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 union having the same thread as the cylinder block drain plug tapping 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 that 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.

Open and secure bonnet.

Release clips and lift out rear engine cover from cab.

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, release the clip by removing bolt and remove the feed pipe.

Remove bolts and lift out front engine cover.

Remove nuts and bolt securing induction elbow to bracket and manifold and remove the elbow.

Remove banjo bolts, unscrew unions and remove injector leak-off pipe to final fuel filter and leak-off rail.

Release injector pipe clamps by removing the three bolts.

Unscrew unions and remove pipes from injectors and fuel injection pump.

Clean any foreign matter from around the injectors.

Remove nuts securing each injector, lift out injectors and recover copper sealing rings and rubber dust seals.

Release 'Dzus' fasteners, remove bolts and remove both undertrays.

Remove bolt and displace exhaust down pipe hanger clip.

Remove nuts from exhaust down pipe joint, release retaining plate, displace down pipe and recover sealing ring from joint.

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

Release hose clips and disconnect vent hose and heater feed hose at thermostat housing and heater return hose at bulkhead.

Release hose clip and remove radiator bottom hose.

Release hose clip and disconnect hose from thermostat outlet pipe.

Remove bolt securing oil filler neck support stay to cylinder head.

Remove two bolts securing thermostat cover. Lift off cover and gasket and remove thermostat from its housing.

Disconnect 'Lucar' from water temperature sender unit.

Remove bolts securing final fuel filter to cylinder head.

Detach rocker cover and oil filler neck assembly. Recover cork gasket.

Release rocker shaft assembly by removing four nuts securing rocker pedestals. Recover rocker oil feed sealing ring.

Remove push rods noting their respective positions for reassembly.

Remove all cylinder head securing nuts and bolts including the one retaining the inlet manifold elbow clip and remove the clip.

Extract the long cylinder head stud between numbers 3 and 4 injector locations.

Carefully lift off the cylinder head and remove through the cab. Recover cylinder head gasket.

To Refit

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

Clean all faces and use new gaskets as necessary.

Ensure that the cylinder head bolts are tightened in the correct sequence and to the specified torque reading (Refer to Sub-section A412 ENGINE OVERHAUL).

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 the final fuel filter, 'Thermostart' feed pipe and two injector pipes.

Refill the cooling system with coolant.

Start and run engine until a 'Thermostat Open' condition is reached. When this condition is reached, proceed as follows:

Stop engine.

Disconnect 'Lucar' connection from 'Thermostart'.

Remove bolt retaining induction elbow bracket.

Unscrew union of 'Thermostart' feed pipe.

Remove nuts from intake elbow to inlet manifold joint and remove elbow and gasket.

Unscrew cylinder head nut retaining inlet manifold elbow bracket and detach the bracket.

Remove the rocker cover and cork gasket.

Remove the four rocker pedestal nuts and lift off rocker shaft assembly.

Retorque the cylinder head nuts and bolts with the engine HOT.

Reassemble the components previously removed, but do not fit the rocker cover.

Allow engine to cool, if possible overnight.

Ensure that the 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, apply parking brake, select neutral gear and remove chocks from front wheels.

Refit rocker cover and components previously removed.

Refit rear engine cover.

VALVE SPRING RENEWAL

Note: If vehicle is fitted with air/hydraulic brakes, chock the front wheels, release the parking brake and ensure that 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.

Open and secure bonnet.

Release clips and lift out rear engine cover from cab.

Remove bolts and lift out front engine cover.

Release 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, release the clip by removing bolt and remove the feed pipe.

Remove nuts and bolt securing induction elbow to bracket and manifold and remove the elbow.

Remove banjo bolts, unscrew unions and remove injector leak-off pipe to final fuel filter and leak-off rail.

Remove bolt securing oil filler neck support stay to cylinder head.

Release hose clip and disconnect breather hose from rocker cover.

Remove rocker cover and gasket.

