



FUEL SYSTEM

SECTION LI - ELISE 2001 M.Y. Onwards

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LI.1 - GENERAL DESCRIPTION

The 32 litre (7.0 imp.gall) fabricated steel fuel tank is mounted within the chassis crossmember between the passenger compartment and engine bay, with the fuel filler neck connecting to the right hand top of the tank, and the fuel pump/fuel gauge sender unit mounted into the left hand top surface. The modular fuel pump/sender assembly uses an electric motor to power a three stage impeller type pump system submerged within the tank, and incorporates a reservoir canister to avoid fuel starvation from surge effects caused by vehicle acceleration and cornering forces.

The supply pipe from the pump is routed via a replaceable fuel filter mounted at the left hand lower front corner of the engine bay, before connecting with the left hand end of the engine fuel rail. The fuel rail supplies all four injectors, and is fitted at the right hand end with a pressure regulating valve which maintains the pressure of fuel supplied to the injectors at 2.0 to 3.0 bar, dependent on engine load. Excess fuel is returned to the tank via a fuel return line. The constant circulation of fuel through the in-line fuel filter, fuel rail, pressure regulator valve and return line, helps avoid excessive fuel temperature with the consequent risk of vapour locks.

When the ignition is switched on, the engine management ECM energises the fuel pump which will continue to run for as long as the ECM receives ignition pulses from the ignition module (engine cranking or running). If no ignition pulses are received, the ECM switches off the pump either 2 seconds (approx) after the ignition was switched on, or about 10 seconds after a stall. A safety inertia switch is incorporated into the fuel pump electrical circuit, and operates in a severe impact (indicative of a vehicle collision) to switch off the fuel pump feed and minimise the fire risk. The switch is located to the rear of the air filter housing, and is reset once tripped, by pressing the rubber button on the top of the switch.

A roll over valve is mounted behind the fuel filler neck, and is connected between a breather spigot on the neck, and the charcoal canister. This valve allows venting of the tank under normal circumstances, but prevents fuel spilling from the vent pipe if the vehicle is inverted or excessively tilted in an accident. The evaporative emissions control system (EECS) prevents untreated fuel vapour from the tank reaching the atmosphere, by routing the tank vent pipe from the roll over valve to a vapour storage charcoal canister mounted at the left hand side of the engine bay. When the engine is stopped, fuel vapour from the tank is absorbed by a bed of charcoal in the canister. When the engine is running, the engine management ECM opens a solenoid operated purge valve on the canister which allows a port on the throttle body downstream of the throttle valve to draw air through the canister, purging absorbed fuel from the charcoal, and consuming the resultant vapour in the normal combustion process. In this way, the charcoal bed is 'cleaned' ready to absorb more tank vapour.

Full details of fuel pump testing, fuel rail, pressure regulator and fuel injectors, are contained in engine management section EMN.

LI.2 - FUEL FILLING

Fuel Requirement

Only UNLEADED fuel with a minimum octane rating of 95 RON ('Premium' unleaded in U.K.) should be used. Unleaded fuel with an octane rating higher than 95 RON offers no additional benefit.

Note that the filler neck is restricted in size so that only the smaller diameter nozzle used on **unleaded** petrol pumps may be inserted. The use of leaded fuel, or lead replacement petrol (LRP), would cause irreparable contamination of the precious metals used in the catalytic converter and of the exhaust gas sensor used by the computer controlled engine management system.

Fuel Filling

WARNING: Be aware of the danger of explosion when dealing with petrol and its attendant fumes. Before stopping at a filling station, ensure that all cigarettes are extinguished, and that no naked flames or other potential ignition sources are present. Switch off the engine before refuelling.

Filler Cap: The key locking filler cap is located in the right hand rear quarter panel:

- To unlock the cap, insert the key (same key as ignition), turn $\frac{1}{4}$ counterclockwise and withdraw the cap with the key. As the cap is unlocked, any slight pressure differential between the tank and atmosphere will be released, and a brief hiss may be heard, which is completely normal. Note that the key can be withdrawn only from a locked cap.



- To refit, engage the ears on the cap with the slots in the neck, turn the key ¼ clockwise to lock and withdraw the key.

Filling Procedure: Insert the pump nozzle fully into the neck, and fill until the first time the auto-shut off mechanism is triggered. Do not attempt to 'brim' the tank to the top of the filler neck, as expansion of the fuel due to temperature change (especially in hot weather - the temperature in underground storage tanks is significantly colder) may cause flooding of the charcoal canister, or spillage of fuel.

The total fuel tank capacity is 32 litres (7.0 imp.gal).

LI.3 - PRECAUTIONS

The fuel line between pump and injector rail, and the injector rail itself, contain pressurised fuel both when the engine is running, and after switching off. This feature aids engine starting by reducing the time needed to build up operating fuel pressure, and inhibiting the formation of vapour pockets in the supply line of a stopped hot engine.

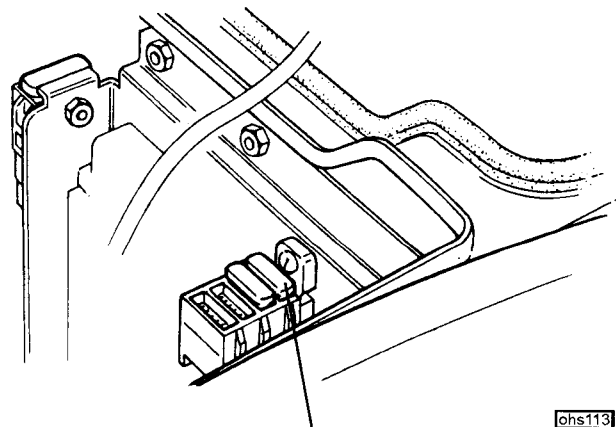
- To minimise the risk of fire and personal injury, relieve the fuel system pressure before servicing any part of the fuel supply circuit. See 'Fuel Pressure Relief Procedure' below.
- To reduce the possibility of sparks occurring when a fuel line is disconnected, or when fuel vapour is present, the negative battery cable should be disconnected before work is commenced.
- When fuel lines are disconnected, absorb any escaping fuel in an absorbent cloth and dispose of safely.

