

TC18, TC21, TC21D CONTENTS

SECTION 1 - ENGINE SYSTEMS

SECTION 2 - FUEL SYSTEM

SECTION 3 - ELECTRICAL SYSTEM

SECTION 4 - SINGLE CLUTCH

SECTION 5 - TRANSMISSION SYSTEMS

SECTION 6 - POWER TAKE-OFF SYSTEMS

SECTION 7 - DIFFERENTIAL, REAR AXLE, AND BRAKES

SECTION 8 - HYDRAULIC SYSTEM

SECTION 9 - STEERING SYSTEM

SECTION 10 - FRONT AXLE AND RELATED PARTS

SECTION 11 - WHEELS AND TIRES

SECTION 12 - SEPARATING THE TRACTOR

SECTION 1

ENGINE SYSTEMS

CONTENTS

| | |
|--|-------------|
| GENERAL INFORMATION | 1-2 |
| ENGINE OVERHAUL | 1-4 |
| DISASSEMBLY, INSPECTION, AND ASSEMBLY OF COMPONENT ASSEMBLIES | 1-14 |
| ENGINE RE-ASSEMBLY | 1-35 |
| ENGINE LUBRICATION SYSTEM | 1-46 |
| COOLING SYSTEM | 1-52 |
| COOLING SYSTEM OVERHAUL | 1-55 |
| TROUBLESHOOTING | 1-63 |
| SPECIFICATIONS | 1-69 |
| TORQUE SPECIFICATIONS | 1-77 |
| SPECIAL TOOLS | 1-78 |
| INDEX | 2-30 |

GENERAL INFORMATION

DESCRIPTION AND OPERATION

This section describes the engine overhaul and repair procedures of the Models TC18, TC21, and TC21D tractors. Repair procedures are essentially the same for all models except as noted in the repair procedures.

The tractors are equipped with three-cylinder in-line engines. They are all four cycle, overhead valve, liquid cooled engines. The engines are identified by a code cast into the lower right side of the cylinder block, just behind the hydraulic pump. The identification numbers of the engines used is shown in the following chart.

IDENTIFICATION CHART

| ENGINE IDENTIFICATION | TRACTOR MODEL | HORSE-POWER |
|-----------------------|---------------|-------------|
| S753 | TC18 | 18.5 |
| S773 | TC21 & TC21D | 21.0 |

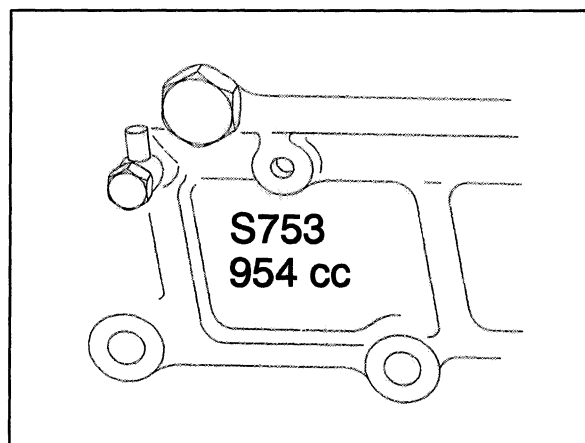


Figure 1-1

CYLINDER HEAD AND VALVE TRAIN COMPONENTS

The cylinder head incorporates the valve assemblies, rocker arms, rocker shaft, push rods, lifters, and pre-combustion chambers. The air intake manifold is incorporated into the left hand side of the valve cover assembly. The exhaust manifold is bolted on the left-hand side of the cylinder head. The cylinder heads have integral valve guides. Standard size valves only are used. Figure 1-2 provides a cut-away front and side view of an engine.

A pre-combustion chamber is located between the injector assembly and the combustion chamber of the cylinder and provides an area for initial ignition of the fuel for improved starting. A glow plug located in the head extends into the pre-combustion chamber and, when energized, pre-heats the fuel-air mixture for improved fuel ignition under cold weather conditions.

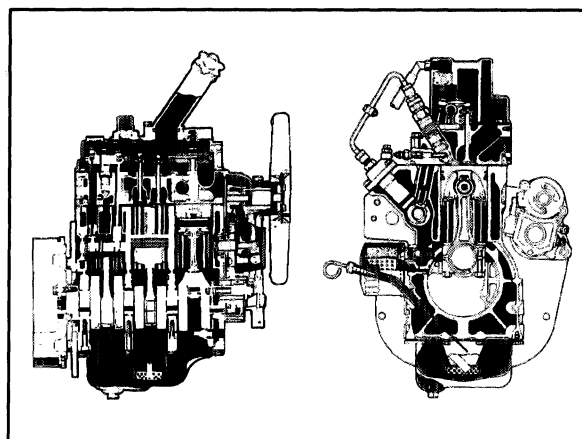


Figure 1-2

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CYLINDER BLOCK ASSEMBLY

The cylinder block assembly contains the pistons, connecting rods, crankshaft, timing gears, and engine oil pump. The engine crankshaft is supported by four main bearings. The front main bearing is a full circle bearing positioned in a bore in the front of the block. The

second, third, and fourth main bearings are split liners located in holders bolted to the block. The camshaft is supported by two ball bearings one located on each end of the block. The engines utilize a straight connecting rod and a three ring piston.

ENGINE OVERHAUL

ENGINE DISASSEMBLY

1. Open the radiator drain, 1, and drain and remove the radiator assembly. See "Radiator Removal" discussed later in this section, pg 1-55.

