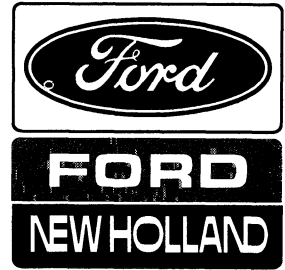


FORD

Service Manual



Tractors

TW5, TW15, TW25, TW35
8530, 8630, 8730, 8830

Part 1 – Engine Systems

Part 2 – Fuel Systems

Vol. 1



40000580
Reprint

CONTENTS

Part 1 – Engine Systems	Vol. 1
Part 2 – Fuel Systems	Vol. 1
Part 3 – Electrical Systems	Vol. 2
Part 4 – Clutches	Vol. 2
Part 5 – Transmission Systems	Vol. 3
Part 6 – Power Take-Off	Vol. 4
Part 7 – Rear Axle & Brakes	Vol. 4
Part 8 – Hydraulic Systems	Vol. 4
Part 9 – Steering Systems	Vol. 5
Part 10 – Front Axle	Vol. 5
Part 11 – Safety Cabs & Platforms	Vol. 6
Part 12 – Separating the Tractor	Vol. 6
Part 13 – Accessories & General	Vol. 6

FOREWORD

This Service Manual provides information for the correct servicing and overhaul of the Ford TW Series and 30 Series 6-cylinder agricultural tractors and is an essential publication for all service personnel carrying out repairs or maintenance on these tractors. We recommend that this manual be available for reference at all times.

The Service Manual consists of thirteen Parts contained in six volumes. A Table of Contents is included in each volume which lists all thirteen Parts and the volume where each can be found.

All Parts are subdivided into Chapters which convey information on general operating principles, detailed inspection and overhaul procedures and, where applicable, specifics on troubleshooting, 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.

The information contained herein 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 any time without notice is reserved. All data in this manual is subject to production variations, and the illustrations do not necessarily depict tractors to standard build specifications.

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/in² (6.9 bar) (7 kgf/cm²). 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 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 or improvised 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 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 it's 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 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 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 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, ensure 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 connections. 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 residual pressure in the lines by moving operating levers several times. This will remove the danger of personal injury by oil spurt.
- 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.
- 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 engaged.
- Always lower equipment to the ground when leaving the tractor.
- If high lift attachments are fitted to a tractor 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 tractor on an incline. If unavoidable, take extra care and block all wheels.
- Observe recommended precautions as indicated in this Repair Manual Part 13 when dismantling the air conditioning system as escaping refrigerant can cause frostbite.
- Prior to removing wheels and tyres 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 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.

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

Safety is everybody’s responsibility.

PART 1

ENGINE SYSTEMS

Chapter 1

ENGINE AND LUBRICATION SYSTEM

Section	Page
A. DESCRIPTION AND OPERATION	1
B. CYLINDER HEAD, VALVES AND RELATED PARTS	4
C. ENGINE FRONT COVER AND TIMING GEARS	20
D. OIL PAN AND OIL PUMP	26
E. CONNECTING RODS, BEARINGS, PISTONS, RINGS, CYLINDER BLOCK AND SLEEVES	32
F. MAIN BEARINGS, FLYWHEEL AND CRANKSHAFT	46
G. CAMSHAFT	53
H. ENGINE COMPRESSION TEST	55

A. DESCRIPTION AND OPERATION

This chapter describes the overhaul and repair of the six cylinder, direct injection diesel engines of the Ford TW-5, TW-15, TW-25 and TW-35 series tractors.

All the engines are of similar design and many service procedures are common throughout the range. Each engine has a bore and stroke of 4.4 in (111.8 mm) which generates a displacement of 401 cu in (6580 cc). Increased power levels of the various models from the base engine are achieved by tailored fuel systems and the addition of a turbocharger or a turbocharger and intercooler combination.

CYLINDER HEAD ASSEMBLY— INCLUDING VALVE TRAIN COMPONENTS

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 manifold being on the right side of the engine, and the exhaust manifold on the left.

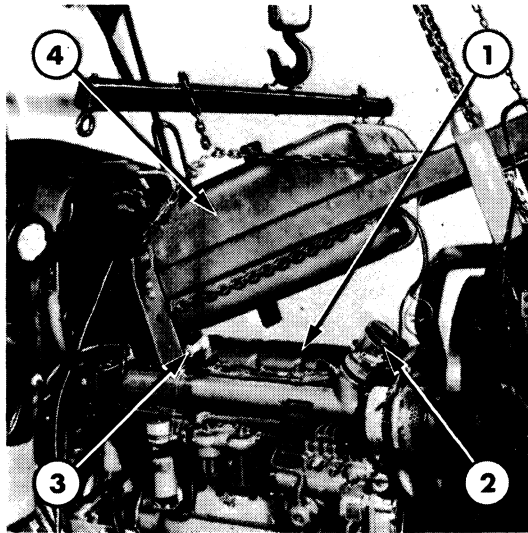


Figure 4

Access to Cylinder Head

- | | |
|------------------------------|------------------------|
| 1. Valve Cover | 3. Fuel Shut-Off Valve |
| 2. Intake Manifold Air Inlet | 4. Main Fuel Tank |

