

160 Fuel Tank and Fuel Pump

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160-2 Fuel Tank and Fuel Pump

Fuel tank

GENERAL

This repair group covers service information for the fuel supply system.

See also:

- **100 Engine-General** for model year, engine code, and DME applications
- **130 Fuel Injection (M54 Engine)**
- **131 Fuel Injection (N52 Engine)**
- **132 Fuel Injection (N54 Engine)**
- **133 Fuel Injection (V8 Engine)**
- **ECL Electrical Component Locations** for fuel pump fuse and relay access information

Fuel tank

The saddle-shaped plastic fuel tank is mounted underneath the center of the car (underneath the rear seat). Mounted in the fuel tank are the electric fuel pump, fuel level sending units and suction jet pump. Connecting lines for the evaporative emission control system are also attached to the tank.

Fuel tank capacity for 5 Series models is listed in **Table a**.

Table a. Fuel tank capacity for 5 Series models	
Tank capacity	70 liters (18.5 US gal)
Reserve capacity	10 liters (2.6 US gal)

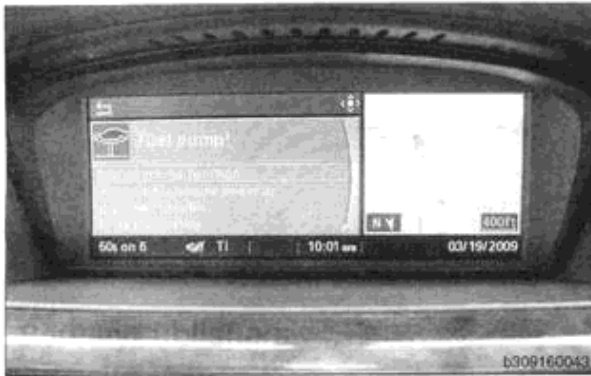
Fuel delivery systems

5 Series models use two main fuel delivery systems. Naturally aspirated M54, N52, V8 (N62) engines use only an electric fuel pump. Turbocharged N54 engine models use an electric and mechanical fuel pump.

M54 and N62 engine fuel injectors are installed in machine-bored holes in the intake manifold. An in-tank electric fuel pump delivers pressure-regulated fuel to the fuel rail. The fuel pump is controlled by the DME via a fuel pump relay (K96). It operates at a pressure of 3.5 bar (50.7 psi).

N52 engine fuel injectors are installed in machine-bored holes in the cylinder head. An in-tank electric fuel pump delivers pressure-regulated fuel to the fuel rail. The fuel pump is a variable speed pump controlled by the EKP (electric fuel pump control) module and delivers only the amount of fuel needed for engine operation. This eliminates excess fuel delivery and reduces pump wear. It can operate at up to 5 bar (72.5 psi) and 95 liters (25 gallons) per hour.

N54 engine direct fuel injection allows for precise metering of mixture and higher compression. This is made possible by locating a fuel injector for each cylinder centrally between the valves. The electric fuel pump delivers fuel to a high pressure fuel pump. The high pressure fuel pump is driven by a chain and can provide fuel pressure from 5 bar (72.5 psi) up to 200 bar (2900 psi).

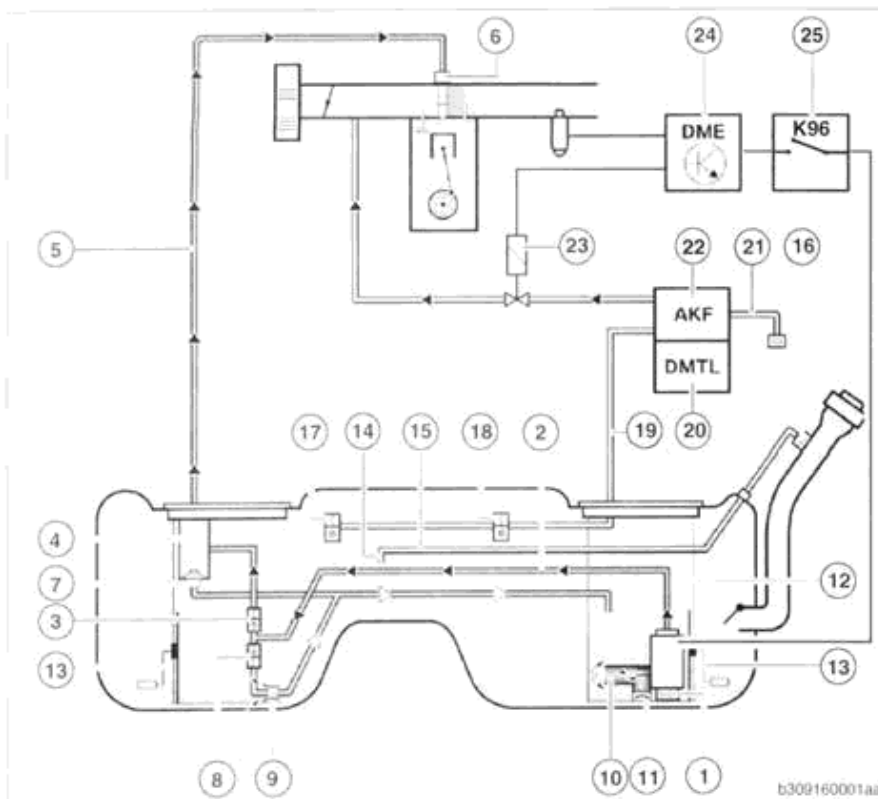


Electric fuel pump

An electric fuel pump is mounted in the fuel tank in tandem with the right side fuel level sender and suction jet pump. A suction jet pump is located in the left side of the tank to transfer fuel to the right side. The combined fuel filter / pressure regulator delivers pressurized fuel to the fuel injection system. The system is a non-return design; there is one fuel line to the fuel injectors and excess fuel flows directly from the fuel filter / pressure regulator back into the tank.

⚡ Fuel pump self-diagnostics are built into the DME. A failure in the fuel pump circuit may set a fault code.

Fuel system schematic (M54, N62 engines)

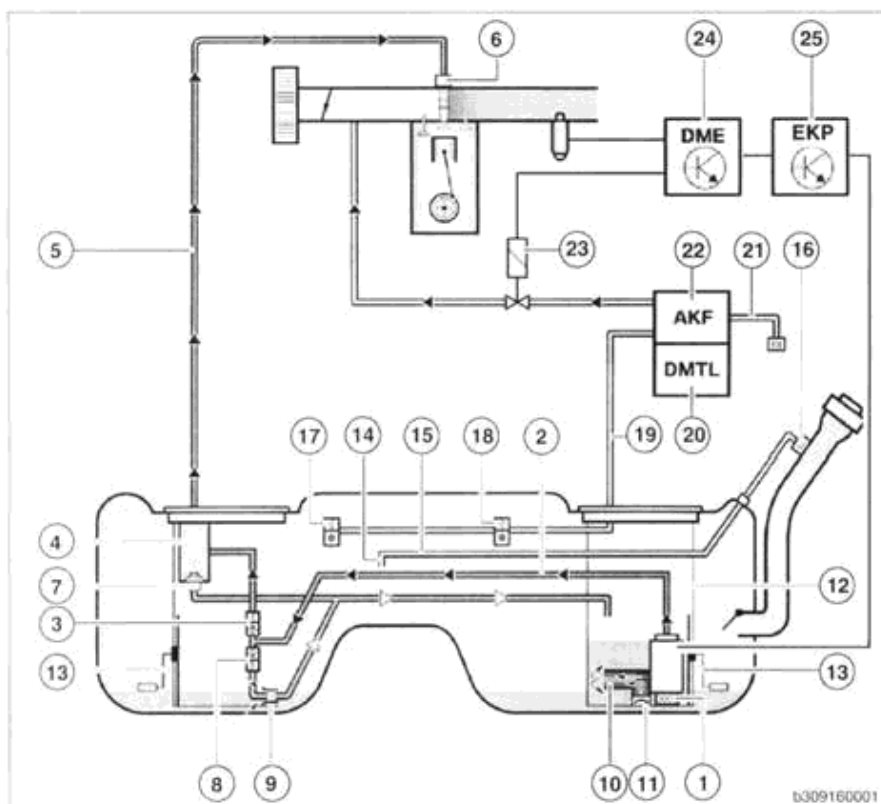


1. Electric fuel pump
2. Fuel supply line
3. Check valve
4. Fuel filter
5. Fuel supply line to engine
6. Fuel injector
7. Pressure regulator
8. Check valve
9. Left suction jet pump
10. Right suction jet pump
11. Pump initial filling valve
12. Fuel baffle
13. Fuel level sender
14. Refueling line connector
15. Refueling ventilation line
16. Refueling ventilation nipple
17. Left operation ventilation valve
18. Right operation ventilation valve
19. Operation ventilation line
20. Diagnosis pump for tank leakage (DMTL)
21. Fresh air vent line
22. Activated carbon canister
23. Fuel tank vent valve
24. Engine control module (ECM)
25. Fuel pump relay (K96)

160-4 Fuel Tank and Fuel Pump

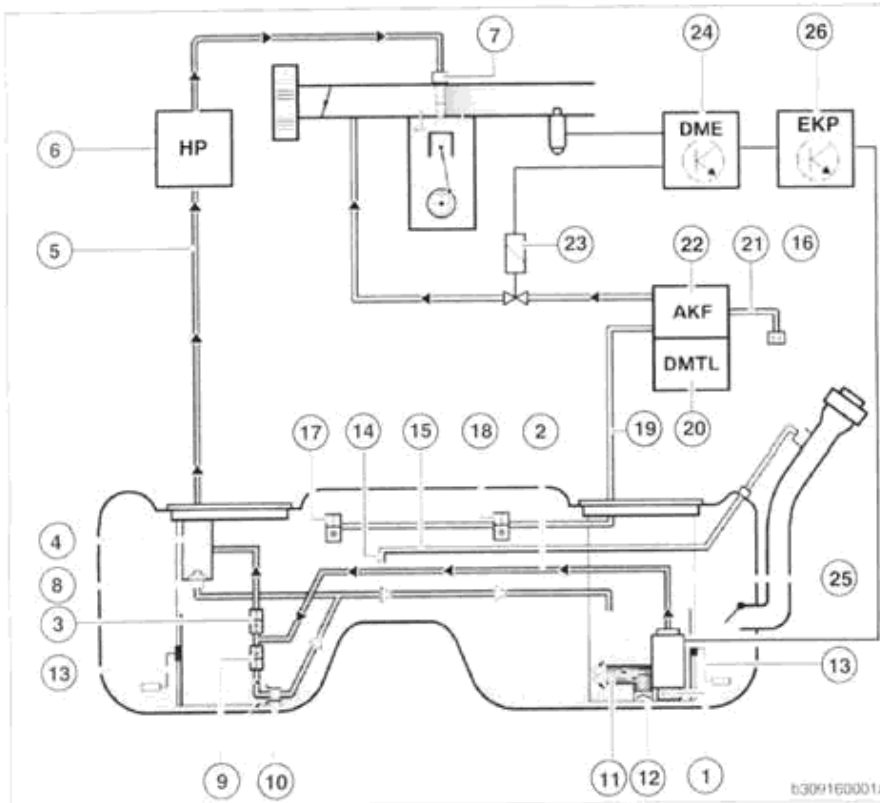
Fuel system schematic (N52 engine)