Fuel Pressure Relief Procedure

This procedure should be used prior to disconnecting any part of the fuel line except the unpressurised return line.

- Pull out the fuel pump fuse (to rear of engine management ECM at LH side of rear luggage compartment), start the engine, and run until it stops from starvation. Crank the engine for a further few seconds.
- If the engine is a non-runner, pull out the fuel pump fuse, and crank the engine for 20 seconds to minimise residual fuel pressure.
- Disconnect the battery.
- Surround the pipe joint with a shop towel to absorb fuel contained in the pipework before releasing the joint.

WARNING: Be aware of the possibility of full pressure retention in the fuel line caused by an injector circuit fault.

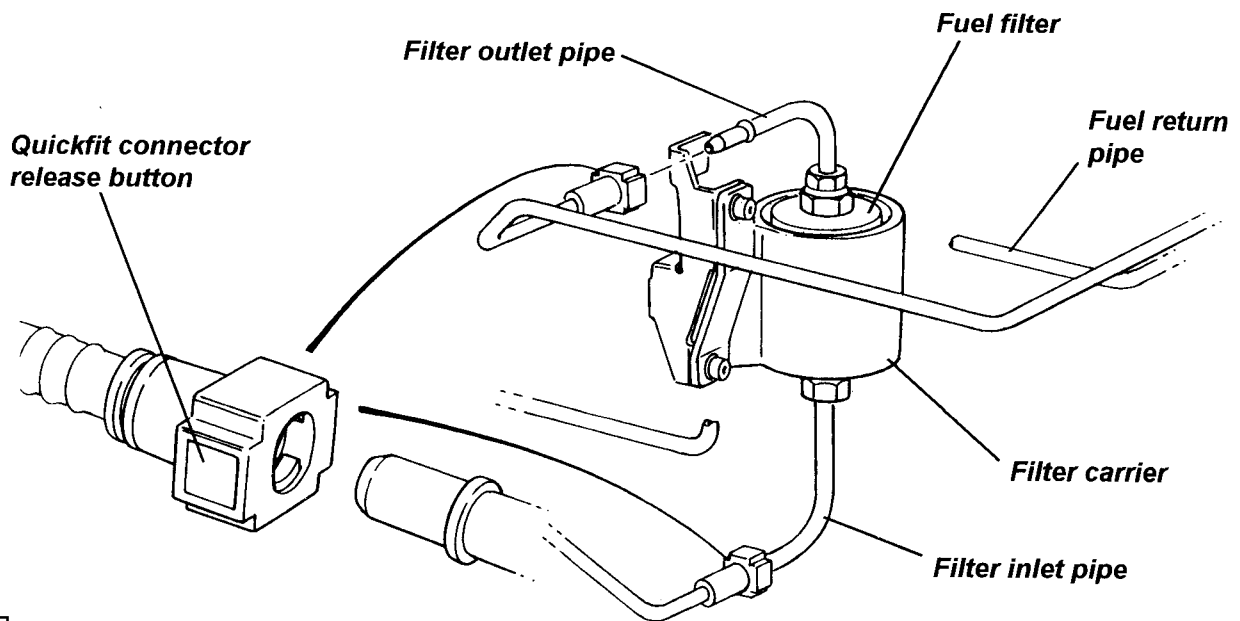


Fuel pump fuse (20A)

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LI.4 - FUEL FILTER

The fuel filter is fitted in the feed line between pump and injector rail, and protects the delicate injectors from dirt particles and debris not screened out by the pump inlet strainers. The paper element fuel filter is contained within a sealed steel canister, mounted, at the lower left hand front corner of the engine bay, in a plastic holder. Each end of the filter canister is fitted with a short elbow pipe to which the fuel pipes are connected by quick-fit couplings. At intervals specified in the maintenance schedule, the fuel filter should be renewed by following the procedure below;

