

## FOREWORD

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 Repair 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 does not compromise his own personal safety nor the safety of others by his choice of methods or tools.

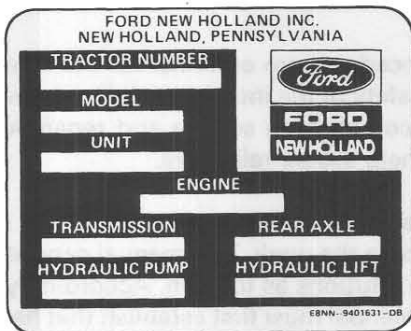
As you read through this manual, you will come across **NOTES** and **WARNINGS**. Each one is there for a specific purpose. **NOTES** are given to prevent you from making an error that could damage the vehicle. **WARNINGS** remind you to be especially careful in those areas where carelessness can cause personal injury.

The Manual is divided into eleven Parts each sub-divided in turn into Chapters. Each Chapter contains information on general operating principles, detailed inspection and overhaul and, where applicable, specific trouble shooting, special tools and specifications. Any reference in this Manual to right, left, rear, front, top or bottom is as viewed from the operator's seat looking forward towards the loader.

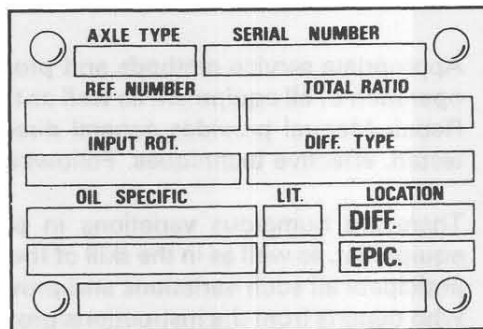
The material contained in this Manual was correct at the time of going to print but Ford New Holland policy is one of continuous improvement and the right to change prices, specifications, equipment or design at any time without notice is reserved. All data in this Manual is subject to production variations,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

Measurement details in this Manual are tabled with the British standard first, with the metric equivalent following in brackets.

## PRODUCTION DATE CODES AND UNIT SERIAL NUMBERS



**Figure 1**  
Vehicle Identification Plate



**Figure 2**  
Four Wheel Drive Front Axle Identification Plate



IR-INTRO

**Figure 3**  
Cab Identification Plate



TI

**Figure 4**  
Backhoe Identification Plate

The vehicle identification plate, Figure 1, is located on the left hand side of the steering console and is stamped with the following information:

Unit Serial Number, Model Code, Production Date Code of the complete Unit, of the Engine, the Transmission, and the Rear Axle assembly:

The identification plate for the Four Wheel Drive front axle (where fitted), Figure 2, is located on the rear right-hand side of the front axle casing.

The Cab/ROPS identification plate, Figure 3 is located on the right-hand 'B' pillar of the cab/ROPS frame.

The identification plate for the backhoe assembly (where fitted), Figure 4, is attached to the rear left hand side of the mainframe on the sideshift models, or attached to the side frame under the left hand rear fender on centre pivot models.

Whenever effecting a repair or overhaul of the Unit, the relevant information should be noted and used when referring to Service Bulletins or ordering parts.

# SAFETY PRECAUTIONS

Practically all Service work involves the need to drive the tractor. The Operators 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 practised 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 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 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 raised implement.
- **Compressed Air**  
The pressure from a compressed air line is often as high as 100 lbf/in<sup>2</sup> (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, swarf, 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 remove dust, etc., from one place to another. Look around before using an air hose as bystanders may get grit in their eyes, ears or skin.

- **Hand Tools**

Many cuts, abrasions and injuries are caused by defective or improvised tools. Never use the wrong tool for the job, as this generally leads 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 re-assembly of major and sub components, always use the Special Service Tools recommended. These will reduce the work effort, labour 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 ensure 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 fluid 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 the 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 realised. 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 units 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 unit 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, ensure that safe and stable supports are installed, beneath axle housings, casings, etc., before commencing work.
- Use footsteps or working platforms when servicing those areas of a tractor that are not within easy reach.
- Prior to pressure testing, ensure all hoses and connectors, not only of the tractor, but also those of the test equipment, are in good condition and tightly secured. 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.
- Always lower the loader and backhoe buckets to the ground before leaving the vehicle.
- If high lift attachments are fitted to a unit beware of overhead power, electric or telephone cables when travelling. Drop attachment near to ground level to increase stability and minimise risks.
- Do not park or attempt to service a unit on an incline. If unavoidable, take extra care and block all wheels.
- Prior to removing wheels and tyres from a unit, 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 tyres beware of over inflation – constantly check the pressure. Over inflation can cause tyre burst and result in personal injury.

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.

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

**Safety is everybody's responsibility.**

## LOADER ARM SUPPORT

The Ford 455C, 555C and 655C are equipped with a loader arm support. The loader arm support (2) is stored on the left hand loader arm (3), and retained in position by a single spring loaded pin (1), Figure 1.

