a pipe to the tank breather outlet in the pump module flange. The ROVs contain non-return valves which close in the event of the vehicle overturning, preventing liquid fuel escaping from the tank via the breather pipe.

### FUEL FILTER



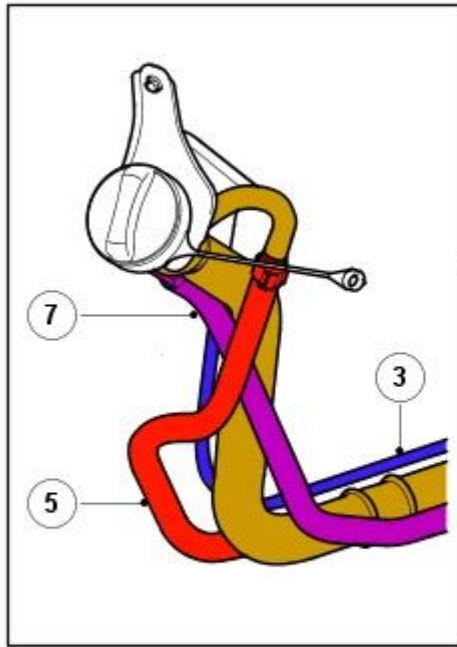
<b>Item</b>	<b>Description</b>
1	Screw M8 (2 off)
2	Bracket
3	Fuel feed to engine (HP injection pump)
4	Fuel return from cooler
5	Fuel return/air bleed to tank
6	Water drain valve
7	Filter canister
8	Clamp bracket
9	Fuel feed from pump module

The fuel filter is located behind the fuel cooler, at the rear of the engine and is protected by the engine undertray. The fuel filter assembly comprises a bracket and the filtration element which is contained within a canister.

The filter canister is attached to a circular bracket which is clamped around the filter canister with a bolt and nut. The bracket is attached on the inside of the right hand chassis rail with two screws. Removal of the fuel filter requires loosening of the bolt and nut and removing the filter canister from the circular bracket.

The filter element has a capacity of 500 cm<sup>3</sup> (30.5 in<sup>3</sup>). The filtration element can filter particulate matter larger than 2 microns. A water drain plug is located on the base of the filter. The filter can be purged of water by partially unscrewing the filter element plug and allowing fuel to drain into a suitable container. The plug must be tightened to a torque specified in the Service Repair Manual.

## FUEL FILLER



E44419

<b>Item</b>	<b>Description</b>
8	Filler cap
9	Screw M8
10	Filler pipe
11	Lower mounting bracket to EPB bracket

The fuel filler head is positioned at the rear of the vehicle, above the right hand rear wheel. The filler head is covered by a moulded plastic cover 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.

**NOTE:**

The fuel filler head plastic cover does not lock on NAS vehicles.

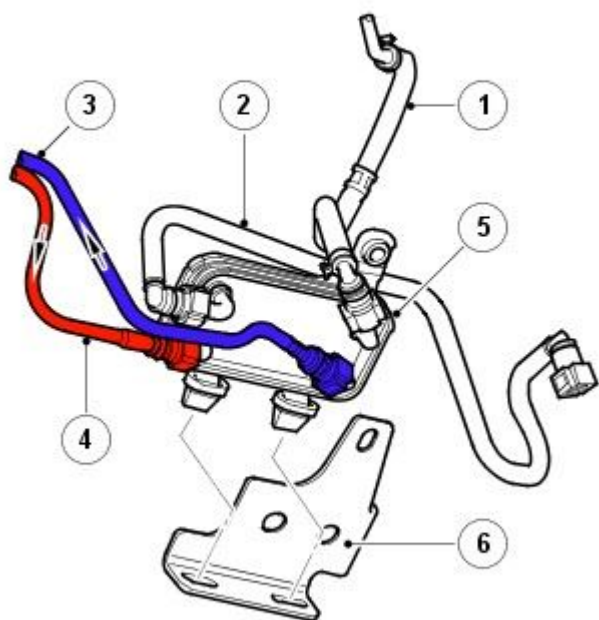
The filler head is a stainless steel fabrication. Two brackets provide for the attachment of the filler head to the vehicle body and the chassis electronic park brake bracket.

A connection on the rear of the filler head allows for the connection of the fuel tank breather pipe from the fuel tank breather stub. The fuel tank breather pipe has a quick release fitting and connects to the breather pipe from the fuel tank breather stub. The fuel filler vent pipe from the tank is vented to atmosphere. The vent pipe incorporates an insect trap at its termination near the filler head. The fuel filler pipe locates in a short flexible hose attached to the tank and is secured with two worm drive clamps.

A smaller pipe, which is not associated with the fuel system, is attached to the side of the fuel filler pipe. This pipe connects to the rear differential and provides breathing for the differential case. The pipe terminates near the fuel filler head.

**FUEL COOLER**





E44420

Item	Description
1	Pipe - HP pump to cooler
2	Pipe - cooler to fuel filter
3	Coolant outlet
4	Coolant inlet
5	Fuel cooler
6	Bracket

The fuel cooler uses engine coolant, direct from the lower part of the radiator, to cool fuel returning to the tank from the HP injection pump.

The fuel cooler is located on the right hand side of the chassis, at the rear of the engine, near to the starter motor. A bracket, which is attached to the right hand chassis rail, provides for the attachment of the cooler. The bracket has two slots which accept two plastic pegs which are attached to the cooler. A bolt is inserted through a hole in the bracket and screws into a captive nut on the cooler to positively secure the cooler to the bracket.

The cooler has four quick fit connector pipes which provide for the attachment of the fuel inlet hose from the HP injection pump, the fuel outlet hose to the fuel filter, the coolant inlet hose from the radiator and the coolant outlet hose to the coolant thermostat housing. The coolant pipes can be identified by their smaller diameter.