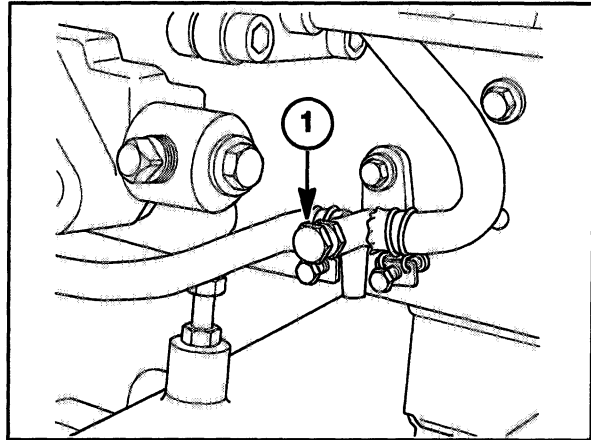


Figure 1-3

2. Disconnect the electrical connector, 1, for the head lamps.

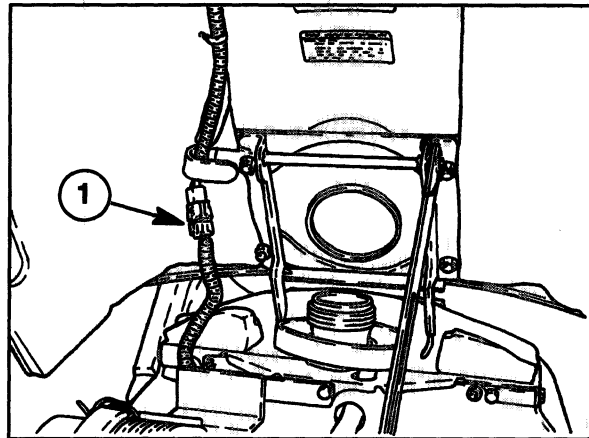


Figure 1-4

3. Remove the clip pin, 1, from the hood support, 2, and gradually lower the hood.

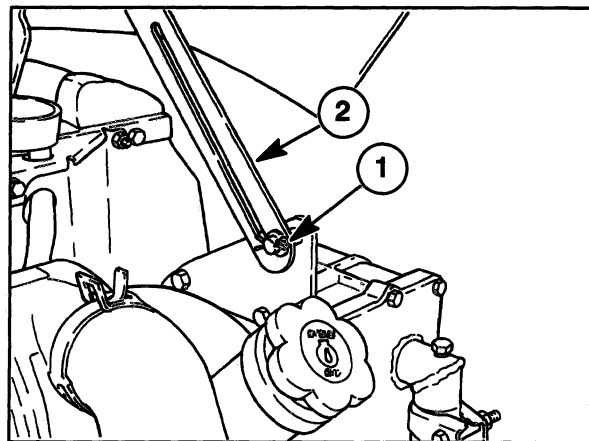


Figure 1-5

SECTION 1 - ENGINE SYSTEMS

4. Pull the instrument panel out by hand and remove the clip pins, 1, from the hood hinge pins, 2. Then remove the hinge pins.
5. Raise the hood and remove from the tractor.

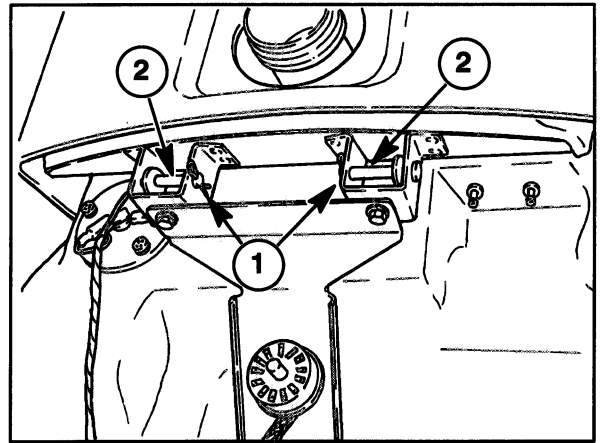


Figure 1-6

6. Remove the whole air cleaner assembly, 1, along with the air cleaner hoses.

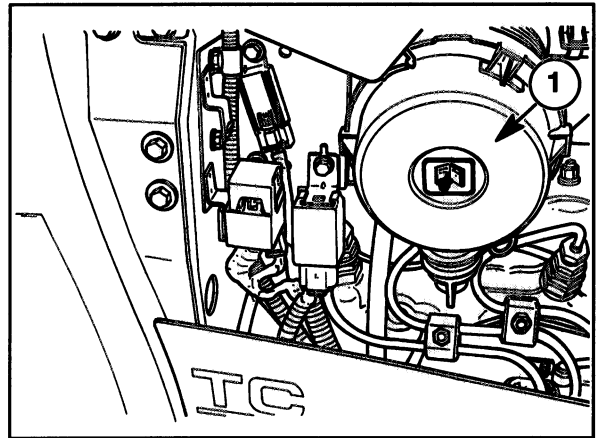


Figure 1-7

7. Remove the two capscrews, 1, and remove the air cleaner mounting bracket, 2.

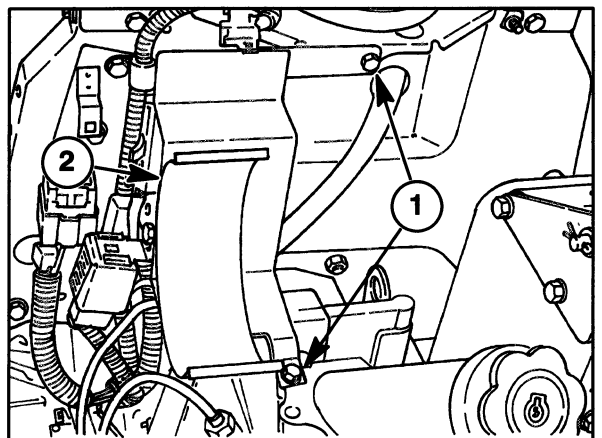


Figure 1-8

- Remove the exhaust muffler and manifold assembly, 1.

