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# NEW HOLLAND

# 1920

# 2120

# REPAIR

# MANUAL



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## FOREWORD

This repair manual provides information for the proper servicing and overhaul of Ford 1920 and 2120 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.



# 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<sup>2</sup>). 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 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.

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### 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

### MODELS 1920 AND 2120

#### Chapter 1

##### ENGINE AND LUBRICATION SYSTEM

Section	Page
A. DESCRIPTION AND OPERATION .....	1
B. OVERHAUL .....	5
C. COMPRESSION TEST .....	47

#### Chapter 2

##### COOLING SYSTEM

Section	Page
A. DESCRIPTION AND OPERATION .....	49
B. OVERHAUL .....	51

#### Chapter 3

##### TROUBLE SHOOTING, SPECIFICATIONS AND SPECIAL TOOLS

Section	Page
A. TROUBLE SHOOTING .....	59
B. SPECIFICATIONS .....	63
C. SPECIAL TOOLS .....	70



# PART 1 ENGINE SYSTEMS MODELS 1920 AND 2120

## Chapter 1 ENGINE AND LUBRICATION SYSTEM

Section	Page
A. DESCRIPTION AND OPERATION .....	1
B. OVERHAUL .....	5
C. COMPRESSION TEST .....	47

### A. DESCRIPTION AND OPERATION

This chapter describes engine overhaul and repair procedures for the Models 1920 and 2120 tractor engines. The engines are of the same general design and repair

procedures are essentially the same except as noted in the repair procedures.

Both engines are four cylinder, four cycle, overhead valve, liquid cooled engines, Figures 1 and 2.

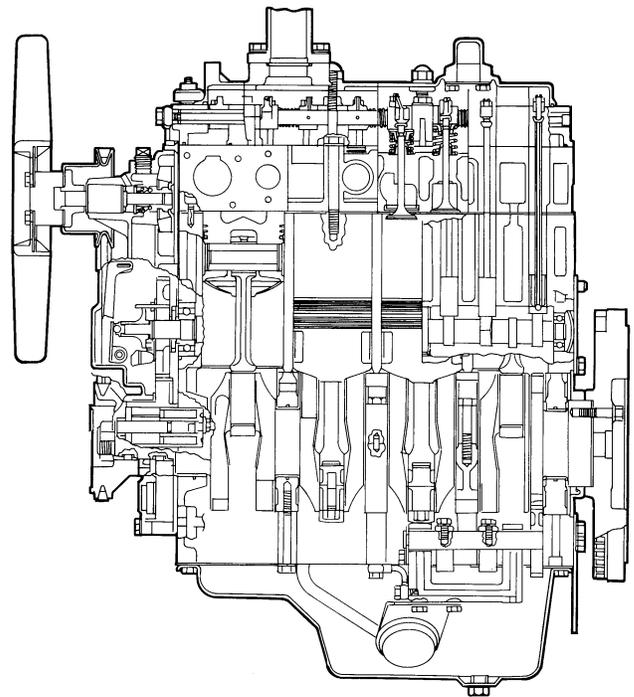
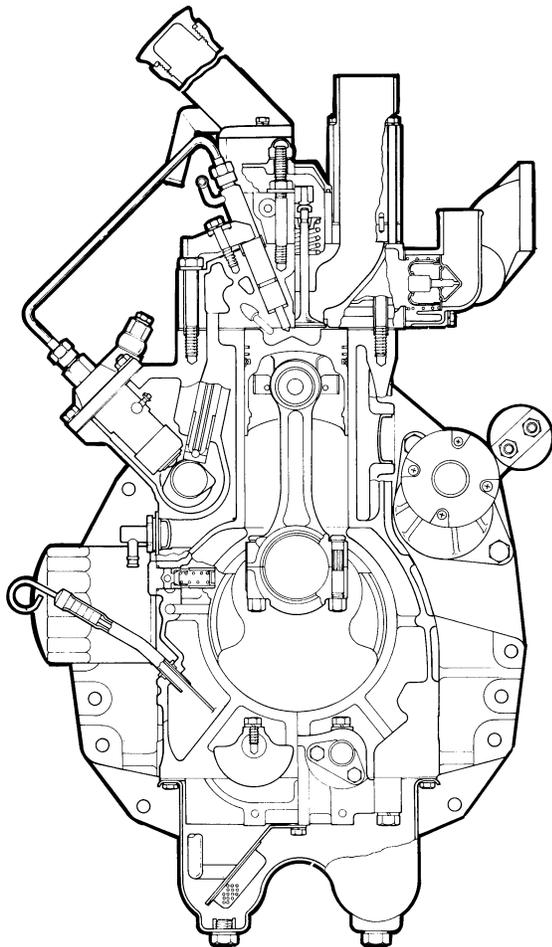
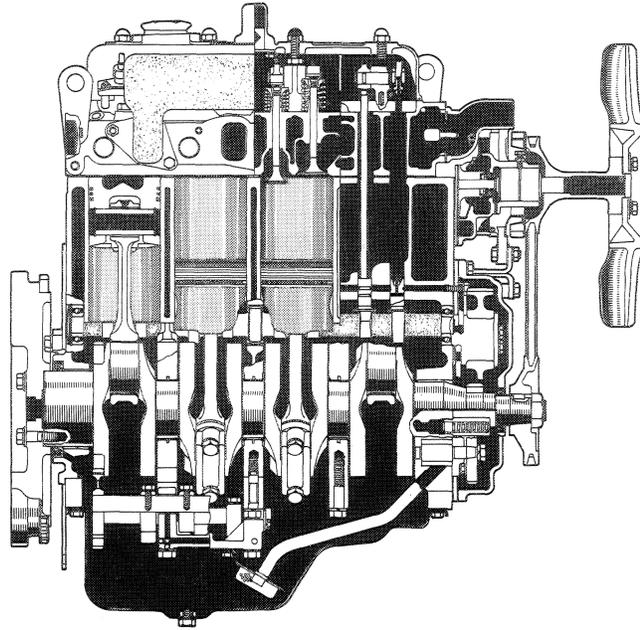
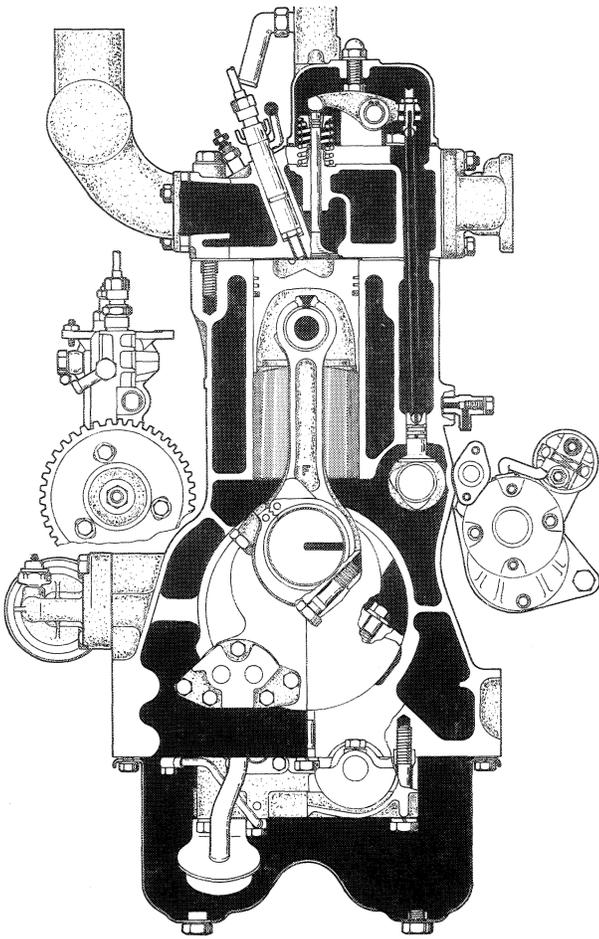


Figure 1  
Engine Assembly – Model 1920

S-24332



S-24333

**Figure 2**  
Engine Assembly — Model 2120

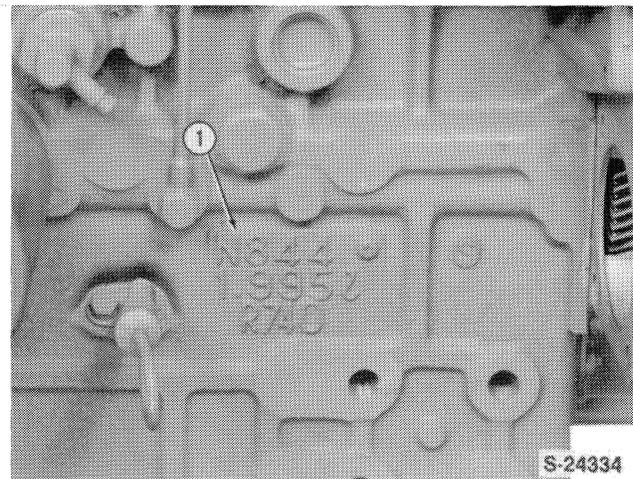
The engines are identified by a code number cast into the side of the cylinder block, Figures 3 and 4.

Engine Identification	Tractor Model	Horsepower
N844	1920	32
T854 B	2120	42

**CYLINDER HEAD AND VALVE TRAIN COMPONENTS**

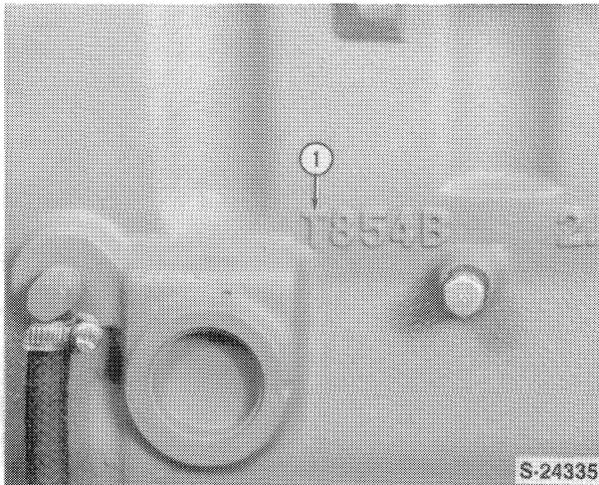
The cylinder head incorporates the valve assemblies, rocker arms, rocker shaft, push rods, and lifters.

On the Model 1920 tractor, the intake manifold is located on the top of the cylinder head and is separate from the valve cover, Figure 5.



S-24334

**Figure 3**  
Engine Identification Code — Model 1920  
1. Engine Code Number



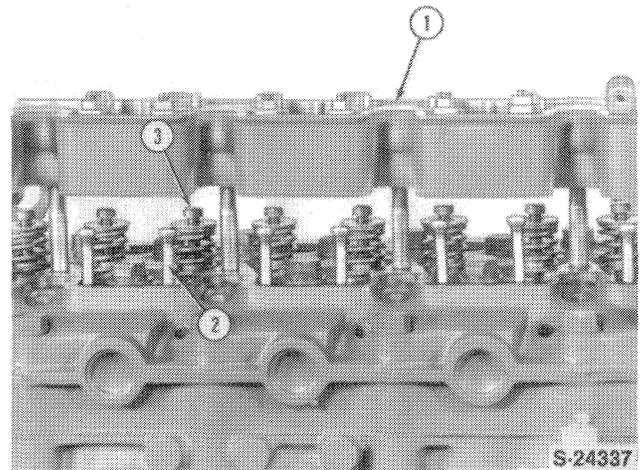
**Figure 4**

**Engine Identification Code — Model 2120**

- 1. Engine Code Number

The valve rocker arms and support shaft are mounted in a separate support casting bolted to the top of the cylinder head, Figure 6.