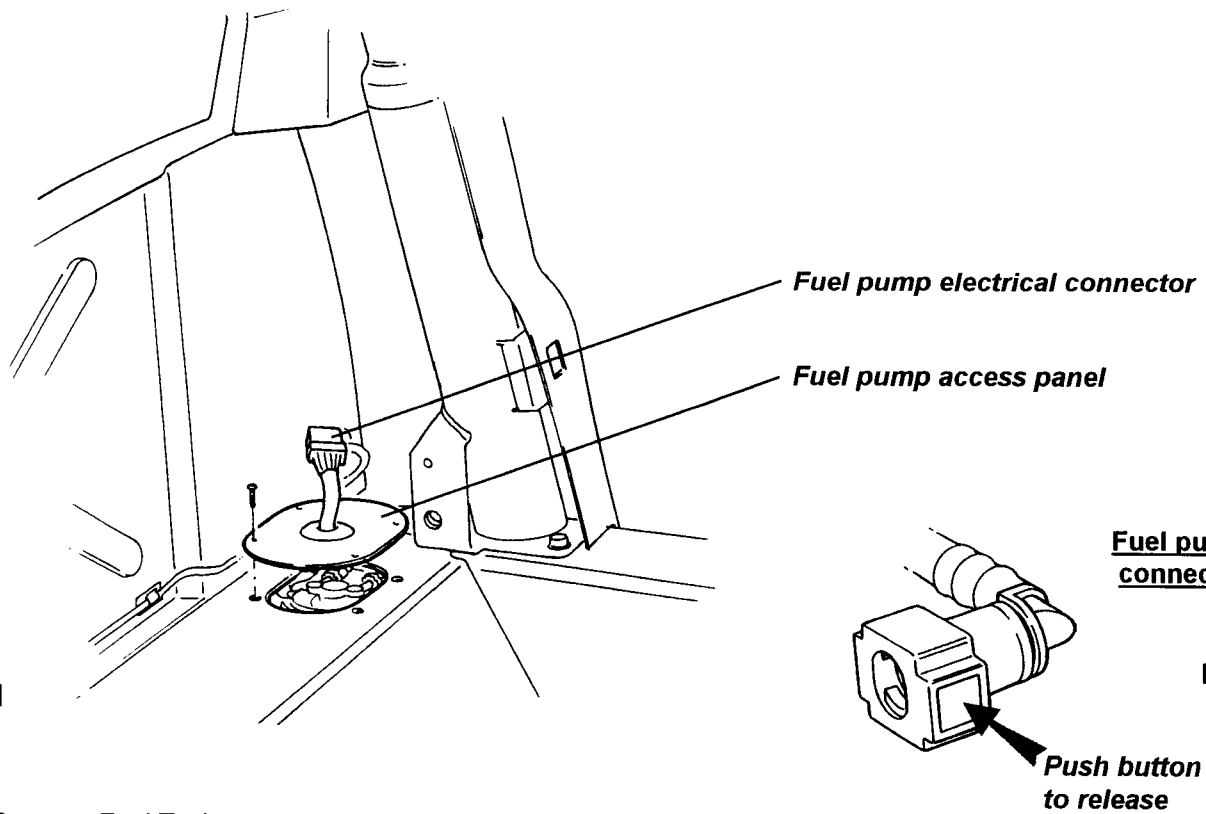


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1. Remove the engine bay undertray for access.
2. **WARNING:**
 - i) The fuel in the filter and connecting pipework remains pressurised after switching off the ignition. Before disconnecting the fuel line, carry out the fuel pressure relief procedure detailed in sub-section LI.3.
 - ii) In order to minimise the possibility of syphoning of fuel from the filter inlet pipe after disconnection, first remove the fuel filler cap to release any tank pressure. Squeeze the two release buttons in each of the quick fit connectors, and withdraw each pipe. Raise and secure the supply pipe from the tank to a level above the fuel tank to prevent the possibility of syphoning.
3. Press back the retaining clip, and withdraw the filter canister from its carrier. Remove the two elbow pipes from the canister.
4. Fit the two elbow pipes to the new filter canister, torque tightening to 27 - 34 Nm. Note that the top, outlet end of the canister is identified by 'O' in the canister end face, and position the outlet pipe approximately 30° counterclockwise with respect to the bottom pipe when viewed from above. Fit the canister into its holder (direction of flow arrow pointing upwards), and check that the retaining clip is engaged.
5. Lubricate the spigot on each elbow pipe with a light spray of WD40 before firmly pushing the connector onto the spigot until an audible 'click' is heard. Check security by pulling and twisting the joint.
6. Start the engine, and check for fuel leaks.

LI.5 - FUEL TANK

The fabricated steel fuel tank is mounted within the chassis crossmember between the engine bay and passenger compartment. A removeable panel is provided in the top of the chassis crossmember in the cabin, which provides to the fuel pipe connections and harness connector. If the pump/gauge sender unit is to be replaced, the tank must be removed from the chassis.



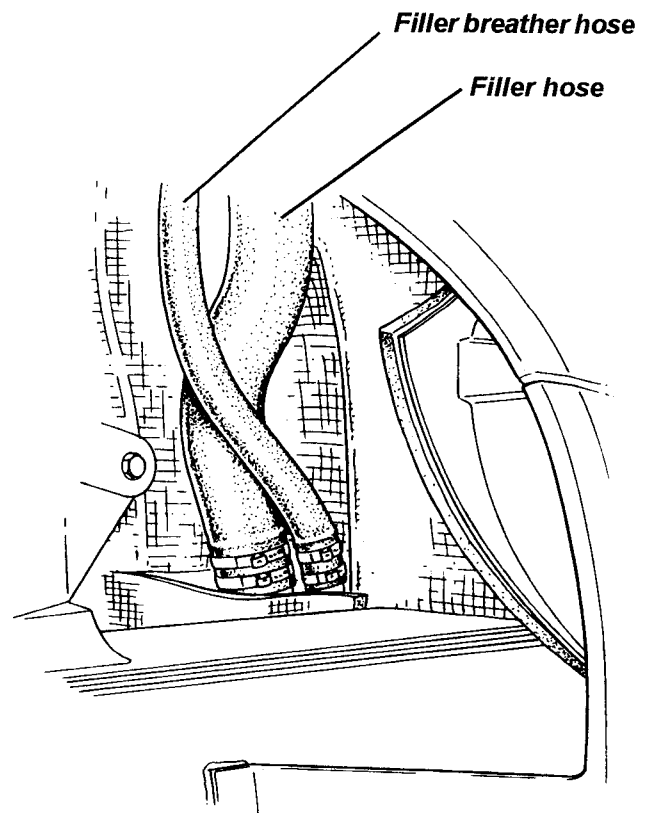
To Remove Fuel Tank

1. Remove the left hand seat and rear bulk-head trim panel. From the left hand rear corner of the cabin, disconnect the pump harness, and remove the access panel on the top of the chassis rear crossmember for access to the fuel pump connections.

WARNING: The fuel line between pump and engine remains pressurised after switching off the ignition. Before disconnecting the fuel line, carry out the fuel pressure relief procedure detailed in sub-section LI.3.

Release the feed and return pipes from the fuel pump by squeezing together the release buttons on the push fit connectors, and withdrawing from the spigots.