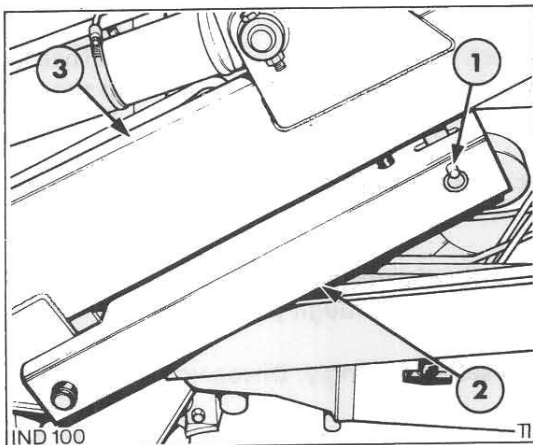
**⚠ WARNING:** *To avoid personal injury never work beneath or around an unsupported loader. Always install the loader arm support.*

To install the support, raise the loader to full height then withdraw the retaining pin and position the support onto the load lift cylinder. Slowly lower the loader until the support (1) takes the weight of the loader, Figure 2. Do not apply down pressure on the loader lift cylinders.

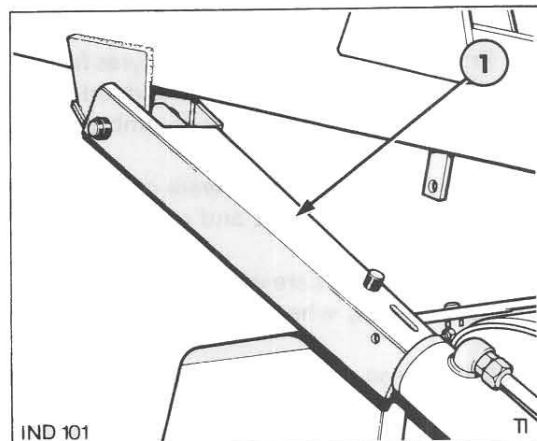
**NOTE:** *To prevent damage to the loader lift cylinder rod never release the support before raising the loader.*

To remove the support, raise the loader to full height then lift and position the support onto the loader arm. Retain the support to the loader arm with the retaining pin then lower the loader to the ground.

**⚠ WARNING:** *To avoid serious injury whilst servicing the unit always ensure the loader bucket is on the ground in the dumped position or in the raised position with the loader arm support installed. Never work under or around a raised loader without the loader arm support installed.*



1. Loader Arm Support Stored



2. Loader Arm Support Installed

# PART 1

## ENGINE SYSTEMS

### Chapter 1

#### 3-CYLINDER DIESEL ENGINE

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### Chapter 2

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### Chapter 3

#### COOLING SYSTEM

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# Chapter 4

## TROUBLE SHOOTING, SPECIFICATION AND SPECIAL TOOLS

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# PART 1

## ENGINE SYSTEMS

### Chapter 1

#### 3-CYLINDER DIESEL ENGINE

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#### A. 3-CYLINDER DIESEL ENGINE – DESCRIPTION AND OPERATION

This Chapter describes the overhaul and repair of the 3-cylinder direct injection diesel engine.

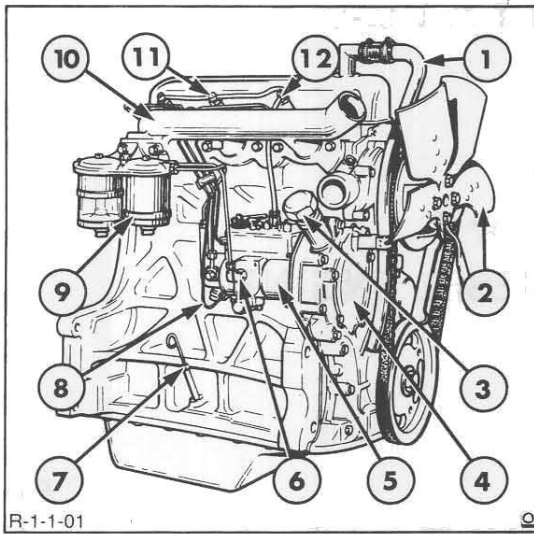
The following chart shows the 3-cylinder diesel engine options available.

The engine Figure 1, features a cross flow cylinder head with the inlet and exhaust manifolds on opposite sides of the head. The combustion chamber is formed in the crown of the piston which has three compression and one oil control ring all located above the piston pin.

The cylinder head assembly incorporates the valves, valve springs and the spring retainers. Valve guides are an integral part of the cylinder head with replaceable valve seats pressed into the valve ports.

Model	Ford 455C
No. of Cylinders	3
Bore	4.4 in. (111.8 mm)
Stroke	4.4 in. (111.8 mm)
Displacement	201 in <sup>3</sup> (3294 cm <sup>3</sup> )

## PART 1-ENGINE SYSTEMS



**Figure 1**

3-Cylinder Diesel Engine with DPA Distributor Type Fuel Injection Pump

- |                            |                            |
|----------------------------|----------------------------|
| 1. Ventilation Tube        | 7. Oil Level Indicator     |
| 2. Fan                     | 8. High Pressure Fuel Pipe |
| 3. Oil Filler Cap          | 9. Fuel Filters            |
| 4. Timing Cover            | 10. Inlet Manifold         |
| 5. Injection Pump          | 11. Rocker Cover           |
| 6. Low Pressure Fuel Inlet | 12. Injector               |

### Cylinder Head Assembly

The cylinder head assembly incorporates the valves, valve springs, and rotators. The valve rocker arm shaft assembly is bolted to the cylinder block, through the head. The intake and exhaust manifolds are bolted to the head, the intake on the right hand side, and the exhaust on the left. The water outlet connection and thermostat are attached to the front of the cylinder head.

