Tecumseh Engine
Model V70
Service Manual No. 9-50281

J I Case
A Tenneco Company

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SECTION 1

SPECIFICATIONS

107 and 117

TYPE:	Tecumseh-Vert.
BLOCK:	Cast Aluminum
MAIN BEARINGS:	Aluminum Alloy
VALVES:	Heat Treated
EXHAUST VALVE SEAT:	Cast In Block
IGNITION:	Flywheel Magneto
GOVERNOR:	Internal Mech. Flyweight

Displacement	15.0
Stroke	2-17/32"
Bore	2.750 / 2.751
Timing Dimension* Before Top Dead Center for Vertical Engines	V. .080 / .090
Point Setting	.020
Spark Plug Gap	.030
Valve Clearance	.010 Both
Valve Seat Angle	45°
Valve Spring Free Length	1-9/16"

Valve Spring Comp. Length	45/64"
Valve Guides Over-Size Dimensions	.3432 / .3442
Valve Seat Width	3/64"
Crankshaft End Play	.006 / .022
Dia. Crankshaft Conn. Rod Journal	1.1865 / 1.1870
Magneto Side Main Bearing Dia.	1.0005 / 1.0010
P.T.O. Side Main Bearing Dia.	1.0005 / 1.0010
Conn. Rod Dia. Crank Bearing	1.1880 / 1.1885
Piston Diameter	2.7427 / 2.7442

Piston Pin Diameter		.6250 / .6254
Width Comp. Ring Groove		.0795 / .0805
Width Oil Ring Groove		.1880 / .1890
Side Clearance Ring Groove	(Top) Comp.	.0020/.0035
	(Bot.) Comp.	.0015/.0035
	Oil	.0010/.0030
Ring End Gap		.010 / .020
Top Piston Land Clearance		.023 / .028
Piston Skirt Clearance		.0045 / .0060
Camshaft Bearing Dia.		.6235 / .6240
Cam Lobe Dia. Nose to Heel		1.267 / 1.263

TORQUE SPECIFICATIONS

		INCH POUNDS	FT. POUNDS
Cylinder Head Bolts		140 - 200	12 - 16
Connecting Rod Lock Nuts	1.5 - 3.5 H.P. 4 6 H.P.	65 - 75 86 - 110	5.5 - 6 7 - 9
Flange to Cylinder		65 - 110	5.5 - 9
Flywheel Nut		360 - 400	30 - 33
Spark Plug		180 - 240	15 - 20
Magneto Stator to Cylinder		60 - 84	5 - 7
Starter to Blower Housing		40 - 45	3.5
Blower Housing to Crankcase		72 - 96	6 - 8
Breather Cover		25 - 30	2 - 2.5
Intake Pipe to Cylinder		72 - 96	6 - 8
Carburetor to Intake Pipe		48 - 60	4 - 5
Air Cleaner to Carburetor		15 - 20	1 - 1.5
Muffler Bolts to Cylinder	1 - 3.5 H.P. 4 - 6 H.P.	35 - 45 90 - 150	3 - 3.5 8 - 12
Drain Plug (engine)		150 - 160	12 - 13

SECTION 2

GENERAL INFORMATION AND TROUBLESHOOTING

ENGINE IDENTIFICATION

Tecumseh engines are identified by model number stamped on a nameplate. The nameplate is located on the crankcase. (Fig 2-1) Always include the entire model number in any correspondence concerning the engine.

SHORTBLOCKS

When repairing an engine by using a shortblock, be sure the original engine tag containing the type number, is placed in a similar position on the shortblock.

For further identification, all identification tags on the shortblock should remain there.

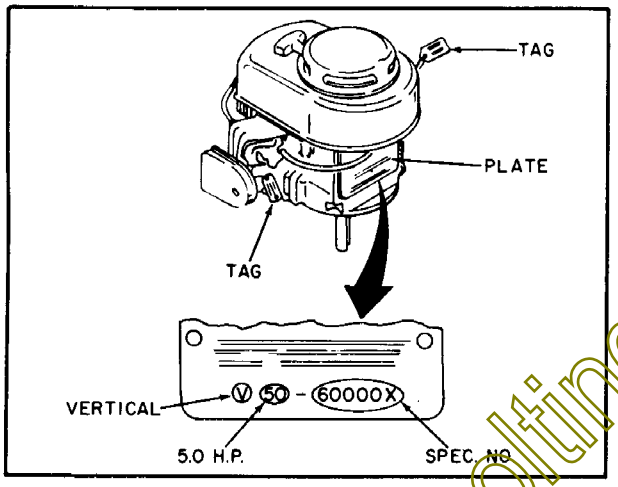


Figure 2-1

MAINTENANCE RULES to insure proper engine operation.

These rules should be observed.

1. Clean air filter regularly as required by operating conditions.
2. Use clean, fresh gasoline.
3. Do not mix oil with gasoline.
4. Use correct grade of motor oil, and make sure proper oil level is maintained.
5. Keep vent hole in fuel tank cap open.
6. Maintain proper cooling of engine. Keep engine shrouds free of dirt, grass, and other foreign matter.
7. Clean engine and exhaust ports frequently to prevent carbon buildup.
8. Make sure governor maintains correct speed range for application. Never run with a disconnected governor on governed models.
9. Tighten all fasteners, especially mounting bolts, to keep damaging vibration at a minimum.
10. If driven equipment is balanced, vibration will be cut down considerably.

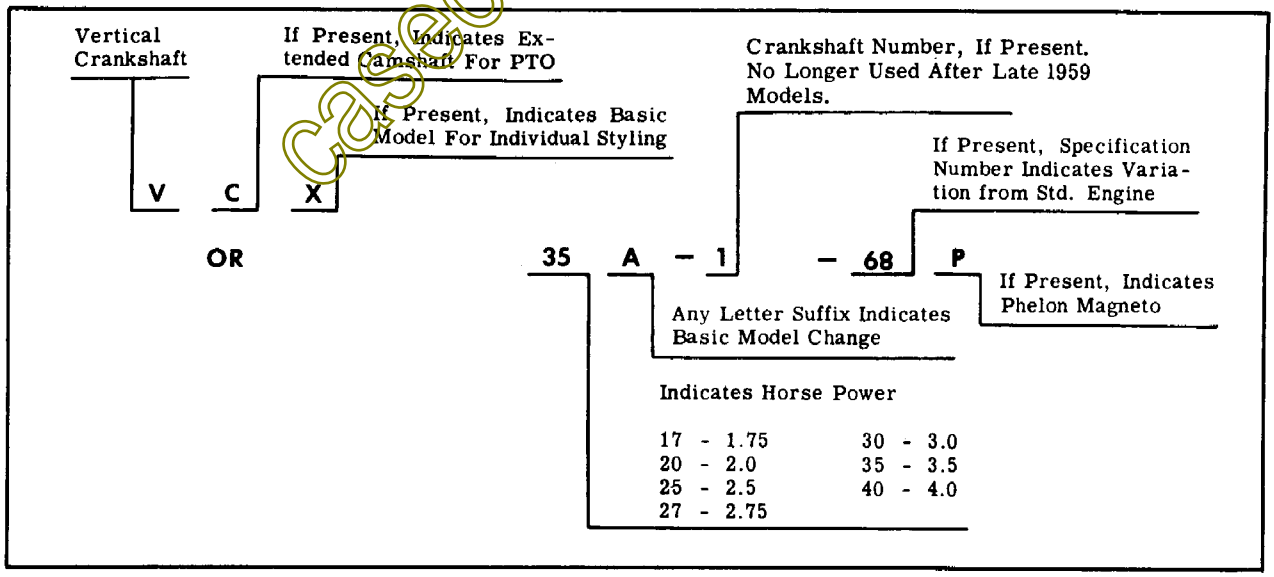


Figure 2-2

FUELS AND LUBRICANTS

Tecumseh 4-cycle engines are lubricated by oil distributed to the working parts by a pressure system, splash system, or combination system. The correct grade and type of oil for each engine will be found on the nameplate of the engine.

CAUTION Multiple weight oils such as all season, 10W-30, are not recommended, except in snow blower application.

GENERAL

Cleanliness of fuel and oil is essential for proper engine operation. Make sure that gasoline and oil are stored in clean, covered, rust-free containers. Dirt in fuel can clog small ports and passages of carburetor causing engine failure. Use fresh gasoline only. Gasoline, standing for long periods of time, develops a gum that will result in fouled spark plugs, clogged fuel lines, carburetors, and fuel screens. Dirty oil causes engine wear. When servicing engines showing indications of dirty gasoline or oil, report the conditions to the engine owner, cautioning him against continued use of contaminated fuels or lubricants.

ENGINE MOUNTING

The engine must be firmly and rigidly mounted on the associated equipment. Keep mounting bolts tight to prevent excessive vibration of the engine. On rotary lawnmowers, keep the blade properly balanced to eliminate vibration. Check equipment for free operation to prevent engine overloading.

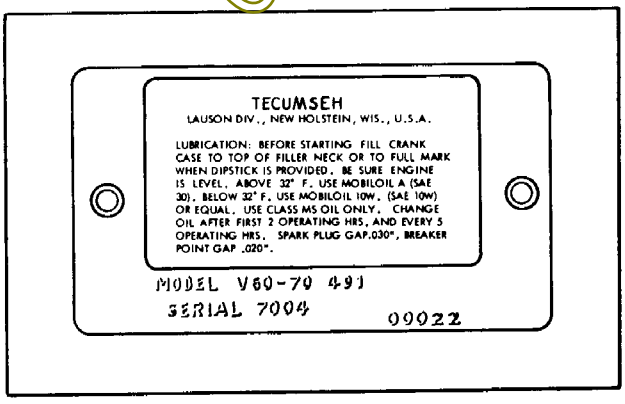
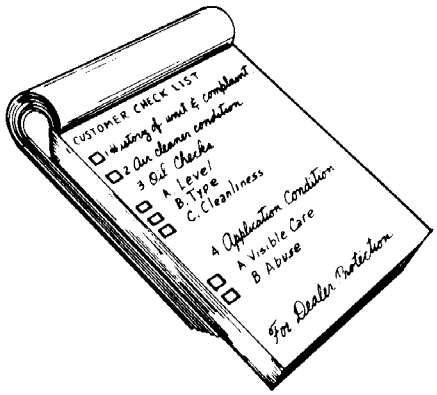


Figure 2-3



1. Note customer's complaints through an interview.

2. Check air cleaner condition.
   a. How Dirty?
   b. Is air cleaner, base, cover and element present and in good condition?

3. Check oil.
   a. Is level correct — too high, too low?
   b. Is oil sludged and gritty — (black oil is normal)
   c. What type of oil is used?
   Note: Brand, cost, weight, A.P.I. Classification.

4. The engine and application condition
   a. Is the unit clean — free from oil and dirt? Are the cooling fins clean and free from accumulated clippings, etc.
   b. Is the application well lubricated?
   c. Are blades sharp and balanced?
   d. Are all fasteners in place and tight?

Figure 2-4

ENGINE TUNE-UP PROCEDURE

Upon receiving an engine for repair, learn the history of the unit from the customer.

1. Service or replace air cleaner.

2. Clean fuel lines, filter, and tank.

3. Check engine compression with gauge. The crankshaft should resist turning as the piston approaches top-dead-center, then snap over sharply as top-dead-center is passed. Low compression engines should be overhauled. Cylinder compression in new engines is approximately 80 psi. When compression drops below 60 psi, rings or other parts are needed.

4. Clean and regap, or replace spark plug, refer to Electrical Manual.

5. Check governor operation. Adjust governor according to information given in Governor Section.

6. Check magneto. Adjust breaker point gap. Inspect magneto, condenser, and breaker point connections. Refer to Electrical Manual.

7. Fill crankcase with oil. Fill fuel tank with correct fuel.

8. Start engine. If engine does not start, refer to trouble chart.

9. Adjust carburetor.

10. Run engine, checking frequently for signs of improper operation.

COMMON TROUBLES AND REMEDIES. The following chart lists the most common troubles experienced with gasoline engines. Possible causes of trouble are given along with probable remedy.

ENGINE TROUBLESHOOTING CHART

Cause	Remedy and Reference
ENGINE FAILS TO START OR STARTS WITH DIFFICULTY	
No fuel in tank	Fill tank with clean, fresh fuel.
Shut-off valve closed	Open valve.
Obstructed fuel line	Clean fuel screen and line. If necessary, remove and clean carburetor.
Tank cap vent obstructed	Open vent in fuel tank cap.
Water in fuel	Drain tank. Clean carburetor and fuel lines. Dry spark plug points. Fill tank with clean, fresh fuel.
Engine over-choked.	Close fuel shut-off and pull starter until engine starts. Reopen fuel shut-off for normal fuel flow.
Improper carburetor adjustment	Adjust carburetor.
Loose or defective magneto wiring	Check magneto wiring for shorts or grounds; repair if necessary.
Faulty magneto	Check timing, point gap, and, if necessary, overhaul magneto.
Blown head gasket	If head or cylinder not warped, replace with new gasket. Retorque head bolts. See Fig. 10-1. Torque per requirements
Crankcase seals leak	Replace worn crankcase seals. Some engines do not have a lower seal. Check bearing surface of bottom half of crankcase.
Loose blade adapter and/or pulley	Tighten loose parts

ENGINE TROUBLESHOOTING CHART (Cont.)

Cause	Remedy and Reference
ENGINE FAILS TO START OR STARTS WITH DIFFICULTY (Cont.)	
Spark plug fouled	Clean and regap spark plug.
Spark plug porcelain cracked	Replace spark plug.
Poor compression	Overhaul engine.
ENGINE KNOCKS	
Carbon in combustion chamber	Remove cylinder head or cylinder and clean carbon from head and piston.
Loose or worn connecting rod	Replace connecting rod.
Loose flywheel	Check flywheel key and keyway; replace parts if necessary. Tighten flywheel nut to proper torque (Table of Specifications).
Worn cylinder	Replace cylinder.
Improper magneto timing	Time magneto.
ENGINE MISSES UNDER LOAD	
Spark plug fouled	Clean and regap spark plug.
Spark plug porcelain cracked	Replace spark plug
Improper spark plug gap	Regap spark plug.
Pitted magneto breaker points	Clean and dress breaker points. Replace badly pitted breaker points.
Magneto breaker arm sluggish	Clean and lubricate breaker point arm.
Faulty condenser (except on Tecumseh Magneto)	Check condenser on a tester, replace if defective.
Improper carburetor adjustment	Adjust carburetor.

Cause	Remedy and Reference
ENGINE MISSES UNDER LOAD (Cont.)	
Improper valve clearance	Adjust valve clearance.
Weak valve spring	Replace valve spring.
Crankcase seals leak	Replace worn crankcase seals. Some engines have no lower seal. Check bearing surface of bottom half of crankcase.
ENGINE LACKS POWER	
Choke partially closed	Open choke.
Improper carburetor adjustment	Adjust carburetor.
Magneto improperly timed	Time magneto.
Worn piston or rings	Replace piston or rings.
Lack of lubrication	Fill crankcase to the proper level.
Air cleaner fouled	Clean air cleaner.
Valves leaking	Grind valves.
Blown head gasket	If head or cylinder not warped, replace gasket. Retorque head bolts. See Fig. 10-1. Torque per requirements.
Crankcase seals leaking	Replace worn crankcase seals. Some engines have no lower seal. Check bearing surface of crankshaft.
Carburetor dirty or damaged.	Clean and repair carburetor.
Ignition system malfunction.	Check and repair system,
ENGINE OVERHEATS	
Engine improperly timed	Time engine.

ENGINE TROUBLESHOOTING CHART (Cont.)

Cause	Remedy and Reference
ENGINE OVERHEATS (Cont.)	
Carburetor improperly adjusted	Adjust carburetor.
Air flow obstructed	Remove any obstructions from air passages in shrouds.
Cooling fins clogged	Clean cooling fins.
Excessive load on engine	Check operation of associated equipment. Reduce excessive load.
Carbon in combustion chamber	Remove cylinder head or cylinder and clean carbon from head and piston.
Lack of lubrication	Fill crankcase to proper level.
Pulleys too tight	Follow prescribed pulley tension requirements. (See Owner's Manual.)
ENGINE SURGES OR RUNS UNEVENLY	
Fuel tank cap vent hole clogged	Open vent hole.
Governor parts sticking or binding.	Clean, and if necessary repair governor parts.
Carburetor throttle linkage or throttle shaft and/or butterfly binding or sticking.	Clean, lubricate, or adjust linkage and deburr throttle shaft or butterfly.
ENGINE VIBRATES EXCESSIVELY	
Engine not securely mounted	Tighten loose mounting bolts.
Bent crankshaft	Replace crankshaft.
Associated equipment out of balance	Check associated equipment.
Loose blade adapter and/or pulley	Tighten loose parts.
BREATHER PASSING OIL	
Engine speed too fast	Use tachometer to adjust correct RPM.

ENGINE TROUBLESHOOTING CHART (Cont.)

Cause	Remedy and Reference
BREATHER PASSING OIL (Cont.)	
Loose oil fill cap or gasket damaged or missing.	Install new ring gasket under cap and tighten securely.
Oil level too high	Check oil level – Turn dipstick cap tightly into receptacle for accurate level reading. DO NOT fill above full mark.
Breather mechanism damaged	Check reed plate and assembly and replace complete unit.
Breather mechanism dirty	Clean thoroughly in solvent. Use new gaskets when reinstalling unit.
Drain hole in breather box clogged.	Clean hole with wire to allow oil to return to crankcase.
Piston ring end gaps aligned.	Rotate end gaps so as to be staggered 90° apart.
Breather mechanism installed upside down	Small oil drain holes must be down to drain oil from mechanism.
Breather mechanism loose or gaskets leaking.	Install new gaskets and tighten securely.
Damaged or worn oil seals on end of crankshaft.	Replace seals.
Rings not seated properly.	Check for worn or out of round cylinder. Replace rings. Break in new rings with engine working under a varying load. Rings must be seated under high compression or in other words under varied load conditions.
Breather assembly not assembled correctly	Reassemble correctly.
Cylinder cover gasket leaking	Replace cover gaskets.
HIGH OIL CONSUMPTION	
Burning oil	Check for worn rings, replace.
Excessive load on engine	Check operation of associated equipment. Reduce excessive load.

