

GROUP H

BRAKES

ANTI-LOCK BRAKING SYSTEM (ABS)

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ABS

DRIVING WITH ABS, MAINTENANCE

Instructions

When the ignition is switched on, the 'ABS' symbol in the instrument panel illuminates and then goes out after approximately 4 seconds.

If the ABS telltale either does not go out or comes on intermittently while driving, then there is a fault in the system.

With both ABS-2E and ABS-2EH, diagnosis can be made either with the diagnostic switch KM-640 in position "K" or with TECH 1 Scan Tool, fitted with the 87-94 ECU Program Module.

After driving off from rest, the ABS carries out a self-test which may be audible as a noise from the return pump.

When braking hard, the vehicle remains free from wheel lock until the vehicle almost stops (approximately 4 km/h), thus guaranteeing vehicle control.

Braking in the control range of the ABS is indicated to the driver by a pulsing of the brake pedal, combined with noises from the return pump, warning him/her to adjust his/her speed in relation to the road surface conditions.

If a defect occurs in the ABS, the ABS telltale lights up, indicating that the ABS is inoperative. However the conventional braking system remains fully functional. Should a defect become apparent, the vehicle should be checked and /or repaired as soon as possible by an authorised Holden Dealer.

Maintenance

The following points must be observed when working on a Calibra vehicle fitted with ABS:

- When carrying out electrical welding operations, the wiring harness plug must be removed from the electronic control unit.
- During painting operations, the electronic control unit may be exposed to a maximum temperature of 95 °C for a short time and for a longer term - approximately 2 hours, to a maximum of 85 °C.
- After working on the braking system, it must be bled and a pressure inspection carried out.
- All connections are to be checked for leaks.
- Ensure that battery cable connections are clean and tight.
- Do not use a 'quick' battery charger to start the engine.
- Ensure all wiring harness connections are sound.
- Never unplug the wiring harness multiplug from the electronic control unit or plug it in, while the ignition is switched on.

General Information Before Repairs on the ABS

After operations that affect ABS components (e.g. accident repairs), the entire ABS must be checked.

With either ABS-2E or ABS-2EH:

System checking and diagnosis can be made either with the diagnostic switch KM-640 in position "K" or with TECH 1 Scan Tool, fitted with the 87-94 ECU Program Module.

Also refer to the "ABS Checking Procedures" included in this Section.

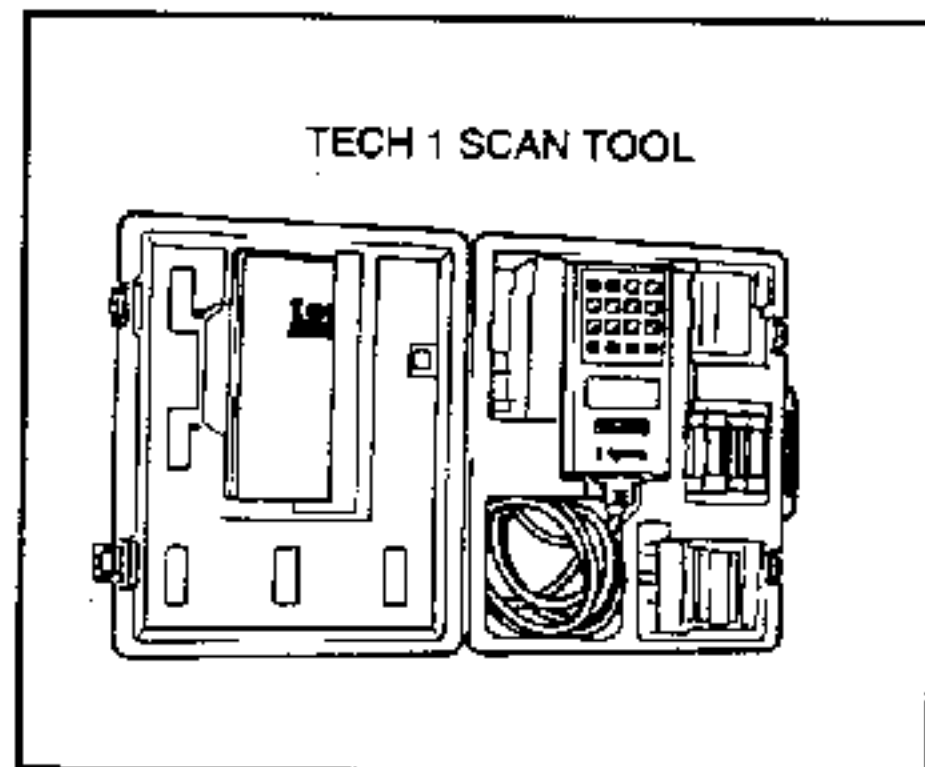
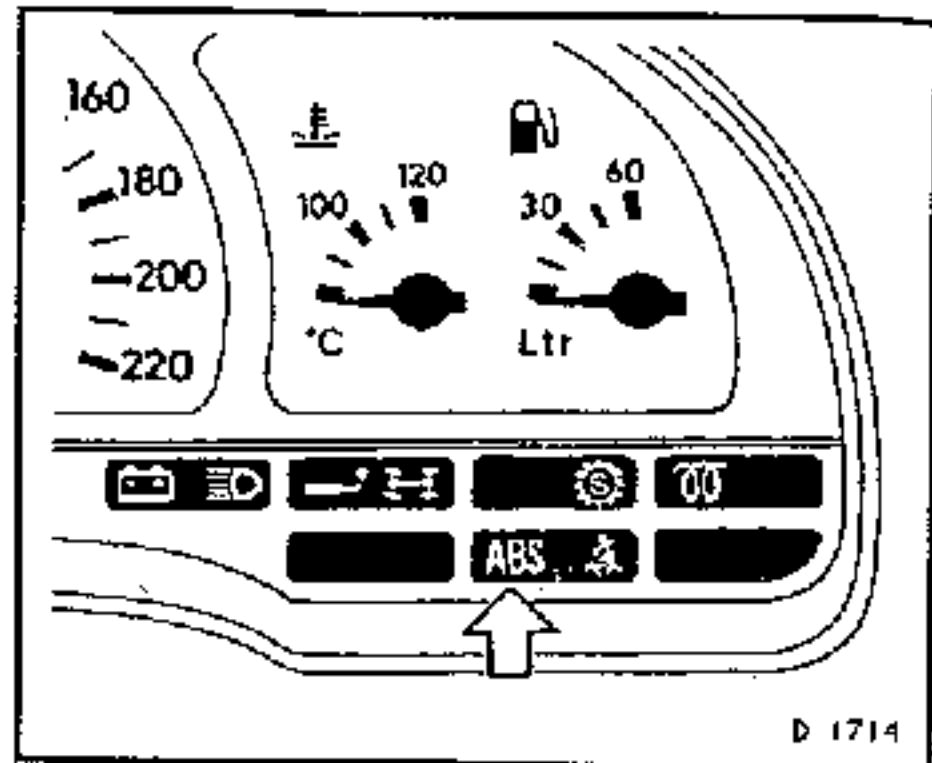
Function Check

After work on the braking system has been completed, where ABS component have NOT been involved, a simple function check is sufficient.

After starting the engine, the ABS telltale in the instrument panel, must go out.

Important!

The brake master cylinder on Calibra vehicles fitted with ABS are not serviceable and if found to be faulty, must be replaced as a complete unit.



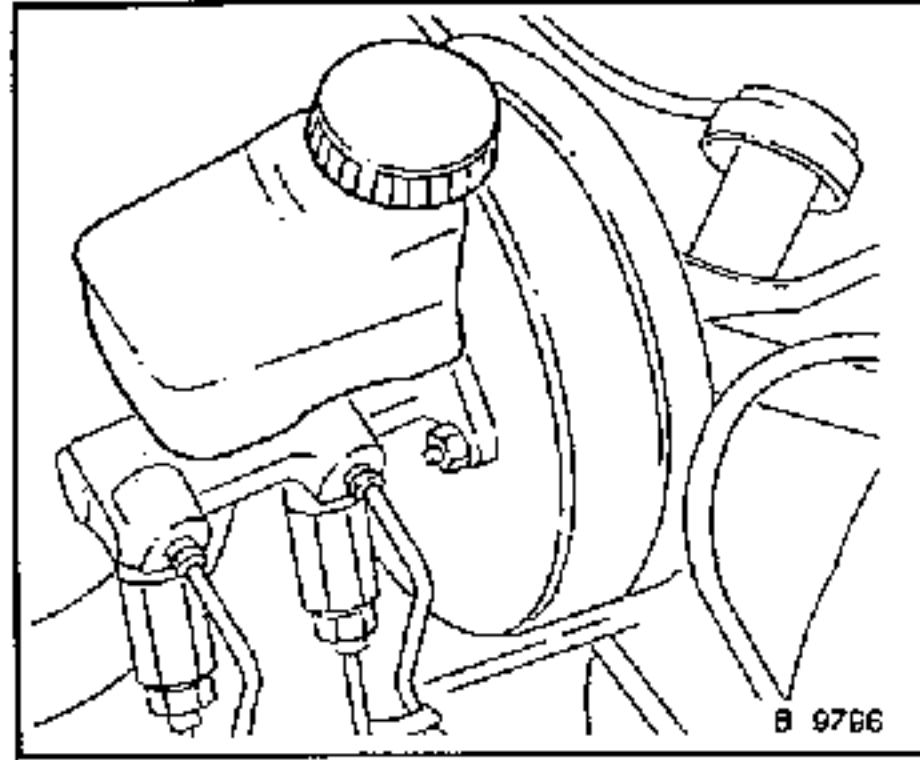
ABS

Hydraulic Modulator, Remove and Install (ABS -2E and ABS-2EH)

Remove, Disconnect

Ground cable from battery.

Top up brake fluid level to the 'MAX' mark in the master cylinder reservoir.



Remove, Disconnect

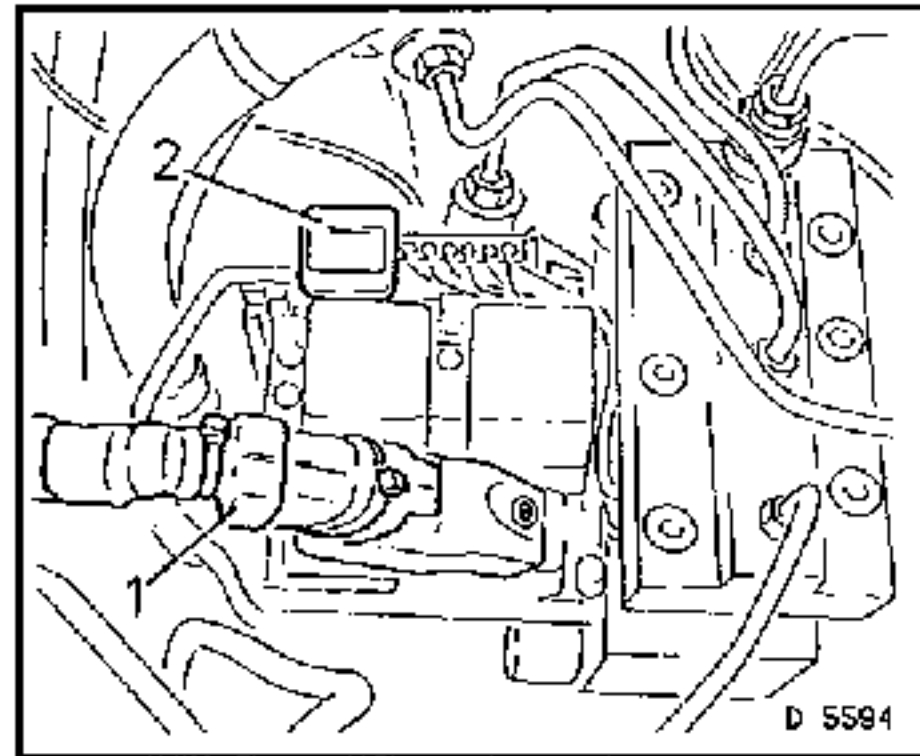
Cover from hydraulic modulator

Wiring harness plug connection (1).

Solenoid valves plug connection (2).

Brake lines from the hydraulic modulator.

If necessary lines may be carefully pushed aside but all openings must be plugged.

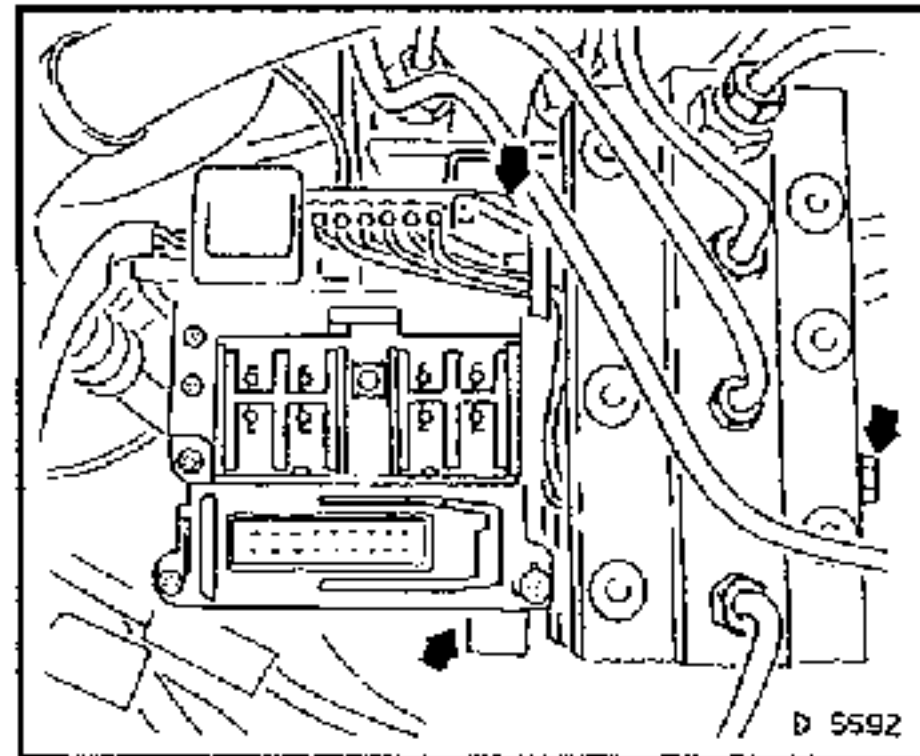


Remove, Disconnect

Ground cable from hydraulic modulator.

Hydraulic modulator from bracket - tilt slightly and remove upwards.

When the hydraulic modulator is to be replaced, plug all fluid openings and remove both relays, if possible.



Inspect

Hydraulic modulator bracket for a sound seating - clean.

Damping bearing for good condition and correct seating.

Install, Connect

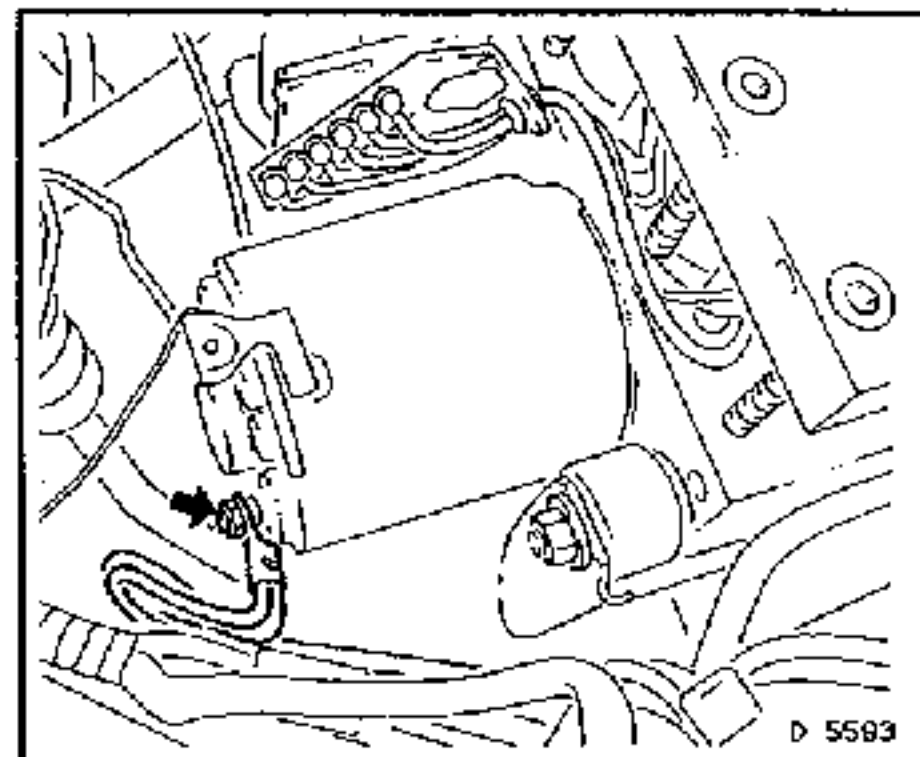
Ground cable to hydraulic modulator.

Hydraulic modulator to bracket.

Brake line union nuts to modulator.

Tighten (Torque)

Hydraulic modulator to bracket.....	8 Nm
Brake line union nuts.....	16 Nm



ABS

Install, Connect

Wiring harness plug connection (1)

Solenoid valves plug connection (2)

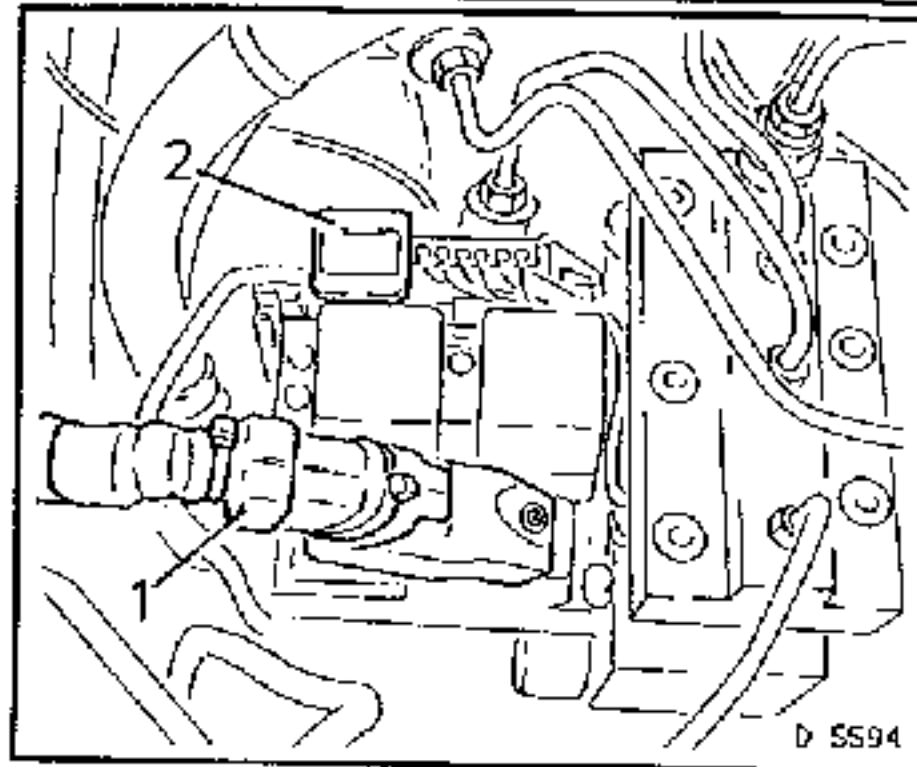
Both relays (if possible), cover to hydraulic modulator.

Remove cap from bleed screw and bleed brake system and check for leaks.

Important!

Always bleed the front brake circuits first, on Calibra vehicles fitted with ABS.

Carry out a function check.



Electronic Control Unit (ABS-2E)

Important!

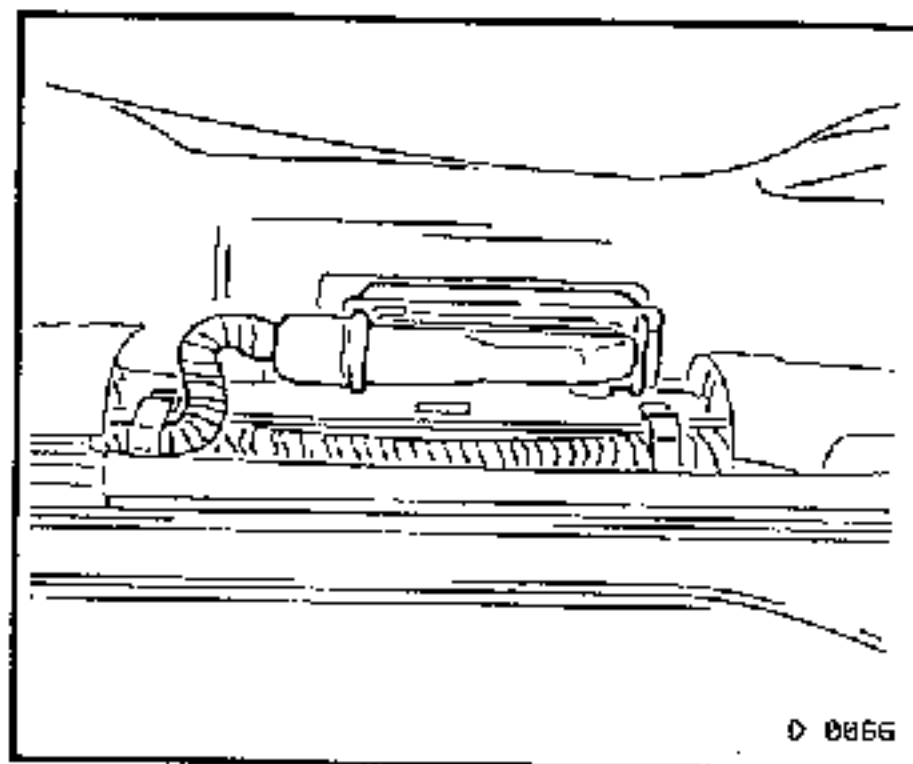
Only remove electronic control unit when the ignition is switched off and the battery ground, disconnected.

Remove, Disconnect

Cover of control unit from left reinforcement.

Control unit from bracket.

Wiring harness plug from control unit.



Install, Connect

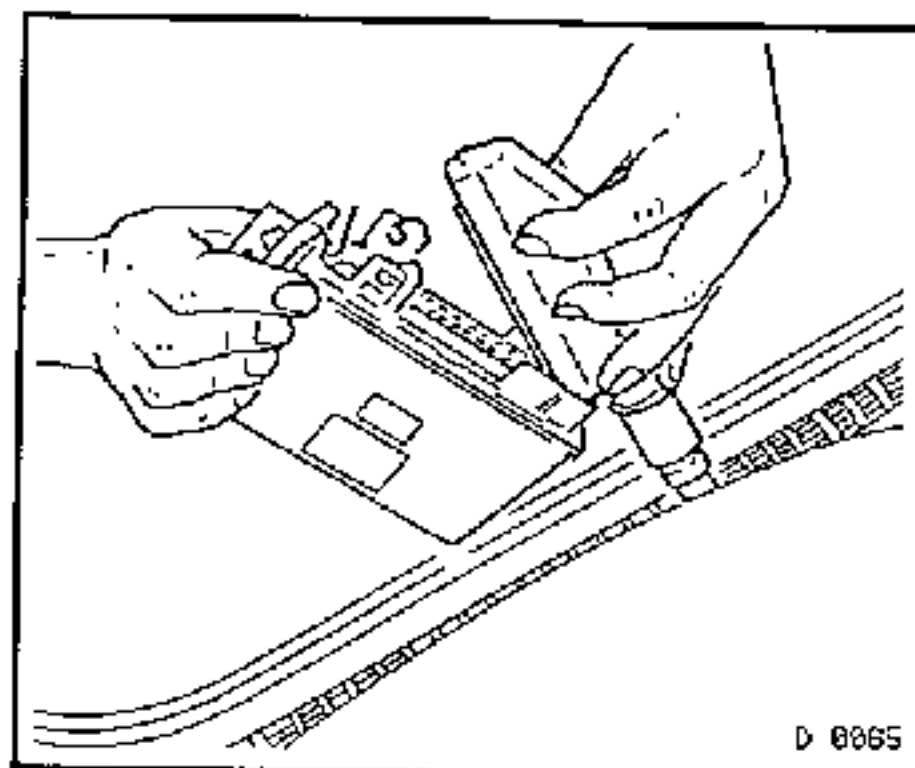
Wiring harness plug in the bracket on the control unit. Push until the catch clicks in with an audible sound.

Control unit in bracket.

Ground cable to battery.

Carry out a function check.

Install cover over control unit.



Electronic Control Unit, Remove and Install (ABS-2EH)

Important!

Only remove electronic control unit when the ignition is switched off and the battery ground, disconnected.

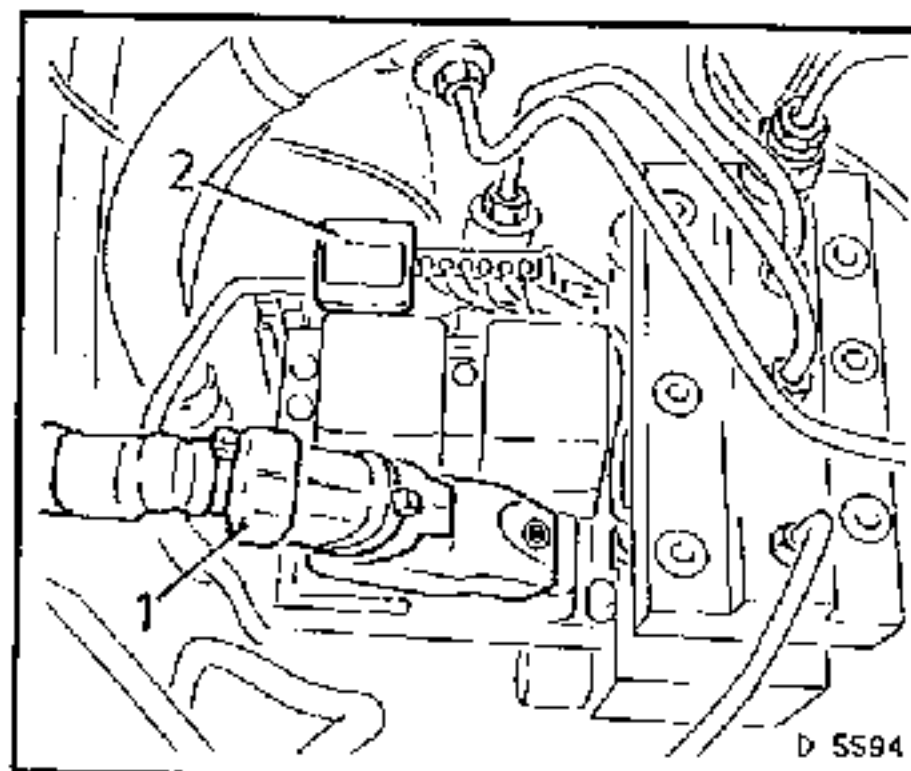
Remove, Disconnect

Ground cable from battery.

Cover from hydraulic modulator.

Wiring harness plug connection (1).

Solenoid valves plug connection (2).



ABS

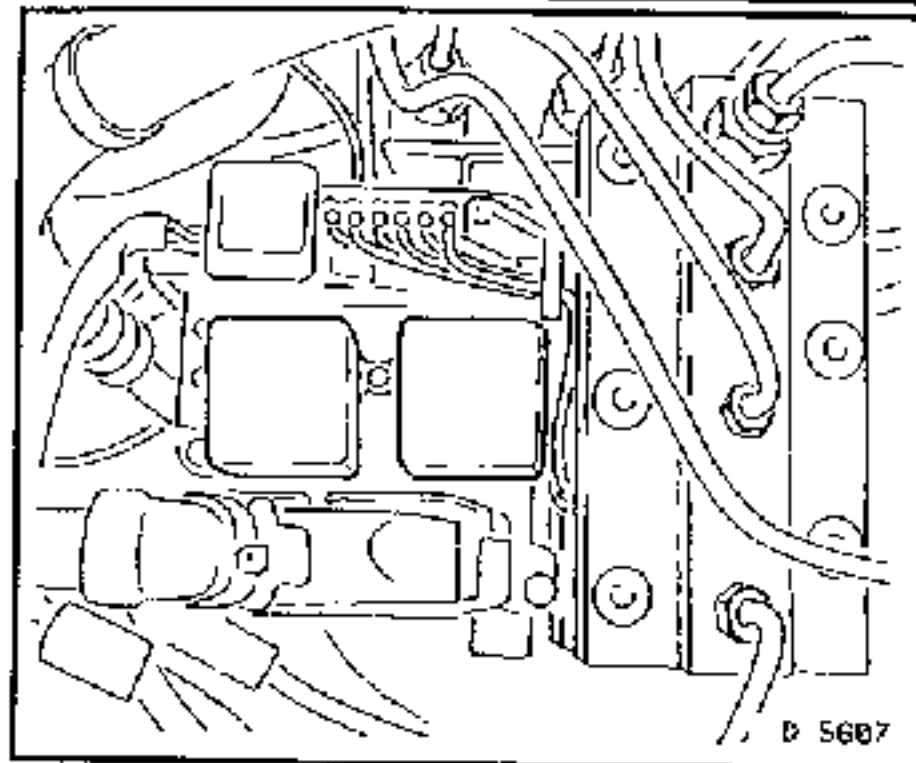
Remove, Disconnect

Relay for solenoid valve, relay for pump motor, if possible.

Wiring harness plug (1).

Fastening bolts (2).

Remove control unit.



Install, Connect

In reverse order.

Tighten (Torque)

Control unit fastening bolts..... 1.5 Nm

Wheel Speed Sensor, Remove and Install

FRONT WHEEL BRAKE

Remove, Disconnect

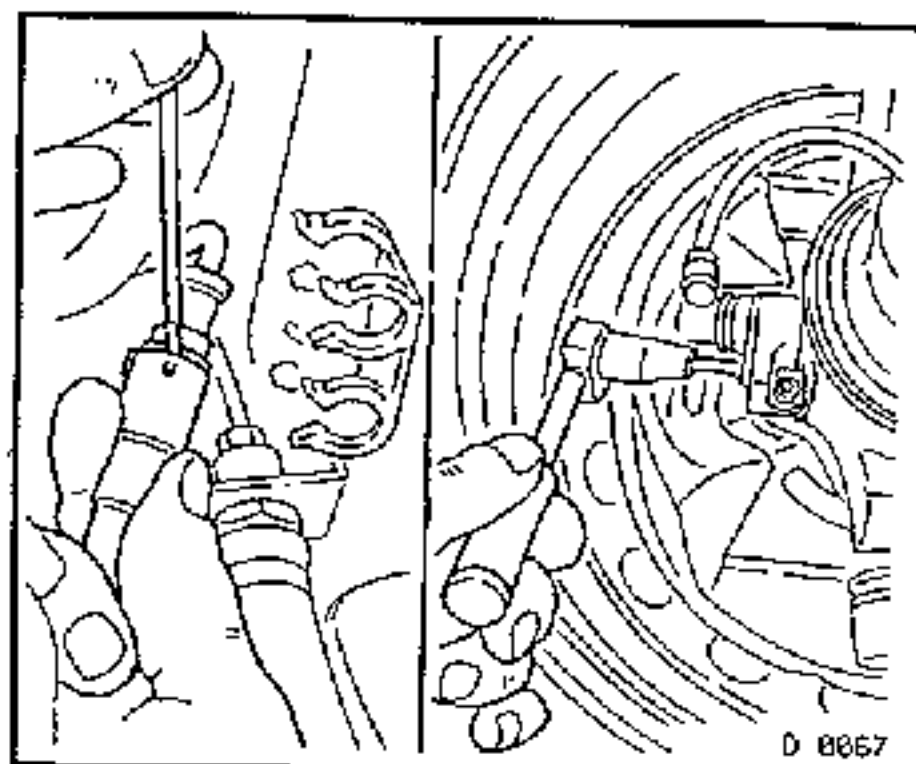
Ground cable from battery.

Wiring harness plug from bracket on wheel well.

Wiring harness plug from wheel speed sensor plug.

Wheel speed sensor cable from retaining clips.

Wheel speed sensor from bracket - lever out with a screwdriver.



Install, Connect

Wheel speed sensor to bracket. Coat metal housing of wheel speed sensor with lithium bearing grease, NLGI No. 4 EP.

Tighten (Torque)

Wheel speed sensor to bracket..... 8 Nm

Install, Connect

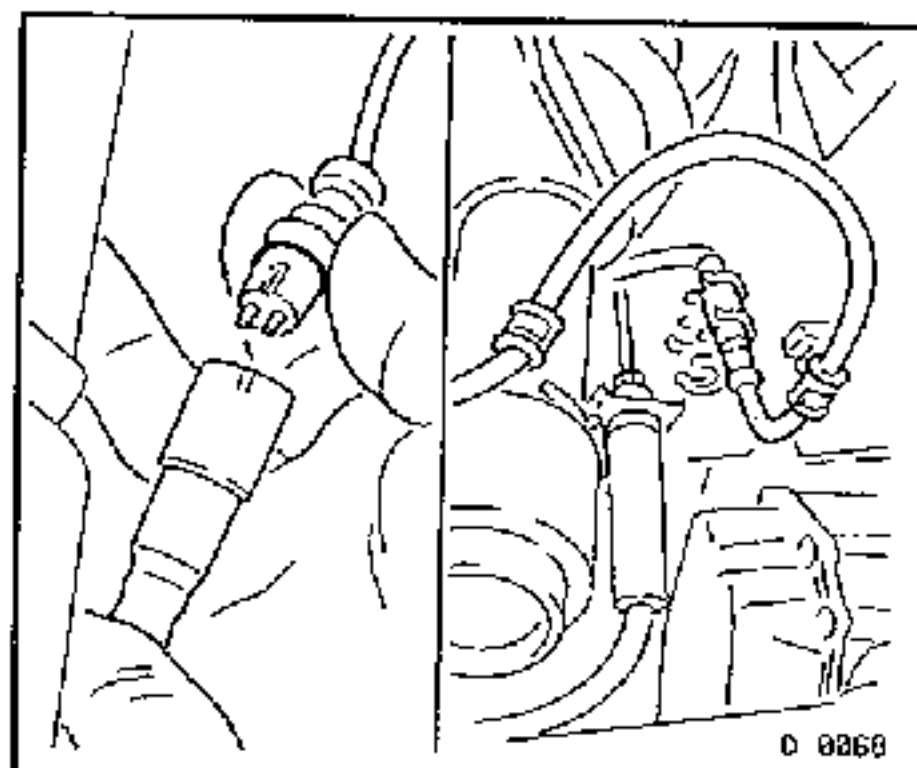
Wheel speed sensor cable in retaining clips.

Wheel speed sensor plug to wiring harness plug.

Wiring plug in bracket on wheel well.

Ground cable to battery.

Carry out a function check.

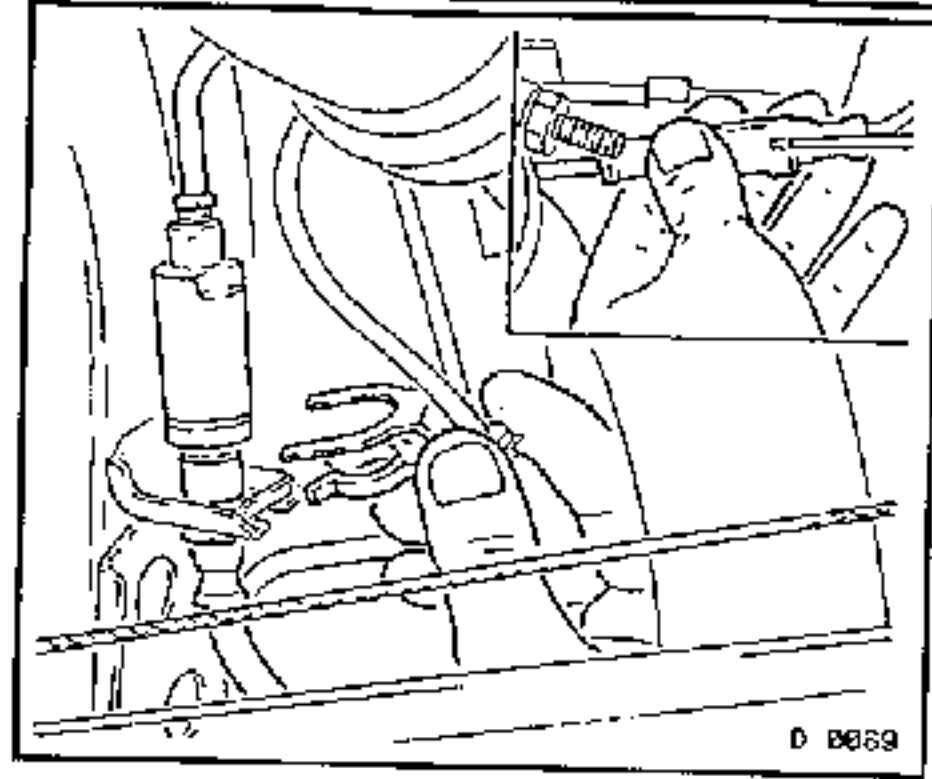


ABS

Wheel Speed Sensor, Remove and Install

REAR WHEEL BRAKE

- Ground cable from battery.
- Wiring harness plug from bracket on vehicle underbody.
- Wiring harness plug from wheel speed sensor plug.
- Wheel speed sensor cable from retaining clips.

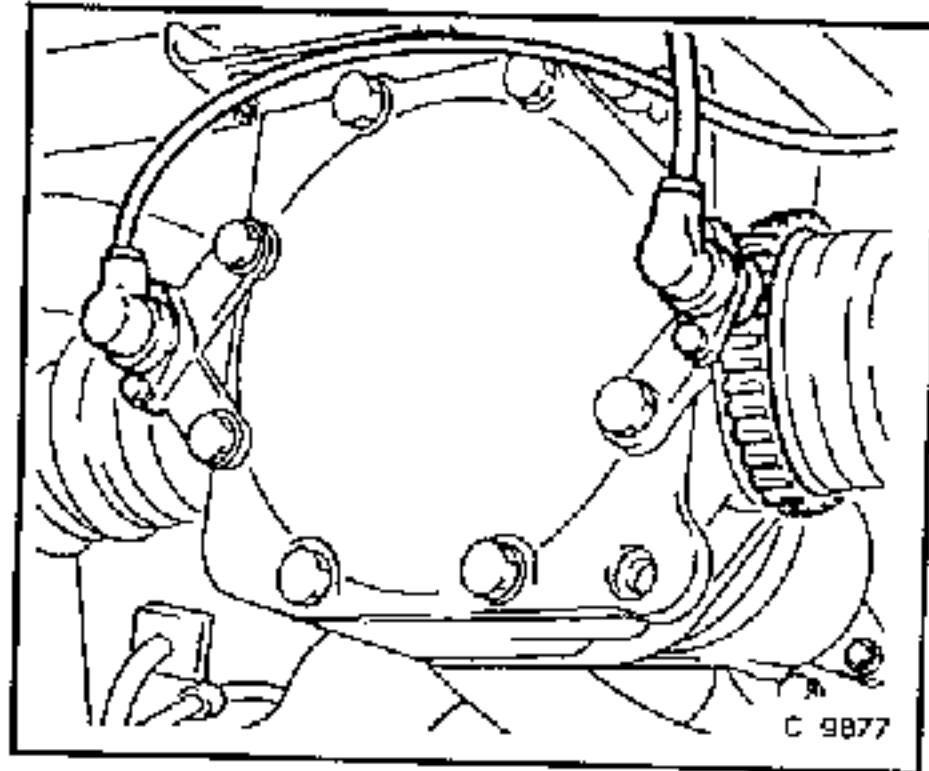


Note:

Illustration C 9077 shows the rear wheel speed sensor for the 4WD Calibra, while illustration D 2248 shows the FWD version.

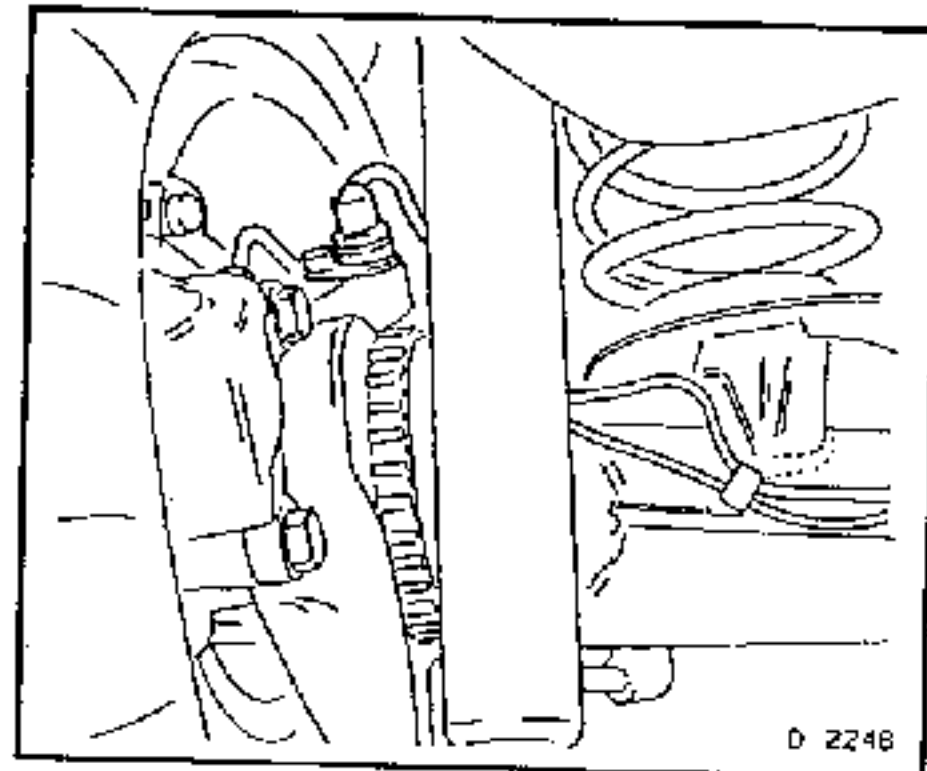
Remove, Disconnect

- Wheel speed sensor with spacer ring.



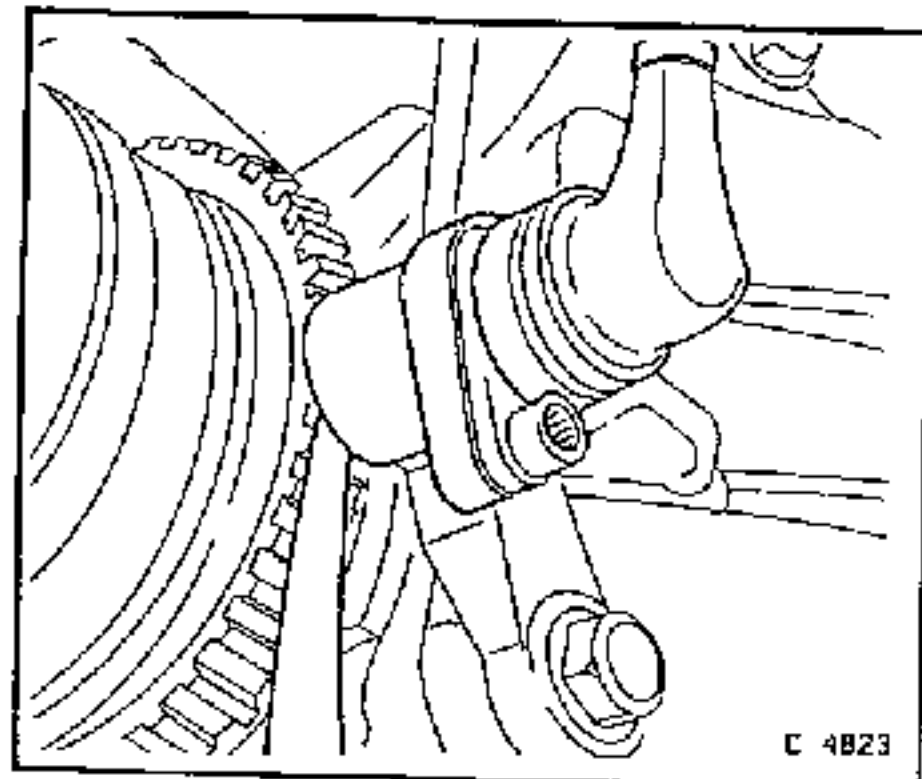
Install, Connect

- Wheel speed sensor with spacer ring.
- Before installation, coat metal housing of wheel speed sensor with lithium bearing grease, NLGI No. 4 EP.
- Wheel speed sensor in clips.
- Wheel speed sensor plug to wiring harness plug.
- Plug connector to bracket.
- Ground cable to battery.



Inspect

- Wheel speed sensor air gap to pulse ring.
- With 4WD only:
 - Specification = 0.5 - 1.5 mm.
 - Adjust by placing spacer shims underneath sensor.
- Carry out function check.



ABS

Relay for Solenoid Valve or Pump Motor, Remove and Install

(ABS-2E/ABS -2EH, up to MY93½)

Important!

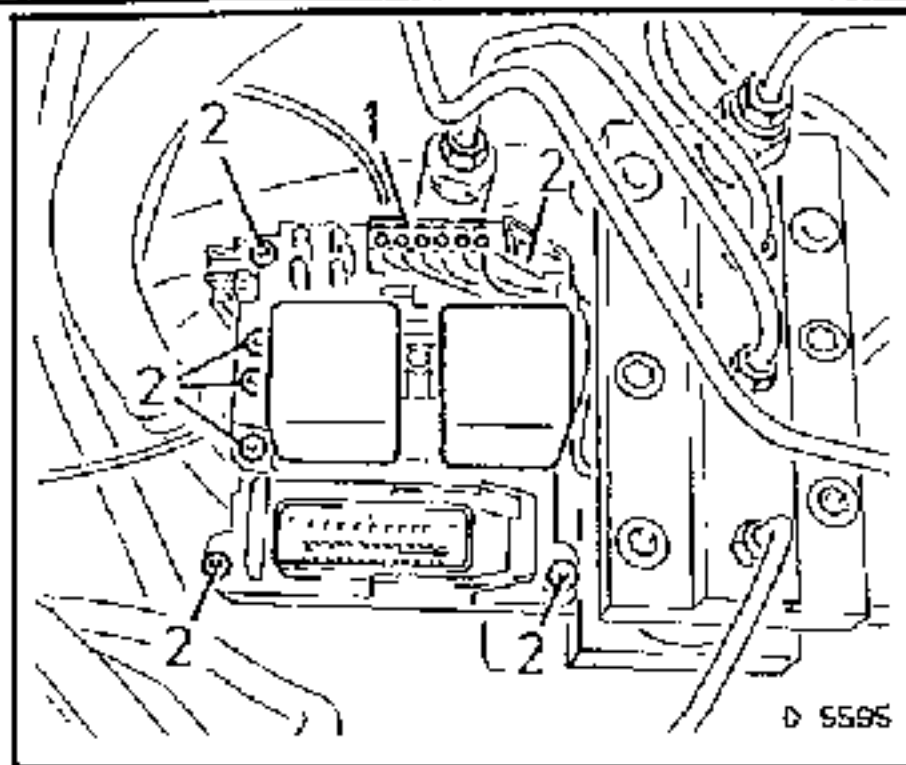
As of My 93½, the relays are an integral part of the control unit and can therefore only be replaced with the control unit.

Remove, Disconnect

Ground cable from battery.

Cover from hydraulic modulator.

Relay for solenoid valve and relay fro pump motor.



Install, Connect

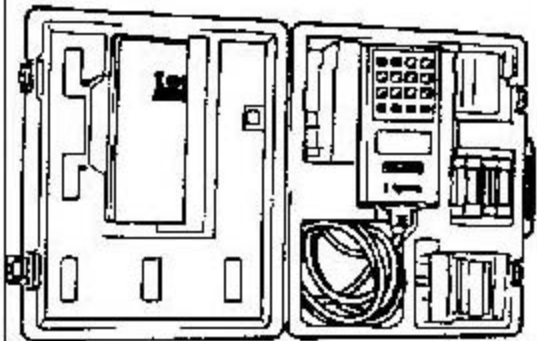
Relays.

Cover of hydraulic modulator.

Ground cable to battery.

Carry out function check.

TECH 1 SCAN TOOL



GROUP N

ELECTRICAL EQUIPMENT AND INSTRUMENTS

ANTI-THEFT WARNING SYSTEM

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ANTI-THEFT WARNING SYSTEM

GENERAL INFORMATION

The electronically controls Anti-theft Warning System (ATWS) ensures a high degree of safety from vehicle break-ins, robbery and vehicle theft. The ATWS is used in conjunction with central door locking.

The ATWS monitors the doors, luggage compartment, passenger compartment, engine compartment, radio, luggage compartment and special circuits in the vehicle. Also as of model year 1993, the rear window is monitored via the rear window demist heated wires.

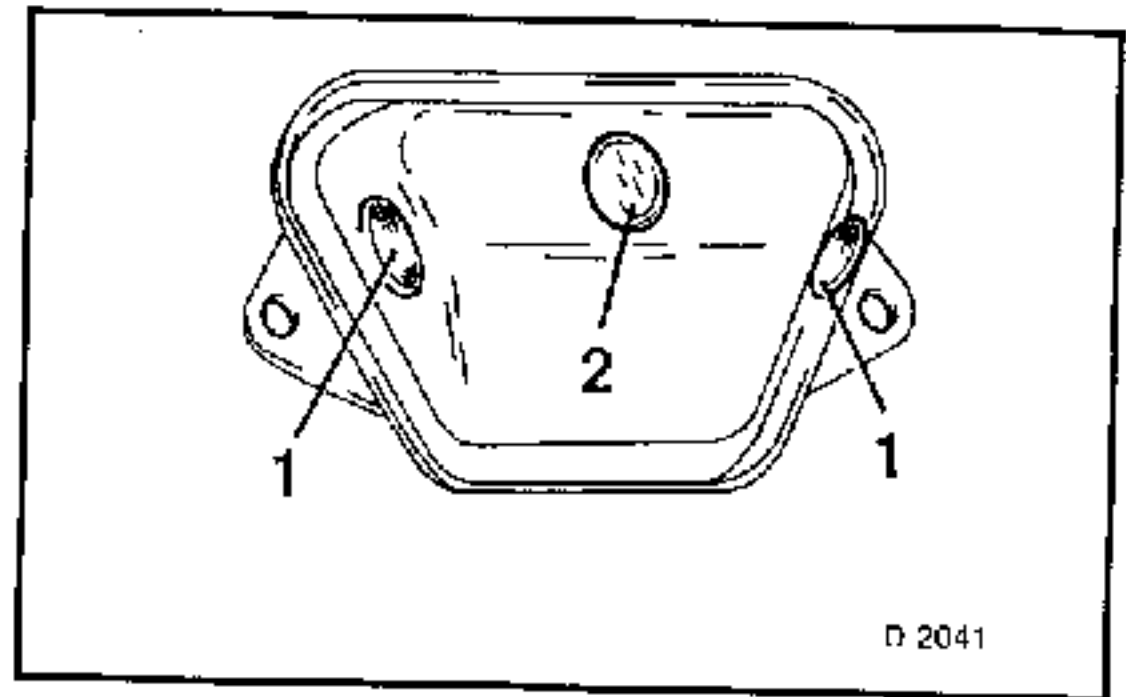
Two ultrasonic modules monitor the vehicle interior. The modules are positioned in the headlining above the B pillars. The housings are coloured to match the headlining.

A signal sent from the ultrasonic sensor is compared hundredths of a second later with the echo registered at the sensor. The sensor is switched over from the sender to the receiver. After every activation process, the control unit learns how the echo looks in a normal state. As soon as the signal deviates from the state, the warning signal is triggered.

Ultrasonic module, passenger side

This ultrasonic module employs two ultrasonic sensors and a light diode. The light diode serves to indicate the condition of the ATWS and to send out the alarm and trouble blink code.

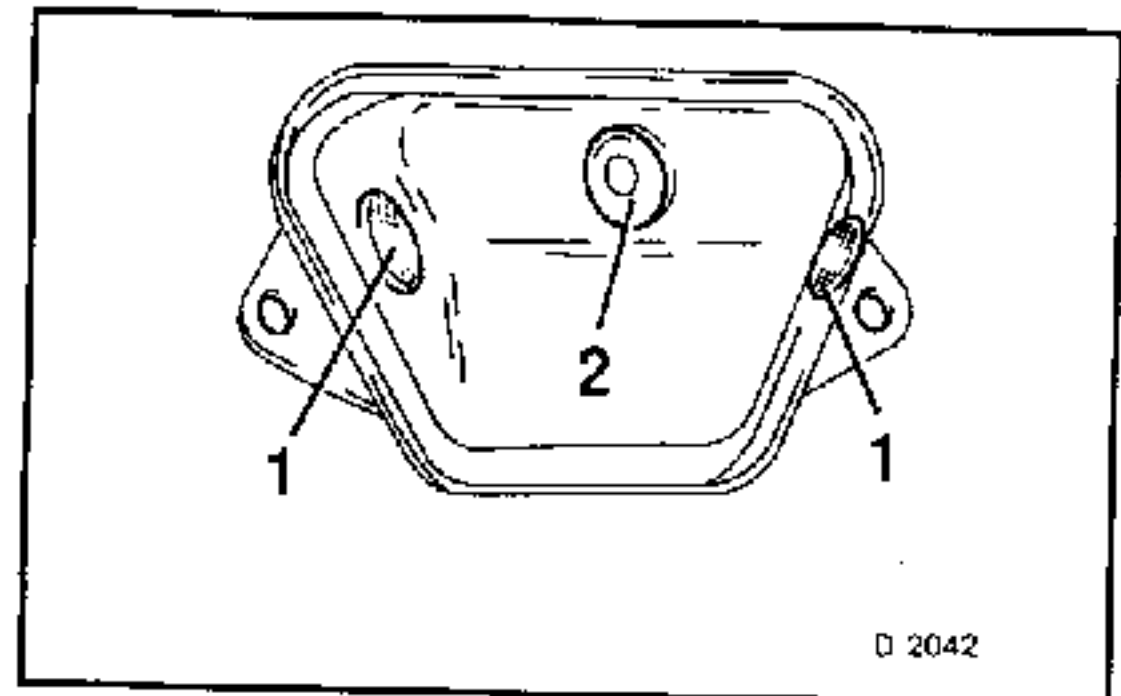
1. Ultrasonic sensor
2. Light diode



Ultrasonic module, drivers side

When the ATWS is switched on, the interior can be intentionally excepted from monitoring (i.e. when animals are to remain in the vehicle). To do this, actuate the button at ultrasonic sensor on the drivers side before activating the system.

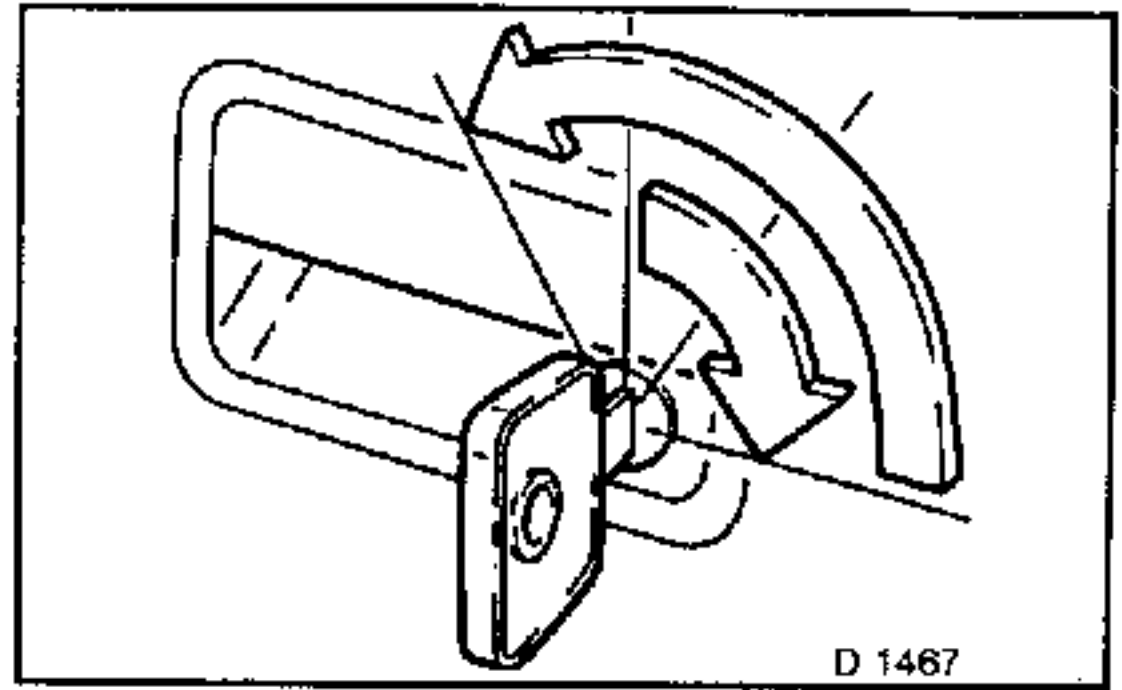
1. Ultrasonic sensor
2. Key button



ANTI-THEFT WARNING SYSTEM

At the same time the drivers door is closed - in the anti-theft position - the ATWS is switched on by turning the key 90° to the right, and turned off by turning the key approx. 120° to the left.

The luggage compartment lock can be deactivated / activated only if beforehand the ATWS has been activated at the lock on the drivers door.

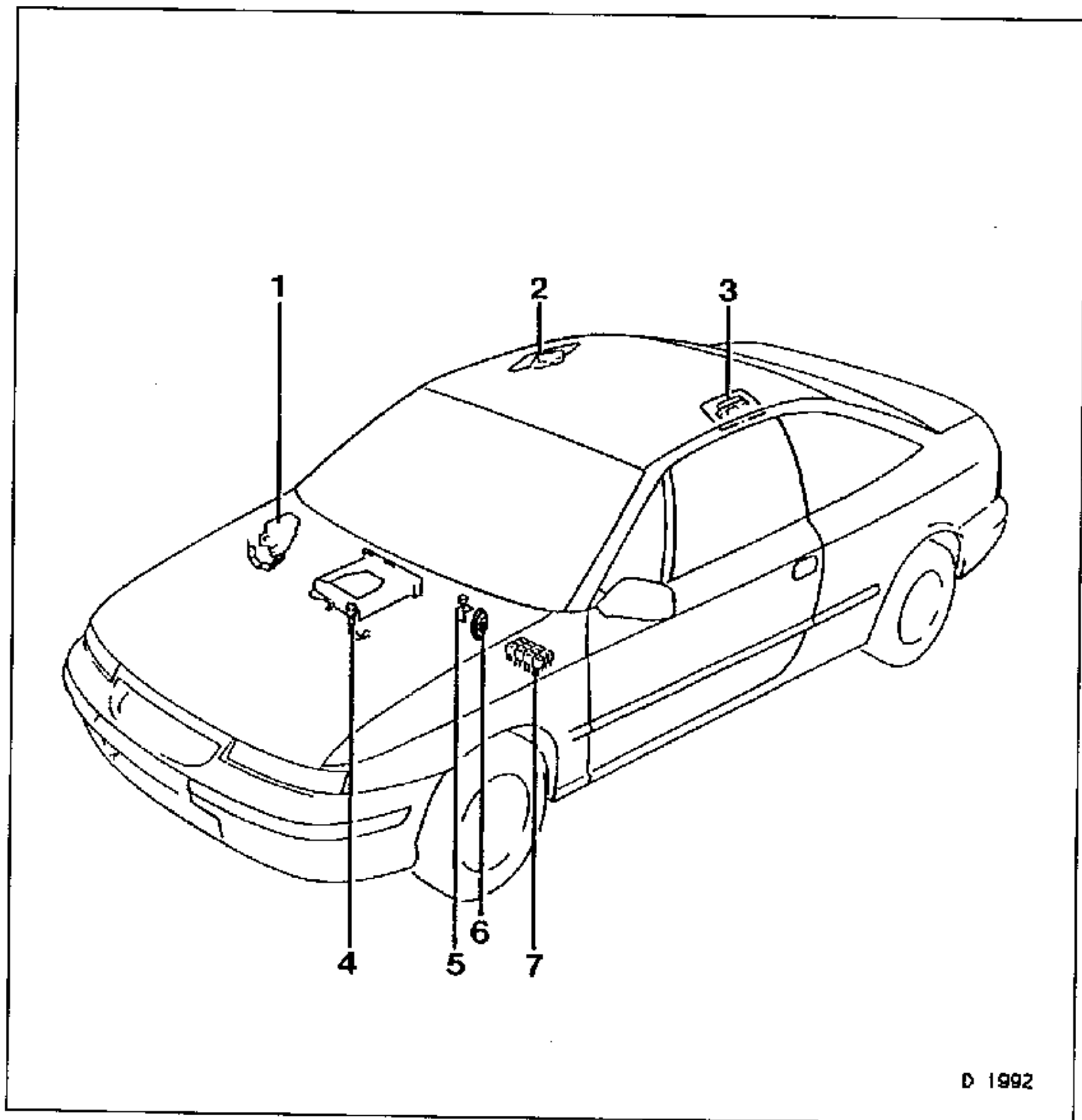


After being switched on, the ATWS indicates alarm readiness by illuminating the light diode in the ultrasonic module on the passenger side for 10 seconds. During this time the control unit carries out a self test. After a period of 10 seconds and an additional 10 seconds after extinction of the LED, the ATWS is activated. The correct functioning of the ultrasonic sensors requires that all windows and the sun roof be closed.

ANTI-THEFT WARNING SYSTEM

SURVEY OF COMPONENTS

- 1 - Control unit K94
- 2 - Ultrasonic sensor with LED
- 3 - Ultrasonic sensor with probe
- 4 - Radio contact
- 5 - Bonnet contact
- 6 - Horn, anti-theft warning system
- 7 - Relay, starter circuit interruption K3



D 1992

ANTI-THEFT WARNING SYSTEM

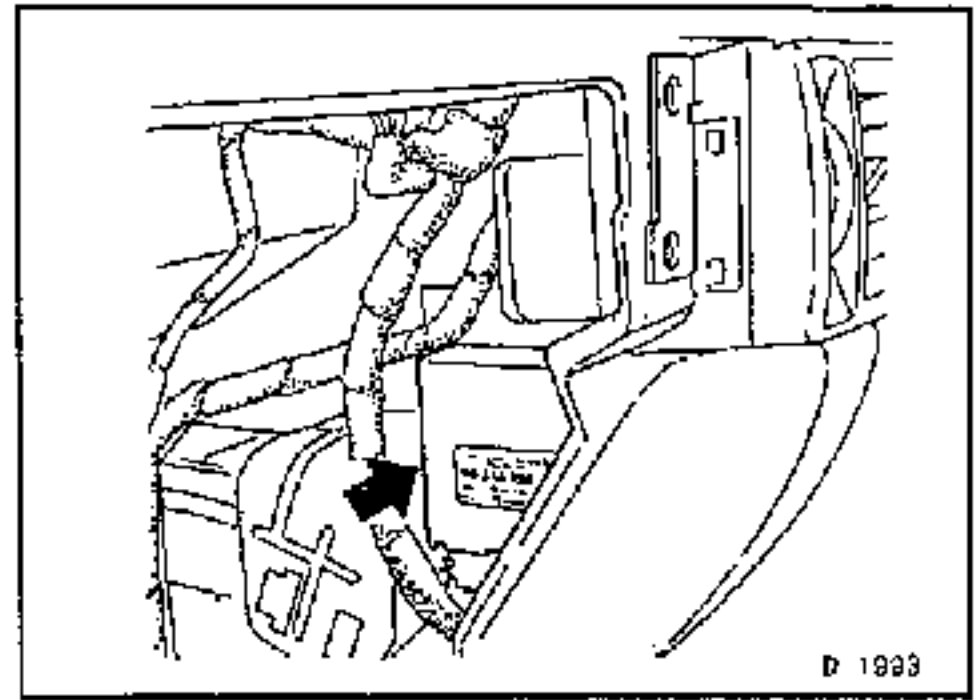
CONTROL UNIT FOR ANTI-THEFT WARNING SYSTEM, REMOVE AND INSTALL

Remove, Disconnect

Disconnect battery.

Glove compartment – group D (Mixed-air Heating (Interior) Remove and Install Completely).

Upper air duct, fastening bolt, control unit – towards front, wiring harness plug above.



Install, Connect

Wiring harness plug, control unit, fastening bolt, air duct, glove compartment.

Reconnect battery.

ULTRASONIC SENSOR, REMOVE AND INSTALL

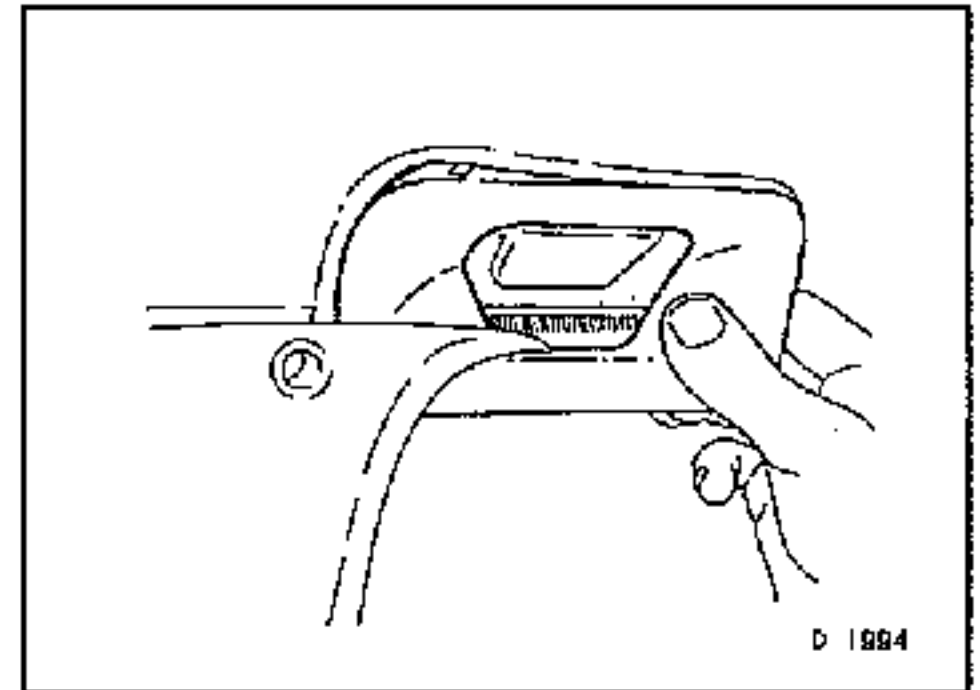
Remove, Disconnect

Disconnect battery.

B pillar trim – unscrew and pull out above.

Trim for ultra sonic sensor – pull out downwards.

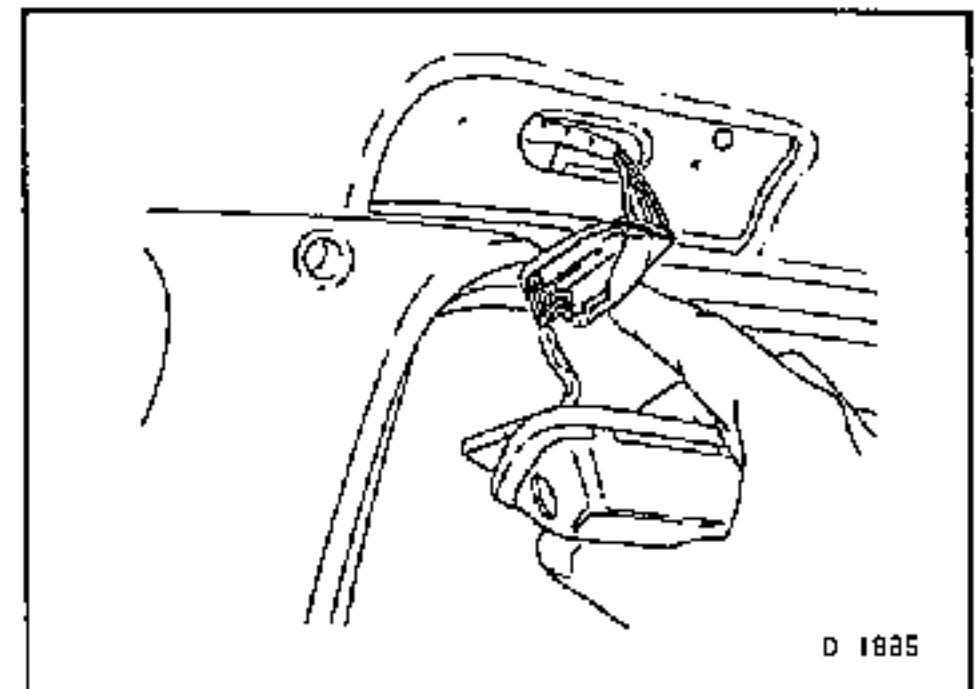
Ultrasonic sensor, wiring harness plug.



Install, Connect

Wiring harness plug, ultrasonic sensor, trim.

Ultrasonic sensor, B pillar trim, reconnect battery.



ANTI-THEFT WARNING SYSTEM

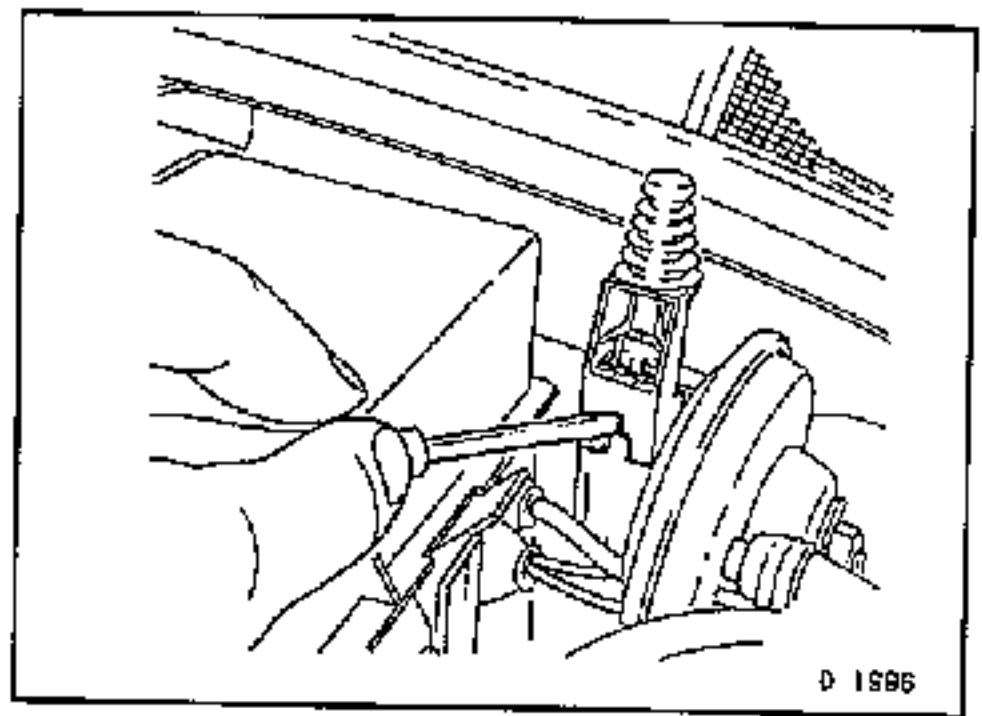
BONNET CONTACT, REMOVE AND INSTALL

Remove, Disconnect

Bonnet contact – press in tongue at plug casing using screwdriver, wiring harness plug.

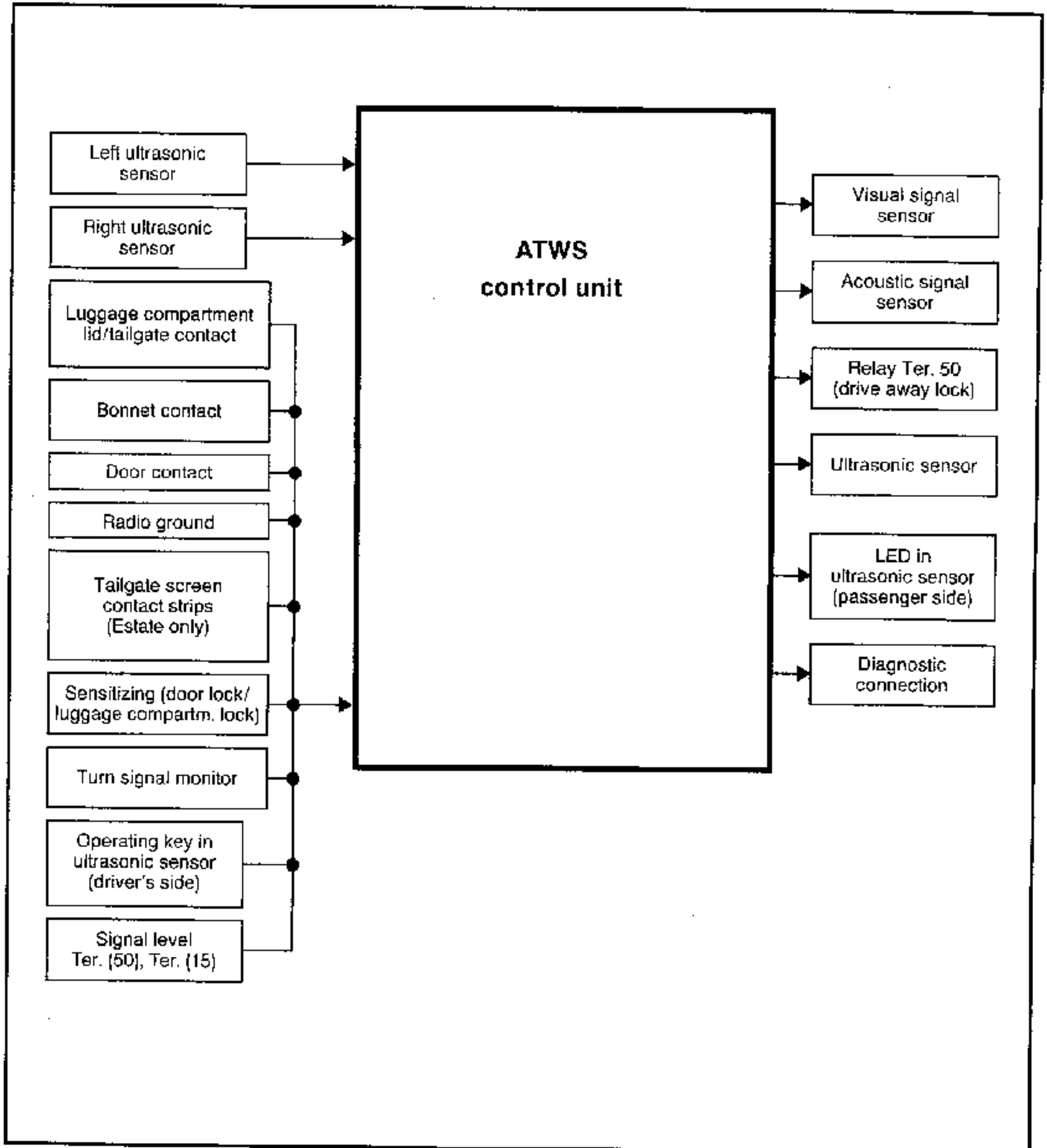
Install, Connect

Wiring harness plug, snap in bonnet contact.



ANTI-THEFT WARNING SYSTEM

4 Block Diagram, Anti Theft Warning System



GROUP J

DOUBLE OVERHEAD CAM ENGINE

ENGINE DAMPING BLOCKS; ENGINE SHORT BLOCK

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DOHC ENGINE - ENGINE SHORT BLOCK

Engine Damping Blocks, Replace

Remove, Disconnect

Ground cable from battery.

Install, Connect

Engine to Engine Holder KM-263-B.

Remove, Disconnect

If fitted, the lower engine cover.

Replace Right Hand Damping Block:

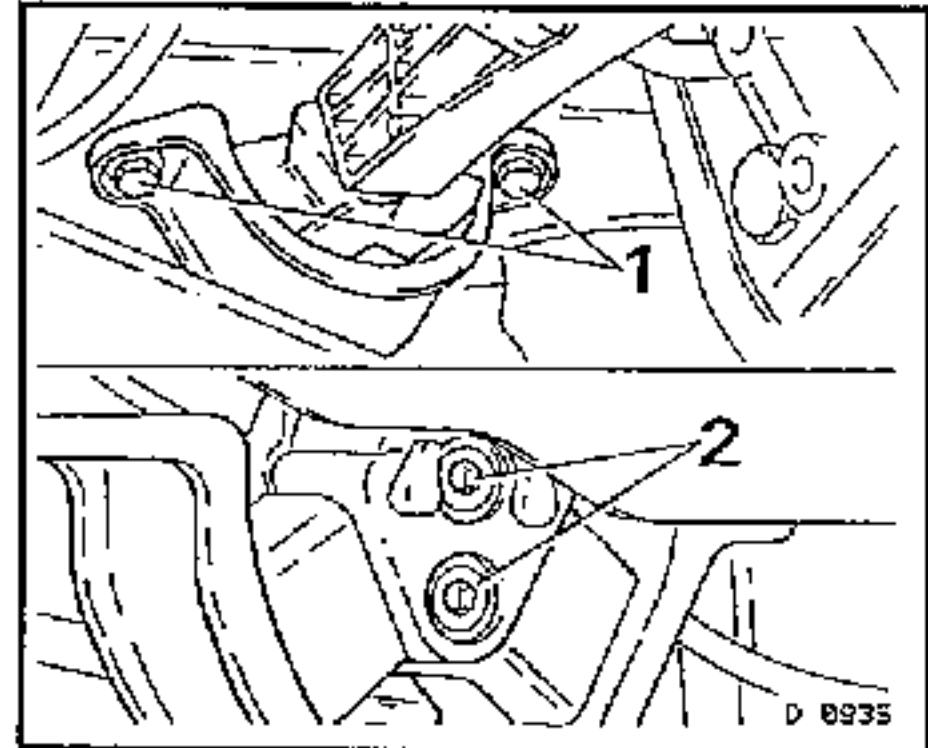
Remove, Disconnect

Protective cover from wheel well.

Engine damping block from side member (1).

Lower engine slightly.

Bolts (2) from the holder.



Install, Connect

Engine damping block to bracket.

Tighten (Torque)

Engine damping block to bracket	35 Nm
Bracket to cylinder block.....	60 Nm
Engine damping block to side member	65 Nm*

* Use locking compound to Holden's Specification HN1256, Loctite 242 or equivalent.

Front Left Hand Engine Damping Block, Replace

Remove, Disconnect

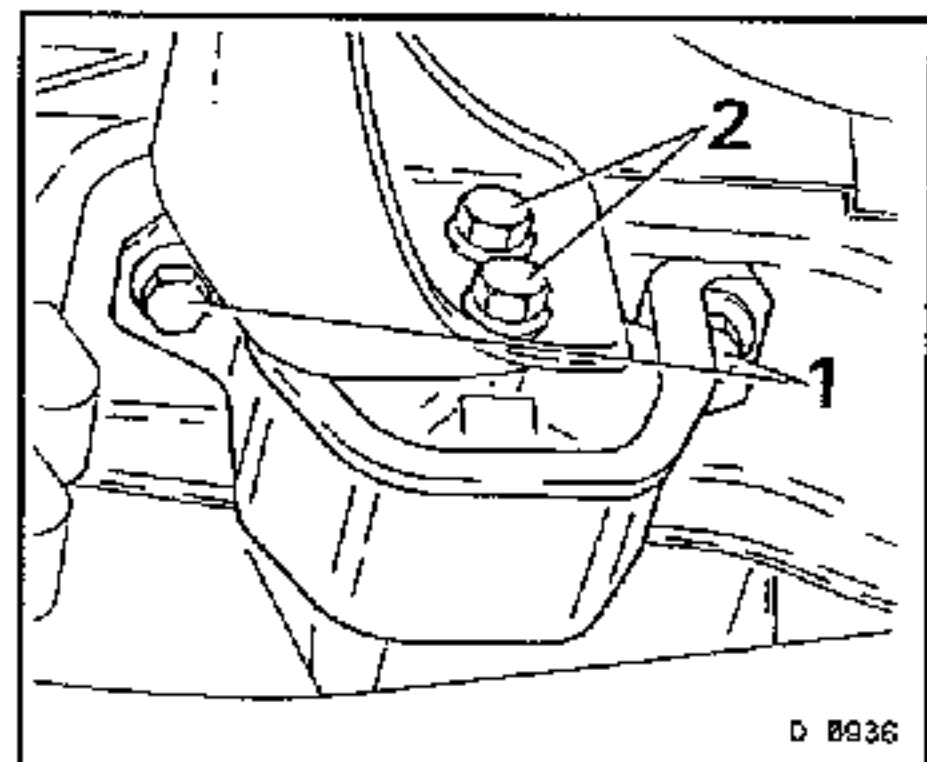
Engine damping block from side member (1).

Engine damping block from bracket (2).

Tighten (Torque)

Engine damping block to bracket	60 Nm
Engine damping block to side member	65 Nm*

* Use locking compound to Holden's Specification HN1256, Loctite 242 or equivalent.



DOHC ENGINE - ENGINE SHORT BLOCK

Replace Rear Engine Damping Block:

For C 20 XE Engines:

Remove, Disconnect

Engine damping block from front axle body (1)

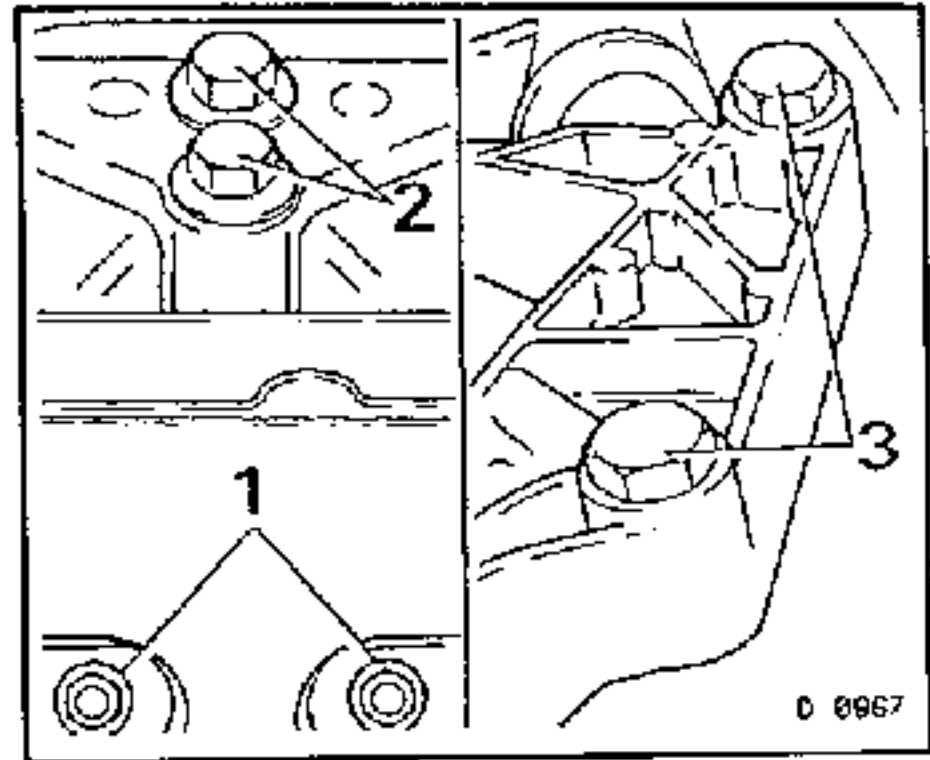
Engine damping block from bracket (2).

Bracket from transmission (3).

Tighten (Torque)

Bracket to transmission.....	60 Nm*
Engine damping block to bracket	45 Nm
Engine damping block to front axle body ..	40 Nm

* Use new locking plates.



For C 20 LET:

Lower front axle body. Refer to Section E, "Frame, Front Wheel Suspension System, Wheels and Tyres", in Volume 1.

Remove, Disconnect

Engine damping block from bracket.

Tighten (Torque)

Engine damping Block to bracket 45 m

Install, Connect

Front axle body.

With all Engines:

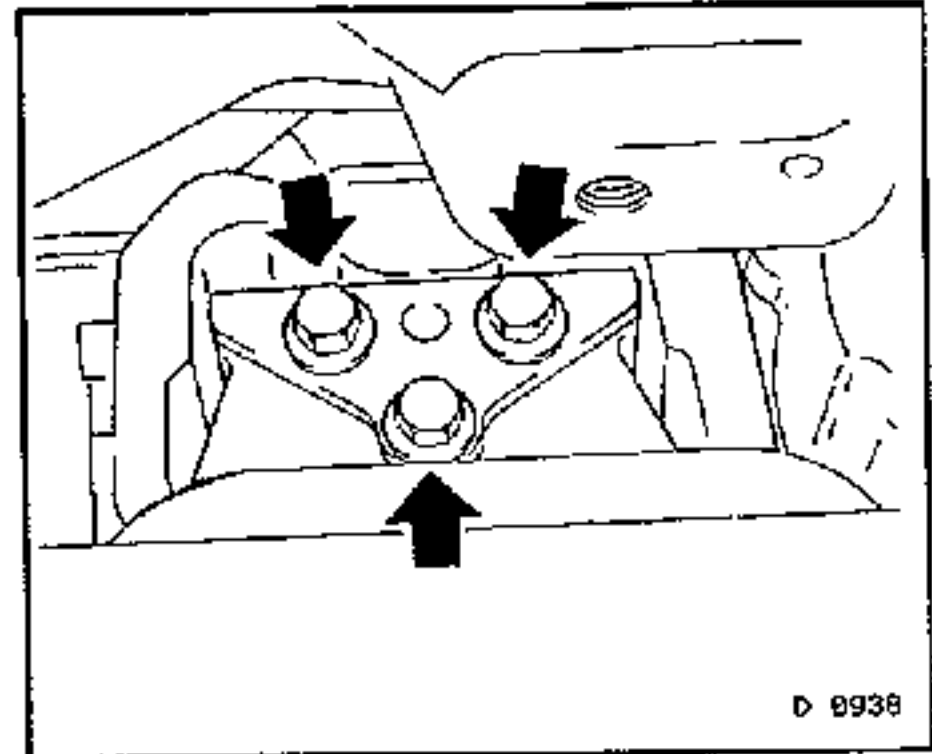
Remove, Disconnect

Engine Holder KM-263-B.

Install, Connect

Engine lower cover.

Ground cable to battery.



Engine without Transmission, Remove and Install (C 20 XE without Pot Flywheel)

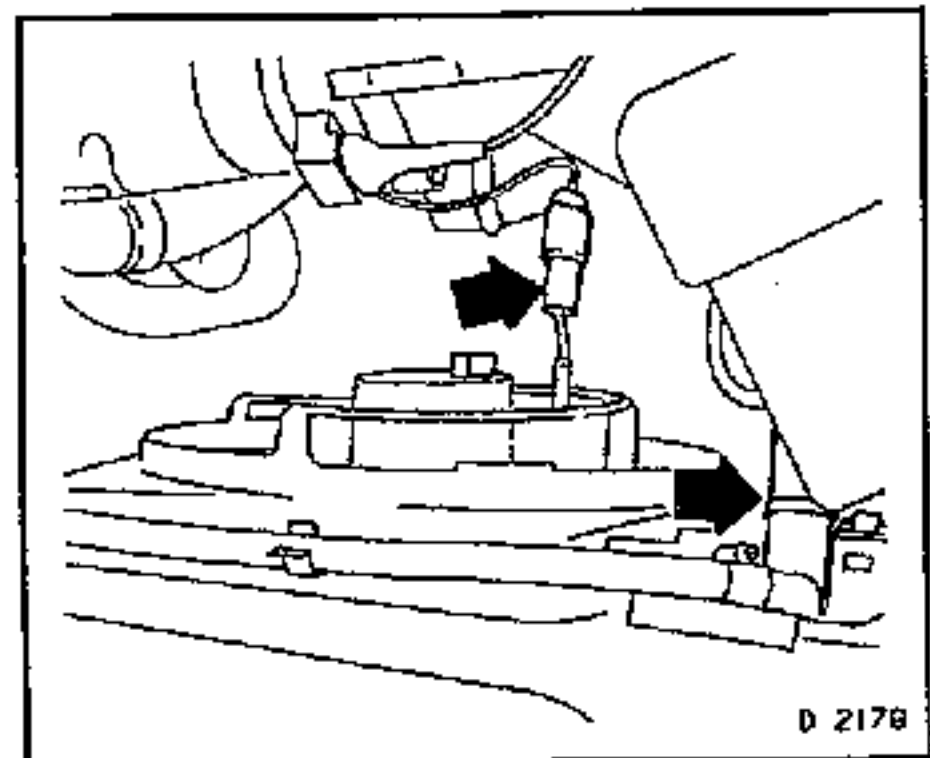
Remove, Disconnect

Bonnet, engine compartment cover.

Ground cable from battery.

Lower coolant hose from radiator (arrow).

Fan motor wiring harness plug (arrow).



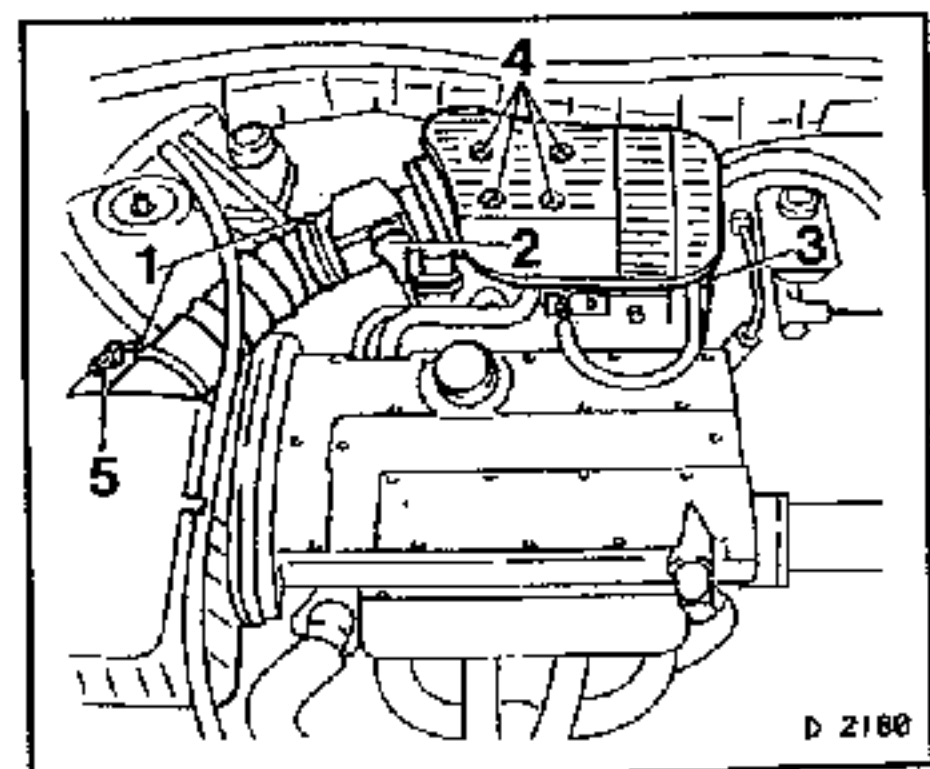
Remove, Disconnect

Air intake hose (1), wiring harness plug (2) from mass air flow meter, idle speed adjuster hose (3) from pre-volume chamber.

Pre-volume chamber (4) with mass air flow meter.

Wiring harness plug (5) from inductive pulse pick-up.

Air cleaner housing. Refer to 'Air Cleaner Housing, Remove', in the Section "Engine Timing Side, Air Cleaner", in this Volume.



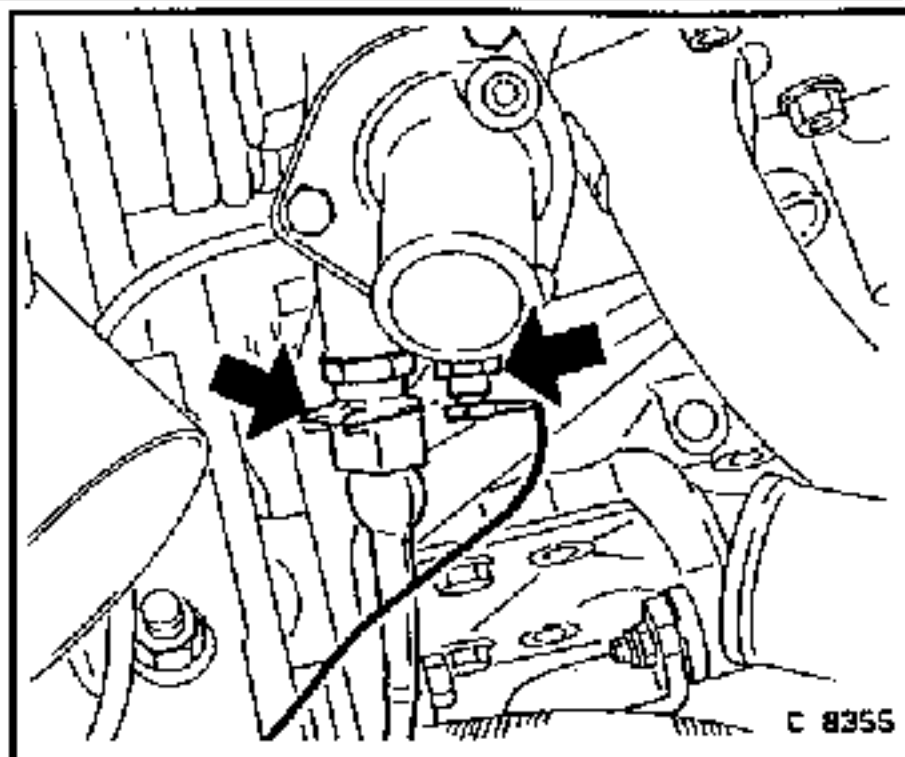
DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

Coolant hose.

Wiring harness plugs (arrows) from the thermostat housing.

Performance header. Refer to 'Gasket, Performance Header. Replace', in the Section "Cylinder Head", in this Volume.

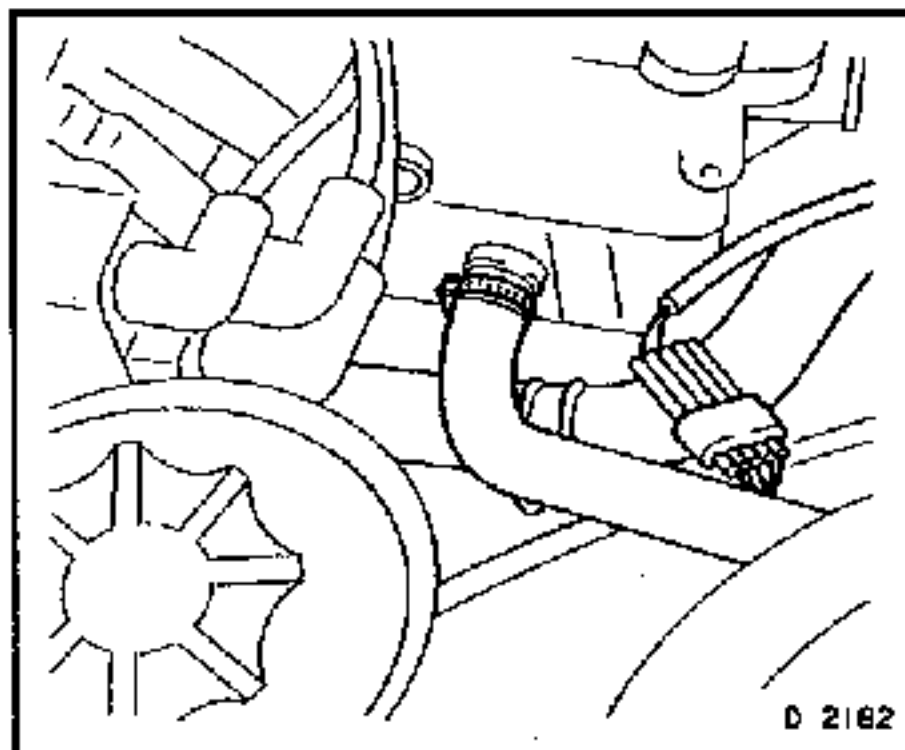


Remove, Disconnect

Wiring harness plug and high voltage cable from high voltage distributor.

Coolant hose from cylinder head, coolant hoses from coolant pipe. Use a suitable clean container to drain coolant.

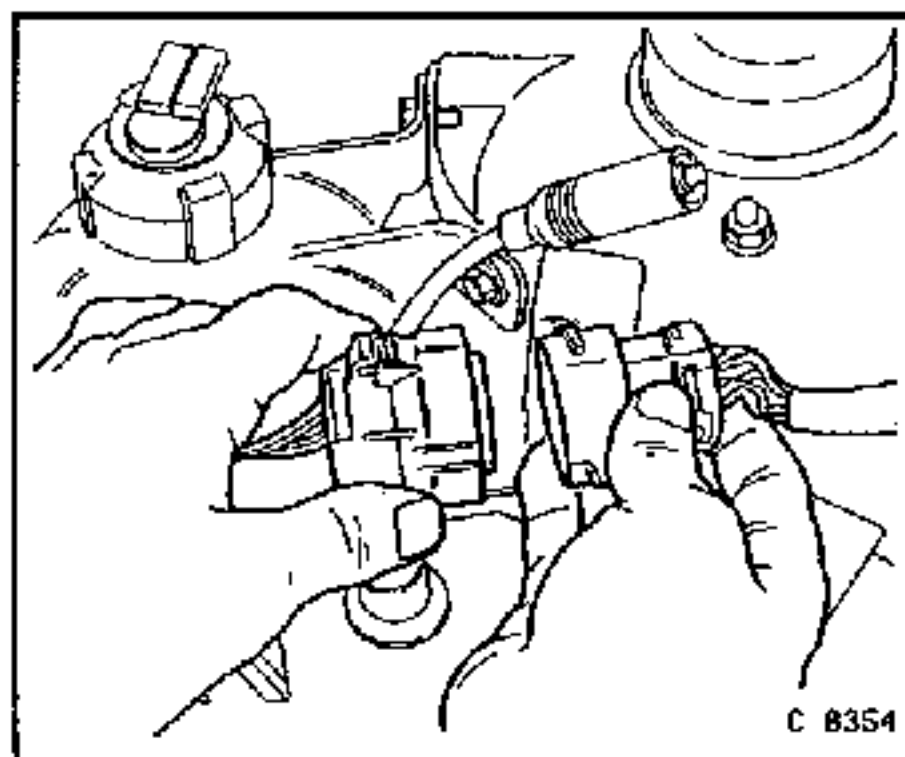
Multi-plug.



Remove, Disconnect

Wiring harness plug for reversing lamp.

Engine to body wiring harness multi-plug.

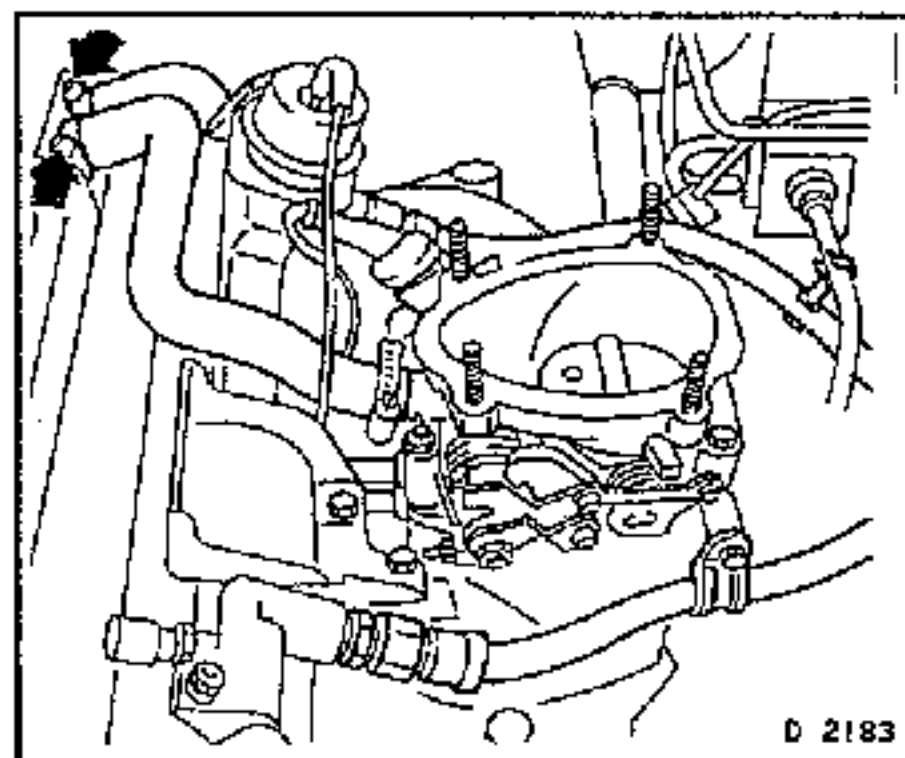


Remove, Disconnect

Bowden cable.

Fuel lines, sealing first with suitable clamps to prevent fuel spillage.

Hose connections (arrows) from cylinder head cover.



DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

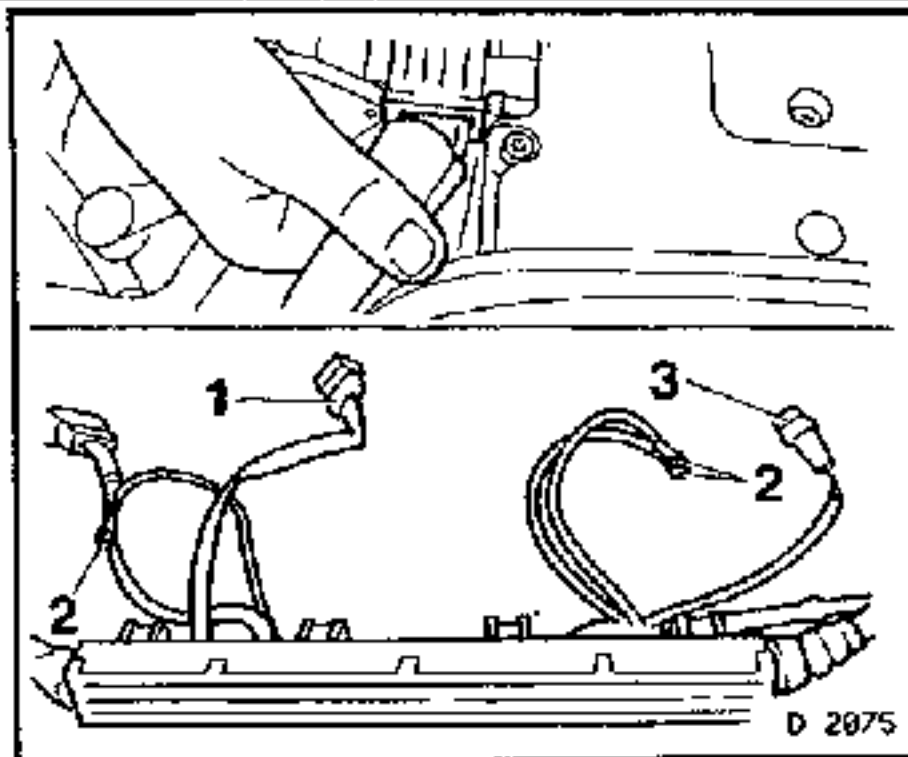
Plug strip from injectors.

Wiring harness plug (1) from throttle valve switch (M 2.5) or potentiometer (M 2.8).

Ground connections (2) from fuel distributor pipe.

Wiring harness plug (3) from controlled canister purge valve.

Lay injector plug strip towards the rear of the engine.

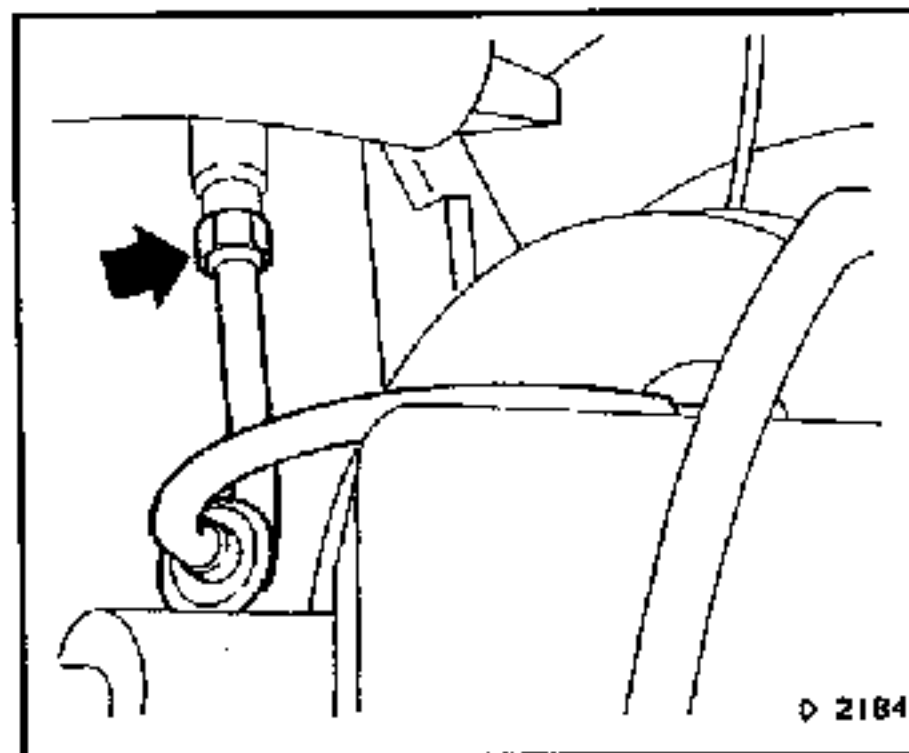


Remove, Disconnect

Brake servo vacuum line (arrow) from intake manifold.

Alternator. Refer to the Section "Alternator", in this Volume.

Coolant hose from the coolant reservoir tank.

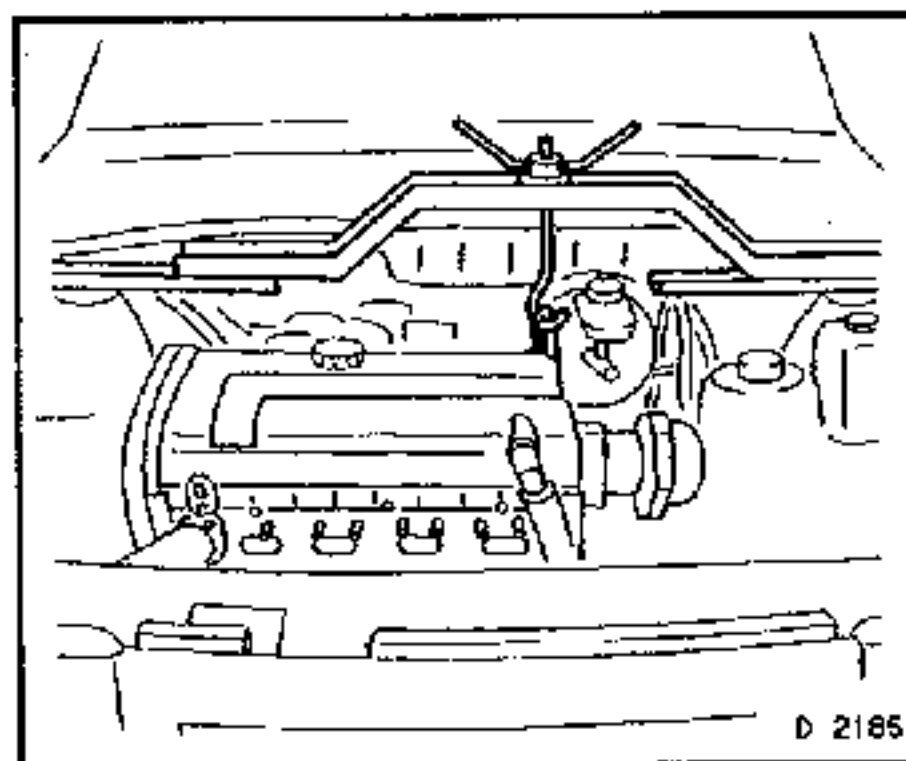


Remove, Disconnect

Clutch cable from the clutch release lever, the shift rod and shift guide. Refer to Section K "Clutch and Transmission" in Volume 4.

Upper transmission bolts from the cylinder block.

Attach engine holder KM-263-B.



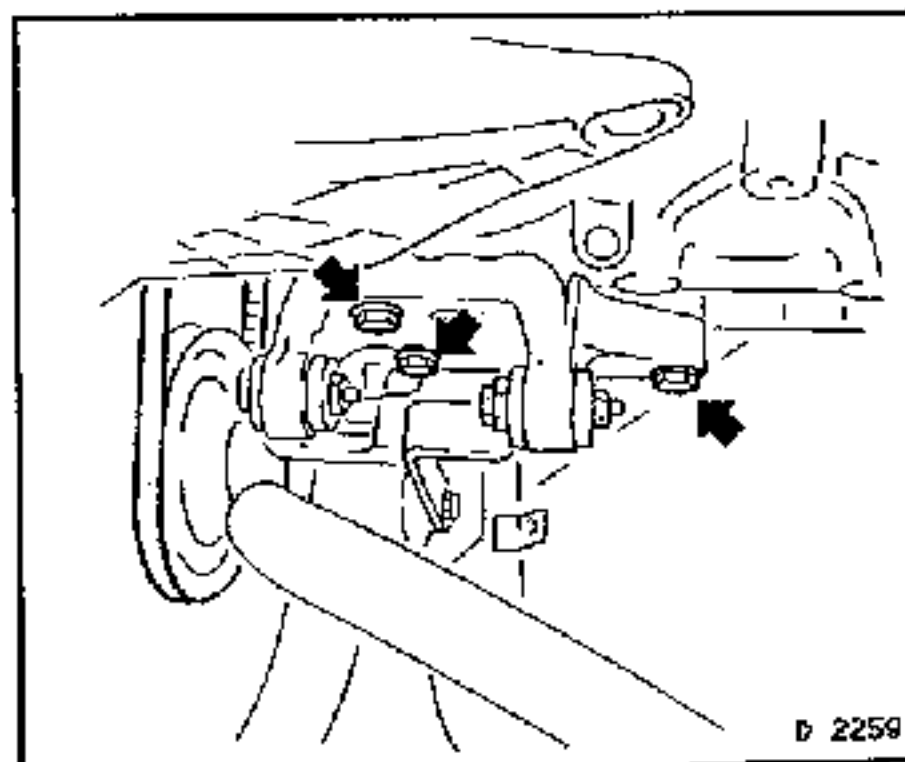
Remove, Disconnect

V-belts for power steering pump and A/C compressor.

Power steering pump (arrows) from cylinder block. Lay the pump and bracket to one side.

Important!

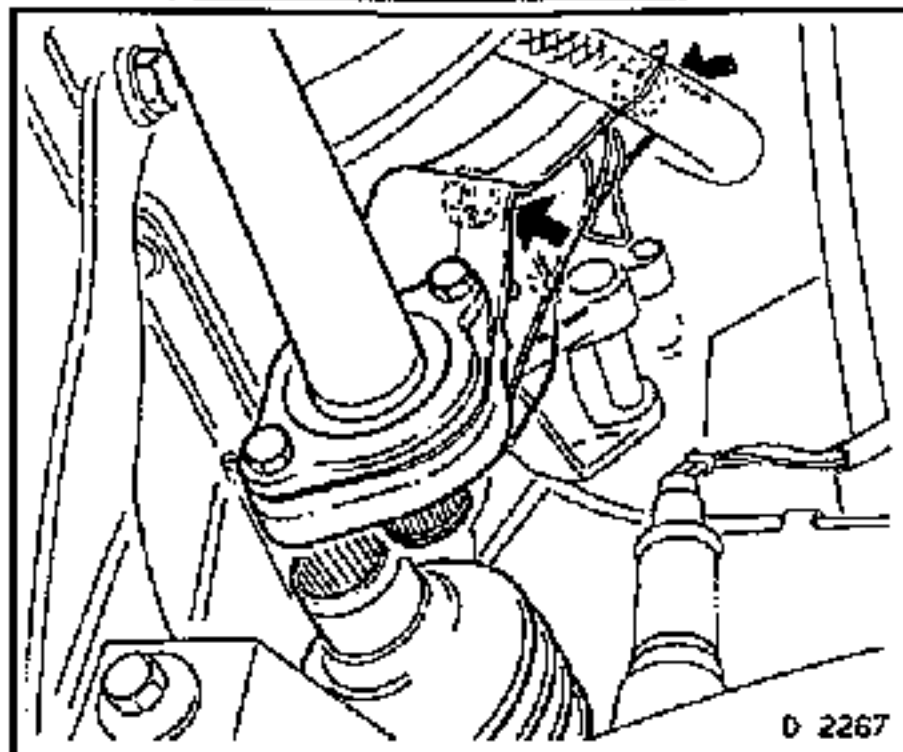
Leave the hydraulic system intact.



DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

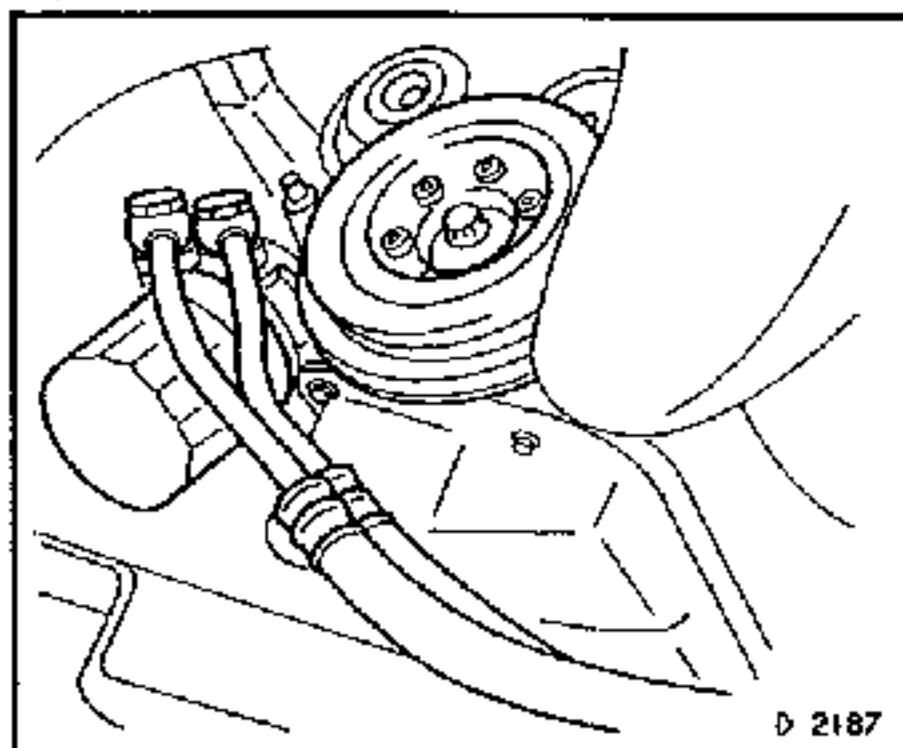
Intermediate shaft bracket (arrows), from cylinder block.



Remove, Disconnect

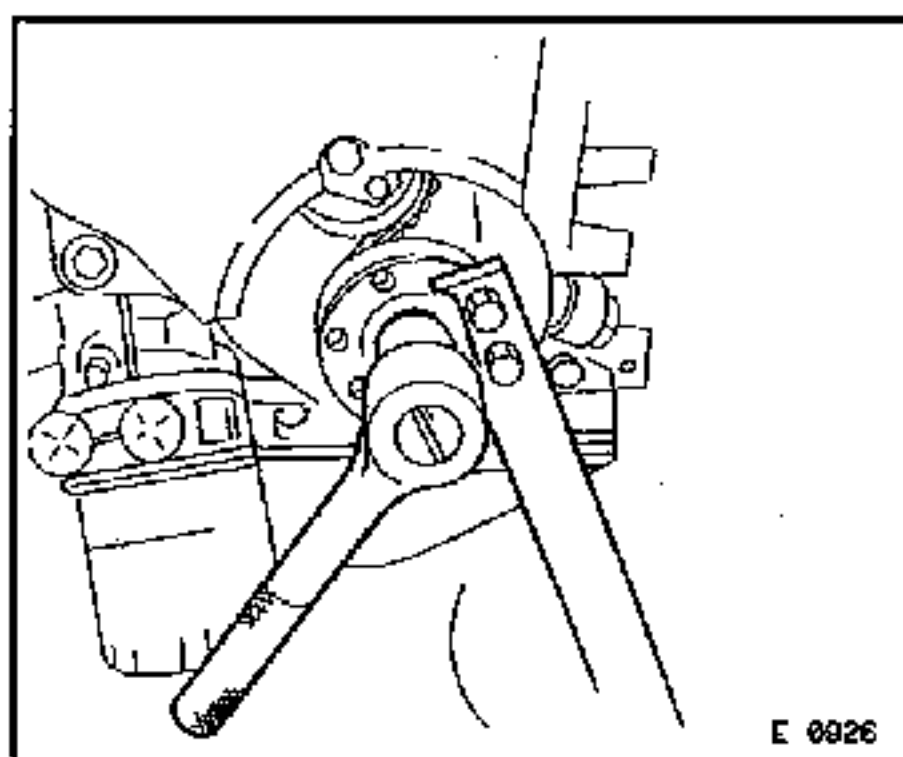
Crankshaft pulley, using KM-321-A. Hold the toothed belt drive gear with MKM-604-21 (Torx E 20) during this process.

Oil cooler lines and oil filter cartridge. Use a commercially available removal tool. Collect oil with a suitable sized clean container.



Remove, Disconnect

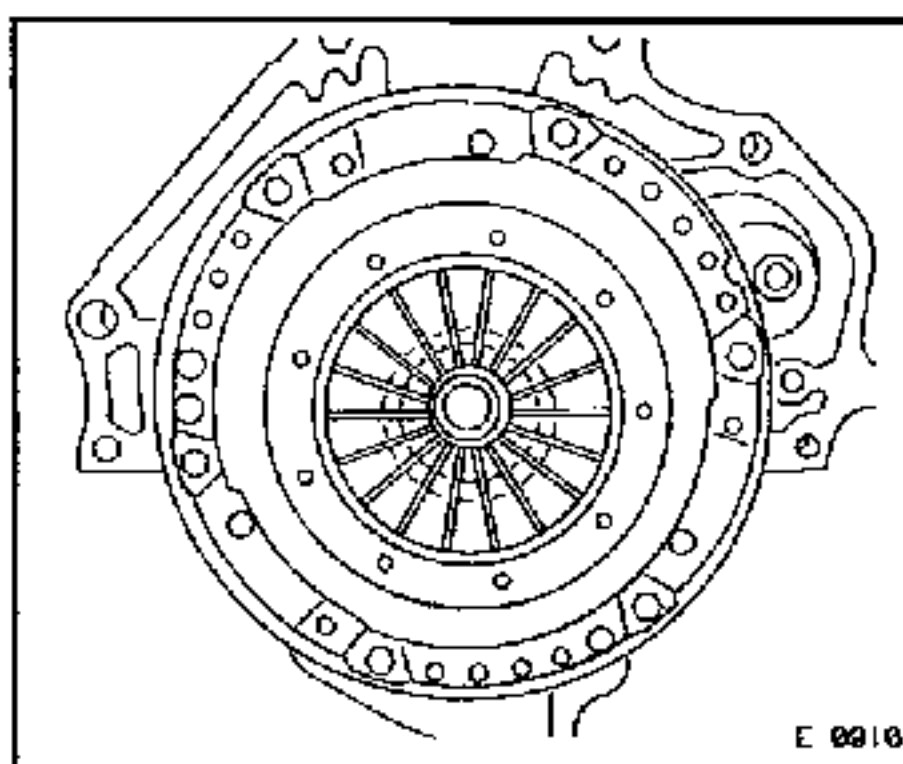
Fastening bolt for the toothed belt drive gear, using MKM-604-21 (Torx E 20). Hold the gear with holding wrench KM-662-A, as shown. Follow manufacturer's instructions.



Remove, Disconnect

Clutch assembly. Refer to Section K, "Clutch and Transmission", in Volume 4.

Wiring harness plug for dynamic oil level check.

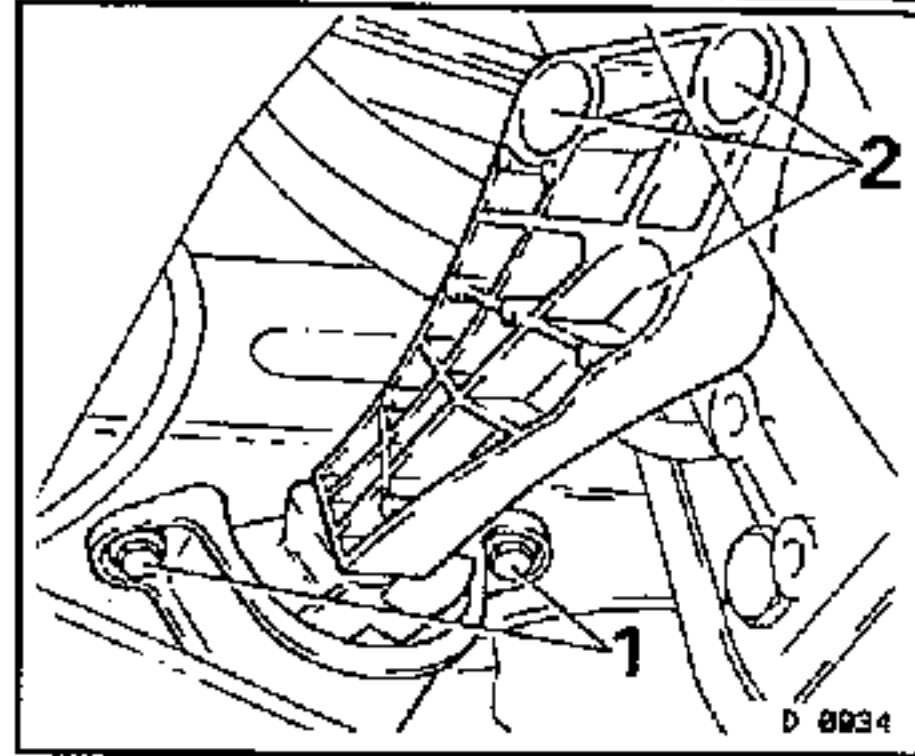


DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

Engine damping block (1) from the side member.

Bracket (2) from the cylinder block.



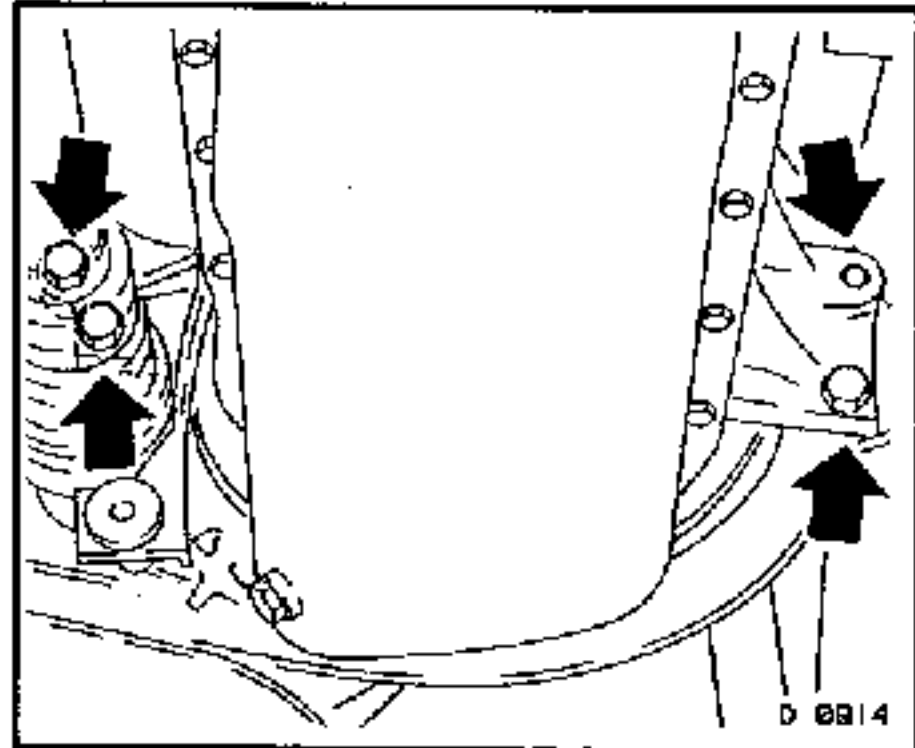
Remove, Disconnect

The lower transmission bolts (arrows) from the cylinder block.

Support engine with jack.

Remove holder KM-263-B.

Attach lifting cable to engine and support, pull the transmission from the engine and remove engine up and out of the engine compartment.



Install, Connect

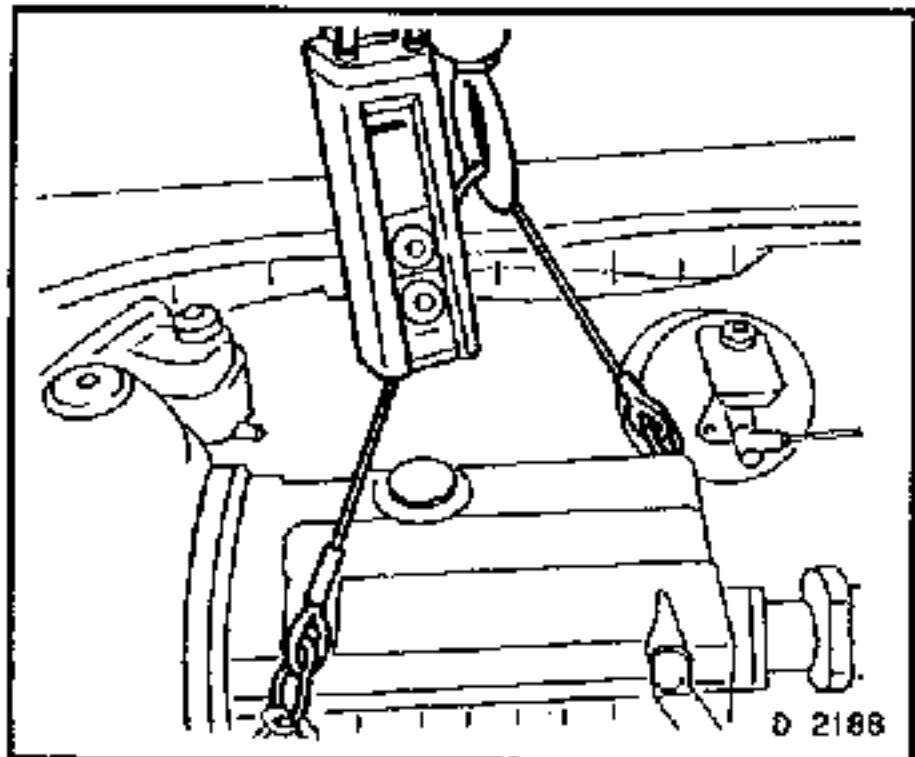
Lower engine, aligning the sleeves in the rear of the cylinder block, with the transmission.

Tighten (Torque)

Transmission to cylinder block,
upper bolts..... 75 Nm.

Install, Connect

Engine holder KM-263-B, then remove the supporting jack.