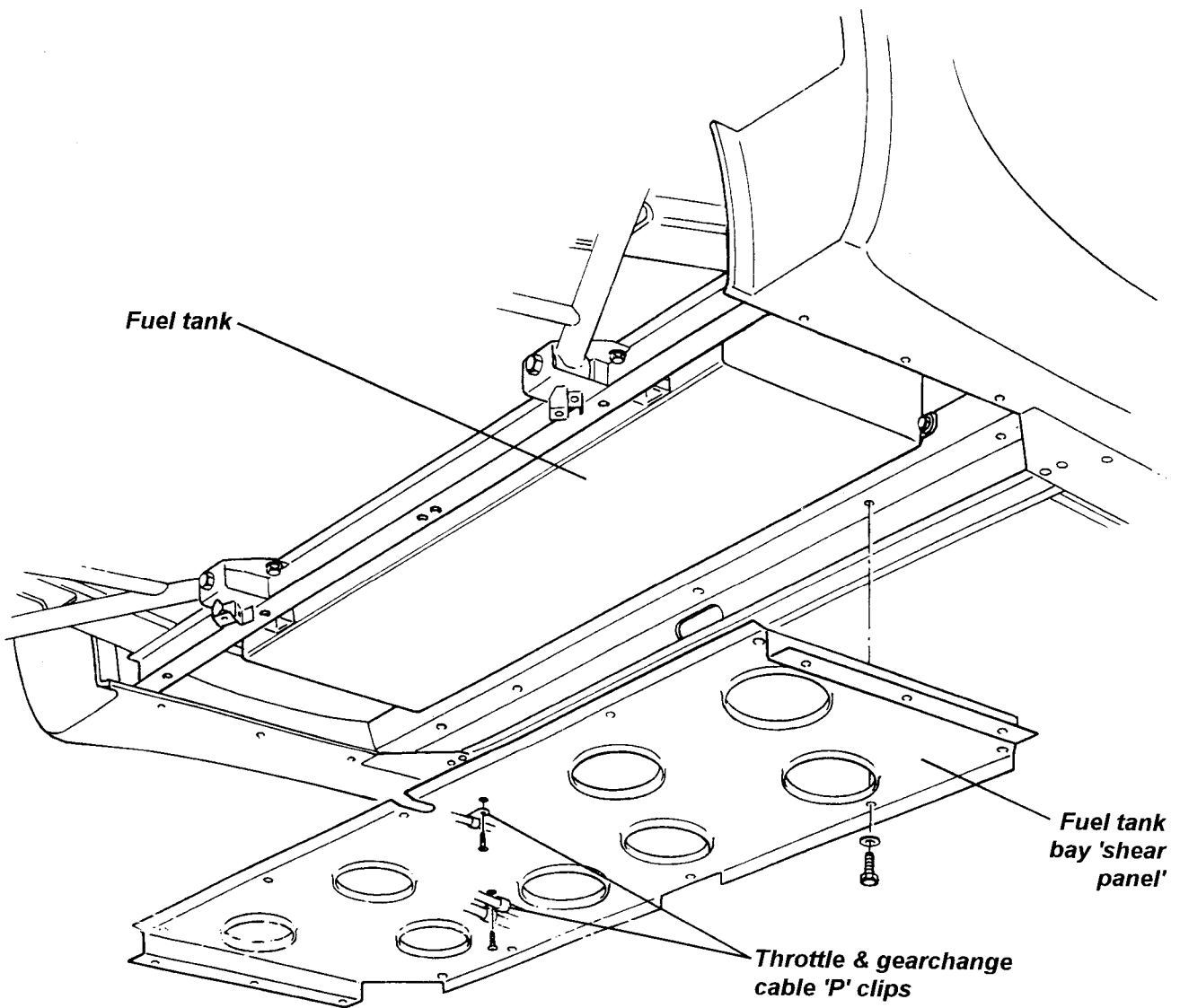
2. If necessary, syphon fuel from the tank to reduce the weight before removal.
3. Remove the RH rear wheel and wheelarch liner to provide access to the filler hose connections. Release the filler hose and filler breather hose from the tank spigots, and cap both orifices to prevent debris ingress and reduce the fire hazard.