Fuel system schematic (N52 engine)



1. Electric fuel pump
2. Fuel supply line
3. Check valve
4. Fuel filter
5. Fuel supply line to engine
6. Fuel injector
7. Pressure regulator
8. Check valve
9. Left suction jet pump
10. Suction jet pump
11. Pump initial filling valve
12. Fuel baffle
13. Fuel level sender
14. Refueling line connector
15. Refueling ventilation line
16. Refueling ventilation nipple
17. Left operation ventilation valve
18. Right operation ventilation valve
19. Operation ventilation line
20. Diagnosis pump for tank leakage (DMTL)
21. Fresh air vent line
22. Activated carbon canister
23. Fuel tank vent valve
24. Engine control module (ECM)
25. Fuel pump module (EKP)

Fuel system schematic (N54 engine)



1. Electric fuel pump
2. Fuel supply line
3. Check valve
4. Fuel filter
5. Fuel supply line to engine
6. High pressure fuel pump
7. Fuel injector
8. Pressure regulator
9. Check valve
10. Left suction jet pump
11. Suction jet pump
12. Pump initial filling valve
13. Fuel level sender
14. Refueling line connector
15. Refueling ventilation line
16. Refueling ventilation nipple
17. Left operation ventilation valve
18. Right operation ventilation valve
19. Operation ventilation line
20. Diagnosis pump for tank leakage (DMTL)
21. Fresh air vent line
22. Activated carbon canister
23. Fuel tank vent valve
24. Engine control module (ECM)
25. Fuel baffle
26. Fuel pump module (EKP)

160-6 Fuel Tank and Fuel Pump

Warnings and Cautions

Warnings and Cautions

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. Avoid spraying fuel. Use shop towels to capture leaking fuel.
- Before beginning work on the fuel system, place a fire extinguisher in the vicinity of the work area.
- Work only on the fuel system when engine temperature is below 40°C (104°F).
- Electric fuel pump starts each time a door is opened.
- Fuel is highly flammable. When working around fuel, do not disconnect wires that could cause electrical sparks. Do not smoke or work near heaters or other fire hazards.
- Wear eye protection, face shield and protective clothing to avoid injuries from contact with fuel.
- When working on an open fuel system, wear suitable hand protection, as prolonged contact with fuel can cause illnesses and skin disorders.
- Unscrew the fuel tank cap to release pressure in the tank before working on fuel lines.
- Do not use a work light with an incandescent bulb near fuel. Fuel may spray on the hot bulb causing a fire.
- Make sure the work area is properly ventilated.
- Due to risk of personal injury, be sure the engine is cold before beginning work on engine components.

CAUTION—

- Prior to disconnecting the battery, read the battery disconnection cautions given in **001 Warnings and Cautions**.
- Before making any electrical tests with ignition switched 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 other DME components, including the engine control module (ECM), connect and disconnect wires and test equipment with ignition OFF.
- Cleanliness is essential when working with the fuel system. Thoroughly clean the fuel line unions before disconnecting any of the lines. Plug open fuel lines and ports.
- 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.
- Use new seals, O-rings and hose clamps when replacing fuel system components.
- Replace aluminum fasteners when loosened.
- For reliable identification test fastener with magnet for aluminum composition.

FUEL TANK EVAPORATIVE CONTROL SYSTEM

Evaporative control, also referred to as running losses control, is designed to prevent fuel system evaporative losses from venting into the atmosphere. The components of this system allow control and monitoring of evaporative losses by on-board diagnostic (OBD II) software incorporated into the engine control module (ECM).

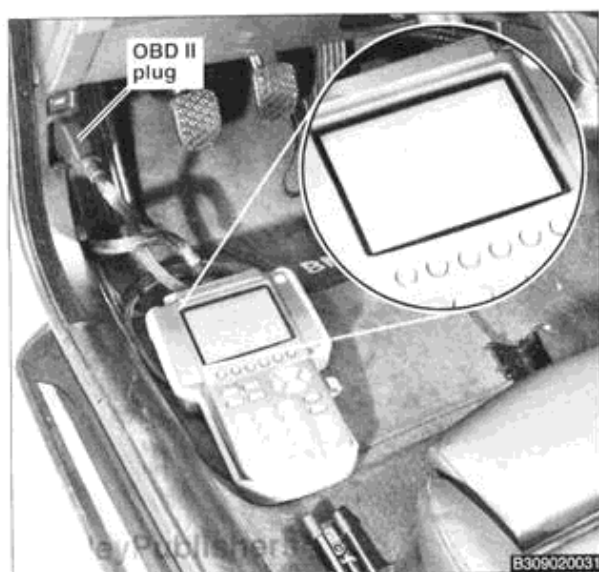
Listed below are the main components of the evaporative control system and their functions:

- Carbon canister stores fuel vapors.
- Plumbing ducts vapors from fuel tank to canister and from canister to intake manifold.
- Carbon canister purge valve is controlled by engine control module (ECM).
- Pressure regulator shunts excess fuel volume directly back to fuel tank before it circulates through fuel lines.
- Leak detection unit (DMTL) pressurizes fuel tank and evaporative system to monitor system leaks.

Evaporative system troubleshooting

- Start by accessing diagnostic trouble codes (DTCs) using a BMW scan tool.
 - For purposes of OBD II emissions compliance, the DME system sets a diagnostic trouble code (DTC) when it detects a leak in the evaporative control system.
 - Malfunction indicator light (MIL) is illuminated upon second recurrence of fault. See **OBD On-Board Diagnostics**.
- When leak testing, observe the following conditions to obtain plausible results:
 - Fuel tank $\frac{1}{4}$ to $\frac{3}{4}$ full.
 - Vehicle parked for at least 2 hours to allow fuel to reach ambient temperature. Ideal fuel temperature is 10° - 20° C (50° - 68° F).
 - Do not refuel immediately before leak test.
- If a leak is detected, check the following areas:
 - Fuel filler cap leaking or off.
 - Fuel tank ventilation lines leaking at fuel tank or activated carbon canister.
 - Tank ventilation valve leaking (in engine compartment).
 - Fuel level sensor and fuel pump assembly cover leaking.

For evaporative system component replacement, see **Fuel Supply Components** in this repair group.



160-8 Fuel Tank and Fuel Pump

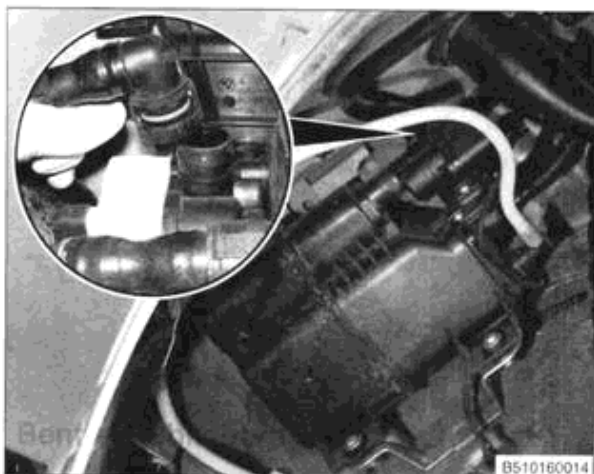
Evaporative system leak test

Evaporative system leak test

Use the following leak test when diagnosing evaporative system leak fault codes.

- Working underneath left rear bumper: gain access to activated carbon canister. See **Activated carbon canister, removing and installing** in this repair group.

- ◀ Remove fresh air line (inset) from DMTL pump.



- ◀ Install BMW test adapter 83 30 0 433 207 (B) (or suitable substitute) at DMTL fresh air connection (A).

- Connect evaporative system smoke machine (C) to test adapter (B). BMW recommends VACUTEC 625-522B (nitrogen pressure swing absorption technology).

- Remove fuel filler cap.

- Activate smoke machine and fill fuel system with smoke until it escapes from fuel filler neck.

- Shut off smoke machine.

WARNING—

- Use only smoke machine that utilizes nitrogen to pressurize fuel system.
- The fuel system may release a substantial amount of fuel-rich gasoline vapors during testing. Work in a well ventilated area.

- Reinstall fuel filler cap.

- Reactivate smoke machine and fill fuel system with smoke.

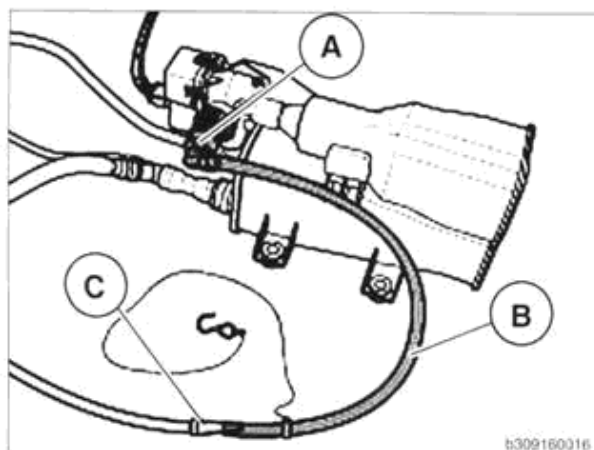
WARNING—

- Do not exceed a maximum fuel system pressure of 0.3 bar (4 psi) when using smoke machine.

- Examine fuel system components for signs of escaping smoke. Repair or replace faulty components.

- After completing tests:

- Attach DMTL fresh air line.
- Check and clear fault codes from ECM memory.



FUEL SYSTEM TROUBLESHOOTING

Fuel pump fuse and relay (M54, N62 engines)

Begin troubleshooting fuel system faults by checking fuel pump fuse and relay. Also, check DME main relay and integrated voltage supply module (IVM). The fuel pump relay is located behind the glove compartment. See **ECL Electrical Component Locations** for access information.

