NEW HOLLAND 1120 1220 REPAIR MANUAL

NEW HOLLAND

SERVICE

42112020 (SE4601)

Reprinted

FOREWORD

This repair manual provides information for the proper servicing and overhaul of Ford 1120 and 1220 Tractor Models and is an essential publication for all service personnel carrying out repairs and maintenance procedures.

The Manual is divided into twelve PARTS, each sub-divided into Chapters. Each Chapter contains information on general operating principles, detailed inspection and overhaul and, where applicable, trouble shooting, special tools and specifications.

The material contained in this Manual was correct at the time of going to print, but Ford New Holland, Inc. policy is one of continuous improvement and the right to change prices, specifications, equipment or design at anytime without notice is reserved. All data in this Manual is subject to production variations, so overall dimensions and weights should be considered as approximate only and the illustrations do not necessarily depict the unit to standard build specification.

FORD NEW HOLLAND, INC.

PRODUCTION DATE CODES AND SERIAL NUMBERS

The Tractor Identification Plate is located on the left side of the transmission case on the Ford 1120 and 1220 Tractors and is stamped with the following information:

Production Identification Number — Two letter prefix followed by the Tractor Serial Number.

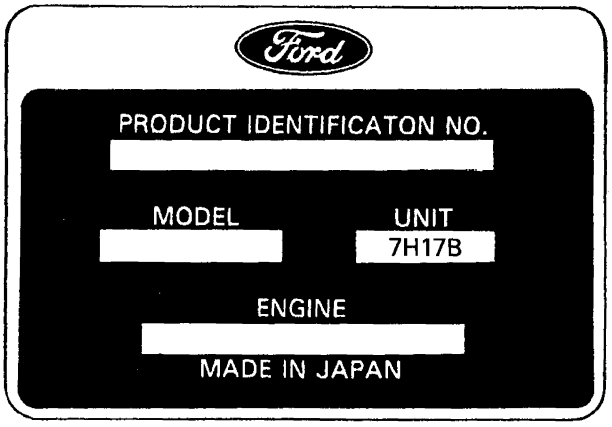
Whenever effecting repair or overhaul the relevant series information should be noted and used when referring to Service Bulletins and/or the Parts Catalog.

Model — Production Model Code

Unit — Production Unit Date Code*

Engine — Serial Number and Engine Production Date Code

TRACTOR SERIES IDENTIFICATION PLATE



First Number YEAR	First Letter MONTH		Second Number DAY OF MONTH	Second Letter PRODUCTION SHIFT
4 — 1984	A—Jan.	G—July	01/28/29/30/31	A—Midnight
5 — 1985	B—Feb.	H—Aug.		B—Day
6 — 1986	C—March	J—Sept.		C—Afternoon
7 — 1987	D—April	K—Oct.		
8 — 1988	E—May	L—Nov.		
	F—June	M—Dec.		

*Example of Production Unit Date Code 7 H 17 B

- 7 — Year of Final Assembly 1987
- H — Month of Year August
- 17 — Day of Month (Seventeen)
- B — Shift Period Day

SAFETY PRECAUTIONS

Practically all service work involves the need to drive the tractor. The Operator's Manual, supplied with each tractor, contains detailed safety precautions relating to driving, operating and servicing that tractor. These precautions are as applicable to the service technician as they are to the operator, and should be read, understood and practiced by all personnel.

Prior to undertaking any maintenance, repair, overhaul, dismantling or re-assembly operations, whether within a workshop facility or out "in the field," consideration should be given to factors that may have an effect upon safety, not only upon the mechanic carrying out the work, but also upon bystanders.

PERSONAL CONSIDERATIONS

- The wrong clothes or carelessness in dress can cause accidents. Check to see that you are suitably clothed.

  Some jobs require special protective equipment.

- **Eye Protection**
  The smallest eye injury may cause loss of vision. Injury can be avoided by wearing eye protection when engaged in chiselling, grinding, discing, welding, painting, etc.

- **Breathing Protection**
  Fumes, dust and paint spray are unpleasant and harmful. These can be avoided by wearing respiratory protection.

- **Hearing Protection**
  Loud noise may damage your hearing and the greater the exposure the worse the damage. If you feel the noise is excessive, wear ear protection.

- **Hand Protection**
  It is advisable to use a protective cream before work to prevent irritation and skin contamination. After work clean your hands with soap and water. Solvents such as white spirit, paraffin, etc., may harm the skin.

- **Foot Protection**
  Substantial or protective footwear with reinforced toe-caps will protect your feet from falling objects. Additionally, oil-resistant soles will help to avoid slipping.

- **Special Clothing**
  For certain work it may be necessary to wear flame or acid-resistant clothing.

- Avoid injury through incorrect handling of components. Make sure you are capable of lifting the object. If in doubt get help.

EQUIPMENT CONSIDERATIONS

- **Machine Guards**
  Before using any machine, check to ensure that the machine guards are in position and serviceable. These guards not only prevent parts of the body or clothing from coming in contact with the moving parts of the machine, but also ward off objects that might fly off the machine and cause injury.

- **Lifting Appliances**
  Always ensure that lifting equipment, such as chains, slings, lifting brackets, hooks and eyes are thoroughly checked before use. If in doubt, select stronger equipment than is necessary.

  Never stand under a suspended load or a raised implement.

- **Compressed Air**
  The pressure from a compressed air line is often as high as 100 psi (6.9 bar) 7 (kgf/cm^2). It is perfectly safe if used correctly. Any misuse may cause injury.

  Never use compressed air to blow dust, filing, dirt, etc., away from your work area unless the correct type of nozzle is fitted.

  Compressed air is not a cleaning agent, it will only move dust, etc., from one place to another. Look around before using an air hose as bystanders may get grit into their eyes, ears or skin.

- **Hand Tools**
  Many cuts, abrasions and injuries are caused by defective tools. Never use the wrong tool for the job, as this generally leads either to some injury, or to a poor job.

  Never use

  — A hammer with a loose head or split handle.
  — Spanners or wrenches with splayed or worn jaws.
  — Spanners or files as hammers; or drills, clevis pins or bolts as punches.

  For removing or replacing hardened pins use a copper or brass drift rather than a hammer.

  For dismantling, overhaul and assembly of major and sub components, always use the Special Service Tools recommended.

  These will reduce the work effort, labor time and the repair cost.

  Always keep tools clean and in good working order.

- **Electricity**
  Electricity has become so familiar in day to day usage that its potentially dangerous properties are often overlooked. Misuse of electrical equipment can endanger life.

  Before using any electrical equipment — particularly portable appliances — make a visual check to make sure that the cable is not worn or frayed and that the plugs, sockets, etc., are intact. Make sure you know where the nearest isolating switch for your equipment is located.

GENERAL CONSIDERATIONS

- **Solvents**
  Use only cleaning fluids and solvents that are known to be safe. Certain types of fluids can cause damage to components such as seals, etc., and can cause skin irritation. Solvents should be checked that they are suitable not only for the cleaning of components and individual parts, but also that they do not the affect personal safety of the user.

- **Housekeeping**
  Many injuries result from tripping or slipping over, or on, objects or material left lying around by a careless worker. Prevent these accidents from occurring. If you notice a hazard, don't ignore it — remove it.

  A clean, hazard-free place of work improves the surroundings and daily environment for everybody.

- **Fire**
  Fire has no respect for persons or property. The destruction that a fire can cause is not always fully realized. Everyone must be constantly on guard.

  — Extinguish matches/cigars/cigarettes, etc., before throwing them away.
  — Work cleanly, disposing of waste material into proper containers.
  — Locate the fire extinguishers and find out how to operate them.
  — Do not panic — warn those near and raise the alarm.
  — Do not allow or use an open flame near the tractor fuel tank, battery or component parts.

- **First Aid**
  In the type of work that mechanics are engaged in, dirt, grease, fine dusts, etc., all settle upon the skin and clothing. If a cut, abrasion or burn is disregarded it may be found that a septic condition has formed within a short time. What appears at first to be trivial could become painful and injurious. It only takes a few minutes to have a fresh cut dressed, but it will take longer if you neglect it. Make sure you know where the First Aid box is located.

- **Cleanliness**
  Cleanliness of the tractor hydraulic system is essential for optimum performance. When carrying out service and repairs plug all hose ends and component connections to prevent dirt entry.

  Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficiency and working life of a component and lead to costly replacement. Use of a high pressure washer or steam cleaner is recommended.

OPERATIONAL CONSIDERATIONS

- Stop the engine, if at all possible, before performing any service.
- Place a warning sign on tractors which, due to service or overhaul, would be dangerous to start. Disconnect the battery leads if leaving such a unit unattended.
- Do not attempt to start the engine while standing beside the tractor or attempt to by-pass the safety start switch.
- Avoid prolonged running of the engine in a closed building or in an area with inadequate ventilation as exhaust fumes are highly toxic.
- Always turn the radiator cap to the first stop, to allow pressure in the system to dissipate when the coolant is hot.
- Never work beneath a tractor which is on soft ground. Always take the unit to an area which has a hard working surface — concrete for preference.
- If it is found necessary to raise the tractor for ease of servicing or repair, make sure that safe and stable supports are installed beneath axle housings, casings, etc., before commencing work.
- Certain repair or overhaul procedures may necessitate "separating the tractor," either at the engine/front transmission or front transmission/rear transmission locations. These operations are simplified by the use of the Tractor Splitting Kit/Stands. Should this equipment not be available, then every consideration must be given to stability, balance and weight of the components, especially if a cab is installed.
- Use footsteps or working platforms when servicing those areas of a tractor that are not within easy reach.
- Before loosening any hoses or tubes connecting implements to remote control valves, etc., switch off the engine, remove all pressure in the lines by operating levers several times. This will remove the danger of personal injury by oil pressure.
- Prior to pressure testing, make sure all hoses and connectors not only of the tractor, but also those of the test equipment, are in good condition and tightly sealed. Pressure readings must be taken with the gauges specified. The correct procedure should be rigidly observed to prevent damage to the system or the equipment, and to eliminate the possibility of personal injury.
- When equipment or implements are required to be attached to the hydraulic linkage, either for testing purposes or for transportation, then "position control" should be used.
- Always lower equipment to the ground when leaving the tractor.
- If high lift attachments are installed on a tractor beware of overhead power, electric or telephone cables when traveling. Drop attachment near to ground level to increase stability and minimize risks.
- Do not park or attempt to service a tractor on an incline. If unavoidable, take extra care and block all wheels.
- Observe recommended precautions as indicated in this Repair Manual when dismantling the air conditioning system as escaping refrigerant can cause frostbite.
- Prior to removing wheels and tires from a tractor, check to determine whether additional ballast (liquid or weights) has been added. Seek assistance and use suitable equipment to support the weight of the wheel assembly.
- When inflating tires beware of over inflation — constantly check the pressure. Overinflation can cause tires to burst and result in personal injury.
- Some components on your tractor, such as gaskets and friction surfaces (brake lining, clutch lining, etc.) may contain asbestos. Breathing asbestos dust is dangerous to your health. You are therefore advised to have any maintenance or repair operation on such components carried out by an authorized Ford New Holland Dealer. If, however, service operations are to be undertaken on parts that contain asbestos, the essential precautions are listed below must be observed.
  - Work out of doors or in a well ventilated area.
  - Dust found on tractor or produced during work on the tractor should be dampened, placed in a sealed container and marked to ensure safe disposal.

— If any cutting, drilling, etc., is attempted on materials containing asbestos, the item should be dampened and only hand tools or low speed power tools used.

- Continuous long term contact with used engine oil may cause skin cancer. Avoid prolonged contact with used engine oil. Wash skin promptly with soap and water.