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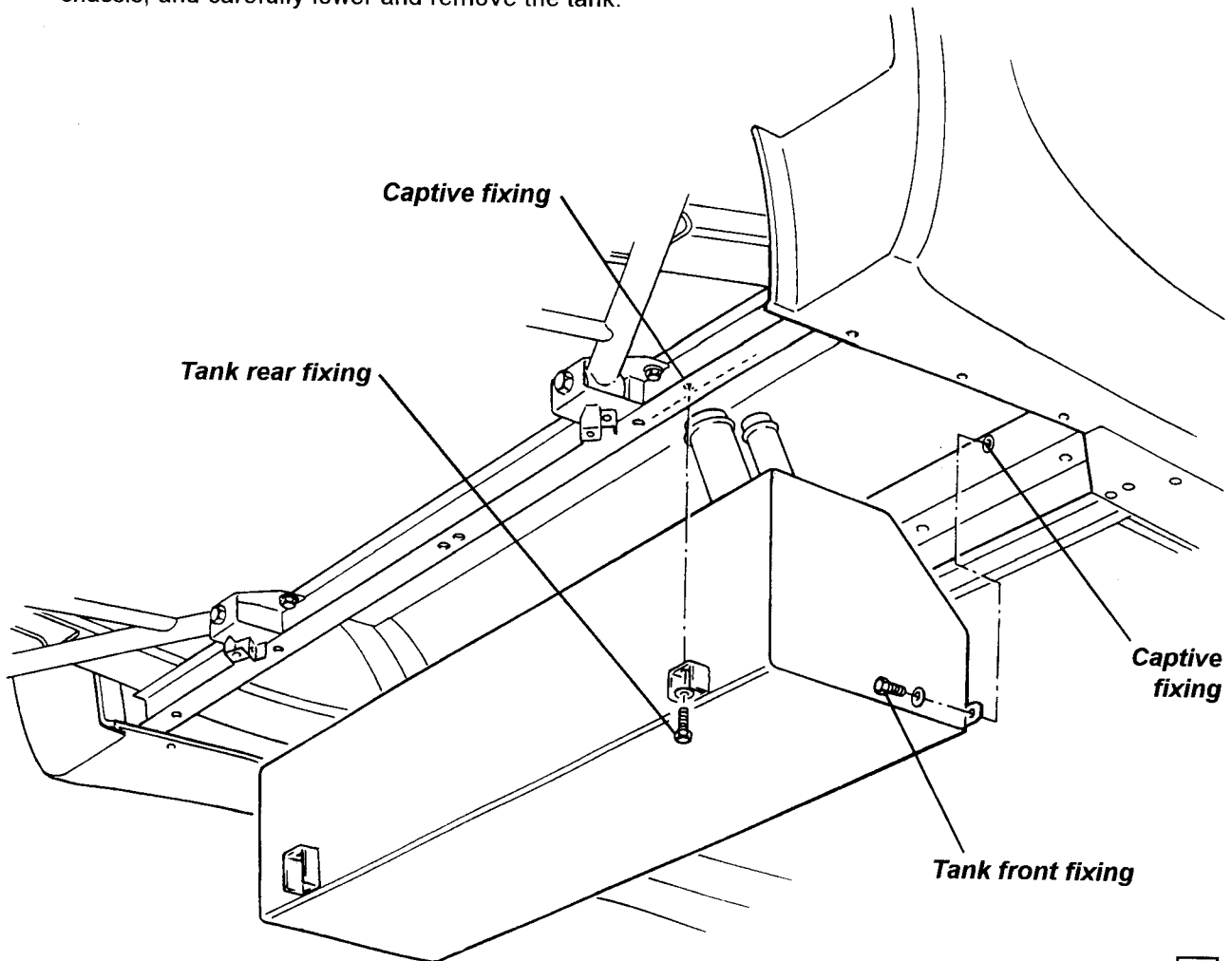
4. Remove the engine bay undertray/diffuser.
5. Disconnect control cables:
 - Release the two gearchange cables from the transmission levers and abutment bracket.
 - Release the parking brake cable from the horseshoe compensator and abutment brackets.
 - Release the throttle cable from the engine.
 - Release the gearchange cable and throttle cable 'P' clips from the perforated 'shear panel' below the fuel tank.
6. Release the fixings along the front and rear edge, and remove the 'shear panel' which closes the chassis box section housing the fuel tank. Note that this panel is a structural part of the chassis, and that the car should not be used without the panel fitted.



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7. Support the tank before removing the four bolts securing the fixing brackets at the base of the tank to the chassis, and carefully lower and remove the tank.



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8. Refit the tank in reverse order to removal, taking care to connect the fuel pipes to the correct spigots on the fuel pump assembly;
- Feed spigot marked 'F' (rearmost);
 - Return spigot marked 'R' (foremost).
 - Note that the centre (vent) connector is not used, and is blanked off internally.
- Ensure that the 'shear panel' is fitted beneath the fuel tank bay before driving the car.

LI.6 - FUEL PUMP/SENDER ASSEMBLY

The combined fuel pump/fuel gauge sender assembly is mounted submerged in the left hand side of the fuel tank, and utilises an electric motor to power a three stage impeller type pump, and a reservoir canister to avoid fuel starvation from surge effects caused by vehicle acceleration and cornering forces.

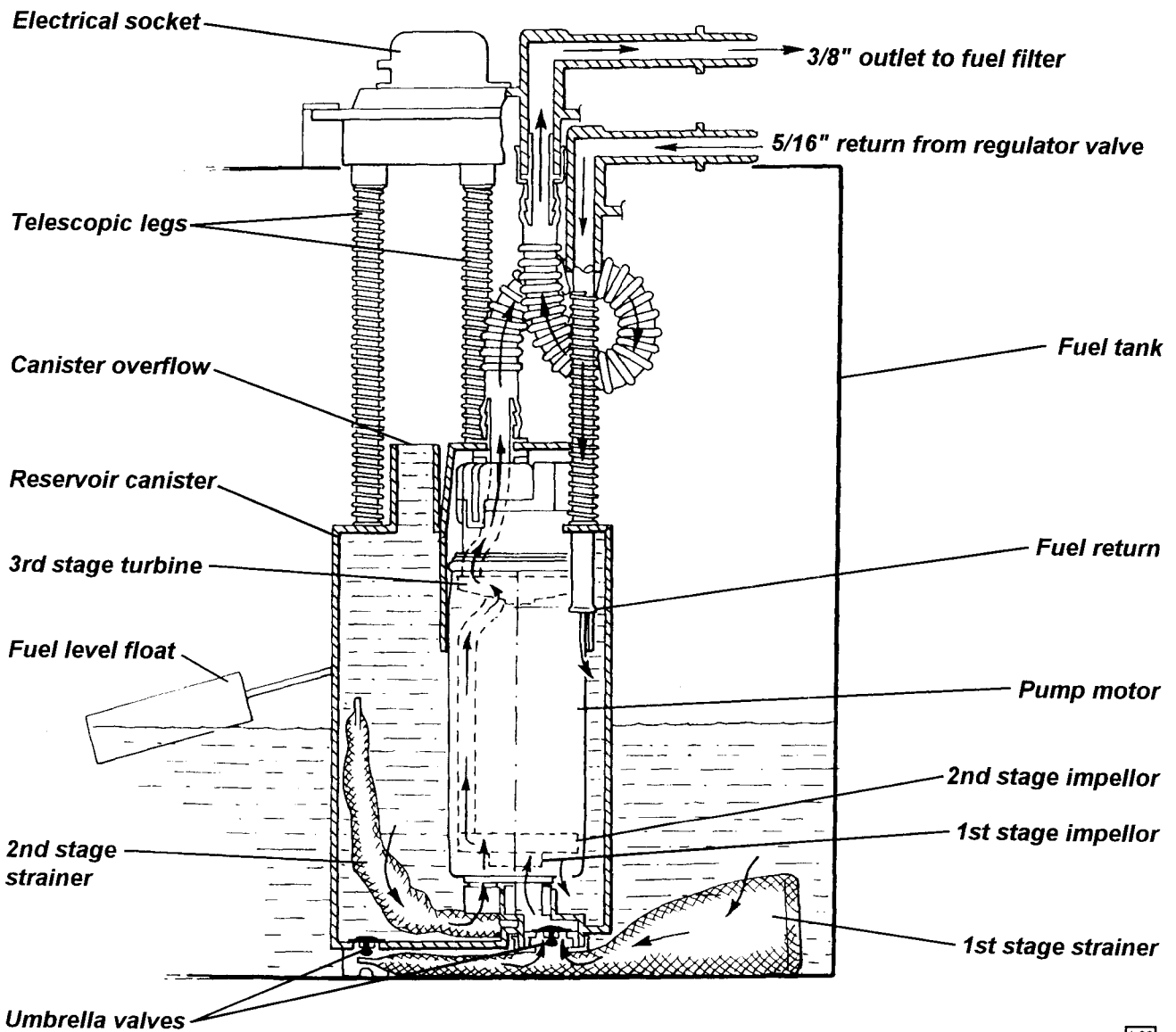
The complete unit is spring loaded against the bottom of the tank by three telescopic legs carried on the end plate, which is sealed and secured to a flange in the tank top surface by an 'O' ring and circlip. The orientation of the unit is dictated by a tab on the pump endplate.