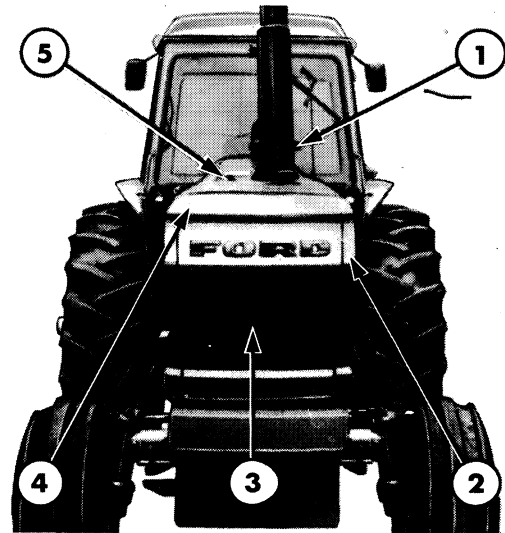


Figure 5

Sheet Metal: TW-25 and TW-35

- | | |
|----------------|------------------|
| 1. Pre-Cleaner | 4. Hood Panel |
| 2. Side Panels | 5. Fuel Tank Cap |
| 3. Grille | |

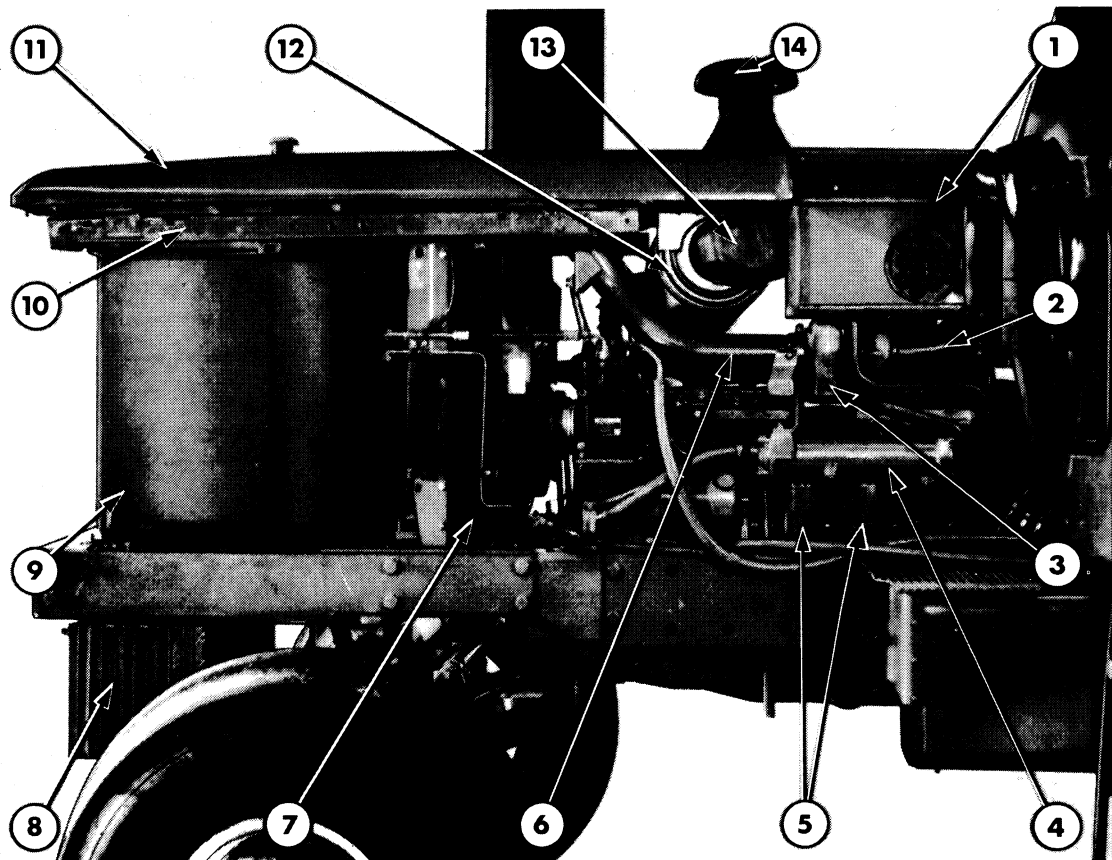


Figure 6

Access to Engine (TW-35)