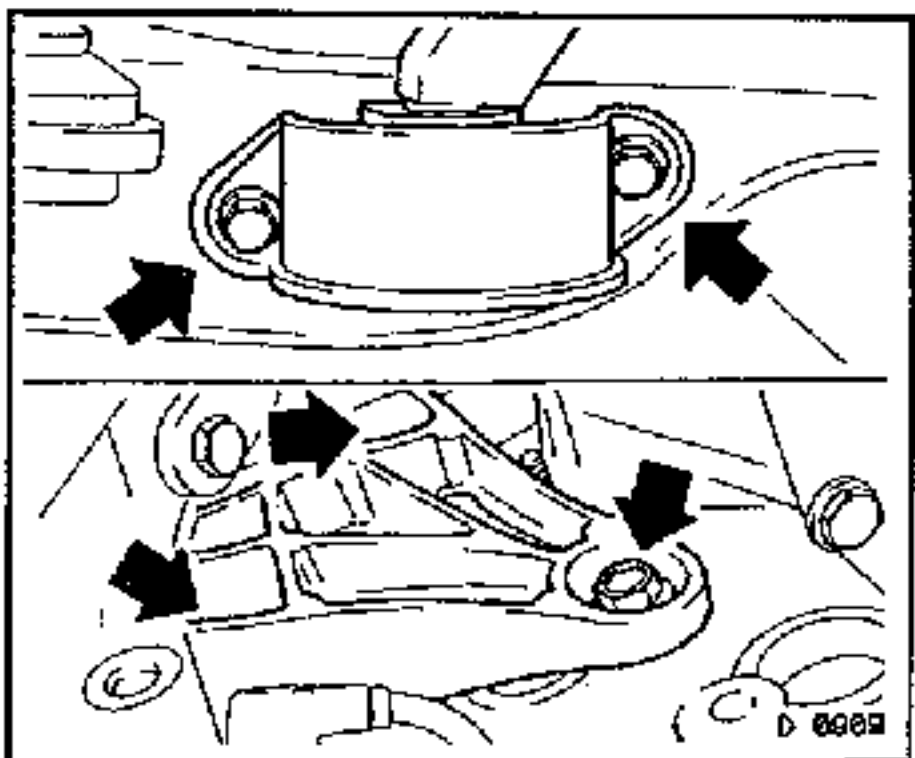
Tighten (Torque)

Transmission to cylinder block,
lower bolts..... 75 Nm

Engine suspension bracket to
cylinder block..... 60 Nm

Right engine damping block to
side member..... 65 Nm*

* Apply locking compound such as Loctite 242 or equivalent to Holden's Specification HN1256.

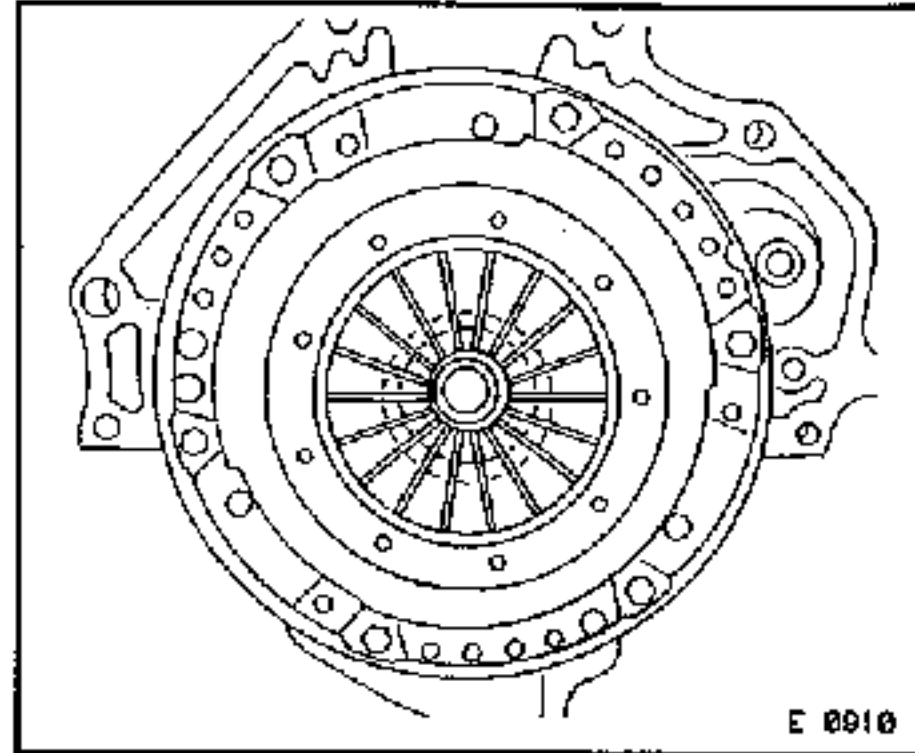


DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

Wiring harness plug for dynamic oil level check.

Clutch assembly. Refer to Section K, "Clutch and Transmission", in Volume 4.



Install, Connect

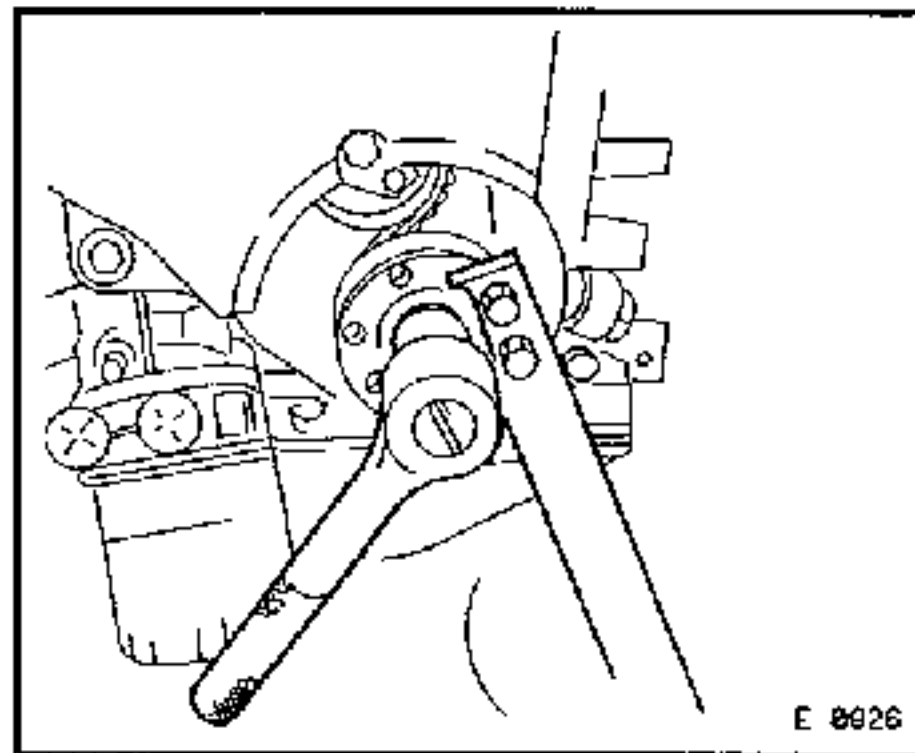
Toothed belt drive gear to crankshaft. Use holding wrench KM-662-A to hold while tightening with MKM-604-21 (Torx E 20)

Torque - Angle Method

Fastening bolt for toothed belt drive gear to crankshaft..... 250 Nm + 40° + 50°

Important!

Use a new bolt and apply grease to the threads before installation.

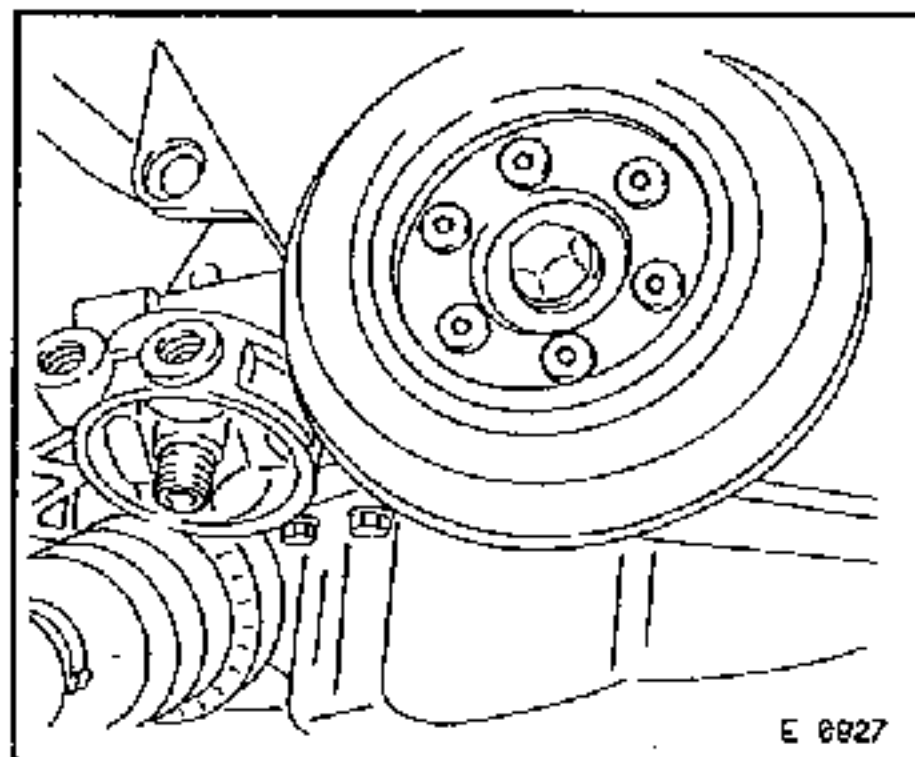


Install, Connect

Crankshaft pulley, using KM-321-A, while holding the toothed belt drive gear with MKM-604-21 (Torx E 20).

Tighten (Torque)

Crankshaft pulley to toothed belt drive gear..... 20 Nm



install, Connect

Oil filter to oil pump, after filling with clean engine oil.

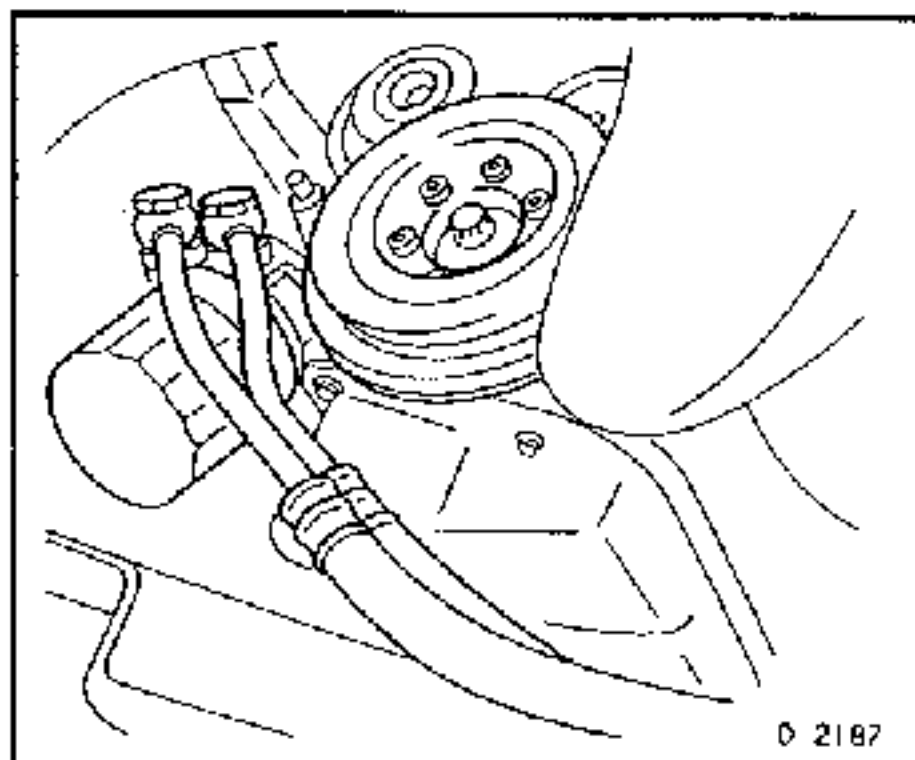
Oil cooler lines to adaptor.

Tighten (Torque)

Oil filter to oil pump..... 15 Nm
Oil cooler lines to adaptor..... 38 Nm

Note:

Use a thin film of clean engine oil on the new filter seal ring, before installation.



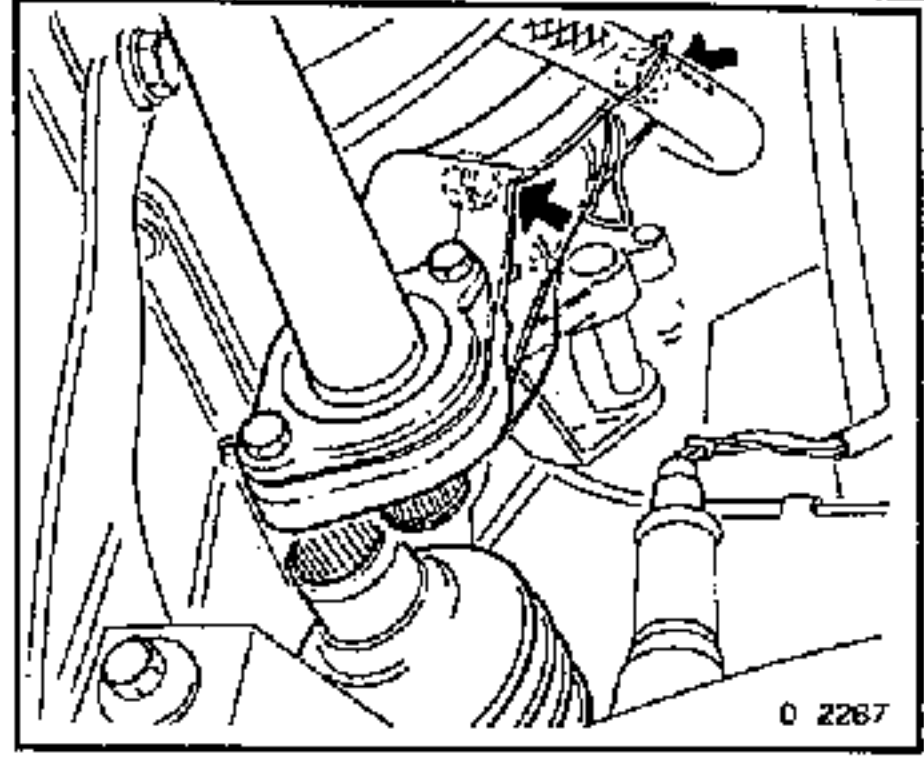
DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

Intermediate shaft bracket.

Tighten (Torque)

Intermediate shaft bracket to cylinder block..... 55 Nm



Install, Connect

Power steering pump bracket to cylinder block.

Tighten (Torque)

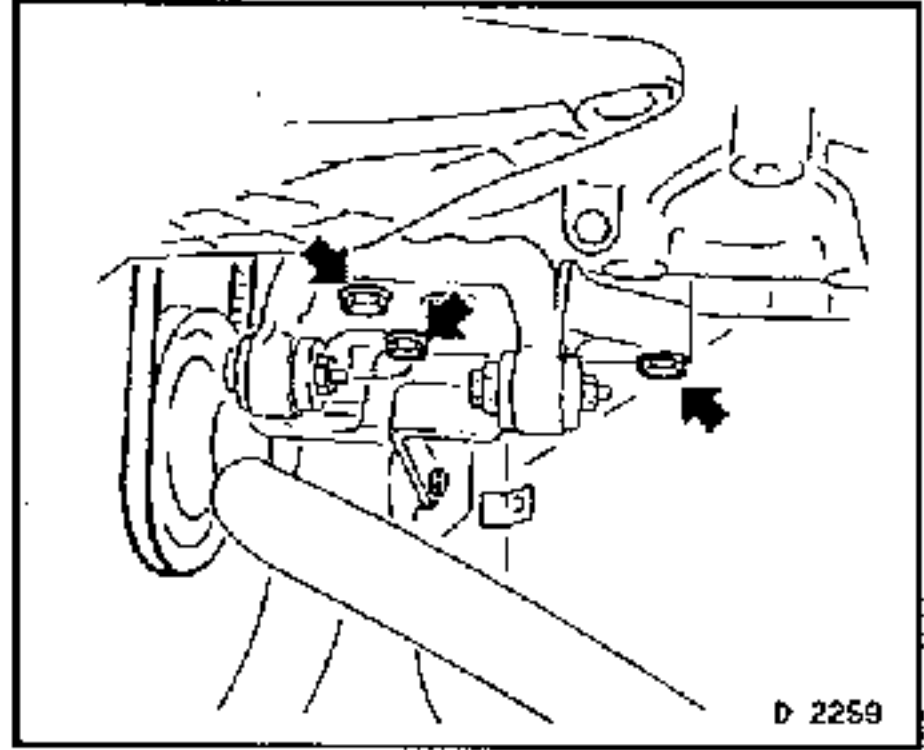
Power steering pump bracket to cylinder block..... 40 Nm

Adjust

V-belt tension. Refer to "Checking and Adjusting Procedures", in this Volume.

Note:

All V-belts have the same tension specification.



Install, Connect

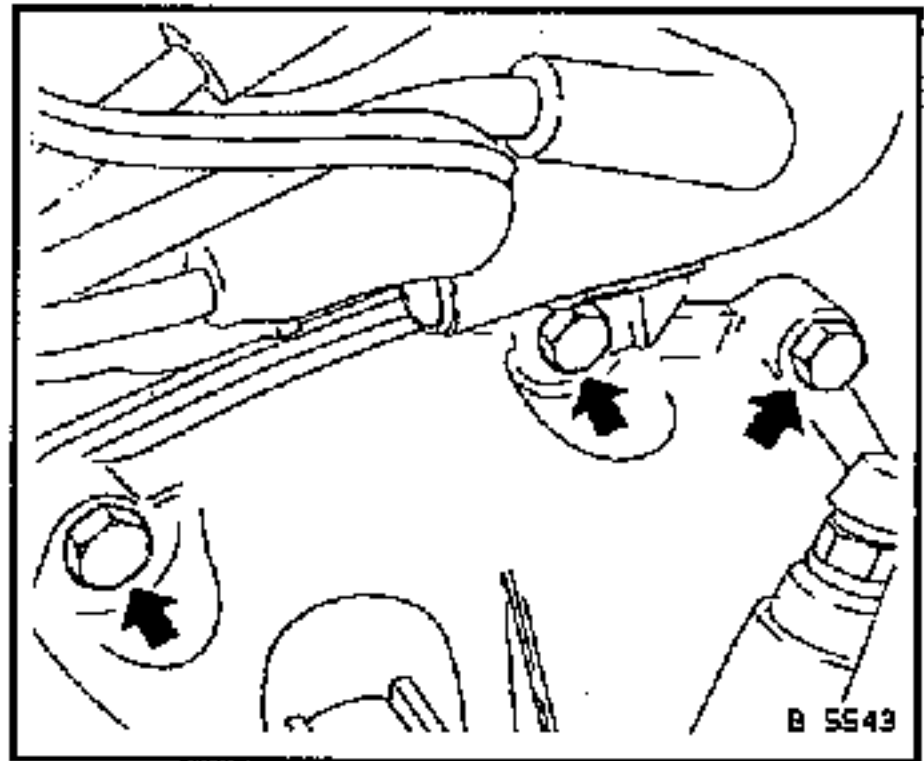
Transmission to cylinder block upper bolts.

Tighten (Torque)

Transmission to cylinder block upper bolts..... 75 Nm

Install, Connect

Shift guide, shift rod and clutch cable. Refer to Section K "Clutch and Transmission", in Volume 4.



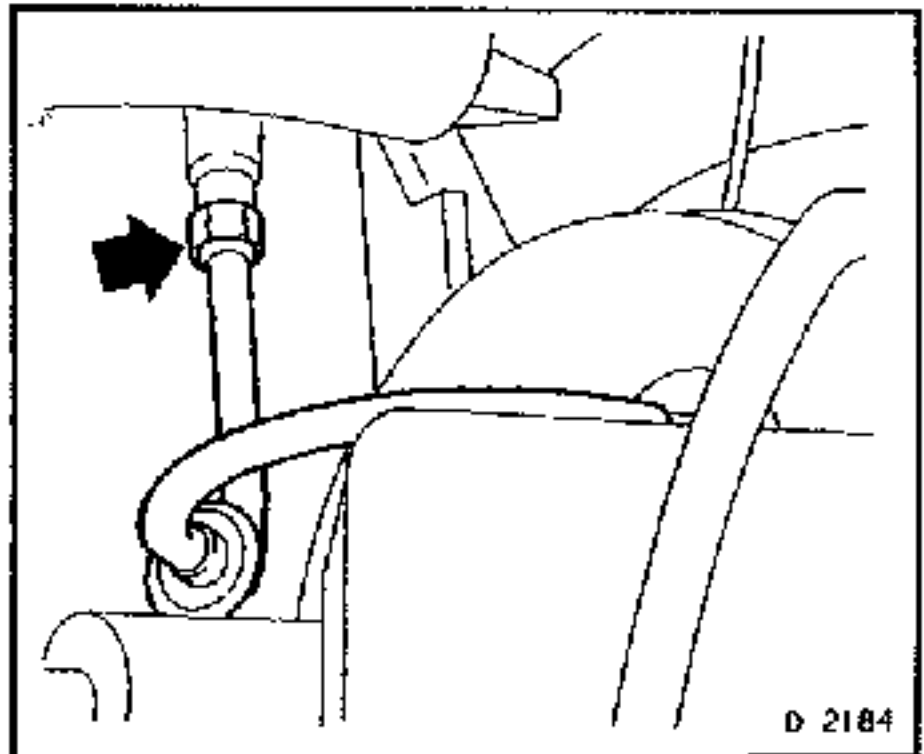
Install, Connect

Alternator. Refer to the Section "Alternator", in this Volume.

Coolant hoses to coolant reservoir tank.

Tighten (Torque)

Brake servo vacuum line to intake manifold 20 Nm



DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

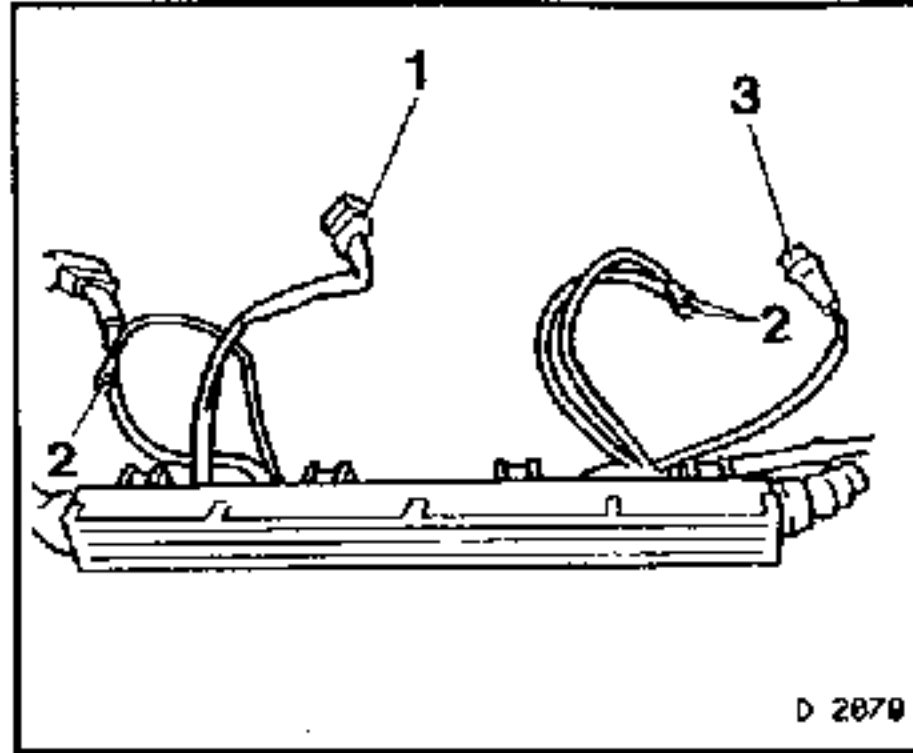
Wiring harness plug (3) and vacuum hose to controlled canister purge valve.

Ground connections (2) to fuel distributor pipe.

Wiring harness plug (1) to throttle valve switch (M 2.5) or potentiometer (M 2.8).

Injector plug strip to injectors.

Check that all ground connections are in good condition and secure.



Install, Connect

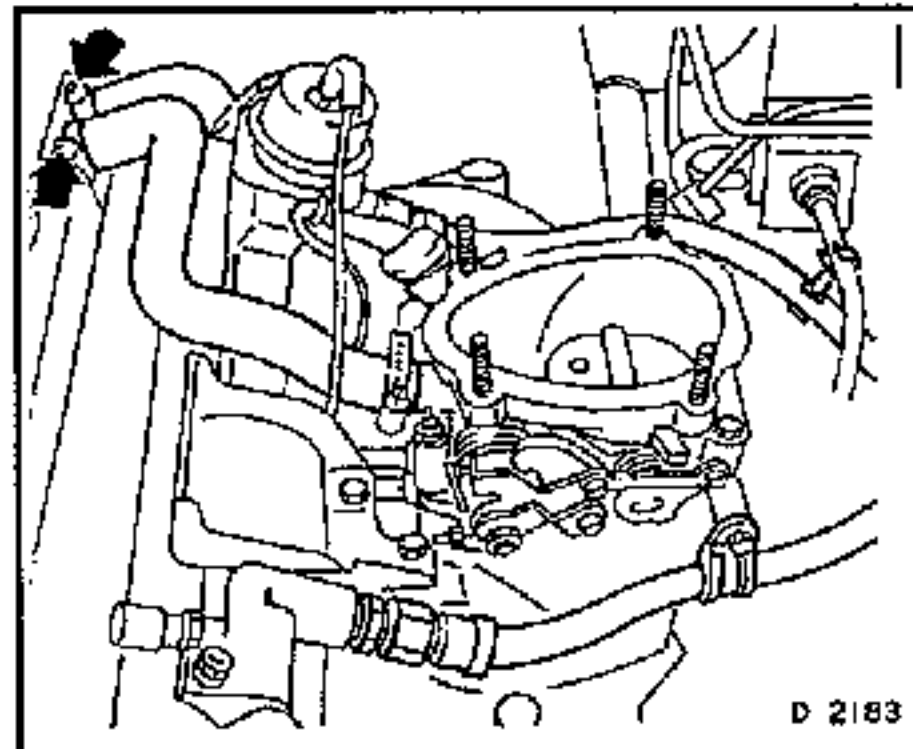
Hose connections (arrows) to cylinder head cover.

Fuel lines. Remove clamps.

Bowden cable. Install with no tension on the cable.

Engine to body harness multi-plug.

Reversing lamp, wiring harness plug.



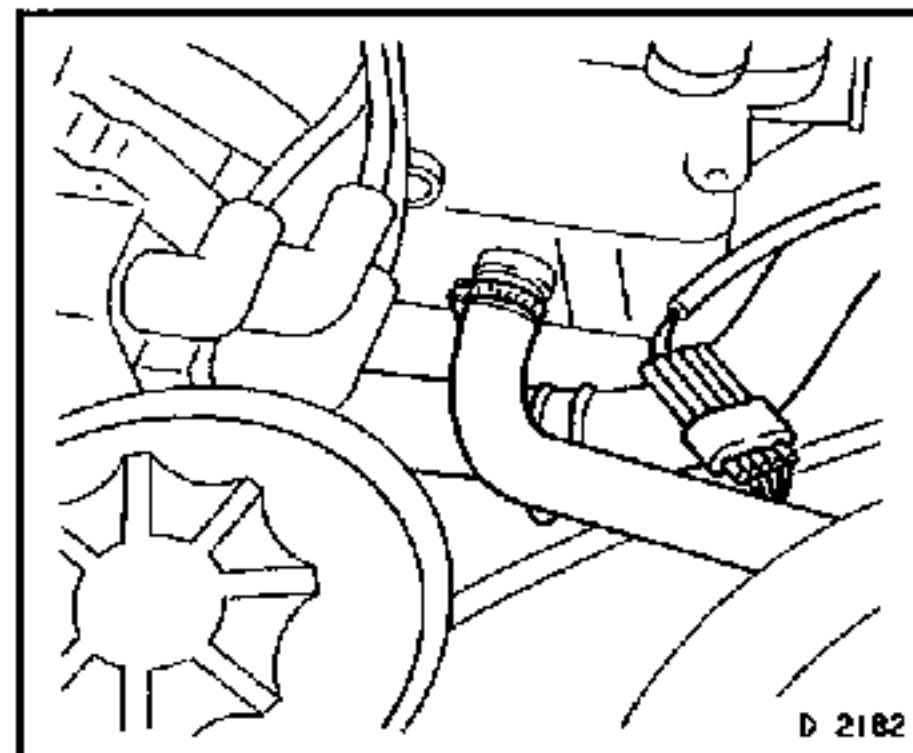
Install, Connect

Multi-plug.

Coolant hoses to coolant pipe.

Coolant hose to cylinder head.

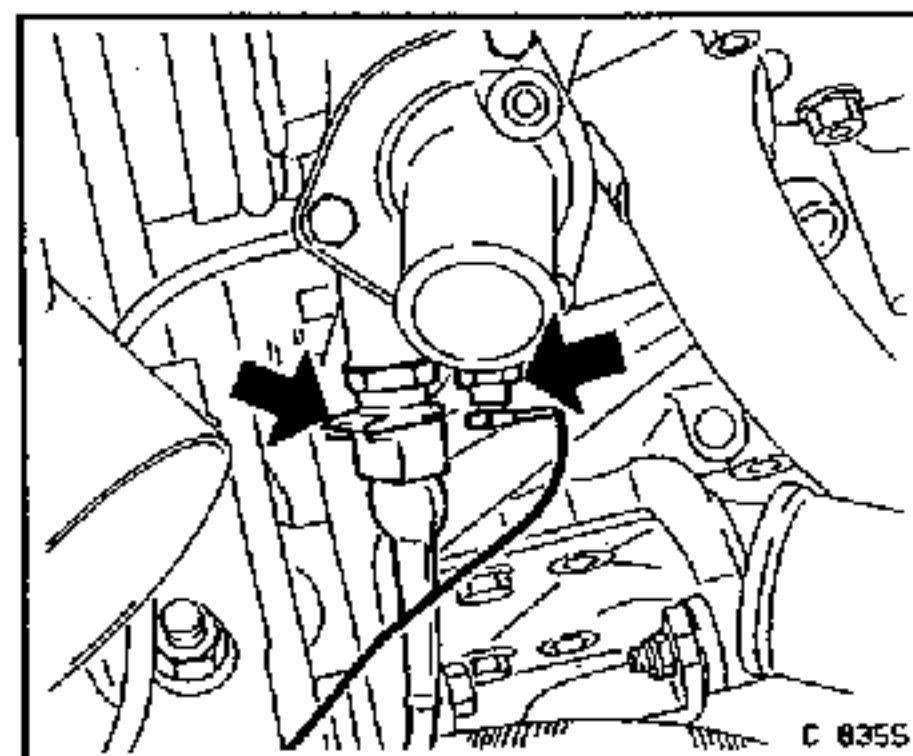
Wiring harness plug a high voltage cable to high voltage distributor.



Install, Connect

Performance header. Refer 'Gasket, Performance Header to Cylinder Head, Replace', in Section, 'Cylinder Head', in this Volume.

Wiring harness plugs (arrows) and upper coolant hose to thermostat housing.



DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

Air cleaner housing. Refer to 'Air Cleaner Housing, Remove', in the Section "Engine Timing Side, Air Cleaner", in this Volume.

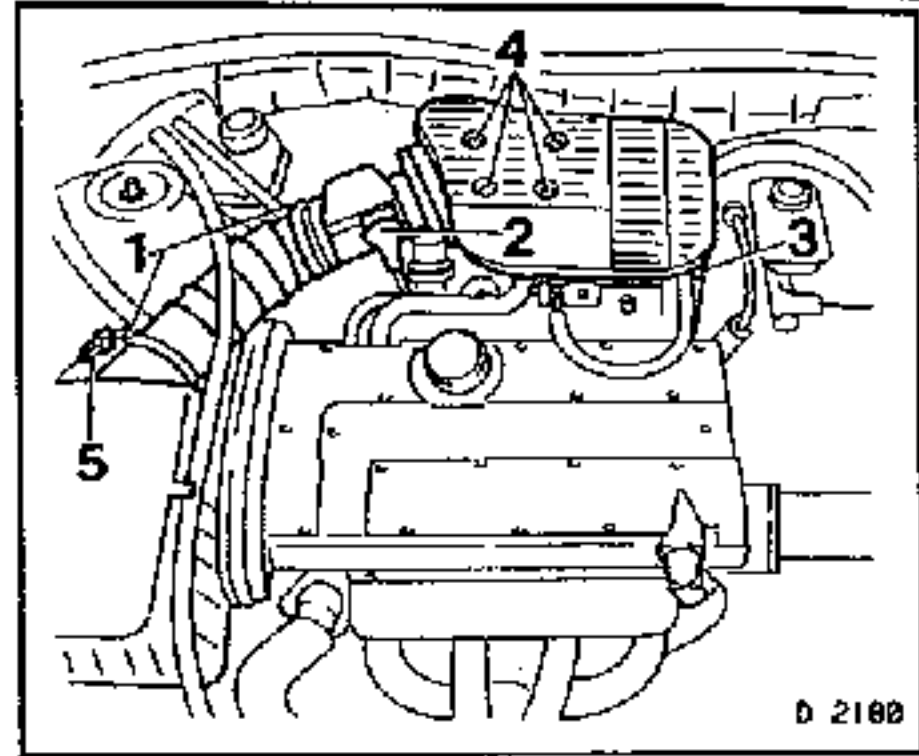
Wiring harness plug (5) to inductive pulse pick-up.

Pre-volume chamber (4) with mass air flow meter.

Idle speed adjuster hose (3) to pre-volume chamber.

Wiring harness plug (2) to mass air flow meter.

Air intake hose (1).



Install, Connect

Fan motor wiring harness plug (arrow).

The lower coolant hose to the radiator.

Ground cable to battery.

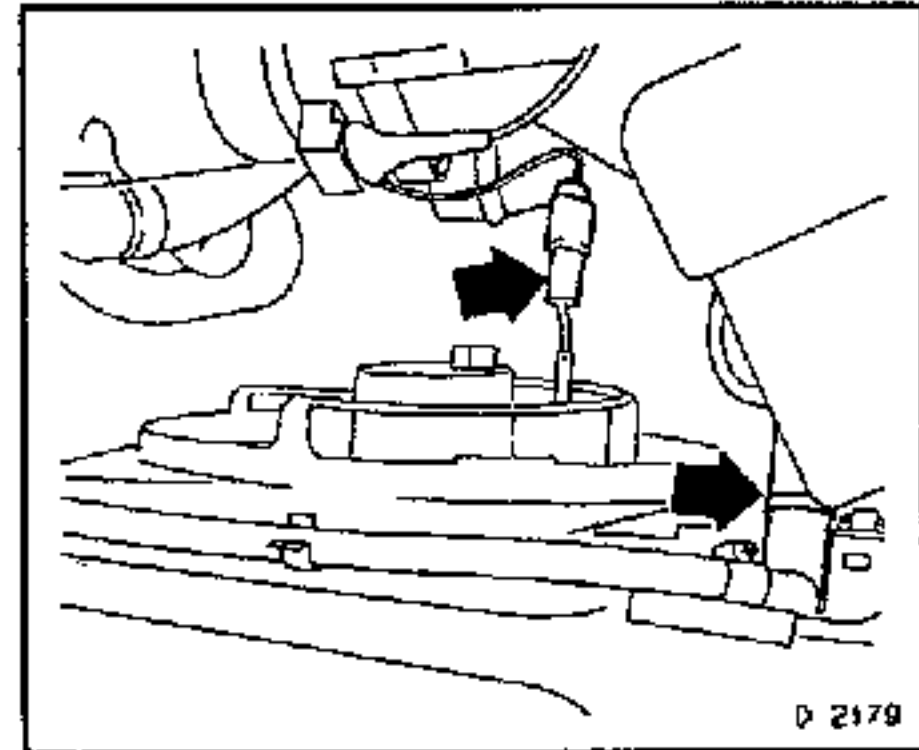
Engine compartment cover.

Bonnet.

Inspect

Engine oil level, topping up as necessary.

Top up and bleed cooling system. Refer to "Cooling System", in this Volume.



Engine with Transmission, Remove and Install (C 20 XE or C 20 LET with Pot Flywheel)

Remove, Disconnect

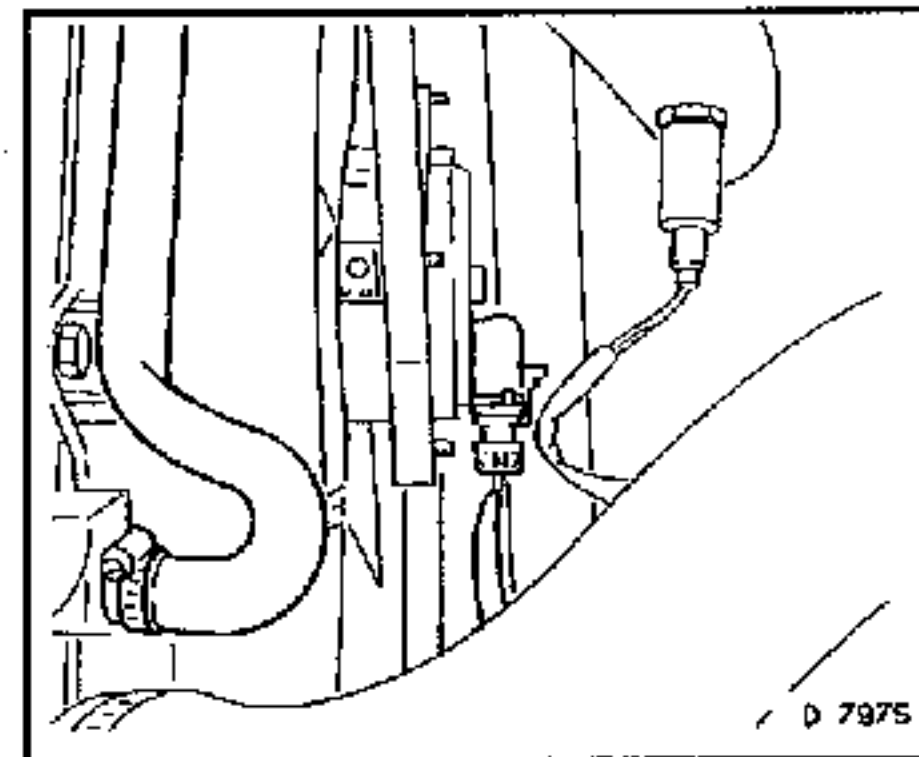
Engine compartment cover.

Battery.

Disconnect fan motor wiring harness plug.

Radiator fan shroud with fan motor, from radiator. Remove upwards.

The lower coolant hose from the radiator. Collect coolant in a suitable sized, clean container.

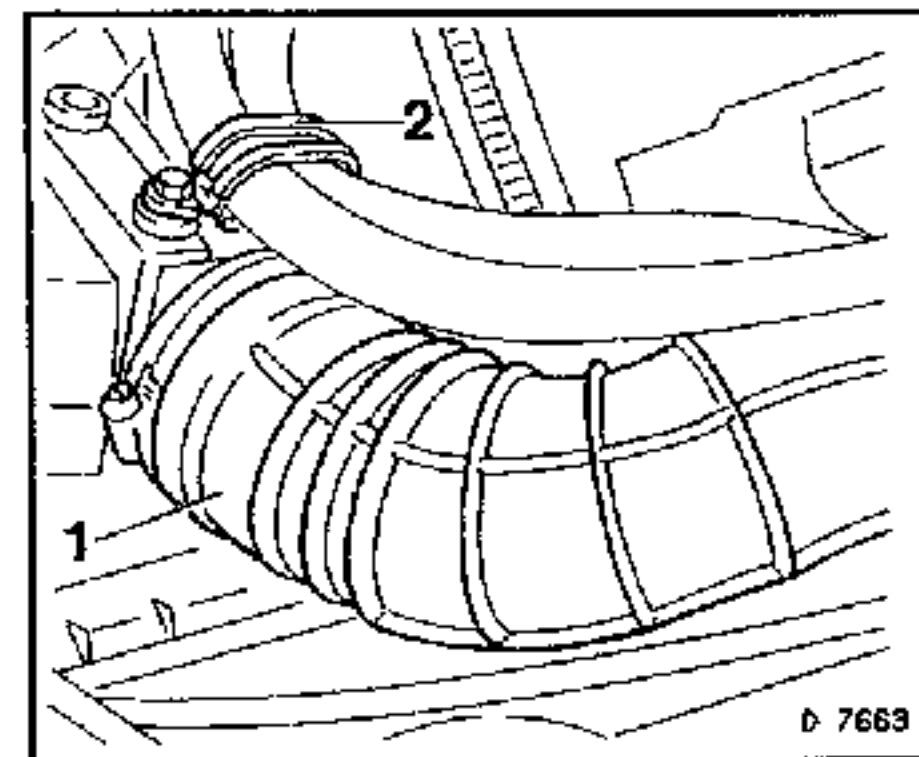


Remove, Disconnect

For C 20 LET:

Air hose (1) and retainer (2). Plug turbocharger openings to prevent dirt entry.

Cover from throttle valve manifold.



DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

For C 20 XE:

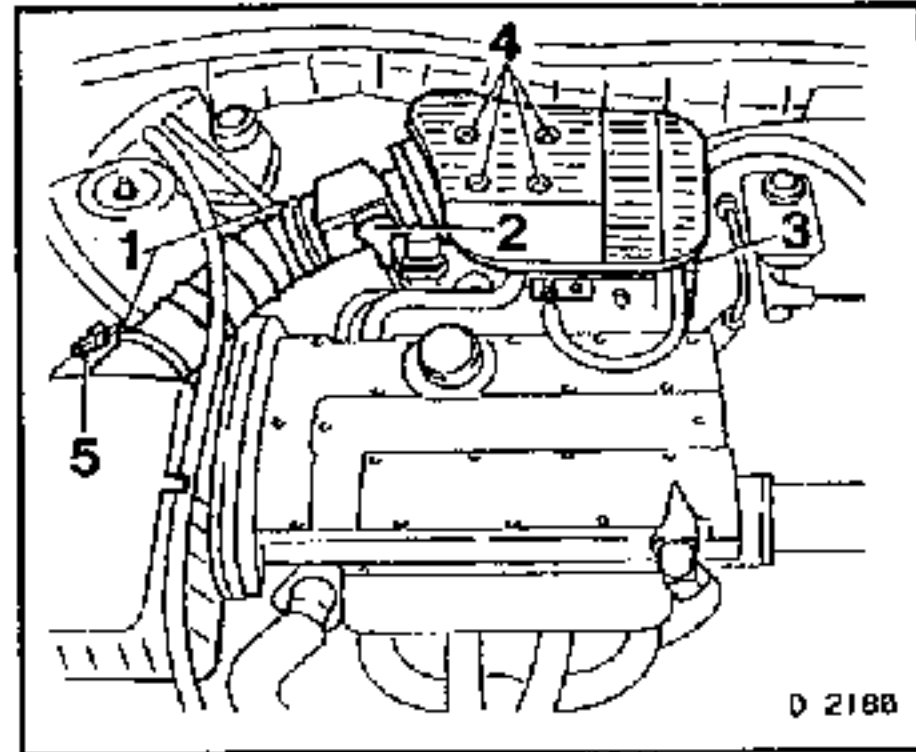
Air intake hose (1).

Wiring harness plug (2) from mass air flow meter.

Idle speed adjuster hose (3) from the pre-volume chamber.

Pre-volume chamber with mass air flow meter (4).

Wiring harness plug (5) from inductive pulse pick-up.

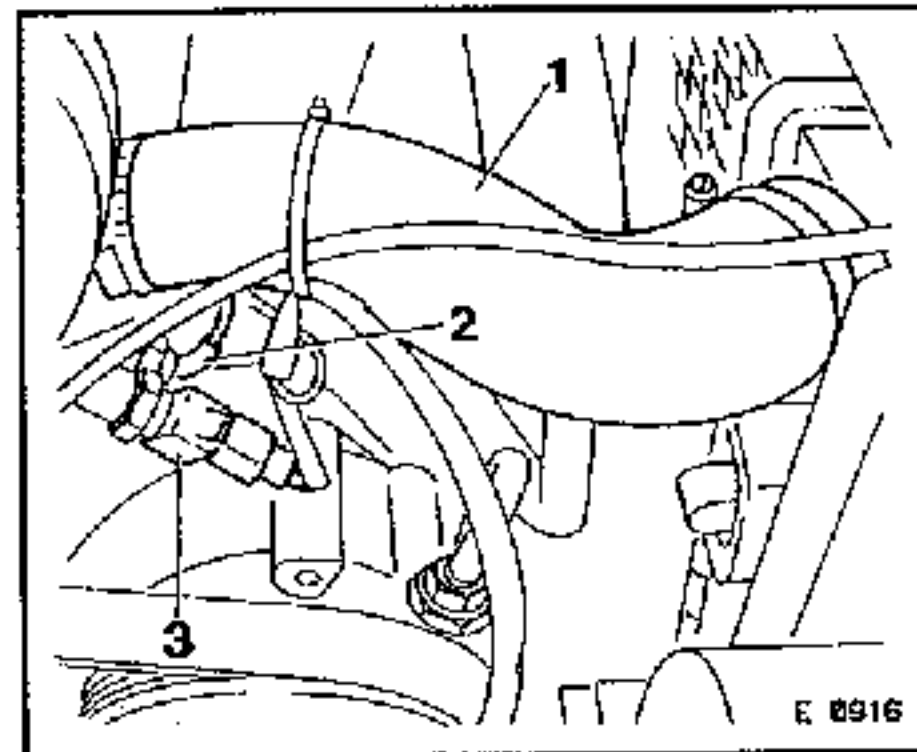


Remove, Disconnect

Coolant hose (1).

Wiring harness plugs (2 and 3) from the thermostat housing.

Coolant hoses from the coolant reservoir tank.

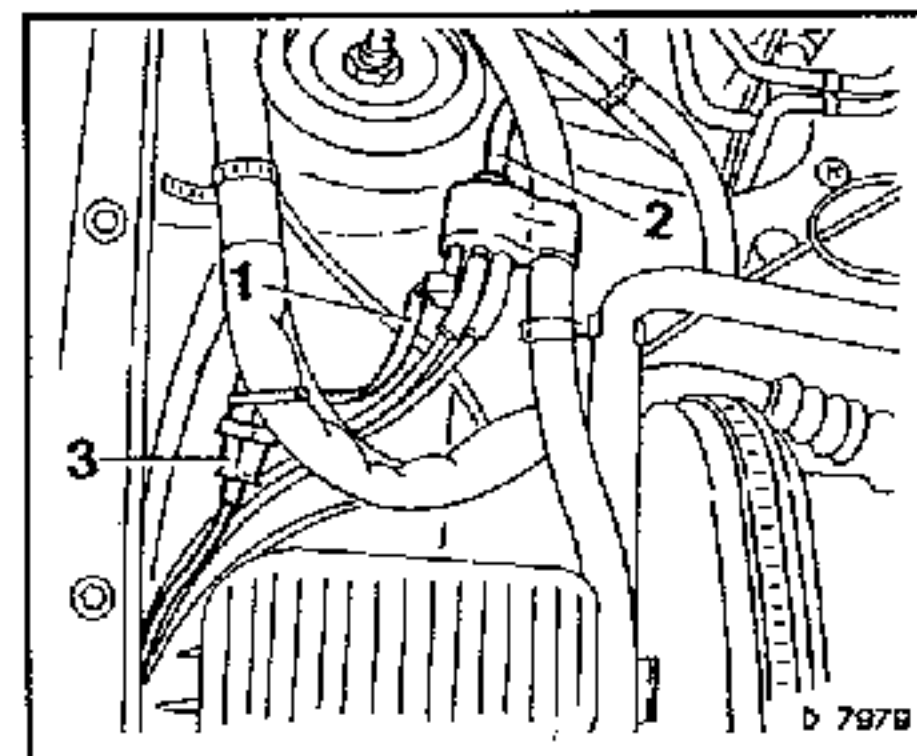


Remove, Disconnect

For C 20 LET:

Wiring harness plug (1) and hose (2) from the charge pressure switch-over valve.

Wiring harness plug (3).

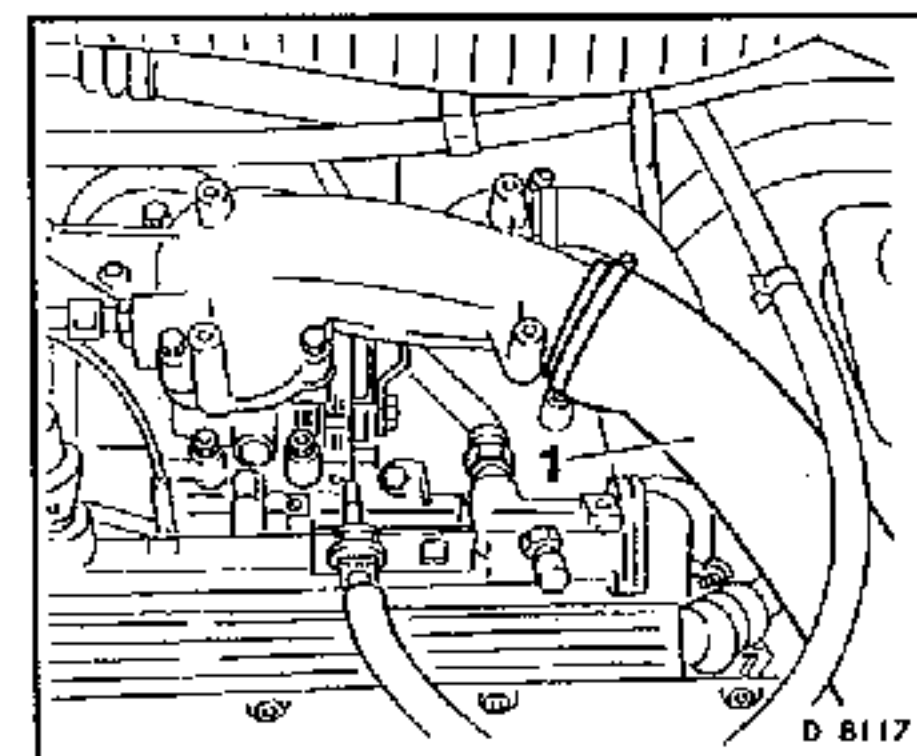


Remove, Disconnect

For C 20 LET:

Air hose (1) from charge air cooler and throttle valve manifold.

Throttle housing to control unit vacuum hose.

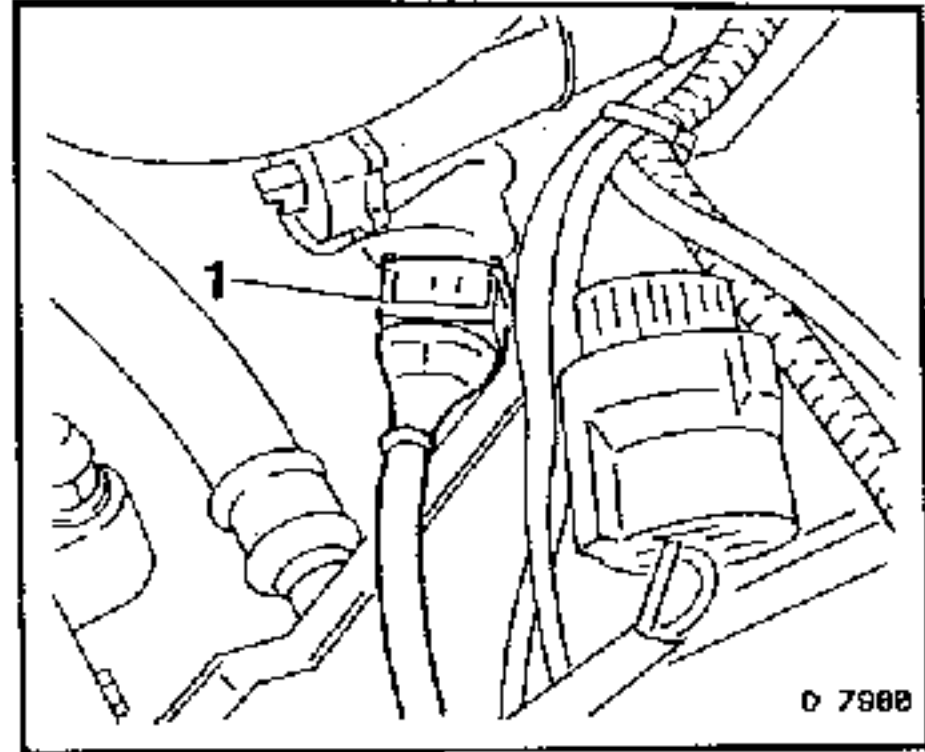


DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

Wiring harness plug (1) from ignition coil control unit.

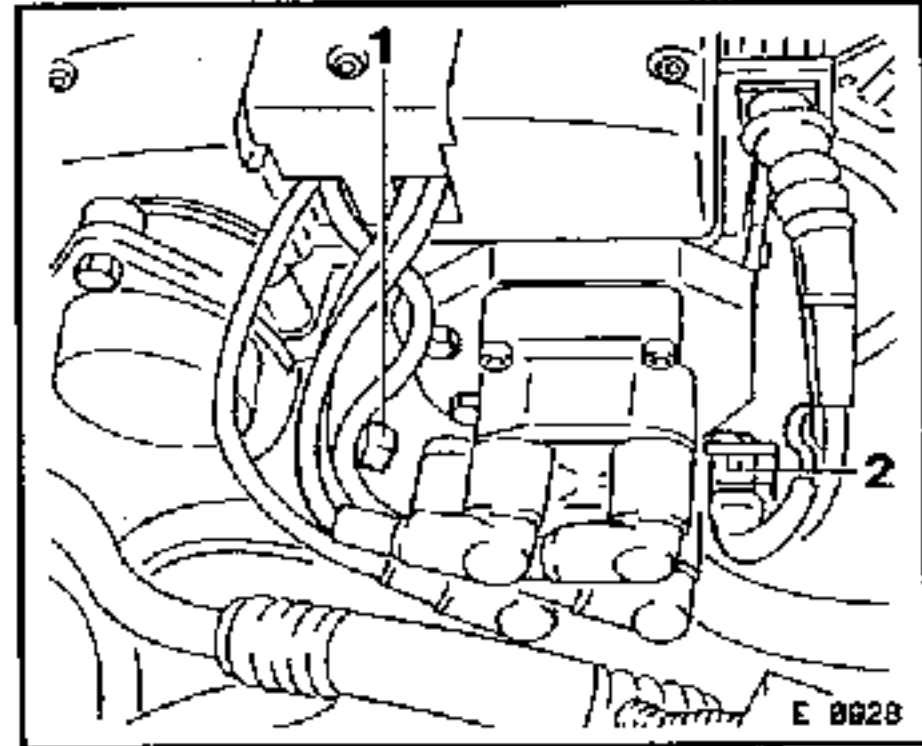
Wiring harness plug and high voltage cable from high voltage distributor.



Remove, Disconnect

For C 20 XE: Engine as of MY'93:

Wiring harness plug from camshaft sensor (1) and dual spark ignition coil (2).



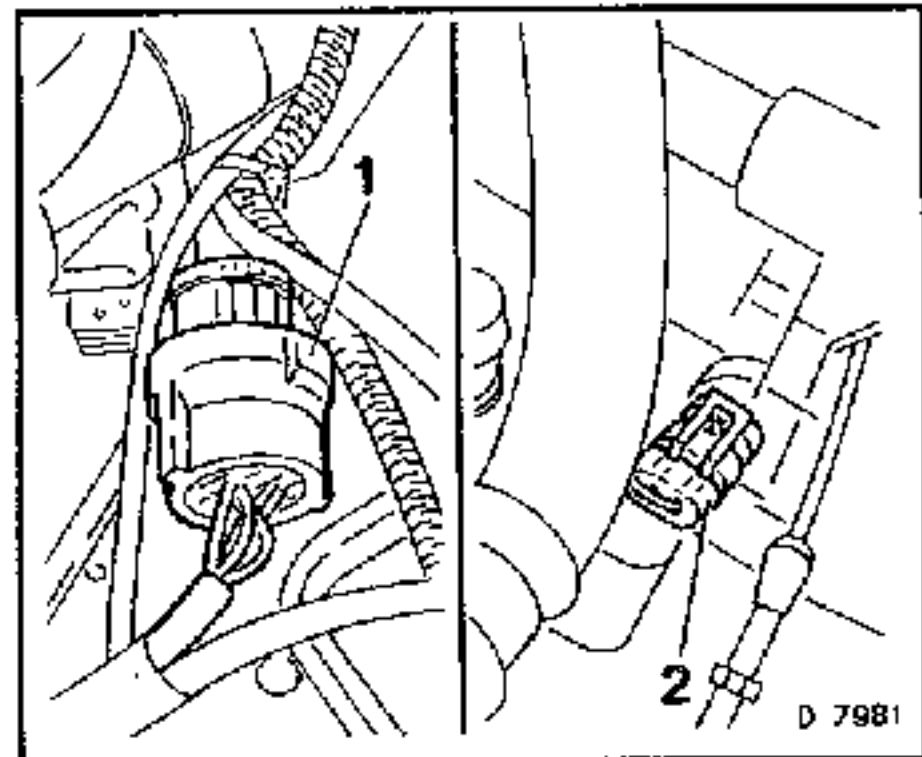
Remove, Disconnect

Engine to body harness multi-plug.

Wiring harness plug (2) for reversing lamp.

For C 20 LET only:

Wiring harness plug from 1st gear recognition switch.



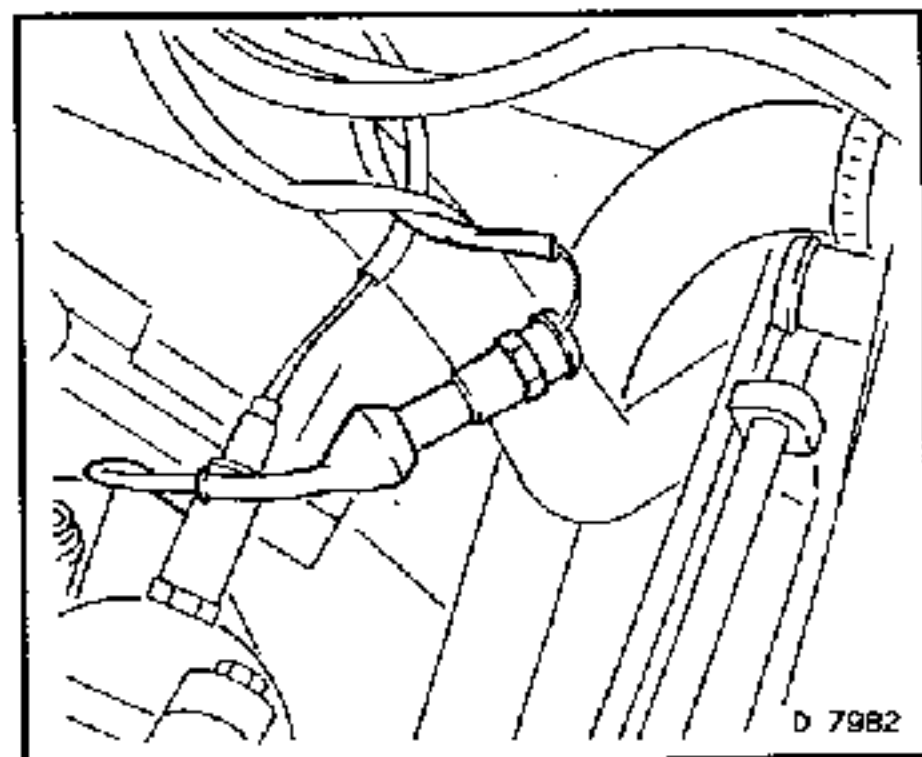
Remove, Disconnect

Wiring harness plug from dynamic oil level check.

Wiring harness plug from oxygen sensor, at bulkhead.

For C 20 LET only:

Transfer box temperature sensor wiring harness plug.



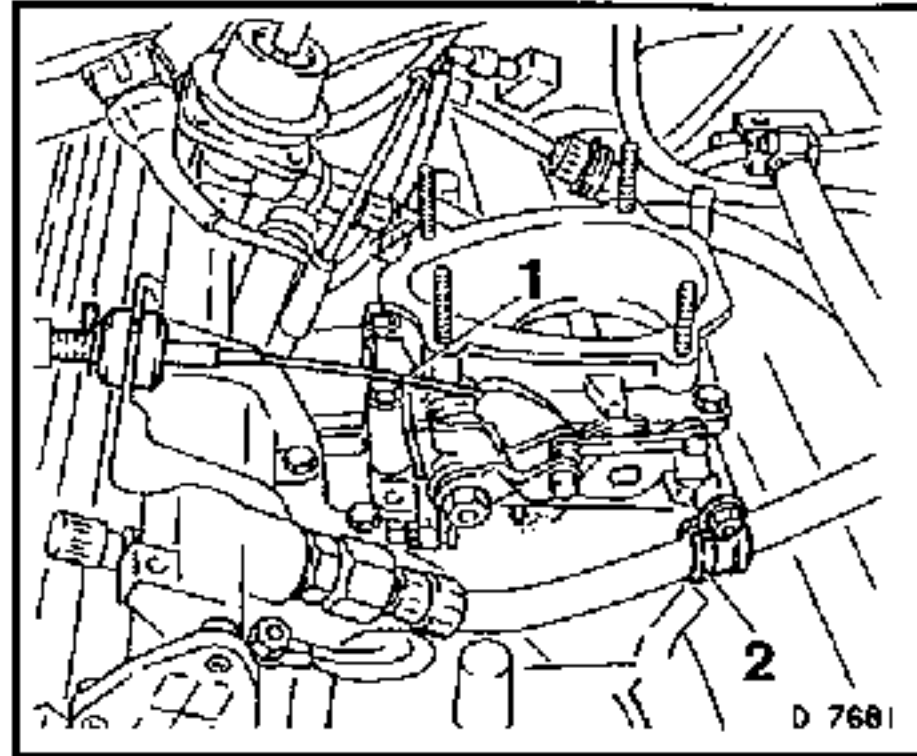
DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

Bowden cable (1).

Fuel lines, sealing first with suitable clamps to prevent fuel spillage.

Fuel line bracket (2) from throttle body.



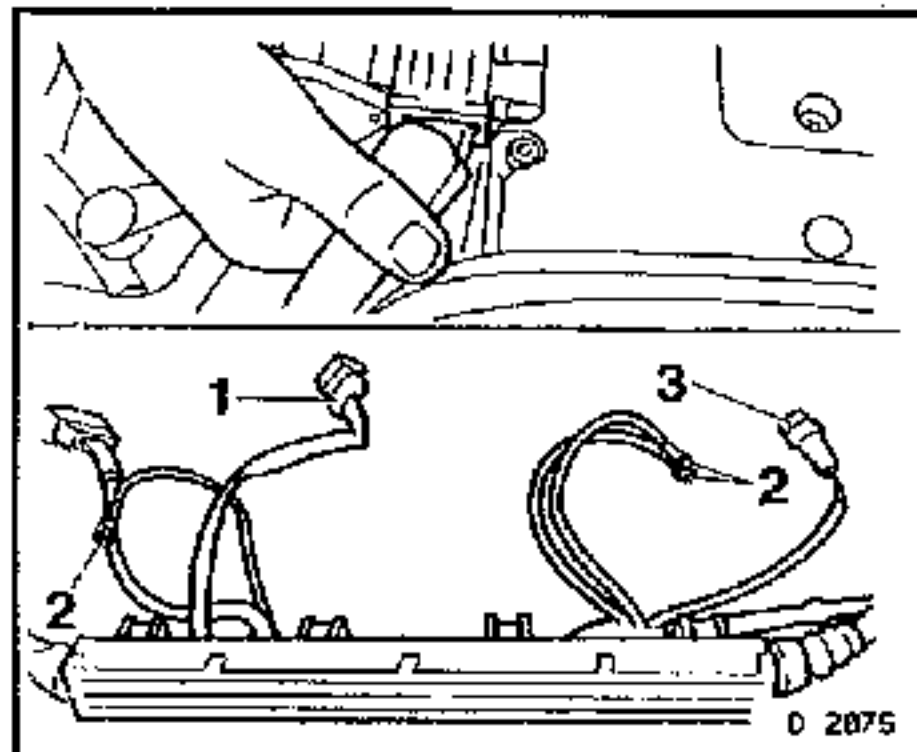
Remove, Disconnect

For C 20 XE:

Wiring harness plug from throttle valve switch (M 2.5) or potentiometer (M 2.8).

Ground connections (2) from fuel distributor pipe.

Wiring harness plug (3) from controlled canister purge valve.



Remove, Disconnect

For C 20 LET:

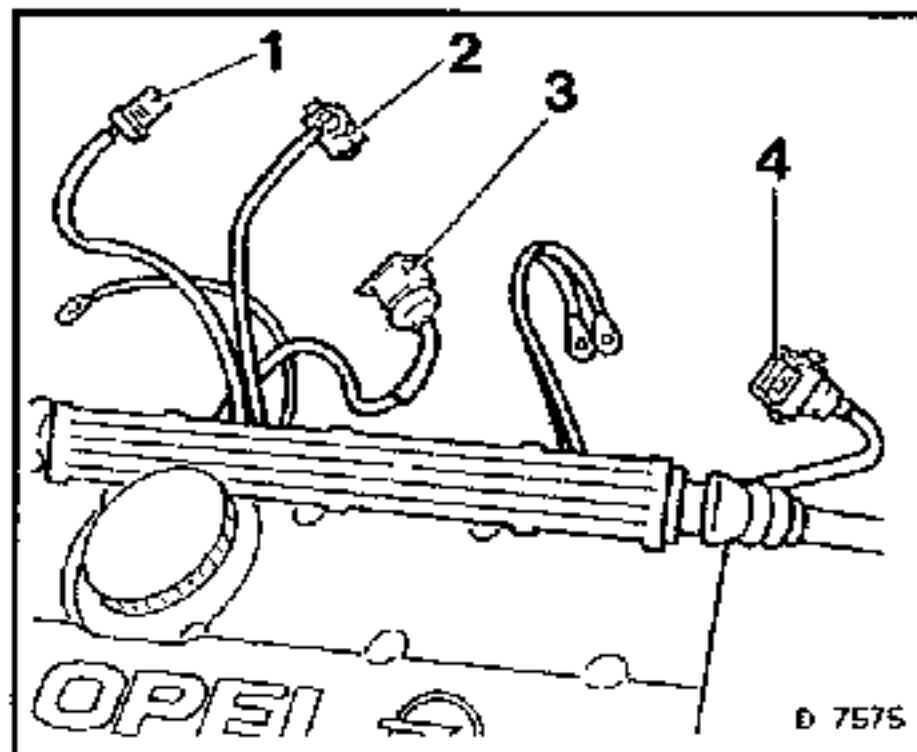
Wiring harness plug (1) from hot start valve.

Wiring harness plug (2) from intake air temperature sensor.

Wiring harness plug (3) from throttle valve potentiometer.

Wiring harness plug (4) from controlled canister purge valve.

After pulling back the retaining clamp at the No. 1 fuel injector, remove the injector plug strip and lay the wiring harness to one side.

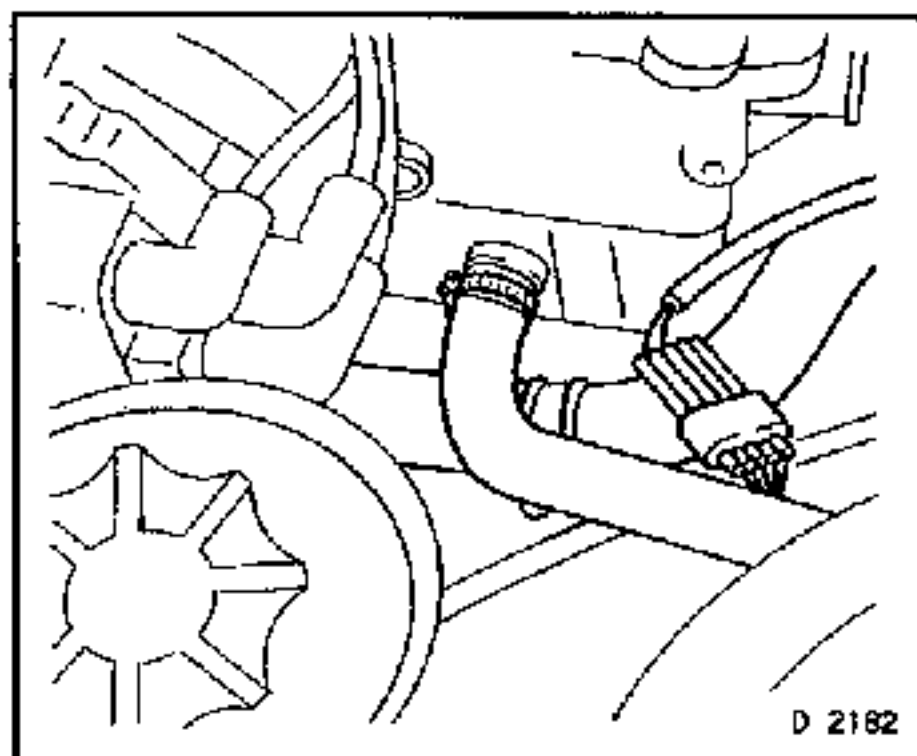


Remove, Disconnect

Coolant hose from cylinder head.

Coolant hoses from the coolant pipes.

Multi-plug.



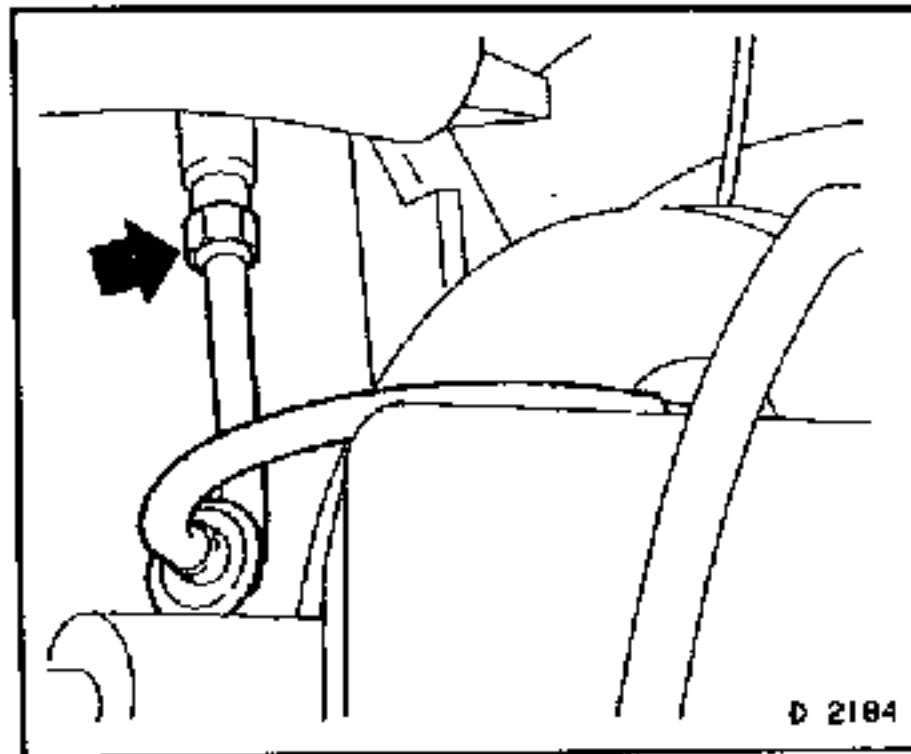
DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

Brake servo vacuum line (arrow) from intake manifold.

Vacuum hose from the controlled canister purge valve.

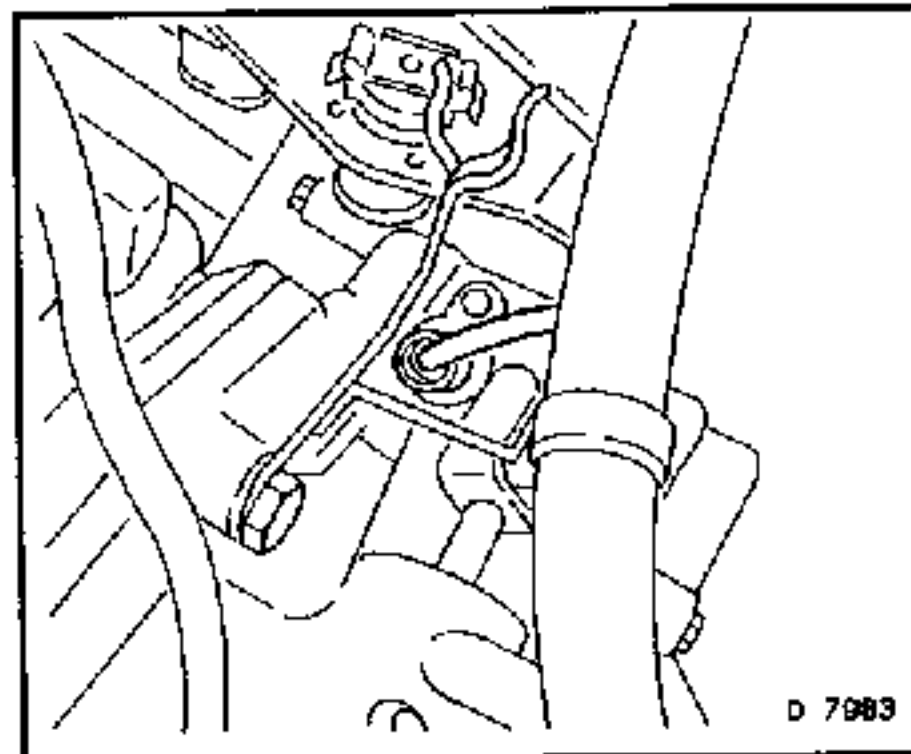
Clutch cable from the clutch release lever. Refer to Section K, "Clutch and Transmission." in Volume 4.



Remove, Disconnect

Speedometer cable or wiring harness plug for odometer frequency sensor.

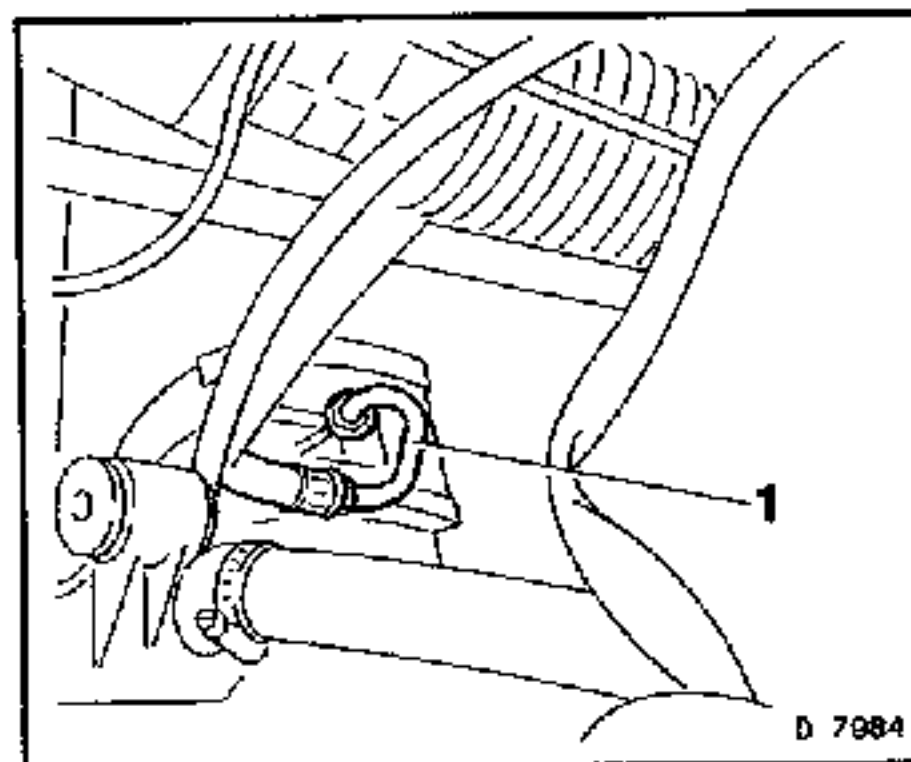
Shift rod and shift guide. Refer to Section K, "Clutch and Transmission." in Volume 4.



Remove, Disconnect

For C 20 LET:

Hydraulic line (1) from the transfer box. Place a clean container beneath.



Remove, Disconnect

Engines up to MY'93:

V- belts from alternator, power steering pump and A/C compressor.

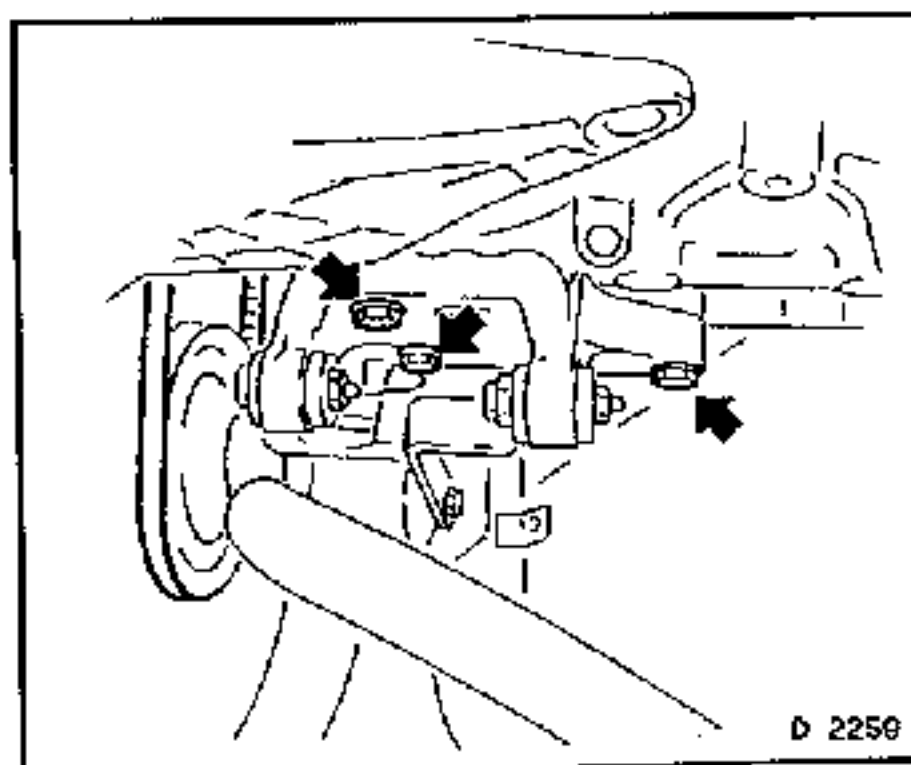
Power steering pump bracket from the cylinder block.

Swing to one side and secure.

Important!

Do not disconnect any hydraulic or A/C lines.

Attach engine holder KM-263-B.

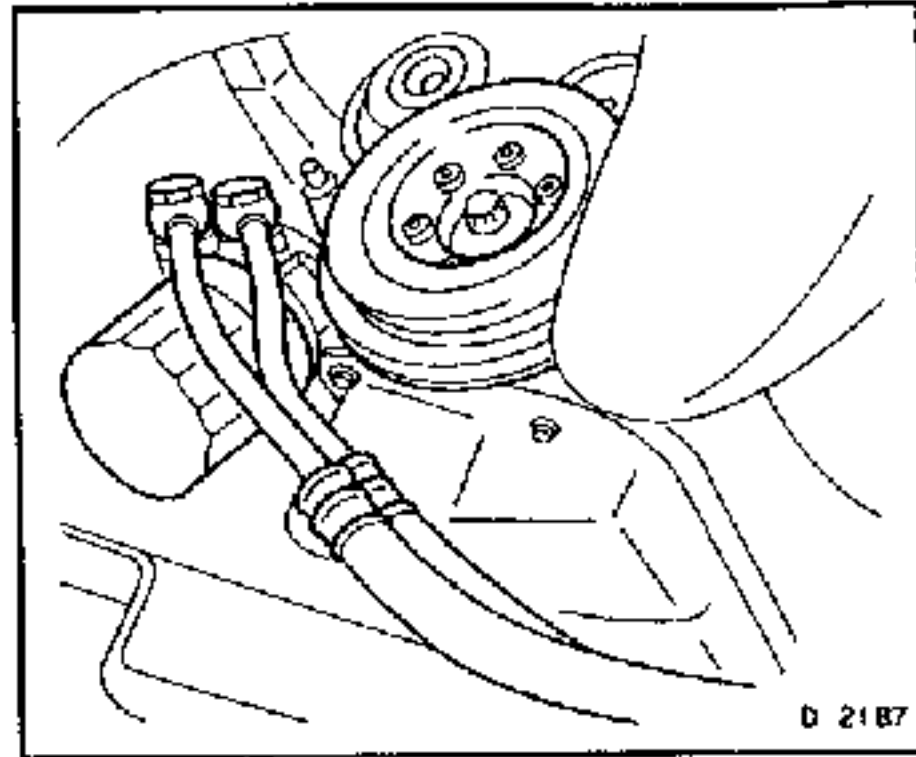


DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

Oil cooler lines.

Oil filter cartridge, using a commercially available tool. Place a suitable sized, clean container underneath the engine.

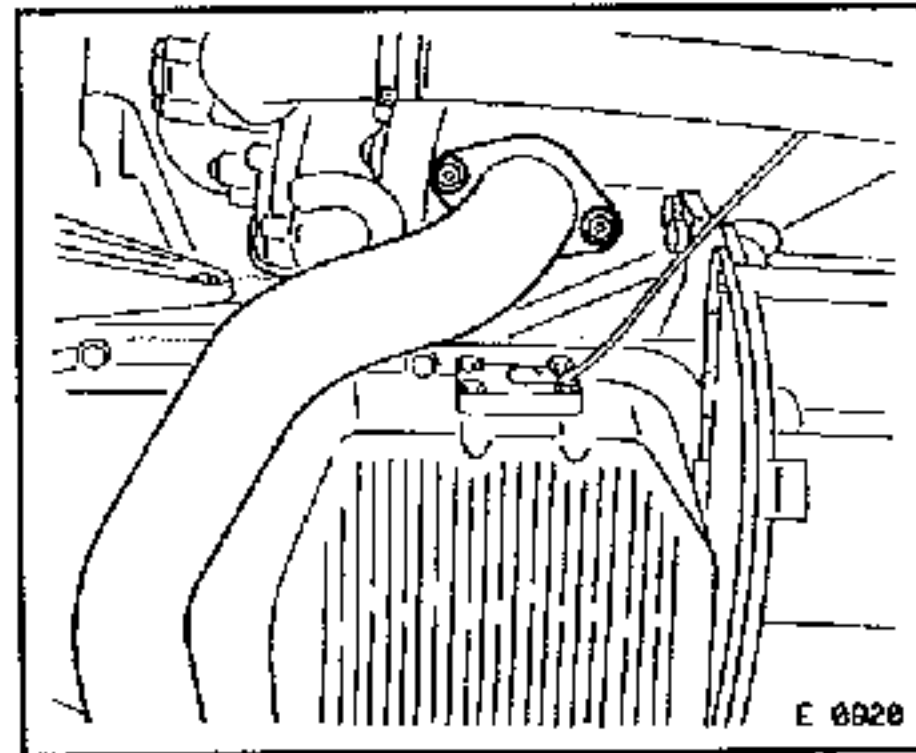


Remove, Disconnect

Exhaust pipe or performance header. Refer to 'Gasket, Performance Header, Replace', in the Section 'Cylinder Head', in this Volume.

For C 20 LET:

The lower charge air line.



Remove, Disconnect

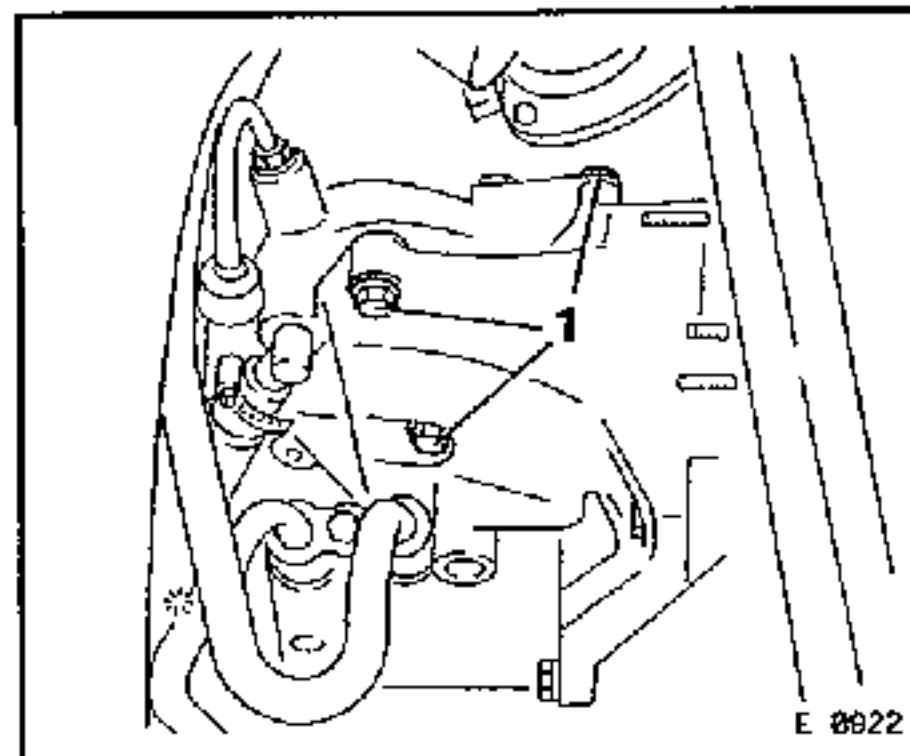
Mark the direction of rotation of the ribbed V- belt.

Engines as of MY'93:

Release ribbed V-belt, by rotating the tension roller clockwise, then remove the ribbed V-belt.

Fastening bolts (1) from the power steering hydraulic pump.

Swing pump to one side and secure. Do not disconnect hydraulic lines.

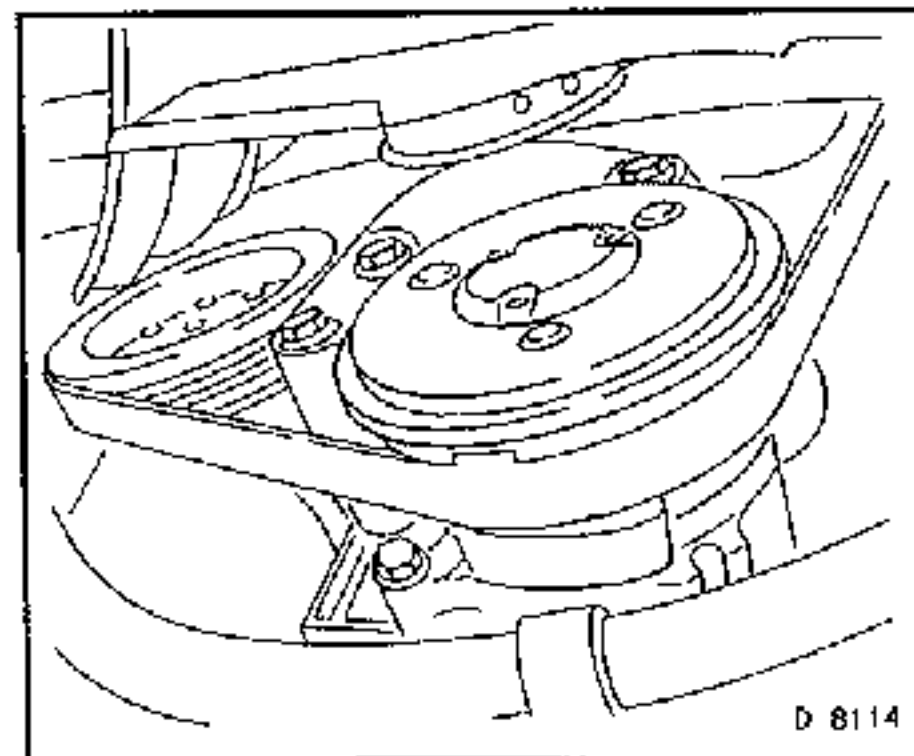


Remove, Disconnect

Engines as of MY'93:

Power steering pump and compressor from the bracket.

Refer to 'Engine Accessories Bracket, Replace', in the Section 'Engine Timing Side, Air Cleaner Housing', in this Volume.

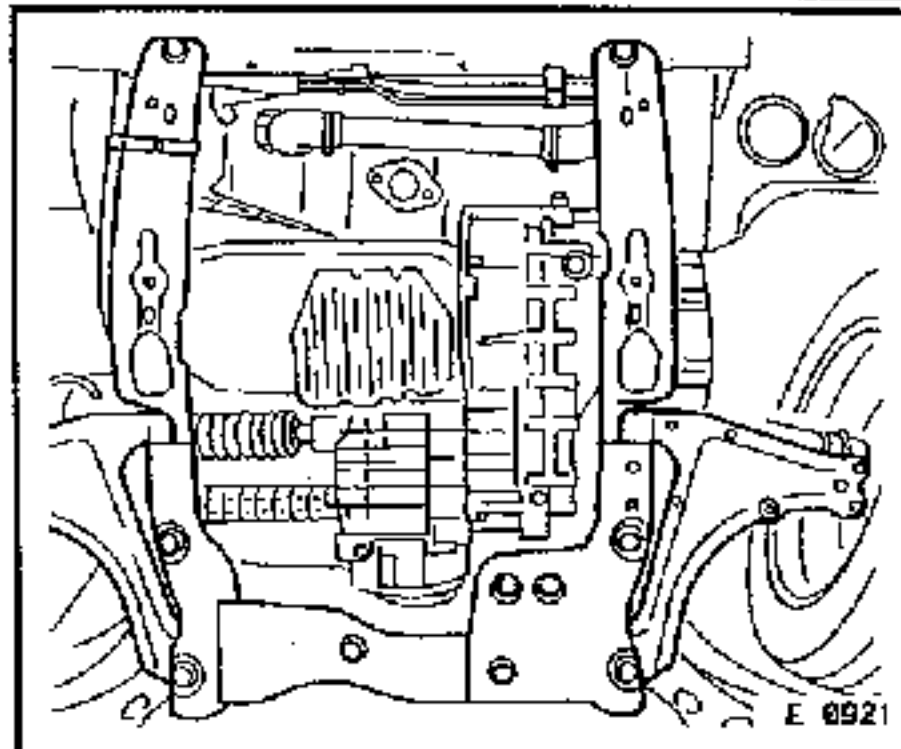


DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

Front wheels, ball joints from steering knuckles and axle driving shafts from the front axle body.

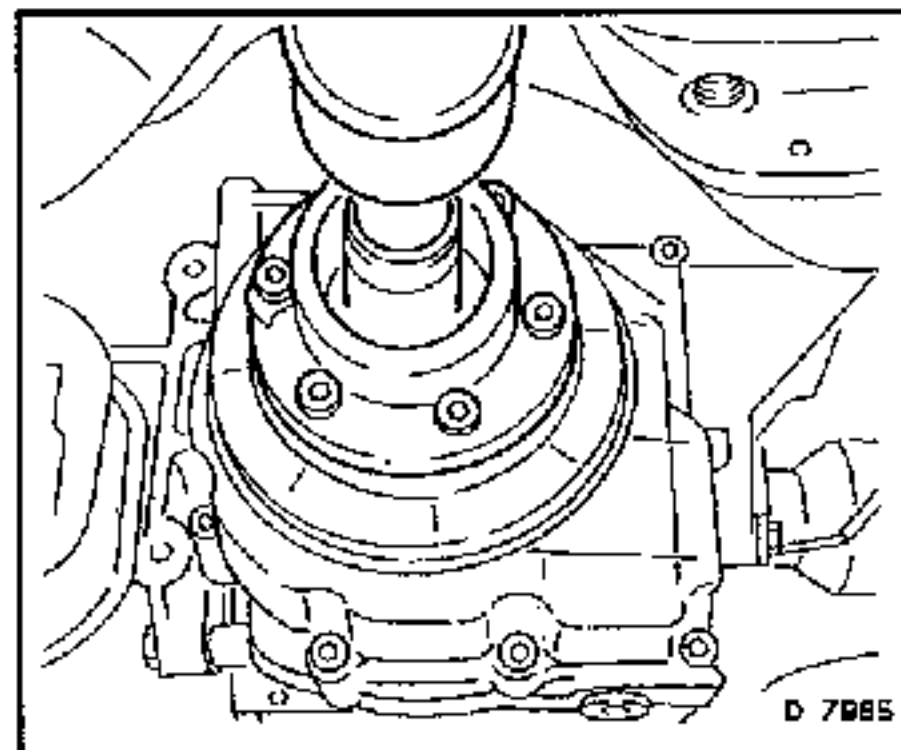
Refer to Groups E, "Frame, Front Suspension et al" in Volume 1 and K, "Clutch and Transmission" in Volume 4.



Remove, Disconnect

For C 20 LET:

Cardan shaft from transfer box. Refer to Section K, "Clutch and Transmission" in Volume 4.



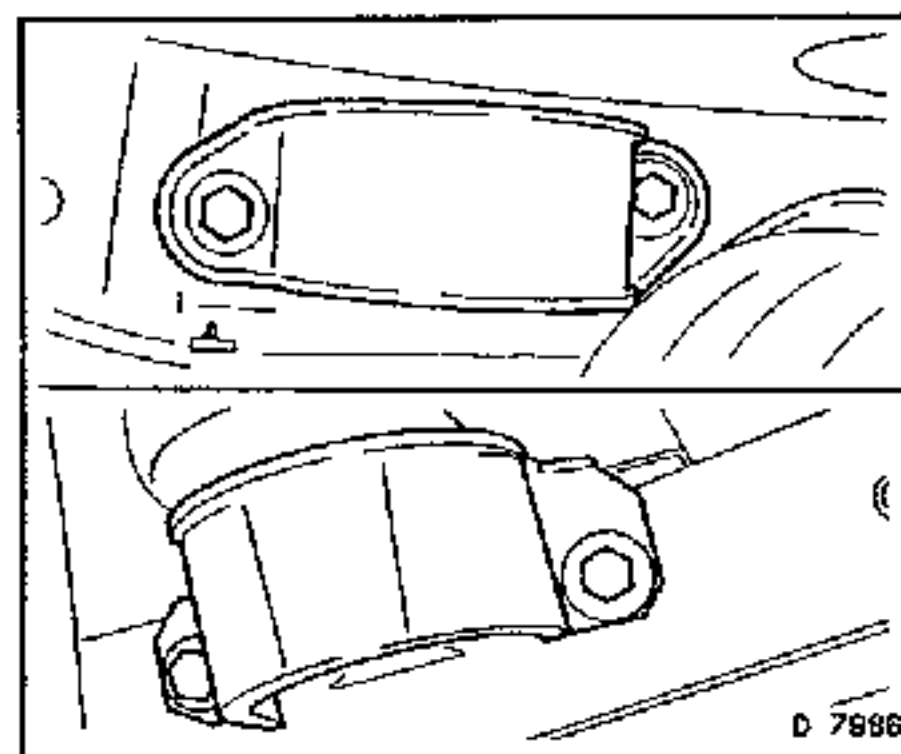
Remove, Disconnect

Ground cable from transmission.

Support engine with jack, then remove engine damping blocks from side members.

Remove holder KM-263-B.

Lower engine with transmission downwards.



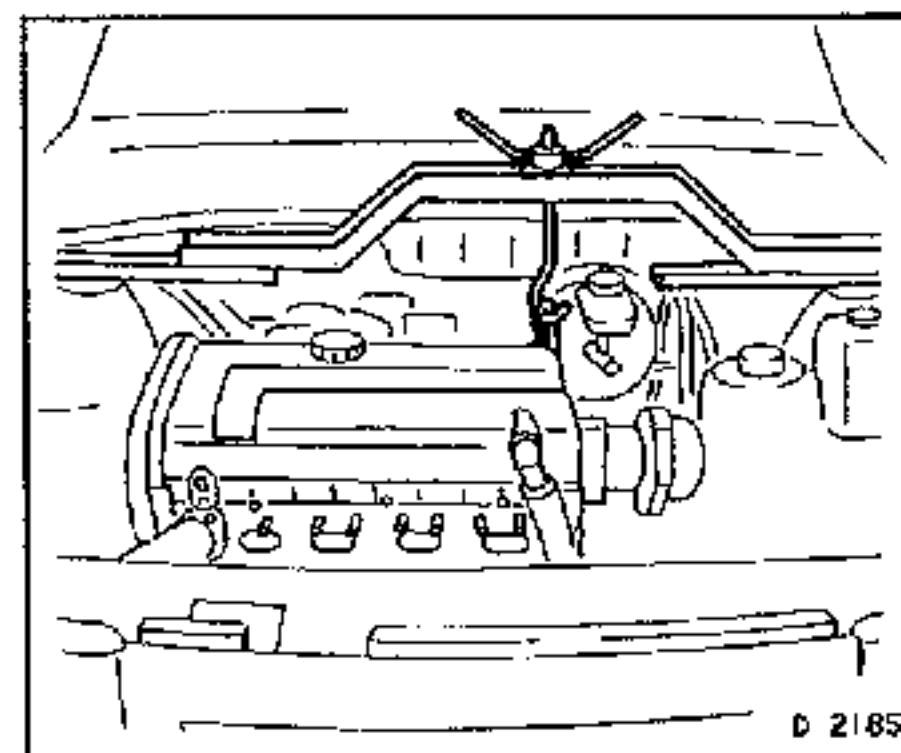
Install, Connect

Engine with transmission into engine compartment.

Tighten (Torque)

Engine damping blocks to side members 65 Nm *

* Clean threads and apply locking compound such as Loctite 242 or equivalent, to Holden's Specification HN1256.



DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

Ground cable to transmission.

Oil filter to oil pump, after filling with clean engine oil.

Note:

Use a thin film of clean engine oil on the new filter seal ring, before installation.

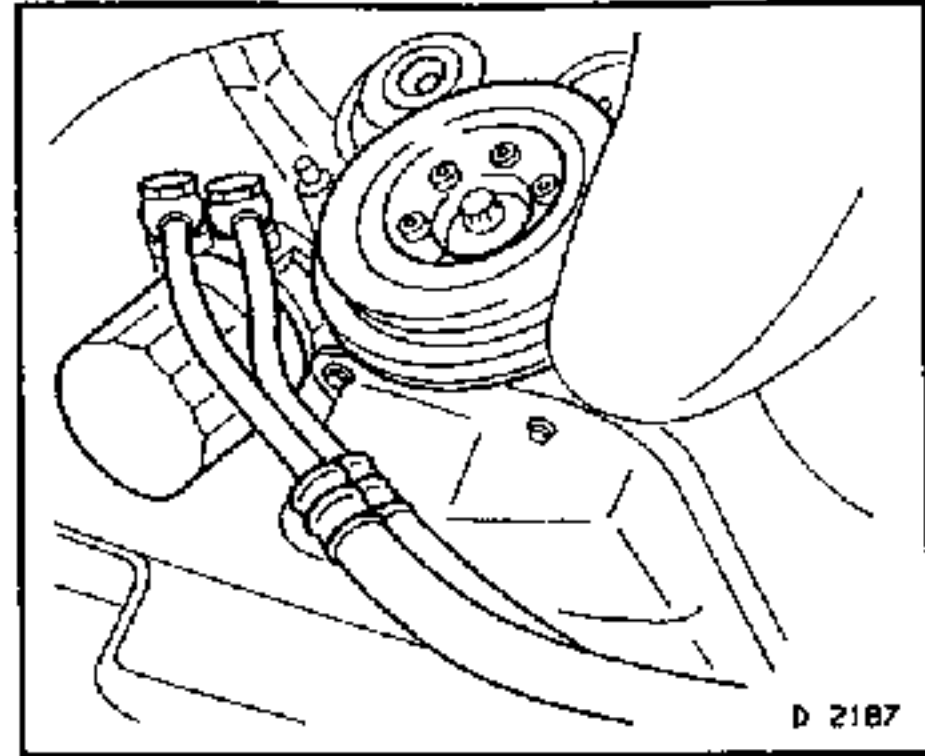
Oil cooler lines to adaptor.

Tighten (Torque)

Oil filter cartridge to oil pump	15 Nm
Oil cooler lines to adaptor	30 Nm

For C 20 LET:

Cardan shaft to transfer box	30 Nm
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Install, Connect

Engines as of MY'93:

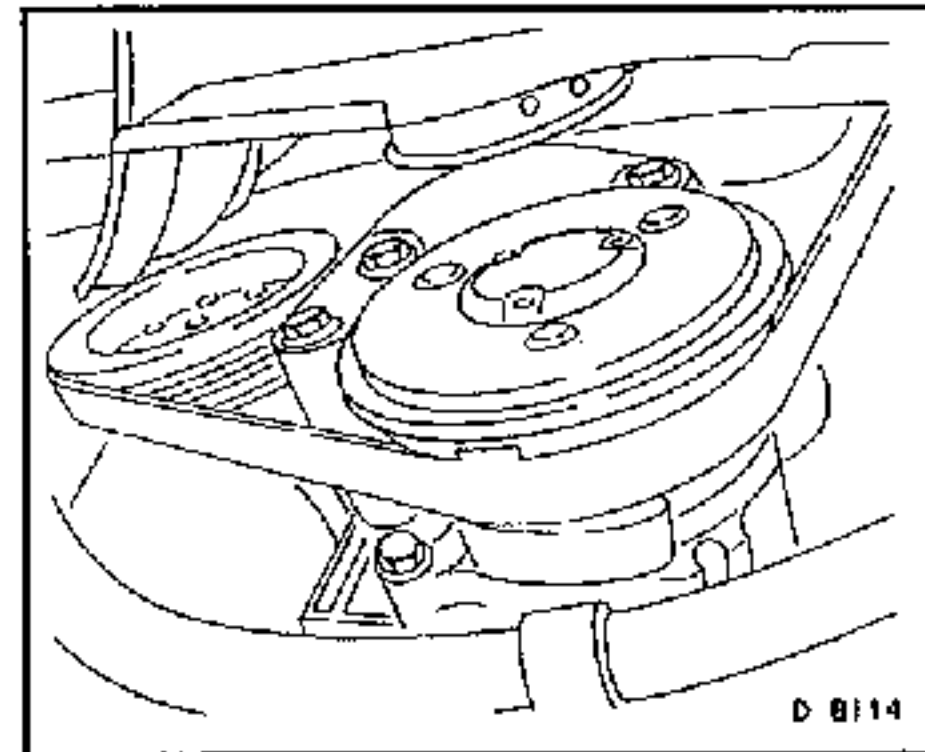
Power steering pump and A/C compressor to accessories bracket.

Refer to 'Engine Accessories Bracket, Replace', in the Section 'Engine Timing Side, Air Cleaner Housing', in this Volume.

Ribbed V-belt. Rotate the ribbed V-belt tension roller in an anti-clockwise direction to allow belt installation.

Note:

Direction of ribbed V-belt rotation before installation.



Install, Connect

Front axle body, axle driving shafts, ball joints in steering knuckles, front wheels.

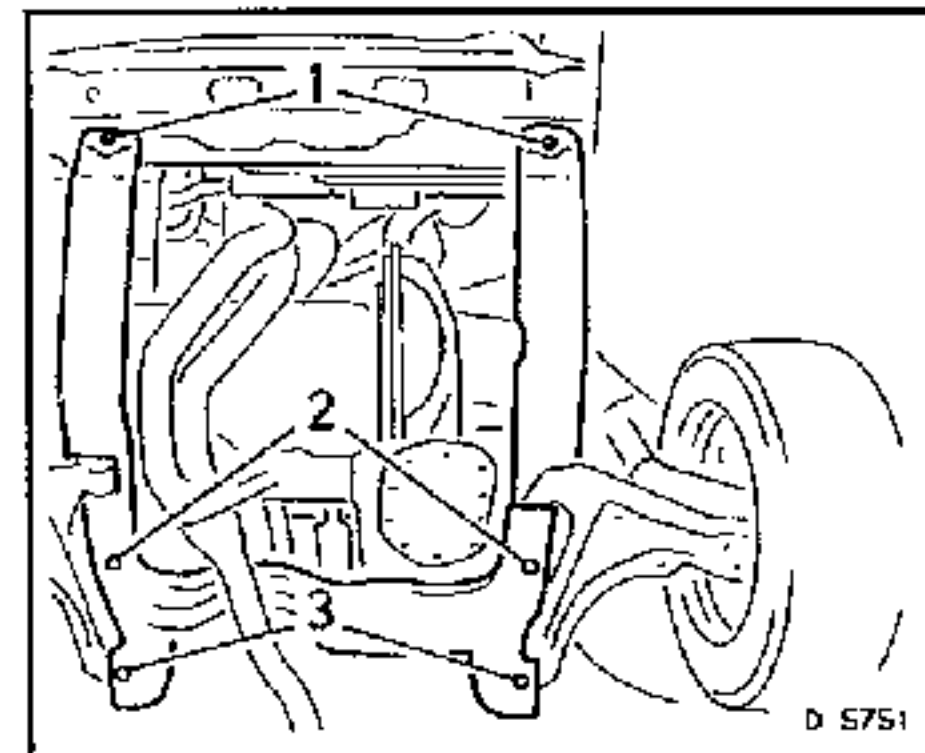
Refer to Groups E, 'Frame, Front Suspension et al' in Volume 1 and K, 'Clutch and Transmission' in Volume 4.

Tighten (Torque)

Front axle body to underbody	
Bolts (1)	115 Nm
Bolts (2)	170 Nm

Torque - Angle Method

Bolts (3)	100Nm + 75° - 90°
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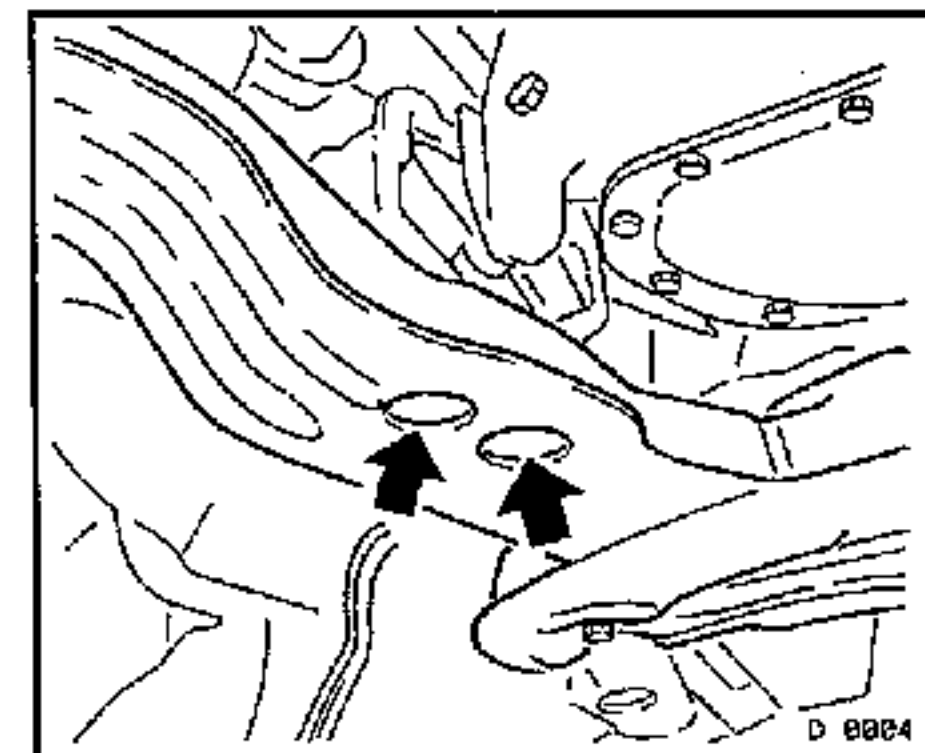
Tighten (Torque)

Transmission bracket to front axle (arrows)	40 Nm
Ball joints to steering knuckle	70 Nm *
Front wheels to front hub	110 Nm

* Use new retaining clamps and nuts.

Remove, Disconnect

Engine holder KM-263-B



DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

Engine pipe or performance header.

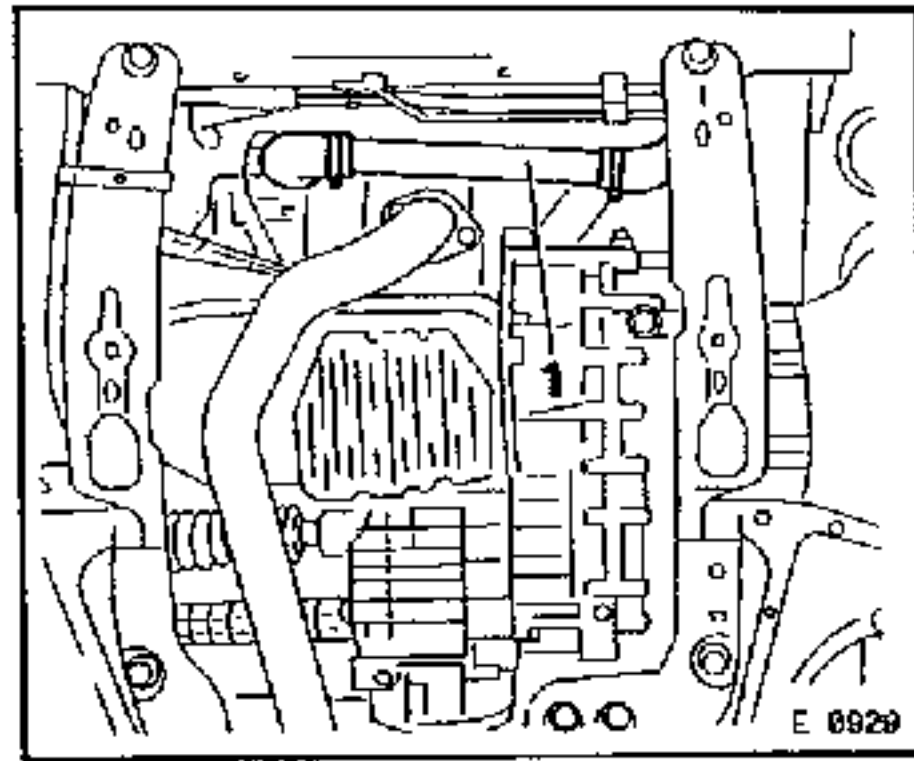
Refer to 'Gasket, Performance Header, Replace', in the Section "Cylinder Head", in this Volume.

For C 20 LET:

The lower air charge line (1).

Tighten (Torque)

Exhaust pipe to exhaust adaptor (C 20 LET)	12 Nm
Performance header with cover plate to cylinder head	22 Nm
Exhaust pipe to catalytic converter	25 Nm



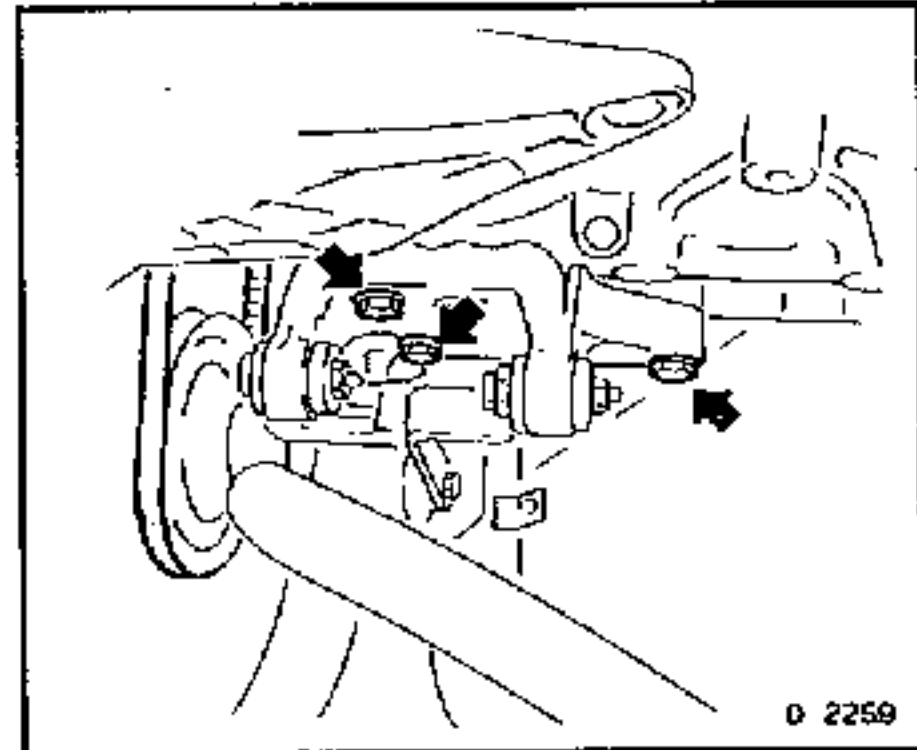
Engines up to MY'93:

Tighten (Torque)

Power steering pump bracket to cylinder block	40 Nm
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Adjust

V-belt tension. Refer to "Checking and Adjusting Procedures", in this Volume.



Install, Connect

For C 20 LET:

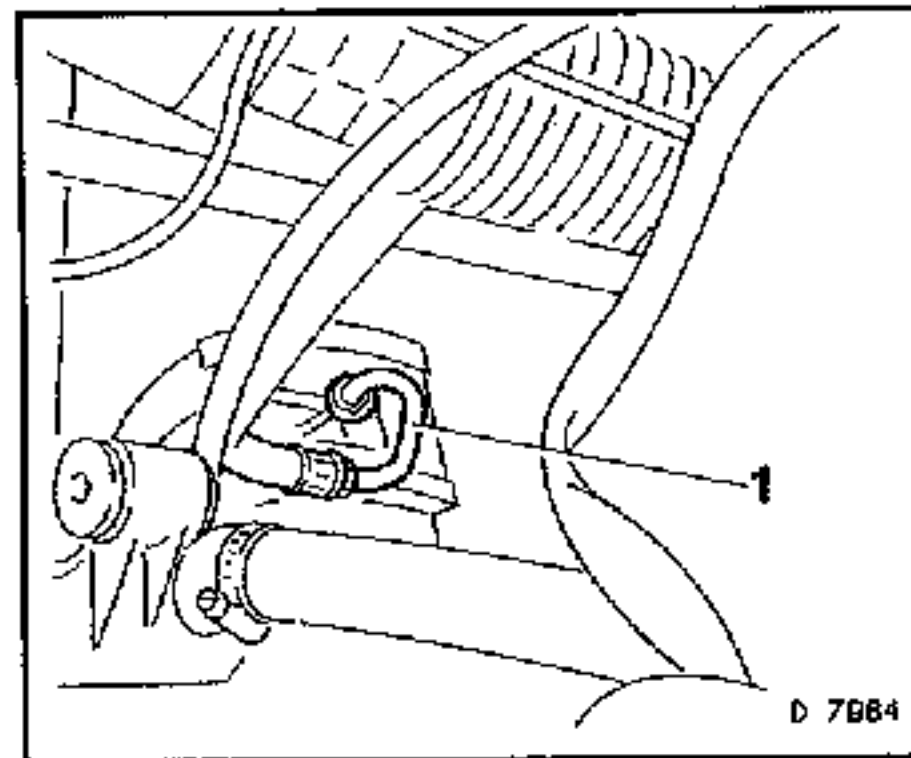
Tighten (Torque)

Hydraulic line to transfer box	30 Nm
--------------------------------------	-------

Install, Connect

Shift guide, shift rod and clutch cable. Refer to Section K "Clutch and Transmission", in Volume 4.

Speedometer cable or wiring harness plug to the odometer frequency sensor.



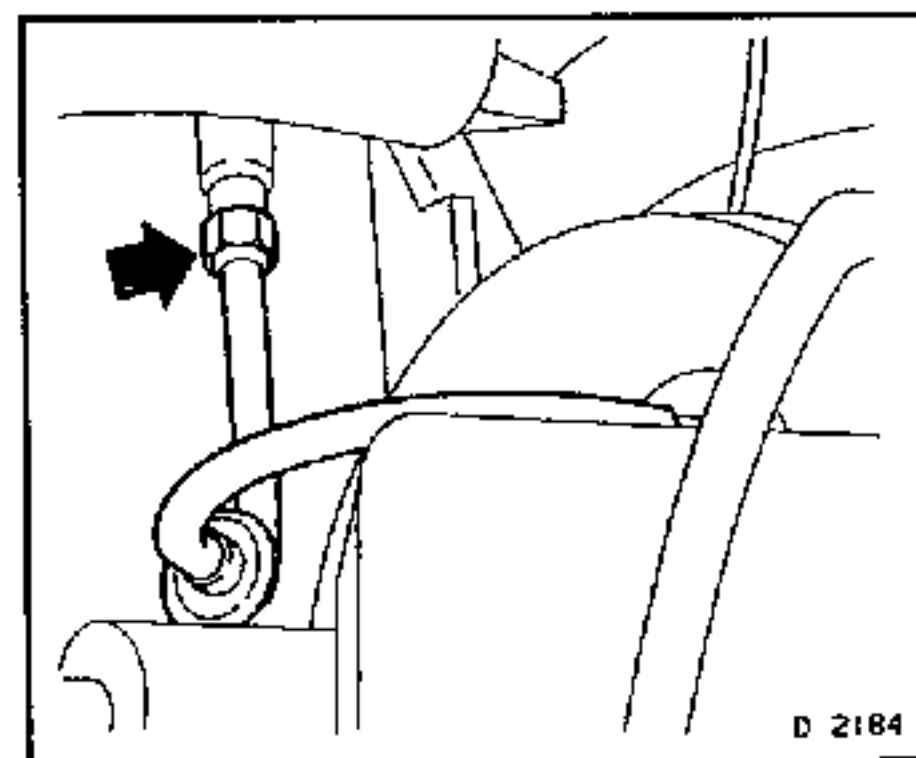
Install, Connect

Vacuum hose to controlled canister purge valve.

Brake servo vacuum line to intake manifold.

Tighten (Torque)

Brake servo vacuum line to intake manifold	20 Nm
--	-------



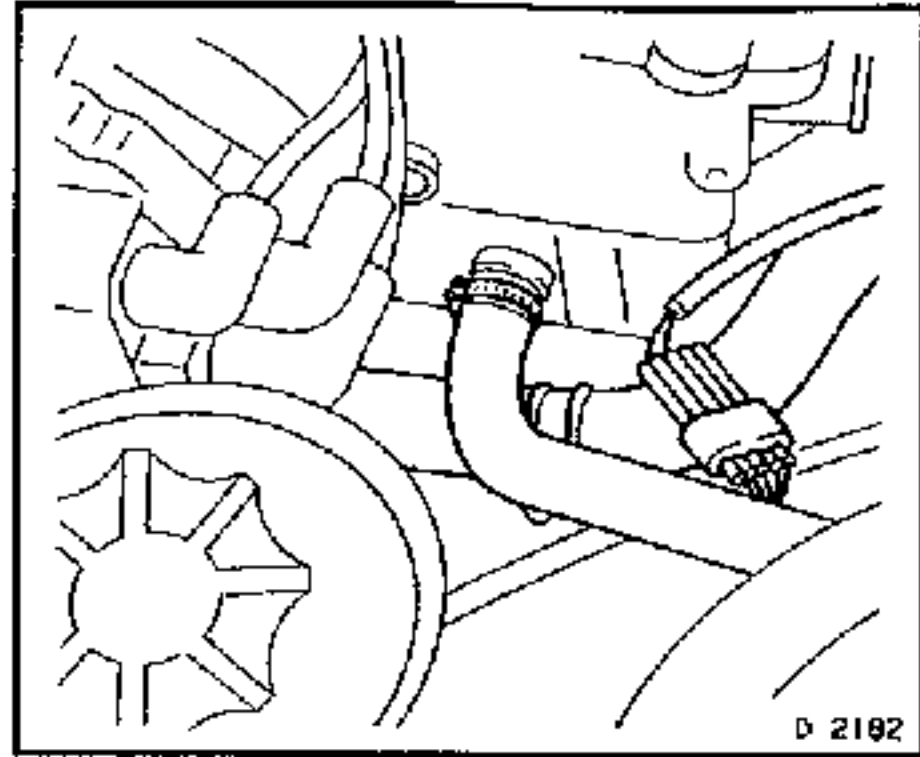
DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

Multi-plug.

Coolant hoses to coolant pipe.

Coolant hose to cylinder head.



Install, Connect

For C 20 LET:

Plug strip to injectors.
Ground connections.

Wiring harness plug (4) to controlled canister purge valve.

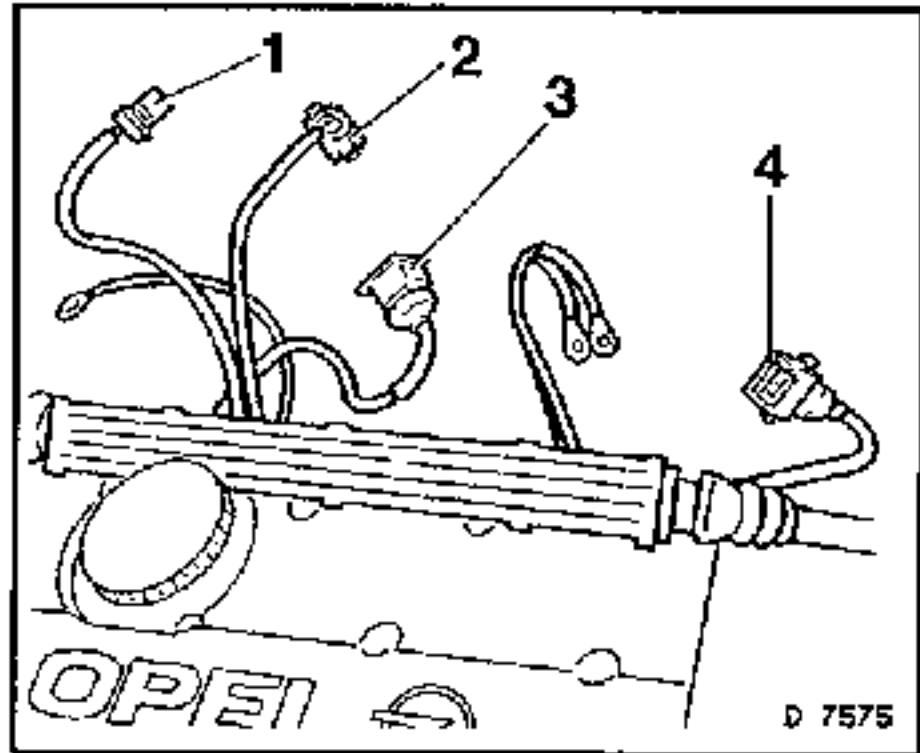
Wiring harness plug (3) to throttle valve potentiometer.

Wiring harness plug (2) to Intake air temperature sensor.

Wiring harness plug (1) to hot start valve.

Note:

The routing of all wiring and connectors.



Install, Connect

For C 20 XE:

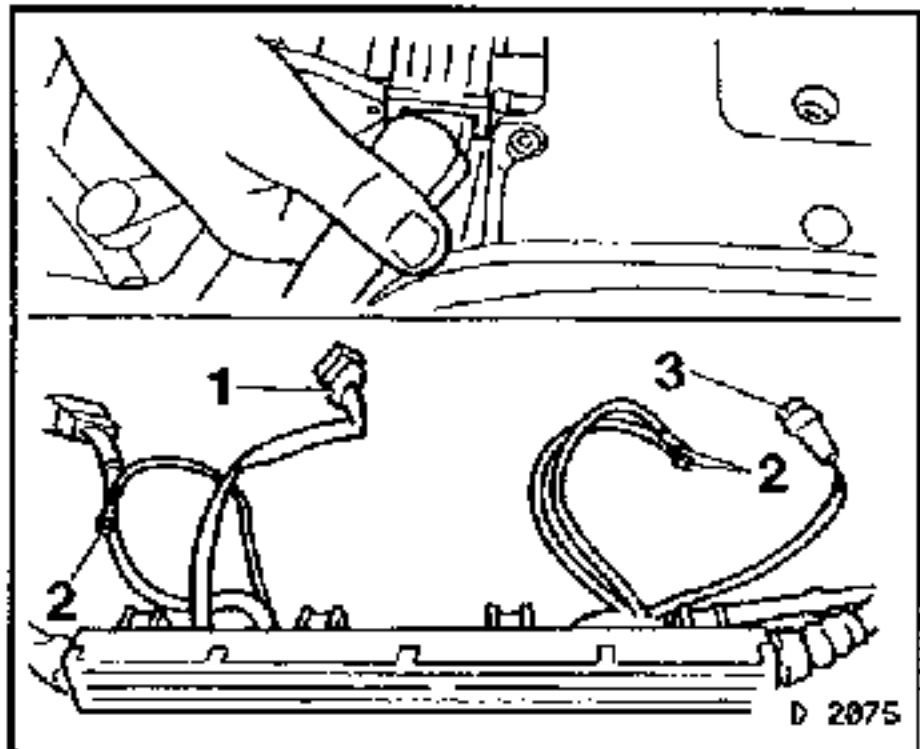
Wiring harness plug (1) to controlled canister purge valve.

Ground connections (2) to fuel distributor pipe.

Wiring harness plug (1) to throttle valve switch (M 2.5) or potentiometer (M 2.8).

Note:

The routing of all wiring and connectors.



Install, Connect

Bowden cable. Install without cable tension.

Fuel lines, then remove clamps.

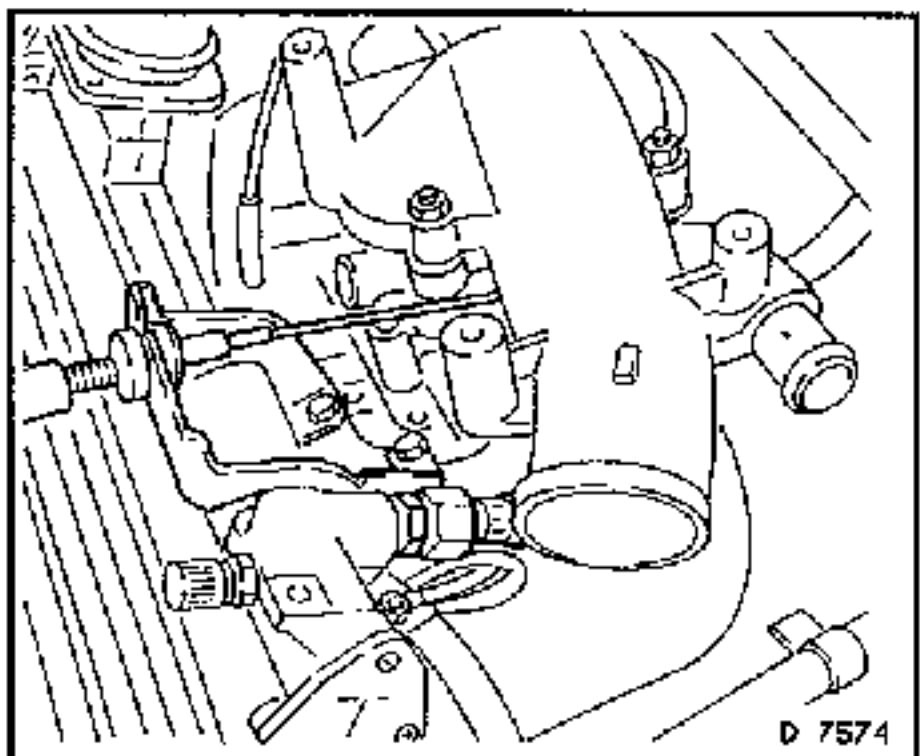
Fuel line bracket to throttle body.

Oxygen sensor wiring harness plug.

Wiring harness plug for dynamic oil level check.

For C 20 LET:

Transfer box temperature sensor wiring harness plug.



DOHC ENGINE - ENGINE SHORT BLOCK

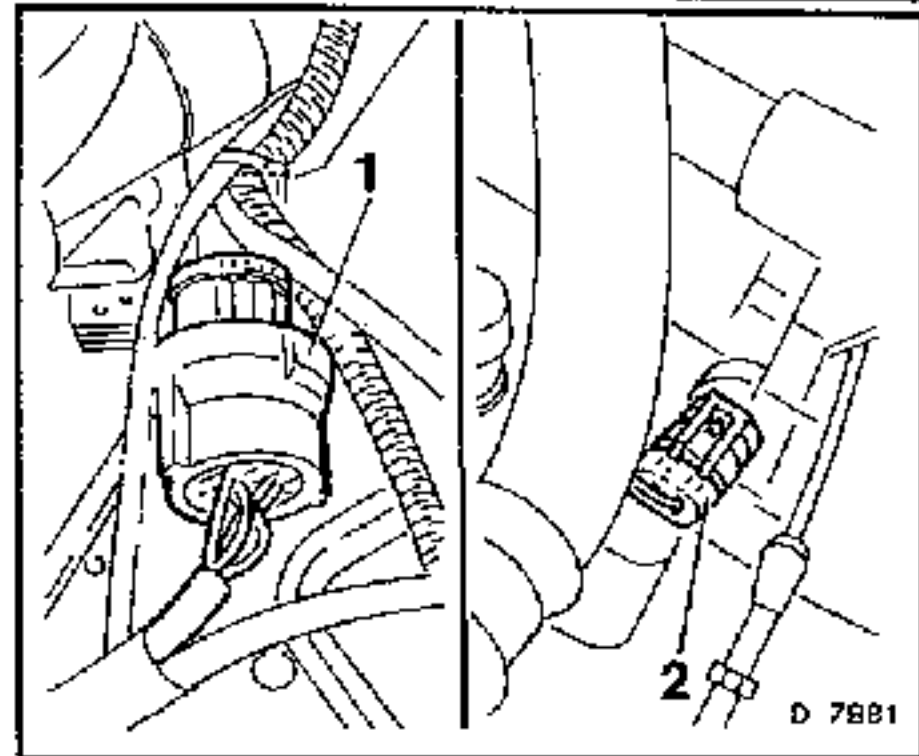
Install, Connect

Engine harness to body wiring harness multi-plug (1).