Valve guides are integral with the cylinder head, and valves with oversize stems are available for service. Special replaceable cast alloy valve seats are pressed into each valve port, and exhaust valves are fitted with positive valve rotators. Intake valves use umbrella-type seals while the exhaust valves use a square section O-ring.

Valve lash is maintained by self-locking adjusting screws. The camshaft runs in four replaceable bearings, and is driven by the camshaft drive gear in mesh with the camshaft and crankshaft gears. Camshaft thrust is controlled by a plate secured to the block and located between the camshaft gear and the front journal of the camshaft. A helical gear mounted on the rear of the camshaft drives the tractor hydraulic system pump, optional on some tractor models.

The cylinder head bolts are evenly spaced in a six-point pattern around each cylinder. Diesel engine injectors are mounted outside the rocker cover.

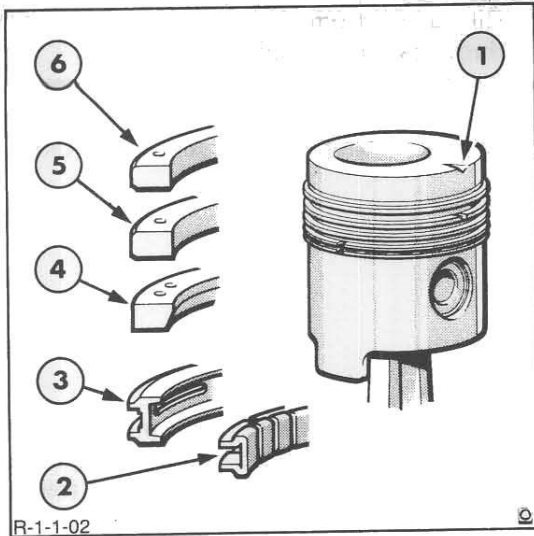
The engine cylinder head is designed with the entire face of the cylinder head flat. The combustion chambers are recessed into the piston crowns.

### Crankshaft Assembly

The crankshaft is supported in the cylinder block by four main bearings and the crankshaft end thrust is suppressed by a thrust bearing located on the second main bearing.

The piston is connected to the crankshaft by a heavy I-beam connecting rod. The crankshaft end of the connecting rod has an insert-type copper lead or aluminum tin alloy bearing. The piston end of the connecting rod has a replaceable bronze bushing. The piston pin is a free-floating steel pin held in place in the piston by two snap rings.

Front and rear crankshaft oil sealing is effected by one piece, single lip type seals.



**Figure 2**  
Conventional Piston and Rings

1. Notch to Front of Engine
2. Expander for Oil Control Ring
3. Oil Control Ring
4. 1st Compression Ring
5. 2nd Compression Ring
6. Top Compression Ring

### Pistons

Pistons are an aluminium alloy with combustion chambers recessed into the piston crowns. Each piston, Figure 2, has three compression rings and one oil control ring, all of which are located above the piston pin.

### Connecting Rods

The piston connecting rods are of 'I' section, with replaceable bronze piston pin bushings. Full-floating piston pins are retained by two snap rings in each piston.

### Manifolds

The cast iron intake and exhaust manifolds are on opposite sides of the cylinder head for better heat distribution in the head, and less heat transfer to the intake manifold. All tractors are fitted with vertical exhaust systems.

The intake manifolds are connected through tubing to the air cleaner. The diesel engine intake manifold is provided with a tapped hole for installation of a thermostart or an ether cold starting aid kit.

**NOTE:** *On tractors where cold start equipment is not installed, the plug in the manifold should remain securely installed at all times, since considerable damage to the cylinder bores could result from its absence. The cylinder bores can also be damaged by grit and other foreign matter passing through the air cleaner hose connections if they are not properly secured.*

### Cylinder Block Assembly

The cylinder block is alloy cast iron with heavy webbing and deep cylinder skirts. The block features full length water jackets for cooling the cylinders, which are bored integral with the block. Cylinders are in-line and vertical, and numbered from 1 to 3, front to rear.

The oil pan is attached to the bottom of the cylinder block and is the sump for the lubrication system. The engine front cover is attached to the front engine adapter plate forming a cover for the timing gears.

## PART 1-ENGINE SYSTEMS

The crankshaft gear is keyed and press fitted on the front of the crankshaft. The crankshaft gear drives the camshaft idler gear, which is attached to the front of the cylinder block. The idler gear drives the camshaft gear and the injection pump drive gear.

Oil passes from the pump to an external, throw-away, spin-on type filter incorporating a relief valve which permits oil to be by-passed, if filter blockage occurs, and so ensures engine lubrication at all times.