Safety precautions are very seldom the figment of someone's imagination. They are the result of sad experience, where most likely someone has paid dearly through personal injury.

Heed these precautions and you will protect yourself accordingly. Disregard them and you may duplicate the sad experience of others.

SERVICE TECHNIQUES

A. SERVICE SAFETY

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all equipment as well as the personal safety of the individual doing the work. This Shop Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing equipment, as well as in the skill of the individual doing the work. This Manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this Manual must first establish that he compromises neither his personal safety nor the equipment integrity by his choice of methods, tools or parts.

B. SERVICE TECHNIQUES

Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficient working life of a component and lead to costly replacement.

Time spent on the preparation and cleanliness of working surfaces will pay dividends in making the job easier and safer and will result in overhauled components being more reliable and efficient in operation.

Use cleaning fluids which are known to be safe. Certain types of fluid can cause damage to 'O' rings and cause skin irritation. Solvents should be checked that they are suitable for the cleaning of components and also that they do not risk the personal safety of the user.

Replace 'O' rings, seals or gaskets whenever they are disturbed. Never mix new and old seals or 'O' rings, regardless of condition. Always lubricate new seals and 'O' rings with hydraulic oil before installation.

When replacing component parts use the correct tool for the job.

HOSES AND TUBES

Always replace hoses and tubes if the cone end or the end connections are damaged.

When installing a new hose loosely connect each end and make sure the hose takes up the designed position before tightening the connection. Clamps should be tightened sufficiently to hold the hose without crushing and to prevent chafing.

The hoses are the arteries of the unit, be sure they are in good condition when carrying out repairs or maintenance, otherwise the machine's output and productivity will be affected.

After replacing a hose on a moving component make sure the hose does not foul by moving the component through its complete range of travel.

Be sure any hose which has been installed is not kinked or twisted.

Hose connections which are damaged, dented, crushed or leaking restrict oil flow and the productivity of the components being served. Connectors which show signs of movement from the original swaged position have failed, and will ultimately separate completely.

A hose with a chafed outer cover will allow water entry. Concealed corrosion of the wire reinforcement will subsequently occur along the hose length with resultant hose failure.

Ballooning of the hose indicates an internal leakage due to structural failure. This condition rapidly deteriorates and total hose failure soon occurs.

Kinked, crushed, stretched or deformed hoses generally suffer internal structural damage which can result in oil restriction, a reduction in the speed of operation and ultimate hose failure.

Free-moving, unsupported hoses must never be allowed to touch each other or related working surfaces. This causes chafing which reduces hose life.

PART 1
ENGINE SYSTEMS

Chapter 1
ENGINE AND LUBRICATION SYSTEM

Chapter 2
COOLING SYSTEMS

Chapter 3
TROUBLE SHOOTING, SPECIFICATIONS AND SPECIAL TOOLS

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PART 1
ENGINE SYSTEMS

Chapter 1
ENGINE AND LUBRICATION SYSTEM

A. DESCRIPTION AND OPERATION

This chapter describes the overhaul and repair of the Ford 1120 and 1220 diesel engines.

The engines, Figure 1, are of the same basic design and repair procedures are essentially the same except as noted in the repair procedures.

The Ford Model 1120 and 1220 tractors are equipped with three-cylinder in-line, liquid cooled, four cycle, overhead valve engines.

The engine model is identified by a code number cast into the side of the engine block as shown in the following chart.

IDENTIFICATION CHART

ENGINE CODE	TRACTOR MODEL	HORSEPOWER
S723	F1120	14
S753	F1220	17

CYLINDER HEAD AND VALVE TRAIN COMPONENTS

The cylinder head incorporates the valve assemblies, rocker shaft, rocker arm components and precombustion chambers.

The intake manifold is incorporated into the left hand side of the valve cover assembly.

Standard size only valves are utilized with valve guides. Only standard size valves are available for service.

Models 1120 and 1220 have a one piece rocker shaft assembly.

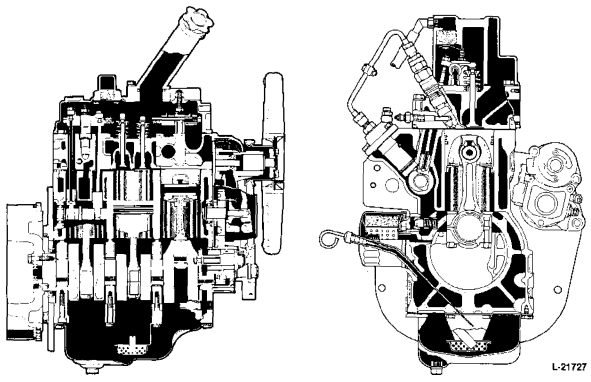

Figure 1
Three Cylinder — Models 1120 and 1220

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A precombustion 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 precombustion chamber and, when energized, preheats the fuel-air mixture for improved fuel ignition under cold weather conditions.

CYLINDER BLOCK ASSEMBLY

The cylinder block assembly contains the pistons, connecting rods, crankshaft, camshaft, timing gears and engine oil pump.

The engine crankshaft is supported by four main bearings. The front main bearing is a full circle bearing located in the block. The 2nd, 3rd and 4th main bearings are split liners located in holders bolted to the block.

The camshaft assembly is supported on two roller bearings located one on each end of the block.

The engines utilize a straight connecting rod and a three ring piston.

LUBRICATION SYSTEM

A gear-rotor type oil pump is driven by the crankshaft gear and is located in a bore in the front end of the engine block. The oil pick-up tube attaches to the rear of the pump and extends into the oil pan sump.

OIL FLOW (Models 1120 and 1220)
Reference — Figure 2

Oil is picked up from the sump by the intake tube and drawn into a lower side drilling in the block to the oil pump. Pressurized oil from the pump flows through passages in the block, past the relief valve, through the oil filter and returns to the area of the drilled bolt of the oil transfer tube located on the right hand side of the block.

The relief valve is mounted in the side of the block and intersects the main oil passage. When the oil pressure becomes higher than the rated value, oil is discharged through the relief valve into the crankcase sump.

Pressurized oil flows from the oil gallery through passages in the block crankshaft bearings. Drilled passages in the crankshaft connect the oil passage from the main bearings to the connecting rod journals.

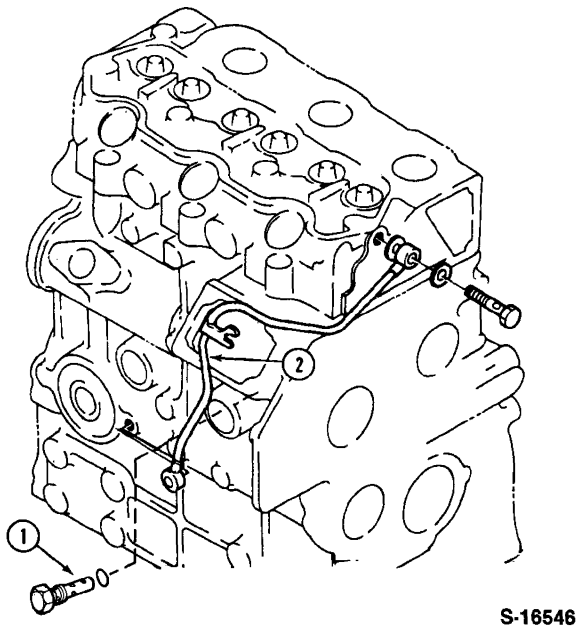

Figure 2
Engine Oil Pump Relief Valve and Transfer Tube — Models 1120 and 1220

1. Relief Valve and O-Ring
2. Oil Transfer Tube (External)

The remaining portion of the oil is directed through the external tube to the cylinder head. The external tube is attached by drilled bolts between the side of the block and the front of the cylinder head. Oil flows from the main oil gallery through the tube and a passage in the head to No. 1 rocker shaft pedestal into the rocker shaft. Oil flows through a small hole in the rocker arms and lubricates the valve stems, push rods and tappets.

Oil flows from the top of the head back to the crankcase sump. Cylinder walls, pistons, and piston pins are splash-lubricated by the crankshaft.

ENGINE OIL FILTER

Because engine oil becomes contaminated with dust, carbon particles, metal dust and sludge, it is directed through a filter before entering the engine lubrication passages. The filter is a full-flow type whereby all of the oil from the pump is routed through the filter. To protect the engine from a loss of lubrication, the filter contains a relief valve which opens if the element becomes plugged, Figure 3.

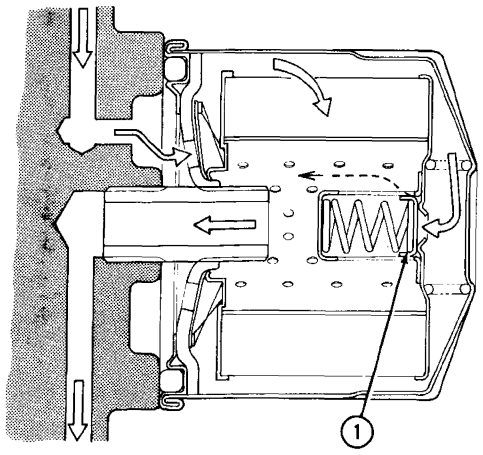

Figure 3
Full Flow Oil Filter Assembly
1. Relief Valve

B. ENGINE OVERHAUL

CYLINDER HEAD AND RELATED COMPONENTS

REMOVAL

1. Drain the radiator, Figure 4.

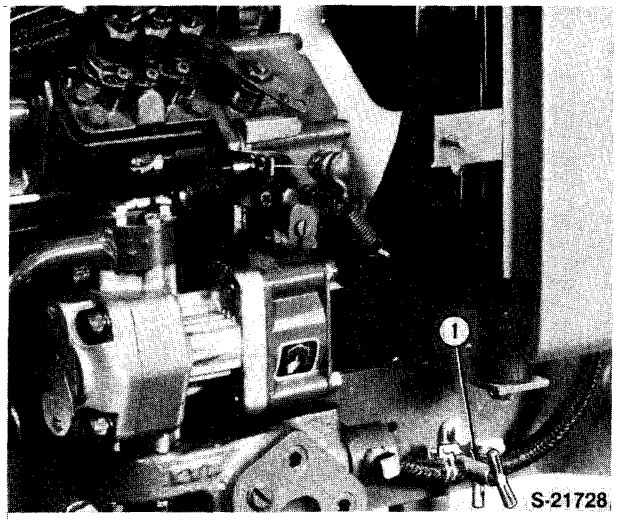

Figure 4
Radiator Coolant Drain
1. Drain Cock

2. Remove the air cleaner assembly, Figure 5.
3. Remove the upper radiator hose.
4. Remove the exhaust muffler and manifold assembly, Figure 5.
5. Remove the upper radiator brace (4) from the top of the cylinder head, Figure 5.
6. Remove the injector lines and cap all openings.
7. Remove the glow plugs (6), Figure 6.
8. Remove the injector assemblies (3), Figure 6.

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

9. Remove the temperature sender switch, Figure 7.
10. Remove the water pump and thermostat assembly, Figure 8.
11. Remove the external oil transfer tube (2), Figure 2.
12. Remove the valve cover and gasket.
13. Remove the valve rocker arm and shaft as an assembly, Figure 9.
14. Remove the push rods (5), Figure 9.

