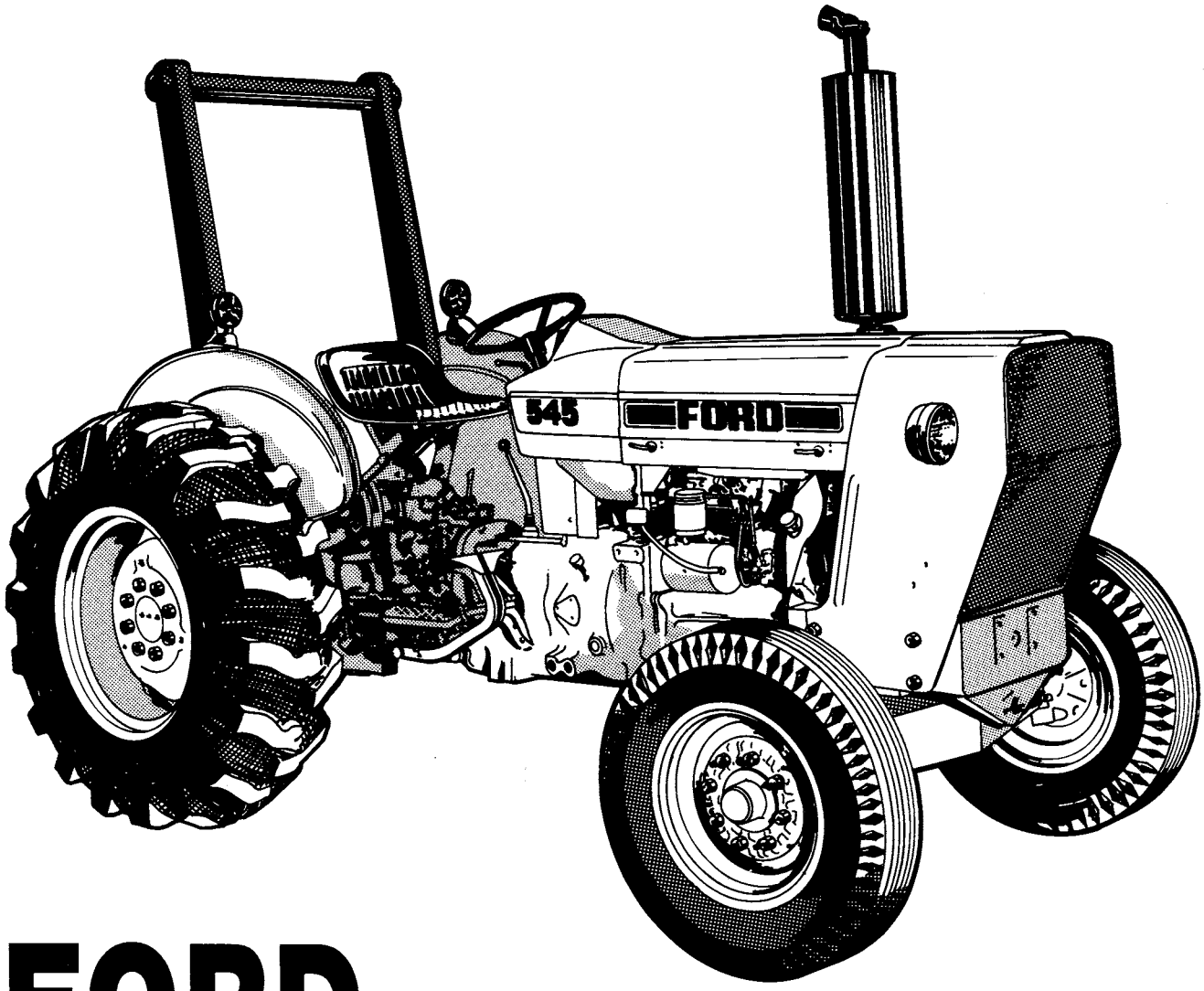


FORD

INDUSTRIAL TRACTORS

Repair Manual

40023021 (SE4044)

Reprinted

FOREWORD

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

The Industrial Tractor Models covered were produced in 1975 through 6/83. Special service instructions are identified by tractor model number or applicable production dates throughout the text.

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 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 approximately only and the illustrations do not necessarily depict the unit to standard build specification.

TRACTOR OPERATIONS
FORD MOTOR COMPANY

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 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 psi (6.9 bar) 7 (kgf/cm^2). It is perfectly safe if used correctly. Any misuse may cause injury.

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

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

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

  Never use

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

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

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

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

  Always keep tools clean and in good working order.

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

  Before using any electrical equipment — particularly portable applicances — 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 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 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 is 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.

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 motor vehicles 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 vehicles, 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 vehicle integrity by his choice of methods, tools or parts.

B. SERVICE TECHNIQUES

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

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

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

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

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

HOSES AND TUBES

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

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

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

After hose replacement to a moving component check the hose does not foul by moving the component through the complete range of travel.

