

160 Fuel Tank and Fuel Pump

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GENERAL

This repair group covers service information specifically for the fuel pump, tank, filter, and fuel lines. Information on the fuel injection system is covered in 130 Fuel Injection.

NOTE —
Fuel filter replacement is covered in 020 Maintenance.

The following cautions and warnings should be observed when servicing the fuel system.

- WARNING —**
- The fuel system is designed to retain pressure even when the ignition is off. When working with the fuel system, loosen the fuel lines slowly to allow residual fuel pressure to dissipate gradually. Avoid spraying fuel.
 - Before beginning any work on the fuel system, place a fire extinguisher in the vicinity of the work area.
 - Fuel is highly flammable. When working around fuel, do not disconnect any wires that could cause electrical sparks. Do not smoke or work near heaters or other fire hazards.
 - Always unscrew the fuel tank cap to release pressure in the tank before working on the tank or lines.
 - Do not use a work light near any fuel. Fuel may spray onto the hot bulb causing a fire.
 - Make sure the work area is properly ventilated.

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CAUTION—

- Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.
- Before making any electrical tests with the ignition turned on, disable the ignition system as described in **120 Ignition System**. Be sure the battery is disconnected when replacing components.
- To prevent damage to the ignition system or the electronic fuel system components, including the control unit, always connect and disconnect wires and test equipment with the ignition off.
- Cleanliness is essential when working with the fuel system. Thoroughly clean the fuel line unions before disconnecting any of the lines.
- Use only clean tools. Keep removed parts clean and sealed or covered with a clean, lint-free cloth, especially if completion of the repair is delayed.
- Do not move the car while the fuel system is open.
- Avoid using high pressure compressed air to blow out lines and components. High pressure can rupture internal seals and gaskets.
- Always replace seals and O-rings.

FUEL TANK AND LINES

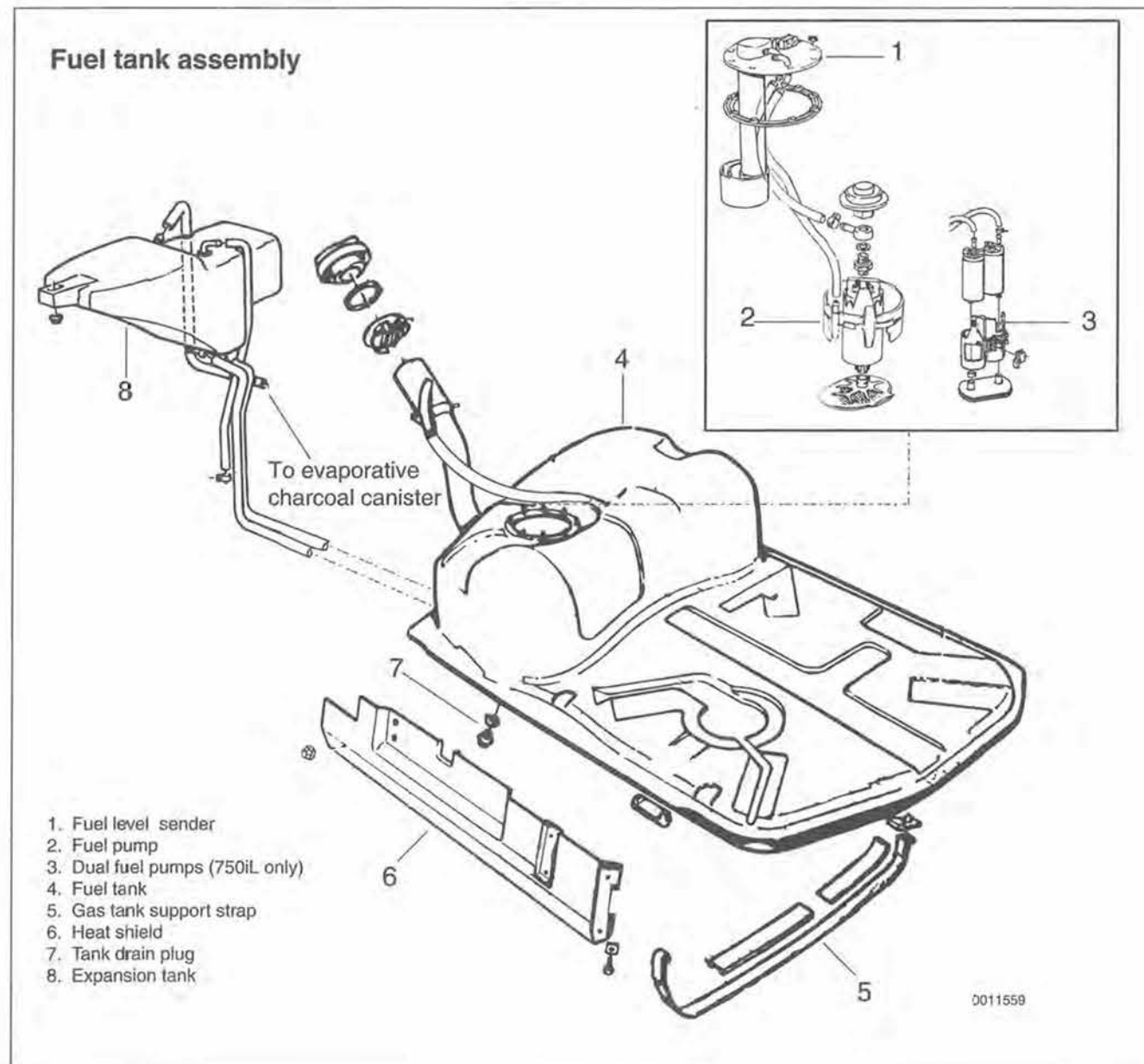
The metal fuel tank is located at the rear of the car beneath the luggage compartment. The tank capacity for the different models is listed in **Table a**. Mounted in the fuel tank are the fuel level sender and the fuel pump. Connecting lines for the evaporative emission control system and expansion tank are also attached to the tank.