The camshaft gear, attached to the front of the camshaft by a bolt, lock washer, flat washer and a spacer, is keyed to maintain the position of the gear and the drive shaft. All the timing gears can be checked by observing the timing punch marks on the gears.

Oil flows from the filter to the main oil gallery which runs the length of the cylinder block and intersects the camshaft follower chambers.

The main gallery also supplies oil to the crankshaft main bearings and to the connecting rod journals via drillings in the crankshaft. Drilled passages from each main bearing direct oil to the camshaft bearings.

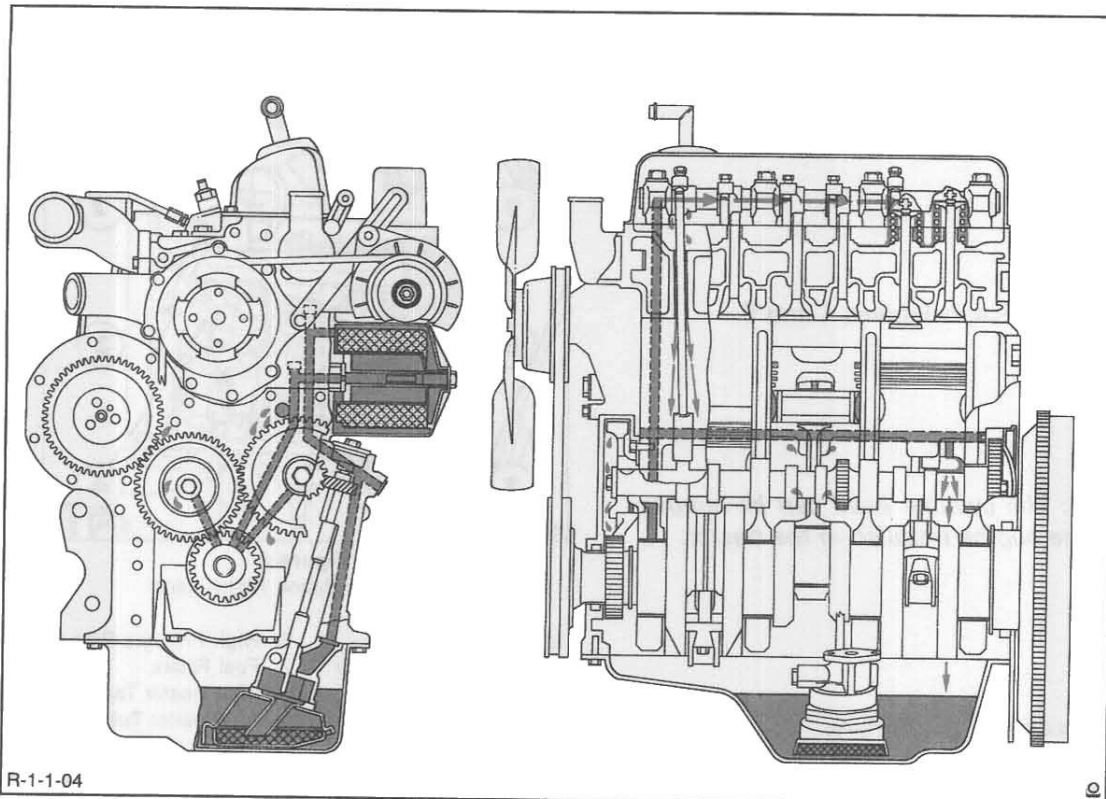
### LUBRICATION SYSTEM

Lubrication of the engine is maintained by a rotor type oil pump mounted at the base of the engine block. The oil pump is driven from the camshaft and draws oil from the engine sump through a wire mesh screen.

The camshaft drive gear bushing is pressure lubricated through a drilled passage from the front main bearing. The gear has small oil passages machined on both sides which allow the oil to escape.

A spring loaded relief valve in the pump body limits the pressure in the system by directing excess oil back to the intake side of the pump.

The timing gears are lubricated by oil from the cam follower chamber and the pressure lubricated camshaft drive gear bushing.



**Figure 3**  
3-Cylinder Engine Lubrication System

■ Lubrication Oil

Cylinder walls, piston and piston pins are splash lubricated by the connecting rods and rotating crankshaft.

As the camshaft turns, holes in the camshaft and camshaft bearing align and a regulated stream of oil is directed to the cylinder head and on up the rocker arm shaft support bolt to the rocker shaft.

An intermittent flow of oil is directed to the valve rocker arm shaft assembly via a drilled passage in the cylinder block located vertically above No. 1 camshaft bearing. This drilling aligns with a corresponding hole in the cylinder head.

The oil flows from the shaft through drilled holes in each rocker arm bushing to lubricate both ends of the arms. Excess oil flows down the push rods and assists in lubricating the cam followers before draining back into the sump through cored openings in the block.