The exhaust manifold is bolted to the left side of the cylinder head, Figure 5.



**Rocker Shaft Support — Model 1920**

- 1. Rocker Arms and Shaft
- 2. Push Rod
- 3. Valve Stem Cap

On the Model 2120 tractor, the rocker arms and support shafts are mounted directly to the top of the cylinder head, Figure 7.

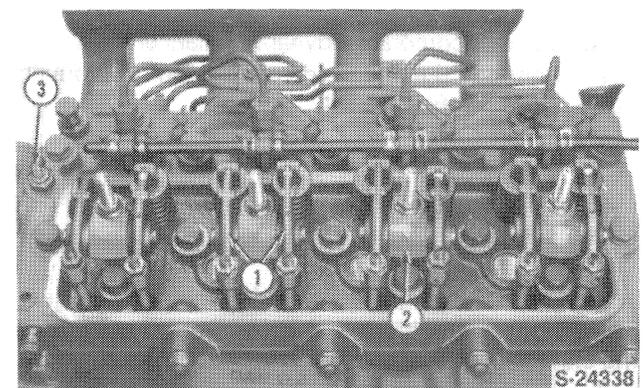
The intake manifold is bolted to the right side of the head and the exhaust manifold is mounted to the left side of the head, Figure 8.



**Figure 5**

**Engine Top View — Model 1920**

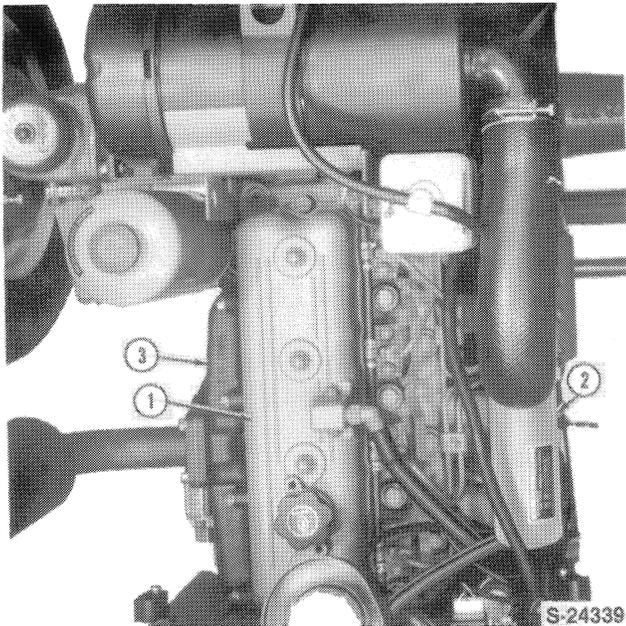
- 1. Intake Manifold
- 2. Valve Rocker Cover
- 3. Exhaust Manifold



**Figure 7**

**Rocker Arm Support — Model 2120**

- 1. Rocker Arms (8)
- 2. Supports (4)
- 3. Temperature Sensor Switch



**Figure 8**

**Engine Top View — Model 2120**

- 1. Valve Cover
- 2. Intake Manifold
- 3. Exhaust Manifold

The crankshaft is supported on five main bearings. The front bearing is supported in a bore in the front casting of the cylinder block.

On the Model 1920 engine, the rear bearing is a split liner supported by a holder in the rear casting of the engine block. On the 2120 Model engine the rear bearing is a one piece bushing type bearing and is located in a cover bolted to the rear of the engine block.

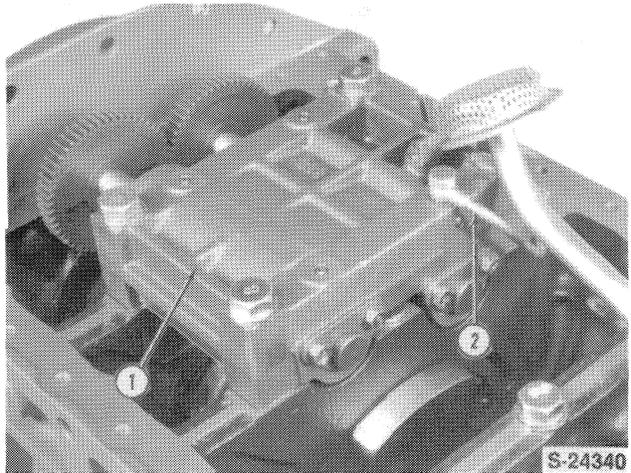
All remaining bearings are split liners retained in cast iron holders.

Both engines incorporate a dynamic balancer assembly, that is bolted to the under side of the block and driven by the crankshaft, Figure 9.

**LUBRICATION SYSTEM  
Model 1920**

The oil pump assembly is located within the idle gear at the front of the block and below and to the left of the crankshaft as viewed from the front. The oil pump is driven by the crankshaft gear.

Oil is picked up from the sump by the intake tube and drawn into the lower side drilling in the block to the oil pump. Oil from the pump flows through passages in



**Figure 9**

**Dynamic Balancer Location —  
Model 2120 Shown**

- 1. Dynamic Balancer
- 2. Oil Lubrication Tube Assembly

the block, past the relief valve, through the oil filter and returns to the main oil gallery in the area of the drilled bolt located on the side of the block. Oil flow in the main oil gallery extends to the main bearings. Oil flow to the main bearings passes through drilled passages in the crankshaft to the connecting rod bearings.

Oil from the main oil gallery supplies pressure oil to the dynamic balancer through a tube connected to the under side of the block.

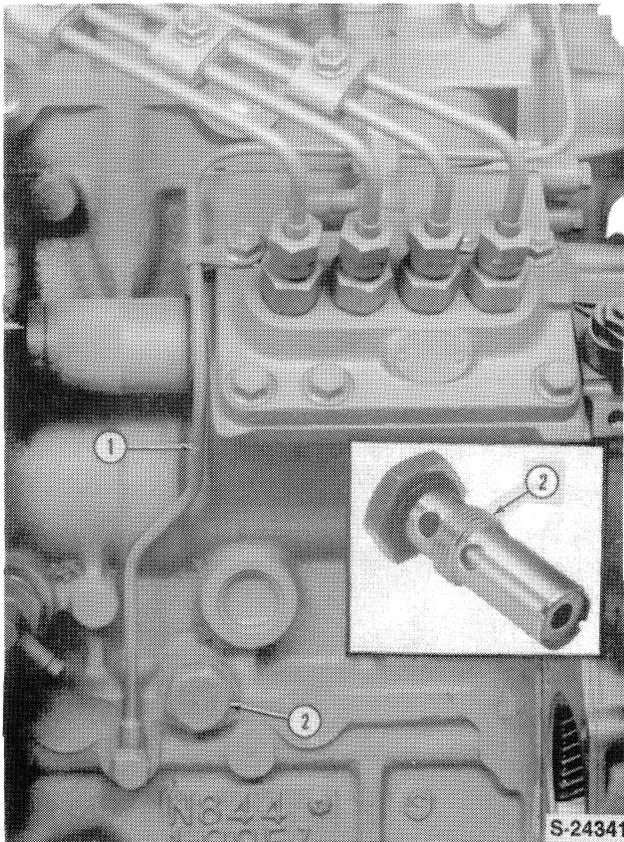
Pressure oil from the main oil gallery flows through a tube (1), to the front of the valve rocker shaft to lubricate the rocker arms, valve stems, push rods and tappets, Figure 10.

The relief valve (2), Figure 10, is mounted in the side of the block and intersects the main oil passage. When the oil pressure exceeds the rated pressure, oil is by-passed through the relief valve directly to sump.

The cylinder walls, pistons and piston pins are splash lubricated by the crankshaft.

**LUBRICATION SYSTEM  
Model 2120**

The oil pump is located in a bore in the front of the block assembly below and to the left of the crankshaft as viewed from the front. The oil pump is driven by the crankshaft gear.



**Figure 10**

**Valve Train Lubrication Tube — Model 1920**

1. Oil Lubrication Tube    2. Pressure Relief Valve

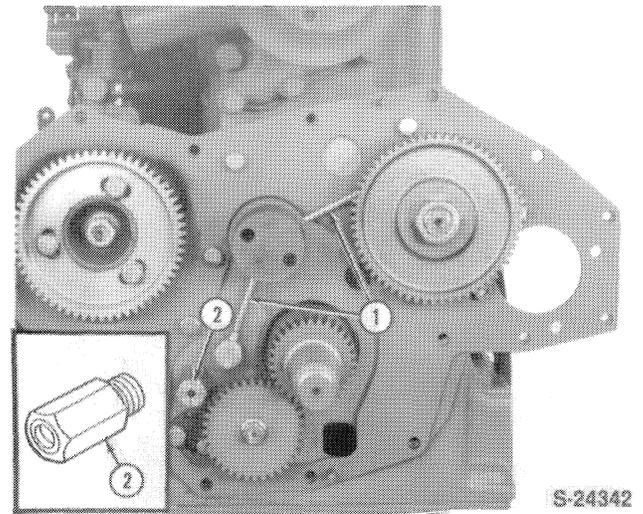
Oil is picked up from the sump by the intake tube and drawn into the lower side of the oil pump body. Oil from the pump flows through passages in the block, past the relief valve, through the oil filter and returns to the main oil gallery in the area of the drilled bolt located directly above the oil pump.

Oil flow in the main oil gallery extends the length of the block on the right hand side to connecting passages to each of the main bearings.

Oil flow to the main bearings passes through drilled passage in the crankshaft to the connecting rod bearings.

Oil from the main oil gallery supplies pressure oil to the dynamic balancer through a tube connected to the under side of the block.

The remaining oil flow is directed through the external tube (1), Figure 11, at the front of the block to a drilled bolt located above the camshaft and extends into an oil gallery that extends the length of the block on the



**Figure 11**

**Valve Train Lubrication Tube — Model 2120**

1. Oil Lubrication Tube    2. Pressure Relief Valve

left hand side. The valve tappet bores are located within this oil passage. Oil flows around the tappets for lubrication and into a cross drilling in the tappets. From the tappets, oil flows through the center of the tappet and up the hollow push rods to the rocker arm assembly.

The adjusting screws and rocker arms have drilled passages which provide pressurized lubrication to the rocker arms shafts. Controlled leakage at the rocker arms flows from the top of the head back to the sump.

Cylinder walls, pistons and piston pins are splash lubricated by the crankshaft.

## B. OVERHAUL

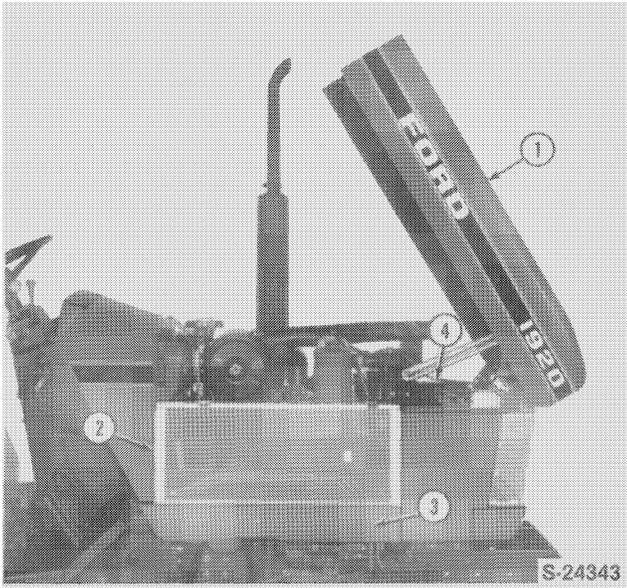
### CYLINDER HEAD AND RELATED COMPONENTS REMOVAL

#### CYLINDER HEAD

#### REMOVAL

Reference — Figure 12

1. Open the hood and remove the side covers. Disconnect the headlight wiring. Remove the hood assembly.
2. Drain the coolant from the radiator and engine block, Figure 13.
3. Remove the air cleaner assembly along with the air cleaner hoses, Figure 14.

