

110 Engine Removal and Installation

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GENERAL

Some special tools are required for removal and installation of the engine. Be sure to have the necessary equipment on hand before starting the job. Label all components, wires, and hoses before removing them as an aid to installation.

Engine removal procedures are organized according to engine code. For engine code and application information, see **100 Engine-General**.

CAUTION—

- Engine removal requires disconnecting the battery. This may erase system fault code(s) that have been stored in control unit memories. Check for fault codes prior to detaching the battery cables.
- If the **Check Engine** light is illuminated with the engine running, see **100 Engine-General** for On-Board Diagnostics fault code information.
- If any other system faults have been detected (indicated by an illuminated ANTI LOCK, SRS, EML or ASC warning light, see the appropriate repair group in this manual or an authorized BMW dealer for more information on fault codes.

M30 ENGINE

Engine, removing and installing (M30 engine)

Cover all painted surfaces before beginning the removal procedure. As an aid to installation, label all components, wires, and hoses before removing them. Use new gaskets, O-rings and seals during reassembly.

WARNING—

Be sure the engine is cold before beginning the removal procedure.

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- Disconnect negative (–) battery cable. See **020 Maintenance**.

CAUTION—

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

- Raise hood fully and support.
- Raise 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 splash shield under engine, if applicable.
- Remove transmission from car. See **230 Manual Transmission** or **240 Automatic Transmission**.

CAUTION—

Do not reuse alignment sleeves. Use new alignment sleeves when installing transmission.

NOTE—

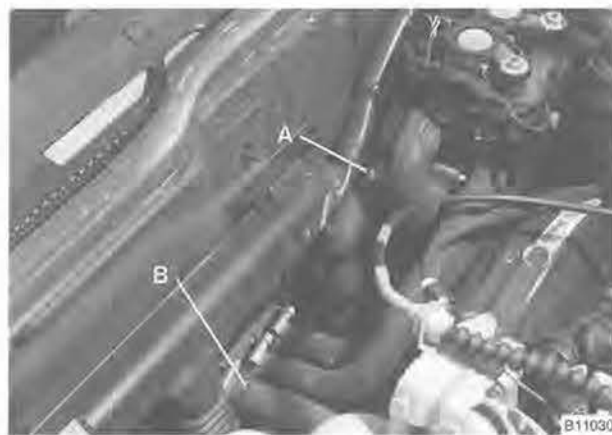
On cars with automatic transmission, detach the ATF cooler lines bracket from the side of the engine oil pan.

- Remove front exhaust pipe from exhaust manifold. See **180 Exhaust System**.
- Drain engine coolant from engine block and from radiator. See **170 Radiator and Cooling System**.
- Detach coolant hoses from radiator. On cars with automatic transmission, carefully detach ATF cooler lines from radiator. Cap off open ATF lines.
- Working at rear of engine compartment, detach hoses at coolant expansion tank. Detach electrical connector for coolant level sensor. Remove coolant expansion tank from car.
- Remove radiator and cooling fan. See **170 Radiator and Cooling System**.

NOTE—

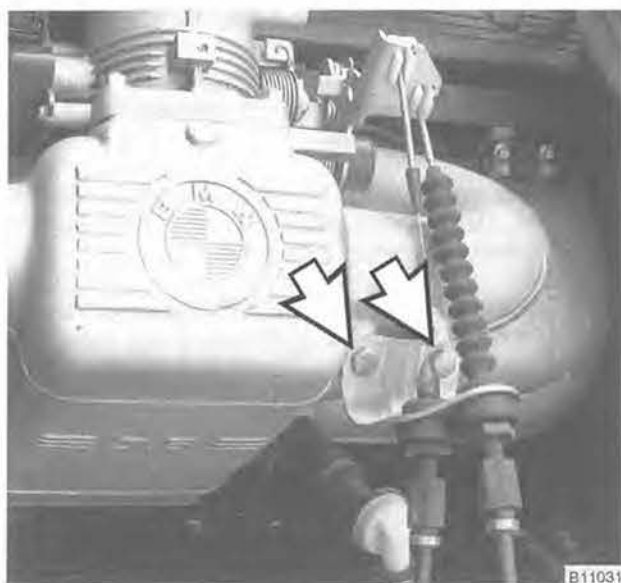
The radiator cooling fan mounting nut (32 mm wrench) has left-hand threads.

- Detach heater hoses from heater valve (A) and heater core (B).