NOTE—

The 750iL model with M70 engine is equipped with two fuel pumps.

Table a. E32 Fuel Tank Capacities

Year & Model	Capacity
735i 1988 - 1992 740i 1993 - 1994	81 liters (21.4 gal)
735iL 1988 - 1992 740iL 1993 - 1994 750iL 1988 - 1994	91 liters (24 gal)



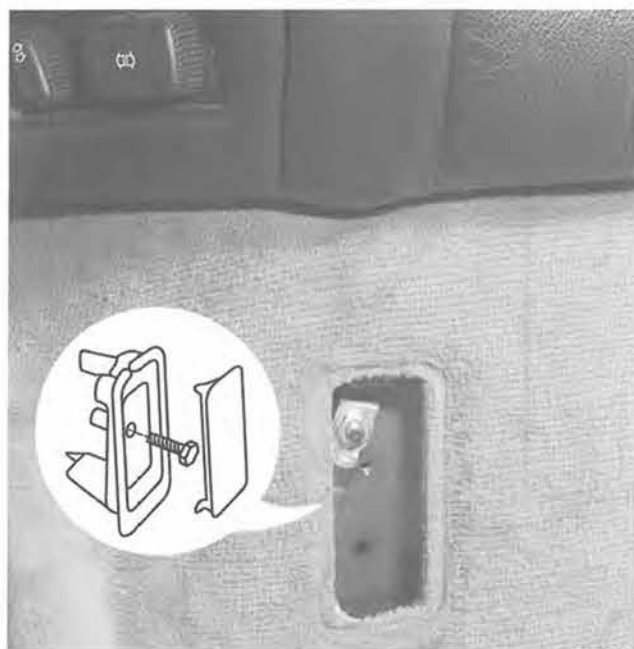
Fuel tank, removing and installing

The fuel tank should be drained into a storage unit prior to removal. Use an approved transfer pump and container. The fuel can be pumped out via a hose inserted in the filler neck. The tank can also be drained through the drain plug in the bottom of the tank.

WARNING—

Before removing the tank, be sure that all hot components such as the exhaust system are completely cooled down.

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- Disconnect negative (–) battery cable behind access cover at rear seat bulkhead.

CAUTION—

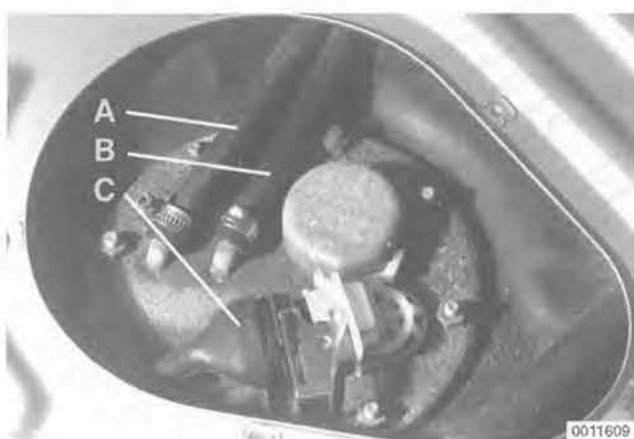
Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.

