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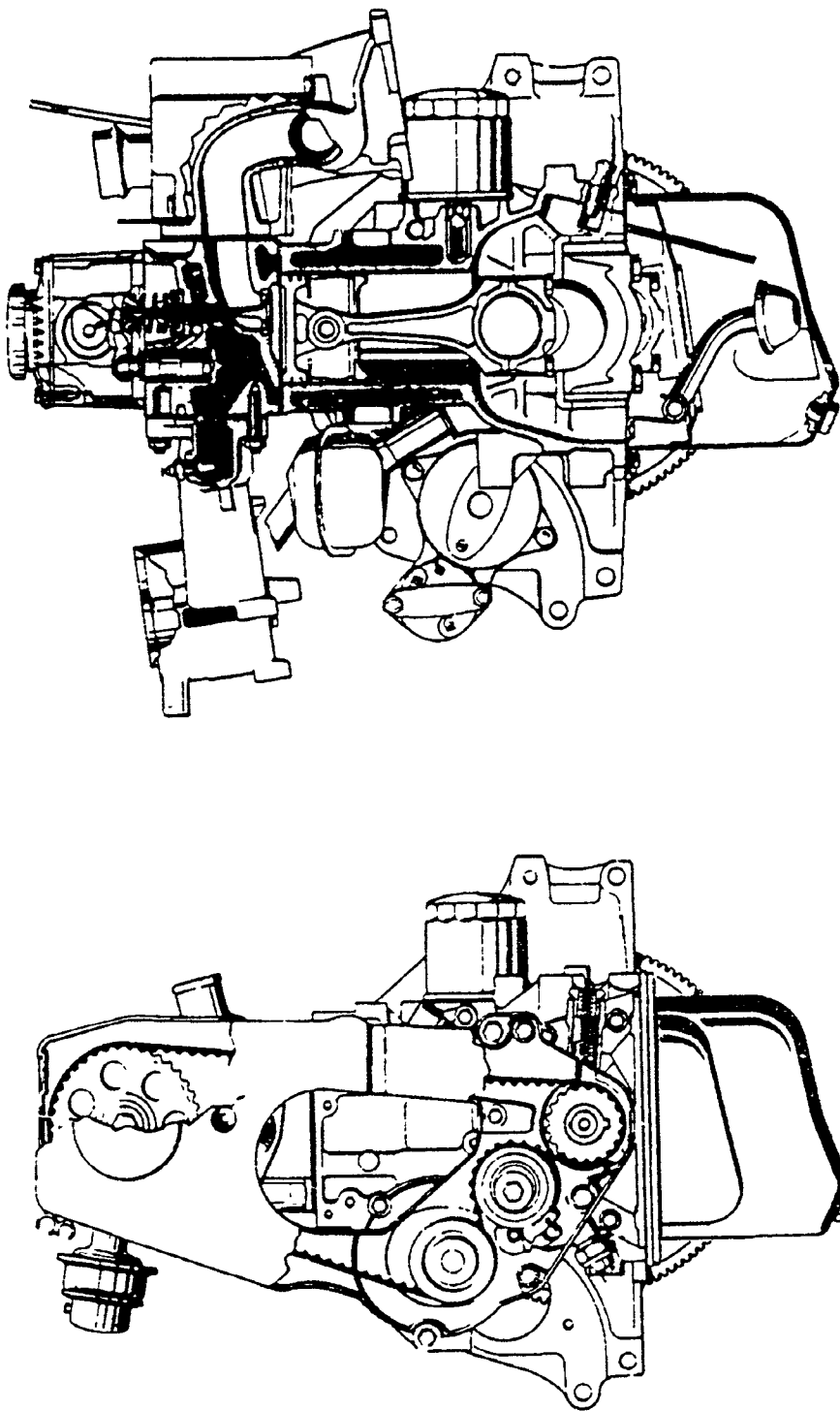
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ILLUSTRATIONS

14 NV

Engine Timing

Cross Section



D 1176

Fig 1

14 NV
Longitudinal Section

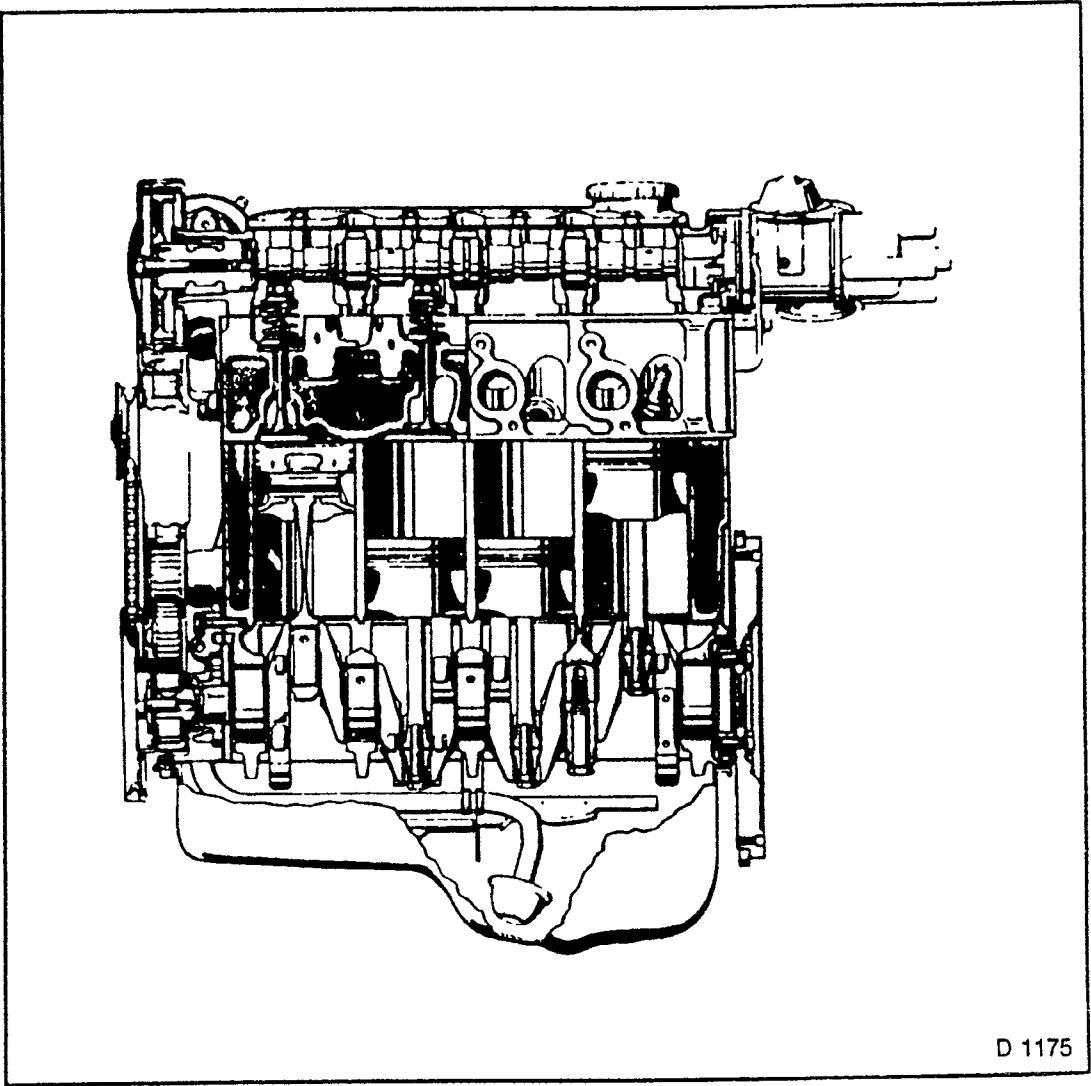
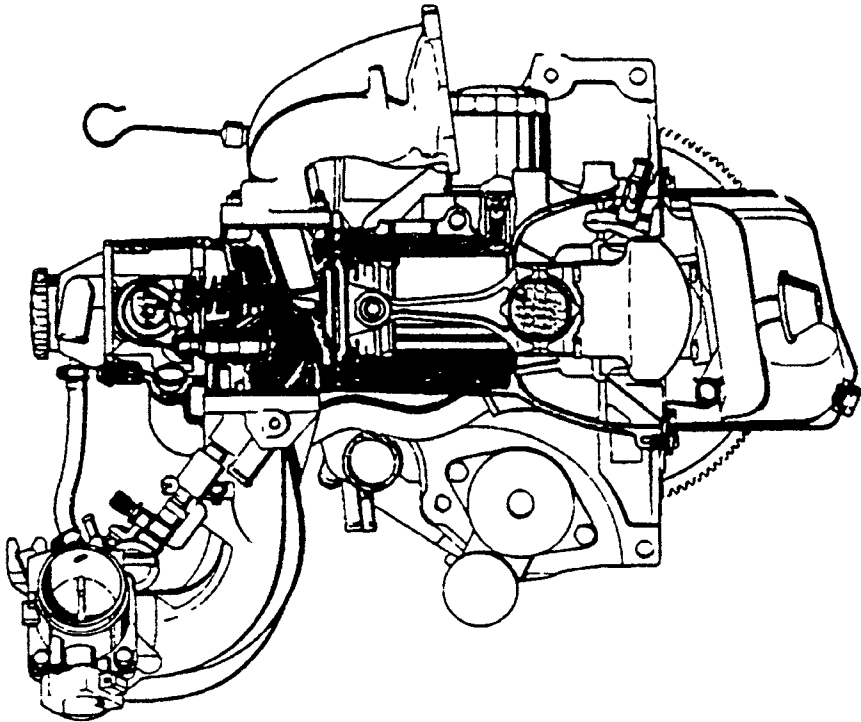


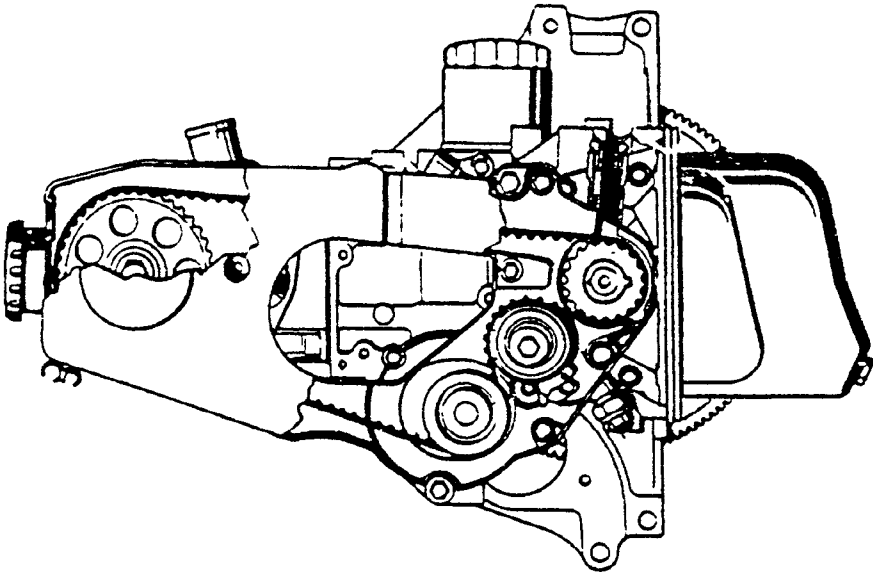
Fig 2

C 16 SE

Cross Section



Engine Timing



D 5887

Fig 3

C 16 SE
Longitudinal Section

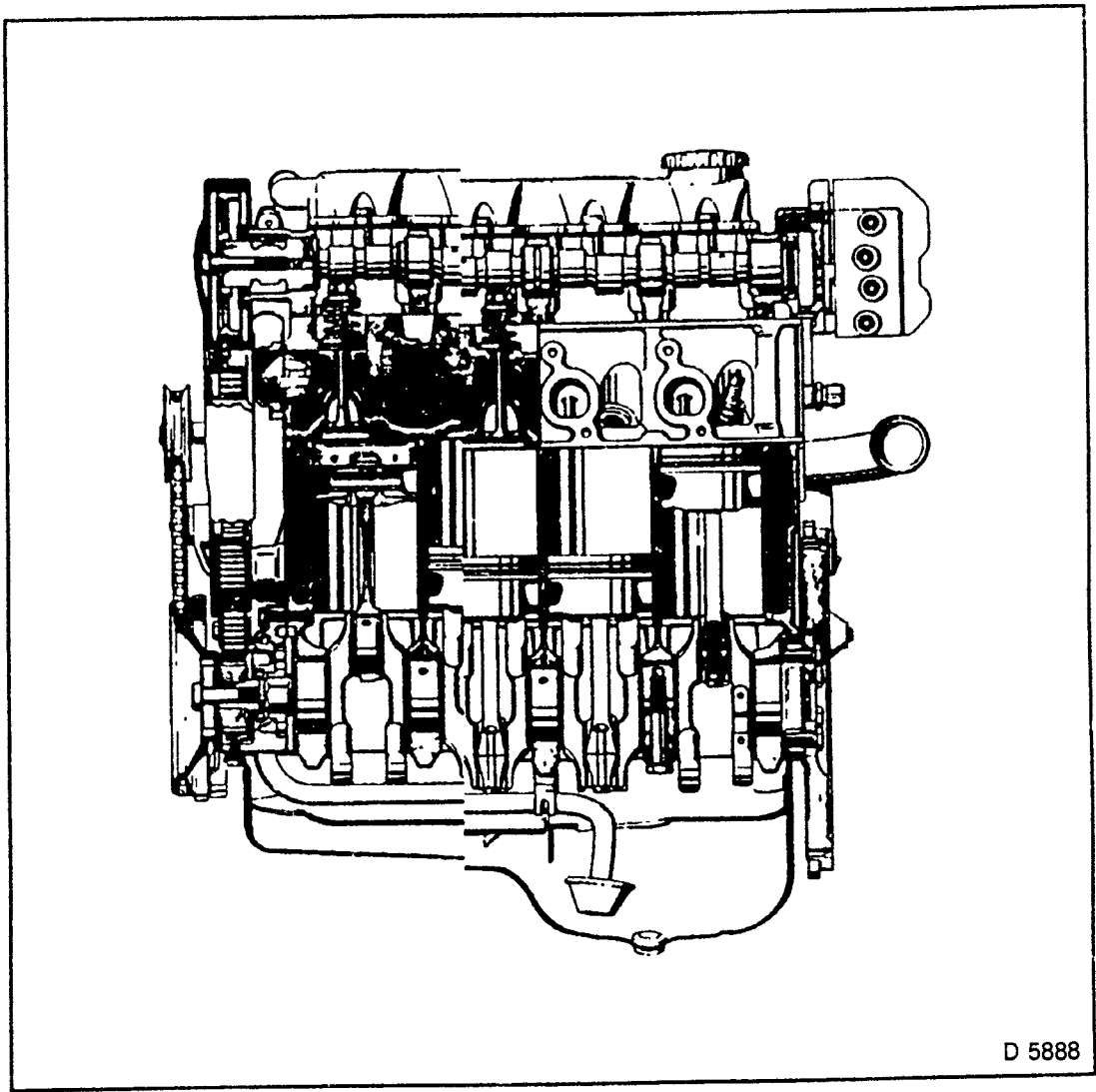
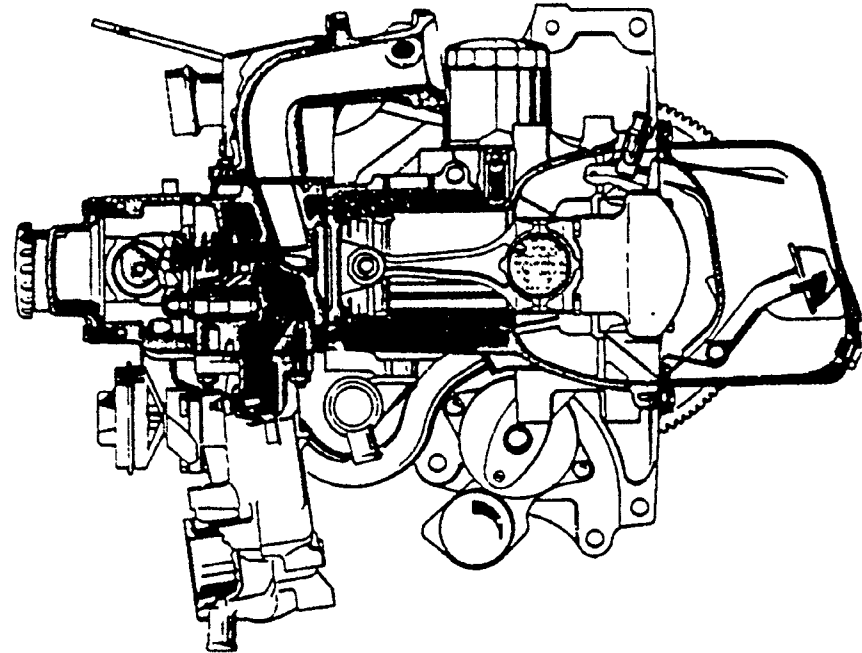


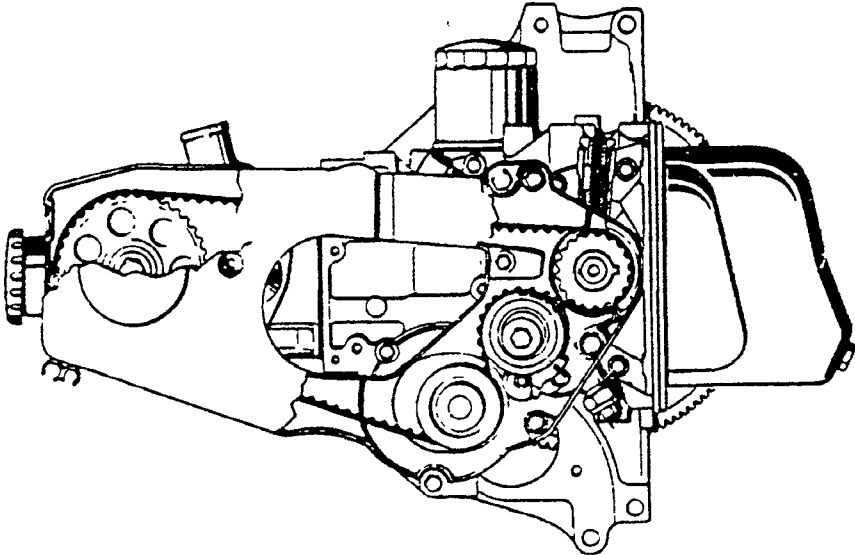
Fig 4

C 16 NZ

Cross Section



Engine Timing



D 1178

Fig 5

C 16 NZ
Longitudinal Section

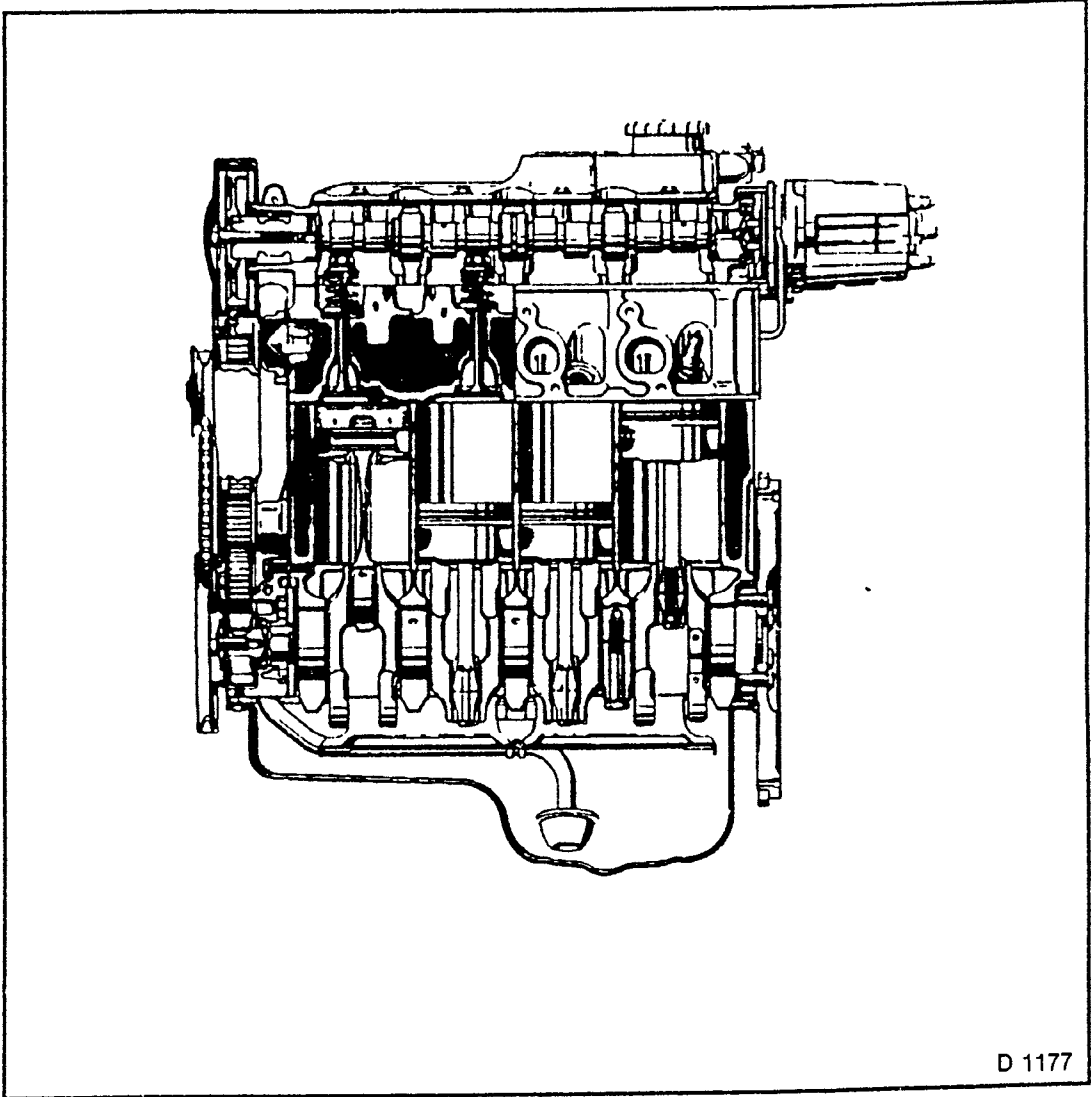


Fig 6

ENGINE CHECKING AND ADJUSTING OPERATIONS

Recommended Torque Values

	Nm
Alternator bracket to cylinder block (M 10)	40
Alternator to bracket (M 10)	35 ²⁾
Alternator to bracket (M 8)	30
Oil filter cartridge to connection fitting (cylinder block)	15 ¹⁾
Oil filter cartridge to oil pump	15 ²⁾
Oil pressure switch/sensor to oil pump	30 ¹⁾
Oil pressure switch/sensor to oil pump	40 ²⁾
Retaining strap to alternator	25
Spark plugs to cylinder head ...	25
Water pump to cylinder block (M 6) ...	8 ¹⁾
Water pump to cylinder block (M 8) .	25 ²⁾

1) 1,4/1,6 ltr. engine
2) 1,8/2,0 ltr engine

V-Belt Tension — Check and Adjust

(except 1,6 ltr. with power steering)

REMOVE, DISCONNECT

1. If present: air intake hose.

MEASURE

1. V-belt tension — KM-128-A.
2. 450 N (new V-belt)
3. 250 to 300 N (used V-belt)
4. Press Lever "A", until pin touches V-belt and a buzzing tone is audible.
5. Multiply value by 100, corresponds to V-belt tension in N.

INSTALL, CONNECT

1. Air intake hose.

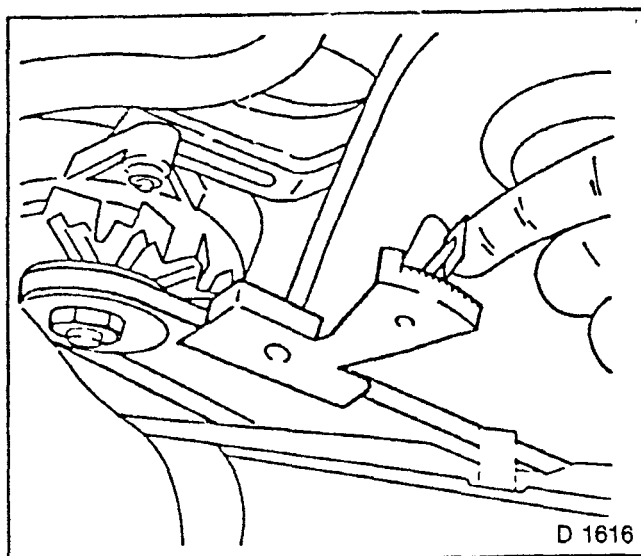


Fig. 7

ADJUST

1. V-belt tension.
2. Loosen clamping bracket.
3. Lower alternator fastening.
4. Push alternator.

TIGHTEN (TORQUE)

1. Clamping bracket to alternator — 25 Nm.
2. Lower alternator fastening (M8) — 30 Nm.
3. Lower alternator fastening (M10) — *40 Nm.

*With 1,8 and 2,0 ltr. engines — 35 Nm.

Ribbed V-belt Tension — Check and Adjust

(16SE with Air-conditioning).

REMOVE, DISCONNECT

1. Air intake hose.
2. Loosen clamping bracket.
3. Lower alternator bracket.

ADJUST

1. Ribbed V-belt tension — KM-612 and torque wrench.
2. New ribbed V-belt: 400 to 430 N equals 55 Nm.*
3. Used ribbed V-belt: 350 N equals 50 Nm.*

*Display on torque wrench.

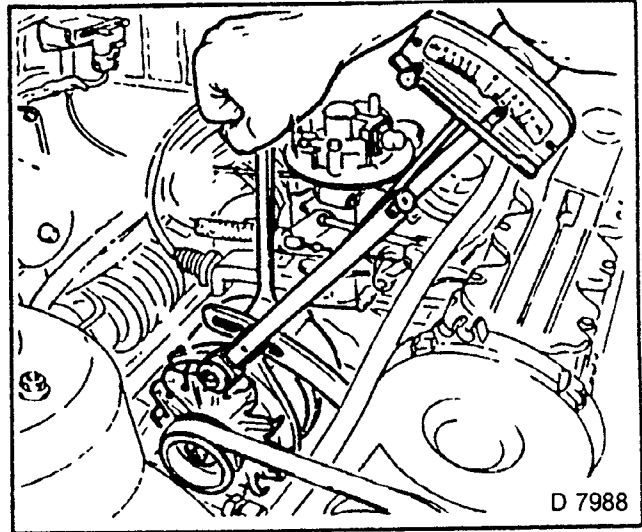


Fig. 8

TIGHTEN (TORQUE)

1. Clamping bracket to alternator — 25 Nm.
2. Lower alternator bracket (M8) — 30 Nm.
3. Lower alternator bracket (M10) — 35 Nm.

INSTALL, CONNECT

1. Air intake hose.

Compression — Check

Engine at operating temperature (oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$).

REMOVE, DISCONNECT

1. All spark plugs.
2. With injection engines, wiring plug (1) from fuel pump relay.
Installation position of fuel pump relay — see section N.
3. Terminal “15” or wiring plug (2) from ignition coil.

NOTE:

Use compression recorder with rubber cone and measuring range to 1750 kPa (17.5 bar/253.75 psi).

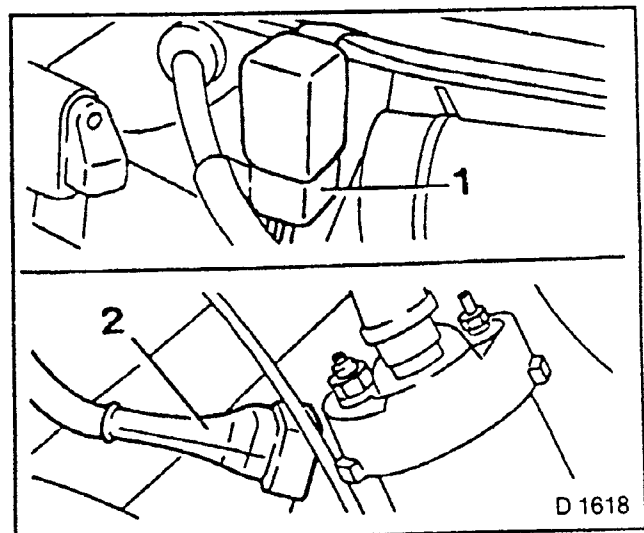


Fig 9

INSPECT

- 1. Compression.
- 2. Operate starter approximately four seconds with fully opened throttle valve — minimum engine speed approximately 300 rpm.
- 3. Permissible pressure deviation of individual cylinders approximately 100 kPa (1 bar/17.5 psi).

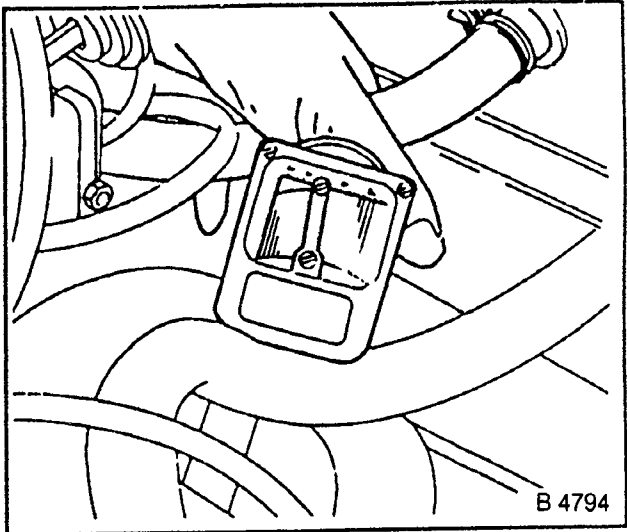


Fig. 10

TIGHTEN (TORQUE)

- 1. Spark plugs in cylinder head — 25 Nm.

INSTALL, CONNECT

- 1. Wiring plug (1) to fuel pump relay.
- 2. Wiring plug (2) or terminal “15” to ignition coil.

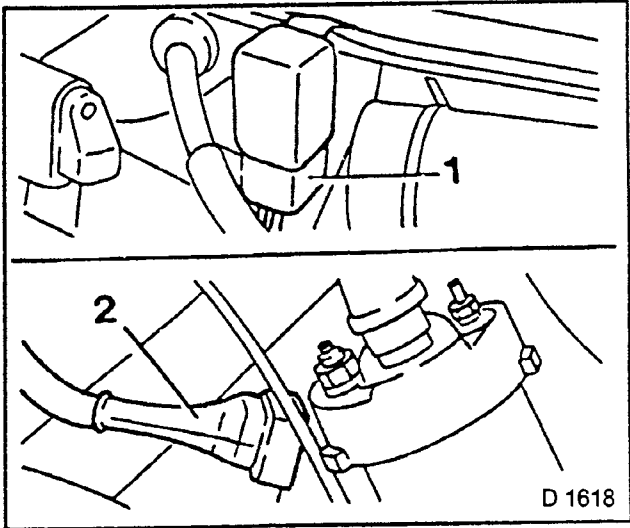


Fig. 11

Engine Pressure Loss — Check

Engine at operating temperature
(oil temperature — $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$).

REMOVE, DISCONNECT

1. All spark plugs.
2. Air cleaner.
3. Oil filler opening cover.
4. Coolant compensation tank cover.
5. Oil dipstick.
6. If present:
Air intake hose.
Pre-volume chamber.

ADJUST

1. Piston of 1st cylinder at TDC position — markings.
Determine TDC position — see operation.
“Timing, Check and Adjust” — page 15.

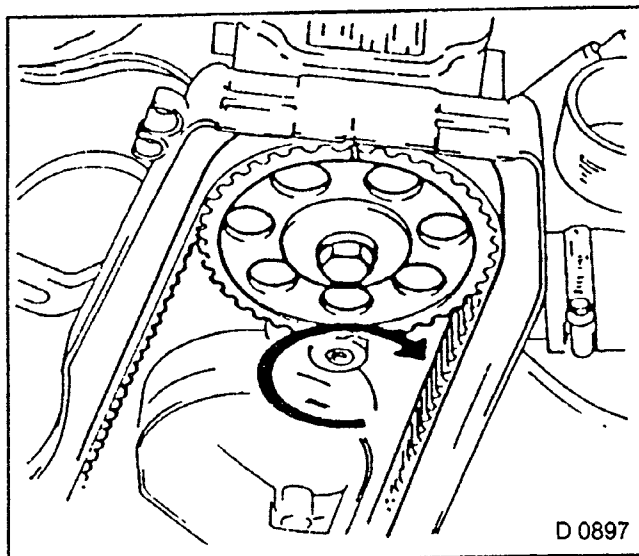


Fig 12

INSTALL, CONNECT

1. Connecting piece to spark plug bore of 1st cylinder.
2. Compression loss tester to compressed air system.
3. Connecting hose to connecting piece (observe manufacturer's instructions).

NOTE:

When checking, the crankshaft must **not** turn. Disconnect tester, correct crankshaft position and reconnect connection hose.

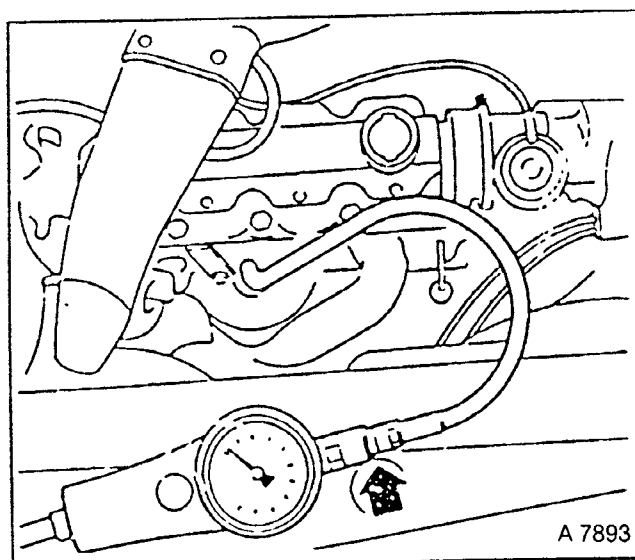


Fig. 13

INSPECT

1. Compression loss.
2. Permitted total compression loss per cylinder approximately 25%.
3. Permitted compression deviation of individual cylinders approximately 10%.
4. Air flow to:
 - intake pipe
 - exhaust
 - compensation tank
 - crank housing.

INSPECT

1. Compression loss analogously with 3rd, 4th and 2nd cylinders.
2. Piston of cylinder to be checked in TDC position.
Ignition sequence: 1-3-4-2
3. Ascertain TDC position by making marks on camshaft timing gear.
4. Turn camshaft timing gear a further 90° in direction of engine rotation (align marking on camshaft timing gear and toothed belt cover).
5. Ascertain TDC position for 4th and 2nd cylinder similarly.

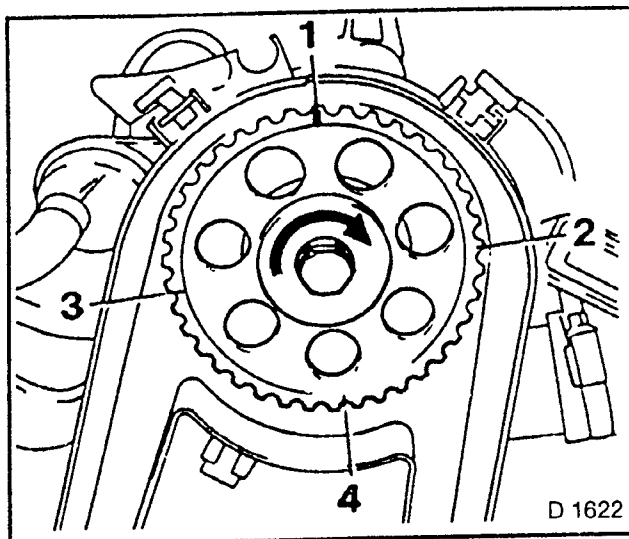


Fig. 14

TIGHTEN (TORQUE)

- 1 Spark plugs in cylinder head — 25 Nm.

INSTALL, CONNECT

1. Oil dipstick.
2. Cover.
3. Air cleaner.
4. If removed:
Pre-volume chamber,
— Air intake hose.

Engine Oil Temperature — Measure

MEASURE

- 1 Engine oil temperature — MKM-596.
2. Insert measuring probe into dipstick guide pipe to approximately 1 cm above oil pan floor
- 3 Seal the guide pipe opening with enclosed rubber plug.

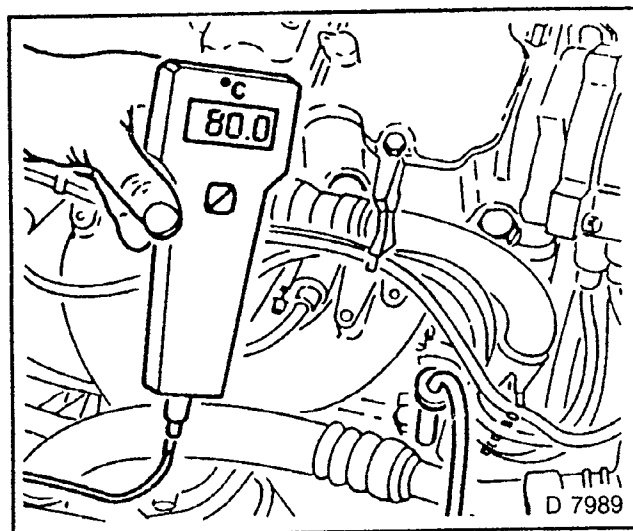


Fig. 15

Engine Oil Pressure — Check

REMOVE, DISCONNECT

1. Oil pressure switch/sensor.

INSPECT

1. Oil pressure — KM-498-B (1) and KM-135 (2).
2. Oil pressure minimum 0.3 bar/4.5 psi at idle speed.
3. Oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$.

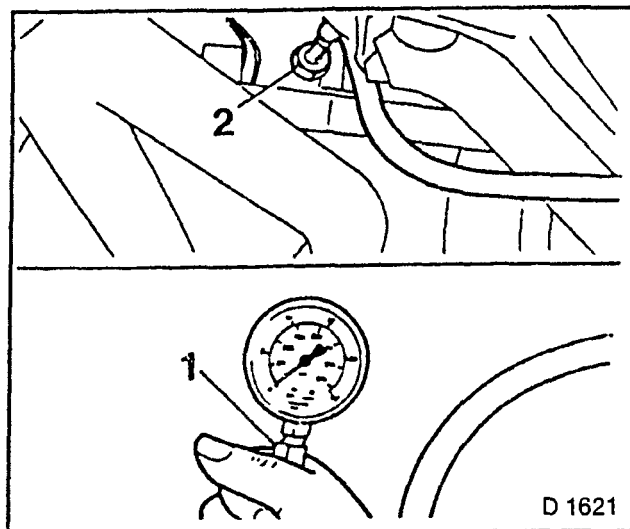


Fig. 16

INSTALL, CONNECT

1. Oil pressure switch/sensor.

TIGHTEN (TORQUE)

1. 1,4/1,6 Ltr: Oil pressure switch/sensor to oil pump — 30 Nm.
2. 1,8/2,0 Ltr: Oil pressure switch/sensor to oil pump — 40 Nm.

Engine Oil Consumption — Measure

GENERAL

The term “oil consumption” of an internal combustion engine refers to the amount of oil which is used as a result of combustion. Oil consumption should under no circumstances be confused with oil loss caused by leaks in 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 produced by friction away.
3. Conduct combustion residue away.

These tasks necessitate the consumption of a certain amount of oil.

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 need be topped up between the prescribed oil change intervals, or even no topping up at all. Topping up is however absolutely necessary if the oil level sinks below the “MIN” mark on the dipstick. Ensure that the oil level does not exceed the upper “MAX” mark on the dipstick, which leads to increased oil consumption.

As oil consumption is a technical necessity, indications that an engine is not consuming oil means that we can conclude that the oil is being diluted by special operating conditions. Frequent cold starts, driving when over-cold, etc. result in the oil flowing back to the oil pan containing fuel particles and condensation, and becomes “diluted”; this can lead to the incorrect supposition that the engine is not consuming any oil at all. Oil diluted in this fashion lacks lubricating power and may lead to engine damage if the prescribed oil change intervals are not observed. The main causes for oil dilution are driving in mainly urban traffic and frequent driving at too low engine speeds when the engine is cold.

The oil consumption first begins to stabilize after operating for a few thousand kilometers. Measurements of the oil consumption only become realistic after about 7 500 km. Before measuring the oil consumption, ensure that the engine is not losing oil due to 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 two minutes before the oil level can be checked.

If, after an oil change, the maximum engine oil filling does not match the maximum level mark on the dipstick, this can be attributed to manufacturing tolerances.

All information regarding filling quantities are included in the Owner's and Driver's Manual.

MEASURING METHOD

1. The check is carried out with the vehicle on a horizontal surface with the engine at operating temperature (engine oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$).
2. Allow engine to run at idle speed immediately before draining the engine oil.
3. Drain engine oil immediately after switching off engine and record the time with a stopwatch — draining time three minutes. (Experiments have indicated that the draining should be kept within three minutes). Always allow the engine oil to drain until the stream of oil turns into drops.
4. Allow the drained engine oil to cool down to approximately $20^{\circ}\text{C}/68^{\circ}\text{F}$ (1 to 2 hours).
5. The amount of cooled oil determined in a measuring cylinder* and fresh oil is added up to the maximum engine oil filling quantity, minus 0,25 litres for the unchanged engine oil filter.
6. Using this amount of engine oil, the customer should travel at least 500 km without changing the engine oil. (The driver should keep to his/her normal routes and driving style).
7. The procedure described above (points 1 to 4) is then repeated with exactly the same time for draining.
- 8 The amount of engine oil "missing" from the measuring cylinder is the engine oil consumption/distance covered.

*Commercially available measuring cylinder (transparent) with a capacity of 1 to 2 litres.

TIMING, CHECK AND ADJUST (1,4/1,6 LTR.)

REMOVE, DISCONNECT

1. If necessary:
 - Air cleaner
 - Air intake hose.
2. Front toothed belt cover.
3. For split version, upper part of front toothed belt cover.
4. Turn crankshaft in direction of rotation of engine, until marks align.

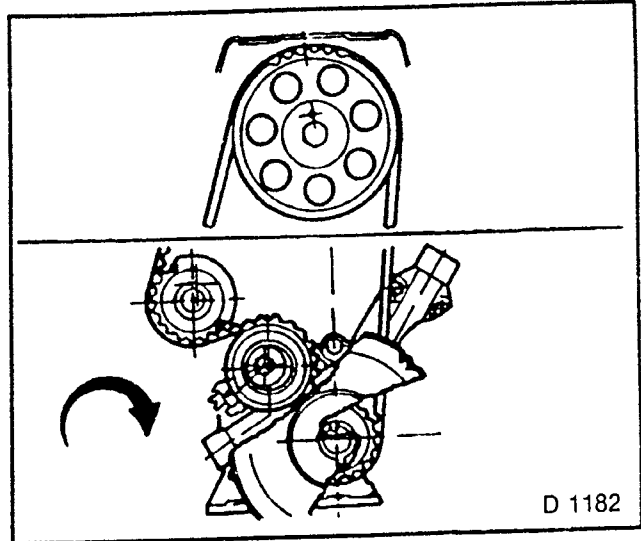


Fig. 17

INSPECT

1. Cast in lower part of front toothed belt cover aligns with marking on crankshaft pulley.

NOTE:
ON 14 NV ENGINES PLACE
CRANKSHAFT PULLEY ON FIRST
MARKING (10° BTDC).

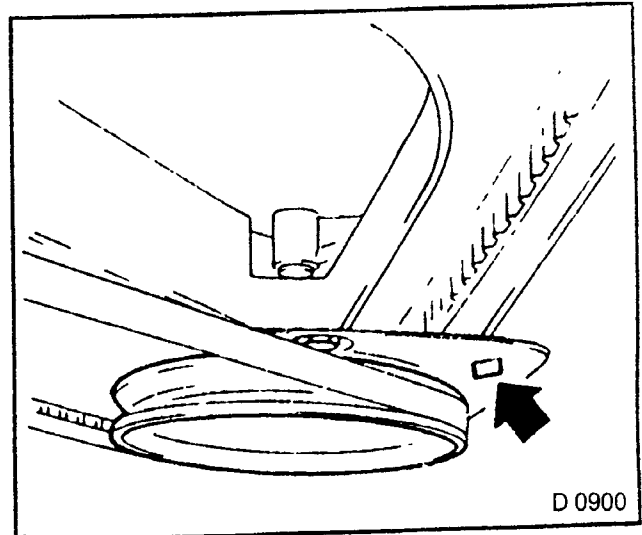


Fig. 18

INSPECT

- 1 On the 16 SE engines, TDC mark is on increment disc (in conjunction with ribbed V-belt pulley)

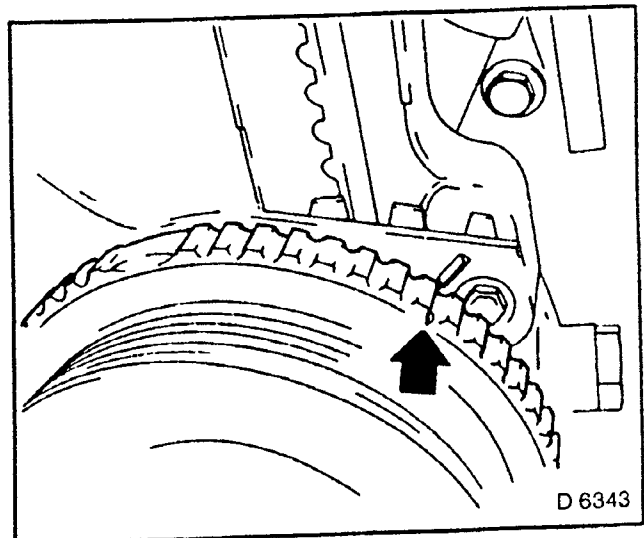


Fig. 19

INSPECT

1. On the 16 SE engine, TDC mark is on V-belt pulley (in conjunction with increment disc.)

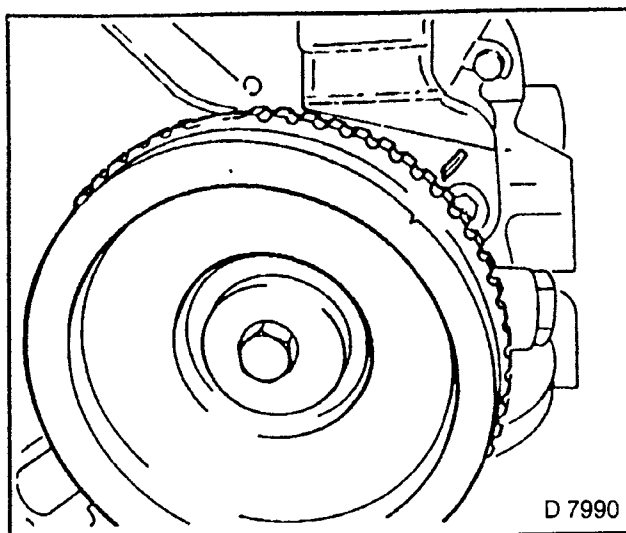


Fig 20

INSPECT

1. At the same time, the marks on the camshaft pulley and toothed belts cover must align.

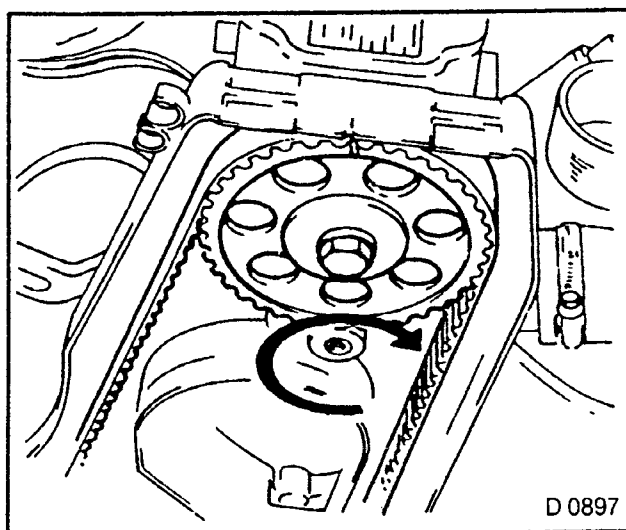


Fig 21

ADJUST

- 1 Timing.
2. Loosen water pump.
3. Remove toothed belt from camshaft timing gear.
4. Put camshaft timing gear (short distance) on marking.
5. Install and tension toothed belt.
6. Front toothed belt cover.
7. If removed:
 - Air intake hose.
 - Air cleaner.

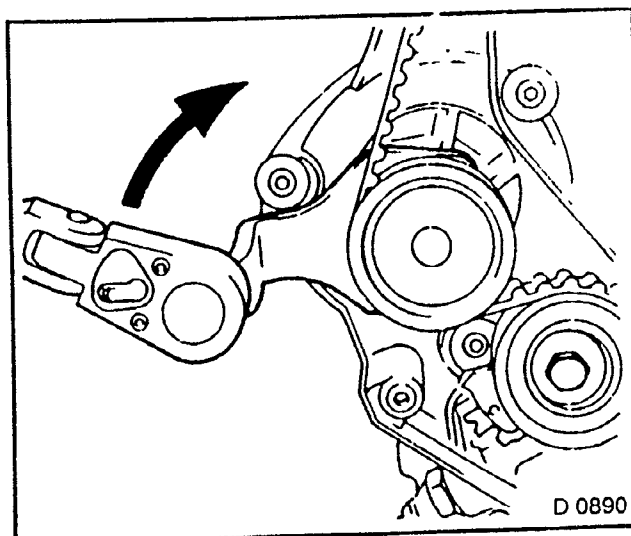


Fig. 22

Timing — Check and Adjust (1,8/2,0 ltr.)

REMOVE, DISCONNECT

1. If necessary:
 - Air cleaner.
 - Air intake hose.
2. Front toothed belt cover.

INSPECT

1. Put crankshaft pulley notch on indicator in direction of engine rotation.
2. At the same time, the marks on the camshaft pulley and toothed belts cover must align.

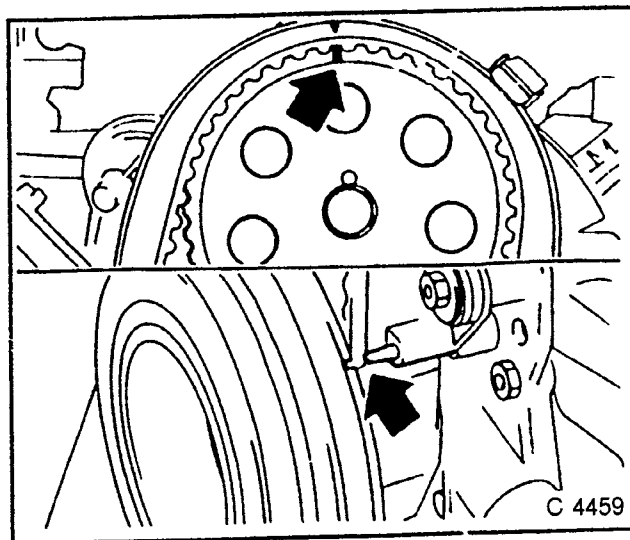


Fig. 23

ADJUST

1. Timing.
2. Loosen water pump, remove toothed belt from camshaft timing gear and put camshaft timing gear (short distance) on marking.
3. Install and tension toothed belt.

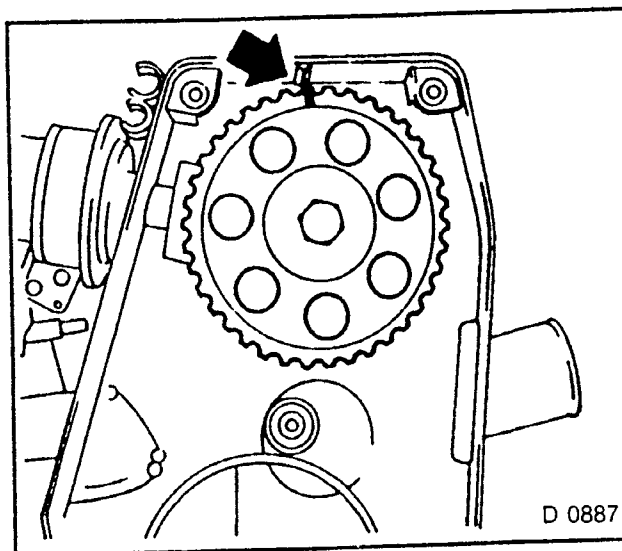


Fig. 24

INSTALL, CONNECT

1. Front toothed belt cover.
2. If removed:
 - Air intake hose.
 - Air cleaner.

Toothed Belt — Install and Tension
(1,4/1,6/1,8/2,0 ltr. with Toothed Belt Tension Roller)

NOTE:
ADJUSTMENT OF TOOTHED BELT IS CARRIED OUT ON COLD ENGINE.

INSPECT

- 1. TDC position of 1st cylinder:
- 2. Marking on camshaft timing gear aligns with marking on toothed belt rear cover.

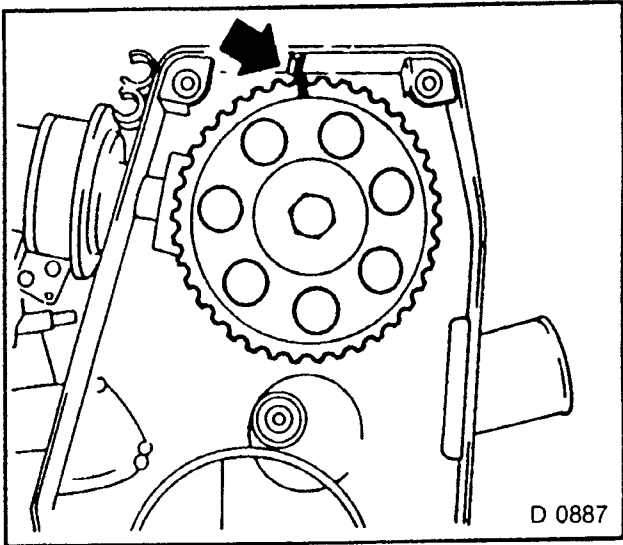


Fig. 25

INSPECT

- 1. Punch marks on arrow on toothed belt drive gear (1) must align in the centre of the groove (2) on the oil pump housing or toothed belt cover in position illustrated.

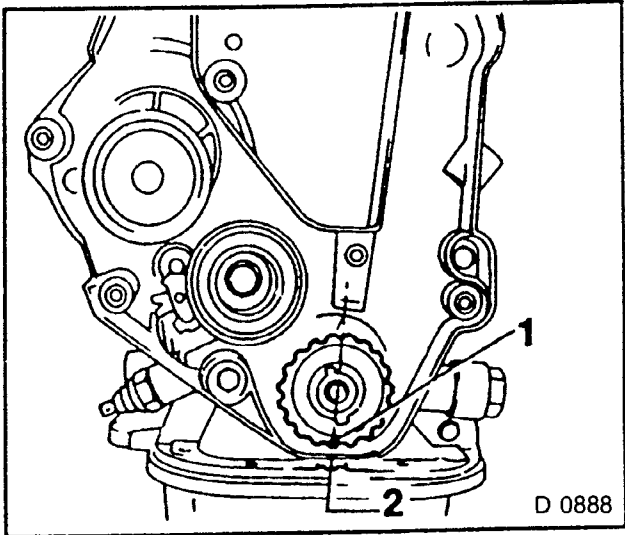


Fig. 26

- 2. Loosen fastening screws for water pump. Do **not** remove.

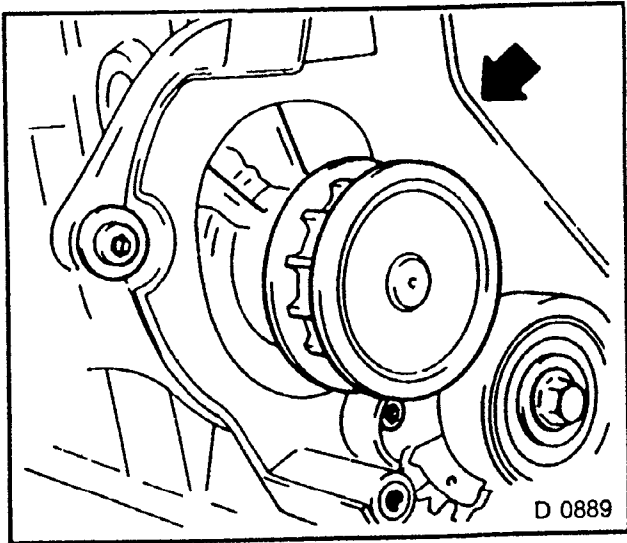


Fig. 27

3. Mount toothed belt

NOTE:
TENSIONED SIDE TAUT.

ADJUST

- 1. Tighten toothed belt by turning water pump in direction illustrated using KM-421-A.

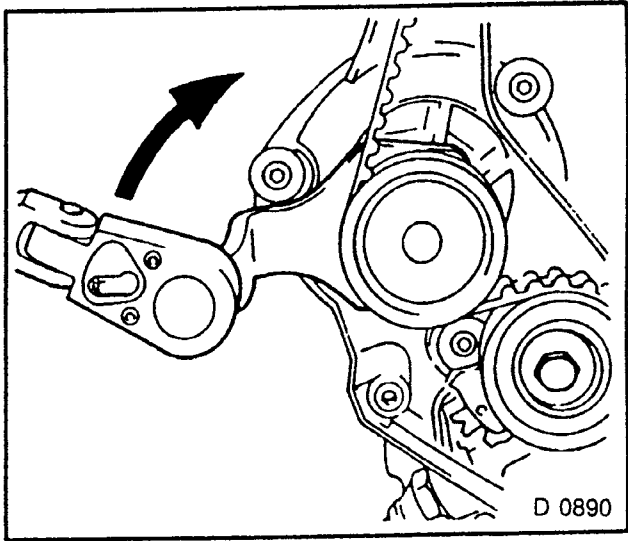


Fig. 28

INSPECT

- 1. Movable part (1) of tension roller (2) now has to be positioned at the right-hand stop.

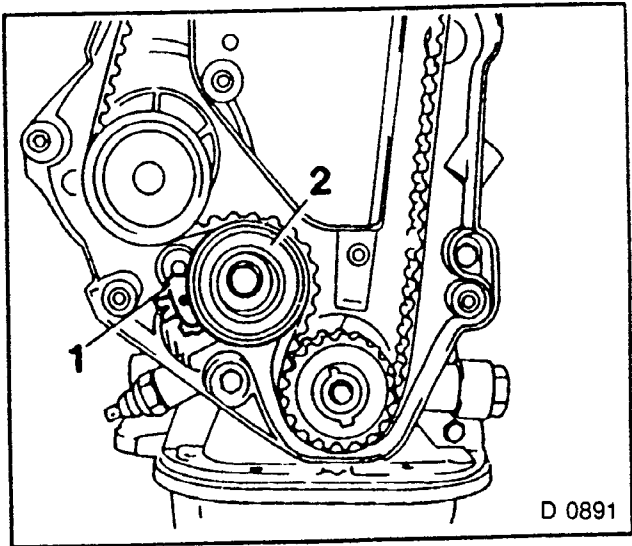


Fig. 29

- 2. Turn crankshaft in engine rotation direction (arrow) 720°, until camshaft timing gear and toothed belt drive gear are positioned on marking — 1st cylinder on TDC — again. For this use crankshaft pulley fastening screws.

NOTE:
TURN CRANKSHAFT JERK-FREE AND SMOOTHLY IN ORDER TO AVOID JUMPING OVER OF TOOTHED BELT. THE POSITION OF THE WATER PUMP MUST NOT BE ALTERED WHEN ROTATING THE ENGINE.

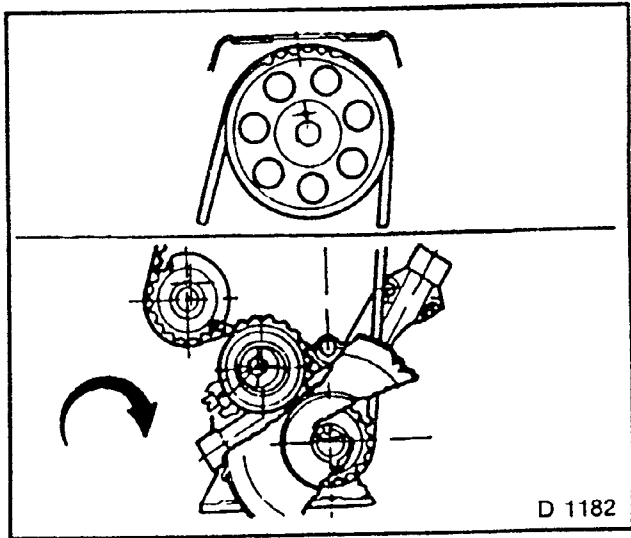


Fig. 30

ADJUST

1. Loosen toothed belt by turning water pump with KM-421-A in illustrated direction until indicator (1) and notch on tension roller support plate (2) align. See Fig. 31.

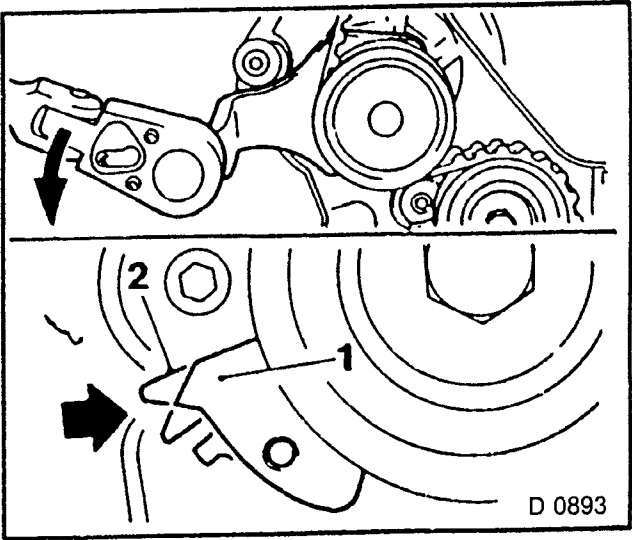


Fig. 31

TIGHTEN (TORQUE)

1. Water pump to cylinder block — 8 Nm (M6).

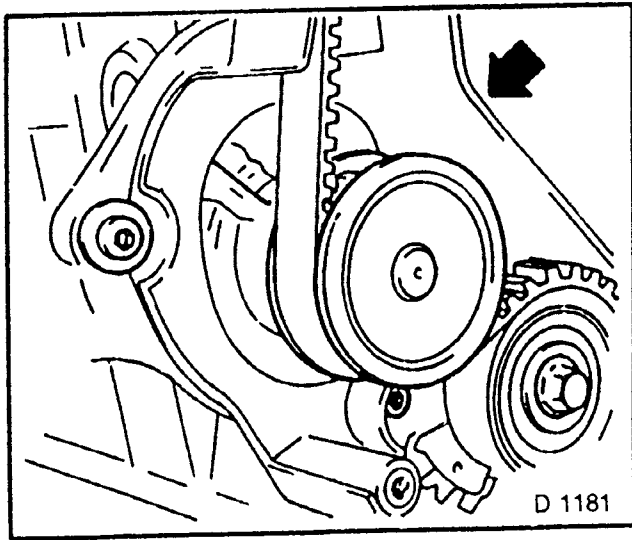


Fig. 32

INSPECT

1. Correct toothed belt tension has been achieved when the indicator on the movable part of the tension roller aligns with the tension roller support plate.

NOTE:
IF THE INDICATOR POSITION SHOWN IN FIG. 33 IS NOT REACHED, THE ADJUSTING OPERATION MUST BE REPEATED.

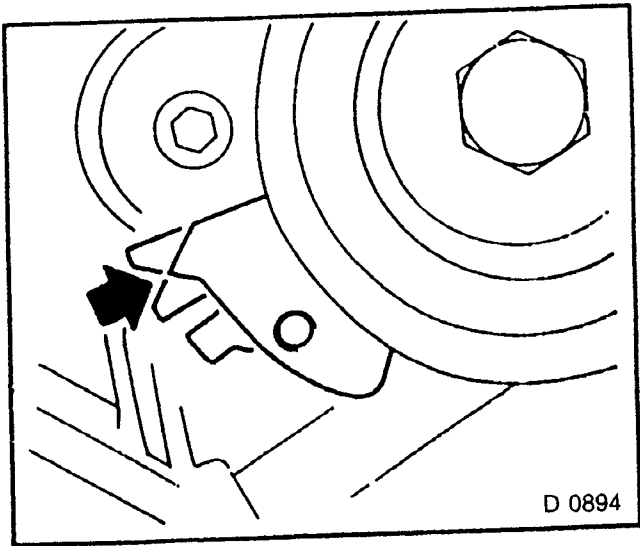


Fig. 33

ENGINE TIMING SIDE

1,4/1,6 ltr.*
1,8/2,0 ltr.

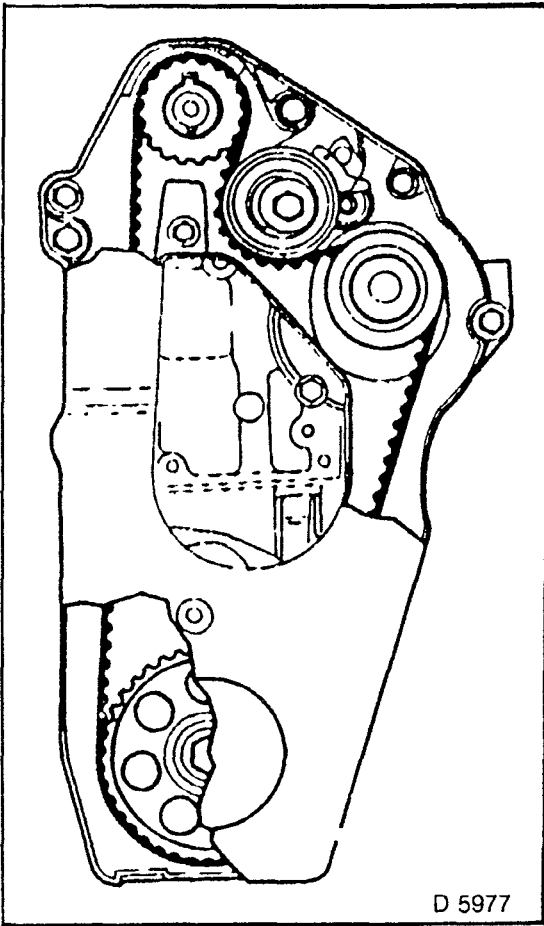


Fig. 34

*Version with toothed belt tension roller.

Recommended Torque Values

	Nm
Camshaft housing cover to housing	8
Camshaft sprocket to camshaft	45
Crankshaft pulley to toothed belt drive pinion	20 ²⁾
Crankshaft pulley with toothed belt drive pinion to crankshaft (M10 — see position ³⁾)	
Crankshaft pulley with toothed belt drive pinion to crankshaft (M 12)	95 + 30° + 15°
Front toothed belt cover to rear toothed belt cover	4 ¹⁾
Pulley to pump for power steering	25 ⁴⁾
Pump for power steering to engine block	30 ⁴⁾
Rear toothed belt cover to camshaft housing and oil pump housing	6 ²⁾
Rear toothed belt cover to camshaft housing and oil pump housing	12 ¹⁾
Toothed belt tension roller to oil pump	20 ¹⁾
Toothed belt drive pinion to crankshaft	130 + 40° to 50° ²⁾

¹⁾ 1,4/1,6 ltr. engine

²⁾ 1,8/2,0 ltr. engine

³⁾ Tighten bolt (thread length 23 mm) 20 00 560 (11 073 353) to 55 Nm.

Tighten bolt (thread length 30 mm) 6 14 938 (90 299 605) to 55 Nm + 45° + 15° (use new bolt).

⁴⁾ 16SE only with Air-conditioning.

⁵⁾ Use new bolts.

**Rear Toothed Belt Cover
— Remove and Install
(1,4/1,6/1,8/2,0 ltr. with
Toothed Belt Tension
Roller)**

REMOVE, DISCONNECT

- 1. Toothed belt — see operation “Toothed Belt, Replace”.
Camshaft housing cover, camshaft timing gear.

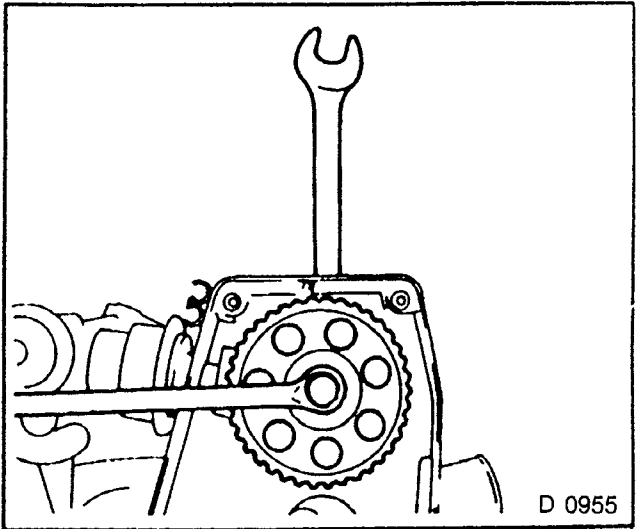


Fig 35

REMOVE, DISCONNECT

- 1. Toothed belt tension roller.
- 2. Toothed belt drive gear.
- 3. Rear toothed belt cover.

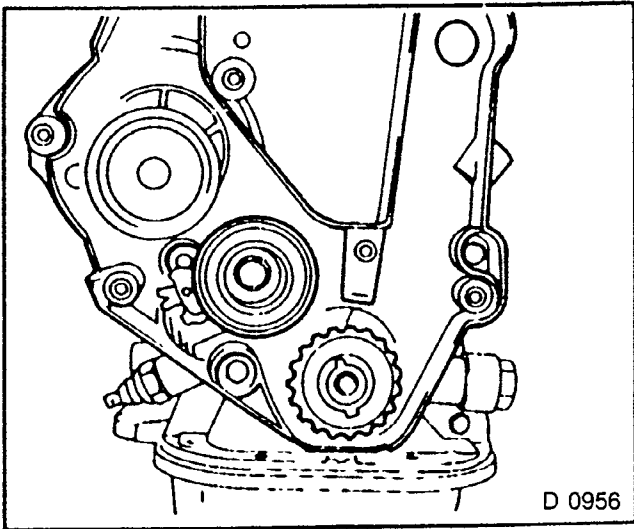


Fig. 36

TIGHTEN (TORQUE)

- 1. Rear toothed belt cover to oil pump housing and camshaft housing — 12 Nm.
- 2. Push toothed belt drive gear onto crankshaft journal — note installation position.

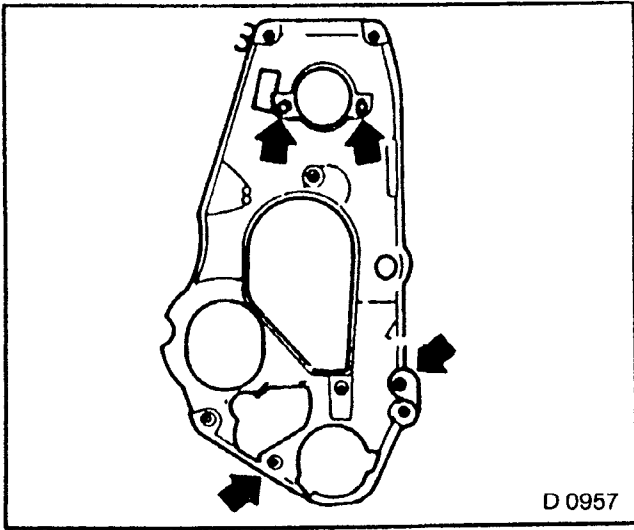


Fig. 37

INSTALL, CONNECT

- 1. Toothed belt tension roller.

NOTE:
NOTE INSTALLATION POSITION.
INSERT TONGUE (1) OF TENSION
ROLLER SUPPORT PLATE INTO
BORE (2) OF OIL PUMP HOUSING.

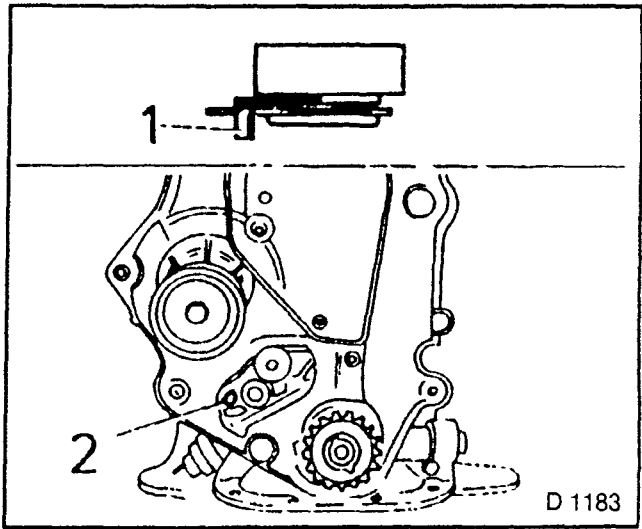


Fig. 38

TIGHTEN (TORQUE)

- 1. Toothed belt tension roller to oil pump — 20 Nm.

NOTE:
TURN TONGUE (1) OF TENSION
ROLLER SUPPORT PLATE TO STOP
ON OIL PUMP (2) BEFORE
TIGHTENING TENSION ROLLER.

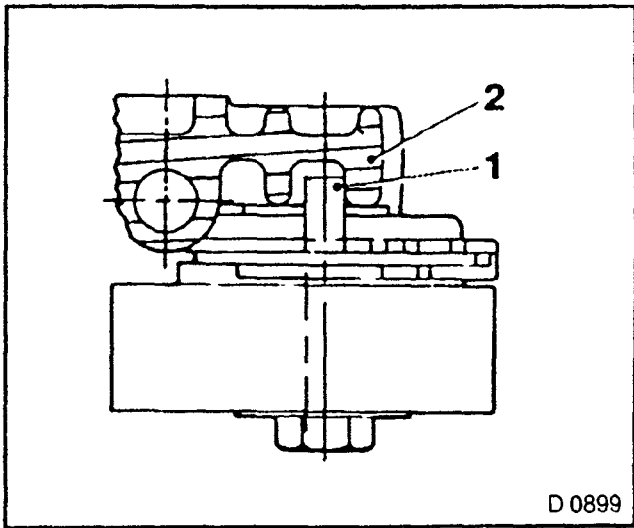


Fig. 39

TIGHTEN (TORQUE)

- 1. Camshaft timing gear to camshaft — 45 Nm.
- 2. Camshaft housing cover to housing — 8 Nm.
- 3. Install toothed belt — see operation "Toothed Belt, Replace".

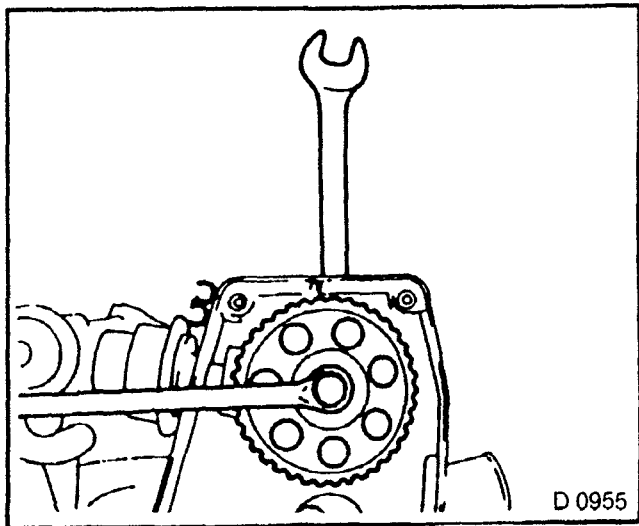


Fig. 40

Toothed Belt — Replace (1,4/1,6 ltr. with Toothed Belt Tension Roller)

REMOVE, DISCONNECT

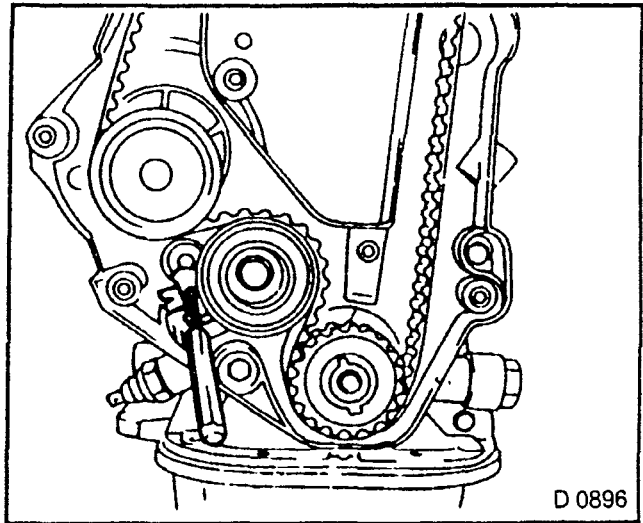
1. Ground lead from battery.
2. Air cleaner.
3. Air intake hose.

REMOVE, DISCONNECT

1. Clutch cover plate.
2. Crankshaft pulley — counterhold with KM-517 on flywheel.
3. Lower part of toothed belt front cover.

REMOVE, DISCONNECT

1. Toothed belt from toothed belt tensioner.
To do this, turn toothed belt tensioner in clockwise direction until bores coincide.
2. Tighten toothed belt tensioner.
3. Remove toothed belt.



D 0896

Fig 41

ADJUST

1. Toothed belt tension.
See operation "Toothed Belt, Insert and Tension". Page 18.

TIGHTEN (TORQUE)

1. Front toothed belt cover to rear toothed belt cover — 4 Nm.
2. Crankshaft pulley with toothed belt drive gear to crankshaft — see "Recommended Torque Values", page 21.

NOTE:
WHEN INSTALLING
CRANKSHAFT PULLEY,
COUNTERHOLD WITH KM-517.

3. Install clutch cover plate.
4. After installation of the crankshaft pulley in the C 16 SE engine, check the distance between the inductive pulse pick-up and the increment disc.

Toothed Belt Tension Roller — Replace (1,4/1,6 ltr.)

REMOVE, DISCONNECT

- 1 Toothed belt — see “Toothed Belt, Replace”.
- 2. Toothed belt tension roller.

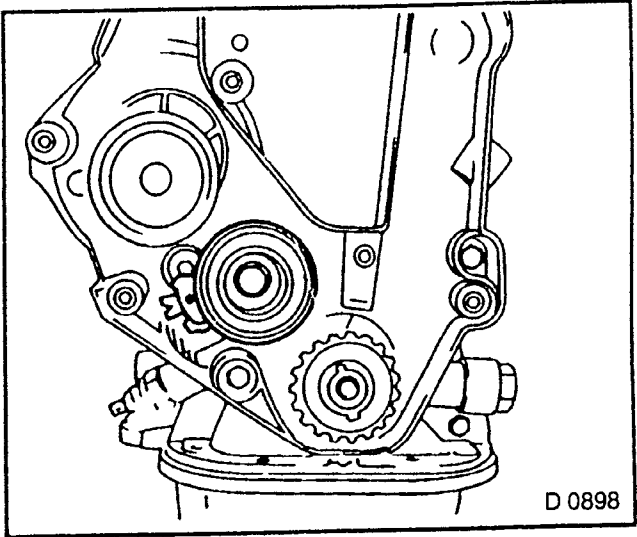


Fig. 42

- 3. Insert toothed belt tension roller.

NOTE:
NOTE INSTALLATION POSITION.
INSERT TONGUE (1) OF TENSIONER SUPPORT PLATE IN BORE (2) OF OIL PUMP HOUSING.

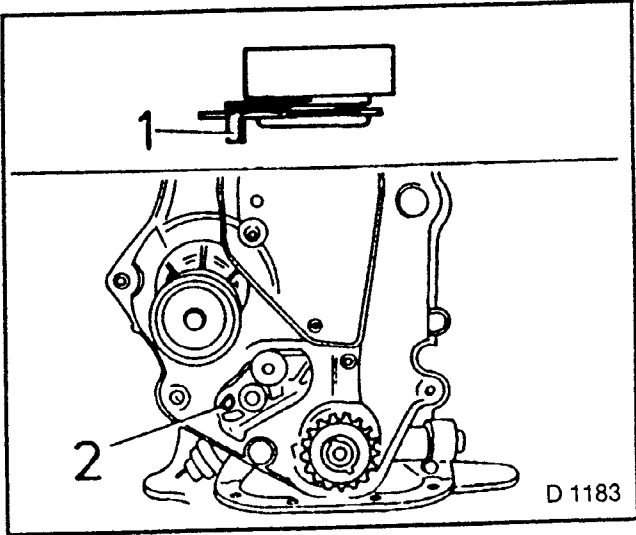


Fig. 43

TIGHTEN (TORQUE)

- 1. Toothed belt tension roller to oil pump — 20 Nm.

NOTE:
TURN TONGUE (1) OF TENSION ROLLER SUPPORT PLATE TO STOP ON OIL PUMP (2) BEFORE TIGHTENING TENSION ROLLER.

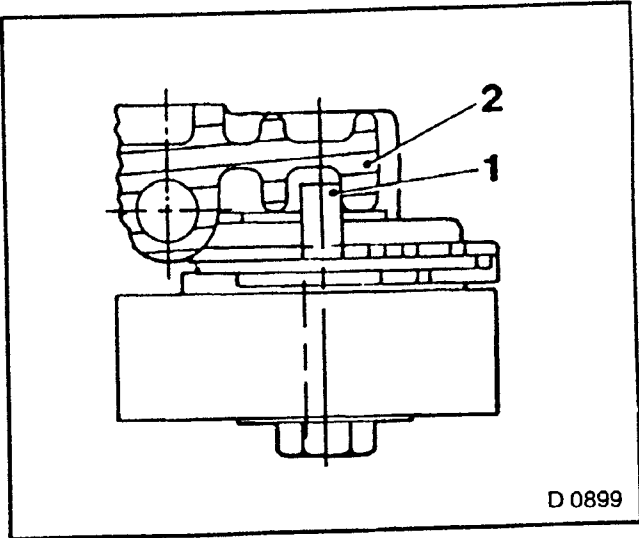


Fig. 44

INSTALL, CONNECT

- 1. Toothed belt — see operation “Toothed Belt, Replace”. Page 24.

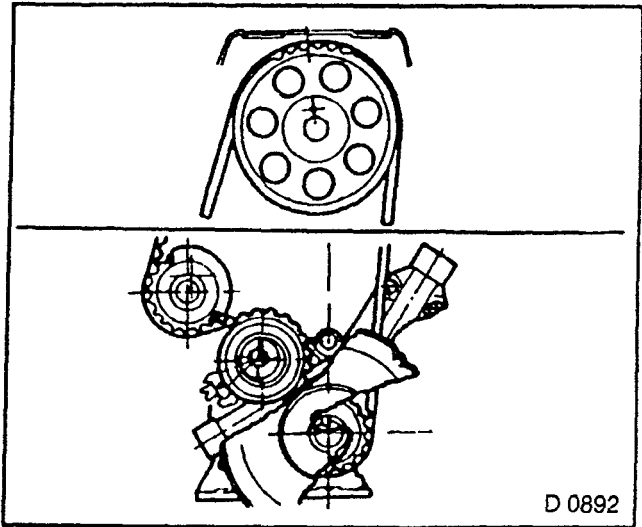


Fig. 45

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CYLINDER HEAD, CAMSHAFT HOUSING

1,4/1,6 ltr

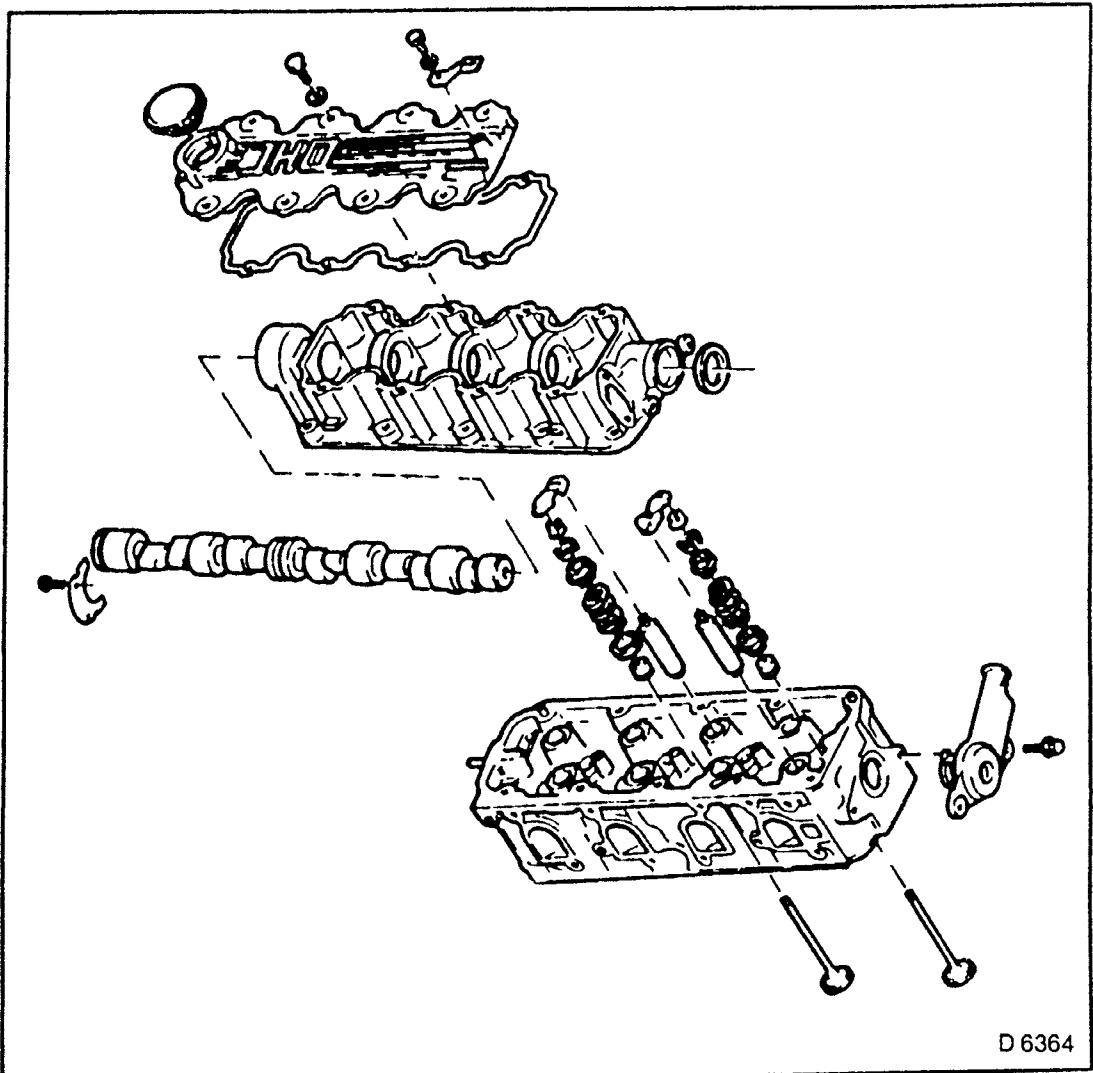


Fig. 46

Hydraulic valve lash adjustment

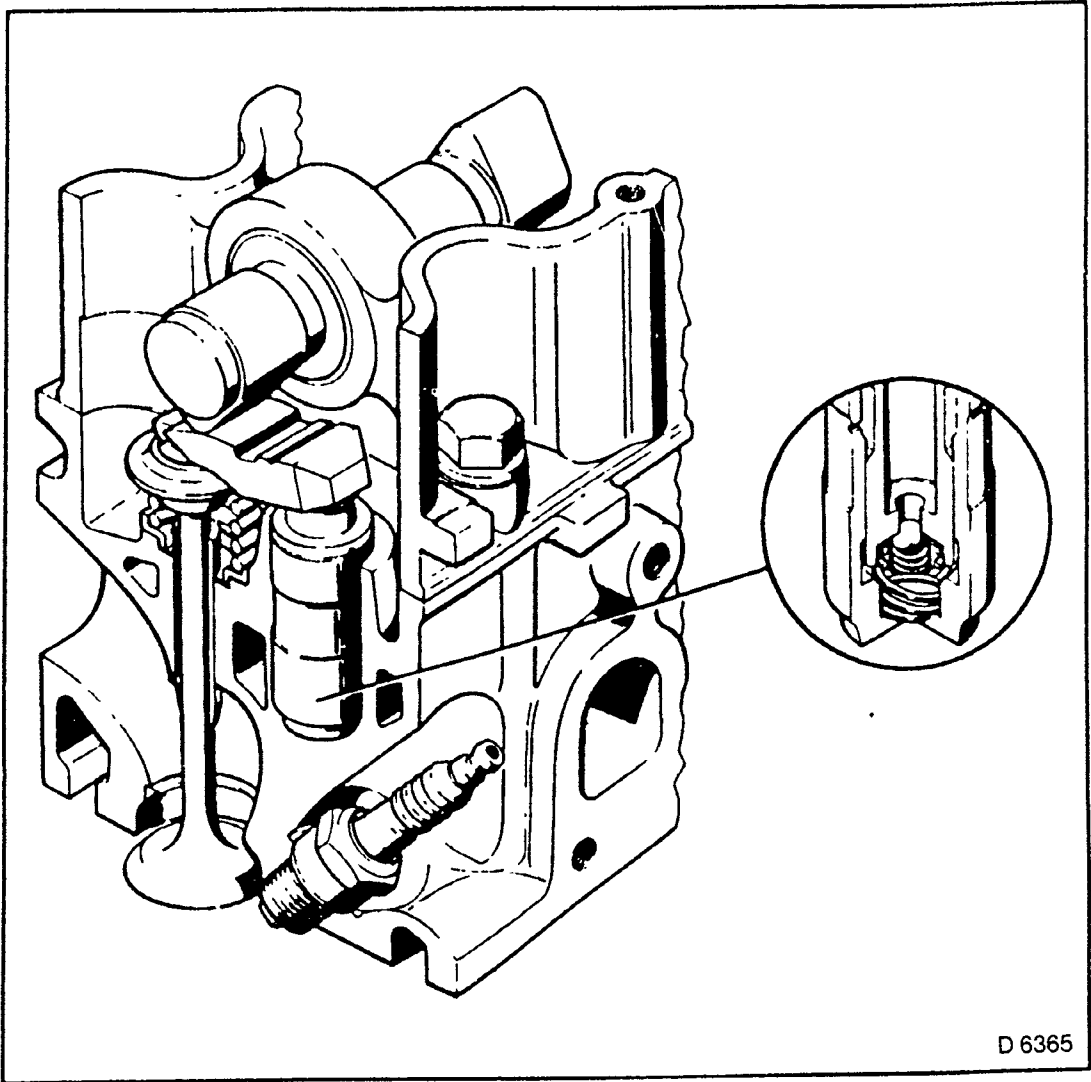


Fig. 47

Hydraulic valve tappet

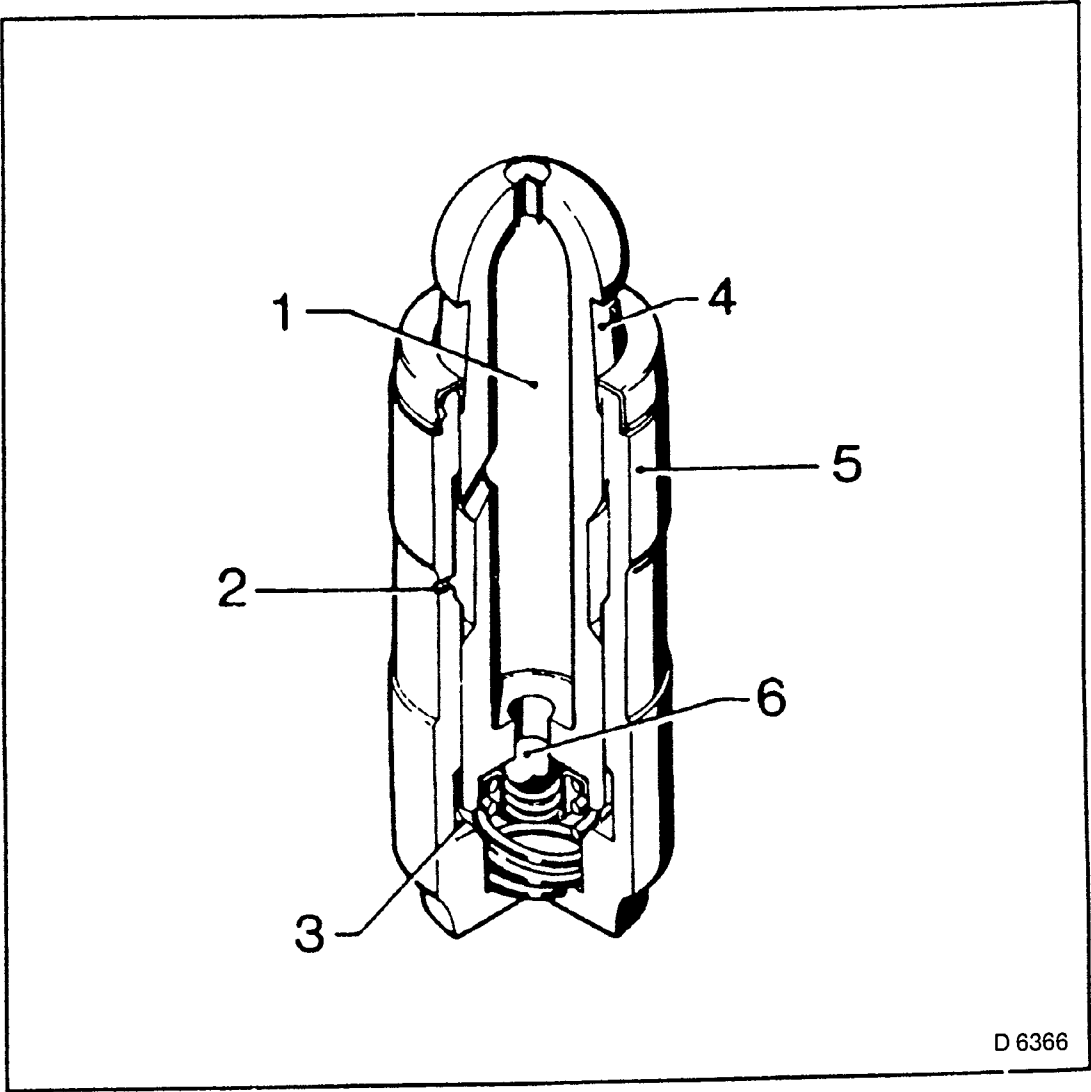


Fig. 48

- 1. Oil reservoir.
- 2. Oil feed.
- 3. Pressure chamber.
- 4. Piston with ball end (moveable).
- 5. Pressure cylinder (fixed).
- 6. Closure ball.

Recommended Torque Values

	Nm
Camshaft housing cover to housing	8
Camshaft pressure plate to camshaft housing	8
Camshaft sprocket to camshaft	45
Cylinder head to cylinder block	25 + 60° + 60° + 60° 3) 4)
Cylinder head to cylinder block	55 + 60° + 60° + 30° 1) 3) 4)
Exhaust manifold to cylinder head	22
Front exhaust pipe to exhaust manifold	25
Fuel pump to camshaft housing	18 5)
Intake air preheating scoop to exhaust manifold	8
Intake manifold to cylinder head	22
Pulley to pump for power steering	25 6)
Rear toothed belt cover to camshaft housing	6 7)
Rear toothed belt cover to camshaft housing	12 1)
Spark plugs to cylinder head	25
Thermostat housing to cylinder head	10 1)
Thermostat housing to cylinder head	15 2)

- 1) 1,4/1,6 ltr. engine
- 2) 1,8/2,0 ltr. engine
- 3) Use new bolts.
- 4) After test run turn a further 30° + 15°.
- 5) Only 14 NV engine.
- 6) Only 1,6 ltr. with power steering.

Rear Seal Ring in Camshaft Housing — Replace (1,8/2,0 ltr.)

REMOVE, DISCONNECT

- 1. High voltage distributor.
- 2. Seal ring — installing lever.
Do not damage camshaft housing.

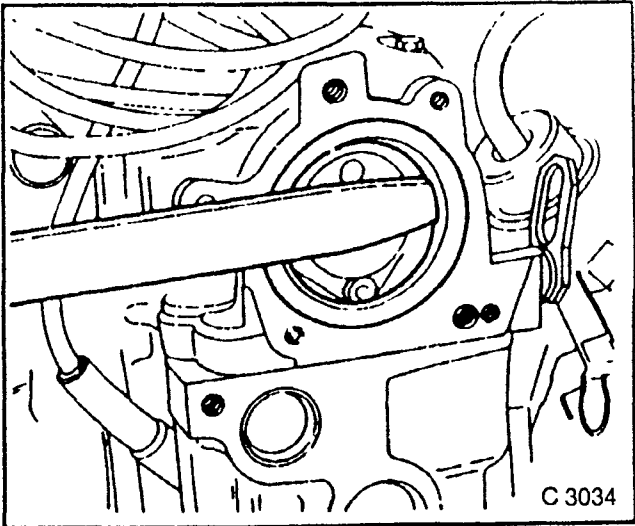


Fig. 49

INSTALL, CONNECT

- 1. Seal ring with KM-636
- 2. High voltage distributor

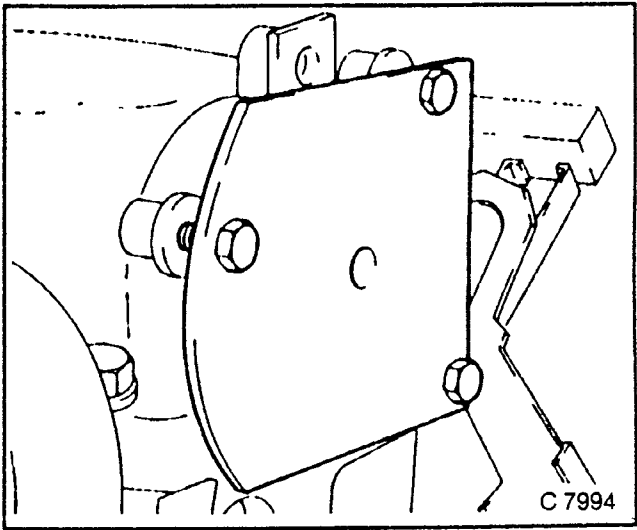


Fig. 50

Front Seal Ring in Camshaft Housing — Replace

Release toothed belt and remove from camshaft timing gear — see operation “Toothed Belt, Replace”. Page 24.

REMOVE, DISCONNECT

- 1. Camshaft housing cover.
- 2. Camshaft timing gear.

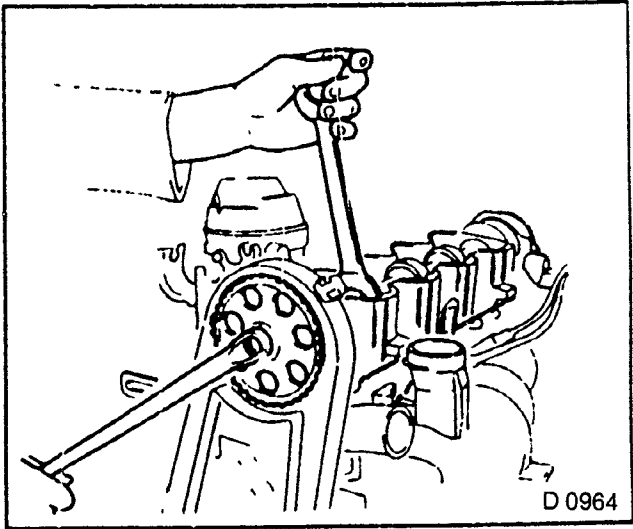


Fig. 51

REMOVE, DISCONNECT

- 1. Seal ring
 - drill hole in centre
 - turn in self-tapping screw
 - lever out seal ring.

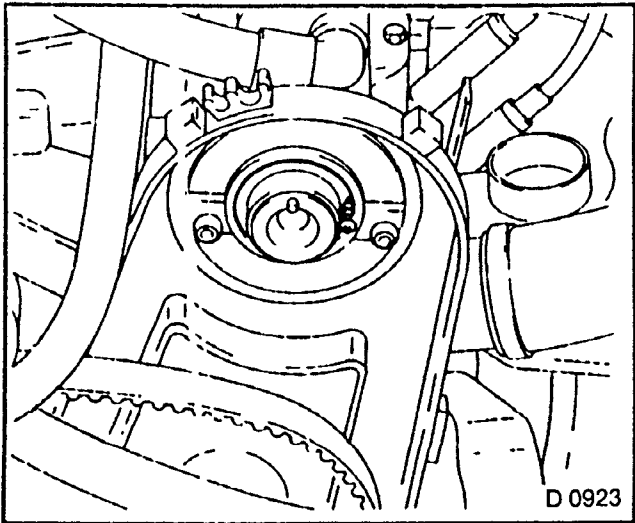


Fig. 52

INSTALL, CONNECT

1. Seal ring with KM-422.
2. Use bolt and washer of camshaft timing gear.
3. Coat sealing lip of seal ring lightly with protective grease.

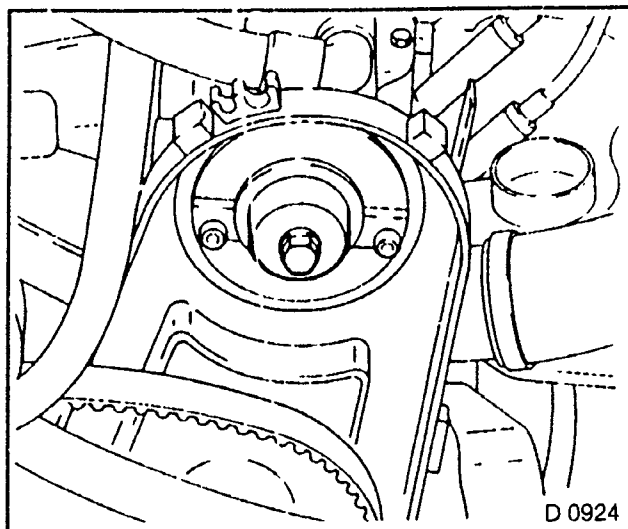


Fig. 53

TIGHTEN (TORQUE)

1. Camshaft timing gear to camshaft
— 45 Nm.
2. Camshaft housing cover to housing
— 8 Nm.
3. Install and tension toothed belt.

Gasket — Exhaust Manifold/Cylinder Head — Replace

REMOVE, DISCONNECT

1. Front exhaust pipe from exhaust manifold.
2. If present:
 - Pre-heater hose.
 - Pre-heater scoop from exhaust manifold.
3. Exhaust manifold from cylinder head.

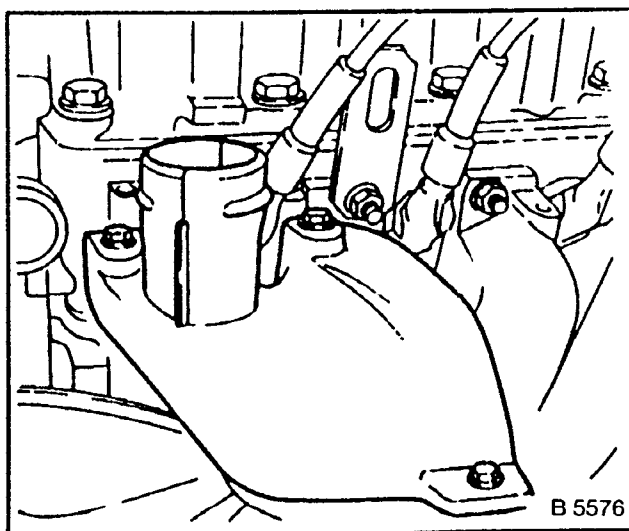


Fig. 54

CLEAN

- 1. Sealing surfaces.
- 2. Insert new gasket.

TIGHTEN (TORQUE)

- 1. Exhaust manifold to cylinder head
— 22 Nm.
- 2. Front exhaust pipe to exhaust manifold
— 25 Nm.
- 3. Pre-heater scoop to exhaust manifold
— 8 Nm.
- 4. Install pre-heater hose.

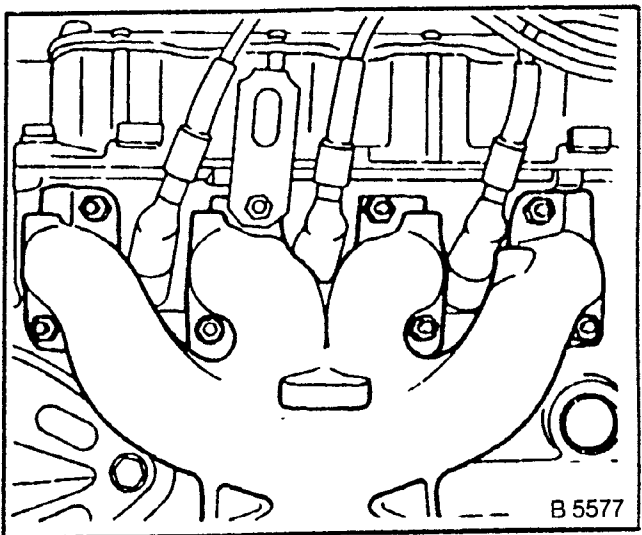


Fig 55

**Gasket — Intake
Manifold/Cylinder Head —
Replace (C 16SE)**

REMOVE, DISCONNECT

- 1. Ground cable from battery.
- 2. Air intake hose (1).
- 3. Engine vent hoses (2) from throttle body.
- 4. Lower coolant hose — collect coolant.

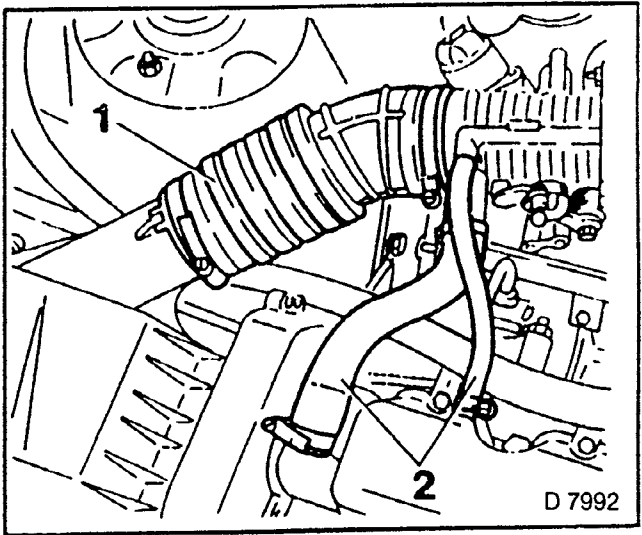


Fig 56

REMOVE, DISCONNECT

- 1. Upper alternator fastening.
- 2. Remove V-belt.
- 3. Swing alternator backwards.
- 4. Bowden cable.
- 5. Brake servo vacuum line from intake manifold.

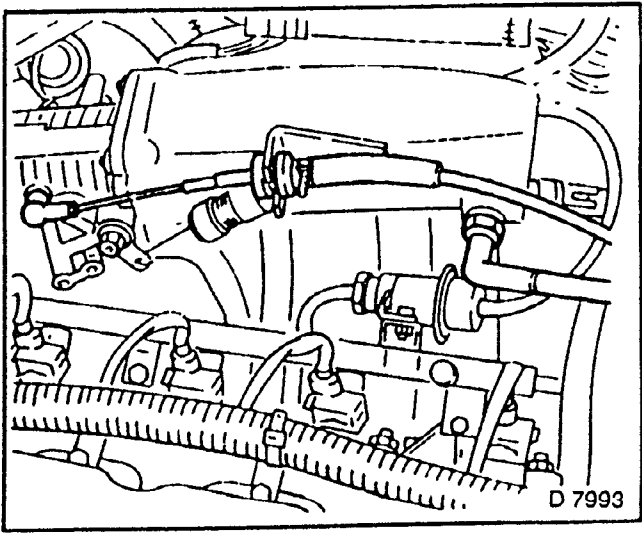


Fig. 57

REMOVE, DISCONNECT

- 1. Wiring harness plug (1) from intake air temperature sensor.
- 2. Wiring harness plug (2) from injection valves.
- 3. Wiring harness plug from coolant temperature sensor.

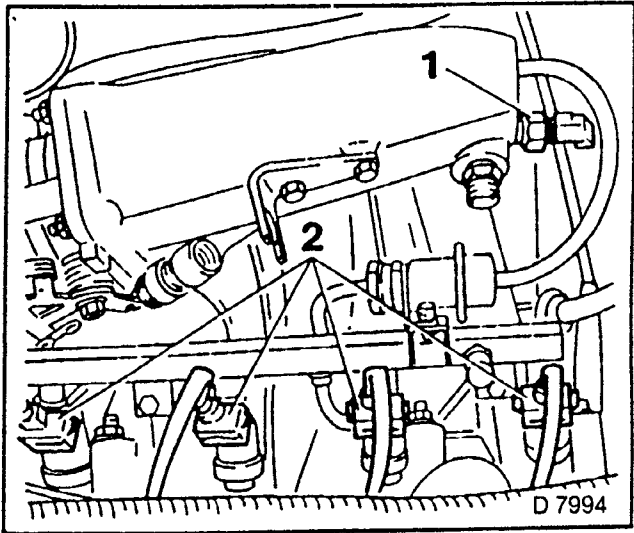


Fig. 58

REMOVE, DISCONNECT

- 1. Wiring harness plug (1) from throttle valve potentiometer.
- 2. Wiring harness plug (2) from idle speed stepper motor.

Note routing of leads.

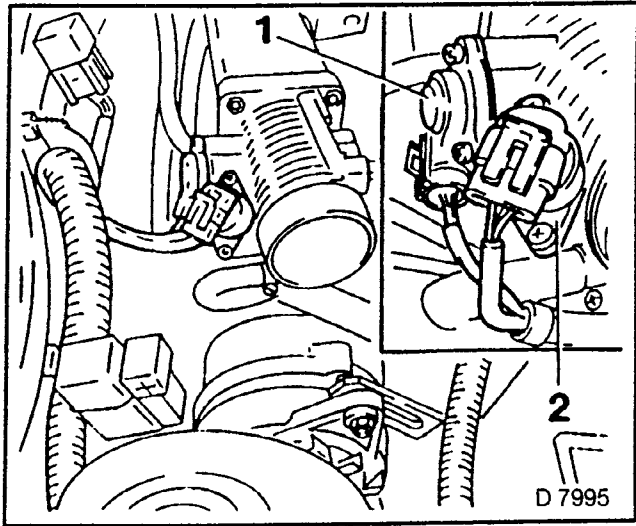


Fig. 59

REMOVE, DISCONNECT

- 1. Fuel lines — mark and close off with spring clamps.

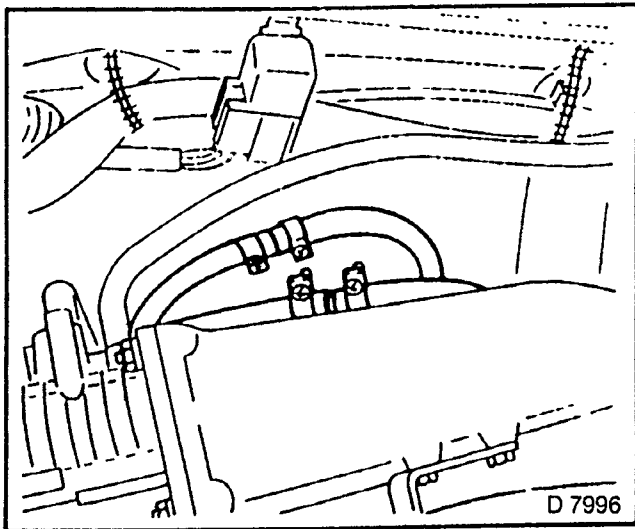


Fig. 60

REMOVE, DISCONNECT

- 1. Coolant hose from intake manifold.
- 2. Coolant hoses and vacuum hoses from throttle body.
- 3. Ground connections.
- 4. Intake manifold from cylinder head.

CLEAN

Sealing surfaces.

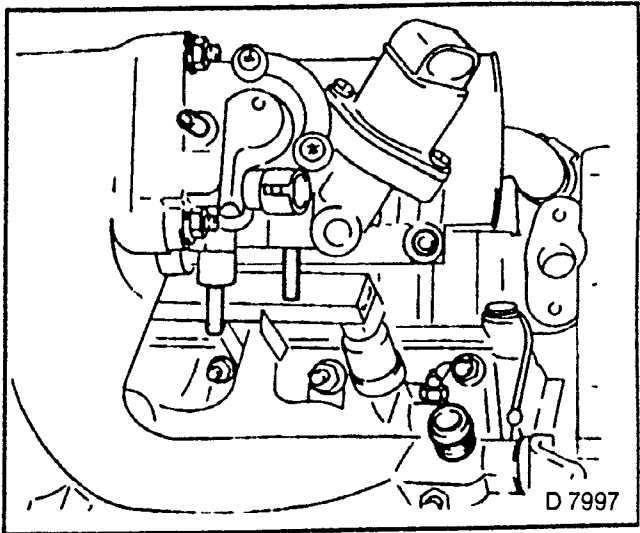


Fig. 61

TIGHTEN (TORQUE)

- 1. Intake manifold to cylinder head — 22 Nm.
- 2. Use new gasket.
- 3. Ground connections — note correct seat.

INSTALL, CONNECT

- 1. Coolant hoses and vacuum hoses to throttle body and intake manifold.
- 2. Fuel lines marked.

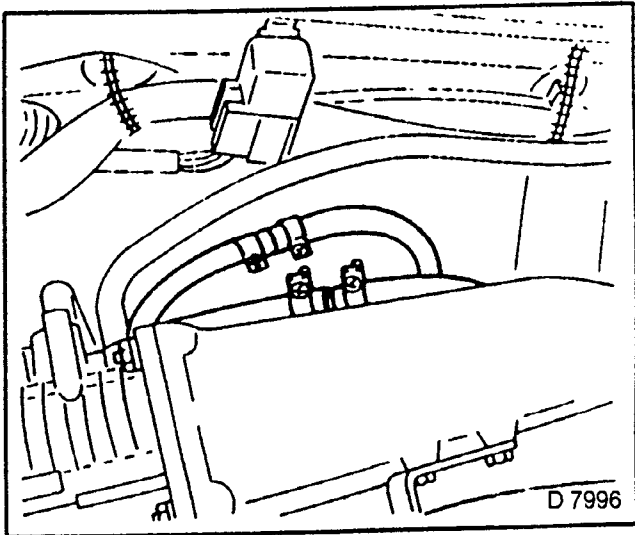


Fig. 62

INSTALL, CONNECT

- 1 Wiring harness plug (1) to throttle valve potentiometer.
- 2. Wiring harness plug (2) to idle speed stepper motor.
- 3. Wiring harness plug to intake air temperature sensor.
- 4. Wiring harness plug to injection valves.
- 5. Wiring harness plug to coolant temperature sensor.

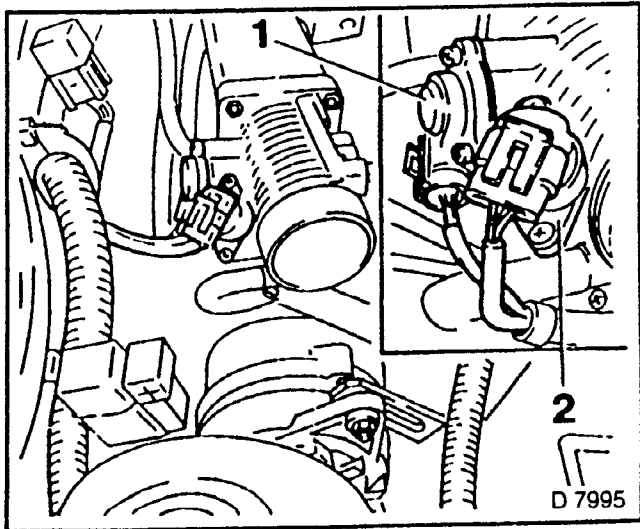


Fig. 63

INSTALL, CONNECT

1. Brake servo vacuum line to intake manifold.
2. Bowden cable.
3. V-belt for alternator.
4. V-belt tension.

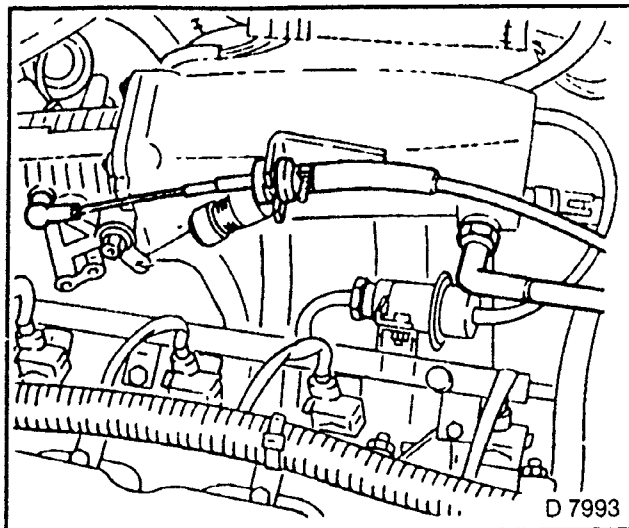


Fig. 64

INSTALL, CONNECT

1. Air intake hose (1).
2. Engine vent hoses (2) to throttle body.
3. Lower coolant hose.
4. Ground cable to battery.
5. Top up and bleed cooling system.

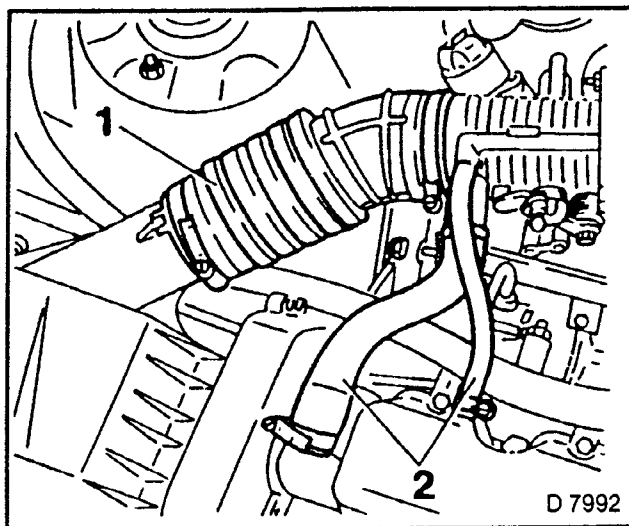


Fig. 65

Hydraulic Valve Lash Adjuster — Replace

REMOVE, DISCONNECT

1. Camshaft.
2. Rocker arms.
3. Valve lash adjuster.

4. Insert valve lash adjuster.

ADJUST

Not necessary, as pre-tension has been taken into account during manufacture.

INSTALL, CONNECT

1. Rocker arms.
2. Camshaft.

Fuel Pump — Replace (14 NV)

REMOVE, DISCONNECT

1. Ground lead from battery.
2. Fuel hoses — close off with spring clips.
3. Fuel pump from camshaft housing.

CLEAN

1. Sealing surfaces.
2. Insert new gasket.

TIGHTEN (TORQUE)

1. Fuel pump to camshaft housing — 18 Nm.
2. Attach fuel hoses.
3. Remove spring clips.
4. Ground cable to battery.

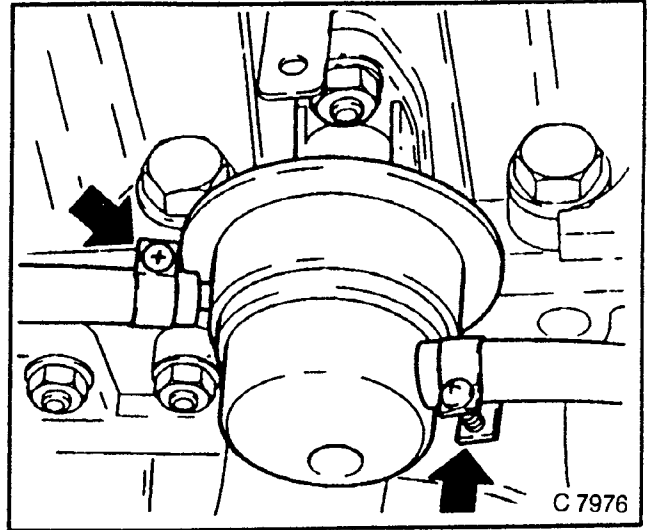


Fig. 66

Camshaft and Rocker Arm — Remove and Install

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Oil reservoir for power steering.
3. If present — front toothed belt cover.
4. Fuel pump — if present (fuel hoses remain connected).
5. Camshaft housing cover.
6. Bring all pistons to centre position — 90° CA BTDC.
7. Turn crankshaft in engine rotational direction.

REMOVE, DISCONNECT

1. Camshaft pulley — relax tension on toothed belt and remove.
2. Ignition distributor.
3. Rear seal ring from camshaft housing — if present (with installing lever, do **not** damage camshaft housing).
4. Thrust plate.

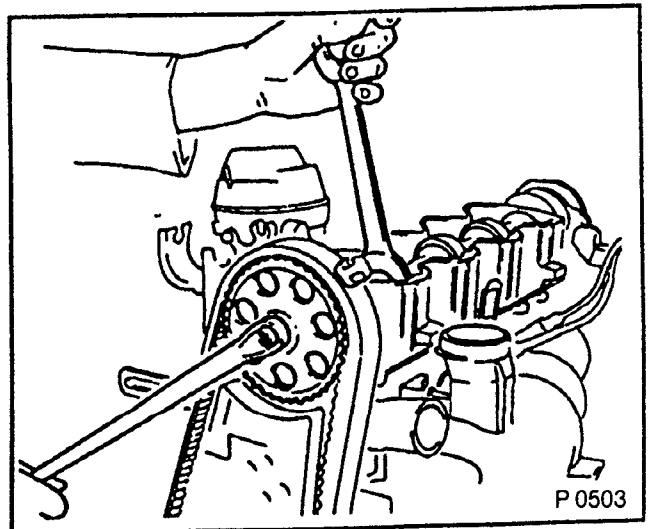


Fig. 67

REMOVE, DISCONNECT

1. Camshaft from camshaft housing.
2. Position commercially available valve holder (manufactured by Sauer, Germany) and hold all rocker arms down equally. Observe manufacturer's instructions
3. Camshaft from camshaft housing.
4. Release tension on valve holder and remove.
5. Remove rocker arms and pushers.

INSPECT

1. All parts.
2. Replace all rocker arms when replacing camshaft.

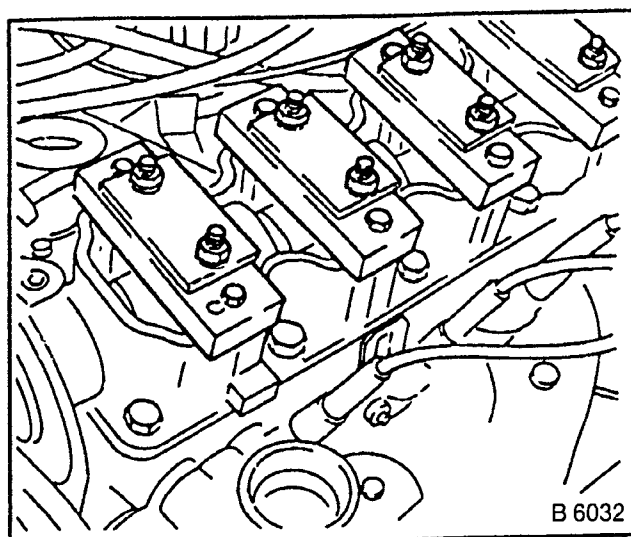


Fig. 68

INSTALL, CONNECT

1. Pushers.
2. Rocker arms — tension with valve holder.
3. Coat sliding surfaces with MOS_2 paste.
4. Camshaft in camshaft housing.

TIGHTEN (TORQUE)

1. Thrust plate for camshaft to camshaft housing — 8 Nm.
2. Remove valve holder.

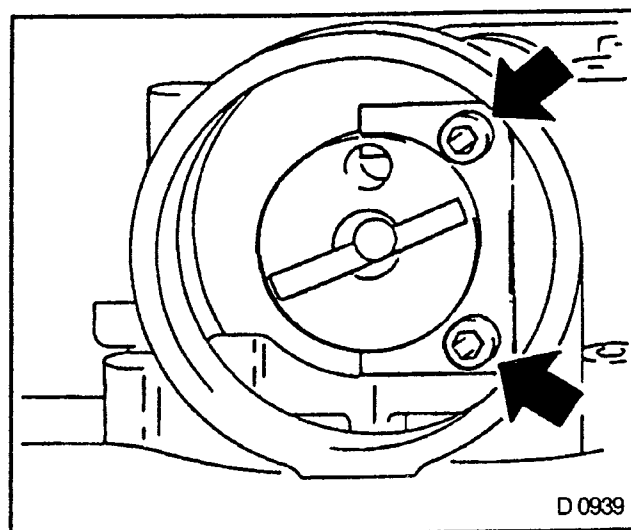


Fig. 69

INSTALL, CONNECT

1. Rear seal ring into camshaft housing — KM-636.
2. Ignition distributor.

TIGHTEN (TORQUE)

1. Camshaft pulley to camshaft — 45 Nm.
2. Fuel pump to camshaft housing — 18 Nm.

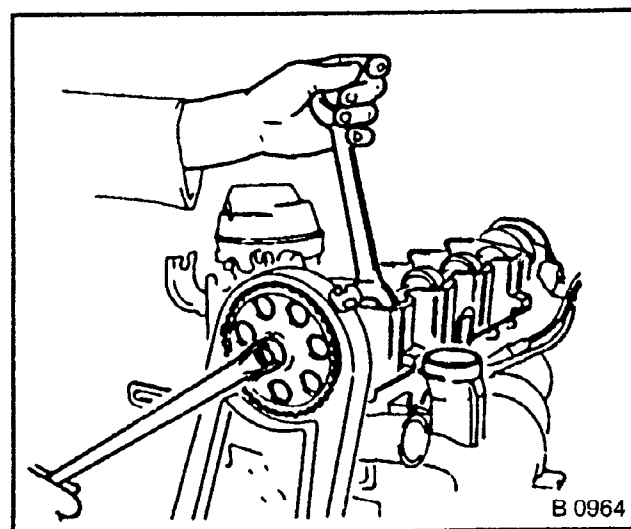


Fig. 70

INSTALL, CONNECT

- 1. Install toothed belt and tension.
- 2. Camshaft housing cover.
- 3. Front toothed belt cover.
- 4. Power steering fluid reservoir.
- 5. Ground cable to battery.

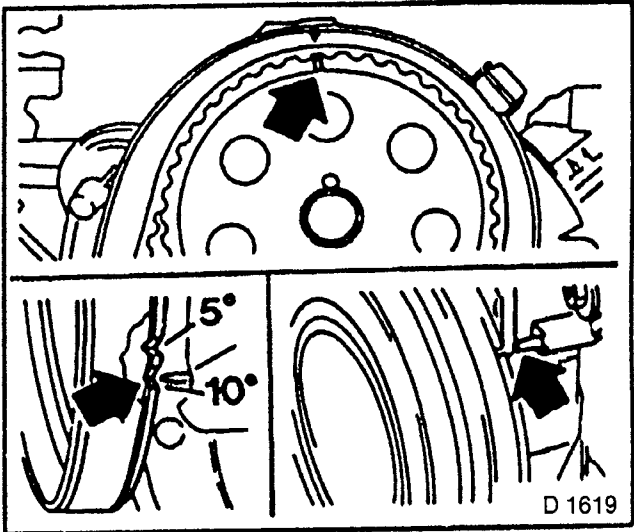


Fig. 71

Camshaft Housing — Replace

REMOVE, DISCONNECT

- 1. Cylinder Head.
- 2. Ignition distributor.
- 3. If present:
 - Fuel pump
 - Rear seal ring
 - Thrust plate
 - Camshaft
 - Front seal ring.

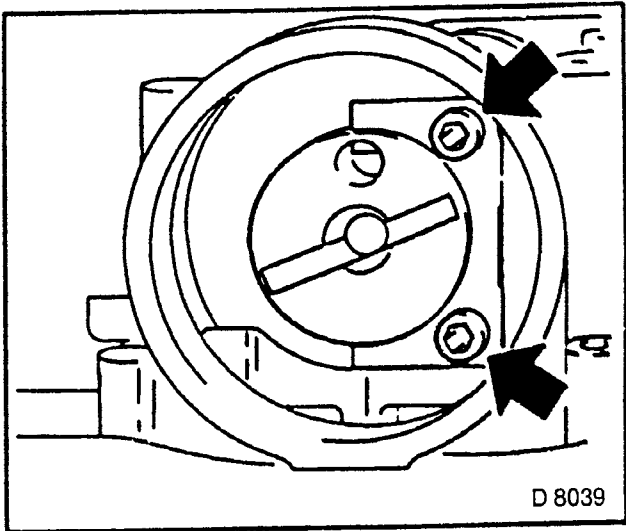


Fig. 72

INSPECT

- 1. Replace all parts, if necessary.
- 2. Always replace all rocker arms when replacing camshaft.

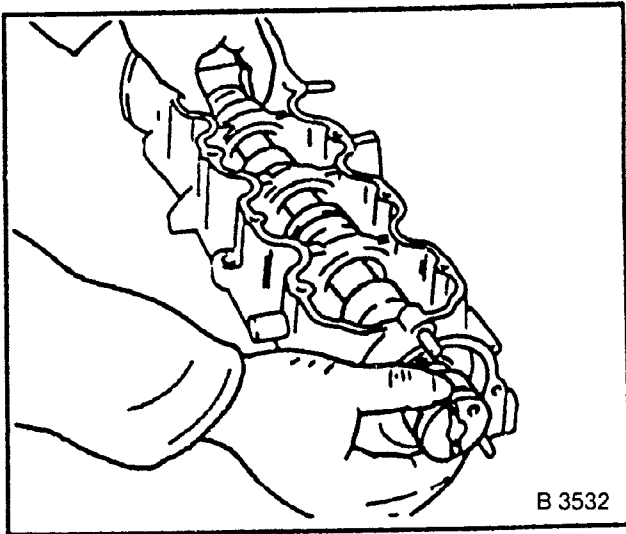


Fig. 73

TIGHTEN (TORQUE)

1. Guide plate to camshaft housing
— 8 Nm.
2. Insert camshaft with MOS₂ paste.

INSTALL, CONNECT

1. 1,8/2,0 ltr.: rear seal ring — KM-636.
2. Front seal ring — KM-422.

TIGHTEN (TORQUE)

1. Fuel pump to camshaft housing
— 18 Nm (14 NV).

INSTALL, CONNECT

1. Cylinder head.
2. Ignition distributor.

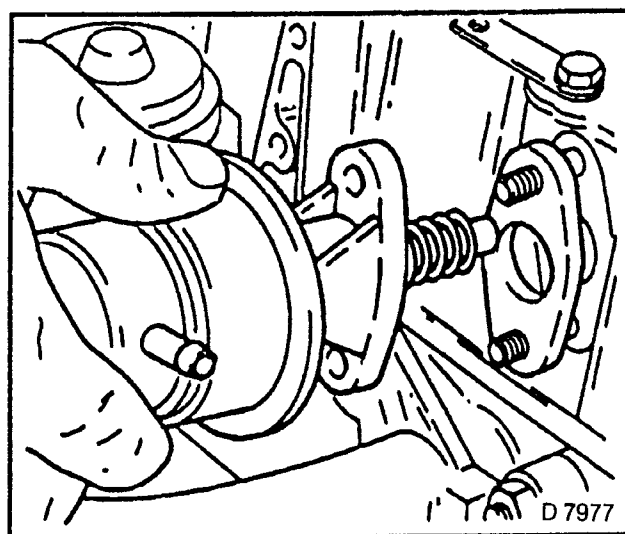


Fig. 74

Strainer (Filter) in Camshaft Housing Cover — Clean

NOTE:
THE STRAINER (FILTER) CANNOT BE REMOVED FROM THE 16 SE ENGINES.

REMOVE, DISCONNECT

1. Camshaft housing cover.
2. Cleaner.

CLEAN

1. Sealing surfaces.
2. Cleaner.

INSTALL, CONNECT

1. Cleaner.
2. Camshaft housing cover to housing
— 8 Nm.

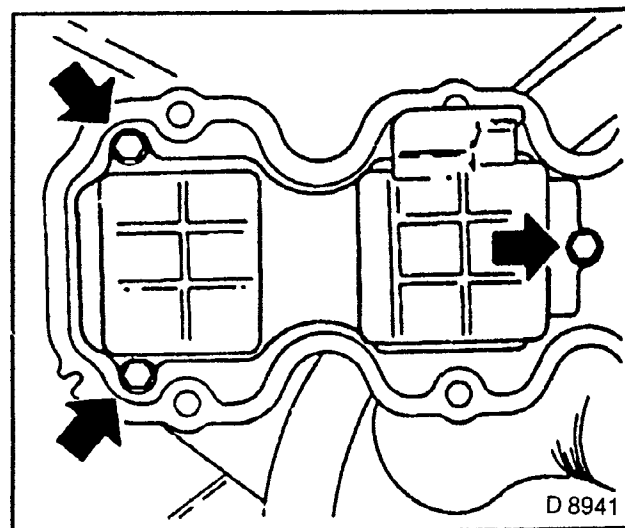


Fig. 75

Spark Plug Thread — Recondition

Remove cylinder head.
Ream thread and recut — commercially available spark plug thread drill (observe manufacturer's instructions).

INSTALL, CONNECT

Thread bush on spark plug — dimension (1) — 17 mm.

TIGHTEN (TORQUE)

Spark plug with threaded bushing into cylinder head — 25 Nm.
Install cylinder head.

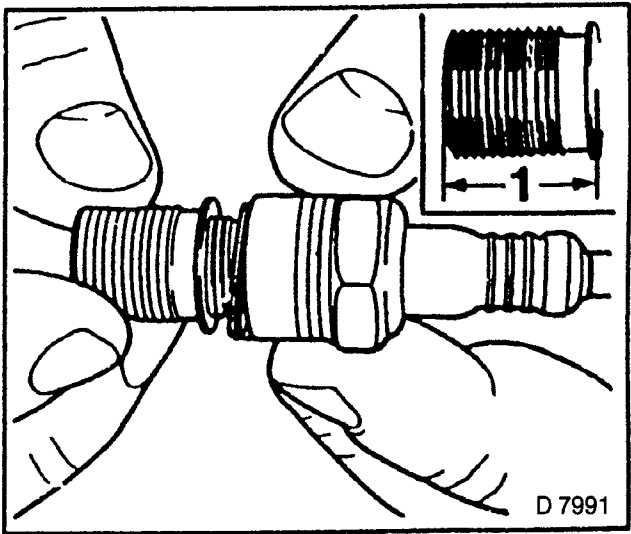


Fig. 76

Cylinder Head — Remove and Install

The following describes the removal of the cylinder head on the 18SE/20SEH engine. Proceed similarly for all other engines.

NOTE:
REMOVE CYLINDER HEAD ONLY FROM COLD ENGINE (ROOM TEMPERATURE).

REMOVE, DISCONNECT

- 1. Ground cable from battery.
- 2. Lower hose bend from pipe bend — collect coolant.
- 3. Upper hose bend.
- 4. Air cleaner
- 5. If present:
 - Air intake hose
 - Pre-volume chamber.
- 6. Drive belt for alternator.

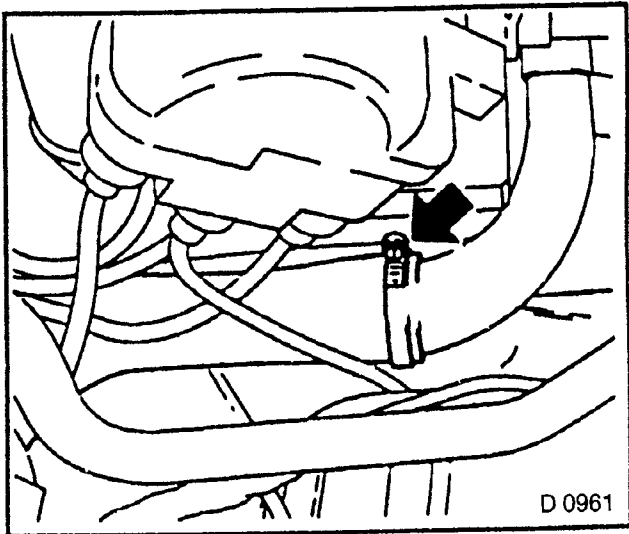


Fig. 77

REMOVE, DISCONNECT

Mark fuel hoses before removal and close off with spring clamps.

1. Cable connections.
2. Hoses and leads from cylinder head.
3. Accelerator cable.
- 1,6 ltr. with power steering.
4. Pulley from power steering pump.

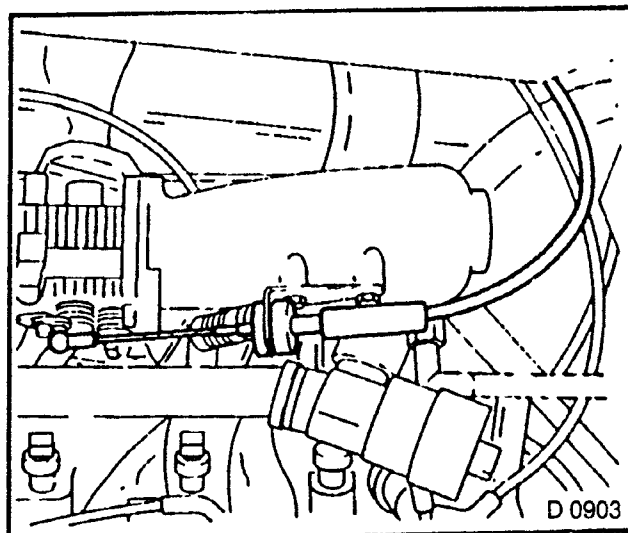


Fig. 78

REMOVE, DISCONNECT

1. Front toothed belt cover.
2. Position piston of 1st cylinder at TDC.
3. Position of timing markings — see "Timing, Check and Adjust", page 15.
4. Release tension of toothed belt and remove — see "Toothed Belt, Replace", page 24.
5. Camshaft housing cover.
6. Camshaft pulley.

REMOVE, DISCONNECT

1. Upper bolts of rear toothed belt cover.
2. Exhaust pipe from exhaust manifold.
3. Disconnect oxygen sensor wiring harness plug (C 16 SE).
4. Cylinder head.
5. Loosen bolts from outside inwards (at first quarter turn then half turn) in a spiral pattern.
6. Camshaft housing from cylinder head.
7. Remove rocker arm.
8. Pressure parts.
9. Hydraulic valve lash adjuster.

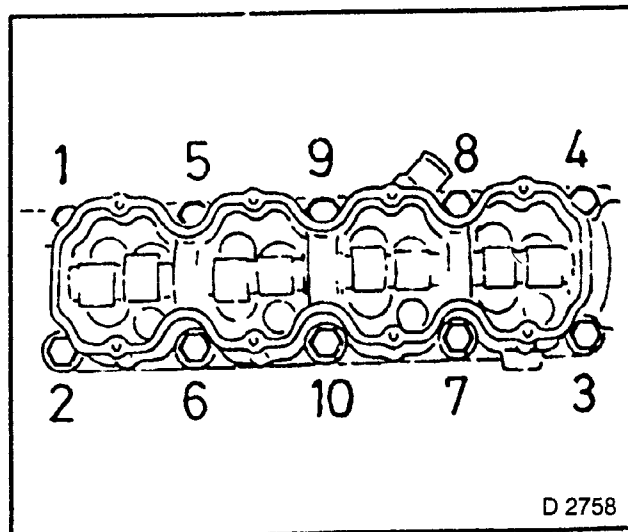


Fig. 79

CLEAN

1. All sealing surfaces.
2. Bore holes in cylinder head bolts.
3. Check cylinder block and cylinder head for plane surface.

INSTALL, CONNECT

1. Cylinder head sealing — marking "OBEN/TOP" facing upwards and to steering side of the engine.

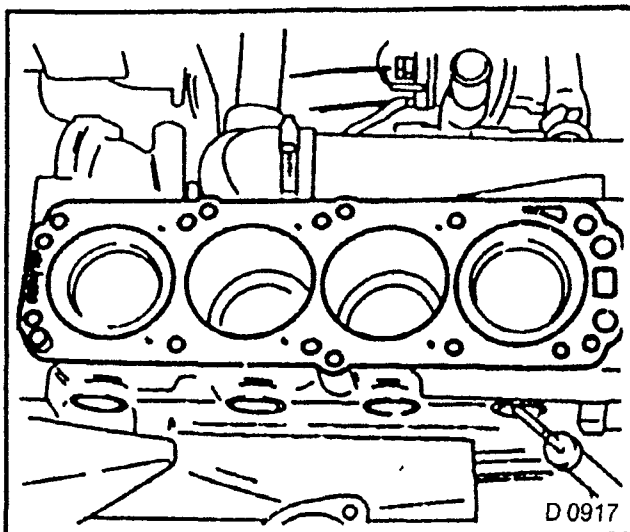


Fig. 80

INSTALL, CONNECT

1. Place cylinder head on cylinder block.
2. Insert hydraulic valve lash adjuster, pressure parts and rocker arm — MoS₂ paste.
3. Insert camshaft housing — Sealing Compound Locktite 242.

NOTE:

1. Use new cylinder head bolts.
2. Screw in bolts until they rest on cover.

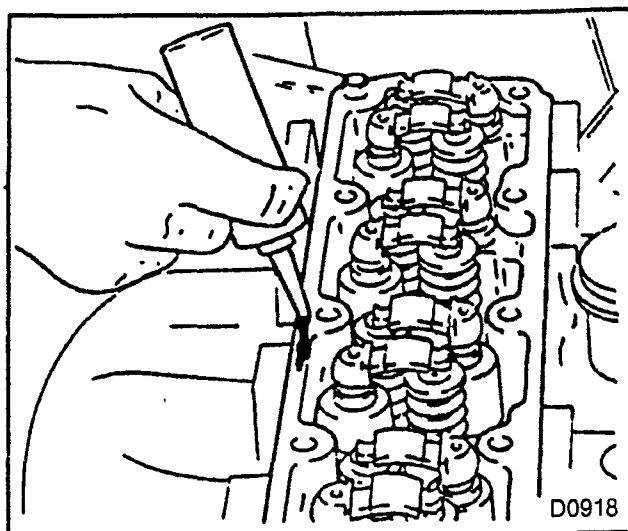


Fig. 81

TORQUE — ANGLE METHOD

1. Cylinder head to cylinder block.
2. Tighten cylinder head bolts from inside outwards, in four stages in a spiral pattern — torque wrench and KM-470-B.

Engine	Torque	Further turn angle
1,4 / 1,6 Ltr.	55 Nm	60° + 60° + 30°*
1,8 / 2,0 Ltr.	25 Nm	60° + 60° + 60°*

*After test run, turn a further 30° + 15°

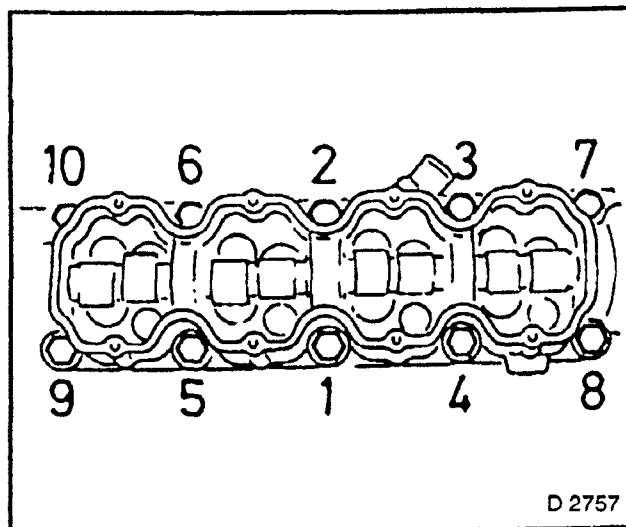


Fig. 82

TIGHTEN (TORQUE)

1. Toothed belt rear cover to camshaft housing
1,4/1,6 ltr.: 12 Nm.
1,8/2,0 ltr.: 6 Nm.
2. Camshaft gear to camshaft — 45 Nm.
3. Install and tension toothed belt.

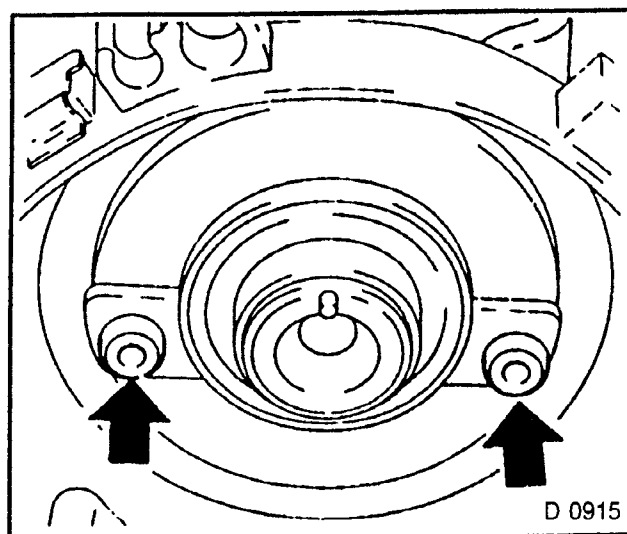


Fig. 83

TIGHTEN (TORQUE)

1. Camshaft housing cover to housing — 8 Nm.
2. Insert new gasket.
3. Install toothed belt front cover.

INSTALL, CONNECT

1. All hose, line, and cable connections to cylinder head.
2. Note condition and seating.
3. Observe marks on fuel lines when installing — remove spring clips.
4. Install accelerator cable free of tension
5. Drive belt for alternator
6. On 1,6 ltr. with power steering: pulley to pump — 25 Nm.
7. Air cleaner.
8. Pre-volume chamber.
9. Air intake hose.

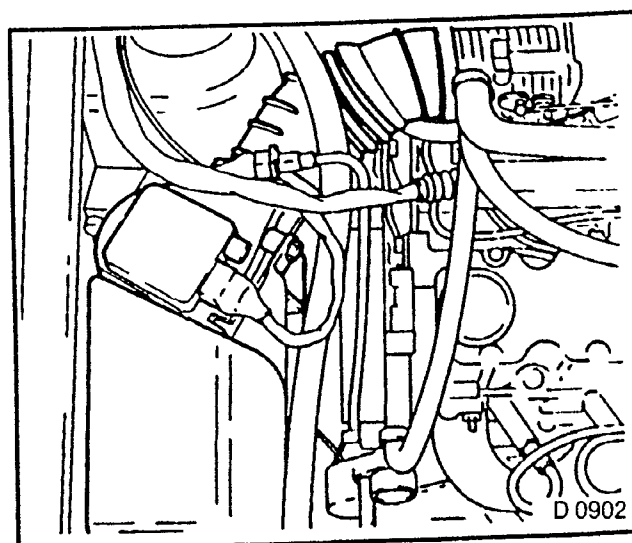


Fig. 84

INSTALL, CONNECT

1. Front exhaust pipe.
2. Ground lead to battery.
3. Fill up cooling system.
4. Bleed and check for leaks.

NOTE:

AFTER ENGINE TEST RUN, TURN CYLINDER HEAD BOLTS SPIRALLY FROM INSIDE OUTWARDS A FURTHER 30° + 15°.

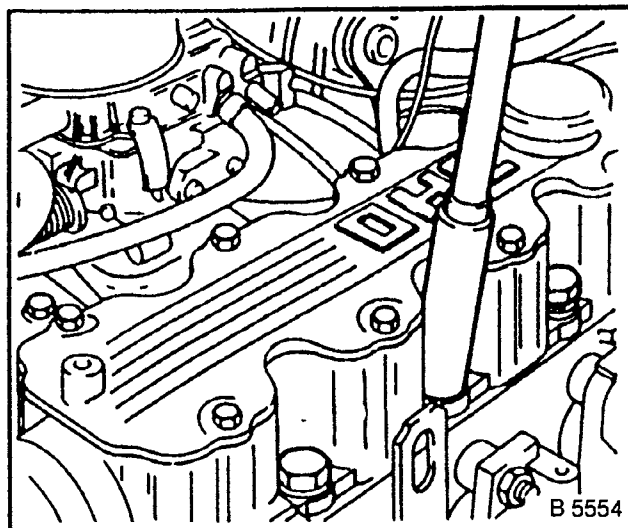


Fig. 85

Cylinder Head — Disassemble and Assemble

REMOVE, DISCONNECT

1. Exhaust manifold.
2. Intake manifold.
3. Thermostat housing.
4. Thermostat (on 1,4 and 1,6 ltr. engines).
5. Spark plugs.
6. Tension valve springs — KM-348.
7. Valve cones.
8. Valve spring plates.
9. Valve springs.
10. Valves.
11. Valve rotators (exhaust).
12. Spring seat rings (inlet).
13. Mark valves.