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

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

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

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

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

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

PART 1
ENGINE SYSTEMS

Chapter 1
ENGINES AND LUBRICATION SYSTEM

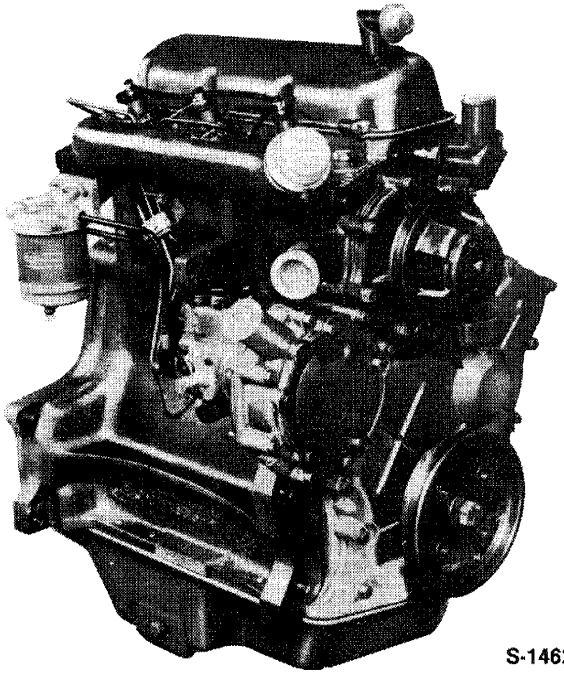
Chapter 2
COOLING SYSTEM

Chapter 3
TROUBLE SHOOTING, SPECIFICATIONS AND SPECIAL TOOLS

PART 1
ENGINE SYSTEMS

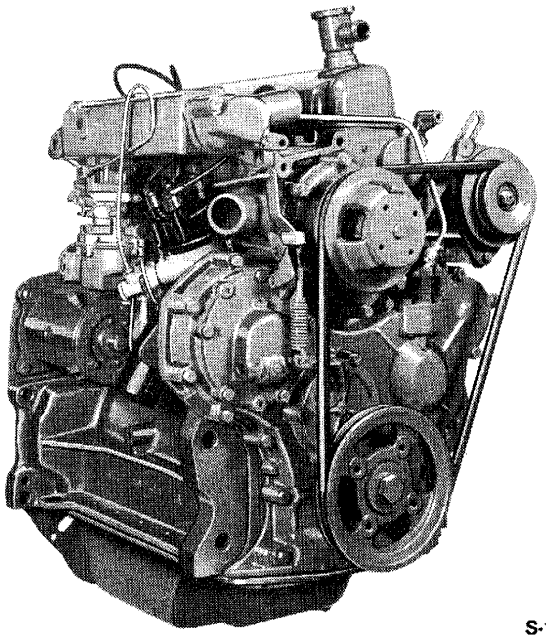
Chapter 1
ENGINES AND LUBRICATION SYSTEM

A. DESCRIPTION AND OPERATION



S-14621

Figure 1
3-Cylinder Diesel Engine with Distributor Type Fuel Injection Pump



S-182

Figure 2
3-Cylinder Gasoline Engine

This Chapter describes the overhaul and repair of the three-cylinder diesel and gasoline Ford Tractor engines.

All the engines are of similar design and hence service procedures are basically common throughout the range.

PRINTED IN U.S.A.

The engines feature cross-flow cylinder heads with the inlet and exhaust manifolds on opposite sides of the head. Combustion chambers are formed in the piston crowns.

Diesel engine pistons have three compression and one oil control ring all located above the piston pin.

Gasoline engine pistons have two compression and one oil control ring all located above the piston pin.

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

The engine front cover attached to the engine front adapter plate, houses the timing gears. On gasoline engines, the fuel pump and the governor are mounted on the front cover, and the fuel pump is driven by an eccentric on the front end of the camshaft.

The gasoline engine intake manifold is designed with a water jacket around the main runner to provide a constant circulation of coolant to control air intake temperature.

The following chart shows the engine options available

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.

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 side, and the exhaust on the left. On all diesels, the water outlet connection and thermostat are attached to the front of the cylinder head. On gasoline engines, the water outlet and thermostat are at the front of the intake manifold. 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.

MODEL	230A		340A	445	530A		540A	545
	GAS	DIESEL	DIESEL	DIESEL	GAS	DIESEL	DIESEL	DIESEL
NO OF CYLINDERS	3	3	3	3	3	3	3	3
BORE/ STROKE	4.2 x 3.8	4.2 x 4.2	4.2 x 4.2	4.2 x 4.4	4.4 x 4.4	4.4 x 4.4	4.4 x 4.4	4.4 x 4.4
DISPLACEMENT	158	175	175	183	201	201	201	201
NET ENG. HP.	33	40.5	44.5	47.6	56	56	55	55

CRANKSHAFT ASSEMBLY

The crankshaft is supported in the cylinder block by four main bearings for the 3-cylinder engine. Crankshaft end thrust is controlled by a thrust bearing located on the second main bearing.

