IN-SITU OPERATIONS
CYLINDER HEAD

PARTIAL DRAINING

Only partial draining of the cooling system is necessary during some operations and the following method has been found satisfactory:

Obtain a suitable threaded reducing union having the same thread as the cylinder block drain plug tapping (20 T.P.I. and 12.7 mm (½ in.) diameter) to which a length of plastic piping may be attached. The piping should be 1,0 m. to 1,5 m. (3 to 5 feet) in length.

If the engine is cold, the cooling system will be under a partial vacuum. Under this condition remove the cylinder block drain plug and immediately fit the adaptor **before** removing the coolant filler cap.

Where an 'Engine Warm' condition exists, relieve the pressure in the system by releasing, but not removing, the coolant filler cap followed by re-tightening after the pressure diminishes. Only then must the cylinder block drain plug be removed and the reducing union fitted, followed by the removal of the coolant filler cap.

Where it proves necessary to completely drain the cooling system, use one of the above methods **followed** by the disconnection of hoses between the engine and radiator. The above routine will minimise the loss of coolant and anti-freeze.

CYLINDER HEAD

Note: If vehicle is fitted with air/hydraulic brakes, chock the front wheels, release the parking brake and ensure the system is charged to a minimum of 6,0 bar (95 lbf.in^2) to ensure full release of parking brake. Alternatively, 'Wind-off' the spring brake actuator.

To Remove

Disconnect battery.

Remove passenger seat by removing pedestal bolts.

Release clips and lift out rear engine cover.

Release hose clip and remove hose from induction elbow.

Pull intake hose from its location on front grille duct.

Remove bolts and lift out air cleaner assembly.

Remove heater air ducting from its locations at bulkhead and inner wing.

Disconnect 'Lucar' connection from 'Thermostart'.

Unscrew unions of 'Thermostart' feed pipe and remove pipe.

Unscrew union of fuel return pipe at final fuel filter.

Remove banjo bolts securing injector leak-off pipe to injectors and final fuel filter.

Release final fuel filter from inlet manifold by removing bolts.

Remove injector pipe clamp bolts and remove the clamps.

Unscrew unions of injection pipes at injectors and fuel injection pump and remove pipes.

Remove bolts and remove front section of engine cover.

Release hose clip and detach oil filler hose.

Remove nut and bolt from oil filler pipe bracket and remove filler assembly.

Remove bolts, release 'Dzus' fasteners and remove rear undertray.

Remove cylinder block drain plug and partially drain coolant (Refer to 'Partial Draining' at beginning of section).

Release hose clip and disconnect top hose from thermostat outlet.

Release hose clips securing heater and by-pass hoses to water header rail and disconnect hoses.

Remove 'Lucar' connector from coolant temperature sender unit.

Release hose clip of crankcase ventilation hose at rocker cover and displace hose assembly.

Remove nuts at exhaust down pipe flange, disconnect steady bracket and displace downpipe. Recover sealing ring.

Remove nuts and rubber seals from rocker cover and detach cover and gasket.

Remove nuts locating rocker shaft, remove all cylinder head securing bolts and lift rocker assembly clear.

Lift out push rods noting their respective positions for reassembly.

Remove cylinder head complete with manifolds and water header rail. Recover cylinder head gasket.

To Refit

Refitting is a reversal of the removal procedure but without refitting the rocker cover.

Ensure that the cylinder head bolts are tightened in the correct sequence and to the specified torque reading.

Ensure that the front wheel chocks are in position, engage top gear, release parking brake and raise one rear wheel.

Ask an assistant to turn the wheel in the normal direction of rotation and carry out an initial setting of the tappets. Temporarily fit the rocker cover.

Lower the rear wheel, select neutral gear, apply parking brake but do not remove the chocks.

Bleed final fuel filter.

Refill cooling system with coolant.

Start and run engine until a 'Thermostat Open' condition is reached.

Stop engine.

Remove rocker cover and retighten cylinder head bolts to correct torque with engine HOT. Check rocker shaft end nuts for security.

Allow engine to cool, if possible overnight.

Ensure that front wheel chocks are still in position, engage top gear, release parking brake and raise one rear wheel.

Ask an assistant to turn the rear wheel in the normal direction of rotation and set the tappets with the engine COLD.