- Raise rear of car and support in a safe manner.

WARNING—

Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

- Remove fuel tank filler cap and drain fuel tank using an approved evacuation or draining method.
- Working in luggage compartment, remove floor carpeting. Then remove access cover above fuel pump/fuel level sender.



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- Supply hose **A**, return hose **B** and electrical harness connector **C**.

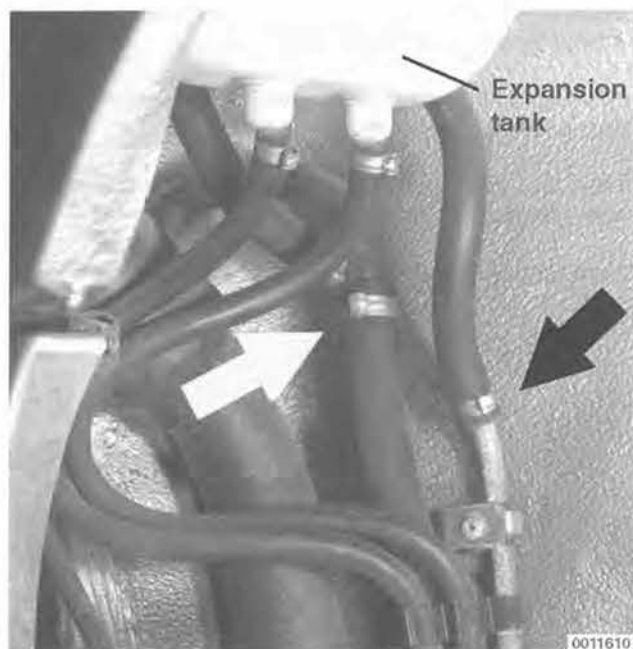
- Disconnect hoses and electrical harness connector at fuel pump/fuel level sensor.

NOTE—

Models with M70 engine use an additional supply hose (not shown).

- Working within fuel filler door, pry out rubber sealing gasket.

FUEL TANK AND FUEL PUMP 160-5



- Remove right rear wheel housing trim. Then disconnect two vent hoses from expansion tank.

NOTE—

Remove the right rear road wheel as necessary for removal of the wheel housing trim.

- While supporting tank from below, remove fuel tank heat shield and support strap mounting bolts. Carefully lower tank from car.

- Installation is reverse of removal.

- Always use new seals, gaskets, O-rings and hose clamps.
- Inspect all rubber parts including hoses and replace any that are chafed, dried out or cracked.
- Inspect heat shield and replace if corroded or damaged.
- Inspect rubber buffers and liners on fuel tank, support straps and on underside of body. Replace rubber parts that are hardened or damaged.

Tightening Torques

- Fuel level sender/fuel pump to fuel tank
 - M6 nut 10 Nm (89 in-lb)
 - M8 bolt 23 Nm (17 ft-lb)
- Fuel tank to body 23 Nm (17 ft-lb)
- Heat shield to fuel tank (bolts) 10 Nm (89 in-lb)
- Fuel tank drain plug
(use new seal ring) 25 Nm (18 ft-lb)
- Hose clamps
 - 10 mm to 16 mm diameter 2.0 Nm (18 in-lb)

Fuel level sender and fuel pump, removing

The fuel level sender is mounted in the fuel tank together with the fuel pump assembly. The sender has a float connected to a variable resistance for fuel level and a switch that closes to turn on the low fuel light. When replacing the sender/pump assembly always replace hose clamps, gaskets and O-rings.