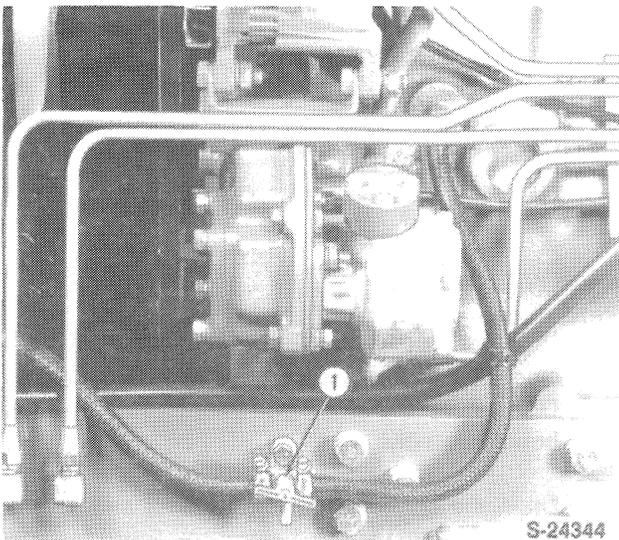


**Figure 12**

**Engine Hood and Side Panel Removal**

- 1. Hood Assembly
- 2. Side Screen
- 3. Lower Panel
- 4. Headlight Wiring

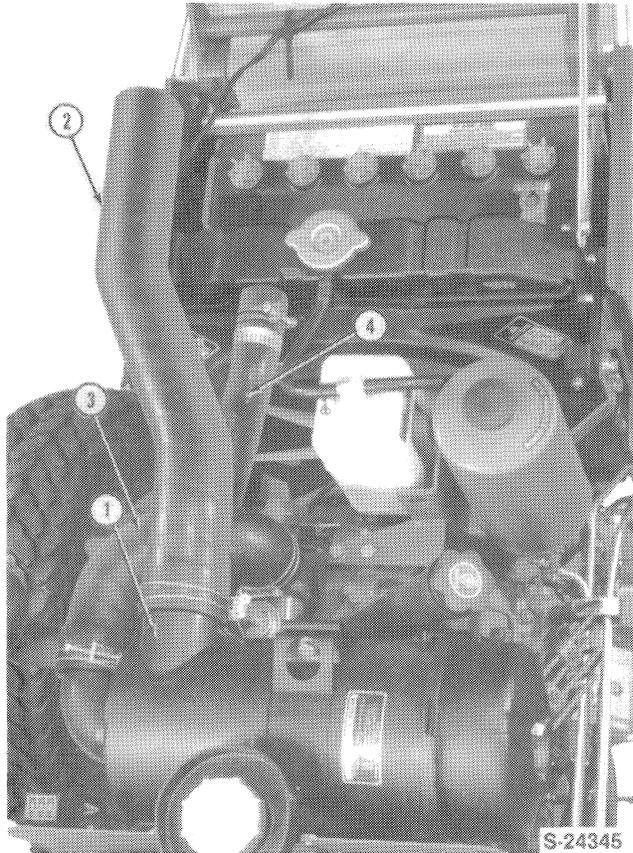
- 4. Remove the upper radiator hose from the cylinder head, Figure 14.
- 5. Remove the exhaust muffler and manifold assembly, Figure 5 and 8.
- 6. Remove the fuel injection lines (1) and fuel leak-off line (3) and cap all openings, Figure 15.



**Figure 13**

**Radiator Drain**

- 1. Drain Cock



**Figure 14**

**Cylinder Head Removal — Model 1920 Shown**

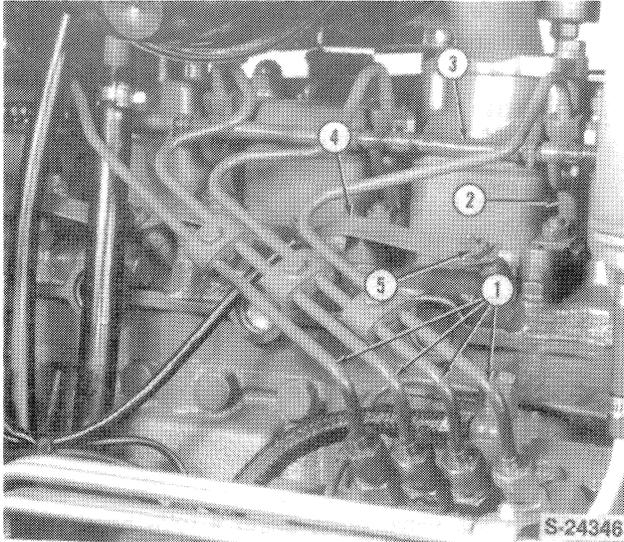
- 1. Air Cleaner Assembly
- 2. Air Inlet Tube
- 3. Air Outlet Tube
- 4. Upper Radiator Hose

- 7. Remove the injector assemblies (2), Figure 15.
- 8. Remove the thermostat housing (2) and thermostat, Figure 16.

**Model 1920**

**NOTE:** On the Model 1920 tractor, remove the fuel tank and baffle. Refer to "Fuel Tank Removal," Part 12, Chapter 1.

- 1. Remove the oil pressure sensor switch (3), Figure 17.
- 2. Remove the external oil tube banjo bolt (2), Figure 17, from the front end of the valve rocker shaft.
- 3. Remove the air intake manifold (1), Figure 5.
- 4. Remove the valve cover assembly (2), Figure 5.

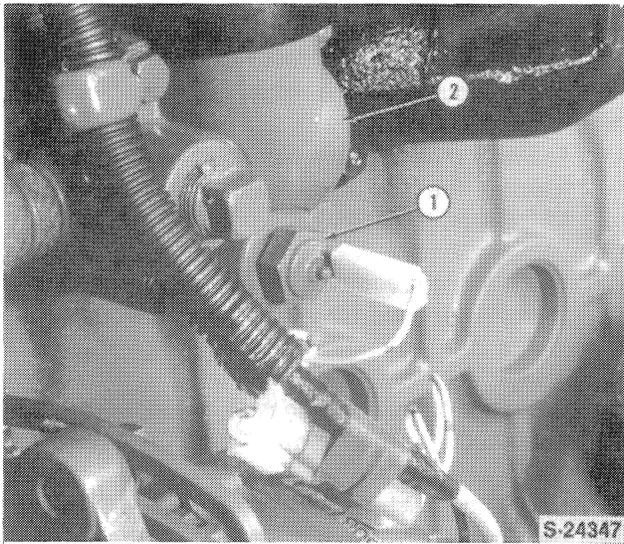


**Figure 15**  
**Injector and Glow Plug Removal —**  
**Model 1920 Shown**

- |                       |                             |
|-----------------------|-----------------------------|
| 1. Injector Lines     | 4. Glow Plug Wire Connector |
| 2. Injector Assembly  | 5. Glow Plug Assembly       |
| 3. Fuel Leak-Off Line |                             |

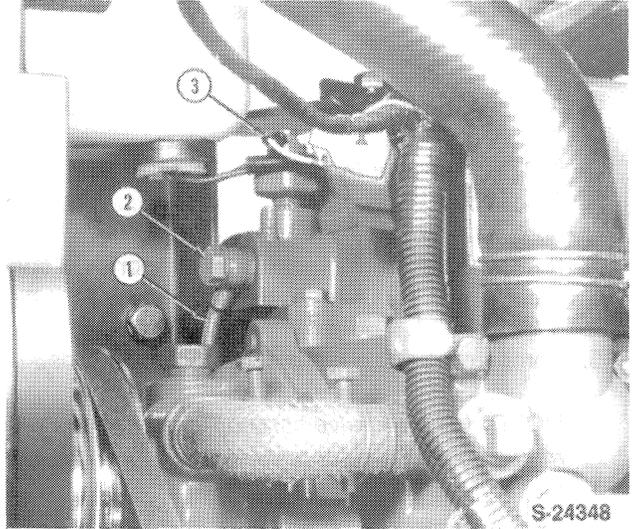
5. Remove the valve rocker support (1), as an assembly, Figure 6.

**NOTE:** Alternately loosen the rocker support bolts a turn at a time to prevent distorting the rocker shaft.



**Figure 16**  
**Temperature Sender Switch —**  
**Model 1920 Shown**

- |                  |                                      |
|------------------|--------------------------------------|
| 1. Sender Switch | 2. Thermostat (Water Outlet) Housing |
|------------------|--------------------------------------|



**Figure 17**  
**External Oil Transfer Tube —**  
**Model 1920 Shown**

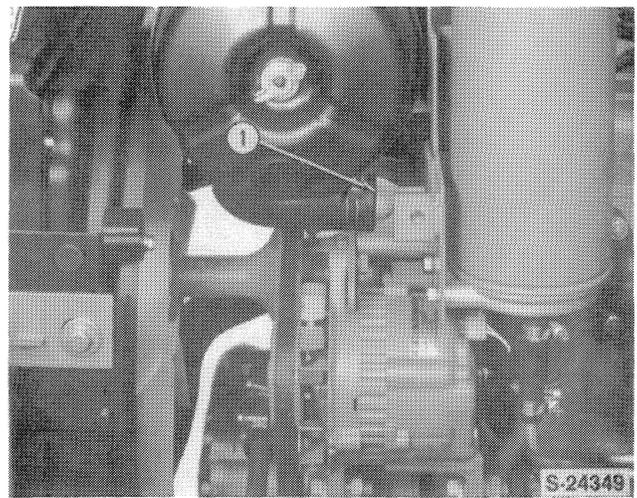
- |                  |                               |
|------------------|-------------------------------|
| 1. External Tube | 3. Oil Pressure Sender Switch |
| 2. Banjo Bolt    |                               |

6. Remove the valve stem caps and push rods.

**NOTE:** Keep all valve components in separately marked containers for reassembly in their original position.

**Model 2120**

1. Remove the thermostat housing, thermostat and gasket, Figure 18.



**Figure 18**  
**Thermostat and Housing Removal —**  
**Model 2120**

- |                                      |
|--------------------------------------|
| 1. Thermostat Housing (Water Outlet) |
|--------------------------------------|

2. Remove the temperature sensor switch (3), Figure 7.

3. Remove the valve cover assembly (1), Figure 8.

**NOTE:** Use care to not lose the cover bolt sealing washer.

4. Remove each of the rocker arm supports (2) and rocker arms (1) as an assembly, Figure 7.

5. Remove the valve stem caps and push rods.

**NOTE:** Keep all valve components in separately marked containers for reassembly in their original location.

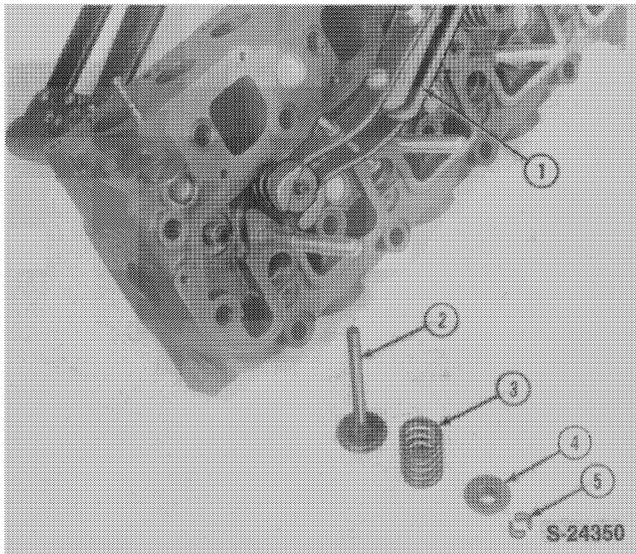
**Model 1920 and 2120**

Loosen the cylinder head bolts gradually a half turn at a time to prevent warping of the cylinder head and remove the cylinder head.