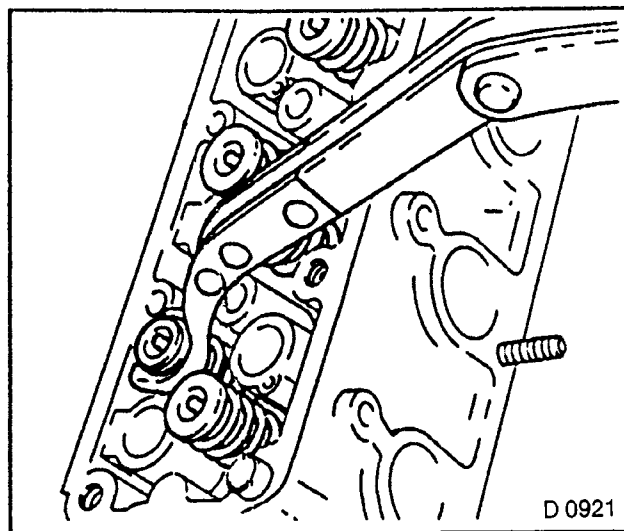


Fig. 86

CLEAN, INSPECT

1. Individual parts.
2. Sealing surfaces.
3. Guides.
4. Sliding points.
5. Bearing beds

WARNING:

DO NOT DAMAGE VALVE SEATINGS.

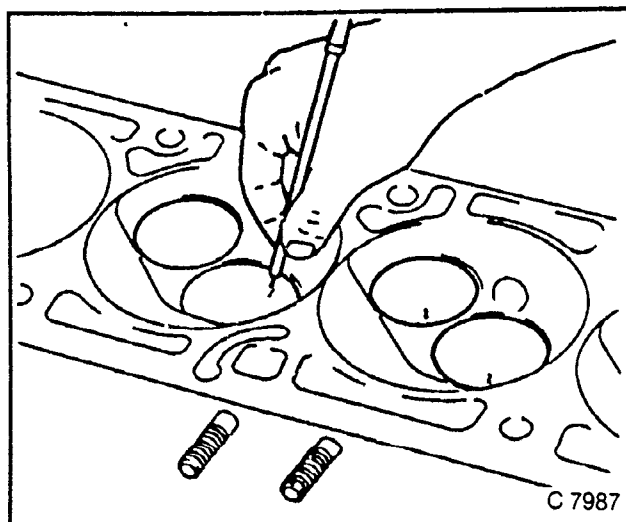


Fig. 87

INSTALL CONNECT

1. Valves.
2. Valve rotators (exhaust).
3. Spring seat rings (inlet)
4. New valve stem seals — with installing sleeve and KM-352.
5. Valve springs.
6. Valve spring plates.
7. Valve cones — KM-348.
8. Thermostat or thermostat housing with new seal ring.

NOTE:

1. Insert valves with engine oil.
2. Install valve stem seals with mounting sleeve.

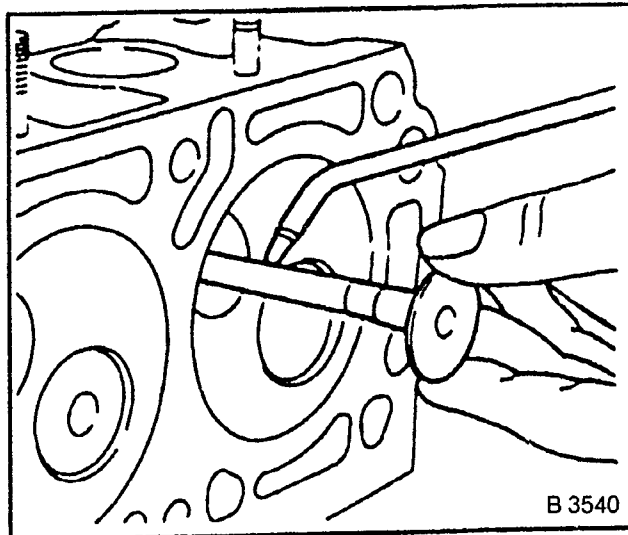


Fig. 88

TIGHTEN (TORQUE)

1. Exhaust manifold to cylinder head — 22 Nm.
2. Intake manifold to cylinder head — 22 Nm.
3. Thermostat housing to cylinder head:
1,4/1,6 ltr. engine: 10 Nm.
1,6/2,0 ltr. engine: 15 Nm.
4. Spark plugs to cylinder head — 25 Nm.

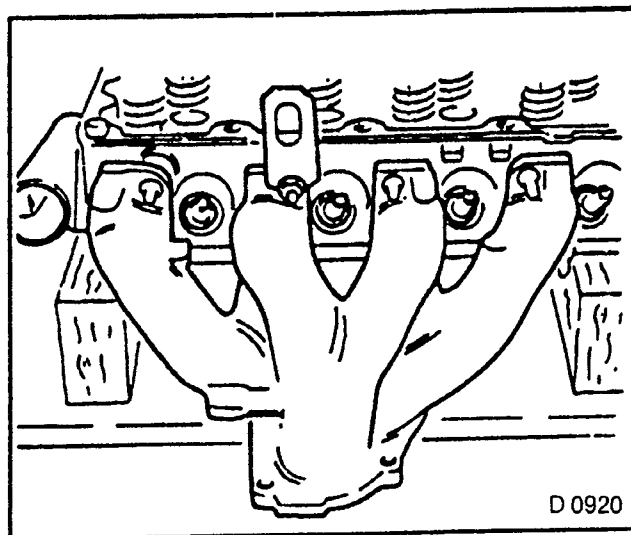


Fig. 89

Cylinder Head — Overhaul

Cylinder head disassembled

VALVE, GRIND IN

1. Oil valve stem.
2. Use fine-grained grinding past, lift up valve from seating in a rhythmical manner — distribution of grinding paste.

CLEAN

1. Valves.
2. Cylinder head.

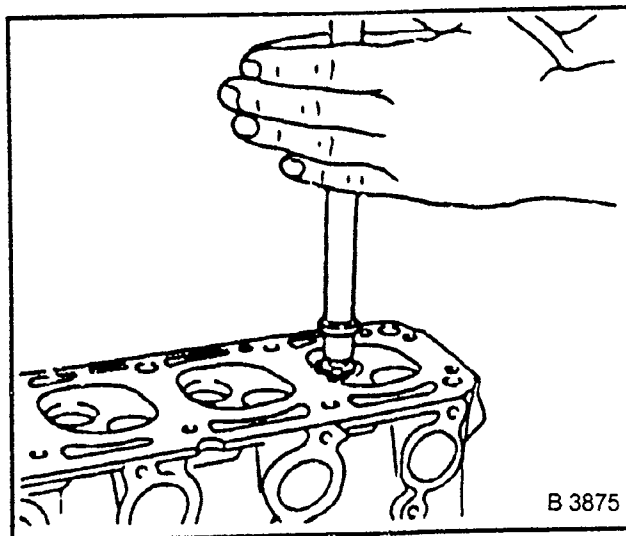


Fig 90

Valve — Grind

WARNING:

- 1 No crator — like burns on valve cone.
- 2 Re-grinding possible once or twice.
- 3 Angle on valve plate: 46°, see also “Technical Data”.
- 4 Dimension “1” must not be exceeded.
- 5 Grinding on valve stem end not permissible.

INSPECT

- 1. Valve stem projection
1,4/1,6 ltr. engine: KM-419
1,8/2,0 ltr. engine: KM-512.

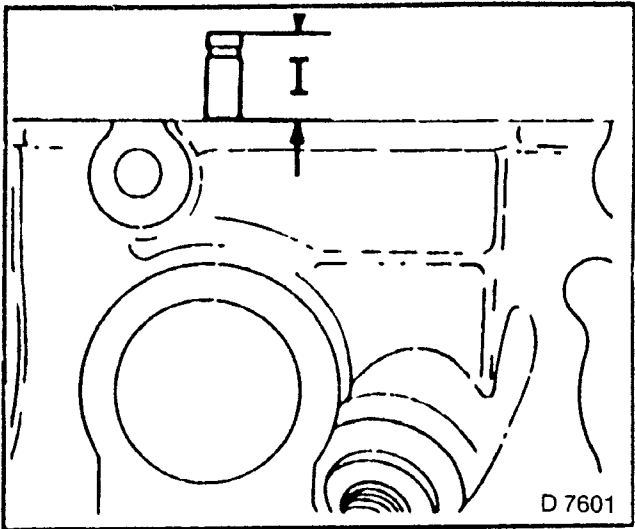


Fig 91

Valve Guide — Ream

MEASURE

- 1. Diameter of valve guide — dial gauge and internal measuring instrument.

NOTE:
VALVE OVERSIZES ARE ALREADY AVAILABLE EX WORKS.
OVERSIZE IDENTIFICATION: ON THE VALVE GUIDE AND ON THE VALVE STEM END WITH THE FOLLOWING LISTED IDENTIFICATION FIGURES/LETTERS. SEE ALSO “TECHNICAL DATA”, PAGE 312.

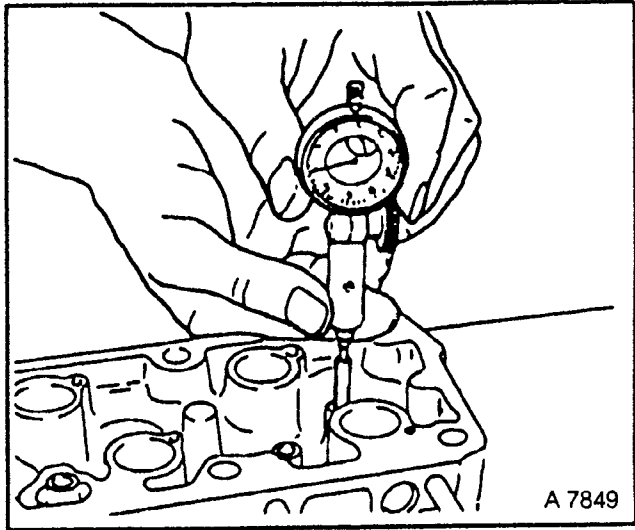


Fig 92

Size	Reamer	Identification	
		Production	Service
Normal		none	K
0,075	KM-253	1	K1
0,150	KM-254	2	K2
0,250	KM-255	—	A

Ream valve guide from upper side of cylinder head to next oversize.
After reaming, cross out identification mark and stamp in new identification mark.

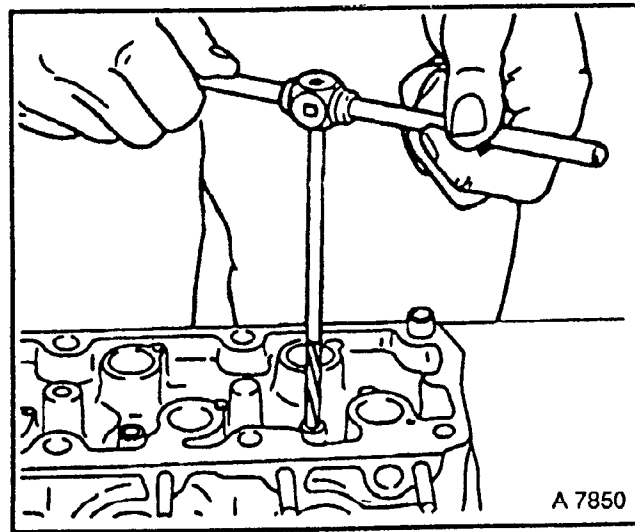


Fig. 93

Valve Seating — Mill

Put down cylinder head on block of wood.
Inlet and exhaust — Guide Drift KM-340-7
and Valve Seat Cutter KM-340-11.
Valve seat — 45° — side face, upper
correction — 30° — side face (arrows on
cutter).

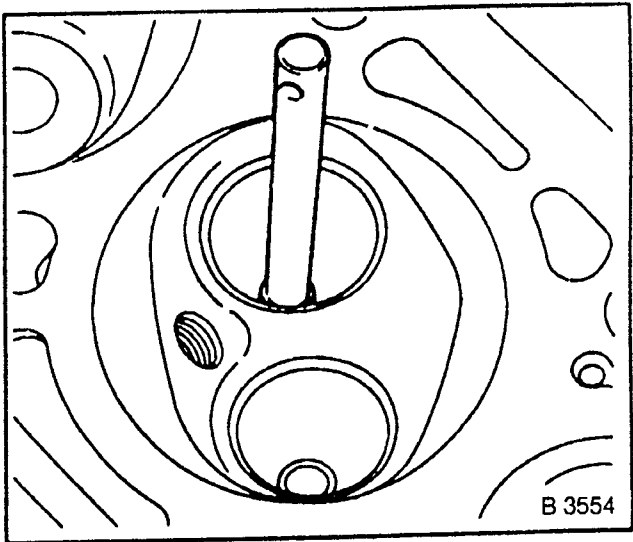


Fig. 94

Engine	Cutter	Valve seat width (in mm)	
		Inlet	Exhaust
1,4/1,6 ltr.	KM-340-11	1,3 to 1,5	1,6 to 1,8
1,8/2,0 ltr.	KM-340-11	1,0 to 1,5	1,7 to 2,2

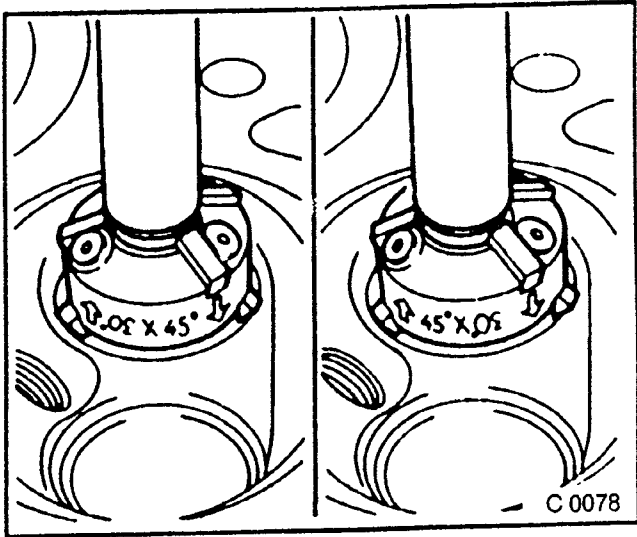


Fig. 95

INSPECT

1. Valve stem projection.
1,4/1,6 ltr. engine: KM-419
1,8/2,0 ltr. engine: KM-512

NOTE:

1. If dimension "1" is exceeded, use new valves.
2. Check valve stem projection again.
3. If dimension "1" is exceeded again:
replace cylinder head.

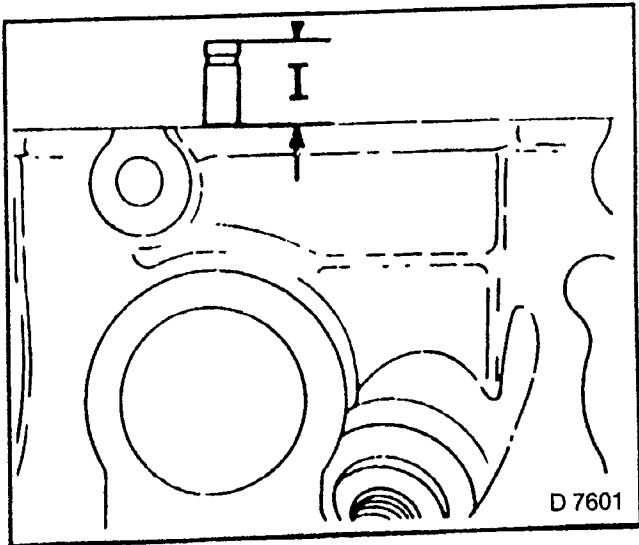


Fig. 96

Cylinder Head — Check for Plane Surface

INSPECT

- 1. Cylinder head for deformity and distortion — straight edge and feeler gauge. Permissible deviation — see “Technical Data”, page 312.

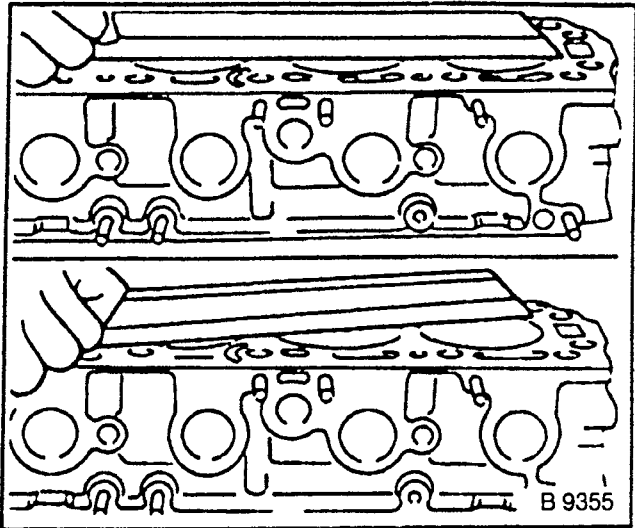


Fig. 97

MEASURE

- 1. Cylinder head height (II) — for dimensions see “Technical Data”, page 312.

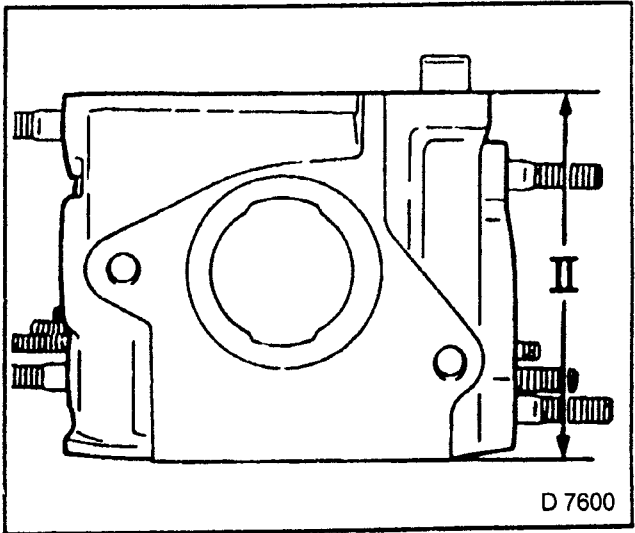


Fig. 98

CRANK DRIVE

Recommended Torque Values

	Nm
Con-rod bearing cover to con-rod	1) 1)
Con-rod bearing cover to con-rod	35 + 45° + 15° 2)
Crankshaft bearing cover to cylinder block	50 + 45° + 15° 1)
Crankshaft bearing cover to cylinder block	50 + 45° + 15° 2)
Flywheel to crankshaft	35 + 30° + 15° 1)
Flywheel to crankshaft	65 + 30° + 15° 2)

- 1) 1,4/1,6 ltr. engine
- 2) 1,8/2,0 ltr. engine
- 3) Use new bolts.
- 4) Tighten bolt (thread length 15 mm) 6 22 412 (02 865 514) to 28 Nm.
Tighten bolt (thread length 40 mm) 6 22 431 (90 281 728) to 25 Nm + 30° (use new bolt).

Starter Ring Gear — Replace

REMOVE, DISCONNECT

- 1. Flywheel.

DISASSEMBLE

- 1. Drill starter ring gear underneath tooth gap approximately 8 mm deep with 6 mm drill.

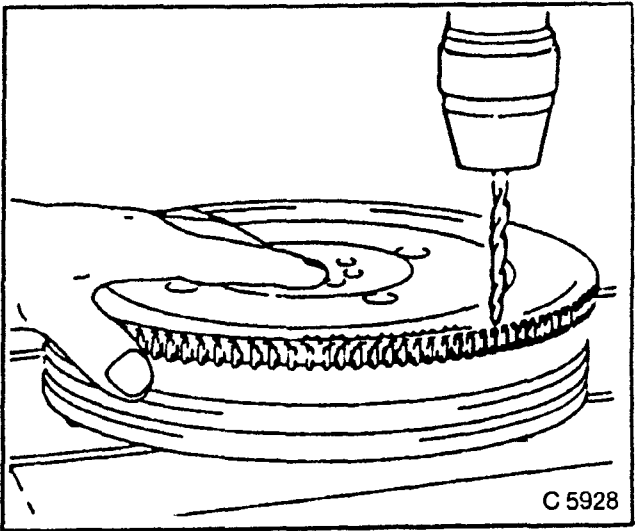


Fig. 99

DISASSEMBLE

- 1. Separate starter ring gear with chisel on the drilling point.

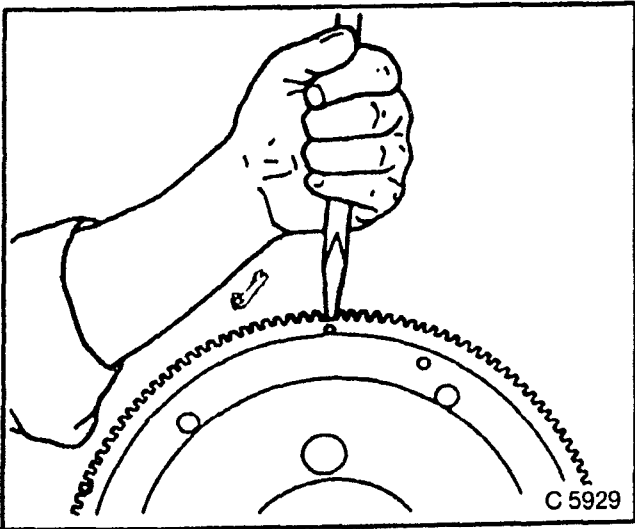


Fig. 100

ASSEMBLE

- 1. Starter ring gear with inner chamfered edge to flywheel.
- 2. Heat starter ring gear evenly to 180°C/356°F to 230°C/446°F (yellow burnished colour).

INSTALL, CONNECT

- 1. Flywheel.

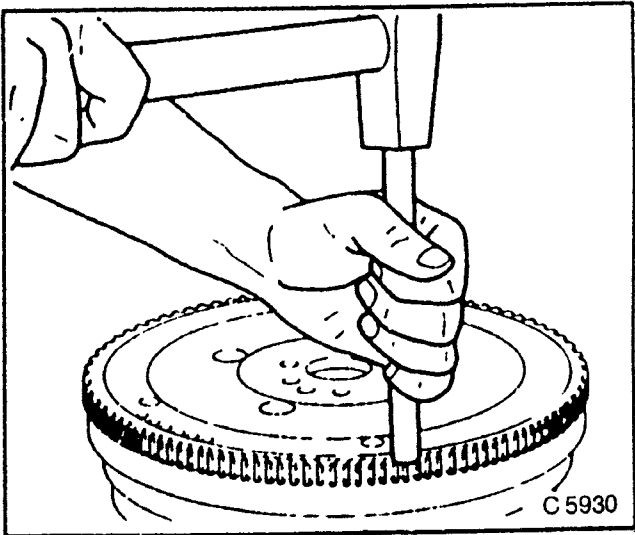


Fig. 101

INSPECT

- 1. Lateral run-out of starter ring gear — max. 0,5 mm.

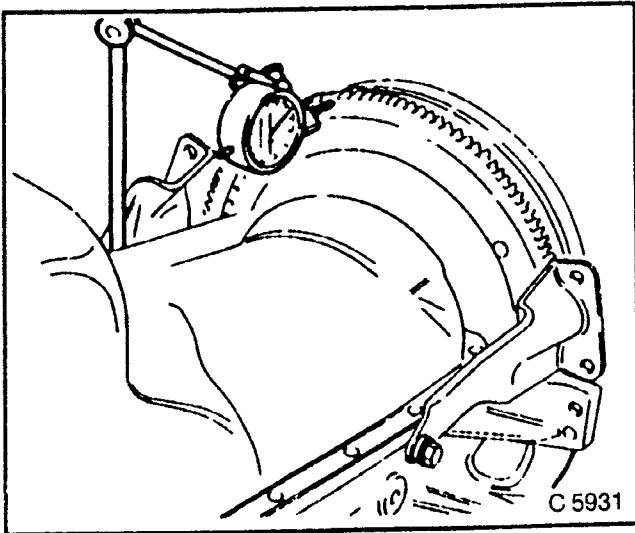


Fig. 102

Drive Disc — Remove and Install (18SE only)

REMOVE, DISCONNECT

- 1. Transmission — See Section K.
- 2. Drive disc — lock with KM-652.

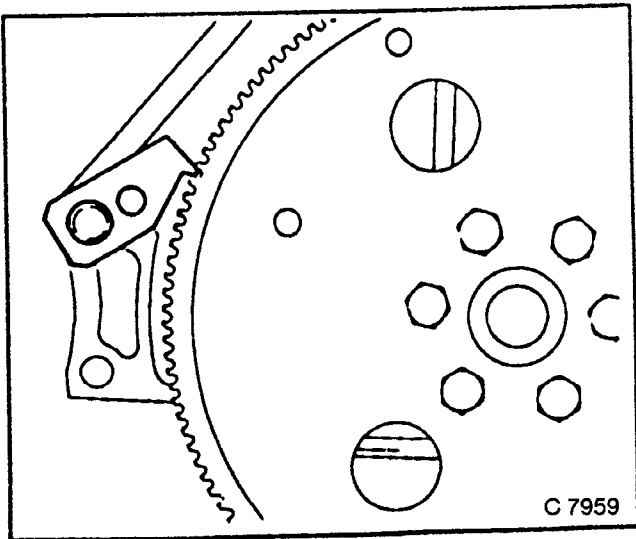


Fig. 103

TIGHTEN (TORQUE)

- 1 Drive disc to crankshaft — 60 Nm*.
*Bolt must be recut before reuse and inserted coated with Locking Compound Locktite 242.

INSTALL, CONNECT

- 1. Transmission — see Section K.

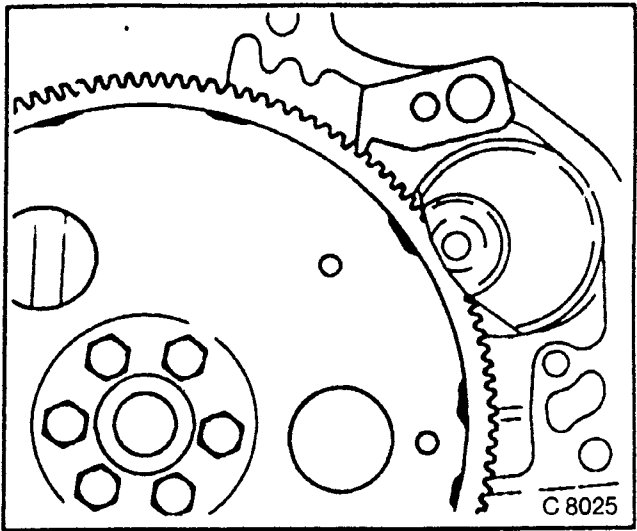


Fig. 104

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

REMOVE, DISCONNECT

- 1. Toothed belt.
- 2. Toothed belt drive gear.
- 3. If necessary: rear toothed belt cover.
- 4. Seal ring — make hole in middle of ring.
- 5. Screw in self-tapping screw and edge out.

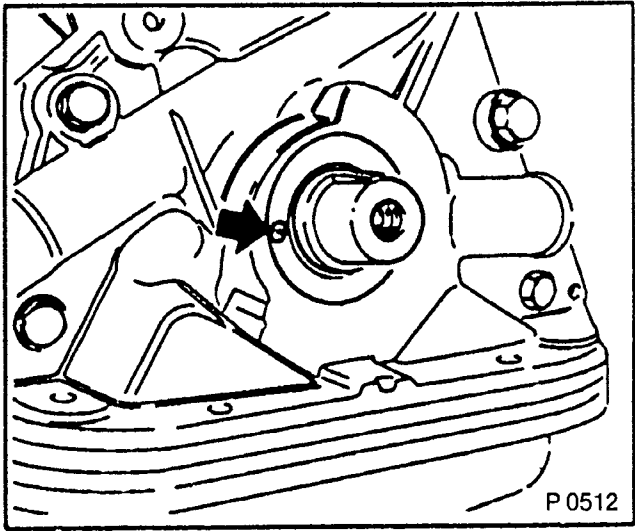


Fig. 105

INSTALL, CONNECT

- 1. Protective sleeve seal ring.
- 2. Coat seal lips of shaft seal ring with protective grease.

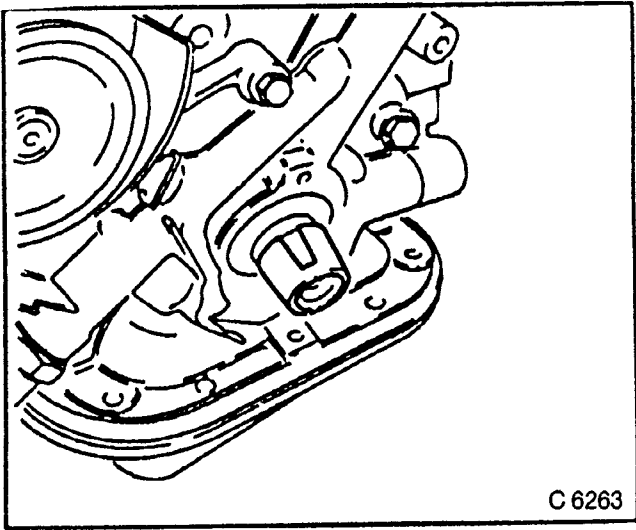


Fig. 106

INSTALL, CONNECT

- 1. Seal ring:
 - 1,4/1,6 ltr. engine: KM-417
 - 1,6/2,0 ltr. engine: KM-513-A.
- 2. If removed:
 - Rear toothed belt cover
 - toothed belt drive gear
 - toothed belt.

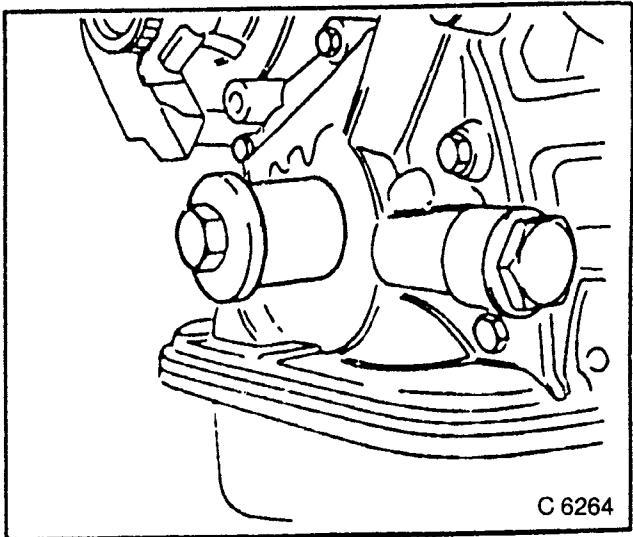


Fig. 107

INSPECT

- 1. After installation of the crankshaft pulley in C 16SE engines,
- 2. Check the distance between the inductive pulse pick-up and the increment disc.

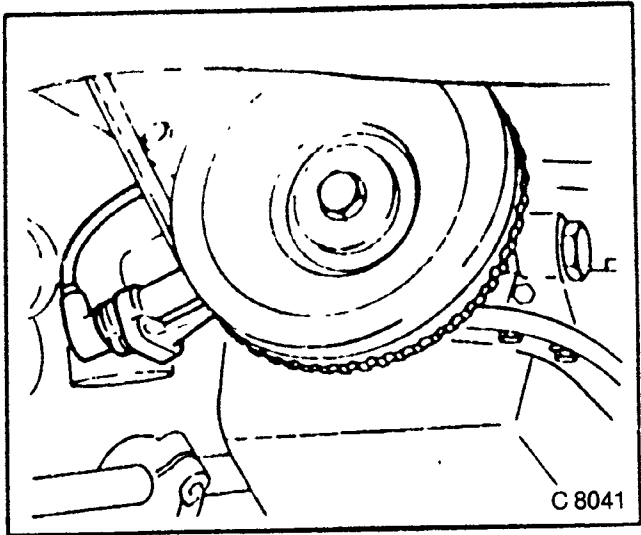


Fig. 108

**Seal Ring —
Crankshaft — Rear —
Replace
(1,6 ltr. Engine)**

REMOVE, DISCONNECT

- 1. Transmission.
- 2. Clutch (see Section K).
- 3. Drive disc or flywheel.
- 4. Make hole in middle of seal ring, turn in self-tapping screw and edge out.

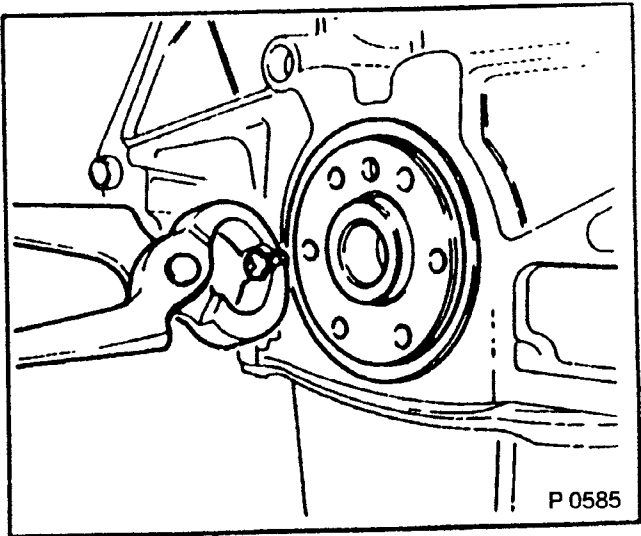


Fig. 109

INSTALL, CONNECT

- 1. Seal ring — protective sleeve.
- 2. Coat seal lips of shaft seal ring with protective grease. Use KM-535 or KM-635.
- 3. Flywheel or drive disc.
- 4. Clutch.
- 5. Transmission — see Section K.

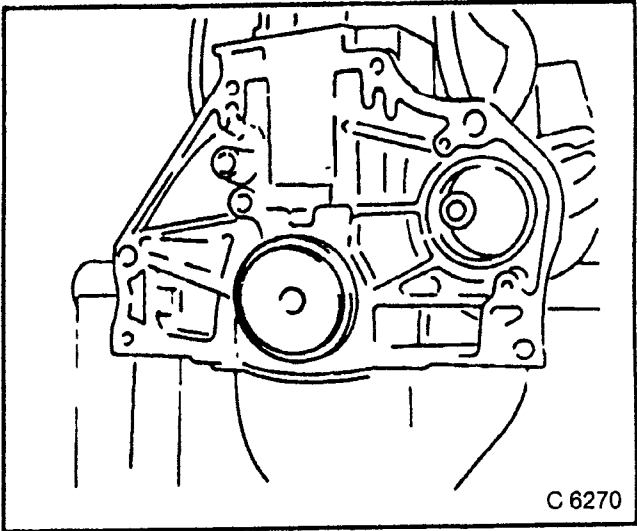


Fig. 110

**Seal Ring —
Crankshaft — Rear —
Replace
(MT except for 1,6 ltr.
Engine)**

REMOVE, DISCONNECT

- 1. Clutch.
- 2. Thrust bearing — see Section K.
- 3. Flywheel.
- 4. Guide sleeve for thrust bearing.

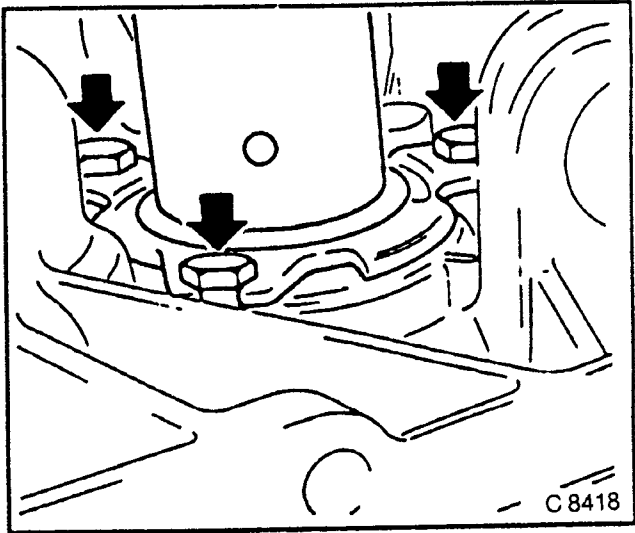


Fig. 111

INSTALL, CONNECT

- 1. Hook KM-469-6 between sealing lip and crankshaft journal.

ASSEMBLE

- 1. Support KM-469-4.
- 2. Lever KM-469-13-A.
- 3. Pin KM-328-8.

REMOVE, DISCONNECT

- 1. Shaft seal ring with assembly KM-469-A.

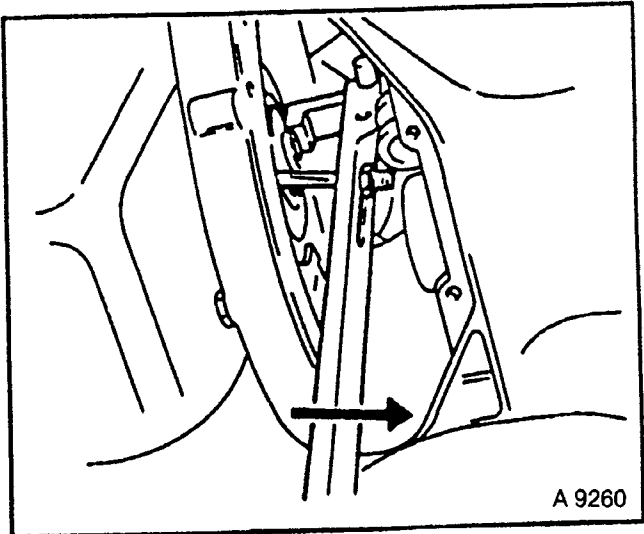


Fig. 112

- 2. Coat seal lips of shaft seal ring with protective grease.

INSTALL, CONNECT

- 1 Seal ring onto crankshaft journal — protective sleeve:
1,4 ltr. engine: KM-469-9
1,8/2,0 ltr. engine: KM-635-1
- 2. Place thrust collar on seal ring:
1,4 ltr. engine: KM-469-10
1,8/2,0 ltr. engine: KM-635-2

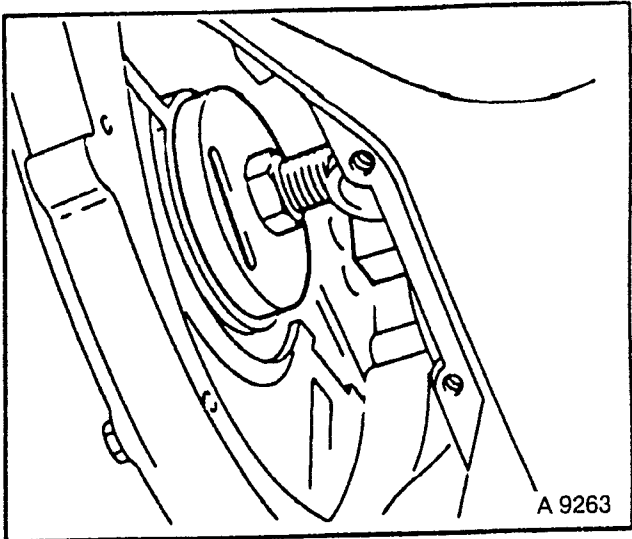


Fig. 113

INSTALL, CONNECT

- 1. Seal ring to stop on cylinder block — retaining plate, hex bolt
1,4 ltr. engine: KM-469-11-A, KM-469-12-A
1,8/2,0 ltr. engine: KM-469-12-A, KM-511-11.

NOTE:
INSERT LOCATING PINS INTO HOLES ON TRANSMISSION.
REMOVE ASSEMBLY.

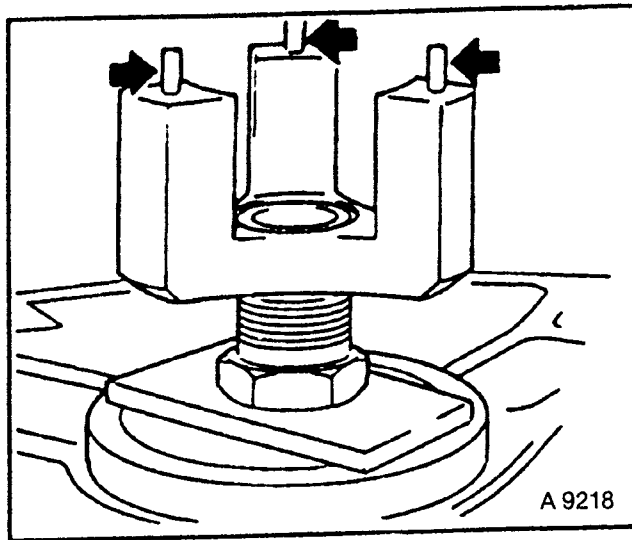


Fig. 114

TIGHTEN (TORQUE)

- 1. Guide sleeve for thrust bearing to transmission — 22 Nm (bolt M8).

INSTALL, CONNECT

- 1. Flywheel.
- 2. Clutch.
- 3. Thrust bearing.

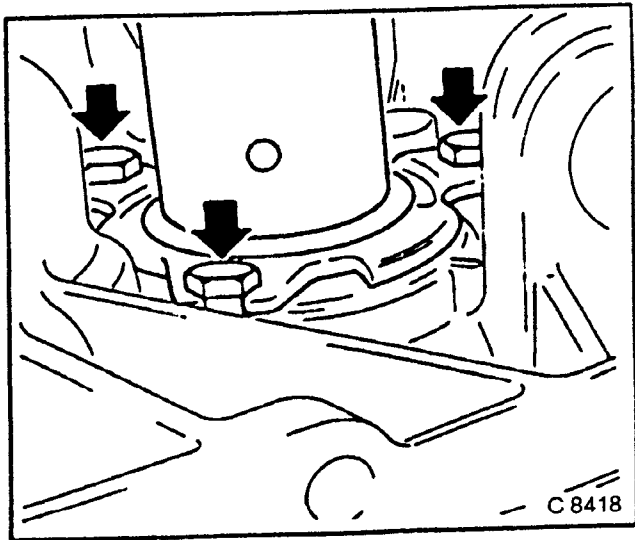


Fig. 115

Piston with Con-rod — Remove and Install (Engine Installed)

REMOVE, DISCONNECT

- 1. Cylinder head, oil pan.
- 2. Piston with con-rod.
Mark con-rod bearing cover.

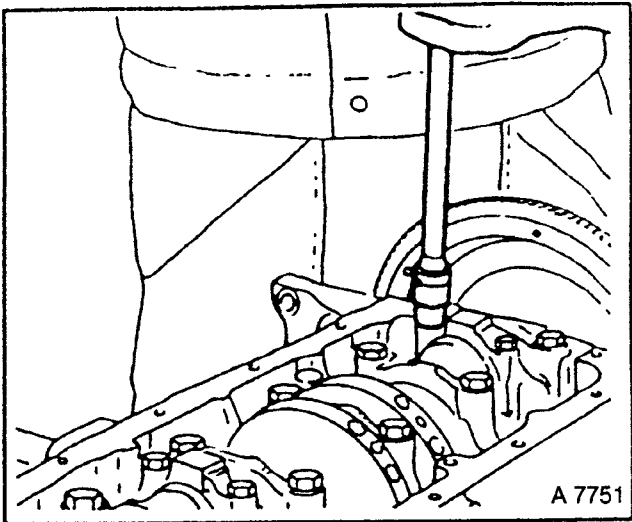


Fig. 116

INSPECT

- 1. Replace all parts, if necessary.

NOTE:

- Ring gap offset:
 - 1. Piston rings — 180°.
 - 2. Oil scraper rings — 25 to 50 mm from gap of intermediate ring to the left and to the right.

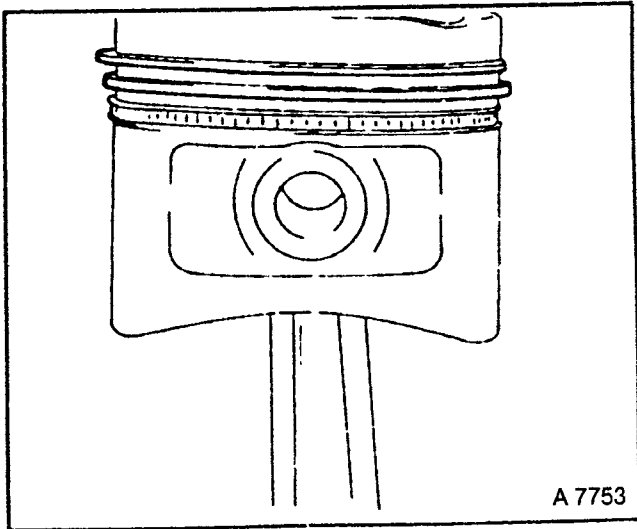


Fig. 117

INSTALL, CONNECT

- 1. Piston with con-rod. Insert with engine oil.

NOTE:

INSTALLATION POSITION:
ARROW/NOTCH ON PISTON HEAD
TO TIMING SIDE OF ENGINE. BEADS
ON CON-ROD TO CLUTCH SIDE.

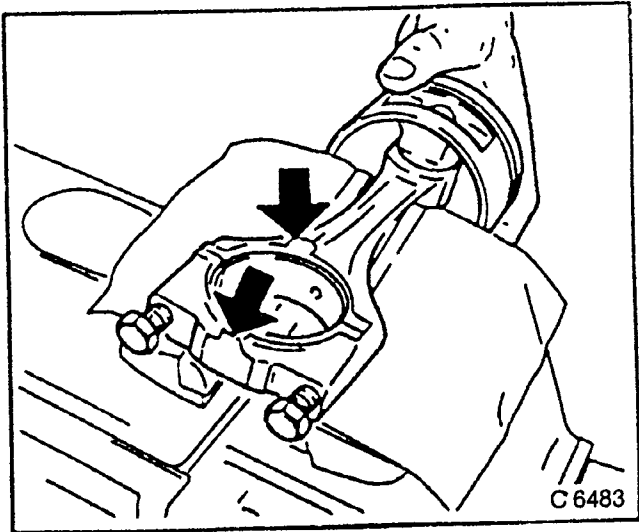


Fig. 118

TORQUE — ANGLE METHOD

1. Con-rod bearing cover to con-rod — See Recommended Torque Values, page 50.
2. Install oil pan and cylinder head.

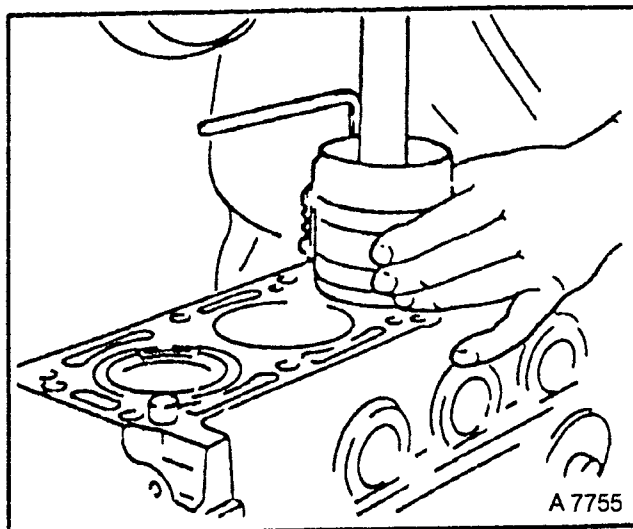


Fig. 119

Piston Rings — Replace

REMOVE, DISCONNECT

1. Piston with con-rod.
2. Piston rings — commercially available piston ring clamp pliers.

CLEAN

1. Piston ring grooves — ground piece of old piston ring.

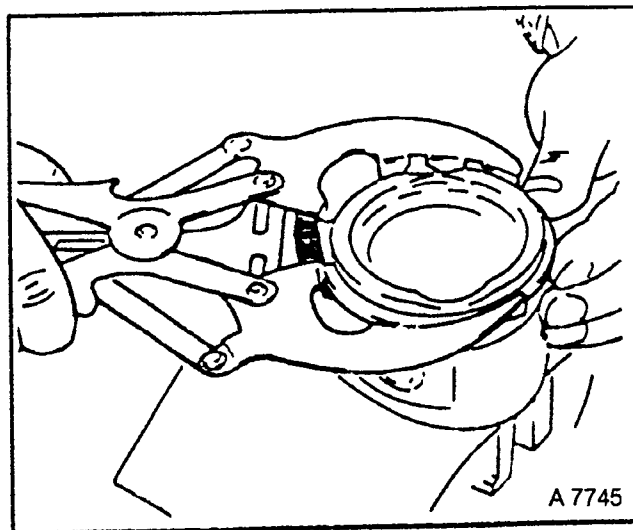


Fig. 120

INSPECT

1. Piston ring gap.
For piston ring sizes, permissible piston ring gaps — see "Technical Data", page 312.

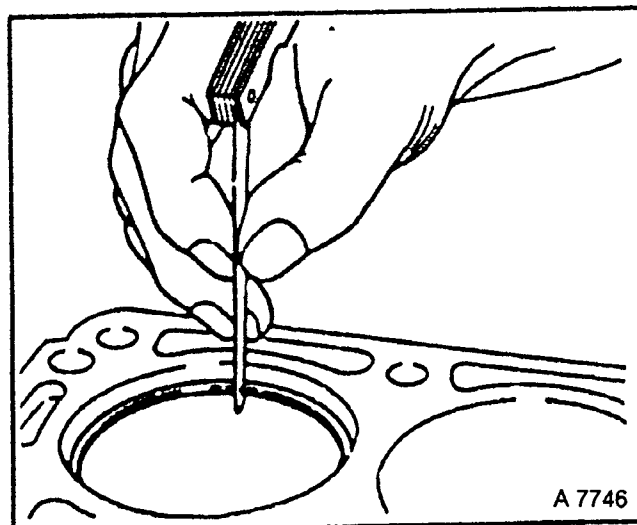


Fig. 121

INSTALL, CONNECT

- 1. Oil scraper ring.
- 2. Offset ring gaps of steel band rings each 25 to 50 mm to the left or right of the intermediate ring gap.
- 3. Piston rings.
- 4. Offset ring gaps by approximately 180°.
- 5. Second piston ring with identification mark "TOP" facing upwards.
- 6. Piston with con-rod.

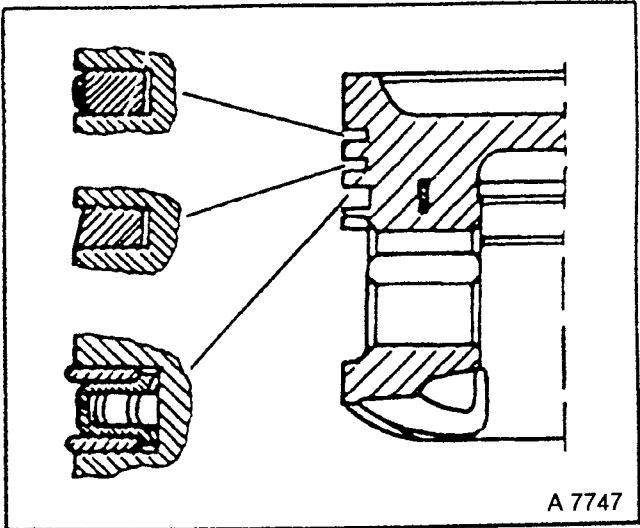


Fig. 122

**Engine Block —
Check for Plane Surface**

CLEAN

- 1. Cylinder block sealing surfaces.

INSPECT

- 1. Cylinder block sealing surfaces' length and breadth for bending and also the diagonals for warping.
Use aligning ruler and feeler gauge.

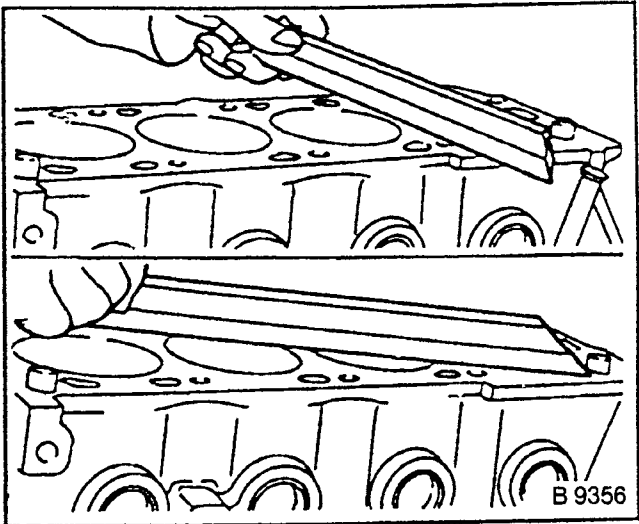


Fig. 123

NOTE:
AFTER SURFACE GRINDING,
CHECK PISTON PROJECTION. See
Technical Data PAGE 312.

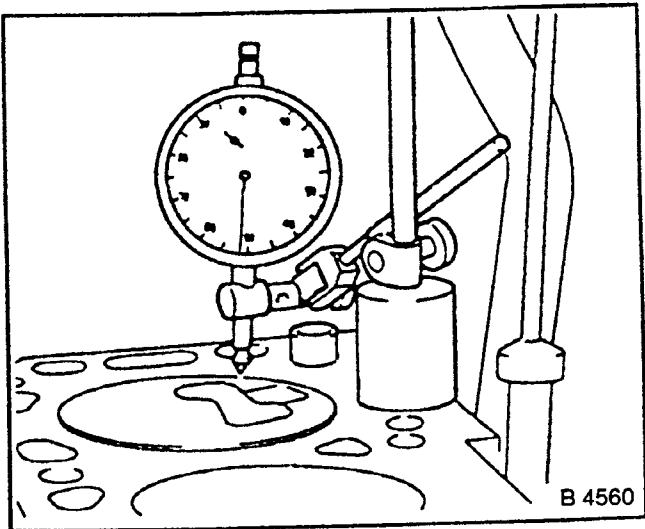


Fig. 124

Con-rod Bearing — Replace

REMOVE, DISCONNECT

- 1. Oil pan.
- 2. Con-rod bearing cover. Mark con-rod bearing.

CLEAN

- 1. Con-rod journal.
- 2. Con-rod bearing cover.

INSTALL, CONNECT

- 1. New bearing shells — (Insert with engine oil).
- 2. Con-rod bearing cover.

TORQUE — ANGLE METHOD

- 1. Con-rod bearing cover to con-rod — See Recommended Torque Values, page 50.
- 2. Oil pan.

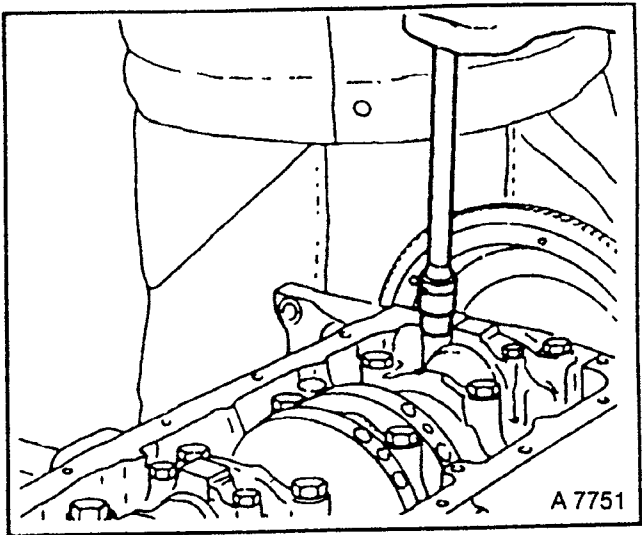


Fig. 125

Con-rod — Replace

REMOVE, DISCONNECT

- 1. Piston with con-rod.

DISASSEMBLE

- 1. Con-rod piston assembly.
- 2. Press out piston bolts:
 - 1,6 ltr. engine: KM-634-6.
 - 1,8/2,0 ltr. engine: KM-634-3

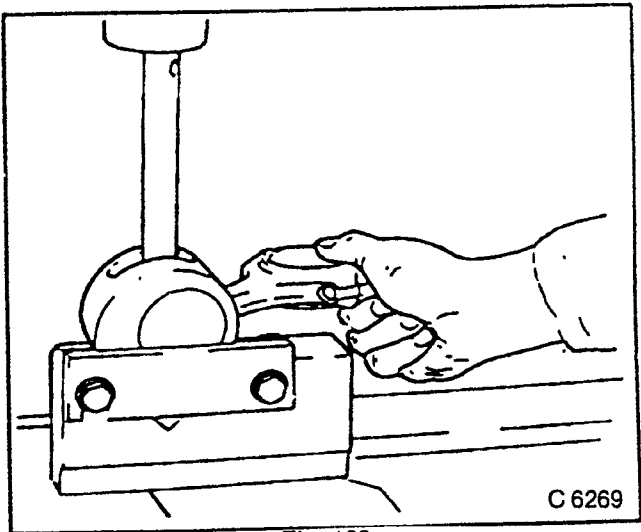


Fig. 126

ASSEMBLE

- 1. Guide drift:
 - 1,6 ltr. engine: KM-634-3, KM-634-5 and KM-634-4.
 - 1,8/2,0 ltr. engine: KM-634-6, KM-634-8 and KM-634-7.
- 1,6 ltr. engine: Place KM-634-9 on right slanted side. Align con-rod with piston — observe installation position.
- 2. Slide guide drift in horizontal position through piston and con-rod as far as side plate stop.
- 3. Tighten bolts evenly. Piston must rest flush on the rear plate.
- 4. Remove centre piece from guide drift.
- 5. Insert piston pins (lubricated) into guide drift.

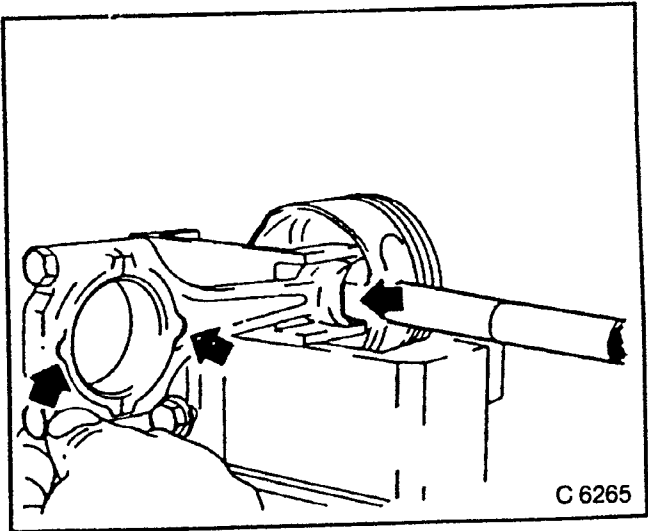


Fig. 127

6. Coat con-rod eye and upper part of con-rod stem with colour — commercially available thermocolour pencil. When the required installation temperature is reached, the green colour changes to black. The colour marking must not change colour over its whole length but only up to the beginning of the con-rod stem.

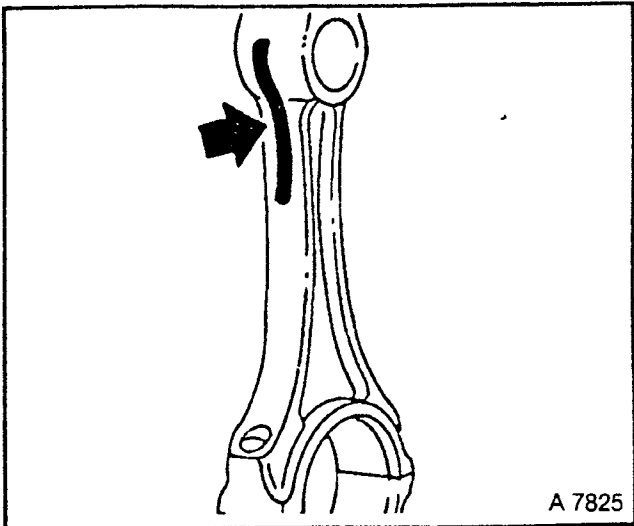


Fig. 128

7. Heat new con-rod with hotplate at upper con-rod eye.
Installation temperature: 280°C/536°F to max. 320°C/608°F.
8. Rest eye surface evenly on the hotplate and reduce heat conduction with incombustible firebrick.

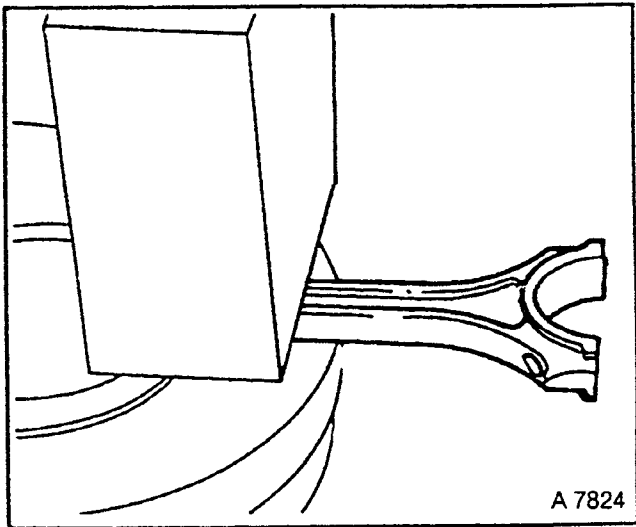


Fig. 129

NOTE:

1. Since the con-rods have no counterweights, re-working is not possible. Exchange con-rods in sets only.
2. Installation position:
beads on con-rod point to the flattening on the piston pin eye.

NOTE:

Firmly seated piston pin can **NOT** be pushed in. Carry out installation quickly.

ASSEMBLE

1. Con-rod.
2. Piston pin.
3. Piston.
4. Push in guide drift with piston pin as far as stop into piston.

INSTALL, CONNECT

1. Piston with con-rod.

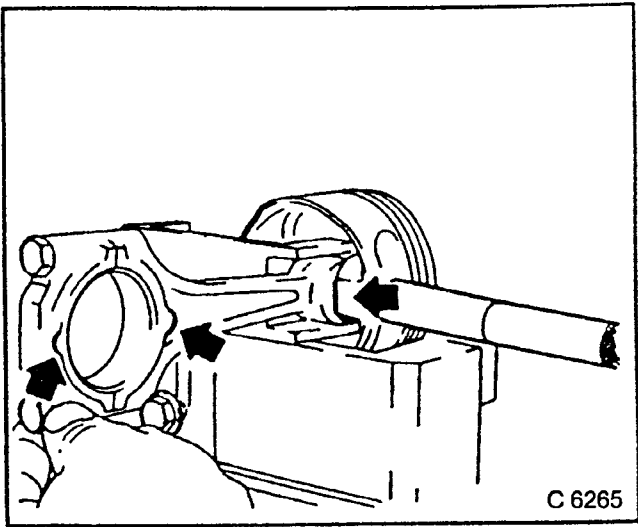


Fig. 130

Crankshaft — Remove and Install

1. Mount engine on Engine Overhaul Stand KM-412 with appropriate adaptors.
2. Drain engine oil — place collecting pan underneath.

REMOVE, DISCONNECT

1. Attaching aggregates.
2. Flywheel/drive disc.
3. Oil pan.
4. Oil pump.
5. Mark con-rod bearing cover.
6. Crankshaft bearing cover.

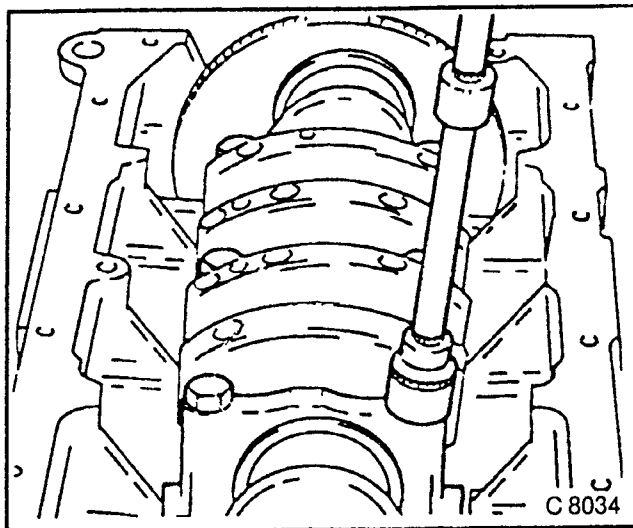


Fig. 131

REMOVE, DISCONNECT

1. Crankshaft from cylinder block.

CLEAN

INSPECT

1. Crankshaft.
2. Replace all parts if necessary.
3. Modify pulse sensor disc when replacing crankshaft — if present.

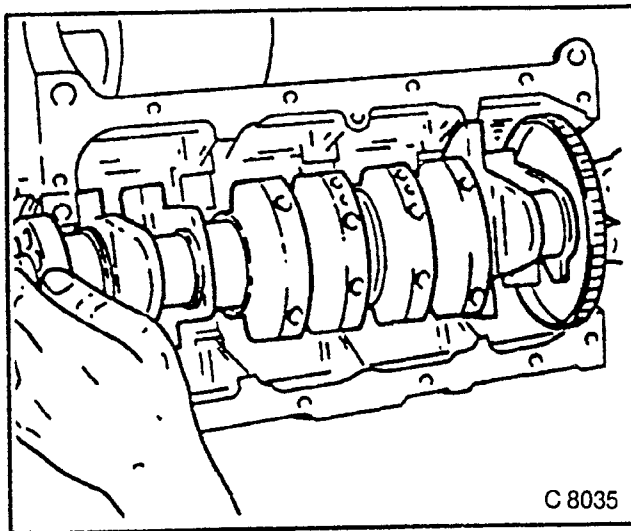


Fig. 132

INSTALL, CONNECT

1. New bearing shells into cylinder block and bearing cover.
2. Coat bearing shells with engine oil. For oversizes of bearing shells see "Technical Data", page 312.

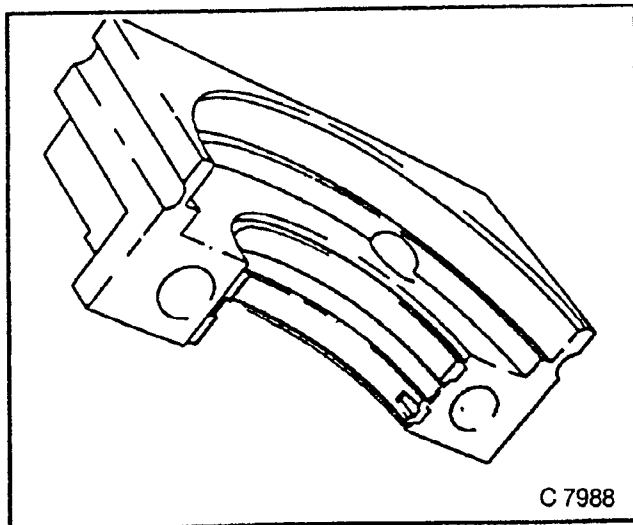


Fig. 133

INSTALL, CONNECT

- 1. New crankshaft into cylinder block.
- 2. The seating of the crankshaft can be corrected by light blows with a rubber hammer on the crank arm (arrow).

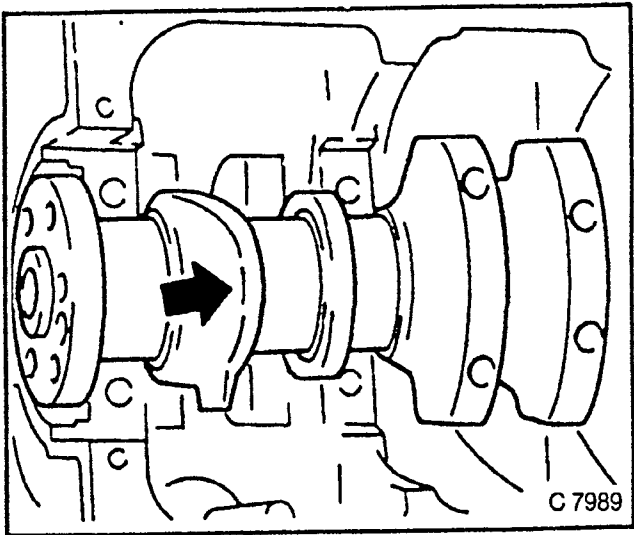


Fig. 134

INSTALL, CONNECT

- 1. Bearing front and rear covers — coat inner surfaces with Sealing Compound Locktite 515 flexible gasket or equivalent.

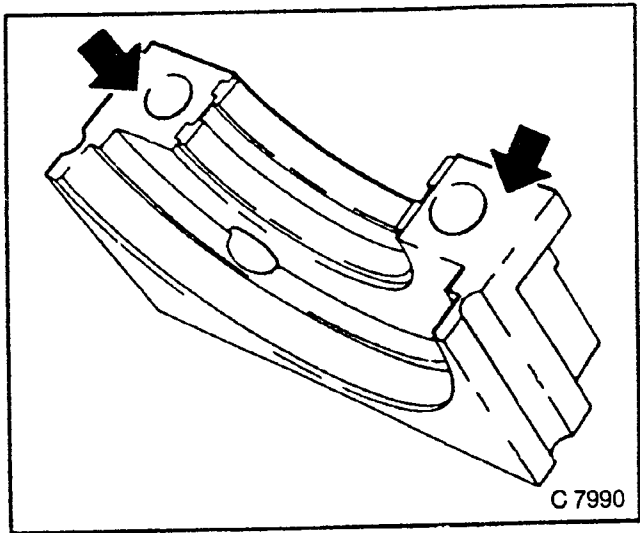


Fig. 135

- 2. Apply a bead of Adhesive Sealing Compound Locktite 242 in the grooves of the two bearing covers.

NOTE:

- 1. Camshaft housing cover.
- 2. After installation, press in adhesive sealing compound from above again until it emerges from the bearing cover joints.

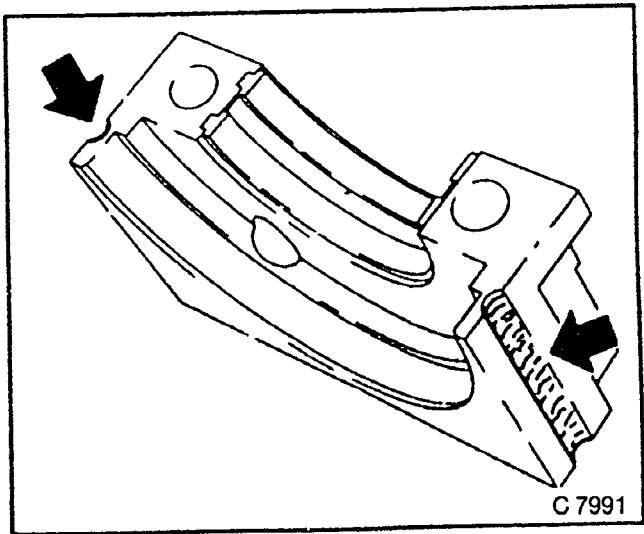


Fig. 136

TORQUE — ANGLE METHOD

- 1. Crankshaft bearing cover to cylinder block.
- 2. Con-rod bearing cover to con-rod — see Recommended Torque Values, page 50.
- 3. Align bearing front cover to engine fore part.

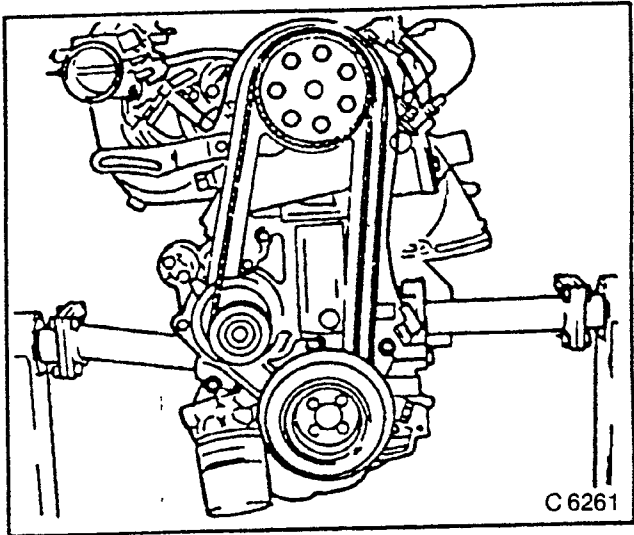


Fig. 137

INSTALL, CONNECT

- 1. Oil pump.
- 2. Oil pan.
- 3. Crankshaft rear seal ring.
- 4. Flywheel/drive disc.
Attaching aggregates.

NOTE:

- 1. Before installation of toothed belt, check timing.
- 2. Engine from Engine Stand KM-412.
- 3. Adapter from engine.
- 4. Install engine.

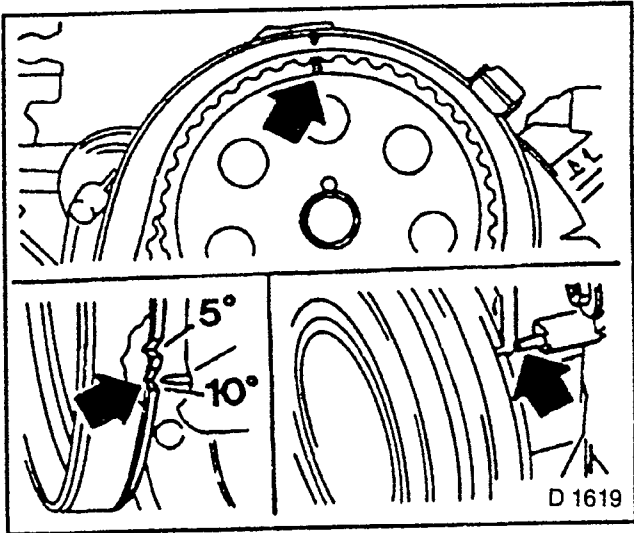


Fig. 138

Crankshaft — Check

INSPECT

- 1. End play — bearing shells installed.
- 2. Front end contact surfaces of flywheel/drive disc.
Permissible end play — see Technical Data, page 312.

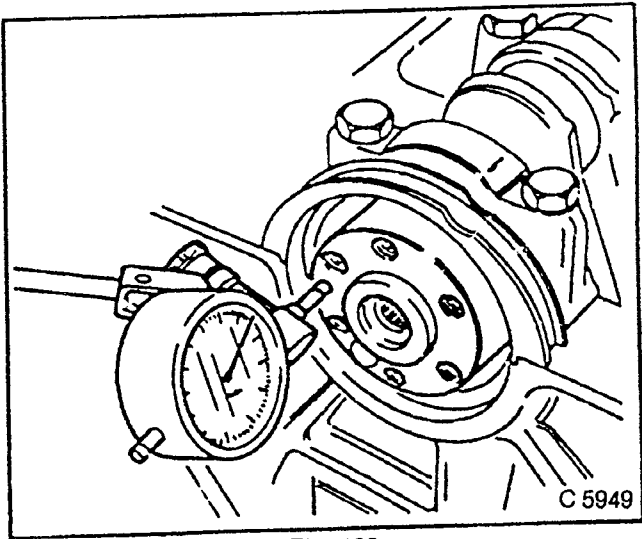


Fig. 139

INSPECT

- 1. Out-of-round (run-out) — middle bearing shell removed.
When mounted on front and rear bearing.
Permissible out-of-round. See Technical Data, page 312.

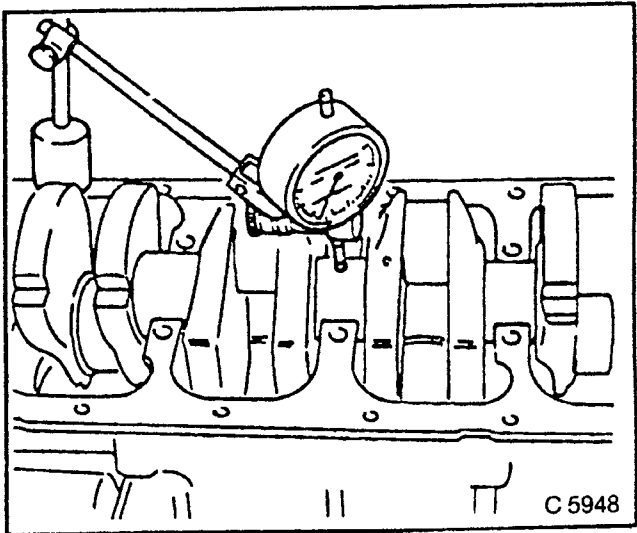


Fig. 140

INSPECT

- 1. Bearing play — bearing cover removed.

MEASURE

- With “Plastigage” (ductile plastic threads).
- 1. Cut threads to length of bearing width and lay axially between crankshaft journal and bearing shell (arrow).
 - 2. Install bearing cover with correct torque — see “Recommended Torque Values”, page 50.

NOTE:

- 1. Remove grease from crankshaft journal.
- 2. Lubricate bearing shell slightly so that the thread does not tear when the bearing cover is removed.

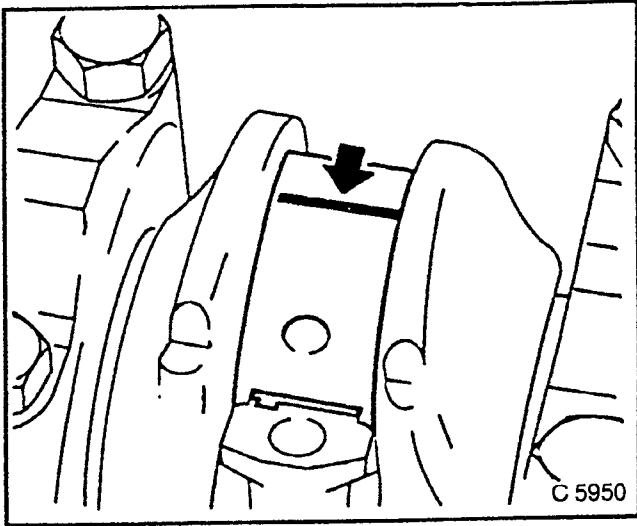


Fig. 141

REMOVE, DISCONNECT

- 1. Bearing cover.

MEASURE

- 1. Width of compressed plastic thread (arrow). Compare with measuring scale.

“Plastigage” is available for varying tolerance ranges.
Type: PG-1, colour: green.

Permissible tolerance ranges — see Technical Data, page 312.

TORQUE — ANGLE METHOD

- 1. Bearing cover to cylinder block — see Recommended Torque Values, page 50.

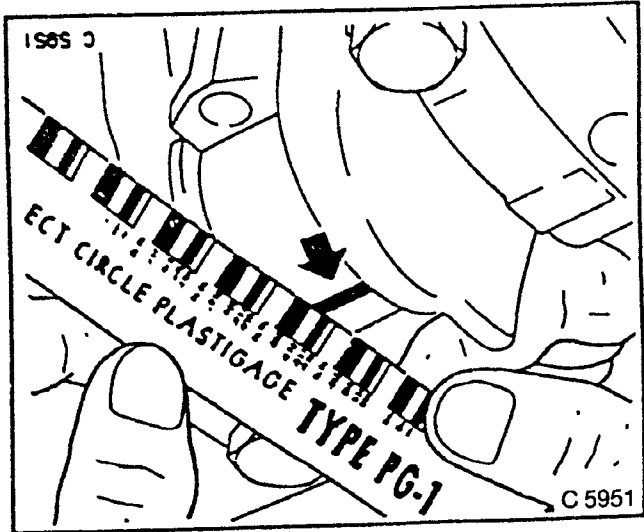


Fig. 142

Flywheel — Remove and Install (1,6 ltr. Engine)

REMOVE, DISCONNECT

- 1. Transmission.
- 2. Clutch — see corresponding operations in Section K.
- 3. Flywheel — lock with KM-652.

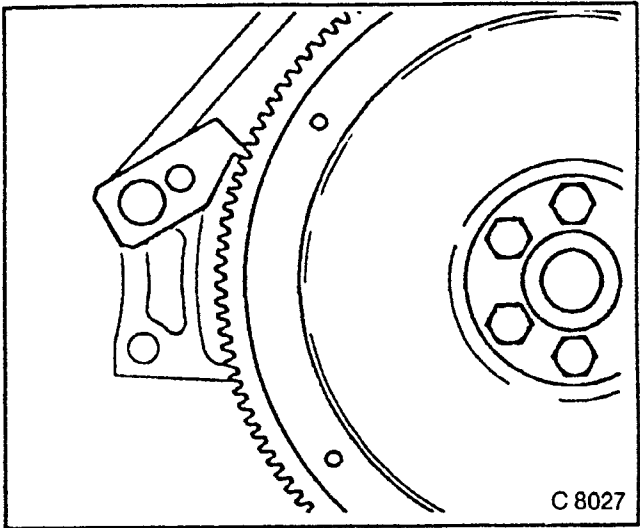


Fig. 143

TORQUE — ANGLE METHOD

- 1. Flywheel to crankshaft — 35 Nm + 30° to 15°
Use new bolts.

INSTALL, CONNECT

- 1. Clutch.
- 2. Transmission — see corresponding operations in Section K.

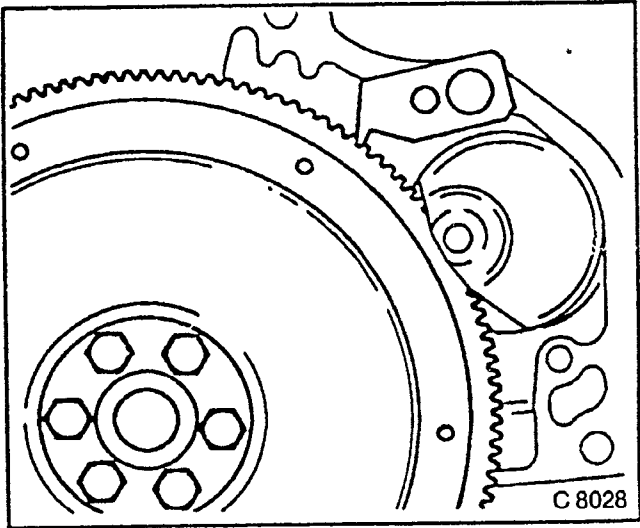


Fig. 144

Flywheel — Remove and Install (except for 1,6 ltr. Engine)

REMOVE, DISCONNECT

- 1. Clutch.
- 2. Thrust bearing.
- 3. Guide sleeve for thrust bearing.
See corresponding operations in Section K.
- 4. Flywheel — lock with KM-517.
Mark installation position.

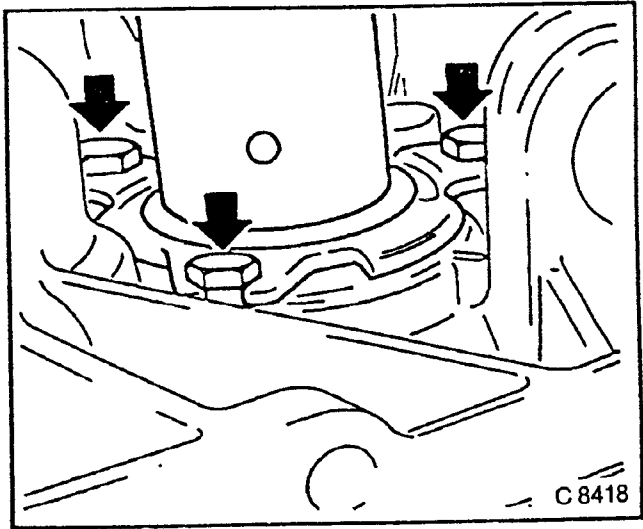


Fig. 145

TIGHTEN (TORQUE)

- | Engine | 1,4 ltr. | 1,8/2,0 ltr. |
|--|-------------------------|-------------------------------|
| 1. Flywheel to crankshaft | 35 Nm
+ 30° to 15°*) | 65 Nm
+ 30° to 15°**)**)) |
| 2. Guide sleeve for thrust bearing to transmission housing | 22 Nm | 22 Nm |
- *) Use new bolts.
**) Insert bolts with Locking Compound Loctite 242
3. Install guide sleeve, thrust bearing, clutch.

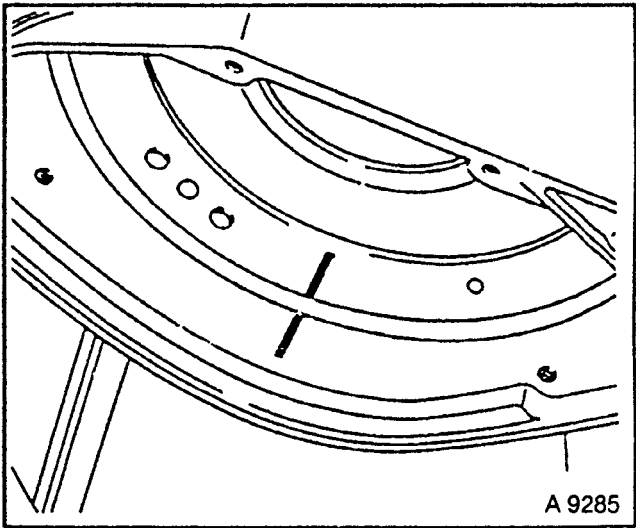


Fig. 146

Recommended Torque Values — Oil Circuit

	Nm
Bracket for oil intake pipe to cylinder block	6 ²⁾
Bracket for oil intake pipe to cylinder block	8 ¹⁾³⁾
Oil drain plug to oil pan	45 ²⁾
Oil drain plug to oil pan	55 ¹⁾
Oil filter cartridge to connection fitting (cylinder block)	15 ¹⁾
Oil filter cartridge to oil pump	15 ²⁾
Oil intake pipe to oil pump	8 ³⁾
Oil pressure switch/sensor to oil pump	30 ¹⁾
Oil pressure switch/sensor to oil pump	40 ²⁾
Oil pump to cylinder block	6
Screw plug for pressure relief valve to oil pump	30

¹⁾ 1,4 / 1,6 ltr. engine
²⁾ 1,8 / 2,0 ltr. engine
³⁾ Bolt must be recut before reusing and installed using Locking Compound (Loctite 242).

Oil Filter Cartridge — Replace

REMOVE, DISCONNECT

1. Oil filter cartridge — commercially available tool.

INSTALL, CONNECT

1. Oil filter cartridge by hand — oil seal ring.
2. Fill up engine oil.

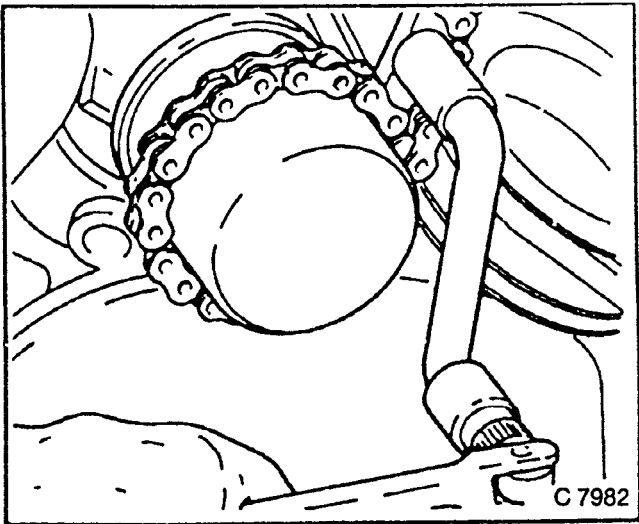


Fig. 147

Bypass Valve — Replace

Oil filter removed.

REMOVE, DISCONNECT

1. Bypass valve.
2. Cut thread in locking disc with M 10 tap (3rd stage).
3. Turn in M 10 bolt.
4. Take out bypass valve from seating.

INSTALL, CONNECT

1. Bypass valve — with drift (\varnothing approximately 15 mm) until it rests.

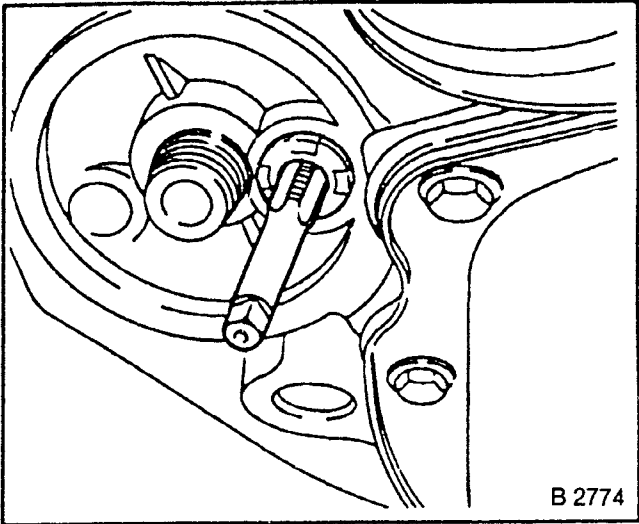


Fig. 148

Oil Pump — Remove and Install

REMOVE, DISCONNECT

1. Rear toothed belt cover.
2. Oil pan.
3. Oil pump intake pipe from oil pump.
4. Oil filter cartridge.
5. Plug from oil pressure switch/sensor.
6. Oil pump from cylinder block.
7. Oil pressure switch/sensor from oil pump.

CLEAN

1. Sealing surfaces.

INSTALL, CONNECT

1. Oil pressure switch/sensor to oil pump.
2. Oil pump to cylinder block.
3. Oil pump intake pipe.
4. Oil pan.
5. Wiring harness plug.
6. Oil filter cartridge.
7. Toothed belt cover.
8. Toothed belt — see operation.

TIGHTEN (TORQUE)

1. Oil pressure switch/sensor to oil pump — 40 Nm*.
 2. Oil pump to cylinder block — 6 Nm.
 3. Oil intake pipe to oil pump — 8 Nm**.
- * 1,4 and 1,6 ltr. 30 Nm.
** Insert bolts with Locking Compound (Loctite 242).

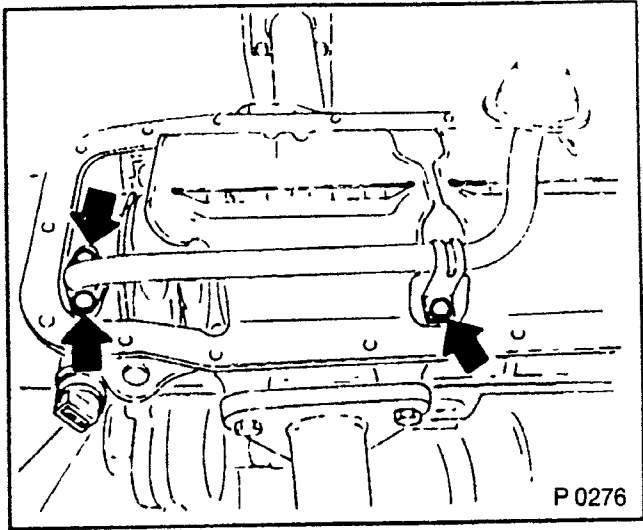


Fig. 149

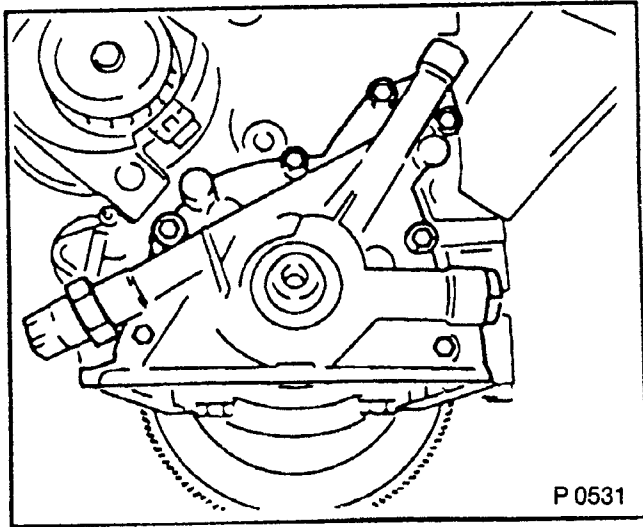


Fig. 150

Oil Pump — Check

REMOVE, DISCONNECT

1. Oil pump.
2. Oil pump cover.
3. Pressure relief valve.

INSPECT

1. Recess of pair of toothed gears.
1,4 / 1,6 ltr.: 0,08 to 0,15 mm.
1,8 / 2,0 ltr.: 0,03 to 0,1 mm
2. Check housing.
3. Oil pump cover.
4. Pressure relief valve for signs of wear.

INSTALL, CONNECT

1. Oil pump cover with Sealing Compound (Locktite 242).
2. Pressure relief valve with new copper sealing ring.
3. Oil pump with new sealing ring.

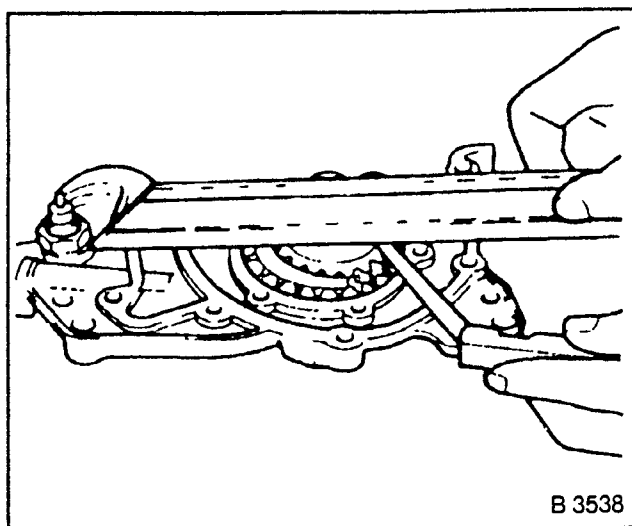


Fig. 151

Oil Pump Safety Valve — Replace

REMOVE, DISCONNECT

1. Closure plug.
2. Seal ring.
3. Spring.
4. Piston.

Fig. 152 shows C 16 NZ engine.

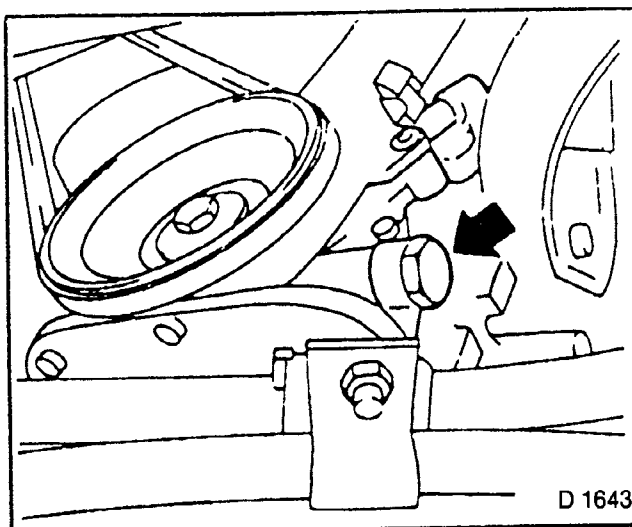


Fig. 152

INSTALL, CONNECT

1. Piston (observe installation position).
2. Spring.
3. Seal ring.
4. Closure plug.

TIGHTEN (TORQUE)

1. Closure plug to oil pump — 30 Nm.

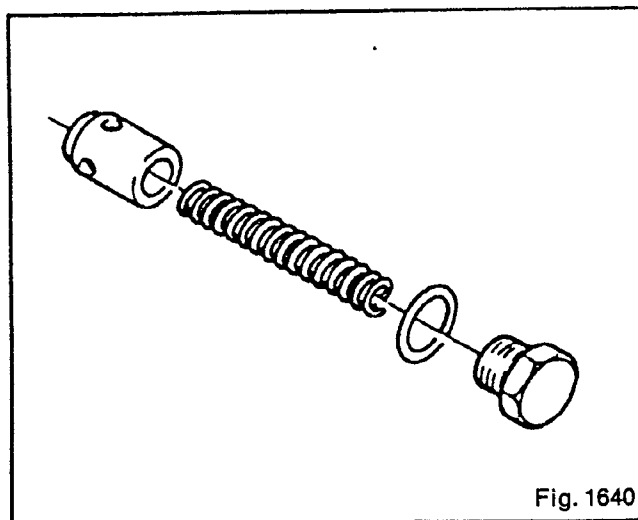


Fig. 153

COOLING SYSTEM

Recommended Torque Values

	Nm
Camshaft housing cover to housing	8
Camshaft sprocket to camshaft	45
Rear toothed belt cover to camshaft housing	12 ¹⁾
Temperature sensor to intake manifold	10
Thermostat housing to cylinder head	10 ¹⁾
Thermostat housing to cylinder head	15 ²⁾
Water outlet fitting to thermostat housing	8
Water pump to cylinder block (M 6)	8 ¹⁾
Water pump to cylinder block (M 8)	25 ²⁾

¹⁾ 1,4 / 1,6 ltr. engine

²⁾ 1,8 / 2,0 ltr. engine

Radiator — Remove and Install

REMOVE, DISCONNECT

- 1. Ground cable from battery.
- 2. Coolant hoses — collect coolant.
- AT:
Fluid lines from radiator — close openings.
- Wiring harness plug (1) from fan motor.

REMOVE, DISCONNECT

- 1. Coolant hose.
- 2. Wiring harness plug from temperature sensor.
- 3. Retaining bracket (1).
- 4. Radiator — if necessary, first fan shroud with fan motor.
- 5. When replacing, transfer attaching parts.

INSTALL, CONNECT

- 1. Radiator.
- 2. Retaining bracket.
- 3. If disconnected: fan shroud with fan motor to radiator.
- 4. Coolant hoses to radiator.

INSTALL, CONNECT

- 1. Wiring harness plug to temperature sensor.
- 2. Wiring harness plug (1) to fan motor.
- 3. Ground cable to battery.
- 4. Top up and bleed cooling system.

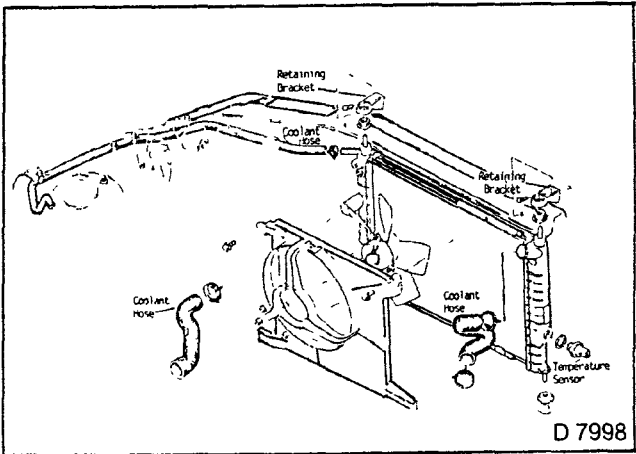


Fig. 154

Cooling System — Top Up and Bleed

NOTE:

RADIATOR AND HEATER CORE ARE MADE OF ALUMINIUM. TO AVOID CORROSION, USE ONLY ANTI-FREEZE WITH CORROSION PROTECTION, SABS 1251

1,4 / 1,6 ltr. engines:

REMOVE, DISCONNECT

1. Wiring harness plug.
2. Coolant temperature sensor.
3. Fill with coolant, until it flows out bubble-free from the installation port of the temperature sensor.

TIGHTEN (TORQUE)

1. Temperature sensor to intake manifold — 10 Nm.
2. Connect wiring plug.

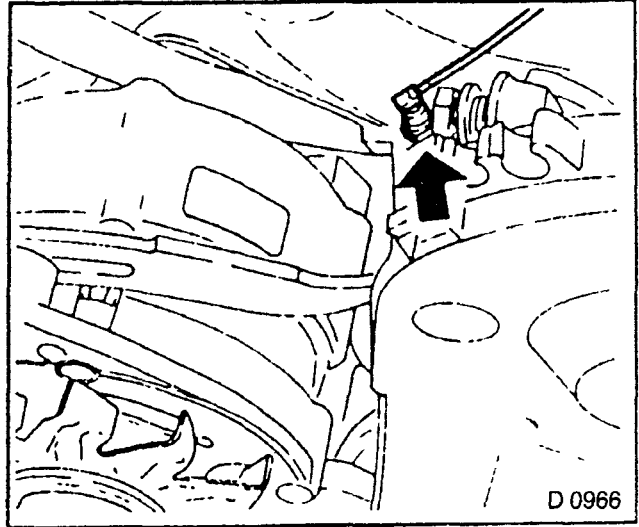


Fig. 155

ALL ENGINES:

Fill coolant to "KALT" mark on compensation tank.

NOTE:

AFTER CLOSING THE COOLING SYSTEM, LET ENGINE RUN WARM UNTIL THERMOSTAT OPENS (COOLANT APPROXIMATELY 92°C/197,6°F).

INSPECT

1. Coolant level.
2. Allow engine to cool.
3. If necessary top up coolant to "KALT" mark on compensation tank.

1,8 / 2,0 ltr. engines:

Cooling system bleeds itself during engine warming-up phase.

Cooling System — Check for leaks

Engine at operating temperature (oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$).
Check coolant level.

KM-471 and commercially available radiator checking instrument onto compensation tank (observe manufacturer's instructions). Apply approximately 100 kPa (1 bar/14,5 psi) pressure to cooling system.

INSPECT

- 1. Cooling system for leaks.
- 2. Remove tester.
- 3. Close compensation tank.

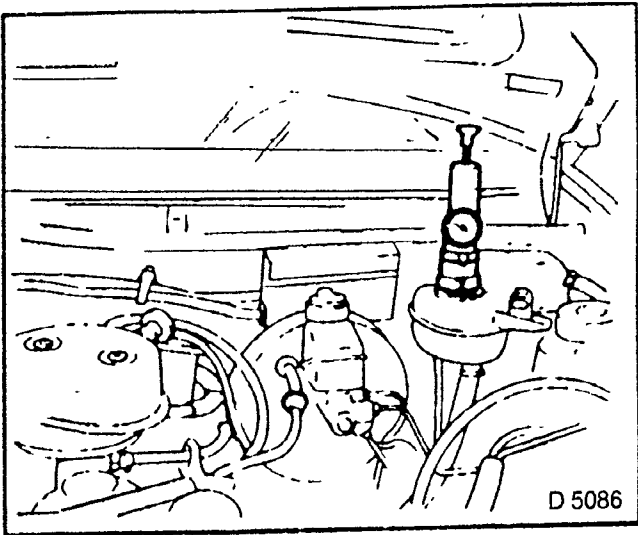


Fig. 156

Coolant Temperature — Measure with Closed Cooling System

INSTALL, CONNECT

Temperature Gauge 17 57 230 (90 141 985) in heating hose.
Follow manufacturer's Instructions.

MEASURE

- 1. Coolant temperature — operating temperature approximately $80^{\circ}\text{C}/176^{\circ}\text{F}$

REMOVE, DISCONNECT

- 1. Temperature gauge.

INSTALL, CONNECT

- 1. Heating hose.
- 2. Bleed cooling system.

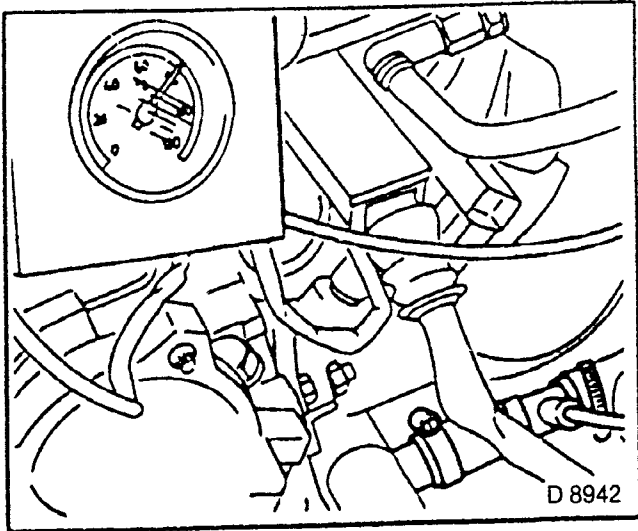


Fig. 157

Fan Motor — Replace

REMOVE, DISCONNECT

- 1. Ground cable from battery.
- 2. Wiring harness plug from fan motor.
- 3. Fan shroud with fan motor from radiator.

When replacing:
Fan motor from fan shroud.

INSTALL, CONNECT

- 1. Fan shroud with fan motor to radiator.
- 2. Wiring harness plug to fan motor.
- 3. Ground cable to battery.

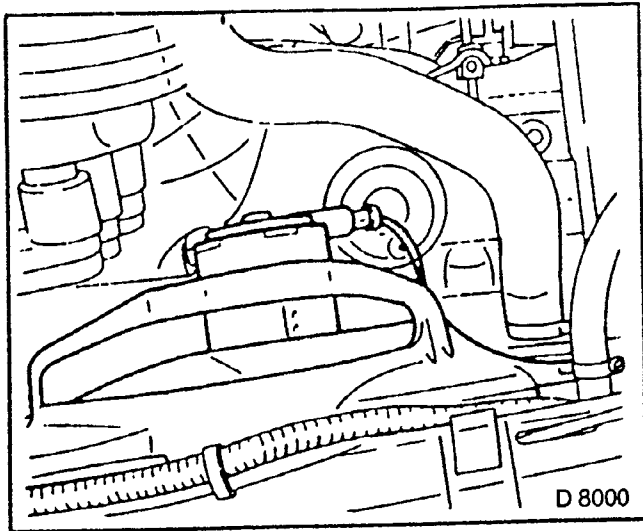


Fig. 158

Thermostat — Replace (1,4/1,6 ltr.)

REMOVE, DISCONNECT

1. Lower coolant hose from radiator — collect coolant.
2. Release and remove toothed belt. See operation "Toothed Belt, Replace", page 24
For clearer representation, Fig. 159 shows removed engine.
3. Camshaft housing cover.
4. Camshaft timing gear.
5. Toothed belt rear cover from camshaft housing.

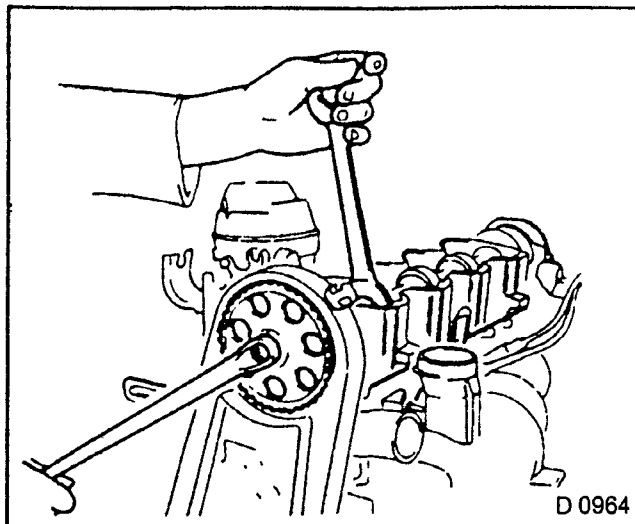


Fig. 159

REMOVE, DISCONNECT

1. Swing toothed belt rear cover to one side.
2. Thermostat housing from cylinder head.
3. Thermostat.

CLEAN

1. Sealing surfaces.

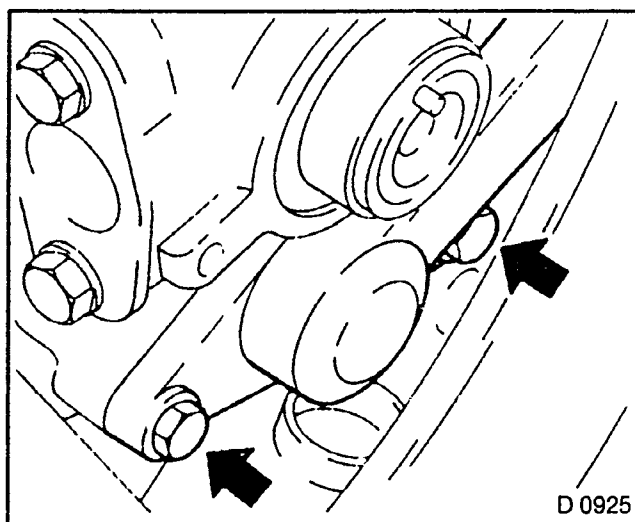


Fig. 160

Insert thermostat with sealing ring — note recess in cylinder head.

TIGHTEN (TORQUE)

1. Thermostat housing to cylinder head — 10 Nm.
2. Toothed belt rear cover to camshaft housing — 12 Nm.
3. Install coolant hose.

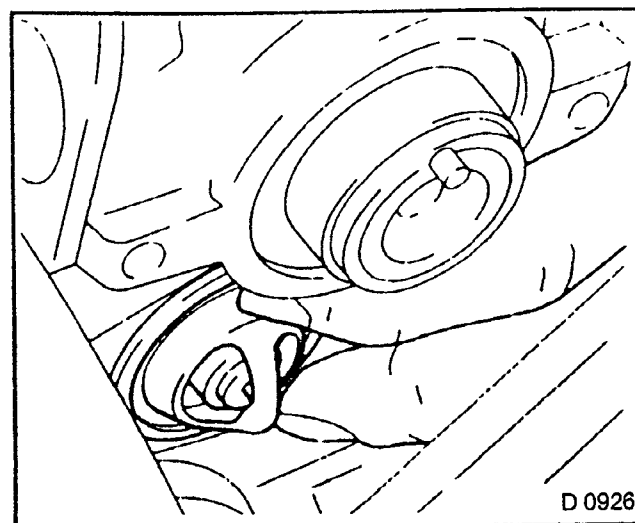


Fig. 161

TIGHTEN (TORQUE)

- 1. Camshaft timing gear to camshaft
— 45 Nm.
- 2. Camshaft housing cover to housing
— 8 Nm.
- 3. Insert and tension toothed belt.
- 4. Fill up and bleed cooling system.

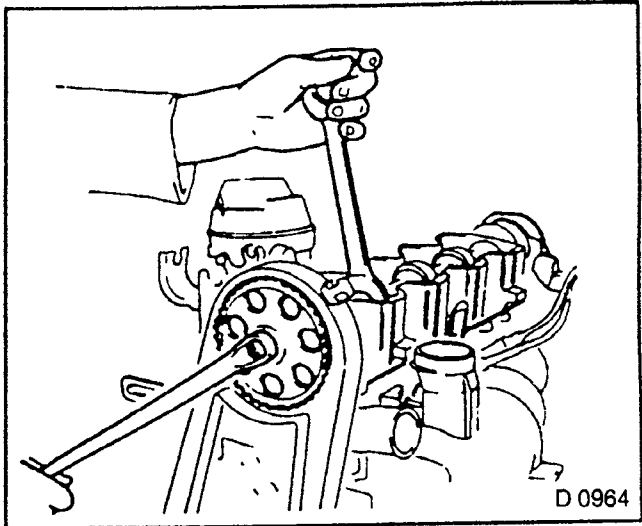


Fig. 162

**Thermostat — Replace
(1,8/2,0 ltr.)**

REMOVE, DISCONNECT

- 1. Water outlet nozzle with thermostat from thermostat housing.
- 2. Coolant hose — collect coolant.

NOTE:

**ONLY REPLACE THERMOSTAT
TOGETHER WITH WATER OUTLET
NOZZLE.**

TIGHTEN (TORQUE)

- 1. Water outlet nozzle to thermostat housing — 8 Nm.

INSTALL, CONNECT

- 1. Coolant hose.
- 2. Fill and bleed cooling system.

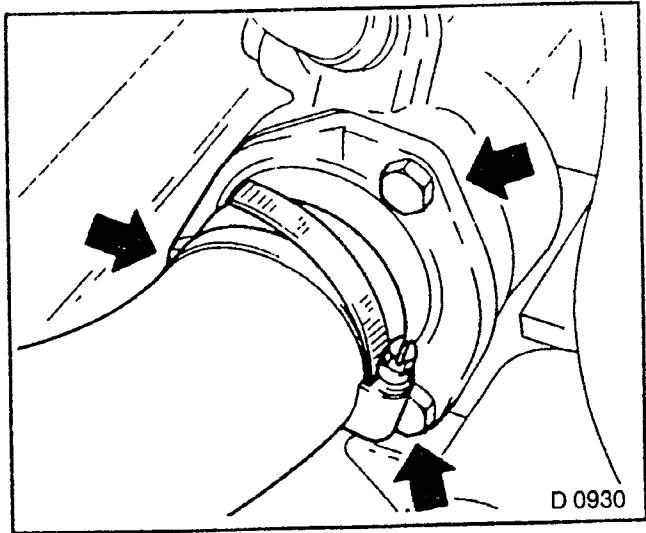


Fig. 163

**Water Pump — Remove
and Install**

REMOVE, DISCONNECT

- 1. Lower coolant hose from pipe bend — collect coolant.
- 2. Front toothed belt cover.
- 3. Position piston of 1st cylinder to TDC.
- 4. Position of timing marks — see operation "Timing, Check and Adjust", page 15.
- 5. Water pump from cylinder block — release tension of toothed belt.

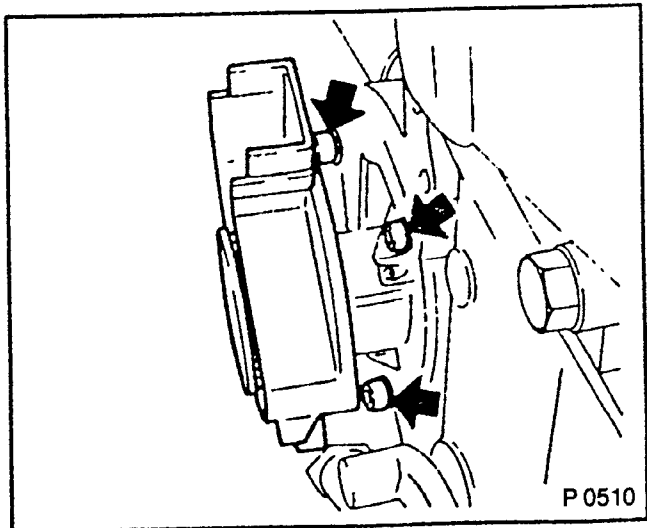


Fig. 164

CLEAN

- 1. Sealing surfaces.
- 2. Coat sealing surfaces with Silicon Grease B0400571 (Kluber unisilikon TK 572/300).

INSTALL, CONNECT

- 1. Water pump to cylinder block — Use new gasket.
- 2. Coolant hose.
- 3. Install toothed belt and tension.
- 4. Top up cooling system and bleed.

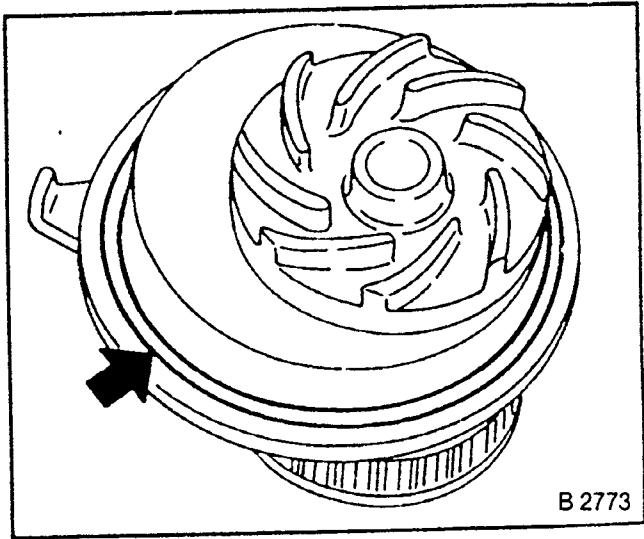


Fig. 165

ENGINE DAMPING BLOCKS, ENGINE, SHORT BLOCK ENGINE

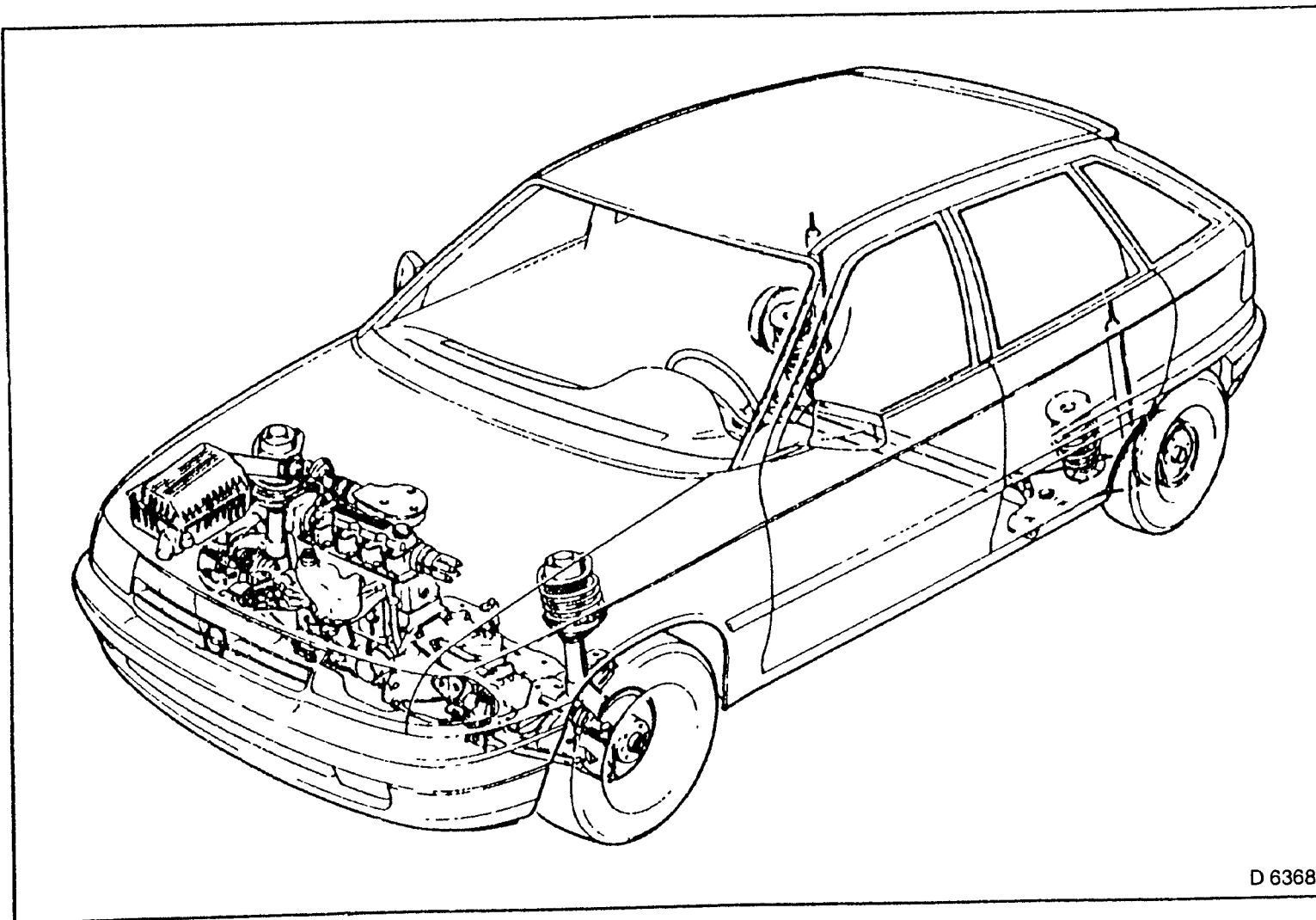


Fig. 166

Recommended Torque Values — Engine Damping Blocks, Short-block

	Nm
Bracket for oil intake pipe to cylinder block	6 ²⁾
Bracket for oil intake pipe to cylinder block	8 ¹⁾
Cylinder head to cylinder block	25 + 60° + 60° + 60° ³⁾³⁾
Cylinder head to cylinder block	55 + 60° + 60° + 30° ¹⁾³⁾
Engine suspension bracket to cylinder block	60
Oil drain plug to oil pan	45 ²⁾
Oil drain plug to oil pan	55 ¹⁾
Oil intake pipe to oil pump	8 ²⁾
Oil pan to cylinder block	5 ²⁾³⁾
Oil pan to cylinder block	8 ¹⁾³⁾
Power steering pump to engine block	30 ⁴⁾
Pulley to power steering pump	25 ⁴⁾
Right engine damping block to side member	65 ²⁾
Starter support to cylinder block	25 ²⁾
Starter to cylinder block	25 ¹⁾
Starter to cylinder block	45 ²⁾⁷⁾
Transmission to engine	75

- ¹⁾ 1,4 / 1,6 ltr. engine
- ²⁾ 1,8 / 2,0 ltr. engine
- ³⁾ Bolt must be recut before reusing and inserted using Locking Compound (Loctite 242).
- ⁴⁾ Only 1,6 ltr with power steering.
- ⁵⁾ Use new bolts.
- ⁶⁾ After test run turn a further 30°
- ⁷⁾ Tighten engine side — transmission side to 75 Nm
- ⁸⁾ Installation time maximum 10 mins.

Engine without Transmission — Remove and Install (1,4/1,6 ltr.)

REMOVE, DISCONNECT

- 1. Battery.
- 2. Bonnet.
- 3. Lower coolant hose from radiator — collect coolant.
- 4. Upper coolant hose.

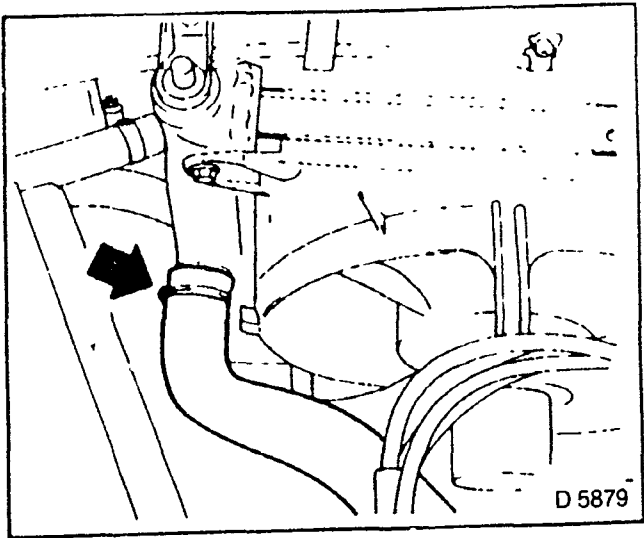


Fig. 167

REMOVE, DISCONNECT

- 1. Air cleaner
- 2. If present: Air intake hose.
Pre-volume chamber.
- 3. All cable connections.
- 4. Hoses and lines from engine.
- 5. Accelerator cable.

NOTE:

- 1. Mark fuel lines before removal.
- 2. Close off with spring clips.

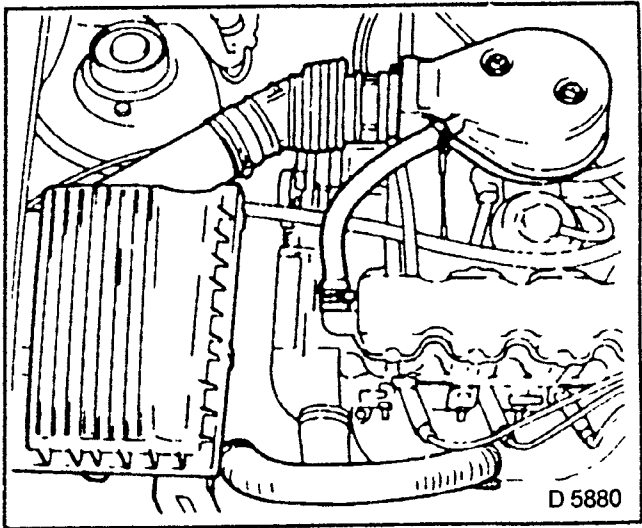


Fig. 168

REMOVE, DISCONNECT

- 1. Transmission from engine — upper bolts.

NOTE:

LEAVE ONE FASTENING BOLT IN TO RETAIN.

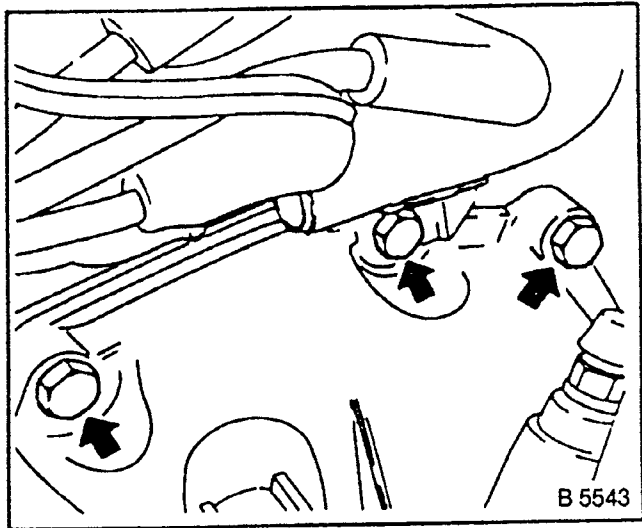


Fig. 169

Attach engine to Engine Holder KM-263-B.

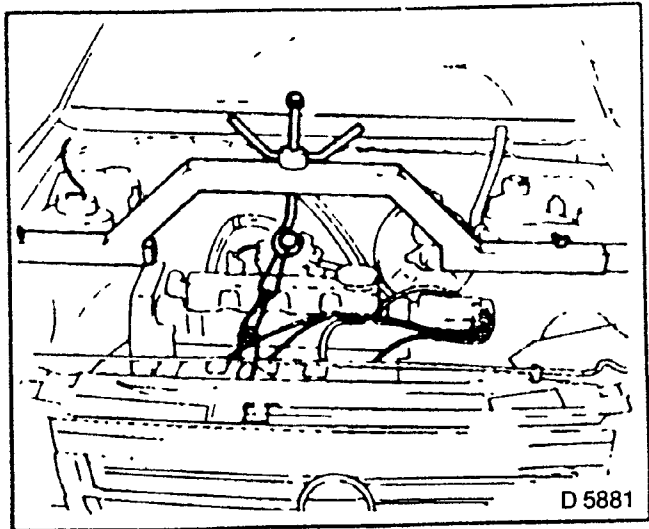


Fig. 170

REMOVE, DISCONNECT

1. Front exhaust pipe.

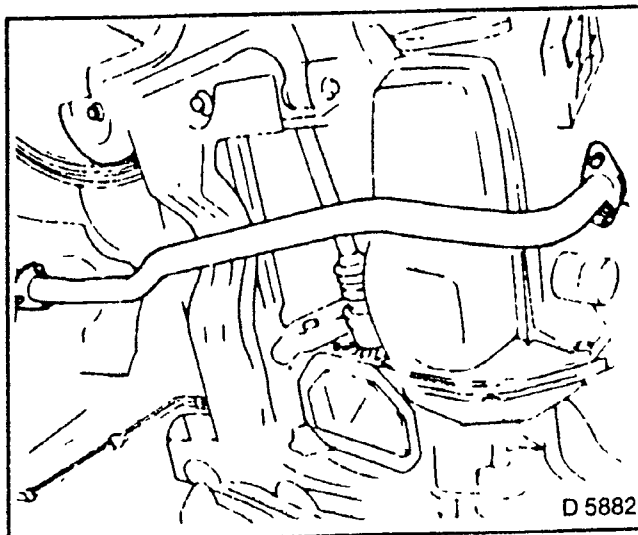


Fig. 171

REMOVE, DISCONNECT

1. Clutch assembly — See corresponding operation in Section K.
2. Engine right damping block from side member.
3. Engine suspension bracket from cylinder block.
4. Transmission from engine — lower bolts.

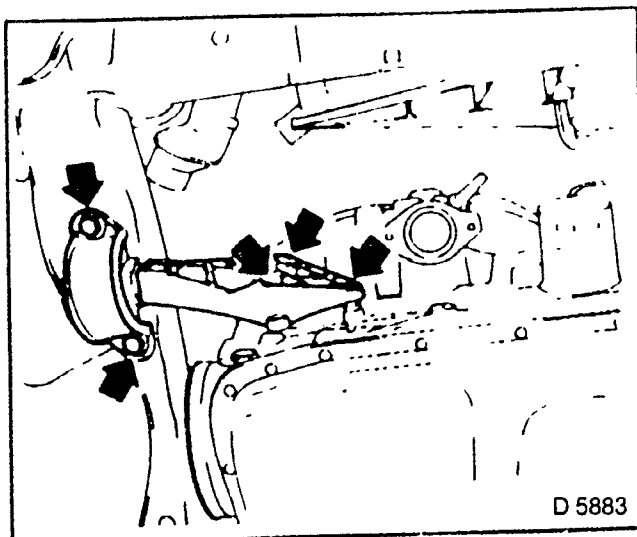


Fig. 172

5. Support engine with jack.
6. Remove KM-263-B.
7. Place engine on steel cable.
8. Unbolt upper fastening bolt for transmission — engine (retaining).
9. Support transmission with vehicle jack
10. Press engine off from transmission.
11. Lift out

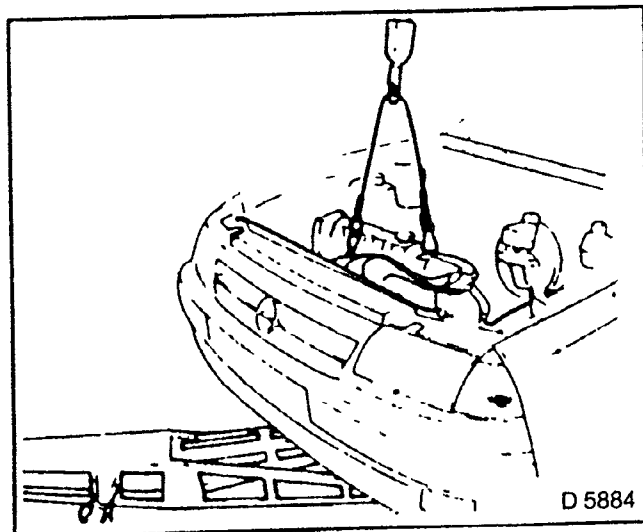


Fig. 173

INSTALL, CONNECT

- 1. Lower engine.
- 2. Insert guide sleeves of engine block into transmission.
- 3. Support engine with vehicle jack.
- 4. Remove steel cable.

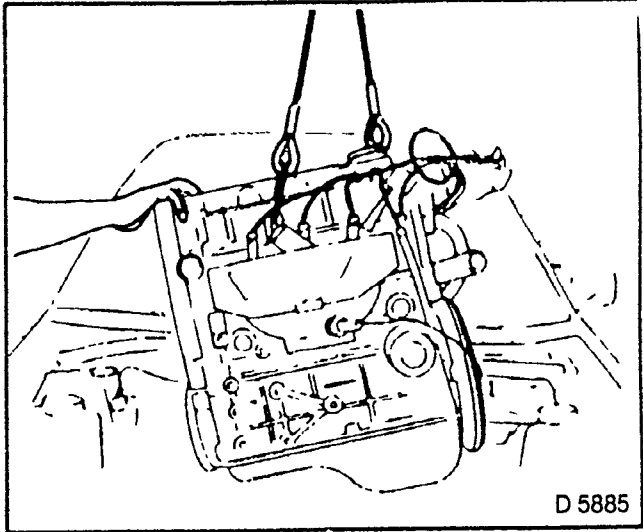


Fig. 174

TIGHTEN (TORQUE)

- 1. Transmission to engine.
- 2. Upper bolts — 75 Nm

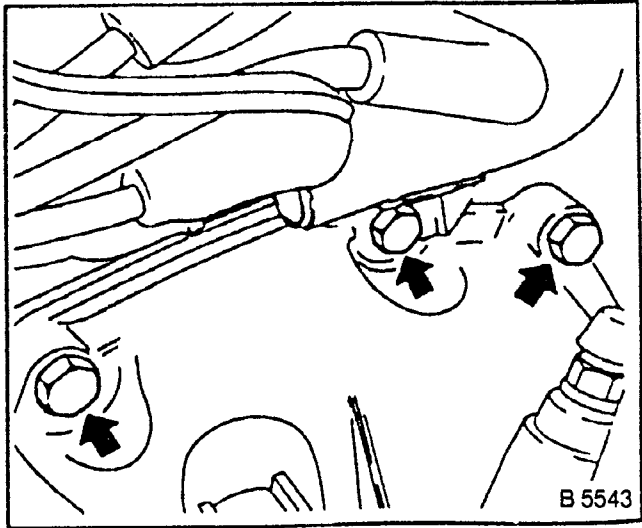


Fig. 175

- 3. Attach engine to Engine Holder KM-263-B.
- 4. Remove vehicle jack.

INSTALL, CONNECT

- 1. Engine suspension bracket to cylinder block.
- 2. Engine damping block to side member.
- 3. Turn fastening bolts by hand.

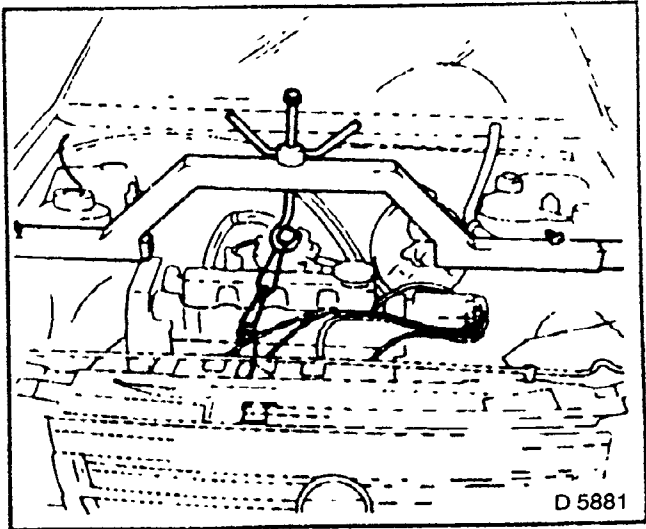


Fig. 176

TIGHTEN (TORQUE)

1. Transmission to engine, lower bolts — 75 Nm.
2. Engine suspension bracket to cylinder block — 60 Nm
3. Engine right damping block to side member — 65 Nm*.

*Insert bolts with Locking Compound (Locktite 242).

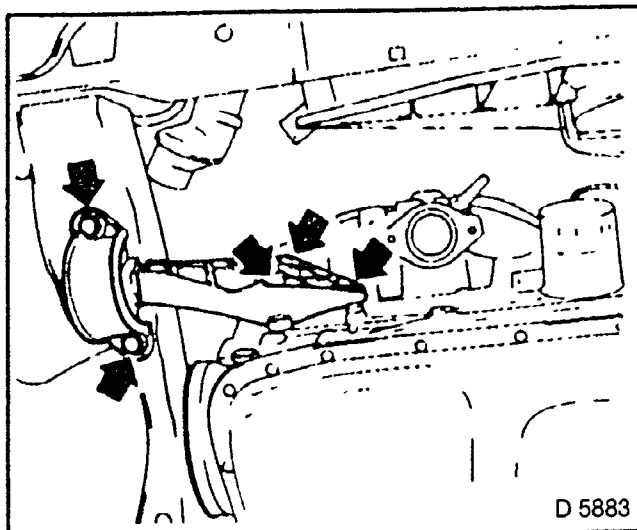


Fig. 177

INSTALL, CONNECT

1. Clutch assembly.
See corresponding operation in Section K.
2. Front exhaust pipe.
3. Remove KM-263-B.

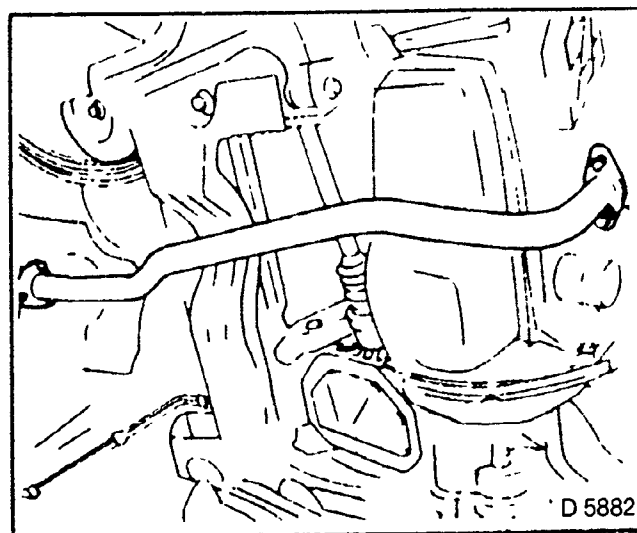


Fig. 178

INSTALL, CONNECT

1. All hose, line and wiring connections to engine.
2. Note condition and seating.
3. Note marks made when installing fuel lines.
4. Remove spring clips.
5. Install accelerator cable free of tension.
6. Air cleaner.
7. If present: Air intake hose.
Pre-volume chamber.

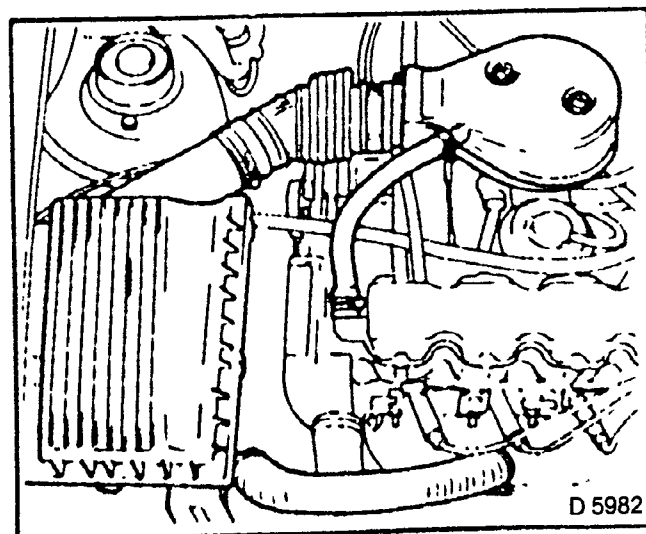


Fig. 179

INSTALL, CONNECT

1. Battery.
2. Bonnet

INSPECT

1. Engine oil level.
2. Bleed hydraulic system — see corresponding operation in Section M.
3. Fill up and bleed cooling system.
4. Check for leaks.

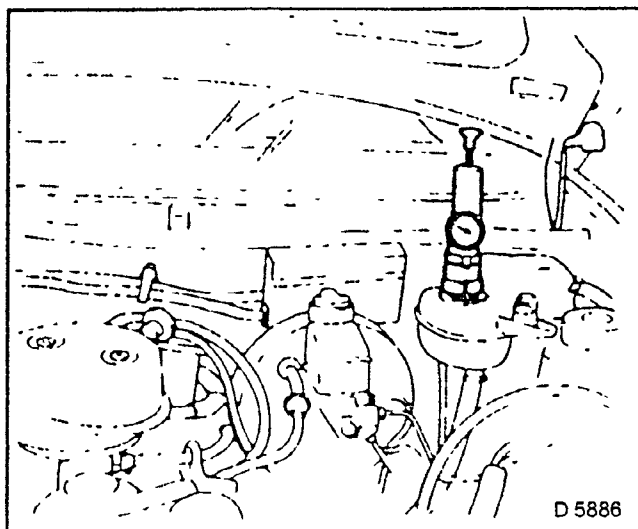


Fig. 180

Engine — Repair Using Short Block

1. Remove attaching parts.
2. Install engine on Engine Overhaul Stand KM-412 with appropriate adaptors.
3. Drain engine oil — place collecting pan underneath.

REMOVE, DISCONNECT

1. Toothed belt rear cover.

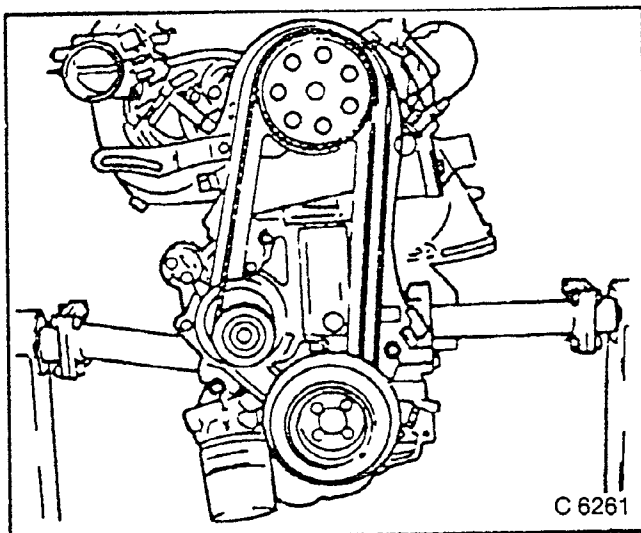


Fig. 181

REMOVE, DISCONNECT

1. Water pump.
2. Starter.
3. Line and flange for crankcase ventilation.
4. Inductive pulse pick-up, if present.

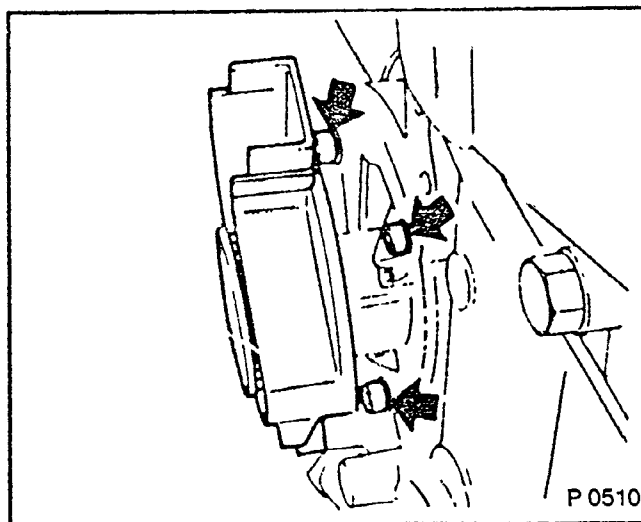


Fig. 182

REMOVE, DISCONNECT

- 1. Cylinder head.
- 2. Loosen bolts in a spiral pattern from outside inwards — at first 1/4, then 1/2 turn.
- 3. Camshaft housing from cylinder head.
- 4. Remove rocker arms.
- 5. Thrust plates.
- 6. Hydraulic valve lash adjusters.

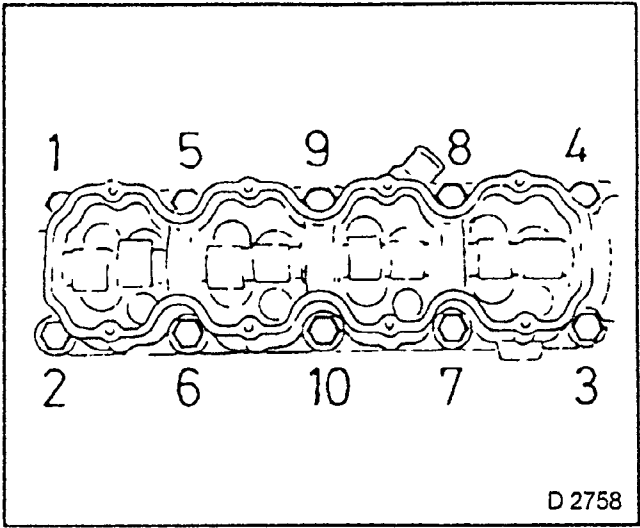


Fig. 183

REMOVE, DISCONNECT

- 1. Oil pan.
- 2. Oil intake tube.
- 3. Baffle plate — if present.

CLEAN

INSPECT

Replace all parts if necessary.

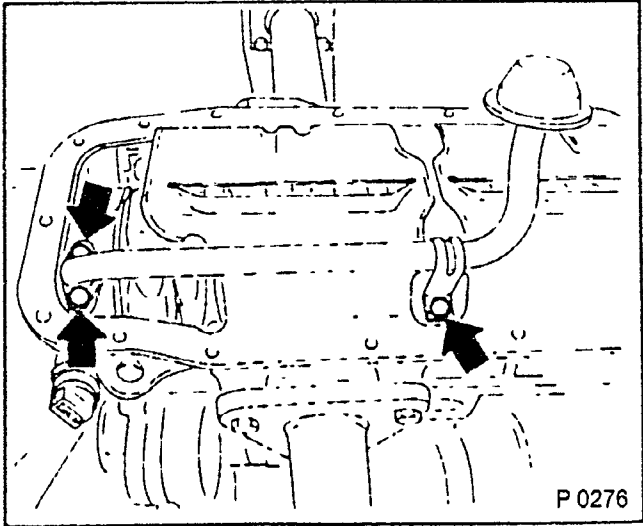


Fig. 184

New Short Block — Complete

TIGHTEN (TORQUE)

- 1. Intake manifold to oil pump — 8 Nm.
- 2. Insert bolts with Locking Compound (Loctite 242).
- 3. Cover joints (cylinder block oil pump housing and cylinder block bearing cover) with Sealing Compound.
On 1,4 and 1,6 ltr. engine, mount cork gasket.
On 1,6 ltr. engine, mount baffle plate and second cork gasket.
On 1,8 and 2,0 ltr. engine, fit gasket on baffle plate.

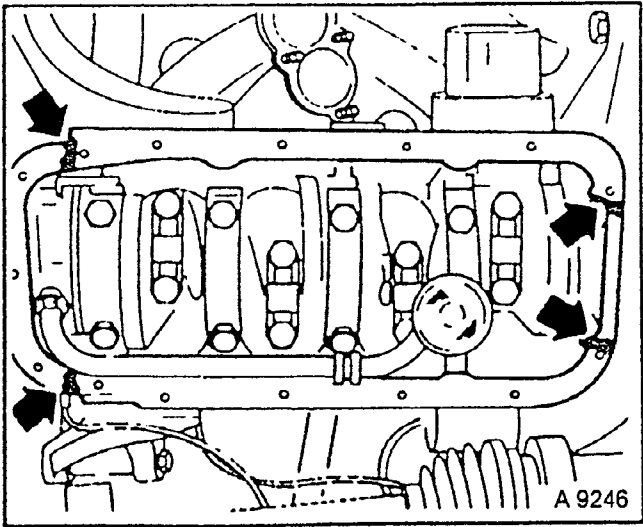


Fig. 185

TIGHTEN (TORQUE)

Engine	1,4/1,6 ltr.	1,8/2,0 ltr.
Bracket for intake manifold to cylinder block	8 Nm	6 Nm
Oil pan to cylinder block*	8 Nm	5 Nm
Oil drain plug to oil pan	55 Nm	45 Nm

*Insert bolts with Locking Compound (Loctite 242).

INSTALL, CONNECT

- 1. Centering sleeves into cylinder block to stop using KM-427.

INSPECT

- 1. Cylinder head for plane surface.
- 2. Put on cylinder head gasket — identification mark "OBEN/TOP" facing upwards and to timing side of engine.

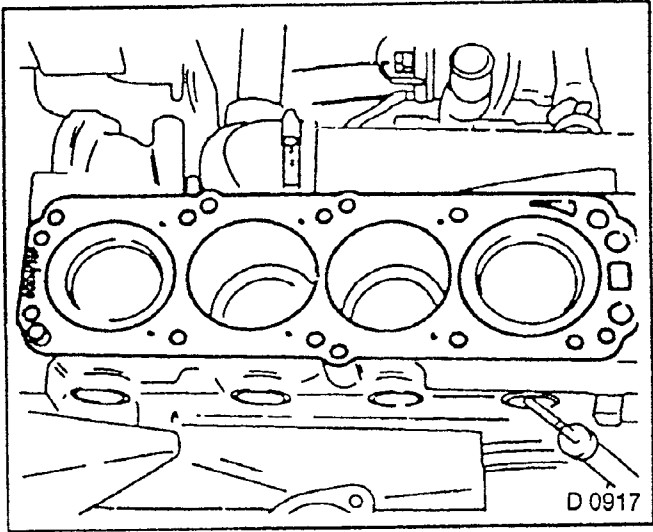


Fig. 186

INSTALL, CONNECT

- 1. Cylinder head — 1st cylinder in TDC position.
- 2. Coat sliding surfaces of hydraulic valve lash adjusters, thrust plates and rocker arms with MoS₂ paste.
- 3. Camshaft housing — Sealing Compound (Locktite 242).

NOTE:

- 1. Use new cylinder head bolts.
- 2. Screw in bolts to stop.

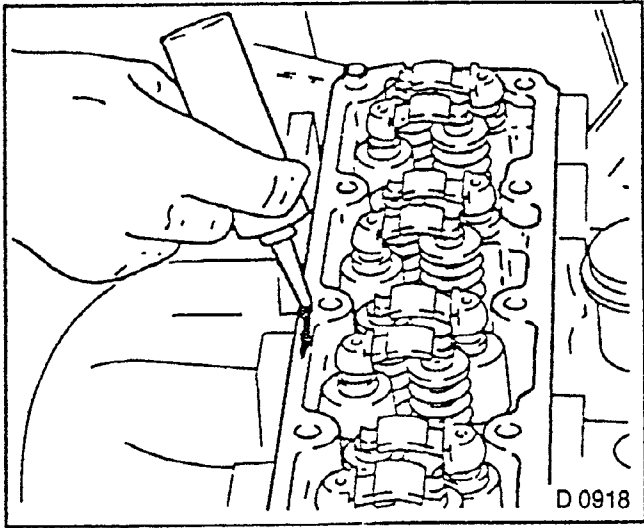


Fig. 187

TORQUE — ANGLE METHOD

- 1. Cylinder head to cylinder block.
- 2. Tighten bolts in spiral pattern from inside outwards — in four stages, torque wrench and Angle Torque Wrench KM-470-B.
1,4/1,6 ltr., engine:
55 Nm + 60° + 60° + 30°.
1,8/2,0 ltr. engine:
25 Nm + 60° + 60° + 60°

NOTE:

AFTER TEST RUN, TIGHTEN CYLINDER HEAD BOLTS ANOTHER 30° + 15°.