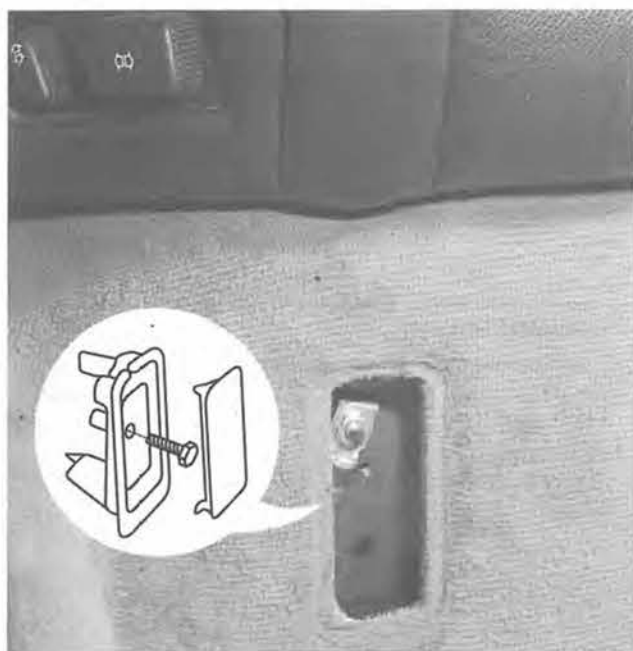
WARNING—

When removing the fuel level sender or the fuel pump assembly, the fuel tank should be drained.

- Disconnect negative (–) battery cable behind access cover at rear seat bulkhead. Insulate cable end.

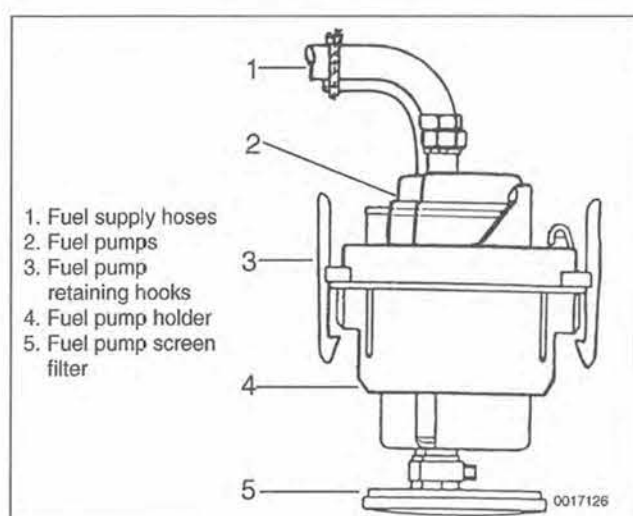
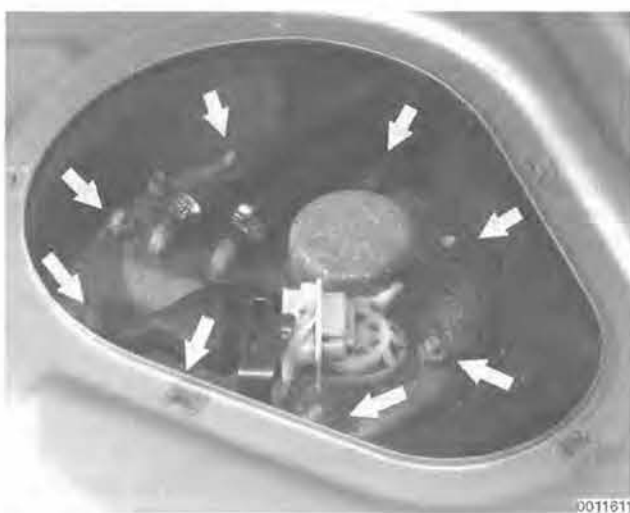
CAUTION—

Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.



160-6 FUEL TANK AND FUEL PUMP

- Remove fuel tank filler cap and drain fuel tank using an approved evacuation or draining method.
- Working in luggage compartment, remove access cover from above fuel level sender/pump assembly.
- Label and disconnect fuel hoses and harness connector from fuel level sender.
- Remove fuel level sender mounting nuts or bolts (arrows).



- Dual fuel pump assembly for M70 engines. (Single fuel pump assembly on M30 and M60 engines is similar.)
- Slowly withdraw sender from tank, allowing fuel to drain off. Release fuel pump retaining hooks (3) and remove pump(s), allowing fuel to drain off.

WARNING —

Fuel may be spilled. Do not smoke or work near heaters or other fire hazards.

- Install fuel pump(s) so that retaining hooks are correctly fitted.

NOTE —

Use a new gasket between the level sender and the top of the tank.