Wiring harness plug (2) for reverse lamp.

For C 20 LET:

Wiring harness plug for first gear recognition switch.

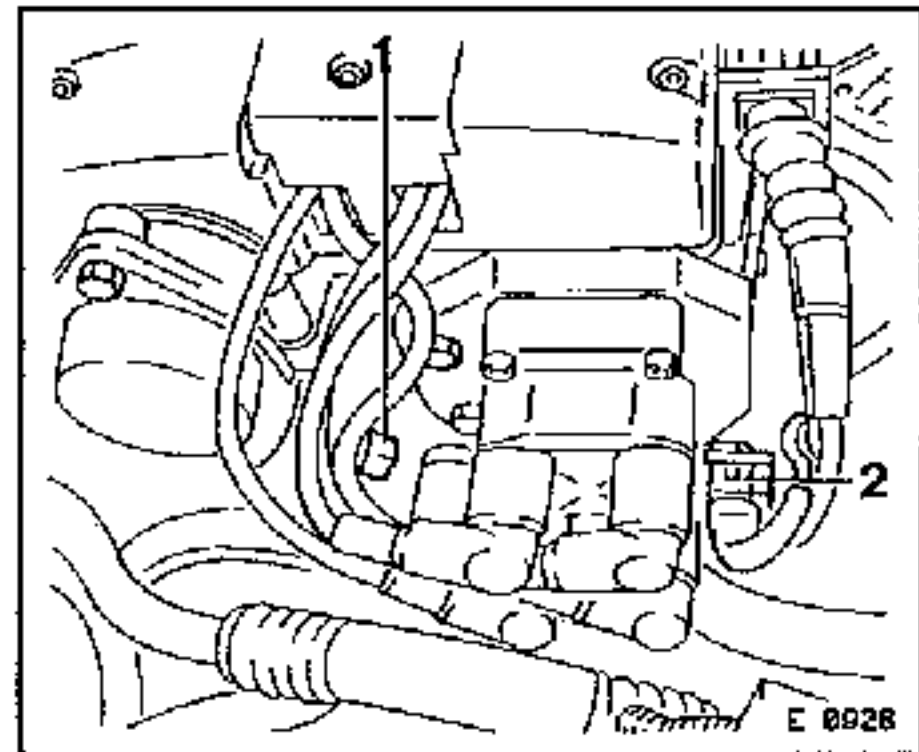


Install, Connect

C 20 XE Engines as of MY'93:

Wiring harness plug to camshaft sensor (1).

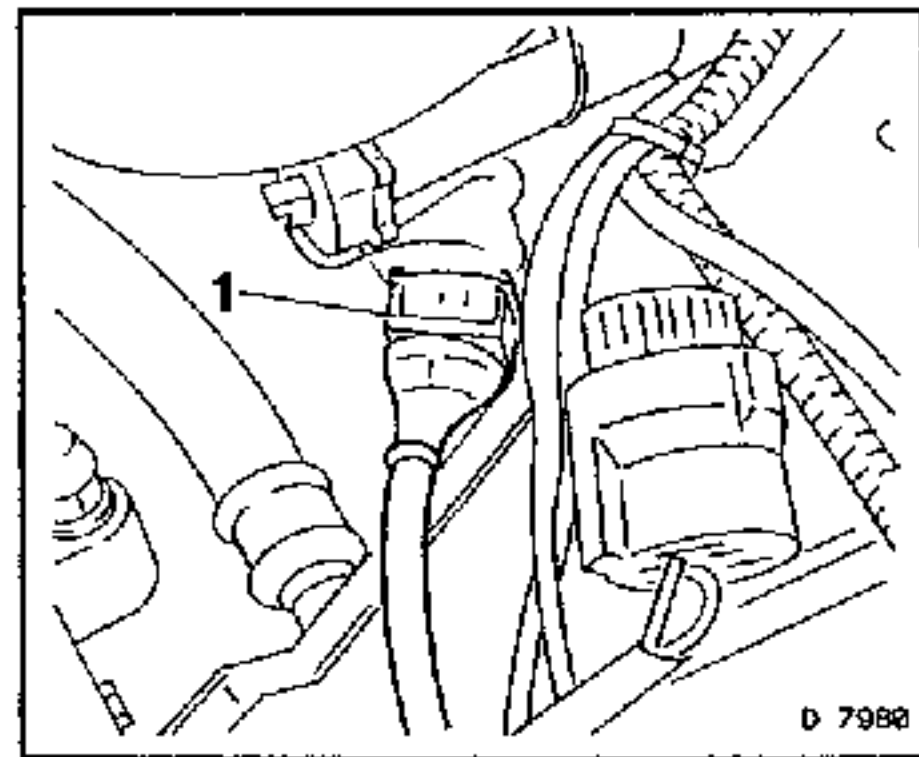
Wiring harness plug to ignition coil (2).



Install, Connect

Wiring harness plug and high voltage cables to high voltage distributor.

Wiring harness plug (1) to ignition coil/control unit.

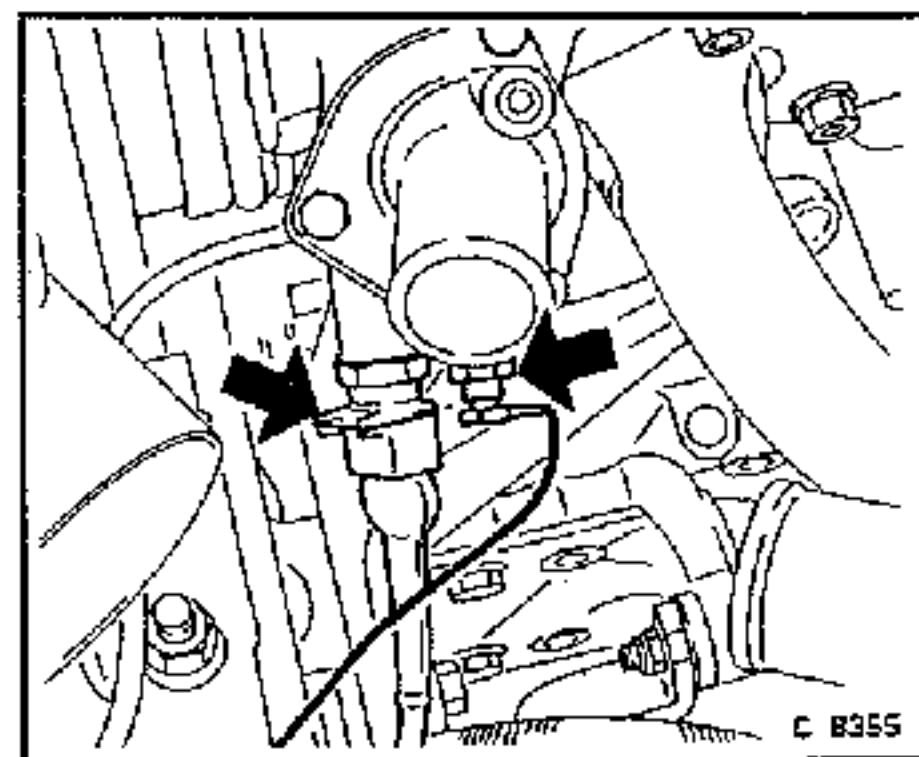


Install, Connect

Wiring harness plugs (arrows) to thermostat housing.

Upper coolant hose to thermostat housing.

Coolant hoses to coolant reservoir tank.



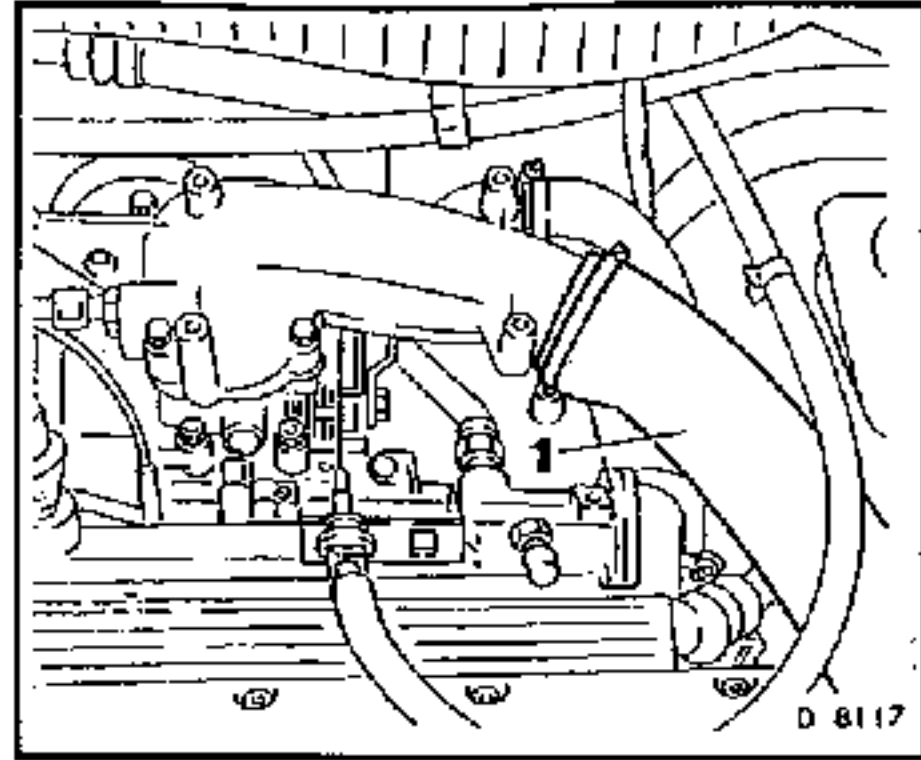
DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

For C 20 LET:

Air hose (1) to charge air cooler and throttle valve manifold.

Vacuum hose from throttle body to control unit.

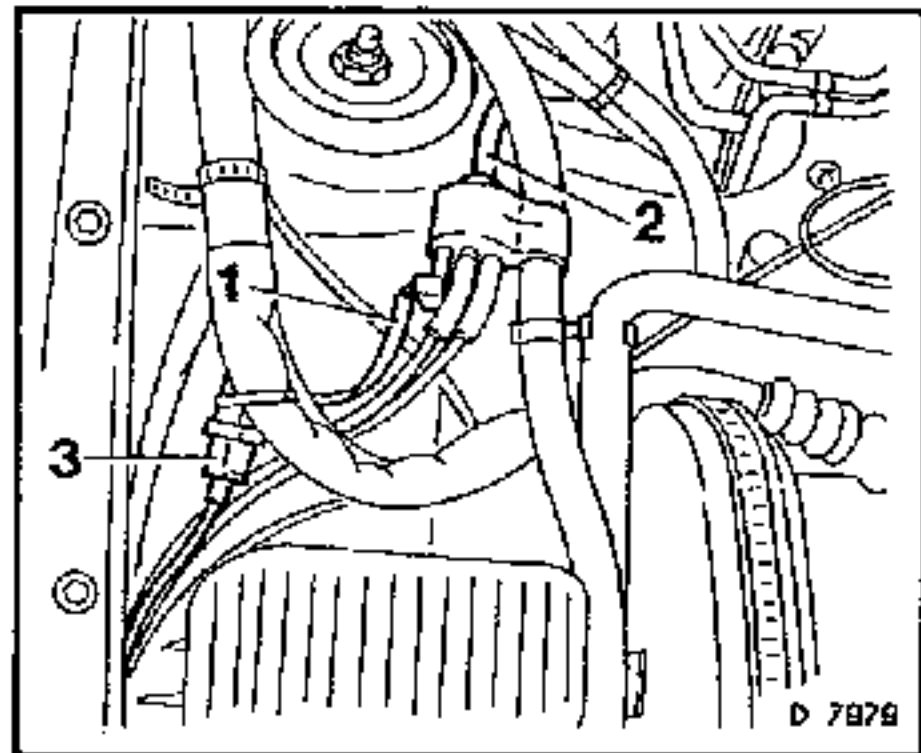


Install, Connect

For C 20 LET:

Wiring harness plug (3) and wiring harness plug (1).

Hose (2) to charge pressure control switch-over valve.



Install, Connect

For C 20 XE:

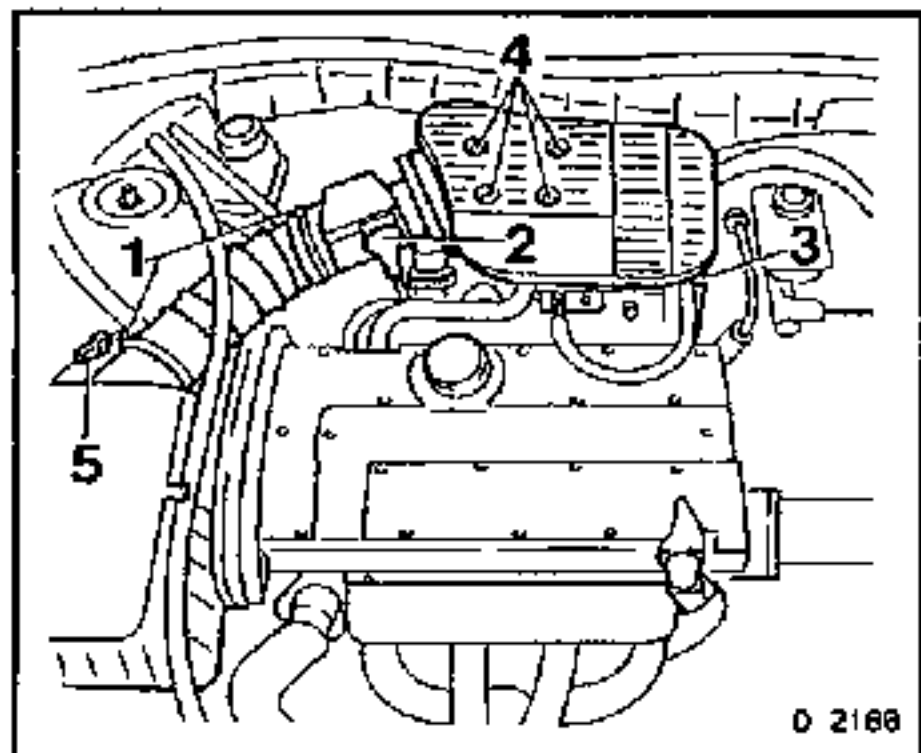
Wiring harness plug (5) to inductive pulse pick-up.

Pre-volume chamber with mass air flow meter (4).

Idle speed adjuster hose (3) to pre-volume chamber.

Wiring harness plug (2) to mass air flow meter.

Air intake hose (1).



Install, Connect

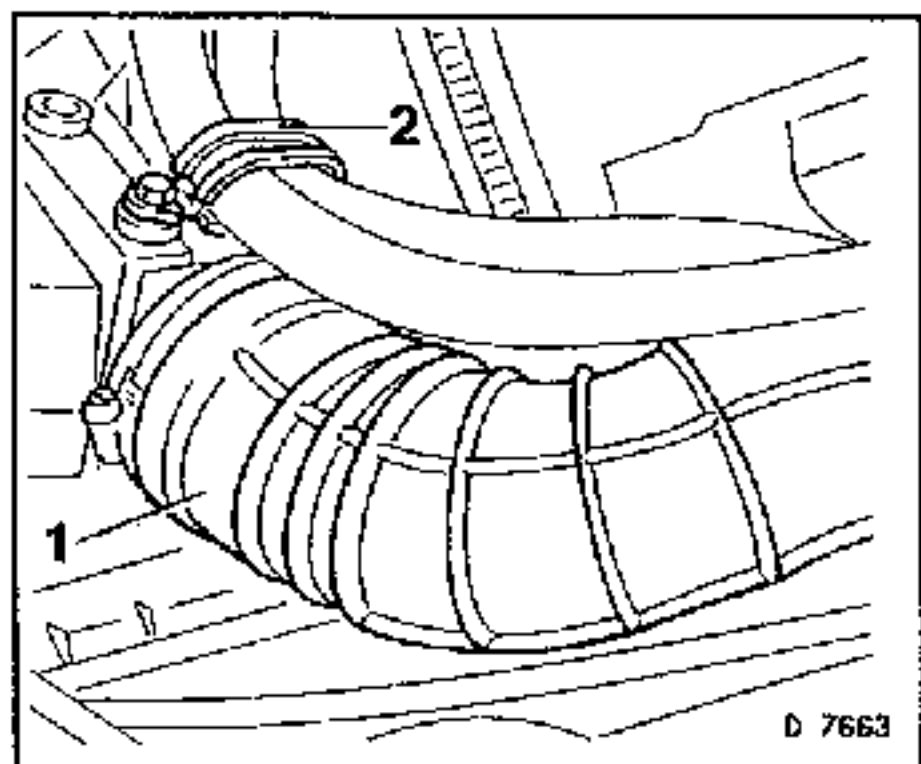
For C 20 LET:

Air hose (1) and bracket (2)

Cover to throttle valve manifold.

Tighten (Torque)

Cover to throttle valve manifold 5 Nm



DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

The lower coolant hose to the radiator.

Fan motor and fan shroud, to the radiator.

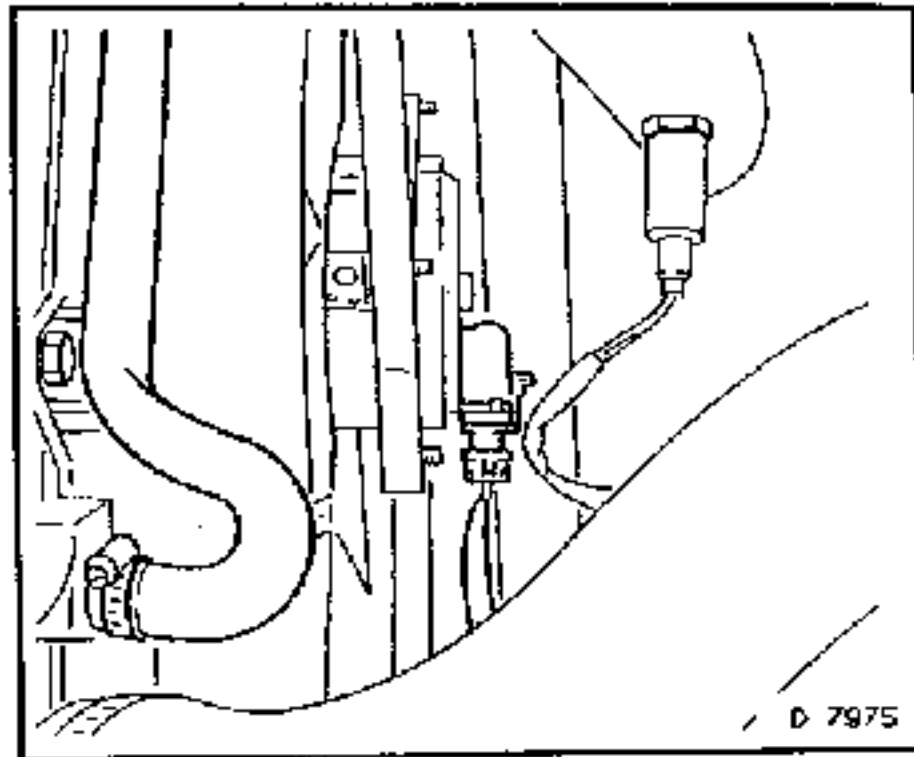
Ground cable to battery.

Inspect

Check engine oil level and top up as necessary.

Top up and bleed cooling system. Refer to "Cooling System" Section in this Volume.

Top up and bleed the hydraulic braking system. Refer to Section H, "Brakes", in Volume 1.



Engine Repair, Using Short Block

Disconnect

All engine attaching parts and mount on engine overhaul stand KM-412.

For C 20 XE:

Use adaptor KM-412-8-A.

For C 20 LET:

Use adaptor KM-412-8-2

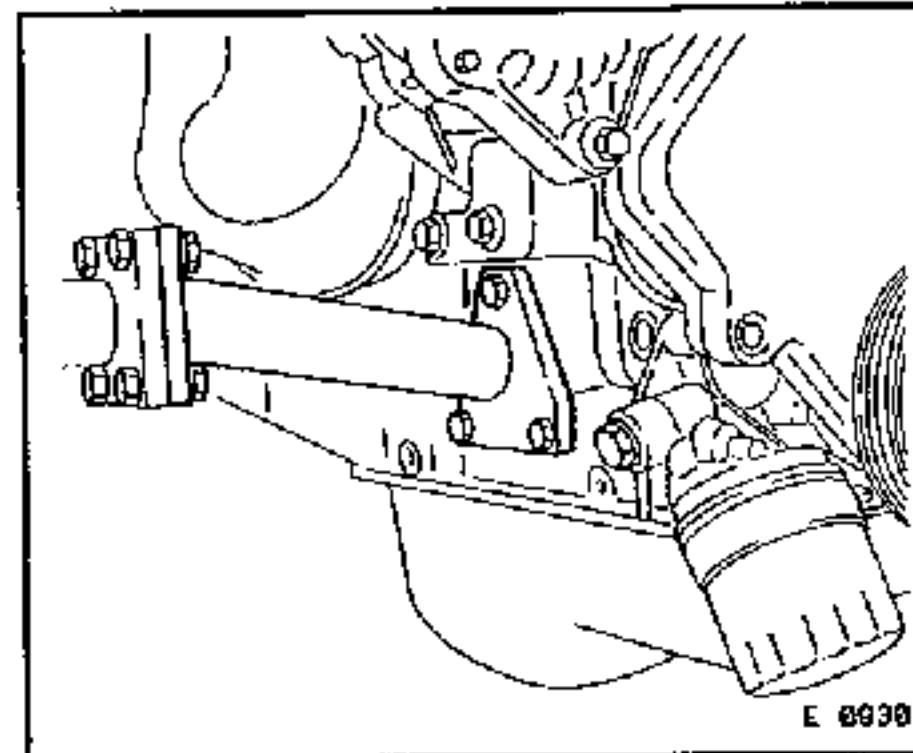
Drain engine oil into a suitable clean container.

Install, Connect

Oil pan drain plug.

Tighten (Torque)

Oil pan drain plug to oil pan..... 45 Nm

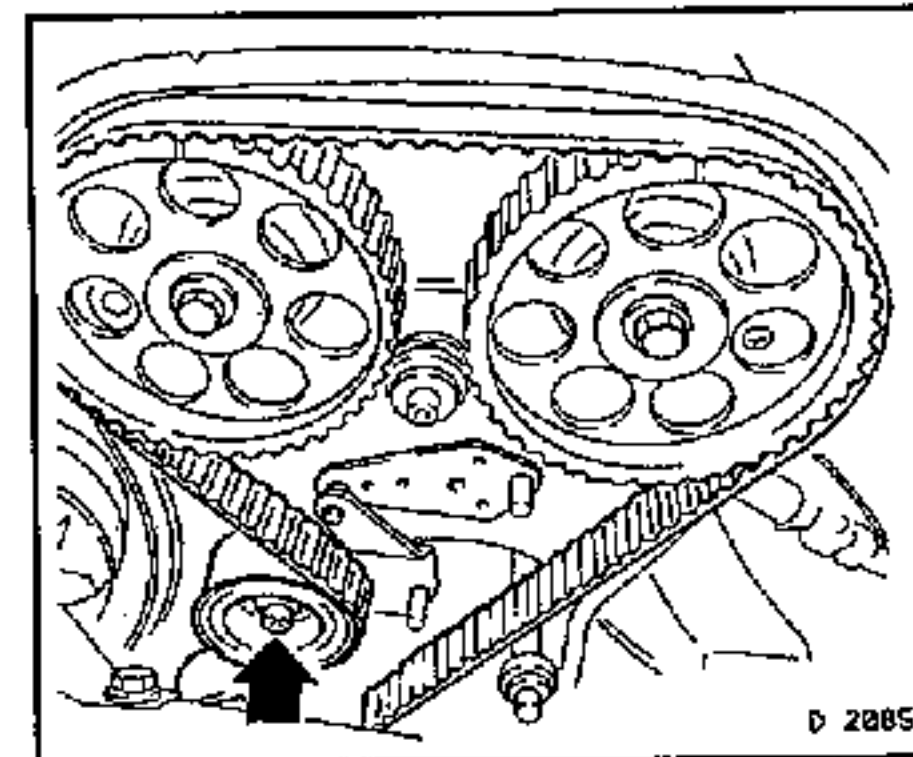


Remove, Disconnect

Front toothed belt cover.

Toothed belt tension roller (arrow), toothed belt guide pulley, toothed belt.

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.



Remove, Disconnect

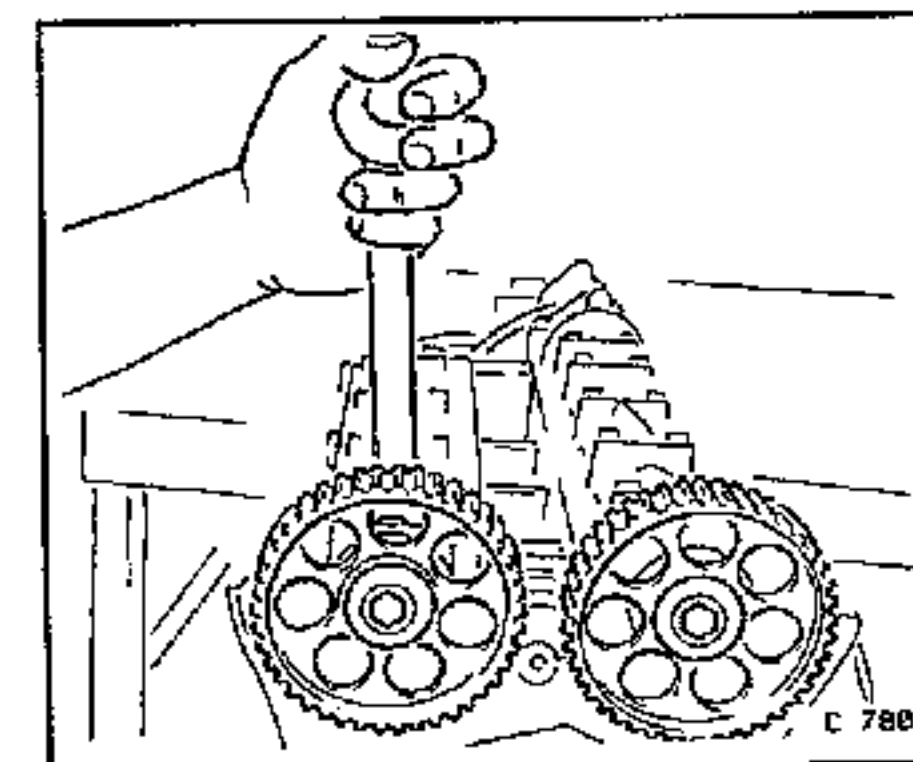
Ignition cable cover.

Spark plug connectors, using KM-717.

Crankcase ventilation hose connections from cylinder head cover.

Cylinder head cover.

Camshaft gears. Refer "Camshaft Gears, Remove and Install", in this Section.



DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

Rear toothed belt cover. Refer "Toothed Belt Rear Cover, Replace", in this Volume.

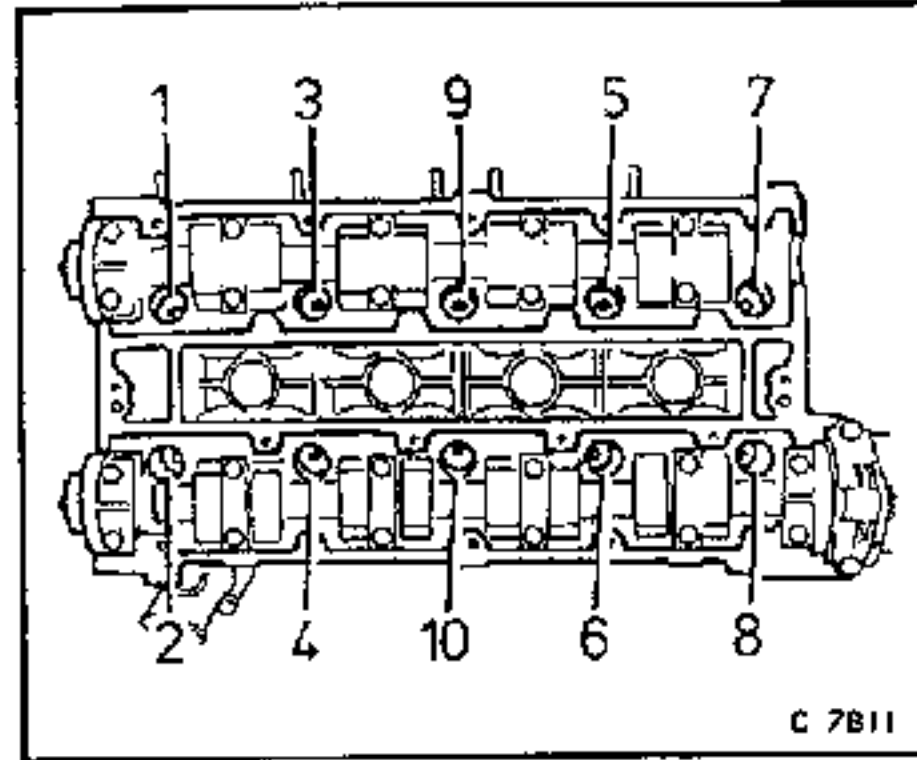
Intake manifold to cylinder block support.

Cylinder head bolts. Progressively loosen cylinder head bolts in the sequence shown, using MKM-604-19-A (Torx E 14).

Important!

First loosen all bolts $\frac{1}{4}$ turn, then $\frac{1}{2}$ turn.

When removing the bolts, take note of the washers under each of the bolts.

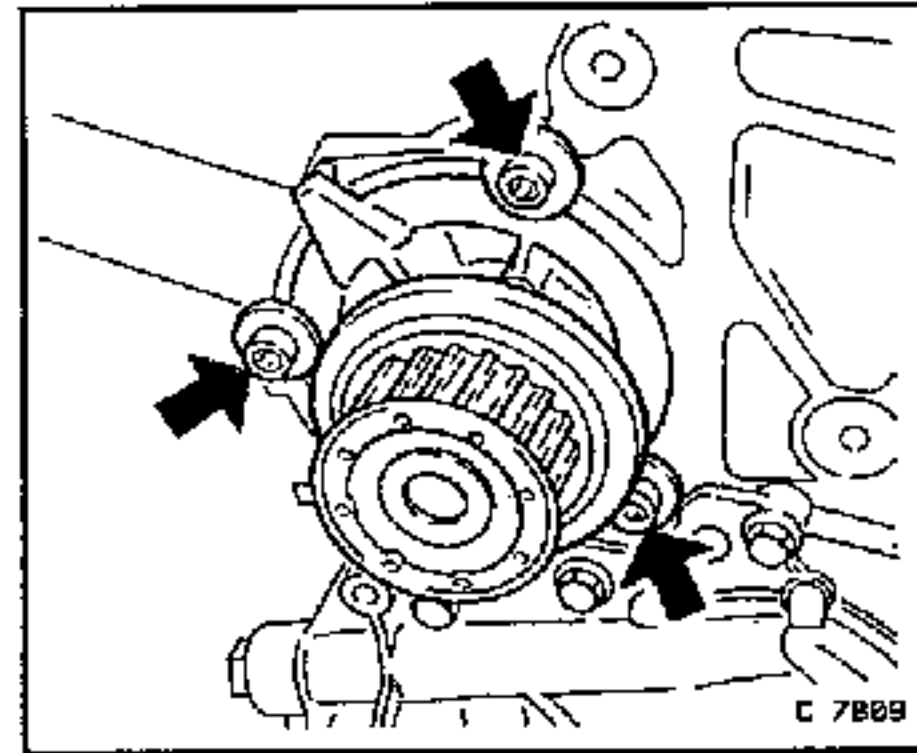


Remove, Disconnect

Water pump (arrows) from the cylinder block.

Toothed belt drive gear, after first removing the fastening bolt for the toothed belt drive gear, using MKM-604-21 (Torx E 20). Hold the gear with wrench KM-662-A.

Then, install puller KM-210-A, with KM-516 and KM647, as required.

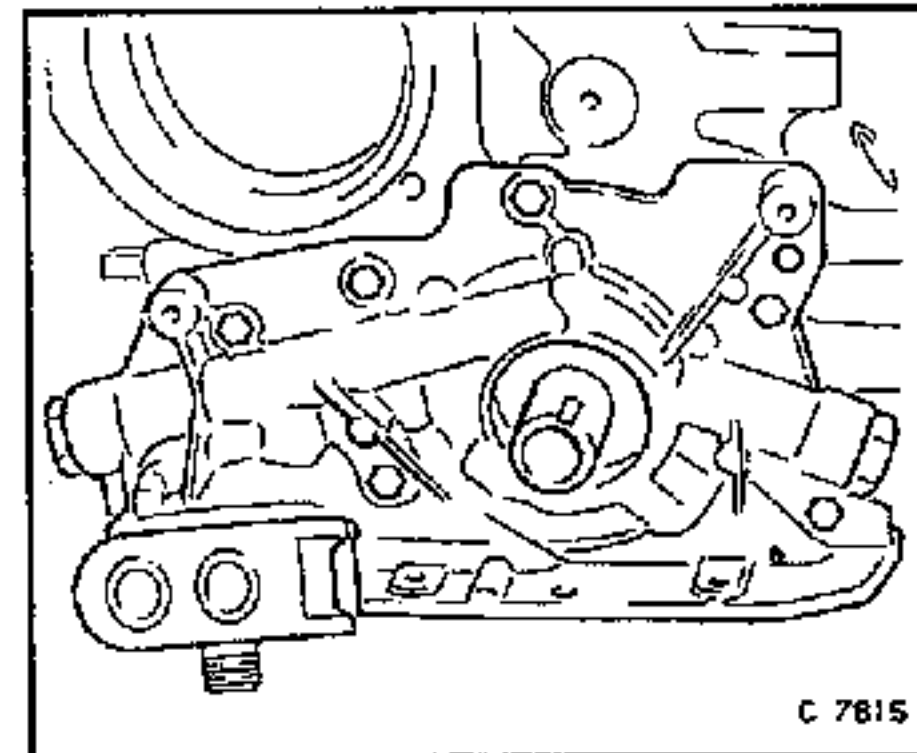


Remove, Disconnect

Oil pan, oil intake pipe and baffle plate.

Spacing ring from crankshaft journal.

Oil pump.



Remove, Disconnect

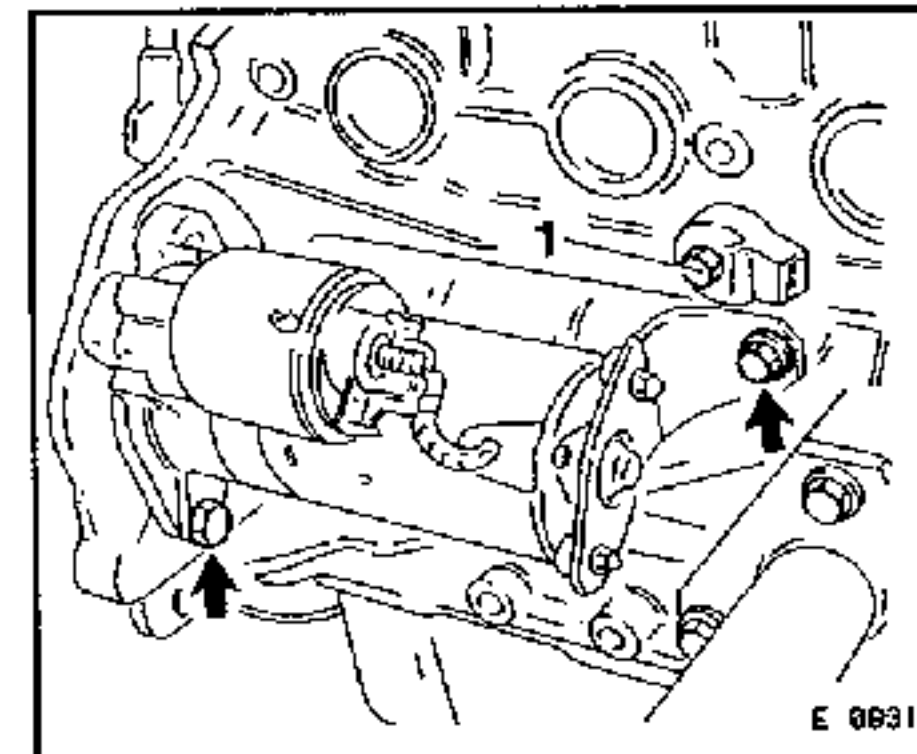
Coolant hose from coolant inlet fittings.

Coolant pipe.

Oil temperature switch.

Starter motor with support (arrows).

Knock sensor (1).



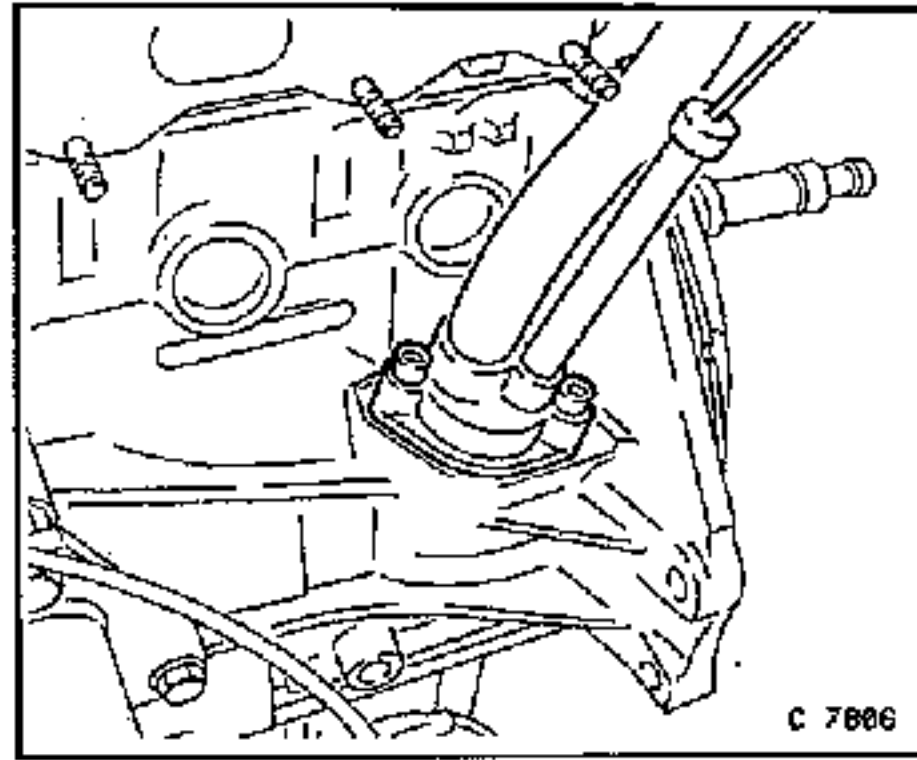
DOHC ENGINE - ENGINE SHORT BLOCK

Remove, Disconnect

Inductive pulse pick-up.
Engine ventilation flange.

Clean, Inspect

All parts, replacing as required.



Assemble New Short Block

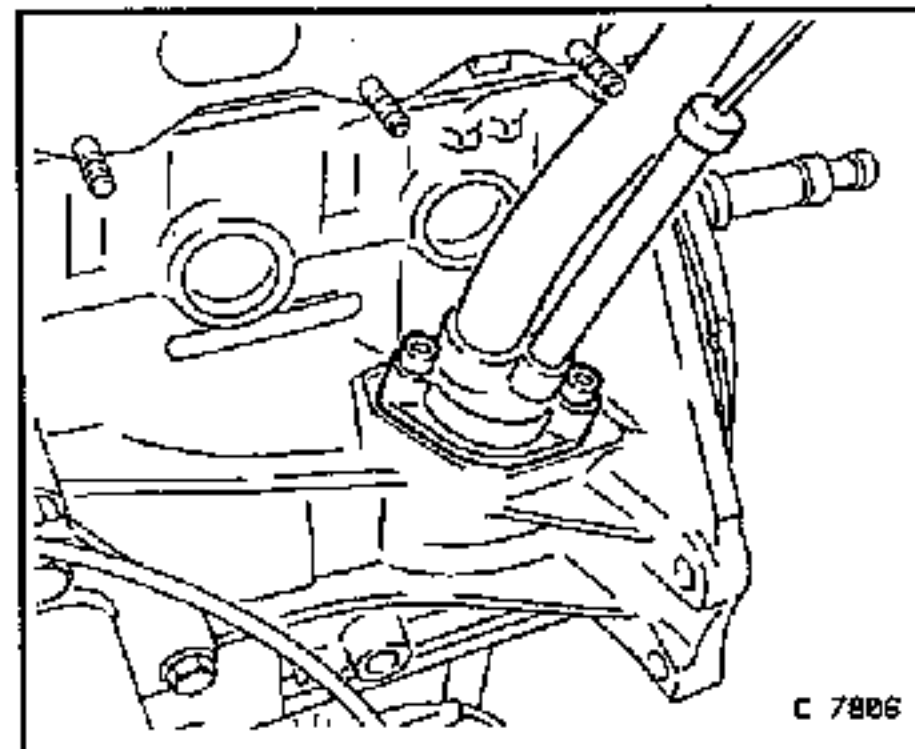
Install, Connect

Locating sleeves in the cylinder block top surface, using KM-427.

Tighten (Torque)

Engine ventilation flange to cylinder block.....	25 Nm *
Inductive pulse pick-up to cylinder block.....	6 Nm **
Starter motor to cylinder block.....	45 Nm
Starter support to cylinder block.....	25 Nm
Knock sensor to cylinder block.....	20 Nm
Oil temperature switch cylinder block.....	30 Nm
Coolant pipe to cylinder block.....	20 Nm

- * Use a new gasket
- ** Use a new seal ring



Install, Connect

Coolant hose to water inlet fitting.
Oil pump with a new gasket.

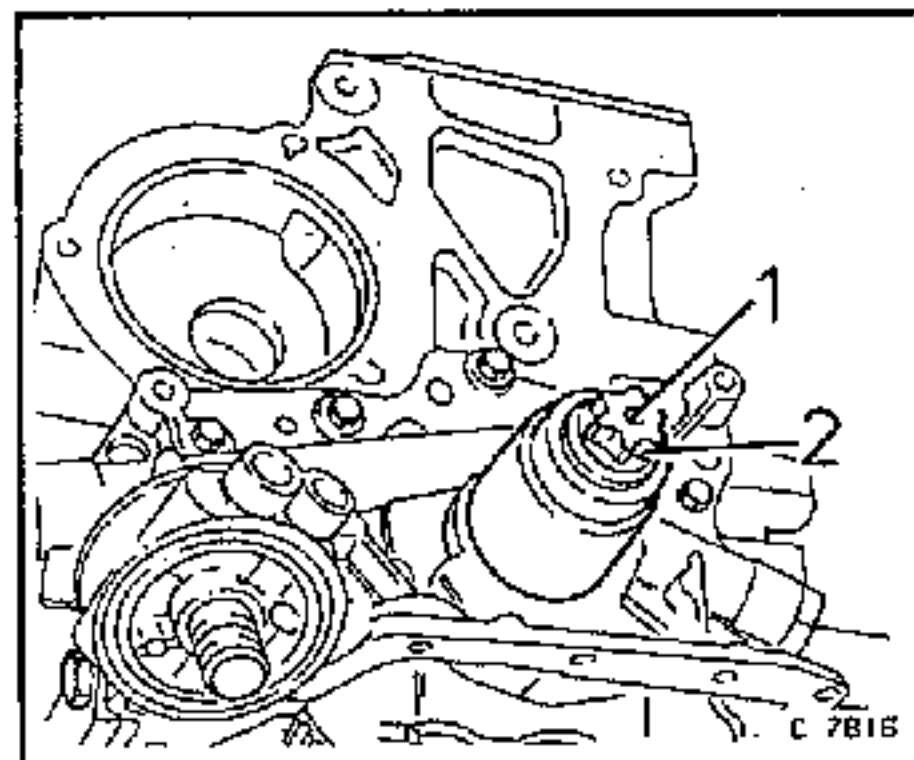
Tighten (Torque)

Oil pump to cylinder block	6 Nm
----------------------------------	------

Install, Connect

Seal ring, using KM-693 and the Torx bolt (1) and washer (2) from the toothed belt drive gear.

Note:
Apply protective grease to the seal lip before installation.

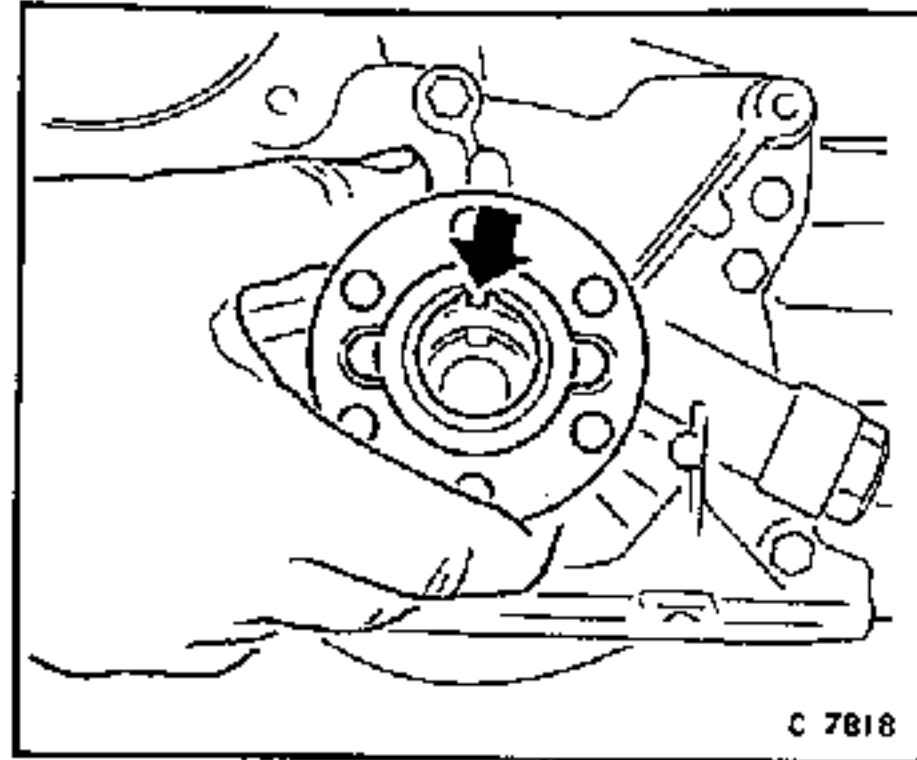


DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

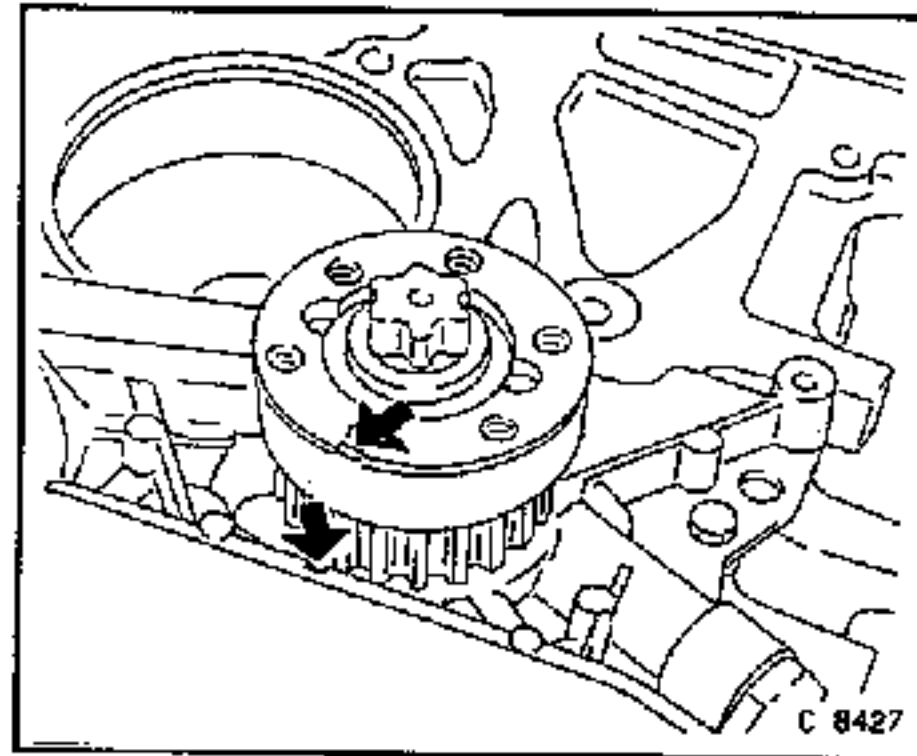
The spacing ring, coating first with sealant such as Dow Corning Silicone 732 or equivalent, to Holden's Specification HN1373.

Toothed belt drive gear, noting the installation position.



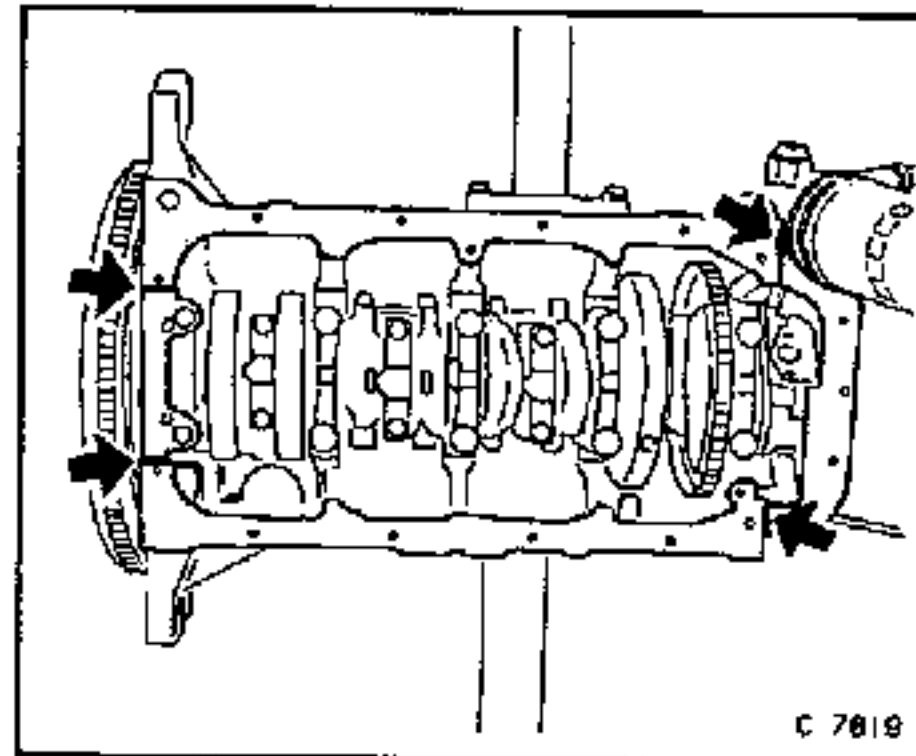
Adjust

Using MKM-604-21 (Torx E20), turn the crankshaft in the direction of rotation until No.1 piston is at TDC, as indicated in illustration C 8427.



Apply

Adhesive sealing compound such as General Electric RTV159 or equivalent, to the places indicated (arrows).



Install, Connect

Cork gasket and baffle plate.

Oil intake bracket and pipe.

Second cork gasket.

Oil pan to cylinder block.

Tighten (Torque)

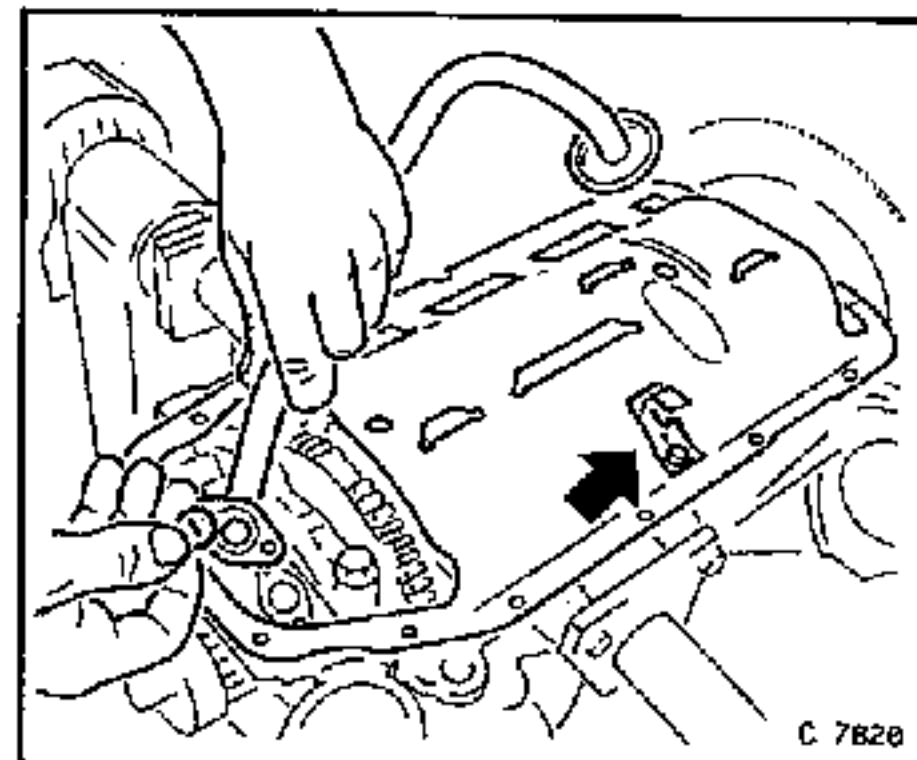
Oil intake pipe bracket to cylinder block ..	6 Nm
Oil intake pipe to oil pump	8 Nm
Oil pan to cylinder block.....	15 Nm *

* Insert oil pan bolts using locking compound such as Loctite 242 or equivalent to Holden's Specification HN1256

Important!

Maximum installation time is 10 minutes.

When installing the cork gaskets, check for the correct number of spacing rings.



DOHC ENGINE - ENGINE SHORT BLOCK

Install, Connect

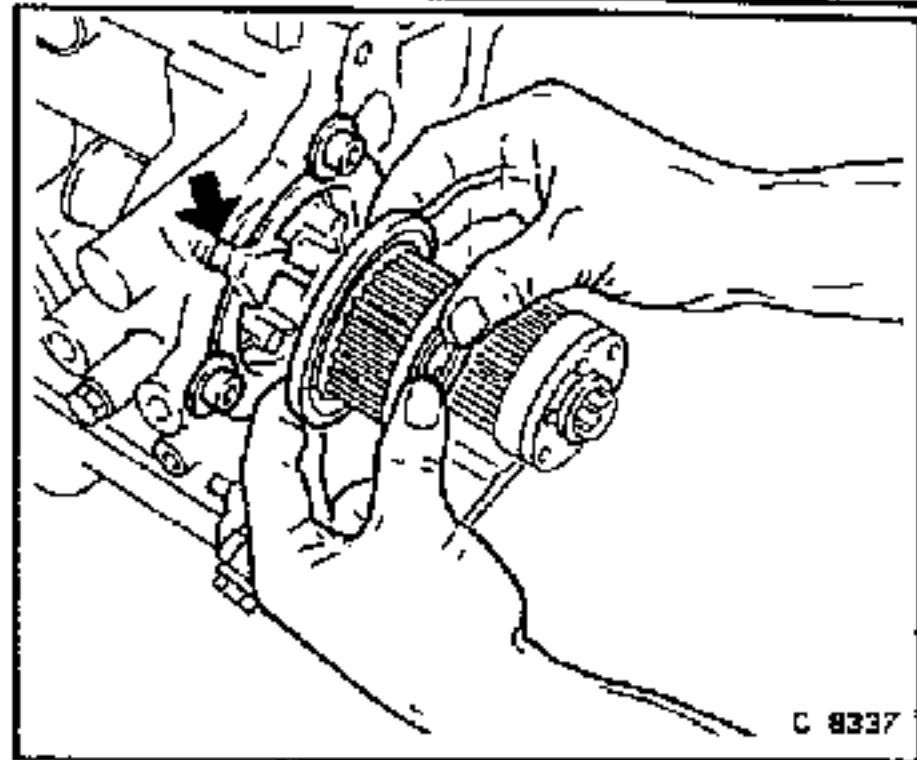
Water pump to cylinder block, after applying a thin bead of silicone grease such as Dow Corning No. 44 or equivalent to Holden's Specification HN1014:

Tighten (Torque)

Water pump to cylinder block 25 Nm

Important!

The two lugs on the cylinder block and water pump must be aligned (arrow).



Install, Connect

New cylinder head gasket. Align the mark "OBEN/TOP" upwards and to the timing side of the engine.

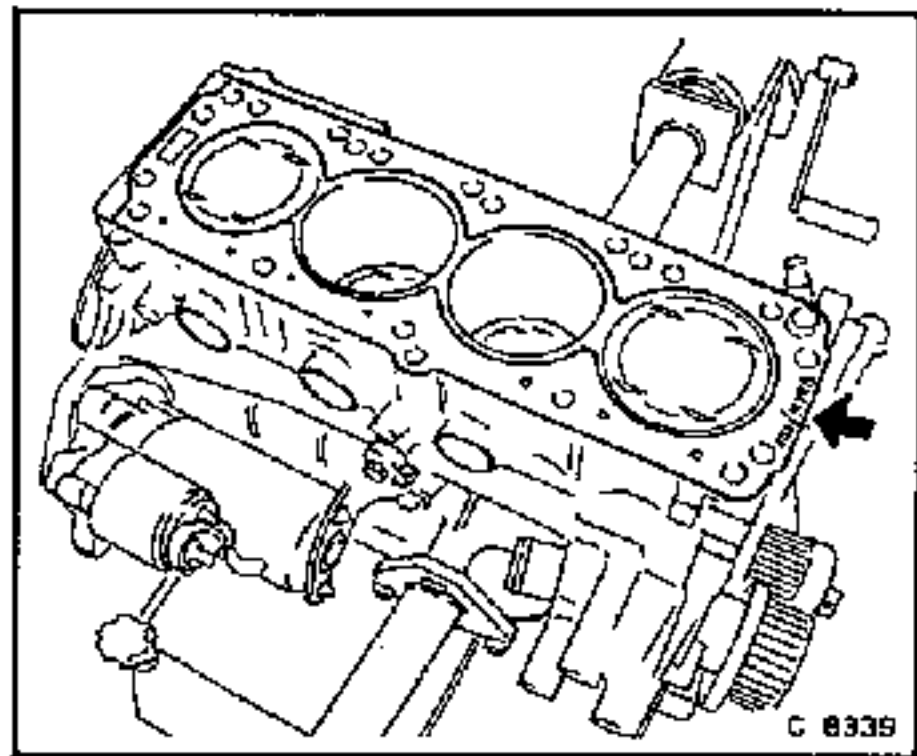
Install the cylinder head, indexing with the locating sleeves in the cylinder block.

Install new cylinder head bolts, each with a washer.

Using MKM-604-19-A (Torx E 14), install bolts until they are all just seated.

Important!

Use NEW bolts.

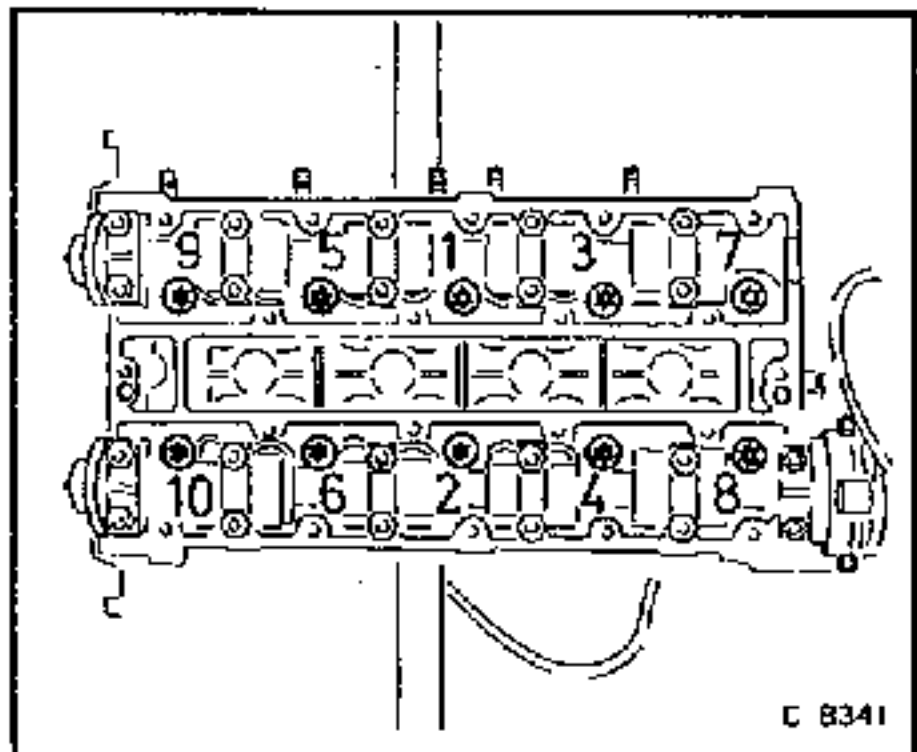


Tighten (Torque)

Cylinder head to cylinder block.
Tighten in the sequence shown, in four stages, using angular wrench KM-470-B.

Torque - Angle Method

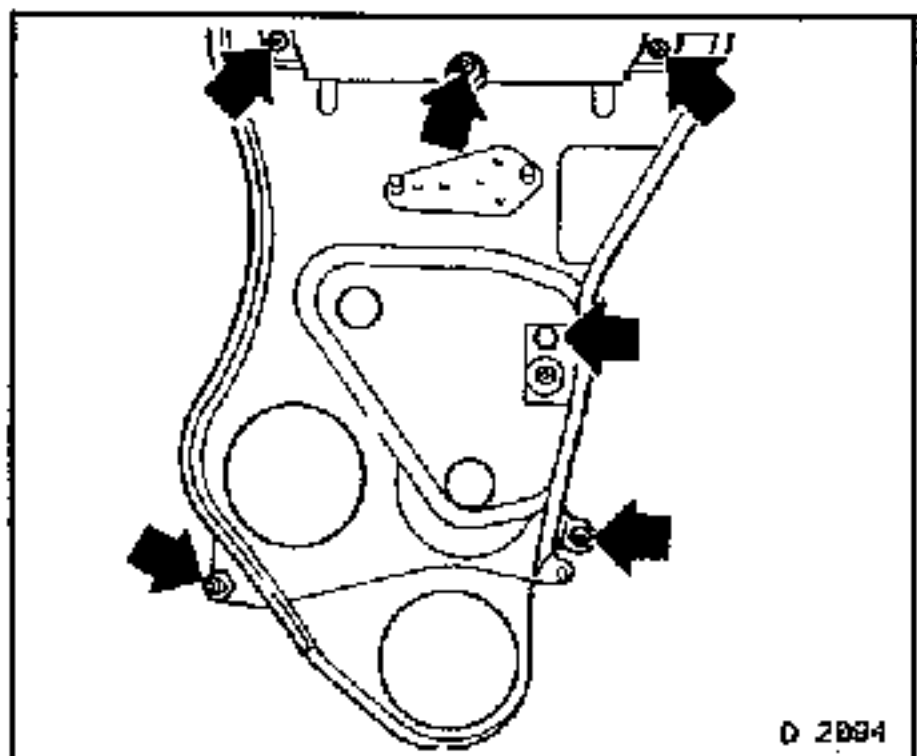
Tightening procedure 25 Nm + 90° + 90° + 90°



Tighten (Torque)

Rear toothed belt cover to cylinder block 6 Nm
Intake manifold to cylinder head support 25 Nm *

* For C 20 LET Engines:
Install after the engine has been installed in the vehicle.



DOHC ENGINE - ENGINE SHORT BLOCK

Engines up to MY'93:

Install, Connect

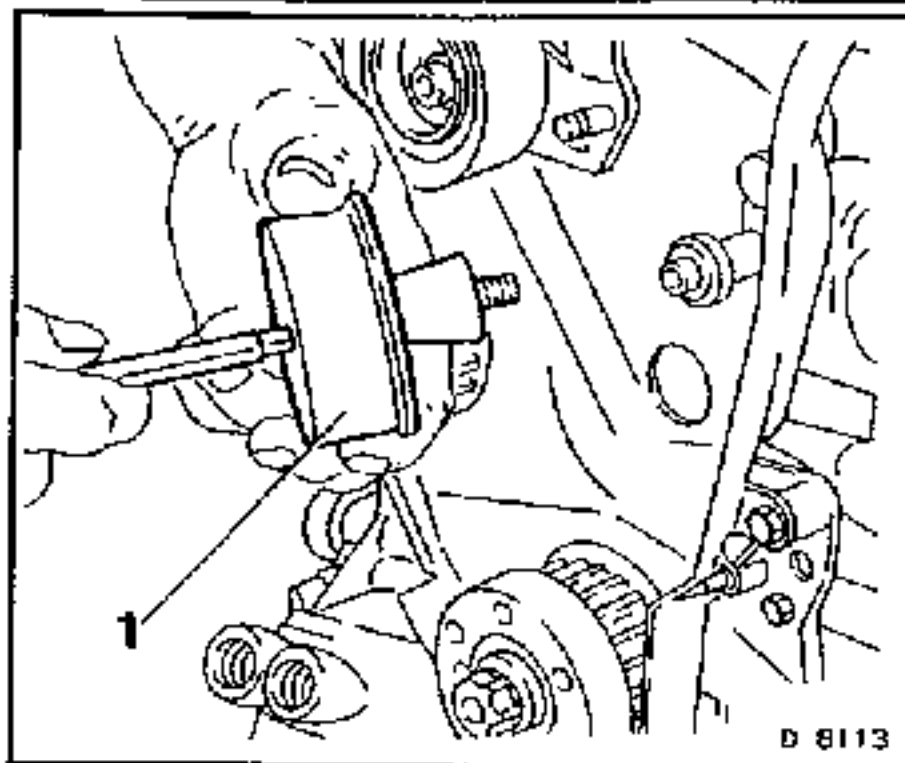
Toothed belt guide pulley (1) to cylinder block, installing the spacing sleeve with the small diameter to the toothed belt guide pulley or to the tension roller carrier plate.

Toothed belt tension roller to cylinder block.

Torque - Angle Method

Toothed belt guide pulley to cylinder block 25 Nm + 45° + 15° *

* Use new bolts.



Engines as of MY'93:

Install, Connect

Toothed belt guide pulley (1) to cylinder block.

Toothed belt guide pulley (2) to guide pulley bracket.

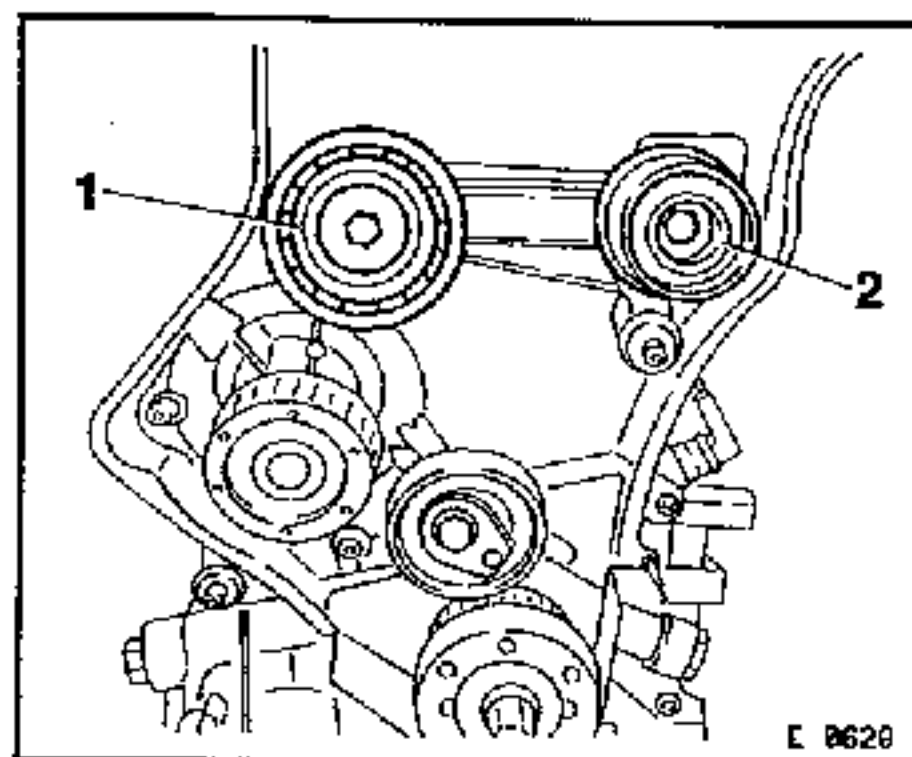
Toothed belt tension roller to oil pump housing.

Tighten (Torque)

Toothed belt guide pulley (1) to cylinder block 25 Nm

Toothed belt guide pulley (2) to guide pulley bracket 25 Nm

Toothed belt tension roller to oil pump housing 20 Nm



Install, Connect

Camshaft gears with the timing marks to the front.

Before installing, turn each camshaft until the locating pin faces upwards, by using an open ended spanner on the camshaft hex provided.

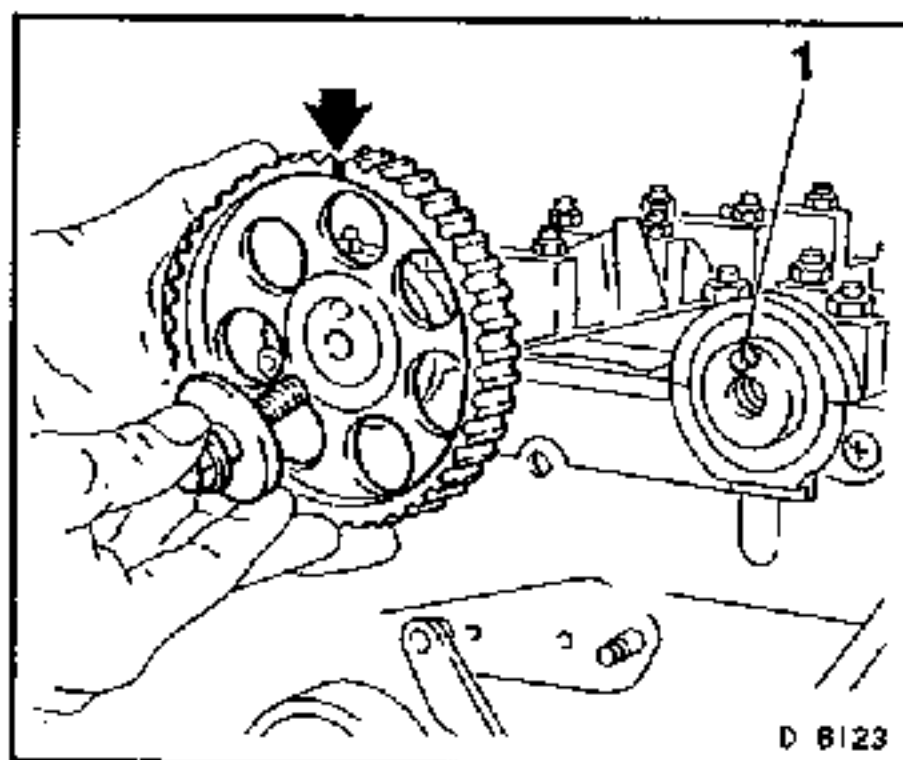
Each camshaft gear must index with this pin before tightening a new fastening bolt.

Torque - Angle Method

Camshaft gear to camshaft 50 Nm + 60° + 15°

Note:

Hold each camshaft at the hex during the tightening process.



Install, Connect

Cylinder head cover with a new gasket.

Crankcase ventilation hoses to the cylinder head cover.

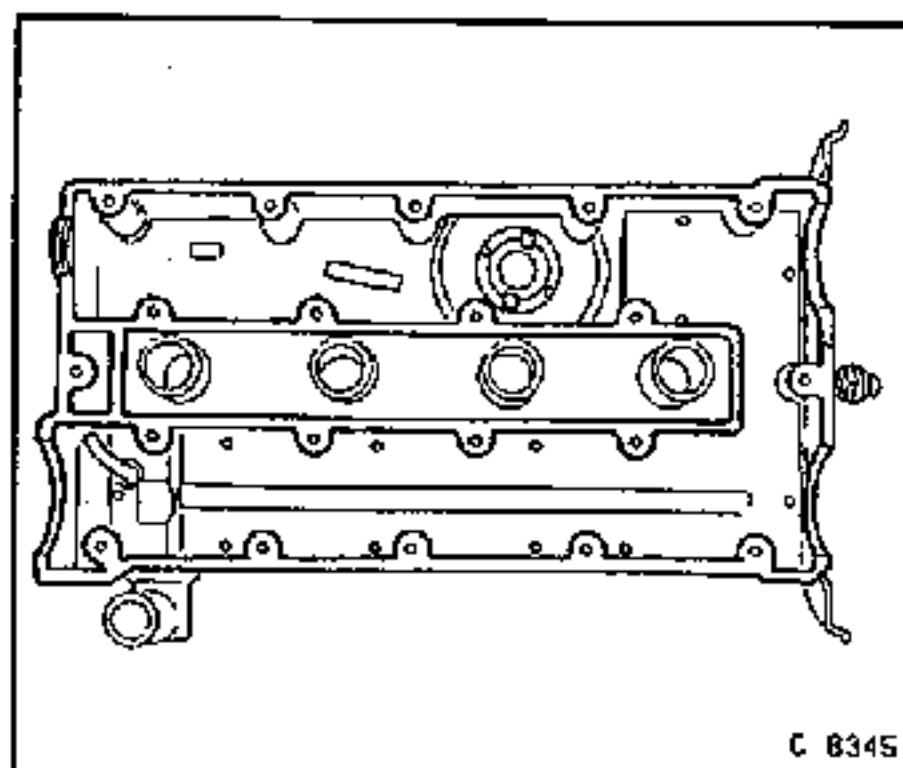
Spark plug connectors.

Ignition cable cover.

Tighten (Torque)

Cylinder head cover to cylinder head 8 Nm

Ignition cable cover to cylinder head cover 8 Nm



DOHC ENGINE - ENGINE SHORT BLOCK

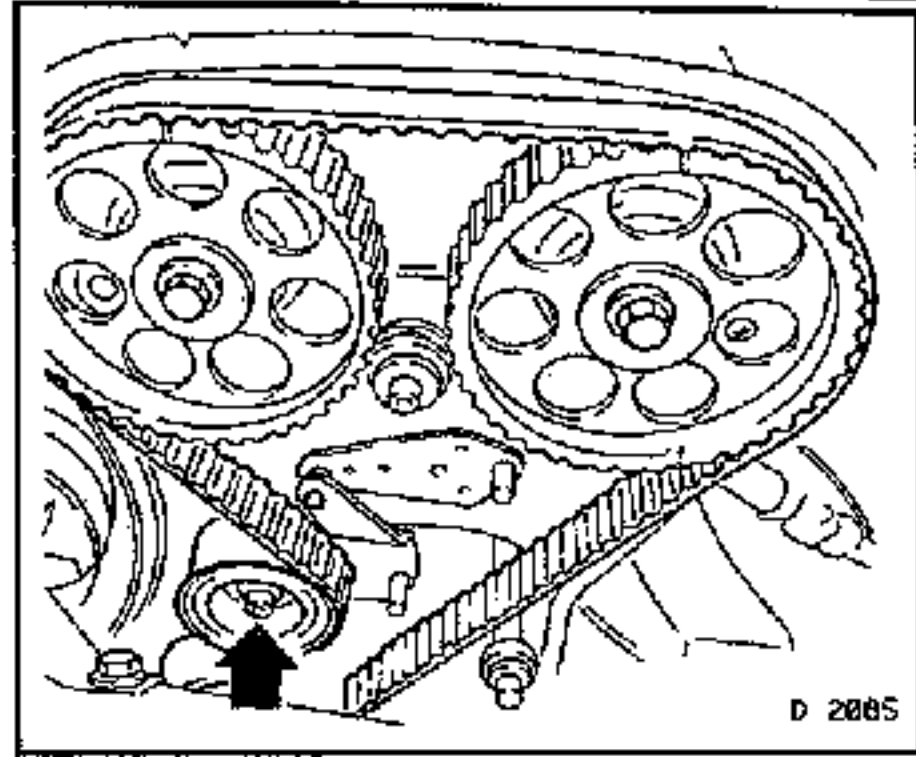
Install New Toothed Belt

Important!

The tooth profile for the toothed belt differs from engines up to MY'93 and for those from MY'93 onwards.

Adjust

Refer "Toothed Belt, Replace", in this Volume.



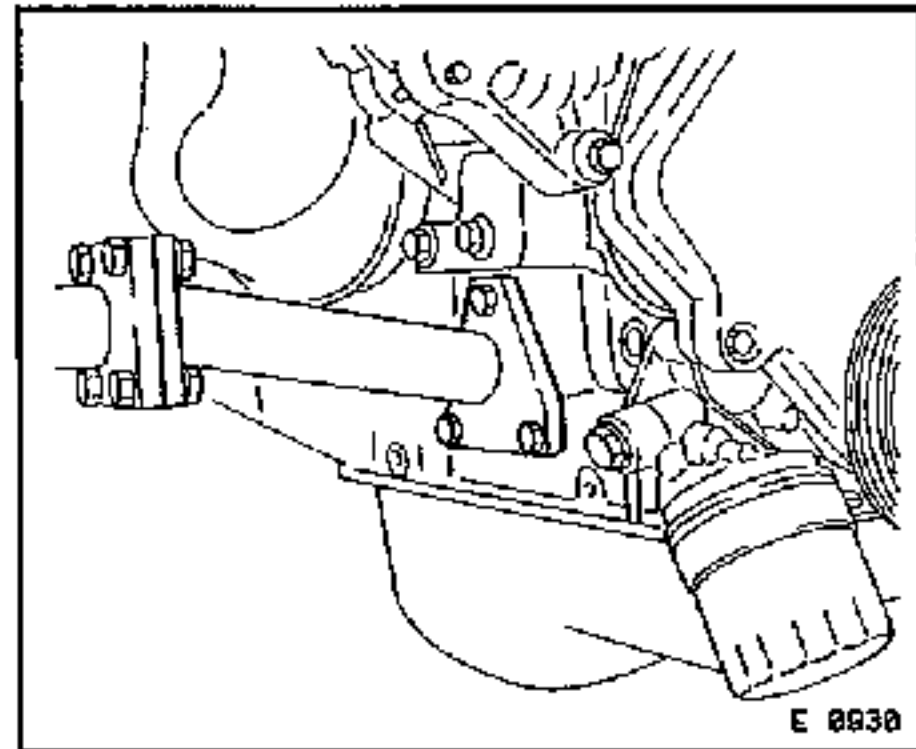
Inspect

Top up engine oil to the "MAX" mark on the dipstick.

Remove, Disconnect

Engine from engine overhaul stand KM-412.

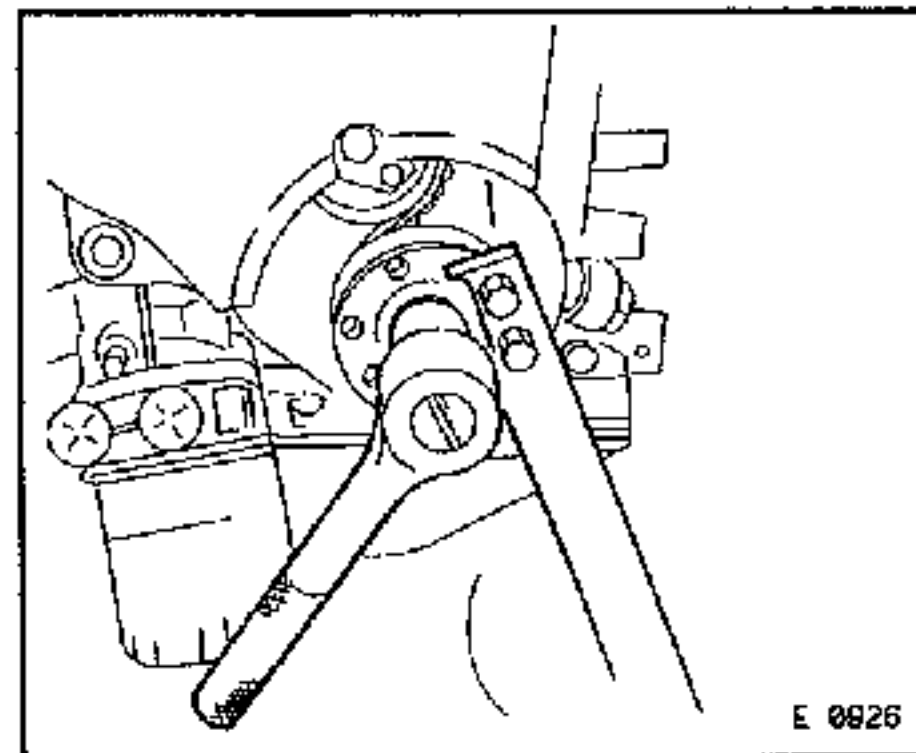
Adaptors from the engine.



Important!

Remove the fastening bolt temporarily fitted to the toothed belt drive gear.

After the engine has been installed in the vehicle, replace with a new bolt. Refer to "Engine without Transmission, Remove and Install", in this Section.



DOHC ENGINE - ENGINE SHORT BLOCK

RECOMMENDED TORQUE VALUES

(Engine Damping Blocks; Engine Short Block)

	Nm
Alternator clamping bracket to intake manifold.....	25
Bracket for P/S pump and A/C compressor to cylinder block.....	40
Bracket, intermediate shaft to cylinder block.....	55 (2)
Bracket, oil intake pipe to cylinder block.....	6
Bracket, transfer box to cylinder block.....	60
Brake servo vacuum line to intake manifold.....	20
Camshaft gear to camshaft.....	50 + 60° + 15° (4)
Cardan shaft to transfer box.....	30 (3)
Coolant pipe to cylinder block.....	20
Crankshaft pulley to toothed belt drive gear.....	20
Cylinder head cover to cylinder head.....	8
Cylinder head to cylinder block.....	25 + 90° + 90° + 90° (4)(9)
Engine bracket left, to transmission.....	60
Engine bracket rear, to transmission.....	60 (10)
Engine damping block left, to engine bracket.....	60
Engine damping block left, to side member.....	65 (5)
Engine damping block rear, to crossmember.....	40
Engine damping block rear, to engine bracket.....	45
Engine damping block right, to engine bracket.....	35
Engine damping block right, to side member.....	65 (5)
Exhaust pipe to exhaust adaptor.....	12 (1)
Hydraulic line to transfer box.....	30 (3)
Ignition cable cover to cylinder head cover.....	8
Inductive pulse pick-up to cylinder block.....	6
Knock sensor to cylinder block.....	20
Oil cooler lines to adaptor.....	30
Oil drain plug to oil pan.....	45
Oil filter cartridge to oil pump.....	15
Oil intake pipe to oil pump.....	8 (5)
Oil pan to cylinder block.....	15 (5)(6)
Oil temperature switch to cylinder block.....	30
Performance header with cover plate to cylinder head.....	22
Rear toothed belt cover to cylinder block.....	6
Right engine damping block to side member.....	65 (5)
Shift rod to knurled bolt.....	15
Spark plug to cylinder head.....	25
Starter to cylinder block - engine side (M 10).....	45
Starter to cylinder block - transmission side (M 12).....	60
Support for starter to cylinder block.....	25
Support to intake manifold and cylinder block.....	25
Thermostat housing to cylinder head.....	15
Toothed belt drive gear to crankshaft.....	250 + 40° - 50° (4)(7)
Toothed belt guide roller to cylinder block.....	25 + 45° + 15° (4)
Toothed belt guide roller to cylinder block.....	25 (7)
Toothed belt tension roller to cylinder block.....	25 + 45° + 15° (4)
Toothed belt tension roller to cylinder block.....	20 (7)
Transmission to cylinder block (M 10).....	45
Transmission to cylinder block (M 12).....	60
Water pump to cylinder block.....	25
Wheel bolts to front wheel hub.....	110

- (1) C 20 LET only.
- (2) Vehicles with front wheel drive.
- (3) Vehicles with four wheel drive.
- (4) Use new bolt/s.
- (5) Threads must be cleaned before reuse and coated with Locking Compound to Holden's Specification HN1256, Loctite 242 or equivalent.
- (6) Maximum assembly time 10 minutes.
- (7) Engines as of MY'93.
- (8) Install bolt with grease.
- (9) No re-tightening required.
- (10) Use new locking plates.

GROUP J

DOUBLE OVERHEAD CAM ENGINE

CHECKING AND ADJUSTING PROCEDURES

TABLE OF CONTENTS

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Compression, Check.....	J - 273
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Engine Oil Pressure, Check.....	J - 274
Engine Pressure Loss, Check.....	J - 274
Engine Oil Consumption, Measure.....	J - 278
Valve Timing, Check and Adjust (Engines up to MY'93).....	J - 279
Valve Timing, Check and Adjust (Engines as of MY'93).....	J - 280
Toothed Belt Tension, Adjust (Engines up to MY'93).....	J - 281
Toothed Belt, Install and Tension (Engines as of MY'93).....	J - 281
Recommended Torque Values.....	J - 282

DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

V-belt Tension, Check and Adjust

Note:

For engines as of MY'93, this operation is not required, as these engines are fitted with an automatic, ribbed V-belt tension roller.

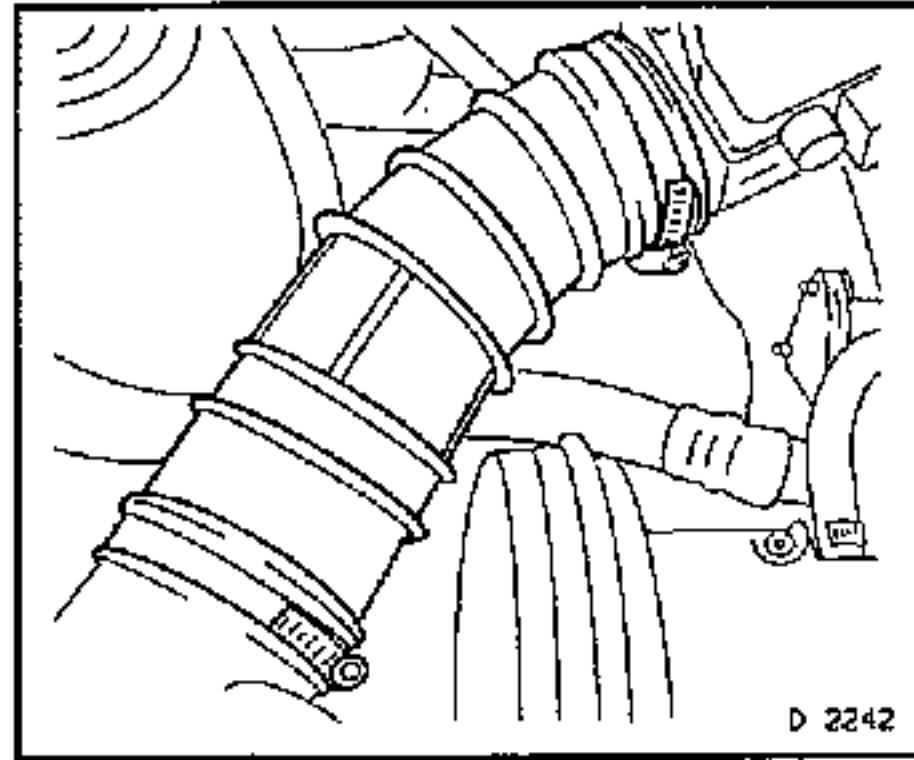
Remove, Disconnect

For C 20 XE;

Air intake hose.

For C 20 LET;

Cover from throttle valve manifold.



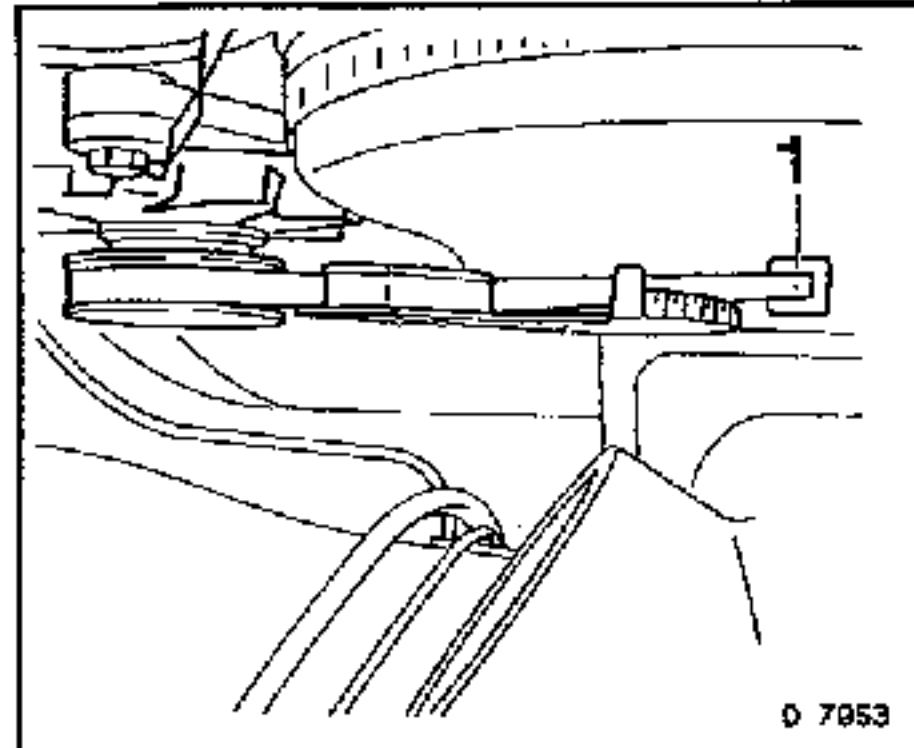
Measure

V-belt tension, using KM-128-A. Push lever (1) until pin touches V-belt and a buzzing sound is heard.

Read off measurement and multiply by 100 to calculate the V-belt tension in N.

Specification:

Used V-belt	250 - 300 N
New V-belt	450 N.



Adjust

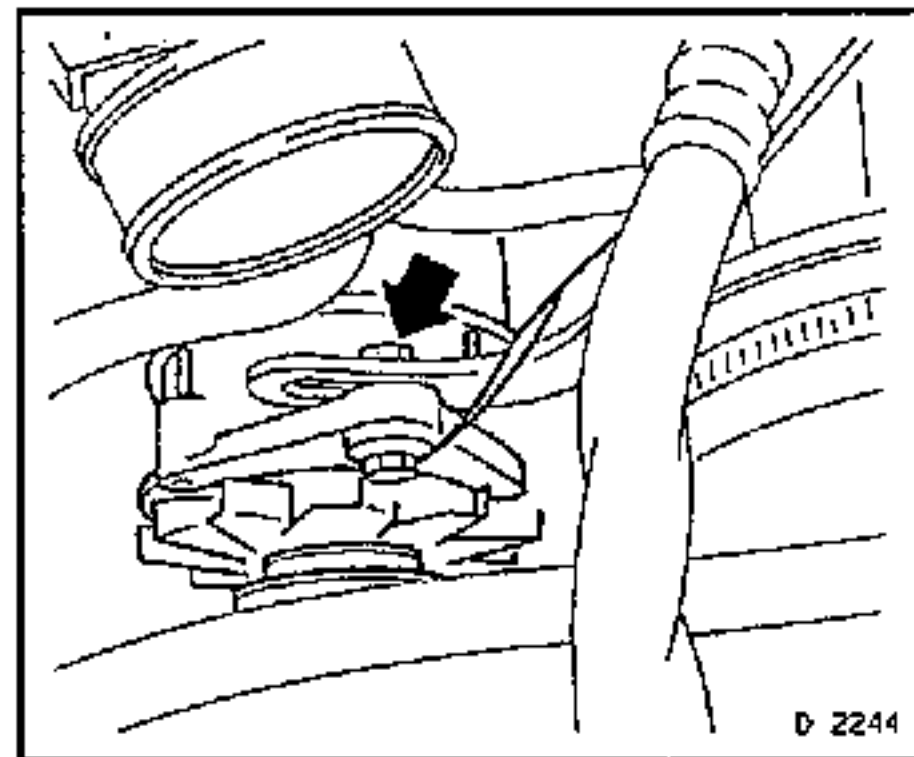
Loosen clamping bracket and lever alternator bracket, to move alternator.

Inspect

Check that the ground cable is in perfect condition.

Install, Connect

Air intake hose or throttle manifold cover.



Tighten (Torque)

Clamping bracket to alternator.....	25 Nm.
Lower alternator bracket (M 10).....	40 Nm.
Cover to throttle valve manifold	5 Nm.

DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

Compression, Check

Engine is to be at normal operating temperature (oil temperature to be at least 80 °C).

Remove, Disconnect

Ignition cable cover from cylinder head cover

Spark plug connectors, using KM-717, then spark plugs, using KM0194-B.

Terminal "15" from ignition coil or wiring harness plug from ignition control unit.

Fuel pump relay (arrow).

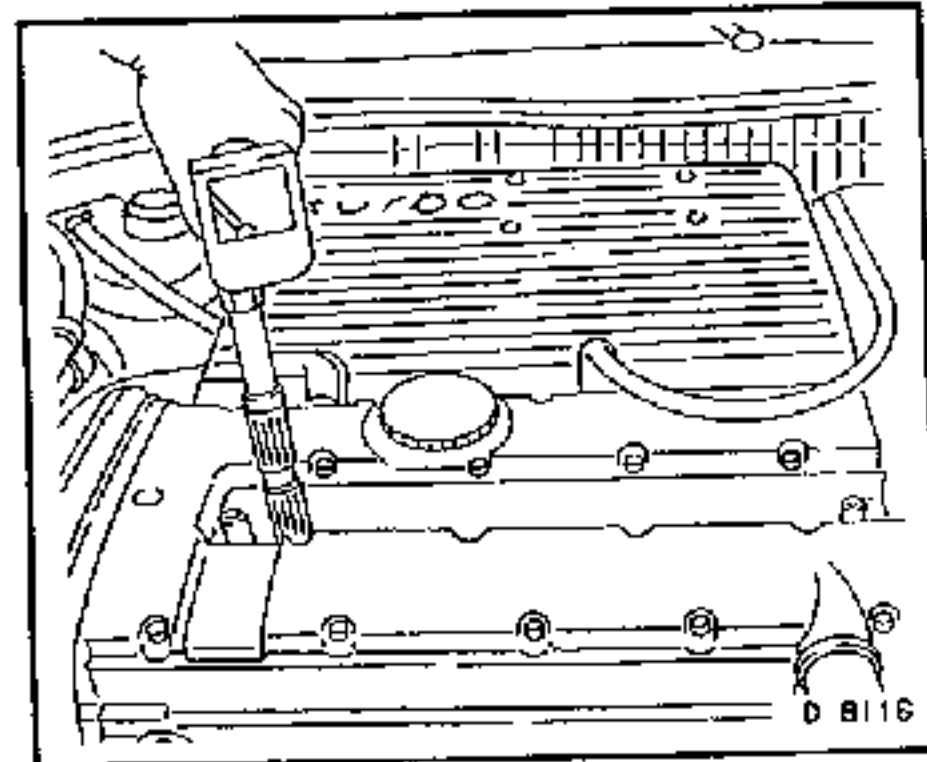
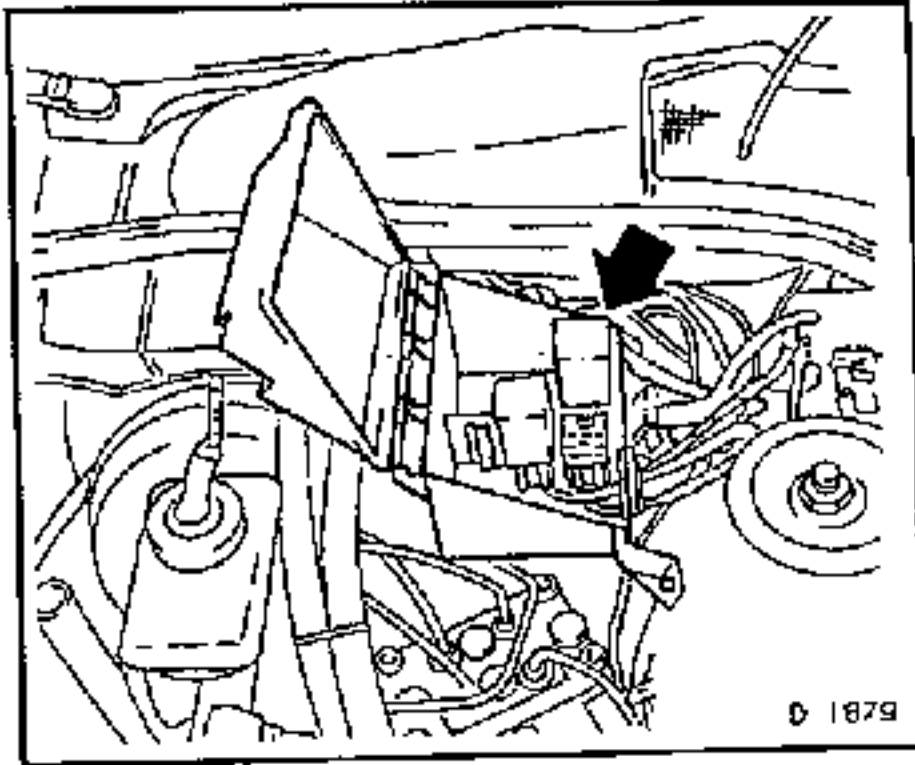
Note:
For the C 20 XE (as of MY'93) and the C 20 LET engines, the fuel pump relay is located in the front right footwell.

Inspect

Note:
Use compression gauge with a rubber cone and a measuring range of 1,750 kPa.

Operate starter for approximately 4 seconds with a fully opened throttle valve. The engine speed is to be at least 300 rpm.

Allowed deviation of individual cylinders must not exceed 100 kPa.

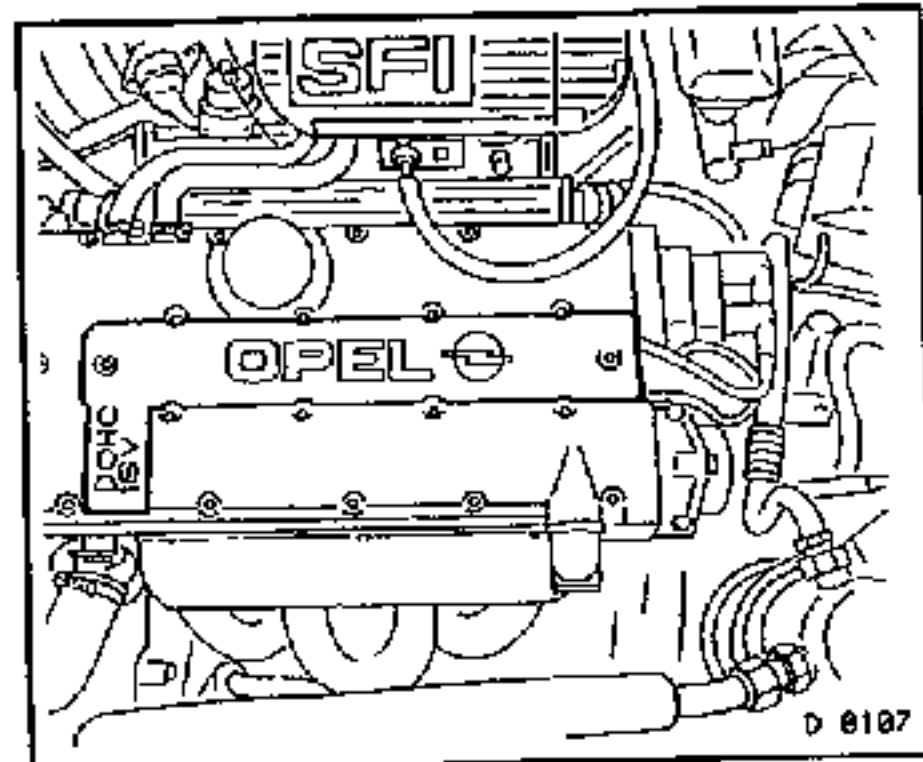


Install, Connect

Spark plugs.
Spark plug connectors.
Ignition cable cover to cylinder head.

Tighten (Torque)

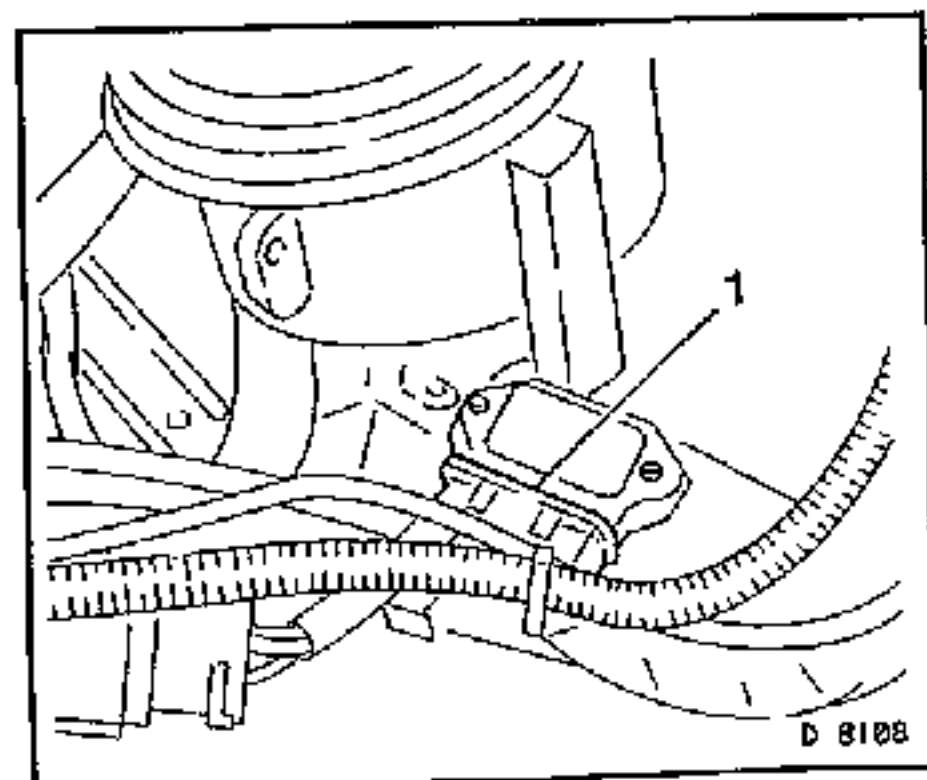
Spark plug to cylinder head	25 Nm
Ignition cable cover to cylinder head cover	8 Nm



Install, Connect

Terminal "15" to ignition coil or wiring harness plug (1) to ignition coil control unit.

Fuel pump relay.



DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

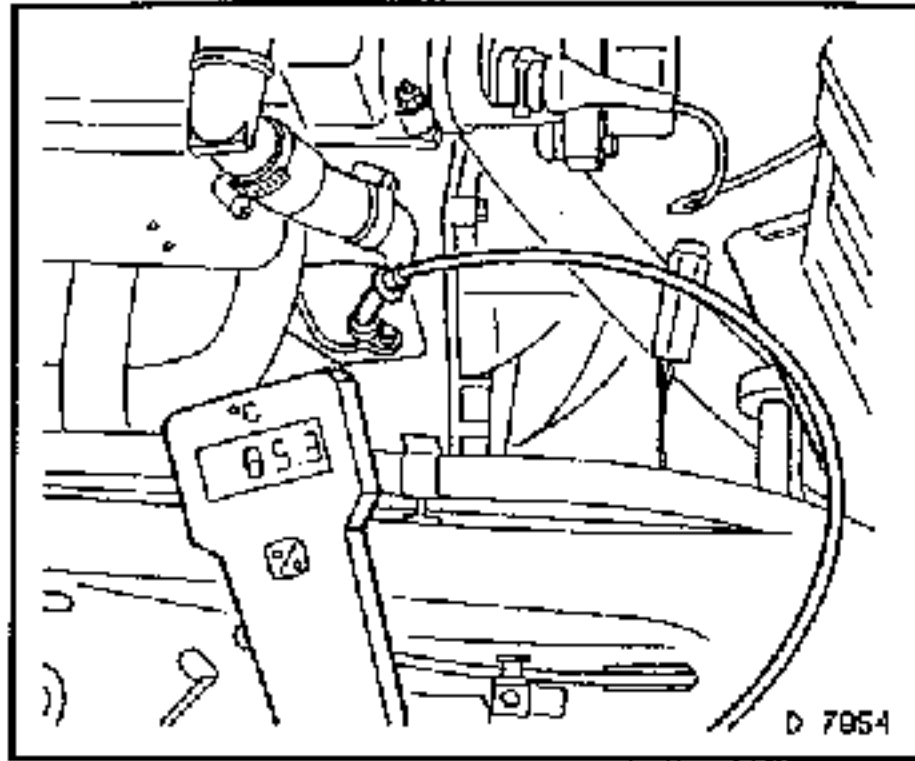
Engine Oil Temperature, Measure

Measure

Engine oil temperature, using MKM-596.

Insert measuring probe in dipstick tube to approximately 1 cm above the bottom of the oil pan.

Seal dipstick tube with rubber plug supplied. Observe manufacturer's instructions.



Engine Oil Pressure, Check

Remove, Disconnect

If fitted, engine compartment cover.

Oil pressure switch.

Install, Connect

Oil pressure gauge KM-498-B and KM-135 to oil pressure switch opening.

Check

That engine oil pressure is at least 30 kPa at idle speed with an oil temperature of at least 80 °

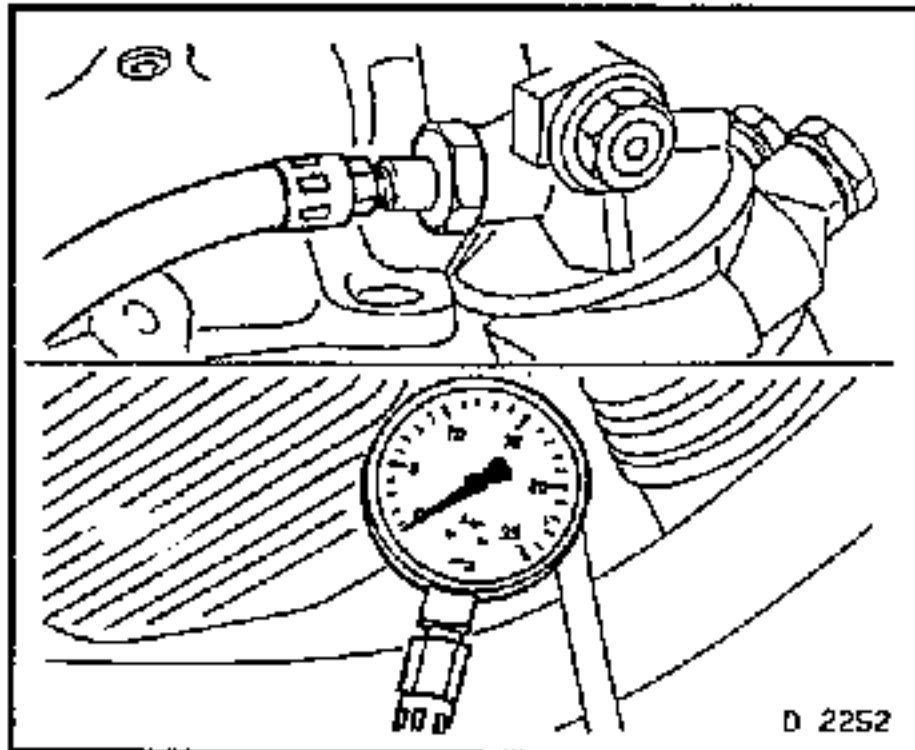
Install, Connect

Oil pressure switch to oil pump.

Engine compartment cover, if removed.

Tighten (Torque)

Oil pressure switch to oil pump..... 40 Nm



Engine Pressure Loss, Check

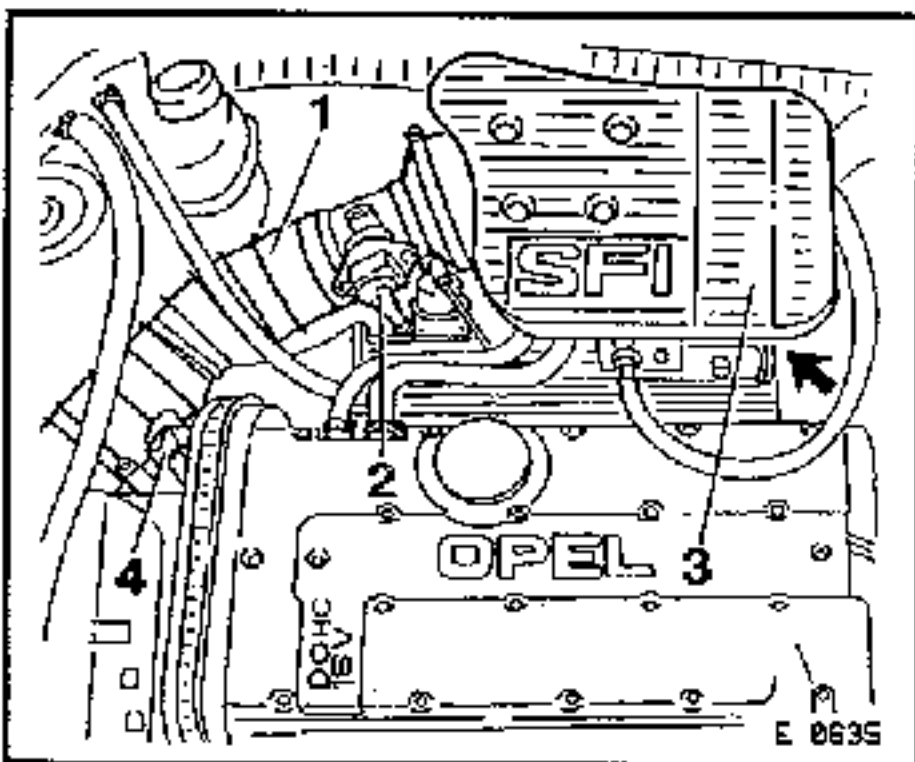
Remove, Disconnect

If fitted, engine compartment cover.

Air intake hose (1) from air cleaner, wiring harness plug (2) from mass air flow meter, Hose (arrow) from pre-volume chamber, pre-volume chamber (3) with the air intake hose.

For C 20 XE as of MY'93:

Wiring harness plug (4) from the intake air temperature sensor.



Remove, Disconnect

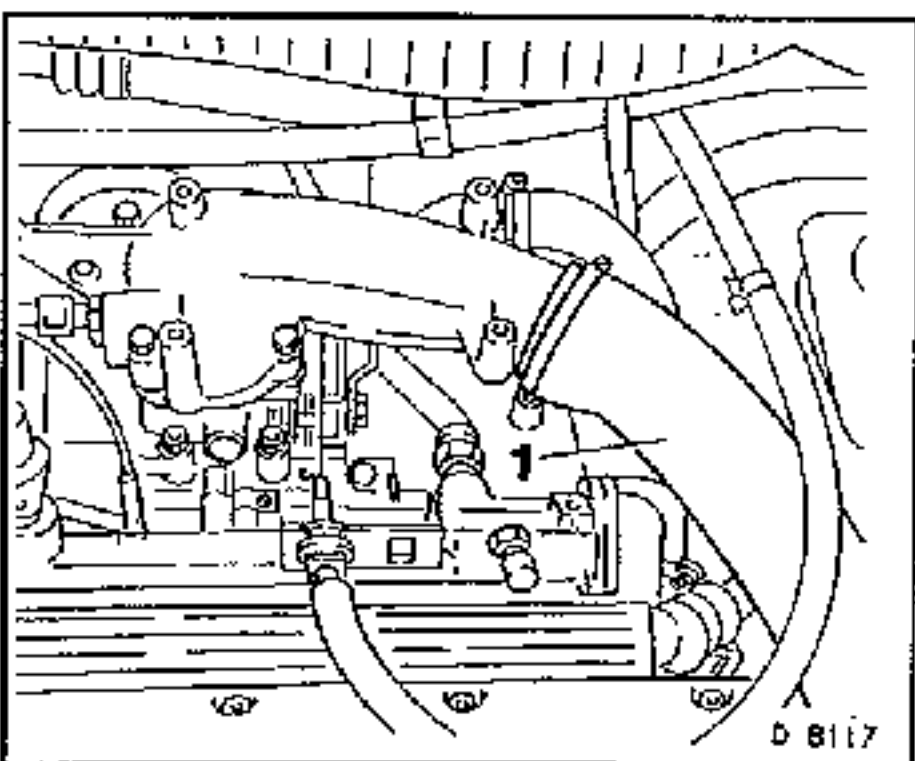
For C 20 LET:

Cover from throttle valve manifold.

Air intake hose (1) from throttle valve manifold.

Ignition cable cover from cylinder head cover

Spark plug connectors, using KM-717, then spark plugs, using KM0194-B.



DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

Remove, Disconnect

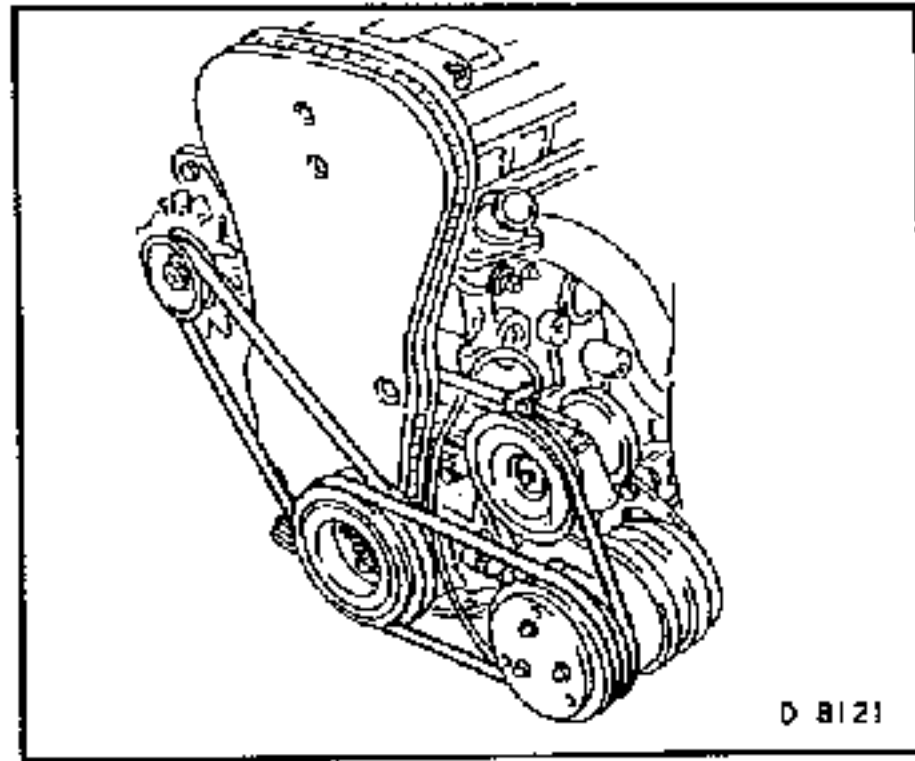
If fitted, engine compartment cover.

Engines up to MY'93:

V-belt from alternator, power steering pump and A/C compressor

With all DOHC Engines:

Front toothed belt cover.

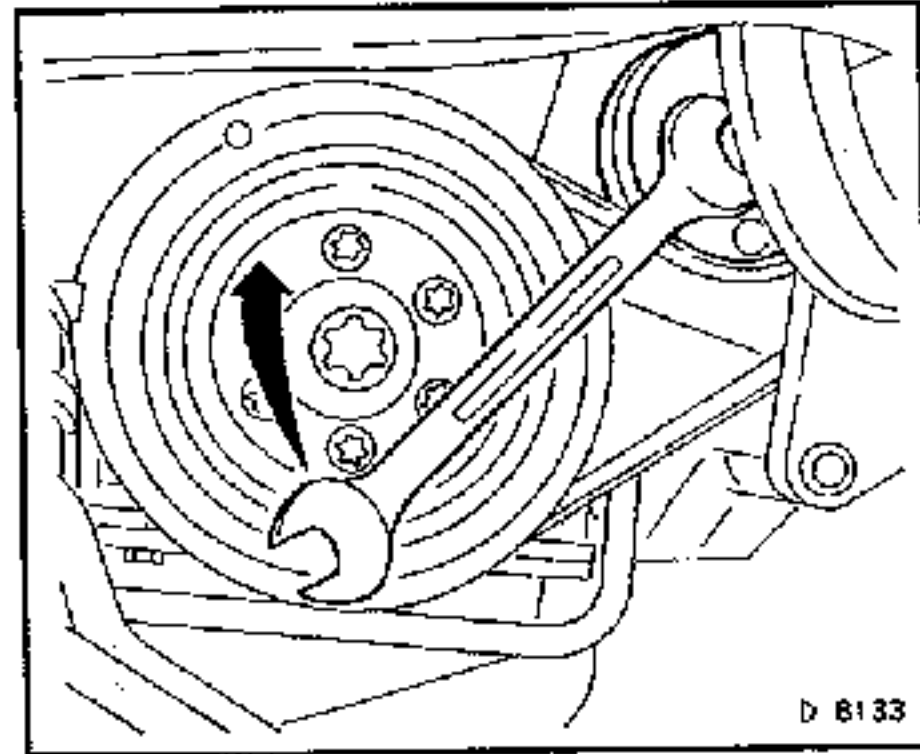


Remove, Disconnect

Engines as of MY'93:

Mark direction of rotation of ribbed V-belt, with felt tipped pen or similar.

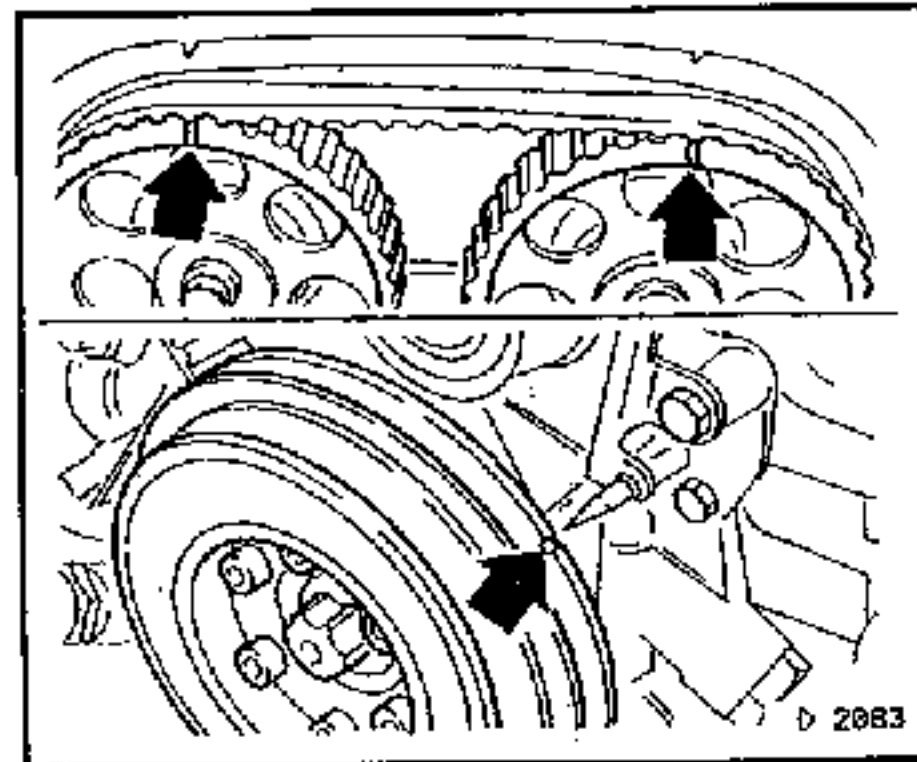
Ribbed V-belt by turning the ribbed V-belt tension roller in the direction of the arrow.



Inspect

Using MKM-604-21 (Torx E 20) at the fastening bolt for the crankshaft pulley, turn the crankshaft slowly and evenly until No. 1 piston is at the "TDC" position, as indicated by the pulley notch and pointer being aligned.

The camshaft gears must then be aligned with the notches on the cylinder head cover.



Install, Connect

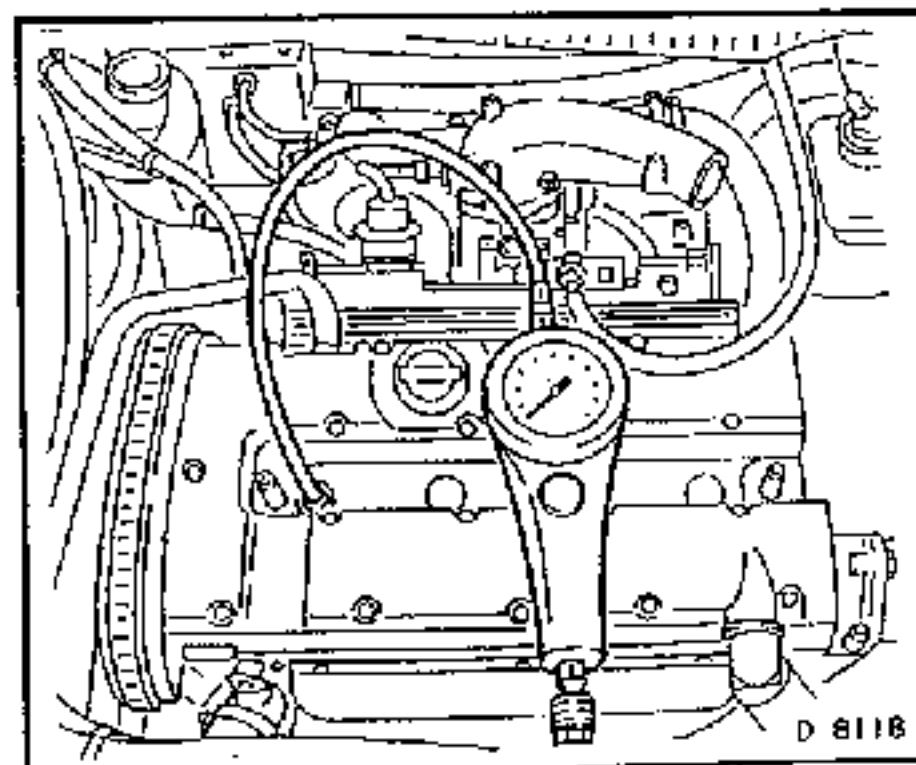
Adaptor in spark plug hole for the 1st cylinder to be checked.

The compression loss tester to a compressed air supply, then calibrate the tester.

The compression loss tester to the adaptor. Observe manufacturer's instructions.

Important!

The crankshaft must not turn during this test operation. To stop this, engage 1st gear and the park brake.



DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

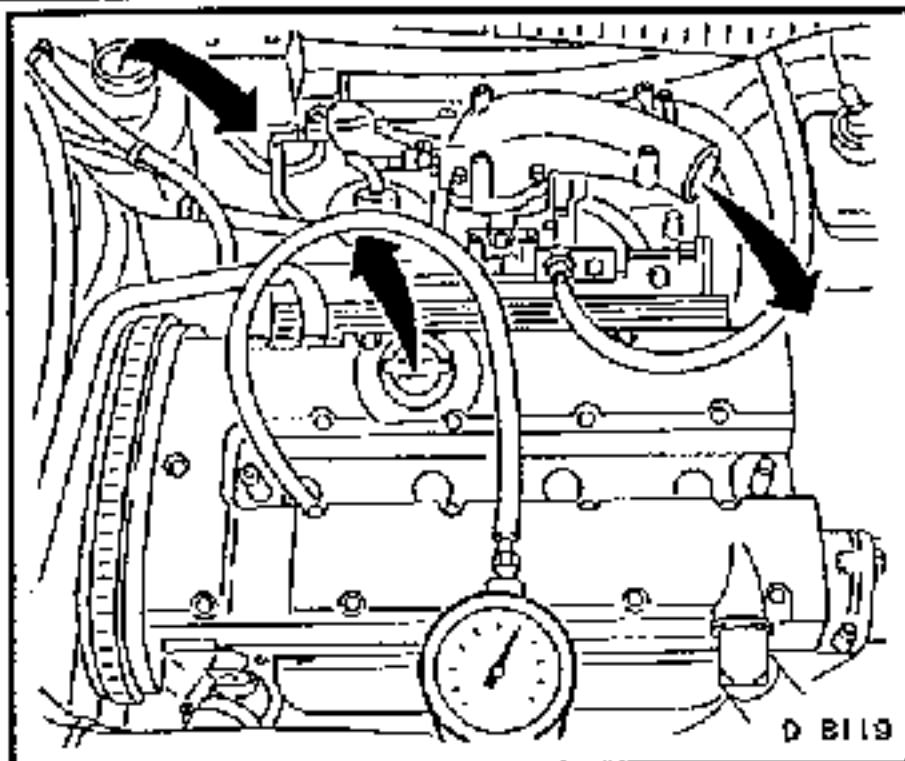
Inspect

Air flow from:

Intake and exhaust, coolant reservoir tank and crankcase.

Allowable compression variation between individual cylinders is approximately 10%.

Allowable total compression loss on one cylinder is 25%.

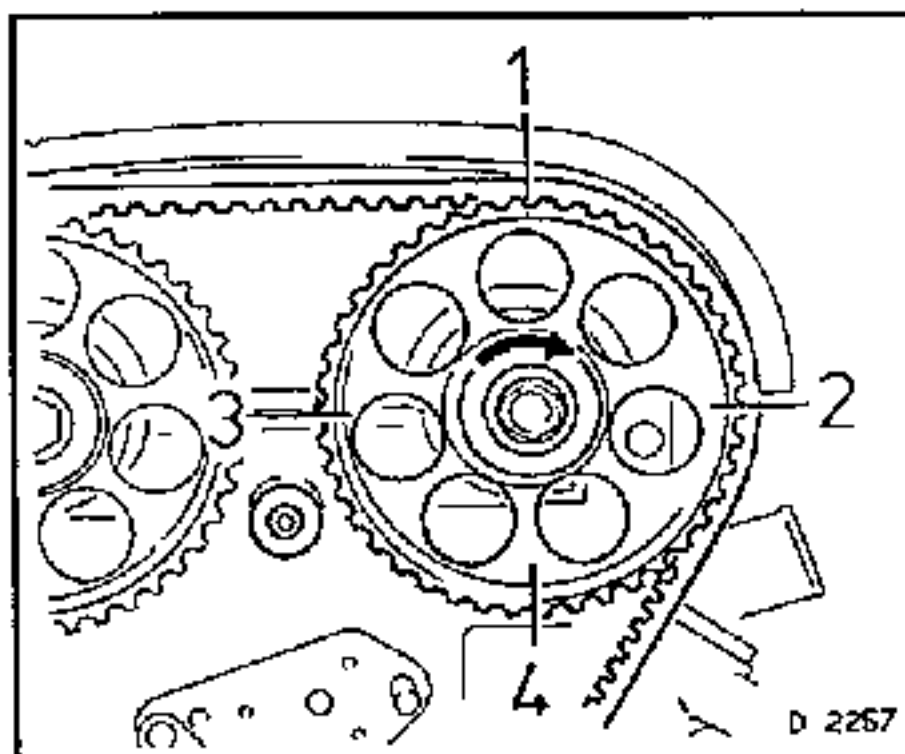


Inspect

Compression loss for the remaining cylinders.

Cylinders are to be checked in the firing order sequence of 1, 3, 4, 2, with each piston at "TDC".

An indication of these positions can be gained by marking one camshaft pulley.