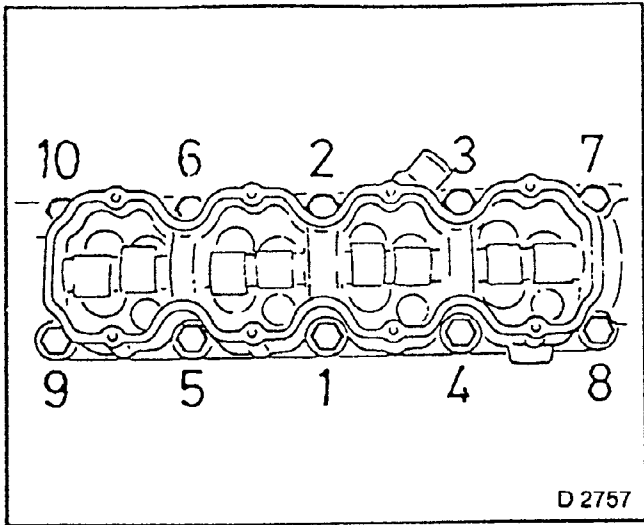


Fig. 188

TIGHTEN (TORQUE)

Engine	1,4/1,6 ltr.	1,8/2,0 ltr.
Starter to cylinder block	25 Nm	*45 Nm
Starter support to cylinder block	—	25 Nm

- *Engine side — on transmission side, tighten to 75 Nm after installing engine.
1. Install line and flange for crankcase ventilation, inductive pulse pick-up.
 2. Check distance between inductive pulse pick-up and increment disc.

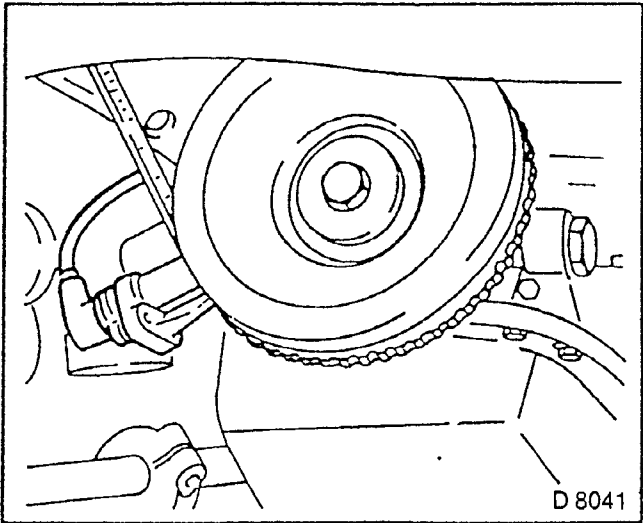


Fig. 189

INSTALL, CONNECT

1. Water pump — new rubber O-ring.
2. Coat sealing surfaces with Silicone Grease B0400571 (Kluber Unisilikon TK 572/300).
3. Toothed belt rear cover.
4. Top up engine oil to “MAX” marking on oil dipstick.

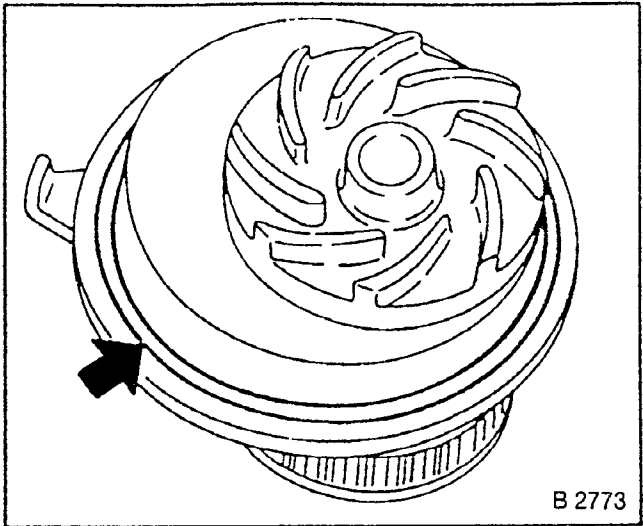


Fig. 190

NOTE:

BEFORE INSTALLATION OF TOOTHED BELT, CHECK TIMING.

REMOVE, DISCONNECT

1. Engine from Engine Stand KM-412.
2. Adapter from engine.
3. Install engine.

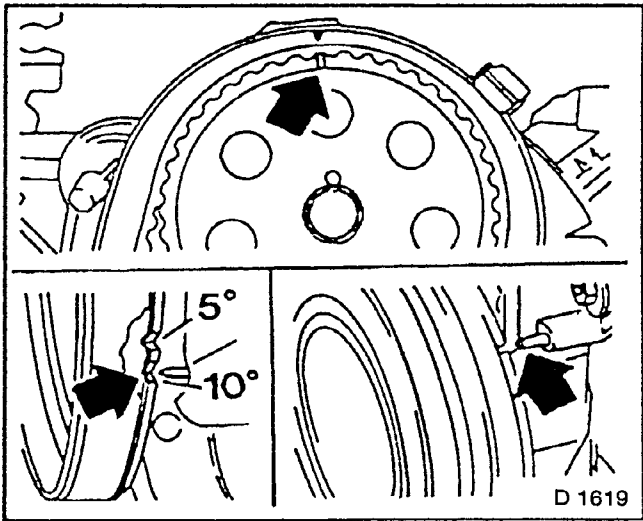


Fig. 191

2 E 3 CARBURETTOR (14NV)

Idle Speed and CO Content in Exhaust — Adjust

Checking conditions:

- 1. Engine functioning correctly —valves, timing.
- 2. Oil temperature $\geq 80^{\circ}\text{C}/173^{\circ}\text{F}$.
- 3. Ignition system functioning correctly.
- 4. Intake system leakproof.
- 5. Clean air filter installed.
- 6. Intake air pre-heating correct.
- 7. Acceleration actuation correct.
- 8. Electrical consumers switched off.

Checking conditions:

- 1. Tachometer and CO tester connected.
- 2. Adjusting screw (3) must not touch stepped plate (4).

AT: selector lever position "P"

ADJUST

- 1. Idle speed at adjusting screw (1).
 - 2. CO content in exhaust at mixture adjusting screw (2) — see fig. 192.
- Adjustment values: see Technical Data, page 312.
- If adjustment not possible, see "Trouble-shooting Chart", page 98.

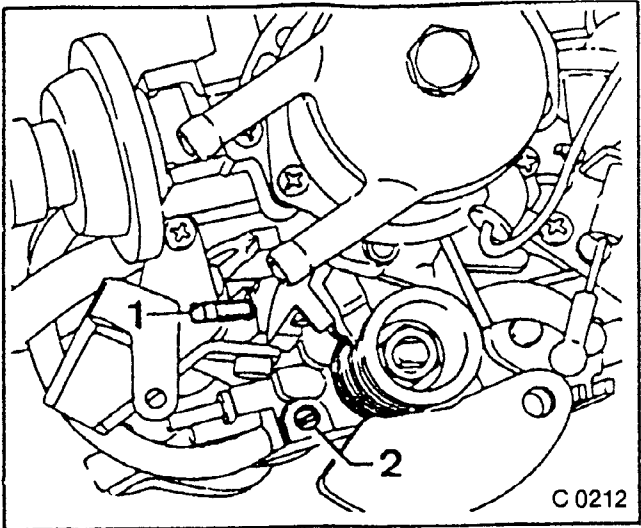


Fig. 192

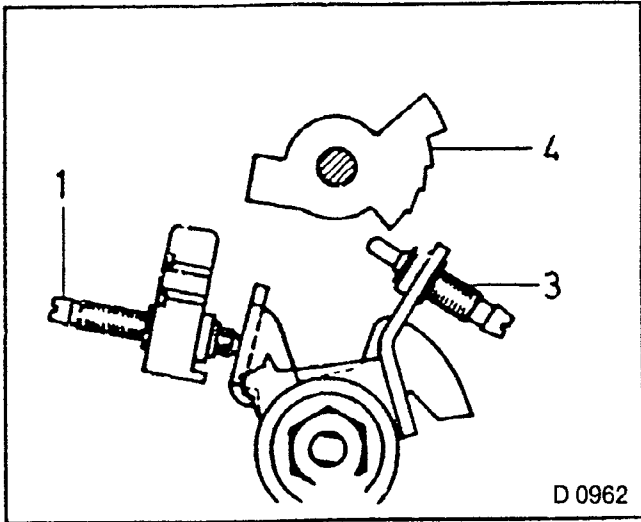


Fig. 193

Fast Idle — Check and Adjust

CHECKING CONDITIONS:

- 1. Oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$.
- 2. Idle speed adjustment correct.

ADJUST

- 1. Adjusting screw (3) on 2nd highest stage of stepped plate (4).
- 2. Start engine without touching accelerator pedal.
- 3. Adjustment on adjusting screw (3).
- 4. Replace safety catch.
- 5. Adjustment values: see Technical Data, page 312.

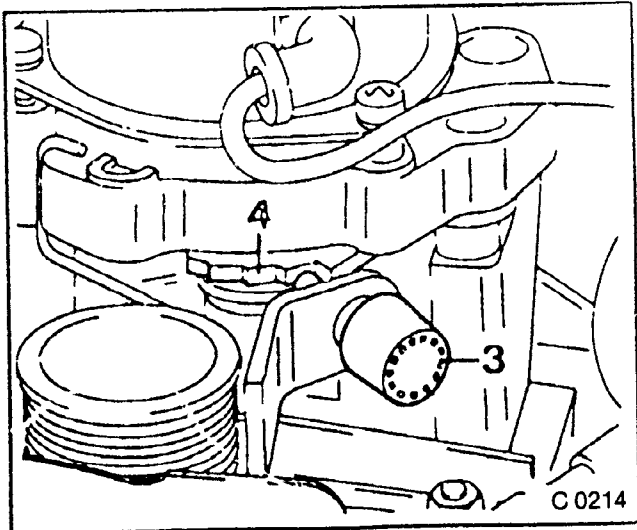


Fig. 194

Pulldown Unit — Check

CHECK PULLDOWN UNIT:

REMOVE, DISCONNECT

1. Air cleaner.
2. Vacuum hoses (1) and (2) from carburettor.
3. Close off connection (1).
4. Connect Vacuum Hand Pump MKM-667 to (2).
5. Create pressure difference of 300 mbar/43.5 psi.

INSPECT

1. Pulldown unit (3) for leaks.
2. Pressure difference must remain constant.
3. If not, to eliminate leaks, if necessary, replace pulldown unit.

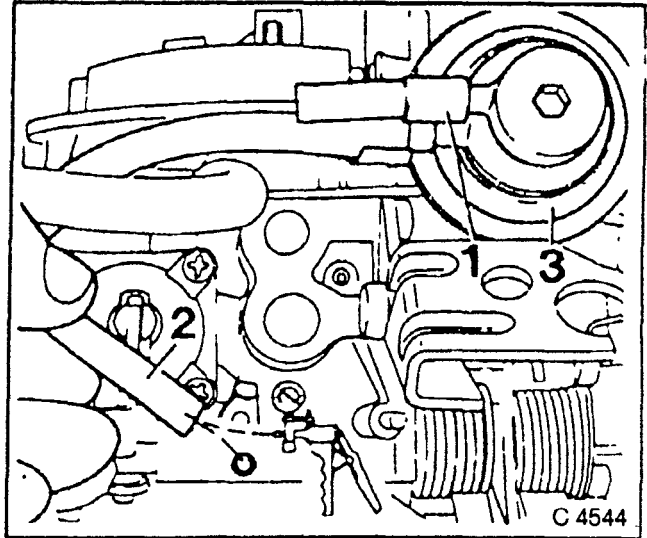


Fig. 195

THERMO TIME VALVE, CHECK

CHECKING CONDITIONS:

1. Thermo time valve (1) at temperature of approximately 20°C/68°F.
2. Current supply to wiring harness plug (2) correct — at least 11,5 volts.

INSPECT

1. Function of thermo time valve.
2. Measure electrical resistance — 4,5 to 7,5 ohms at 20 to 30°C/68 to 86°F
3. Connect Vacuum Pump MKM-667 and actuate — thermo time valve must have passage.
4. Attach wiring plug (2) to thermo time valve (1).
5. Ignition switched on.
6. Actuate Vacuum Hand Pump MKM-667 continuously.
7. Ascertain switchover time — 4 to 10 seconds at + 20°C/68°F until increase in pressure difference.
8. If necessary, replace thermo time valve.

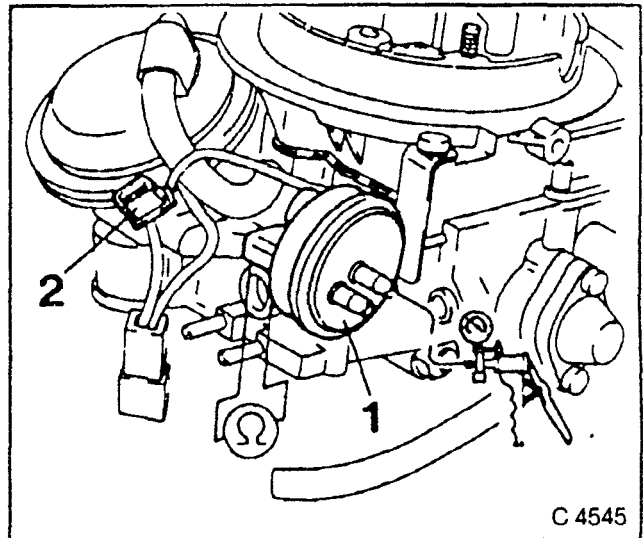


Fig. 196

Thermo Time Valve — Remove and Install

REMOVE, DISCONNECT

- 1. Fuel hose — if present
- 2. Air filter hood.
- 3. Wiring harness plug.
- 4. Vacuum line from thermo time valve (1).
- 5. Thermo time valve with bracket (2).

INSTALL, CONNECT

- 1. Thermo time valve.
- 2. Vacuum line.
- 3. Wiring harness plug.
- 4. Air cleaner hood.
- 5. Fuel hose.

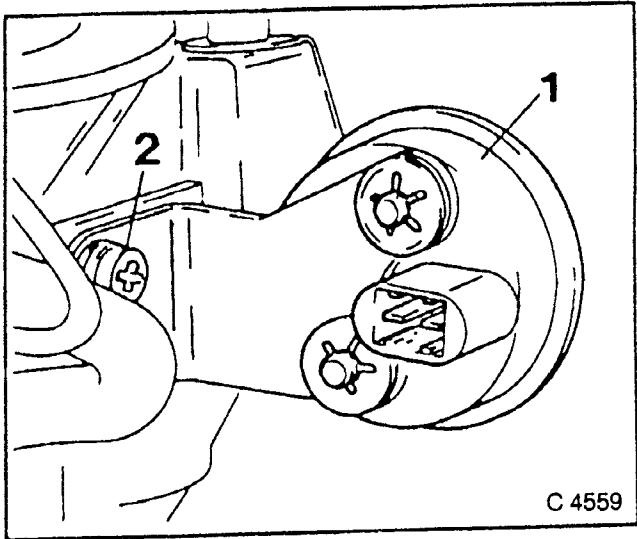


Fig. 197

Choke Valve Gap — Check and Adjust

CHECKING CONDITIONS:

- 1. Pulldown unit free of leaks.
- 2. Choke cover removed.
- 3. Choke valve closed.
- 4. Adjusting screw (1) stays on highest stage of stepped plate (2).
- 5. Vacuum lines removed from pulldown box.

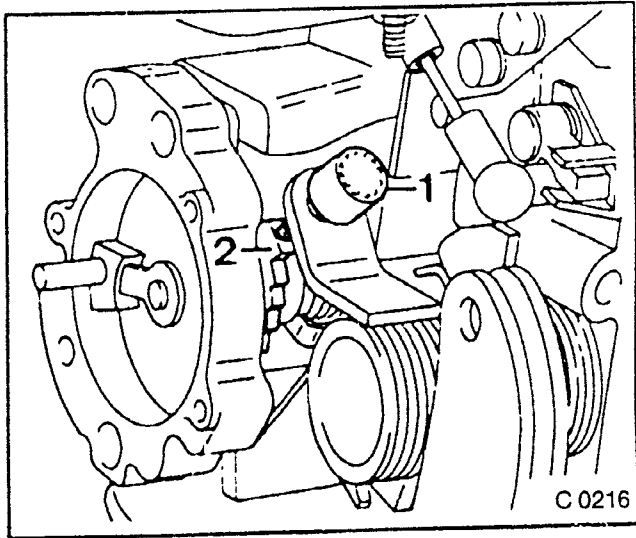


Fig. 198

“SMALL” CHOKE VALVE GAP, CHECK

MEASURE

- 1. Choke valve gap — see Technical Data, page 312.
- 2. Push in pulldown diaphragm rod (1) with screwdriver to first pressure point.
- 3. Adjust pulldown gap (arrow) on the wide side if necessary by turning the adjusting screw on the pulldown unit (2).

Checking value: see Technical Data, page 312.

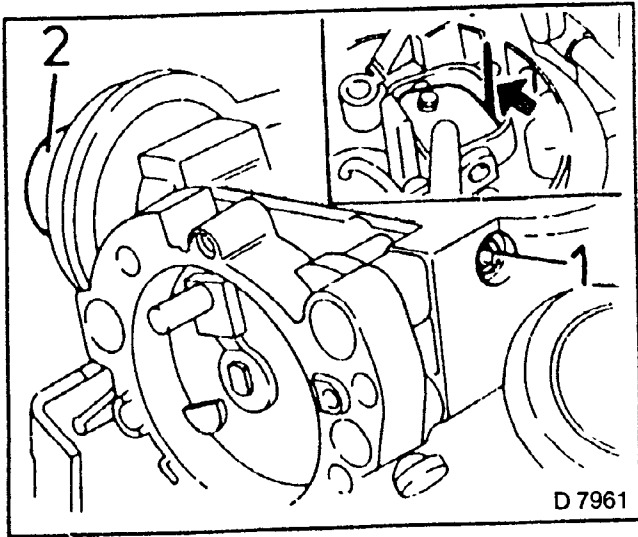


Fig. 199

"LARGE" CHOKE VALVE GAP, CHECK**MEASURE**

1. Choke valve gap — see Technical Data, page 312.
2. Same measurement as "small" choke valve gap however pulldown diaphragm rod pushed in as far as stop.
3. If necessary, adjust at adjusting screw (1) of diaphragm rod.

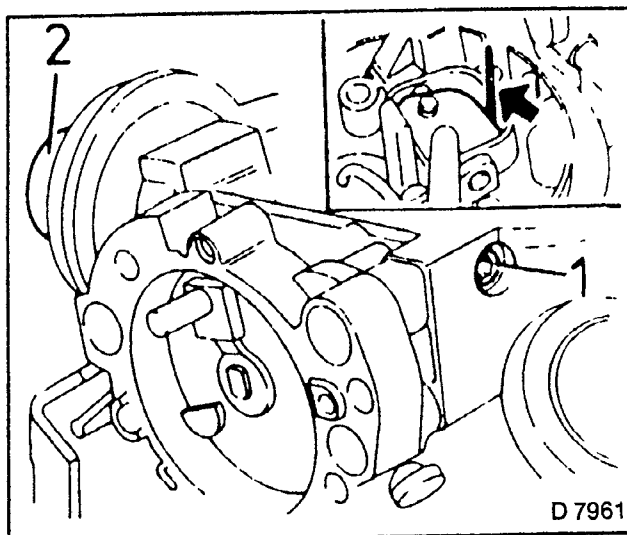


Fig. 200

Choke Valve Forced Opening — Adjust

CHECKING CONDITIONS: CHOKE COVER REMOVED

MEASURE

1. Choke valve gap.
2. Press carrier lever (1) to stop in direction of arrow and detain with rubber ring.
3. Throttle lever in full throttle position.
4. If necessary, correct choke valve gap by bending the segment (2).

Adjustment values — see Technical Data, page 312.

Opening too small — Enlarge gap of segment (2) — screwdriver.

Opening too small — Lessen gap of segment (2) — pointed pliers.

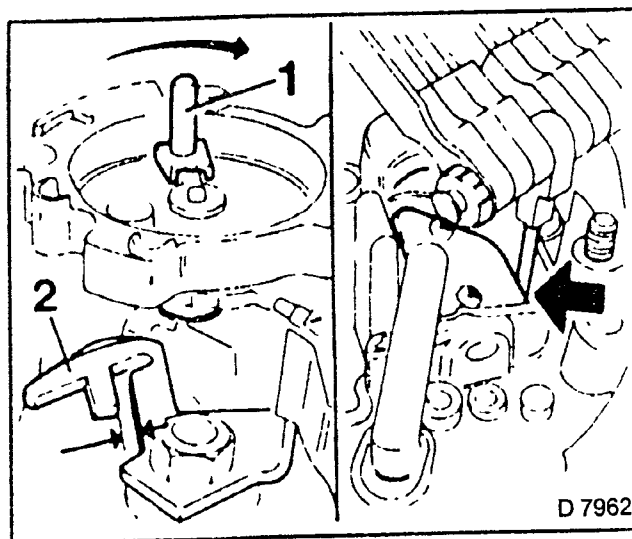


Fig. 201

Position of Stepped Plate — Check and Adjust

CHECKING CONDITIONS:

1. Choke valve gap correct.
2. Choke cover removed.

INSPECT

1. Position of stepped plate.
2. Open throttle valve.
3. Press driving lever (3) lightly in direction of arrow.
4. Close throttle valve again.
5. Adjusting screw (4) must rest on stop of second highest stage of stepped plate (1).
6. Check choke valve gap — see Technical Data, page 312.

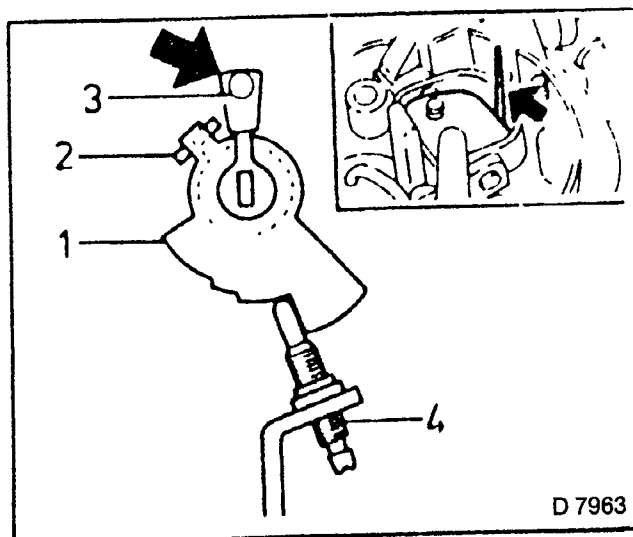


Fig. 202

ADJUST

- 1. Position of stepped plate (1).
- 2. Correct by bending the lever (2).

NOTE:

CORRECT POSITION OF RETURN SPRINGS (ARROW).

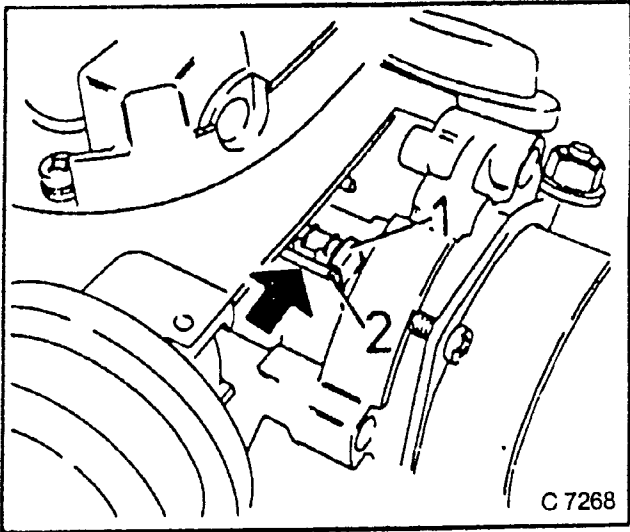


Fig. 203

Choke Cover Position — Check

INSPECT

Notch marks must align.

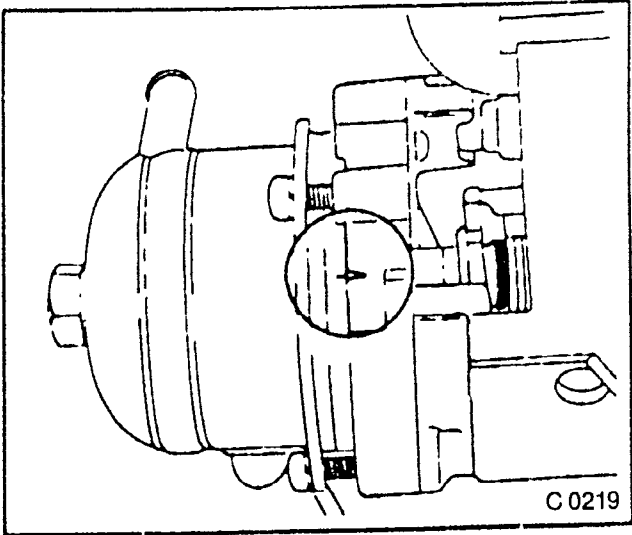


Fig. 204

Cold Start Adjustment, Throttle Valve Gap — Check and Adjust

CHECKING CONDITIONS:

- 1. Carburettor removed, adjusting screw (1) rests on highest stage of stepped plate (2).

MEASURE

- 1. Throttle valve gap — if necessary correct with drill.
- 2. Correction at adjusting screw (1).
- 3. Correct fast idling speed after installing carburettor.
Adjustment value — see Technical Data, page 312.
- 4. Replace safety catch at adjusting screw (1).

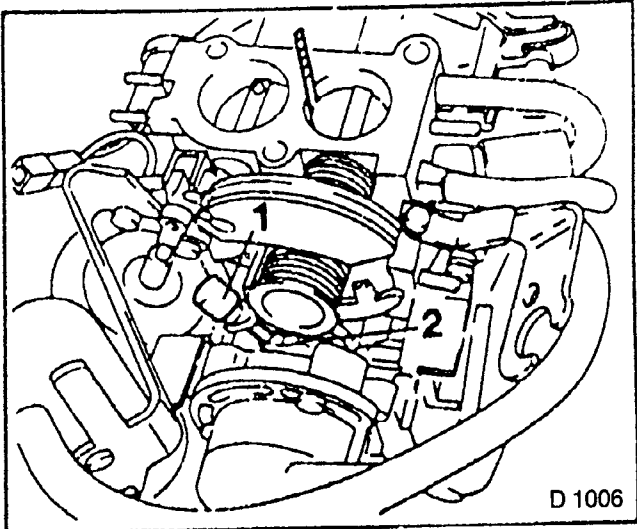


Fig. 205

Basic Adjustment of Throttle Valve — Stage II, Check

MEASURE

1. Throttle valve gap — feeler gauge 0,05 mm.
2. Throttle valve gap stage II is adjusted at the factory and should only be corrected if all other causes of fault are eliminated and malfunctions exist on the throttle valve stage II (throttle valve jams, idle speed adjusting problems) — see Trouble-shooting Chart, page 98.
3. Correction at the throttle valve stop screw (1).

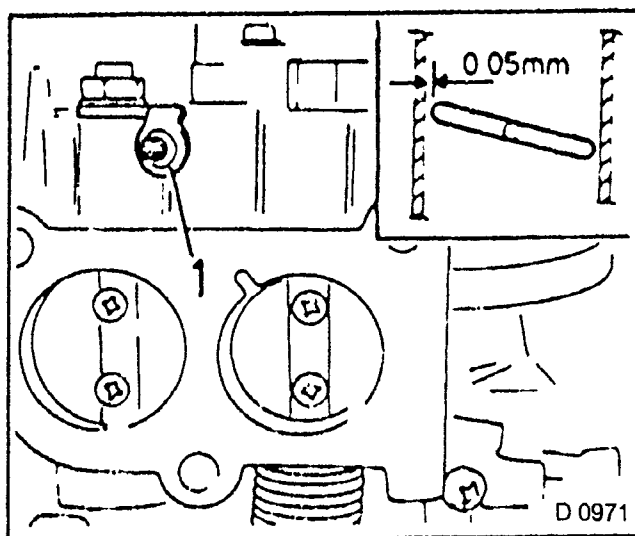


Fig. 206

Injection Quantity — Check and Adjust

CHECKING CONDITIONS:

1. Float chamber normal level, fuel must flow.
2. Start of injection immediately after throttle valve actuation.
3. Carburettor removed.

MEASURE

1. Injection quantity — carburettor checking instrument.
2. Turn stepped plate (4) and hold, so that adjusting screw (3) does not rest on it.
3. Open throttle valve fully ten times — 1 second/stroke, pause three seconds between strokes.
Checking value — see Technical Data, page 312.

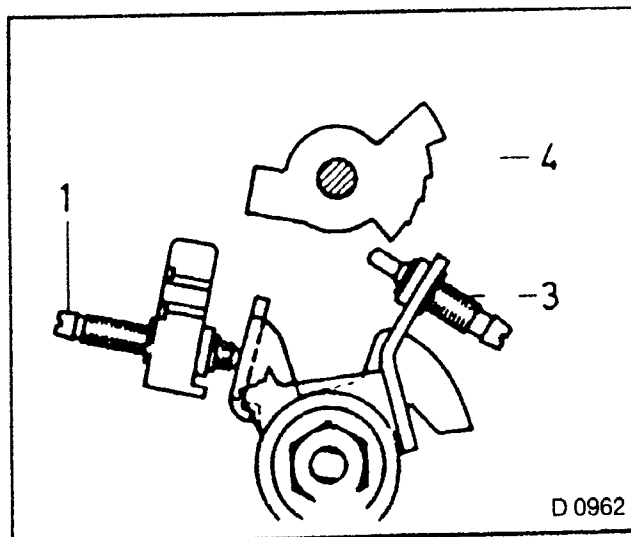


Fig. 207

ADJUST

1. Injection quantity.
If deviations from checking value exist, check accelerator pump.
If necessary replace defective parts.
2. Loosen clamp bolt (1) and turn curved plate (2).
Injection quantity larger: in direction of "+"
Injection quantity smaller: in direction of "-"

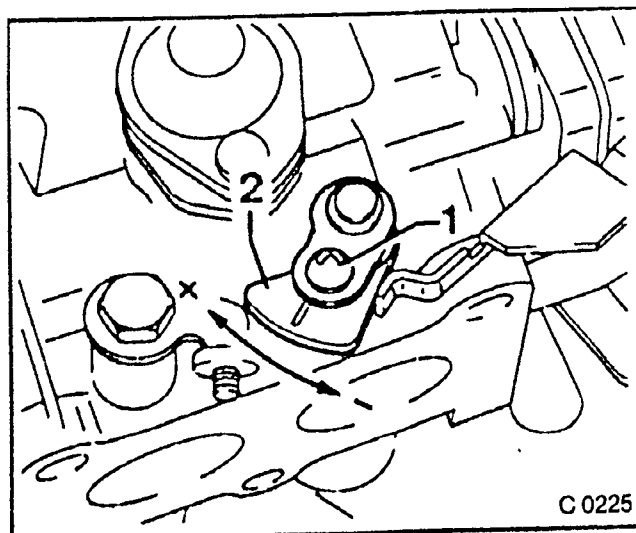


Fig. 208

Accelerator Pump — Remove and Install

REMOVE, DISCONNECT

- 1. Air cleaner hood.
- 2. Pump cover with pump lever (1).
- 3. Pump diaphragm (2).
- 4. Pump spring (3).
- 5. Spring washer.
- 6. Pump intake valve (4).

INSTALL, CONNECT

- 1. Accelerator pump assembly — sequence portrayed.
- 2. Observe correct seating and sealing.
- 3. Clean return nozzle (5).
- 4. Air cleaner hood.

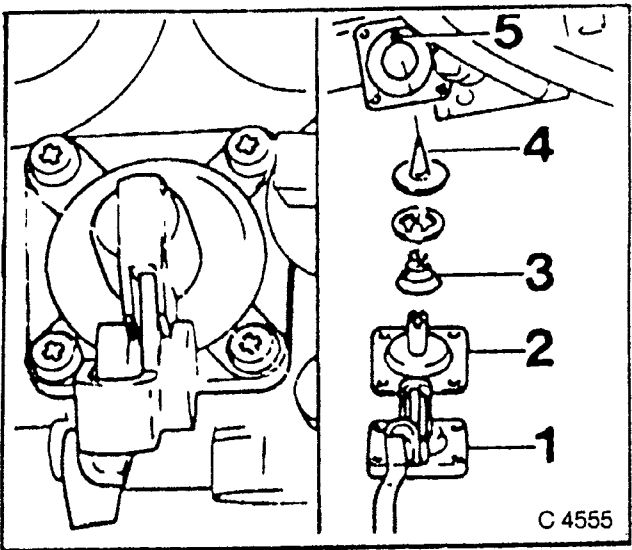


Fig. 209

Release and Forced Return — Stage II, Check and Adjust

CHECKING CONDITIONS:

- 1. Carburettor removed.
- 2. Throttle valve stage I in idle speed position.

MEASURE

- 1. Distances “1” and “2” — each on the narrowest position.
Adjusting values — see Technical Data, page 312.
If necessary, correct by bending forks.

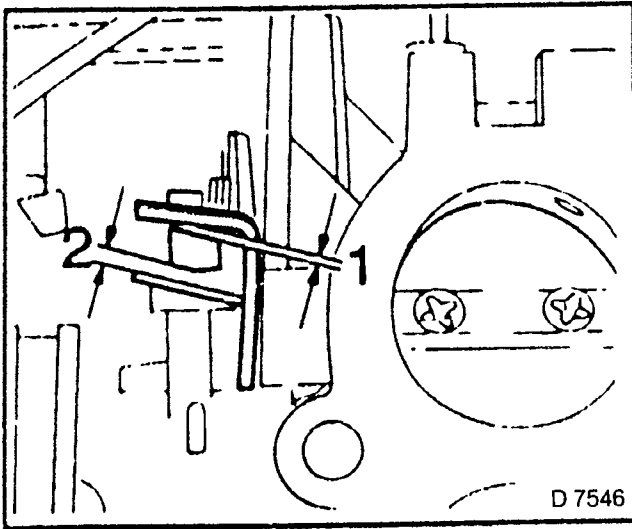


Fig. 210

Pull Rod for Stage II — Check

CHECKING CONDITIONS:

Release and forced return correct.

MEASURE

- 1. Pre-tension — see Technical Data, page 312.
- 2. Hang out ball socket (1). If necessary replace vacuum unit stage II.

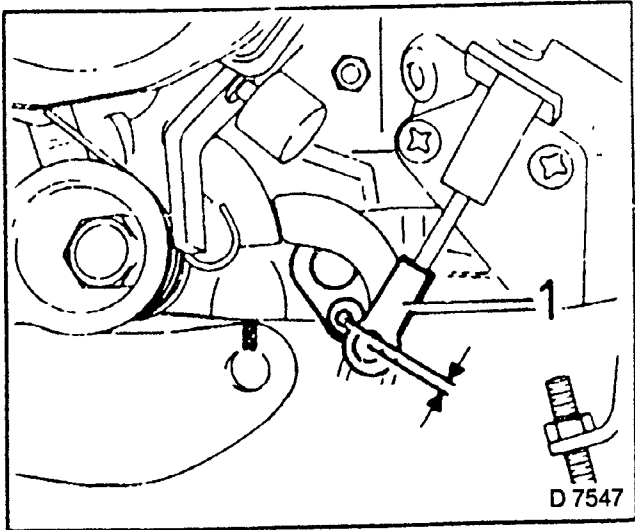


Fig. 211

Vacuum Unit — Stage II — Check for Leaks

INSPECT

1. Vacuum line and vacuum unit stage II for leaks.
2. Connect Vacuum Hand Pump MKM-667 and create pressure difference.
If reduction in pressure difference is found, the vacuum unit/vacuum line is defective. Replace if necessary.

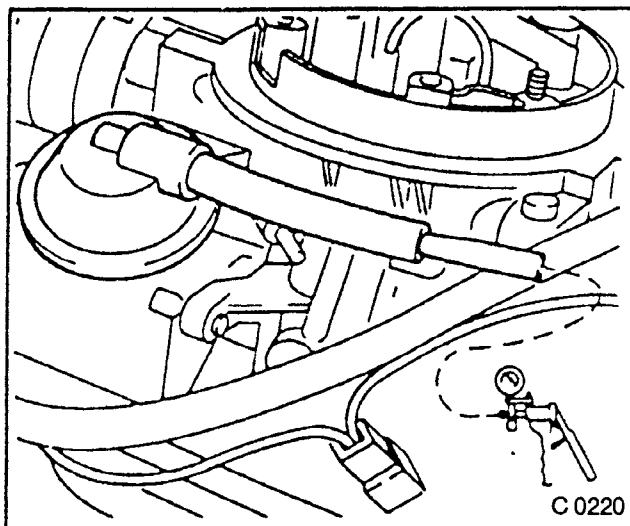


Fig. 212

Vacuum Unit — Stage II — Remove and Install

CARBURETTOR REMOVED

REMOVE, DISCONNECT

1. Choke cover.
2. Gas bubble separator — if present.
3. Vacuum unit line from carburettor, pull rod (1).
4. Vacuum unit (3) with bracket (2) (arrows)

INSTALL, CONNECT

1. Vacuum unit to carburettor.
2. Check pre-tension of pull rod — see Technical Data, page 312.
3. Vacuum line.
4. Gas bubble separator.
5. Choke cover.

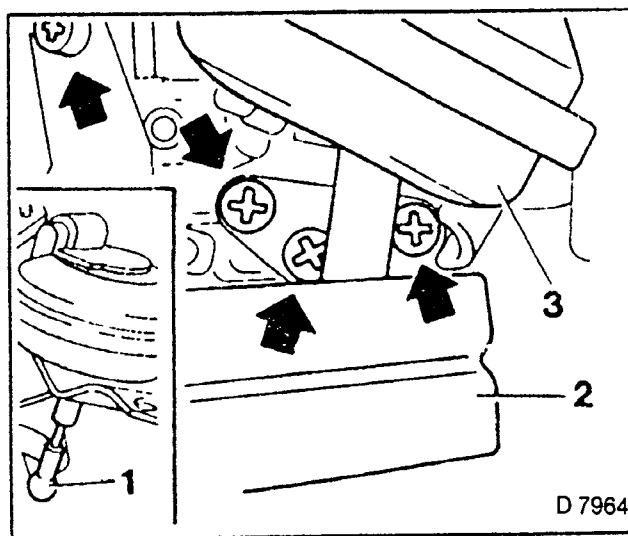


Fig. 213

Enrichment Valve, Remove and Install

REMOVE, DISCONNECT

1. Air cleaner hood.
2. Diaphragm cover (1).
3. Pressure spring (2).
4. Enrichment valve (3).

INSTALL, CONNECT

1. Enrichment valve assembly.
2. Air cleaner.

Ensure there are no leaks, note correct seating and bore — hole in cover (1).

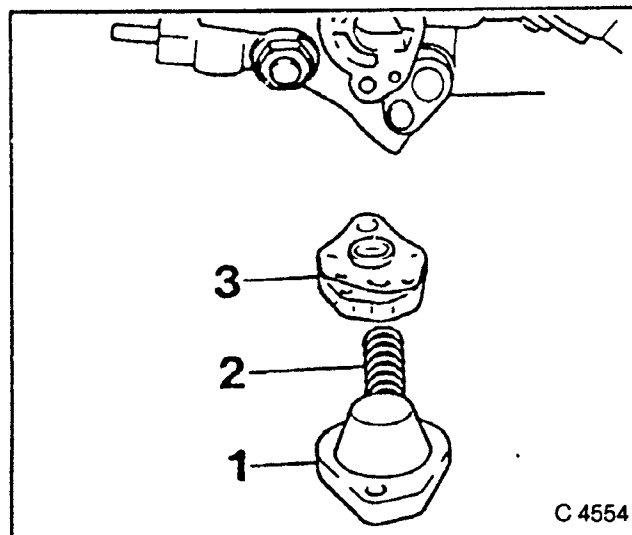


Fig. 214

Choke Body — Remove and Install

CARBURETTOR REMOVED

NOTE:

OBSERVE INSTALLATION POSITION OF CONNECTING ROD (1) — Fig. 216.

REMOVE, DISCONNECT

- 1. Choke cover.
- 2. Choke body.

INSTALL, CONNECT

- 1. Choke body.
- 2. Adjust choke cover.

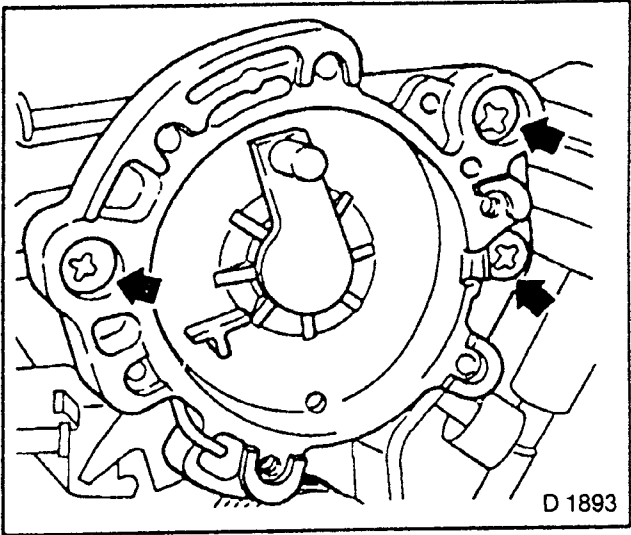


Fig 215

Pulldown Unit — Remove and Install

REMOVE, DISCONNECT

- 1. Choke body.
- 2. Hose connections.
- 3. Pin.
- 4. Pulldown unit.

INSTALL, CONNECT

- 1. Pulldown unit.
- 2. Pin.
- 3. Hoses.
- 4. Choke body.

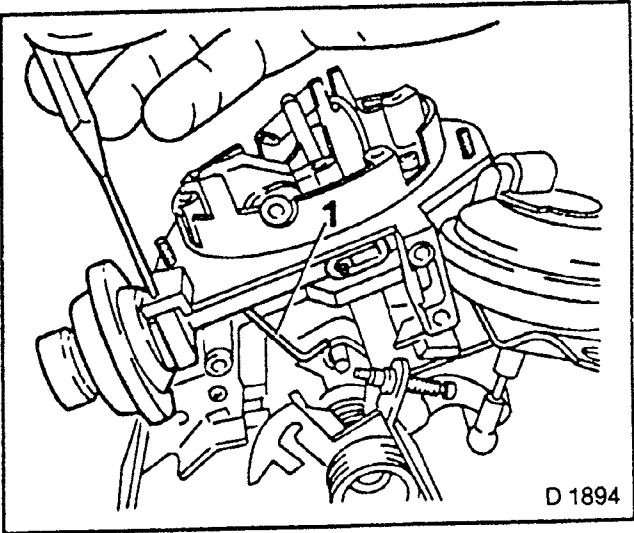


Fig. 216

INSPECT

- 1. Choke valve gap.

2 E 3 Carburettor — Remove and Install

REMOVE, DISCONNECT

- 1. Air cleaner hood.
- 2. Cable and line connections to carburettor.
- 3. Carburettor actuation.
- 4. Fastening bolts.

CLEAN

- 1. Sealing surfaces on carburettor and intake manifold flange.
- 2. Installation is carried out in reverse order — use new gasket.
- 3. Adjust carburettor actuation.

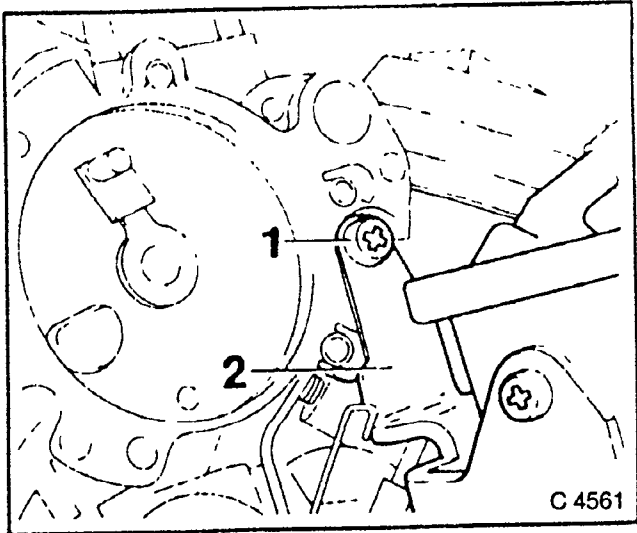


Fig. 217

Carburettor Cover — Remove and Install (Carburettor Removed)

REMOVE, DISCONNECT

1. Choke cover.
If present, fastening screw (1) of gas bubble separator (2) — Fig. 217.
2. Vacuum lines from pulldown unit, carburettor cover — bolts (3, 4, 5, 6)
Observe different lengths of bolts.
Bolts (3, 4): 1 = 35 mm
Bolts (5, 6): 1 = 25 mm

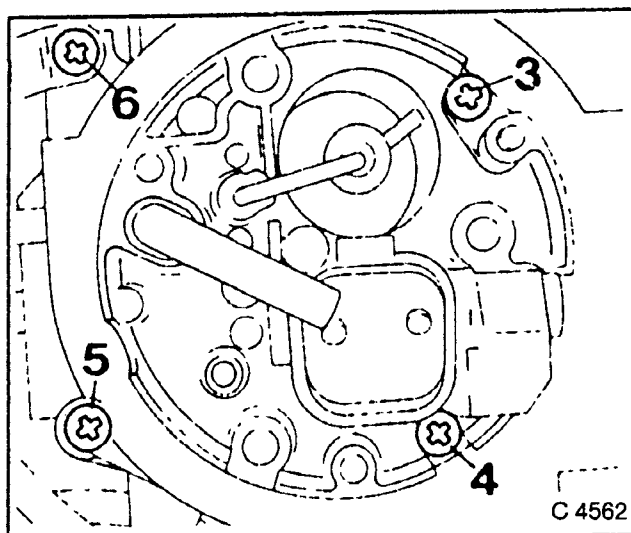


Fig. 218

INSTALL, CONNECT

1. Carburettor cover — new gasket — fastening bolts — vacuum lines to pulldown unit.

INSTALLATION NOTE:

Correct seating of the springs on flange of choke housing.

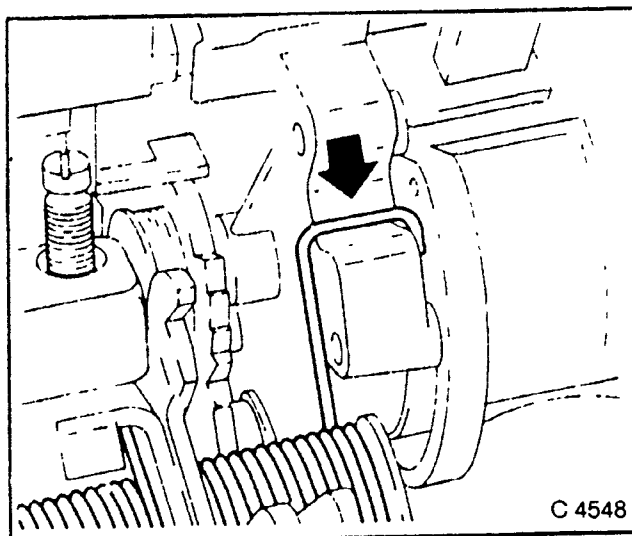


Fig. 219

Float — Remove and Install

REMOVE, DISCONNECT

1. Carburettor cover.
2. Pin (1).
3. Float (2) installing drift.

INSTALL, CONNECT

1. Float.
2. Pin — note correct seating of float needle (3)
3. Carburettor cover.

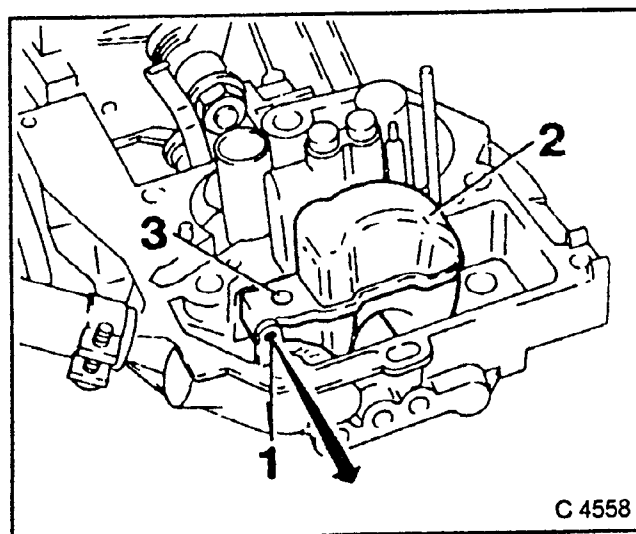


Fig. 220

Main Nozzles — Remove and Install

REMOVE, DISCONNECT

1. Carburettor cover.
2. Main nozzles: stage I (1), stage II (2).
3. Clean with compressed air.
4. Check nozzle size — see Technical Data.

INSTALL, CONNECT

1. Main nozzles.
2. Carburettor cover.

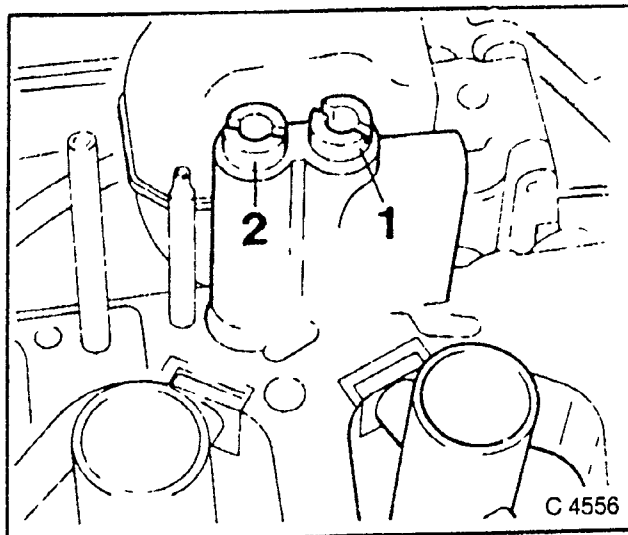


Fig. 221

Idle Nozzle — Remove and Install

REMOVE, DISCONNECT

1. Air cleaner hood.
2. Idle nozzle — near choke valve axle and air correction nozzle stage 1.
3. Clean with compressed air.
4. Check nozzle size — see Technical Data.

INSTALL, CONNECT

1. Idle nozzle.
2. Air cleaner hood.
3. Check idling and CO content.
If necessary, adjust.

Pre-atomizer — Remove and Install

Carburettor cover removed.

WARNING:

DO NOT DAMAGE SEALING SURFACES.

REMOVE, DISCONNECT

1. Lever out pre-atomizer (alternately on either side).
2. Retaining clip (2).
3. Gasket (1).

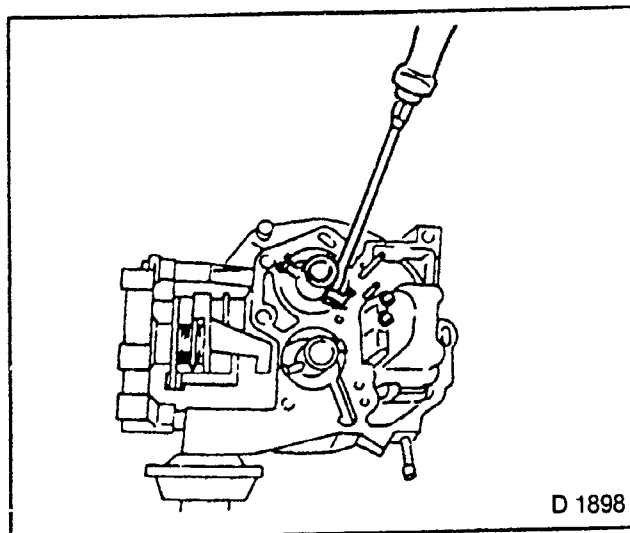


Fig. 222

NOTE:
ENSURE PERFECT SEATING OF GASKET (1) AND RETAINING CLIP (2).

INSTALL, CONNECT

- 1. Retaining clip.
- 2. Gasket.
- 3. Press in pre-atomizer.

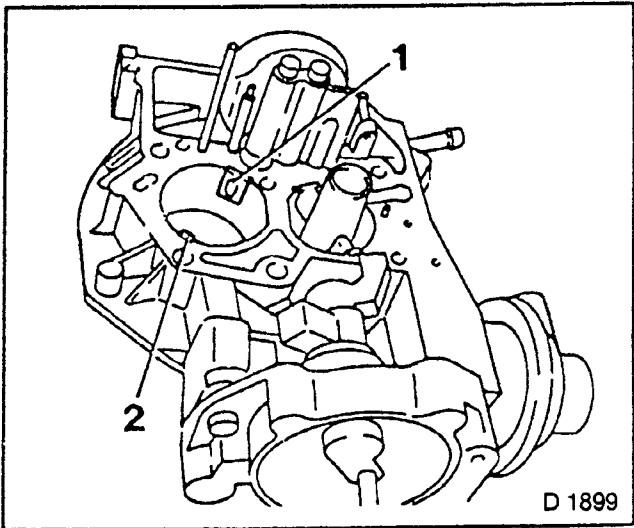


Fig. 223

Accelerator Pipe — Remove and Install

Carburettor cover removed.

WARNING:
DO NOT DAMAGE SEALING SURFACE, NOTE O-RING (1) AND SCREEN (2).

REMOVE, DISCONNECT

- 1. Accelerator pipe.

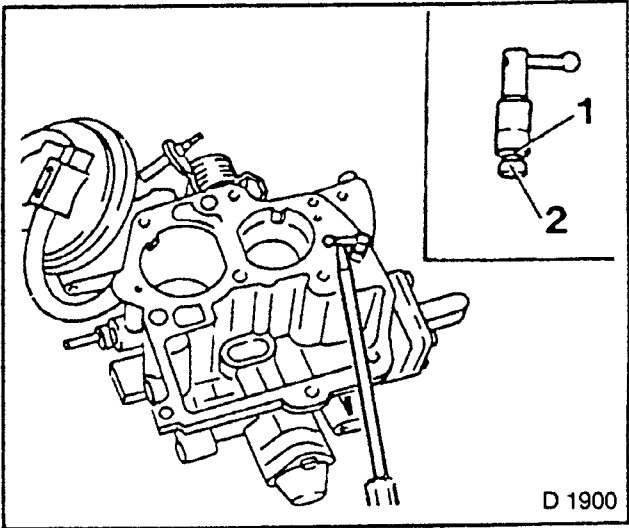


Fig. 224

INSTALL, CONNECT

- 1. Insert (press in) accelerator pipe so that the fuel jet sprays in the direction of the recess (arrow).

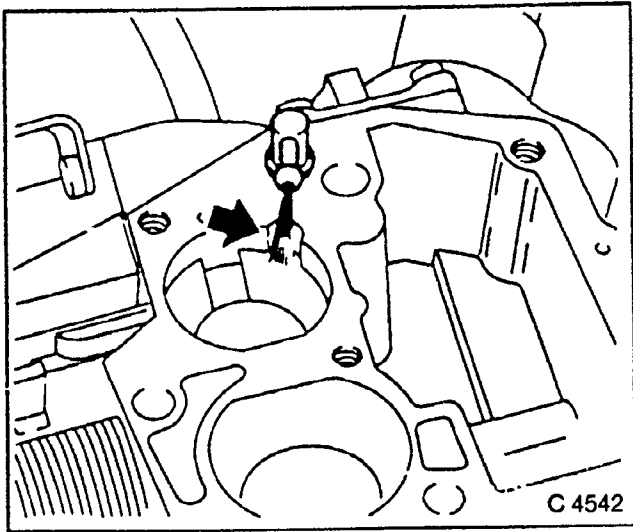


Fig. 225

Float Level — Check

REMOVE, DISCONNECT

1. Carburettor.
2. Carburettor cover.

MEASURE

1. Float level. Dimension — see Technical Data.
2. Hold carburettor slanted when measuring so that the valve pin (1) is not caused to deflect by the float weight.
The float level is dependent on the float weight — see Technical Data — and therefore not adjustable — if necessary replace float.

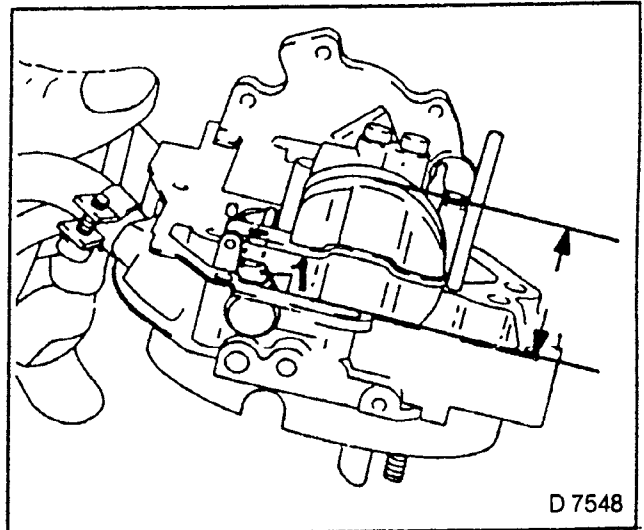


Fig. 226

Carburettor Actuation — Adjust

ADJUST

When adjusting idle speed, accelerator cable must be free of tension, slight play must be present in accelerator cable.

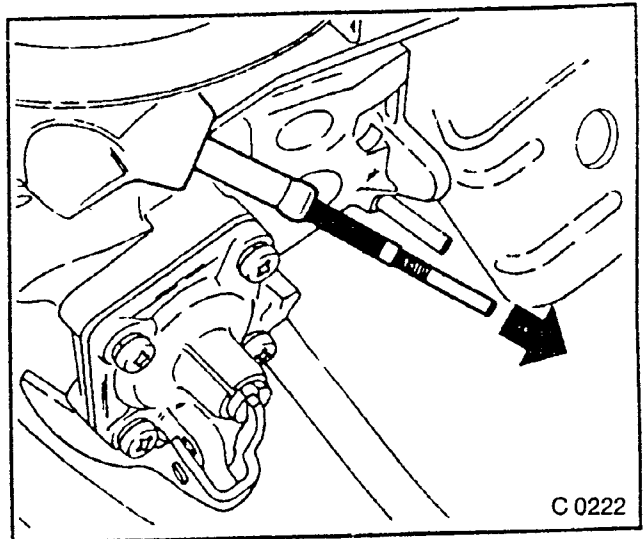


Fig. 227

Filter in Fuel Feed — Remove and Install

REMOVE, DISCONNECT

1. Fuel feed line from carburettor.
2. Filter.
3. Turn M 3 bolt approximately 5 mm into filter and remove filter.

INSTALL, CONNECT

1. Filter — push in until it engages.
2. Fuel feed line to carburettor.
3. Replace filter each time the carburettor is cleaned.

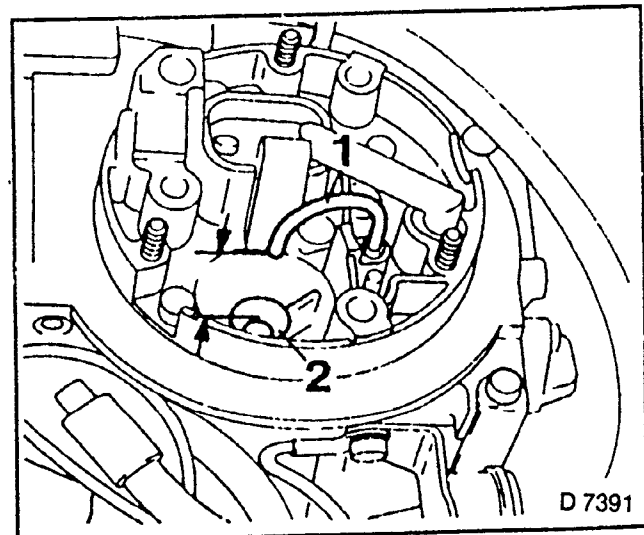


Fig. 228

Enrichment Pipe — Check and Adjust

Checking conditions — air cleaner hood removed.

MEASURE

1. Distance between enrichment pipe (1) and pre-atomizer (2) — see Technical Data.
2. Outlet of enrichment pipe points vertically to centre of pre-atomizer.

Trouble-shooting Chart (2 E 3 Carburettor)

COMPLAINTS

Cold start (starting)												
Warming up (stalling after cold start)												
Cold idling (speed too high/too low)												
Cold driving characteristics, transition cold (pick-up poor, jerking)												
Automatic choke cuts out incompletely or late												
Warm start (starting time over 5 s)												
Idling (uneven, too high, too low)												
Idling speed or CO content too high (cannot be adjusted)												
Transition when accelerating (jerking)												
Transition at high engine speeds (to 2nd stage)												
Backfiring during coasting												
Performance (too low, missing at full load)												
Fuel consumption too high												
Idle speed (no warming up)												

Note:

Pre-requisites for the use of this chart are:

- 1 Perfect functioning of the engine. (timing, valves, etc)
- 2 Ignition system and adjustment in perfect condition
- 3 Leak — free intake system
- 4 Exhaust system in perfect condition
- 5 Correct control of intake air pre-heating
- 6 Clean air filter
- 7 Fuel pressure to carburettor correct.

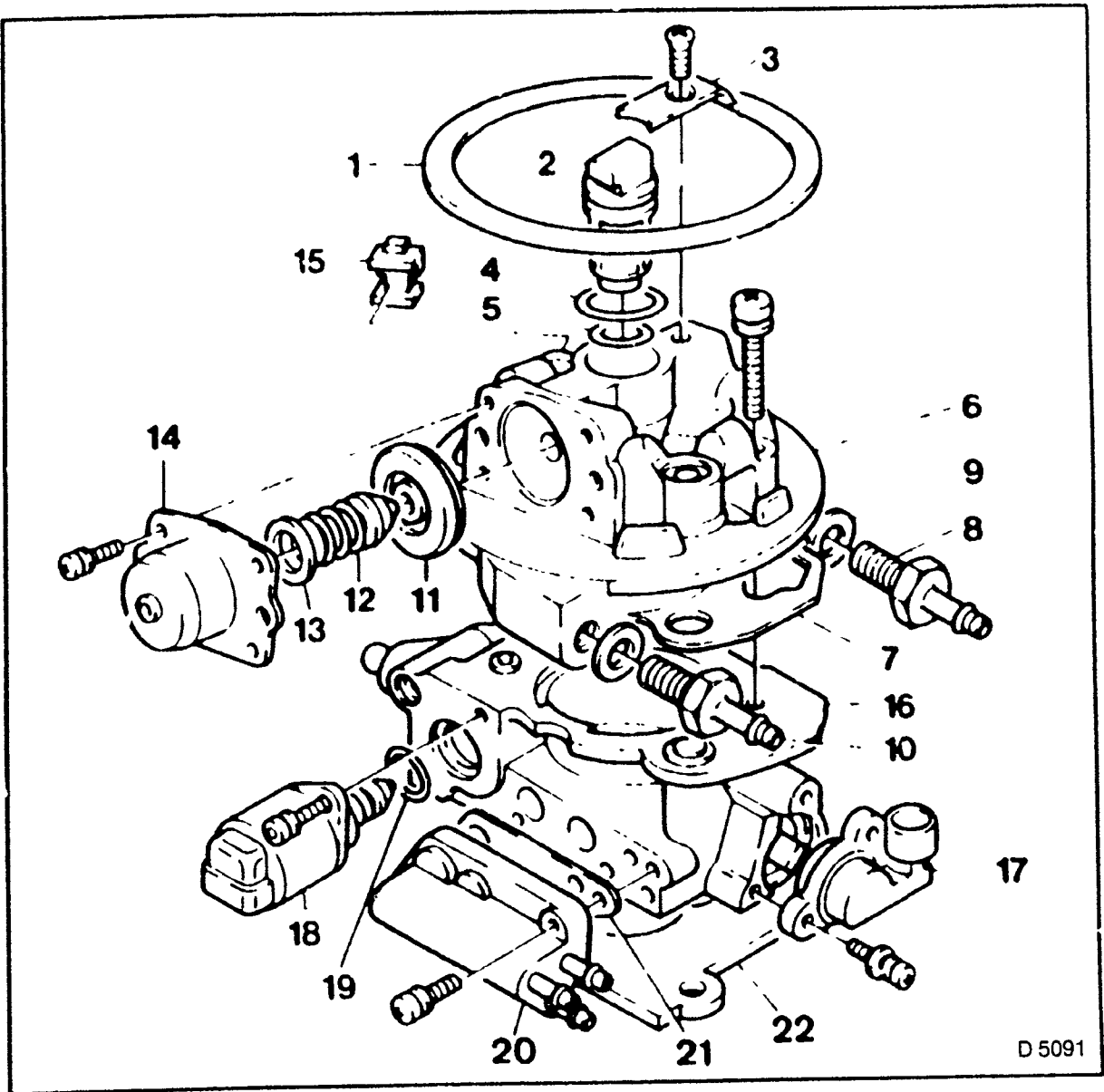


Fig. 229

MULTEC CENTRAL FUEL INJECTION (C 16 NZ)

Arrangement of Throttle Valve Injection Housing

- | | |
|--|---|
| <ul style="list-style-type: none">1. Gasket.2. Injection valve.3. Injection valve bracket.4. Injection valve upper O-Ring.5. Injection valve lower O-Ring.6. Throttle valve injection housing upper part.7. Gasket for upper part of throttle valve injection housing. | <ul style="list-style-type: none">8. Fuel inlet connection.9. Fuel inlet connection gasket.10. Fuel return connection.11. Fuel pressure regulator diaphragm.12. Fuel pressure regulator spring.13. Fuel pressure regulator spring seating.14. Fuel pressure regulator cover.15. Connection cable rubber grommet.16. Throttle valve part.17. Throttle valve potentiometer.18. Idle speed control stepper motor.19. O-ring.20. Flange for vacuum connections.21. Flange gasket for vacuum connections.22. Injection housing gasket for intake manifold. |
|--|---|

General Information

The central fuel injection for the C 16 NZ engine is equipped with self-diagnosis. Faults that occur are stored as "trouble codes" and can be read out from the engine telltale as a blink code or with the TECH 1 Hand Tester.

Control Unit — Remove and Install

REMOVE, DISCONNECT

1. Ground lead from battery.
2. Right front footwell panelling.
3. Storage compartment.
4. Bracket with control unit (1).
5. Wiring harness plug.
6. Control unit from bracket.

NOTE:

**CONTROL UNIT DEFECTIVE:
REPLACE CONTROL UNIT
COMPLETELY.**

INSTALL, CONNECT

1. Control unit to bracket.
2. Wiring harness plug.
3. Control unit with bracket.
4. Footwell panelling.
5. Storage compartment.
6. Ground lead to battery.

INSPECT

Carry out function check according to trouble-shooting programme.
If code 51 appears or the engine telltale flashes constantly when no code is signalled, either the program memory is not in perfect condition (pin bent) or the control unit is defective.

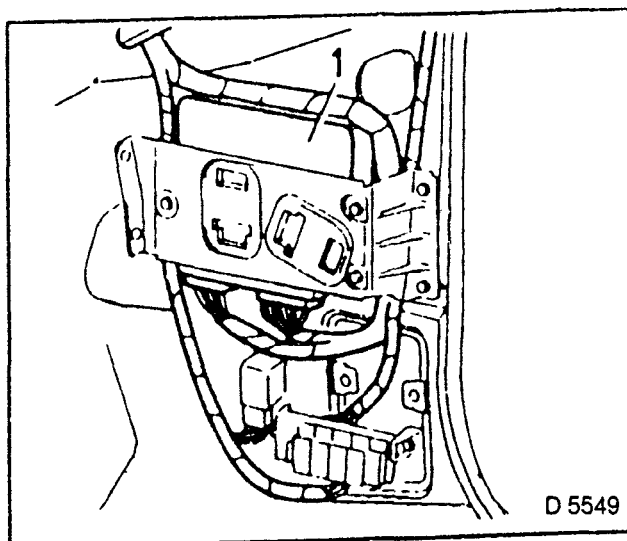


Fig. 230

Throttle Valve Injection Housing — Remove and Install

REMOVE, DISCONNECT

- 1 Air cleaner hood.
- 2 Injection valve rubber grommet.
- 3 All wiring harness plugs.
- 4 Fuel lines from connections on throttle valve injection housing.
- 5 Vacuum connections from vacuum connections flange.
- 6 Actuation rod.
- 7 Throttle valve injection housing from intake manifold.

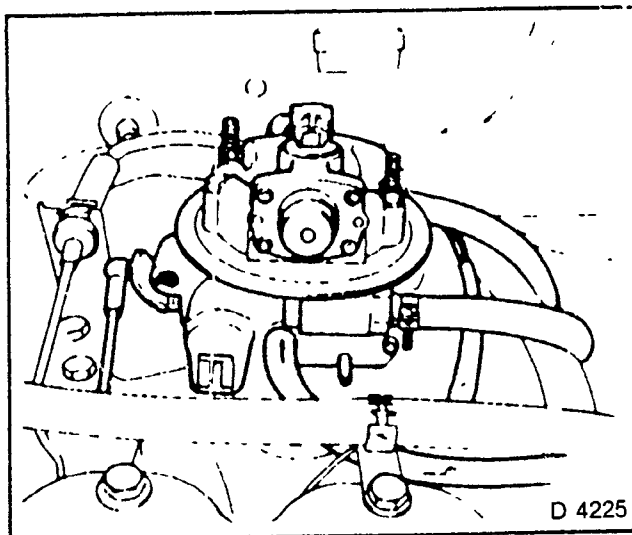


Fig. 231

WARNING:

NOTE SAFETY MEASURES AND NATIONAL REGULATIONS. FUEL SYSTEM IS UNDER PRESSURE. REMOVE FUEL PUMP RELAY. START ENGINE FOR AT LEAST FIVE SECONDS — PRESSURE REDUCTION.

TIGHTEN (TORQUE)

1. Throttle valve injection housing to intake manifold — 22 Nm.
2. Insert nuts with Locking Compound (Loctite 242).
3. Install new injection housing gasket — intake manifold, all lines and plug connectors in reverse order.

NOTE:

DO NOT MIX UP VACUUM HOSES.
1 = INTAKE AIR PRE-HEATING
2 = EXHAUST GAS RECIRCULATION

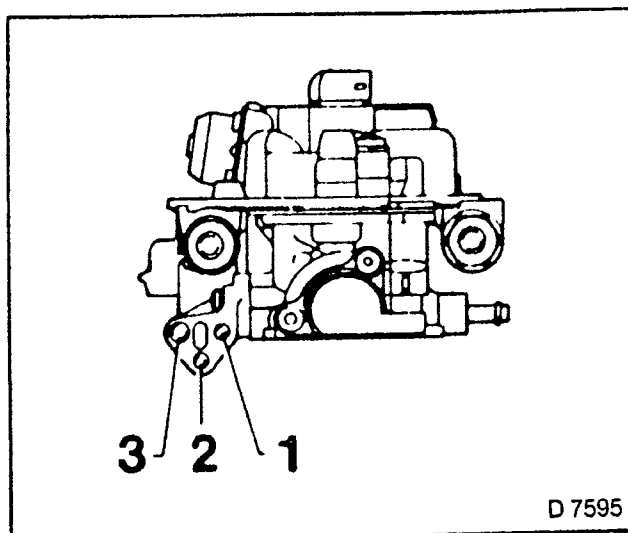


Fig. 232

Throttle Valve Potentiometer — Remove and Install

REMOVE, DISCONNECT

1. Air cleaner cover
2. Wiring harness plug.
3. Throttle valve potentiometer.

TIGHTEN (TORQUE)

1. Throttle valve closed.
2. Potentiometer to throttle valve injection housing — 2,0 Nm.
Note proper seating of carrier on throttle valve shaft.
3. Insert bolts with Locking Compound (Loctite 242).

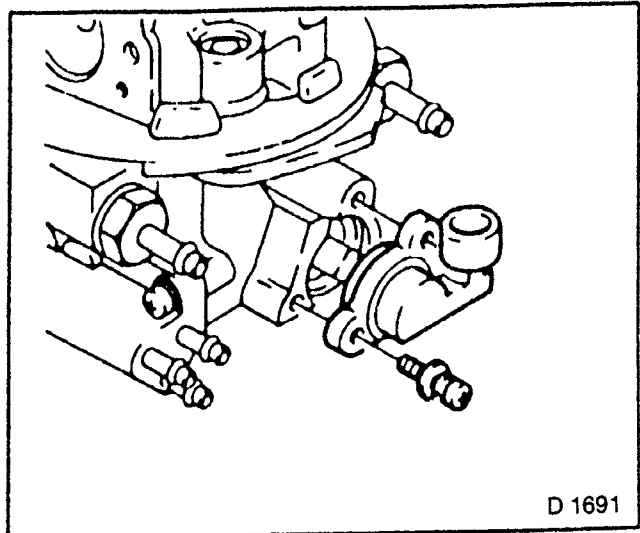


Fig. 233

Injection Valve, Remove and Install

REMOVE, DISCONNECT

1. Air cleaner cover.
2. Wiring harness plug from injection valve.
3. Bolt with bracket.
4. Injection valve carefully from throttle valve injection housing.

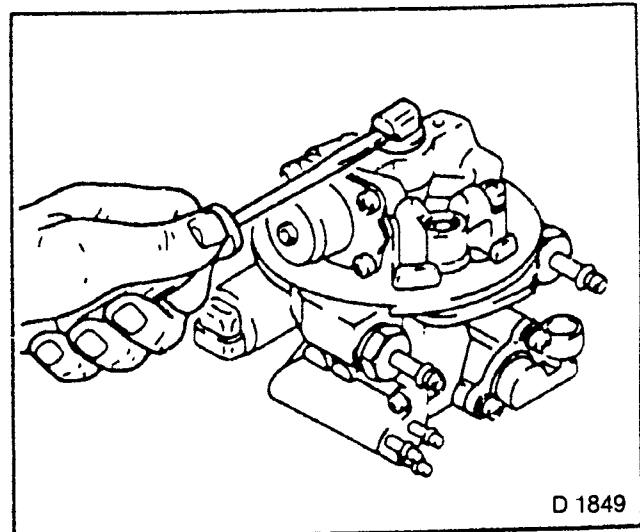


Fig. 234

INSTALL, CONNECT

1. Injection valve — new seal rings.
2. Electrical plug part points towards bracket bolt.
3. Wiring plug to injection valve.
4. Air cleaner cover.

TIGHTEN (TORQUE)

1. Bracket bolt to throttle valve injection housing — 3,0 Nm.
2. Install with Locking Compound (Loctite 242).

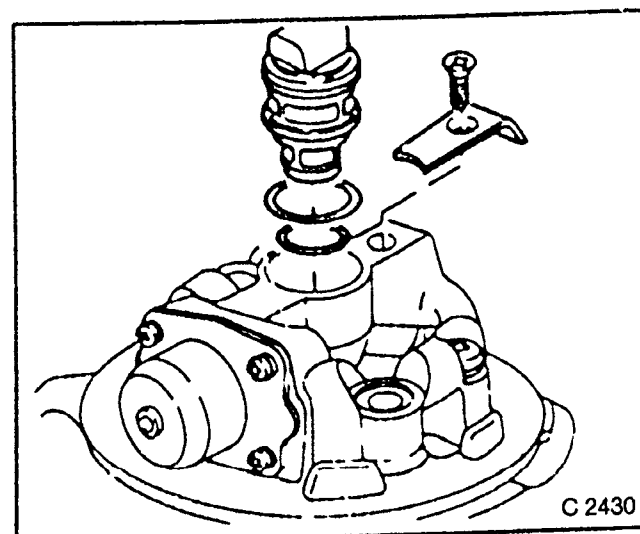


Fig. 235

Fuel Pressure Regulator, Fuel Pressure Regulator Diaphragm — Remove and Install

WARNING

**NOTE SAFETY MEASURES AND
NATIONAL REGULATIONS.**

Fuel system is under pressure.

- 1. Remove fuel pump relay.
- 2. Start engine for at least five seconds — pressure reduction if the fuel pressure regulator cover becomes detached the diaphragm must be replaced.

REMOVE, DISCONNECT

- 1. Air cleaner cover.
- 2. Cover.
- 3. Spring and diaphragm.

INSTALL, CONNECT

- 1. Diaphragm.
- 2. Spring.
- 3. Cover
 - Diaphragm must sit in groove of fuel injection throttle valve housing.
- 4. Air cleaner cover.

TIGHTEN (TORQUE)

- 1. Fuel pressure regulator to throttle valve injection housing — 2,5 Nm.
- 2. Insert bolts with Locking Compound (Locktite 242).

Fuel Pressure — Check

WARNING

**FUEL ESCAPES
NOTE SAFETY MEASURES AND
NATIONAL REGULATIONS.**

Fuel system is under pressure.

- 1. Remove fuel pump relay.
- 2. Start engine for at least five seconds — pressure reduction.

INSTALL, CONNECT

- 1. Fuel Pressure Gauge MKM-588 into fuel feed line (1).

INSPECT

- 1. Fuel pressure — nominal value:
1,0 bar/14,5 psi.

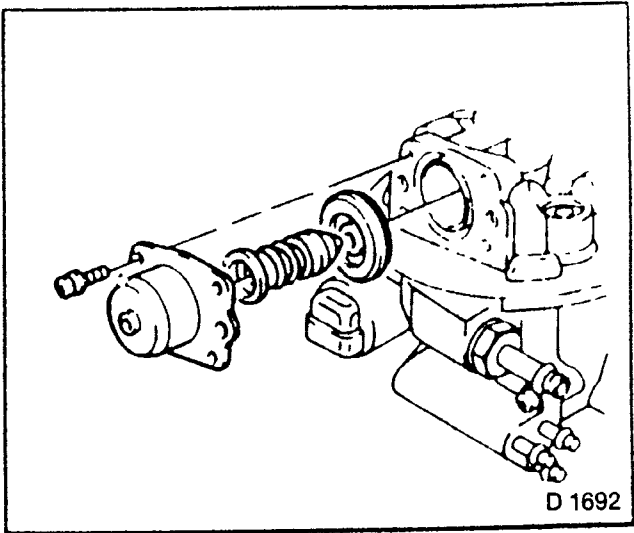


Fig. 236

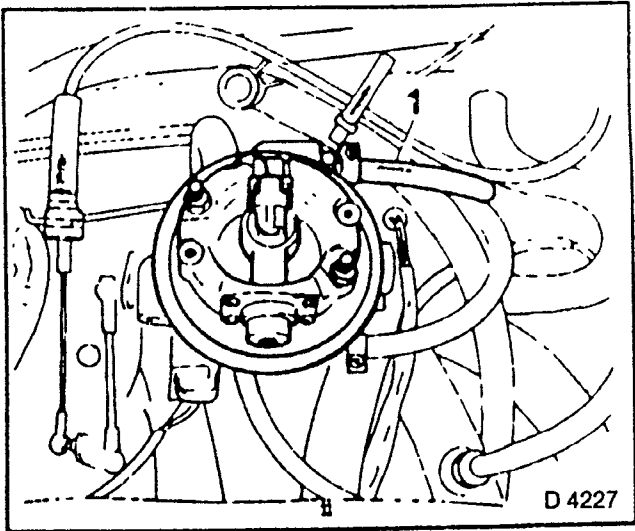


Fig. 237

Throttle Valve Injection Housing Upper Part — Remove and Install

REPLACING CONVERT INJECTION VALVE, FUEL CONNECTIONS AND FUEL PRESSURE REGULATOR.

REMOVE, DISCONNECT

- 1. Air cleaner hood.
- 2. Injection valve wiring harness plug.
- 3. Injection valve rubber grommet.
- 4. Fuel lines.
- 5. Upper part — two bolts and nuts.

INSTALL, CONNECT

- 1. Fuel lines — use new gaskets.
- 2. Injection valve rubber grommet.
- 3. Injection valve wiring harness plug.
- 4. Air cleaner hood.

TIGHTEN (TORQUE)

- 1. Upper part to throttle valve injection housing — 6 Nm.
- 2. Throttle valve injection housing to intake manifold — 22 Nm.
- 3. Use new gasket.
- 4. Insert bolts and nuts with Locking Compound (Loctite 242).

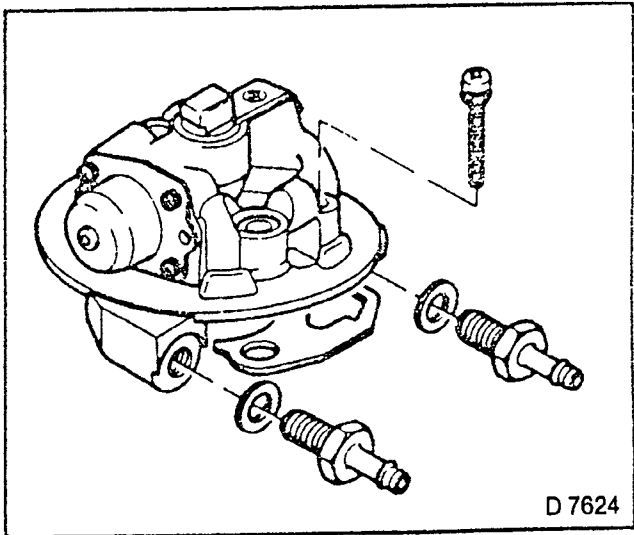


Fig. 238

Idle Air Control Stepper Motor — Remove and Install

REMOVE, DISCONNECT

- 1. Air cleaner cover.
- 2. Wiring harness plug.
- 3 Idle air control stepper motor.

NOTE:

TO AVOID DAMAGING HOUSING DURING INSTALLATION, THE DISTANCE BETWEEN PISTON AND FLANGE SHOULD BE NOT LARGER THAN 28 mm (1) IF THERE IS A VARIATION, PRESS IN PISTON CAREFULLY TO STOP.

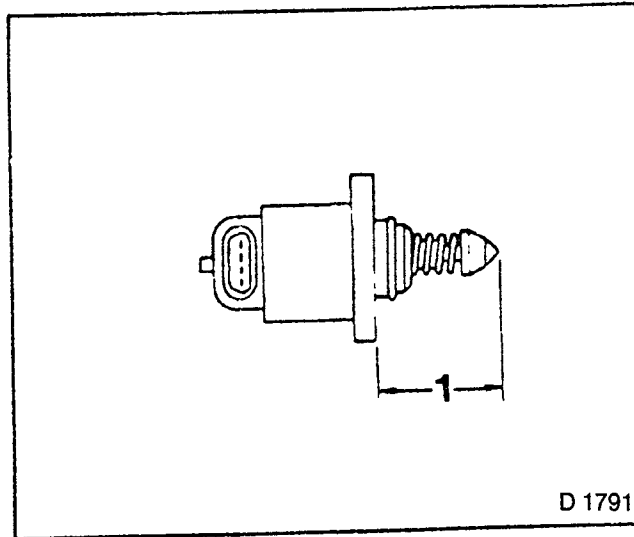


Fig. 239

TIGHTEN (TORQUE)

1. Idle air control stepper motor to throttle valve injection housing — 2,5 Nm.
2. New rubber O-ring, install bolts with Locking Compound (Loctite 242).
3. Air cleaner cover.

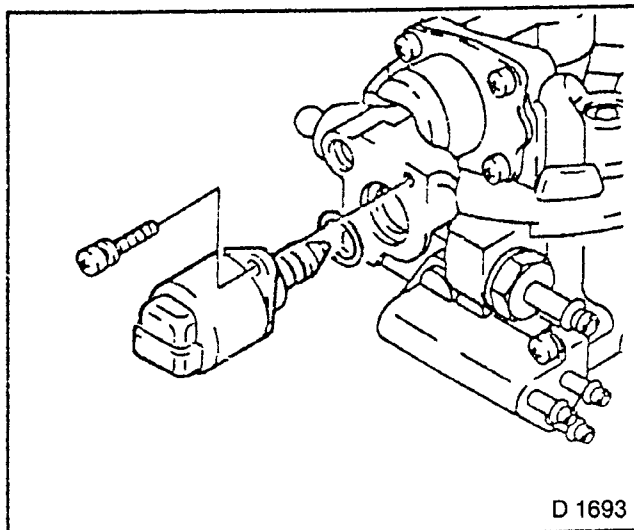


Fig. 240

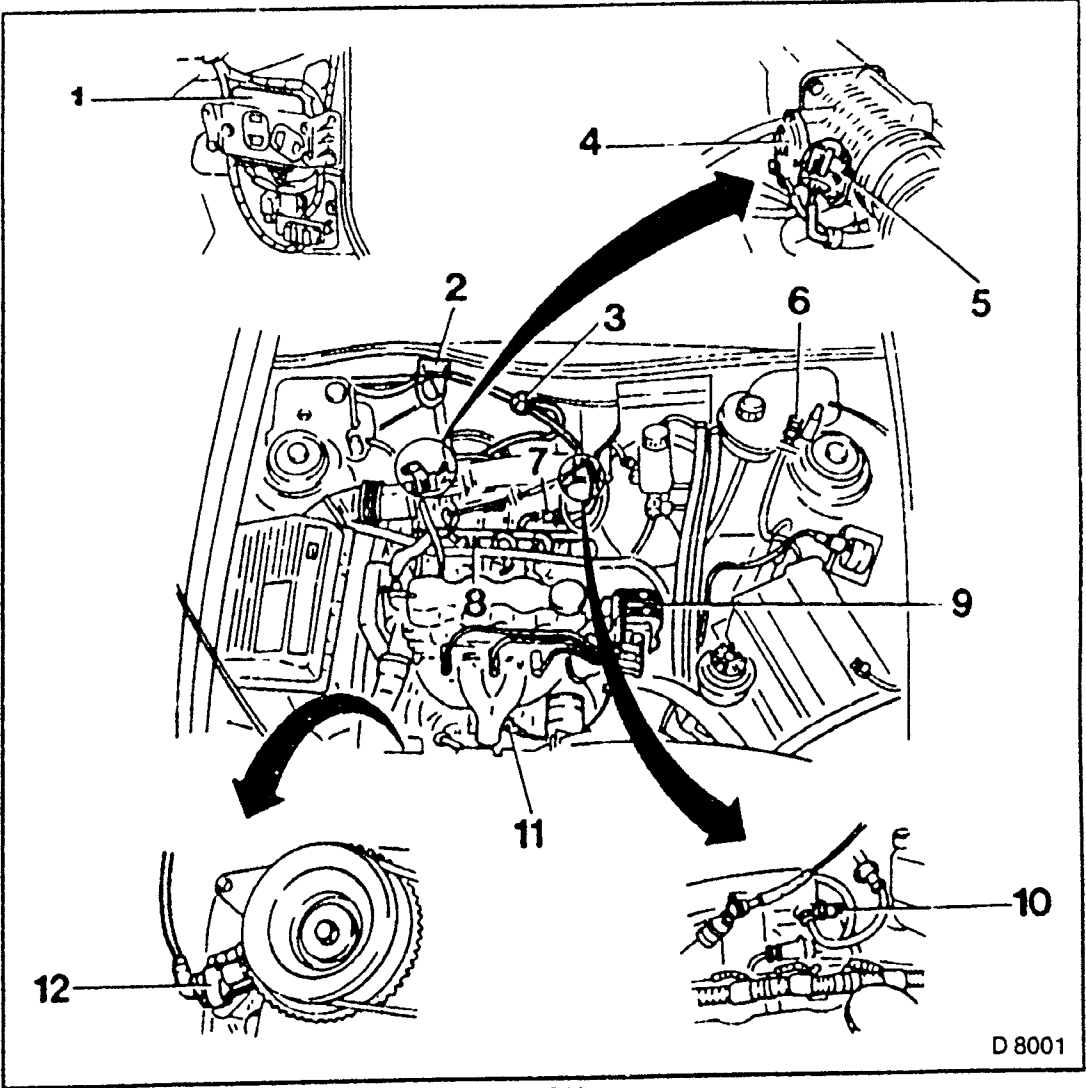


Fig 241

Motronic M 1.5.4

- 1. Control unit.
- 2. Intake manifold pressure sensor.
- 3. Tank vent valve. (N/A Delta).
- 4. Throttle valve potentiometer.
- 5. Idle speed control stepper motor.

- 6. Octane number plug.
- 7. Fuel pressure regulator.
- 8. Injection valves.
- 9. Dual spark ignition distributor.
- 10. Intake air temperature sensor.
- 11. C.O. Potentiometer.
- 12. Inductive pulse pick-up.

Throttle Valve Potentiometer — Remove and Install

REMOVE, DISCONNECT

- 1. Wiring harness plug for throttle valve potentiometer.
- 2. Throttle valve potentiometer.

INSTALL, CONNECT

- 1. Throttle valve potentiometer.
- 2. Wiring harness plug for throttle valve potentiometer.

Note proper seating.

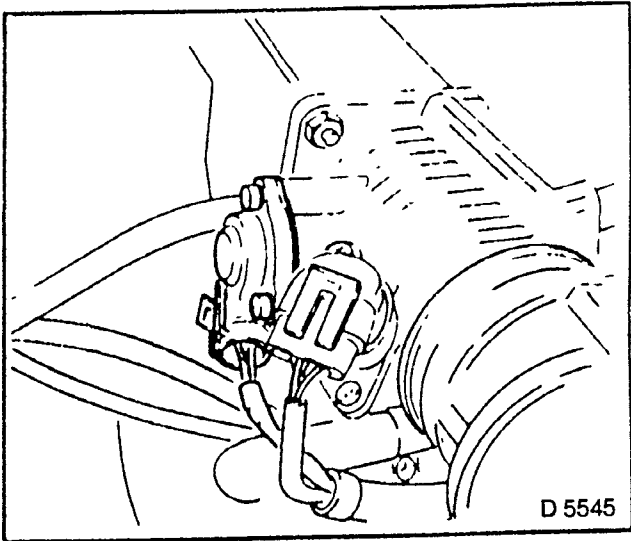


Fig. 242

Idle Air Control Stepper Motor — Remove and Install

REMOVE, DISCONNECT

- 1. Wiring harness plug for idle air control stepper motor.
- 2. Idle air control stepper motor.
- 3. Seal ring.

INSTALL, CONNECT

- 1. Seal ring.
- 2. Idle air control stepper motor.
- 3. Wiring harness plug for idle air control stepper motor.

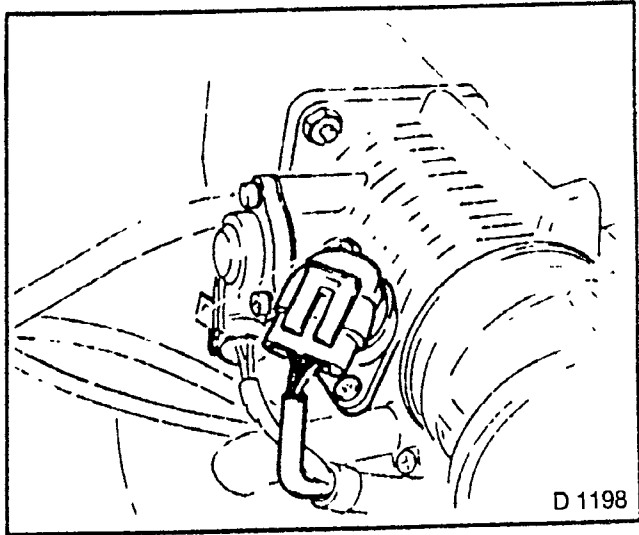


Fig. 243

INSTALL, CONNECT

- 1. Injection valve with new seal rings into fuel distributor pipe.
- 2. Injection valve spring clamp.
- 3. Fuel distributor pipe to intake manifold.
- 4. Injection valve wiring harness plug.
- 5. Ground cable to battery.

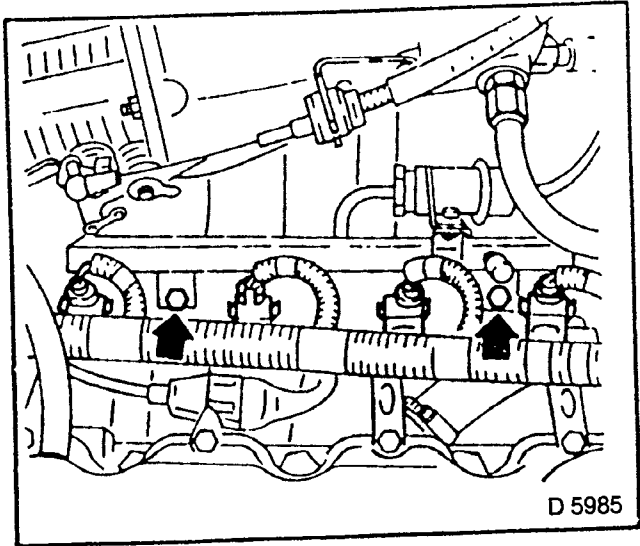


Fig. 244

Fuel Pressure — Check

INSTALL, CONNECT

- 1 Fuel Pressure Gauge KM-J-34740-91 to fuel distributor pipe.

INSPECT

- 1. Fuel pressure.
Nominal value: 3 bar/43,5 psi

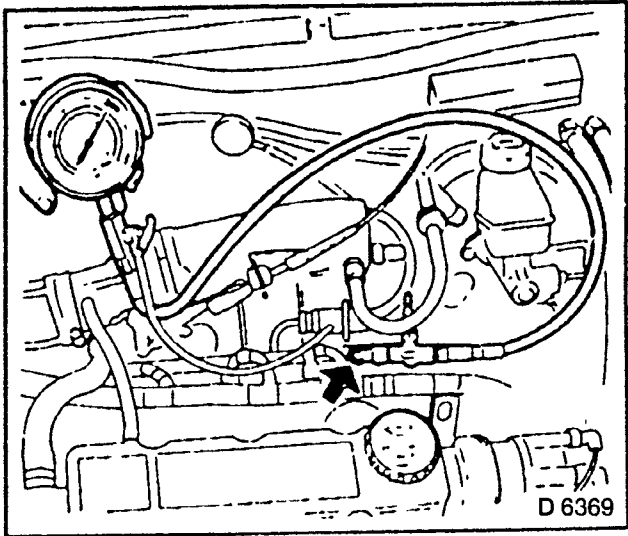


Fig. 245

Fuel Pressure Regulator — Remove and Install

REMOVE, DISCONNECT

- 1. Vacuum hose from fuel pressure regulator.
- 2. Fuel line from fuel pressure regulator — counterhold with suitable open-ended wrench.
- 3. Fuel pressure regulator.

WARNING:
FUEL ESCAPES
NOTE SAFETY MEASURES AND NATIONAL REGULATIONS.

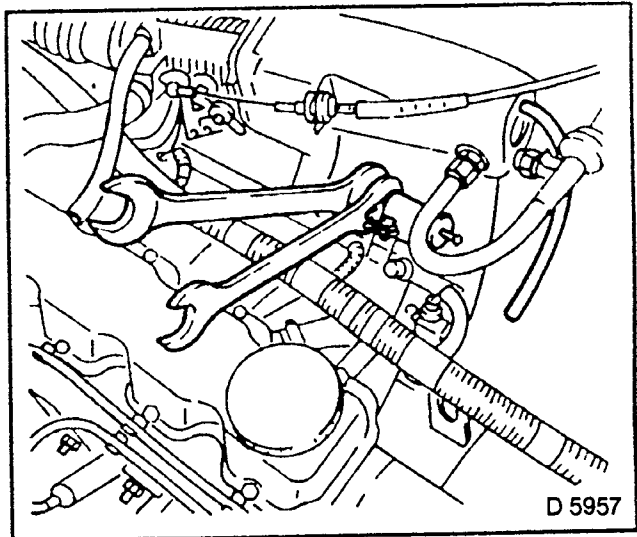


Fig. 246

INSTALL, CONNECT

- 1. Fuel pressure regulator — tightening torque 8 Nm.
- 2. Use new seal rings.
- 3. Fuel line to fuel pressure regulator.
- 4. Vacuum hose to fuel pressure regulator.

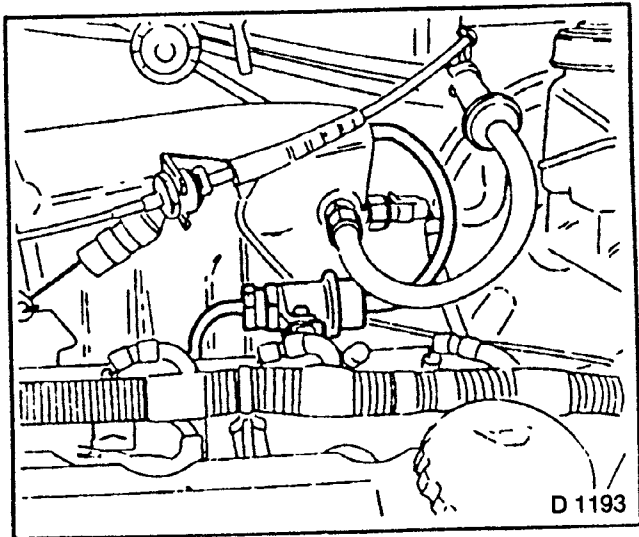
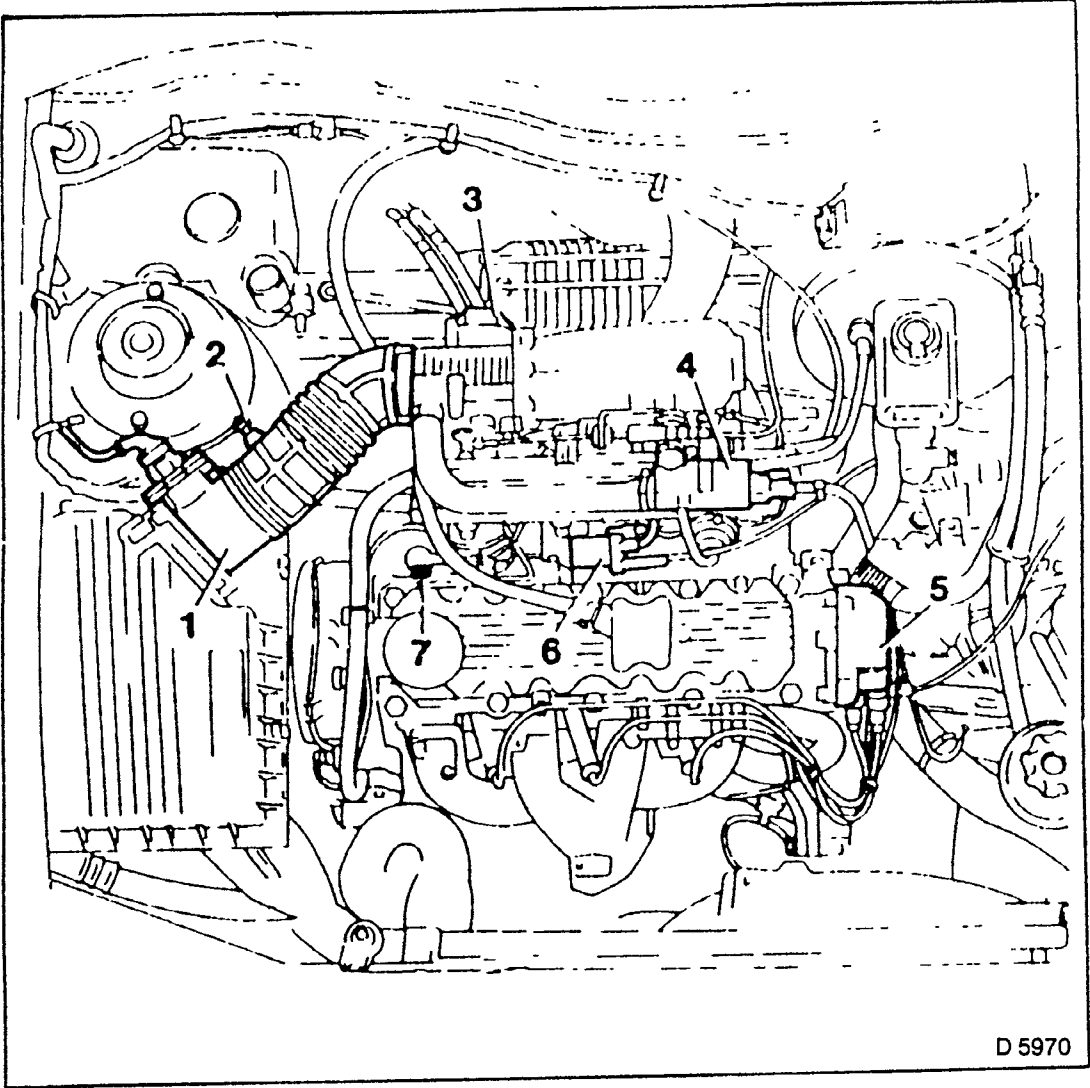


Fig. 247



D 5970

Fig. 248

Motronic M 1.5.4 (18 SE/20 SEH)

- 1. (Hot film) mass air flow sensor.
- 2. Intake air temperature sensor.
- 3. Throttle valve potentiometer.
- 4. Idle speed adjuster.
- 5. High voltage distributor.
- 6. Tank vent valve.
- 7. Coolant temperature sensor.



Hot Film Mass Air Flow Meter — Remove and Install

REMOVE, DISCONNECT

1. Intake air temperature sensor wiring plug.
2. Hot film mass air flow meter wiring plug.
3. Air intake hose.
4. Upper part of air cleaner with hot film mass air flow meter.

NOTE:

DO NOT DISASSEMBLE HOT FILM MASS AIR FLOW METER. REMOVE AND INSTALL AS COMPLETE UNIT ONLY.

IF EXTERNAL DAMAGE (E.G. DEFORMATION OF THE GRILLE) IS APPARENT, REPLACE HOT FILM MASS AIR FLOW METER.

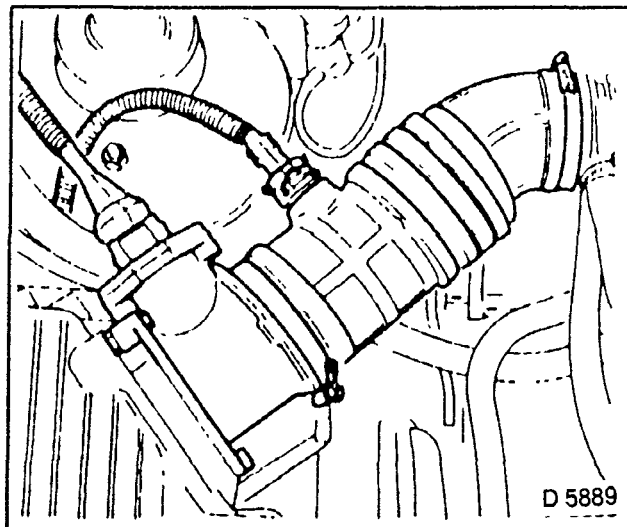


Fig. 249

REMOVE, DISCONNECT

1. Hot film mass air flow meter with seal ring from upper part of air cleaner.

INSTALL, CONNECT

1. Hot film mass air flow meter with new seal ring. Insert two bolts with Locking Compound (Loctite 242).
2. Upper part of air cleaner with hot film mass air flow meter.
3. Air intake hose.
4. Intake air temperature sensor wiring plug.
5. Hot film mass air flow meter wiring plug.

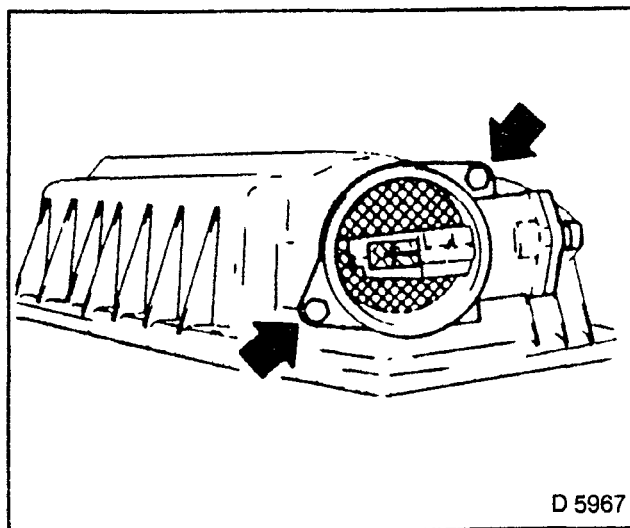


Fig. 250

Fuel Pressure Regulator — Remove and Install

WARNING:

**FUEL ESCAPES.
NOTE SAFETY MEASURES AND
NATIONAL REGULATIONS**

REMOVE, DISCONNECT

1. Vacuum hose.
2. Fuel hoses.
3. Fuel pressure regulator.

INSTALL, CONNECT

1. Fuel pressure regulator.
2. Fuel hoses.
3. Vacuum hose.

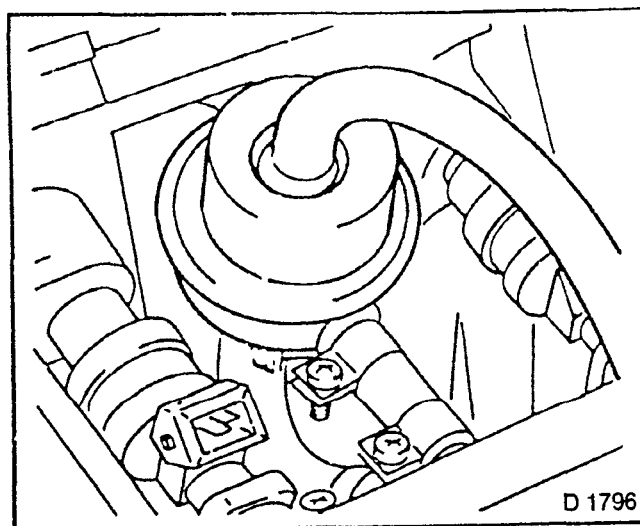


Fig. 251

Idle Speed Adjuster — Remove and Install

REMOVE, DISCONNECT

1. Wiring harness plug for idle speed adjuster.
2. Hose clamps.
3. Idle speed adjuster.

INSTALL, CONNECT

1. Idle speed adjuster.
2. Hose clamps.
3. Wiring harness plug for idle speed adjuster — ensure good condition and firm seat of hoses and hose clamps.

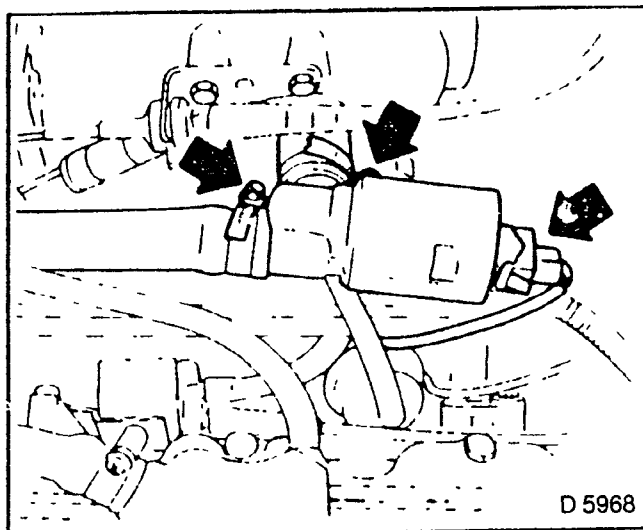


Fig. 252

Throttle Body — Remove and Install

REMOVE, DISCONNECT

1. Wiring harness plug for intake air temperature sensor.
2. Air intake hose.

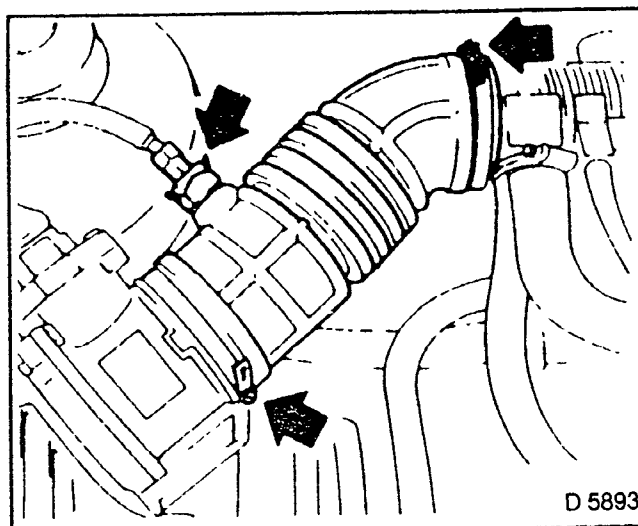


Fig. 253

REMOVE, DISCONNECT

1. Idle speed adjuster hose.
2. Crankcase ventilation hoses.
3. Tank vent valve vacuum hose.
4. Wiring harness plug for throttle valve potentiometer.
5. Coolant hoses.
6. Throttle body with gasket.

NOTE:

**COOLANT ESCAPES
PLACE COLLECTING BASIN
UNDERNEATH.**

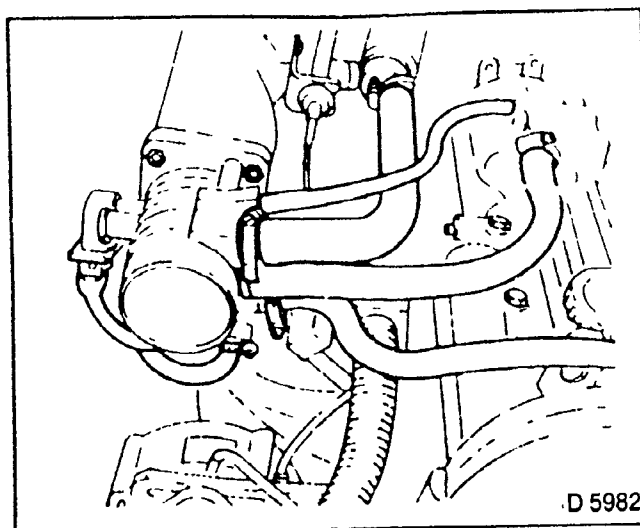


Fig. 254

CLEAN

Sealing surfaces.

INSTALL, CONNECT

- 1. Throttle body with new gasket.
- 2. Wiring harness plug for throttle valve potentiometer.
- 3. Tank vent valve vacuum hose.
- 4. Coolant hoses.

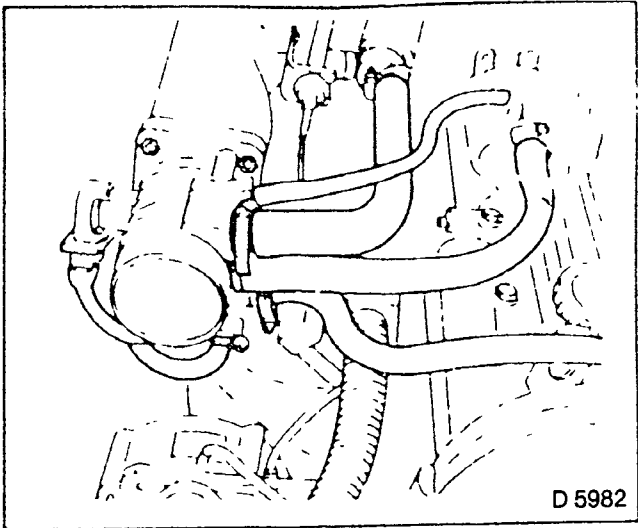


Fig 255

INSTALL, CONNECT

- 1. Air intake hose.
- 2. Wiring harness plug for intake air temperature sensor.
- 3. Idle speed adjuster hose.
- 4. Crankcase vent hoses.

INSPECT

- 1. Top up and bleed cooling system.
- 2. Ensure good condition and firm seat of hose connections.

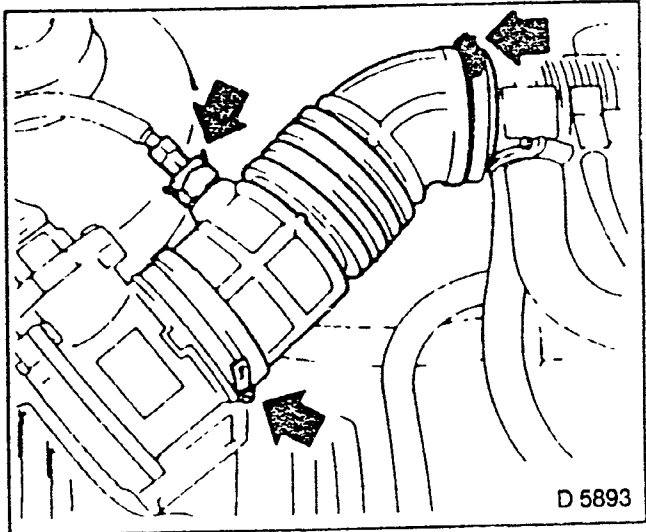


Fig. 256

Fuel Pressure — Check

REMOVE, DISCONNECT

- 1. Disconnect fuel feed line (Arrow)
Fig. 257.

WARNING:

**FUEL ESCAPES.
NOTE SAFETY MEASURES AND
NATIONAL REGULATIONS.**

INSTALL, CONNECT

- 1. Fuel Pressure Gauge MKM-588 into fuel feed line.

INSPECT

- 1. Fuel pressure.
- 2. Vacuum hose for fuel pressure regulator.
Connected: 1,8 — 2,2 bar.
Disconnected: 2,5 — 3,0 bar.

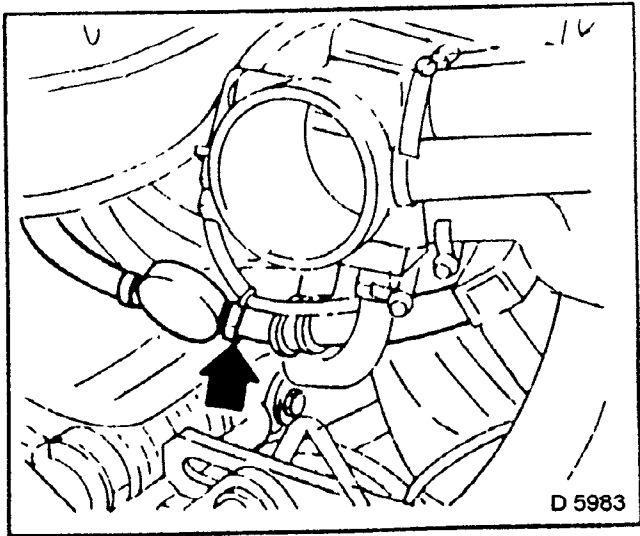


Fig. 257

Tank Vent Valve — Remove and Install

REMOVE, DISCONNECT

- 1. Tank vent valve wiring harness.
- 2. Hoses.
- 3. Close off hose to active carbon canister — spring clamp.
- 4. Tank vent valve (1).

INSTALL, CONNECT

- 1. Tank vent valve (1).
- 2. Hoses — remove spring clamps.
- 3. Tank vent valve wiring plug.

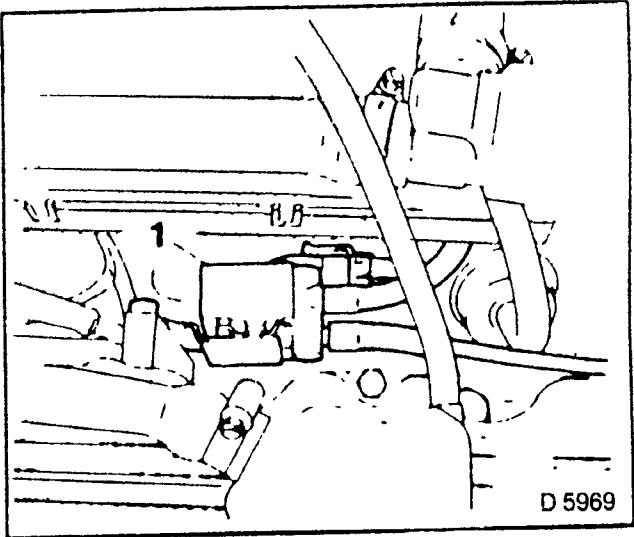


Fig. 258

Injection Valves — Remove and Install

REMOVE, DISCONNECT

- 1. Brake servo vacuum hose.
- 2. Diaphragm damper.
- 3. Plug strip for injection valves.
- 4. Idle speed adjuster.

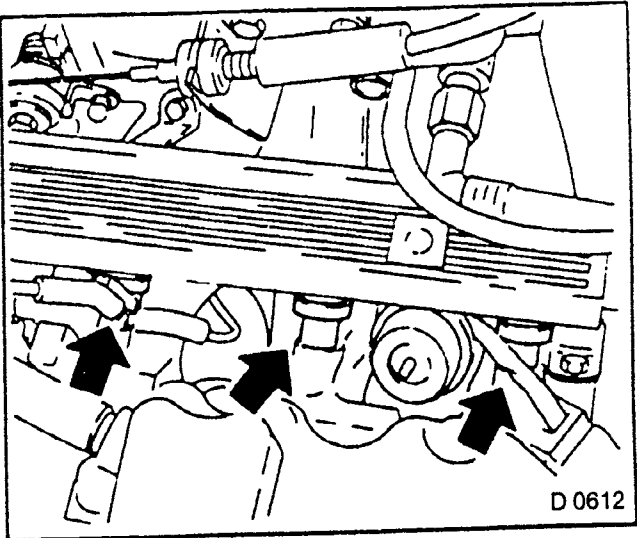


Fig. 259

REMOVE, DISCONNECT

- 1. Four spring clamps for injection valves — screwdriver.

WARNING:
FUEL ESCAPES
OBSERVE SAFETY MEASURES AND
NATIONAL REGULATIONS.

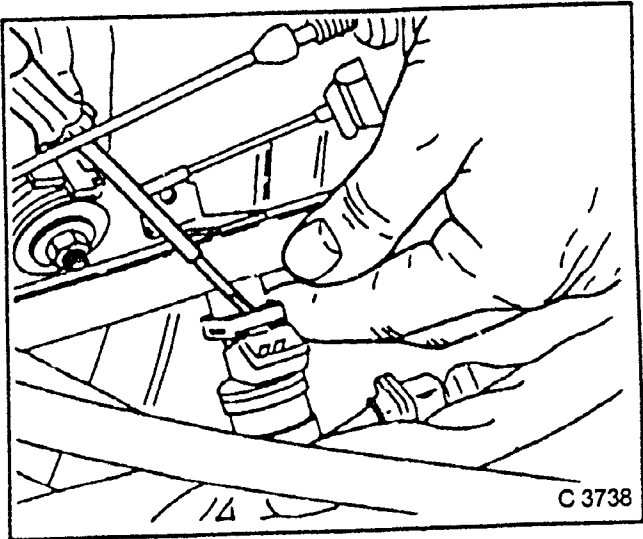


Fig. 260

REMOVE, DISCONNECT

- 1. Loosen fuel distributor pipe.
- 2. Fuel feed bracket.
- 3. Injection valve from distributor pipe.

INSTALL, CONNECT

- 1. Injection valve — new seal rings.
- 2. Retaining clips.
- 3. Fuel feed bracket.
- 4. Fuel distributor pipe.
- 5. Idle speed adjuster.
- 6. Plug strip for injection valves.
- 7. Diaphragm damper.
- 8. Brake servo vacuum hose.

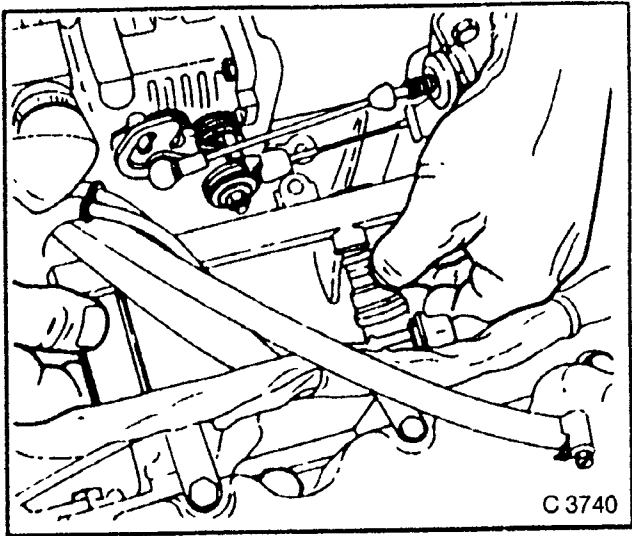


Fig. 261

Throttle Valve Potentiometer — Remove and Install

REMOVE, DISCONNECT

- 1. Wiring harness plug for throttle valve potentiometer.
- 2. Throttle valve potentiometer.

INSTALL, CONNECT

- 1. Throttle valve potentiometer.
- 2. Wiring harness plug for throttle valve potentiometer.
- 3. Note proper seating.

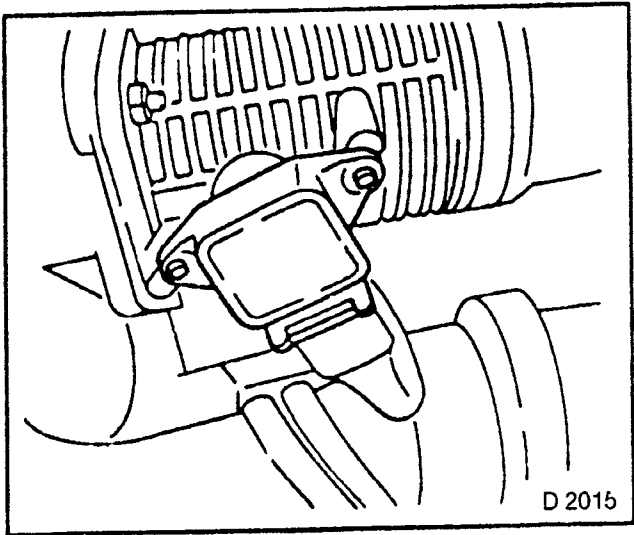


Fig. 262

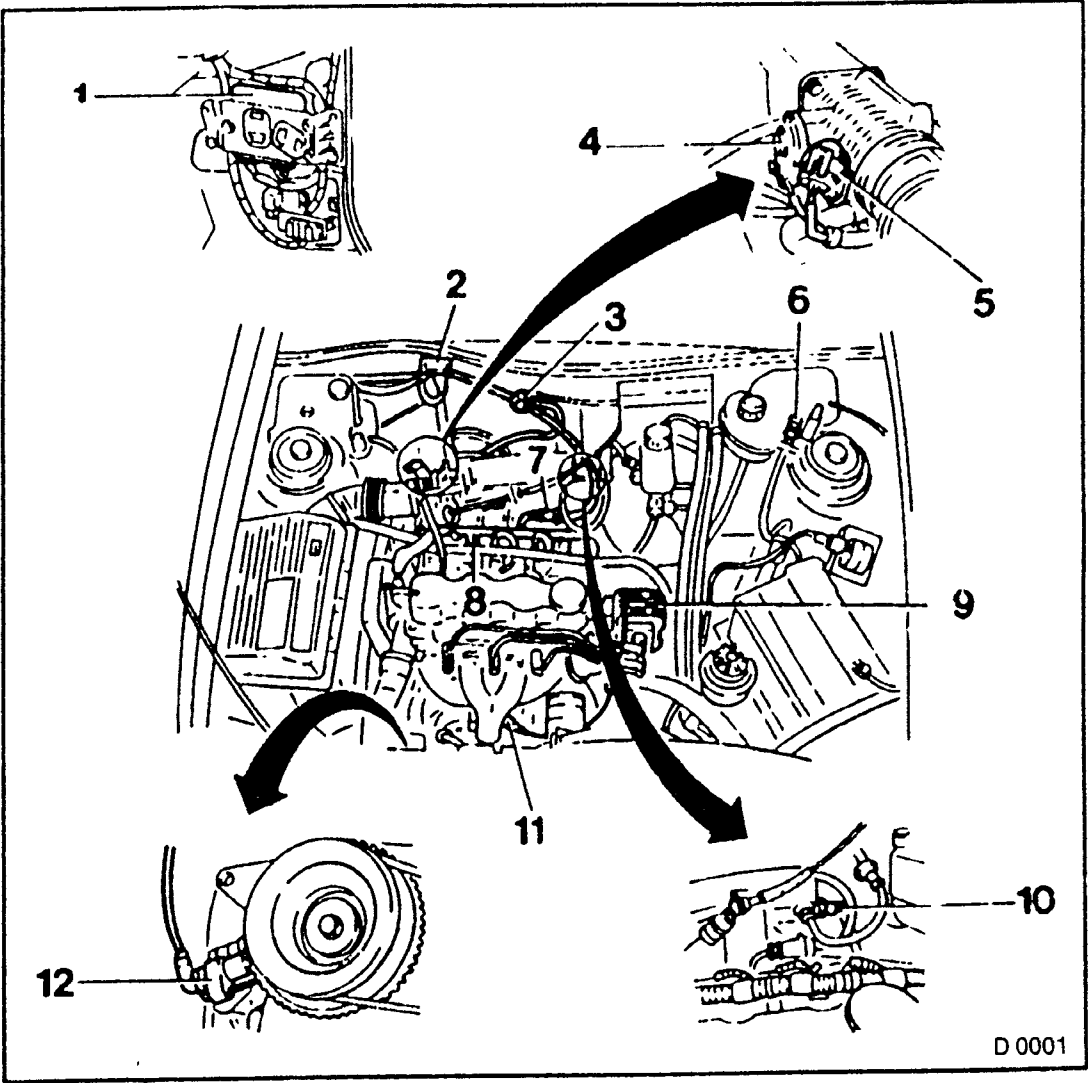


Fig 263

Bosch M1.5.4 (C 16 SE)

1. Control unit (installation position in right footwell).
2. Intake manifold pressure sensor.
3. Tank vent valve.
4. Throttle valve potentiometer.
5. Idle air control stepper motor.
6. Octane number plug.
7. Fuel pressure regulator.
8. Fuel distributor pipe with injection valves.
9. Dual spark ignition coil.
10. Intake air temperature sensor.
11. Oxygen sensor. (N/a to DMC).
12. Inductive pulse pick-up.

Intake Air Temperature Sensor — Remove and Install (C 16 SE)

REMOVE, DISCONNECT

- 1. Wiring harness plug for intake air temperature sensor.
- 2. Intake air temperature sensor.

TIGHTEN (TORQUE)

- 1. Intake air temperature sensor to intake manifold — 27 Nm.
- 2. Intake air temperature sensor wiring plug.

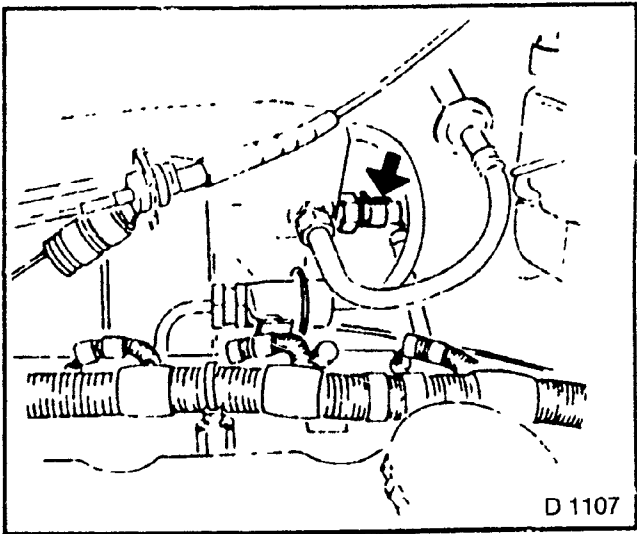


Fig. 264

Coolant Temperature Sensor — Remove and Install (C 16 SE)

REMOVE, DISCONNECT

- 1. Wiring harness plug for coolant temperature sensor.
- 2. Coolant temperature sensor.
- 3. Coolant escapes — place collecting pan underneath.

TIGHTEN (TORQUE)

- 1. Coolant temperature sensor with new seal ring to cylinder head — 20 Nm.
- 2. Wiring harness plug for coolant temperature sensor.
- 3. Fill up and bleed cooling system.

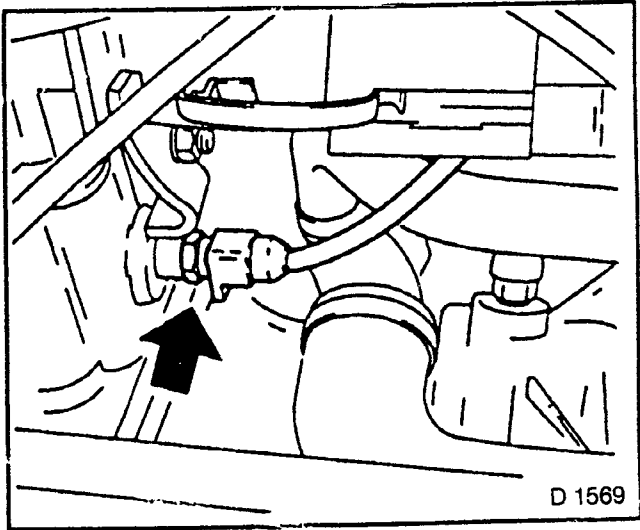


Fig. 265

Intake Air Temperature Sensor — Remove and Install (16NZ/18SE/20 SEH)

REMOVE, DISCONNECT

- 1. Wiring harness plug for intake air temperature sensor.
- 2. Air intake hose.
- 3. Intake air temperature sensor.

WARNING:
DO NOT DAMAGE AIR INTAKE HOSE.

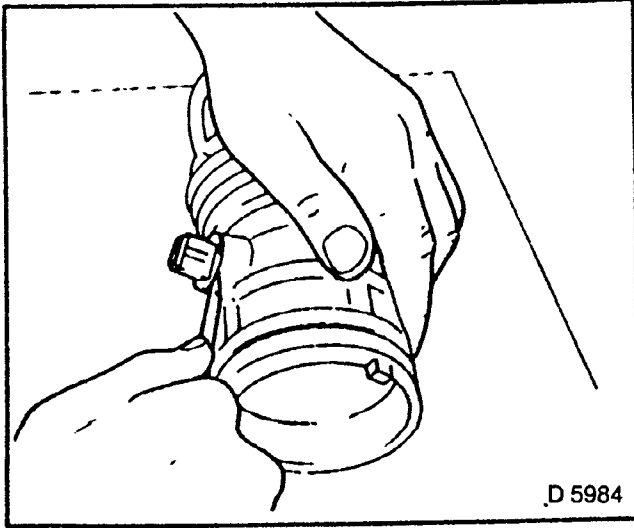


Fig. 266

INSTALL, CONNECT

1. Temperature sensor into air intake hose.
2. Note proper seating.
3. Air intake hose.
4. Wiring harness plug for intake air temperature sensor.

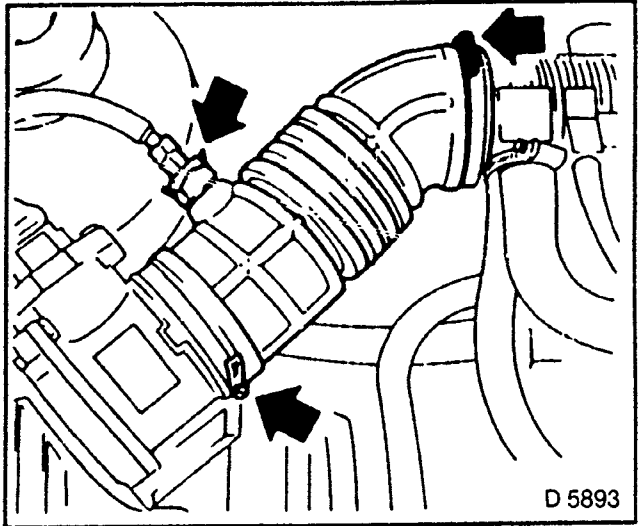


Fig. 267

Coolant Temperature Sensor — Remove and Install (C 16 NZ)**REMOVE, DISCONNECT**

1. Wiring harness plug for coolant temperature sensor.
2. Coolant temperature sensor from intake manifold.

NOTE:
COOLANT ESCAPES.

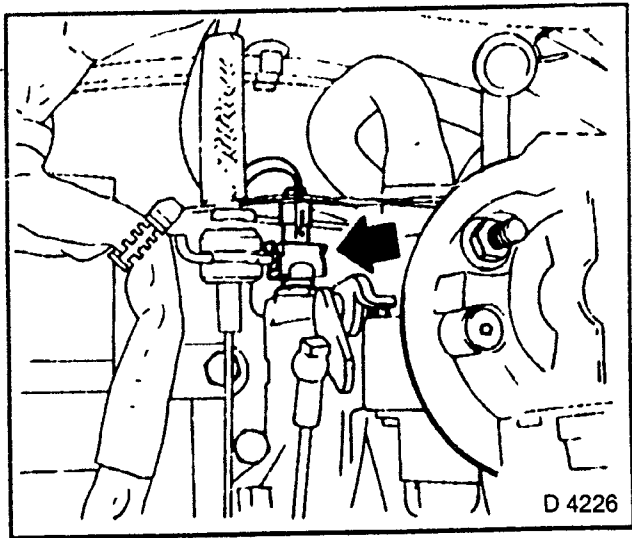


Fig. 268

TIGHTEN (TORQUE)

1. Coolant temperature sensor with new seal ring to intake manifold — 20 Nm.
2. Wiring harness plug for coolant temperature sensor.
3. Fill up and bleed cooling system.

Coolant Temperature Sensor — Remove and Install (18 SE/20 SEH)

REMOVE, DISCONNECT

- 1. Wiring harness plug for coolant temperature sensor.
- 2. Coolant temperature sensor.
- 3. Coolant escapes — place collecting basin underneath.

TIGHTEN (TORQUE)

- 1. Coolant temperature sensor to intake manifold — 10 Nm.
- 2. Wiring harness plug for coolant temperature sensor.
- 3. Fill up and bleed cooling system.

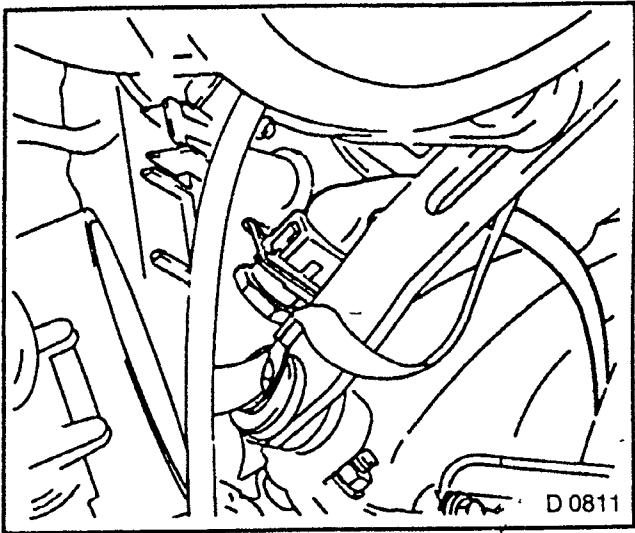


Fig. 269

Control Unit — Remove and Install (18 SE/20 SEH)

REMOVE, DISCONNECT

- 1. Turn off ignition.
- 2. Storage compartment.
- 3. Right footwell panelling.
- 4. Wiring harness plug.
- 5. Bracket with control unit.
- 6. Control unit from bracket.

INSTALL, CONNECT

- 1. Control unit to bracket.
- 2. Bracket with control unit.
- 3. Wiring harness plug.
- 4. Footwell panelling.
- 5. Storage compartment.

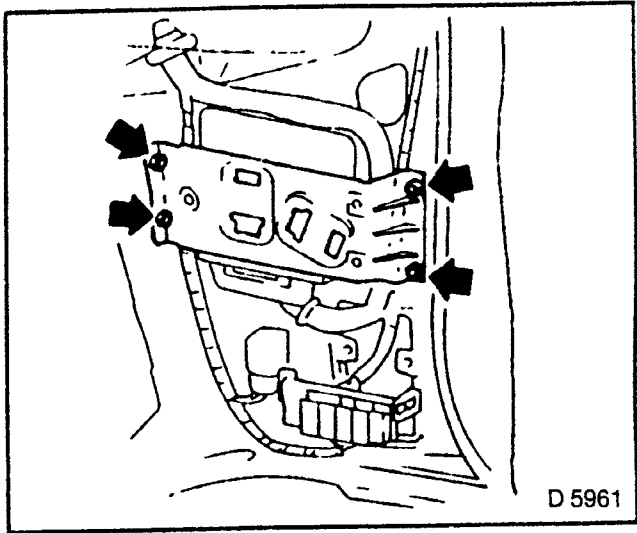


Fig. 270

Control Unit — Remove and Install (C 16 SE)

REMOVE, DISCONNECT

- 1. Switch off ignition.
- 2. Storage compartment.
- 3. Right footwell panelling.
- 4. Bracket with control unit.
- 5. Wiring harness plug.
- 6. Control unit (1) from bracket.

NOTE:
CONTROL UNIT CONSISTS OF TWO PARTS:
BASIC CONTROL UNIT
PROGRAMME MEMORY (PROM)

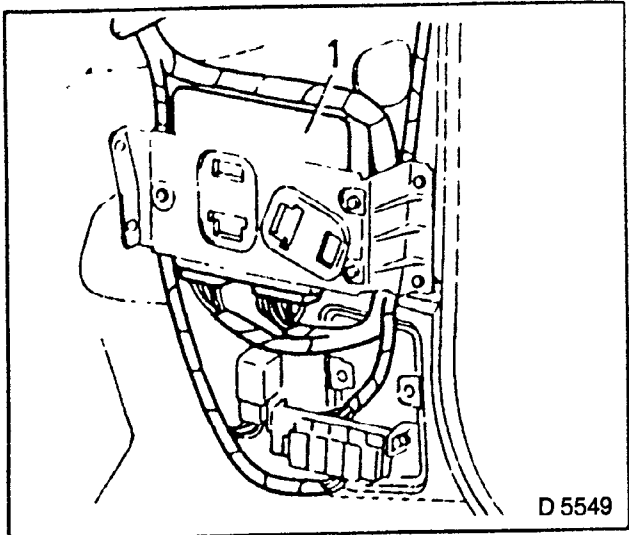


Fig. 271

NOTE:

Control unit in order, programme memory defective:
Install new programme memory in existing control unit.
Programme memory in order, control unit defective:
Install existing programme memory in new control unit from Service — it is supplied without programme memory.

DISASSEMBLE

- 1. Control unit.
- 2. Remove programme memory cover.
- 3. Release programme memory and lift it out.

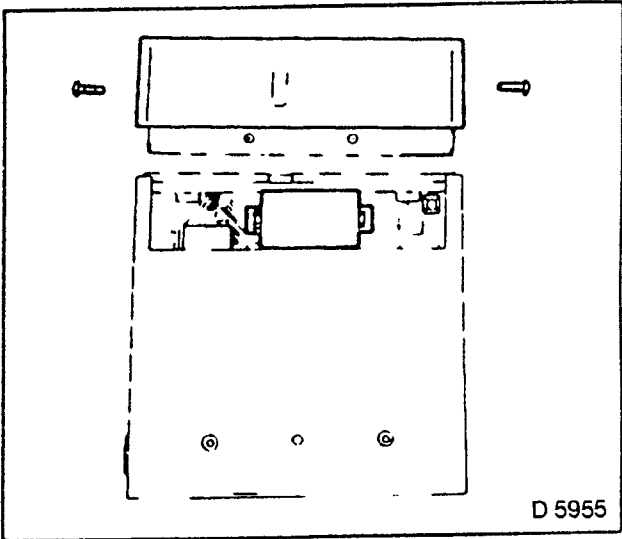


Fig. 272

Intake Manifold Pressure Sensor — Remove and Install (C 16 SE, C 16 NZ)

REMOVE, DISCONNECT

- 1. Lift water deflector.
- 2. Vacuum hose.
- 3. Wiring harness plug.
- 4. Intake manifold pressure sensor.

INSTALL, CONNECT

- 1. Intake manifold pressure sensor.
- 2. Wiring harness plug.
- 3. Vacuum hose.
- 4. Water deflector.

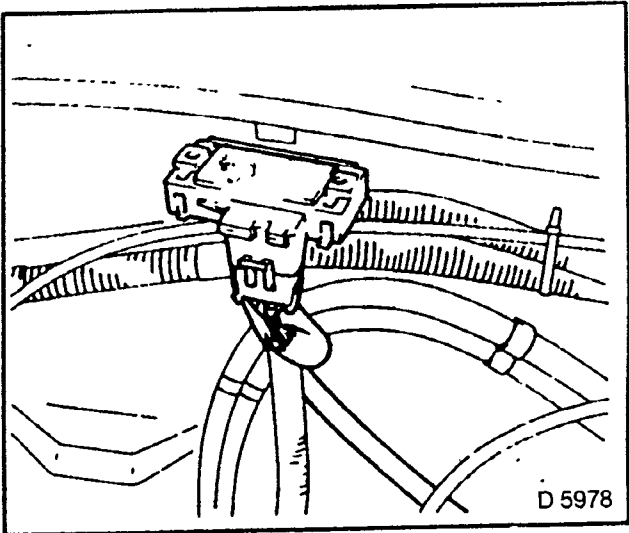


Fig. 273

NOTE:

THE VACUUM HOSE MUST BE INSTALLED ALWAYS FALLING FROM INTAKE MANIFOLD PRESSURE SENSOR TO THROTTLE VALVE HOUSING.

Ignition Distributor — Remove and Install (14 NV, C 16 NZ)

REMOVE, DISCONNECT

- 1. Mark position.
- 2. Wiring harness plug.
- 3. Hose from vacuum unit (if present).
- 4. Distributor cap.
- 5. Ignition distributor.

INSTALL, CONNECT

- 1. Ignition distributor on marking.
- 2. Distributor cap.
- 3. Hose on vacuum unit (if present).
- 4. Wiring harness plug.

INSPECT

- 1. Adjust ignition.

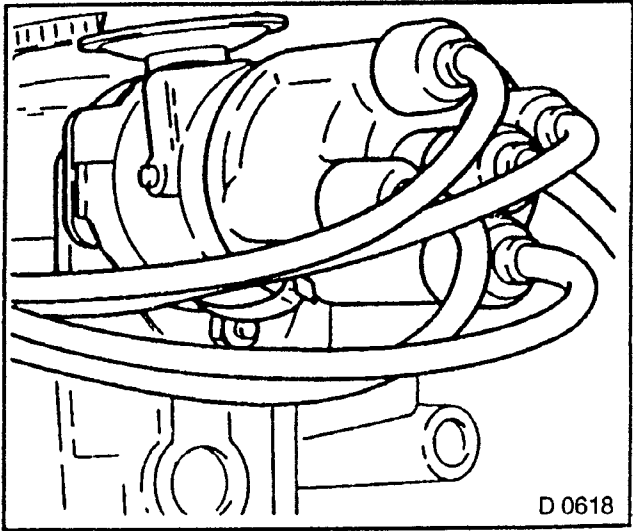


Fig. 274

Ignition Basic Adjustment (14 NV)

CHECKING CONDITIONS:
Oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$

ENGINE OFF
Vacuum hose removed from vacuum unit
Opel Tester connected.

START ENGINE
Speed between 700 rpm and 1000 rpm.

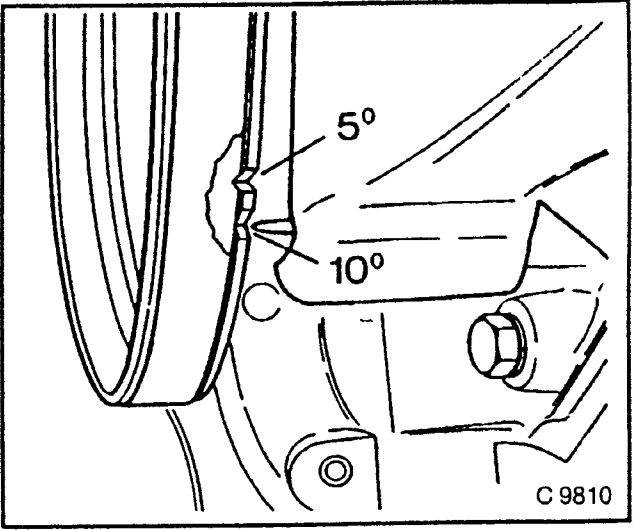


Fig. 275

INSPECT

- 1. Firing angle — nominal value: 5° BTDC.
If necessary correct ignition basic adjustment by turning distributor.
- 2. Install vacuum hose on vacuum unit.

NOTE:
**AFTER BASIC IGNITION
ADJUSTMENT — CHECK IDLE
SPEED AND CO CONTENT IN
EXHAUST AND IF NECESSARY
ADJUST.**

High Voltage Distributor — Remove and Install (18 SE/20 SEH)

REMOVE, DISCONNECT

High voltage distributor cap — MKM-604-A.

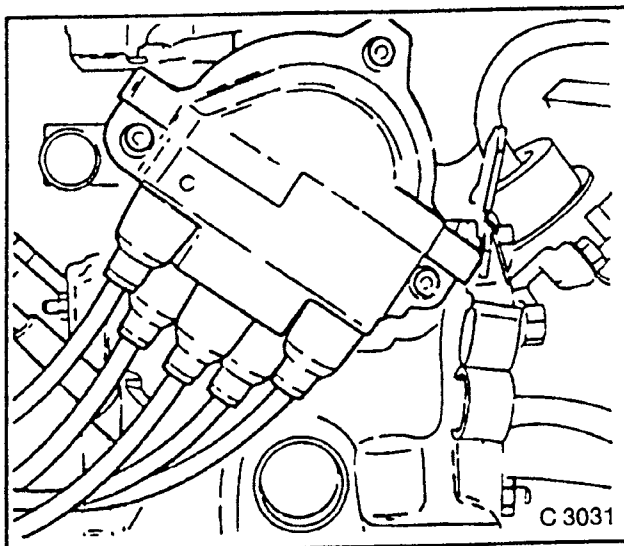


Fig. 276

REMOVE, DISCONNECT

1. Dust cover.
2. High voltage distributor rotor.

INSTALL, CONNECT

1. High voltage distributor rotor.
2. Dust cover.
3. High voltage distributor cap.
4. Insert bolts with Locking Compound.

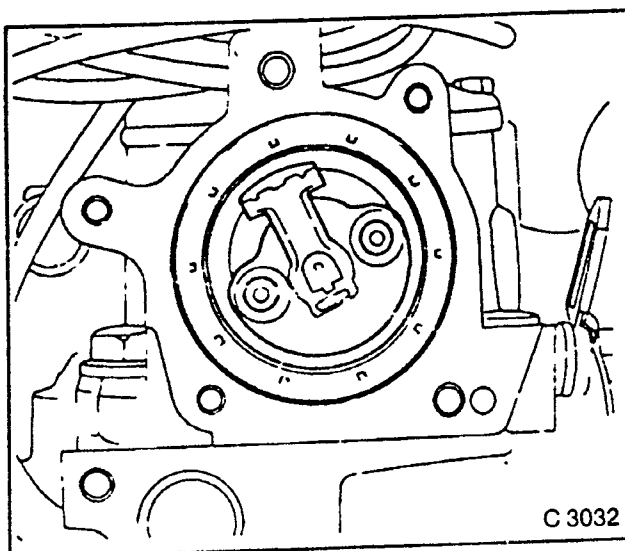


Fig. 277

Ignition Coil — Remove and Install (14 NV, 18 SE/20 SEH)

REMOVE, DISCONNECT

1. Wiring harness plug.
2. Ignition coil.

INSTALL, CONNECT

1. Ignition coil.
2. Wiring harness plug.

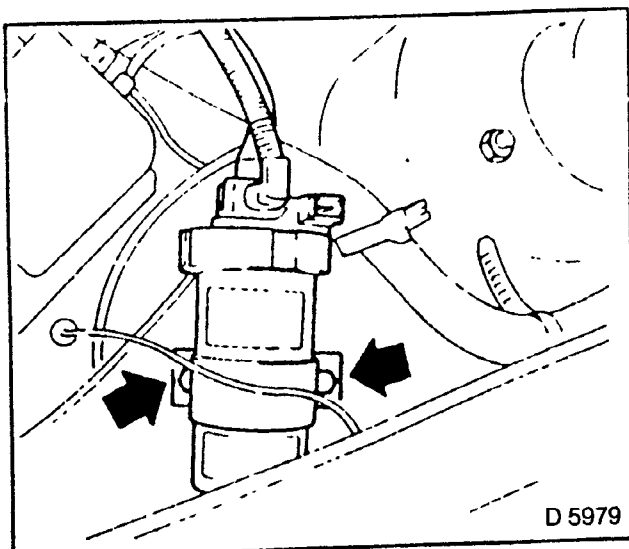


Fig. 278

Ignition Coil — Remove and Install (C 16 NZ)

REMOVE, DISCONNECT

- 1. Wiring harness plug.
- 2. Ignition coil.

INSTALL, CONNECT

- 1. Ignition coil.
- 2. Wiring harness plug.

