

INSTRUCTION MANUAL AND PARTS CATALOG

FOR

Forney

**ARC WELDER
200 AMP., DC WELDER
AND
AC POWER PLANT**



MODEL

**F200P-35M
F200P-35E**

SPECIFICATION

**6.0CCK-331P/
6.0CCK-332E/**



Forney WELDING EQUIPMENT & SUPPLIES, LTD.
BOX 1040 / 120 EAST 5th AVE., REGINA, SASK. S4P 3B2

REFER TO FIRST PAGE OF PARTS SECTION FOR MODEL IDENTIFICATION.

NOTE: REFER TO 927-1092 SUPPLEMENTARY PARTS LIST FOR "CSA" QUALIFIED UNITS, MODIFICATION 38.

INSTRUCTIONS FOR ORDERING REPAIR PARTS

FOR PARTS OR SERVICE, CONTACT THE DEALER FROM WHOM YOU PURCHASED THIS EQUIPMENT OR REFER TO YOUR NEAREST AUTHORIZED SERVICE STATION.

TO AVOID ERRORS OR DELAY IN FILLING YOUR PARTS ORDER, PLEASE FURNISH ALL INFORMATION REQUESTED.

Onan
ELECTRIC PLANT
MODEL AND SPEC. NO. _____

SERIAL NO. _____

IMPORTANT ALWAYS GIVE ABOVE NOS WHEN ORDERING PARTS

DC WELDER RATING
200 AMPS @ 28 VOLTS
WELDING SERVICE RANGE
50-200 AMPS, 2700 RPM
50% DUTY CYCLE @ 200 AMPS
100% DUTY CYCLE @ 140 AMPS

AC RATING
_____ VOLTS, SINGLE PHASE
3.5 KW @ 100% DUTY CYCLE
60 CYCLE @ 1800 RPM
USE _____ VOLT BATTERY

MANUFACTURED BY
ONAN

MINNEAPOLIS, MINNESOTA, U.S.A.
FOR ELEC EQUIPMENT ONLY
99A954

REFER TO THE UNIT NAMEPLATE

1. Always give the complete:

MODEL AND SPECIFICATION NO.
SERIAL NO.

2. State definite shipping instructions.
3. Give the part number, description and quantity of each item. Do not order by reference number or group number. If an old part cannot be identified, return the part prepaid to your dealer or nearest AUTHORIZED SERVICE STATION. Print your name and address stating the reason for returning the part.

Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicates items are back ordered.

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

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

En esta lista de partes los precios se omiten de proposito, ya que bastante confusion resultado de fluctuaciones de los precios, derechos aduanales, impuestos de venta, cambios extranjeros etc.

Consiga los precios vigentes de su distribuidor de productos "ONAN".

200 AMP. WELDER CCK SERIES

927-1030

3FL74

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KEEP THIS MANUAL HANDY SO THAT IT CAN BE READILY REFERRED TO WHEN ORDERING PARTS, MAKING ADJUSTMENTS, ETC.

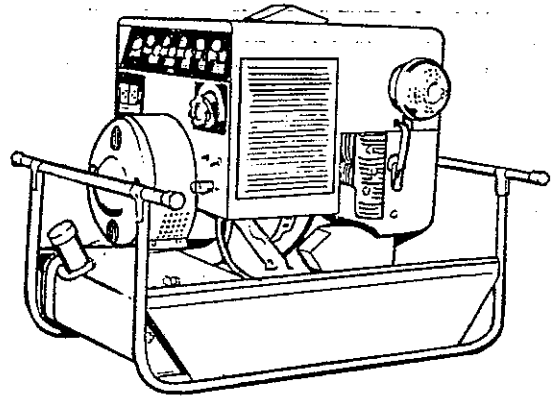
IMPORTANT...RETURN WARRANTY CARD ATTACHED TO UNIT

INTRODUCTION

The CCK series welder is a complete engine-driven arc welding machine. It consists of a gas or gasoline engine directly connected to an electric generator and mounted to a sturdy carrying frame.

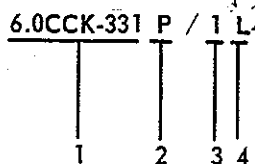
The welder is rated 200 amperes, 30 volts direct current at 50% duty cycle. Auxiliary alternating current is available: AC output is 120 or 240 volts and is rated 3500 watts, 60 hertz; or 2500 watts, 50 hertz, single-phase, 100% duty cycle. AC output is available at any time the welding current is not being used through a simple lever control. This AC output is convenient for emergency lighting, running power tools, etc., when working at locations away from AC power line sources. Models are available in either voltage with electric or manual starting.

When instructions in this manual refer to a specific model of welder, identify the model by referring to the complete Model and Specification Number as shown on the unit nameplate.



TYPICAL 200 AMPERE WELDER

How to interpret MODEL and SPEC NO.



1. Factory code for general identification.
2. Specific Type:
P - PORTABLE. Pull rope starting.
E - ELECTRIC. Electric starting at welder.
3. Factory code for optional equipment.
4. Specification (Spec) letter advances when factory makes production modifications.

WARNING This symbol is used throughout this manual to warn of possible personal injury.

CAUTION This symbol refers to possible unit damage.



MANUFACTURER'S WARRANTY

Onan 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 Onan's instructions.

Onan will, under this warranty, repair or replace, as Onan may elect, any part which on examination shall disclose to Onan's satisfaction to have been defective in material and workmanship; provided that such part shall be returned to Onan's factory or one of its Authorized Service Stations, transportation charges prepaid, not later than one (1) year after the product is first placed in service. Such defective part will be repaired or replaced free of charge, including labor (in accordance with rates approved by Onan) during the stated one (1) year coverage under this warranty.

THIS WARRANTY AND ONAN'S OBLIGATION THEREUNDER IS IN LIEU OF ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL OTHER OBLIGATIONS OR LIABILITIES, INCLUDING LIABILITY FOR INCIDENTAL AND CONSEQUENTIAL DAMAGE.

No person is authorized to give any other warranty or to assume any other liability on Onan's behalf unless made or assumed in writing by an Officer of Onan, and no person is authorized to give any warranty or to assume any liabilities on the Seller's behalf unless made or assumed in writing by such Seller.

ONAN 1400 72RD AVENUE N.E. • MINNEAPOLIS, MINNESOTA 55432
A DIVISION OF ONAN CORPORATION

SAFETY PRECAUTIONS

ALWAYS EMPLOY PRECAUTIONARY MEASURES DURING ARC WELDING OPERATIONS TO ENSURE MAXIMUM PERSONAL SAFETY AND THE SAFETY OF NEARBY PERSONNEL.

- **Operate And Maintain The Machine And Its Equipment Properly.**

Do not overload the cables. Do not use worn or poorly connected cables. Do not allow the welding cables to contact hot metal, water, oil or grease. Prevent cables from becoming a stumbling hazard by keeping them in order and out of the way.

Use electrode holders that are completely insulated. Do not use holders with defective jaws.

Do not use the welder without grounding the frame or the case. Do not ground to pipelines carrying gases of flammable liquids. Be sure the conductors can safely carry the grounding current.

Keep all connections clean and tight.

Do not use an electric welder on an engine unless both the engine's battery cables and alternator wires are disconnected.

- **Take Precautions Against Electric Shock.**

NEVER work in a damp area without suitable insulation against shock.

NEVER stand in water or on a wet floor or use wet gloves when welding.

ALWAYS dry out the work pieces or bench if there is any evidence of moisture.

OPEN power circuits before inspecting machines.

ALWAYS turn off the machine when leaving the work.

- **Do Not Weld Near Inflammable Materials.**

NEVER weld in or near EXPLOSIVE ATMOSPHERES.

Clean any container that has held combustible or flammable materials by approved or prescribed methods. A very small amount of residual gas or

liquid can cause a serious explosion. When the contents of the container is unknown, use an explosimeter.

Use carbon dioxide or nitrogen to ventilate a container. NEVER USE OXYGEN.

When the container has held a gas or liquid that readily dissolves in water, perform the following:

1. Flush the container several times with water and a wetting agent (e.g., a low powered detergent). Then, fill with as much water as the work permits.
2. Provide a vent or opening in the container to allow the release of air pressure.

When the container has held a gas or liquid that does not readily dissolve in water, proceed as follows:

1. Clean the container with steam or a cleaning agent and purge all air with a gas such as carbon dioxide or nitrogen.
2. Use steam to clean out light material.
3. To clean out heavy grease or oil, use a strong caustic soda solution.
4. Before welding on the container, PURGE ALL AIR with a gas such as carbon dioxide or nitrogen.