M30 ENGINE

ENGINE REMOVAL AND INSTALLATION 110-3



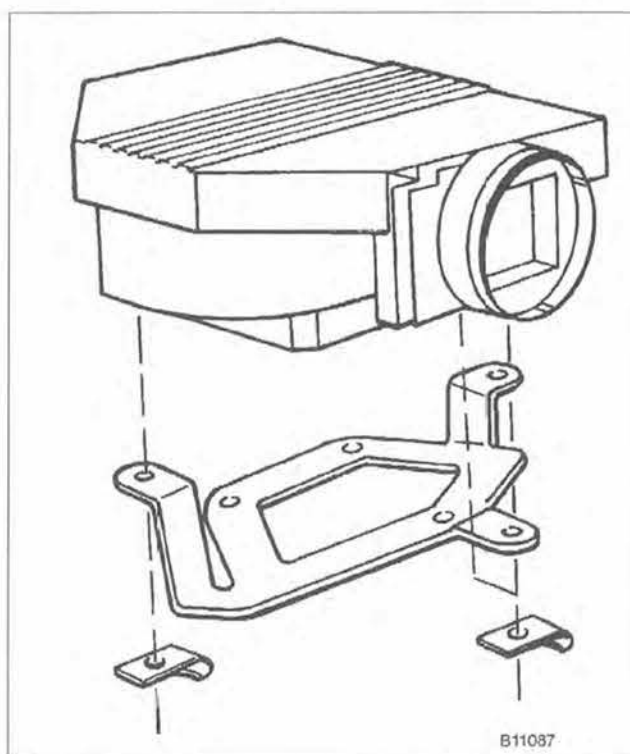
➤ Unhook accelerator and cruise control cables from throttle levers. Remove bolts (**arrows**). Remove cable bracket from intake manifold.

- Remove V-belt from A/C compressor and remove compressor from its mounting bracket without detaching any refrigerant lines.

NOTE—

Move the A/C compressor out of the way without distorting or damaging any lines. Support the compressor by hanging it from the chassis using stiff wire

- Remove power steering pump V-belt and remove pump from its mounting bracket. Leave all hoses connected. Use stiff wire to hang pump from body.

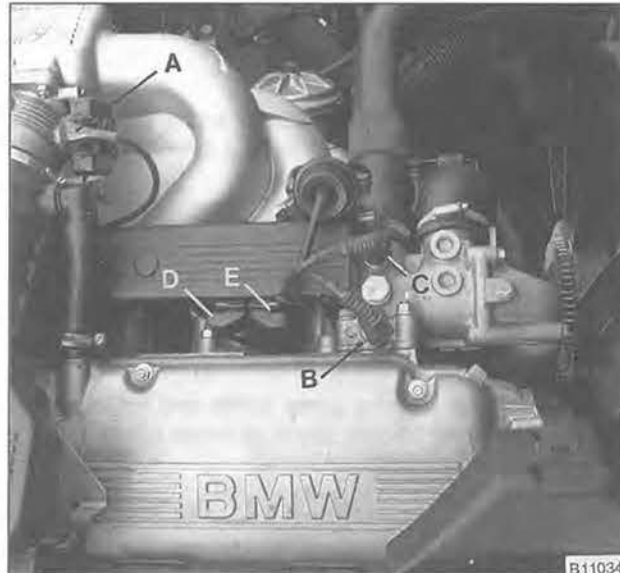


➤ Remove intake air hoses/ducts from air flow sensor and from alternator. Detach electrical connector from air flow sensor. Remove air flow sensor by removing three retaining clips from below.

- Remove air cleaner housing and duct work, loosening hose and mounting clamps as necessary.

- Detach high tension lead from ignition coil.

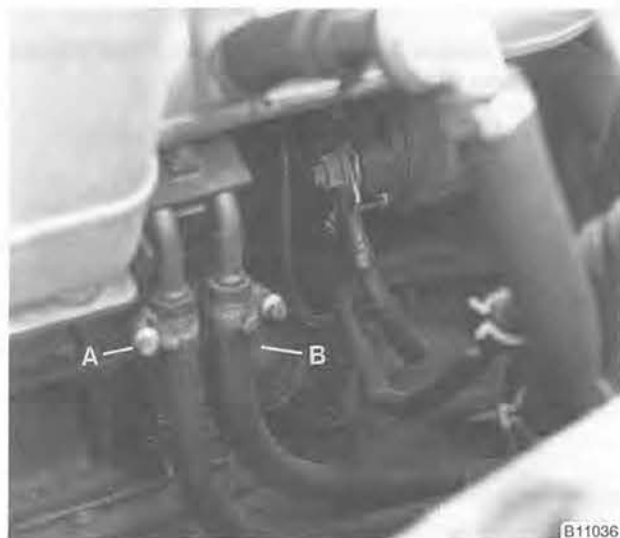
110-4 ENGINE REMOVAL AND INSTALLATION



A. Throttle switch
B. Coolant temperature sensor
C. Temperature gauge sender
D. Engine speed/reference point sensor
E. Cylinder identification sensor

Working at side of cylinder head, detach electrical connectors.

- Detach electrical connector from oil pressure switch at left rear corner of cylinder head.
- Detach evaporative purge hose from charcoal canister on left fender. Detach wires from starter motor and alternator. See 121 **Battery, Starter, Alternator**.
- Working beneath intake manifold, detach electrical connectors for oxygen sensor, oil level sensor, and evaporative purge valve.