Cause	Remedy and Reference
HIGH OIL CONSUMPTION (Cont.)	
Engine speed too fast	Use tachometer to adjust correct RPM.
Loose oil fill cap or gasket damaged or missing	Install new ring gasket under cap and tighten securely.
Oil level too high	Check oil level — Turn dipstick cap tightly into receptacle for accurate level reading. DO NOT fill above full mark.
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Rings not seated properly	Check for worn or out of round cylinder. Replace rings. Break in new rings with engine working under a varying load. Rings must be seated under high compression or in other words under varied load conditions.
Cylinder cover gasket leaking.	Replace cover gaskets.

ENGINE REMOVAL

1. Remove attachment drive and tractor drive belts as outlined in operators manual.

2. Remove two hood attaching screws and nuts, disconnect lights if equipped, and remove hood.

3. Remove choke-throttle linkage from carburetor.

4. Remove fuel line from carburetor and plug line, or drain fuel tank.

5. Remove battery ground cable and starter leads.

6. Remove locknuts, washers, and rubber cushions from studs at front of engine mounting plate.

7. Remove top nuts and lockwashers from two rear engine mounts.

8. Remove bottom nut, lockwasher and flat washer from front engine mount.

9. Lift front of engine until front mount is free then pull up and forward to remove engine.

Reverse removal procedure to install.

SECTION 3

CARBURETOR-GENERAL INFORMATION

AIR CLEANER SERVICE

Service the air cleaner frequently to prevent clogging of the cleaner and to prevent dust and dirt from entering the engine. Service the air cleaner as follows:

PAPER TYPE ELEMENT

Remove every 10 hours or oftener if under dusty conditions. Tap to remove loose dirt and/or blow from inside out with low pressure air. Replace if torn or perforated or when plugged to maintain proper carburetor setting (50 hrs.). Do Not Wash In Any Liquid And Do Not Oil. Wipe inside of housing to remove all dirt, replace element.

GENERAL

The fuel system consists of a carburetor, air cleaner, fuel tank, and fuel lines. The function of the system is to mix fuel and air in the proper proportion so that the mixture will burn efficiently in the engine at any rate of speed.

Float feed carburetors (figure 3-1) use a hollow metal float to maintain the operating level of fuel in the carburetor. As the fuel is used, the fuel level in the carburetor bowl drops and the float moves downward. This actuates the inlet needle valve to allow fuel to flow by gravity into the fuel bowl. As the fuel level in the bowl again raises, it raises the float. This float motion closes the needle valve to stop the fuel flow at the proper level.

CARBURETOR OPERATION

The carburetor is designed to provide the correct fuel mixture to the engine at any operating speed.

In the CHOKE position, the choke shutter is closed, and the only air entering the engine enters through openings around the shutter. As the starting device is operated to start the engine, the air pressure in the carburetor is reduced as air is drawn into the engine. Since the air passage is blocked by the choke shutter, fuel is drawn from the main nozzle and from both idle fuel discharge ports and mixes with the air that passes through the throttle shutter. This makes a very rich fuel mixture which is needed to start a cold engine.

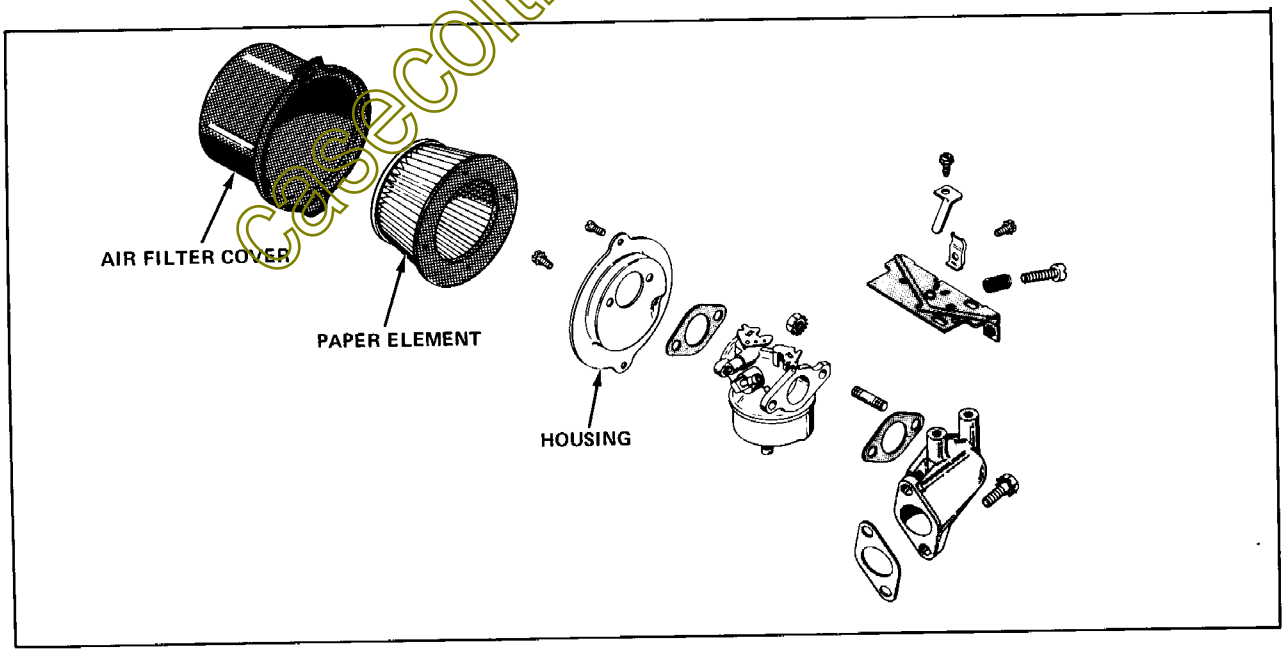


Figure 3-1

At IDLE, a relatively small amount of fuel is required to operate the engine. The throttle is almost closed, shutting off the fuel supply from all except the one idle fuel discharge orifice, so that the suction created by the engine draws fuel only from that orifice.

During INTERMEDIATE operation, a second orifice is uncovered as the throttle shutter opens, and more fuel is allowed to mix with the air flowing into the engine.

During HIGH SPEED operation, the throttle shutter is fully opened. Air flows through the carburetor at high speed. The venturi, which decreases the size of the air passage through the carburetor, further accelerates the air flow. This high speed movement of the air decreases the air pressure, and fuel is drawn into the air stream through the main nozzle that opens into the venturi, mixing with the air in the air passage. As the engine load increases, air is automatically bled into the main nozzle through the air bleed tube located in the air horn. This allows liquid fuel to be metered freely from the main nozzle.

FUEL MIXTURE ADJUSTMENTS

Check adjustment screw tip for damage. If ridge ring on seat area can be felt with thumb nail, needle must be replaced. See Figure 3-2.

Three screws must be adjusted before attempting to operate a newly overhauled carburetor.

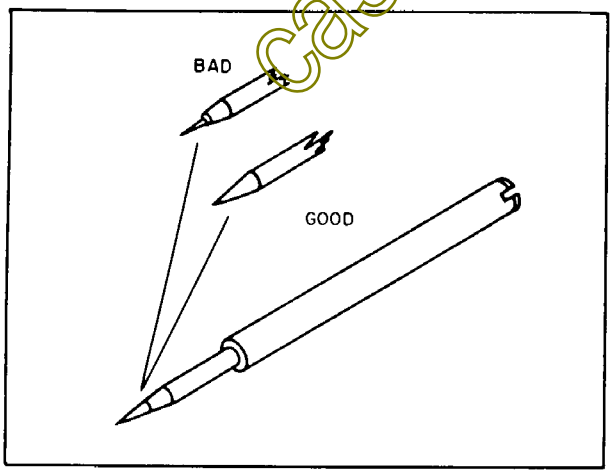


Figure 3-2

ADJUSTMENT	APPROXIMATE SETTING
Main Mixture and Idle Mixture Needles	Turn completely in finger-tight and then back out 1 turn.
Idle Speed (Top of Carburetor) Screw	Back out screw. Then turn in until screw just touches throttle lever and continue 1 turn more.

FINAL CARBURETOR ADJUSTMENTS

Allow engine to warm up to normal running temperature. With engine running at maximum recommended RPM, loosen main metering screw until engine "lopes" or rolls, then tighten screw until engine starts to cut out. Note the number of turns from one extreme to the other. Loosen screw to a point midway between the extremes. (Fig. 3-3)

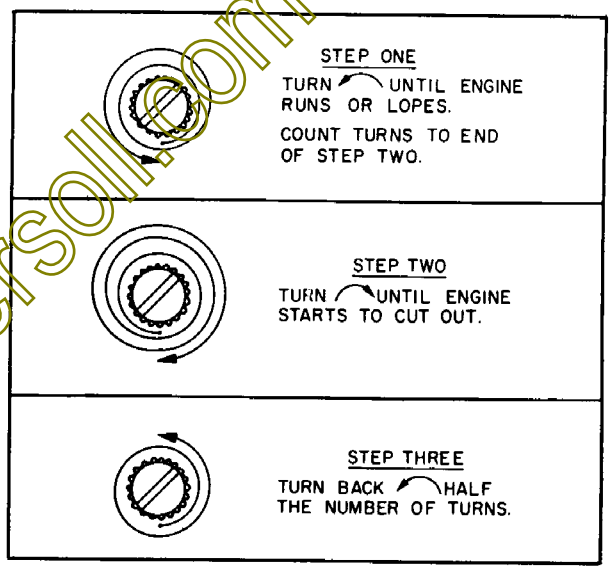


Figure 3-3

CARBURETOR INSTALLATION

1. Secure carburetor on engine.
2. Install shrouding or control panels. Connect choke and throttle control wires.
3. Position control panel to carburetor. Connect carburetor fuel lines.
4. Install air cleaner.
5. Adjust carburetor as described in fuel mixture adjustment section. Adjust carburetor linkage for control panel operated carburetors as described in carburetor control linkage section.

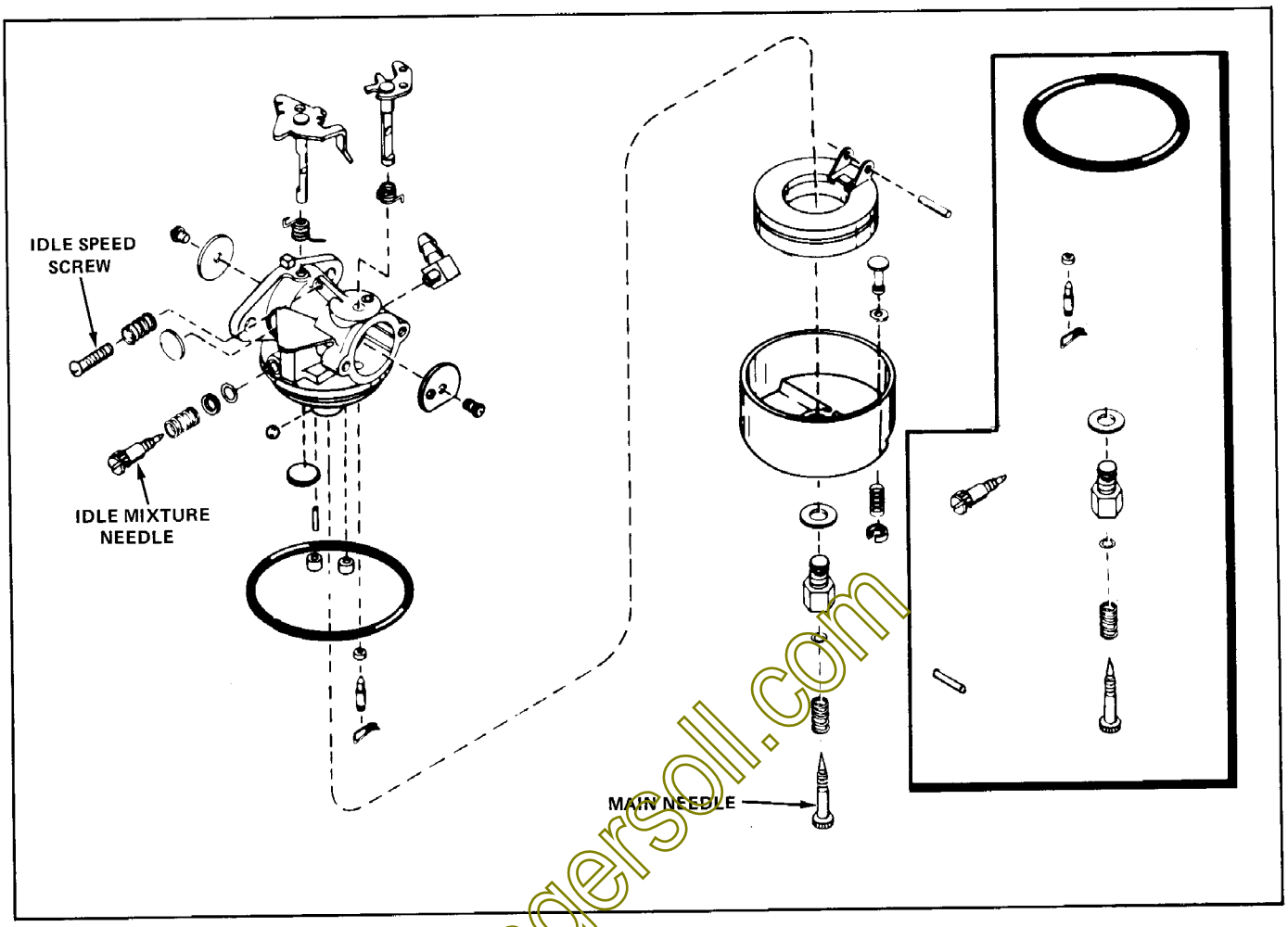
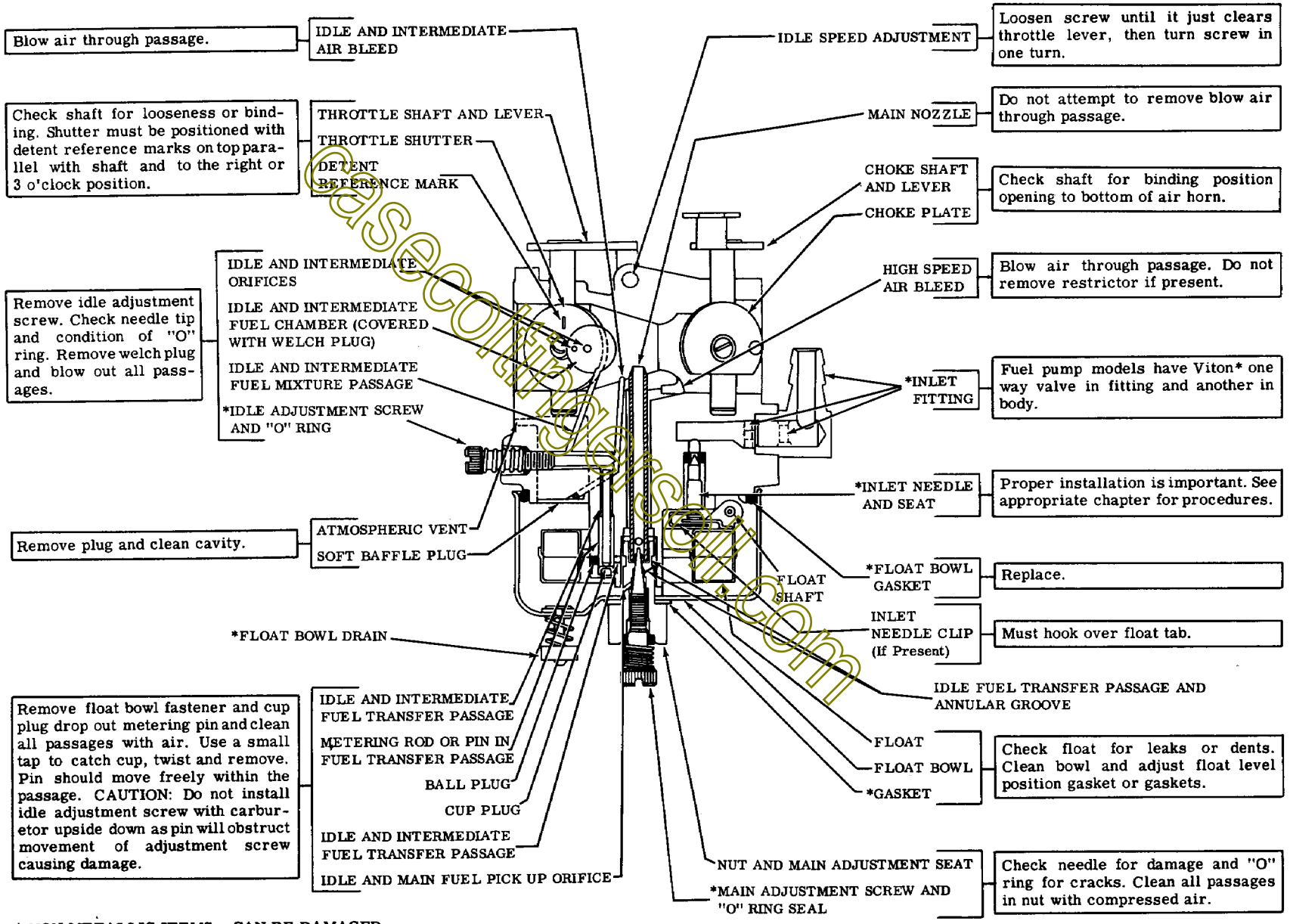


Figure 3-4

POINTS TO CHECK FOR CARBURETOR MALFUNCTION

TROUBLE	CORRECTIONS
Carburetor out of adjustment	3-11-12-13-15-20
Engine will not start	1-2-3-4-5-6-8-11-12-14-15-19-24
Engine will not accelerate	2-3-11-12-24
Engine hunts (at idle or high speed)	3-4-8-9-10-11-12-20-21-24
Engine will not idle	4-8-9-11-12-13-14-20-21-22-24
Engine lacks power at high speed	2-3-6-8-11-12-20-21-24
Carburetor floods	4-7-17-21-22
Carburetor leaks	6-7-10-18-23-24
Engine overspeeds	8-9-11-14-15-18-20
Idle speed is excessive	8-9-13-14-15-18-20
Choke does not open fully	8-9-15
Engine starves for fuel at high speed (leans out)	1-3-4-6-11-15-17-19-21
Carburetor runs rich with main adjustment needle shut off	7-11-17-18-19-21
Performance unsatisfactory after being serviced.	1-2-3-4-5-6-7-8-9-10-11-15-16-17-18-19-20-21

1. Open fuel shut off valve at fuel tank - fill tank with fuel.
2. Check ignition, spark plug and compression.
3. Clean air cleaner - service as required.
4. Dirt or restriction in fuel system - clean tank and fuel strainers, check for kinks or sharp bends.
5. Check for stale fuel or water in fuel - fill with fresh fuel.
6. Examine fuel line and pick-up for sealing at fittings.
7. Check and clean atmospheric vent holes.
8. Examine throttle and choke shafts for binding or excessive play - remove all dirt or paint, replace shaft.
9. Examine throttle and choke return springs for operation.
10. Examine idle and main mixture adjustment screws and "O" rings for cracks or damage.
11. Adjust main mixture adjustment screw - some models require finger tight adjustment. Check to see that it is the correct screw.
12. Adjust idle mixture adjustment screw. Check to see that it is the correct screw.
13. Adjust idle speed screw.
14. Check position of choke and throttle plates.
15. Adjust control cable or linkage to assure full choke and carburetor control.
16. Clean carburetor after removing all non-metallic parts that are serviceable. Trace all passages.
17. Check inlet needle and seat for condition and proper installation.
18. Check sealing of welch plugs, cups, plugs and gaskets.
19. Check fuel pump operation - pump element, inner and outer one way valves.
20. Adjust governor linkage.
21. Adjust float setting.
22. Check float shaft for wear and float for leaks or dents.
23. Check seal for fuel drain or bowl gasket.
24. Is carburetor operating at excessive angle - 31° or more?



