

**SERVICE
AND
PARTS CATALOG**

**SERIES
NB**

INDUSTRIAL ENGINES

MODELS

NB- MS/1846A

NB- MS/1847A

NB- MS/2131A

NB- MS/2132A

NB- MS/2166A

NB- MS/2167A

Safety Precautions

Before operating the engine, read this manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the equipment is properly operated and maintained.**

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER This symbol warns of immediate hazards which will result in severe personal injury or death.

⚠ WARNING This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.

⚠ CAUTION This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that can result in severe personal injury. Take care in following these recommended procedures. All local, state and federal codes should be consulted and complied with.

⚠ WARNING This engine is not designed or intended for use in any type of aircraft. Use of this engine in aircraft can result in engine failure and cause severe personal injury or death.

GENERAL

- Provide appropriate fire extinguishers and install them in convenient locations. Use an extinguisher rated ABC by NFPA.
- Make sure that all fasteners on the engine are secure and accurately torqued. Keep guards in position over fans, driving belts, etc.
- If it is necessary to make adjustments while the engine is running, use extreme caution when close to hot exhausts, moving parts, etc.
- Used engine oils have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

BATTERIES

- Before starting work on the engine, disconnect batteries to prevent inadvertent starting of the engine. Disconnect negative (-) cable first.
- DO NOT SMOKE while servicing batteries. Lead acid batteries give off a highly explosive hydrogen gas which can be ignited by flame, electrical arcing or by smoking.
- Verify battery polarity before connecting battery cables. Connect negative (-) cable last.

PROTECT AGAINST MOVING PARTS

- Do not wear loose clothing in the vicinity of moving parts, such as PTO shafts, flywheels, blowers, couplings, fans, belts, etc.
- Keep your hands away from moving parts.

FUEL SYSTEM

- DO NOT fill fuel tanks while engine is running.
- DO NOT smoke or use an open flame in the vicinity of the engine or fuel tank. Internal combustion engine fuels are highly flammable.
- Fuel line must be of steel piping, adequately secured, and free from leaks. Piping at the engine should be approved flexible line. Do not use copper piping for flexible lines as copper will work harden and become brittle enough to break.
- Be sure all fuel supplies have a positive shutoff valve.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.

EXHAUST SYSTEM

- Exhaust products of any internal combustion engine are toxic and can cause injury, or death if inhaled. When operating the engine in a confined area, make sure the ventilation system is operating properly.
- DO NOT use exhaust gases to heat a compartment.
- Make sure that your exhaust system is free of leaks. Make sure that exhaust manifolds are secure and are not warped by bolts unevenly torqued.

EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, a poisonous gas that can cause unconsciousness and death. It is an odorless and colorless gas formed during combustion of hydrocarbon fuels. Symptoms of carbon monoxide poisoning are:

- Dizziness
- Headache
- Weakness and Sleepiness
- Vomiting
- Muscular Twitching
- Throbbing in Temples

If you experience any of these symptoms, get out into fresh air immediately, shut down the unit and do not use it until it has been inspected.

The best protection against carbon monoxide inhalation is proper installation and regular, frequent inspections of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.

KEEP THE UNIT AND SURROUNDING AREA CLEAN

- Make sure that oily rags are not left on or near the engine.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and present a potential fire hazard.

ONAN INDUSTRIAL ENGINES

NB **SERIES**



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GENERAL INFORMATION

THIS MANUAL PROVIDES INFORMATION FOR PROPER OPERATION, MAINTENANCE, AND SERVICE PROCEDURES; ALSO PARTS CATALOG.

WE SUGGEST THIS BOOK BE KEPT HANDY FOR READY REFERENCE WHEN NECESSARY, EITHER FOR ORDERING PARTS OR MAKING ADJUSTMENTS.

IMPORTANT...RETURN WARRANTY CARD ATTACHED TO UNIT

GENERAL INFORMATION

INTRODUCTION

This publication provides service instructions and an illustrated parts list for the air cooled, electric starting, gasoline engines described below.

TRACTOR - ENGINE MODEL REFERENCE

Tractor Model No.	ONAN Engine Model No.
424 (10 h.p.)*	NB-MS/1846
430 (12 h.p.)*	NB-MS/1847
424 (10 h.p.)*	NB-MS/2131
430 (12 h.p.)*	NB-MS/2132
424 (10 h.p.)*	NB-MS/2166
430 (10 h.p.)*	NB-MS/2167

* Measured at 3600rpm

SPECIFICATIONS

Number of cylinders	1
Displacement	30.0 cu. in.
Cylinder bore	3-9/16 in.
Piston stroke	3 in.
Compression ratio	7:1
Oil capacity	2 qts.

The nameplate reference to the ONAN Engine Model number will show an alphabetical suffix. This signifies the particular configuration of the engine and must be included as part of the complete Model and Spec designation.

OPERATION

PRELIMINARY

Before starting a new engine make sure it is adequately supplied with oil and fuel. Check the break-in procedures and plan the initial operation and maintenance accordingly.

Crankcase Oil: Fill the crankcase with 2 quarts of a good quality detergent oil meeting the requirements for API designation SE or SE/CC. Use SAE viscosity 5W30 when the expected starting temperature is below 32° F and SAE 30 when it is above.

Fuel: Use clean, regular grade, automotive gasoline. Do not use highly leaded premium types.

For new engines, most satisfactory results are obtained by using nonleaded gasoline. For older engines that have previously used leaded gasoline, heads must be taken off and all lead deposits removed from engine before switching to nonleaded gasoline.

CAUTION

If lead deposits are not removed from engine before switching from leaded to nonleaded gasoline, preignition could occur causing severe damage to the engine.

STARTING

Refer to the tractor manual for location, setting, and operation of the electric start, choke and throttle controls. If engine fails to start, rust inhibiting oil, used for shipment, may have fouled the plug. Clean plug and dry thoroughly.

STOPPING

Refer to the tractor manual for location and operation of the STOP control.

BREAK-IN PROCEDURE

Proper break-in is essential in providing optimum engine performance and life. Improper break-in can cause severe cylinder scoring, bearing galling, cylinder wall glazing and poor piston ring seating. The engines covered in this publication have been run-in at the factory. After initial start, run the engine at about half load for 30 minutes and then on three quarter load for another 30 minutes. During the next four hours apply varying loads including intermittent full load. (Do not bog the engine down or exceed the full nameplate horsepower rating.) Drain the oil at the end of this 5 hour period and refill. Thereafter check the oil as prescribed in the maintenance schedule. This break-in plus conscientious maintenance will help assure many hours of satisfactory service.

OUT-OF-SERVICE PROTECTION

Protect an engine that is to be out-of-service for more than 30 days as follows:

1. Run engine until thoroughly warm.
2. Turn off fuel supply and run until engine stops.
3. Drain oil from oil base while still warm. Refill and attach a warning tag stating oil viscosity used.
4. Remove spark plug. Pour 1 oz. (two tablespoons) of rust inhibitor (or SAE #50 oil) into the cylinder. Crank engine over a few times. Install spark plug.
5. Service air cleaner.
6. Clean governor linkage and protect by wrapping with a clean cloth.
7. Plug exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.
8. Wipe entire unit. Coat rustable parts with a light film of grease or oil.
9. Provide a suitable cover for the entire unit.
10. If battery is used, disconnect and follow standard battery storage procedure.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to-and-from the engine.
2. Keep cooling fins clean. Air housing should be properly installed and undamaged.

LOW TEMPERATURES

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm. If an unexpected temperature drop causes an emergency, move the unit to a warm location or apply heat externally until oil flows freely.
2. Use fresh fuel. Protect against moisture condensation.
3. Keep fuel system clean, and batteries in a well-charged condition.

DUST AND DIRT

1. Keep unit clean. Keep cooling system clean.
2. Service air cleaner as frequently as necessary.
3. Change oil oftener under dusty conditions.
4. Keep oil and gasoline in dust-tight containers.
5. Keep governor linkage clean.

HIGH ALTITUDE

For operation at altitudes of 2500 feet above sea level, close carburetor main jet adjustment slightly to maintain proper air-to-fuel ratio (refer to the FUEL SYSTEM SECTION). Maximum power will be reduced approximately 4% for each 1000 feet above sea level, after the first 1000 feet.

GENERAL MAINTENANCE

MAINTENANCE SCHEDULE

The factory recommended maintenance schedules, Tables 1 and 2, should be used as a guide to get long and efficient unit life. Neglecting routine maintenance can result in failure or permanent damage to the unit. Table 1 maintenance should be performed by the operator and Table 2 maintenance by qualified service personnel (ONAN dealer). Units operating under abnormally adverse conditions should receive more frequent maintenance checks and service. See Figures 1 and 2.

TABLE 1. OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS			
	8	40	100	200
Inspect Unit	x			
Check Fins For Dirt	x			
Check Oil Level	x			
Check Air Cleaner		xl		
Clean Governor Linkage		xl		
Check Spark Plug			x	
Change Crankcase Oil		xl		
Clean Crankcase Breather				x
Clean Fuel System				x
Check Battery				x

xl - Perform more often in extremely dusty conditions.

TABLE 2. CRITICAL MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS		
	200	400	1000
Remove Carbon		x	
Check Valve Clearance		x	
Clean Carburetor		x	
Clean Engine	x		
Remove & Clean Oil Base		x	
Grind Valves (if required)		x	
General Overhaul (if required)			x

Do not allow grass cuttings, leaves, etc. to accumulate on the engine, especially between the cylinder head fins or in the governor control area. Make frequent inspections and perform a thorough cleaning at the end of the mowing and plowing season.

Consult your Onan dealer if noticing any unusual sounds, loss of power, overheating, etc.

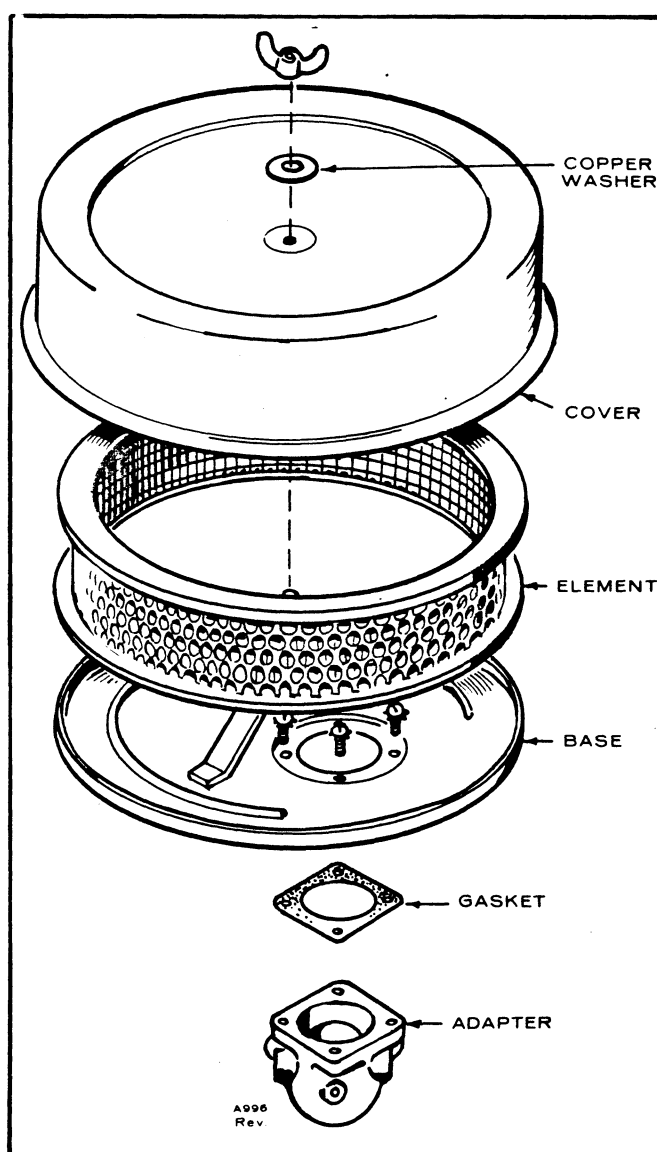


FIGURE 1. AIR CLEANER ASSEMBLY

AIR CLEANER

Each NB series engine is equipped with a paper cartridge, automotive type air cleaner (Figure 1). Under normal usage the cleaner should be changed every 200 hours. Extremely dusty conditions may require a change every 50 hours. The cleaner should be inspected more frequently, especially if the engine appears to be losing power or idles roughly. If the cleaner element is dirty, it may be cleaned by tapping gently on a flat surface. When cleaning, do not dent the plastic sealing surfaces. Wipe the sealing surfaces and the air cleaner pan and cover clean before re-assembling. When replacing the wing nut don't forget the copper washer. Tighten the wing nut finger tight only.

CRANKCASE OIL

Check the oil level as the Operator Maintenance Schedule, Table 1, directs. If oil addition is necessary, make sure it is exactly the same as that previously used. Fill only to the full mark on the oil level indicator, Figure 4. If it is time to change the oil, drain the oil thoroughly with the engine warm and refill with 2 quarts of good quality detergent oil, Designation SE. (MS or MS/DG oil may be used if SE is not available, although changing brands and/or designations is not advisable). Use oil of the SAE viscosity recommended in Figure 2.

BREATHER VALVE

Referring to Figure 3, remove the hose from the breather valve at the valve compartment cover. Wash the valve and filter in kerosene or other suitable solvent. Dry and replace. The valve must work free and the hose must not be restricted to prevent expelled air from re-entering the crankcase. Install parts removed with new gaskets.

CAUTION When reinstalling breather assembly, make sure the oil return hole in the lower right hand corner of the baffle plate is not covered by the gaskets.

