Onan®

OPERATOR'S/SERVICE MANUAL AND PARTS CATALOG

SERIES NB

180 AMP. AC WELDER

MODELS

5.0 NB-341P/1
5.0 NB-343P/1
5.0 NB-341E/1
5.0 NB-343E/1

ONAN 1400 73RD AVENUE N.E. • MINNEAPOLIS, MINNESOTA 55432
A DIVISION OF STUDEBAKER CORPORATION
N.Y. INTERNATIONAL OFFICE: Empire State Bldg.

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Important Safety Precautions

Read and observe these safety precautions when using or working on electric generators, engines and related equipment. Also read and follow the literature provided with the equipment.

Proper operation and maintenance are critical to performance and safety. Electricity, fuel, exhaust, moving parts and batteries present hazards that can cause severe personal injury or death.

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC

Fire, explosion, and personal injury can result from improper practices.

- Used engine oil, and benzene and lead, found in some gasoline, have been identified by government agencies as causing cancer or reproductive toxicity. When checking, draining or adding fuel or oil, do not ingest, breathe the fumes, or contact gasoline or used oil.
- Do not fill tanks with engine running. Do not smoke around the area. Wipe up oil or fuel spills. Do not leave rags in engine compartment or on equipment. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip fuel supply with a positive fuel shutoff.
- Do not store or transport equipment with fuel in tank.
- Keep an ABC–rated fire extinguisher available near equipment and adjacent areas for use on all types of fires except alcohol.
- Unless provided with equipment or noted otherwise in installation manual, fuel lines must be copper or steel, secured, free of leaks and separated or shielded from electrical wiring.
- Use approved, non-conductive flexible fuel hose for fuel connections. Do not use copper tubing as a flexible connection. It will work–harden and break.

EXHAUST GAS IS DEADLY

- Engine exhaust contains carbon monoxide (CO), an odorless, invisible, poisonous gas. Learn the symptoms of CO poisoning.
- Never sleep in a vessel, vehicle, or room with a genset or engine running unless the area is equipped with an operating CO detector with an audible alarm.
- Each time the engine or genset is started, or at least every day, thoroughly inspect the exhaust system. Shut down the unit and repair leaks immediately.
- Warning: Engine exhaust is known to the State of California to cause cancer, birth defects and other reproductive harm.

Make sure exhaust is properly ventilated.

- Vessel bilge must have an operating power exhaust.
- Vehicle exhaust system must extend beyond vehicle perimeter and not near windows, doors or vents.
- Do not use engine or genset cooling air to heat an area.
- Do not operate engine/genset in enclosed area without ample fresh air ventilation.
- Expel exhaust away from enclosed, sheltered, or occupied areas.
- Make sure exhaust system components are securely fastened and not warped.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not remove any guards or covers with the equipment running.
- Keep hands, clothing, hair, and jewelry away from moving parts.
- Before performing any maintenance, disconnect battery (negative [–] cable first) to prevent accidental starting.
- Make sure fasteners and joints are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- If adjustments must be made while equipment is running, use extreme caution around hot manifolds and moving parts, etc. Wear safety glasses and protective clothing.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.
- Always disconnect battery negative (–) lead first and reconnect it last. Make sure you connect battery correctly. A direct short across battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is explosive.
- Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the area thoroughly.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can be ignited by equipment operation or cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. **Do not operate diesel equipment where a flammable vapor environment can be created by fuel spill, leak, etc., unless equipped with an automatic safety device to block the air intake and stop the engine.**

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not service control panel or engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel.
- Do not connect the generator set to the public utility or to any other electrical power system. Electrocution can occur at a remote site where line or equipment repairs are being made. An approved transfer switch must be used if more than one power source is connected.
- Disconnect starting battery (negative [–] cable first) before removing protective shields or touching electrical equipment. Use insulative mats placed on dry wood platforms. Do not wear jewelry, damp clothing or allow skin surface to be damp when handling electrical equipment.
- Use insulated tools. Do not tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- With transfer switches, keep cabinet closed and locked. Only authorized personnel should have cabinet or operational keys. Due to serious shock hazard from high voltages within cabinet, all service and adjustments must be performed by an electrician or authorized service representative.

If the cabinet must be opened for any reason:

1. Move genset operation switch or Stop/Auto/Handcrank switch (whichever applies) to Stop.
2. Disconnect genset batteries (negative [–] lead first).
3. Remove AC power to automatic transfer switch. If instructions require otherwise, use extreme caution due to shock hazard.

MEDIUM VOLTAGE GENERATOR SETS (601V TO 15kV)

- Medium voltage acts differently than low voltage. Special equipment and training are required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Induced voltage remains even after equipment is disconnected from the power source. Plan maintenance with authorized personnel so equipment can be de-energized and safely grounded.

GENERAL SAFETY PRECAUTIONS

- Do not work on equipment when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.
- Never step on equipment (as when entering or leaving the engine compartment). It can stress and break unit components, possibly resulting in dangerous operating conditions from leaking fuel, leaking exhaust fumes, etc.
- Keep equipment and area clean. Oil, grease, dirt, or stowed gear can cause fire or damage equipment by restricting airflow.
- Equipment owners and operators are solely responsible for operating equipment safely. Contact your authorized Onan/Cummins dealer or distributor for more information.

KEEP THIS DOCUMENT NEAR EQUIPMENT FOR EASY REFERENCE.

ONAN AC WELDER

180 AMP.

SERIES

NB

940- 1000 4A70

TABLE OF CONTENTS

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

The welder is a complete engine-driven, alternating current arc welding machine. It consists of a gasoline engine directly connected to an electric generator. They are mounted to a sturdy carrying frame.

The welder is rated 180 amperes, 25 volts, alternating current, 50% duty cycle. Auxiliary alternating current is available. AC output is 120 volts and is rated 5000 watts, 60 cycle, 100% duty cycle. AC output is available at any time although at reduced output when the welding current is being used. This AC output is convenient for emergency lighting, running power tools, etc., when working at locations away from AC power line sources.

All 1/16″ through 5/32″ electrodes may be used. Electrodes 3/16″ which do not exceed the welder capacity may be used.

When instructions in this manual refer to a specific model of welder, identify the model by referring to the MODEL AND SPECIFICATION NO. as shown on the unit nameplate.

ENGINE MODEL REFERENCE

MODEL NO.	TYPE	AC VOLTAGE
5.0NB-341P/1	Manual Start	120 V
5.0NB-343P/1	Manual Start	120/240 V
5.0NB-341E/1	Electric Start	120 V
5.0NB-343E/1	Electric Start	120/240 V

How to interpret MODEL and SPEC NO.

5.0NB-341 E / 1 A

1 2 3 4

1. Factory code for general identification purposes.
2. Specific Type:
   P-PORTABLE, manual starting.
   E-ELECTRIC starting, at welder only.
3. Factory code for optional equipment supplied.
4. Specification (Spec Letter) advances with factory production modification.

ONAN MANUFACTURER'S WARRANTY

The Manufacturer warrants, to the original user, that each product of its manufacture is free from defects in material and factory workmanship if properly installed, serviced and operated under normal conditions according to the Manufacturer's instructions.

Manufacturer's obligation under this warranty is limited to correcting without charge at its factory any part or parts thereof which shall be returned to its factory or one of its Authorized Service Stations, transportation charges prepaid, within one year after being put into service by the original user, and which upon examination shall disclose to the Manufacturer's satisfaction to have been originally defective. Correction of such defects by repair to, or supplying of replacements for defective parts, shall constitute fulfillment of all obligations to original user.

This warranty shall not apply to any of the Manufacturer's products which must be replaced because of normal wear, which have been subject to misuse, negligence or accident or which shall have been repaired or altered outside of the Manufacturer's factory unless authorized by the Manufacturer.

Manufacturer shall not be liable for loss, damage or expense directly or indirectly from the use of its product or from any other cause.

The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and of all other liabilities or obligations, on part of Manufacturer. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an officer of the Manufacturer.

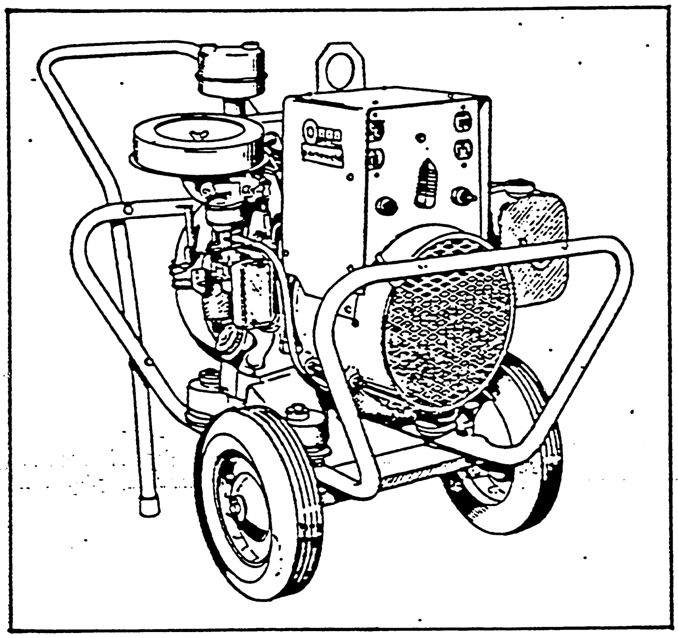
SPECIFICATIONS

Nominal dimensions (inches)	
Height	24
Width	23
Length	30 3/4
Weight (Lbs.)	
Skid mounted – manual start	280
– electric start	300
Dolly mounted – manual start	300
– electric start	320
Number of cylinders	1
Displacement (cubic inches)	30.0
Cylinder bore	3 9/16
Piston stroke	3
Horsepower (at 3600 rpm)	12
Compression ratio	7 : 1
Oil capacity	2 quarts
Fuel capacity	1 1/2 gal.

INSTALLATION

GENERAL

Installation can affect welder life, operation costs and frequency of necessary repairs. Plan installations carefully to assure best performance. Use the installation recommendation as a guide, improvising or altering as required. A two-wheeled dolly is available as an option for units which must be moved frequently.



A few precautions should be observed when a welder is used in a more or less permanent location, or is to be mounted in a vehicle.

VENTILATION

Welders generate considerable heat during operation. Provide unobstructed separate air inlet and outlet openings (minimum area of 3 1/2 sq. ft. each) in any small enclosure. Locate the inlet opening as close to the front of the engine blower intake as possible and the outlet opening toward the generator end and somewhat higher than the inlet opening. Position air inlet and outlet opening to prevent recirculation of heated air.

EXHAUST

When an extension exhaust pipe is attached to the engine, use a piece of flexible tubing between this pipe and the engine. The muffler should be fitted to the outer end of the exhaust pipe.

WARNING *Gasoline engine exhaust gases are deadly. Never operate welder inside a building or confined area without piping exhaust gases outside the enclosure.*

MOBILE MOUNTING

Mount the welder securely in place, as considerable strain is present on rough roads or in turning sharp corners, etc. Extra vehicle floor support may be necessary to keep the welder mounting bolts from tearing loose. Use pipe clamps or U-bolts to secure the welder frame to the floor. Maximum operation angle is 15° sideways, 30° front-to-rear tilt.

For convenience in servicing, especially draining oil, it may be desirable to elevate the welder above the vehicle floor.

PRESTART INFORMATION

When the unit is to be used for welding, always connect the welding cables to the power terminals on the panel before starting. It is not necessary to observe polarity in making ground connections between welder and the work. Welding current selection may be made with the unit running but not under load.

WARNING *Do not, under any circumstances, touch the terminals of the welder while it is operating! Although the voltage is not high, it can cause severe shock with possible serious consequences! Stop the unit before making connections.*

INITIAL START

Check the engine to make sure it has been filled with oil and fuel. See the recommendations below.

Crankcase Oil: Use a good quality detergent oil that meets the API (American Petroleum Institute) service designations, MS, MS/DG or MS/DM. Recommended SAE oil numbers for expected ambient temperatures are as follows:

TEMPERATURE	GRADE
Above 30°F	SAE 30
Below 30°F	SAE 5W-20

The engine oil capacity is two U.S. quarts. Do not mix brands or grades. Refer to Maintenance Section for recommended oil changes and complete lubricating oil recommendations.

Recommended Fuel: Use clean, fresh, regular grade, automotive gasoline. Do not use highly leaded premium types. Never fill the tank when the engine is running; leave some fuel expansion space. Open fuel line valve on fuel filter bowl.

NOTE: *On cold starts, set the Idle Lever in the idle position (down) to start. The Idle Lever is located adjacent to the governor yoke control shaft. Set manual choke as necessary for weather conditions.*

MANUAL START

Welders Equipped With Optional Readi-Pull Starter: The starter rope is in the starting position and will automatically rewind to this position after the rope is pulled and released.

Welders Not Equipped With The Optional Readi-Pull Starter: Wind starting rope on flywheel rope sheave in a clockwise direction to within approximately 6" of the starting rope handle.

Crank unit with a rapid, smooth pull on the starting rope. If unit does not start readily, change choke setting. Avoiding overchoking as this can cause oil dilution which can result in excessive wear of internal engine parts.

If the engine fails to start within two or three rope pulls, rust inhibitor oil injected into the cylinder at the factory may have fouled the spark plug. Remove the plug and clean in nonflammable solvent. Dry thoroughly and reinstall. Engine should now start without difficulty. Heavy exhaust smoke may be noticed when engine is first started. This is normal and is caused by the inhibitor oil burning off.

As soon as unit starts, adjust choke to best running position, gradually adjusting choke control as unit warms up.

ELECTRIC START

1. Adjust choke according to temperature conditions. Adjust as explained for manual start models.
2. Move ignition switch to ON.
3. Push START switch, located on rear side of control box, firmly. If unit does not start within a few seconds, release the START switch and wait a few seconds before reattempting to start. If unit does not start after two attempts, open the choke and repeat starting sequence.

   NOTE: *A distinct metallic clicking noise will be heard just as unit starts and again just as it stops. This is the decompression release . . . and is a normal noise to be expected.*
4. After unit starts, adjust choke to best running position. Gradually adjust choke control as unit warms up.

Should the charge condition of the battery become so low that it cannot furnish enough power for cranking, the engine can be started by manually cranking with the starting rope.

NOTE: *The battery charge voltage is regulated to supply a nominal 1.5 amp charge rate at full rpm. Manual start models are not equipped with a battery charge circuit.*

APPLYING LOAD

Allow the plant to warm up thoroughly at idle speed before applying a heavy welding load. Set Idle Lever at high speed position before applying a load. The welder is thermally protected and self-regulating.

Should a short circuit occur on auxiliary power, the overload protection circuit breaker will open. Correct the short circuit or overload problem and depress the "Push to Reset" button on the load panel.

STOPPING

Manual Start Units: Depress stop button located on upper rear side of blower housing. Hold button down until engine is completely stopped.

Electric Crank: Move ignition switch to STOP or OFF position. If ignition switch is left in "ON" position when unit is not running, battery will be discharged.

BREAK-IN PROCEDURE

No matter how carefully engine parts are manufactured or expertly assembled, there are always slight variations in fit between metal parts such as pistons, rings, main and connecting rod bearings.

Break-in, or ideal fitting of all internal moving parts can best be achieved by maintaining proper cooling and correct lubrication during the running-in period. Break-in can take as little as ten operating hours or it may take many hundreds of hours. Extended periods of very heavy engine loading (above rated horsepower or electrical output) during this initial service period can cause severe cylinder scoring or bearing galling. On the other hand, extended periods of very light loading during initial break-in may cause cylinder wall glazing and/or poor piston ring seating. Engine parts damage can also be caused by using the wrong type and viscosity oil and high engine operating temperatures during break-in.

All engines use more oil than normal during the first hours of operation. As internal moving parts are run-in by controlled operation, oil consumption should gradually decrease until the rate of consumption is stabilized. It is extremely rare that oil consumption drops to zero. All engines use some oil even when in perfect condition and properly broken-in. Oil consumption varies according to engine design, engine (piston) speed, size of engine, type of oil, oil viscosity, length of operating periods, operating temperatures, engine loading, etc. As engine operation is continued, clearance between moving parts increase slightly due to normal wear of piston rings, cylinder walls, valve guides, oil seals, etc. These clearances increase until oil consumption is excessive and engine parts have to be replaced and/or refitted. This usually takes hundreds of hours.

Each Onan engine is run-in at the Onan factory for a minimum of two hours. This is not enough running time to completely break-in the engine. Proper completion of the break-in period is up to the customer.

Generator sets manufactured by Onan can be loaded to full nameplate rated output (not until they bog down) as soon as they are put into operation. However, it is recommended during these first few hours of operation that generator sets be loaded to 80% of rated capacity. Initial heavy loading helps seat piston rings and brings oil consumption to normal in the shortest time.

During break-in, check oil level at least every eight (8) operational hours. Add oil if the level is at low on the dipstick. Never over-fill. This may cause oil to foam and enter the breather system.

Drain the initial oil fill after 50 hours of operation while the engine is hot.

Controlled break-in with proper oil and a conscientiously applied maintenance program will help assure satisfactory service for hundreds of hours from your Onan electric welder.

WELDING CURRENT CONTROL

The control panel contains a current selector handle which can be turned to any one of the dial positions to obtain the required welding amperage. Make sure the handle snaps firmly into place when making the desired amperage selection.

WELDING CABLE SIZE

Keep the welding cables as short as possible and check all connections for tightness. Consult Table 1 for correct cable size for current draw and cable length.

TABLE 1. RECOMMENDED WELDING CABLE SIZE

AC POWER AMPERES	TOTAL CIRCUIT LENGTH IN FEET					
	100	150	200	250	300	400
75	6	4	3	3	2	1
100	4	3	3	2	1	1/0
150	3	2	1	1/0	2/0	3/0
200	2	1	1/0	2/0	3/0	4/0

When welding with long cables, avoid allowing the cables to form coils. A coil of cable will produce a magnetic field that can lower the generator output. If you have excess cable on the floor, tape the cables together at short intervals and arrange them in "snake" fashion to take up the slack.

CAUTION *Do not change the amperage tap (control handle) while the power is being used for welding or pipe thawing. The sudden connection break can produce an arc within the control box which can cause serious damage to the switching members or other components in the control circuit. Disconnect one electrode clamp from the work when changing amperage selection.*

AUXILIARY AC POWER

Two welding generator sets are available; one with 120 volt AC, 5 KW and the other with 120/240 volt AC, 5 KW auxiliary power supplies. The 120 volt model is equipped with two 120 volt duplex receptacles with each outlet (4) rated at 15 amps. Although a total of 60 amps is available, no more than 15 amps may be drawn from any individual outlet.

The three outlets of the 120/240 volt model are rated at 20 amperes each and the same rule applies – no more than 20 amps draw from any individual outlet.

Use of auxiliary power is not recommended while welding current is being used. If necessary, however, a low wattage trouble light may be connected without undue loss of welding power. The Governor Control lever must be in the "weld" position for both weld and auxiliary power.

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 plant.
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 crankcase oil every 100 operating hours.
4. Keep oil and gasoline in dust-tight containers.
5. Keep governor linkage clean.

HIGH ALTITUDE

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

ADJUSTMENTS

CARBURETOR

The carburetor (Figure 1) has a main fuel (high speed) adjustment (needle A) and a fuel idle adjustment (needle B). The main adjustment (needle A) affects operation under heavy load conditions. Idle adjustment affects operation at light or no load. Under normal circumstances, factory carburetor adjustments should not be disturbed. If the adjustments have been disturbed, turn needles off their seats, 1 to 1-1/2 turns to permit starting, then, readjust them for smooth operation.

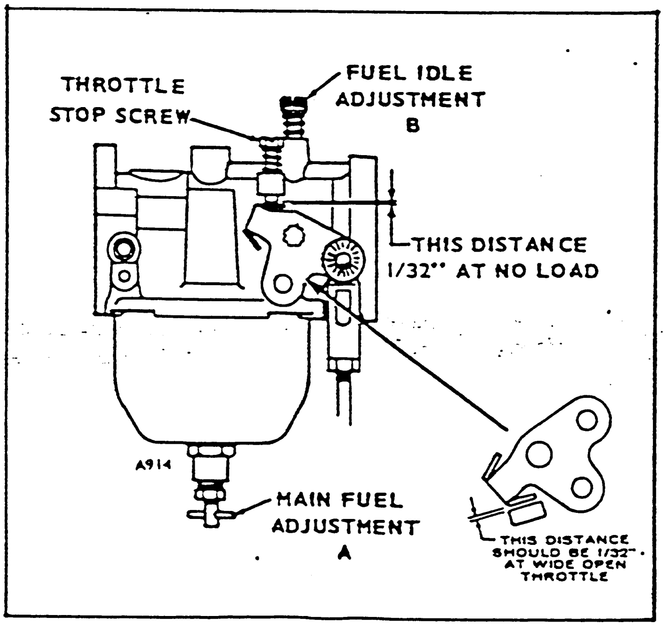


FIGURE 1. CARBURETOR ADJUSTMENTS

CAUTION *Forcing the needle against its seat will damage it. The needle does not completely shut off fuel when turned fully in.*

If the engine runs unevenly at half or full load due to faulty carburetion, the main adjusting needle needs adjusting. Make the adjustment while the engine is running at normal operating temperature and with almost a full load connected to the engine.

Turn the main adjusting needle out about two full turns. Then turn it slowly in until the engine begins to lose power and speed. Then turn it out very slowly until the engine runs smoothly at full power and speed. When adjusting the idle jet needle, the engine should be running at normal operating temperature and without a load connected. Turn the idle adjusting needle in until the engine loses considerable speed. Then turn it out until the engine runs smoothly.

Set the throttle stop screw (located on carburetor throttle lever) with no load connected and while running at a low rated speed setting. Turn the screw to give 1/32" clearance between the screw and the upper throttle arm stop (Figure 1).

If the engine develops a "hunting" condition (alternate increase and decrease of engine speed) try correcting by opening the main adjusting needle a little more. Do not open more than 1/2 turn beyond the maximum point of power. If this does not correct the condition, follow the instructions for regulating the sensitivity of the governor under GOVERNOR ADJUSTMENT.