Wear goggles and gloves when cleaning with steam or caustic soda.

Always clean the container in a well ventilated area, away from any open flame.

When scraping or hammering heavy sludge or scale, use a WET, spark resistant tool.

Always keep head and arms as far away from the work as possible.

- **Never Weld On Hollow (Cored) Castings That Have Not Been Properly Vented.**

- **Never Pick Up Hot Metal With Bare Hands.**

- **Do Not Weld In Confined Areas Without Adequate Ventilation.**

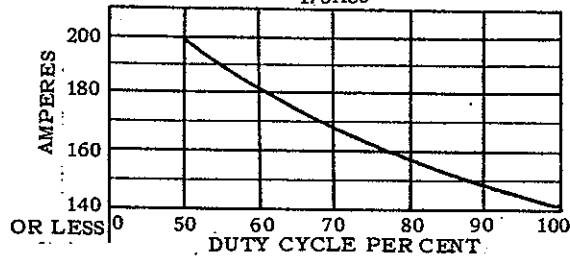
SPECIFICATIONS

Nominal Dimensions (inches)

| | |
|---------------------------------------|------------|
| Height | 26-1/2 |
| Width | 29 |
| Length | 36 |
| Number of Cylinders | 2 |
| Displacement (cubic inches) | 50 |
| Cylinder Bore | 3-1/4 |
| Piston Stroke | 3 |
| Horsepower (at 1800 rpm) | 10.2 |
| Compression Ratio | 5.5:1 |
| Oil Capacity | 4 quarts |
| Fuel Capacity | 7-1/3 gal. |

DUTY CYCLE CHART

178A36



Duty cycle equals one 10 minute period.

When interpreting the Duty Cycle Chart, note that at 200 amperes rated load, actual welding time must not exceed 50% of each 10 minute operating period. As the welding load is reduced, the welder can run for longer periods because less no-load operating time is required for the machine to cool. Continuous welding is permissible at 140 amperes or less. Extreme ambient temperatures must also be taken into consideration.

- **Never Wear Frayed, Flammable Or Otherwise Inadequate Clothing When Welding. Keep Clothing Dry.**

Avoid wearing light colored or open shirts that allow arc rays to penetrate and expose parts of the body to ultra-violet rays. Do not wear flammable cotton fabrics when arc welding. Wear heavy shoes, tightly laced.

To prevent severe burns from splatter and molten metal, wear leather or asbestoes gloves at all times protecting the hands and wrists. When welding in vertical and overhead positions, wear ear shields under helmet and leather sleevelets, apron, and leggings.

- **Use Eye Protection At All Times.**

ALWAYS wear safety goggles under the welding helmet. Keep the helmet, hand shields, and face shield in good condition. Replace defective equipment.

All arc welding produces intense ultra-violet and infra-red radiation. When welding in open areas, provide portable non-reflecting screens to protect nearby personnel from arc rays.

DIMENSIONS AND CLEARANCES

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

| | MINIMUM | MAXIMUM |
|---|---------|----------------|
| Tappet to Cylinder Block | 0.0015 | 0.003 |
| Valve Stem in Guide – Intake | 0.001 | 0.0025 |
| Valve Stem in Guide – Exhaust | 0.0025 | 0.004 |
| Valve Tappet Clearance, Intake | 0.006 | 0.008 |
| Valve Tappet Clearance, Exhaust | 0.015 | 0.017 |
| Valve Seat Face Width | 1/32 | 3/64 |
| Valve Face Angle | | 44° |
| Valve Seat Angle | | 45° |
| Valve Interference Angle | | 1° |
| Crankshaft Main Bearing Clearance | | |
| Aluminum Alloy, Flanged - Prior to Spec H | 0.0025 | 0.0038 |
| Bronze-Faced, Begin Spec H | 0.0025 | 0.0038 |
| Crankshaft End Play | 0.006 | 0.012 |
| Camshaft Bearing | 0.0015 | 0.003 |
| Camshaft End Play | 0.003 | |
| Rod Bearing (Aluminum Rod) | 0.002 | 0.0033 |
| Rod Bearing (Forged Rod) | 0.0005 | 0.0023 |
| Connecting Rod End Play | 0.002 | 0.016 |
| Timing Gear Backlash | 0.002 | 0.003 |
| Oil Pump Gear Backlash | 0.002 | 0.005 |
| Piston to Cylinder, (measured below oil control ring - 90° from pin) Clearance | 0.0015 | 0.0035 |
| Piston Pin in Piston | | Thumb Push Fit |
| Piston Pin in Rod | 0.0002 | 0.0007 |
| Piston Ring Gap in Cylinder | 0.010 | 0.023 |
| Breaker Point Gap (Full Separation) | | 0.020 |
| Spark Plug Gap – For Gaseous Fuel | | 0.018 |
| Spark Plug Gap – For Gasoline Fuel | | 0.025 |
| Crankshaft Main Bearing Journal – Standard Size | 1.9992 | 2.000 |
| Crankshaft Rod Bearing Journal – Standard Size | 1.6252 | 1.6260 |
| Cylinder Bore – Standard Size | 3.249 | 3.250 |

ASSEMBLY TORQUES

Assembly torques as given here require the use of a torque wrench. These assembly torques will assure proper tightness without danger of stripping the threads.

| BOLT TORQUES | LB.-FT. |
|---|---------|
| Cylinder Head Cap Screws | 29-31 |
| Rear Bearing Plate Nuts | 20-25 |
| Connecting Rod Screw - Aluminum Rod | 24-26 |
| Connecting Rod Bolt - Forged Steel Rod | 27-29 |
| Flywheel Cap Screw | 35-40 |
| Armature Through Stud and Nut | 35-40 |
| Other 5/16" Cylinder Block Studs and Nuts | 10-12 |

INSTALLATION

GENERAL

Proper installation increases welder life, decreases operating costs, and reduces the frequency of necessary repairs. Plan installations carefully to ensure best welder performance.

An optional two-wheeled dolly is available for units that must be moved frequently. See Figure 1.

VENTILATION

Welders generate considerable heat during operation. When the welder is to operate in any small enclosure, provide separate, unobstructed air inlet and outlet openings (minimum area of 3-1/2 square feet each). Locate the inlet opening as close to the front of the engine as possible and provide an outlet opening toward the generator end somewhat higher than the inlet opening.

EXHAUST

When mounting an extension exhaust pipe to the engine, use a piece of flexible tubing between the extension and the engine. Fit the muffler to the outer end of the exhaust pipe.

WARNING EXHAUST GASES ARE POISONOUS!

Never operate the welder inside a building or confined area without piping exhaust gases outside the enclosure.

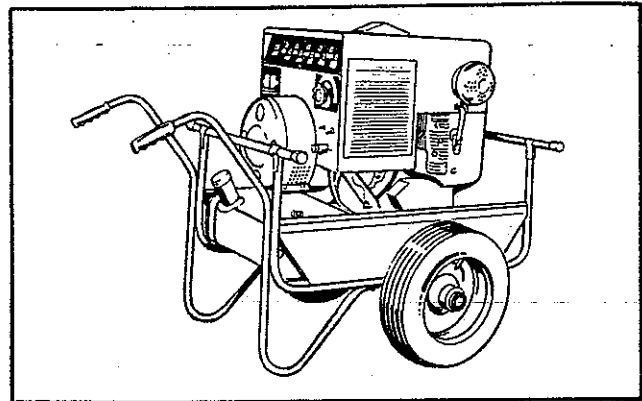


FIGURE 1. TWO WHEEL DOLLY

MOBILE MOUNTING

When the welder is mobile mounted, extra vehicle floor support may be necessary to prevent the welder mounting bolts from disengaging because of rough roads, turning sharp corners, etc. Use pipe clamps or U-bolts to secure the welder frame to the floor. For servicing convenience (especially when draining the oil), elevate the welder above the vehicle floor. Maximum operation angle of the unit is 15° sideways, 30° front-to-rear.

OIL DRAIN EXTENSION

An extension pipe and coupling on the engine oil base serves as an aid when draining the oil. Electric start models have an additional 45° elbow used for battery clearance. See Figure 2.