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

The crankshaft rear main bearing cap is sealed by two composition type side seals and a gasket positioned between the cap and the engine rear adapter plate.

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

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. Tractors can be equipped with exhaust manifolds for either horizontal or vertical exhaust systems. Diesel 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. The gasoline engine intake manifold is a water-jacketed design, providing a constant circulation of coolant around the intake main runner to control the intake manifold temperature.

NOTE: *On diesel 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 firing order is 1-2-3 on all 3-cylinder engines.

The oil pan is pressed steel on the LCG models 230A and 530A and cast iron on the industrial models 340A, 445, 540A and 545.

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. On gasoline engines, the fuel lift pump is mounted on the front cover. The gasoline engine governor is also housed in the cover. 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 either the injection pump drive gear on diesel engines, or the distributor governor drive gear on gasoline engines.

The camshaft gear is attached to the front of the camshaft by a bolt, lock washer, flat washer and a spacer. On gasoline engines, an eccentric is mounted on the front of the camshaft which drives the fuel pump through a push rod. In both cases, the gear is keyed to the camshaft to maintain the position of the gear and drive the shaft. On gasoline engines, the governor ball cage and inner race are also attached to the distributor drive gear, which in effect becomes the governor drive. All the timing gears can be checked by observing the timing punch marks on the gears.

PISTONS:

Pistons are of aluminum alloy with combustion chambers recessed into the piston crowns.

Gasoline engine pistons have two compression rings and one oil control ring. An expander is installed behind the slotted oil control ring.

Diesel engines have trunk-type pistons with a continuous skirt around the entire piston. Each diesel piston has three compression rings and one oil control ring, all of which are above the piston pin.

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.

LUBRICATION SYSTEM

Lubrication of the engine is maintained by a rotor type oil pump mounted at the base of the engine block, Figure 3. The oil pump is driven from the camshaft and draws oil from the engine sump through a wire mesh screen.

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.

Oil passes from the pump to an external, throw-away, spin-on type filter incorporating a bypass valve which permits oil flow even if filter blockage occurs, assuring engine lubrication at all times.

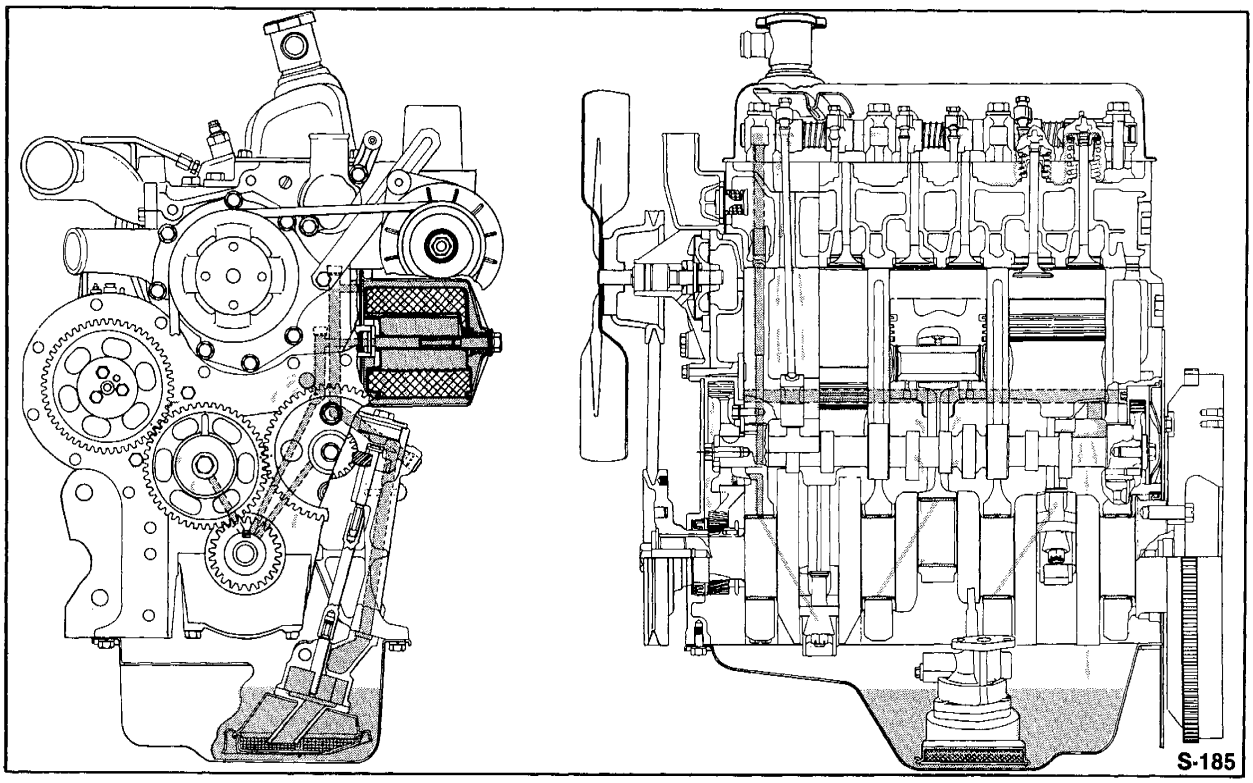


Figure 3
3-Cylinder Engine Lubrication System

Oil flows from the filter to the main oil gallery which runs the length of the cylinder block and intersects the tappet bores.