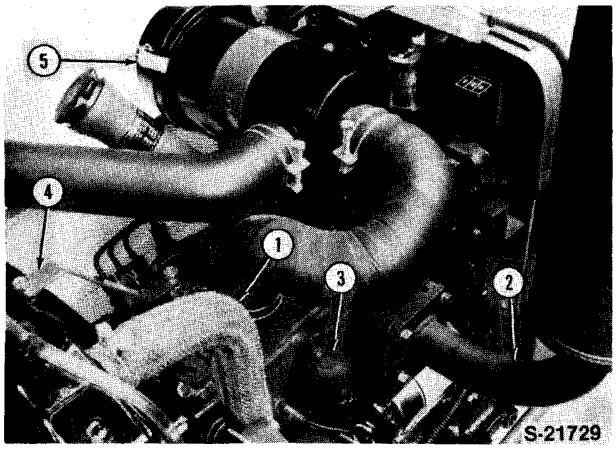

Figure 5
Cylinder Head Removal
1. Upper Radiator Hose
2. Exhaust Muffler
3. Exhaust Manifold
4. Radiator Brace
5. Air Cleaner

NOTE: *Be sure to keep the valve components in separately marked containers for reassembly in their original position.*

15. Remove the cylinder head bolts alternately a half turn at a time to prevent warping the head.

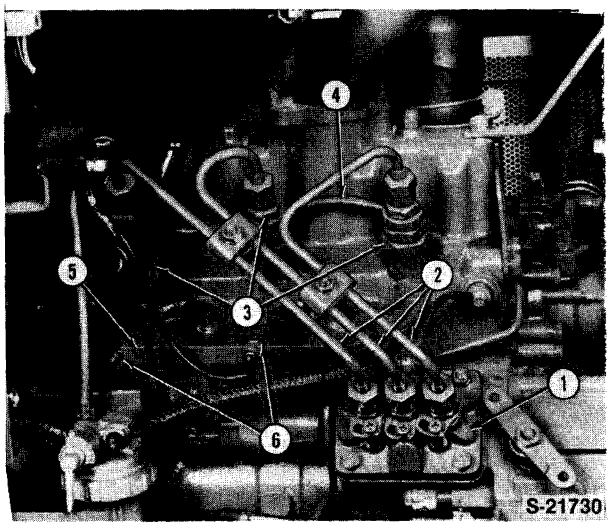

Figure 6
Injector Removal

1. Injection Pump
2. Injector Lines
3. Injectors
4. Injector Leak-Off Lines
5. Glow Plug Connector
6. Glow Plugs

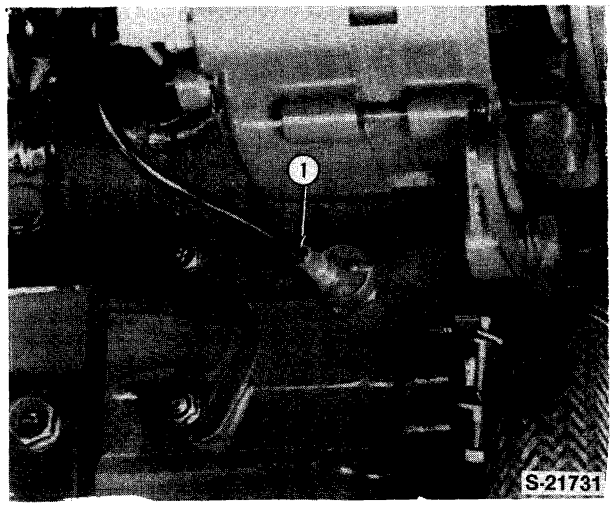

Figure 7
Temperature Sender Switch

1. Sender Switch

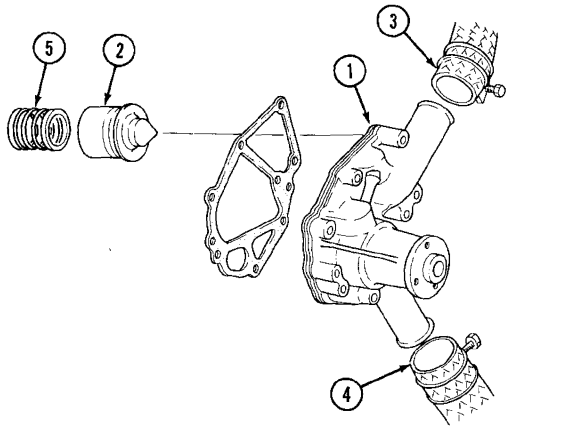

Figure 8
Water Pump and Thermostat

1. Water Pump Assembly
2. Thermostat
3. Upper Radiator Hose
4. Lower Radiator Hose
5. Spring

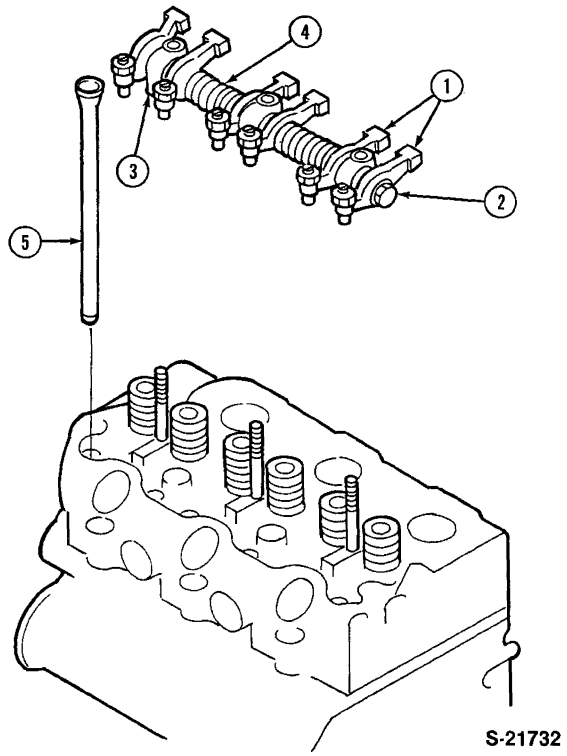

Figure 9
Rocker Shaft Removal

1. Rocker Arms
2. Shaft
3. Rocker Arm Support
4. Springs
5. Push Rod

DISASSEMBLY

1. Clean the cylinder head and remove any carbon deposits from around the valve heads.

2. Use a valve spring compressor and remove the valve spring retainer locks, spring and spring retainers from the valves, Figure 10.

3. Remove the valves and place the valve components together with the valve in separate containers for reassembly in their original positions.

4. Remove the precombustion chambers, Figure 11.

   NOTE: *Be sure to remove the sealing washer located between the precombustion chamber and the head.*

INSPECTION AND REPAIR

Cylinder Head:

1. Clean all carbon deposits from the combustion chamber, precombustion chamber and valve ports using a wire wheel and scraper.

2. Clean all dirt residue from the gasket surface using care not to scratch or nick the machined surface.

3. Clean the cylinder head in solvent and blow dry with compressed air.

4. Check the casting for cracks or damage in the following areas:

   - Valve ports
   - Valve seats
   - Combustion and precombustion chambers
   - External cracks in the water jackets

5. Inspect the gasket surface for scratches or nicks which could leak after assembly.

6. Examine the core hole plugs for rust or signs of leakage. If a plug shows signs of damaging rust or leakage, replace all the plugs in the head.

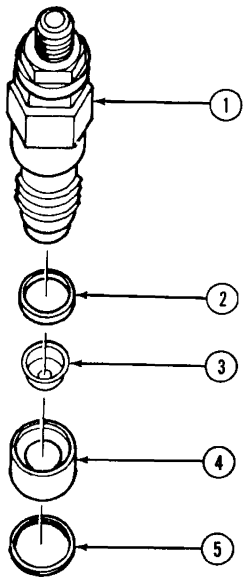

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Figure 10
Valve Removal

1. Valve
2. Valve Spring
3. Valve Retainer Lock
4. Retainer

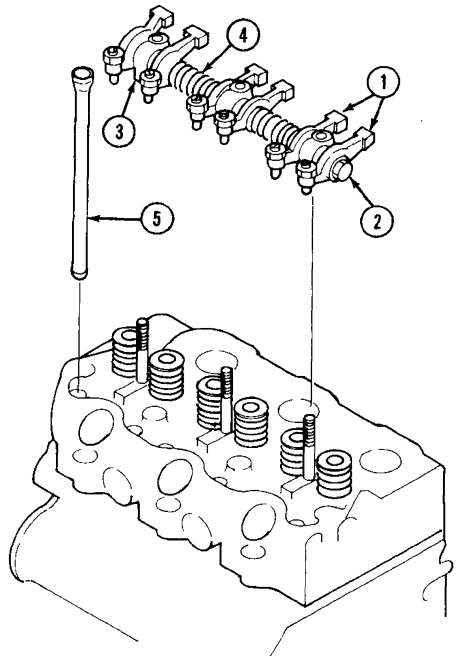

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Figure 11
Precombustion Chamber Removal

1. Injector Assembly
2. Gasket
3. Cup Shield
4. Pre Chamber
5. Gasket

7. Using a straight edge and feeler gauge, check the cylinder head for warp along lines A, B, C, D, E and F, Figure 12.

   Resurface or replace the head if warpage is greater than 0.005 in. (0.12 mm).

VALVE SEATS

Examine the valve seats 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, Figure 13.

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.

1. Check the seat for surface defects. Use a 45° stone if necessary to reface.

2. Check the seat width, Figure 13.

   Use a 30° stone to lower the seat if necessary.

   Use a 60° stone to raise the seat if necessary.

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

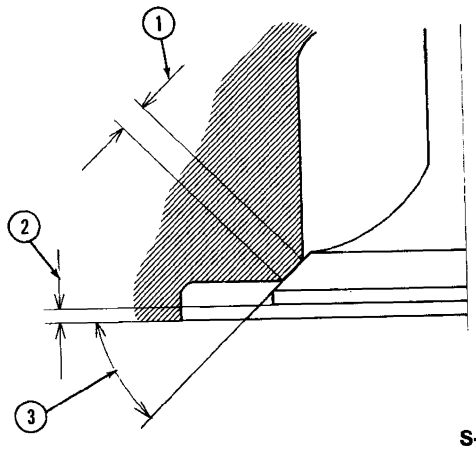

Figure 13
Valve Seat Dimensions

1. Valve Seat Width — .063-.070 in. (1.6-1.8 mm) — Seat must strike center of valve face
2. Width — .033-.045 in. (0.85-1.15 mm)
3. Angle of Valve Seat — 45°

VALVES

1. Clean all deposits from the valves using a soft wire brush and inspect the condition of the valve. Discard valves that are badly burned, cracked or bent, Figure 14.

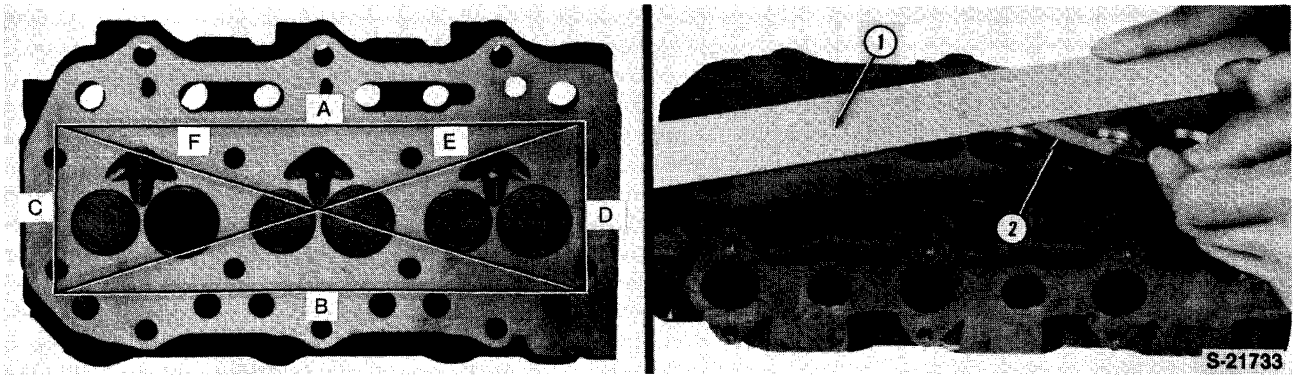

Figure 12
Measuring Cylinder Head Flatness

1. Straight Edge
2. Feeler Gauge

2. Using a micrometer, measure the valve stem at points A, B and C, Figure 15.

   Replace valve if the stem diameter is less than the following dimensions as measured at the wear points.