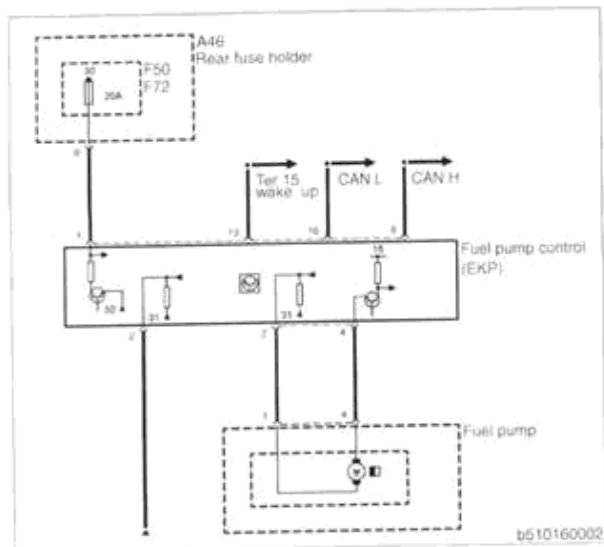
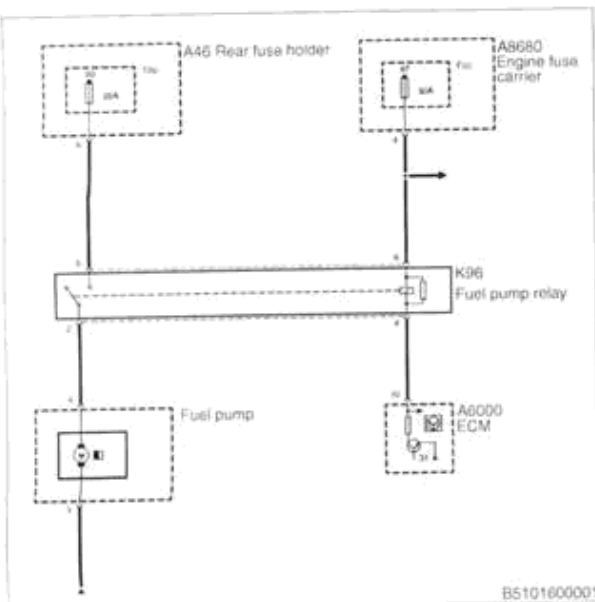
➤ Fuel pump supply circuit is fuse-protected by:

- M54 engine: fuse F50 in the rear fuse holder;
- N62 engine (to 05/2009): fuse F50 in the rear fuse holder
- N62 engine (from 05/2009): fuse F72 in the rear fuse holder

CAUTION—

• *Relay and fuse positions and wire colors vary. A good way to verify a relay position or wire colors is to compare the wiring colors at the relay socket to the colors indicated on the wiring diagrams in **ELE Electrical Wiring Diagrams**.*

- The engine control module (ECM) supplies switched ground to relay. During starting, the fuel pump runs as long as ignition switch is in START position and continues to run once engine starts. If electrical system faults interrupt power to fuel pump, the engine does not run.



Fuel pump fuse and module (N52, N54 engines)

Begin troubleshooting fuel system faults by checking fuel pump fuse. The fuel pump fuse is located in the rear fuse holder. See **ECL Electrical Component Locations** for access information.

➤ Fuel pump circuit is fuse-protected by:

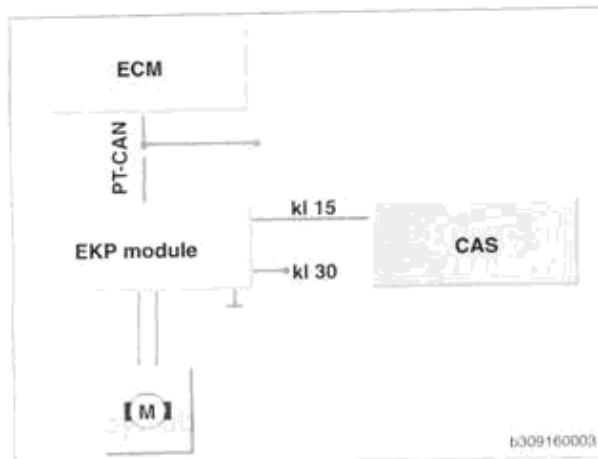
- N52 engine (to 05/2009): Fuse F50
- N52 engine (from 05/2009): Fuse F72
- N54 engine: Fuse F72

CAUTION—

• *Relay and fuse positions and wire colors vary. A good way to verify a relay position or wire colors is to compare the wiring colors at the relay socket to the colors indicated on the wiring diagrams in **ELE Electrical Wiring Diagrams**.*

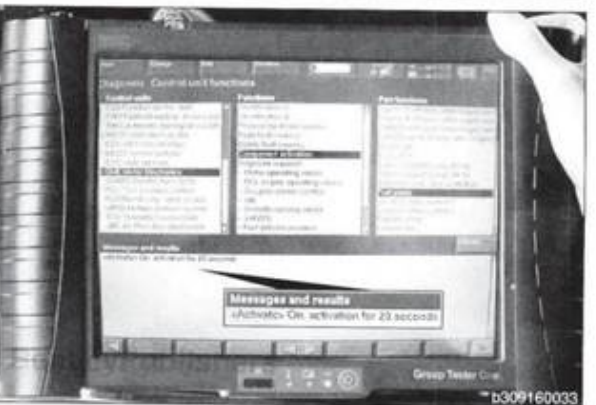
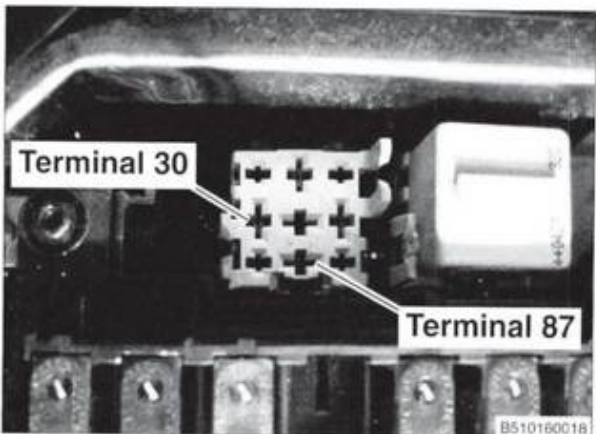
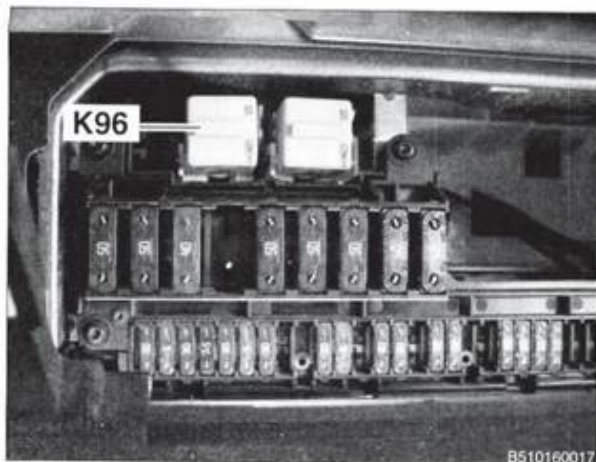
- The ECM calculates the amount of fuel required at the given point in time and the electric fuel pump is activated as required. The total volume required is transmitted as a message to the EKP control module via PT-CAN.

The EKP module converts this message into an output voltage which controls the fuel pump. The fuel pump is capable of delivering up to 95 liters (25 gallons) per hour at a pressure of 5 bar (72.5 psi). On turbo engine models, if the ECM detects a fault in the low pressure fuel sensor, the fuel pump is activated to 100% or 5 bar (72.5 psi).



160-10 Fuel Tank and Fuel Pump

Operating fuel pump for tests (M54, N62 engines)



Operating fuel pump for tests (M54, N62 engines)

This procedure explains how to operate the fuel pump for testing purposes without having to run the engine.

- Remove fuel pump relay (K96) located in relay panel behind the glove compartment. See **ECL Electrical Component Locations** for access information.
- Connect relay socket terminal 30 to relay socket terminal 87 with fused jumper wire.
 - Use 14 ga wire to make jumper and include an in-line fuse holder with a 15A fuse. To avoid relay socket damage from repeated connecting and disconnecting, also include a toggle switch in jumper harness.
 - Fuel pump operates as soon as jumper wire is attached.
- If pump does not run with jumper installed, fault could be in fuel pump, fuse F50, or wiring to pump. Check pump, fuses and its wiring. See **Fuel pump electrical circuit, testing** in this repair group.
- After completing tests, remove jumper harness and install relay.

Operating fuel pump for tests (N52, N54 engines)

This procedure explains how to operate the fuel pump for testing purposes without having to run the engine.

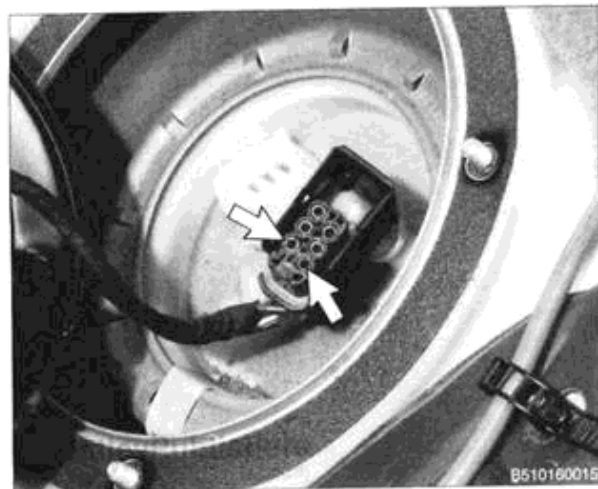
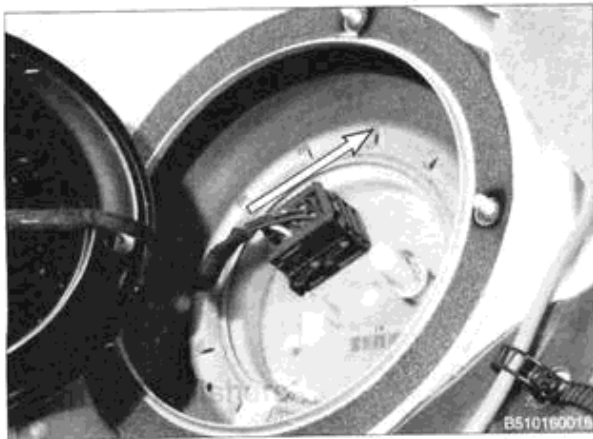
- Using BMW scan tool:
 - Identify vehicle
 - Select **Next** (arrow)
 - Select **Control Module Functions**
 - Select **Complete Vehicle**
 - Select **Drive**
 - Select **DME (Motor Electronics)**
 - Select **Component Activation**
 - Select **Fuel Pump**
- Fuel pump will run at 100% (5 bar) for 20 seconds.

Fuel pump electrical circuit, testing

If fuel pump does not operate or there is no fuel pressure, first test fuel pump electrical circuit.

- Remove rear seat to access fuel pump and fuel level sender. See **Accessing fuel pump and fuel level senders** in this repair group.