Dependent upon which valve springs are to be changed, remove the injector appropriate to that cylinder. Recover the copper sealing ring and rubber dust seal.

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

Ask an assistant to turn the rear wheel slowly in the normal direction of rotation until the appropriate piston reaches T.D.C. on its compression stroke. This can be verified by observing the rockers of that cylinder and feeling for compression via the injector hole. A length of suitable wire may be used to check that the piston has reached the top of its stroke. The piston crown will then act as a platform for the valve during the valve spring removal and refitting operations.

Remove the four nuts securing the rocker pedestals and lift the complete rocker assembly from its location on cylinder head. Recover the rocker oil feed sealing ring.

Fit adaptor PD6118-1 to one of the vacant injector studs and use in conjunction 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.

Reset the tappets with the engine COLD.

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

PISTONS AND CONNECTING RODS

PISTONS AND CONNECTING RODS

Note: The following procedure applies only to vehicles having vacuum/hydraulic brakes and not equipped with power assisted steering.

To Remove

Remove cylinder head (Refer to Sub-section CYLINDER HEAD).

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

Unscrew gland nut of dip-stick tube and remove complete with dip-stick.

Drain and remove engine oil sump.

Remove oil pump suction pipe and strainer assembly. Recover '0' ring.

Remove oil pump delivery pipe and pressure relief valve assembly. If the relief valve is separated, a new gasket must be fitted.

Remove the connecting rod end cap and push the piston and connecting rod up the bore. The assembly may then be removed as follows:

Number one piston is removed through the bonnet aperture.

Number four piston is removed through the cab.

Note: If it is necessary to remove number two or three pistons, the following additional operations are necessary:

Release the propshaft centre bearing and lower 152 mm to 228 mm (6 in to 9 in) and support in that position.

Remove the nuts from the two long vertical bolts fitted to the rear engine mountings and cross-member.

Remove two bolts from the rear of each front engine mounting support bracket.

Support the engine in such a manner that it may be raised or lowered.

Release hose clip and disconnect radiator hose at water pump intake.

Remove engine cooling fan.

Remove the remaining bolts from the front engine mounting support brackets.

Slowly lower the engine until it is just possible to remove number two piston and connecting rod through the bonnet aperture, without coming into contact with the bulkhead. During the lowering operation ensure that a fouling condition does not arise at the following points:

a) Crankshaft pulley to front cross-member.
b) Water pump spindle to radiator matrix.
c) Gear lever to cab floor (engaging gear should relieve this condition).

Note: To remove number three piston and connecting rod, proceed as above, but raise the engine until the bell housing is almost touching the cab floor. The assembly may then be removed through the cab.

To Refit

Refitting is a reversal of the removal instructions.

Refill with coolant.

Adjust fan belt.

LUBRICATION SYSTEM

SUMP

To Remove

Disconnect battery.

Open and secure bonnet.

Release clips and lift out 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.

Support sump, remove all bolts and two nuts securing sump. Lower sump and remove gasket.

To Refit

Clean all joint faces.

Apply 'Hylomar' to sump gasket and position on cylinder block.

Position sump and refit bolts and two nuts. Tighten bolts and nuts evenly.

Fit dipstick tube assembly and tighten gland nut.

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

Refit undertrays, cross-stay and rear engine cover.

STRAINER

To Remove

Disconnect battery.

Open and secure bonnet.

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

Remove the two bolts securing the strainer to the suction pipe and lower the strainer.

To Refit

Refitting is a reversal of the removal procedure.

OIL PUMP

To Remove

Disconnect battery.

Open and secure bonnet.

Release clips and remove rear engine cover.

Unscrew gland nut of dipstick tube, remove bolt to release tube from bracket adjacent to thermostat cover and remove the tube assembly.

Remove radiator (Refer to Sub-section C200).

Release 'Dzus' fasteners, remove cross strap bolts and detach front and rear undertrays.

Disconnect harness plug from alternator.

Remove alternator pivot bolts, adjustment strap securing bolt and remove alternator complete with adjustment strap. Recover spacer from bolt securing adjustment strap.