Lower rear wheel, select neutral gear, apply parking brake and remove chocks from front wheels.

Refit rocker cover.

Refit engine rear cover.

VALVE SPRING RENEWAL

Note: During reassembly it is necessary to turn the engine. If the vehicle is fitted with air/hydraulic brakes, chock the front wheels, release the parking brake and ensure the system is charged to a minimum of 6,0 bar (95 lbf.in.^{2}) to ensure full release of parking brake. Alternatively, 'Wind off' the spring brake actuator.

To Remove

Disconnect battery.

Remove passenger seat.

Release clips and remove rear engine cover.

Release hose clips and detach hose from induction elbow and front grille intake duct.

Pull heater air ducting from its location on bulkhead and inner wing.

Remove bolts from air cleaner assembly and lift assembly clear complete with hoses.

Release hose clip and detach oil filler hose, remove nut and bolt from filler neck bracket and remove complete assembly.

Partially drain the coolant (Refer to 'Partial Draining' at beginning of section).

Unscrew union of fuel return pipe at final fuel filter.

Remove banjo bolts from each injector and final fuel filter and remove injector leak-off pipe.

Release hose clips of breather hose at rocker cover and detach the hose.

Remove rocker cover.

Slacken all cylinder head bolts by one quarter turn each, in the opposite sequence of tightening.

Remove the eleven long setscrews retaining the rocker shaft. Remove the nut adjacent to the front and rear rocker pedestals and lift complete rocker assembly from its location on cylinder head.

Chock the front wheels, release the parking brake, engage top gear and jack up one rear wheel.

Dependent upon which valve springs are to be changed, remove the injector appropriate to that cylinder.

Ask an assistant to turn the rear wheel slowly in the normal direction of rotation until the piston of that cylinder reaches T.D.C. The piston crown will then act as a platform for the valve during the valve spring removal and refitting operations.

Remove a suitable injector to allow adaptor PD 6118-1 to be fitted to one of the injector studs and use with compressor 6118-B.

Compress the valve spring and remove the cotters. Release the pressure and remove the spring cap and springs. If dealing with an inlet valve remove the valve stem seal. Renew if necessary.

Note: It is essential that the engine is not turned until the new valve springs are fitted, otherwise the valve will fall into the cylinder making it necessary to remove the cylinder head.

To Refit

Refitting is a reversal of the removal instructions with the following additions.

It is essential that a new sealing ring is fitted to every injector which has been removed.

Ensure that the cylinder head bolts are tightened in the correct sequence and to the specified torque reading.

Carry out an initial setting of the tappets with the engine COLD.

Refit the rocker cover.

Ensure that the front wheel chocks are still in position, apply parking brake, select neutral gear and lower rear wheel.

Start and run engine until a 'Thermostat Open' condition is obtained. Stop engine.

Raise rear wheel, select top gear and release parking brake.

Remove rocker cover and retorque cylinder head bolts with engine HOT.

Allow engine to cool, preferably overnight and reset the tappets with engine COLD.

Refit rocker cover, lower rear wheel, apply parking brake, select neutral gear and remove wheel chocks.

PISTONS AND CONNECTING RODS

Note: If vehicle is fitted with air/hydraulic brakes, chock the front wheels, release the parking brake and ensure the system is charged to a minimum of 6,0 bar (95 lbf.in^2) to ensure full release of parking brake. Alternatively, 'Wind-off' the spring brake actuator.

To Remove

Disconnect battery.

Remove passenger seat.

Release clips and remove rear engine cover.

Release hose clips and release hoses from induction elbow and front grille intake duct.

Remove bolts securing air cleaner assembly and remove assembly.

Release heater air duct and displace from bulkhead and inner wing.

Disconnect wire to 'Thermostart', unscrew unions and remove 'Thermostart' feed pipe.

Unscrew union and banjo bolts and detach fuel return pipe and injector leak-off pipe at final fuel filter.

Remove nuts and bolts securing fuel filter to inlet manifold and remove filter.

Release injector pipe clamps by removing bolts. Remove clamps.

Remove bolts securing injector pipe clamp plate to cylinder block and remove clamp plate.

Unscrew unions securing injector pipes to injectors and fuel injection pump and remove pipes.

Remove bolts securing engine cover front section and lift cover clear.

Release hose clips from oil filler pipe, remove bolt from pipe steady bracket, release the hose from rocker cover and remove filler pipe assembly.