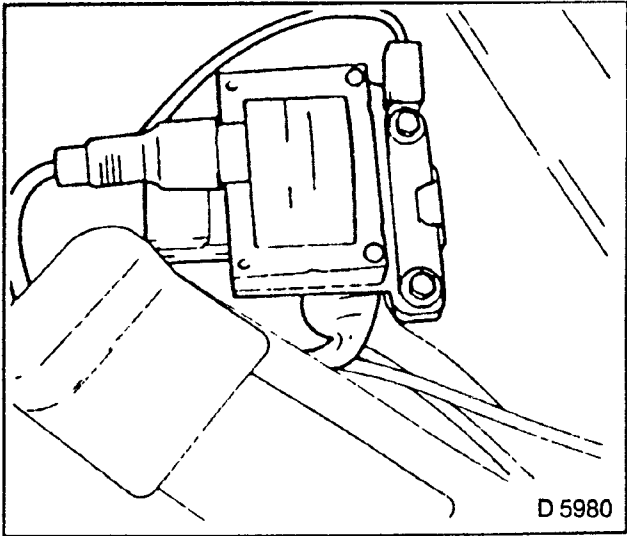


Fig. 279

Dual Spark Ignition Coil — Remove and Install (C 16 SE)

REMOVE, DISCONNECT

- 1. Ignition cable.
- 2. Wiring harness plug (1).
- 3. Fastening bolts (2).
- 4. Dual spark ignition coil.

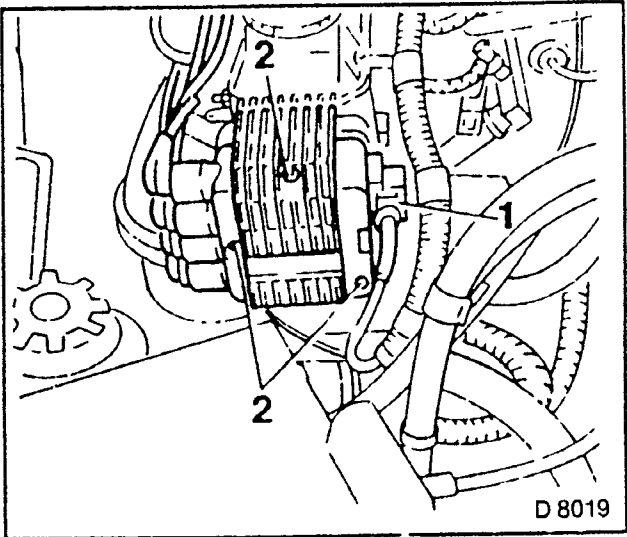


Fig. 280

INSTALL, CONNECT

- 1. Dual spark ignition coil — tightening torque 8 Nm.
- 2. Wiring harness plug.
- 3. Ignition cable — note firing sequence.

NOTE:

CYLINDER NUMBERS ARE ON EDGE OF DUAL SPARK IGNITION COIL HOUSING.

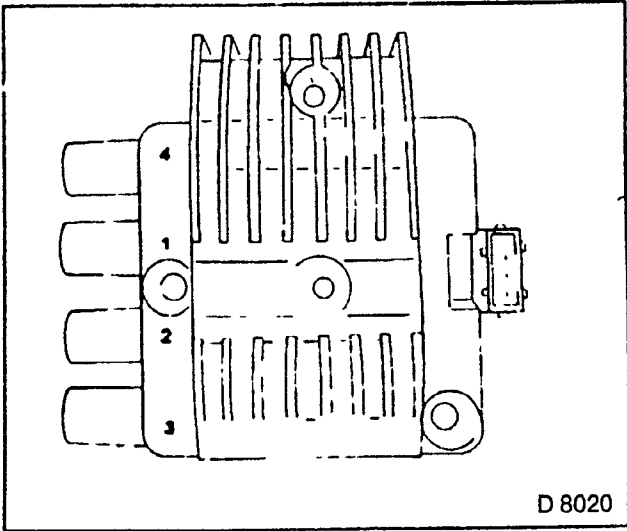


Fig. 281

Inductive Pulse Pick-up — Remove and Install (C 16 SE)

REMOVE, DISCONNECT

- 1. Disconnect wiring harness plug.
- 2. Detach wiring from wiring harness.

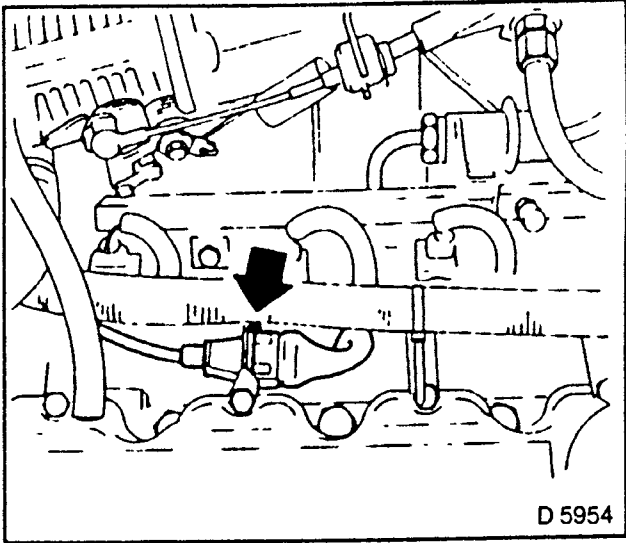


Fig. 282

REMOVE, DISCONNECT

- 1 Pulse pick-up from bracket.

INSTALL, CONNECT

- 1. Pulse pick-up into bracket — note thorough cleanliness.
- 2. Connect wiring harness plug.
- 3. Secure wiring to wiring harness.
Note proper installation of wiring.

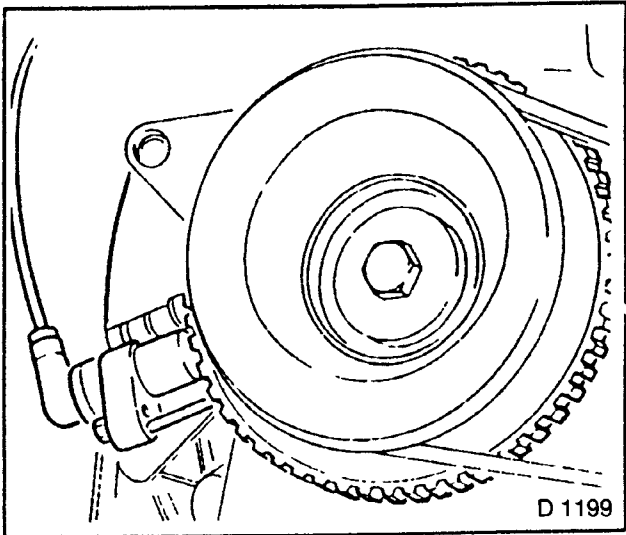


Fig. 283

Gap between Inductive Pulse Pick-up and Increment Disc — Check (C 16 SE)

MEASURE

Distance between inductive pulse pick-up and increment disc — feeler gauge.
Nominal value: $1,0 \pm 0,7$ mm.
If gap dimension is incorrect — replace bracket of inductive pulse pick-up.

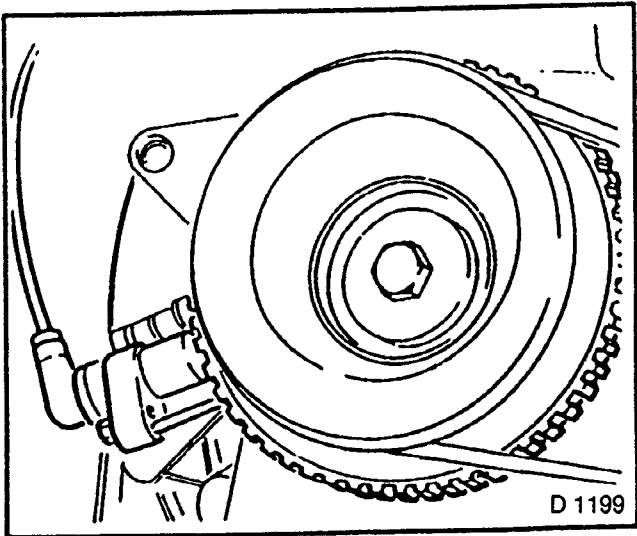


Fig. 284

**Inductive Pulse Pick-up —
Remove and Install
(18 SE, 20 SEH)**

REMOVE, DISCONNECT

- 1. Disconnect wiring harness plug — observe cable routing.
- 2. Inductive pulse pick-up with seal ring.

INSTALL, CONNECT

- 1. Inductive pulse pick-up with new seal ring.
- 2. Connect wiring harness plug — note correct cable routing.

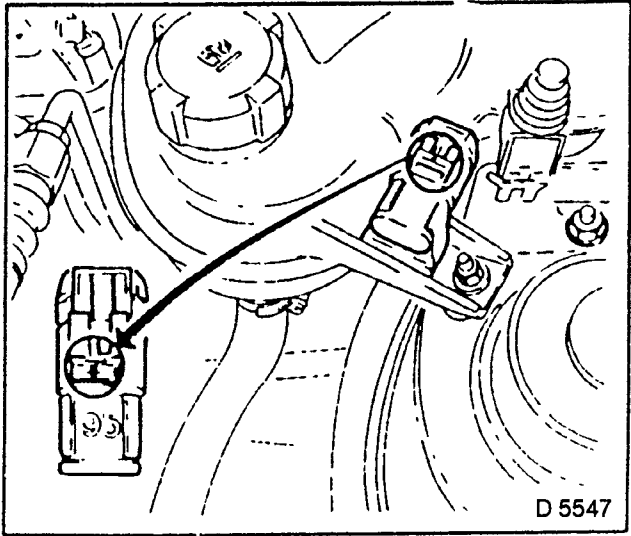


Fig. 285

**Octane Number Plug,
Code (all except 14 NV)**

- 1. Remove octane number plug from bracket.
- 2. Disconnect plug and turn so that arrow on bracket points to adjusted octane number.

Bosch Starter

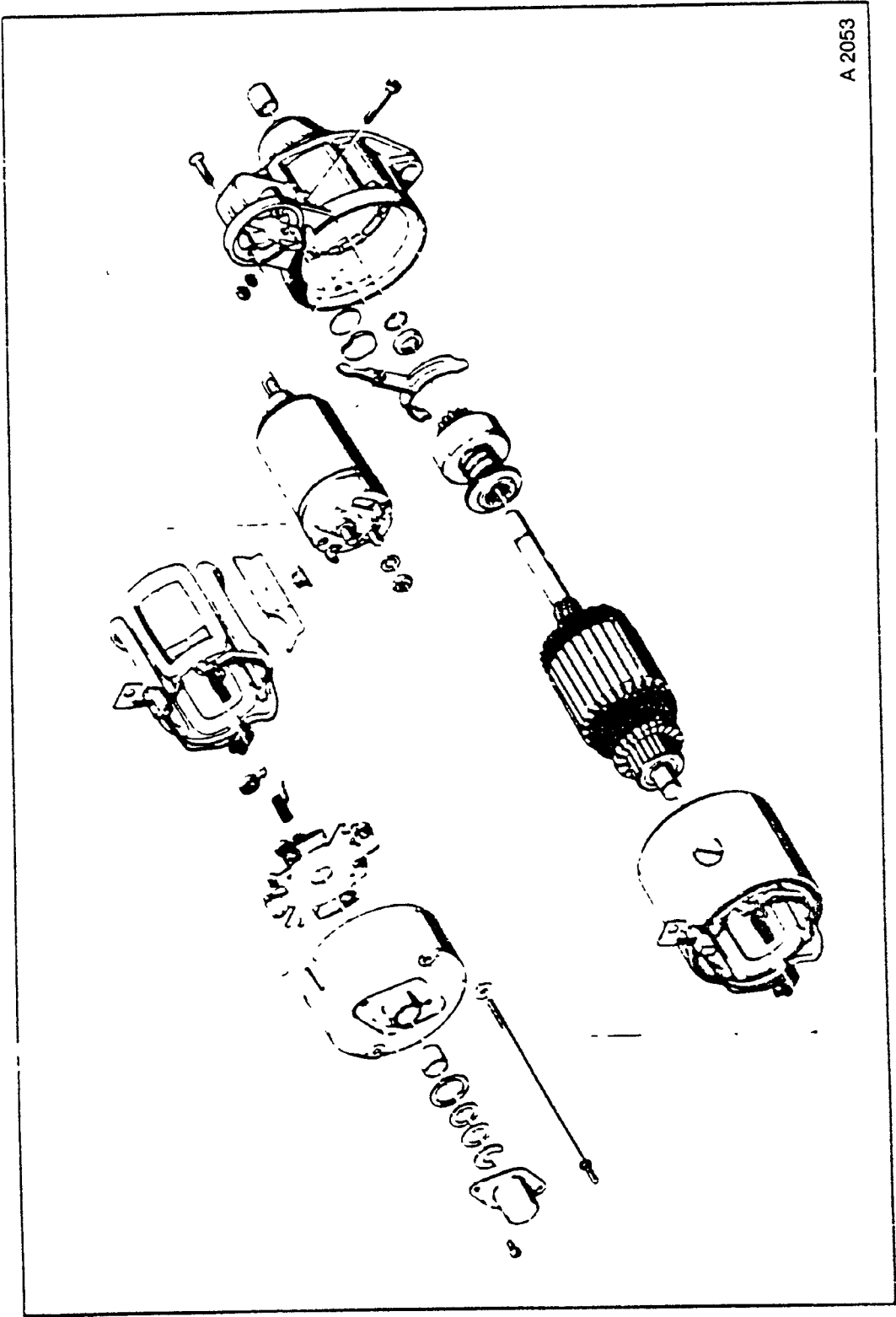


Fig. 286

Bosch Starter with Reduction Gear

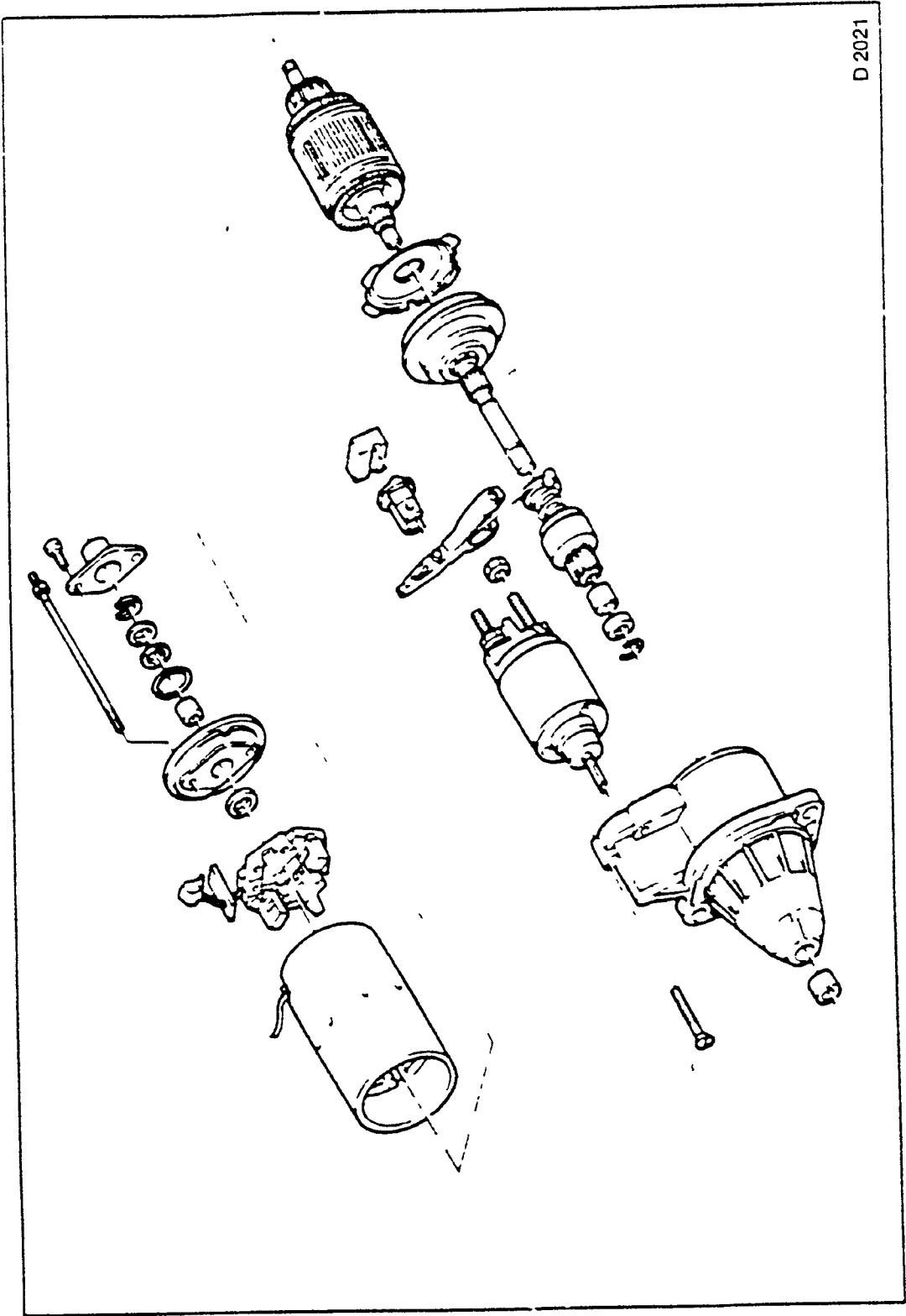


Fig. 287

Starter — Remove and Install

REMOVE, DISCONNECT

- 1. Ground lead from battery.
- 2. Wiring connections from starter.
- 3. Upper bolt (transmission side with 1,8 and 2,0 ltr. engines).
- 4. Lower bolt (engine side).
- 5. Bolt of starter support — if present — from engine block.

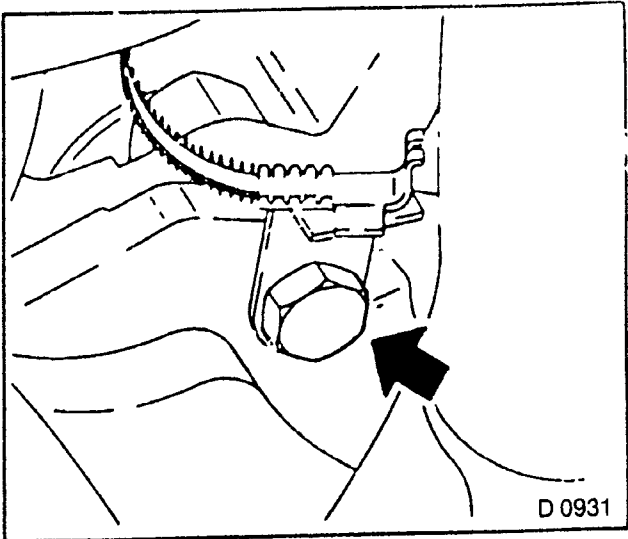


Fig. 288

TIGHTEN (TORQUE)

Engine	1,4/1,6 ltr.	1,8/2,0 ltr.
1. Starter to cylinder block		
— Engine side	25 Nm	45 Nm
2. — Transmission side	—	75 Nm
3. Starter support to cylinder block	—	25 Nm
4. Connect all wiring, connect battery		
5. Note correct condition and seating		

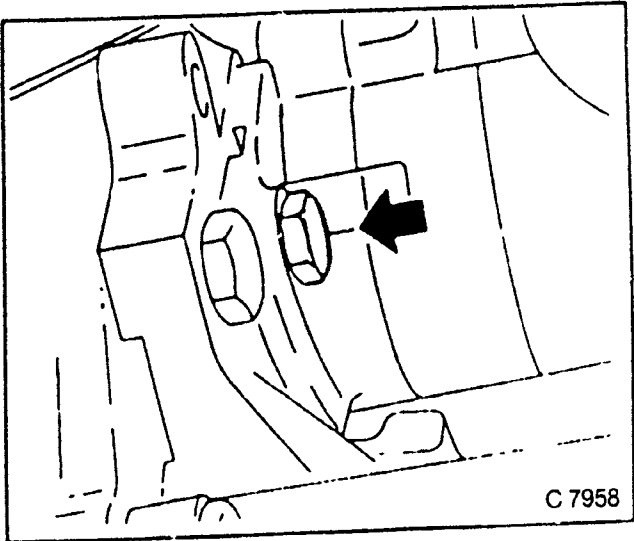


Fig. 289

Starter — Check (installed)

INSPECT

- 1. **BATTERY**
Properly charged and connection terminals in good condition (positive and negative).
- 2. **STARTER CABLE**
Perfect connection to starter and to battery positive terminal, maximum permissible voltage loss in cable should not be greater than 0,5 volts when starting — measure voltage at starter terminal “50” if voltage loss is larger.
Check contact part of ignition lock, selector lever switch, plug connections for adequate contact.
- 3. **STARTER**
Connect Opel Tester — note operating instructions.
Red connection clamp to positive terminal of battery.
Black connection clamp to negative terminal of battery.
Clamp — on probe to connecting lead between battery and starter — arrow on clamp — on probe must point away from battery. Put into direct gear, apply service and parking brakes and actuate starter (starter does not turn engine and blocks).

NOTE:
MAXIMUM LENGTH OF CHECK: FIVE SECONDS.

MEASURE

- Voltage approximately 8V
Current consumption approximately 410A
- | | |
|------------------------------|---|
| Voltage too low | — localize voltage drop |
| Current consumption too high | — short circuit in starter |
| Current consumption too low | — collector dirty
— carbon brushes worn
— ignition switch contact defective
— interruption |

When current consumption is too high or too low — overhaul starter.

Starter — Check (Removed and Disassembled) (Bosch)

CLEAN

- 1. Rotor windings.
- 2. Cleaning petrol (normal commercial) — only short contact permissible.

INSPECT

- 1. Rotor winding — for short — circuited turn with suitable tester.
- 2. Short-circuited turn — replace rotor.

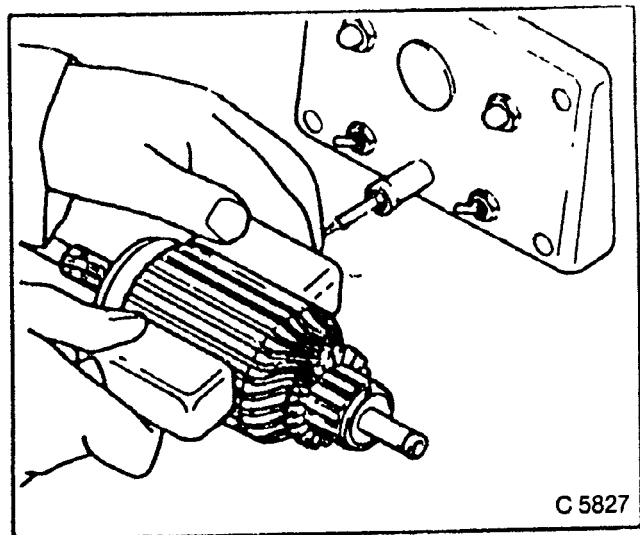


Fig. 290

INSPECT

1. Rotor winding — for short-circuit to ground.
2. Hold probes to armature core and corresponding collector lamination, test lamp must not illuminate.
3. Short-circuit to ground — replace rotor.

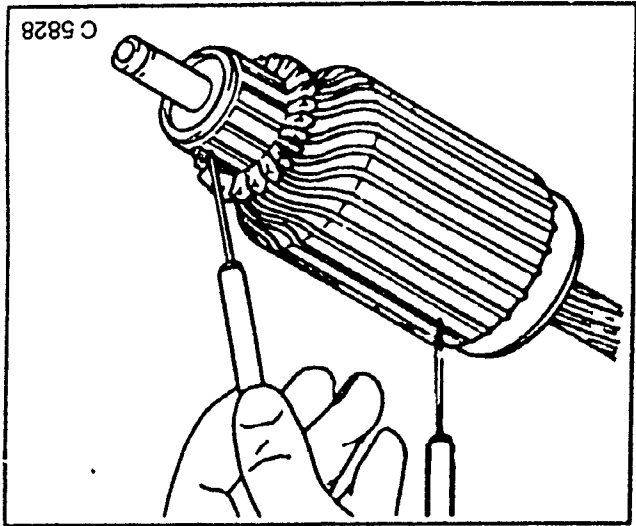


Fig. 291

INSPECT

1. Rotor winding — for interruption.
2. Set windings in circuit with ammeter.
3. Scan collector from lamination to lamination quickly.
- Test voltage: 2 volts.
4. Voltage variations indicate interruptions.
5. Interruption — replace rotor.

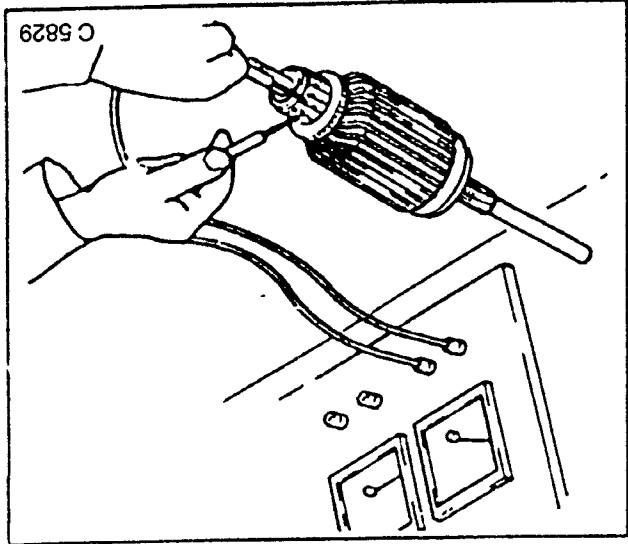


Fig. 292

INSPECT

1. Field winding (except stator with permanent magnets)
2. Replace burned or charred windings.
3. Field winding — for short-circuit to ground.
4. Hold probed to ends of windings and stator, test lamp must not illuminate.
5. Short-circuit to ground — replace field winding.

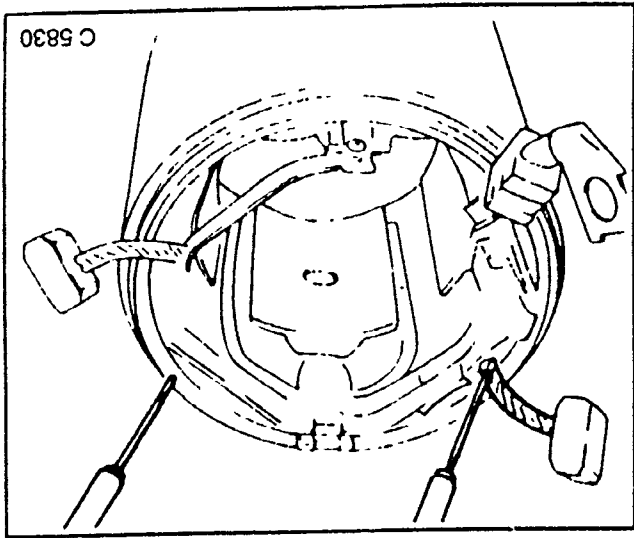


Fig. 293

INSPECT

1. Positive brush holder — for short-circuit to ground.
2. Hold probes on negative brush holder and positive brush holder, test lamp must not illuminate.
3. Short-circuit to ground of brush holder — replace brush holder plate.

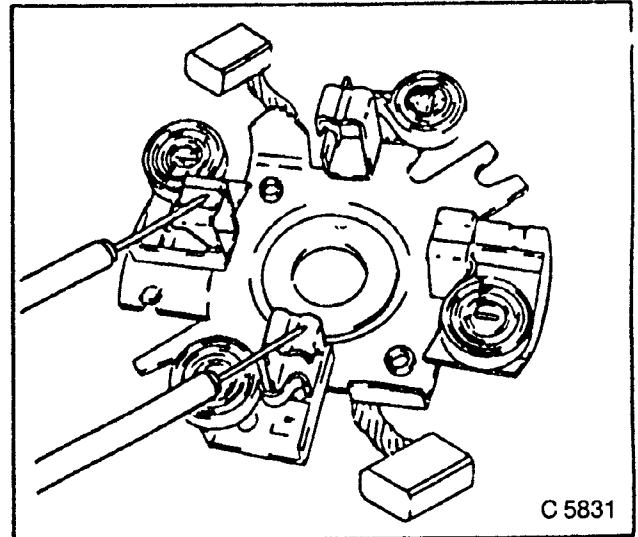


Fig. 294

Field Winding — Replace

(Except stator with permanent magnets)

STARTER REMOVED AND DISASSEMBLED**REMOVE, DISCONNECT**

1. Field winding.
2. Mark installation position of pole piece in housing.
3. Loosen four pole piece screws.

INSTALL, CONNECT

1. Field winding.
2. Note correct order of rubber grommet (1).
3. Align pole piece parallel to housing and tighten.

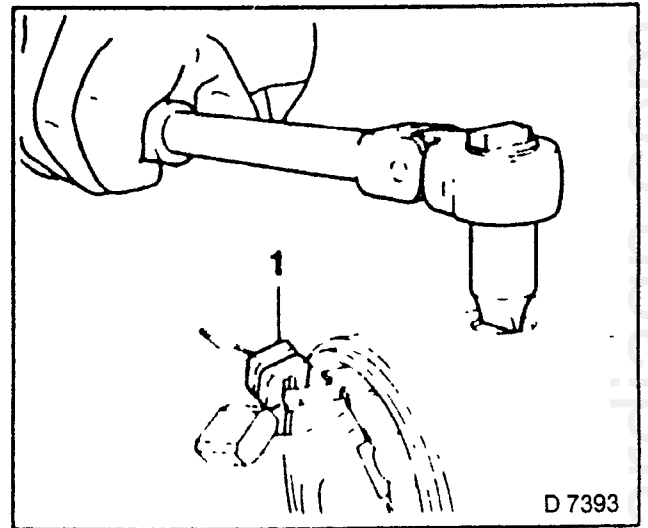


Fig. 295

Carbon Brushes — Replace (Bosch Starter)**STARTER REMOVED AND DISASSEMBLED**

Recommended if length falls below 13 mm (Bosch starter).

REMOVE, DISCONNECT

1. Unsolder carbon brushes from brush holder plate.

INSTALL, CONNECT

1. Solder carbon brushes.
2. Hold flex with flat nose pliers, to prevent solder from running up flex.

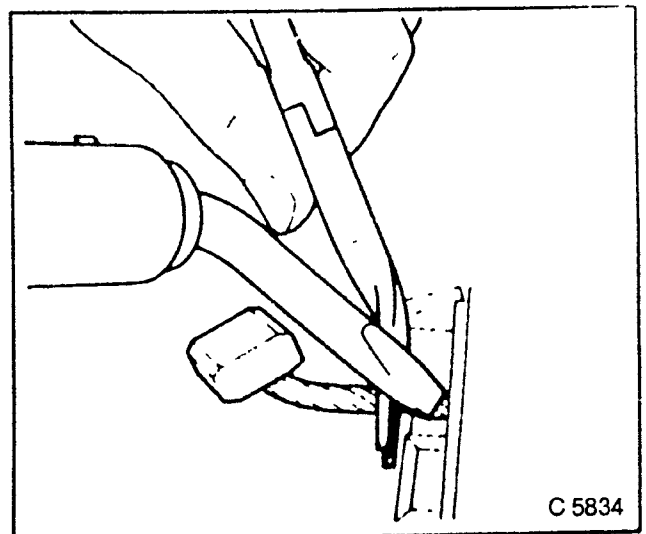


Fig. 296

**Bearing Bushings —
Replace (Bosch Starter)**

STARTER REMOVED AND DISASSEMBLED

NOTE:

- 1. Soak bearing bushings before installation at least 1/2 hour in oil.

REMOVE, DISCONNECT

- 1. Press bushing out of drive bearing — suitable drift

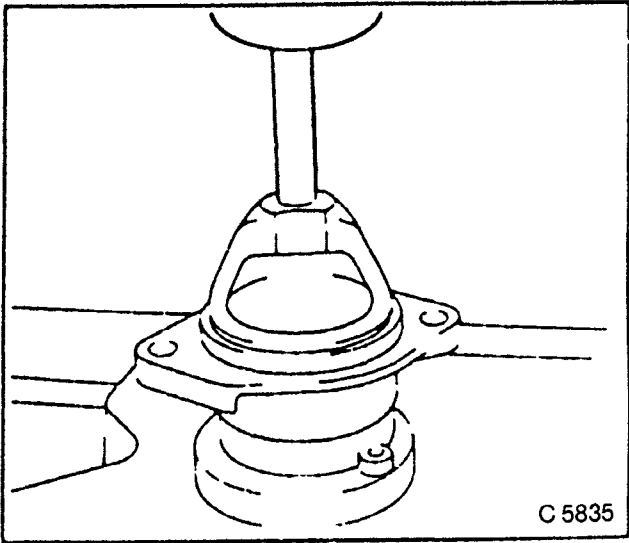


Fig. 297

INSTALL, CONNECT

- 1. Press bushing (1) flush into drive bearing — KM-266-A.

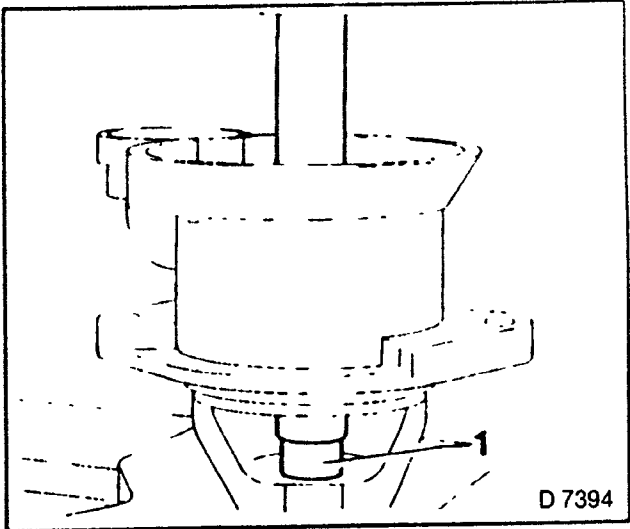


Fig. 298

REMOVE, DISCONNECT

- 1. Bushing from collector bearing — Bosch starter.
- 2. Press off with suitable drift — place pipe piece (1) underneath.

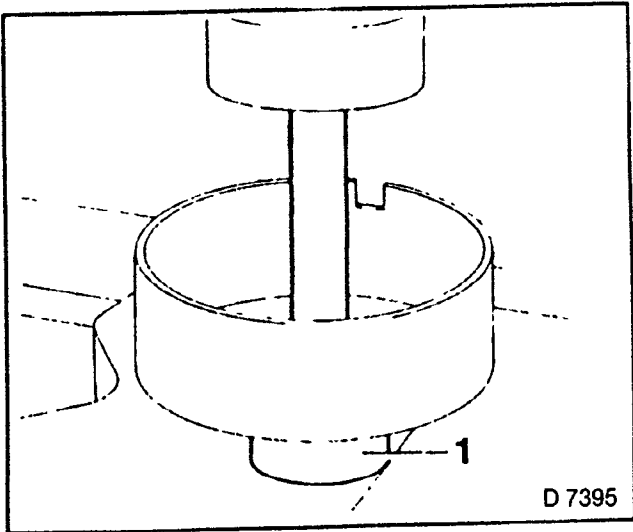


Fig. 299

INSTALL, CONNECT

- 1. Press bushing into collector bearing (1)
— KM-266-A.

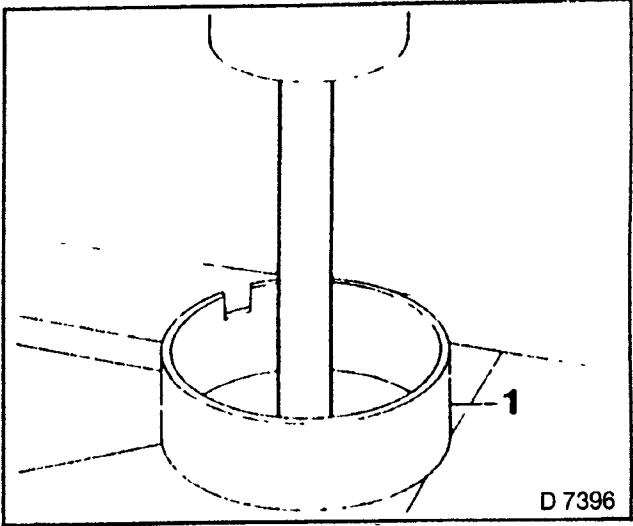


Fig. 300

REMOVE, DISCONNECT

- 1. Remove with inner extractor.

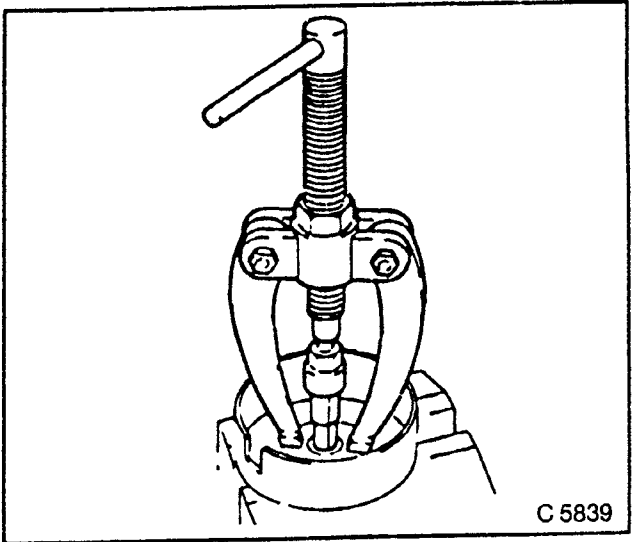


Fig. 301

INSTALL, CONNECT

- 1. Press in bushing — suitable drift.

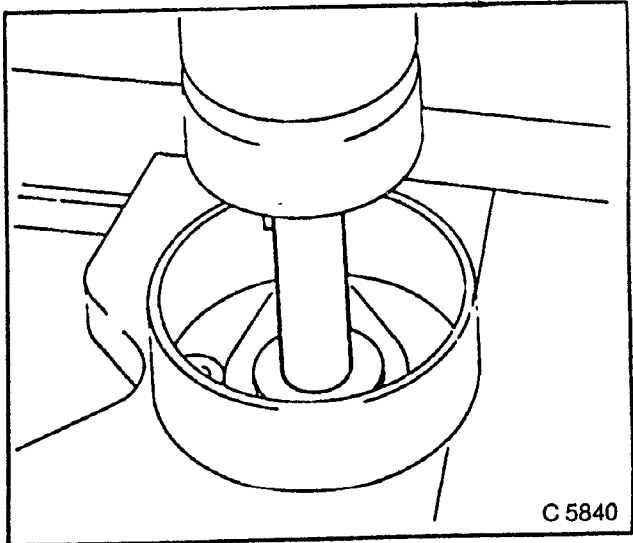


Fig. 302

Bosch Starter — Disassemble and Assemble

REMOVE, DISCONNECT

- 1. Support from starter (if present).
- 2. Bearing cap from collector.
- 3. Remove armature retaining clip (1) and spacer washer(s) (2) from armature shaft.
- 4. Note rubber seal (3).

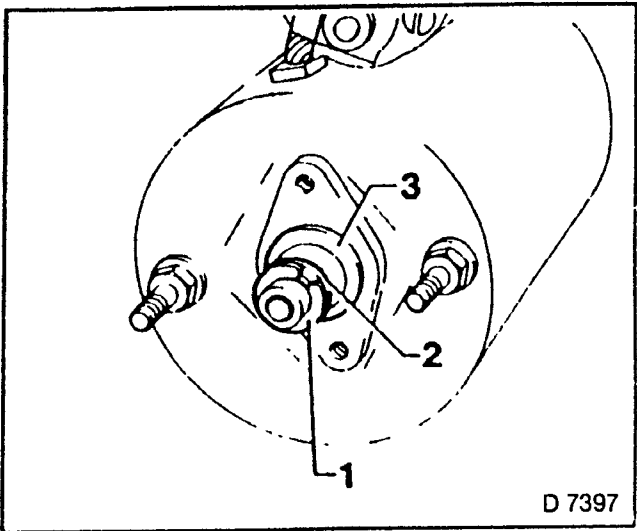


Fig. 303

REMOVE, DISCONNECT

- 1. Collector bearing.
- 2. Stator mounting screws (1).

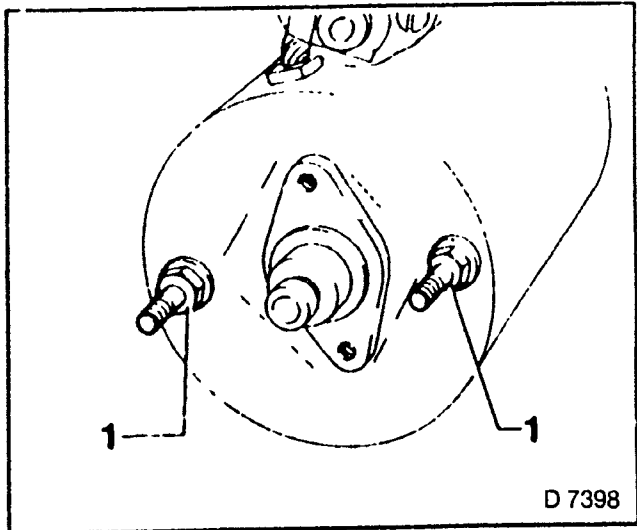


Fig. 304

REMOVE, DISCONNECT

- 1. Remove brush holder plate from rotor.
- 2. Remove positive carbon brushes (arrows) from brush holder using suitable remover hooks (bent electrode wire).

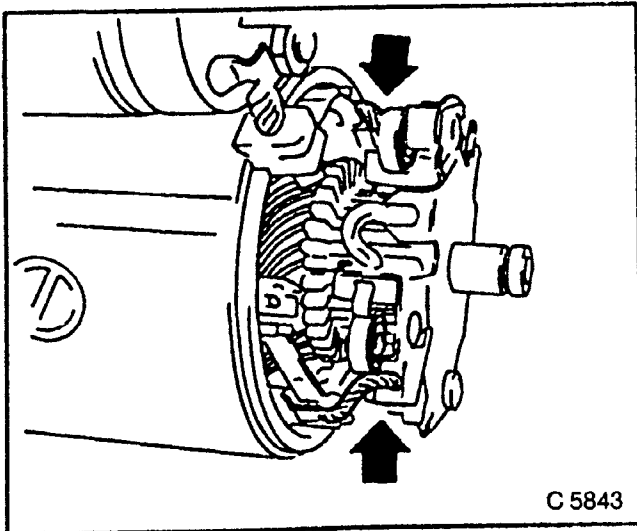


Fig. 305

REMOVE, DISCONNECT

- 1. Field windings connection — from solenoid switch.

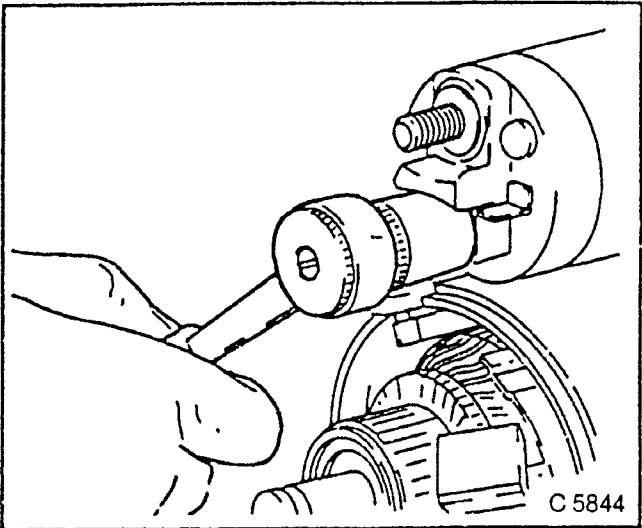


Fig 306

REMOVE, DISCONNECT

- 1. Solenoid switch.
- 2. Unscrew from drive bearing.
- 3. Pull back and detach.

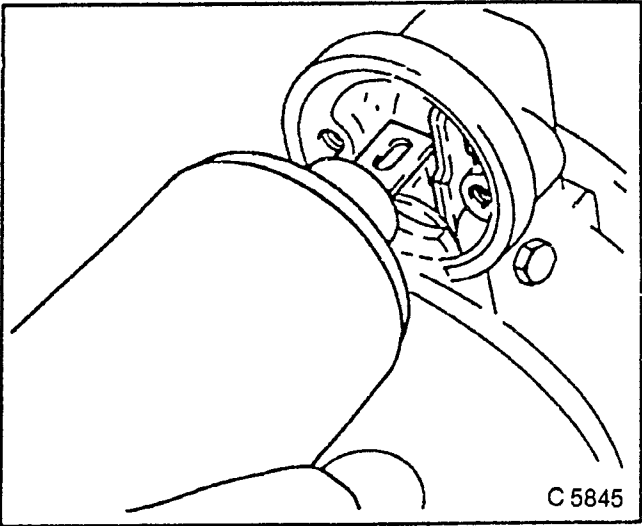


Fig. 307

REMOVE, DISCONNECT

- 1. Stator.
- 2. Axle for engaging lever — unscrew nut (1).
- 3. Sealing plate (2).

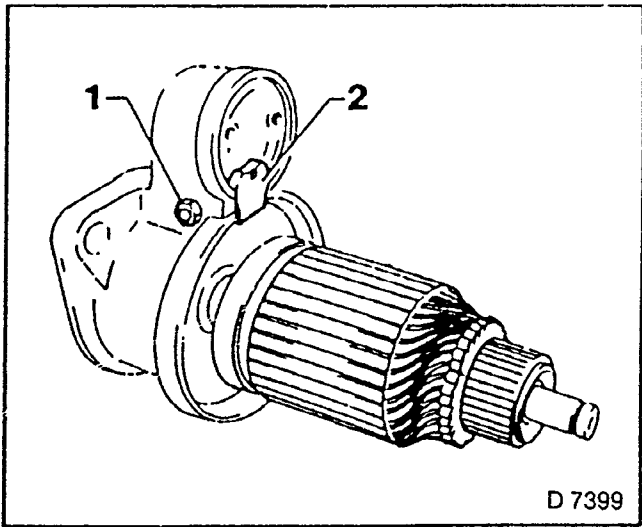


Fig. 308

REMOVE, DISCONNECT

- 1. Remove rotor with engaging lever (1) from drive bearing.
- 2. Remove engaging lever.

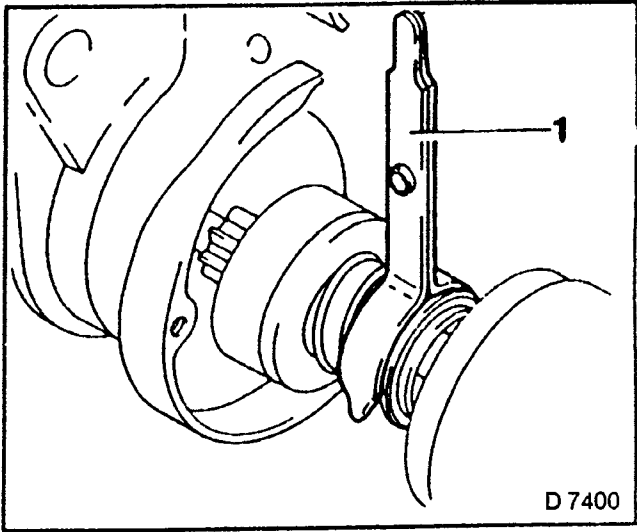


Fig. 309

REMOVE, DISCONNECT

- 1. Retaining ring (1).
- 2. Knock back onto armature shaft.

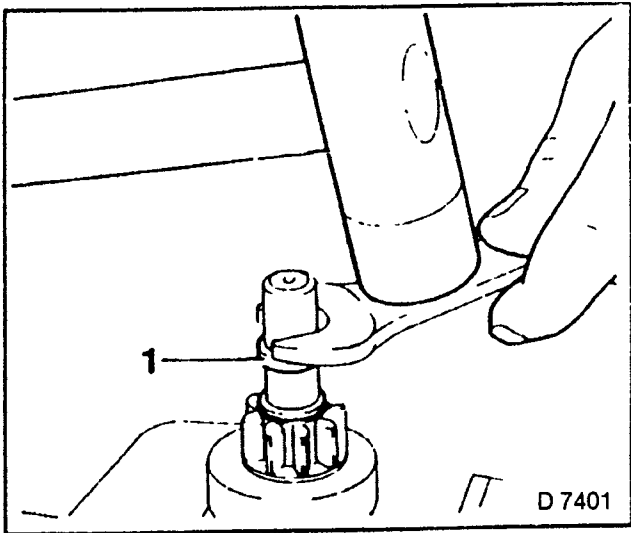


Fig. 310

REMOVE, DISCONNECT

- 1. Remove snap ring (1) — pliers (commercially available).
- 2. Remove retaining ring (2) and washer (3).

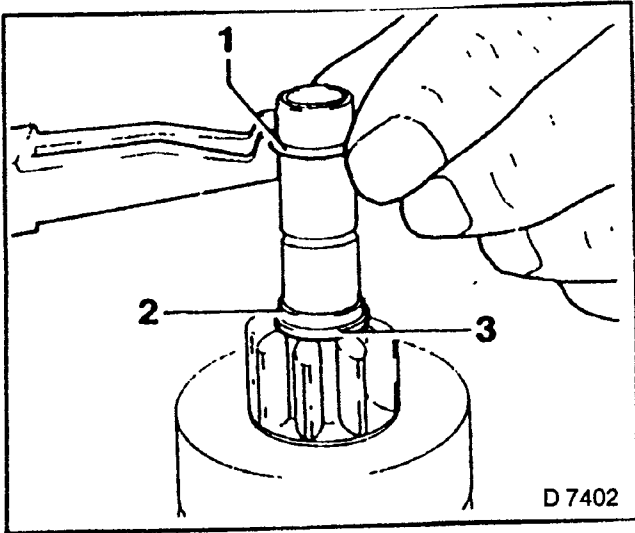


Fig. 311

REMOVE, DISCONNECT

- 1. Free wheel with pinion.

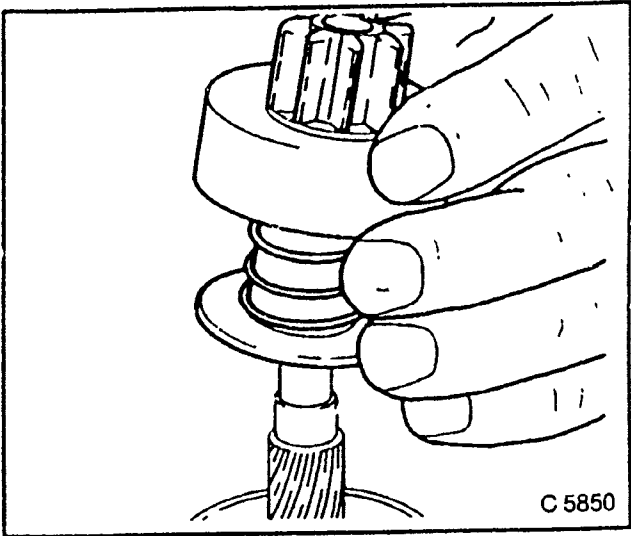


Fig. 312

INSTALL, CONNECT

- 1. Lubricate sliding parts — Grease.
- 2. Free wheel with pinion
 - washer
 - new snap ring
 - press retaining ring over snap ring with two wrenches.
- 3. Rotor with engaging lever — install into drive bearing.
- 4. Sealing plate — Install with metal side to drive bearing.
- 5. Collector bearing.
- 6. Note alignment of bores in brush holder.
- 7. Check starter.

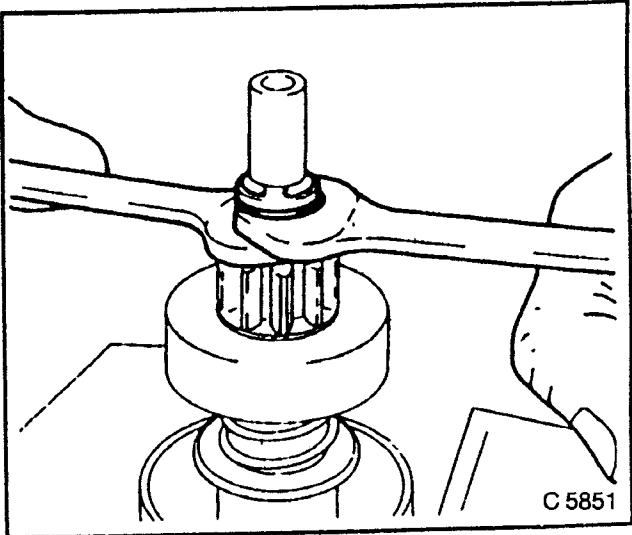


Fig. 313

Bosch Reduction Gear Starter — Disassemble and Assemble

REMOVE, DISCONNECT

- 1. Unscrew field winding connection (2).
- 2. Solenoid switch — loosen (1) and detach.

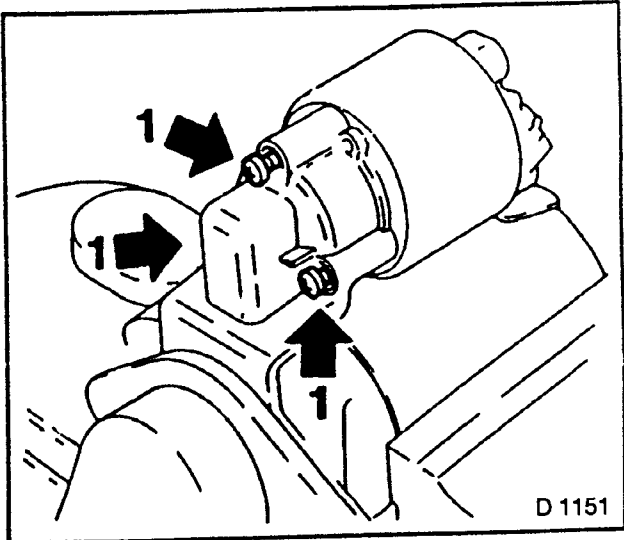


Fig. 314

REMOVE, DISCONNECT

- 1. Stator mounting screws (3).

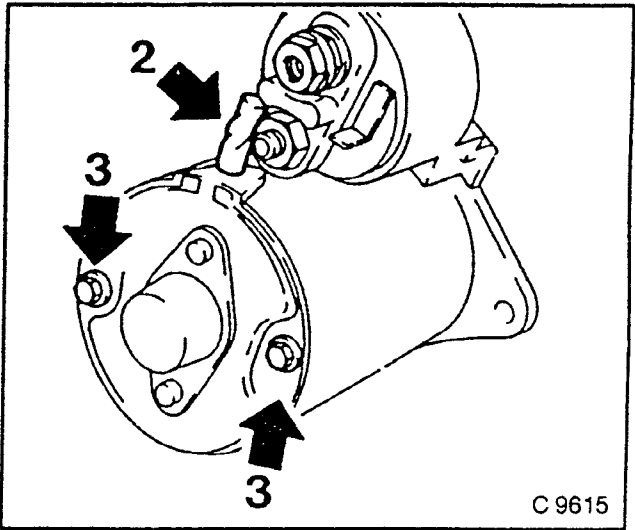


Fig. 315

REMOVE, DISCONNECT

- 1. Drive bearing.
- 2. Lever out sealing plate.
- 3. Pull out engaging lever bearing from guide.

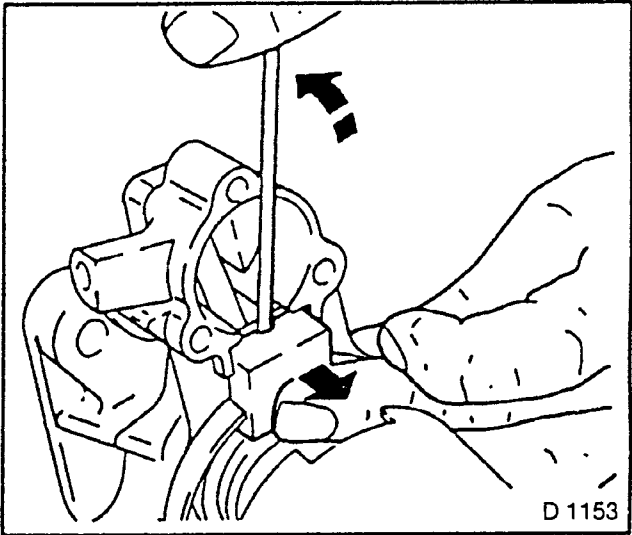


Fig 316

REMOVE, DISCONNECT

- 1. Pull out reduction gear from stator.
- 2. Metal cap.

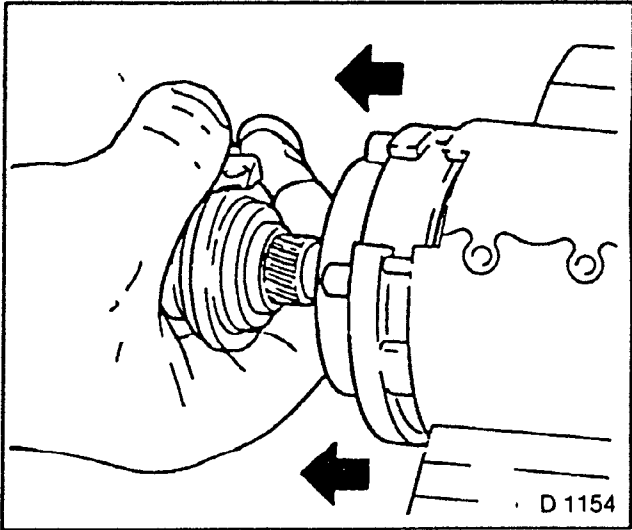


Fig. 317

REMOVE, DISCONNECT

- 1. Rotor from stator — with collector bearing.
- 2. Remove metal cap.

WARNING:
DO NOT DAMAGE PERMANENT
MAGNETS.

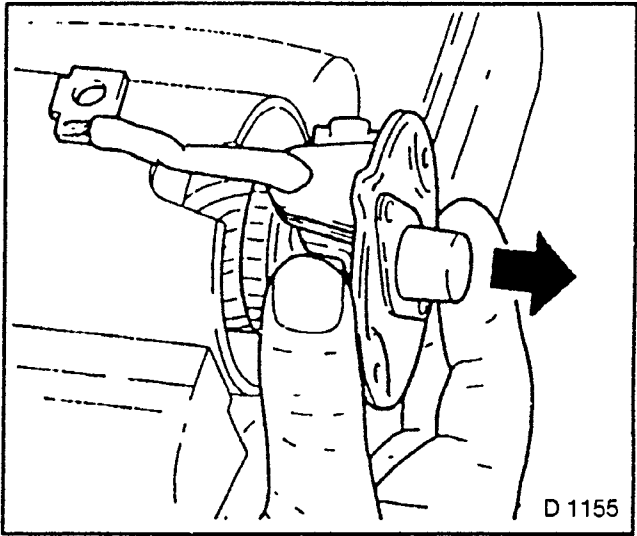


Fig. 318

REMOVE, DISCONNECT

- 1. Protective cap from collector bearing.

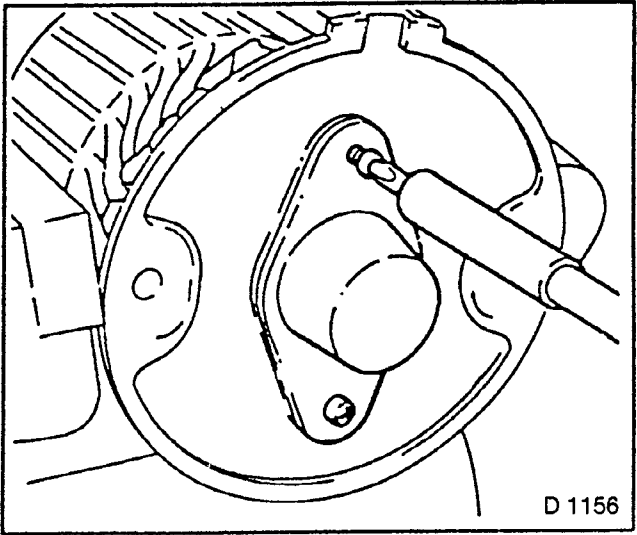


Fig. 319

REMOVE, DISCONNECT

- 1. Collector bearing.
- 2. Remove lock washer.
- 3. Washer.
- 4. Seal rings.

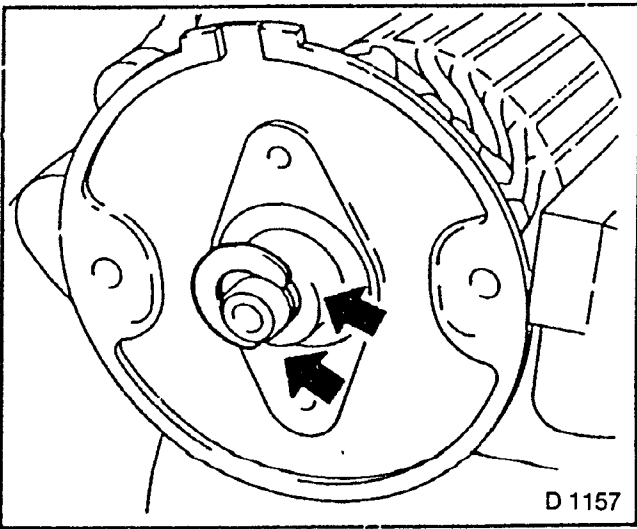


Fig. 320

REMOVE, DISCONNECT

- 1. Brush holder plate.
When re-using:
push carbon brushes onto suitable piece
of pipe (1) or shaft, to prevent contact
springs from springing out.

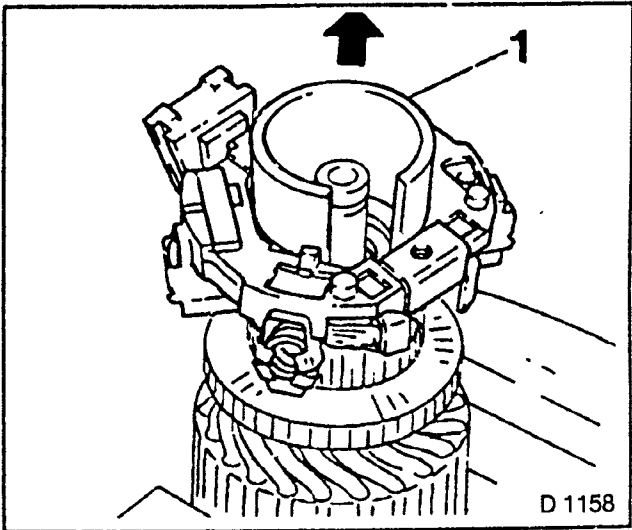


Fig. 321

REMOVE, DISCONNECT

- 1. Reduction ring gear (plastic).
- 2. Disconnect retaining ring and snap ring
— see operation “Bosch Starter,
Disassemble and Assemble”.
- 3. Remove lock washer (1) and washer (2).

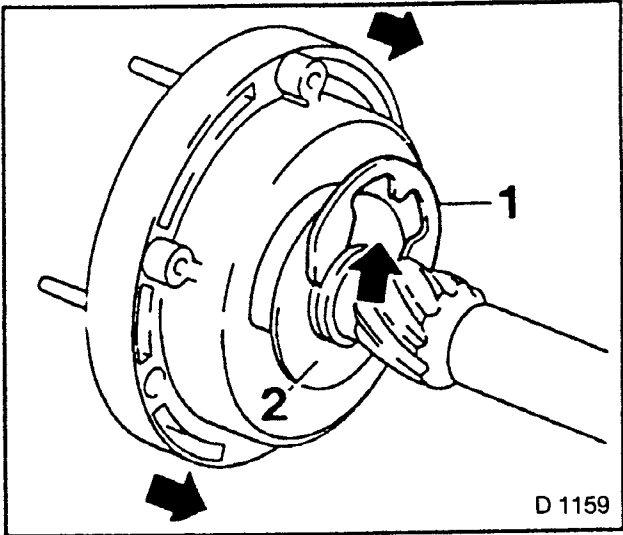


Fig. 322

REMOVE, DISCONNECT

- 1. Knock permanent magnets carefully from
stator.
Use soft metal drift.

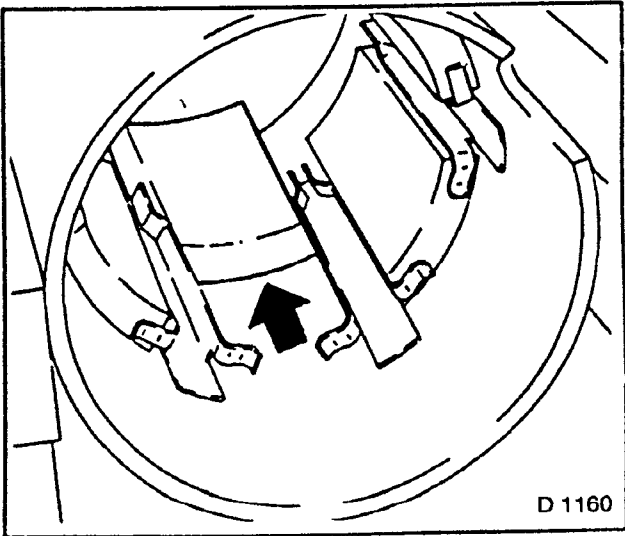


Fig. 323

INSTALL, CONNECT

1. Permanent magnets.
2. Reduction ring gear.
3. Rotor.
4. Brush holder plate.
5. Collector bearing.
6. Bearing cap.
7. Insert seal ring (arrow).
8. Solenoid switch.

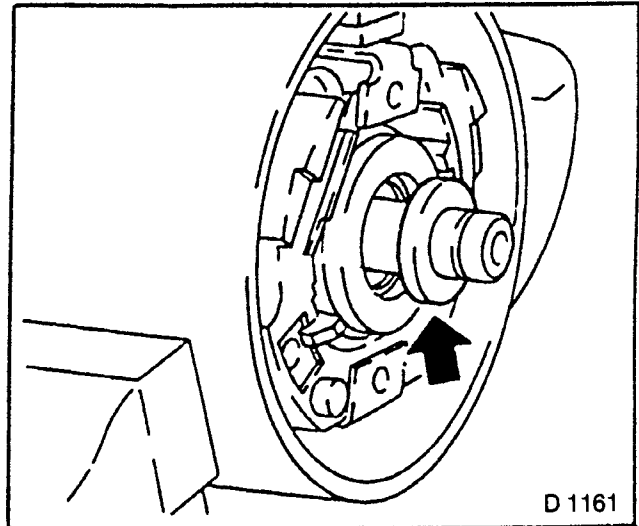


Fig. 324

Bosch Alternator

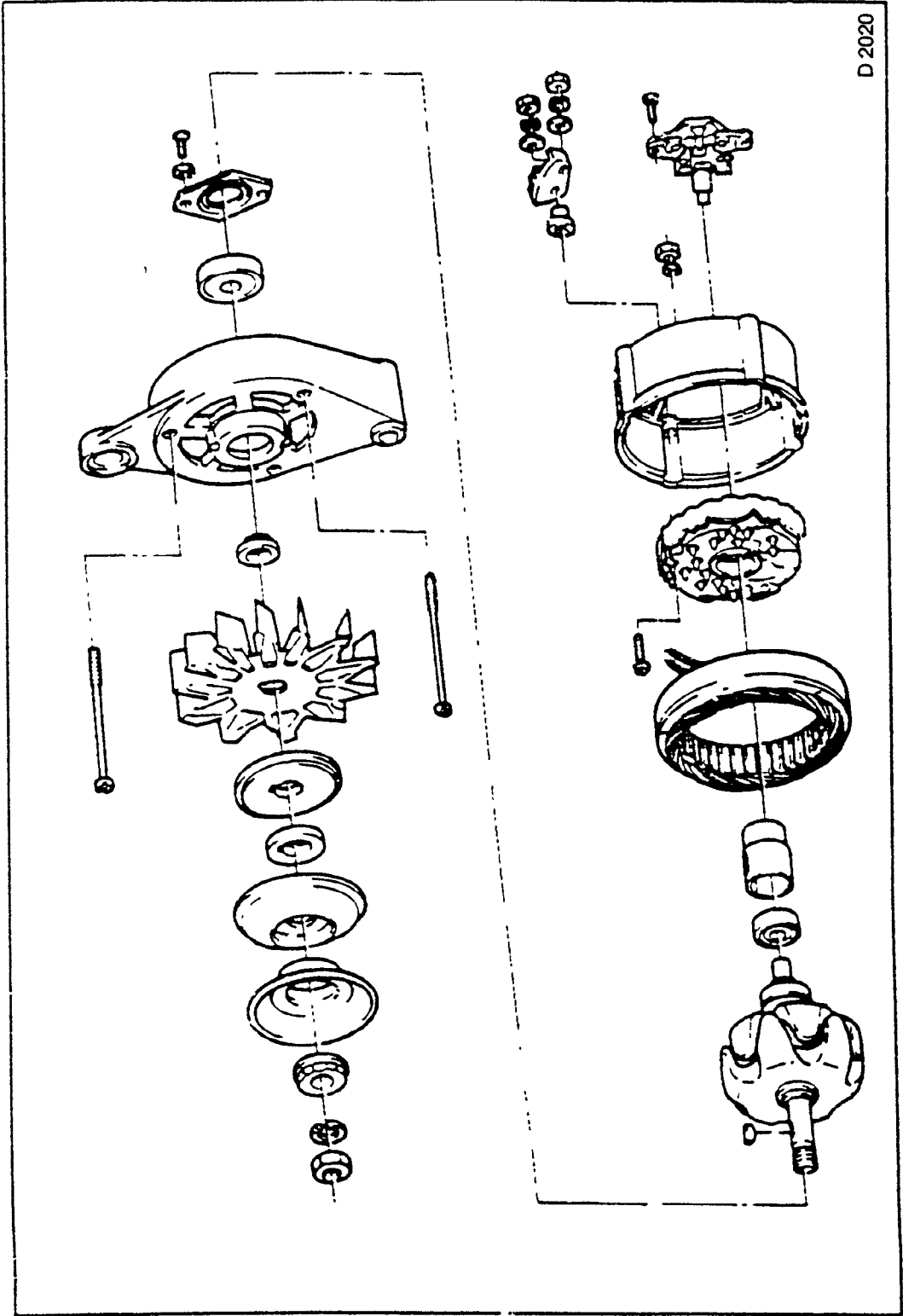


Fig 325

Alternator — Remove and Install

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Air intake hose — if present.
3. Cable connections from alternator.
4. Drive belt.
5. Alternator from retaining strap and lower fastening.

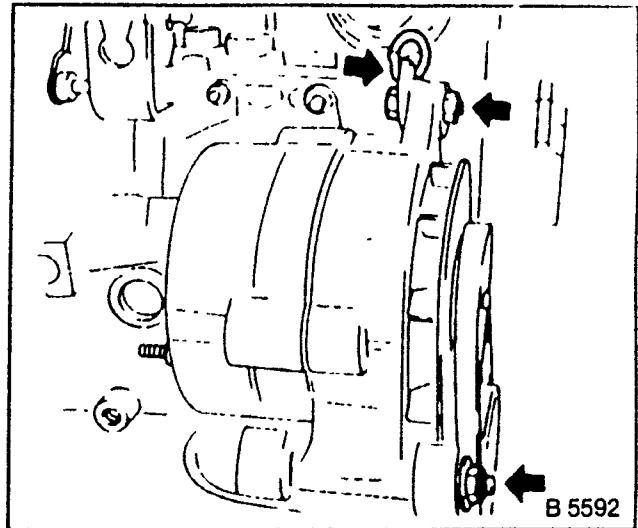


Fig. 326

INSTALL, CONNECT

1. Alternator (tighten by hand).
2. Install and tension drive belt.
3. Cable connections to alternator.
4. Ensure perfect condition and seating.
5. Air intake hose — if present.
6. Ground cable to battery.

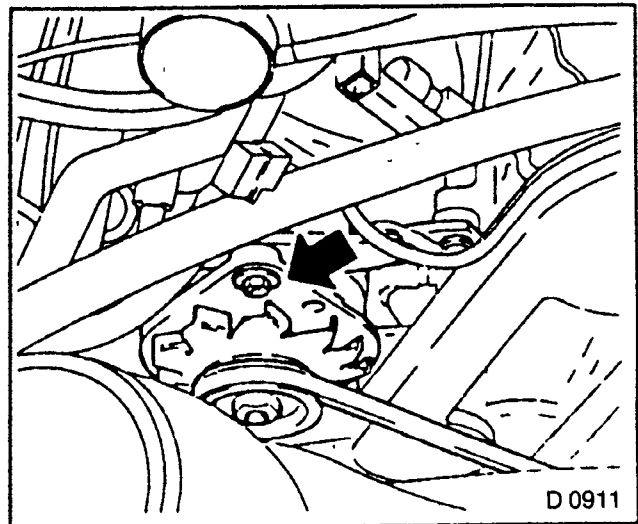


Fig. 327

Bosch Alternator — Check

The check consists of a performance check and a regulator voltage check, carry out the performance check first! For simultaneous evaluation of electronic components, use appropriate oscilloscope curve.

The check can be carried out in assembled condition as well as on the test stand. The check described here is for alternators in assembled condition, which can be applied analogously to the test stand.

A fully charged battery is required for this check.

WARNING:

Note the following safety measures:

1. Negative terminal from battery, alternator and regulator must match.
2. Never allow alternator to run on an uncontrolled open circuit.
3. Never short the terminals to alternator and regulator.
4. Do not reverse polarity of alternator.
5. When an additional battery is connected (e.g. as starting aid), it must be noted that the same battery terminals are connected.
6. When charging the battery with a charger, connecting lines of charger must be connected to correct battery terminals. Disconnect ground cable during charging.

INSPECT

- 1. Alternator output.
- 2. Circuit diagram.
 - 1. Load resistor, set parallel to battery.
 - 2. Battery.
 - 3. Voltmeter.
 - 4. Ammeter.
 - 5. Ignition lock.
 - 6. Charge telltale.
 - 7. Alternator.
- 3. Disconnect battery.
- 4. Disconnect connecting cable from alternator terminal "B +".
- 5. Set ammeter (measuring range 100A) in disconnected line.
- 6. Connect battery.
- 7. Connect controllable load resistor to battery terminals.
- 8. Before connecting, set resistor at "O"; connect first to battery, then to resistor.
- 9. Connect tachometer.
- 10. Connect oscilloscope according to manufacturer's instructions.
- 11. Connect battery.
- 12. Start engine and read off resulting current at various engine speeds.

INSPECT

- 1. Alternator output.
 - 2. Adjust load resistor, if the required load currents are not attained.
- The shape of the voltage curves on oscilloscope should be regular.
- Test value: 5 to 7A
- If the required minimum current intensity is not attained, or if the oscilloscope picture shows variations, the alternator should be overhauled.

INSPECT

- 1. Regulated voltage.
- 2. Circuit diagram.
 - 1. Battery.
 - 2. Ignition lock.
 - 3. Charge telltale.
 - 4. Resistor, for attainment of load current with the battery set in series.
 - 5. Voltmeter.
 - 6. Ammeter.
 - 7. Alternator.

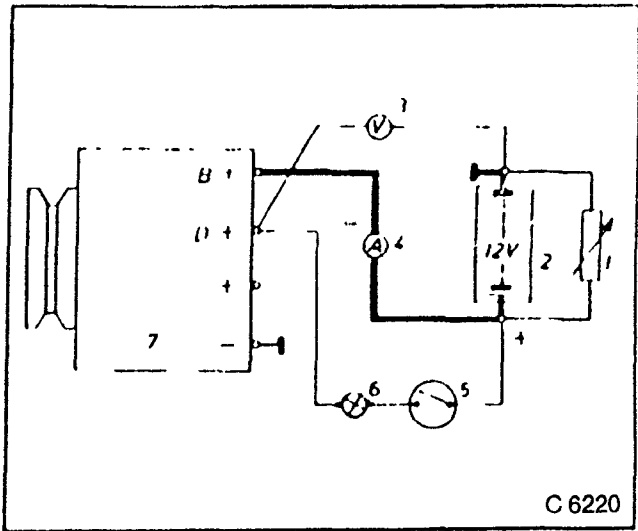


Fig. 328

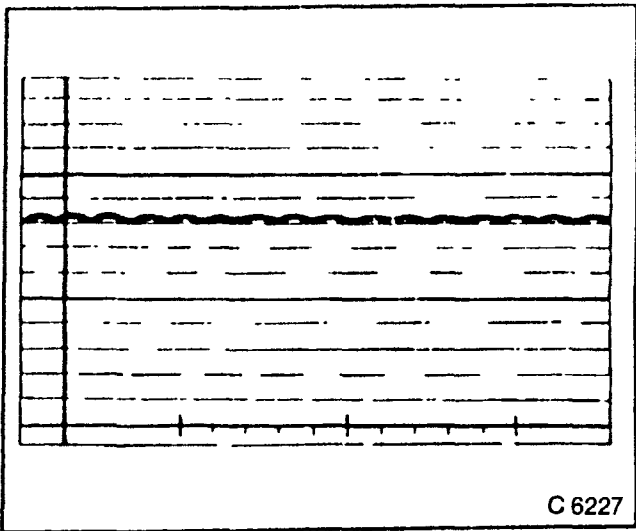


Fig. 329

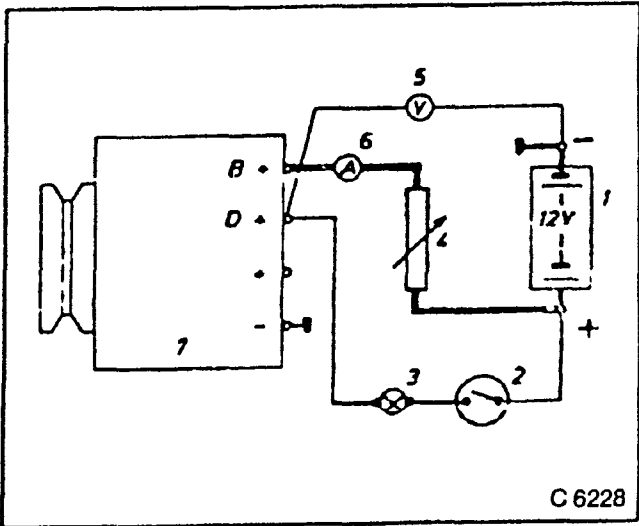


Fig. 330

INSPECT

1. Regulated voltage.
2. Bosch alternator:
Connect tachometer, voltmeter, ammeter and load resistor according to manufacturer's instructions.
3. Disconnect ground cable from battery.
4. Disconnect cable from alternator terminal "B +".
5. Set ammeter (measuring range 100 A) between disconnected cable and alternator terminal "B +".
6. Set resistor in series to battery.
7. Connect ground cable to battery.
8. Start engine.
Bosch alternator:
9. Adjust load resistor, until ammeter shows prescribed value.
10. Read off regulated voltage — for test values see Technical Data page 312.

WARNING:

ONLY CHECK ALTERNATOR WITH PARALLEL SWITCHING, FULLY CHARGED BATTERY, SWITCH OFF LOAD RESISTOR AND BATTERY AFTER ALTERNATOR STANDSTILL.

DISCONNECTING OF LOAD WITHOUT PARALLEL SWITCHING BATTERY LEADS TO VOLTAGE TRANSIENTS, WHICH CAN LEAD TO DAMAGE TO THE ALTERNATOR DIODES.

Bosch Alternator — Disassemble and Assemble

REMOVE, DISCONNECT

1. Pulley nut.
2. Spring ring.
3. Washer.
4. Pulley halves.
5. Spacing ring.
6. Fan wheel.
7. Spring washer.

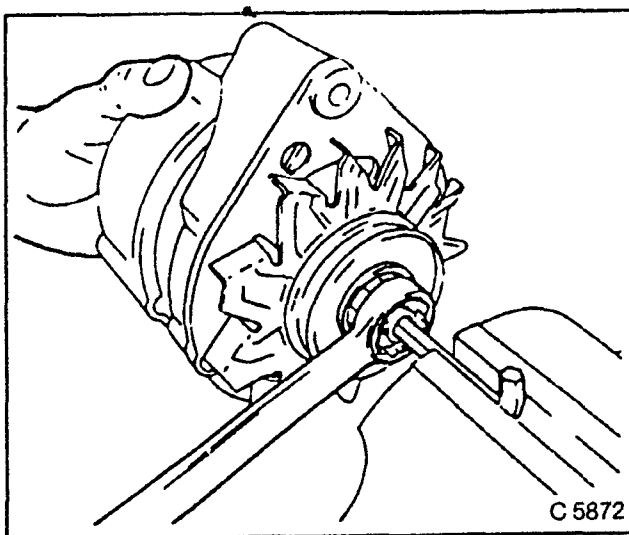


Fig. 331

REMOVE, DISCONNECT

- 1. Voltage regulator with brush holder.

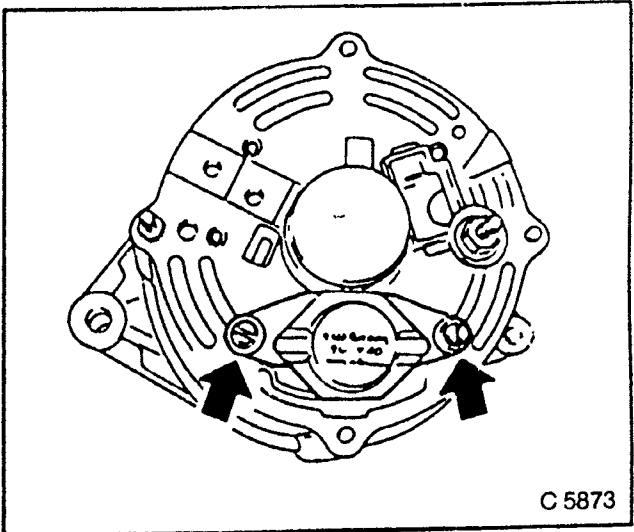


Fig. 332

REMOVE, DISCONNECT

- 1. Mark position of drive bearing to slip ring bearing.
- 2. Drive bearing with claw — pole rotor.
- 3. Four fastening bolts.

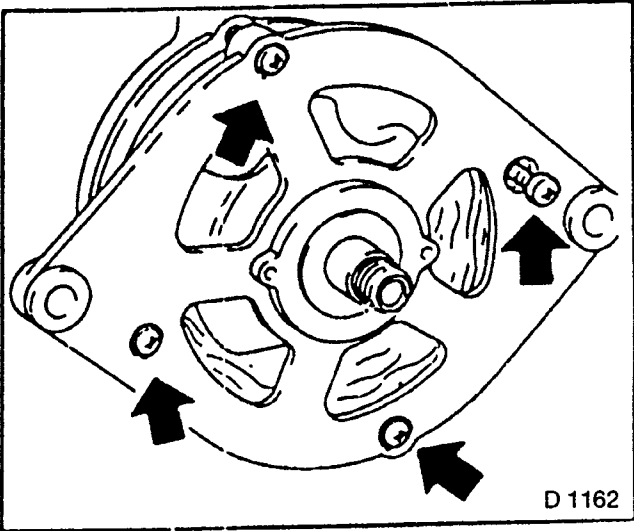


Fig. 333

REMOVE, DISCONNECT

- 1. Claw — pole rotor from drive bearing.
- 2. Lay suitable pipe piece (1) underneath.

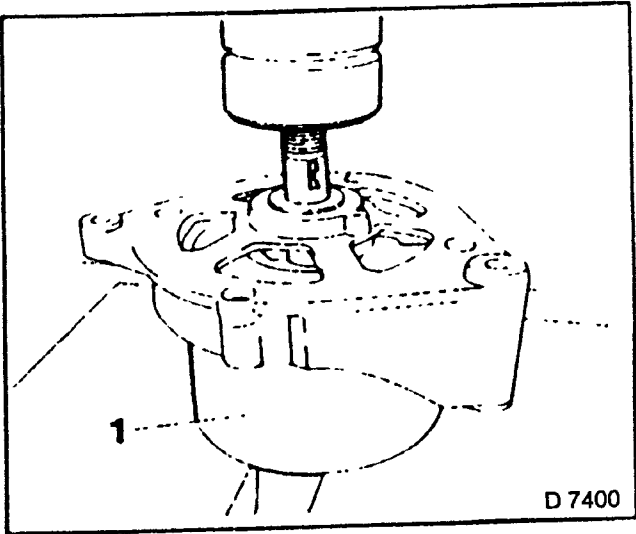


Fig. 334

REMOVE, DISCONNECT

- 1. Bearing cover of drive bearing.
- 2. Ball bearing from drive bearing.

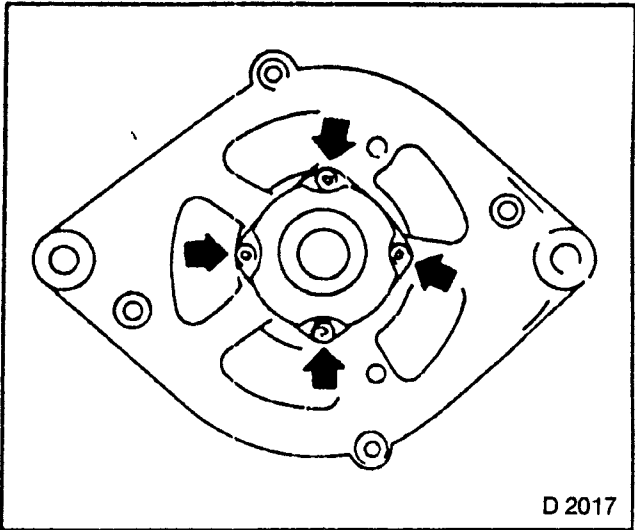


Fig. 335

REMOVE, DISCONNECT

- 1. Ball bearing from rotor shaft.

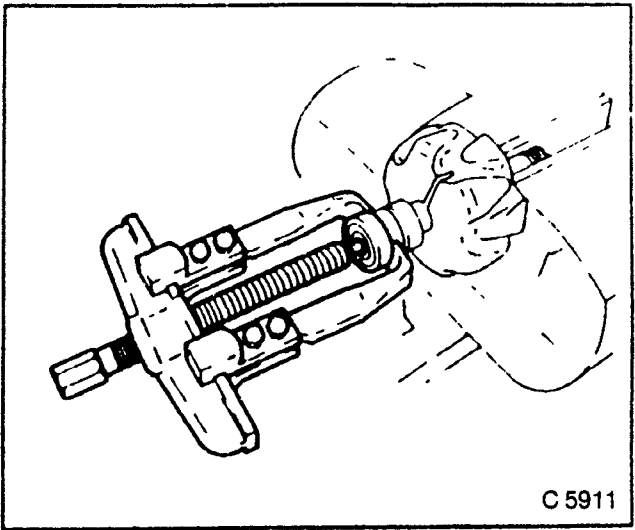


Fig. 336

REMOVE, DISCONNECT

- 1. Nut from connecting pins "B +" and "D +".
- 2. Washers and insulating material.

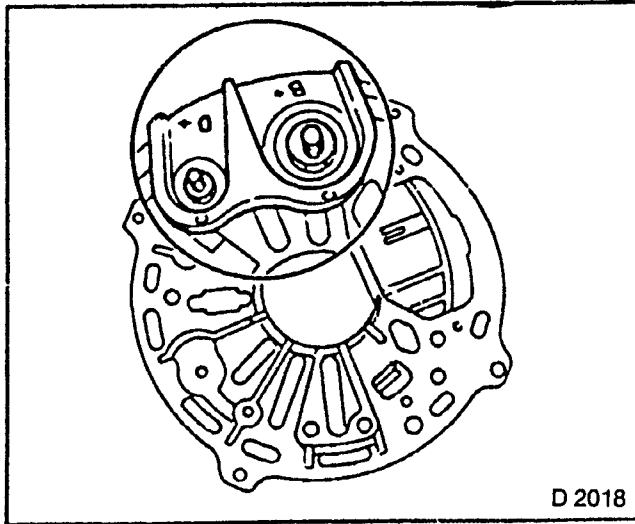


Fig. 337

REMOVE, DISCONNECT

- 1. Diode plate.
- 2. Remove together with stator winding from slip ring bearing.
- 3. Splash guard sleeve (if present).

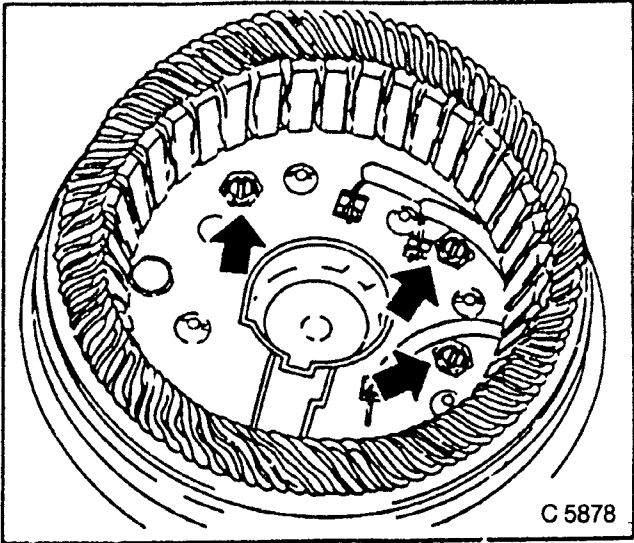


Fig. 338

REMOVE, DISCONNECT

- 1. Carefully bend off diode plate.
- 2. Unsolder stator winding from diode plate.

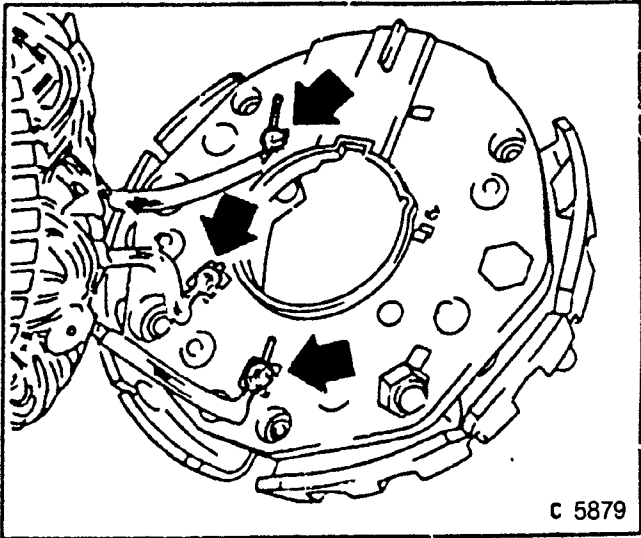


Fig. 339

INSTALL, CONNECT

- 1. Ball bearing (1).
- 2. Press onto rotor shaft — KM-151.
- 3. Ball bearing.
- 4. Press into drive bearing, install bearing cover.

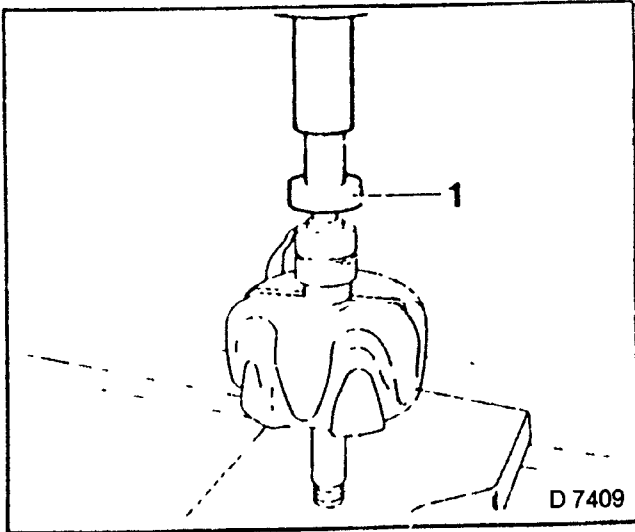


Fig. 340

INSTALL, CONNECT

1. Install claw — pole rotor into drive bearing.
2. Press spacing washer (1) onto rotor shaft — KM-151.

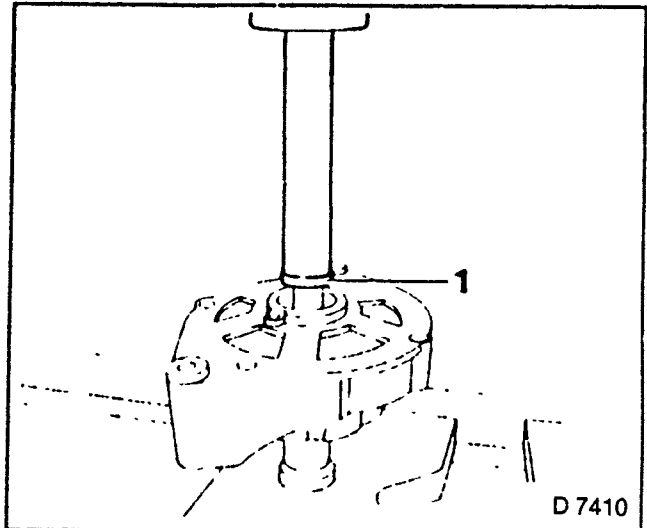


Fig. 341

INSTALL, CONNECT

1. Stator winding.
2. Solder phase sections to diode plate.
3. Grease ball bearing (if necessary) with Bearing Grease BO 400852.
4. Install diode plate with stator winding.
5. Note insulating sleeve for connecting pin.
6. Splash guard sleeve (if present).
7. Drive bearing and slip ring bearing on mark made previously.

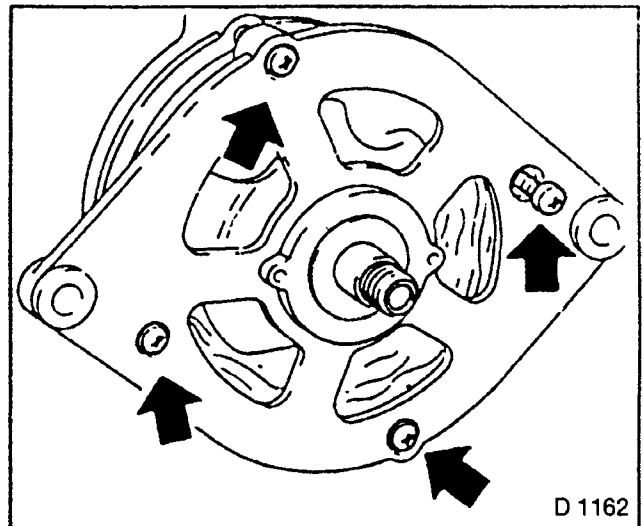


Fig. 342

TIGHTEN (TORQUE)

1. Housing bolts — 3,5 to 5,5 Nm.
2. Spring ring.
3. Washer.
4. Belt pulley halves.
5. Spacing ring.
6. Spring washer.
7. Fan wheel.
8. Pulley nut — 35 to 45 Nm.

Bosch Alternator — Overhaul

DISASSEMBLE

- 1. Alternator.

CLEAN

- 1. Alternator individual parts.
- 2. Cleaning petrol (commercially available)
— only brief contact permissible.

INSPECT

- 1. Ball bearing — replace if necessary.
- 2. Phases of stator winding — for short circuit to ground.
- 3. Use ohmmeter — nominal value: resistance infinite.
- 4. Replace stator with short circuit to ground.

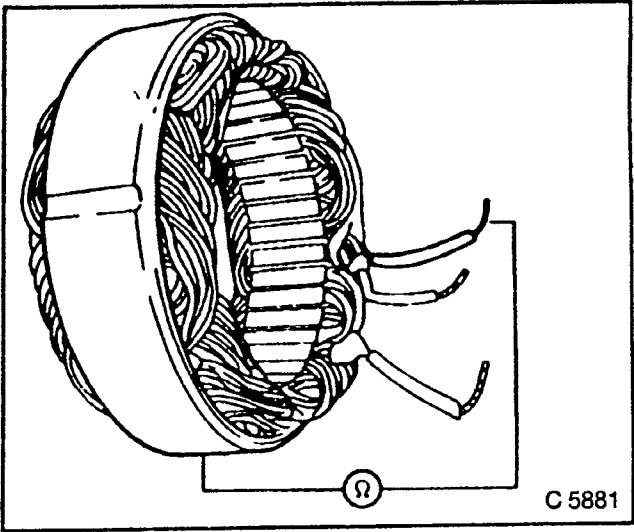


Fig. 343

INSPECT

- 1. Phases of stator winding — for short-circuited turn.
- 2. Use ohmmeter.
- 3. Resistance of two phases against one another: see Technical Data.
- 4. Replace stator with short-circuited turn.

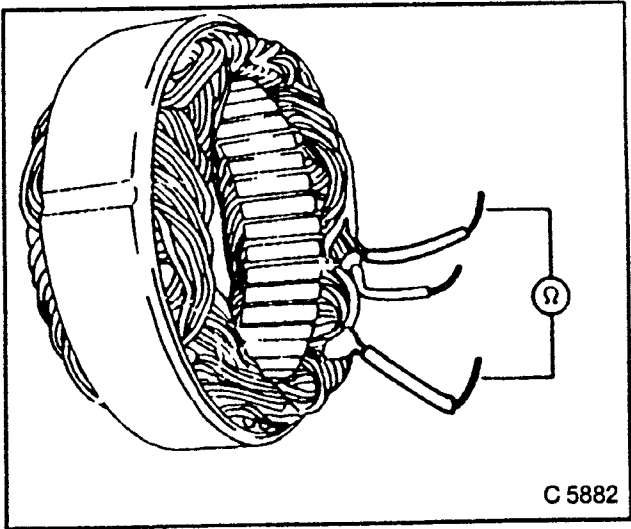


Fig. 344

INSPECT

- 1. Rotor winding — for short circuit to ground.
- 2. Use ohmmeter — nominal value: resistance infinite.
- 3. Replace rotor with short circuit to ground.

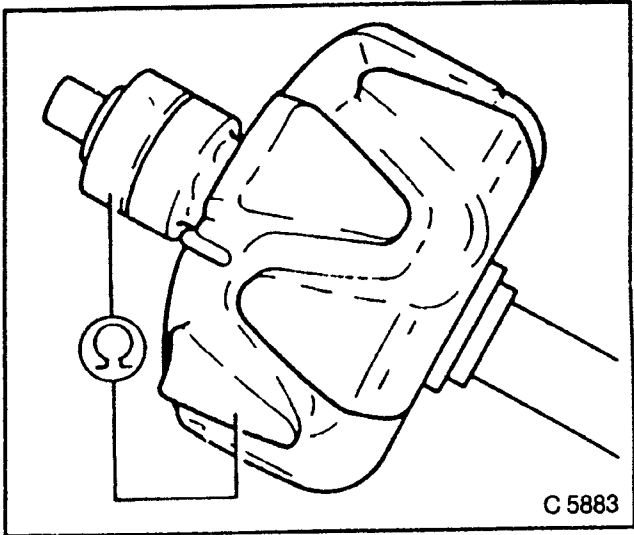


Fig. 345

INSPECT

- 1. Rotor winding — for short-circuited turn.
- 2. Use ohmmeter.
- 3. Resistance of slip rings against one another: See Technical Data page 312.
- 4. Replace rotor with short-circuited turn.

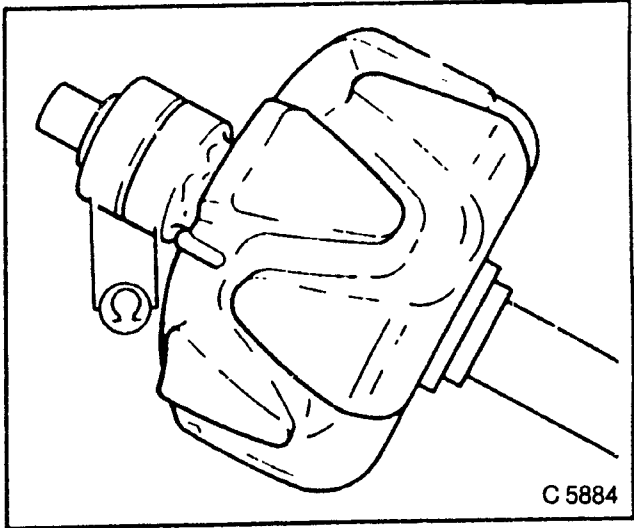


Fig. 346

CLEAN

- 1. Disconnect slip rings on lathe — emery cloth.

INSPECT

- 1. Slip rings — for-out-of-round, permissable variation: 0,03 mm.
- 2. Turn unoven slip rings on lathe — do not fall below dimension. See Technical Data page 312.
- 3. Polish and clean slip rings.

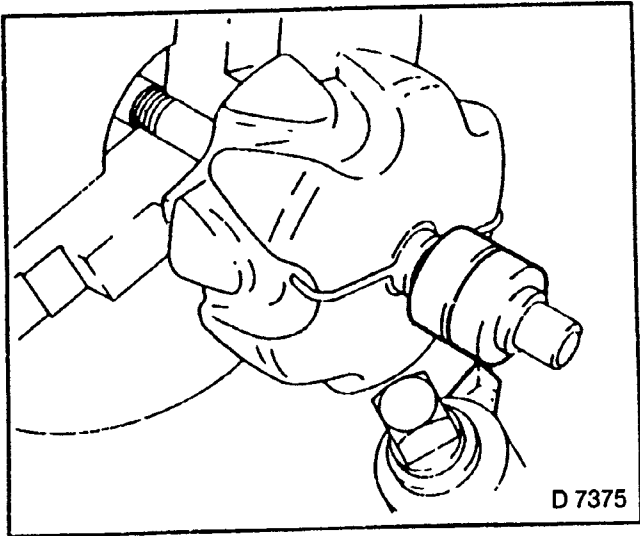


Fig. 347

INSPECT

- 1. Carbon brushes — for wear.
Minimum length "A" — 5 mm.
- 2. Replace worn carbon brushes.

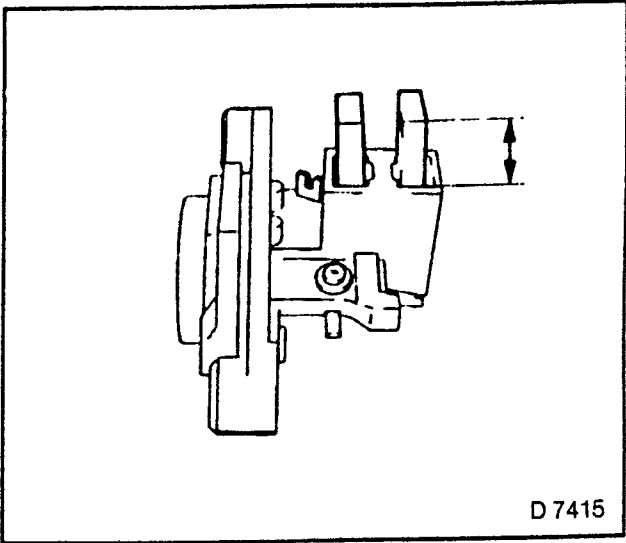


Fig. 348

INSPECT

- 1. Diodes.
- 2. Circuit diagram of electrically regulated alternator:
 - 1. Rectifier diode.
 - 2. Excitation diode.
 - 3. Stator winding.
 - 4. Excitation winding.
 - 5. Electronic voltage regulator (installed).
 - 6. Battery.
 - 7. Ignition lock.
 - 8. Charge telltale.

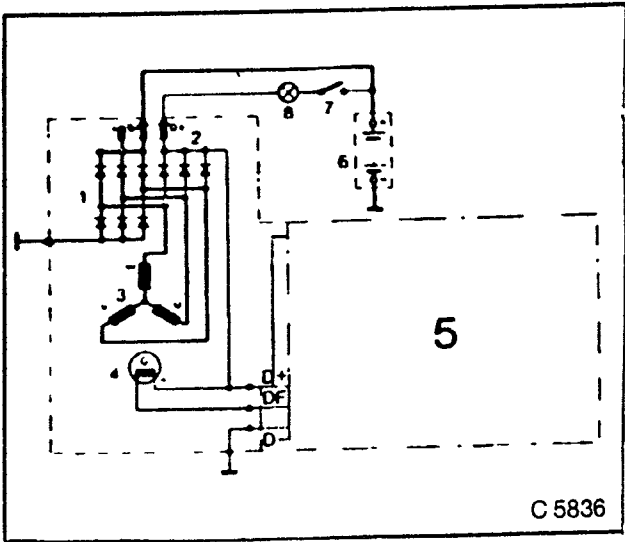


Fig. 349

INSPECT

- 1. Diodes.
For passage, interruption, short circuit, blocking action. Test result gives only qualitative information about the effectiveness and the condition of diodes barrier layer. If an exact check of the diodes is to be undertaken, diode — checking equipment should be used. If a diode is faulty, the whole diode plate should be replaced. The described check for test lamps is carried out at a voltage of 24 volts maximum.

INSPECT

- 1. Negative diodes (1).
- 2. Positive probe (2) to diode housing.
- 3. Negative probe (3) to diode connection.
- 4. Test lamp should illuminate.
- 5. Exchange probes — see Fig. 350.
- 6. Test lamp should not illuminate.
- 7. Negative diodes have passage from housing to connections; they block in opposite direction.

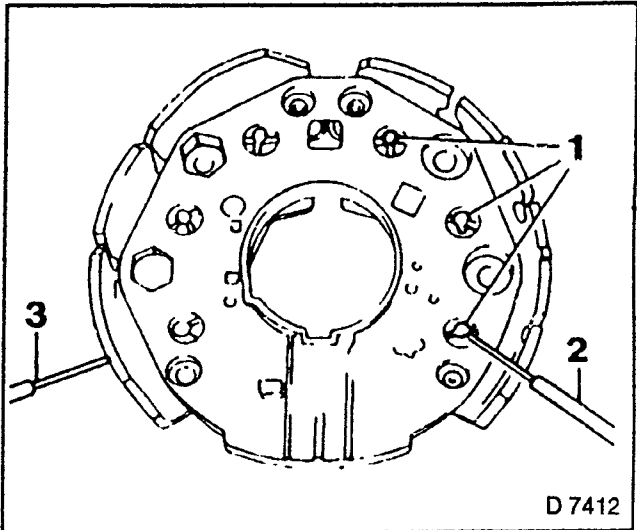


Fig. 350

INSPECT

- 1. Positive diodes (1)
- 2. Positive probe (2) to diode connection.
- 3. Negative probe (3) to diode housing.
- 4. Test lamp should illuminate.
- 5. Exchange probes.
- 6. Test lamp should not illuminate.
- 7. Positive diodes have passage from connection to housing and block in opposite direction.

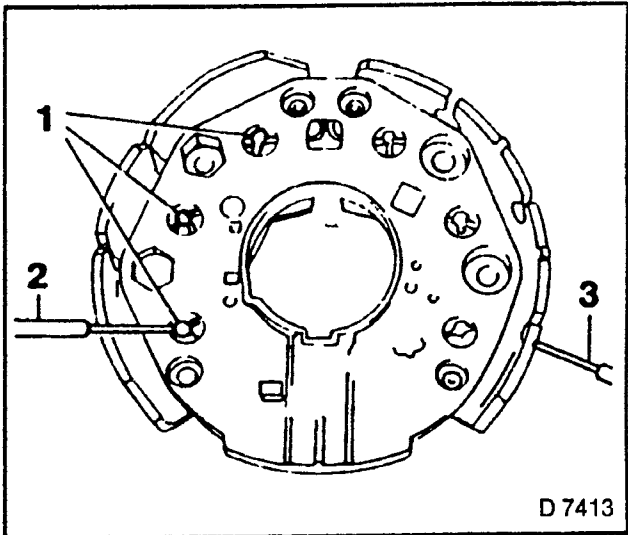


Fig. 351

INSPECT

- 1. Excitation diodes (1).
- 2. Positive probe (2) to diode connection.
- 3. Negative probe to contact rail (3).
- 4. Test lamp should illuminate.
- 5. Exchange probes.
- 6. Test lamp should not illuminate.

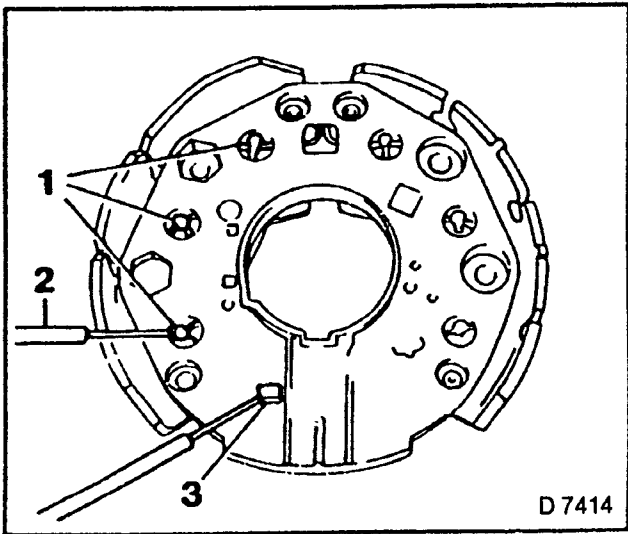
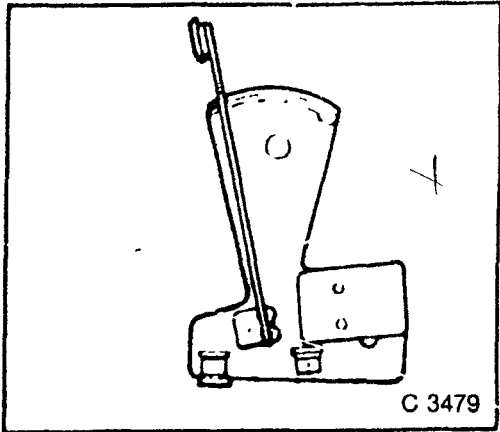


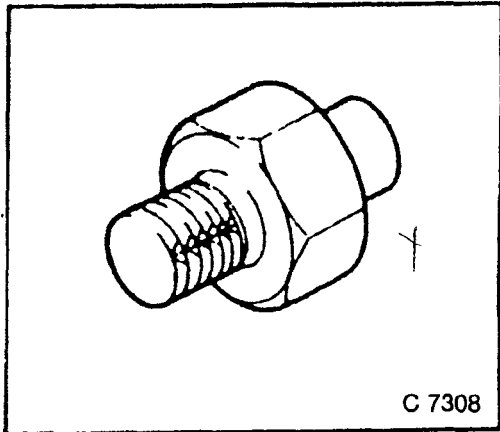
Fig. 352

Special Service Tools

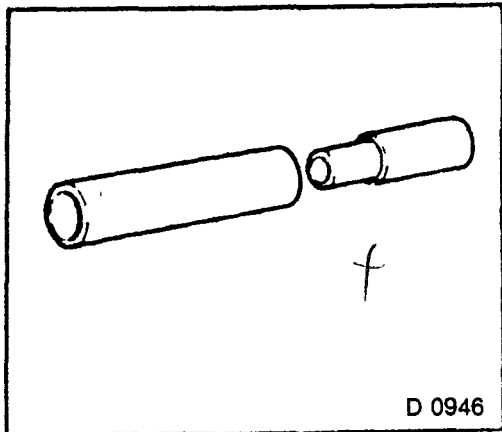
KM-128-A BELT TENSION GAUGE
To check V-belt tension.



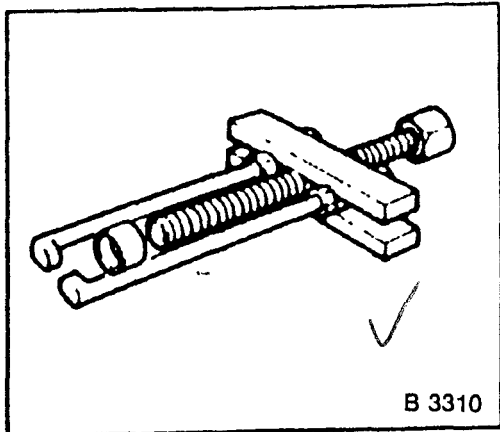
KM-135 ADAPTER
To measure engine oil pressure in conjunction with KM-498-B.



KM-151 REMOVER/INSTALLER
(no longer available)
To remove and install the needle bearing of the alternator.

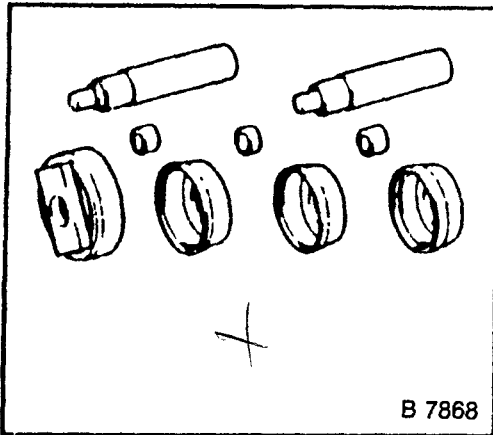


KM-210-A STEERING WHEEL PULLER
To remove the toothed belt pulley in conjunction with KM-516 and KM-647.

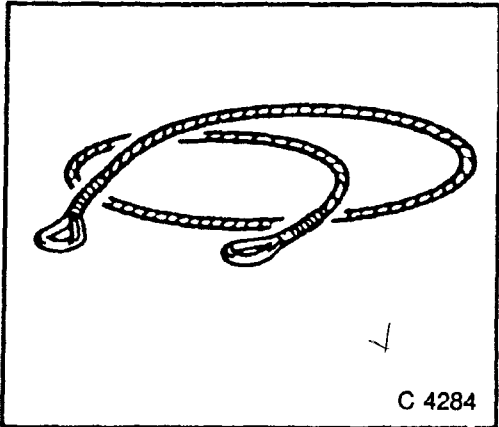


KM-235-D RING INSTALLER

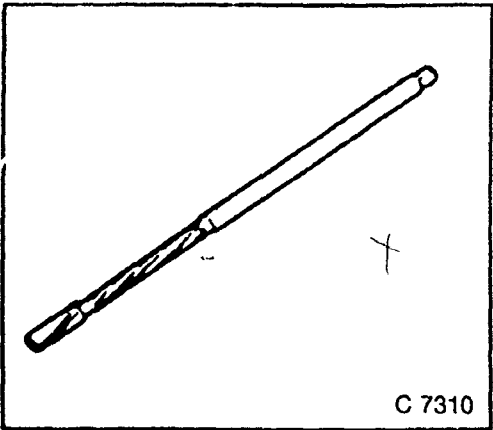
To install seal ring in crankshaft bearing.



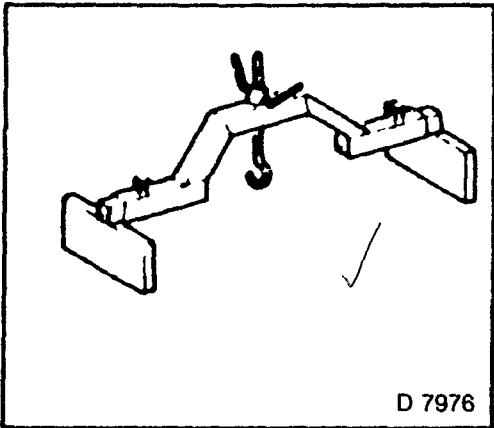
KM-252-2-A ENGINE LIFTER
To remove and install the engine.



- KM-253 REAMER 0,075 MM OVERSIDE *)**
 - KM-254 REAMER 0,150 MM OVERSIZE *)**
 - KM-255 REAMER 0,250 MM OVERSIZE *)**
- *) No longer available.
To ream the valve guide bore

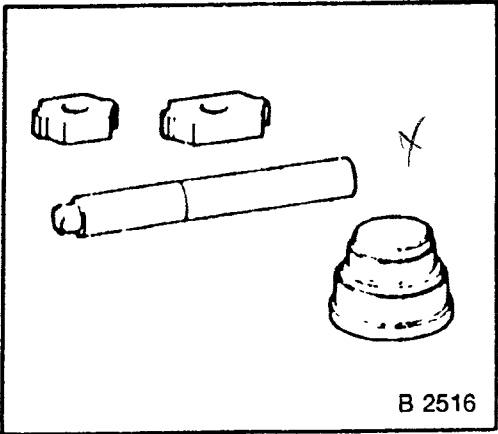


KM-263-B LIFTER/HOLDER



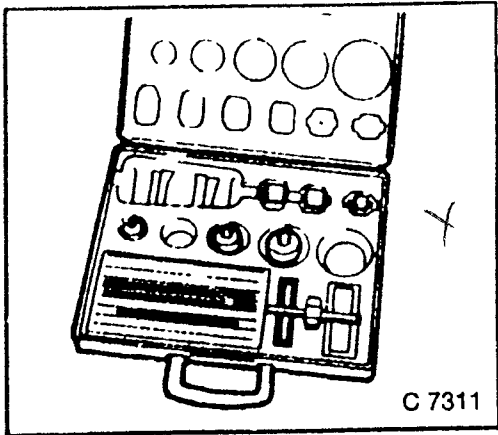
KM-266-A REMOVER/INSTALLER

To install starter bearing bushings/install
TDC sensor sleeve.



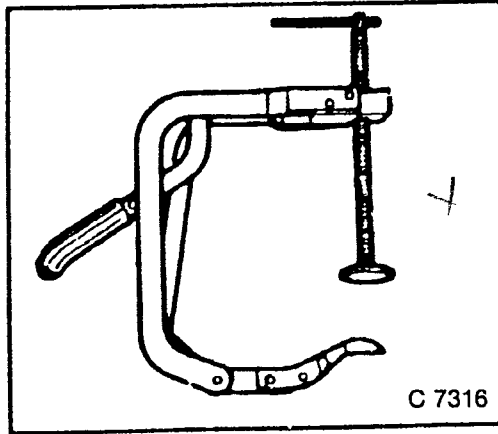
KM-340-C CUTTER SET

To cut and correct valve seating.



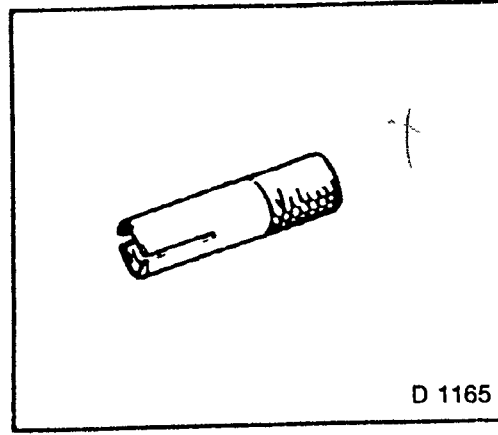
KM-348 SPRING COMPRESSOR

To compress valve springs, cylinder head
removed.

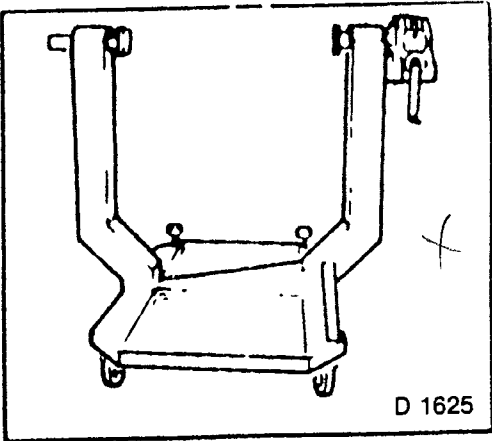


KM-352 INSTALLER

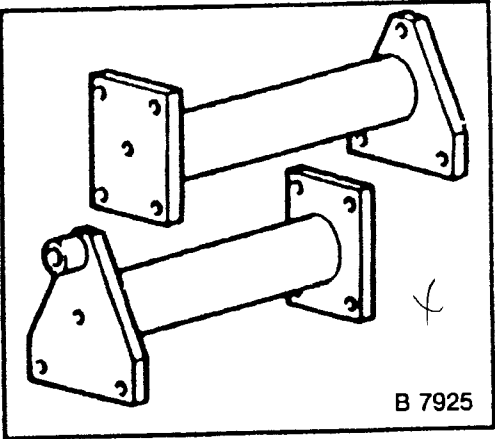
To install the valve stem sealing.



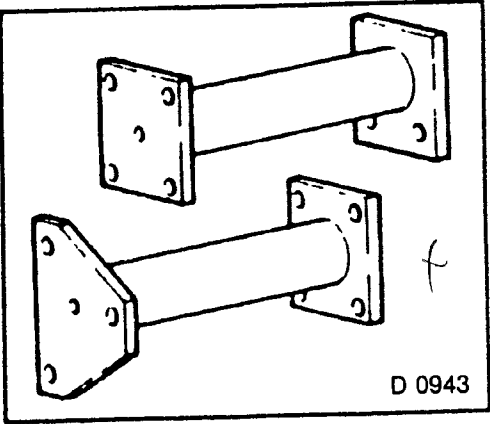
KM-412 ENGINE OVERHAUL STAND
To hold removed engine.



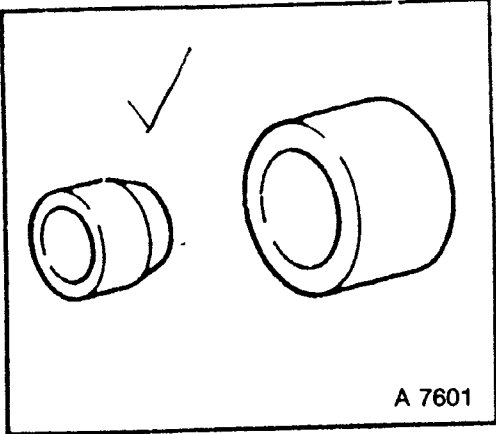
KM-412-8 ADAPTER (1,8/2,0 ltr.)
To hold engine in conjunction with KM-412



KM-412-10 ADAPTER (1,4/1,6 ltr.)
To hold engine in conjunction with KM-412.

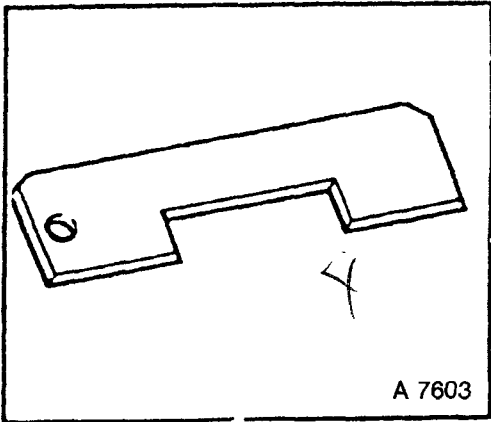


KM-417 INSTALLER
To install crankshaft seal ring into oil pump housing.



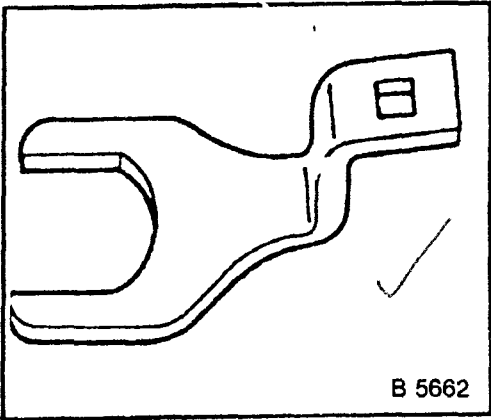
KM-419 DISTANCE GAUGE

To check projection to valve guide after reworking valve seat.



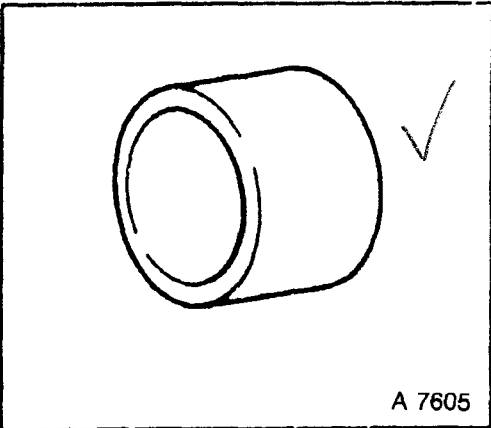
KM-421-A ADJUSTING WRENCH

To adjust tension of toothed belt.



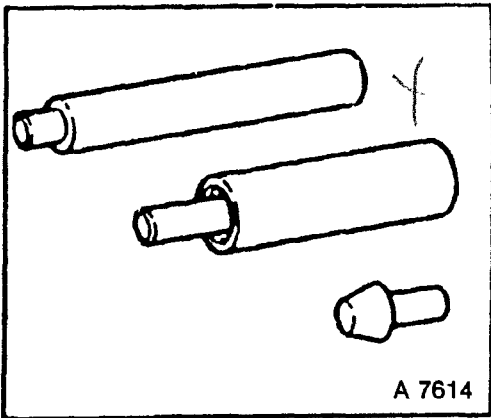
KM-422 INSTALLER

To install seal ring into camshaft carrier.



KM-427 INSTALLER

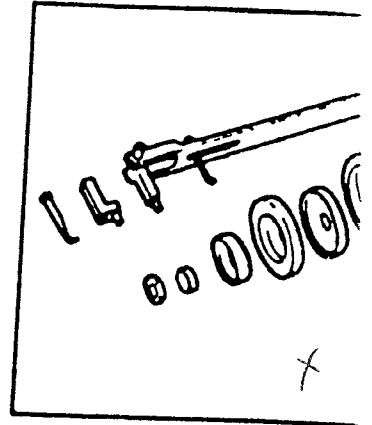
To install guide pins into engine block.



ENGINE

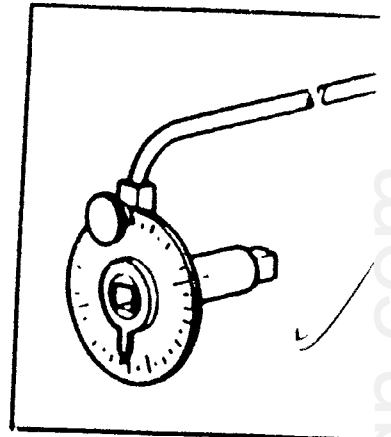
KM-469-A REMOVER/INSTALLER

To remove and install crankshaft seal ring.



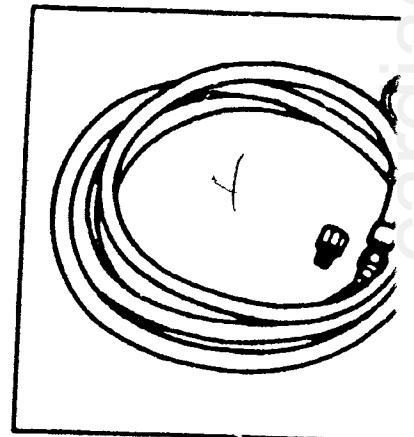
KM-470-B ANGULAR TORQUE WRENCH

To tighten cylinder head bolts.



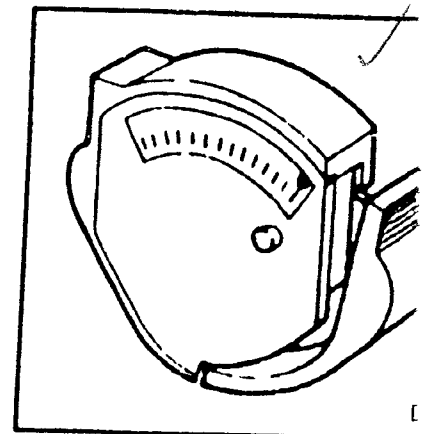
KM-498-B PRESSURE GAUGE

To check engine oil pressure in conjunction with KM-135.



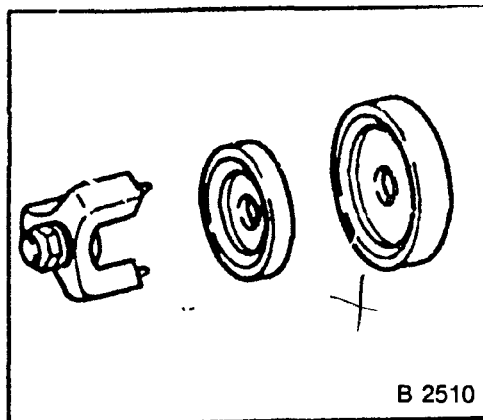
KM-510-A TENSION GAUGE (1,8/2,0 ltr.) (For version without toothed belt tension roller)

To check and adjust toothed belt tension.

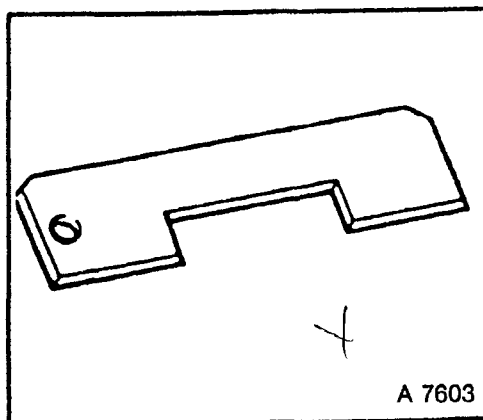


KM-511 INSTALLER

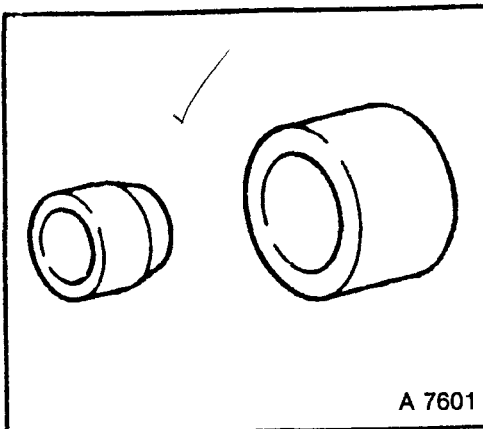
To install crankshaft seal ring in conjunction with KM-469-A.

**KM-512 DISTANCE GAUGE**

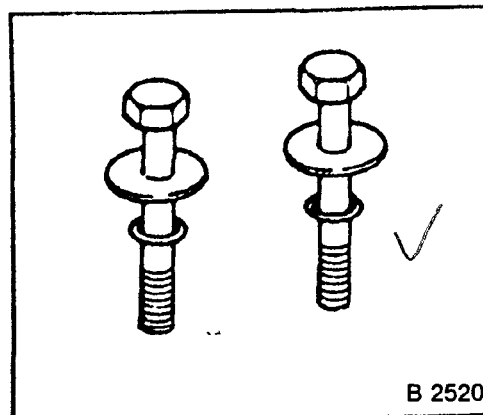
To check protrusion of valve guide after reworking valve seat.

**KM-513-A ASSEMBLY SLEEVES**

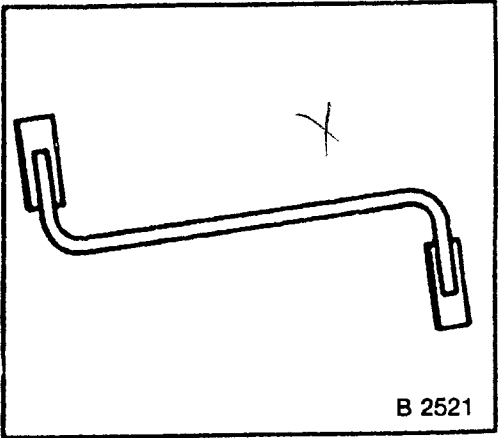
To install front crankshaft seal ring.

**KM-516 PULLER BOLTS**

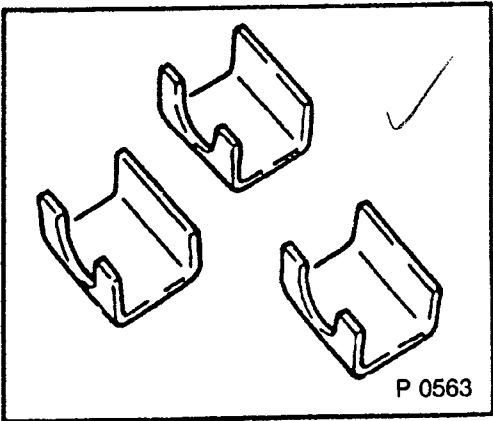
To remove toothed belt drive pinion in conjunction with KM-210-A and KM-467.



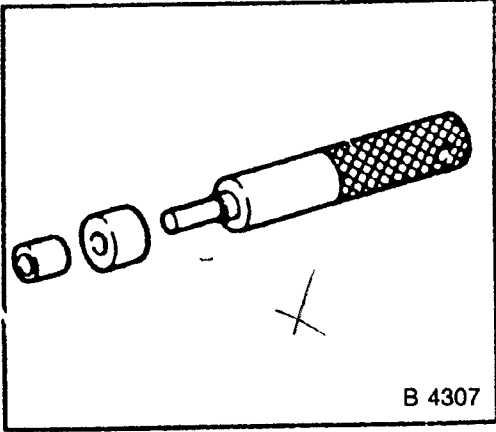
KM-517 LOCKING DEVICE
To lock the flywheel.



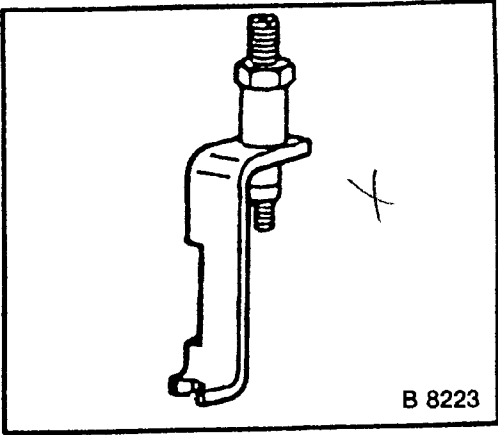
KM-526-A CLAMPS
Clutch assembly with 3 clamps.



KM-535 INSTALLER
To install crankshaft seal ring in conjunction with KM-511 or KM-635, engine removed.

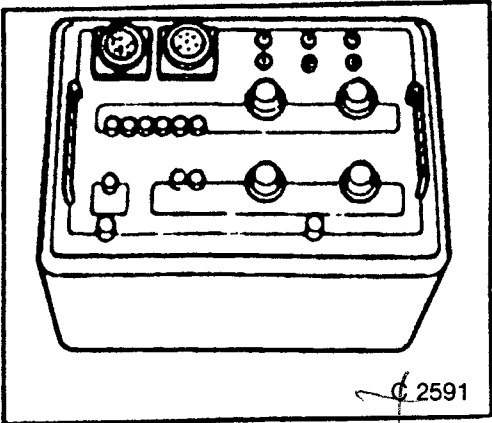


KM-565 REMOVER/INSTALLER
To remove and install rocker arms and valve play compensators.



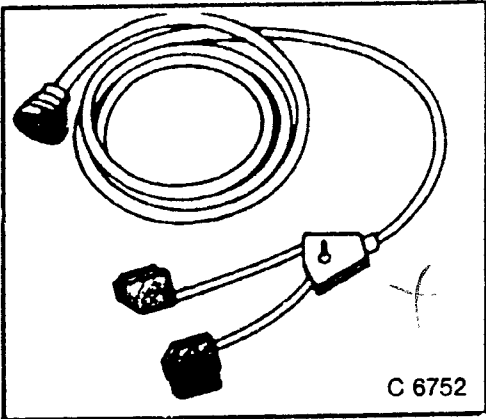
**KM-566-1 UNIVERSAL CHECKING
ADAPTER**

To check L-Jetronic in conjunction with
KM-566-10 and MKM-587-A.



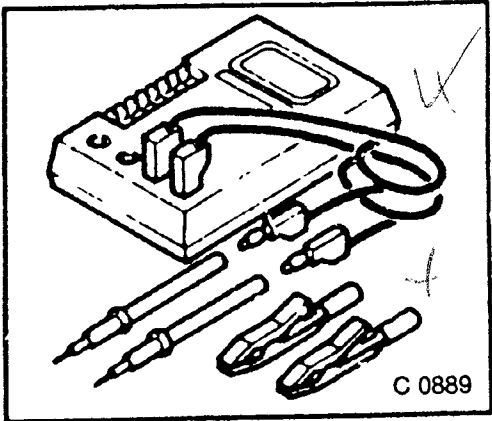
KM-566-10 CHECKING CABLE

To check L-Jetronic in conjunction with
KM-566-1 and MKM-587-A.



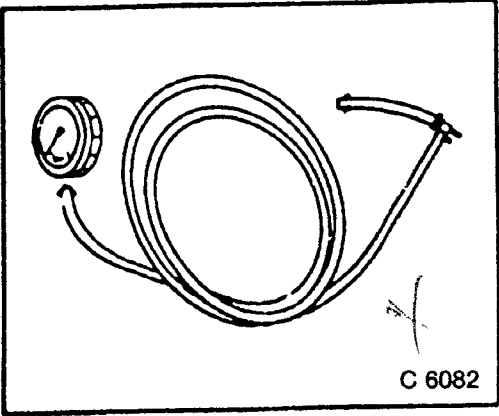
MKM-587-A MULTIMETER

Measurements of vehicle electronics.



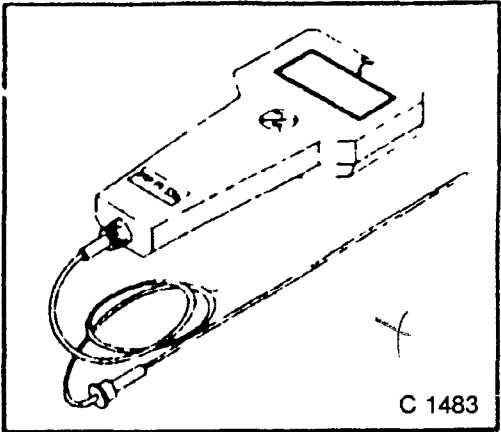
MKM-588 PRESSURE GAUGE

To check the fuel pressure, injection engines
only.



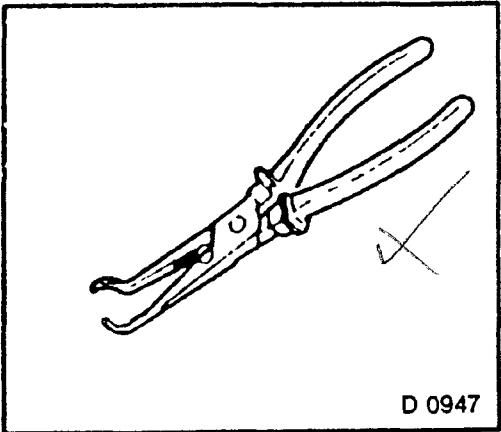
MKM-596 GAUGE

To measure oil temperature, special exhaust gas test (ASU).



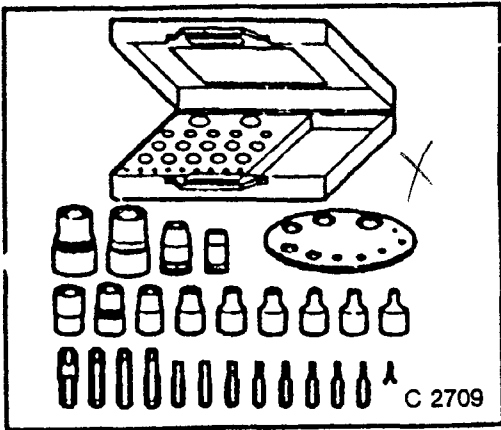
MKM-597 REMOVING PLIERS (replaced by KM-717)

To remove spark plug connectors.



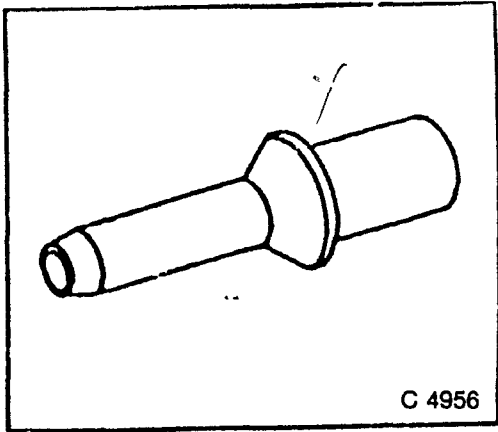
MKM-604-B TORX BIT AND SOCKET SET

To remove and install Torx bolts.

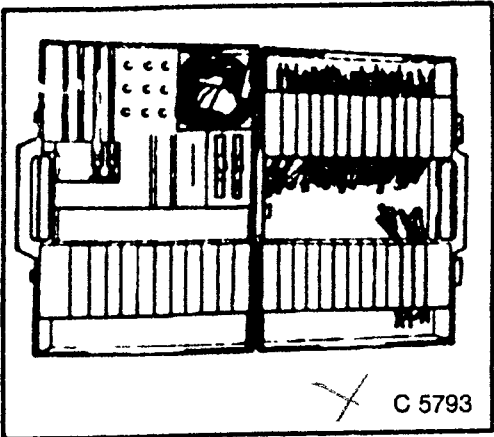


KM-605 ADAPTER

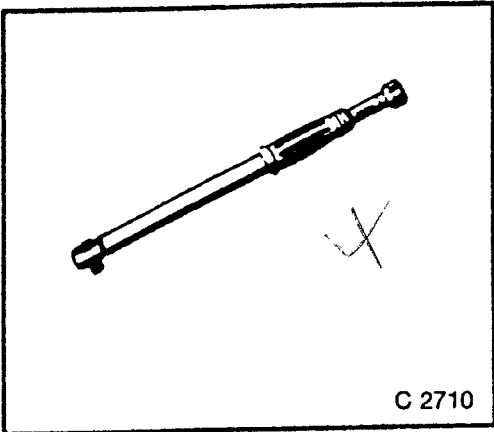
To connect CO tester, vehicles with open loop catalytic converter.



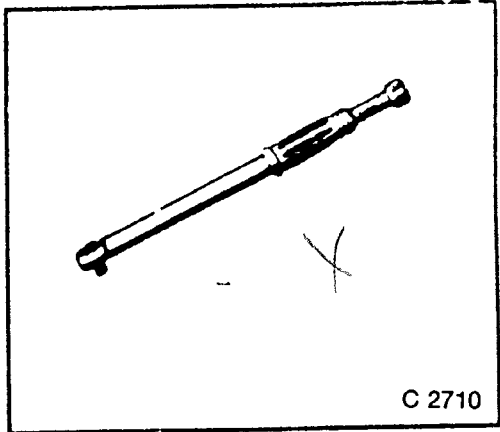
KM-609 ELECTRONIC KIT I
Diagnosis of electric and electronic systems.



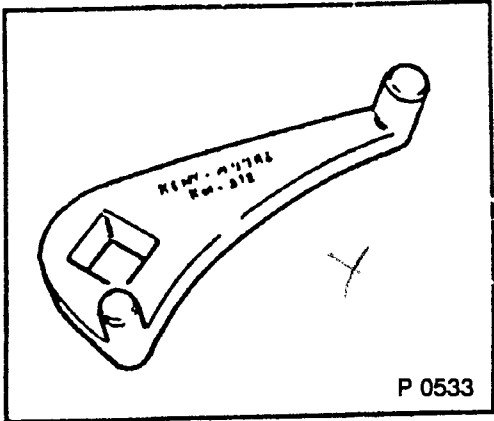
MKM-610 TORQUE WRENCH 1/2" DRIVE
Measuring range 30 — 130 Nm.



MKM-611 TORQUE WRENCH 3/8" DRIVE
Measuring range 10 — 60 Nm.

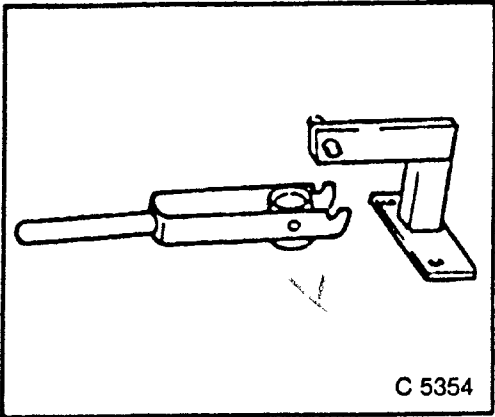


KM-612 RIBBED V-BELT TENSIONER
To tension ribbed V-belt, 1,6 ltr. engines with power steering.



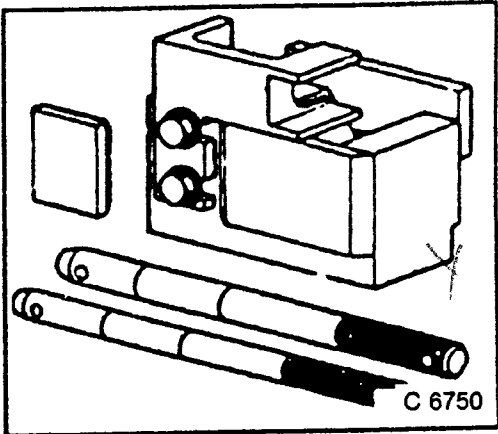
KM-632-A TENSIONER

To tension clutch assembly, engine removed.



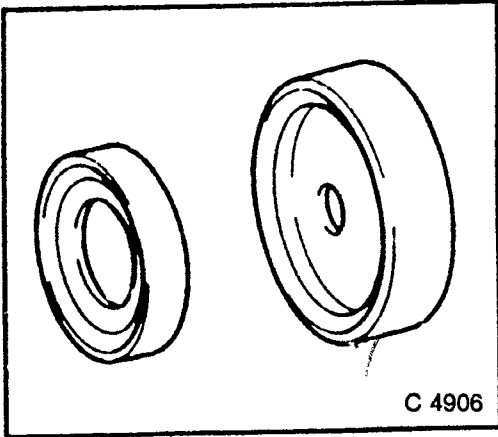
KM-634 REMOVER/INSTALLER

To remove and install piston pins.



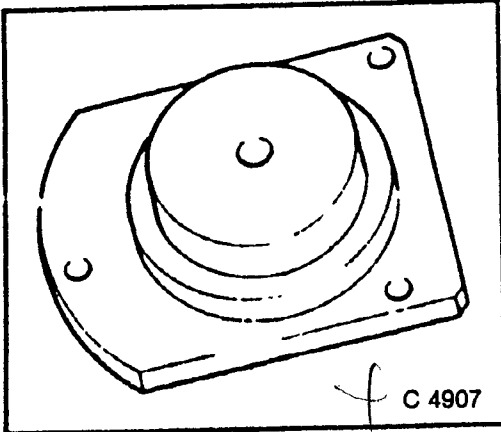
KM-635 INSTALLER

To install rear crankshaft seal ring in conjunction with KM-469-A.



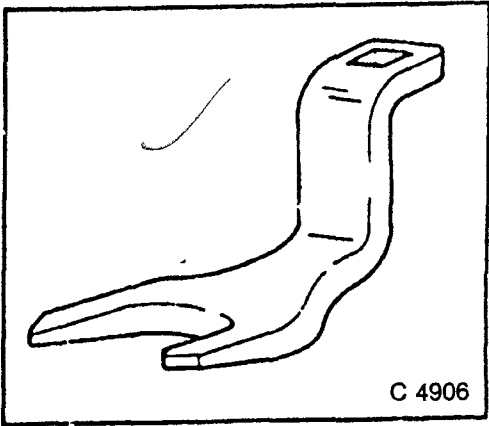
KM-636 INSTALLER

To install rear camshaft seal ring.



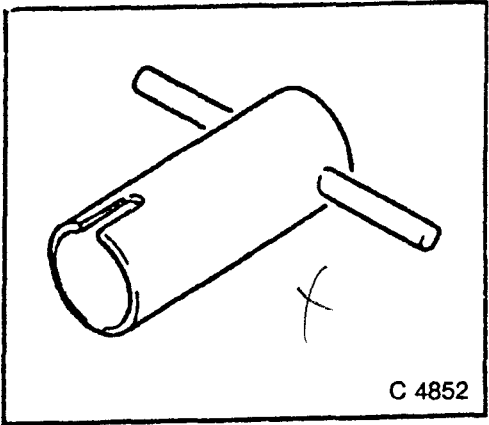
KM-637 ADJUSTING WRENCH

To adjust toothed belt tension.



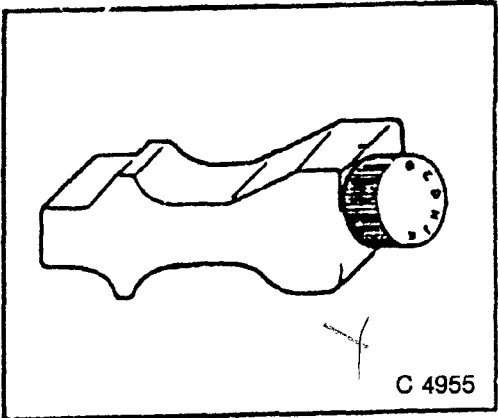
KM-639 REMOVER/INSTALLER

To remove and install idle cut-off valve, 2 E 3 carburettor.



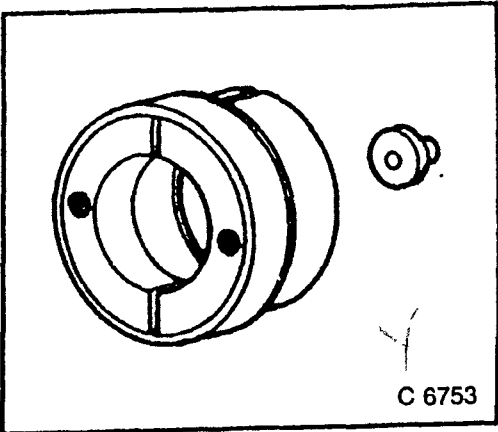
KM-640 DIAGNOSTIC SWITCH

To trigger blink codes, engines with self-diagnosis.