CHECK BREAKER POINTS

Replace burned or faulty points. If only slightly burned, dress smooth with file or fine stone. Measure gap with thickness gauge; gap points at .020".

Ignition breaker points (Figure 2), must be correctly gapped. Crank engine to fully open breaker points (1/4 turn after top center). Loosen and move stationary contact to correct the gap at full separation. Tighten contact and check gap.

Ignition points should break contact just when the 22° timing mark aligns with the flywheel timing mark. Final timing is corrected by properly shifting the breaker point box on its mounting and using a timing light. If specified timing cannot be obtained by moving the breaker box, check to be sure timing marks on gears are aligned. Timing procedures appear in the IGNITION SYSTEM section.

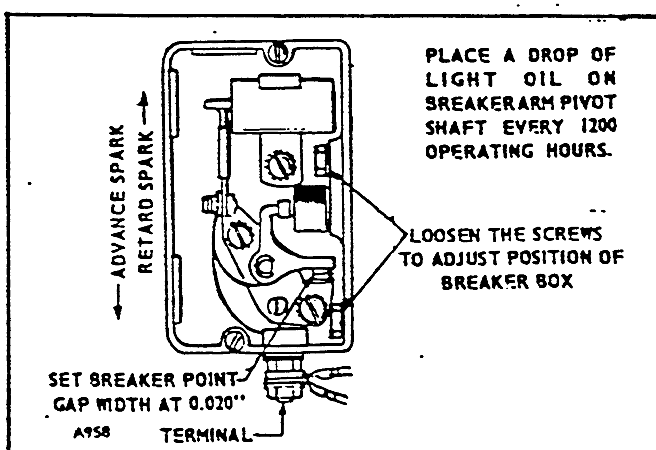


FIGURE 2. IGNITION ADJUSTMENTS

GOVERNOR ADJUSTMENT

Engine speed is governor-controlled, and preset at the factory. Proper governor adjustment is one of the most important factors in maintaining the power and speed desired from the engine.

These engines are adapted for use where a double range of speed settings is desired. Engine speed is controlled at idle and maximum by simply shifting the governor control lever up for high speed and down for idle.

The design of the governor gives an automatic decrease in sensitivity when the speed is increased and the result is good stability at both speeds.

Before making governor adjustment, run the engine about 15 minutes to reach normal operating temperature. If the engine is being run with the throttle wide open, either the governor is not properly adjusted or the engine is overloaded. It is difficult to determine if after long usage the governor spring has become fatigued. If, after properly making all other adjustments, the regulation is still erratic, install a new spring (Figure 3).

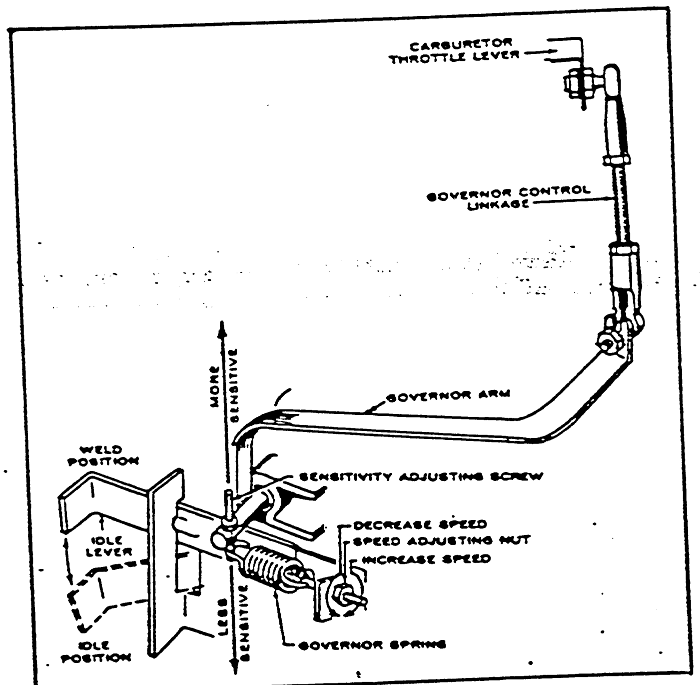


FIGURE 3. GOVERNOR ADJUSTMENTS

A reliable instrument for checking engine speed is required for accurate governor adjustment. Engine speed can be checked with a tachometer.

Check the governor arm, linkage, throttle shaft, and lever for binding condition or excessive slack and wear at connecting points. A binding condition at any point will cause the governor to act slowly and regulation will be poor. Excessive looseness will cause a hunting condition and regulation will be erratic. Work the arm back and forth several times by hand while the engine is idle. If either of these conditions exist, find out where the trouble lies and adjust or replace parts as needed.

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 length so that with the engine stopped and tension on the governor spring, the lower stop on the carburetor throttle lever is 1/32" from stop pin. (Figure 1). This setting allows immediate control by the governor after starting and synchronizes travel of the governor arm and the throttle shaft.

Procedure: This gives the procedure only briefly. Refer to the details on each subject herein.

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.

Approximately 3600 rpm is the recommended maximum full load speed for continuous operation. The speed must agree with the 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 3).

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 turning the screw in. To decrease sensitivity, move the governor spring away from the governor shaft by turning the screw out.

SERVICE AND MAINTENANCE

AIR FILTER

The NB series engine is equipped with a paper cartridge, automotive type air filter (Figure 4). Under normal usage the filter should be changed every 200 hours. Extremely dusty conditions may require a change every 50 hours. The filter should be inspected more frequently, especially if the engine appears to be losing power or idles roughly. If the filter 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 reassembling. When replacing the wing nut don't forget the copper washer. Tighten the wing nut finger tight only.

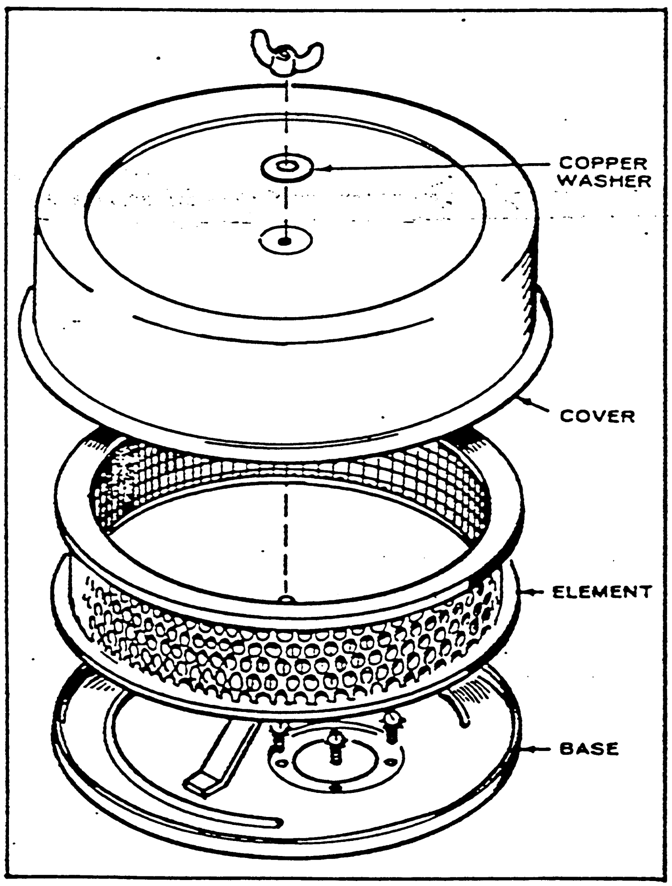


FIGURE 4. AIR FILTER ASSEMBLY

BREATHER VALVE

Remove the hose from the breather valve at the valve compartment cover (Figure 5). 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.

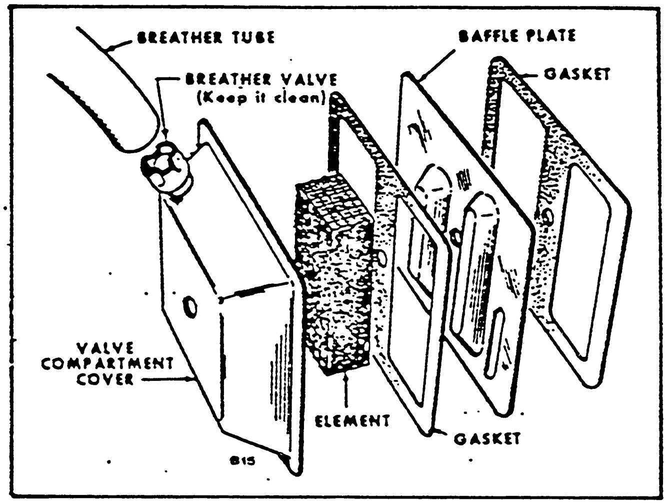


FIGURE 5. BREATHER VALVE AND FILTER MAINTENANCE

CRANKCASE OIL

Oil capacity is 2 U.S. quarts. Fill to the *full* mark on oil indicator. Use a good quality detergent oil classified for service MS or MS/DG. Do not use service DS oil at any time. Use the proper SAE number of oil for the expected temperature conditions. Do not mix brands or grades. Extremely dusty or low temperature conditions require oil change at 20 hrs.

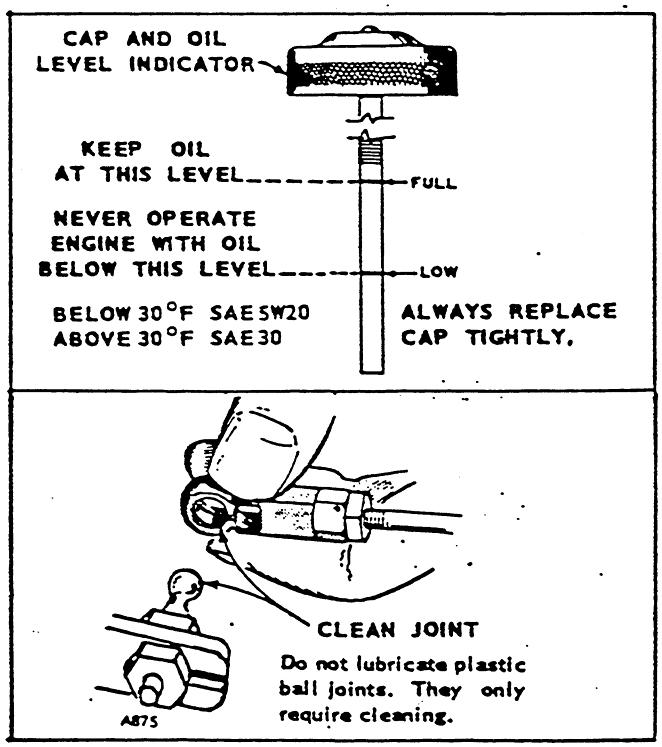


FIGURE 6. MAINTENANCE PROCEDURES

MAINTENANCE SCHEDULE

Use this factory recommended maintenance schedule (based on favorable operating conditions) to serve as a guide to get long and efficient welder life. Neglecting routine maintenance can result in failure or permanent damage to the welder. Maintenance is divided into two categories: (1) *operator maintenance* – performed by the operator and (2) *critical maintenance* – performed by qualified service personnel.

OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS			
	8	50	100	200
Inspect Welder	x			
Check Breaker Points			x	
Check Oil Level	x			
Clean Air Cleaner		x1		
Clean Governor Linkage		x1		
Check Spark Plugs			x	
Change Crankcase Oil			x1	
Clean Crankcase Breather				x
Clean Fuel System				x
Check Battery			x	

x1 - Perform more often in extremely dusty conditions.

CRITICAL MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	OPERATIONAL HOURS		
	200	500	1000
Check Collector Rings		x1	
Check Brushes		x2	
Remove Carbon & Lead	x3		
Check Valve Clearance	x		
Clean Carburetor		x	
Clean Generator		x	
Grind Valves (if required)		x	
General Overhaul (if required)			x

x1 - Perform more often in extremely dusty conditions.

x2 - Replace brushes when worn to 5/16'' or less.

x3 - The frequency of necessary carbon or lead deposit removal will vary with operating conditions. Frequent short operating periods, consistently cool operation, use of highly leaded gasoline, etc. are some causes of more rapid formations of combustion deposits. Remove deposits as experience indicates the necessity. Always install new gaskets.

For any abnormalities in operation, unusual noises from engine or generator, loss of power, overheating, etc., contact your dealer.

ENGINE TROUBLESHOOTING

OPERATOR'S TROUBLE-SHOOTING GUIDE for ONAN GASOLINE ENGINES (Air Cooled)

System	CAUSE \ TROUBLE	Hard Starting or Failure to Start	Starter Motor Doesn't Turn	Engine Misfires	Speed Too High	Speed Too Low	Hunting Condition	No Governor Control	Poor Sensitivity	Excessive Oil Consumption	Excessive Fuel Consumption			Engine Backfires at Carburetor	Engine Overheats	Mechanical Knocks	Black Smoky Exhaust	Blue Smoky Exhaust
COOLING SYSTEM	Blown Head Gasket	●		●											●			
	Overheating									●						●	●	
	Dirt on Cooling Fins														●			
	Inadequate Air Circulation (Ventilation)									●					●			
FUEL SYSTEM	Out of Fuel, or Shut-off Valve Closed	●																
	Poor Quality Fuel	●		●							●					●		
	Dirty Fuel Filter	●		●														
	Fuel Line Leaks	●		●			●				●							
	Mixture Too Rich	●		●							●			●			●	
	Mixture Too Lean	●		●											●			
	Engine Flooded	●												●				
	Run for Long Periods of Time at No Load			●														
	Restricted Air Intake, Dirty Air Filter	●		●							●						●	
GOVERNOR SYSTEM	Linkage Loose or Disconnected							●										
	Linkage Binding					●	●	●										
	Excessive Wear in Linkage						●	●	●									
	Incorrect Governor Adjustment				●	●			●									
	Spring Sensitivity Too Great				●		●											
LUBRICATION SYSTEM	Low Oil Supply														●	●		
	Excess Oil in Crankcase									●								●
	Oil Leaks From Engine Base or Connections									●								
	Crankcase Oil Too Light or Diluted									●					●	●		●
	Crankcase Oil Too Heavy	●																
STARTING SYSTEM AND IGNITION SYSTEM	Battery Discharged or Defective	●	●															
	Loose Battery Connections	●	●															
	Load Connected When Starting	●																
	Open Solenoid	●	●															
	Defective Starter	●	●															
	Wrong Plug or Point Setting	●		●														
	Incorrect Timing	●		●							●			●	●	●	●	
	Spark Too Far Advanced													●	●			

CARBURETOR

Carburetor maintenance should consist of regular cleaning. Some types of gasoline have a tendency toward formation of gum deposits inside the carburetor. This gum formation can usually be removed by soaking in alcohol or acetone. A fine, soft wire may be used to clean jets.

Gasoline: Adjusting the carburetor means obtaining the correct fuel-to-air mixture for smooth, efficient operation. The carburetor should be adjusted in two steps – first the idle adjustment and then the load adjustment (Figure 7).

Important: *If the carburetor is completely out-of-adjustment so the engine will not run, open both needle valves 1 to 1-1/2 turns off their seats to permit starting. Do not force the needle valves against their seats. This will bend the needle.*

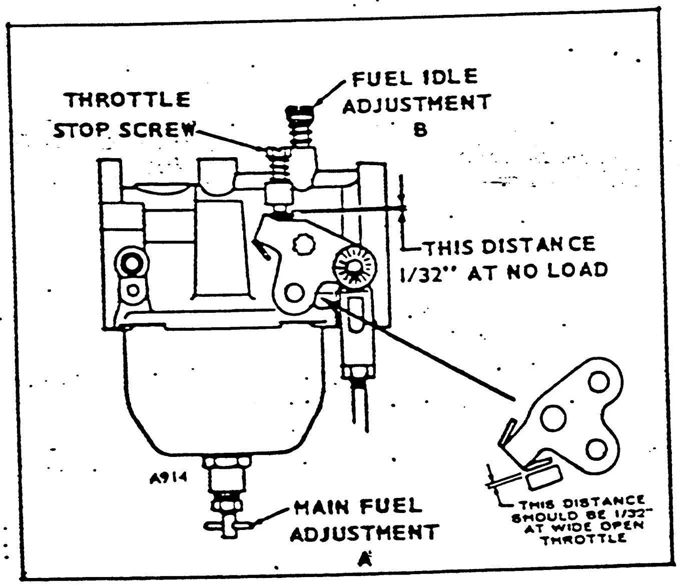


FIGURE 7. CARBURETOR

Before adjusting the carburetor, be sure the ignition system is working properly and the governor is adjusted. Then allow the engine to warm up.

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

Alternate Method, Use When There is No-Load Adjustment Possible.

1. Start the engine and allow it to warm up.
2. Push in on the governor mechanism to slow the unit down to about 400-500 rpm.
3. Set the idle adjustment screw for even operation (so the engine is running smoothly).
4. Release the governor mechanism to allow the engine to accelerate. 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.

With the carburetor and governor adjusted, set the throttle stop screw, Figure 7, to allow 1/32" clearance to the stop pin with the engine operating at no load. This prevents excessive hunting when a large load is suddenly removed.

Removal and Disassembly:

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

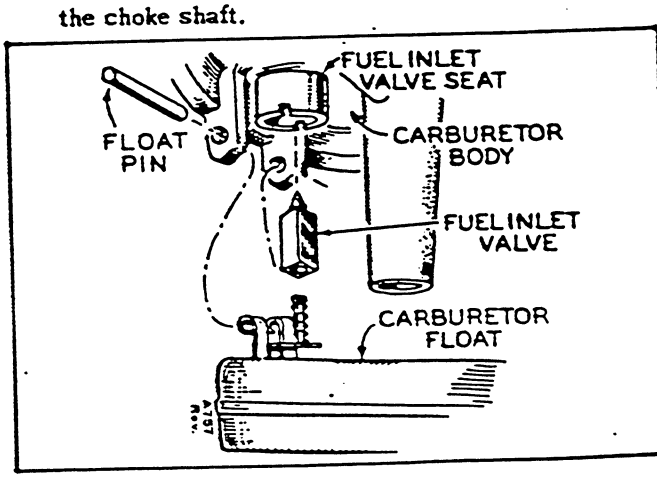


FIGURE 8. CARBURETOR DISASSEMBLY

Cleaning and Repair: 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.

Check the adjusting needles and nozzle for damage. If float is loaded with fuel or damaged, replace it. The float should fit freely on its pin without binding. Invert the carburetor body and measure the float level, Fig. 9.

If necessary, bend the small lip that the intake valve rides on to adjust float level.

Check the choke and throttle shafts for excessive side play and replace if necessary. Do not remove the coating on the throttle shaft. This is teflon, used to reduce wear and friction between the shaft and carburetor body.

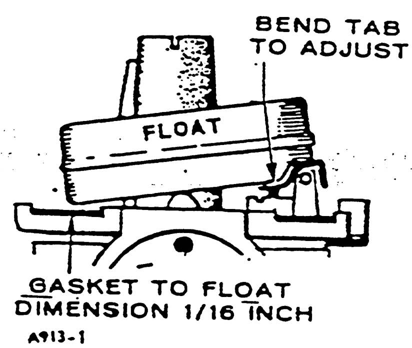


FIGURE 9. FLOAT LEVEL ADJUSTMENT

Assembly and Installation:

1. Install the throttle shaft and valve, using new screws and lock washers. Install the 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 lock washers.
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 9.
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, breather hose, and choke.
12. Install the air cleaner.

To check float level, remove the entire main fuel adjustment assembly from the float bowl (unscrew large nut from float bowl – Figure 9). Invert the carburetor cover and float. With the float parallel to the cover gasket. The float tab should just touch the fuel inlet valve spring. With the float then hanging, its weight should compress the spring and the top of the float should be 1/16 - 1/8 from the cover gasket. The proper level from the float to the gasket should be 1/16" with the valve spring compressed. 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.*

Properly seated valves are essential to good engine performance. The aluminum cylinder head is removable for valve servicing. Do not pry to loosen the cylinder head, rap sharply on the edge with a soft faced hammer, taking care not to break any cooling fins. A conventional type valve spring lifter may be used when removing the valve spring locks, which are of the split type. Clean all carbon deposits from the cylinder head, piston top, valves, guides, etc. If a valve face is burned or warped, or the stem worn, install a new valve.

Worn valve stem guides may be replaced from inside the valve chamber. Valve locks are split, tapered type, the smaller diameter of which must face toward the valve head. Tappets are also replaceable from the valve chamber, after first removing the valve assemblies.

The valve *face* angle is 44°. The valve *seat* angle is 45°. This 1° interference angle results in a sharp seating surface between the valve and the top of the valve seat. The interference angle method of grinding valves minimumizes face deposits and lengthens valve life (Figure 10).

The valves should not be hand lapped, if at all avoidable, since the sharp contact may be destroyed. Valve faces should be finished in a machine to 44°. Valve seats should be ground with a 45° stone, and the width of the seat band should be 1/32 to 3/64 of an inch wide. Grind only enough to assure proper seating.

Remove all grinding compound from engine parts and place each valve in its proper location. Check each

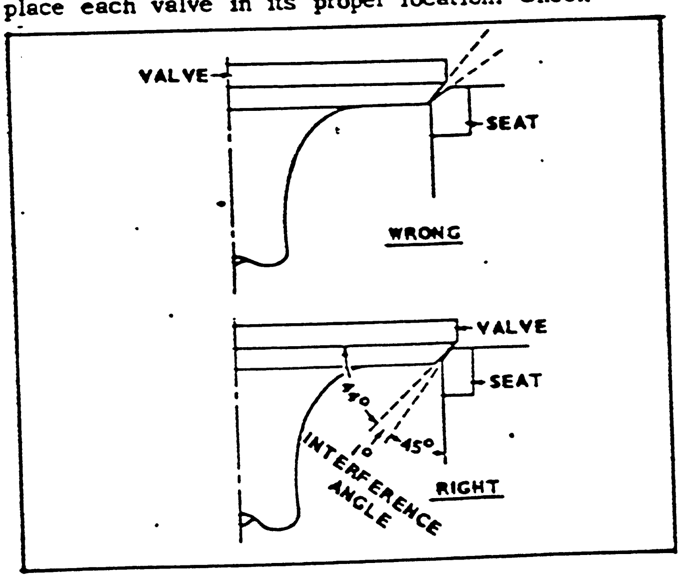


FIGURE 10. VALVE GRINDING

valve for a tight seat, 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 part of a turn against the seat.