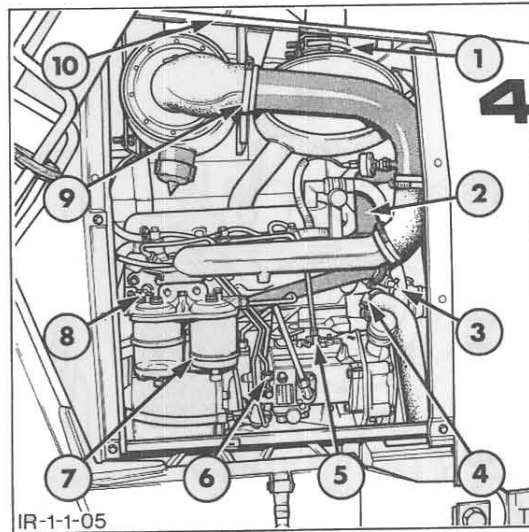
## B. 3-CYLINDER DIESEL ENGINE – OVERHAUL

## CYLINDER HEAD, VALVES AND RELATED PARTS

## REMOVAL

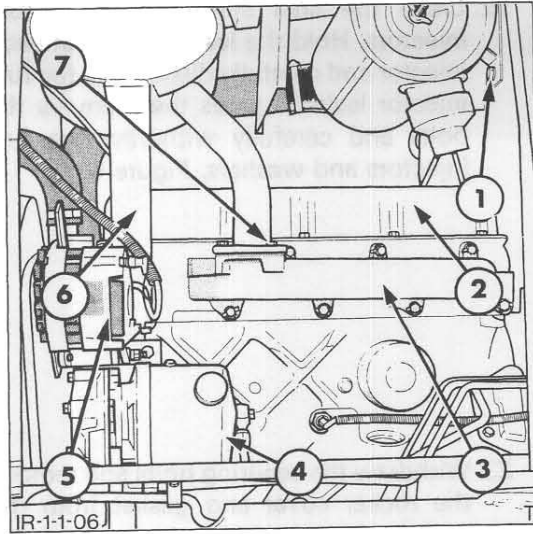
With reference to Figures 4 and 5

**NOTE:** The cylinder head can be removed with the engine installed in the tractor.



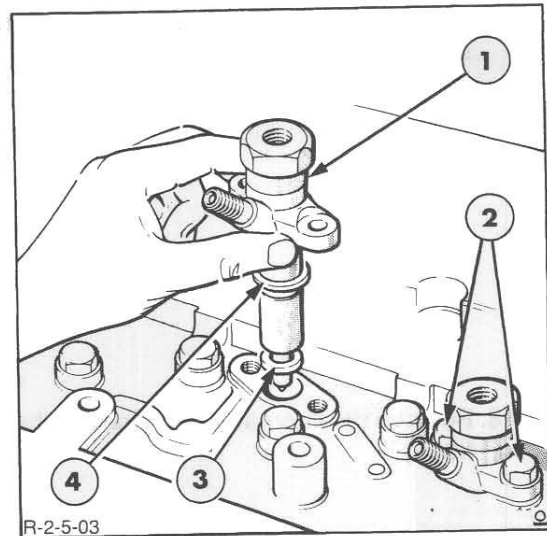
**Figure 4**  
Engine Installation Right-Hand

- |                            |                              |
|----------------------------|------------------------------|
| 1. Disconnect the battery: | 6. High Pressure Pipe        |
|                            | 7. Fuel Filters              |
|                            | 8. Rear Heater Tap           |
|                            | 9. Air Cleaner Tube and Pipe |
|                            | 10. Top Hood Panel           |
2. Ford 455C remove the engine side panels.
  3. Drain the coolant from the radiator and engine cylinder block:
  4. Shut-off the heater hose taps then disconnect and plug the heater hoses (where fitted).
  5. Remove the radiator top hose.
  6. Remove the exhaust muffler extension pipe.
  7. Remove the air cleaner pre-cleaner.
  8. Remove the air cleaner to intake manifold tube and hoses.
  9. Remove the top hood panel.
  10. Remove the exhaust muffler.



**Figure 5**  
Engine Installation Left-Hand

- |                     |                         |
|---------------------|-------------------------|
| 1. Air Cleaner      | 5. Alternator           |
| Retaining Bolts     | 6. Exhaust Muffler      |
| 2. Rocker Cover     | Bracket                 |
| 3. Exhaust Manifold | 7. Exhaust Muffler Pipe |
| 4. Steering Pump    |                         |



**Figure 6**  
Fuel Injector Removal

- |                                 |
|---------------------------------|
| 1. Fuel Injector Assembly       |
| 2. Fuel Injector Mounting Bolts |
| 3. Copper Washer                |
| 4. Cork Washer                  |

11. Shut-off the fuel tank tap then disconnect the low pressure fuel lines and remove the fuel filters from the inlet manifold and cap the exposed openings.

12. Disconnect and remove the injector fuel pipes from the fuel injection pump and the injectors. Cap the exposed openings in the pump, injectors and tubes.