Release 'Dzus' fasteners, remove undertray cross-stay bolts and displace both undertrays.

Partially drain coolant (Refer to 'Partial Draining' at beginning of section).

Release hose clips of hose to thermostat elbow, by-pass hose, water gallery and heater feed hose. Remove hoses.

Disconnect 'Lucar' connector from temperature sender unit.

Remove nuts and bolt from exhaust flange and down pipe bracket and displace down pipe. Collect flange sealing ring.

Withdraw dipstick, unscrew dipstick tube gland nut from sump and remove tube.

Remove the sump drain plug and drain engine oil.

Release hose clip of crankcase ventilation hose and remove hose and valve assembly from rocker cover.

Remove nuts securing rocker cover, lift off cover and collect stud seals and gasket.

Remove two nuts locating rocker shaft, remove all cylinder head securing bolts and detach complete rocker assembly.

Lift out push rods noting their respective positions for reassembly.

Remove cylinder head complete with manifolds and water header rail. Lift off cylinder head gasket.

Release hose clip of exhauster oil return pipe and detach pipe from stub of sump.

Remove bolts securing sump, lower sump and collect re-inforcement strips and joint gaskets.

Refer to Sub-section A312 ENGINE OVERHAUL for details of removing pistons and connecting rods.

To Refit

Refer to Sub-section A312 ENGINE OVERHAUL for details of reassembly of pistons and connecting rods, cylinder head bolt tightening sequence and torque figures.

Rebuild in reverse order, but do not refit rocker cover.

Ensure that front wheel chocks are still in position, engage top gear, release parking brake and raise one rear wheel.

Ask an assistant to turn the wheel in normal direction of rotation and carry out an initial setting of the tappets. Fit rocker cover temporarily.

Lower rear wheel, select neutral gear, apply parking brake but do not remove chocks.

Bleed final fuel filter.

Refill cooling system with coolant.

Start engine and run until a 'Thermostat Open' condition is reached.

Stop engine.

Remove rocker cover and retighten cylinder head bolts to correct torque with engine HOT. Check rocker shaft end nuts for security.

Allow engine to cool, if possible overnight.

Ensure that front wheel chocks are still in position, engage top gear and raise one rear wheel. Release parking brake.

Ask an assistant to turn the rear wheel in the normal direction of rotation and set the tappets with the engine COLD.

Lower rear wheel, select neutral gear, apply parking brake and remove chocks from front wheels.

Refit the rocker cover.

Refit engine rear cover.

LUBRICATION SYSTEM

SUMP

To Remove

Disconnect battery.

Release clips and remove rear engine cover from cab.

Remove bolts and release 'Dzus' fasteners securing front and rear undertrays and remove undertrays and cross-stay.

Unscrew dipstick housing gland nut and withdraw dipstick and tube assembly.

Remove sump drain plug and drain engine oil.

Release hose clip securing air intake hose to intake elbow and displace hose.

Detach opposite end of air intake hose from front grille and remove hose.

Slacken hose clip of exhauster return hose and detach from sump adaptor.

Support sump, remove all bolts, collect reinforcement strips. Lower sump and remove gaskets.

To Refit

Clean all joint faces.

Apply 'Hylomar' to gaskets and position on cylinder block.

Fit sealing strips to grooves of timing case and main bearing cap oil seal housing. Check that the sealing strips contact the gaskets when in position, trimming if necessary. If satisfactory, remove and apply 'Hylomar' to the ends and groove contact area and re-assemble.

Fit sump, reposition dipstick tube and retighten gland nut.

Refill sump with engine oil, run engine and check for leaks.

STRAINER

To Remove

Disconnect battery.

Remove the sump (Refer to Sub-section SUMP).

Remove nuts securing oil strainer and suction pipe assembly to oil pump and remove assembly.

To Refit

Clean joint faces and fit a new gasket between the oil pump and suction pipe.

Refitment is a reversal of the removal procedure.

OIL PUMP

To Remove

Disconnect battery.

Remove sump (Refer to Sub-section SUMP).

Detach the oil delivery pipe by removing the bolts securing it to the cylinder block and oil pump. Collect the gasket from the oil pump face and the sealing ring from its location in the cylinder block.

Remove front main bearing cap setscrews which also secure the oil pump.