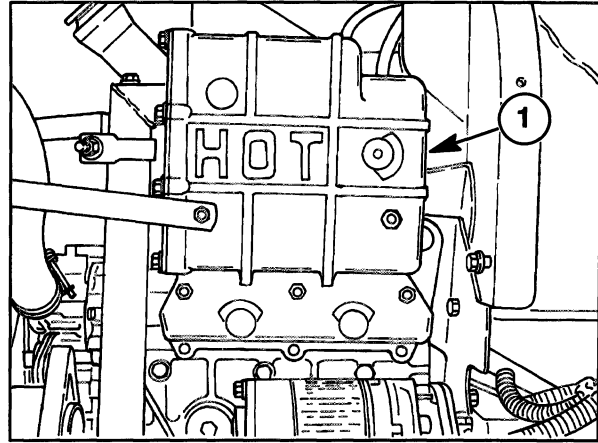


Figure 1-9

FUEL INJECTOR AND GLOW PLUG REMOVAL

- Clean all dirt and oil from the injectors and surrounding areas.
- Disconnect the fuel lines, 1, from the injectors and cap all openings.
- Remove the three glow plugs, 2.
- Disconnect the return line to the fuel tank from the number three injector.
- Remove the injector assemblies, 3.

NOTE: Be sure to remove the injector sealing washer from the injector bore, if not removed with the injector.

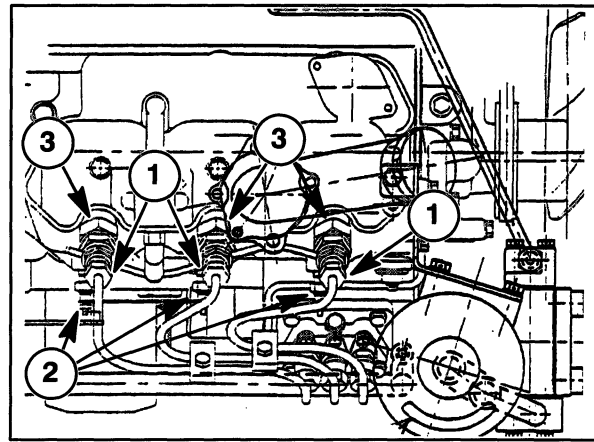


Figure 1-10

OIL PRESSURE SWITCH REMOVAL

- Disconnect and remove the oil pressure switch, 1.

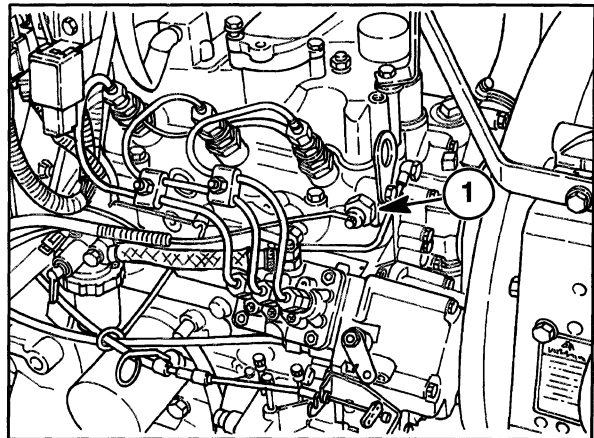


Figure 1-11

TEMPERATURE SENDING SWITCH AND ALTERNATOR REMOVAL

1. Remove the temperature sending switch, 1, from the front of the cylinder head.
2. Loosen the alternator mounting bolts, 2, and remove the V-belt, 3, from the drive pulley.
3. Disconnect the wires from the back of the alternator.
4. Remove the alternator mounting bolts and remove the alternator, 4.

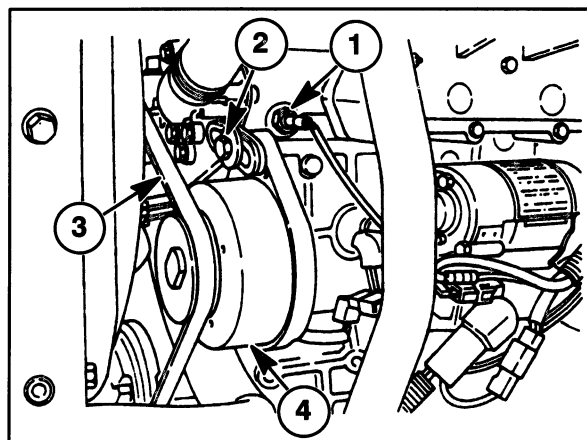


Figure 1-12

FAN, WATER PUMP, AND EXTERNAL OIL TUBE REMOVAL

1. Remove the fan and water pump assembly. See "Water Pump and Thermostat Removal" discussed later in this section, pg 1-57.
2. Remove the external oil transfer tube banjo bolts, 1, from the front of the cylinder head and the side of the cylinder block and remove the external oil transfer tube.