* NON METALLIC ITEMS - CAN BE DAMAGED BY HARSH CARBURETOR CLEANERS

SECTION 4

CARBURETOR-SERVICE

IDENTIFICATION

When servicing this carburetor, use the Parts Manual for the proper service parts information. Further identification of the carburetor is stamped on the carburetor body as shown in Figure 3-1. Refer to the standard service part number and the identification number on the carburetor body (Figure 3-1), in any correspondence.

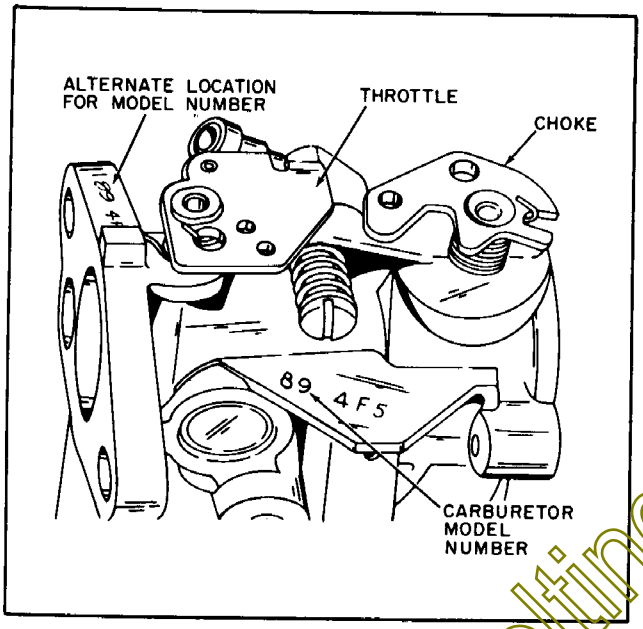


Figure 4-1

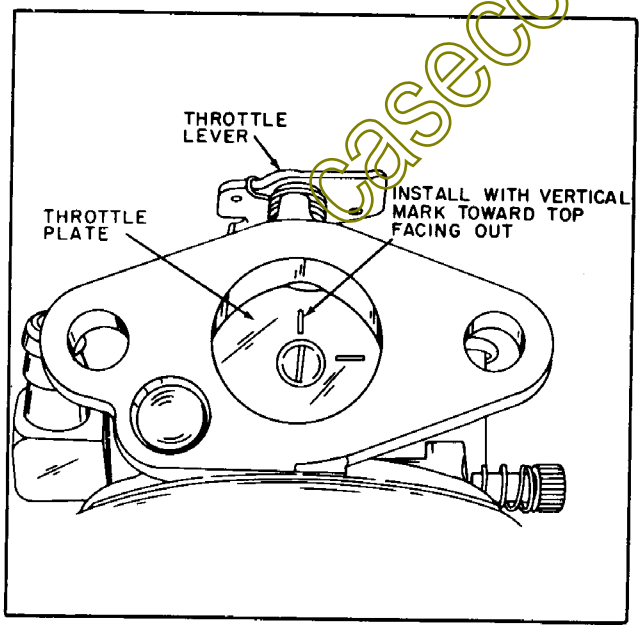


Figure 4-2

This carburetor is a conventional float type carburetor with refinements for better operation and ease of servicing.

DISASSEMBLY AND SERVICE INSTRUCTIONS: (Figure 4-3)

Remove the carburetor from the engine. Normally, it is easier to remove the intake manifold and carburetor assembly from the engine, disconnect the governor linkage, fuel line and grounding wire, and disassemble the carburetor from the intake manifold at the work bench.

The following instructions are in a sequence to be followed for complete overhaul of this carburetor. If it is necessary to service only a portion of the carburetor, follow the instructions pertaining to that service.

THROTTLE - Examine the throttle lever and plate prior to disassembly. Replace any worn parts.

a. Remove the screw in the center of the throttle plate and pull out the throttle shaft lever assembly. (Figure 4-2)

b. When reassembling, it is important that the lines on the throttle plate (Figure 4-2) are facing out when in the closed position. Position throttle plates with two lines, at 12 and 3 o'clock. The throttle shaft must be held in tight to the bottom bearing to prevent the throttle plate from riding on the throttle bore of the body, causing excessive throttle plate wear and governor hunting.

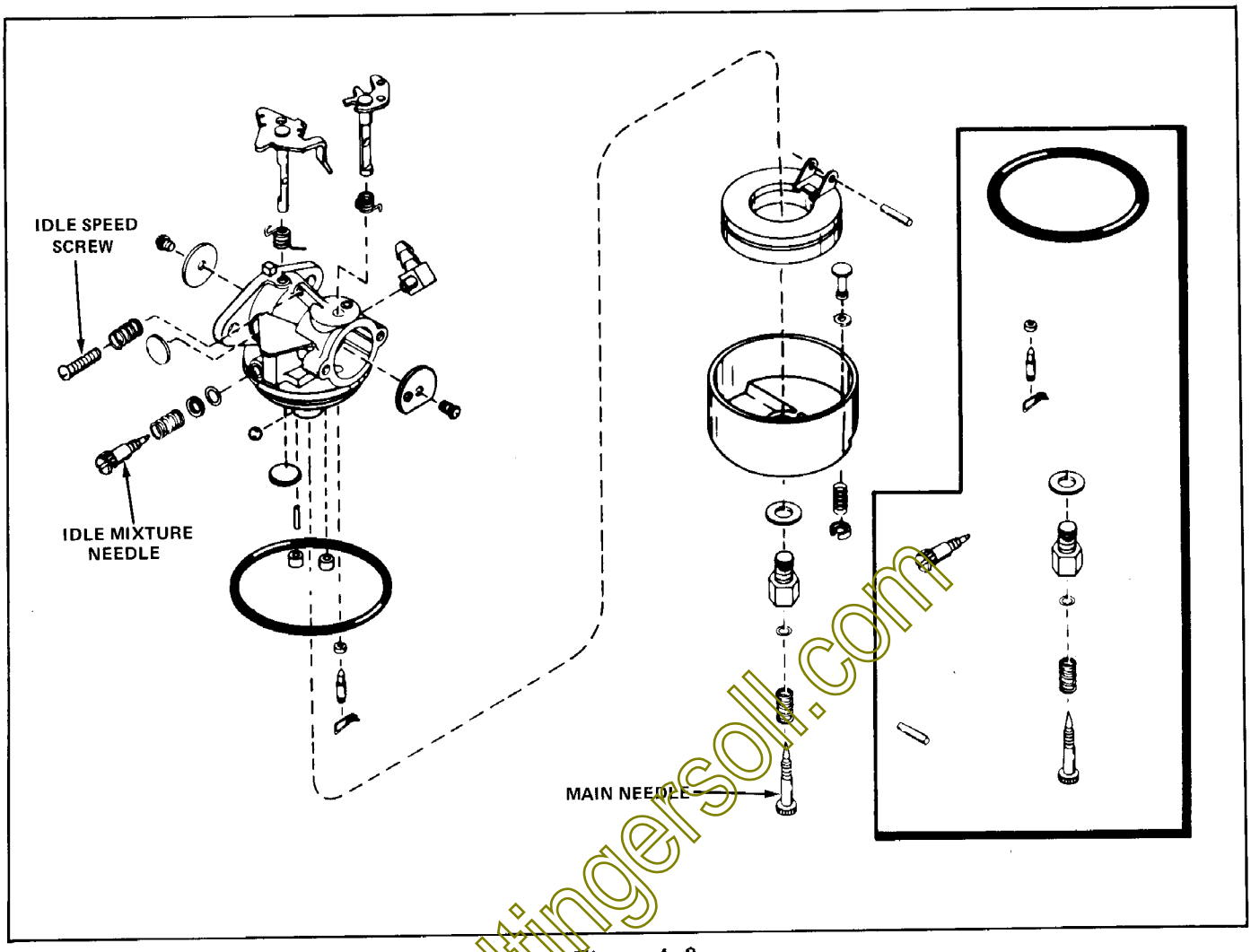


Figure 4-3

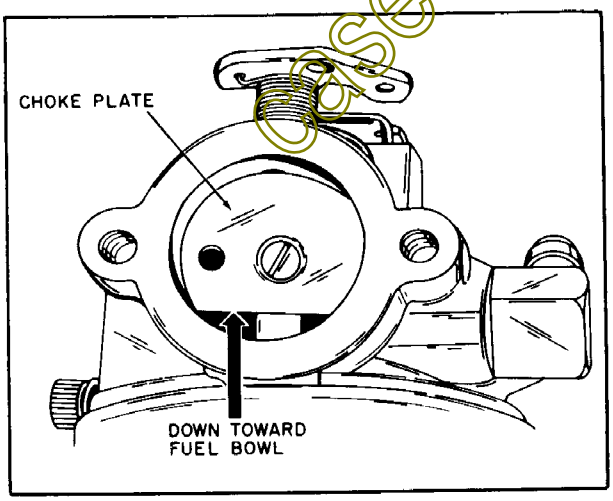


Figure 4-4

CHOKE. Examine the choke lever and shaft at the bearing points and holes into which the linkage is fastened, (Figure 4-5) and replace if worn. The choke plate is inserted into the air horn of the carburetor in such a position that the flat surface of the choke (Figure 4-4) is toward the fuel bowl. Record the choke plate movement. Choke plates will operate either clockwise or counterclockwise. Hold the choke shaft securely into the bearing bore when replacing the choke plate. This will prevent binding and excessive choke plate wear.

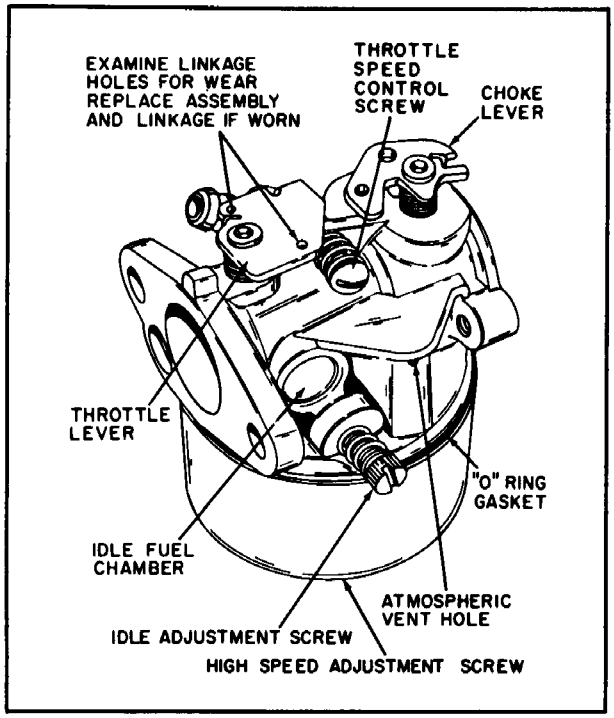


Figure 4-5

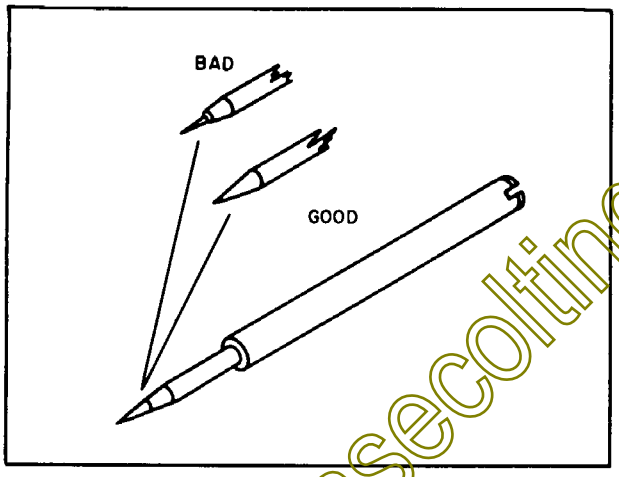


Figure 4-6

IDLE ADJUSTING SCREW

Remove the idle screw from the carburetor body and examine the point for damage to the seating surface on the taper. (Figure 4-6) If damaged; replace the idle adjusting needle. Tension is maintained on the screw with a coil spring and sealed with an "O" ring. Examine and replace the "O" ring if damaged.

HIGH SPEED ADJUSTING SCREW

For service examine the taper of the high speed adjusting screw. (Figure 4-6) If the taper is damaged at the area where it seats, replace the screw and fuel bowl retainer nut as an assembly.

The fuel bowl retainer nut contains the seat for the screw. Examine the sealing "O" ring, the high speed adjusting screw. Replace if it indicates wear or cuts.

During high speed adjusting screw reassembly, position the coil spring on the adjusting screw, followed by the small brass washer and the "O" ring seal.

FUEL BOWL RETAINING NUT - remove the fuel bowl retaining nut and fiber washer. (Figure 4-7) Replace the washer, if cracked or worn.

a. The retaining nut contains the transfer passage through which fuel is delivered to the high speed and idle fuel system of the carburetor. It is the larger hole closest to the hex nut end of the fitting. If a problem occurs with the idle system of the carburetor, examine the small fuel passage in the annular groove in the retaining nut. This passage must be clean for the proper transfer of fuel into the idle metering system.

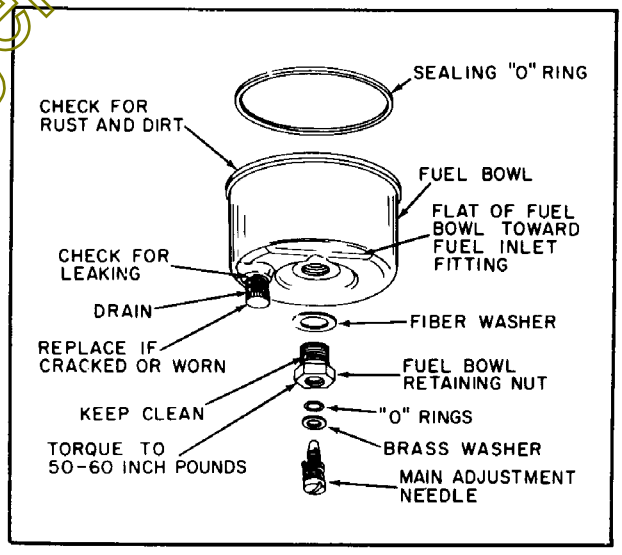


Figure 4-7

b. When replacing, torque the fuel bowl nut to 50-60 inch pounds.

FUEL BOWL - Fuel bowl should be examined for rust and dirt. (Figure 4-7) Thoroughly clean before replacing. If it is impossible to properly clean the fuel bowl, replace it.

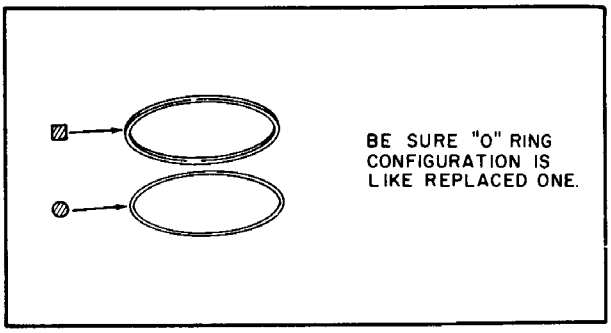


Figure 4-8

a. Check the fuel bowl drain for leaking. Replace the rubber gasket on the inside of the drain valve.

b. The large "O" rings (Figures 4-7 and 4-8) sealing the fuel bowl to the carburetor body must be in good condition to prevent leakage. Examine the "O" ring for swelling or cuts. Moisten the "O" ring seal with either water or a very small amount of fuel or oil to allow the fuel bowl to slide onto the "O" ring properly. Hold the carburetor body in an inverted position and place the "O" ring on the carburetor body and then position the fuel bowl.

