SECTION

M

SERVICING THE

KOHLER

K241 AND K301

ENGINES

PRINTED IN U.S.A.

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Introduction

This manual covers servicing the Kohler 10HP 241 and 12HP 301 engines. There are some minor differences between these engines such as the bore and stroke. The difference will be indicated in the manual when they appear. These engines are of the 4 cycle type, splash oil lubrication, cast iron block and electric starting.

IMPORTANT

REFER TO THE SPECIFICATIONS SECTION OF THIS MANUAL FOR DIMENSIONS, TOLERANCES, ETC. WHEN SERVICING THIS ENGINE THESE DATA ARE NOT INCLUDED IN THIS SECTION.

CHECKING COMPRESSION PRESSURE

Should you receive a service complaint dealing with excessive oil consumption, loss of power, hard starting, rough running or excessive smoke, check the compression pressure and the crankcase vacuum.

1. Steam clean engine thoroughly.

2. Warm up engine to operating temperature.

3. Remove the spark plug.

4. With the speed control lever in neutral or brake position, use a compression gauge similar to that shown in Figure M-1.

5. Crank the engine with the starter and check the compression pressure, refer to Specification Section. If the pressure is 20 PSI or more below the specified pressure, leaking valves or excessive ring clearance is indicated. ***NOTE*** Engine cranking speed must be more than 750 RPM so the automatic compression release is released. At less than 750 RPM the compression reading will be incorrect.

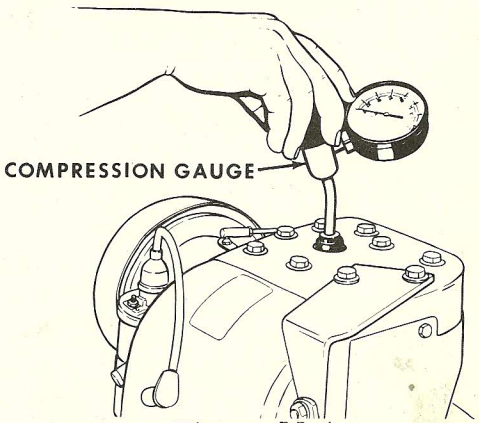


Figure M-1

CHECKING CRANKCASE VACUUM

The crankcase breather maintains a partial vacuum in the crankcase. To check vacuum proceed as follows:

1. Drill and tap a 1/8" NPT in a 3/4" pipe plug or use a 1/8" to 3/4" pipe reducing bushing. Install in place of the engine oil dipstick and plug.

2. Attach vacuum gauge to pipe plug, Figure M-2. Start engine and run at low idle speed. Refer to Specification Section for proper vacuum.

No or low vacuum indicates a faulty breather, excessive blowby, leaking valves or worn oil seals.

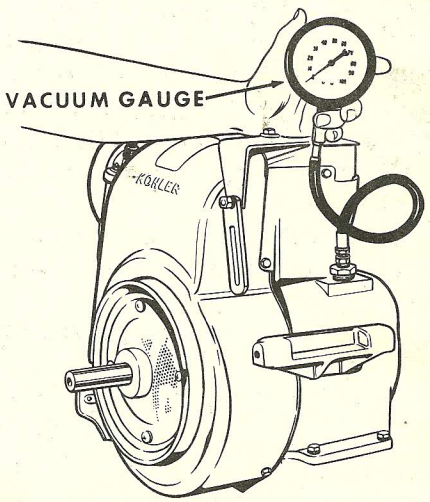


Figure M-2

CYLINDER HEAD VALVES, GUIDES AND SPRINGS

(Refer to Figure M-3)

Removal

Steam clean engine before doing any disassembly or service work.

Disconnect the fuel line from either the carburetor or the fuel pump and drain the fuel pump. Disconnect the choke and throttle connections at the carburetor. Disconnect governor linkage and remove carburetor (1) and baffle (2).

Remove and disassemble breather (25-31), cylinder head bolts (4). Remove the engine air deflector (5), cylinder baffle (6) and head baffles (7). Remove the generator adjusting bracket (8).

Remove the spark plug (9), wire (10), cylinder head (11) and gasket (12) from cylinder block (13). Using a valve spring compressor, inset A, compress the valve springs (17) and remove the valve retainer locks (15). Remove the valve retainers (16), springs, spring retainers (18), and valves (19).

To remove valve guides (20), drive them down into the tappet chamber and carefully break them off. Drive the balance of the guides down and remove. **CAUTION** Be very careful not to damage the cylinder block when breaking off the guides. The exhaust valve seat (21) can be removed by using a seat removing tool, refer to inset B. Remove tappet adjusting screws (22) if they are to be replaced.

Inspection

Remove all carbon from head, bore and valve guides. Blow out with compressed air. Refer to Pages M-6 and M-7 for inspection of valves, seats.

Inspect the tappet adjusting screws for wear and replace if worn.

Check the cylinder head for warpage by using a face plate. The head should make contact at all gasket surfaces. If it doesn't, replace cylinder head.

Installation

Drive new valve guides (20) in place until they are flush with the bottom of the valve chamber. The guides must be reamed to size after installing, refer to Specification Section for proper dimension. Install exhaust seat (21) by cooling it in dry ice and drive into the block.

Install valves (19), spring retainers (18) springs (17) and valve retainers (16). Compress valve springs and install locks (15).

Install new head gasket (12) after soaking it in oil. Install head (11) baffles (6) and (7), air deflector (5) generator bracket (8) and head bolts (4).

Tighten head bolts to proper torque. Back of the bolts and retorque to proper torque. Refer to Specifications Section.

Clean, regap and install spark plug (9). Adjust tappets, refer to tappet adjustment. Install the breather assembly in the following order, stud (24) gasket (25), plate (26) with small drilled hole down, reed valve (27) and baffle (28).

Clean and lubricate filter (29) with engine oil and install. Install outer gasket (30), seal (31), cover (32) washer (33), and nut (34). Tighten the nut only enough to make a good seal.

Install baffle (2) carburetor (1) and gasket. Connect throttle and choke connections. Connect governor linkage and fuel line.

TAPPET ADJUSTMENTS

Hand crank the engine to set piston at the DC mark of the compression stroke, inset C. Outward pressure will be felt when the thumb is placed over the spark plug opening when the piston is coming up on the compression stroke. A lighter pressure is also felt on the exhaust stroke. DO NOT CONFUSE THE TWO. Refer to Specification Section for proper tappet clearance. Using a feeler gauge, set tappets, inset D.