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

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.

The timing gears are lubricated by oil from the main gallery and the pressure lubricated camshaft drive gear bushing.

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

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 the No. 1 camshaft bearing. This drilling aligns with a corresponding hole in the cylinder head. 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. 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 tappets before draining back into the sump through cored openings in the block.

B. ENGINE OVERHAUL—CYLINDER HEAD, VALVES AND RELATED PARTS

REMOVAL

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

1. Disconnect the battery.
   - Remove the battery and battery tray.
   - Remove the vertical muffler (if installed)
2. Drain the radiator and cylinder block.
3. Shut off the heater hose taps then disconnect and plug the heater hoses. (if present)
4. Remove the radiator top hose.
5. Shut off the main fuel tank tap.
   - Remove the hood panel assembly.
   - Remove the radiator shell support.
   - Remove the two bolts securing the fuel tank to the hood rear support.
   - Disconnect the horizontal type exhaust pipe, if present, from the exhaust manifold.
   - Disconnect the air inlet hose at the intake manifold (diesel), or at the carburetor on gasoline models.

     NOTE: *On gasoline engines, disconnect the fuel line and linkage from the carburetor. Remove the carburetor from the intake manifold. Disconnect the vacuum advance line from the intake manifold.*
6. Disconnect and remove the rocker cover ventilation tube.
7. Disconnect the alternator, oil pressure and temperature senders, air cleaner restriction indicator and cold start wiring harness connections, if present.
8. Remove the alternator adjusting bracket, Figure 4.

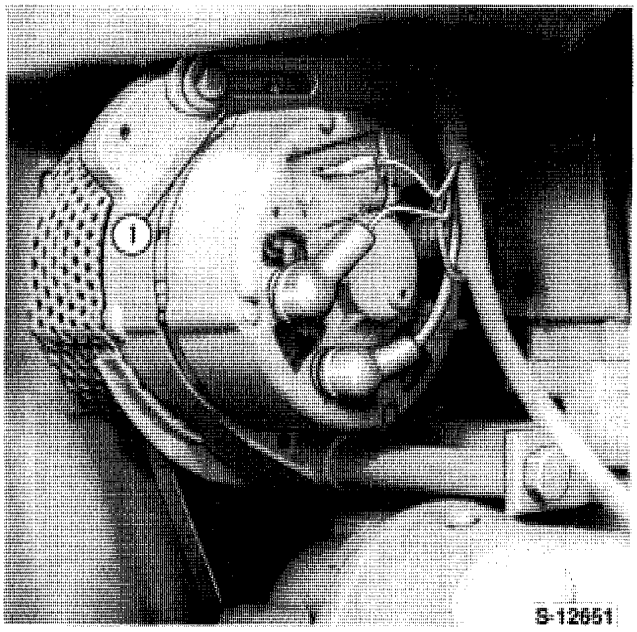


Figure 4
Alternator Assembly
1. Belt Tension Adjusting Bracket

   - Remove the vertical type exhaust pipe and bracket, if present.
9. Bend the lock tabs back, withdraw the attaching bolts and remove the exhaust manifold and gasket.
10. Disconnect the cold start equipment, if present.
11. On diesel engines, remove the injector lines from the fuel injection pump and the injectors. Cap the exposed openings in the pump, injectors and tube ends.
    - Disconnect the fuel lines and remove the fuel filter(s).
12. Withdraw the retaining bolts and lockwashers and remove the inlet manifold and gasket.
13. Withdraw the securing bolts and remove the rocker arm cover and gasket from the cylinder head.

PRINTED IN U.S.A.

14. On diesel engines, hold the leak-off pipe at each injector and carefully disconnect the fuel injector leakoff pipes. Clean the area surrounding the fuel injectors then remove the bolts and carefully withdraw the fuel injectors and washers, Figure 5.