- | | | |
|-------------------------------------|------------------------------|-------------------------------------|
| 1. Grille Support (Intercooler) | 6. Turbocharger Exhaust Tube | 11. Hood Panel |
| 2. Intercooler-to-Turbocharger Tube | 7. Radiator | 12. Air Cleaner |
| 3. Turbocharger | 8. Front Weights | 13. Air Cleaner-to-Intercooler Tube |
| 4. Oil Cooler | 9. Fuel Tank | 14. Pre-Cleaner |
| 5. Engine Oil Filter | 10. Side Panel Rail | |

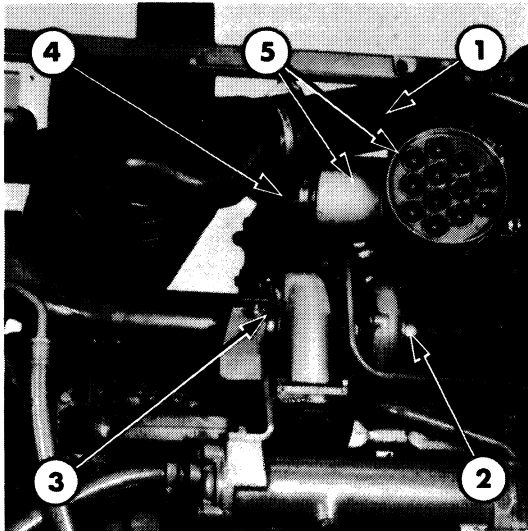


Figure 7

Turbocharger and Intercooler

1. Air Cleaner-to-Turbocharger Tube
2. Air Cleaner-to-Turbocharger Tubes and Clamps
3. Exhaust Clamp and Tube
4. Aspirator Tube
5. Intercooler

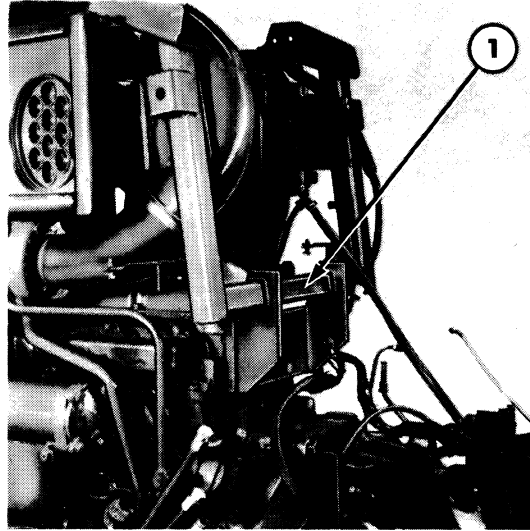


Figure 8

Engine Access

1. Intercooler Support Bracket

7. Unscrew the eight retaining bolts and withdraw the intercooler assembly.

8. Remove the clamps from the air intake and exhaust hose. Disconnect and remove the two turbocharger oil tubes.

9. Unscrew the six retaining bolts and withdraw the turbocharger assembly.

10. Remove the intercooler support bracket at the rear of the engine, Figure 8.

11. Remove the support bracket, fan and alternator bracket, and water pump as required, Figure 9.

ALL TRACTORS

1. Unscrew the twelve exhaust manifold bolts, and remove the exhaust manifold and gasket.

2. Remove the thermostart unit and the fuel delivery lines. Plug the fuel line, injector and fuel pump openings to prevent the entry of dirt.