Pull the oil pump from its location on the main bearing cap.

The oil strainer assembly may be removed from the pump by removing the two nuts securing it.

Refer to Sub-section A312 ENGINE OVERHAUL for oil pump dismantling and overhaul procedure.

To Refit

Clean all joint faces and renew gaskets and sealing ring as necessary.

Refit in reverse order and retighten main bearing setscrews to 116 Nm (85 lbf.ft).

OIL PRESSURE RELEASE VALVE

To Remove

Disconnect battery.

Remove sump (Refer to Sub-section SUMP).

Unscrew relief valve cap and washer from oil pump.

Remove pressure spring and plunger.

To Refit

Refit in reverse order.

Note: The spring pressure is pre-set and no attempt should be made to adjust the operating pressure. Refer to Sub-section A312 ENGINE OVERHAUL for load/length figures.

OIL FILTER HEAD

To Remove

Disconnect battery.

Release 'Dzus' fasteners and bolts securing undertrays and remove undertrays.

Unscrew filter canister from filter head.

Remove nuts securing filter head to cylinder block.

Pull filter head from its location on cylinder block studs.

To Refit

Refitment is a reversal of the dismantling procedure noting the following:

Clean joint faces and use a new gasket ensuring that it is correctly fitted, i.e. large and small holes aligned with the equivalent holes drilled in cylinder block.

Upon completion of reassembly, start the engine and run for a few seconds to replenish the filter canister.

Check the oil level and top-up as necessary.

Check for oil leaks.

OIL COOLER

To Remove

Remove the fuel injection pump (Refer to Sub-section FUEL INJECTION PUMP).

Remove the nuts retaining the inlet manifold and final fuel filter.

Extract the front upper manifold stud and remove the manifold.

Remove the twelve bolts securing the oil cooler plate to the cylinder block, but do not remove the four nuts from the outer face at this stage.

Remove the oil cooler assembly.

Note: A small amount of coolant may remain trapped in the pocket of the oil cooler and will spill during removal.

To separate the cooler element from the outer plate remove the four nuts from outer face. During separation note that 'O' ring seals are fitted to the oil feed and return passages and the four studs.

To Refit

Clean all joint faces, use a new gasket and 'O' ring seals.

Refitting is a reversal of the removal procedure. When completed, run the engine and check that the oil pressure is correct.

FUEL SYSTEM

EXHAUST FLANGE SEALING RING

To Remove

Position vehicle on a hoist or over a pit.

Remove bolts and release 'Dzus' fasteners of rear undertray. Remove the undertray.

Release clips and remove rear engine cover.

Remove nuts at exhaust flange, remove nut and bolt from downpipe steady bracket and release retainer plate.

Displace exhaust down pipe and collect sealing ring.

To Refit

Fit new exhaust flange sealing ring and reassemble in reverse order.

EXHAUST MANIFOLD AND GASKET

To Remove

Remove exhaust down pipe (Refer to Exhaust Flange Sealing Ring).

Pull heater air ducting from its location at the bulkhead and duct on inner wing.

Unscrew twelve nuts from manifold securing studs and remove manifold.

Remove gaskets from cylinder head to manifold joint.

To Refit

Clean faces of manifold and cylinder head.

Fit new manifold gaskets.

Reassemble in reverse order.

INLET MANIFOLD AND GASKET

To Remove

Position vehicle on a hoist or over a pit.

Release clips and remove rear engine cover.

Release hose clip at induction elbow and displace hose.

Remove air intake hose from front grille duct by pulling clear.

Remove bolts securing air cleaner assembly and remove assembly.

Disconnect wire to 'Thermostart', unscrew unions and remove 'Thermostart' feed pipe.

Unscrew union and banjo bolts, detach fuel return pipe and injector leak-off pipe at final fuel filter.

Remove nuts and bolts securing final fuel filter to inlet manifold and remove the filter.

Remove nuts and bolts securing engine cover front section and lift cover clear.

Release injector pipe clamps by removing bolts. Remove clamps.

Remove bolts securing injector pipe clamp plate to cylinder block and remove clamp plate.

Unscrew unions securing injector pipes to injectors and fuel injection pump and remove pipes.

Release hose clip and detach crankcase ventilation hose from inlet manifold.

Remove twelve nuts from manifold securing studs and remove manifold.