    NOTE: *On gasoline engines remove the spark plugs.*

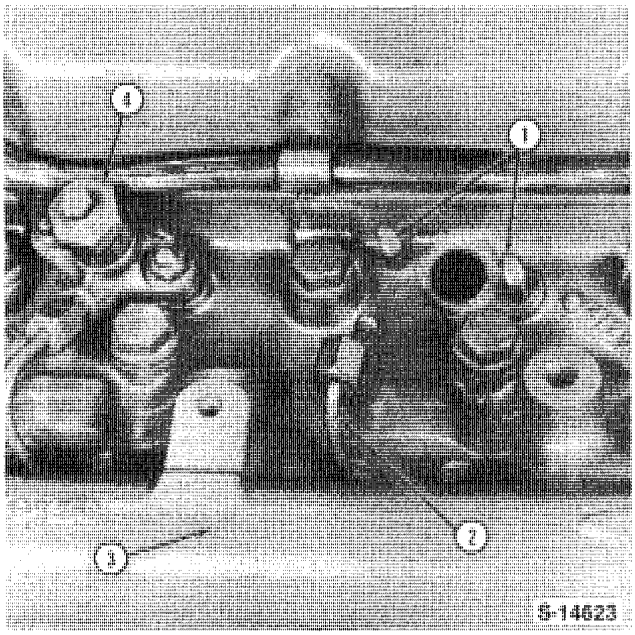


Figure 5
Fuel Injector Removed

1. Fuel Injector Mouting Studs
2. Fuel Injection Tube
3. Intake Manifold
4. Fuel Injector Assembly

15. Check the push rods for straightness by rotating the rods with the valve closed and identify any bent rods.

16. Progressively loosen the rocker shaft retaining bolts which also serve as cylinder head bolts. Remove the rocker shaft assembly.

    NOTE: *Leave the bolts in the rocker shaft supports during removal as they retain the supports on the shaft.*

17. Remove the push rods and place in a numbered rack.

18. Remove the remaining cylinder head bolts and washers working inwards from the ends to the center of the head.

19. Lift the cylinder head from the block. If necessary pry the head off, using the pads provided, and taking care not to damage the cylinder head or block faces, Figure 6.

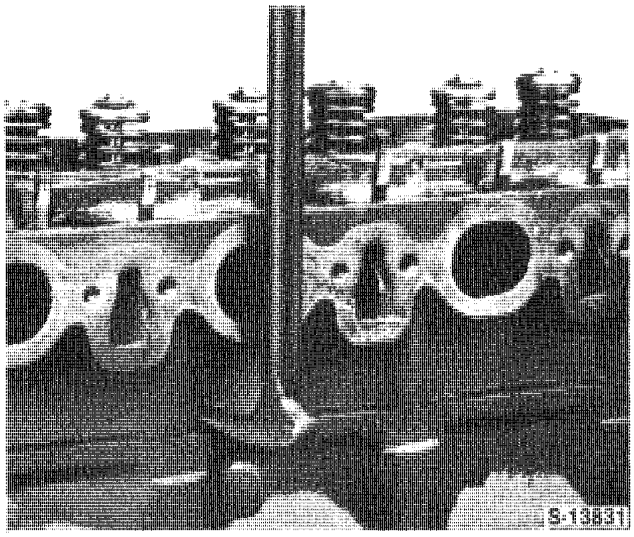


Figure 6
Cylinder Head Removal

DISASSEMBLY

THERMOSTAT:

1. Remove the coolant outlet connection and the thermostat and gasket, from the diesel cylinder head, Figure 7, or the gasoline engine intake manifold, Figure 8.

CYLINDER HEAD:

2. Clean the head and remove the carbon deposits from around the valve heads.

3. Using a valve spring compressor, Figure 9, remove the retainer locks, spring retainers or rotators, springs and seals from each valve, Figure 10.

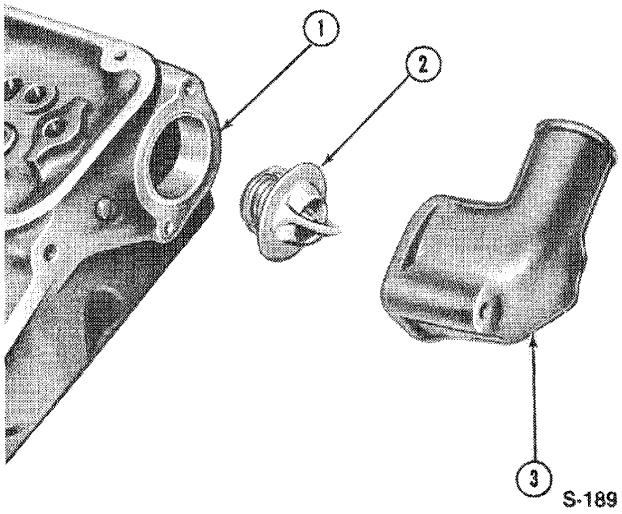


Figure 7
Thermostat Location-Diesel
1. Cylinder Head
2. Thermostat
3. Coolant Outlet Connection