Label and then remove fuel supply (B) and return lines (A).

WARNING—

Fuel may be expelled under pressure. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Before detaching fuel hoses, wrap a cloth around fuel hoses to absorb any leaking fuel. Plug all open fuel lines.

- Remove large hose from brake system vacuum booster. Plug opening in vacuum booster.

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- Remove access plugs (**arrows**) and mounting nuts from fuel injection wiring harness bracket. Lift bracket and harness off and set it aside.
- Working under car, remove nuts and ground strap from engine mounts.
- Using an engine lifting device, carefully raise engine out of car, checking for any wiring, fuel lines, or mechanical parts that might become snagged as engine is removed.
- Installation is reverse of removal.
 - Check that guide pins in engine mounts correctly engage alignment holes in subframe as engine is lowered into place.
 - Adjust tension of all drive belts.
 - Change engine oil and filter and check all other fluid levels. See **020 Maintenance**.
 - Refill cooling system as described in **170 Radiator and Cooling System**.
 - Use new gaskets when installing front exhaust pipe, as described in **180 Exhaust System**.

CAUTION—

Do not reuse alignment sleeves. Use new alignment sleeves when installing transmission.

Tightening Torques (M30 Engine)

- ATF cooler lines to radiator
(use new O-rings) 20 Nm (15 ft-lb)
- Coolant drain plug to cylinder block . . 25 Nm (18 ft-lb)
- Engine mount to engine bracket
or subframe (M10) 47 Nm (34 ft-lb)
- Exhaust pipe to exhaust manifold (use new nuts)
1st stage tighten evenly 10 ± 2 Nm (89 ± 12 in-lb)
2nd stage loosen nuts $1\frac{1}{2}$ turn
- Radiator cooling fan
to coolant pump (left threads) 40 Nm (30 ft-lb)
- Radiator drain screw to radiator 2.5 Nm (22 in-lb)
- Wiring to alternator (M8 nut) 13 Nm (9.5 ft-lb)
- Wiring to starter
 - M6 nut 6 Nm (53 in-lb)
 - M8 nut 12 Nm (9 ft-lb)

M30 ENGINE

M60 ENGINE (V-8)

Engine, removing and installing (M60 engine)

Cover all painted surfaces before beginning the removal procedure. As an aid to installation, label all components, wires and hoses before removing them. Use new gaskets, O-rings and seals during reassembly.

WARNING—

Due to risk of personal injury, be sure the engine is cold before beginning the removal procedure.

- Disconnect negative (–) battery cable. See **020 Maintenance**.

CAUTION—

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

- Raise hood fully and support.
- Raise 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 splash shield under engine, if applicable.
- Working beneath car, remove heat shields from left and right side of front suspension crossmember. Detach front exhaust pipes from exhaust manifolds. See **180 Exhaust System**.
- Detach harness connector from oil level sensor in oil pan. Detach wiring from wiring guide.
- Remove transmission. See **240 Automatic Transmission**.
- Drain engine coolant from engine block and radiator. Remove radiator and radiator cooling fan. See **170 Radiator and Cooling System**.

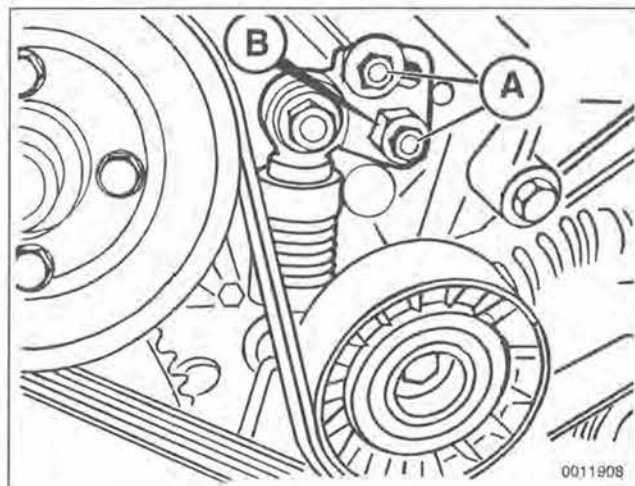
NOTE—

• The radiator cooling fan mounting nut (32 mm wrench) has left-hand threads.

• Cap off the open ATF cooler lines. Remove any brackets holding the lines to the engine block.

- Remove coolant expansion tank from rear of engine compartment, detaching hoses and electrical connector.

ENGINE REMOVAL AND INSTALLATION 110-7



- ◀ Loosen mounting nuts on belt tensioner (A). Use an open end wrench to rotate tensioner hex (B) counterclockwise and remove belt. Remove belt tensioner from engine.

- Detach oil filter housing from bracket on body. Detach harness connector from oil pressure switch at oil filter housing. Unclip wire from wiring guide.