3. Unscrew the fourteen intake manifold bolts, and remove the intake manifold and gasket.

4. Remove the breather tube from the rocker cover.

5. Drain the engine coolant.

6. Remove the fuel filters and lines from the engine. Plug all openings to prevent the entry of dirt.

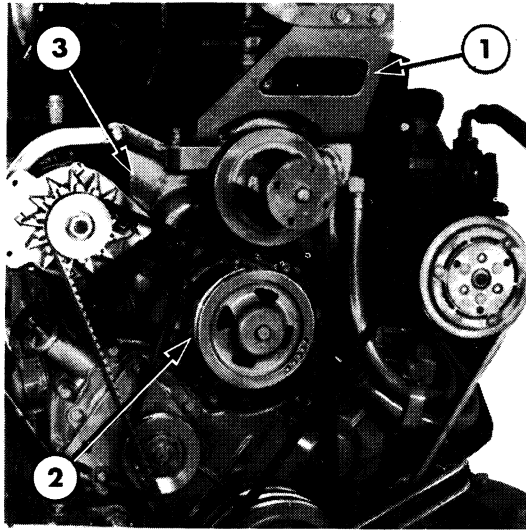


Figure 9
Engine Access

1. Bracket
2. Water Pump
3. Fan and Alternator Bracket

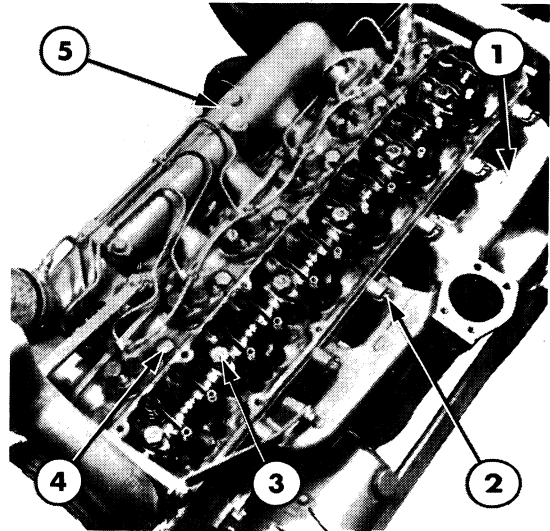


Figure 10
Top View of Engine

1. Exhaust Manifold
2. Lock Tab
3. Head/Rocker Arm Bolt
4. Head Bolt
5. Intake Manifold

7. Remove the rocker arm cover and gasket.

8. Remove the injector leak-off line at No. 6 cylinder.

9. Unscrew the two nuts from each injector, and remove the injectors. If the injectors cannot be withdrawn by hand it may be necessary to pry them out. Keep the area clean to avoid fouling the injectors with dirt.

10. Visually check the push rods for straightness by rotating them with the valve closed. Loosen the rocker arm shaft bolts evenly and remove the assembly from the tractor, Figure 10.

NOTE: Do not remove the rocker arm shaft retaining bolts unless it is necessary to disassemble the rocker arm shaft.

11. Remove the valve push rods from their holes in the cylinder head and arrange them in a rack in the order in which they were removed. It is important that the rods are installed in the same bores during reassembly.

12. Loosen and remove the cylinder head retaining bolts evenly, working from the ends to the centre of the head, and carefully lift the cylinder head from the block.

DISASSEMBLY

1. Before removing the valves from the cylinder head, clean all carbon deposits from the valve heads.

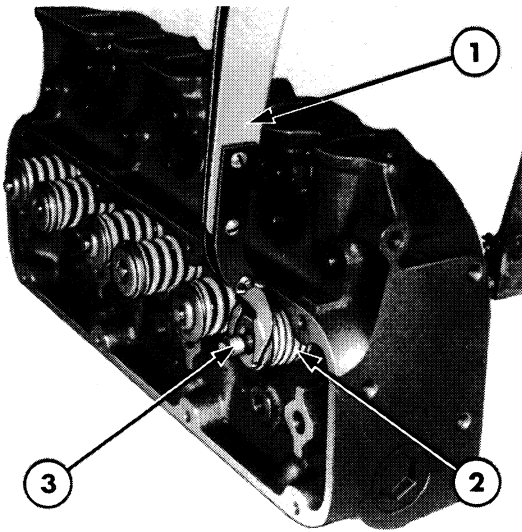


Figure 11

Removing Valves

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

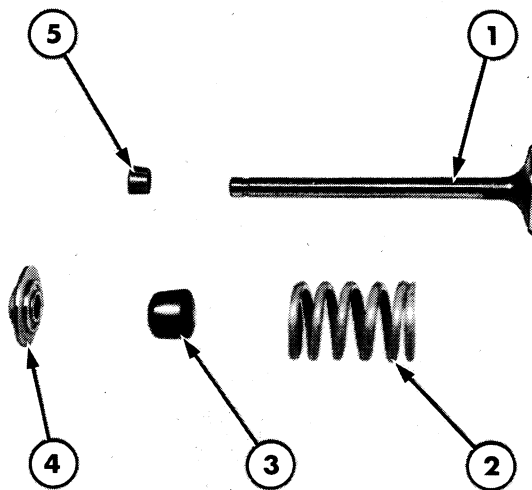


Figure 12

Intake Valve Assembly

1. Intake Valve
2. Spring
3. Seal (TW-5 only)
4. Retainer
5. Retainer Locks

2. Position the valve spring compressor over the valve and spring, and compress the spring, Figure 11.

Intake Valves: Remove the retainer locks, spring retainer, spring, and valve stem seal, Figure 12.

Exhaust Valves: Remove the retainer locks, the seal from its groove, and the valve rotator and spring, Figure 13.

3. Lift the valves from the cylinder head and place them in a numbered rack so they can be reinstalled in their respective guides. Keep the exhaust valve rotators with the valves from which they were removed.