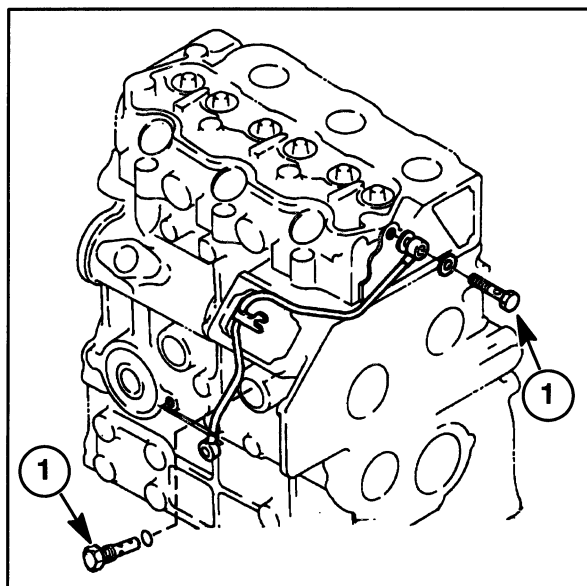


Figure 1-13

VALVE COVER REMOVAL

1. Remove the valve cover, 1, and gasket.

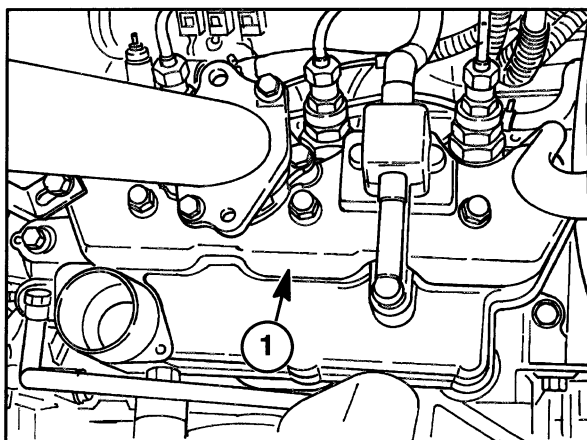


Figure 1-14

ROCKER SHAFT AND PUSH ROD REMOVAL

1. Remove the valve rocker arms, 1, shaft, 2, rocker arm supports, 3, and springs, 4, as an assembly
2. Remove the push rods, 5.

NOTE: Be sure to keep the valve components in separately marked containers for re-assembly in their original position.

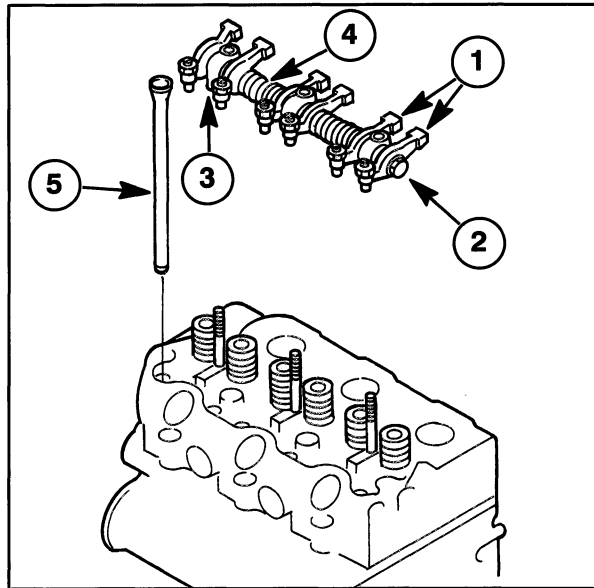


Figure 1-15

CYLINDER HEAD REMOVAL

1. To remove the cylinder head, remove the cylinder head bolts, 1, by alternately loosening a half turn at a time to prevent warping the head.

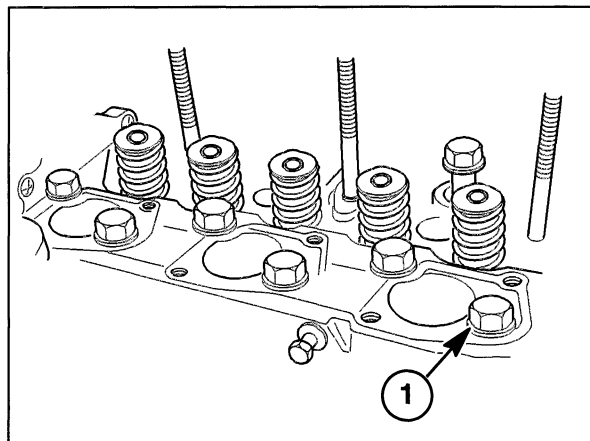


Figure 1-16

VALVE TAPPET REMOVAL

1. Remove the valve tappets, 1, from the machined bore in the cylinder block.

NOTE: Be sure to keep the valve components in separately marked containers for re-assembly in their original position.

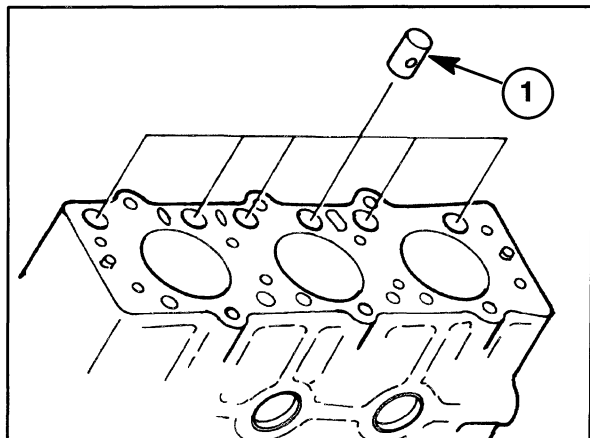


Figure 1-17

FUEL SHUT-OFF SOLENOID REMOVAL

1. Remove the wire connector, 1, and unscrew the fuel shut-off solenoid, 2.

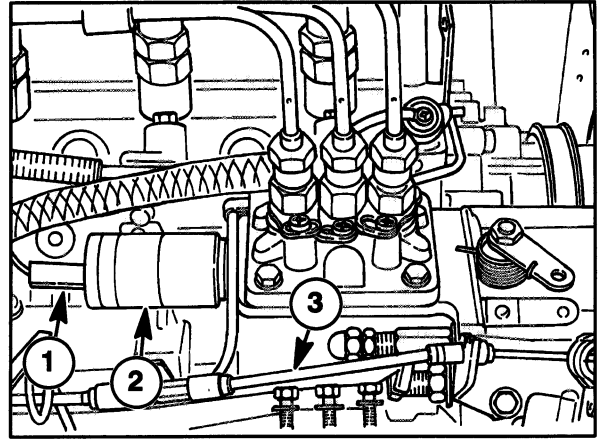


Figure 1-18

ENGINE TIMING GEAR COVER, TIMING GEARS, AND CAMSHAFT

1. Drain the engine crankcase oil into a suitable container.
2. Remove the nut, 1, and washer, 2, and remove the pulley, 3, from the crankshaft, 4.
3. Disconnect the throttle control cable from the governor lever, 3, Figure 1-18.