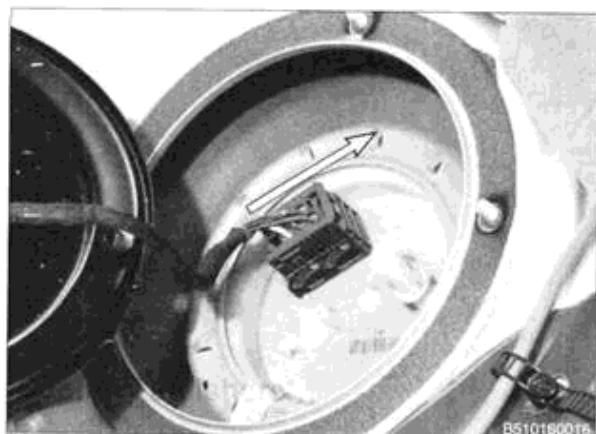
- Slide electrical connector lock (in direction of **arrow**) and remove connector from fuel pump and fuel level sender.



- Connect voltmeter between fuel pump leads (**arrows**) on connector.
- Activate fuel pump. See **Operating fuel pump for tests** in this repair group.
- Use digital multimeter to test for battery voltage at fuel pump connector leads.
- If voltage and ground are present, fuel pump is probably faulty. If there is no voltage, check wiring between fuel pump and fuel pump module.
- After completing tests, reconnect fuel pump harness connector.

160-12 Fuel Tank and Fuel Pump

Fuel pump power consumption, testing (M54, N62 engines)



Fuel pump power consumption, testing (M54, N62 engines)

- Remove rear seat to access fuel pump and fuel level sender. See **Accessing fuel pump and fuel level senders** in this repair group.

✦ Disconnect harness connector from fuel pump.

- Make sure battery voltage at fuel pump connector is 12.6 volts. Charge battery if necessary.

- Attach digital ammeter between pump lead and harness. Connect jumper wire between pump and harness.

CAUTION—

- Do not allow the test leads to short to ground.

- Activate fuel pump. See **Operating fuel pump for tests (M54, N62 engines)** in this repair group.

✦ Compare ammeter reading with specification listed in table.

Fuel pump current (M54, N62 engines)

Current consumption	8 - 13 amps
---------------------	-------------

- Higher than normal power consumption by fuel pump may indicate a worn pump, causing intermittent fuel starvation due to pump overheating and seizure. Replace pump.
- Lower than normal power consumption may indicate blockage in a fuel line. Before replacing fuel pump, be sure to check that return line and pump pickup (inside fuel tank) are not obstructed.



Fuel Tank and Fuel Pump 160-13

Fuel pump power consumption, testing (N52, N54 engines)

Fuel pump power consumption, testing (N52, N54 engines)

If fuel delivery is erratic or poor, or if fuel pump makes abnormally loud noises, test pump power consumption.

Using BMW factory scan tool or equivalent:

- Identify vehicle
- Select **Next** (arrow)
- Select **Function Selection**
- Select **DME (Motor Electronics)**
- Select **Fuel Pump**
- Select **Control Current**
- Select **Next** (arrow)



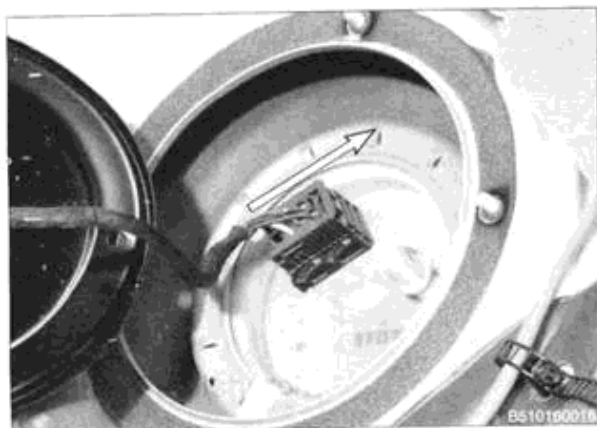
Follow steps on screen to monitor fuel pump current.

Fuel pump current (N52, N54 engines)

Current consumption (fuel pump activated with BMW scan tool)	8 - 13 amps
--	-------------

An alternate method is to install a digital ammeter in fuel pump circuit using the following steps.

- Remove rear seat to access fuel pump and fuel level sender. See **Accessing fuel pump and fuel level senders** in this repair group.
- Slide locking connector in direction of arrow and remove electrical connector from fuel pump.
- Make sure battery voltage at fuel pump connector is 12.6 volts. Charge battery if necessary.



160-14 Fuel Tank and Fuel Pump

Fuel pressure gauge, installing



- Attach digital ammeter between pump lead and harness. Connect jumper wire between pump and harness.

CAUTION—

- Do not allow the test leads to short to ground.

- Activate fuel pump. See **Operating fuel pump for tests (N52, N54 engines)** in this repair group.



- Compare ammeter reading with specification listed in table.

Fuel pump current (N52, N54 engines)

Current consumption (fuel pump activated with scan tool)	8 - 13 amps
--	-------------

- Higher than normal power consumption by fuel pump may indicate a worn pump, causing intermittent fuel starvation due to pump overheating and seizure. Replace pump.
- Lower than normal power consumption may indicate blockage in a fuel line. Before replacing fuel pump, be sure to check that return line and pump pickup (inside fuel tank) are not obstructed.

Fuel pressure gauge, installing

Working in engine compartment, install fuel pressure gauge at Schrader valve on fuel rail.

- Remove upper engine covers. See **020 Maintenance**.

Use a fuel pressure gauge with a minimum range of 0 to 7 bar (0 to 100 psi).

WARNING—

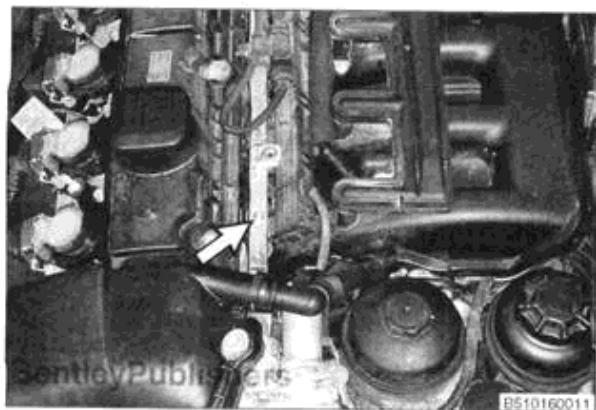
- The fuel system is designed to retain pressure even when the ignition is OFF. When working with the fuel system, loosen fuel lines slowly to allow residual fuel pressure to dissipate. Avoid spraying fuel. Use shop towels to capture leaking fuel.
- Fuel pump starts each time door is opened.
- Make sure the fuel pressure gauge is securely connected to the fuel rail to prevent it from coming loose under pressure.

- Remove engine top cover. See **020 Maintenance**.

M54 engine



- Remove Schrader valve cap (**arrow**) at fuel rail and connect fuel pressure gauge.

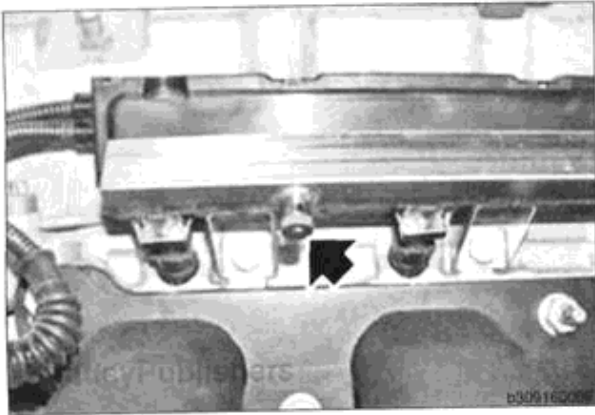


Fuel Tank and Fuel Pump 160-15

Fuel pressure gauge, installing

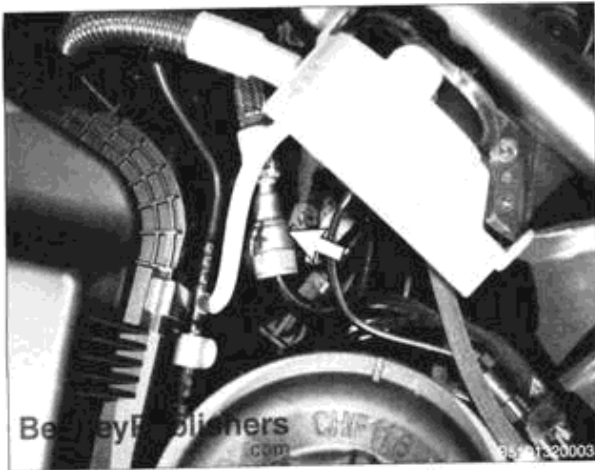
N52 engine

- Remove Schrader valve cap (**arrow**) at fuel rail and connect fuel pressure gauge.

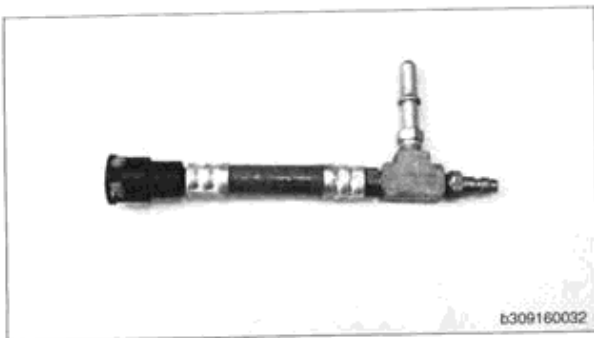


N54 engine

- Working at left side engine compartment near strut tower, disconnect fuel line (**arrow**).

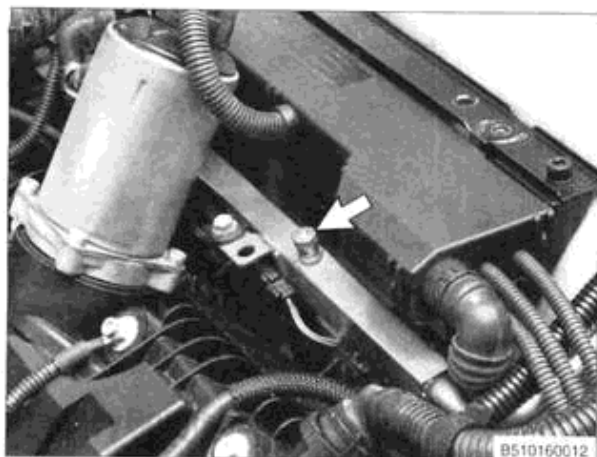


- Install compatible T-style test adapter and install fuel pressure gauge.