Remove fan belt.

Remove cooling fan.

Remove crankshaft pulley bolt and withdraw the pulley.

Release fuel injection pump control springs from bracket on timing cover.

Turn engine to T.D.C. to assist timing operation during reassembly.

Remove timing cover and recover bracket and fuel injection pump control springs.

Recover oil thrower from crankshaft nose.

Remove bolts and retainer plate and withdraw idler gear and hub.

Extract camshaft drive gear using Tool PD 155B/2 and adaptors PD 155-1.

Remove three bolts securing the dowelled driving gear to injection pump. Unscrew unions of exhauster outlet pipe and oil feed pipe.

Carefully note the timing marks on injection pump and timing case.

Remove nuts securing injection pump to timing case, ease pump from its mounting studs and recover gasket.

Remove four bolts and withdraw timing case from its location on cylinder block complete with exhauster but leaving injection pump suspended by the injector pipes.

Drain the engine oil sump.

Support the sump, remove the remaining bolts and nuts and remove sump.

Remove oil pump suction pipe and strainer assembly, delivery pipe and pressure release valve assembly. Recover '0' ring seal.

Using suitable circlip pliers, remove circlip from oil pump idler gear shaft and withdraw gear.

Remove three bolts and detach oil pump assembly from cylinder block.

To Refit

Refitting is a reversal of the removal procedure noting the following.

Prime the pump with clean engine oil.

Clean all joint faces and use new gaskets. Inspect and if necessary renew timing cover oil seal.

For details of valve and injection pump timing refer to Sub-section A412 ENGINE OVERHAUL.

Before starting, crank the engine (with stop control operating) until oil has circulated or oil pressure is indicated.

OIL PRESSURE RELEASE VALVE

To Remove

Disconnect battery.

Open and secure bonnet.

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

Unscrew union of oil pump outlet pipe.

Remove bolt securing valve housing to cylinder block and remove the outlet pipe and valve housing assembly.

Separate the pipe and housing by removing the two bolts from the flange. Recover the gasket.

Cover the end of the release valve body to prevent possible loss of components, remove the split pin, release the spring retaining cap, spring and plunger.

To Refit

Refitting is a reversal of the removal procedure using new gaskets.

Note: The spring pressure is pre-set and no attempt should be made to adjust the operating pressure. Refer to Sub-section A412 ENGINE OVERHAUL for load/ length figures.

OIL FILTER HEAD

To Remove

Open and secure bonnet.

Turn steering onto full right hand lock.

Remove bolts securing right hand noise insulation panel to chassis member and remove panel.

Remove two nuts retaining the filter head to the cylinder block and withdraw the filter head from the studs. Discard the gasket.

Unscrew filter canister from filter head.

To Refit

Refitting is a reversal of the removal procedure noting the following:

Clean joint faces and use a new gasket ensuring that it is correctly fitted.

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.

FUEL SYSTEM

EXHAUST FLANGE SEALING RING

To Remove

Disconnect battery.

Open and secure bonnet.

Remove bolts, release 'Dzus' fasteners and remove undertrays and cross strap.

Remove nut and bolt securing down pipe steady bracket.

Release down pipe by removing three nuts at manifold joint. Displace down pipe and retainer plate and recover sealing ring.

To Refit

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

EXHAUST MANIFOLD AND GASKET

To Remove

Disconnect battery.

Remove exhaust down pipe (Refer to EXHAUST FLANGE SEALING RING).

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

Release clips and lift out rear engine cover.

Remove bolts and lift out front engine cover.

Unscrew four 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.

INLET MANIFOLD AND GASKET

To Remove

Disconnect battery.

Open and secure bonnet.

Release clips and remove rear engine cover.

Remove bolts and lift out front engine cover.

Release hose clip at induction elbow and displace hose.

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

Remove 'Lucar' connector from 'Thermostart'.

Unscrew union of 'Thermostart' feed pipe.