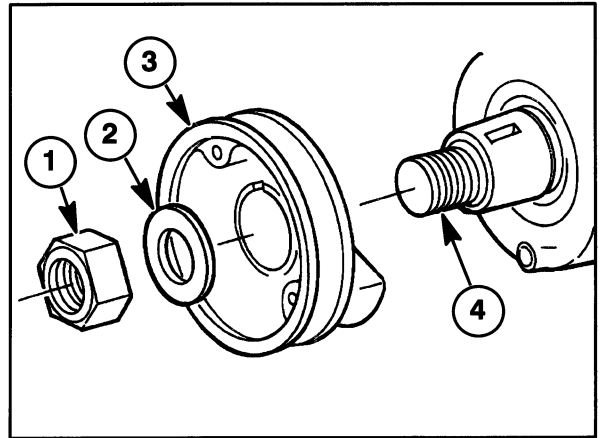


Figure 1-19

4. Remove the injection pump mounting bolts and raise the injection pump enough to remove the spring pin, 1, and separate the governor link from the control rack.

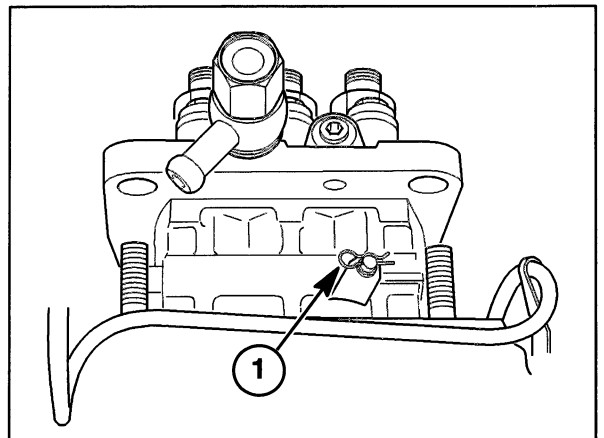


Figure 1-20

5. If equipped, remove the power steering pump reservoir tank dipstick-filler cap, 1. Remove the reservoir drain plug, 2, from the bottom of the reservoir, and drain the fluid out of the reservoir tank, 3, into a suitable container.
6. Loosen the hose clamp, 4, on the suction tube and disconnect the hose from the suction tube.
7. Remove the pressure tube, 5, from the engine side of the steering pump.
8. Remove the through bolts, 6, and remove the steering pump from the front cover. Cap and plug all lines and openings.

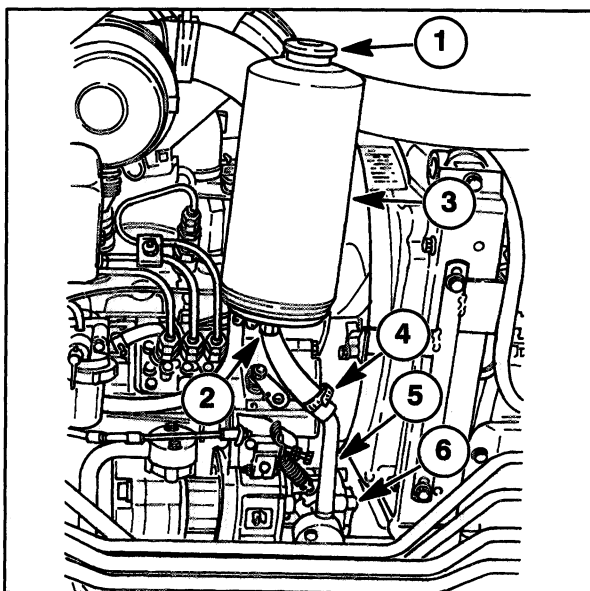


Figure 1-21

9. Remove the retaining bolts, 1, and lift the front cover, 2, and gasket, 3, off the locating dowels.

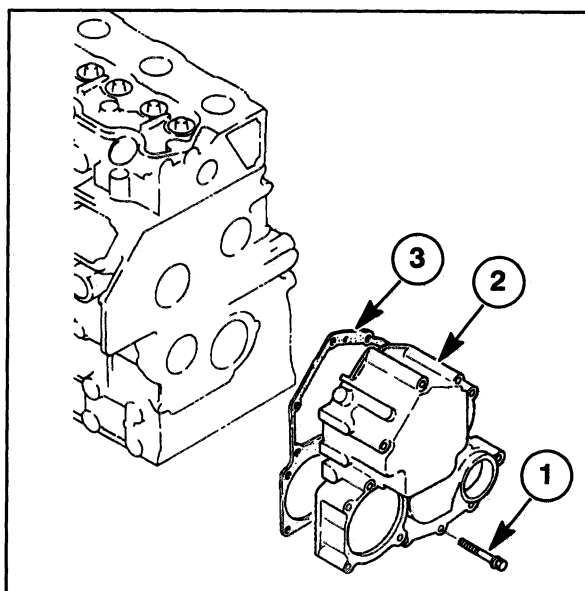


Figure 1-22

Timing Gears and Camshaft Removal

1. Remove the retaining ring, 1, and remove the idler gear and oil pump assembly, 2.

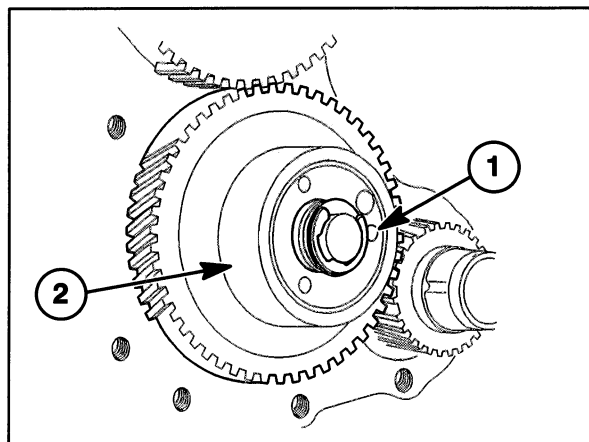


Figure 1-23

2. Remove the two bolts securing the keeper plate, 1. One bolt must be accessed using the access hole, 2, in the cam gear.
3. Slide the camshaft and gear out of the camshaft bore.