Tightening Torques

- Fuel level sender/fuel pump assembly to fuel tank
 - M6 (nut) 10 Nm (89 in-lb)
 - M8 (bolt) 23 Nm (17 ft-lb)
- Hose clamps
 - 10mm to 16mm diameter 2.0 Nm (18 in-lb)

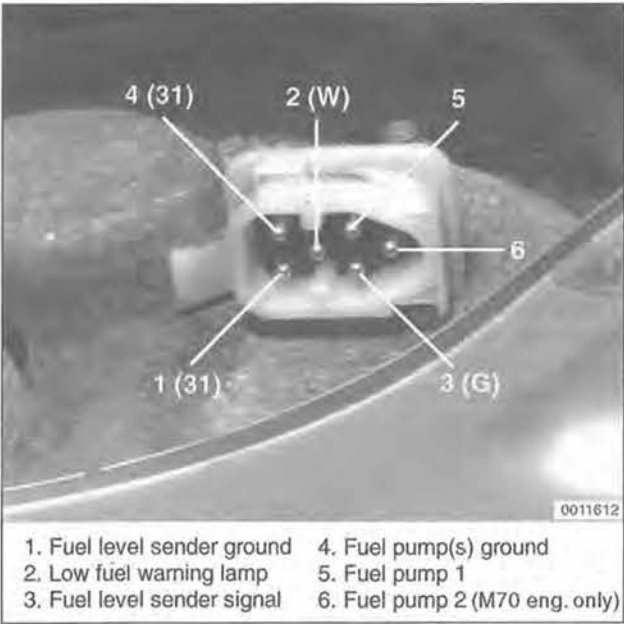
- Reconnect harness connector and hoses.
- Fill tank and check for leaks by running engine.
- Install access cover and its mounting screws.
- Reconnect negative (–) battery cable.

Fuel level sender, testing

- Fuel pump/level sender connector.
- The removed sender can be tested using an ohmmeter. **Table b** lists resistance values for the sender at various float positions.

Table b. Fuel Level Sender Resistances

Connector terminals	Float position	Test result (ohms)
G and 31	slowly moving from empty to full position	resistance continuously changing (no breaks)
	Empty	88.7 ± 2.8 ohms
	Full	3.2 ± 0.7 ohms
W and 31	Empty (low fuel warning)	continuity



- 1. Fuel level sender ground
- 2. Low fuel warning lamp
- 3. Fuel level sender signal
- 4. Fuel pump(s) ground
- 5. Fuel pump 1
- 6. Fuel pump 2 (M70 eng. only)

FUEL PUMPS

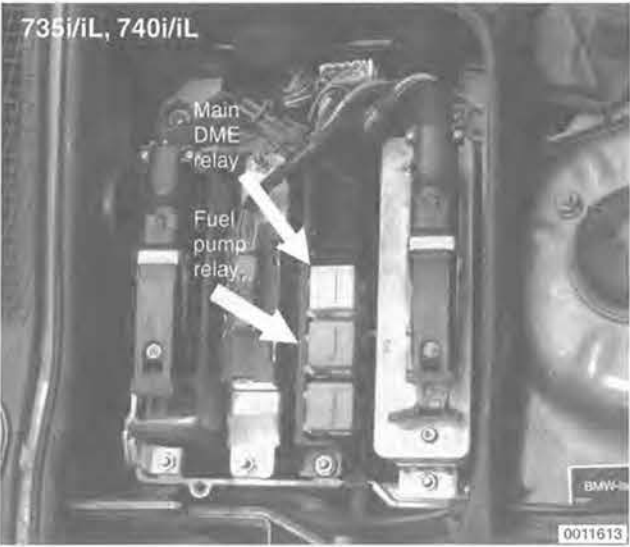
The electric fuel pump assembly is submersed in the bottom of the fuel tank. The 735i/iL and 740i/iL models are equipped with one fuel pump. The 750iL model is equipped with a pair of fuel pumps mounted side by side.

The fuel pump delivers fuel at high pressure to the fuel injection system. A pressure regulator maintains system pressure. The quantity of fuel supplied exceeds demand, so excess fuel returns to the fuel tank via a return line. See **130 Fuel Injection** for more information on system pressure and the fuel pressure regulator.

NOTE —
Fuel pump removal procedures are given earlier under **Fuel level sender and fuel pump, removing**.

The pump is cooled and lubricated by fuel and may therefore be damaged if allowed to run dry or if the fuel pickup strainer/filter becomes blocked. Access to the pump is from the top of the fuel tank through the luggage compartment.