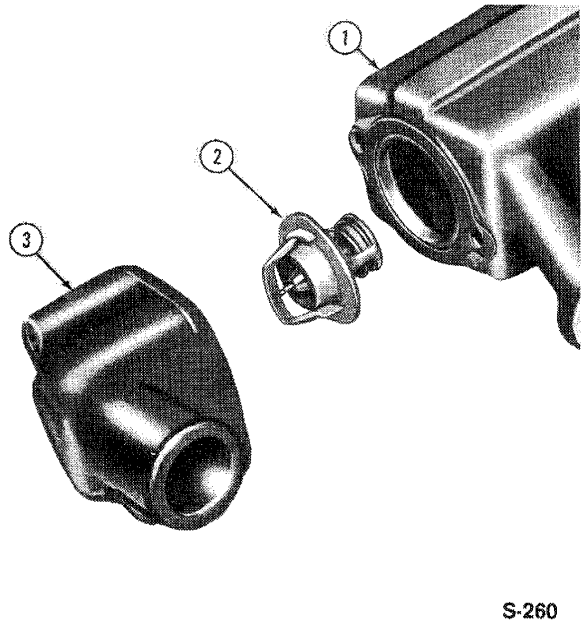


Figure 8
Thermostat Location-Gasoline
1. Intake Manifold
2. Thermostat
3. Coolant Outlet Connection

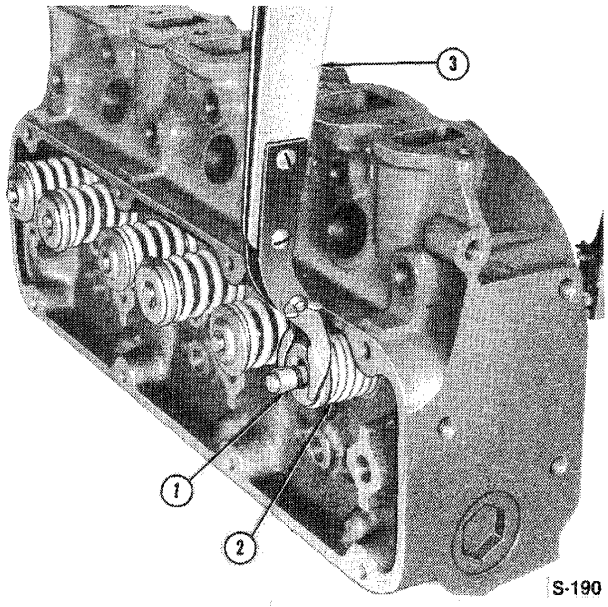


Figure 9
Valve Removal
1. Retainer Locks
2. Valve Spring
3. Valve Spring Compressor

4. Withdraw the valves and place in a numbered rack together with the exhaust valve rotators.

ROCKER SHAFT ASSEMBLY:

5. Remove the cylinder head bolts which pass through the rocker shaft supports and slide the rocker shaft components from the shaft, Figure 11.

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.

2. Inspect the cylinder head for damage and, if necessary, remove nicks and burrs from the gasket faces using a suitable abrasive. Be sure all traces of abrasive material are removed after repair. On diesel engines, be sure to remove any injector washers that may have remained in the bores.

PRINTED IN U.S.A.