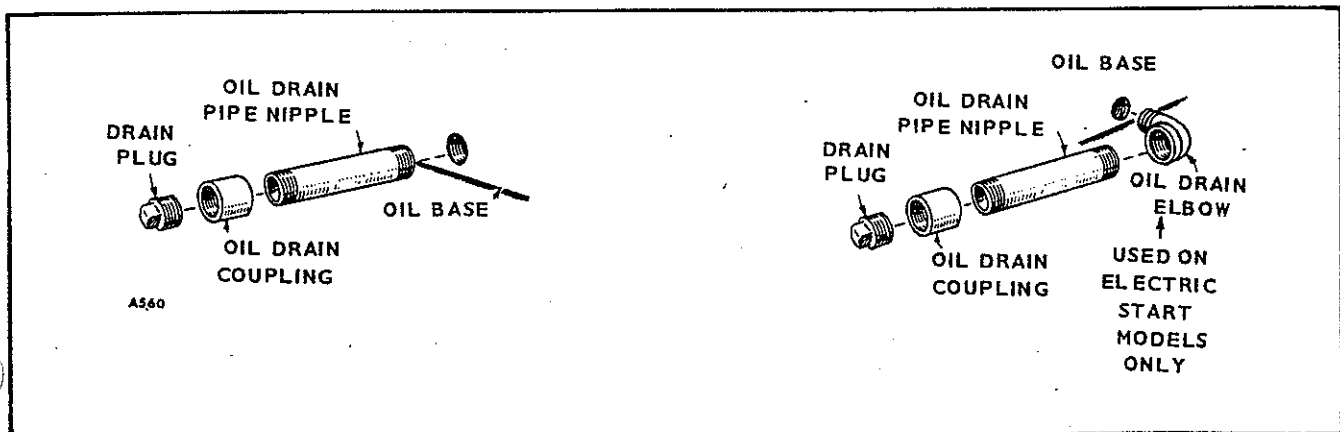


FIGURE 2. OIL DRAIN EXTENSION PIPES

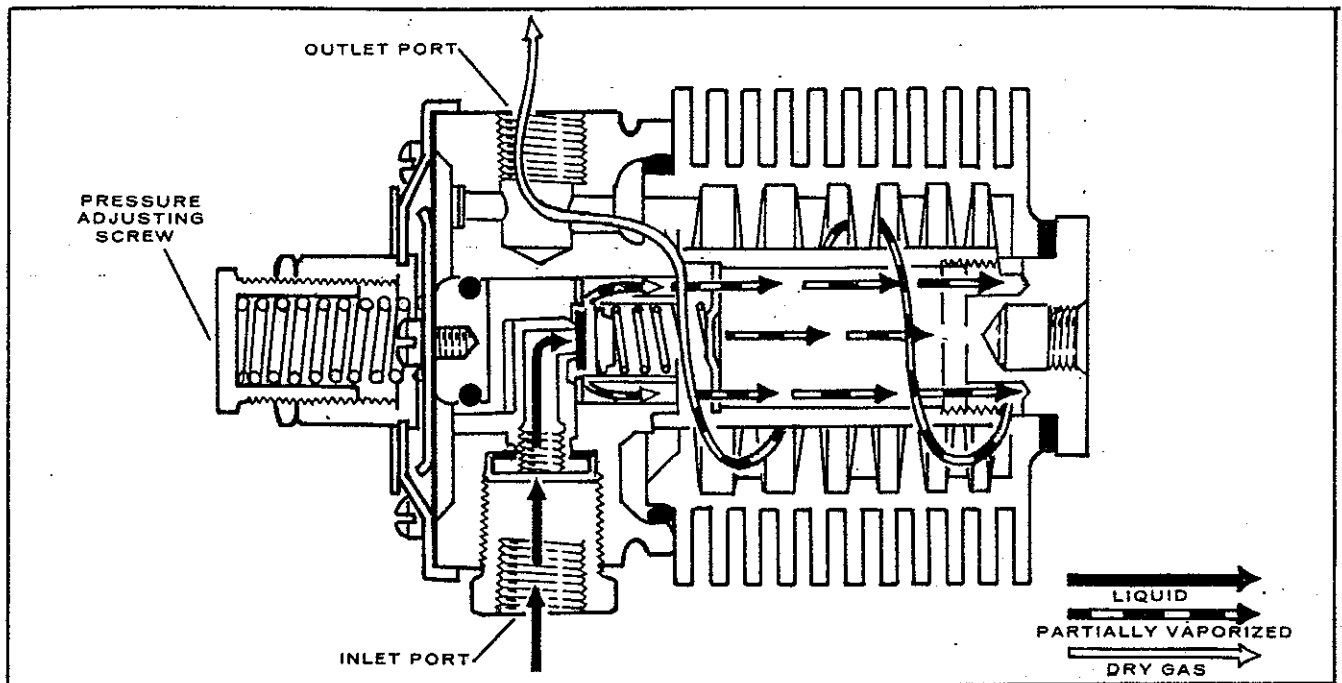


FIGURE 3. LPG VAPORIZATION PROCESS

BATTERY (Electric Start Models)

Connect the battery cable marked POS to the positive battery terminal; connect the unmarked cable to the negative terminal. Always keep the battery connections clean and tight.

ELECTRODES

The CCK welder can use all 1/16-inch through 5/32-inch electrodes. The 3/16-inch positive and negative electrodes that do not exceed the welder capacity may be used.

LPG FUEL CONNECTION

LPG fueled engines are equipped with a gas carburetor, a secondary (demand) gas regulator and a combined vaporizer and primary regulator assembly. The vaporizer consists of a high pressure regulator and vaporizer in a single unit. The high pressure regulator reduces LPG tank pressure to a uniform outlet pressure of 7 psi. The vaporizer section, installed in the path of the engine air cooling system, furnishes the heat required to offset the cooling effect produced as the LPG fuel is expanded and becomes gas. Connect the fuel line to the vaporizer inlet (1/4-inch pipe-tapped hole). Figure 3 illustrates the vaporization process.

The secondary regulator supplies gas to the carburetor on demand. Incoming gas pressure to this regulator must not exceed 10 psi. Bleed air from the fuel line by depressing the primer button. Major components of the LPG system are shown in Figure 4.

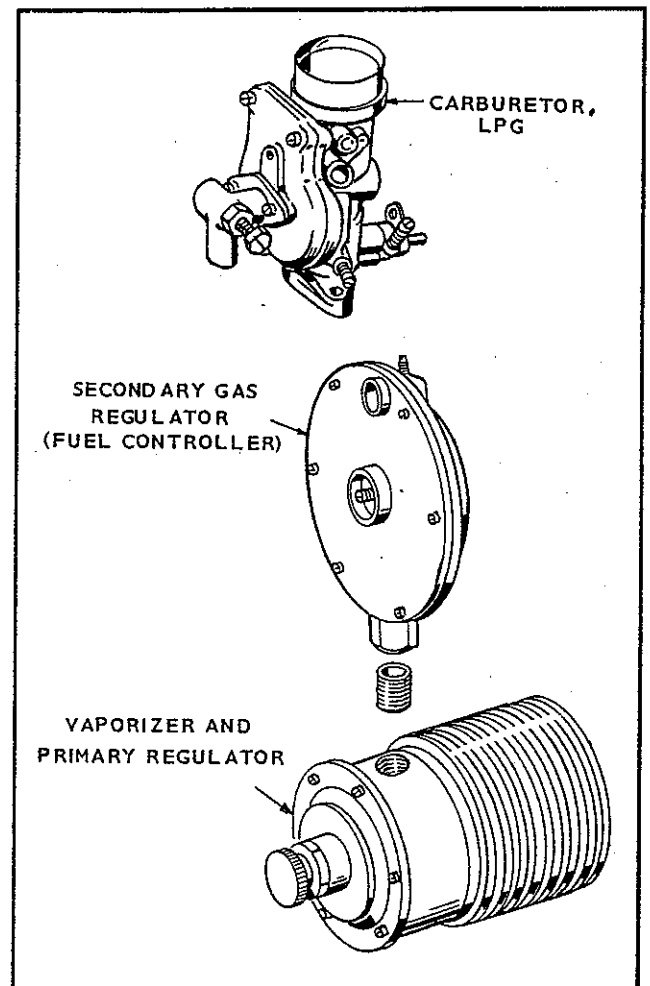


FIGURE 4. LPG FUEL SYSTEM COMPONENTS

OPERATION

INITIAL START

Be sure the engine is filled with oil and fuel. If the first attempt at starting the engine fails, the inhibitor oil used at the factory may have fouled the spark plugs - remove the plugs, clean in gasoline, dry thoroughly and reinstall. When the engine is first started, heavy exhaust smoke is normal and is caused by the inhibitor oil.

Crankcase Oil: Use good quality detergent oil that meets API (American Petroleum Institute) service designations SE, SE/CC (former designation was MS or MS/DS). The oil must be labeled as having passed the SE Sequence Tests. Refer to the *Maintenance Section* for the correct SAE grade oil.