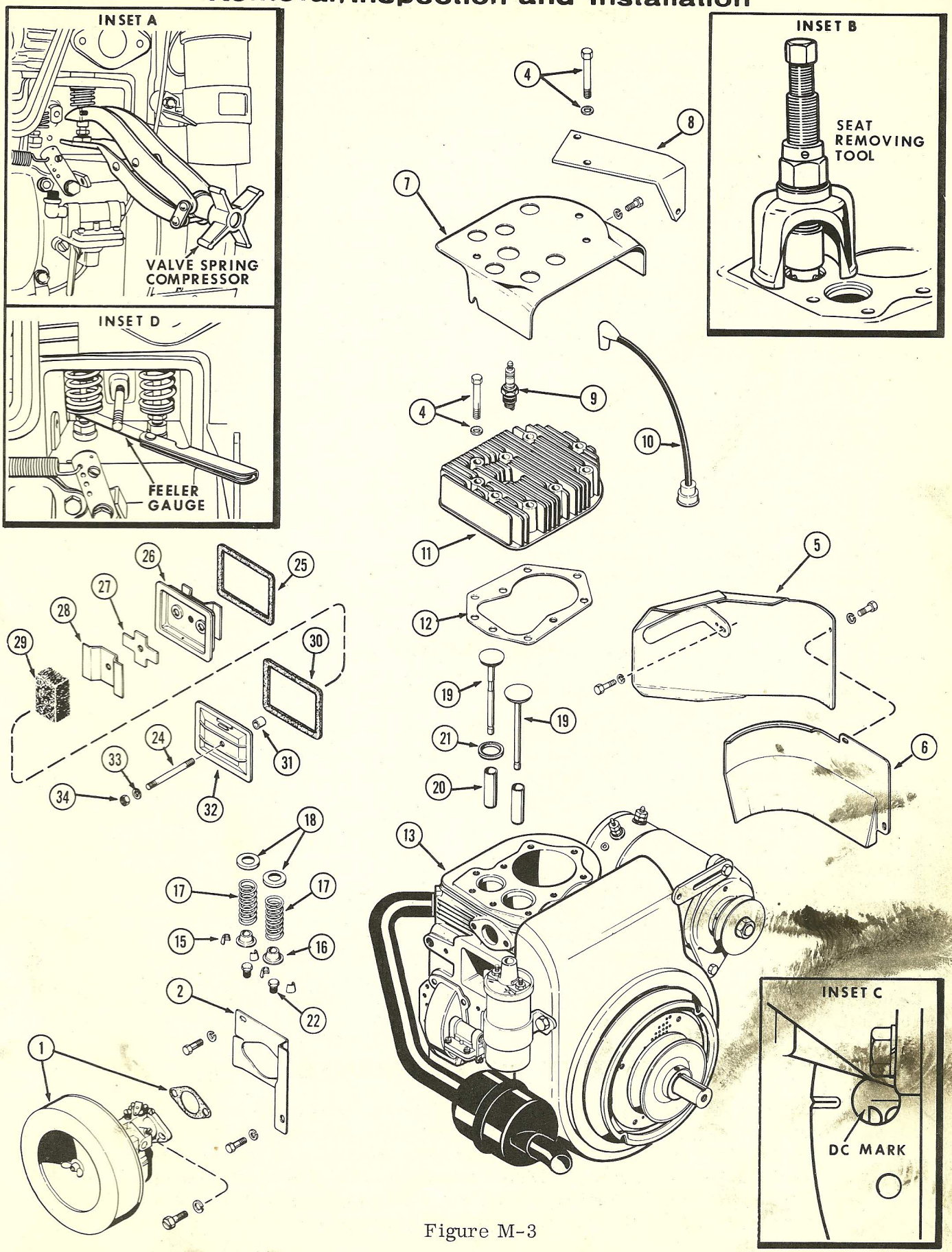


Figure M-3

INSPECTION OF THE VALVES,GUIDES AND SPRINGS

Valve springs should be checked for flat squared ends, broken or cracked coils and correct spring pressure. Use a Valve Spring Tension Tester. Refer to "Specification" Section.

Valve guides can be checked for wear by using a bore gauge and micrometer, Figure M-4.

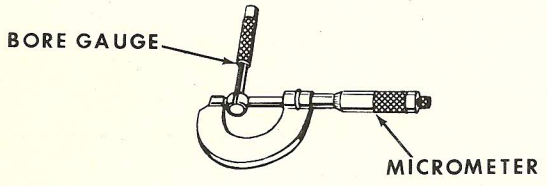


Figure M-4

The valve guide should be checked at the top, middle and bottom of the bore for wear, Figure M-5.

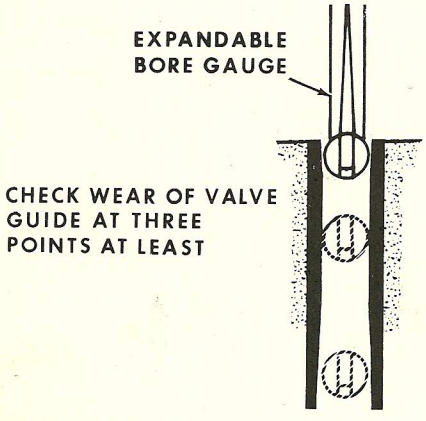


Figure M-5

The inside diameter wear limits of the valve guide should not exceed the specification given in the "Specification" Section, at any point along the bore of the guide. Replace guide if it does. Check the new valve guides after installation to make sure that the bore is not less than the inside diameter given in the "Specification" Section. Using an Arbor equal to the inside diameter of the valve guide will keep the guide from collapsing when pressed in place.

Clean the valves with a power driven fine wire brush being very careful not to scratch the valve stems. Reference is made to the different parts of the valve, Figure M-6.

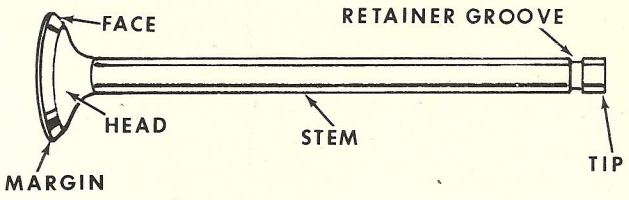


Figure M-6

Inspect the valves for excessive wear or necked stems, Figure M-7. This can be caused by lack of lubrication,plugged or dirty cooling fins or operating the engine under continous overload at excessive engine RPM. If these conditions exist the valves and guides should be replaced.

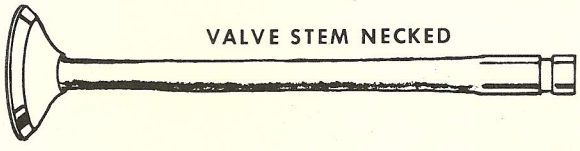


Figure M-7

Inspect the valves for deep grooves in the face, Figure M-8. This can be caused by abrasives entering the engine through the intake system or not servicing the air cleaner regularly. A leaking breather gasket can also cause this condition. If grinding the valve face will not correct this condition, replace the valves.

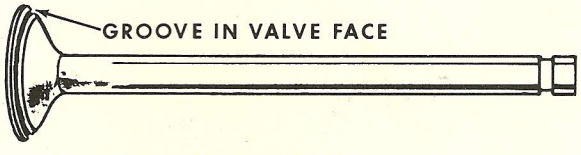


Figure M-8

Inspect the valve face and stem for rust or pitting, Figure M-9. Rust or pitting can usually be removed by grinding the valve face. If rust or pitting on the valve stem exist the valve should be replaced.These conditions can be caused by using poor quality engine oil or fuel that doesn't meet the specification given in the Operator's Manual. Rust could be caused by improper storing of the engine.

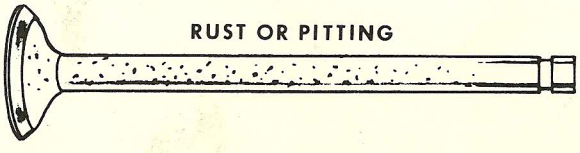


Figure M-9

INSPECTION OF THE VALVES, GUIDES AND SPRINGS (Contd)

Heavy carbon or varnish deposits on the valve, Figure M-10, should be removed before valves are ground. This condition is usually caused by worn piston rings and bore which allow too much oil to reach the combustion chamber. This condition could also be caused by worn valve guides. These conditions should be corrected or the same trouble with the valves will happen again.