NOTE—

Leave oil lines attached to filter housing.

- Remove alternator cooling duct. See 121 Battery, Starter, Alternator.
- Detach wiring leads from starter and alternator at positive (+) battery junction block in rear of engine compartment. See 121 Battery, Starter, Alternator.
- Remove upper section of air cleaner housing complete with mass air flow sensor, detaching and labeling connectors, ducting and hoses as necessary.
- Detach throttle cable from throttle housing and cable bracket. Detach evaporative purge hose from underside of throttle housing.
- Detach vacuum hose from brake vacuum booster. Plug opening in vacuum booster.

- ◀ Separate main wiring harness plug (A). Unclip diagnostic connector (B) from bracket.

- Remove plastic engine covers. Detach harness connectors from ignition coils.

NOTE—

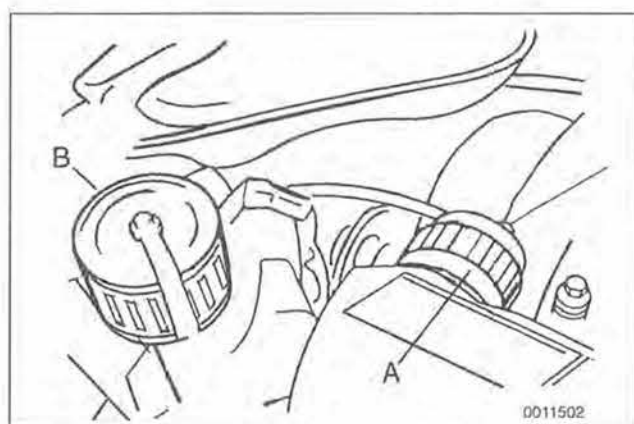
Note ground strap at cylinders #3 and #7. See 120 Ignition System.

- Working in center of engine, detach and label all harness connectors from left and right wiring harness ducting. These include:
 - Knock sensors
 - Cylinder position sensor
 - Intake air temperature sensor
 - Throttle potentiometer
 - Camshaft position sensor
 - Idle actuator

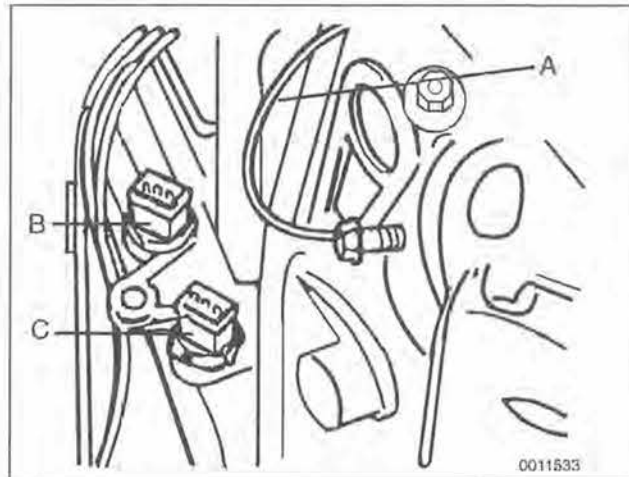
CAUTION—

Be sure to label the connectors to aid installation.

- Unbolt wiring harness ducting from left and right cylinder heads. Remove ducting from cylinder heads and lay to one side.



110-8 ENGINE REMOVAL AND INSTALLATION



➤ At rear of engine near engine lifting bracket, detach ground wire for ignition coils (A) and coolant temperature sensors, white connector (B), black connector (C).

— Remove power steering pump from pump bracket without detaching any lines. Use stiff wire to hang pump from body. See **320 Steering and Wheel Alignment**.

— Remove A/C compressor from its mounting bracket without detaching any refrigerant lines. Use stiff wire to hang compressor from body.

CAUTION—

The A/C refrigerant lines must not be loosened or detached. Use care to avoid kinking or bending refrigerant lines.

— Detach fuel supply and return lines from fuel injector rail.

WARNING—

Fuel may be expelled under pressure. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Before detaching fuel hoses, wrap a cloth around fuel hoses to absorb any leaking fuel. Plug all open fuel lines.

— Detach all coolant hoses from coolant cross-pipe (accumulator) at rear of engine.

— Install engine lifting device to front and rear lifting points. Raise engine slightly until its weight is supported.

— Remove nuts from left and right engine mounts. Detach ground strap from engine mount bracket. Carefully raise engine out of car.

NOTE—

Check for any wiring, fuel lines, or mechanical parts that might become snagged as engine is removed.

— Installation is reverse of removal.

- On cars with automatic transmission, use new O-rings at ATF cooler lines.
- Use new alignment sleeves when installing transmission.
- Be sure engine drive belts properly engage pulley grooves. When installing belt, preload tensioner to stop (toward belt), then tighten tensioner clamping nut.
- Change engine oil and filter. Check all other fluid levels as described in **020 Maintenance**.
- Refill and bleed cooling system as described in **170 Radiator and Cooling System**.
- Install front exhaust pipes using new gaskets and copper paste and new mounting hardware. See **180 Exhaust System**.