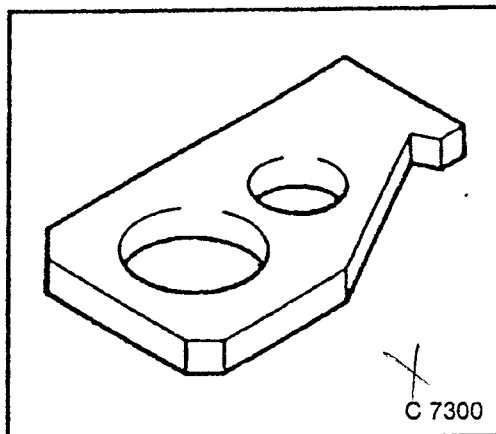
KM-647 REMOVER

To remove toothed belt drive gear in conjunction with M-210-A and KM-516.

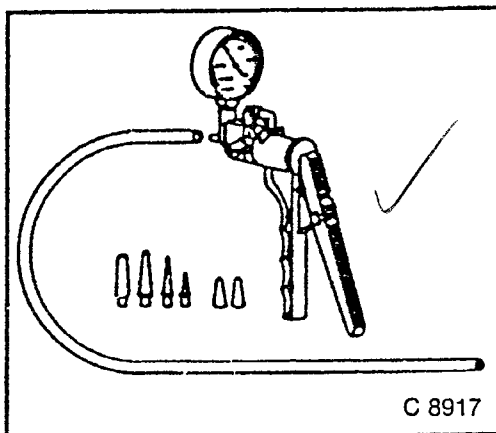


KM-652 LOCKING DEVICE

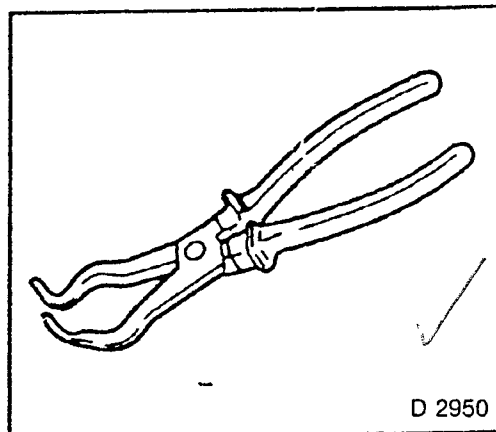
To lock flywheel.

**MKM-C67 PRESSURE AND VACUUM
PUMP**

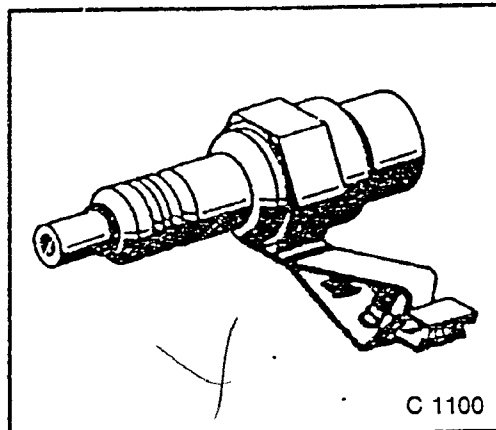
To check for leaks in vacuum unit.

**KM-717 REMOVING PLIERS**

To remove spark plug connectors.

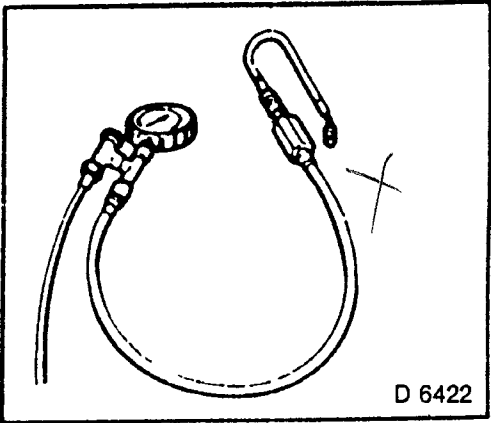
**KM-J-26792 SPARK TESTER**

To check ignition spark.



**KM-J-34730-91 FUEL PRESSURE
TESTER**

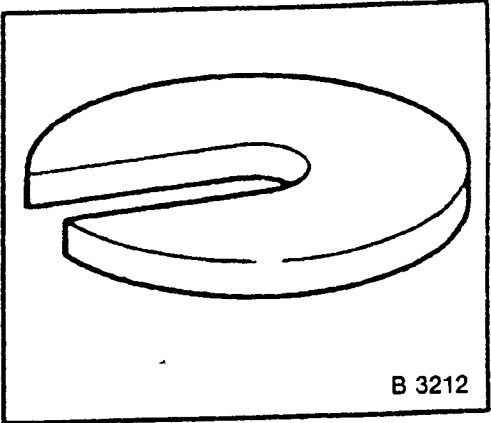
To check fuel pressure.



Cooling System

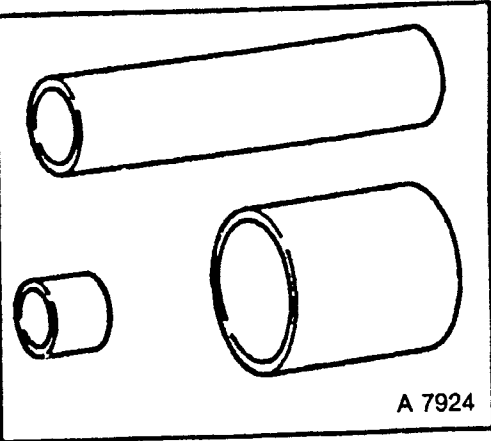
KM-251-01 REMOVER PLATE

To remove water pump drive and impeller.



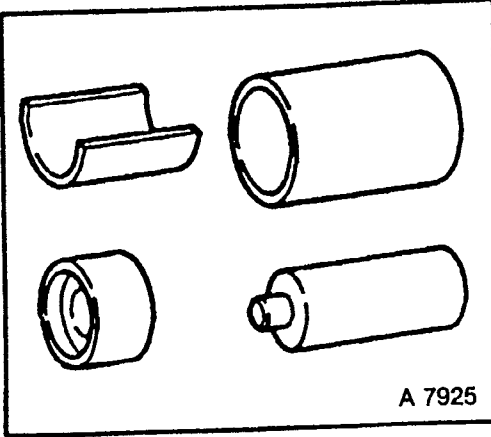
**KM-258 INSTALLER SLEEVES (no longer
available)**

To disassemble and assemble water pump.



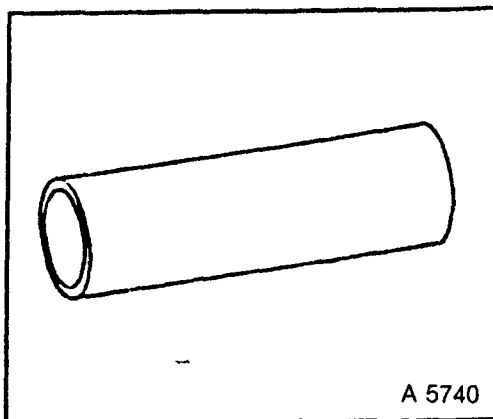
KM-265 INSTALLER (no longer available)

To assemble water pump.

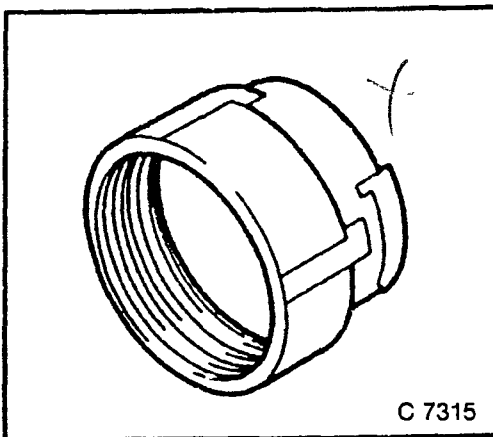


KM-302 INSTALLER

To install seal ring in water pump housing.

**KM-471* ADAPTER**

To check pressurized cooling system in conjunction with cooling system tester*.



* Cooling system tester — see “EUROLINE” catalogue.

Diagnosis of cooling system in conjunction with KM-471.

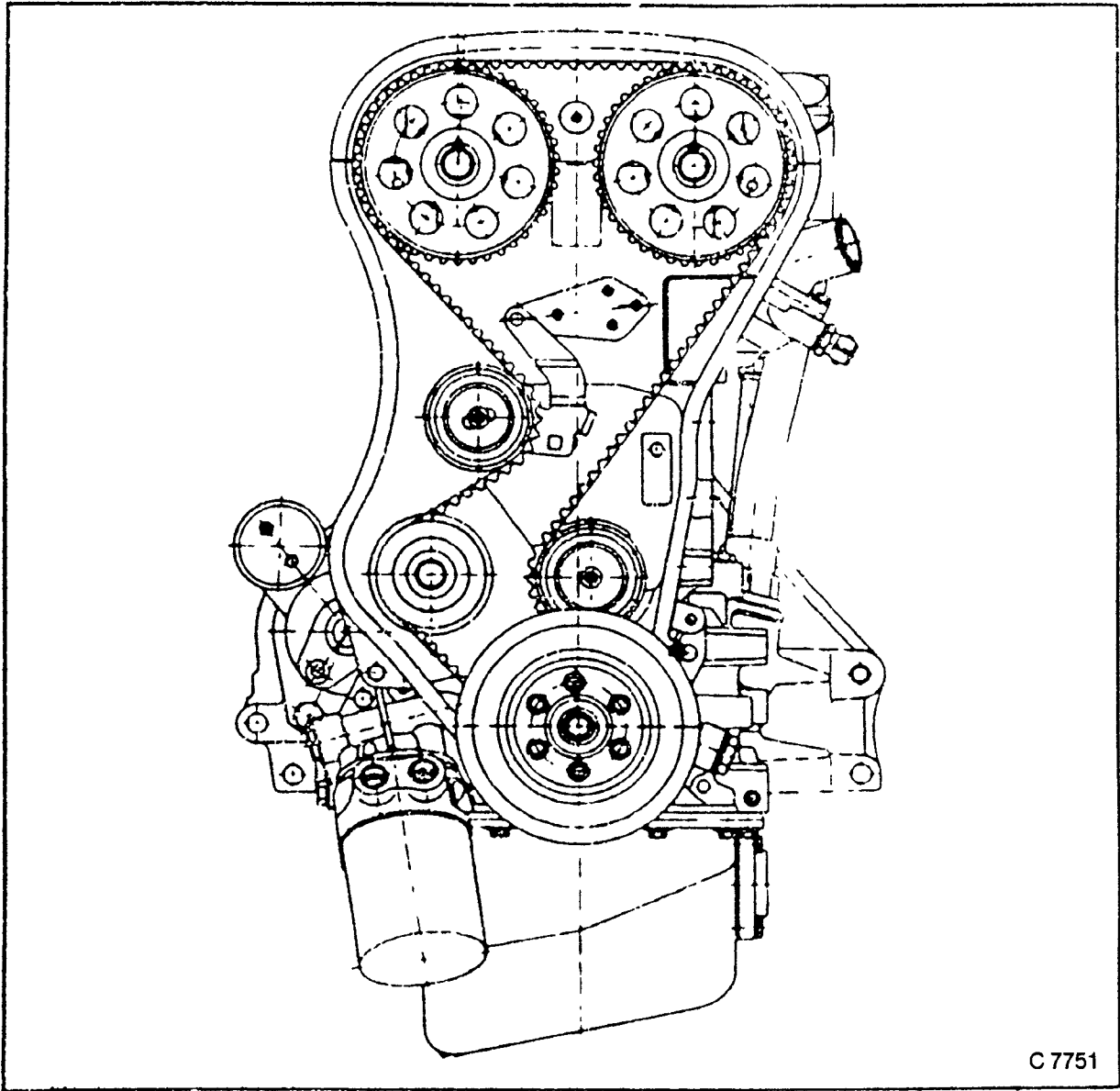


Fig 353

C 20 XE/E20 LET
Engine Timing

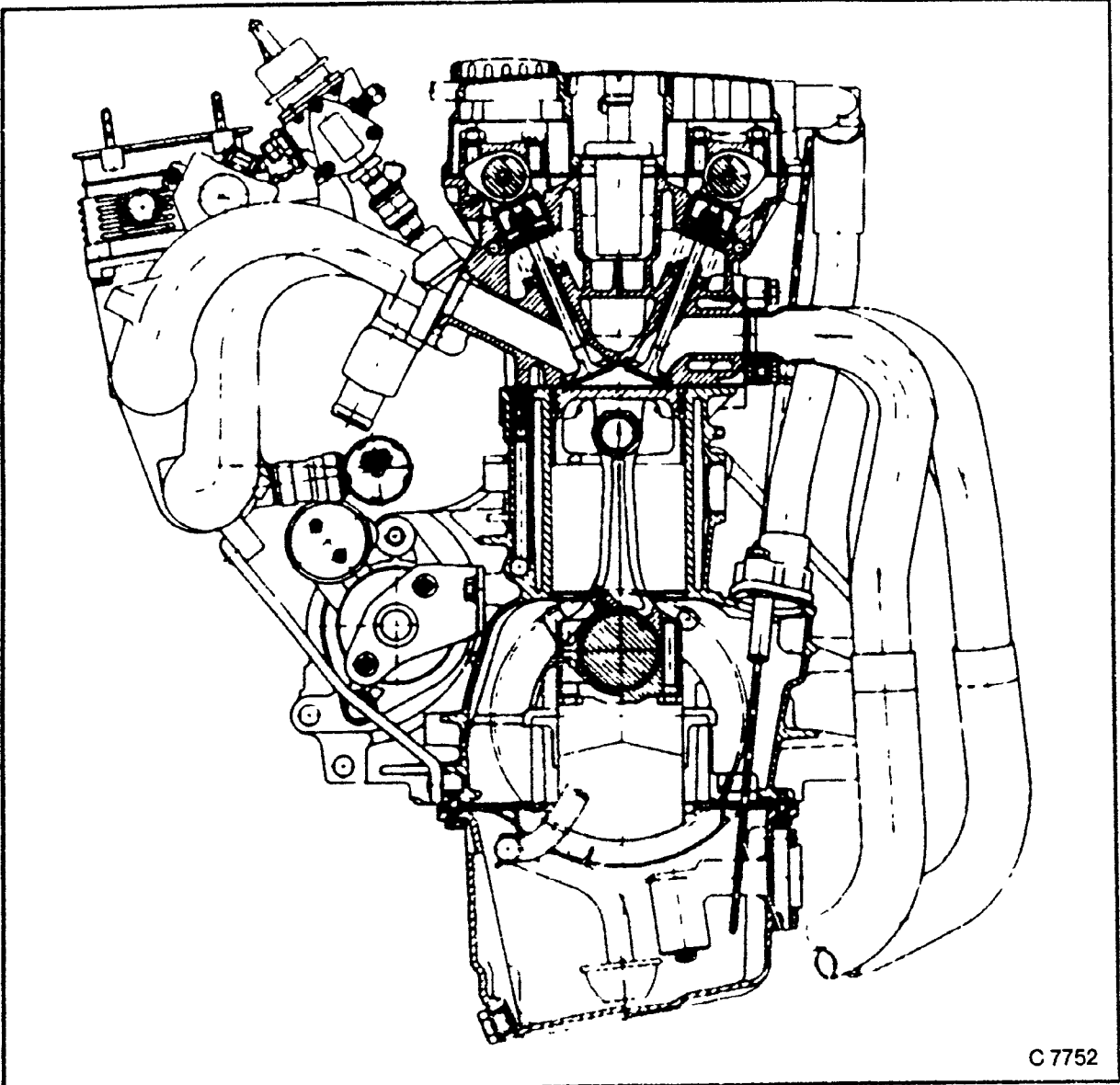
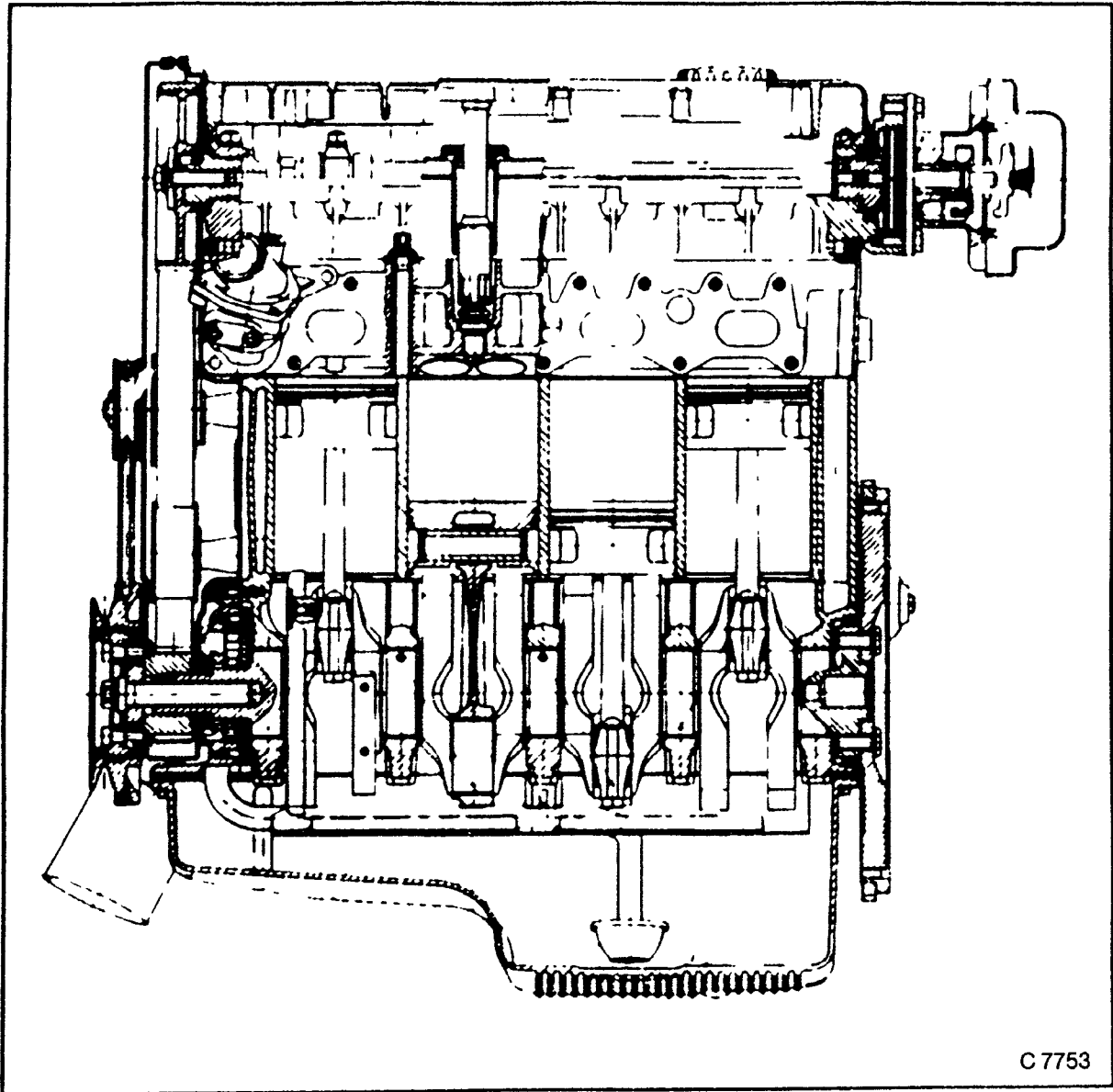


Fig. 354

C 20 XE
Cross-section



C 7753

Fig. 355

C 20 XE/20 LET
Longitudinal section

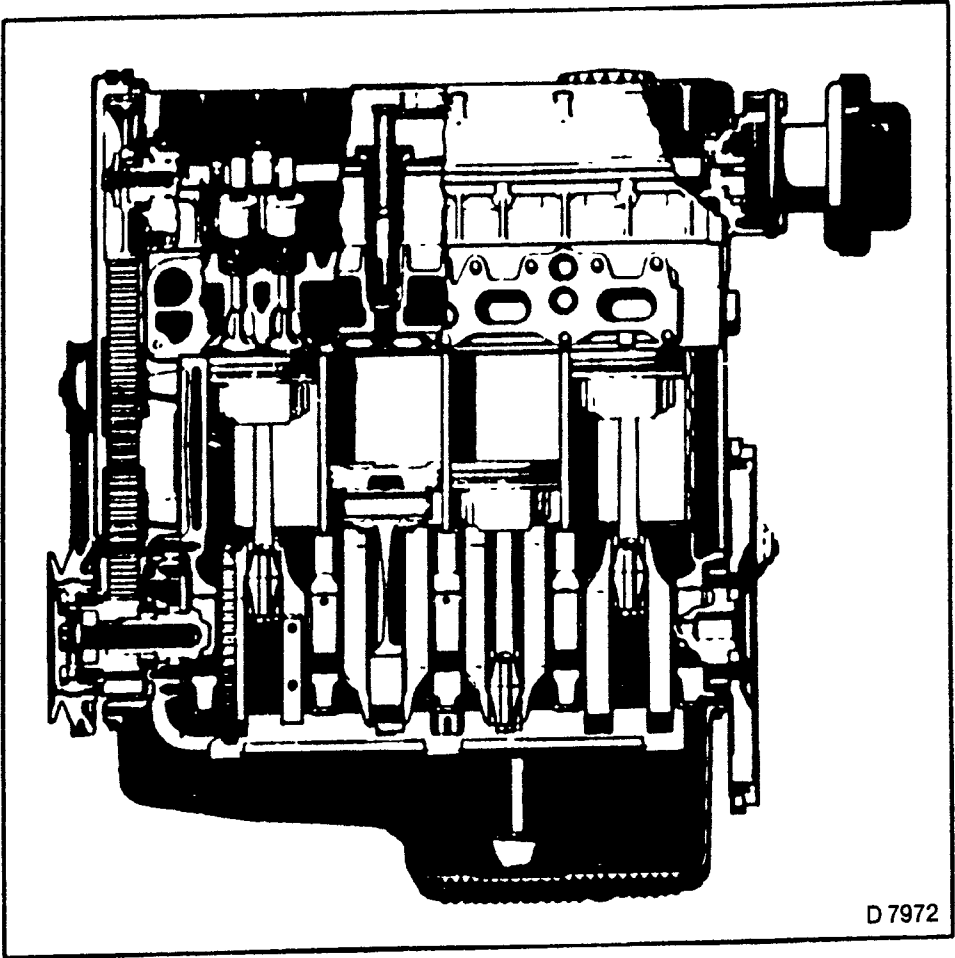


Fig. 356

C 20 LET — Side view

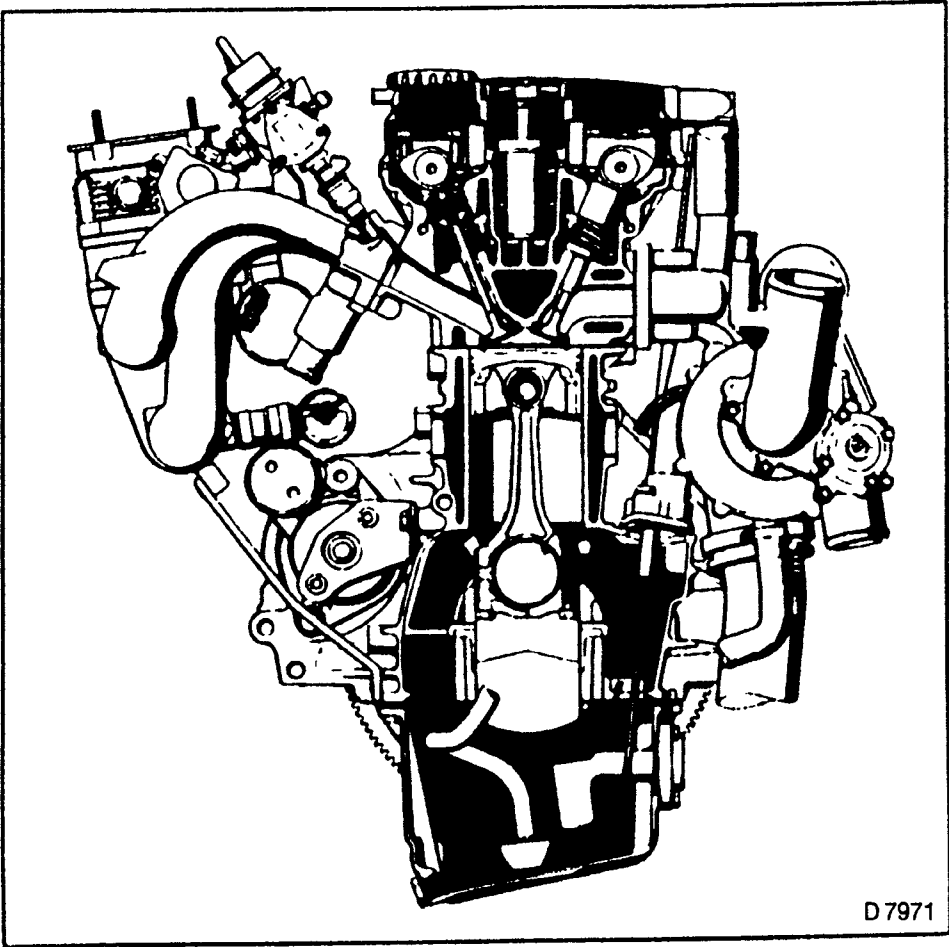
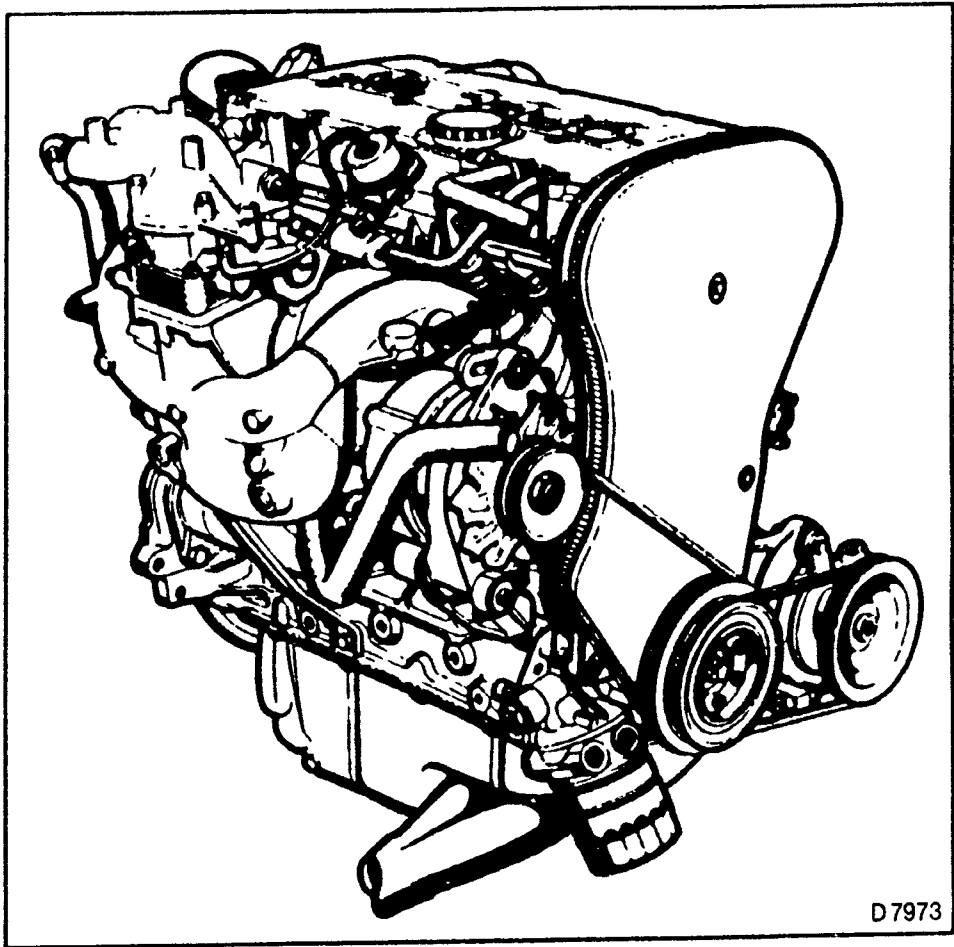


Fig. 357

C 20 LET — Cross-section



D 7973

Fig. 358

C 20 LET — Engine intake side.

Engine checking and adjusting operations

RECOMMENDED TORQUE VALUES

	Nm
Ignition cable cover to cylinder head cover	8
Spark plug to cylinder head	25
Tension strap to alternator (M 10)	35
Tension strap to alternator (M 8)	25
Clamping bracket to alternator	25
Clamping bracket, alternator to intake manifold	25
Cover to throttle valve manifold	5 ¹⁾
Front toothed belt cover to cylinder head, intermediate piece and oil pump	8
Oxygen sensor to exhaust diverter manifold	30 ¹⁾

¹⁾ C 20 LET only

Compression — Check

REMOVE, DISCONNECT

- 1 Remove Fuse No. 2 (For Fuel Pump) 20A.

NOTE:
USE COMPRESSION RECORDER
WITH RUBBER CONE AND
MEASURING RANGE TO 1750 kPa
(17,5 BAR/253,75 PSI).
ENGINE AT OPERATING
TEMPERATURE (OIL
TEMPERATURE ≥ 80°C/176°F)

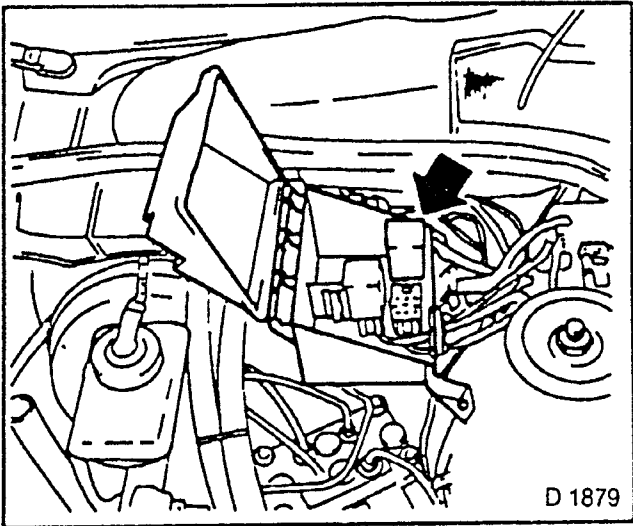


Fig. 360

INSPECT

- 1. Compression.
- 2. Actuate starter approximately four seconds with fully opened throttle valve — minimum engine speed approximately 300 rpm.
- 3. Permissible pressure deviation of individual cylinders approximately 100 kPa (1 bar/17,5 psi).

TIGHTEN (TORQUE)

- 1. Spark plug on cylinder head — 25 Nm.
Use KM-194.

INSTALL, CONNECT

- 1. Spark plug connection.
- 2. Ignition cable cover to cylinder head cover.
- 3. Terminal “15” to ignition coil.
- 4. Fuel pump relay.

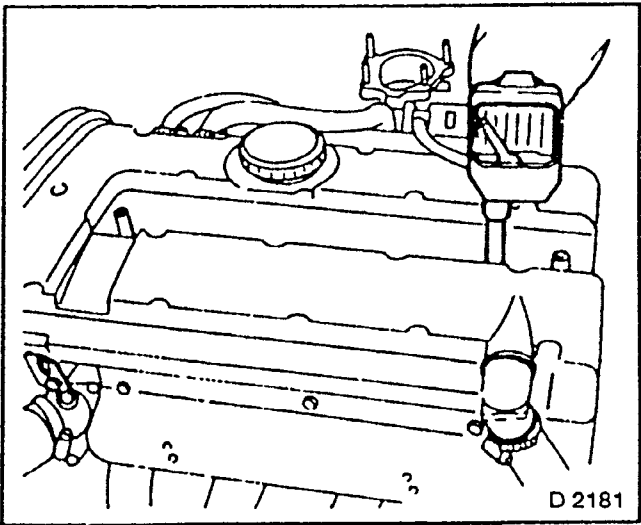


Fig. 361

Engine Pressure Loss — Check

Engine at operating temperature (oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$).

REMOVE, DISCONNECT

1. Pre-volume chamber.
2. Air intake hose.
3. Ignition cable cover from cylinder head cover.
4. All spark plugs — KM-194.
5. Spark plug connection — KM-717.
6. Coolant compensation tank cover.
7. Oil filler cover.
8. Oil dipstick.
9. V-belt for alternator.
10. Front toothed belt cover.

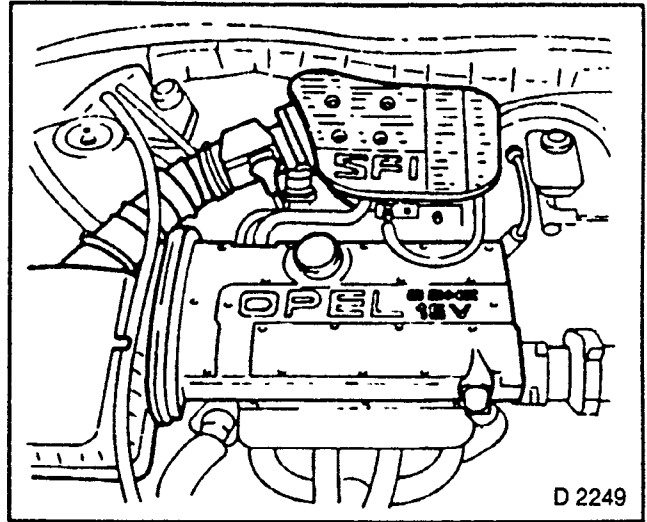


Fig. 362

REMOVE, DISCONNECT

C 20 LET:

1. Throttle manifold cover (1).
2. Ignition cable cover from cylinder head cover (2).
3. All spark plugs — KM-194.
4. Spark plug connectors — KM-717.
5. Coolant compensation tank closure cap.
6. Oil filler aperture closure cap.
7. Oil dipstick.
8. V-belt for alternator.
9. Front toothed belt cover.

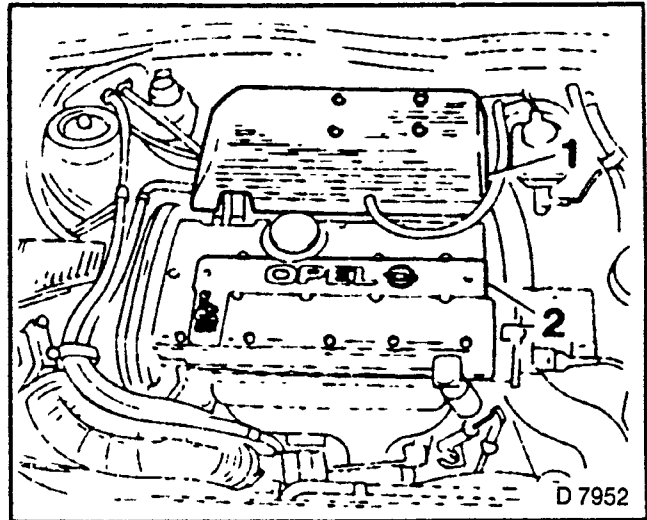


Fig. 363

INSTALL, CONNECT

1. Connecting piece into spark plug bore of 1st cylinder.
2. Compression loss tester onto compressed air system.
3. Connecting hose onto connecting piece (observe manufacturer's instructions).

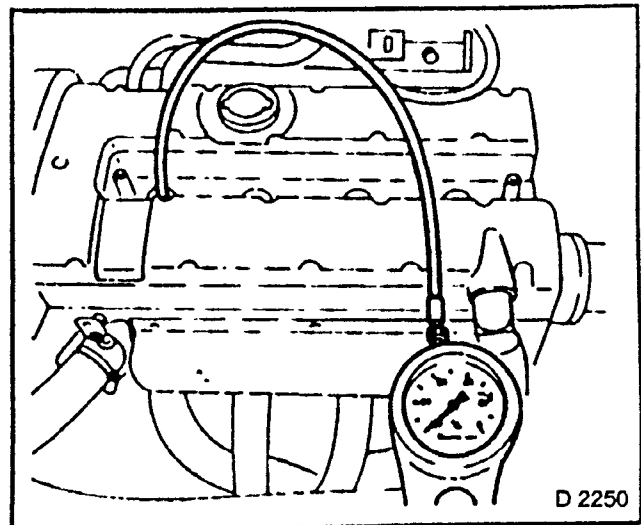


Fig. 364

- 4. Piston of 1st cylinder onto ignition TDC position — markings. For this, attach MKM-604-21 (Torx Nut E 20) to fastening bolts for toothed belt drive gear and position crankshaft pulley in rotational direction of engine on marking.
- 5. Simultaneously, markings of camshaft sprockets and cylinder head cover must align.

NOTE:
TURN CRANKSHAFT PULLEY
SLOWLY AND REGULARLY.

INSPECT

- 1. Compression loss — crankshaft must not turn.
- 2. Permitted total compression loss per cylinder approximately 25%.
- 3. Permitted compression deviation of individual cylinder approximately 10%.
- 4. Air flow to:
 - intake manifold
 - exhaust
 - compensation tank
 - crankcase.

INSPECT

- 1. Compression loss analogously with 3rd, 4th and 2nd cylinders.
- 2. Piston of cylinder to be checked in ignition TDC position.
- 3. Ignition sequence: 1 — 3 — 4 — 2.
- 4. Ascertain ignition TDC position by positioning marks on camshaft sprocket.
- 5. Turn crankshaft a further 180° in engine rotational direction (corresponds to 90° on camshaft) using MKM-604-21 (Torx Nut E 20) (markings on camshaft sprocket and cylinder head cover align).
- 6. Determine ignition TDC position for 4th and 2nd cylinders similarly.

WARNING:
TURN CRANKSHAFT PULLEY
SLOWLY AND REGULARLY.

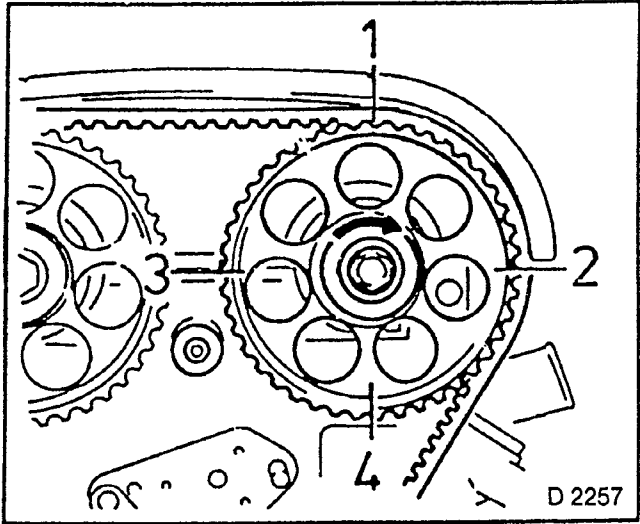


Fig. 365

**INSTALL, CONNECT
2,0 XE**

1. Spark plugs — 20 Nm.
Use KM-194.
2. Front toothed belt cover.
3. Place on V-belt and tension.
4. Oil filler aperture cover.
5. Oil dipstick.
6. Coolant compensation tank cover.
7. Ignition cable cover from cylinder head cover.
8. Pre-volume chamber.
9. Air intake hose.

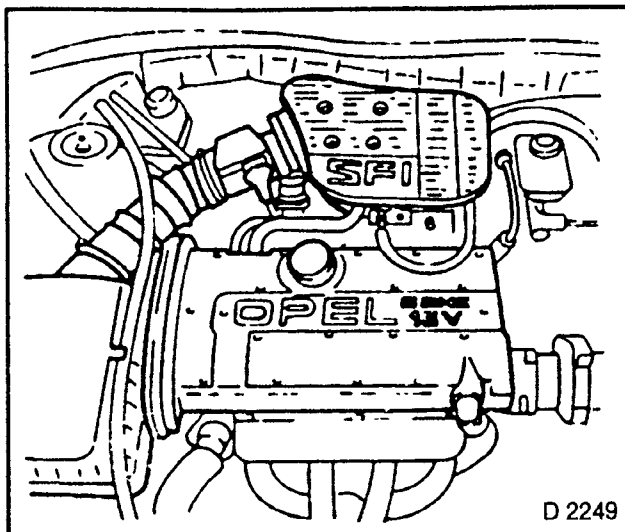


Fig. 366

INSTALL, CONNECT**C 20 LET**

1. Spark plugs — 25 Nm.
2. Use KM-194.
3. Front toothed belt cover.
4. Place on V-belt and tension.
5. Oil filler aperture cover.
6. Oil dipstick.
7. Coolant compensation tank cover.
8. Ignition cable cover from cylinder head cover.
9. Cover to throttle manifold — 5 Nm.

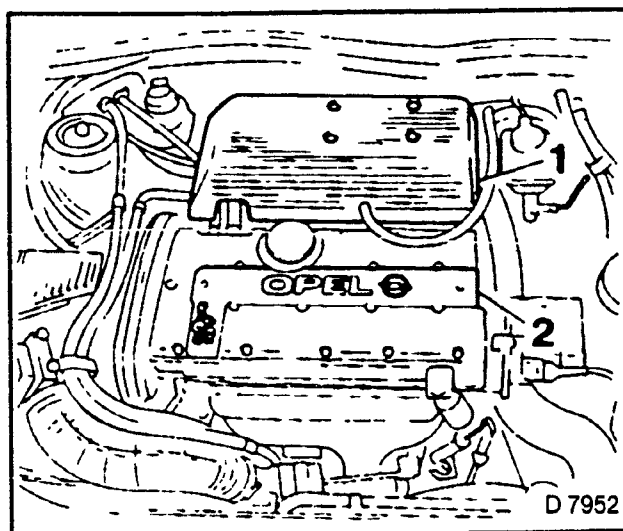


Fig. 367

Engine Oil Temperature — Measure

MEASURE

1. Engine oil temperature — MKM-596
2. Insert measuring probe into dipstick guide pipe to approximately 1 cm above oil pan floor.
3. Seal guide pipe opening with enclosed rubber plug (observe manufacturer's instructions).

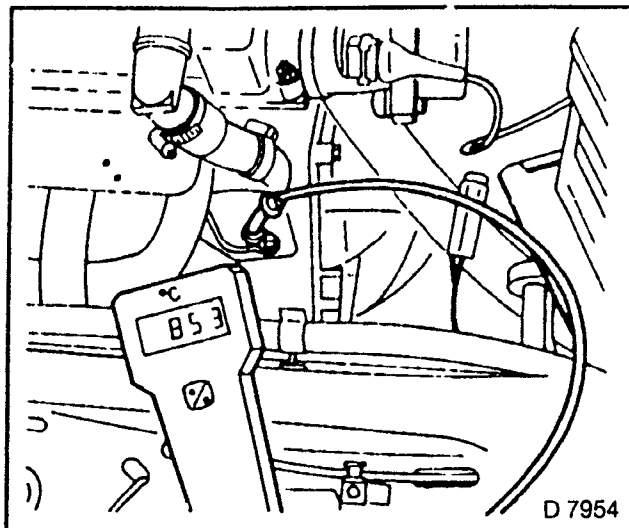


Fig. 368

Engine Oil Pressure — Check

REMOVE, DISCONNECT

1. Oil pressure switch.

INSPECT

1. Oil pressure — KM-498-B and KM-135.
2. Oil pressure minimum 0,3 bar/5,25 psi at idle speed and oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$.

INSTALL, CONNECT

1. Oil pressure switch.

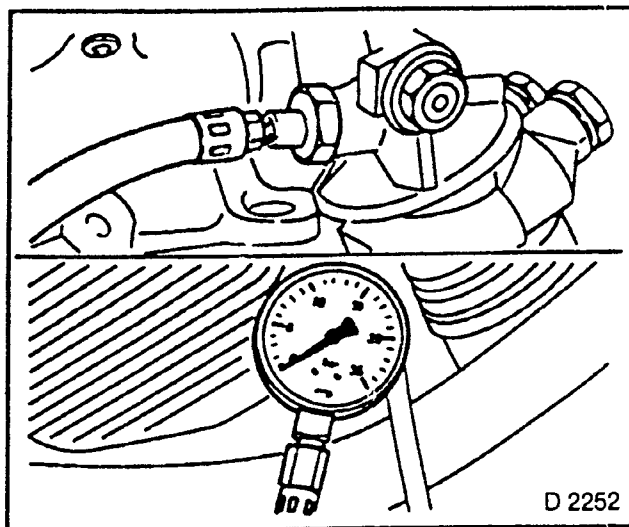


Fig. 369

ENGINE OIL CONSUMPTION — MEASURE

GENERAL

The term “oil consumption” of an internal combustion engine refers to the amount of oil which is used as a consequence of combustion. Oil consumption should under no circumstances be confused with oil loss caused by leaks in 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 produced by friction away.
3. Conduct combustion residue away.

These tasks make necessary the consumption of a certain amount of oil, i.e. the expectations of many who claim that further development of the internal combustion engine will lead to an engine that does not require oil are absolutely nonsensical.

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 need be topped up between the prescribed oil change intervals, or even no topping up at all.

Topping up is however absolutely necessary if the oil level sinks below the “MIN” mark on the dipstick. Likewise, ensure that the oil level does not exceed the upper “MAX” mark on the dipstick, which leads to increased oil consumption.

As oil consumption is a technical necessity, indications that an engine is not consuming oil means that we can conclude that the oil is being diluted by special operating conditions.

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

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

The oil consumption first begins to stabilize after operating for a few thousand kilometers; therefore, measurements of the oil consumption only become realistic after about 7 500 km. Before measuring the oil consumption, ensure that the engine is not losing oil due to 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 checked.

If, after an oil change, the maximum engine oil filling does not match the maximum level mark on the dipstick, this can be attributed to manufacturing tolerances.

All information regarding the permissible engine oil consumption and filling quantities are included in the Owner's & Driver's Manual.

MEASURING METHOD

1. The check is carried out with the vehicle on a horizontal surface with the engine at operating temperature (engine oil temperature $\geq 80^{\circ}\text{C}/176^{\circ}\text{F}$).
2. Allow engine to run at idle speed immediately before draining the engine oil.
3. Drain engine oil immediately after switching off engine and record the time with a stopwatch — draining time: 3 minutes. (Experiments have indicated that the draining should be kept within 3 minutes).

Always allow the engine oil to drain until the stream of oil turns into drops.

4. Allow the drained engine oil to cool down to approximately $20^{\circ}\text{C}/68^{\circ}\text{F}$ (1 to 2 hours).
5. The amount of cooled oil determined in a measuring cylinder* and fresh oil is added up to the maximum engine oil filling quantity, minus 0,25 litres for the unchanged engine oil filter.
6. Using this amount of engine oil, the customer should travel at least 500 km without changing the engine oil. (The driver should keep to his/her normal routes and driving style).
7. The procedure described above (points 1 to 4) is then repeated with exactly the same time for draining.
8. The amount of engine oil “missing” from the measuring cylinder is the engine oil consumption/distance covered.

* Commercially available measuring cylinder (transparent) with a capacity of 1 to 2 litres.

Timing — Check and Adjust

REMOVE, DISCONNECT

- 1. Drive belt for alternator.
- 2. Front toothed belt cover.

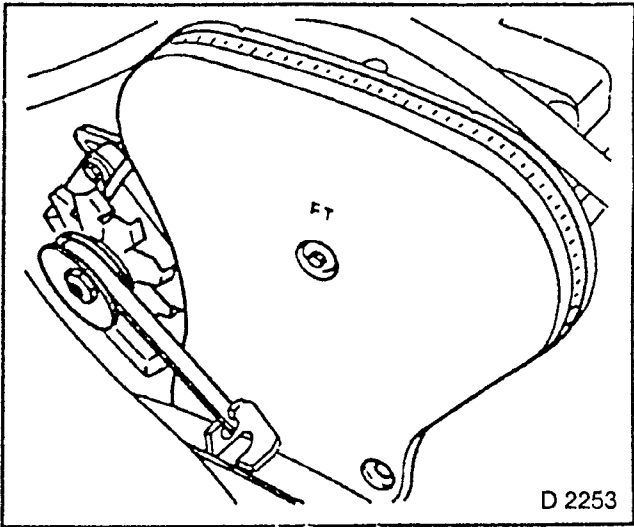


Fig. 370

INSPECT

TIMING

Place MKM-604-21 (Torx Nut E 20) on fastening bolt for toothed belt drive gear and position crankshaft pulley in rotational direction of engine on marking. Simultaneously, markings on camshaft gear and cylinder head cover must align.

NOTE:

Turn crankshaft pulley slowly and regularly.

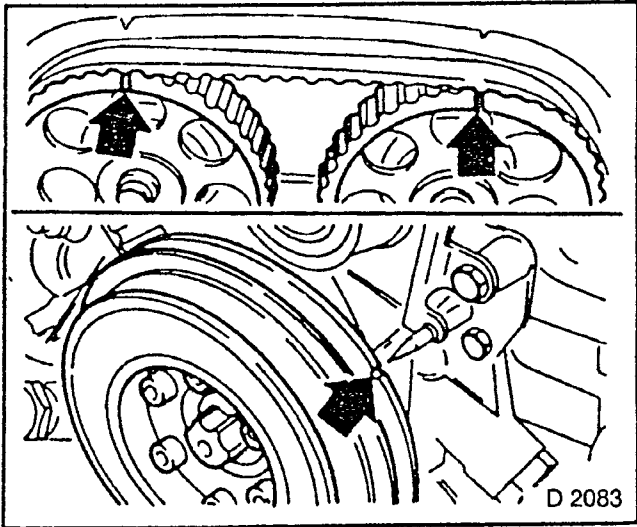


Fig. 371

ADJUST

- 1. Timing.
- 2. Loosen tension roller.
- 3. Remove toothed belt.
- 4. Place camshaft sprockets (short distance) on marking.

WARNING:
ADJUSTMENT OF THE TENSION OF A USED TOOTHED BELT IS NOT PERMISSIBLE.
ALWAYS INSTALL A NEW TOOTHED BELT DURING OPERATIONS WHICH INVOLVE THE REMOVAL OF THE TOOTHED BELT.
SEE OPERATION “TOOTHED BELT, REPLACE” PAGE 168.

INSTALL, CONNECT

- 1. Front toothed belt cover.
- 2. Install V-belt and tension.

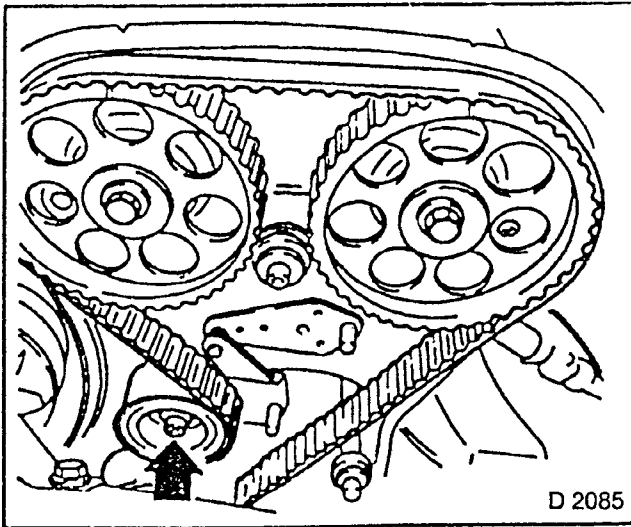


Fig. 372

C 20 LET:

In addition, air cleaner housing.

Engine Timing Side — Air Cleaner Housing

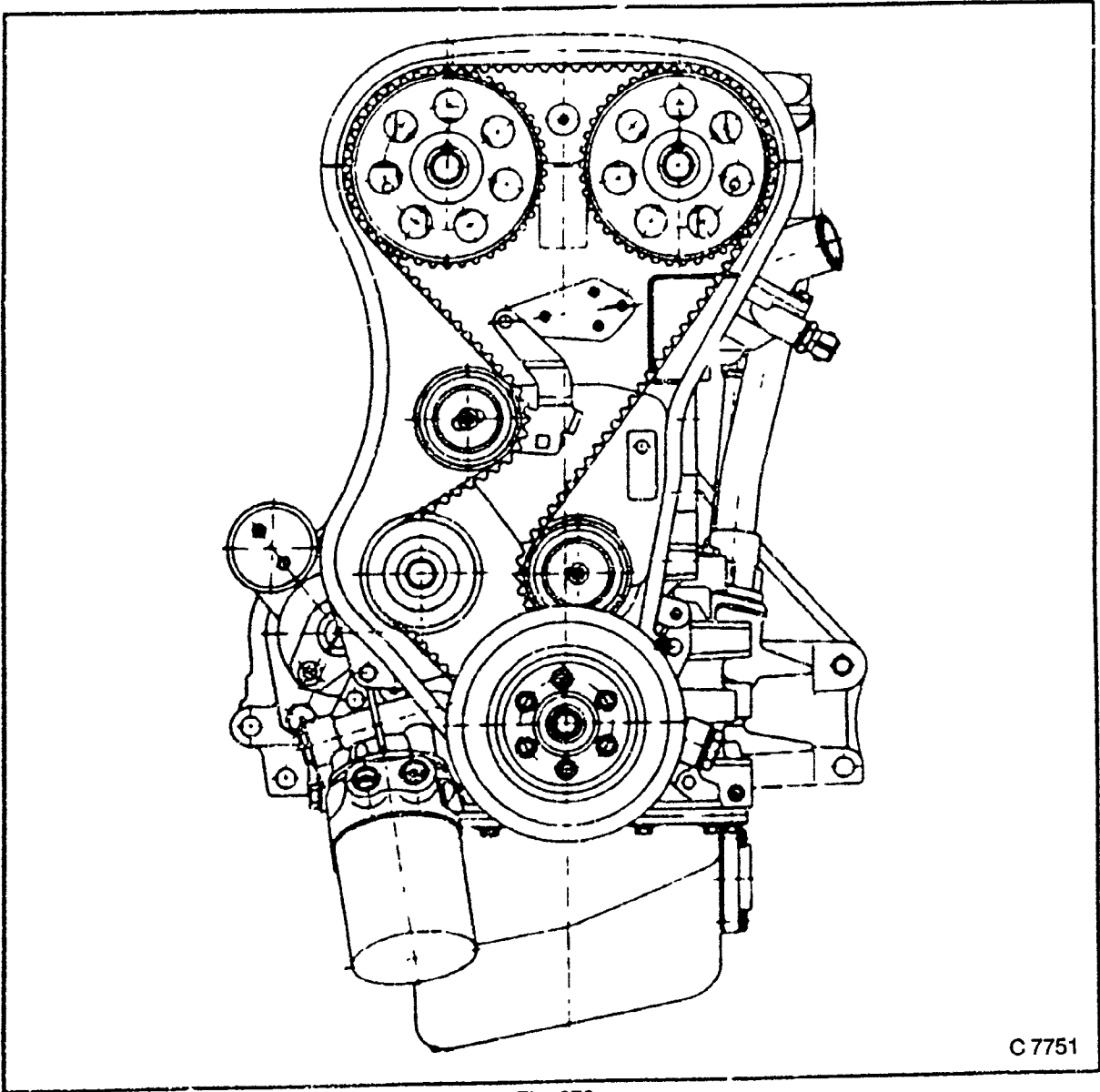


Fig. 373

C 20 XE/20 LET
Engine Timing

cardiagn.com

RECOMMENDED TORQUE VALUES

	Nm
Crankshaft pulley to toothed belt drive pinion	20
Front toothed belt cover to cylinder head	8
Front toothed belt cover to intermediate piece	8
Front toothed belt cover to oil pump	8
Guide roller to cylinder block	25 + 45° + 15° ¹⁾
Tension roller to cylinder block	25
Tension strap to alternator (M 10)	35
Tension strap to alternator (M 8)	25

¹⁾ Use new bolts

Toothed Belt — Replace

REMOVE, DISCONNECT

- 1. Ground cable from battery.
 - 2. Air intake hose.
 - 3. Engine compartment cover.
 - 4. Air cleaner housing.
- Fig. 374 shows C 20 XE engine.

REMOVE, DISCONNECT

- 1. Drive belt for alternator.
- 2. Power steering pump.
- 3. If present: drive belt for air-conditioning compressor.

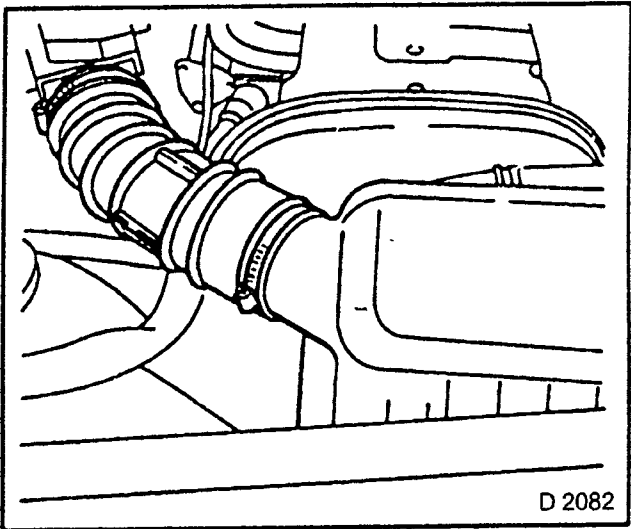


Fig. 374

REMOVE, DISCONNECT

- 1. Front toothed belt cover.
- 2. Piston of 1st cylinder in ignition TDC position — markings.
For this, attach MKM-604-21 (Torx Nut E 20) to fastening bolt of toothed belt drive gear.

NOTE:
TURN CRANKSHAFT SLOWLY AND REGULARLY.

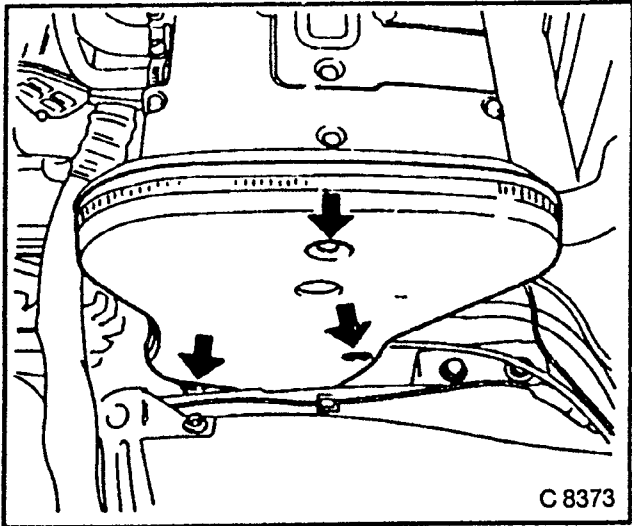


Fig. 375

REMOVE, DISCONNECT

1. Crankshaft pulley with Splined Wrench KM-321-A.
For this, attach MKM-604-21 (Torx Nut E 20) to fastening bolt of toothed belt drive gear and counterhold.

NOTE:
BEFORE REMOVING CRANKSHAFT PULLEY, CHECK POSITION OF MARKINGS (CRACKSHAFT PULLEY AND CAMSHAFT SPROCKETS).

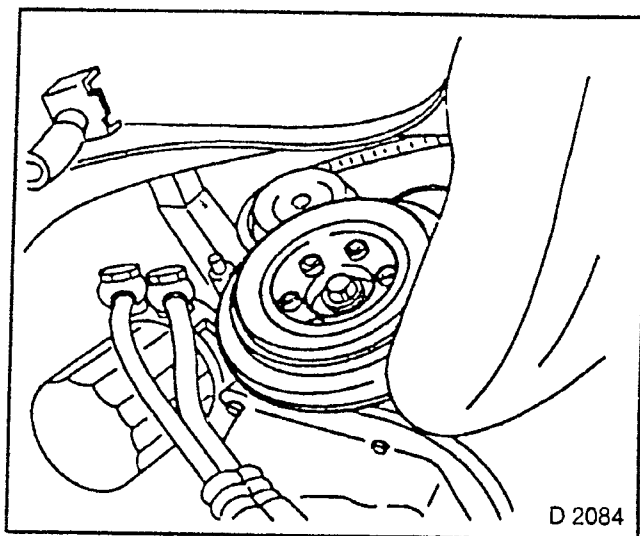


Fig. 376

2. Loosen tension roller and remove toothed belt.

WARNING:
DO NOT TURN CRANKSHAFT OR CAMSHAFT WITH LOOSENED TENSION ROLLER — TOOTHED BELT MAY SPRING OVER.

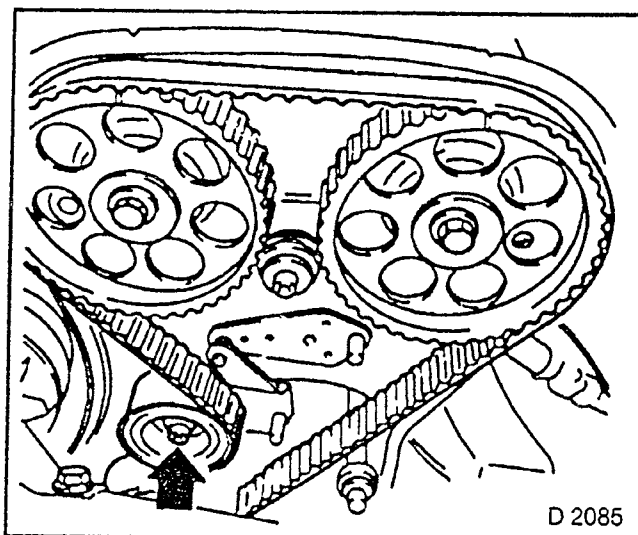


Fig. 377

INSTALL NEW TOOTHED BELT — DRIVING SIDE TAUT**INSTALL, CONNECT**

1. Crankshaft pulley with Splined Wrench KM-321-A.
For this, attach MKM-604-21 (Torx Nut E 20) to fastening bolt of toothed belt drive gear and counterhold.

TIGHTEN (TORQUE)

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

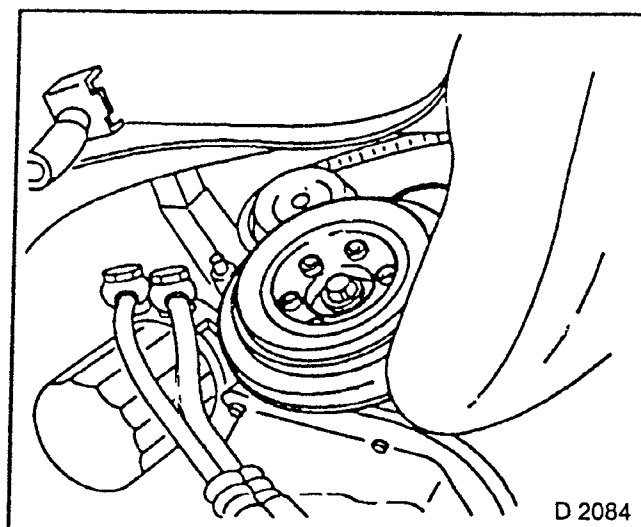


Fig. 378

ADJUST

1. Toothed belt tension.

NOTE:
ADJUSTMENT IS CARRIED OUT
WITH COLD ENGINE — ROOM
TEMPERATURE.
ATTACH ADJUSTER KM-666 —
FASTENING BOLT (1) LOOSENED.

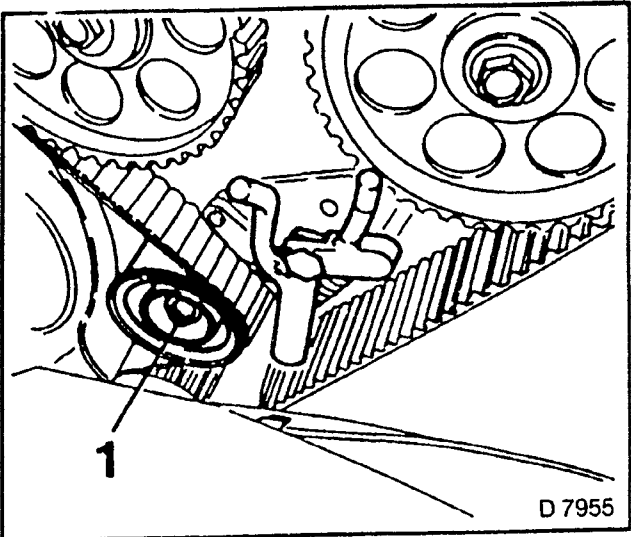


Fig. 379

2. Counter-clockwise — seen from TDC —
mark 8th tooth of camshaft sprocket.

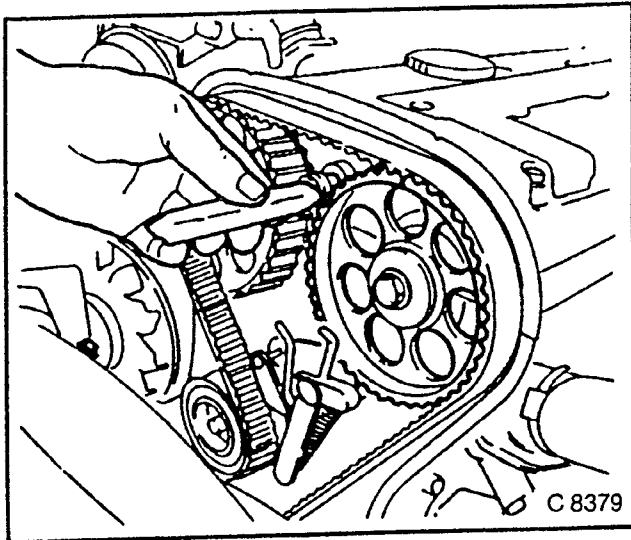


Fig. 380

3. Attach MKM-604-21 (Torx nut E 20) to
fastening bolt (1) of toothed belt drive
gear.
4. Turn crankshaft two revolutions and
eight-teeth (camshaft pulley) in engine
rotational direction (2) — mark (3) aligns
with notch (4) on cylinder head cover.

WARNING:
TURN CRANKSHAFT UNIFORMLY
AND WITHOUT JERKING —
TOOTHED BELT MAY JUMP.

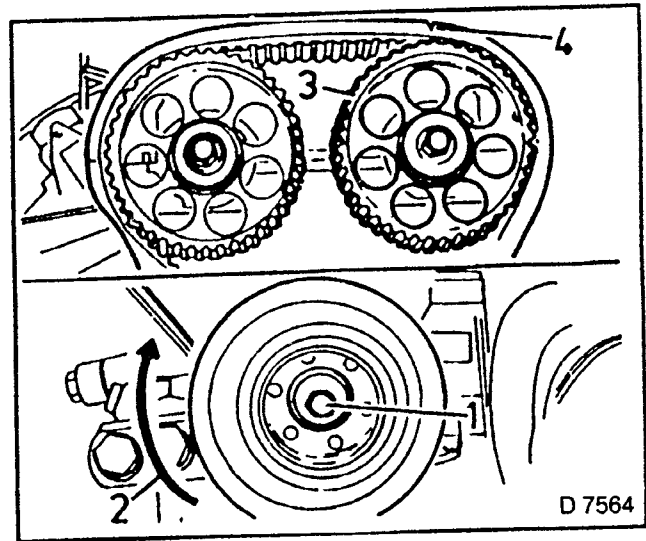


Fig. 381

TORQUE — ANGLE METHOD

- 1. Tension roller to cylinder block —
25 Nm. 45° + 15°.
- 2. Use new bolt.
- 3. Remove Adjuster KM-666.
- 4. Turn camshaft sprockets further to TDC marking.
(Notch of crankshaft pulley must then match pointer — arrow.)

INSTALL, CONNECT

- 1. Front toothed belt cover — 8 Nm.

NOTE:

ENSURE FIRM SEATING OF RUBBER GROMMETS ON FASTENING PIN.

INSTALL, CONNECT

- 1. Drive belt for power steering pump.
 - 2. Drive belt for air-conditioning compressor — if present.
- See Sections M and D.

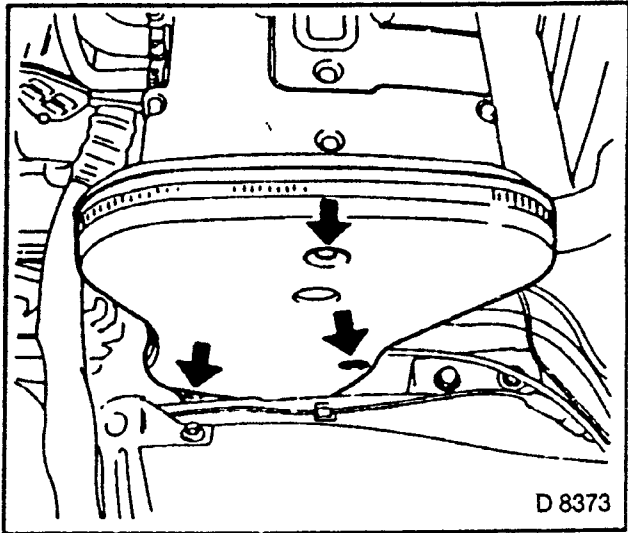


Fig. 382

Toothed Belt Tension Roller — Replace

REMOVE, DISCONNECT

- 1. Toothed belt — see operation “Toothed Belt, Replace”, page 184.
Tension roller (A) with tension roller carrier plate (B).
- 2. Spacing sleeve.

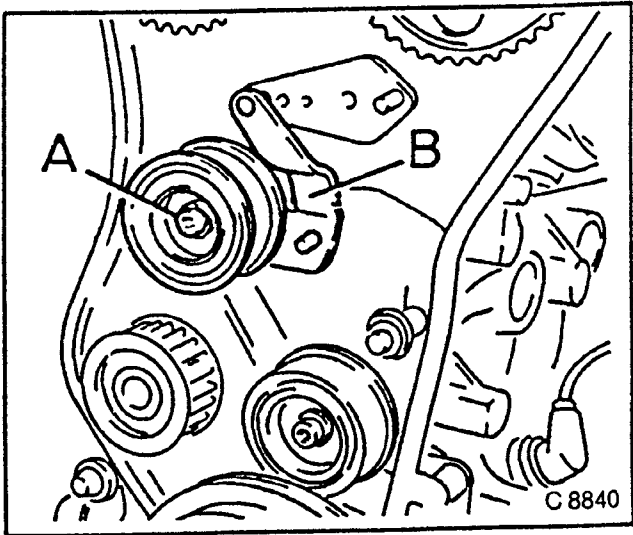


Fig. 383

INSTALL, CONNECT

1. Tension roller with tension roller carrier plate.
2. Spacing sleeve.

NOTE:
WHEN INSTALLING SPACING SLEEVE, ENSURE THAT THE SMALLER DIAMETER POINTS TOWARDS THE ROLLER CARRIER PLATE.

TORQUE — ANGLE METHOD

1. Tension roller to cylinder block — 25 Nm. $45^\circ + 15^\circ$.
 Use new bolt.
2. Install new toothed belt.
 See operation "Toothed Belt, Replace", page 184.

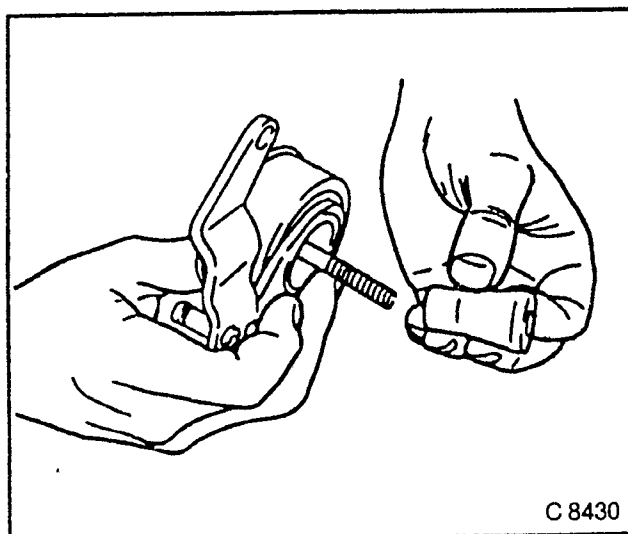


Fig. 384

Toothed Belt Guide Roller — Replace

REMOVE, DISCONNECT

1. Toothed belt — see operation "Toothed Belt, Replace", page 184.
2. Guide roller (A) with spacing sleeve.

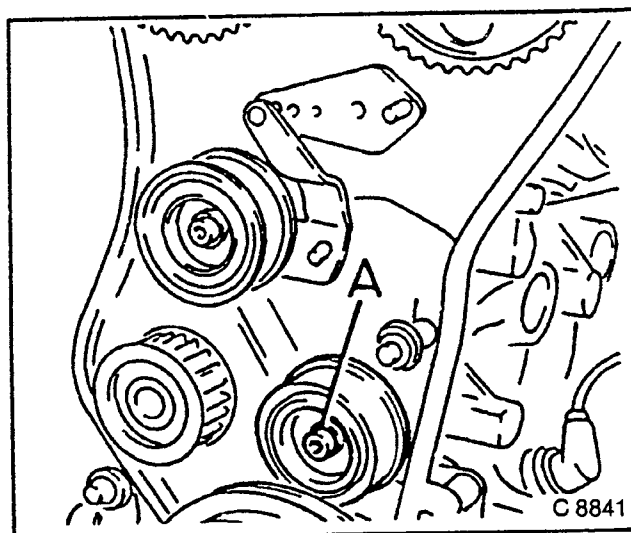


Fig. 385

INSTALL, CONNECT

1. Guide roller (A) with spacing sleeve.

NOTE:
WHEN INSTALLING SPACING SLEEVE, ENSURE THAT THE SMALLER DIAMETER POINTS TOWARDS THE ROLLER CARRIER PLATE.

TIGHTEN (TORQUE)

1. Guide roller to cylinder block — 25 Nm.
 Use new bolt.
2. Install new toothed belt.
 See operation "Toothed Belt, Replace", page 184.

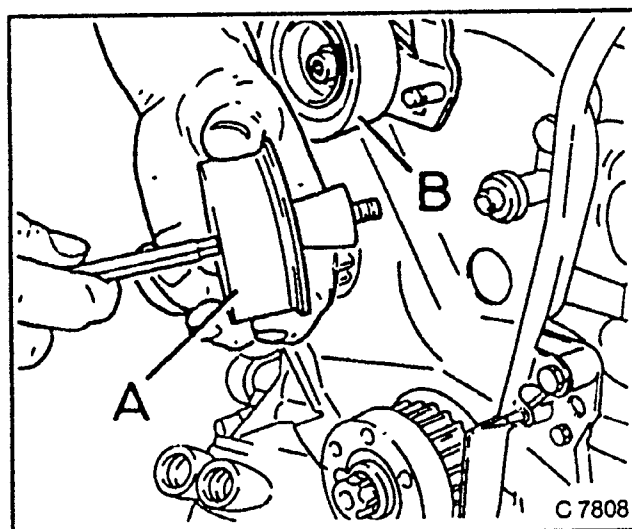


Fig. 386

Air Cleaner Housing — Remove and Install (C 20 LET)

REMOVE, DISCONNECT

1. Wiring plug (1).
2. Bracket (2).
3. Intake hose (3).
4. Upper part of housing (two clamps, two bolts).
5. Cleaner element.
6. Lower part of housing (three bolts) upwards.

INSTALL, CONNECT

1. Lower part of housing — ensure that sleeve is correctly seated.
2. Cleaner element.
3. Upper part of housing.
4. Intake hose.
5. Bracket.
6. Wiring plug.

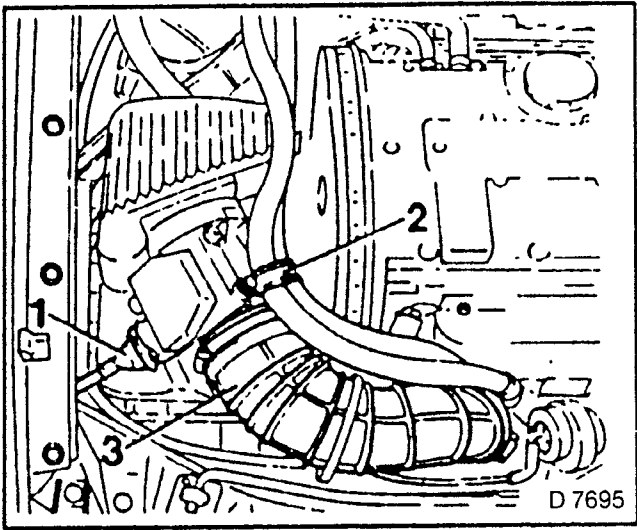


Fig. 387

Cylinder Head

Recommended Torque Values

	Nm
Alternator tension strap to intake manifold	25
Camshaft bearing cover to cylinder head (M 8)	20
Camshaft sprocket to camshaft	50 + 60° + 15° ¹⁾
Cylinder head cover to cylinder head	8
Cylinder head to cylinder block	25 + 65° + 65° + 65° ²⁾
Ignition cable cover to cylinder head cover	8
Intake manifold to cylinder head	22
Rear camshaft bearing cover to cylinder head (M 6)	10
Rear toothed belt cover to cylinder head	6
Spark plug to cylinder head	25
Thermostat housing to cylinder head	15
Brake servo vacuum line to intake manifold	15
Clamping bracket, alternator to intake manifold	25
Cover plate to cylinder head (M 6 bolt)	9
Cover to throttle valve manifold	5 ¹⁾
Fastening bolt to bracket	20°
Fastening bolts to exhaust joint	12 ³⁾
Front toothed belt cover to cylinder head, intermediate piece and oil pump	8
Performance header with cover plate to cylinder head	22

¹⁾ C 20 LET only.
²⁾ Use new nuts.
³⁾ Use new bolt(s)
⁴⁾ After test run, turn a further 30° to 45°.

Camshaft Seal Ring — Replace

REMOVE, DISCONNECT

1. Toothed belt — see operation "Toothed Belt, Replace", page 184.
2. Camshaft sprockets.
3. Seal ring — make hole in middle of ring (arrow), turn in self-tapping screw and edge out.

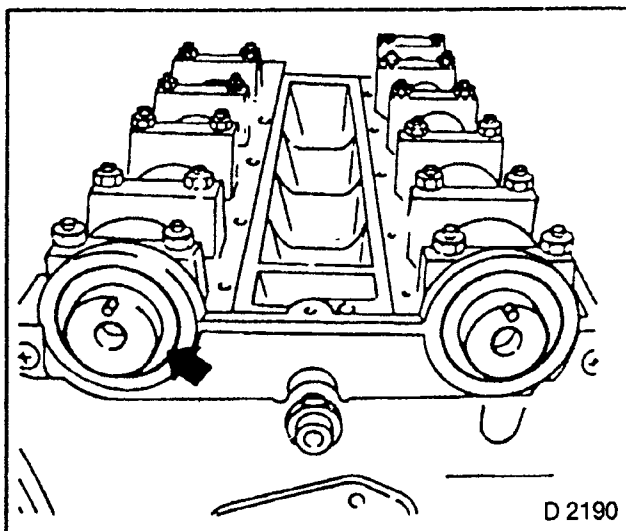


Fig. 388

CLEAN

Sealing surfaces

INSTALL, CONNECT

1. Seal ring with KM-422 — use bolt and washer of camshaft sprocket.
2. Coat sealing lip of seal rings with protective grease.
3. Toothed belt.
4. Camshaft sprockets.

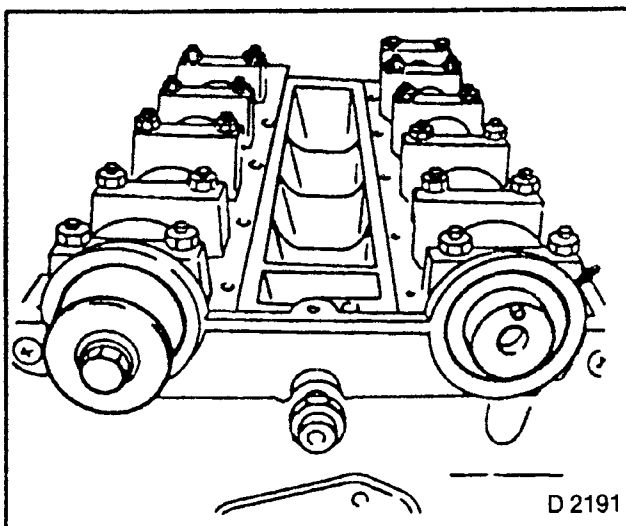


Fig. 389

Gasket — Intake Manifold/Cylinder Head — Replace (C 20 LET)

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Throttle valve manifold cover.
3. Alternator.

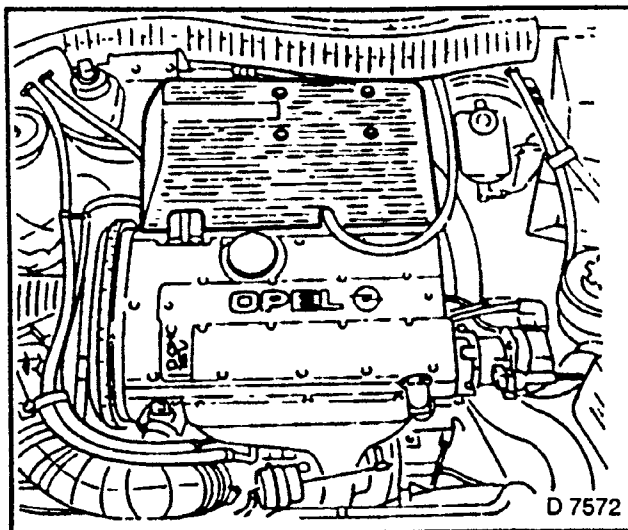


Fig. 390

REMOVE, DISCONNECT

- 1. Coolant hose (1) from compensation tank.
- 2. Coolant hose (2) from intake manifold.
- 3. Collect coolant.

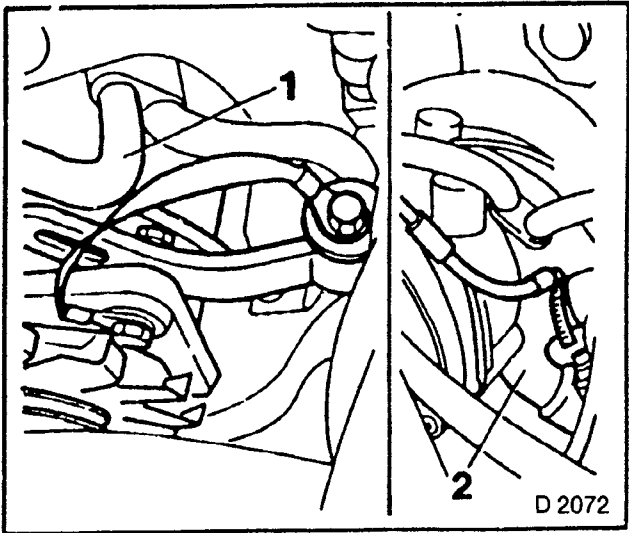


Fig. 391

REMOVE, DISCONNECT

- 1. Air hose (1) from throttle valve manifold.

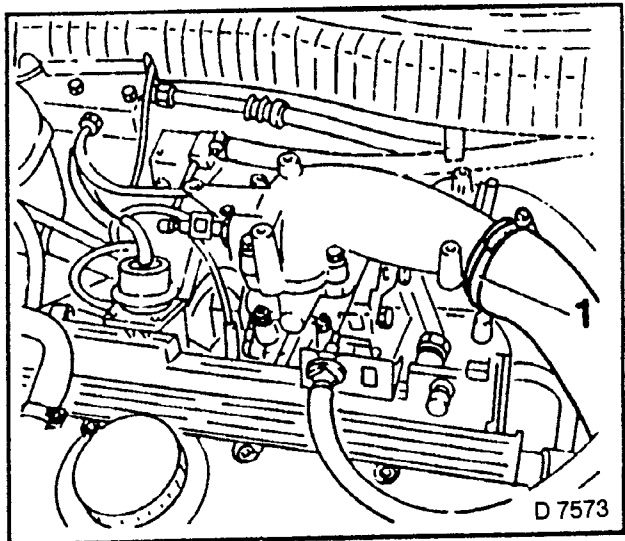


Fig. 392

REMOVE, DISCONNECT

- 1. Brake servo vacuum line (arrow) from intake manifold.
- 2. Intake manifold/cylinder block support from intake manifold.
- 3. Loosen lower fastening bolt.
- 4. Swing support aside.

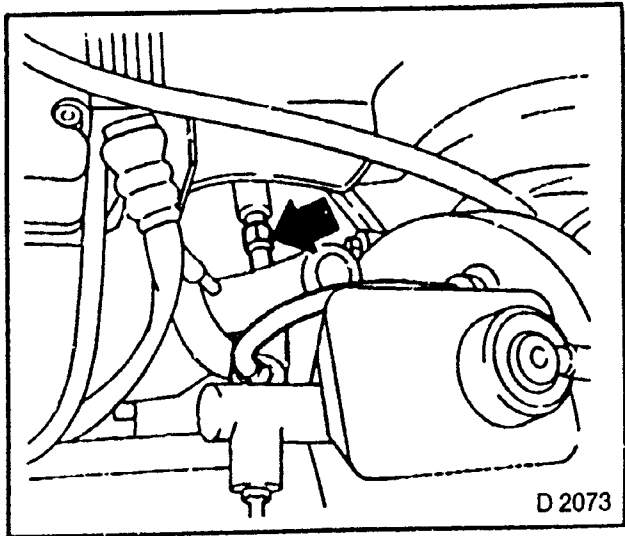


Fig. 393

REMOVE, DISCONNECT

1. Bowden cable.
2. Fuel lines — close off with spring clamps.
3. Engine vent hoses from cylinder head cover.

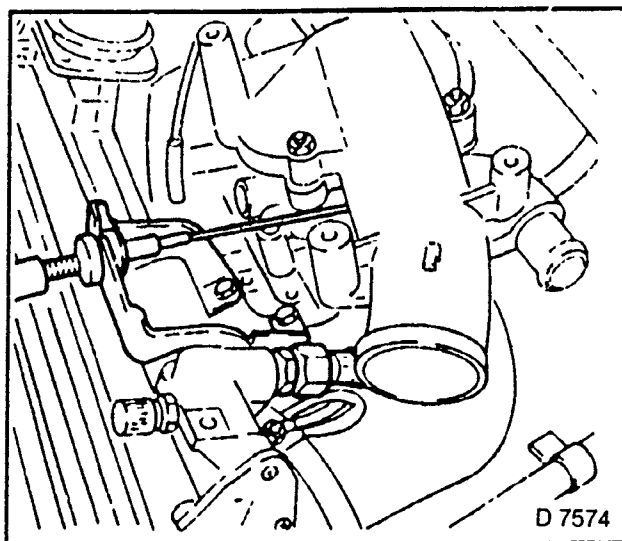


Fig. 394

REMOVE, DISCONNECT

1. Plug strip from injection valves — For this, pull back retaining clamp of 1st cylinder injection valve.
2. Wiring plug (1) for hot start valve.
3. Wiring plug (2) for intake air temperature sensor.
4. Wiring plug (3) for throttle valve potentiometer.
5. Wiring plug (4) for tank vent valve.
6. Ground connections from fuel distributor pipe.
7. Note routing of lines.

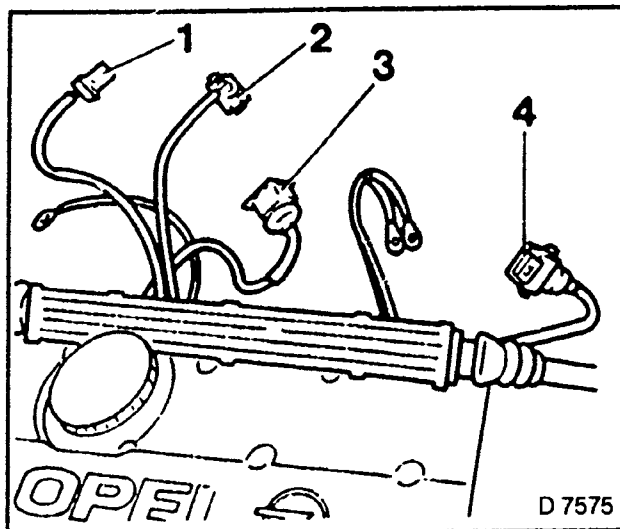


Fig. 395

REMOVE, DISCONNECT

1. Wiring plug from idle speed adjuster.
2. Lay plug strip for injection valves aside at front.

REMOVE, DISCONNECT

1. Vacuum hose (1) from throttle valve housing.
2. Vacuum hose (2) from branch piece.

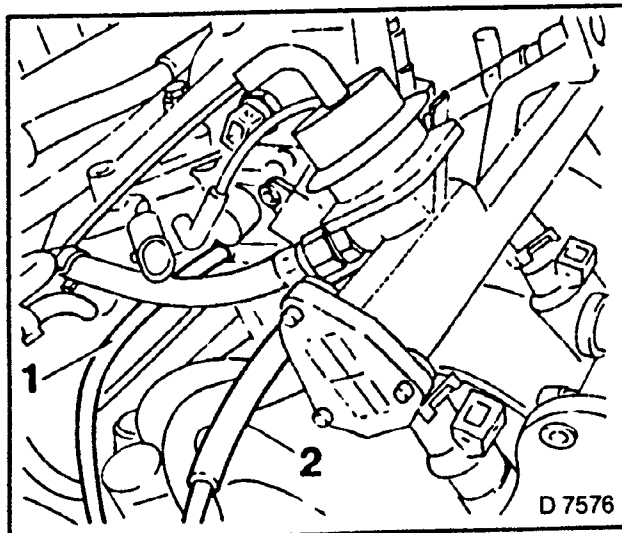


Fig. 396

REMOVE, DISCONNECT

1. Fastening nuts from intake manifold.
2. Vacuum line (1) from tank vent valve.
3. Tank vent valve.
4. Intake manifold from cylinder head.

CLEAN

1. Sealing surfaces.

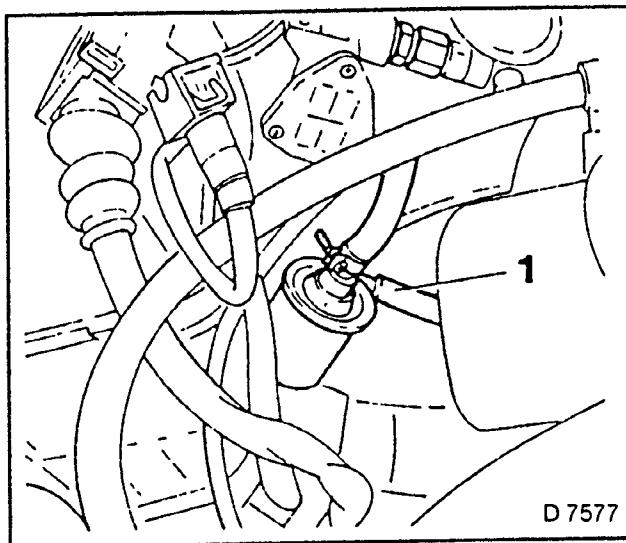


Fig. 397

INSTALL, CONNECT

1. Intake manifold with new gasket to cylinder head.
2. Tank vent valve.
3. Vacuum line to tank vent valve.

TIGHTEN (TORQUE)

1. Intake manifold to cylinder head — 22 Nm.

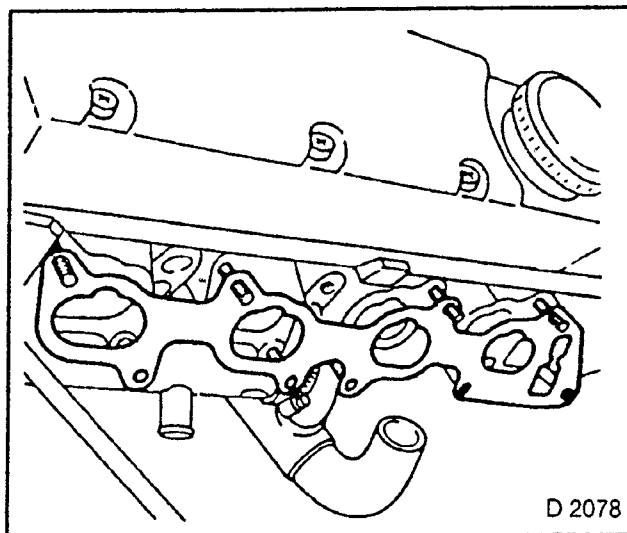


Fig. 398

INSTALL, CONNECT

1. Connect plug strip to injection valves.
2. Vacuum hoses.
3. Wiring plug (1) for hot start valve.
4. Wiring plug (2) for intake air temperature sensor.
5. Wiring plug (3) for throttle valve potentiometer.
6. Wiring plug (4) for tank vent valve.
7. Wiring plug to idle speed adjuster.
8. Ground connections to fuel distributor pipe.
9. Note routing of lines.
10. Check that all ground connections are in good condition and correctly seated.

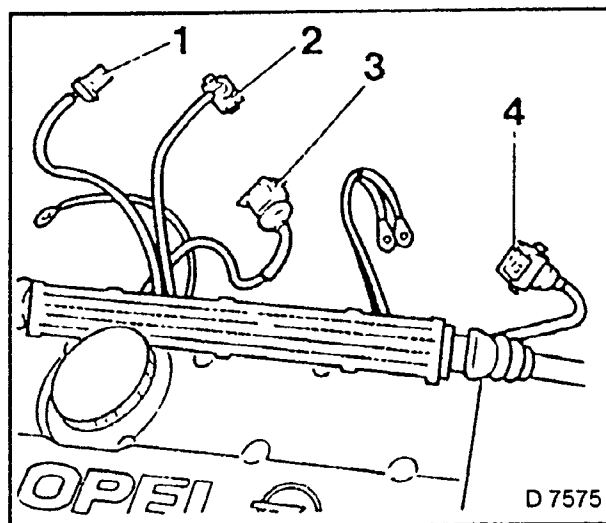


Fig. 399

INSTALL, CONNECT

- 1. Hose connections to cylinder head cover.
- 2. Fuel lines — remove spring clamps.
- 3. Bowden cable — install free of tension.

TIGHTEN (TORQUE)

- 1. Support to intake manifold and cylinder block — 25 Nm.
- 2. Brake servo vacuum line to intake manifold — 15 Nm.

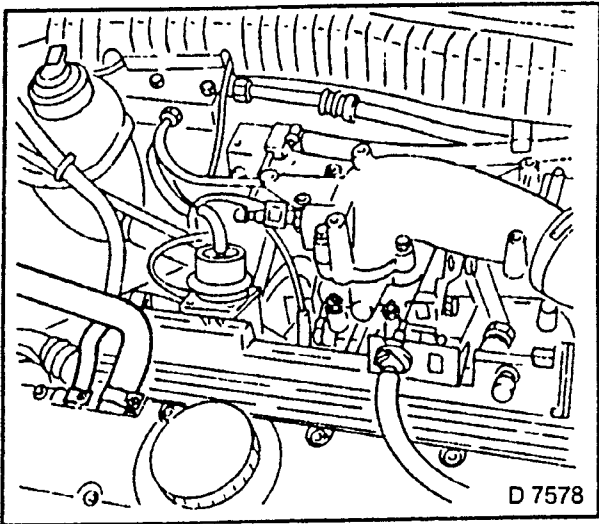


Fig. 400

INSTALL, CONNECT

- 1. Air hose to throttle valve manifold.
- 2. Coolant hoses to compensation tank or intake manifold.

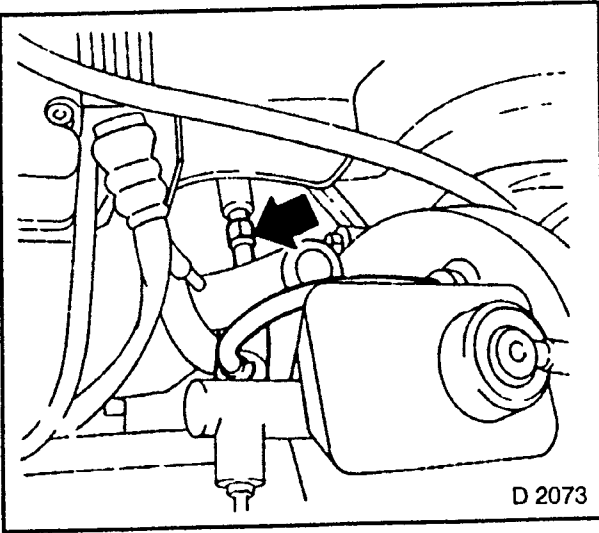


Fig. 401

INSTALL, CONNECT

- 1. Alternator.
- 2. Cover to throttle valve manifold — 5 Nm.
- 3. Ground cable to battery.
- 4. Top up cooling system and bleed.

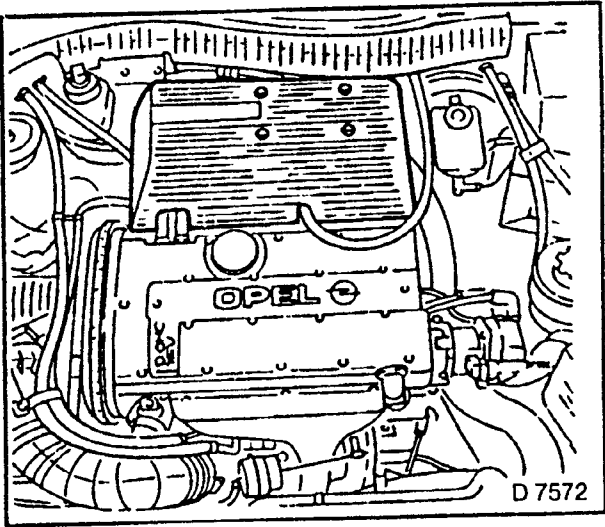


Fig. 402

Exhaust Camshaft — Replace

Inlet Camshaft — Replace

REMOVE, DISCONNECT

- 1. Toothed belt — see operation “Toothed Belt, Replace”, page 184.
- 2. Camshaft sprockets.
- 3. High voltage distributor.

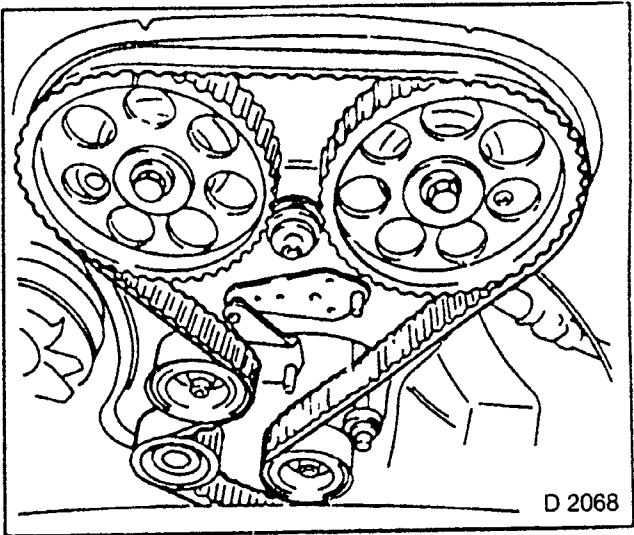


Fig. 403

REMOVE, DISCONNECT

- 1. Camshaft bearing cover.
- 2. Loosen bolts in stages — 1/2 to full turn.

WARNING:

THE CAMSHAFT MUST BE EVENLY AND UNIFORMLY LOOSENED FROM THE BEARING SEAT — FRONT GUIDE BEARING.

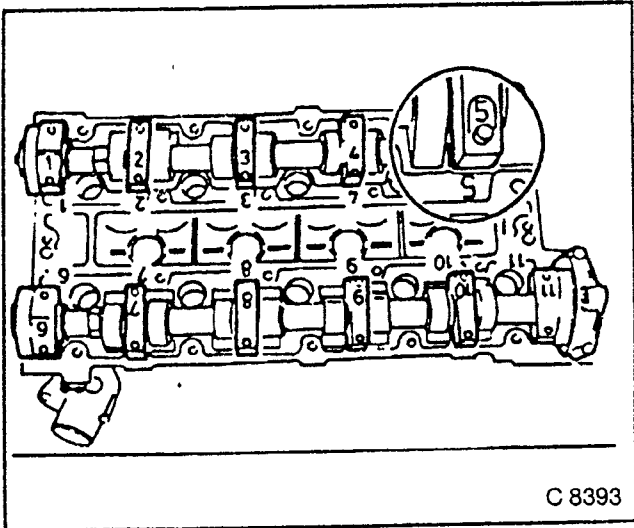


Fig. 404

CLEAN

INSPECT

- 1. Replace all components if necessary.
- 2. Coat sliding surfaces of valve lifter and camshaft with MoS₂ paste.
- 3. Insert camshaft.
- 4. Apply Sealing Compound Locktite 242 to sealing surfaces of outer camshaft bearing cover.

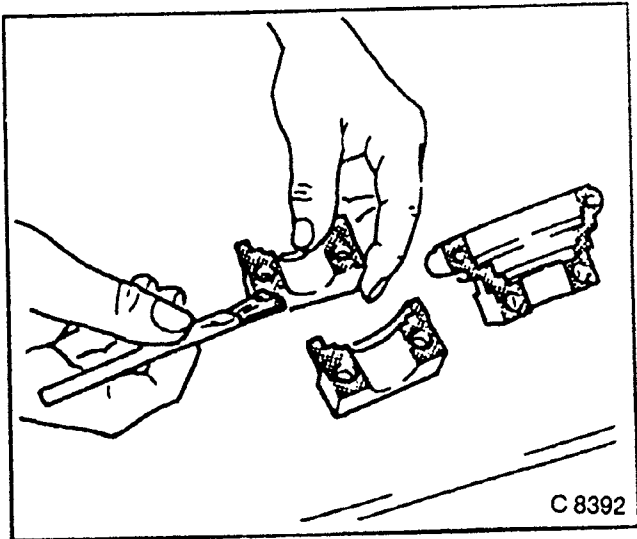


Fig 405

INSTALL, CONNECT

- 1. Camshaft bearing cover.

WARNING:
IDENTIFICATION NUMBERS OF
CAMSHAFT BEARING COVERS
MUST MATCH THOSE IN CYLINDER
HEAD.

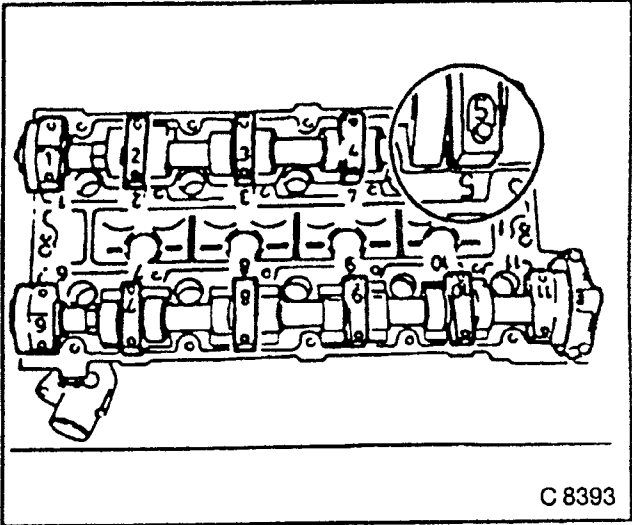


Fig. 406

TIGHTEN (TORQUE)

- 1. Camshaft bearing cover to cylinder head (M8) — 20 Nm.
- 2. Rear camshaft bearing cover to cylinder head (M6) — 10 Nm.

WARNING:
INSTALL CAMSHAFT COVER FROM
INSIDE OUTWARDS. INSTALL
FASTENING NUTS IN STAGES —
1/2 TO FULL TURN.

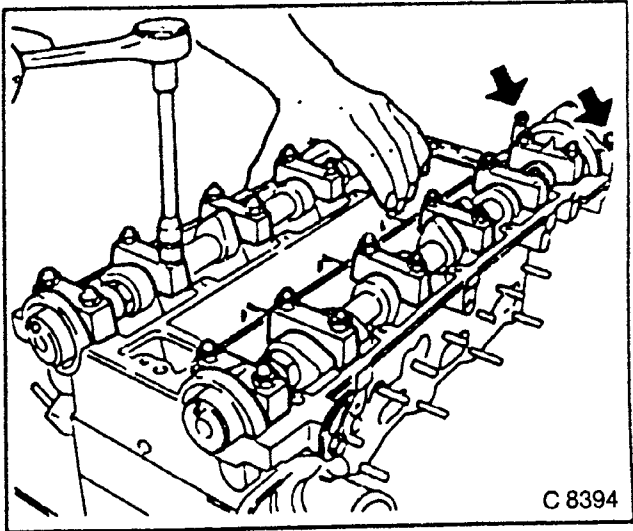


Fig. 407

- 3. Turn camshaft with wrench to that pin (A) points upwards.

INSTALL, CONNECT

- 1. New camshaft seal rings with KM-422.
- 2. Use bolt and washer of camshaft sprocket.
- 3. Coat seal lips of seal ring with protective grease.
- 4. High voltage distributor.
- 5. Camshaft sprockets.
- 6. Toothed belt.

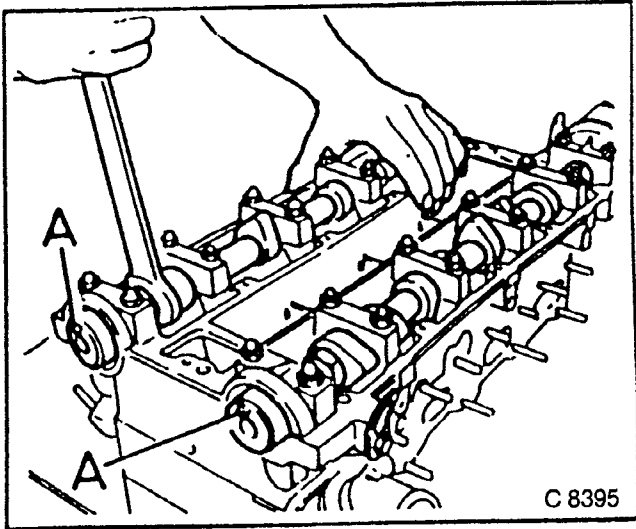


Fig. 408

Camshaft Sprockets — Remove and Install

REMOVE, DISCONNECT

- 1. Toothed belt — see "Toothed Belt, Replace", page 184.
- 2. Ignition cable cover.
- 3. Spark plug connection with KM-717.
- 4. Hose connections (arrows) from cylinder head cover.
- 5. Cylinder head cover.

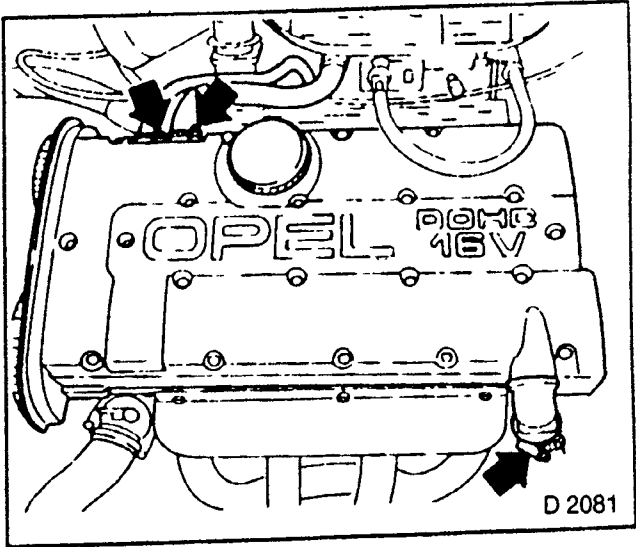


Fig. 409

REMOVE, DISCONNECT

- 1. Camshaft sprockets.
- 2. Counterhold with wrench on hex of camshaft.

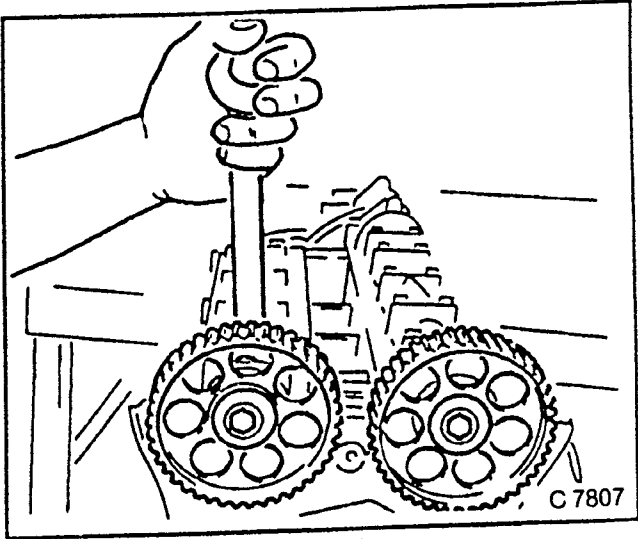


Fig. 410

INSTALL, CONNECT

- 1. Camshaft sprockets with timing markings forward.
- 2. Pin (A) of camshaft engages in bore hole of camshaft sprocket.

TORQUE — ANGLE METHOD

- 1. Camshaft sprocket to camshaft — 50 Nm. + 60° + 15°. Use new bolt. During installation, counterhold on hex of camshaft.

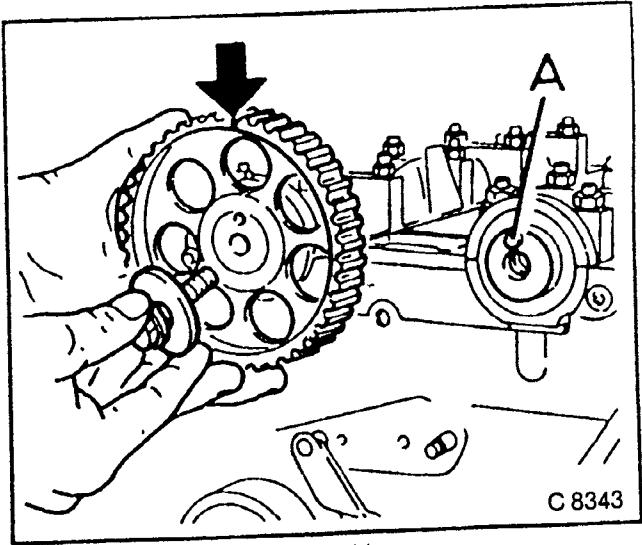


Fig. 411

INSTALL, CONNECT

1. Cylinder head cover with new gasket.
2. Hose connections (arrows) to cylinder head cover.
3. Spark plug connection.
4. Ignition cable cover.
5. New toothed belt — see "Toothed Belt, Replace", page 184.

TIGHTEN (TORQUE)

1. Cylinder head cover to cylinder head — 8 Nm.
2. Ignition cable cover to cylinder head cover — 8 Nm.

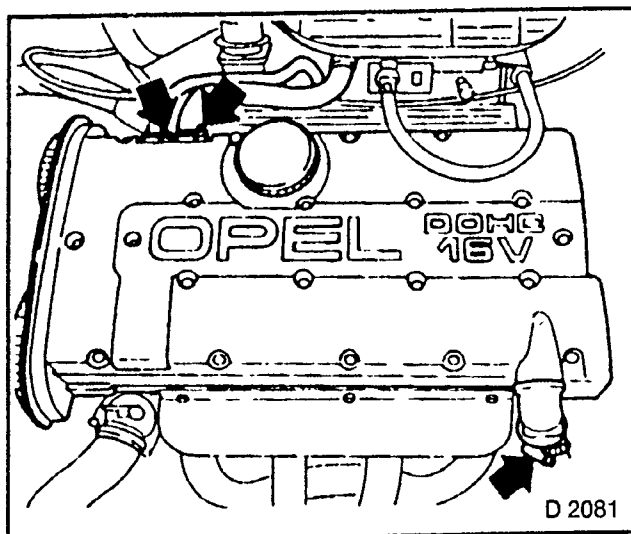


Fig 412

Cylinder Head — Remove and Install

WARNING:
REMOVE CYLINDER HEAD ONLY
WITH COLD ENGINE (ROOM
TEMPERATURE).

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Engine compartment cover.
3. Lower hose bend (arrow) from radiator — collect coolant.
4. Toothed belt — see "Toothed Belt, Replace", page 184.

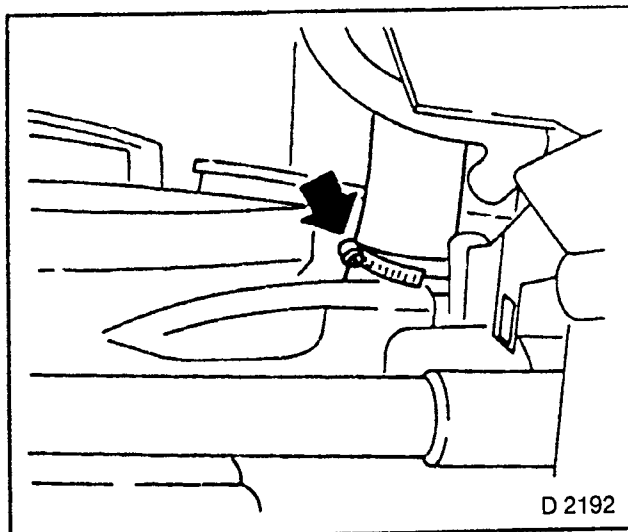


Fig. 413

REMOVE, DISCONNECT

1. Camshaft sprockets.
2. Fan manifold.
3. Wiring plug (1) from mass air flow meter.
4. Hose.
5. Idle speed adjuster (2) from pre-volume chamber.
6. Pre-volume chamber with mass air flow meter (3).

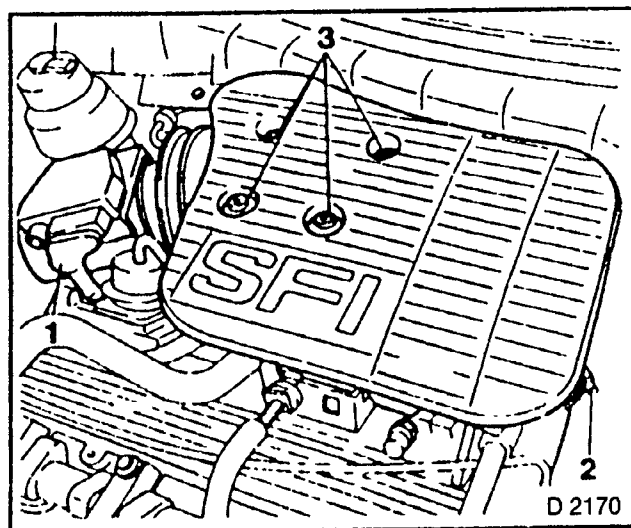


Fig. 414

REMOVE, DISCONNECT

1. Upper hose bend and wiring plug from thermostat housing.
2. Fastening bolt (arrow) from cylinder head.
3. Wiring plug and high voltage cable from ignition coil.
4. Wiring plug from high voltage distributor.
5. Coolant hose.
6. Multiple plug.

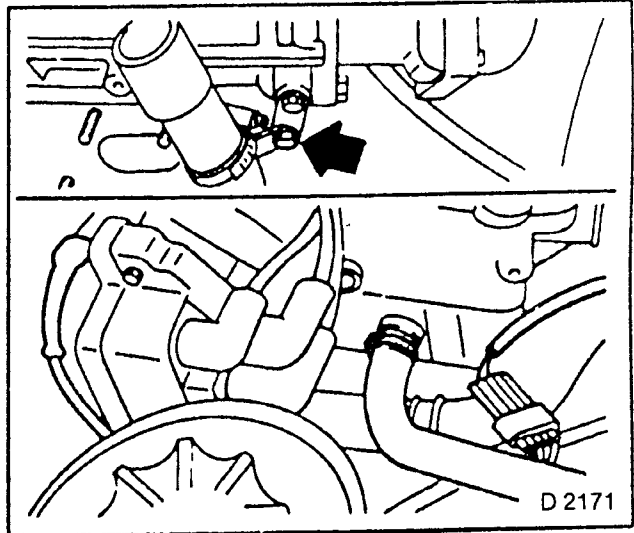


Fig. 415

REMOVE, DISCONNECT

1. Bowden cable.
2. Fuel lines — close with spring clamps.

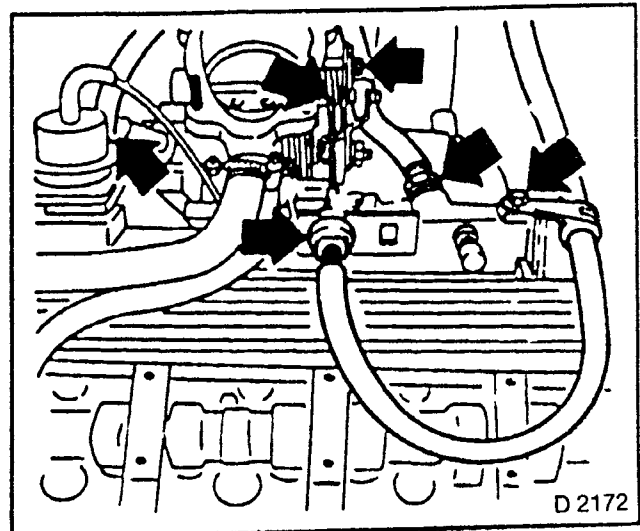


Fig. 416

REMOVE, DISCONNECT

1. Contact strip from injection valves.
2. Wiring plug (1) from throttle valve switch.
3. Ground connections (2) from fuel distributor pipe.
4. Wiring plug (3) from tank vent valve.
5. Lay aside injection valve contact strip to rear.

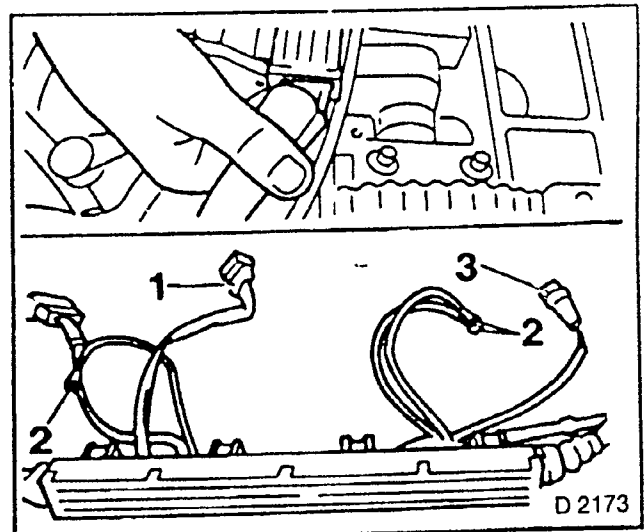


Fig. 417

REMOVE, DISCONNECT

- 1. Wiring plug from idle speed adjuster (1).
- 2. Brake servo vacuum line from intake pipe (2).
- 3. Intake pipe — cylinder block support from intake pipe (3).
- 4. Compensation — tank coolant pipe hose from coolant pipe (4).

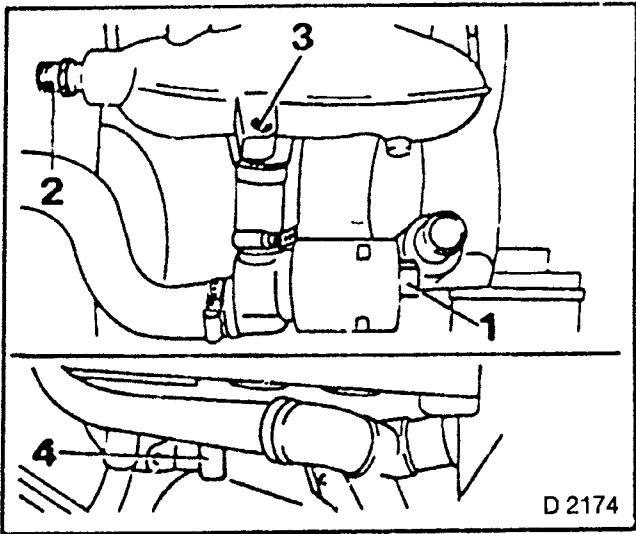


Fig. 418

REMOVE, DISCONNECT

- 1. Wiring plug from knock sensor (between starter and coolant pipe).
- 2. Rear toothed belt cover from cylinder head.

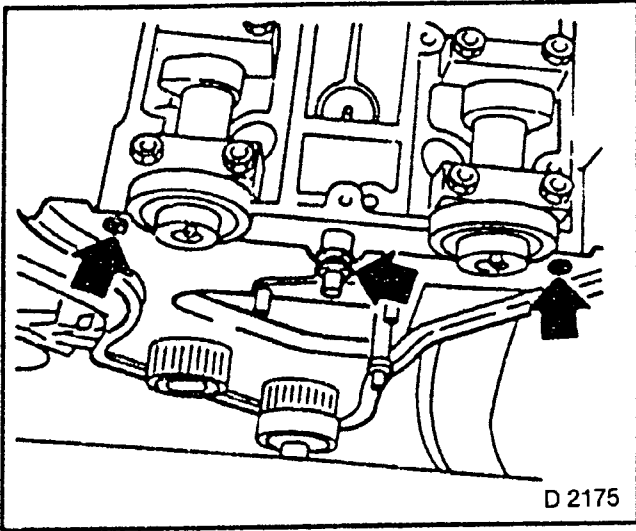


Fig. 419

REMOVE, DISCONNECT

- 1. Cylinder head bolts in illustrated order with MKM-604-19 (Torx Nut E 14).

NOTE:
LOOSEN CYLINDER HEAD BOLTS WITH FIRST 1/4, THEN 1/2 TURN.
WHEN REMOVING CYLINDER HEAD BOLTS, NOTE STEEL WASHERS.

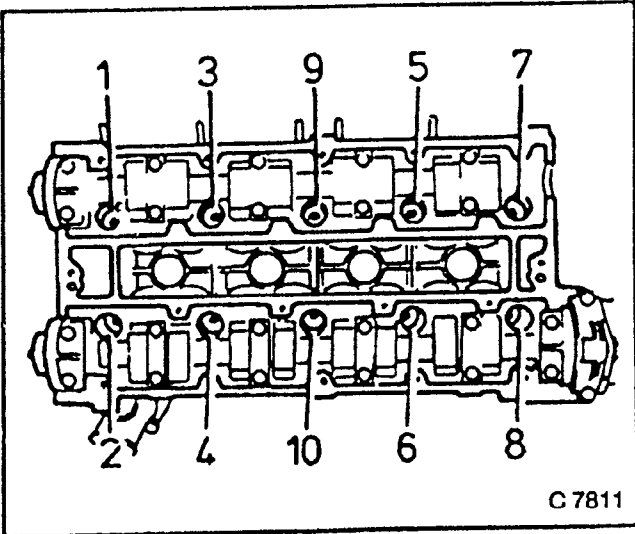


Fig. 420

CLEAN

- 1. All sealing surfaces.
- 2. Drill holes of cylinder head bolts.
- 3. Check cylinder block and cylinder head for plane washer.

INSTALL, CONNECT

- 1. New cylinder head gasket — mark “OBEN/TOP” upwards and towards timing side of engine.

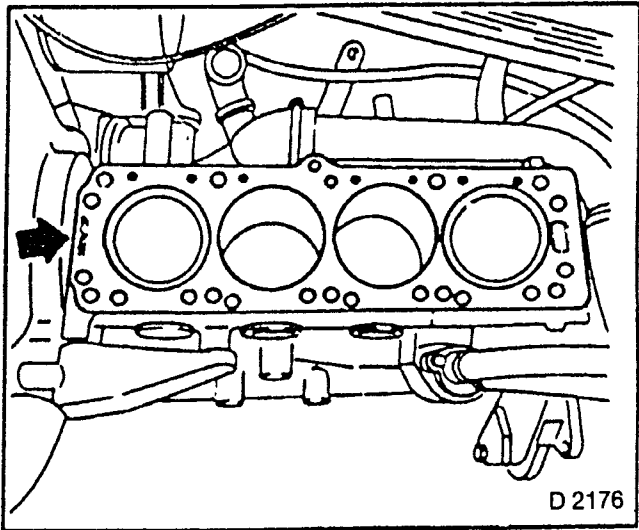


Fig. 421

- 2. Place cylinder head on cylinder block.
- 3. Insert steel washers and cylinder head bolts.

NOTE:
USE NEW CYLINDER HEAD BOLTS.
SCREW IN BOLTS UP TO STOP
WITH MKM-604-19 (TORX NUT E 14).

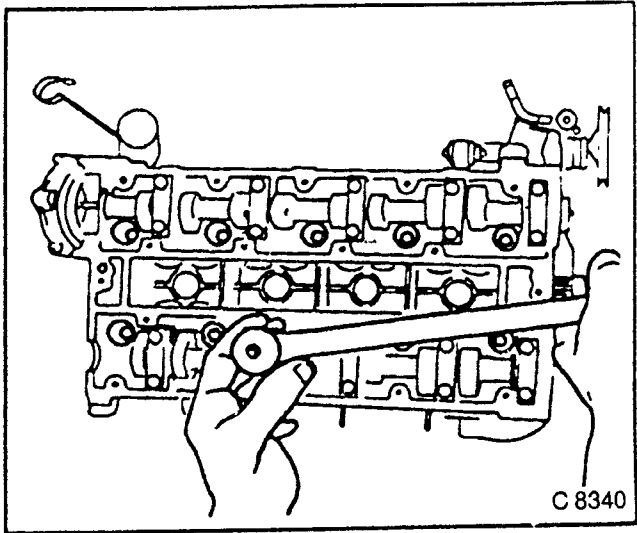


Fig. 422

TORQUE — ANGLE METHOD

- 1. Cylinder head to cylinder block.
Tighten cylinder head bolts in illustrated order, in four stages — Torque Wrench KM-470-B.
Tightening mode: 25 Nm + 65° + 65° + 65°.
- 2. After test run, turn a further 30° + 15°.

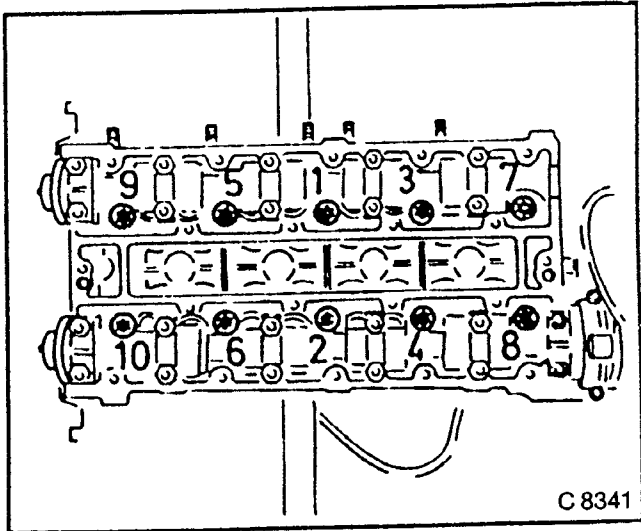


Fig. 423

TIGHTEN (TORQUE)

- 1. Rear toothed belt cover to cylinder head — 6 Nm.
- 2. Connect knock sensor wiring plug (between starter and coolant pipe).
- 3. Install compensation tank — coolant pipe hose to coolant pipe (4).
- 4. Intake pipe — cylinder block support to intake pipe (3) — 25 Nm.
- 5. Brake servo vacuum line to intake pipe (2) — 15 Nm.
- 6. Connect wiring plug to idle speed adjuster (1).

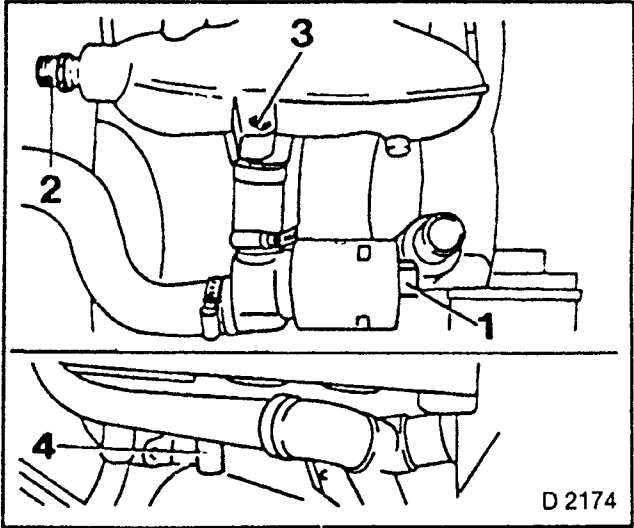


Fig. 424

INSTALL, CONNECT

- 1. Wiring plug (1) to throttle valve switch.
- 2. Ground connections (2) to fuel distributor pipe.
- 3. Wiring plug (3) to tank vent valve.
- 4. Injection valve contact strip.
- 5. Check all ground connections for perfect condition and firm seating.

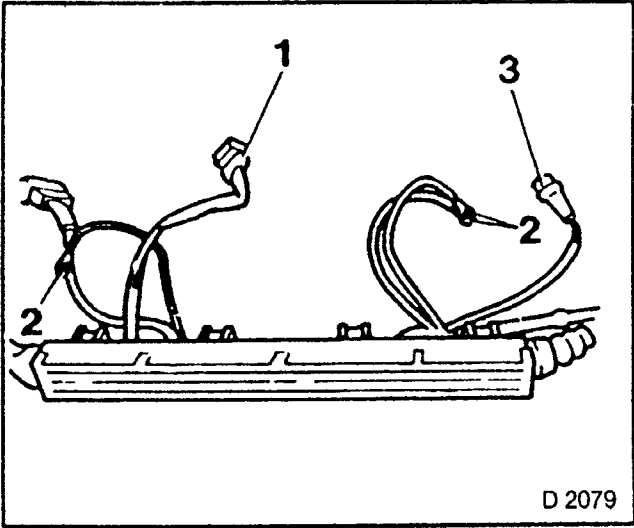


Fig. 425

INSTALL, CONNECT

- 1. Fuel lines.
- 2. Bowden cable.

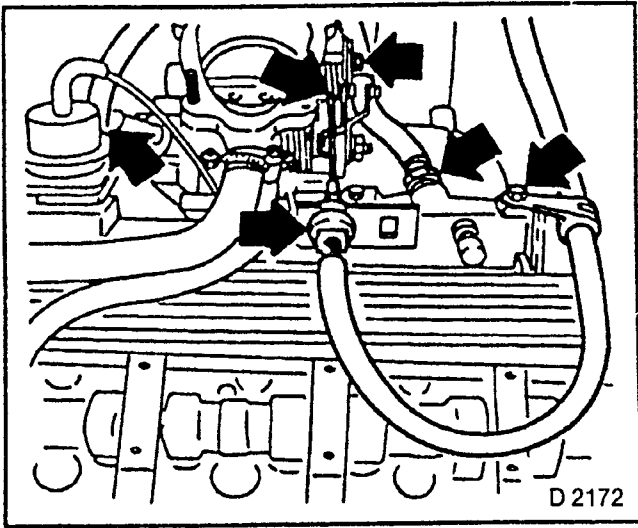


Fig. 426

INSTALL, CONNECT

1. Coolant hose to cylinder head.
2. Multiple plug.
3. Wiring plug and high voltage cable to ignition coil.
4. Wiring plug to high voltage distributor.
5. Fastening bolt (arrow) to cylinder head.
6. Wiring plug and upper hose bend to thermostat housing.

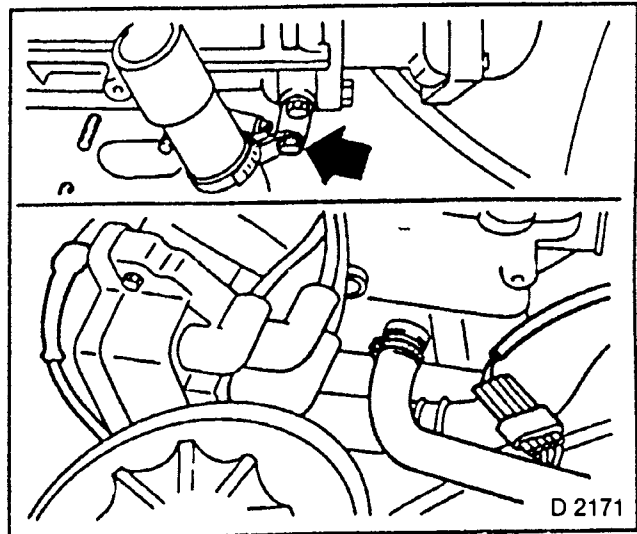


Fig. 427

INSTALL, CONNECT

1. Pre-volume chamber with mass air flow meter (3).
2. Idle speed adjuster hose to pre-volume chamber (2).
3. Mass air flow meter wiring plug (1).
4. Lower hose bend to radiator.
5. Fan manifold.
6. Camshaft sprockets.
7. New toothed belt.
8. Engine compartment cover.
9. Ground cable to battery.
10. Top up and bleed cooling system.
11. Check for leaks.

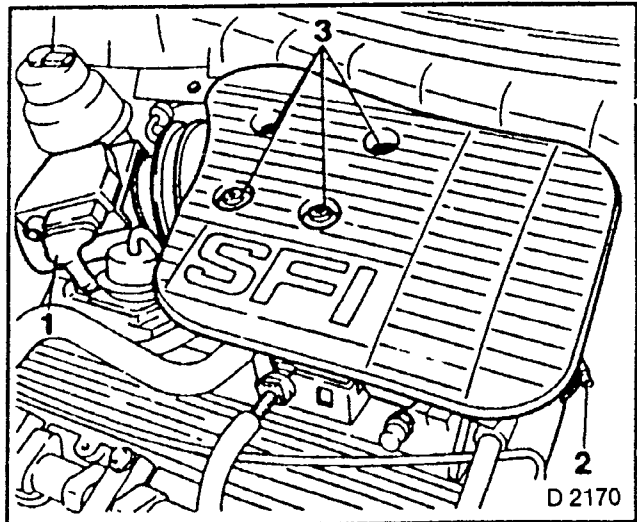


Fig 428

Cylinder Head — Disassemble and Assemble

REMOVE, DISCONNECT

- 1. Cylinder head.
- 2. High voltage distributor.
- 3. Intake pipe.
- 4. Thermostat housing.
- 5. Spark plugs with KM-194.

REMOVE, DISCONNECT

- 1. Camshaft bearing cover.
- 2. Loosen nuts in stages — 1/2 to full turn.

WARNING:
**THE CAMSHAFT MUST BE EVENLY
AND REGULARLY LOOSENED
FROM BEARING SEAT — FRONT
GUIDE BEARING.**

- 3. Remove camshaft.

REMOVE, DISCONNECT

- 1. Hydraulic valve lifter with rubber sucker.

NOTE:
**PLACE VALVE LIFTER (A) IN
INSTALLATION POSITION (GROOVE
IN LOWER AREA).**

DISASSEMBLE

NOT anticipated for valve lifter.

- 1. Mark valves.
- 2. Tension valve spring with KM-348 and Adapter KM-653.

REMOVE, DISCONNECT

- 1. Valve spring plate.
- 2. Valve cones.
- 3. Valve spring.

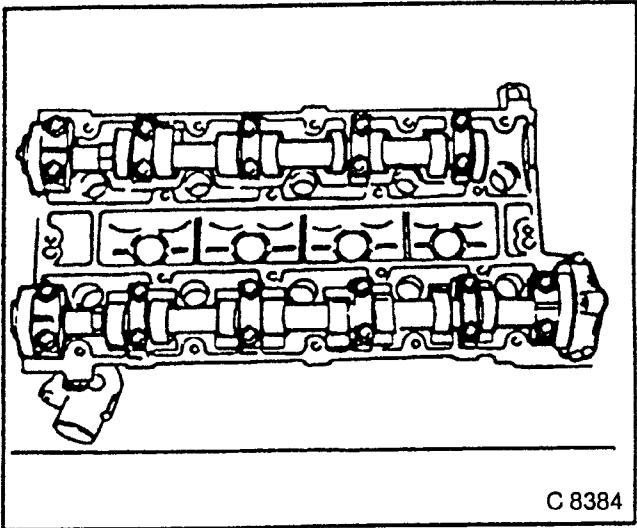


Fig 429

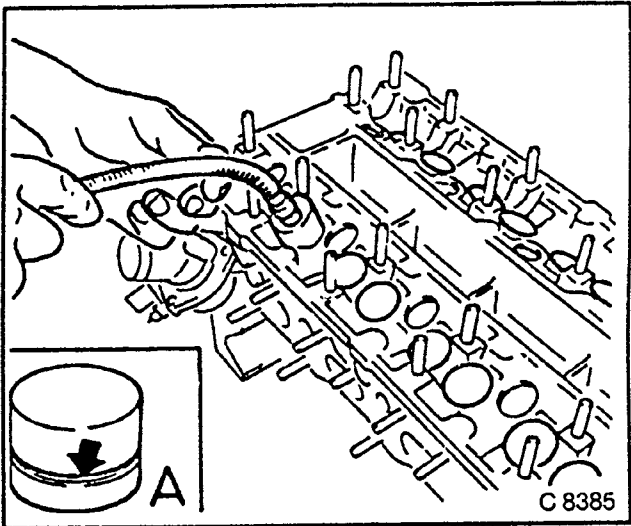


Fig. 430

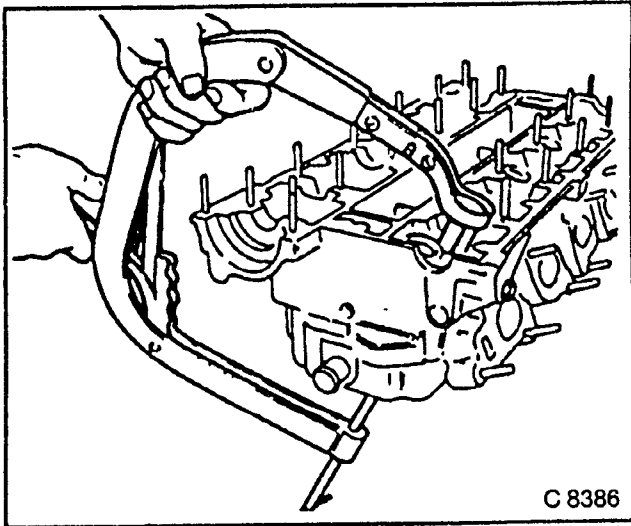


Fig. 431

REMOVE, DISCONNECT

- 1. Valve stem seal.
- 2. Valve spring washer.
- 3. Valve.

CAUTION:
SODIUM-FILLED EXHAUST VALVES
MUST NOT BE DISPOSED OF WITH
“NORMAL SCRAP”.
OBSERVE LEGAL REGULATIONS
WHEN DISPOSING OF SODIUM-
FILLED EXHAUST VALVES.

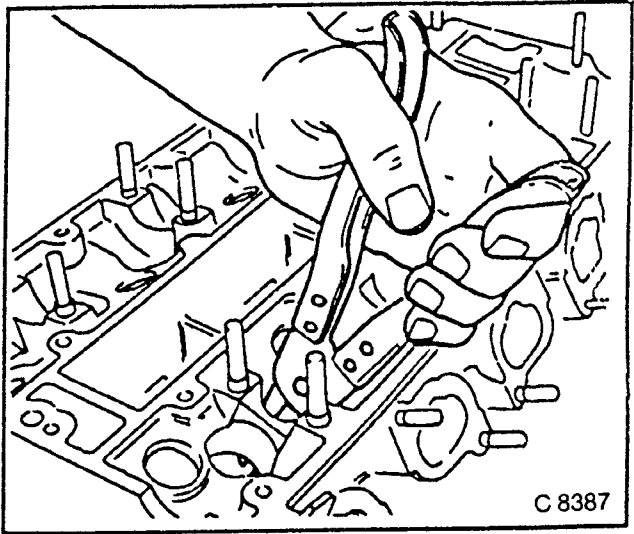


Fig. 432

CLEAN

INSPECT

- 1. Individual parts.
- 2. Sealing surfaces.
- 3. Guide.
- 4. Sliding and bearing parts.

WARNING:
DO NOT DAMAGE VALVE SEATS.

- 5. Overhaul cylinder head.

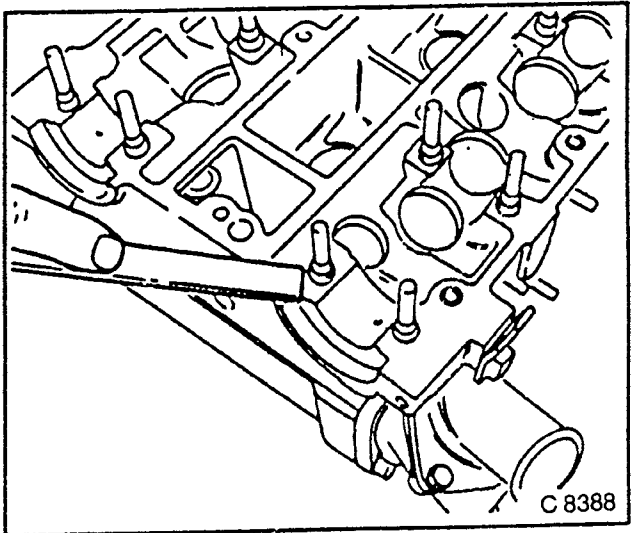


Fig. 433

WARNING:

- 1. Insert valves with engine oil.
- 2. Insert valve spring washer.
- 3. Coat inside of Installer KM-663 thinly with grease.
- 4. Insert new valve stem seal.

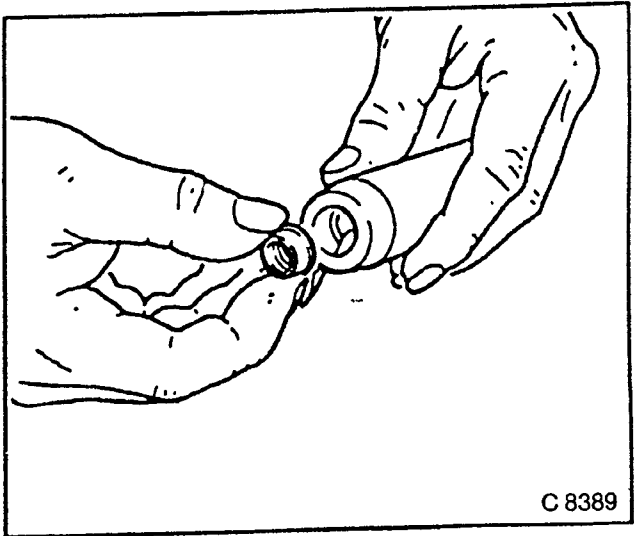


Fig. 434

- 5. Cut installer sleeve (included in package) to required length and push on to valve stem.
- 6. Place installer KM-663 with valve stem seal onto guide and **carefully** drive in to stop with LIGHT hammer blows.

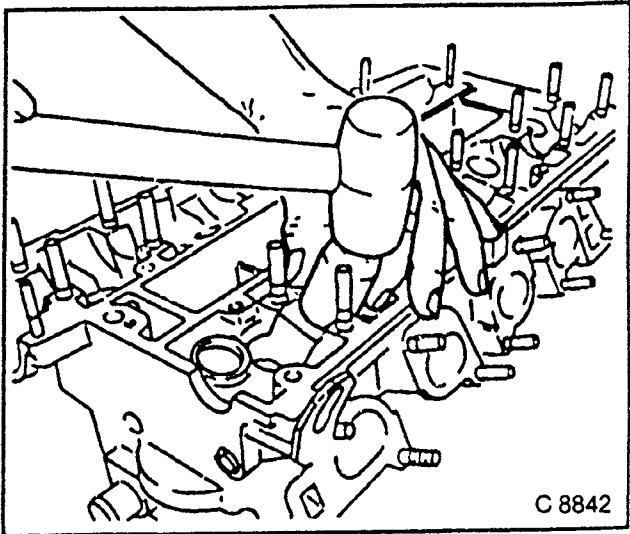


Fig. 435

INSTALL, CONNECT

- 1. Valve spring.
- 2. Valve spring plate.
- 3. Valve cones with KM-348 and Adapter KM-653.
- 4. Valve lifter.
- 5. Coat sliding surfaces of valve lifter.
- 6. Camshaft with MoS₂ paste.
- 7. Insert camshaft.

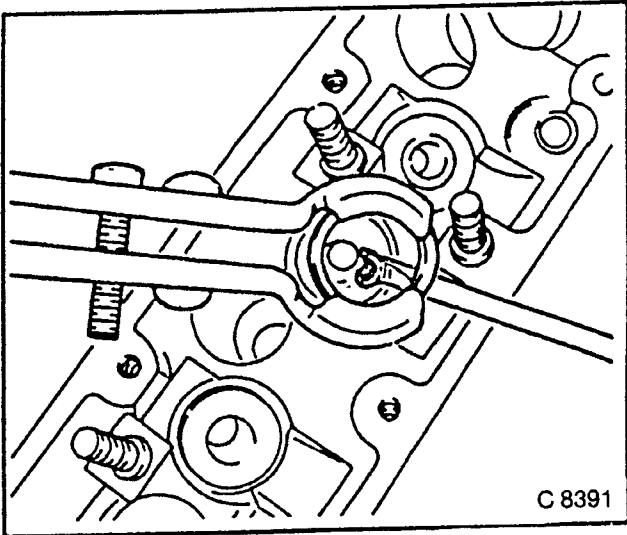


Fig. 436

- 8. Apply Sealing Compound Locktite 515 flexible gasket or equivalent to the sealing surfaces of outer camshaft bearing cover.

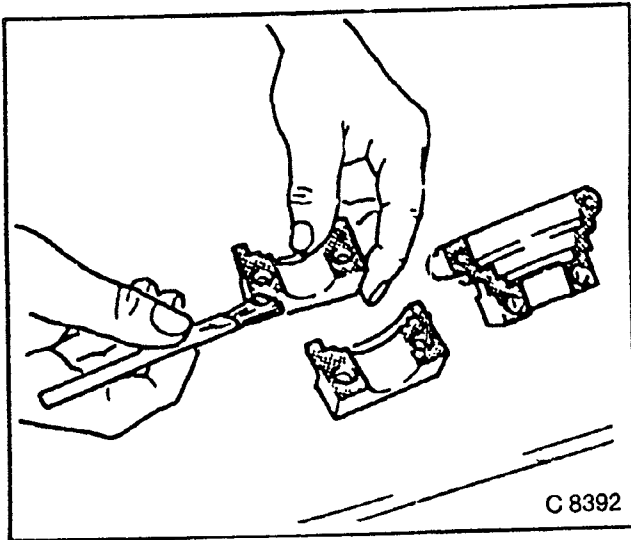


Fig. 437

INSTALL, CONNECT

- 1. Camshaft bearing cover.

NOTE:
IDENTIFICATION NUMBERS OF
CAMSHAFT BEARING COVER
MUST MATCH THOSE IN CYLINDER
HEAD.

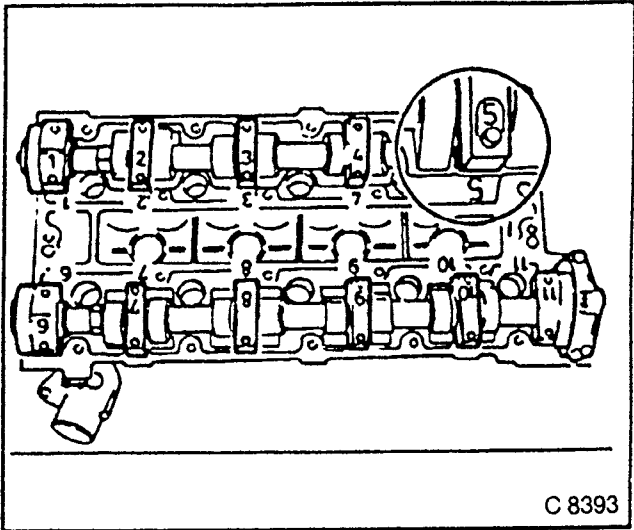


Fig 438

TIGHTEN (TORQUE)

- 1. Camshaft bearing cover to cylinder head (M8) — 20 Nm.
- 2. Rear camshaft bearing cover to cylinder head (M6) — 10 Nm.

WARNING:
INSTALL CAMSHAFT BEARING
COVER FROM INSIDE OUTWARDS.
INSTALL FASTENING NUTS IN
STAGES — 1/2 TO FULL TURN.

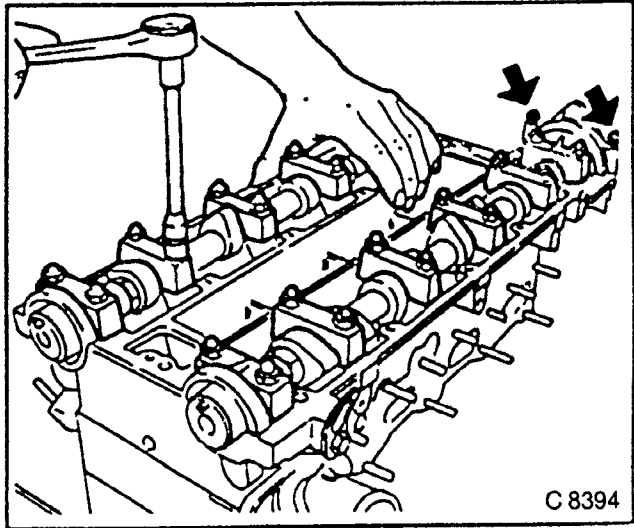


Fig 439

- 3. Turn camshaft with wrench so that pin (A) points upwards.

INSTALL, CONNECT

- 1. New camshaft seal rings with KM-422 — use bolt and washer of camshaft sprocket.
- 2. Coat seal lips of seal ring with protective grease.