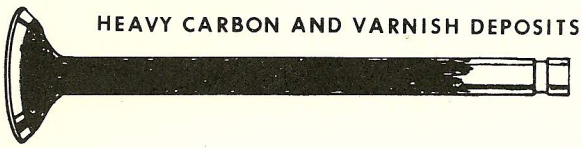


Figure M-10

Inspect the valve head for dishing and the valve face for deep burned spots, Figure M-11. These conditions can't be corrected by grinding the valves. The valves should be replaced. These conditions are usually caused by running the engine under excessive load, at high engine temperatures.

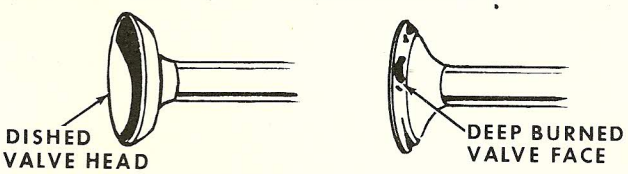


Figure M-11

Valves with worn lock grooves or the stem is worn or dished beyond the chamfer must be replaced, Figure M-12.

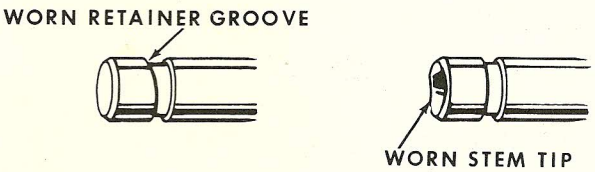


Figure M-12

The checking of the valve stem diameter can best be done with a good accurate micrometer Figure M-13.

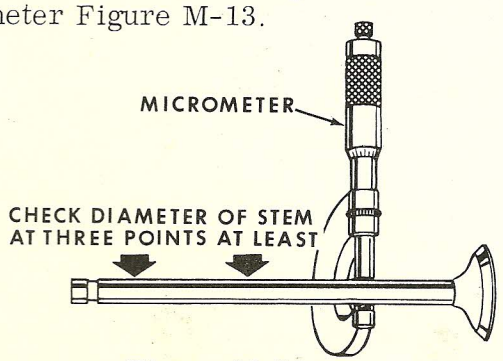


Figure M-13

The valve stem should not vary more than the wear limits given in the "Specification" Section at any point on the valve stem. If this condition exists, the valves must be replaced.

The checking of the valve face runout should be done after the valves have been ground. A Vee block type holder with a dial indicator, Figure M-14, should be used to check the valve face runout. The valve face should not vary more than the specification given in the "Specification" Section. The valve stem runout can also be checked with this Vee block and dial indicator.

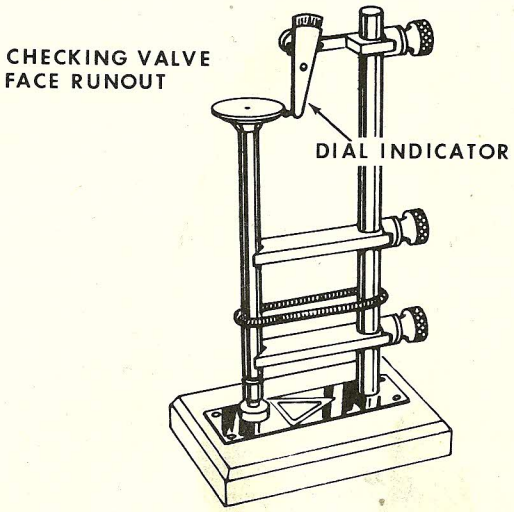


Figure M-14

IMPORTANT

Small amounts of very fine pitting, Figure M-15, may be found on the surfaces of the valve faces and seats after the valves are cleaned.

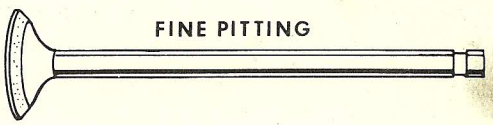


Figure M-15

These are normal and will not affect engine performance. This fine pitting is caused by a normal oxidation process and can happen on any engine during the run-in-period. It is not necessary to grind valves or seats if this fine pitting is found as the pitting will generally reoccur after the engine is run for a few hours.

REFACING INTAKE AND EXHAUST VALVES

Before refacing the valves they should be wire brushed, cleaned and inspected. Refer to the "Specification" Section for the correct valve face grinding angle. Set the refacing machine protractor at this angle. Be sure the chuck of the machine is clean before installing valve. Dress the grinding wheel before starting to reface each valve. Take only light cuts as the valve is refaced and the last cut must be very fine so the valve face will have a polished finish.

IMPORTANT Replace any valve that after grinding has a thin edge or margin, Figure M-16. If the margin on the ground valve is less than half the margin on a new valve, replace the valve.

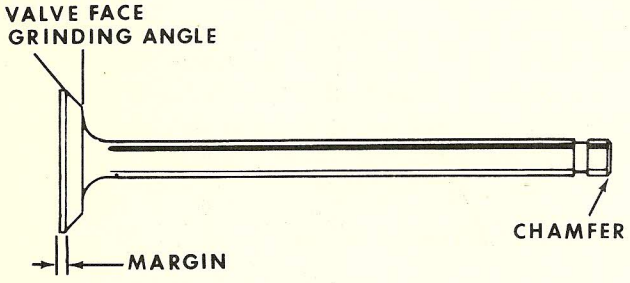
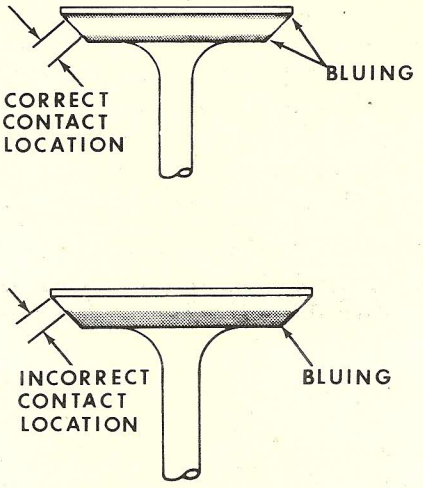


Figure M-16

The tip end of the valve should be checked for roughness or wear. Usually this can be removed with some very light cuts against the side of the grinding wheel and will square up the end. Never grind the chamfer off the valve stem end. Any excessive grinding should not be done to the stem end. Replace the valve.

Before installing new valves a fine finish grinding should be done to each new valve. Check the valve face and valve stem runout before installing (Refer to Page M-9).

The valve face and seat contact location should be checked. Place valve bluing (Prussion Blue) on the face of the valve. Install the valve in the head and rotate the valve on its seat. Remove the valve and inspect the contact area on the valve face. The bluing will have been removed from the valve face evenly at the top edge of the contact area, Figure M-17. This is due to the fact that the valve face and seat are ground with 1° INTERFERENCE ANGLE. Refer to "Specification" Section.



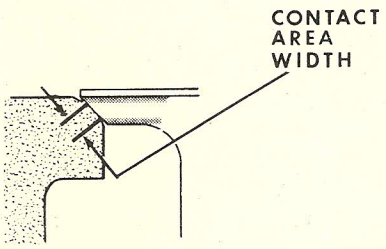


Figure M-17

When the top edge of the contact area is too high or low on the valve face, the seat contact area must be moved. This is done by using the narrowing stones (Refer to Page M-9). The contact area width should never exceed the dimension given in the Specification Section.

CAUTION

DO NOT USE BLUING TO CHECK VALVE SEAT AND VALVE FACE RUN-OUT. The valve face could be contacting the seat at only a few points, but the bluing would still be rubbed off by the high points and make it appear as though you had solid contact all around. The only thing bluing will indicate is the location on the valve face where the seat is contacting -- no more!