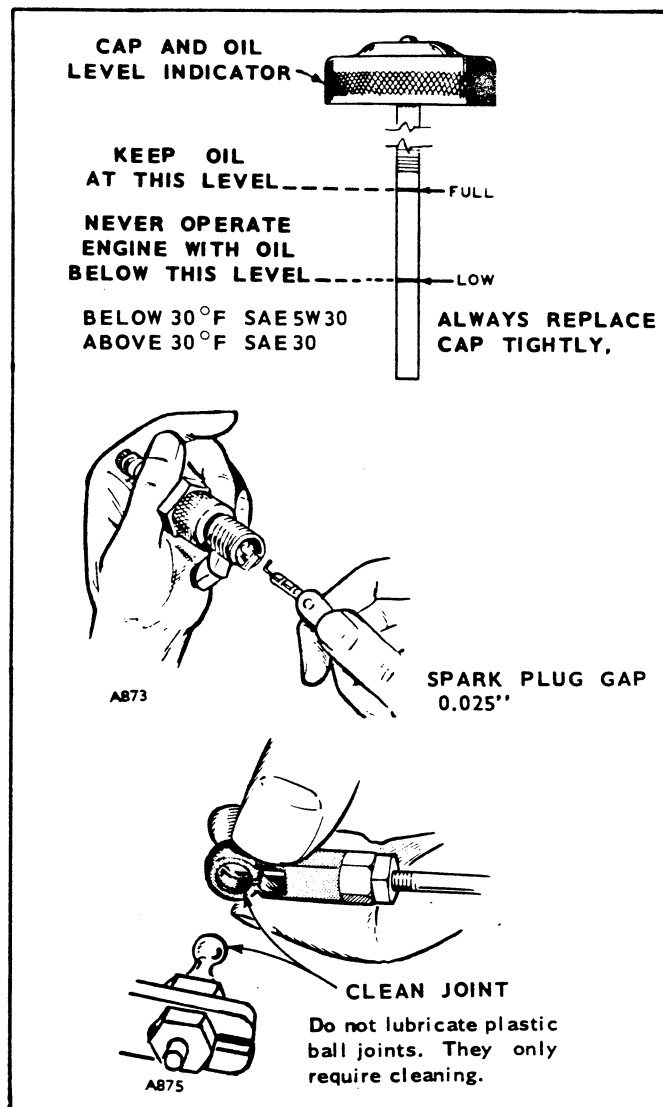


FIGURE 2. MAINTENANCE PROCEDURES

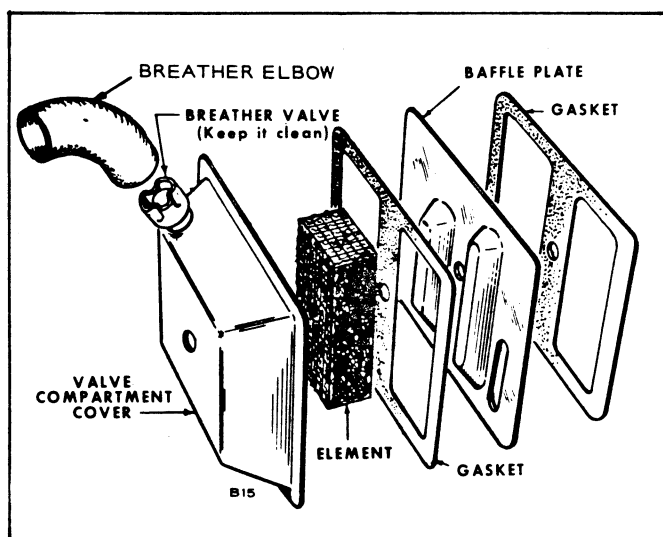


FIGURE 3. BREATHER VALVE MAINTENANCE

ENGINE TROUBLESHOOTING

TROUBLE																				GASOLINE ENGINE TROUBLESHOOTING GUIDE											
Backfire at Carburetor	Bearing Wear	Black Exhaust	Blue Exhaust	Burned Valves	Connecting Rod Wear	Crankshaft Slowly	Cylinder Wear	Engine Stops	Failure to Start	Governor Hunting	High Oil Pressure	Low Oil Pressure	Loss of Coolant (Water Cooled)	Misfiring	Overheating (Air Cooled)	Overheating (Water Cooled)	Piston Wear	Poor Compression	Ring Wear	Sticking Valves	CAUSE										
																						STARTING SYSTEM									
																						Loose or Corroded Battery Connection									
																						Low or Discharged Battery									
																						Faulty Starter									
																						Faulty Start Solenoid									
																						IGNITION SYSTEM									
																						Ignition Timing Wrong									
																						Wrong Spark Plug Gap									
																						Worn Points or Improper Gap Setting									
																						Bad Ignition Coil or Condenser									
																						Faulty Spark Plug Wires									
																						FUEL SYSTEM									
																						Out of Fuel - Check									
																						Lean Fuel Mixture - Readjust									
																						Rich Fuel Mixture or Choke Stuck									
																						Engine Flooded									
																						Poor Quality Fuel									
																						Dirty Carburetor									
																						Dirty Air Cleaner									
																						Dirty Fuel Filter									
																						Defective Fuel Pump									
																						INTERNAL ENGINE									
																						Wrong Valve Clearance									
																						Broken Valve Spring									
																						Valve or Valve Seal Leaking									
																						Piston Rings Worn or Broken									
																						Wrong Bearing Clearance									
																						COOLING SYSTEM (AIR COOLED)									
																						Poor Air Circulation									
																						Dirty or Oily Cooling Fins									
																						Blown Head Gasket									
																						COOLING SYSTEM (WATER COOLED)									
																						Insufficient Coolant									
																						Faulty Thermostat									
																						Worn Water Pump or Pump Seal									
																						Water Passages Restricted									
																						Defective Gaskets									
																						Blown Head Gasket									
																						LUBRICATION SYSTEM									
																						Defective Oil Gauge									
																						Relief Valve Stuck									
																						Faulty Oil Pump									
																						Dirty Oil or Filter									
																						Oil Too Light or Diluted									
																						Oil Level Low									
																						Oil Too Heavy									
																						Dirty Crankcase Breather Valve									
																						THROTTLE AND GOVERNOR									
																						Linkage Out of Adjustment									
																						Linkage Worn or Disconnected									
																						Governor Spring Sensitivity Too Great									
																						Linkage Binding									

DIMENSIONS, CLEARANCES AND TORQUES

DIMENSIONS AND CLEARANCES

All clearances given at room temperature of 70°F.
All dimensions in inches unless otherwise specified.

	Minimum	Maximum
CAMSHAFT		
Bearing Diameter Assembled (Replacement)	1.3757	1.3787
Bearing Journal Diameter	1.3745	1.3740
Bearing Clearance Limit (Replacement)	.0012	.0047
End Play, Camshaft		.003
Tappet Diameter	.7480	.7475
Tappet Bore Diameter	.7505	.7515
CONNECTING RODS		
Large Bore Diameter	1.6280	1.6285
Small Bore Diameter	.7504	.7507
CYLINDER		
Cylinder Bore (Std.)	3.5635	3.5645
CRANKSHAFT		
Main Bearing Dia.-Std. Assembled (Replacement)	2.0020	2.0040
Main Bearing Journal Diameter	2.0000	1.9992
Main Bearing Clearance (Replacement)	.0020	.0048
Connecting Rod Journal Diameter	1.6260	1.6252
Rod Bearing Clearance	.002	.0033
End Play, Crankshaft	.006	.012
End Play, Connecting Rod	.002	.016
PISTON		
Piston Clearance to Cylinder Wall (Measure 90° to Pin, Just Below Oil Ring Groove)	.0025	.0045
PISTON PIN		
Piston Clearance (Thumb Push Fit)	.0001	.0005
Connecting Rod Bushing Clearance	.0002	.0007
PISTON RINGS		
Ring Gap (In Cylinder)	.013	.023
Ring Width, Top	.0935	.0925
2nd	.0935	.0925
Oil	.1865	.1860
VALVE, INTAKE		
Stem Diameter	.3430	.3425
Guide Clearance	.0010	.0035
Valve Face		44°
Valve Clearance		.010
VALVE, EXHAUST		
Stem Diameter	.3415	.3410
Guide Clearance	.0025	.0040
Valve Face		44°
Valve Clearance		.014
GEARS		
Timing Gear Back Lash	.002	.003
VALVE GUIDE		
Length, Intake		2-3/16
Exhaust		2-1/2
Outside Diameter	.7510	.7505
Inside Diameter, Intake	.344	.346
Exhaust	.344	.345
Cylinder Block Guide Bore Diameter	.7505	.7515

(Continued on following page)

DIMENSIONS AND CLEARANCES

(continued)

VALVE SEATS (Stellite)

	Minimum	Maximum
Valve Seat Bore		
Diameter, Intake	1.5645	1.5655
Exhaust	1.251	1.252
Seat Insert Outside Diameter, Exhaust	1.256	1.255
Intake	1.5685	1.5675
Seat Width	1/32	3/64
Seat Angle		45°

VALVE SPRINGS

Load, Valve Closed	38 lbs.	42 lbs.
Load, Valve Open	71 lbs.	79 lbs.

SPARK PLUGS

Spark Plug Gap025
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BREAKER POINT SETTING

Transistor Ignition Gap008
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TAPPETS

Gasoline, Intake010
Exhaust014

IGNITION TIMING SPARK ADVANCE

CAP. DISCH. Ignition (without Automatic Spark Advance)	20° BTC
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COMPRESSION

(Due to compression release feature compression must be measured with piston about 1/8 inch down from top of stroke. Turn to TC on compression stroke. Then turn an additional 2 inches of Flywheel travel.)

70 - 75 lbs.

ASSEMBLY TORQUES

Assembly torques as given here require the use of a torque wrench. These assembly torques will assure proper tightness without danger of stripping the threads. If a torque wrench is not available, you will have to estimate the degree of tightness necessary for the stud, nut, or screw being installed and tighten accordingly. Be careful not to strip the threads. Check all studs, nuts and screws often. Tighten as needed to prevent them from working loose.

Bolt Torque	FT.-LB.
Rear Bearing Plate Cap Screws	30-35
Connecting Rod Bolt-Alum. Rod	24-26
Flywheel Cap Screw - Cast Iron Wheel	40-45
Other 5/16" Cylinder Block Studs & Nuts	10-12
Cylinder Head Bolt	29-31
Gearcase Cover Screws	14-18
Oil Base Mounting Screws	38-43
Spark Plug	15-20
Starter Mounting Bracket to Block	25-30

FUEL SYSTEM

CARBURETOR

Carburetor maintenance should be based on regular cleaning in accordance with the maintenance schedule and the following instructions. Factory carburetor adjustments normally should be left unchanged. However, if the adjustments have been disturbed, use the *full load* method or the *no load* method given below. Turn the needles 1 to 1-1/2 turns off their seats as required for initial starting, then make further adjustments for smooth operation. Be sure the ignition system is working properly and the governor is properly adjusted.

CAUTION Forcing the needles against their seats will damage them. Even when turned fully in, the needles still permit some flow of fuel. See Figure 4.

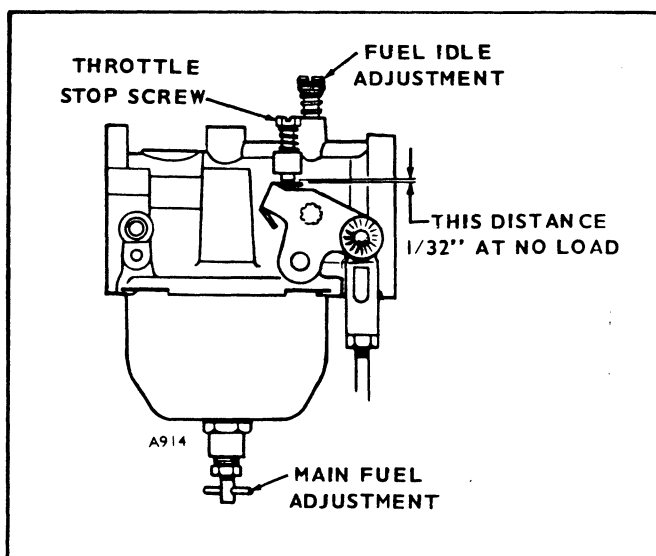


FIGURE 4. CARBURETOR ADJUSTMENT

Adjustment Under Load

1. Allow the engine to warm up. With the engine under no load, turn the idle adjustment out until the engine speed drops slightly below normal. Then turn the needle in until the speed returns to normal.
2. Apply a full load to the engine. Carefully turn the main adjustment in until the speed drops slightly below normal. Then turn the needle out until speed returns to normal.

Adjustment When Load Condition Is Not Possible:

1. Allow the engine to warm up.
2. Push in the governor mechanism until the unit slows down to about 900 rpm.
3. Set the idle adjustment screw for smooth engine operation.
4. Release the governor mechanism so the engine accelerates. If the engine accelerates evenly and without a lag, the main adjustment is correct. If not, adjust the needle outward about 1/2 turn and again slow down the engine and release the mechanism. Continue until the engine accelerates evenly and without a time lag after releasing the governor.
5. With the carburetor and governor adjusted, set the throttle stop screw, Figure 4, to allow 1/32" clearance at the stop pin with the engine operating at no load. This prevents excessive hunting when a large load is suddenly removed.

Removal and Disassembly. Carburetor removal and disassembly should be performed as follows:

1. Remove the fuel line, governor linkage and air cleaner assembly.
2. Remove the two carburetor mounting nuts and pull off the carburetor.
3. Remove the air cleaner from the carburetor.
4. Remove the two screws that mount the choke to the carburetor and remove the assembly.
5. Remove the float bowl nut and bowl.
6. Remove the float pin and float, Figure 5.
7. Lift out the float valve and unscrew its seat.
8. Remove the no-load adjusting needle.
9. Remove the load adjusting needle and spring.
10. Remove the throttle plate screws and the plate and pull out the throttle shaft.
11. Remove the choke plate screws, plate, and pull out the choke shaft.

Cleaning: To clean the carburetor, soak all components thoroughly in a good carburetor cleaner, following the cleaner manufacturer's instructions. Be sure all carbon is cleaned from the carburetor bore, especially in the area of the throttle valve. Blow out the passages with compressed air. If possible, avoid using wire to clean out the passages.

Inspection: After cleaning the carburetor components inspect the parts and obtain replacements for those which are damaged. Check the adjusting needle, nozzles and float for damage. If the float is loaded with fuel

or is otherwise damaged, replace it. It should also fit freely upon its pin without binding. Invert the carburetor body and measure the float level per Figure 6. Check the choke and throttle shafts for excessive side play.

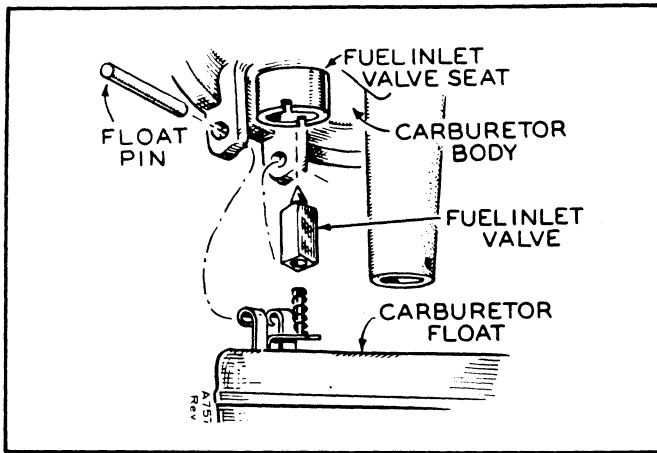


FIGURE 5. CARBURETOR DISASSEMBLY

Reassembly and Installation. Reassembly and installation should be performed as follows:

1. Install the throttle shaft and valve, using new screws and lockwashers. Install with bevel mated to the carburetor body. To center the valve, back off the stop screw, close the throttle lever, and seat the valve by tapping it with a small screwdriver; then tighten the two screws.
2. Install choke shaft and valve. Center the valve in the same manner as the throttle valve (step 1). Use new screws and lockwashers.
3. Install the main nozzle, making sure it seats in the body casting.
4. Install the intake valve seat and valve.
5. Install the float and float pin. Center the pin so the float bowl does not ride against it.
6. Check the float level with the carburetor casting inverted. See Figure 6.
7. Install the bowl ring gasket, bowl and bowl nut. Make sure that the bowl is centered in the gasket, and tighten the nut securely.
8. Install the load adjusting needle with its spring. Turn in until it seats and back out 1 to 1-1/2 turns.
9. Install the idle adjusting screw finger tight. Then back out 1 to 1-1/2 turns.
10. Install the choke and adjust.
11. Install the carburetor on the engine and connect the gasoline inlet, governor mechanism, and choke.
12. Install the air cleaner.

Adjusting Float Level:

To check float level, remove the entire main fuel adjustment assembly from the float bowl (unscrew large nut from float bowl - Figure 6). The proper level from the float to the gasket should be 1/8 inch. The float tab should just touch the fuel inlet valve and not compress the inlet valve spring. Adjust by bending the tab on the float.

NOTE: Do not apply excessive pressure to float valve.

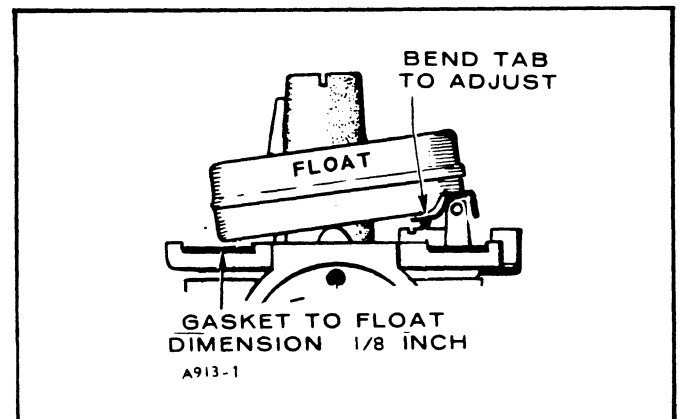


FIGURE 6. ADJUSTING FLOAT LEVEL

VALVE SYSTEM

VALVE SYSTEM

Valve servicing should be performed only by qualified service personnel and in accordance with the critical maintenance schedule or whenever indicated by the troubleshooting procedures.

Accessibility: For accessibility of the valves and related parts, remove the cylinder head (aluminum) by rapping it sharply on the edge with a soft-faced hammer (do not pry). Take care not to break any cooling fins. Use a conventional valve spring lifter to remove the valve spring locks (split type).

Cleaning and Inspection: Clean all carbon deposits from the cylinder head, piston top, valves, guides, etc. Replace valves with worn stems or burned or warped faces and also worn stem guides and tappets.