TIGHTEN (TORQUE)

- 1. Spark plug in cylinder head — 25 Nm.
Use KM-194.
- 2. Thermostat housing to cylinder head — 15 Nm.
Use new seal ring.
- 3. Intake pipe to cylinder head — 22 Nm.
Use new gasket.
- 4. Install high voltage distributor and cylinder head.

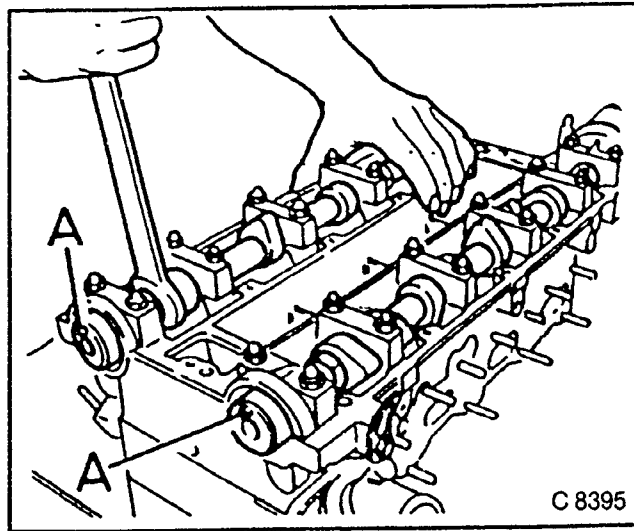


Fig. 440

Exhaust Valve (Sodium-filled) — Disposal

CAUTION:
SODIUM-FILLED EXHAUST VALVES
MUST NOT BE DISPOSED OF WITH
“NORMAL SCRAP”. OBSERVE
LEGAL REGULATIONS WHEN
DISPOSING OF SODIUM-FILLED
EXHAUST VALVES.

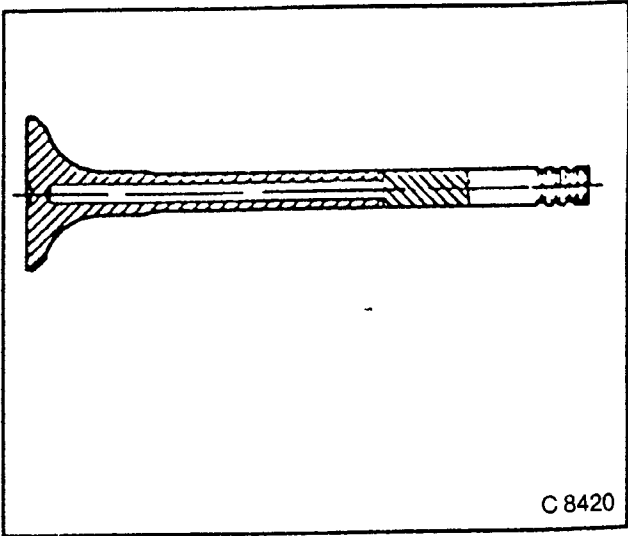


Fig. 441

Cylinder Head — Overhaul

CYLINDER HEAD DISASSEMBLED

VALVE — GRIND IN

1. Oil valve stem, use fine-grained grinding paste.
2. Lift valve up rythmically from seat — distribution of grinding paste.

CLEAN

1. Valves.
2. Cylinder head.

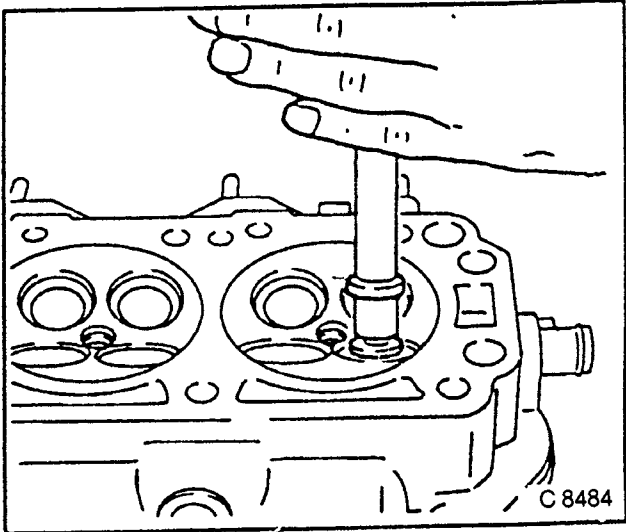


Fig. 442

VALVE, GRIND

NOTE:
NO CRATER-LIKE BURNS ON
VALVE CONE.
REGRINDING POSSIBLE ONCE OR
TWICE.
ANGLE AT VALVE HEAD: 45° 20'.
INSTALLATION HEIGHT OF INLET
AND EXHAUST VALVE, UPPER
EDGE OF STEM — VALVE SPRING
WASHER BEARING SURFACE: See
“Technical Data”, PAGE 312.

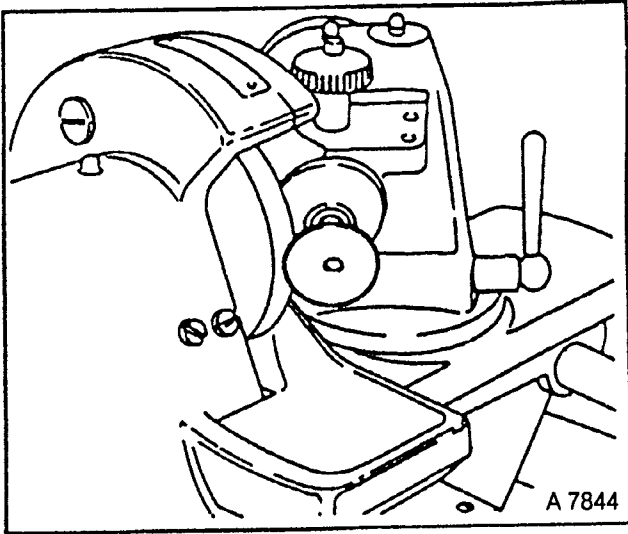


Fig. 443

Valve Guide — Ream

MEASURE

Diameter of valve guide — dial gauge and internal measuring instrument.

NOTE:
OVERSIZE VALVES MAY ALREADY BE FACTORY-INSTALLED.
OVERSIZE IDENTIFICATION:
ON THE VALVE GUIDE AND AT THE VALVE STEM END WITH THE FOLLOWING IDENTIFICATION NUMBERS/LETTERS.
SEE ALSO “TECHNICAL DATA”, PAGE 312.

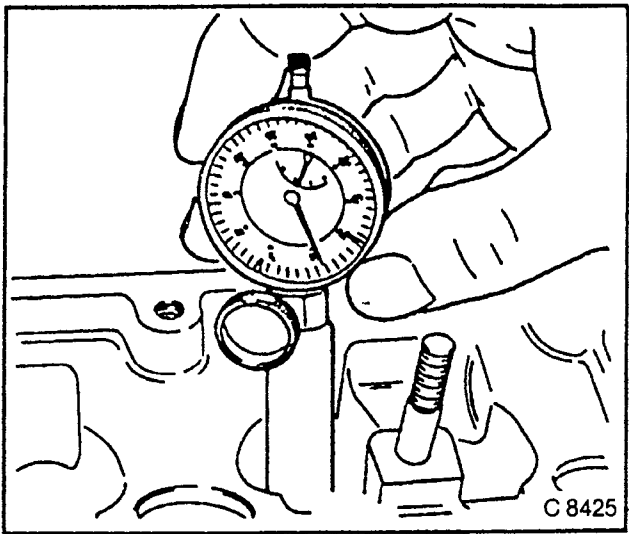


Fig. 444

Size	Reamer	Identification	
		Production	Service
Normal		none	K
0,075	KM-664-1	1	K 1
0,150	KM-664-2	2	K 2

- 2. Rear valve guide from upper side of cylinder head to next oversize.
- 3. After reaming, cross out identification and stamp in new identification.

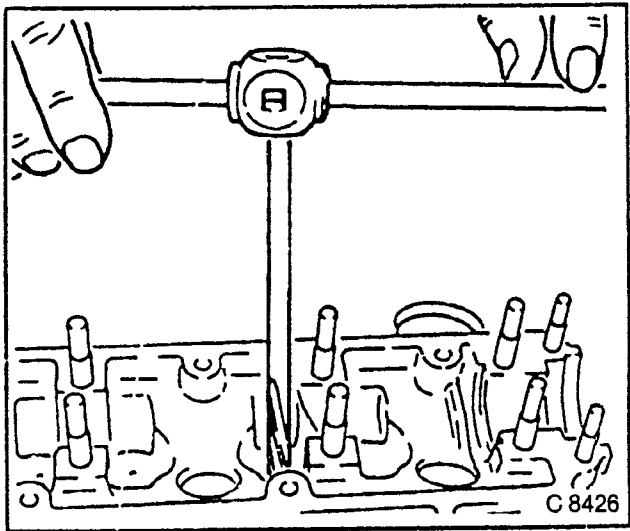


Fig. 445

Valve Seat — Cut

Lay cylinder head on wooden blocks.

NOTE:
REWORKING TO VALVE SEAT PERMISSIBLE TO 0,4 MM.

INSTALL, CONNECT

Guide Drift KM-340-7.

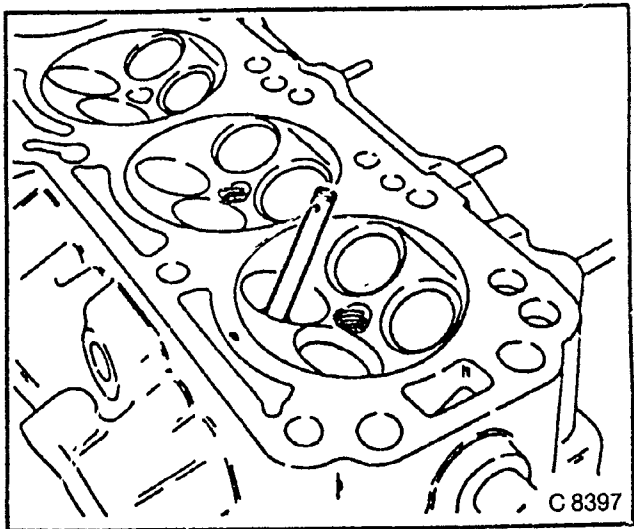


Fig. 446

INSTALL, CONNECT

- 1. KM-340-12.
- 2 Valve seat — 45° side, upper correction — 30° side.

NOTE:
NOTE ARROW ON CUTTER.

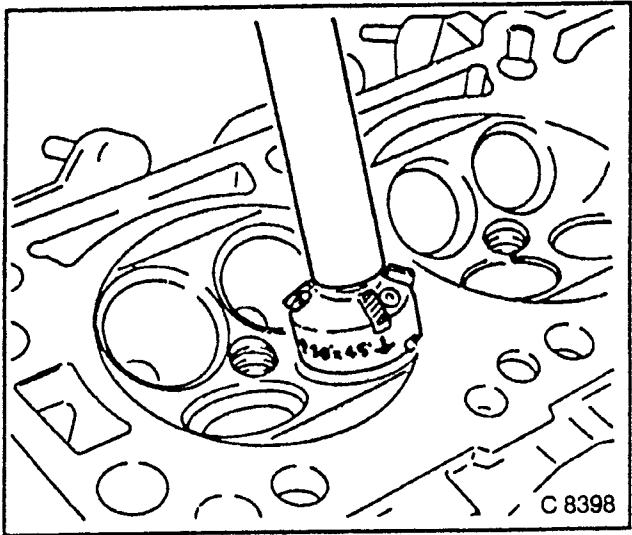


Fig. 447

INSTALL, CONNECT

- 1. KM-340-26.
- 2. Lower correction — 60°.

NOTE:
INSTALLATION HEIGHT OF INLET AND EXHAUST VALVE, UPPER EDGE OF STEM — VALVE SPRING WASHER BEARING SURFACE: SEE "TECHNICAL DATA", PAGE 312.

CLEAN

Cylinder head of chippings.

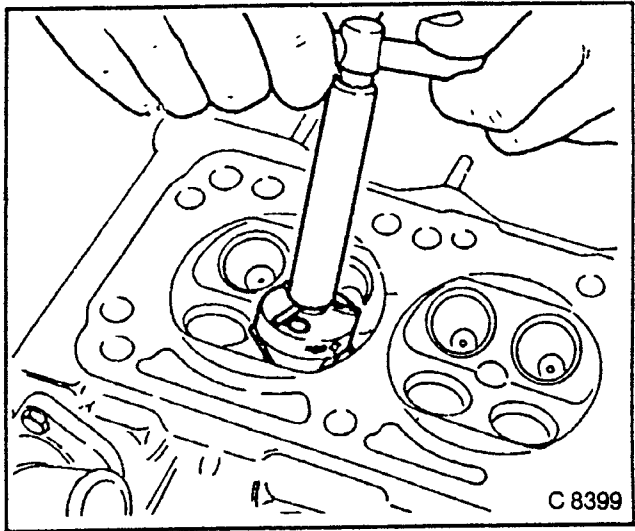


Fig. 448

INSPECT

- 1. Valve seat width: inlet (A), exhaust (B).
- 2. Grind in valve.
- 3. Carry out test for leaks with cleaning petrol.

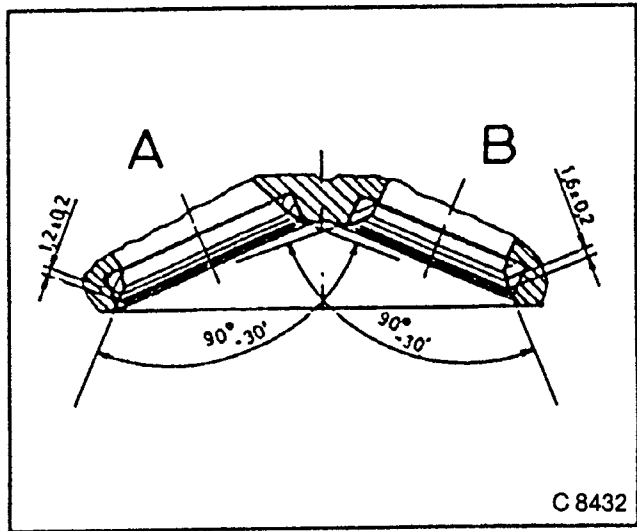


Fig. 449

Cylinder Head — Check for Plane Surface

CLEAN

Cylinder head sealing surface.

INSPECT

1. Cylinder head length and breadth for deformation and the diagonals for distortion — straight edge and feeler gauge.
Permissible deviation: 0,05 mm.

WARNING:

Plane grinding of cylinder head permissible **only within** given tolerances.
Total height of cylinder head: 135.58 to 135.68 mm. (sealing surface to sealing surface).

Crank Drive

RECOMMENDED TORQUE VALUES

	Nm
Con-rod bearing cover to con-rod	35 + 45° + 15° ³⁾
Cylinder head to cylinder block	25 + 65° + 65° + 65° ³⁾
Flywheel to crankshaft	65 + 30° + 15° ³⁾
Front toothed belt cover to cylinder head, adapter and oil pump	8
Oil pan to cylinder block	15 ¹⁾
Rear toothed belt cover to cylinder block	6
Toothed belt drive pinion to crankshaft	250 + 40° to 50° ³⁾
Wheel bolts to front wheel hub	110

- 1) Insert bolts using Locking Compound Locktite 242
2) Installation time maximum 10 mins
3) Use new bolt(s).
4) Insert bolt using grease
5) After test run turn a further 30° + 15°

Rear Crankshaft Seal Ring — Replace

REMOVE, DISCONNECT

1. Clutch.
2. Thrust bearing.
3. Guide sleeve for thrust bearing — Section K.
4. Flywheel.

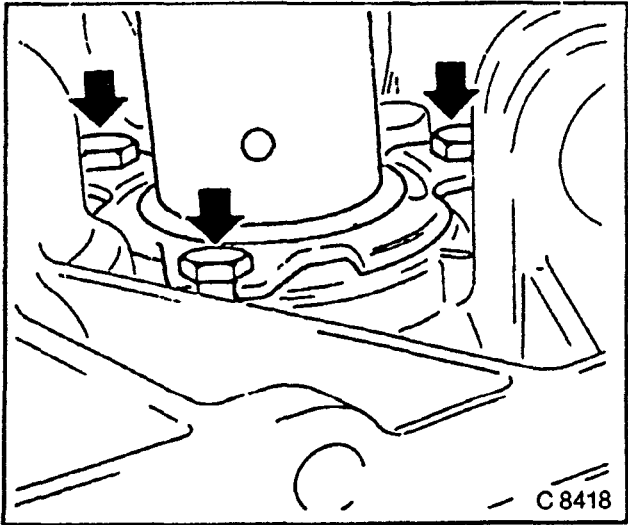


Fig. 450

INSTALL, CONNECT

1. Hook KM-665 between sealing lip and crankshaft journal.

ASSEMBLE

1. Support KM-469-4.
2. Lever KM-469-13-A.
3. Pin KM-328-8.

REMOVE, DISCONNECT

1. Shaft seal ring.

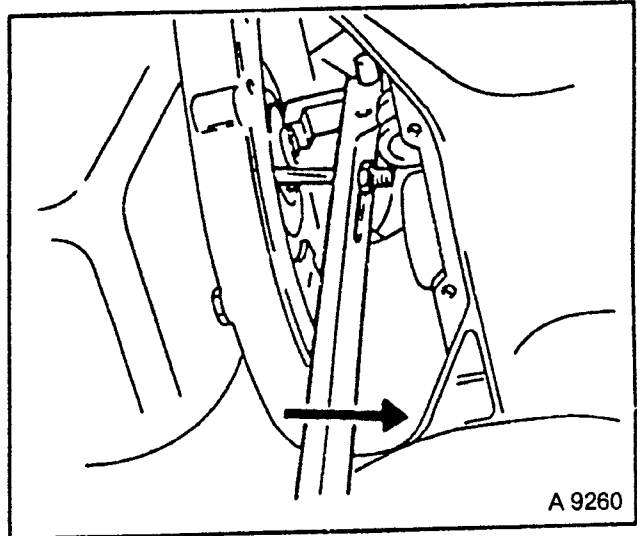


Fig. 451

2. Coat sealing lips of shaft seal ring with protective grease.

INSTALL, CONNECT

1. Seal ring on crankshaft journal.
2. Protective Sleeve KM-635-1.
3. Thrust Collar KM-635-2 on seal ring.

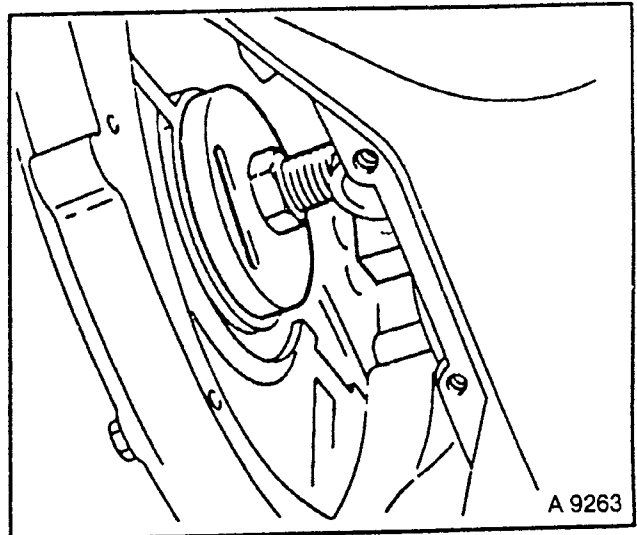


Fig. 452

INSTALL, CONNECT

1. Seal ring firmly in cylinder block.
2. Retaining Plate KM-511-11.
3. Hex Bolt KM-469-12-B.

NOTE:
INSERT LOCATING PINS INTO HOLES ON TRANSMISSION.

3. Remove assembly.
4. Install flywheel.
5. Guide sleeve.
6. Thrust bearing.
7. Clutch.

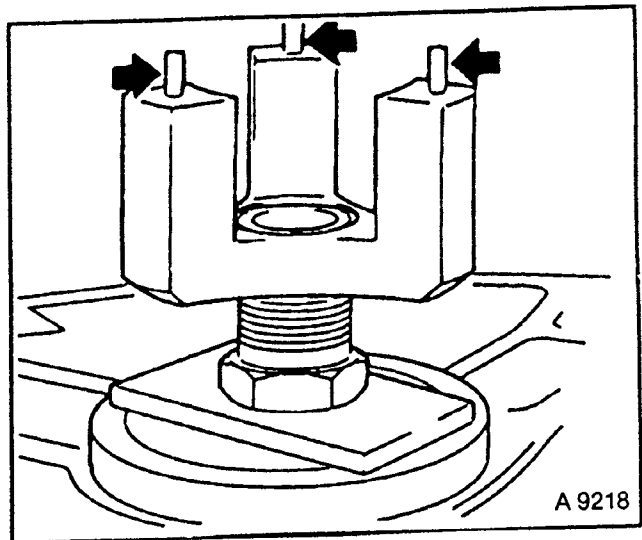


Fig. 453

Seal Ring — Rear Crankshaft — Replace (Version with Pot Flywheel)

REMOVE, DISCONNECT

- 1. Transmission, clutch — Section K.
- 2. Pot flywheel.

REMOVE, DISCONNECT

- 1. Make hole in middle of seal ring. Screw in self-tapping screw and edge out.

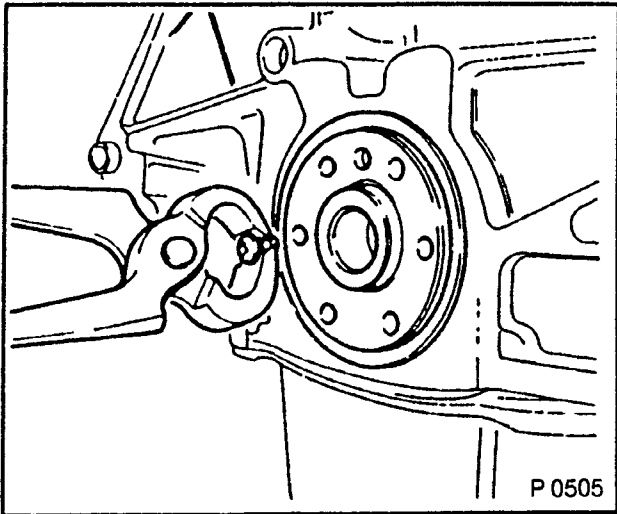


Fig. 454

INSTALL, CONNECT

- 1. Seal ring — Protective Sleeve KM-635-1.
- 2. Coat sealing lip of shaft seal ring with protective grease.
- 3. Thrust Ring KM-635-2, KM-535.

INSTALL, CONNECT

- 1. Clutch, transmission — Section K.
- 2. Pot flywheel.

Crankshaft Front Seal Ring (Oil Pump Housing) — Replace

REMOVE, DISCONNECT

- 1. Right front wheel.
- 2. Toothed belt — see "Toothed Belt, Replace", page 184.

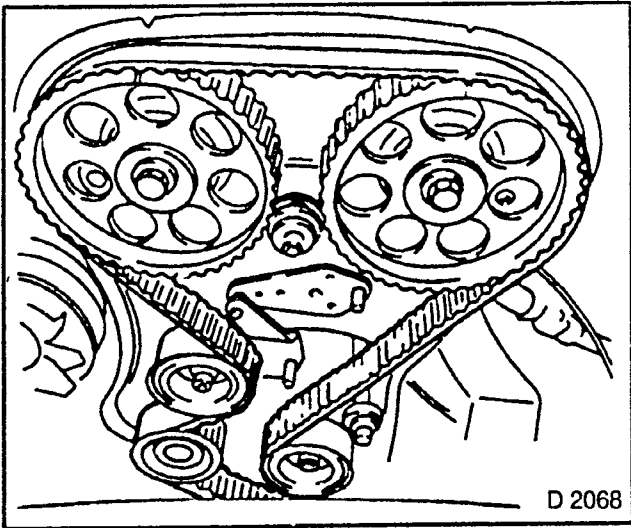


Fig. 455

REMOVE, DISCONNECT

1. Toothed belt drive gear.
2. Install MKM-604-21 (Torx Nut E 20).
3. Holding Wrench KM-662-A — follow manufacturer's Instructions.
4. If necessary, install Remover KM-210-A with KM-516 and KM-647.
5. Remove toothed belt drive gear.

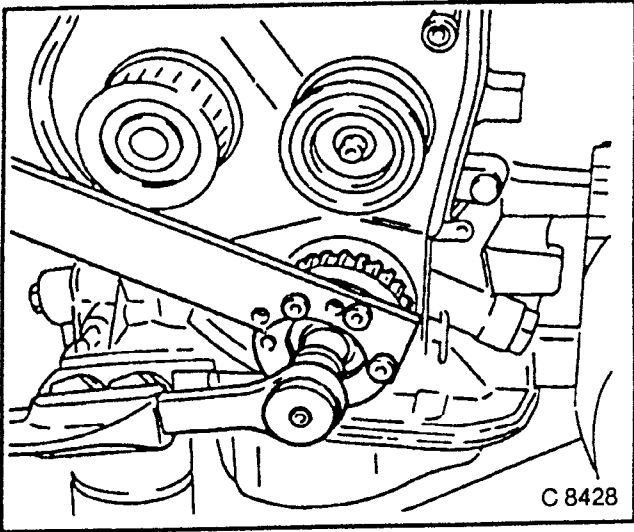


Fig. 456

REMOVE, DISCONNECT

1. Spacing ring.
2. Seal ring — make hole in middle of ring.
3. Turn in self-tapping screw and edge out.

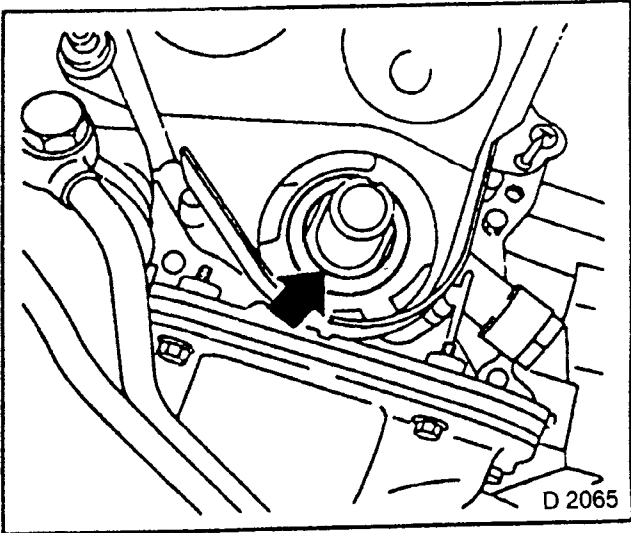


Fig. 457

INSTALL, CONNECT

1. Seal ring with KM-693.
2. Use torx bolt (1) and washer (2) of toothed belt drive gear.
3. Coat sealing lips of seal ring with protective grease.

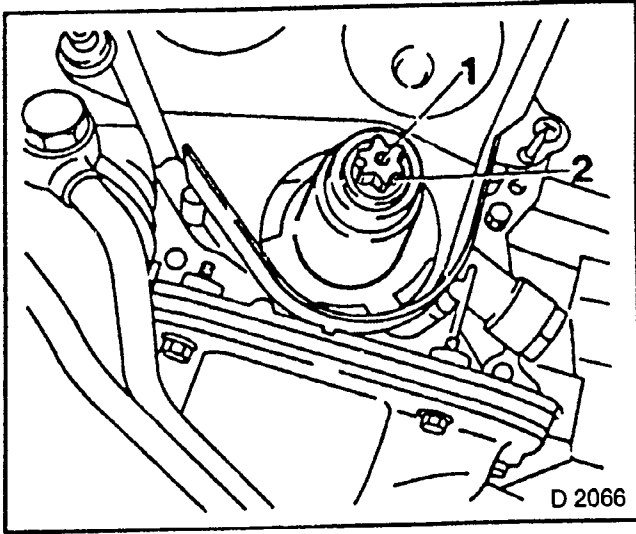


Fig. 458

INSTALL, CONNECT

- 1. Spacing ring on crankshaft journal — coat fore part thinly with Sealing Compound Locktite 515 flexible gasket or equivalent.
- 2. Toothed belt drive gear on crankshaft journal — observe installation position.

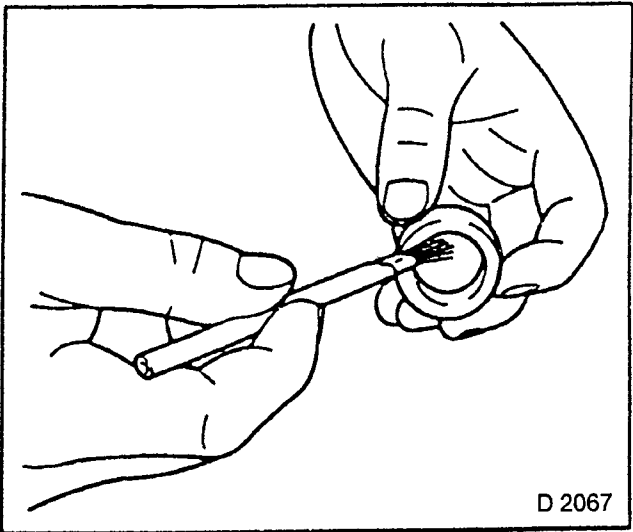


Fig 459

TORQUE — ANGLE METHOD

- 1. Toothed belt drive gear to crankshaft — 250 Nm. + 40° to 50°. Use new bolt.

NOTE:
INSERT FASTENING BOLT OF TOOTHED BELT DRIVE GEAR WITH GREASE.

- 2. When installing, mount MKM-604-21 (Torx Nut E 20) and Holding Wrench KM-662-A as illustrated — observe manufacturer's instructions.

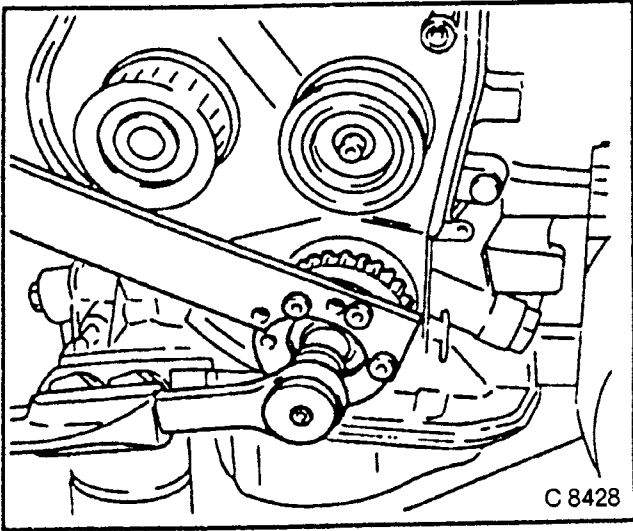


Fig. 460

INSTALL, CONNECT

- 1. New toothed belt — see “Toothed Belt, Replace”, page 168.
- 2. Right front wheel.

TIGHTEN (TORQUE)

- 1. Wheel bolts to front wheel hub — 110 Nm.

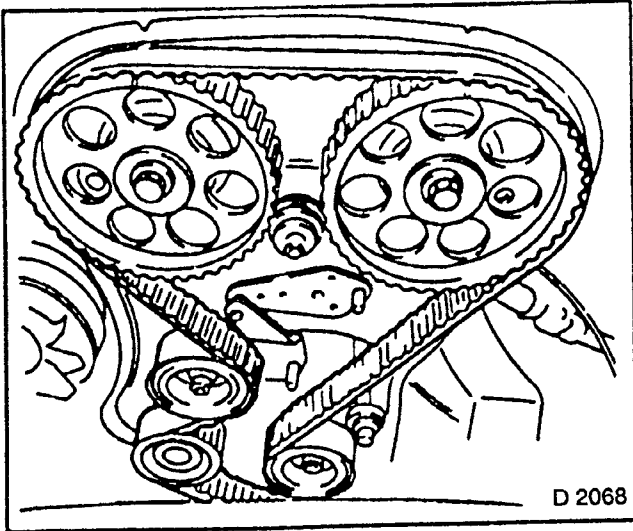


Fig. 461

Piston with Con-rod — Remove and Install

REMOVE, DISCONNECT

1. Cylinder head.
2. Oil pan — see "Gasket Oil Pan, Replace", page 208.
3. Piston with con-rod.
4. Mark con-rod bearing cap.

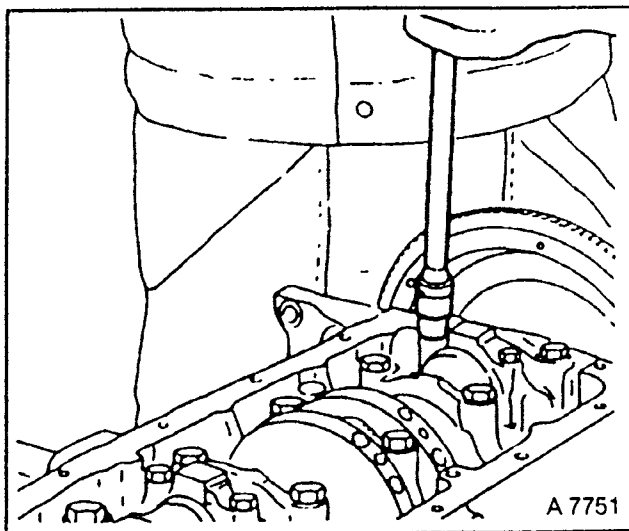


Fig. 462

INSPECT

Replace all parts if necessary.

NOTE:
RING GAP OFFSET OF PISTON RINGS — 180°. UPPER STEEL BAND RING 25 TO 50 MM TO LEFT AND UPPER STEEL BAND RING 25 TO 50 MM TO RIGHT OF GAP OF INTERMEDIATE RING.

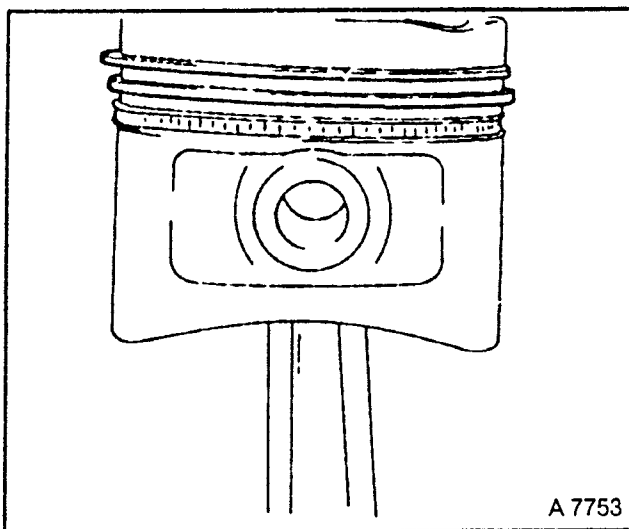


Fig. 463

INSTALL, CONNECT

1. Piston with con-rod — insert with engine oil.

NOTE:
NOTE INSTALLATION POSITION. ARROW ON PISTON HEAD POINTS TO ENGINE TIMING SIDE. BEADS ON CON-ROD (ARROWS) TO CLUTCH SIDE.

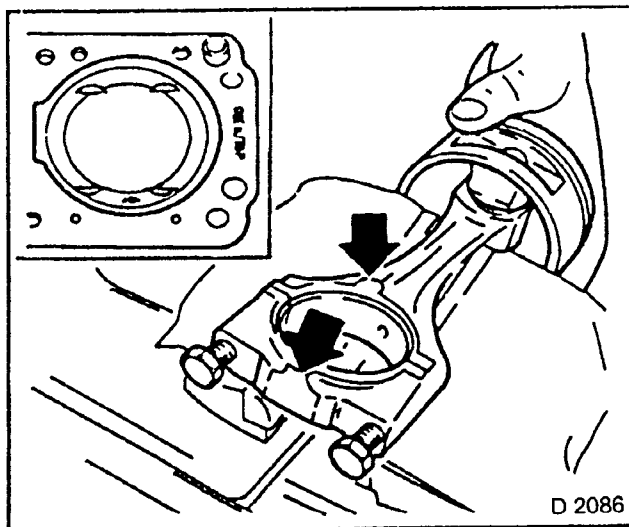


Fig. 464

TORQUE — ANGLE METHOD

1. Con-rod bearing cap to con-rod — 35 Nm. + 45° + 15°. Use new bolts.
2. Install oil pan.
3. Cylinder head.

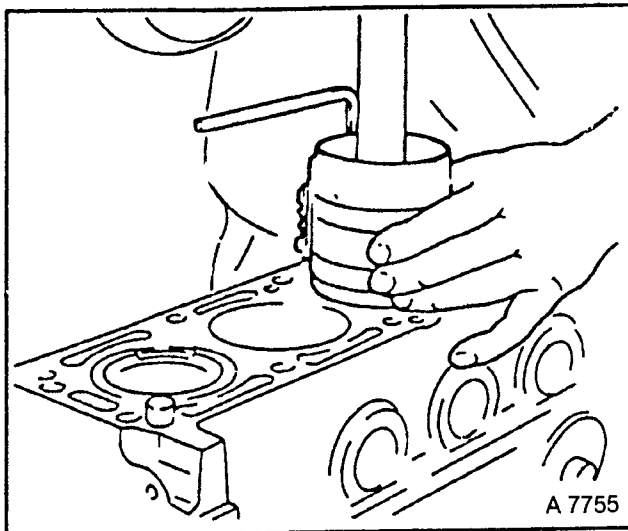


Fig 465

Con-Rod Bearing — Replace**REMOVE, DISCONNECT**

1. Oil pan.
2. Con-rod bearing cap — mark.
3. Con-rod bearing.

CLEAN

1. Con-rod journal.
2. Con-rod bearing cap.

INSTALL, CONNECT

1. New bearing shells with engine oil.
2. Con-rod bearing cap.

TORQUE — ANGLE METHOD

1. Con-rod bearing cap to con-rod — 35 Nm. + 45° + 15°. Use new bolts.
2. Install oil pan.

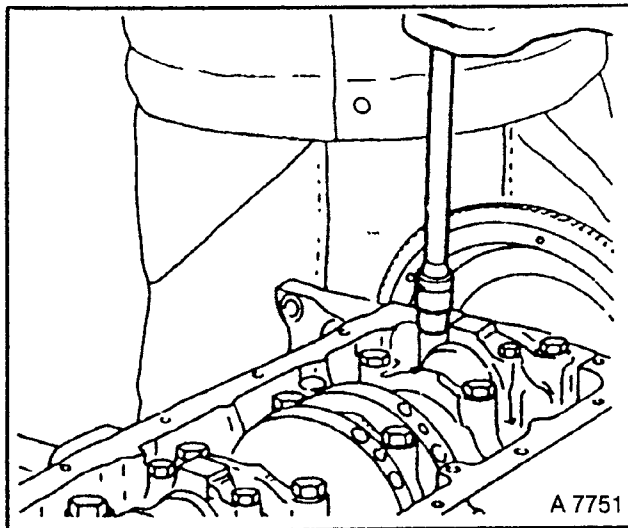


Fig. 466

Con-Rod — Replace**REMOVE, DISCONNECT**

1. Piston.
2. See "Piston with Con-rod, Remove and Install", page 200.
3. Piston pin retainer — press out piston pin.

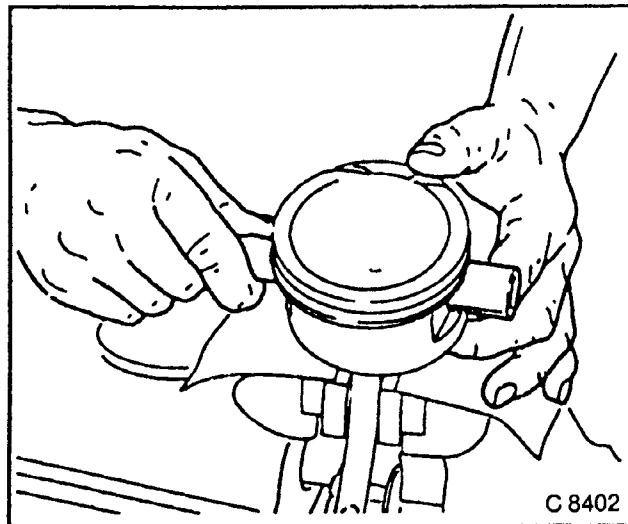


Fig. 467

ASSEMBLE

- 1. Con-rod.
- 2. Piston.
- 3. Piston pin — coat lightly with engine oil.
- 4. New piston pin retainer.

NOTE:
NOTE INSTALLATION POSITION —
ARROW ON PISTON HEAD POINTS
TOWARDS TIMING SIDE, BEAD ON
CON-ROD TO CLUTCH SIDE OF
ENGINE.

INSTALL, CONNECT

- 1. Piston with con-rod.

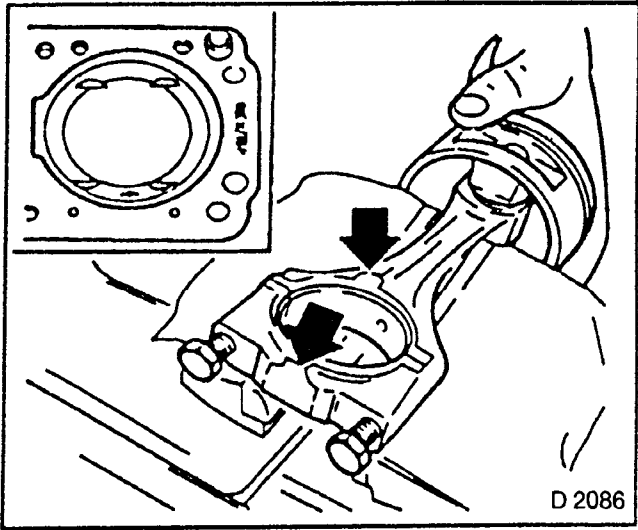


Fig. 468

Flywheel — Remove and Install

REMOVE, DISCONNECT

- 1. Transmission clutch — see operations in Section K.
- 2. Flywheel — mark installation position.
- 3. Attach MKM-604-21 (Tox Nut E 20) to fastening bolt of toothed belt drive gear (arrow) and counterhold.

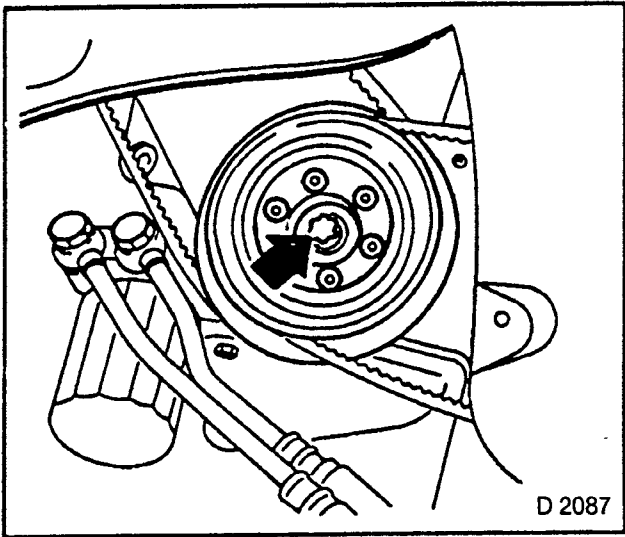


Fig. 469

TORQUE — ANGLE METHOD

- 1. Flywheel to crankshaft — 65 Nm. + 30° to 45°. Use new bolts.
- 2. When installing, attach MKM-604-21 (Torx Nut E 20) to fastening bolt of toothed belt drive gear and counterhold.
- 3. Install guide sleeve.
- 4. Thrust bearing and clutch. See operations in Section K.

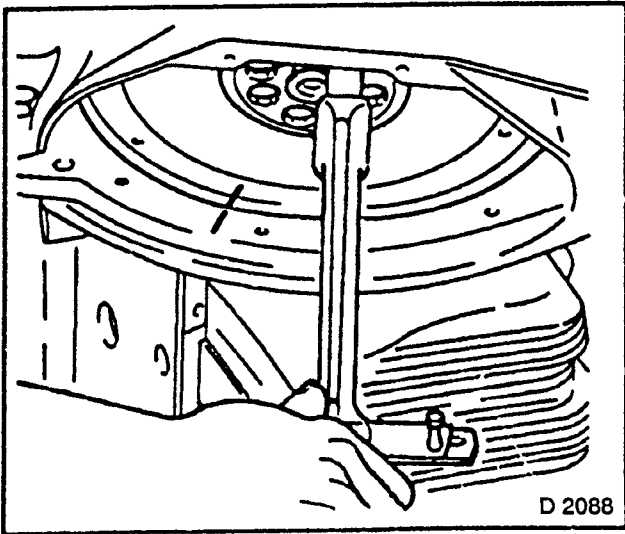


Fig. 470

Pot Flyweel — Remove and Install

REMOVE, DISCONNECT

- 1. Transmission clutch — see operations in Section K.
- 2. Pot flywheel — mark installation position.
- 3. Lock pot flywheel with KM-652.

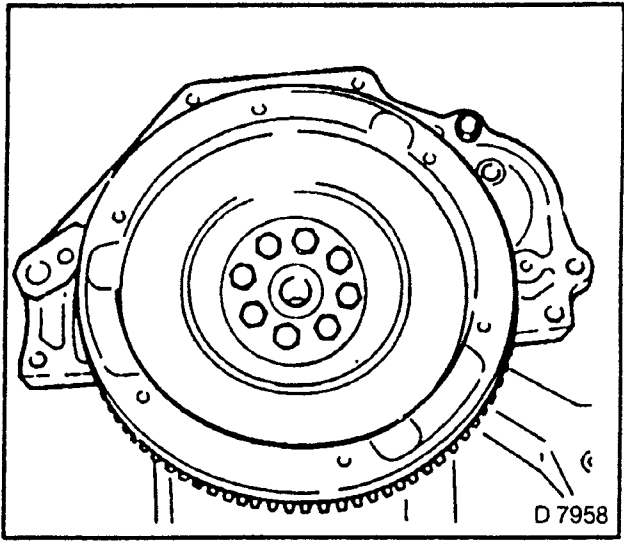


Fig. 471

- 4. Lock pot flywheel with KM-652.

TORQUE — ANGLE METHOD

- 1. Pot flywheel to crankshaft — 65 Nm + 30° + 15°. Use new bolts.

INSTALL, CONNECT

- 1. Transmission clutch — see operations in Section K.

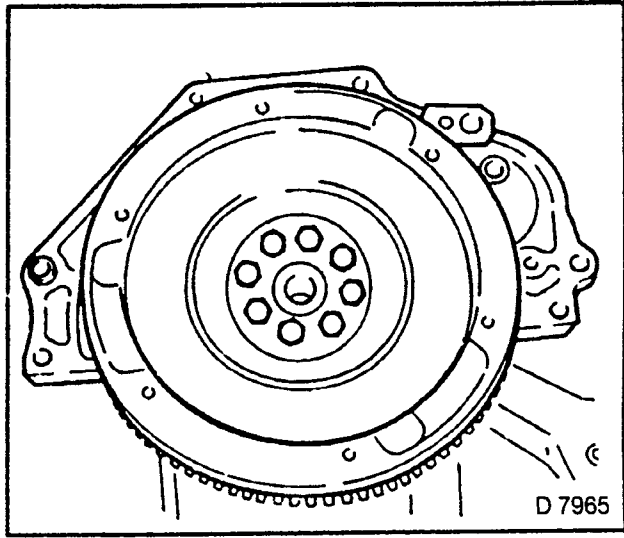


Fig. 472

Cylinder Block — Check for Plane Surface

CLEAN

Cylinder block sealing surfaces.

INSPECT

- 1. Cylinder block sealing surfaces' length and breadth for bending and also diagonals for warping.
- 2. Use aligning ruler and feeler gauge.

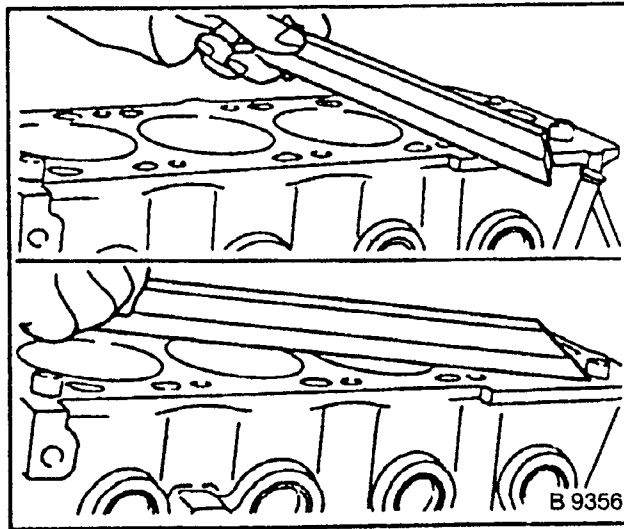


Fig. 473

NOTE:
AFTER SURFACE GRINDING,
CHECK PISTON PROJECTION.
PERMISSIBLE PISTON
PROJECTION: 0,40 MM.

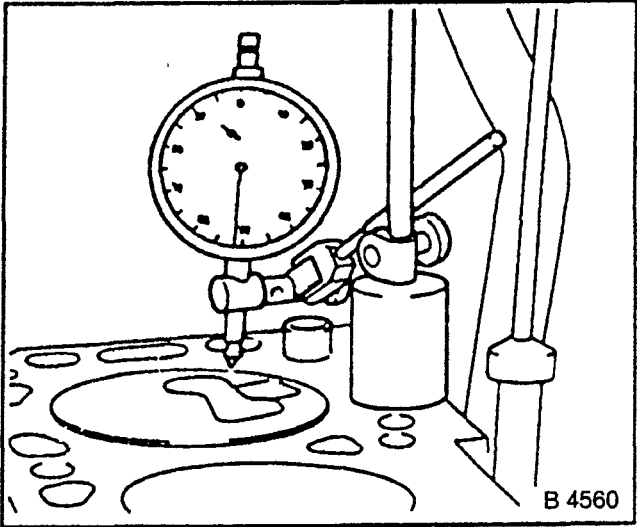


Fig. 474

RECOMMENDED TORQUE VALUES — OIL CIRCUIT

	Nm
Adapter (threaded piece) of oil cooler to oil pump	23 ³⁾
Closure bolt (safety valve) to oil pump	30
Closure bolt to oil thermostat housing (M 20)	20 + 60° + 90° ¹⁾
Front toothed belt cover to cylinder head, intermediate piece and oil pump	8
Oil cooler lines to adapter	30
Oil cooler lines to oil cooler	30
Oil drain plug to oil pan	45
Oil feed line to cylinder block screw fitting	20 ³⁾
Oil feed line to turbocharger	12 ³⁾
Oil filter cartridge to oil pump	15
Oil intake pipe to oil pump	8 ³⁾
Oil pan to cylinder block	15 ³⁾⁴⁾
Oil pump cover to oil pump	6
Oil pump to cylinder block	6
Oil temperature switch to cylinder block	30
Rear toothed belt cover to cylinder block	6
Toothed belt drive gear to crankshaft	250 + 40° to 50° ¹⁾³⁾
Wheel bolts to front wheel hub	110

¹⁾ Use new bolt(s)
²⁾ Insert bolt with grease.
³⁾ Insert bolts with Locking Compound Locktite 242.
⁴⁾ Max. installation time 10 min.
⁵⁾ C 20 LET only.

By-pass Valve — Replace
REMOVE, DISCONNECT

- 1. Flap of engine compartment cover for oil filter cartridge.
- 2. Oil cooler lines from adapter.
- 3. Oil filter cartridge with commercially available remover.
- 4. Threaded rod.
- 5. Remove adapter.

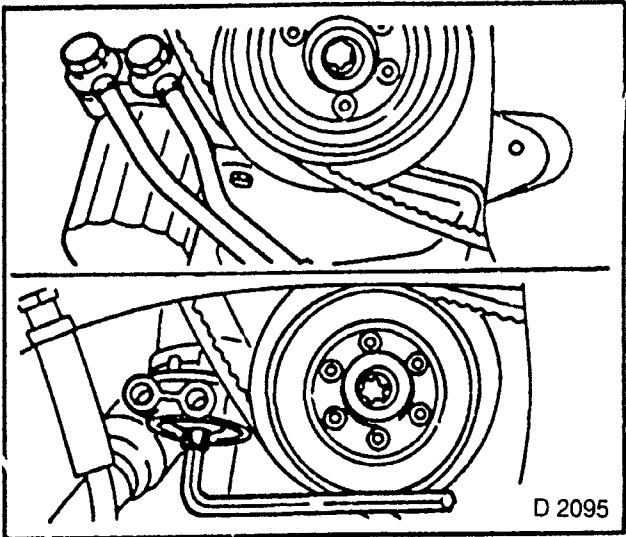


Fig. 475

REMOVE, DISCONNECT

- 1. Bypass valve.
- 2. Cut thread in sealing washer with screw tap M 10 (3rd stage).
- 3. Turn in M 10 bolt.
- 4. Pull bypass valve out of seating.

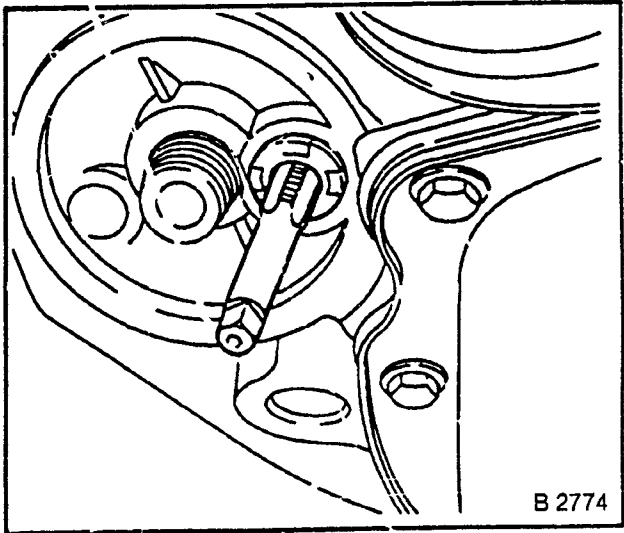


Fig. 476

INSTALL, CONNECT

- 1. Bypass valve — with drift (ϕ approximately 15 mm) to stop.
- 2. Adapter with new seal ring — threaded rod — new oil filter cartridge — fill with engine oil.
- 3. Oil cooler lines to adapter.
- 4. Engine compartment cover flap (if present) for oil filter cartridge.

TIGHTEN (TORQUE)

- 1. Adapter (threaded rod) to oil pump — 23 Nm.
Insert with Locking Compound Locktite 242.
- 2. Oil filter cartridge to oil pump — 15 Nm.
- 3. Oil cooler lines to adapter — 30 Nm.

INSPECT

- 1. Engine oil level.

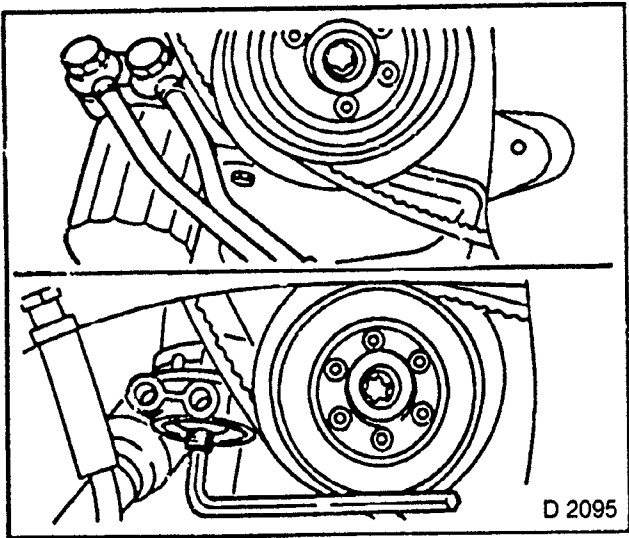


Fig. 477

Oil Pump — Remove and Install

REMOVE, DISCONNECT

1. Right front wheel.
2. Toothed belt — see “Toothed Belt, Replace”, page 168.
3. Toothed belt tension roller.
4. Toothed belt guide roller.
5. Camshaft sprockets.
6. Rear toothed belt cover.
7. Toothed belt drive pinion.
8. Mount MKM-604-21 (Torx Nut E 20) and Holding Wrench KM-662-A, as shown in illustration — observe manufacturer's instructions.
9. If necessary, mount Remover KM-210-A with KM-516 and KM-647.
10. Remove toothed belt drive gear.

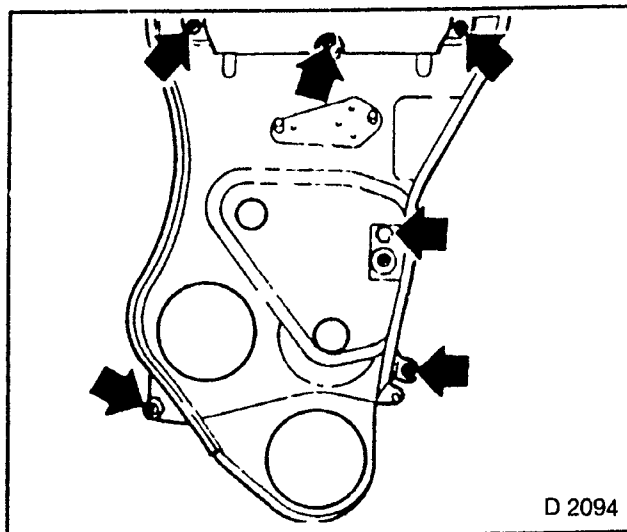


Fig 478

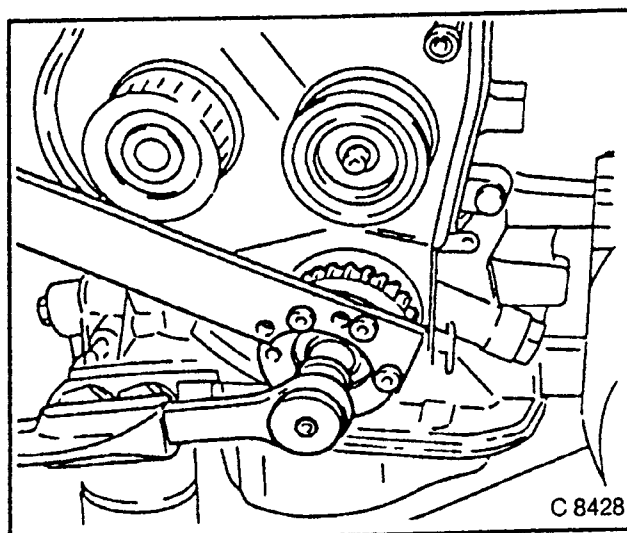


Fig. 479

REMOVE, DISCONNECT

1. Spacing ring (1) from crankshaft journal.
2. Oil pan.
3. Oil pressure switch wiring plug.
4. Oil cooler lines from adapter.
5. Oil filter cartridge with commercially available remover.
6. Oil pump (arrows) from cylinder block.
7. When replacing oil pump modify adapter for oil cooler with new seal ring and oil pressure switch.
8. Overhaul oil pump.

CLEAN

Sealing surfaces.

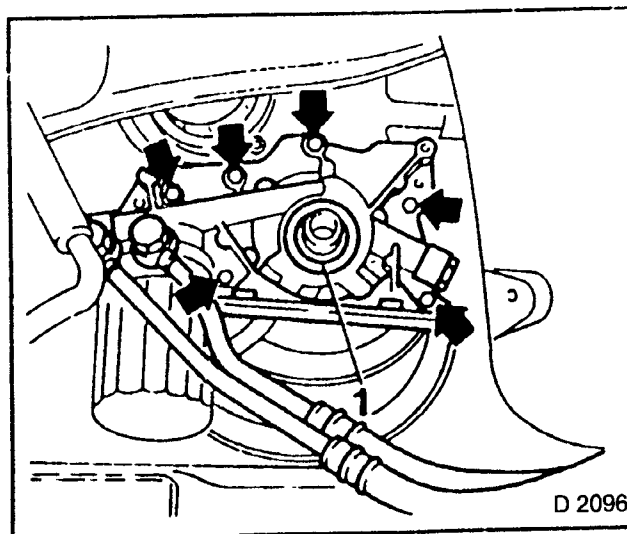


Fig. 480

INSTALL, CONNECT

1. Oil pump with new seal ring (use KM-693 — coat seal lips with protective grease) and gasket.
2. New oil filter cartridge (fill with engine oil).
3. Oil cooler leads.
4. Wiring plug.
5. Oil pressure switch.
6. Oil pan — See "Gasket Oil Pan, Replace", page 208.
7. Spacing ring onto crankshaft journal — coat fore part with Sealing Compound Locktite 515 flexible gasket or equivalent.

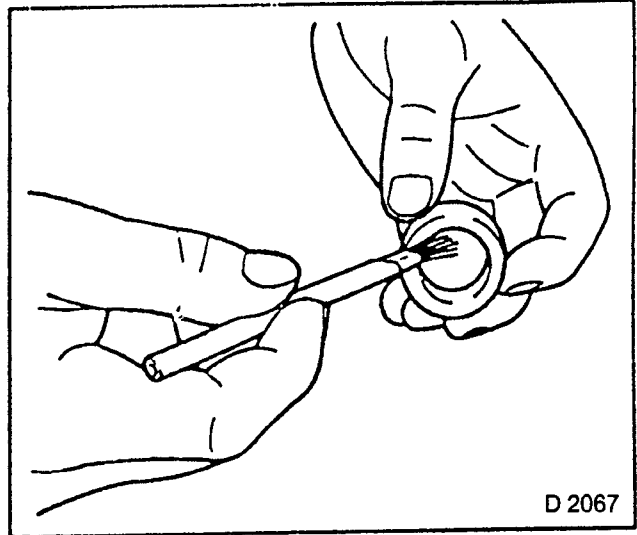


Fig. 481

TIGHTEN (TORQUE)

1. Oil pump to cylinder block — 6 Nm.
2. Oil filter cartridge to oil pump — 15 Nm.
3. Oil cooler leads to adapter — 30 Nm.

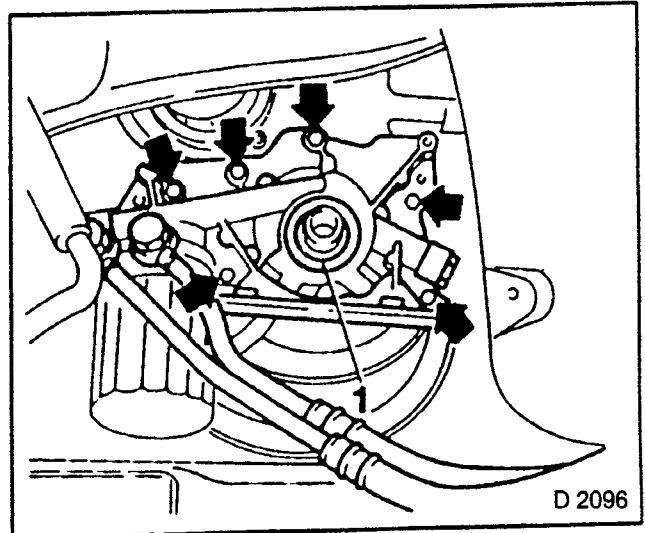


Fig. 482

TORQUE — ANGLE METHOD

1. Toothed belt drive pinion to crankshaft — 250 Nm + 40° to 50°. Use new bolt.

NOTE:

INSERT FASTENING BOLT OF TOOTHED BELT DRIVE PINION WITH GREASE.

2. When installing toothed belt drive pinion, mount MKM-604-21 (Torx Nut E 20) and Holding Wrench KM-662-A, as illustrated — observe manufacturer's instructions.

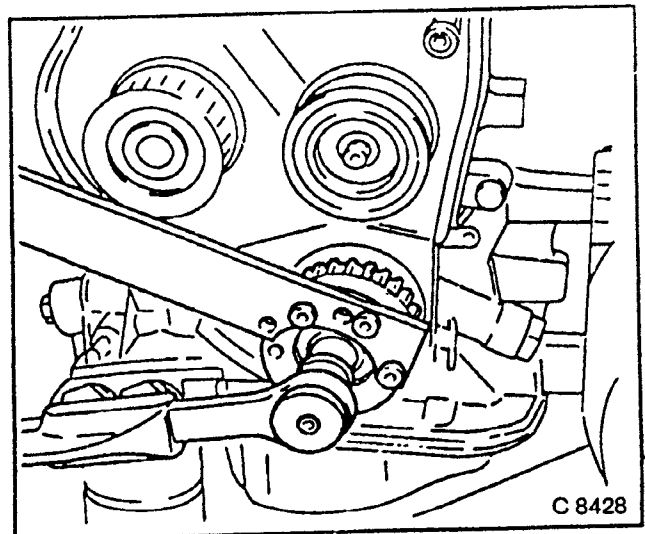


Fig. 483

INSTALL, CONNECT

- 1. Rear toothed belt cover — 6 Nm.
- 2. Camshaft sprockets.
- 3. Toothed belt guide roller.
- 4. Toothed belt tension roller.
- 5. Toothed belt.
- 6. Right front wheel — 110 Nm.

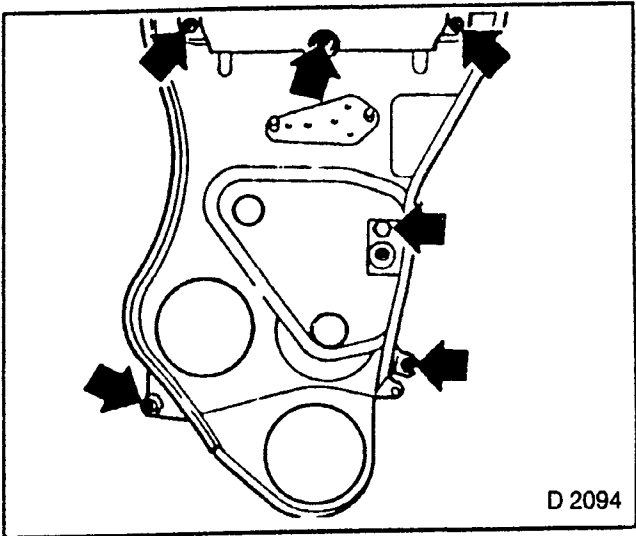


Fig. 484

**Gasket — Oil Pan —
Replace**

REMOVE, DISCONNECT

- 1. Performance header.
- 2. Wiring plug for dynamic oil level check.
- 3. Transmission cover.
- 4. Place collecting basin underneath.
- 5. Oil drain plug — drain engine oil.
- 6. Install oil drain plug — 45 Nm.

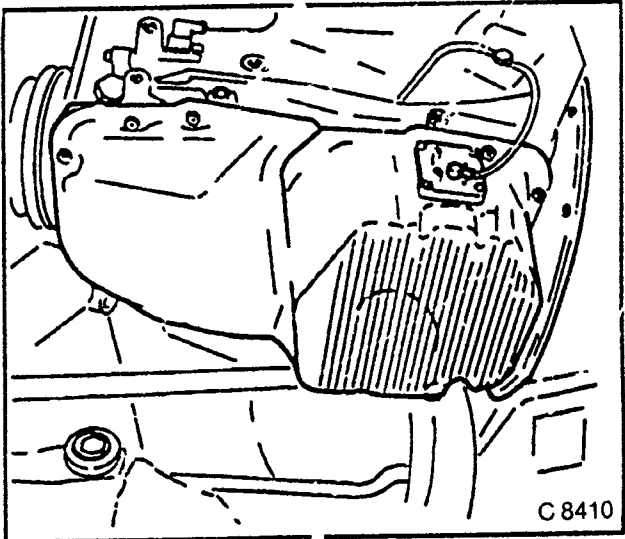


Fig. 485

REMOVE, DISCONNECT

- 1. Oil pan.
- 2. Oil intake tube.
- 3. Oil intake tube bracket.
- 4. Baffle plate.

CLEAN

Sealing surfaces.

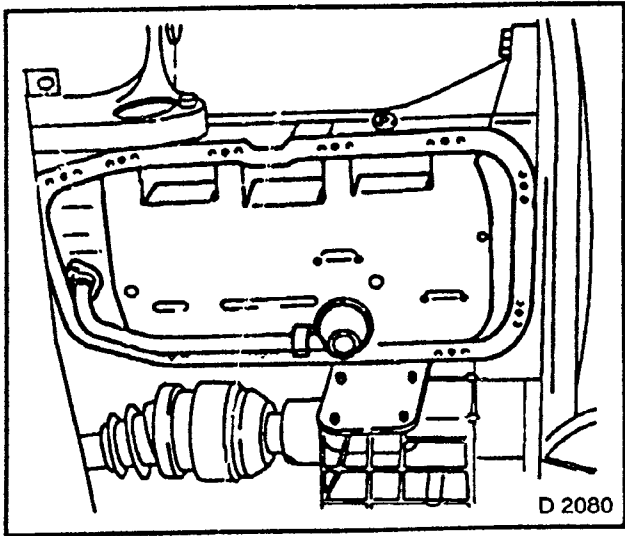


Fig. 486

Coat joins with Sealing Compound
Loctite 242.
Install cork seal.

NOTE:
CHECK THAT ALL SPACING RINGS
ARE PRESENT.

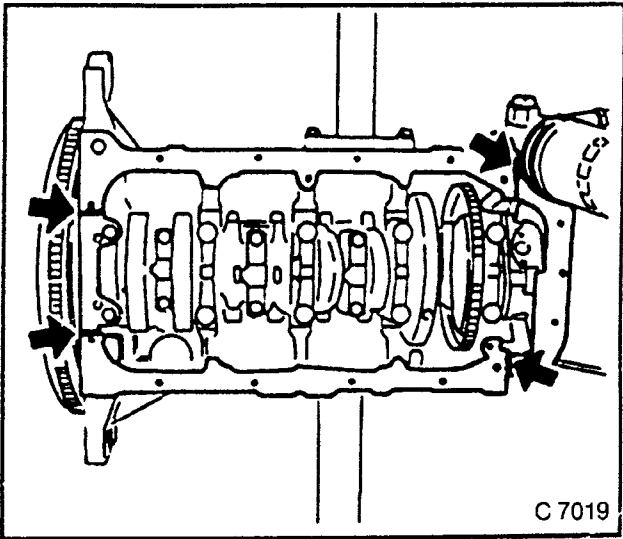


Fig. 487

INSTALL BAFFLE PLATE

TIGHTEN (TORQUE)

1. Oil intake tube bracket to cylinder block — 6 Nm.
2. Oil intake tube with new seal ring to oil pump — 8 Nm.
Insert bolts with Locking Compound
Loctite 242.

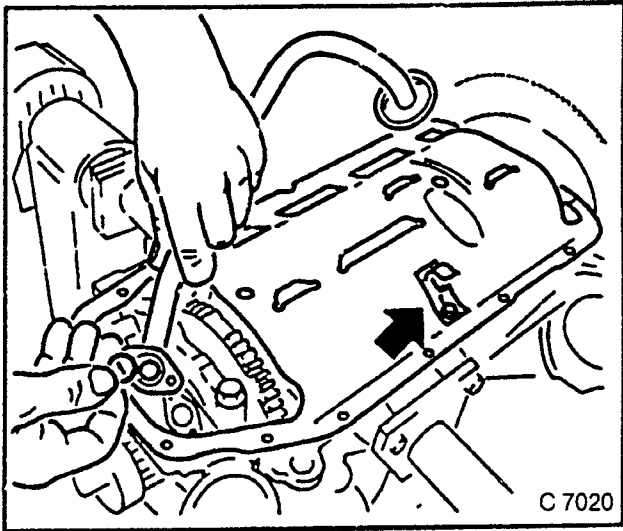


Fig. 488

INSTALL SECOND CORK SEAL

NOTE:
CHECK THAT ALL SPACING RINGS
ARE PRESENT.

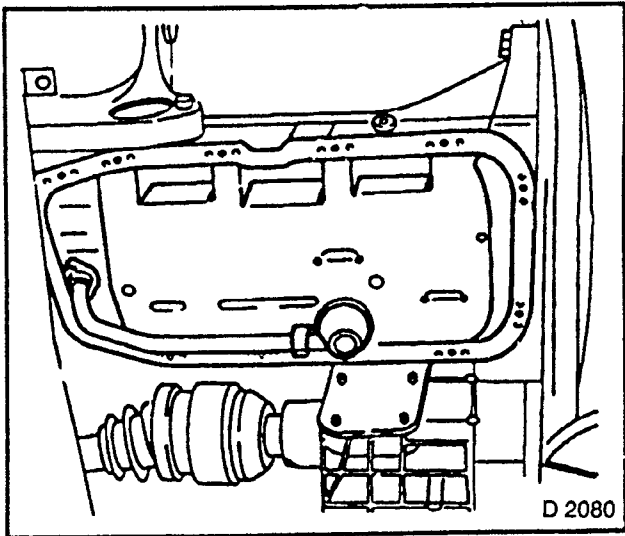


Fig. 489

INSTALL, CONNECT

1. Oil pan — 15 Nm. maximum installation time fifteen minutes.
2. Install bolts with Locking Compound Locktite 242.
3. Transmission cover.
4. Wiring plug for dynamic oil level check.
5. Performance header.
6. Top up engine oil to marking "MAX" on oil dipstick.

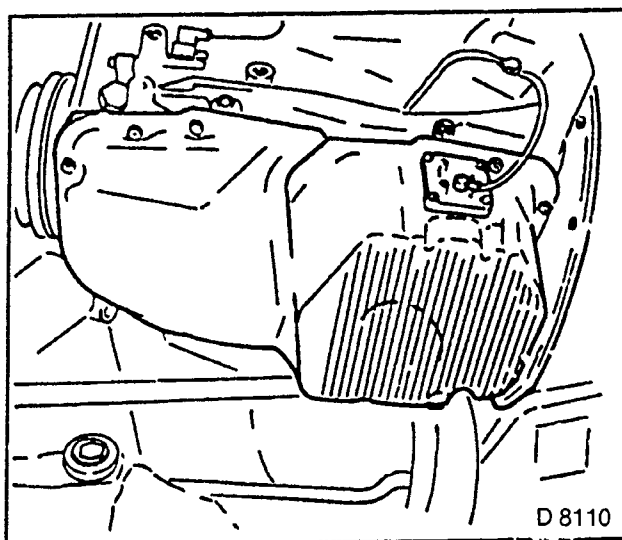
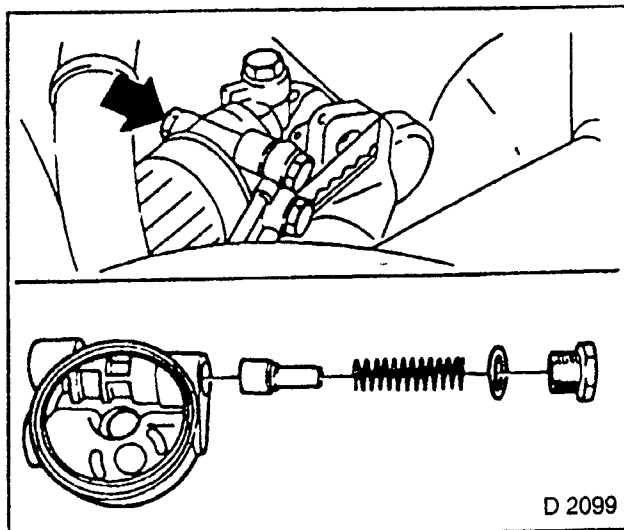


Fig. 490

Thermostat — Replace
REMOVE, DISCONNECT

1. Engine compartment cover.
2. Closure plug.
3. Seal ring.
4. Spring.
5. Piston.

**INSTALL, CONNECT**

1. Removed components in order. Shown Fig. 454.
2. Engine compartment cover.

TORQUE — ANGLE METHOD

1. Closure plug (M20) to thermostat housing — 20 Nm + 60° + 30°.
Use new bolts.

Fig. 491

Oil Pump Safety Valve — Replace

REMOVE, DISCONNECT

- 1. Engine compartment cover.
- 2. Closure plug.
- 3. Seal ring.
- 4. Spring.
- 5. Piston.

INSTALL, CONNECT

- 1. Removed components in order. Shown Fig. 491.
- 2. Engine compartment cover.

TIGHTEN (TORQUE)

- 1. Closure plug to oil pump — 30 Nm.

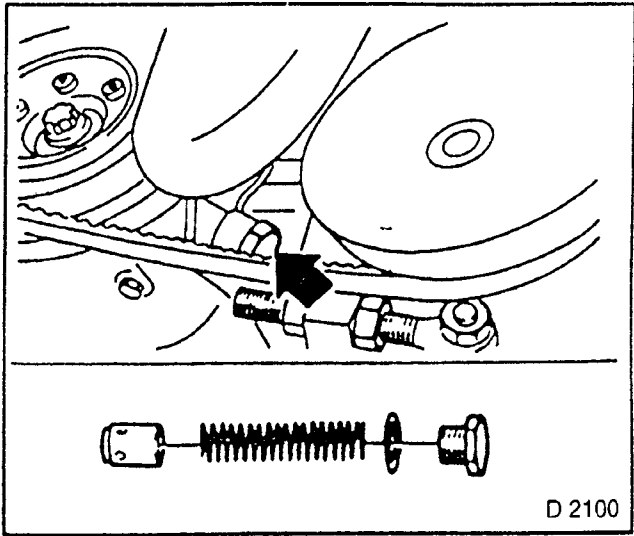


Fig. 492

Cooling System

RECOMMENDED TORQUE VALUES

	Nm
Camshaft sprocket to camshaft	50 + 60° to 75° ³⁾
Cover plate to cylinder head (M 6 bolts)	9
Cover plate to cylinder head (M 8 nuts)	22 ¹⁾
Cover to throttle valve manifold	5 ²⁾
Front toothed belt cover to cylinder head, intermediate piece and oil pump .	8
Guide pulley to cylinder block	25 + 45° to max. 60° ³⁾
Rear toothed belt cover to cylinder block	6
Tension roller to cylinder block	25 + 45° to max 60° ³⁾
Thermostat housing to cylinder head	15
Water outlet connection to thermostat housing	8
Water pump to cylinder block	25
Camshaft housing cover to camshaft housing	8
Crankshaft pulley to toothed belt drive gear	20
Temperature sensor to thermostat housing	11

¹⁾ Not present on C 20 LET
²⁾ C 20 LET only
³⁾ Use new bolt(s)

Seal Ring — Thermostat Housing/Cylinder Head — Replace

REMOVE, DISCONNECT

- 1. Engine compartment cover.
- 2. Lower hose (arrow) from radiator — collect coolant.
- 3. Upper hose from thermostat housing.
- 4. Cover plate for fantail manifold from cylinder head.

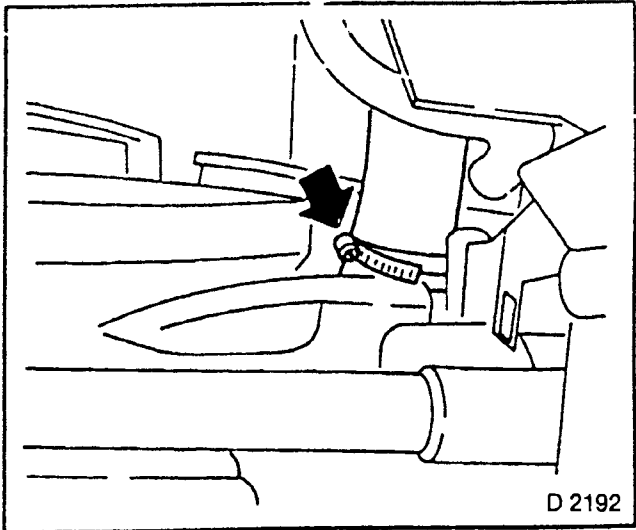


Fig. 493

REMOVE, DISCONNECT

- 1. Wiring plug (arrows) from thermostat housing.
- 2. Thermostat housing from cylinder head.

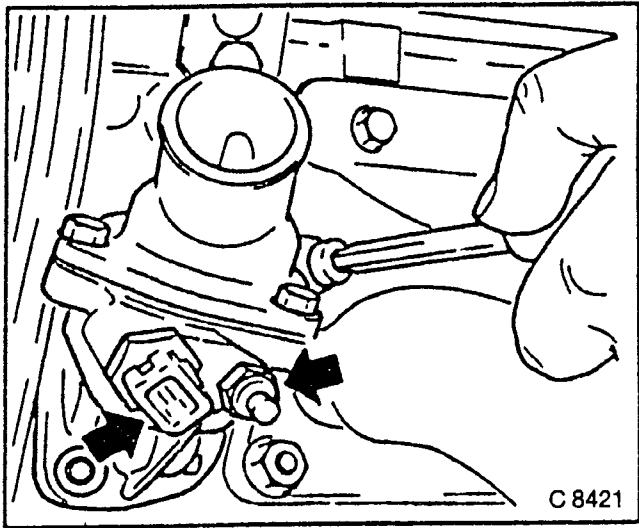


Fig. 494

- 3. Remove seal ring.

CLEAN

Sealing surfaces.

INSTALL, CONNECT

- 1. New seal ring.
- 2. Thermostat housing.
- 3. Wiring plug.
- 4. Cover plate.
- 5. Upper and lower hoses.
- 6. Engine compartment cover.

TIGHTEN (TORQUE)

- 1. Thermostat housing to cylinder head — 15 Nm.
- 2. Cover plate to cylinder head (bolt M6) — 9 Nm.
- 3. Cover plate to cylinder head (nut M8) — 22 Nm.
- 4. Top up and bleed cooling system.

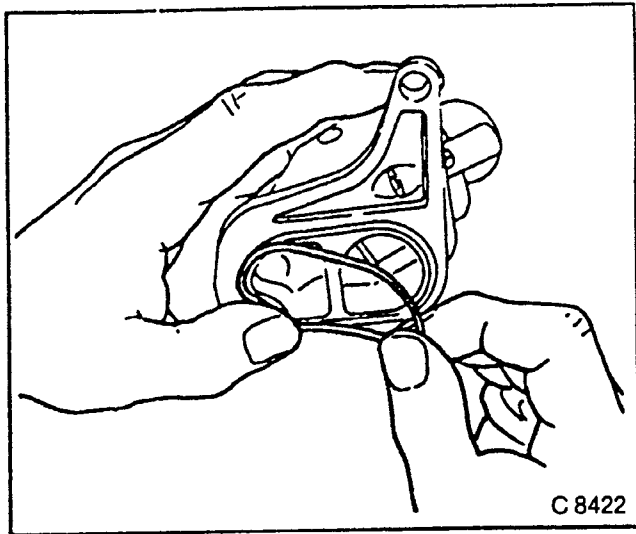


Fig. 495

Cooling System — Top up and Bleed

NOTE:
USE OPEL/VAUXHALL RADIATOR
ANTI-FREEZE (SABS 1251)

REMOVE, DISCONNECT

1. Allen bolt.
2. Top up coolant in compensation tank, until it escapes without bubbles from mounting bore hole of allen bolt.
3. Insert allen bolt with Sealing Compound Loctite 242.
4. Top up coolant to marking "KALT" in compensation tank.
5. Close cooling system and allow engine to run warm until thermostat opens. (approximately 92°C/198°F coolant temperature).

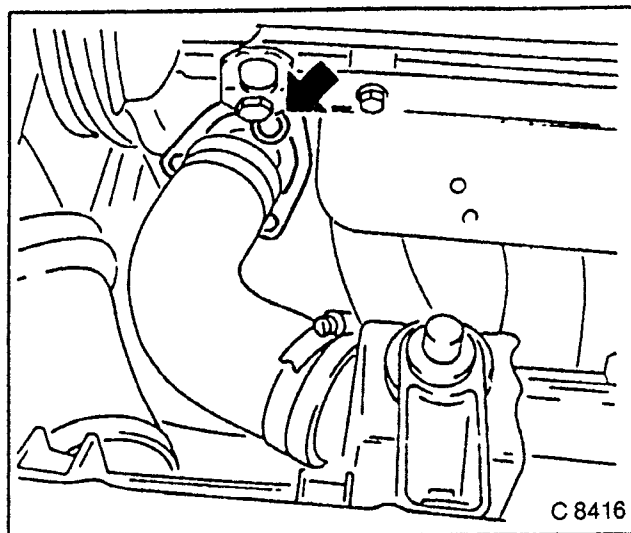


Fig. 496

INSPECT

1. Coolant level.
2. Allow engine to cool.
3. Top up coolant to marking "KALT" in compensation tank if necessary.

Coolant Temperature — Measure with Closed Cooling System

INSTALL, CONNECT

1. Temperature Gauge 17 57 230 (90 141 985) between coolant hose and heating connection pipe in cylinder head. Observe manufacturer's instructions.

MEASURE

1. Coolant temperature — operating temperature approximately 80°C/176°F.

REMOVE, DISCONNECT

1. Temperature gauge.

INSTALL, CONNECT

1. Coolant hose.
2. Top up and bleed cooling system.

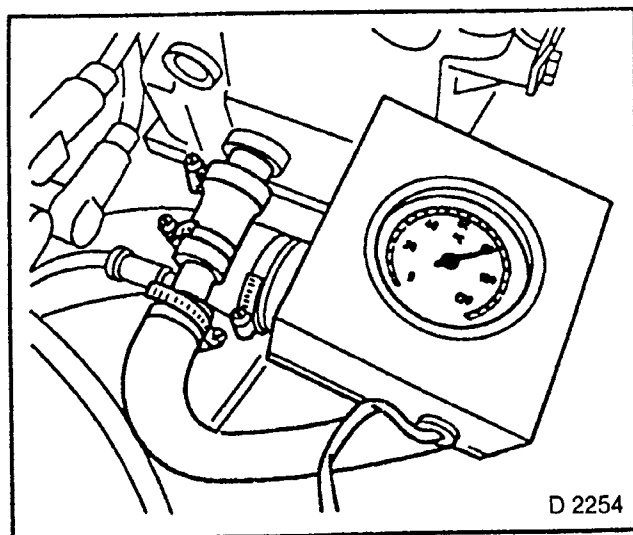


Fig. 497

Thermostat — Replace

REMOVE, DISCONNECT

- 1. Engine compartment cover.
- 2. Lower hose bend from radiator — collect coolant.
- 3. Upper hose bend from water outlet connection.
- 4. Water outlet connection with thermostat from thermostat housing.
- 5. Remove seal ring.

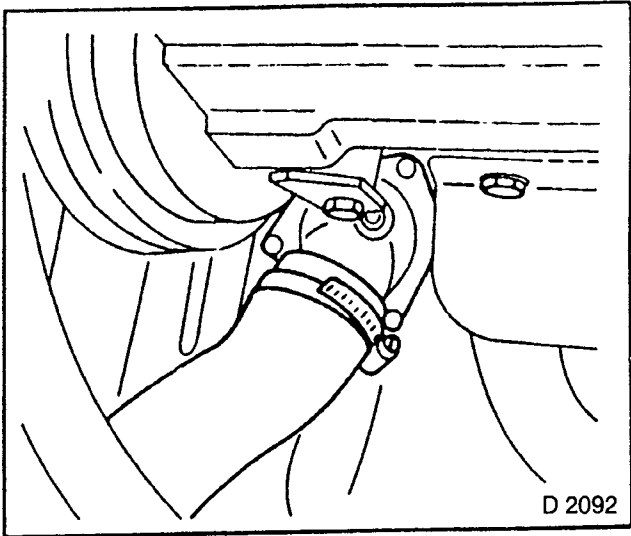


Fig. 498

CLEAN

Sealing surfaces

INSTALL, CONNECT

- 1. New seal ring.
- 2. Water outlet connection with thermostat to thermostat housing — 8 Nm.
- 3. Upper and lower hose bends.
- 4. Engine compartment cover.
- 5. Top up and bleed cooling system.

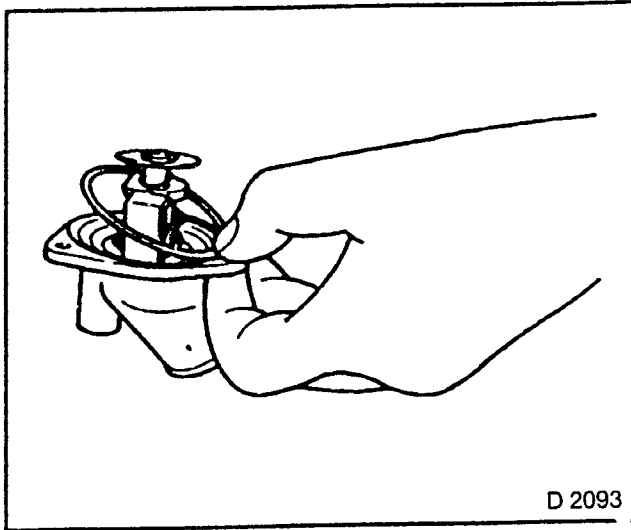


Fig. 499

Water Pump — Remove and Install

REMOVE, DISCONNECT

- 1. Engine compartment cover.
- 2. Lower hose bend from radiator — collect coolant.
- 3. Toothed belt — See “Toothed Belt, Replace”, page 168.
- 4. Toothed belt tension roller.
- 5. Toothed belt guide roller.
- 6. Camshaft sprockets.
- 7. Rear toothed belt cover (arrows).

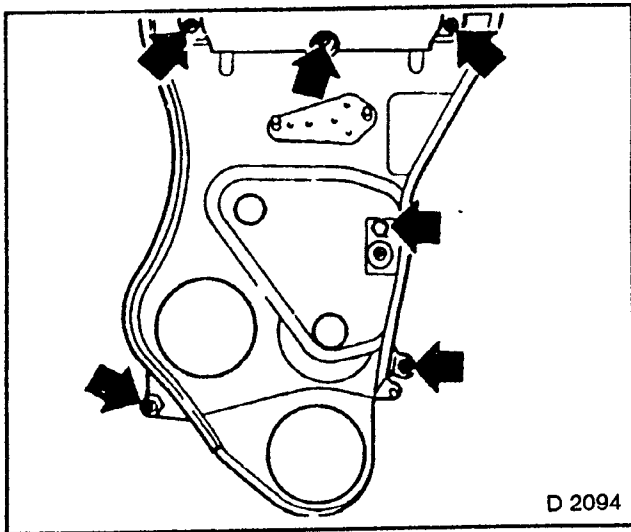


Fig. 500

REMOVE, DISCONNECT

Water pump from cylinder block.

CLEAN

- 1. Sealing surfaces.
- 2. Before installing water pump.
- 3. Coat sealing surfaces of cylinder block and new seal ring slightly with Silicon Grease B 0400571.

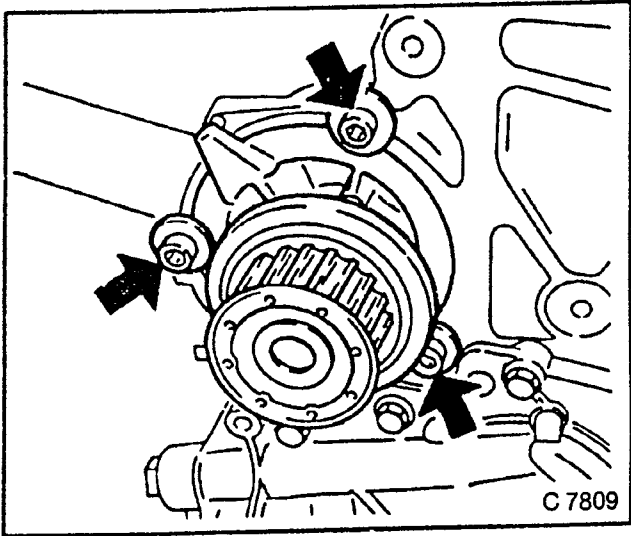


Fig. 501

Insert water pump in cylinder block.

NOTE:
SPRUES OF WATER PUMP AND CYLINDER BLOCK MUST ALIGN.

TIGHTEN (TORQUE)

- 1. Water pump to cylinder block — 25 Nm.
- 2. Pull rear cover up to toothed belt gear of water pump.

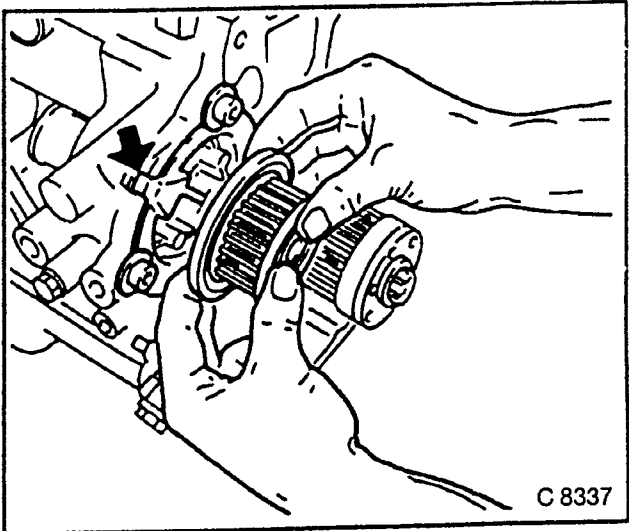


Fig. 502

INSTALL, CONNECT

- 1. Rear toothed belt cover — 6 Nm.
- 2. Camshaft sprockets.
- 3. Toothed belt guide roller.
- 4. Toothed belt tension roller.
- 5. Toothed belt.
- 6. Lower hose bend to radiator.
- 7. Engine compartment cover.
- 8. Top up and bleed cooling system.

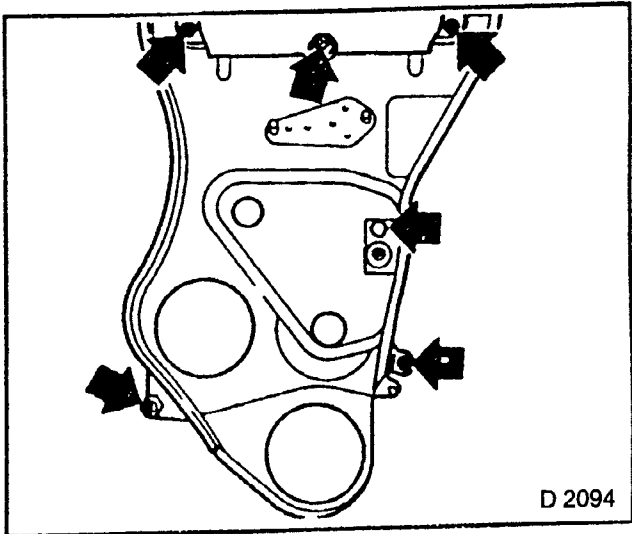


Fig. 503

Engine Damping Blocks — Engine — Short-Block

RECOMMENDED TORQUE VALUES

	Nm
Brake servo vacuum line to intake manifold/intake pipe	15
Clamping bracket to alternator	25
Clamping bracket, alternator to intake manifold/intake pipe	25
Cylinder head cover to cylinder head	8
Cylinder head to cylinder block	25 + 65° + 65° + 65° ¹⁾
Front toothed belt cover to cylinder head, intermediate piece and oil pump . . .	8
Guide pulley to cylinder block	25 + 45° to max. 60° ⁴⁾
Ignition cable cover to cylinder head cover	8
Oil pan to cylinder block	15 ⁵⁾
Oil temperature switch to cylinder block	30
Right engine damping block to side member	65 ⁶⁾
Shift rod to knurled bolt	15
Spark plug in cylinder head	25
Support to intake manifold and cylinder block	25
Tension roller to cylinder block	25 + 45° to max. 60° ⁴⁾
Thermostat housing to cylinder head	15
Toothed belt drive gear to crankshaft	250 + 40° to 50° ⁷⁾
Water pump to cylinder block	25
Wheel bolts to front wheel hub	110
Bracket for power steering pump/AC compressor to cylinder block	40
Bracket, oil intake pipe to cylinder block	6
Camshaft sprocket to camshaft	50 + 60° to 75° ⁴⁾
Coolant pipe to cylinder block	20
Crankshaft pulley to toothed belt drive gear	20
Engine suspension bracket to cylinder block	60
Exhaust pipe to exhaust diverter manifold	12 ¹⁾
Inductive pulse pick-up to cylinder block	6
Intermediate shaft bracket to cylinder block	55 ²⁾
Knock sensor to cylinder block	20
Oil cooler lines to adapter	30
Oil drain plug to oil pan	45
Oil filter cartridge to oil pump	15
Oil intake pipe to oil pump	8 ³⁾
Performance header with cover plate to cylinder head	22
Rear toothed belt cover to cylinder block	6
Starter to cylinder block (engine side)	45
Transfer box bracket to cylinder block	60
Transmission to engine block	75
Engine ventilation flange to cylinder block	25
Guide roller to cylinder block	25
Inductive pulse pick-up to cylinder block	6
Oil intake pipe bracket to cylinder block	6

¹⁾ C 20 LET only
²⁾ Vehicles with front wheel drive.
³⁾ Use new bolt(s).
⁴⁾ Insert bolts with Locking Compound Loctite 242.
⁵⁾ Maximum installation time 10 minutes.
⁶⁾ Insert bolt with grease.
⁷⁾ After test run, turn bolts a further 30° to 45°.

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Engine with Transmission — Remove and Install (C 20 LET with Pot Flywheel)

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Disconnect fan motor wiring plug.
3. Fan shroud with fan motor from radiator — remove upwards.
4. Lower hose bends from radiator — collect coolant.

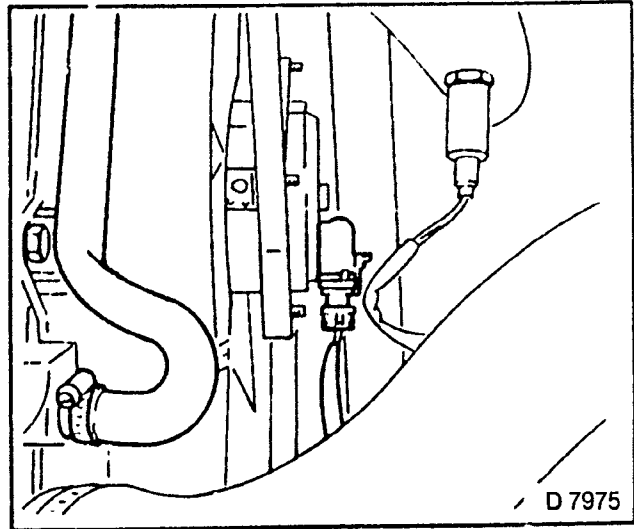


Fig. 504

REMOVE, DISCONNECT

C 20 LET:

1. Air hose (1) — close turbocharger openings.

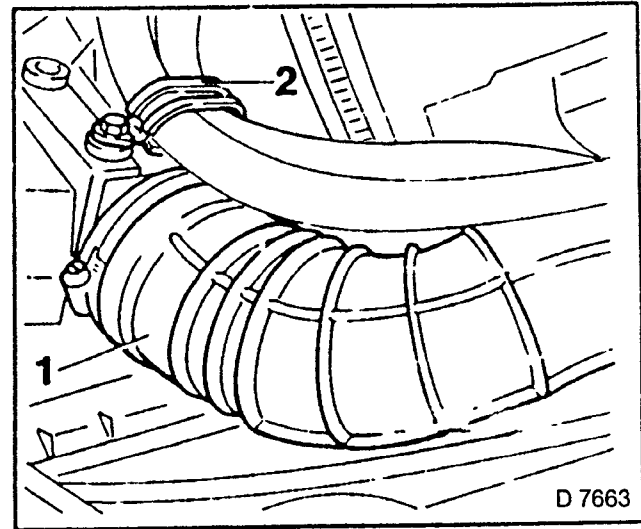


Fig. 505

REMOVE, DISCONNECT

C 20 LET:

1. Wiring plug (1) and hose (2) from charge pressure bypass valve.
2. Disconnect wiring plug (3).
3. Air hose between charge cooler and throttle valve manifold.
4. Vacuum hose between throttle valve housing and control unit.

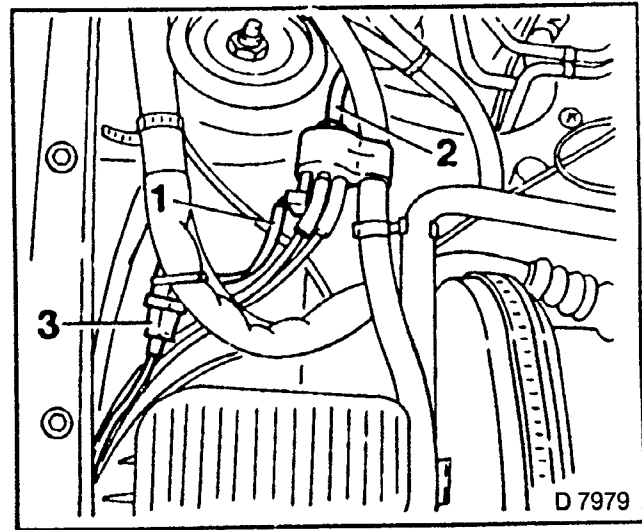


Fig. 506

REMOVE, DISCONNECT

- 1. Wiring plug from high voltage distributor.
- 2. High voltage cable from ignition coil.
- 3. Wiring plug (1) from ignition coil control unit.

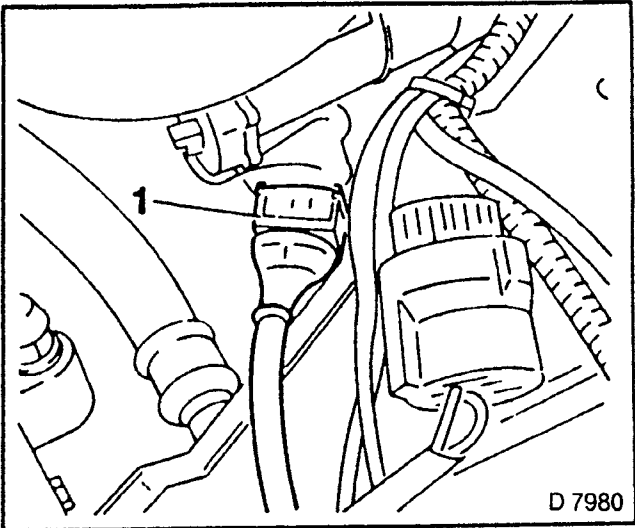


Fig. 507

REMOVE, DISCONNECT

- 1. Disconnect engine/body multi-plug (1).
- 2. Disconnect wiring plug (2) for reversing lamps.
- 3. Wiring plug from 1st gear recognition (C 20 LET only).

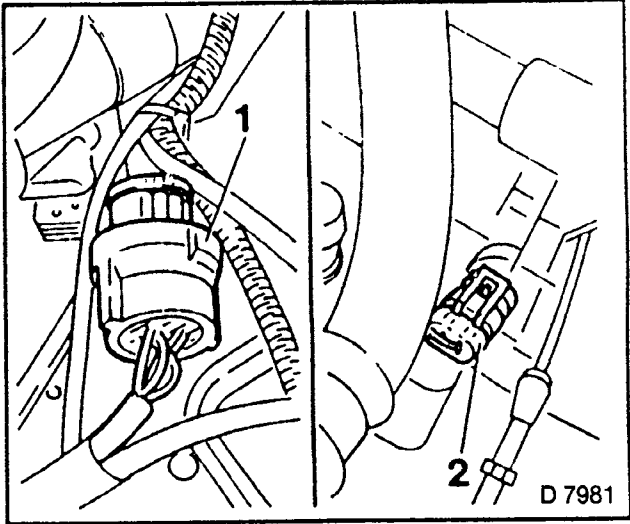


Fig. 508

REMOVE, DISCONNECT

- 1. Wiring plug for dynamic oil level check.
- 2. Disconnect wiring plug from oxygen sensor on bulkhead.

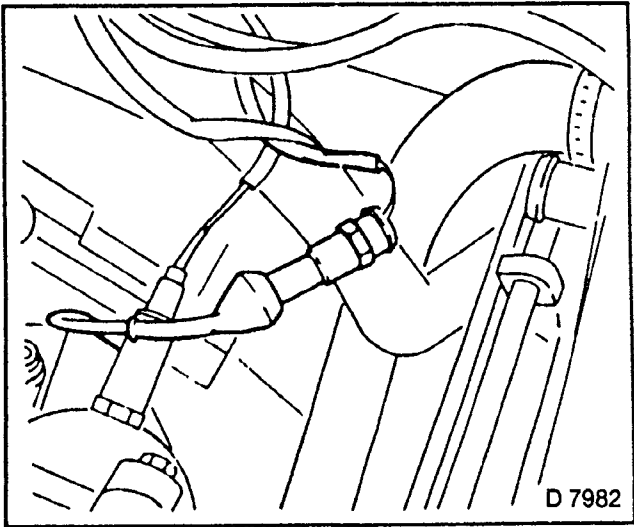


Fig. 509

REMOVE, DISCONNECT

C 20 LET:

- 1. Wiring plug (1) for hot start valve.
- 2. Wiring plug (2) for intake air temperature sensor.
- 3. Wiring plug (3) for throttle valve potentiometer.
- 4. Wiring plug (4) for tank vent valve.
- 5. Ground connections from fuel distributor pipe.

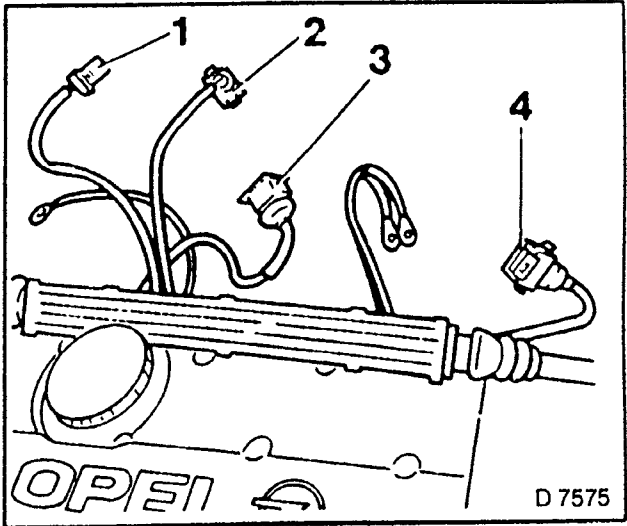


Fig. 510

REMOVE, DISCONNECT

C 20 XE

- 1. Wiring plug (1) from throttle valve switch.
- 2. Ground connections (2) from fuel distributor pipe.
- 3. Wiring plug (3) from tank vent valve.

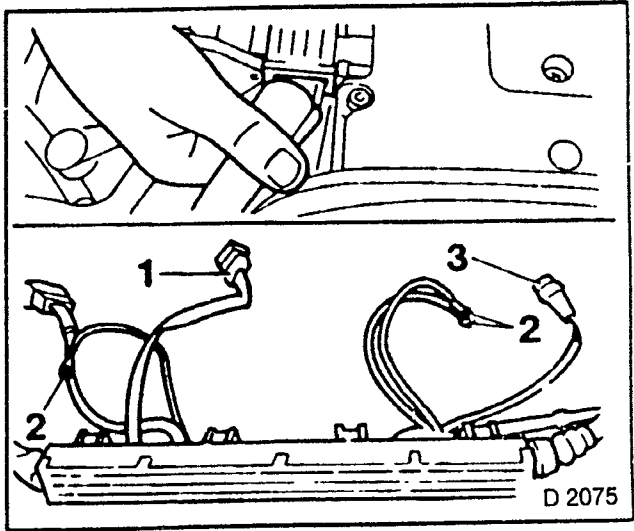


Fig. 511

REMOVE, DISCONNECT

- 1. Bowden cable.
- 2. Fuel lines — close off with spring clamps.
- 3. Plug strip from injection valves — for this, pull back retaining clamp on 1st cylinder injection valve.
- 4. Lay entire wiring harness aside.

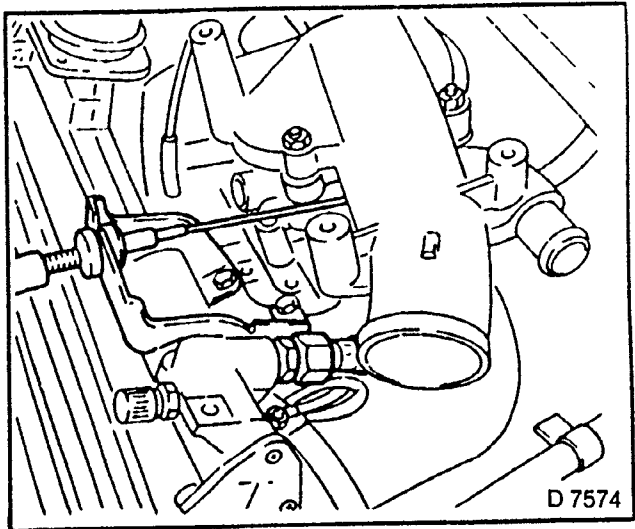


Fig. 512

REMOVE, DISCONNECT

- 1. Coolant hose from cylinder head.
- 2. Lower hose bend from coolant pipe.
- 3. Multi-plug.
- 4. Coolant hose from coolant pipe.

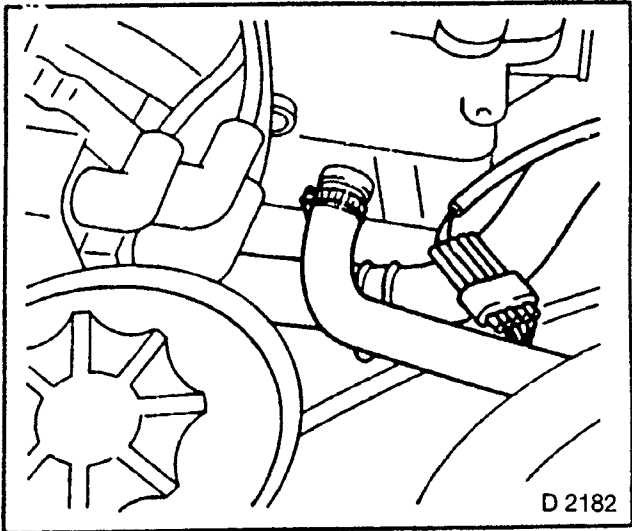


Fig. 513

REMOVE, DISCONNECT

- 1. Brake servo vacuum line (arrow) from intake manifold.
- 2. Vacuum hose from tank vent valve.
- 3. Clutch cable from clutch release lever.

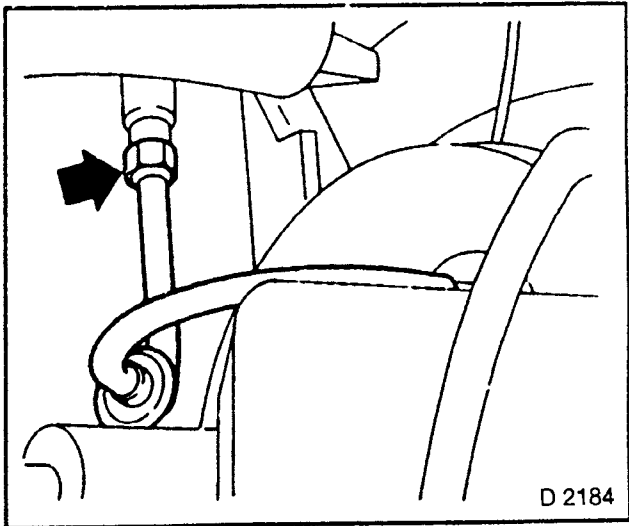


Fig. 514

REMOVE, DISCONNECT

- 1. Speedometer cable or wiring plug from odometer frequency sensor.
- 2. Shift rod.
- 3. Shift linkage — See Section K.

REMOVE, DISCONNECT

- 1. Attach engine to Engine Holder KM-263-B.
- 2. Drive belt for power steering pump.
- 3. Pump assembly bracket from cylinder block.
- 4. Detach assembly to one side.

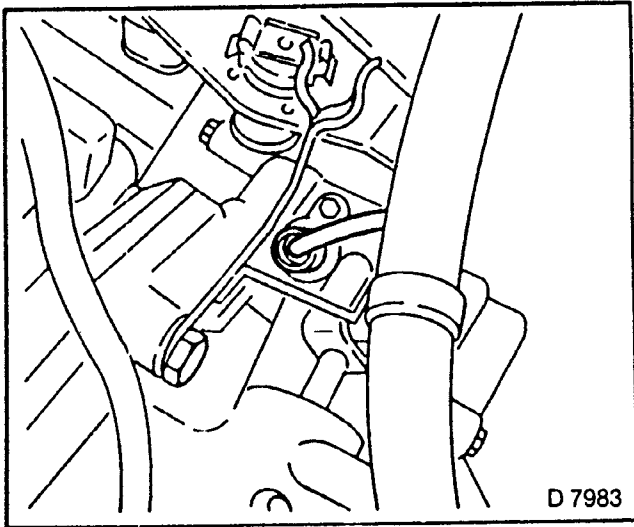


Fig. 515

NOTE:
SYSTEM REMAINS CLOSED.

REMOVE, DISCONNECT

- 1. Oil cooler lines.
- 2. Oil filter cartridge with commercially available remover — place collecting basin underneath.
- 3. Exhaust pipe or performance header.

C 20 LET:

Lower charge air line.

REMOVE, DISCONNECT

- 1. Front wheels.
- 2. Ball joints from steering knuckles.
- 3. Axle shafts.
- 4. Front axle body — See Section E and K.

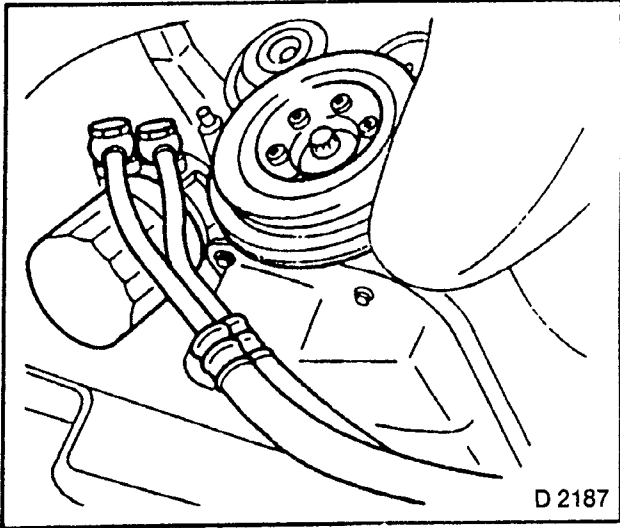


Fig. 516

REMOVE, DISCONNECT

- 1. Support engine with jack.
- 2. Ground cable from transmission.
- 3. Engine damping blocks from side members.
- 4. Remove Engine Holder KM-263-B,
- 5. Lower engine with transmission.

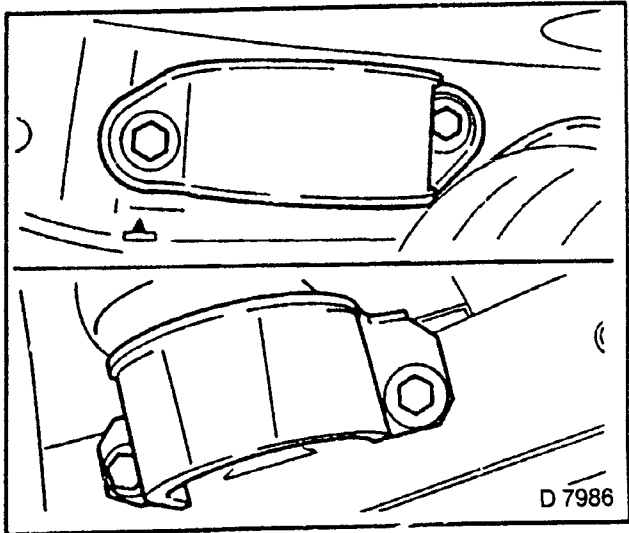


Fig. 517

INSTALL, CONNECT

- 1. Engine with transmission in engine compartment.
- 2. Attach engine to Engine Holder KM-263-B.

TIGHTEN (TORQUE)

- 1. Engine damping blocks to side members — 65 Nm. Insert bolts with Locking Compound Loctite 242.

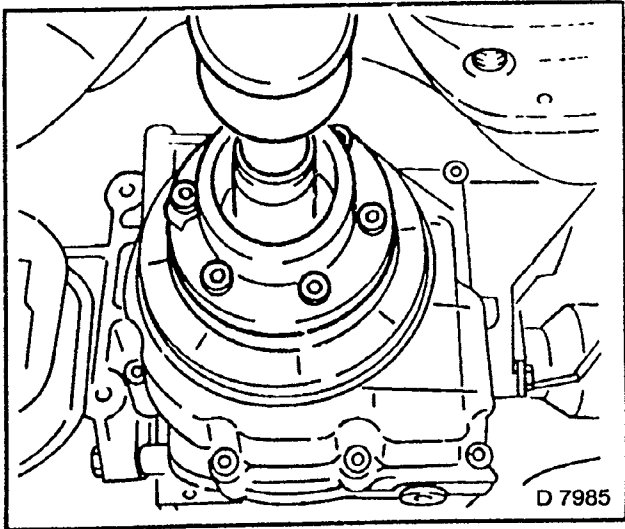


Fig. 518

INSTALL, CONNECT

1. Front axle body.
2. Axle shafts.
3. Ball joints in steering knuckles.
4. Front wheels — See Section E and K.

TIGHTEN (TORQUE)

Front axle body to underbody

Bolts (1) — 115 Nm.

Bolts (2) — 170 Nm.

TORQUE — ANGLE METHOD

Bolts (3 in Fig. 519).— 100 Nm. + 75° to 90°.

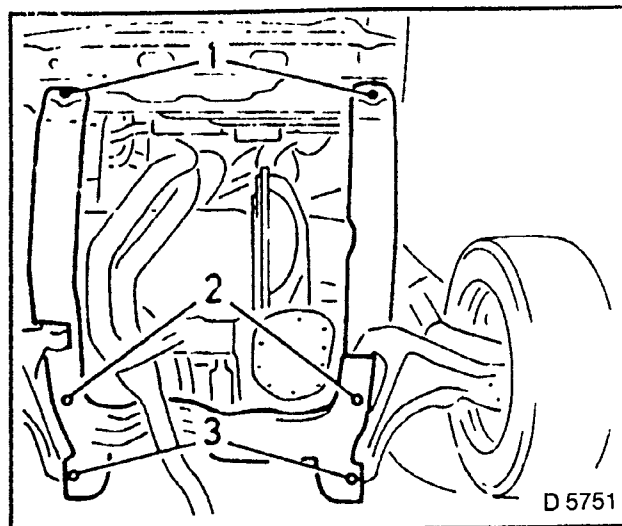


Fig. 519

TIGHTEN (TORQUE)

1. Transmission bracket to front axle body (arrows) — 40 Nm.
2. Ball joints to steering knuckles — 70 Nm.
3. Use new retaining clamps and nuts.
4. Front wheels to wheel hubs — 110 Nm.

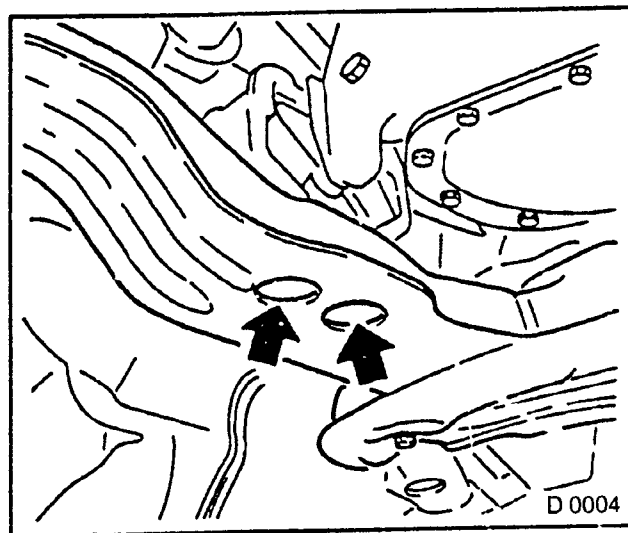


Fig. 520

INSTALL, CONNECT

1. Lower charge air line (C 20 LET), exhaust pipe or performance header.
2. Oil filter cartridge (fill with engine oil), oil cooler lines.

TIGHTEN (TORQUE)

1. Exhaust pipe to exhaust adapter (C 20 LET) — 12 Nm.
2. Performance header with cover plate to cylinder head — 22 Nm.
3. Oil filter cartridge to oil pump — 15 Nm.
4. Oil cooler lines to adapter — 30 Nm.

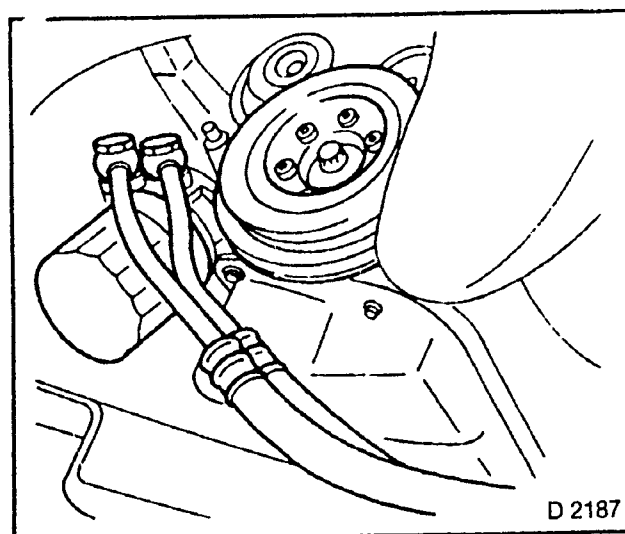


Fig. 521

TIGHTEN (TORQUE)

Pump assembly bracket to cylinder block — 40 Nm.

ADJUST

Drive belt tension — Section M.

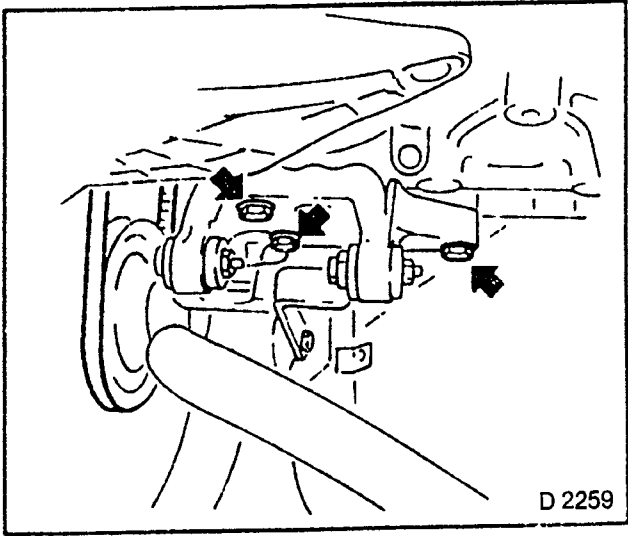


Fig. 522

INSTALL, CONNECT

- 1. Remove Engine Holder KM-263-B.
- 2. Shift rod, adjustment — See Section K.

TIGHTEN (TORQUE)

Shift rod to knurled bolt — 15 Nm.

INSTALL, CONNECT

- 1. Speedometer cable or odometer frequency sensor.
- 2. Clutch cable.
- 3. Vacuum hose to tank vent valve.
- 4. Brake servo vacuum line to intake manifold — 15 Nm.

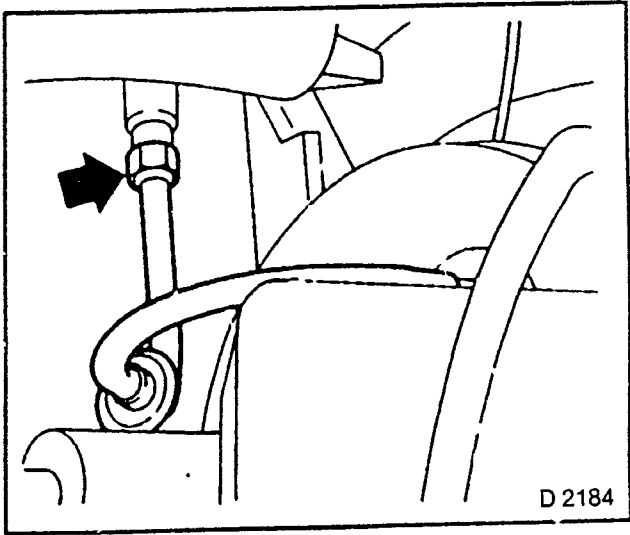


Fig. 523

INSTALL, CONNECT

C 20 LET:

- 1. Injection valves plug strip.
- 2. Wiring plug (1) for hot start valve.
- 3. Wiring plug (2) for intake air temperature sensor.
- 4. Wiring plug (3) for throttle valve potentiometer.
- 5. Wiring plug (4) for tank vent valve.
- 6. Ground connections.
- 7. Note routing of leads.

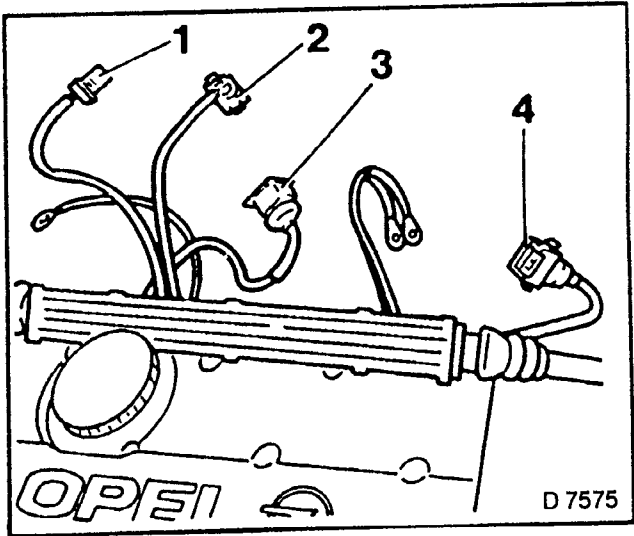


Fig. 524

INSTALL, CONNECT

C 20 XE

- 1. Wiring plug (1) to throttle valve switch.
- 2. Ground connections (2) to fuel distributor pipe.
- 3. Wiring plug (3) to tank vent valve.
- 4. Note routing of leads.

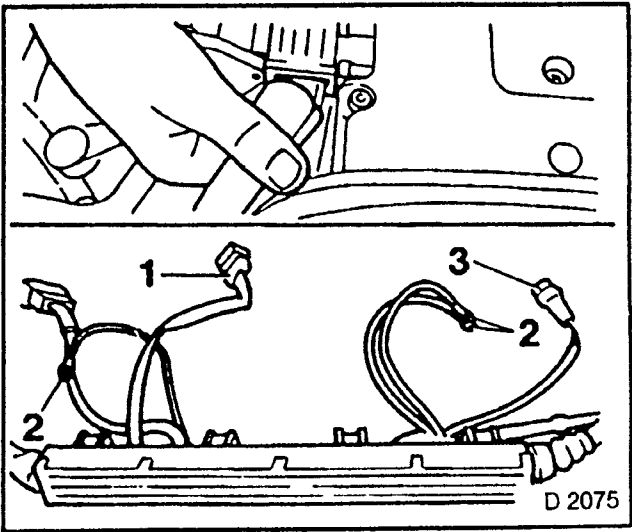


Fig. 525

INSTALL, CONNECT

- 1. Fuel lines.
- 2. Remove spring clamps.
- 3. Bowden cable.
- 4. Coolant hoses to cylinder head.

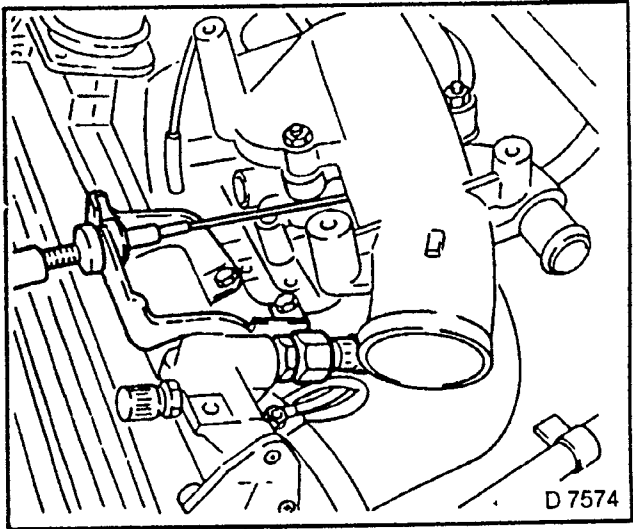


Fig. 526

INSTALL, CONNECT

- 1. Engine/body multi-plug (1).
- 2. Wiring plug (2) for reversing lamps.
- 3. Wiring plug for 1st gear recognition (C 20 LET only).

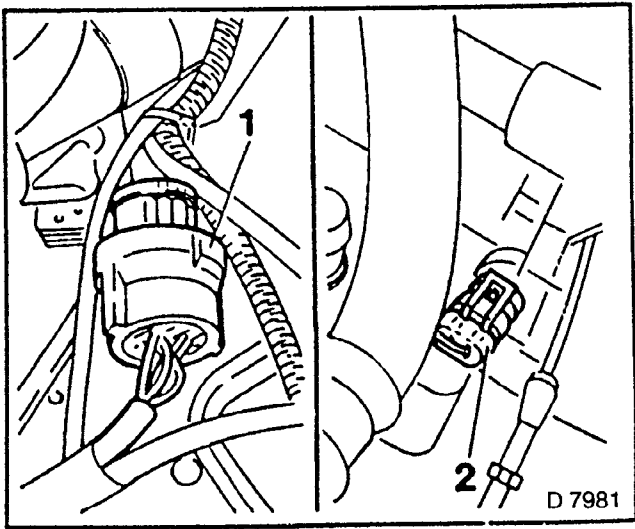


Fig 527

INSTALL, CONNECT

- 1. Wiring plug to high voltage distributor.
- 2. High voltage cables to ignition coil.
- 3. Wiring plug to ignition coil control unit.

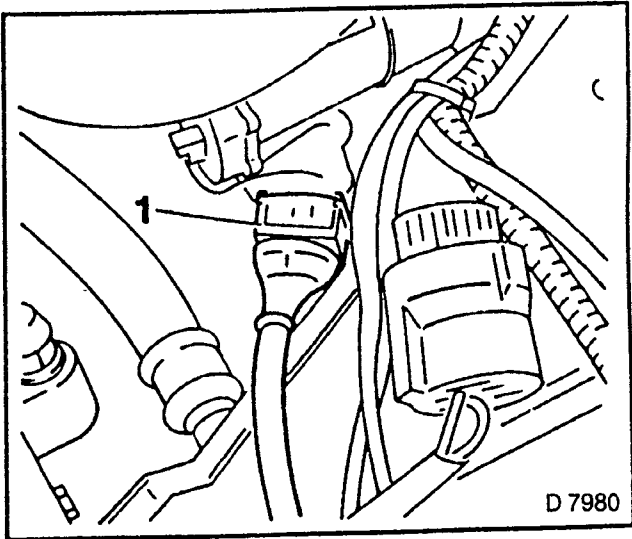


Fig. 528

INSTALL, CONNECT

- 1. Wiring plug to temperature sensor and to temperature pick-up.
- 2. Upper hose bend to thermostat housing.
- 3. Coolant hoses to compensation tank.

IN ADDITION FOR C 20.LET:

- 1. Charge cooler air hose — throttle valve manifold.
- 2. Wiring plug and hose to charge pressure bypass valve.

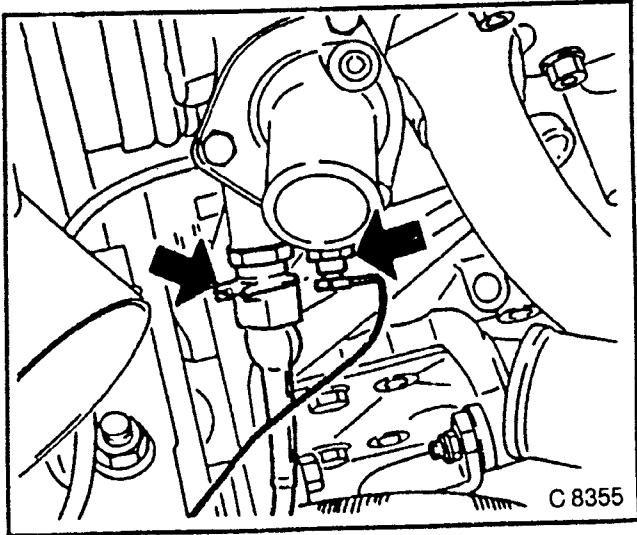


Fig. 529

INSTALL, CONNECT

20 XE

- 1. Air intake hose (1), wiring plug (2) to mass air flow meter.
- 2. Idle speed adjuster hose (3) to pre-volume chamber.
- 3. Pre-volume chamber with mass air flow meter (4).
- 4. Wiring plug (5) for inductive pulse pick-up.

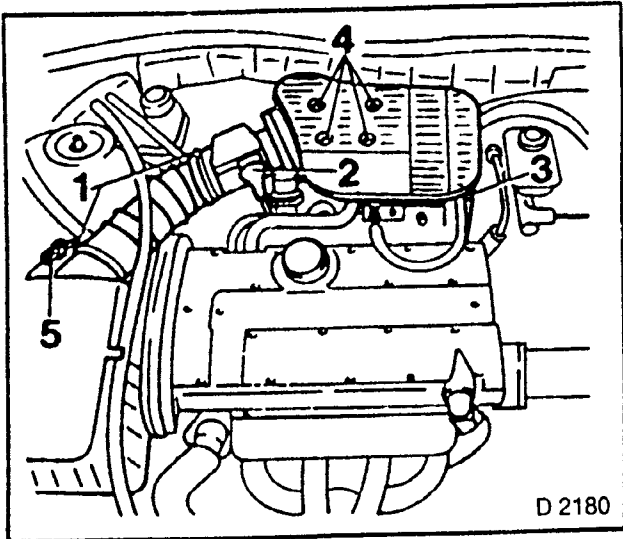


Fig. 530

INSTALL, CONNECT

C 20 LET:

1. Throttle valve manifold cover.
2. Air hose (1).

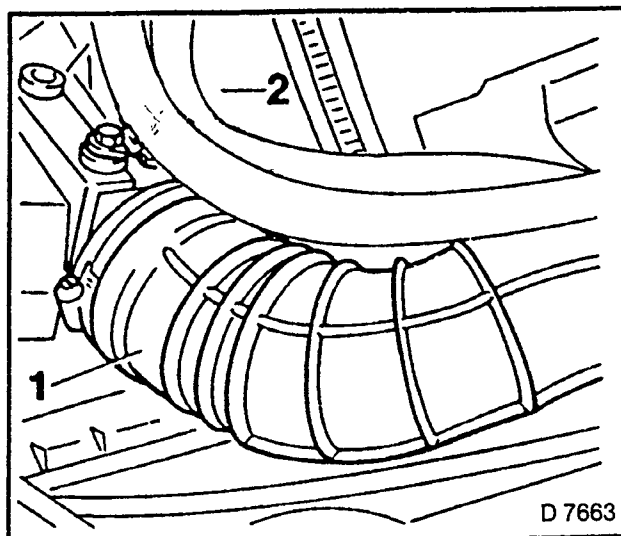


Fig. 531

INSTALL, CONNECT

1. Lower hose bend to radiator.
2. Fan motor.
3. Fan motor multi-plug.
4. Ground cable to battery.

INSPECT

1. Check engine oil level, correct if necessary.
2. Top up and bleed cooling system.
3. Charge and evacuate hydraulic system — See Section K

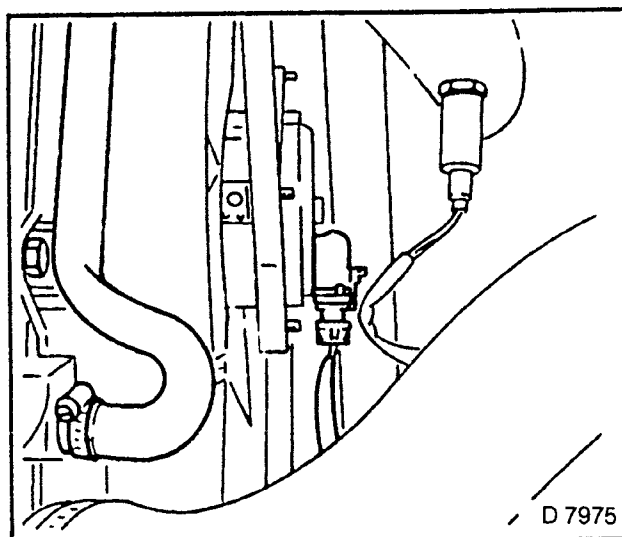


Fig 532

Engine — Repair using Short Block

ATTACHING PARTS, REMOVE

1. Mount engine on Mounting Trestle KM-412.
2. Use Adapter KM-412-8
3. Drain engine oil — place collecting basin underneath.
4. Install oil drain plug — 45 Nm

REMOVE, DISCONNECT

1. Front toothed belt cover.
2. Loosen tension roller (arrow) — toothed belt.
3. Tension roller, guide roller — note spacer sleeve.

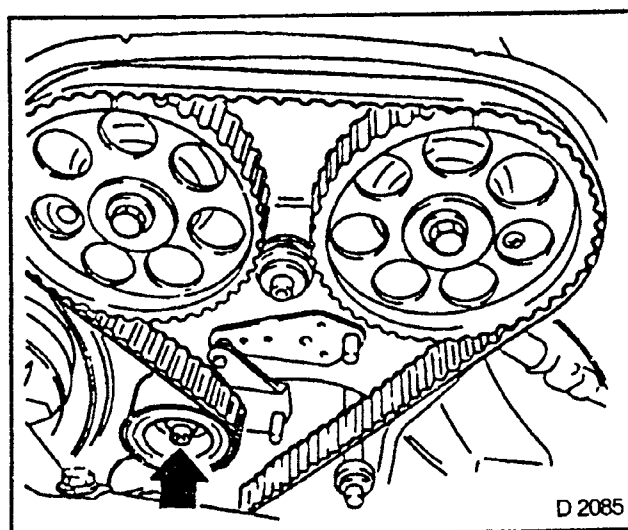


Fig. 533

REMOVE, DISCONNECT

- 1. Ignition cable cover.
- 2. Spark plug connection — KM-717.
- 3. Crankcase housing ventilation hose connection from cylinder head cover.
- 4. Cylinder head cover.
- 5. Camshaft sprockets — counterhold on hex of camshaft with wrench.

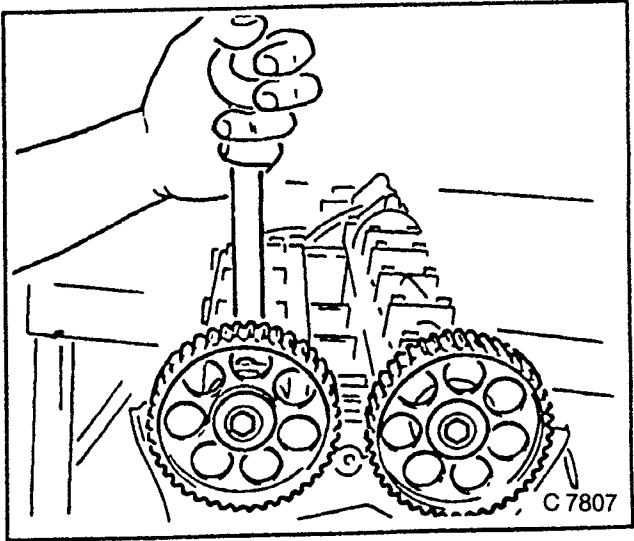


Fig. 534

REMOVE, DISCONNECT

- 1. Rear toothed belt cover.
- 2. On vehicles with front wheel drive: Intake manifold — cylinder block support.
- 3. Cylinder head bolts. In illustrated order with MKM-604-19 (Torx Nut E 14).

NOTE:
LOOSEN CYLINDER HEAD BOLTS FIRST 1/4, THEN 1/2 TURN.
WHEN REMOVING CYLINDER HEAD BOLTS, NOTE STEEL WASHERS.

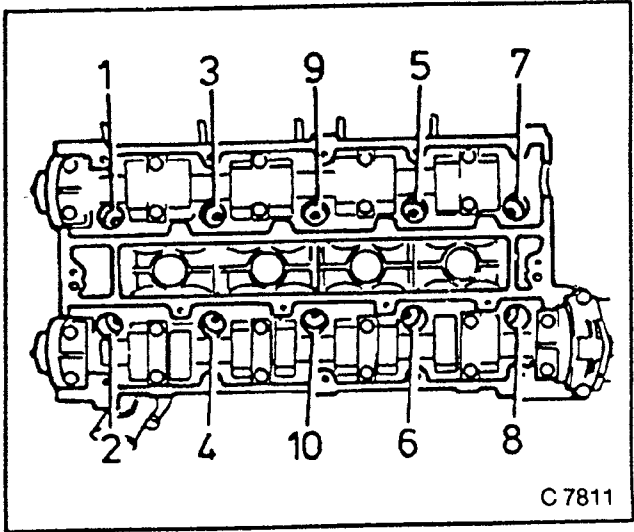


Fig 535

REMOVE, DISCONNECT

- 1 Water pump.
- 2. Toothed belt drive gear — if necessary.
- 3 Install Remover KM-210-A with KM-516 and KM-647

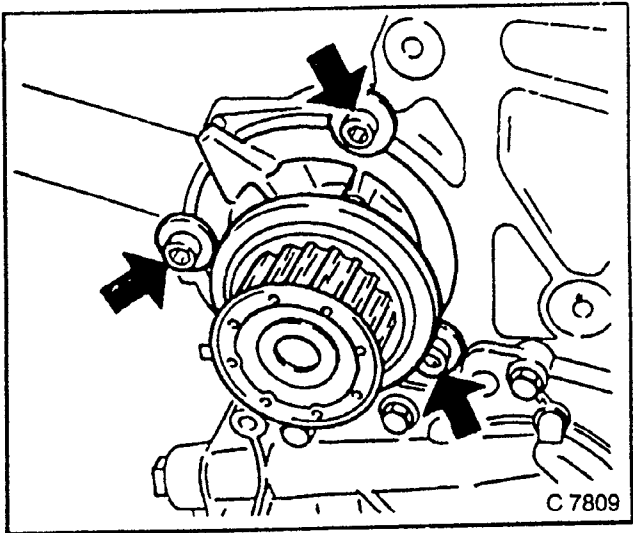


Fig. 536

REMOVE, DISCONNECT

- 1. Oil pan.
- 2. Oil intake pipe.
- 3. Oil intake pipe bracket.
- 4. Baffle plate.
- 5. Spacing ring from crankshaft journal.
- 6. Oil pump.

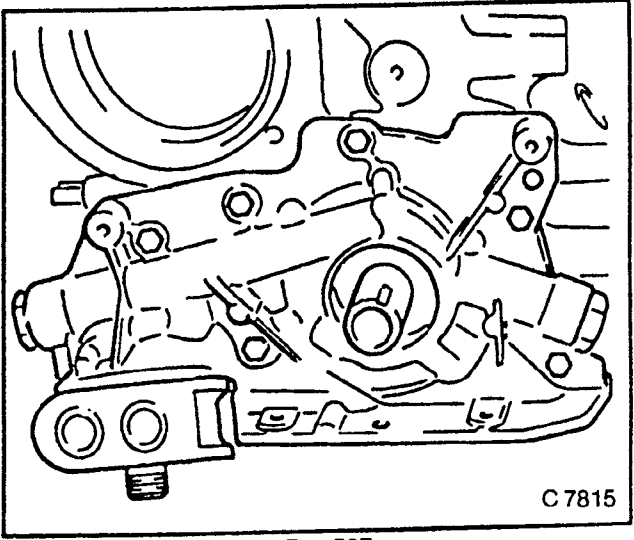


Fig. 537

REMOVE, DISCONNECT

- 1. Coolant hose from water inlet connection.
- 2. Coolant pipe.
- 3. Oil temperature switch.
- 4. Starter with support (arrows).
- 5. Knock sensor (A).

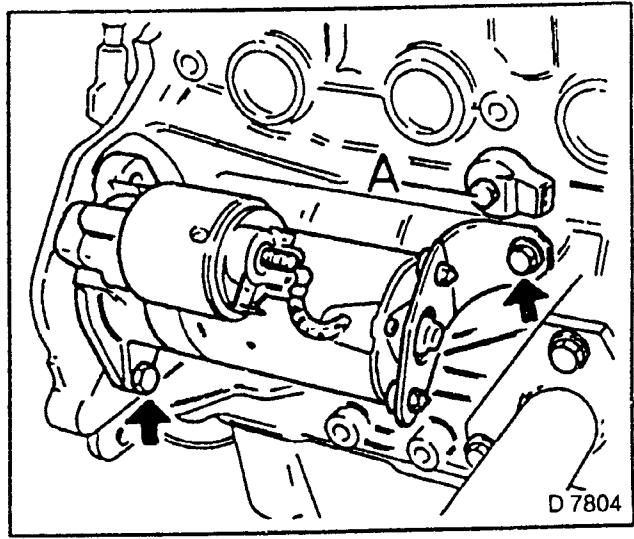


Fig. 538

REMOVE, DISCONNECT

- 1. Inductive pulse pick-up.
- 2. Engine vent flange.

CLEAN

INSPECT

All parts, replace if necessary.

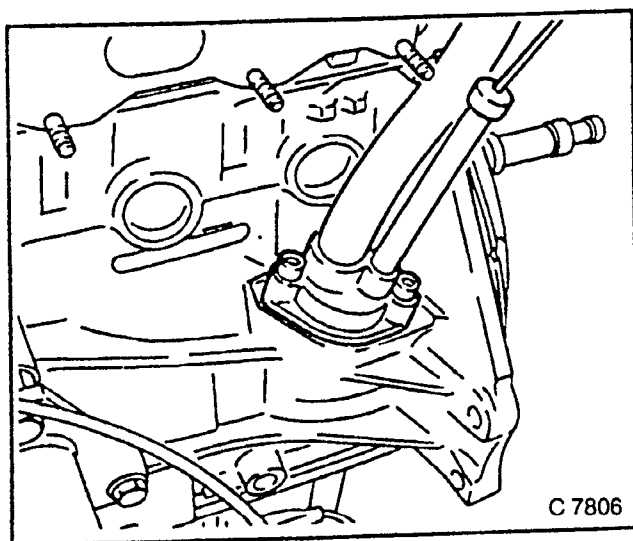


Fig. 539

New Short Block — Complete

INSTALL, CONNECT

- 1. Centering sleeve in cylinder head and clutch housing.

TIGHTEN (TORQUE)

- 1. Engine vent flange to cylinder block — 25 Nm.
- 2. Inductive pulse pick-up to cylinder block — 6 Nm. (Use new seal ring).
- 3. Starter to cylinder block — 45 Nm.
- 4. Knock sensor to cylinder block — 20 Nm.
- 5. Starter support to cylinder block — 25 Nm.
- 6. Oil temperature switch to cylinder block — 30 Nm. (Use new gasket).
- 7. Coolant pipe to cylinder block — 20 Nm.

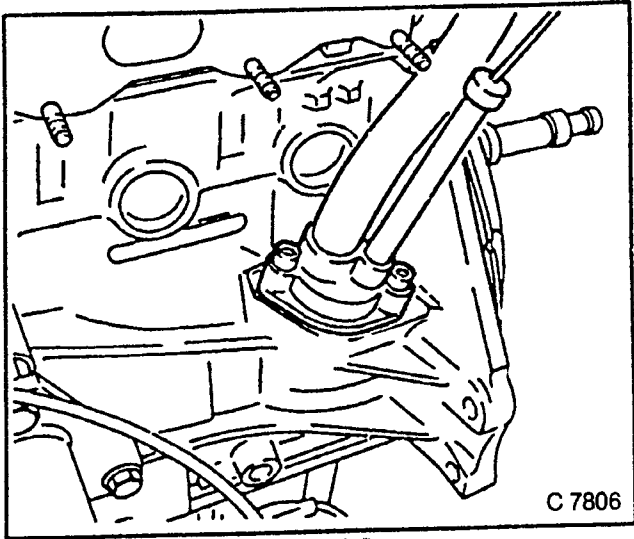


Fig. 540

INSTALL, CONNECT

- 1. Coolant hose to water inlet connection.
- 2. Oil pump with new gasket — 6 Nm.
- 3. Seal ring — KM-693, use Torx bolt (1) with washer (2) of toothed belt drive pinion.
- 4. Coat seal lips with protective grease.

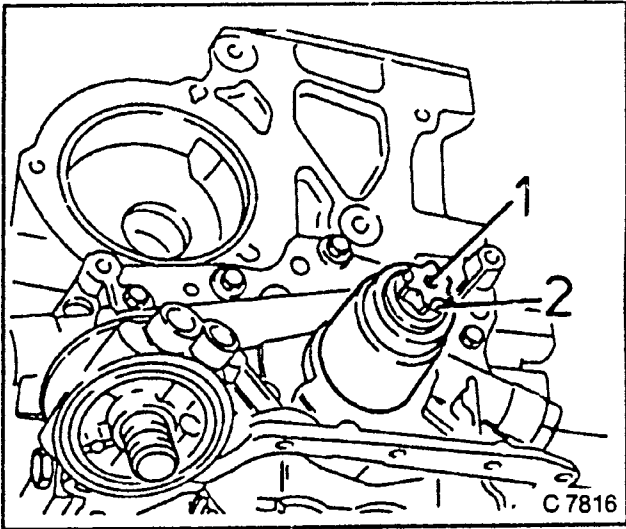


Fig 541

INSTALL, CONNECT

- 1. Coat fore part of spacing ring with Sealing Compound Locktite 515 flexible gasket or equivalent.
- 2. Toothed belt drive pinion — observe installation position.