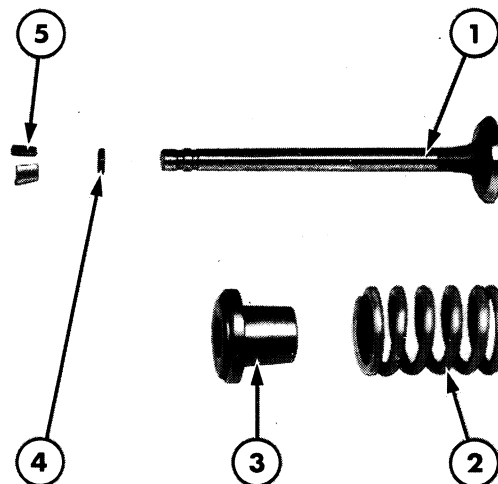


Figure 13

Exhaust Valve Assembly

1. Exhaust Valve
2. Valve Spring
3. Rotator
4. Seal
5. Retainer Locks

CLEANING

1. With the valves removed clean the valve guide bores.

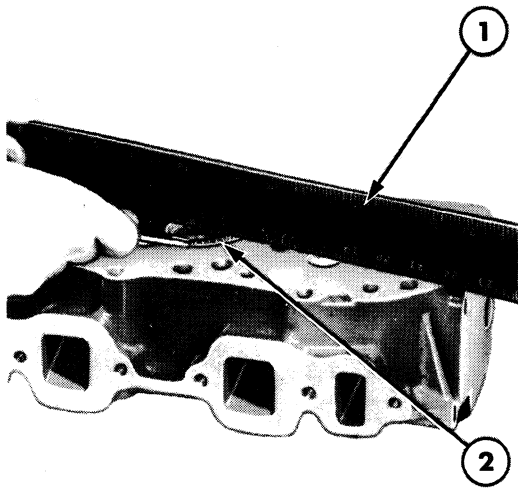


Figure 14

Measuring Cylinder Head Flatness

1. Straight Edge
2. Feeler Gauge

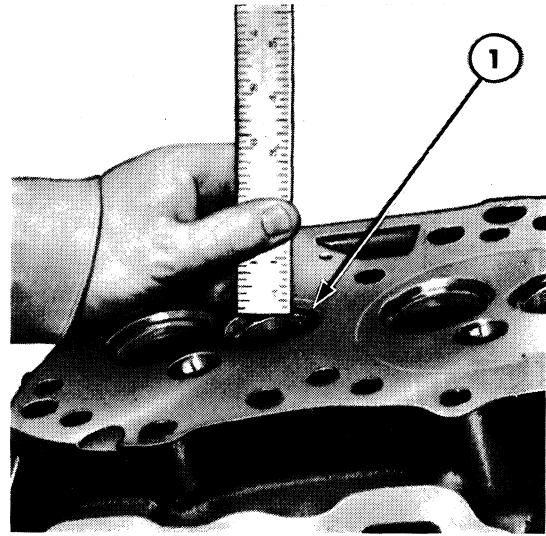


Figure 15

Measuring Valve Seat Width

1. Valve Seat

INSPECTION AND REPAIR

1. Inspect the cylinder head for cracks, nicks or burrs. Install a new head if necessary. Remove all burrs or nicks from the gasket surface.
2. With a straight edge and feeler gauge, check the flatness of the cylinder head, Figure 14. Specifications for flatness are 0.006 in (0.15 mm) maximum overall, or 0.003 in (0.76 mm) in any six inches (152.40 mm).

NOTE: *If the face of the cylinder head does not meet the flatness specification it may be skimmed, provided that the depth from the lower face of the valve seat insert to the cylinder head face is not reduced to less than 0.117 in (2.97 mm).*

3. If the head has been skimmed, determine that all the head bolts will bottom. Place the cylinder head, less gasket, on the block and install and finger tighten all the head

bolts (rocker arm shaft supports and washers should be used under the long bolts). Using a feeler gauge, check the clearance between the underside of the head bolts and the cylinder head rocker arm support. If the clearance is 0.010 in (0.25 mm) or greater for any bolt, use a ½ in x 13 UNC-2A thread tap and increase the tap depth. The head bolts should be marked so they are reinstalled in the hole in which they were checked.

4. The intake and exhaust valve ports in the cylinder head are equipped with removable valve seat inserts. Remove and replace inserts that are cracked or loose, or that show excessive wear.
5. To install a larger insert than originally fitted, machine the counter bore for the seat in the cylinder head to the dimensions in Table 1, Page 14. The insert must be thoroughly chilled in dry ice before installation.