Valve Grinding: Referring to Figure 7, grind the valves and seats as required to obtain a 44 degree valve face angle and a 45 degree seat angle so that there is a one degree interference angle. This results in a sharp seating surface between each valve and valve seat, minimizing face deposits and extending valve life. Do not hand lap the valves. Bring the valve faces to a 44 degree angle in a valve grinding machine and grind the valve seats with a 45 degree stone so that the seat band is 1/32 to 3/64 inch wide. Grind only enough to assure proper seating.

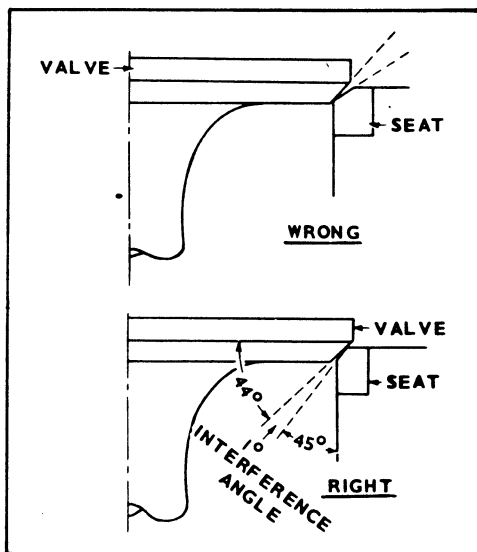


FIGURE 7. VALVE GRINDING

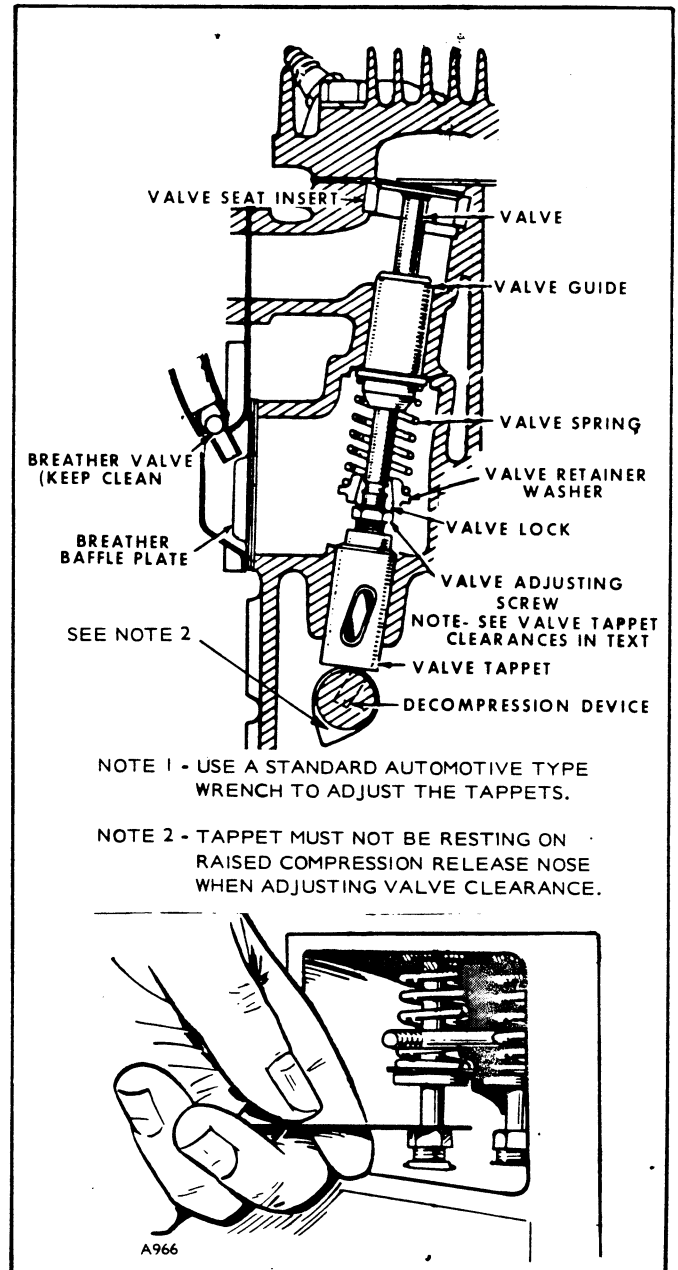


FIGURE 8. TAPPET ADJUSTMENT

Reassembly: Before reassembly remove all grinding compound from the engine parts and then place each valve in its proper location. Check that each valve is seated tightly, using an air pressure type testing tool. If such a tool is not available, make pencil marks at intervals across the valve face and observe if the marks rub off uniformly when the valve is rotated through part of a turn against the seat. Regrind or replace parts as necessary if poor seating is found.

Tappet Adjustment: Adjust tappets as follows:

1. Remove spark plug and valve cover.
2. Turn the engine over by hand until piston reaches top center (compression stroke); then turn flywheel approximately 30° after top center. (Tappet must not be resting on decompression device, Figure 8.)
3. Using a feeler gauge, set intake valve clearance at .010" and exhaust valve clearance at .014".
4. Replace spark plug and valve cover.

ENGINE DISASSEMBLY

ENGINE DISASSEMBLY AND REASSEMBLY

Disassembly and reassembly of engine components should be as follows. All parts should be cleaned and inspected before reassembly. Unsatisfactory parts should be repaired or replaced with good parts before reassembly. This may require replacing some assemblies. See the PARTS CATALOG section.

GEAR COVER

For removal of the gear cover, remove the mounting screws and loosen it by tapping it with a soft-faced hammer. After cleaning, inspect and reassemble per Figure 9.

When installing the gear cover, make sure that the pin in the gear cover engages the metal-lined (smooth) hole in the governor cup. Turn the governor cup so that the metal-lined hole is at the three o'clock position. The smooth side of the governor yoke must ride against the governor cup. Turn the governor arm and shaft clockwise as far as possible and hold in this position until the gear cover is installed flush against the crankcase. Be careful not to damage the gear cover oil seal. Adjust the roll (stop) pin to protrude to a point $\frac{3}{4}$ " from the cover mounting surface.

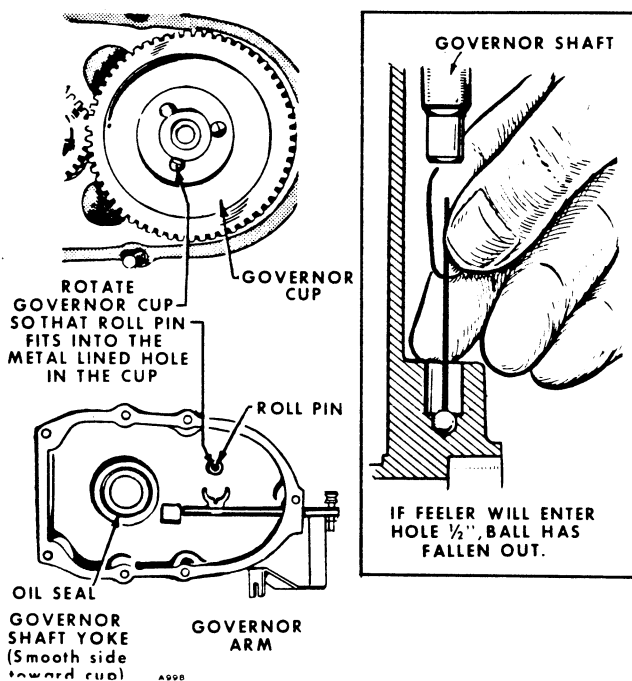


FIGURE 9. GEAR COVER ASSEMBLY

GOVERNOR CUP

After removal of the gear cover, detach the snap ring from the cam shaft center pin to remove the governor cup. Removal of the governor cup will release the flyballs which must be protected from damage and loss. See Figure 10.

Carefully inspect the flyballs for grooves or flat spots; the ball spacer for wear or other damage, and the race surface of the governor cup for grooves or roughness. The fit of the governor cup on the camshaft center pin must be free spinning but without excessive looseness or wobble.

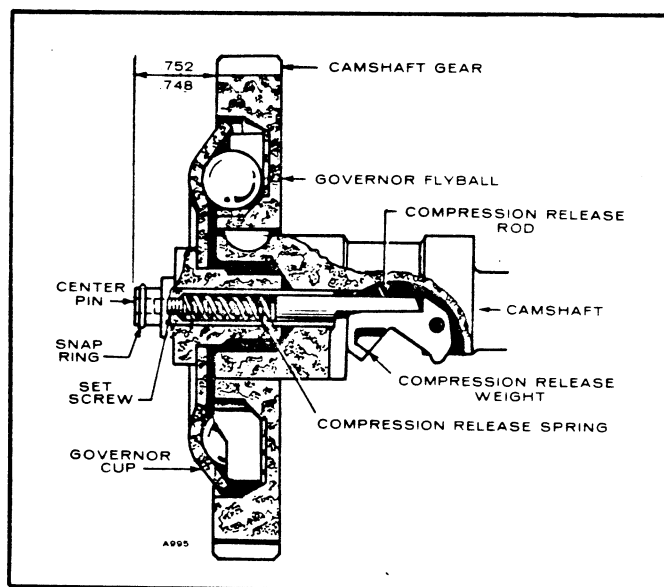


FIGURE 10. GOVERNOR CUP DETAILS

When installing the governor cup, tilt the engine so the gear is up, put the flyballs in place (equally spaced), and install the cup and snap ring on the center pin. See Figure 11.

The camshaft center pin extends out $\frac{3}{4}$ " from the end of the camshaft. This distance provides an in-and-out travel distance of $\frac{7}{32}$ " for the governor cup, as illustrated in Figure 10. Hold the cup against the flyballs when measuring. If the distance is less (the engine may race, especially at no load), remove the center pin and press a new pin in only the required amount. Otherwise, grind off the hub of the cup as

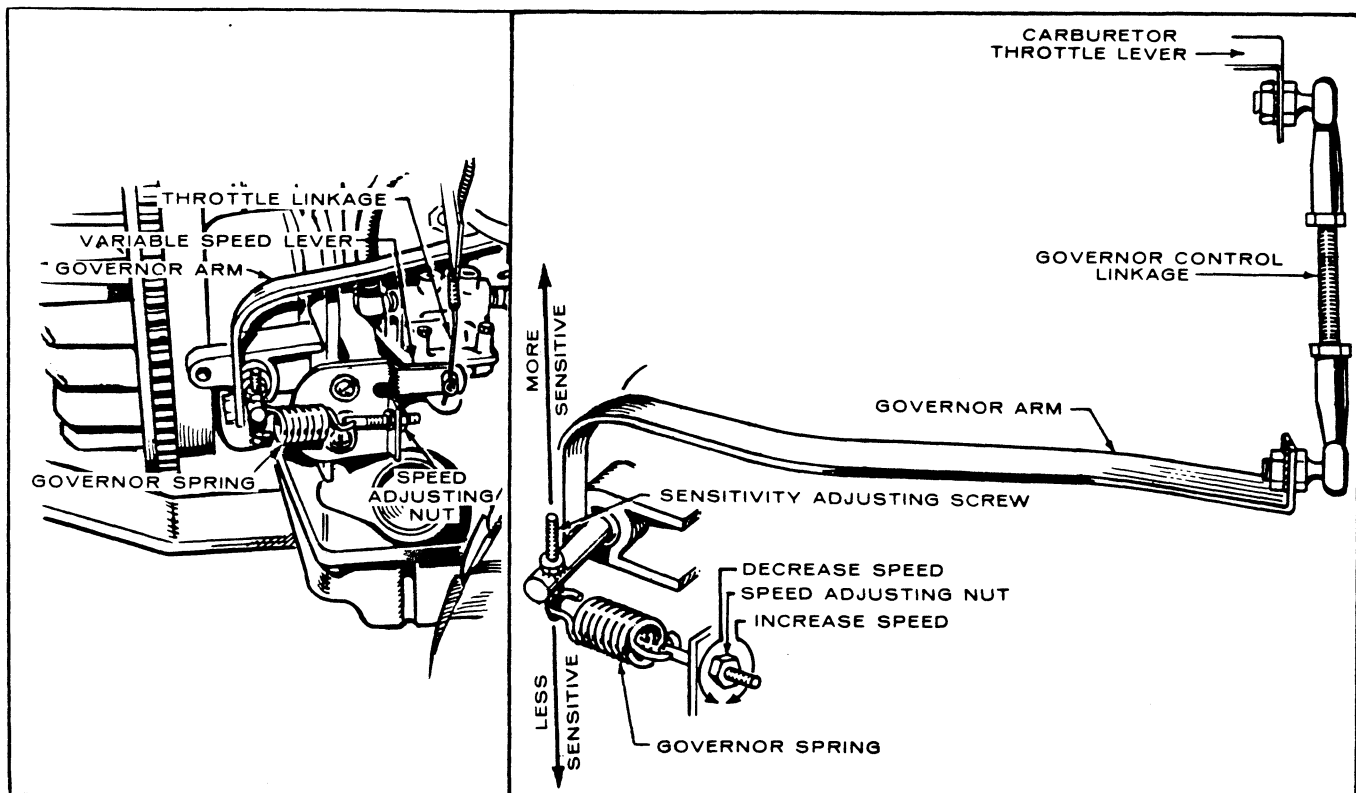


FIGURE 11. GOVERNOR ADJUSTMENT

required. The camshaft center pin cannot be pulled outward nor removed without damage. If the center pin extends out too far, the cup will not hold the flyballs properly.

The setscrew shown in Figure 10 should normally remain undisturbed, but if it has been reset or if parts have been replaced, the setscrew should be positioned so that the nose of the compression release weight is even with the cam base circle when the nose is at the "in" position. Secure the setscrew with Loctite. The nose is to be not more than 0.001" outside the base circle nor less than 0.004" inside the base circle.

GOVERNOR

Adjustment rather than disassembly is more usually required for the governor. Adjustment is for the purpose of maintaining the power and speed output at the desired level. This requires that the variable speed governor be so adjusted that there is an automatic decrease in sensitivity when the speed is increased. This provides good stability at all speeds.

Before adjusting the governor, run the engine for about 15 minutes until engine reaches normal operating temperature. Use a tachometer for checking engine speed.

First check the governor arm, linkage, throttle shaft, and lever to make sure they are not binding or showing

excessive slack and wear at the connecting points. Loose linkage or binding in the linkage will cause a hunting condition, and erratic operation. Work the arm back and forth several times by hand while the engine is idle. If either binding or looseness exists, pinpoint the trouble and adjust or replace parts as needed. See Figure 11.

Linkage: The engine starts at wide-open throttle. The length of the linkage connecting the governor arm to the throttle arm is adjusted by rotating the ball joint. Adjust the length so that with the engine stopped and tension pulling on the governor spring, the stop screw on the carburetor throttle lever is 1/32" from the stop pin, Figure 4. This setting allows immediate control by the governor after starting and synchronizes travel of the governor arm and the throttle shaft.

Adjustment:

1. Adjust the carburetor main jet for the best fuel mixture at full load operation.
2. Adjust the carburetor idle needle with no load connected.
3. Adjust the length of the governor linkage.
4. Check the governor linkage and throttle shaft for binding or excessive looseness.
5. Adjust the governor spring tension for nominal engine speed at no-load operation.
6. Check the rpm drop between no-load and full-load operation and adjust the governor sensitivity as needed.

7. Recheck the speed adjustment.
8. Set the carburetor throttle stop screw.
9. Adjust the throttle stop screw on the carburetor to allow a recommended minimum idling speed of 1000-1100 rpm. (A lower minimum does not assure smooth operation under load.)

NOTE: *Approximately 3000 rpm is the recommended maximum full load speed for continuous operation. The speed must agree with load requirements.*

Speed Adjustment: The speed at which the engine operates is determined by the tension applied to the governor spring. Increasing spring tension increases engine speed. Decreasing spring tension decreases engine speed. The no-load speed of the engine should be slightly higher than the speed requirements of the connected load.

If a speed adjustment is needed, turn the speed adjusting nut in to increase the speed or out to decrease the speed (Figure 11).

Adjust the tension of the governor spring for minimum speed. Adjust the throttle linkage so that shifting of the throttle speed lever will give a desired range of speeds. First, shift the lever to minimum (slow) position and with no load connected, adjust the spring tension for about 1000-1100 rpm.

Adjust the sensitivity while operating at minimum speed to attain the smoothest no load to full load operation as follows:

The sensitivity of the governor depends upon the position of the arm end of the governor spring. A threaded stud on the governor arm provides for adjustment. To increase sensitivity, move the governor spring toward the governor shaft by loosening the upper locknut on the threaded stud and tightening the lower nut. To decrease sensitivity, reverse the procedure.