The *Maintenance Section* describes the recommended oil change periods and maintenance requirements.

Recommended Fuel: Use clean, fresh, regular grade, automotive gasoline. Do not use highly leaded premium types. For new engines, most satisfactory results can be obtained by using unleaded gasoline. For older engines that have previously used leaded gasoline, the heads must be taken off and all lead deposits removed from the engine before switching to unleaded gasoline.

CAUTION If lead deposits are not removed from engine before switching from leaded to unleaded gasoline, pre-ignition could occur causing severe damage to the engine.

WARNING Never fill the tank when the engine is running. Allow tank space for fuel expansion.

STARTING

Manual Starting: The fuel system must be primed if the welder has been idle long enough for the gasoline to evaporate from the carburetor. To prime, remove the engine and control cover. Operate the fuel pump primer rod (Figure 5) approximately 15 complete strokes to fill the carburetor.

NOTE: The primer rod and starting rope are furnished on portable models only.

If the engine camshaft pump lobe is up, crank the engine one revolution to permit hand priming. Return the priming rod to the downward position after priming. Replace the engine and control cover.

Starting the engine in cold temperatures may require full choking. In mild temperatures or when the engine is still warm from a recent operation, little or no choking is necessary. To operate the choke control, pull outward.

1. Welder equipped with optional Readi-Pull Starter: The starter rope is in the starting position and automatically rewinds to this position after the rope is pulled and released.

Welder not equipped with the Readi-Pull Starter: Wind the starting rope on the flywheel rope sheave in a clockwise direction to within approximately 6 inches of the starting rope handle.

2. Crank the unit with a rapid pull on the starting rope. DO NOT JERK the rope. If the unit does not start immediately, change the choke setting. Avoid over-choking as this can cause oil dilution that can result in excessive wear of the internal engine parts.

NOTE: Setting the throttle control lever in the *POWER* position (1800 rpm) aids starting, especially in cold weather. As soon as the unit starts, adjust the choke control to the best running position, gradually pushing the choke in as the unit warms up.

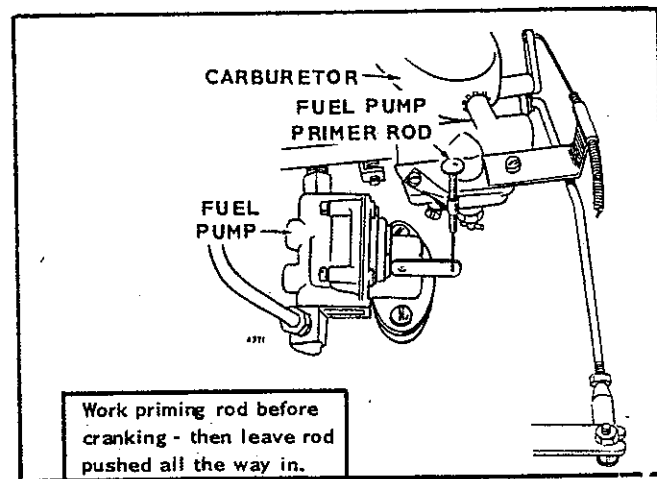


FIGURE 5. PRIMING FUEL PUMP

Electric Start: On initial start (or if the unit has run out of fuel), it is necessary to pump fuel to the carburetor. It usually takes about 30-revolutions to properly fill the carburetor.

1. Snap the ignition switch located on the control panel to the ON position. (The battery must be connected.)
2. Adjust the choke according to temperature conditions.
3. Push the START switch firmly. If the unit does not start within a few seconds, release the START switch and wait a few seconds before reattempting. If the unit does not start after the second attempt, open the choke and repeat the starting sequence.
4. After the unit starts, adjust the choke to the best running position. Gradually push the choke control in as the unit warms up.

LPG FUEL (Liquid Withdrawal)

Open the fuel tank valve and check for fuel system leaks. Bleed air from the system by temporarily pressing the primer button on the secondary regulator.

Engine cranking normally draws fuel from the secondary (demand) regulator. It may be necessary to press the secondary regulator primer button for the initial start.

CAUTION The ignition switch must be in the OFF position when the engine is not running to avoid discharging the battery.

Should the battery discharge to where it cannot furnish enough power for cranking, start the engine by manually cranking with a starting rope.

OIL PRESSURE

Normal operating oil pressure is 20-35 pounds. Pressure is higher until the engine warms up.

CAUTION If the oil pump loses its prime resulting in no oil pressure, stop the engine immediately, remove the oil pressure relief valve (Engine Disassembly section) and fill the pressure line. Replace the relief valve and adjust.

BREAK IN PROCEDURE

Initial welder operation, using SE/CC oil should be performed as follows:

1. One-half hour at 1/2 load.
2. One-half hour at 3/4 load.
3. Full load.

Check the oil every 8 of the first 50 hours of operation. Add oil if necessary. Never overfill; this causes the oil to foam and enter the breather system. Drain the oil while the engine is hot, after the first 50 operational hours.

A disciplined break-in procedure using the proper oil and employing a routine maintenance schedule helps to ensure satisfactory welder service.

IMPORTANT: Before fifty operating hours, the cylinder head bolts must be re-torqued as described in the Engine Disassembly section, Cylinder Heads.

WELDING CURRENT ADJUSTMENT

Welders have an engine speed control lever and a fine current adjustment control (Figure 6).

When the engine speed control lever is in the WELD position (2500rpm), AC output is cut off and only welding current is available. When the lever is in the POWER position, welding current is by-passed and only AC output is available.

The jack receptacle type main current control connects

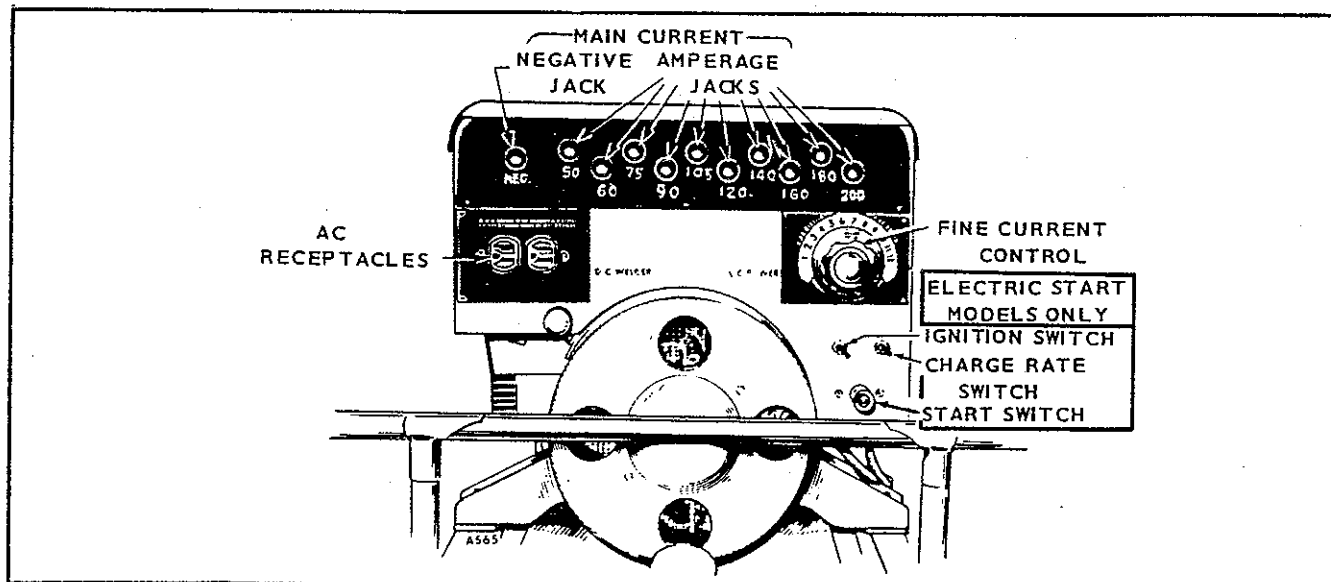


FIGURE 6. CONTROL PANEL SWITCHES AND ADJUSTMENTS

various resistance units into the welding circuit, limiting the amount of current at each jack receptacle. The fine current control provides for further adjustment between the jack receptacles of the main control.

CAUTION Resistance units generate considerable heat inside the welder control box. Always keep the engine and control cover on the unit to properly direct cooling air to the control box. NEVER WELD WITH THE ENGINE AND CONTROL COVER REMOVED!