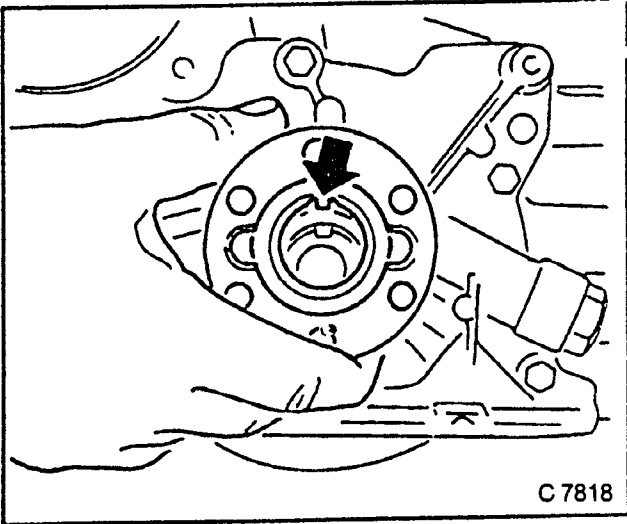


Fig. 542

3. Position piston of 1st cylinder to ignition TDC.
4. For this, attach MKM-604-21 (Torx Nut E 20) to fastening bolt of toothed belt drive pinion.
5. Coat joints of oil pump housing/cylinder block and bearing cover/cylinder block with Sealing Compound Locktite 242.

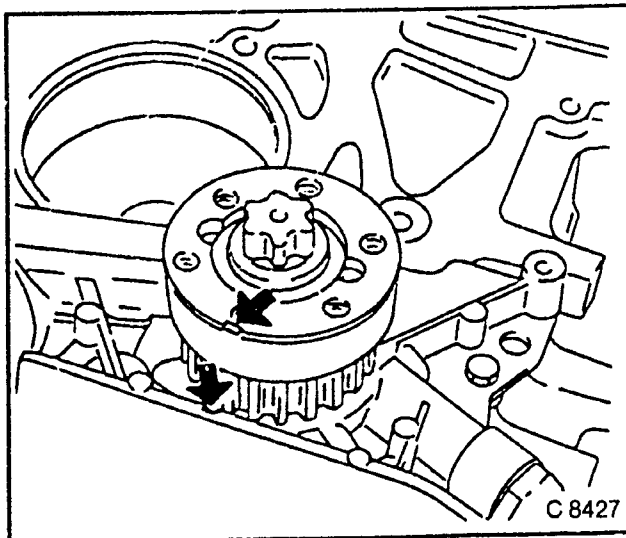


Fig. 543

TIGHTEN (TORQUE)

1. Install cork seal and baffle plate.
2. Oil intake pipe bracket to cylinder block — 6 Nm.
3. Oil intake pipe (use new seal ring) to oil pump — 8 Nm.
4. Install second cork seal.
5. Oil pan to cylinder block — 15 Nm.*
*Insert bolts with Locking Compound (Locktite 242).
Maximum installation time ten minutes.
6. When installing cork seals, check that all spacing rings are present.

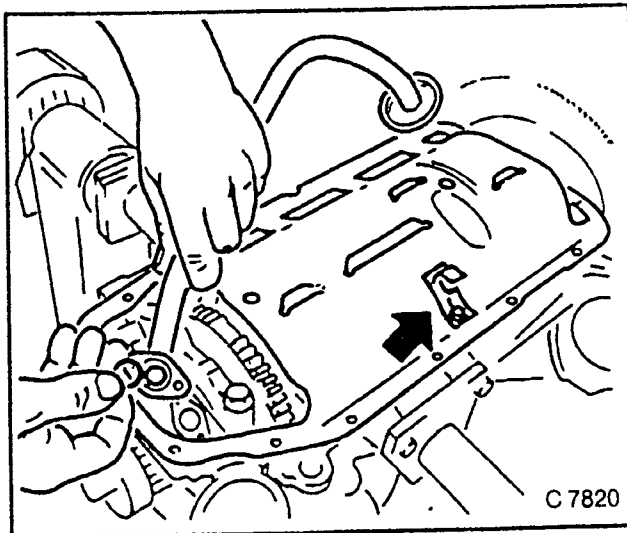


Fig. 544

TIGHTEN (TORQUE)

1. Water pump to cylinder block — 25 Nm.
2. Coat cylinder block sealing surface and water pump seal ring lightly with Silicon Grease B04 00571.
3. Pull rear cover onto toothed belt gear.

NOTE:

SPRUES OF WATER PUMP AND CYLINDER BLOCK MUST ALIGN.

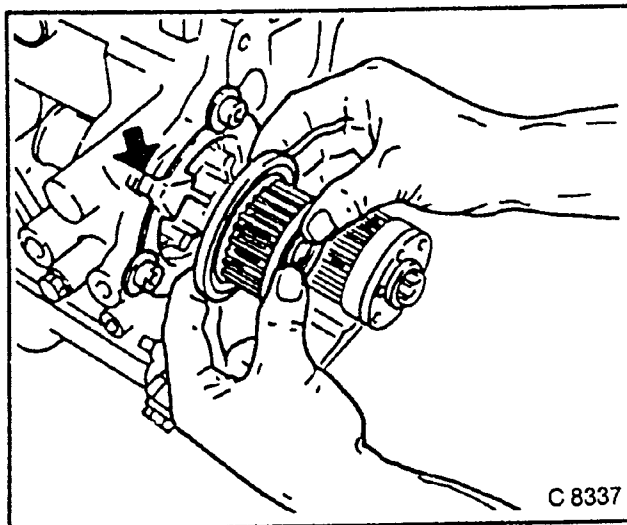


Fig. 545

INSTALL, CONNECT

1. New cylinder head gasket — mark "OBEN/TOP" upwards and towards timing side of engine.
2. Place cylinder head on cylinder block.
3. Steel washers, tighten cylinder head bolts with MKM-604-19 (Torx Nut E 14) to stop.

NOTE:

USE NEW CYLINDER HEAD BOLTS.

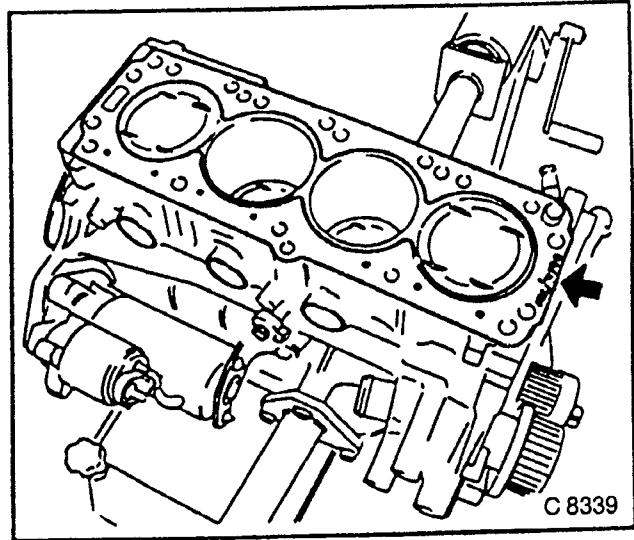


Fig. 546

TORQUE — ANGLE METHOD

1. Cylinder head to cylinder block — 25 Nm. + 65° + 65° + 65°.
2. Tighten in illustrated order — Torque Wrench KM-470-B.
3. After test run, turn a further 30° + 15°.

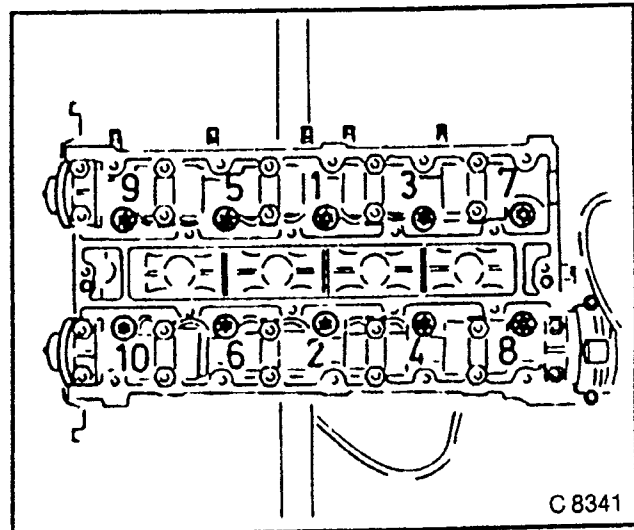


Fig. 547

TIGHTEN (TORQUE)

1. Rear toothed belt cover to engine block — 6 Nm.
2. Intake pipe cylinder block support to intake pipe — 25 Nm.

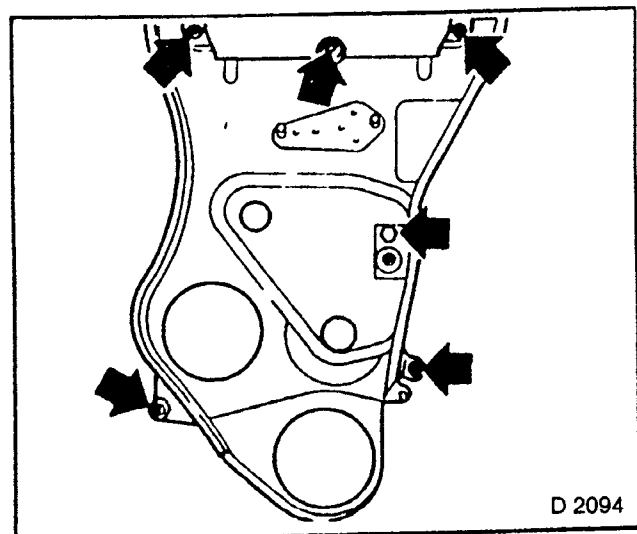


Fig. 548

TIGHTEN (TORQUE)

1. Guide roller (A) to cylinder block — 25 Nm.
2. Install tension roller (B) on cylinder block.

NOTE

INSTALL SPACING SLEEVE WITH SMALLER DIAMETER TO GUIDE ROLLER OR TENSION ROLLER CARRIER PLATE.

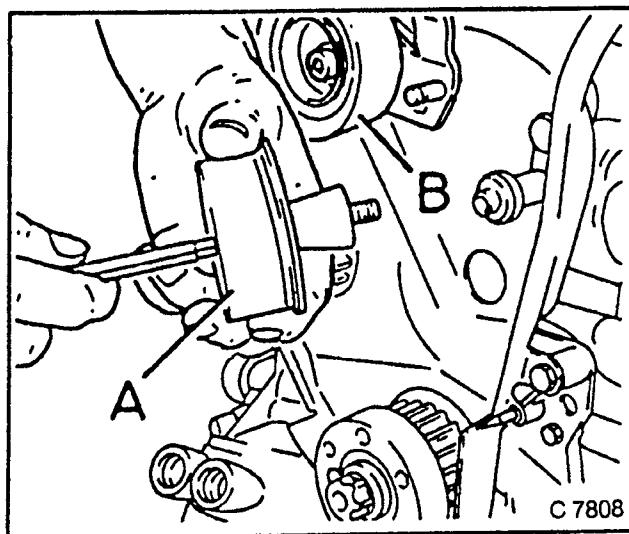


Fig. 549

INSTALL, CONNECT

1. Camshaft sprockets with timing markings towards front.
2. Turn pin (A) of camshaft to highest point, must engage in bore hole of camshaft sprocket when installed.

TORQUE — ANGLE METHOD

1. Camshaft sprocket to camshaft — 50 Nm + 60° + 15°. Use new bolt.
2. Counterhold with open-ended wrench on camshaft when installing.

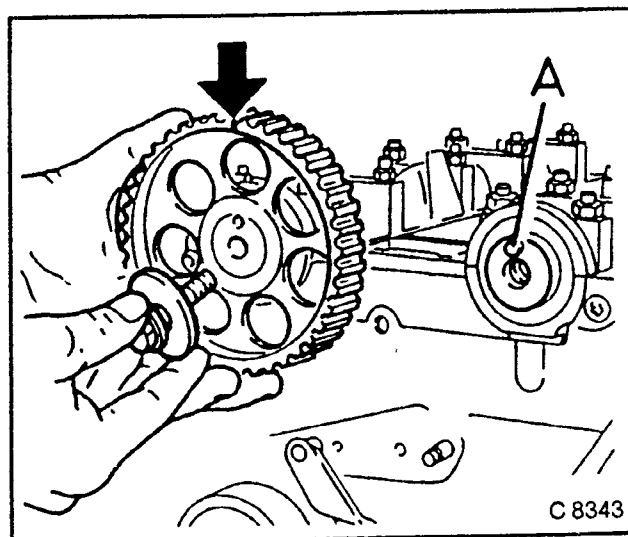


Fig. 550

INSTALL, CONNECT

1. Cylinder head cover with new gasket.
2. Crankcase vent hose connection to cylinder head cover.
3. Spark plug connection.
4. Ignition cable cover.

TIGHTEN (TORQUE)

1. Cylinder head cover to cylinder head — 8 Nm.
2. Ignition cable cover to cylinder head cover — 8 Nm.

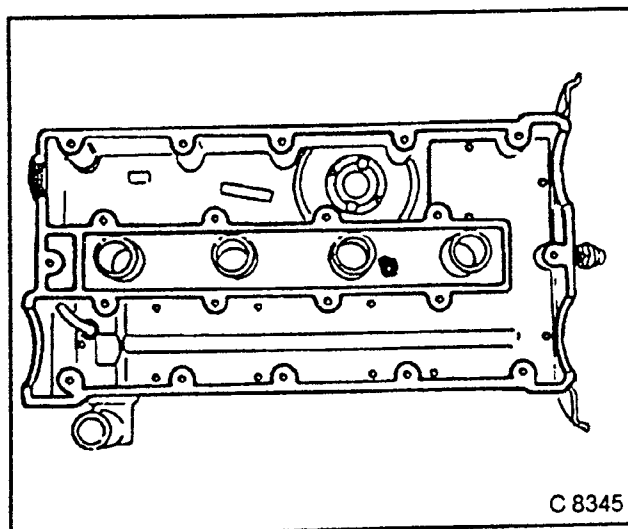


Fig. 551

INSTALL NEW TOOTHED BELT.**ADJUST**

1. Toothed belt tension.
See operation "Toothed Belt, Replace", page 184.
2. Top up engine oil to mark "MAX" on oil dipstick.

REMOVE, DISCONNECT

1. Engine from Mounting Trestle KM-412.
2. Adapter from engine.

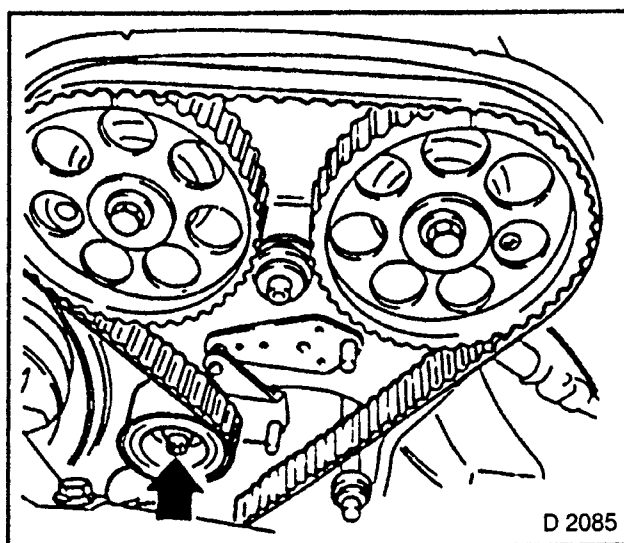


Fig. 552

NOTE:

1. Remove fastening bolt of toothed belt drive gear.
2. Install new fastening bolt after installation of engine.

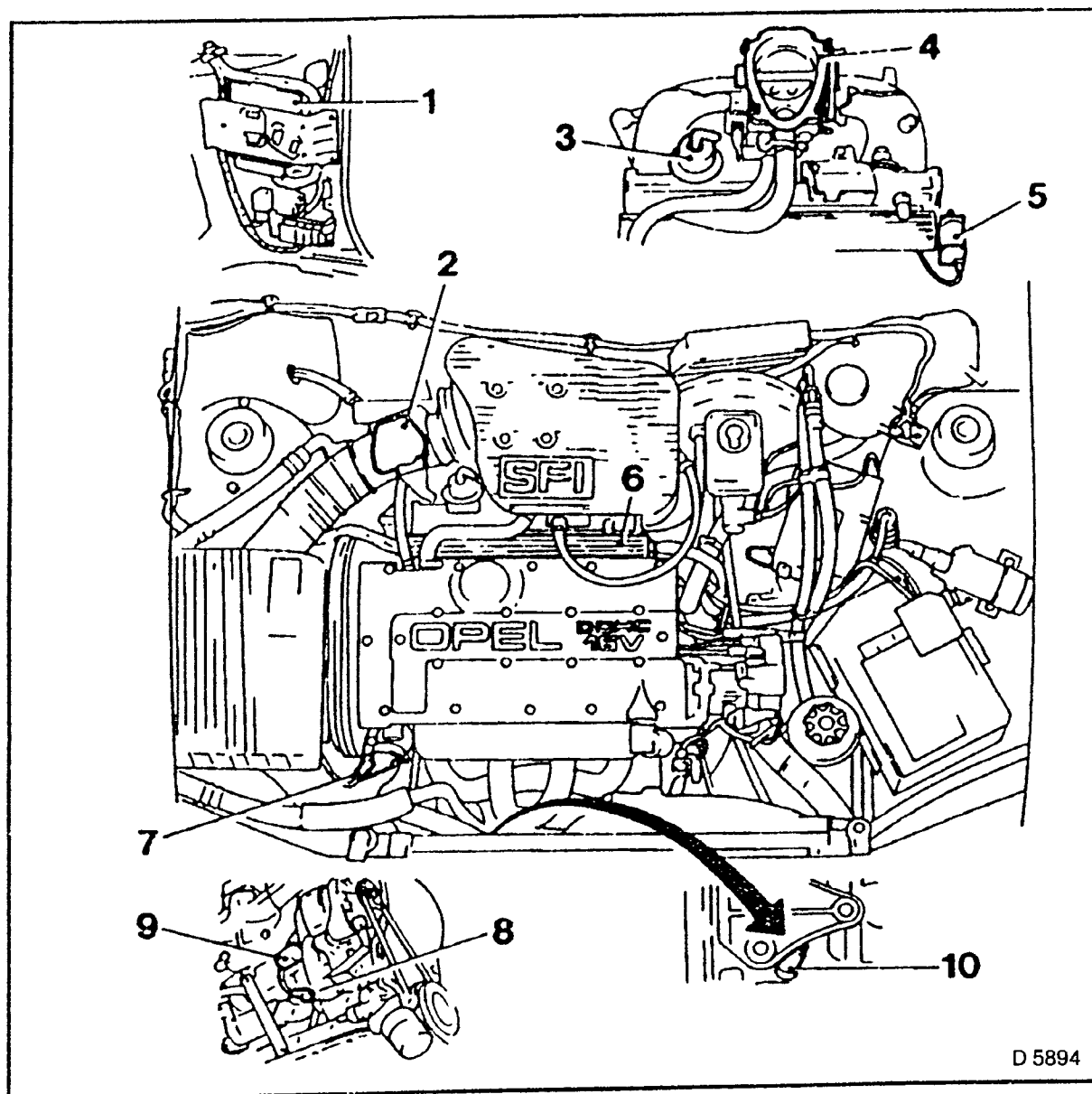


Fig. 553

Motronic M 1.5.4 (C 20 XE)

- 1 Control unit
(installation position in right footwell)
- 2 Hot wire mass air flow meter.
- 3 Fuel pressure regulator.
- 4 Throttle body.
- 5 Tank vent valve.
- 6 Injection valves plug strip.
- 7 Coolant temperature sensor.
- 8 Knock sensor.
- 9 Idle speed adjuster.
- 10 Inductive pulse pick-up.

Throttle Body — Remove and Install

REMOVE, DISCONNECT

1. Pre-volume chamber.
2. Fuel line bracket (1).
3. Throttle valve switch wiring harness plug (2).
4. Accelerator cable.
5. Crankcase vent hose (3).
6. Vacuum hose from fuel pressure regulator.

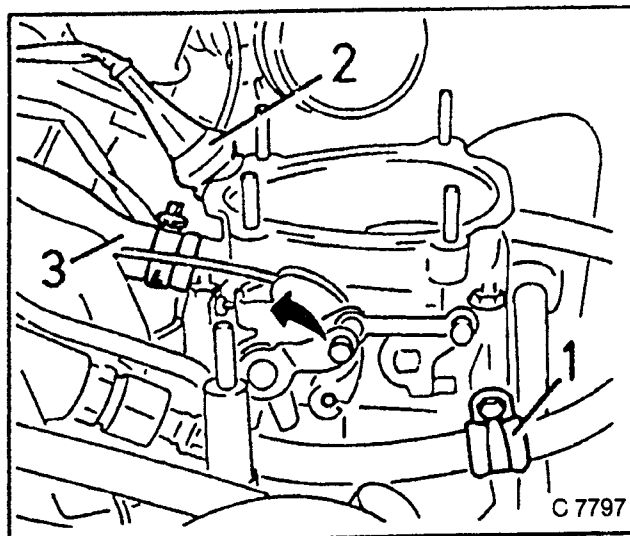


Fig. 554

REMOVE, DISCONNECT

1. Throttle body.
2. Throttle valve switch.

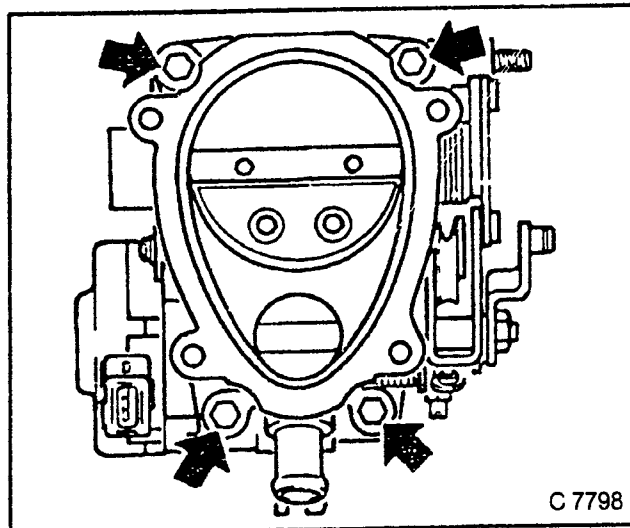


Fig. 555

INSTALL, CONNECT

1. Throttle valve switch.
2. Throttle body — tightening torque 9 Nm.
3. Fuel pressure regulator vacuum hose.
4. Crankcase vent hose (3).
5. Accelerator cable.
6. Throttle valve switch wiring harness plug (2).
7. Fuel line bracket (1).
8. Pre-volume chamber.

WARNING:

IF THERE IS A DEFECT ON THE THROTTLE VALVE LINKAGE THE COMPLETE THROTTLE BODY TOGETHER WITH LINKAGE MUST BE REPLACED. A CORRECT ADJUSTMENT WITH WORKSHOP TOOLS IS NOT POSSIBLE.

ADJUST

Throttle valve switch.

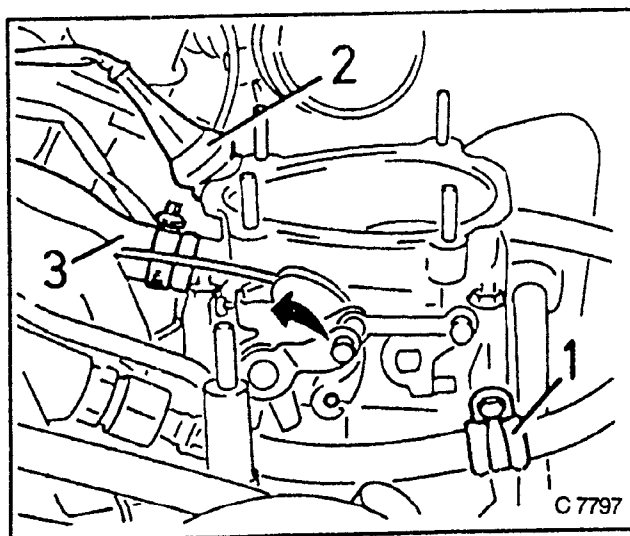


Fig. 556

Throttle Valve Switch — Remove and Install

REMOVE, DISCONNECT

1. Pre-volume chamber.
2. Hot wire mass air flow meter.
3. If necessary, throttle body.
4. Wiring harness plug (1).
5. Throttle valve switch (2).

INSTALL, CONNECT

1. Adjust throttle valve switch.
2. Wiring harness plug.
3. Throttle body.
4. Hot wire mass air flow meter.
5. Pre-volume chamber.

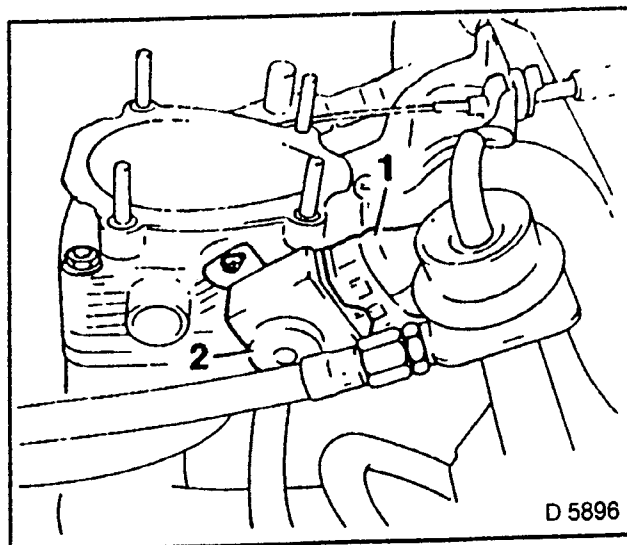


Fig. 557

Throttle Valve Switch — Adjust

REMOVE, DISCONNECT

1. Pre-volume chamber.
2. Hot wire mass air flow meter.
3. If necessary throttle body.

ADJUST

1. Loosen bolts.
2. Turn switch anti-clockwise until resistance is noticeable.
3. Tighten throttle valve switch in this position. If the throttle valve is opened wide, there must be a noticeable click, which is repeated when closing.

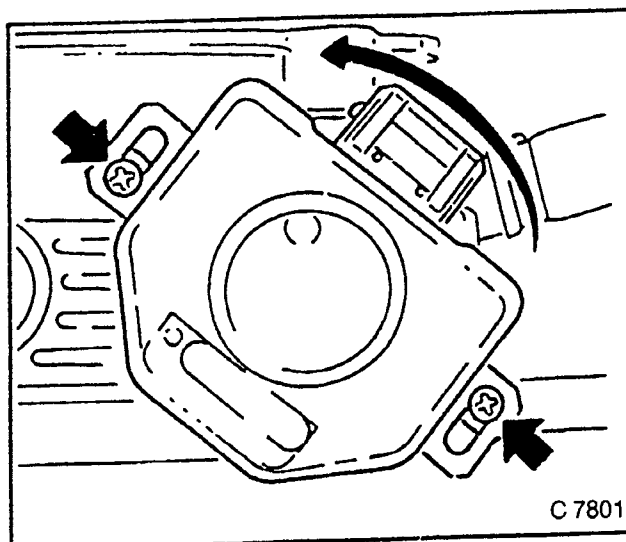


Fig. 558

INSTALL, CONNECT

1. Throttle body.
2. Hot wire mass air flow meter.
3. Pre-volume chamber.

Injection Valves — Remove and Install

REMOVE, DISCONNECT

1. Pre-volume chamber.
2. Bowden cable (1).

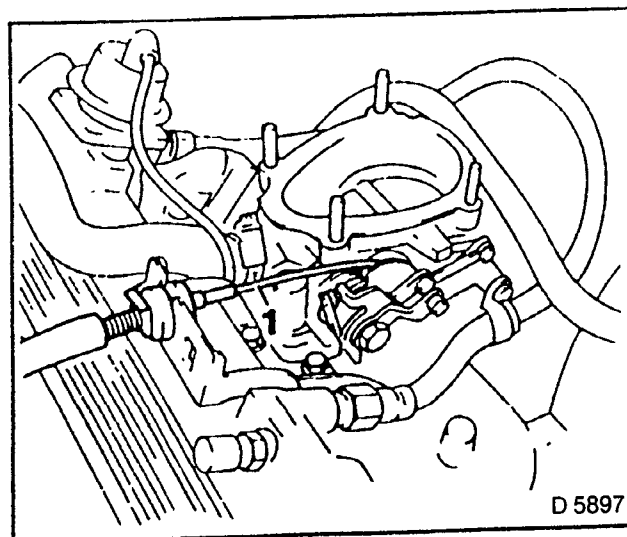


Fig. 559

REMOVE, DISCONNECT

- 1. Crankcase vent hoses (1), (2).
- 2. Fuel pressure regulator vacuum hose (3).
- 3. Wiring harness plug — hot wire mass air flow meter (4).
- 4. Throttle valve switch wiring harness plug (5).

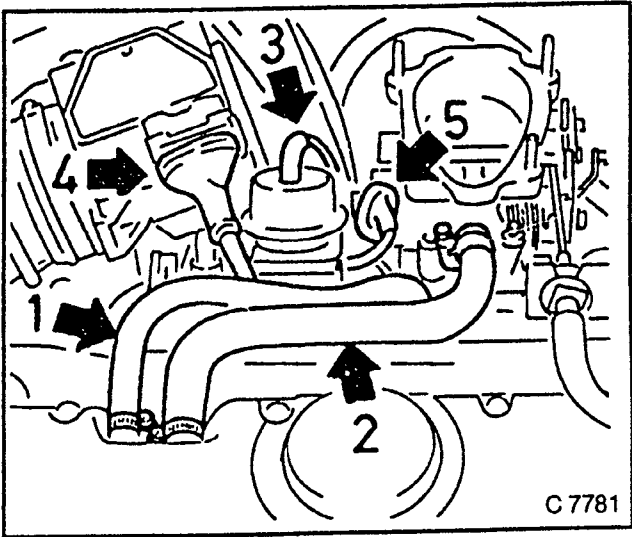


Fig. 560

REMOVE, DISCONNECT

- 1. Bowden cable bracket.

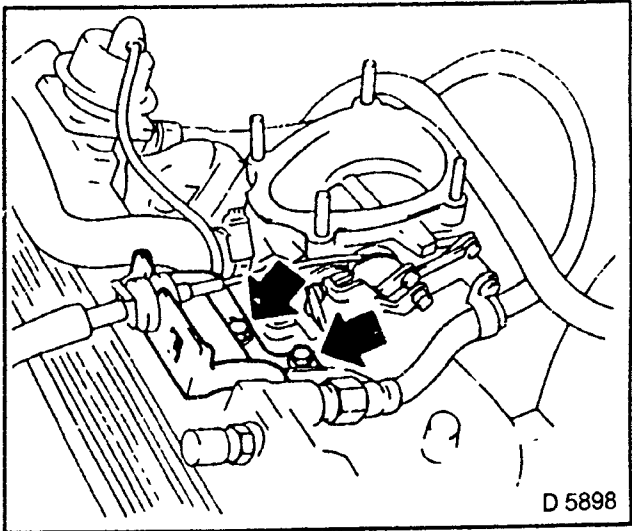


Fig 561

REMOVE, DISCONNECT

- 1. Injection valves plug strip.
- 2. Retaining clamp from 1st cylinder injection valve from plug strip.
- 3. Remove plug strip.
- 4. Insert retaining clamp in plug strip.

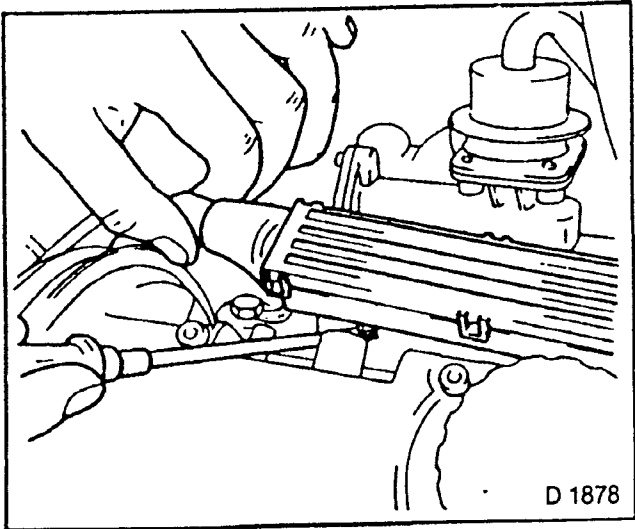


Fig 562

REMOVE, DISCONNECT

- 1. Ground cables (1) and (2).
- 2. Fuel distributor pipe with injection valves.

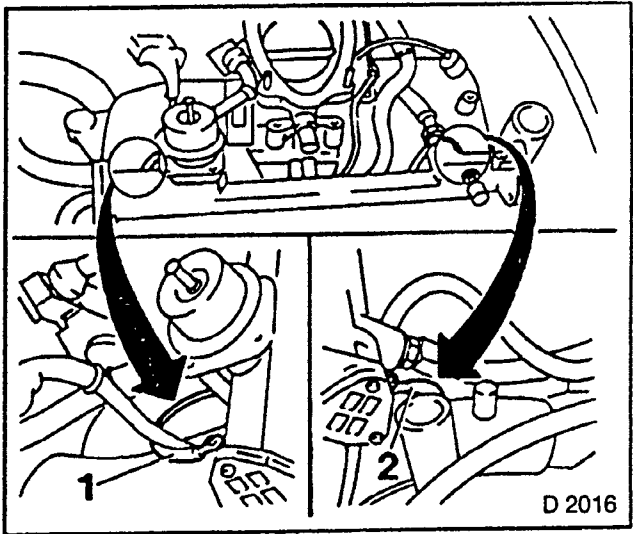


Fig. 563

REMOVE, DISCONNECT

- 1. Spring clip.
- 2. Injection valve from fuel distributor pipe.

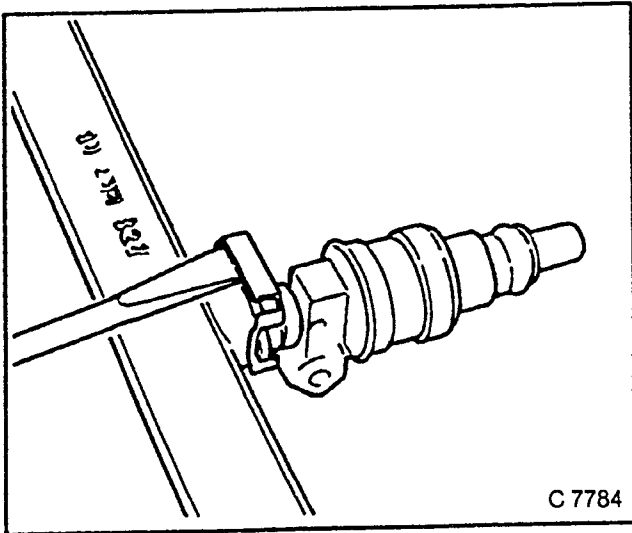


Fig. 564

NOTE:
USE NEW SEAL RINGS
NOTE CORRECT POSITION OF
HOSES AND CABLES.

INSTALL, CONNECT

- 1. Injection valve to fuel distribution pipe — spring clip.
- 2. Fuel distributor pipe with injection valves — nuts — ground cable — nuts.
- 3. Injection valves plug strip.
- 4. Accelerator cable bracket — tightening torque 8 Nm.

INSTALL, CONNECT

- 1. Throttle valve switch wiring harness plug.
- 2. Hot wire mass air flow meter wiring harness plug.
- 3. Fuel pressure regulator vacuum hose.
- 4. Crankcase vent hoses.
- 5. Pre-volume chamber.

ADJUST

Bowden cable.

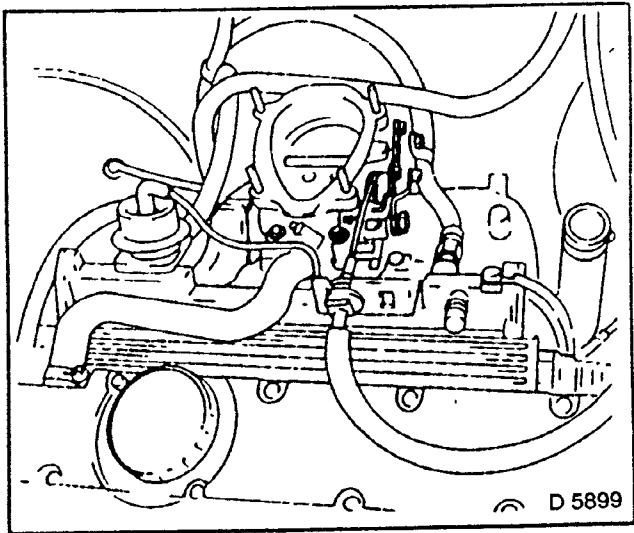


Fig. 565

Hot Wire Mass Air Flow Meter — Remove and Install

REMOVE, DISCONNECT

- 1. Wiring harness plug.
- 2. Hose clamps (1).
- 3. Hot wire mass air flow meter.

INSTALL, CONNECT

- 1. Hot wire mass air flow meter.
- 2. Hose clamps.
- 3. Wiring harness plug.

NOTE:

ENSURE THAT HOSES AND HOSE CLAMPS ARE IN GOOD CONDITION AND CORRECTLY SEATED.

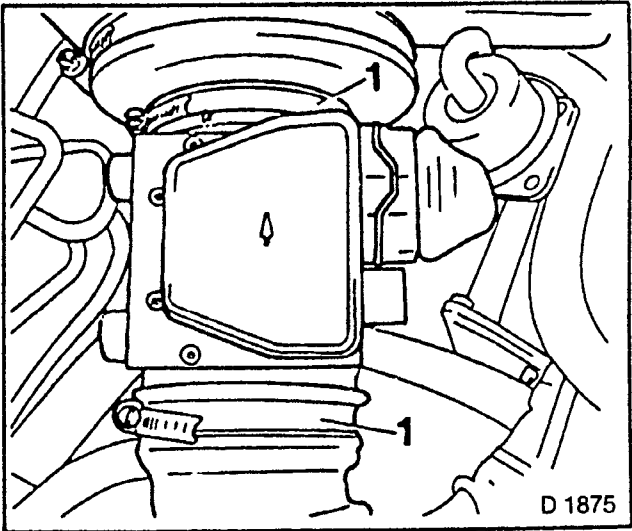


Fig. 566

High Voltage Distributor — Remove and Install (2,0 ltr. with Motronic ML 4.1. M 1.5)

REMOVE, DISCONNECT

High voltage distributor cap — MKM-604-B.

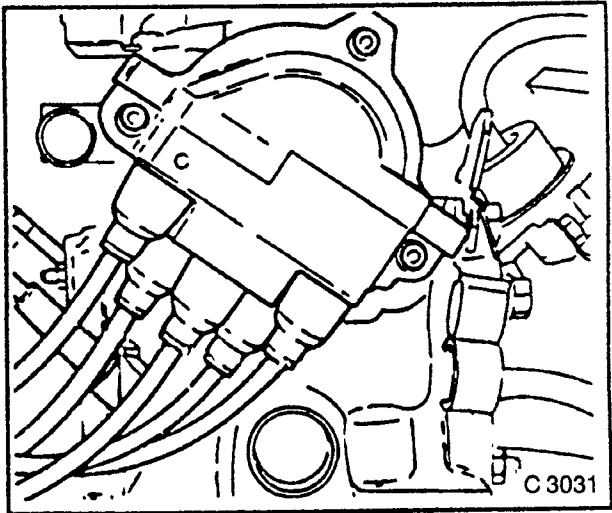


Fig. 567

REMOVE, DISCONNECT

- 1. Condensation barrier.
- 2. High voltage distributor armature.

INSTALL, CONNECT

- 1. High voltage distributor armature.
- 2. Condensation barrier.
- 3. High voltage distributor cap.
- 4. Insert bolts with Locking Compound (Loctite 242).

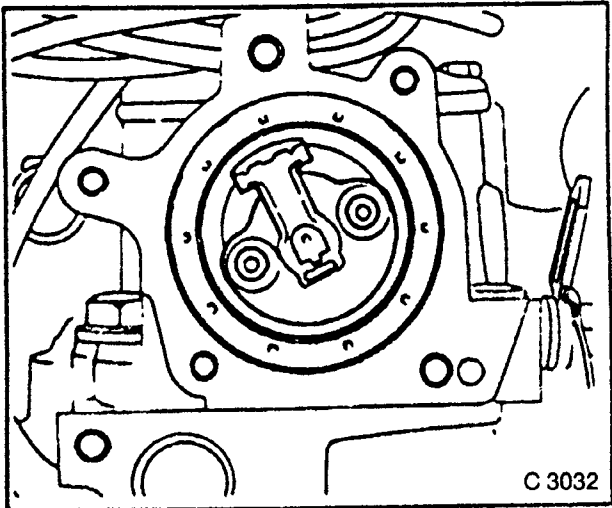


Fig. 568

Inductive Pulse Pick-up — Remove and Install

REMOVE, DISCONNECT

1. Disconnect wiring harness plug for inductive pulse pick-up — note cable routing.

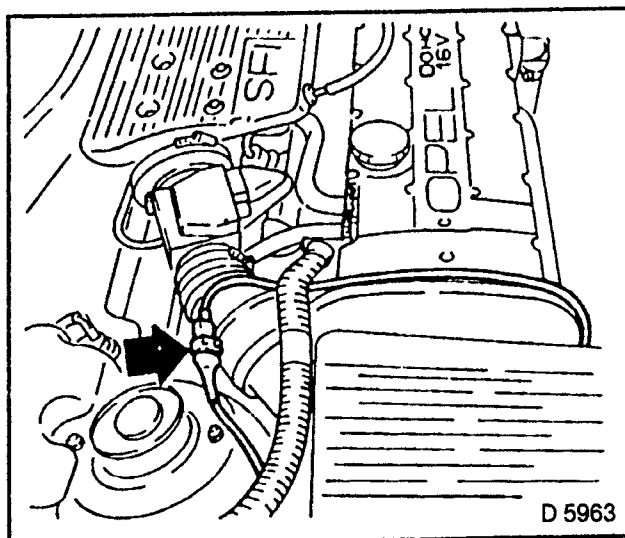


Fig. 569

REMOVE, DISCONNECT

1. Inductive pulse pick-up.
2. Seal ring.

INSTALL, CONNECT

1. Inductive pulse pick-up with new seal ring — torque 6 Nm.
2. Connect wiring harness plug for inductive pulse pick-up.
3. Note correct wiring installation.

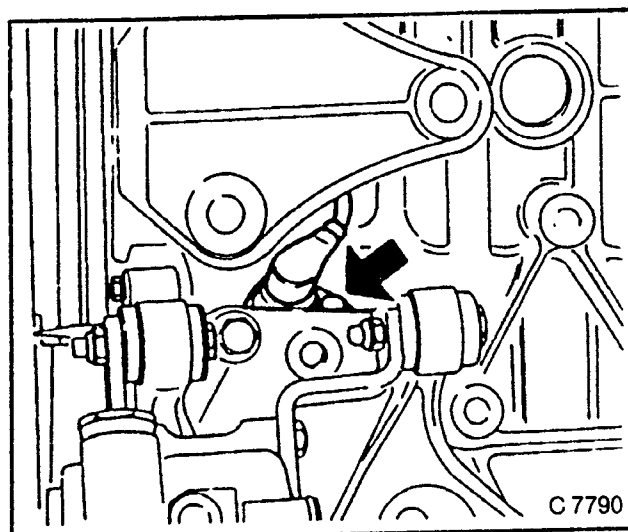


Fig. 570

Knock Sensor — Remove and Install

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Wiring harness plug for knock sensor.
3. Knock sensor.

CLEAN

Contact surfaces on knock sensor — engine block.

TIGHTEN (TORQUE)

1. Knock sensor to engine block — 20 Nm. Observe extreme cleanliness.
2. Wiring harness plug for knock sensor.
3. Ground cable to battery.

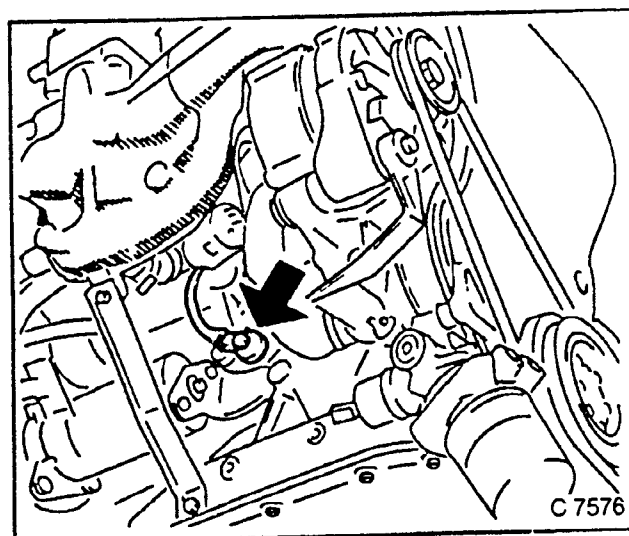


Fig. 571

Ignition Coding Plug

WARNING

Do not change ignition coding plug.

The coding plug adapts the ignition characteristic curve to the regulations of the various countries (noise, exhaust gas).

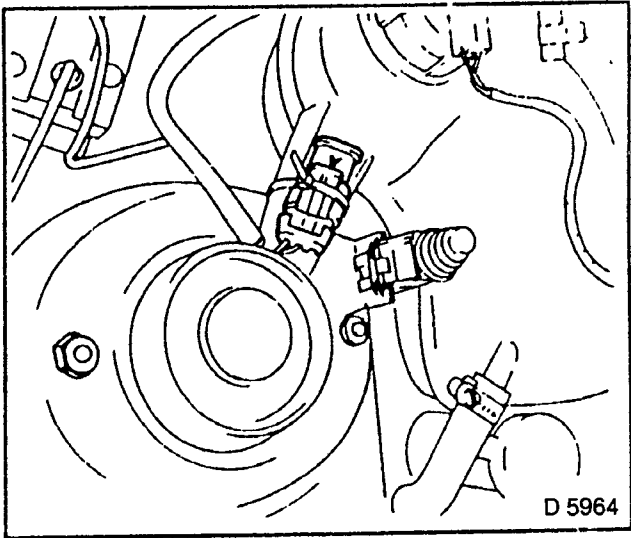


Fig. 572

Fuel Pressure Regulator — Remove and Install

CAUTION:

FUEL ESCAPES
OBSERVE SAFETY MEASURES AND
NATIONAL REGULATIONS.

REMOVE, DISCONNECT

1. Pre-volume chamber.
2. Hot wire mass air flow meter wiring harness plug.
3. Throttle valve switch.
4. Wiring harness plug.
5. Fuel pressure regulator vacuum hose.
6. Fuel pressure regulator

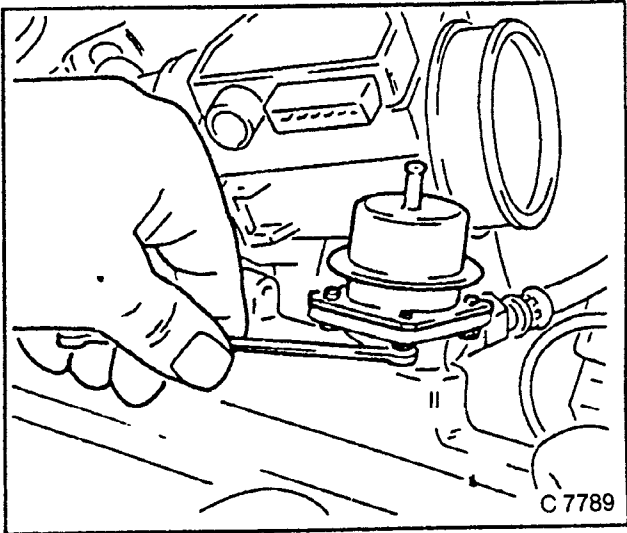


Fig. 573

INSTALL, CONNECT

1. Fuel pressure regulator with new seal rings — tightening torque 4 Nm.
2. Fuel pressure regulator vacuum hose.
3. Throttle valve switch wiring harness plug.
4. Hot wire mass air flow meter wiring harness plug.
5. Pre-volume chamber.

Fuel Pressure — Check

REMOVE, DISCONNECT

1. Open closure bolt (1) slowly — pressure reduction.
2. Fuel pressure regulator vacuum hose connected to intake manifold.

INSPECT

1. Fuel pressure gauge KM-J-34740-91 to checking connection.
2. Bleed fuel pressure gauge.
3. Start engine — idle speed.
4. Fuel pressure — prescribed value: 3 bar/43,5 psi.

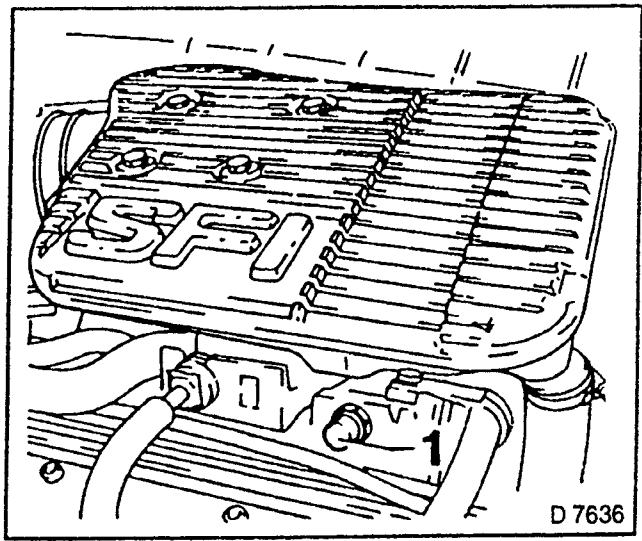


Fig. 574

Idle Speed Adjuster — Remove and Install

NOTE:

MARK INSTALLATION POSITION OF HOSES.

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Hose (1) from pre-volume chamber.

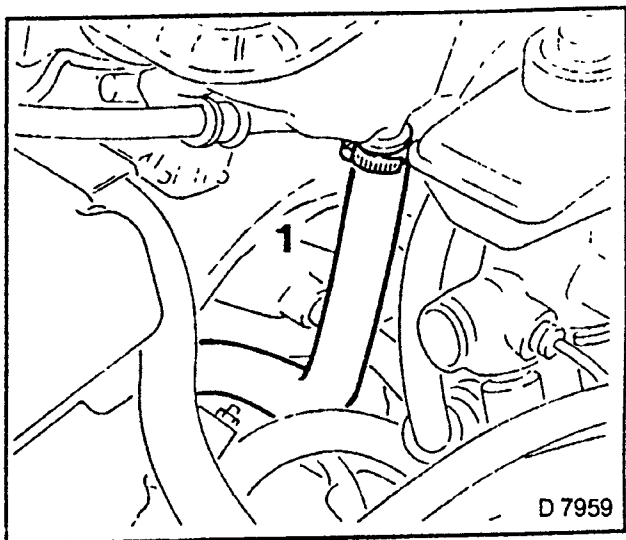


Fig. 575

REMOVE, DISCONNECT

1. Engine compartment cover.
2. Idle speed adjuster wiring harness plug.
3. Idle speed adjuster with hoses.
4. Hoses from idle speed adjuster.

INSTALL, CONNECT

1. Hoses to idle speed adjuster.
2. Idle speed adjuster with hoses.
3. Hose (Fig. 575-1) to pre-volume chamber.
4. Idle speed adjuster wiring harness plug.
5. Ground cable to battery.
6. Ensure that hoses and hose clamps are in good condition and correctly seated.

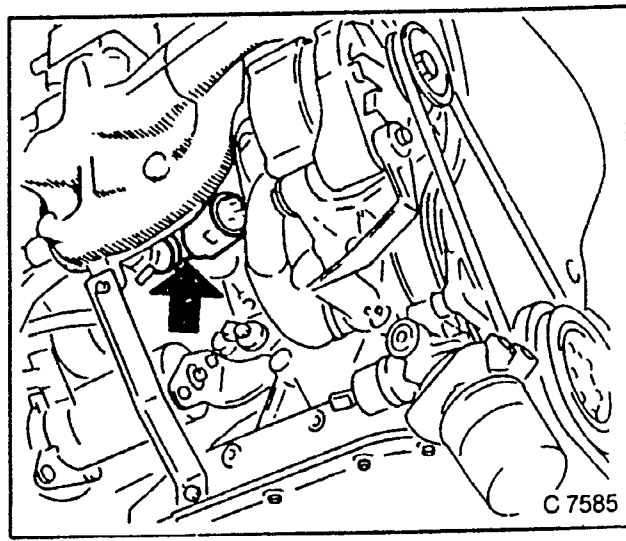


Fig. 576

Control Unit — Remove and Install

REMOVE, DISCONNECT

- 1. Switch off ignition.
- 2. Storage compartment.
- 3. Front right footwell panelling.
- 4. Control unit.
- 5. Wiring plug.

INSTALL, CONNECT

- 1. Wiring plug.
- 2. Control unit.
- 3. Front right footwell panelling.
- 4. Storage compartment.

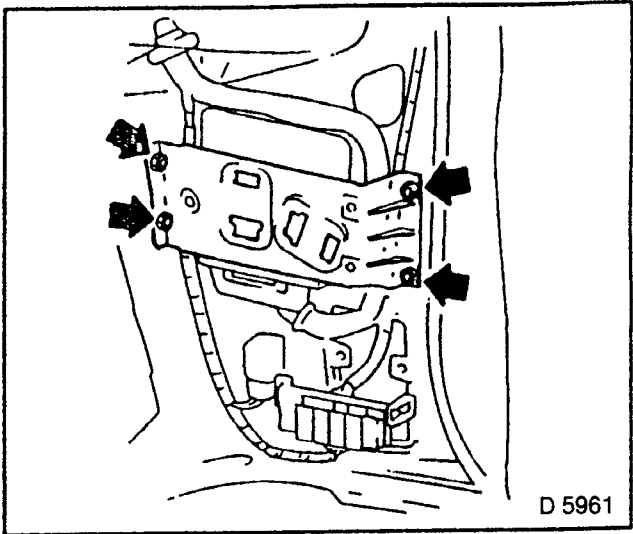


Fig. 577

Coolant Temperature Sensor — Remove and Install

CAUTION

COOLANT ESCAPES
PLACE COLLECTING BASIN
UNDERNEATH.

REMOVE, DISCONNECT

- 1. Wiring harness plug for coolant temperature sensor.
- 2. Coolant temperature sensor with seal ring.

TIGHTEN (TORQUE)

- 1. Coolant temperature sensor to thermostat housing — 11 Nm.
- 2. Use new seal ring.
- 3. Wiring harness plug for coolant temperature sensor.

NOTE:

FILL UP AND BLEED COOLING
SYSTEM.

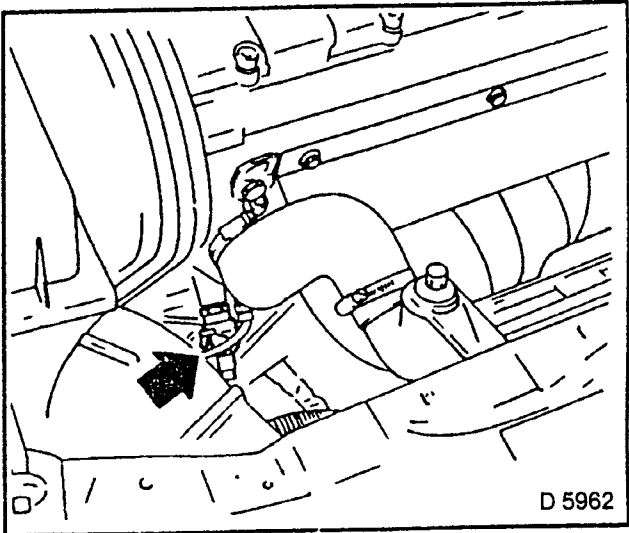


Fig. 578

Pre-volume Chamber — Remove and Install

REMOVE, DISCONNECT

1. Hose (1).
2. Hose clip (2).
3. Bolts (3).
4. Pre-volume chamber — note seal ring.

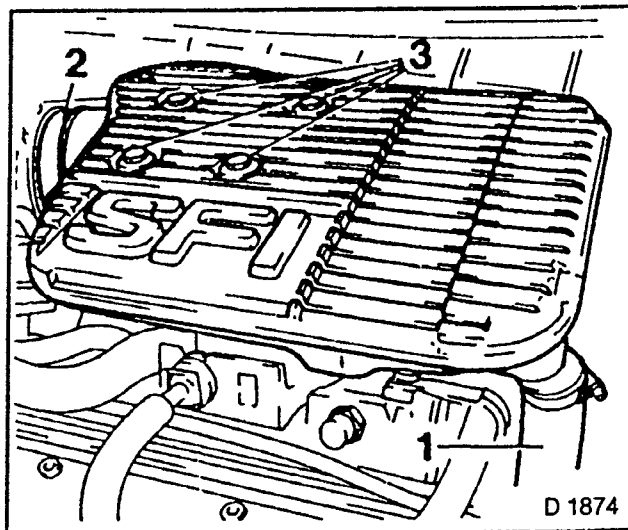


Fig. 579

NOTE:

1. Before inserting the seal ring, coat four to six fixing points in the gasket guide of the pre-volume chamber with Cement, Catalogue No. 15 04 851 (09 293 725).
2. Note correct seating of seal ring.
3. Repeat fixing each time the pre-volume chamber is removed.

INSTALL, CONNECT

1. Pre-volume chamber.
2. Hose clip Fig. 579-2.
3. Bolts Fig. 579-3.
4. Hose Fig. 579-1.

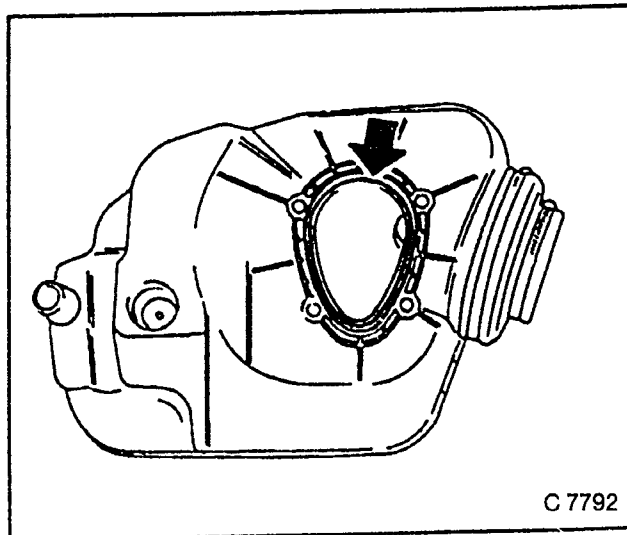


Fig. 580

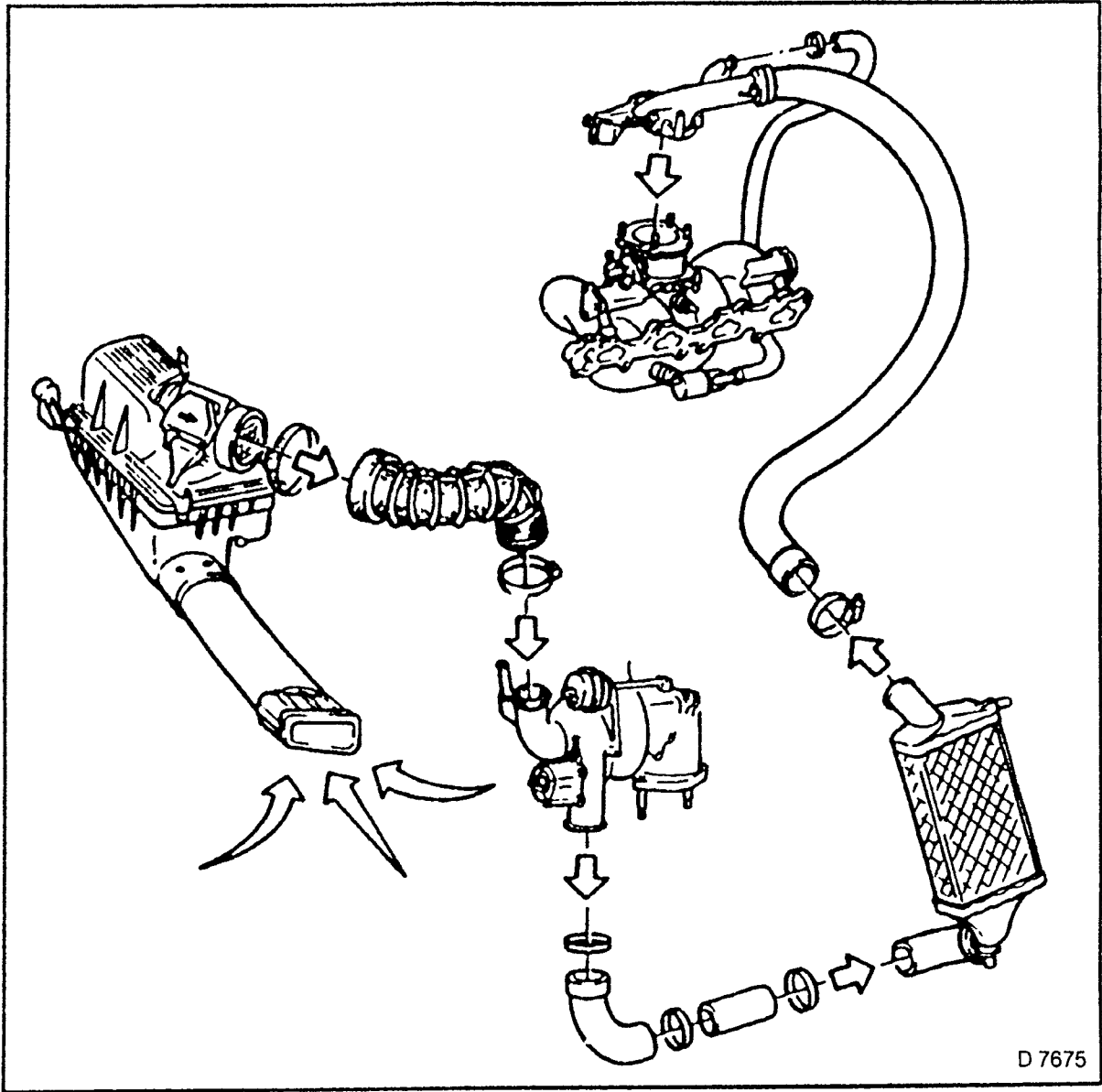
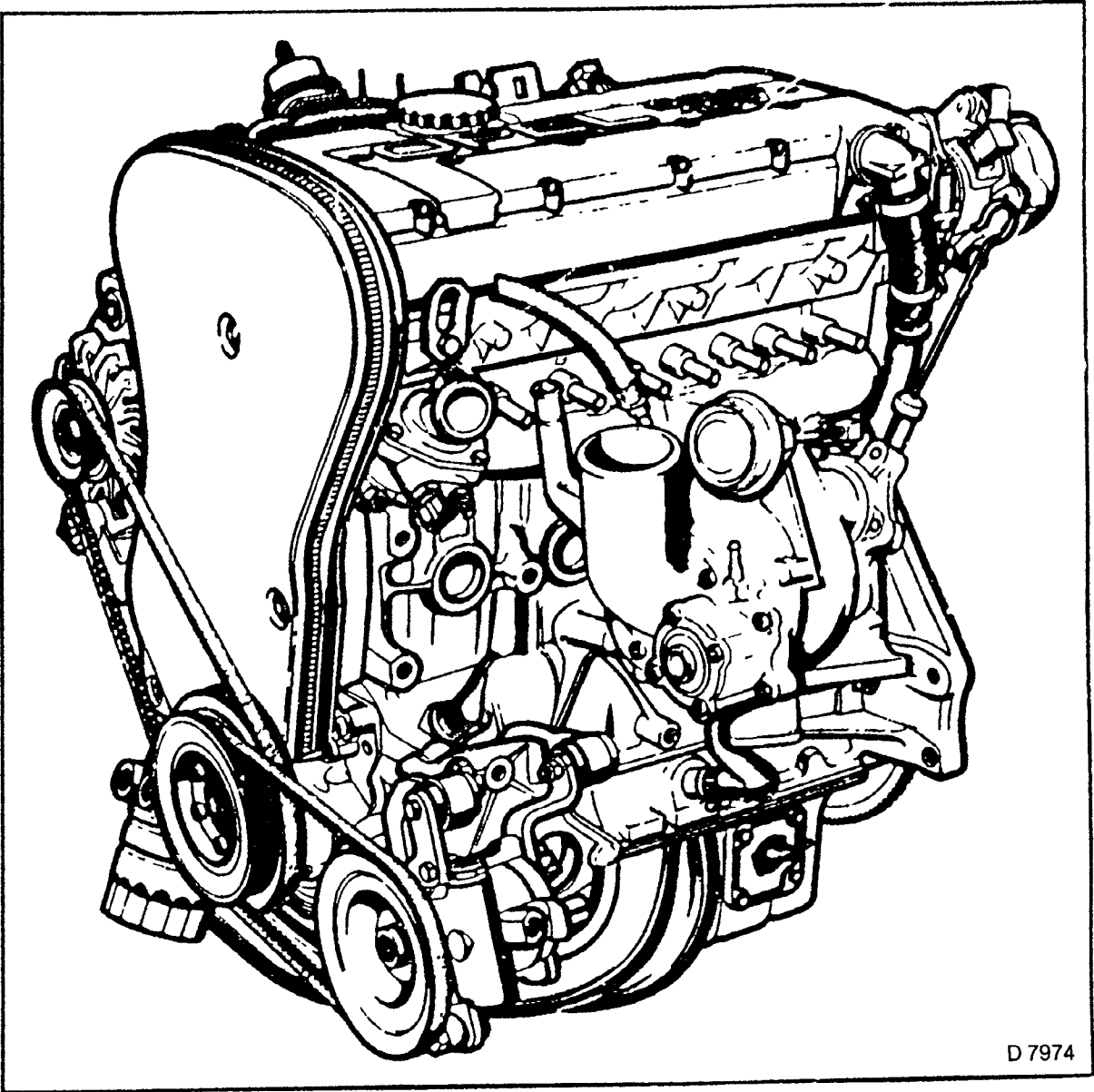


Fig. 581 — Air Feed

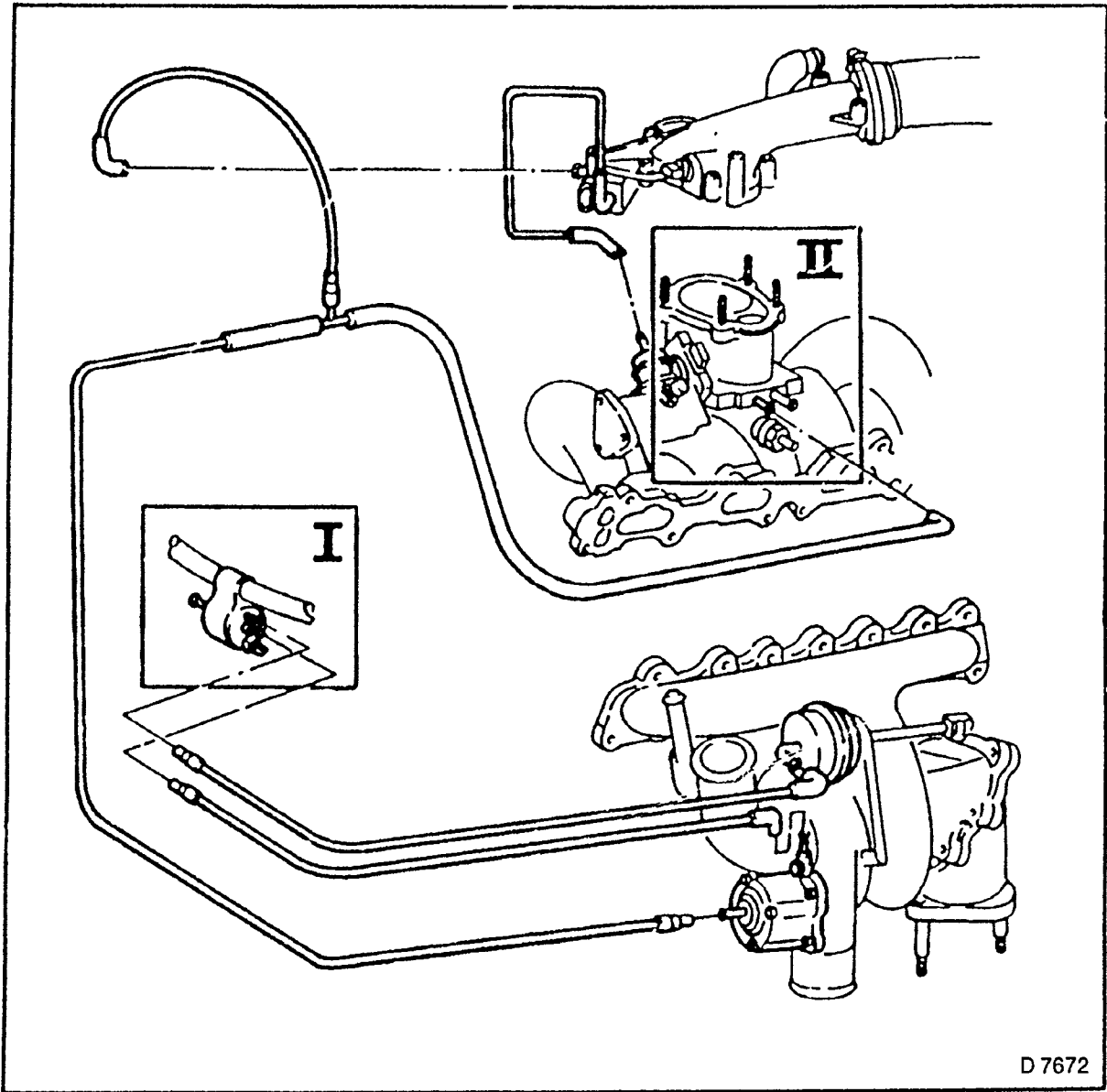
**Turbocharging System
(C 20 LET)**



D 7974

Fig 582

Engine exhaust side — 2,0 LET



D 7672

Fig. 583

Overall survey of pressure
and vacuum hoses.

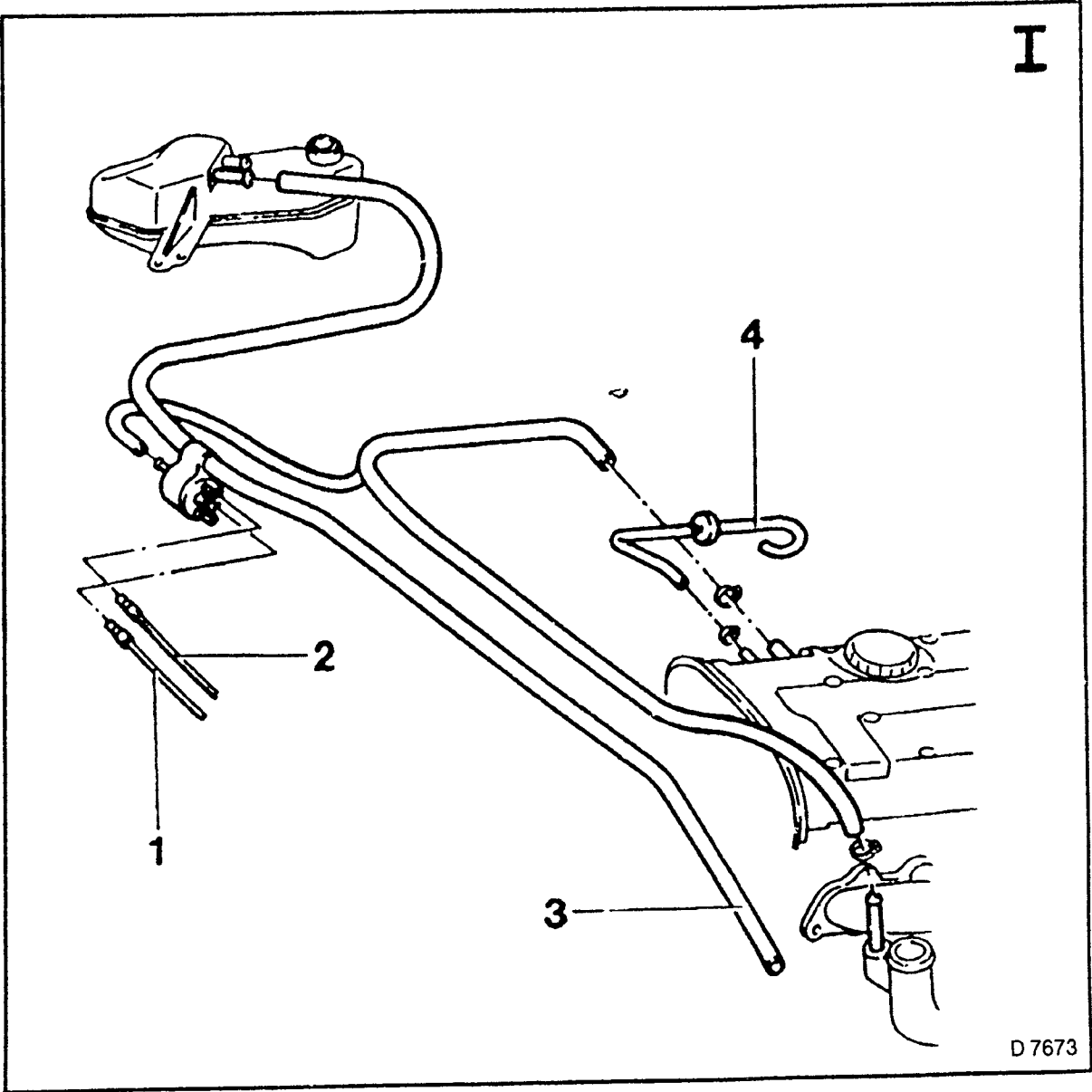


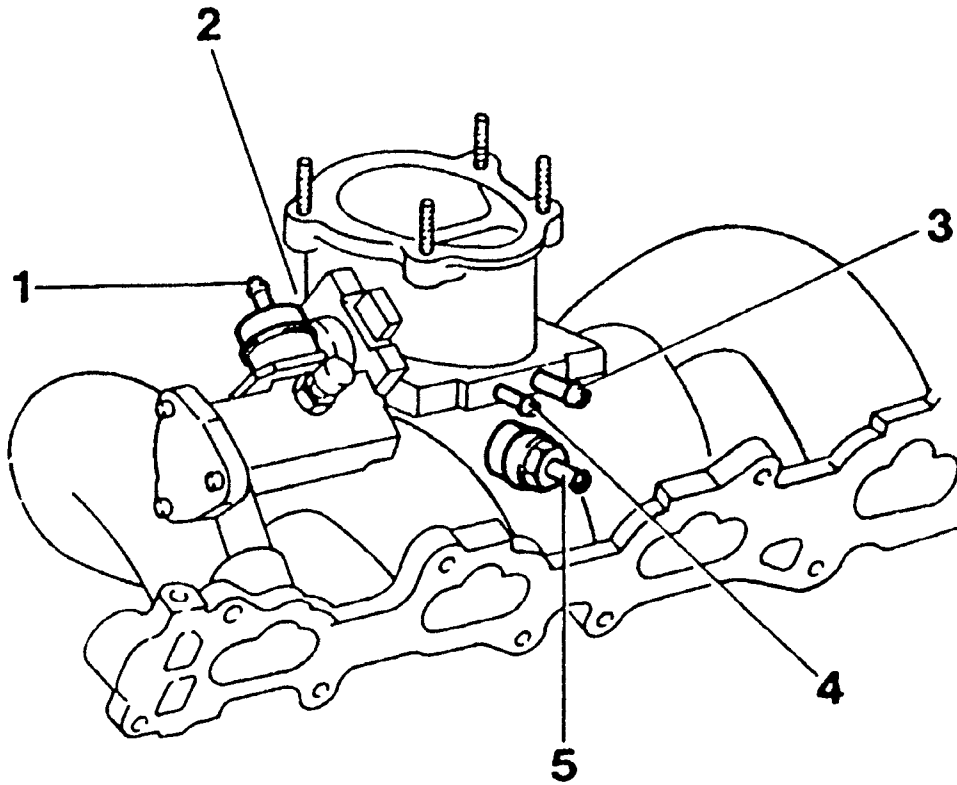
Fig 584

Survey of pressure/vacuum hoses

ILLUSTRATION 1

- 1. Connection to air bypass valve.
- 2. Connection to control unit — charge pressure regulating valve.
- 3. Turbocharger — coolant return line.
- 4. Connection to crankcase ventilation.

See local graphics!

II

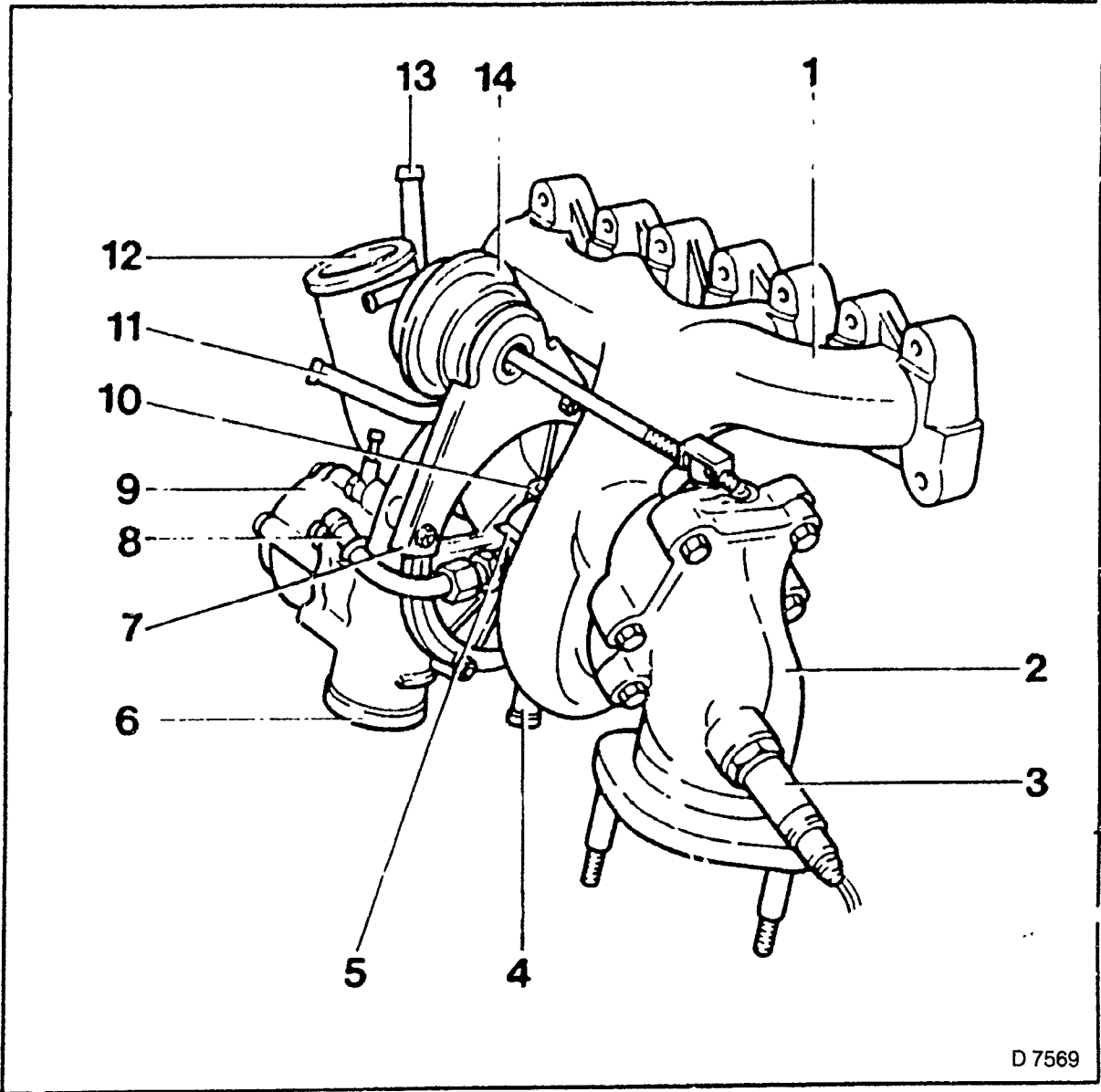
D 7674

Fig. 585

Survey of pressure/vacuum hoses.

ILLUSTRATION 2

1. Connection to hot start valve.
2. Connection to control unit.
3. Connection to tank vent valve.
4. Connection to air bypass valve/hot start valve.
5. Connection to crankcase ventilation.



D 7569

Fig. 586

Survey — Turbocharger Attaching Parts.

ILLUSTRATION 1

- 1. Exhaust manifold with integrated turbine casing.
- 2. Exhaust adapter
- 3. Oxygen sensor.
- 4. Oil return.
- 5. Bearing housing.
- 6. Pressure side of compressor housing.
- 7. Compressor housing.
- 8. Coolant feed from radiator.
- 9. Air bypass valve.
- 10. Oil feed.
- 11. Coolant return to compensation tank.
- 12. Intake side of compressor housing.
- 13. Connection for engine ventilation.
- 14. Control unit with actuating rod for charge pressure control rod.

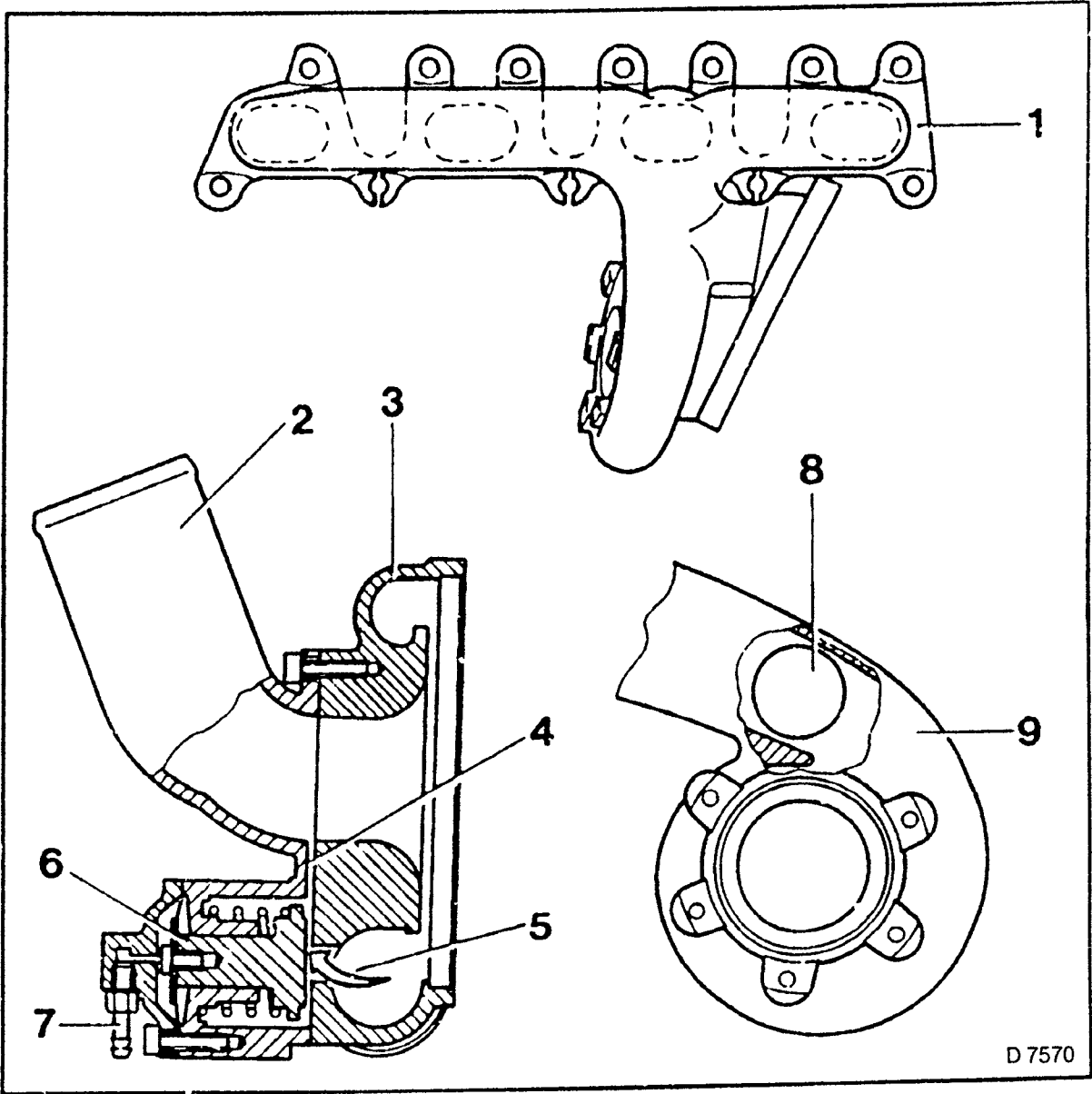
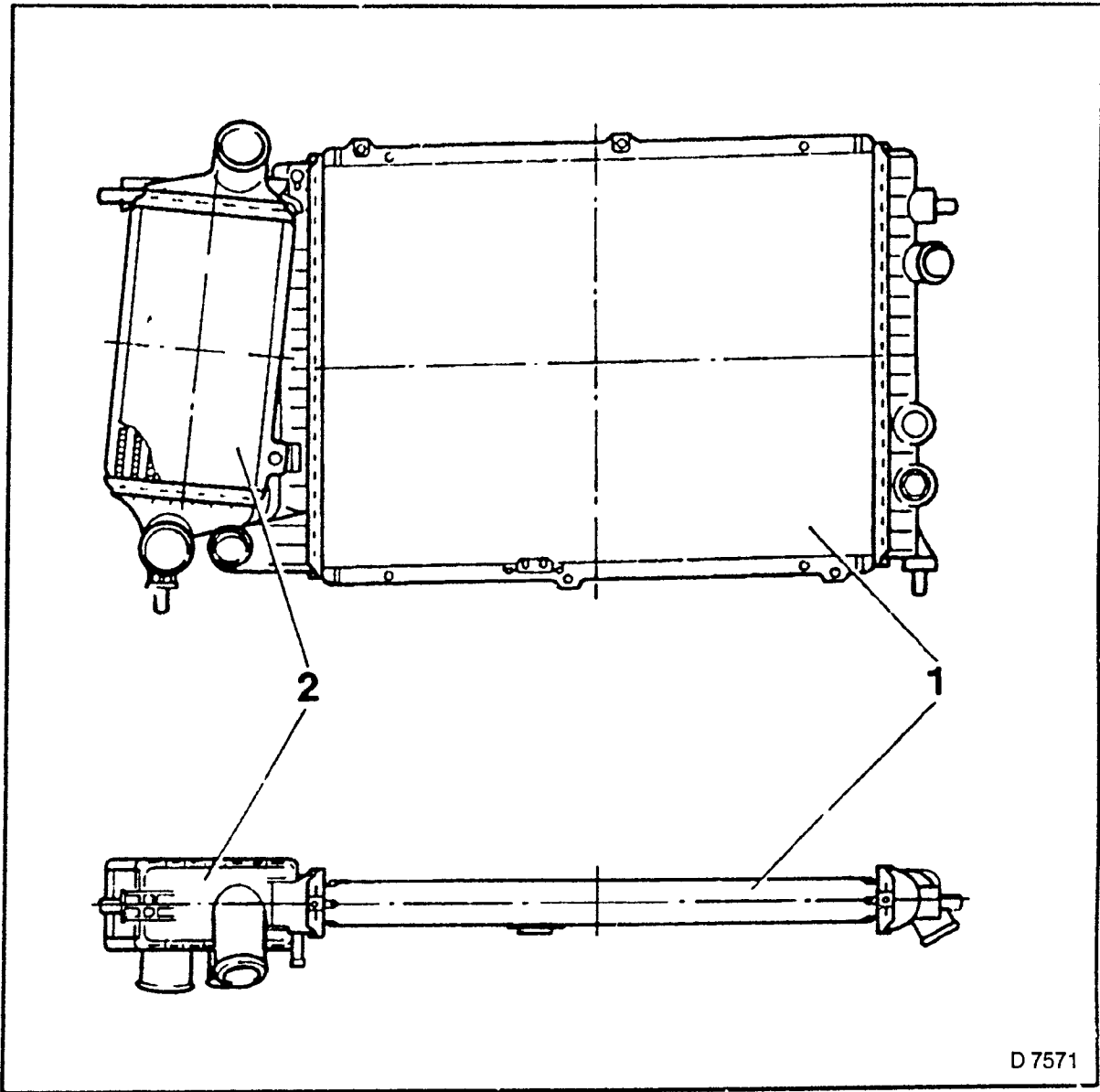


Fig. 587

Survey — Turbocharger Attaching Parts.

ILLUSTRATION 2

- 1. Exhaust manifold with integrated turbine casing.
- 2. Intake side of compressor housing.
- 3. Compressor housing.
- 4. Bypass air channel.
- 5. Bypass air circulation.
- 6. Air bypass valve (open).
- 7. Intake manifold pressure connection.
- 8. Wastegate channel.
- 9. Turbine casing.



D 7571

Fig. 588

Survey — Turbocharger Attaching Parts.

ILLUSTRATION 3

- 1. Water cooler.
- 2. Charge cooler.

RECOMMENDED TORQUE VALUES — TURBOCHARGING SYSTEM

	Nm
Coolant feed line to turbocharger	20
Coolant return line to turbocharger	20
Cover plate to cylinder head (M 6 bolts)	9
Cover to throttle valve manifold	5
Exhaust diverter manifold to turbocharger	20 ¹⁾
Exhaust manifold with turbocharger to cylinder head	25 ¹⁾
Exhaust pipe to exhaust diverter manifold	12 ¹⁾
Oil feed line to cylinder block screw connection	20
Oil feed line to turbocharger	12
Oxygen sensor to exhaust diverter manifold	22
Studs in exhaust diverter manifold	

- ¹⁾ Use new nuts.
- ²⁾ Use new bolts.

Important Repair Instructions

During all operations on the “Turbocharging System”, ensure that work is carried out with the utmost cleanliness and great care.

For checking of individual components of the turbocharger, use the “Motronic M 2.7” Checking Procedures.

Note:

All data is collected by the control unit and can be read out using TECH 1.
If the nominal and actual values do not match, the control unit switches to its emergency operation program.

Carry out the following visual checks:

Air-conducting hoses for good condition and correct seat.

Pressure/vacuum hoses correctly connected — see Fig. 583.

Condition of pressure/vacuum hoses.

On operations on oil circuit components — turn over engine without fuel supply and ignition before putting into operation — to build up engine oil pressure. Engine oil filling quantities — see “Technical Data”.

Always cover up turbocharger after removing air hoses.

The extent of repairs to the turbocharger is confined to the operations described hereafter.
Replacement of single components is not permitted.

Coolant Return Line (Turbocharger) — Remove and Install

REMOVE, DISCONNECT

- 1. Heat shield from cylinder head.
- 2. Intake hose.
- 3. Hosed bracket from hot-wire mass air flow meter.
- 4. Engine vent hose from turbocharger.
- 5. Timing hoses.
- 6. Coolant feed line.
- 7. Oil feed and return lines.

For this, see operation “Gasket — Exhaust Manifold/Cylinder Head, Replace”, page 273.

REMOVE, DISCONNECT

- 1. Coolant return line (1) from compensation tank and pull out from rubber bearing (2).

REMOVE, DISCONNECT

- 1. Disconnect wiring plug (1) for oxygen sensor. (Where fitted).
- 2. Front exhaust pipe.
- 3. Exhaust manifold from head.
- 4. Exhaust manifold gasket from cylinder head.

CLEAN

Sealing surfaces of cylinder head and exhaust manifold.

REMOVE, DISCONNECT

- 1. Coolant return line (1).
- 2. Bracket (2) from turbocharger.

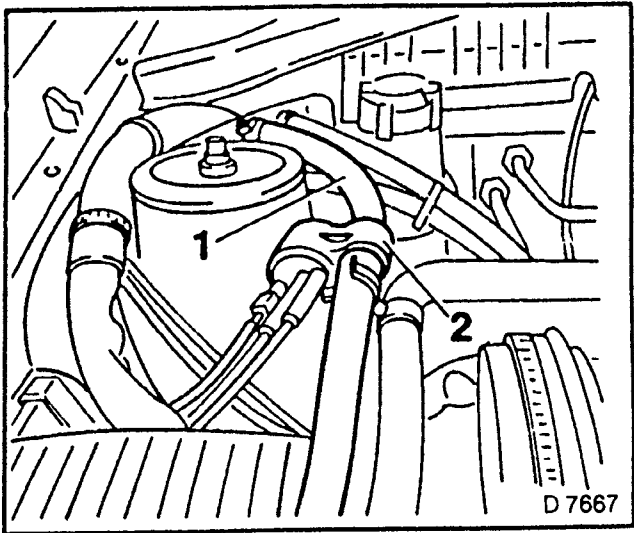


Fig. 589

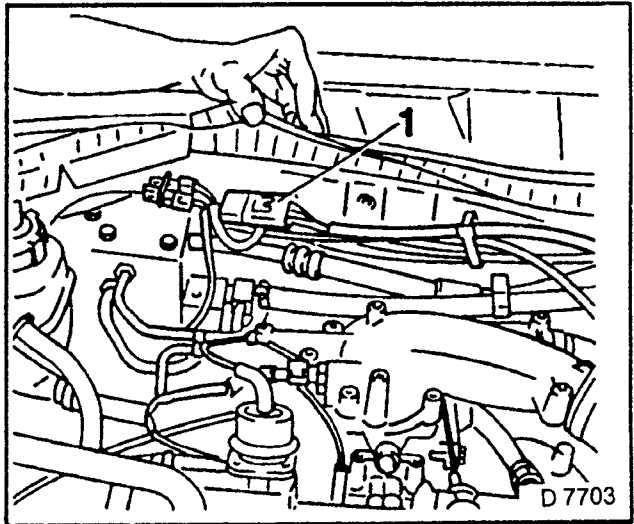


Fig 590

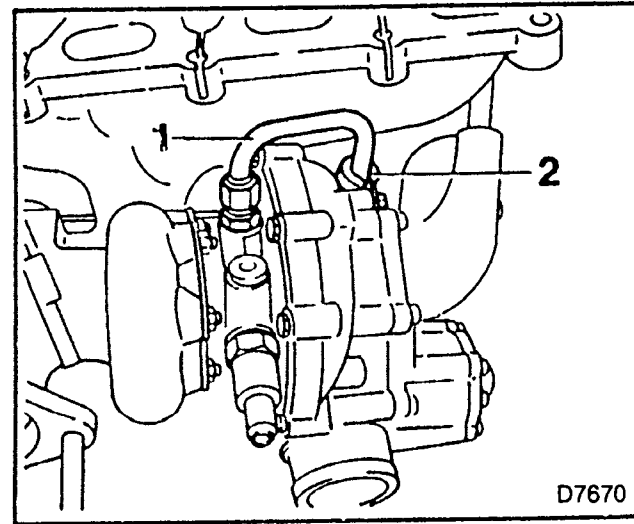


Fig. 591

INSTALL, CONNECT

1. Coolant return line (1) and bracket (2) to turbocharger.
2. Exhaust manifold to cylinder head — use new gasket and nuts.

TIGHTEN (TORQUE)

1. Exhaust manifold to cylinder head — 25 Nm.
2. Coolant return line to turbocharger — 20 Nm.

INSTALL, CONNECT

1. Heat shield to cylinder head.
2. Intake hose.
3. Hose bracket to hot-wire mass air flow meter.
4. Engine vent hose to turbocharger.
5. Timing hoses.
6. Coolant feed line.
7. Oil feed and return lines.

For this, see operation “Gasket — Exhaust Manifold/ Cylinder Head, Replace”, page 273.

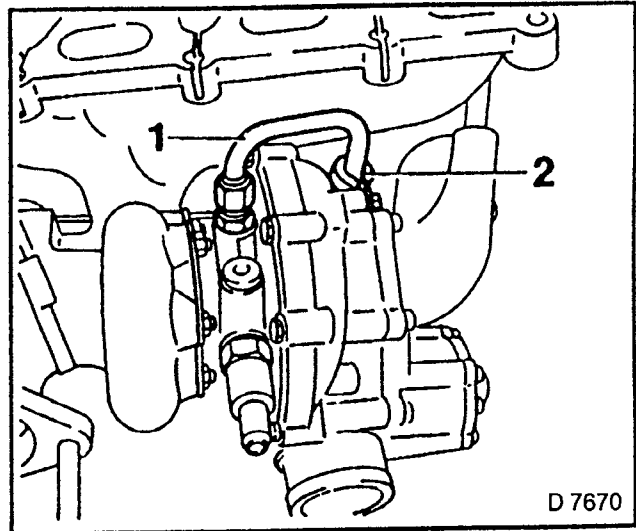


Fig. 592

Coolant Feed Line (Turbocharger) — Remove and Install**REMOVE, DISCONNECT**

1. Coolant feed line (1) from turbocharger and water cooler.
2. Collect coolant.

INSTALL, CONNECT

1. Coolant feed line to turbocharger and water cooler.
2. Coolant feed line to turbocharger — 20 Nm.
3. Top up and bleed cooling system.

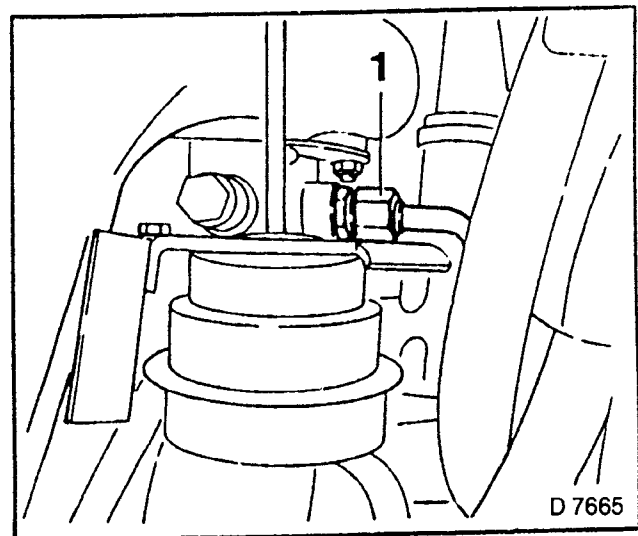


Fig. 593

Charge Cooler — Remove and Install**REMOVE, DISCONNECT**

1. Water cooler.
2. Charge cooler from water cooler.

INSTALL, CONNECT

1. Charge cooler to water cooler.
2. Water cooler.
3. Top up and bleed cooling system.

Water Cooler — Remove and Install

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Wiring plug from fan motor.
3. Coolant hose.
4. Water cooler/turbocharger.
5. Remove fan motor with fan shroud upwards.

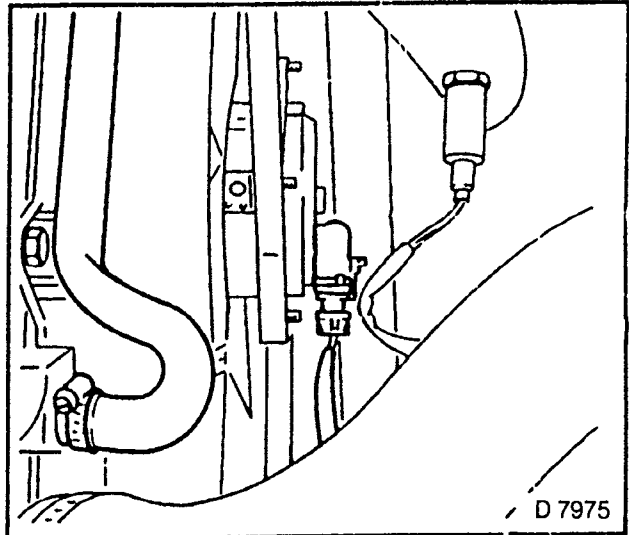


Fig. 594

REMOVE, DISCONNECT

1. Air hoses from charge cooler.
2. Coolant hoses from water cooler — collect coolant.
3. Wiring plug from temperature sensor.

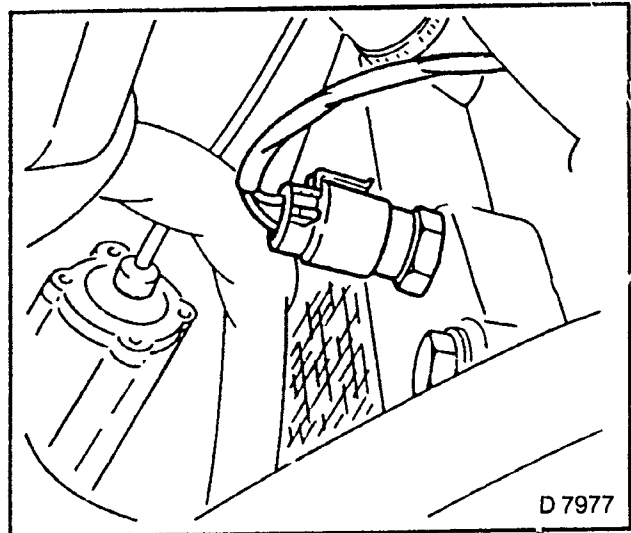


Fig. 595

INSTALL, CONNECT

1. Coolant hose.
2. Water cooler/turbocharger.
3. Wiring plug to fan motor.
4. Ground cable to battery.
5. Top up and bleed cooling system.

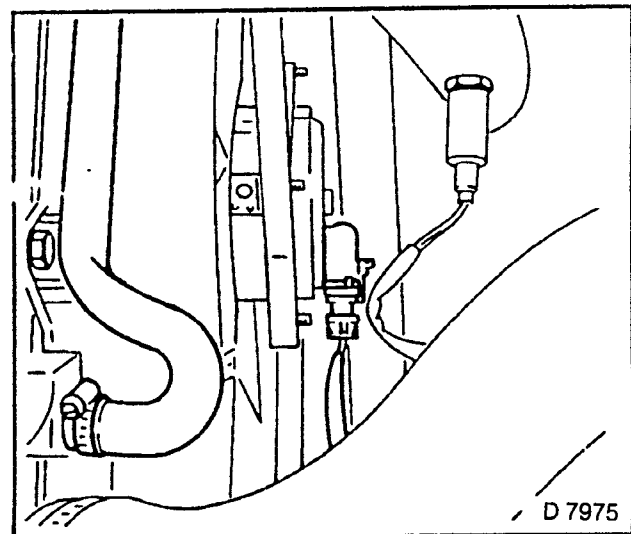


Fig. 596

Oil Return Line (Turbocharger) — Remove and Install

REMOVE, DISCONNECT

- 1. Oil return line.
- 2. Place collecting basin underneath.
Note escaping oil.

INSTALL, CONNECT

- 1. Oil return line.
- 2. Check engine oil level, correct if
necessary.

Oil Feed Line (Turbocharger) — Remove and Install

REMOVE, DISCONNECT

- 1. Oil feed line.
Note escaping oil.

INSTALL, CONNECT

- 1. Oil feed line — replace seal rings.
- 2. Oil feed line to turbocharger — 12 Nm.
- 3. Oil feed line to cylinder block screw
connection — 20 Nm.
- 4. Check engine oil level, correct if
necessary.

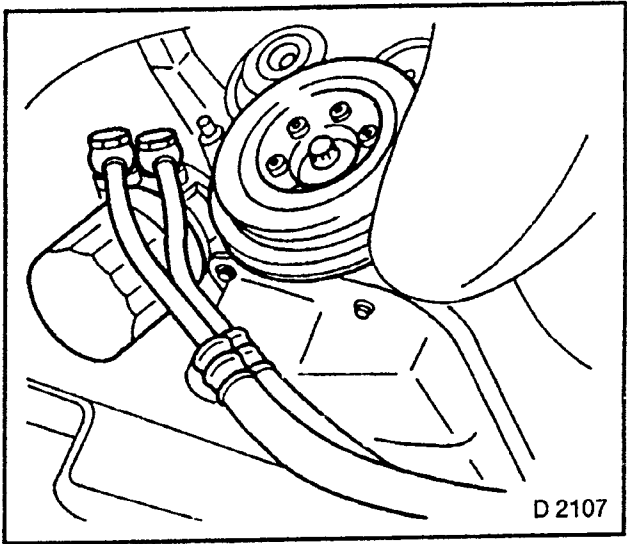


Fig. 597

Gasket — Exhaust Manifold/Cylinder Head — Replace

REMOVE, DISCONNECT

- 1. Heat shield from cylinder head. Intake
hose (1).
- 2. Engine vent hose from turbocharger.

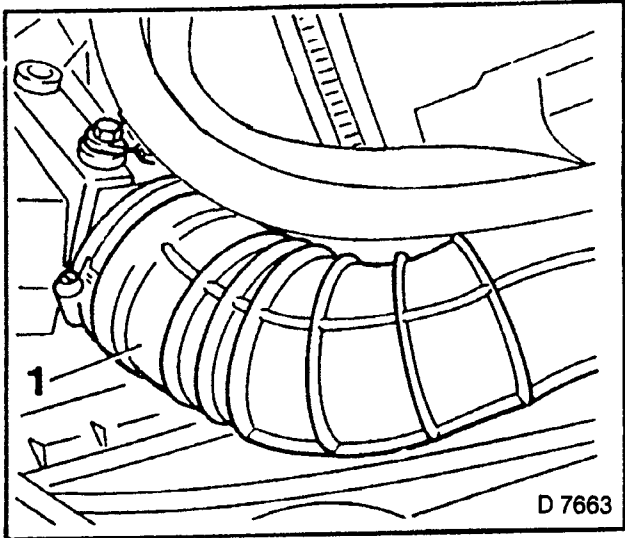


Fig. 598

REMOVE, DISCONNECT

Timing hoses (1), (2) and (3). from turbocharger.

NOTE:

MARK TIMING HOSES BEFORE REMOVAL.
SURVEY OF CONNECTIONS — SEE FIG. 583.

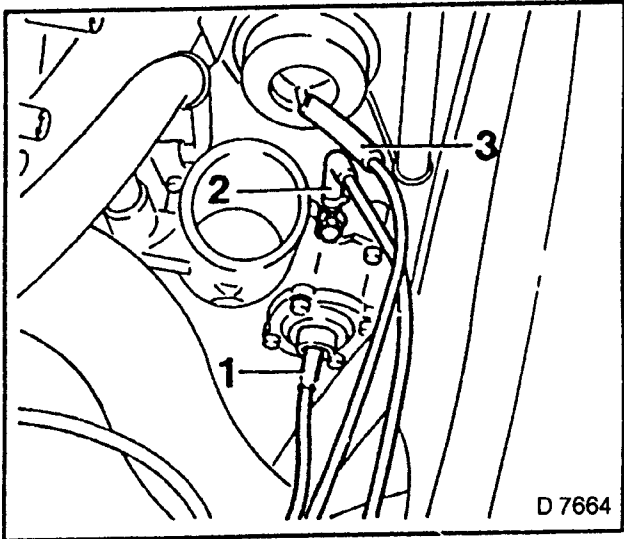


Fig. 599

REMOVE, DISCONNECT

- 1. Coolant feed line (1) from turbocharger.
- 2. Place collecting basin underneath.
- 3. Collect coolant.

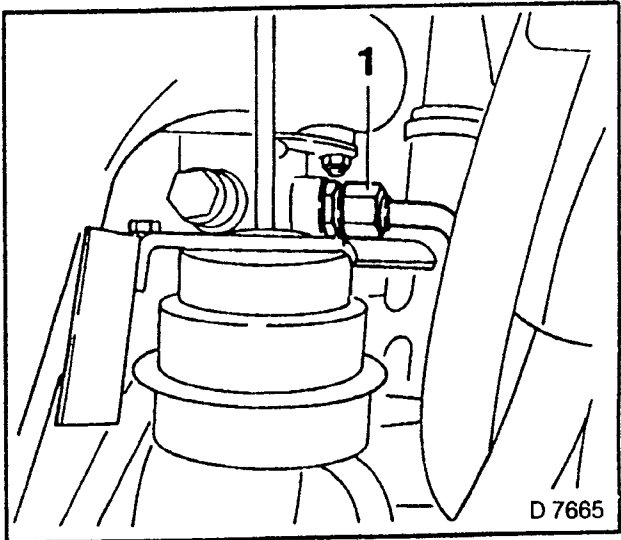


Fig. 600

REMOVE, DISCONNECT

- 1. Oil feed line (1).
- 2. Oil return line (2) from turbocharger
- 3. Note escaping oil.
- 4. Close off oil lines

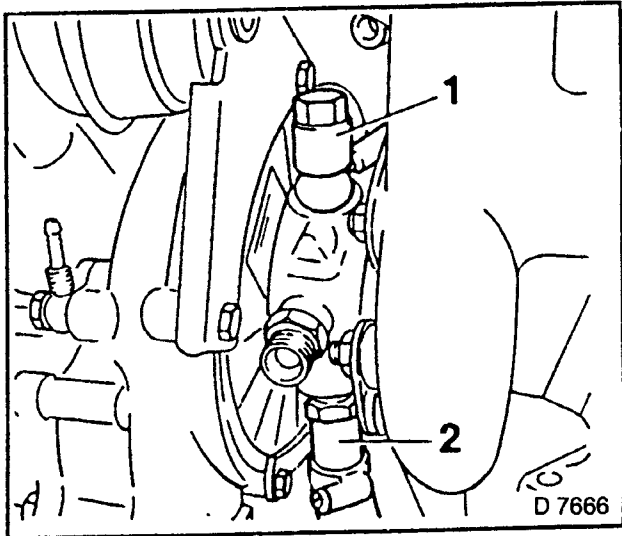


Fig. 601

REMOVE, DISCONNECT

- 1. Coolant return line (1) from compensation tank and pull out of rubber bearing (2).

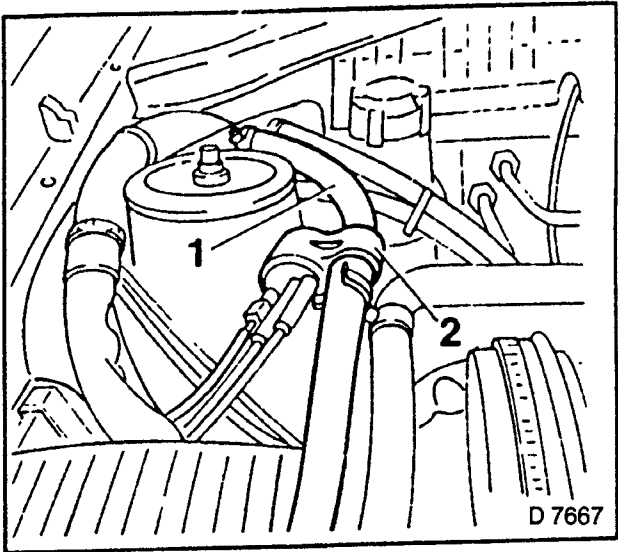


Fig. 602

REMOVE, DISCONNECT

- 1. Front exhaust pipe from exhaust adapter.

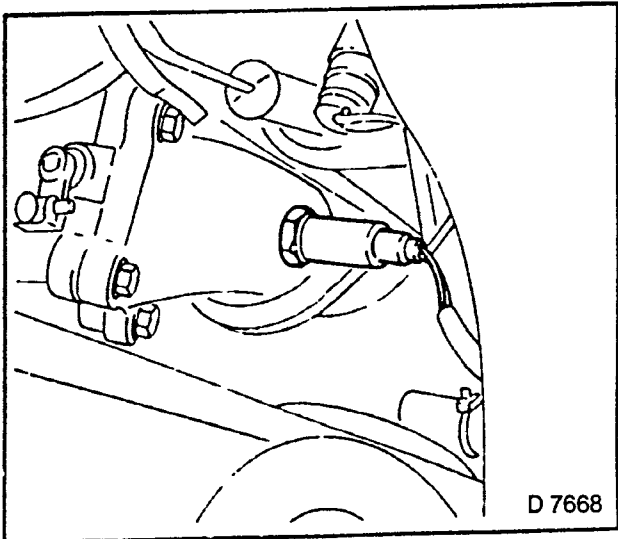


Fig. 603

REMOVE, DISCONNECT

- 1. Exhaust manifold from cylinder head.
- 2. Exhaust manifold gasket from cylinder head.

CLEAN

- 1. Sealing surfaces of cylinder head and exhaust manifold.

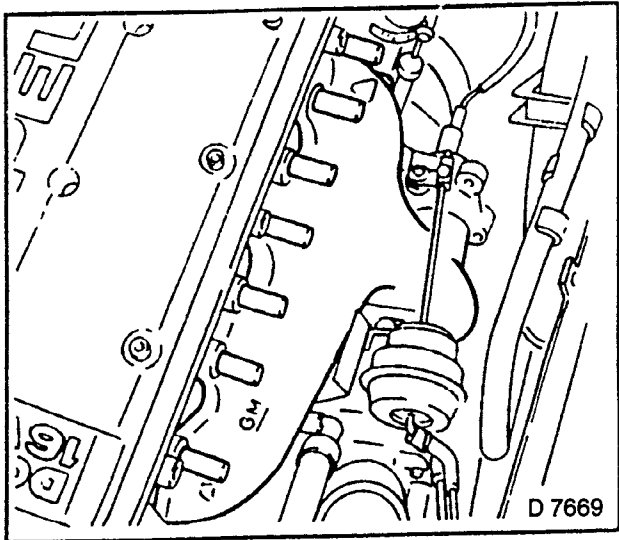


Fig. 604

REMOVE, DISCONNECT

- 1. Coolant return line (1).
- 2. Bracket (2) from turbocharger.
- 3. If the exhaust manifold is replaced with the turbocharger, the exhaust adapter must be transferred — use new bolts.

Exhaust adapter to turbocharger
— 20 Nm.

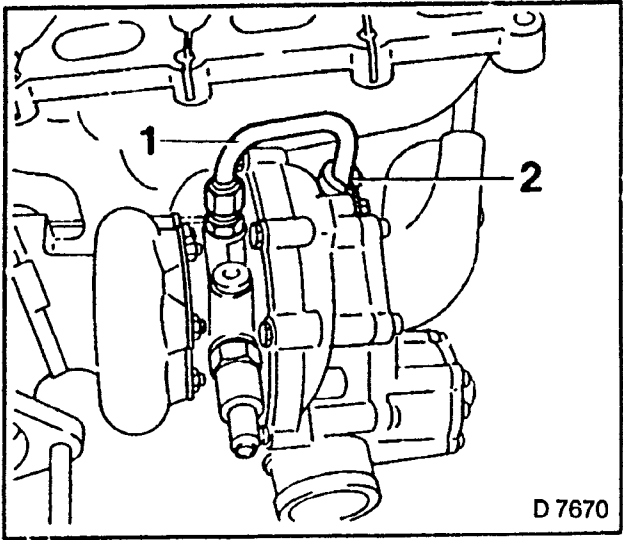


Fig. 605

INSTALL, CONNECT

- 1. Coolant return line (1).
- 2. Bracket (2) to turbocharger.
- 3. Exhaust manifold to cylinder head — use new gasket and nuts.

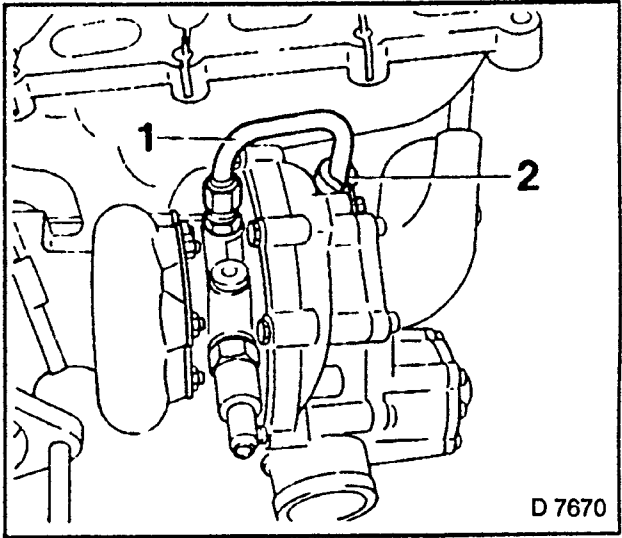


Fig. 606

TIGHTEN (TORQUE)

- 1. Exhaust manifold to cylinder head
— 25 Nm.
- 2. Coolant return line to turbocharger
— 20 Nm.

INSTALL, CONNECT

- 1. Front exhaust pipe to exhaust adapter.

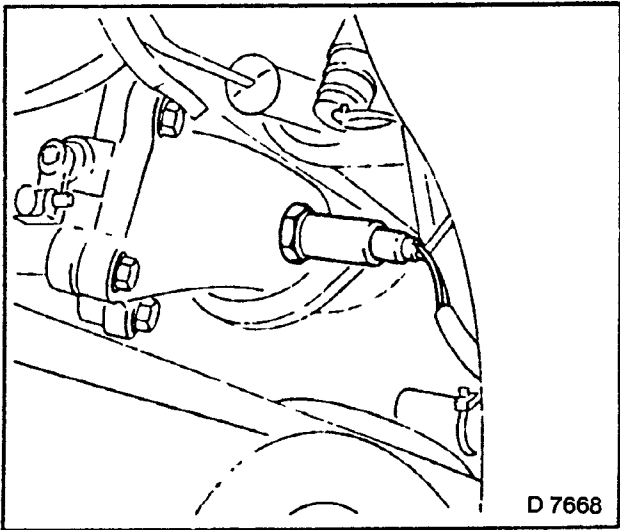


Fig. 607

INSTALL, CONNECT

- 1. Oil feed line (1) with new seal rings.
- 2. Oil return hose to turbocharger.
- 3. Coolant feed line (2) to turbocharger.
- 4. Timing hoses to turbocharger.

NOTE:

NOTE MARKS ON TIMING HOSES MADE PREVIOUSLY — SEE ALSO SURVEY OF CONNECTIONS, FIG. 583. OBSERVE ROUTING OF LINES.

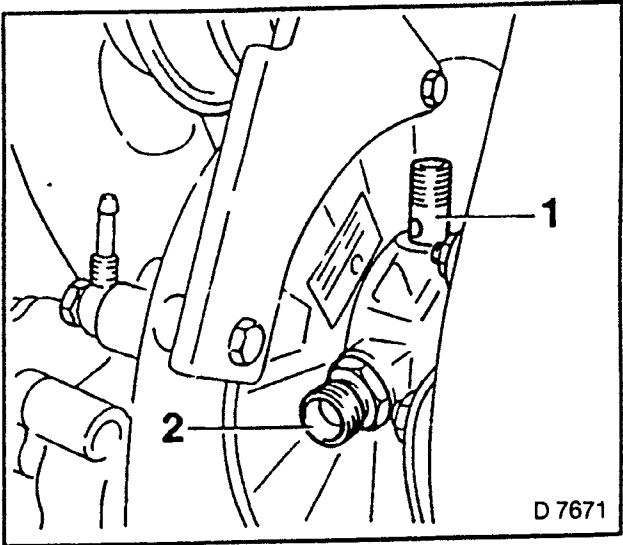


Fig. 608

INSTALL, CONNECT

- 1. Pull coolant return hose (1) through rubber bearing (2).
- 2. Coolant return hose to compensation tank.

TIGHTEN (TORQUE)

- 1. Oil feed line to turbocharger — 12 Nm.
- 2. Coolant feed line to turbocharger — 20 Nm.

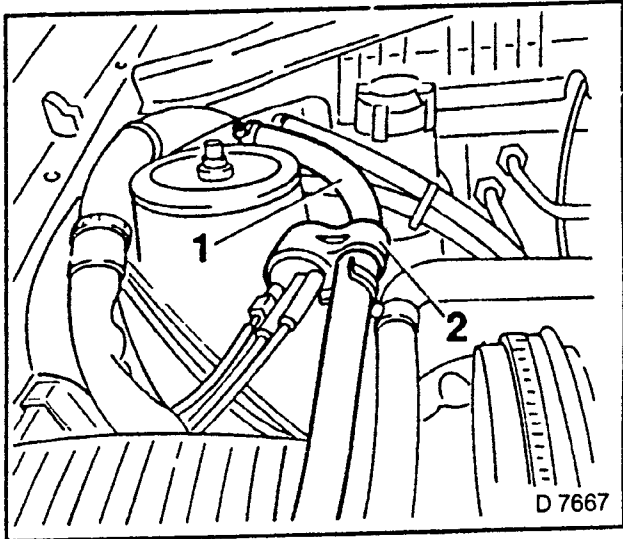


Fig 609

INSTALL, CONNECT

- 1. Heat shield to cylinder head — 9 Nm.
- 2. Engine vent hose to turbocharger.
- 3. Intake hose (1) and hose bracket (2) to hot-wire mass air flow meter.
- 4. Top up and bleed cooling system.
- 5. Check engine oil level, correct if necessary.

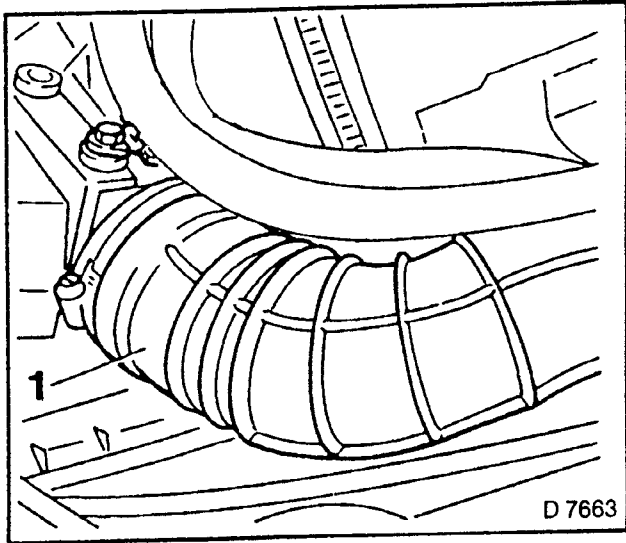
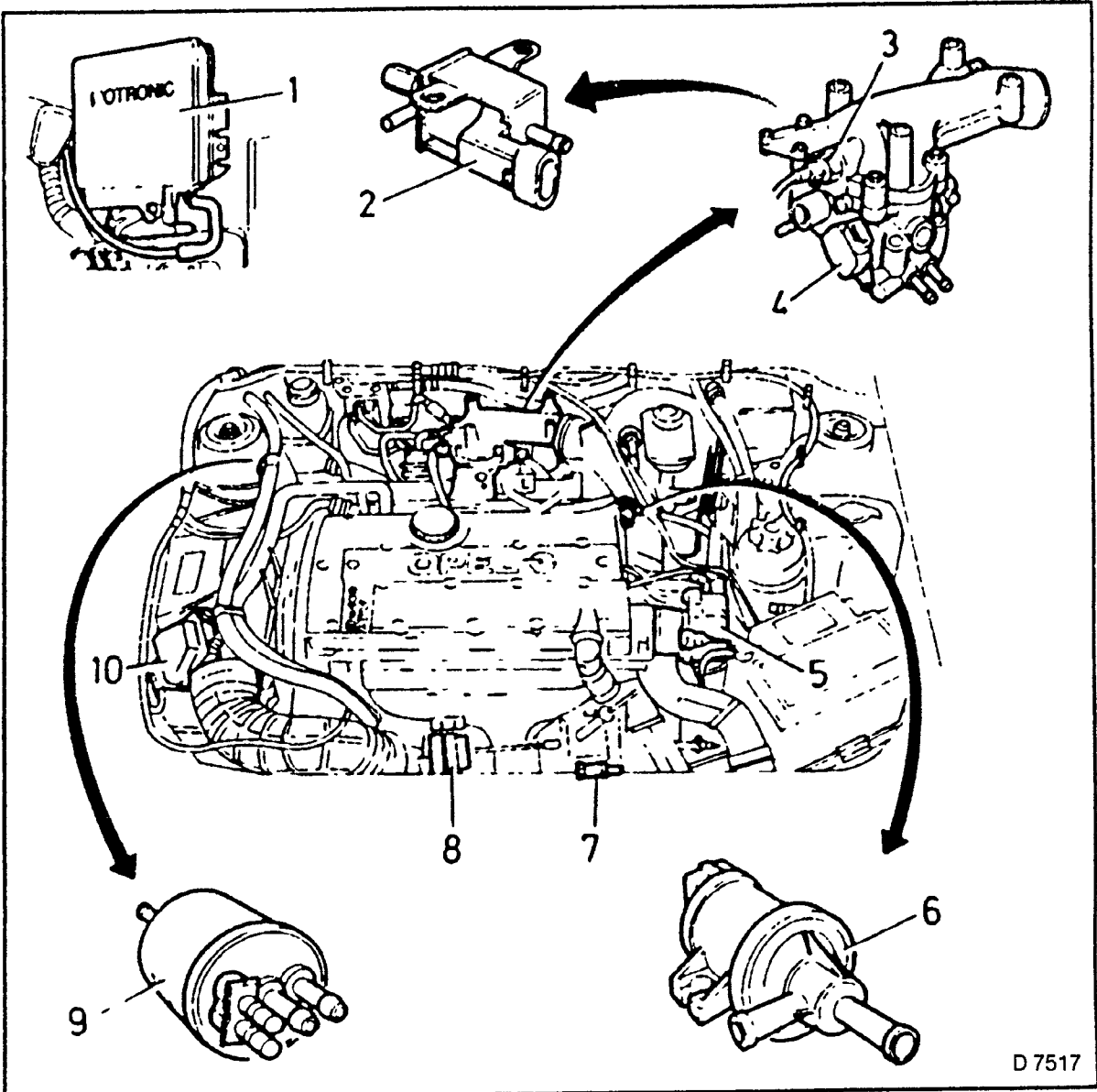


Fig. 610



D 7517

Fig. 611

**MOTRONIC M 2.7 (C 20 LET)
INJECTION SYSTEM**

1. Control unit
(installation position: right footwell).
2. Hot start valve.
3. Intake air temperature sensor.
4. Throttle valve potentiometer.
5. High voltage distributor with integrated Hall sensor.
6. Tank vent valve (N/a to Delta).
7. Oxygen sensor.
8. Control unit — charge pressure control valve.
9. Bypass valve — charge pressure control.
10. Hot-wire mass air flow meter.

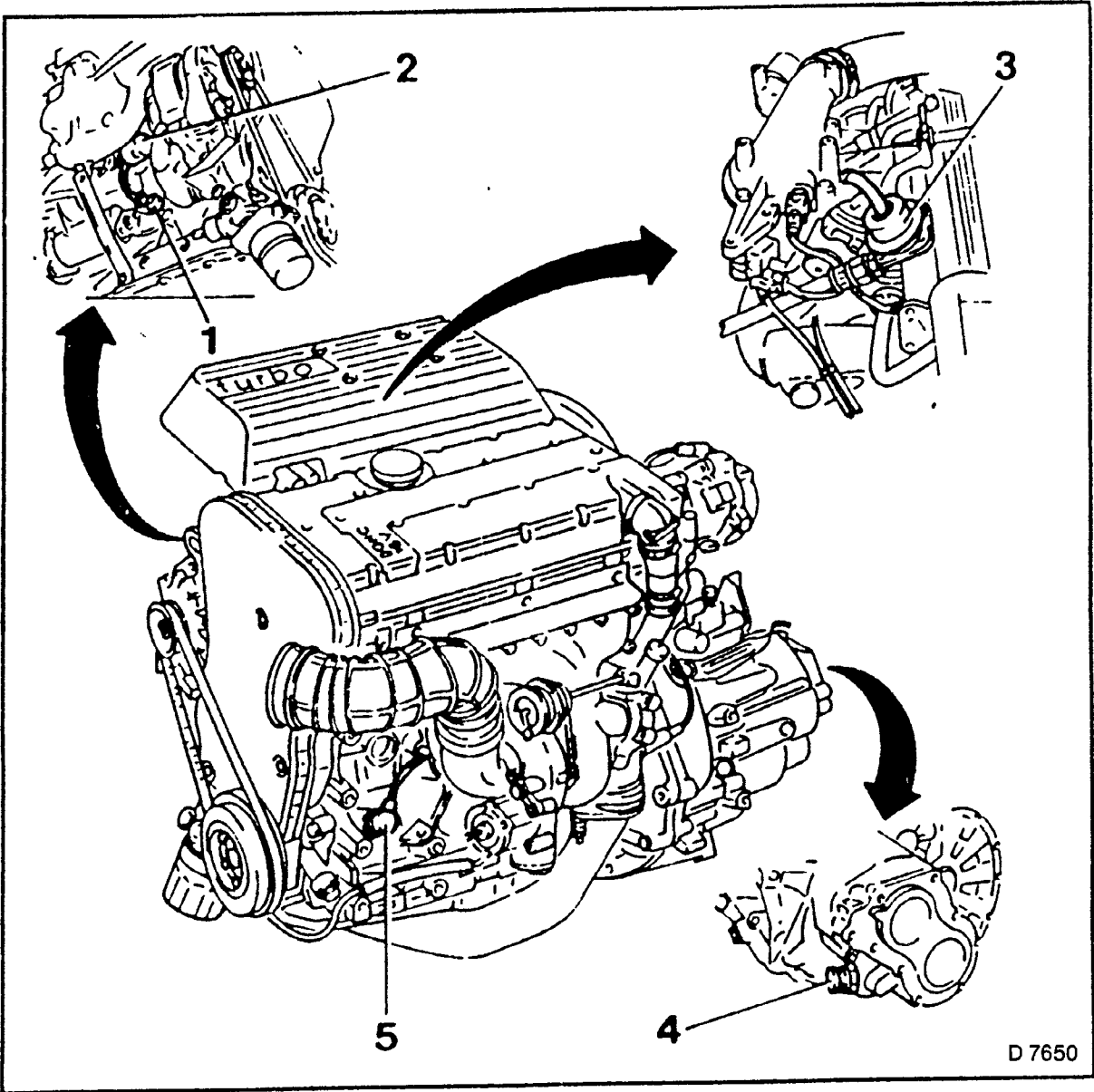


Fig. 612

**MOTRONIC M 2.7 (C 20 LET)
INJECTION SYSTEM**

- 1. Knock sensor.
- 2. Idle speed adjuster.
- 3. Fuel pressure regulator.
- 4. 1st gear recognition switch.
- 5. Inductive pulse pick-up.

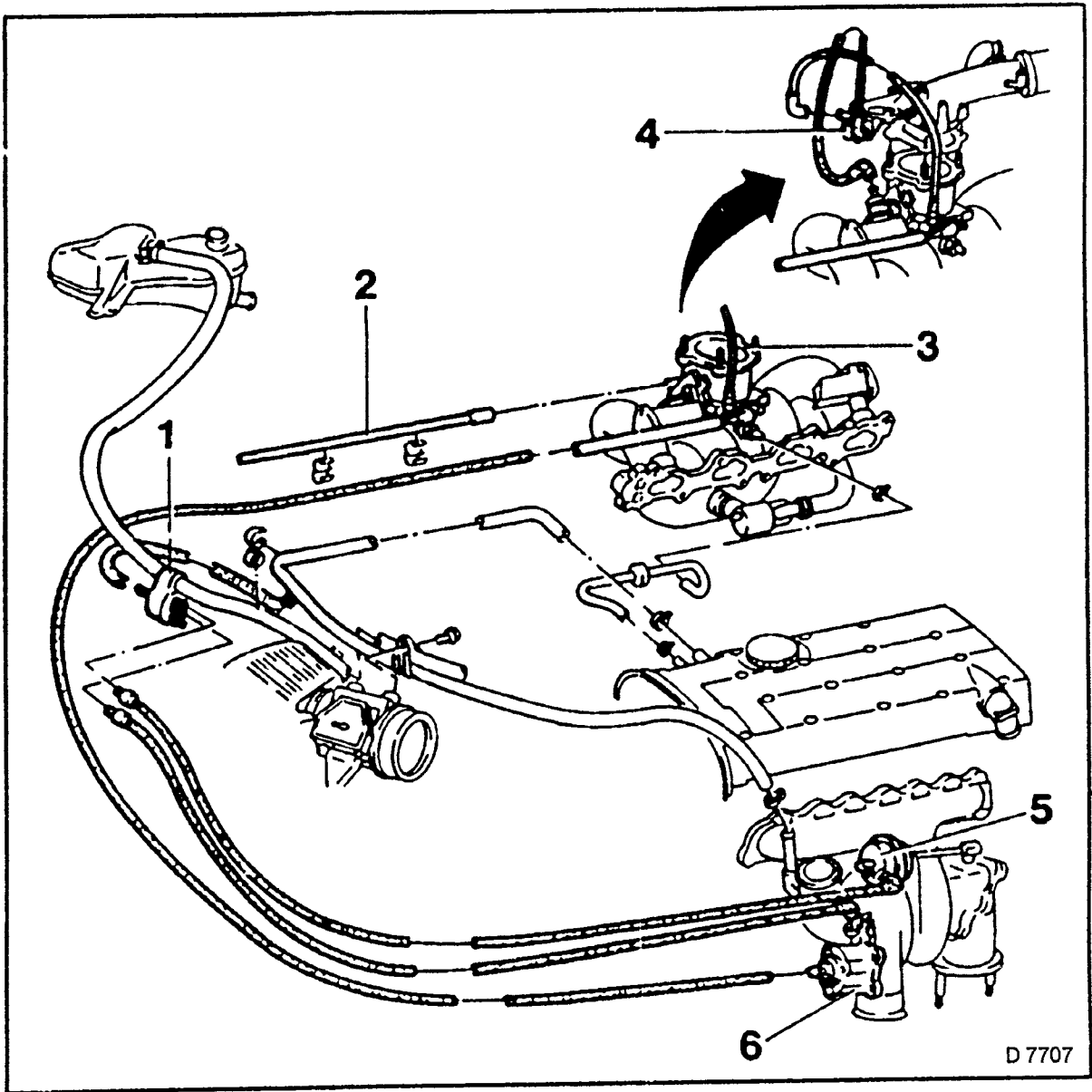


Fig. 613

**MOTRONIC M 2.7 (C 20 LET)
INJECTION SYSTEM**

- 1. Bypass valve — charge pressure control.
- 2. Connection to M 2.7 control unit.
- 3. Throttle body.
- 4. Hot start valve.
- 5. Control unit — charge pressure control valve.
- 6. Air bypass valve.

Throttle Body — Remove and Install

REMOVE, DISCONNECT

- 1. Cover for throttle valve manifold.
- 2. Hoses (1) and (2) from throttle valve manifold.

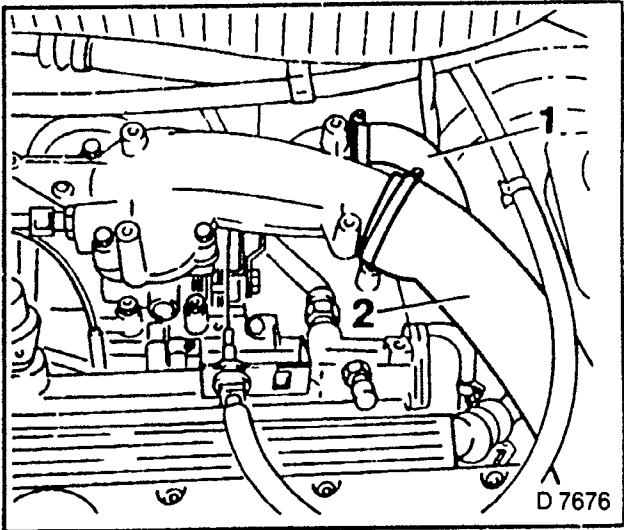


Fig. 614

REMOVE, DISCONNECT

- 1. Mark vacuum hoses.
- 2. Wiring plug (1) for intake air temperature sensor.
- 3. Wiring plug and vacuum hoses from hot start valve (2).

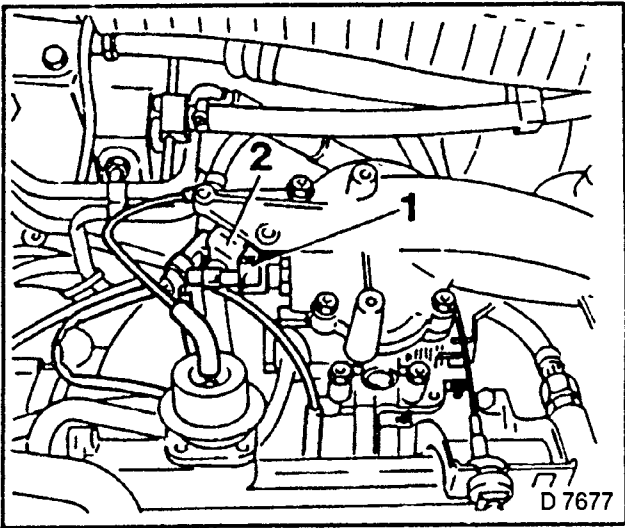


Fig 615

REMOVE, DISCONNECT

- 1. Throttle valve manifold (1) with gasket.

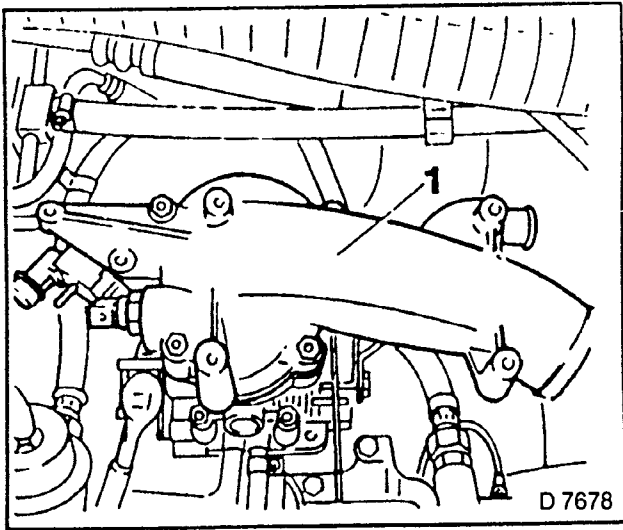


Fig 616

REMOVE, DISCONNECT

- 2. Wiring plug (1) from throttle valve potentiometer.
- 3. Pressure/vacuum hose (2) from throttle body.

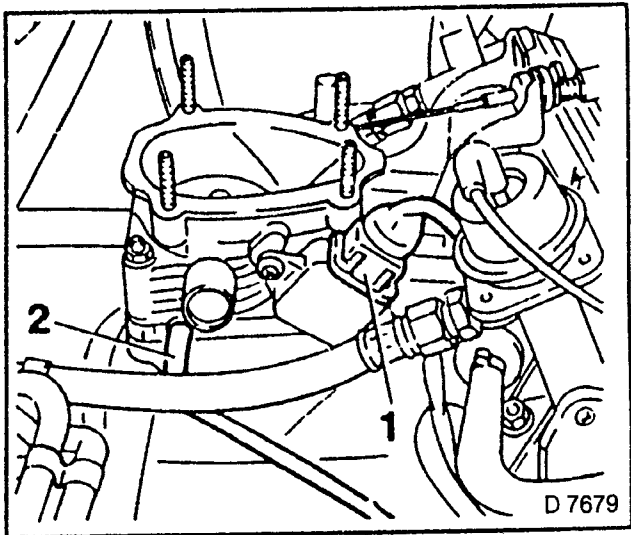


Fig. 617

REMOVE, DISCONNECT

- 1. Pressure/vacuum hoses (1). and (2) from throttle body.

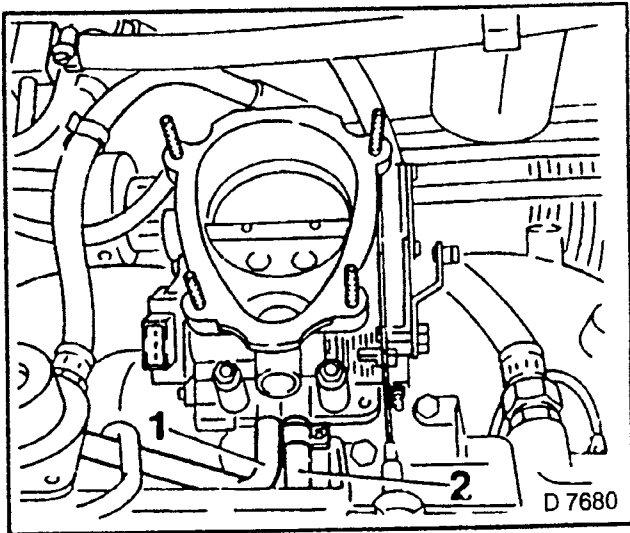


Fig. 618

REMOVE, DISCONNECT

- 1. Bowden cable (1).
- 2. Fuel line bracket (2).

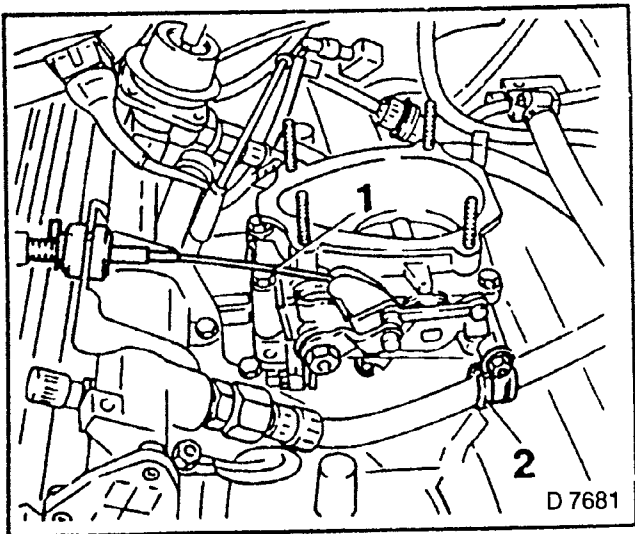


Fig 619

REMOVE, DISCONNECT

- 1. Nuts (1) from throttle body.
- 2. Throttle body with gasket.

CLEAN

Sealing surfaces between throttle body and intake manifold.
Observe utmost cleanliness.

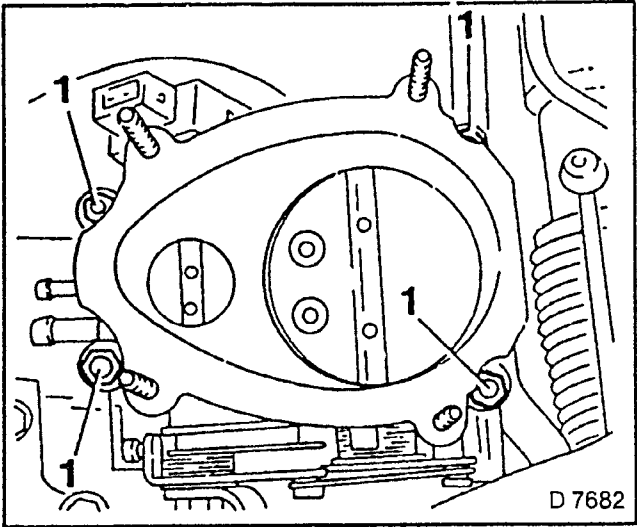


Fig. 620

INSTALL, CONNECT

- 1. Throttle body with new gasket —
tightening torque 9 Nm.

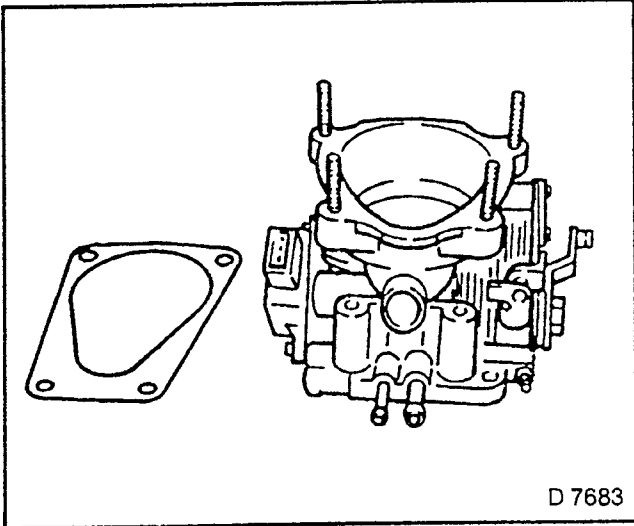


Fig. 621

INSTALL, CONNECT

- 1. Bowden cable (1).
- 2. Fuel line bracket (2).

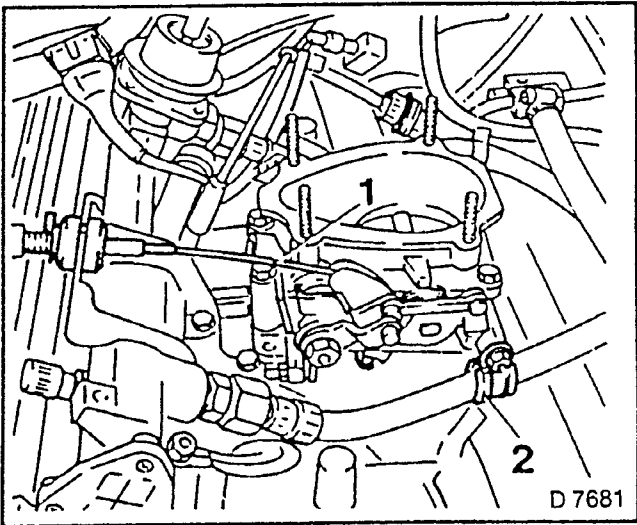


Fig. 622

INSTALL, CONNECT

- 1. Pressure/vacuum hoses (1) & (2) to throttle body.

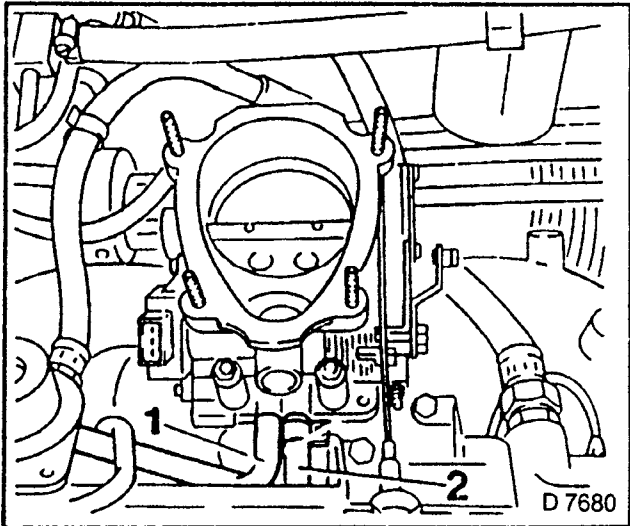


Fig. 623

INSTALL, CONNECT

- 1. Wiring plug (1) for throttle valve potentiometer.
- 2. Pressure/vacuum hose (2) to throttle body.

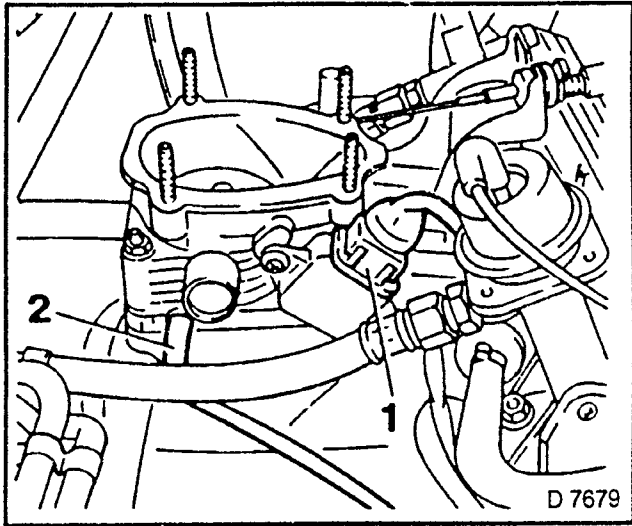


Fig. 624

THROTTLE BODY CONNECTION

- 1 = Connection to control unit M 2.7
- 2 = Connection to branch piece.
- 3 = Connection to tank vent valve.