A too-sensitive setting will result in a surging speed (hunting) condition, an alternate increase and decrease in engine speed. An opposite setting will result in too much speed variation between no load and full load conditions. Thus, the correct position of the governor spring will result in the most stable speed regulation without causing a surge condition.

Always recheck the speed adjustment after a sensitivity adjustment. Increasing sensitivity will cause a slight decrease in speed and will require a slight increase in the governor spring tension.

TIMING GEARS

If replacement of either the crankshaft gear or the camshaft gear becomes necessary, install both gears new, never one only. To remove the crankshaft gear, first remove the snap ring, then attach the gear pulling ring (Onan Tool No. 420A248) using two #10-32 screws (Figure 12). Tighten the screws alternately until both are tight. Attach a gear puller to the puller ring and proceed to remove the gear.

The camshaft gear is pressed on and keyed to the camshaft. The camshaft and gear must be removed as an assembly after first removing the crankshaft gear lock ring and washer. Before removing the camshaft and gear assembly, remove the cylinder head and valve assemblies. Remove the fuel pump and tappets. After removing the governor cup assembly from the gear, the camshaft may be pressed out of the gear by use of a hollow tool or pipe which will fit over the camshaft center pin. Do not press on the center pin or damage it in any way. The governor ball spacer is a press fit to the camshaft gear.

When pressing a camshaft gear onto the camshaft, be sure the gear is started straight and that the key is properly in place. Install the governor cup assembly before installing the camshaft and gear in the engine.

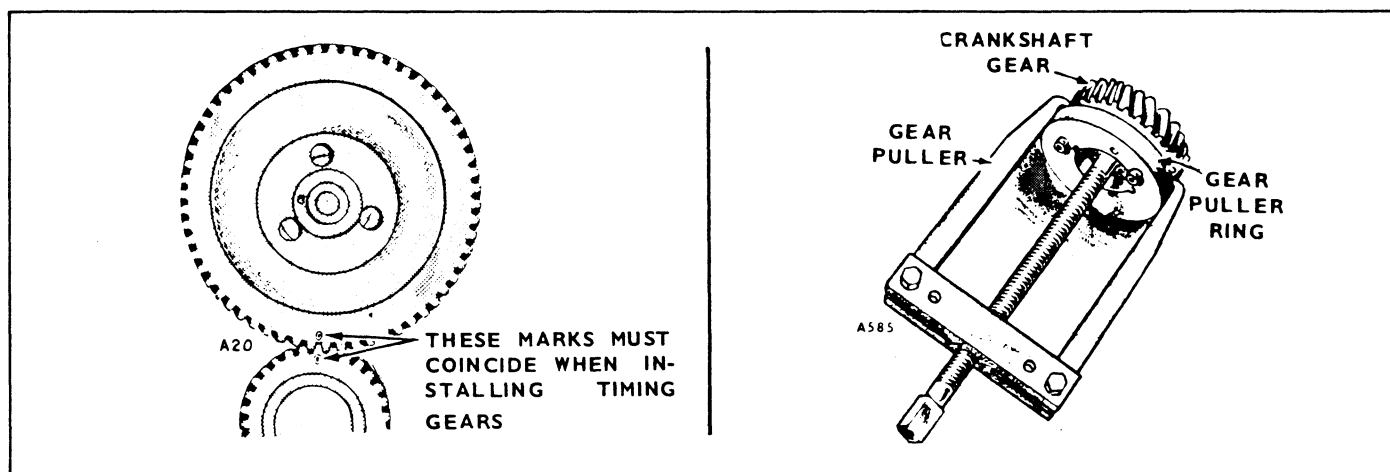


FIGURE 12. TIMING GEAR REMOVAL AND INSTALLATION

Each timing gear is stamped with an O mark near the edge. The gear teeth must mesh so that these marks exactly coincide when the gears are installed in the engine. Be sure, when installing the camshaft gear and shaft assembly, that the thrust washer is properly in place behind the camshaft gear. Replace the retaining washer and lock ring to the crankshaft.

PISTON AND RINGS

The piston and connecting rod assembly is removed outward from the cylinder after removal of the cylinder head. The piston is fitted with two compression rings and one oil control ring with an expander. Inspect the piston. The piston ring grooves should be cleaned of any carbon deposits, and the oil return slots in the lower groove must be open.

If the piston is badly scored, very loose in the cylinder, has badly-worn ring grooves, or otherwise is not in good condition, install new piston. Also install new piston if the old one is loose on the piston pin and 0.002" oversize piston pin will not correct it. Handle piston carefully to avoid nicking the walls. Any raised surface of this type must be dressed down carefully.

Inspect the rings carefully for fit in grooves, for tension, and for seating on cylinder walls. Install new rings where there is any doubt about the condition of the old rings.

For the following, refer to Figure 13. Before installing new rings on the piston, check the ring gap by placing each ring squarely in its cylinder at a position corresponding to the bottom of its travel. The gap between the ends of the ring is given in the **ASSEMBLY TORQUES AND CLEARANCES** section. Rings which are slightly oversize may be filed as necessary to obtain the correct gap, but do not use rings which require too much filing. Standard size rings may be used on .005" oversize piston. .010", .020", .030" and .040" oversize rings are to be used on corresponding oversize piston. Rings of the tapered type are usually marked *top* on one side, or identified in some other manner, and the ring must be installed with this mark toward the closed end of the piston.

Space each ring gap one third of the way around the piston from the preceding one, with no gap directly in line with the piston pin. The bottom piston ring groove should be fitted with an expander and an oil control ring and the two upper grooves fitted with compression rings. The chrome-faced ring should be fitted in the top groove. The oil control ring is selected for best performance in regard to the correct unit pressure characteristics.

The piston is fitted with a full-floating-type piston pin. The pin is kept in place by two lock rings in the piston, one at each side. Be sure these lock rings are properly in place before installing the piston and connecting rod in the engine. Refer to the **ASSEMBLY TORQUES AND CLEARANCES** section for the correct piston-to-cylinder clearance.

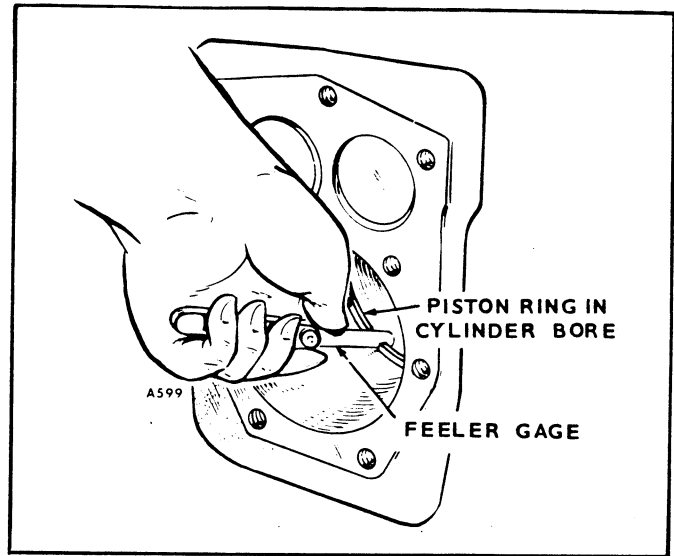


FIGURE 13. FITTING PISTON RINGS TO TYPICAL CYLINDER

CONNECTING ROD

The connecting rod should be serviced at the same time the piston or piston rings are serviced. Rod must be removed with the piston. Rod is available in standard or .010", .020", or .030" undersize.

Install the connecting rod and cap as shown in Figure 14. Coat the crankshaft journal bearing surfaces with oil before installing the rod. Crank the engine by hand to see that the rod is free. If necessary, rap the connecting rod cap screws sharply with a soft-faced hammer to set the rod square on the journal.

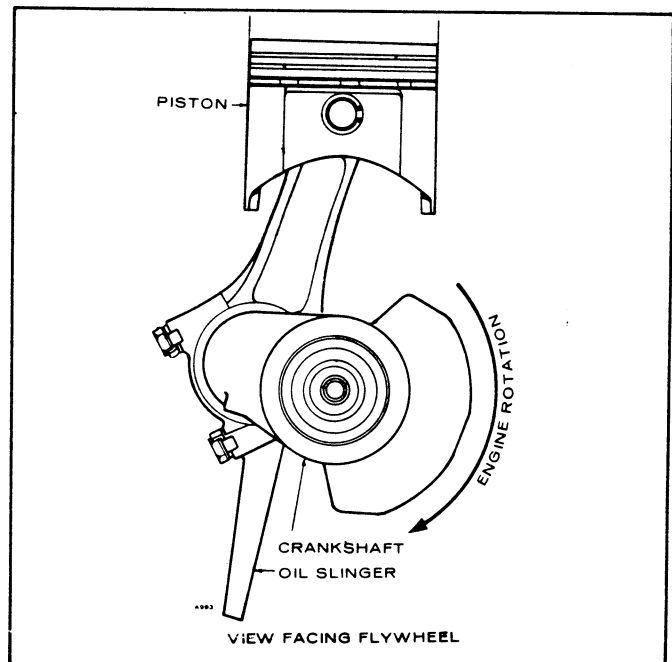


FIGURE 14. CONNECTING ROD INSTALLATION

CRANKSHAFT

Inspect the bearing journals. If they are scored and cannot be smoothed out by dressing down, the bearing journals should be refinished to use nearest available undersize bearings or a new crankshaft should be installed. If a worn main bearing journal cannot be fitted with an available precision type undersize bearing, then refinish it to the next undersize.

BEARINGS

Removal of the camshaft or crankshaft bearings requires complete disassembly of the engine. Use a press or a suitable drive plug to remove the bearings. Support the casting to avoid distortion and avoid damaging the bearing bore during removal and installation. Use oil on the bearings to reduce friction when installing and again lubricate with oil after installing. See Figure 15.

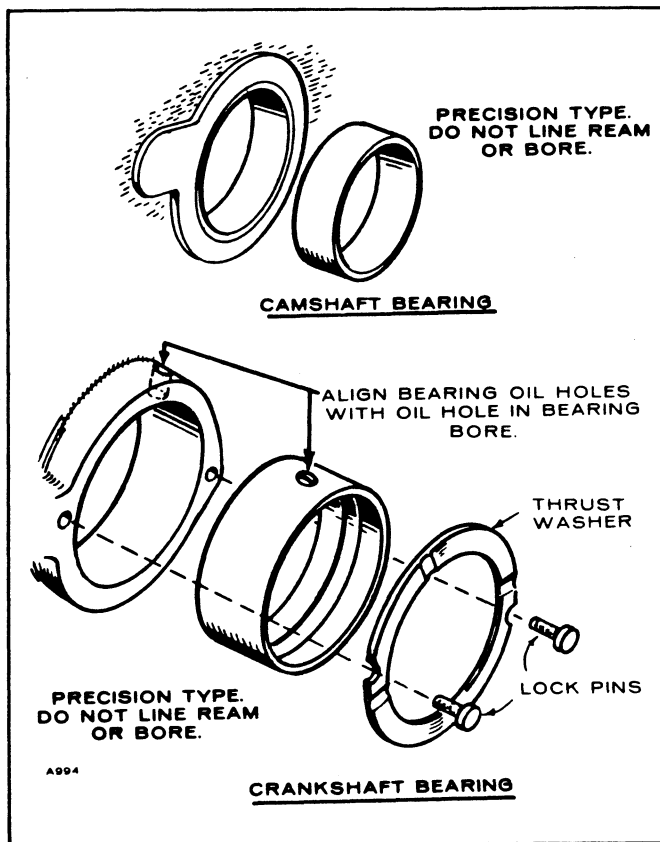


FIGURE 15. CAMSHAFT AND CRANKSHAFT BEARINGS

New crankshaft main bearings are precision type which *do not* require line reaming or line boring after installation. They are available in standard size, .002", .010", .020", or .030" undersize. Expand the bearing bore by placing the casting in hot water or in an oven heated to 200°F.

CAUTION

If a torch is used, apply only a little heat.

If practical, cool the precision bearing to shrink it. Align the oil hole(s) in the bearing with the oil hole(s) in the bearing bore. The oil passage must be at least 1/2 open. The cold oiled precision bearing should require only light taps to position it. Install the bearing flush with the inside end of the bore. If head of lock pin is damaged, use side cutters or Easy Out tool to remove and install new pin. Apply oil to thrust washer to hold it in place while installing the crankshaft. Oil grooves in thrust washers must face the crankshaft, washers must be flat (not bent) and washers two notches must fit over two lock pins to prevent riding on crankshaft.

New camshaft bearings are precision type which *do not* require line reaming or line boring after installation. Coat the bearing with lubricating oil to reduce friction. Place the bearing on the crankcase over the bearing bore with the elongated hole in proper position and narrow section facing out (except bores without oil holes install with bearing groove at the top). Be sure to start the bearing straight. Press the front bearing in flush with the outside end of the bearing bore. Press the rear bearing in flush with the bottom of counterbore which receives the expansion plug.

CRANKSHAFT ENDPLAY

After the rear bearing plate has been assembled with the cap screws torqued to 30-35 foot pounds, check the endplay per Figure 16. If the endplay is not within the 0.006 to 0.012 inch limits, remove the rear bearing plate and change gaskets as required to obtain the right clearance.

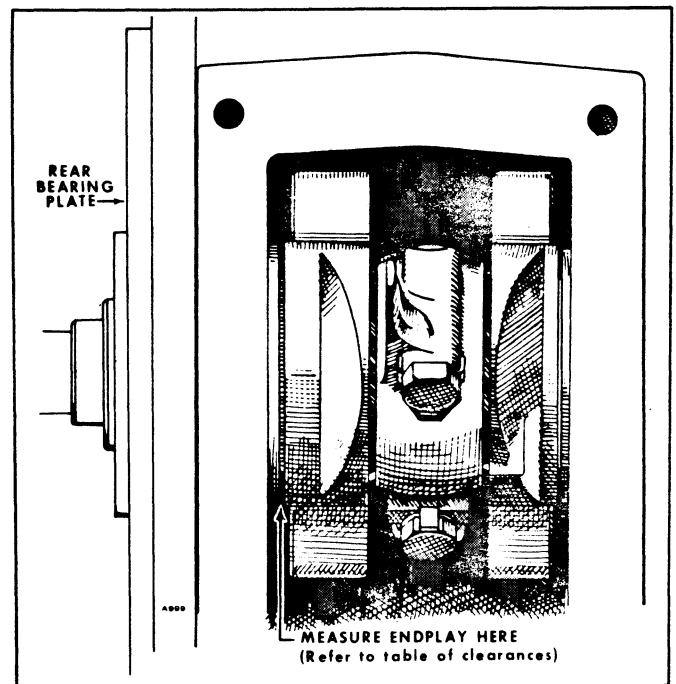


FIGURE 16. CRANKSHAFT ENDPLAY

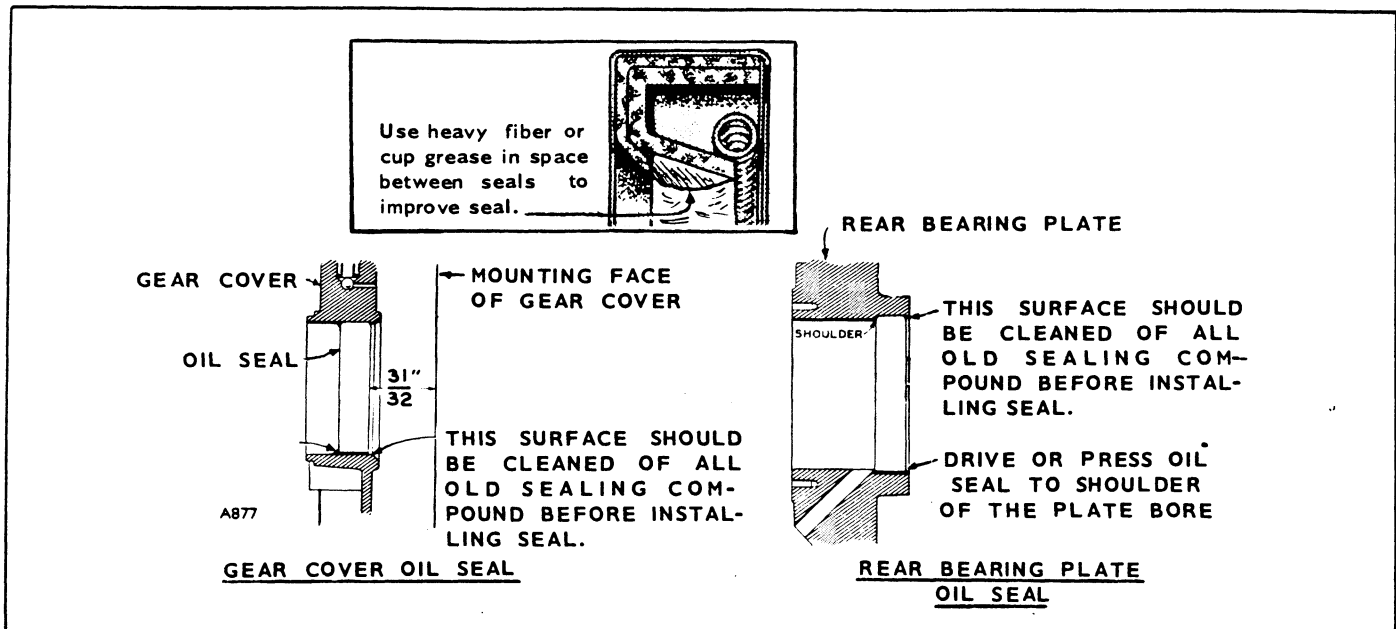


FIGURE 17. GEAR COVER AND REAR BEARING PLATE OIL SEALS

OIL SEALS

The bearing plate must be removed to replace its oil seal. Drive the oil seal out from the inside.