1. Plug cables into proper jack receptacles to obtain the amperage recommended for the electrode used.
2. Set fine current control at its approximate center position (midway between minimum and maximum). Try the welding characteristics, making fine current adjustments as necessary.

NOTE: Fine current control range is greater than the current spread of the main current control jack receptacles. If perfect arc conditions are not obtained by normal procedure, try the next higher or lower jack receptacle connections and readjust the fine current control to compensate.

3. Unsatisfactory adjustment of the welding current indicates poor electrical contact. Check welding cable connections at the welder, ground clamp and clamp connections on the object being welded, and the electrode holder connections.

WELDING CABLE CONNECTIONS

Insert the welding cables into the main current jack receptacles (Figure 7), according to welding requirements. Some welding jobs may require frequent polarity changes to permit using various types of welding rods.

Straight Polarity Welding: Connect the *electrode* cable to the negative (NEG.) jack receptacle. Connect the *ground* cable to the desired current jack receptacle.

Reverse Polarity Welding: Connect the *ground* cable to the negative (NEG.) jack receptacle. Connect the *electrode* cable to the desired current jack receptacle.

AC OUTPUT

Move the speed control lever to the POWER position (1800 rpm on 60 hertz models or 1500 rpm on 50 hertz models). This bypasses welding current control and supplies 120 (or 240) volt current to the output receptacles. Limit AC loads to not more than 3500 watts, 60 hertz, or 2500 watts, 50 hertz.

MICRO SWITCH

The engine speed control lever governs micro switch operation. If the micro switch becomes stuck or otherwise inoperative, welder operation is vitally affected. Refer to the wiring diagrams that follow the Parts Catalog in this manual.

1. If the micro switch DC contacts remain closed when the speed control lever is in the WELD position, welder voltage at no-load increases from a normal 60 volts (approximate) to 80 volts. At heavy welding load, speed drops excessively and appears to lack power.
2. If the micro switch DC contacts remain open when the speed control lever is in the POWER position, AC voltage is low, with similar low power performance.
3. If the micro switch AC contacts fail to close with the speed control lever in the POWER position, no AC output is available.
4. If the micro switch AC contacts remain closed with the speed control lever in the WELD position, AC output voltage is excessively high, and any AC load connected is damaged.

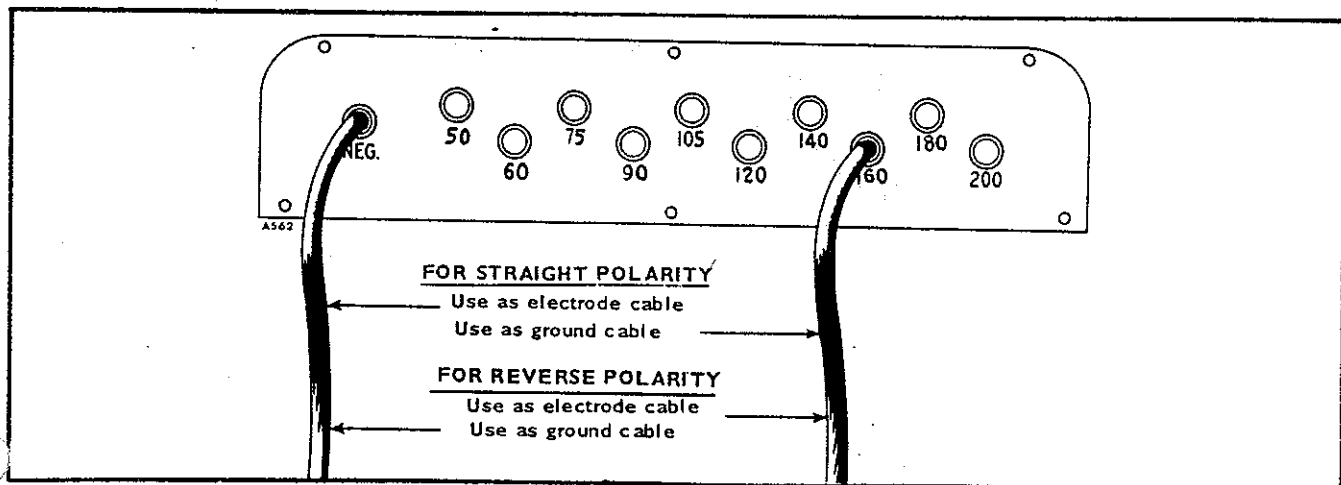


FIGURE 7. MAIN CURRENT JACK RECEPTACLES

HI-LO BATTERY CHARGE SWITCH

When the welder is used infrequently, keep the Hi-Lo toggle switch in the Hi position to provide approximately a 2 ampere charge rate. Under normal operation, keep the switch in the Lo position — this provides a 1-1/4 ampere charge.

STOPPING

Before stopping the engine, place the speed control lever in the POWER position and allow the engine to run at the lower speed for at least 30 seconds. If the engine speed control lever remains in the WELD position when the engine is stopped, restarting the engine may be difficult.

To stop a MANUAL START unit, press firmly on the STOP button (located on the engine blower housing) until the engine has come to a complete stop. If the STOP button is released too soon, the engine picks up speed again and continues to run.

To stop an ELECTRIC START unit, snap the ignition (located on the control panel) to OFF.

EXERCISE

Using the engine infrequently results in starting difficulties. Therefore, operate the welder one 30-minute period each week. Run longer if the battery needs charging (Electric Start models).

OUT-OF-SERVICE PROTECTION

Protect a CCK series welder that is to be out-of-service for more than 30 days as follows:

1. Run the engine until thoroughly warm.
2. Turn off the fuel supply and run the engine until it stops.
3. Drain the oil from the oil base while it is still warm. Refill with new oil and attach a warning tag, stating the oil viscosity used.
4. Remove each spark plug. Pour one ounce (two tablespoons) of rust inhibitor (or SAE #30 oil) into each cylinder. Crank the engine slowly (by hand) several times. Install the spark plugs.
5. Service the air cleaner.
6. Clean the governor linkage and protect it by wrapping with a clean cloth.
7. Plug the exhaust outlet to prevent moisture, dirt, bugs, etc. from entering the outlet.
8. Wipe generator brushes, slip rings, etc. Do not apply lubricant or preservative.
9. Wipe the entire unit. Coat the rustable parts with a light film of grease or oil.
10. Provide a suitable cover for the entire unit.
11. Disconnect the battery on electric start models and follow the standard battery storage procedure.

OPERATION AT HIGH TEMPERATURES

1. See that nothing obstructs the air flow to-and-from the welder.
2. Keep the cooling fins clean. The air housing should be properly installed and undamaged.
3. Keep the ignition timing properly adjusted.
4. Use oil with correct viscosity.

OPERATION AT LOW TEMPERATURES

1. Use the correct SAE number oil for the temperature conditions. Change oil only when the engine is warm. If the temperature drops unexpectedly and causes an emergency, move the welder to a warm location or apply flameless heat externally until the oil flows freely.
2. Use fresh regular grade (not premium) gasoline. Protect against moisture condensation. Below 0°F, adjust the carburetor main jet for slightly richer fuel mixture.
3. Keep the ignition system clean, properly adjusted, and batteries well-charged.
4. Partially restrict the cool air flow to the cooling fan, but avoid overheating.

OPERATION IN DUSTY CONDITIONS

1. Keep welder clean. Keep cooling fins free of dirt, etc.
2. Service air cleaner as frequently as necessary.
3. Change crankcase oil every 50 operating hours or less.
4. Keep oil and gasoline in dust-tight containers.
5. Keep governor linkage clean.
6. Clean generator brushes, slip rings, and commutator.

OPERATION AT HIGH ALTITUDE

When operating the welder at altitudes of 2500 feet above sea level, slightly closing the carburetor jet adjustment maintains proper air-to-fuel ratio (refer to the *Fuel System* section). Maximum power reduces approximately 4% for each 1000 feet above sea level after the first 1000 feet. Thus, at an altitude of 5000 feet, the welder delivers approximately 160 amperes with proper carburetor adjustment.