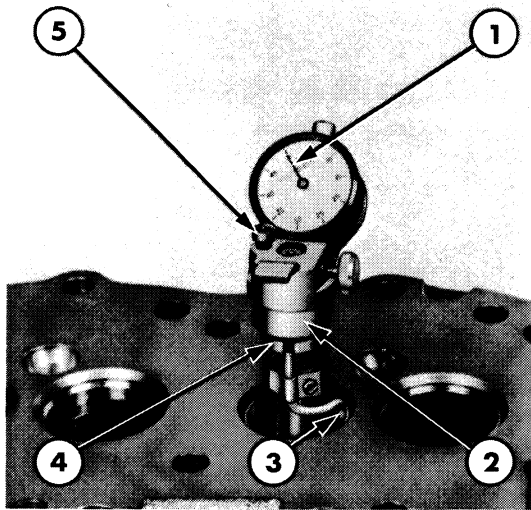


Figure 16

Checking Valve Seat Concentricity

1. Set Dial at "0"
 2. Valve Seat Concentricity Gauge
 3. Set Point to Ride on Valve Seat Face
 4. Rotate Sleeve Clockwise and Read Dial
 5. Tighten Pilot
6. Measure the width of the valve seats, Figure 15, and reface the seats if they do not meet the specifications shown in Figure 17.
 7. Measure the concentricity of the valve seat with a suitable gauge, Figure 16, or check with Prussian Blue. If the valve seat runout exceeds 0.0015 in (0.0381 mm) reface the seat.

NOTE: Reface the valve seat and face at the same time so the finished measurements correspond to Figure 17.

Remove only enough metal from the seat to clean up the pits and grooves, or to correct the seat runout. After refacing, the seat should measure 0.094 in (2.38 mm) $\pm$ 0.015 in (0.40 mm). If the refaced seat exceeds this width, narrow the seat by removing stock from the top or bottom of the seat. See Step 8. If the seat measures less than this width, widen the seat.

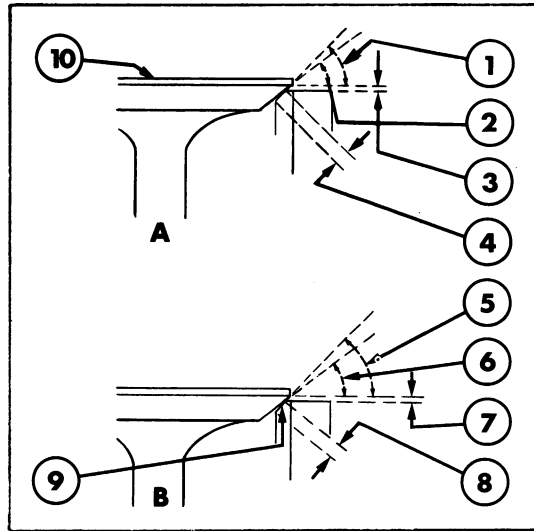


Figure 17

Valve Face and Seat Angles

- A. Ford TW-5 intake and Exhaust Valves
Ford TW-15, TW-25 and TW-35 Exhaust Valves
 - B. Ford TW-15, TW-25 and TW-35 Intake Valves
1. Valve Seat Angle — 45°
 2. Valve Face Angle — 44 1/2°
 3. 1/32 in (0.79 mm)
 4. Seat Width 3/32 in (2.38 mm)
 5. Valve Seat Angle — 30°
 6. Valve Face Angle — 29 1/2°
 7. 1/16 in (1.59 mm)
 8. Seat Width — 3/32 in $\pm$ 1/64 in (2.38 $\pm$ 0.40 mm)
 9. Valve Seat
 10. Valve Face
8. Rotate a new or refaced valve lightly in the seat, using Prussian Blue. If the blue is transferred to the valve face 0.625 in (1.59 mm) below the upper edge of the valve face, 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:

FORD TW-15 INTAKE AND EXHAUST VALVES, TW-15, TW-25 AND TW-35 EXHAUST VALVES

Lower the valve seat by removing metal from the top of the seat with a 30° grinding wheel. Raise the valve seat by removing metal from the bottom of the seat with a 60° grinding wheel, Figure 18.

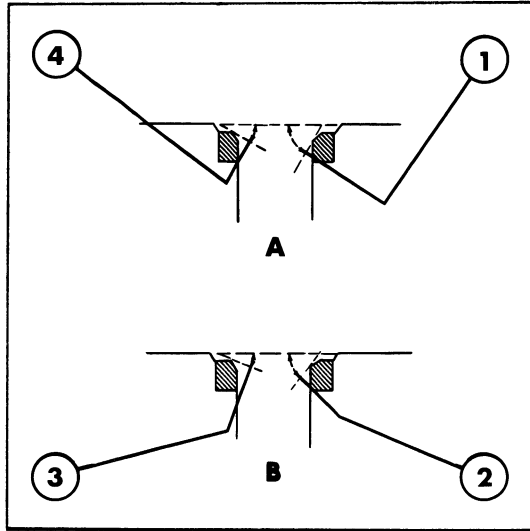


Figure 18

Dressing Valve Seats

- A. Ford TW-5 Intake and Exhaust Valves
Ford TW-15, TW-25 and TW-35 Exhaust Valves
B. Ford TW-15, TW-25 and TW-35 Intake Valves
1. 60°
 2. 45°
 3. 15°
 4. 30°