Lightly oil the valve stems and reassemble all parts removed. Adjust the valve clearance.

TAPPET ADJUSTMENT

The engine is equipped with adjustable tappet. To make a tappet adjustment, remove the blower housing, valve

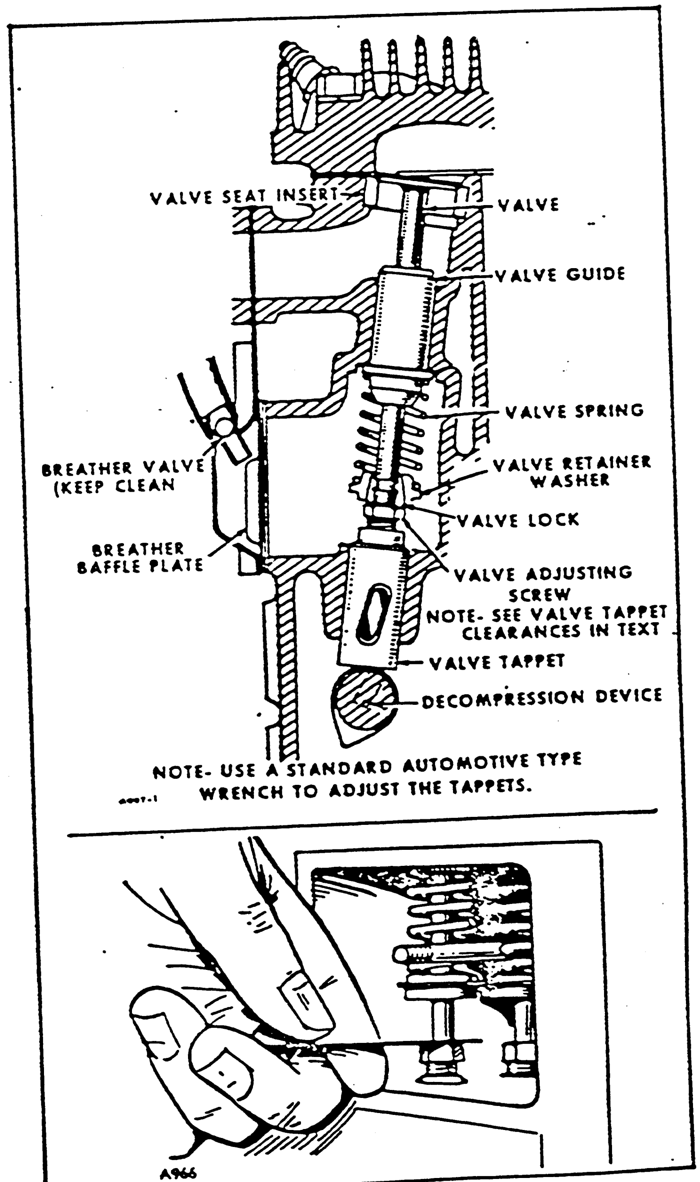


FIGURE 11. TAPPET ADJUSTMENT

cover and the spark plug. Turn the flywheel by hand to the end of the compression stroke until the T/C mark on the flywheel aligns with the 0° (degree) mark on the gear case cover. At this point the valves are closed and the valve stems and tappets should separate sufficiently to insert a feeler gauge (Figure 11). Starting with the thickest gauge that will enter the gap, turn the adjusting screw until the clearances specified in the Table of Clearances are obtained.

For example, if the largest gauge that will enter is .014 on the intake valve, this means that the adjusting screw must be turned out. When at proper setting, the .011 feeler gauge will enter but the .012 gauge will not.

NOTE: *Make sure to exert downward pressure on the tappet so that contact with the cam lobe is maintained when measurements are taken. If this is not done, a false measurement may result.*

If more clearance is required, reverse the above procedure, but starting with the smallest feeler gauge and turning the adjusting screw in.

In order to receive satisfactory performance of the ignition system all components must be in good condition and the spark must be properly timed. Hard starting, low power and erratic operation can often be caused by faulty ignition. If poor ignition is suspected, the first thing to do is to determine if the ignition system is actually at fault. A simple operational test will determine this.

NOTE: *Manual start models are equipped with magneto ignition. Electric start models have automotive type battery ignition.*

Remove the high tension lead from the spark plug and hold the end terminal approximately 3/16″ from a clean metal part of the engine. Crank the engine fast enough to produce a spark. If a sharp, snappy spark occurs, the trouble apparently is not in the coil, condenser, or breaker points although it could be in the spark plug. If there is no spark or one that is weak or yellowish in color, ignition trouble is indicated.

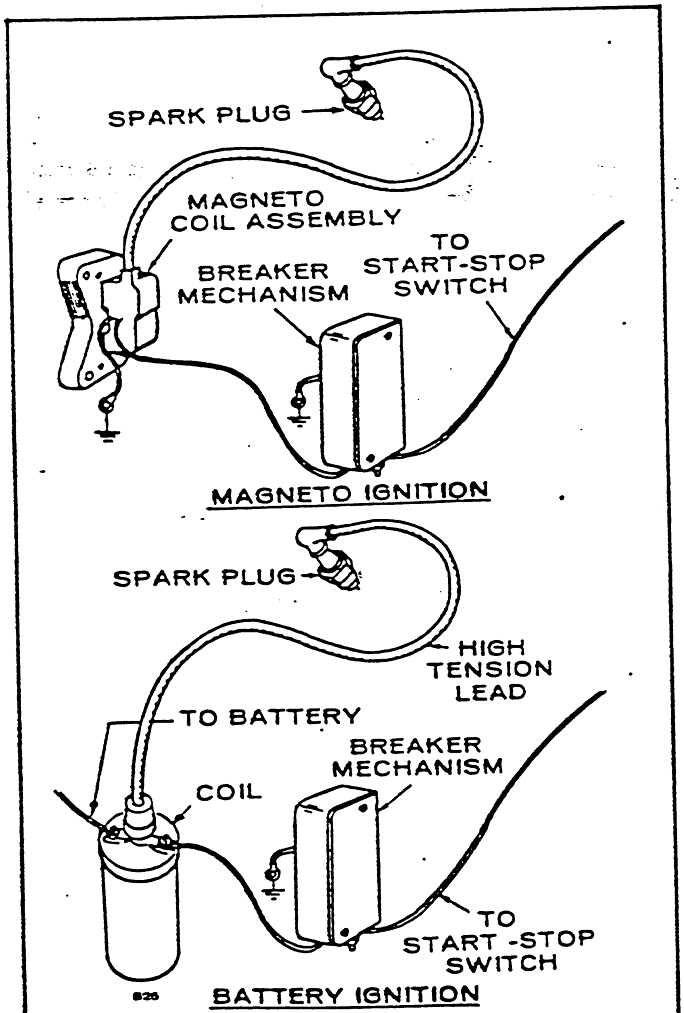


FIGURE 12. NB IGNITION SYSTEMS

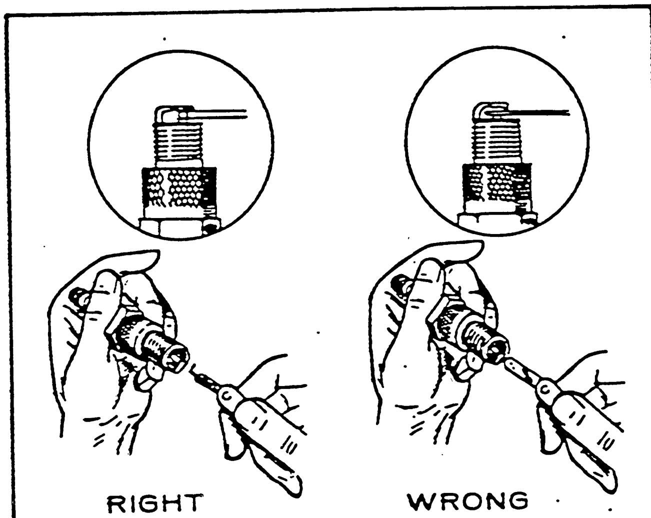


FIGURE 13. SETTING SPARK PLUG GAPS

High Tension Lead: Inspect Ignition lead for cracks or breaks in the insulation that may weaken the current before it reaches a plug. A high tension wire touching metal at some point may make operation unsatisfactory.

Spark Plug: Engine misfire or generally poor operation is often caused by a spark plug in poor condition or with the wrong gap setting. Remove the spark plug and carefully check for the following conditions:

Porcelain insulator cracked or coated with oil.
Electrodes burned or worn away.
Wrong gap setting.

If the porcelain insulator is cracked or broken or if the electrodes are badly worn or burned replace the spark plug with a new one.

If not, it can probably be restored to good operating condition by the following steps:

1. Degrease wet or oily plug and dry thoroughly.
2. File center electrode to a flat surface.
3. Adjust gap to .025″. Use a round wire gauge for more accurate measurement.
4. Install plug. Tighten to torque value of 15-20 ft. pounds.

Breaker Points: The condition and adjustment of the breaker points greatly affect the performance of the engine. If points are burned or badly oxidized, little or no current will pass. As a result, the engine may not operate at all or, if it does run, it is likely to miss, particularly at full throttle.

Always replace badly burned or pitted breaker points. If only slightly pitted or burned, the points can be dressed down with a file or fine stone. This will help temporarily but points should be replaced at first opportunity. If points are oxidized, rub a piece of coarse cloth across the surface. Dirty or oily points can be cleaned with a cloth but be sure no particles of lint are left between surfaces.

Measure the gap with a thickness gauge and set at .020". To set the gap, crank the engine to fully open the breaker points (1/4 turn after top center). Loosen and move stationary contact to correct the gap at full separation. The mating surfaces of breaker points must make contact evenly. Point alignment is extremely important to proper engine operation and point life.

Adjustment of the breaker points affects the time that contacts are opened and closed. Timing of the spark plug firing, which occurs when the breaker points separate, is critical to best engine performance. The spark must fire the fuel mixture at the proper split second when the piston is at the proper location in the cylinder to get the most power from the fuel charge. Set the ignition timing as follows:

1. Adjust the ignition breaker point gap width to .020 inch at full separation.
2. Remove breaker box cover.
3. Crank the engine over slowly by hand in the direction of crankshaft rotation until the T/C mark on the flywheel and the 22° mark on the gear cover are exactly in line ON THE COMPRESSION STROKE (Figure 14).
4. Turn the flywheel to the left, against crankshaft rotation, until the mark is about two inches past the 25° mark on the gear cover.
5. Turn the flywheel slowly to the right and note whether the ignition points just separate when the mark on the flywheel aligns with the 22° mark on the gear cover (engine must be on the compression stroke). If marks align as the points break, timing is correct. If not, loosen the breaker box mounting screws and shift the whole breaker box assembly slightly upward to retard the timing (points breaking too soon), or slightly downward to advance the timing (points not breaking soon enough). Tighten the breaker box mounting screws securely after making an adjustment.

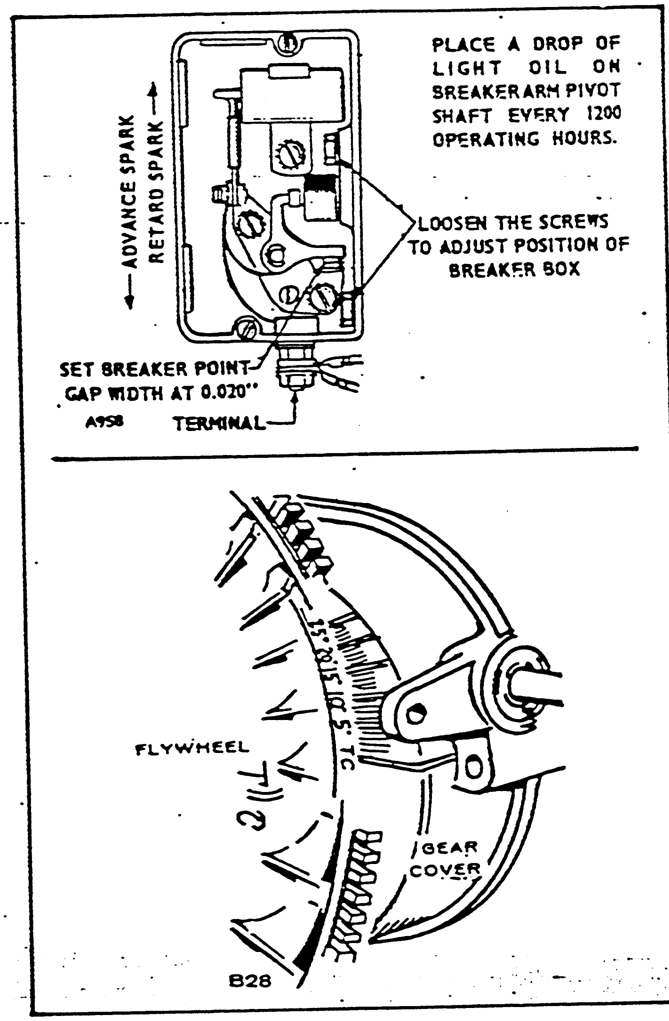


FIGURE 14. IGNITION TIMING

GEAR COVER

After removing the mounting screws, tap the gear cover gently with a soft-faced hammer to loosen it.

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 3/4" from the cover mounting surface.

GOVERNOR CUP

With the gear cover removed, the governor cup can be taken off after removing the snap ring from the camshaft center pin. Catch the flyballs while sliding the cup off. See Figure 15.

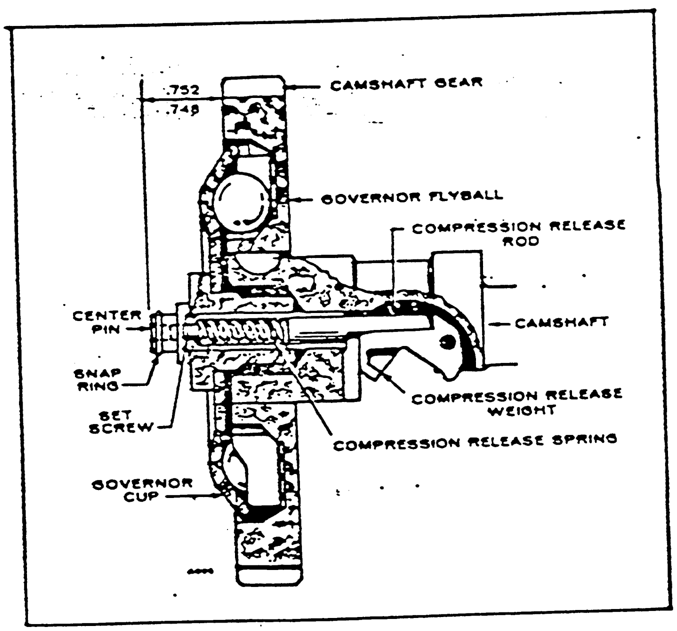


FIGURE 15. GOVERNOR CUP DETAILS

In order to facilitate easier cranking, a compression release has been built into the camshaft gear and governor assembly. See Figure 15. This device holds the exhaust valve open approximately .020" on the compression stroke when starting. After the engine starts, the compression release weight retracts due to centrifugal force and the exhaust valve functions normally. No adjustment of this assembly is required nor possible.

When starting or stopping, there will be a sharp, metallic click caused by the decompression release.

Replace with a new part, any flyball which is grooved or has a flat spot, the ball spacer if its arms are worn or otherwise damaged, and the governor cup if the race surface is grooved or rough. The governor cup must be a free spinning fit on the camshaft center pin, but without excessive looseness or wobble.

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 16.

The camshaft center pin extends out 3/4" from the end of the camshaft. This distance provides an in and out travel distance of 7/32" for the governor cup, as illustrated. 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 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.

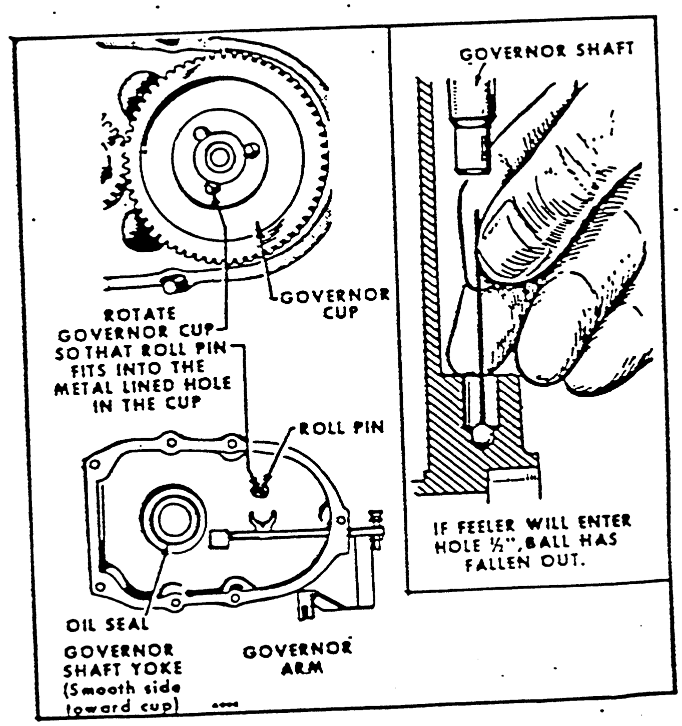


FIGURE 16. GEAR COVER ASSEMBLY

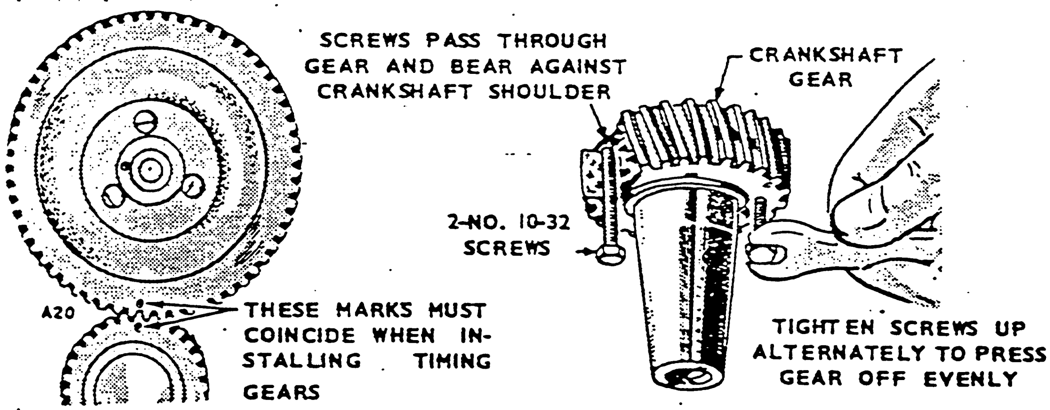


FIGURE 17. TIMING GEAR REMOVAL AND INSTALLATION

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 insert two long #10-32 steel screws into the tapped gear holes and tighten the screws alternately. As the screws are tightened, the screw ends will seat against the crankshaft shoulder and force the gear off the end of the crankshaft. See Figure 17.

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.

Each timing gear is stamped with 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.

PISTONS AND RINGS

The piston and connecting rod assembly is removed outward from the cylinder. The pistons are fitted with two compression rings and one oil control ring with an expander. Inspect each 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 pistons are badly scored, very loose in the cylinder, have badly-worn ring grooves, or otherwise are not in good condition, install new pistons. Install new pistons if the old ones are loose on the piston pins and 0.002″ oversize piston pins will not correct it. Handle pistons 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 following, refer to Figure 18. 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 Clearances (see Repair 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 pistons. Use .010″, .020″, .030″ and .040″ oversize rings

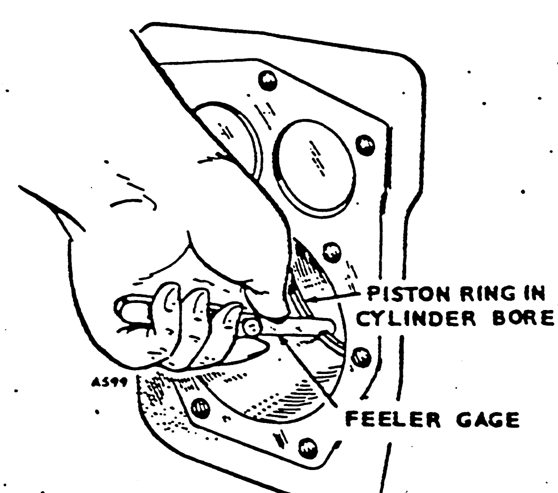


FIGURE 18. FITTING PISTON RINGS TO CYLINDER

on corresponding oversize pistons. 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 Table of Torques and Clearances for the correct piston-to-cylinder clearance.

CONNECTING RODS

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

Install the connecting rod and cap as shown in Figure 19. 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.

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 21.