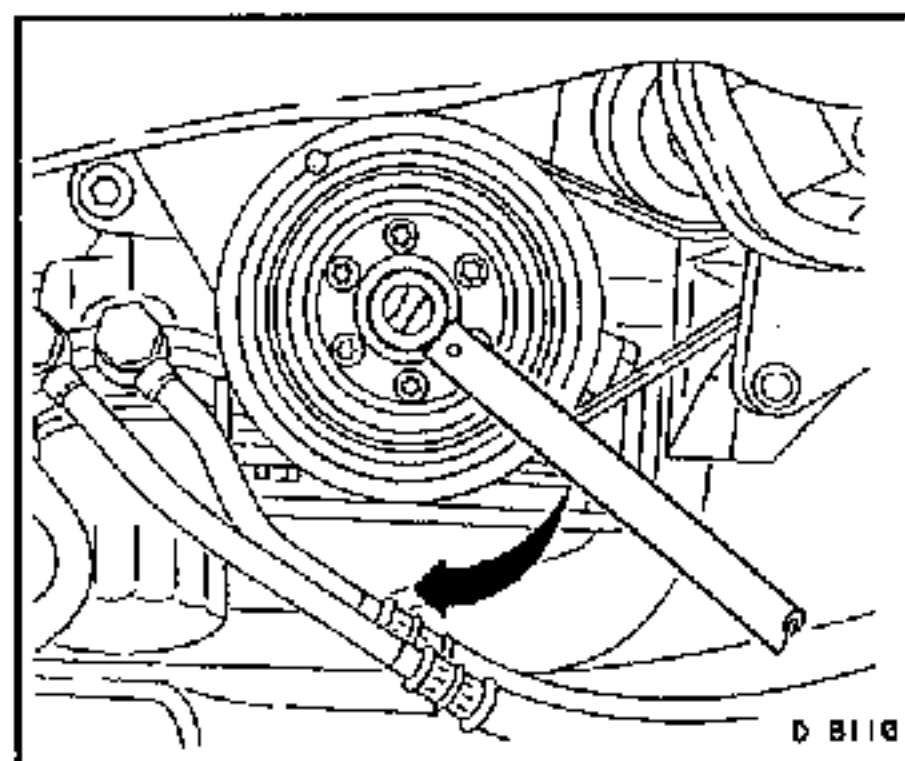
Inspect

Turn the crankshaft with MKM-604-21 (Torx E 20), a further 180° in the direction of engine rotation (this corresponds to 90° at the camshaft), until the mark on the camshaft pulley aligns with the notch on the cylinder head cover.

Determining the remaining piston positions is a similar process.

Important!

Turn the crankshaft smoothly and slowly.



Install, Connect

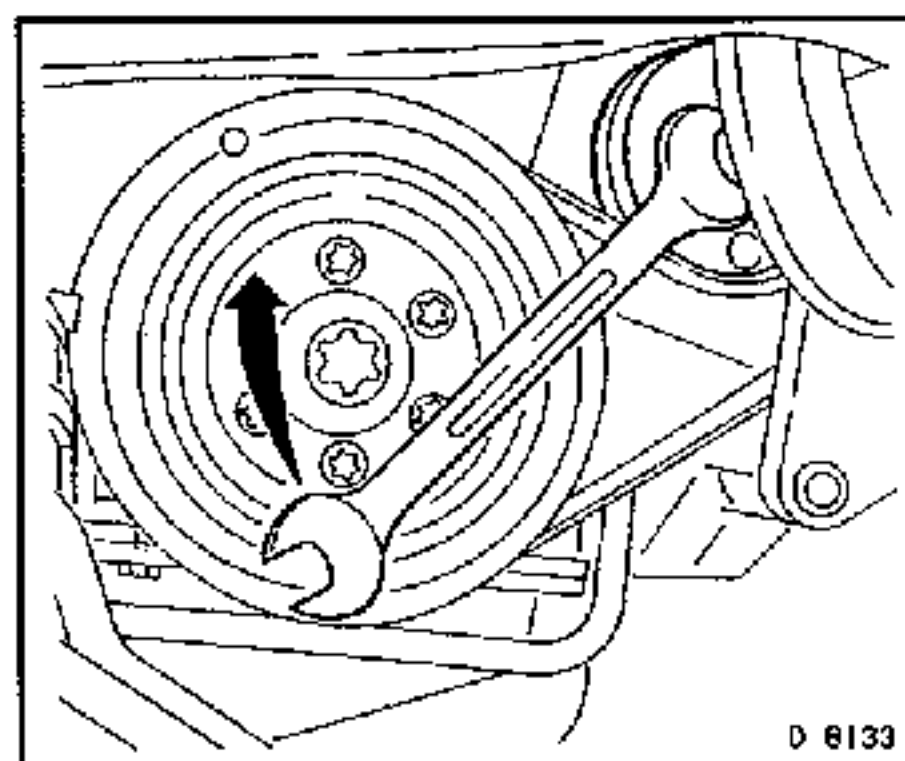
Engines as of MY'93:

Ribbed V-belt by turning the ribbed V-belt tension roller in the direction of the arrow.

Note:

Pay attention to the direction of rotation mark on the ribbed V-belt when installing.

If removed, the engine compartment cover.



DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

Install, Connect

Front toothed belt cover.

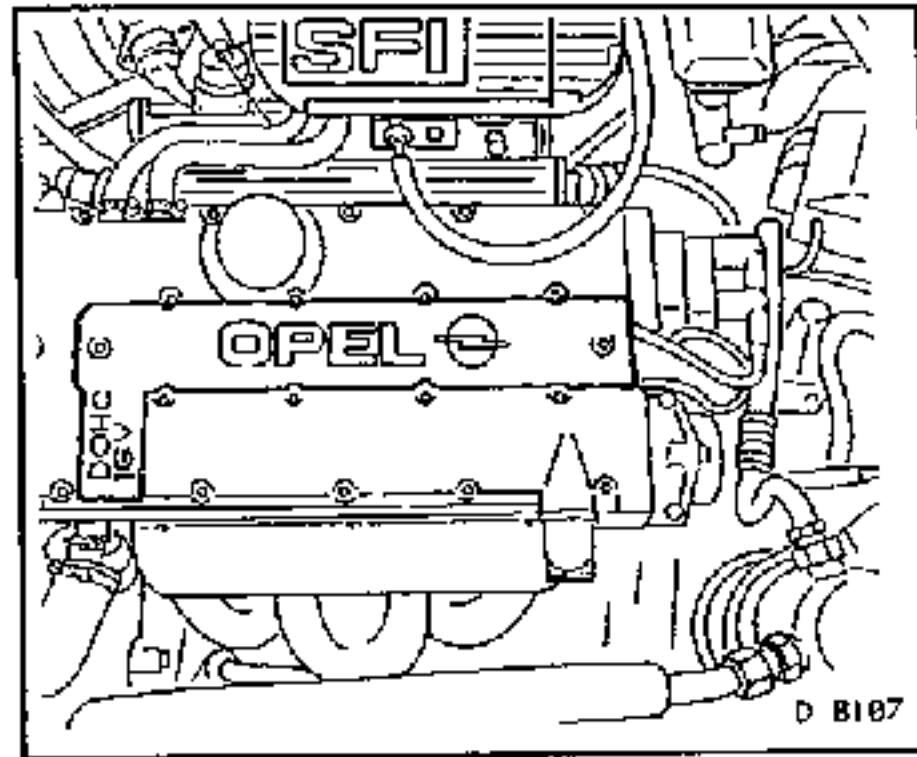
Engines up to MY'93:

Install and tension the V-belt. Refer to: "V-belt Tension, Check and Adjust", earlier in this Section.

Spark plugs, using KM-194-B, then install the spark plug connectors.

Ignition cable cover to cylinder head cover.

Oil filler cap, engine dipstick, coolant reservoir cap.



Install, Connect

Pre-volume chamber (3) with air intake hose, hose (arrow) to pre-volume chamber, wiring harness plug (2) to mass air flow meter, air intake hose (1) to air cleaner.

For C 20 XE, as of MY'93:

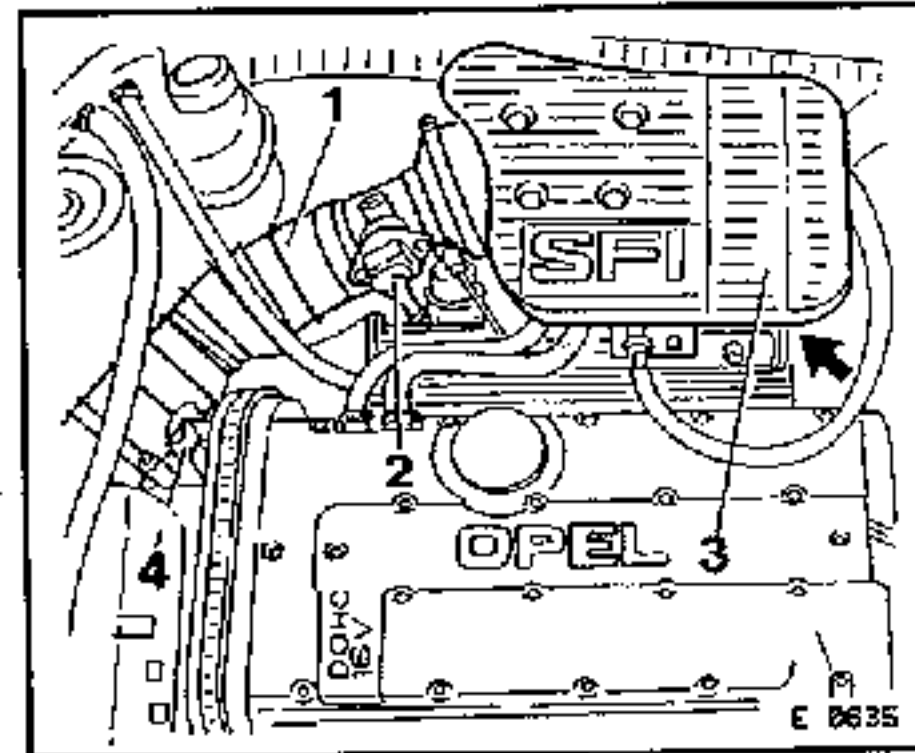
Wiring harness plug (4) to intake air temperature sensor.

For C 20 LET:

Air intake hose and throttle valve manifold cover.

Tighten (Torque)

Cover to throttle manifold	5 Nm
Spark plugs to cylinder head	25 Nm
Ignition cable cover to cylinder head cover	8 Nm



DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

Engine Oil Consumption, Measure

General

The term "oil consumption" of an internal combustion engine refers to the amount of oil that is used because of combustion. Oil consumption should under no circumstances be confused with oil loss caused by leaks from the oil pan, cylinder head cover, etc.

The task of the engine oil is to:

1. Separate surfaces that slide on one another with an oil film, i.e. prevent dry friction.
2. Conduct the heat away, that is produced by friction.
3. Conduct combustion residue away.

These tasks require that the engine will consume a certain amount of oil; i.e. the expectation of many who claim that further development of the internal combustion engine will lead to an engine that does not require oil, are totally without foundation.

The oil consumption is however, influenced by external operating factors, driving style and manufacturing tolerances. Under normal circumstances, the consumption is so minimal that only a small amount needs to be topped up between the prescribed oil change intervals, or even no topping up at all.

Topping up is necessary however, if the oil level falls below the "MIN" mark on the dipstick.

Similarly, the oil level should not exceed the upper "MAX" mark on the dipstick, as this leads to an increased consumption of oil.

As oil consumption is a technical necessity, indications that an engine is not consuming oil means that it can be concluded that the oil is being diluted because of the particular operating conditions under which the vehicle is being subjected.

Frequent cold starts, driving when over-cold, etc., result in the oil flowing back to the oil pan containing fuel particles and condensation, and thereby becoming "diluted". This situation can lead to the incorrect supposition that the engine is not consuming any oil at all.

Oil diluted in this way, lacks lubricating quality and may lead to engine damage if the prescribed oil change intervals are not observed. The main causes for oil dilution are frequent driving in urban traffic and frequent driving at low engine speeds, particularly when the engine is cold.

With a new vehicle, the rate of oil consumption starts to stabilise after the vehicle has travelled a few thousand kilometres; therefore, measurements of oil consumption only become realistic after about 7,500 km. Before measuring the oil consumption, check that the engine is not losing oil through a leak.

Notes:

- The oil dipstick can only be used for checking and not for measurement.
- The engine must always be switched off for at least 2 minutes before the oil level can be accurately checked.
- If, after an oil change, the recommended quantity of engine oil level does not match the maximum level on the dipstick, this can be attributed to manufacturing tolerances.

All information regarding permissible oil consumption and filling quantities is included in the Owner's Handbook.

Measuring Method

1. The check is carried out with the vehicle on a horizontal surface with the engine at operating temperature (engine oil temperature at least 80 °C).
2. Allow the engine to run at idle speed immediately before draining the oil.
3. Drain engine oil immediately after switching the engine off and record the time with a stop watch - draining time 3 minutes. (Experiments have shown that effective engine draining should be complete in 3 minutes.) Always allow the engine oil to drain until the stream of oil reduces to drops.
4. Allow the drained engine oil to cool down to approximately 20 °C (1 to 2 hours).
5. Measure the amount of cooled oil in a commercially available, transparent measuring cylinder (with a capacity of 1 to 2 litres), then add sufficient fresh oil to bring the total quantity to the recommended maximum, less 0.25 litres for the unchanged oil filter.
6. Using this amount of oil, the customer should drive the vehicle for at least 500 km without changing the engine oil. (The customer's normal driving style and routes should be maintained during this period.)
7. The procedure described above (points 1 to 4) is then repeated with exactly the same amount of time for draining.
8. The amount of engine oil "missing" from the second measurement is the engine oil consumed for that particular distance travelled.

DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

Valve Timing, Check and Adjust (Engines up to MY'93)

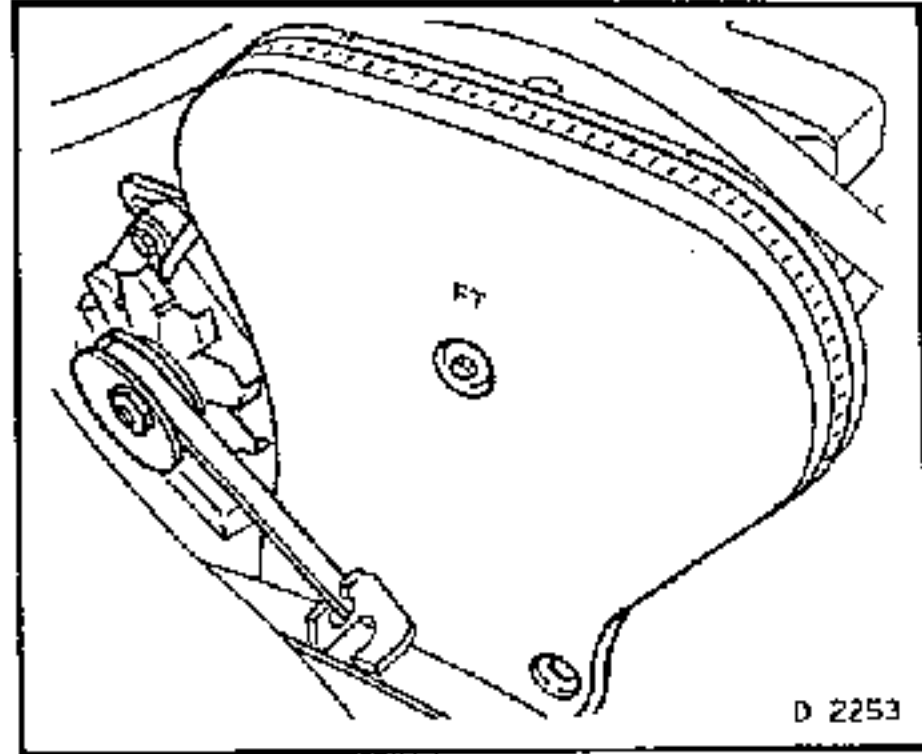
Remove, Disconnect

Air cleaner housing. Refer to; "Air Cleaner Housing, Remove and Install", in the next Section, in this Volume.

V-belt from alternator.

Front toothed belt cover.

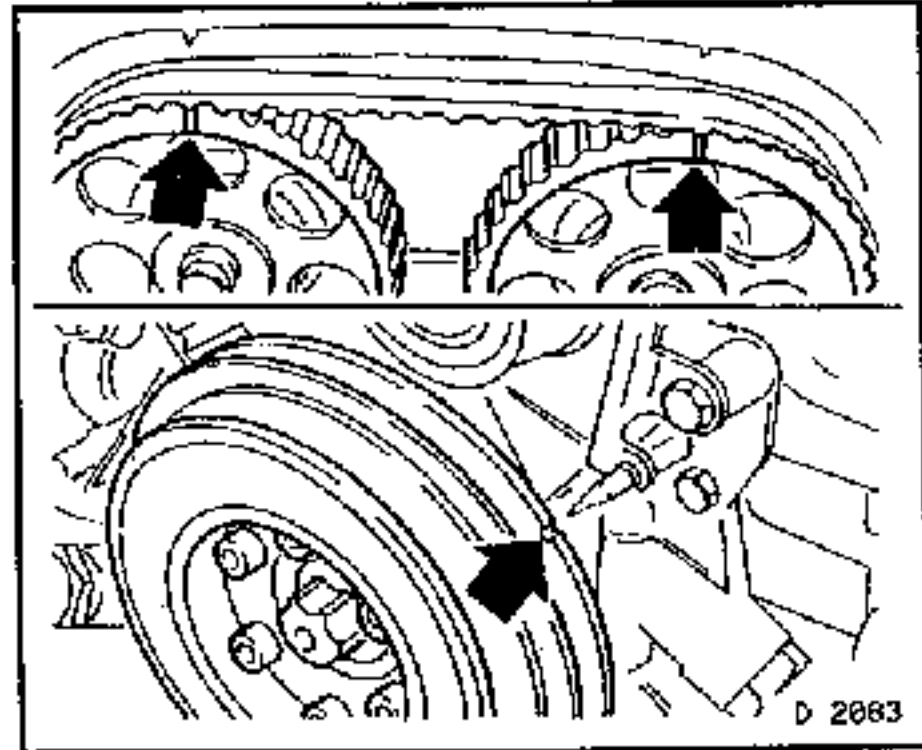
If fitted, the engine compartment cover



Inspect

Using MKM-604-21 (Torx E 20) at the fastening bolt for the crankshaft pulley, turn the crankshaft slowly and evenly until No. 1 piston is at the 'TDC' position, as indicated by the pulley notch and pointer being aligned.

The camshaft gears must then be aligned with the notches on the cylinder head cover.



Remove, Disconnect

The toothed belt tension roller (arrow) and, remove toothed belt.

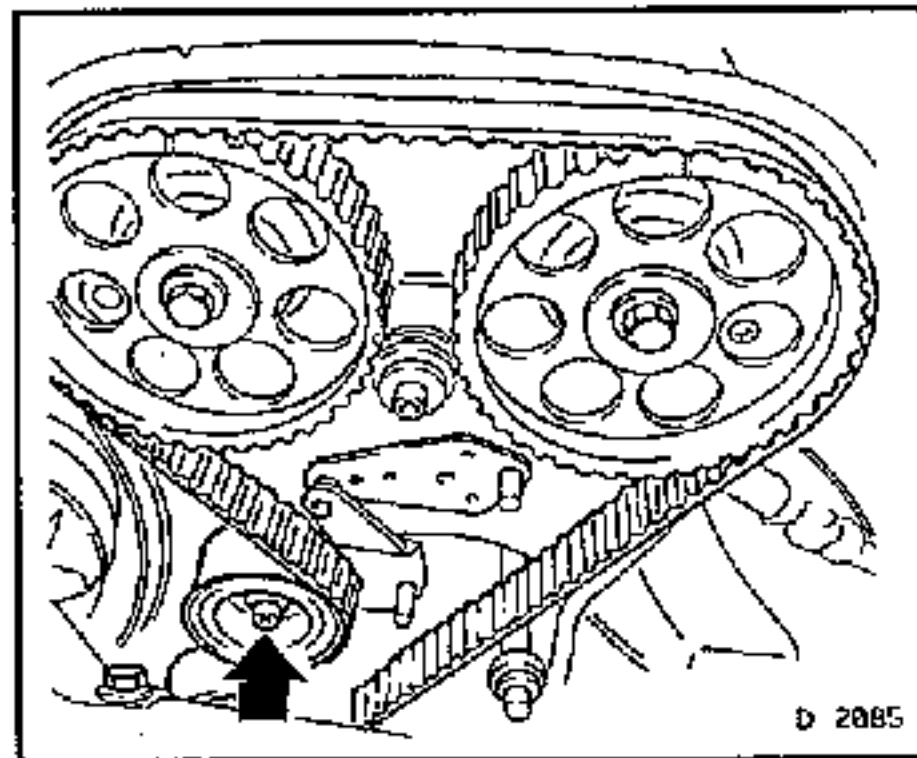
Place camshaft pulleys on the marks.

Important!

Adjustment of the tension on a used toothed belt is NOT permitted. After any operation that involves the removal of the toothed belt, ALWAYS install a new toothed belt to the engine. Refer to; "Toothed Belt, Replace", in the next Section, in this Volume.

Note:

Replacement of the toothed belt is a service requirement every 4 year period or 60,000 km whichever occurs first.



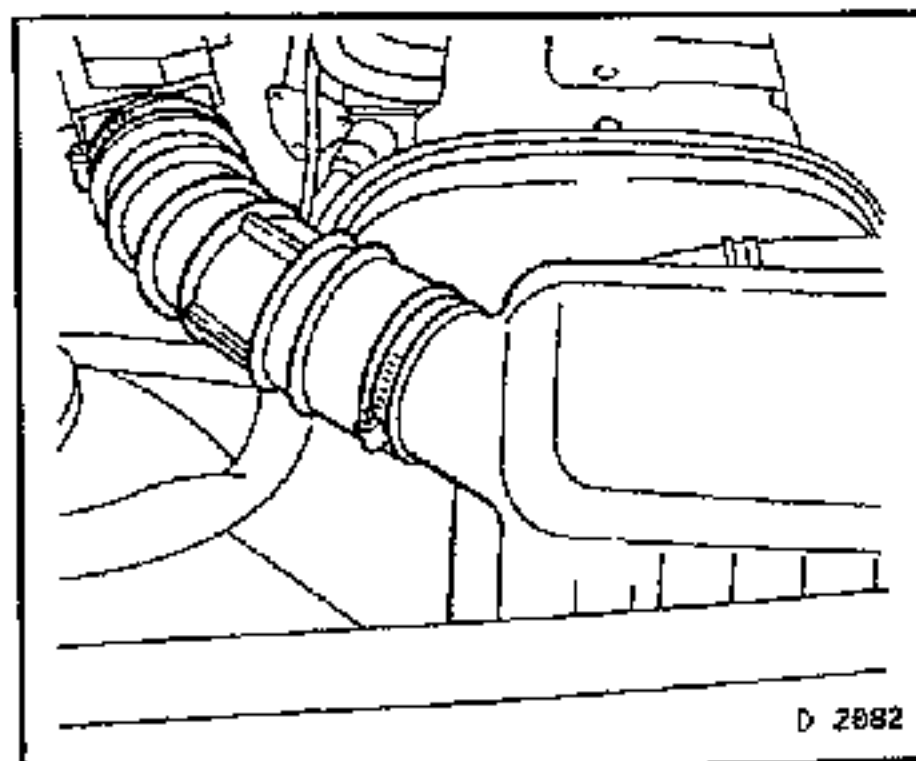
Install, Connect

Front toothed belt cover.

V-belts to alternator, power steering pump and A/C compressor and tension. Refer to; "V-belt Tension, Check and Adjust", earlier in this Section.

Air cleaner housing. Refer to; "Air Cleaner Housing, Remove and Install", in the next Section in this Volume.

Engine compartment cover, if removed.



DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

Valve Timing, Check and Adjust (Engines as of MY'93)

Remove, Disconnect

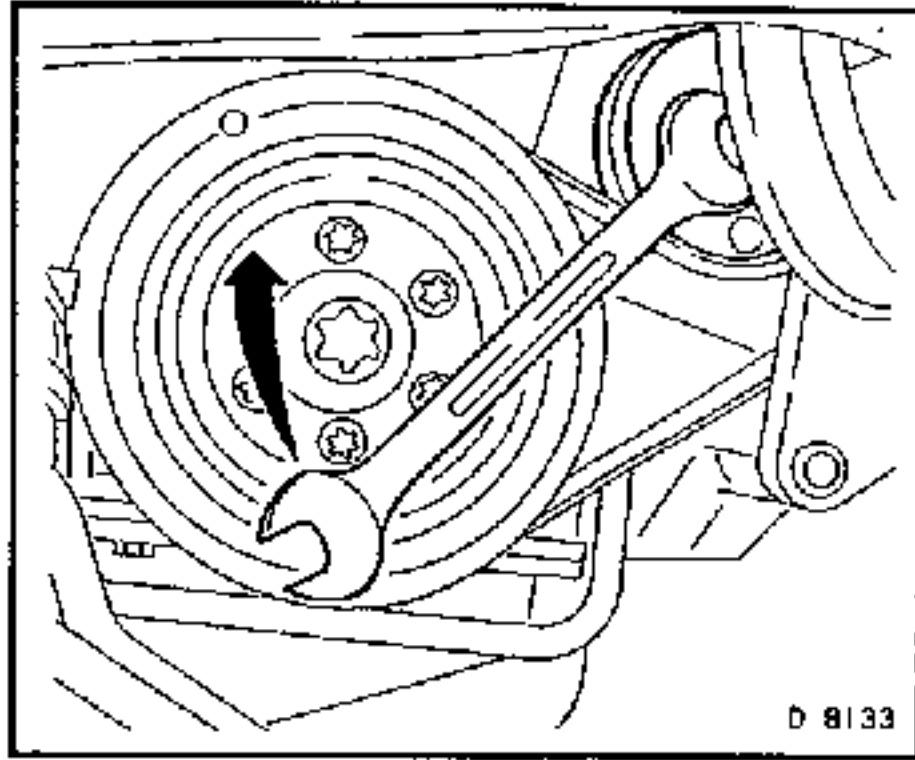
Air cleaner housing. Refer to; "Air Cleaner Housing, Remove and Install", in the next Section in this Volume.

Mark the direction of rotation on the ribbed V-belt with a felt tipped pen or similar.

Release tension of ribbed V-belt, via ribbed V-belt tension roller in the direction of arrow and remove ribbed V-belt.

Front toothed belt cover.

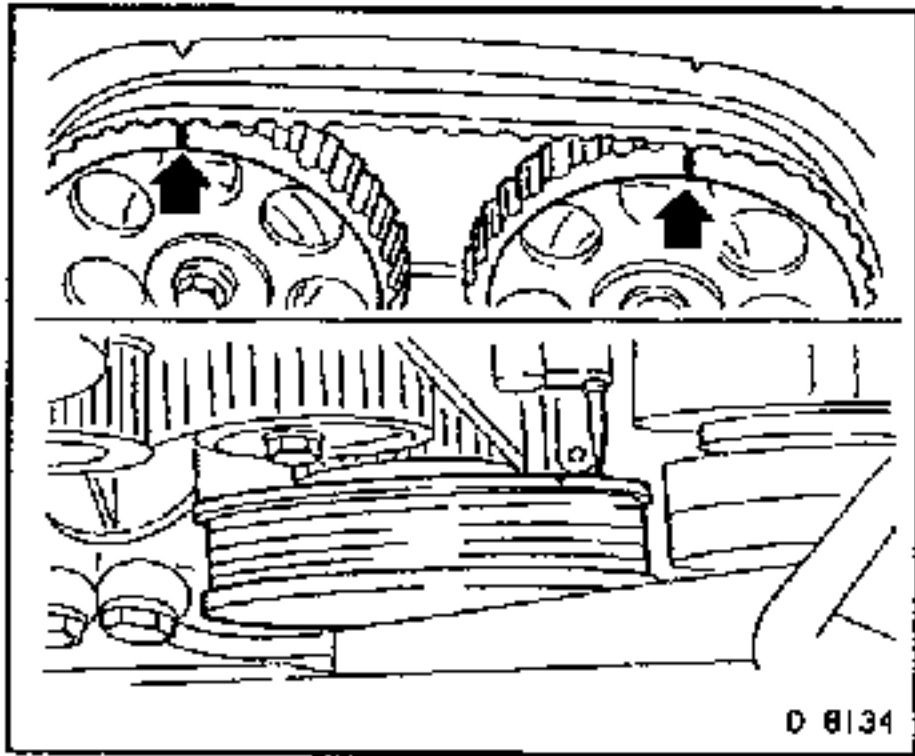
Engine compartment cover, if fitted.



Inspect

Using MKM-604-21 (Torx E 20) at the fastening bolt for the crankshaft pulley, turn the crankshaft slowly and evenly until No. 1 piston is at the "TDC" position, as indicated by the pulley notch and pointer being aligned.

The camshaft gears must then be aligned with the notches on the cylinder head cover.



Remove, Disconnect

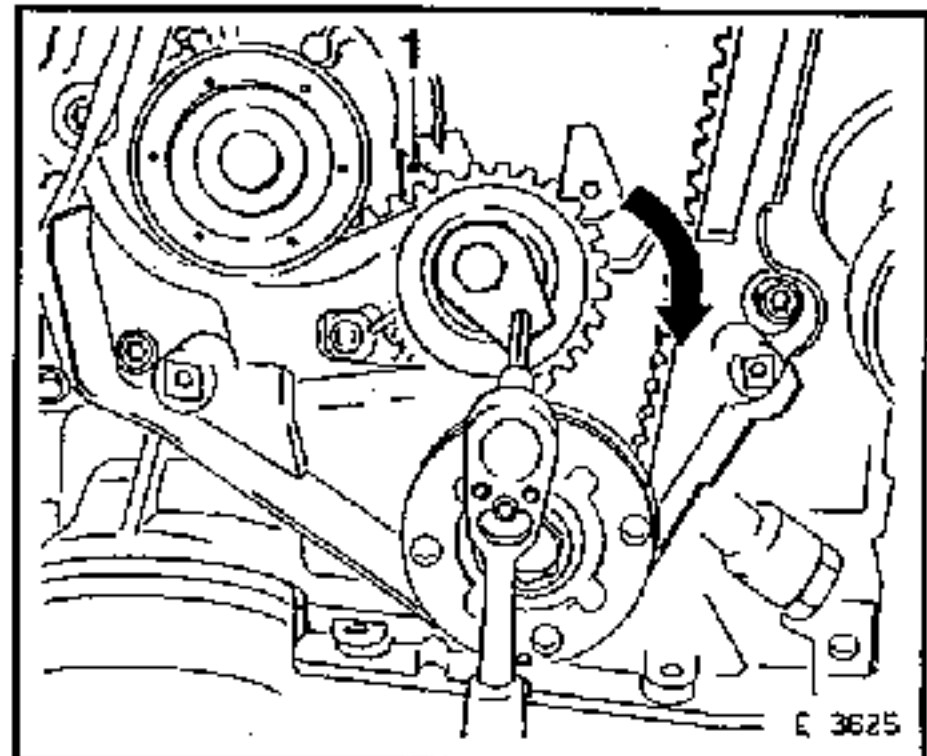
Loosen toothed belt tension roller, then turn cam in direction of arrow (clockwise) until pointer (1) lies at the left stop.

Remove toothed belt.

Adjust

Place camshaft pulleys on their respective marks.

Adjust toothed belt tension. Refer to; "Toothed Belt, Replace", in the next Section in this Volume.



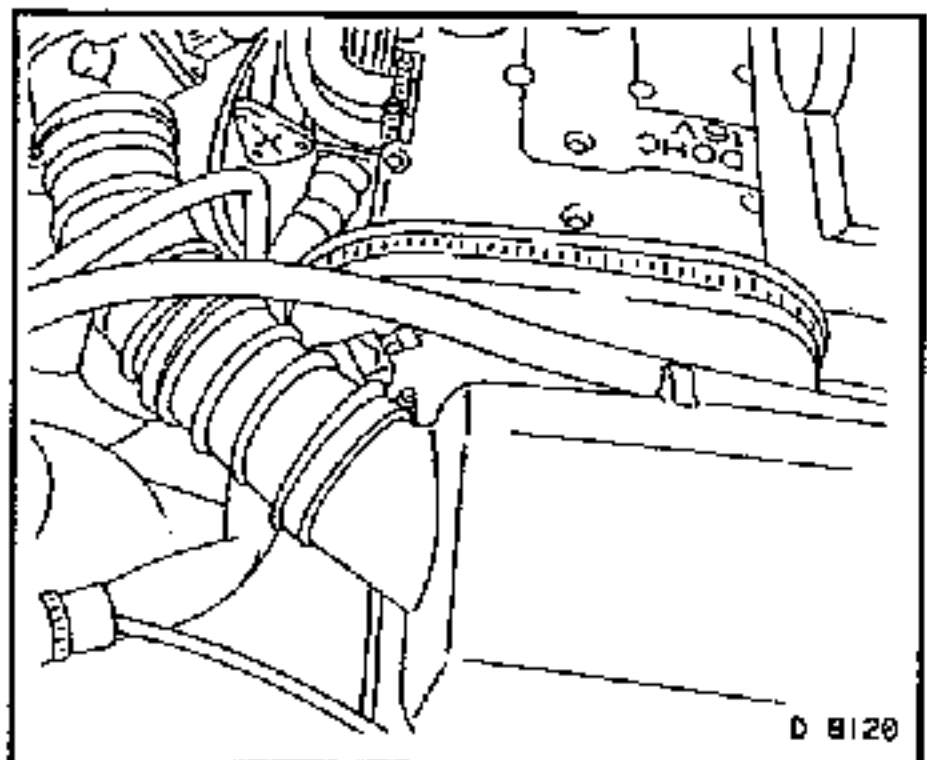
Install, Connect

Front toothed belt cover.

Install ribbed V-belt. Refer to; "Ribbed V-belt Tension, Check and Adjust", earlier in this Section.

Air cleaner housing. Refer to; "Air Cleaner Housing, Remove and Install", in the next Section in this Volume.

Engine compartment cover, if removed.



DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

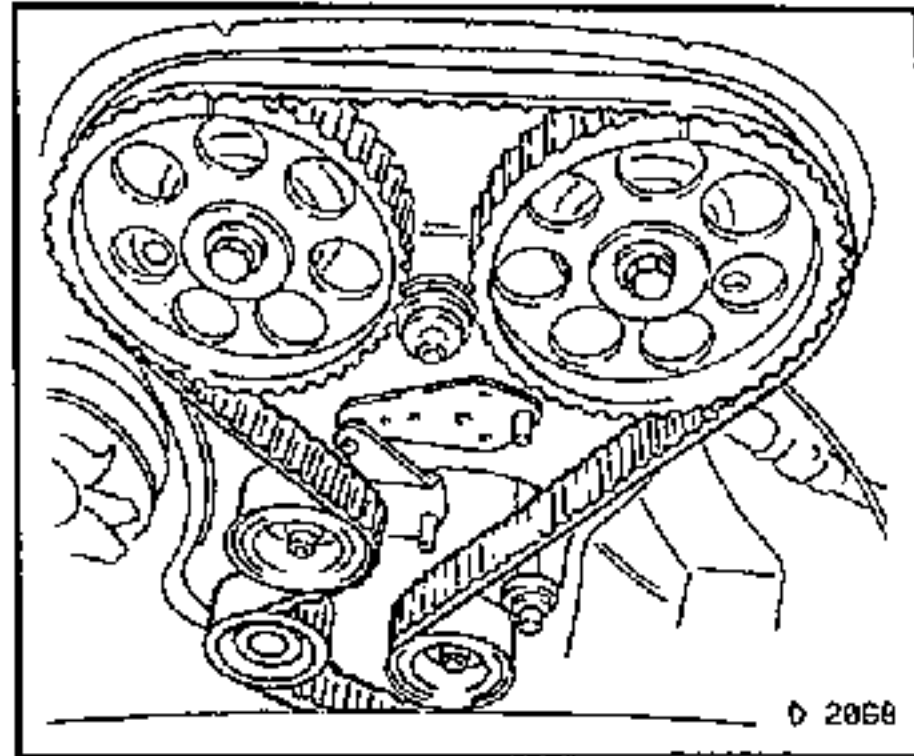
Toothed Belt Tension, Adjust (Engines up to MY'93)

Important!

Adjustment of the tension on a used toothed belt is NOT permitted. After any operation that involves the removal of the toothed belt, ALWAYS install a new toothed belt to the engine. Refer to; "Toothed Belt, Replace", in the next Section, in this Volume.

Note:

Replacement of the toothed belt is a service requirement every 4 year period or 60,000 km whichever occurs first.



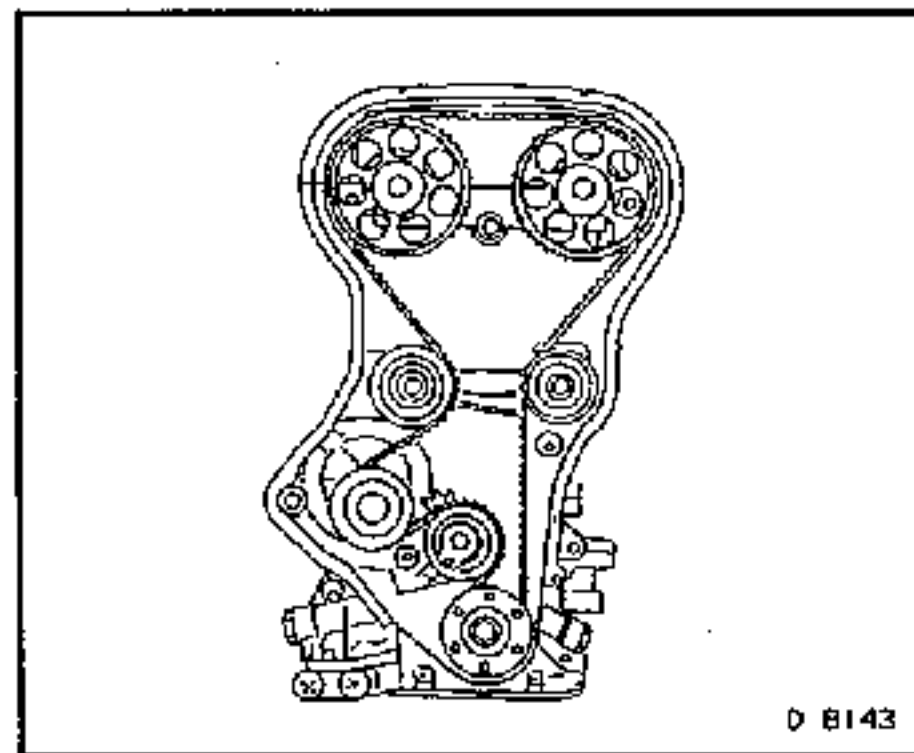
Toothed Belt Tension, Adjust (Engines as of MY'93)

Adjust

The toothed belt is automatically tensioned by the toothed belt tension roller. The adjustment procedure is detailed in; "Toothed Belt, Replace", in the next Section in this Volume.

Note:

Replacement of the toothed belt is a service requirement every 4 year period or 60,000 km whichever occurs first.



DOHC ENGINE-CHECKING & ADJUSTING PROCEDURES

RECOMMENDED TORQUE VALUES (Engine Checking and Adjusting Procedures)

	Nm
Alternator clamping bracket to intake manifold.....	25
Clamping bracket to alternator.....	25
Cover to throttle valve manifold.....	5 (1)
Front toothed belt cover to cylinder head, intermediate piece and oil pump	8
Ignition cable cover to cylinder head cover.....	8
Lower alternator bracket fastening (M 10).....	40
Oil pressure switch to oil pump.....	40
Spark plug to cylinder head.....	25

(1) C 20 LET only

GROUP N

ELECTRICAL EQUIPMENT AND INSTRUMENTS

CHECK CONTROL

TABLE OF CONTENTS

	PAGE
Control Unit for Check Control, Replace	N - 16
Check Control Bulbs, Replace (Analog Instruments).....	N - 16
Sensor for Remaining Coolant Quantity, Replace	N - 16
Sensor for Remaining Cleaning Fluid Quantity, Replace.....	N - 17
Sensor for Remaining Engine Oil Quantity, Replace	N - 17

CHECK CONTROL

CONTROL UNIT FOR CHECK CONTROL, REPLACE

Remove, Disconnect

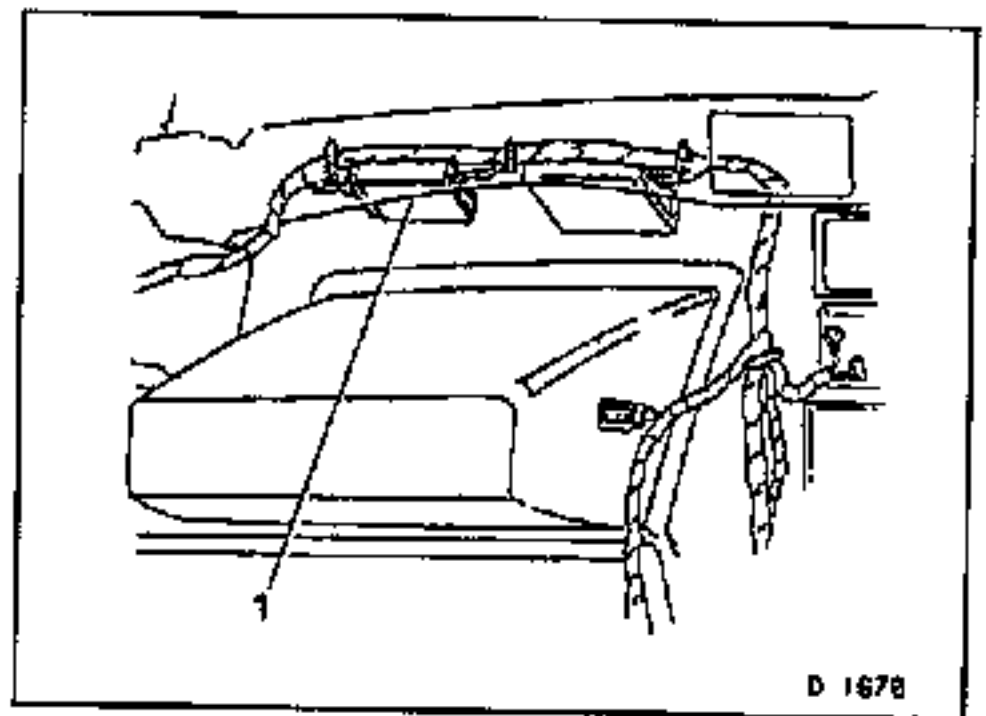
Glove compartment – group D (Mixed Air Heating (Interior),
Remove and Install Completely)

Wiring harness plug from control unit (1), control unit.

Illus. shows control unit as seen from engine compartment.

Install, Connect

Control unit, wiring harness plug, glove compartment.



CHECK CONTROL BULBS, REPLACE (ANALOG INSTRUMENTS)

Remove, Disconnect

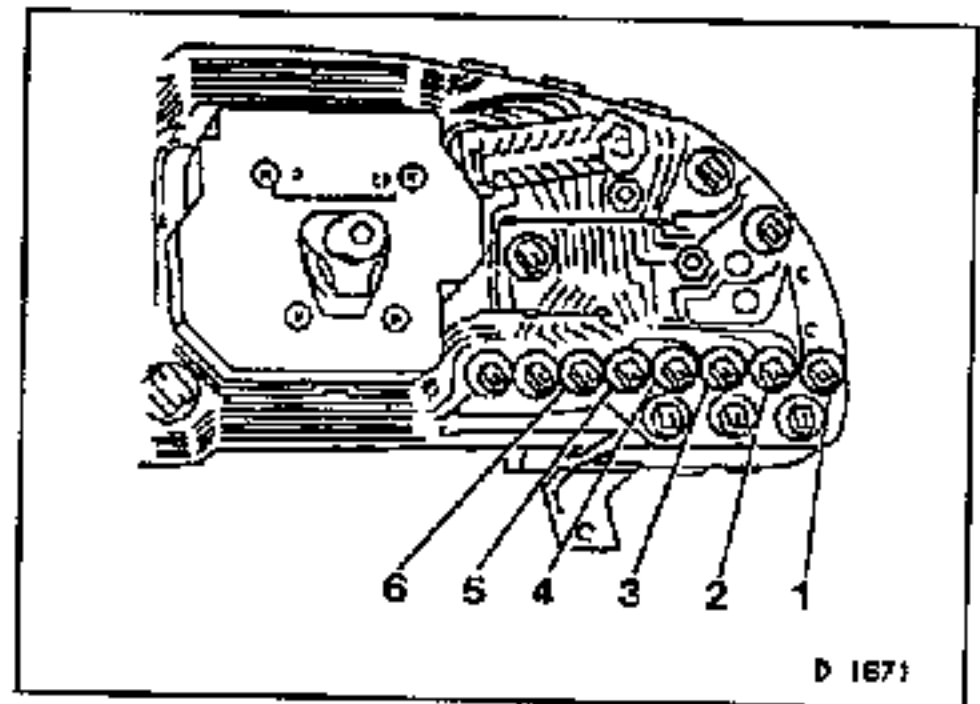
Instrument assembly – group N.

Relevant bulb from instrument assembly (turn to the left).

- 1 – Cleaning fluid level
- 2 – Oil level
- 3 – Coolant level
- 4 – Low beam/rear lamp
- 5 – Brake lamp/trailer brake lamp
- 6 – Brake lining thickness front

Install, Connect

Bulb, instrument assembly.



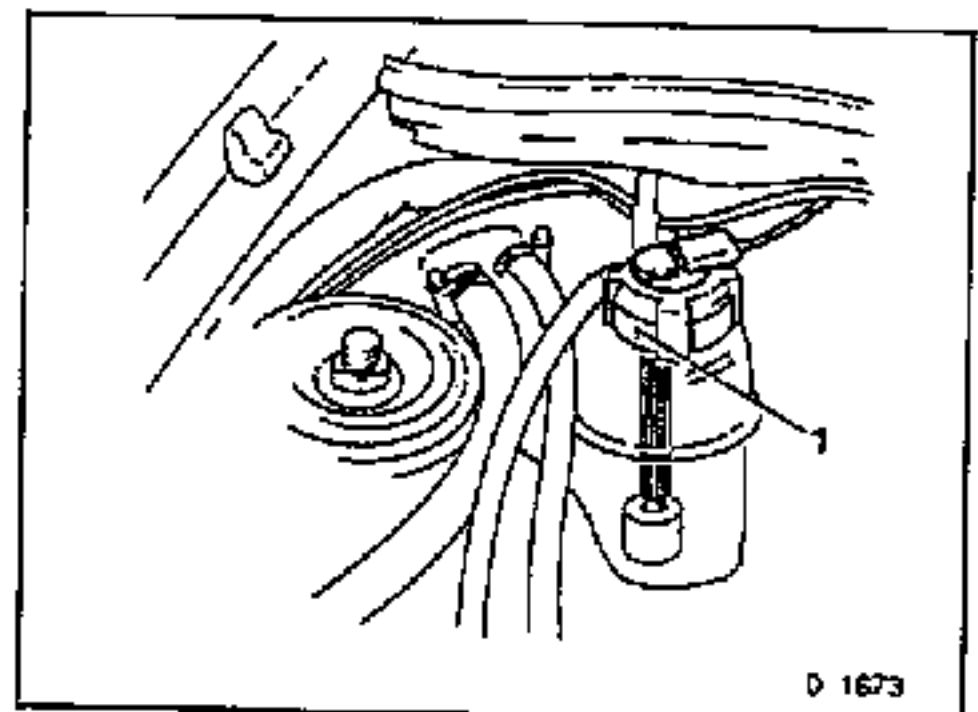
SENSOR FOR REMAINING COOLANT QUANTITY, REPLACE

Remove, Disconnect

Wiring harness plug, sensor for coolant compensating tank.

Install, Connect

Sensor, wiring harness plug.



CHECK CONTROL

SENSOR FOR REMAINING CLEANING FLUID QUANTITY, REPLACE

Remove, Disconnect

Wiring harness plug, reservoir sensor.

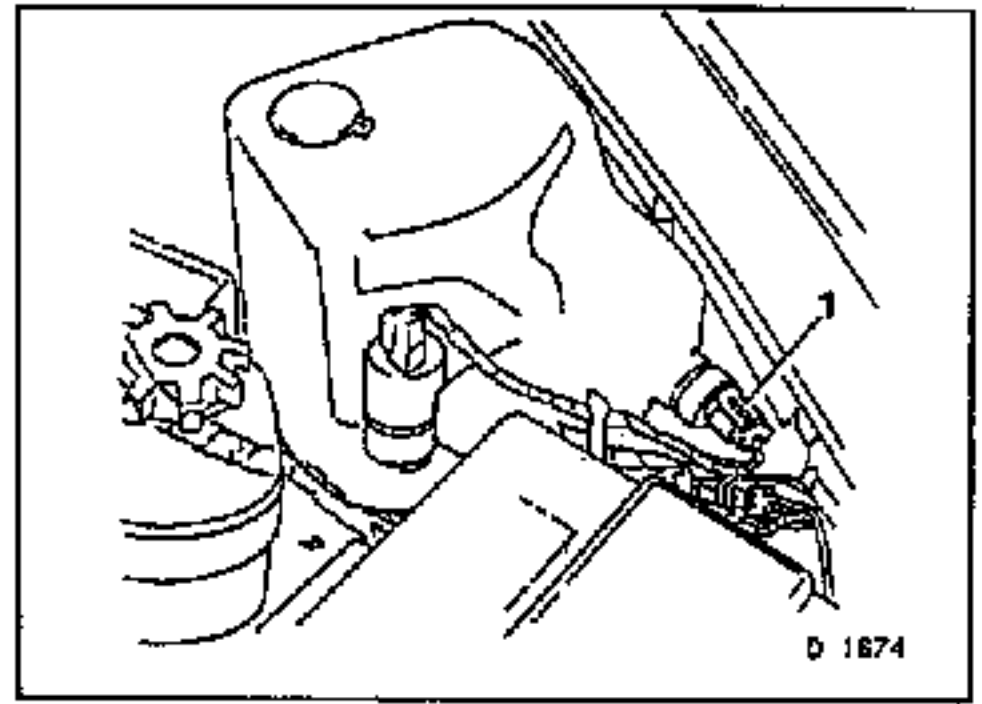
Important!

Collect any cleaning fluid which may run out.

Install, Connect

Sensor, wiring harness plug.

Top up cleaning fluid.



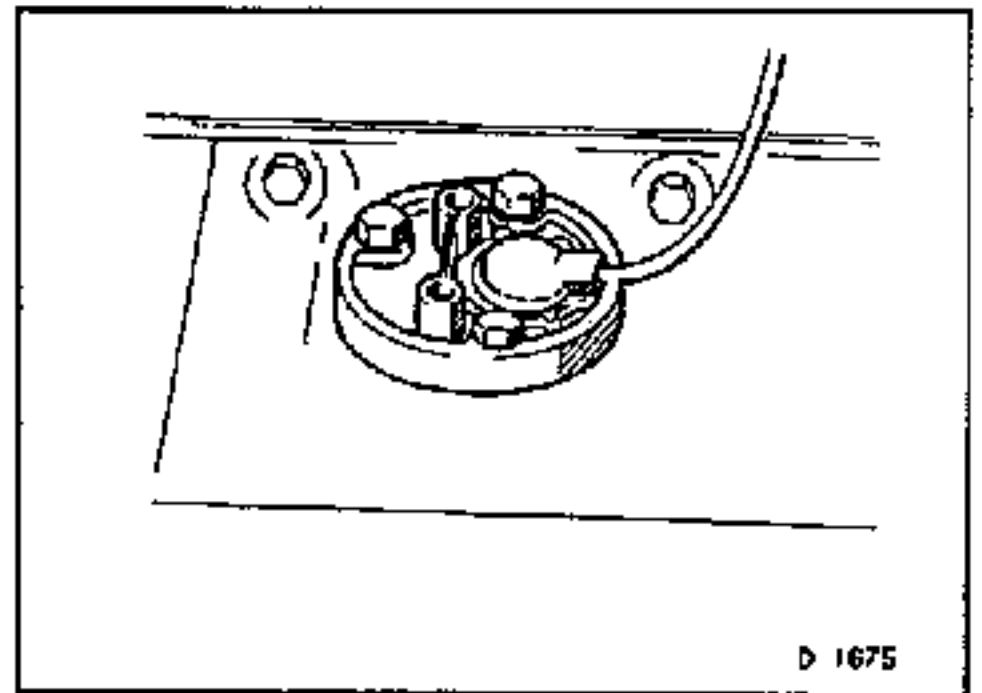
SENSOR FOR REMAINING ENGINE OIL QUANTITY, REPLACE

Remove, Disconnect

Wiring harness plug from sensor, sensor from oil pan.

Install, Connect

Sensor, wiring harness plug.



GROUP J

DOUBLE OVERHEAD CAM ENGINE

COOLING SYSTEM

TABLE OF CONTENTS

	PAGE
Seal Ring - Thermostat Housing to Cylinder Head, Replace	J - 392
Radiator, Remove and Install (C 20 XE Engine) *	J - 393
Cooling System, Check for Leaks	J - 393
Cooling System, Top Up and Bleed	J - 393
Fan Motor, Replace	J - 394
Thermostat, Replace	J - 394
Water Pump, Replace	J - 395
Recommended Torque Values	J - 396

*For C 20 LET Engine, see Section, "TURBOCHARGING SYSTEM", in this Volume.

DOHC ENGINE - COOLING SYSTEM

Seal Ring - Thermostat Housing to Cylinder Head, Replace

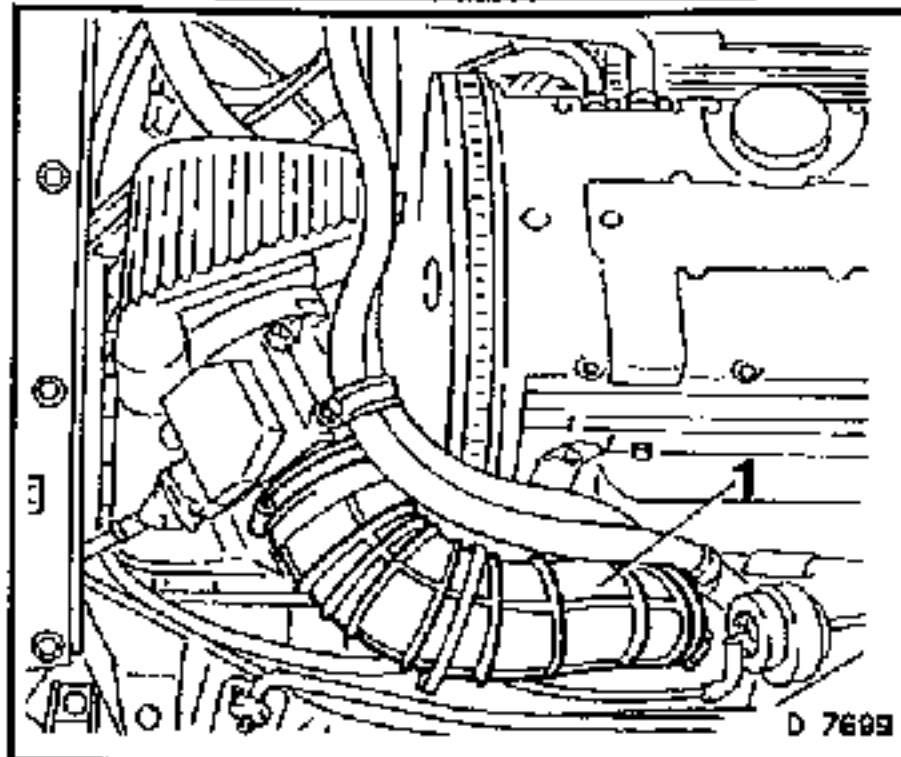
Remove, Disconnect

For C 20 LET:

Air intake hose (1) from hot wire mass air flow meter and turbocharger.

Engine compartment cover.

The lower coolant hose from radiator. Collect coolant in a suitable, clean container.



Remove, Disconnect

Coolant hose (1).

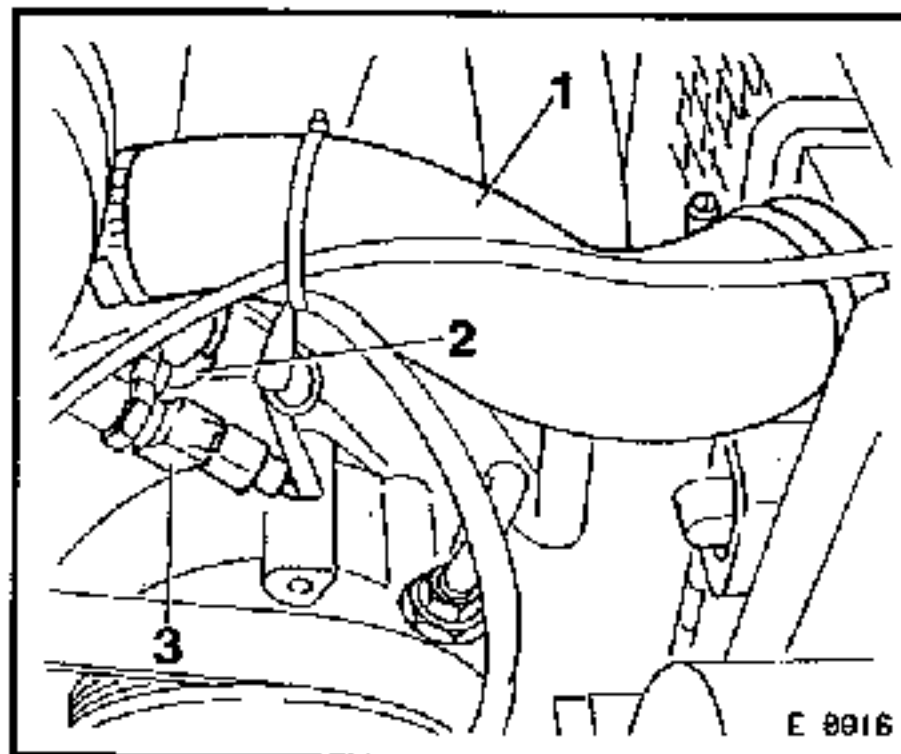
Wiring harness plugs (2 and 3) from the thermostat housing.

For C 20 XE:

Performance header. Refer to 'Gasket, Performance Header, Replace', in the Section "Cylinder Head", in this Volume.

Thermostat housing from cylinder head.

Remove seal ring.



Clean

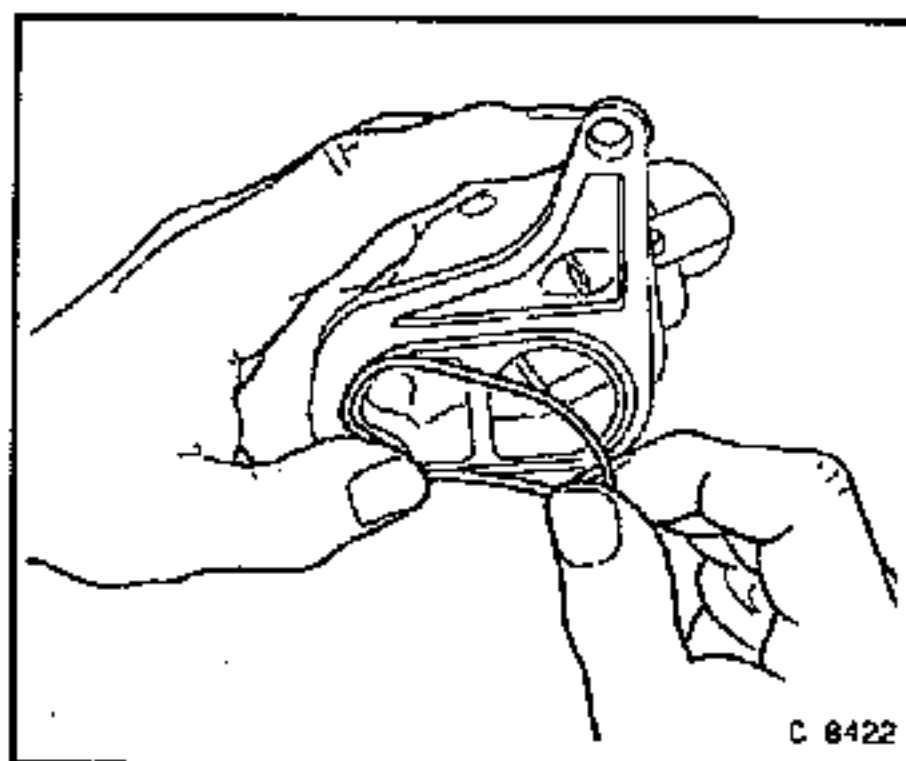
Sealing surfaces.

Install, Connect

New seal ring to thermostat housing.

Tighten (Torque)

Thermostat housing to cylinder head	15 Nm
Cover plate to cylinder head (bolts M 6).	9 Nm
Cover plate to cylinder head (nuts M 8).	22 Nm



Install, Connect

Wiring harness plugs to thermostat housing.

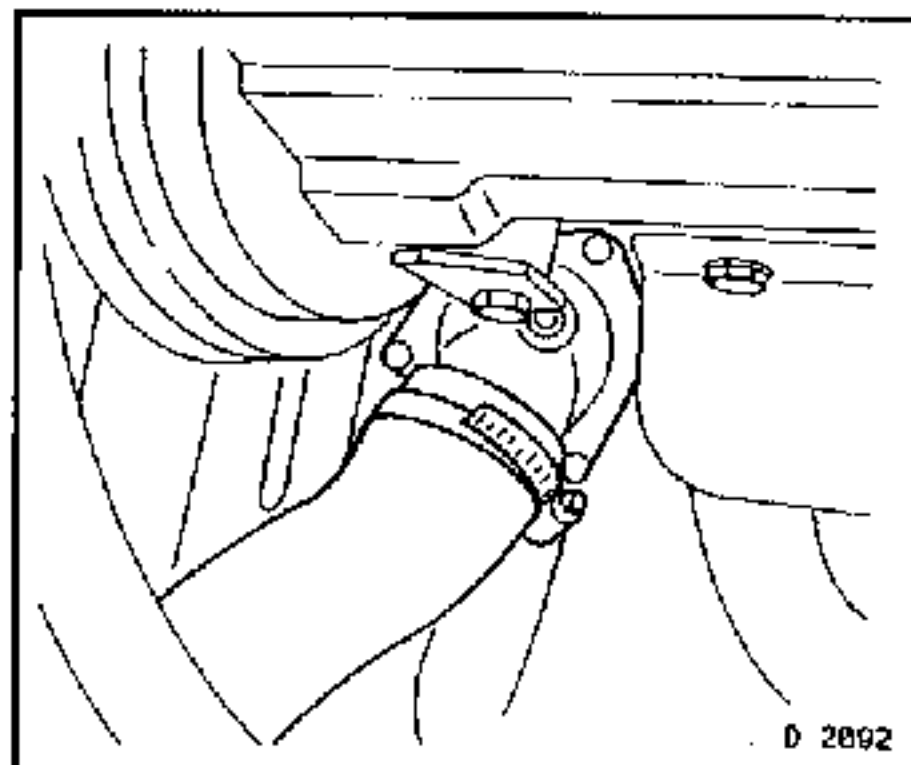
Upper and lower coolant hoses.

For C 20 LET:

Air intake hose.

Engine compartment cover.

Top up and bleed cooling system, as detailed in this Section.



DOHC ENGINE - COOLING SYSTEM

Radiator, Remove and Install (C 20 XE)

Remove, Disconnect

Ground cable from battery.

Engine compartment cover.

The lower coolant hose (1) from radiator. Collect coolant in a suitable, clean container.

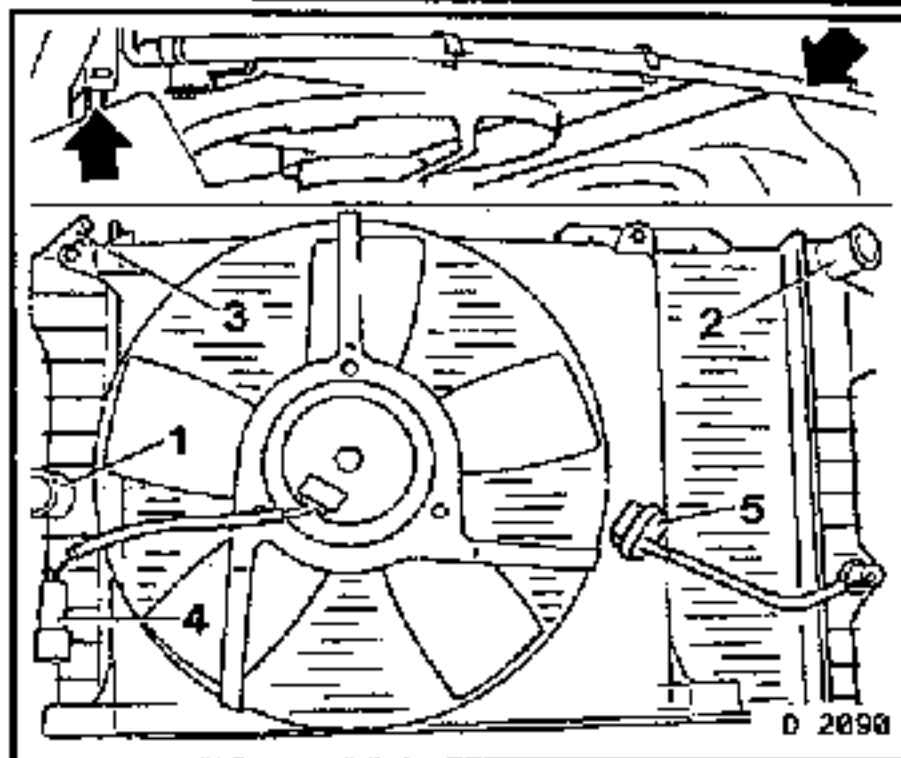
Upper coolant hose (2) from radiator.

Coolant reservoir hose from radiator (3).

Multi-plug from fan motor.

Multi-plug from temperature sensor.

Retainer (arrows) from air deflector.



Remove radiator with fan motor and radiator fan shroud, in an upwards direction.

Transfer attaching parts when replacing

Install, Connect

Radiator in lower retainer.

Retainer on air deflector.

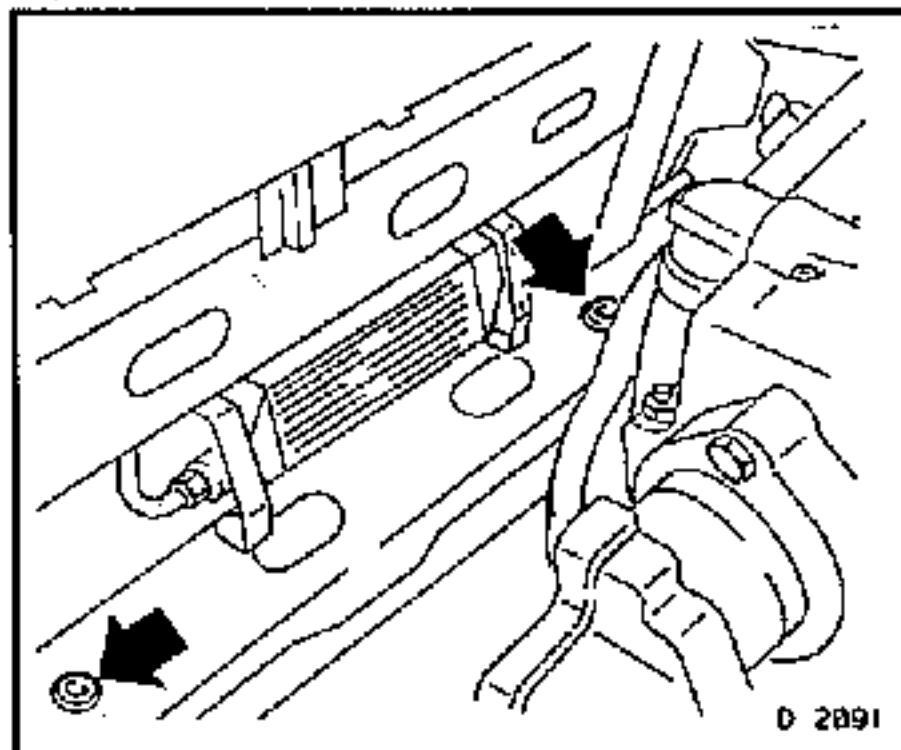
Coolant hoses.

Multi-plugs.

Engine compartment cover.

Ground cable to battery.

Top up and bleed cooling system as detailed in this Section.



Cooling System, Check for Leaks

Engine must be at operating temperature (oil temperature to be at least 80 °C).

Check coolant level.

Install, Connect

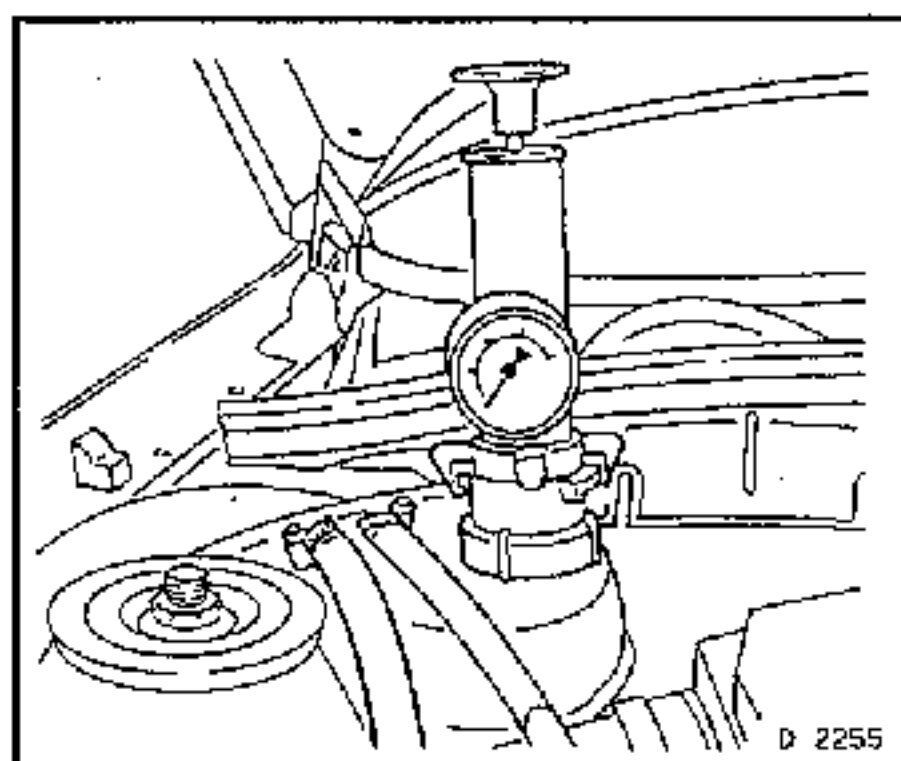
Use KM 471 with a commercially available pressure tester to the coolant reservoir tank, observing manufacturer's instructions.

Pressurise cooling system to 100 kPa (1 bar).

Inspect

Cooling system for leaks.

Remove tester and close coolant reservoir tank.



Cooling System, Top Up and Bleed

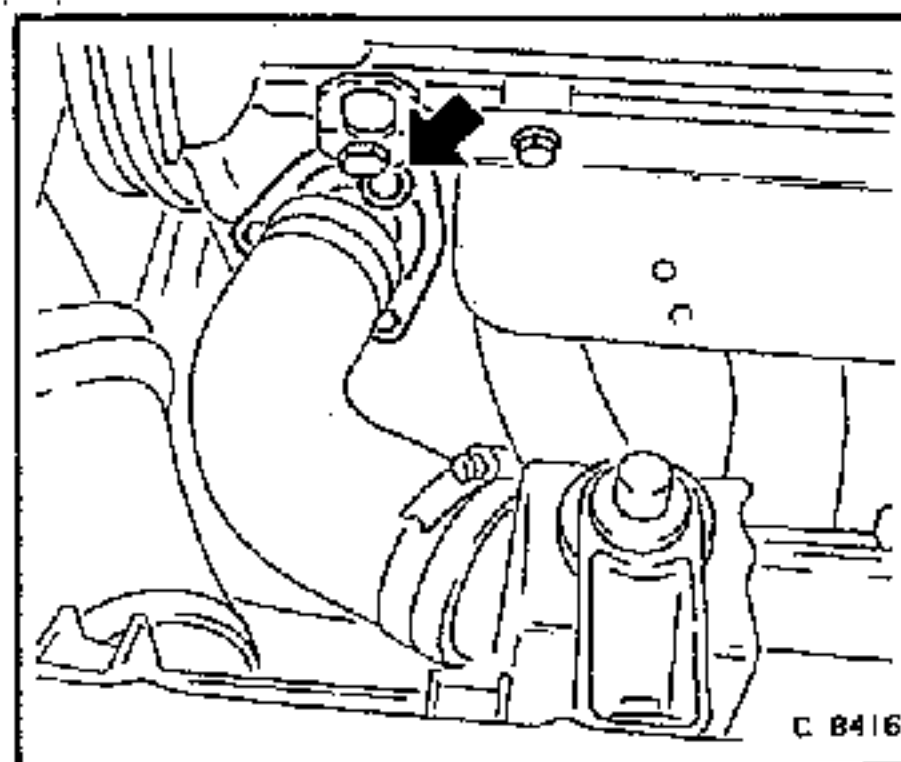
Important!

Only use an ethylene glycol based coolant inhibitor/anti-freeze, that complies with Holden's Specification HN2043.

Ratio of coolant additive must be maintained at 50% additive to 50% clean water

Remove, Disconnect

Allen key headed bolt (arrow)



DOHC ENGINE - COOLING SYSTEM

Fill coolant reservoir tank with coolant until it flows from the Allen key headed bolt hole, free of bubbles.

Install, Connect

Allen key headed bolt, after applying sealing compound to the threads, such as Loctite 515 or equivalent, to Holden's Specification HN1581.

Fill coolant to "KALT" (cold) mark on the reservoir tank.

Seal the cooling system and run the engine until operating temperature is reached and the thermostat opens (coolant temperature approximately 92 °C).

Inspect

Coolant level. Allow the engine to cool down. Then, if necessary, top up coolant to "KALT" (cold) mark on the coolant reservoir tank, using 50% coolant to 50% clean water.

Fan Motor, Replace

Remove, Disconnect

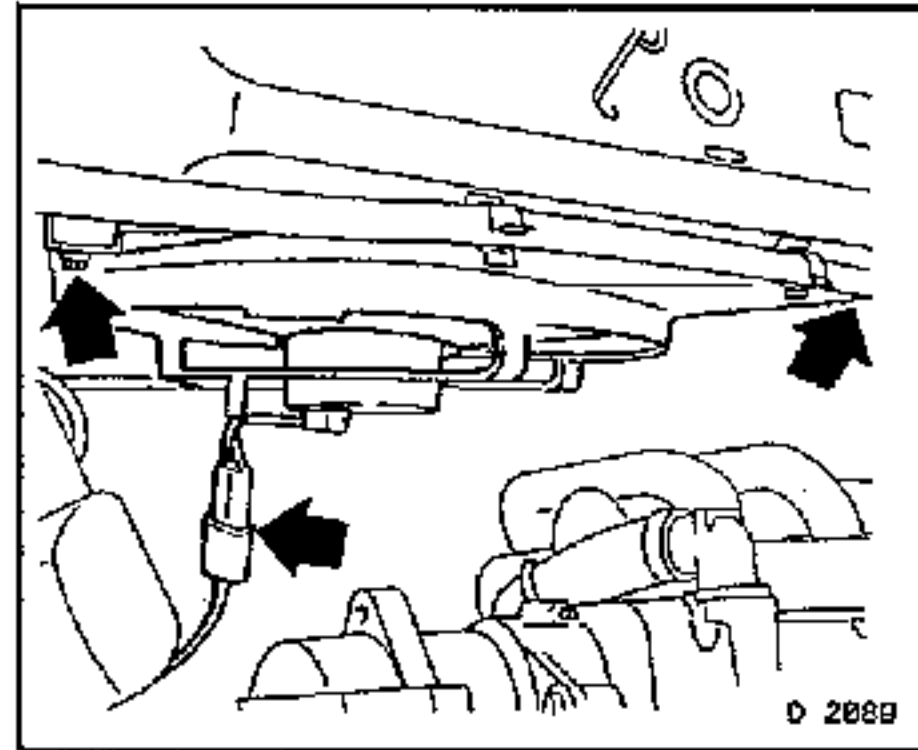
Ground cable from battery.

Multi-plug (arrow).

Radiator fan shroud with the fan motor attached. Remove upwards.

For C 20 LET:

Coolant hose from radiator fan shroud bracket.



Remove, Disconnect

Fan motor from radiator fan shroud and fan.

Install, Connect

Fan to fan motor and radiator fan shroud.

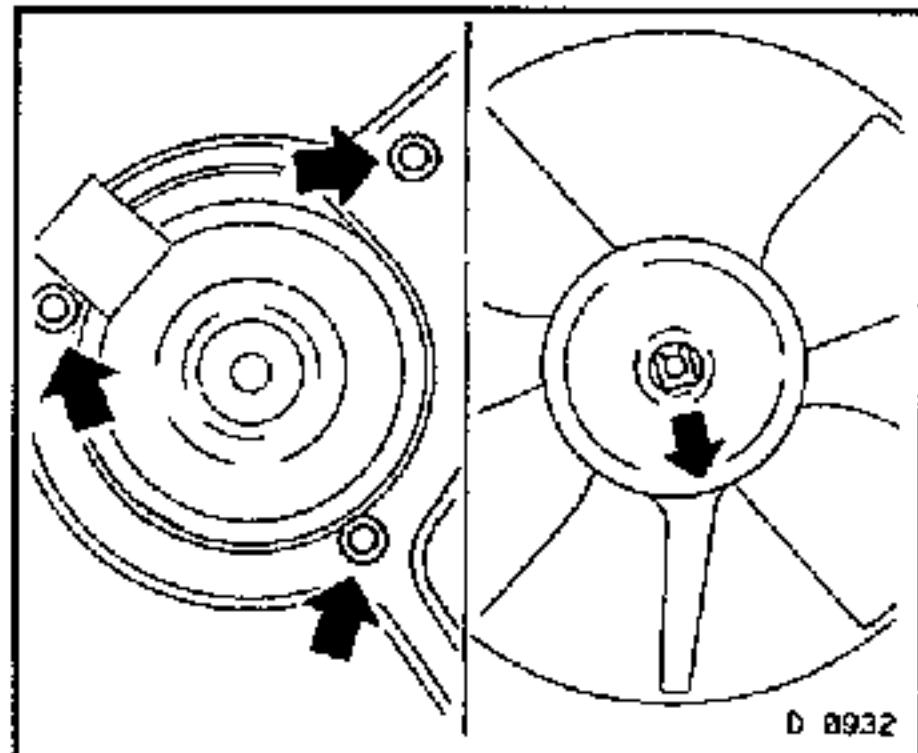
Radiator fan shroud with fan motor to radiator.

Multi-plug.

Ground cable to battery.

For C 20 LET:

Coolant hose to radiator fan shroud bracket.



Thermostat, Replace

Remove, Disconnect

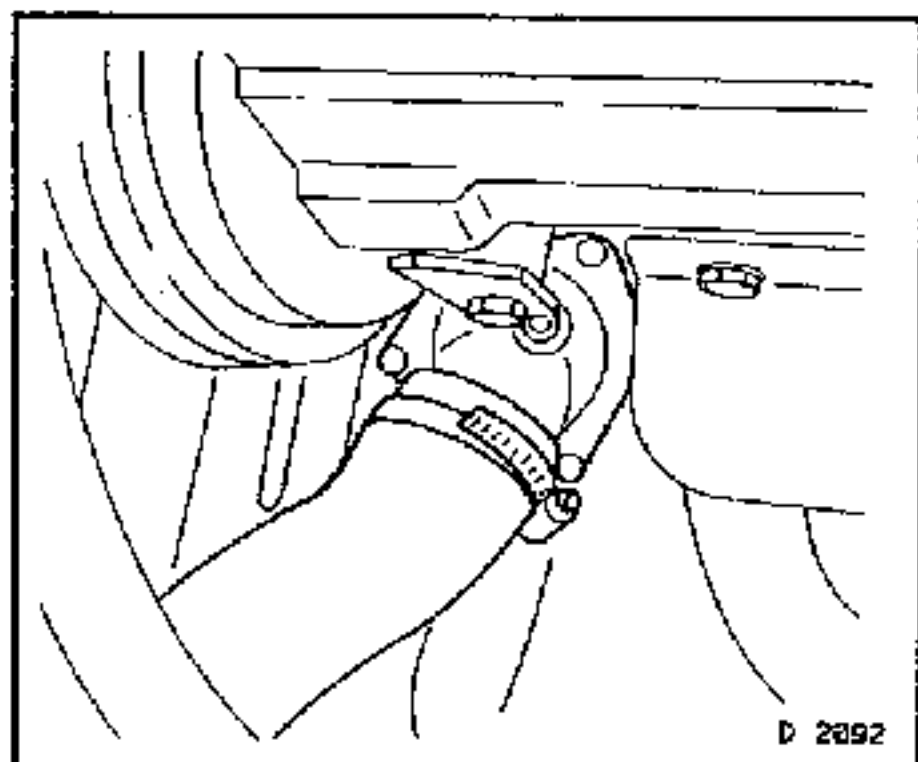
Engine compartment cover.

The lower coolant hose from the radiator. Collect the coolant in a suitable clean container.

Upper coolant hose from the water outlet fitting.

Water outlet fitting with thermostat from the thermostat housing.

Sealing ring.



DOHC ENGINE - COOLING SYSTEM

Clean

Sealing surfaces.

Install, Connect

New seal ring.

Water outlet fitting with the thermostat, to the thermostat housing.

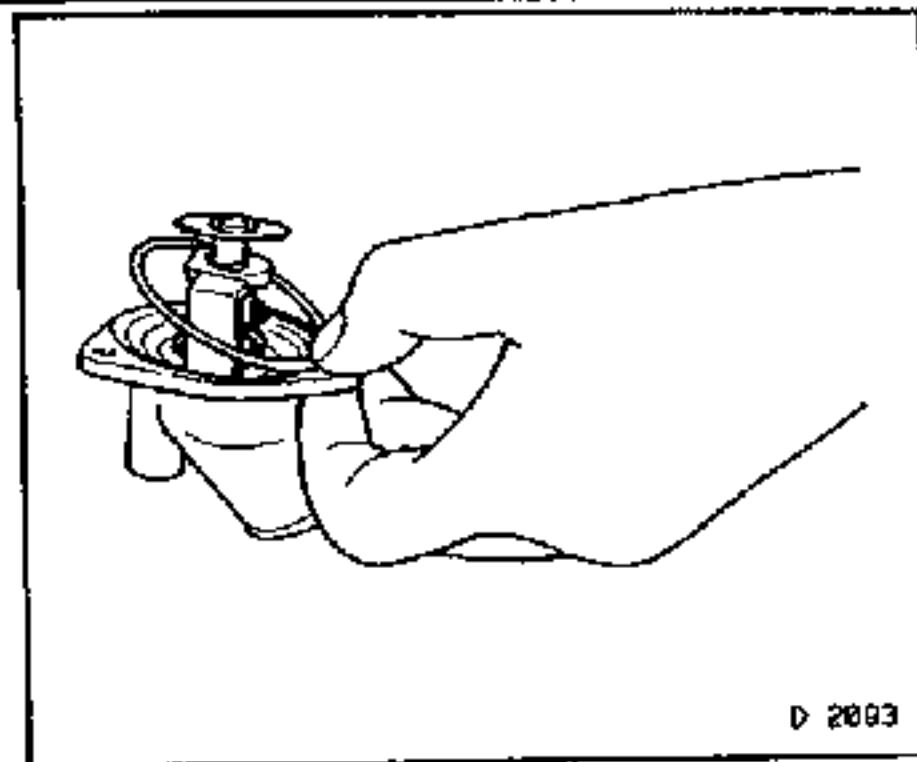
Tighten (Torque)

Water outlet fitting to thermostat housing 8 Nm

Upper and lower coolant hoses.

Engine compartment cover.

Top up and bleed cooling system as detailed in this Section.



Water Pump, Replace

Remove, Disconnect

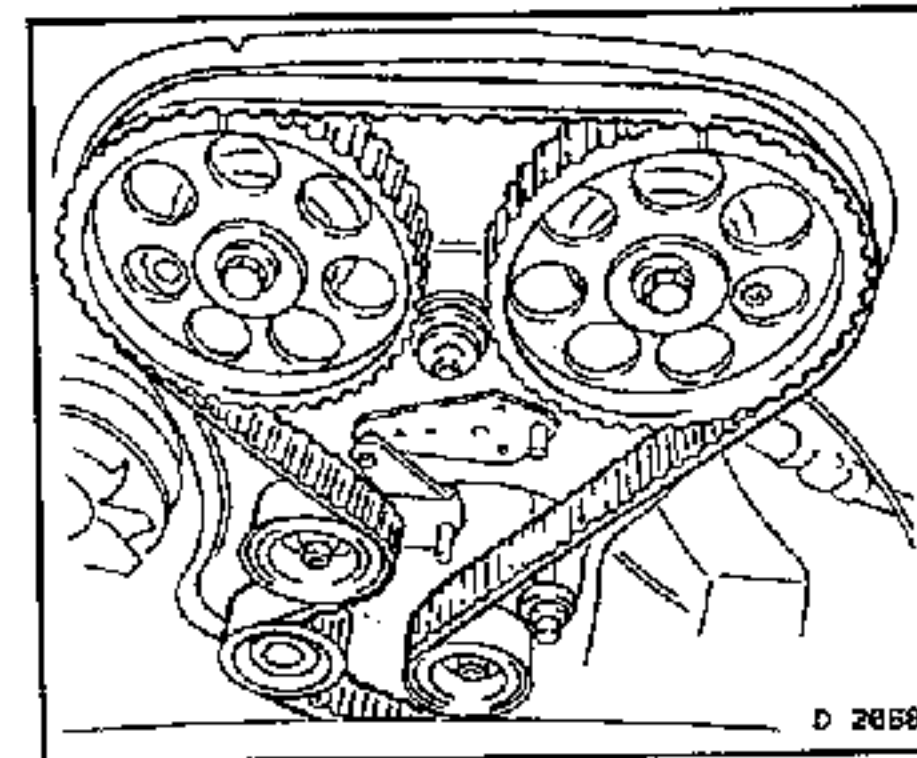
Engine compartment cover.

The lower coolant hose from the radiator. Collect the coolant in a suitable clean container.

Engines as of MY'93:

Mark the direction of rotation of the toothed belt.

Toothed Belt. Refer to this operation in the Section, "Engine Timing Side, Air Cleaner Housing", in this Volume.



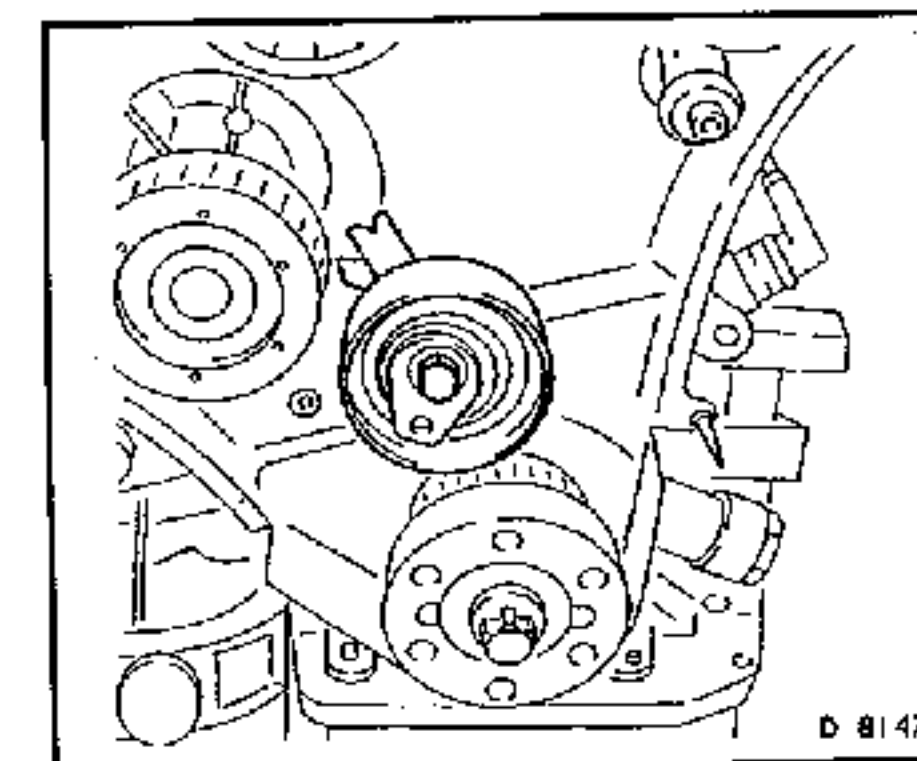
Remove, Disconnect

Engines up to MY'93:

Rear toothed belt cover. Refer to this operation in the Section, "Engine Timing Side, Air Cleaner Housing", in this Volume.

Engines as of MY'93:

Toothed belt tension roller from the oil pump housing

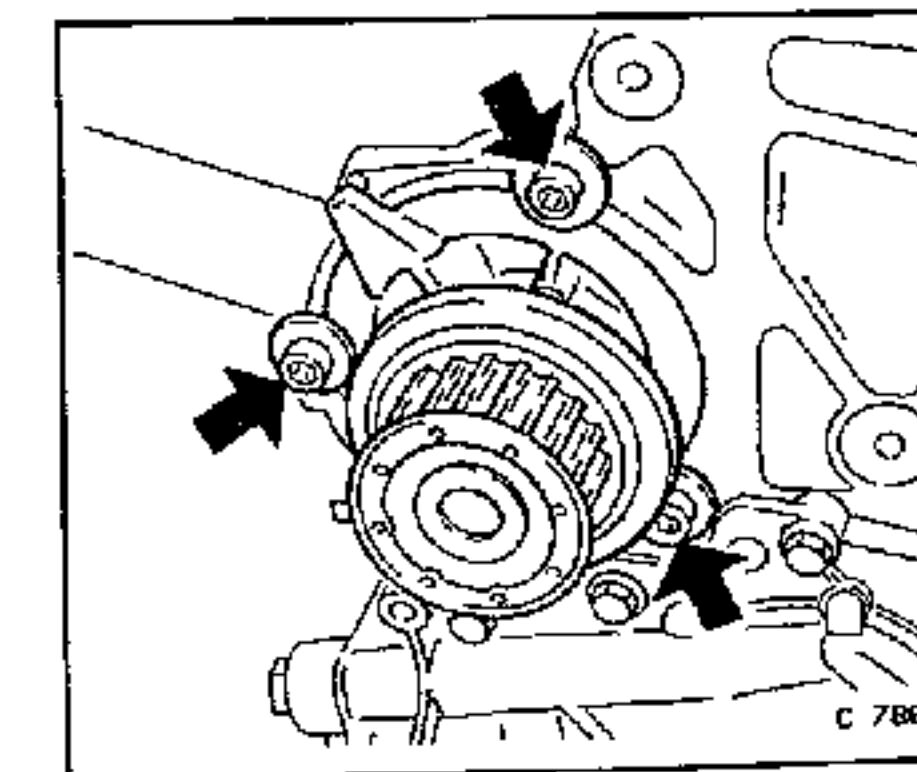


Remove, Disconnect

Water pump from cylinder block.

Clean

Sealing surfaces.



DOHC ENGINE - COOLING SYSTEM

Install, Connect

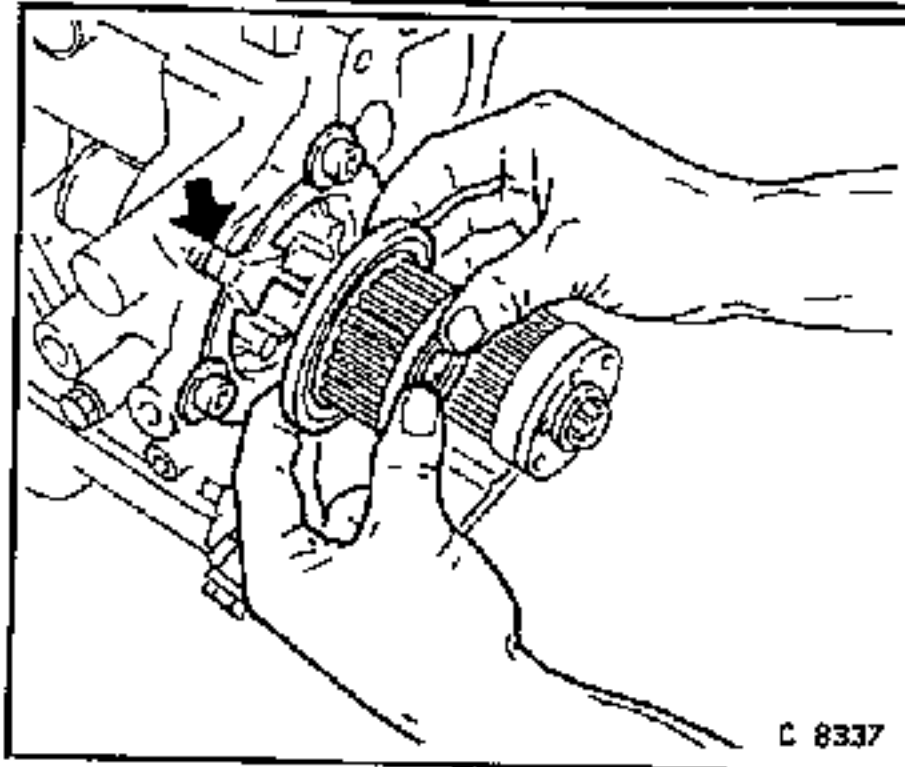
Before installing the water pump lightly coat the sealing surface in the cylinder block and a new sealing ring with silicone sealant such as Dow Corning or equivalent to Holden's Specification HN1014.

Tighten (Torque)

Water pump to cylinder block..... 25 Nm

Important!

The spur on the cylinder block must align with that on the water pump (arrow).



Install, Connect

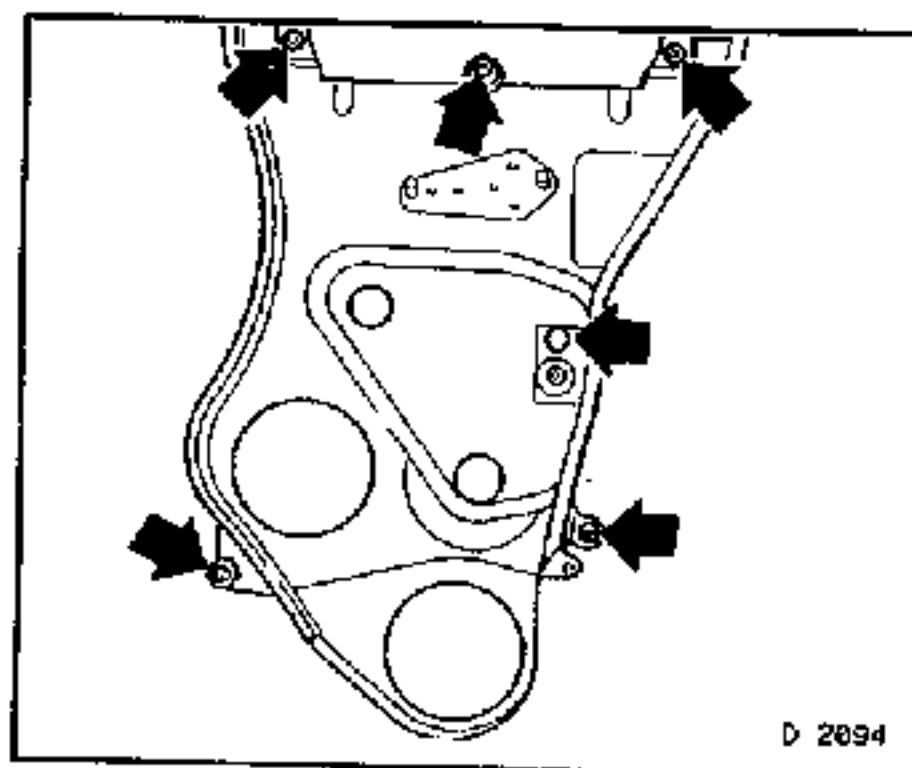
Engines up to MY'93:

Rear toothed belt cover. Refer to this operation in the Section, "Engine Timing Side, Air Cleaner Housing", in this Volume.

Engines as of MY'93:

Toothed belt tension roller. Refer to this operation in the Section, "Engine Timing Side, Air Cleaner Housing", in this Volume.

Toothed belt. Refer to this operation in the Section, "Engine Timing Side, Air Cleaner Housing", in this Volume.

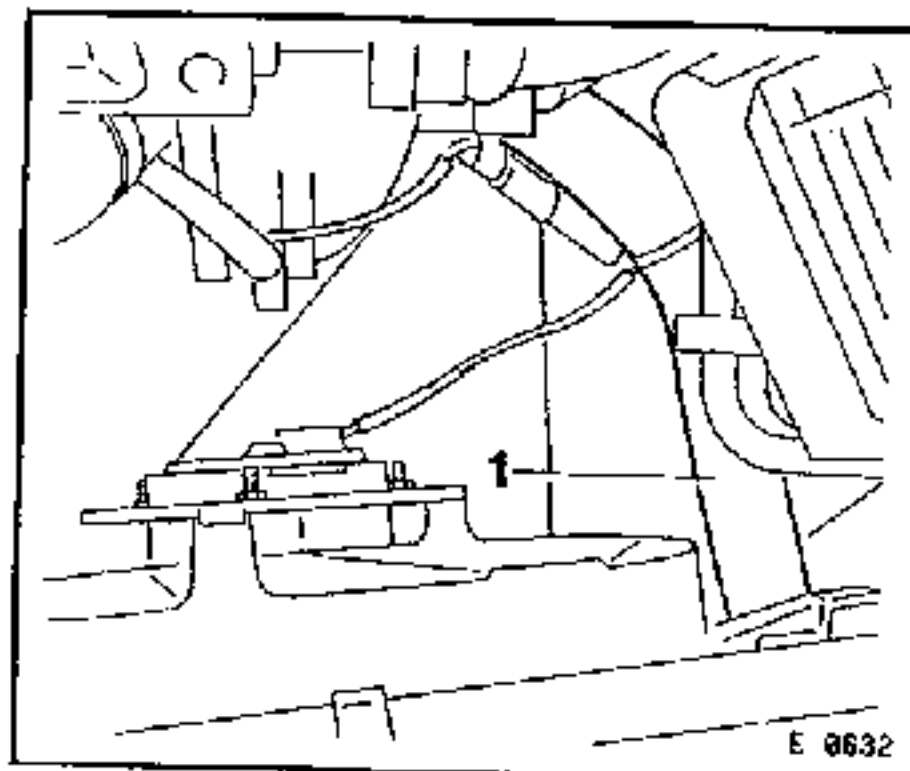


Install, Connect

The lower coolant hose (1) to the radiator.

Engine compartment cover.

Top up and bleed cooling system as detailed in this Section.



RECOMMENDED TORQUE VALUES

(Cooling System)

	Nm
Camshaft housing cover to housing	8
Camshaft pulley to camshaft	45
Rear toothed belt cover to oil pump housing and camshaft housing	8
Temperature sensor to intake manifold	10
Thermostat housing to cylinder head	15
Water outlet connection to thermostat housing	8

DOHC ENGINE - CRANK DRIVE

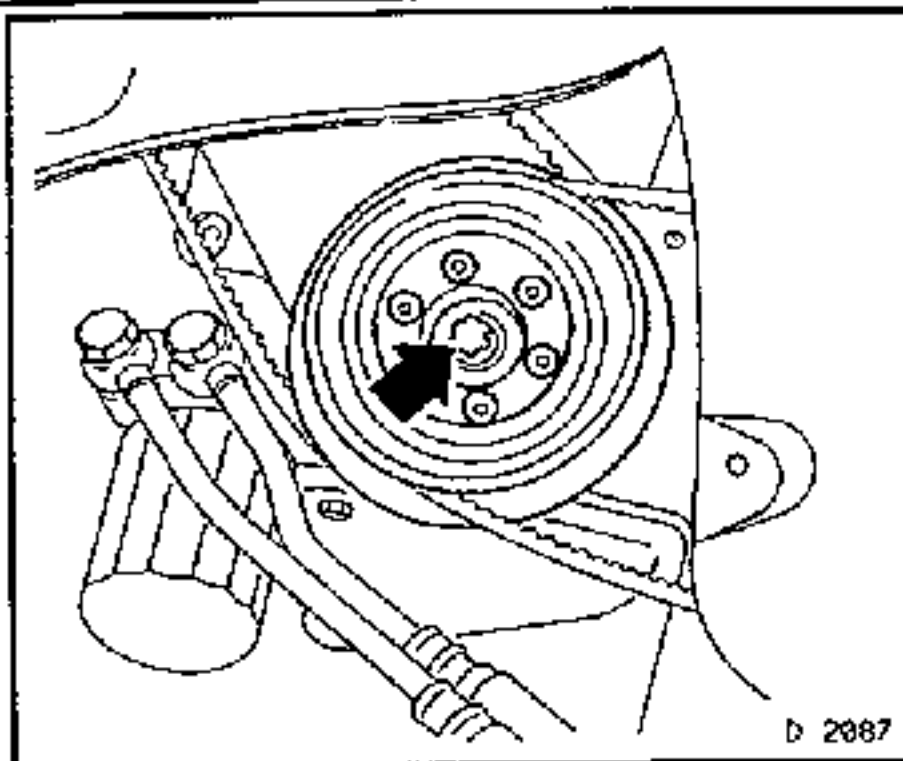
Flywheel, Remove and Install

Remove, Disconnect

Transmission and clutch. Refer to Section K, "Clutch and Transmission", in Volume 4.

Flywheel after marking the relative position to the crankshaft.

Use MKM-604-21 (Torx E 20) on the toothed belt drive gear (arrow) to hold the crankshaft when loosening the flywheel fastening bolts.



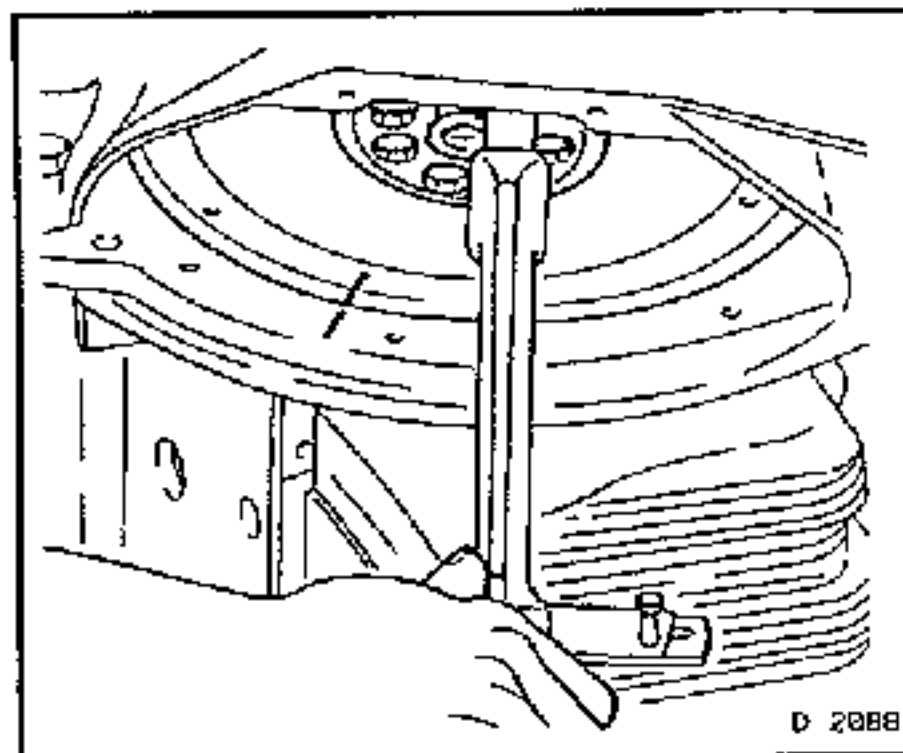
Torque - Angle Method

Flywheel to crankshaft..... 65 Nm + 30° + 15° +
* Use new bolts.

Use MKM-604-21 (Torx E 20) on the toothed belt drive gear to hold the crankshaft while tightening the flywheel fastening bolts.

Install, Connect

Clutch, thrust bearing guide sleeve, thrust bearing, and transmission. Refer to Section K, "Clutch and Transmission", in Volume 4.



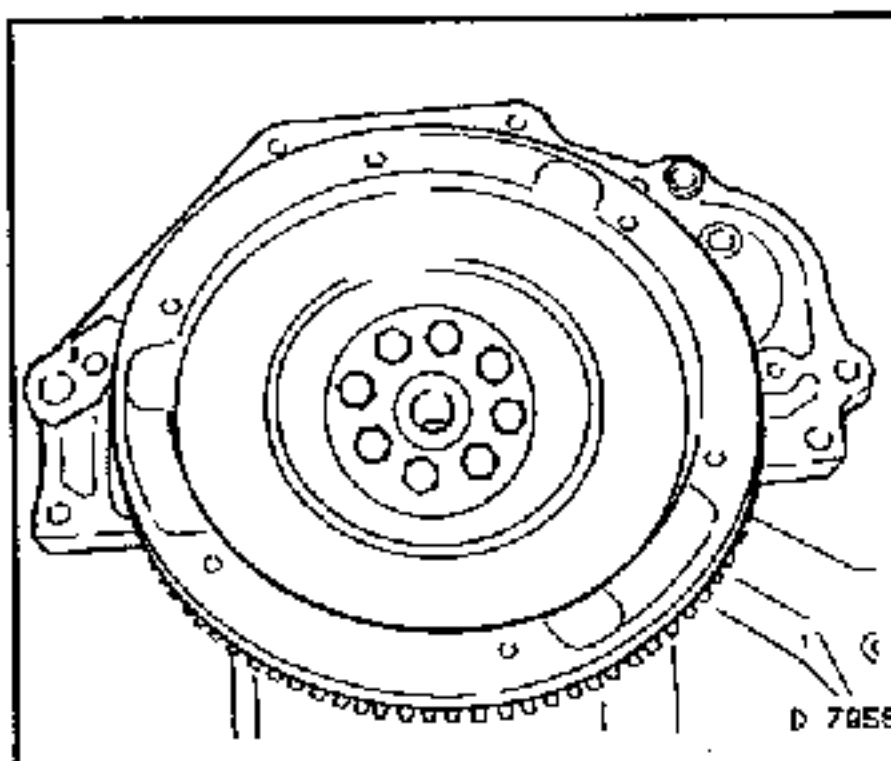
Pot Flywheel, Remove and Install

Remove, Disconnect

Transmission and clutch. Refer to Section K, "Clutch and Transmission", in Volume 4.

Pot flywheel after marking the relative position to the crankshaft.

Hold the pot flywheel by using KM-652.

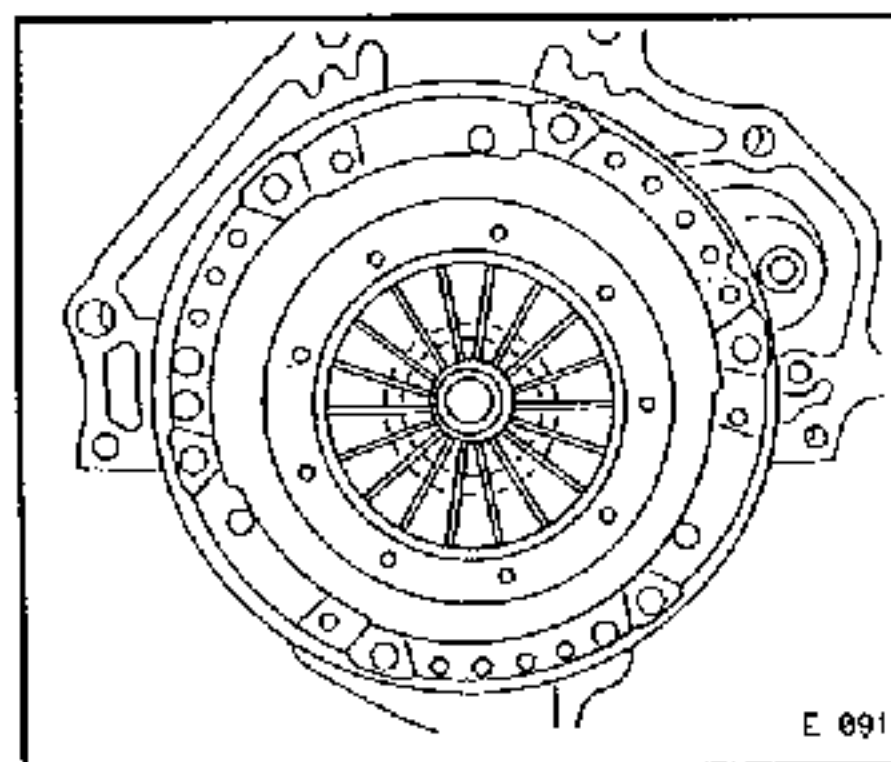


Torque - Angle Method

Flywheel to crankshaft..... 65 Nm + 30° + 15° +
* Use new bolts.

Install, Connect

Clutch, thrust bearing guide sleeve, thrust bearing, and transmission. Refer to Section K, "Clutch and Transmission", in Volume 4.



DOHC ENGINE - CRANK DRIVE

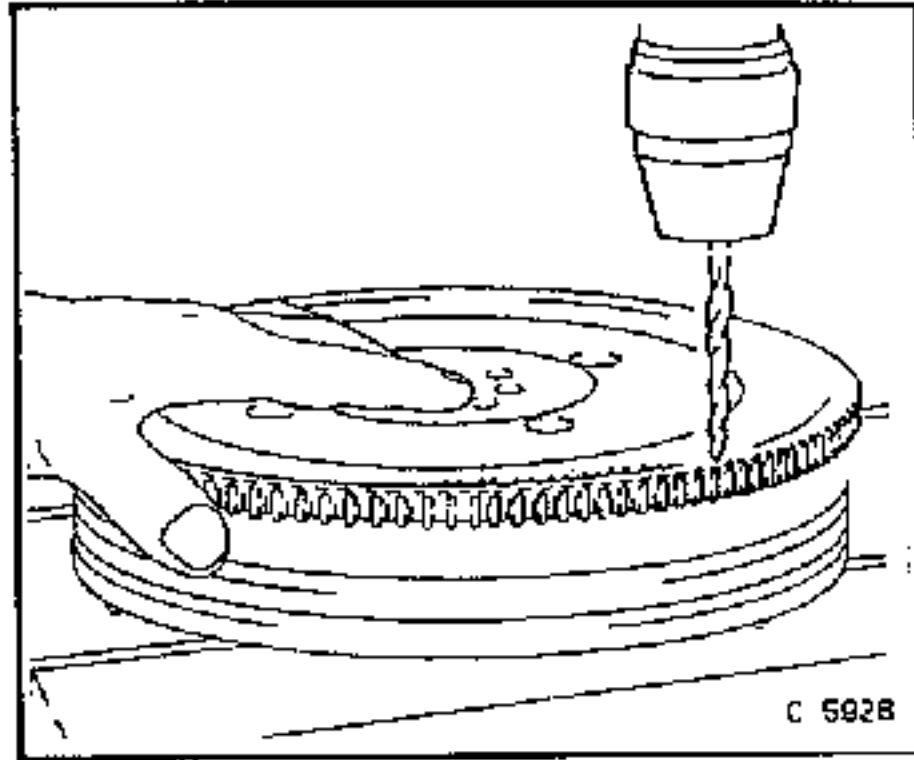
Starter Ring Gear, Replace

Remove, Disconnect

Flywheel. Refer to previous operation, in this Section.

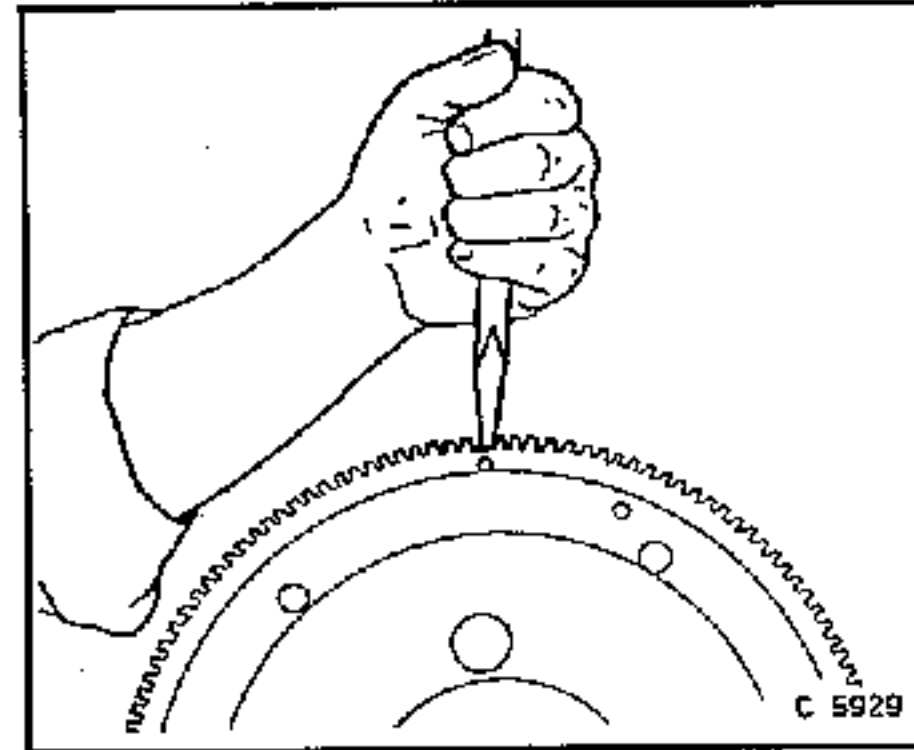
Disassemble

Drill starter ring gear at a tooth gap, using a 6 mm drill bit to a depth of approximately 8 mm.



Disassemble

Separate starter ring gear using a cold chisel at the drilled hole.

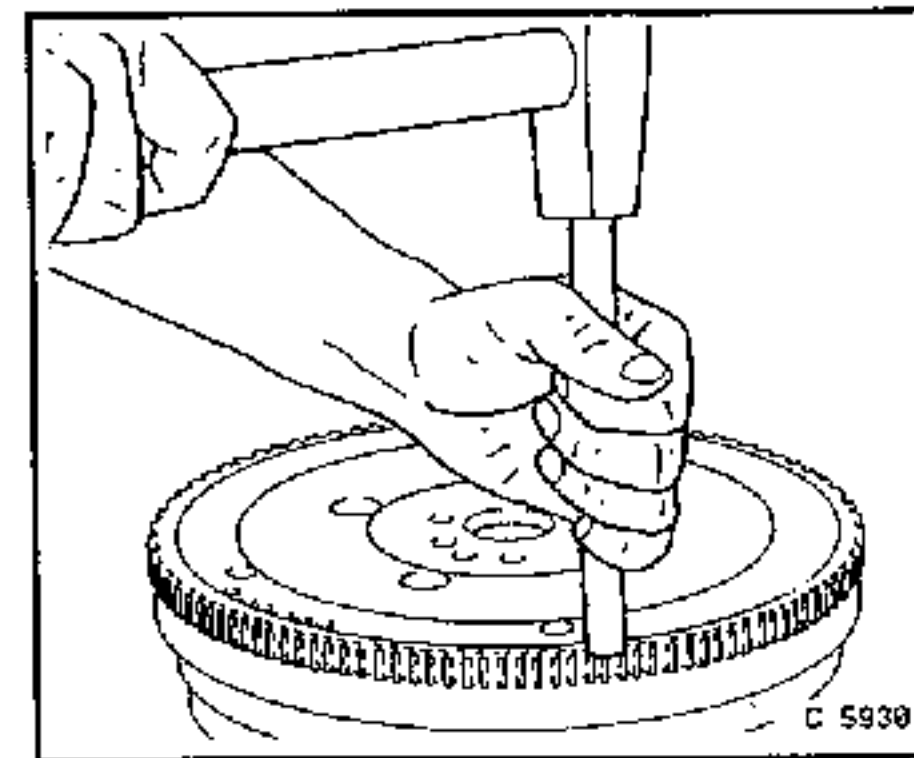


Assemble

Starter ring with the chamfered edge to the flywheel, after heating the ring gear to a temperature between 180 - 230 °C (yellow burnished colour).

Install, Connect

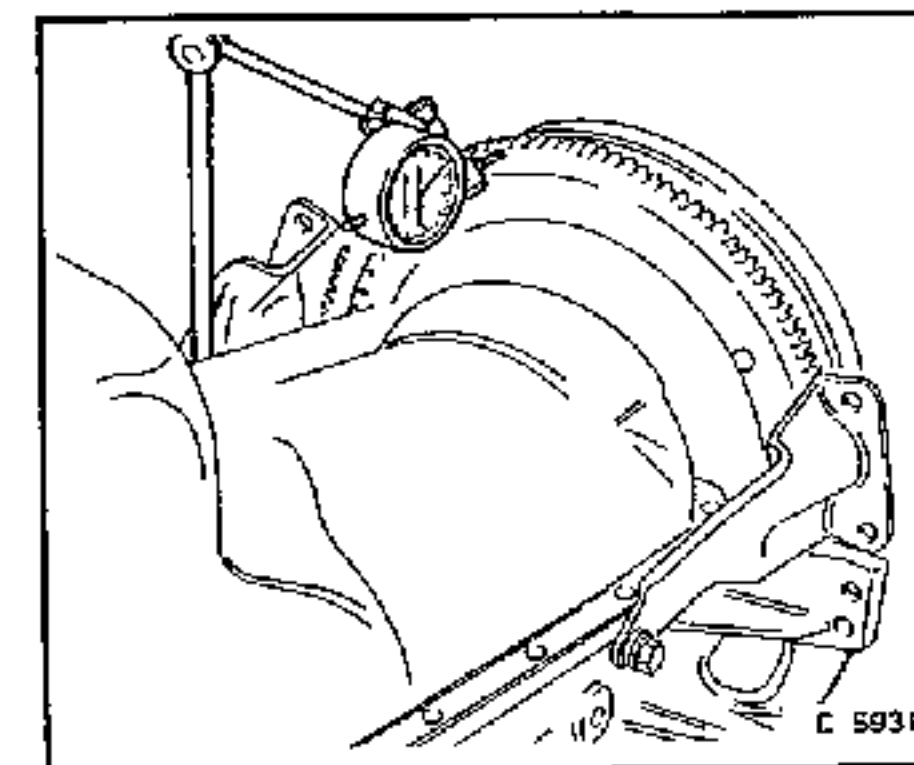
Flywheel. Refer to the previous operation in this Section.



Check

Using a dial indicator and magnetic stand and check the lateral run-out of the starter ring gear.

Specification 0.5 mm max.



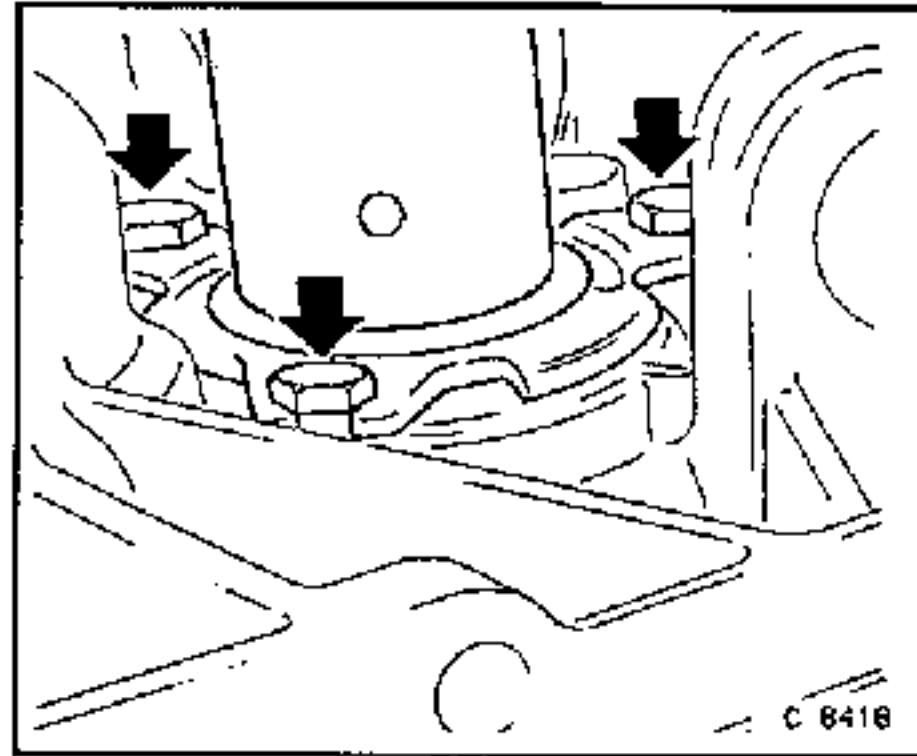
DOHC ENGINE - CRANK DRIVE

Rear Crankshaft Seal Ring, Replace (Engines without Pot Flywheel)

Remove, Disconnect

Transmission, clutch, thrust bearing and thrust bearing guide sleeve. Refer to Section K, "Clutch and Transmission", in Volume 4.

Flywheel. Refer to operation in this Section.



Install, Connect

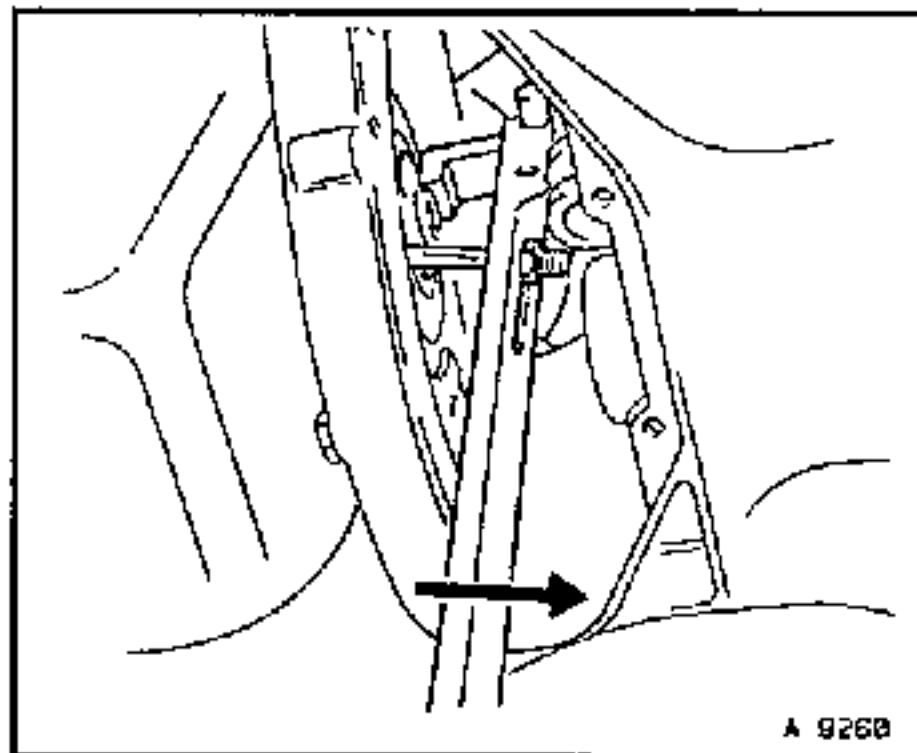
Remover hook KM-665 between seal lip and the crankshaft journal.

Assemble

Support KM-469-4, lever KM-469-13-A and pin KM-328-8.

Remove, Disconnect

Shaft seal ring using this combination of special service tools.

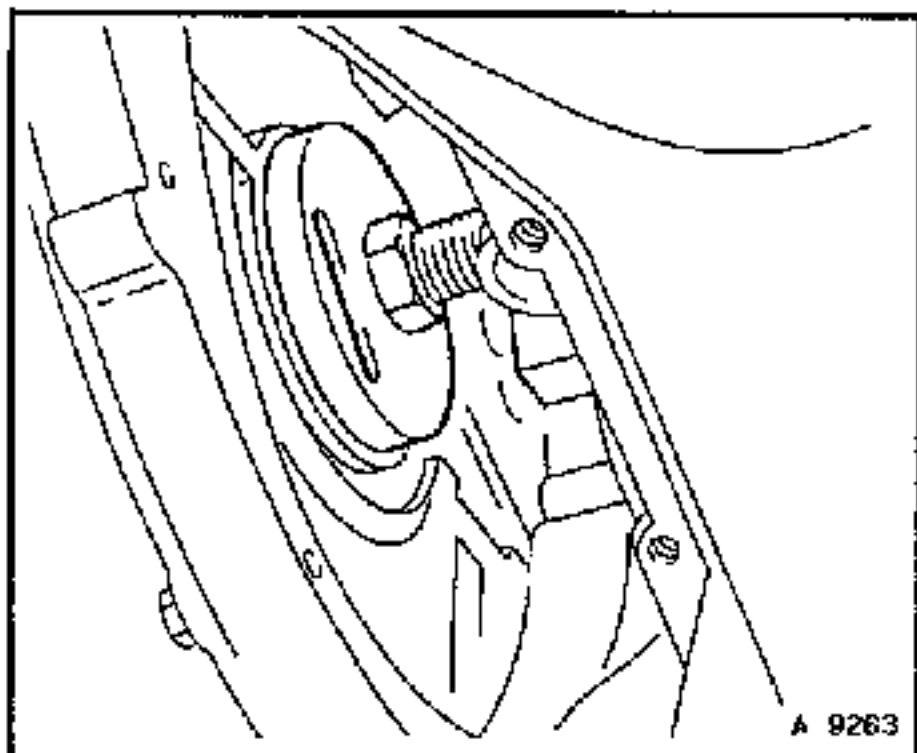


Apply protective grease to the seal lip before installing.

Install, Connect

Using protective sleeve KM-635-1, install seal onto crankshaft journal.

Mount compress ring KM-635-2 on seal ring.



Install, Connect

Seal ring to stop on cylinder block. Use holding plate KM-511-11 and Torx bolt KM-469-12-B.

Important!

Insert the locating pins (arrows) into the bores of the transmission.

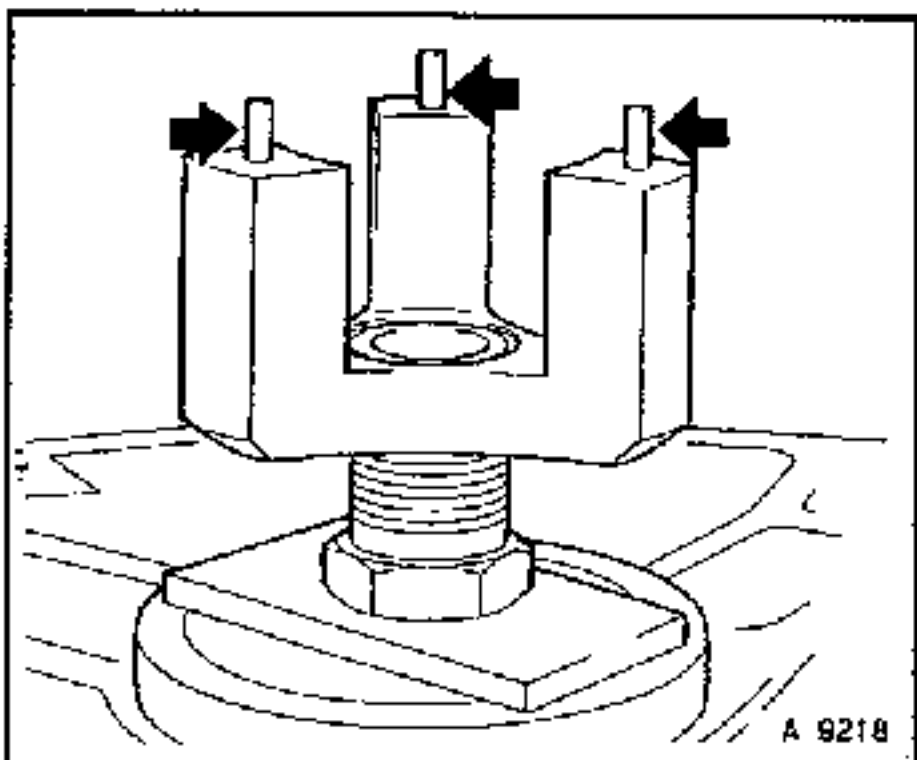
Remove, Disconnect

Special service tools.

Install, Connect

Flywheel. Refer to the previous operation in this Section.

Clutch, thrust bearing guide sleeve, thrust bearing, and transmission. Refer to Section K, "Clutch and Transmission", in Volume 4.