	Intake	Exhaust
1120 and 1220	0.271 in. (6.89 mm)	0.269 in. (6.84 mm)

3. If inspection indicates that the valve is in satisfactory condition, the valve face and stem should be ground to the specifications shown in Figure 13.

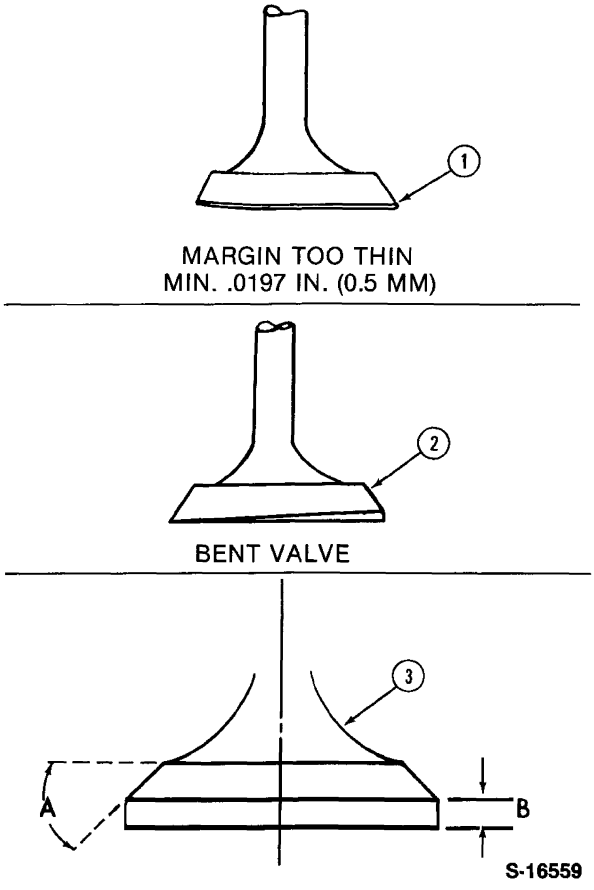

Figure 14
Valves

1. Margin Too Thin
2. Bent Valve
3. Correctly Ground Valve

A. Angle — 45°
B. Correct Margin

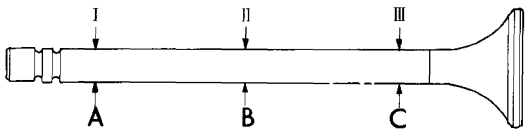

Figure 15
Valve Stem Wear Points

IMPORTANT: *The finished valve seat should contact the center of the valve face. Use Prussion Blue to lightly coat the valve seat. Place the valve in position and rotate the valve slightly holding a light pressure against the valve. If the blue is transferred to the center of the valve face, the contact is correct.*

If Prussion Blue is not available, mark the valve face and seat with a soft lead pencil as shown, Figure 16. Rotate the valve slightly in the seat. The pencil lines will be broken at the seat contact area.

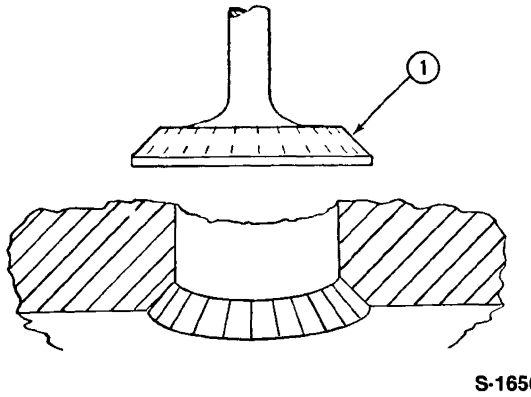

Figure 16
Valve Seat Contact

1. Contact Area

VALVE GUIDES

Thoroughly clean the valve guide before attempting to check internal wear.

1. Using a small hole gauge, measure the valve guide at the top and bottom wear points, Figure 17.

2. Determine the stem to guide clearance by subtracting the stem diameter from the valve guide diameter, Figure 18.

3. If valve guides are worn beyond wear limits, replace the head, see "Specifications," Chapter 3.

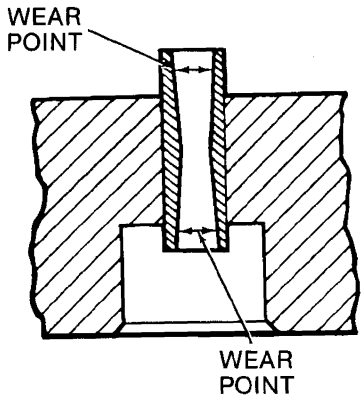

Figure 17
Valve Bell-Mouth Wear Points

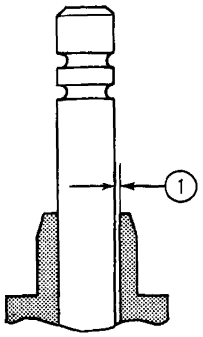

Figure 18
Valve Stem
1. Valve Stem-to-Guide Clearance Check

VALVE SPRINGS

1. Place the valve springs on a flat surface. Measure the free standing height and squareness, Figure 19.

   Replace springs that do not meet the following specifications.

	Max. out-of -Square	Min. Face Length
Model 1120-1220	0.079 in. (2.0 mm)	1.319 in. (33.5 mm)

2. Place the springs in a suitable spring tester and measure the spring load rating to determine spring tension. Replace springs that do not meet the following load specification.

   Model 1120 and 1220
   .15 lbs. (7 kg) at 1.2 in. (30.4 mm)

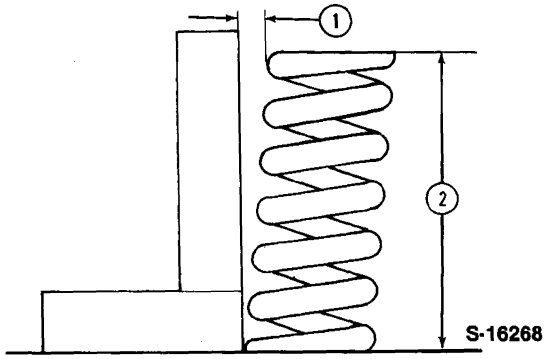

Figure 19
Valve Spring Height and Squareness Check
1. Squareness Check 2. Height Check

ROCKER ARMS – PIVOT SHAFTS

1. Examine the rocker arms and shafts for wear or damage. Check the adjusting screws for damaged threads or excessive wear. Check the valve stem contact area for pitting or excessive wear. Slight wear patterns may be removed using a fine grit oil stone.

2. Using a micrometer, measure the wear points on the rocker shaft, Figure 20.

   Replace the rocker shaft when the minimum shaft diameter is less than the following:

	Min. Shaft Dia.
Model 1120-1220	0.456 in. (11.57 mm)

3. Using a hole gauge, measure the inside diameter of the rocker arm, Figure 21.

   Replace rocker arms when the shaft bore exceeds the following measurements:

	Max. Bore Dia.
Model 1120-1220	.0462 in. (11.74 mm)

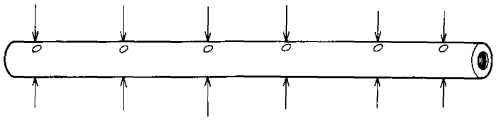

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Figure 20
Rocker Arm Wear Points

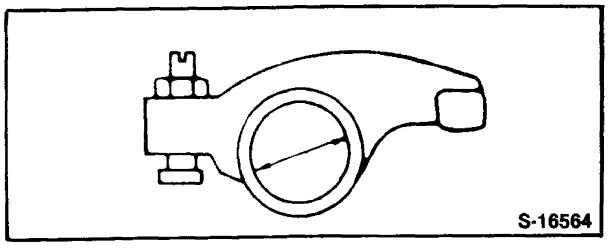

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Figure 21
Measurement — Inside Bore

ASSEMBLY

Cylinder Head

1. Insert each valve in the guide from which it was removed and lightly tap the valve to be sure of an even seat around the valve face. Remove the valve and remove all traces of lapping compound.

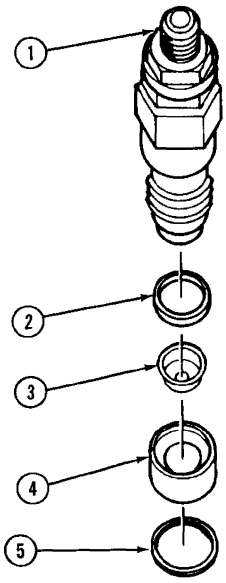
2. Using a spring compressor, assemble the valves, springs, retainers and keepers in the cylinder head.

3. Install a new precombustion chamber using a new sealing washer, Figure 22.

   NOTE: *If removed, always install a new precombustion chamber. The precombustion chamber is a press fit in the cylinder head and should not be reused. On installation, be sure to position the locating tang correctly in the groove in the cylinder head.*

INSTALLATION

In manufacture, the ultimate engine compression ratio is established by the thickness of the head gasket used. For service, replacement head gaskets of different thickness are available and the correct head gasket must be selected based on the amount the pistons protrude above the face of the block at top-dead-center.



S-22151

Figure 22
Precombustion Chamber Installation
1. Injector Assy.
2. Gasket
3. Cup Shield
4. Pre Chamber
5. Gasket

Correct head gasket usage is determined as follows:

1. Postion the piston at the top-dead-center. Use a dial indicator to determine the distance the piston projects above the block, Figure 23.