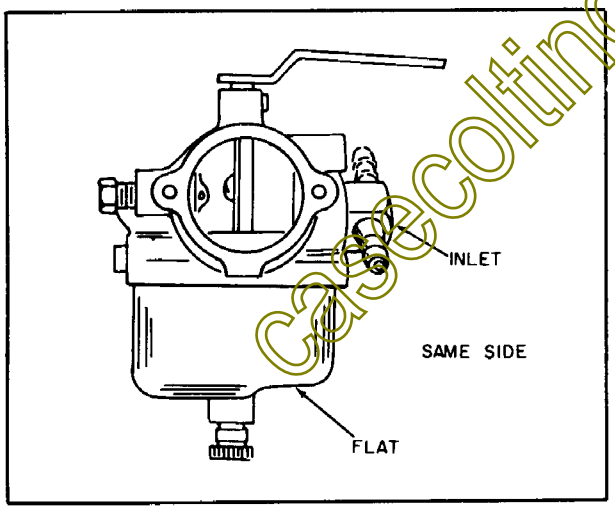


Figure 4-9

CAUTION

The fuel bowl flat surface must be positioned on the same side of the carburetor as the fuel inlet fitting. (Figure 4-9)

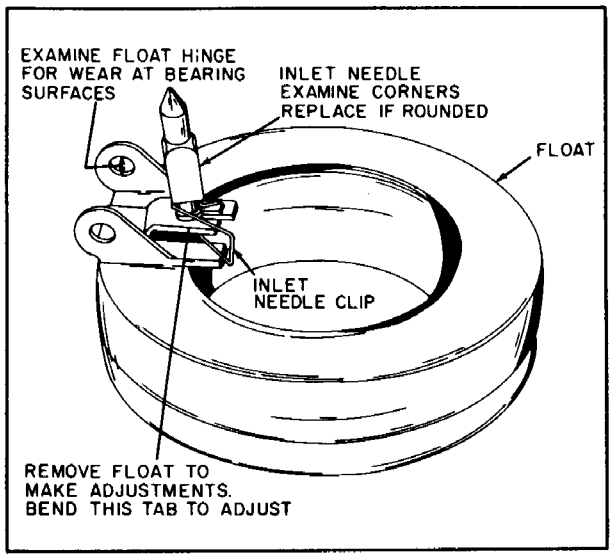


Figure 4-10

FLOAT - Remove the float (Figure 4-10) from the carburetor main body by pulling out the float axle with a pair of needle nose pliers.

CAUTION

When the float is being removed from the carburetor body the inlet needle will be lifted off of the seat, because it is attached to the float with an anchoring clip.

a. Examine the float for crushing or holes. Examine the float hinge (Figure 4-10) bearing surfaces through which the float axle passes and replace if worn. Excessive wear on the tab of the float hinge that contacts the inlet needle will require replacement of the float to assure proper fuel metering within the carburetor.

b. When the float is reassembled with the inlet needle in position the float setting is measured as indicated below. Two different float settings are available. The index pad on the carburetor body dictates which setting to use.

1. If the index pad on the carburetor body is not machined, measure the float setting from the rim of the carburetor body. The float setting from the rim of the carburetor body to the float is .200" -.220". For convenience, place a No. 4 (.209") twist drill across the rim between the center leg and the unmachined index pad, parallel to the float axle. (Figure 4-11) This will assure a uniform float setting.

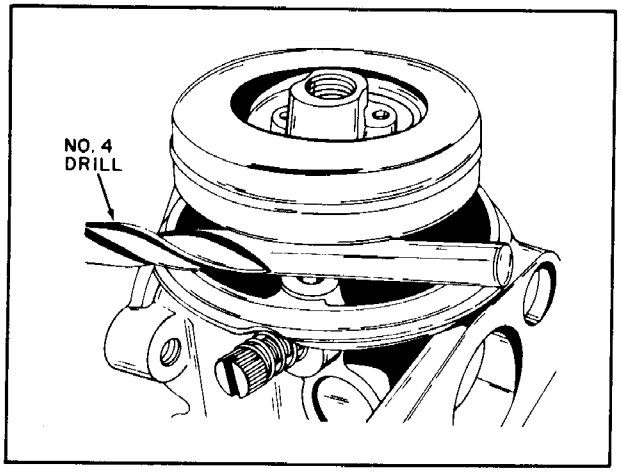


Figure 4-11

2. Remove the float to make adjustments. Bend the tab on the float hinge to correct setting.

3. Examine the float axle and bearing surface of the float hinge for wear. Replace if worn. Accurate float setting is not possible with worn parts.

CAUTION

Do not use compressed air to flush carburetor unless fuel bowl and float have been removed.

Then - always direct low pressure air through system opposite normal fuel flow to dislodge foreign matter toward reverse taper of any restricting passages.

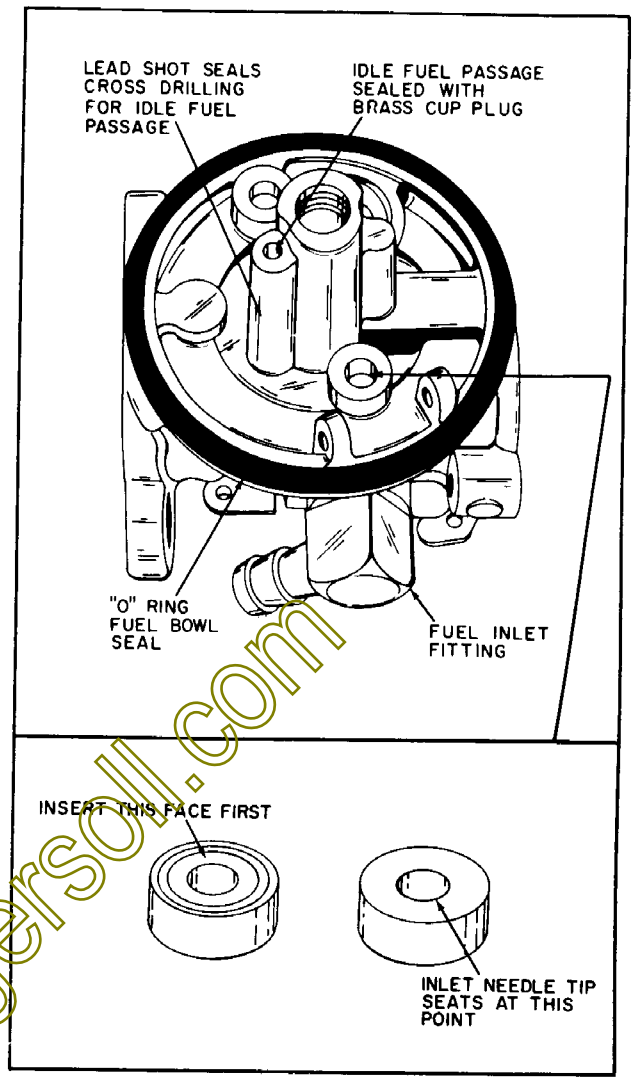


Figure 4-12

INLET NEEDLE AND SEAT - (Figure 4-12) The inlet needle and seat in this carburetor are of a different design than is normally found in a float carburetor. There is no inlet seat fitting to remove during disassembly. The inlet needle is anchored to the float tab by a clip, (Figure 4-10) to assure proper movement of the inlet needle off of the seat when the float drops. The inlet needle clip must be positioned as shown in Figures 4-10 and 4-14 during reassembly.

a. Examine the inlet needle. If any wear is evident, or any of the corners show signs of rounding, the needle should be replaced. See Figure 4-6.

b. The inlet needle seals on a Viton rubber seat in the carburetor body. To remove, put a few drops of heavy engine oil on the seat. Place an air hose to the inlet fitting and allow a short blast of air to pass through blowing out the seat. The seat may also be pried out with a short piece of hooked wire. Examine for cuts and scratches. The seat (Figure 4-12) is inserted grooved side first. Moisten the cavity with oil and use a flat faced punch to press the inlet seat into position.

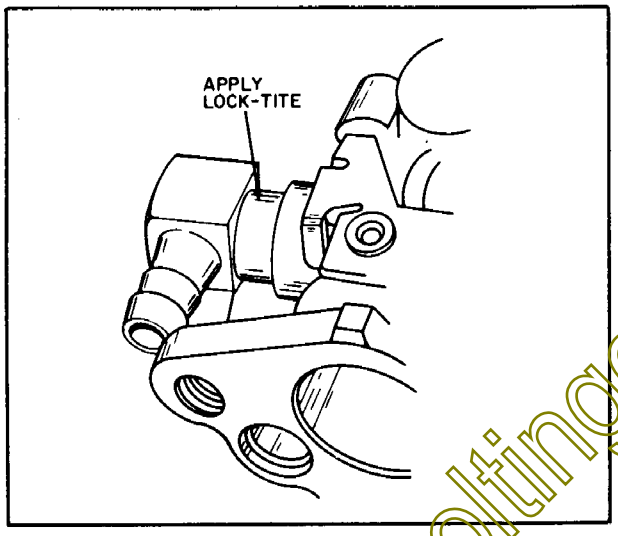


Figure 4-13

FUEL INLET FITTING

The fitting may be removed from the carburetor by twisting and pulling. Make a note of the position in which the fitting was originally installed for proper fuel flow when the carburetor is re-installed on the engine.

When inserting the fitting into the carburetor body, seal it with Lock-tite grade A. Insert the tip of the fitting (Figure 4-13) into the carburetor body, then coat the remainder of the shank with Lock-tite grade A. Press the fitting in until the shoulder contacts the carburetor. Use inlet fittings without screens for replacement only.

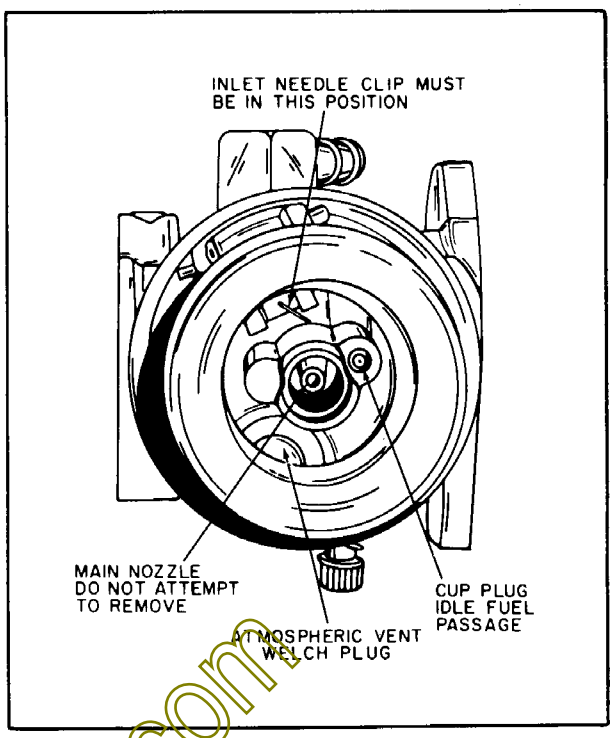


Figure 4-14

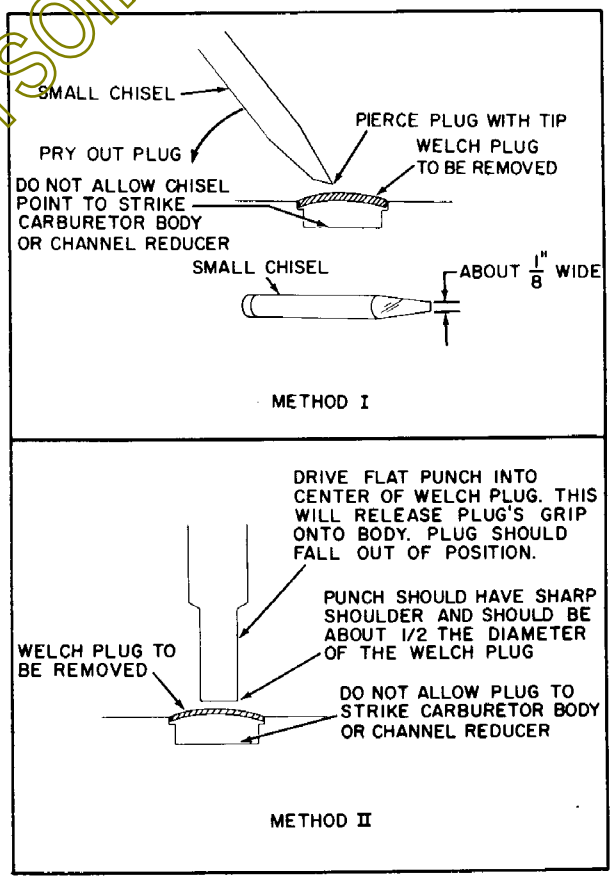


Figure 4-15

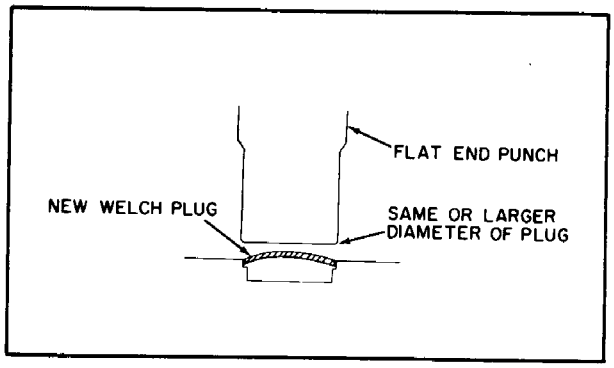


Figure 4-16

WELCH PLUG SERVICE

Removing Welch Plug (Figure 4-15)

Method 1

1. Drive small chisel into welch plug.

2. Push down on chisel to pry plug out of position.

   Sharpen small chisel to sharp wedge as shown in figure.

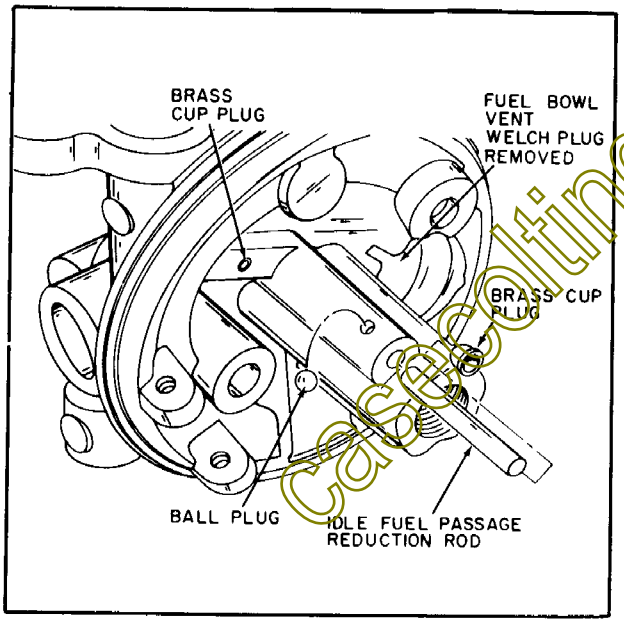


Figure 4-17

Method II

1. Select flat punch size equal to about 1/2 the diameter of welch plug.

2. Drive punch into center of plug. Dent in plug will release its grip on carburetor body and plug will fall out of position.

Installing New Welch Plug (Figure 4-15)

1. Clean receptacle in carburetor body thoroughly.

2. Place welch plug into receptacle with convex (raised portion) up.

3. With punch that is equal or greater than size of plug, flatten plug by striking punch with hammer.

   CAUTION: Merely flatten welch plug. Do not dent or drive the center of the plug below the top surface of the carburetor.

CARBURETOR BODY - Examine the carburetor body for wear and damage.

a. It may be necessary to remove the large welch plug (Figures 4-14 and 4-17) if excessive dirt has accumulated in the atmospheric vent cavity, or it may be possible to clean this cavity with carburetor cleaner or compressed air without removing the welch plug.

b. The carburetor body contains a main nozzle tube (Figure 4-14) pressed into the carburetor body to a predetermined depth and positioning within the venturi of the carburetor. Do not attempt to remove this main nozzle. Any movement of this nozzle will seriously affect the metering characteristics of the carburetor and will require replacement of the entire carburetor.

c. Clean the accelerating well surrounding the main nozzle with compressed air and carburetor cleaning solvents. With the choke plate and shaft removed, compressed air may be blown in through the high speed air bleed, (located just behind the lower choke shaft bearing and immediately in front of the venturi) to remove any dirt that may have accumulated.

d. The carburetor body contains two cup plugs. (Figure 4-17)

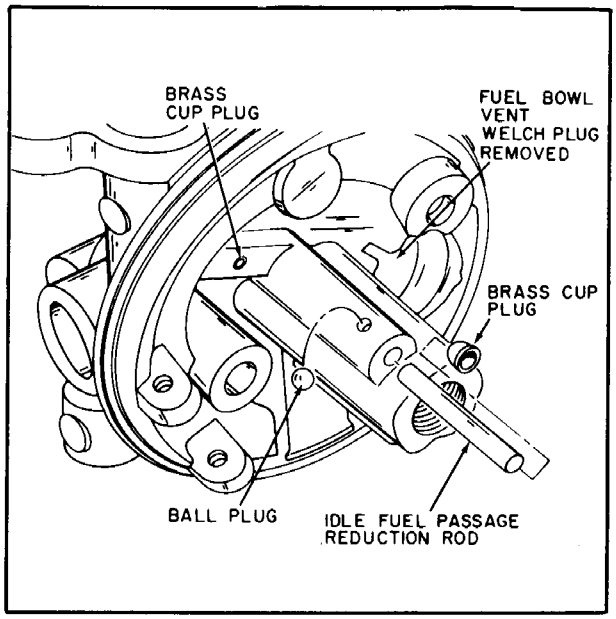


Figure 4-17

1. A cup plug, located near the inlet seat cavity, high up on the carburetor body, seals off the idle air bleed. This is a straight passage drilled into the carburetor throat. If removed, a new plug must be used to assure proper sealing of the passage.

2. Another cup plug is located in the base (Figures 4-14 and 4-17) where the fuel bowl nut seals the idle fuel passage. Removal of this plug will allow removal of the metering rod (Figure 4-17) from the idle fuel passage. A new plug must always be used for replacement, and must be tightly sealed when it is replaced.