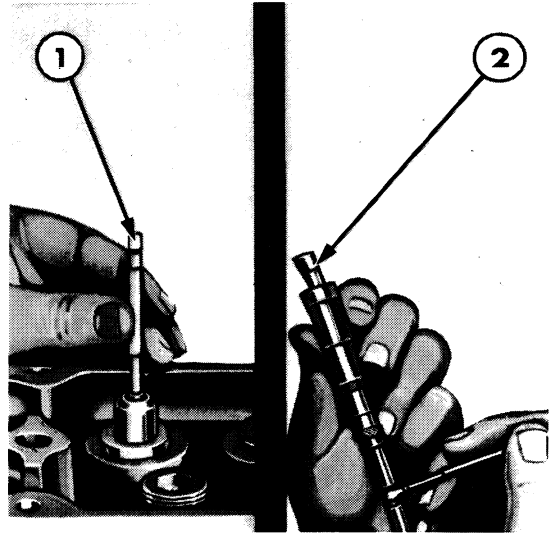


Figure 19

Measuring Valve Guide

1. Telescope Gauge
2. Micrometer

TW-15, TW-25 AND TW-35 INTAKE VALVES

Lower the valve seat by removing stock from the top of the seat with a 15° grinding wheel. Raise the seat by removing stock from the bottom of the seat with a 45° grinding wheel, Figure 18.

IMPORTANT: *Some cylinder heads may have one or more 0.003 in (0.0762 mm) or 0.015 in (0.381 mm) oversize valve guides and valves installed. The exhaust manifold side of the cylinder head opposite these valves will be stamped '03' or Y003 OS as appropriate.*

Valve stem-to-guide clearance tolerances are as follows. Intake valves, 0.0010–0.0045 in (0.0245–0.114 mm) — exhaust valves, 0.0020–0.0055 in (0.0508–0.0139 mm).

Measure stem-to-guide clearance with a telescoping gauge and micrometer, Figure 19. If the clearance is not within tolerances, or if excessive oil consumption is indicated, replace the guides concerned.

Valves with oversize stems are available for service. If it is necessary to ream the valve guides to install valves with oversize stems use the Oversize Valve Guide Reamers, Tool No. FT.6202 or 2136, and ream the guides in steps, using the small reamer and standard diameter pilot first.

The Oversize valve Guide Reamer Kit contains:

Reamer Diameter

- 0.003 in (0.0762 mm) oversize
- 0.015 in (0.3810 mm) oversize
- 0.030 in (0.7620 mm) oversize

Pilot Diameter

- Standard Diameter
- 0.003 in (0.0762 mm) oversize
- 0.015 in (0.3810 mm) oversize

NOTE: *Always reface the valve seat after reaming the valve guide.*

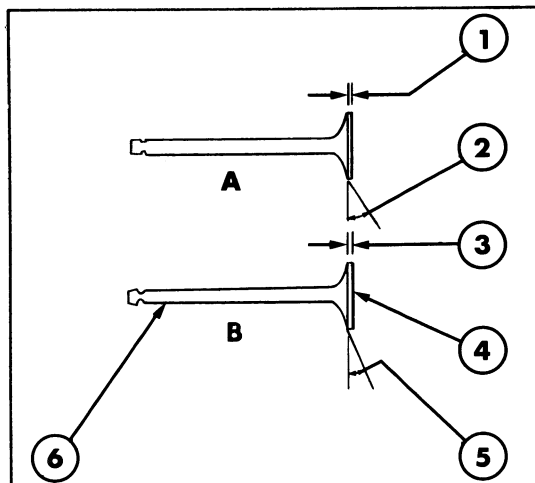


Figure 20

Critical Valve Measurements and Inspection Checks

- A. Ford TW-5 Intake and Exhaust Valves
Ford TW-15, TW-25 and TW-35 Intake Valves
B. Ford TW-15, TW-25 and TW-35 Intake Valves

1. $\frac{1}{32}$ in (0.79 mm) Minimum
2. $44\frac{1}{2}^\circ$
3. $\frac{1}{16}$ in (1.58 mm)
4. Check Maximum Valve Face Run-Out
5. $29\frac{1}{2}^\circ$
6. Check for Bent Stems and Correct Diameter