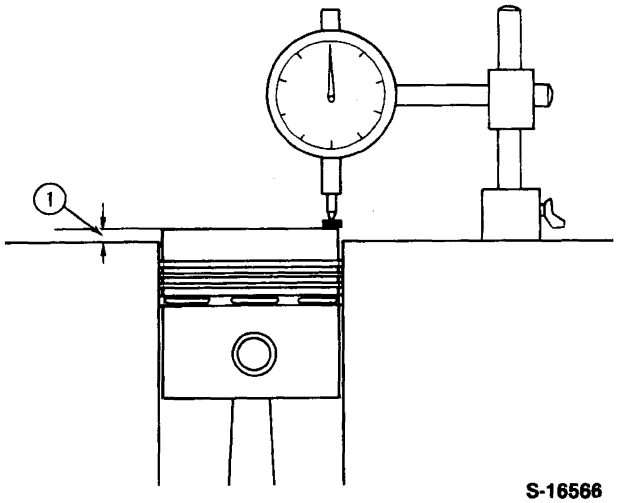


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Figure 23
Measuring Piston Height Above Block Face
1. Piston Height Dimension

NOTE: *Measure each of the pistons while holding a slight down pressure on the piston. Use the dimension taken from the cylinder with the greatest projection in selecting the gasket as indicated in the following chart and Figure 24.*

2. Place the head gasket with the side marked TOP up on the engine block.

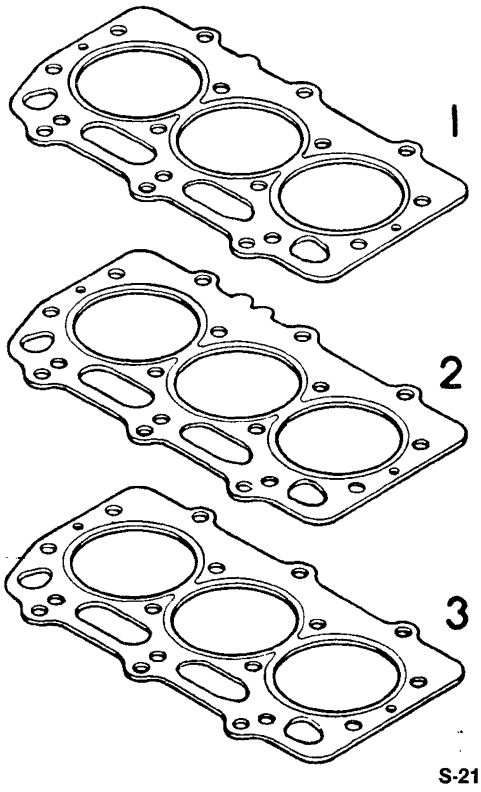


Figure 24
Select the Cylinder Head Gasket

1. t=.043 in. (1.1 mm)
2. t=.047 in. (1.2 mm)
3. t=.051 in. (1.3 mm)

NOTE: *Lubricate threads before tightening.*

3. Install the head bolts and studs. Torque the bolts in stages to the following torque specifications.

	Head Bolt Torque
Model 1120	37.9-41.5 lbs. ft. (51.4-56.3 Nm)

4. Install the assembled rocker assemblies, Figure 25. Torque the support bolts to specifications, see Chapter 3.

5. Adjust the rocker arm valve clearance. Be sure the tappet is in the lowest position.

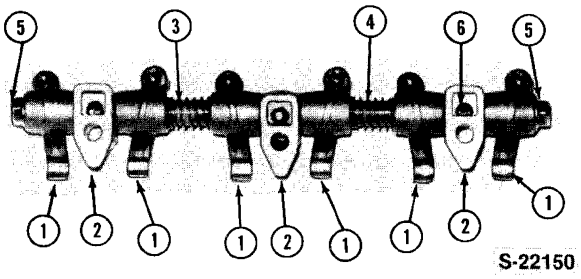


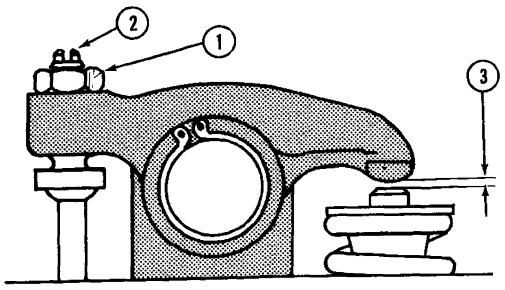
Figure 25
Valve Rocker Assembly

1. Rocker Arms
2. Rocker Shaft Support
3. Springs
4. Rocker Shaft
5. Retaining Bolts
6. Spring Pin

To be sure the lifter is in the correct position, bring the piston to top-dead-center on the compression stroke (both valves closed), Figure 26. With the locknut loosened, turn the adjusting screw to obtain a clearance of 0.008 in. (0.2 mm) cold. Tighten the locknut to the specified torque.

Tractor Model	Measurement	Head Gasket to be Mounted (Tightened Thickness)	
			Part No. S8A-
1120	.022-.026 in. (0.55-0.65 mm)	.043 in. (1.1 mm)	111146821
	.026-.030 in. (0.65-0.75 mm)	.047 in. (1.2 mm)	111146831
	.030-.033 in. (0.75-0.85 mm)	.051 in. (1.3 mm)	111146840
1220	.018-.022 in. (0.45-0.55 mm)	.043 in. (1.1 mm)	111146882
	.022-.026 in. (0.55-0.65 mm)	.047 in. (1.2 mm)	111146892
	.022-.030 in. (0.65-0.75 mm)	.051 in. (1.3 mm)	111146901

NOTE: *Lowest four digits of code numbers are stamped on the head gasket. Install head gasket with code numbers at top.*



S-16107

Figure 26
Valve Lash Adjustment

1. Locknut
2. Adjusting Screw
3. Valve Clearance 0.008 in. (0.2 mm)

ENGINE FRONT COVER, TIMING GEARS, CAMSHAFT AND OIL PUMP

REMOVAL

For detailed description of radiator removal, see Chapter 2.

1. Drain the radiator.
2. Drain the engine crankcase oil.
3. Remove the upper and lower radiator hoses and drain hose together.
4. Remove the upper radiator support.
5. Remove the radiator mounting bolts and remove the radiator, Figure 27.
6. Remove the coolant fan and fan pulley, Figure 28.
7. Disconnect the wiring harness from the alternator assembly.
8. Remove the alternator assembly and mounting brackets, Figure 29.
9. Remove the hydraulic pump mounting bolts.
10. Remove the throttle control cable (4) from the governor lever, Figure 30.
11. Remove the injector lines and cap all openings.
12. Remove the injection pump mounting bolts. Raise the injection pump sufficiently to remove the snap pin and separate the link from the control rack, Figure 31.
13. Remove the crankshaft pulley, Figure 32.
14. Remove the timing gear cover and gasket, Figure 33.

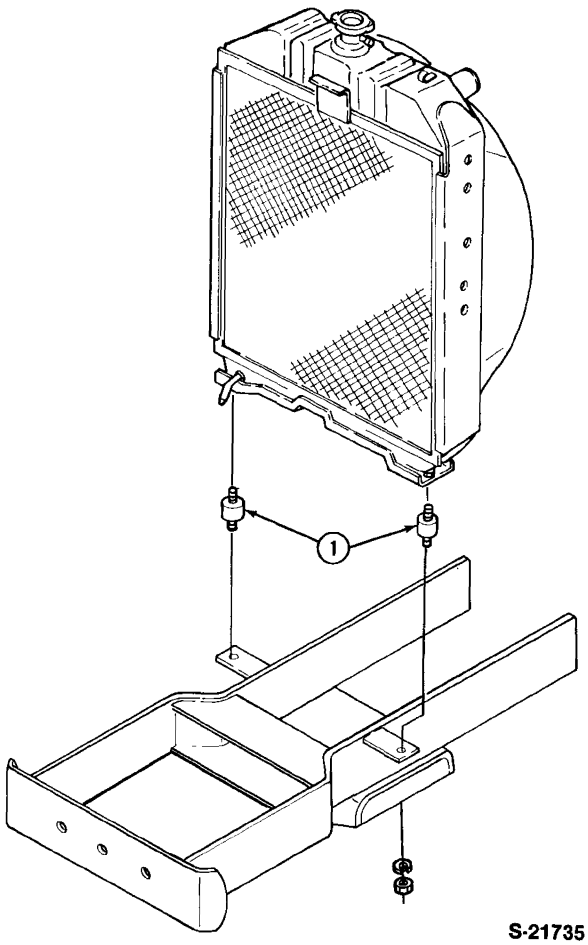


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Figure 27
Radiator Removal

1. Mounting Studs

OIL PUMP REMOVAL

The oil pump is located inside of the idler gear at the front of the block. It is located to the left of the crankshaft as viewed from the front.

The idler gear is driven by the crankshaft gear and is pinned to the outer oil pump rotor, Figure 34.

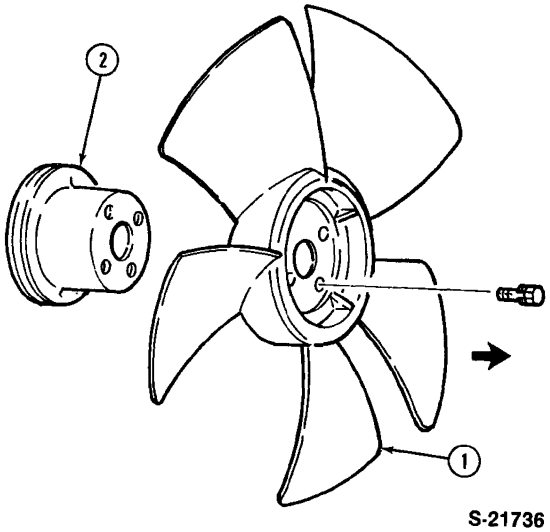

Figure 28
Cooling Fan and Pulley Removal

1. Fan
2. Pulley

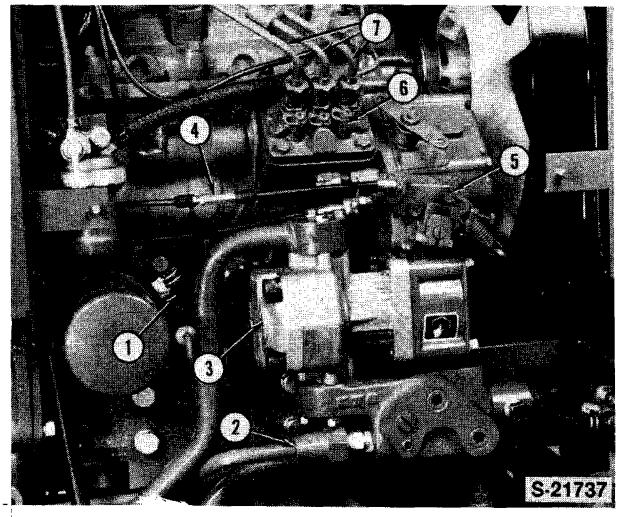

Figure 30
Hydraulic Pump Removal

1. Hydraulic Inlet Line
2. Hydraulic Outlet Line
3. Hydraulic Pump
4. Throttle Control Cable
5. Governor Lever
6. Injection Pump
7. Injection Lines

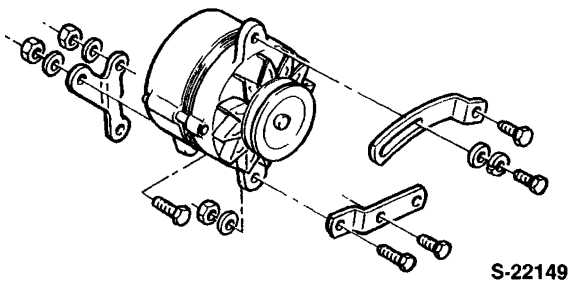

Figure 29
Alternator Removal

1. Remove the "E" snap ring and slide the idler gear along with the rotors, pump cover, shim, springs and collar off the pump shaft as an assembly, Figures 35 and 36.