The pump is housed within a reservoir canister kept filled with fuel even at very low tank levels. The pump connects with a port on the bottom of the canister fitted with a strainer sock in order to screen dirt particles from the fuel line and help separate any water content from the fuel. The first stage impeller pump draws fuel from the tank via this sock, and outputs it into the canister, which fills up to its overflow port in the top surface. The second stage impeller pump draws fuel from within the canister via another strainer sock, and supplies the high pressure third stage turbine pump which outputs fuel from the top end of the pump into the



flexible pipe connected to the supply connection on the pump assembly top plate. From here, fuel is piped to the fuel rail on the engine, from which it returns to the inlet connection on the top plate and spills into the canister to supplement the primary pump output and keep the canister fully filled. An umbrella valve in the bottom of the canister allows fuel to flow into the canister whenever the tank level is higher than the canister level. This feature also permits a continued fuel supply to the secondary pump stage in the event of a blocked primary stainer.

A removeable panel in the chassis behind the LH seat provides access to the fuel pipe connections, but if the fuel pump or gauge sender unit require attention, it is necessary to remove the fuel tank from the chassis.



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To Test Fuel Pump Output

The procedure for testing fuel pressure, set by the pressure regulator valve on the end of the fuel rail, is detailed in section EMO. Base fuel pressure is 3.0 bar. If the result of this test is satisfactory, the fuel pump delivery quantity may be checked as follows:

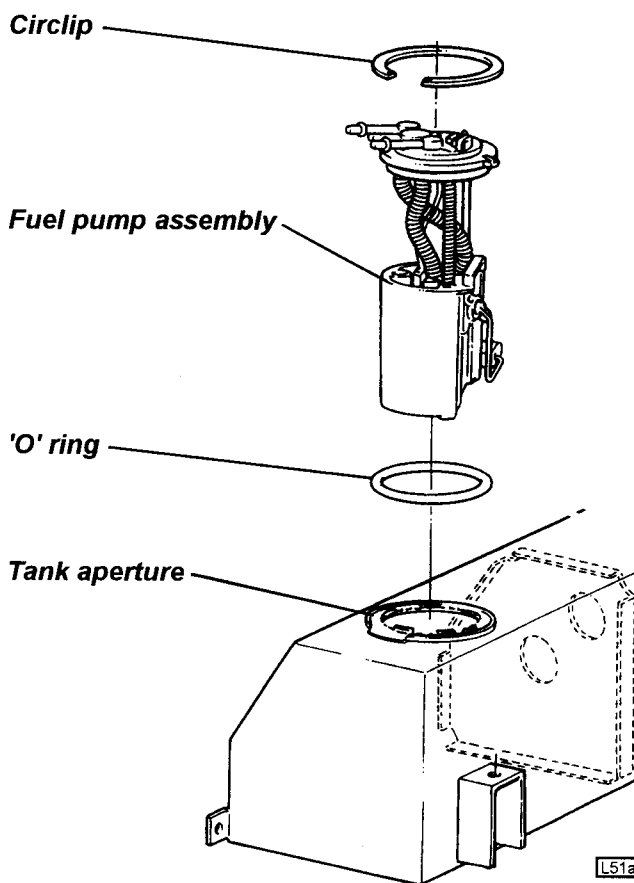
WARNING: Take all necessary precautions to guard against fire and explosion risk when dealing with fuel and fuel vapour.



1. Disconnect the fuel rail return line (e.g. at quick fit connector), and arrange for collection of return fuel into a suitable container.
2. Arrange for an auxiliary 12 volt feed to the fuel pump to allow continuous operation.
3. Run the pump for one minute and measure the fuel quantity delivered.
Specification = 2.0 - 2.8 litres.
If below specification, check the fuel filter for restriction before replacing the fuel pump.

To Remove Pump/Sender Assembly

1. Remove the fuel tank (see sub-section LI.5).
2. Release the circlip securing the pump assembly into the tank top flange, noting that the unit is lightly spring loaded, and withdraw the unit and sealing 'O' ring. Take suitable precautions to catch any dripping fuel. Cap the tank aperture to prevent dirt ingress and to reduce the fume hazard.
3. To release the fuel gauge sender unit, unclip the black foot from the base of the canister, and disengage the sender mounting bracket from the canister. Disconnect the electrical cables from the unit and withdraw. Take care not to damage the float arm.
4. For access to the pump, depress the three retaining barbs, and withdraw the reservoir canister from the pump assembly. Unplug the pump electrical connector, and pull the pump from its outlet spigot.
5. Thoroughly clean the fuel inlet strainer socks on the pump and canister before refitting.