Before installing the seals, fill the space between seals with a fibrous grease or stiff cup grease. This will improve sealing. See Figure 17.

When installing the gear cover oil seal, tap the seal inward until it is $\frac{31}{32}$ of an inch from the mounting face of the cover. Install new style, thin, open-face seal $1\frac{7}{64}$ inch from the mounting face of cover.

When installing the bearing plate oil seal, tap the seal into the bearing plate bore to bottom against the shoulder in the plate bore. Use a seal expander, or place a piece of shim stock around the end of the crankshaft, when replacing the bearing plate to avoid damaging the seal. Remove the shim stock as soon as the plate is in place.

CYLINDER

The cylinder wears very little in normal service. If, through improper lubrication or accident, the cylinder wall should become scored or worn badly, the cylinder may be rebored and honed to accommodate a new piston and ring set of the available oversizes. Pistons are available in .005 inch, .010 inch, .020 inch, .030 inch and .040 inch oversize. Piston rings are available in .010 inch, .020 inch, .030 inch and .040 inch oversize. Use standard size rings on a .005 inch oversize piston. If the cylinder is not being reconditioned, but new piston rings are being installed, remove any ridge which may have become formed at the top of piston ring travel in the cylinder bore. Engine might be fitted at the factory with a .005 inch oversize piston and are so indicated by a letter E following the engine serial number stamped on the

cylinder block and on the unit nameplate. The standard cylinder bore size appears in ASSEMBLY TORQUES AND CLEARANCES section.

CYLINDER HEAD

When reassembling the cylinder head to the cylinder, tighten the cylinder head bolts as shown in Figure 18 to about 15 foot-pounds before repeating the sequence to a 29-31 foot-pound torque. After the engine has

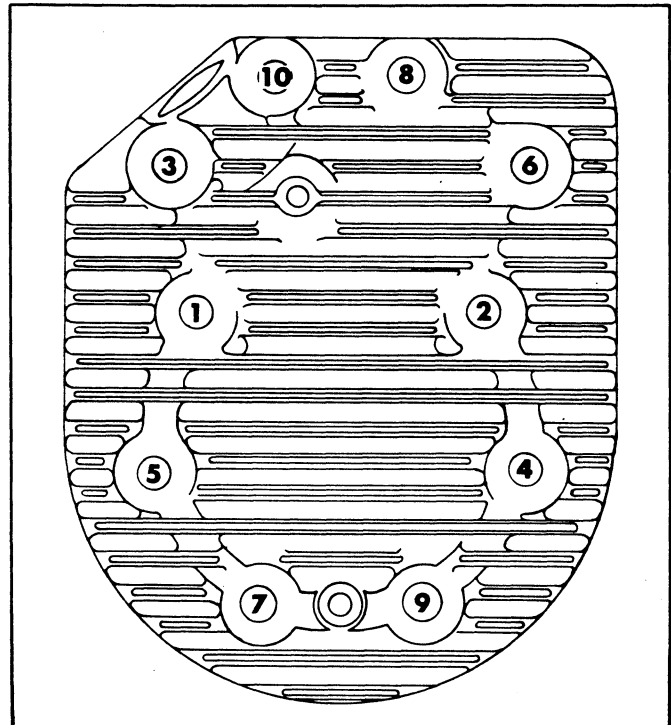


FIGURE 18. CYLINDER HEAD TORQUING SEQUENCE

been operated and brought to its normal hot temperature, shut it off and allow it to cool to room temperature. Then retighten the bolts to the same torque as before in the same sequence. Perform this retightening within the first 50 hours of operation after the reassembly.

FLYWHEEL

To remove the flywheel, turn the flywheel mounting screw outward about two turns. Use a screwdriver

behind the flywheel to take up the crankshaft end play. Then strike a sharp endwise blow on the head of the cap screw with a heavy soft-faced hammer to loosen. A suitable puller (with claws or with bolts to agree with flywheel) may be used to pull the flywheel.

Do not drop the flywheel. A broken fin will destroy the balance. Always use a steel key for mounting the flywheel.

STARTING SYSTEM

ELECTRIC STARTER

Normal wear such as that of brushes should only require minor maintenance for replacement. Damage caused by misuse or accident may require complete overhaul. Disassembly, reassembly, repair, testing, and maintenance should be performed as required in accordance with the instructions given.

Disassembly: Disassemble the starter as shown in Figure 19 as follows:

1. Remove the through bolts.
2. Remove as a unit the armature drive end cap and drive assembly. Detach the brushes from the brush holders to remove the end cap assembly.
3. To separate the components of the unit removed above, take off the self-locking nut at the end of the armature shaft.

Cleaning:

1. Wipe the field coil, armature, and brushes with a clean dry cloth. Also use filtered compressed air at low pressure if it is available.
2. Soak bearing equipped parts in clean mineral spirits and complete cleaning by brushing. Be sure to separate or otherwise keep from the mineral spirits any rubber components.
3. Use only an approved non-flammable solvent for cleaning the rubber parts.
4. Make sure that all solvent has been evaporated off or otherwise removed before use of the parts.

Reassembly: Reassemble the unit in the reverse order of disassembly while observing the following:

1. Apply a film of medium engine oil to the bearing portions before reassembly.

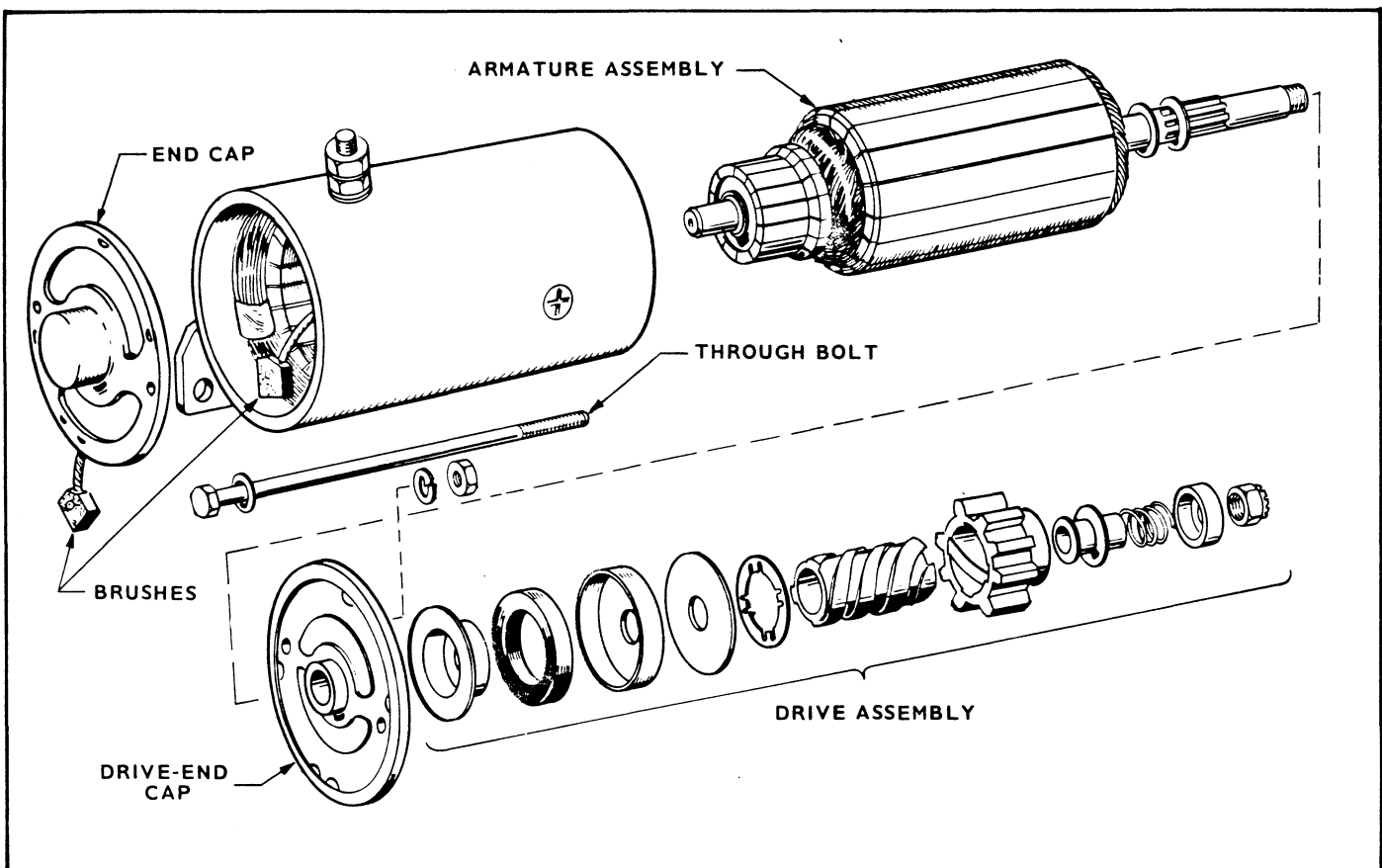


FIGURE 19. ELECTRIC STARTER ASSEMBLY

2. Apply a small quantity of a very light grade oil to the exterior and interior of the shaft screw.
3. Make sure that the spline threads are on the armature side when assembling the drive assembly. Tighten the self-locking nut to a torque of 14-18 foot pounds.
4. Space washers to give an end play of 0.005 to 0.015 inch for the armature.
5. Tighten the through bolts to a torque of 3-5 foot pounds.

Performance Testing:

1. Use conductor of at least #14 AWG diameter and as short as possible to wire the unit as shown in Figure 20. With the battery providing at least 11.8 volts (after switch is closed) the rpm should be not less than 8000 and the current draw not greater than 25 amperes. If this no-load test is failed, proceed with the inspection of the drive assembly before overhauling the unit again or changing the wiring.
2. Perform inspection of the drive assembly by instantaneously applying the above voltage to the unit and observing for abnormal movement of the gear or other indications of disrepair.
3. If either of the above inspections indicated that the unit was faulty, examine the unit for the following defects, replacing, cleaning, or repairing as required. Refer to instructions for inspection given under the next subheading.
 - a. Overheating of brush springs and consequent loss of tension
 - b. Improper seating of brushes
 - c. Insufficient end play of armature
 - d. Presence of open or shorting in armature
 - e. Grounding of armature
 - f. Shorting or grounding of field
 - g. Lack of good electrical connection
 - h. Dirty condition of commutator

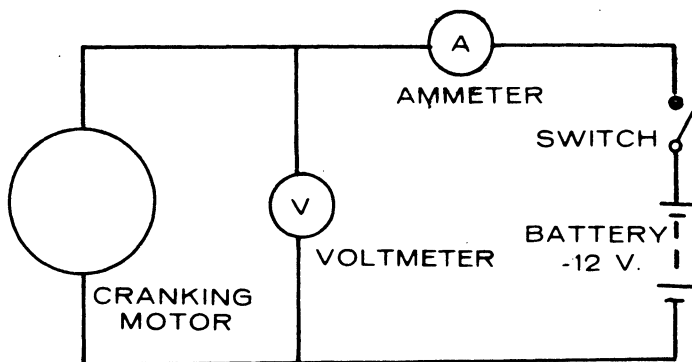


FIGURE 20. CRANKING MOTOR WINDINGS

Inspection:

1. Grounded armature – Apply one test probe of a test lamp on the commutator and the other probe to the core or shaft to check for grounding of the armature.

2. Shorted armature – Revolve the armature in a growler while holding a strip of steel (such as a hacksaw blade) above it. If a short circuit is present it will be indicated by vibration of the strip when the short circuit area is under it.
3. Open in armature – To examine for an open in the armature, look first at the commutator riser bars to see if there are loose connections where the conductors are joined to the commutator bars.
4. Open in field coil – Contact the probes of the test lamp to the ends of the field coils. Failure of the lamp to light indicates a field coil open.
5. Grounded field coil – Apply one test lamp probe to the yoke of the field coil and the other to the field connector. Lighting of the lamp indicates grounding of the field coil.
6. Excessive brush wear – To check need for replacement of brushes due to wear, examine as shown in Figure 21. Replace each brush showing 3/8 inch or more wear.

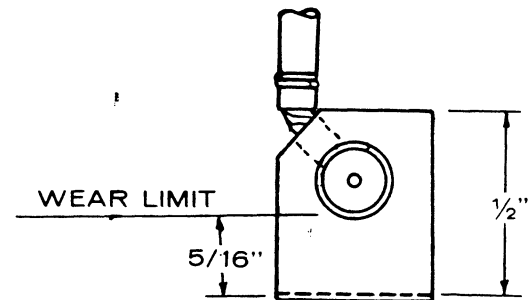


FIGURE 21. BRUSH INSPECTION FOR WEAR

7. Unsatisfactory brush spring pressure – Use a tension meter to measure the tension exerted by each brush spring. Replace when reading is not in the 17 to 25 ounce range.
8. Drive assembly – Check the drive assembly by fully compressing the drive spring, releasing, and observing the return of the gear assembly to its original position.

IGNITION AND BATTERY CHARGING ALTERNATOR

The engine is equipped with a flywheel mounted alternator which supplies voltage to both the ignition and battery charging circuits. The ignition system is a breakerless type. The battery charging circuit supplies approximately 10amps maximum and 2amps minimum battery charge rate.

IGNITION

The breakerless ignition is factory-set and should normally require no adjustment. However, if through accident or misuse, the ignition system becomes out of adjustment, readjust as follows:

1. Locate the dowel pin as shown in Figure 22 (pin protrudes about 3/16 inch from surface).
2. Move the flywheel so that the pin is adjacent to the ignition stator pin and measure the gap with a feeler gauge.