3. A small ball plug (Figure 4-17) located on the side of the idle fuel passage allows access to the idle fuel cross passage. This small fuel passage has been calibrated. Do not insert improper sized drill rods for cleaning purposes. If removed, it is very important that the cross passage be tightly sealed with a new plug.

   a. When inserting a new ball plug into the idle fuel passage, insert a tight drill rod into the idle fuel passage to act as an anvil, preventing driving the ball plug in too deeply.

e. A welch plug on the side of the carburetor body, just above the Idle Adjusting Screw seals the Idle Fuel Chamber. (Figure 4-18) This welch plug may be removed for thorough cleaning of the idle fuel mixture passage and the Primary and Secondary Idle Fuel discharge ports. Clean with solvent and compressed air. DO NOT use any tools that may change the size of the discharge ports.

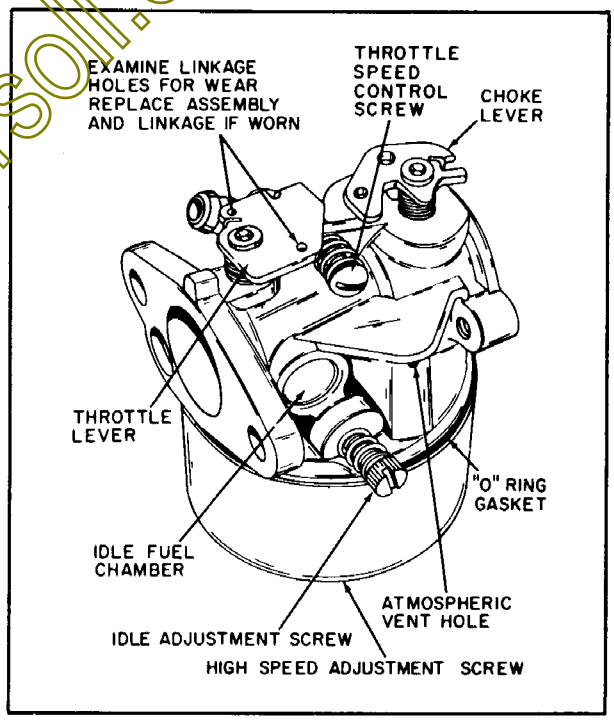


Figure 4-18

SECTION 5

GOVERNOR SERVICE

MECHANICAL GOVERNORS

NOTE

Skip steps 1 and 2 if existing control system has not been removed.

1. Install solid linkage between governor lever and throttle lever. Install linkage in top governor lever hole (Figure 5-1).

2. Install governor spring and linkage between control lever and lower hole in governor lever. (Figure 5-1)

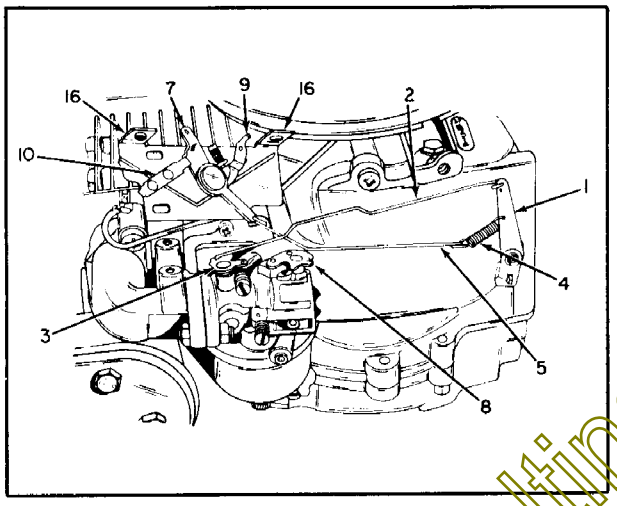


Figure 5-1

3. Set control lever to idle position so that no spring tension affects adjustment.

4. Loosen screw so that the governor lever is loose in clamp. Rotate both lever and clamp to move throttle to full open position (away from idle speed regulating screw).

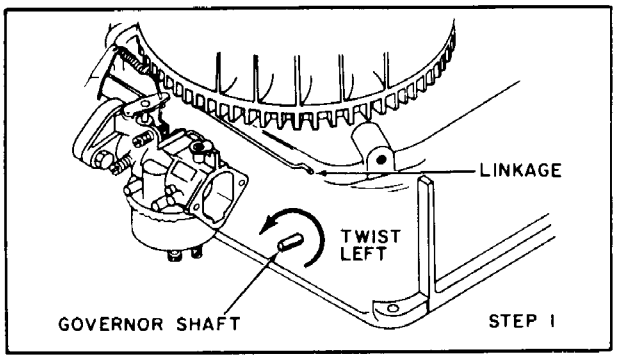


Figure 5-2

5. Tighten screw when no end play exists in direction of open throttle. (See Figures 5-2 and 5-3)

6. Move control lever to full speed setting and check to see that control linkage opens the throttle.

NOTE

For a further explanation, turn the governor lever and clamp counterclockwise to open throttle.

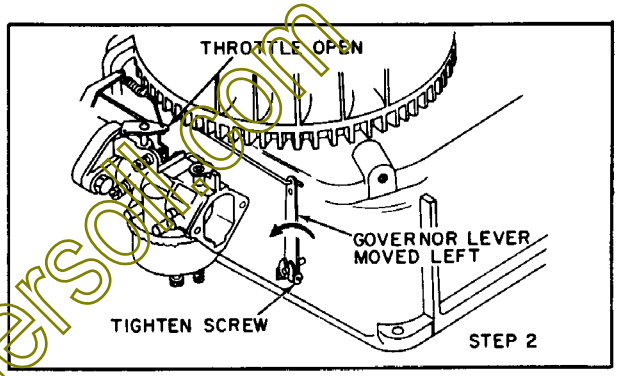


Figure 5-3

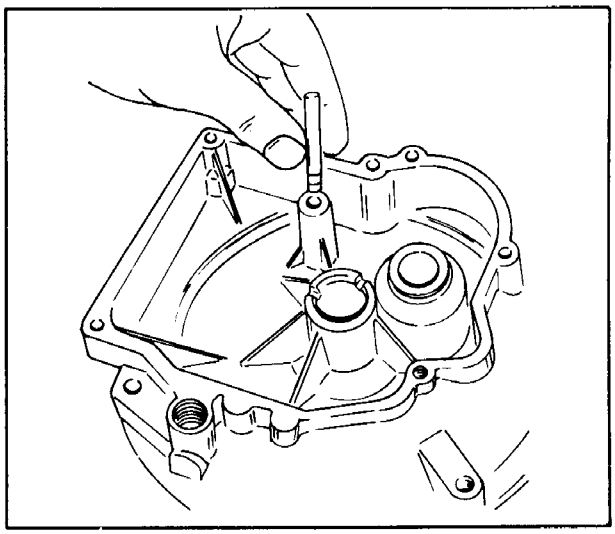


Figure 5-4

GOVERNOR SHAFT INSTALLATION

NOTE

For best results, use a vise or press.

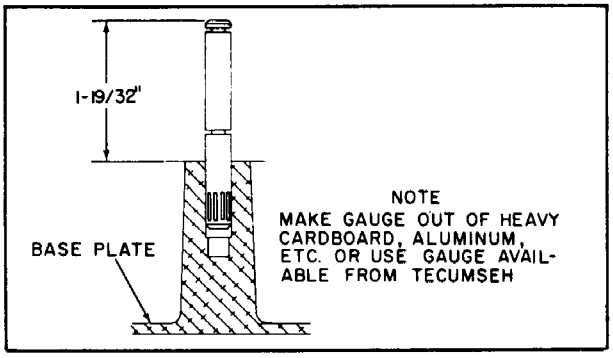


Figure 5-5

1. Using a soft hammer, tap lightly to start the shaft into the shaft boss.

2. Place the unit into a vise or press and slowly press in on shaft to dimension shown (Figure 5-5) or use applicable gauge (Figure 5-6).

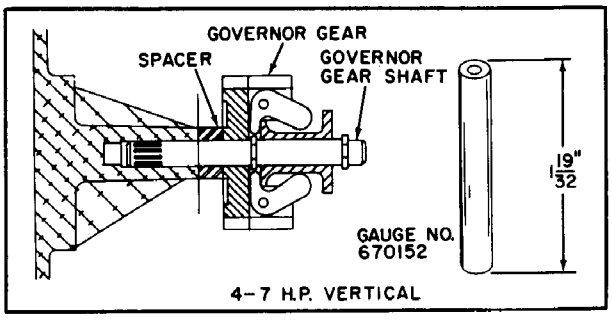


Figure 5-6

3. The shaft must be driven in straight. For this reason, the following method is not recommended, but is given for use in an emergency, where vises or presses may not be available.

4. If shaft is driven with a hammer, support flange with a wooden block beneath the governor shaft boss. Place hard wood block on top of shaft and hammer on block. DO NOT HAMMER DIRECTLY ON THE SHAFT.

SECTION 6

CARBURETOR CONTROL LINKAGE

GENERAL

Use the following text both (1) to explain the purpose or function of the different carburetor parts and (2) as a number key to the accompanying illustration. (Figure 6-1)

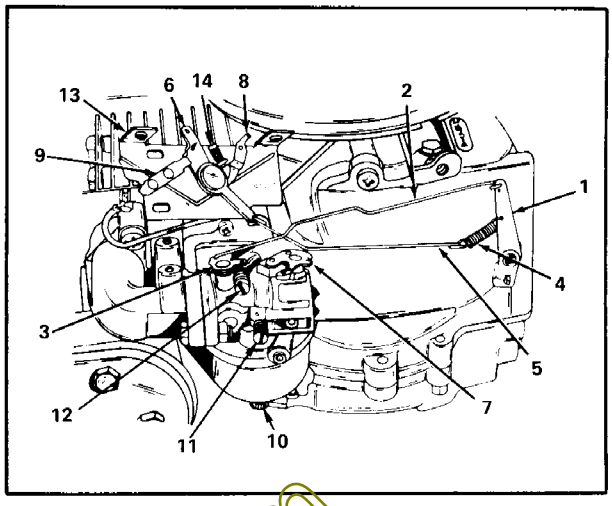


Figure 6-1

1 GOVERNOR LEVER - This lever attaches to the governor rod and rotates with the rod in response to governor action. The governor action in turn is affected by engine R.P.M., and governor spring pressure.

2 SOLID LINKAGE - This non-adjustable link always attaches the governor lever to the throttle lever. Therefore, any movement of the governor lever produces a corresponding movement in the throttle lever. This linkage should never be deformed in hopes of helping increase engine efficiency.

3 THROTTLE LEVER - Physically connected to the throttle shaft and shutter so that any rotative movement in the lever causes like movement in the other parts.

4 GOVERNOR SPRING - Connects between the governing system, and the control system. Variable tension puts a resistance to movement on the governing system. With no tension, the governor is free to move as soon as a few hundred R.P.M. will cause sufficient force to move the weights (such as while at idle). With full tension, the engine must attain full operating R.P.M. (such as 3600 R.P.M.) for the centrifugal force of the weights to activate the governor mechanism.

5 GOVERNOR SPRING LINKAGE - Connects between the governor spring and control lever. It (like the solid linkage) should not be deformed.

6 CONTROL LEVER - Mounted on a control panel, it is the operator's means of controlling engine speed by varying governor spring tension.

7 CHOKE LEVER - Physically connected to the choke shaft and shutter so that any movement transmitted to the lever also affects shutter position.

8 CHOKE CONTROL LEVER - A tang on the control lever, or linkage which positively controls the choke lever.

9 CONTROL PANEL - A rigidly mounted plate, containing levers, alignment holes, clamps, decals, and other devices necessary for control of engine speed. It is constructed and calibrated so that, when adjusted correctly, the amount of governor spring tension applied can be visually determined on the control panel.

10 MAIN ADJUSTMENT NEEDLE - A metering screw to regulate the fuel-air mixture entering the air horn for smooth, efficient engine operation.

11 IDLE ADJUSTMENT NEEDLE - A metering device to regulate the pre-mixed fuel-air entering the air horn for smooth engine idling operation.

12 IDLE SPEED REGULATING SCREW - A screw threaded through a boss on the carburetor body to act as a throttle lever stop, thereby controlling low idling speed.

13 BOWDEN WIRE CLAMP LOCATIONS - Threaded angle brackets which will receive a screw and clamp arrangement to hold the Bowden wire cover in a rigid position for proper operation.

14 HIGH SPEED SETTING SCREW - A screw threading into a tapped tang on the control panel to act as a control lever stop at the high speed end, thereby limiting top engine R.P.M.

SECTION 7

ENGINE THEORY AND PRE-OVERHAUL CHECK

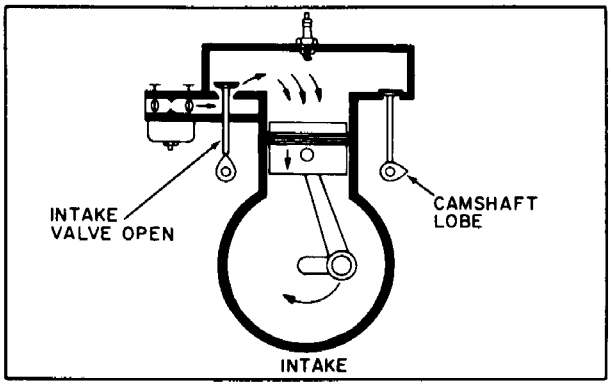


Figure 7-1

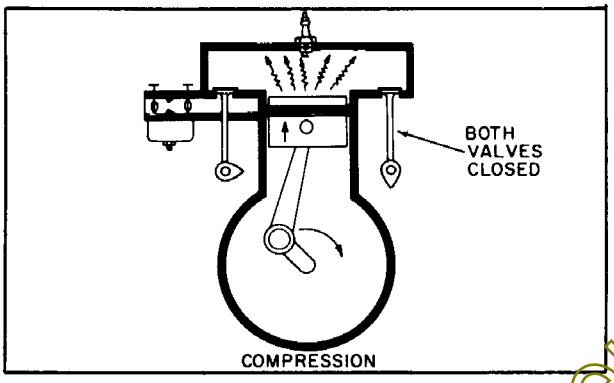


Figure 7-2

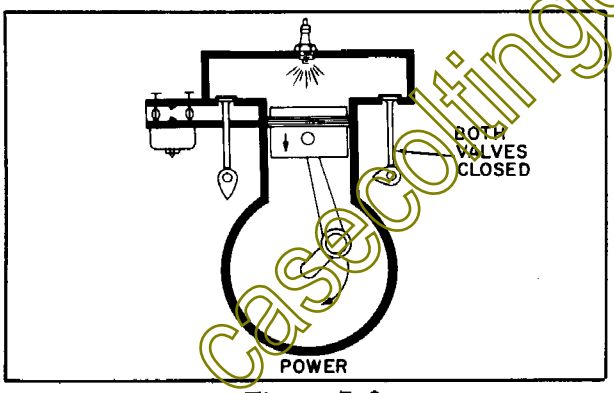


Figure 7-3

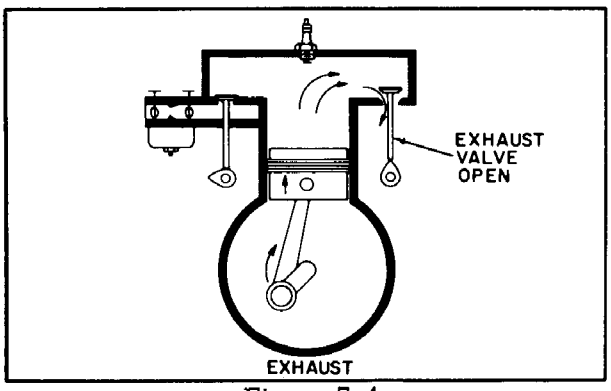


Figure 7-4

4-CYCLE THEORY

INTAKE - Air is mixed with fuel in the carburetor and the mixture is drawn into the combustion chamber by the downward movement of the piston. The intake valve is open to allow the fuel-air mixture to enter the combustion chamber. The INTAKE valve is opened at the proper time by the lobe on the camshaft which is geared to the crankshaft.

The exhaust valve is closed.

COMPRESSION - As the piston reaches Bottom Dead Center the INTAKE valve closes. The piston then rises compressing the fuel and air mixture trapped in the combustion chamber because both valves are closed.

POWER - As the piston reaches the Before Top Dead Center (BTDC) ignition point, the spark plug fires, igniting the fuel-air mixture. In the time it takes to ignite all the available fuel, the piston has moved to TDC (Top Dead Center) ready to take the full combustive force of the fuel for maximum power and piston downward travel. The expanding gases force the piston down. Both valves remain closed.

EXHAUST - As the piston starts to the top of the cylinder, the exhaust gases are forced out the open exhaust valve.

After the piston reaches Top Dead Center (TDC) the four cycle process will begin again as the piston moves downward and the intake valve opens.

PRE-OVERHAUL CHECK

If a check of carburetion and ignition indicates no faulty operation, check the following:

a. Insert a compression gauge into spark plug port. Crank engine and check compression reading on gauge, which should be no less than 60 psi (new engines should be about 80 psi) for an engine with a compression release cam, the reading could be 45 psi or less. Engines with lower reading indicate the need for piston, ring and bore service, if the engine must run near rated horsepower. See Figure 7-5.