CAUTION—

Do not interchange knock sensor harness connectors. Serious engine damage may result.

Tightening Torques (M60 Engine)

- ATF cooler lines to radiator (use new O-rings)
 - M18 cap nut 20 Nm (15 ft-lb)
 - M22 cap nut 22 Nm (17 ft-lb)
- Coolant drain plug
 - to cylinder block (M14) 25 Nm (18 ft-lb)
- Engine mount to engine bracket
 - or subframe (M10) 47 Nm (35 ft-lb)
- Radiator cooling fan to
 - coolant pump (left-hand threads) 40 Nm (30 ft-lb)
- Radiator drain screw to radiator 2.5 Nm (22 in-lb)
- Wiring to alternator (M8 nut) 13 Nm (9.5 ft-lb)
- Wiring to starter
 - Terminal 30h (M5) 5 Nm (44 in-lb)
 - Terminal 50 (M6) 6 Nm (53 in-lb)
 - Terminal 30 (M8) 12 Nm (9 ft-lb)

M70 ENGINE (V-12)

**Engine, removing and installing
(M70 engine)**

Cover all painted surfaces before beginning the removal procedure. As an aid to installation, label all components, wires, and hoses before removing them. Use new gaskets, O-rings and seals during reassembly.

WARNING—

Due to risk of personal injury, be sure the engine is cold before beginning the removal procedure.

- Disconnect negative (–) battery cable. See **020 Maintenance**.

CAUTION—

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

- Raise hood fully and support.
- Raise 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 splash shield under engine, if applicable.
- Remove transmission. See **240 Automatic Transmission**.
- Remove poly-ribbed drive belts. See **020 Maintenance**.

110-10 ENGINE REMOVAL AND INSTALLATION

CAUTION—

Use a wooden block or other stop to support the engine on top of the suspension cross-member. Allowing the engine to sag during or after transmission removal can cause damage to heater hose connections at the engine compartment rear bulkhead.

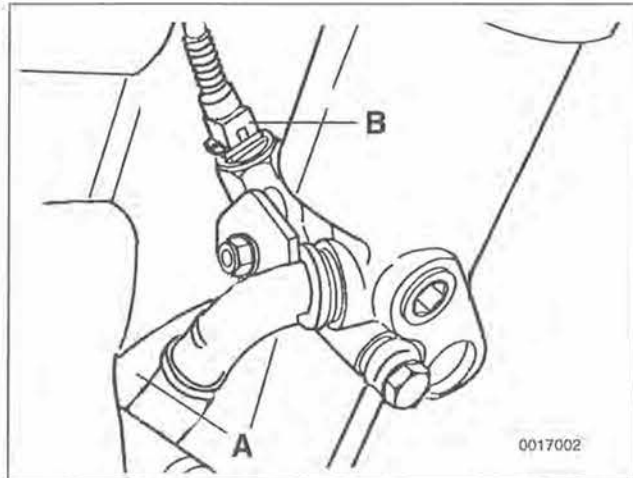
- Drain engine coolant from engine block and radiator. Remove radiator and radiator cooling fan. See **170 Radiator and Cooling System**.

NOTE—

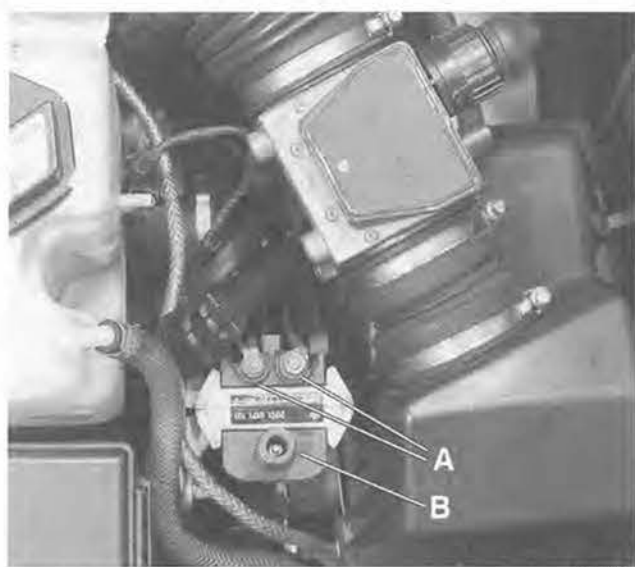
- The radiator cooling fan mounting nut (32 mm wrench) has left-hand threads.
- Cap off the open ATF cooler lines. Remove any brackets holding the lines to the engine block.