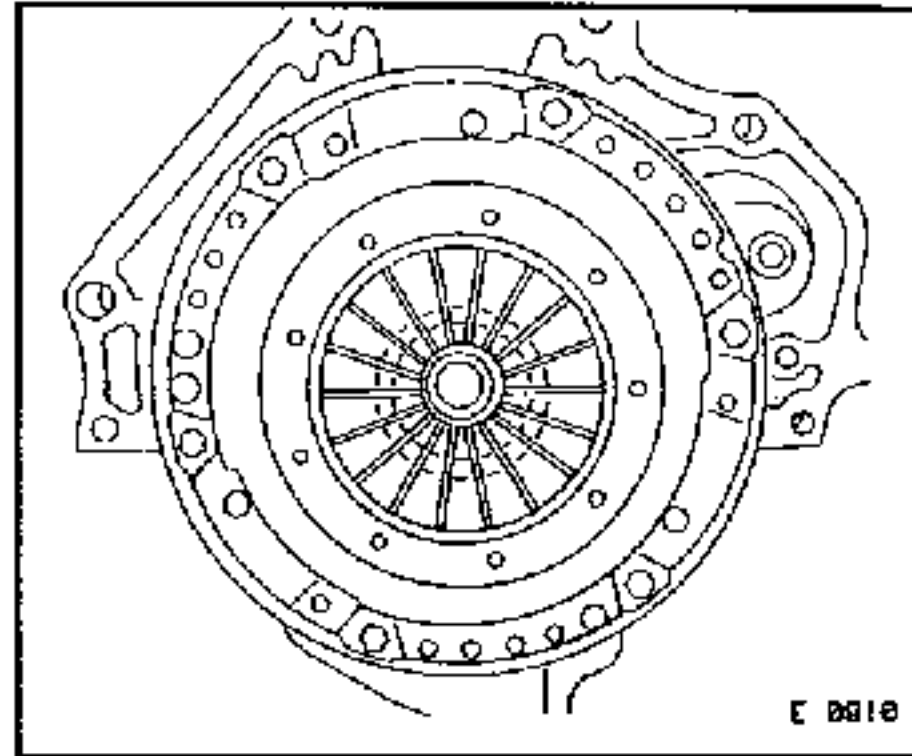
DOHC ENGINE - CRANK DRIVE

Rear Crankshaft Seal Ring, Replace (Engines with Pot Flywheel)

Remove, Disconnect

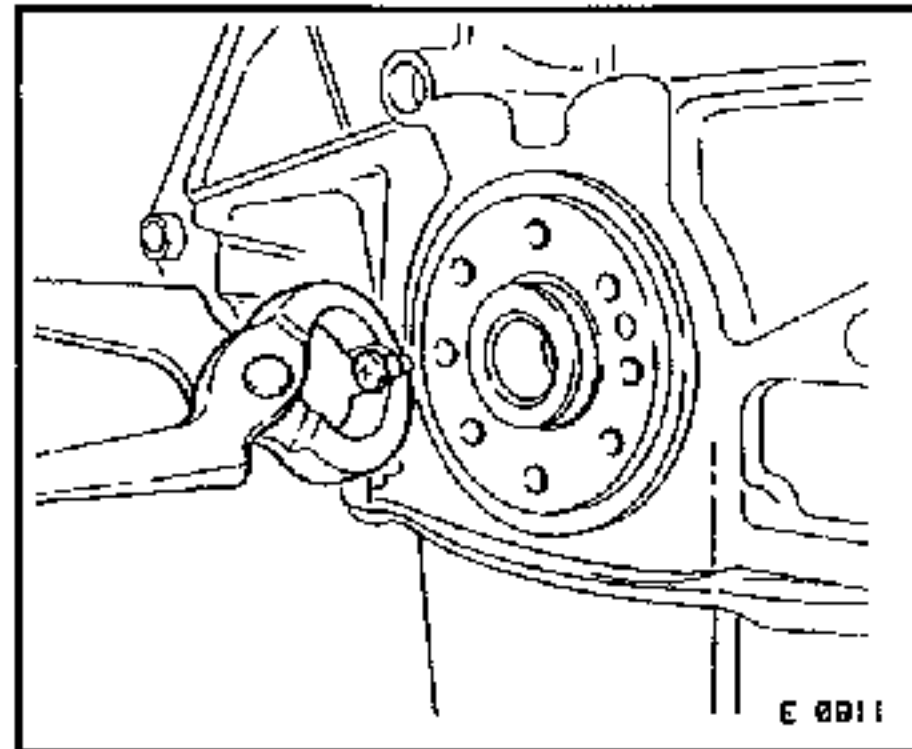
Transmission and clutch. Refer to Section K, "Clutch and Transmission", in Volume 4.

Pot flywheel. Refer to the operation described in this Section.



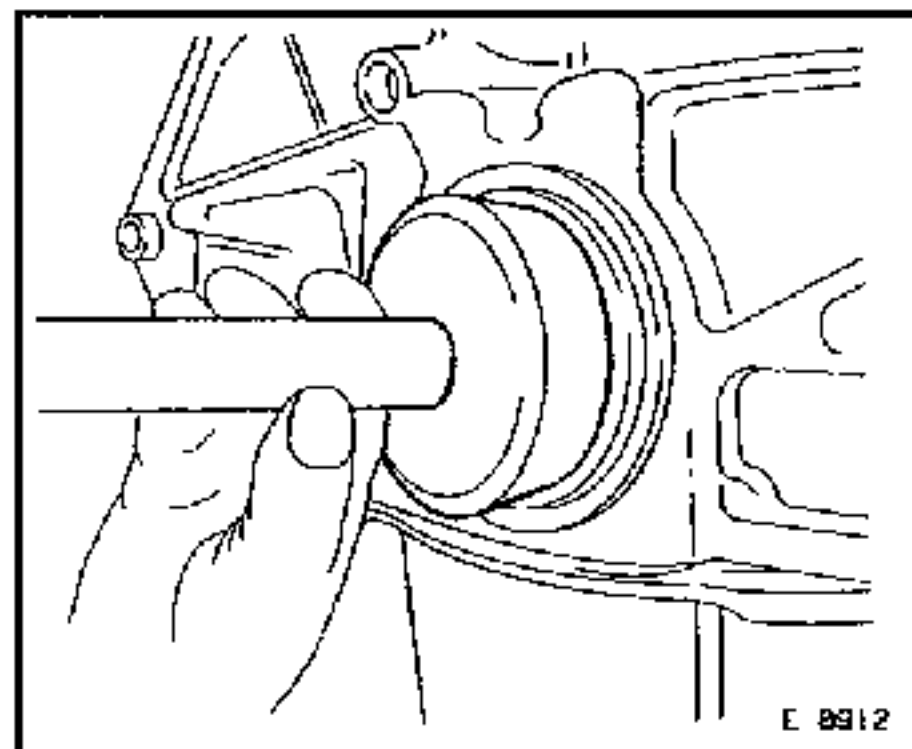
Remove, Disconnect

Drill a hole in the centre of one side of the seal ring, insert a self tapping screw and lever the seal out, with a suitable tool.



Install, Connect

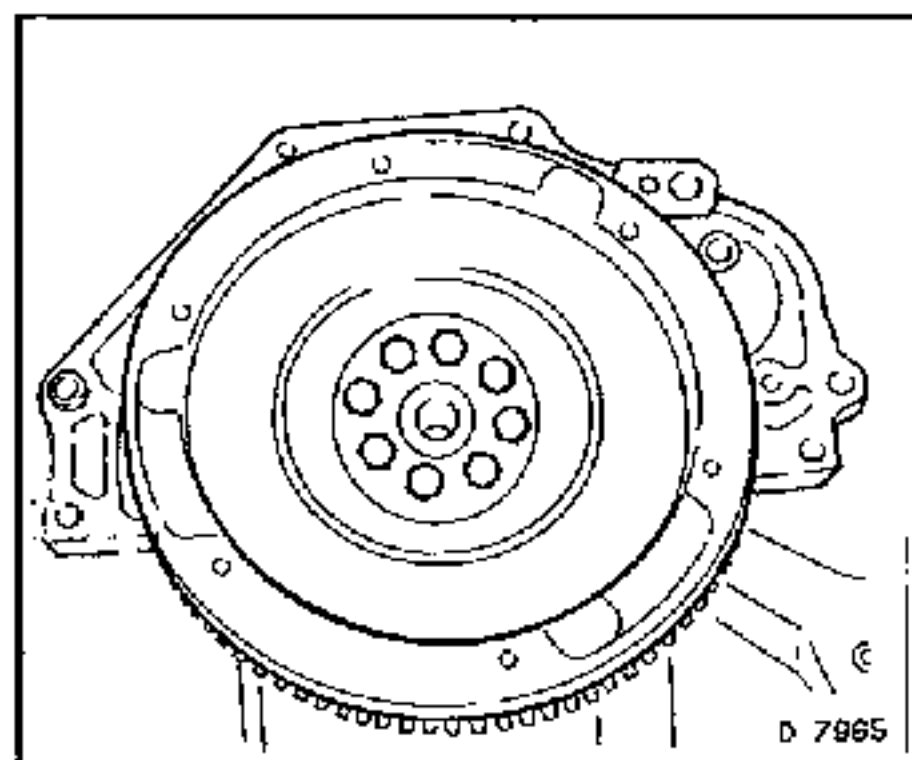
Seal ring using protective sleeve KM-635-1. Coat seal lip with protective grease before installing. Compress ring KM-635-2 and KM-535.



Install, Connect

Pot flywheel. Refer to the previous operation in this Section.

Clutch, thrust bearing guide sleeve, thrust bearing, and transmission. Refer to Section K, "Clutch and Transmission", in Volume 4.



DOHC ENGINE - CRANK DRIVE

Front Crankshaft Seal Ring (in Oil Pump Housing), Replace

Note:

While the operation is described here is for engines up to MY'93, the procedure is similar for all engines.

Remove, Disconnect

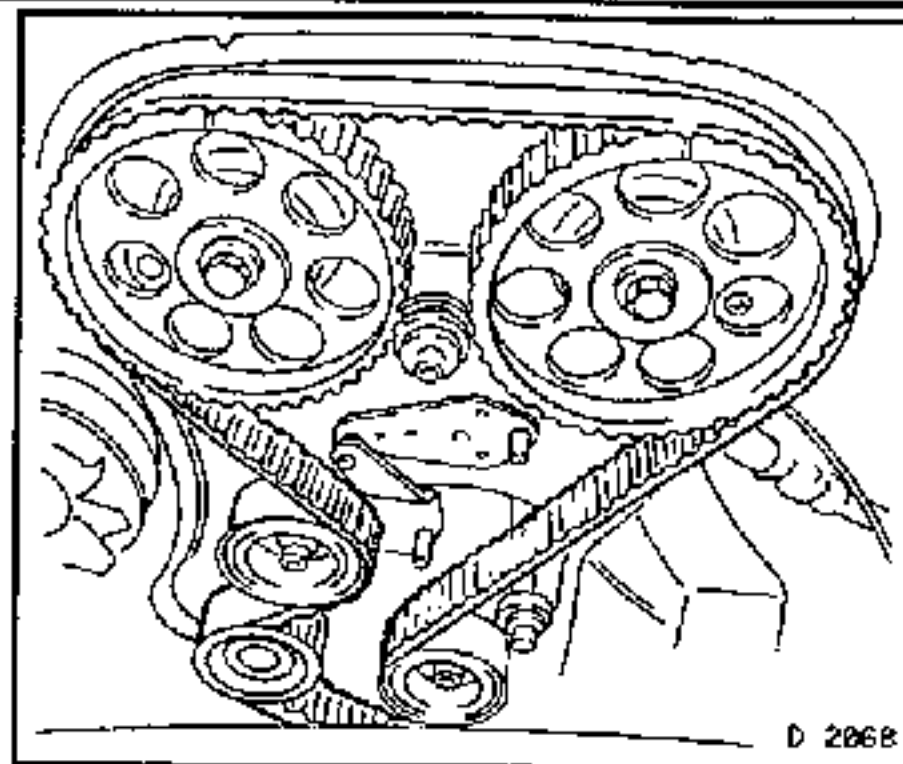
Right front wheel.

Engine compartment cover.

Engines as of MY'93:

Mark the direction of rotation of the toothed belt.

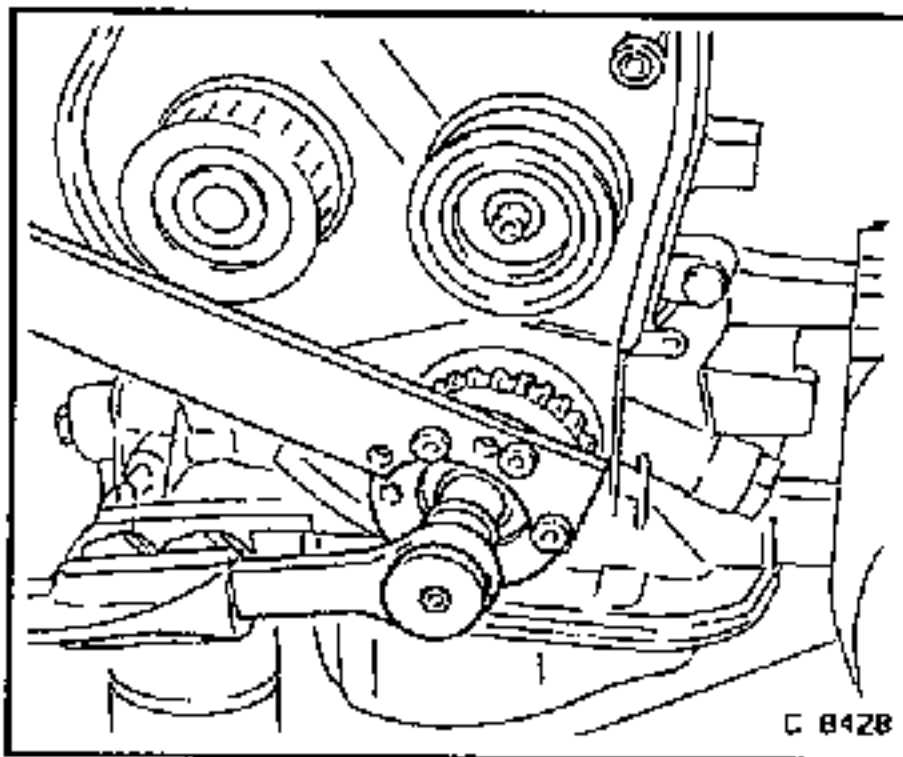
Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.



Remove, Disconnect

Toothed belt drive gear. Use holding wrench KM-662-A and MKM-604-21 (Torx E 20), to remove the fastening bolt.

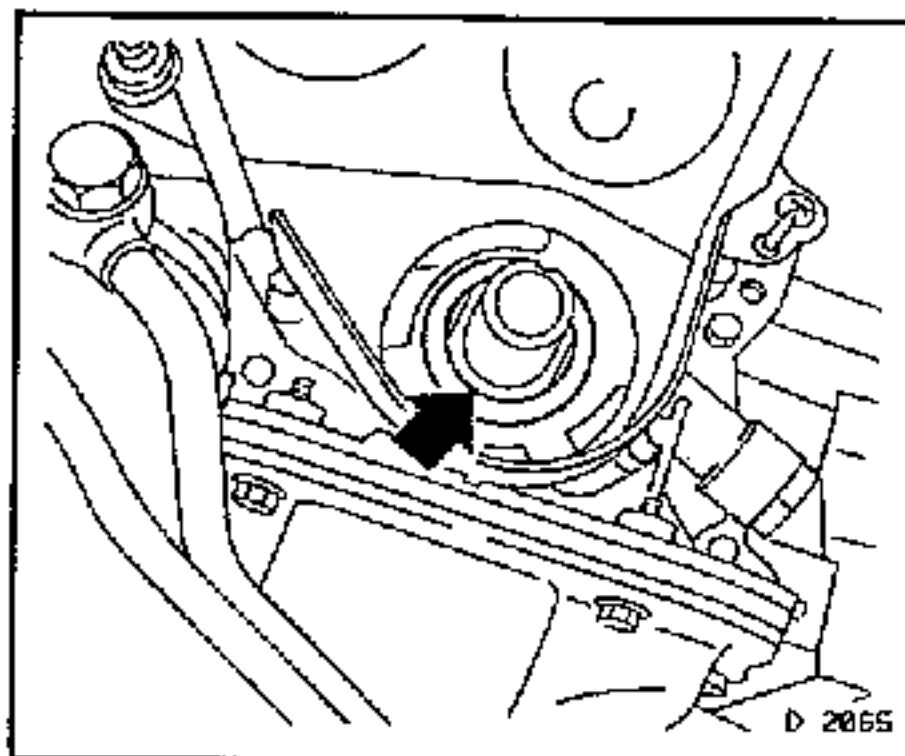
Install wheel puller KM-210-A, with KM-516 and KM-647 if necessary, to remove the toothed belt drive gear.



Remove, Disconnect

Spacing ring.

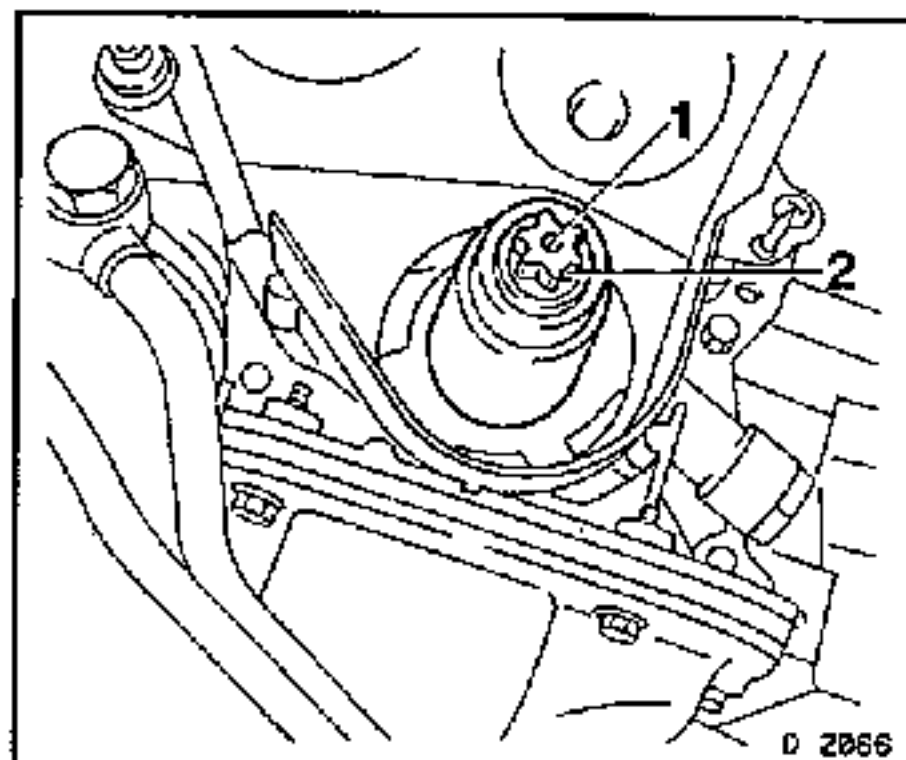
Drill a hole in one side of the sealing ring. Insert a self tapping screw and remove the seal using a suitable tool.



Install, Connect

Seal ring with KM-693 and the toothed belt drive gear torx bolt (1) and washer.

Coat the seal lip with protective grease before installing.

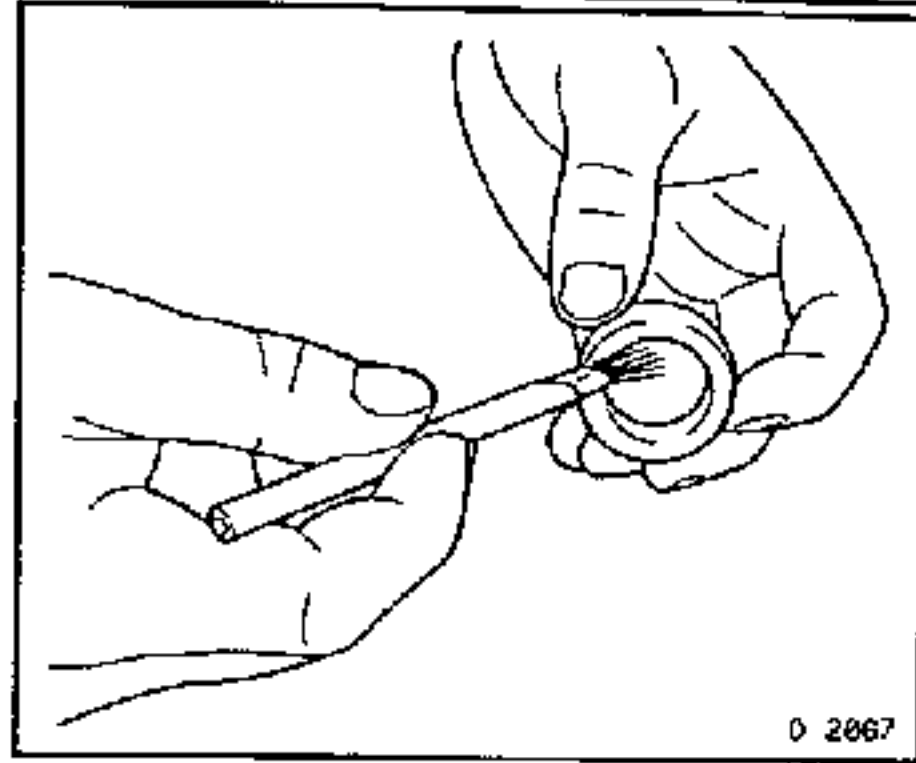


DOHC ENGINE - CRANK DRIVE

Install, Connect

Spacing ring on crankshaft journal. Apply a thin layer of silicone sealant such as Dow Corning 732 or equivalent to Holden's Specification HN1373, to the spacing ring before installation.

Toothed belt drive gear to the crankshaft journal noting the alignment position.



Torque - Angle Method

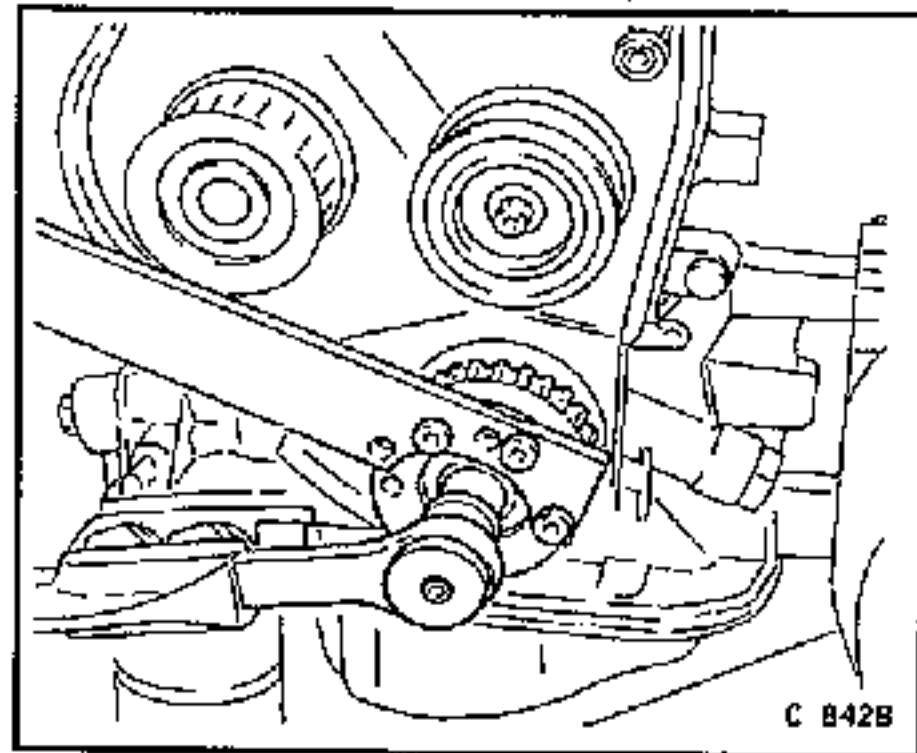
Toothed belt drive gear to crankshaft..... 250 Nm + 40° + 50° *

* Use new bolt.

Important!

Apply grease to the toothed belt drive gear bolt threads before installing.

To tighten the bolt, use holding wrench KM-662-A and MKM-604-21 (Torx E 20). Observe manufacturer's instructions.



Install, Connect

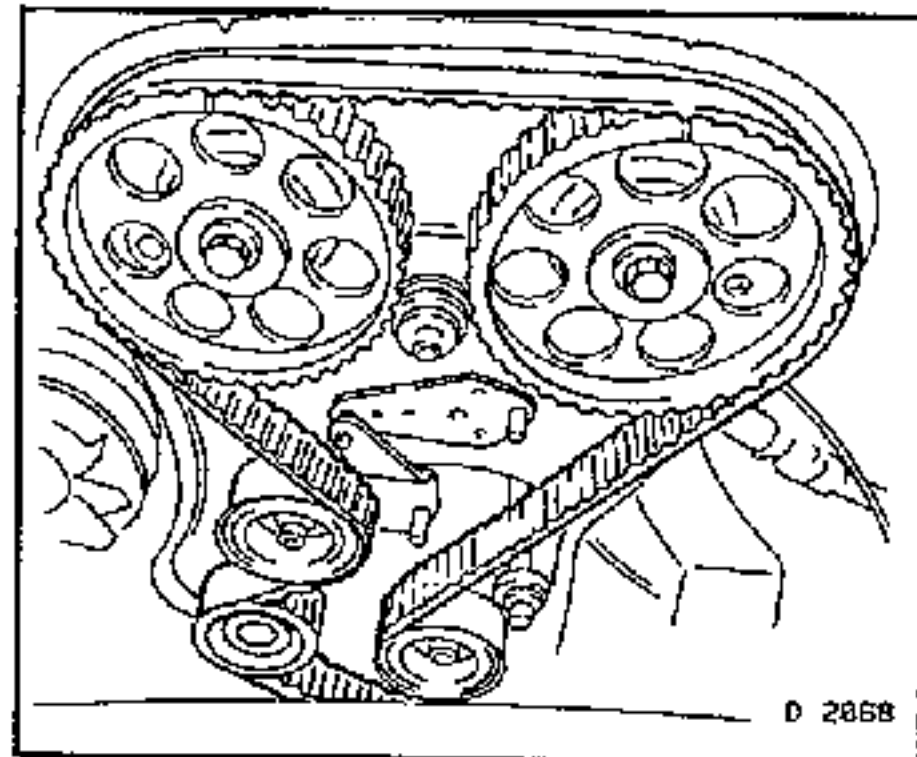
Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

Engine compartment cover.

Right front wheel.

Tighten (Torque)

Wheel bolts to front wheel hub 110 Nm



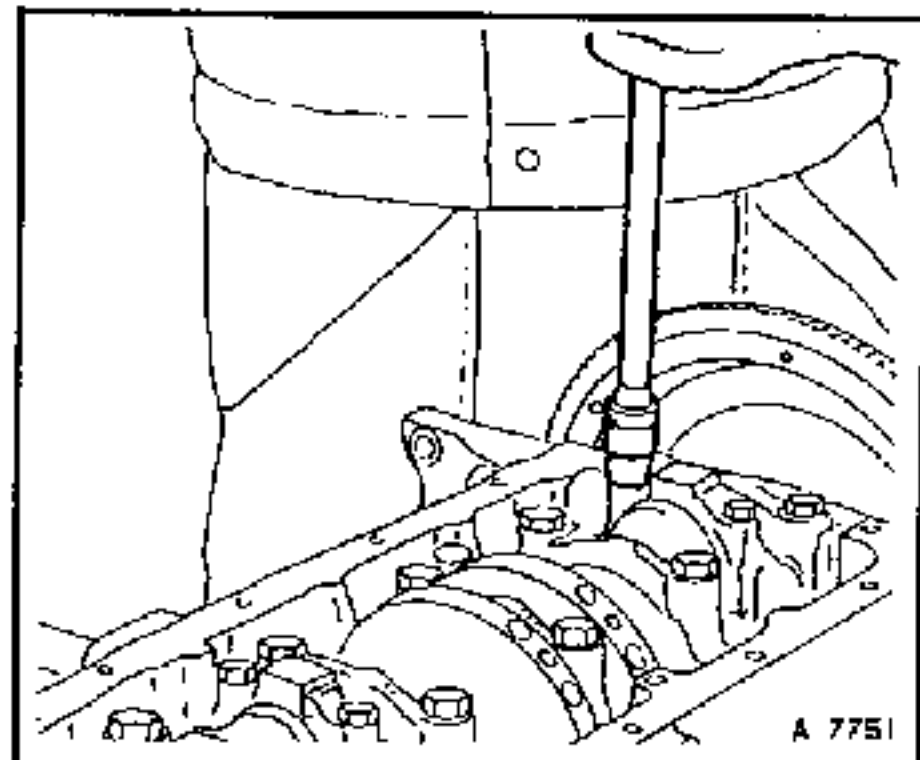
Piston with Con-rod, Remove and Install

Remove, Disconnect

Cylinder head. Refer to the Section "Cylinder Head", in this Volume.

Oil pan. Refer "Oil Pan Gasket, Replace", in the Section "Oil Circuit", in this Volume.

Piston with con-rod. Mark the con-rod cover before removal.



DOHC ENGINE - CRANK DRIVE

Inspect

All parts, replacing as necessary.

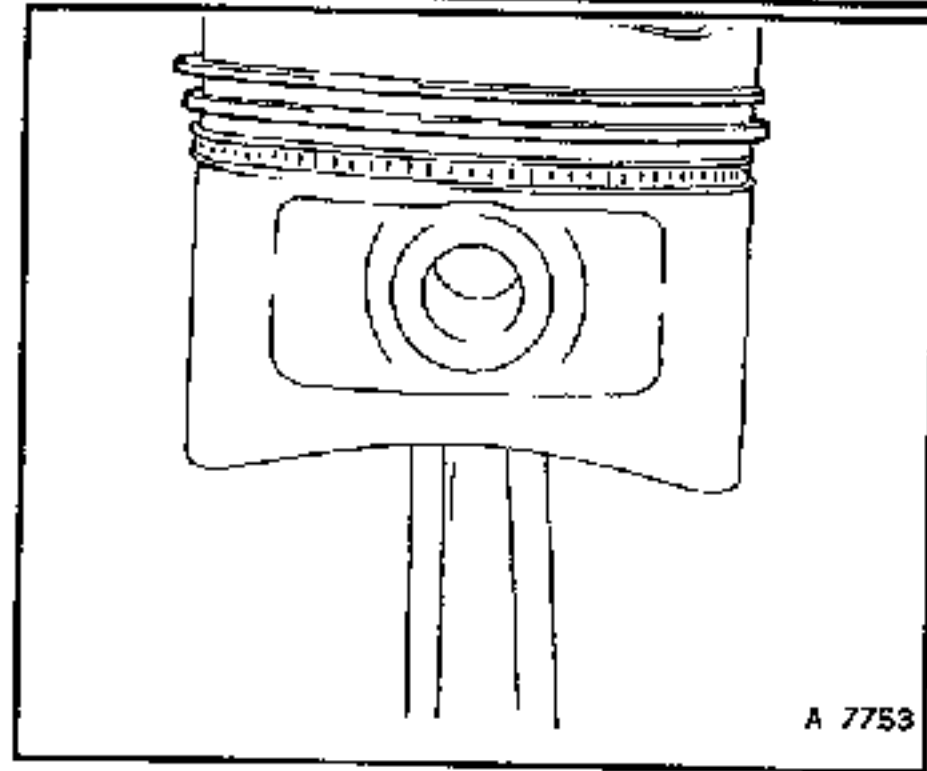
Install, Connect

Install piston rings, using a commercially available tool.

Important!

For the two compression rings, align the ring gaps 180° apart.

When installing the segmented oil control ring, arrange the upper steel ring from 25 - 50 mm to the left of the gap of the intermediate ring and the lower steel ring, 25 - 50 mm to the right.

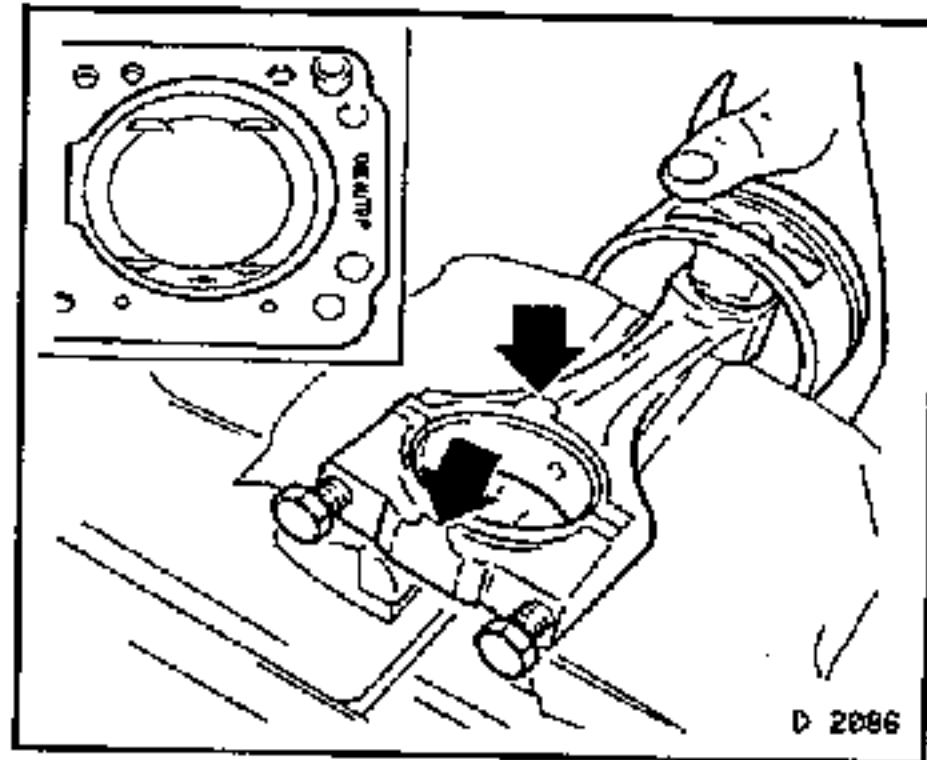


Install, Connect

Piston with con-rod. Insert with parts coated with clean engine oil.

Important!

Note the installation position. The arrow on the piston crown points to the engine timing side and the bead on the con-rod (arrows) to the clutch side.



Torque - Angle Method

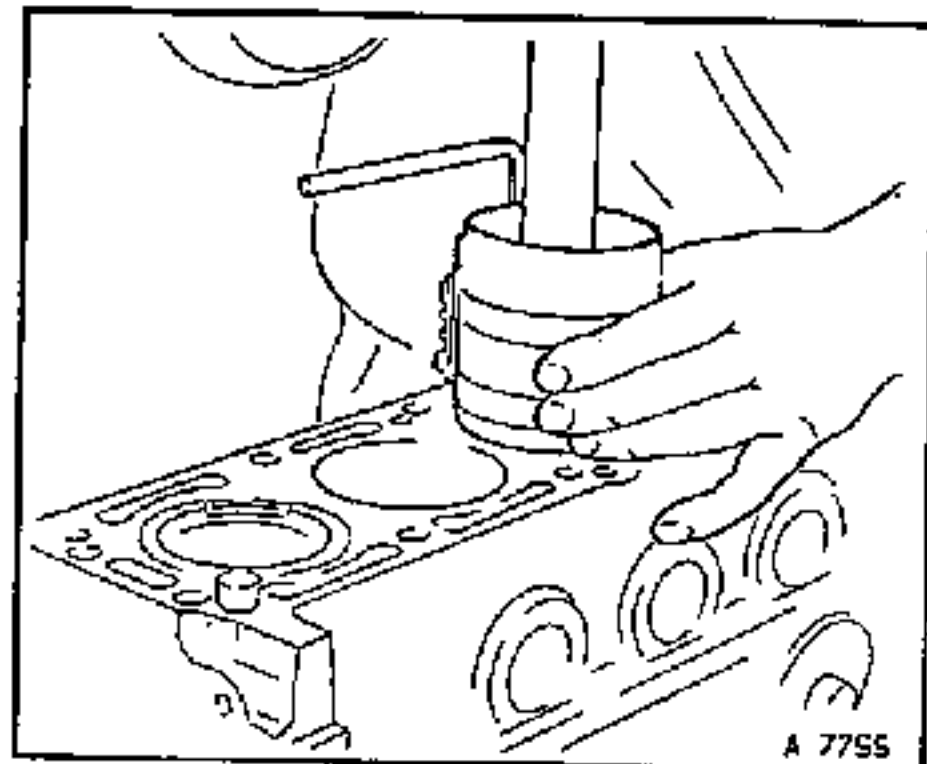
Con-rod bearing cover to con-rod 35 Nm + 45° + 45° *

* Use new bolts.

Install, Connect

Oil pan. Refer 'Oil Pan Gasket, Replace', in the Section "Oil Circuit", in this Volume.

Cylinder head. Refer to the Section "Cylinder Head", in this Volume.



Piston Rings, Replace

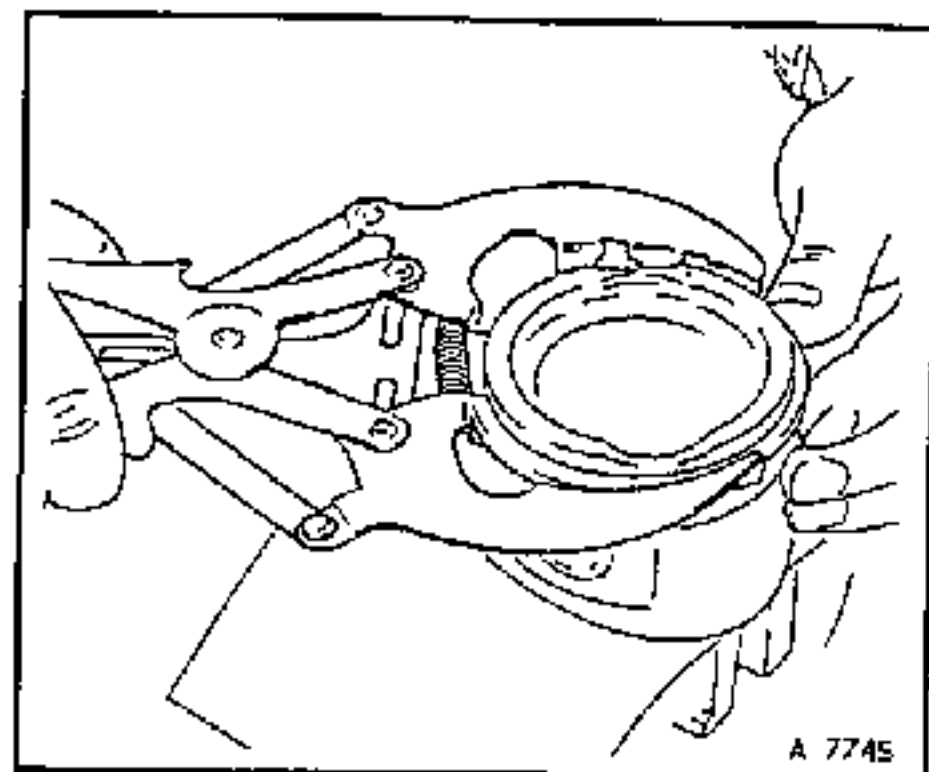
Remove, Disconnect

Piston with con-rod. Refer to previous Operation in this Section.

Piston rings, using commercially available, piston ring clamp pliers.

Clean

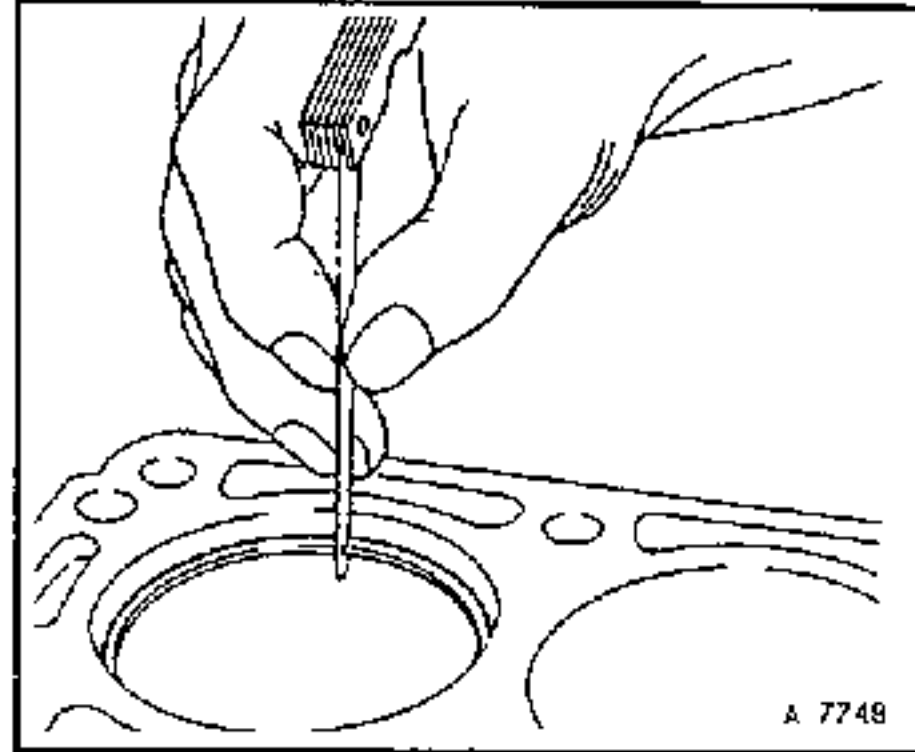
Piston ring grooves, using a ground section of an old piston ring.



DOHC ENGINE - CRANK DRIVE

Check

Piston ring gap. For these and piston sizes, refer to "Technical Data" at the end of this Volume.



Install, Connect

Oil scraper ring;

Arrange offset of steel band rings, each 25 - 50 mm to the left and right of the intermediate ring gap.

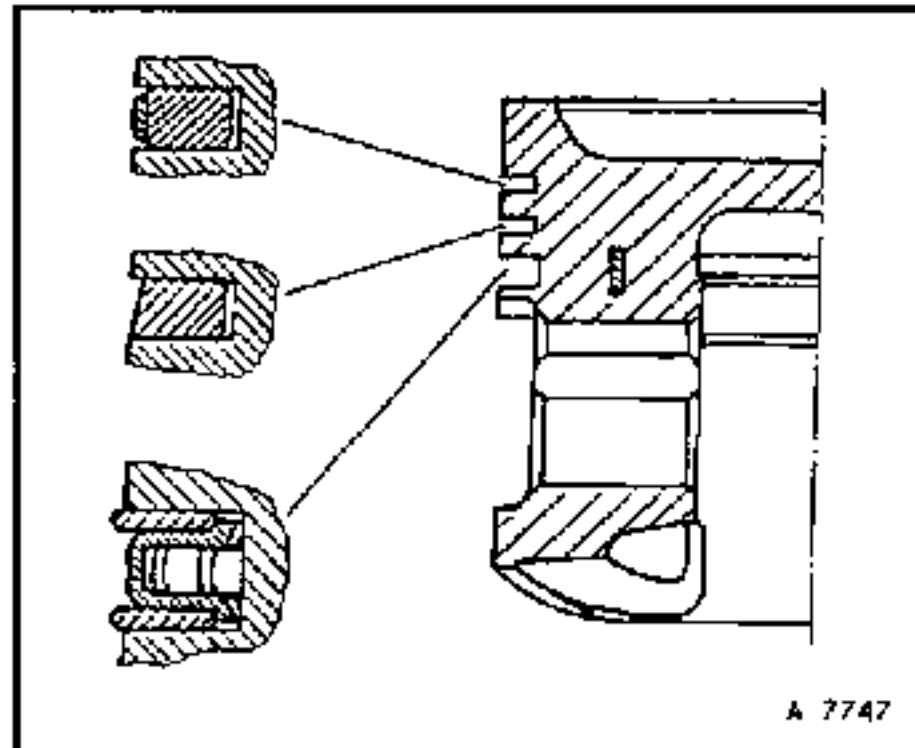
Piston rings;

Arrange offset of ring gaps by approximately 180.

Important!

Install the second piston ring with the "TOP" identification mark facing upwards.

Piston with con-rod. Refer to previous Operation in this Section.



Crankshaft, Remove and Install

Mount engine on Engine Overhaul Stand KM-412, with appropriate adaptors.

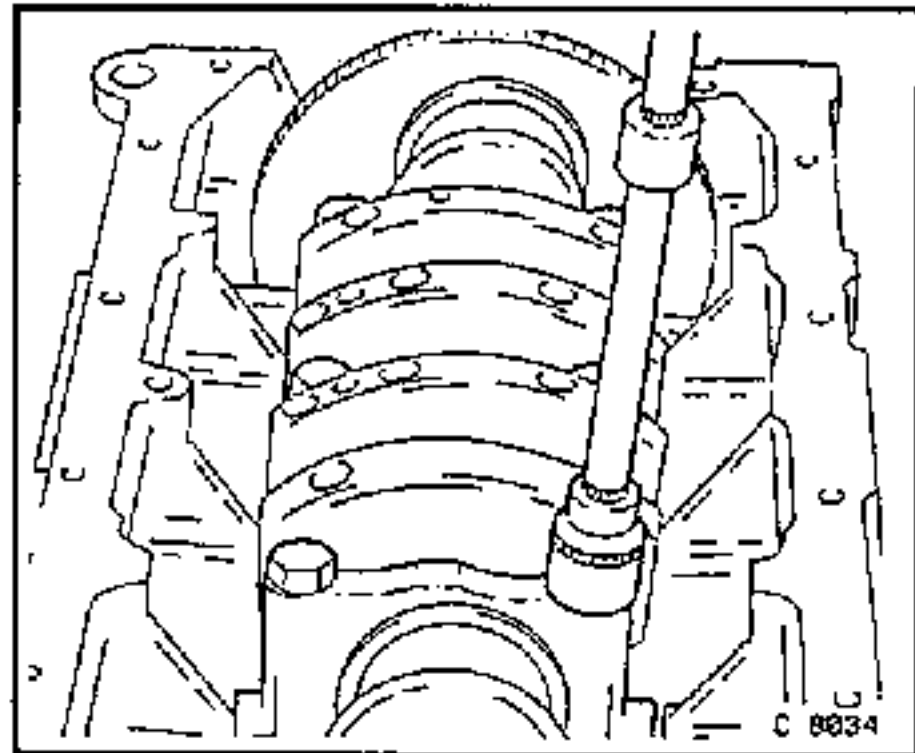
Drain engine oil into a suitable container.

Remove, Disconnect

The following items;

Drive disc, oil pan and oil pump. Refer to various Operations in this Volume.

Con-rod and crankshaft main bearing covers after marking each for correct reassembly.



Remove, Disconnect

Crankshaft from the engine block.

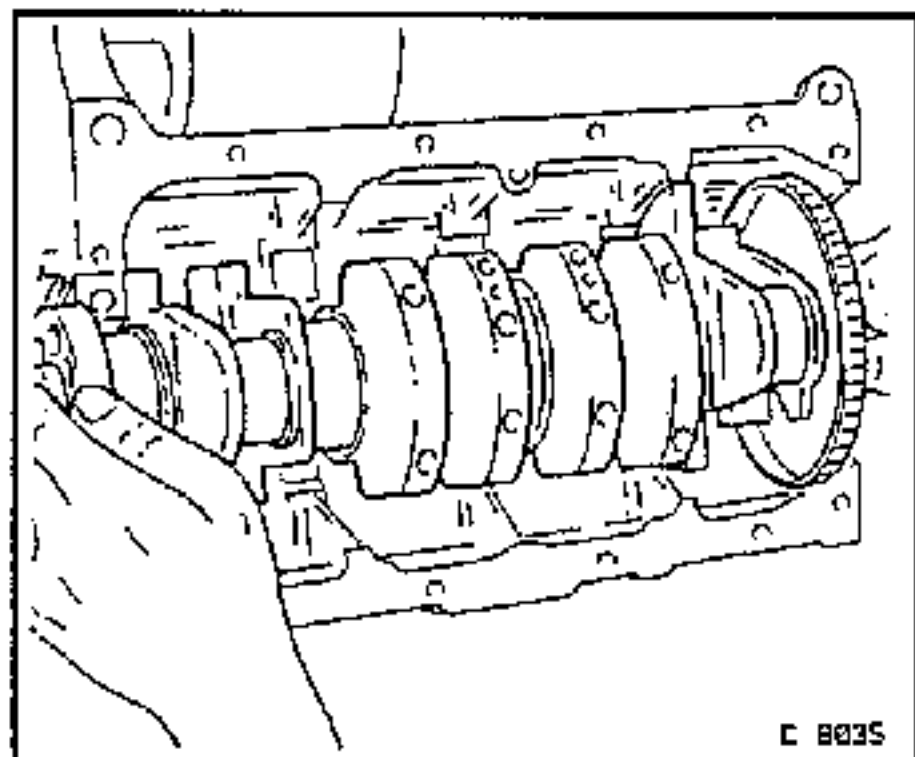
Clean

Inspect

Crankshaft. Refer to this Operation, later in this Section.

Replace all parts as required.

If replacing the crankshaft, the pulse sensor disc may need to be modified.



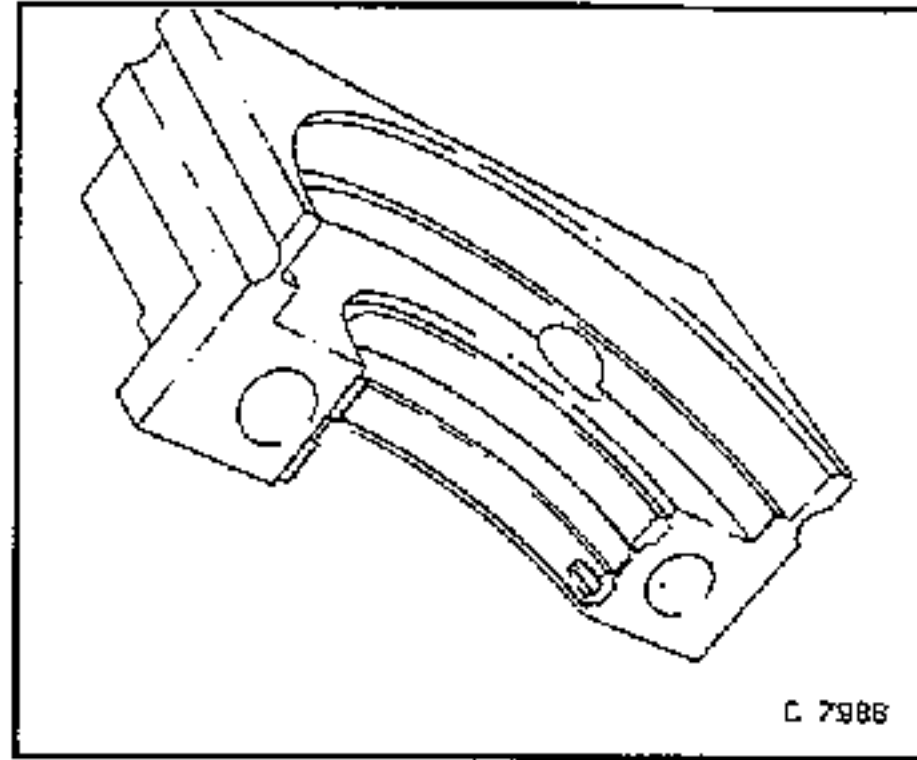
DOHC ENGINE - CRANK DRIVE

Install, Connect

New bearing shells into the cylinder block and bearing covers.

Coat bearings with clean engine oil.

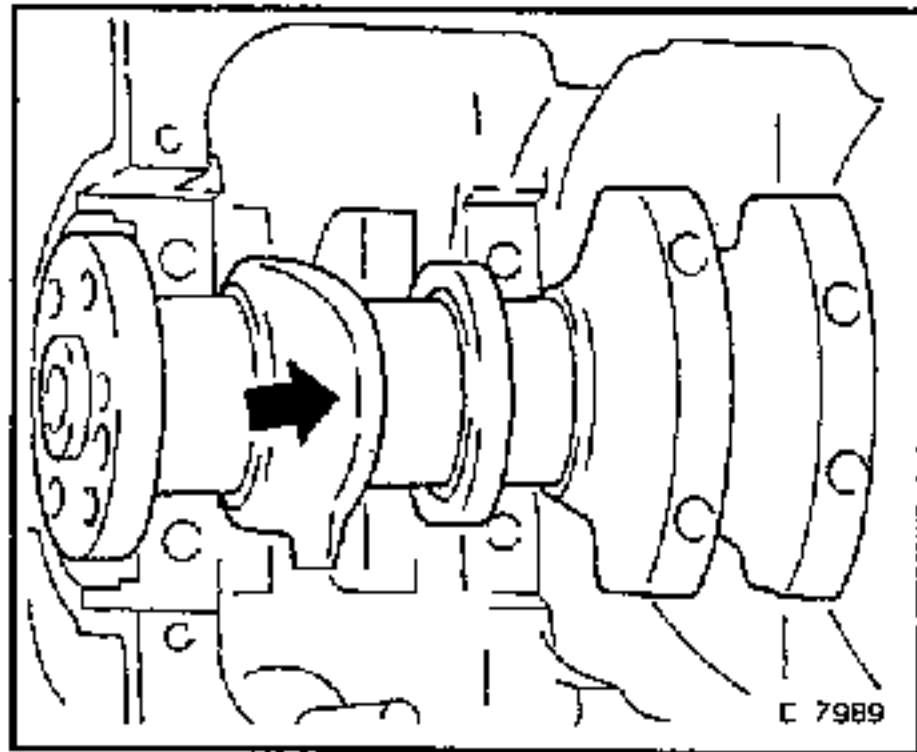
Refer to "Technical Data" at the end of this Volume for oversize bearing shell specifications.



Install, Connect

New crankshaft into the cylinder block.

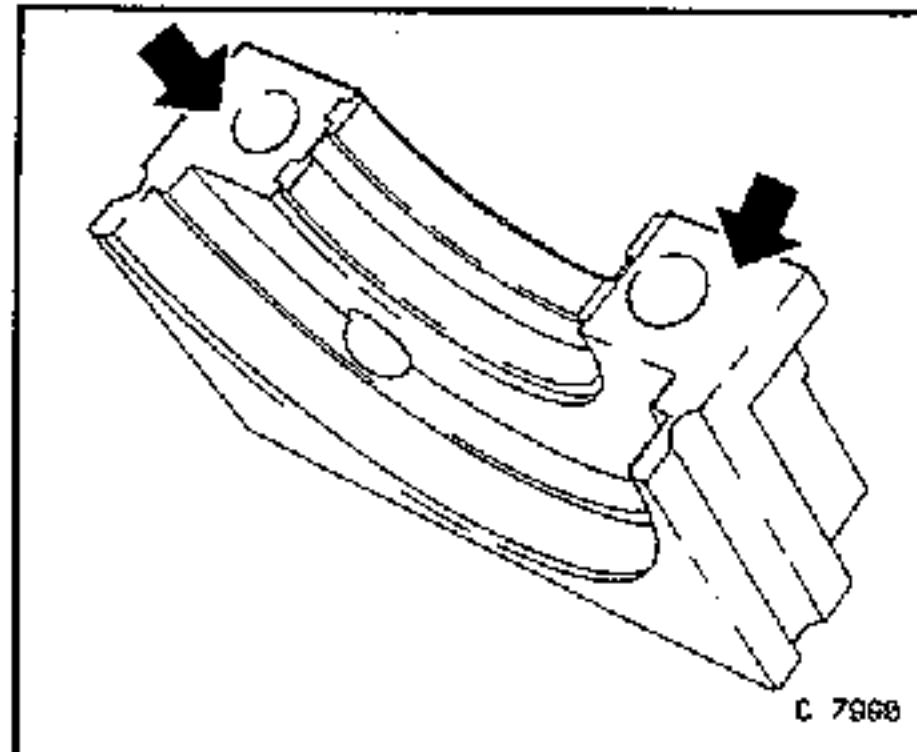
The seating of the crankshaft can be corrected by light blows with a rubber hammer on the crank throw land (arrow).



Install, Connect

Front and rear main bearing covers.

Coat mating surfaces (arrows) with sealing compound, to Holden's Specification HN1373, such as Dow Corning Silicone 732, or equivalent.

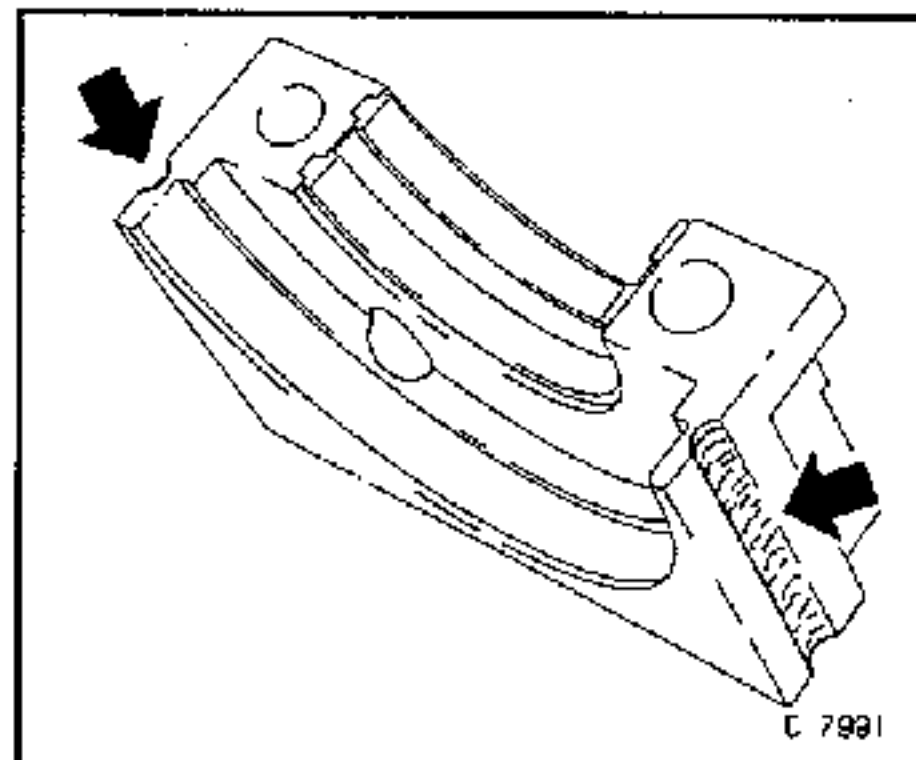


Install, Connect

Apply a bead of sealing compound such as General Electric RTV 159 or equivalent, to the side grooves of both bearing cover halves (arrows).

Important!

After installation of bearing cover, press in the sealing compound from above, until it emerges from the joints.



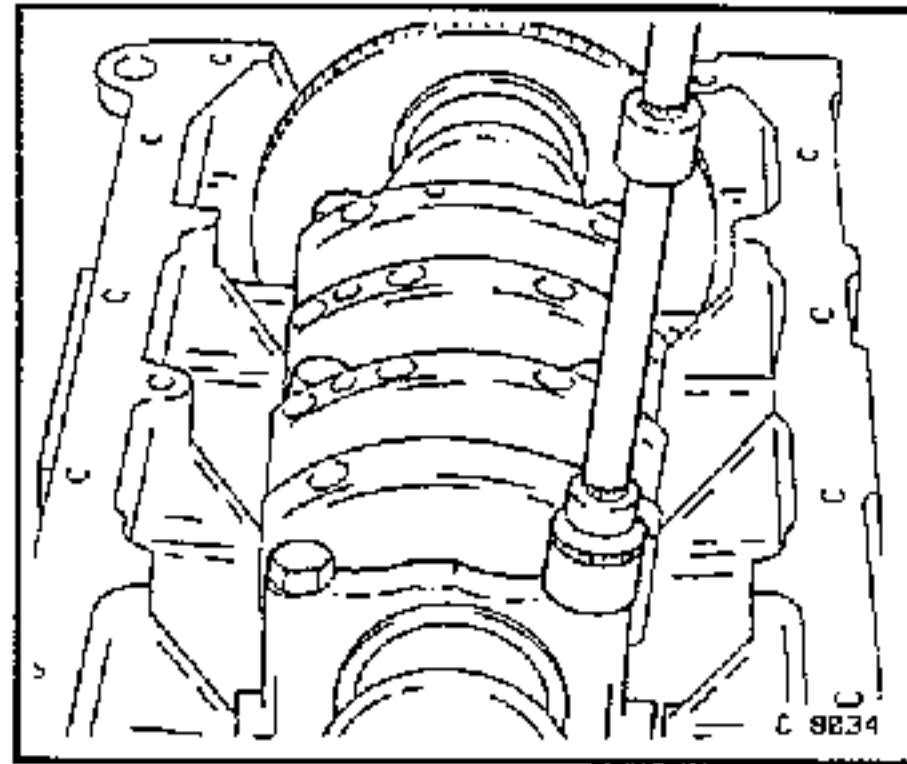
DOHC ENGINE - CRANK DRIVE

Torque - Angle Method

Crankshaft bearing cover to cylinder block.....	50 Nm + 45° + 15°
Con-rod bearing cover to con-rod.....	35 Nm + 45° + 15°

Use new bolts.

Align the front bearing cover to the engine on the timing side.



Install, Connect

Oil pump, oil pan, rear crankshaft seal, drive plate and engine accessories, as detailed in various sections in this Volume.

Important!

Check valve timing before installing toothed belt.

Remove, Disconnect

Engine from Engine Stand KM-412 and adaptors from the engine.

Install engine.

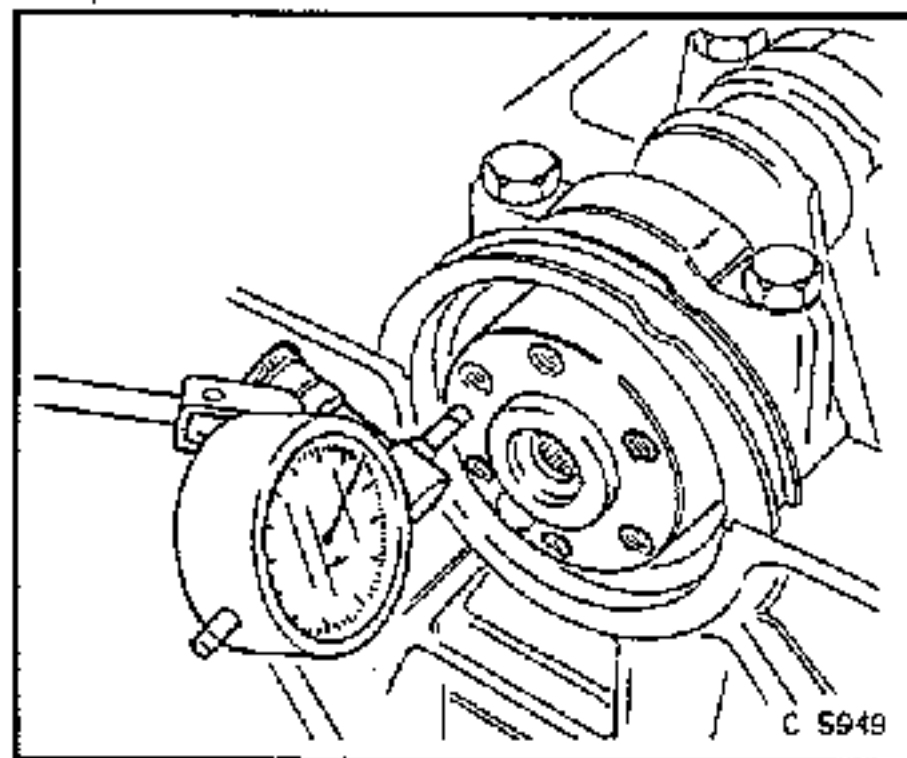
Crankshaft, Check

Inspect

Crankshaft end play with bearing shells installed.

Crankshaft mounting surfaces for the drive plate.

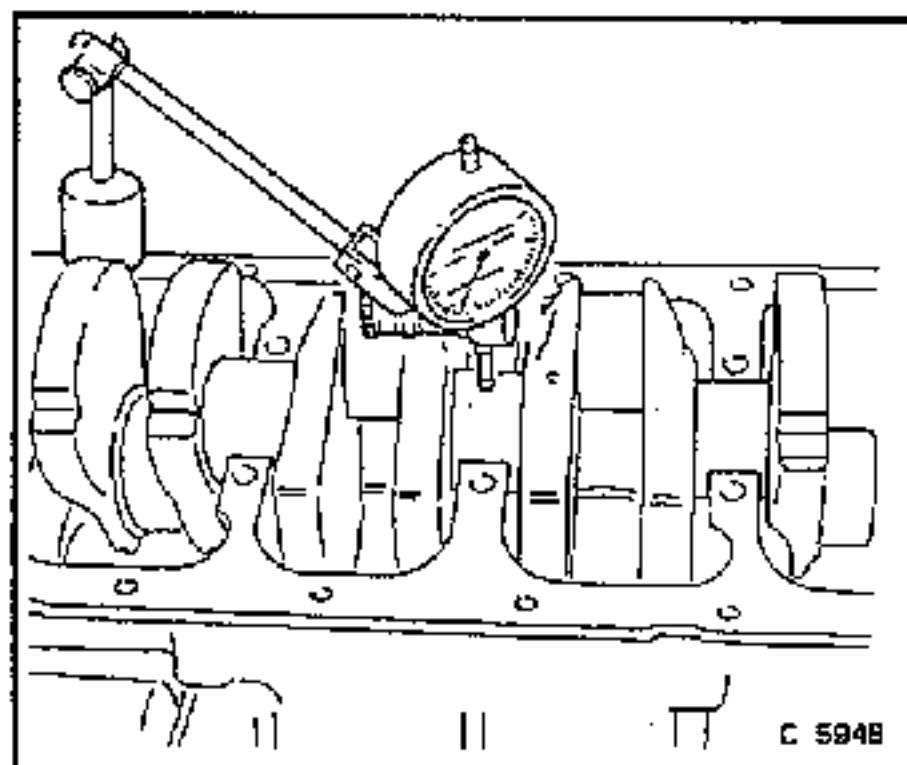
For tolerance specifications, refer to; "Technical Data"; at the end of this Volume.



Inspect

With the main bearing covers and shells removed, check for out-of-round on crankshaft main journals with a dial indicator.

For tolerance specifications, refer to; "Technical Data"; at the end of this Volume.



DOHC ENGINE - CRANK DRIVE

Bearing Clearance with Covers Removed.

Inspect

Important!

Lightly grease the crankshaft journal and lightly oil the bearing shells to avoid the gauging strip tearing when the bearing cover is removed.

Measure

With commercially available "Plastigage" material.

Cut threads to length of bearing width and lie along crankshaft journal (arrow). Install bearing cover and torque bolts

Torque - Angle Method

Crankshaft bearing cover to cylinder block	50 Nm + 45° + 15°
Con-rod bearing cover to con-rod .	35 Nm + 45° + 15°

Measure

Width of each compressed strip (arrow), using the measuring scale.

Note:

"Plastigage" is available in a number of varying tolerance ranges.

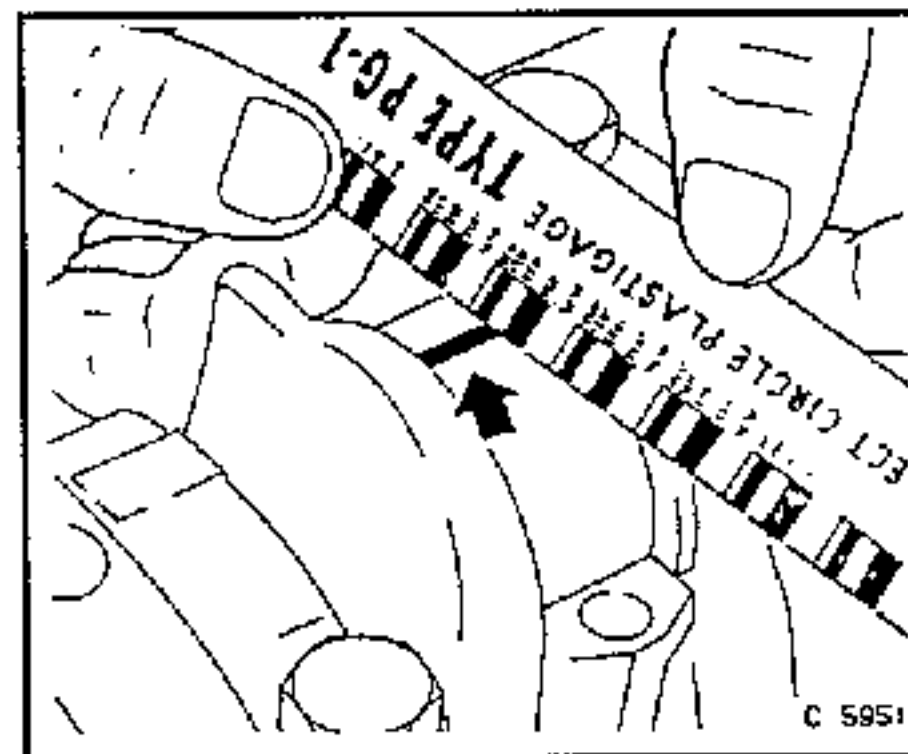
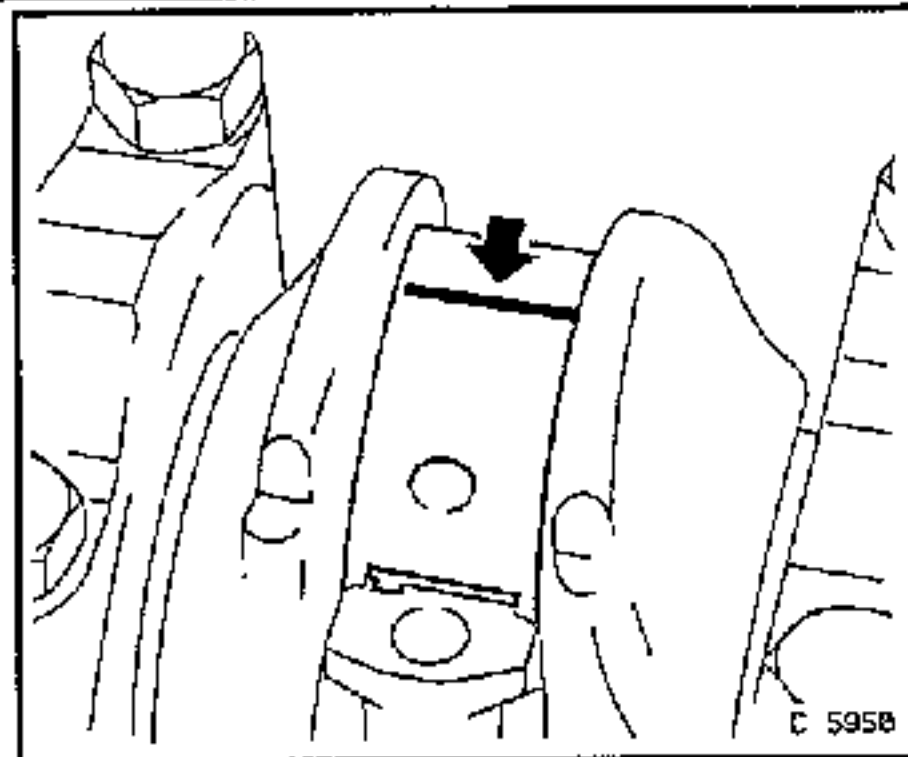
For bearing clearance tolerances, refer to; "Technical Data" at the end of this Volume.

Torque - Angle Method

All bearing covers to the cylinder block and con-rods.

Crankshaft bearing cover to cylinder block	50 Nm + 45° + 15°
Con-rod bearing cover to con-rod .	35 Nm + 45° + 15°

Use new bolts.



Con-rod Bearing, Replace

Remove, Disconnect

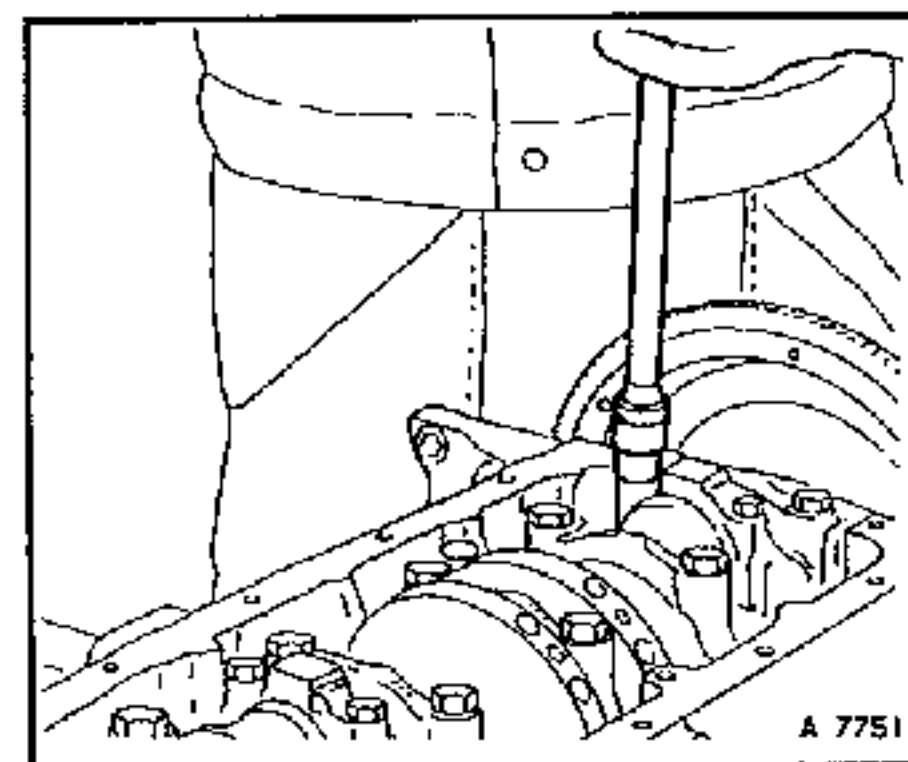
Oil pan. Refer 'Oil Pan Gasket, Replace', in the Section "Oil Circuit", in this Volume.

Mark con-rod cover to con-rod.

Con-rod bearing.

Clean

Con-rod bearing journal, con-rod bearing cover.



Install, Connect

New bearing shells, applying clean engine oil.

Con-rod bearing cover.

Torque - Angle Method

Con-rod bearing cover to con-rod . 35 Nm + 45° + 15°

Use new bolts.

Install, Connect

Oil pan. Refer 'Oil Pan Gasket, Replace', in the Section "Oil Circuit", in this Volume.

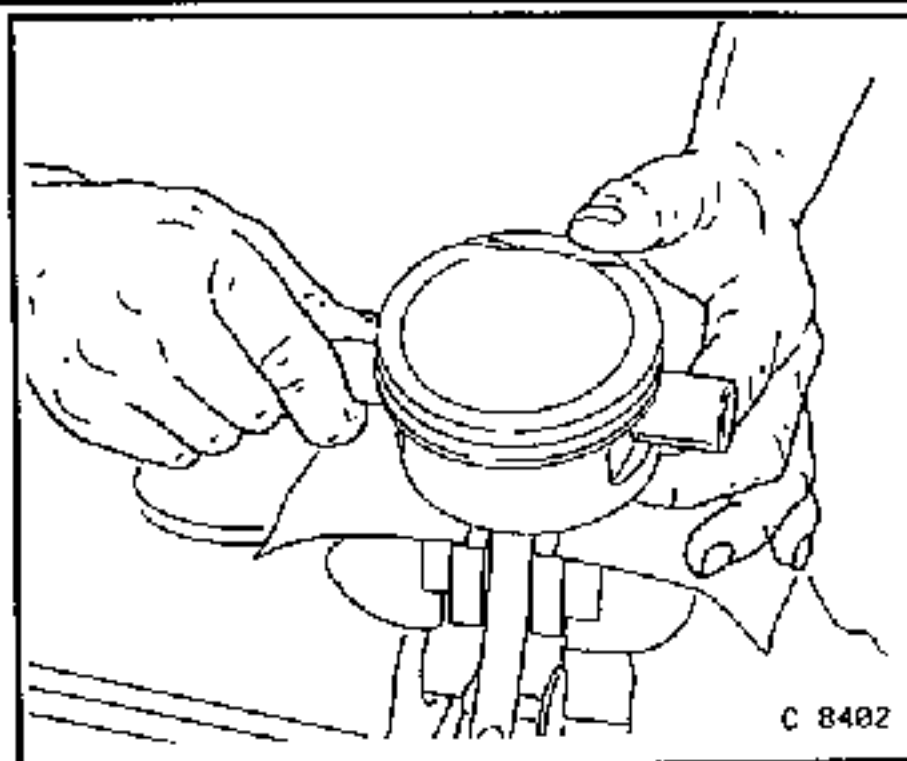
DOHC ENGINE - CRANK DRIVE

Con-rod, Replace

Remove, Disconnect

Piston. Refer 'Piston with Con-Rod, Remove and Install', in this Section.

Press out piston pin retainer from the piston pin.



Assemble

Con-rod, piston, piston pin. Coat all parts lightly with clean engine oil.

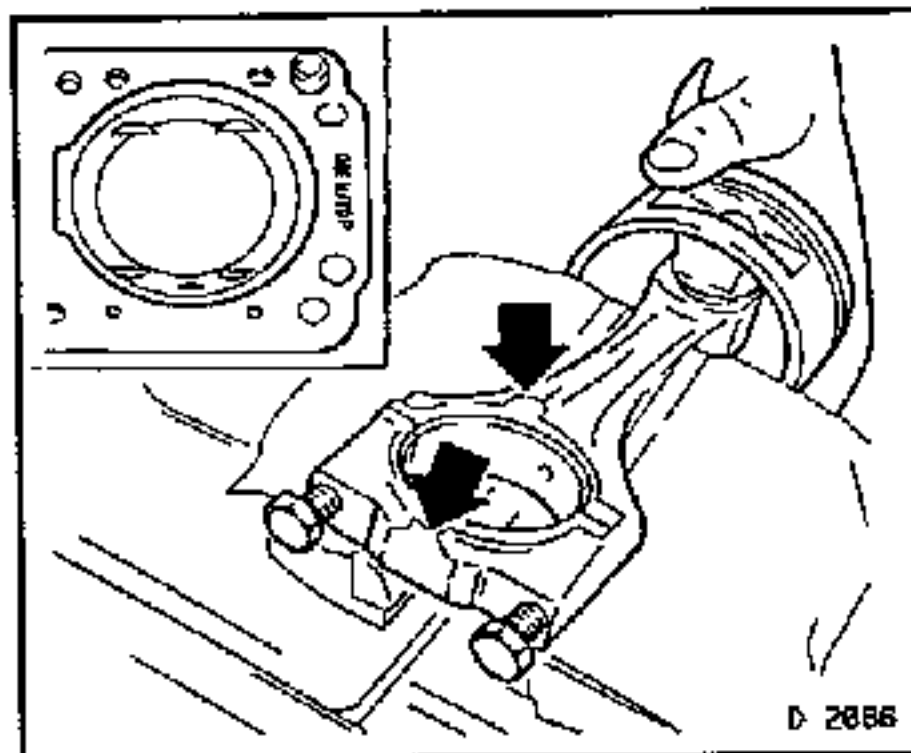
Use a new piston pin retainer.

Important!

Note the installation position. The arrow on the piston crown points to the engine timing side and the bead on the con-rod (arrows) to the clutch side.

Install, Connect

Piston. Refer 'Piston with Con-Rod, Remove and Install', in this Section.



Cylinder Block, Check for Plane Surface (Cylinder Head Removed)

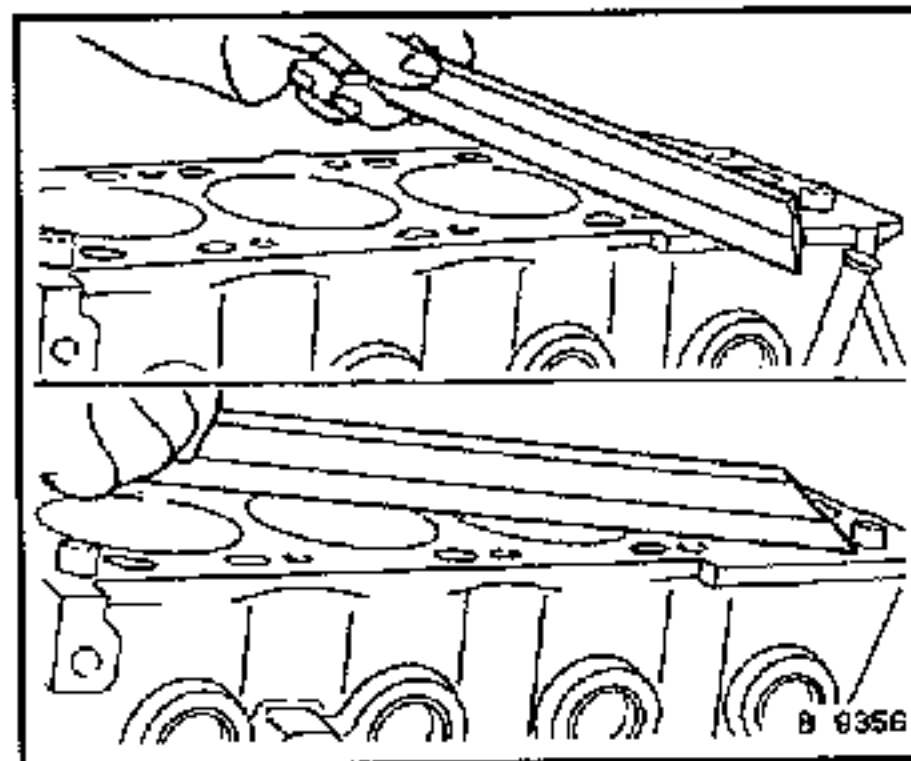
Clean

Cylinder block sealing surface.

Inspect

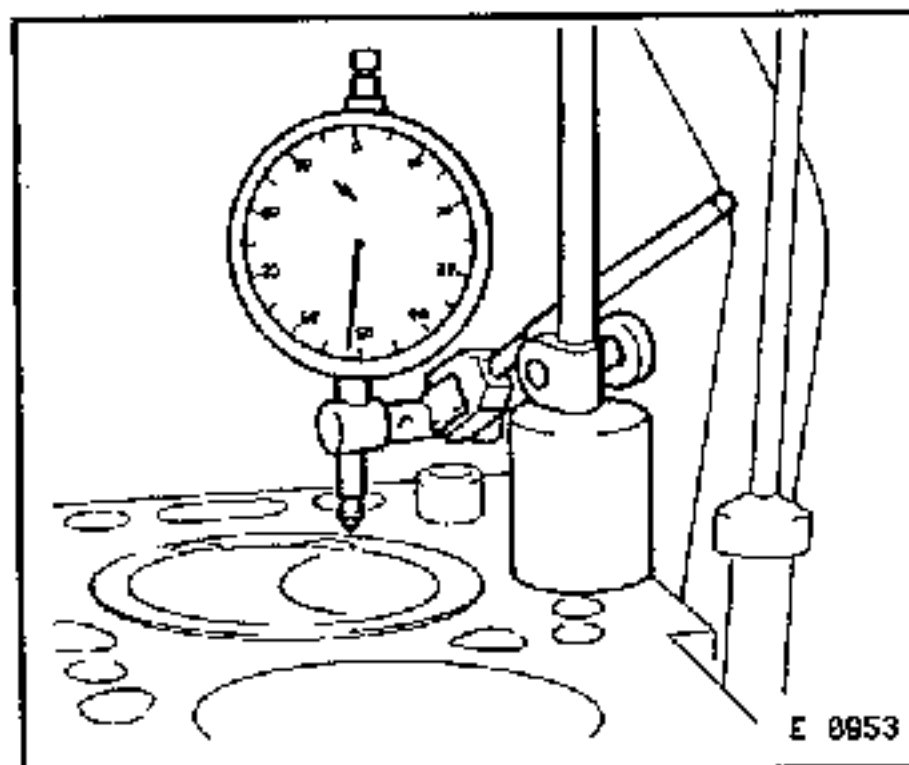
Cylinder block sealing surface, lengthwise, sideways and diagonally for warpage. Use a straight edge and feeler gauge.

Specification..... 0.025 mm max.



Important!

After surface grinding, check that piston projection does not exceed 0.4 mm



DOHC ENGINE - CRANK DRIVE

RECOMMENDED TORQUE VALUES

(Crank Drive)

	Nm
Con-rod bearing cover to con-rod	35 + 45° + 15° (3)
Cylinder head to cylinder block	25 + 90° + 90° + 90° (3)(5)
Flywheel to crankshaft.....	65 + 30° + 15° (3)
Front toothed belt cover to cylinder head, intermediate piece and oil pump....	8
Oil pan to cylinder block	15 (1)(2)
Pot flywheel to crankshaft.....	65 + 30° + 15° (3)
Rear toothed belt cover to cylinder block	6
Toothed belt drive gear to crankshaft.....	250 + 40° - 50° (3)(4)
Wheel bolts to front wheel hub.....	110

- (1) Apply Locking Compound to bolt threads, such as Loctite 242 or equivalent to GMH Spec. HN1256.
- (2) Maximum assembly time 10 minutes.
- (3) Use new bolt/s.
- (4) Insert bolt with greased thread.
- (5) No re-tightening required.

DOHC ENGINE - CYLINDER HEAD

Front Seal Ring - Camshaft Housing, Replace

Remove, Disconnect

Engines up to MY'93:

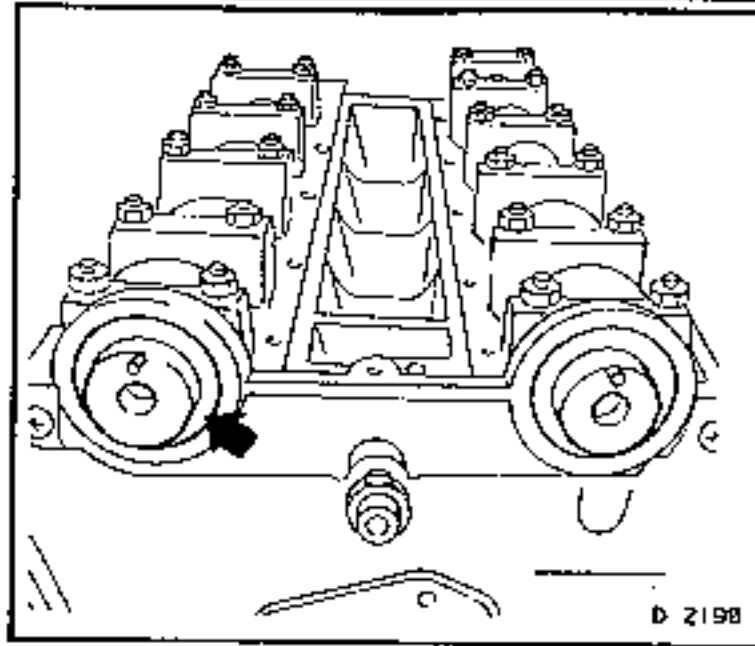
Mark the direction of rotation of the toothed belt.

All Engines:

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

Camshaft gear/s. Refer "Camshaft Gears, Remove and Install", in this Section.

Drill a small hole in the centre of the seal (arrow). Insert self tapping screw and remove seal by carefully levering against the screw.



Clean

All sealing surfaces.

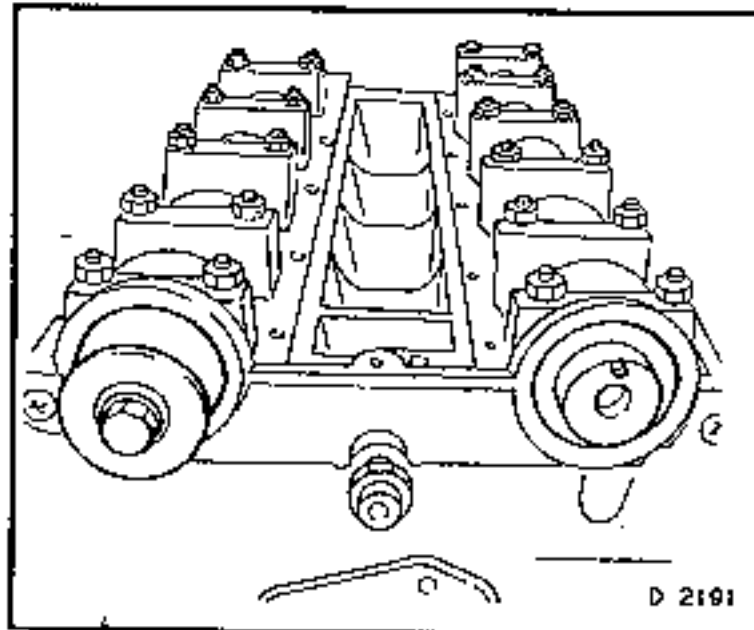
Install, Connect

New seal ring, using KM-422 and the camshaft gear retaining bolt.

Coat the seal lip with grease, before installation.

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

Camshaft gear/s. Refer "Camshaft Gears, Remove and Install", in this Section.



Gasket - Performance Header to Cylinder Head, Replace (C 20 XE)

Remove, Disconnect

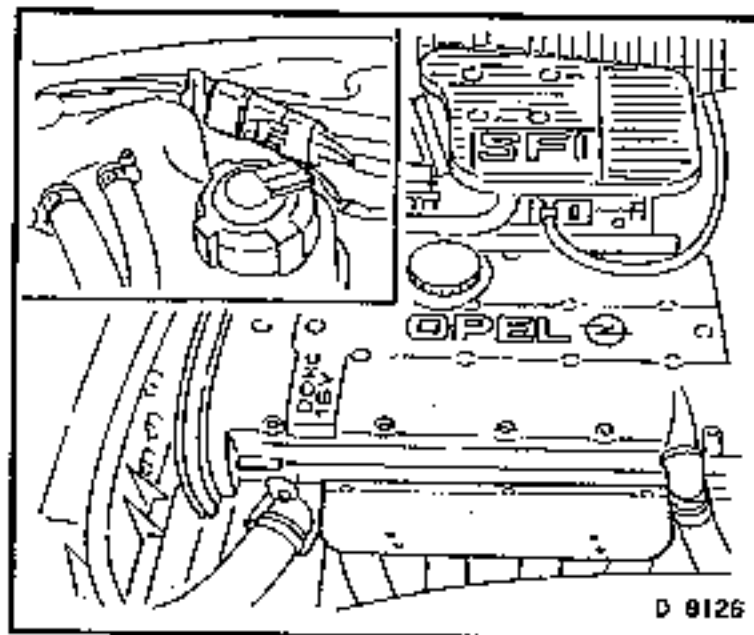
Ground cable from battery.

Cover plate from performance header.

Bolts from performance header.

For C 20 XE:

Disconnect wiring harness plug from oxygen sensor.



Remove, Disconnect

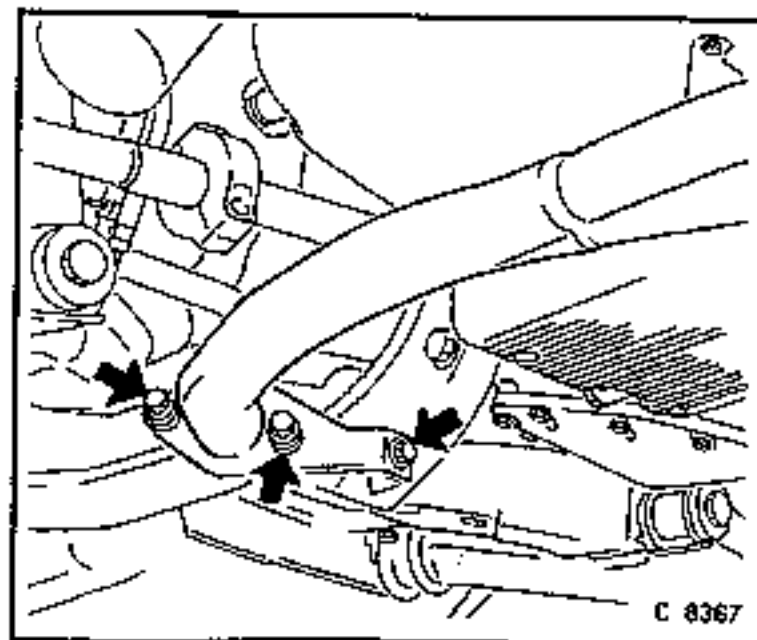
Engine compartment cover.

Fastening bolts from exhaust joint and bracket.

Engines as of MY'93 (with A/C):

Flange, oil dipstick tube/engine vent from cylinder block.

Remove performance header, downwards.



DOHC ENGINE - CYLINDER HEAD

Clean

All sealing surfaces.

Install, Connect

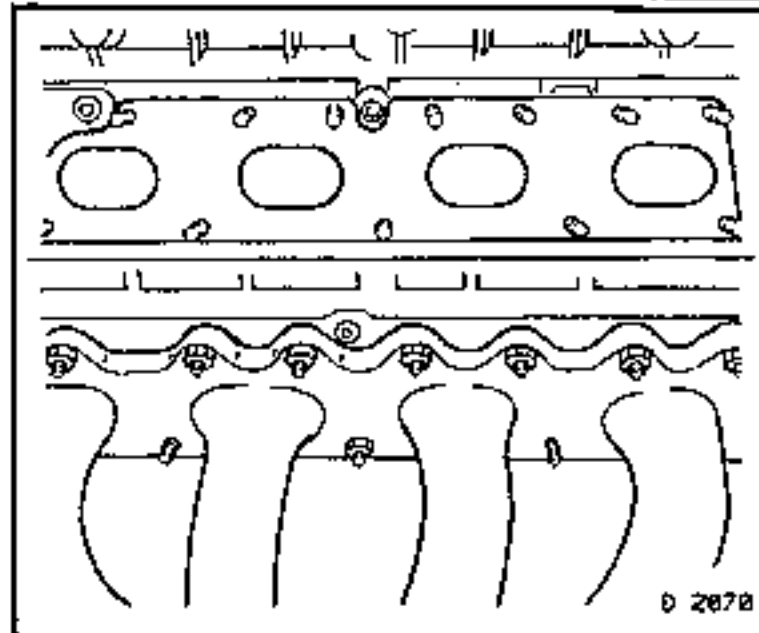
Performance header, using new gasket.

Exhaust joint and bracket.

Tighten (Torque)

Performance header to cylinder head.....	22 Nm *
Cover plate to cylinder head bolts (M 6) .	9 Nm
Fastening bolts to exhaust joint.....	12 Nm
Fastening bolts to bracket	20 Nm

* Use new gasket.



Install, Connect

For C 20 XE:

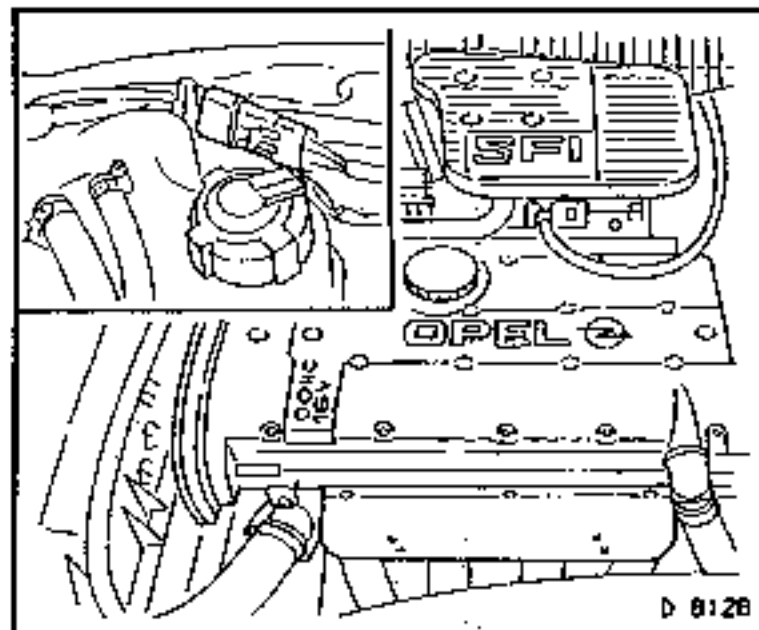
Connect oxygen sensor wiring harness plug.

If removed:

Flange, oil dipstick guide tube/engine vent to cylinder block.

Engine compartment cover.

Ground cable to battery.



Gasket - Intake Manifold to Cylinder Head, Replace (C 20 XE)

Remove, Disconnect

Ground cable from battery.

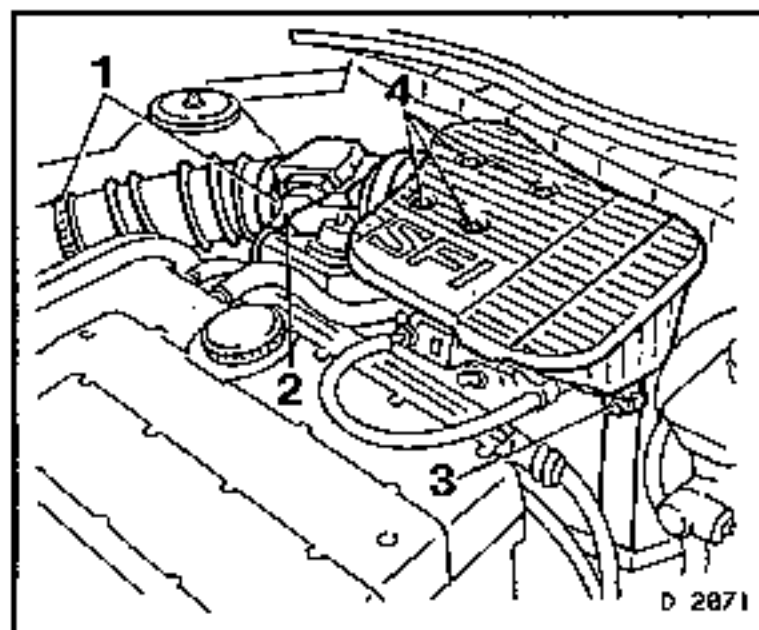
Engine compartment cover.

Lower coolant hose from radiator. Collect coolant in a suitable, clean container.

C 20 XE Engine as of MY'93:

Wiring harness plug from intake air temperature sensor.

Air intake hose (1), wiring harness plug (2) from mass air flow meter, hose connection (3) from pre-volume chamber, pre-volume chamber (4), with mass air flow meter.



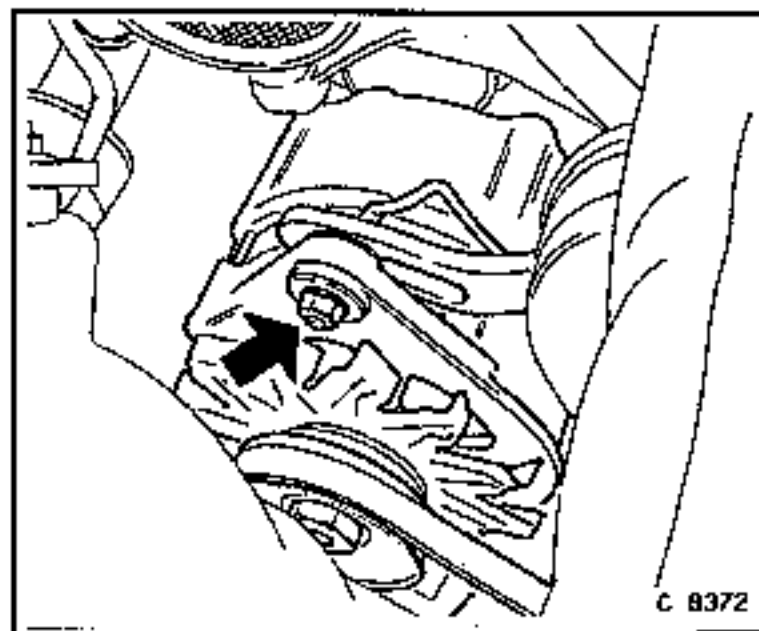
Remove, Disconnect

Engines up to MY'93:

V-belt from alternator.

Alternator clamping bracket from intake manifold.

Loosen lower alternator bracket, then swing the alternator outwards.



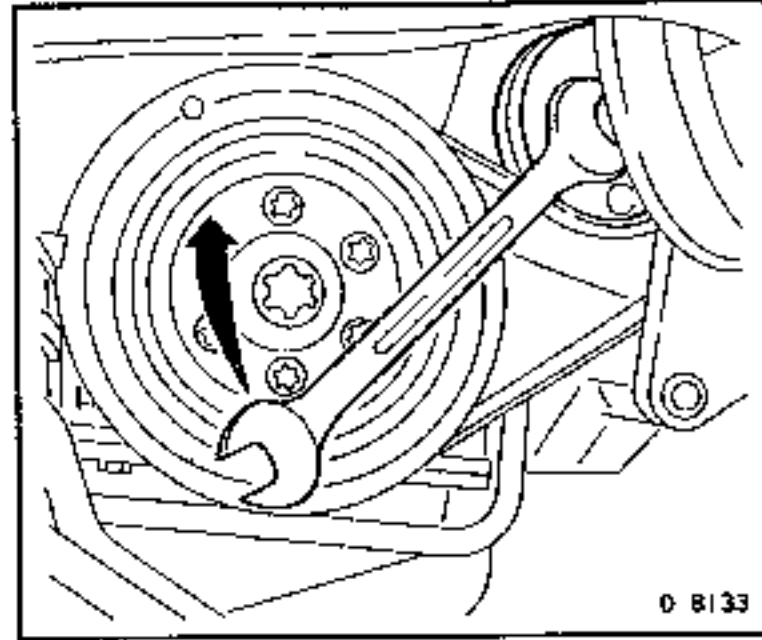
DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

Engines as of MY'93:

Mark the direction of rotation of ribbed V-belt.

Release ribbed V-belt, using the ribbed V-belt tension roller, by rotating the tension roller (arrow), then remove the ribbed V-belt.

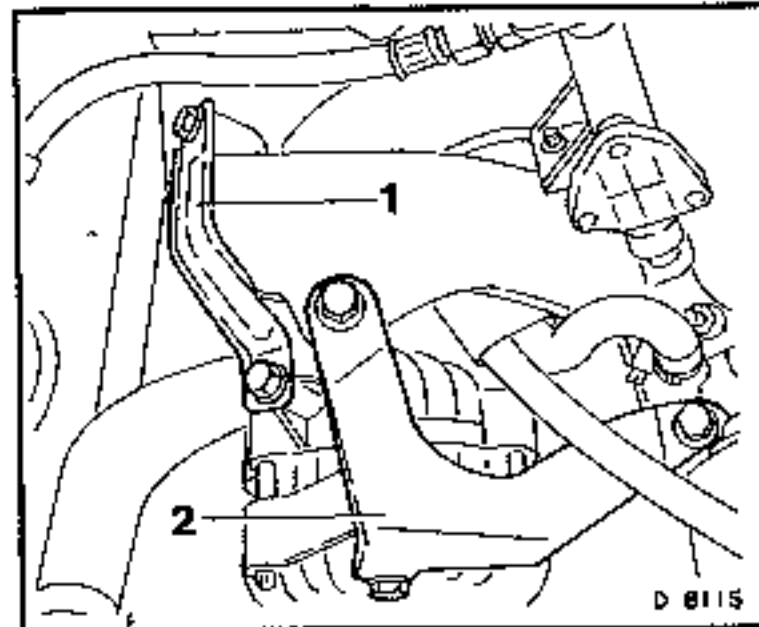


Remove, Disconnect

Engines as of MY'93:

Support (1) and brace (2) from the alternator or from intake manifold.

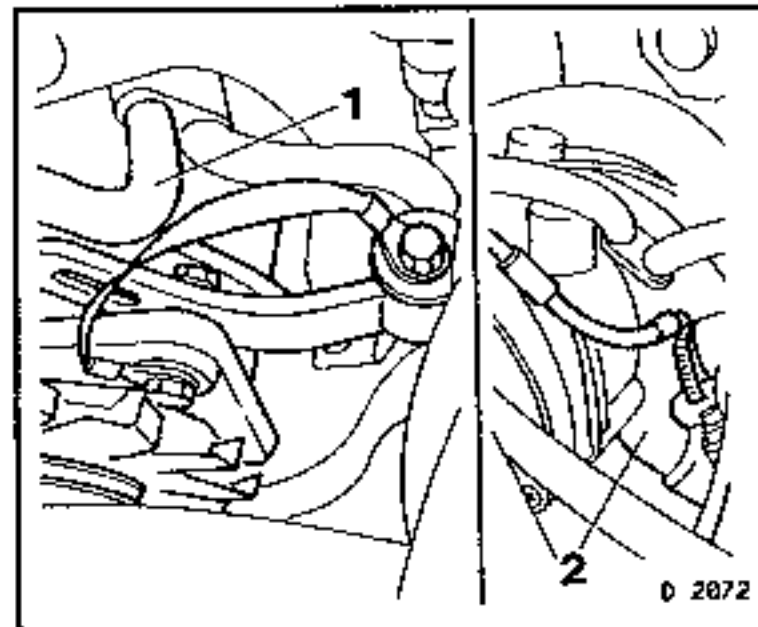
Loosen the lower alternator fastening bolt then swing alternator outwards.



Remove, Disconnect

Coolant hose (1) from the coolant reservoir.

Coolant hose (2) from the intake manifold.



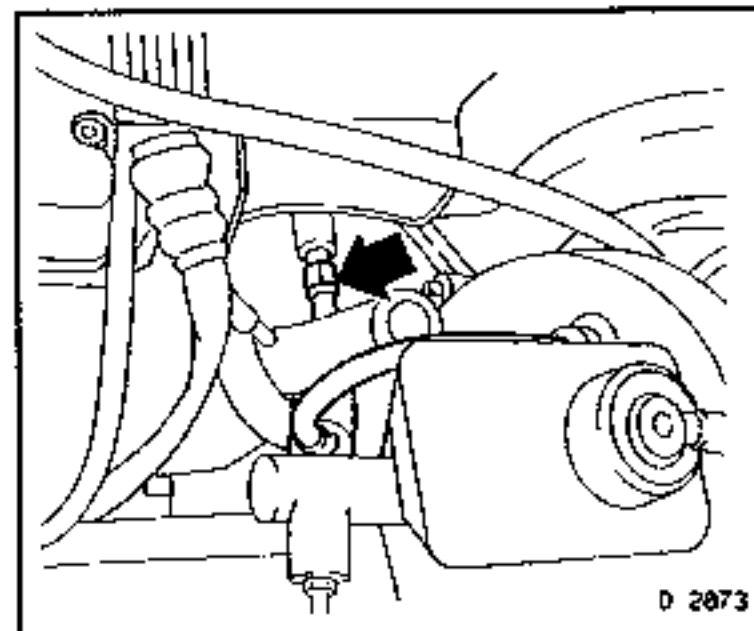
Remove, Disconnect

Brake servo vacuum line (arrow) from intake manifold.

If fitted;

Vacuum line from the intermediate piece from the brake servo connection.

Intake manifold to cylinder head support. Loosen the lower fastening bolt, then swing the support to one side.

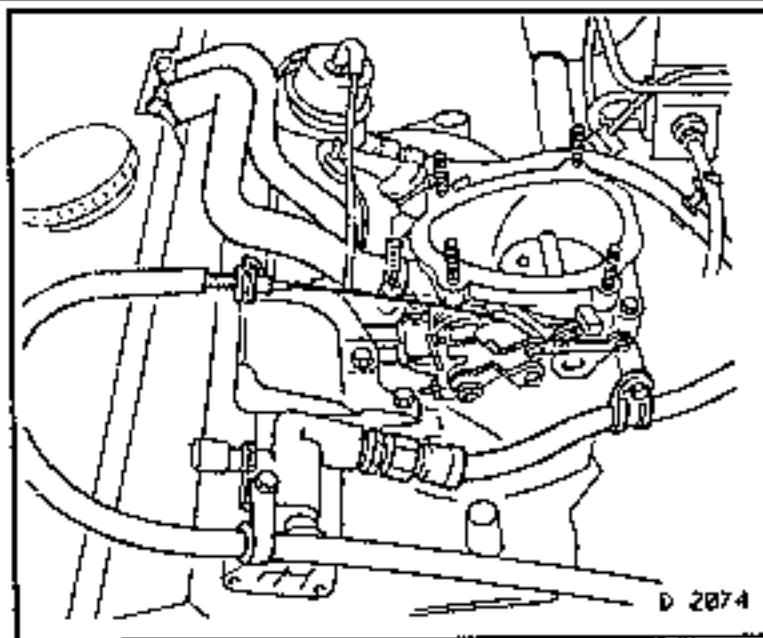


DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

Bowden cable, fuel lines, sealing first with suitable clamps to prevent fuel spillage.

Engine vent hose connections from cylinder head cover.



Remove, Disconnect

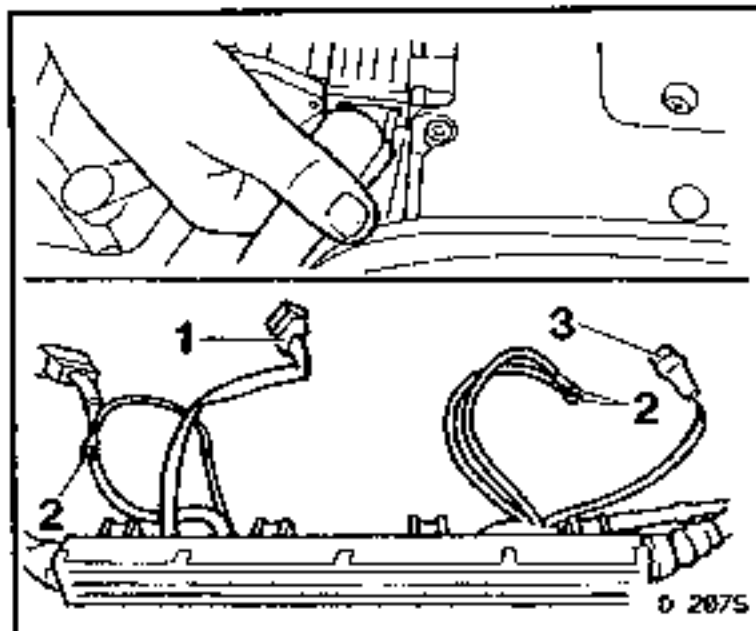
Injector plug strip as follows;

Fuel injector wiring harness plug (1) from throttle valve switch or potentiometer.

Ground connections (2) from fuel distributor pipe.

Wiring harness plug (3) from controlled canister purge valve.

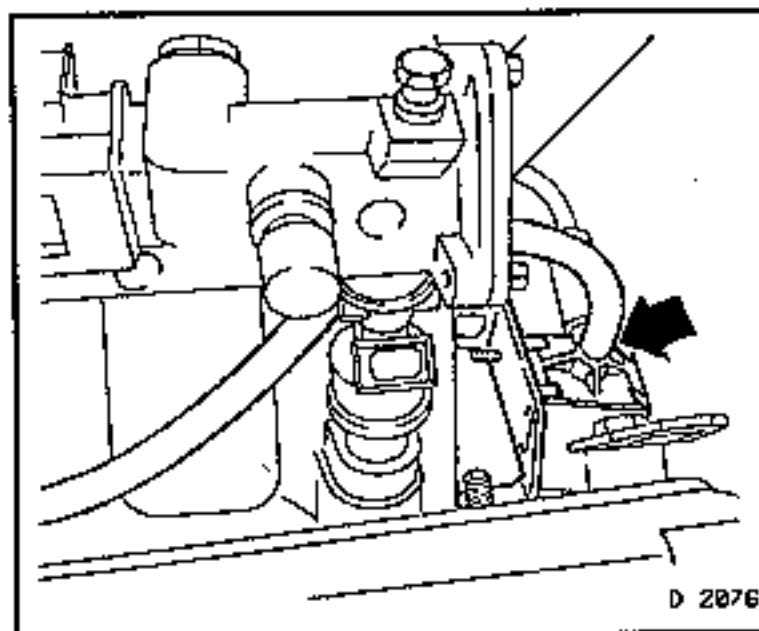
Lay the fuel injector plug strip over to the rear.



Remove, Disconnect

Fastening nuts from intake manifold.

Vacuum line (arrow) from controlled canister purge valve, then remove the controlled canister purge valve.



Support the intake manifold, then;

Remove, Disconnect

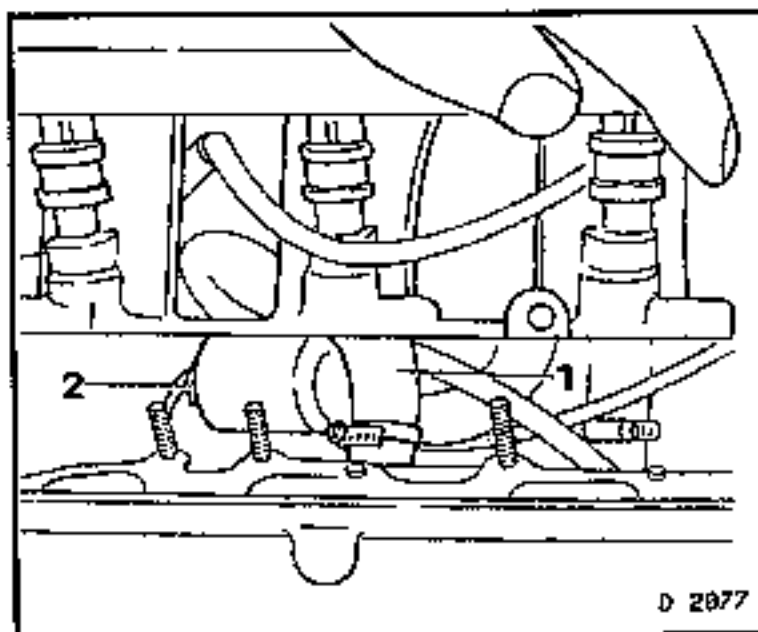
Coolant hose (1) from coolant pipe.

Wiring harness plug (2) from idle speed adjuster.

Intake manifold from the engine.

Clean

All sealing surfaces, taking care not to damage machined alloy surfaces.



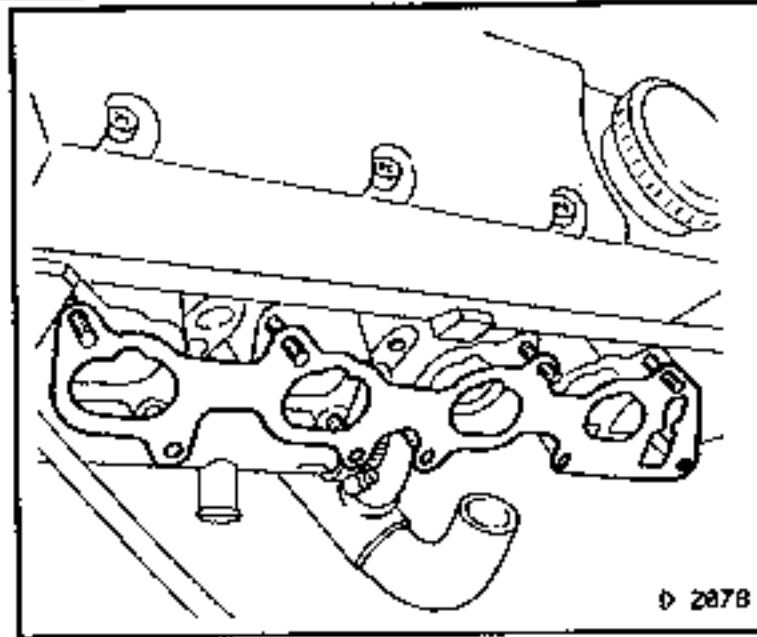
DOHC ENGINE - CYLINDER HEAD

Install, Connect

- Intake manifold, using new gasket.
- Wiring harness plug to idle speed adjuster.
- Coolant hose to coolant pipe.
- Controlled canister purge valve and vacuum line.

Tighten (Torque)

Intake manifold to cylinder head 22 Nm

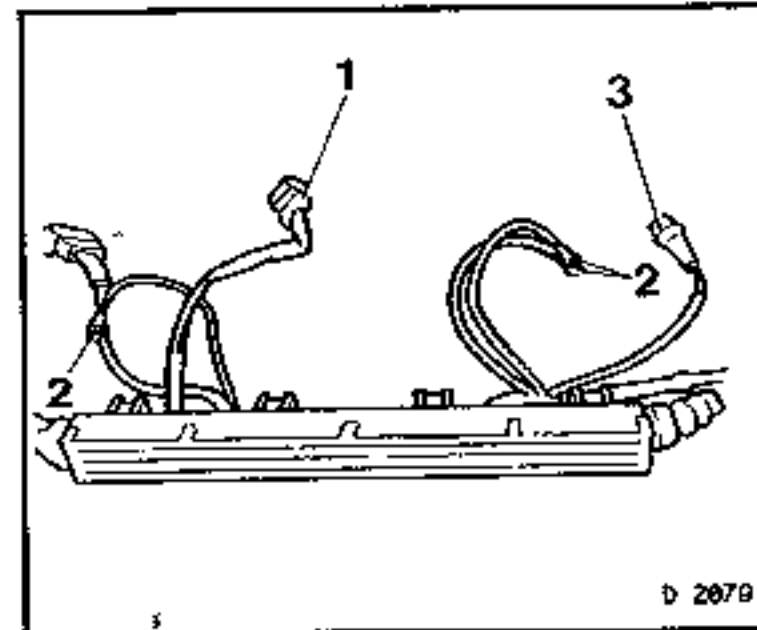


Install, Connect

- Wiring harness plug (3) to controlled canister purge valve.
- Ground connections (2) to fuel distributor pipe.
- Wiring harness plug (1) to throttle valve switch or potentiometer.
- Injector plug strip.

Important!

Check that all ground connections are in good condition and secure.

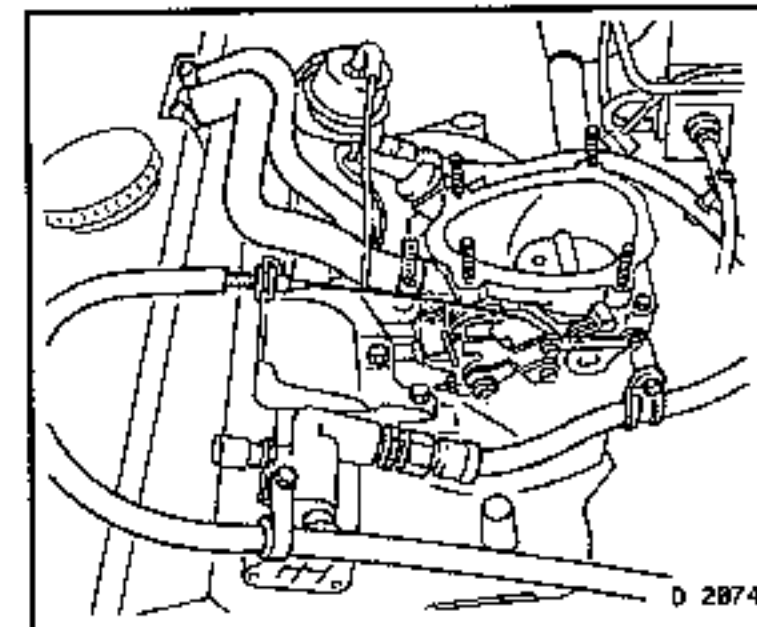


Install, Connect

- Hose connections to cylinder head cover.
- Fuel lines, then remove clamps.
- Bowden cable.
- Brake servo vacuum line to intake manifold.
- If removed;
Vacuum line to intermediate piece for brake servo connection.

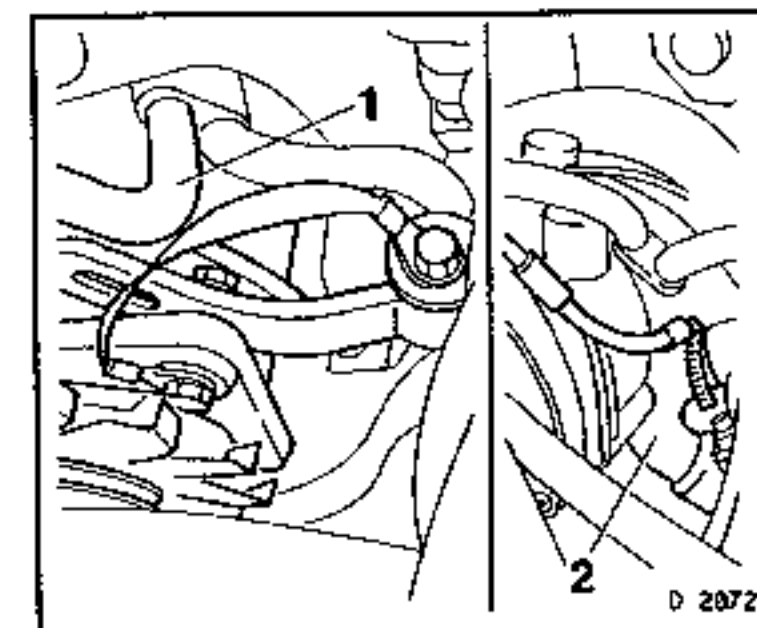
Tighten (Torque)

Intake manifold to cylinder block support 25 Nm
Brake servo vacuum line to intake manifold . 20 Nm



Install, Connect

- Coolant hoses (1 and 2) to coolant reservoir tank or to intake manifold.



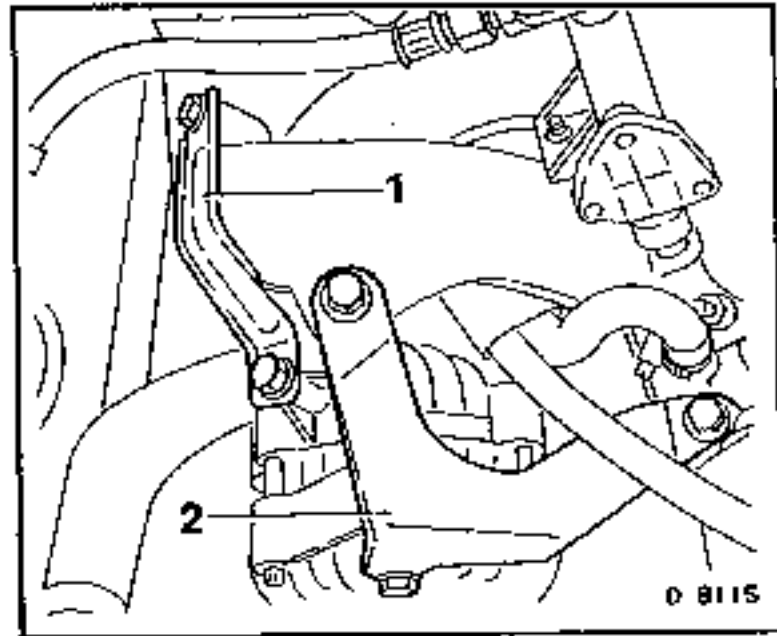
DOHC ENGINE - CYLINDER HEAD

Install, Connect

Engines up to MY'93:

Alternator clamping bracket to intake manifold.

Install V-belt to alternator and tension. Refer 'V-belt, Tension, Check and Adjust', in the Section, 'Checking and Adjusting Procedures', in this Volume.



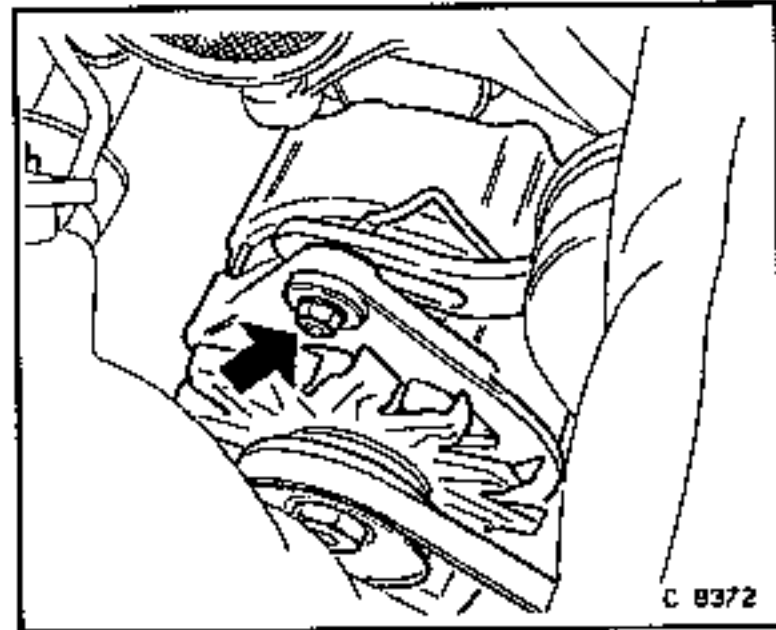
Install, Connect

Engines as of MY'93:

Support (1) and brace (2) to alternator or to intake manifold.

Tighten (Torque)

Alternator support and brace	18 Nm
Lower alternator fastening bolt	35 Nm

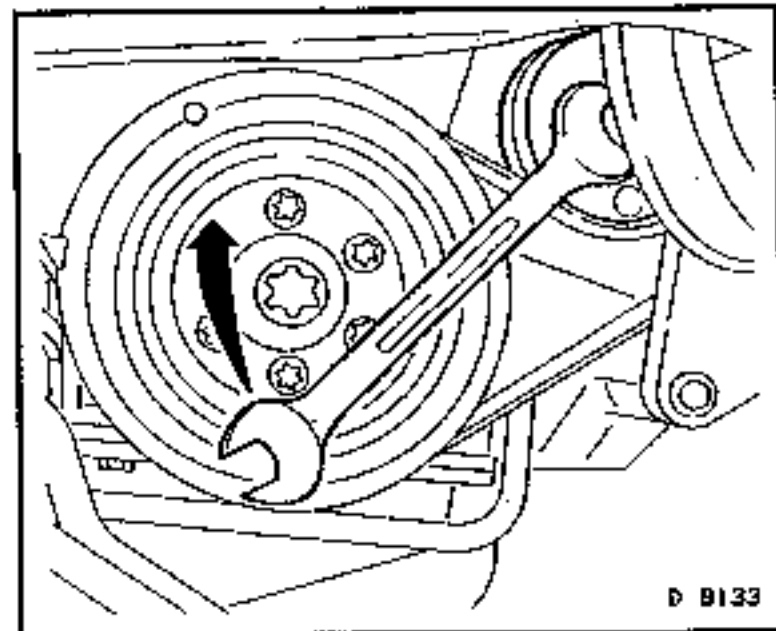


Install, Connect

Engines as of MY'93:

Ribbed V-belt, after releasing the ribbed V-belt tension roller (arrow).

Note the direction of rotation of the ribbed V-belt, when installing.



Install, Connect

Pre-volume chamber (4) with mass air flow meter, hose connection (3), to pre-volume chamber, wiring harness plug (2) to mass air flow meter, air intake hose (1).

C 20 XE Engine as of MY'93:

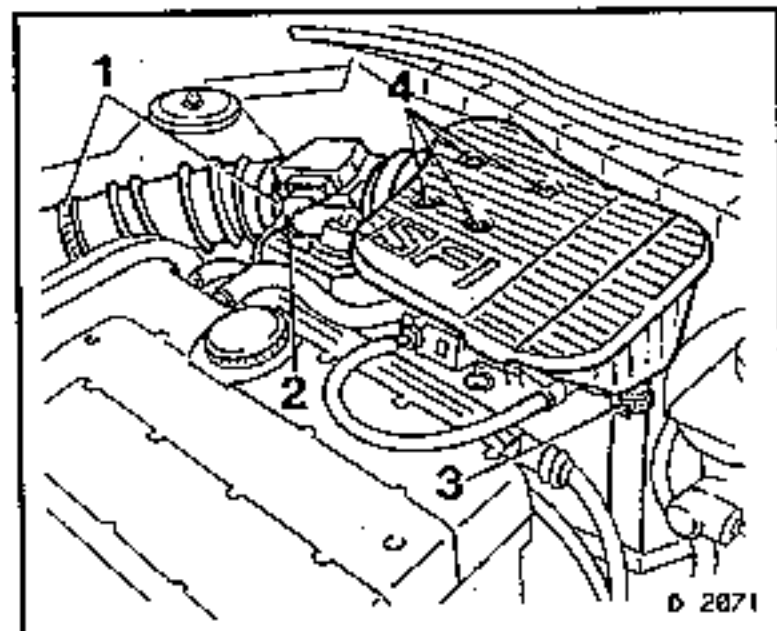
Wiring harness plug to intake air temperature sensor.

The lower coolant hose to the radiator.

Engine compartment cover.

Ground cable to battery.