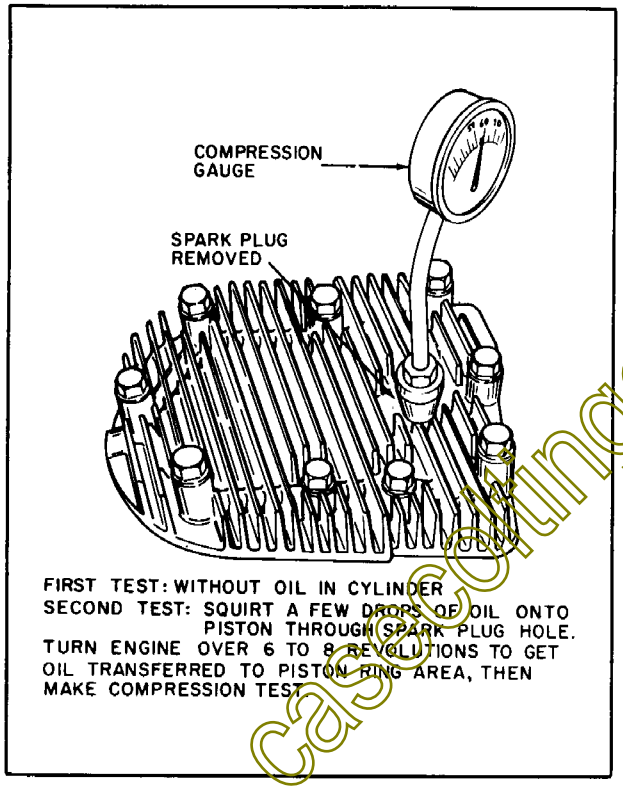


Figure 7-5

b. If a compression gauge is not available, disconnect spark plug lead to insure that engine will not start and pull starter rope slowly. There should be considerable resistance as the piston approaches top-dead-center, lasting for several seconds. If resistance decreases rapidly, it indicates poor compression, usually the result of one or more of the following:

1. Defective head gasket.
2. Warped head.
3. Burned valves.
4. Carbon accumulation on valves.
5. Worn piston rings.
6. Worn cylinder bore.
7. Weak or broken valve springs.
8. Improper valve clearance.
9. Ring gaps not staggered around the piston.

c. Crank engine slowly, checking for noise, binding, scraping, or other signs of improper operation, due to damaged bearings, connecting rod, valves or to a bent crankshaft.

d. Check crankshaft end play. Excessive play indicates worn rod bearings or piston pin.

e. Replace leaking oil seals.

f. Remove valve spring cover and crankcase breather assembly. Check valve clearance while piston is in either compression or power stroke so that cams on camshaft are free of valve lifters. Make this check when engine is cold. Valve clearance should be 0.010 in. Valve lifter clearance adjustment is described in Section 9.

POINTS TO CHECK FOR ENGINE POWER

Ignition - Must be properly timed so that spark plug fires at precise moment for full power.

Valve - Check for seating, warping, sticking. Grind and lap to proper angle.

Spark Plug Gap - Adjust to proper setting, use round feeler gauge.

Cylinder Head - Should not be warped. Gasket surface must be true.

Valve Seat - Must be of specified angle and width.

Cylinder Head Bolts - Tighten to proper torque.

Valve Guide - Examine for wear, varnish which may prevent proper valve action.

Cylinder Head Gasket - Must form perfect seal between cylinder and head.

Fins - Keep clean to prevent power loss because of over-heating.

Valve Spring - Check free length, must have proper tension to close valve and hold on seat.

Piston Rings - Piston rings must be fitted properly with recommended end gap to assure sufficient pressure on cylinder wall to transfer heat and seal high pressure.

Valve Gap - Must be adjusted to proper gap.

Piston Pin - Must allow friction free movement of connecting rod and piston.

Cam Lobes - Check for wear, must be proper size to open valve fully to allow complete discharge of exhaust and intake of fuel.

Piston Fit - Must be fitted to cylinder with recommended clearance.

Connenting Rod - Match marks must be matched and connecting rod nuts tightened to proper torque.

Oil Passages - All oil holes and passages must be clear to allow full lubrication for friction free operation.

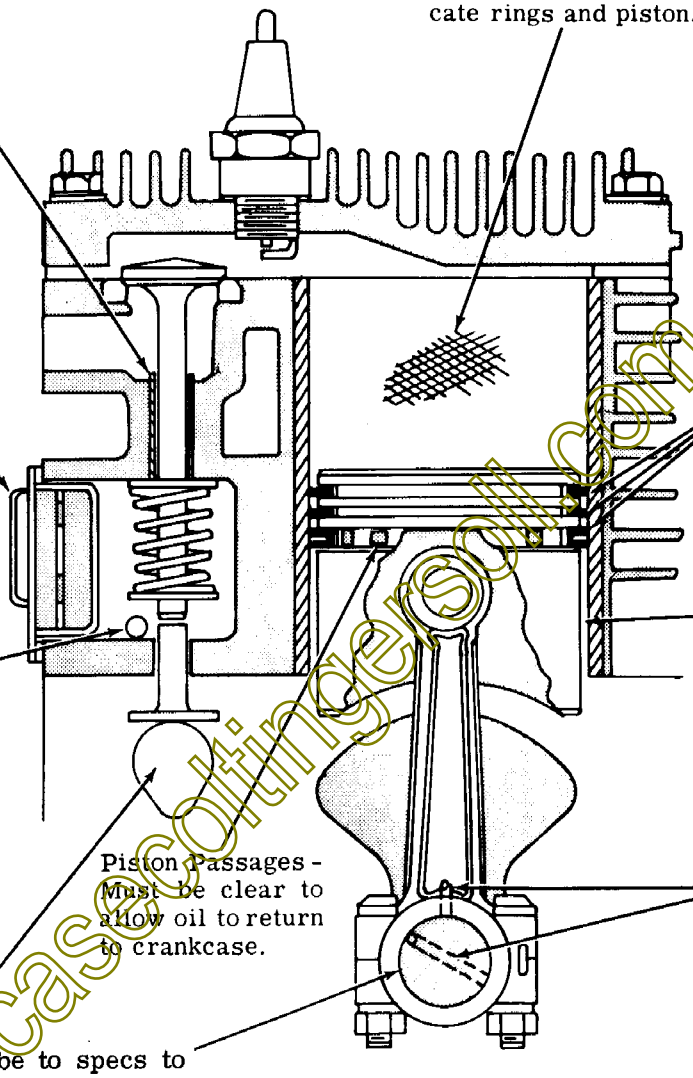
Air Filter - Should be clean to allow engine to breath.

Carburetor - Must be set properly to assure proper and sufficient air and fuel.

POINTS TO CHECK FOR ENGINE OIL CONTROL

Valve Guides - Must be within tolerances to prevent oil entering combustion chamber. To prevent exhaust gases from entering crankcase.

Cylinder Wall Finish - Cylinder wall glaze must be broken prior to installing new piston rings to allow rings to seat and control oil, also acts as reservoir for oil to lubricate rings and piston.



Breathers - Must operate properly to prevent oil from being expelled out of engine.

Piston Rings - Are to fit squarely to cylinder wall with proper end gap and ring to groove clearance, with inside chamfer to top of piston.

Drain Holes - In breather box and under oil seals must be clear (mag end vertical engine) to allow oil to return to crankcase.

Piston Fit - Must be within specs for proper oil control and wiping of excessive oil from cylinder wall.

Piston Passages - Must be clear to allow oil to return to crankcase.

Oil Passages - Must be clear for proper distribution to load carrying bearing surfaces.

Bearings - Should be to specs to prevent excessive oil spillage and cause pressure loss in pressure systems.

Oil control means the effective distribution of oil within the engine for friction free operation and control to prevent oil from being burned or leaking at gasket surfaces.

Gasket Surfaces - Must not be nicked, old gasket removed, always use new gaskets.

Oil Filter Caps - Must always be tight, gasket must be used and seal perfect to prevent spillage out of breather.

Oil Level - Overfilling will cause leaking, burning and oil fouled spark plugs.

Engine Speed - Excessive speeds will cause excessive oil consumption by burning and leaking.

SECTION 8

PISTON, RING, PIN, CONNECTING ROD AND CRANKSHAFT SERVICE

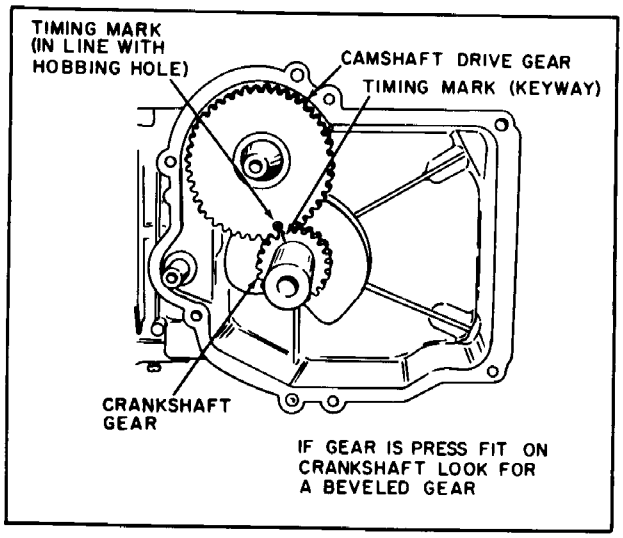


Figure 8-1

On the camshaft the timing mark is located in line with the center of the hobbing hole. If no line is visable, therefore, use the center of the hobbing hole to align with the crankshaft gear marked tooth.

On the crankshaft, the timing mark is the tooth in line with the keyway.

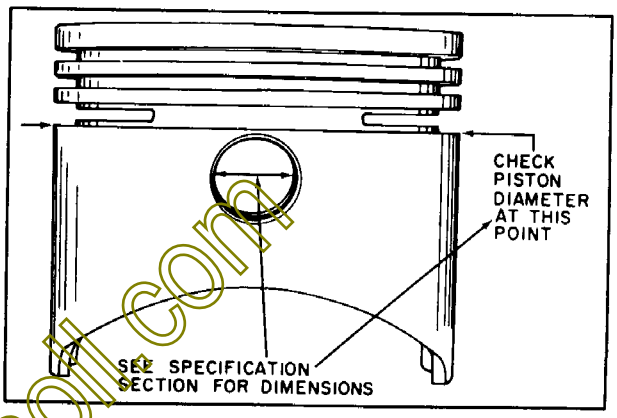


Figure 8-2

CRANKSHAFT

Timing mark alignment can be used for disassembly, but is mandatory for reassembly.

Replace crankshaft if:

1. Threads can't be redressed.
2. Bearing surfaces are worn, scratched, or damaged
3. Alignment is out of round.
4. Flats have developed.

NEVER TRY TO STRAIGHTEN BENT CRANKSHAFTS.

When replacing, lubricate bearing surfaces.

Use oil seal protectors.

TIMING MARKS Fig. 8-1

Matched timing marks on the camshaft gear and the crankshaft gear are necessary for a properly performing engine.

PISTON - When removing piston, clean carbon from upper cylinder bore and head. Check piston dimensions as shown in Figure 8-2. Piston and pin must be replaced in matched pairs.

RINGS - Replace rings in sets. Stagger ring gaps.

Check ring clearances as shown in Figure 8-3.

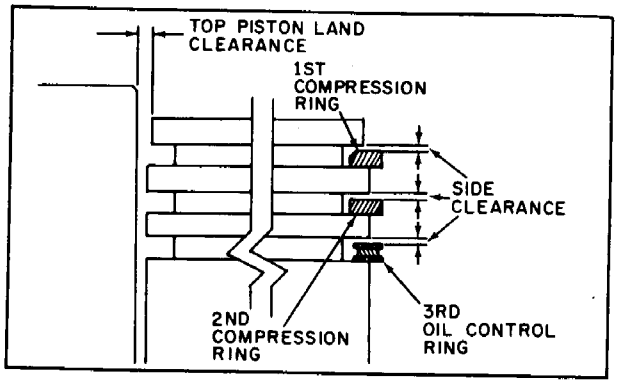


Figure 8-3

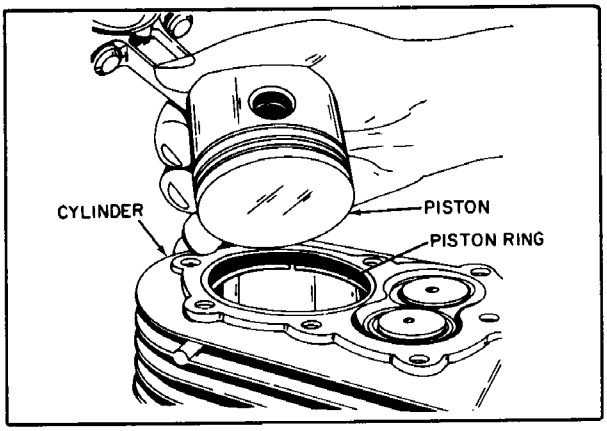


Figure 8-4

When using new rings, wipe cylinder wall with fine emery cloth to deglaze. Clean thoroughly.

Check ring gap. Place ring squarely in center of ring travel area. (Figure 8-4 and 8-5)

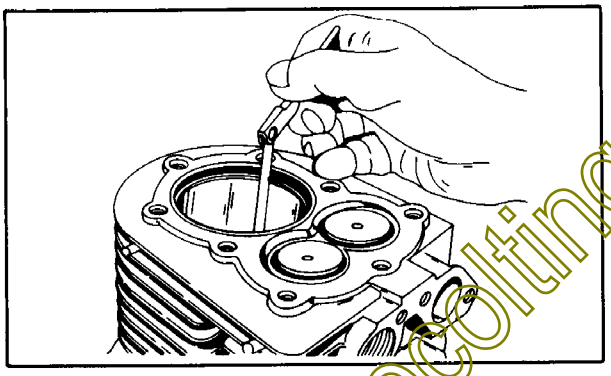


Figure 8-5

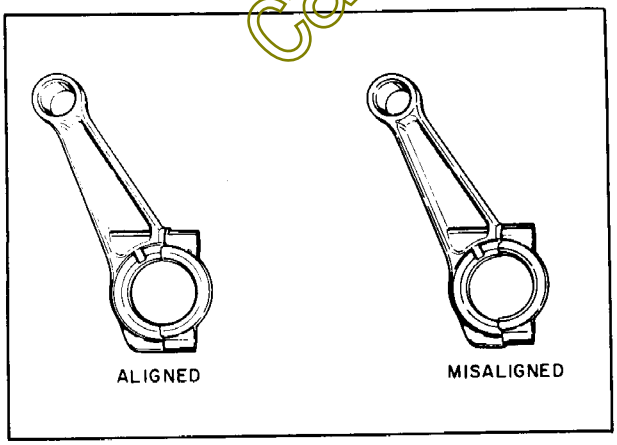


Figure 8-6

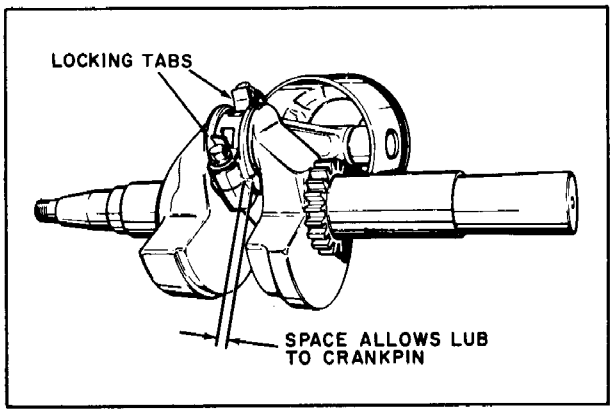


Figure 8-7

CONNECTING RODS - The connecting rods are offset, and have the cap fitted from the camshaft side of the engine.

The rods do not have match marks on early types.

A dipper is a stamped part of the lock plate. Use a new lock plate whenever the rod cap is removed.

CAUTION EARLY TYPE CAPS CAN BE DISTORTED IF THE CAP IS NOT HELD TO THE PIN WHILE THREADING THE BOLTS TIGHT.

Undue force should not be used.

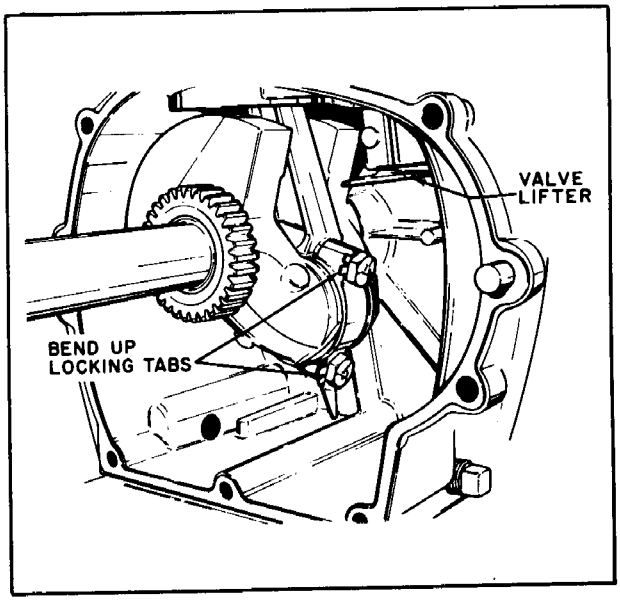


Figure 8-8

Later model rods have serrations which prevent distortion during tightening. They also have match marks which MUST FACE OUT WHEN ASSEMBLING THE ROD. (Figure 8-9)

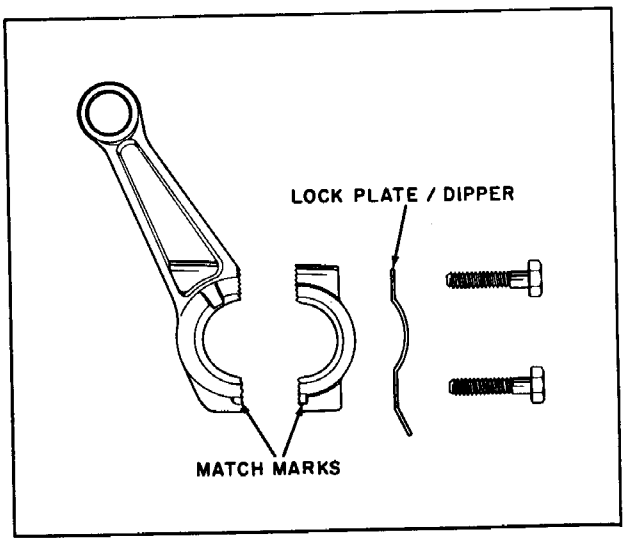


Figure 8-9

SECTION 9

CAMSHAFT, VALVES, SPRINGS AND OIL PUMP SERVICE

CAMSHAFT - Align timing marks to relieve valve lifter pressure when removing camshaft.