13. Disconnect the thermostart fuel pipe at the intake manifold and plug the exposed openings.

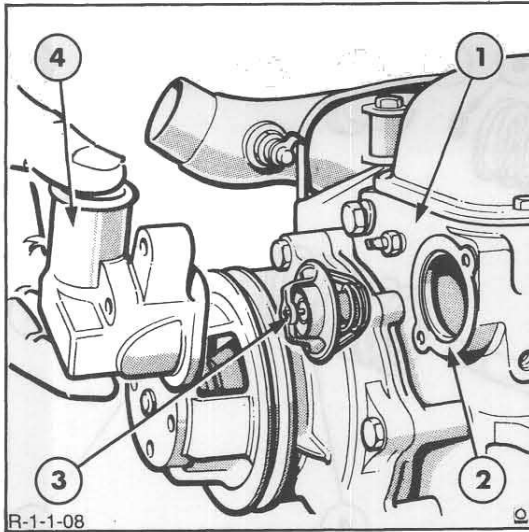
4. Disconnect and remove the rocker cover ventilation tube.

5. Disconnect the cold start equipment and plug the exposed openings (where fitted).

6. Disconnect the alternator, oil pressure, coolant temperature sender, air cleaner restriction indicator, fuel injection pump solenoid, horn and cold start wiring harness connections (where fitted).

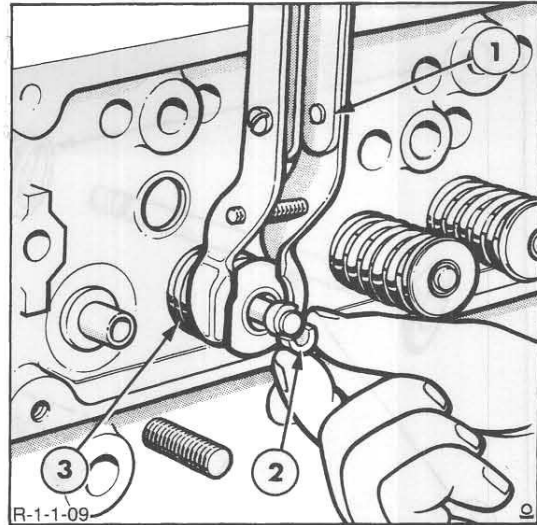
17. Remove the front engine harness and secure with tape clear of the engine.
  18. Remove the alternator and guard (where fitted).
  19. Bend back the lock tabs, withdraw the attaching bolts and remove the exhaust manifold and gasket.
  20. Remove the air cleaner assembly.
  21. Withdraw the retaining bolts and lockwashers and remove the inlet manifold and gasket.
  22. Clean the area surrounding the fuel injectors. Hold the leak-off pipe at each injector and carefully disconnect the fuel injector leak-off pipes then remove the bolts and carefully withdraw the fuel injectors and washers, Figure 6.
  23. Withdraw the securing bolts and remove the rocker cover and gasket from the cylinder head.
  24. Check the push rods for straightness by rotating the rods with the valve closed and identify any bent rods.
  25. Loosen the rocker shaft retaining bolts, which also serve as cylinder head bolts, evenly and alternately. Remove the rocker shaft assembly.
- NOTE:** Leave the bolts in the rocker shaft supports during removal as they retain the support on the shaft.





**Figure 7**  
Coolant Outlet and Thermostat Removal

1. Cylinder Head
2. Gasket
3. Thermostat
4. Coolant Outlet Connection



**Figure 8**  
Valve Removal

1. Valve Spring Compressor
2. Retainer Locks
3. Valve Spring

26. Remove each push rod in turn and place in a numbered rack so that it can be replaced in the same position when assembling the engine.

27. Remove the remaining cylinder head bolts and washers working inwards from the ends to the centre of the head.

28. Lift the cylinder head from the block. If necessary lever the head off on the pads provided, taking care not to damage the cylinder head or block faces.