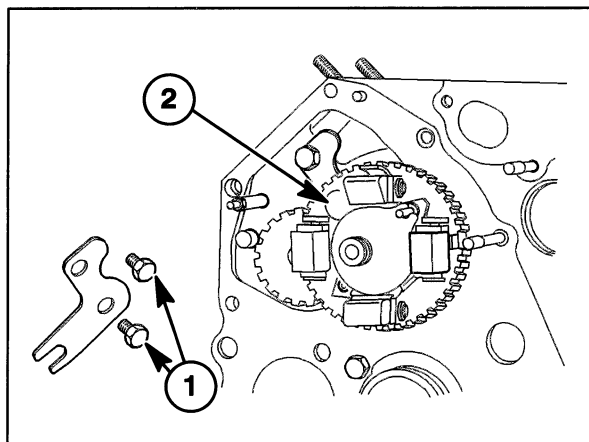


Figure 1-24

Oil Sump Removal

1. Remove the oil sump retainer bolts, 1.
2. Remove the oil sump and discard gasket.

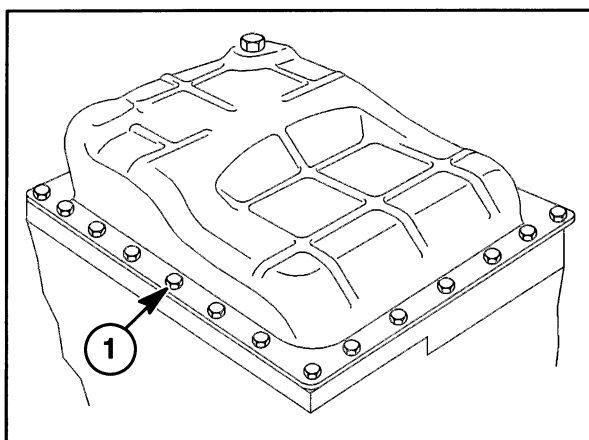


Figure 1-25

Oil Suction Pipe and Strainer Removal

1. Remove the two retaining bolts, 1.
2. Remove the oil strainer, 2, and rotate the oil suction pipe, 3, out of its bore.

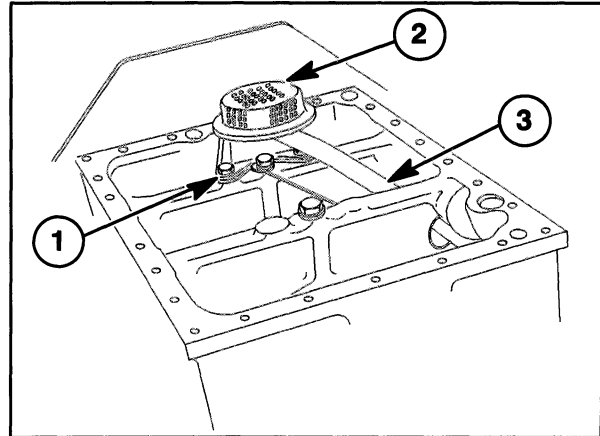


Figure 1-26

Connecting Rods, Bearings, and Piston Removal

1. Remove the bolts, 1, retaining the three connecting rod caps, 2.
2. Remove the connecting rod caps with lower half of the connecting rod bearing.

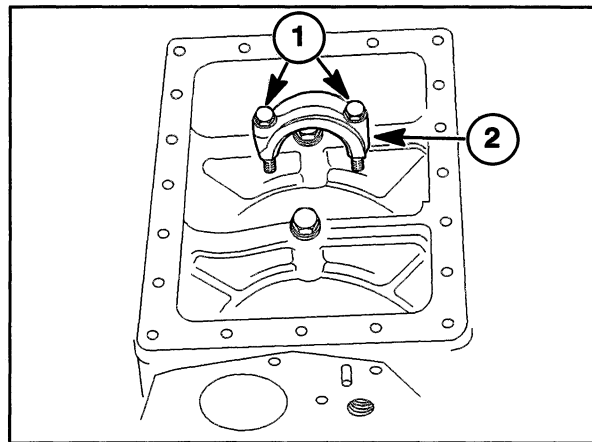


Figure 1-27

3. If necessary, remove any ridge from the top of the cylinder bores using a suitable ridge reamer.
4. Push the piston and connecting rod out of the cylinder block.
5. Replace the connecting rod caps to the piston assembly it was removed from. Keep together in cylinder sequence.

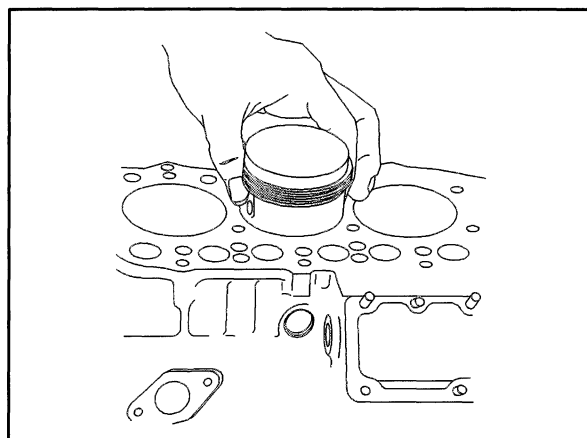


Figure 1-28

Flywheel Removal

1. Loosen the flywheel retaining bolts, 1.
2. Using a brass drift and hammer, tap the end of the crankshaft, 2, to loosen the flywheel, 3, from the shaft.
3. Remove the retaining bolts, lock washers, and flywheel from the crankshaft.