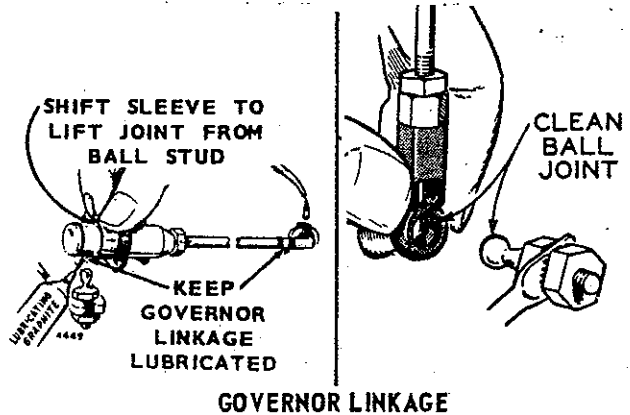
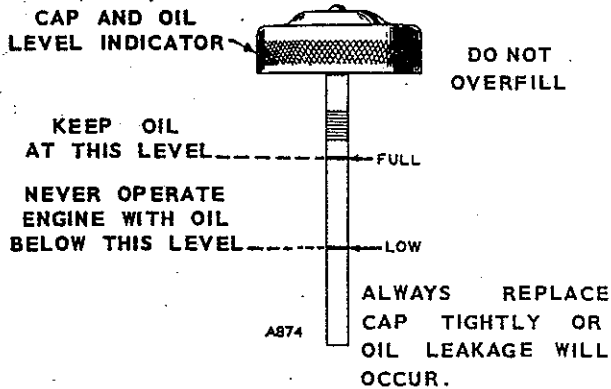
MAINTENANCE

CRANKCASE OIL

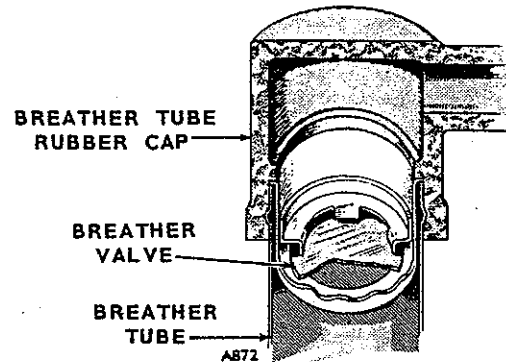
Oil capacity is 4 quarts, U.S. measure. Fill to full mark on oil indicator. Use good quality detergent oil meeting API (American Petroleum Institute) service designations SE/CC. In addition, the oil must be labeled as having passed the SE Sequence Tests. Use following SAE oil numbers for expected ambient temperatures.

| | |
|-------------|---|
| Above 30°F | SAE 30 |
| 0°F to 30°F | SAE 10W |
| Below 0°F | SAE 5W (SAE 5W-20 if 5W is not available) |

Do not mix brands or grades. Extremely dusty or low temperature conditions require oil change at 50 hours.

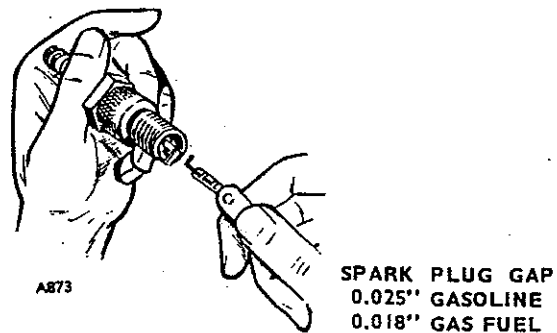
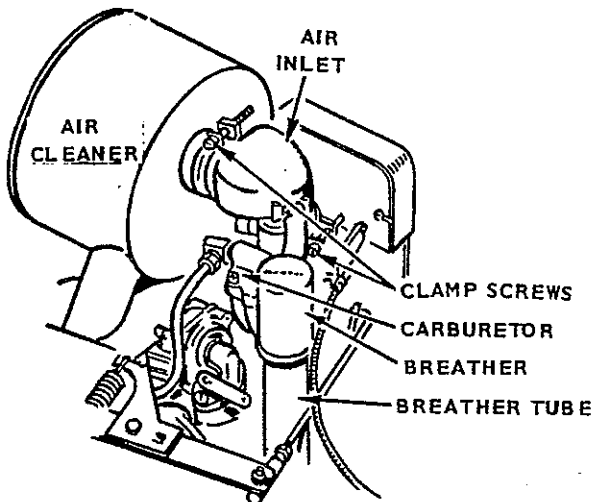


CRANKCASE BREATHER



Lift off rubber breather cap. Carefully pry valve from cap. Otherwise press hard with both of your thumbs on top of cap and fingers below to release valve from rubber cap. Wash this fabric flapper type check valve in fuel. Dry and install, positioning perforated disc toward engine.

AIR CLEANER



SPARK PLUG GAP
0.025" GASOLINE
0.018" GAS FUEL

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 Fuel | x | | | |
| Check Oil Level | x | | | |
| Clean Air Cleaner * | | x1 | | |
| Clean Governor Linkage | | x1 | | |
| Check Spark Plugs | | | x | |
| Change Crankcase Oil | | | x1 | |
| Check Battery | | | x | x2 |
| Clean Crankcase Breather | | | | x |
| Clean Fuel System | | | | x |
| Replace Oil Filter | | | | x1 |

x1 - Perform more often in extremely dusty conditions.

x2 - Replace brushes when worn to 5/8 inch or less.

- * Remove air filter cartridge and shake out accumulated dirt. Do not wash. Install new cartridge every 500 hours.

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

CRITICAL MAINTENANCE SCHEDULE

| MAINTENANCE ITEMS | OPERATIONAL HOURS | | | |
|--------------------------------------|-------------------|-----|------|------|
| | 200 | 500 | 1000 | 5000 |
| Check Breaker Points | x | | | |
| Clean Commutator and Collector Rings | x1 | | | |
| Check Brushes | x2 | | | |
| Remove Carbon & Lead | | x3 | | |
| Check Valve Clearance | | x | | |
| Clean Carburetor | | x | | |
| Clean Generator | | | x | |
| Remove & Clean Oil Base | | | 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 5/8 inch 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.

FUEL SEDIMENT

Empty carburetor and fuel filter (strainer) bowls of any accumulated sediment. Clean filter screen thoroughly. Assemble and check for leaks.

ENGINE TROUBLESHOOTING

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

GOVERNOR

The governor keeps engine speed nearly constant, regardless of the load. Nominal welding speed is 2500 rpm. When the engine speed control lever is in the POWER position for AC output, engine speed is approximately 1800 (60 hertz) or 1500 rpm (50 hertz) depending on the particular unit.

Before making any governor adjustment, see that the carburetor is properly adjusted. Check engine speed with a tachometer. Be sure welder is thoroughly warmed up. Refer to Figure 11.

1. Check the length of the linkage (A) that connects the governor arm and the carburetor throttle arm. This linkage synchronizes the governor arm travel
2. Set engine speed control lever (C) to the POWER position, where the lever boss (D) engages with the notch (E) in the lever bracket (L).
3. Adjust the spring tension to produce engine speed of approximately 1850 rpm (1550 rpm on 50 hertz models) at no-load. Spring tension is adjusted by loosening the locknuts (F) and turning the inner