160-16 Fuel Tank and Fuel Pump

Fuel pressure regulator



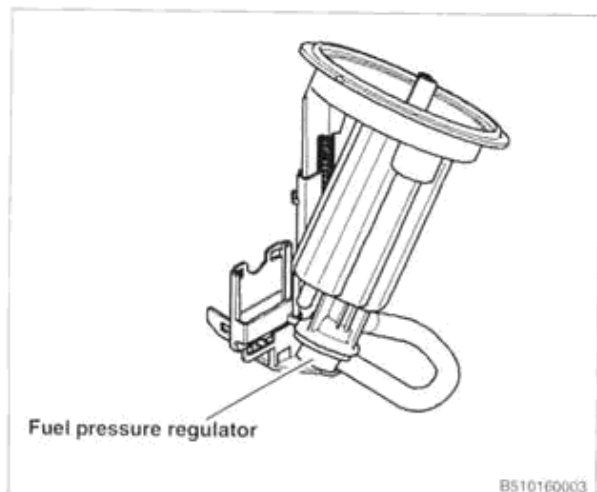
V8 engine

- Remove Schrader valve cap (**arrow**) at fuel rail and connect fuel pressure gauge.

Fuel pressure regulator

Fuel pressure is created by the fuel pump and maintained by the fuel pressure regulator.

- Fuel pressure regulator is integrated into the fuel filter assembly.



Fuel delivery, testing

Checking fuel delivery is a fundamental part of troubleshooting and diagnosing the DME system. Fuel pressure directly influences fuel delivery. There are two significant fuel delivery values to be measured:

- **System pressure** is created by fuel pump and maintained by pressure regulator. System pressure is adjustable only by the ECM.
- **Residual pressure** is pressure maintained in closed system after engine and fuel pump are shut off.

System pressure

- Attach fuel pressure gauge. See **Fuel pressure gauge, installing** in this repair group.
- Activate fuel pump. See **Operating fuel pump for tests** in this repair group. Compare fuel pressure to specifications in accompanying table.

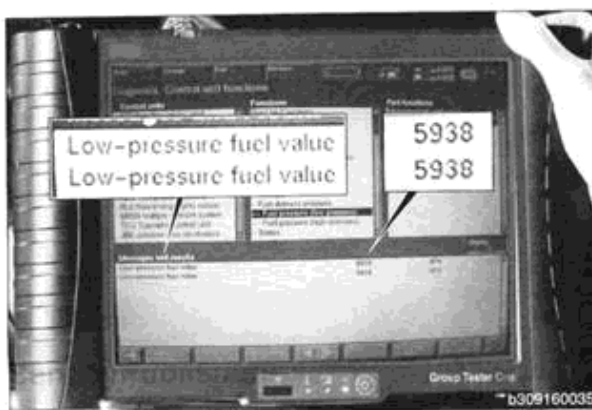
Fuel system pressure specification

M54, V8 (N62) engine	3.5 ± 0.2 bar (50.76 ± 2.9 psi)
N52, N54 engine	5 ± 0.2 bar (72.5 ± 2.9 psi)

CAUTION—

- The fuel pump is capable of developing a higher pressure than that regulated by the pressure regulator. Do not allow pressure to rise above 6.5 bar (94 psi). Damage to the fuel lines or fuel system components could result.

- After completing tests without running engine, check for fault codes and reset ECM memory.
- ◀ N54 engine: Compare fuel pressure on gauge to data value on BMW scan tool.
- If pressure does not match, replace fuel pressure regulator. See **Fuel pump, removing and installing** in this repair group.
- After completing tests, note the following:
 - M54, N52, V8 (N62) engine: replace Schrader valve cap.
 - N54 engine: reassemble fuel line.
 - Check and clear fault codes from ECM memory.



160-18 Fuel Tank and Fuel Pump

Fuel delivery, testing

Residual pressure

For quick restarts and to avoid vapor lock when the engine is hot, the fuel injection system retains fuel pressure after the engine is shut off. This residual pressure is primarily maintained by the fuel pressure regulator and a check valve at the fuel pump outlet.

- Attach fuel pressure gauge. See **Fuel pressure gauge, installing** in this repair group.
- Start engine and allow it to run for approximately one minute. Note fuel pressure reading. Shut OFF engine.
- Note fuel pressure after approximately 20 minutes. Make sure pressure does not drop more than 0.5 bar from system pressure.

Fuel system pressure specification

M54, V8 (N62) engines: System pressure, engine not running	3.5 ± 0.2 bar (50.76 ± 2.9 psi)
N52, N54 engines: System pressure, engine not running	5 ± 0.2 bar (72.5 ± 2.9 psi)

CAUTION—

- The fuel pump is capable of developing a higher pressure than that regulated by the pressure regulator. Do not allow pressure to rise above 6.5 bar (94 psi). Damage to the fuel lines or fuel system components could result.

- When finished, disconnect pressure gauge and fitting, and replace Schræder valve cap.
- If fuel system does not maintain pressure:
 - Visually check for leaks in fuel lines and unions.
 - Check for leaking injector(s).
 - Check for faulty fuel pump check valve.

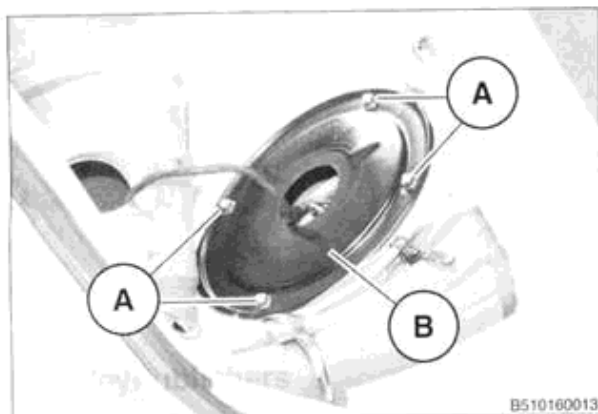
FUEL PUMP AND FUEL LEVEL SENDERS

Accessing fuel pump and fuel level senders

NOTE—

- Right side fuel pump / fuel level sender shown. Accessing left side fuel level sender is similar.

- Remove rear seat cushion. See **520 Seats**.
- Peel back carpet to expose fuel sender service cover.
- ◀ Working at ride side fuel tank:
 - Remove fasteners (A).
 - Remove fuel pump access cover (B).
- Installation is reverse of removal.



Fuel pump and fuel level sender (right side), removing

- Drain fuel tank. See **Fuel tank, draining** in this repair group.
- Disconnect negative cable from battery.

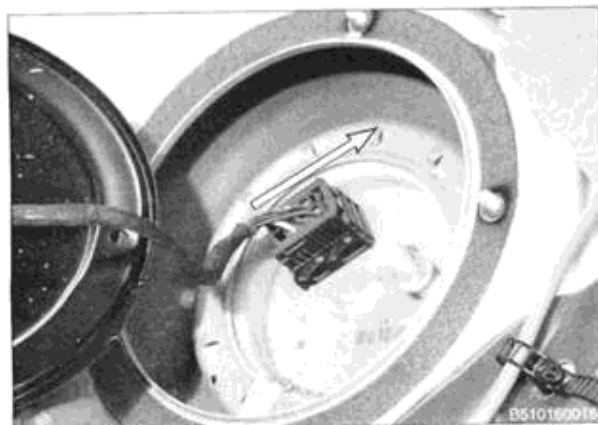
CAUTION—

- Prior to disconnecting the battery, read the battery disconnection cautions given in **001 Warnings and Cautions**.

- Remove left side fuel filter and level sender. See **Fuel filter and fuel level sender (left side), removing** in this repair group.
- Remove fuel pump access cover. See **Accessing fuel pump and fuel level senders** in this repair group.
- ◀ Slide electrical connector lock in direction of **arrow**, remove connector and fuel lines if equipped.

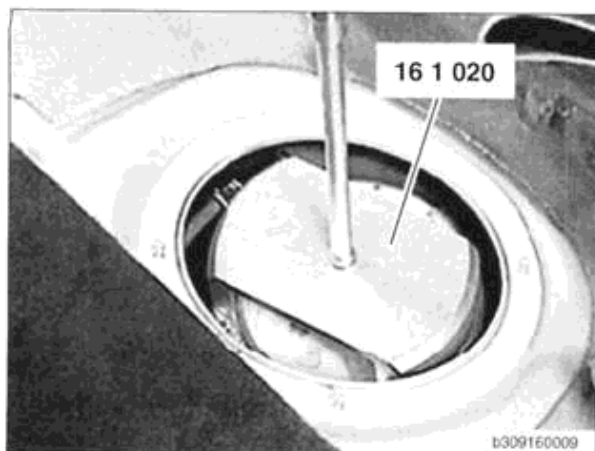
WARNING—

- When disconnecting fuel hose, wrap shop towel around end of hose to prevent spray of fuel under pressure.

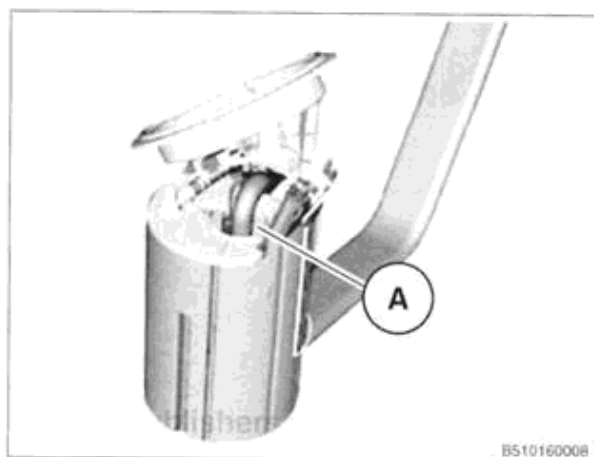


160-20 Fuel Tank and Fuel Pump

Fuel pump and fuel level sender (right side), removing



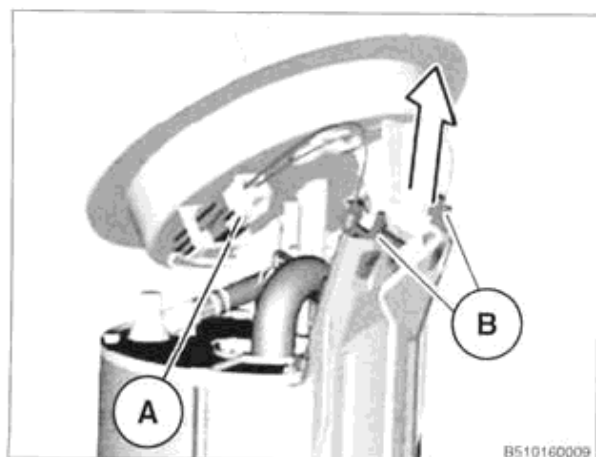
- Using BMW special tool 16 1 020, remove fuel pump service cap.
- Secure a stiff wire to hose pack through left side fuel tank service opening. This will help with installation.



- Carefully raise and to remove sending unit with hose pack from fuel tank, being careful not spill fuel from charge container (A). Remove and discard sending unit sealing O-ring.

CAUTION—

- Do not bend fuel sender arm.
- Be prepared to catch any dripping fuel.



To replace fuel level sender use following step.