160-8 FUEL TANK AND FUEL PUMP



Fuel Pump Fuse and Relay

- Fuel pump relay locations.
- The fuel pump is operated by a fuel pump relay. The fuel pump circuit is protected by fuse no. 23 located in the main fuse box. Fuel pump and DME main relay locations in the various models are listed in **Table c.**

Table c. Fuel Pump and DME Relay Locations

Year & model	Relay locations
735i/iL 1988 - 1992 740i/iL 1993 - 1994	In electronics box (E-box)
750iL 1988–1994	In auxiliary relay panel II (right side of engine compartment)

The engine control module (ECM) and the DME main relay supply power to the fuel pump relay. During starting, the fuel pump runs as long as the ignition switch is in the start position and continues to run once the engine starts. If an electrical system fault interrupts power to the fuel pump, the engine will not run.

Operating Fuel Pump for Tests

To operate a fuel pump for testing purposes without having to run the engine, the fuel pump relay can be bypassed to power the pump directly.

NOTE—

Two versions of fuel pump relays are used. Except for some 1988-1990 M70 engines, a 4-pin relay is used. On most 1988 through 1990 750iL cars, a 7-pin solid state relay is used. Testing procedures and troubleshooting vary depending on relay type installed.

- To run fuel pump, remove relay and identify terminals numbers on relay and match to socket numbers on relay socket.

- Jumper socket terminal 30 to socket terminal 87 with a fused jumper wire. Pump should run. After completing the tests, remove jumper wire.

CAUTION—

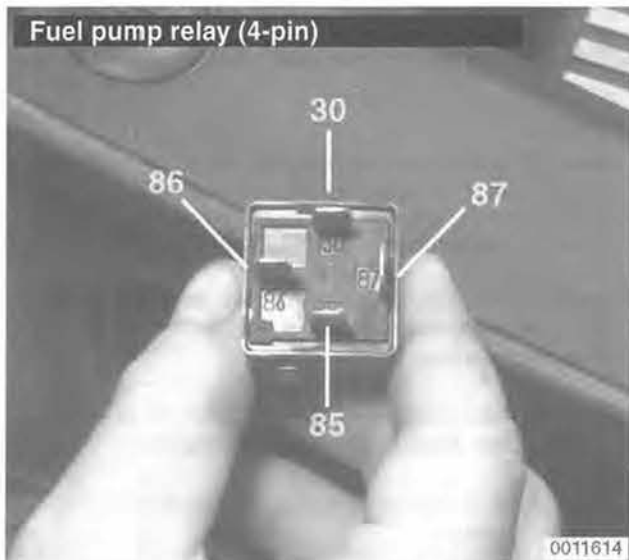
- Relay locations may vary. Use care when identifying relays and when troubleshooting the electrical system at the fuse/relay panel. See **Electrical Wiring Diagrams** for complete circuit information.
- On cars with 4-pin relay, there is a 1.5 mm² red wire at terminal 30 in the relay socket. If in doubt, consult an authorized BMW dealer.
- On M70 engines with 7-pin relays, there is a 2.5 mm² red wire at terminal 30 in the relay socket. The M70 solid state relay uses a tachometer signal and a start signal to run the pumps.

NOTE—

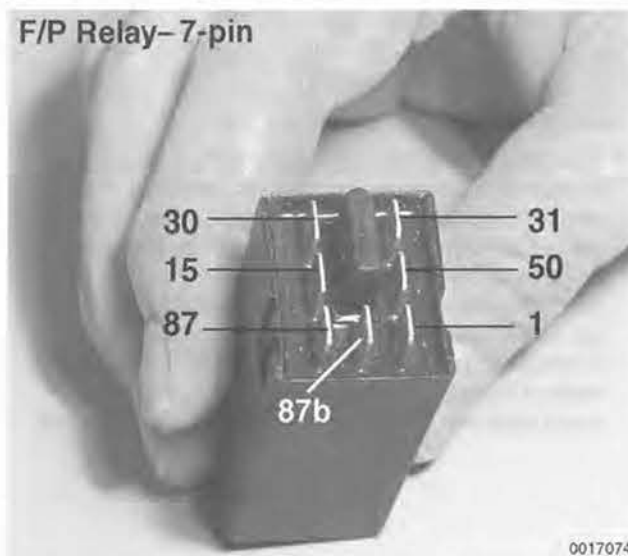
- On 750iL models, be sure to test both fuel pumps.
- The jumper wire should be 1.5 mm² (14 ga.) and should include an in-line fuse holder with a 16 amp fuse. To avoid fuse/relay panel damage from repeated connecting and disconnecting, also include a toggle switch. A heavy-duty jumper, BMW tool no. 61 3 050, is also available from an authorized BMW dealer.