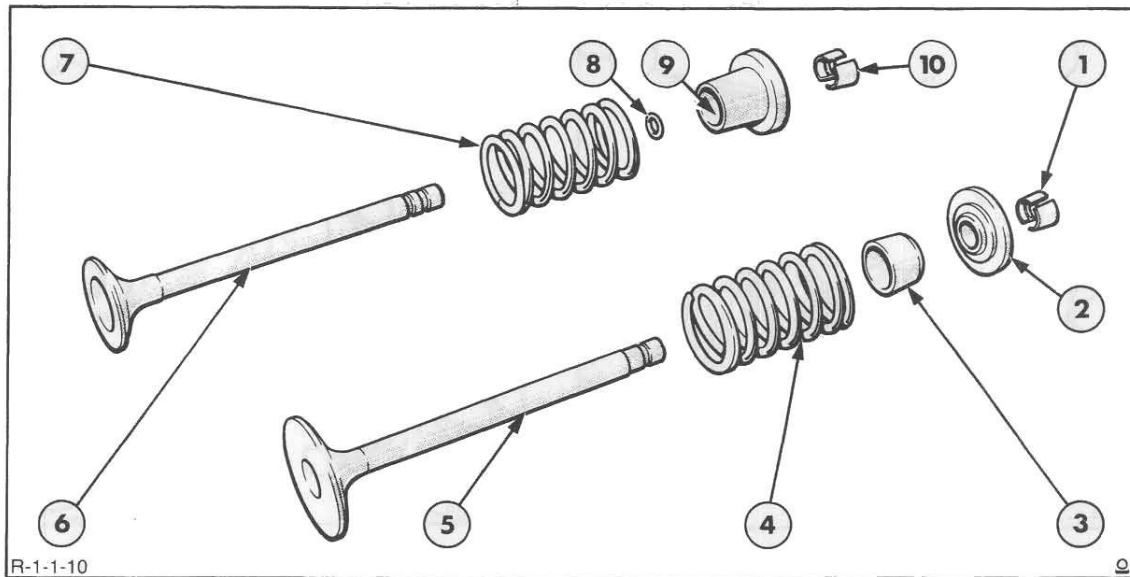
## DISASSEMBLY

### Thermostat

1. Remove the coolant outlet connection and the thermostat and gasket, Figure 7.

### Cylinder Head

1. Clean the head and remove carbon deposits from around the valve heads.
2. Using a valve spring compressor, Figure 8 remove the retainer locks, spring retainers/rotators, springs and seals from each valve, Figure 9.
3. Withdraw the valves and place in a numbered rack.



**Figure 9**  
Valve Assembly Components

- |                                      |   |
|--------------------------------------|---|
| 1. Intake Valve Spring Retainer Lock | 6. Exhaust Valve                        |
| 2. Intake Valve Spring Retainer      | 7. Exhaust Valve Spring                 |
| 3. Intake Valve Seal                 | 8. Exhaust Valve Seal                   |
| 4. Intake Valve Spring               | 9. Exhaust Valve Spring Retainer        |
| 5. Intake Valve                      | 10. Exhaust Valve Spring Retainer Locks |

### Rocker Shaft Assembly

1. Remove the cylinder head bolts which pass through the rocker shaft supports and slide the rocker shaft components from the shaft, Figure 10.

2. Inspect the cylinder head for damage and, if necessary, remove nicks and burrs from the gasket faces using a suitable abrasive. Ensure all traces of abrasive material are removed after repair.

### INSPECTION AND REPAIR

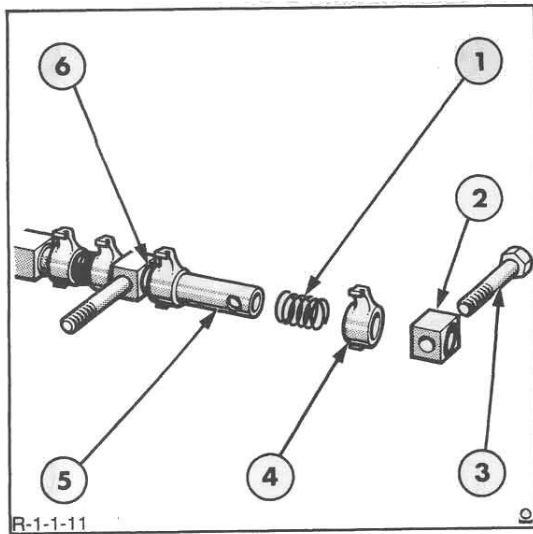
#### Cylinder head

1. Scrape all gasket surfaces clean then wash the cylinder head in a suitable solvent and thoroughly dry with a lint free cloth or compressed air. Clean the valve guide bores with a valve guide cleaning tool.

**NOTE:** Ensure the injector washers have been removed from the injector bores prior to cleaning.

3. Use a straight edge and feeler gauges to check the flatness of the cylinder head in all directions, Figure 11. For flatness requirement see "Specifications" – Chapter 4.

**NOTE:** If the cylinder head exceeds the flatness specification it may be skimmed providing the depth from the lower face of the valve insert to the cylinder head face is not less than 0.064 in. (1.63 mm), see the inset of Figure 11.



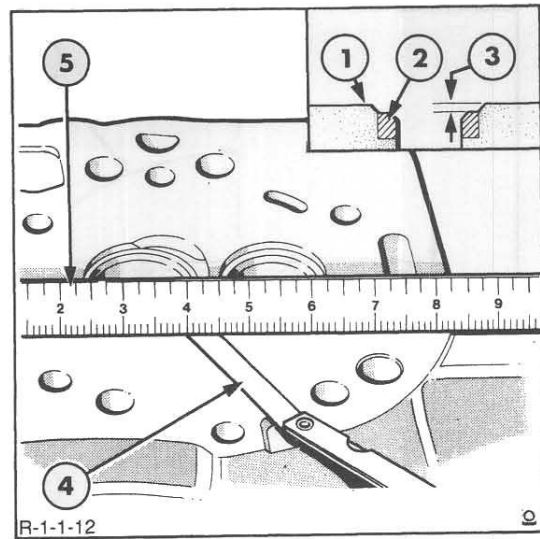
**Figure 10**  
Rocker Shaft Disassembled

- |                   |               |
|-------------------|---------------|
| 1. Spring         | 4. Rocker Arm |
| 2. Shaft Support  | 5. Shaft      |
| 3. Retaining Bolt | 6. Spacer     |

4. If the head has been skimmed, determine that all the cylinder head bolt faces will bottom. Place the cylinder head, less gasket, on the block and install all the head bolts.

5. Install all the bolts finger tight and ensure the rocker shaft supports are fitted with long bolts. Using a feeler gauge, check the clearance between the underside of the bolt heads and the cylinder head or rocker shaft support.