Working from above:

- Remove both mass air flow sensors, air intake bellows, and air filter housings.
- Drain windshield washer fluid tank, detach hoses and harness connectors, and remove tank.
- Detach heater hoses at rear of engine.
- Drain oil filter housing by loosening oil filter cap. Detach oil pipes (A) on oil filter housing. Disconnect oil pressure switch harness connector (B).
- Unclip data link connector from left side of engine.



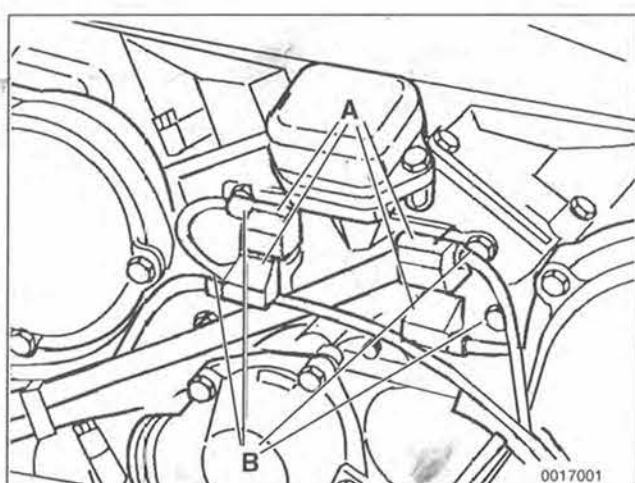
ENGINE REMOVAL AND INSTALLATION 110-11



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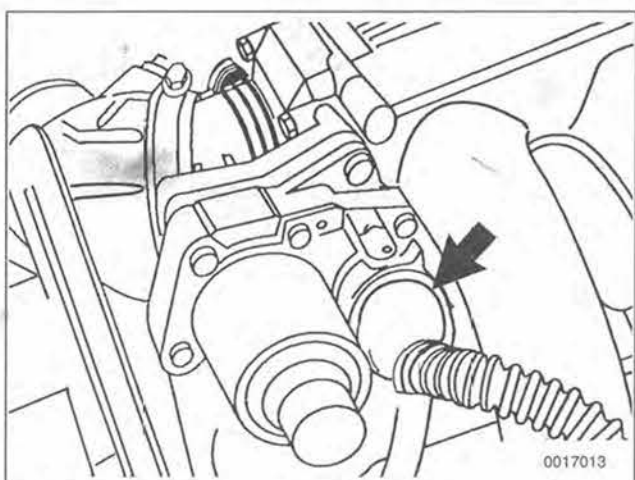
➤ Detach ignition coil connectors (A). Remove mounting fasteners (B) and remove right ignition coil.

— Detach alternator harness connectors at alternator.



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➤ Working at front of engine in front of oil filler cap, pull off oil drip shield. Label and detach electrical harness connectors (A). Remove fasteners (B), remove bracket and detach harness plugs.

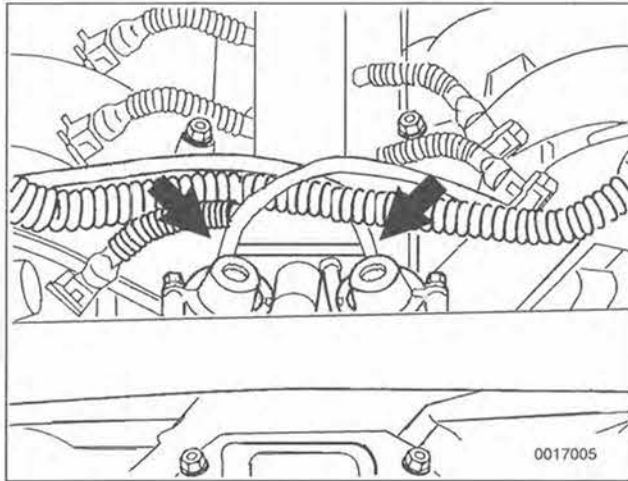


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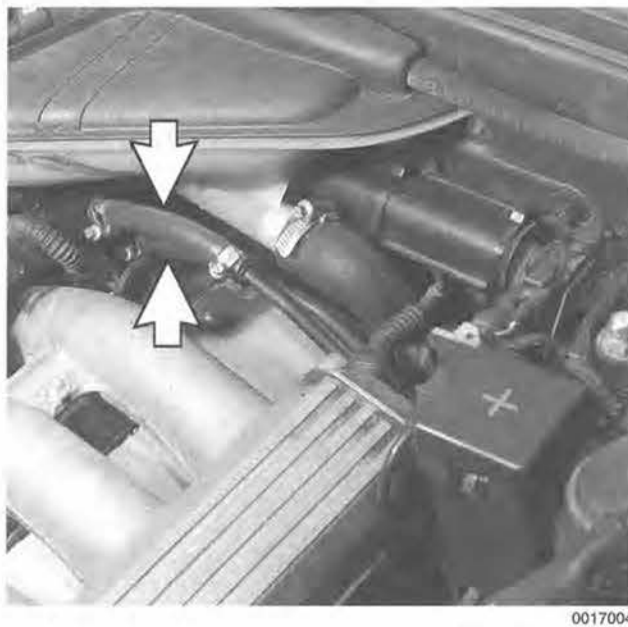
➤ Disconnect throttle valve assembly harness connectors (arrow), left and right sides.