- Remove wire from holders and disconnect electrical connector (A). Carefully unlock tabs (B) and pull fuel level sensor off in direction of arrow.
- Installation of fuel level sender is reverse of removal. **See Fuel pump and fuel level sender (right side), installing** in this repair group for fuel pump installation.

Fuel Tank and Fuel Pump 160-21

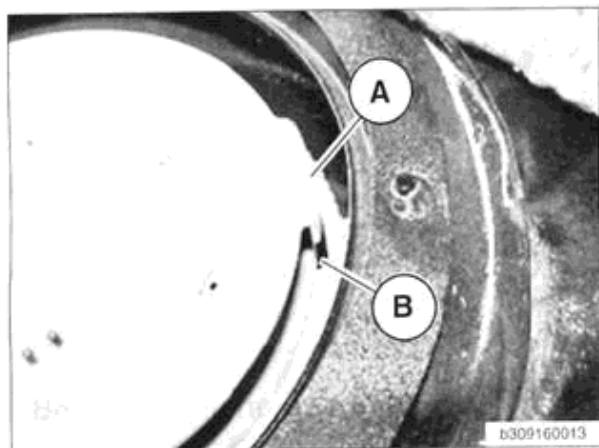
Fuel pump and fuel level sender (right side), installing

Fuel pump and fuel level sender (right side), installing

- Working inside fuel tank carefully install fuel pump and fuel level sender. If necessary rotate hose pack and tilt toward fuel level sender.

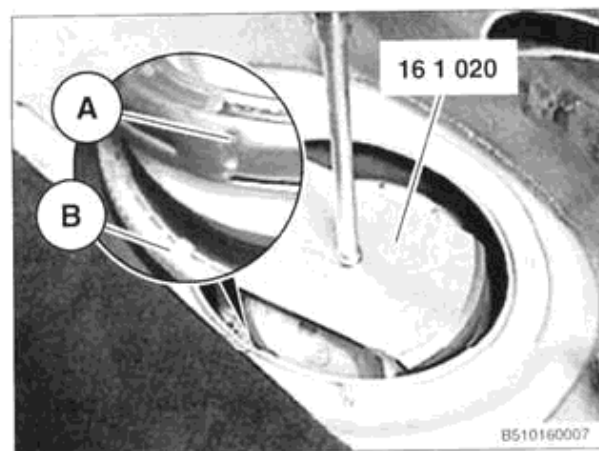
CAUTION—

- To avoid kinking hoses be sure to rotate sensor unit and hoses in the same direction.
- Do not bend fuel sender arm.



- ◀ When installing check to see that service cap lug (A) engages with corresponding slot (B) of fuel tank.

- Install service cap hand tight.



- ◀ Using BMW special tool 16 1 020 tighten service cap until notch on service cap (A) point to notch on fuel tank (B).

Tightening torque

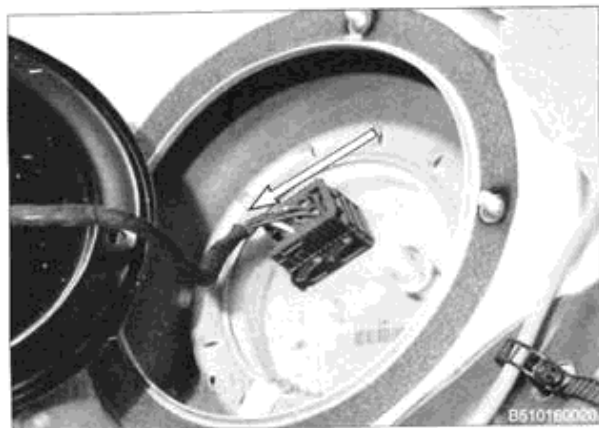
Service cap to fuel tank	45 ± 5 Nm (33 ± 3.6 ft-lb)
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- ◀ Connect electrical connector by sliding lock in direction of **arrow** and connect fuel line if equipped.

- Install fuel tank access cover.

CAUTION—

- After finishing repairs but before starting engine, be sure there is at least 5 liters (1.5 gallons) of fuel in the tank. The fuel pump is damaged if run without fuel.



160-22 Fuel Tank and Fuel Pump

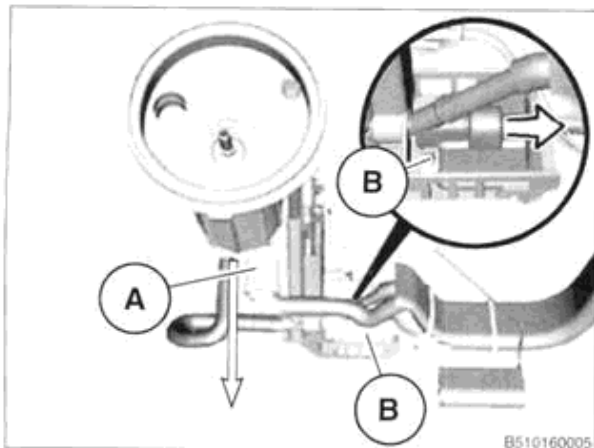
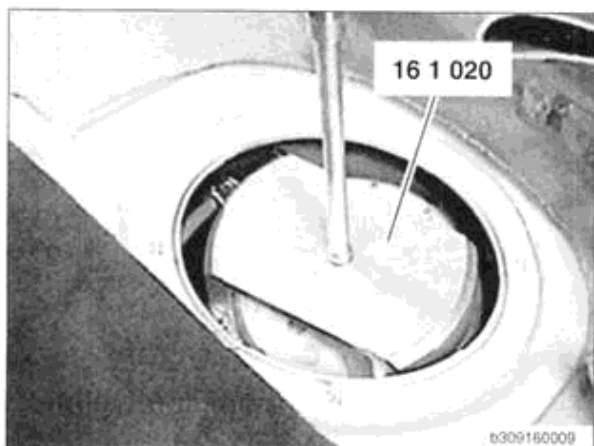
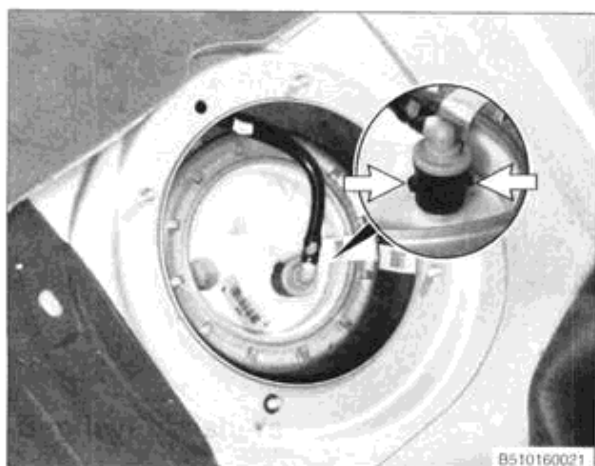
Fuel filter and fuel level sender (left side), removing

Fuel filter and fuel level sender (left side), removing

- Drain fuel tank. See **Fuel tank, draining** in this repair group.
- Disconnect negative cable from battery.

CAUTION—

- Prior to disconnecting the battery, read the battery disconnection cautions given in **001 Warnings and Cautions**.



- Remove left side fuel sender access cover. See **Accessing fuel pump and fuel level senders** in this repair group.

- ◀ Disconnect electrical connector (if equipped). Using only your fingers press tabs (**inset**) together and pull fuel supply (**B**) line straight up.

- ◀ Using special tool 16 1 020, remove fuel pump service cap.

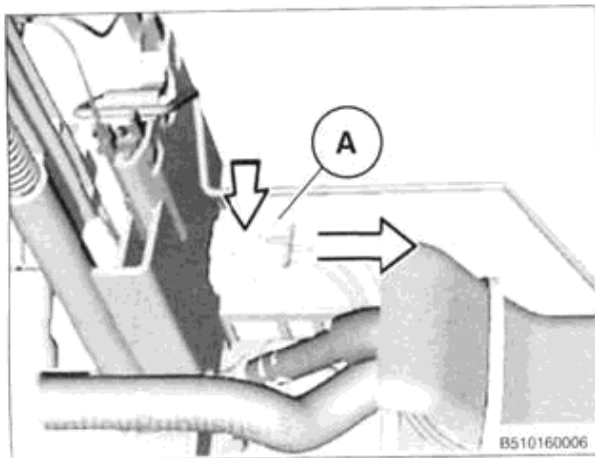
- Carefully lift sender out of tank with hose pack. Remove and discard fuel tank seals (O-rings).

- ◀ Disconnect line (**A**) at fuel filter in direction of **arrow** and seal connection at fuel filter. Disconnect suction jet pump from fuel filter by pressing catch (**B**) downwards, then detach suction jet pump.

Fuel Tank and Fuel Pump 160-23

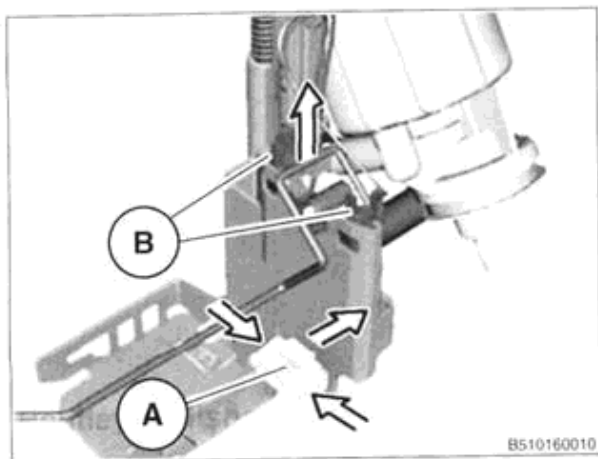
Fuel filter and fuel level sender (left side), installing

- Unlock and disconnect electrical connector (A) on sending unit.
- Remove sending unit from vehicle.



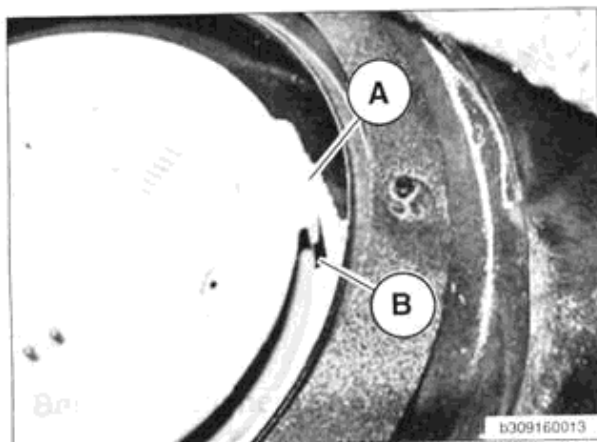
To replace fuel level sender, use following step.