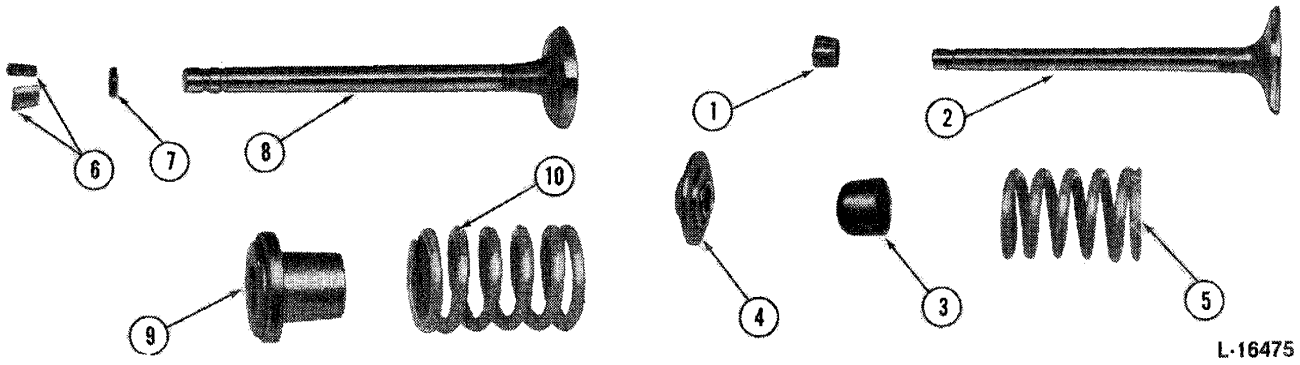


Figure 10
Valve Assembly Components

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

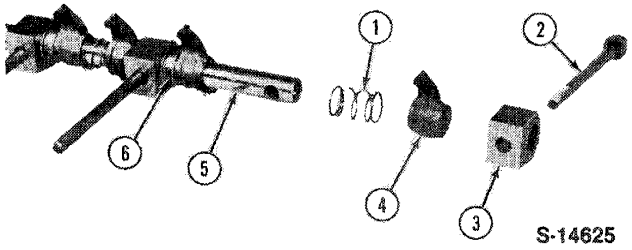


Figure 11
Rocker Shaft Disassembled

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

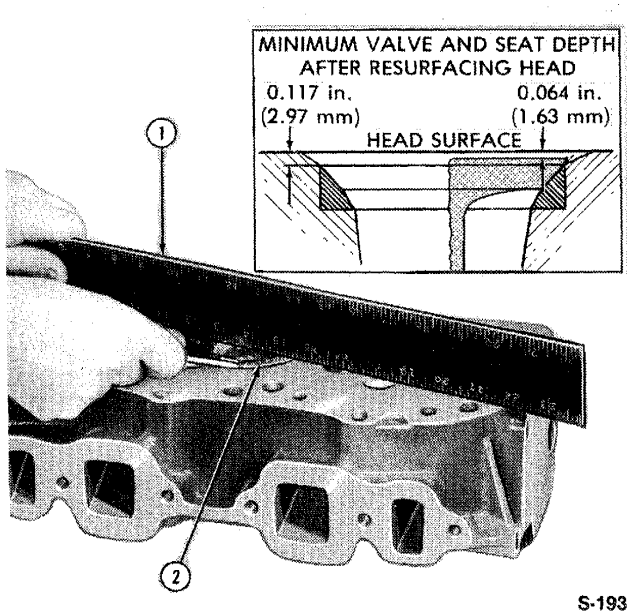


Figure 12
Measuring Cylinder Head Flatness

1. Straight Edge
2. Feeler Gauge

3. Use a straight edge and feeler gauge to check the flatness of the cylinder head in all directions, Figure 12. For flatness requirement see "Specifications" — Chapter 3.

NOTE: *If the cylinder head does not meet the flatness specification, it may be resurfaced providing the depth from head face to valve seat and valve head is not less than the minimums shown in Figure 12.*

4. After re-surfacing the head, check whether any cylinder head bolts are bottoming by mounting the cylinder head on the block without a gasket and without any of the pistons at T.D.C. Install all the bolts, with washers, finger tight and ensure the rocker shaft supports and flat washers are fitted with the long bolts. If a 0.010 in. (0.25 mm) feeler gauge can be inserted under any bolt head then the bolt is bottoming and the cylinder block thread must be increased in depth. Use a ½ in. x 13 UNC-2A bottoming tap. Mark the bolts to be sure they are installed in the same holes.

VALVE SEATS:

5. Examine the valve seats and reface if pitted but replace if damaged. If necessary, install an oversize insert by machining the seat counterbore in the cylinder head, see "Specifications" — Chapter 3. 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 S010-0S or S020-0S on the exhaust manifold side in line with the valve seat concerned.*

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

6. Check the width of the valve seat faces and, if necessary, reface by grinding to the dimensions shown in Figure 13.

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

Check the location of the valve seat contact on the valve face and regrind the seat to specification, Figure 14.

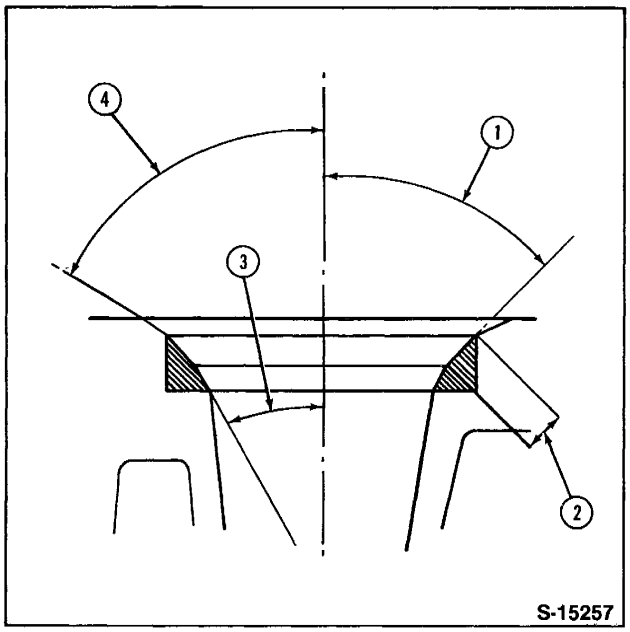


Figure 13
Valve Seat Dimensions

1. Valve Seat Angle:
   45°00'-45°30' for all Valve Seats
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. Seat Relief Angle, Upper - 30°
4. Seat Relief Angle, Lower - 60°