**DISASSEMBLY**

**Reference — Figure 19**

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



**Figure 19**

**Cylinder Head Valve Removal**

- |                            |             |
|----------------------------|-------------|
| 1. Valve Spring Compressor | 3. Spring   |
| 2. Valve                   | 4. Retainer |
|                            | 5. Keepers  |

2. Using a valve spring compressor, compress the valve spring (3) and remove the retainer locks (5).

3. Release the valve spring compressor and remove the valve spring and retainer (4).

4. Remove the valves (2) from the head and place in a numbered container to facilitate identification for installing the components in their original location on assembly.

**INSPECTION AND REPAIR**

**CYLINDER HEAD**

1. Clean the 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. Check the head for cracks or damage in the following areas:

- Valve ports.
- Valve seats.
- External cracks in the water jackets.

5. Inspect the gasket surfaces for scratches or nicks which would 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 the plugs in the head.

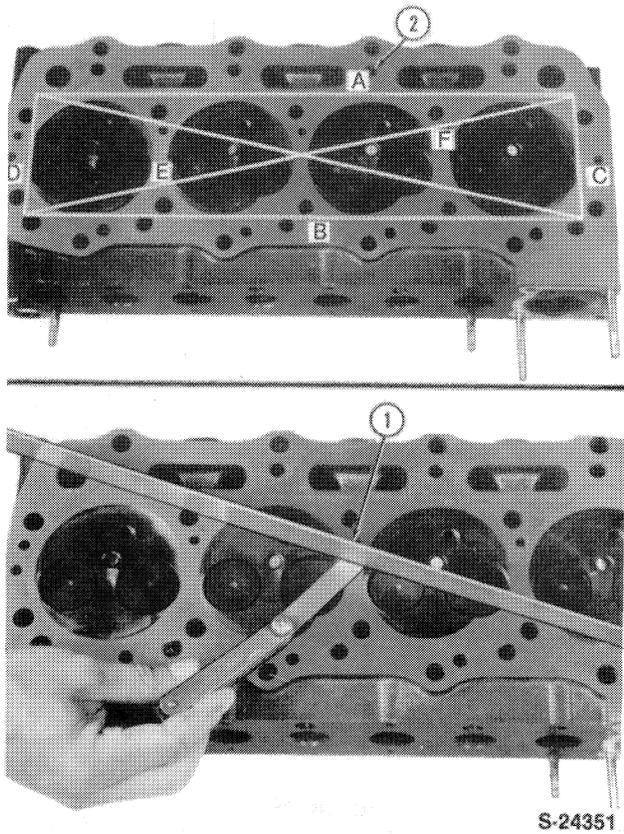
7. Use a straight edge and feeler gauge and check the cylinder head for warp in the area shown at Figure 20.

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

8. Check the push rods for straightness. Replace bent push rods. Do not attempt to straighten.

**VALVE SEATS**

Examine the valve seats and reface the seat if damaged.



**Figure 20**

**Cylinder Head Flatness Check**

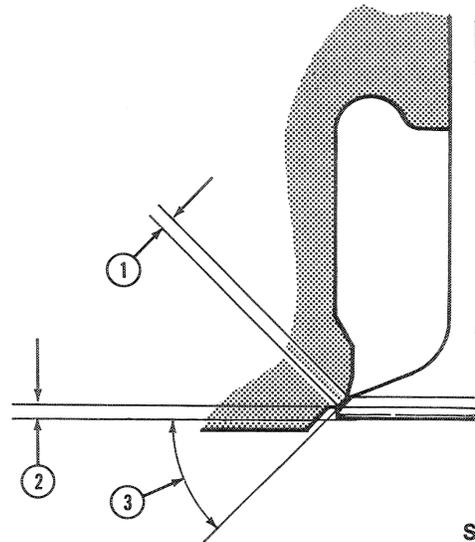
1. Straight Edge
2. Check Areas

Valve seat grinding requires that the seat be ground to the correct width and properly positioned as shown in Figure 21.

A valve that extends too deep into the combustion area 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. Grind away only enough material to provide a smooth even seat.
2. Check the seat width, Figure 21. If necessary, use a 15° stone to lower the seat contact point and use a 75° stone to raise the seat contact point, Figure 22.

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

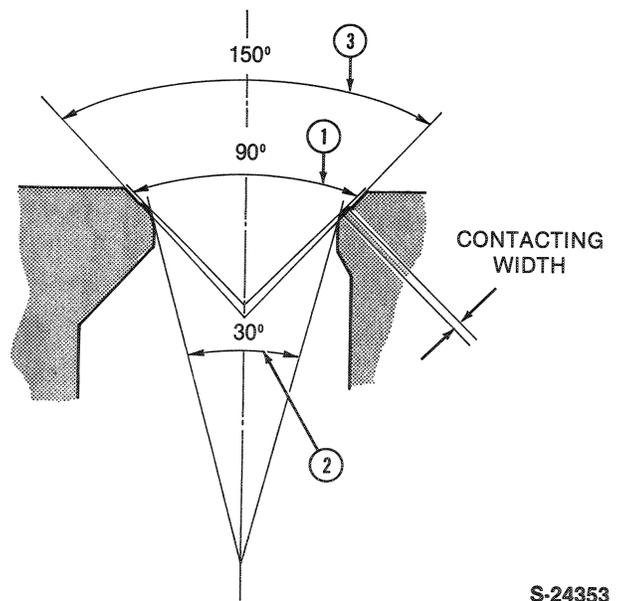


S-24352

**Figure 21**

**Valve Grinding Checks**

1. Correct Valve Seat Width and Location
2. Correct Valve Head Margin
3. 45° Valve Seat Angle



S-24353

**Figure 22**

**Valve Seat Grinding**

1. Seat Angle — 45°
2. Lower Seat Location — 15° Stone
3. Raise Seat Location — 75° Stone

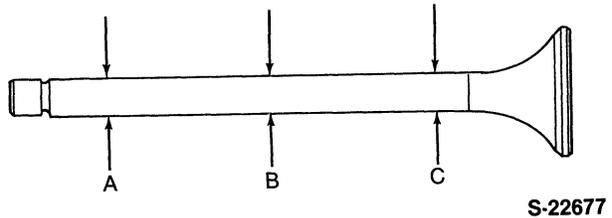
**VALVES**

1. Clean all deposits from the valves using a soft wire brush. Inspect the condition of the valve and discard any that are badly burned, cracked or bent, Figure 23.
2. Using a micrometer, measure the stem diameter at three points "A," "B" and "C," Figure 24.

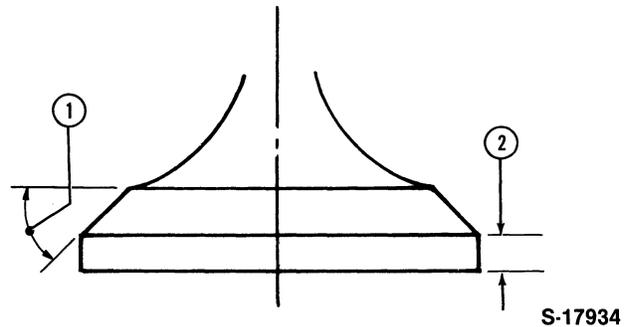
Replace valves if the stem wear diameter is less than the following dimensions:

	Intake	Exhaust
Model 1920	.271 in. (6.89 mm)	.269 in. (6.84 mm)
Model 2120	.310 in. (7.88 mm)	.309 in. (7.85 mm)

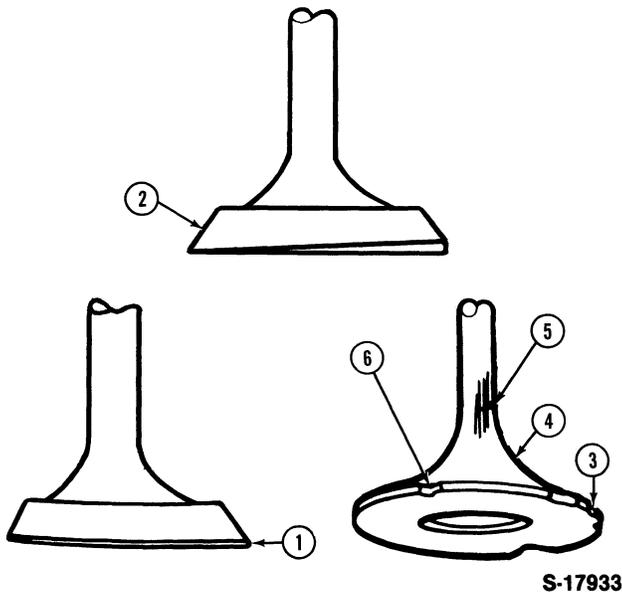
3. If inspection indicates that the valve may be re-used, the valve should be ground as shown, Figure 25.



**Figure 24**  
**Valve Stem Wear Check**



**Figure 25**  
**Valve Correctly Ground**  
1. 45° Angle Seat      2. Minimum Valve Margin



**Figure 23**  
**Valve Defect Inspection**

- |                      |                    |
|----------------------|--------------------|
| 1. Margin Too Thin — | 2. Bent Valve      |
| 1920 — .002 in.      | 3. Pitting         |
| (.5 mm) min          | 4. Indented        |
| 2120 — .039 in.      | 5. Wear or Necking |
| (1.0 mm) min.        | 6. Burned          |

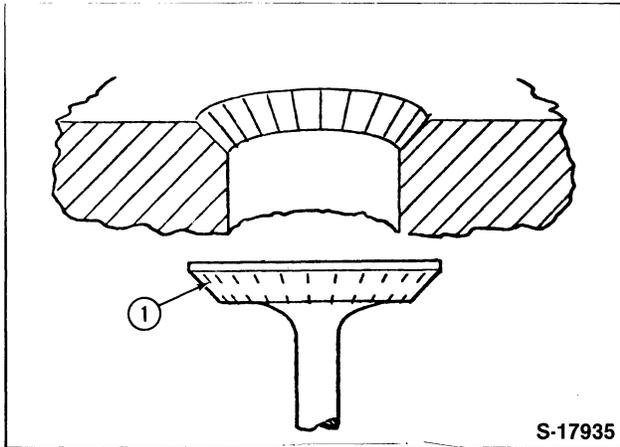
**IMPORTANT:** After grinding the valve and seat, check to assure that the seat contacts the center of the valve face. Using Prussian Blue, lightly coat the valve seat, place the valve in position and rotate the valve slightly while holding a light pressure against the valve. If the blue is transferred to the center of the valve face, the contact is correct.