If the pump does not run with the jumper installed, the fault could be in the fuel pump or the wiring to the pump. Check the pump and its wiring as described below.

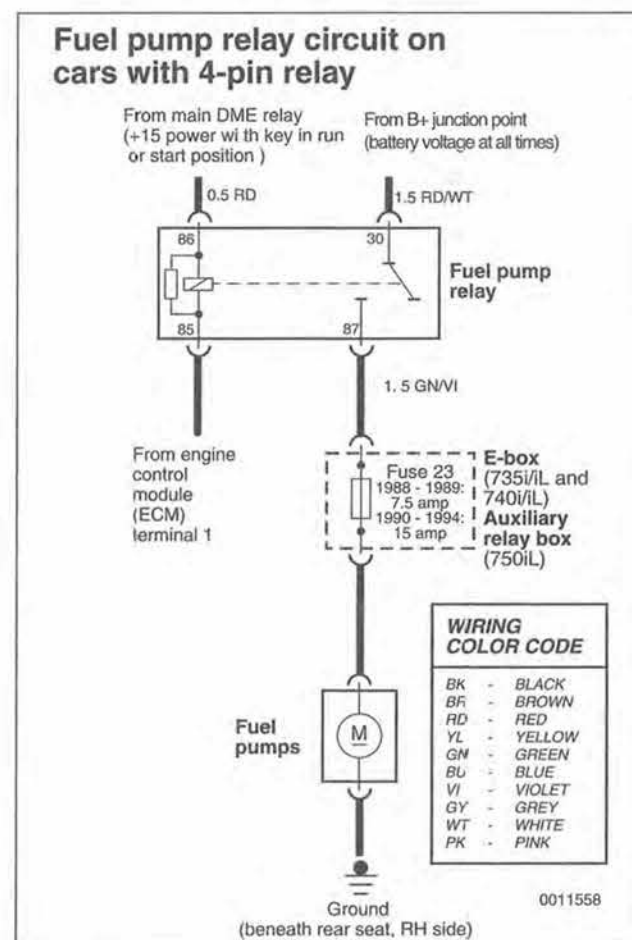
Fuel pump relay (4-pin)



F/P Relay— 7-pin



160-10 FUEL TANK AND FUEL PUMP



Fuel Pump Tests

Troubleshooting of any fuel pump fault should begin with checking the fuel pump fuse and the fuel pump relay. The DME main relay should also be checked. Fuel pressure and rate of fuel delivery are the important fuel pump performance measurements.

NOTE—

Special tools are required for some of the tests described here.

Fuel pump electrical circuit, checking

- Fuel pump electrical circuit for all engines with 4-pin relay.

NOTE—

Fuel pump circuit on M70 engines with 7-pin relays varies from circuit shown. The 7-pin relays are solid state relays and use a tachometer input and a starter input to run the pumps. See **Electrical Wiring Diagrams** for complete circuit information.

- Working from luggage compartment, remove floor carpeting. Then remove access cover from above fuel level sender/pump assembly.
- Remove fuel pump relay and operate fuel pump as described under **Operating Fuel Pump for Tests**.
- The pump should run. Disconnect relay jumper wire when finished.



- Testing fuel pump with digital voltmeter.

- If fuel pump does not run, disconnect harness connector from level sender/pump assembly. With relay jumper wire reconnected as described above, check for positive (+) battery voltage at terminal 5 (6 for fuel pump II on M70) and ground (–) at terminal 4.
- On 750iL: Repeat procedure with second fuel pump relay. Test for voltage and ground.
- If voltage and ground are present, fuel pump is probably faulty. If there is no voltage, check wiring from fuel pump relay and make sure relay is functioning correctly.

Fuel pump delivery pressure and delivery rate, checking

CAUTION—

The fuel pump is capable of developing a higher pressure than that regulated by the pressure regulator. In the event the fuel pump check valve is faulty (stuck closed), make sure the fuel pressure does not rise above 6.0 bar (87 psi).

- Remove fuel tank filler cap.