   NOTE: *The oil pump shaft and port block assembly is a press fit in the block, Figure 37. Do not remove the oil pump shaft and port block unless required due to damage or excessive wear. If necessary to remove, see "Port Block and Shaft Removal" below.*

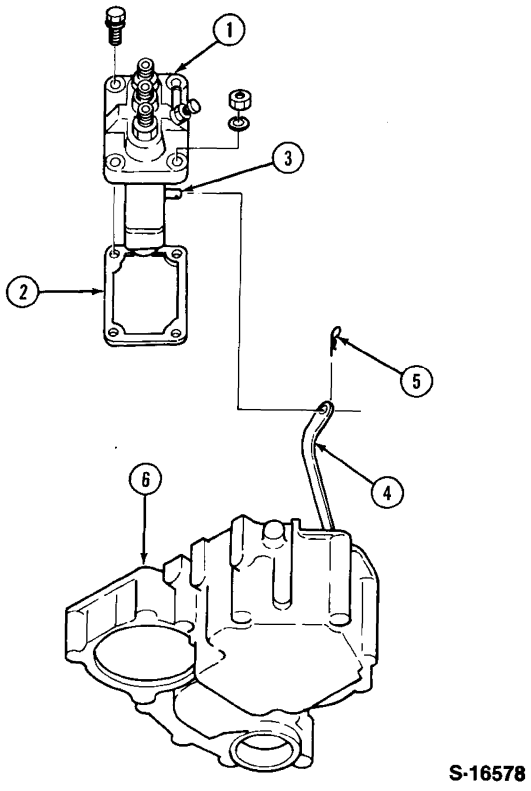

Figure 31
Injection Pump Removal

1. Injection Pump
2. Shim
3. Rack Control Pin
4. Governor Control Link
5. Snap Pin
6. Front Cover

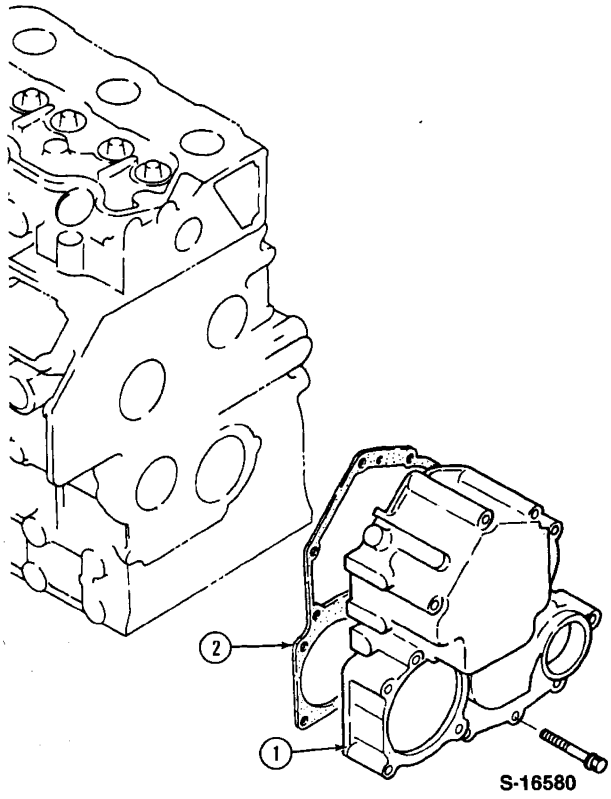

Figure 33
Timing Gear Case Removal

1. Gear Case
2. Gasket

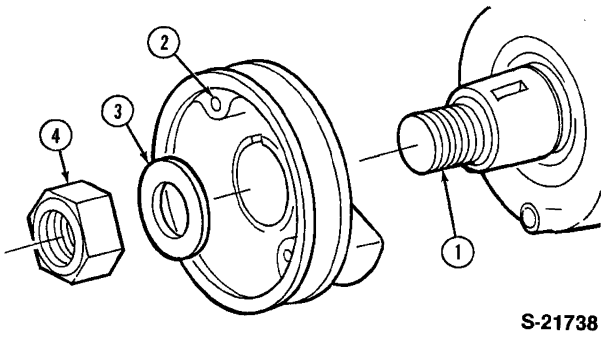

Figure 32
Crankshaft Pulley Removal

1. Crankshaft
2. Pulley
3. Washer
4. Nut

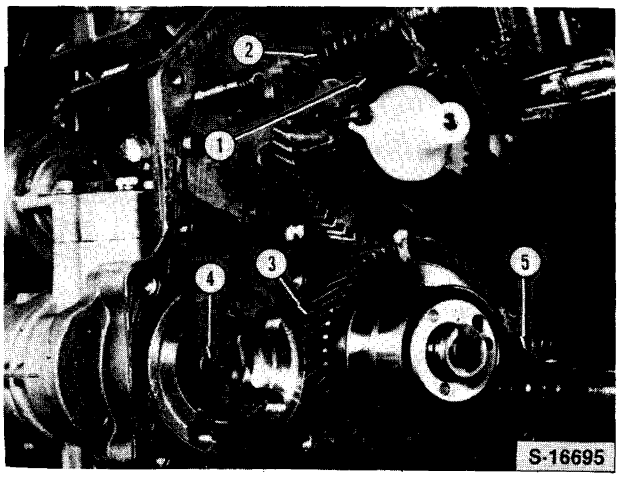

Figure 34
Camshaft Removal

1. Governor Assembly
2. Camshaft Gear
3. Idler Gear
4. Hydraulic Pump Drive Shaft
5. Crankshaft Gear

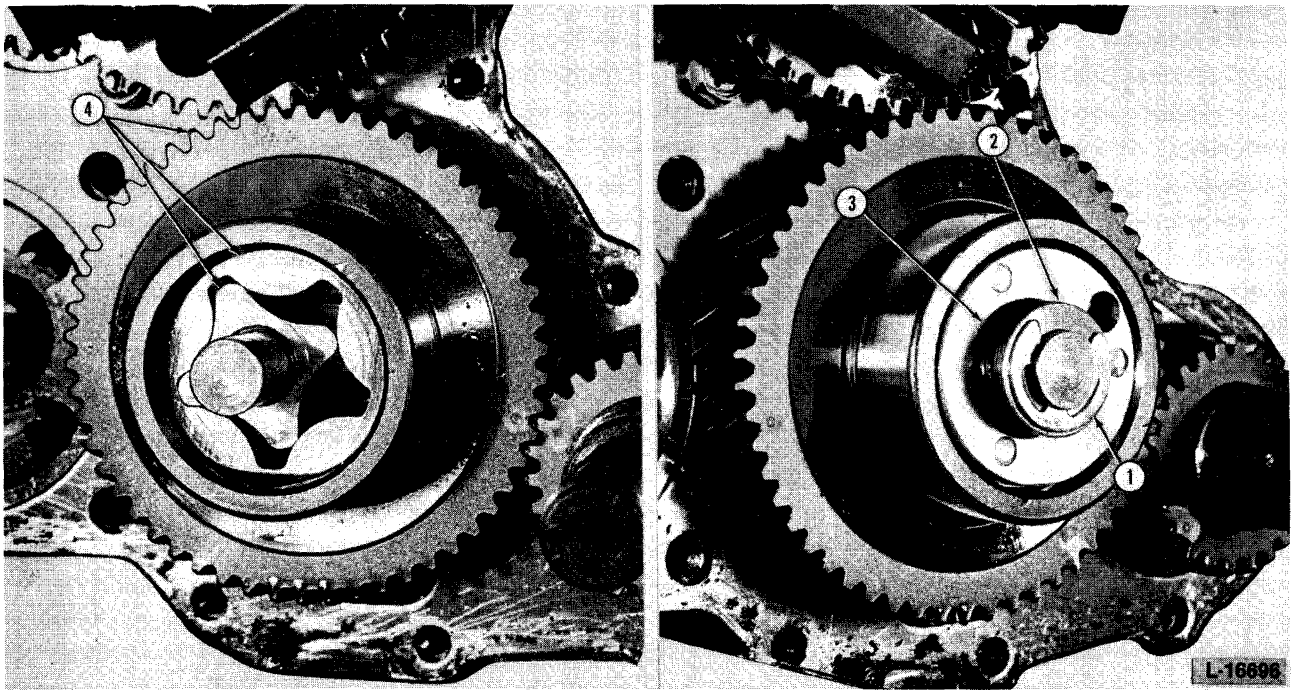

Figure 35
Oil Pump Removal

1. "E" Snap Ring
2. Collar
3. Spring
4. Gear and Rotor Assembly

OIL PUMP INSPECTION AND REPAIR

Reference — Figure 36

1. Wash all parts in a suitable solvent and dry with a lint free cloth or compressed air.

2. Inspect the inside of the pump cover and the forward face of the port head for scratches and score marks.

3. Use a feeler gauge and measure the rotor-to-rotor clearance, Figure 38.

Rotor-to-Rotor Wear Clearance
0.010 in. (.25 mm) max.

ASSEMBLY AND INSTALLATION

1. Assemble the outer rotor (3), pin (4), spring (2) and idler gear (1), Figure 39.

2. Turn the crankshaft to align the timing marks between the crankshaft gear and camshaft gear with the idler gear and install the thrust washer and idler gear on the port block.

3. Install the inner rotor (7), cover (6), shim (4), spring (3), collar (2) and "E" ring (1), Figure 36.

4. Using a dial indicator against the pump cover as shown in Figure 40, measure the movement of the inner rotor end clearance against the spring pressure.

   The total rotor cover movement against the spring movement should not be less than 0.004 in. (0.10 mm), or more than 0.008 in. (0.20 mm).

   Insufficient rotor clearance may cause binding and damage to the inner rotor cover or port block. Excess clearance may allow the oil to bypass around the sides of the rotor resulting in a loss of pressure and volume in the lubrication circuit.

   Adjust the rotor clearance by selecting shims (4), Figure 36, of the correct thickness.

   Shims are available in .004 in. (.100 mm), .006 in. (.15 mm), .008 in. (.20 mm) and .020 in. (.50 mm).

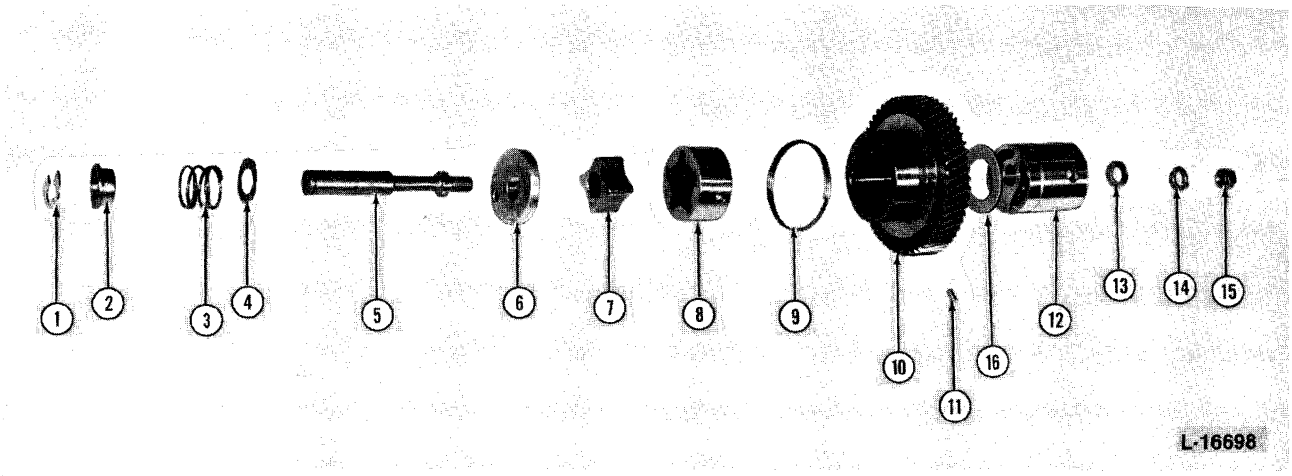

Figure 36
Oil Pump Assembly — Model 1120 and 1220

1. Snap Ring
2. Collar
3. Spring
4. Shim
5. Shaft
6. Cover
7. Inner Rotor
8. Outer Rotor
9. Spring Retainer
10. Gear and Housing
11. Pin
12. Port Head
13. Washer
14. Spring Washer
15. Nut
16. Thrust Washer