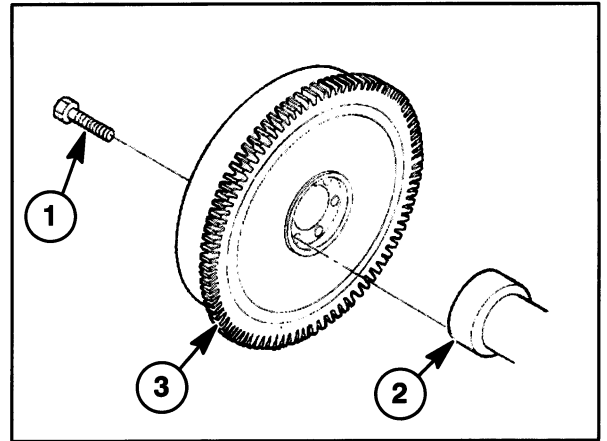


Figure 1-29

Backplate and Oil Seal Removal

1. Remove the backplate retaining bolts and remove the backplate.
2. Remove the rear oil seal, 1.

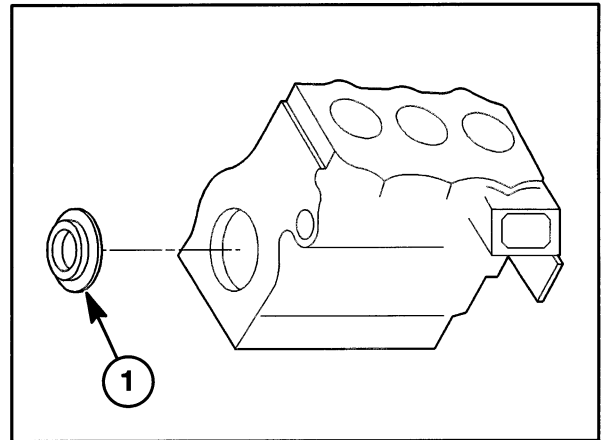


Figure 1-30

Crankshaft and Main Bearings Removal

1. Remove the crankshaft bearing holder retaining bolts, 1.
2. Slide the crankshaft and main bearing assembly through the rear of the engine.

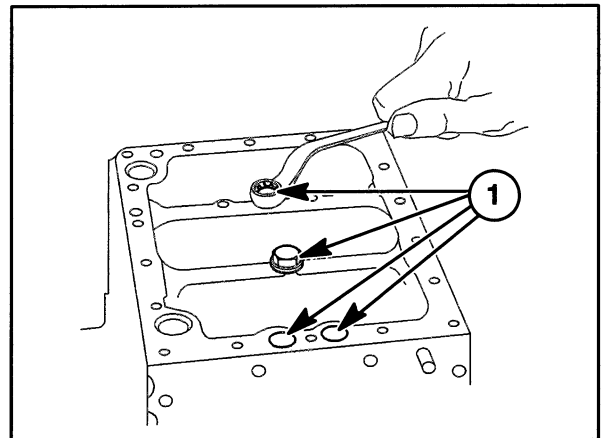


Figure 1-31

DISASSEMBLY, INSPECTION, AND ASSEMBLY OF COMPONENT ASSEMBLIES

CYLINDER HEAD DISASSEMBLY

1. Clean the cylinder head and remove any carbon deposits from around the heads.
2. Use a valve spring compressor and remove the valve spring retainer locks, 1, spring, 2, and spring retainer, 3, from each valve, 4.
3. Remove the valves and place the valve components together in separately marked containers for re-assembly in their original position.

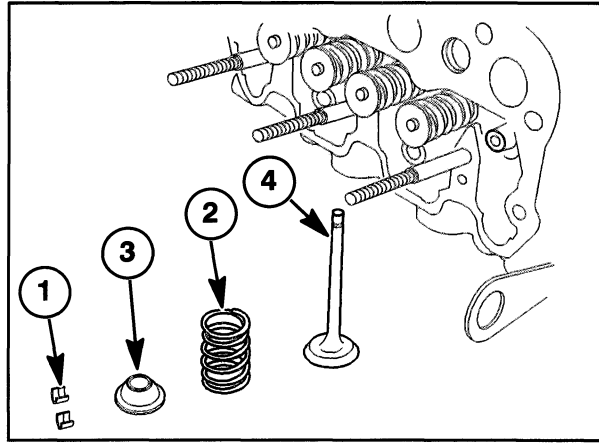


Figure 1-32

CYLINDER HEAD INSPECTION AND REPAIR

1. Clean all carbon deposits from the combustion chamber and valve ports using a wire brush and scraper.
2. Clean all dirt and residue from the gasket surface using care not to scratch or nick the machined surface.
3. Clean the cylinder head in solvent and air dry.
4. Inspect the head for cracks in the following areas:
 - Valve ports
 - Valve seats
 - Pre-chamber
5. Inspect the gasket surfaces for scratches or nicks, which could cause leakage.
6. Examine the core hole plugs for rust or signs of leakage. If a plug shows signs of damaging rust or leakage, replace all plugs in the head.
7. Using a straight edge, 1, and a feeler gauge, 2, check the cylinder head for warpage lengthwise, crosswise, and diagonally. Resurface or replace the head if the warpage is greater than 0.12 mm (0.005 in.).

NOTE: If resurfacing requires removal of more than 0.50 mm (0.020 in.) material replace the head.

8. Inspect the pre-chamber for carbon deposits and looseness. Remove any carbon deposits found. If the pre-chamber is found to be loose, the cylinder head is warped and must be replaced.