Remove six bolts securing manifold to cylinder head and remove manifold complete with induction elbow.

Recover manifold gaskets.

To Refit

Clean faces of manifold and cylinder head.

Fit new manifold gaskets.

Reassemble in reverse order.

AIR CLEANER

To Remove

Disconnect battery.

Release clips and lift out rear engine cover.

Open and secure bonnet.

Release hose clip and remove intake hose from air cleaner stub.

Remove bolts and lift out air cleaner assembly.

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

To Refit

Refitting is a reversal of the removal instructions.

THERMOSTART UNIT

To Remove

Disconnect battery.

Release clips and remove rear engine cover.

Disconnect 'Lucar' connector from 'Thermostart'.

Unscrew union of fuel feed pipe.

Unscrew and remove 'Thermostart' unit.

To Refit

Refitting is a reversal of the removal instructions.

Bleed the fuel feed pipe to 'Thermostart' before attempting to start engine.

FINAL FUEL FILTER

To Remove

Disconnect battery.

Release clips and remove rear engine cover.

Open and secure bonnet.

Release hose clip, disconnect hose from induction elbow and detach air intake hose from front grille duct.

Remove bolts and lift air cleaner assembly clear of engine compartment.

Remove bolt and clip securing fuel filter feed and return pipes to cylinder head.

Unscrew unions of feed and return pipes at filter.

Remove banjo bolt securing the 'Thermostart' pipe to adaptor nut at rear of filter.

Unscrew union of leak-off pipe adjacent to number four injector.

Remove banjo bolt securing adaptor for leak-off pipe and return to tank line to filter.

Unscrew unions, remove injector leak-off to filter pipe and displace the return to tank line.

Unscrew union of lift pump to filter pipe.

Remove bolts and detach filter assembly from cylinder head.

To Refit

Refitting is a reversal of the removal instructions.

Note: It is essential to bleed the system before attempting to start the engine. Commence bleeding at the filter, followed by the feed pipe at the injection pump, the lower bleed screw and the upper bleed screw of the pump. The pump return pipe should then be bled at the union adjacent to the injection pump followed by bleeding at the union where the pipe enters the final fuel filter. Bleed two injector pipes and start the engine.

Check for leaks.

FUEL LIFT PUMP

To Remove

Release clips and lift out rear engine cover.

Unscrew unions of both pipes at the pump.

Remove four nuts from pump securing studs and recover two reinforcement strips.

Withdraw the pump from the studs.

To Refit

Refitting is a reversal of the removal instructions.

Bleed the fuel system.

If it is necessary to dismantle the pump refer to Sub-section A412 ENGINE OVERHAUL.

FUEL INJECTOR

To Remove

Release clips and lift out rear engine cover.

Open and secure bonnet.

Release hose clip and disconnect hose at induction elbow.

Pull intake hose from its location on front grille duct.

Remove bolts and lift out air cleaner assembly.

Unscrew union at rear of fuel leak-off pipe.

Remove four banjo bolts securing leak-off pipe to injectors and remove pipe.

Unscrew union of injector feed pipe.

Remove nuts securing injector and remove the injector.

Recover the copper sealing ring and dust seal.

To Refit

Refitting is a reversal of the removal instructions.

For injector servicing details refer to Sub-section A412 ENGINE OVERHAUL.

Note: It is essential that a new copper sealing is used every time that an injector is fitted.

FUEL INJECTION PUMP

To Remove

Disconnect battery.

Remove radiator (Refer to Sub-section C200).

Remove bolts and detach access plate from timing cover.

Remove three bolts securing drive gear to injection pump drive shaft, but do not allow gear out of mesh.

Unscrew unions of final fuel filter feed and return pipes at the pump.

Disconnect throttle cable at clevis and adjuster and displace.

Disconnect auto-stop cable at injection pump.

Unscrew unions of injector pipes and displace.

Carefully note timing marks on timing case and injection pump body.

Remove nuts securing injection pump to timing case and withdraw pump.