If Prussian Blue is not available, mark the valve face or seat with a soft lead pencil as shown, Figure 26. Rotate the valve slightly in the seat. The penciled lines will be broken at the seat contact area.

**VALVE GUIDES**

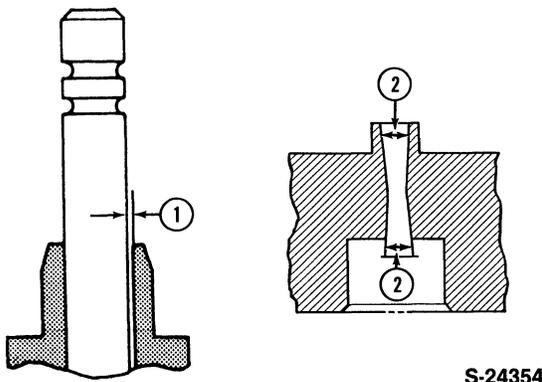
Thoroughly clean the valve guides before attempting to check internal wear.

1. Using a small hole gauge, measure the valve guide bore at the top and bottom wear points, Figure 27.



**Figure 26**  
**Valve Seat Contact Location**

1. Seat



**Figure 27**

**Valve Stem-to-Guide Clearance Check**

1. Stem-to-Guide Clearance
2. Wear Points — Valve Guide

2. Determine the stem-to-guide clearance by subtracting the stem diameter from the valve guide. Replace the valves if the clearance is more than the specified limits:

**Clearance**

Model 1920 . . . . .008 in. (0.2 mm) max.  
Model 2120 . . . . .012 in. (0.3 mm) max.

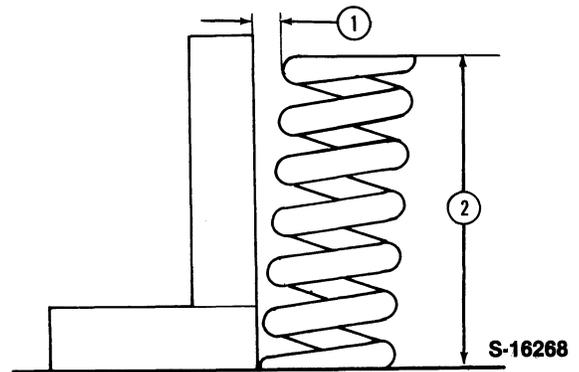
3. Replace the cylinder head if excessive clearance is determined. See "Specifications," Chapter 3 for wear limits.

**VALVE SPRINGS**

1. Place the valve springs on a flat surface. Measure the free-length of the spring and squareness, Figure 28.

Replace springs that do not meet the following specifications:

	<b>Maximum Out of Square</b>	<b>Minimum Free-Length</b>
Model 1920	.079 in. (2.0 mm)	1.319 in. (33.5 mm)
Model 2120	.063 in. (1.2 mm)	1.732 in. (44 mm)



**Figure 28**

**Valve Spring Length and Squareness Check**

1. Squareness
2. Free Length

2. Place the springs in a suitable spring load tester and measure the spring load rating. Replace the springs that do not meet the following load specifications:

**Load Rating**

Model 1920 . . . . .28 lbs. (min.) at 1.2 in. height  
(7 kg at 30.4 mm)

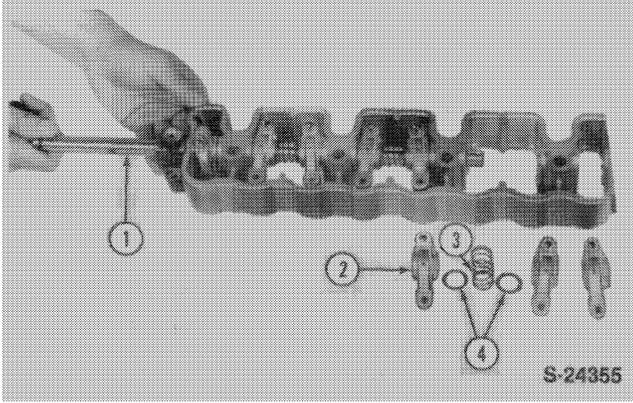
Model 2120 . . . . .29 lbs. (min. at 1.2 in height  
(13 kg at 30.4 mm)

**ROCKER ARM PIVOTS**

**DISASSEMBLY**

**Model 1920**

1. Screw a 8M bolt into the front end of the rocker shaft and pull the rocker shaft out of the support, Figure 29.



**Figure 29**

**Valve Rocker Shaft Removal — Model 1920**

- 1. Rocker Arm Shaft
- 2. Rocker Arm
- 3. Spring
- 4. Shim

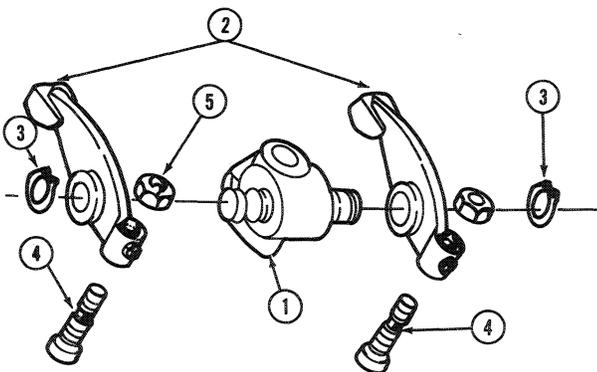
2. Remove the springs (3), shims (4), and rocker arms (2), Figure 29.

**Model 2120**

- 1. Remove the snap rings (3) from each end of the rocker arm shaft (1), Figure 30.
- 2. Slide the rocker arms (2) off the shaft.

**INSPECTION AND REPAIR**

- 1. Inspect the rocker arms and shafts for wear of damage.



**Figure 30**

**Rocker Arm Pivot Components — Model 2120**

- 1. Support and Shaft Assembly
- 2. Rocker Arms
- 3. Snap Rings
- 4. Adjusting Bolt
- 5. Nut

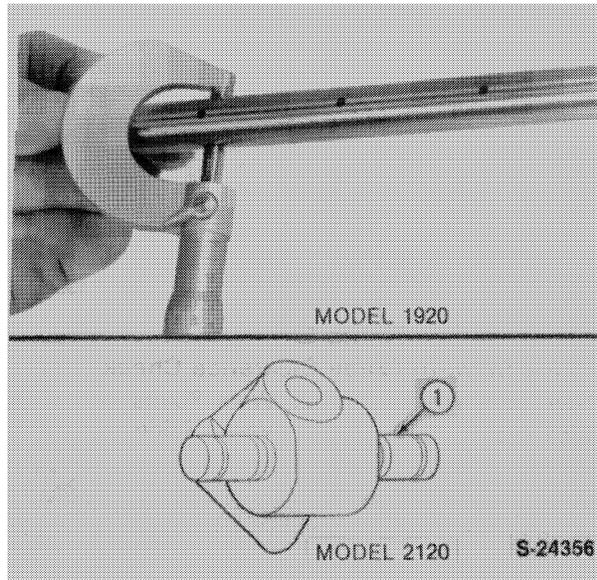
- 2. Inspect the valve stem contact area for pitting or wear. Slight wear patterns may be removed using a fine grit stone.
- 3. Check the adjusting screws for damaged threads or excessive wear.

Replace any components which are visually worn or damaged.

- 4. Using a micrometer, measure the diameter of the rocker arm shaft, Figure 31.

Replace the rocker shaft if the wear at any point exceeds the following diameter:

	<b>Minimum Shaft Diameter</b>
Model 1920	.585 in. (14.87 mm)
Model 2120	.534 in. (13.56 mm)

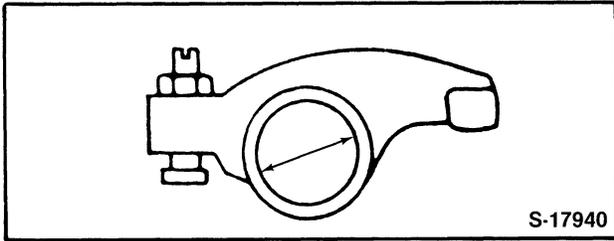


**Figure 31**

**Rocker Shaft Wear Check**

- 1. Wear Points
- 5. Using a hole gauge, measure the inside bore diameter of the rocker arm, Figure 32.

Subtract the rocker shaft diameter from the rocker arm bore diameter to obtain the shaft-to-arm clearance.



**Rocker Arm Wear Check**

Replace the rocker arm and/or shaft assembly if the clearance exceeds the following specifications:

Clearance .....008 in. (0.2 mm) max.

**PUSH RODS**

1. Check all push rods for straightness by rolling on a flat surface. Replace rods which are bent.
2. Inspect the ends of the push rods for excessive wear. If any push rod is worn, the corresponding lifter and rocker arm should also be inspected for excessive wear.

**ASSEMBLY**

**CYLINDER HEAD**

1. Insert each valve into the guide from which it was removed and lightly lap the valve to be sure of an even set all around the valve face.
2. Remove the valve and remove all traces of lapping compound.
3. Using a spring compressor, assemble the valves, springs, retainers and locks.

4. Assemble the rocker arms onto the pivot shafts and install the snap rings.

**INSTALLATION**

During assembly, the ultimate engine compression ratio is established by the thickness of the head gasket used. For service replacement, head gaskets of different thicknesses are available. The correct head gasket must be selected based upon the amount of pistons protrude above the face of the block when at top-dead-center.

The correct head gasket usage is determined as follows:

1. Position each of the pistons at top-dead-center and using a dial indicator, determine the distance each piston projects above the face of the block, Figure 33.

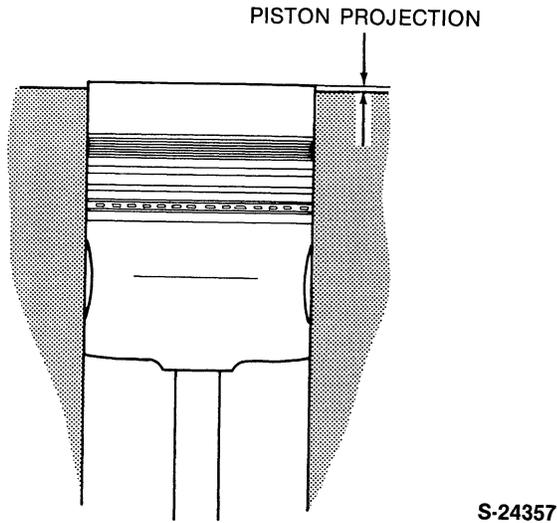
**NOTE:** Measure each of the pistons while holding a slight down pressure on the piston. Use the dimension taken from the cylinder which has the greatest projection and select a head gasket as indicated in the following chart.

The variation between the pistons must not be greater than .004 in. (.1 mm).

2. If removed, install the tappets.
3. Select the proper head gasket and place it on the block with the side marked with the last four digits of part no. code, or "top" facing up.
  - Carefully set the cylinder head in position without disturbing the head gasket.
4. Lubricate the head bolts with engine oil and install the bolts loosely.