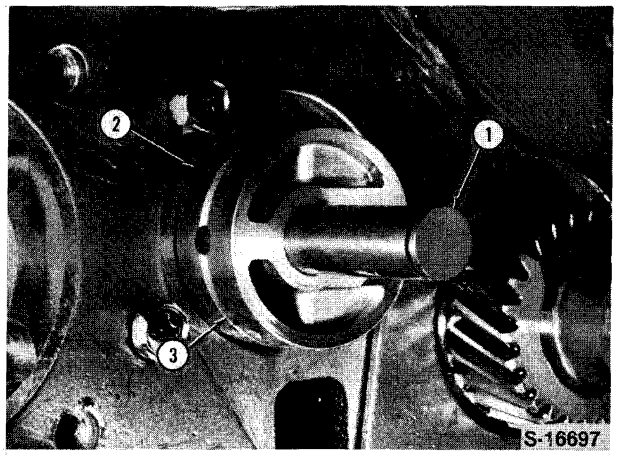

Figure 37
Oil Pump Shaft and Port Block
1. Pump Shaft 2. Port Block 3. Groove

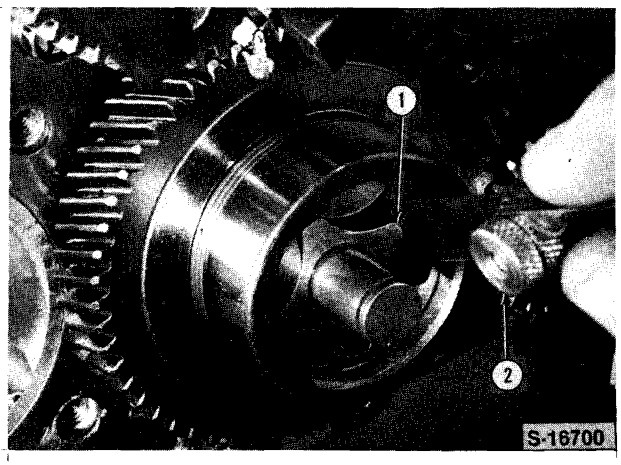

Figure 38
Oil Pump Wear Check
1. Rotor-to-Rotor Wear Clearance 2. Feeler Gauge

PORT BLOCK REMOVAL

1. Remove the oil pump rotor and gear assembly as described above.

2. Using Tool No. 11097, place collars in the grooves of the port block assembly, Figure 41. Align the set screws of the puller with the counterbores in the collars and tighten. Using a slide hammer as shown in Figure 42, remove the port block assembly.

NOTE: *The port block is a press fit in the block.*

3. Remove the oil pump shaft (5), Figure 36, from the port block.

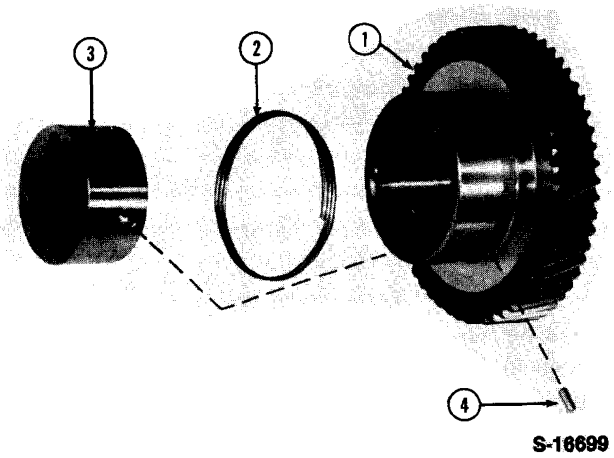

Figure 39
Oil Pump Installation – Model 1120 and 1220
1. Gear and Housing
2. Spring Retainer
3. Outer Rotor
4. Pin

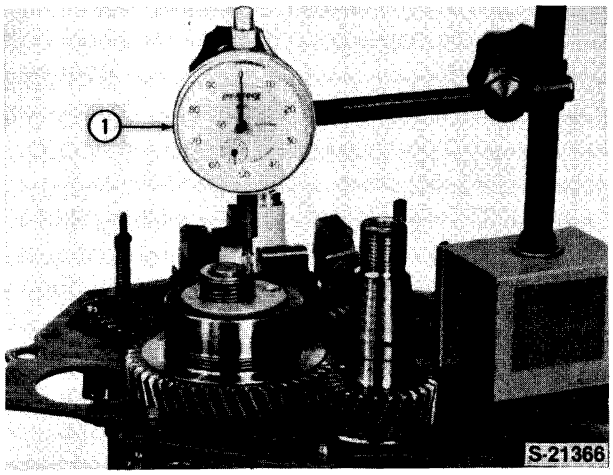

Figure 40
Inner Rotor Clearance Check
1. Dial Indicator

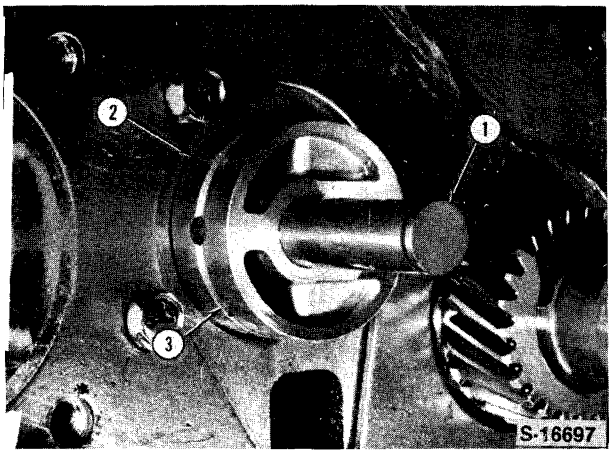

Figure 41
Oil Pump Shaft and Port Block
1. Shaft
2. Port Block
3. Grooves

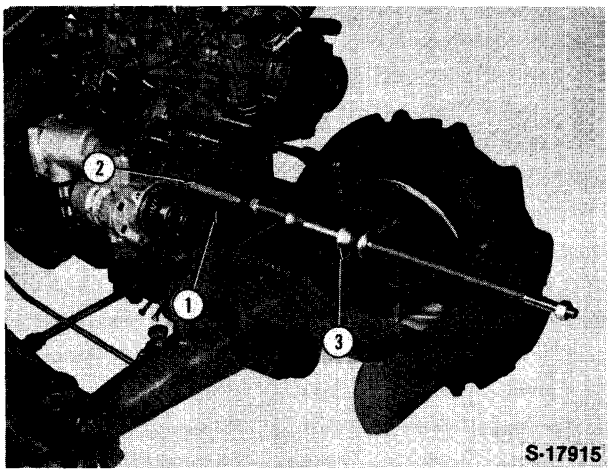

Figure 42
Engine Oil Pump Port Block Removal
1. Puller Tool No. 11097
2. Set Screw
3. Slide Hammer

PORT BLOCK INSTALLATION

1. Using Tool No. 11063, insert the threaded guides (2) into the engine block, Figure 43. Assemble the oil pump shaft to the port block using lock washer and nut. Insert the port block assembly into the installer and place on the guide pins as shown in Figure 44. Use a suitable driver and install the port block assembly as shown in Figure 45. Installer tool must bottom against the engine block to have oil pump port block in the proper installed position.

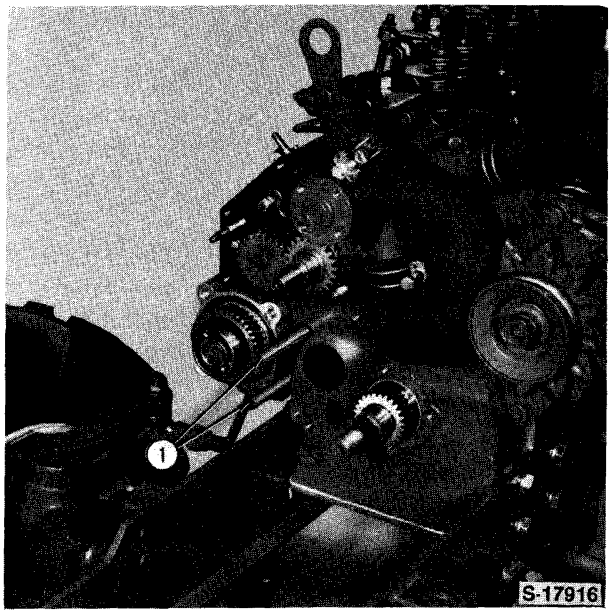

Figure 43
Engine Oil Pump Port Block Installation
1. Guide Pins — Tool No. 11063

2. Position the thrust washer (9) and idler gear assembly (8) onto the port block, Figure 46.

3. Assemble the inner rotor, cover, shim, spring and collar and install the "E" snap ring on the shaft, Figure 46.

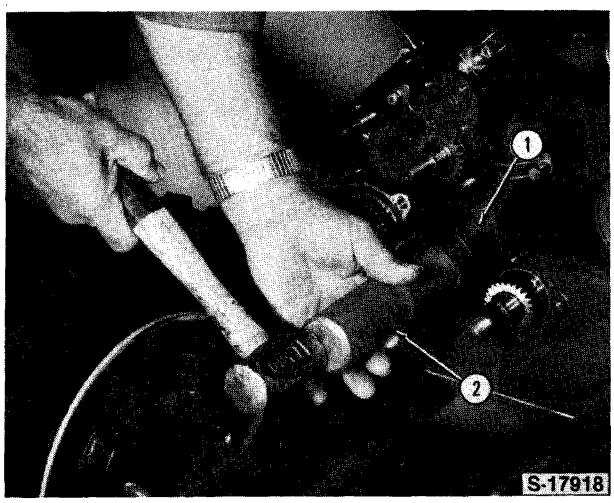

Figure 45
Engine Oil Pump Port Block Installation
1. Port Block Installer
2. Driver

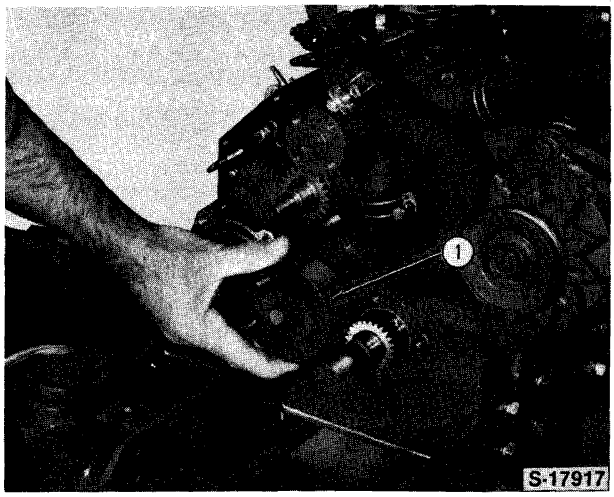

Figure 44
Port Block Installation
1. Port Block Installer Tool No. 11063

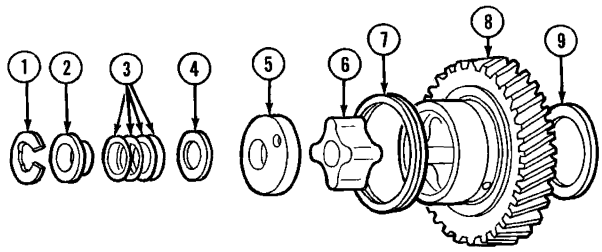

Figure 46
Idler Gear and Oil Pump Components
1. "E" Ring
2. Collar
3. Spring
4. Shim
5. Cover
6. Rotor
7. Spring
8. Idler Gear
9. Thrust Washer