Top up and bleed cooling system. Refer to the Section, 'Cooling System', in this Volume for details.



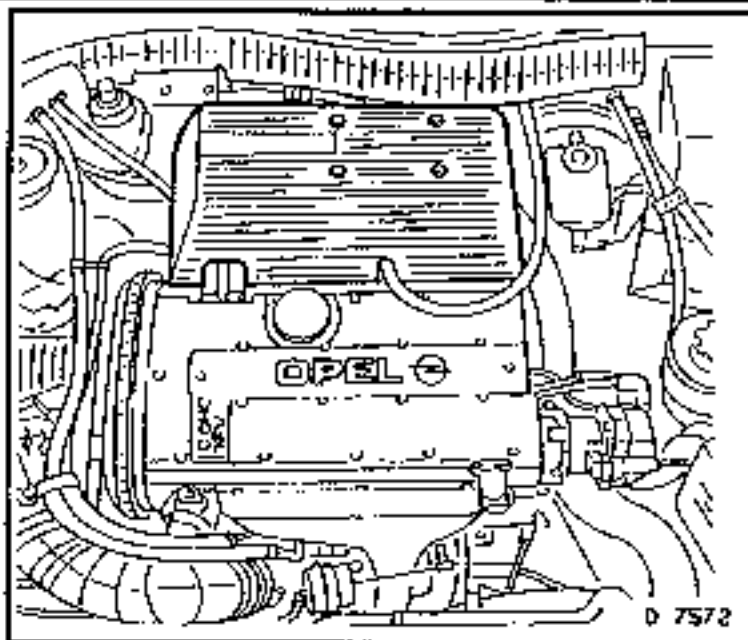
DOHC ENGINE - CYLINDER HEAD

Gasket - Intake Manifold to Cylinder Head, Replace (C 20 LET)

Remove, Disconnect

Ground cable from battery.

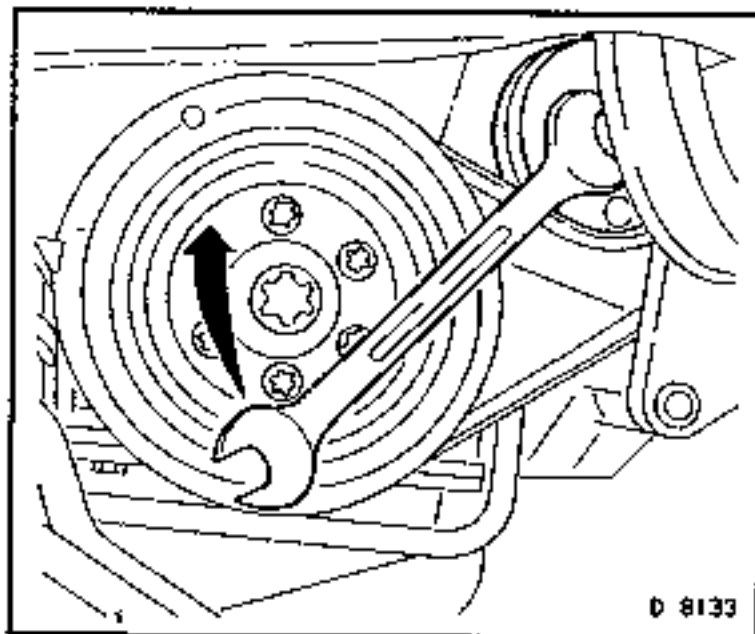
Cover from throttle valve manifold.



Remove, Disconnect

Mark the direction of rotation of the ribbed V-belt.

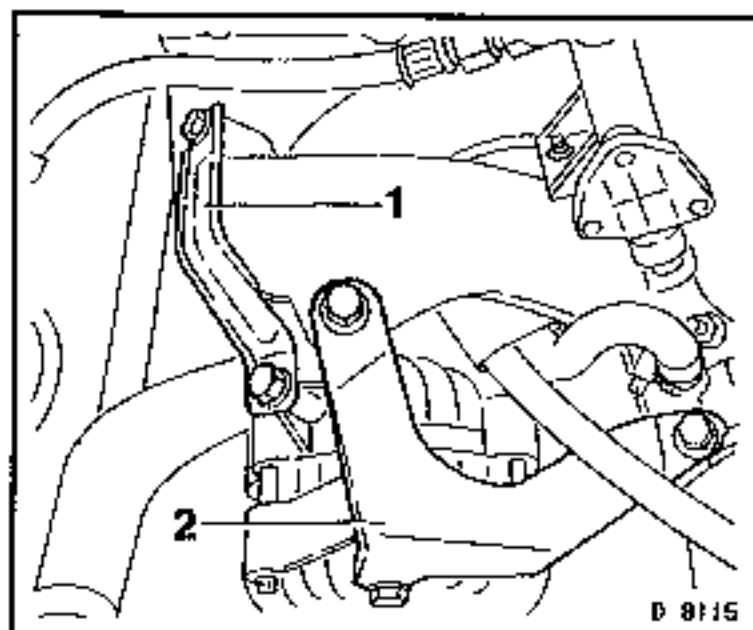
Release ribbed V-belt, using the ribbed V-belt tension roller, by rotating the tension roller (arrow), then remove the ribbed V-belt.



Remove, Disconnect

Support (1) and brace (2) from alternator or from intake manifold.

Loosen the lower alternator fastening bolt, then swing the alternator to the rear.

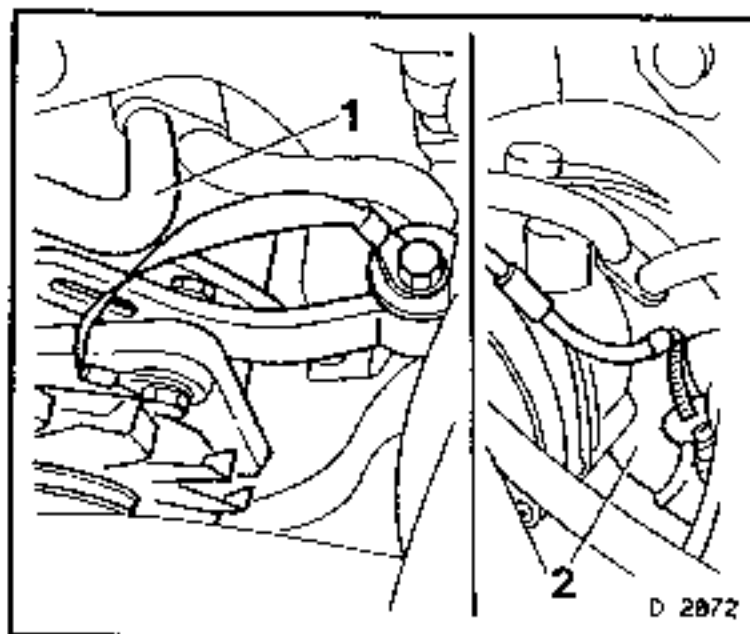


Remove, Disconnect

Coolant hose (1) from the coolant reservoir tank.

Coolant hose (2) from intake manifold.

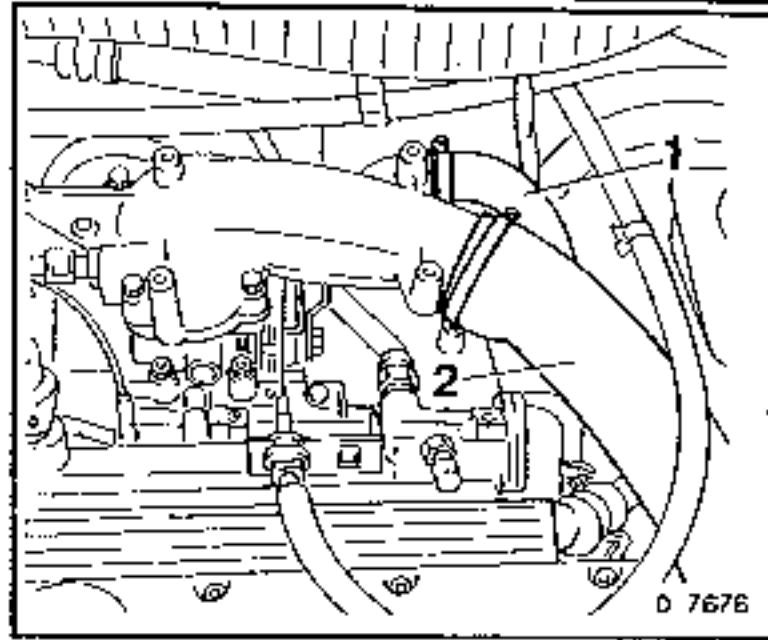
Collect coolant in a suitable, clean container.



DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

Air hoses (1 and 2) from throttle valve manifold.

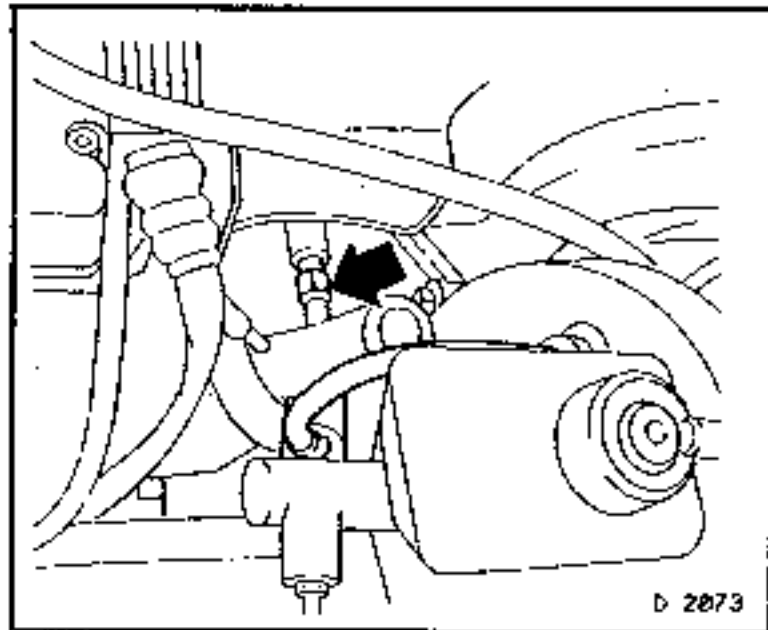


Remove, Disconnect

Brake servo vacuum line (arrow) from intake manifold.

If fitted;
Vacuum line from Intermediate piece for brake servo connection.

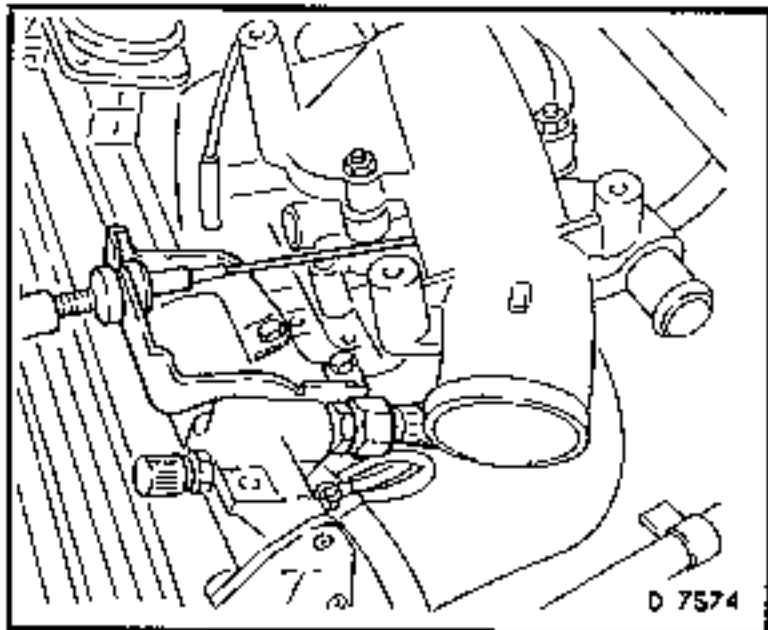
Intake manifold to cylinder block support. Loosen the lower fastening bolt, then swing support to one side.



Remove, Disconnect

Bowden cable, fuel lines, sealing first with suitable clamps to prevent fuel spillage.

Engine vent hose connections from cylinder head cover.



Remove, Disconnect

Injector plug strip as follows;

Pull back the retaining clip from No. 1 cylinder injector.

Wiring harness plug (1) from hot start valve.

Wiring harness plug (2) from intake air temperature sensor.

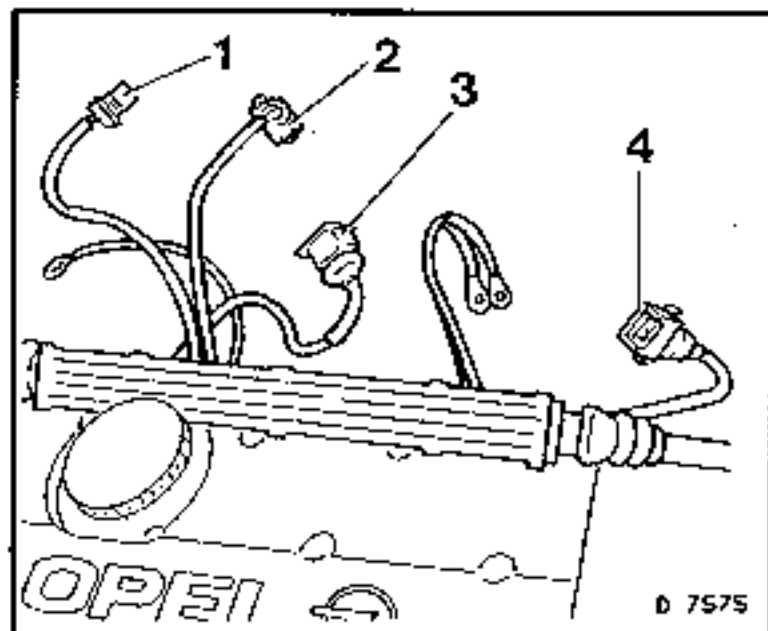
Wiring harness plug (3) from throttle valve potentiometer.

Wiring harness plug (4) from controlled canister purge valve.

Ground connections from fuel distributor pipe.

Note:

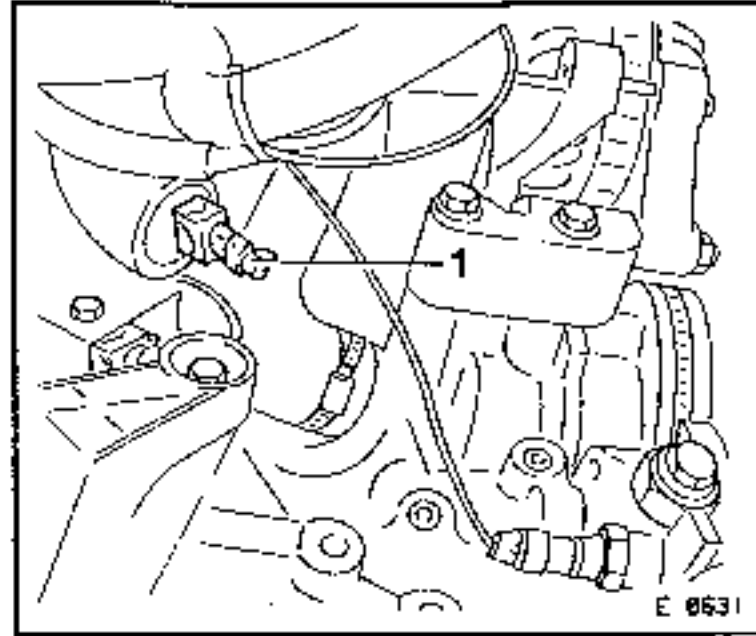
Routing of all wiring and connections.



DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

Wiring harness plug (1) from idle speed adjuster.
Lay the fuel injector plug strip over to the front.

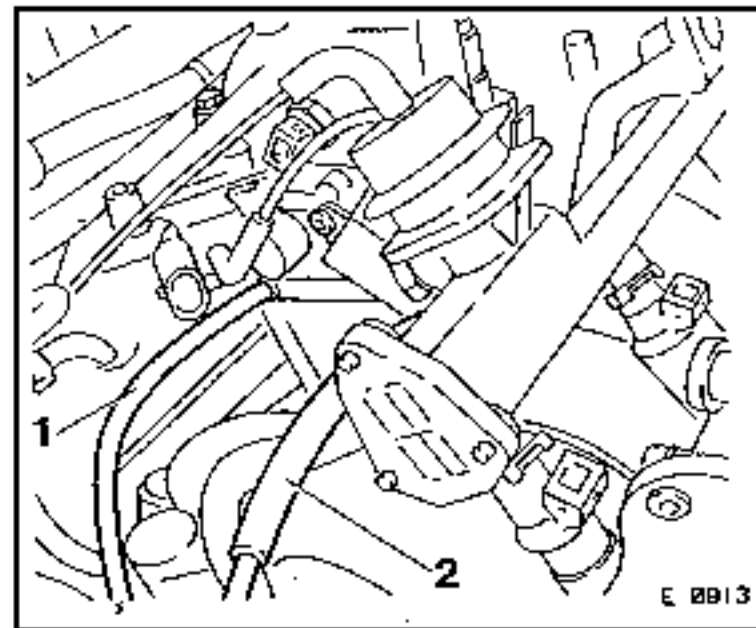


Remove, Disconnect

Vacuum hose (1) from the throttle body.
Vacuum hose (2) from the 'T' piece.
Intake manifold from the engine.

Clean

All sealing surfaces, taking care not to damage machined alloy surfaces.

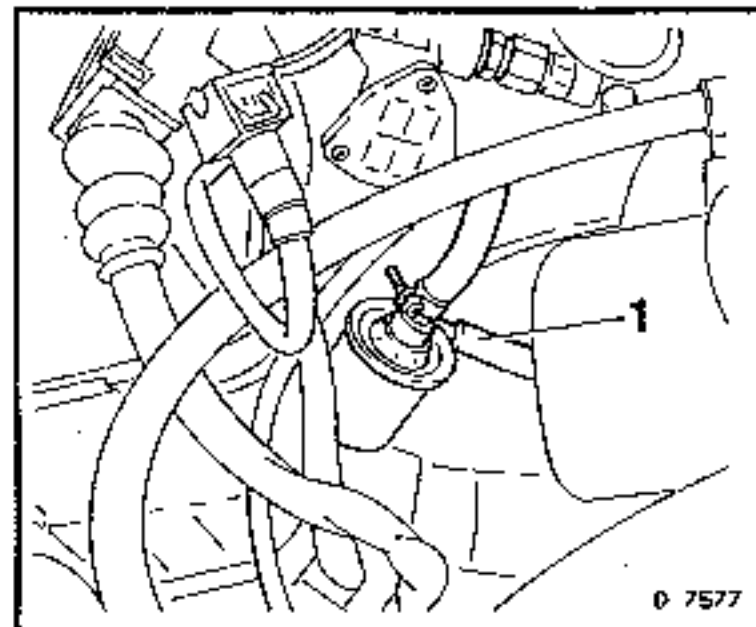


Remove, Disconnect

Fastening nuts from the intake manifold.
Vacuum line (1) from the controlled canister purge valve, then the controlled canister purge valve.
Intake manifold from the cylinder head.

Clean

All sealing surfaces, taking care not to damage machined alloy surfaces in the process.

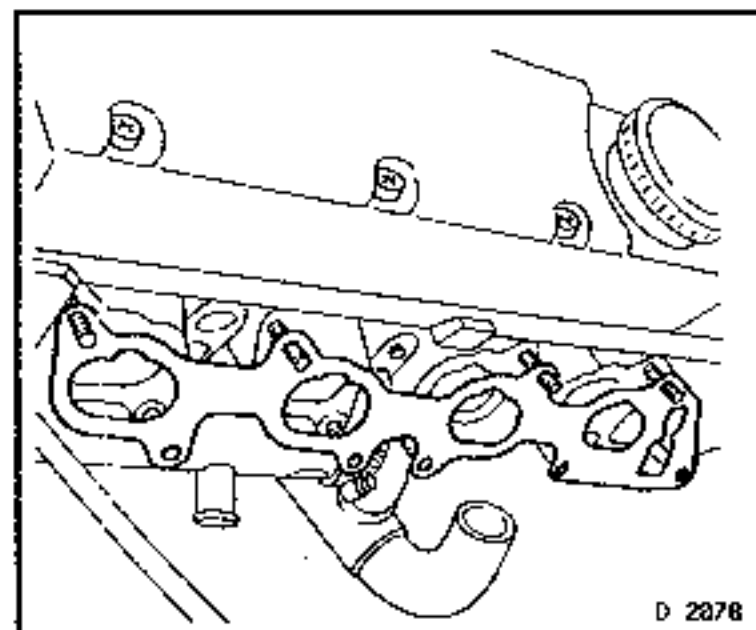


Install, Connect

Intake manifold, using new gasket.
Controlled canister purge valve and vacuum line.

Tighten (Torque)

Intake manifold to cylinder head 22 Nm



DOHC ENGINE - CYLINDER HEAD

Install, Connect

Injector plug strip to injectors.

All vacuum hoses.

Wiring harness plug (1) to hot start valve.

Wiring harness plug (2) to intake air temperature sensor.

Wiring harness plug (3) to throttle valve potentiometer.

Wiring harness plug (4) to controlled canister purge valve.

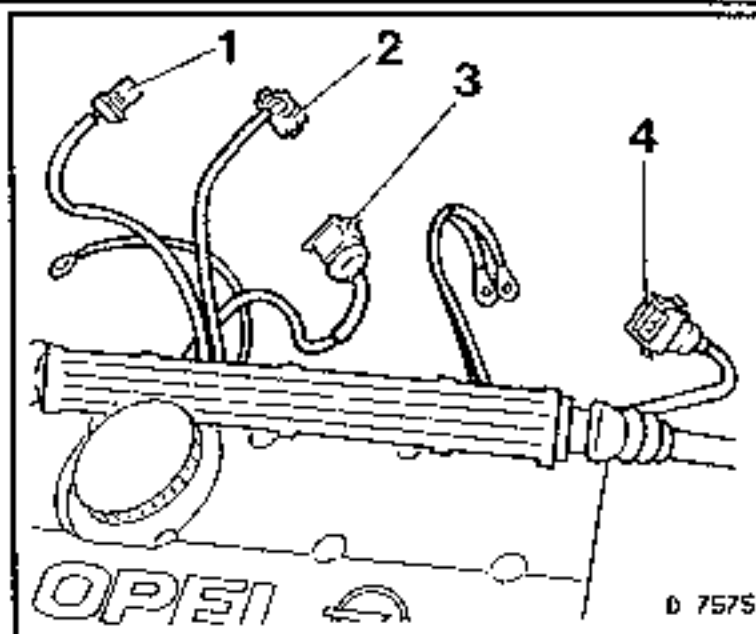
Wiring harness plug to idle speed adjuster.

Ground connections (2) to fuel distributor pipe.

Note:

Wiring harness routing.

Check that all ground connections are in good condition and secure.

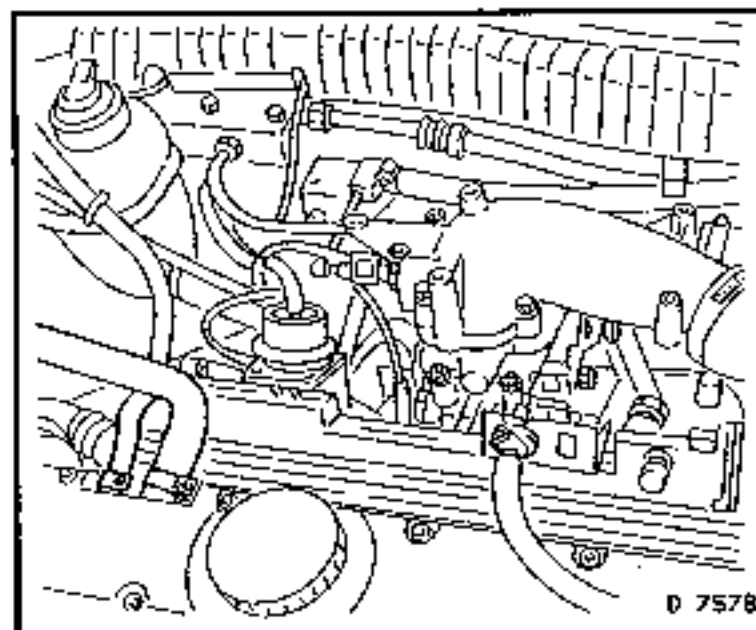


Install, Connect

Engine vent hoses to cylinder head cover.

Fuel lines. Disconnect clamps.

Bowden cable. Install with no tension on the cable.



Install, Connect

Air hose to throttle valve manifold.

Coolant hoses to coolant reservoir tank or intake manifold.

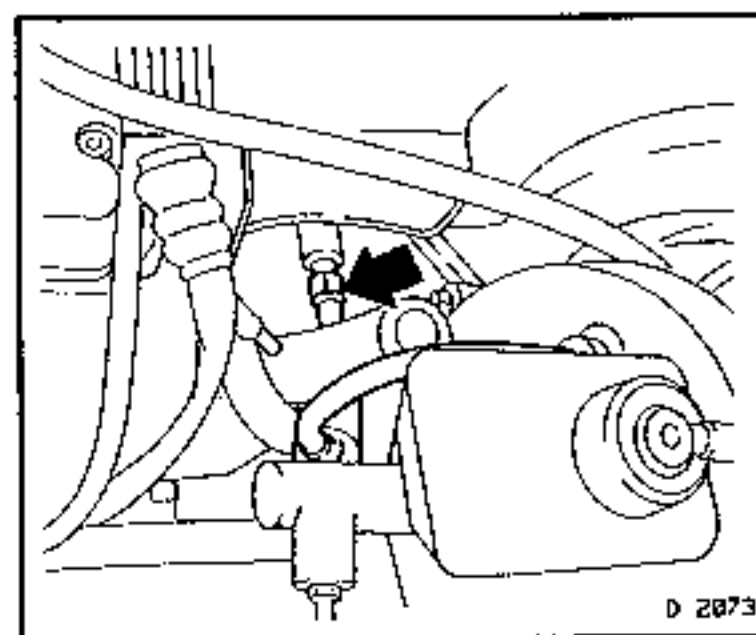
Brake servo line to intake manifold (arrow).

Tighten (Torque)

Intake manifold to cylinder block support	25 Nm
Brake servo line to intake manifold	20 Nm

If removed;

Vacuum line to intermediate piece from brake servo connection.



Install, Connect

Alternator support (1) and brace (2) to alternator or intake manifold.

Tighten (Torque)

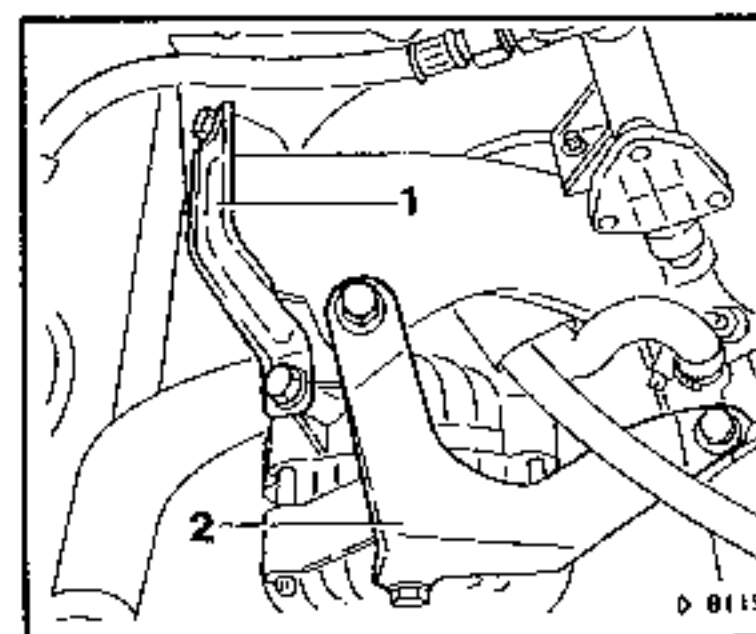
Alternator support and brace	18 Nm
Lower alternator fastening bolt	35 Nm

Install, Connect

Install ribbed V-belt, using the ribbed V-belt tension roller.

Note:

The direction of rotation of the ribbed V-belt.



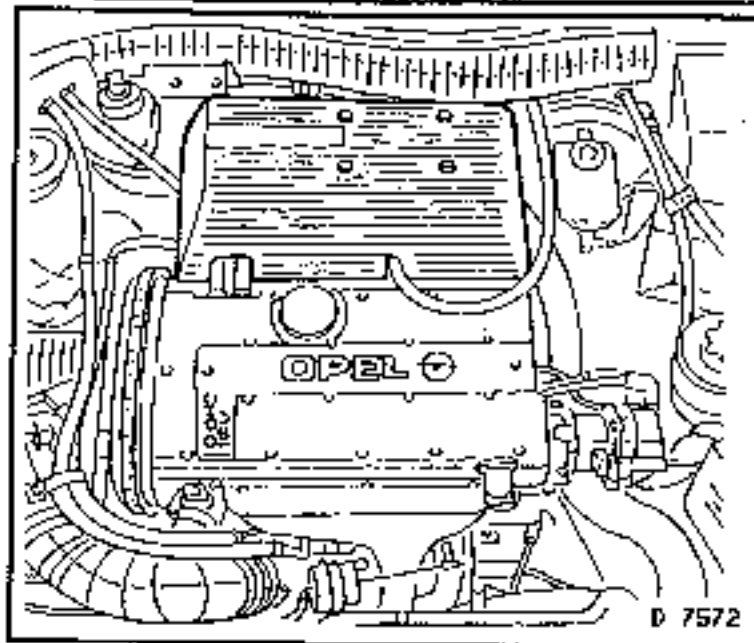
DOHC ENGINE - CYLINDER HEAD

Install, Connect and Tighten (Torque)

Cover to throttle valve manifold, 5 Nm

Ground cable to battery.

Top up and bleed cooling system. Refer to the Section, "Cooling System", in this Volume for details.



Camshaft (Intake and/or Exhaust), Replace

Remove, Disconnect

Note:

Before removing the toothed belt, rotate the crankshaft in the direction of engine rotation until the TDC mark is 60° BTDC (dimension I).

Engines as of MY'93:

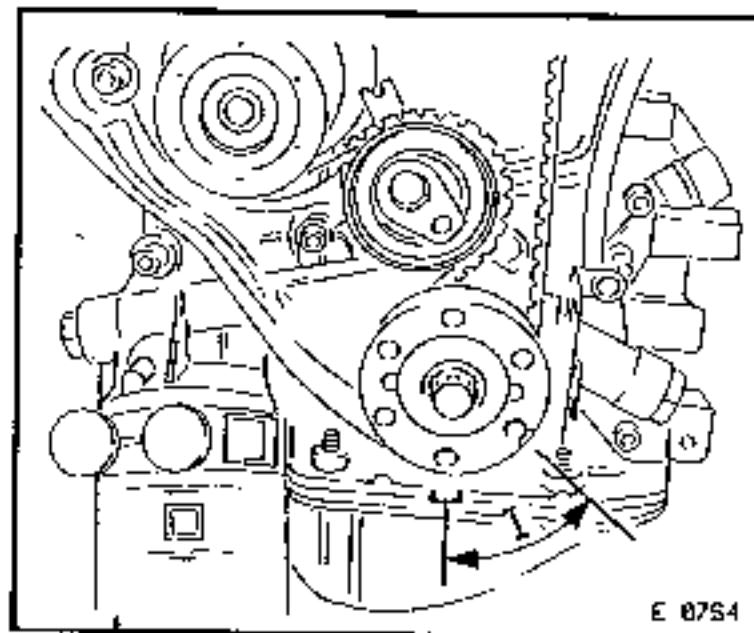
Mark the direction of rotation of the toothed belt.

All Engines:

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

Camshaft gear/s. Refer "Camshaft Gears, Remove and Install", in this Section.

High voltage distributor. Refer to the appropriate Motronic Section in this Volume.



Remove, Disconnect

C 20 XE Engines as of MY'93:

Camshaft sensor disc. Refer to the Motronic M 2.8 Section in this Volume.

All Engines:

Camshaft bearing cover.

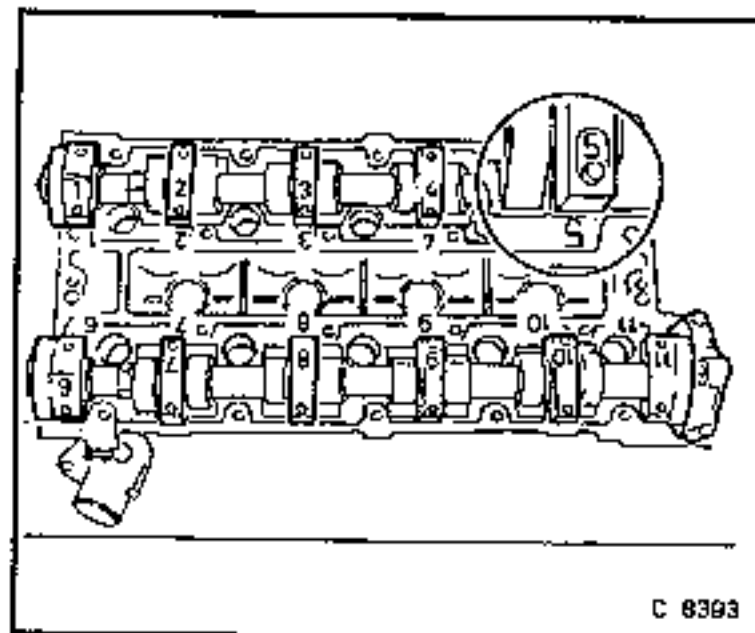
Progressively loosen nuts in stages of 1/8 to 1 turn, working from the outside, inwards.

Note:

The numbered identification markings on each camshaft bearing cap.

Important!

Camshaft must come away evenly from the bearing seats and from the front guide bearing.

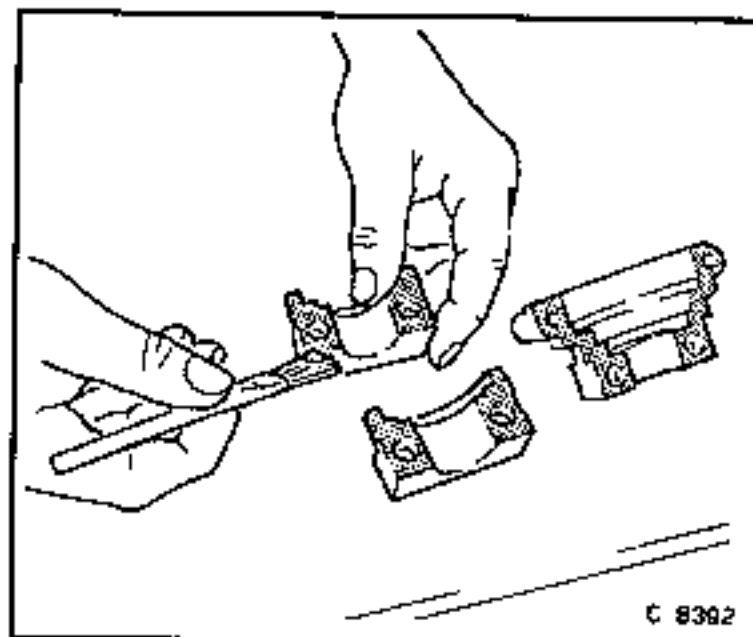


Clean, Inspect

All parts, replacing as necessary.

Coat all sliding surfaces with molybdenum disulphide (MoS₂) grease or spray.

Apply silicone sealing compound such as Dow Corning 732 or equivalent, to Holden's Specification HN1373, to the sealing surfaces of the outer camshaft bearing covers.



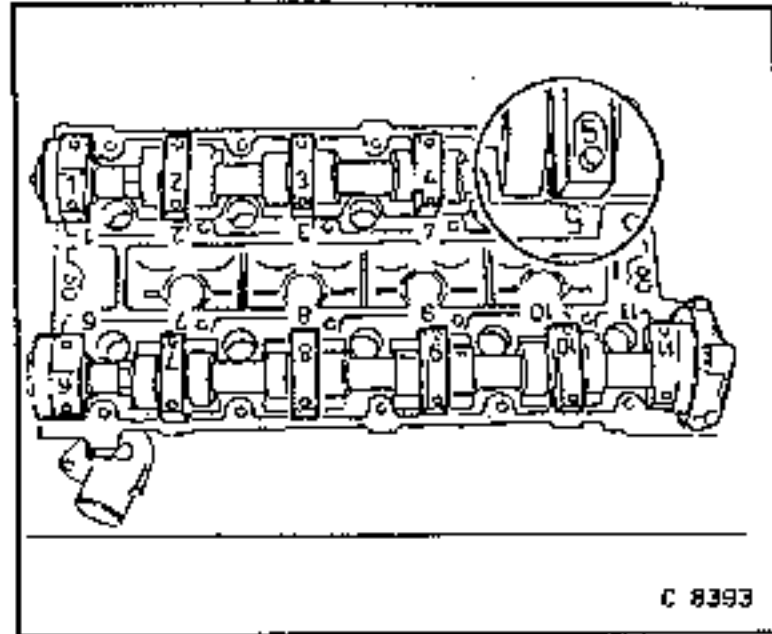
DOHC ENGINE - CYLINDER HEAD

Install, Connect

Camshaft bearing covers.

Important!

Take care that the identification number on each cover, matches with the number on the cylinder head.

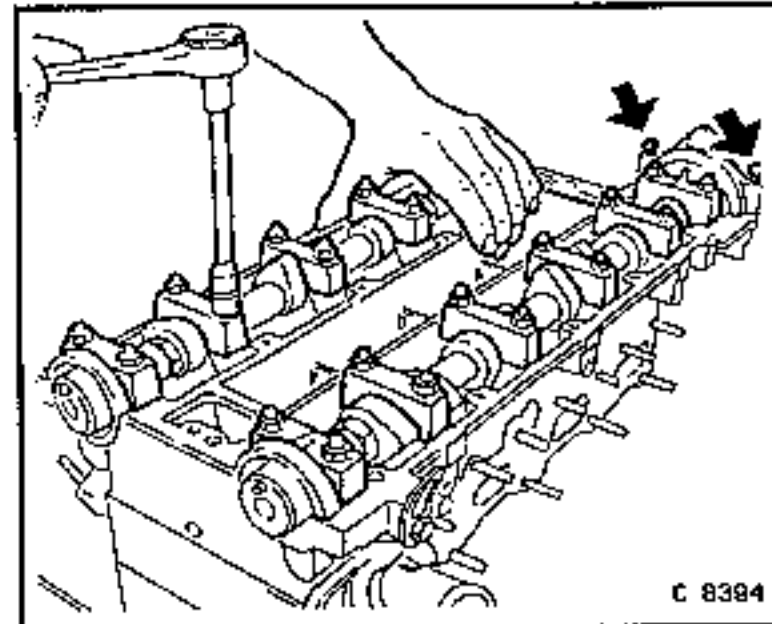


Tighten (Torque)

Camshaft bearing cover to cylinder head	20 Nm
Rear camshaft bearing cover (arrows) to cylinder head (M 6)	10 Nm

Important!

Progressively tighten the camshaft covers 1/2 to 1 turn at a time, working from the centre, outwards.



Turn camshaft with open ended spanner, until the guide studs (1), point upwards.

Install, Connect

New camshaft sealing rings, using KM-422 and the camshaft gear retaining washer.

Apply grease to the seal lips before installation.

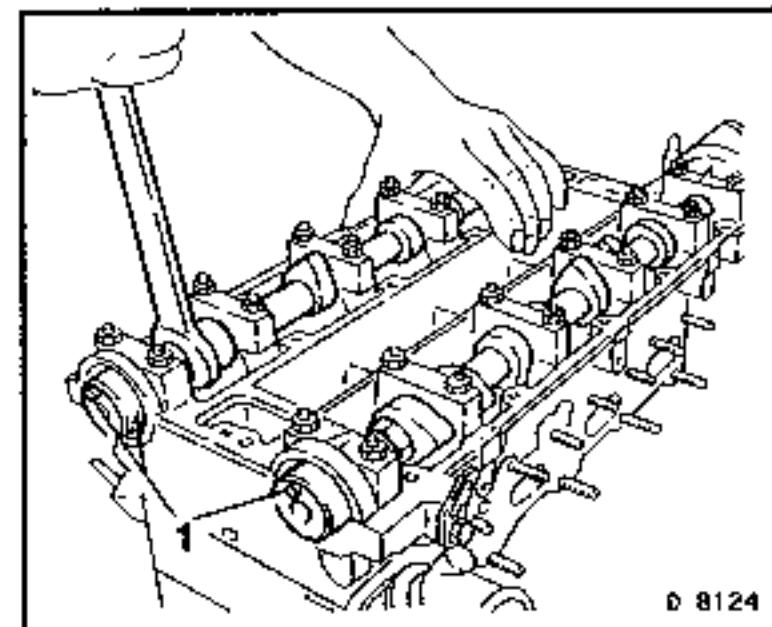
High voltage distributor.

Camshaft gear/s. Refer "Camshaft Gears, Remove and Install", in this Section.

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

C 20 XE Engine as of MY'93:

Camshaft sensor disc. Refer to Motronic M 2.B Section in this Volume, for details.



Camshaft Gears, Remove and Install

Remove, Disconnect

Engines as of MY'93:

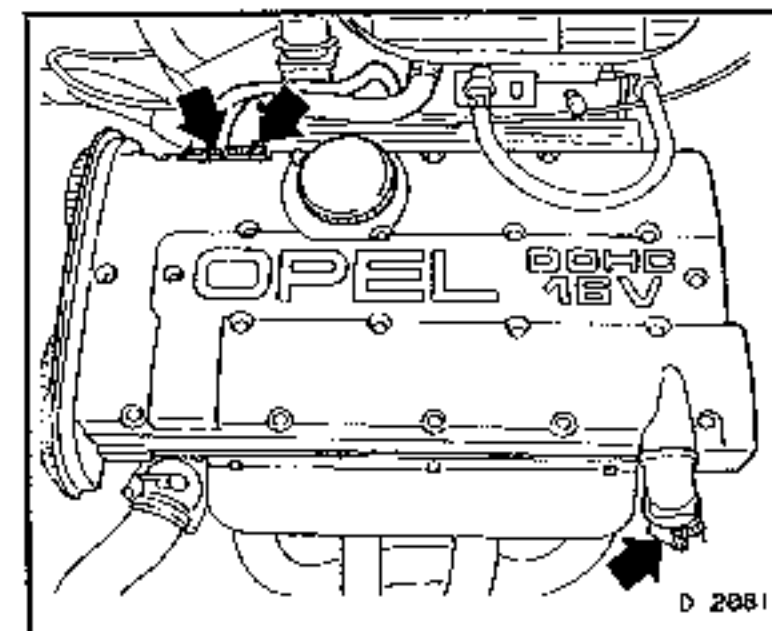
Mark the direction of rotation of the toothed belt.

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

Ignition cable cover, spark plug connections, using KM-717.

Hose connections (arrows) from cylinder head cover.

Cylinder head cover.

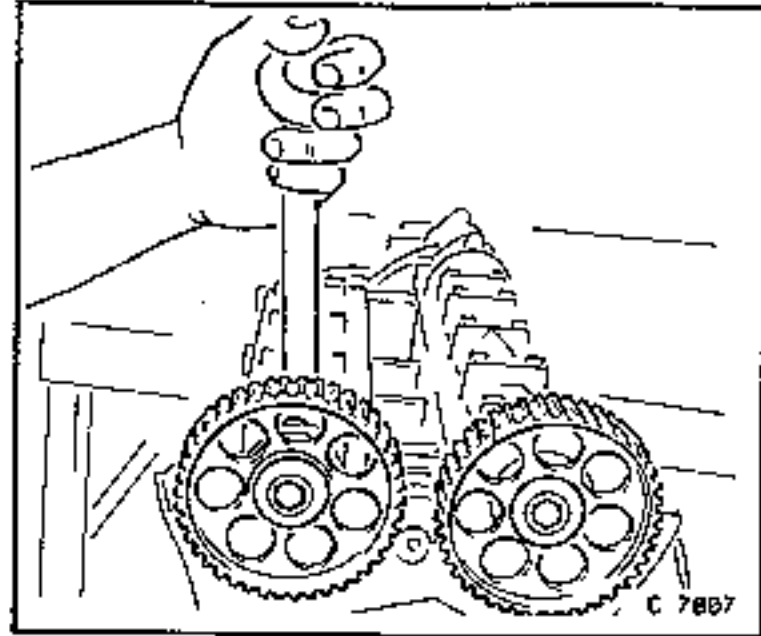


DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

Camshaft gear/s.

Hold each camshaft with an open ended spanner on the hex provided, while loosening the retaining bolt.



Install, Connect

Camshaft gear/s, with the timing mark to the front (arrow). The guide pin on the camshaft engages with the corresponding hole in the camshaft gear.

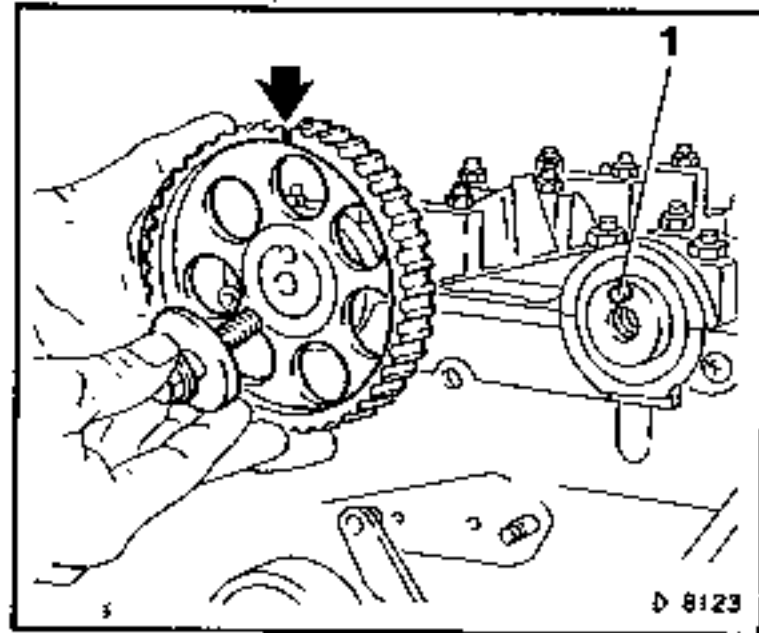
Torque - Angle Method

Camshaft gear to camshaft 50 Nm + 60° + 15° *

* Use new bolt/s.

Note:

While tightening, hold the camshaft with an open ended spanner on the hex provided.



Install, Connect

Cylinder head cover with a new gasket.

Hose connections (arrows) to cylinder head cover.

Spark plug connectors.

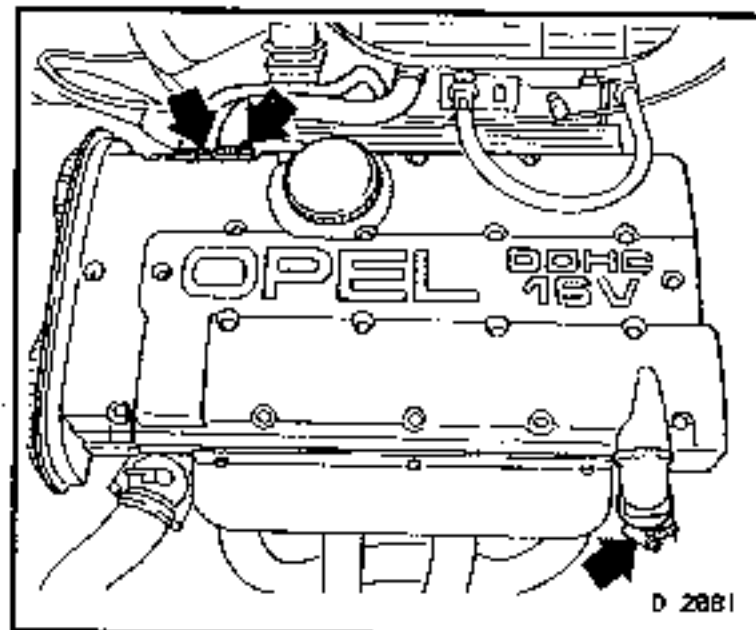
Ignition cable cover.

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

Tighten (Torque)

Cylinder head cover to cylinder head 8 Nm

Ignition cable cover to
cylinder head cover 8 Nm



Cylinder Head, Remove and Install (C 20 XE)

Important!

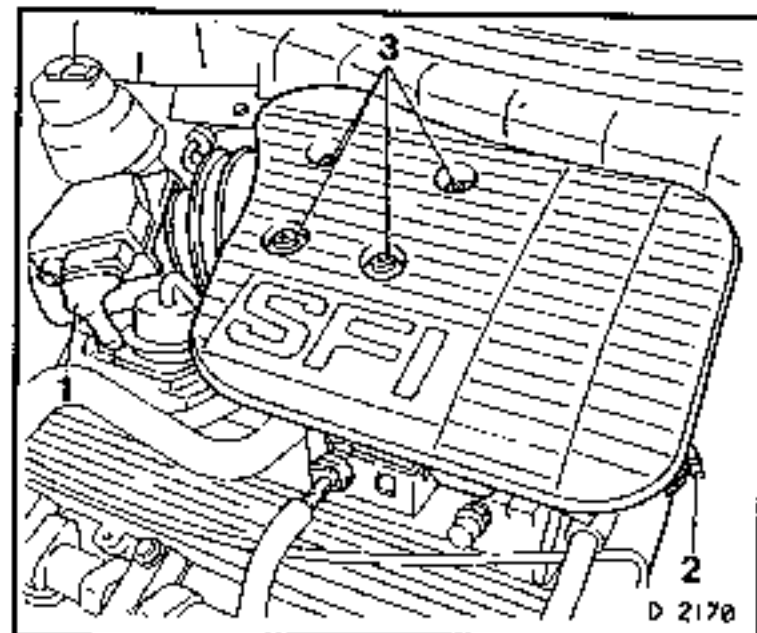
Only remove the cylinder head when the engine is cold, (i.e. at room temperature).

Remove, Disconnect

Ground cable from battery.

Wiring harness plug (1) from mass air flow meter, Idle speed adjuster hose (2) from pre-volume chamber.

Pre-volume chamber (3) with mass air flow meter.



DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

The lower coolant hose from the radiator. Collect the coolant in a suitable, clean container.

Note:

Before removing the toothed belt, rotate the crankshaft in the direction of engine rotation until the TDC mark is 60° BTDC (dimension I).

Engines as of MY'93:

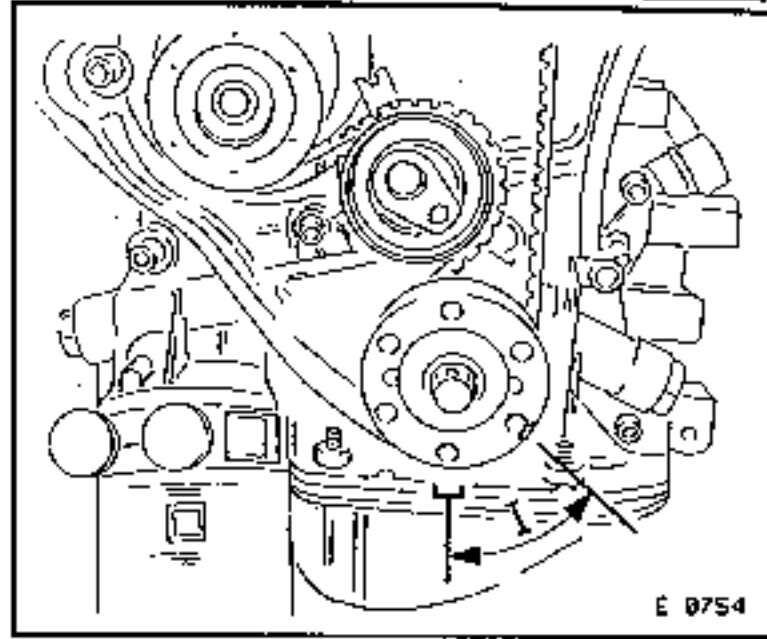
Mark the direction of rotation of the toothed belt.

All Engines:

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

Camshaft gear/s. Refer "Camshaft Gears, Remove and Install", in this Section.

Performance header. Refer "Gasket, Performance Header to Cylinder Head, Replace". in this Section.

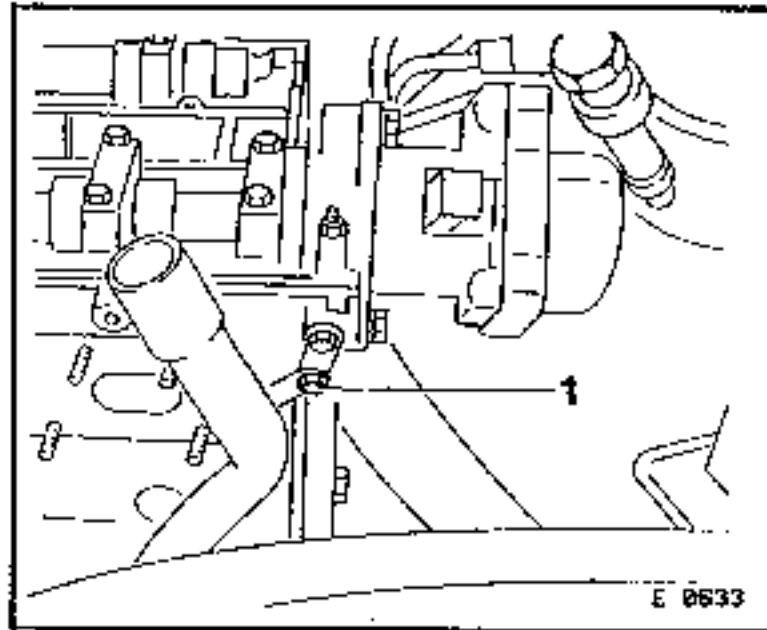


Remove, Disconnect

Wiring harness plug and upper coolant hose from the thermostat housing.

Wiring harness plug and high voltage cables from the high voltage distributor.

Fastening bolt (1).

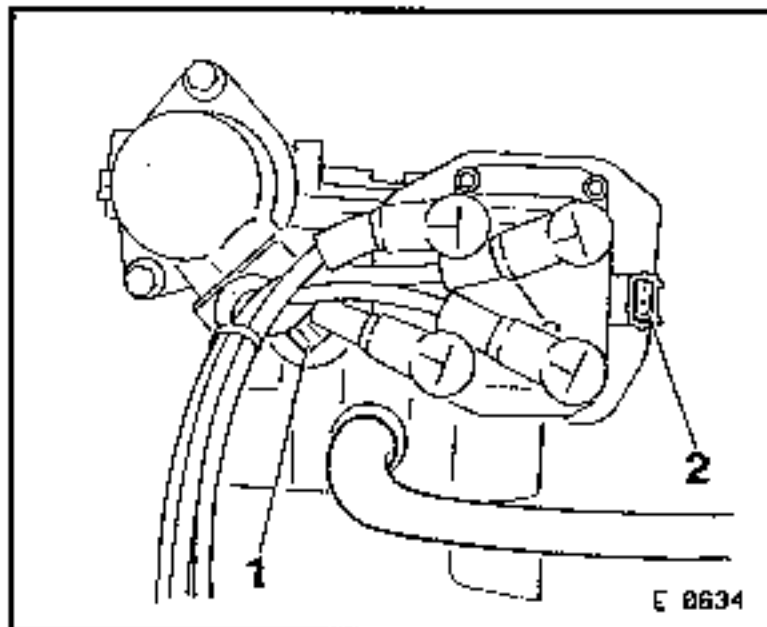


Remove, Disconnect

C 20 XE Engines as of MY'93:

Wiring harness plug (1) from camshaft sensor.

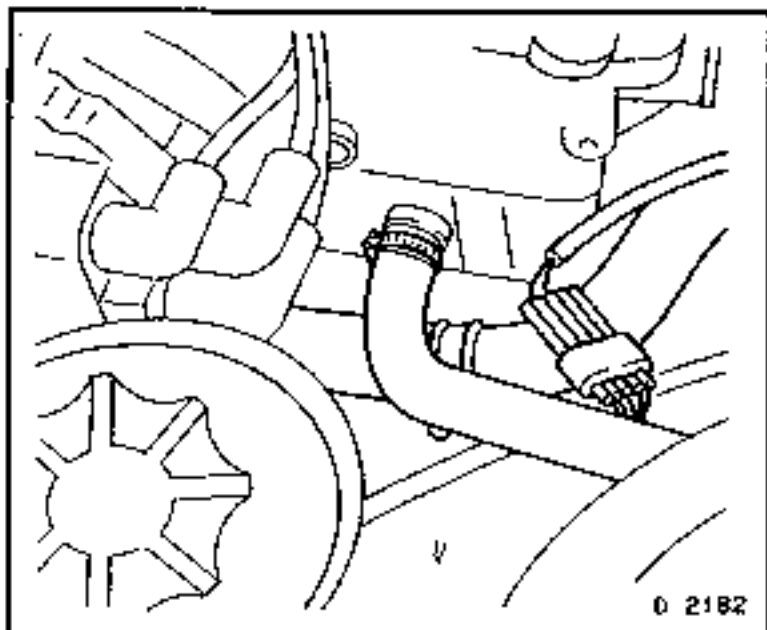
Wiring harness plug (2) from dual spark ignition coil.



Remove, Disconnect

Coolant hose.

Multi-plug.

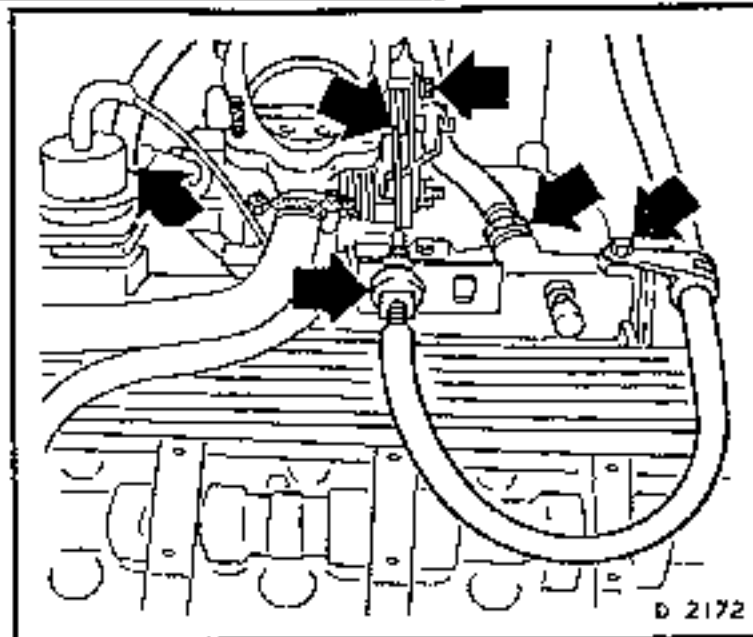


DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

Bowden cable.

Fuel lines, sealing first with suitable clamps to prevent fuel spillage.



Remove, Disconnect

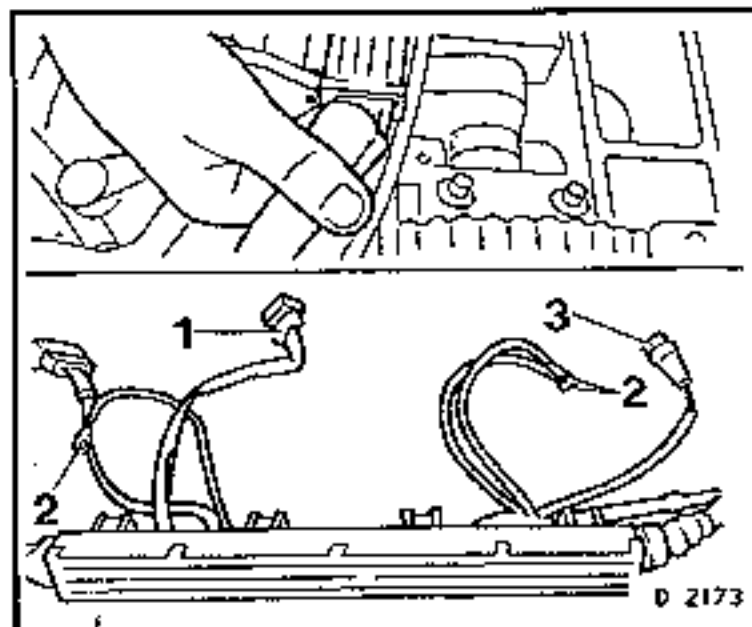
Plug strip from injectors.

Wiring harness plug (1) from throttle valve switch (M 2.5) or potentiometer (M 2.8).

Ground connections (2) from fuel distributor pipe.

Wiring harness plug (3) from controlled canister purge valve.

Lay injector plug strip towards the rear of the engine.



Remove, Disconnect

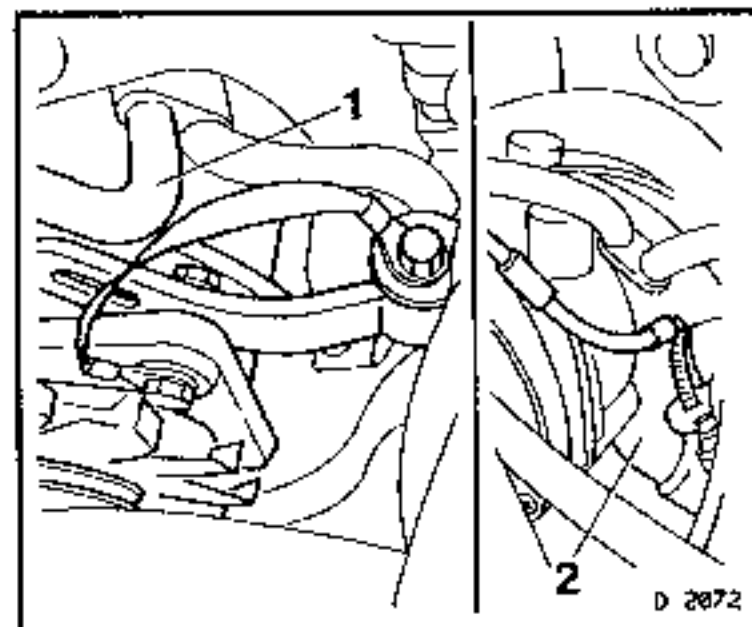
Engines up to MY'93:

Alternator clamping bracket from intake manifold.

Loosen lower alternator fastening bolt. Swing alternator to the rear.

Coolant hose (1) from coolant reservoir tank.

Coolant hose (2) from intake manifold.

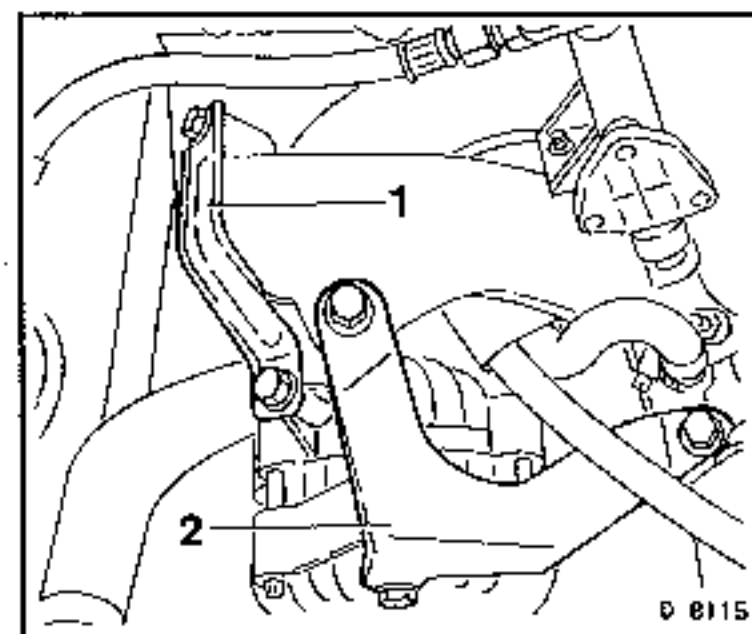


Remove, Disconnect

Engines as of MY'93:

Clamping bracket and brace from alternator or from intake manifold.

Loosen lower alternator bolt and swing alternator to the rear.



DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

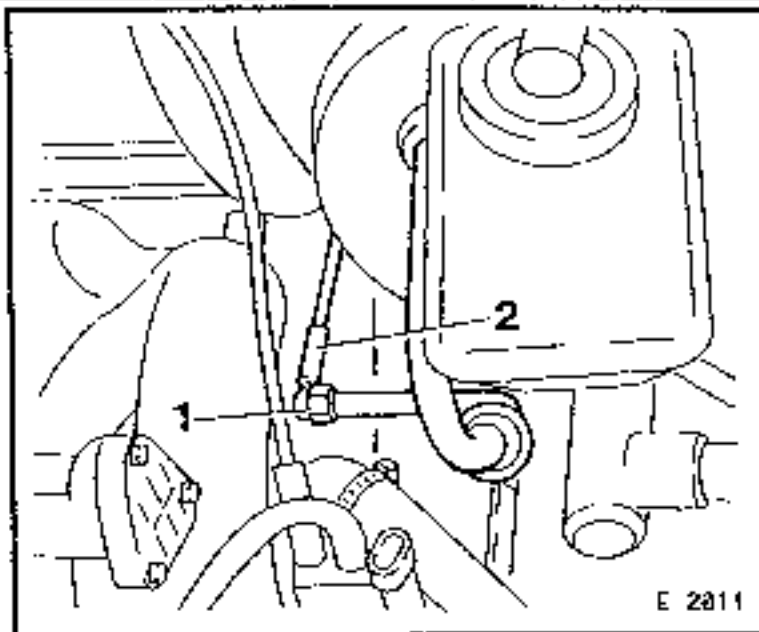
Brake servo vacuum line (1) from intake manifold.

If fitted;

Vacuum line (2) from intermediate piece for brake servo connection.

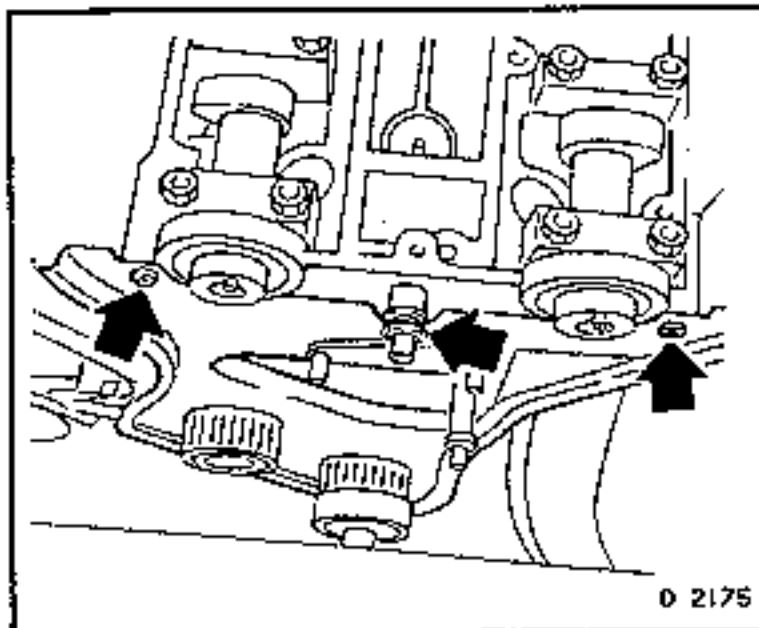
Intake manifold to cylinder block support, from the intake manifold.

Coolant hose from the coolant reservoir.



Remove, Disconnect

Fastening bolts (arrows) of the rear toothed belt cover from the cylinder head. Refer to this operation in "Engine, Timing Side, Air Cleaner", in this Volume.



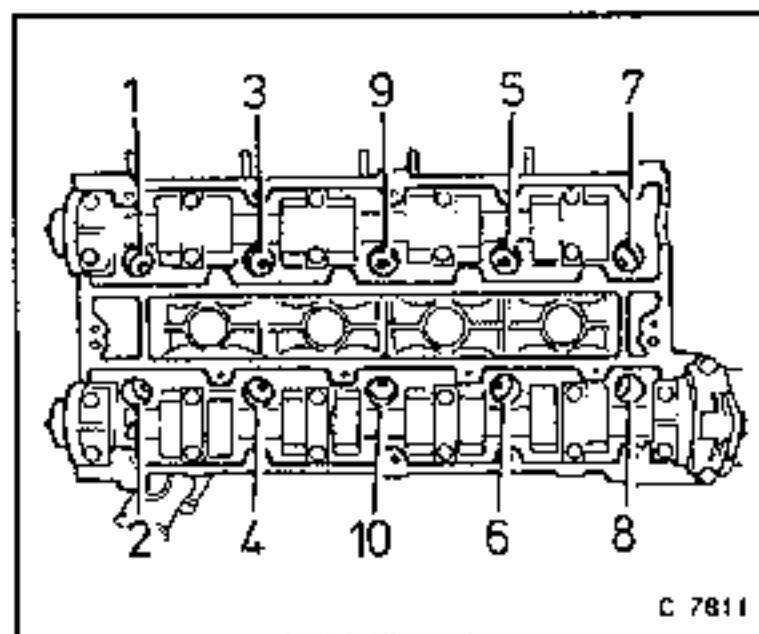
Remove, Disconnect

Progressively loosen the cylinder head bolts in the sequence shown, using MKM-604-19-A (Torx E 14).

Important!

First loosen all bolts $\frac{1}{4}$ turn, then $\frac{1}{2}$ turn.

When removing the bolts, take note of the washers.



Clean

All sealing surfaces, counter bores for the cylinder head bolts and the threads in the cylinder block.

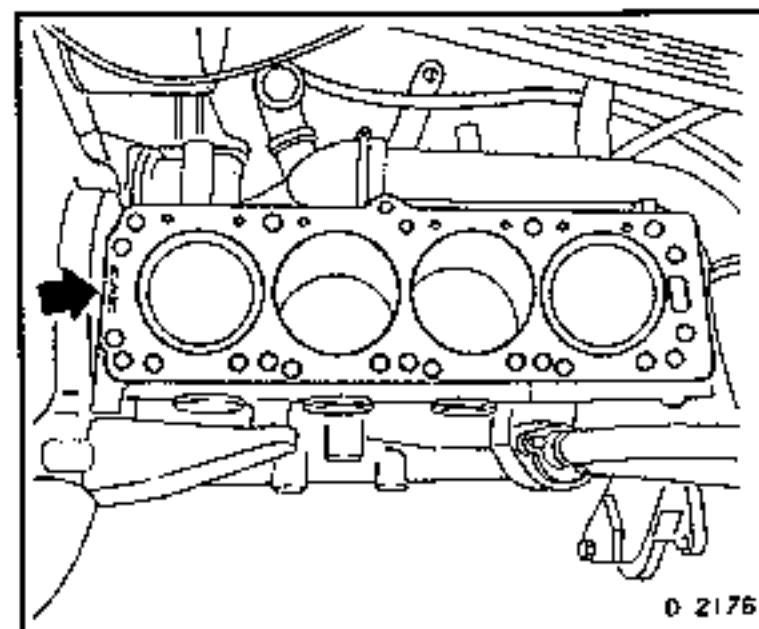
Take care not to damage finely machined surfaces.

Check

Cylinder block and head for plane surface. Refer to this operation at the end of this Section.

Install, Connect

New cylinder head gasket onto the guide bushes in the cylinder block. Align the mark "OBEN/TOP" (arrow), upwards and towards the timing side of the engine.



DOHC ENGINE - CYLINDER HEAD

Install, Connect

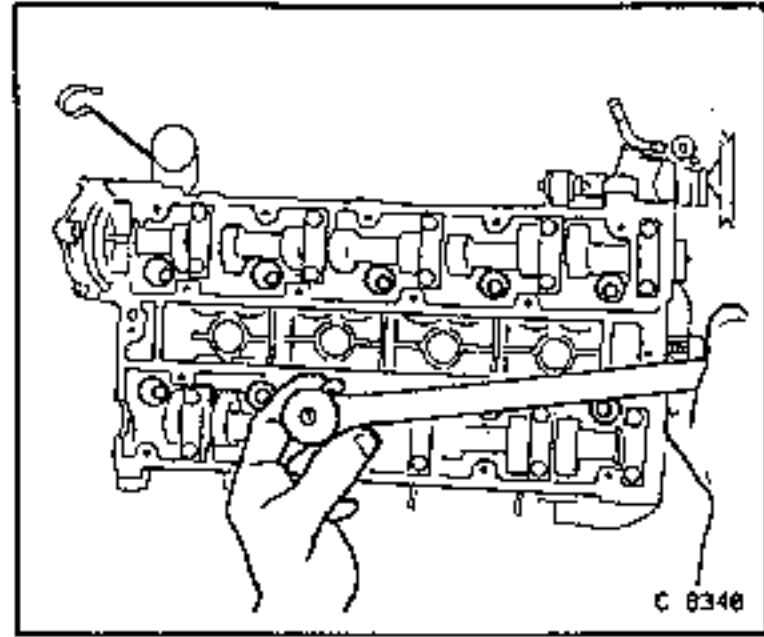
Mount cylinder head on the cylinder block, indexing with the location tubes in the cylinder block.

Insert new cylinder head bolts with their washers.

Important!

New bolts MUST be used.

Insert bolts until they are all seated, using MKM-604-19-A (Torx E 14).



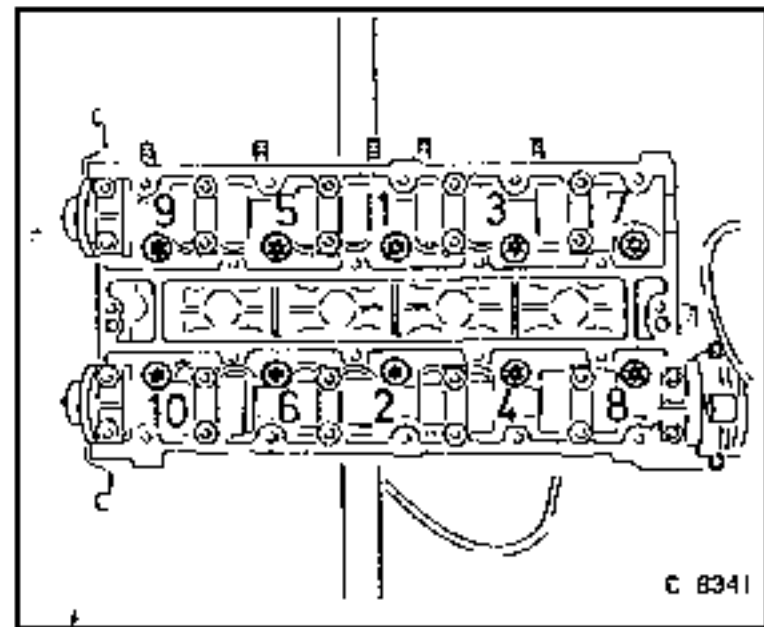
Tighten (Torque)

Cylinder head to cylinder block.
Tighten cylinder head bolts in the sequence shown, in four stages, using angular torque wrench KM-470-B.

Torque - Angle Method

Tightening procedure..... 25 Nm + 90° + 90° + 90° *

* No re-tightening is required



Tighten (Torque)

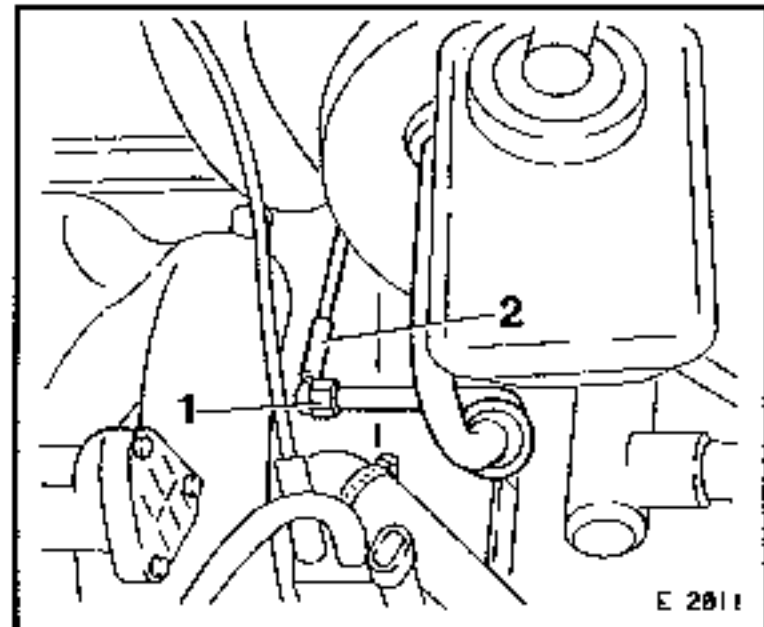
Rear toothed belt cover to cylinder head.....	6 Nm
Intake manifold to cylinder block support	25 Nm
Brake servo vacuum line to intake manifold.....	20 Nm

Install, Connect

Coolant pipe to coolant reservoir

If removed;

Vacuum Line (2) to intermediate piece for brake servo connection.

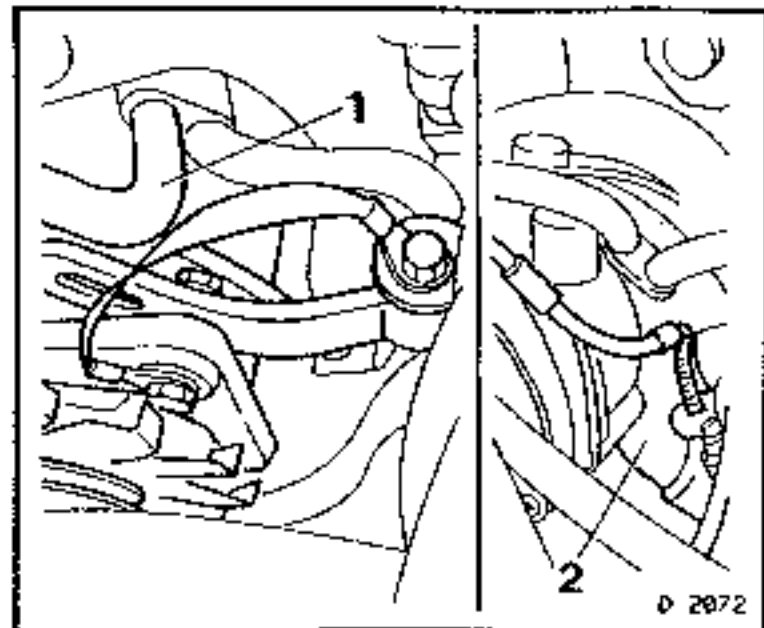


Tighten (Torque)

Clamping bracket to alternator and intake manifold	18 Nm
Support to alternator and intake manifold.....	18 Nm
Alternator clamping bracket to intake manifold.....	25 Nm

Install, Connect

Coolant hose (1 and 2).



DOHC ENGINE - CYLINDER HEAD

Install, Connect

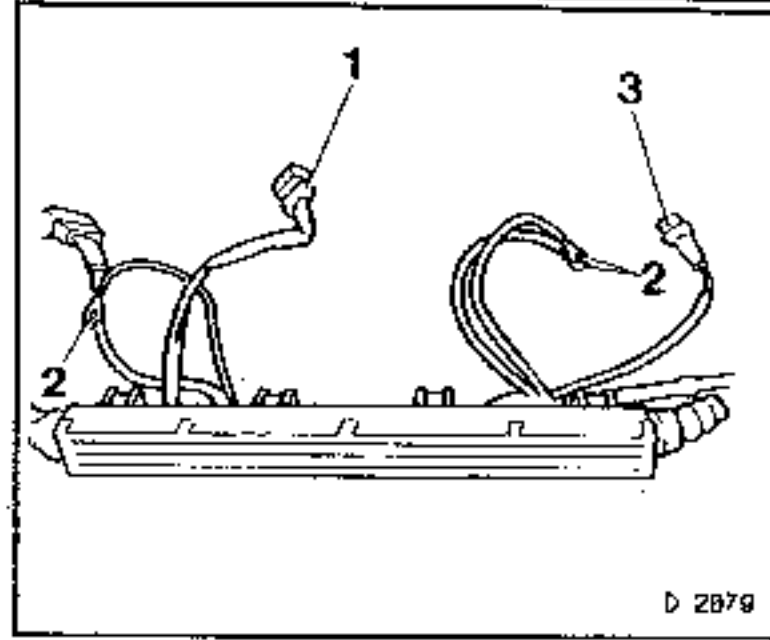
Wiring harness plug (3) to controlled canister purge valve.

Ground connections (2) to fuel distributor pipe.

Wiring harness plug (1) to throttle valve switch (M 2.5) or potentiometer (M 2.8).

Plug strip to injectors.

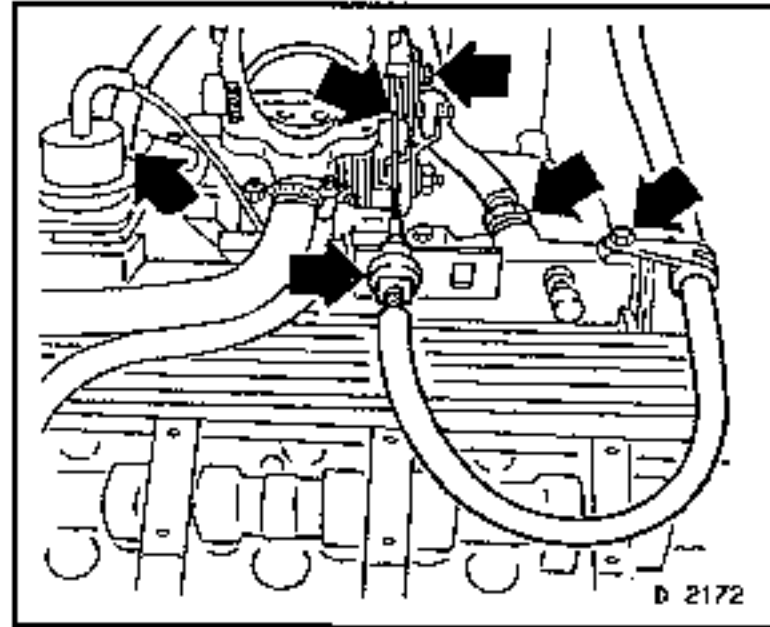
Check that all ground connectors are in good condition and secure.



Install, Connect

Fuel lines. Disconnect clamps.

Bowden cable. Install with no tension on the cable.



Install, Connect

C 20 XE Engines as of MY'93:

Wiring harness plug to camshaft sensor and dual spark ignition coil.

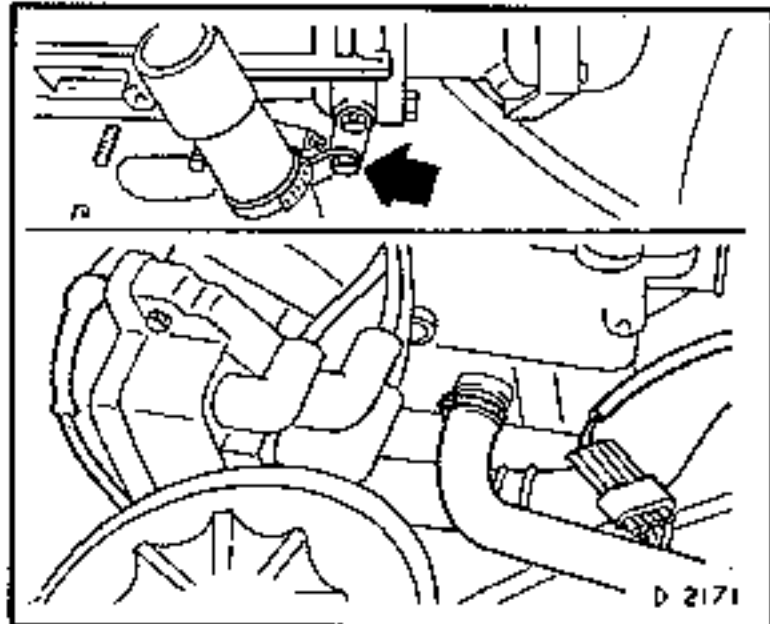
Coolant hose to cylinder head.

Multi-plug.

Wiring harness plug and high voltage cable to high voltage distributor.

Fastening bolt (arrow) to cylinder head.

Wiring harness plug and upper coolant hose to thermostat housing.



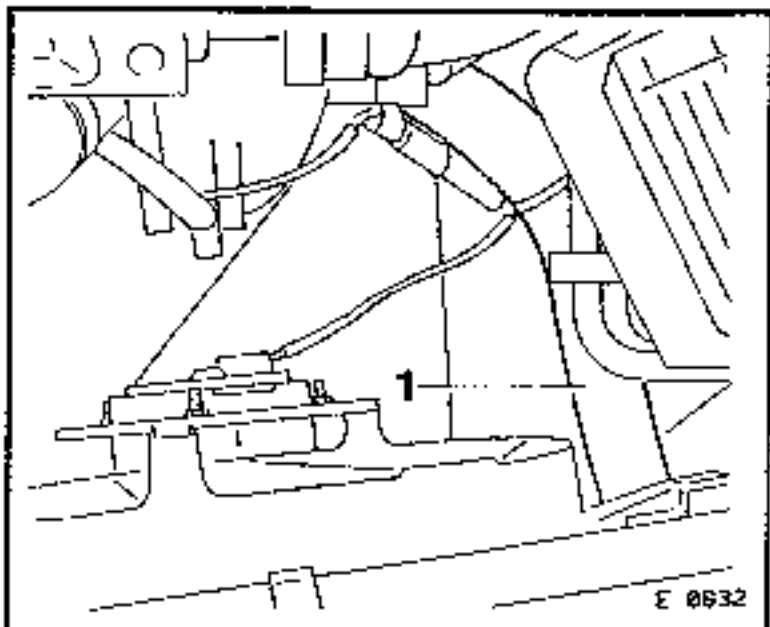
Install, Connect

Performance header. Refer "Gasket, Performance Header to Cylinder Head, Replace". In this Section.

Camshaft gear/s. Refer "Camshaft Gears, Remove and Install", In this Section.

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

Lower coolant hose (1) to the radiator.



DOHC ENGINE - CYLINDER HEAD

Install, Connect

Pre-volume chamber (3) with mass air flow meter.

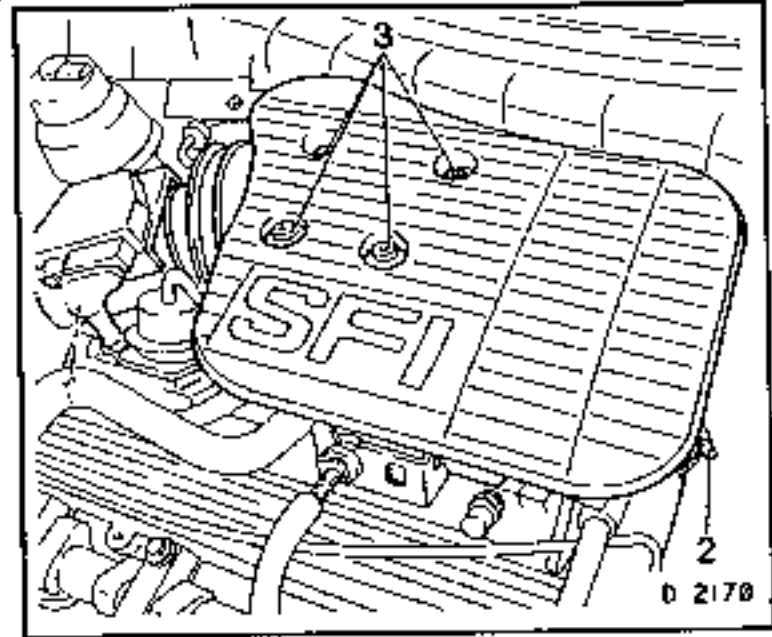
Hose (2) to pre-volume chamber.

Wiring harness plug (1) to air flow meter.

Engine compartment cover.

Ground cable to battery.

Top up and bleed cooling system. Refer "Cooling System", in this Volume.



Cylinder Head, Remove and Install (C 20 LET)

Important!

Only remove the cylinder head when the engine is cold, (i.e. at room temperature).

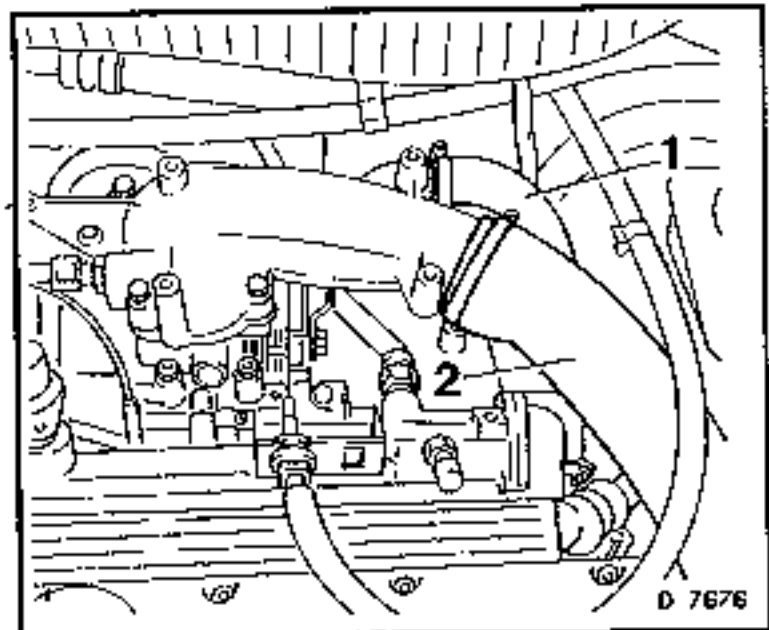
Remove, Disconnect

Ground cable from battery.

Cover from throttle valve manifold.

Air hose (1) from throttle valve manifold.

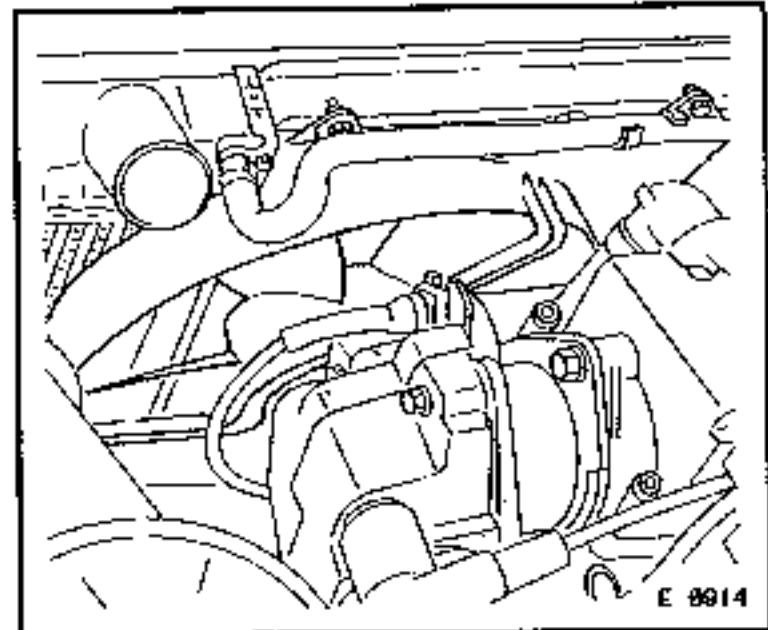
Air hose (2) from charge air cooler or from throttle valve manifold.



Remove, Disconnect

Wiring harness plug from fan motor.

Fan motor with fan shroud.



Remove, Disconnect

The lower coolant hose from the radiator. Collect coolant in a suitable, clean container.

Note:

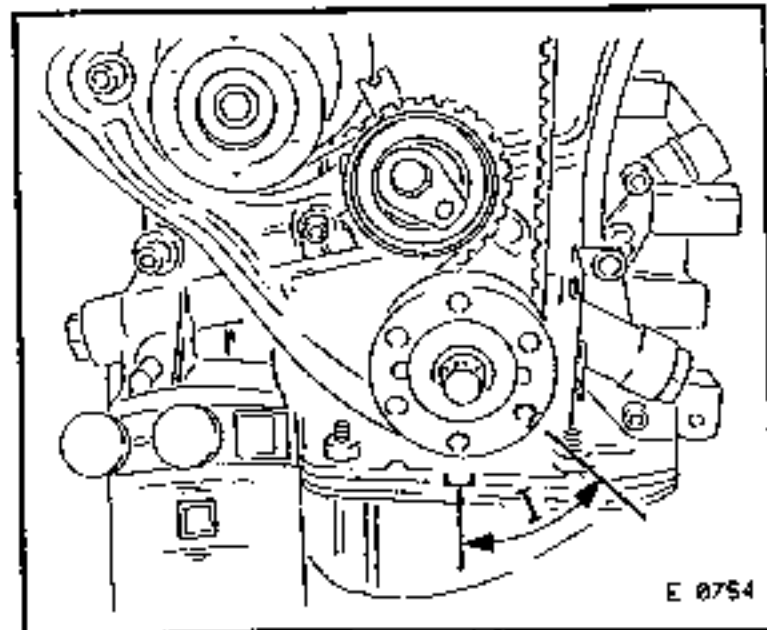
Before removing the toothed belt, rotate the crankshaft in the direction of engine rotation until the TDC mark is 60° BTDC (dimension I).

Mark the direction of rotation of the toothed belt.

Toothed Belt. Refer "Toothed Belt, Replace", in this Volume.

Camshaft gear/s. Refer "Camshaft Gears, Remove and Install", in this Section.

Exhaust manifold with turbocharger. Refer to the Section, "Turbocharging System - C 20 LET" in this Volume.

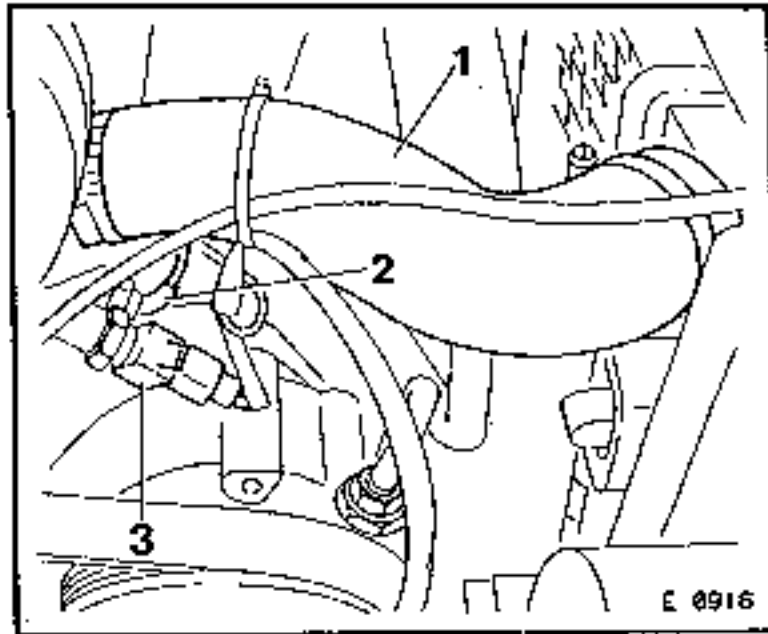


DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

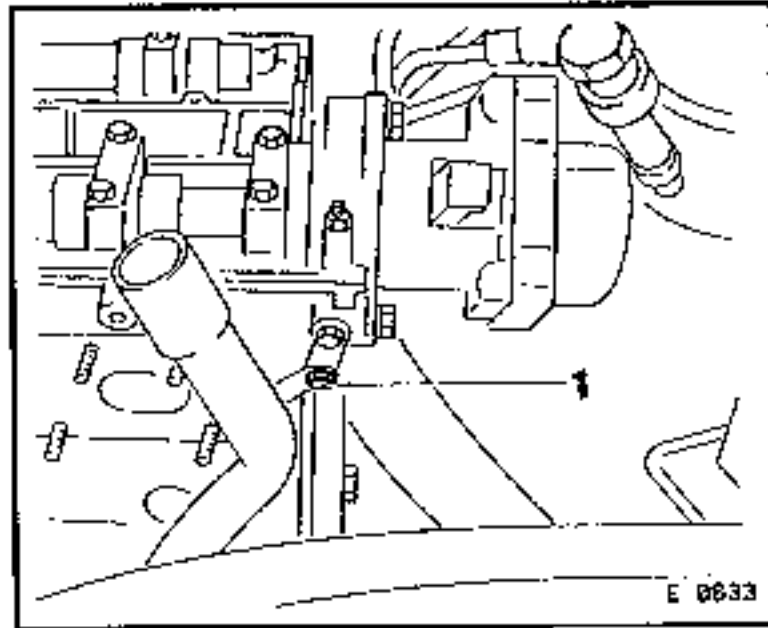
Coolant hose (1).

Wiring harness plugs (2 and 3) from the thermostat housing.



Remove, Disconnect

Fastening bolt (1) from the cylinder head.

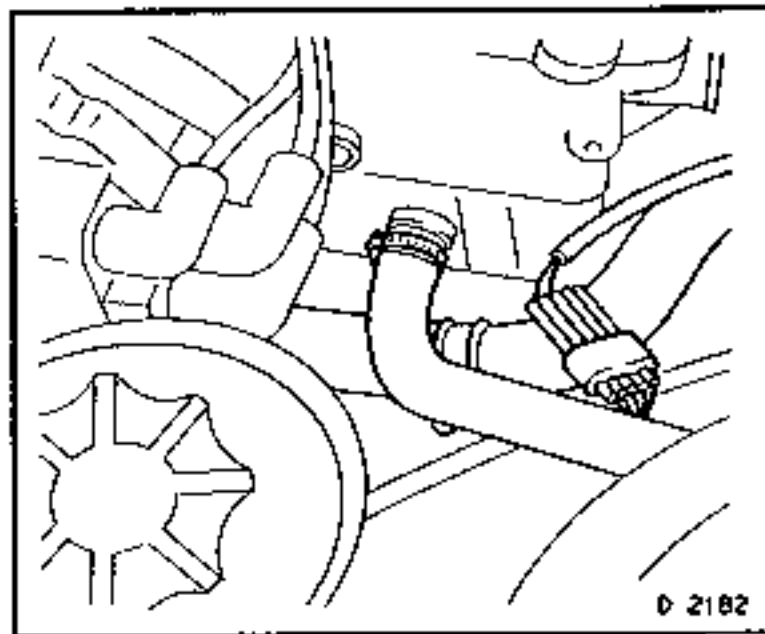


Remove, Disconnect

Coolant hose.

Multi-plug.

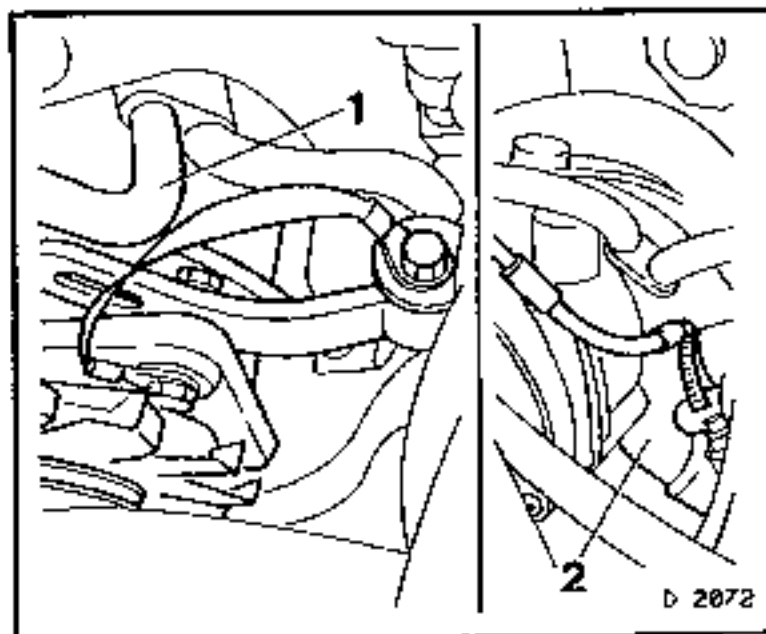
Wiring harness plug and high voltage cable from the high voltage distributor.



Remove, Disconnect

Coolant hose (1) from the coolant reservoir tank.

Coolant hose (2) from the intake manifold.

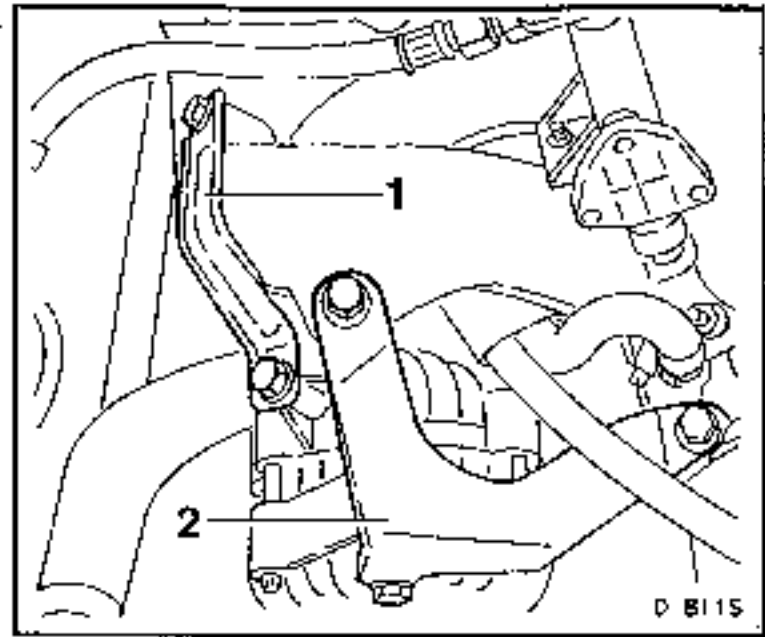


DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

Clamping bracket and brace from alternator or from intake manifold.

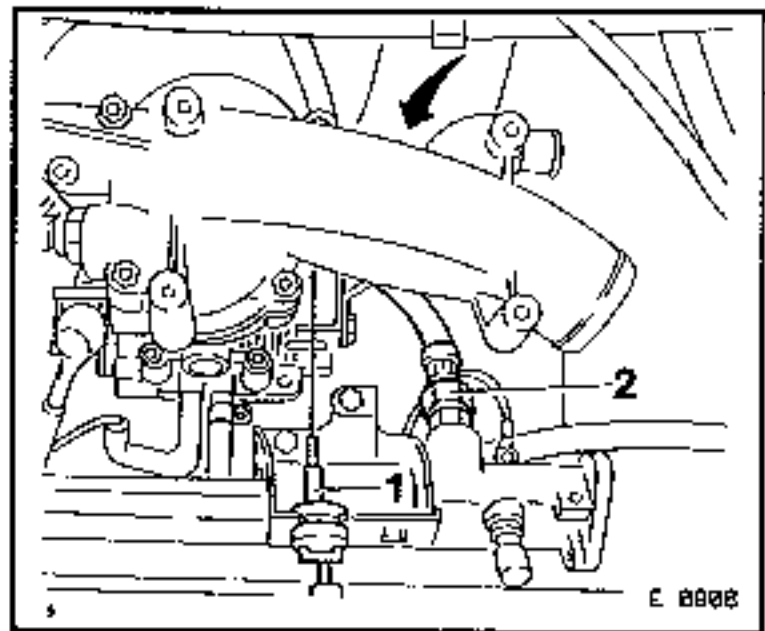
Loosen lower alternator bolt and swing alternator to the rear.



Remove, Disconnect

Bowden cable (1), fuel line bracket (arrow).

Close off fuel lines using a suitable clamp.



Remove, Disconnect

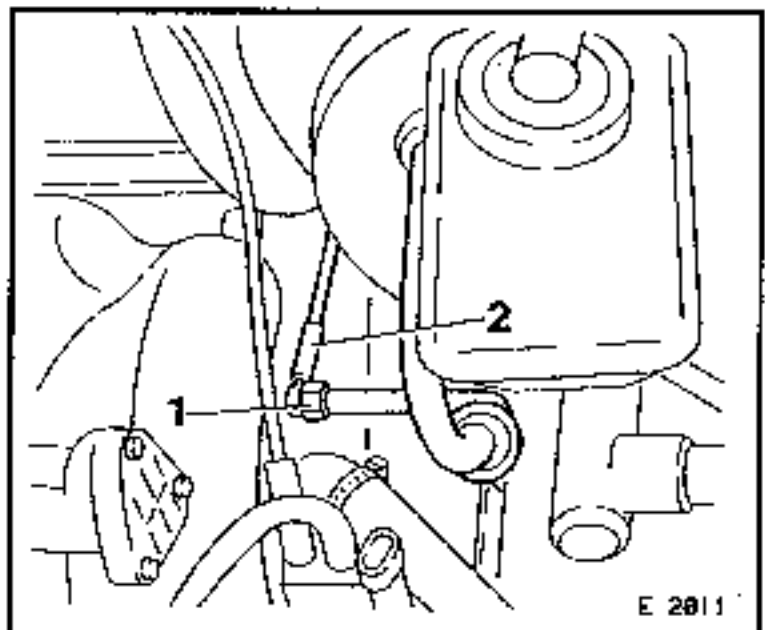
Brake servo line (1) from the intake manifold.

If fitted;

Vacuum line (2) from intermediate piece for brake servo connection.

Intake manifold to cylinder block support from Intake manifold.

Coolant pipe from the coolant reservoir tank.



Remove, Disconnect

Injector plug strip from connectors. To do this, first pull back retaining clamp for the No. 1 injector.

Wiring harness plug (1) from hot start valve.

Wiring harness plug (2) from intake air temperature sensor.

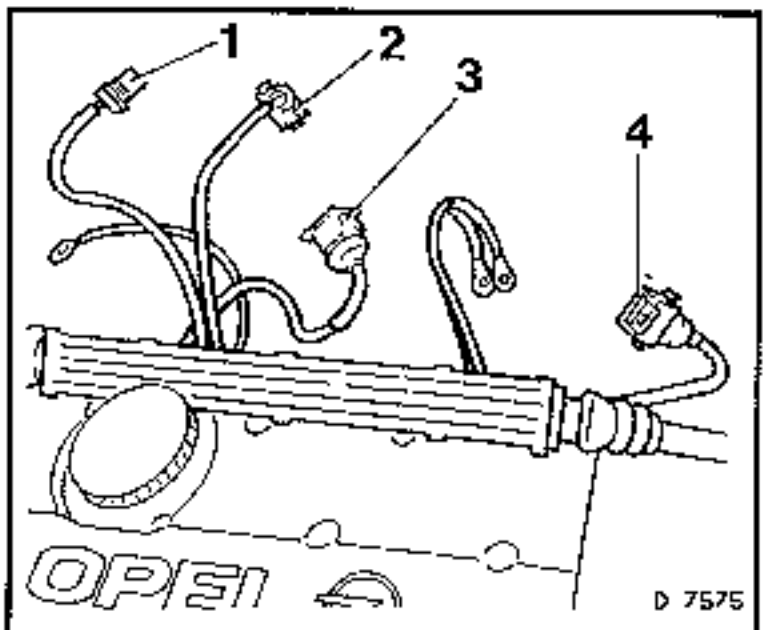
Wiring harness plug (3) from throttle valve potentiometer.

Wiring harness plug (4) from controlled canister purge valve.

Ground connections from fuel distributor pipe.

Note:

Routing of all wiring and connections.

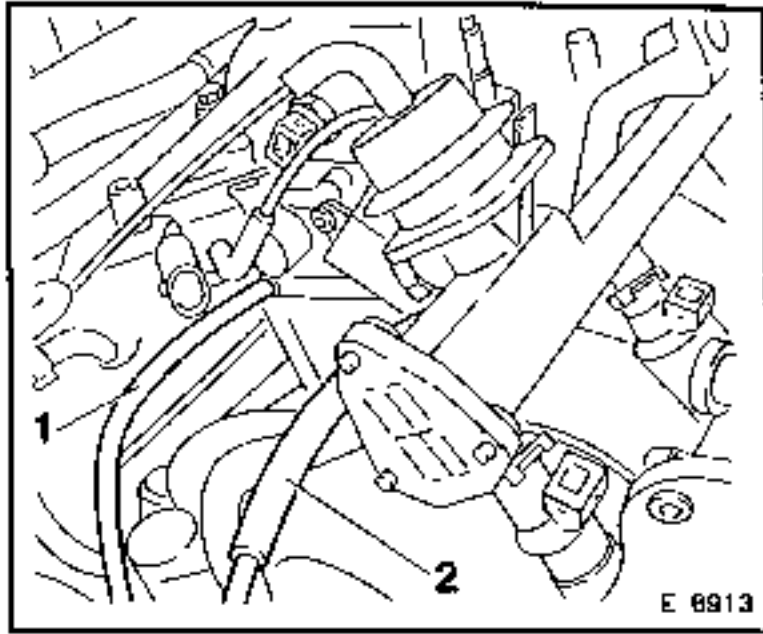


DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

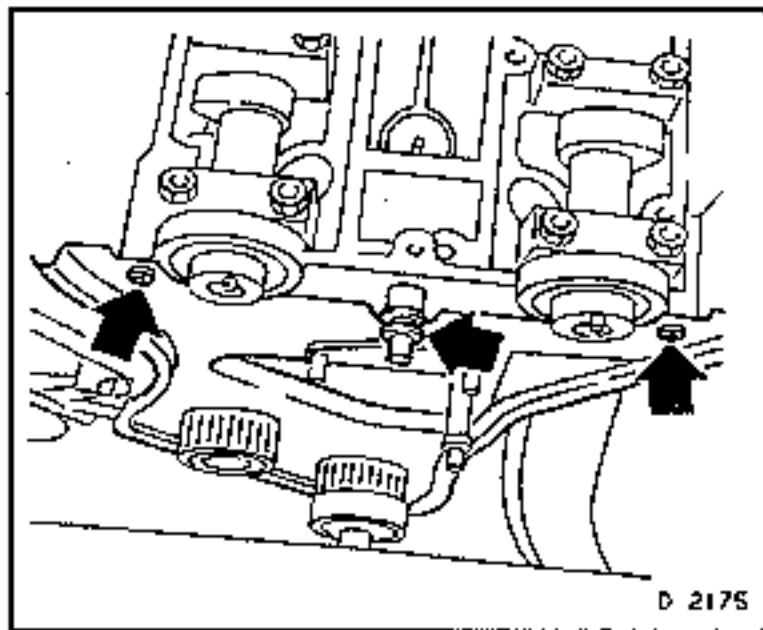
Vacuum hose (1) from the throttle body.

Vacuum hose (2) from the 'T' piece.



Remove, Disconnect

Fastening bolts (arrows) of the rear toothed belt cover from the cylinder head. Refer to this operation in "Engine, Timing Side, Air Cleaner", in this Volume.



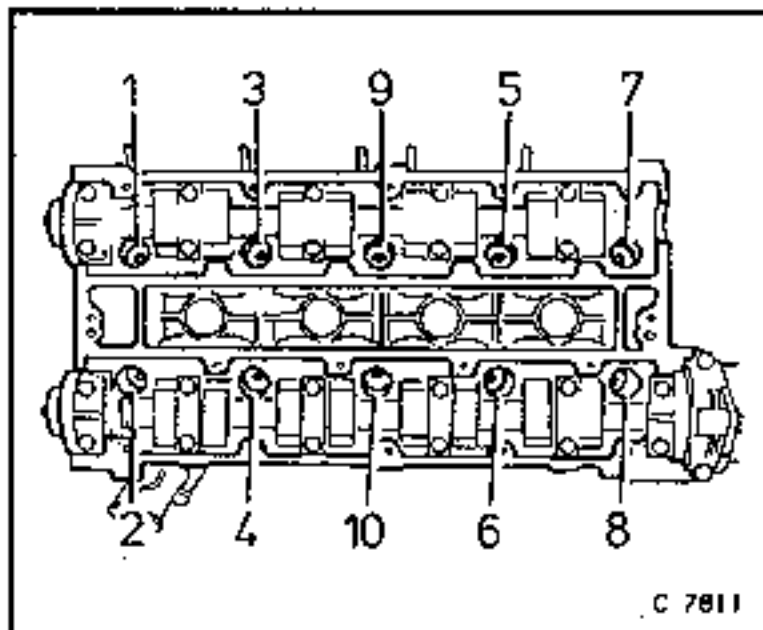
Remove, Disconnect

Progressively loosen the cylinder head bolts in the sequence shown, using MKM-604-19-A (Torx E 14).

Important!

First loosen all bolts $\frac{1}{4}$ turn, then $\frac{1}{2}$ turn.

When removing the bolts, take note of the washers.



Clean

All sealing surfaces, counter bores for the cylinder head bolts and the threads in the cylinder block.

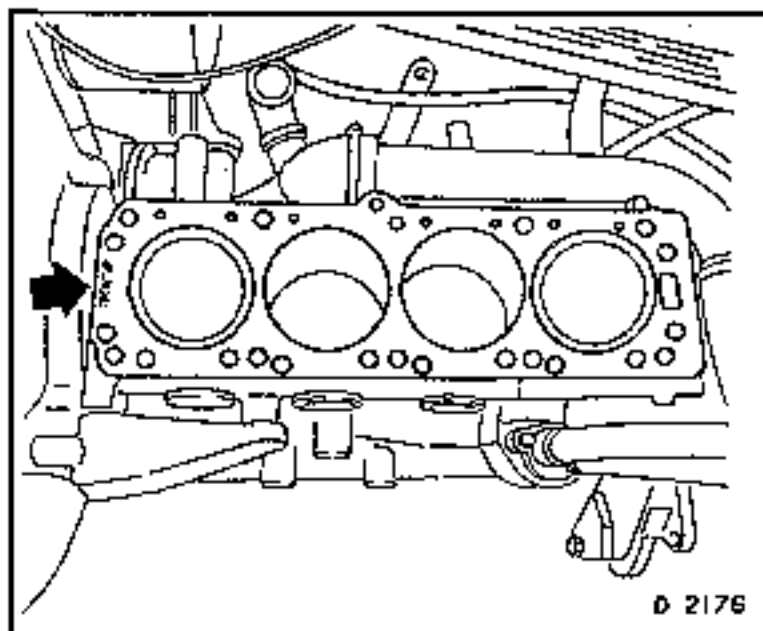
Take care not to damage finely machined surfaces.

Check

Cylinder block and head for plane surface. Refer to this operation at the end of this Section.

Install, Connect

New cylinder head gasket onto the guide bushes in the cylinder block. Align the mark "OBEN/TOP" (arrow), upwards and towards the timing side of the engine.



DOHC ENGINE - CYLINDER HEAD

Install, Connect

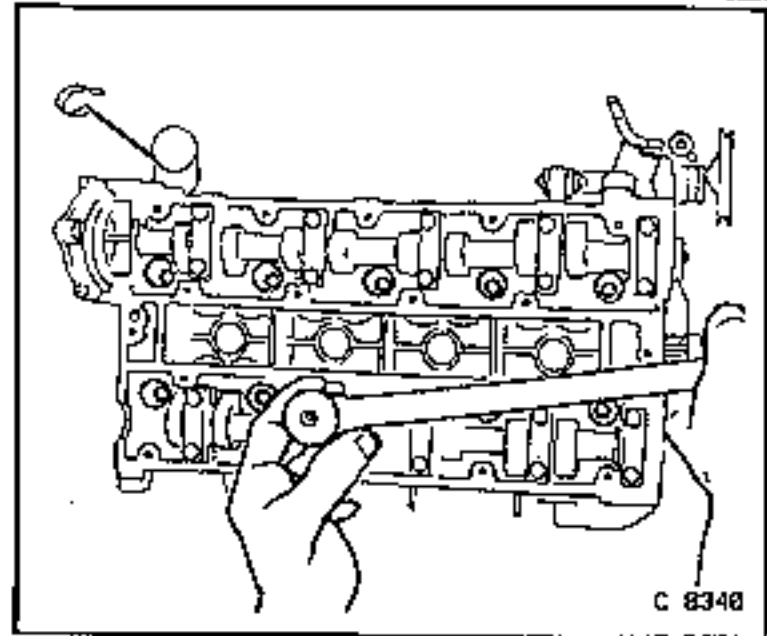
Mount cylinder head on the cylinder block, indexing with the location tubes in the cylinder block.

Insert new cylinder head bolts with their washers.

Important!

New bolts MUST be used.

Insert bolts until they are all seated, using MKM-604-19-A (Torx E 14).



Tighten (Torque)

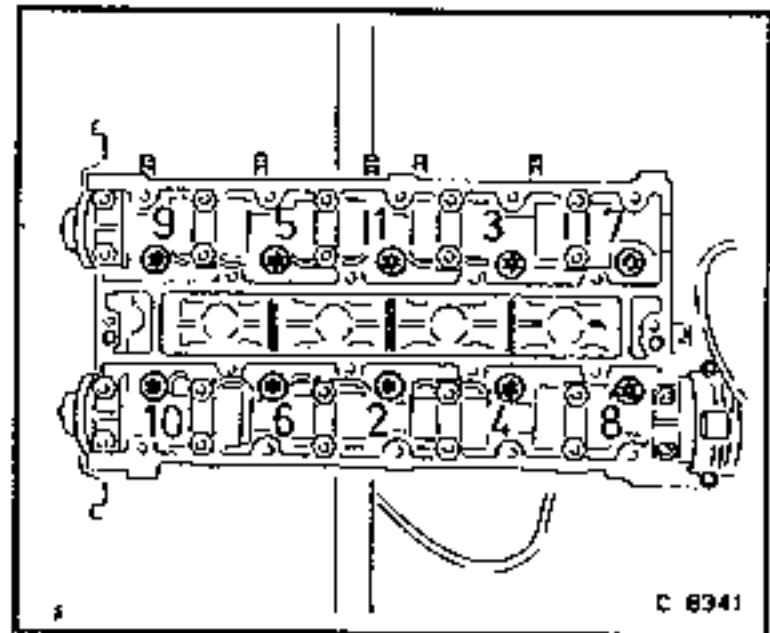
Cylinder head to cylinder block.

Tighten cylinder head bolts in the sequence shown, in four stages, using angular torque wrench KM-470-B.

Torque - Angle Method

Tightening procedure..... 25 Nm + 90° + 90° + 90° *

* No re-tightening is required



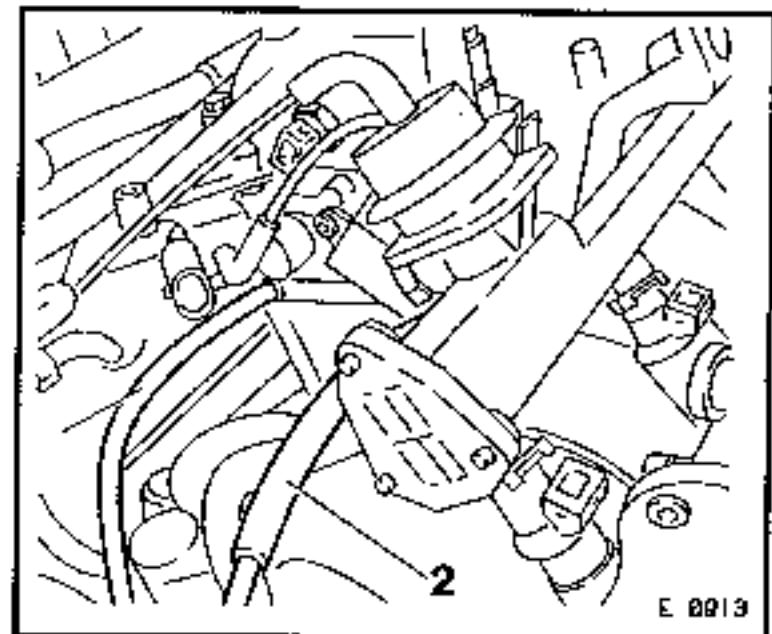
Tighten (Torque)

Rear toothed belt cover to cylinder head..... 6 Nm

Install, Connect

Vacuum hose (1) to throttle body.

Vacuum hose (2) to the 'T' piece.



Install, Connect

Ground connections to the fuel distributor pipe.

Wiring harness plug (4) and vacuum hose from carbon canister to controlled canister purge valve.

Wiring harness plug (3) to throttle valve potentiometer.

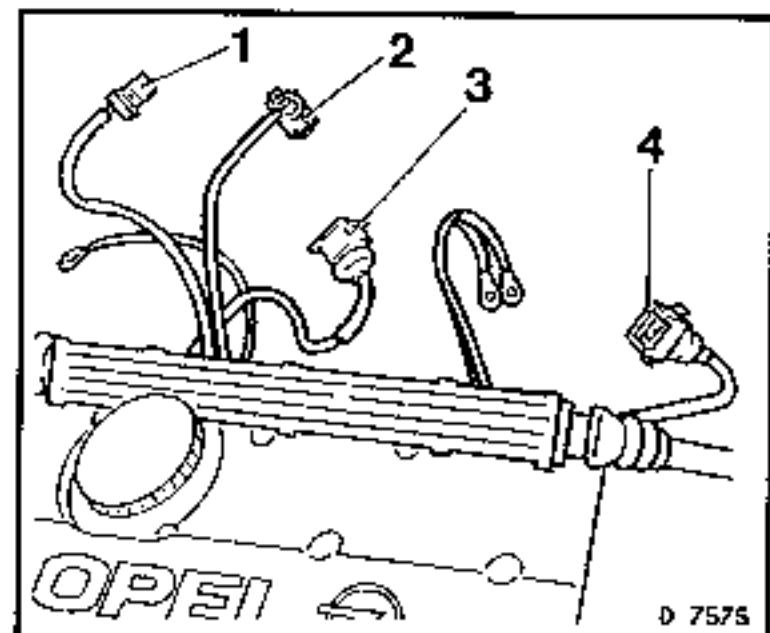
Wiring harness plug (2) to intake air temperature sensor.

Wiring harness plug (1) to hot start valve.

Note:

Routing of all wiring and connections.

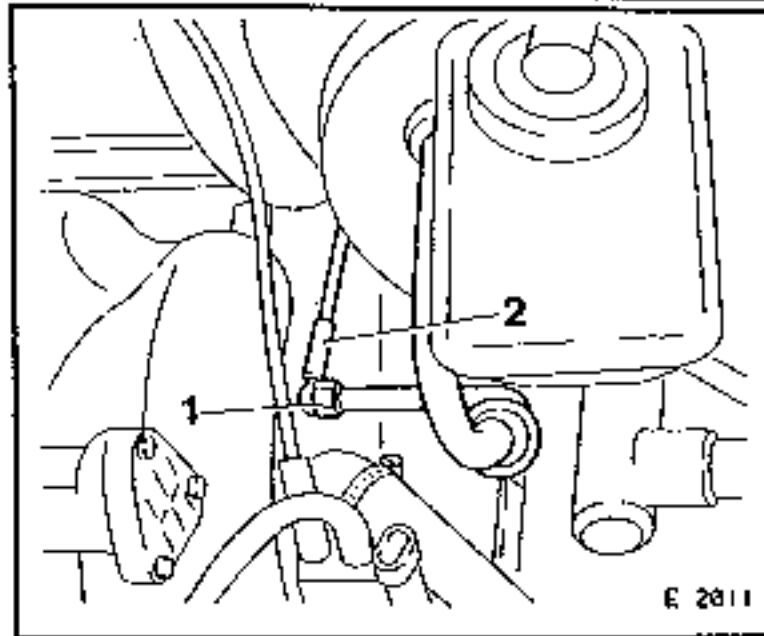
The injector plug strip to the injectors.



DOHC ENGINE - CYLINDER HEAD

Tighten (Torque)

Intake manifold to cylinder block support 25 Nm
Brake servo line (1) to intake manifold..... 20 Nm
If removed;
Vacuum line to intermediate piece for brake servo
connection.



Install, Connect

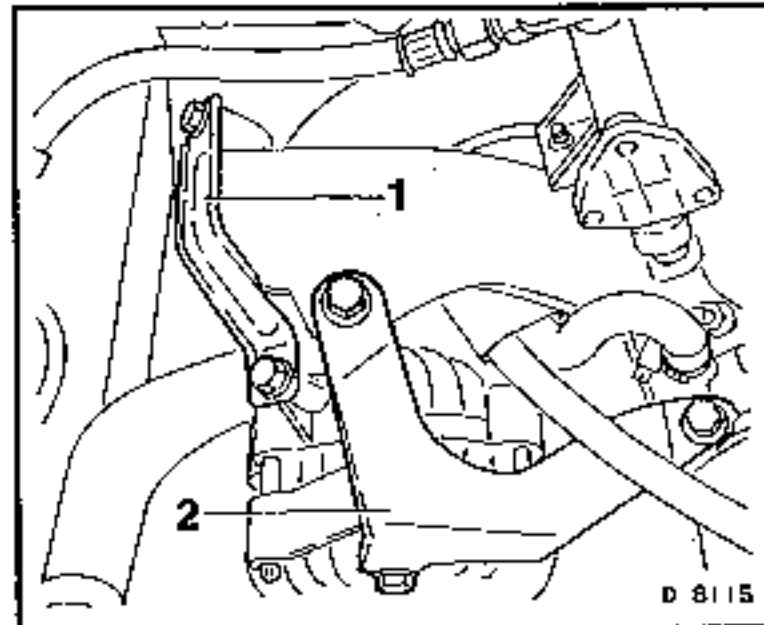
Fuel lines. Disconnect clamps.

Bowden cable. Install with no tension on the cable.

Tighten (Torque)

Clamping bracket (1) to alternator
and Intake manifold 18 Nm
Support (2) to alternator and
Intake manifold 18 Nm
Alternator clamping bracket to
Intake manifold 25 Nm

Coolant pipe to coolant reservoir tank or to intake
manifold



Install, Connect

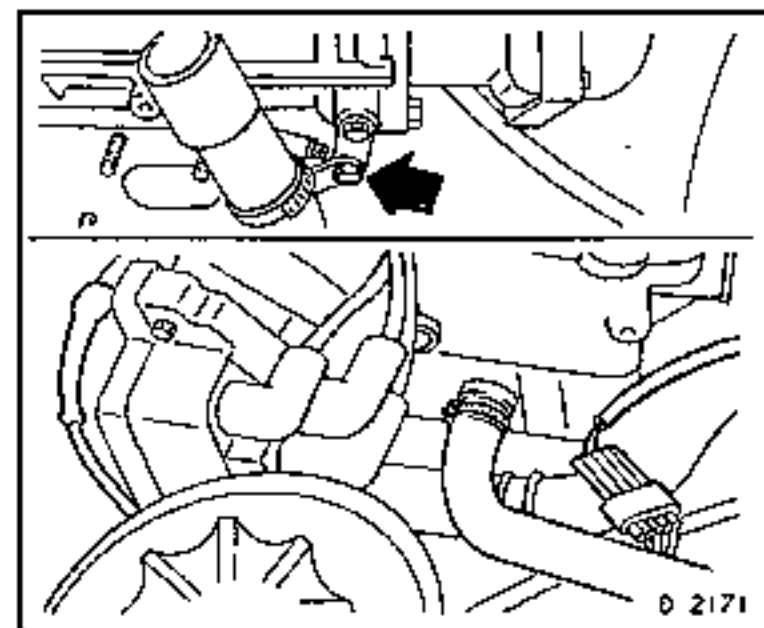
Coolant hose to cylinder head.

Multi-plug.

Wiring harness plug and high voltage cable to high
voltage distributor.

Fastening bolt (arrow) to cylinder head.

Wiring harness plug and upper coolant hose to
thermostat housing.

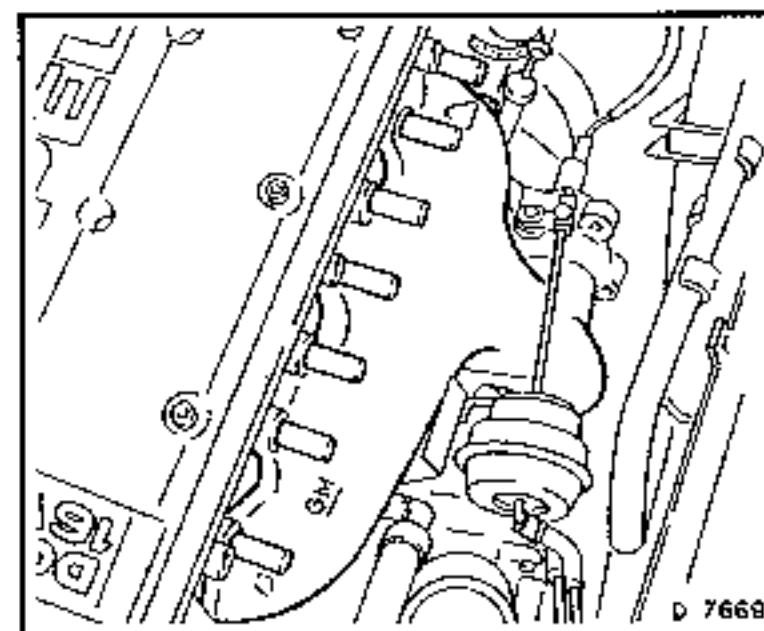


Install, Connect

Exhaust manifold with turbocharger. Refer to the
Section, "Turbocharging System - C 20 LET" in this
Volume.