To Refit

Refitting is a reversal of the removal instructions. Take particular care not to disengage the mesh of the pump drive gear and ensure that its dowel locates correctly into the slot in the face of the pump drive shaft.

Bleed the fuel system.

Adjust the auto-stop control cable (Refer to ENGINE AUTO-STOP CONTROL).

ENGINE AUTO-STOP CONTROL

To Remove

Disconnect battery.

Release clips and remove rear engine cover.

Open and secure bonnet.

Release clip and remove air intake hose at intake elbow and front grille duct.

Remove air cleaner assembly.

Disconnect wiring harness at multi-plug adjacent to auto-stop control.

Slacken clamp bolt securing auto-stop control inner cable to stop control lever at injection pump, unscrew cable adjuster from bracket and displace cable.

Remove two bolts securing auto-stop control bracket to cylinder block.

Separate the support bracket from auto-stop control unit by removing the three nuts.

To Refit

Refit the support bracket to auto-stop control.

Secure the auto-stop control and bracket assembly to the cylinder block, fit the outer cable to its bracket and locate the inner cable in the clamp bolt of stop control lever at injection pump.

Ensure that the control cable is correctly located in its adjuster and that the adjuster is in the mid-way position.

Move the stop lever against its stop position and then move it slightly towards the run position until the dimension is obtained as shown in Fig. 1.

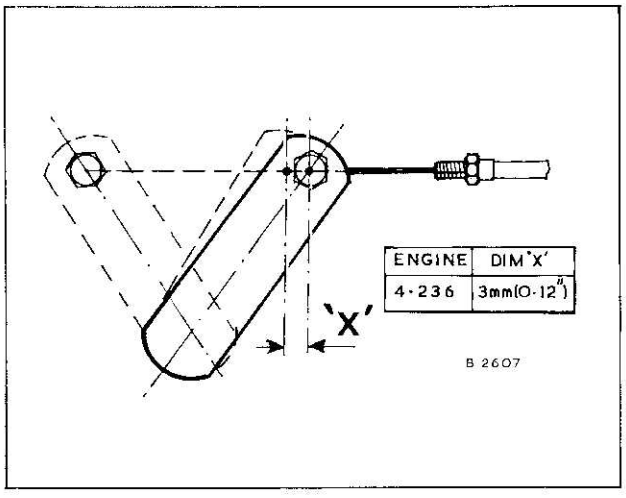

Fig. 1 *Stop control lever setting*

Retighten the inner cable clamp bolt without disturbing the stop lever setting or control cable.

Reconnect the wiring harness multi-plug.

Reconnect battery.

Check the operation of the auto-stop control by starting and stopping the engine.

Refit air cleaner assembly, air intake hose and rear engine cover.

Close the bonnet.

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 the speedometer/tachograph drive cable from gearbox and displace.

Release the propshaft from the gearbox.

Support the engine and remove the remaining bolts from the crossmember.

If vehicle is fitted with air/hydraulic brakes, release clip holding compressor hose and pipe to gearbox and displace.

Support the gearbox and remove remaining nuts retaining bell housing to flywheel housing. Two nuts cannot be removed completely until the gearbox is partially withdrawn.

Withdraw the gearbox.

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

Using a suitable tube against the bearing outer race, drift the bearing squarely into position. The face of the bearing should be 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 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.

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

Unscrew speedometer/tachograph drive cable from gearbox and displace.

Release propshaft from gearbox.

Support engine and remove remaining bolts from crossmember.

If vehicle is fitted with air/hydraulic brakes, release clip holding compressor hose and pipe to gearbox and displace.

Withdraw the gearbox.

Remove clutch assembly.

Remove the flywheel.

Unscrew bolts securing oil seal housing to cylinder block and remove housing.

Remove the oil seal from its housing.

To Refit

For details of fitting a new seal refer to Sub-section A412 ENGINE OVERHAUL.

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

Tighten flywheel setscrews to a torque of 108 Nm (80 lbf.ft).