MODEL	MEASUREMENT	HEAD GASKET PART NUMBER AND THICKNESS
1920	From 0.0197 to 0.0236 in. (0.5 to 0.6 mm)	111147180 — .047 in. (1.2 mm)
	From 0.0236 to 0.0276 in. (0.6 to 0.7 mm)	111147190 — 0.51 in. (1.3 mm)
	From 0.0276 to 0.0315 in. (0.7 to 0.8 mm)	1111472000 — 0.55 in. (1.4 mm)
2120	Less than .0236 in. (0.6 mm)	111146733 — .060 in. (1.5 mm)
	Greater than .0236 in. (0.6 mm)	111146783 — .070 in. (1.7 mm)

**NOTE:** The last four digits of the part number are stamped on the head gasket.



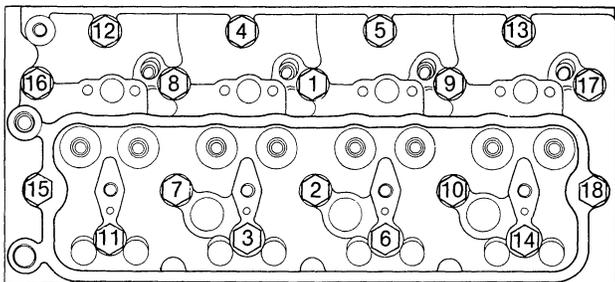
S-24357

**Figure 33**  
**Measuring Piston Height Above Face of Block**

5. Gradually tighten the head bolts in stages in sequence as shown, Figure 34.
6. Tighten all bolts to the specified torque:  
Head bolt torque . . . . .65-69 lbs. ft. (88-93 Nm)
7. Replace the push rods and valve stem caps in their original locations.
8. Install the assembled rocker shaft, tighten the support bolts in steps to the specified torque. See "Specifications," Chapter 3.

On the Model 2120, place the 3 shims on each rocker arm stud bolt.

Position the assembled rocker arm and shaft assemblies over the stud bolts and install the nuts and washers.



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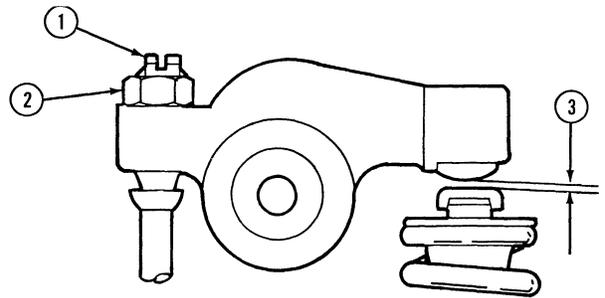
**Figure 34**  
**Cylinder Head Bolt Tightening Sequence**

**NOTE:** Use care to carefully position the rocker arms over the valve stem caps and push rods.

Tighten the nuts to the specified torque:

Rocker post stud nut torque . . . . .20-29 lbs. ft. (27-39 Nm)

Adjust the valve rocker arms to valve clearance, Figure 35. Be sure the tappet is in its lowest position before making the adjustment. To be sure the tappet is in its lowest position, bring the piston to top-dead-center on the compression stroke (both valves closed).



S-24359

**Figure 35**  
**Valve Clearance Adjustment (Cold)**

1. Adjusting Screw	3. Valve Clearance —
2. Locknut	1920 — 0.008 in.
	(0.2 mm)
	2120 — 0.012 in.
	(0.3 mm)

Loosen the adjusting bolt lock nut (2) and turn the adjusting screw to obtain the specified clearance:

**VALVE CLEARANCE (Intake and Exhaust)**

Model 1920 . . . . .008 in. (0.2 mm)  
Model 2120 . . . . .012 in. (0.3 mm)

Tighten the locknut.

**ENGINE FRONT COVER, TIMING GEARS AND OIL PUMP REMOVAL**

**Model 1920**

To remove the front cover assembly, first remove the radiator. See "Radiator Removal," Chapter 2, this part.

1. Drain the oil from the power steering reservoir tank, Figure 36.

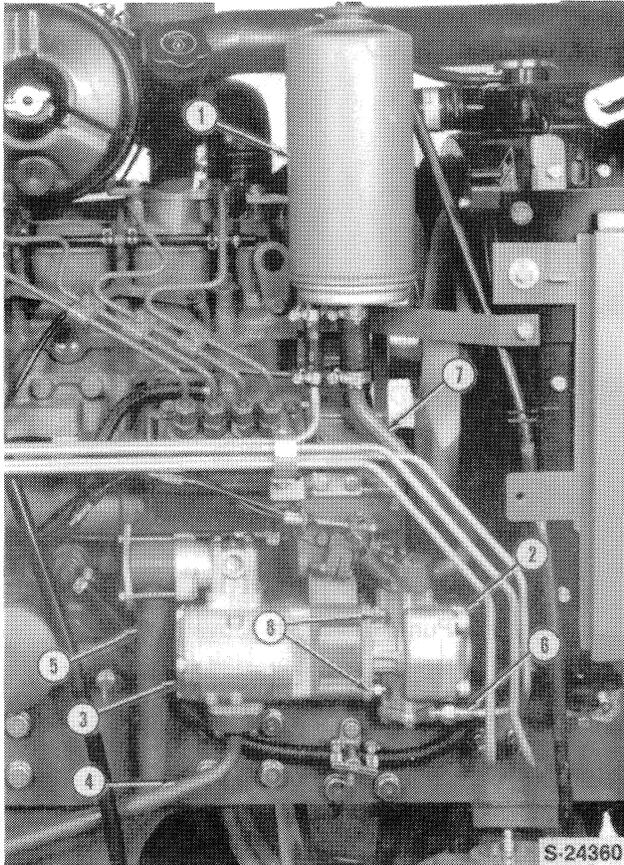


Figure 36

### Hydraulic System and Power Steering Pump Removal — Model 1920

- |                                  |                                 |
|----------------------------------|---------------------------------|
| 1. Power Steering Reservoir Tank | 5. Hydraulic Intake Tube        |
| 2. Power Steering Pump           | 6. Power Steering Pressure Tube |
| 3. Hydraulic System Pump         | 7. Power Steering Intake Tube   |
| 4. Hydraulic Pressure Tube       | 8. Pump Mounting Studs          |
2. Drain the transmission/hydraulic system oil and collect in a clean container. See Operator's Manual.
  3. Remove the tube supporting clamp from the under side of the transmission housing for supporting the hydraulic system intake and pressure tubes.
  4. Remove the high pressure hydraulic tube, Figure 36.
  5. Remove the intake tube clamp bolts and move the tube away from the side of the engine, Figure 36.

6. Remove the power steering intake and pressure tubes from the power steering pump, Figure 36.
7. Remove the pump mounting stud nuts and remove the power steering pump (2) and hydraulic system pump (3) from the cover, Figure 36.
8. Disconnect the alternator wiring and remove the alternator assembly, Figure 37.

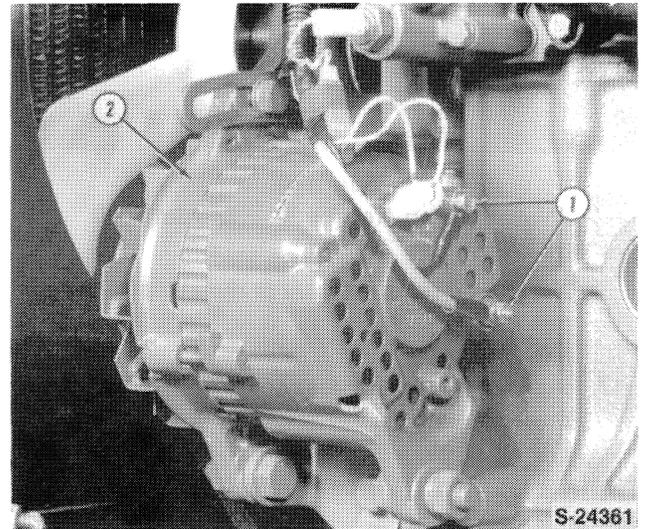
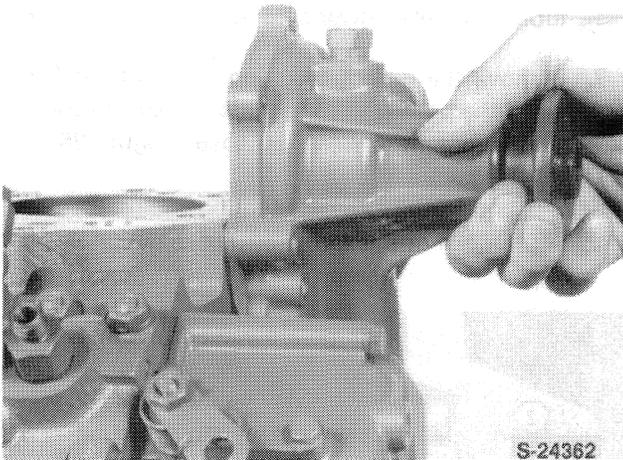


Figure 37

### Alternator Removal — Model 1920

- |                        |                        |
|------------------------|------------------------|
| 1. Wiring — Alternator | 2. Alternator Assembly |
|------------------------|------------------------|
9. Remove the fan belt.
  10. Remove the cooling fan.
  11. Remove the crankshaft pulley retaining nut and pull the crankshaft pulley off of the crankshaft.
- NOTE:** Use a suitable puller if necessary. Do not use a hammer to loosen the pulley.
12. Remove the water pump assembly, Figure 38.
  13. Remove the injector lines and cap all openings, Figure 39.
  14. Remove the engine stop solenoid, Figure 39.
  15. Disconnect the throttle control cable from the governor linkage.
  16. Remove the injection pump mounting bolts and raise the injection pump enough to disconnect the hairpin and separate the governor link from the control rack, Figures 39 and 40.



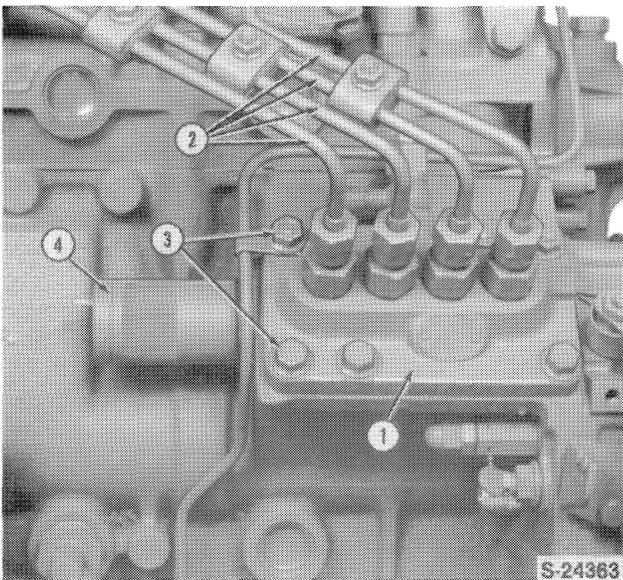
**Figure 38**  
Water Pump Removal — Model 1920

**NOTE:** It is not necessary to remove the injection pump.

17. Remove the timing gear cover bolts and remove the cover and gasket.

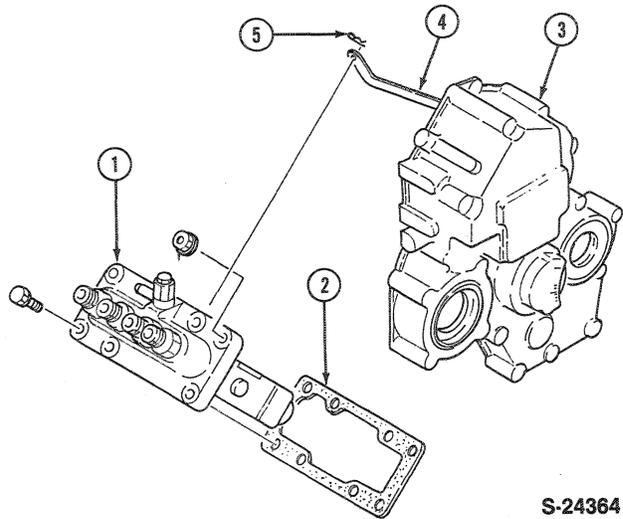
**TIMING GEAR COVER REMOVAL**  
Model 2120

To remove the front cover, first remove the radiator. See "Radiator Removal," Chapter 2, this part.