6. If a 0.010 in. (0.25 mm) feeler gauge can be inserted under the bolt head then the bolts are bottoming and the cylinder block thread must be increased in depth. Use a  $\frac{9}{16} \times 13$  UNC-2A thread tap. The head bolts should be marked so they are reinstalled in the holes in which they were checked.



**Figure 11**  
Measuring Cylinder Head Flatness

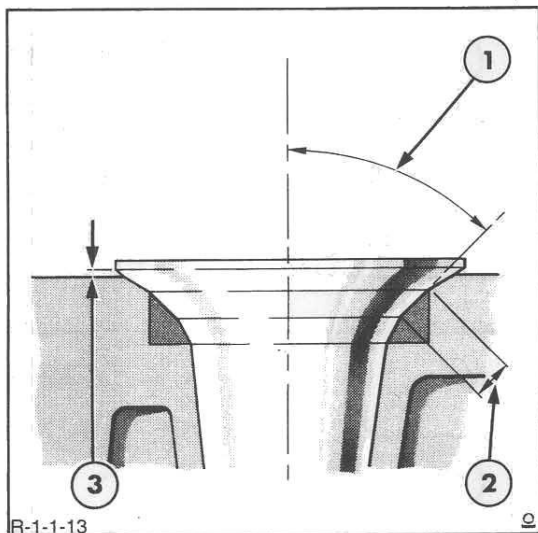
- |                       |                  |
|-----------------------|------------------|
| 1. Cylinder Head Face | 4. Feeler Gauge  |
| 2. Valve Seat Insert  | 5. Straight Edge |
| 3. Minimum Depth      |                  |

### Valve Seats

1. Examine the valve seat inserts and reface if pitted but renew if loose or damaged. If necessary, install an oversize insert by machining the seat counterbore in the cylinder head, see "Specifications" – Chapter 4. The insert must be chilled in dry-ice prior to installation.

**NOTE:** Valve seat inserts of 0.010 in. (0.25 mm) and 0.020 in. (0.5 mm) oversize on diameter are sometimes installed in cylinder heads in production. Heads fitted with oversize inserts are stamped  $\frac{SO10}{OS}$  or  $\frac{SO20}{OS}$  on the exhaust manifold side in line with the valve seat concerned.

2. When replacing exhaust valve seat inserts ensure the replacement inserts are of the correct type as the size and material specification varies for the different engine types.



**Figure 12**  
Valve Seat Dimensions

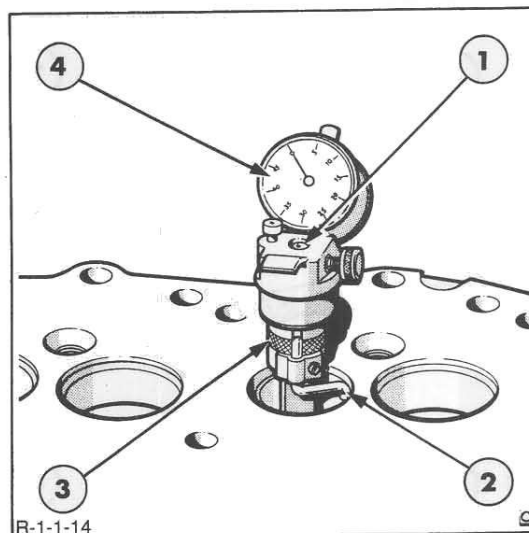
1. Valve Seat Angle:  
45°00' – 45°30' Exhaust and Intake Valves
2. Valve Seat Width:  
Intake 0.080 – 0.102 in. (2.032 – 2.590 mm)  
Exhaust 0.084 – 0.106 in. (2.133 – 2.692 mm)
3. Valve Head Protrusion

3. Check the width of the valve seat inserts and, if necessary, reface by grinding to the dimensions shown in Figure 12.

4. Measure the concentricity of the valve seat with a suitable gauge, as shown in Figure 13. If the valve seat runout exceeds the specified figure, see "Specifications" – Chapter 4, reface the seat.

5. Using a seat cutter with the correct angle (refer to Figure 11 and "Specifications," Chapter 4) remove only enough stock from the seat to clean up the pits and grooves, or to correct the seat eccentricity. After refacing, the seat width must be within the specified limit.

6. If the refaced seat exceeds this width, narrow the seat by removing stock from the top or bottom of the seat. If the seat measures less than this width, widen the seat.



**Figure 13**  
Checking Valve Seat Concentricity

1. Gauge Pilot
2. Pointer to Ride on Valve Seat Face
3. Sleeve for Rotating Pointer
4. Dial Gauge

**NOTE:** Refacing of the valve seat should always be co-ordinated with refacing of the valve to ensure a compression tight fit.

7. Rotate a new or refaced valve lightly in the seat, using Prussian Blue. If the blue is transferred to the valve face the specified distance (valve head protrusion) below the upper edge of the valve face, Figure 12, the contact is satisfactory. If the blue is transferred to the valve face above or below this point, raise or lower the seat as follows:-
8. Lower the valve seat by removing stock from the top of the seat with a 30° grinding wheel, Figure 14. Raise the seat by removing stock from the bottom of the seat with a 60° grinding wheel.