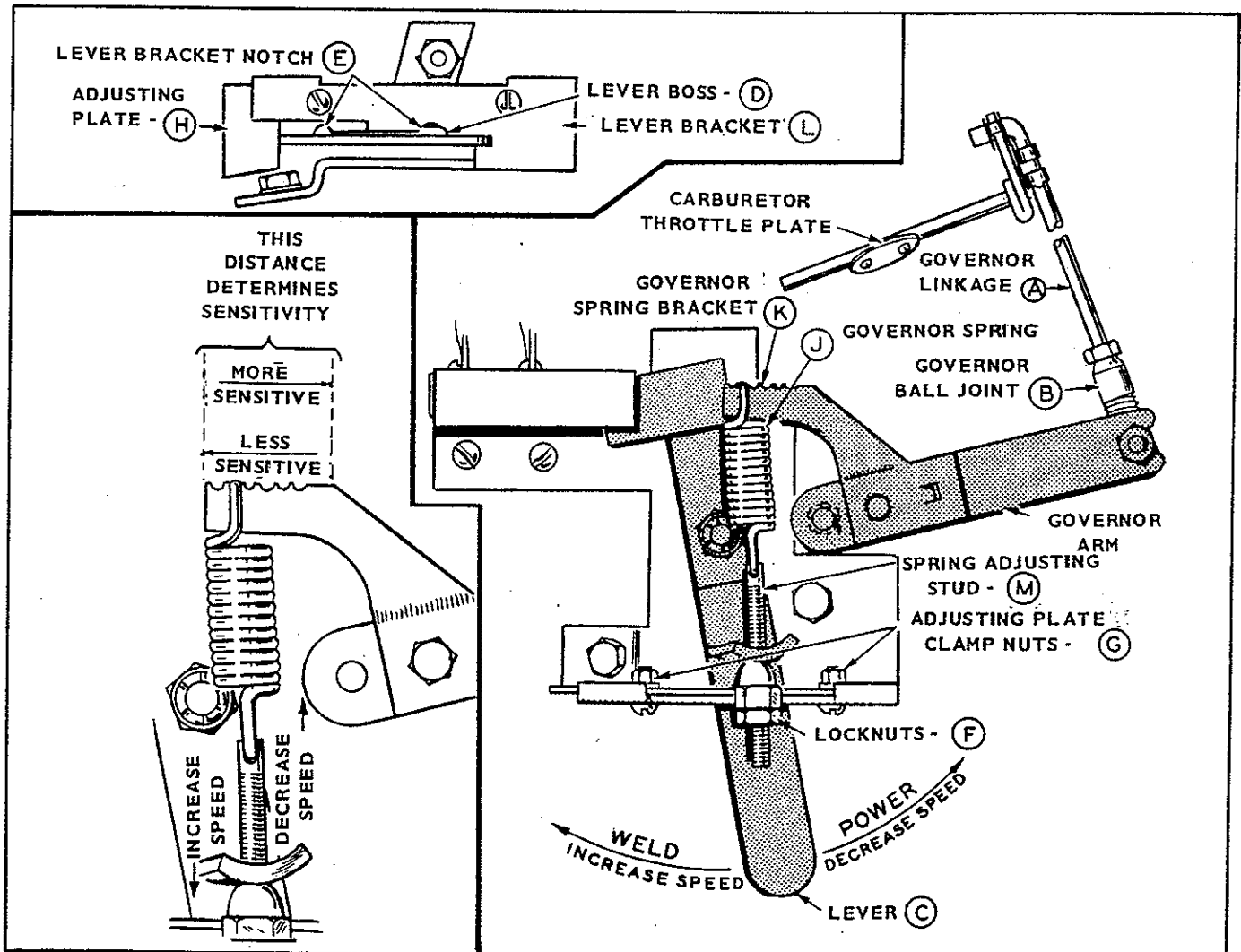


FIGURE 11. GOVERNOR AND GOVERNOR LINKAGE

nut on spring adjusting nut (M). This determines engine speed for AC operation.

4. Pull engine speed control lever to the WELD position. The speed should then be approximately 2700rpm at no-load. If speed is not approximately 2700rpm, loosen the two nuts (G) holding the adjusting plate (H); and slide the plate either in or out to gain the desired speed. Retighten the nuts.
5. Check engine speed while welding at maximum current. Engine speed at full welding load should be approximately 200rpm lower (about 2500rpm) than no-load speed. If speed drop is excessive, move the governor spring (J) in towards the gover-

nor arm one or more notches on the spring bracket (K) until speed drop is approximately 200rpm. This requires a new speed adjustment; repeat steps 2, 3, and 4.

If the spring is moved in too far, the engine "hunts" (alternately increases and decreases in speed). If hunting develops before speed drop is reduced by 200rpm, try correcting it by slightly enriching the carburetor adjustment. Do not turn the carburetor main adjustment needle out more than 1/2 turn (early models only) past its original full power setting.

IGNITION SYSTEM

MAGNETO STATOR INSTALLATION

The magneto stator assembly is mounted on the gear cover. Remove the flywheel to expose it. On engines *without* spark advance mechanism, the stator has two pairs of mounting holes. The outermost holes give 25° spark advance mechanism (welders prior to Spec H). Connect the smaller (ground) coil lead to the stator mounting screw. Engines with spark advance mechanism (begin Spec H) and engines without spark advance (begin Spec L) have one set of mounting holes only. Connect the larger stator lead to the breaker box insulated terminal that connects to the ignition coil (welders prior to Spec H) and breaker points. Be sure the larger lead is held in place to prevent rubbing on the flywheel.

The stator coil, used on welders beginning Spec H, includes both the primary and secondary windings. There is no separate automotive type coil used.

IGNITION COIL INSTALLATION (Prior to Spec H)

Coil connections differ between magneto ignition engines and battery ignition engines. Refer to Figure

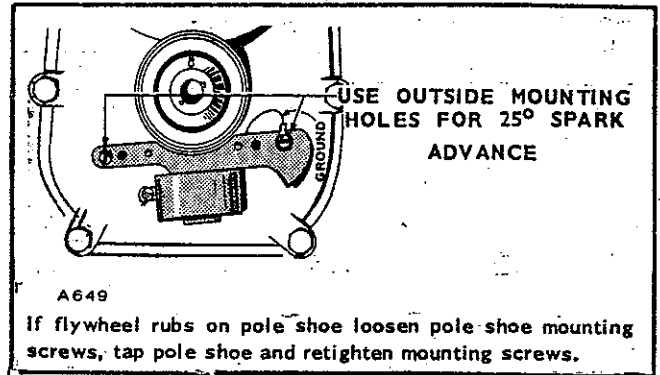


FIGURE 12. MAGNETO STATOR INSTALLATION

13. The ignition coil is grounded on magneto ignition engines, but not grounded with battery ignition.

TIMING IGNITION (Prior to Spec H, Begin Spec L)

Ignition timing procedure is the same for manual-start engines with magneto ignition as for electric-start engines with 12-volt battery ignition.

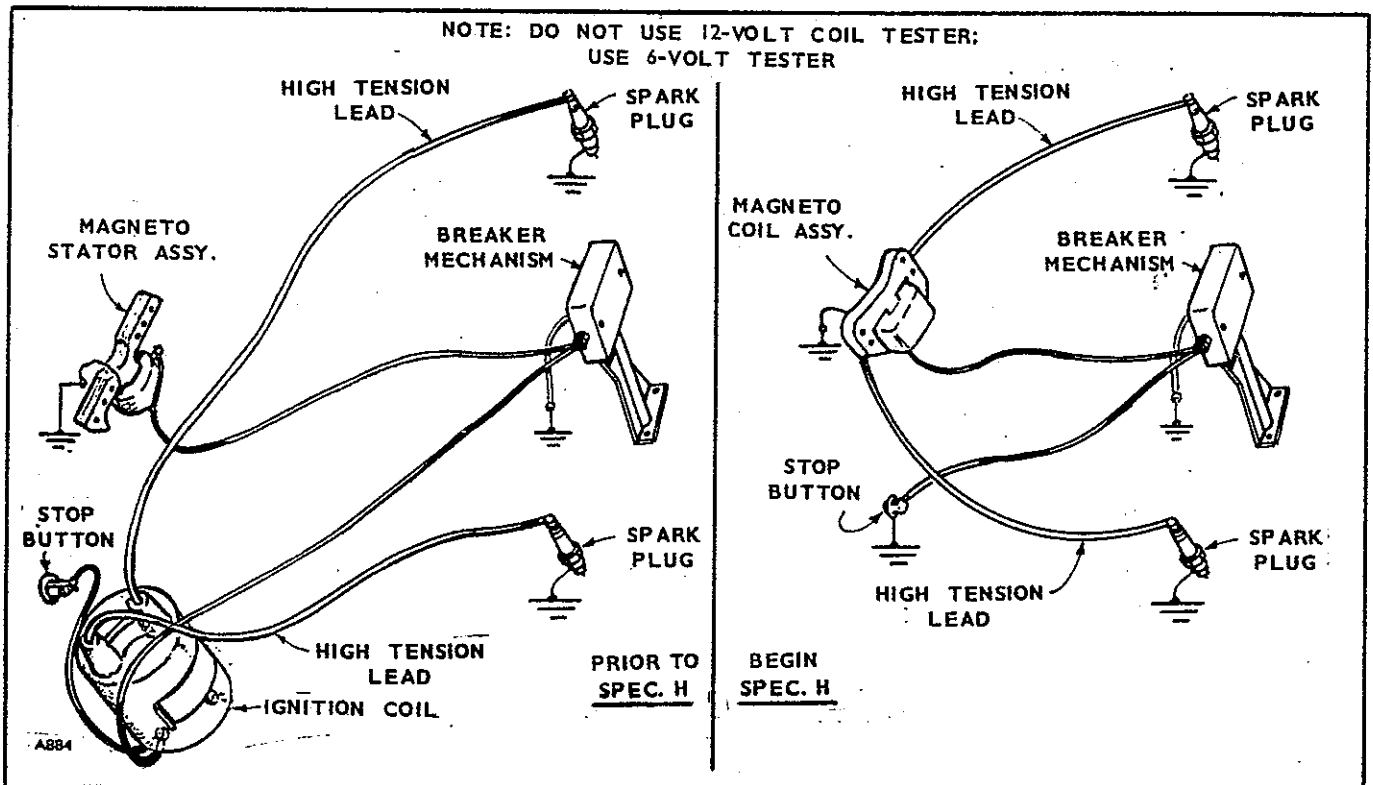


FIGURE 13. IGNITION SYSTEMS

Spark advance is 25° (prior to Spec H) or 20° (begin Spec L) before top center. The correct timing is stamped on the cylinder block near the breaker box.