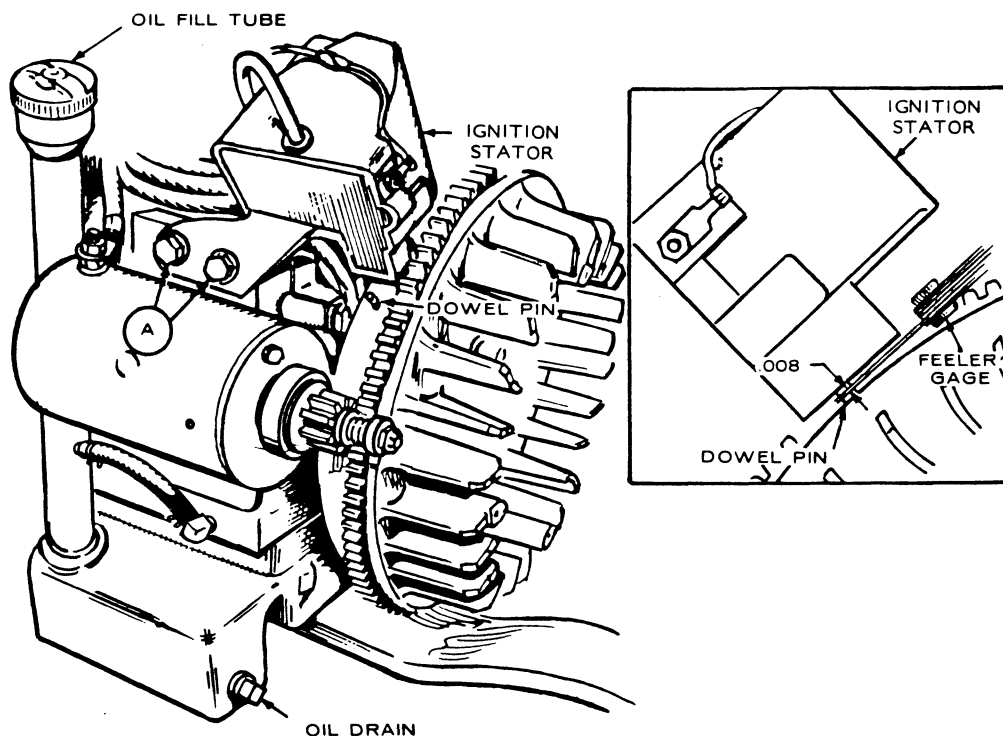


FIGURE 22. IGNITION GAP ADJUSTMENT

3. If the gap is not 0.008 inch, adjust by loosening the mounting bolts (shown as F on Figure 23) and tap the assembly lightly up or down as indicated until the proper gap is attained.
4. Tighten the bolts and recheck the gap. Readjust as required.

BATTERY CHARGE CIRCUIT ADJUSTMENT

The battery charge voltage is regulated by solid state rectifiers contained in the regulator mounted on the dash panel. At full engine RPM the charge rate is approximately 10 amperes. At idle speed, about 1000 rpm, the rate is 2-3 amperes. There is no adjustment possible within the regulator, therefore maintenance is minimal except for keeping the heat dissipating fins clean at all times.

WIRE LOCATIONS

If the original wiring has been affected by any change, rewire as follows, referring to Figure 23.

1. Push the end of the spark plug cable A firmly into the ignition stator E as far as possible. Position it under the bottom cooling fin on the engine block. Make sure that installation of the bearing plate does not cause the cable to be pinched.
2. Feed the alternator cable B through the bracket, under the bottom fin and out the carburetor side. Avoid pinching the alternator cable.
3. Pass the alternator lead wire C through the bracket and around the spark plug leadwire so as to prevent interference with the flywheel.
4. Make sure that terminal D is in the position shown and is not touching any metal surfaces such as the ignition stator or the shrouding.

GENERAL PRECAUTIONS

After reassembling the starter to the engine, exercise the following precautions as a measure of protection and assurance of satisfactory performance.

1. Make sure the shaft of the cranking motor is parallel to the central axis of the engine. Also be sure the mounting bolts are sufficiently tight so that the cranking motor does not shift when starting. Check that no foreign material has been left at the mating surfaces.
2. When starting the engine do not run the cranking motor continuously for more than 20 seconds. Allow at least 30 seconds of rest time between each cranking cycle. If the engine does not start after 5 attempts, check for some other cause of non-start.
3. If the engine does not crank do not leave the starter in a stall (locked rotor) condition longer than 10 seconds.
4. Check to see lubrication described in the reassembly instructions was performed. If not, dismantle and lubricate using the reassembly procedures.

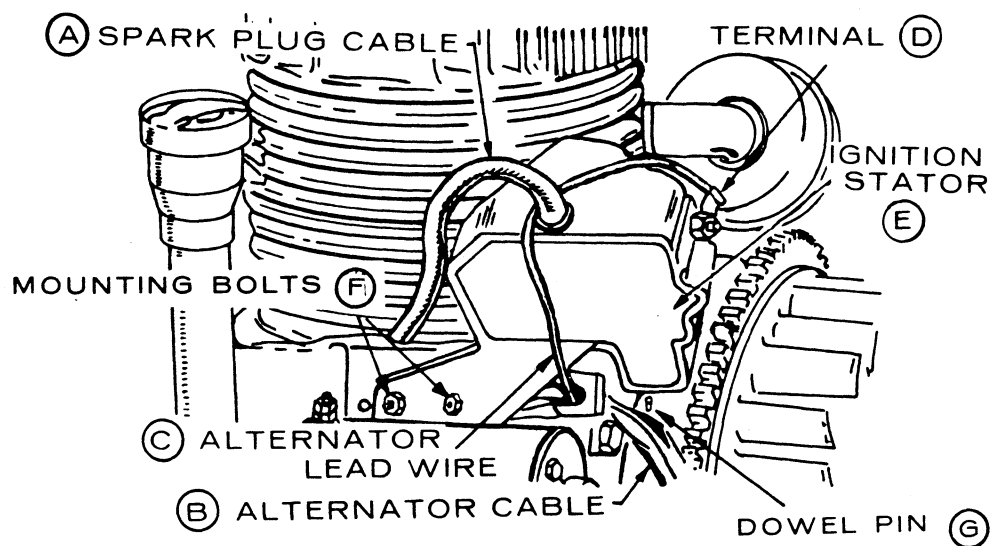
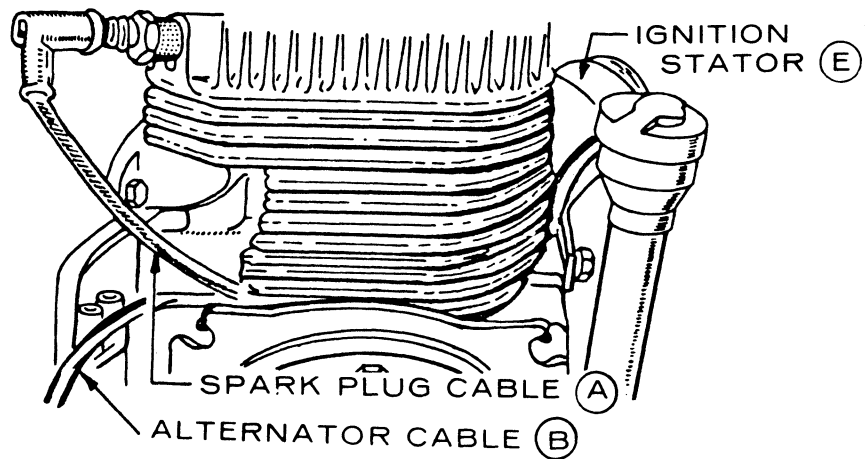


FIGURE 23. WIRE POSITIONING

PARTS CATALOG

This parts catalog applies to Onan Engines, NB-MS/1846, NB-MS/1847, NB-MS/2131, NB-MS/2132, NB-MS/2166 and NB-MS/2167. Parts are arranged in groups of related items. Each illustrated part is identified by a reference number corresponding to the same reference number noted in the listing. Parts illustrations are typical. Unless otherwise mentioned in the description, parts are interchangeable between models. Right and left plant sides are determined by *facing* the blower end (front) of the engine.

INSTRUCTIONS FOR ORDERING REPAIR PARTS

For parts or service, contact the dealer from whom you purchased this equipment or refer to your Nearest Authorized Onan Parts and Service Center.

To avoid errors or delay in filling your parts order, please furnish all information requested.

Always refer to the nameplate on your unit:

1. Always give the MODEL and SPEC NO. and SERIAL NO.

Onan
MODEL AND SPEC NO. _____

SERIAL NO. _____

IMPORTANT ALWAYS GIVE ABOVE NOS WHEN ORDERING PARTS

HORSEPOWER _____

OIL CAPACITY _____ 2 QUARTS

CHECK OIL LEVEL DAILY
BELOW 30° F. SAE 5W20
ABOVE 30° F. SAE 30

CHANGE OIL AFTER FIRST 5 HOURS
CHANGE OIL EVERY 40 OPERATING HOURS
EVERY 20 HOURS DUSTY CONDITIONS

FUEL _____ REGULAR GASOLINE

BATTERY _____ 12V NEG GND
DO NOT REVERSE BATTERY CONNECTIONS

VALVES COLD _____ IN-010 EXH-014

SPARK PLUG GAP _____ .025

TRANSISTOR IGN GAP _____ .008

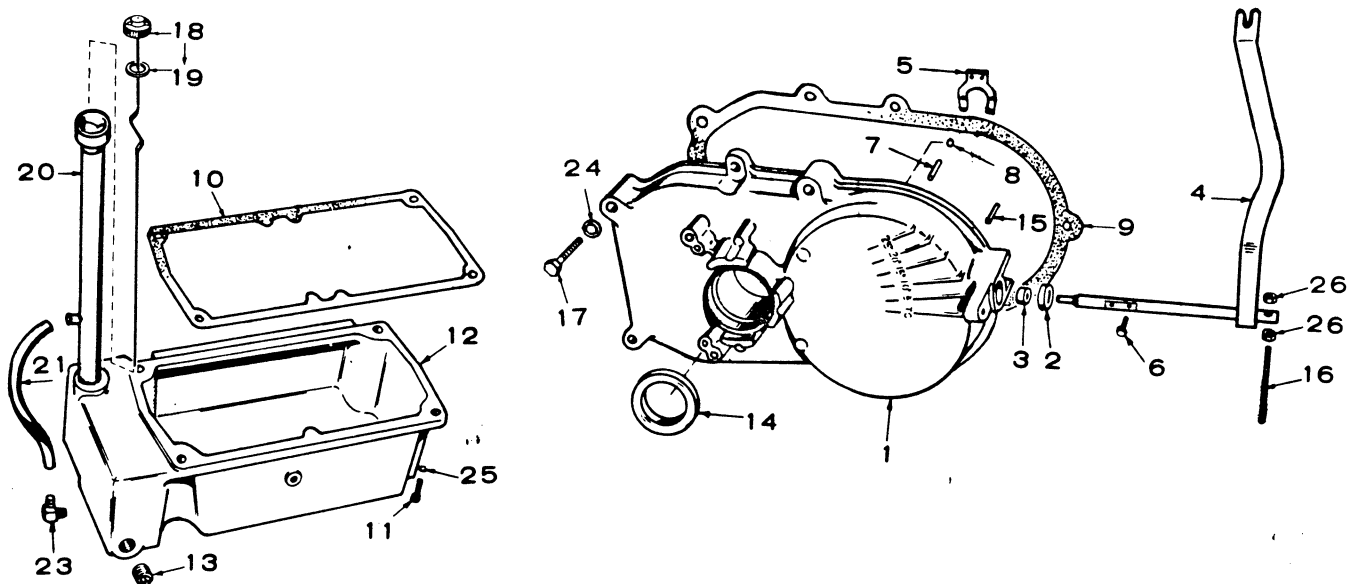
MANUFACTURED BY
ONAN
DIV OF ONAN CORPORATION
MINNEAPOLIS, MINNESOTA, U.S.A.
99A1143

For handy reference, insert YOUR engine nameplate information in the spaces above.

2. Do not order by reference number or group number, always use part number and description.
3. Give the part number, description and quantity needed of each item. If an older part cannot be identified, return the part prepaid to your dealer or nearest AUTHORIZED SERVICE STATION. Print your name and address plainly on the package. Write a letter to the same address stating the reason for returning the part.
4. State definite shipping instructions. Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicates items are back ordered.

Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

For current parts prices, consult your Onan Dealer, Distributor or Parts and Service Center.



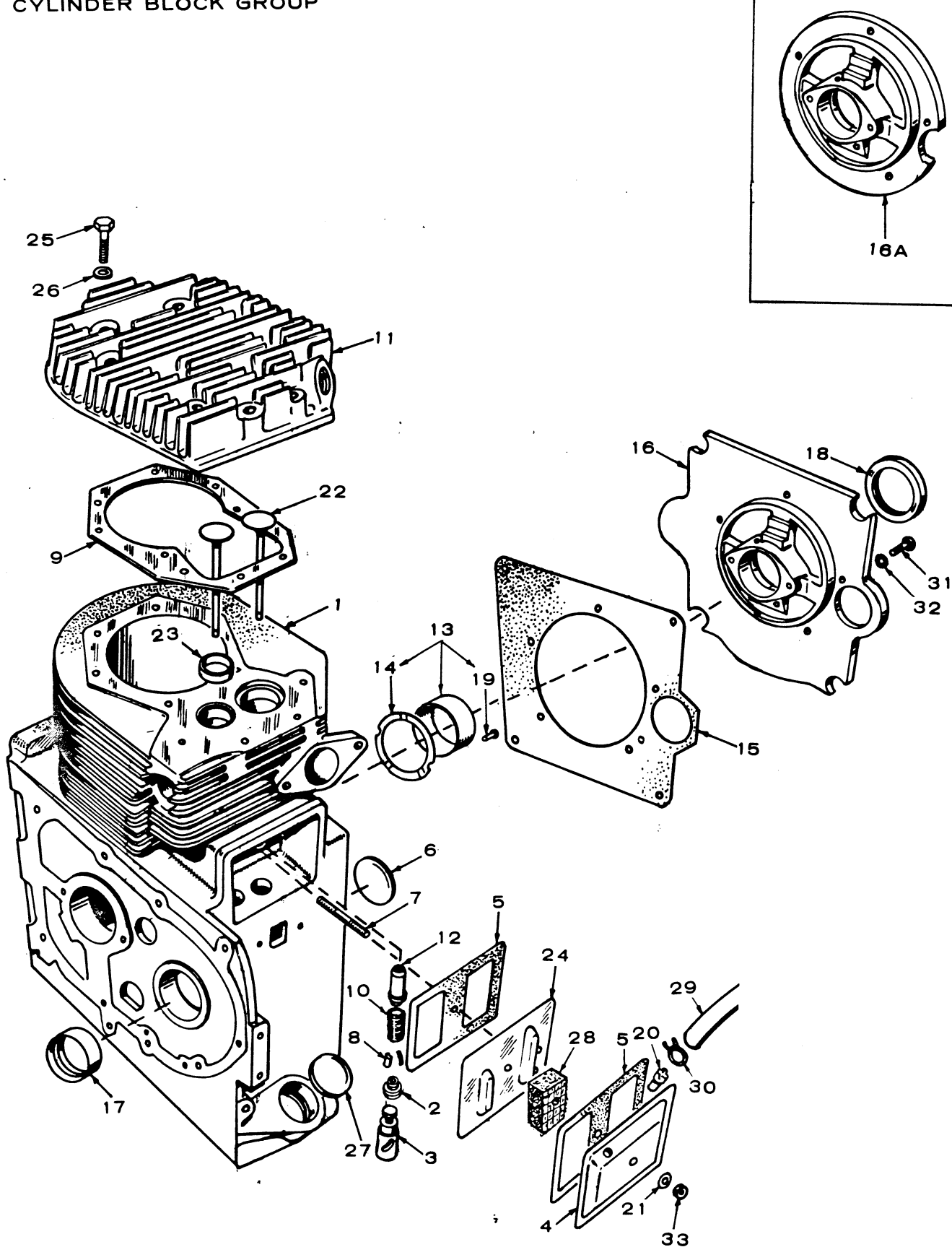
GEAR COVER AND OIL BASE GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	103B353	1	Cover Assembly, Gear (Includes Parts Marked *)
2	509P8	1	*Seal, Oil - Governor Shaft
3	510P13	1	*Bearing, Governor Shaft (Upper)
4	150B1043	1	*Shaft & Arm, Governor
5	150A1187	1	*Yoke, Governor Shaft
6	815-46	2	*Screw, Governor Yoke Mounting (Special)
7	516-130	1	*Pin, Governor Cup Stop (In Gear Cover)
8	510P14	1	*Ball, Bearing - Governor Shaft
9	103B11	1	Gasket, Gear Cover
10	102B107	1	Gasket, Oil Base Mounting
11	102A455	1	Screw, Cap - Oil Base to Block
12	102B681	1	Base, Oil
13	505-110	1	Plug, Oil Drain (3/8)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
14	509A40	1	*Seal, Gear Cover
15	516-11	2	Pin, Gear Cover (5/16 x 3/4")
16	150A96	1	*Stud, Governor Sensitivity
17	SCREW, HEX HEAD CAP - GEAR COVER		
	800P32	4	5/16-18 x 1-3/4"
	800-34	1	5/16-18 x 2-1/4"
18	123A1106	1	Cap and Indicator, Oil Fill
19	123A191	1	Gasket, Oil Fill Cap
20	123B1115	1	Tube, Oil Fill
21	503B589	1	Line, Oil Balance
23	502-313	1	Elbow, Oil Balance Line
24	850-45	5	Washer, Lock (5/16)
25	850-50	4	Washer, Lock (3/8)
26	870-131	2	Nut, Hex (10-32)

* - Included in Gear Cover Assembly.