Re-fitting Pump/Sender Assembly

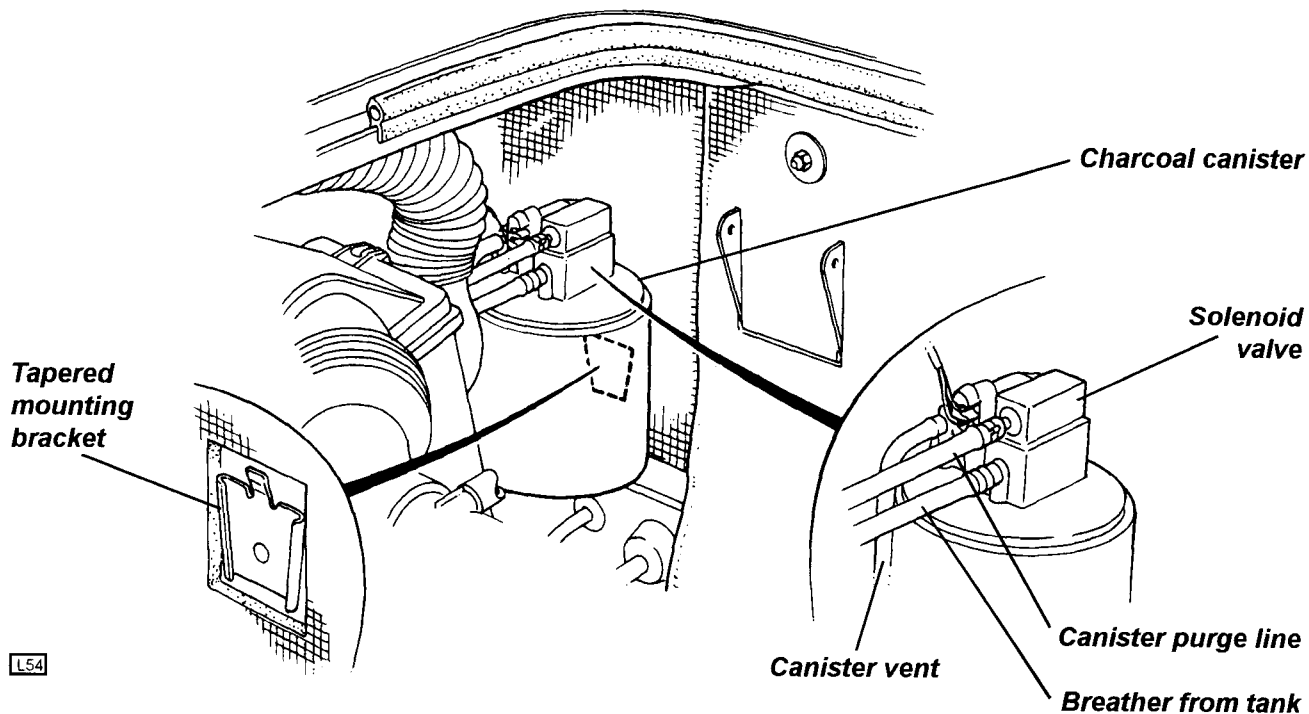
Fit the pump assembly into the tank aperture using a new 'O' ring, and locate the positional tab on the pump top plate in the tank flange slot. Retain with the circlip. Refit the fuel tank and 'shear' panel.

LI.7 - CHARCOAL CANISTER

In order to prevent fuel vapour venting from the fuel tank to atmosphere, the breather pipe from the tank is routed to a canister filled with activated-charcoal, which absorbs and stores the fuel vapour when the engine is stopped. When the engine is running, the canister is connected to the depression in the intake plenum via a port in the throttle body, such that fresh air is drawn through the canister to purge the charcoal of its absorbed fuel, with the resultant gas then consumed by the engine in the normal combustion process.