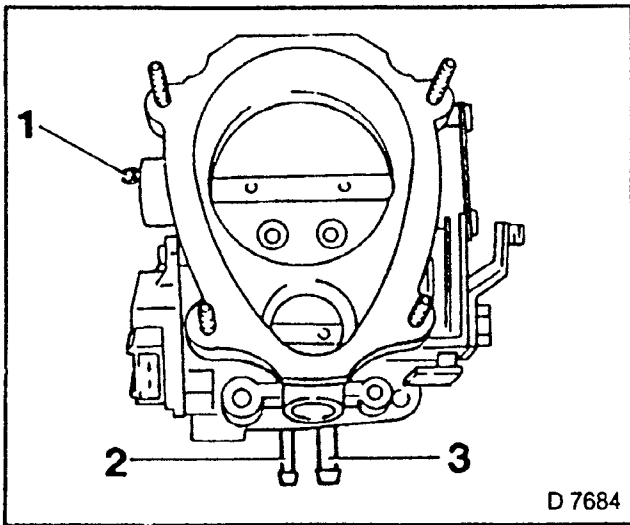


Fig. 625

BRANCH PIECE CONNECTION

- 1 = Connection to hot start valve.
 2 = Connection to air bypass valve, turbocharger.

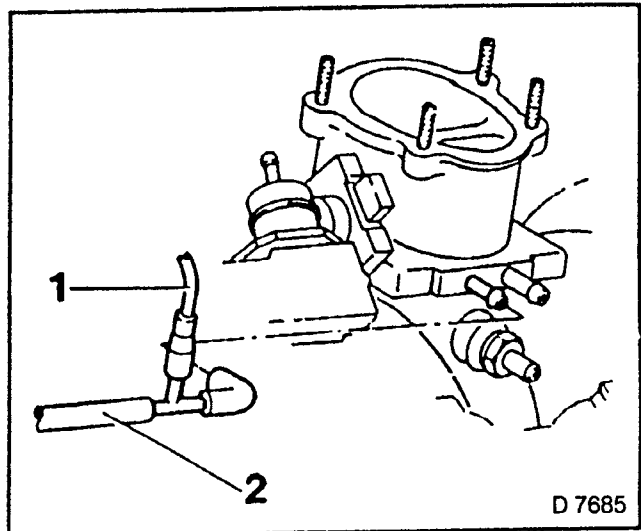


Fig. 626

INSTALL, CONNECT

1. Throttle valve manifold (1) with new gasket — tightening torque 8 Nm.

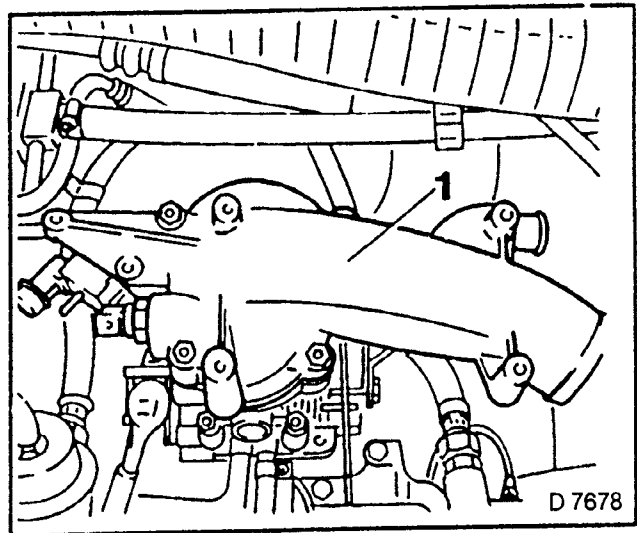


Fig. 627

INSTALL, CONNECT

1. Pressure/vacuum hose to branch piece.
2. Vacuum hoses and wiring plug to hot start valve (2).
3. Wiring plug (1) for intake air temperature sensor.
4. Hose for idle speed adjuster and for charge cooler to throttle valve manifold.
5. Throttle valve manifold cover — tightening torque 5 Nm.

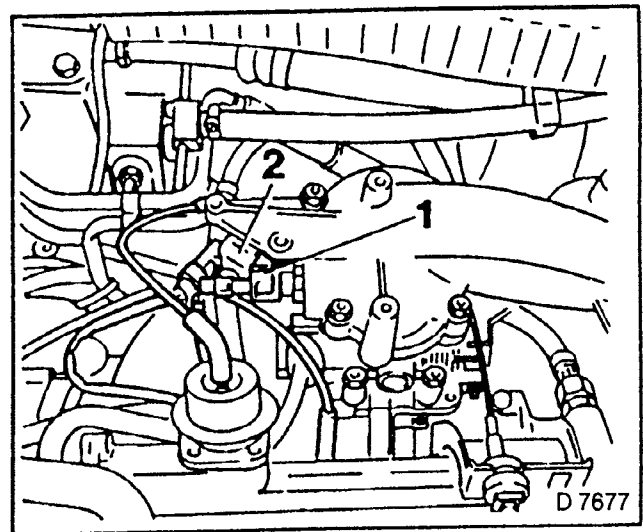


Fig. 628

Throttle Valve Potentiometer — Remove and Install

For a clearer representation, Fig. 583 shows the throttle valve potentiometer with the throttle valve manifold removed.

REMOVE, DISCONNECT

1. Throttle valve manifold cover.
2. Wiring plug for throttle valve potentiometer.
3. Throttle valve potentiometer (1).

INSTALL, CONNECT

1. Throttle valve potentiometer (1).
2. Wiring plug for throttle valve potentiometer.
3. Throttle valve manifold cover.

TIGHTEN (TORQUE)

1. Throttle valve manifold cover to throttle body 5 Nm.

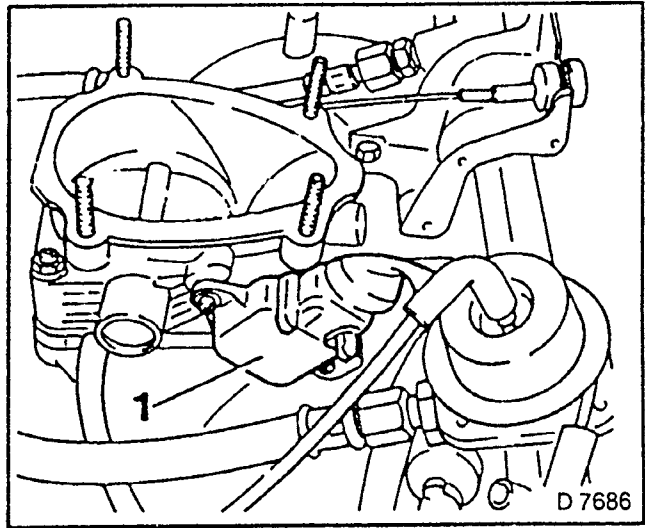


Fig. 629

Injection Valves — Remove and Install

REMOVE, DISCONNECT

1. Throttle valve manifold cover.
2. Bowden cable (1).
3. Crankcase ventilation hoses (2) and (3).

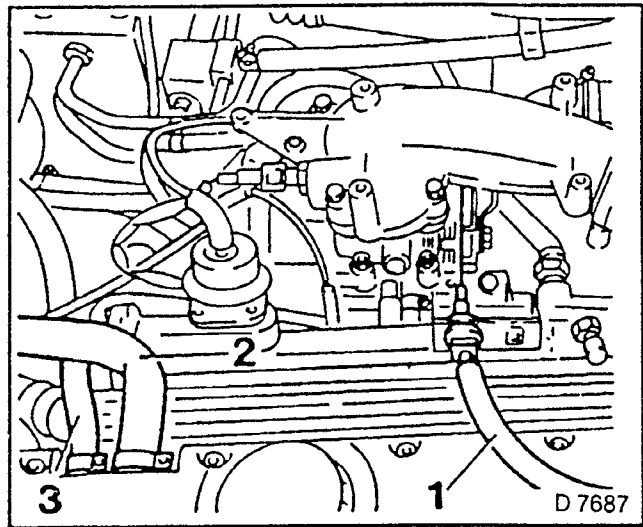


Fig. 630

REMOVE, DISCONNECT

1. Retaining clamp (1) from 1st cylinder injection valve from plug strip.
2. Remove plug strip.
3. Insert retaining clamp (1) in plug strip.

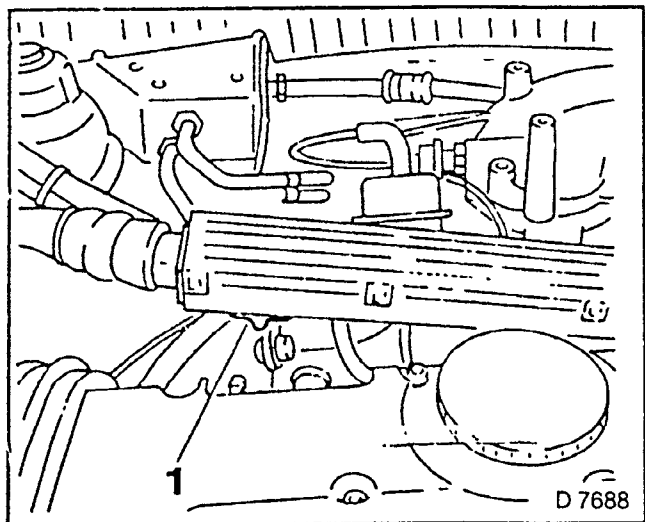


Fig. 631

REMOVE, DISCONNECT

- 1. Bowden cable bracket (1).
- 2. Ground cable (2).

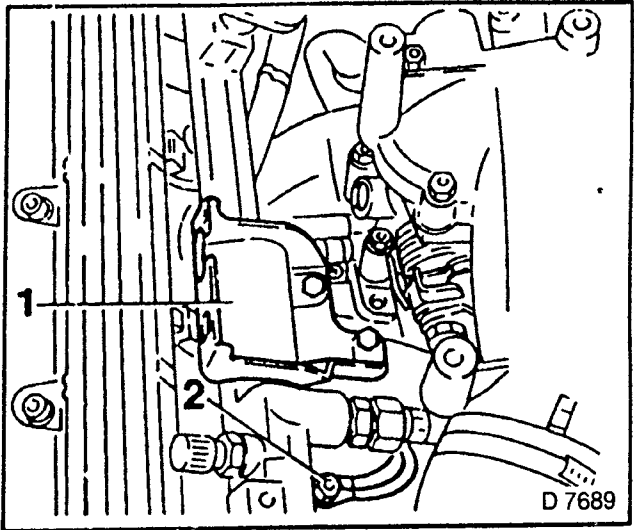


Fig. 632

REMOVE, DISCONNECT

- 1. Ground cable (1).

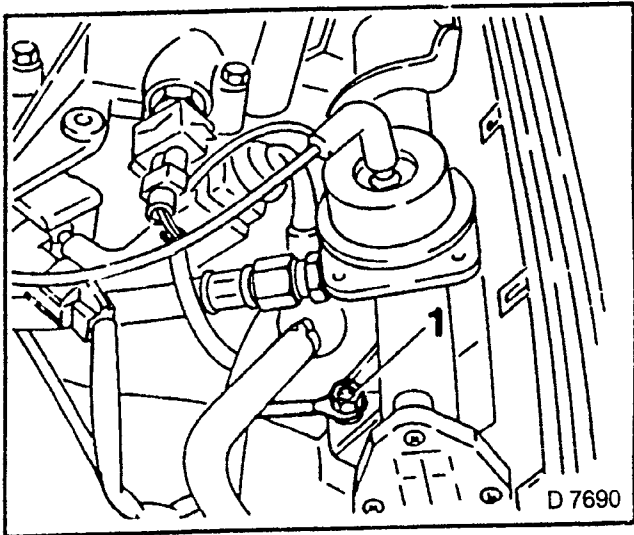


Fig. 633

REMOVE, DISCONNECT

- 1. Fuel distributor pipe.
- 2. Fuel distributor pipe with injection valves from intake manifold.
- 3. Spring clamp.
- 4. Injection valves from fuel distributor pipe.

WARNING:
FUEL ESCAPES
OBSERVE SAFETY MEASURES AND
NATIONAL REGULATIONS.

INSTALL, CONNECT

- 1. Injection valve with new seal rings in fuel distributor pipe.
- 2. Spring clamp.

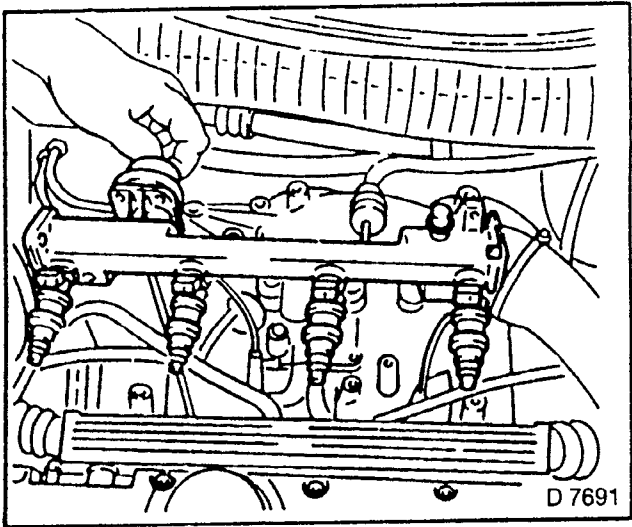


Fig 634

INSTALL, CONNECT

1. Fuel distributor pipe with injection valves in intake manifold — ensure correct seating.
2. Ground cables (1) and (2) to fuel distributor pipe.

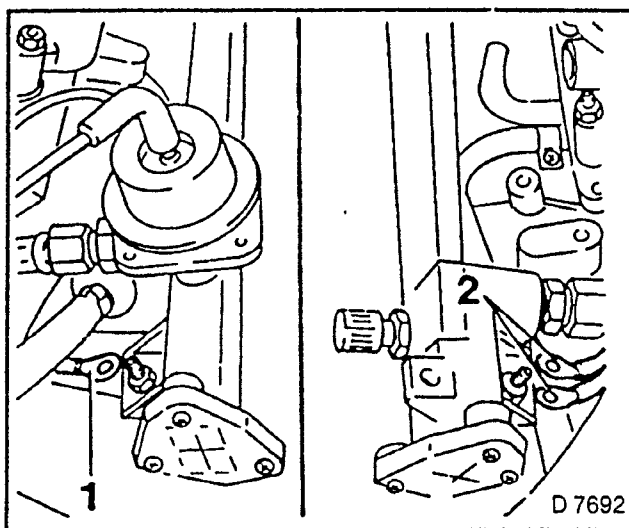


Fig 635

INSTALL, CONNECT

1. Bowden cable bracket (1).
2. Plug strip (2) on injection valves.
3. Plug strip must engage audibly — ensure correct seating.

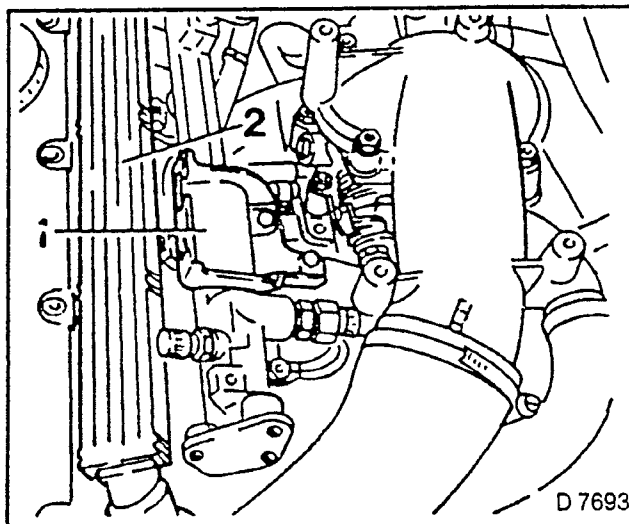


Fig 636

INSTALL, CONNECT

1. Attach Bowden cable (1) free of tension.
2. Crankcase ventilation hoses (2) and (3).
3. Throttle valve manifold cover — tightening torque 5 Nm.

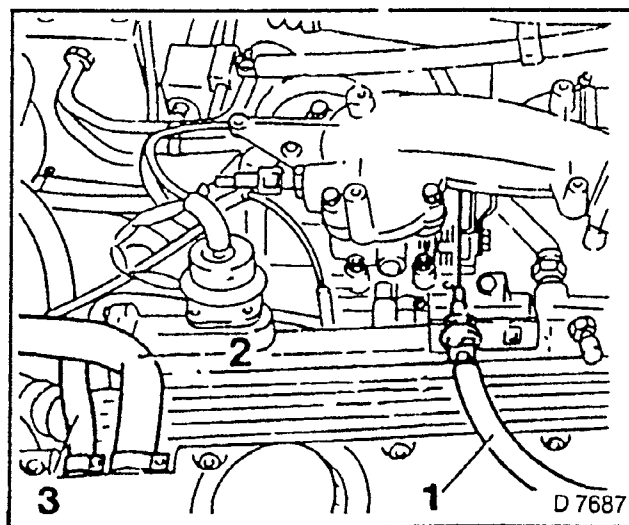


Fig 637

Hot Start Valve — Remove and Install

See Fig. 583 — Hot start valve with the throttle valve manifold removed.

REMOVE, DISCONNECT

- 1. Throttle valve manifold cover.
- 2. Wiring plug for hot start valve.
- 3. Vacuum hoses.
- 4. Hot start valve (1) from throttle valve manifold — if necessary.
- 5. Remove throttle valve manifold.

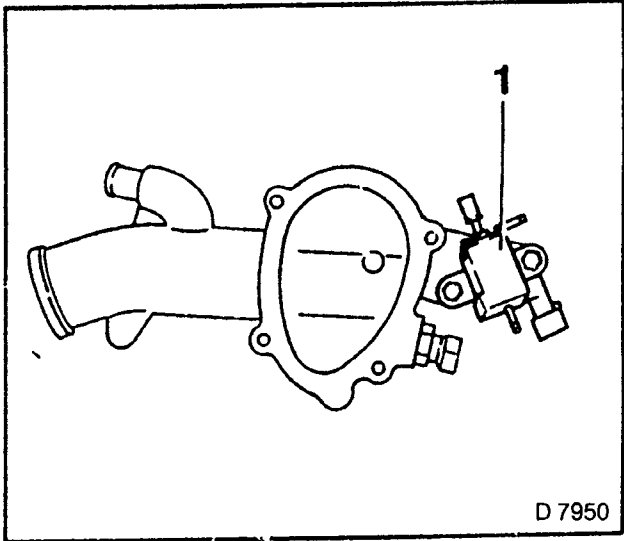


Fig. 638

- 6. Connection diagram of hot start valve.

INSTALL, CONNECT

- 1. Hot start valve (1) to throttle valve manifold.
- 2. Vacuum hoses.
- 3. Wiring plug.
- 4. Throttle valve manifold cover — tightening torque 5 Nm.

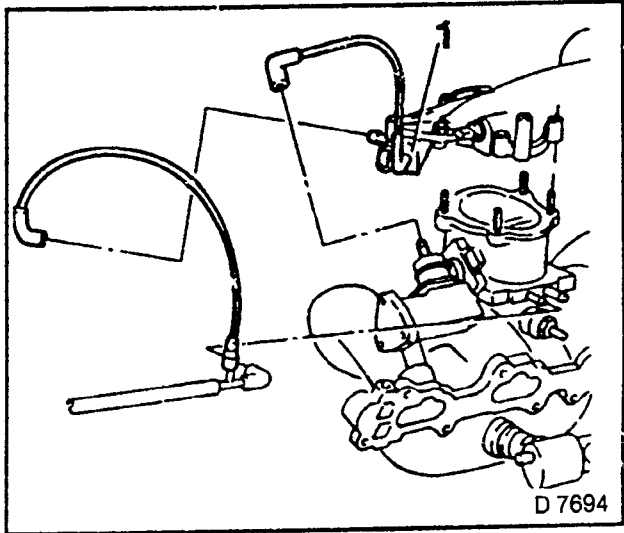


Fig. 639

Hot-wire Mass Air Flow Meter — Remove and Install

REMOVE, DISCONNECT

- 1. Wiring plug (1) and
- 2. Intake hose (3) from hot-wire mass air flow meter.

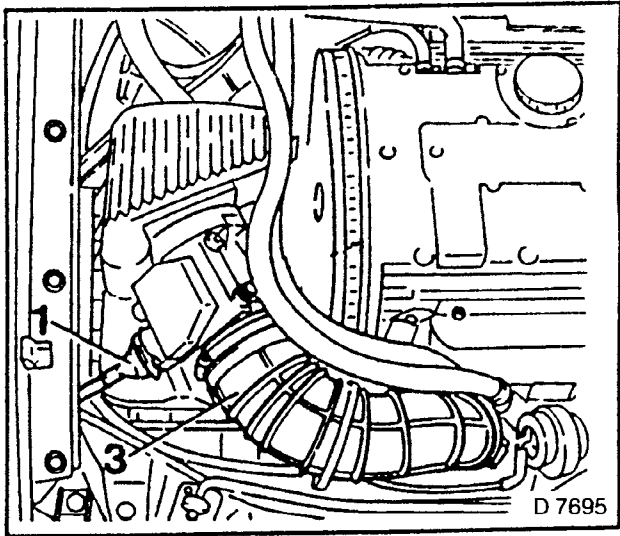


Fig. 640

REMOVE, DISCONNECT

- 1. Upper part of air cleaner with hot-wire mass air flow meter.
- 2. Hot-wire mass air flow meter (1) from upper part of air cleaner.
- 3. Note seal ring in upper part of air cleaner.

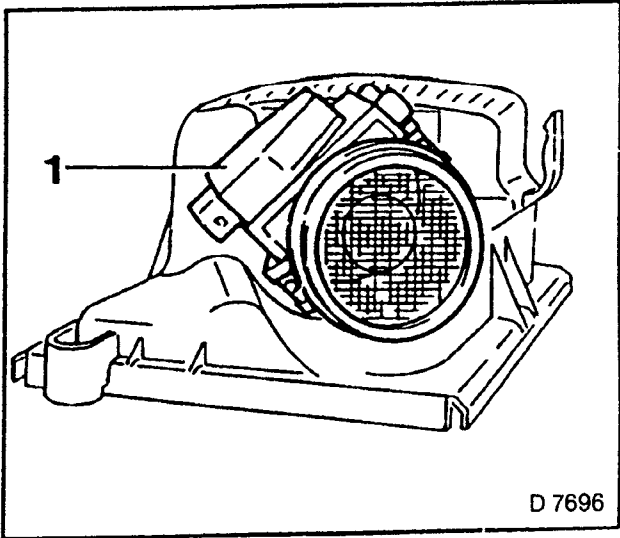


Fig. 641

INSTALL, CONNECT

- 1. Hot-wire mass air flow meter with new seal ring in upper part of air cleaner.
- 2. Upper part of air cleaner with hot-wire mass air flow meter.

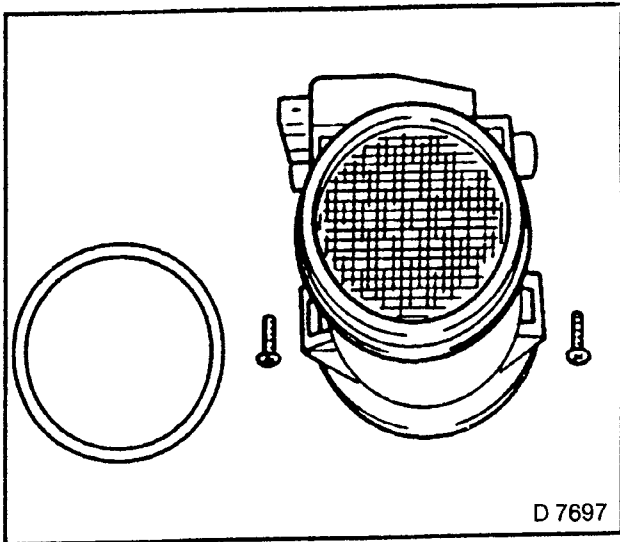


Fig. 642

INSTALL, CONNECT

- 1 Wiring plug (1) and,
- 2. Intake hose (3), to hot-wire mass air flow meter.
- 3. Ensure that intake hose is correctly seated.

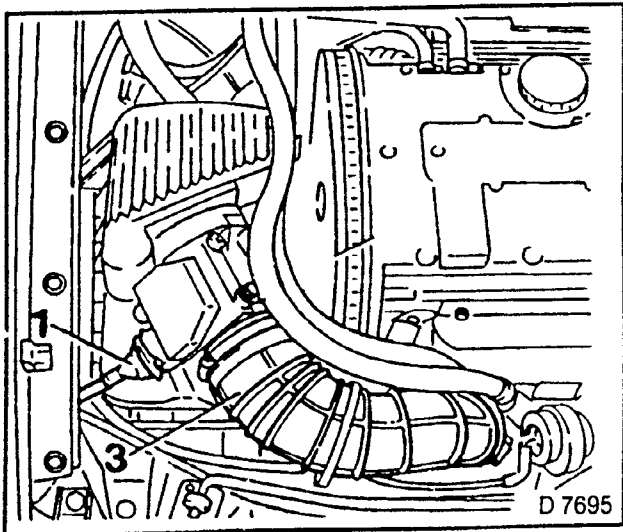


Fig. 643

Inductive Pulse Pick-up — Remove and Install

REMOVE, DISCONNECT

1. Disconnect wiring plug (1) — note routing of cables.

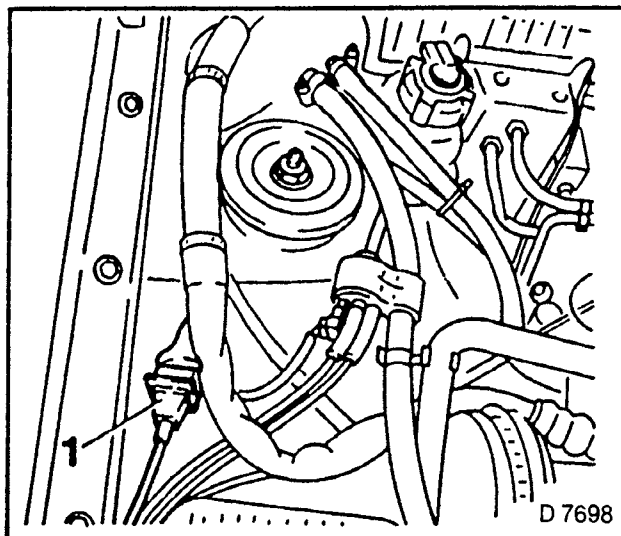


Fig. 644

REMOVE, DISCONNECT

1. Intake hose (1) between hot-wire mass air flow meter and turbocharger.

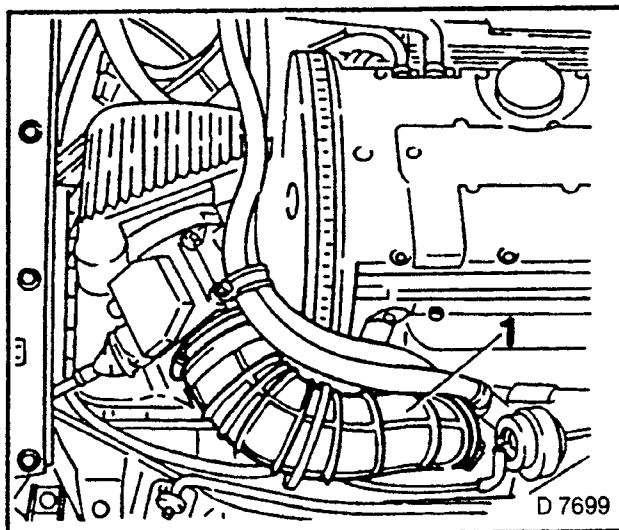


Fig 645

REMOVE, DISCONNECT

- 1 Inductive pulse pick-up with seal ring.

INSTALL, CONNECT

1. Inductive pulse pick-up with new seal ring — tightening torque 6 Nm.
2. Intake hose between hot-wire mass air flow meter and turbocharger.
3. Connect wiring plug.
4. Ensure that intake hose is correctly seated.

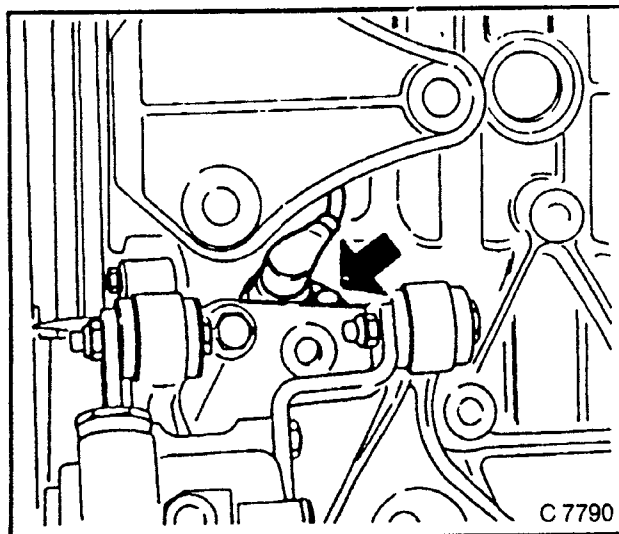


Fig 646

Fuel Pressure Regulator — Remove and Install

REMOVE, DISCONNECT

1. Throttle valve manifold cover.
2. Vacuum hose.
3. Fuel pressure regulator (1) from fuel distributor pipe.

WARNING:
FUEL ESCAPES
OBSERVE SAFETY MEASURES AND
NATIONAL REGULATIONS.

INSTALL, CONNECT

1. Fuel pressure regulator to fuel distributor pipe.
2. Vacuum hose to fuel pressure regulator.
3. Throttle valve manifold cover.

TIGHTEN (TORQUE)

1. Fuel pressure regulator to fuel distributor pipe — 4 Nm.
2. Throttle valve manifold cover to throttle valve manifold — 5 Nm.

Fuel Pressure — Check

REMOVE, DISCONNECT

1. Throttle valve manifold cover.
2. Slowly open screw cap (1) — pressure decreases.
3. Fuel pressure gauge KM-J-34730-1 or KM-J-34730-91 to checking connection
4. Bleed fuel pressure gauge.
5. Start engine — idle speed.

MEASURE

1. Fuel pressure.
2. Vacuum hose for fuel pressure regulator.
 Connected: 2,2 — 2,7 bar.
 Removed: 3,0 — 3,5 bar.

INSTALL, CONNECT

1. Throttle valve manifold cover —
 tightening torque 5 Nm.

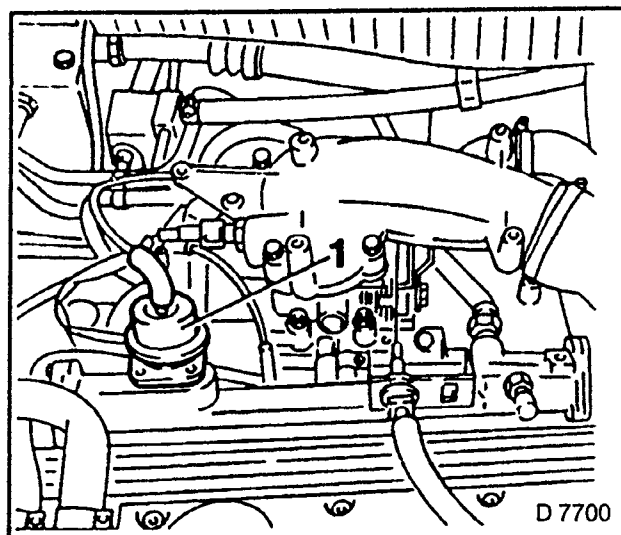


Fig. 647

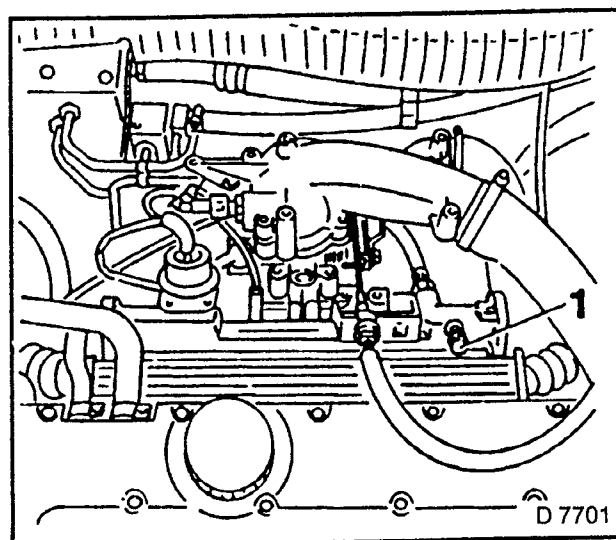


Fig. 648

Fuel Pump Relay — Remove and Install

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Front right footwell cover.
3. Fuel pump relay (1) from socket.

INSTALL, CONNECT

1. Fuel pump relay (1) in socket.
2. Front right footwell cover.
3. Ground cable to battery.

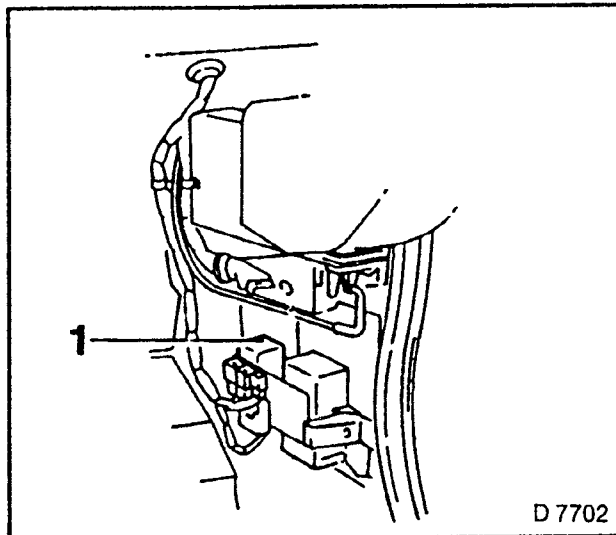


Fig. 649

Idle Speed Adjuster — Remove and Install

For clearer representation, Fig. 583 shows the idle speed adjuster with the engine removed.

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Alternator.
3. Throttle valve manifold cover
4. Hose (1) from throttle valve manifold and hose (2) from intake manifold.
5. Wiring plug from idle speed adjuster.
6. Idle speed adjuster — note routing of hoses.

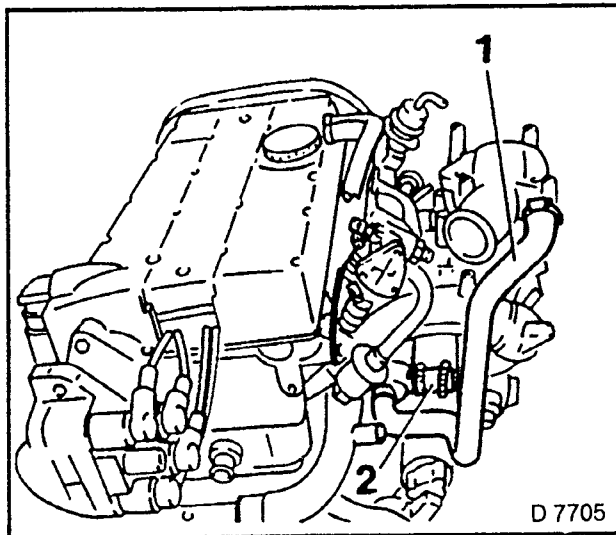


Fig. 650

INSTALL, CONNECT

1. Idle speed adjuster.
2. Hoses to intake manifold and to throttle valve manifold.
3. Wiring plug for idle speed adjuster.
4. Alternator.
5. Throttle valve manifold cover — tightening torque 5 Nm.
6. Ground cable to battery.

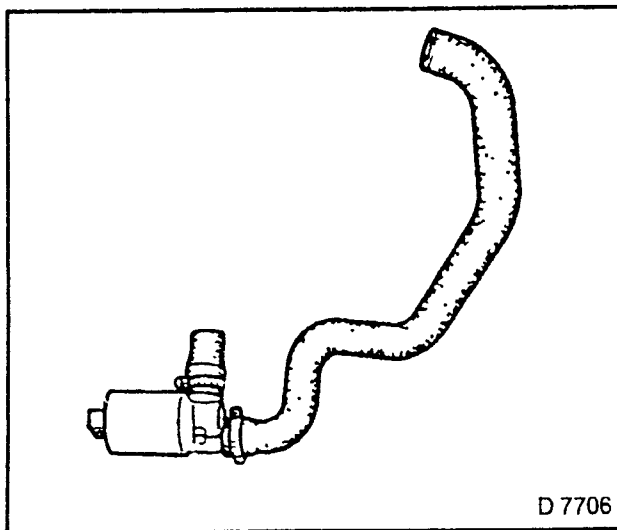


Fig 651

Control Unit — Remove and Install

REMOVE, DISCONNECT

1. Ground cable from battery.
2. Front right footwell cover.
3. Relay bracket.
4. Wiring plug for control unit.
5. Control unit.
6. Pressure vacuum hose (1) from control unit.

INSTALL, CONNECT

1. Pressure/vacuum hose to control unit.
2. Control unit.
3. Wiring plug for control unit.
4. Relay bracket.
5. Front right footwell cover.
6. Cover below glove compartment.
7. Ground cable to battery.

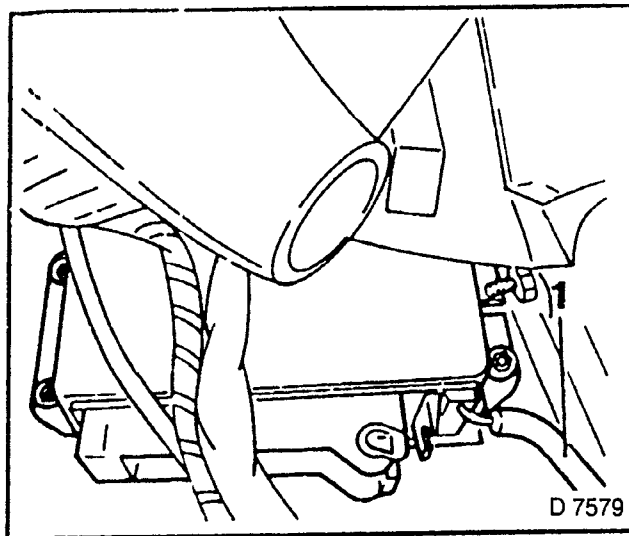


Fig. 652

Tank Vent Valve — Remove and Install

REMOVE, DISCONNECT

1. Wiring plug for tank vent valve.
2. Hoses (1) and (2) — close off hose (2) (spring clamps).
3. Tank vent valve.
Hose 1 = connection to throttle body
Hose 2 = connection to active carbon canister.

INSTALL, CONNECT

1. Tank vent valve.
2. Hoses — remove spring clamps.
3. Wiring plug for tank vent valve.

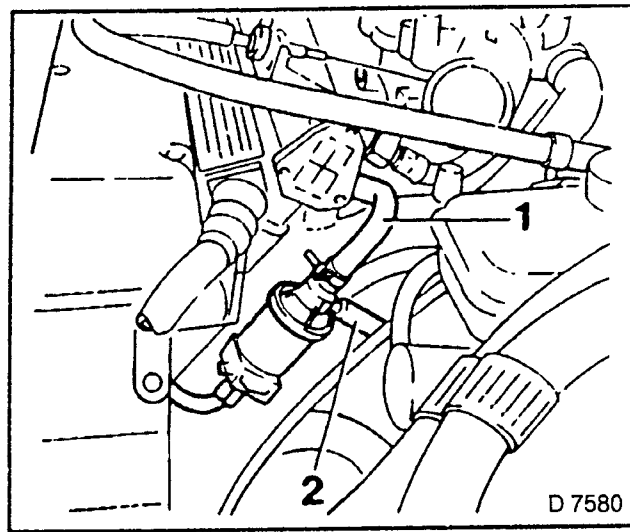


Fig. 653

Intake Air Temperature Sensor — Remove and Install

REMOVE, DISCONNECT

- 1. Throttle valve manifold cover.
- 2. Wiring plug for intake air temperature sensor.
- 3. Intake air temperature sensor (1) with seal ring.

INSTALL, CONNECT

- 1. Intake air temperature sensor (1) with new seal ring — Tightening torque 10 Nm.
- 2. Wiring plug for intake air temperature sensor.
- 3. Throttle valve manifold cover — tightening torque 5 Nm.

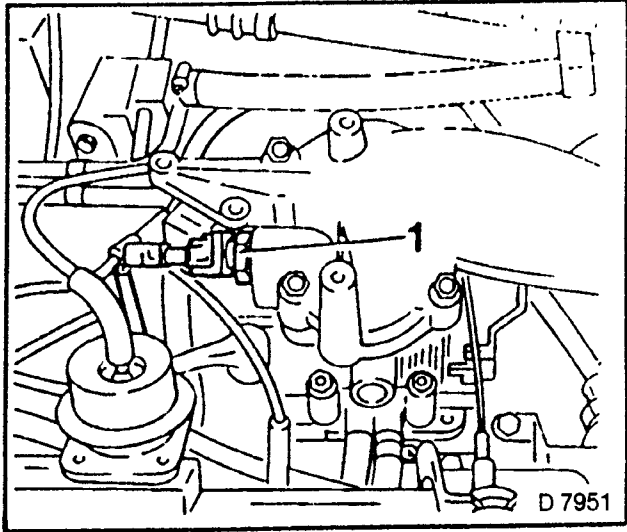


Fig. 654

Coolant Temperature Sensor — Remove and Install

REMOVE, DISCONNECT

- 1. Intake hose (1) between hot-wire mass air flow meter and turbocharger.

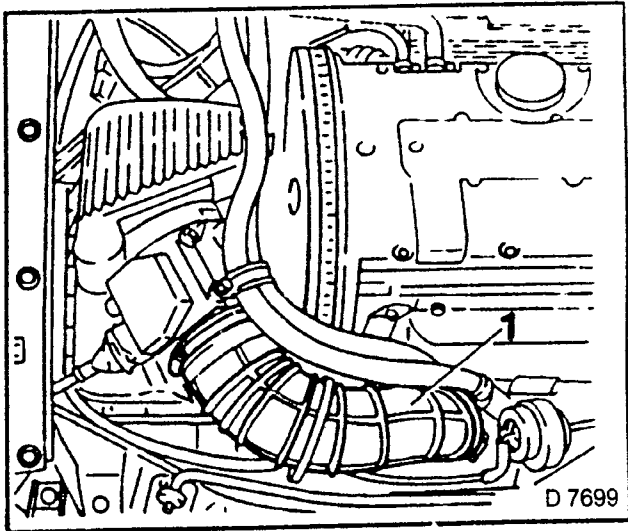


Fig 655

REMOVE, DISCONNECT

- 1. Wiring plug for coolant temperature sensor.
- 2. Coolant temperature sensor (1).
- 3. Coolant escapes — collect coolant.

INSTALL, CONNECT

- 1. Coolant temperature sensor with new seal ring — tightening torque 11 Nm.
- 2. Wiring plug (1) for coolant temperature sensor.
- 3. Intake hose between hot-wire mass air flow meter and turbocharger — ensure correct seating.
- 4. Top up and bleed cooling system.

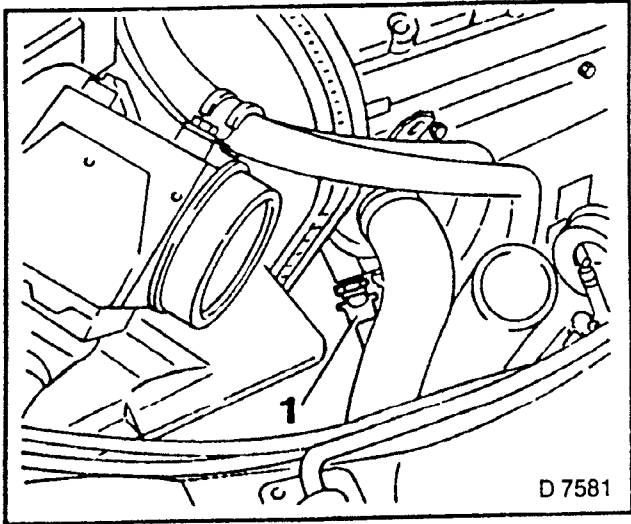


Fig. 656

Bypass Valve — Charge Pressure Control — Remove and Install

REMOVE, DISCONNECT

1. Wiring plug for bypass valve for charge pressure control.
2. Pressure/vacuum hoses — mark installation positions.
3. Bypass valve for charge pressure control from rubber bearing (1).

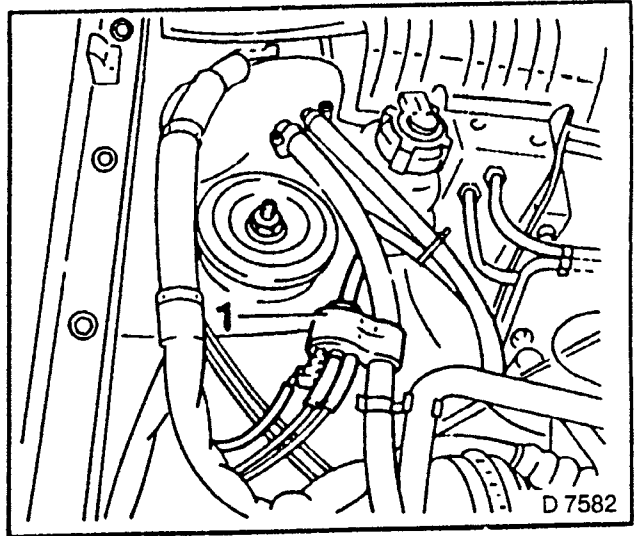


Fig. 657

INSTALL, CONNECT

1. Bypass valve for charge pressure control in rubber bearing (1).
2. Pressure/vacuum hoses — note marks made previously.
3. Wiring plug for bypass valve.

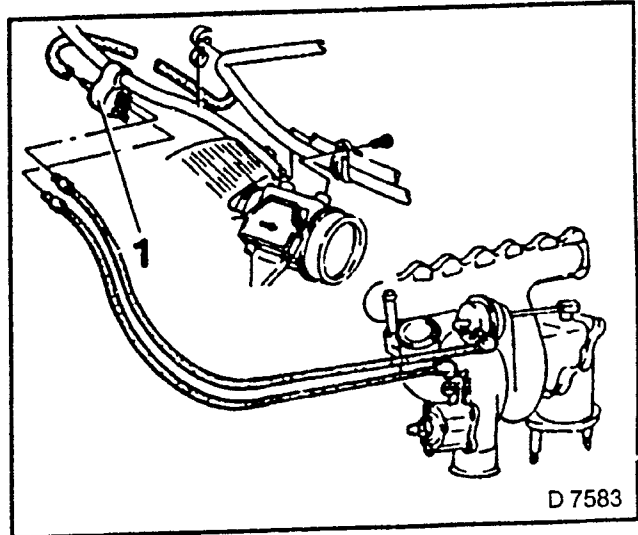


Fig. 658

Ignition Coil — Remove and Install

Ignition switched off.

REMOVE, DISCONNECT

1. Cable connections from ignition coil (1).
2. Wiring plug (2) from trigger box.
3. Ignition coil.

INSTALL, CONNECT

1. Ignition coil (1).
2. Wiring plug (2) to trigger box.
3. Cable connections to ignition coil.

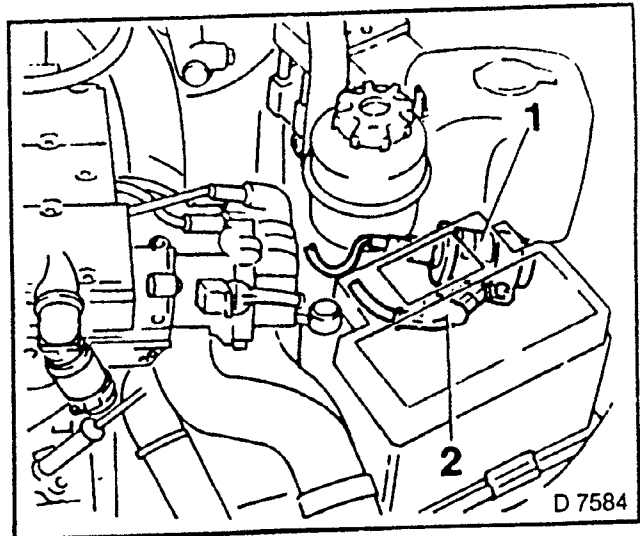


Fig. 659

Starter — Remove and Install

REMOVE, DISCONNECT

- 1. Ground cable from battery.
- 2. Upper starter bolt (arrow).
- 3. Engine compartment cover.
- 4. Intake pipe-cylinder block support, brake servo.
- 5. Vacuum hose from intake pipe (if necessary).
- 6. Cable connection from starter.
- 7. Starter support from cylinder block, lower starter bolt.

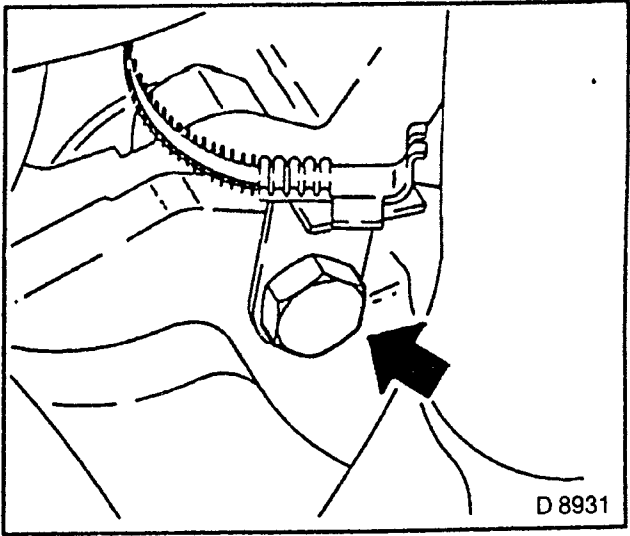


Fig. 660

TIGHTEN (TORQUE)

- 1. Starter to cylinder block (A) — 45 Nm.
- 2. Starter to cylinder block (transmission side) — 75 Nm.
- 3. Starter support to cylinder block (B) — 25 Nm.
- 4. Brake servo vacuum hose to intake pipe — 15 Nm.
- 5. Support to intake pipe and cylinder block — 25 Nm.
- 6. Connect cables.
- 7. Connect battery.
- 8. Ensure perfect condition and seating.
- 9. Install engine compartment cover.

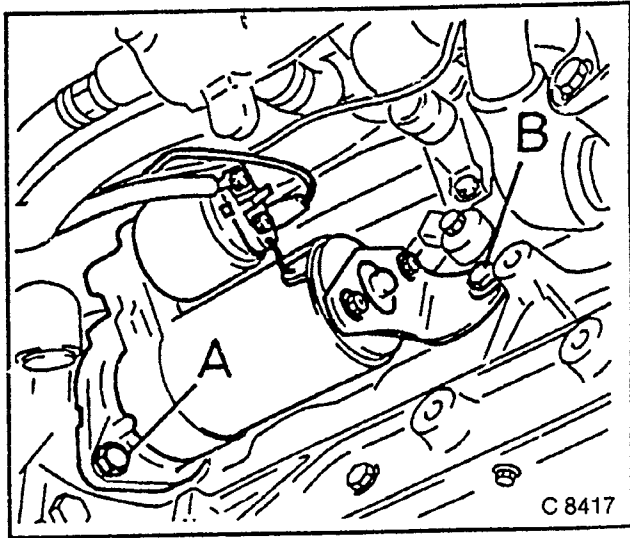


Fig 661

Alternator — Remove and Install

REMOVE, DISCONNECT

- 1. Ground cable from battery.
- 2. Air intake hose.
- 3. Throttle valve manifold cover
- 4. Upper alternator fastening from clamping bracket.
- 5. Remove V-belt.
- 6. Cable connections from alternator
- 7. Alternator from lower fastening.

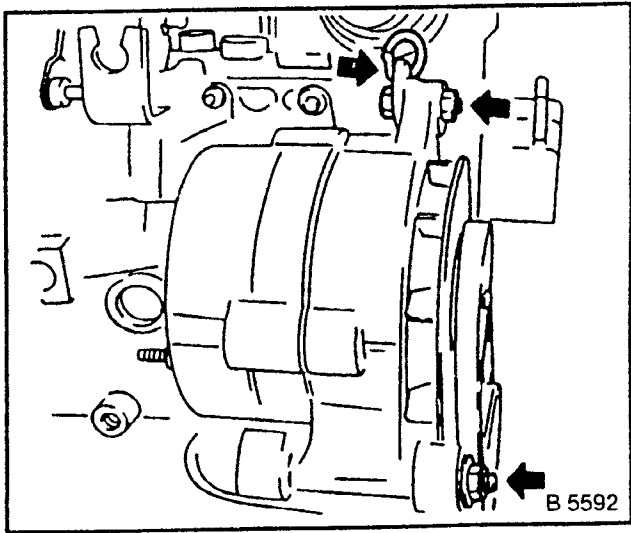


Fig 662

INSTALL, CONNECT

1. Alternator to bracket — 25 Nm.
2. Cable connections to alternator.
3. Ensure perfect condition and seating.
4. Install V-belt and tension.
5. Air intake hose.
6. Connect battery.

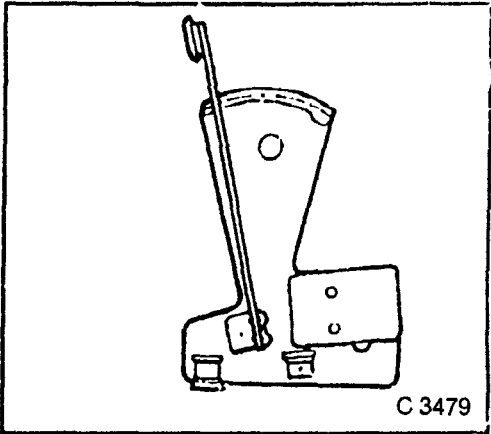


Fig. 663

SPECIAL SERVICE TOOLS

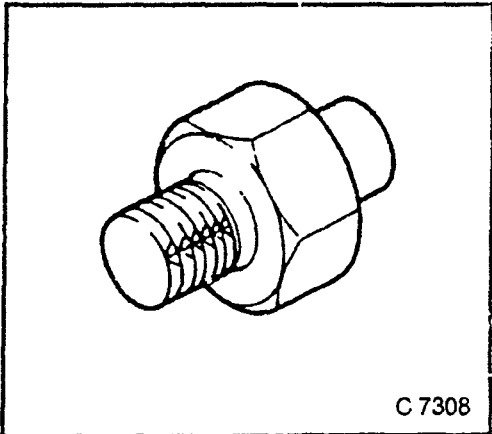
KM-128-A TENSION GAUGE

To check the V-belt tension.



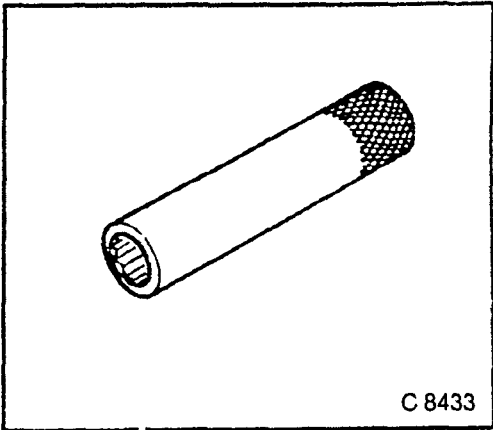
KM-135 ADAPTER

To measure engine oil pressure in conjunction with KM-498-B.



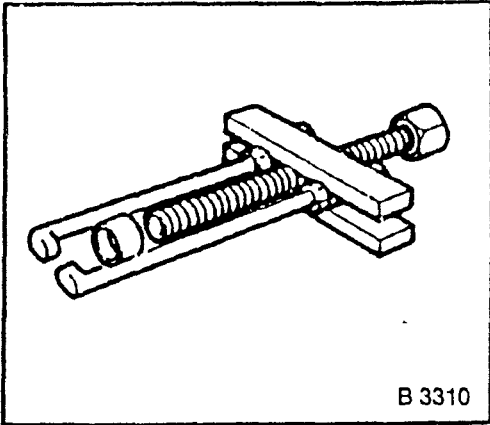
KM-194 SPARK PLUG WRENCH

To remove and install spark plugs with size 16 mm.



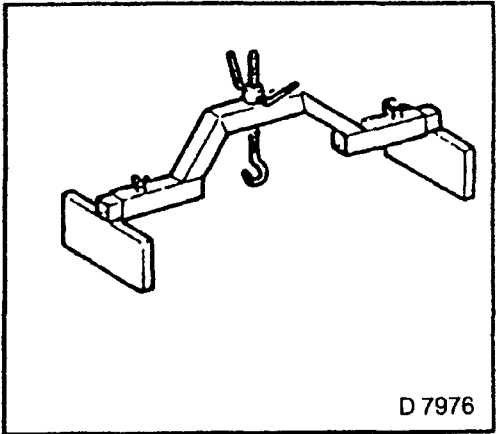
KM-210-A WHEEL PULLER

To remove toothed belt drive pinion in conjunction with KM-516 and KM-647.



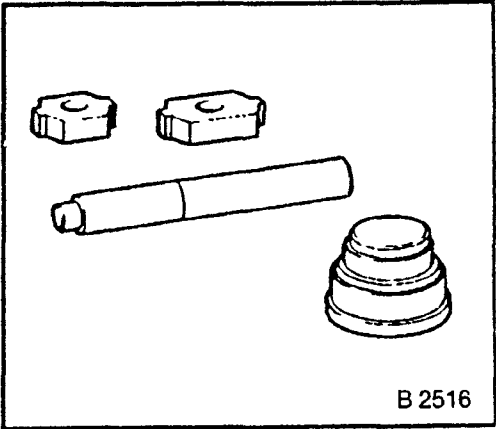
KM-263-B ENGINE LIFTER/HOLDER

Attach engine to lifter without cable to bracket with commercially available spring hook.



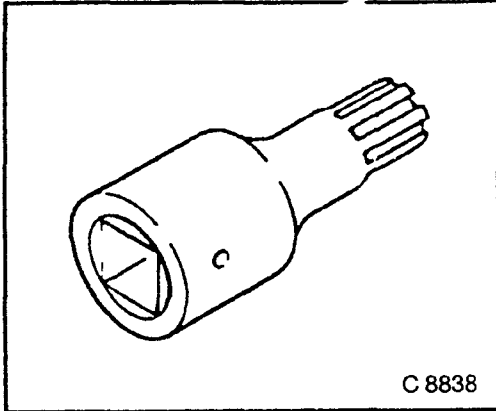
KM-266-A REMOVER/INSTALLER

To install starter bearing bushings/install TDC sensor sleeve.



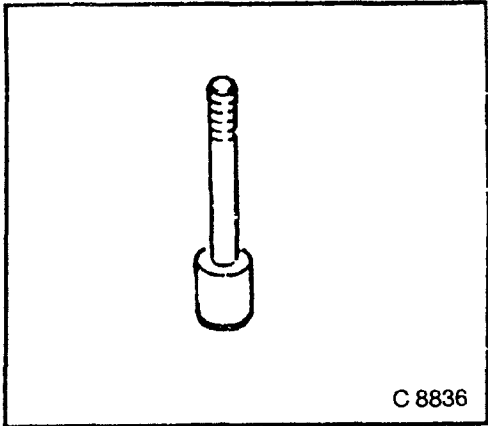
KM-321-A SPLINED WRENCH

To remove/install crankshaft pulley.



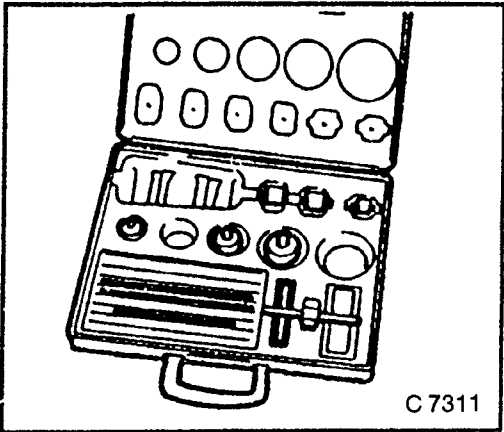
KM-328-8 PIN

To remove the rear crankshaft seal ring in conjunction with KM-469-4, KM-469-13-A and KM-665 (transmission installed).



KM-340-C VALVE CUTTER SET

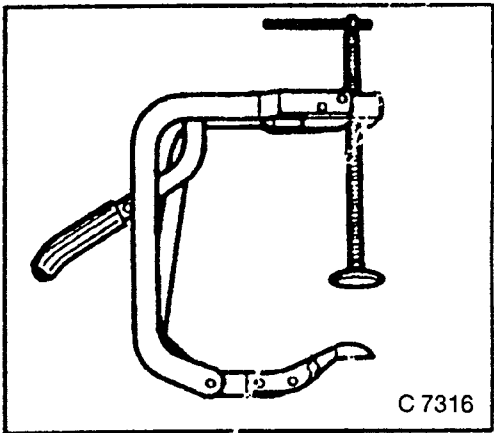
To cut, correct valve seat.



C 7311

KM-348 SPRING COMPRESSOR

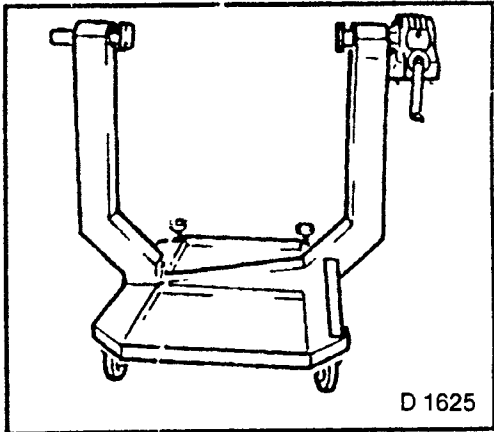
To compress valve spring in conjunction with KM-653.



C 7316

KM-412 ENGINE OVERHAUL STAND

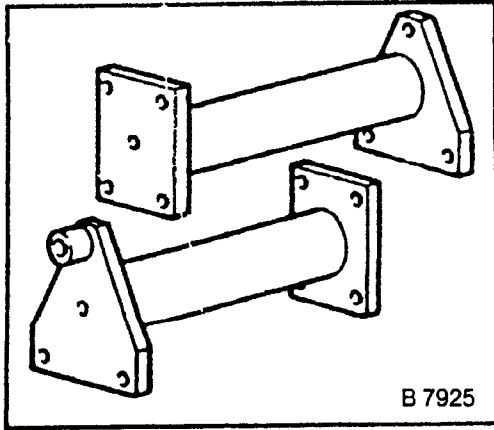
To hold removed engine.



D 1625

KM-412-8 ADAPTER

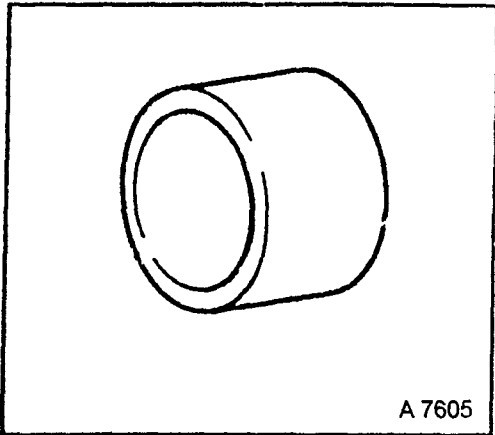
To hold removed engine in conjunction with KM-412.



B 7925

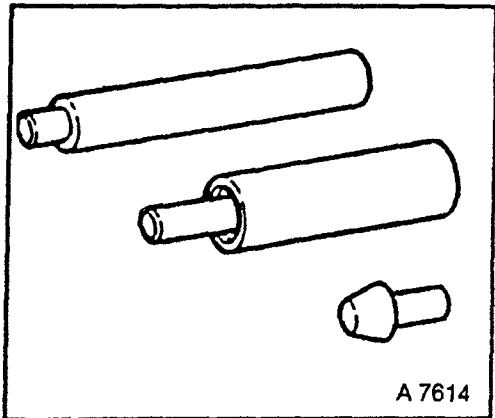
KM-422 REMOVER/INSTALLER

To install seal ring into camshaft carrier.



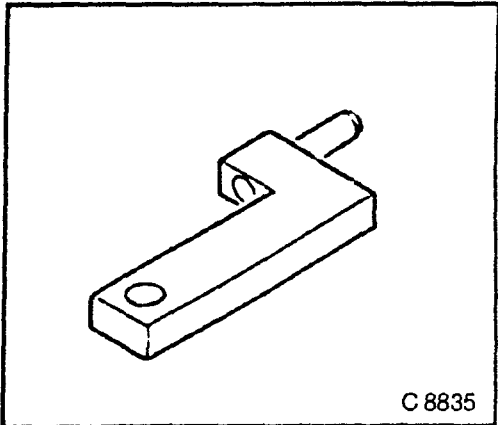
KM-427 REMOVER/INSTALLER

To install centring pin in engine block.



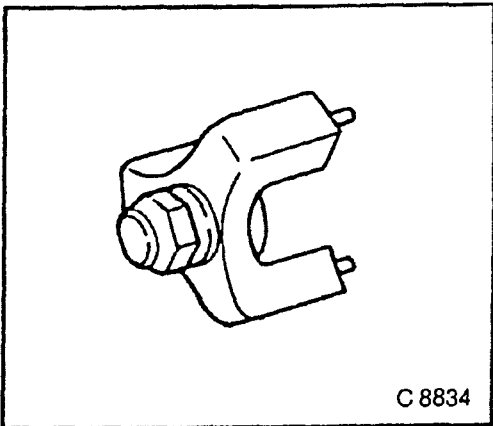
KM-469-4 SUPPORT

To remove rear crankshaft seal ring in conjunction with KM-328-8, KM-469-13-A and KM-665 (transmission installed).



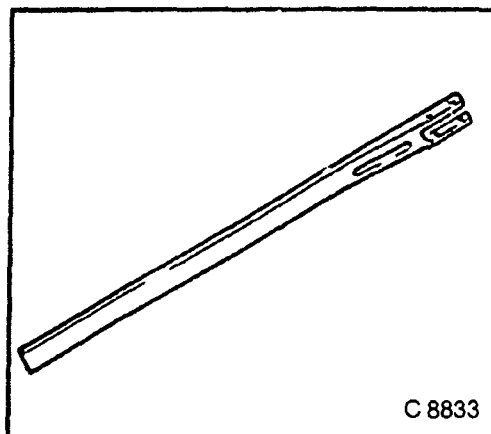
KM-469-12-B HEX BOLT

To install rear crankshaft seal ring in conjunction with KM-511-11, KM-635-1 and KM-635-2 (transmission installed).

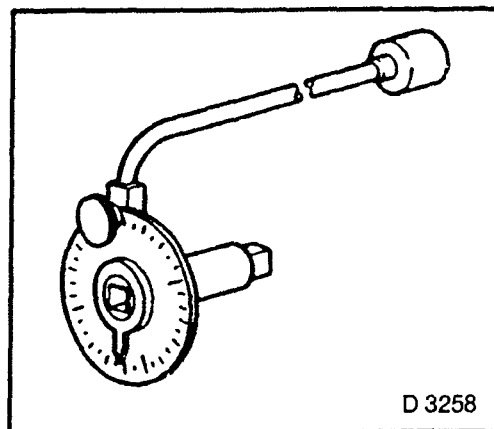


KM-469-13-A LEVER

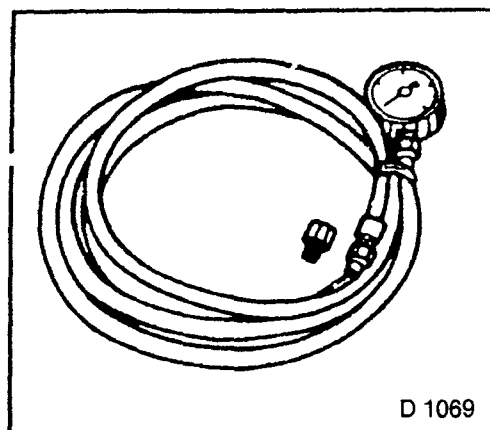
To remove rear crankshaft seal ring in conjunction with KM-328-8, KM-469-4 and KM-665 (transmission installed).

**KM-470-B ANGULAR TORQUE WRENCH**

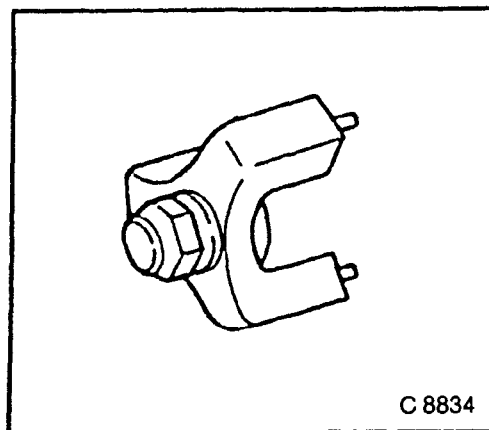
To tighten cylinder head bolts.

**KM-498-B PRESSURE GAUGE**

To check oil pressure in conjunction with KM-135.

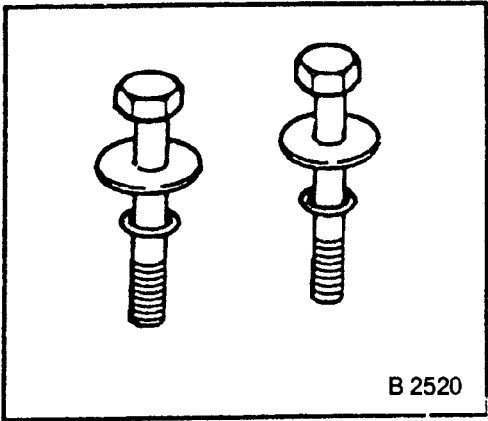
**KM-511-11 HOLDING PLATE**

To install crankshaft seal ring in conjunction with KM-469-12-B, KM-635-1 and KM-635-2 (transmission installed).



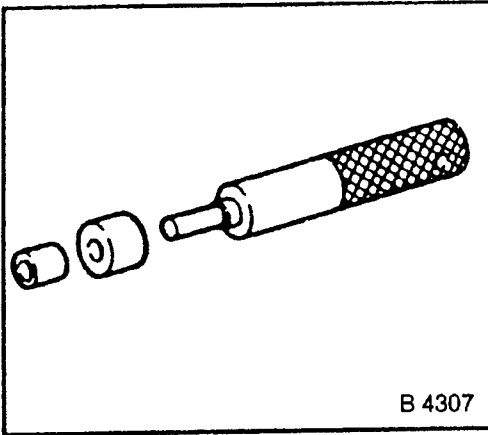
KM-516 PULLER SCREWS

To remove toothed belt drive gear in conjunction with KM-210-A and KM-647.



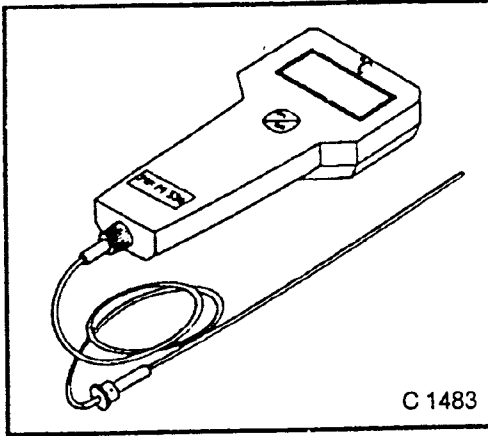
KM-535 INSTALLER

To install rear crankshaft seal ring in conjunction with KM-635-1 and KM-635-2 (transmission removed).



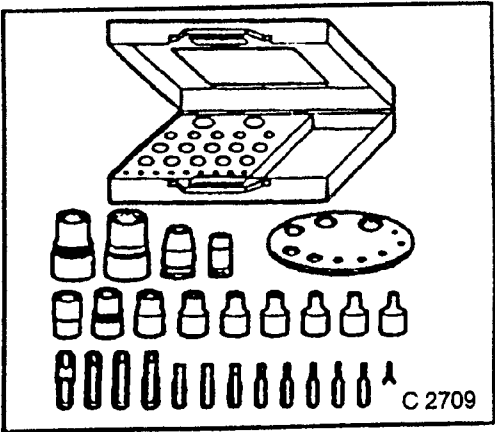
MKM-596 GAUGE

To measure oil temperature (special exhaust gas test — “ASU”).



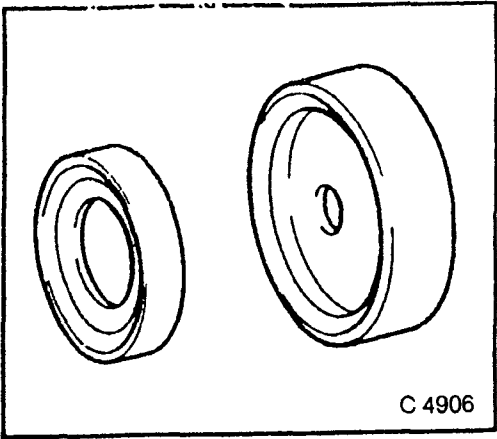
MKM-604-B TORX BIT AND SOCKET SET

To remove/install Torx bolts.



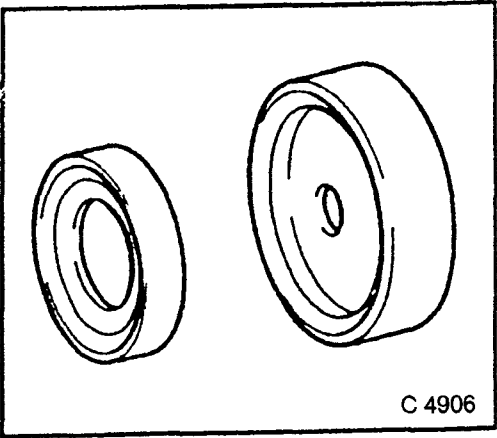
KM-635-1 PROTECTIVE SLEEVE

To install rear crankshaft seal ring in conjunction with KM-469-12-B, KM-511-11 and KM-635-2 (transmission installed) or KM-535 (transmission removed).



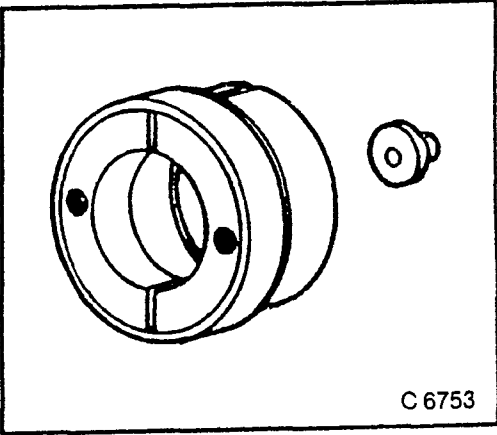
KM-635-2 THRUST RING

To install rear crankshaft seal ring in conjunction with KM-469-12-B, KM-511-11 and KM-635-2 (transmission installed) or KM-535 (transmission removed).



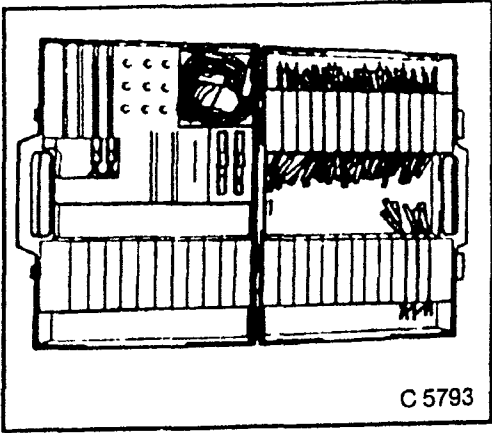
KM-647 REMOVER

To remove toothed belt drive gear in conjunction with KM-210-A and KM-516.



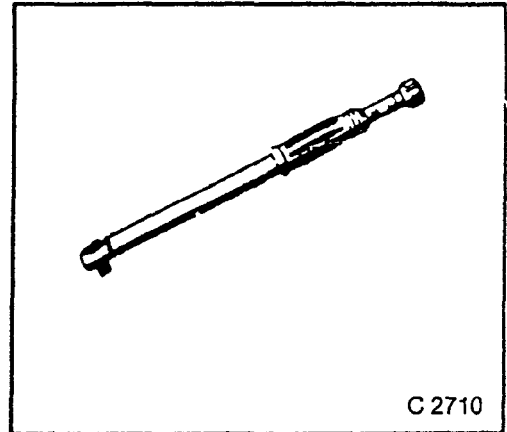
KM-609 ELECTRONIC KIT I

Diagnosis of electric and electronic systems.



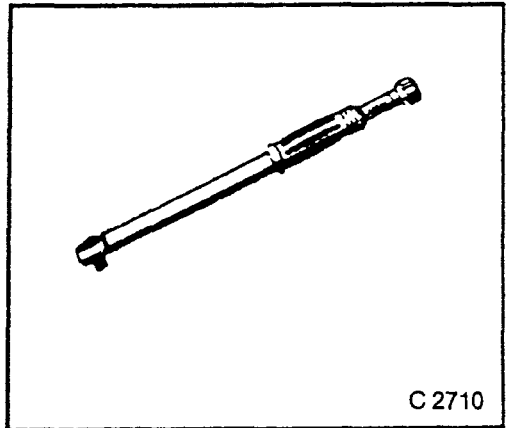
MKM-610 TORQUE WRENCH 1/2"
DRIVE

Measuring range 30 — 130 Nm.



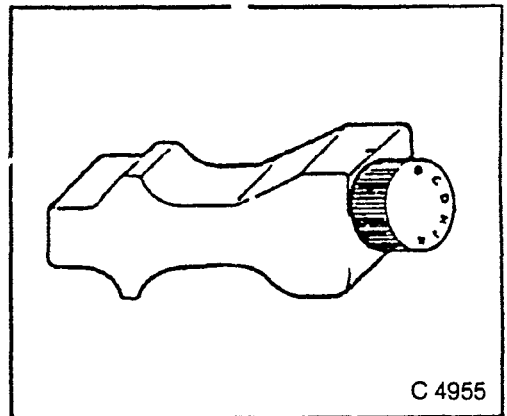
MKM-611 TORQUE WRENCH 3/8"
DRIVE

Measuring range 10 — 60 Nm.



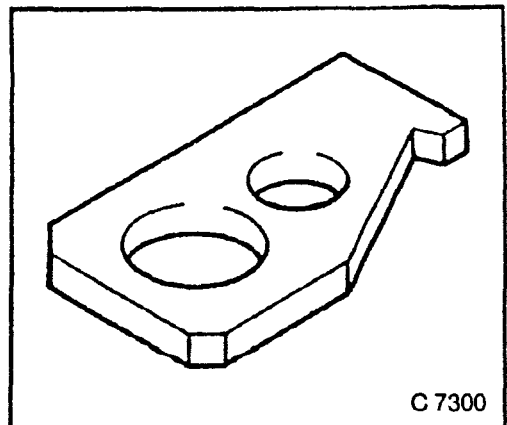
KM-640 DIAGNOSTIC SWITCH

To trigger blink code output, engines with self-diagnosis.



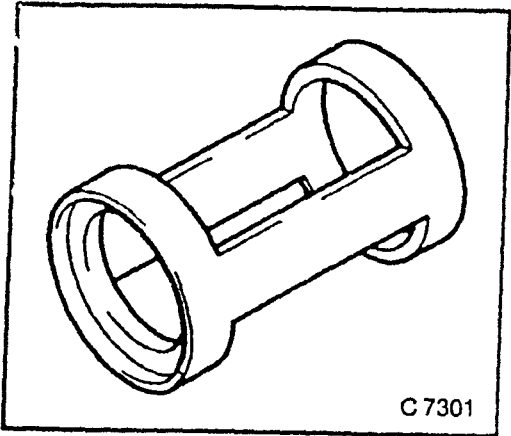
KM-652 FLYWHEEL LOCKING DEVICE

To lock the flywheel.



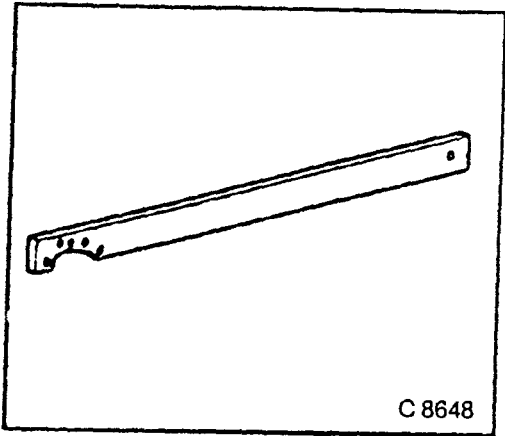
KM-653 ADAPTER

To tension valve spring in conjunction with KM-348.



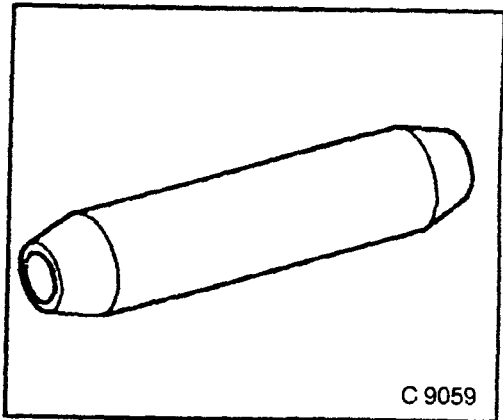
KM-662-A HOLDING WRENCH

To hold the toothed belt drive pinion when removing or installing fastening bolt.



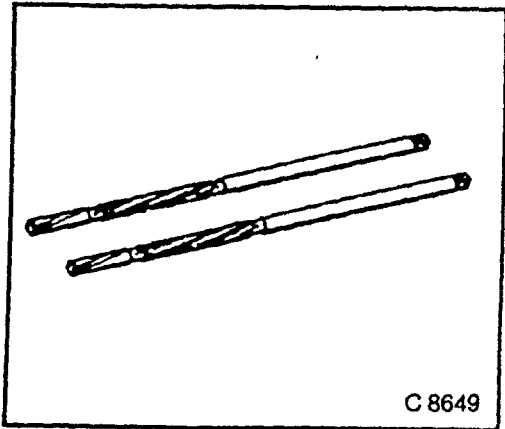
KM-663 INSTALLER

To install valve stem seal.



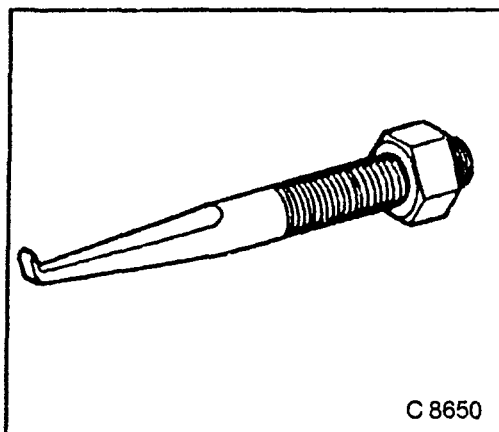
KM-664 REAMER SET

To ream valve guide.

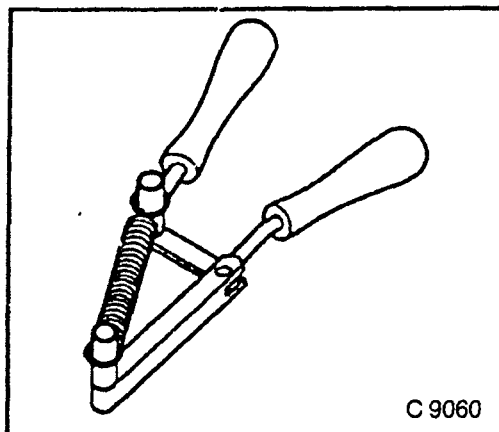


KM-665 REMOVER HOOK

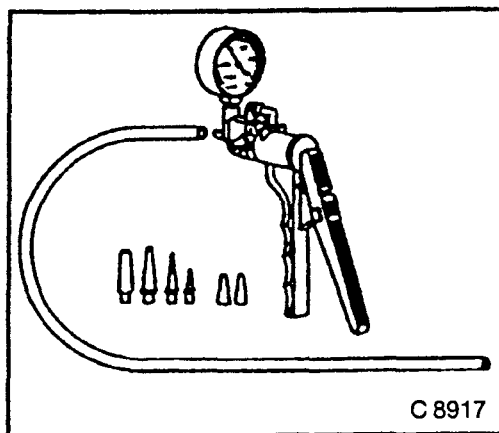
To remove rear crankshaft seal ring in conjunction with KM-328-8, KM-469-4 and KM-469-13-A (transmission installed)

**KM-666 ADJUSTER**

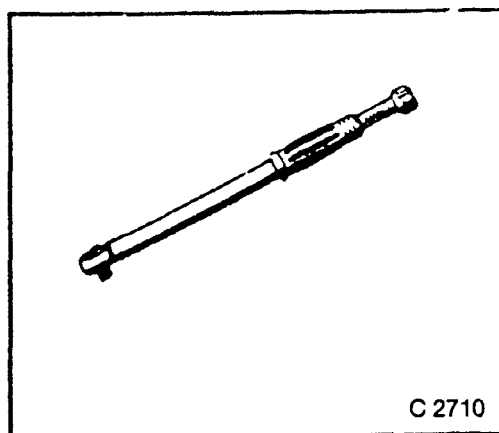
To adjust toothed belt tension.

**MKM-667 PRESSURE AND VACUUM PUMP**

To check for leaks on vacuum unit.

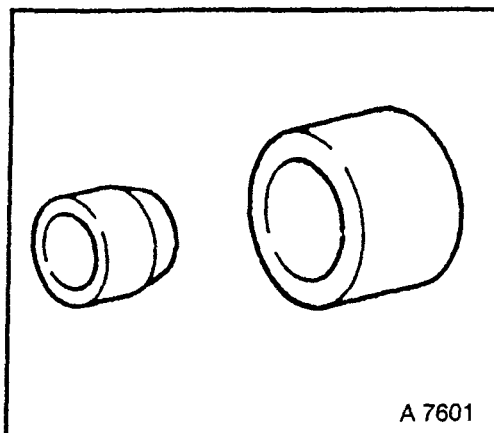
**MKM-669 TORQUE WRENCH**

Measuring range 50 — 300 Nm.

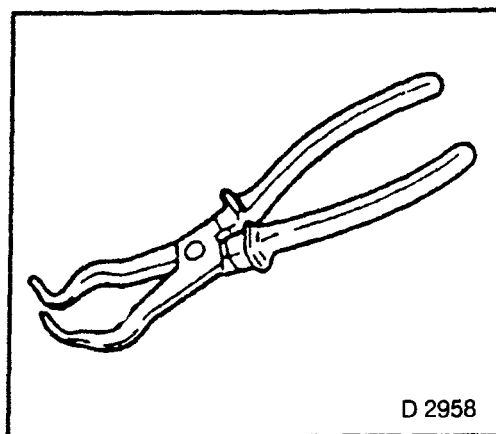


KM-693 ASSEMBLY SLEEVES

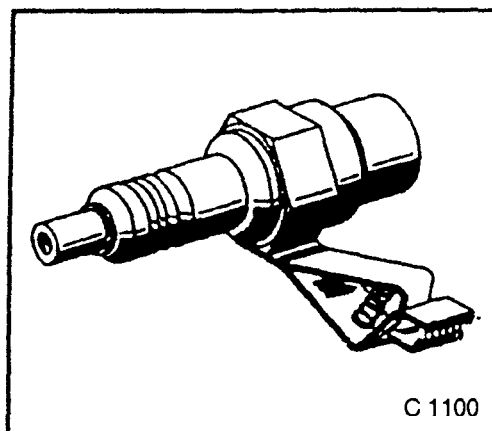
To install crankshaft front seal ring (in oil pump housing).

**KM-717 REMOVING PLIERS**

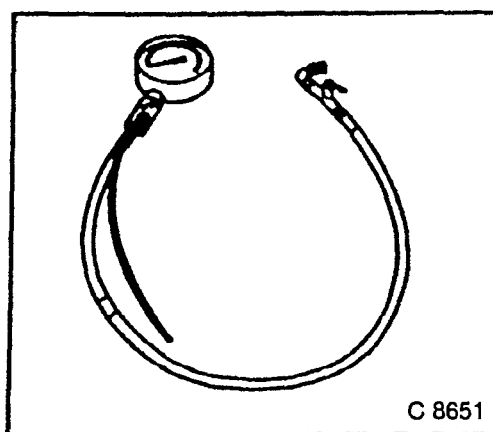
To remove spark plug connectors.

**KM-J-26792 SPARK TESTER**

To check ignition spark.

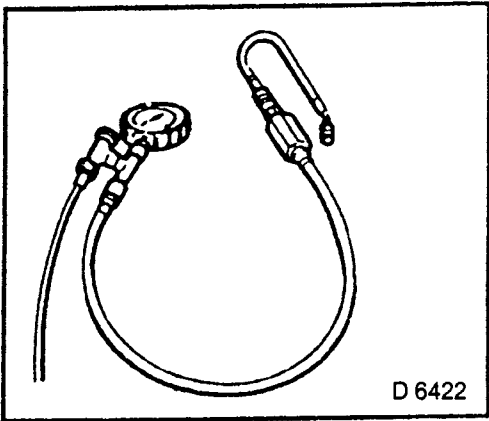
**KM-J-34730-1 PRESSURE GAUGE**

To check fuel pressure.



KM-J-34730-91 PRESSURE GAUGE

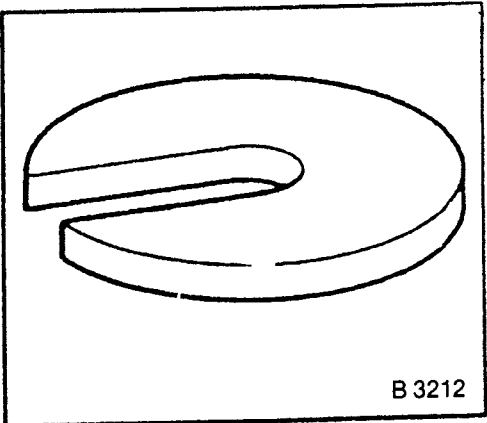
To check fuel pressure.



COOLING SYSTEM

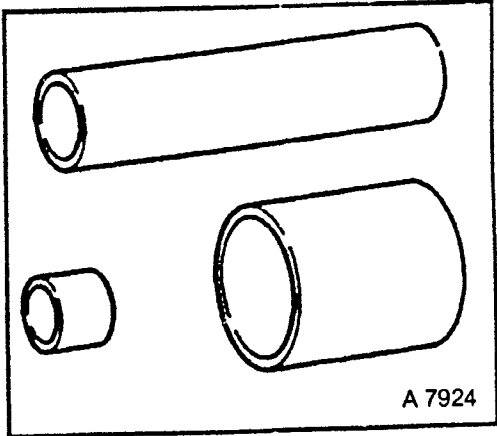
KM-251-01 REMOVER PLATE

To remove water pump drive and impeller.



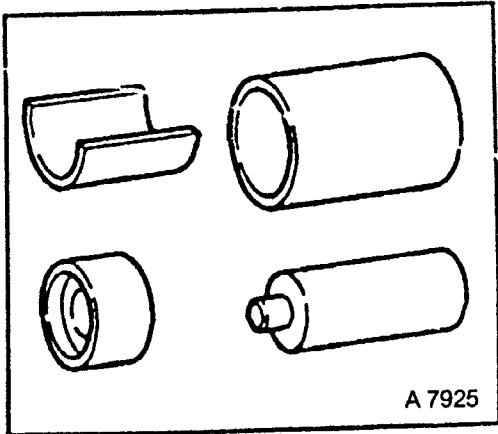
KM-258 INSTALLER SLEEVE

To disassemble and assemble water pump.



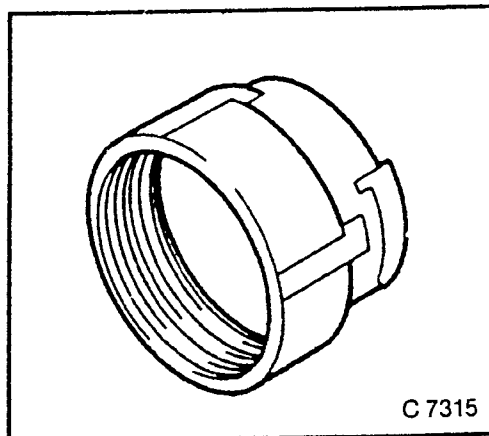
KM-265 INSTALLER

To assemble water pump.

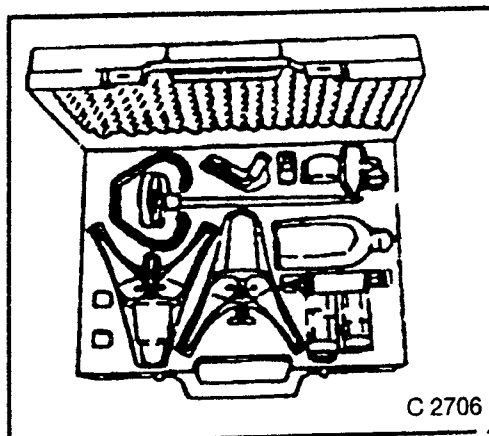


KM-471 ADAPTER

To check the cooling system under pressure in conjunction with MKM-601.

**MKM-601 TESTER (NO LONGER AVAILABLE)**

Diagnosis of cooling system in conjunction with KM-471.



Technical Data

COOLING	14 NV	C 16 NZ	C 16 SE	18 SE	20 SEH	20 XE	20 LET
RADIATOR							
Design:				Cross-flow			
Radiator core surface cm²	1690	1690	1690	1930	—	1930	2000

COOLANT FILLING QUANTITY

ANTI-FREEZE MIXTURE							
(SABS 1251)	6ℓ	6ℓ	6ℓ	7,5ℓ	7,5ℓ	7,5ℓ	7ℓ
(Ratio water to Glycol)	3,36:2,64	3,36:2,64	3,36:2,64	4,2:3,3	4,2:3,3	4,2:3,3	3,9:3,1
				When topping-up use Anti-freeze SABS 1251			

C 20 XE, C 20 LET

Fan	
Design	electric drive
Number of blades	5
Distribution in mm	assymetric
Diameter in mm	366
Thermoswitch	
Switches on at	100°C
Switches off at	95°C
Screw-type lid	
Boiling point	125°C
Opening pressure in kPa (bar)	120 to 135 (1,20 to 1,35)
Thermostat	
Start of opening	91°C
Fully open	107°C
Type	Bypass

TOOTHED BELT TENSION

Applies to engines without toothed belt tension roller:

Adjusting values*	C 18 SE, C 20 SEH
New toothed belt	
Cold	4,5
Warm	7,5
Used toothed belt	
Cold	2,5
Warm	7,0

*Correspond to indication on KM-510-A

Note: 1,4 and 1,6 ltr. engines equipped with automatic toothed belt tension roller
— retensioning not required

TURBOCHARGING SYSTEM

Type:	Exhaust Turbocharger (KKK16) with charge cooler
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OIL CIRCUIT

ENGINE OIL VISCOSITY

The following engine oils can be used:

- A = single grade oils
- B = multi-grade oils
- C = easy run oils

depending on the outside temperature, for both petrol and diesel engines:

ENGINE OIL QUALITY

It is important that the following API and CCMC classes be used:

Engines	Single and multi-grade oils	Easy run oils
Petrol	API - SF/CC, SF/CD, SG/CC, SG/CD CCMC - G4	API - SF/CC, SF/CD, SG/CD CCMC - G5

Important!
CD oils designated by manufacturers specially for diesel engines are not suitable for petrol engines, unless a suitable performance class for petrol engines (e.g. API-SF/CCMC — G4) is also indicated.

ENGINE OIL FILLING QUANTITIES

Engine	Filling with filter change* (litres)	Filling without filter change* (litres)	MIN to MAX (litres)
14 NV	3,5	3,25	1,00
C 16 NZ	3,5	3,25	1,00
C 16 SE	3,5	3,25	1,00
C 20 XE	4,8	4,50	1,00
C 20 LET	4,9	4,50	1,00

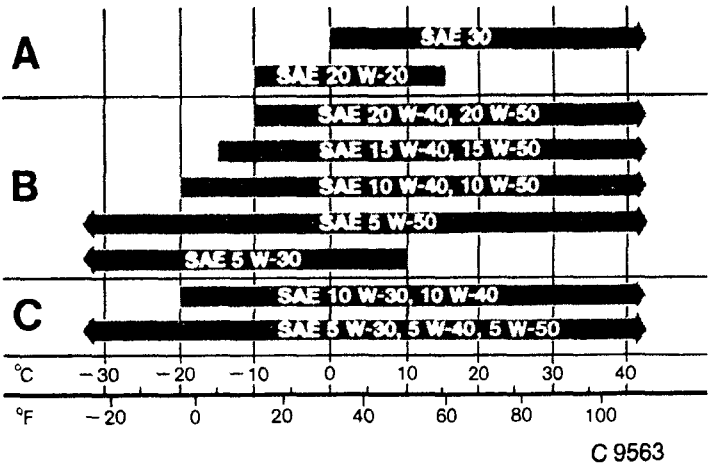
*Up to mark "MAX" on oil dipstick

DISPOSAL

Relevant national regulations are to be observed when disposing of used oil.

OIL PUMP

	14 Nv, C 16 NZ, C 16 SE	18 SE/20 SEH	C20 XE, C 20 LET
Backlash	0,1 to 0,2 mm	0,1 to 0,2 mm	0,1 to 0,2 mm
Recess of gears relative to housing	0,8 to 0,15 mm	0,03 to 0,1 mm	0,3 to 0,1 mm
Oil pressure at idle speed and engine at operating temp (oil temperature $\geq 80^{\circ}\text{C}$)	150 kPa (1,5 bar)	150 kPa (1,5 bar)	250 kPa (2,5 bar)/150 kPa (1,5 bar)
Oil drain plug	M 14 x 1,5	M 14 x 1,5	M 14 x 1,5



ADJUSTMENT VALUES, CHECKING VALUES

14 NV, C 16 NZ, C 16 SE, 18 SE, 20 SEH, 20 XE, 20 LET	
Valve clearance	Hydraulic valve lash adjustment: No adjustment necessary
Distributor dwell angle Distributor closing time	Electronic dwell angle control
Spark plug electrode gap	0,7 to 0,8 mm
Compression	The difference in compression between the individual cylinders in the engine must not exceed 100 kPa (1 bar).
Pressure loss test	Pressure loss per cylinder with engine in perfect condition must not be more than 25%.
Timing	Electronic Adjustment of timing, manual adjustment not possible

IDLE SPEEDS, CO CONTENT, IGNITION ADJUSTMENT

Engine	Idle speed in rpm		CO content in vol. %	Ignition timing at idle speed (w/o vacuum) in °CA BTDC
	Automatic trans.	Manual trans.		
14 NV		900 — 950	0,5 — 1,5	5
C 16 SE		820 — 980	2,0 — 2,5	10
C 16 NZ		780 — 940	2,0 — 2,5	10
18 SE	820 — 980	820 — 980	1,0 — 1,5	10
20 SEH		820 — 980	1,0 — 1,5	13 — 17
20 LET		860 — 1020	1,0 — 1,5	14 — 18
20 XELN		860 — 1020	1,0	14 — 18

When checking idle speed and CO content please note:

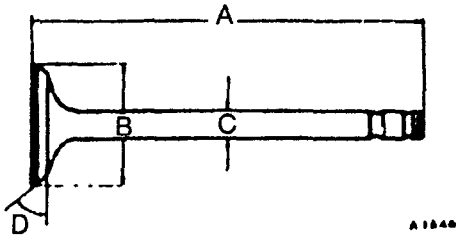
- Electrical consumers switched off
- Engine at operating temperature (oil temperature $\geq 70^{\circ}\text{C}$)

*Ignition adjustment not possible

CYLINDER HEAD

	14 NV	C 16 NZ, C 16 SE	18 SE, 20 SEH	C 20 XE, C 20 LET
Cylinder head gasket Thickness — installed	1,75 to 1,90	1,15 to 1,30	1,15 to 1,30	1,15 to 1,30
Valve seat width on cylinder head				
Inlet	1,3 to 1,5	1,3 to 1,5	1,0 to 1,5	1,0 to 1,4
Exhaust	1,6 to 1,8	1,6 to 1,8	1,7 to 2,2	1,4 to 1,8
Valve stem play				
Inlet	0,018 to 0,052	0,018 to 0,052	0,018 to 0,052	0,03 to 0,06
Exhaust	0,038 to 0,072	0,038 to 0,072	0,038 to 0,072	0,04 to 0,07
Permissible runout of valve stem to valve cone				
Inlet valve	0,03	0,03	0,03	0,03
Exhaust valve	0,03	0,03	0,03	0,03
Overall height of cyl. head (sealing surface to sealing surface)	95,25 ± 0,45	95,25 ± 0,45	95,25 ± 0,45	135,58 to 135,68 —
Installation height				Stem upper edge — valve spring disc bearing surface in cylinder head 38,50 to 39,70
Inlet and exhaust valves	14,4 (Gauge KM-419)	14,4 (Gauge KM-419)	17,85 to 18,25 (Gauge KM-512)	—
Installation height	80,85 to 81,25	80,85 to 81,25	83,50 to 83,80	—
Peak-to-valley height of sealing surf.	max. 0,025	max. 0,025	max. 0,025	max. 0,025
Valve system		Valve lash adjuster (hydraulic)		
Valve lifter		—		
Valve rotator		Exhaust		
Valve play in mm		0		
Installation height, valve guide	—	—	—	10,70 to 11,00

VALVE
DIMENSIONS



14 NV	A in mm		B in mm	C (diameter in mm) and Identification				D in °
	1)	2)		Standard K	Oversize K 1 0,075	Oversize K 2 0,150	Oversize A C,250	
Inlet valve	105	104,6	33	<u>7,012</u> 6,998	<u>7,087</u> 7,073	<u>7,162</u> 7,148	<u>7,262</u> 7,248	46
Exhaust valve	105	104,6	29	<u>6,992</u> 6,978	<u>7,067</u> 7,053	<u>7,142</u> 7,128	<u>7,242</u> 7,228	46
Valve stem bore		—		<u>7,050</u> 7,030	<u>7,125</u> 7,105	<u>7,200</u> 7,180	<u>7,300</u> 7,280	—

1) Production 2) Service

C 16 NZ, C 16 SE	A in mm		B in mm	C (diameter in mm) and Identification				D in °
	1)	2)		Standard K	Oversize K 1 0,075	Oversize K 2 0,150	Oversize A 0,250	
Inlet valve	101,5	101,1	38	<u>7,012</u> 6,998	<u>7,087</u> 7,073	<u>7,162</u> 7,148	<u>7,262</u> 7,248	46
Exhaust valve	101,5	101,1	31	<u>6,992</u> 6,978	<u>7,067</u> 7,053	<u>7,142</u> 7,128	<u>7,242</u> 7,228	46
Valve stem bore		—		<u>7,050</u> 7,030	<u>7,125</u> 7,105	<u>7,200</u> 7,180	<u>7,300</u> 7,280	—

1) Production 2) Service

18 SE/20 SEH	A in mm		B in mm	C (diameter in mm) and Identification				D in °
	1)	2)		Standard K	Oversize K 1 0,075	Oversize K 2 0,150	Oversize A 0,250	
Inlet valve	104,2	103,8	41,8	<u>7,012</u> 6,998	<u>7,087</u> 7,073	<u>7,162</u> 7,148	<u>7,262</u> 7,248	46
Exhaust valve	104,2	103,6	36,5	<u>6,992</u> 6,978	<u>7,067</u> 7,053	<u>7,142</u> 7,128	<u>7,242</u> 7,228	46
Valve stem bore		—		<u>7,050</u> 7,030	<u>7,125</u> 7,105	<u>7,200</u> 7,180	<u>7,300</u> 7,280	—

1) Production 2) Service

VALVE
DIMENSIONS

C 20 XE	A in mm		B \varnothing in mm	C (\varnothing in mm) and Identification				D in °
	1)	2)		Standard K	Oversize K 1 0,075	Oversize K 2 0,150	Oversize A 0,250	
Intake valve	105	104,6	33 \pm 0,1	$\frac{6,970}{6,955}$	$\frac{7,045}{7,030}$	$\frac{7,120}{7,105}$	$\frac{7,220}{7,205}$	45°20
Exhaust valve	105	104,6	29 \pm 0,1	$\frac{6,960}{6,945}$	$\frac{7,035}{7,020}$	$\frac{7,110}{7,095}$	$\frac{7,210}{7,195}$	45°20
Valve stem bore hole	—			$\frac{7,015}{7,000}$	$\frac{7,090}{7,015}$	$\frac{7,165}{7,150}$	$\frac{7,415}{7,400}$	—
Valve stem projection	105	—	—	$\frac{40,3}{39,7}$	—	—	—	
Intake valve dimension F	—	104,6	—	$\frac{40,7}{40,1}$	$\frac{40,3}{39,7}$	$\frac{40,3}{39,7}$	—	—
Valve stem projection	105	—	—	$\frac{40,1}{39,5}$	—	—	—	—
Exhaust valve	—	104,6	—	$\frac{40,5}{39,9}$	$\frac{40,1}{39,5}$	$\frac{40,1}{39,5}$	—	—

1) Production 2) Service

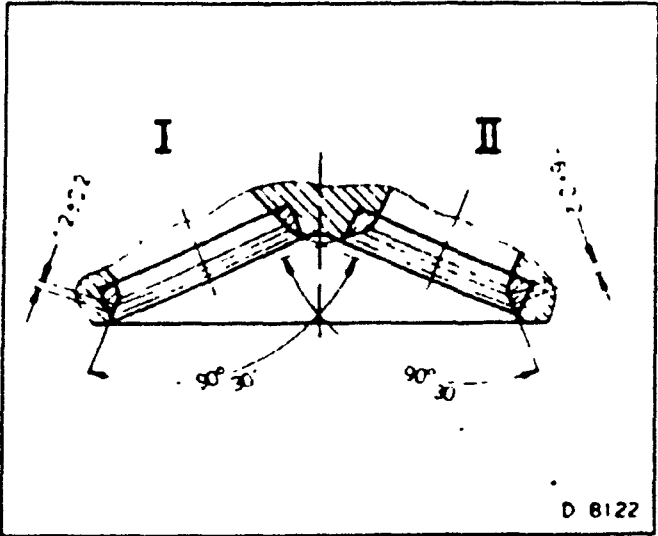
C 20 LET	A in mm		B \varnothing in mm	C (\varnothing in mm) and Identification mark			D
	1) 2)	2)		Standard K	Oversize K 1 0,075	Oversize K 2 0,150	
Inlet valve	105	104,6	33 \pm 0,1	$\frac{6,970}{6,955}$	$\frac{7,045}{7,030}$	$\frac{7,120}{7,105}$	44°40'
Exhaust valve	105	104,6	29 \pm 0,1	$\frac{6,960}{6,945}$	$\frac{7,035}{7,020}$	$\frac{7,110}{7,095}$	44°40'
Valve stem bore	—			$\frac{7,015}{7,000}$	$\frac{7,090}{7,075}$	$\frac{7,165}{7,150}$	—
Valve stem projection inlet valve: dimension E	105	—		$\frac{39,7}{39,1}$	—	—	
	—	104,6		—	$\frac{39,3}{38,7}$	$\frac{39,3}{38,7}$	
Valve stem projection exhaust valve: dimension F	105	—		$\frac{39,5}{38,9}$	—	—	
	—	104,6		—	$\frac{39,1}{38,5}$	$\frac{39,1}{38,5}$	

1) Production 2) Service

VALVE SEAT MACHINING

- I = Inlet valve
- II = Exhaust valve

Refacing at valve seat permissible up to 0,4 mm.



INTAKE AND EXHAUST CAMSHAFTS

Engine		C 20 XE/C 20 LET
Permissible radial runout	mm	0,04
Permissible end play	mm	0,04 to 0,144
Cam lift	mm	9,5
Crankshaft journal	∅ in mm	27,960
		27,939
Diameter in housing	in mm	28,021
		28,000

CAMSHAFT	14 NV	C 16 NZ	C 16 SE	18 SE	2,0 SEH
Identification letter	F	D	B	J	K
Identification colour					
Standard size	grey	brown	white	—	—
0,1 mm undersize	—	—	—	violet	violet
Radial runout in mm	0,04	0,04	0,04	0,04	0,03
End play in mm	0,09 to 0,21	0,09 to 0,21	0,09 to 0,21	0,09 to 0,21	0,09 to 0,21
Cam stroke in mm					
Inlet	6,12	5,61	5,61	6,67	6,67
Exhaust	6,12	6,12	6,12	6,67	—

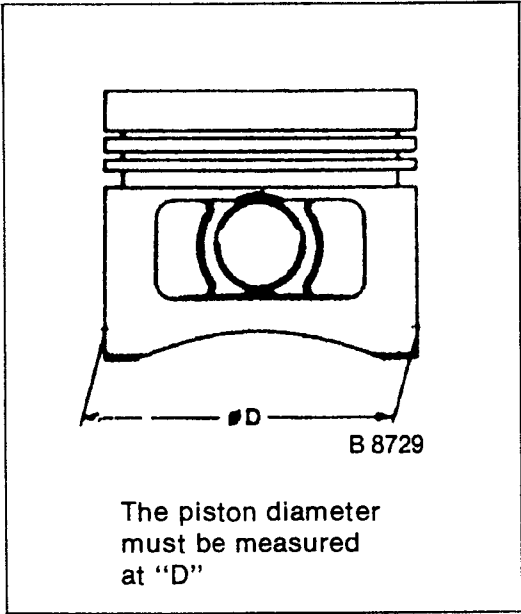
Grinding dimension for camshaft bearing position

Bearing	14 NV, C 16 NZ, C 16 SE		18 SE/2,0 SEH			
	Bearing journal diameter in mm	Diameter in housing	Bearing journal diameter in mm		Diameter in housing	
			Standard	-0,1 mm	Standard	-0,1 mm
1	39,455	39,525	42,470	42,370	42,525	42,425
	39,435	39,500	42,455	42,355	42,500	42,400
2	39,705	39,775	42,720	42,620	42,775	42,675
	39,685	39,750	42,705	42,605	42,750	42,650
3	39,955	40,025	42,970	42,870	43,025	42,925
	39,935	40,000	42,955	42,855	43,000	42,900
4	40,205	40,275	43,200	43,120	43,275	43,175
	40,185	40,250	43,205	43,105	43,250	43,150
5	40,455	40,525	43,470	43,370	43,525	43,425
	40,435	40,500	43,455	43,355	43,500	43,400

Crank Drive

CYLINDER GRINDING AND PISTON DIMENSIONS

14 NV



		Cylinder			Piston		
	Size	Cylinder bore Ø in mm		Coefficient for cylinder bore on crankcase	Respective piston Ø in mm		Coefficient for piston head
Production	1	over	to		over	to	
		<input type="checkbox"/> 77,555	77,565	6	<input type="checkbox"/> 77,535	77,545	6
		77,565	77,575	7	77,545	77,555	7
	2	77,575	77,585	8	77,555	77,565	8
		77,585	77,595	99	77,565	77,575	99
		77,595	77,605	00	77,575	77,585	00
		77,605	77,615	01	77,585	77,595	01
		77,615	77,625	02	77,595	77,608	02
	4	77,665	77,675	07	77,642	77,658	07
Service	Over-size 0,5 mm	78,065	78,075	7 + 0,5	<input type="checkbox"/> 78,042	78,058	7 + 0,5
Production	1	<input type="checkbox"/> 77,775	77,785	8	<input type="checkbox"/> 77,755	77,765	8
	2	77,785	77,795	99	77,765	77,775	99
		77,795	77,805	00	77,775	77,785	00
		77,805	77,815	01	77,785	77,795	01
Service	Over-size 0,5 mm	77,815	77,825	02	77,795	77,805	02
		<input type="checkbox"/> 78,265	78,275	7 + 0,5	78,245	78,255	7 + 0,5

☐ inclusive

CYLINDER GRINDING AND PISTON DIMENSIONS

C 16 NZ, C 16 SE

	Size	Cylinder			Piston		Coefficient for piston head
		Cylinder bore Ø in mm		Coefficient for cylinder bore on crankcase	Respective piston Ø in mm		
		over	to		over	to	
Production	1	□ 78,945	78,955	5	□ 78,925	78,935	5
		78,955	78,965	6	78,935	78,945	6
		78,965	78,975	7	78,945	78,955	7
		78,975	78,985	8	78,955	78,965	8
	2	78,985	78,995	99	78,965	78,975	99
		78,995	79,005	00	78,975	78,985	00
		79,005	79,015	01	78,985	78,995	01
		79,015	79,025	02	78,995	79,005	02
	3	79,025	79,035	03	79,005	79,015	03
		79,035	79,045	04	79,015	79,025	04
		79,045	79,055	05	79,025	79,035	05
		79,055	79,065	06	79,035	79,045	06
	4	79,065	79,075	07	79,045	79,055	07
		79,075	79,085	08	79,055	79,065	08
		79,085	79,095	09	79,065	79,075	09
		79,095	79,105	1	79,075	79,085	1
Service	Over-size 0,5 mm	79,465	79,475	7 + 0,5	79,445	79,455	7 + 0,5
		79,475	79,485	8 + 0,5	79,455	79,465	8 + 0,5
		79,485	79,495	9 + 0,5	79,465	79,475	9 + 0,5
		79,495	79,505	0 + 0,5	79,475	79,485	0 + 0,5

□ inclusive

18 SE

	Size	Cylinder		Respective piston Ø in mm	Coefficient for piston head
		Cylinder bore Ø in mm	Coefficient for cylinder bore on crankcase		
Production	2	84,78	8	84,76	8
		84,79	99	84,77	99
		84,80	00	84,78	00
		84,81	01	84,79	01
		84,82	02	84,80	02
Service	Over-size 0,5 mm	85,27	7 + 0,5	85,28	

CYLINDER GRINDING AND PISTON DIMENSIONS

20 SEH

	Size	Cylinder		Respective piston Ø in mm	Coefficient for piston head
		Cylinder bore Ø in mm	Coefficient for cylinder bore on crankcase		
Production	2	85,98	8	85,96	8
		85,99	99	85,97	99
		86,00	00	85,98	00
		86,01	01	85,99	01
		86,02	02	86,00	02
Service	Over-size 0,5 mm	86,47	7 + 0,5	86,45	

Crank Drive

CYLINDER GRINDING AND PISTON DIMENSIONS
C 20 XE

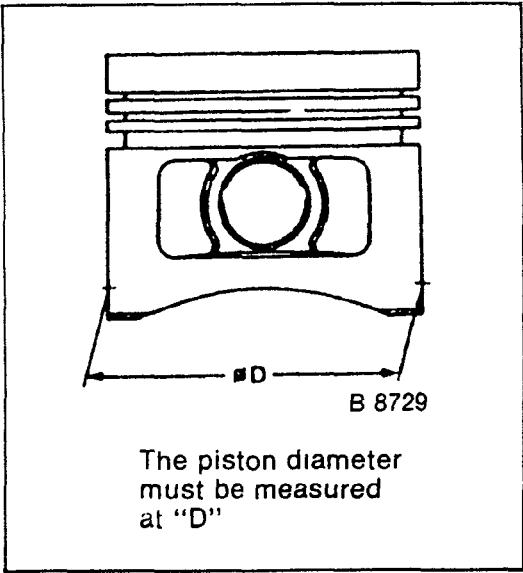
	Size	Cylinder			Coefficient for cylinder bore on crankcase	Piston		Coefficient for piston head
		Cylinder bore (Ø in mm)		Respective piston (Ø in mm)				
		over	to					
Production	1	□ 85,975	85,985	8	□ 85,945	85,955	8	
		85,985	85,995	99	85,955	85,965	99	
		85,995	86,005	00	85,965	85,975	00	
		86,005	86,015	01	85,975	85,985	01	
		86,015	86,025	02	85,985	85,995	02	
Service	Over- size 0,5 mm	86,465	86,475	7 + 0,5	86,435	86,445	7 + 0,5	
		86,475	86,485	8 + 0,5	86,445	86,455	8 + 0,5	
		86,485	86,495	9 + 0,5	86,455	86,465	9 + 0,5	
		86,495	86,505	0 + 0,5	86,465	86,475	0 + 0,5	

□ inclusive

C 20 LET

	Size	Cylinder			Coefficient for cylinder bore on crankcase	Piston		Coefficient on piston head
		Cylinder bore (Ø in mm)		Related piston (Ø in mm)		Coefficient on piston head		
		over	to					
Production	1	□ 85,975	85,985	8	□ 85,915	85,925	8	
		85,985	85,995	99	85,925	85,935	99	
		85,995	86,005	00	85,935	85,945	00	
		86,005	86,015	01	85,945	85,965	01	
		86,015	86,025	02	85,955	85,966	02	
Service	Over- size 0,5 mm	86,465	86,475	7 + 0,5	86,405	86,415	7 + 0,5	
		86,475	86,485	8 + 0,5	86,415	86,425	8 + 0,5	
		86,485	86,495	9 + 0,5	86,425	86,436	9 + 0,5	
		86,495	86,505	0 + 0,5	86,435	86,445	0 + 0,5	

□ inclusive



CYLINDER BORE 14 NV, C 16 NZ, C 16 SE, 18 SE/20 SEH, 20 XE, 20 LET

Reboring cylinder Permissible oversize up to 0,5 mm
(see parts microfiche)
After reboring the cylinders, destroy the original index on the crackcase and stamp in the new oversize index.

Bore	
Permissible out-of-round:	0,013*
Permissible taper:	0,013

*Measure out-of-round at four different levels of bore.

	14 NV	C 16 NZ, C 16 SE	18 SE/20 SEH	20 XE	20 LET
Piston projection above upper edge of cylinder block	0	0,4	0,4	0	0,4
PISTON	14 NV, C 16 NZ, C 16 SE, 18 SE, 20 SEH			20 XE	20 LET
Version	Troughed piston			Forged Piston	
Clearance	In short blocks and cylinder blocks with complete pistons, the piston clearance is 0,02 mm			0,02 — 0,04	0,05 — 0,07m
	In rebuilding (oversize), depending upon the piston available a clearance of 0,01 to 0,03 mm is permissible			0,02 — 0,04	

Piston Rings	14 NV	C 16 NZ, C 16 SE	18 SE, 20 SEH, 20 XE, 20 LET
Squared ring			
Height (mm)	1,5	1,2	1,5
Gap (mm)	0,3 to 0,5	0,3 to 0,5	0,3 to 0,5
Tapered ring			
Height (mm)	1,5	1,5	1,5
Gap (mm)	0,3 to 0,5	0,3 to 0,5	0,3 to 0,5
Oil scraper ring			
Height (mm)	3,0	3,0	3,0
Gap (mm)	0,40 to 1,40*)	0,40 to 1,40*)	0,40 to 1,40*)
Ring gap offset		180°**)	

*) Steel band ring gap
**) Note that the gap of the top steel band ring is displaced 25 to 50 mm to the left, and that of the bottom one 25 to 50 mm to the right, compared with the gap of the intermediate ring.

Piston Pins	14 NV	C 16 NZ, C 16 SE	18 SE, 20 SEH	20 XE	20 LET
Length	55	55	61,5		61,5
Diameter	18	18	21		21
Type	shrink-fit in con-rod			Floating bearing in Con-rod	
Play					
In piston	0,007 to 0,010	0,007 to 0,010	0,011 to 0,014	0,003 to 0,010	0,004 to 0,010
In con-rod	none	none	none	0,015 to 0,030	0,015 to 0,030
Installation	See operation "Con-rod, Replace" pages 59 and 217.				Sliding seat

CONNECTING ROD 14 NV, C 16 NZ, C 16 SE, 18 SE/20 SEH, 20 XE, 20 LET

Permissible weight variation of con-rods without pistons and bearing shells within an engine: 8 g.

As the con-rods have no counterweights, re-working is not possible.
Con-rods must be replaced only as a set.

18 SE/20 SEH — STANDARD SIZE

Bearing journals and colour code	from 57,971	<div><div>26,002</div><div>25,950</div></div>	<div><div>48,988</div><div>48,970</div></div>	<div><div>26,580</div><div>26,460</div></div>	<div><div>26,390</div><div>26,338</div></div>
	to 57,979 white				
	over 57,979				
	to 57,987 green				
	over 57,987 brown				
	to 57,995				

	Crankshaft bearing I, II, IV, V	Guide bearing III	Con-rod bearing 1 to 4	
Bearing shell code Colour code and stamped code identification	brown — 662 N green — 663 N	brown — 655 N green — 656 N		

18 SE/20 SEH — 0,25 mm UNDERSIZE FOR PRODUCTION AND SERVICE

Bearing journal and colour code	from 57,7320 green/	<div><div>26,202</div><div>26,150</div></div>	<div><div>48,738</div><div>48,720</div>blue</div>	<div><div>26,580</div><div>26,460</div></div>	—
	to 57,7385 blue				
	over 57,7385 brown/				
	to 57,7450 blue				

	Crankshaft bearing I, II, IV, V	Guide bearing III	Con-rod bearing 1 to 4	
Bearing shell code Colour code and stamped code identification	brown/blue — 664 A green/blue — 665 A	brown/blue — 657 A green/blue — 658 A		

18 SE/20 SEH — 0,50 mm UNDERSIZE FOR SERVICE

Bearing journals and colour code	from 57,4820 green/	<div><div>26,402</div><div>26,350</div></div>	<div><div>48,488</div><div>48,470</div>white</div>	<div><div>26,580</div><div>26,460</div></div>	—
	to 57,4885 white				
	over 57,4885 brown/				
	to 57,4950 white				

	Crankshaft bearing I, II, IV, V	Guide bearing III	Con-rod bearing 1 to 4	
Bearing shell code Colour code and stamped code identification	brown/white — 666 B green/white — 667 B	brown/white — 659 B green/white — 660 B		

C 20 XE

	Crankshaft bearing journals I, II, III, IV, V	Guide bearings III	Con-rod journals 1 to 4		Con-rod width
	diameter in mm	width in mm	diameter in mm	width mm	mm

STANDARD SIZE FOR PRODUCTION AND SERVICE

Crankshaft and con-rod bearing journals Colour code	from 57,9740	<div><div>26,002</div><div>25,950</div></div>	<div><div>48,988</div><div>48,970</div></div>	<div><div>26,580</div><div>26,460</div></div>	<div><div>26,390</div><div>26,338</div></div>
	to 57,9810 white				
	over 57,9810				
	to 57,9880 green				
	over 57,9880 brown				
	to 57,9950				

	Crankshaft bearing I, II, IV, V	Guide bearings III	Con-rod journals 1 to 4
Bearing shells colour top: code below:	brown green	brown green white	
Bearing shells code top: code below:	GM 74, GM 985 GM 15 662 N	GM 74, GM 985 GM 15 655 N	
		GM 74, GM 985 GM 15 656 N	
	GM 74, GM 985 GM 15 663 N	GM 74, GM 985 GM 15 126 N	

0,25 mm UNDERSIZE FOR PRODUCTION AND SERVICE

Crankshaft and con-rod bearing journals Colour code	from 57,7320 green/ to 57,7385 blue over 57,7385 brown/ to 57,7450 blue	<u>26,202</u> 26,150	<u>48,738</u> 48,720	<u>26,580</u> 26,460	<u>26,390</u> 26,338
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	Crankshaft bearing I, II, IV, V	Guide bearings III	Con-rod journals 1 to 4
Bearing shells colour top: code below:	brown/blue green/blue	brown/blue green/blue	blue
Bearing shells code*) top: code below:	GM 74, GM 985, GM 15 664 A	GM 74, GM 985, GM 15 657 A	
	GM 74, GM 985, GM 15 665 A	GM 74, GM 985, GM 15 658 A	

*Alternatively

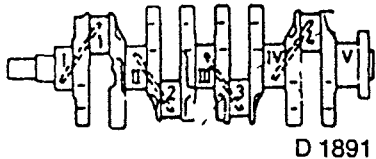
0,25 mm UNDERSIZE FOR SERVICE

Crankshaft and con-rod bearing journals Colour code	from 57,4820 green/ to 57,4885 white over 57,4885 brown/ to 57,4950 white	<u>26,402</u> 26,350	<u>48,488</u> 48,470	<u>26,580</u> 26,460	<u>26,390</u> 26,338
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	Crankshaft bearing I, II, IV, V	Guide bearings III	Con-rod journals 1 to 4
Bearing shells colour top: code below:	brown/white green/white	brown/white green/white	
Bearing shells code*) top: code below:	GM 74, GM 985, GM 15 666 B	GM 74, GM 985, GM 15 659 B	
	GM 74, GM 985, GM 15 661 B	GM 74, GM 985, GM 15 660 B	

*Alternatively

CRANKSHAFT GRINDING DIMENSIONS 20 LET

 D 1891	Crankshaft journals I, II, III, IV, V	Guide bearing III	Con-rod journals 1 to 4		Con-rod width
	diameter in mm	width in mm	diameter in mm	width mm	mm

STANDARD SIZE

Bearing journals and colour code	from 57,9620	26,002	48,988	26,580	26,390
	to 57,9885				
	over 57,9885				
	green	25,950	48,970	26,460	26,338
	brown				

	Crankshaft bearing I, II, IV, V	Guide bearing III	Con-rod bearing 1 to 4	
Bearing shell code Colour code and stamped code	brown — 662 N green — 663 N	brown — 655 N green — 656 N	—	

0,25 mm UNDERSIZE FOR PRODUCTION AND SERVICE					
Bearing journals and colour code	from 57,7320	26,202	48,738	26,580	26,390
	to 57,7385				
	over 57,7385				
	green	26,150	48,720	26,460	26,338
	blue				
	brown				
	blue				

	Crankshaft bearing I, II, IV, V	Guide bearing III	Con-rod bearing 1 to 4	
Bearing shell code Colour code and stamped code	brown/blue — 664 A green/blue — 665 A	brown/blue — 657 A green/blue — 658 A	blue	

0,50 mm UNDERSIZE FOR SERVICE					
Bearing journals and colour code	from 57,4820	26,402	48,488	26,580	26,390
	to 57,4885				
	over 57,4885				
	green	26,350	48,470	26,460	26,338
	white				
	brown				
	white				

	Crankshaft bearing I, II, IV, V	Guide bearing III	Con-rod bearing 1 to 4	
Bearing shell code Colour code and stamped code	brown/white — 666 B green/white — 667 B	brown/white — 659 B green/white — 660 B	white	

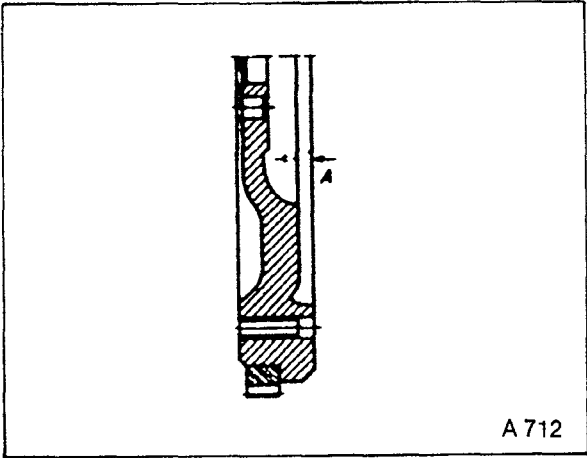
CRANKSHAFT	14 NV, C 16 NZ, C 16 SE	18 SE/20 SEH, 20 XE, C 20 LET
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Crankshaft and con-rod bearing journals	Permissible cut-of-round: 0,04 mm	
Radial runout	Permissible radial runout of centre main bearing journal on mounting the shaft in the cylinder block: 0,03 mm	
Permissible end play	0,1 to 0,2 mm	0,05 to 0,152 mm
Permissible main bearing play Bearing I to V:	0,013 to 0,043 mm	0,015 to 0,04 mm
Permissible con-rod bearing play	0,019 to 0,071 mm	0,006 to 0,031 mm
Permissible con-rod end play	0,11 to 0,24 mm	0,07 to 0,24 mm

FLYWHEEL	14 NV, C 16 NZ, C 16 SE, 18 SE/20 SEH/C 20 XE, 20 LET
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Starter ring gear	Before fitting, heat ring gear to 180°C — 230°C
Lateral run-out	Permissible lateral run-out of installed starter ring gear to flywheel: 0,5 mm
Precision turning	Permissible removal of material in clutch disc lining surface area: 0,3 mm In order to achieve the functional relationship again after removal of material, the same removal of material must take place on the fore part of the flywheel (contact for clutch assembly).

Dimension "A" should always be: (14/16 \emptyset) (2,0 to 2,2 mm) (2,1 to 2,2 mm — 18/2,0 \emptyset)



Carburettor

2 E 3 CARBURETTOR IDENTIFICATION DATA/CALIBRATION

ENGINE		14 NV	
Output in kW (HP)		55 (75)	
Transmission		MT	
Code number		90 107 912	
Colour code	Cover bolts	grey	
	Automatic choke bolts	white	
		1st stage	2nd stage
Main nozzle		X 95	X 110
Air correction nozzle		X 117,5	X 90
Mixture pipe code number		103	51
Pre-atomizer/mixture outflow		8/2,5	7/3,0
Idle fuel/air nozzle		45/130	—
Partial load enrichment		0,55	—
Fuel full load enrichment			80
Cowl		20	24
Choke valve gap	"small"	1,7 — 2,1	—
	"large"	2,5 — 2,9	—
Throttle valve gap		0,8 — 0,9	0,05
Throttle valve dashpot	stroke "H"	—	—
Forced opening of choke valve		1,5 — 3,5	—
Fast idle speed		2200 — 2600	—
Tie rod pre-tension		—	0,5 — 2,0
Release of forced return	Dim. "Y"	—	0,5 — 1,1
	Dim. "Z"	—	0,1 — 0,7
Float needle valve		1,5	—
Float weight (dry)		5,75 — 5,95	—
Float level		28 — 30	—
Injection quantity		10,5 — 13,5	—
Vacuum unit code number			44/50
Pulldown unit code number		59	—
Stepped disc code number		201	—
Pump diaphragm code number		85	—
Part load enrichment valve code number		17	—
Fuel transition system		—	—
Part load enrichment valve switching point		200 ± 40	2,0
Vacuum unit reduction			0,6
Choke switch-off time at approximately 14 volts		144 — 216	
Height of enrichment pipe over pre-atomizer		22 — 24	
Thermo-time valve Passage	°C	below approx. + 28	
	°C	above approx. + 35	
Resistance (at 20 to 30°C)		4,5 — 7,5	
Change-over time (at 20°C)		7 ± 3	
Idle speed		925 ± 25	
CO content		1,0 ± 0,5	

Injection Systems

MULTEC CENTRAL FUEL INJECTION (C 16 NZ)

Fuel pressure:	1,00 bar
Fuel pump:	
Operating voltage	7 — 15 volts
Supply quantity	85 l/h at 12 volts

MOTRONIC M 1.5.4 (C 14 SE, C 16 SE)

Fuel pressure:	3,0 bar
Fuel pump:	
Operating voltage	7 — 15 volts
Supply quantity	85 l/h at 12 volts

MOTRONIC M 1.5.4 (18 SE/ 20 SEH)

Fuel pressure:	Feed:	1,8 — 2,2 bar
	Return:	0,3 — 1,5 bar
Vacuum hose for fuel pressure regulator disconnected	Feed:	2,5 — 3,0 bar
	Return:	0,3 — 1,5 bar
Fuel pump:		
Operating voltage	7 — 15 volts	
Supply quantity	85 l/h at 12 volts	

MOTRONIC 1.5.4 (20 XE)

Fuel pump:	
Operating voltage	7 — 15 volts
Supply quantity	85 l/h at 12 volts
Fuel pressure (feed)	
Vacuum hose for fuel pressure regulator connected:	2,0 — 2,2 bar
disconnected:	2,3 — 2,7 bar

MOTRONIC M 2,7 (20 LET)

Operating voltage	Fuel pump:	7 — 15 volts
Supply quantity		100 l/h at 12 volts
Fuel pressure (feed)		
Vacuum hose for fuel pressure regulator connected:	2,2 — 2,7 bar	
disconnected:	3,0 — 3,5 bar	

Use Checking Procedures for checks of individual components.

Starter

ENGINE	BOSCH
14 NV	12V, 0,85 kW
C 16 SE	12V, 0,9 kW
C 16 NZ	12V, 0,9 kW
C 18 NZ	12V, 1,4 kW
C 20 SEH	12V, 1,4 kW
C 20 XE	12V, 1,4 kW

TEST DATA (BOSCH)

Opel Part No		90 458 462		90 458 462
Bosch code number		0 001 108 079		0 001 112 015
Type		DW → 12 V, 1,4 kW		DM → 12 V, 0,9 kW
Idle speed check	Current (amps)	< 75		< 45
	Engine speed (rpm)	> 2900		> 5500
	Voltage (volts)	11,5		11,5
Short circuit check	Voltage (volts)	3,2	4,2	5,7 ¹⁾ 6,7 ¹⁾
	Current (amps)	430 — 550	580 — 750	350 — 450 ¹⁾ 400 — 500 ¹⁾
Min. voltage for actuat. solenoid switch	Voltage (volts)	8,0 ²⁾ 7,3 ³⁾		8,0 ²⁾ 7,3 ³⁾
Collector diameter	(mm)	31,2		33,5
Minimum length of brushes	(mm)	8,0		3,0

¹⁾ Check with 2 x 143 Ah parallel to 10 m series resistor (E FAL 152/153 connection 30/2)
²⁾ Checking value for relay 0 331 303 505, ..563
³⁾ Checking value for relay 0 331 302 553, ...559

Alternator

CHARACTERISTICS

ENGINE	STRENGTH OF CURRENT IN A	Type	BOSCH Ident No.
14 NV	55	K1 14V 55A 20	0 120 488 159
14 NV	70	K1 14V 28/70 A	0 120 488 191
C 14 SE, C 16 NZ	70	K1 14V 28/70 A	0 120 488 201*
C 16 SE	70	—	—
C 20 XE	70	—	0 120 488 202

*In connection with power steering

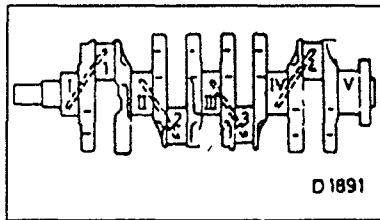
TEST DATA (BOSCH)

Code number	0 120 488 159	0 120 488 191	0 120 488 193
Type	K1 → 14V 55 A 20	K1 → 14V 28/70 A	K1 14V 28/70 A
Voltage rating in volts	14	14	14
Maximum current output in amps	55	70	70
Current output in amps at 1500 rpm	10 ¹⁾	28	27
2000 rpm	36	—	46
6000 rpm	55	70	70
Alternator regulator (electric)			
Regulator voltage in volts at 4000 rpm and under 1 minute	13,7 — 14,5	14,1 — 14,9	13,7 — 14,5
with test loading in amps	5,0 — 7,0	10	10
Minimum diameter of slip rings in mm	31,5	27,2	31,5
Protrusion of carbon brushes in mm	5	min. 5	11 — 12
Resistance of excitation winding in ohms	3,4 + 10%	2,6 + 10%	2,8 + 10%
Resistance of starter winding in ohms	0,14 + 10%	0,1 + 10%	max. 0,1 + 10%
Alternator connection		Y configuration	
Torque of housing nuts in Nm	3,5 — 5,5	4,1 — 5,5	4,1 — 5,5
Torque of pulley nut in Nm	35 — 45	50 ± 5	35 — 45

¹⁾ At 1200 rpm

TEST DATA (BOSCH)

Code number	0 120 488 201	0 120 488 255
Type	K1 → 14V 28/70 A	K1 → 14V 28/70 A
Opel Part No.	90 337 797 90 349 324	90 414 497 90 442 072
Voltage rating in volts	14	14
Maximum current output in amps	70	70
Current output in amps at 1500 rpm	28	28
6000 rpm	70	70
Alternator regulator (electric)		
Regulator voltage in volts at 4000 rpm and under 1 minute	14,1 — 14,9	14,1 — 14,9
with test loading in amps	10	10
Minimum diameter of slip rings in mm	27,2	27,2
Protrusion of carbon brushes in mm	min. 5	min. 5
Resistance of excitation winding in ohms	2,6 + 10%	2,6 + 10%
Resistance of starter winding in ohms	0,1 + 10%	0,1 + 10%
Alternator connection	Y configuration	Y configuration
Torque of housing nuts in Nm	4,1 — 5,5	4,1 — 5,5
Torque of pulley nut in Nm	50 ± 5	50 ± 5

 D 1891	Crankshaft bearing journals I, II, III, IV, V diameter in mm	Guide bearings III width in mm	Con-rod journals 1 to 4 diameter in mm	width in mm	Con-rod width in mm
14 NV, C 16 NZ, C 16 SE STANDARD SIZE FOR PRODUCTION AND SERVICE					
Crankshaft and con-rod bearing journals	<u>54,997</u> 54,980	<u>26,052</u> 26,000	<u>42,987</u> 42,971	<u>22,080</u> 21,960	<u>21,890</u> 21,838
Colour code	none		none		
Bearing shells colour code top: below:	brown green	brown green	none		
Bearing shells code* top:	GM 400 221 N GM 15 256 N	GM 400 225 N GM 15 859 N	GM 400 529 N	GM 124 582 N	GM 40 R 766 N
below:	GM 400 201 N GM 15 257 N	GM 400 205 N GM 15 860 N			

*Alternatively

14NV, C 16 NZ, C 16 SE 0,25 mm UNDERSIZE FOR PRODUCTION AND SERVICE					
Crankshaft and con-rod bearing journals	<u>54,747</u> 54,730	<u>26,252</u> 26,200	<u>42,737</u> 42,721	<u>22,080</u> 21,960	<u>21,890</u> 21,838
Colour code	blue		blue		
Bearing shells colour code top: below:	brown-blue green-blue	brown-blue green-blue	blue		
Bearing shells code* top	GM 400 222 A GM 15 258 A	GM 400 226 A GM 15 861 A	GM 400 530 A	GM 124 583 A	GM 40 R 767 A
below.	GM 400 202 A GM 15 259 A	GM 400 206 A GM 15 862 A			

0,50 mm UNDERSIZE FOR PRODUCTION AND SERVICE					
Crankshaft and con-rod bearing journals	<u>54,495</u> 54,482	<u>26,452</u> 26,400	<u>42,487</u> 42,471	<u>22,080</u> 21,960	<u>21,890</u> 21,838
Colour code	white		white		
Bearing shells colour code top: below:	brown-white green-white	brown-white green-white	white		
Bearing shells code* top	GM 400 223 B GM 15 260 B	GM 400 227 B GM 15 863 B	GM 400 531 B	GM 124 584 B	GM 40 R 768 B
below.	GM 400 203 B GM 15 261 B	GM 400 207 B GM 15 864 B			

Recommended Torque Values

1,4 / 1,6 LTR. ENGINE

	Nm
Alternator to bracket (M 10)	40
Alternator to bracket (M 8)	30
Bracket for alternator to cylinder block (M 10)	40
Bracket for oil intake pipe to cylinder block	8
Camshaft housing cover to housing	8
Camshaft sprocket to camshaft	45
Con-rod bearing cover to con-rod (see position ⁹)	
Crankshaft bearing cover to cylinder block	50 + 45° + 15° ¹⁾
Crankshaft pulley with toothed belt drive pinion to crankshaft (M 10 — see position ⁹)	
Crankshaft pulley with toothed belt drive pinion to crankshaft (M 12)	95 + 30° + 15°
Cylinder head to cylinder block	55 + 60° + 60° + 30° ¹⁾³⁾
Exhaust manifold to cylinder head	22
Flywheel to crankshaft	35 + 30° + 15° ¹⁾
Front exhaust pipe to exhaust manifold	25
Front toothed belt cover to rear toothed belt cover	4
Fuel pump to camshaft housing	18
Intake manifold to cylinder head	22
Left engine bracket to transmission	60
Left engine damping block to engine bracket	60
Oil drain plug to oil pan	45
Oil filter cartridge to connection fitting (cylinder block)	15
Oil intake pipe to cylinder block	8 ⁵⁾
Oil intake pipe to oil pump	8 ⁵⁾
Oil pan to cylinder block	8 ⁵⁾⁸⁾
Oil pressure switch/sensor to oil pump	30
Oil pump to cylinder block	6
Oxygen sensor to exhaust manifold (Multec only)	30 ⁷⁾
Preheater scoop to exhaust manifold	8
Pressure plate for camshaft to camshaft housing	8
Pulley to pump for power steering	25
Pump for power steering to engine block	30
Rear engine bracket to transmission	60 ³⁾
Rear engine damping block to crossmember	40
Rear engine damping block to engine bracket	45
Rear toothed belt cover to camshaft housing and oil pump housing	12
Right and left engine damping blocks to side member	65 ⁵⁾
Right engine bracket to cylinder block	60
Right engine damping block to engine bracket	35
Screw plug for relief pressure valve to oil pump	30
Spark plugs to cylinder head	25
Starter to cylinder block	25
Temperature sensor to intake manifold	10
Tension strap to alternator and intake manifold	25
Thermostat housing to cylinder head	10
Toothed belt tension roller to oil pump	20
Transmission to cylinder block	75
Water pump to cylinder block (M 6)	8

- 1) Use new bolt (s).
- 2) Use new tab washers.
- 3) After test run turn a further $30^{\circ} + 15^{\circ}$.
- 4) Tighten bolt (thread length 15 mm) 6 22 412 (02 865 514) to 28 Nm.
Tighten bolt (thread length 40 mm) 6 22 431 (90 281 728) to 25 Nm + 30° 1).
- 5) Bolt must be recut before reusing and inserted using Locking Compound (Loctite 242).
- 6) Tighten bolt (thread length 23 mm) 20 00 560 (11 073 353) to 55 Nm.
Tighten bolt (thread length 30 mm) 6 14 938 (90 299 605) to 55 Nm + $45^{\circ} + 15^{\circ}$ (use new bolt).
- 7) Insert using Special Grease.
- 8) Installation time max. 10 mins.

Recommended Torque Values

1,8 / 2,0 LTR. ENGINE

	Nm
Alternator to bracket (M 10)	35
Alternator to bracket (M 8)	30
Bracket for alternator to cylinder block (M 10)	40
Bracket for alternator to cylinder block (M 8)	25
Bracket for oil intake pipe to cylinder block	6
Bracket for servo pump to cylinder block	40
Camshaft housing cover to housing	8
Camshaft sprocket to camshaft	45
Con-rod bearing cover to con-rod	35 + 45° + 15° ¹⁾
Crankshaft bearing cover to cylinder block	50 + 45° + 15° ¹⁾
Crankshaft pulley to toothed belt drive pinion	20
Crankshaft pulley to torsional damper	25
Cylinder head to cylinder block	25+60°+60°+60° ¹⁾²⁾
Engine transport strap to camshaft housing	15
Exhaust manifold to cylinder head	22
Exhaust pipe to exhaust manifold	25
Flywheel to crankshaft	65 + 30° + 15° ¹⁾
Intake manifold to cylinder head	22
Left engine bracket to transmission	60
Left engine damping block to engine bracket	60
Oil drain plug to oil pan	45
Oil filter cartridge to oil pump	15
Oil intake pipe to oil pump	8 ⁴⁾
Oil pan to cylinder block	5 ⁴⁾
Oil pressure switch to oil pump	40
Oil pump to cylinder block	6
Oxygen sensor to exhaust manifold (Multec only)	30 ⁵⁾
Preheater scoop to exhaust manifold	8
Pressure plate for camshaft housing	8
Rear engine bracket to transmission	60 ²⁾
Rear engine damping block to crossmember	40
Rear engine damping block to engine bracket	45
Rear toothed belt cover to oil pump housing and camshaft housing	6
Right and left engine damping blocks to side member	65 ⁴⁾
Right engine bracket to cylinder block	60
Right engine damping block to engine bracket	35
Screw plug for relief pressure valve to oil pump	30
Spark plugs to cylinder head	25
Starter to cylinder block — engine side (M 10)	45
Starter to cylinder block — transmission side	75
Support for starter to cylinder block	25
Temperature sensor to intake manifold	10
Tension strap to alternator and intake manifold	25
Thermostat housing to cylinder head	15
Toothed belt drive pinion to crankshaft	130 + 40° to 50° ¹⁾
Torsional damper to toothed belt drive pinion	20
Transmission to cylinder block	75
Water outlet connection to thermostat housing	8
Water pump to cylinder block (M 8)	25

1) Use new bolt(s).
2) Use new tab washers.
3) After test run turn a further 30° + 15°.
4) Bolt must be recut before reusing and inserted using Locking Compound (Loctite 242).
5) Insert using Special Grease.

Recommended Torque Values

DOHC 16V — 2,0 XE/2,0LET

	Nm
AC compressor to auxiliary components support	35 ³⁾
Adapter (threaded coupling) for oil cooler to oil pump	23 ¹⁾
Alternator retaining strap to intake pipe	25
Auxiliary components support to cylinder block	35 ³⁾
Bracket power steering hydraulic pump/AC compressor to cylinder block	35
Bracket to AC compressor	20 ³⁾
Brake servo vacuum line to intake pipe	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° + 15° ⁴⁾
Closure screw (safety valve) to oil pump	30
Closure screw to oil temperature regulator housing (M20)	30
Con-rod bearing cover to con-rod	35 + 45° + 15° ⁴⁾
Coolant feed line to turbocharger	20 ³⁾
Coolant pipe to cylinder block	20
Coolant return line to turbocharger	20 ³⁾
Cover to throttle valve manifold	5 ³⁾
Cover plate to cylinder head (bolts M 6)	9
Cover plate to cylinder head (nuts M 8)	22 ¹⁰³⁾
Crankshaft bearing cover to cylinder block	50 + 45° + 15° ⁴⁾
Crankshaft pulley to toothed belt drive gear	20 ³⁾
Cylinder head cover to cylinder head	8
Cylinder head to cylinder block	25 + 90° + 90° + 90° ⁴⁾
Engine damping block bracket to engine holder	60 ⁴⁾
Engine damping block bracket to support	60 ⁴⁾
Engine damping block to bracket	60
Engine suspension bracket to cylinder block	60
Exhaust diverter manifold to turbocharger	20 ³⁾
Exhaust manifold to cylinder head	22 ³⁾
Exhaust manifold with turbocharger to cylinder head	25 ³⁾ ³⁾
Exhaust pipe to exhaust diverter manifold	12 ³⁾ ³⁾
Fastening bolts to exhaust joint	20
Flywheel to crankshaft	65 + 30° + 15° ⁴⁾
Front toothed belt cover to cylinder head, intermediate piece and oil pump	8
High-performance header with cover plate to cylinder head	22
Ignition lead cover to cylinder head cover	8
Inductive pulse pick-up to cylinder block	6
Intake pipe to cylinder head	22
Intermediate shaft bracket to cylinder block	55
Knock sensor to cylinder block	20
Lower alternator fastening (M 10)	40
Lower alternator fastening	35 ³⁾
Oil cooler lines to adapter	30
Oil cooler lines to cooler	30
Oil draining screw to oil pan	45
Oil feed line to cylinder block screw connection	12 ³⁾

Oil filter element to oil pump	15
Oil intake pipe bracket to cylinder block	6
Oil intake pipe to oil pump	8 ¹⁾
Oil pan to cylinder block	15 ⁹⁾
Oil pressure switch to oil pump	40
Oil pump cover to oil pump	6
Oil pump to cylinder block	6
Oil temperature switch to cylinder block	30
Oxygen sensor to front exhaust pipe	30 ⁹⁾
Pot flywheel to crankshaft	65 + 30° + 15° ⁴⁾
Power steering hydraulic pump to support	25 ³⁾
Rear toothed belt cover to cylinder block	6
Retaining strap to alternator	25
Ribbed V-belt pulley to toothed belt drive gear	20 ³⁾
Ribbed V-belt tension roller to support	18 ³⁾
Right engine damping block to side member	65 ¹⁾
Shackle for power steering hydraulic pump to auxiliary components support	8 ³⁾
Shackle to intake pipe and alternator	18 ³⁾
Spark plug to cylinder head	25
Starter to cylinder block (engine side)	45
Starter to cylinder block (transmission side)	60
Support to intake pipe and alternator	18 ³⁾
Thermostat housing to cylinder head	15
Toothed belt drive gear to crankshaft	250 + 40° to 50° ⁴⁾
Toothed belt guide roller bracket to cylinder block	25 ³⁾
Toothed belt guide roller to cylinder block	25 + 45° + 15° ⁹⁾
Toothed belt guide roller to cylinder block	25 ³⁾
Toothed belt guide roller to guide roller bracket	25 ³⁾
Toothed belt tension roller to cylinder block	25 + 45° + 15° ⁹⁾
Toothed belt tension roller to oil pump	20 ³⁾
Transmission to cylinder block	75
V-belt pulley to toothed belt drive gear	20
Water outlet connection to thermostat housing	8
Water pump to cylinder block	25

¹⁾ Recut threads and insert bolts with Locking Compound Locktite 242
²⁾ Use new nuts
³⁾ On engines as of MY '93
⁴⁾ Use new bolt(s)
⁵⁾ Insert with Special Grease 19 48 602 (5 613 695)
⁶⁾ Installation time max 10 min
⁷⁾ Insert bolt with grease
⁸⁾ Additional tightening not required
⁹⁾ C20LET only
¹⁰⁾ Not present in C20LET

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