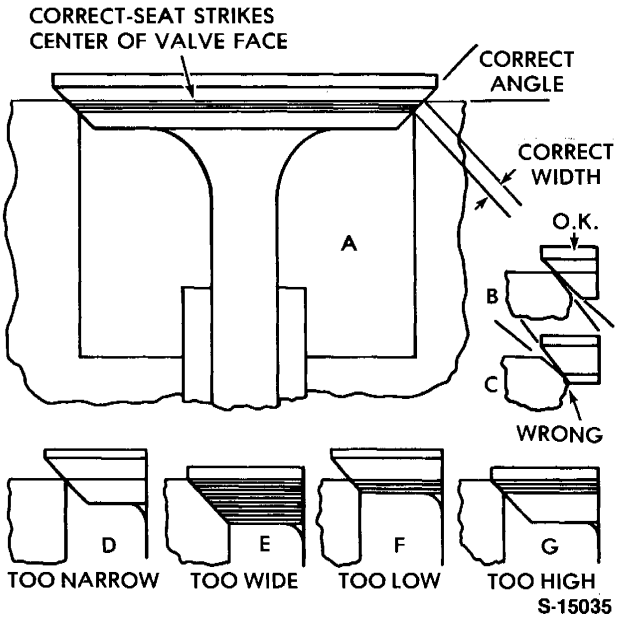


Figure 14
Valve Seat Location

PRINTED IN U.S.A.

Suggest:

If the above button click is invalid.

Please download this document

first, and then click the above link

to download the complete manual.

Thank you so much for reading

Lower the seats by removing material from the top of the seat and raise the seat by removing material from the bottom using the following stones:

	Intake & Exhaust	
	Lower	Raise
All engines	30° Stone	60° Stone

Caution: *Exercise care in grinding seats so as to not remove too much material and ruin seat, Figure 14.*

VALVES:

7. Examine the valve face and, if pitted, replace or reface by grinding to the dimension shown in Figure 15. Before refacing the valve, be sure the valve stem is not bent or worn and check the valve seat run-out, measured at right-angles to the seat, does not exceed a total of 0.0015 in. (0.04 mm).

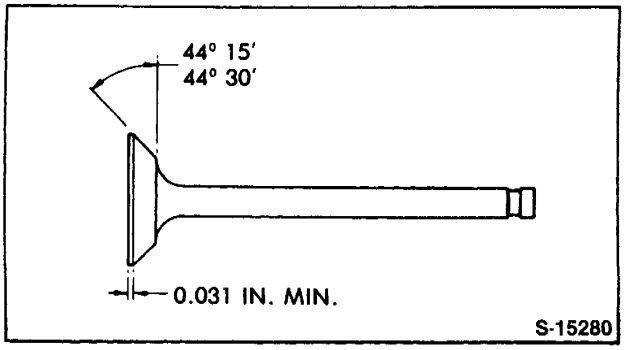


Figure 15
Intake and Exhaust Valves

Remove only enough stock to clean up the pits and grooves. Check the edge of the valve head; if less than 1/32 in. (0.79 mm.) margin, install a new valve.

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

IMPORTANT: *The finished valve seat should contact the center of the valve face. Using a refaced or new valve, check the seat using Prussian Blue. Rotate the valve with a light pressure and if the blue is transferred to the middle of the valve face, the contact is correct.*

VALVE GUIDES:

8. Using a telescope gauge and micrometer, determine the valve to guide clearance, Figure 16. Measure the guide bores at right angles to the engine axis, and subtract the valve stem diameter. If the clearance exceeds the specified limits, see "Specifications" — Chapter 3, ream the valve guide to fit the next oversize valve.

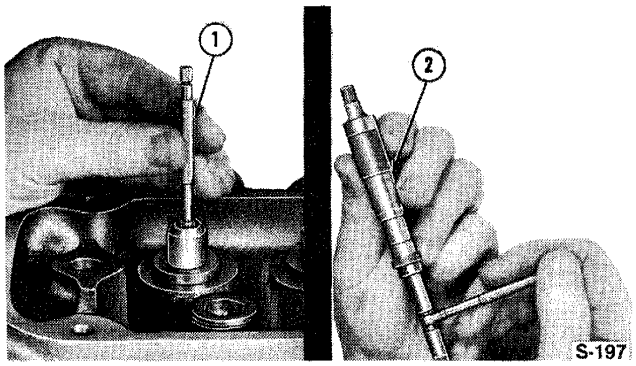


Figure 16
Measuring Valve Guide
1. Telescope Gauge
2. Micrometer

NOTE: *Production cylinder heads may have one or more 0.015 in. (0.38 mm) oversize valve guides and valves installed. Such cylinder heads have 15 or V015-0S stamped on the exhaust manifold side of the head opposite the valve(s) concerned.*

9. Use Kit No. 2136 to ream out the valve guide to accept an oversize valve. The kit contains three reamer and pilot combinations as follows:

- 0.003 in. (0.08 mm) Oversize Reamer and Standard Diameter Pilot.
- 0.015 in. (0.38 mm) Oversize Reamer and 0.003 in. (0.08 mm) Oversize Pilot.
- 0.030 in. (0.76 mm) Oversize Reamer and 0.015 in. (0.38 mm) Oversize Pilot.

When going from a standard valve stem to an oversize always use the reamers in sequence. After reaming a valve guide, always check the valve seating and reface if necessary.