— Remove fuel injector harness cover at top of engine.

110-12 ENGINE REMOVAL AND INSTALLATION



- ◀ Detach fuel pressure regulator vacuum hoses (**arrows**).
- Detach fuel return hose at right rear of engine.

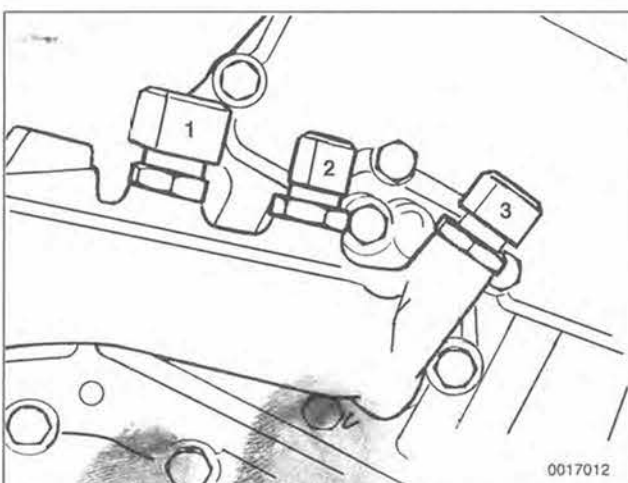


- ◀ Remove fuel supply hoses (**arrows**) at top rear of engine.

WARNING—

Fuel may be expelled under pressure. Do not smoke or work near heaters or other fire hazards. Keep a fire extinguisher handy. Before detaching fuel hoses, wrap a cloth around fuel hoses to absorb any leaking fuel. Plug all open fuel lines.

- Disconnect intake manifold harness connectors.



- ◀ Disconnect temperature sensor harness connectors for fuel injection (1), EML (2) and temperature gauge (3) from cooler crosspipe at rear of engine.
- Pull off fuel injector harness connectors
- Working at engine compartment rear bulkhead, cut off wire ties and remove retaining screws for wiring harness bracket. Lift off harness and set aside.
- Detach alternator harness wires at battery (+) junction block.
- Detach starter harness wires at right strut tower.
- Drain power steering reservoir, then detach fluid supply hose from reservoir.

M70 ENGINE (V-12)

ENGINE REMOVAL AND INSTALLATION 110-13

NOTE—

Power steering pump remains attached to engine during engine removal.

Working underneath engine:

- Remove A/C compressor mounting bolts (**arrows**) and remove A/C compressor from its mounting bracket without detaching any refrigerant lines.

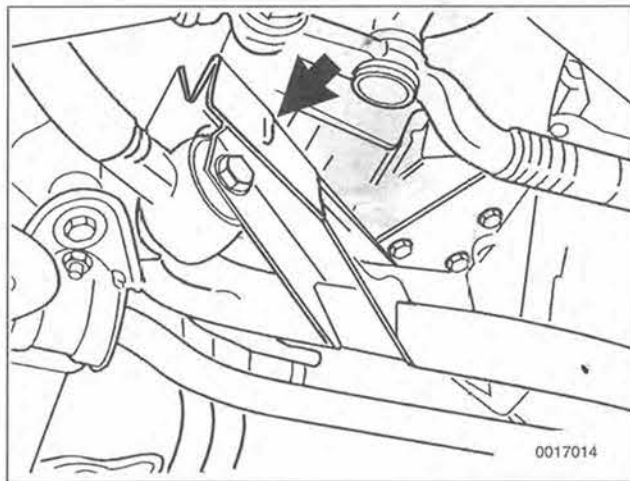
NOTE—

Move the A/C compressor out of the way without distorting or damaging any lines. Support the compressor by hanging it from the chassis using stiff wire.

- Remove alternator cooling duct.
- Detach harness connectors and detach hoses at evaporative purge valves.

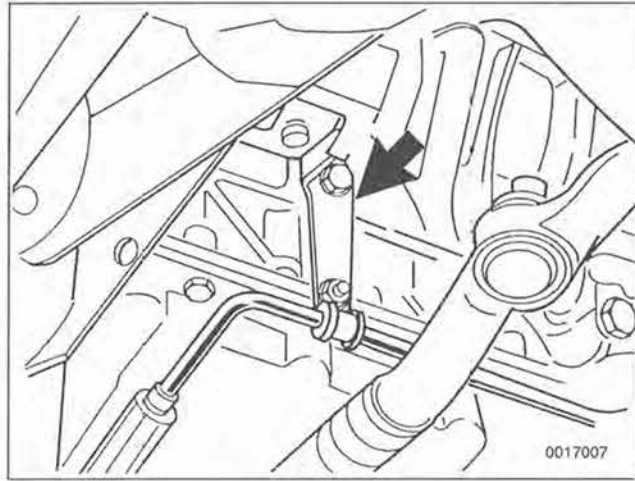
CAUTION—

Mark connectors so they go back in their original locations.