Clean camshaft in solvent, then blow passages dry. Replace camshaft showing wear or scoring. Check cam dimensions against specification dimensions at * points. (Figure 9-1)

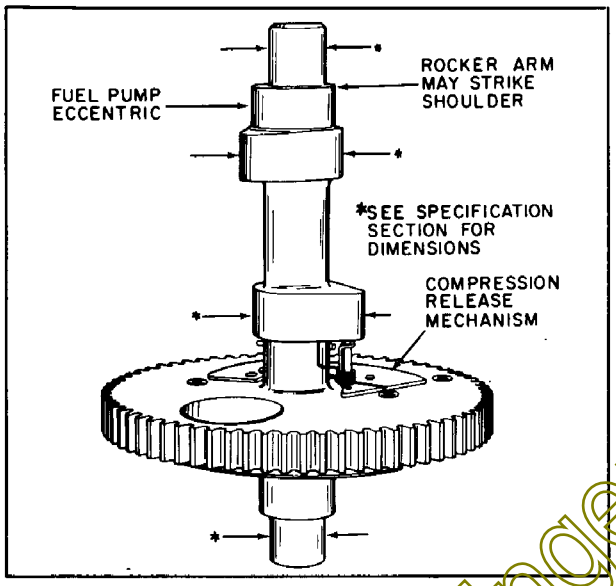


Figure 9-1

Insta-matic Ezee-Start Compression Release. If any parts need replacement, entire camshaft must be replaced.

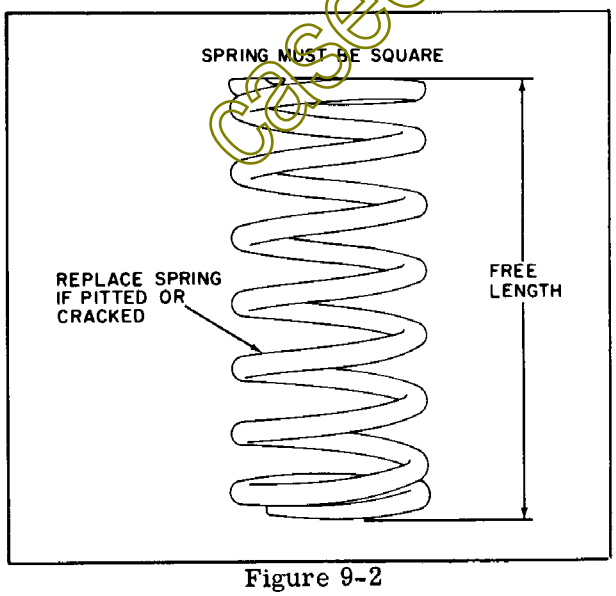


Figure 9-2

Be sure oil pump barrel chamfer is toward filet of camshaft gear when assembled, as is shown in Section 10.

VALVE SPRINGS - Valve springs should be replaced when an engine is overhauled. Weak valve springs will spoil the best overhaul job.

Valve spring free length should be checked. (Figure 9-2) Comparing one spring with the other can be a quick check to notice any difference. If a difference is noticed, carefully measure free lengths and compression length and strength of each spring. See specifications.

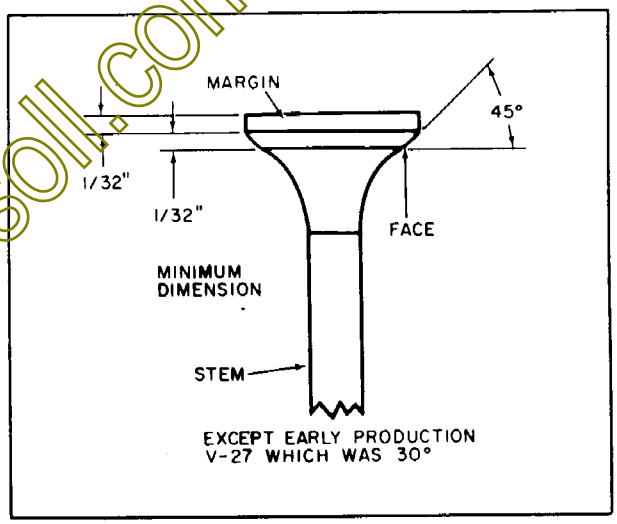


Figure 9-3

VALVE GRINDING AND REPLACEMENT

Valves and valve seats can be reground with a minimum of engine disassembly.

Remove valves as follows:

1. Raise lower valve spring caps while holding valve heads tightly against valve seat to remove valve spring pin.
2. Remove valves, springs and caps from crankcase.

Clean all parts with solvent carefully removing all carbon from valves.

Replace distorted or damaged valves. If valves are in usable condition, grind valve faces in a valve refacing machine and to the angle given in Table of Specifications. Replace valves if faces are ground to less than 1/32". (Fig. 9-3)
Whenever new or reground valves are installed, lap in valves, to insure a gas-tight fit.

1. Coat the valve face sparingly with a fine grade of valve grinding compound. Using a vacuum cup valve grinder to grip valve top, rotate valve on valve seat.

CAUTION The valves are not identical. The exhaust valve "EX", subject to the high exhaust heat, is stellite faced diachrome steel. Make sure this valve is lapped and assembled to the exhaust port.

2. Lift valve from seat every eight or ten strokes to keep compound equalized on surface of valve seat.

3. Continue lapping until valve and seat have a smooth surface, then wash with solvent to remove all traces of lapping compound; dry parts thoroughly.

NOTE Valves with oversized stems are available. Directions for reboring the valve guides in the cylinder block are found in Section 10.

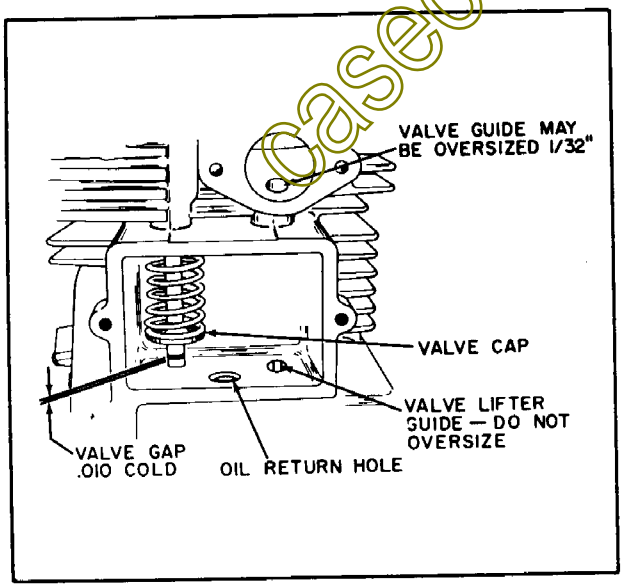


Figure 9-4

Valve grinding changes the valve lifter clearance. After grinding valves, check valve lifter clearance as follows:

1. Rotate crankshaft until cams on camshaft are out of engagement with valve lifters.

2. Insert valves in their guides and hold valves firmly on seats.

3. Check for clearance of .010 inch between each valve stem and valve lifter with feeler gauge. (See Figure 9-4) Grind valve stem in a valve resurfacing machine set to grind a perfectly square face, of proper clearance.

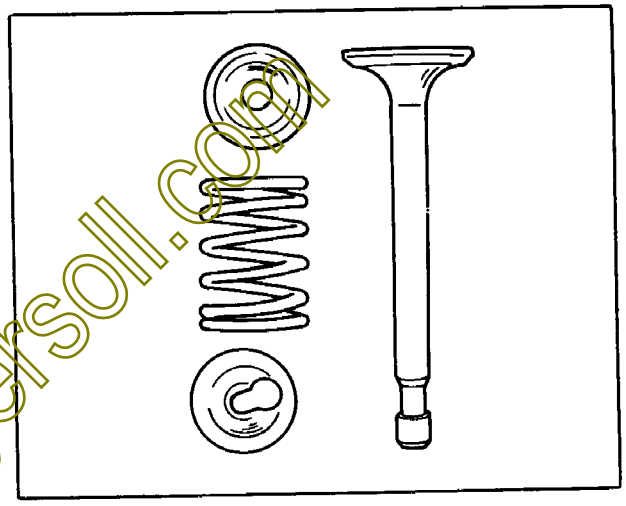


Figure 9-5

Install valves as follows (EARLY MODELS):

1. Position valve spring and upper and lower valve spring caps under valve guide for valve being installed.

2. Install valves in guides, making sure that valve marked "EX" is inserted in exhaust port. The valve stem must pass through the valve spring and the valve spring caps.

3. Insert blade of screwdriver under lower valve spring cap and pry spring up.

4. Insert valve pin through hole in valve stem with a long nosed pliers. Make sure valve pin is properly seated under lower valve spring cap.

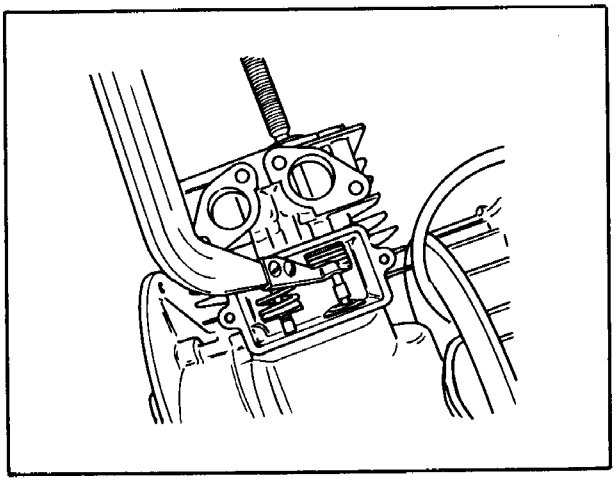


Figure 9-6

Install valves as follows (LATER MODELS):

1. Position valve caps and spring in valve compartment.

2. Install valves in guides with valve marked "EX" in exhaust port. The valve stem must pass through the upper valve cap and spring. The lower cap should sit around the valve lifter exposed end.

3. Compress the valve spring so that the shank is exposed. DO NOT TRY TO LIFT LOWER CAP WITH SPRING.

4. Lift lower valve cap over valve stem shank and center cap to smaller diameter hole.

5. Release valve spring tension to lock cap in place.

BARREL AND PLUNGER OIL PUMP SYSTEM

This system is driven by an eccentric on the camshaft. Drawing oil through the hollow camshaft from the oil sump on its intake stroke. The passage from the sump through the camshaft is aligned with the pump opening.

As the camshaft continues rotation, (pressure stroke), the plunger forces out the oil. The other port in the camshaft is aligned with the pump directing oil (Figure 9-8) out of the top of the camshaft.

At the top end of the camshaft, oil is forced through a crankcase passage to the top main bearing oil groove, aligned with the drilled crankshaft passage. Oil is directed through

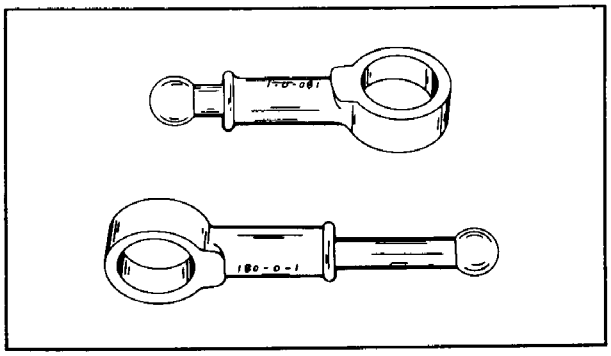


Figure 9-7

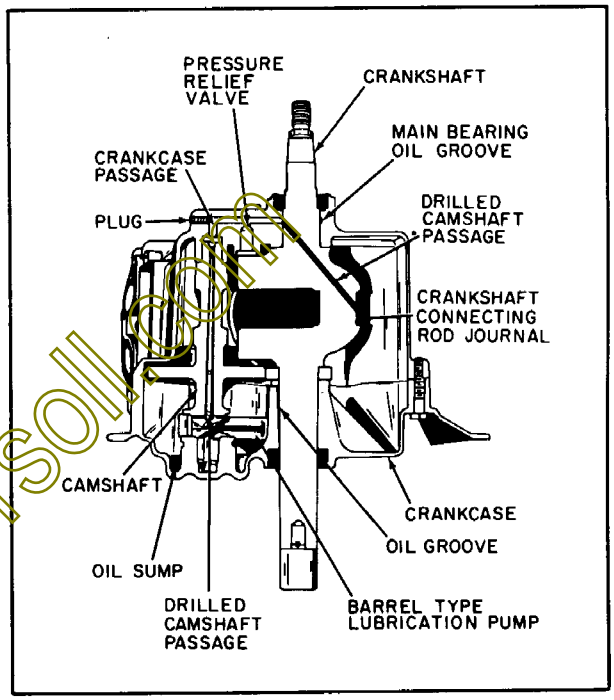


Figure 9-8

this passage to the crankshaft connecting rod journal, then spills from the connecting rod to lubricate the cylinder walls. Normal splash lubricates the other internal parts of the engine.

A pressure relief valve, in the crankcase, relieves excessive pressures (over 28 psi). It usually works only when oil viscosity is extremely heavy due to cold temperatures, or when the system becomes plugged or damaged. The normal pressure created by the lubrication system is 7 psi.

The bottom bearing receives its lubrication through a long, deep groove in the bearing. Constant lubrication of the working parts of the engines insures that the engine will be able to handle heavy loads for extended periods of time without danger of bearing damage.

BARREL TYPE OIL PUMP SERVICE

Remove the barrel type oil pump as follows:

1. Remove the mounting flange as shown in Section 11.

2. Remove barrel and plunger assembly and separate.

Clean and inspect pump parts as follows:

1. Wash pump parts with solvent.

2. Inspect pump plunger and barrel for rough spots or wear. If pump plunger is scored or worn, replace entire pump.

Reassemble oil pump as follows:

1. Lubricate pump parts in engine oil. Manually operate pump to make sure plunger slides freely in barrel.

2. Lubricate all parts. Position barrel on eccentric on camshaft. If the oil pump has a chamfer only on one side, that side must be placed toward the camshaft gear.

3. Install mounting flange as shown in Section 11. Be sure plunger ball seats in recess in flange.

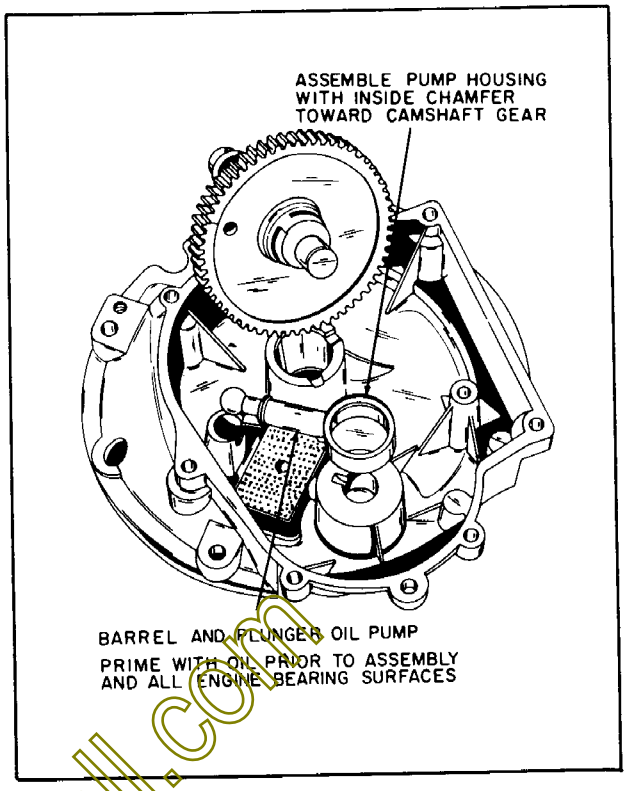


Figure 9-9

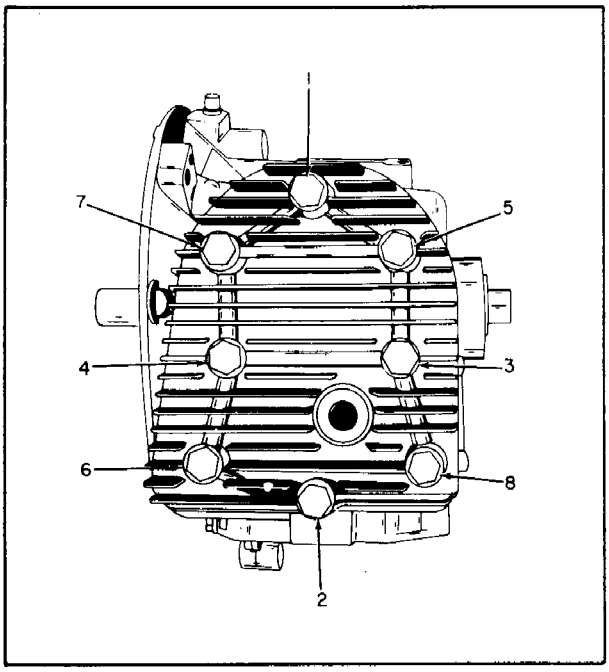


Figure 10-1

CYLINDER AND HEAD SERVICE

Clean oil passages and remove dirt from fins.

Replace crankcase if:

Main or camshaft bearings worn or scored.

Fins broken or cracked.

Warped head mounting surface.

I.D. is more than .005" oversize.

REBORING CYLINDER

Decide whether to rebord for .010" or .020" oversize piston.

Use any standard commercial hone of suitable size. Chuck hone in drill press with spindle speed of about 600 rpm.

Start with coarse stones and center cylinder under press spindle. Lower hone so lower end of stones contact lowest point in cylinder bore.

Rotate adjusting nut so that stones touch cylinder wall and begin honing at bottom of cylinder. Move hone up and down at rate of 50 strokes per minute to avoid cutting ridges in cylinder wall. Every fourth or fifth stroke, move hone far enough to extend the stones one inch beyond top and bottom of cylinder bore.

Check bore every thirty or forty strokes for size and straightness. If stones collect metal, clean with a wire brush each time hone is removed.

Hone with coarse stones until cylinder bore is within .002 inch of desired finish size. Replace coarse stones with burnishing stones and continue until bore is to within .0005 inch of desired size.

Remove burnishing stones and install finishing stones to polish cylinder to final size.

Clean cylinder with solvent and dry thoroughly.

Replace piston and piston rings with parts of correct oversize as indicated in parts manual.