- Squeeze plug (A) tabs and remove in direction of **arrow**. Release catches (B) and pull fuel level sensor out of sender unit. Disconnect wires from pressure regulator and feed out of wire gland.
- Installation of fuel level sender is reverse of removal. **See Fuel pump and fuel level sender (right side), installing** in this repair group for fuel pump installing.



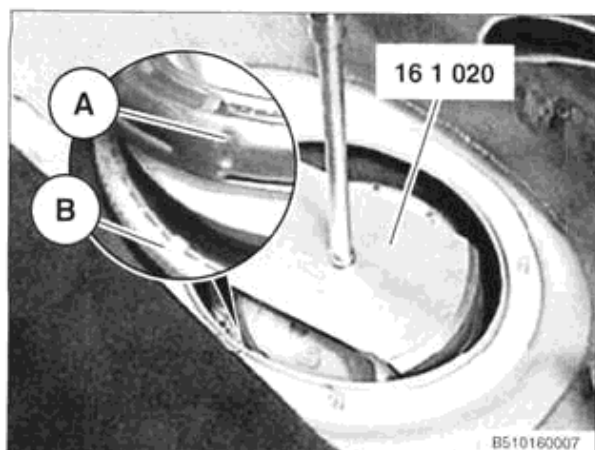
Fuel filter and fuel level sender (left side), installing

- When installing check to see that service cap lug (A) engages with corresponding slot of fuel tank (B).
- Install service cap hand tight.



160-24 Fuel Tank and Fuel Pump

High-pressure fuel pump, removing (N54 engine)



- Using BMW special tool 16 1 020 tighten service cap until notch on service cap (A) points to notch on fuel tank (B).

Tightening torque

Service cap to fuel tank	45 ± 5 Nm (33 ± 3.6 ft-lb)
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- Connect electrical connector (if equipped) and fuel line (inset).
- Install fuel tank access cover.

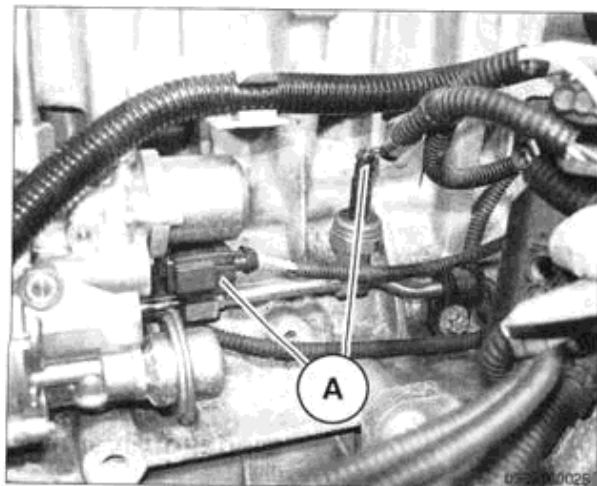
CAUTION—

- After finishing repairs but before starting engine, be sure there is at least 5 liters (1.5 gallons) of fuel in the tank. The fuel pump is damaged if run without fuel.

High-pressure fuel pump, removing (N54 engine)

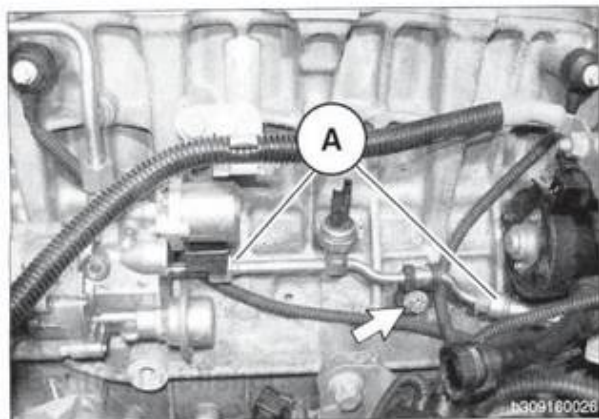
- Remove intake manifold. See 132 Fuel Injection (N54 Engine).

- Working at side of engine block, remove electrical connectors (A) and lay harness aside.



Fuel Tank and Fuel Pump 160-25

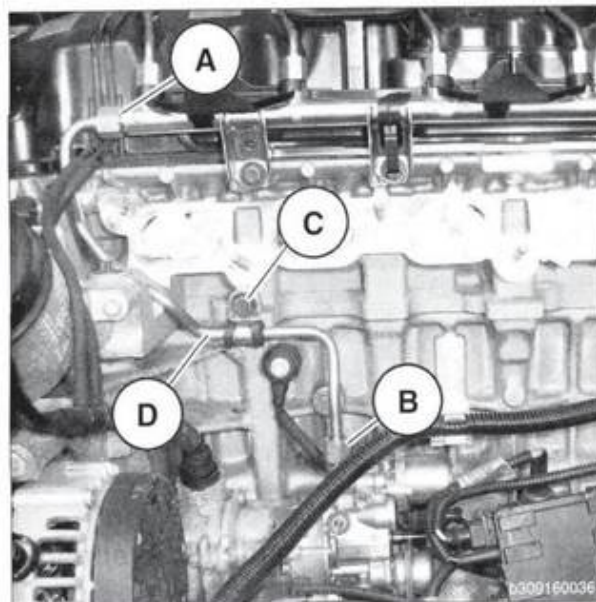
High-pressure fuel pump, removing (N54 engine)



- Remove aluminum fastener (**arrow**) and discard. Detach fuel line (**A**). Seal fuel lines with BMW special tools 13 5 281 and 13 5 282. Remember to replace aluminum fastener (**arrow**) with new.

WARNING —

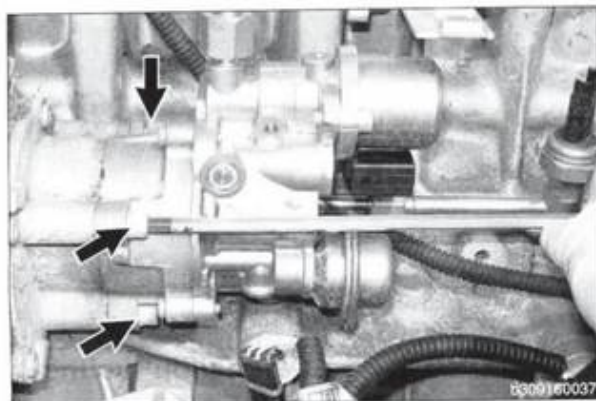
- Wear gloves and face shield when loosening fuel lines.



- Loosen fuel line union nut (**A, B**) in this order. Remove fuel line bracket fastener (**C**) and remove fuel line (**D**). Seal fuel line connections with matching plugs from BMW special tool kit 32 1 270.

WARNING —

- Wear gloves and face shield when loosening fuel lines.



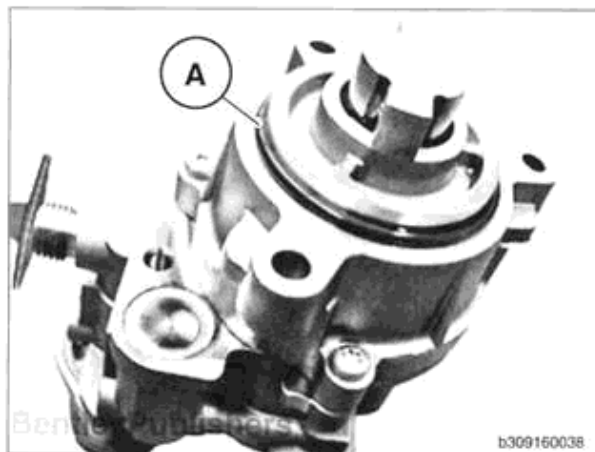
- Remove high-pressure fuel pump mounting fasteners (**arrows**) and remove high-pressure fuel pump. Be prepared to catch any dripping oil with shop cloth.

160-26 Fuel Tank and Fuel Pump

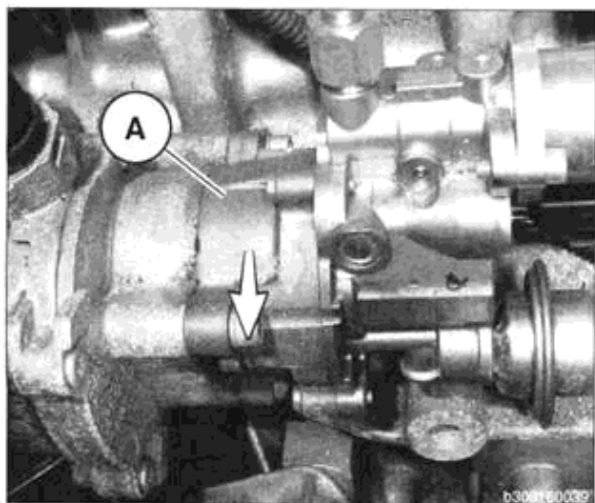
High-pressure fuel pump, installing (N54 engine)

High-pressure fuel pump, installing (N54 engine)

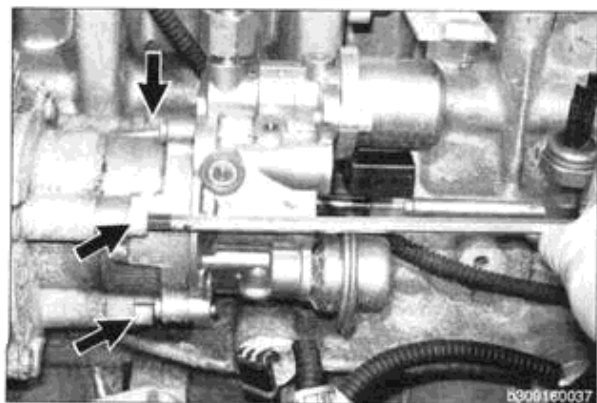
- ◀ Replace high-pressure fuel pump O-ring (**A**) and clean mounting surfaces.



- ◀ When installing, rotate pump (**A**) in direction of **arrow** until flush with mounting surface.

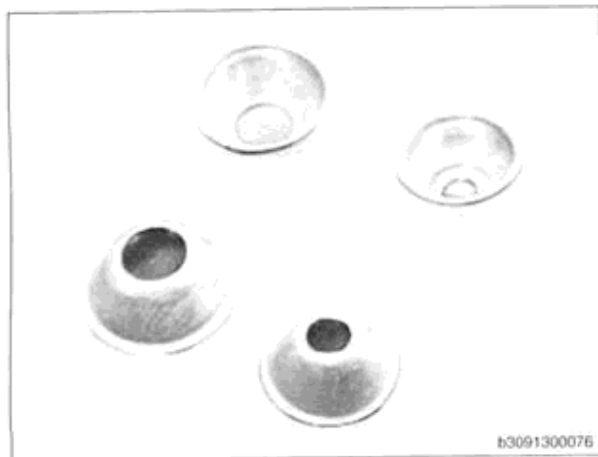


- ◀ Install high-pressure fuel pump fasteners (**arrows**) finger tight.