INTAKE AND EXHAUST VALVE SEATS

GRINDING

Always use a precision type power seat grinder similar to the one shown in Figure M-18. The valve seats cannot be ground with manual operated equipment. The intake valve seat is part of the block and for this reason only a finishing stone should be used to grind the seat. Take very light cuts with the grinding stones so just enough metal is removed to end up with a good smooth seat finish.

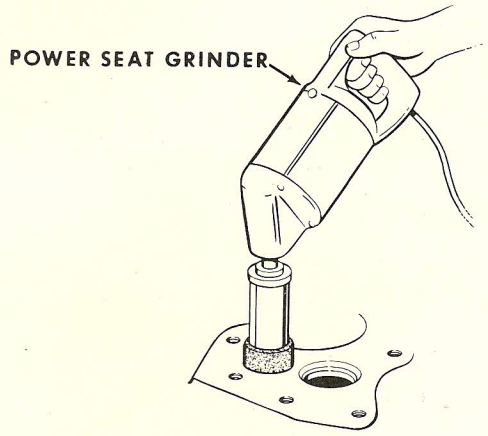


Figure M-18

Refer to "Specification " Section for the proper specifications of the intake, exhaust seats and valve guides, Figure M-19. From the specifications the proper grinding stones and pilot can be chosen.

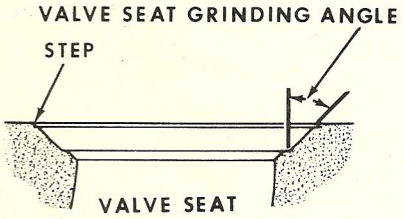


Figure M-19

When using the grinding stones the seat grinding angle of the stone should be dressed on a stone dresser frequently so the seat angle will not vary when grinding the seats.

INSPECTION

The valve seat runout should be checked after finish grinding with a dial indicator and seat grinding pilot, Figure M-20. After checking the runout, turn the pilot 1/4 turn and check runout again. The width of the valve seat contact area must be checked. Refer "Specification " Section for dimension of seat width contact area.

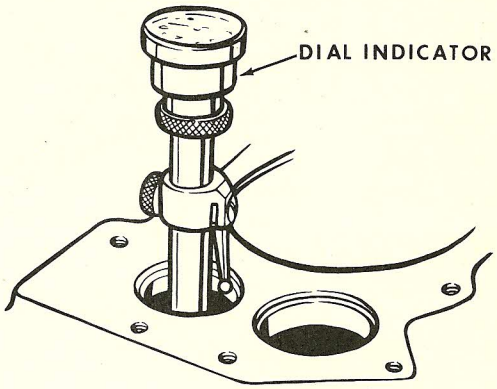


Figure M-20

The valve seat contact area width should never vary from this dimension. The valve seat contact area width and location can be changed slightly by using narrowing stones, Figure M-21.

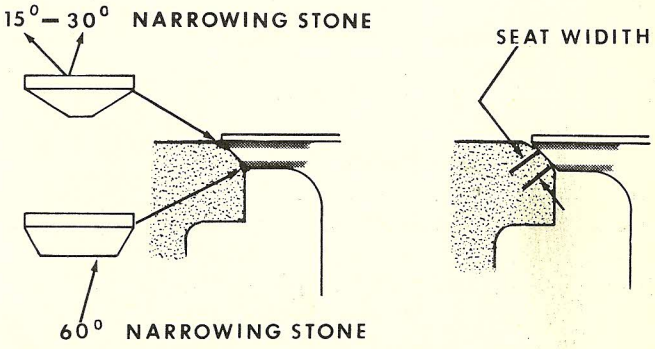


Figure M-21

When the step above the seat, Figure M-21, has been reduced by the grinding operation, installing a new valve will help to restore the compression that would normally be lost by excessive grinding of the seat and valves. Excessive grinding of the valves and seats moves the valves further into the block thereby reducing the compression ratio.

ENGINE AND ATTACHING PARTS

(Refer to Figure M-22 and M-23)

Removal

1. Drain the engine crankcase oil (1).

2. Disconnect positive battery cable (2) from battery.

3. Disconnect fuel line (3) and drain fuel.

4. Disconnect choke control (4), throttle control (5), cables (6) and wires (7) from engine.

5. Remove the engine block air deflector (8) and left hand grille side sheet (9).

6. Disconnect and remove the hydraulic pump (10). Cap the hydraulic lines.

7. Remove the four engine mounting bolts (11).

8. Remove the engine from the left side of the tractor.

9. Remove the fuel tank, supports, generator belt, generator, oil cooler fan, exhaust system and pump drive housing from the engine.