**Figure 39**  
Injection Pump Removal — Model 1920

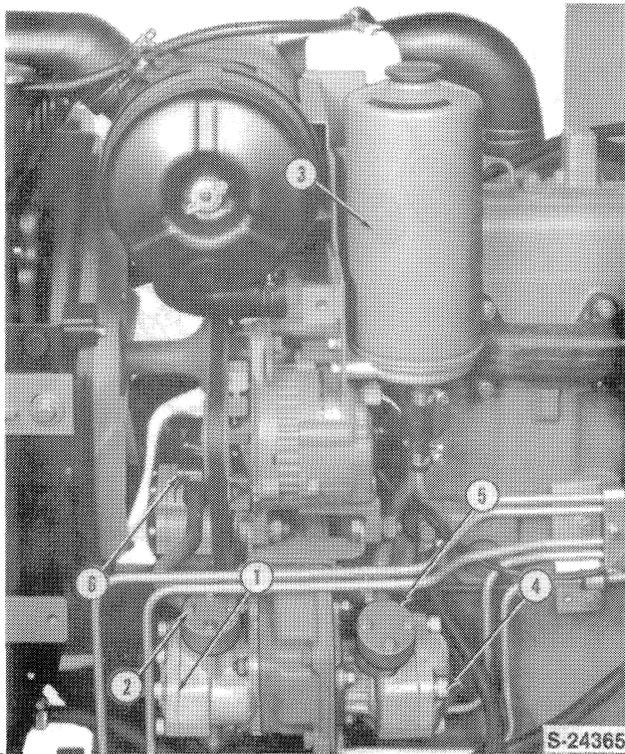
1. Injection Pump	3. Pump Mounting Bolt/Nuts
2. Injector Lines	4. Fuel Stop Solenoid



**Figure 40**  
Timing Gear Cover Removal — Model 1920

- |                   |                  |
|-------------------|------------------|
| 1. Injection Pump | 4. Governor Link |
| 2. Shim           | 5. Hair Pin      |
| 3. Cover          |                  |

1. Drain the transmission/hydraulic system oil and collect in a clean container. See Operator's Manual.
2. Drain the oil from the power steering system reservoir tank, Figure 41.
3. Remove the tube supporting clamp from the underside of the transmission housing for supporting the hydraulic system intake and pressure tubes.
4. Remove the high pressure tube (2), Figure 42.
5. Loosen the inlet tube hose clamps (6), Figure 41.
6. Remove the bolts from the hydraulic pump inlet tube flange and move the tube away from the engine, Figure 42.
7. Remove the hydraulic system pump (1), Figure 42.
8. Remove the transmission pump pressure tube (1), Figure 43.
9. Remove the power steering pump pressure tube (2), Figure 43.
10. Remove the power steering pump (3), Figure 43.
11. Remove the HSS transmission pump (4), Figure 43.



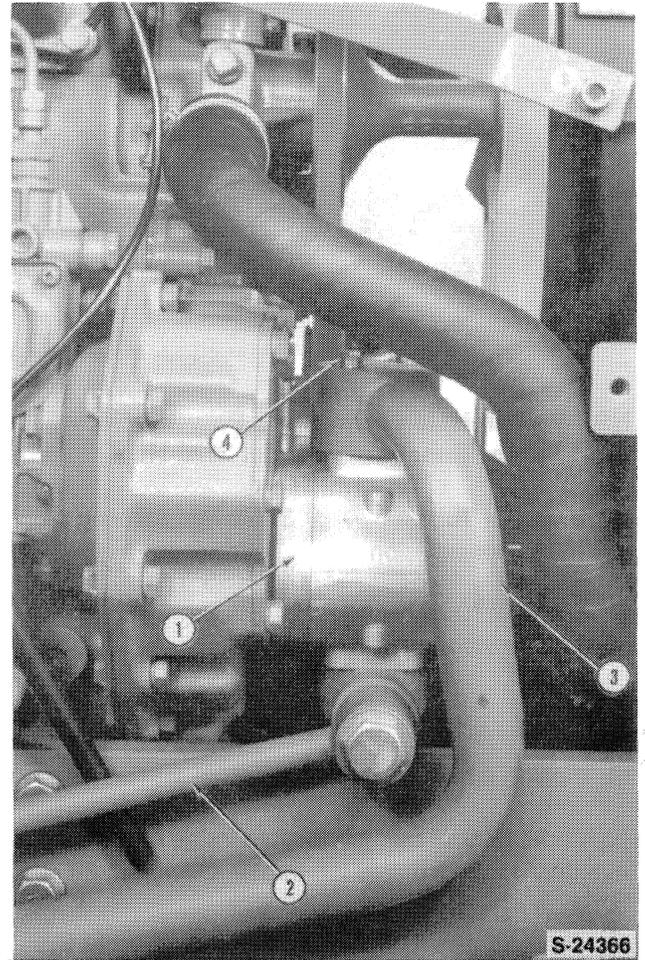
**Figure 41**

**HSS Transmission Pump and Power Steering Pump Removal — Model 2120 HSS Transmission**

- |                                 |                                |
|---------------------------------|--------------------------------|
| 1. HSS Transmission Pump        | 4. Power Steering Pump         |
| 2. HSS Pump Inlet Tube          | 5. Power Steering Inlet Tube   |
| 3. Power Steering Oil Reservoir | 6. Hose Clamp — HSS Pump Inlet |

12. Remove the spacer (6), and pump drive gear (4) and bearings (3), Figure 44.
13. Disconnect the wiring from the alternator and remove the alternator and bracket as an assembly.
14. Remove the cooling fan.
15. Remove the crankshaft pulley nut and pull the pulley off the crankshaft, Figure 44.

**NOTE:** Use a suitable puller if necessary. Do not use a hammer to loosen the pulley.



**Figure 42**

**Hydraulic Pump Removal — Model 2120 HSS Transmission**

- |                          |                        |
|--------------------------|------------------------|
| 1. Hydraulic System Pump | 3. Inlet Tube          |
| 2. High Pressure Tube    | 4. Tube-to-Pump Flange |

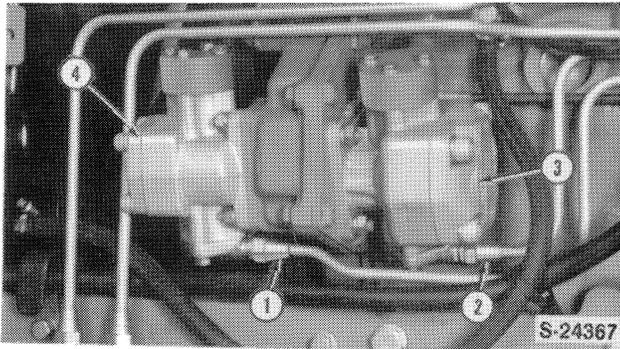
16. Remove the timing gear cover mounting bolts and remove the cover (2), Figure 44.

**TIMING GEARS AND OIL PUMP REMOVAL**

**CAMSHAFT GEAR**

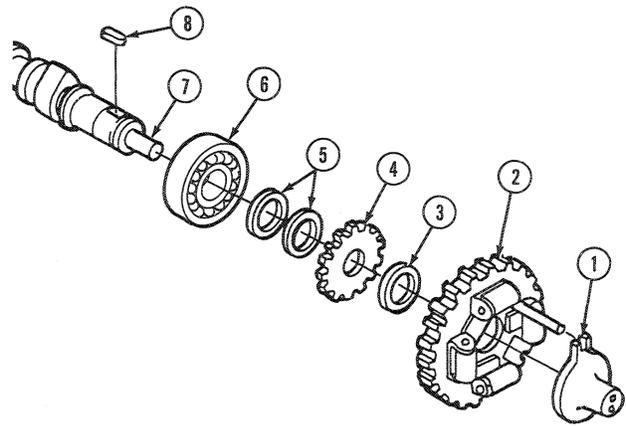
**Model 1920**

1. Remove the governor assembly, camshaft gear and tachometer drive gear components, Figure 45.



**Figure 43**  
**HSS Transmission Pump and Power Steering Pump Removal — Model 2120 HSS Transmission**

- |  |                          |
|--|--------------------------|
| 1. Pressure Tube — HSS Transmission Pump | 3. Power Steering Pump   |
| 2. Pressure Tube — Power Steering Pump   | 4. HSS Transmission Pump |



**Figure 45**  
**Camshaft Gear and Governor Removal Model 1920**

- |                          |             |
|--------------------------|-------------|
| 1. Slider                | 5. Spacers  |
| 2. Gear Assembly         | 6. Bearing  |
| 3. Spacer                | 7. Camshaft |
| 4. Tachometer Drive Gear | 8. Key      |

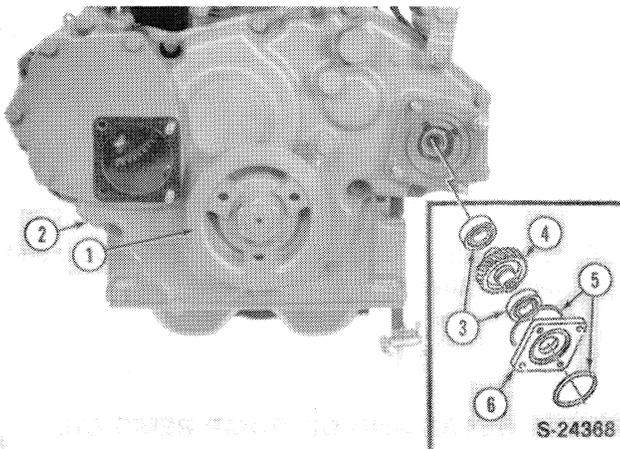
**OIL PUMP ASSEMBLY**

The Model 1920 oil pump is located inside of the pump drive gear at the front of the engine block, Figure 46.

1. Remove the "E" snap ring and slide the drive gear along with the rotors, cover, spring, shim and collar off the pump shaft as an assembly, Figure 47.

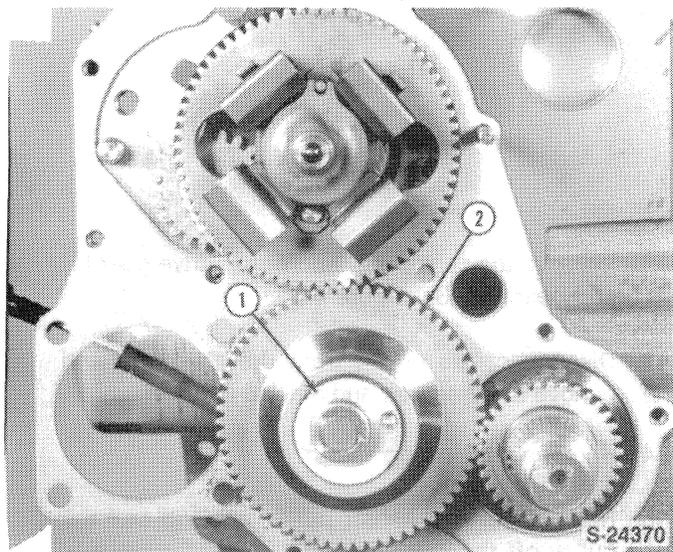
**NOTE:** *The oil pump shaft and port block assembly is a press fit in the block, Figure 48. If necessary to remove due to damage, remove the port block and shaft assembly as follows:*

- Remove the engine front adaptor plate.