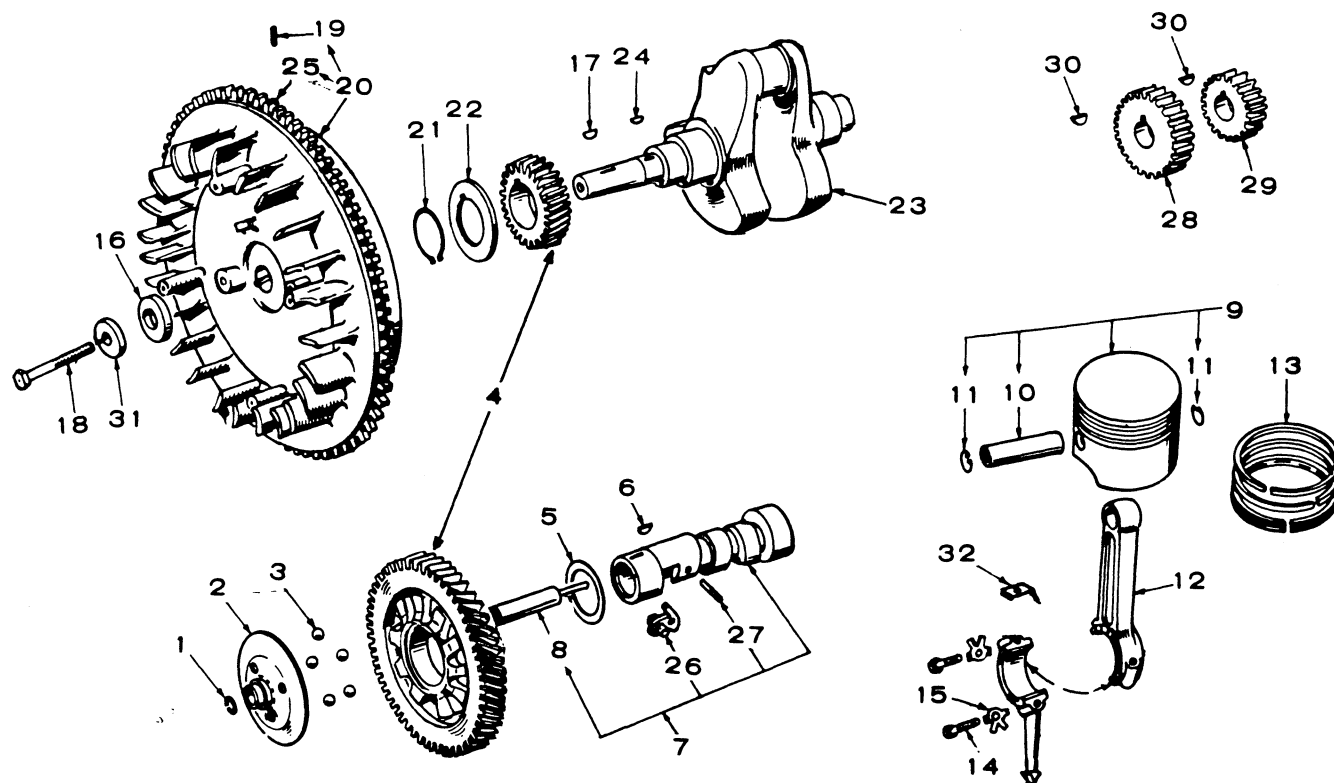
CYLINDER BLOCK GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	BLOCK ASSEMBLY, CYLINDER (Includes Parts Marked *)		
	110A1814	1	NB-MS/1846, NB-MS/1847, NB-MS/2166 & NB-MS/2167 Units
	110A1948	1	NB-MS/2131 & NB-MS/2132 Units
2	110A904	2	Rotocap, Valve
3	TAPPET, VALVE		
	115A6	2	Standard
	115A6-05	2	.005" Oversize
4	110A1782	1	Cover, Valve Compartment
5	110A1791	2	Gasket, (1) Valve Cover, (1) Baffle
6	517-48	1	*Plug, Expansion - Camshaft
7	520A746	1	Stud, Valve Compartment Cover
8	110A639	4	Lock, Valve
9	110B1731	1	Gasket, Cylinder Head
10	110A539	2	Spring, Valve
11	110D1733	1	Head, Cylinder
12	*GUIDE, VALVE		
	110A1762	1	Intake
	110A1763	1	Exhaust
13	BEARING, CRANKSHAFT		
	101K427	2	*Standard
	101K427-02	2	.002" Undersize
	101K427-10	2	.010" Undersize
	101K427-20	2	.020" Undersize
	101K427-30	2	.030" Undersize
14	104A575	2	*Washer, Crankshaft Bearing Thrust
15	101K397	1	*Gasket Kit, Bearing Plate
	*PLATE, REAR BEARING (Excludes Bearing)		
16	101C414	1	NB-MS/1846, NB-MS/1847, NB-MS/2166 & NB-MS/2167 Units
16A	101D409	1	NB-MS/2131 & NB-MS/2132 Units

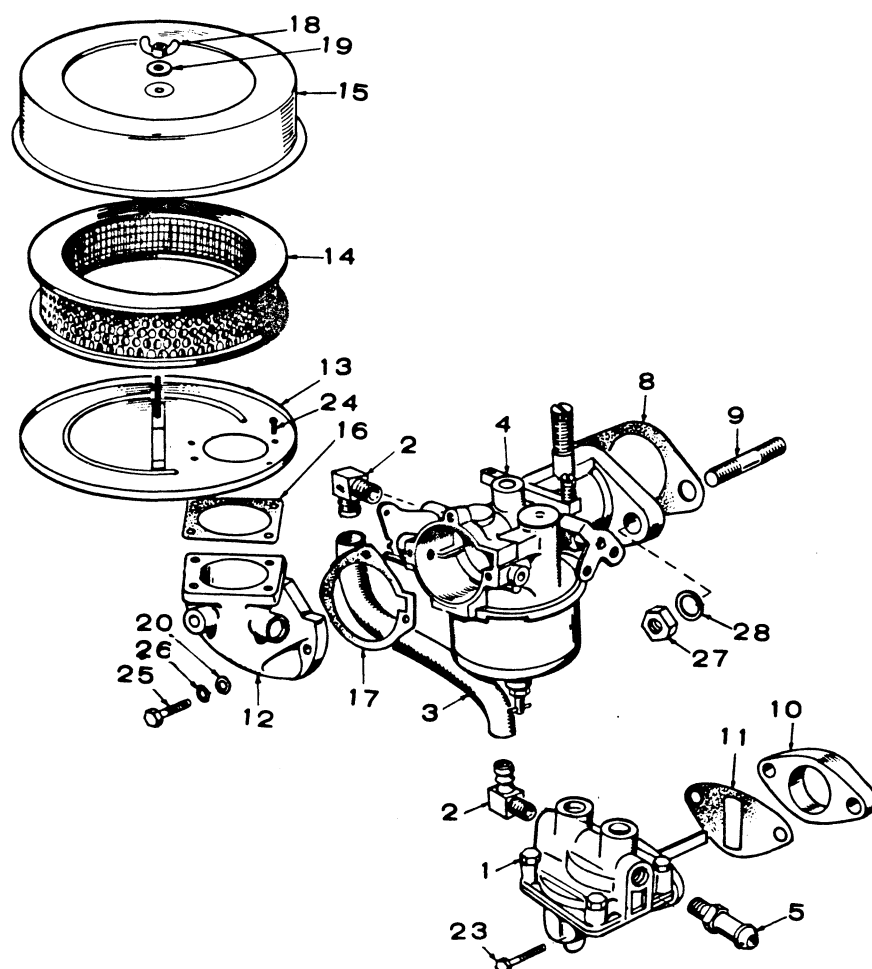
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
17	101A367	2	*Bearing, Camshaft (Precision)
18	509B123	1	*Seal, Bearing Plate
19	516A72	4	*Pin, Main Bearing Stop
20	123A486	1	Valve, Breather
21	526-63	1	Washer, Valve Compartment Cover (Copper)
22	VALVE		
	110B1718	1	Intake
	110B1719	1	Exhaust (Stellite)
23	INSERT, EXHAUST VALVE SEAT (STELLITE)		
	110A1751	1	Standard
	110A1751-02	1	.002" Oversize
	110A1751-05	1	.005" Oversize
	110A1751-10	1	.010" Oversize
	110A1751-25	1	.025" Oversize
24	110A1783	1	Baffle, Breather Plate
25	SCREW, HEX HEAD CAP		
	102A455	4	Cylinder Head (3/8-16 x 1-1/4") (Special)
	800-515	4	Cylinder Head (3/8-16 x 1-3/4") (Special)
	800-516	2	Cylinder Head (3/8-16 x 2") (Special)
26	526A174	10	Washer, Flat - Cylinder Head
27	517-97	1	*Plug, Oil Fill Hole
28	123A996	1	Element, Breather
29	503A574	1	Hose, Breather
30	503-614	1	Clamp, Breather Hose
31	800P517	5	Screw (3/8-16 x 1") - Bearing Plate
32	850-50	5	Washer, Lock (3/8)
33	862-1	1	Nut, Hex (1/4-20) - Valve Cover

* - Included in Cylinder Block Assembly.



CRANKSHAFT, FLYWHEEL, CAMSHAFT AND PISTON GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	150A78	1	Ring, Camshaft Center Pin	15	114A59	2	Lock, Connecting Rod Screw
2	150B612	1	Cup, Governor	16	526A17	1	Washer, Flywheel Mounting
3	510-15	5	Ball, Fly - Governor	17	515-2	1	Key, Flywheel Mounting
4	105A353	1	Gear Set, Timing - Includes Camshaft & Crankshaft Gear (Includes Flyball Spacer & Plate)	18	104A170	1	Screw, Flywheel Mounting (Special)
5	105A4	1	Washer, Camshaft Gear Thrust	19	516P183	1	Pin, Flywheel
6	515-1	1	Key, Camshaft Gear Mounting	20	134B2104	1	Flywheel - Includes Ring Gear & Pin
7	105C338	1	Camshaft - Includes Center Pin Assy. & Compression Relief	21	518-14	1	Lock, Crankshaft Gear Washer
8	150A1296	1	Pin Assembly, Center - Governor	22	104A43	1	Washer, Crankshaft Gear Retainer
9	PISTON & PIN (INCLUDES RETAINING RINGS)			23	CRANKSHAFT 104D720	1	NB-MS/1846, NB-MS/1847, NB-MS/2166 & NB-MS/2167 Units
	112A111	1	Standard		104D735	1	NB-MS/2131 & NB-MS/2132 Units
	112A111-10	1	.010" Oversize	24	515-1	1	Key, Crankshaft Gear Mounting
	112A111-20	1	.020" Oversize	25	104C721	1	Gear, Ring
	112A111-30	1	.030" Oversize	26	105D289	1	Weight, Compression Release
	112A111-40	1	.040" Oversize	27	516-181	1	Pin, Compression Release
10	PIN, PISTON			28	190A284	1	Gear, Transmission Drive (3-3/16") - NB-MS/1846, NB-MS/1847, NB-MS/2166 & NB-MS/2167 Units
	112A112	1	Standard		190A285	1	Gear, Transmission Drive (2-5/16") - NB-MS/1846, NB-MS/1847, NB-MS/2166 & NB-MS/2167 Units
	112A112-02	1	.002" Oversize	29	190A285	1	Gear, Transmission Drive (2-5/16") - NB-MS/1846, NB-MS/1847, NB-MS/2166 & NB-MS/2167 Units
11	518P294	2	Ring, Piston Pin Retaining	30	KEY, TRANSMISSION DRIVE GEAR 515-94	2	NB-MS/1846, NB-MS/1847, NB-MS/2166 & NB-MS/2167 Units
12	ROD, CONNECTING - INCLUDES LOCKS & SCREWS				515-146	1	NB-MS/2131 & NB-MS/2132 Units
	114D204	1	Standard	31	850-55	1	Washer, Lock (7/16)
	114D204-10	1	.010" Undersize	32	104A750	1	Deflector Oil
	114D204-20	1	.020" Undersize				
	114D204-30	1	.030" Undersize				
13	RING SET, PISTON						
	113A142	1	Standard				
	113A142-10	1	.010" Oversize				
	113A142-20	1	.020" Oversize				
	113A142-30	1	.030" Oversize				
	113A142-40	1	.040" Oversize				
14	114A171	2	Screw, Connecting Rod Cap (Special)				

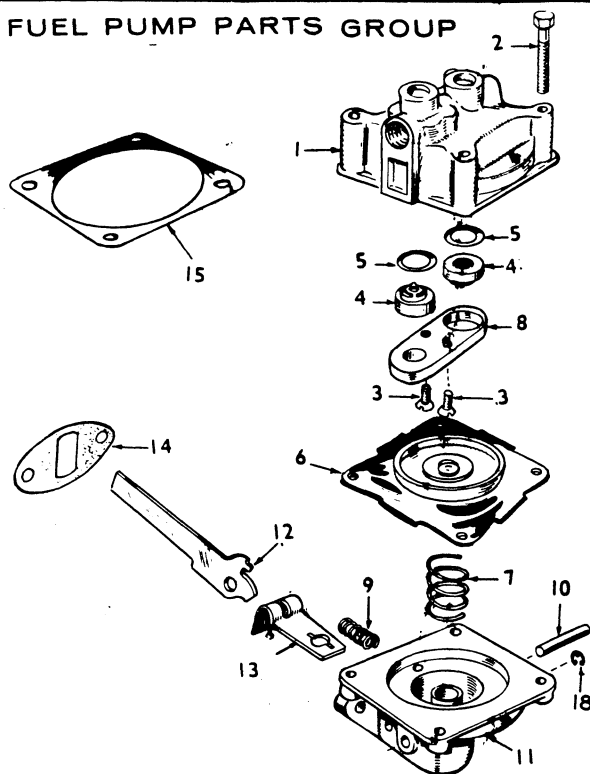


FUEL SYSTEM AND EXHAUST GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	149D1251	1	Pump, Fuel
2	502-313	2	Elbow, Fuel Pump Outlet & Carburetor Inlet
3	503-588	1	Line, Fuel Pump to Carburetor
4	CARBURETOR, GASOLINE (See Separate Group For Components)		
	141D781	1	NB-MS/1846, NB-MS/2131 & NB-MS/2166 Units
	141D772	1	NB-MS/1847, NB-MS/2132 & NB-MS/2167 Units
5	502P368	1	Connector, Hose - Fuel Pump Inlet
8	154A733	2	Gasket, Carburetor Mounting
9	520A114	2	Stud, Carburetor Mounting
10	149A45	1	Spacer, Fuel Pump Mounting
11	149A3	2	Gasket, Fuel Pump Mounting
12	140A1056	1	Adapter, Air Cleaner
13	140A1048	1	Base, Air Cleaner
14	140P1055	1	Element, Air Cleaner

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
15	140C1053	1	Cover, Air Cleaner
16	140A1069	1	Gasket, Air Cleaner
17	140A1087	1	Gasket, Adapter to Carburetor
18	865P22	1	Nut, Air Cleaner
19	526A8	1	Washer, Air Cleaner
20	526-71	3	Washer (Copper) - Adapter Mounting
21	505-3	1	Elbow, Street - Exhaust
22	331A53	1	Locknut, Chase - Exhaust
23	806-9	2	Screw (1/4-20 x 1-1/4") - Fuel Pump Mounting
24	815-154	4	Screw (10-32 x 3/8") - Base to Adapter
25	SCREW, AIR CLEANER ADAPTER MOUNTING		
	813-103	2	10-32 x 3/4" (Bottom)
	813-112	1	10-32 x 2-1/2" (Top)
26	850-30	3	Washer, Lock (#10)
27	868-2	2	Nut, Hex (5/16-24) - Carburetor Mounting
28	854-17	2	Washer, Lock (5/16")