Installation

1. Install the fuel tank supports and fuel tank.

2. Install generator, generator belt and oil cooler fan.

3. Install exhaust system and hydraulic pump drive housing.

4. Install the engine from left side of tractor using four mounting bolts and nuts.

5. Install the hydraulic pump (10) and lines.

6. Install the engine air deflector (8) and left hand grille side sheet (9).

7. Reconnect the fuel line (3), choke control (4), throttle control (5) cables (6) and wires (7) to engine.

8. Refill the crankcase to proper level, refer to operator's manual for correct oil and quantity.

9. Install positive battery cable (2) to battery.

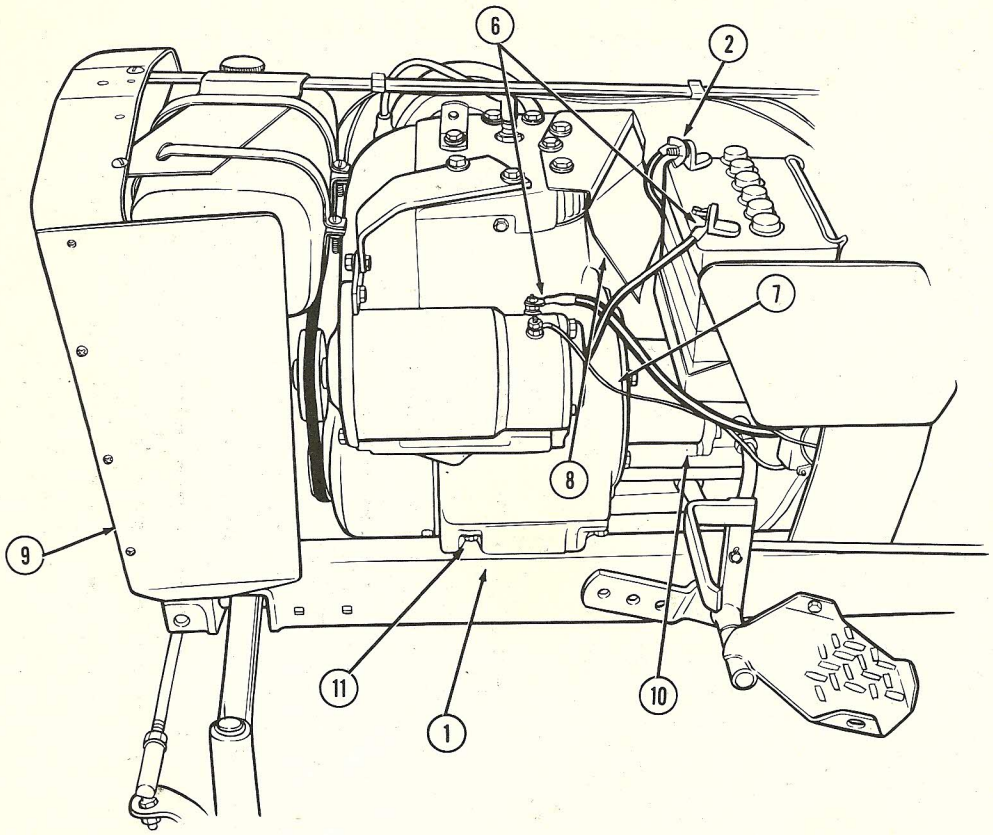


Figure M-22

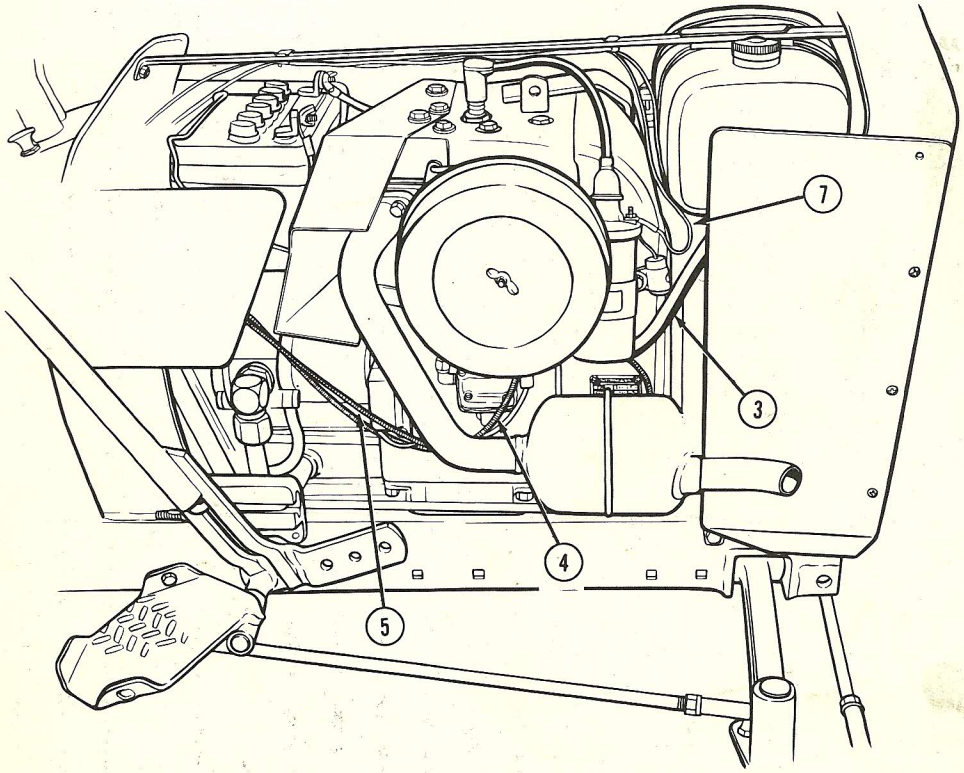


Figure M-23

ENGINE BLOCK

(Refer to Figure M-24)

Disassembly

Remove cylinder head and valve train as described on Page M-4.

1. Remove fuel pump and gasket (1), (If no fuel pump, remove cover and gasket), implement drive pulley (2), key (3), blower housing (4), air intake screen (5), starter pulley (6) and camshaft gear cover and gasket (7).

2. Remove cover and gasket (9), breaker points (8), plunger (10) and coil (11).

4. Remove the lock nut (14), washer (15) and using suitable puller remove the flywheel (16) from crankshaft. The flywheel can also be removed by loosening the nut (14) and tapping on the end of crankshaft, while pulling outward on the flywheel until it is loose from the tapered shaft. Then remove nut (14), washer (15) flywheel (16) and key (17).

5. Using puller (refer to inset A) pull bearing plate (18) from engine. Remove shim gaskets (19), seal (20) and front bearing (21) from bearing plate (18).

6. Remove connecting rod cap (22) and bolts (23). Using a ridge reamer, remove any ridge present at the top of cylinder bore.

7. Push piston and rod assembly (24) up through top of cylinder bore.

8. Either press or tap on pump end of crankshaft (25) to remove from block. Remove bearing (26) from crankshaft or block. Remove oil seal (27) from block.

9. Drive the camshaft pin (28) from the pump end of the block out toward the flywheel end of engine. Remove camshaft (29), shims (32), and valve lifters (30) from block.

10. Loosen clamp on governor arm and remove governor arm (34) from shaft (35) Unscrew governor bushing nut (36) and remove governor stop pin (37).

11. Remove governor shaft (35) from inside of block. Remove governor gear assembly (38) and thrust washer (39) from shaft (40). Remove expansion plug (41) and drive out shaft (40) from valve tappet chamber end of shaft.