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

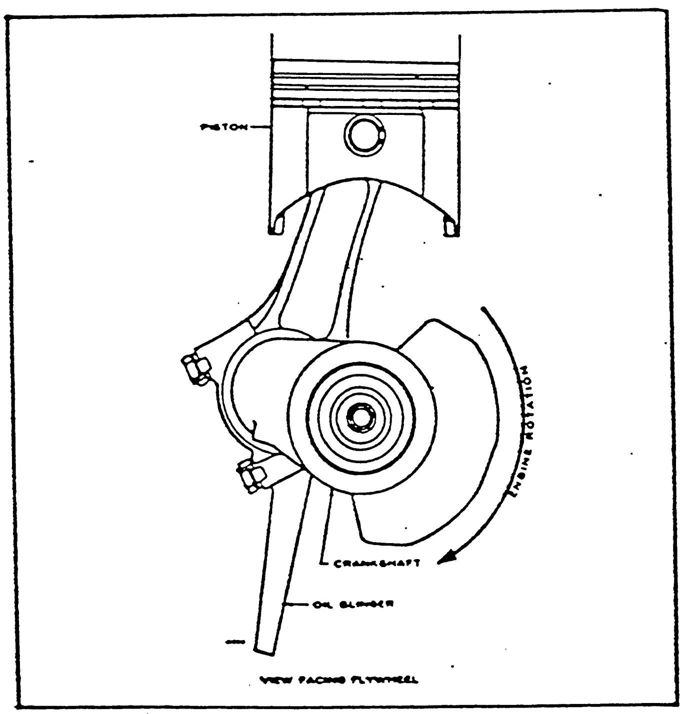


FIGURE 19. CONNECTING ROD INSTALLATION

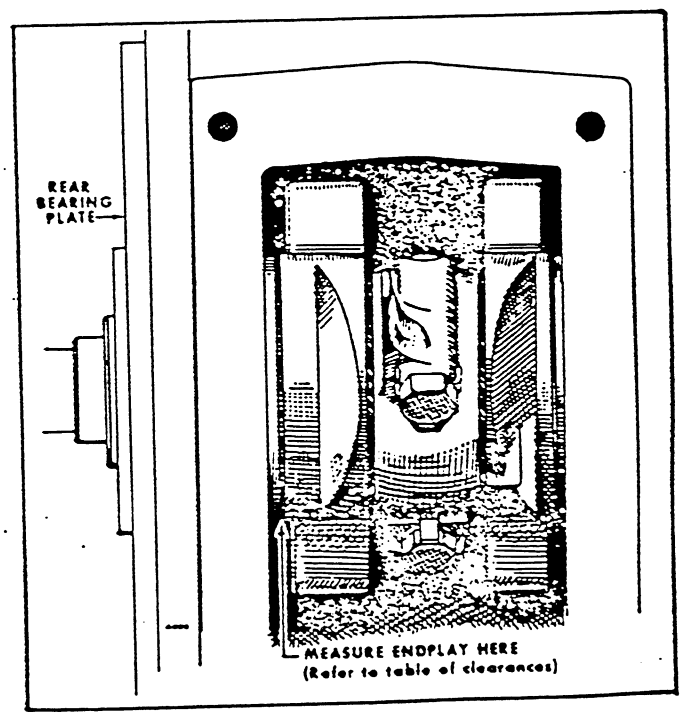


FIGURE 20. CRANKSHAFT ENDPLAY

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.

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 22.

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

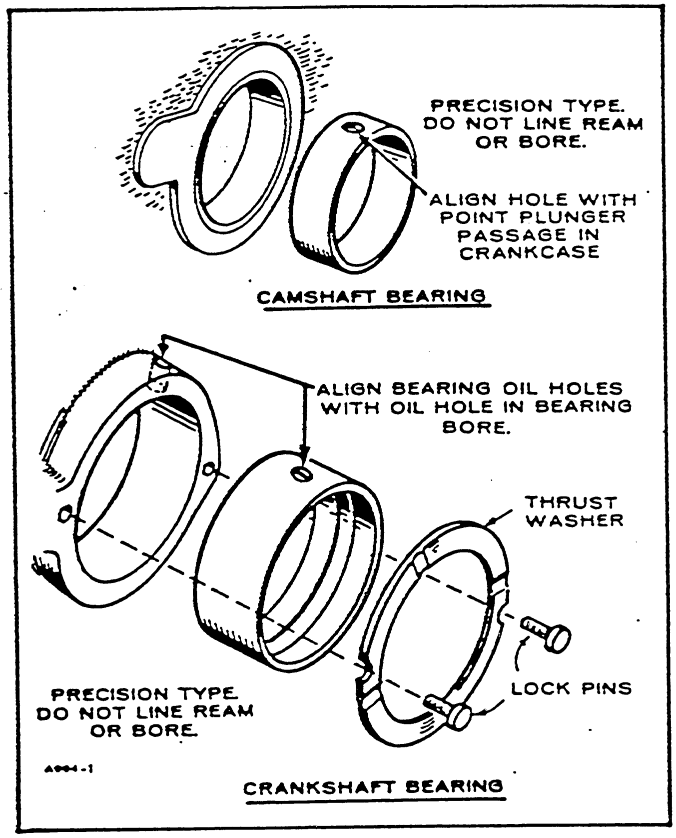


FIGURE 21. CAMSHAFT AND CRANKSHAFT BEARINGS

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 .010", .020", .030" and .040" oversize. Piston rings are available in .010", .020", .030" and .040" oversize. If the cylinder is not being recondi-

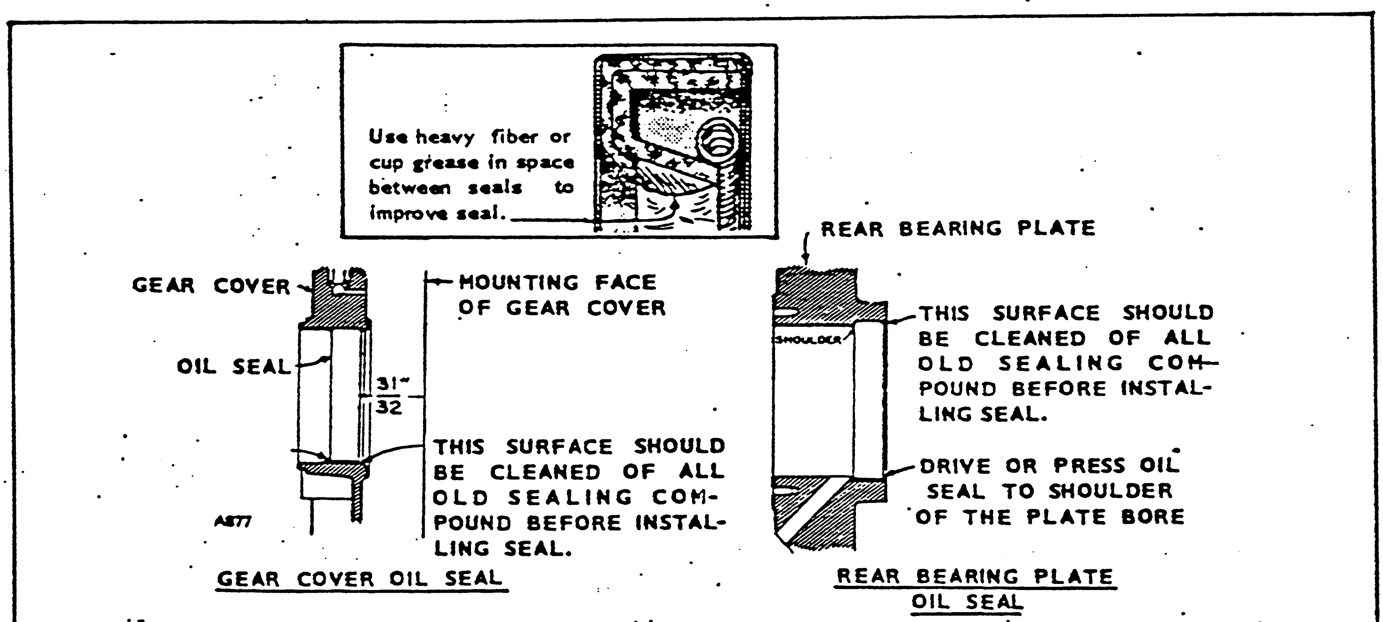


FIGURE 22. GEAR COVER AND REAR BEARING PLATE OIL SEALS

tioned, 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" 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 bore size appears in Table of Torques and Clearances.

CYLINDER HEAD

The cylinder head bolts should be tightened in the order designated in Figure 23 and to the torque specified at the time the engine is assembled or the cylinder head replaced. This should be at room temperature. At some later time, after the engine has been operated so it reached normal hot temperature *and allowed to cool to room temperature*, the cylinder head bolts should be retorqued to the original specified torque. This retight- should be done before the engine has been run a total of fifty operating hours.

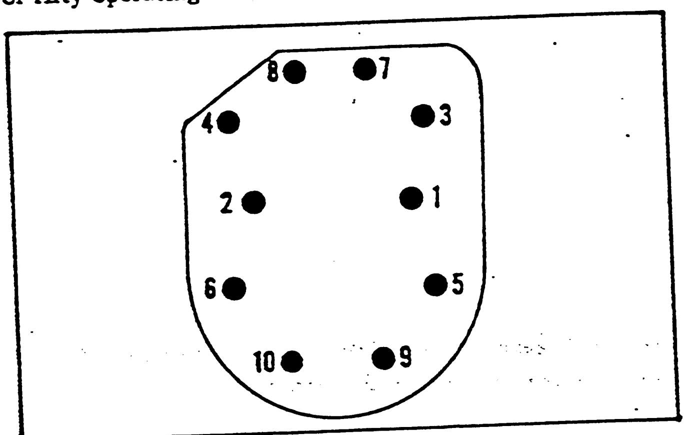


FIGURE 23. HEAD BOLT TIGHTENING DIAGRAM

FLYWHEEL

Removing an aluminum flywheel is a relatively simple process, but the following procedure must be followed to avoid damage to the gear case and possible injury to the operator.

1. Turn the flywheel mounting screw outward about two turns.

   WARNING *Do not remove the screw completely since it acts as a restrainer when the flywheel snaps loose. If the flywheel is not held by the screw, the spring action in the wheel will cause it to fly off with great force which can cause injury to the operator.*

2. Install a puller bar (Onan Part No. 420A100) on the flywheel as shown in Figure 24.
3. Turn the puller bar bolts in, alternately, until the wheel snaps loose on the shaft.

To remove a die cast wheel with puller slots in the face, use a suitable claw type puller.

CAUTION *Do not use a screwdriver or similar tool to pry behind the flywheel against the gear case. The gear case cover is die-cast material and will break if undue pressure is applied in this manner.*

4. Unscrew the puller from the flywheel, remove the flywheel mounting screw and washer and pull the flywheel off the shaft. Take care not to drop the wheel. A bent or broken fin will destroy the balance. Always use a steel key for mounting the flywheel.

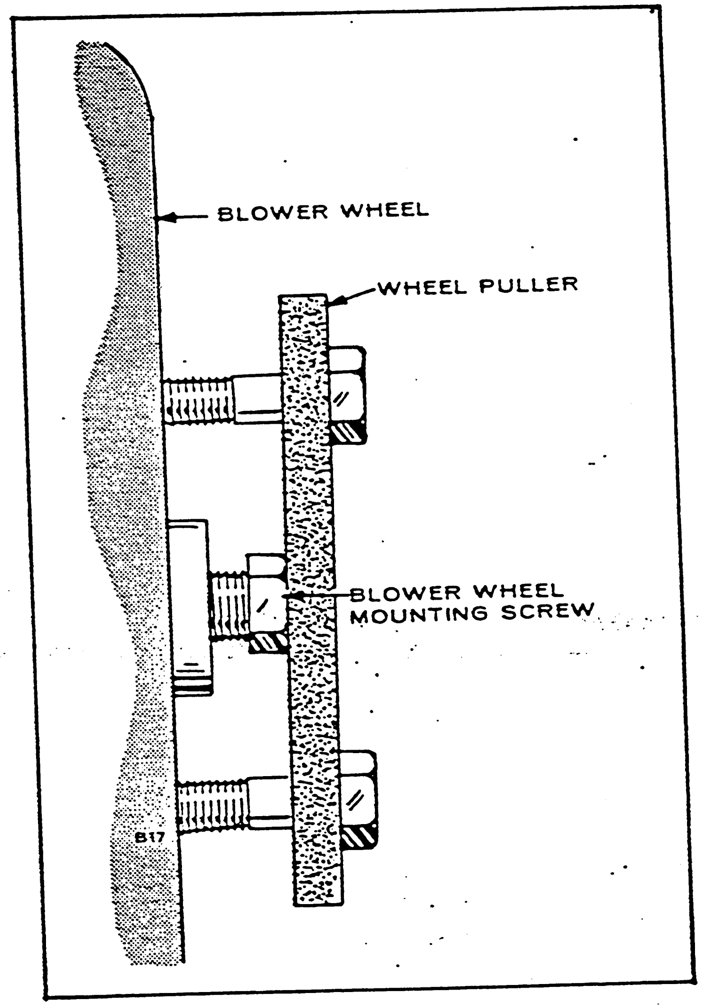


FIGURE 24. BLOWER WHEEL PULLER

TABLE OF TORQUES AND CLEARANCES

Refer to the Trouble Shooting section for assistance in locating and correcting troubles which may occur. If a major repair or overhaul becomes necessary, the engine should be carefully checked and necessary repairs made by a competent mechanic. Maintain factory limits and clearances as shown below, replacing worn parts when necessary.

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 - Die Cast Zinc or Alum.	30-35
Other 5/16" Cylinder Block Studs & Nuts Wheel	10-12
Cylinder Head Capscrews	29-31
Gearcase Cover Screws	14-18
Oil Base Mounting Screws	38-43
Spark Plug	15-20
Starter Mounting Bracket to Block	25-30

CLEARANCES

All clearances given at room temperature of 70°F.

	Minimum		Maximum
Tappet to Cylinder Block Clearance	0.0025"		0.004"
Tappets			
Intake		0.011"	
Exhaust		0.010"	
Valve Stem in Guide - Intake	0.001"		0.0035"
Valve Stem in Guide - Exhaust	0.0025"		0.004"
Valve Seat Interference Width	1/32"		3/64"
Valve Face Angle		44°	
Valve Seat Angle		45°	
Valve Interference Angle		1°	
Crankshaft Main Bearing			
Steel-Backed Aluminum	0.0025"		0.0038"
Crankshaft End Play	0.006"		0.012"
Camshaft Bearing to Camshaft Clearance	0.0015"		0.0030"
Camshaft End Play	0.003"		
Rod Bearing	0.002"		0.0033"
Connecting Rod End Play	0.002"		0.016"
Timing Gear Backlash	0.002"		0.003"
Piston to Cylinder (Measured under oil ring 90° from pin clearance)	0.0025"		0.0045"
Piston Pin in Piston	0.0001"		0.0005"
Piston Pin in Rod	0.0002"		0.0007"
Piston Ring Gap in Cylinder	0.010"		0.023"
Breaker Point Gap		.020"	
Spark Plug Gap		0.025"	
Crankshaft Main Bearing Journal – Std. Size	1.9992"		2.0000"
Crankshaft Rod Bearing Journal – Std. Size	1.6252"		1.6260"
Cylinder Bore – Standard Size	3.5625"		3.5635"
Ignition Timing Advance – Fixed		22°BTC	

GENERATOR REVOLVING FIELD

The generator uses a 2pole revolving field with an exciter winding to excite the field and regulate the AC output (Figure 25).

The generators' AC welding output comes from the stator windings which also supply 120 volts, or 120/240 volts, AC, depending on model. An additional winding supplies power for battery charging system (electric start models only).

To aid servicing and repair, all output leads from the generator are marked. The lead and terminal markings are shown on the welder wiring diagram.

MAINTENANCE

The generator normally requires little care other than periodic inspection of the bearing, collector rings and brushes every 500 hours.

BRUSHES

After approximately 500 hours of operation, remove the generator brushes and inspect for wear, scoring and general conditions.

To remove the brushes, remove the generator fan guard and the fan. The brush guide is now accessible and can be detached by removing the attaching screws in the end bell. Before removing the brushes from the guide, tag the leads 5 and 6 as shown by the markings on the side of the brush holder. See Figure 26. Unscrew the brush retaining screws and pull the brushes from the guide.

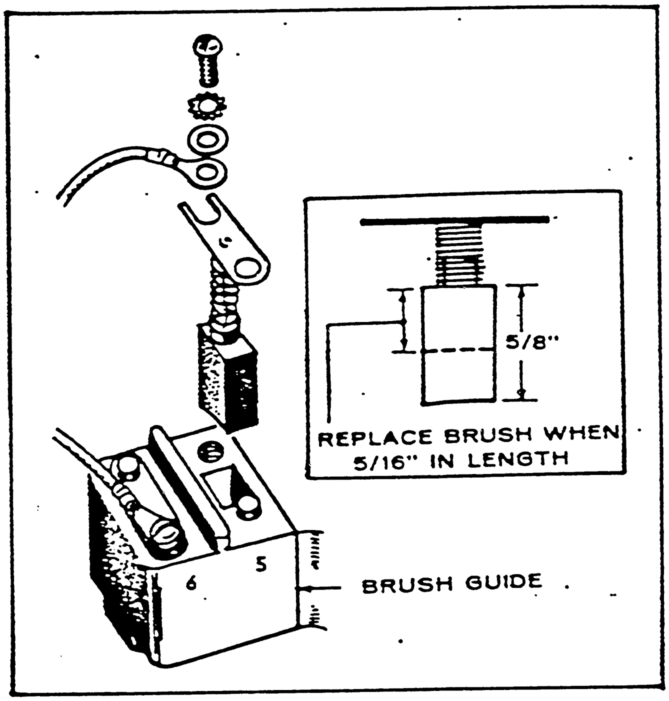


FIGURE 26. GENERATOR BRUSH REMOVAL

The brush faces should have a smooth, coppery cast to them, with no deep grooves present. If serious grooves are noted, the slip rings should be inspected to determine the cause for corrective purposes. If slip ring dressing is required, your nearest Onan Service Center is best equipped to handle the job.

If brushes appear to be in satisfactory condition, and are at least 5/16" in length, replace them in the guide

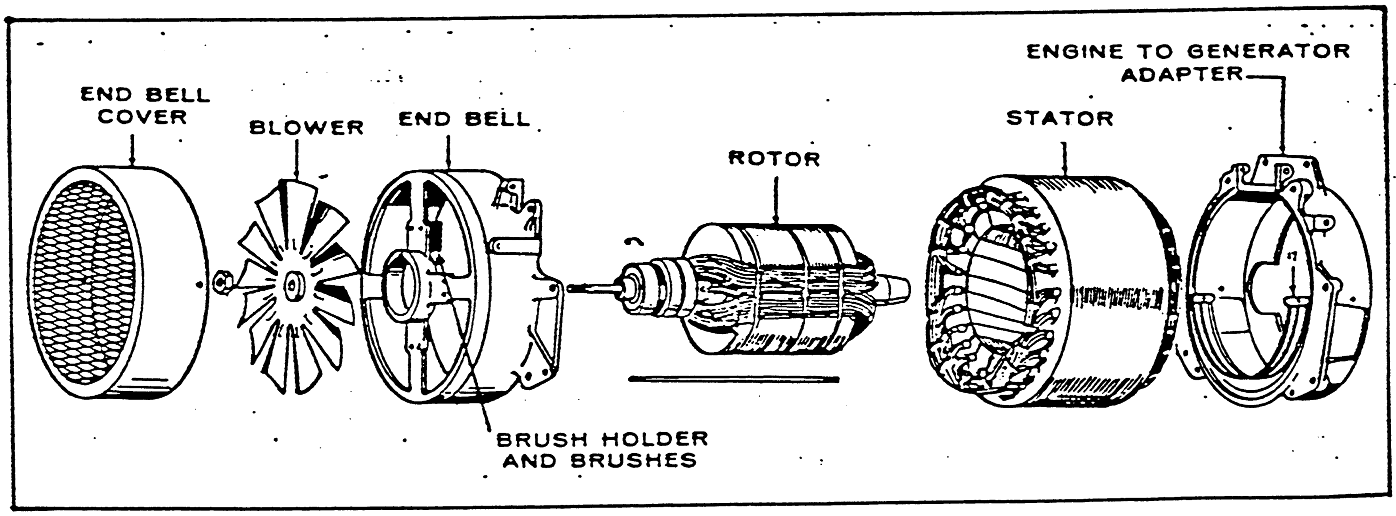


FIGURE 25. NB GENERATOR ASSEMBLY

from which they were removed. Work the brushes up and down in the guide to be sure there is no sticking or binding. If they bind, clean out the guide with air pressure or a small bristle brush until the brushes slide freely in the guide. Replace the brush retainer screws.

If brushes are worn to less than 5/16" length, replace with new brushes. See Figure 26 for comparison scale.

When replacing brushes, don't use a substitute brush that may look identical. It may have entirely different electrical characteristics.

GENERATOR BEARING

This bearing is prelubricated and double-sealed. For maximum reliability, replace during a general overhaul.

COLLECTOR RINGS

Slip (collector) rings may have a dark brown appearance. This is normal and consists of a thin lubricating film which aids in the life of brushes and slip rings. Do not remove the film.

The collector rings must be clean and free of scratches, burrs and marks. If cleaning is necessary, use No. 00 sandpaper to clean the surface. Never use emery cloth or other conducting abrasives.

TROUBLESHOOTING

Unsatisfactory or erratic operation of the generator can, in most cases, be isolated quite simply. Under or over-voltages can usually be traced to improper governor operation causing over, under, and fluctuating engine speeds. If a fault condition persists, checking the entire electrical system with a continuity tester, or ohmmeter, may be required. The tests that follow can be performed without disassembly of the generator.

WARNING *Don't perform troubleshooting tests with the generator running. Serious injury to the operator and damage to the test instruments can result.*

LOSS OF WELDING POWER

1. Remove control box cover screws (at base of cover) and lift off cover.
2. Visually check the rotary switch wiper blade and contact points for burned areas. If questionable contacts are observed, attach one lead of ohmmeter to left hand welding terminal stud; turn switch handle to contact to be tested. Touch the other ohmmeter lead to the reactor lead where it is clamped to the switch terminal. A low (less than 2 ohms) resistance reading should be obtained on the meter if there is a good contact in the switching members. A high resistance indicates poor contact. If cleaning the contact and wiper blade does not restore the contact, switch replacement may be necessary. See Control Box Section.
3. If switch checks out satisfactorily, examine all leads, terminals, and screw connections visually for opens or shorts. A point-to-point check with the ohmmeter will indicate any open circuit.
4. If connections appear all good, isolate the diode (see Control Box Section) attached to the small circuit board back of the control panel top. Check the diode with the ohmmeter by alternately reversing the leads. If the diode passes current in one direction and not the other, the diode is probably good.