Remove gaskets from manifold to cylinder head joint.

To Refit

Clean faces of manifold and cylinder head.

Fit new manifold gaskets.

Reassemble in reverse order.

AIR CLEANER

To Remove

Release clips and remove rear engine cover.

Release hose clip and detach hose from induction elbow.

Open bonnet, release hose clip securing air intake hose to cleaner stub and remove hose.

Remove bolts and lift out air cleaner assembly.

Access to the cleaner element can be obtained by unscrewing centre nut and removing cover and element.

To Refit

Refitting is a reversal of the removal instructions.

THERMOSTART UNIT

To Remove

Release clips and remove rear engine cover.

Disconnect 'Lucar' connector from 'Thermostart'.

Unscrew fuel pipe union.

Unscrew and remove 'Thermostart' unit.

To Refit

Refitting is a reversal of the removal instruction.

FINAL FUEL FILTER

To Remove

Disconnect battery.

Release clips and remove rear engine cover.

Open bonnet.

Remove air cleaner bolts and displace and support assembly clear of working area.

Remove banjo bolts securing following items to final fuel filter and displace as necessary. Filter supply from lift pump, fuel return from injection pump, injector leak-off pipe and return to tank line, fuel supply to injection pump and adaptor for 'Thermostart' supply.

Remove bolts mounting filter to inlet manifold and detach filter assembly. The filter cartridge may be removed by unscrewing from filter head.

To Refit

Refitting is a reversal of the removal procedure.

Bleed the fuel system.

FUEL LIFT PUMP

To Remove

Release clips and detach rear engine cover.

Unscrew unions securing fuel lines to lift pump.

Remove nuts securing lift pump to cylinder block and withdraw the pump from its studs.

Access to filter element can be obtained by removing the cover bolt and lifting off cover, sealing ring and gauze filter element.

To Refit

Refitting is a reversal of the removal procedure using a new lift pump to cylinder block gasket.

Bleed the fuel system.

FUEL INJECTOR

To Remove

Disconnect battery.

Release clips and lift out rear engine cover.

Remove banjo bolt securing leak-off pipe to injector, also the equivalent banjo bolts of the adjacent injectors.

Remove the nuts holding the injector in position.

Unscrew injector pipe union and withdraw injector.

Remove injector compression sealing ring, rubber dust seal and union adaptor.

To Refit

For injector servicing details refer to Sub-section A312 ENGINE OVERHAUL.

Reassembly is a reversal of the dismantling procedure.

FUEL INJECTION PUMP

If vehicle is fitted with air/hydraulic brakes, ensure that there is sufficient air in the system to fully release the parking brake. This will be necessary later in the dismantling procedure.

To Remove

Disconnect battery.

Open the bonnet.

Release clips and lift rear engine cover from cab.

Partially drain the cooling system (See note at start of section).

Remove bolts and lift front section of engine cover from cab.

Release electrical lead from 'Thermostart' unit.

Remove injector pipe clamp plates.

Unscrew unions and remove injector pipes and 'Thermostart' feed pipe.

Disconnect throttle and engine stop cables from injection pump.

Remove banjo bolts and release fuel feed and return pipes from injection pump and final fuel filter.

Release hose clip and remove crankcase ventilation hose from rocker cover.

Remove bolt from oil filler pipe bracket, remove rocker cover bolts and lift rocker cover from engine.

Securely chock the front wheels, engage top gear, release the parking brake and jack-up one rear wheel.

Ask an assistant to turn the rear wheel in the normal direction of rotation until number one piston is at T.D.C. i.e. with the valves of number six cylinder 'rocking' and with clearance existing at both rockers of number one cylinder. This method will ensure that the injection pump drive key is at T.D.C. which is essential to avoid accidental displacement into the timing cover and gears.

Observe and note the position of the timing marks on the injection pump flange and timing case (Fig. 1). Slacken the two nuts retaining the injection pump.