12. Drive out governor shaft needle bearing (42).

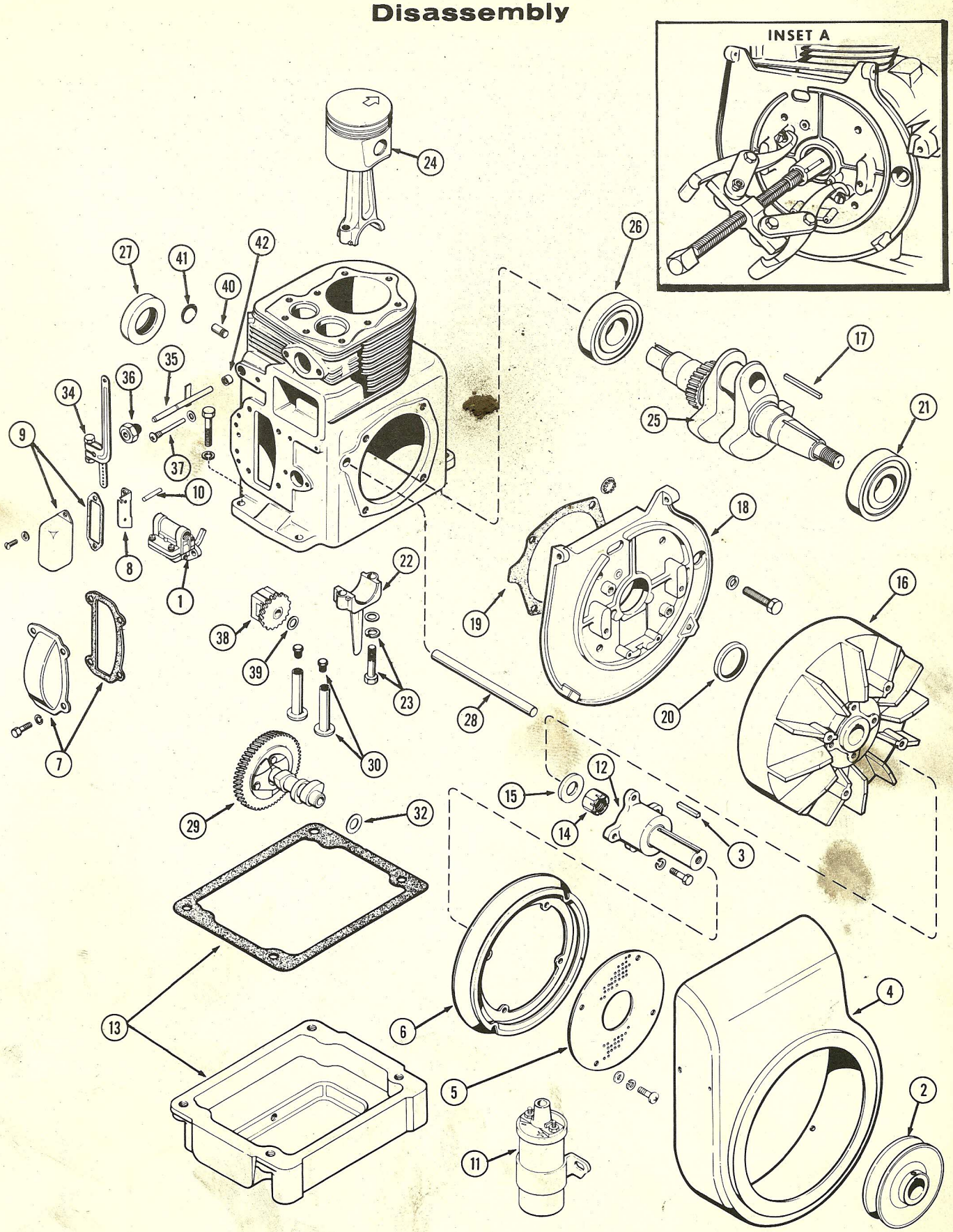


Figure M-24

Disassembly

1. Remove the two piston pin retainer rings and slide the pin out of the rod and piston.

2. To avoid damage to the piston, remove the piston rings with a ring expander, Figure M-25.

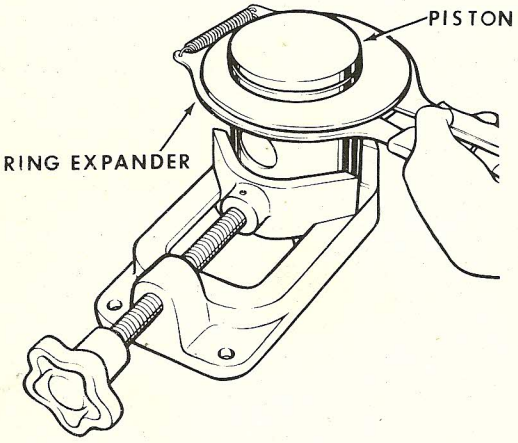


Figure M-25

3. Thoroughly clean the parts before inspection and remove all carbon from piston ring grooves.

Inspection

1. Check the connecting rod and cap for cracks, noticeable twisting and binding. Check the bearing surfaces for wear, scratches, or pitting. If these conditions exist, replace connecting rod.

2. Install the rod and cap onto the crankshaft and using a feeler gauge check for side clearance in the crankshaft journal Figure M-26. Refer to Specification Section for proper clearance.

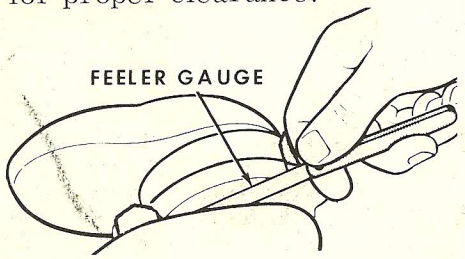


Figure M-26

3. To check the rod bearing clearance use plastic gauge. Place a piece of plastic gauge across the full width of the rod cap, refer to Figure M-27. Tighten bearing cap to specified torque.

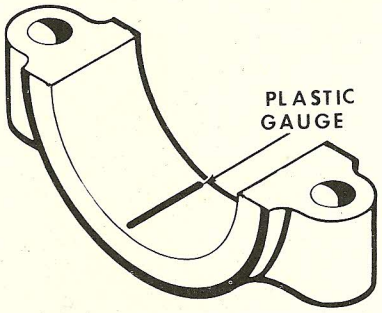


Figure M-27

4. Remove the bearing cap. The flattened plastic gauge will be found either on the rod cap or the crankshaft.

5. Compare the flattened gauge material at its widest point with the scale that is furnished, Figure M-28.

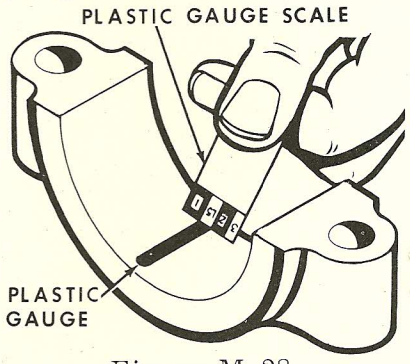


Figure M-28

6. The number within the graduation indicates clearance in thousands of an inch. Refer to Specification Section for proper clearance.

7. Using a micrometer, check the diameter at the top and the skirt of the piston. Check the compression and oil ring groove clearances, Figure M-29. Refer to Specification Section for proper clearance.

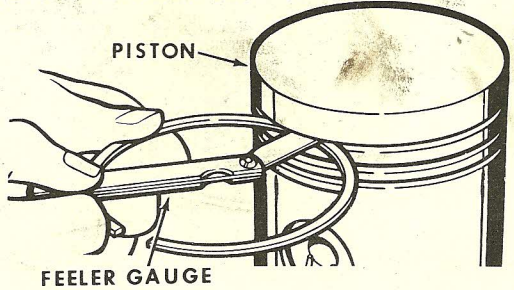


Figure M-29

Inspection (Contd)

8. Inspect piston pin for cracks, excessive wear, score marks or pitting. Replace pin if any of these conditions exist. Check the pin diameter, its fit in the connecting rod and piston. Refer to Specification Section.

Assembly

1. Install the piston pin into the piston and rod. Install retainer rings in the grooves in the piston. ***IMPORTANT*** Arrow on top of the piston must be opposite the boss on the connecting rod and cap, Figure M-30. Using a rod alignment fixture check the rod to piston alignment.

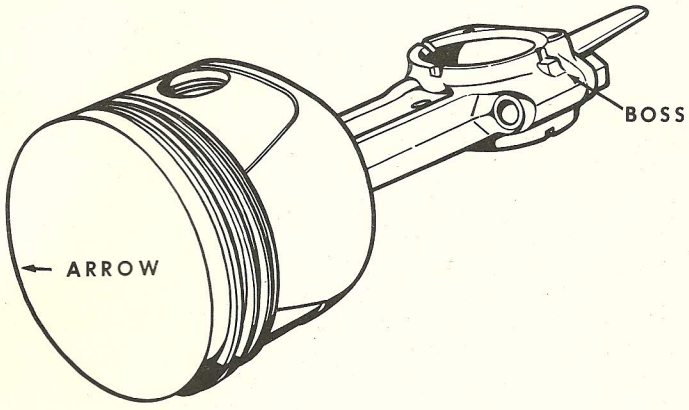


Figure M-30

2. Install each ring 3/4" into the cylinder bore and check the ring gap with a feeler gauge, Figure M-31. Refer to Specification Section for correct ring gap.

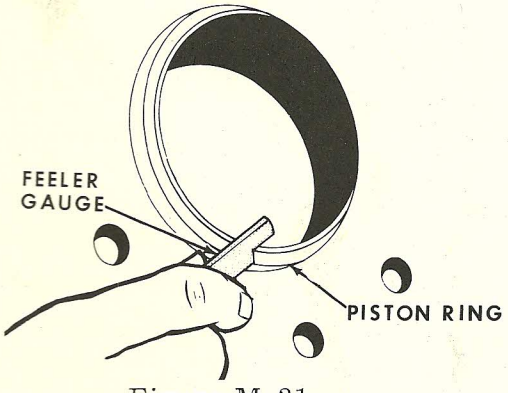


Figure M-31

3. Install the oil ring expander in the bottom groove of piston. Then install the chrome steel rail, cast iron spacer and second chrome steel rail, in the bottom groove of the piston, Figure M-32.