   NOTE: *A bad diode will cause the ignition to short and stop the engine. A marginal diode may operate sufficiently well to enable the engine to run but will not deliver enough current to excite the generator (flash the field). If there is any doubt as to the condition of the diode, replace it without question. Make sure, when replacing, that the arrow on the new diode points in the same direction as the one removed.*
5. Isolate the small resistor from the diode and test with the ohmmeter. Resistance should measure 2.7 ohms ± 5%.
6. Remove the end bell cover and cooling fan. Check the brushes in accordance with the procedure in the Maintenance Section. Check all connections for shorts or opens with the ohmmeter.
7. Isolate the two diodes from the end bell frame by removing the attaching nuts. Test as in Step 3. Replace if marginal.
8. If loss of welding power is noticed only in the upper ampere ranges, it is very possible that the electrolytic capacitors are at fault. An ohmmeter will tell you if the capacitor is shorted but will not tell you if the capacitor is open or has changed value. Unless a special capacitor tester is available, substitution of capacitors known to be good is the quickest way of determining the condition of the suspect capacitors. Observe polarity closely when replacement is made.
9. Further tests of excitation and load windings are possible only after dismantling the generator. It is suggested that this be performed only by an Onan Service Center or qualified electric motor and generator service shop.

LOSS OF AUXILIARY POWER

1. Start the check-out procedure by pressing the reset button(s) on the circuit breaker(s). If the button appears to reset, start the engine to determine whether or not auxiliary power is now available. If circuit breaker again opens, the circuit is either overloaded or a short circuit is causing the breaker to trip. Measure the load being drawn. Total load should not exceed 5KW. Check appliance, tool, or cord plugs for shorts.
2. If no evidence of fault is found with the circuit

breaker, proceed with applicable steps 1 thru 9, preceding.

CONTROL BOX

The rear side of the control panel contains the switching members and connections to the reactor transformer. Also, a small panel on the upper part of the control panel mounts a diode and resistor which provide a DC pulse for generator excitation buildup.

If troubleshooting an inoperative generator indicates replacement of the diode and/or resistor is necessary, certain precautions should be taken to avoid heat damage to the new diode. After unsoldering the lower lead of the diode to be removed, clean any excess solder off the terminal board post. Make a loop in the diode lead and fit it to the solder terminal. Allow enough room between the solder joint and the diode body to allow a small nose pliers to grasp the lead. The pliers will act as a heat sink to absorb the heat applied by the soldering iron. Make the solder joint quickly to avoid overheating the solder joint. Secure opposite lead to the threaded stud along with the resistor lead. When replacing the resistor, the use of reasonable care in soldering will suffice.

If, through accident or misuse, the selector switch becomes damaged or burned, and replacement is necessary, the following procedure should be followed for switch replacement.

1. Disconnect and tag all leads from the control box to the generator.
2. Remove all bolts and screws that attach the control box to the generator frame and lift the assembly off the generator.
3. Use a small pin punch to drive the roll pin from the selector handle and pull the handle off the shaft.
4. With the aid of a snap-ring pliers (Onan Part No. 420P107) remove the snap ring from the selector shaft.
5. Remove the receptacle and circuit breaker mounting screws from panel front. Unscrew the nuts and washers from the terminal studs on the front of the terminal studs on the front of the control panel. Remove the 1/4-20 machine bolt from the top-center of the control panel and pull the panel off.
6. The wiper blade, tension spring, and operating shaft may now be slid out of the switch assembly as a unit. This will release the copper connector bar and terminal stud which should also be removed.
7. The squeeze-type connectors that secure reactor leads x1 through x7 to the selector terminals must be removed with a hack-saw, bolt cutters or other suitable means. If it is determined that this is impossible, the stranded leads may be severed next to the connector. This method is not recommended unless absolutely necessary since shortening the lead will make handling more difficult.
8. Clean the leads with sandpaper and tape any frayed or broken insulation or slide a new glass fiber sleeve over the lead if the insulation is beyond repair. Replace the identifying marker (x1, x2, etc.) on the sleeve.
9. The leads are reassembled to the new selector panel with screw type connectors. See Parts List. Before reassembly, tin or flux any bare copper wires. Insert wire and terminal pin and tighten securely. Flow solder into the connector and wires with either a low flame torch or large soldering copper. This will assure a good, permanent electrical bond.
10. Replace any other parts as necessary and reassemble the new switch in the reverse order of disassembly. When replacing the switch handle, do not overlook replacing the spacer washer under the snap ring.

STARTING SYSTEM

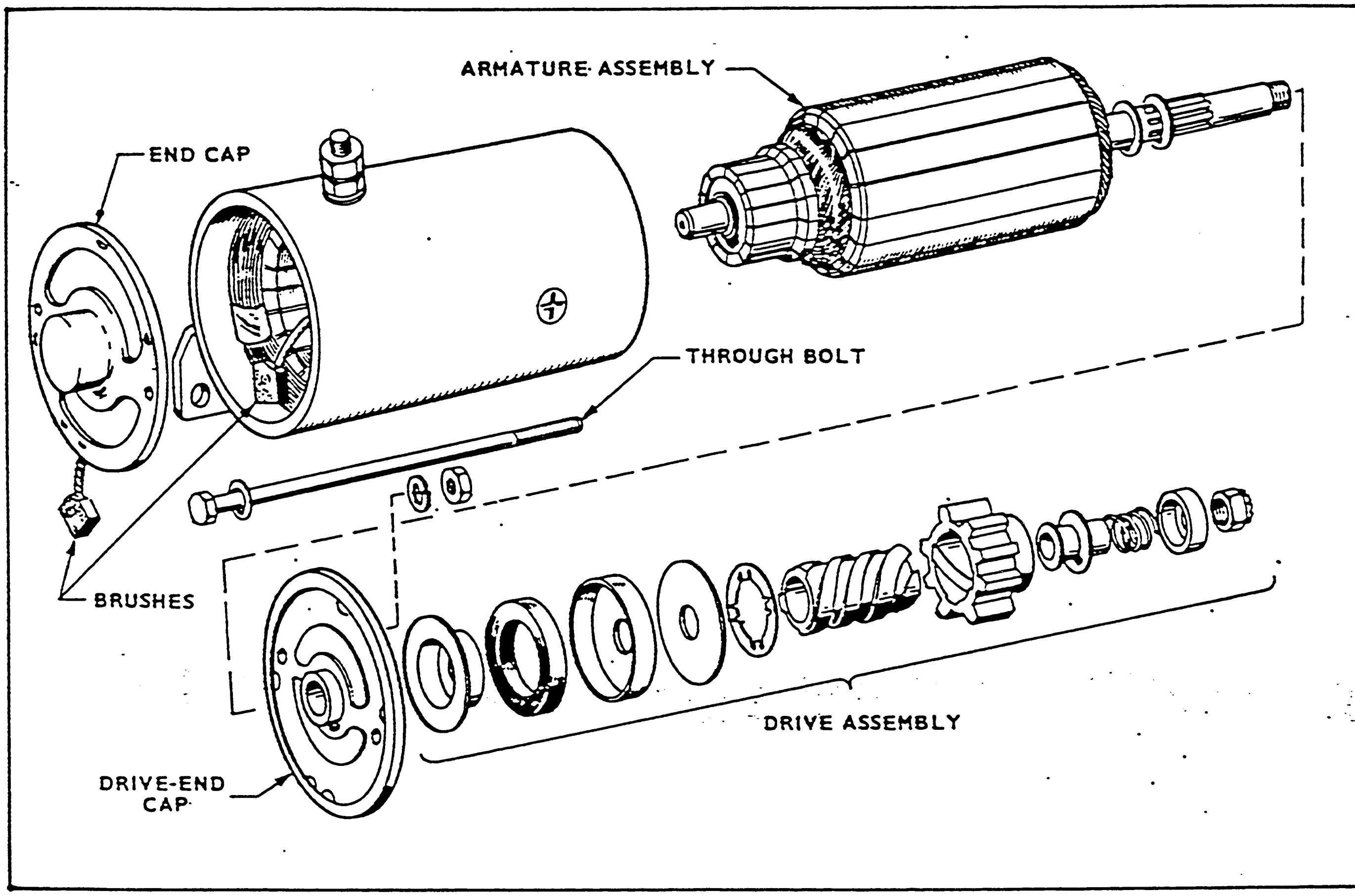


FIGURE 27. ELECTRIC STARTER ASSEMBLY

ELECTRIC STARTER

Over a period of time, depending upon operating conditions, the electric starter may require minor maintenance such as brush replacement. Complete overhaul may be needed if the starter has been damaged through misuse or accident. The following instructions detail disassembly, reassembly, repair, testing, and maintenance.

DISASSEMBLY

Figure 27 is the exploded view of the cranking motor. The disassembly is performed in the following sequence.

1. Remove the through-bolts.
2. The armature, drive and cap assembly and drive assembly are removed as a unit from the drive end. The end cap assembly may be taken off by removing the brushes from the brush holders.
3. If necessary, the drive assembly may be disassembled further by removing the self-locking nut.
4. Remove the terminal, if required.

CLEANING

1. Such parts as the field coil, armature, and brushes are wiped with a clean dry cloth. If compressed air is available this may be used.
2. Bearing equipped parts should not be soaked in a non-petroleum base solvent. These parts are soaked in mineral spirits and cleaned by brushing.
3. The rubber cushion should be cleaned in non-flammable solvent, but never in mineral spirits.
4. All parts that have been washed in solvent should be well dried before use.

REASSEMBLY

Reassembly is the reverse of disassembly. The following precautions should be taken.

1. Apply a film of medium engine oil to the bearing portions before reassembly. Also to the exterior and interior of the shaft screw a small quantity of a very light grade oil should be applied; medium or

heavy oil and grease may cause to the drive assembly to stick in cold weather.

2. Spline threads are provided up to the mid portion of the interior of screw sleeve and when assembling the drive assembly the spline thread portion should be on the armature aide.
3. After the drive assembly is assembled on the shaft the self locking nut is tightened by a torque of 170-220 in-lbs.
4. The armature should be adjusted by spacing washers to give end play of .005" - .015".
5. The thru-bolts are tightened by a torque of 35 - 44 in-lbs.

PERFORMANCE TEST

1. No load test:

The cranking motor is wired up as shown in Figure 28 and run. The values of meter readings should be as follows:

Battery Voltage	11.8 V
Minimum RPM	8,000
Maximum Current Draw	25 Amperes

If the above meter readings are obtained, operation is considered satisfactory.

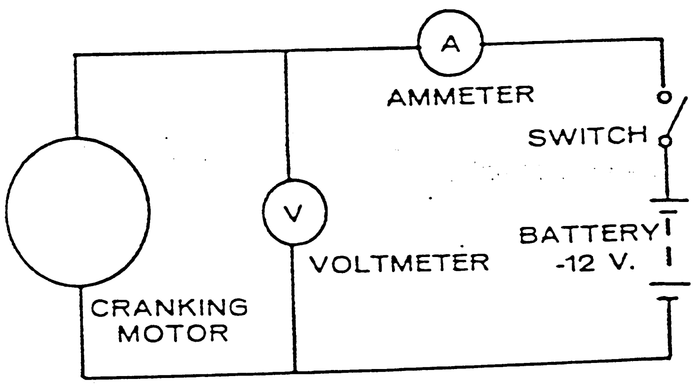


FIGURE 28. CRANKING MOTOR WINDINGS

NOTE: *The conductor for the testing should be at least #14AWG and as short as possible for no-load testing.*

2. Inspection of Drive Assembly:

The operation of the drive assembly is inspected by instantaneously applying rated voltage to the connection circuit in Figure 28.

3. If in either 1 or 2 above an abnormal condition is found, the following inspections are to be made:

Annealed brush springs
Improperly seated brushes
Insufficient armature end play
Shorted or open armature
Shorted or grounded armature
Shorted or grounded field
Poor electrical connection
Dirty commutator

INSPECTION

1. Inspection for Grounded Armature:

Grounds in the armature can be detected by the use of a test lamp and test points. If the lamp lights when one test point is placed on the commutator with other point on the core or shaft, the armature is grounded.

2. Inspection for Shorted Armature:

Short circuits in the armature are located by use of a growler. When the armature is revolved in the growler with a steel strip such as a hack-saw blade held above it, the blade will vibrate above the area of the armature core in which the short circuit is located.

3. Inspection for Open in the Armature:

The most likely place for an open to occur is at the commutator riser bars. Inspect the points where the conductors are joined to the commutator bars for loose connections.

4. Inspection for Open in the Field Coil:

Connect test lamp leads to ends of field coils. If lamp does not light, the field coils are open.

5. Inspection for Grounded Field Coil:

Connect one lead of the test lamp to the yoke and the other lead to the field connector. If the lamp lights, field coil is grounded.

6. Brush Inspection:

When brushes are worn more than 3/8 in. they are to be replaced. Figure 29 shows the limit for wear. See that the brushes move smoothly in the brush holder.

7. Inspection for Brush Spring Pressure:

If the pressure on the tension testing measures 17-25 ounces the pressure on the brush will be sufficient.

8. Drive Assembly Inspection:

Fully compress the drive spring and make certain that the gear assembly freely returns to its original position.

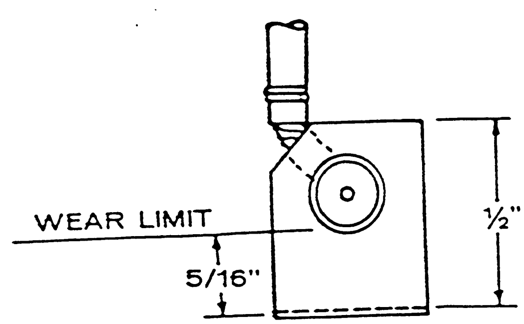


FIGURE 29. BRUSH INSPECTION FOR WEAR

Precautions To Be Taken After Service:

1. The shaft of the cranking motor and the central axis of the engine must be parallel and the mounting bolts should be tightened so that cranking motor does not shift when starting. When tightening is incomplete or any foreign material exists at the mating surface, damage such as cracking the housing may occur.
2. When cranking motor is used the following cranking time should be observed.
   a. Do not put the cranking motor in continuous operation for more than 20 seconds.
   b. Between 20 seconds of cranking time give 30 seconds of rest time between each cranking cycle.
   c. Do not repeat the above (a) step more than 5 times. If the engine does not start, there may be some other cause for non-start and this must be inspected.
3. If the engine does not crank do not leave the starter in a stall (locked rotor) condition longer than 10 seconds.
4. This cranking motor requires no oiling but when it is dismantled, lubrication should be done as instructed in Disassembly Section.
5. When brush length becomes shorter than 3/16″ it is no longer suited for use (see Figure 29). Always replace with genuine Onan parts.

READI-PULL STARTER (Optional)

Refer to Figure 30 showing the Readi-Pull manual starter disassembled.

WARNING *The recoil spring may unwind and cause injury if let fly wildly when starter is disassembled or reassembled.*

The sheave hub bearing (16) has a recess which was packed full of grease at the factory. Normally, no additional lubrication is required. However, if the starter is disassembled for some other reason, add grease to the bearing and to the spring pawls (11) where they contact the ratchet arm (13).

To install a new rope or internal parts, remove the starter from its mounting ring by removing the four clamping screws.

To install a new rope, rotate the sheave (10) with crankshaft rotation direction to fully tighten the spring (8), back up only as necessary to align the hole in the sheave with the slot in the cover (5), clamp the rope to the sheave, then when released, the rope will wind on the sheave.

To install a new recoil spring, remove the sheave from the cover. Wind the spring, with its rivet heads outward, forming a coil small enough to be inserted in the recess of the starter cover. It may be necessary to tie the spring with a piece of wire to prevent its unwinding during installation unless other help is available. Place the spring in the cover recess in crankshaft rotation direction. Remove the tying wire if used. While holding the spring to prevent its unwinding, install the inside end of the spring on the roll pin (7) in the cover. With the pull rope removed, install the sheave assembly in the cover so that the tab on the sheave enters the outside end loop of the recoil spring. Be sure the thrust washer (9) is in place. Then install the pull rope.

Spring breakage is much less common than spring fatigue due to long usage. In either case, the spring should be replaced. Cleaning and lubricating the pawls and ratchet arms in the rope sheave will improve a sluggish acting recoil. To temporarily extend the life of a fatigued spring, try rewinding it *inside out* (rivet heads inward).

To install a ratchet arm (13) in the sheave, the pawl

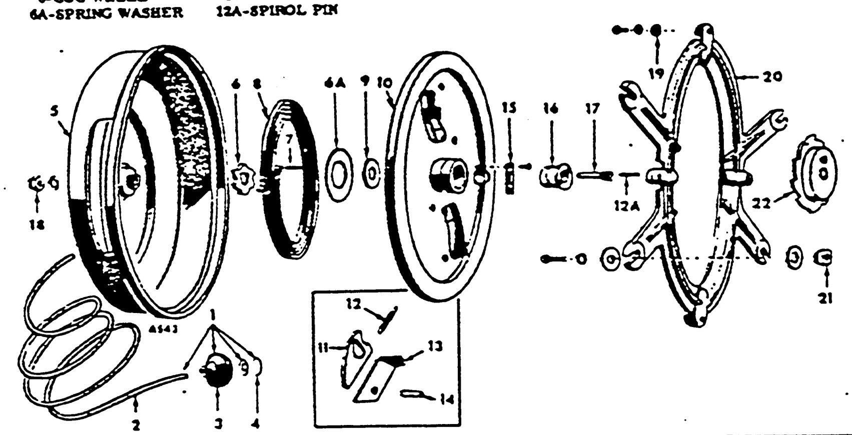


FIGURE 30. READI-PULL STARTER ASSEMBLY

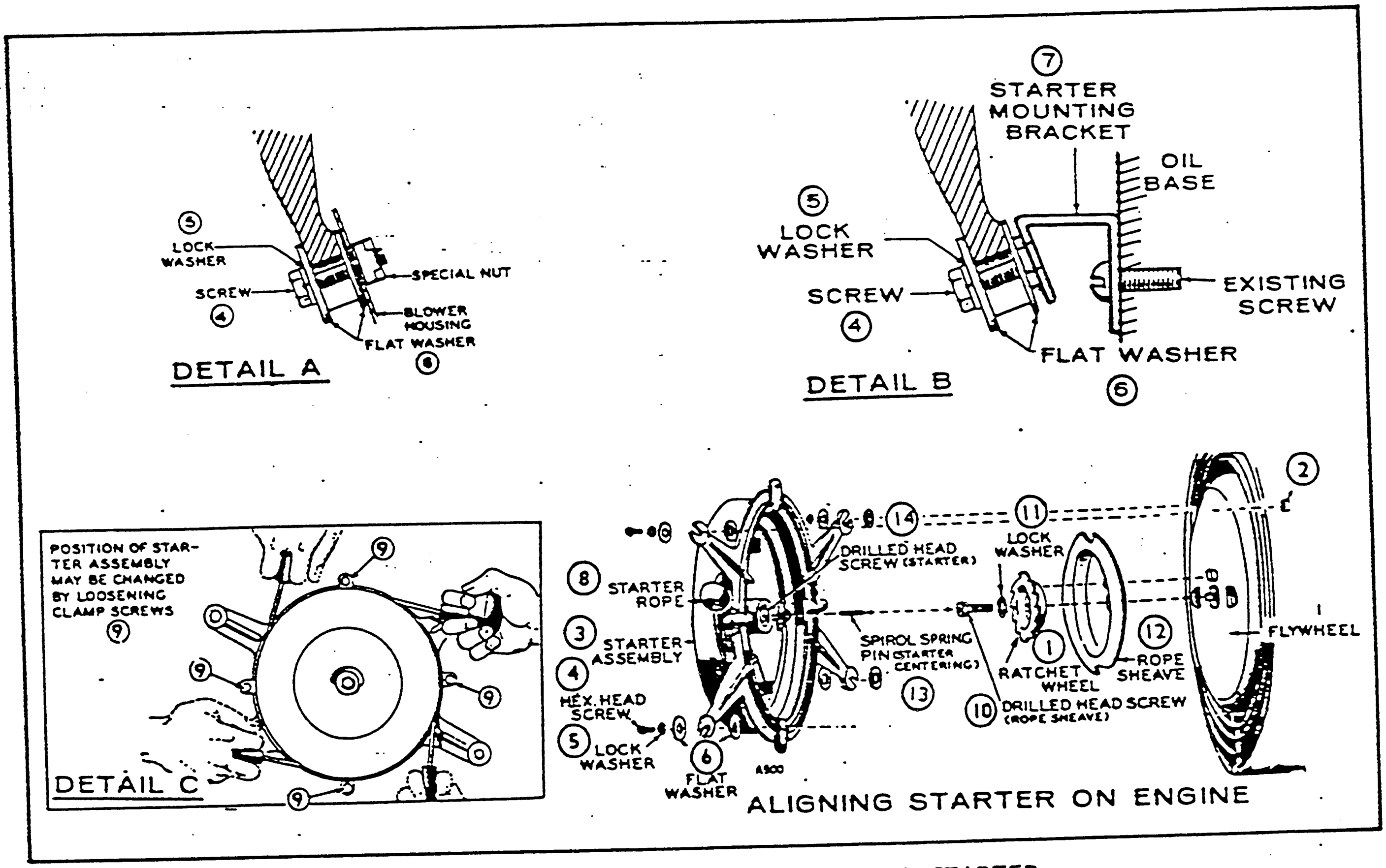


FIGURE 31. INSTALLATION OF READI-PULL STARTER

(11) must first be removed. The ratchet arm will fit in only the correct position. The spring pawl must be installed with its flat edge against the ratchet arm.

The anti-backlash cogwheel (6) is an easy press fit on the starter cover.