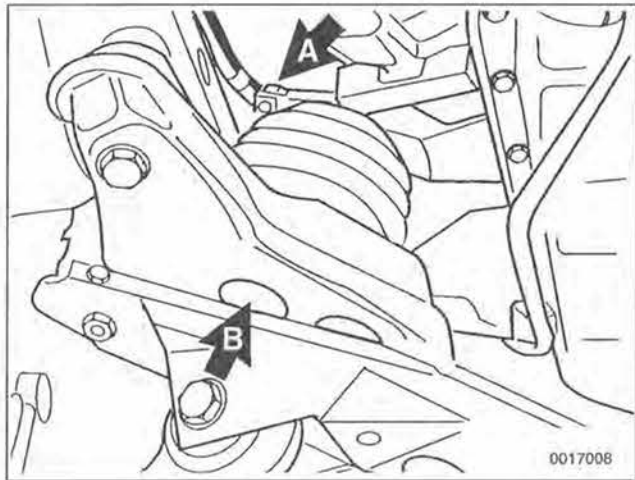


- Remove heat shields (**arrow**) from front suspension members.
- Remove exhaust manifold heat shields. Then detach exhaust pipes from manifolds. See **180 Exhaust System**.
- Remove harness connector from oil level sensor in oil pan. Detach wiring from wiring guide.

110-14 ENGINE REMOVAL AND INSTALLATION

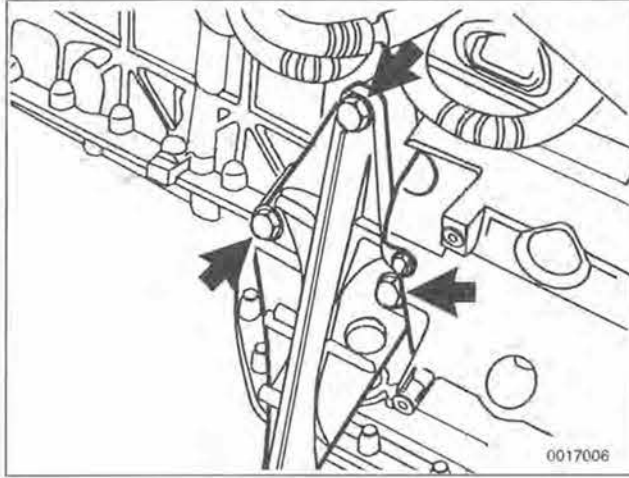


- Remove ASC+T pipe bracket and starter support bracket (arrow) on block. Remove starter.
- Detach ASC+T pipe from filter in front right of engine.



- Using engine lifting equipment, raise engine slightly and support it. Detach ground strap (A) at right engine mount. Remove engine mount fasteners (B).
- Detach oil dipstick guide tube.

ENGINE REMOVAL AND INSTALLATION 110-15



➤ Raise engine slightly and unbolt right engine bracket (arrows).

— Raise engine, twisting rear end to right.

NOTE—

Be sure the left exhaust manifold clears the steering shaft.

— Installation is reverse of removal.

- Place oil cooler and ASC+T pipes in correct positions before engine reinstallation.
- Use new O-rings at ATF cooler lines.
- Be sure engine drive belts properly engage pulley grooves.
- Change engine oil and filter. Check all other fluid levels as described in **020 Maintenance**.
- Refill and bleed cooling system as described in **170 Radiator and Cooling System**.
- Install front exhaust pipes using new gaskets and copper paste and new mounting hardware. See **180 Exhaust System**.

Tightening Torques (M70 Engine)

- ATF cooler lines to radiator (use new O-rings)
 - M18 cap nut 20 Nm (15 ft-lb)
 - M22 cap nut 22 Nm (17 ft-lb)
- Coolant drain plug to cylinder block (M14) 28 Nm (21 ft-lb)
- Engine mount to engine bracket or subframe (M10) 47 Nm (35 ft-lb)
- Radiator cooling fan to coolant pump (left-hand threads) 40 Nm (30 ft-lb)
- Radiator drain screw to radiator 2.5 Nm (22 in-lb)
- Wiring to alternator (M8 nut) 13 Nm (9.5 ft-lb)
- Wiring to starter
 - Terminal 30h (M5) 5 Nm (44 in-lb)
 - Terminal 50 (M6) 6 Nm (53 in-lb)
 - Terminal 30 (M8) 12 Nm (9 ft-lb)



M70 ENGINE (V-12)