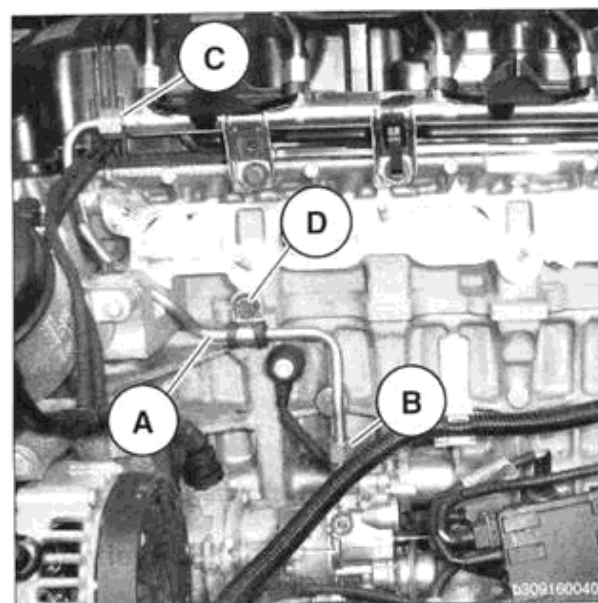


Fuel Tank and Fuel Pump 160-27

High-pressure fuel pump, installing (N54 engine)



- ⚠ Prior to installing high-pressure fuel lines, dispose of any copper sealing rings installed at factory. They are no longer needed.

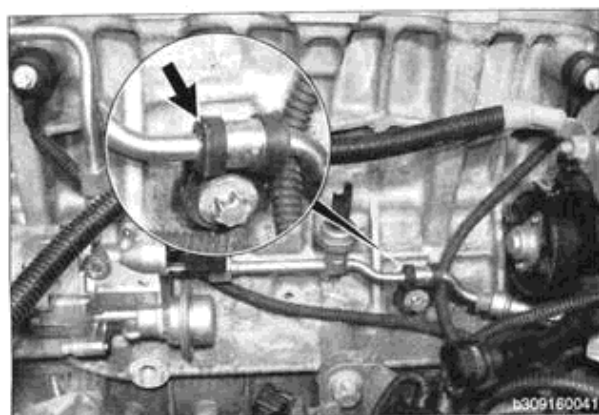


- ⚠ Use the following sequence when installing the fuel line.

- Coat fuel line connections with transmission fluid.
- Preinstall fuel line **A**.
- Tighten union nuts **B**, **C** finger tight.
- Tighten nut **B** to proper torque.
- Tighten union nut **C** to proper torque.
- Tighten fuel line bracket fastener **D**.

Tightening torques

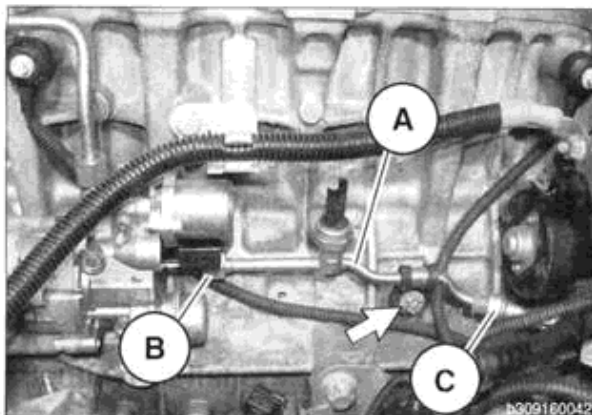
Fuel line to high-pressure fuel pump	30 Nm (22 ft-lb)
Fuel line to fuel rail	30 Nm (22 ft-lb)
Fuel line mount to cylinder head	13 Nm (9.5 ft-lb)



- ⚠ Before installing high-pressure fuel pump supply line, confirm it has updated elastomer mounting clamp (**arrow**). If it has a soldered hold down clamp, replace fuel supply line with updated part.

160-28 Fuel Tank and Fuel Pump

Fuel tank, draining



- Use the following sequence when installing the fuel supply line.
- Coat fuel line connections with transmission fluid.
 - Pre-install fuel line (A).
 - Tighten union nut B and mount fastener (arrow) finger tight. Remember to replace fuel line bracket aluminum fastener with new.
 - Connect fuel line C to fuel supply line A. Listen for audible click.
 - Tighten nut B to proper torque.
 - Tighten fuel line bracket fastener (arrow).

Tightening torques

Fuel line to high-pressure fuel pump	30 Nm (22 ft-lb)
Fuel line bracket to engine	10 Nm (7.3 ft-lb)
• Stage 1	Additional 90° ± 15°
• Stage 2	

- Reassemble engine.
- Check fuel system for leaks.
- Check and clear fault codes from ECM memory.

FUEL SUPPLY COMPONENTS

Fuel tank, draining

When draining fuel tank, use a safe storage unit and an approved fuel pumping device.

WARNING—

- Before starting to work on tank removal, make sure hot components, such as the exhaust system, are completely cooled down.
- Fuel may be spilled. Do not smoke or work near heaters or other fire hazards.

- Start engine and allow to run 10 - 15 seconds to fill fuel compensating siphon assembly. This allows both lobes of fuel tank to be drawn off through fuel filler pipe.
- Disconnect negative cable from battery.

CAUTION—

- Prior to disconnecting the battery, read the battery disconnection cautions given in 001 Warnings and Cautions.

- Remove fuel tank filler cap.
- Slide suction hose into filler neck about 130 cm (51 in), twisting as necessary. Withdraw fuel into storage unit.

- Monitor fuel level reduction in both lobes:
 - Remove rear seat cushion and access both fuel tank sender harness connectors. See **Accessing fuel pump and fuel level senders** in this repair group.
 - Use multimeter to measure resistance at both senders. Resistance should drop as fuel level drops.
- If siphoning mechanism is faulty, drain left tank lobe separately by removing sender cover and pumping fuel directly out of left lobe.
- Remove suction hose from tank filler neck carefully to avoid damaging filler neck baffle plate.

CAUTION—

- After finishing repairs but before starting engine, be sure there is at least 5 liters (1.5 gallons) of fuel in tank. The fuel pump is damaged if run without fuel.

Fuel filter

The fuel filter is a lifetime filter. It is integrated into the left side fuel level sender. See **Fuel level sender (left side), removing** in this repair group.

Fuel pressure regulator

The fuel pressure regulator is integrated into the left side fuel level sender. See **Fuel level sender (left side), removing** in this repair group.

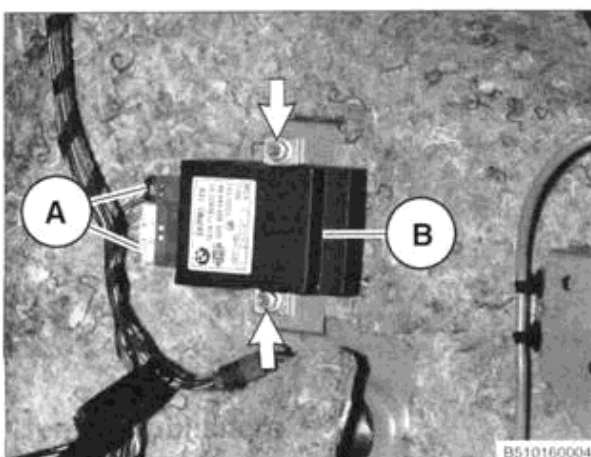
Fuel pump (EKP) module, removing and installing (N52, N54 engine)

- Remove right side luggage compartment trim panel. See **412 Trunk Lid, Tailgate**.
- ◀ Working at fuel pump (EKP) module:
 - Remove electrical connectors (A).
 - Remove fasteners (arrows) and remove EKP module (B).
- Installation is reverse of removal.
 - Remember to code / program fuel pump (EKP) module if replaced. See **600 Electrical System-General** for information on coding and programming.

Tightening torques

Fuel pump (EKP) module to body	8 Nm (5.9 ft-lb)
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- Check and clear fault codes from ECM memory.



B510160004

160-30 Fuel Tank and Fuel Pump

Activated carbon canister, removing and installing

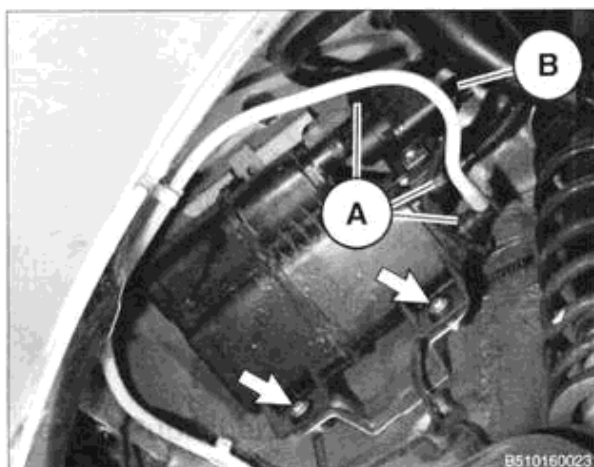
Activated carbon canister, removing and installing

The carbon canister is on the right side behind the right rear wheel well liner.

- Raise rear end of car and support safely.

CAUTION—

- 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 right rear wheel.
- Remove right rear wheel well liner.
- Remove activated carbon canister:
 - Remove line connections at leak detection pump (A).
 - Disconnect electrical connector (B).
 - Remove fasteners (arrows) and remove carbon canister from vehicle.
- Installation is reverse of removal.

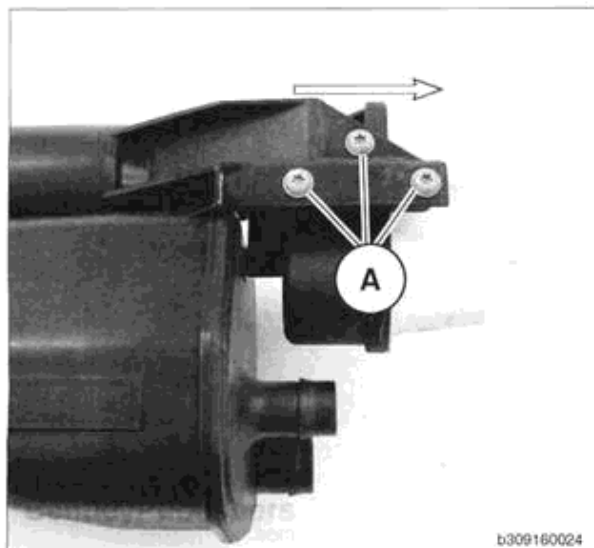
Fuel tank leak detection module (DMTL), removing and installing

The DMTL is mounted to the activated carbon canister.

- Raise car and support safely.

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 activated carbon canister. See **Activated carbon canister, removing and installing** in this repair group.
- Remove fasteners (A) and pull DMTL unit out of carbon canister in direction of arrow.
- Installation is reverse of removal.