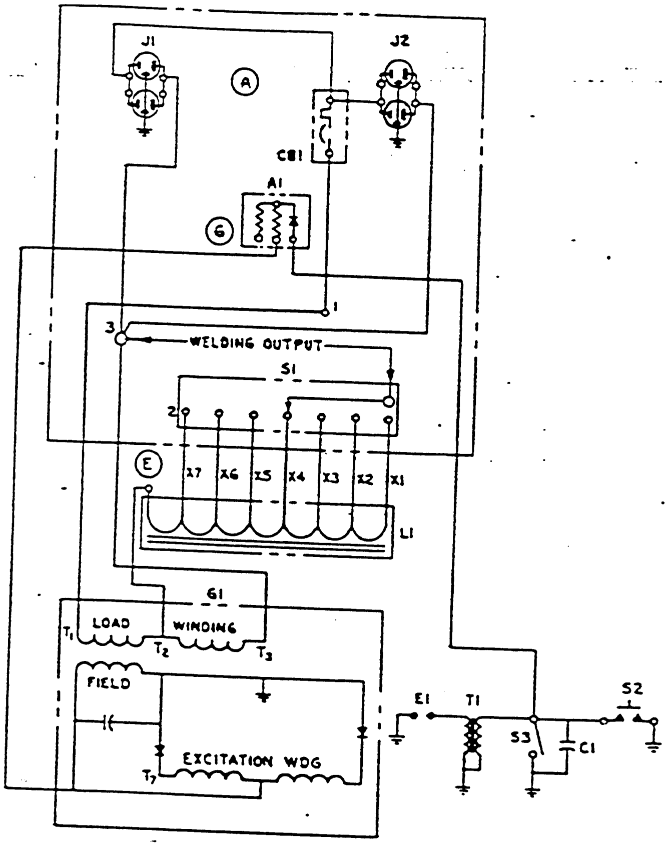
INSTALLING THE READI-PULL STARTER

See that the engine blower housing is in good condition. If the mounting holes are worn or if the blower housing is otherwise damaged, replace it with a new one. Refer to Figure 31.

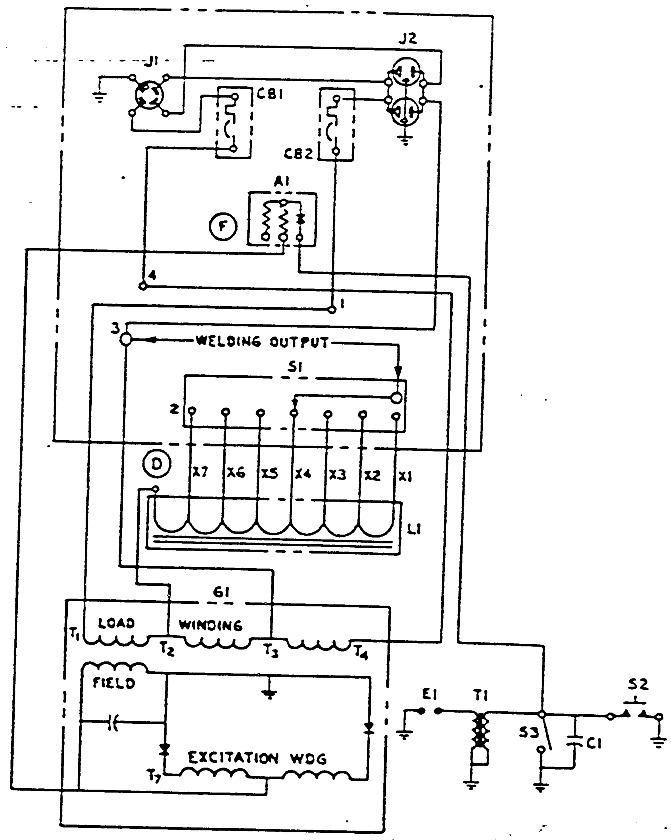
1. Install the new ratchet wheel (1) against rope sheave (12) using lock washer (11) and flywheel mounting screw (10). Discard the large flat washer from engines so equipped. Engage drive hole with flywheel boss.
2. Special nuts (2) are supplied for mounting the starter to the blower housing. If the blower housing is not already fitted with similar nuts, remove the blower housing and install the nuts as shown in detail A. Reinstall the blower housing, tightening securely in place.
3. Use the two bottom screws which hold the blower housing to the oil base to install the left- and right- hand starter mounting brackets (7 in detail B). Do not tighten at this time.
4. Install centering pin (13) in starter center screw (14) allowing 3/8" to protrude so it will engage with pilot hole in the flywheel mounting screw (10).
5. Center the starter assembly over the ratchet wheel with the centering pin (13) engaged. While holding in position, mount the starter using a hex head screw (4), lock washer (5) and two flat washers (6) at each mounting arm as shown in details. Note a thin flat washer is used under each arm and a thick washer outside the arm. Tighten the mounting screws securely.
6. Tighten the two lower screws on the blower housing removed earlier.
7. The direction of pull on the starter rope is adjustable to fit the individual installation. See detail C. To change the direction of pull, loosen the four clamp screws (9) and turn the starter in its mounting ring to the desired position. Tighten the four clamp screws securely. Try the starter several times, making sure that the pull rope will not rub against one of clamping screws.

WIRING DIAGRAMS

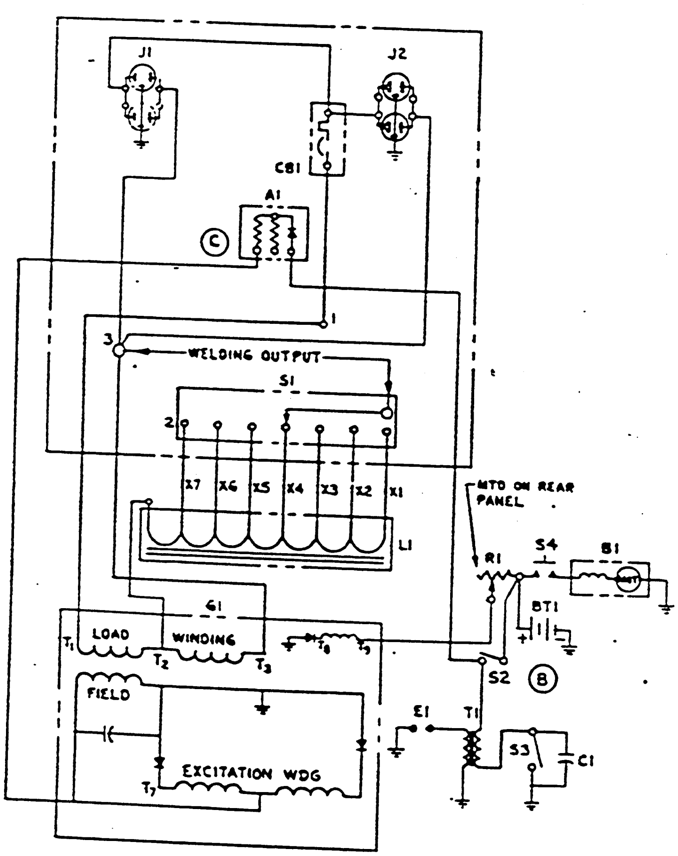
REAR VIEW OF CONTROL PANELS



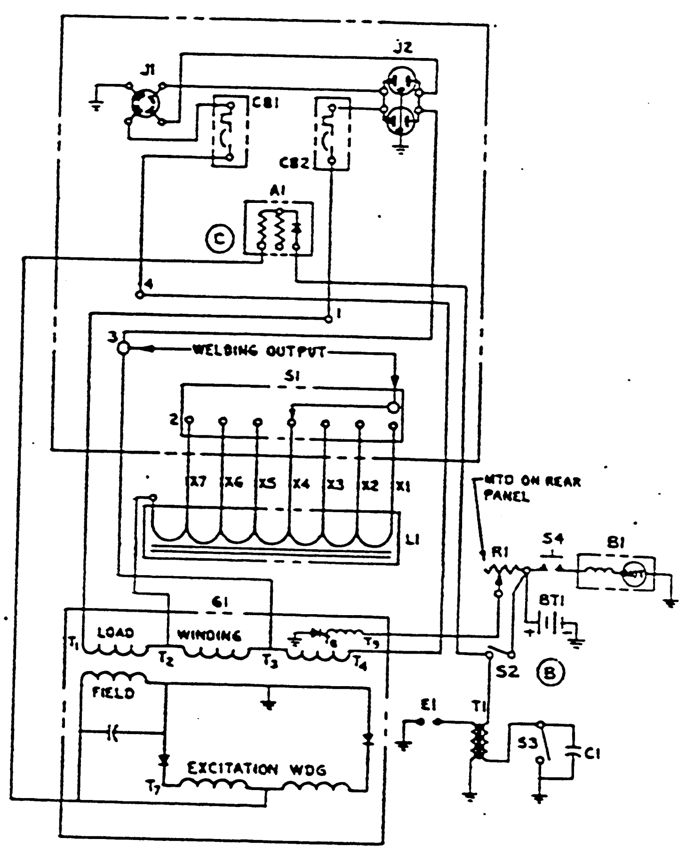
120 VOLT, MANUAL START



120/240 VOLT, MANUAL START



120 VOLT, ELECTRIC START



120/240 VOLT, ELECTRIC START

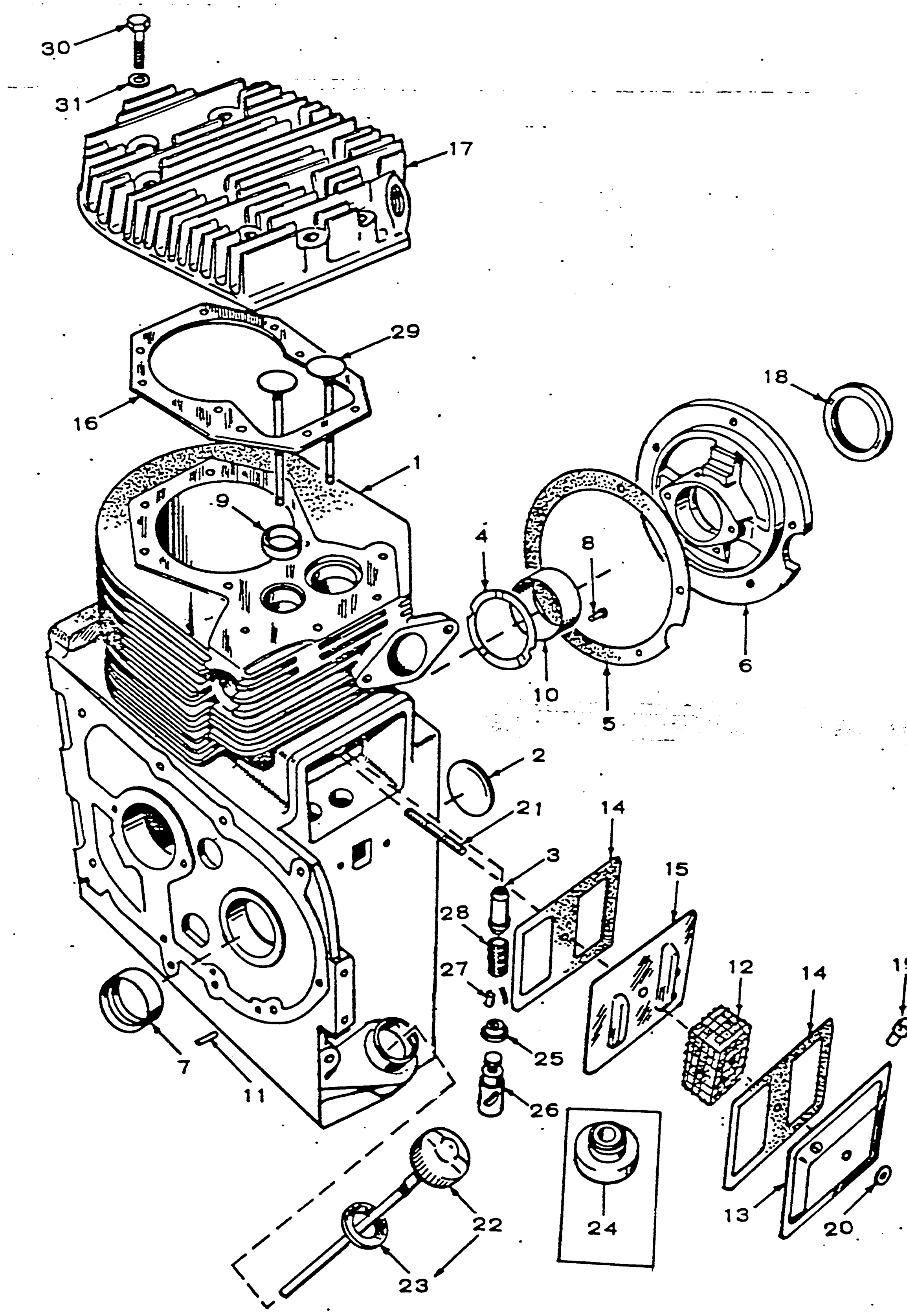
PARTS CATALOG

This catalog applies to the standard 180-ampere welder as listed in the Model Identification Table inside the front cover, also listed below. Each illustrated part is identified by a reference number corresponding to the same reference number below the illustration. Parts illustrations are typical. Using the MODEL or SPEC NO. from the plant nameplate, select the parts Key No. (1, 2, etc. in the last column) that applies to your plant Model and Spec No. This Parts Key No. represents parts that differ between models. Unless otherwise mentioned in the description, parts are interchangeable between models. Right and left plant sides are determined by FACING the engine end (front) of the plant.

PLANT DATA TABLE

SPEC or MODEL or SERIAL	ELECTRICAL DATA							TYPE OF STARTING	USE PARTS KEY NO.
	DC OUTPUT (For Welding)			AC OUTPUT, 1 Phase (Available continuously when not welding)					
	Amps	Volts	Duty Cycle	Watts	Volts	Cycles	Phase		
5.0NB-341P/1*	180	25	50%	5000	120	60	1	Manual	1
5.0NB-343P/1*	180	25	50%	5000	120/240	60	1	Manual	1
5.0NB-341E/1*	180	25	50%	5000	120	60	1	Electric	2
5.0NB-343E/1*	180	25	50%	5000	120/240	60	1	Electric	2

* - The Specification Letter which completes the specification on the nameplate (Example: 5.0NB-341P/1A) advances (A to B, B to C, etc.) with manufacturing changes.



CYLINDER BLOCK GROUP

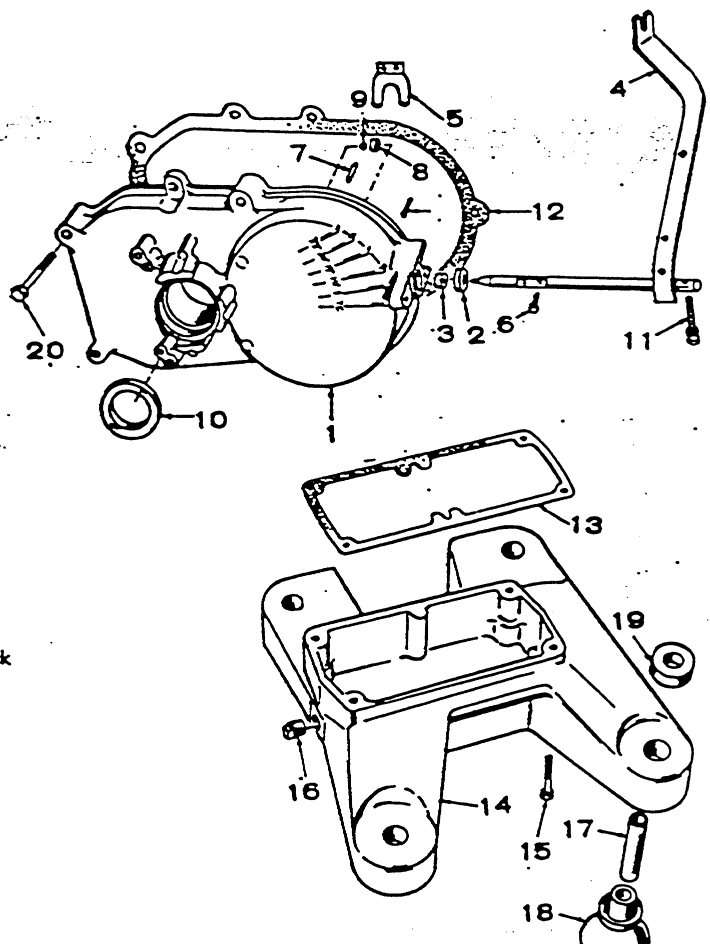
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	110A1823	1	Block Assy., Cylinder - Includes Parts Marked *
2	517-48	1	*Plug, Camshaft Expansion
3	GUIDE, VALVE		
	110A1759	1	*Intake
	110A1760	1	*Exhaust
4	104A575	2	*Washer, Crankshaft Bearing Thrust
5	101K419	1	*Gasket Kit, Bearing Plate
6	101D406	1	*Plate, Rear Bearing (Excludes Bearing)
7	101A367	2	*Bearing, Camshaft Front and Rear (Precision)
8	516A72	4	*Pin, Main Bearing Stop
9	110A1751	1	*Insert, Exhaust Valve Seat (Stellite) Specify: Std. or .002", .005", .010", .025" Oversize
10	101K389	2	*Bearing, Crankshaft - Front and Rear - Specify: Std. or .002", .010", .020", .030" Undersize
11	516A11	2	*Pin, Gear Cover Locating
12	123A996	1	Filter, Valve Compartment
13	110A1782	1	Cover, Valve Compartment
14	110A1791	2	Gasket, Valve Compartment
15	110A1783	1	Baffle, Valve Compartment
16	110A1731	1	Gasket, Cylinder Head
17	110D1733	1	Head, Cylinder
18	509A41	1	Seal, Bearing Plate
19	123A486	1	Valve, Breather
20	526-63	1	Washer (Copper) Valve Compartment Cover
21	520A634	1	Stud, Valve Box Cover
22	123A1130	1	Cap and Indicator Oil Fill
23	123A191	1	Gasket, Oil Fill Cap
24	110A904	1	Rotocap, Valve Exhaust
25	110A893	1	Washer, Valve Spring Retainer - Intake
26	115A6	2	Tappet, Valve - Specify: Std. or .005" Oversize
27	110A639	4	Lock, Valve and Springs Retainer
28	110A539	2	Spring, Valve
29	VALVE		
	110B1718	1	Intake
	110B1719	1	Exhaust (Stellite)
30	SCREW, HEX HEAD CAP		
	102A455	4	Cylinder Head (3/8-16 x 1-1/4")
	800-515	5	Cylinder Head (3/8-16 x 1-3/4")
	800-516	2	Cylinder Head (3/8-16 x 2")
	800-517	5	Bearing Plate (5/16-18 x 7/8")
31	526A174	10	Washer, Flat - Cylinder Head

* - Parts Contained in Cylinder Block Assy.