Check fuel pump delivery pressure:

- Connect in-line a T-fitting and fuel pressure gauge to outlet hose at fuel pump or at fuel rail (**arrow**) in engine compartment.
- Operate fuel pump as described under **Operating Fuel Pump for Tests**. Check that fuel pressure corresponds to specifications listed in **Table d**.

WARNING—

Fuel under pressure is present during the test. Use hose clamps at all connections.

Table d. Fuel Pressure Specifications

Engine	Fuel pressure
M30/M70	3.0 ± 0.06 bar (43.5 ± 0.9 psi)
M60	3.5 ± 0.06 bar (51 ± 0.9 psi)

NOTE—

- On 750iL models test both fuel pumps.
- If the system pressure is low, repeat the test while gradually pinching off the return hose. The pressure should rise rapidly. If not, the fuel pump is most likely faulty.
- If the system pressure is too high, check the return line from the pressure regulator to the tank. If no faults can be found, the pressure regulator is most likely faulty. See **130 Fuel Injection** for testing and replacement procedures.

CAUTION—

Do not use compressed air above 40 psi to blow out lines or components. Internal damage to components may result.

- When finished, disconnect pressure gauge.

Check fuel pump delivery rate:

- Disconnect return line from fuel rail in engine compartment. Connect a length of hose to fitting on fuel rail and place open end of hose in a suitable container for catching fuel (2-quart capacity).
- Run fuel pump for exactly 30 seconds as described under **Operating Fuel Pump for Tests** and measure fuel collected. Compare to specifications listed in **Table e**.

NOTE—

On 750iL models test both fuel pumps.



160-12 FUEL TANK AND FUEL PUMP

Table e. Fuel Pump Delivery Specifications

Model & Engine	Delivery rate (30 seconds @ 12V)
735i/iL M30 engine 740i/iL M60 engine 750iL M70 engine	0.875 liter (0.93 qt)

- When finished testing, reconnect fuel line. Tighten hose clamps.

Fuel pump power consumption, checking

- Disconnect harness connector from fuel level sender/pump assembly.
- Connect an ammeter between fuel pump harness connector and fuel pump terminal.

Fuel pump/level sender connector.

- Connect ammeter between fuel pump power supply terminal in connector (no. 5 or no. 6, as applicable) and corresponding pump terminal. Connect terminal 4 in connector to corresponding pump terminal using an insulated jumper.

CAUTION—
Do not allow test leads to short to ground.

NOTE—
See 600 Electrical System—General for information on electrical tests using a digital multimeter (DMM).

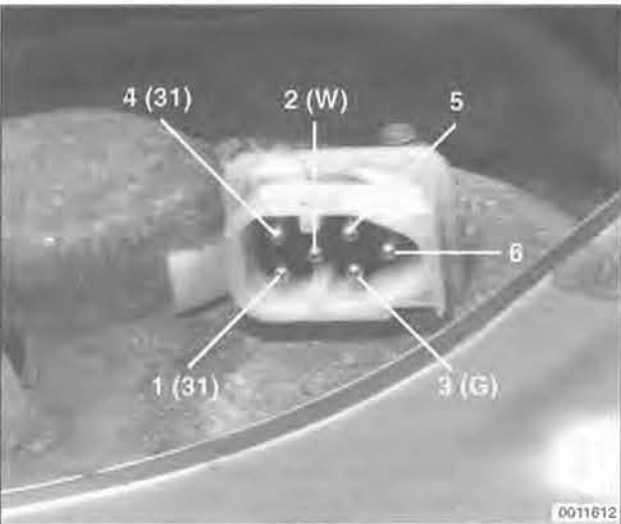
- Run pump as described in Operating Fuel Pump for Tests.
- Compare ammeter reading with specification listed in Table f.

NOTE—
To achieve accurate test results, the battery voltage at the connector should be approximately 13 volts. Charge the battery as necessary.

Table f. Fuel Pump Current

Current consumption (max.)	5.0 amps
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- NOTE—**
- It is a common practice to replace the fuel filter any time the fuel pump is replaced.
 - A higher than normal power consumption usually indicates a worn fuel pump. Be sure to check that the return line and the pump pickup are not obstructed before replacing the pump.



- | | |
|-----------------------------|--------------------------------|
| 1. Fuel level sender ground | 4. Fuel pump(s) ground |
| 2. Low fuel warning lamp | 5. Fuel pump 1 |
| 3. Fuel level sender signal | 6. Fuel pump 2 (M70 eng. only) |