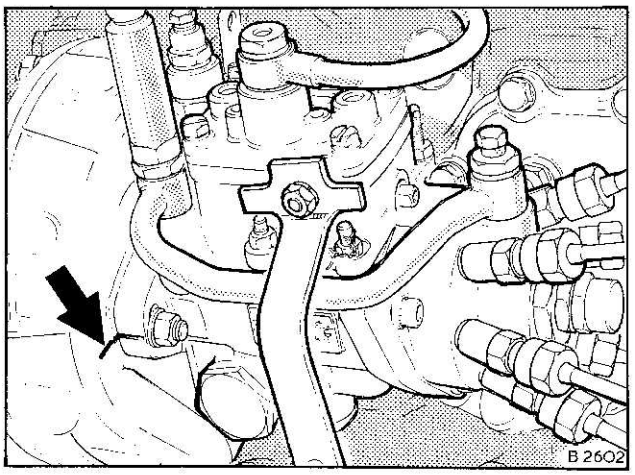

Fig. 1 *Fuel injection pump timing marks*

Remove the timing cover access plate and pump drive gear nut.

Using Tool PD.157 (FUEL PUMP GEAR REMOVER) release the pump drive gear from the tapered drive shaft of the injection pump. Remove the Tool but do not allow the gear to come out of mesh.

Remove the already slackened pump securing nuts and carefully withdraw the pump taking great care not to displace the drive gear key until clear of the timing cover.

Ensure that the engine is not turned until the fuel injection pump has been refitted.

To Refit

Ensure that all joint faces are clean.

Refit the fuel injection pump and reset to the original timing marks.

Note: If a replacement pump is being fitted refer to Sub-section A303 TIMING.

Rebuild in reverse order and bleed the final fuel filter.

CRANKSHAFT AND MAIN BEARINGS

CRANKSHAFT SPIGOT BEARING

To Remove

Disconnect battery.

Detach rear engine cover and remove from cab.

Remove gear lever.

Unscrew two bolts retaining clutch slave cylinder and displace cylinder.

Remove front and top bolts from crossmember.

Remove top nuts from bell housing to flywheel housing studs.

Detach front and rear undertrays and undertray cross-stay.

Unscrew speedometer/tachograph drive cable from gearbox.

Release propshaft from gearbox.

Support gearbox and remove remaining bolts from crossmember.

On vehicles fitted with air/hydraulic brakes, release clip holding compressor hose and pipe to gearbox and displace.

Support the gearbox and remove remaining nuts from bell housing to flywheel housing studs. It will be found that two nuts cannot be removed completely until gearbox is partially withdrawn.

Withdraw the gearbox complete with bell housing.

Remove the clutch assembly.

Remove the flywheel.

Insert Adaptor RG 3072-4 into spigot bearing, attach Slide Hammer MS 3072A and remove spigot bearing.

To Refit

Sparingly lubricate new needle roller bearing with H.M.P. grease.

Position with the integral seal towards the rear of vehicle.

Using a suitable tube against the bearing shell face, carefully drift squarely into crankshaft until bearing shell face is 1,5 mm (0.060 in) below the face of the crankshaft flange.

Rebuild in reverse order using Tool RG 565 to align clutch driven plate.

CRANKSHAFT REAR OIL SEAL

To Remove

Disconnect battery.

Release clips and remove rear engine cover.

Remove gear lever.

Unscrew two bolts retaining clutch slave cylinder and displace cylinder.

Remove front and top bolts from crossmember.

Remove top nuts from bell housing to flywheel housing studs.

Release 'Dzus' fasteners and bolts securing under-trays and cross-stay and remove.

Unscrew speedometer/tachograph drive cable from gearbox.

Release propshaft from gearbox.

Support gearbox and remove remaining bolts from crossmember.

On vehicles fitted with air/hydraulic brakes, release clip holding compressor hose and pipe to gearbox and displace.

Support gearbox and remove remaining nuts from bell housing to flywheel housing studs. It will be found that two nuts cannot be completely removed until the gearbox is partially withdrawn.

Withdraw the gearbox complete with bell housing.

Remove clutch assembly.

Remove setscrews to allow flywheel to be released from its register on crankshaft.

Release, displace and support starter motor.

Remove bolts retaining oil seal shield, remove shield and rubber strip.

Unscrew bolts securing flywheel housing to cylinder block and remove housing.

Remove bolts and detach the two piece seal housing from cylinder block.

Pull the rope type seal from the two half housings.

To Refit

Clean all joint faces.

For details of fitting new oil seal refer to Subsection A312 ENGINE OVERHAUL.

Refitting is a reversal of the removal instructions, using Tool RG 565 to align clutch driven plate.