CAMSHAFT AND GEAR REMOVAL

1. Remove the tappets from the top of the block, Figure 47.

2. Remove the governor assembly and camshaft retaining plate, Figures 48 and 49.

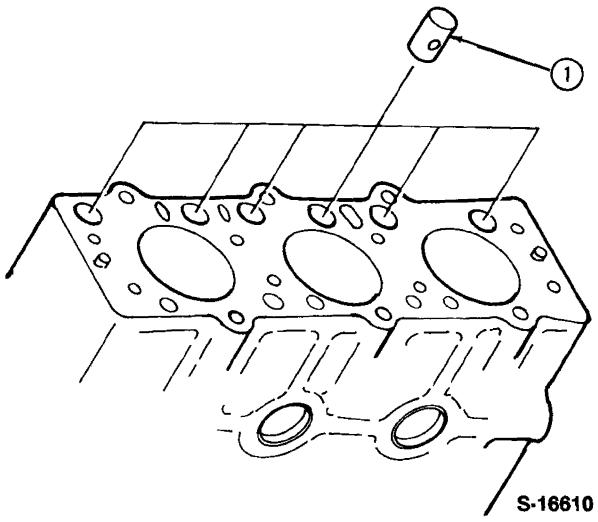

Figure 47
Camshaft Tappet Removal
1. Tappets

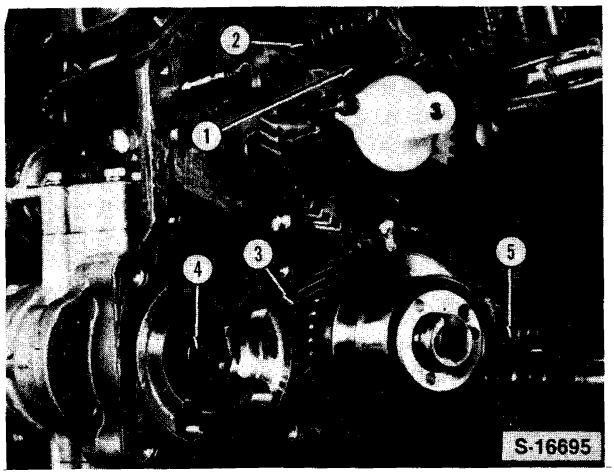

Figure 48
Camshaft Removal
1. Governor Assembly
2. Camshaft Gear
3. Idler Gear
4. Hydraulic Pump Drive Shaft
5. Crankshaft Gear

NOTE: *The camshaft gear contains an access hole for removal of the allen head bolt, Figure 49.*

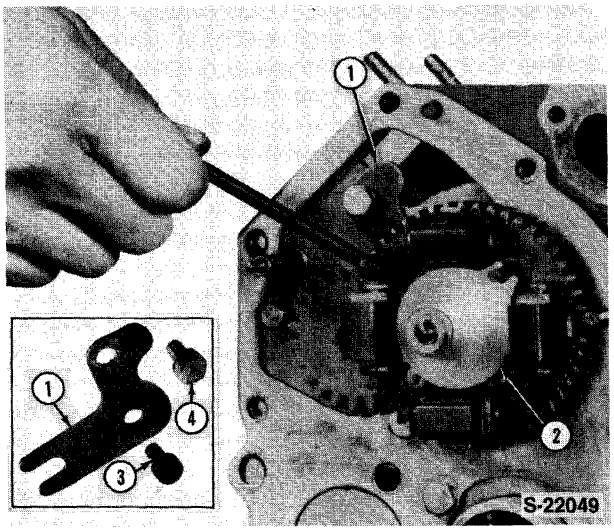

Figure 49
Camshaft Removal
1. Camshaft Retaining Plate
2. Governor Assembly
3. Allen Head Bolt
4. Bolt

NOTE: *If not previously removed, remove the injector pump assembly prior to removing the camshaft.*

3. Remove the camshaft, gear and flyweights as an assembly.

DISASSEMBLY

1. Using a suitable puller, pull the camshaft gear and flyweight assembly off the camshaft.

2. Remove the key (7), spacer (3), tachometer drive gear (4), and spacer (5) from the shaft, Figure 50.

INSPECTION AND REPAIR

GEAR AND WEIGHT ASSEMBLY

1. Wash all components in a suitable solution and air dry.

2. Inspect the flyweight assembly for excess wear or other damage. If defective, replace parts as required.

3. Inspect the gear teeth for excess wear, burrs and scratches. Minor defects may be removed using a fine abrasive. Be sure all parts are thoroughly cleaned before assembly.

4. Inspect the key slot in the gear. If damaged, replace the gear.

5. Inspect the camshaft key. If worn or damaged, replace with a new part.

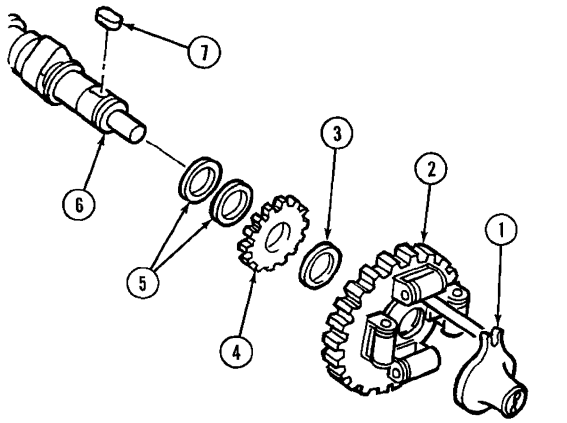

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Figure 50
Governor and Camshaft Gear Removal

1. Slider
2. Gear Assembly
3. Spacer
4. Tachometer Drive Gear
5. Spacer
6. Camshaft
7. Key

CAMSHAFT

1. Inspect the camshaft journals and lobes, Figure 51, for excess wear or damage. Minor scratches may be removed with a fine grit oil stone.

2. Place the camshaft in a set of V-blocks and check the runout with a dial indicator as shown, Figure 52.

   Replace or straighten the camshaft if the runout is more than .004 in. (0.1 mm).

3. Using a micrometer, measure the height of the camshaft lobes, Figure 53.

   Replace the camshaft if any of the lobes are worn to less than the following dimensions.

Valve Lobe Height	1.027 in. (26.1 mm)

4. Check the ball bearings for excess wear or damage and replace any bearings that are rough or uneven when rotated by hand.

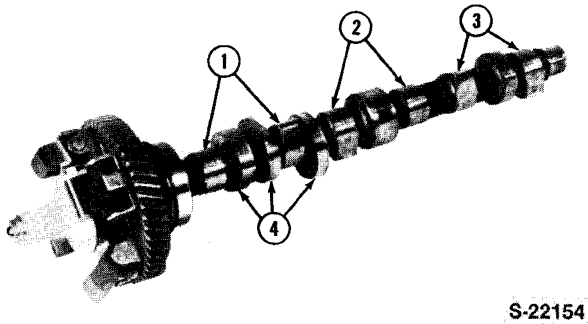

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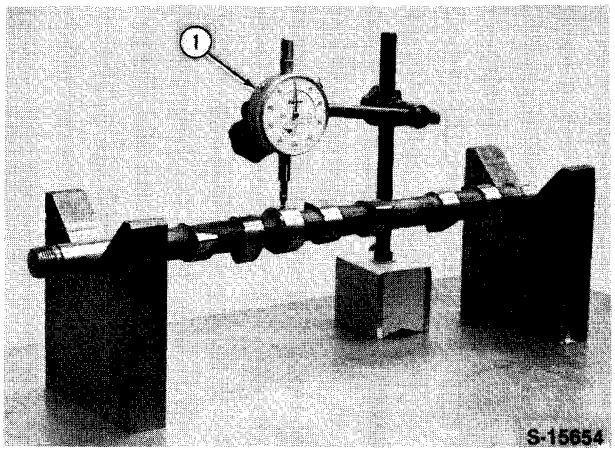
Figure 51
Camshaft Inspection

1. No. 1 Cylinder Valve Cam Lobes
2. No. 2 Cylinder Valve Cam Lobes
3. No. 3 Cylinder Valve Cam Lobes
4. Injection Pump Cam Lobes



S-15654

Figure 52
Camshaft Runout Check

1. Dial Indicator

ASSEMBLY AND INSTALLATION

1. If required, install a new ball bearing on the camshaft.

2. Position the two spacer washers, tachometer drive gear, spacer washer, key and gear and weight assembly on the camshaft as shown, Figure 50.

   NOTE: *Install the cam gear using a suitable hydraulic press and adaptor.*

3. Install the assembled camshaft, tachometer drive gear and retaining plate into the block, Figure 49.

4. Install the slider and collar on the camshaft and governor pin.

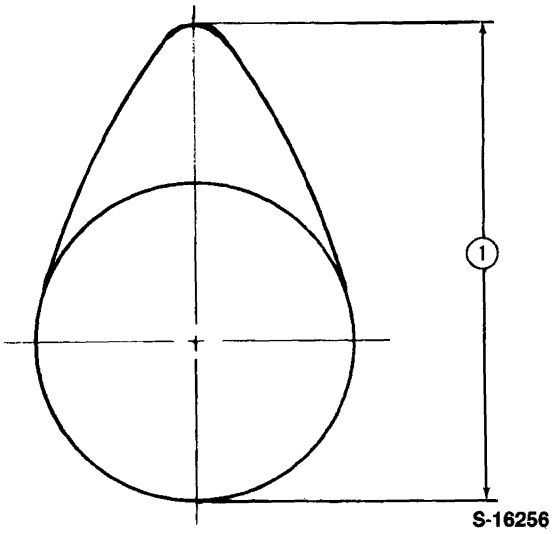


Figure 53
Camshaft Lobe Wear Check
1. Height of Cam

TIMING GEAR COVER
Reference — Figure 54

Inspect the governor linkage and replace any worn parts as required. See Part 2, Chapter 1 for governor linkage overhaul and adjustment.

If required, use a suitable size remover and installer tool and replace the timing gear cover crankshaft oil seal.

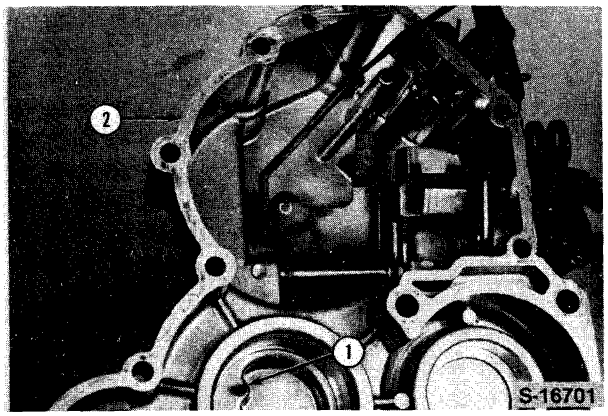


Figure 54
Oil Pump Cover — Dowel Pin Assembly Location
1. Dowel Pin 2. Timing Gear Cover

INSTALLATION

Install the timing gear cover using a new gasket following the removal procedure in reverse order.

NOTE: *On installation of the timing gear cover, be sure to align the hole in the oil pump cover with the roll pin (1), Figure 54, in the timing gear cover.*

CONNECTING RODS, BEARINGS, PISTONS, RINGS AND CYLINDER BLOCK

NOTE: *The connecting rods and pistons can be removed with the engine in the tractor after removal of the cylinder head and oil pan as described previously in this Chapter.*

DISASSEMBLY

1. Remove the connecting rod caps, Figure 55.

2. If necessary, remove any ridge from the top of the cylinder bores with a suitable ridge reamer. Push the pistons out of the cylinder block.

   NOTE: *Be sure to keep the connecting rod caps and bearing liners with their respective connecting rod for reassembly in their original position.*

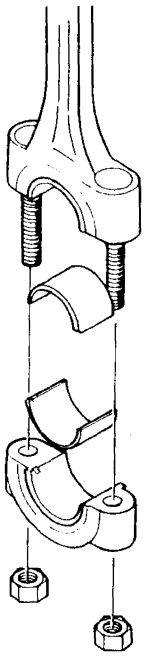


Figure 55
Piston and Connecting Rod Removal