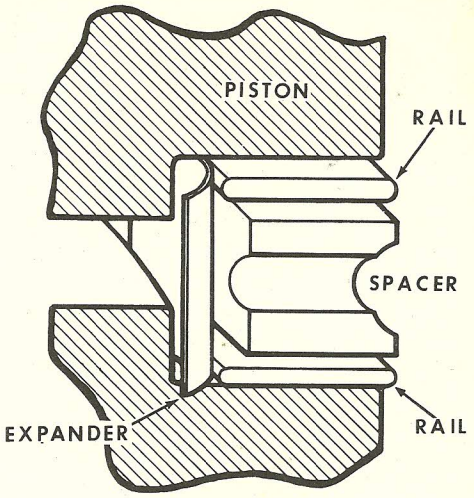


Figure M-32

4. Install the compression ring expander in the second or middle groove of the piston. Then install the chrome steel rail. Install the cast iron ring above rail with the scraper groove down, Figure M-33.

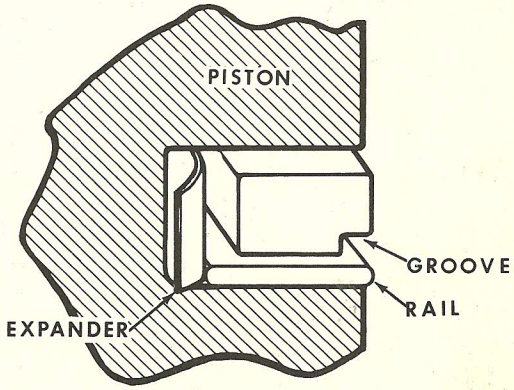


Figure M-33

5. Install top compression ring in last or top groove with bevel up, Figure M-34.

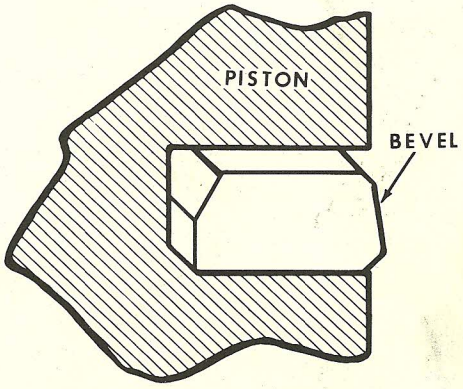


Figure M-34

Inspection

Inspect the crankshaft ball bearings for cracks, pitting or noisey operation. Replace if these conditions exists.

Check the crankshaft rod journal with a micrometer for wear or out of round. Refer to Specification Section.

Using a inside micrometer or bore gauge, Figures M-35 and M-36, check the bore diameter 3/4" from the top of bore at two places. The second reading should be taken 90° around the bore from the first reading. If the out of round exceeds the specified measurement, the cylinder will have to be bored or honed to .010, .020, or .030 inches oversize. Refer to Specification Section.

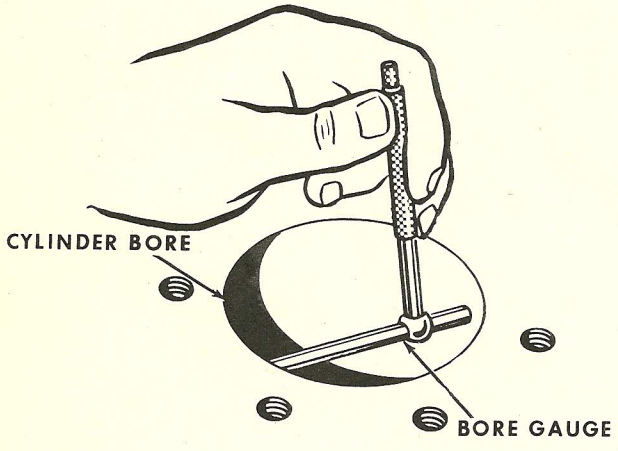


Figure M-35

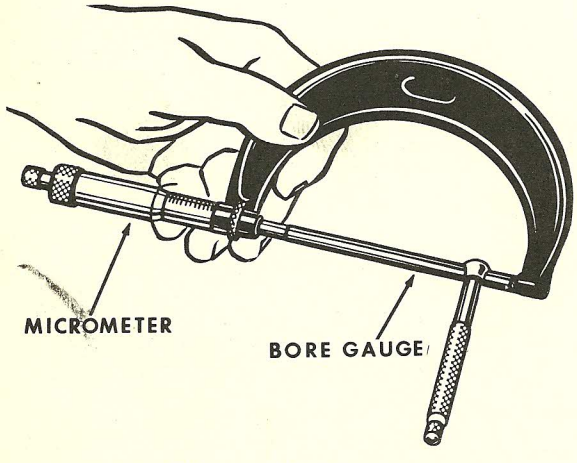


Figure M-36

Check the bore at several points down the length of the bore. This can be done with a bore gauge or taper gauge, Figure M-37.

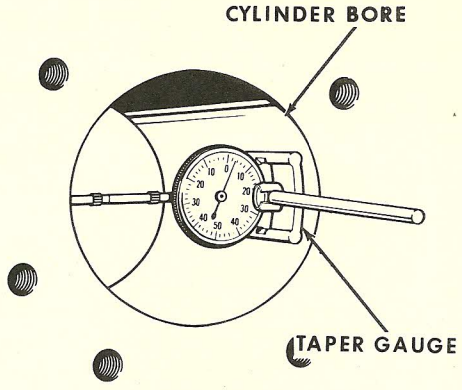


Figure M-37

Subtracting the smallest reading from the largest reading will give the amount of taper in the bore. Refer to Specification Section. If the taper exceeds the specified measurement, the cylinder bore will have to be honed to .010, .020 or .030 inch oversize.

A power cylinder hone can be used with either a drill press or a portable electric drill. Use a 200 to 280 grit stone. It is very important to keep the bore in alignment with the crankshaft cross bore.

After the bore is honed to the proper over size, it must be cleaned thoroughly by washing with soap and hot water. After thoroughly cleaning and drying, lubricate the bore with engine oil.

IMPORTANT

Do not use gasoline or kerosene to clean the bore as neither one will remove the grit from the cylinder bore.

Inspection (Contd)

To check the crankshaft end play, remove the seal from the bearing plate. Install the crankshaft into the block. Install the bearing plate without using shim gaskets. Install the four bearing plate bolts.

IMPORTANT

Draw the bolts up equally, but do not exceed 10 inch lbs. torque, as the bearing plate can be bent or distorted very easy. Using a thickness gauge, check the clearance between the bearing plate and the cylinder block, Figure M-38.

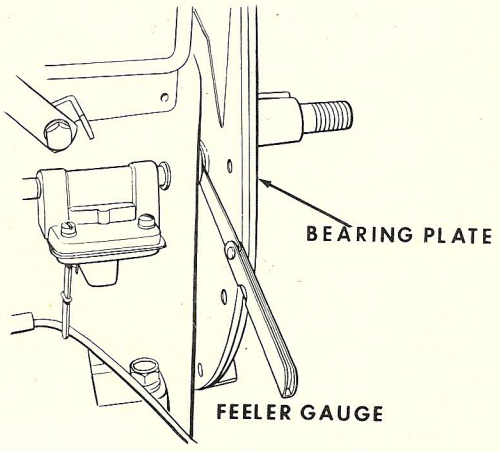


Figure M-38

Take this reading and add the allowable crankshaft end play to it, refer to Specification Section.

EXAMPLE

.035" thickness gauge reading
+ .010" allowable end play
.045 shim gaskets required

The shim gaskets come in .005 and .010 inch thickness, use as many as required for proper end play.