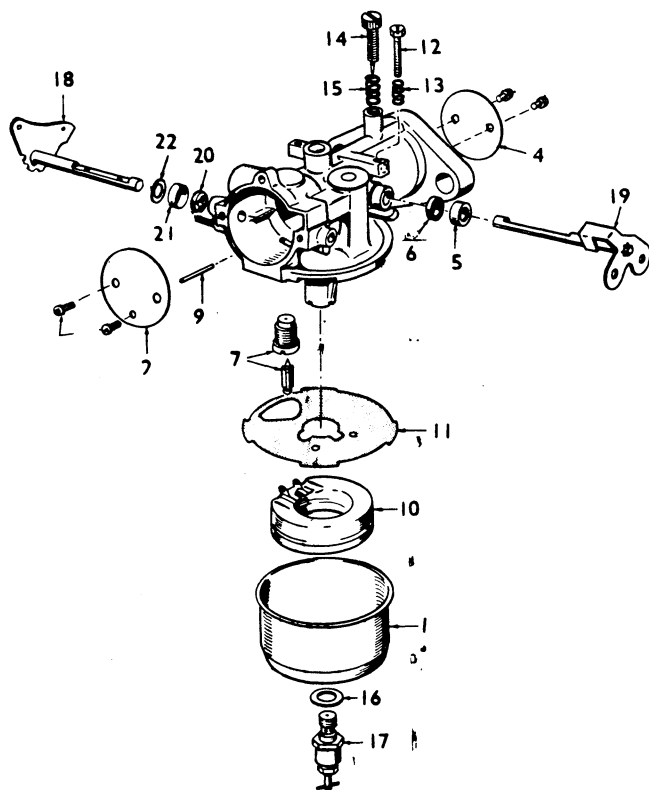
FUEL PUMP PARTS GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	149D1251	1	Pump, Fuel - Complete
	149K526	1	Repair Kit, Fuel Pump - (Includes Parts Marked *)
1			Body, Upper (Not Sold Separately)
2	815-148	4	Screw, Machine (#8-32 x 7/8")
3	815-147	2	Screw, Retainer - Phillips Flat Head (#6-32 x 5/8")
4	149P96	2	*Valve and Cage
5	149A95	2	*Gasket, Valve
6	149A582	1	*Diaphragm Assembly
7	149A672	1	*Spring, Diaphragm
8	149A539	1	Retainer, Valve Cage
9	149A675	1	*Spring, Rocker Arm
10	516A113	1	Pin, Rocker Arm
11			Body, Lower (Not Sold Separately)
12	149A1148	1	Arm, Rocker
13	149A670	1	Link, Rocker
14	149A3	2	*Gasket, Fuel Pump Mounting
15	149A858	1	*Gasket, Diaphragm

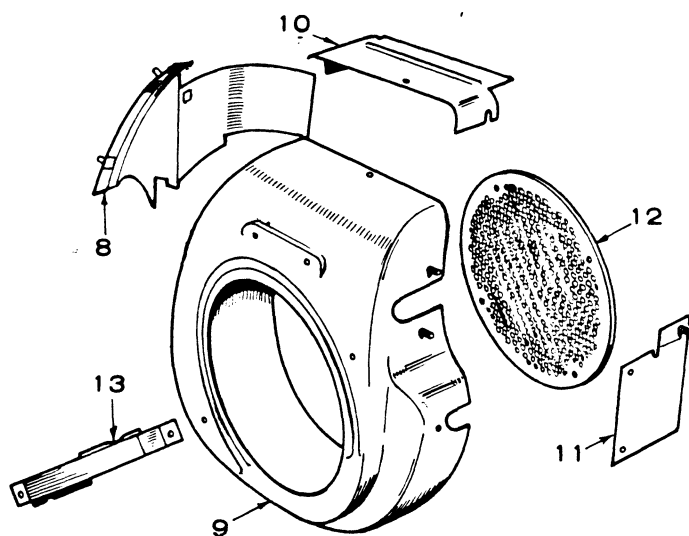
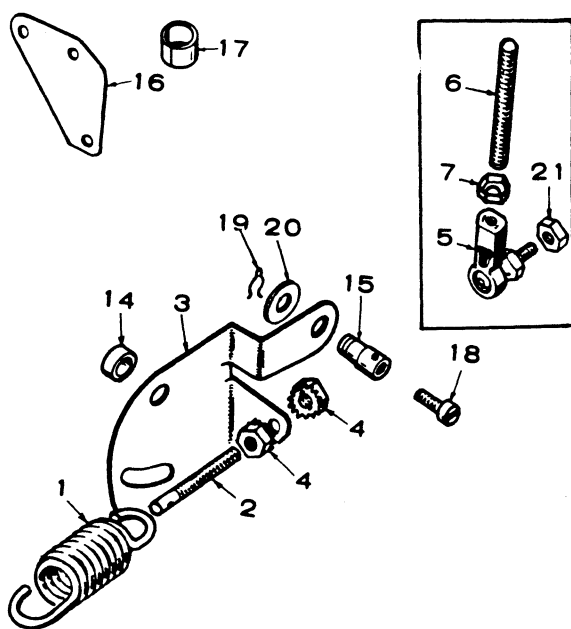
* - Included in 149K526 Repair Kit.

CARBURETOR PARTS GROUP

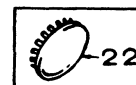


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	CARBURETOR, GASOLINE		
	141D781	1	NB-MS/1846, NB-MS/2131 & NB-MS/2166 Units
	141D772	1	NB-MS/1847, NB-MS/2132 & NB-MS/2167 Units
	141K785	1	Repair Kit (Includes Parts Marked *)
	141K748	1	*Gasket Kit (Includes Parts Marked £)
	154A733	2	*£Gasket, Carburetor Flange
1	141P708	1	Bowl, Fuel
2	PLATE, CHOKE		
	141P741	1	NB-MS/1846, NB-MS/2131 & NB-MS/2166 Units
	141P771	1	NB-MS/1847, NB-MS/2132 & NB-MS/2167 Units
3	141P698	4	Screw & Washer, Choke & Throttle Plate Mounting
4	141P706	1	Plate, Throttle
5	141P705	1	*Retainer, Seal
6	141-661	1	*£Seal, Rubber
7	141P704	1	*Valve Seat Assembly, Fuel
9	141P703	1	*Shaft, Float
10	141P702	1	Float Assembly
11	141P701	1	*£Gasket, Bowl to Body
12	141P700	1	Screw, Throttle Stop
13	141P711	1	Spring, Throttle Stop
14	141P786	1	Needle, Idle Adjusting
15	141P710	1	Spring, Idle Needle
16	141A77	1	*£Washer, Main Jet Assembly
17	141-712	1	Jet Assembly, Main (Adjustable)
18	141P742	1	Shaft, Choke
19	141P775	1	Shaft & Lever, Throttle
20	141P697	1	Seal, Felt
21	141P203	1	Retainer, Felt Seal
22	141P699	1	Washer

* - Parts contained in Repair Kit.
£ - Parts contained in Gasket Kit.

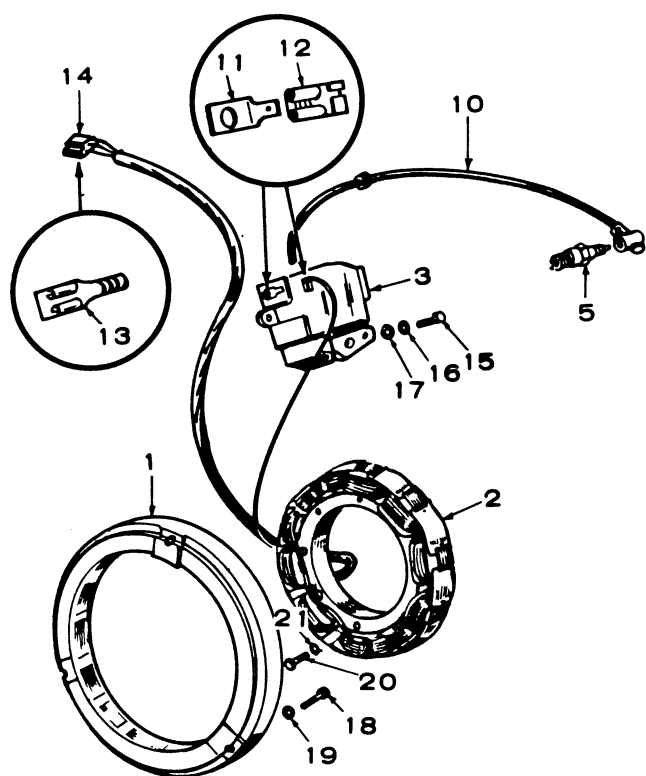


GOVERNOR AND HOUSING GROUP

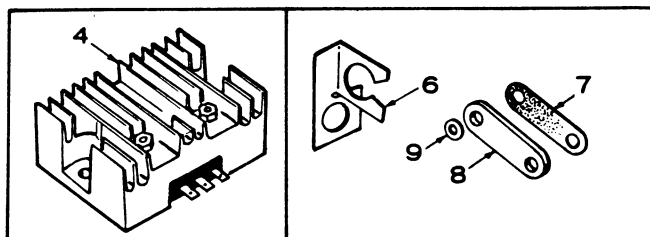


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	150A1044	1	Spring, Governor
2	150A96	1	Stud, Speed Adjusting
3	150B1270	1	Bracket, Speed Adjusting
4	870-131	2	Nut, Speed Adjusting
5	150A1081	2	Joint, Ball
6	150A883	1	Link, Throttle
7	870P188	2	Palnut, Locking
8	134C2045	1	Housing, Cylinder Air
9	134C2049	1	Housing, Blower
10	134C2047	1	Cover, Cylinder Air
11	134B2046	1	Plate, Cylinder Air Housing
12	134A2048	1	Screen, Air Inlet

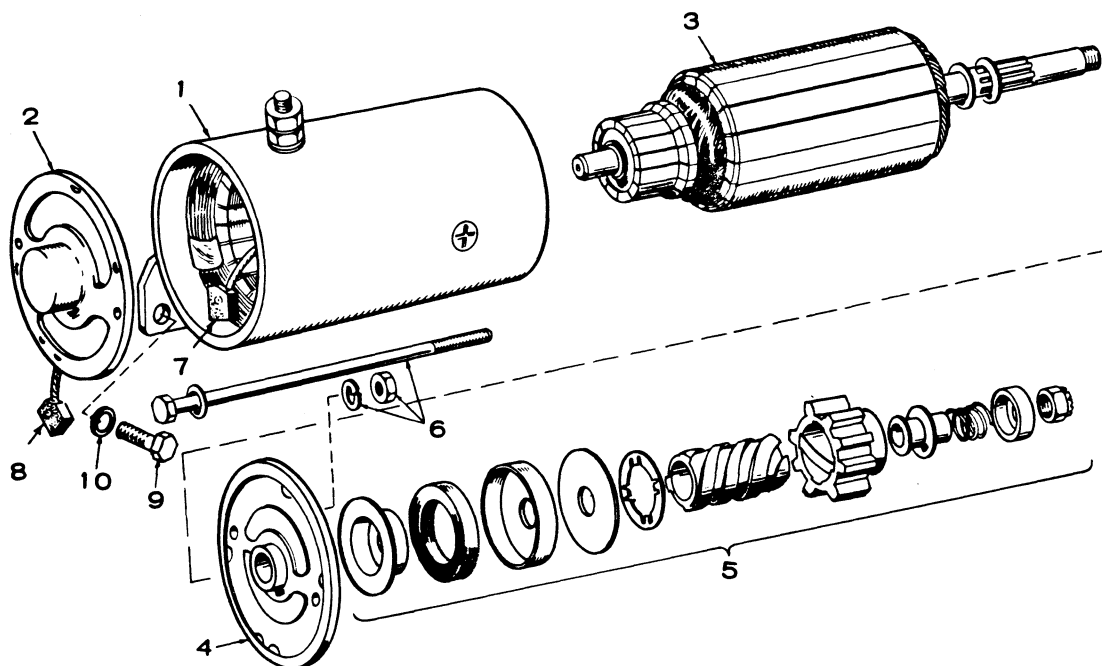
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
13	134B2040	1	Guard, Air Inlet
14	150A1269	2	Bushing, Governor Control Bracket
15	152A155	2	Swivel, Governor Control Arm
16	153A435	1	Bracket, Throttle and Choke
17	134A2100	1	Spacer, Cylinder Head to Cover
18	815-104	1	Screw (8-32 x 5/16")
19	516-59	1	Pin, Cotter
20	526-6	1	Washer, Flat (#12)
21	870-131	2	Nut, Ball Joint
22	517-21	1	Button, Dot (For 7/8" Hole)



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	191C768	1	Rotor, Ignition and Charge - Mounted on Flywheel
2	191D769	1	Stator, Alternator
3	160C1125	1	Stator, Ignition
4	305C480	1	Regulator - Rectifier
5	167-4	1	Plug, Spark
6	167A188	1	Clip, Spark Plug Cable
7	110A1796	1	Gasket, Breaker Hole Cover (Early Models Only)
8	110A1795	1	Cover, Breaker Hole (Early Models Only)
9	526A63	2	Washer, Breaker Hole Cover (Early Models Only)
10	167P1546	1	Cable, Spark Plug
11	323P770	1	Terminal, Ignition Stator (Blade Type)
12	332-1408	1	Terminal, Tractor Connection
13	323P767	3	Terminal, Ignition Stator (Female)
14	323P769	1	Body, Tractor Connection
15	800-28	2	Screw (5/16-18 x 1") - Stator Mounting
16	853-16	2	Washer, Lock (5/16)
17	526-115	2	Washer, Flat (5/16)
18	812-155	3	Screw (1/4-20 x 1-1/4") - Rotor Mounting
19	850-40	3	Washer, Lock (1/4)
20	813-108	3	Screw (10-32 x 1-1/2") - Stator Mounting
21	850-30	3	Washer, Lock (#10)



IGNITION SYSTEM AND CHARGING ALTERNATOR GROUP



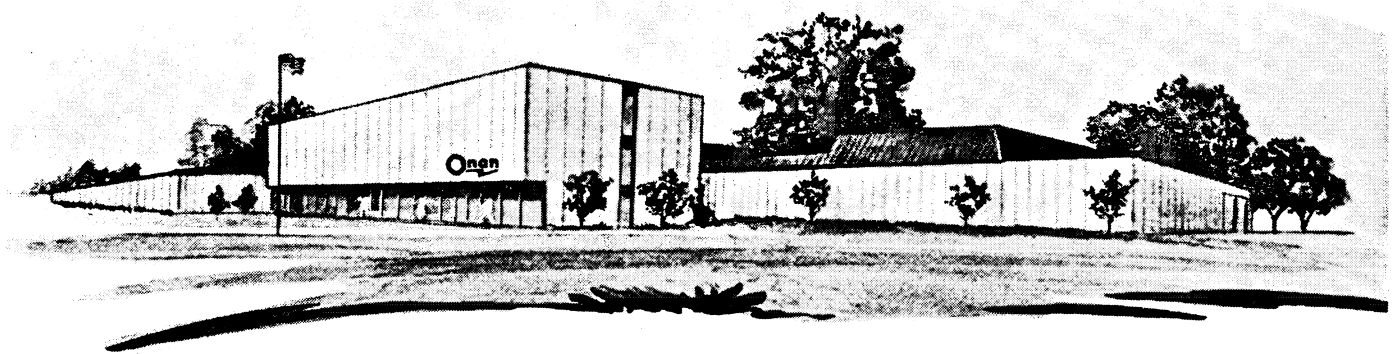
STARTING MOTOR PARTS GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	191C780	1	Motor, Starting
1	191-794	1	Housing Assembly
2	191-795	1	Cap Assembly, End
3	191-796	1	Armature Assembly
4	191-797	1	Cap Assembly, Drive End
5	191-798	1	Drive Assembly, Complete
6	191-799	2	Bolt Assembly - Through
7	191-800	1	Brush, Positive
8	191-801	1	Brush, Negative
9	800-50	2	Screw (3/8-16 x 1'') - Starter Mounting
10	850-50	2	Washer, Lock (3/8) - Starter Mounting

SERVICE KITS

NOTE: For other kits, refer to the group for the part in question.

168K114	1	Gasket Kit, Plant
522K255	1	Overhaul Kit, Engine



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