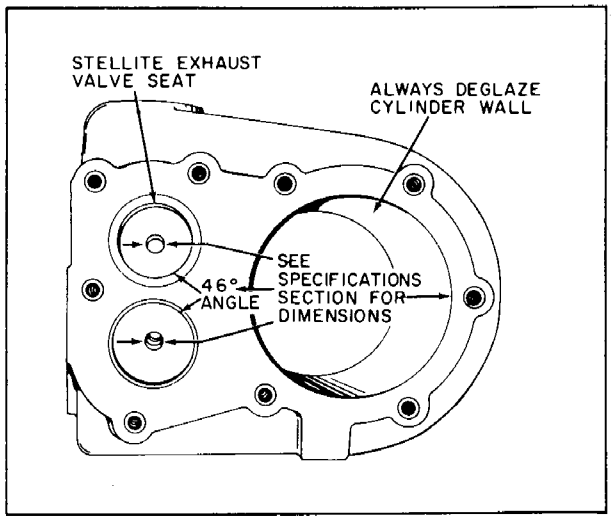


Figure 10-2

REBORING VALVE GUIDES. Valve guides are permanently installed in cylinder. However, if guides wear, they can be rebored to accommodate a 1/32 inch oversized stem. Rebore valve guides as follows:

1. Ream valve guides with a standard, straight shanked hand reamer or low speed drill press. Refer to Table of Specifications to determine correct valve stem diameter.

2. Redrill upper and lower valve spring caps to accommodate oversized valve stems.

3. Reassemble engine as described in Section 9, installing valves with oversized stems in valve guides. See parts book for correct part number for oversize valves.

REGRINDING VALVE SEATS. Valve seats need regrinding only if they are pitted or scored. If there are no pits or scores, lapping in valves will provide a proper valve seat. Valve seats are not replaceable. Regrind the valve seats as follows:

1. Use a grinding stone or a valve seat reseater set to provide the proper angle and seal face dimensions. Check the Table of Specifications for the proper dimensions.

2. If the seat is over 3/64 inch wide after grinding, use a 15° stone or cutter to narrow the face to proper dimension.

3. Inspect seats to make sure that cutter or stone has been held squarely to valve seat and that same dimension has been held around entire circumference of seat.

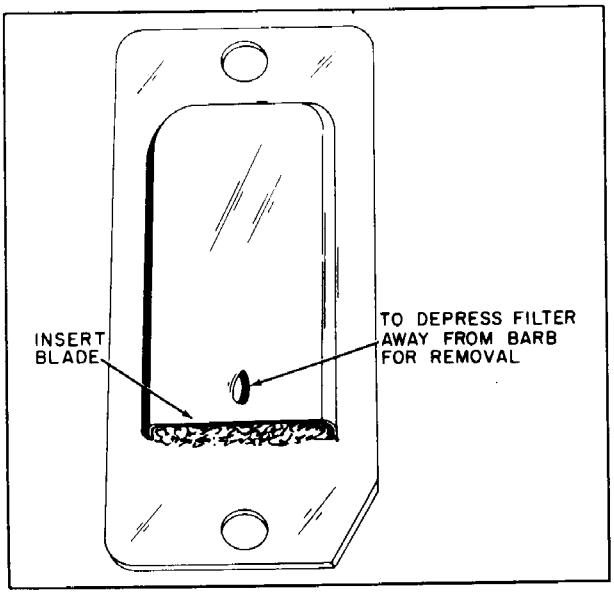


Figure 10-3

4. Lap valves to reground seats as described in Section 9.

CRANKCASE BREATHER SERVICE

The breather has a polyurethane filtering element retained in the breather housing by means of a barb. To remove the filtering element, insert a blade between the filtering element and the barb. Depress the element to remove it.

Clean the filtering element in normal parts cleaning solvents, gasoline or household detergents. The filtering element is self-lubricating from the oily crankcase vapors.

SECTION 11

MOUNTING FLANGE

MOUNTING FLANGE REMOVAL

Remove drain plug from mounting flange and drain oil from crankcase.

Polish crankshaft end with a piece of fine emery cloth if it is rusty or pitted.

The oil seal dust cap on the power take-off end of the crankshaft protects the oil seal from dust, dirt and abrasives. To remove, distort it by striking the edge in several places with a hammer and small chisel or screwdriver (Figure 11-1). After distorting, remove the cap.

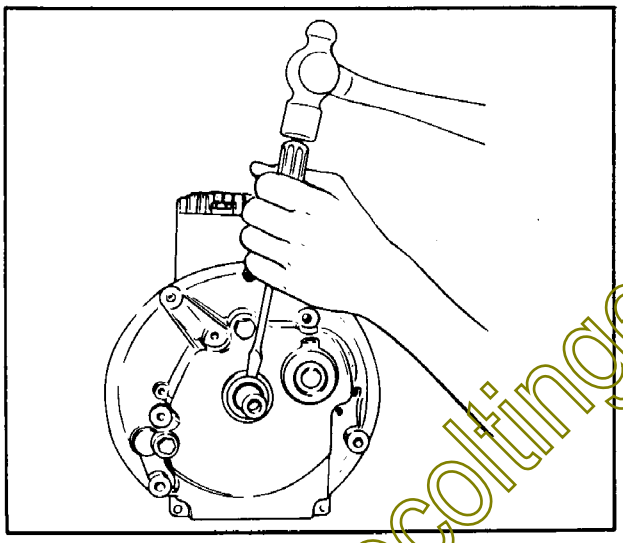


Figure 11-1

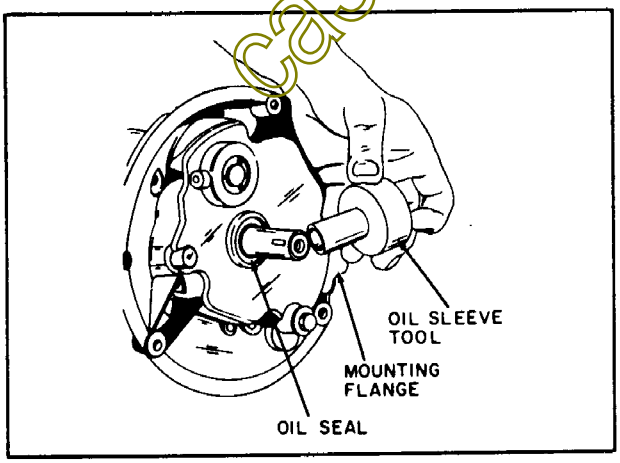


Figure 11-2

Remove mounting bolts. Lightly force sleeve tool (Figure 11-2) into oil seal. Lift mounting flange from cylinder. If necessary, tap edge of flange lightly with a soft hammer, being careful not to break edge of flange.

CLEANING AND INSPECTION

Wash mounting flange thoroughly with solvent, paying special attentionto cleaning sump screen, which is an integral part of the flange.

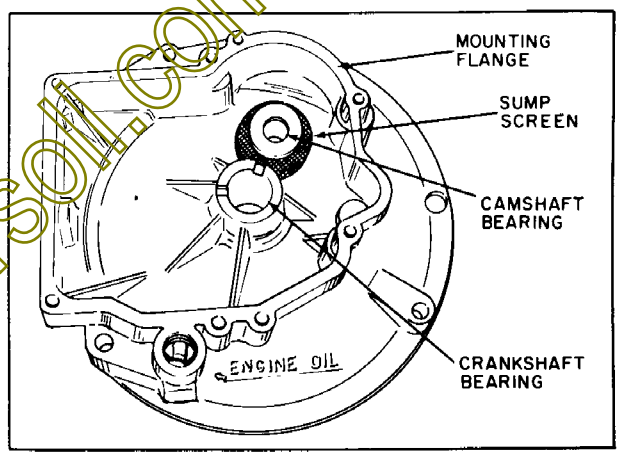


Figure 11-3

Inspect camshaft and main bearings (Figure 11-3) for wear, scoring, or other damage. If bearings are not within limits found in Table of Specifications, or are otherwise damaged, replace entire mounting flange.

Replace mounting flange showing cracks, distortion, and worn threads.

REASSEMBLE AS FOLLOWS:

NOTE Refer to Section 5 for governor shaft installation.

1. Always use a new gasket when replacing mounting flange.

2. Carefully press sleeve tool into oil seal to full depth of seal seat. Holding sleeve tool firmly in place to protect oil seal from damage as crankshaft passes through it. Install mounting flange.

3. Tighten mounting flange bolts evenly and securely and remove sleeve tool.

4. Install dust cap on crankshaft with dust cap driver. Drive dust cap only until it is even with mounting flange boss. (Figure 11-4)

CAUTION Dust protector cap must not contact oil seal. The dust cap rotates with the shaft while the oil seal remains stationary.

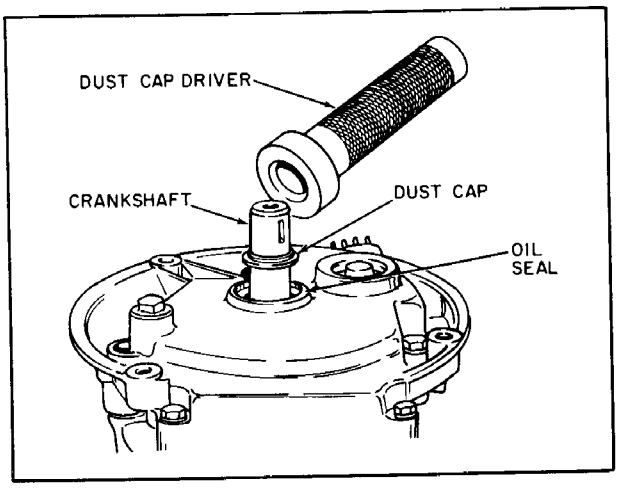


Figure 11-4

SECTION 12

OIL SEAL SERVICE

OIL SEAL REPLACEMENT -

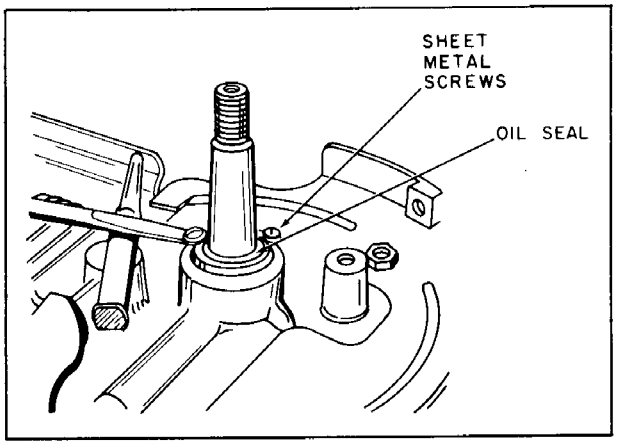


Figure 12-1

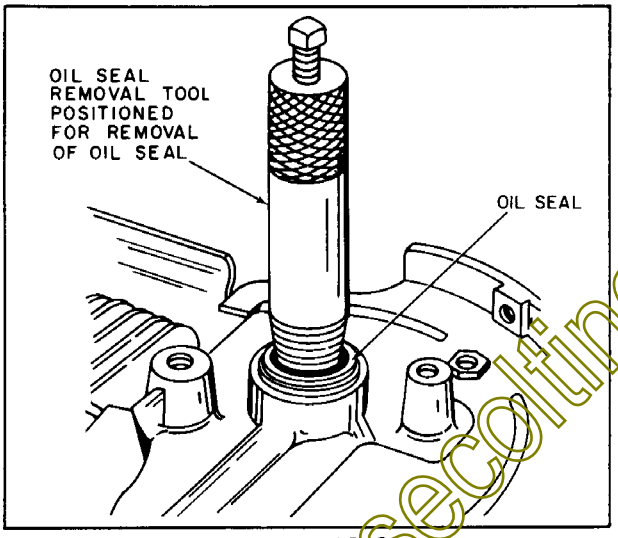


Figure 12-2

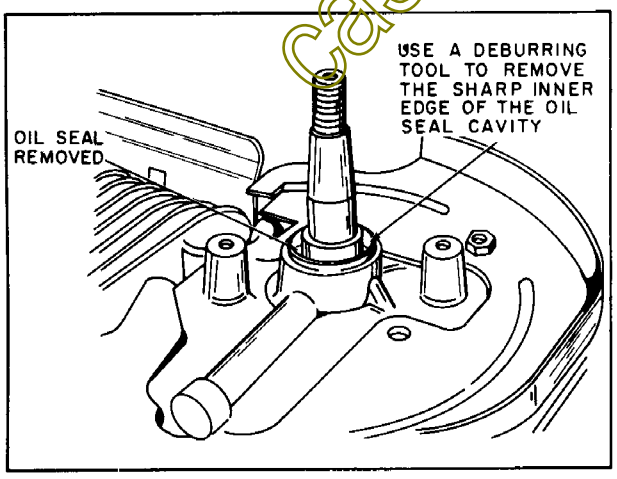


Figure 12-3

* 670193 MUST BE USED WITH 28677 DRIVER. ORDER 28677A IF DRIVER AND ADAPTER ARE NEEDED.

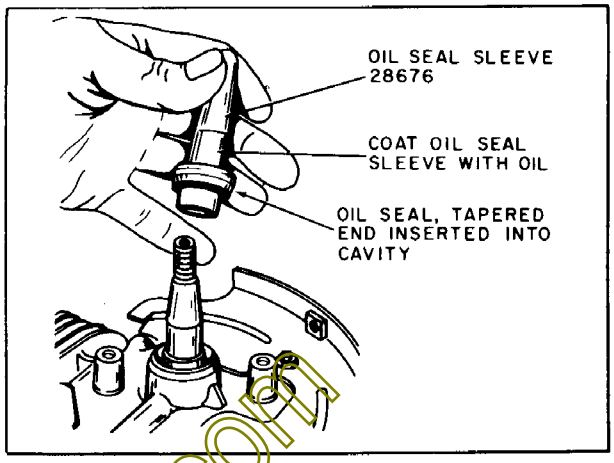


Figure 12-4

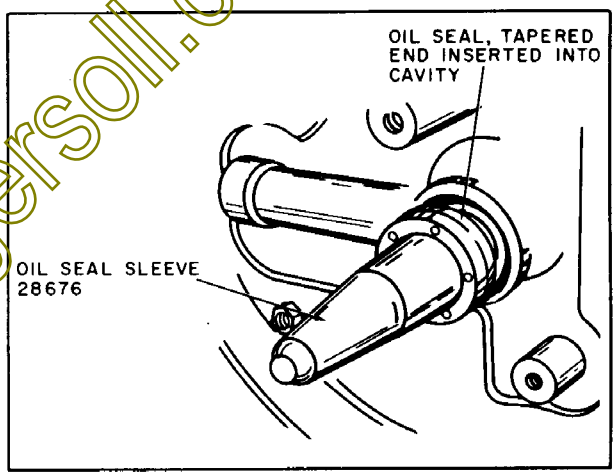


Figure 12-5

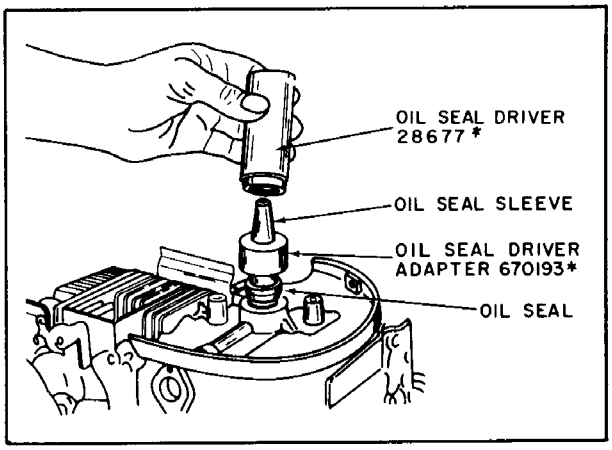


Figure 12-6

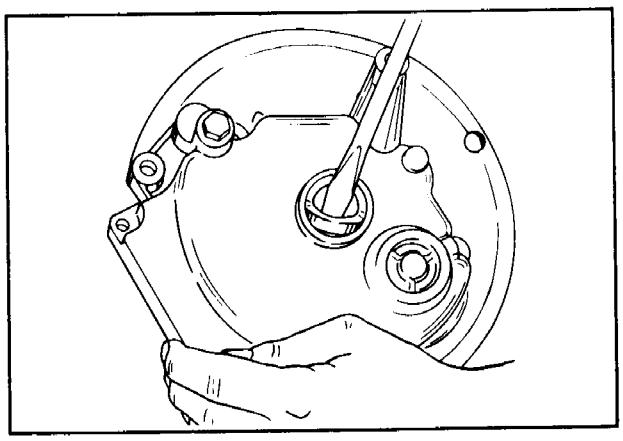


Figure 12-7

Lay mounting flange on a flat surface and position a new oil seal squarely in oil seal seat. Drive seal to bottom of seal seat using tool No. 27572 (Figure 12-8). Make sure seal is squarely and completely seated.

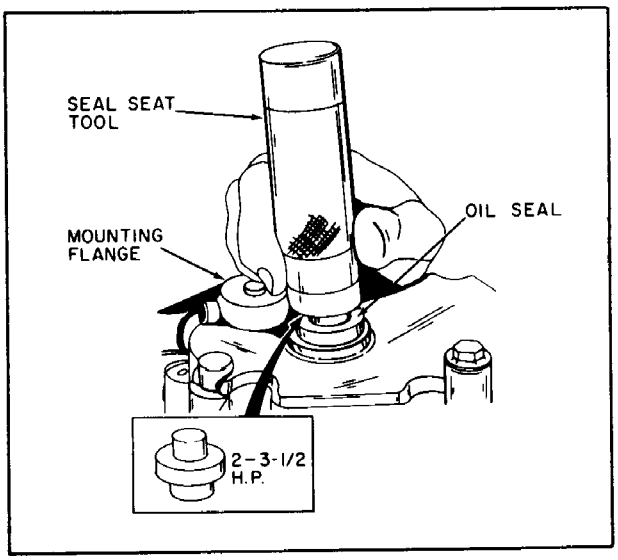


Figure 12-8

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