Camshaft gear/s. Refer "Camshaft Gears, Remove and
Install", in this Section.

Toothed Belt. Refer "Toothed Belt, Replace", in this
Volume.



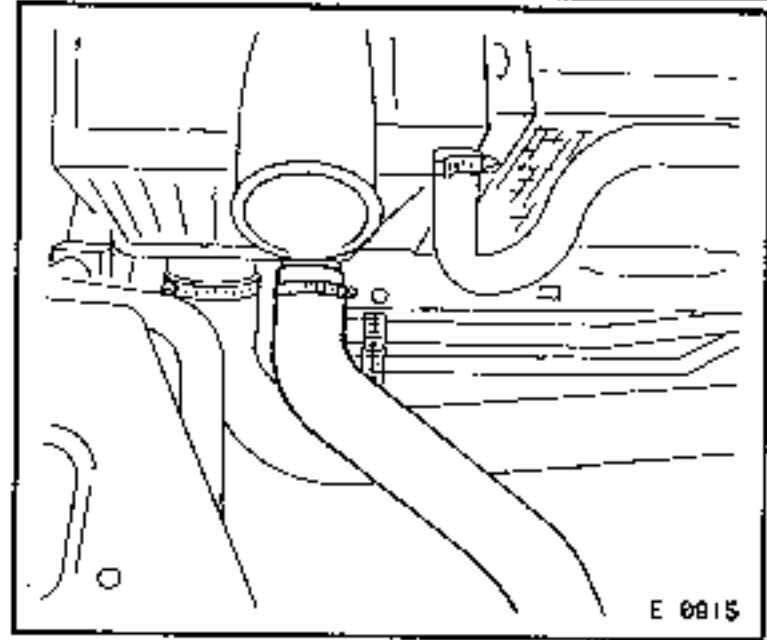
DOHC ENGINE - CYLINDER HEAD

Install, Connect

Lower coolant hose to radiator.

Fan motor with radiator fan shroud, to radiator.

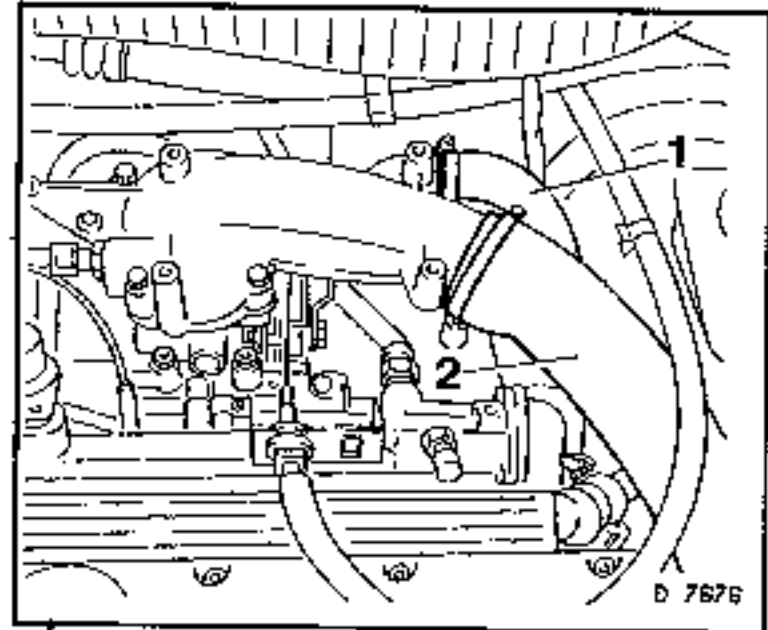
Wiring harness plug to fan motor.



Install, Connect

Air hose (1) to throttle valve manifold/

Air hose (2) to charge air cooler or to throttle valve manifold.



Install, Connect

Cover to throttle valve manifold

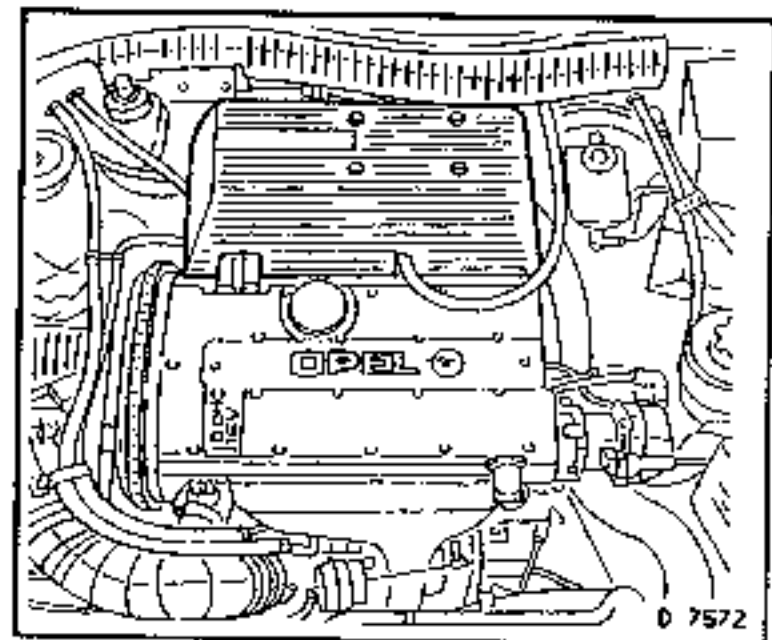
Tighten (Torque)

Cover to throttle valve manifold 5 Nm

Ground cable to battery.

Check engine oil level and adjust as necessary.

Top up and bleed cooling system. Refer to the Section, "Cooling System" in this Volume.



Cylinder Head, Disassemble & Assemble

Remove, Disconnect

Cylinder head. Refer to the previous operations in this Section.

High voltage distributor.

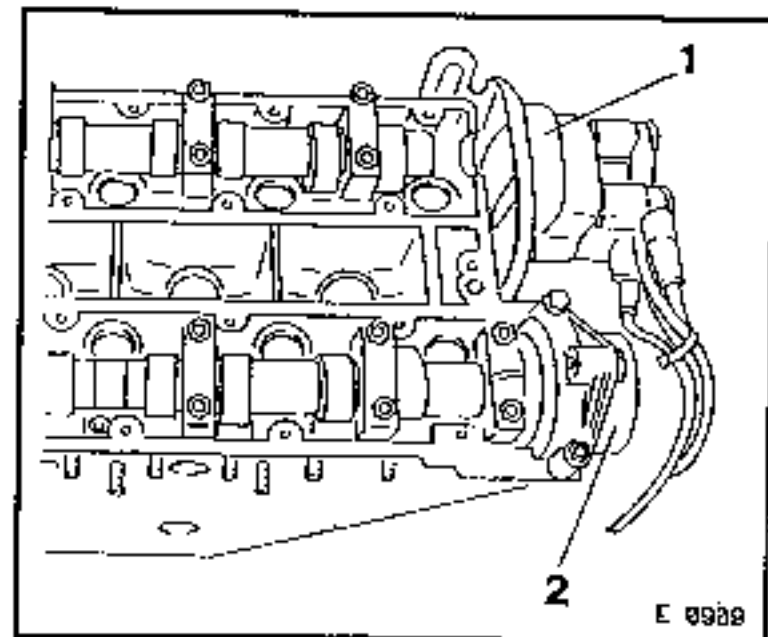
Intake manifold.

Thermostat housing.

Spark plugs, using KM-194-B.

C 20 XE Engine as of MY'93:

Dual spark ignition coil (1) and camshaft sensor (2).



DOHC ENGINE - CYLINDER HEAD

Remove, Disconnect

Camshaft bearing covers.

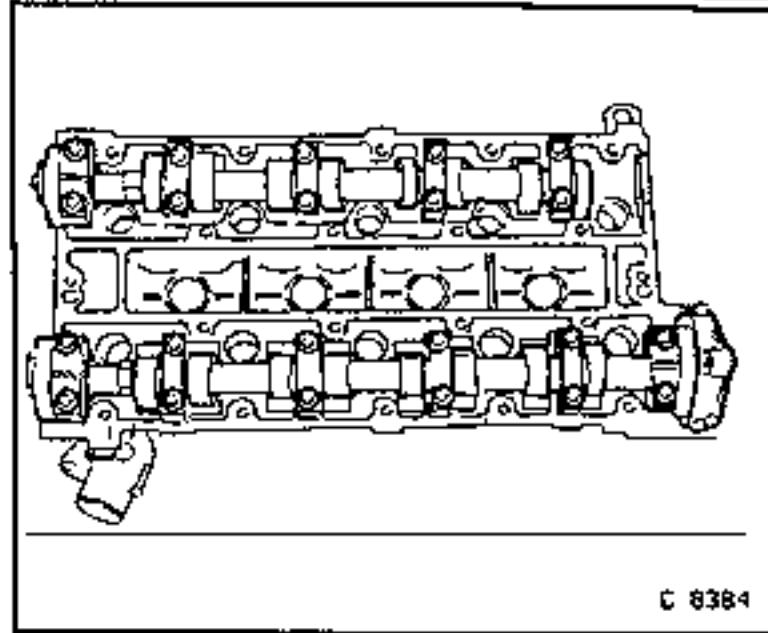
Progressively loosen nuts in stages of $\frac{1}{2}$ to 1 turn, working from the outside, inwards.

Note:

The numbered identification markings on each camshaft bearing cap.

Important!

Camshaft must come away evenly from the bearing seats and from the front guide bearing.



Remove, Disconnect

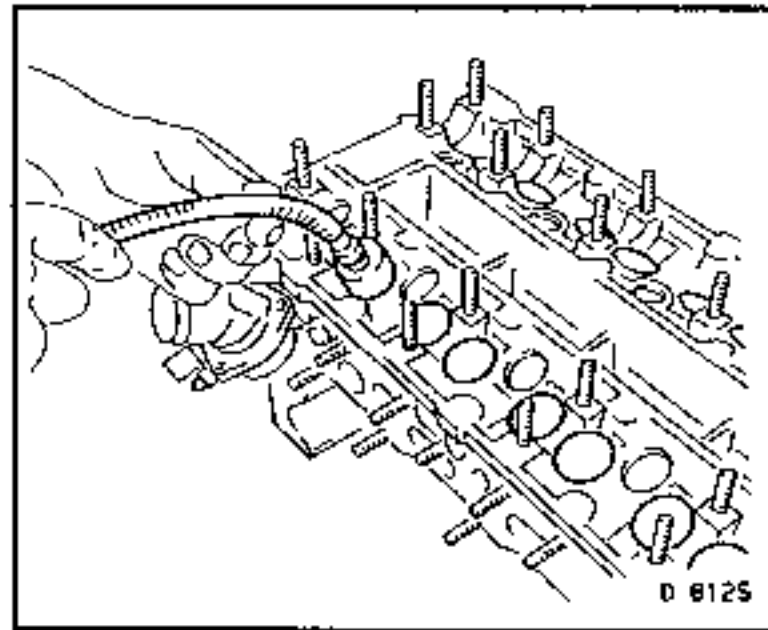
Hydraulic valve lifters using a suitable sized suction cup.

Important!

Store all lifters in the order of removal and in the same attitude (groove in the lower area).

Disassemble

There are no serviceable parts in the hydraulic valve lifters.



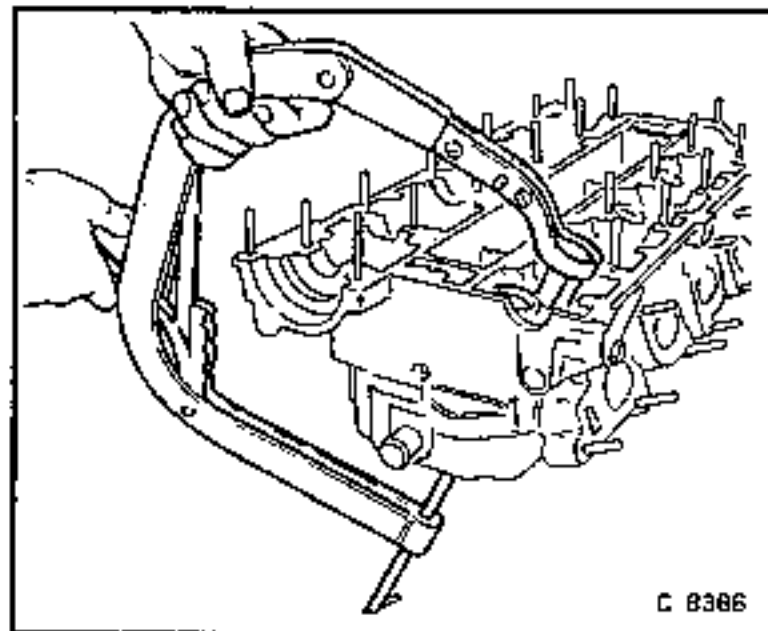
Remove, Disconnect

Valves;
Tension valve springs using KM-348 with adaptor KM-653.

Valve collets, valve spring plates and valve springs.

Important!

All valve train components should be kept in their order of removal.



Remove, Disconnect

Valve stem seals, as shown in illustration C 8387.

Valve spring washers.

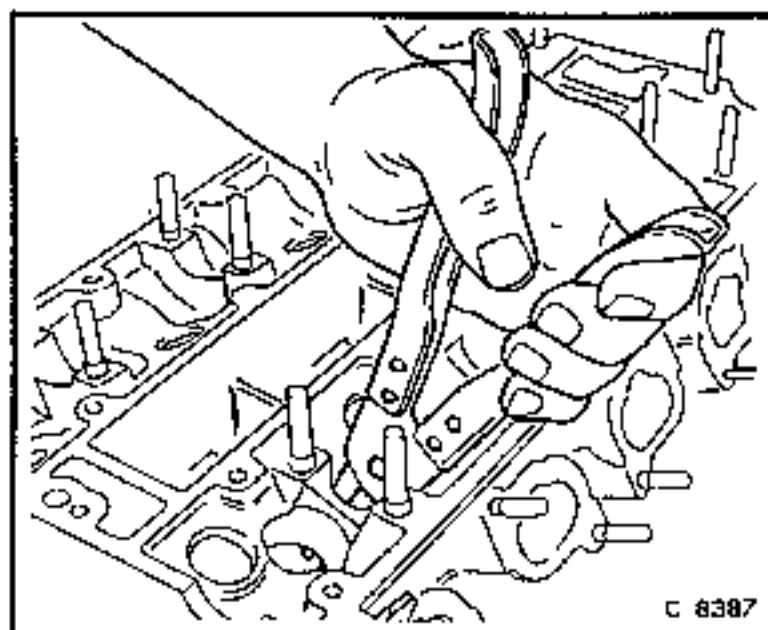
Valves.

Important!

All valve train components should be kept in their order of removal.

Important!

Sodium filled valves are not to be disposed of with 'normal scrap'. Local authority regulations and legal requirements must be observed when disposal is required.



DOHC ENGINE - CYLINDER HEAD

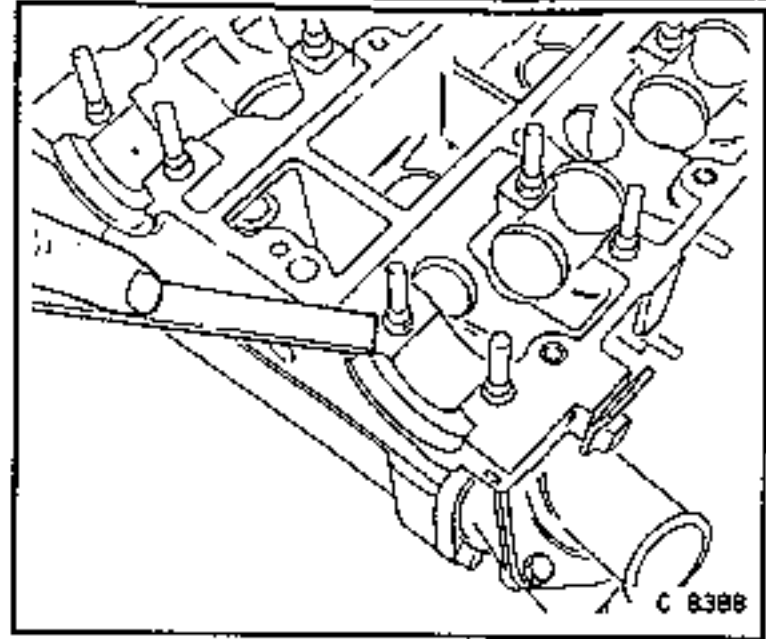
Clean, Inspect

All component sealing surfaces, guides, sliding and bearing surfaces.

Important!

Do not damage valve seats during the cleaning process.

Overhaul cylinder head. Refer to this operation later in this Section.



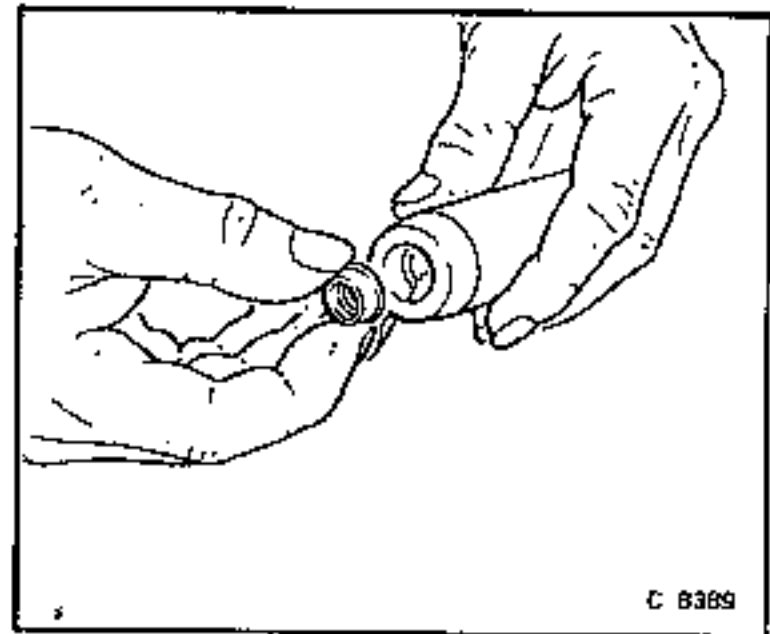
Important!

Insert valves using clean engine oil.

Insert valve spring washers.

Install, Connect

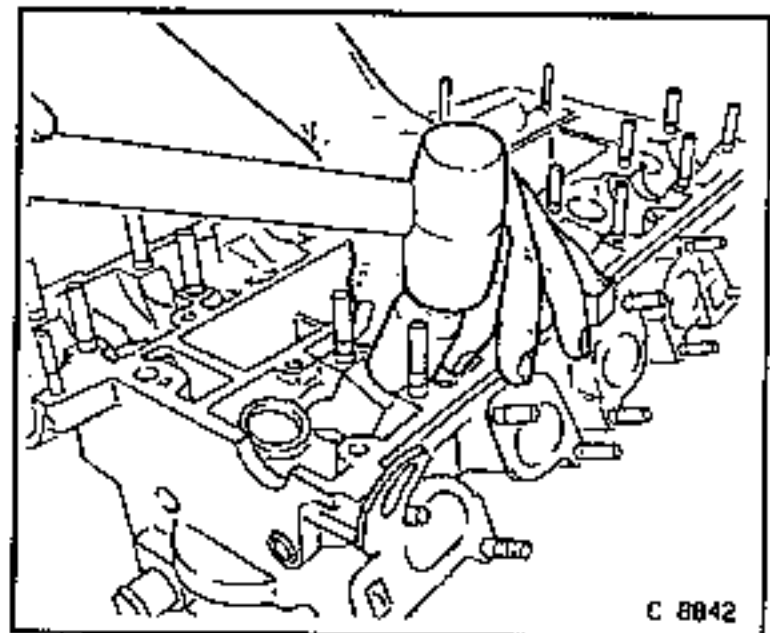
Lubricate installer KM-663 lightly with clean grease and install new valve stems.



Install, Connect

Cut mounting sleeve (contained in the packaging) to the required length and place on the valve stem.

Use installer KM-663 with the valve stem seal mounted on the guide and install by lightly tapping with a hammer, until the installer bottoms out.



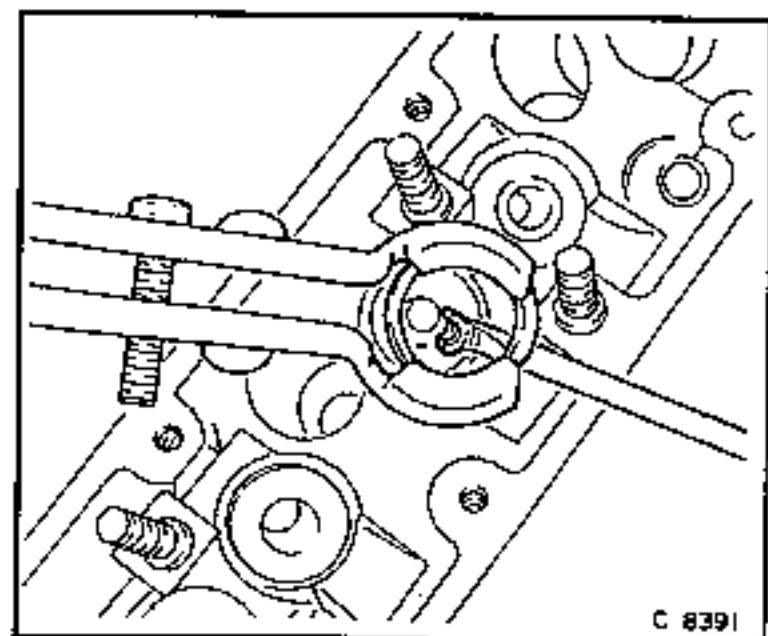
Install, Connect

Valve springs, valve spring plates and valve collets, using KM-34B and adaptor KM-653.

Hydraulic valve lifters.

Lubricate all sliding and rotating components with molybdenum disulphide (MoS_2) grease or spray.

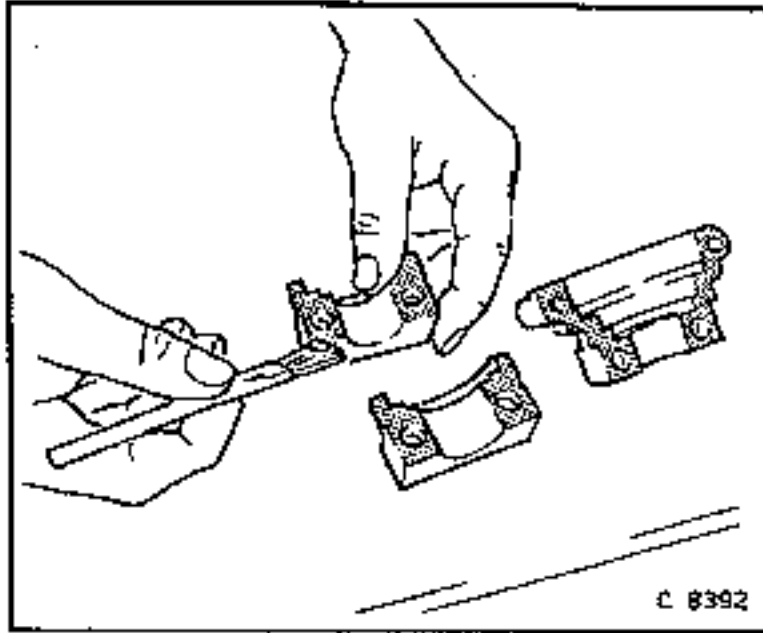
Insert both camshafts.



DOHC ENGINE - CYLINDER HEAD

Apply

Silicone sealing compound such as Dow Corning 732 or equivalent, to Holden's Specification HN1373, to the sealing surfaces of the outer camshaft bearing covers.

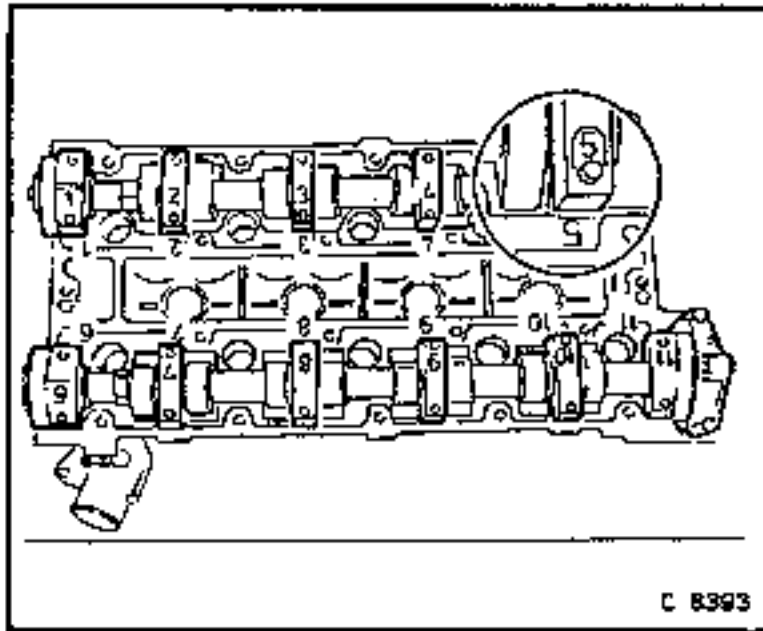


Install, Connect

Camshaft bearing covers.

Important!

Take care that the identification number on each cover, matches with the number on the cylinder head.

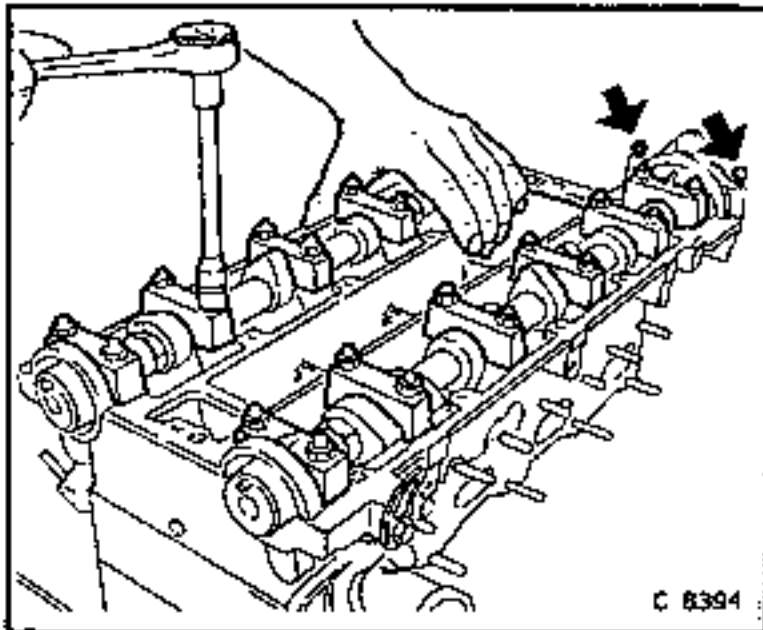


Tighten (Torque)

Camshaft bearing cover to cylinder head (M 8)	20 Nm
Rear camshaft bearing cover (arrows) to cylinder head (M 6)	10 Nm

Important!

Progressively tighten the camshaft covers $\frac{1}{2}$ to 1 turn at a time, working from the centre, outwards.

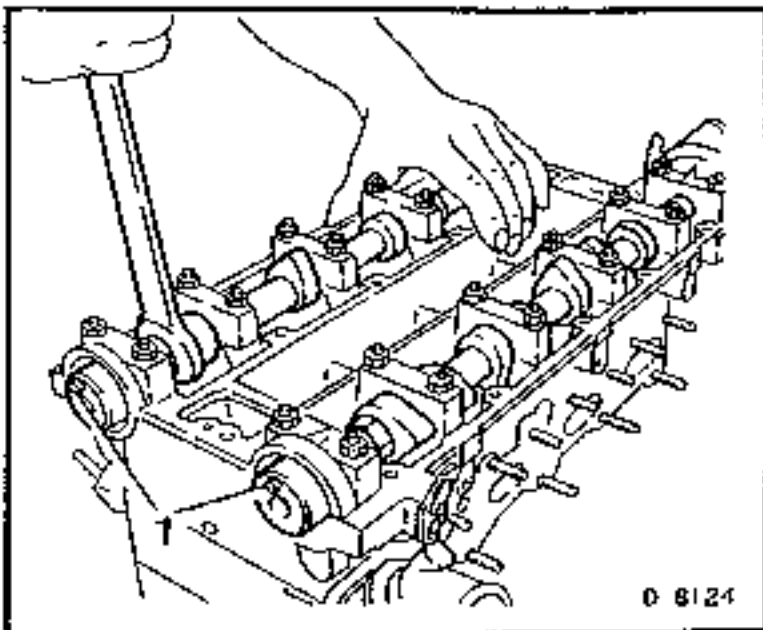


Install, Connect

New seal rings, using KM-422 and the washer and bolt from one of the camshaft gears.

Lubricate each seal lip with grease before installing.

Rotate each camshaft using an open ended spanner on the camshaft hex provided, until each guide pin (1), points upwards.



DOHC ENGINE - CYLINDER HEAD

Install, Connect

Using KM-194-B, install spark plugs.

Thermostat housing to cylinder head using a new 'O' ring.

Intake manifold to cylinder head, using a new gasket.

Tighten (Torque)

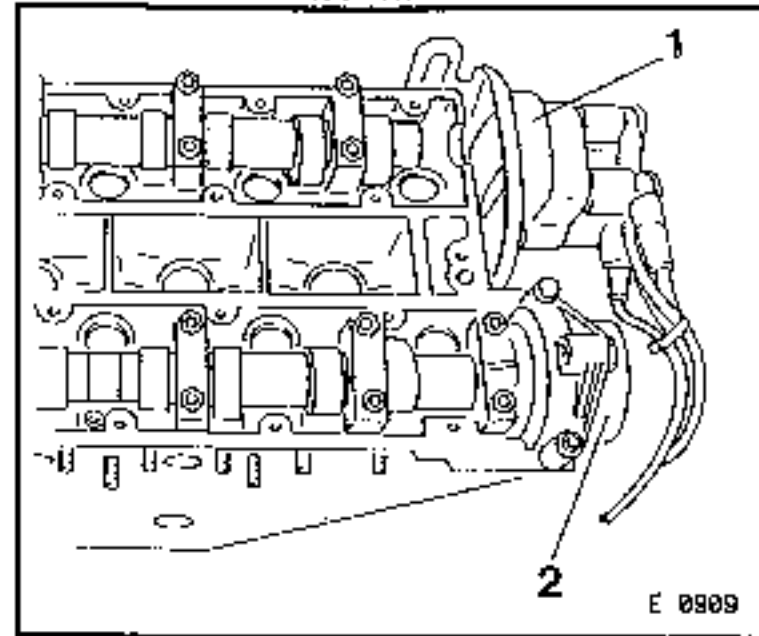
Spark plugs in cylinder head	25 Nm
Thermostat housing to cylinder head	15 Nm
Intake manifold to cylinder head	22 Nm

Cylinder head. Refer operation in this Section.

High voltage distributor. Refer to the appropriate Motronic Section in this Volume.

C 20 XE Engine as of MY'93:

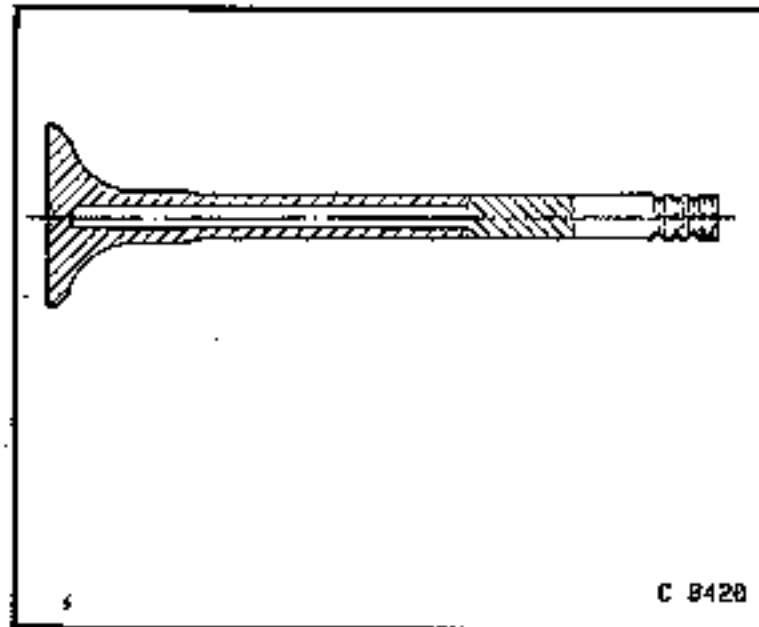
Dual spark ignition coil (1) and camshaft sensor (2). Refer to the appropriate Motronic Section in this Volume.



Exhaust Valve (Sodium filled), Disposal

Important!

Sodium filled valves are not be disposed of with 'normal scrap'. Local authority regulations and legal requirements must be observed when disposal is required.



Cylinder Head, Overhaul

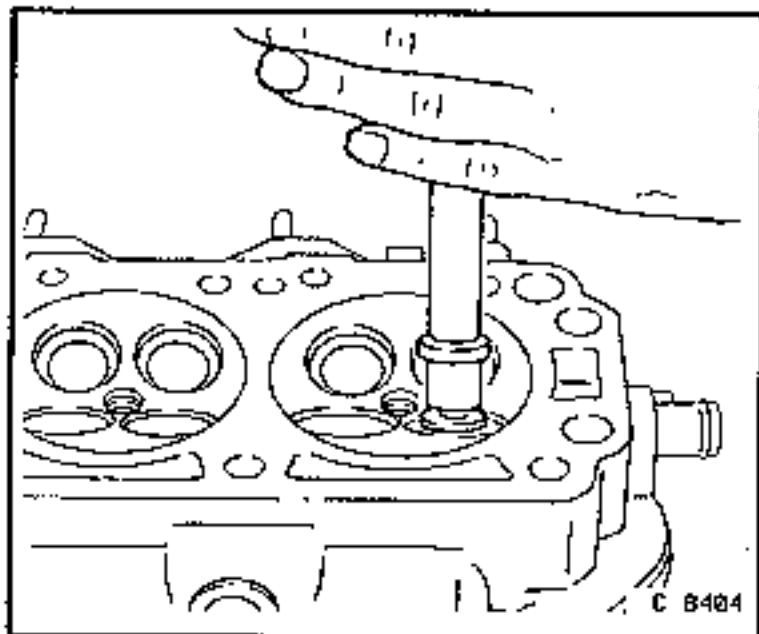
With cylinder head disassembled, as detailed in this Section.

Valve, Lap In

Lightly oil the valve stem, then use fine grade lapping paste applied to the valve seat area. Using a lifting/rotating action in a rhythmical manner, distribute the valve lapping paste.

Clean

Valves and cylinder head from all traces of valve lapping paste.



Valve, Regrind

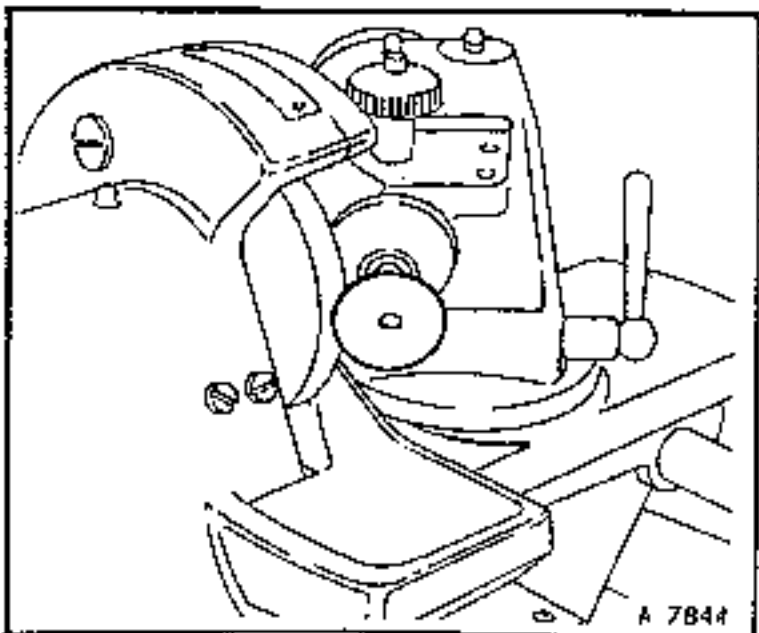
Important!

Should inspection show that either burning or pitting has occurred on the valve seat area, then the valve may be reground no more than twice.

The angle for valve grinding is 45° 20'.

Inspect

Temporarily install valves and measure the stem height above the valve guide. Refer to "Technical Data" at the end of this Volume for specifications.



DOHC ENGINE - CYLINDER HEAD

Valve, Guide, Measure

Measure

Diameter of each valve guide, using a dial indicator and an internal measuring instrument.

Important!

Oversize valve stems may have been fitted in production.

Inspect

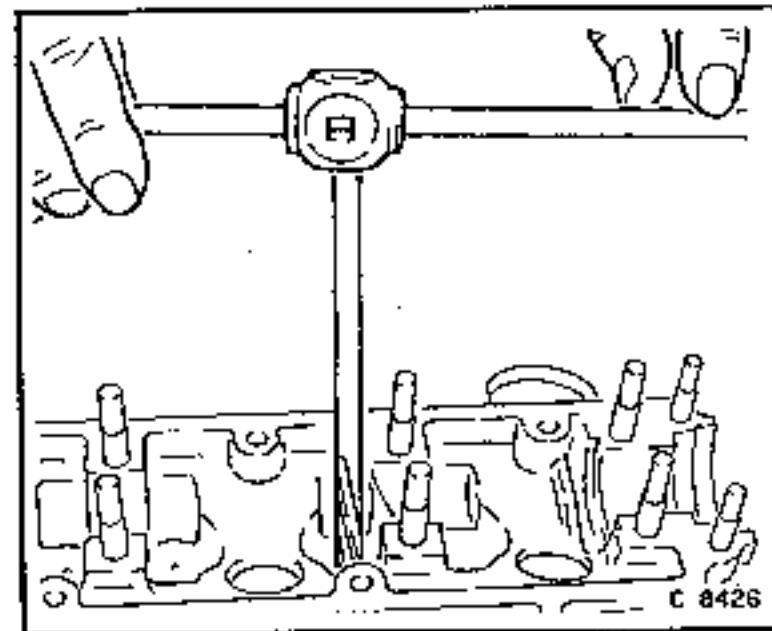
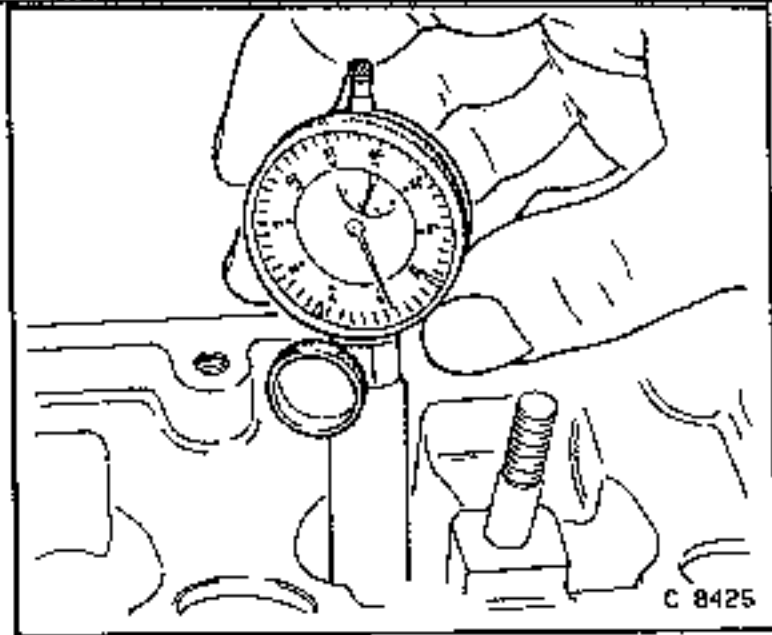
Valves with oversize stems can be identified by markings on the valve guide and the stem end, with the following markings:

Oversize (mm)	Reamer Number	Identification Mark	
		Production	Service
Standard	—	None	K
0.075	KM-664-1	1	K 1
0.150	KM-664-2	2	K 2

Ream

The valve guide, using the next oversize reamer, working from the upper surface of the cylinder head, as shown.

When valve guides have been reamed oversize, remove the original markings and stamp in a new, identification.



Valve Seat, Recondition

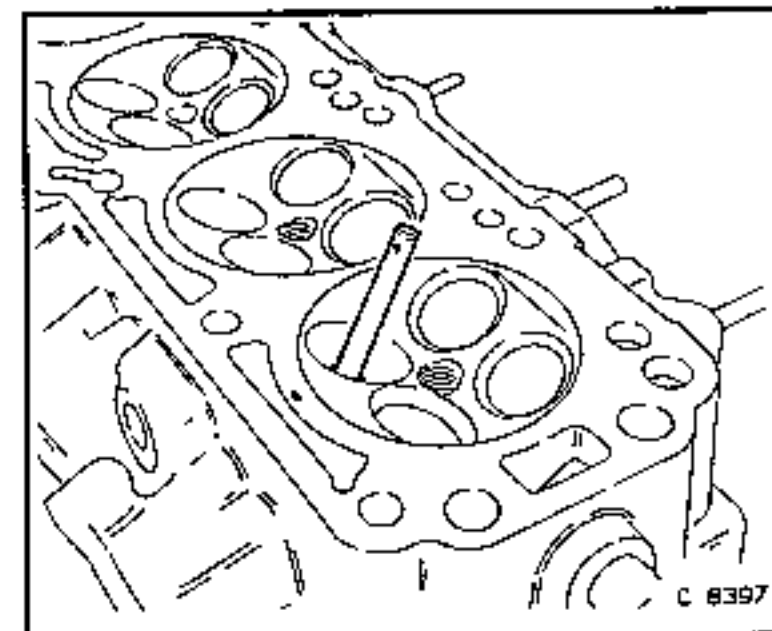
Support cylinder head on a suitable block of wood.

Important!

Valve seat cutting depth is limited to 0.4 mm.

Install, Connect

Guide drift KM-340-7.



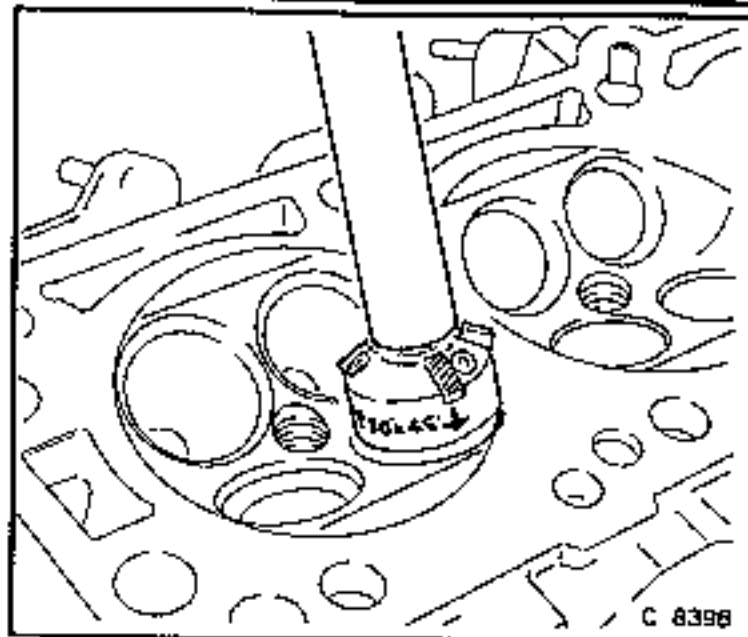
DOHC ENGINE - CYLINDER HEAD

Install, Connect

Valve seat cutter KM-340-12, then recondition valve seat, using the 45° side. Note that the upper side is the corrective 30° cutter.

Important!

Take particular note of the directional arrows on the cutter.



Install, Connect

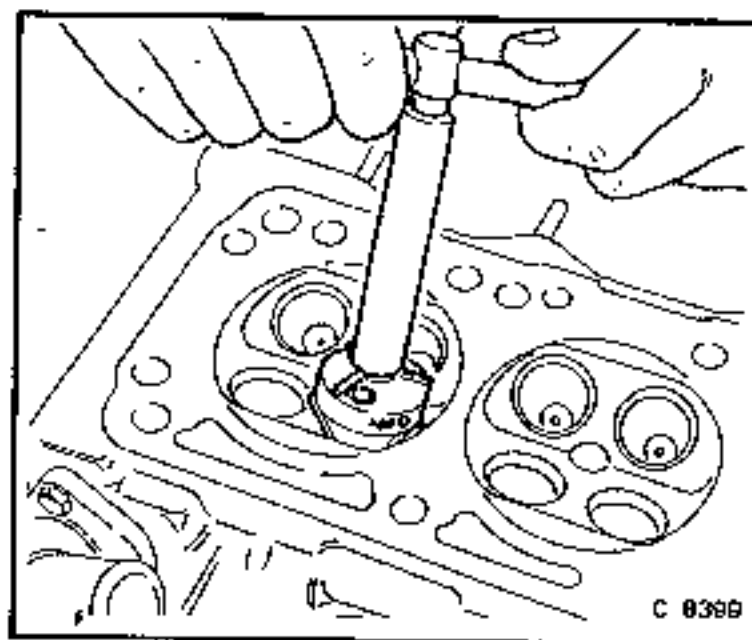
Valve seat cutter KM-340-26, then recondition valve seat. Note that the upper side is the corrective 60° cutter.

Clean

All shavings from the cylinder head and valve ports.

Important!

Once assembled, the valve stem heights must not exceed those stated in "Technical Data" at the end of this Volume.



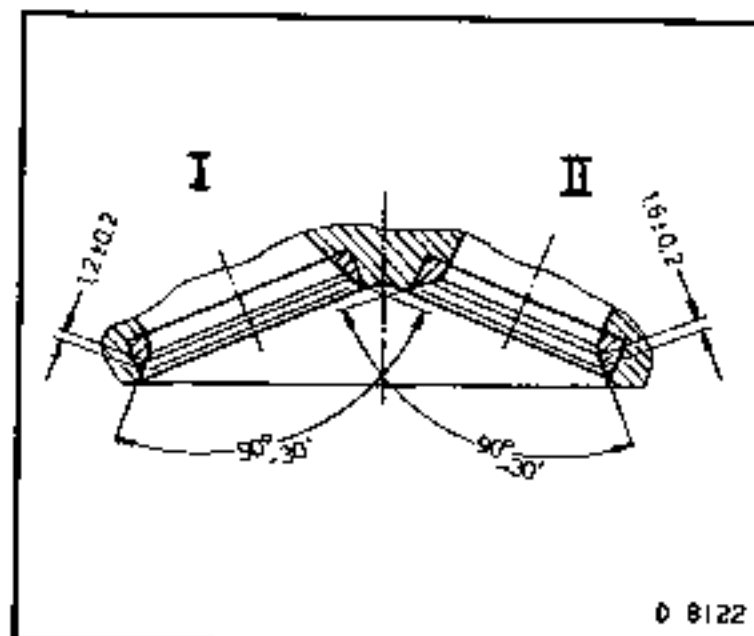
Inspect

Valve seat widths;

Intake (I)	1.2 ± 0.2 mm
Exhaust (II)	1.6 ± 0.2 mm

If required, the seats and valves may need further reconditioning.

With the valves installed, check for leakage by pouring petrol in the combustion chambers.



Cylinder Head Sealing Surface, Check for Plane Surface

Clean

All cylinder head machined surfaces.

Inspect

Cylinder head both in the length and width for distortion and warpage, using a straight edge and a feeler gauge.

Maximum specification variation 0.05 mm

Important!

If grinding is required, it is only possible within the given tolerance of;

Total height of cylinder head..... 135.58 - 135.68 mm

(Sealing surface to sealing surface).

DOHC ENGINE - CYLINDER HEAD

RECOMMENDED TORQUE VALUES

(Cylinder Head)

	Nm
Alternator clamping bracket to intake manifold.....	25
Brake servo vacuum line to intake manifold.....	20
Camshaft bearing cover (rear) to cylinder head (M 6).....	10
Camshaft bearing cover to cylinder head (M 8).....	20
Camshaft pulley to camshaft.....	50 + 60°, then 15° (3)
Cover plate to cylinder head (bolts M 6).....	9
Cover to throttle valve manifold.....	5 (1)
Cylinder head cover to cylinder head.....	8
Cylinder head to cylinder block.....	25 + 90° + 90° + 90° (3)(4)
Fastening bolt to bracket.....	20
Fastening bolts to exhaust joint.....	12 (2)
Front toothed belt cover to cylinder head, intermediate piece and oil pump....	8
Ignition cable cover to cylinder head cover.....	8
Intake manifold to cylinder head.....	22
Intake manifold to cylinder block support.....	25
Lower alternator fastening.....	35 (5)
Performance header with cover plate to cylinder head.....	22 (2)
Rear toothed belt cover to cylinder head.....	6
Shackle to intake manifold and alternator.....	18
Spark plug with threaded bushing to cylinder head.....	25
Support to intake manifold and alternator.....	18
Support to intake manifold and cylinder block.....	25
Thermostat housing to cylinder head.....	15

(1) C 20 LET only.

(2) Use new nuts.

(3) Use new bolt/s.

(4) No re-tightening required.

(5) Engines as of MY '93.

GROUPS K, L, M, N, R, S

**CLUTCH AND TRANSMISSION,
FUEL AND EXHAUST SYSTEMS
STEERING**

**ELECTRICAL EQUIPMENT & INSTRUMENTS,
OPTIONAL EQUIPMENT & ACCESSORIES
CIRCUIT DIAGRAMS**

GENERAL INFORMATION

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Vehicle Identification.....	GI - 2
Lubricants, Sealants and Locking Compounds.....	GI - 4
Safety Measures	GI - 4

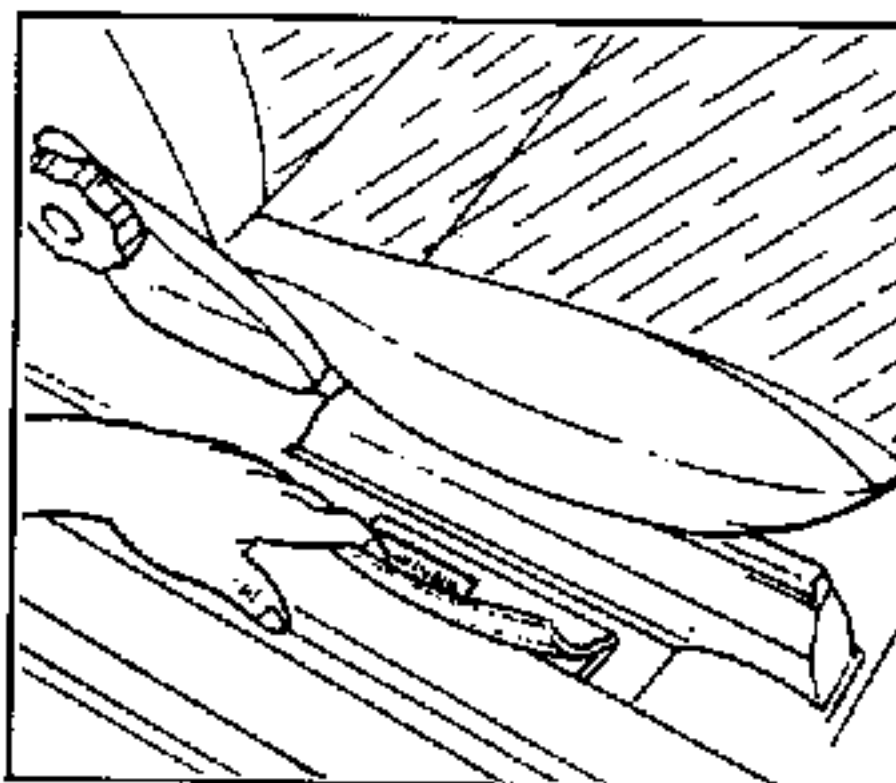
GENERAL INFORMATION

VEHICLE IDENTIFICATION

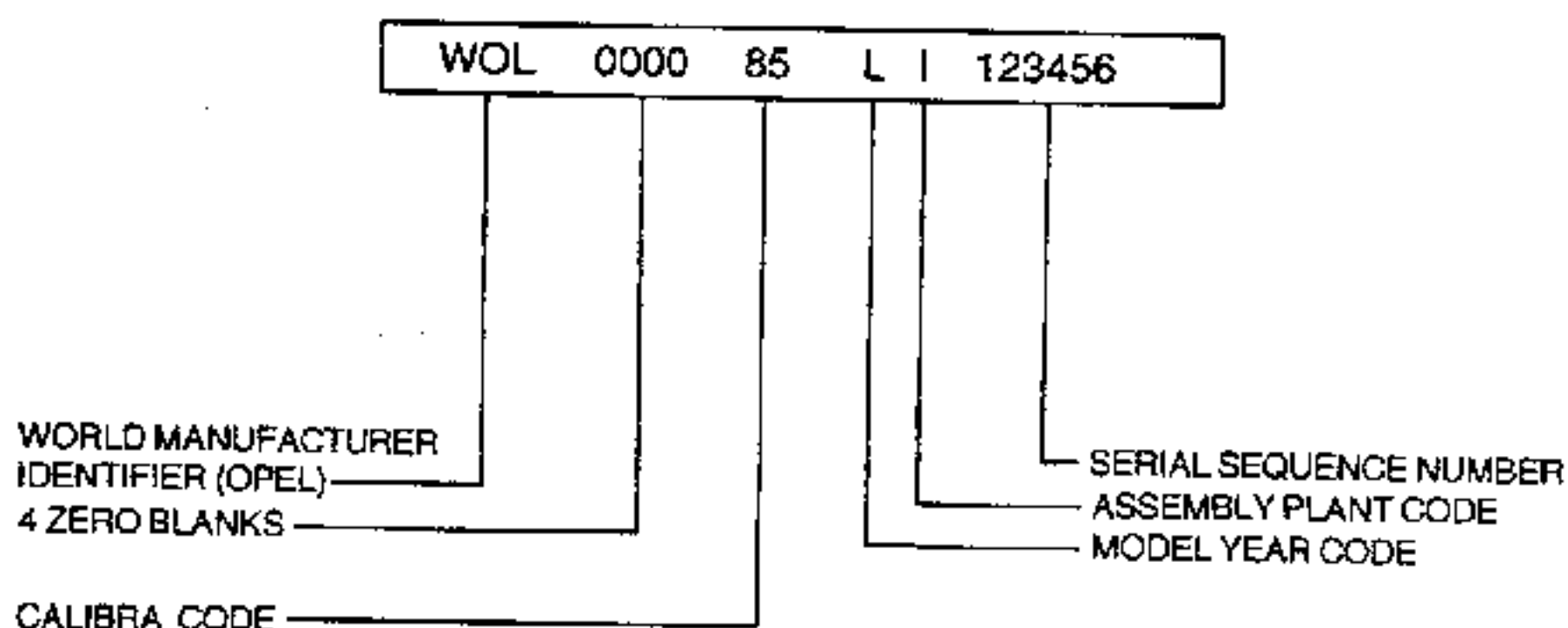
From time to time in this Volume, reference will be made to a particular 'Model Year' (MY), when discussing various changes that have taken place since the introduction of the Calibra vehicle into the Australian market. As the 'Model Year' refers to the time that the vehicle was produced, this may not necessarily be the year in which the vehicle was first registered. The most accurate means of determining the Model Year of a particular vehicle, is to study the Vehicle Identification Number (V.I.N.).

VEHICLE IDENTIFICATION NUMBER

The vehicle identification number is stamped into the body, next to the right hand front seat. To access this number, the carpet has been cut to form a flap.



A breakdown of the Calibra V.I.N. numbering system follows;



As shown, the Model Year of any particular Calibra vehicle can be positively identified from the letter following the model '85' identification. For example, a Model Code of 'M' would indicate that the vehicle was a MY'91 vehicle, whereas a code letter of 'O' would indicate a MY'93, and so on. The Model Year, changes on September 1 each year. Sometimes reference will also be made to 'half year' models (e.g. MY 92½), in this Volume. If so, this would mean that a vehicle was produced after March 1 of that particular year. Therefore a MY'92½ would be a vehicle produced between March 1 and September 1 of 1992.

POWER TRAIN COMBINATIONS

Model Availability		Engine		Transmission		Axle Ratio	
Code	Description	Description		Type	Description	Front	Rear
8YE77 Model '85'	Calibra	C 20 NE	2.0 litre, L4, PFI SOHC	AF 20	4 Speed Automatic	2.40:1	NA
	Hatchback	C 20 XE	2.0 litre, L4, PFI DOHC	F 20	5 speed Manual	3.55:1	NA
	Coupe	C 20 LET	2.0 litre, L4, PFI DOHC - Turbocharged	F 28/6	6 speed Manual	3.72:1	3.70:1

GENERAL INFORMATION

TRANSMISSION RATIOS

Gear Ratio Selection	Transmission		
	AF 20 - 4 speed Automatic - Electronic Control	F 20 - 5 speed Manual Transaxle	F 28/6 - 6 Speed Manual Transaxle with Fixed 4WD
1st Gear	3.672	3.55	3.57
2nd	2.098	2.16	2.13
3rd	1.391	1.48	1.46
4th	1.000	1.13	1.10
5th	—	0.89	0.89
6th	—	—	0.74
Reverse	4.022	3.33	3.32

TRANSMISSION IDENTIFICATION NUMBERS

Manual Transmission - DOHC Engines

F 20 FIVE SPEED TRANSMISSION

The transmission designation of **F 20** (for C 20 XE engined vehicles), is an embossed "F 20" on the upper face of the transmission housing, adjacent to the shift housing.

The serial number is stamped on the transmission end shield cover.

In the example; "A 126 1 2 C 372 xxxx";

- A (1) = Manufacturing plant
- 126 (2) = Day of the year
- 1 (3) = Last digit of the year
- 2 (4) = Work shift (1 is early, 2 is late shift)
- C (6) = Transmission code for short ratio
- 373 (7) = Axle ratio
- xx (5) = Space for numbers or letters for special purposes.

The identification can also consist of two lines.

F 28/6 SIX SPEED TRANSMISSION

For the **F 28/6** transmission fitted to C 20 LET engined vehicles, the transmission identification plate is attached to the horizontal surface, below the clutch release lever.

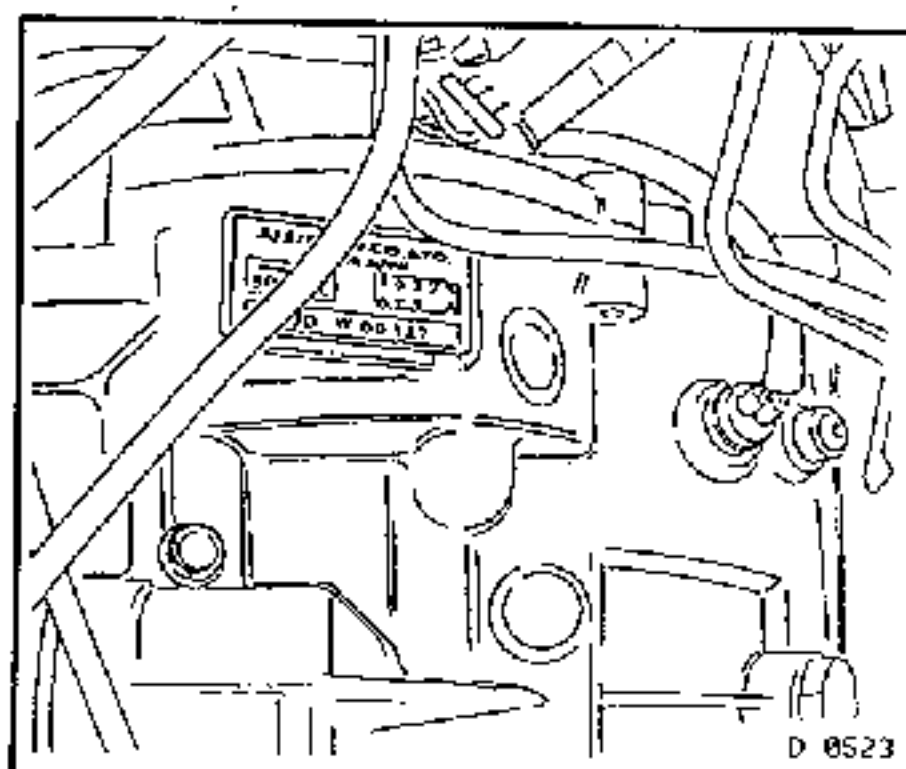
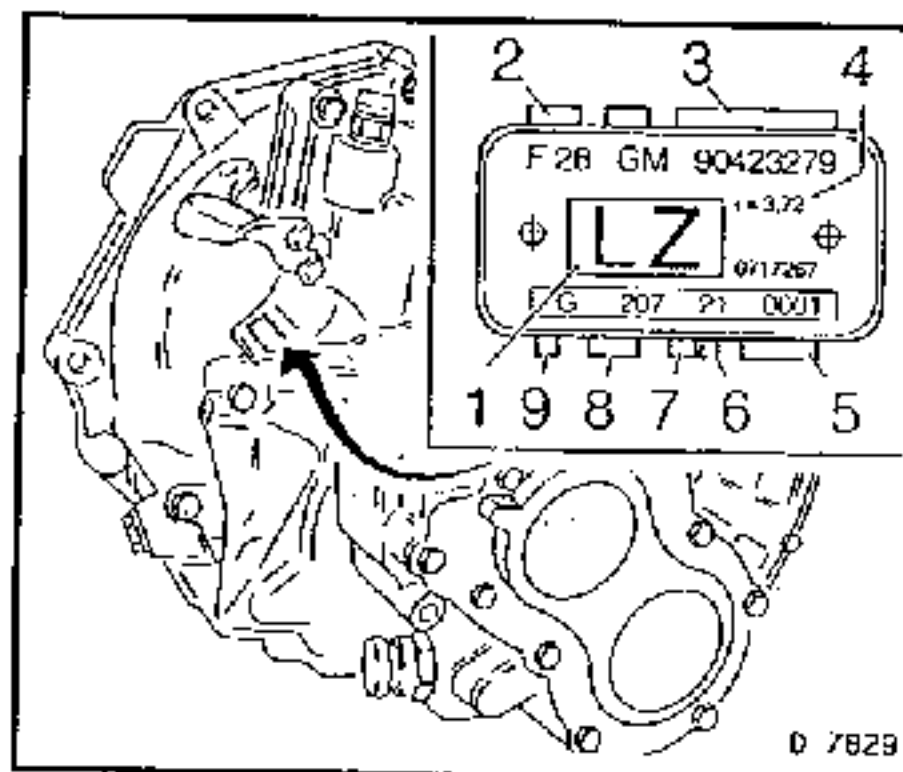
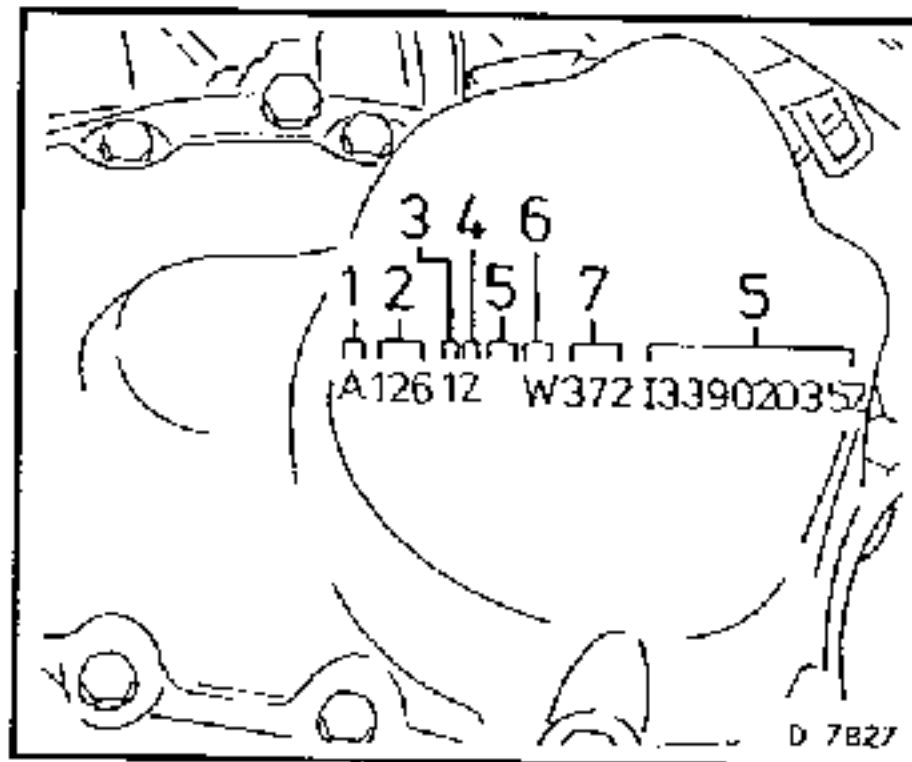
Information on this identification plate, is as shown.

- 1 = Identification code
- 2 = Transmission type
- 3 = Part number
- 4 = Axle ratio
- 5 = Serial number
- 6 = Work shift (1 is early, 2 is late shift)
- 7 = Last digit of the year
- 8 = Day in the year
- 9 = Manufacturing works; e.g. G = Getrag

AF 20 AUTOMATIC TRANSMISSION

The four speed version of this transmission is fitted to the C 20 NE SOHC engine.

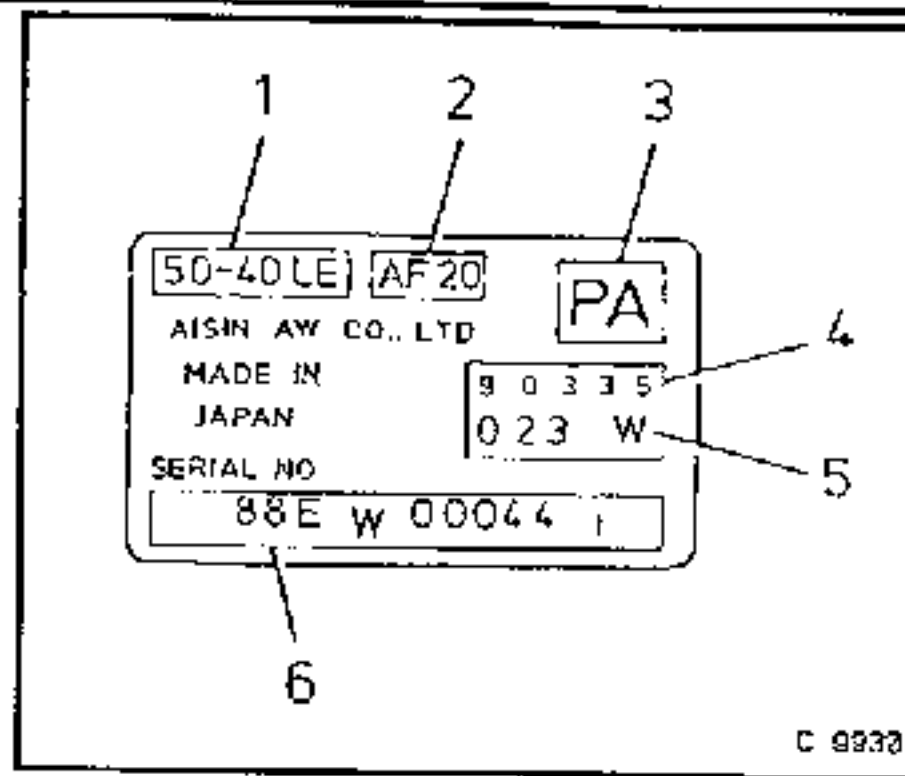
The identification plate is located on the top of the transmission, visible when the engine bonnet is opened.



GENERAL INFORMATION

Explanation of the identification marks are;

- 1 = AW transmission type
- 2 = Opel transmission type
- 3 = Model code
- 4 = Opel parts number
- 5 = Calibration code
- 6 = Series number



LUBRICANTS, SEALANTS AND LOCKING COMPOUNDS

Various lubricants, sealants and locking compounds are called up in the service operations described in this publication. Wherever possible, a local source has been nominated and where applicable, Holden's Specification numbers have also been quoted, to assist Technicians' in locating and using the recommended product in a particular operation.

SAFETY MEASURES

It is expressly recommended that the warnings and cautionary measures outlined in this Publication be carefully read and observed, to limit the possibility of injury to workshop personnel - because of unprofessional conduct - or damage to the vehicle and the possibility of jeopardising safety.

- ★ This vehicle may be equipped with an Air Bag (or SRS - Supplemental Restraint System). Refer to AIR BAG SAFETY REGULATIONS in Volume 1, Section G of the YE Calibra Service Instructions before performing any service operations on or around Air Bag components, the steering mechanism or wiring.
Failure to follow the Safety Regulations could result in Air Bag deployment, resulting in possible injury or unnecessary Air Bag system repairs.
- ★ During operations where there is a risk of an electrical short circuit, disconnect the ground cable from the battery. This also applies when the vehicle is being electrically welded. Disconnecting the ground automatically deletes the memory contents of electronic systems. When the battery is reconnected, the Board Computer must be reprogrammed as necessary. Since the radio is coded and radio stations programmed, the customer must be informed about decoding and the deleted station memory.
- ★ At temperatures above 80° C (e.g. drying oven), remove all electronic control units closest to the heat source.
- ★ Never disconnect or reconnect wiring harness plugs from/to electronic control units or trigger boxes with the ignition switched on.
- ★ Disconnect battery from vehicle electrical system before charging or quick charging.
- ★ Never use a quick charger for starting.
- ★ Use extreme caution when touching high voltage-parts of the ignition system.
- ★ During operations on the fuel system, thoroughly clean the connection points and the immediate vicinity.
- ★ If repairs cannot be carried out immediately, plug opened components or mask them off carefully.
- ★ During operations in the engine compartment, note that the engine cooling fan can switch on automatically with the attendant risks of injury.

GROUP K

CLUTCH & TRANSMISSION

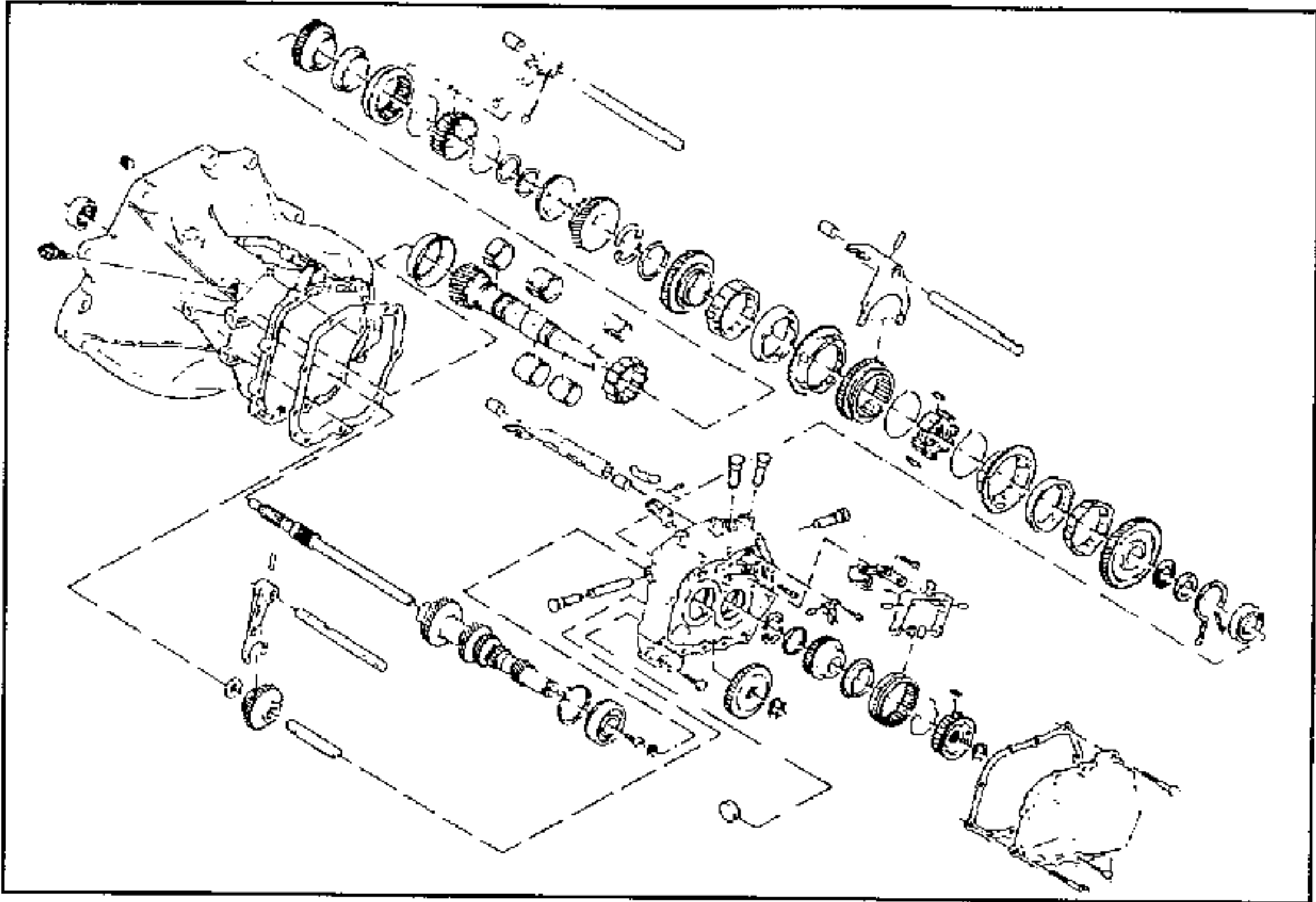
MANUAL TRANSMISSION AND CLUTCH

TABLE OF CONTENTS

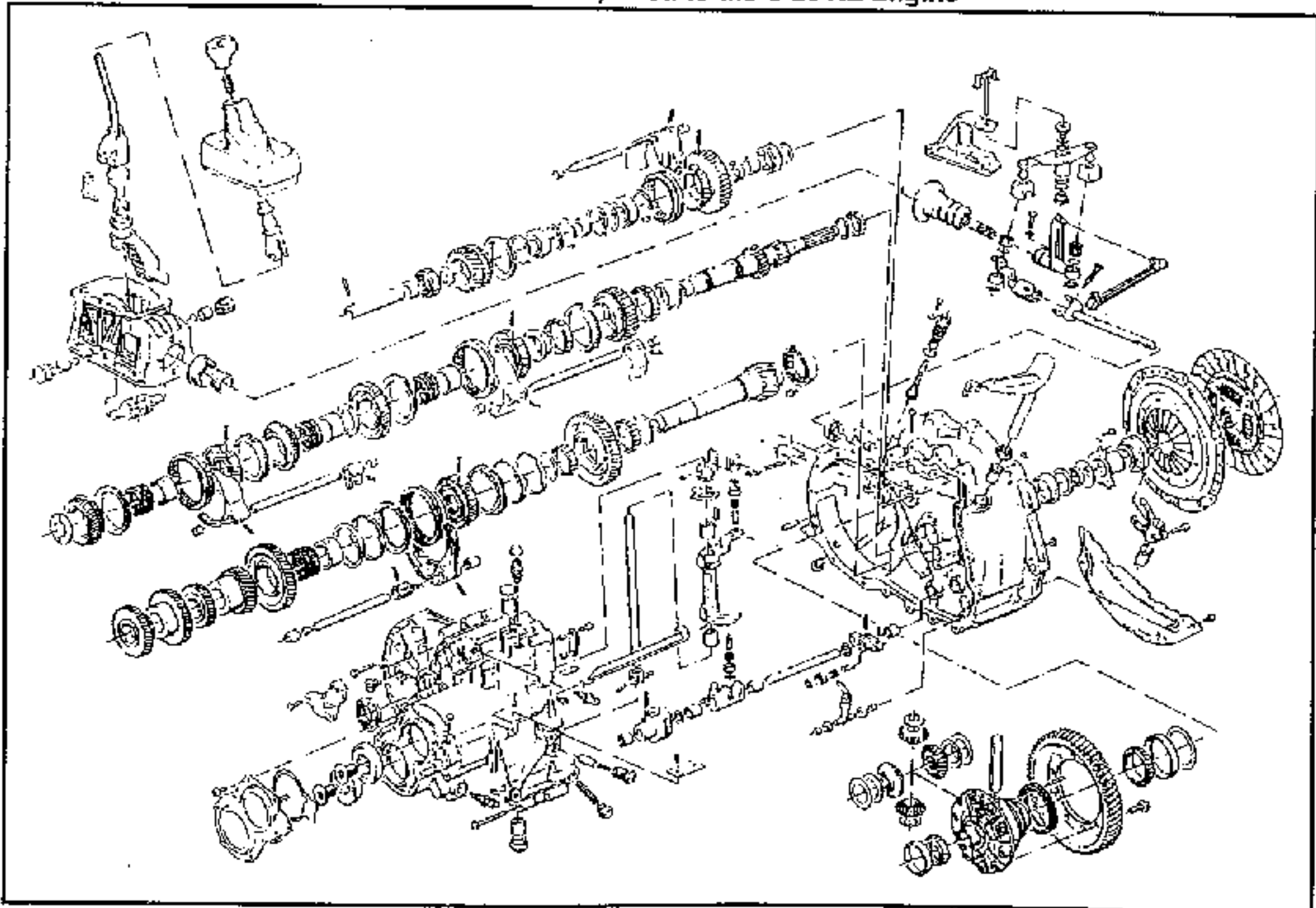
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MANUAL TRANSMISSION & CLUTCH

TRANSMISSION AND CLUTCH ARRANGEMENT ILLUSTRATIONS

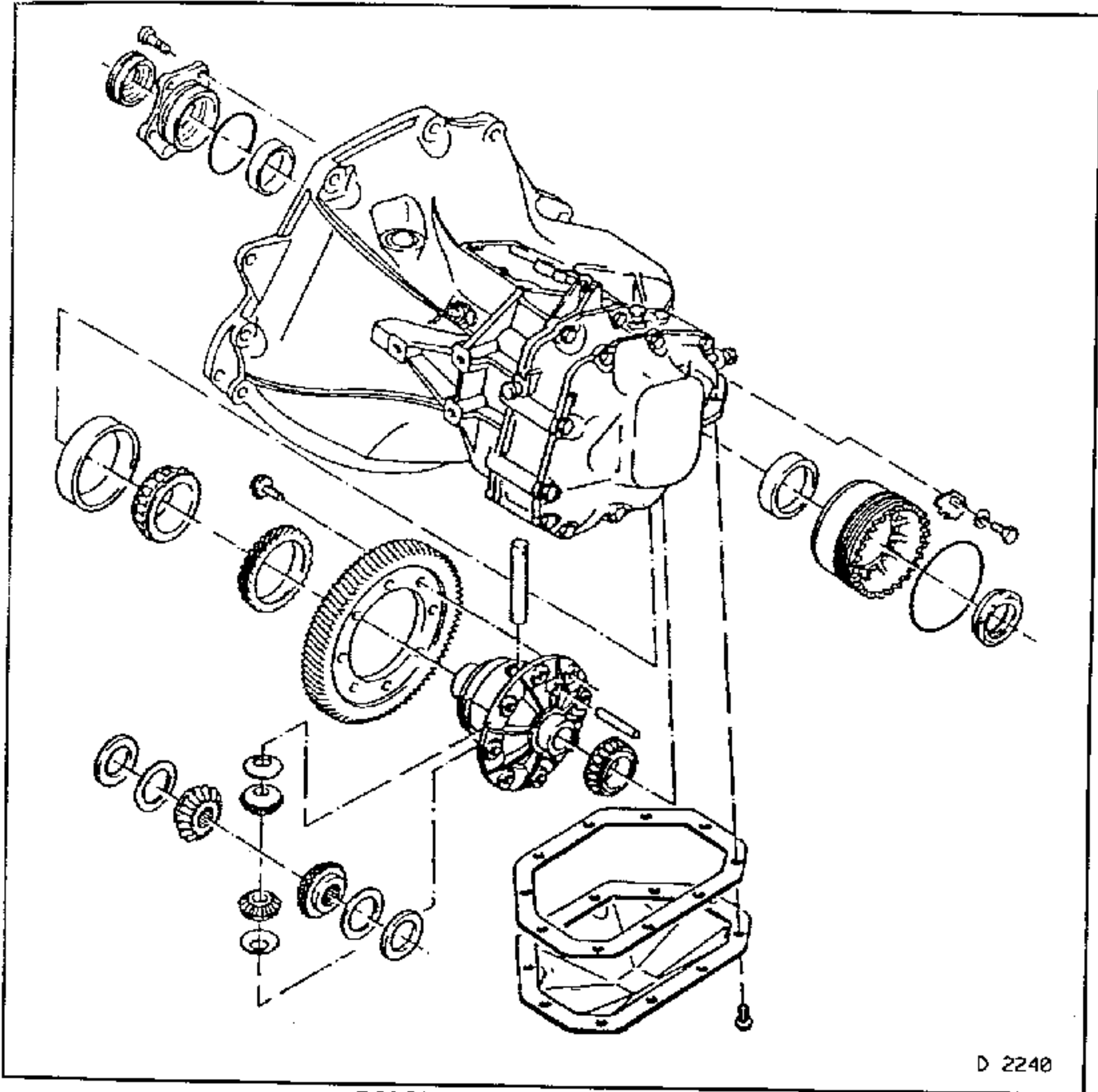


F 20 Transmission, fitted to the C 20 XE Engine



F 28/6 Transmission fitted to the C 20 LET Engine

MANUAL TRANSMISSION & CLUTCH

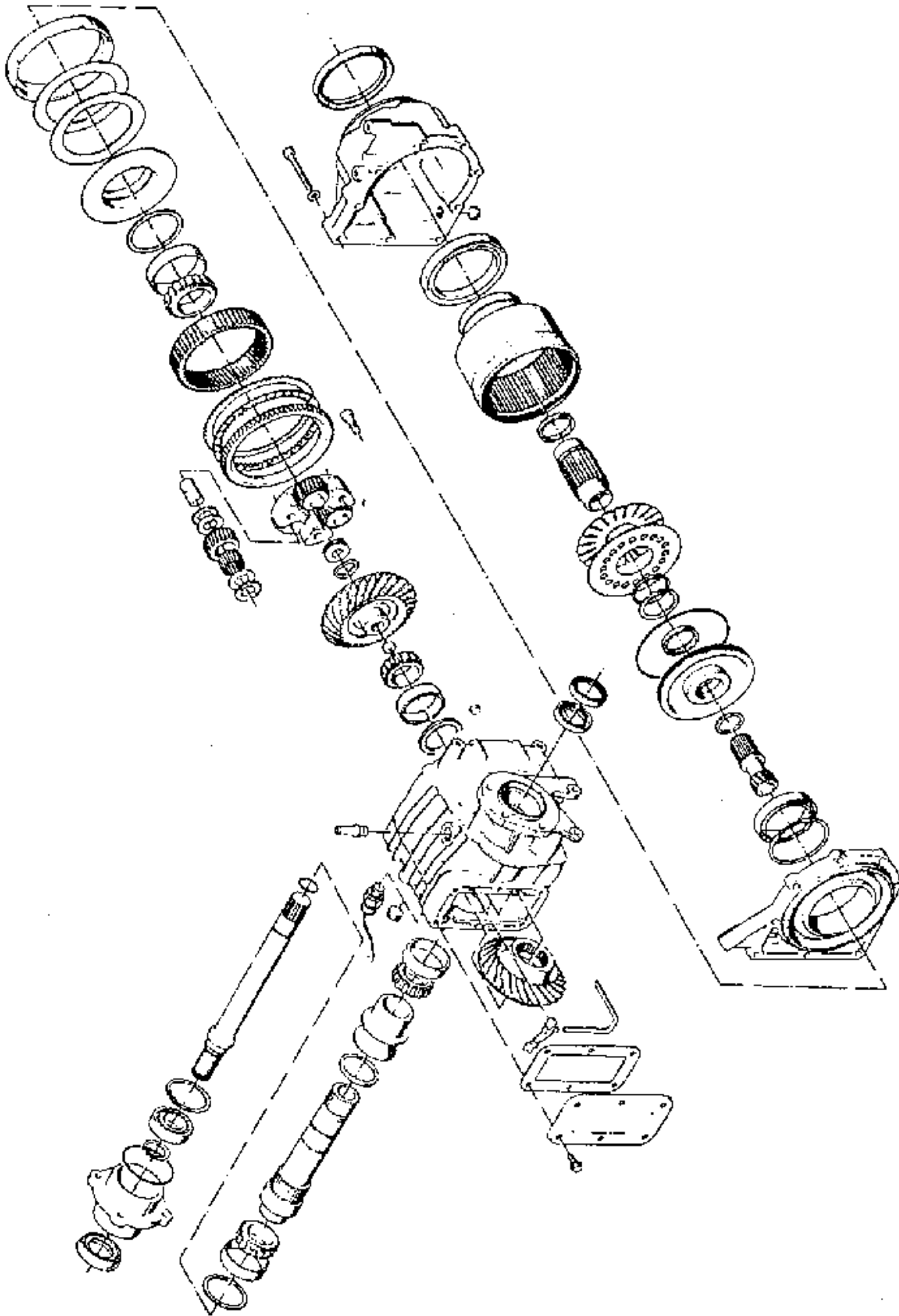


D 2240

F 20 Differential, Front Wheel Drive

MANUAL TRANSMISSION & CLUTCH

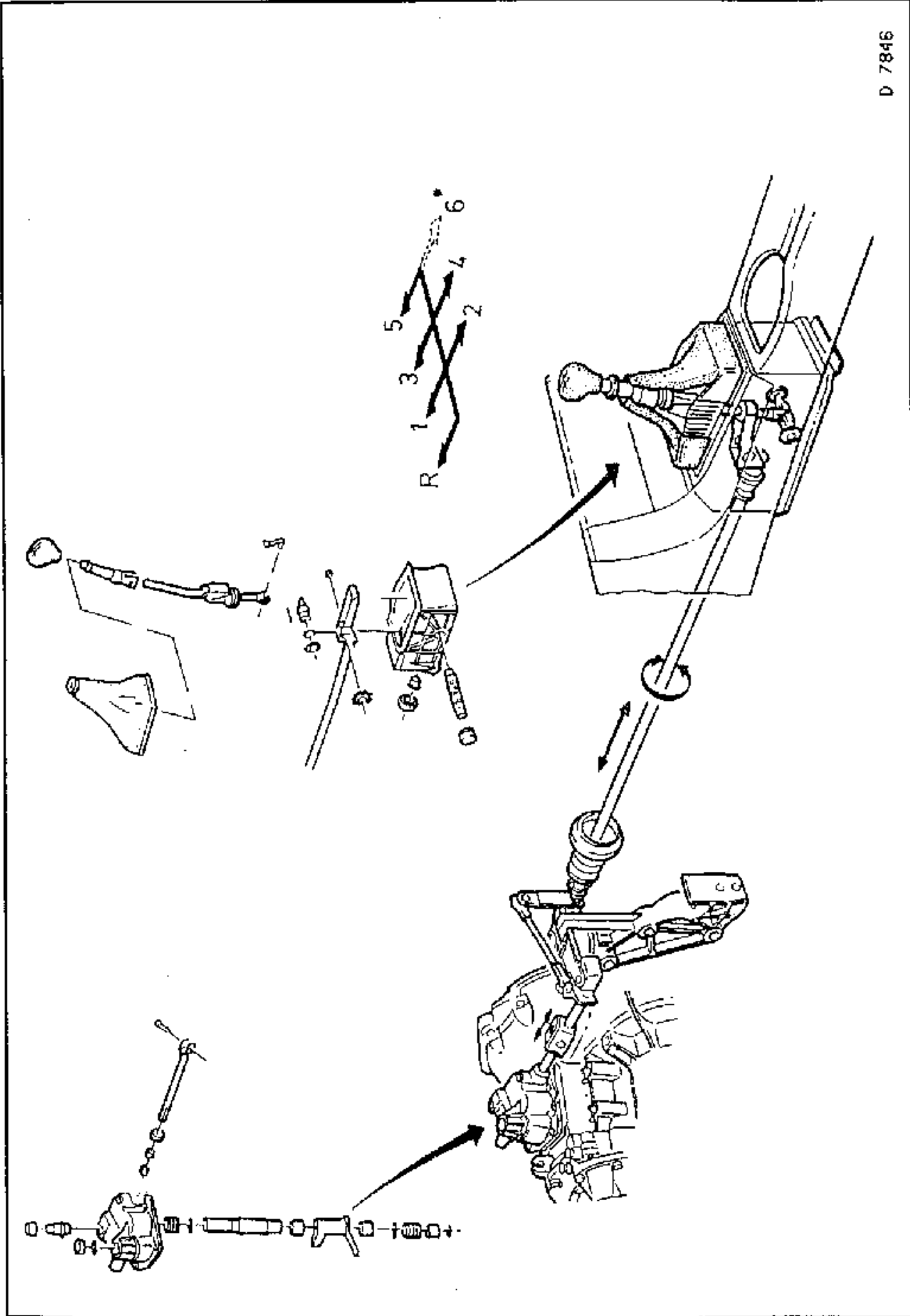
D 7268



Transfer Box (Four Wheel Drive)

MANUAL TRANSMISSION & CLUTCH

D 7846

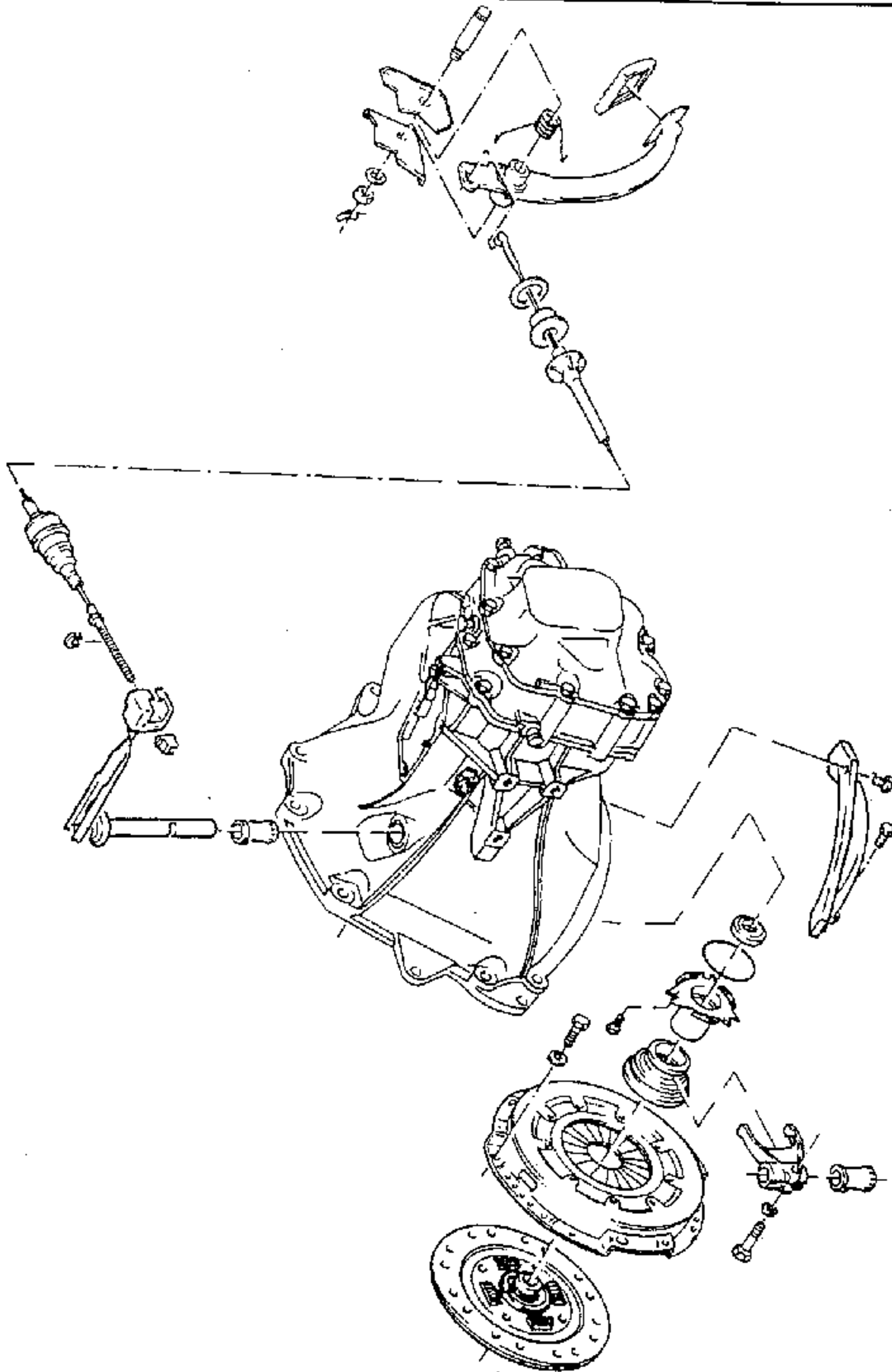


Transmission Shift Linkage

* 6th gear for the F 28/6 Transmission

MANUAL TRANSMISSION & CLUTCH

D 7848



Clutch Assembly - F 20 Transmission

GROUP K

MANUAL TRANSMISSION & CLUTCH

MINOR SERVICING OPERATIONS

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MINOR SERVICING OPERATIONS

CHECKING & ADJUSTING OPERATIONS

Transmission Fluid Level, Check

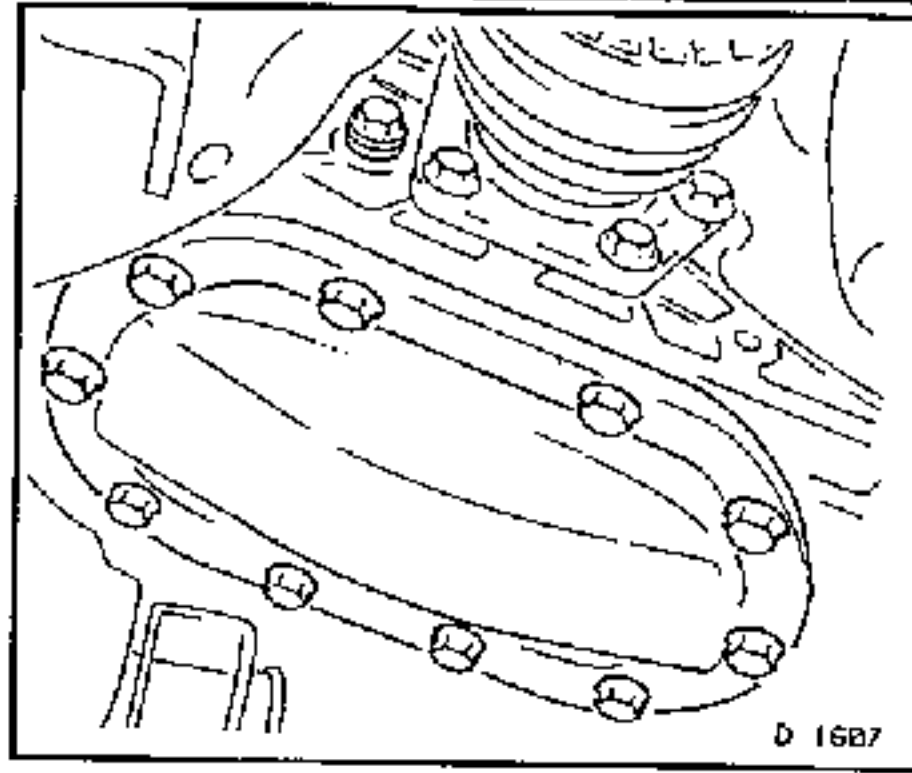
Remove, Disconnect

Lower engine compartment cover.

Fluid check bolt.

F 20: Checking aperture, rear right.

F 28/6 Checking aperture, rear left.

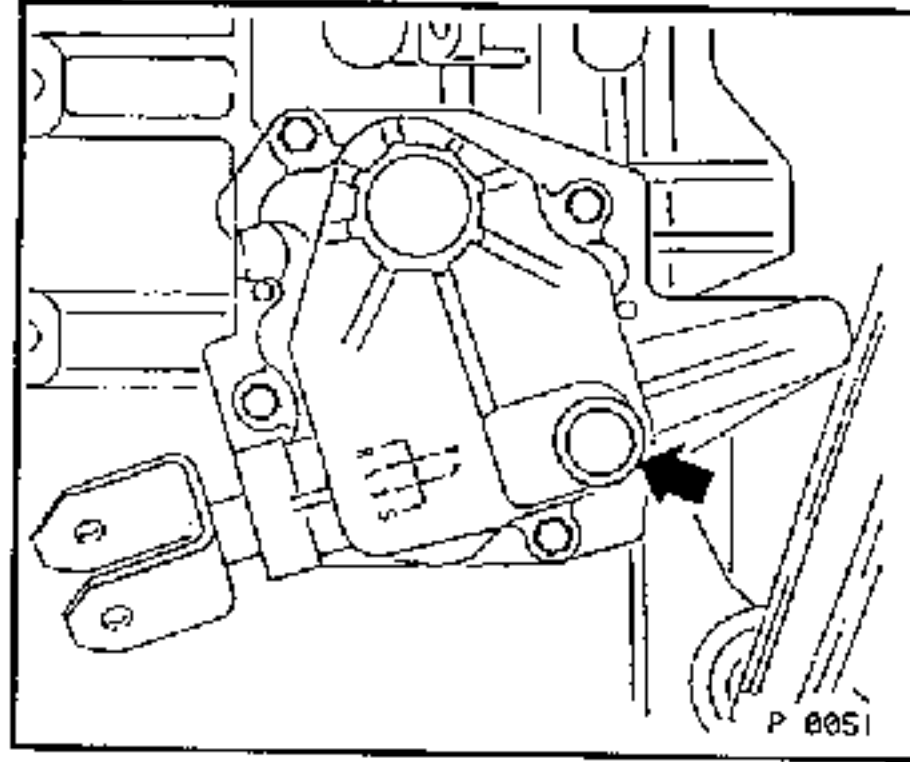


Adjust

Top up fluid as necessary:

F 20: Fill through the aperture for bleeder screw in shift cover (arrow).

F 28/6 Fill through the aperture for bleeder screw.



Inspect

To check the fluid level, fill to the lower edge of the aperture.

Quantity after repairs;

F 20: 1.9 litres

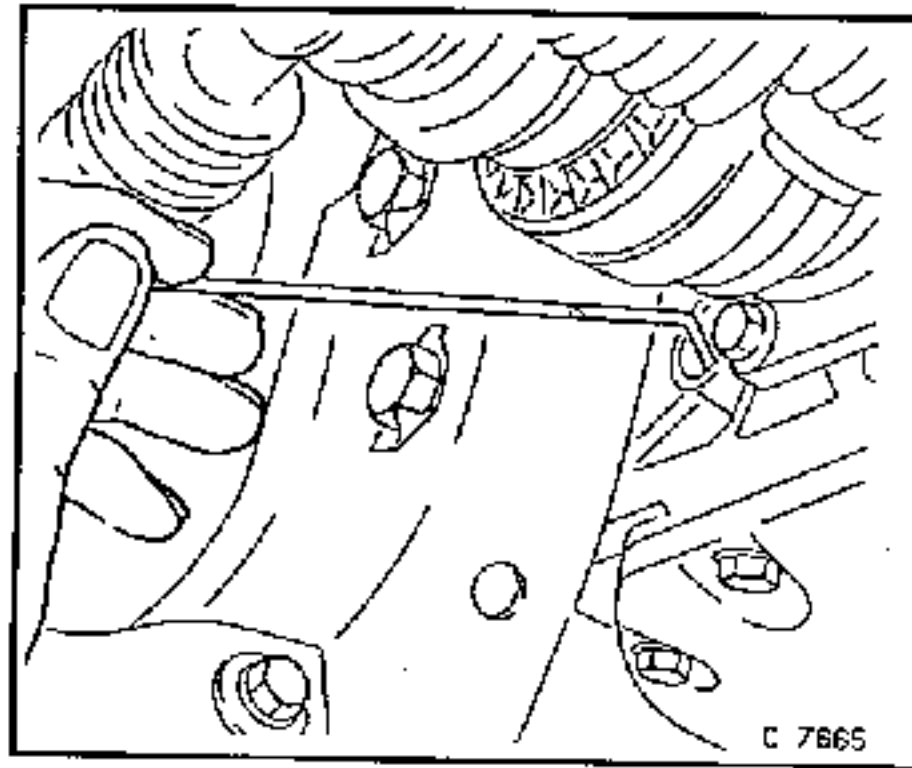
F 28/6 1.8 litres

If fluid needs topping up, simply fill with gear oil 80W GL4 to Holden's Specification HN1855 or equivalent.

Tighten (Torque)

Fluid check bolt F 20 4 Nm

Fluid check bolt F 28/6 30 Nm



Install, Connect

Lower engine compartment cover.

Transmission Shift Linkage - F 20, Adjust

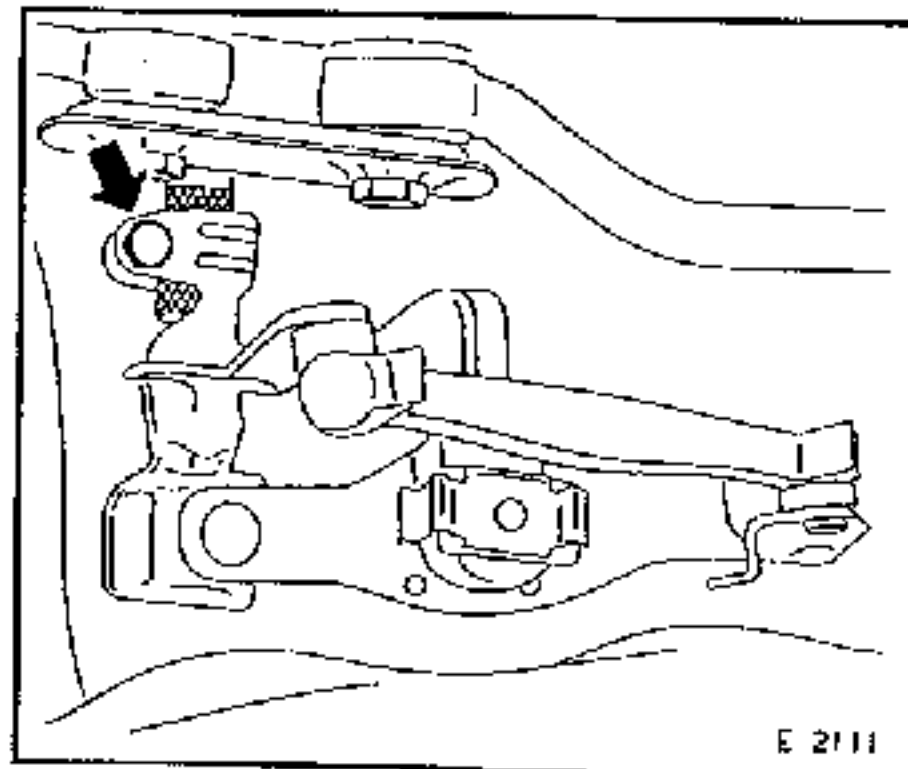
(Up to MY'92½)

With the gearshift in neutral;

Remove, Disconnect

Gearshift lever cover from shift tunnel and fold back.

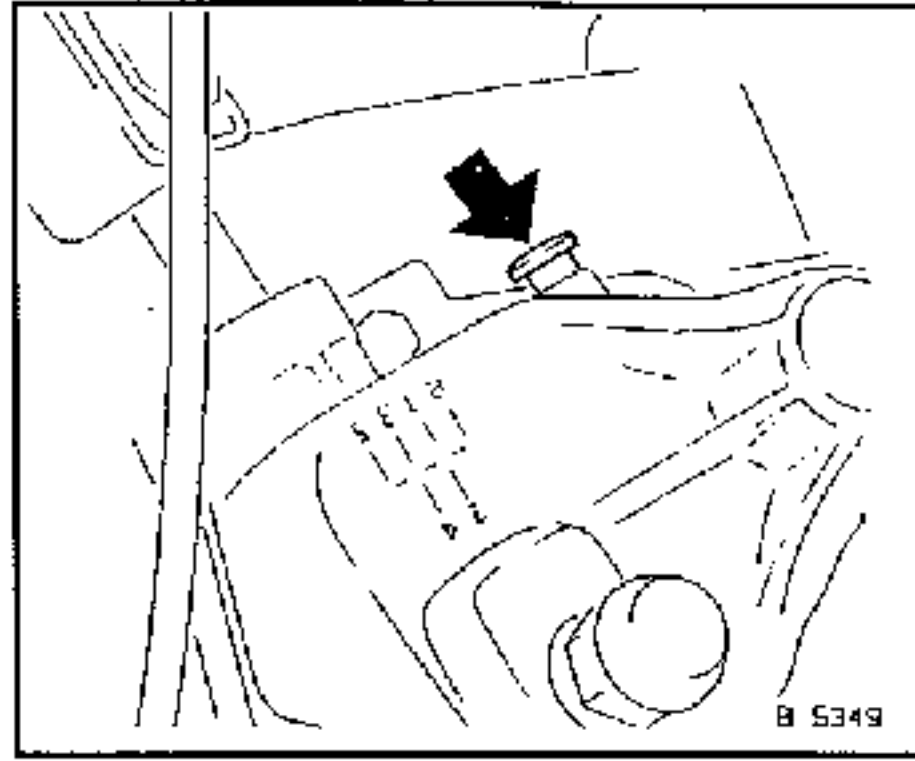
Loosen bolt for shift rod clamp (arrow).



MINOR SERVICING OPERATIONS

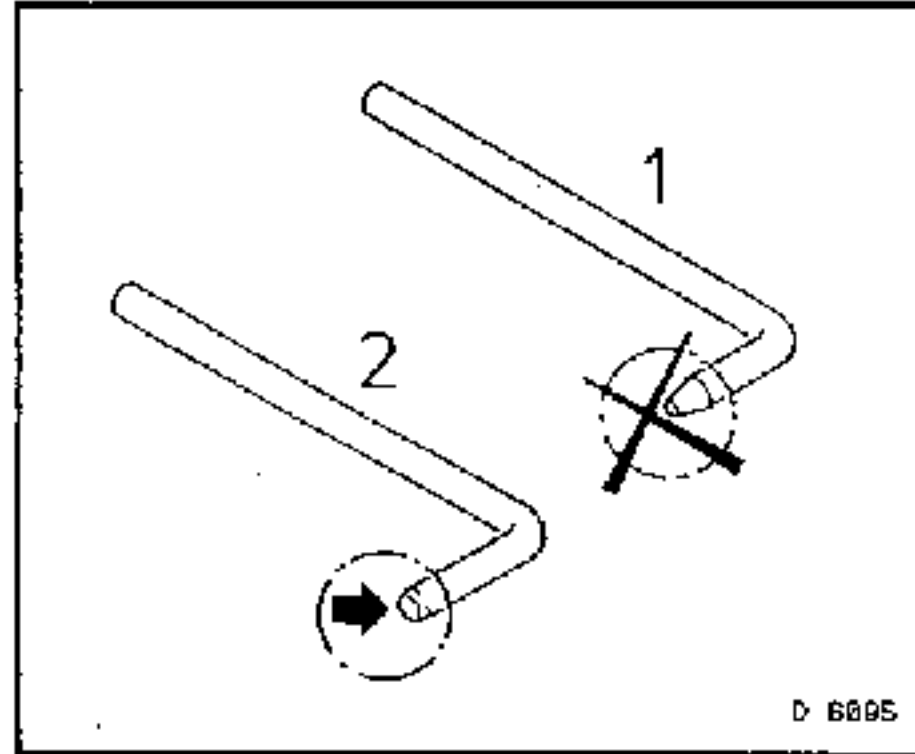
Remove, Disconnect

Plugs for adjustment bore hole from shift cover (arrow).



Adjust

Turn shift rod to the left and insert guide KM-527 or KM-527-A up to the stop in the adjustment bore hole.



Adjust

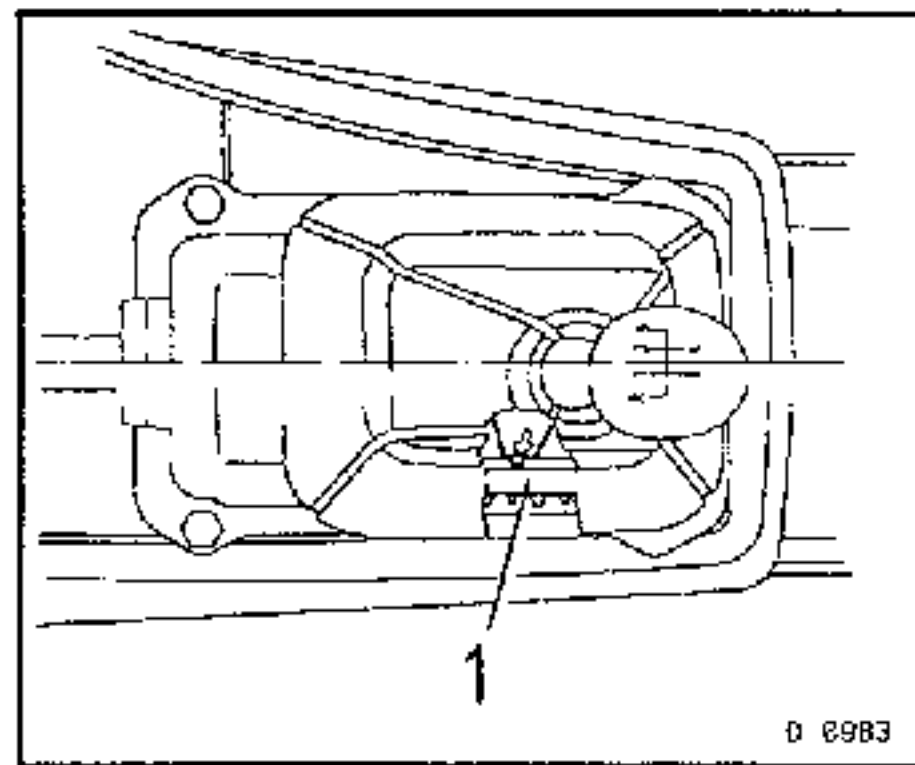
Transmission shift linkage as follows;

Press gearshift lever to the stop so that the tip of the arrow points to the notch (1).

Fasten shift rod in that position.

Tighten (Torque)

Shift rod clamp bolt 15 Nm



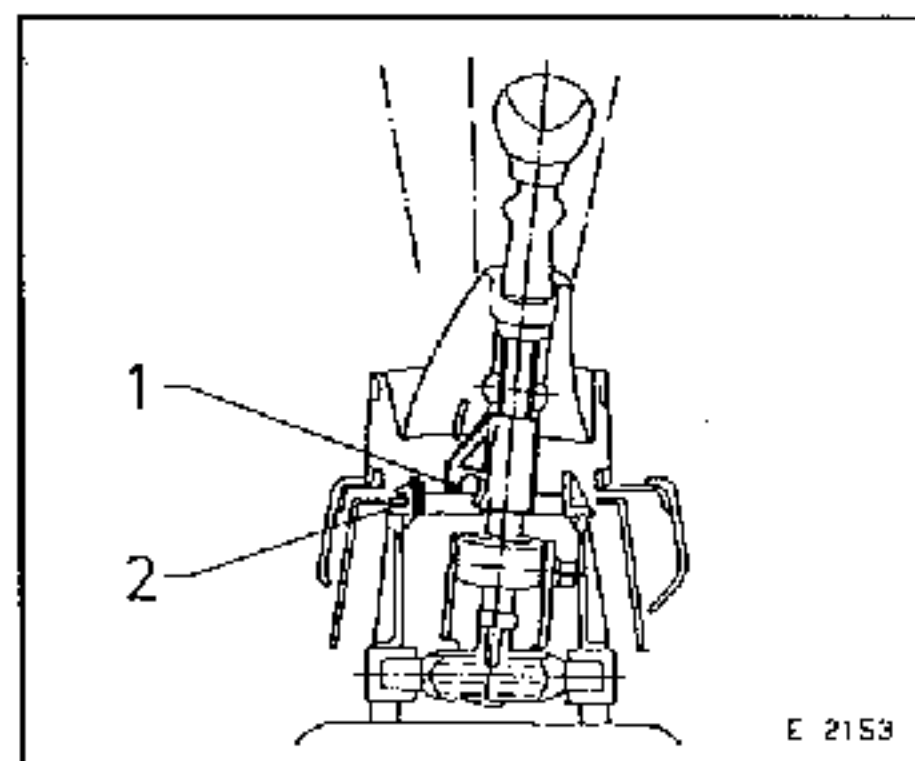
Inspect

Play between the hook (1) and stop (2) with tool KM-527 or KM-527-A inserted, must be a maximum of 3 mm.

Remove KM-527 or KM-527-A from shift cover.

Press new plug to the stop, into the adjustment bore hole.

Fit gearshift lever cover in shift tunnel.



MINOR SERVICING OPERATIONS

Transmission Shift Linkage - F 20, F 28/6, Adjust (As of MY'93)

Remove, Disconnect

Plug (1) from bore hole;

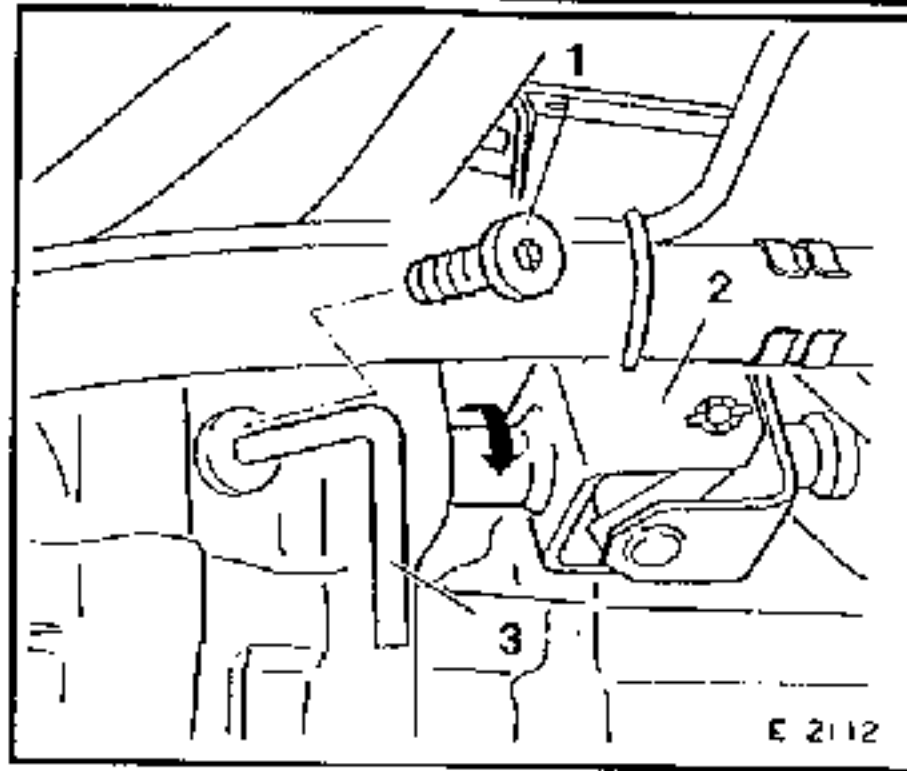
Remove top of transmission for F 28/6.

Remove from shift cover for F 20.

Turn shift rod to the left.

Insert

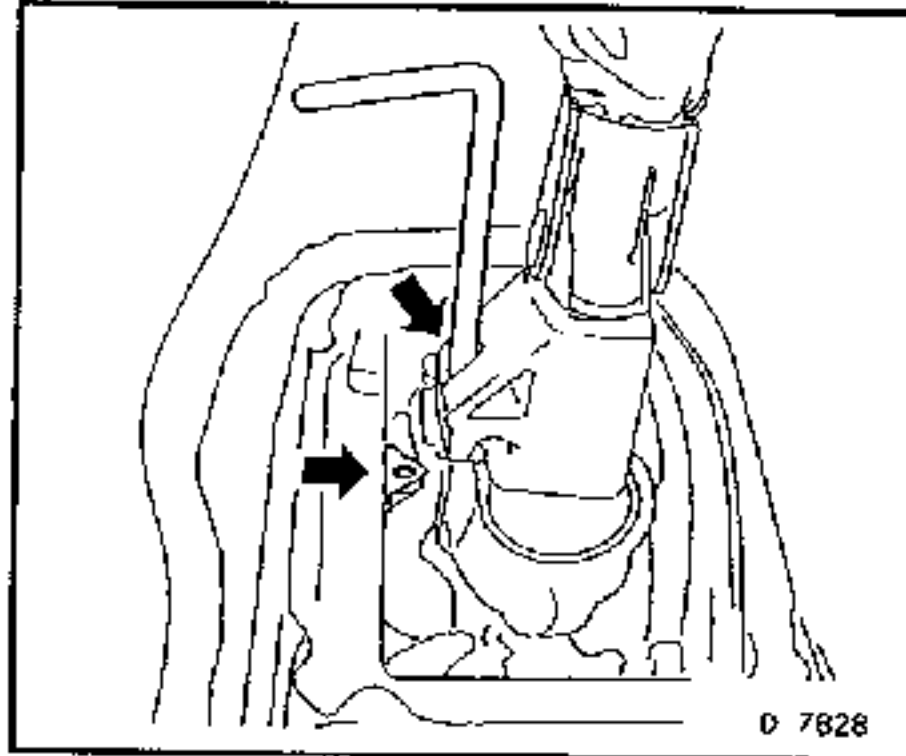
Guide pin KM-527 or KM-527-A (3) up to the stop in the adjustment bore hole



If KM-527 is used, grind a chamfer of 3 mm on the shift leg of the tool.

Install, Connect

Tilt gearshift lever so that a second KM-527 or KM-527-A can be inserted into the bore holes in the gearshift lever and gearshift lever housing. This locks the gearshift lever in place.



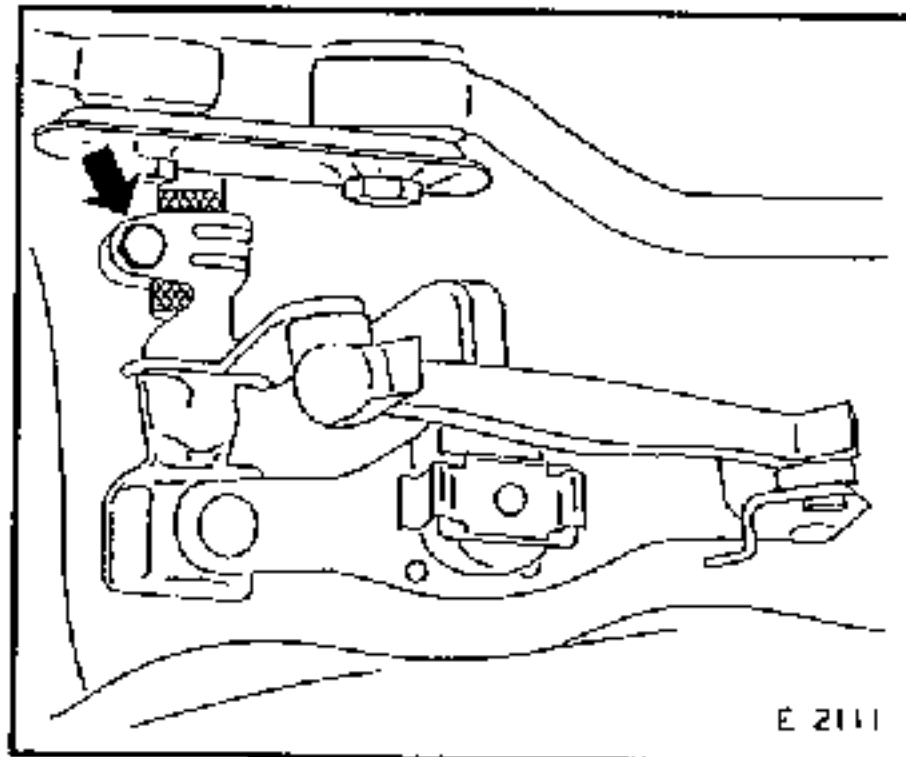
Tighten (Torque)

Shift rod clamp bolt (arrow)..... 15 Nm

Remove, Disconnect

KM-527 or KM-527-A from transmission and press in a new plug to the adjustment bore hole

KM-527 or KM-27-A from gearshift lever housing.

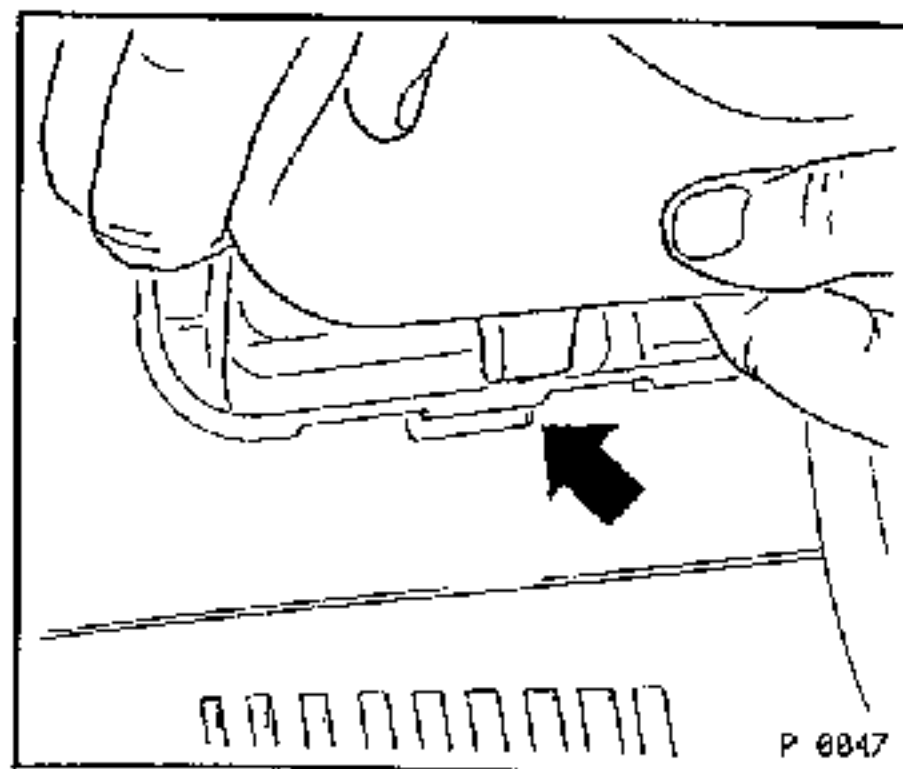


Install, Connect

Fit gearshift lever cover to shift tunnel (arrow).

Inspect

The shift pattern to ensure that all gears can be selected easily and smoothly, with the vehicle stationary, engine running and the clutch pedal depressed.



MINOR SERVICING OPERATIONS

TRANSMISSION SHIFT LINKAGE, SERVICE OPERATIONS

Gearshift Lever, Remove and Install

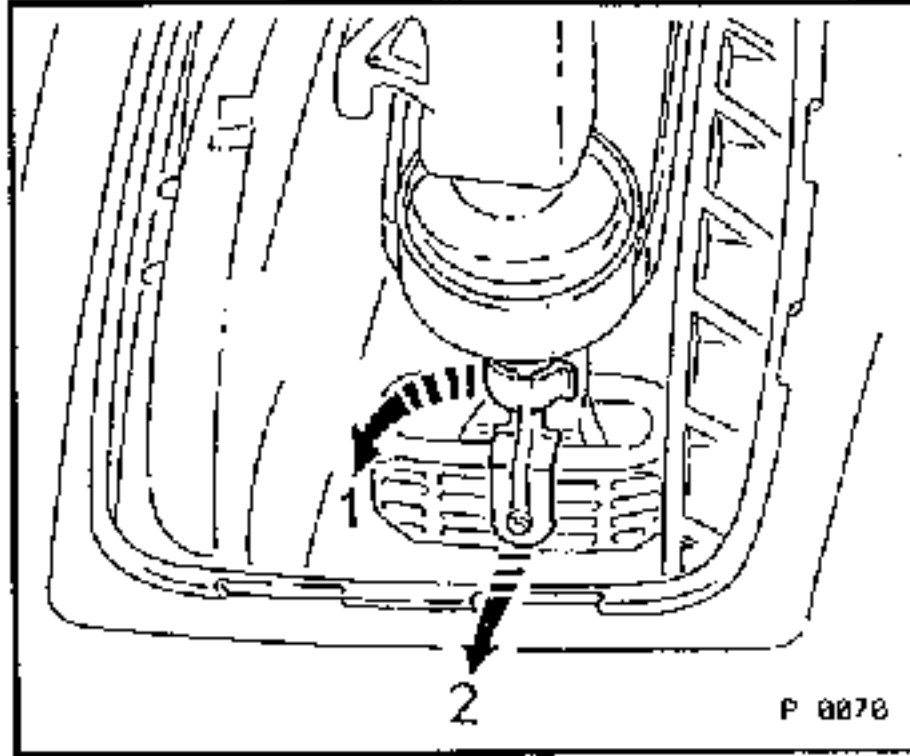
With the gearshift lever in neutral;

Remove, Disconnect

Gearshift lever cover from shift tunnel and fold back.

Press the clip from the gearshift lever (1) and remove the pin (2).

Lever the damping ring from the groove in the gearshift lever.



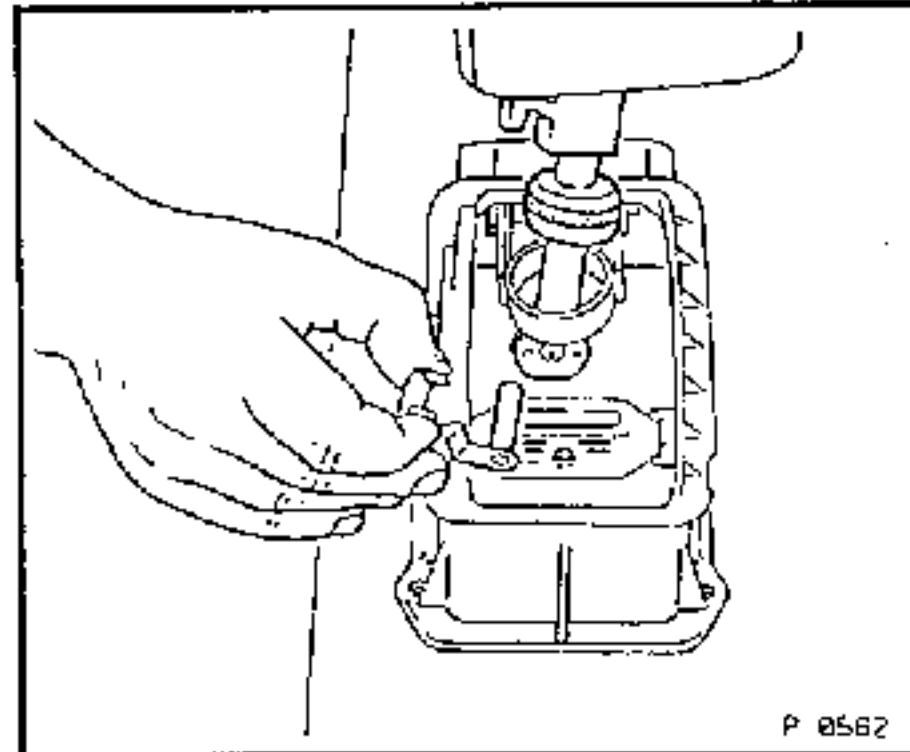
Install, Connect

Fit new damping ring into the gearshift lever groove.

Lubricate gearshift lever bearing with NLGI No. 0, lithium based grease to Holden's Specification HN1923.

Gearshift lever, insert pin and press clip onto gearshift lever.

Fit gearshift lever cover to shift tunnel.



Gearshift Lever Cover, Remove and Install

Remove, Disconnect

Gearshift lever. Refer to previous operation.

Tension gearshift lever in a vice. Place an open-ended spanner under the metal insert and drive off the gearshift lever knob.

Cable tie, then gearshift lever cover.