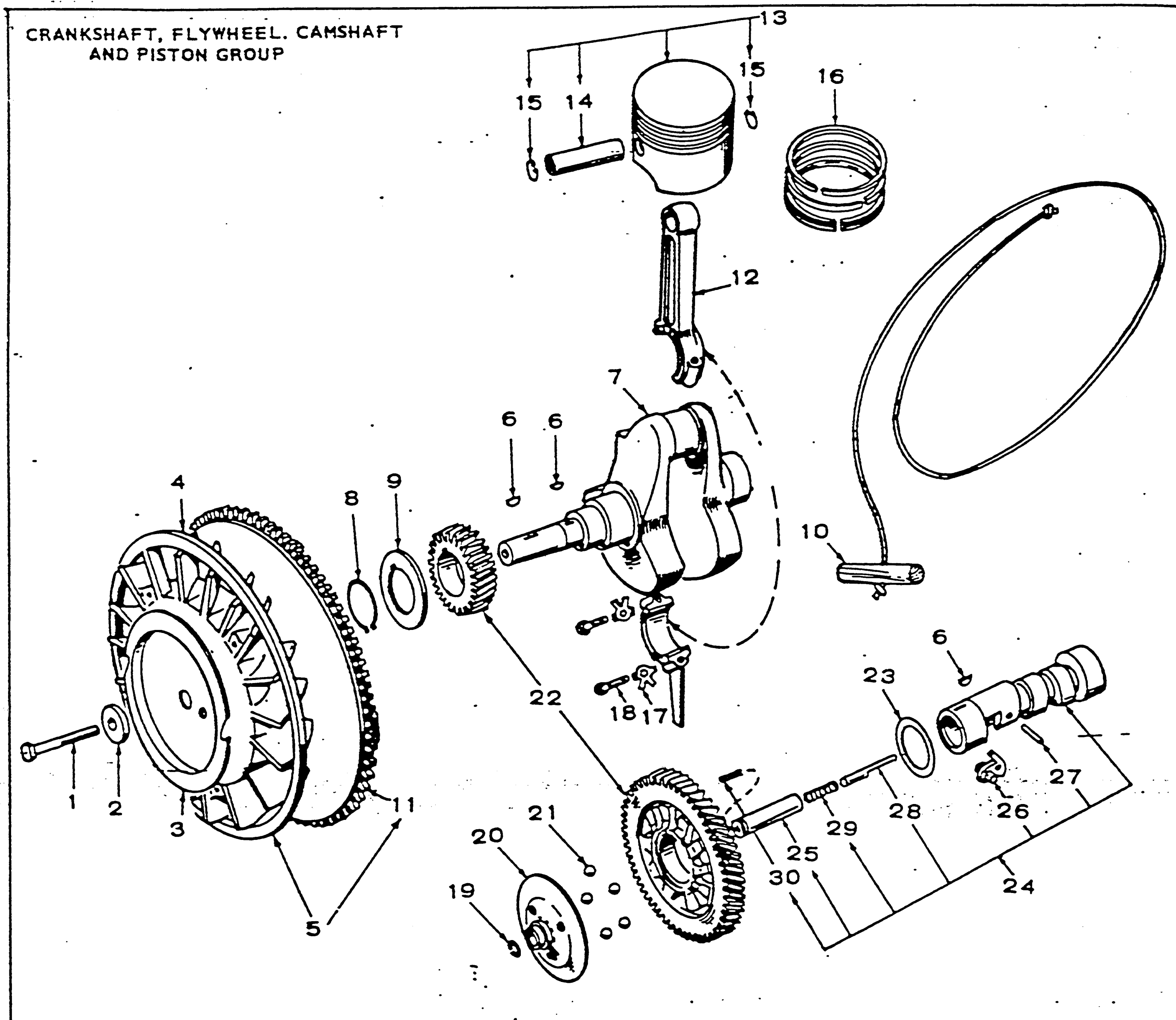
GEAR COVER AND OIL BASE GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	103B328	1	Cover Assy., Gear - Includes Parts Marked *
2	509P8	1	*Seal, Oil - Governor Shaft
3	510P13	1	*Bearing, Governor Shaft (Upper)
4	150B1258	1	*Shaft and Arm, Governor
5	150B1187	1	*Yoke, Governor Shaft
6	822-46	2	*Screw, Yoke Retaining
7	516-130	1	*Pin, Governor Cup Stop (In Gear Cover)
8	510A8	1	*Bearing, Governor Shaft (Lower)
9	510P14	1	*Ball, Bearing - Governor Shaft
10	509A40	1	*Seal, Gear Cover
11	150A136	1	*Stud, Governor Sensitivity
12	103B11	1	Gasket, Gear Cover
13	102B107	1	Gasket, Oil Base Mounting
14	102D625	1	Base, Oil
15	800-56	4	Screw, Cap - Oil Base to Block
16	505-110	1	Plug, Oil Drain
17	402A290	4	Bushing, Mounting Cushions
18	402A283	4	Cushion, Mounting
19	402A282	4	Snubber, Cushion
20	SCREW, GEARCASE MOUNTING		
	114A22	4	5/16-18 x 1-3/4"
	800-34	1	5/16-18 x 2-1/4"

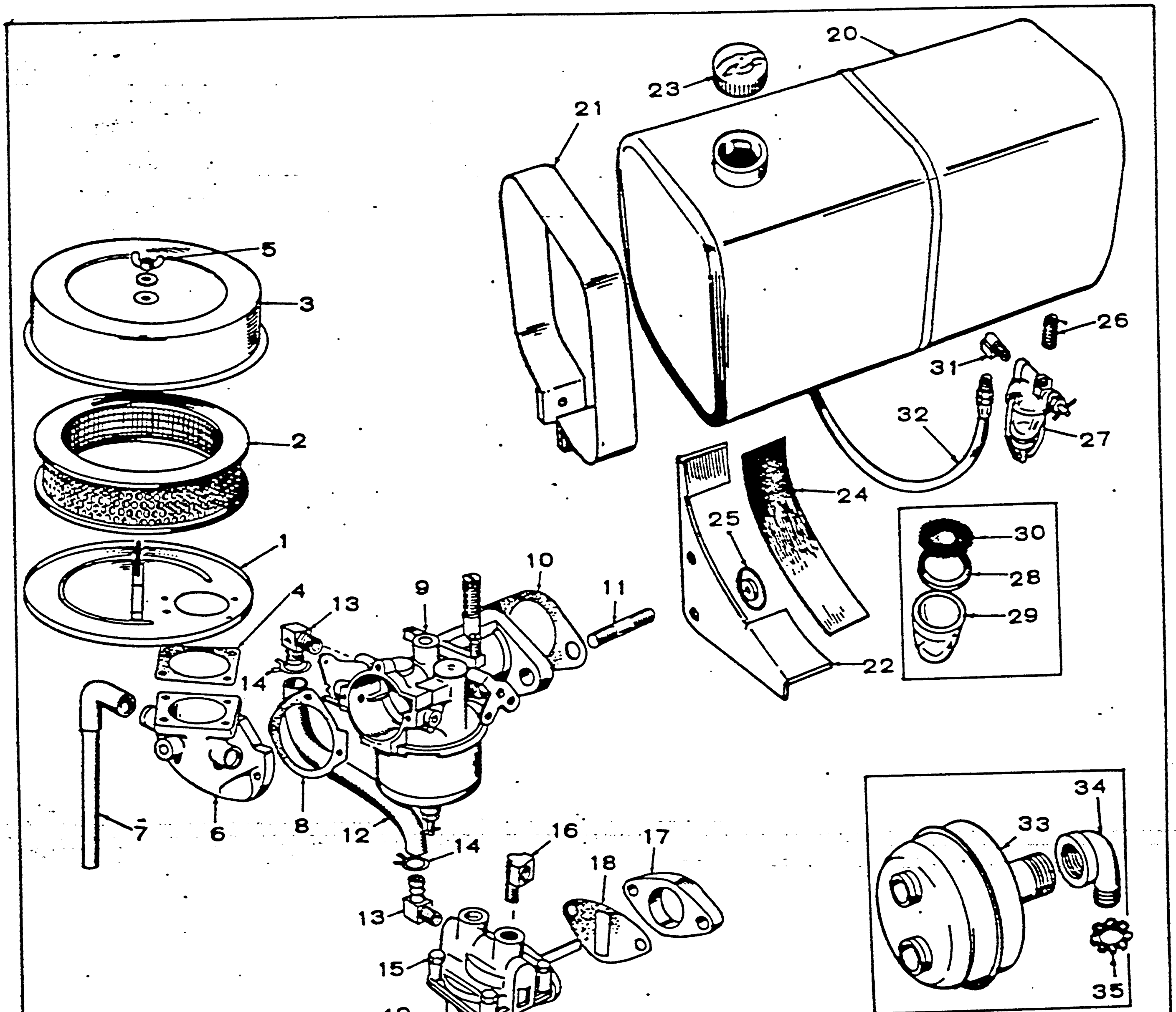
* - Parts Contained in 103B328 Gear Cover Assembly.



CRANKSHAFT, FLYWHEEL. CAMSHAFT AND PISTON GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	104A170	1	Screw, Flywheel Mounting
2	526A17	1	Washer, Wheel Mounting
3	192B308	1	Sheave, Starter Rope
4	160E1080	1	Flywheel, Key 1
5	134A1892	1	Flywheel, Key 2 (Includes Ring Gear)
6	KEY, WOODRUFF		
	515-2	1	Flywheel Mounting
	515-1	1	Crankshaft Gear Mounting
	515-1	1	Camshaft Gear Mounting
7	104D703	1	Crankshaft
8	518-14	1	Lock, Crankshaft Gear Washer
9	104A43	1	Washer, Crankshaft Gear Retaining
10	192A83	1	Rope, Manual Starting
11	134C673	1	Gear, Ring - Key 2
12	114C204	1	Rod, Connecting (Includes Bolts) - Specify: Std. or .010", .020", .030" Undersize
13	112-111	1	Piston and Pin (Includes Retaining Rings) Specify: Std. or .010", .020", .030", .040" Oversize
14	112A112	1	Pin, Piston - Specify Std. or .002" Oversize
15	518A294	2	Ring, Piston Pin Retaining
16	113A142	1	Ring Set, Piston - Specify: Std. or .010", .020", .030", .040" Oversize
17	114A59	2	Lock, Connecting Rod Screw
18	114A171	2	Screw, Hex - Connecting Rod Cap
19	150A78	1	Ring, Camshaft Center Pin
20	150B1116	1	Cup, Governor
21	510-15	5	Ball, Fly - Governor
22	105A353	1	Gear Set, Timing (Includes 1 ea. Crankshaft and Camshaft Gears)
23	105A4	1	Washer, Camshaft Gear Thrust
24	105C338	1	Camshaft (Includes Center Pin and Compression Release)
25	150A1196	1	Pin, Center - Camshaft
26	105D289	1	Weight, Compression Release
27	516-181	1	Pin, Compression Release Weight
28	105A293	1	Rod, Compression Release
29	105A292	1	Spring, Compression Release
30	803-11	1	Screw, Socket - Compression Release



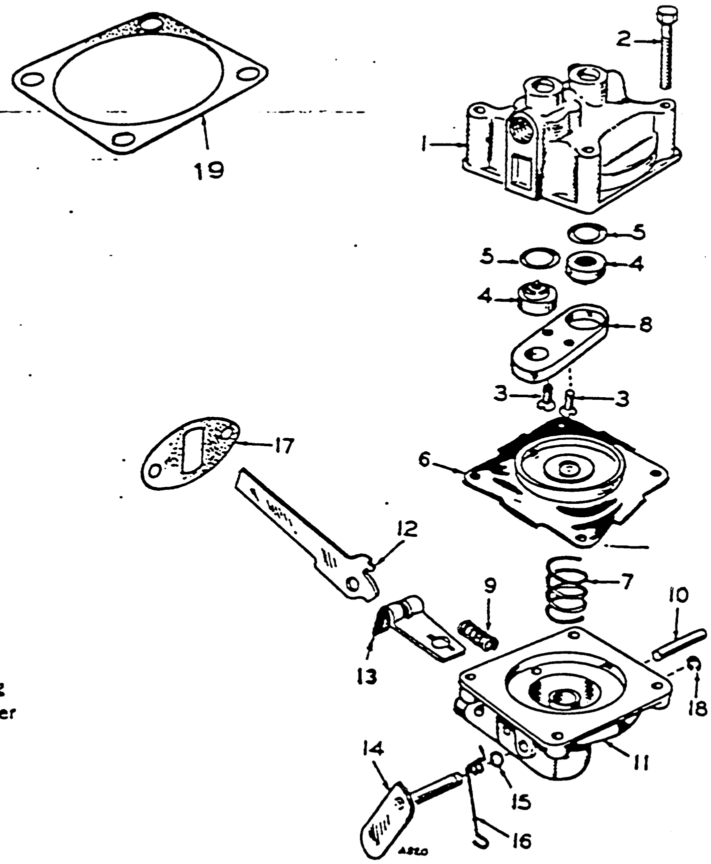
FUEL SYSTEM GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	140A1048	1	Base, Air Cleaner
2	140P1055	1	Element, Air Cleaner
3	140C1053	1	Cover, Air Cleaner
4	140A921	1	Gasket, Air Cleaner
5	865P22	1	Nut, Wing - Air Cleaner
6	140A1063	1	Adapter, Air Cleaner
7	503A516	1	Hose, Breather
8	140A1069	1	Gasket, Adapter to Carburetor
9	141D772	1	Carburetor, Gasoline (NOTE: See separate Group for Components)
10	154A733	1	Gasket, Carburetor Mounting
11	520A526	2	Stud, Carburetor Mounting
12	503A588	1	Line Fuel Pump to Carburetor
13	502-313	2	Elbow, (1) Carburetor Inlet (1) Fuel Pump Outlet
14	503P301	2	Clamp, Fuel Line
15	149D1213	1	Pump, Fuel
16	502-20	1	Elbow, Fuel Pump Inlet
17	149A45	1	Spacer, Fuel Pump Mounting
18	149A3	2	Gasket, Fuel Pump Mounting
19	526-63	2	Washer (Copper) Fuel Pump Mounting
20	159C948	1	Tank, Fuel Mounted
21	159A892	2	Strap, Mounted Fuel Tank
22	159C954	1	Bracket, Mounted Fuel Tank
23	159A7	1	Cap, Mounted Fuel Tank
24	159A893	2	Insulation, Fuel Tank Mounting
25	159A955	8	Spacer, Fuel Tank Mounting
26	502-46	1	Nipple, Fuel Filter to Tank
27	149B79	1	Filter Fuel
28	149-149	1	Gasket, Filter Bowl
29	149-150	1	Bowl, Fuel Filter
30	149-202	1	Screen, Fuel Filter
31	502-2	1	Elbow, Fuel Filter Outlet
32	501A7	1	Line, Flex-Fuel Filter to Pump
33	155B1018	1	Muffler, Exhaust
34	505-3	1	Elbow, Exhaust (1" x 90°)
35	331-53	1	Locknut, Exhaust Elbow

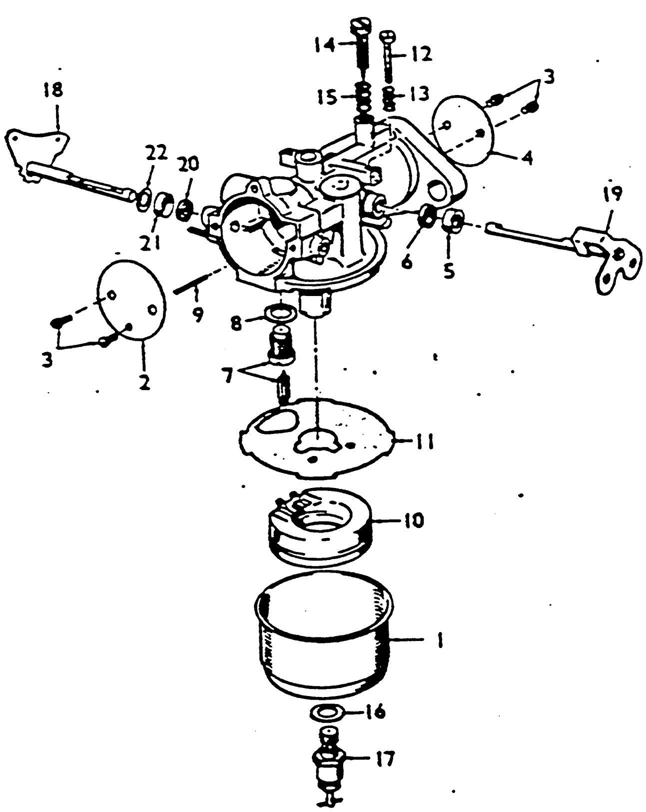
FUEL PUMP PARTS GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	149D1213	1	Pump, Fuel
	149K526	1	Kit, Fuel Pump Repair - Includes Parts Marked •
1		1	Body, Upper (Not Sold Separately)
2	815-148	4	Screw, H. H. (#3-32 x 7/8")
3	815-147	2	Screw, Phillips Flat Head (#6-32 x 5/8")
4	149-96	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		1	Body, Lower (Not Sold Separately)
12	149B1148	1	Arm, Rocker
13	149A670	1	Link, Rocker
14	149A1042	1	Lever, Hand Primer
15	509-65	2	Seal "O" Ring
16	149A1044	1	Spring, Priming Lever
17	149A3	1	•Gasket, Fuel Pump Mounting
18	518-129	1	Ring, Retainer - Primer Lever
19	149A858	1	Gasket, Diaphragm

• - Parts Contained in 149K526 Fuel Pump Repair Kit.



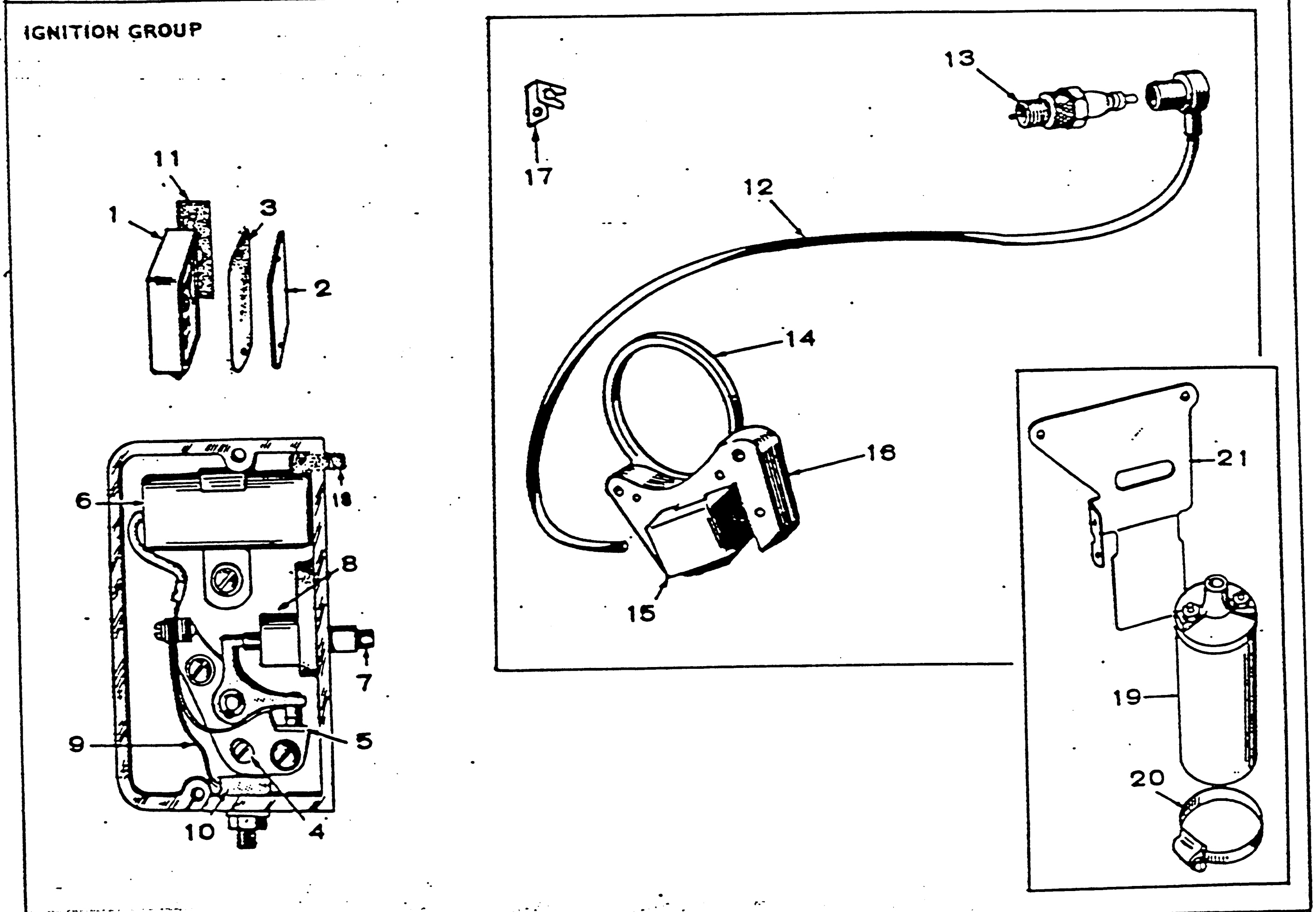
CARBURETOR PARTS GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	141D772	1	Carburetor, Gasoline
	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	141P771	1	Plate, Choke
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
8	141P696	1	•£Washer, Fuel Valve Seat
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	141P709	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.

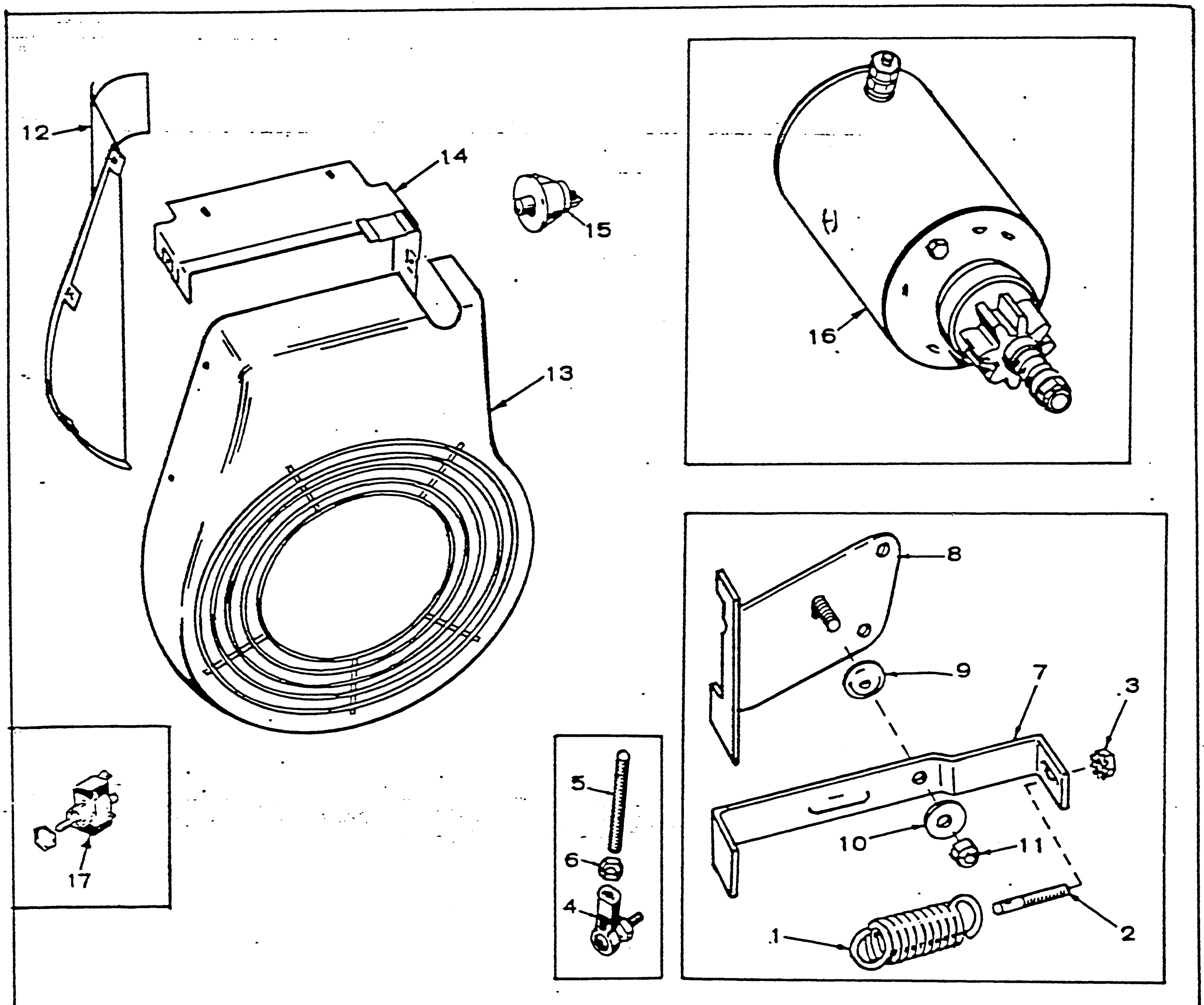
IGNITION GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	160A257	1	Box Assembly, Breaker - Includes Parts Marked *
2	160A930	1	*Cover, Breaker Box
3	160A150	1	*Gasket, Breaker Box Cover
4	160A75	1	*Cam, Point Gap Adjusting
5	160A2	1	*Point Set, Breaker
6	312A69	1	*Condenser
7	160A262	1	*Plunger Assembly, Includes Diaphragm and Guide
8	160A263	1	*Diaphragm Only, Breaker Plunger
9	160A428	1	*Strap, Point Set to Terminal Block
10	160A349	1	*Block and Screw Assembly, Terminal

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
11	160A43	1	Gasket, Breaker Box Mounting
12	CABLE, SPARK PLUG		
	167A1547	1	Key 1
	167A1524	1	Key 2
13	167-28	1	Plug, Spark
14	160B1120	1	Backplate Assembly, Magneto - Includes Parts Marked £ - Key 1
15	160B1002	1	£Coil, Magneto Stator - Key 1
16	160B1119	1	£Pole Shoe, Magneto Stator - Key 1
17	167A188	1	Clip, Spark Plug Cable - Key 1
18	160A261	1	Wick, Breaker Box
19	166B278	1	Coil, Ignition - Key 2
20	503P514	1	Clamp, Coil - Key 2
21	166C537	1	Bracket, Coil Mounting - Key 2

* Parts Contained in 160A257 Breaker Box Assembly.
£ Parts Contained in 160B1120 Backplate Assembly.