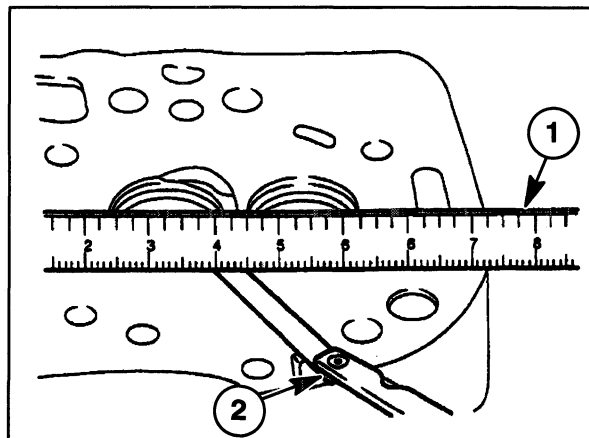


Figure 1-33

VALVE SEATS

Examine the valve seat and reface the seat if damaged. Valve seat grinding requires that the seat be ground to a specific width and positioned to contact the valve face at a specified point. A valve that extends too deep into the combustion chamber will result in valve burning, and if the valve is recessed too deep into the head it will cause a rapid build-up of carbon deposits.

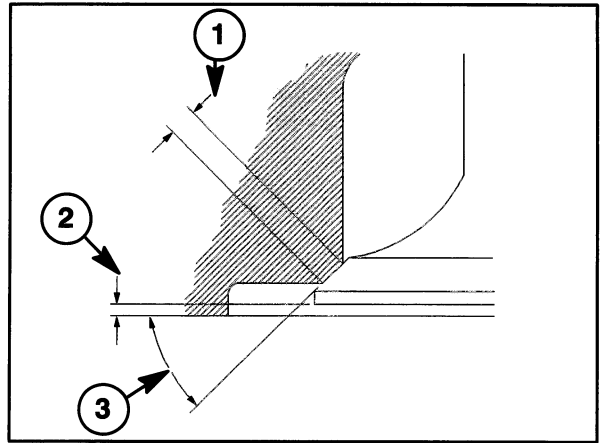


Figure 1-34

1. Correct Valve Seat Width - 1.7 - 2.1 mm (0.067 - 0.0826 in.) - Seat must strike center of valve face
2. Correct Valve Head Margin - 0.775 - 1.075 mm (0.0305 - 0.042 in.)
3. Angle of Valve Seat - 45°

1. Check the seat for surface defects. Use a 45° stone if necessary to reface. Grind away only enough material to provide a smooth even seat.
2. Check the seat width. If necessary, use a 15° stone to lower the seat contact point and a 75° stone to raise the seat contact point.

NOTE: Refacing the seat should always be coordinated with refacing the valve to assure a compression tight fit.

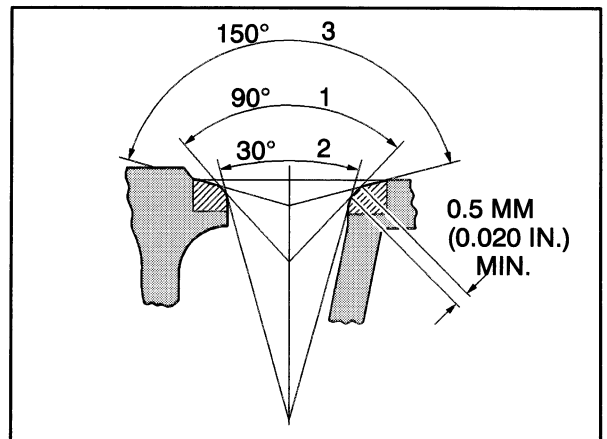


Figure 1-35

1. Seat angle - 45° Stone
2. Lower Seat Location - 15° Stone
3. Raise Seat Location - 75° Stone



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VALVES

1. Clean all deposits from the valves using a soft wire brush. Inspect the condition of the valves. Discard valves that are badly burned, cracked, or bent.

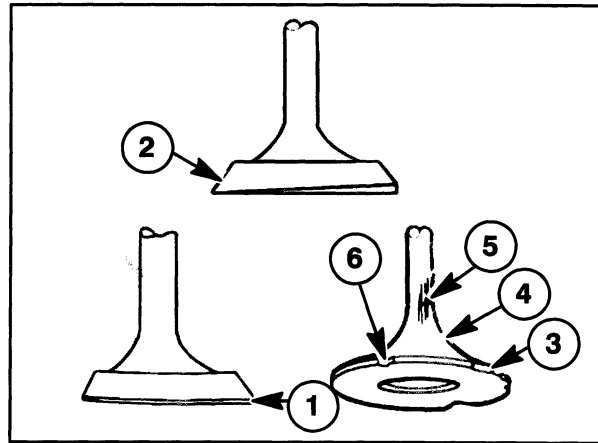


Figure 1-36

1. Margin too Thin - Min. 0.5 mm (0.002 in.)
2. Bent Valve
3. Pitting
4. Indented
5. Wear or Nicking
6. Burned

2. Using a micrometer, measure the valve stem at points "A", "B", and "C". Replace the valve if the stem diameter is less than the following dimensions:

| Intake | Exhaust |
|------------------------|------------------------|
| 6.89 mm (0.271 in.) | 6.84 mm (0.269 in.) |

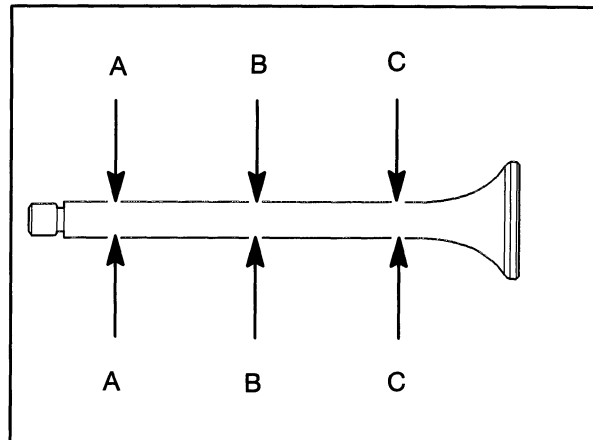


Figure 1-37

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