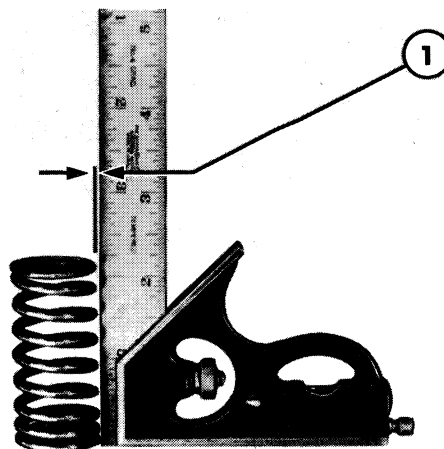


Figure 21

Checking Valve Spring Squareness

1. Not more than $\frac{1}{16}$ in (1.59 mm)

VALVES AND PUSH RODS

INSPECTION

The critical inspection points of the valves are shown in Figure 20. Inspect the valve face and the edge of the valve head for pits, grooves, scores or other defects. Inspect the stem for a bent condition and the end of the stem for grooves or scores. Check the valve head for cracks, erosion, warpage or burn. Minor defects such as small pits or grooves, can be removed.

Check the valve tip for pits or grooves and replace the valve if such a condition exists. Discard valves that are severely damaged.

Discard any valve springs that show signs of erosion or rust. Check each valve spring for squareness, Figure 21. Discard valve springs that are out of square in excess of $\frac{1}{16}$ in (1.59 mm).

TABLE 1

Insert Oversize	Exhaust Valve Inlet	Intake Valve Seat Insert
	Counter Diameter in Cylinder Head	
0.010 in (0.254 mm)	1.607—1.608 in (40.82—40.84 mm)	1.907—1.908 in (43.44—43.46 mm)
0.020 in (0.508 mm)	1.617—1.618 in (41.07—41.10 mm)	1.917—1.918 in (43.69—43.72 mm)
0.030 in (0.762 mm)	1.627—1.628 in (41.33—41.36 mm)	1.927—1.928 in (43.95—43.97 mm)

Download this document.

Click the link below.

**You can download the most perfect
and complete manual in the world
immediately.**



Click Link Below



Download Now!

[Click Here To Get Instant Access](#)

Thank you so much for reading.

Check specified free length and loaded height of the valve springs. Weak valve springs cause poor engine performance. If the free length is less than 2.16 in (54.8 mm), add one 0.030 in (0.76 mm) spacer between the cylinder head spring pad and the valve spring to bring the assembled height to the recommended dimensions of 2.13–2.19 in (53.9–55.6 mm).

Check the valve spring retainer locks to be sure they are in good condition. Rotate the exhaust valve positive rotator to be sure it is not binding or excessively worn. Install new rotators if necessary.

Check the ends of the push rods for nicks, grooves, roughness or excessive wear. If the push rods were not straight when checked or if any of the above wear conditions exist, install new rods. Do not attempt to straighten push rods.

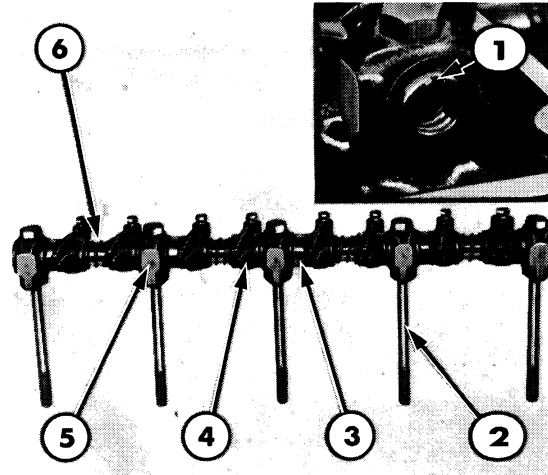


Figure 22
Rocker Arm Shaft

1. Notch
2. Bolt
3. Spacer
4. Rocker Arm
5. Rocker Arm Shaft Support
6. Spring

REFACING VALVES

The valve refacing operation should be closely co-ordinated with the valve seat refacing operating so the finished angle of the valve is $\frac{1}{2}^\circ$ less than the valve seat to provide an interference angle for better seating, Figure 17. Adjust the refacing tool to obtain a face angle of $44\frac{1}{2}^\circ$ or $29\frac{1}{2}^\circ$, Figure 20.

Remove only enough stock to clean up the pits and grooves. Check the edge of the valve head, if less than 0.031 in (0.79 mm) margin, install a new valve.

Remove all grooves or score marks from the valve tip, then chamfer as necessary. Do not remove more than 0.010 in (0.25 mm) from the tip.

ROCKER ARMS AND SHAFT

DISASSEMBLY

To disassemble the rocker shaft assembly, remove the bolts that attach the rocker shaft to the cylinder head from the rocker shaft support, Figure 22.

INSPECTION

1. Inspect the rocker arm adjusting screws and the push rod ends of the rocker arms for stripped or worn threads.
2. Check the ball end of the screws for nicks, scratches or excessive wear.
3. Check the rocker arm locating springs and spacers for breaks or other damage.