After the end play and number of shims have been determined, the bearing plate will have to be pulled off of the block using a puller, Figure M-39.

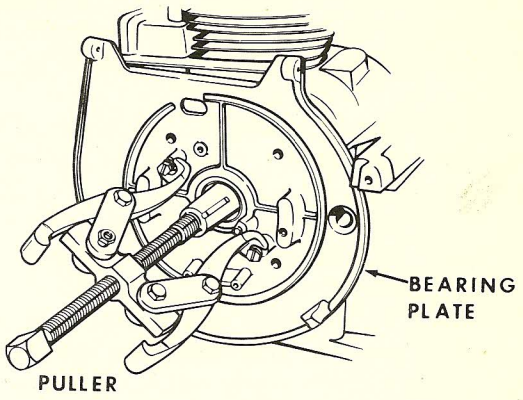


Figure M-39

Check the camshaft pin diameter with a micrometer and the camshaft bore with a inside micrometer. Refer to Specification Section for proper clearance. Replace camshaft if excessive clearance is found.

Check camshaft end play when installing the camshaft using feeler gauge. Excessive end play can be removed by using .005 or .010 inch shims.

22 cc 8 H1370

ENGINE BLOCK

(Refer to Figure M-40)

Assembly

1. When installing governor stub shaft (1), press in until 13/32" of the shaft remains protruding from the block, refer to inset A. Install valve lifters (43).

2. Install gear and weight assembly (2) and governor stop pin (3).

3. Install governor shaft (4), governor shaft bushing (5) and needle bearing (6). Refer to inset B. **NOTE** Needle bearing should be driven into a point that will allow slight back and forth movement of the governor shaft without binding.

4. Install camshaft (8) into the block with proper shims (10). Install camshaft pin (11), from the blower side of block. Install new expansion plug (12).

5. Press the rear crankshaft bearing (13) into the block until it bottoms. Install crankshaft (14) aligning the timing marks on the crankshaft gear and camshaft gear, refer to inset C.

6. Press the front crankshaft bearing (15) into the bearing plate (17).

7. Install the correct number of bearing plate shim gaskets (16) bearing plate (17) and bolts. Refer to Specification Section for proper torque.

8. Stagger the piston ring gaps, lubricated with engine oil and install ring compressor. Install the piston (18) so the arrow is pointing away from the camshaft side of engine.

9. Lubricate the connecting rod (19) and crankshaft journal with engine oil. The piston (18) will have to be driven down with a block of wood into the engine block. Make sure the connecting rod (19) lines up with the crankshaft journal.

10. Install the bearing cap (20) with the boss toward the camshaft and lined up with the boss on the rod. Install bolts (21) and tighten to proper torque. Refer to Specification Section.

11. Install the front oil seal (22) on the blower end of the crankshaft with the lip inward. Be very careful not to damage the oil seal on the shaft keyway. Tap in place until it is flush with the chamfer in the bearing plate (17).

12. Install the flywheel key (23), flywheel (24) washer (25) and lock nut (26) and torque locknut to proper torque.

13. Install crankcase (42) with gasket.

14. Install rear oil seal (28), with the lip outward on pump end of crankshaft, tap into block until it is flush with the machine surface of the block.

15. Install front stub shaft (29) and bolts (30), starter pulley (31) and air intake screen (32).

16. Install blower housing (33), implement drive pulley key (35) and pulley (36). Install fuel pump and gasket (34) (If no fuel pump, install cover and gasket).

17. Install plunger (38), breaker points (37) and cover and gasket (39). Refer to Electrical Sections F for ignition timing and point setting.

18. Install governor arm (40) and spring. Refer to the Fuel Section N for adjustment of the governor.

19. Install camshaft gear cover (27) and gasket.

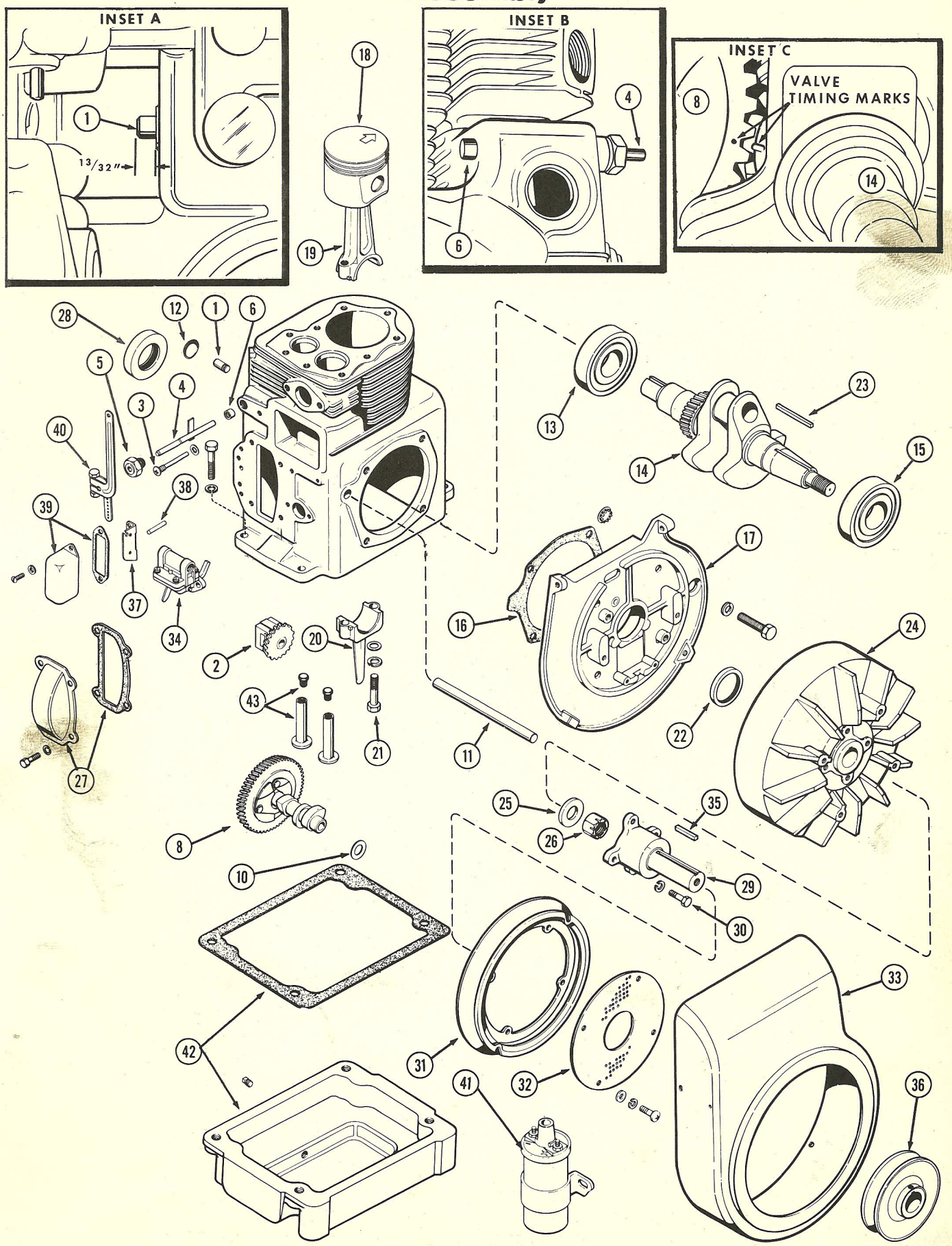


Figure M-40

NOTE: The J. I. Case Company reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.