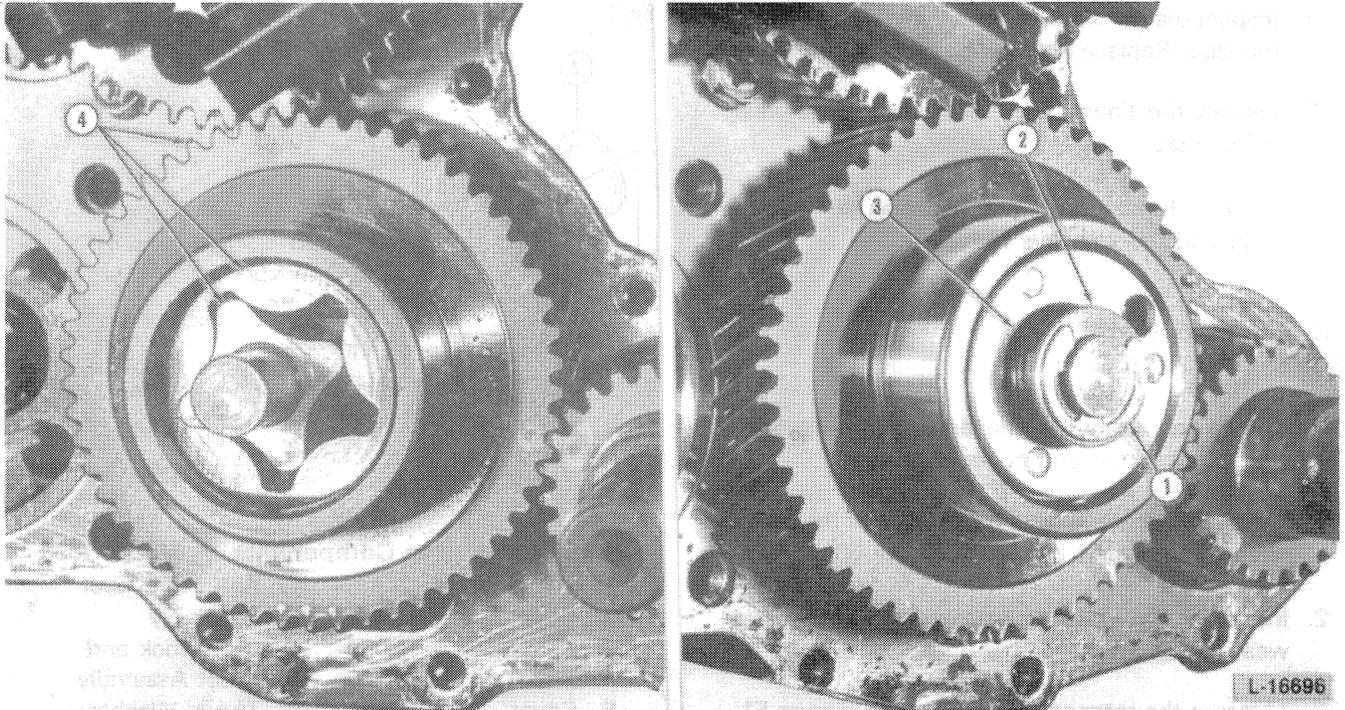


**Figure 44**  
**Timing Gear Cover Removal**

- |                      |               |
|----------------------|---------------|
| 1. Crankshaft Pulley | 4. Drive Gear |
| 2. Timing Gear Cover | 5. O-Ring     |
| 3. Bearing           | 6. Spacer     |



**Figure 46**  
**Oil Pump and Pump Drive Gear**  
 1. Oil Pump                      2. Pump Drive Gear



**Figure 47**

**Engine Oil Pump Removal — Model 1920**

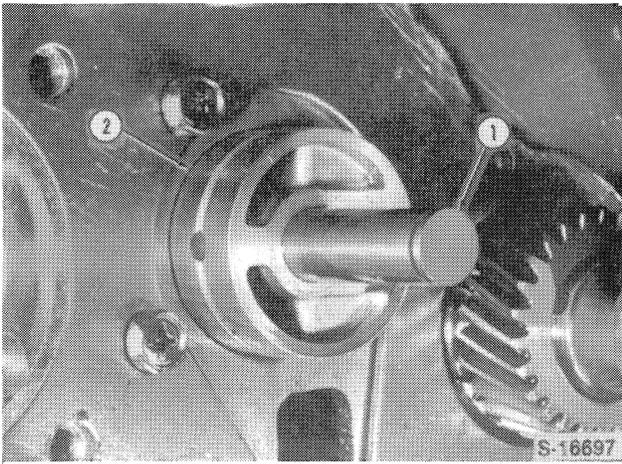
- |                  |           |           |                    |
|------------------|-----------|-----------|--------------------|
| 1. "E" Snap Ring | 2. Collar | 3. Spring | 4. Gear and Rotors |
|------------------|-----------|-----------|--------------------|

- Using Tool No. 11092, place the collars in the grooves of the port block assembly. Align the setscrews of the puller with the counterbores in the collars and tighten. Using a slide hammer as shown, Figure 49, remove the port block.

**INSPECTION AND REPAIR**

**TIMING GEARS AND GOVERNOR ASSEMBLY  
Model 1920**

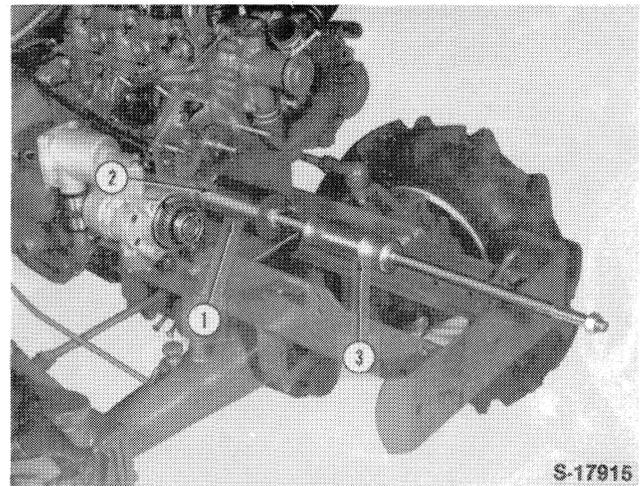
1. Wash all components in a suitable solvent and air dry.



**Figure 48**

**Port Head and Shaft Removal — Model 1920**

- |          |              |
|----------|--------------|
| 1. Shaft | 2. Port Head |
|----------|--------------|



**Figure 49**

**Oil Pump Port Block Removal**

- |                            |                  |                 |
|----------------------------|------------------|-----------------|
| 1. Puller — Tool No. 11092 | 2. Setscrews (2) | 3. Slide Hammer |
|----------------------------|------------------|-----------------|

2. Inspect the governor assembly for excess wear or damage. Replace any components found faulty.
3. Inspect the timing gear teeth for excess wear, chips, etc.
4. Inspect the camshaft and injection pump drive keys and the keyways for wear.

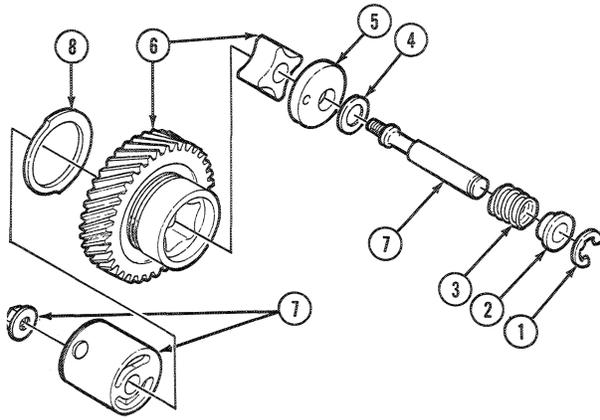
**OIL PUMP ASSEMBLY**  
**Model 1920**

The oil pump consists of the inner and outer rotors, idler gear, port block, shaft and cover, Figure 50.

1. Check for excessive wear on the face of the pump cover (5) and port block (7), Figure 50.
2. Inspect the pump shaft and rotors for excessive wear or scratches.
3. Measure the rotor to rotor clearance, Figure 51. Replace the components as required if wear is excessive. See "Specifications," Chapter 3.

**OIL PUMP INSTALLATION**  
**Model 1920**

If the engine oil pump port block assembly was removed, install a new port block assembly as follows:

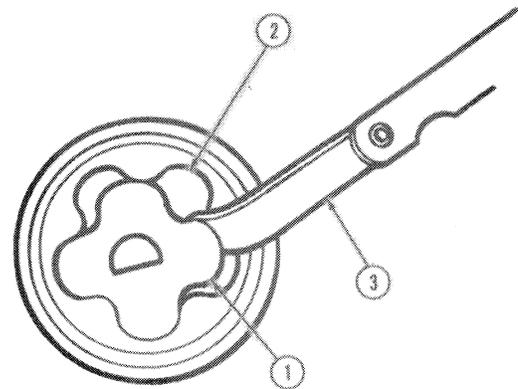
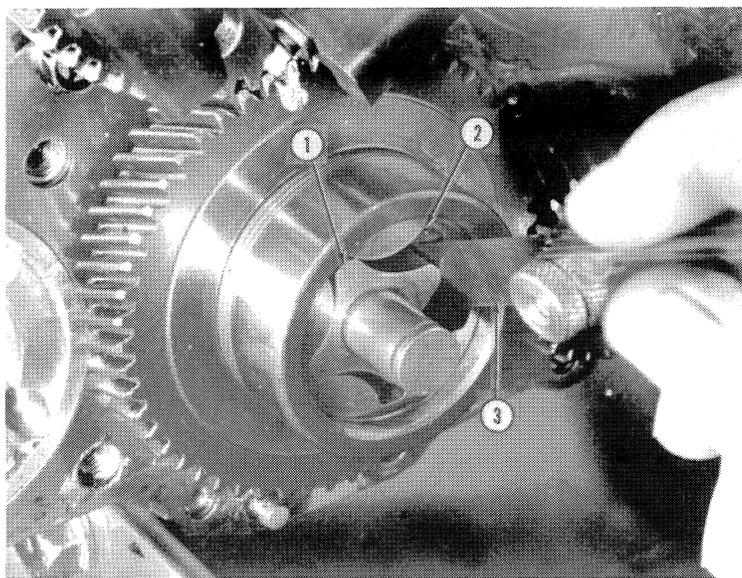


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**Figure 50**  
**Engine Oil Pump Components — Model 1920**

- |                  |                                  |
|------------------|----------------------------------|
| 1. "E" Snap Ring | 6. Rotor and Gear Assembly       |
| 2. Collar        | 7. Port Block and Shaft Assembly |
| 3. Spring        | 8. Thrust Washer                 |
| 4. Shim          |                                  |
| 5. Cover         |                                  |

- Using Tool No. 11063, insert the threaded guide pins (1) into the cylinder block, Figure 52. Assemble the oil pump shaft to the port block using nut and washer previously removed.
- Insert the port block assembly into the installer and place on the guide pins as shown, Figure 53.



S-19267

**Figure 51**  
**Rotor to Rotor Clearance Check**

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