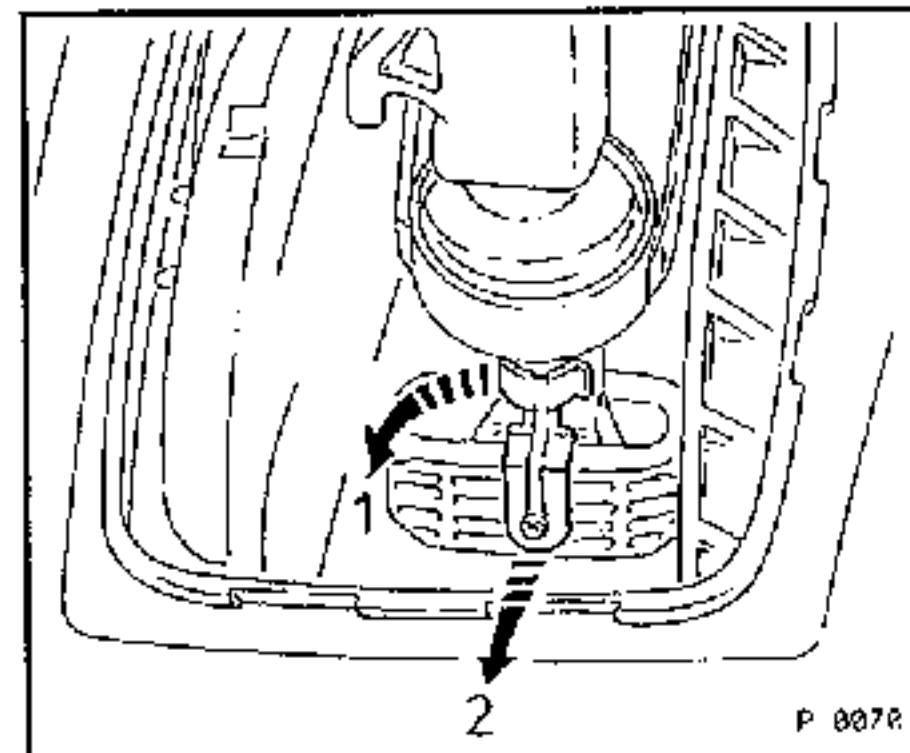
Install, Connect

A new gearshift lever cover - pull up on collar and secure with cable tie.

Lubricate reverse gear pawl knob with soap solution.

Heat the insert of the leather gearshift knob with an industrial hot air gun and press on gearshift lever as far as it will go.

Gearshift lever. Refer to previous operation.

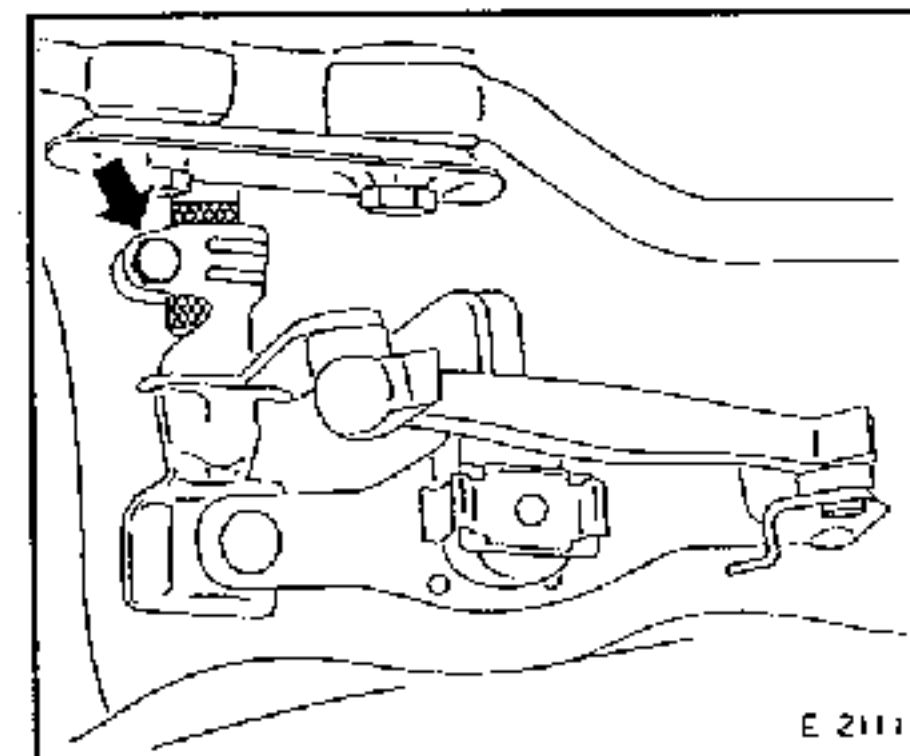


Shift Linkage, Remove and Install

Remove, Disconnect

Loosen bolt for shift rod clamp (arrow).

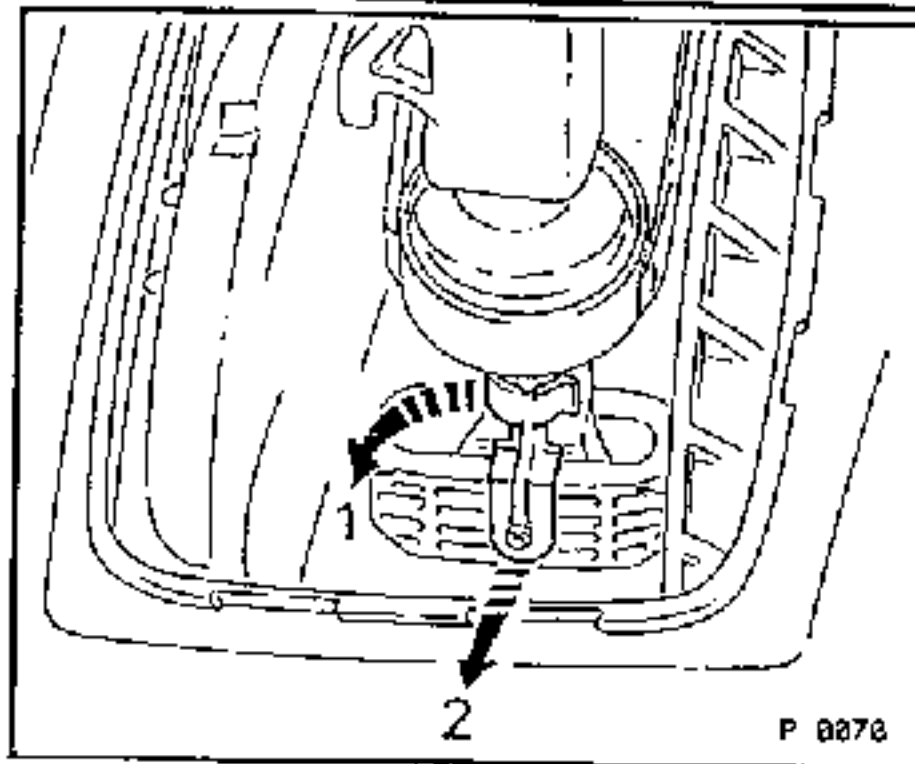
Put manual shift lever in 4th gear position, then separate the plug connection.



MINOR SERVICING OPERATIONS

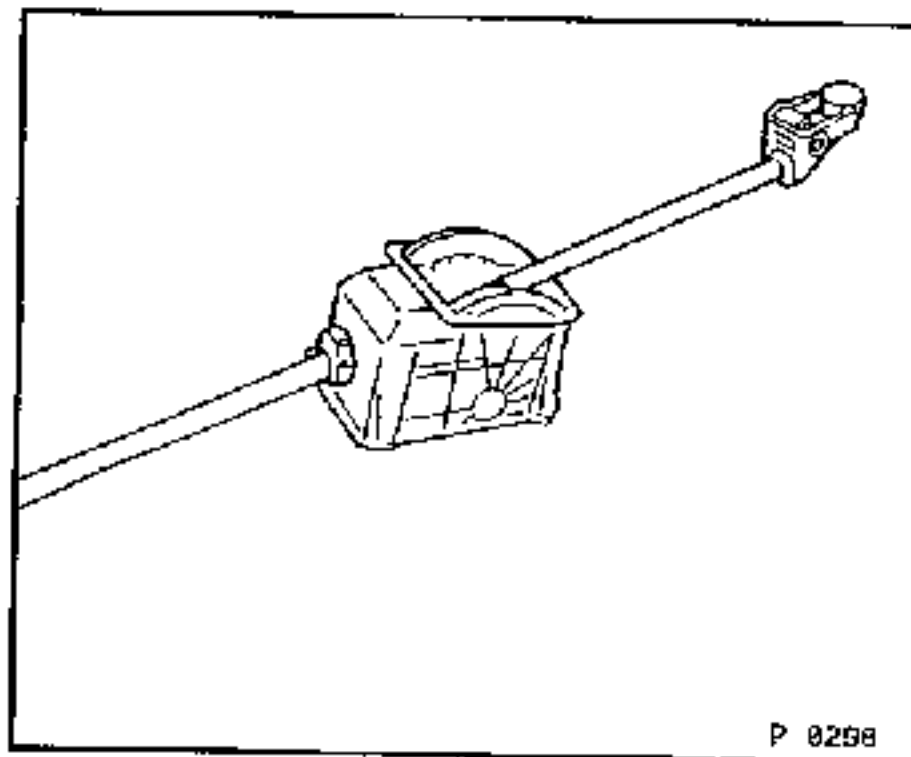
Remove, Disconnect

Gearshift lever. Refer the operation in this Section.



Remove, Disconnect

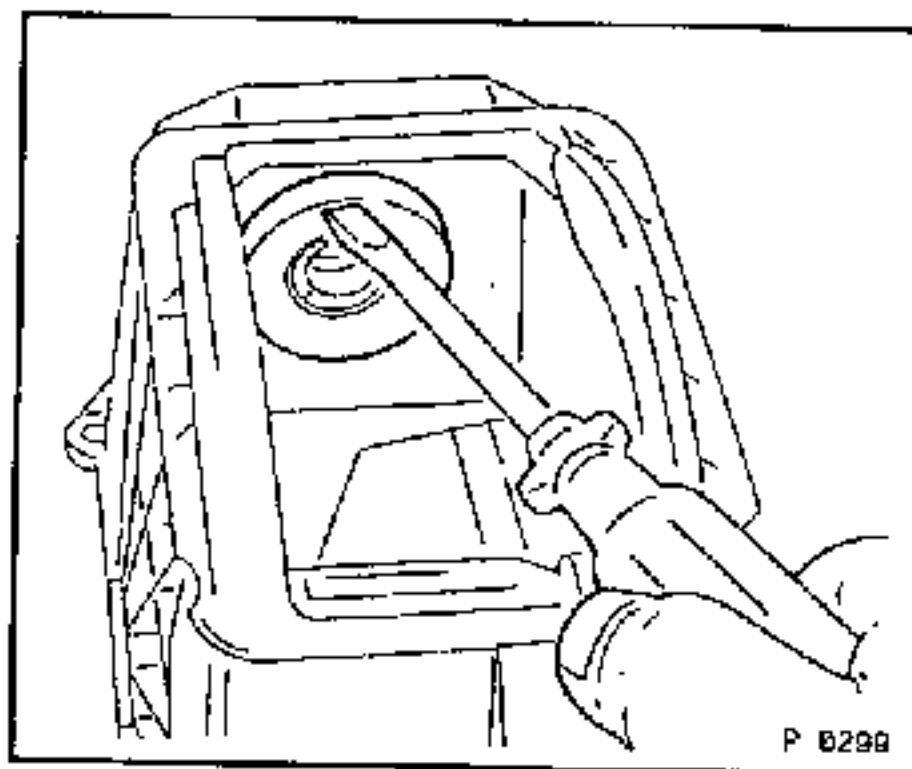
Shift housing with shift rod from underbody.



Remove, Disconnect

Shift rod from bearing bushing.

Bushing with bearing bushing from shift housing.



Remove, Disconnect

Press bearing bushing (1) from bushing (2).

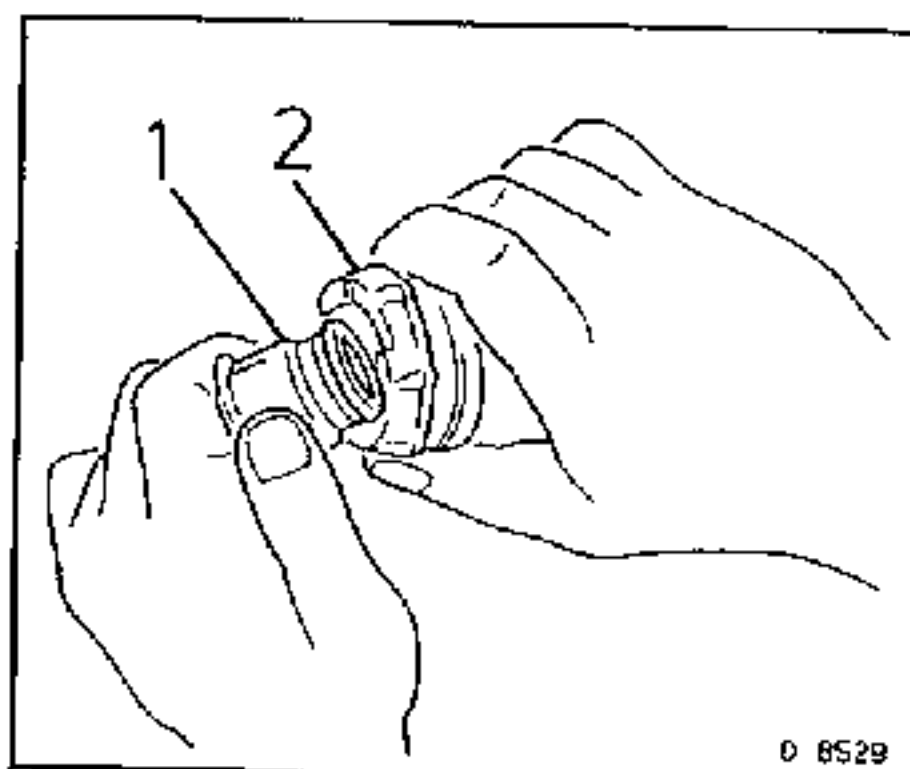
Install, Connect

Press new bearing bushing (1) in bushing (2).

Press bearing ring from the inside, into the shift housing.

Fill the inner grooves of bushing with Silicon Grease, to Holden's Specification HN2056.

Shift rod into bearing bushing.



MINOR SERVICING OPERATIONS

Tighten (Torque)

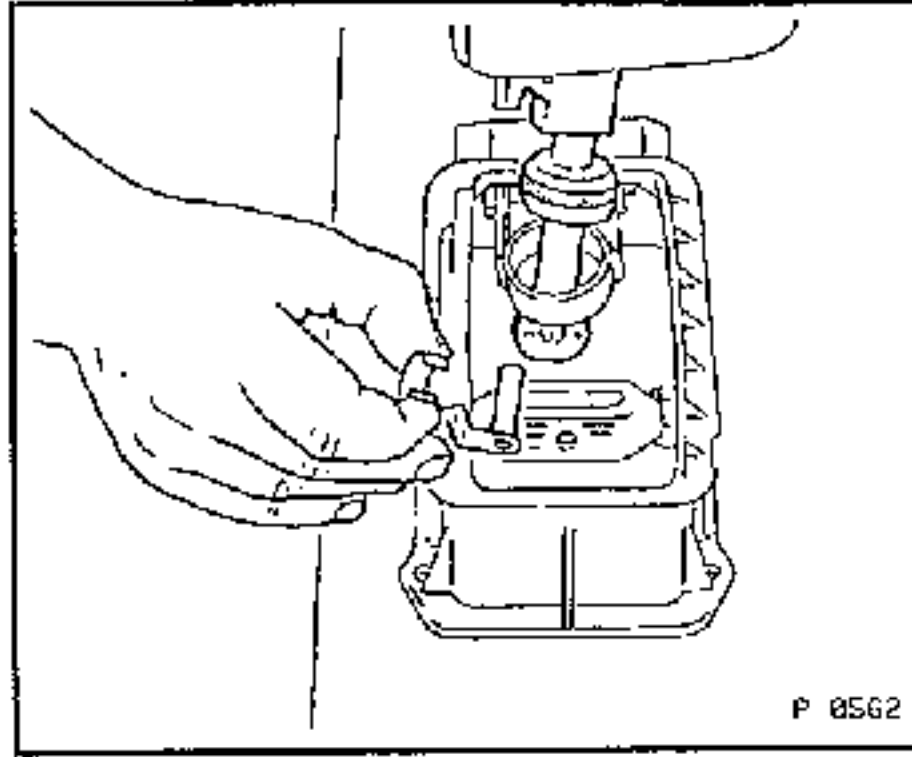
Shift housing to underbody..... 6 Nm

Install, Connect

Gearshift lever.

Adjust

Transmission shift linkage. Refer the operation in this Section.



Dust Boot on Shift Linkage, Replace

Loosen shift rod clamp bolt (arrow).

Select 4th gear - separate the plug connection.

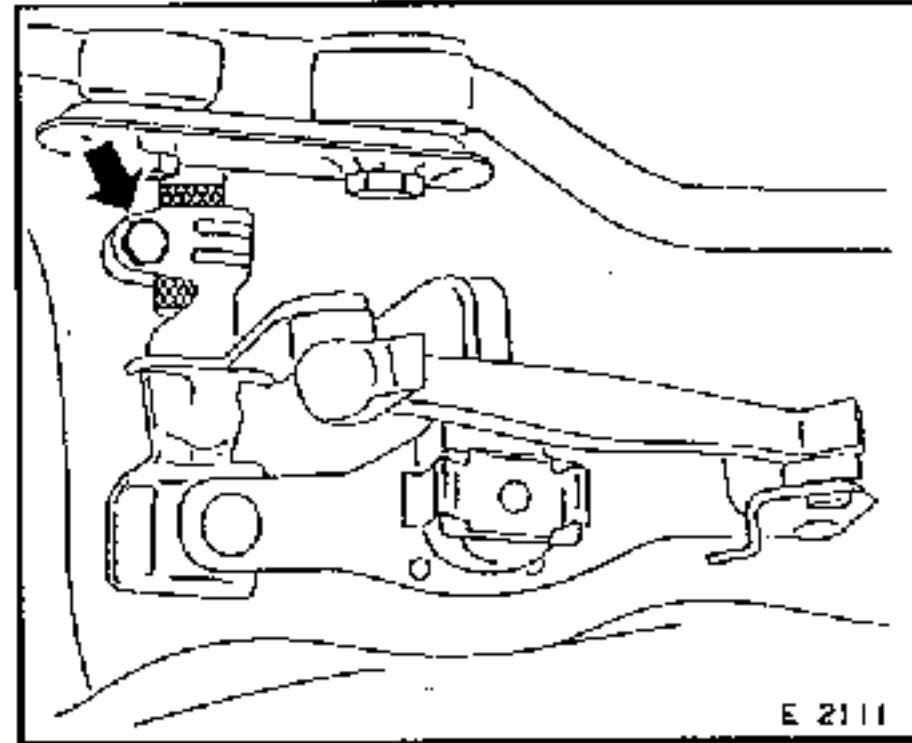
Remove, Disconnect

(Up to MY'92½)

Clamp from shift rod, then dust boot from shift rod and bulkhead.

(As of MY'93)

Dust boot from shift rod and bulkhead.



Install, Connect

Push new dust boot onto shift rod without twisting and insert in bulkhead.

(Up to MY'92½)

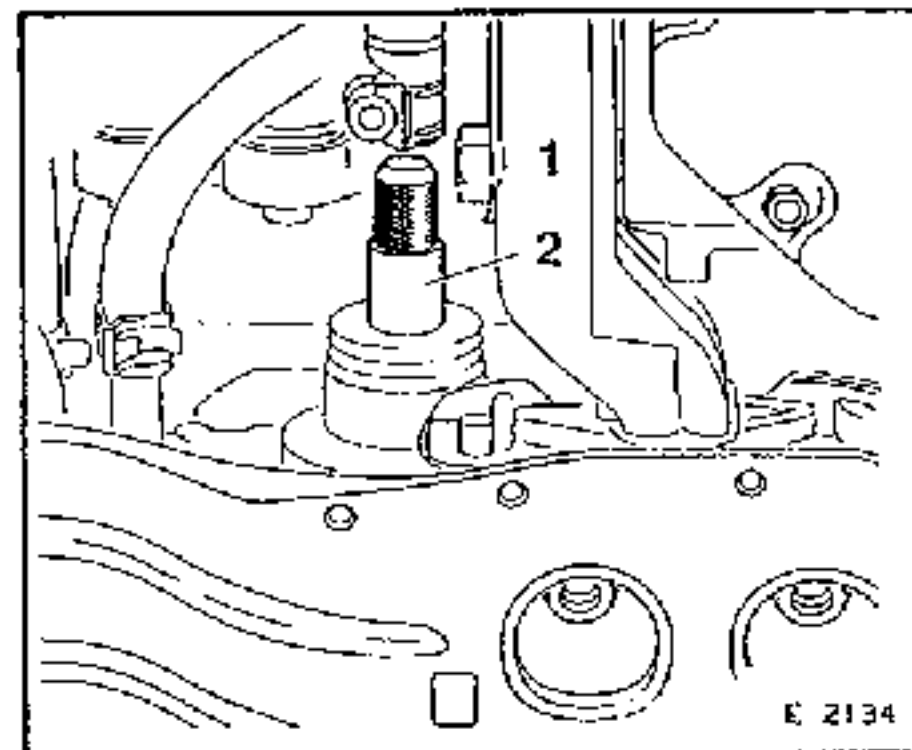
Clamp on shift rod and push knurled stem of the shift rod into the shift guide.

(As of MY'93)

Knurled stem of shift rod into the shift guide.

Adjust

Transmission shift linkage. Refer the operation in this Section.



Shift Guide, Remove and Install Selector Rod, Replace

Remove, Disconnect

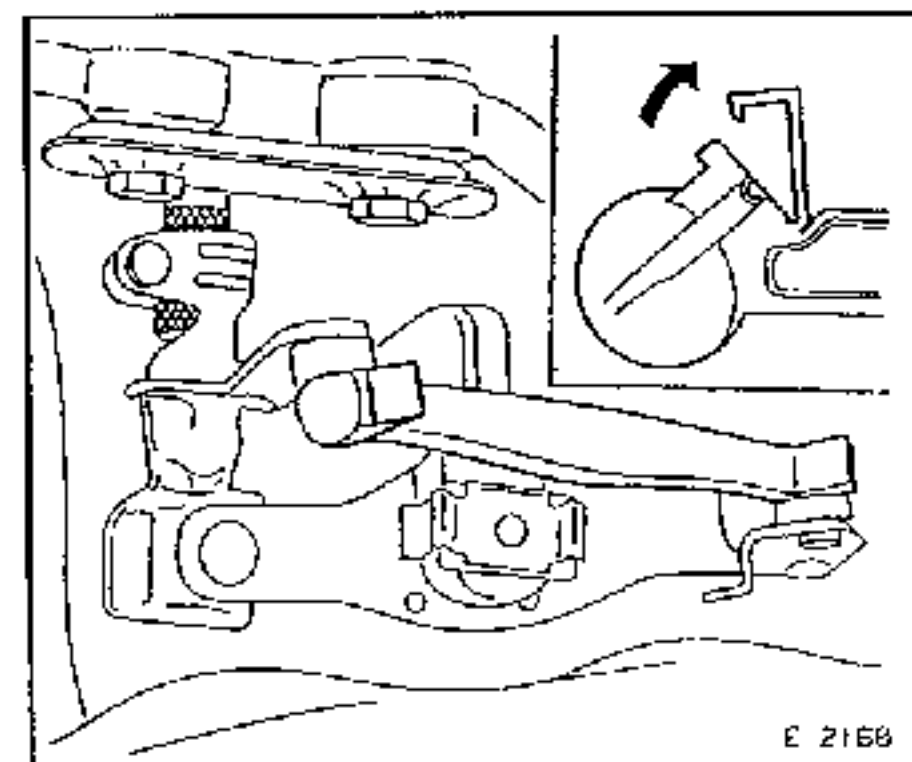
Press plastic clips of selector rod outwards, with a screwdriver (arrow).

Press both ball sockets of selector rod from ball pivot.

Install, Connect

Lubricate ball sockets with Silicone Grease, to Holden's Specification HN2056.

Press ball sockets onto pivot and engage plastic clips.



MINOR SERVICING OPERATIONS

Shift Linkage Lever, Remove and Install

Remove, Disconnect

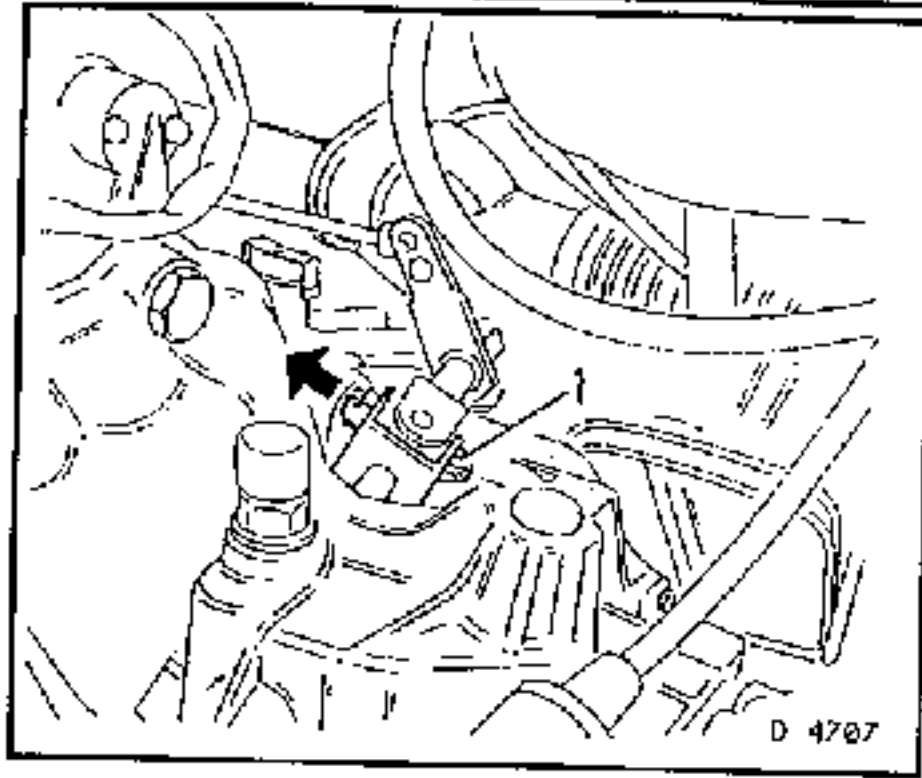
Selector rod.

Separate Cardan joint from shift linkage;

Press the retaining springs (1) of the hollow pin (arrow) together, then press out hollow pin.

Note:

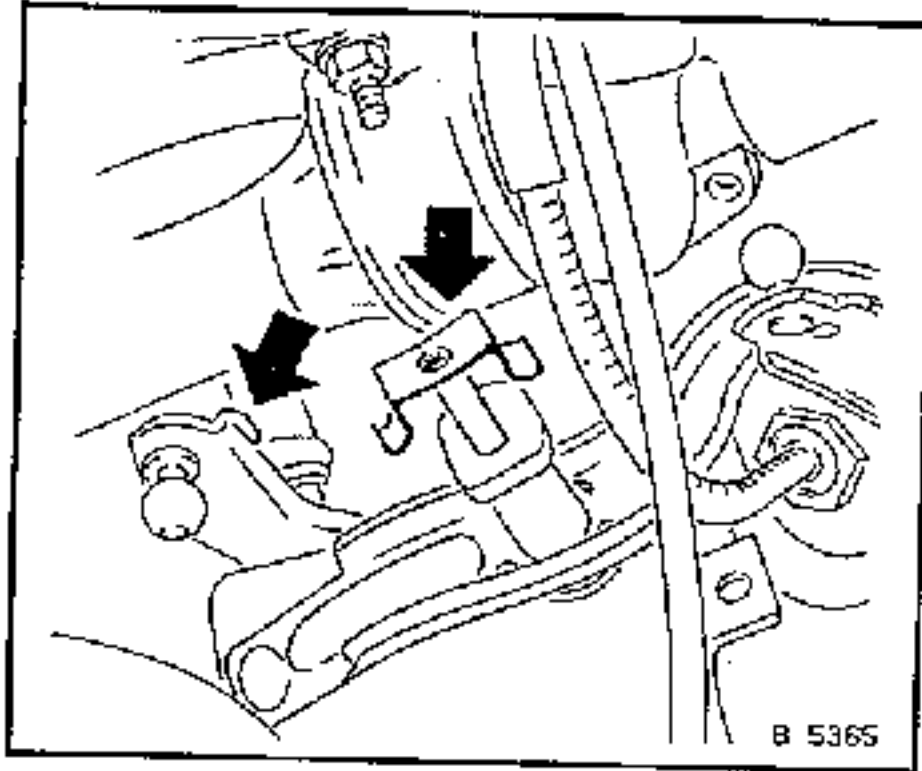
Hollow pin must be replaced once removed.



Remove, Disconnect

Loosen bolt for shift rod clamp (left arrow) and disconnect plug.

Remove pin with spring clip (right arrow) from guide bearing. Remove guide lever assembly from transmission.

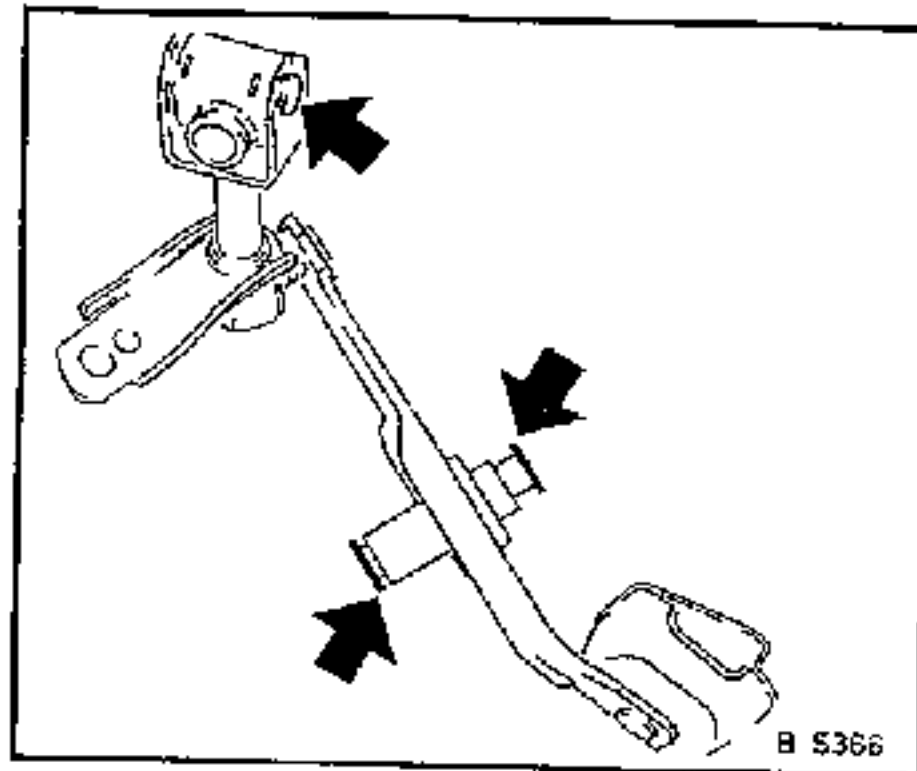


Remove, Disconnect

Both bushings of shift linkage lever bearing may be replaced. If necessary, replace Cardan joints.

Important!

Do not disassemble the shift linkage lever any further.



Install, Connect

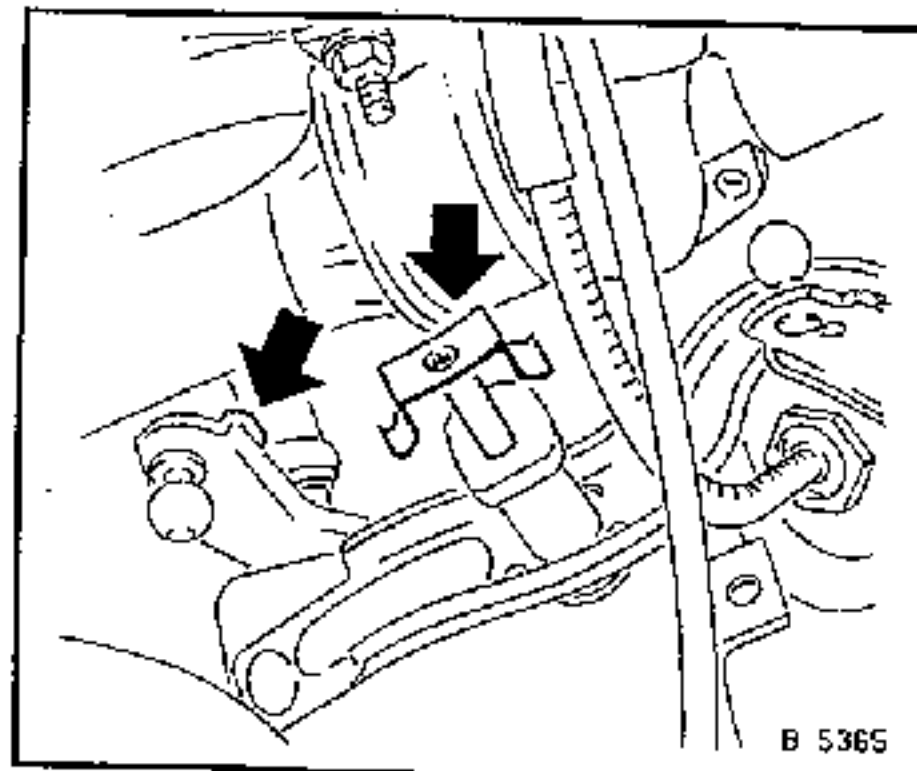
Shift linkage lever assembly to transmission with pin.

Spring clamps until they catch.

Lubricate bearing bushings with Dow Corning No 44, silicone grease or equivalent, to Holden's Specification HN1014.

Shift rod plug connection - connect shift guide.

Shift rods - tighten clamp bolt after adjustment.



MINOR SERVICING OPERATIONS

Install, Connect

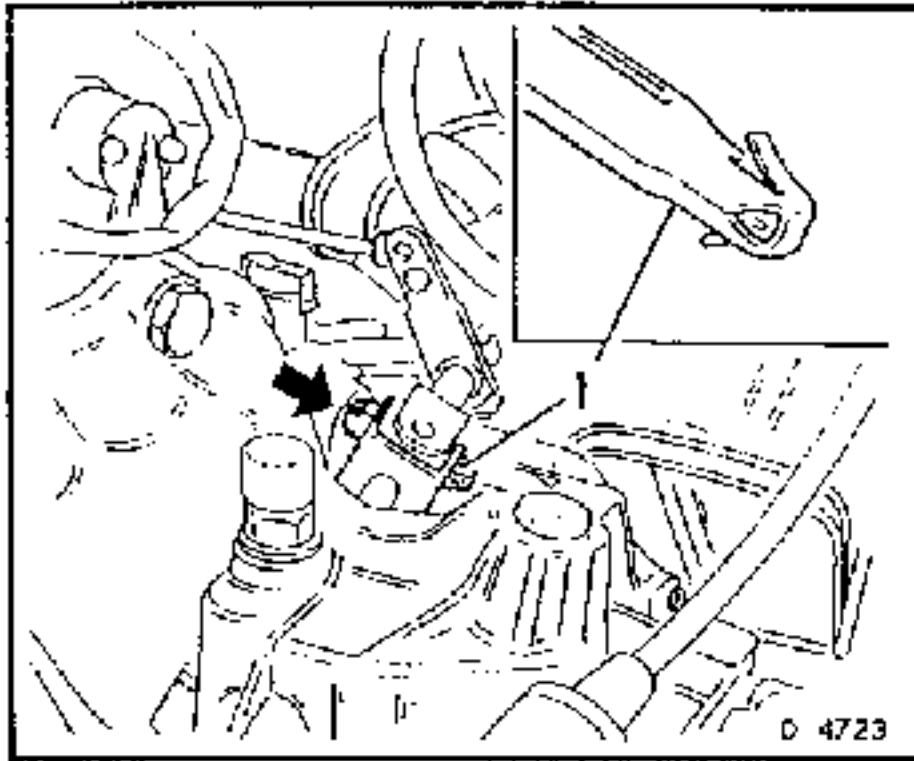
New hollow pin to Cardan joint, secure with expanding springs (1).

Lubricate the pin with Dow Corning No 44, silicone grease or equivalent, to Holden's Specification HN1014.

Press ball sockets of selector rod onto ball pivot of guide lever and engage plastic clips.

Adjust

Transmission shift linkage. Refer the operation in this Section.



Shift Cover, Remove and Disassemble

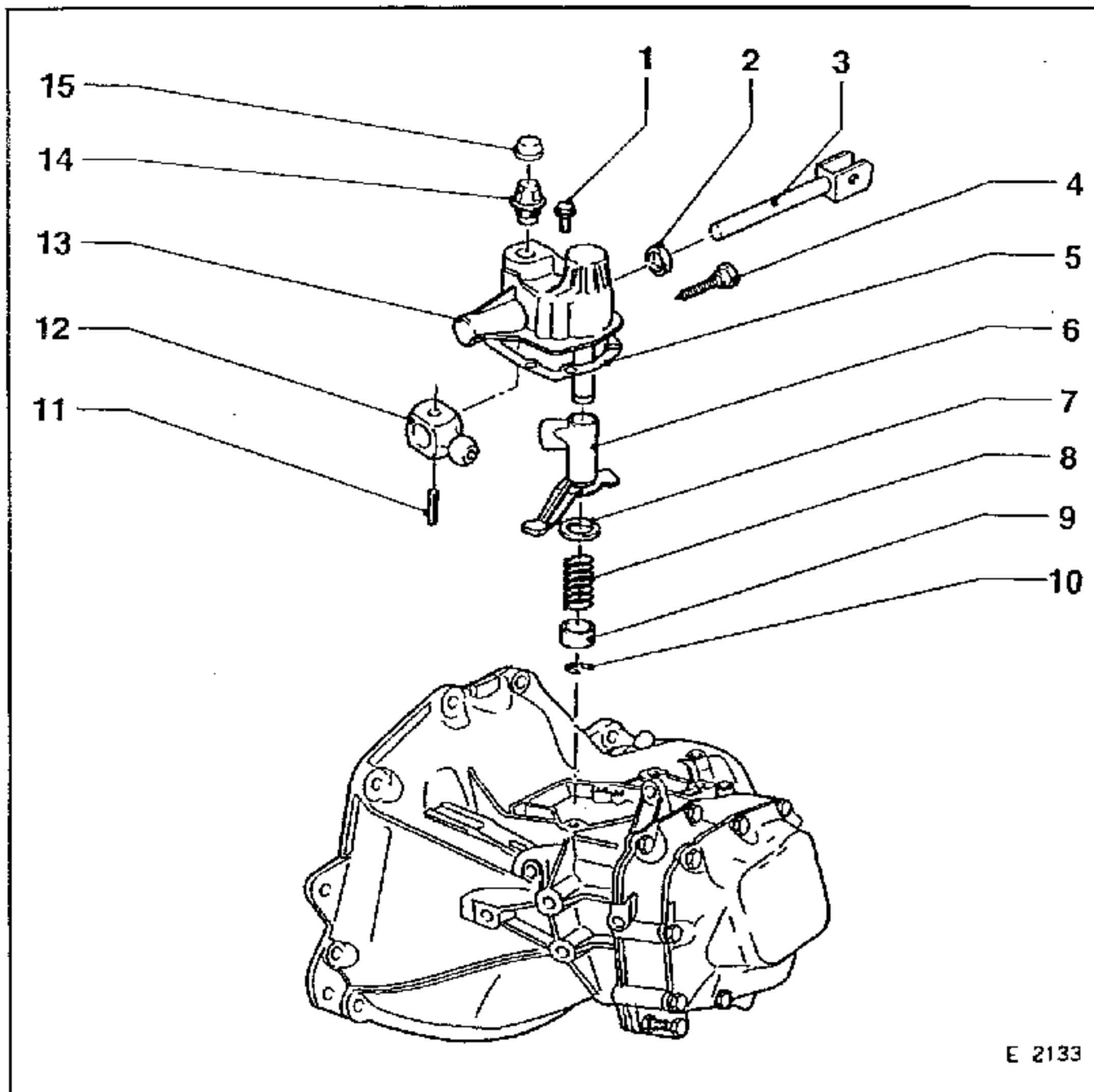


Illustration Key:

- | | | | | |
|-----------------------|----------------------------|-----------------|--------------------|------------------|
| 1 Hex bolt (M 7 x 20) | 4 Adjustment hole plug | 7 Washer | 10 Snap ring | 13 Shift cover |
| 2 Shaft seal ring | 5 Gasket | 8 Thrust spring | 11 Roll pin | 14 Vent bolt |
| 3 Shift rod | 6 Shift Intermediate lever | 9 Bushing | 12 Selector finger | 15 Vent bolt cap |

MINOR SERVICING OPERATIONS

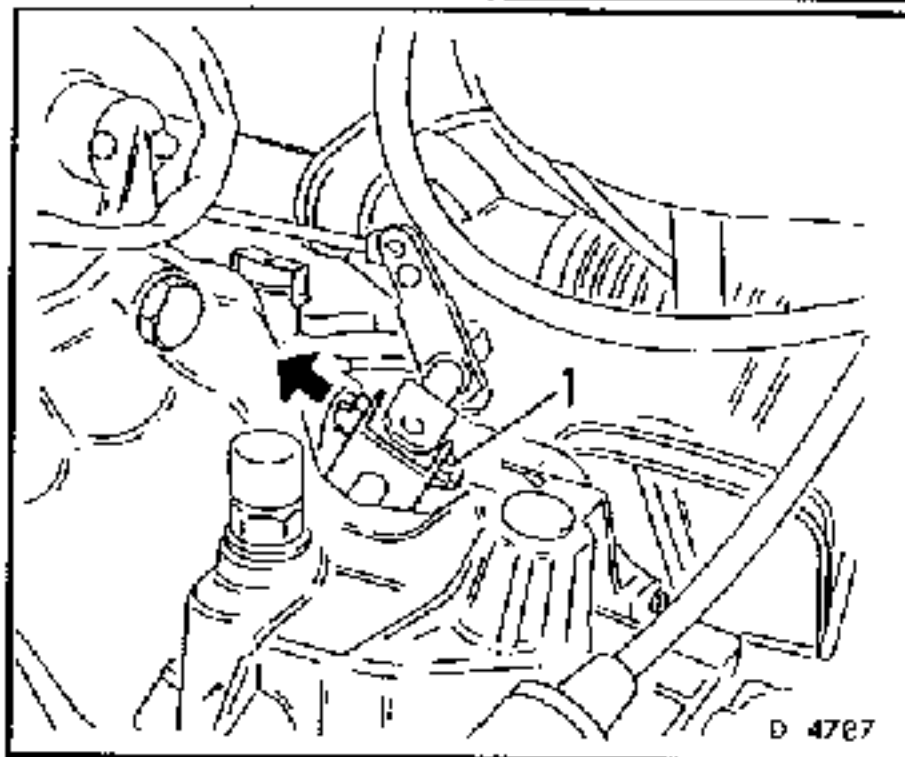
Remove, Disconnect

Separate Cardan joint from shift linkage.

Press hollow pin retaining spring (1) together, then press out pin.

Note:

Hollow pin is to be replaced, once removed.



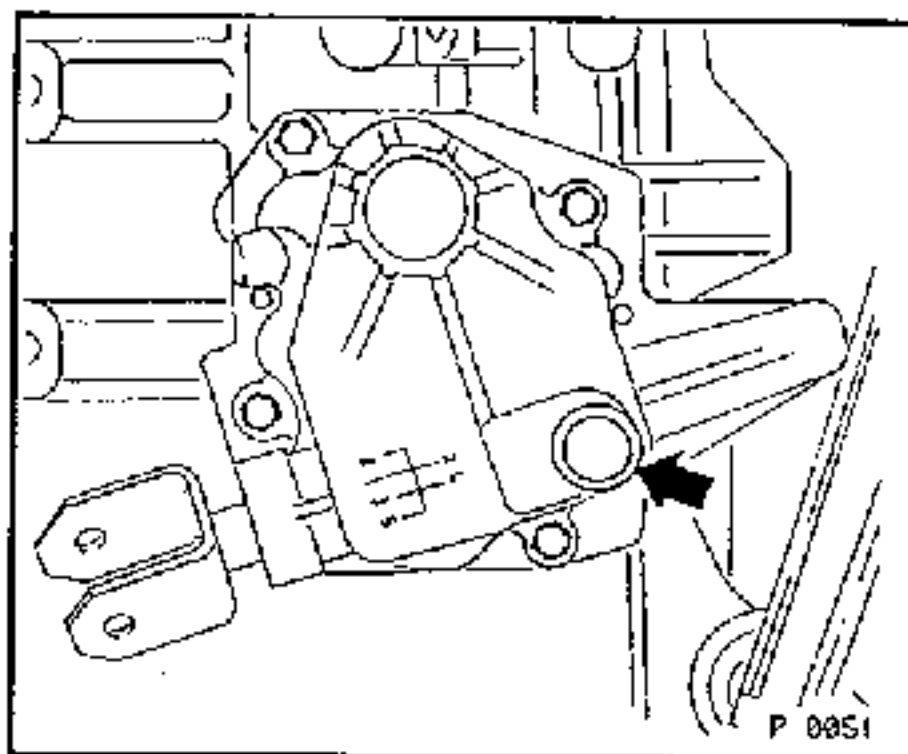
Remove, Disconnect

Closure bolt for transmission ventilation from shift cover (arrow).

Remove plug from adjustment hole and insert KM-527 or KM-527-A.

If KM-527 is used, grind a 3 mm chamfer on the short leg. Re-stamp the tool with the suffix "A".

Shift cover from transmission.

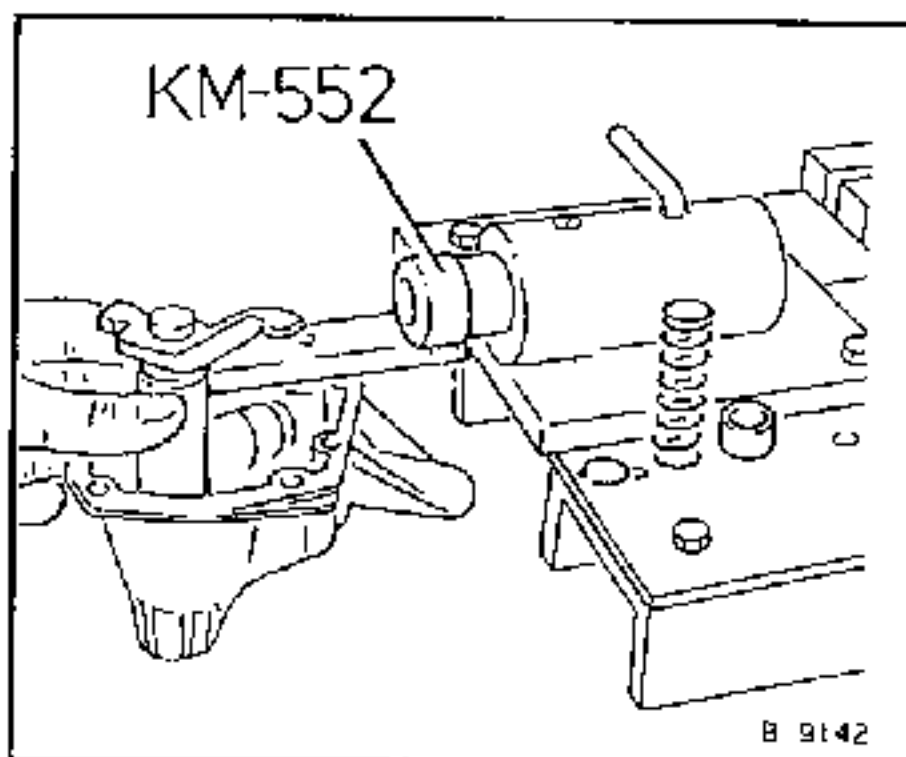


Install, Connect

Shift cover on KM-552 or KM-448 and remove KM-527 or KM-527-A.

Disassemble

Retaining ring, bushing, thrust spring, washer and intermediate shift lever from the guide pin.



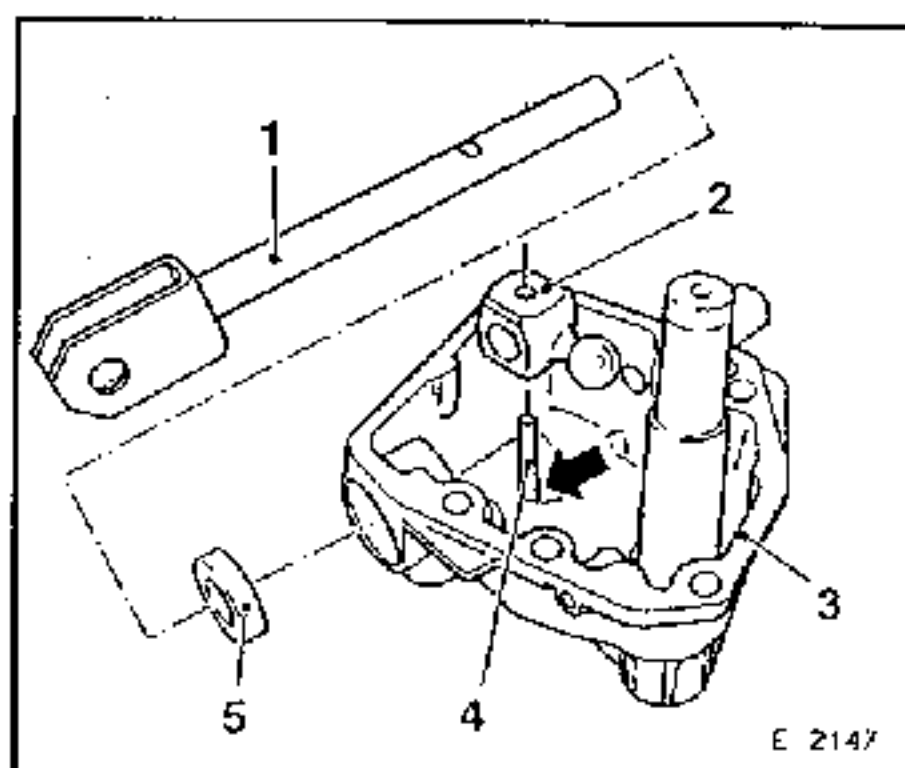
Remove, Disconnect

Turn rod (1) and selector finger (2) so that roll pin (4) in recess (arrow), can be driven out.

Shift rod (1) from selector finger (2) and cover (3). Lever seal (5) from cover (3).

Do not disassemble the cover any further.

The cover is serviced as an assembly with the guide pin.



MINOR SERVICING OPERATIONS

Shift Cover, Assemble and Install

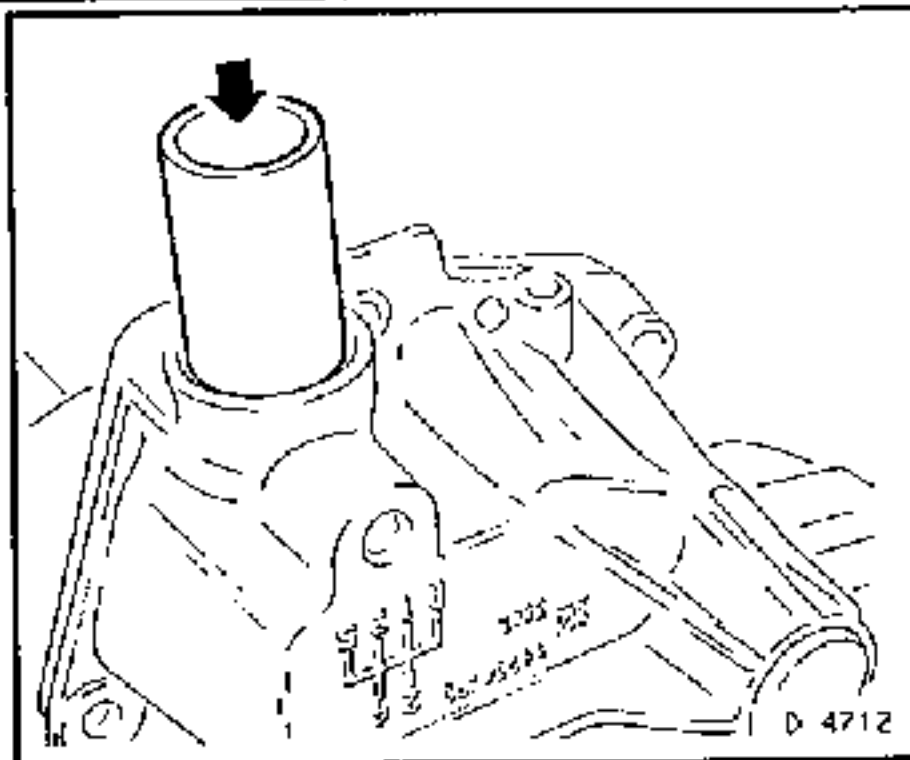
Install, Connect

Drive in new seal ring with suitable sleeve (arrow). Coat seal lips with Molybdenum Disulphide grease to Holden's Specification HN1461.

Lubricate all bearing bushings with GL4, 80W gear oil, to Holden's Specification HN1855.

Guide shift rod into selector finger and cover.

Drive in new roll pin and centre in the selector finger.

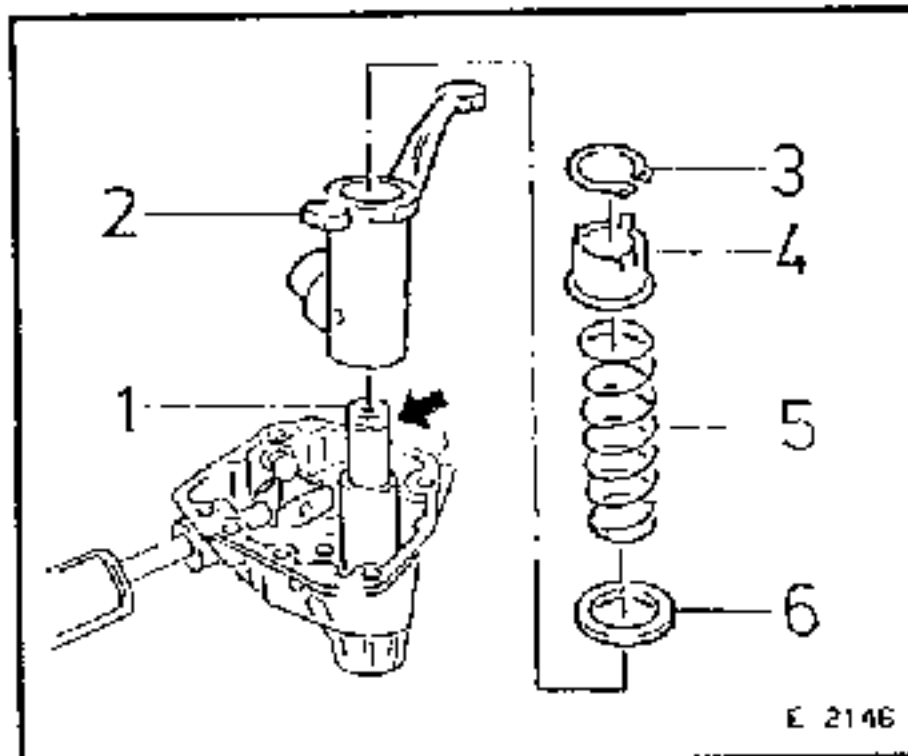


Assemble

Shift cover.

Place intermediate lever (2), washer (6), thrust spring (5) and bushing (4) onto guide pin (1).

Insert new snap ring (3) in groove (arrow).



Before installing cover,

Measure

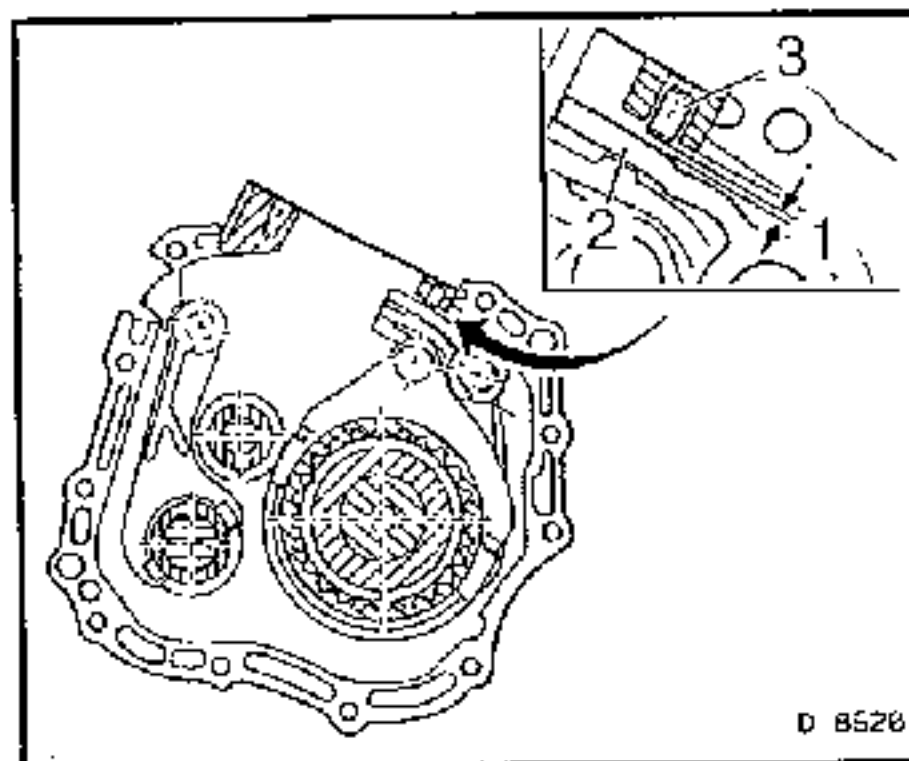
Play (1) between dowel pin (3) and actuation of shift rod, 3rd/4th gear (2), using a feeler gauge.

Specification (1) = 0.5 mm.

Adjust

If play is too large;
Using drift punch, drive dowel pin (3) slightly into transmission housing and check play again.

If play is too small;
No play correction is necessary, as the shift rod presses the dowel pin into the correct position.



Install, Connect

Place KM-527-A into adjustment bore hole.

Apply lithium bearing grease NLGI No. 4, to a new gasket.

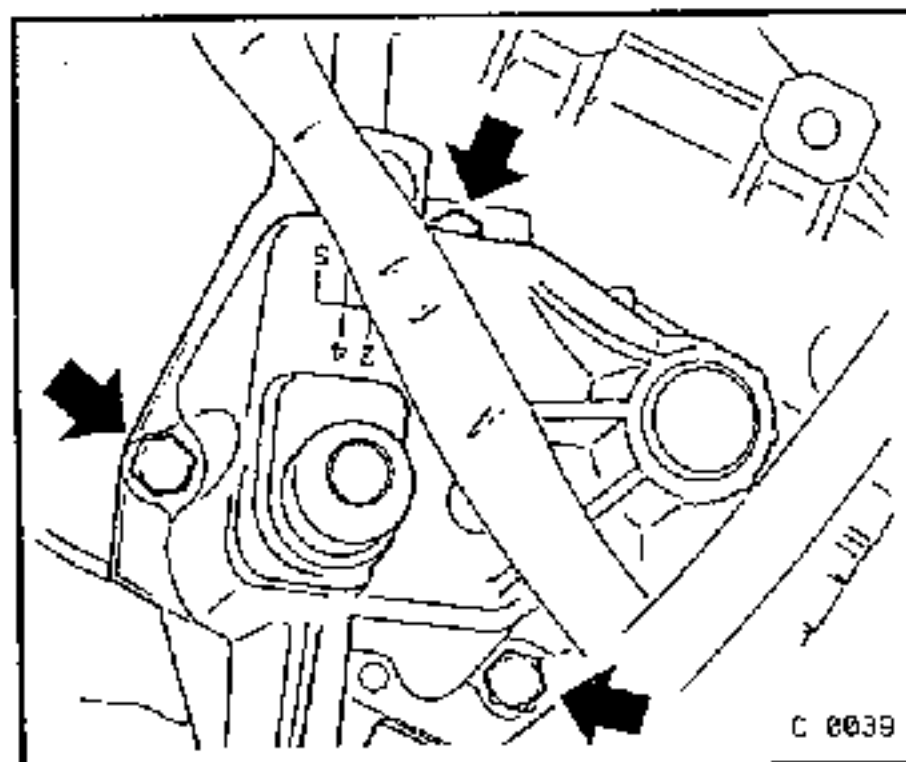
With the transmission in neutral, install the cover.

Tighten (Torque)

Selector cover to transmission 15 Nm

Remove KM-527-A.

Insert new plug to the adjustment bore hole.



MINOR SERVICING OPERATIONS

Install, Connect

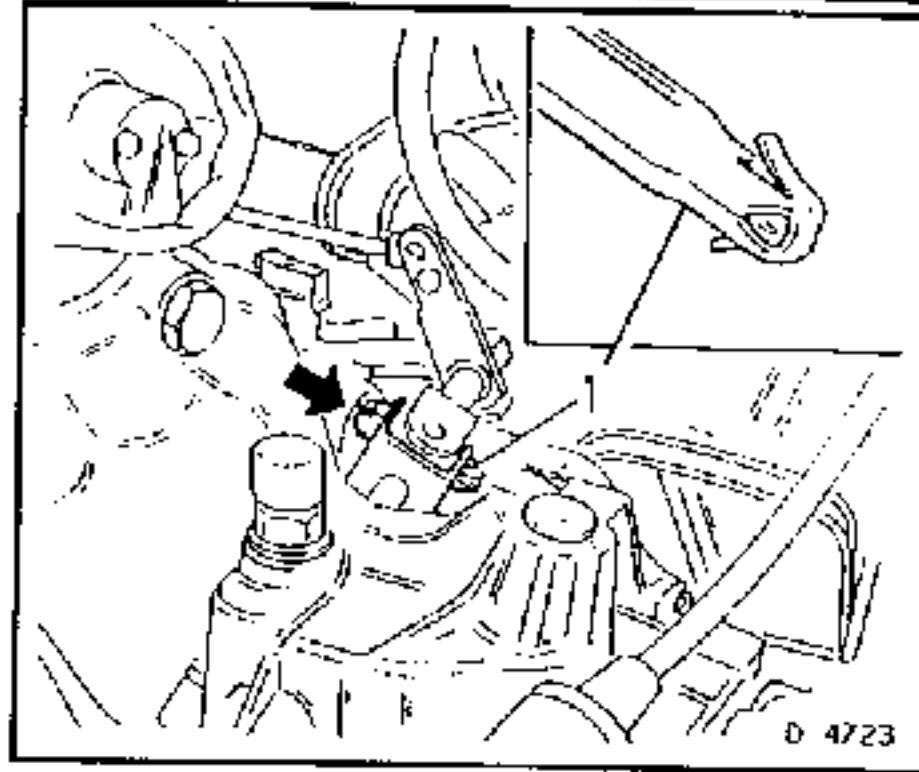
Closure bolt for transmission ventilation.

New hollow pin (1) to Cardan joint - the expanding springs will self-engage.

Lubricate pin with Dow Corning No. 44 silicone grease, to Holden's Specification HN1014, or equivalent.

Inspect

Transmission gear oil level. Refer 'Transmission Shift Linkage, Adjust' in this Section.



TRANSMISSION SEALING OPERATIONS - TRANSMISSION INSTALLED

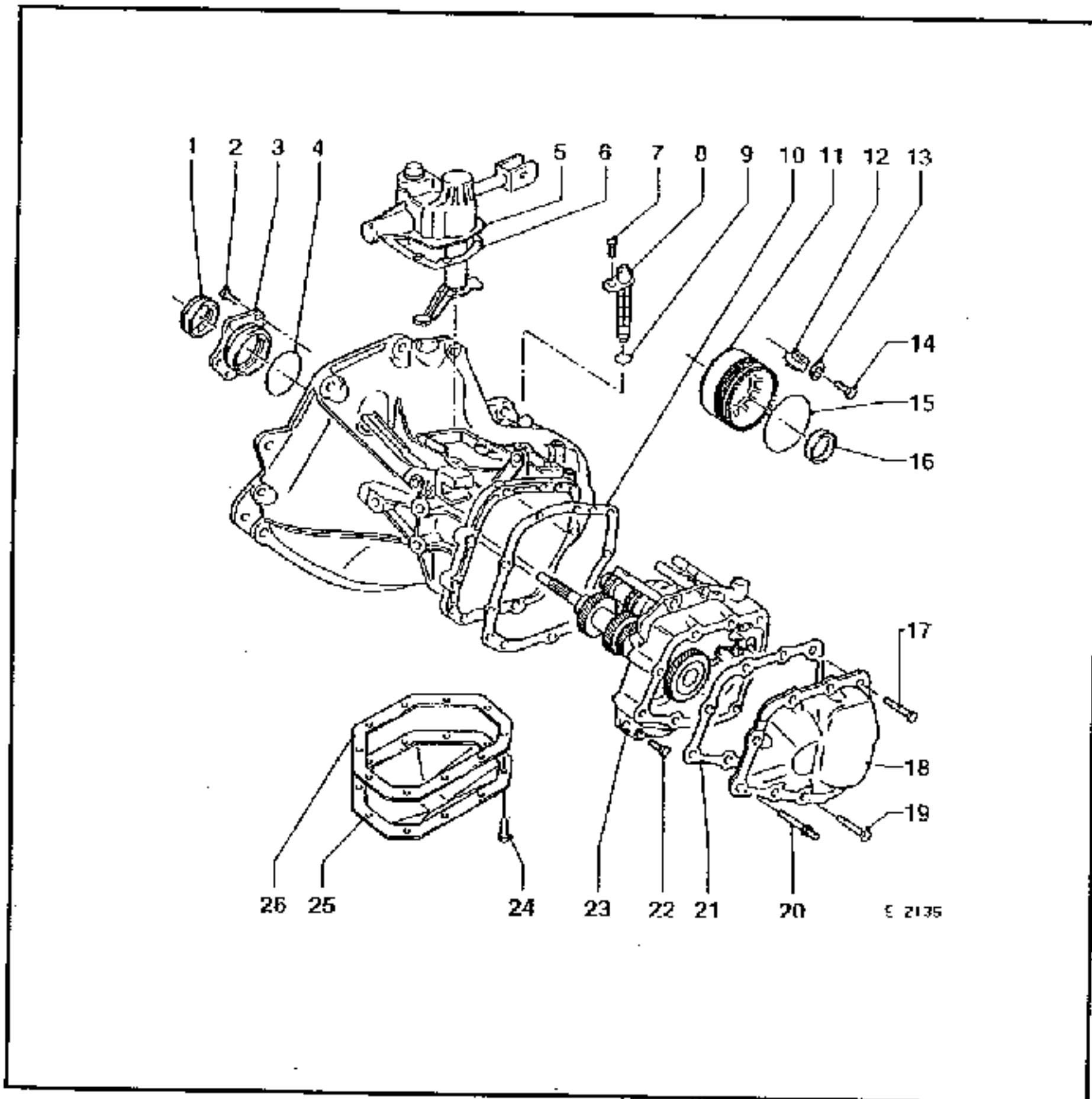


Illustration Key:

- | | | |
|---------------------------|-------------------------|----------------------------|
| 1 Axle shaft seal ring | 10 End cover gasket | 19 Hex bolt M 7 x 15 |
| 2* Hex bolt | 11 Bearing ring | 20 Hex bolt |
| 3* Bearing flange | 12 Tab washer | 21 End shield cover gasket |
| 4* Rubber O-ring | 13 Split washer | 22 Hex bolt |
| 5 Shift cover | 14 Hex bolt | 23 End shield |
| 6 Gasket | 15 Rubber O-ring | 24 Hex bolt |
| 7 Hex bolt | 16 Axle shaft seal ring | 25 Differential cover |
| 8 Speedometer driven gear | 17 Hex bolt M 8 x 58 | 26 Gasket |
| 9 Rubber O-ring | 18 End shield cover | * F 20 FWD only |

MINOR SERVICING OPERATIONS

Axle Shaft Seal Rings, Replace

Note:

For vehicles with 4WD, the operation for the right side (transfer box side), is described in the Section "Sealing Operations on Installed Transfer Box", in this Group.

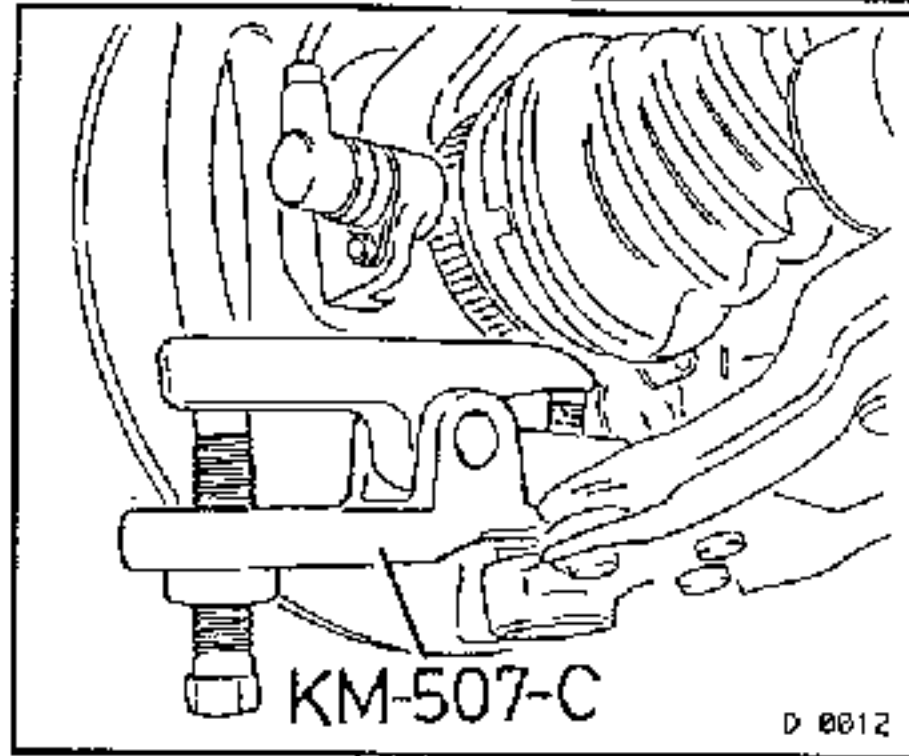
Remove, Disconnect

Both front wheels.

Lower control arm ball joints from steering knuckles, using KM-507-C.

Lower engine compartment cover.

If necessary; the stabiliser mounting from the control arms. Refer to Group E, in Volume 1 for this operation.



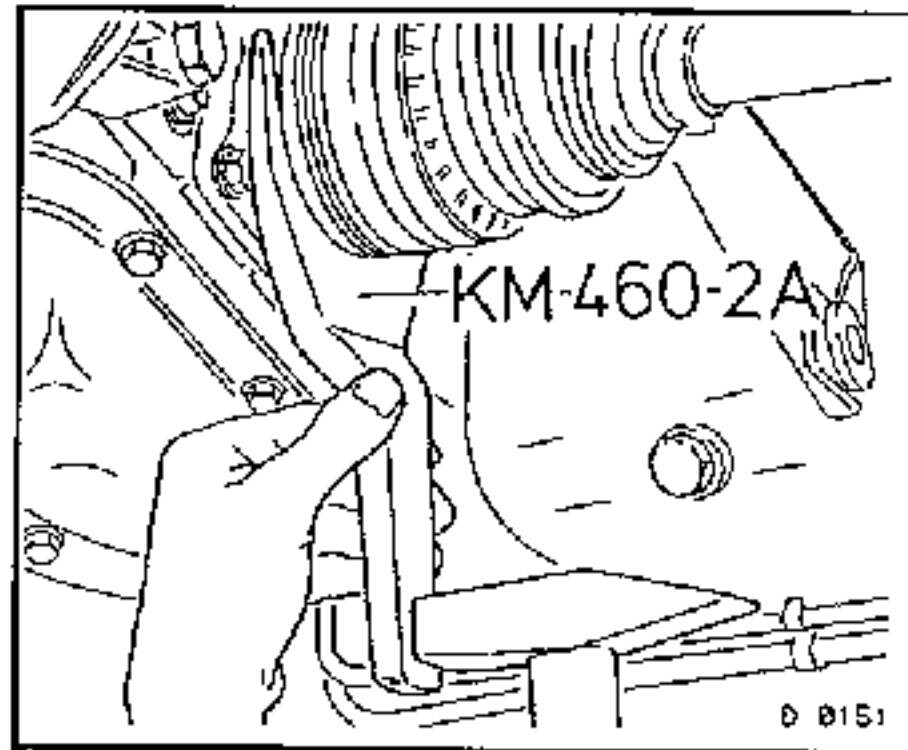
Remove, Disconnect

Axle shafts from the transmission or from the intermediate shaft. Use;

	Left	Right
F 20:	KM-503-A	Soft metal drift
F 28/6	KM-503-A	Soft metal drift

Note:

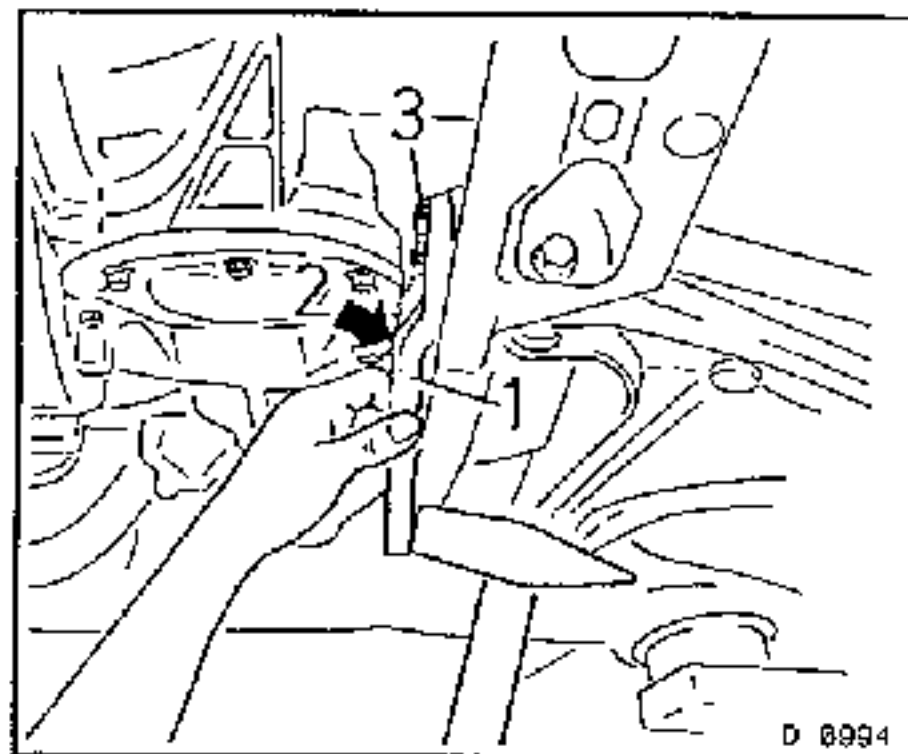
The chamfered edge of the tool faces the transmission.



Important!

For F 20 on the left side;

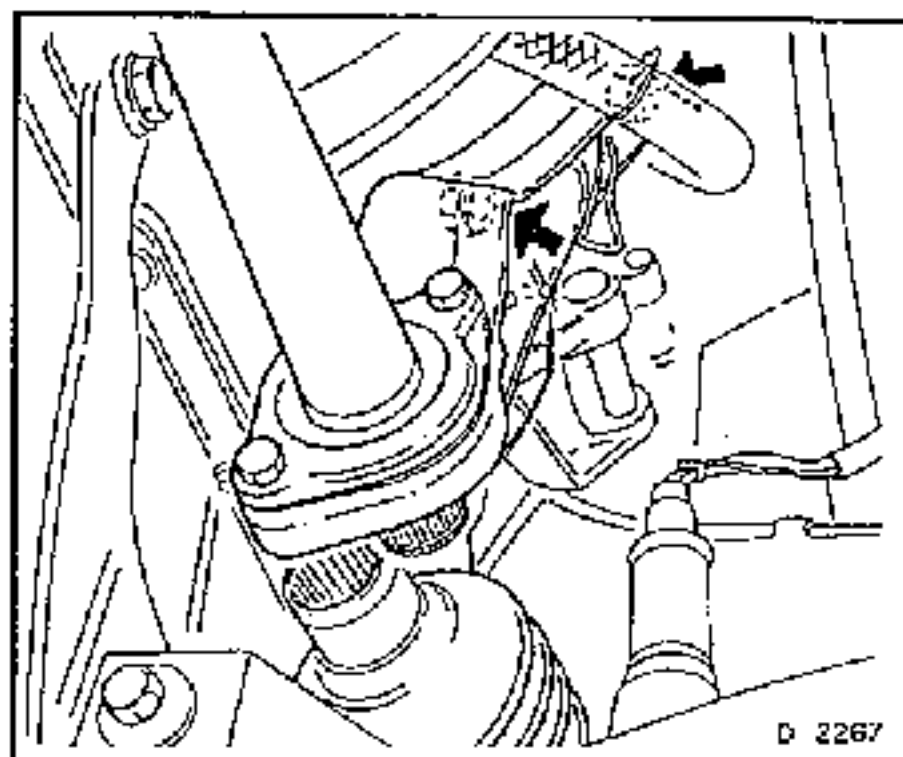
Support KM-503-A (1) on the differential cover (2), NOT on the bearing ring (3).



Remove, Disconnect

For F 20 on the right side;

Unbolt the intermediate shaft bracket from the engine block (2 bolts, arrows) and remove the intermediate shaft from the transmission.



MINOR SERVICING OPERATIONS

Important!

Have a suitable clean container on hand to catch oil spillage

Plugs gaps.

Use tie wire to support the axle shafts. Do not let them hang on their own weight!

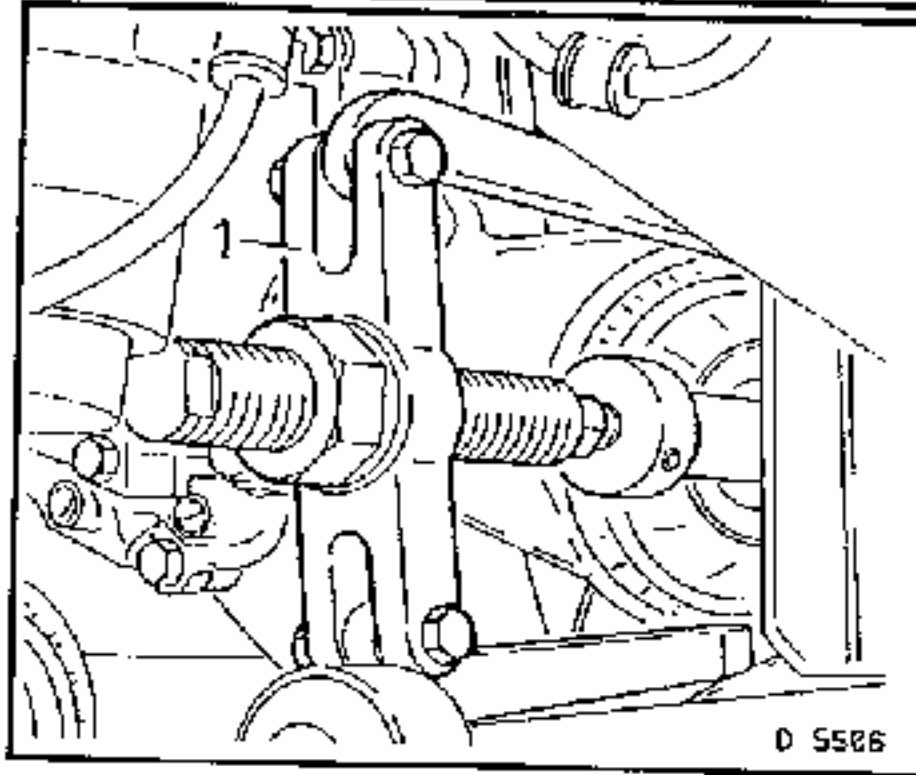
Remove, Disconnect

Seal ring;

F 20: From bearing ring or bearing flange.

F 28/6 From transmission casing.

Use MKM-557 (1) to remove seal rings.



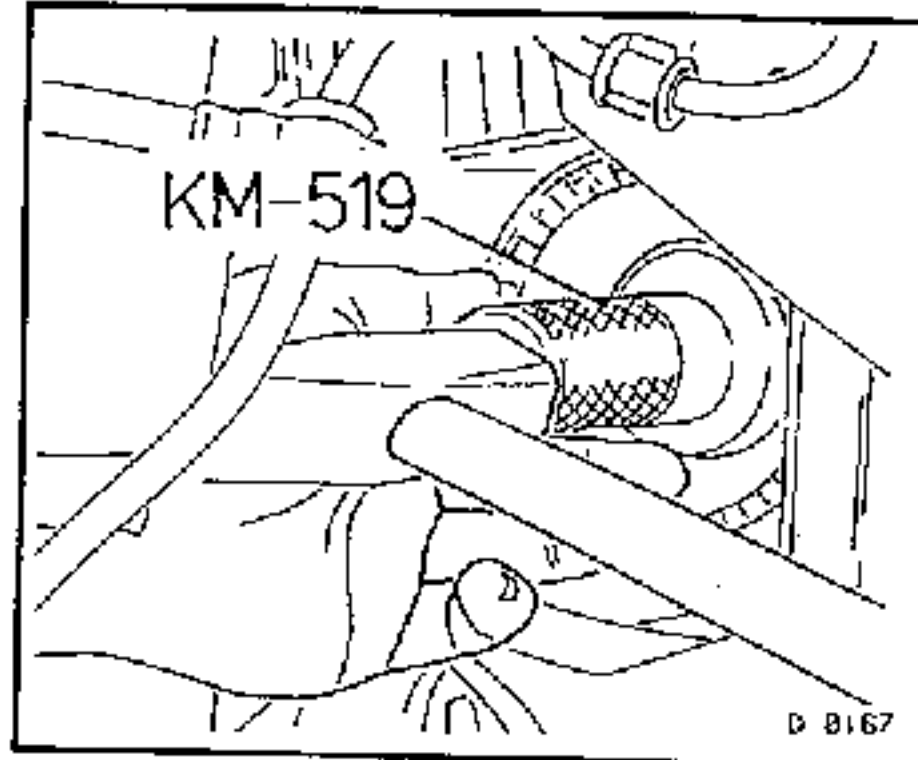
Install, Connect

Seal ring;

F 20: Use KM-519 to install seal in bearing flange or bearing ring.

F 28/6 Use KM-519 to install seal in transmission casing.

Drive seal rings in until they are flush.

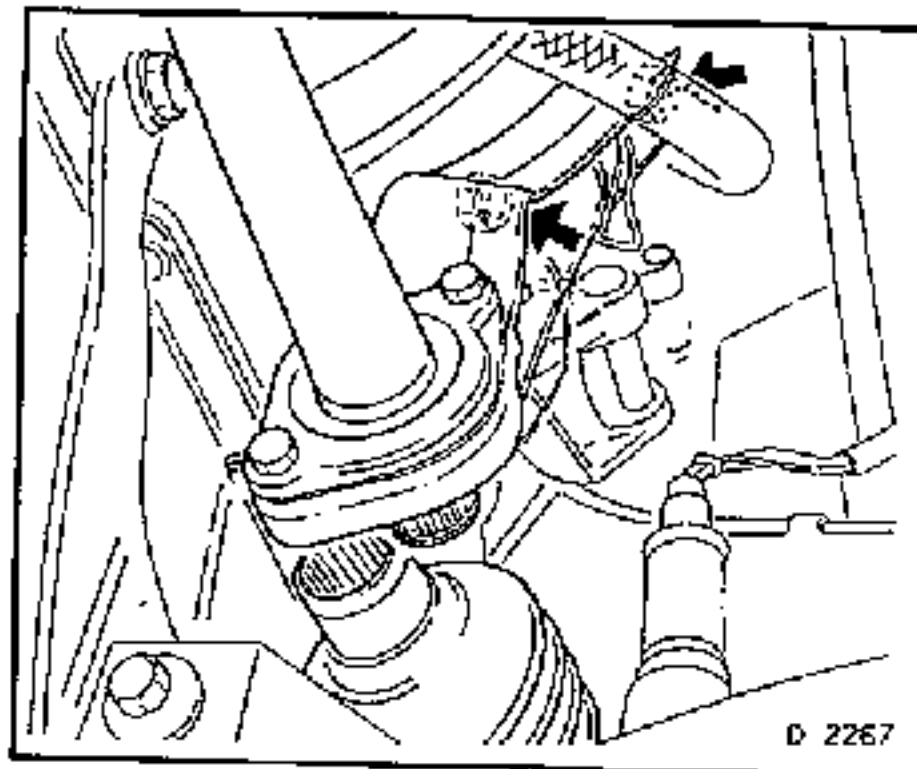


Install, Connect

F 20: Intermediate shaft and bracket.

Tighten (Torque)

Intermediate shaft bracket to engine block..... 55 Nm



Install, Connect

New retaining ring (1) on axle shaft.

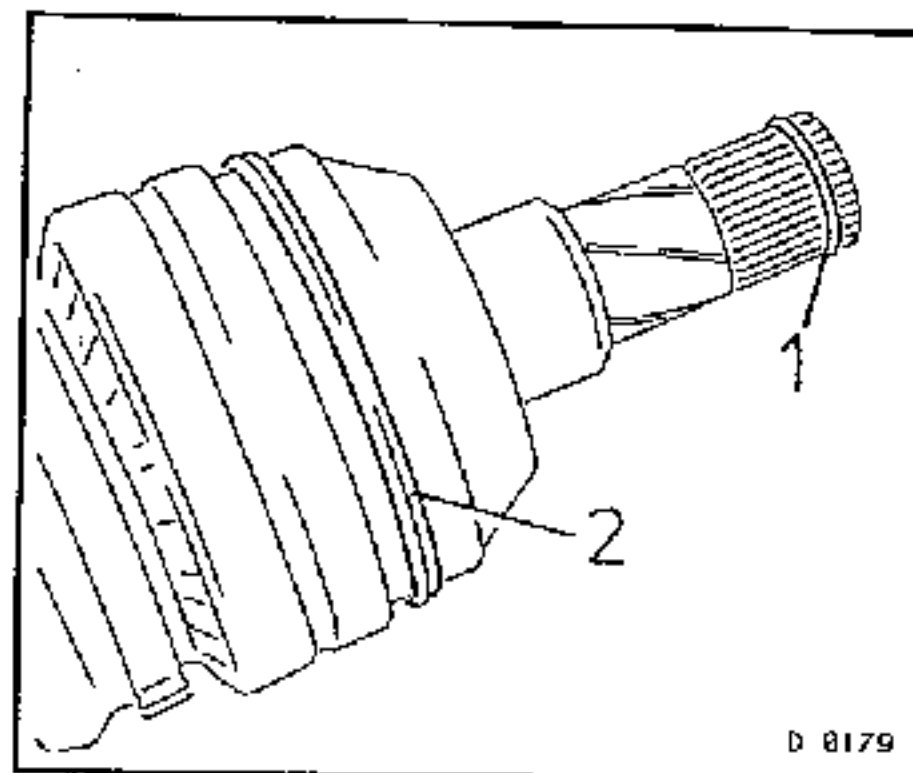
Apply transmission gear oil to the axle splines.

Insert axle into transmission;

Use a square drift and drive on the friction bed weld (2) until the axle engages fully.

Inspect

To check for full installation, try to pull the axle out by grasping on the outer joint diameter (NOT on the axle shaft itself).



MINOR SERVICING OPERATIONS

Install, Connect

New self-locking nut to stabiliser fastening.
 Maintain a pre-tension dimension 't' = 38 - 39 mm.
 Front wheel.

Tighten (Torque)

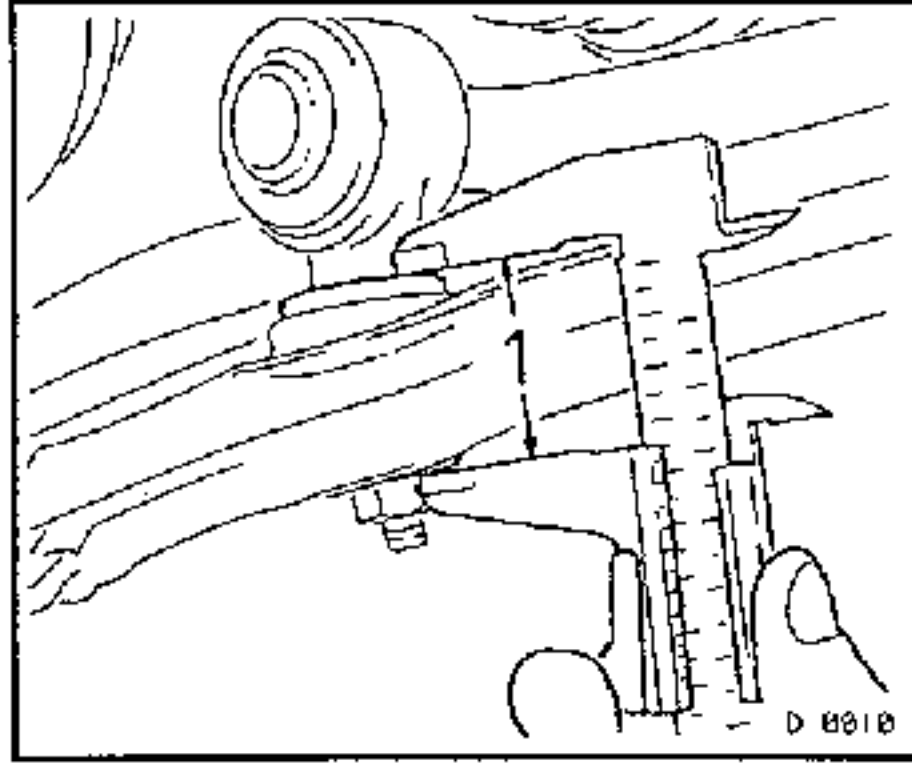
Stabiliser to control arm 20 Nm
 Front wheel..... 110 Nm

Inspect

Transmission oil level. Refer to the operation, in this Section.

Install, Connect

Lower engine compartment cover.



Speedometer Driven Gear and/or O-ring, Replace

For F 20 transmission;

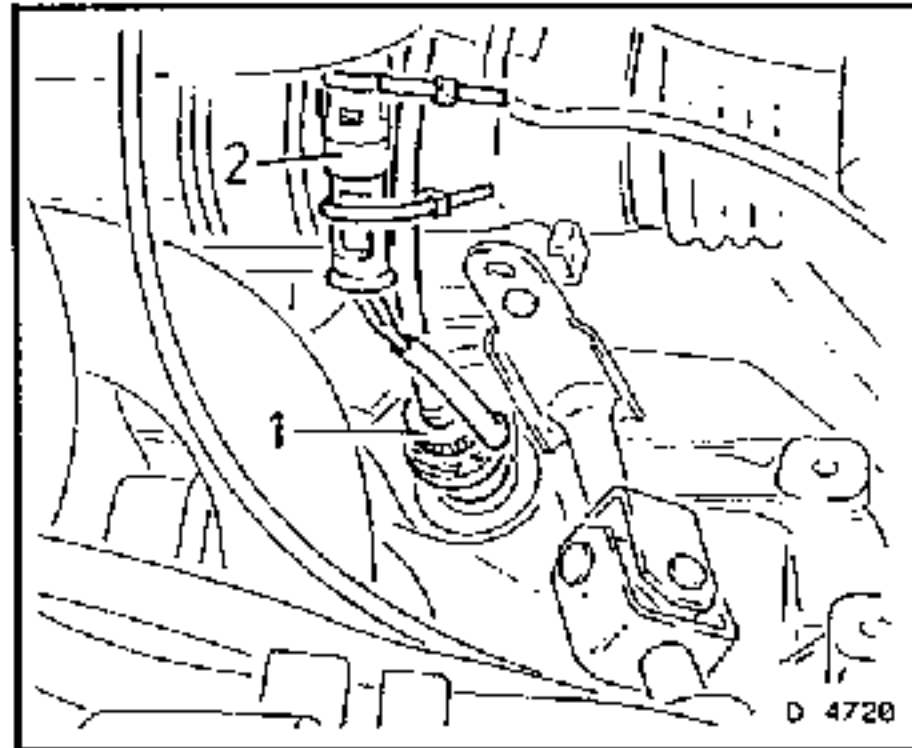
Remove, Disconnect

Speedometer cable (1), and/or wiring harness plug for odometer frequency sensor (2).

Bolt for retainer.

Lever driven gear assembly from transmission.

Rubber O-ring from groove.



Install, Connect

New rubber O-ring (2) in groove (arrow).

Lubricate gear teeth with lithium base grease NLGI No. 4 EP.

Gear and guide (1) into transmission.

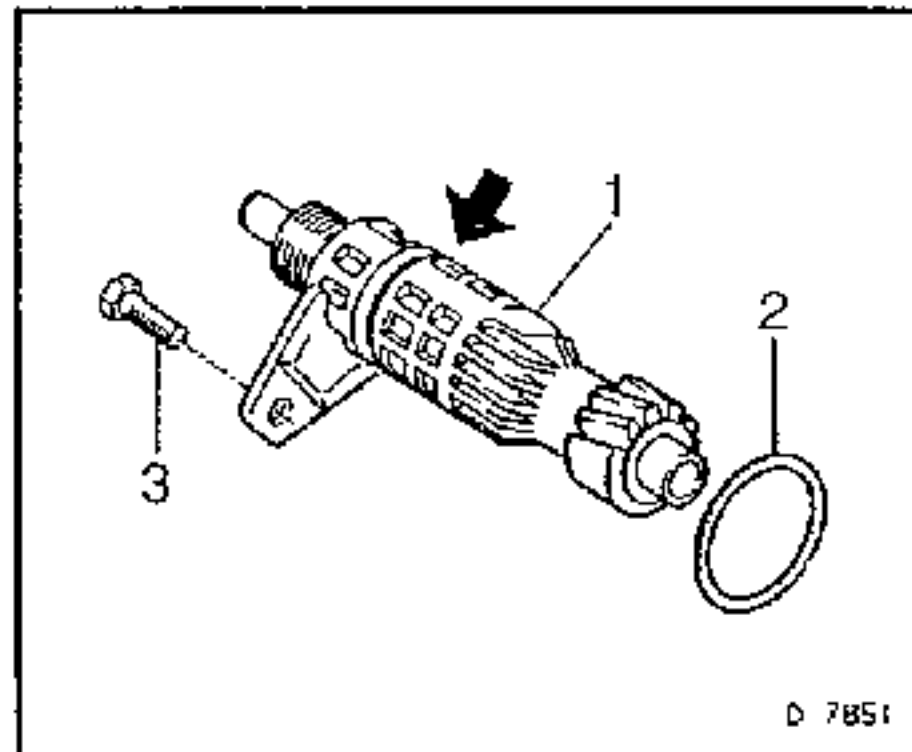
Retaining bolt.

Tighten (Torque)

Speedometer driven gear to transmission.... 4 Nm

Install, Connect

Speedometer cable to guide and/or wiring harness plug to odometer frequency sensor.



For F 28/6 transmission;

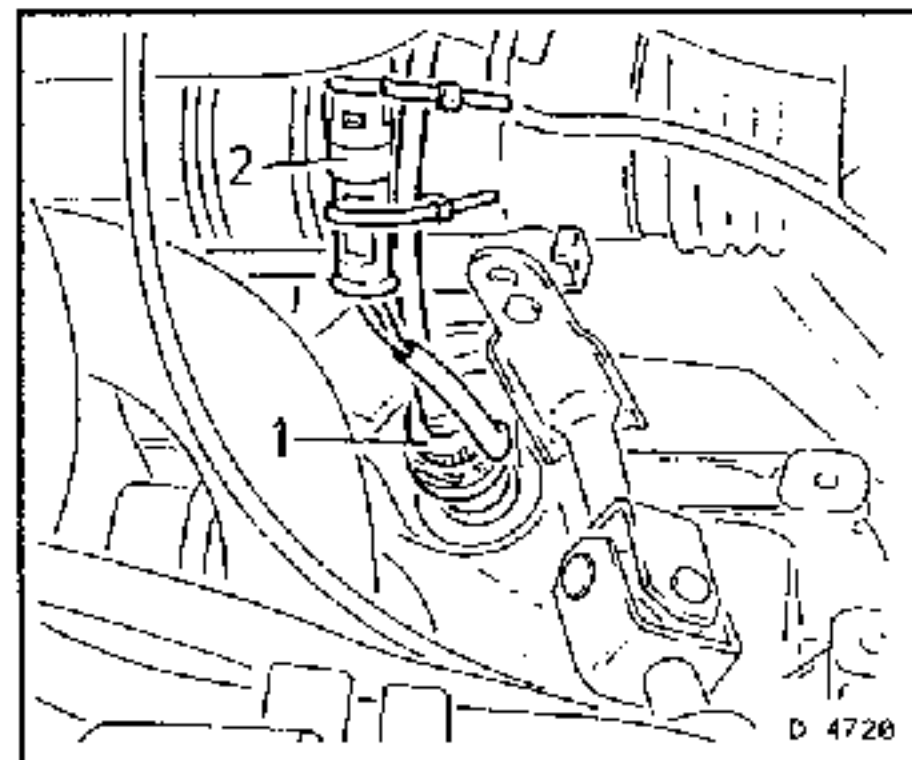
Remove coolant hoses from bracket.

Speedometer cable (1) and/or wiring harness plug from odometer frequency sensor (2).

Retainer plate from guide.

Lever guide from housing.

Rubber O-ring from groove.



MINOR SERVICING OPERATIONS

Install, Connect

New rubber O-ring (2) in groove (arrow).

Lubricate gear teeth with lithium base grease NLGI No. 4 EP.

Insert guide (3) so that groove for retainer faces the retainer bolt hole.

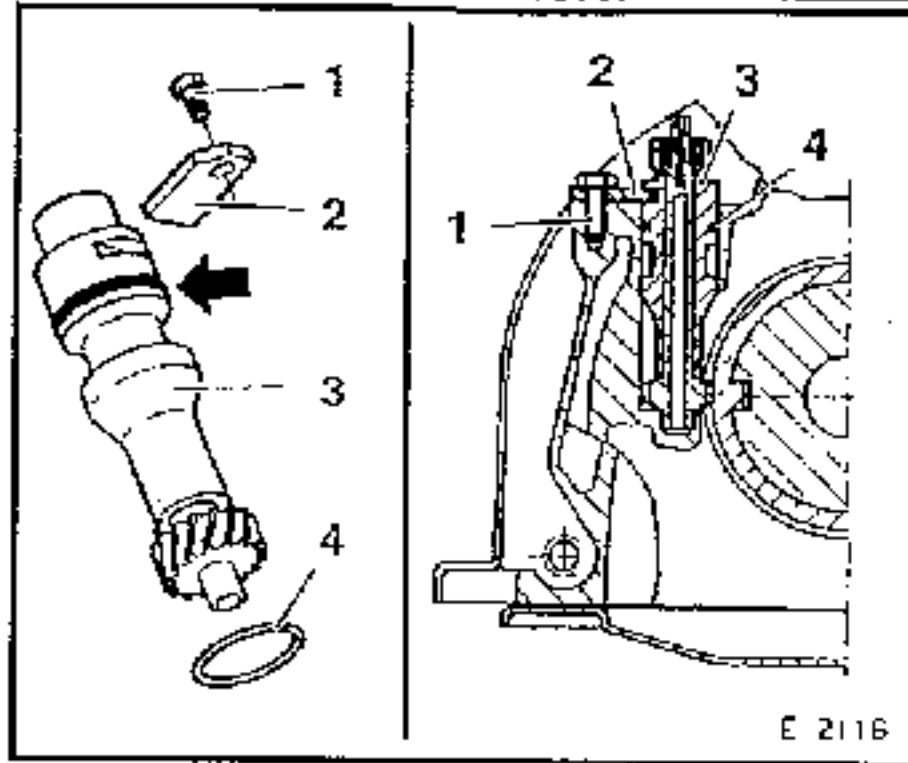
Retaining bolt (1).

Tighten (Torque)

Speedometer driven gear to transmission.... 4 Nm

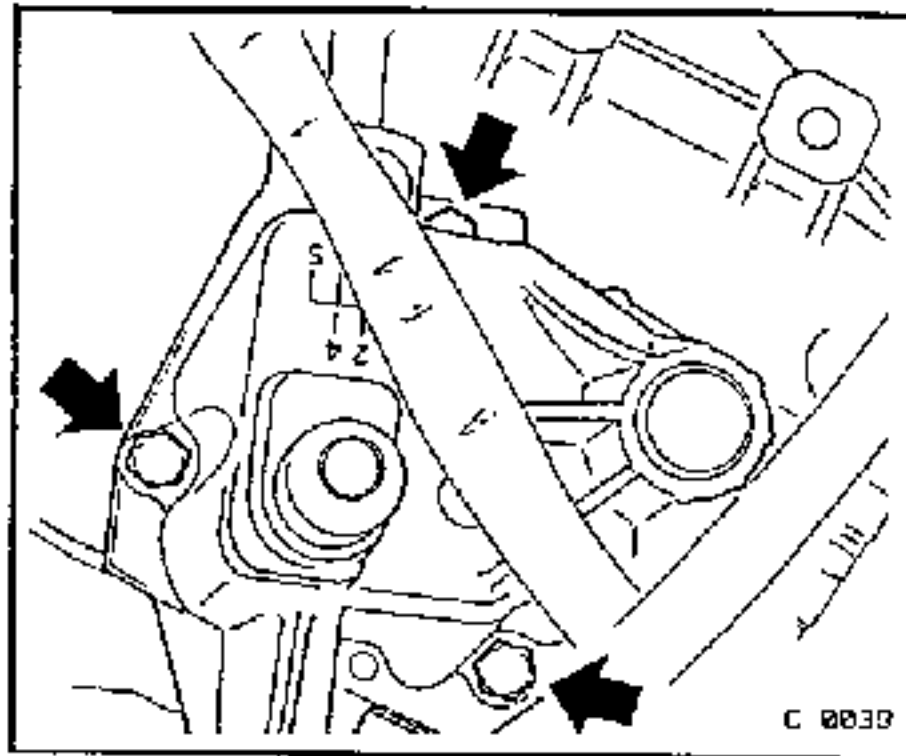
Install, Connect

Speedometer cable to guide and/or wiring harness plug to odometer frequency sensor.



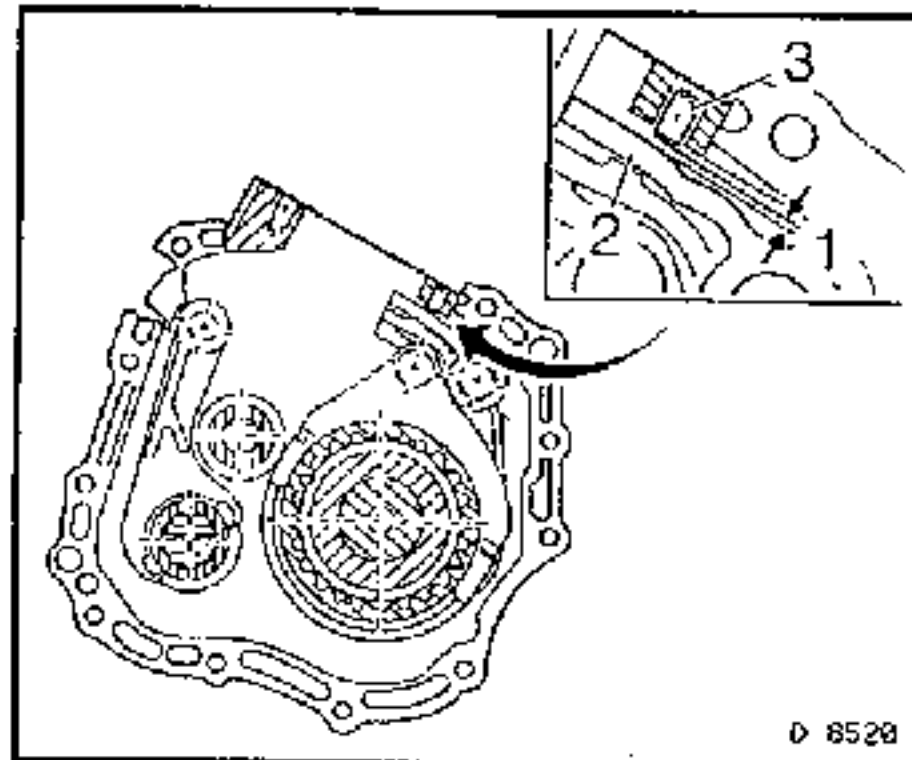
Gasket for Shift Cover, Replace

See "Shift Cover, Remove and Disassemble", in this Section. Disassembly and assembly are not required.



Important!

When installing cover, check the play (1) between the dowel pin and the shift rod actuation. See "Shift Cover, Assemble and Install", in this Section.



Gasket for End Shield, Replace

Remove, Disconnect

Ground cable from battery.

Shift cover. See "Shift Cover, Remove and Disassemble", in this Section.

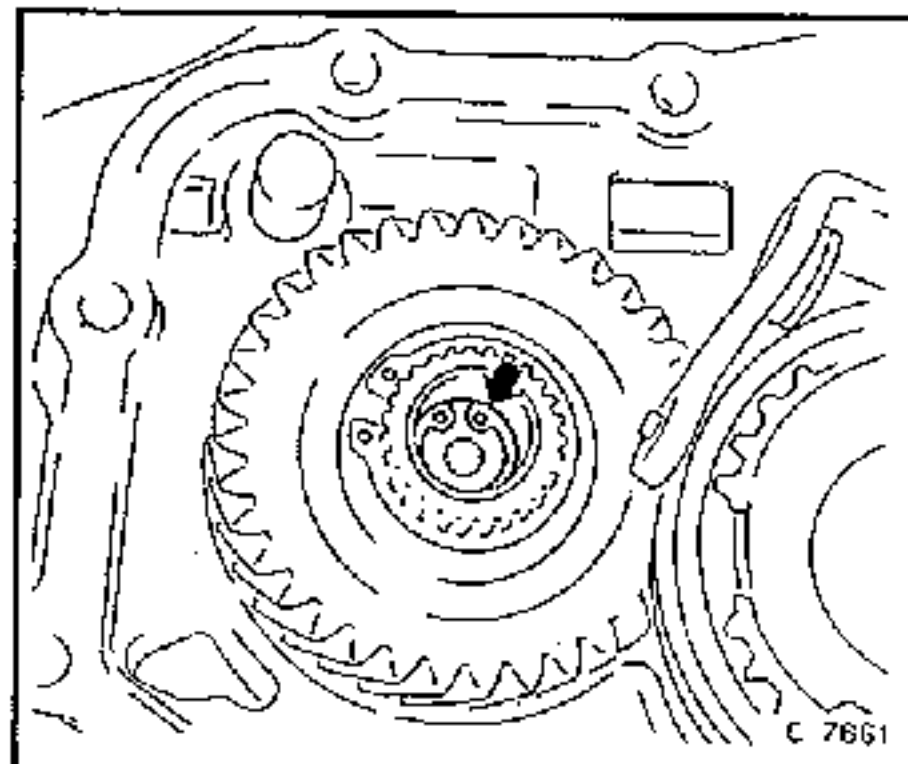
Front left wheel.

Protective panelling from left front wheel housing. See "Wing Remove and Install" in Group A, in Volume 1.

Reversing lamp switch.

Support engine with KM-263-B and spring hooks.

End shield cover from transmission.



MINOR SERVICING OPERATIONS

Remove, Disconnect

Damping block from left front frame side member.

Lower engine with KM-263-B until end shield can be guided out past the front frame side member.

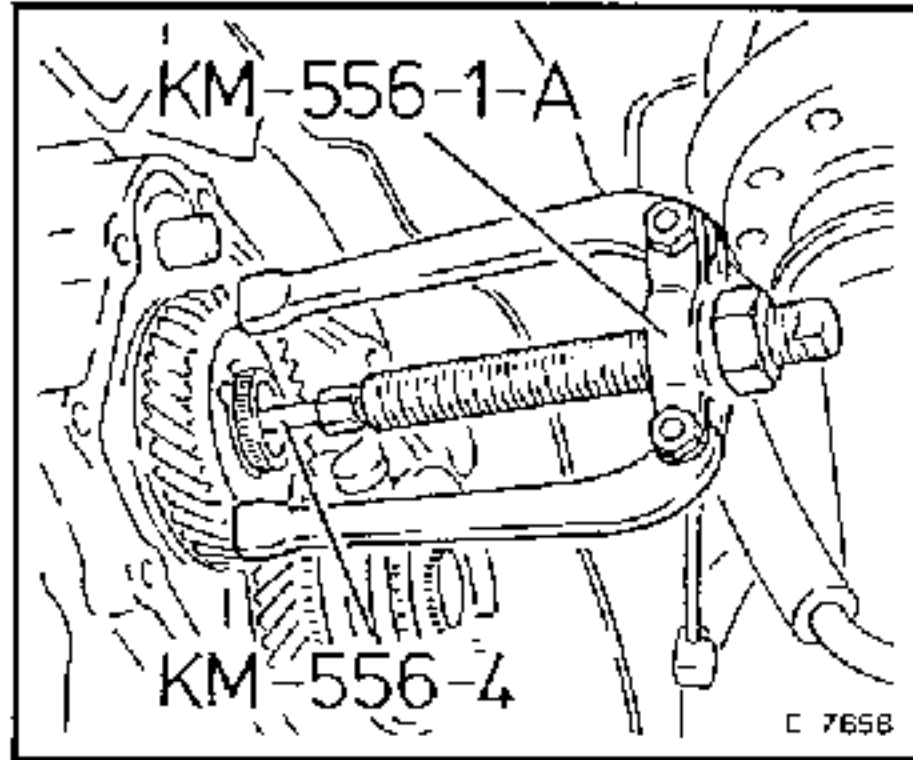
Axle shaft must not be allowed to contact the front axle body.

Remove transmission drive shaft from clutch splines and gear cluster with KM-556-1 and KM-556-4. See "Clutch Disc, Remove and Install", in this Group.

End shield from transmission.

Important!

Have a suitable clean container on hand to catch the spilled gear oil.



Install, Connect

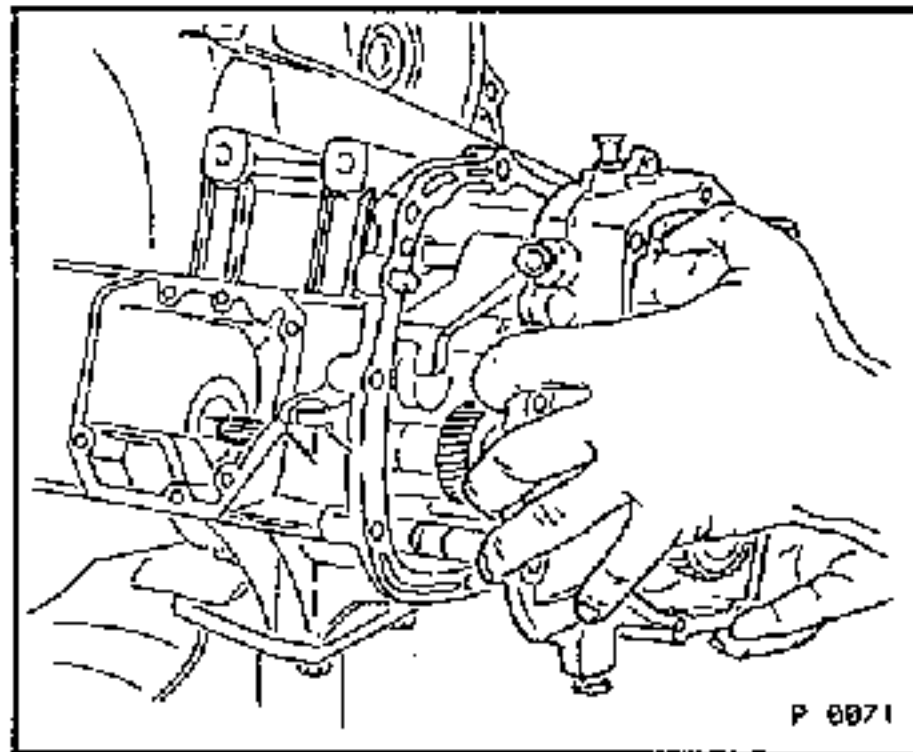
A new gasket to the transmission with lithium bearing grease NLGI No. 4, applied to a new gasket and install end shield cover to transmission. Note the spacing washer (axle reverse idler gear) and magnet.

Tighten (Torque)

End shield cover to transmission	
M 7.....	15 Nm
M 8.....	20 Nm
Reversing lamp switch	20 Nm

Wiring harness plug.

Press in transmission drive shaft to gear cluster and clutch splines (See "Clutch Plate, Remove and Install", in this Group).



Install, Connect

End shield cover to transmission.

After raising engine with hydraulic jack, damping block with new bolts to front side frame members.

Front side panelling.

Front wheel.

Tighten (Torque)

End shield cover to transmission	
M 7 x 1.0	15 Nm
M 8 x 1.25	20 Nm
Damping block to front side frame.....	65 Nm
Wheel studs.....	110 Nm

Install, Connect

Shift cover to transmission. See the operation in this Section.

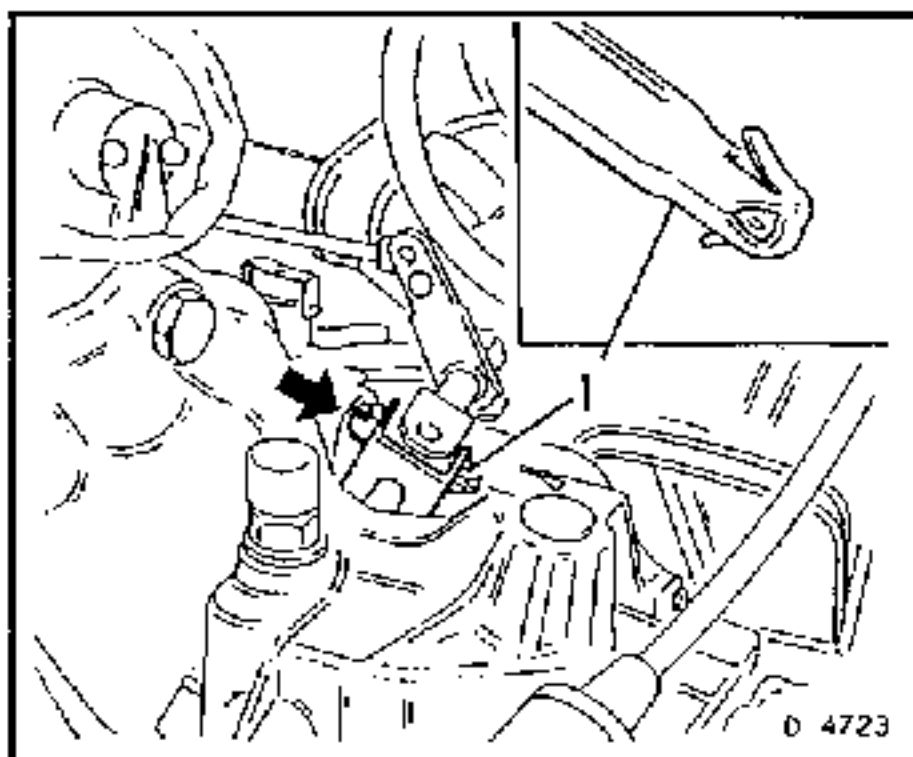
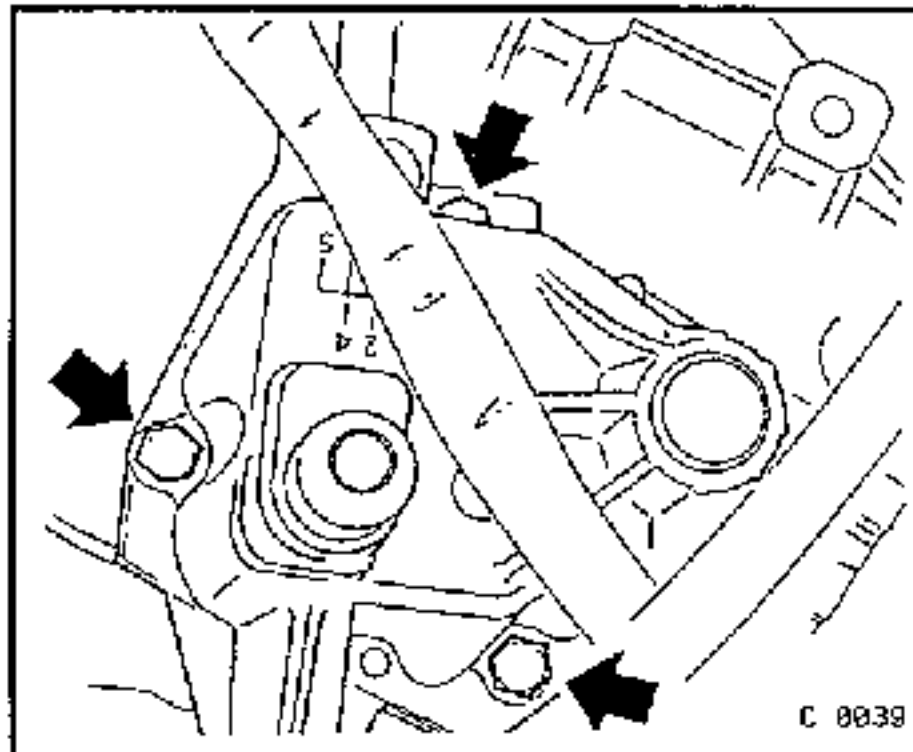
Install, Connect

New hollow pin after lubricating with Dow Corning No 44 silicone grease, to Holden's Specification HN1014, or equivalent. The spring clips are self-engaging.

Remove KM-263-B engine support.

Ground cable to battery.

Top up transmission gear oil. See "Transmission Fluid Level, Check", in this Section.



MINOR SERVICING OPERATIONS

Gasket for Differential Cover, Replace

When cover is removed, oil spillage will occur, so have a suitable, clean container on hand.

Remove, Disconnect

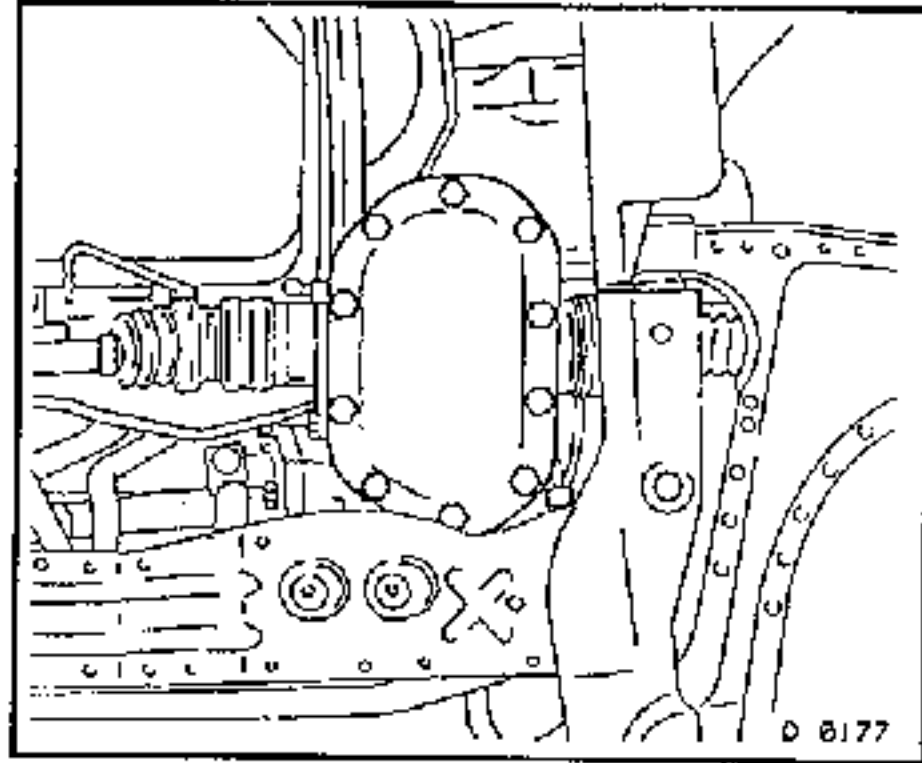
Differential cover.

For 4WD;
Lower front axle body. See operation "Stabiliser, Remove and Install", in Group E, Volume 1.

Important!

Front exhaust pipe, front right wheel and guide joints all remain installed.

Support front axle body when lowered.

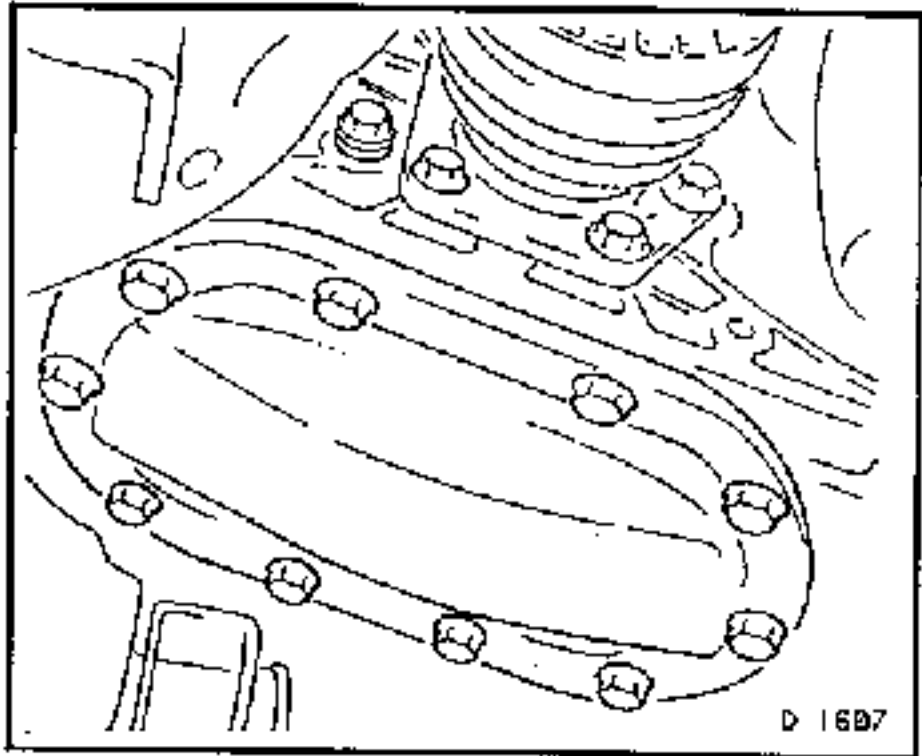


Install, Connect

Apply NLGI No. 4 EP lithium bearing grease, to a new gasket and install cover.

Tighten (Torque)

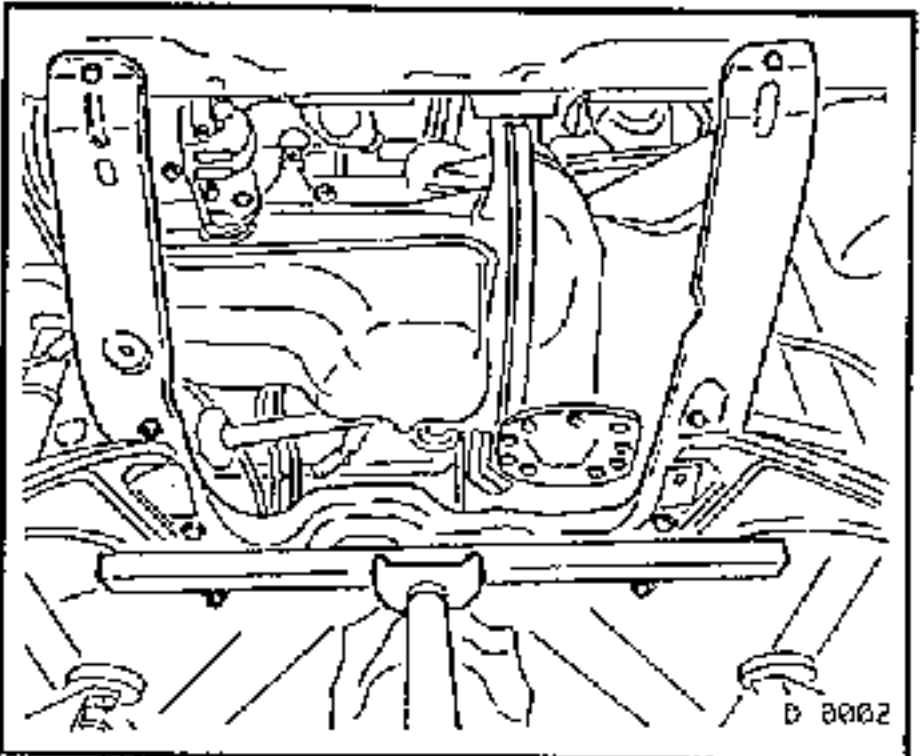
Cover to transmission	
Sheet metal version	30 Nm
Light alloy version	18 Nm



Install, Connect

For 4WD;
Raise front axle body. See operation "Stabiliser, Remove and Install", in Group E, Volume 1.

Top up transmission gear oil. See "transmission Fluid Level, Check", in this Section.



1st Gear Recognition Switch and/or Seal, Replace - F 28/6 Transmission

Remove, Disconnect

Lift circlip and remove wiring harness plug (1).

1st gear recognition switch (2) from the transmission.

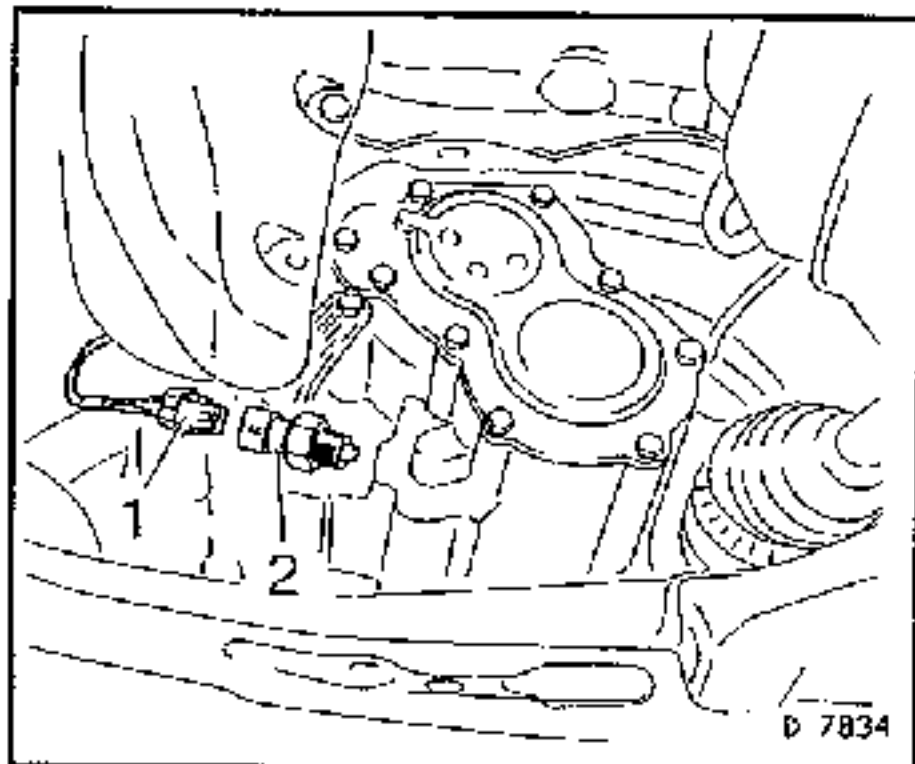
Install, Connect

Apply Loctite 515 or equivalent, to Holden's Specification HN1581 to the switch threads and install.

Tighten (Torque)

1st gear recognition switch	20 Nm
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Wiring harness plug to switch. Ensure that the circlip engages fully.



MINOR SERVICING OPERATIONS

Reversing Lamp Switch and/or Seal, Replace

Remove, Disconnect

Lift circlip, remove wiring harness plug (1).

Remove reversing lamp switch from transmission.

Install, Connect

Apply Loctite 515 or equivalent, to Holden's Specification HN1581 to the switch threads and install.

Tighten (Torque)

1st gear recognition switch 20 Nm

Wiring harness plug to switch. Ensure that the circlip engages fully.