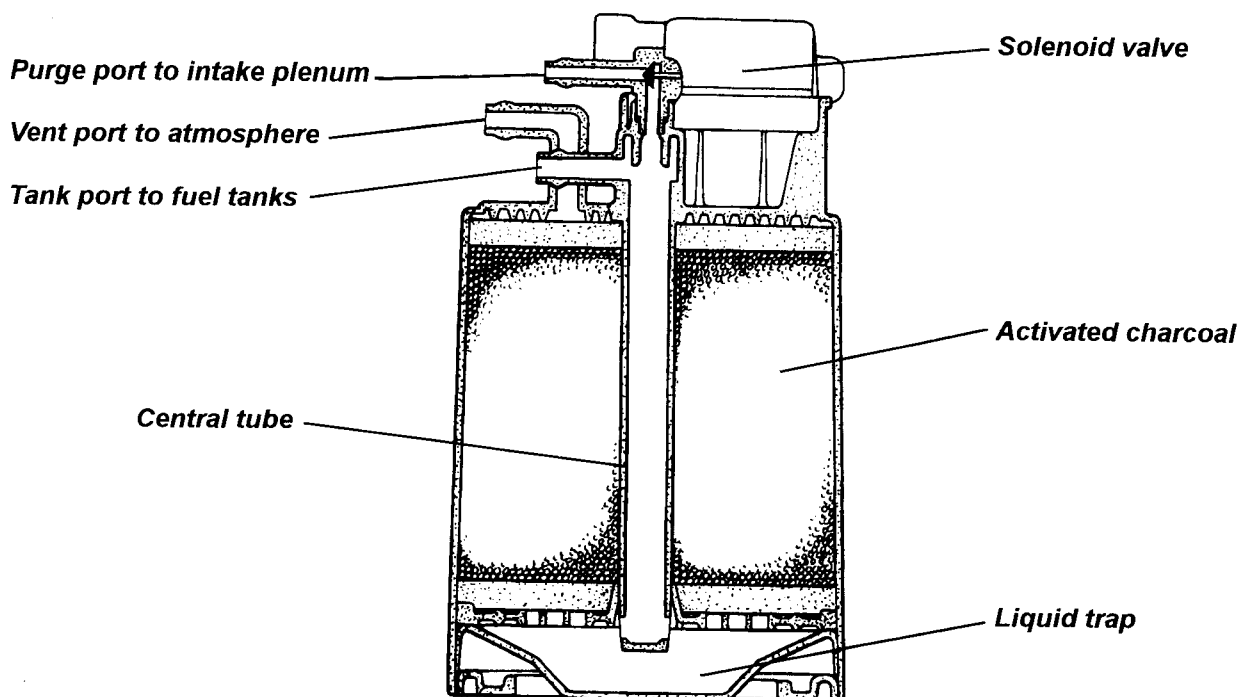
Charcoal Canister

This is mounted at the left hand front corner of the engine bay via a tapered lug on the canister and corresponding bracket on the bulkhead.



Fuel vapour from the top of the fuel tank filler neck is routed via a roll-over valve (to prevent fuel spillage if the car is inverted) mounted on a bracket integral with the filler neck, to the canister port labelled 'tank'. A central tube in the canister connects this port to the underside of the charcoal bed, below which is a reservoir to collect any liquid fuel.

The top side of the charcoal bed is connected via a port in the top of the canister, to atmosphere. A purging port, controlled by a solenoid valve on the top of the canister, connects the tank vent and underside of the charcoal bed with a port on the throttle body such that when the valve is open, the depression in the engine intake draws air through the charcoal bed to purge the canister of vapour, and prepare the charcoal for further absorption.



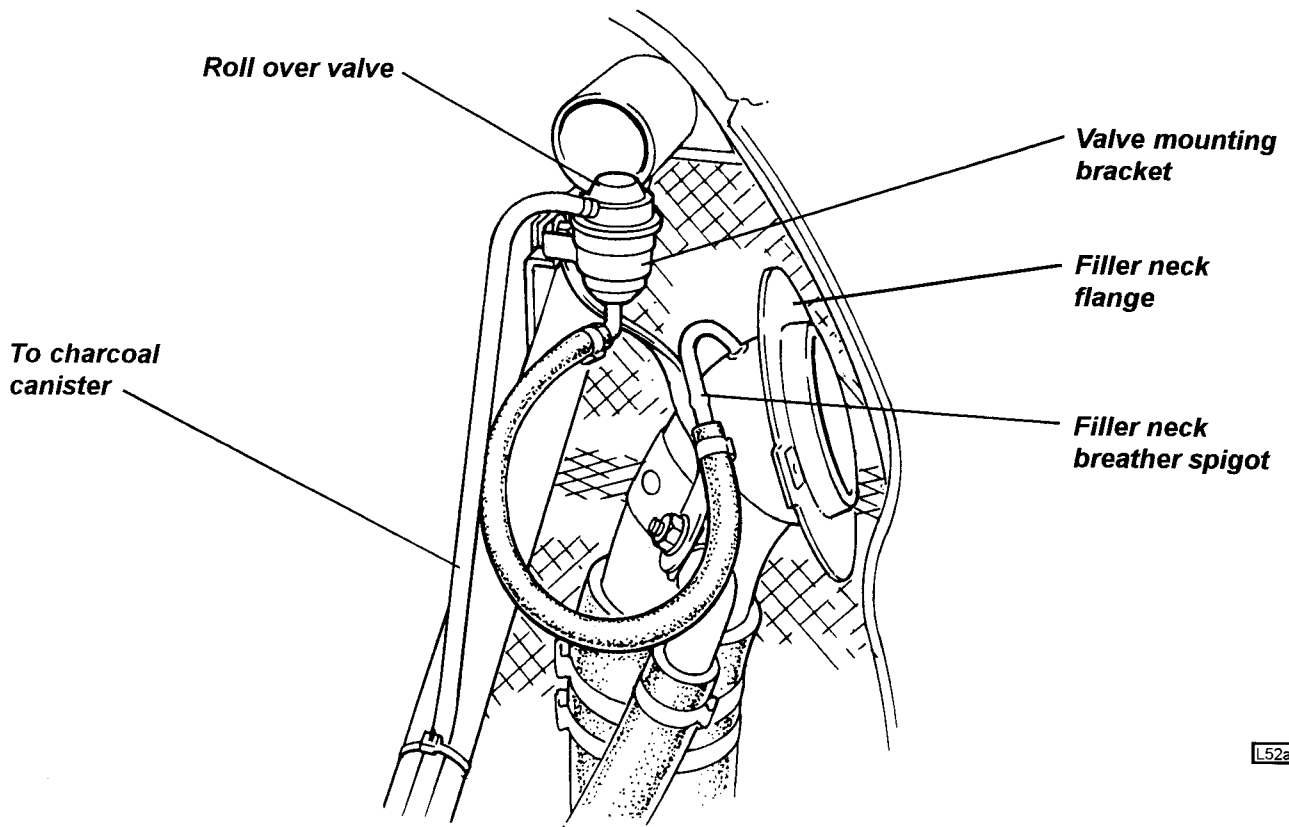


Control System

The canister purge valve is controlled by the engine management ECM, which keeps the valve closed (unenergised) when the engine is cold or idling in order to protect the catalyst and maintain idle quality. At coolant temperatures above 75°C and engine speeds above 1600 rpm, the ECM opens the valve and allows purging of the charcoal to take place, burning the resultant gas in the normal combustion process.

Roll Over Valve

The roll over valve is fitted on a bracket fixed to the roll over bar backstay, and is positioned above the filler neck within the rear clamshell butress. The RH rear wheelarch liner must be removed for access to the valve.



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