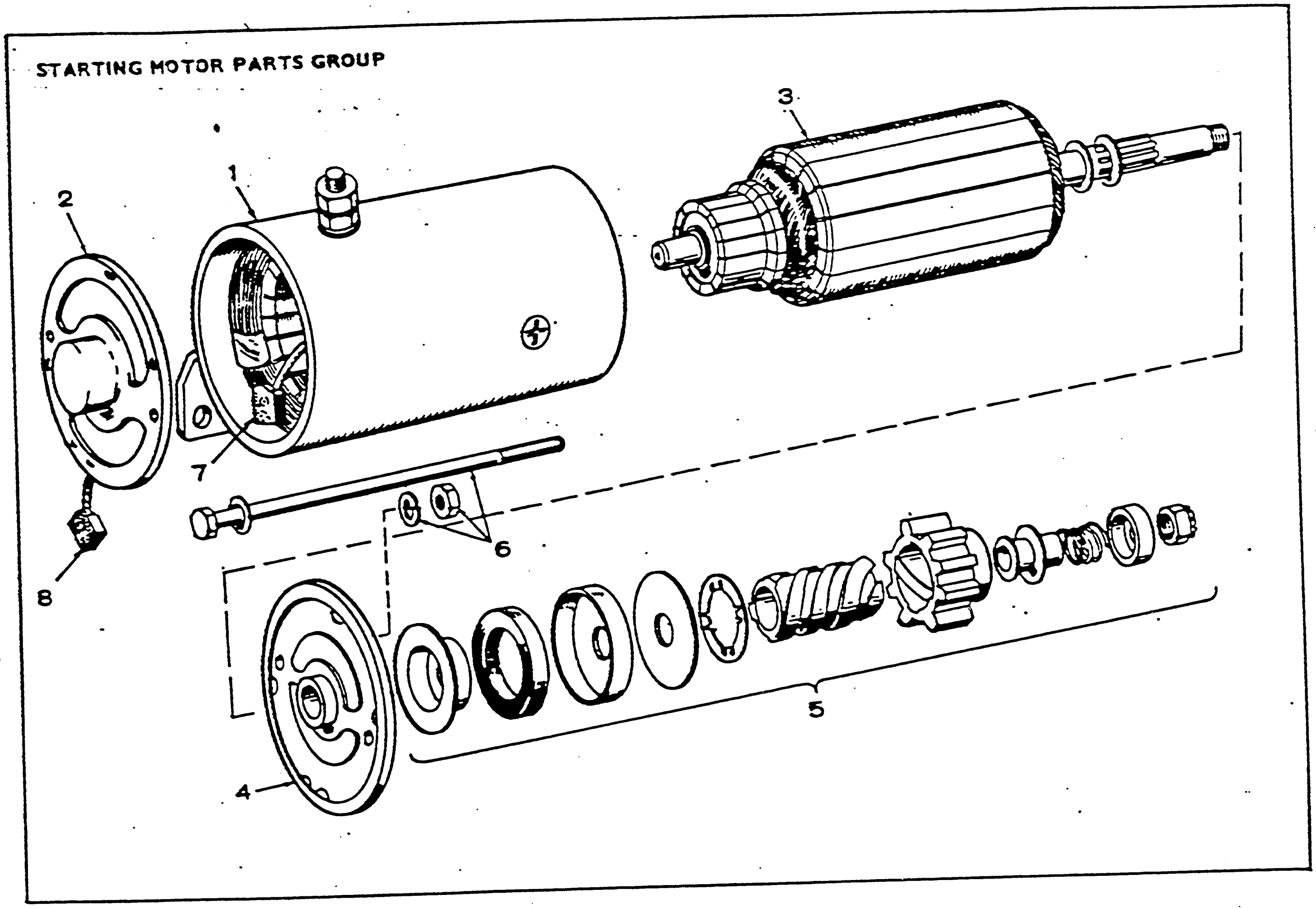


THROTTLE CONTROL, STARTER MOTOR AND HOUSING GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	150A98	1	Spring, Governor
2	150A96	1	Stud, Speed Adjusting
3	870-131	3	Nut, Locking
4	150A1081	2	Joint, Ball
5	150A883	1	Link, Throttle
6	870P188	2	Palnut, Locking
7	150B1238	1	Lever, Throttle Control
8	150B1239	1	Bracket, Throttle Control Lever
9	152A41	1	Washer, Tension

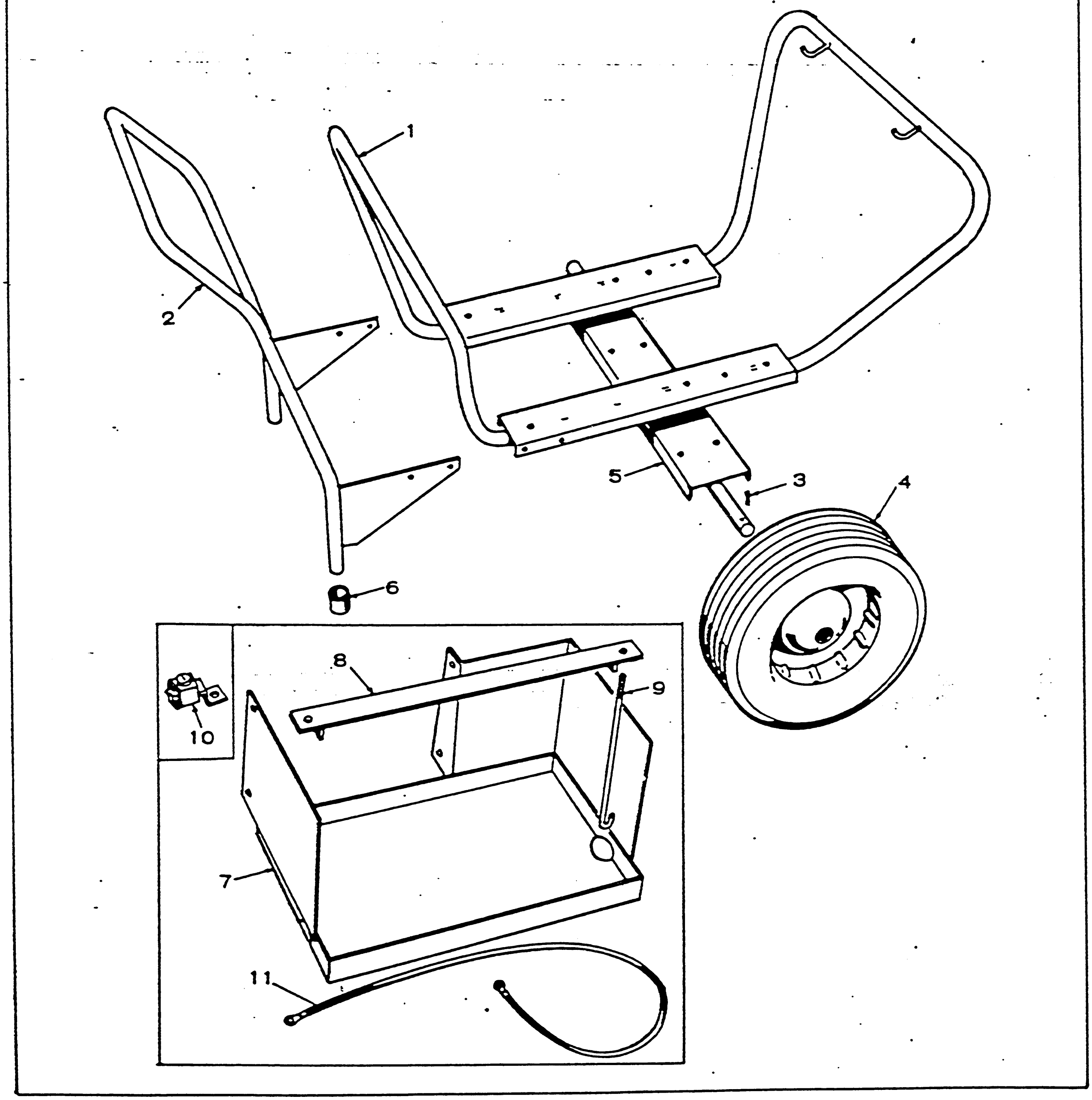
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
10	526-15	1	Washer, Flat
11	870-65	1	Nut, Huglock
12	HOUSING, CYLINDER AIR		
	134C2059	1	Key 1
	134C2058	1	Key 2
13	134C1956	1	Housing, Blower
14	134C2055	1	Cover, Cylinder Air
15	313-18	1	Switch, Stop-Key 1
16	191D767	1	*Motor, Starting-Key 2
17	308-69	1	Switch, Stop-Key 2

* For breakdown, see "STARTING MOTOR PARTS GROUP"



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	191C767	1	Motor, Starting
1	191-804	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	191-805	1	Drive Assembly, Complete
6	191-799	2	Bolt Assembly - Through
7	191-800	1	Brush, Positive
8	191-801	1	Brush, Negative

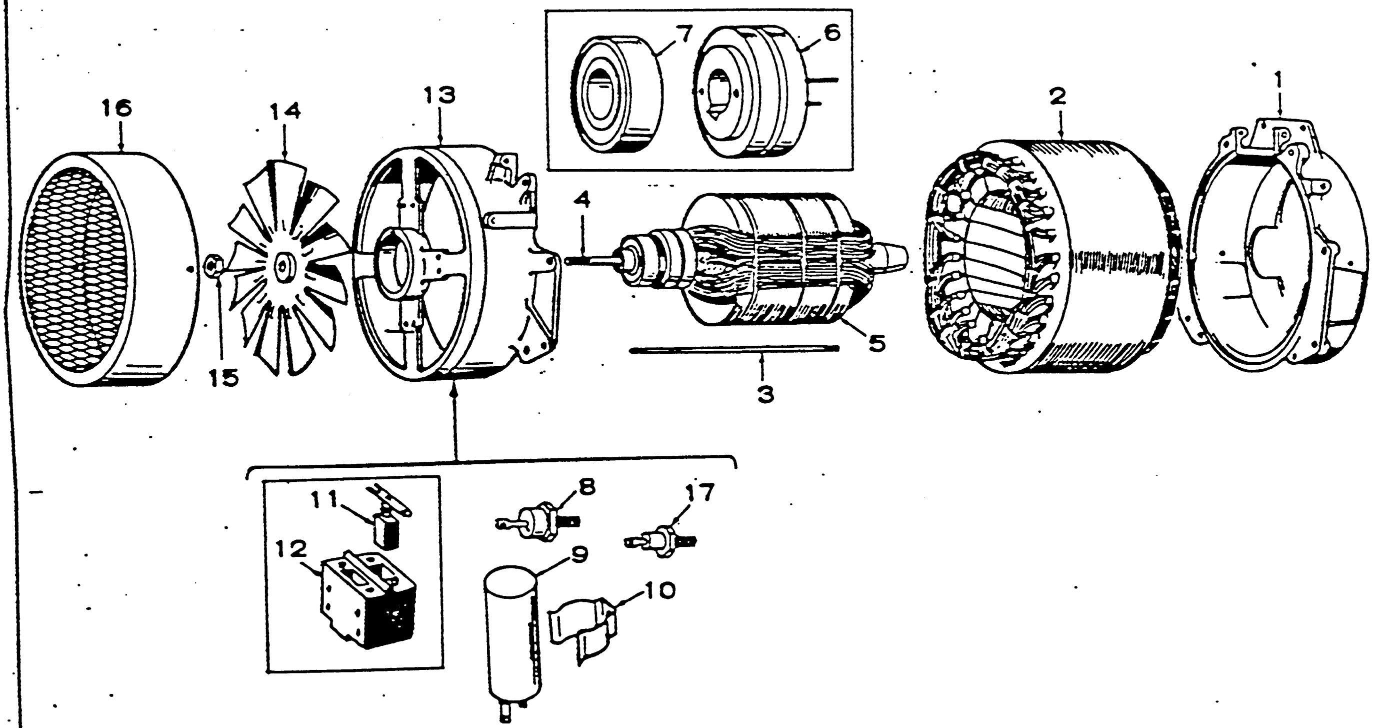
CARRYING FRAME, DOLLY, AND BATTERY GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	410K311	1	Dolly Kit, Includes Parts Marked * Plus Hardware - Optional Equipment
1	403C876	1	Frame, Carrying
2	410B307	1	*Handle, Dolly - Optional Equipment
3	516-42	2	*Pin, Cotter - Optional Equipment
4	410P223	2	*Wheel and Tire - Optional Equipment.
5	410B308	1	*Axle Assy. - Optional Equipment
6	403P588	2	*Tip, Dolly Handle - Optional Equipment

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
7	416D609	1	Rack, Battery - Key 2
8	416A453	1	Strap, Battery Hold-down - Key 2
9	416A454	2	Stud, Battery Hold-down - Key 2
10	332-142	1	Terminal Ground
11	LEAD, BATTERY TO CONTROL - Key 2		
	336A1907	1	10 1/2" (Negative)
	336A1905	1	24" (Positive)

* - Parts Contained in 410K311 Dolly Kit.

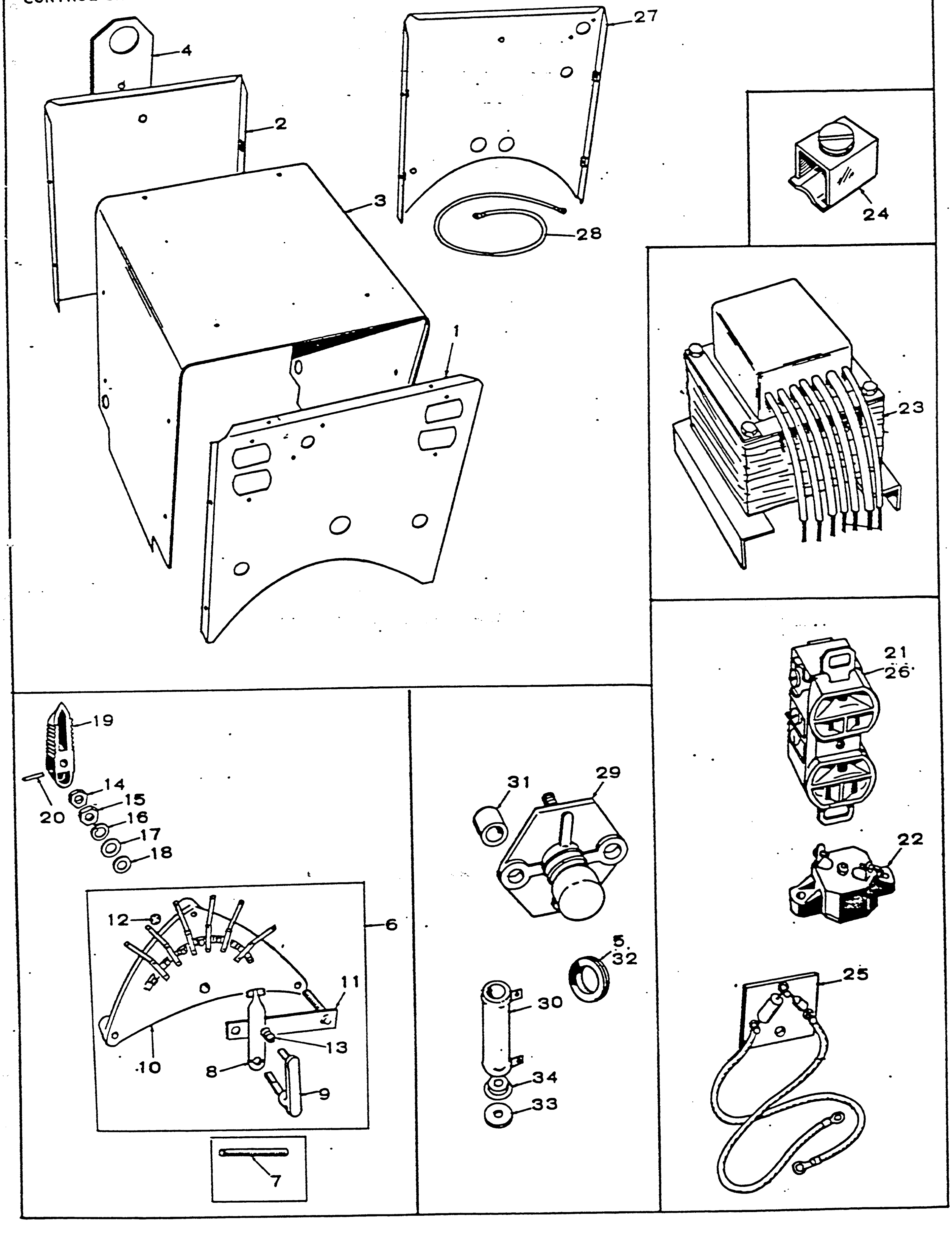


GENERATOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	231D143	1	Adapter, Generator to Engine
2	STATOR, WOUND		
	220D1340	1	Key 1 with 120/240 Volt AC
	220D1433	1	Key 1 with 120 Volt AC
	220D1500	1	Key 2 with 120 Volt AC
	220D1501	1	Key 2 with 120/240 Volt AC
3	520A706	4	Stud, Generator Through
4	520A705	1	Stud, Rotor Through
5	201D1625	1	Rotor, Wound
6	204A61	1	Ring, Collector
7	510A47	1	Bearing, Rotor (Double Sealed and Pre-lubricated)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
8	358C15	2	Rectifier
9	356B35	2	Capacitor
10	518P271	2	Clip, Capacitor Mounting
11	214A59	2	Brush, Generator
12	212A1064	1	Holder, Brush
13	211D182	1	Bell, End
14	205C83	1	Blower, Generator
15	870P203	1	Nut, Rotor Through Stud
16	234C305	1	Cover, End Bell
17	305A235	1	Rectifier, Key 2
	334-26	1	Wire, #16 (10 ft.)

CONTROL GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	PANEL, CONTROL BOX - FRONT		
	301C3075	1	For Units with 120 Volt AC
	301C3117	1	For Units with 120/240 Volt AC
2	301C3074	1	Panel, Control Box - Rear
3	301C3076	1	Wrapper, Control Box
4	403B875	1	Bracket, Lifting
5	508-27	1	Grommet, for 7/16" Hole
6	308C268	1	Switch, Rotary Tap - Includes Parts Marked •
7	308A283	1	Stud, Ground
8	308A265	1	•Blade, Rotary Top Switch
9	308B261	1	•Arm, Rotary Tap Switch
10	308C287	1	•Plate, Rotary Tap Switch
11	308A267	1	•Jumper, Rotary Tap Switch
12	518P283	1	•Ring, Grip - Rotary Tap Switch
13	308A271	1	•Spring, Rotary Tap Switch
14	871-28	2	Nut, Hex. Brass - Jam (3/8-16)
15	871-29	4	Nut, Hex Brass - Full (3/8-16)
16	850-50	2	Washer, Lock (3/8")
17	526-59	4	Washer, Flat - Brass
18	508A150	2	Washer, Insulating
19	303B165	1	Knob, Rotary Tap Switch
20	516P178	1	Pin, Rotary Tap Switch Knob
21	RECEPTACLE, DUPLEX		
	323P707	1	For Units with 120/240 Volt AC
	323P184	2	For Units with 120 Volt AC
22	BREAKER, CIRCUIT		
	320P361	1	40 Ampere
	320P360	1	25 Ampere - For Units with 120/240 Volt AC
23	315D328	1	Reactor Assembly
24	332P1319	6	Connector, Wire
25	332A1208	1	Circuit Board Assy.
26	323P91	1	Receptacle, Twistlock - For Units with 120/240 Volt AC
27	301C3232	1	Panel, Control Box (Rear) - Key 2
28	LEAD, REAR CONTROL BOX PANEL - Key 2		
	336A1904	1	8"
	336A1905	1	24"
29	313A32	1	Switch, Push - Key 2
30	304A168	1	Resistor, 1.5-Ohm - 25 Watt - Key 2
31	301A2404	2	Spacer, Switch Mounting - Key 2
32	GROMMET, REAR CONTROL BOX PANEL - Key 2		
	508P95	1	For 17/32" Hole
	508-8	1	For 13/16" Hole
33	304-292	1	Washer, Insulating - Resistor - Key 2
34	304A14	2	Washer, Centering - Resistor - Key 2

• - Parts Contained in 308C268 Rotary Tap Switch Assembly.

SERVICE KITS AND MISCELLANEOUS

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

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	98C2028	1	Decal Kit
	168K110	1	Gasket Kit, Complete Eng.
	522K251	1	Kit, Overhaul