1. Remove the cover from the breaker box. If the timing is off very far, attain an approximate setting by loosening the mounting screws and shifting the breaker box (and spacer if used) to align the witness marks on the cylinder block and breaker box (or spacer).
2. Slowly crank the engine by hand in the direction of crankshaft rotation until the witness mark on the flywheel and the TC mark on the gear cover are exactly in line (Figure 14).
3. Adjust the ignition breaker point gap width to .020" at full separation.
4. Turn the flywheel to the left; against crankshaft rotation until the timing mark is about two inches past the 25° mark on the gear cover.
5. Slowly turn the flywheel to the right and note whether the ignition points just separate when the flywheel aligns with the correct degree mark (19° or 25°) on the gear cover. Use a continuity light to determine the exact moment of point separation. If the marks align as the points break, timing is correct. If they do not, loosen the breaker box mounting screws and shift the whole breaker box assembly slightly toward the #1 cylinder to retard the timing (points breaking too soon), or shift it slightly away from the #1 cylinder to advance the timing (points not breaking soon enough). Tighten the breaker box mounting screws securely after making an adjustment (Figure 14).

To accurately check the time at which the spark occurs, an automotive-type timing light may be used when the engine is running.

To accurately check the time at which the spark occurs when not running the engine, connect a continuity test lamp set across the ignition breaker points. Touch one test prod to the breaker box terminal (to which the coil lead is connected), and touch the other test prod to a good ground on the engine. If the engine has a magneto ignition, disconnect the primary magneto lead before rotating the crankshaft. Turn the crankshaft against rotation (backwards) until the points close. Then, slowly turn the crankshaft with rotation. The lamp should go out just as the points break.

6. Reinstall the breaker box cover.

TIMING IGNITION (Begin Spec H, Prior to Spec L)

The correct timing (5° stopped or idle speed - 24° running at 1,100 rpm or over) is stamped on the crankcase near the breaker box. If the breaker points separate when the timing marks align (engine stopped) timing is correct. Timing is best adjusted with an automotive-type timing light with the engine running.

Timing Marks on Flywheel: Align the correct timing mark on the flywheel with the TC mark on the gear cover.

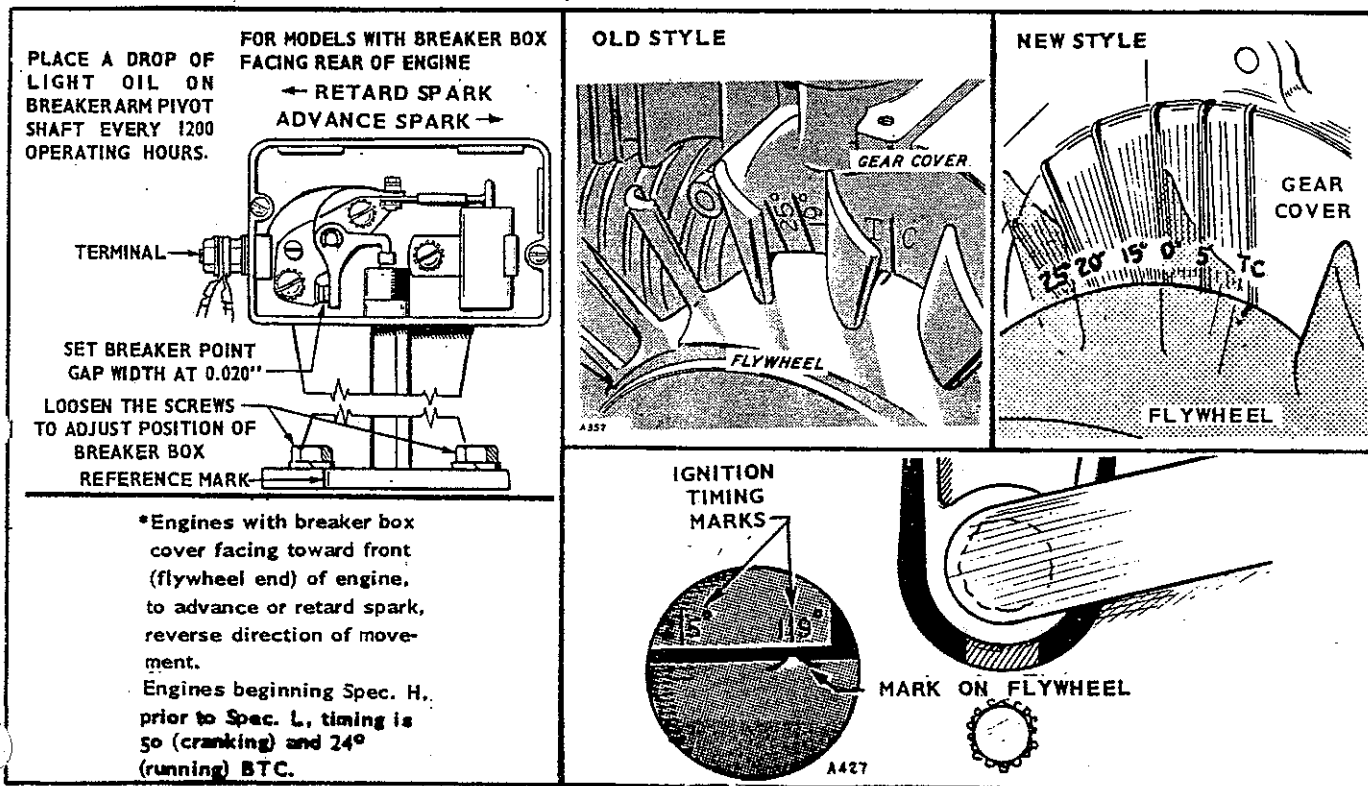


FIGURE 14. IGNITION TIMING

Timing Marks on Gear Cover: Align the correct timing mark on the gear cover with the TC mark on the flywheel.

Timing Marks on Both Gear Cover and Flywheel: Align either the TC flywheel mark with the correct timing mark on the gear cover or the timing mark on the flywheel with the TC mark on the gear cover.

NOTE: Use only one TC mark and one set of timing marks.

SPARK ADVANCE MECHANISM (Begin Spec H, Prior to Spec L).

The spark advance mechanism, located on the rear end of the camshaft, is operated by centrifugal force. As engine speed is increased, weights push the cam, advancing the spark, or release the cam, retarding the spark as engine speed is decreased.

If the spark advance mechanism should become dirty or gummy, causing the mechanism to stick closed (retarded), the engine will lack power. If the mechanism

sticks open (advanced), the engine may possibly kick-back on cranking. The spark advance mechanism can be reached for cleaning by either removing the cup shaped cover in crankcase rear camshaft opening (exposing the mechanism) or by removing camshaft from engine. Do not indent the cup shaped cover as it will interfere with the weight mechanism. To check the operation of the spark advance mechanism, follow these steps:

1. Connect a timing light (either plug).
2. Start the engine and run it at 1400 to 1600 rpm.
3. While watching the timing marks with the timing light, slow the engine to below 800 rpm. When the TC mark on the flywheel disappears and then reappears when the engine is brought back to speed, the spark advance mechanism is operating properly.
4. If the spark advance mechanism does not react as outlined in Step 3, remove, clean and/or replace as necessary.

TESTING IGNITION COIL

Use a 6-volt tester to test the ignition coil. To avoid burning out the coil, do not use a 12-volt tester. Do not leave the coil on the tester over 15 or 20 minutes.

VALVE SYSTEM

Properly seated valves are essential to good engine performance. The aluminum cylinder head is removable for valve servicing. Do not use a 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 split-type valve spring locks. Clean all carbon deposits from the cylinder head, piston top, valves, guides, etc. Install a new valve. If a valve face is burned or warped, or the stem is worn.

Replace worn valve stem guides from inside the valve chamber. Valve locks are the split, tapered-type. The smaller diameter end 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 minimizes face deposits and lengthens valve life. See Figure 15.

Do not hand-lap the valves because the sharp contact may be destroyed. This is especially important where hard alloy-faced valves and seats are used. 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 $3/64''$ wide. Grind only enough to ensure proper seating.

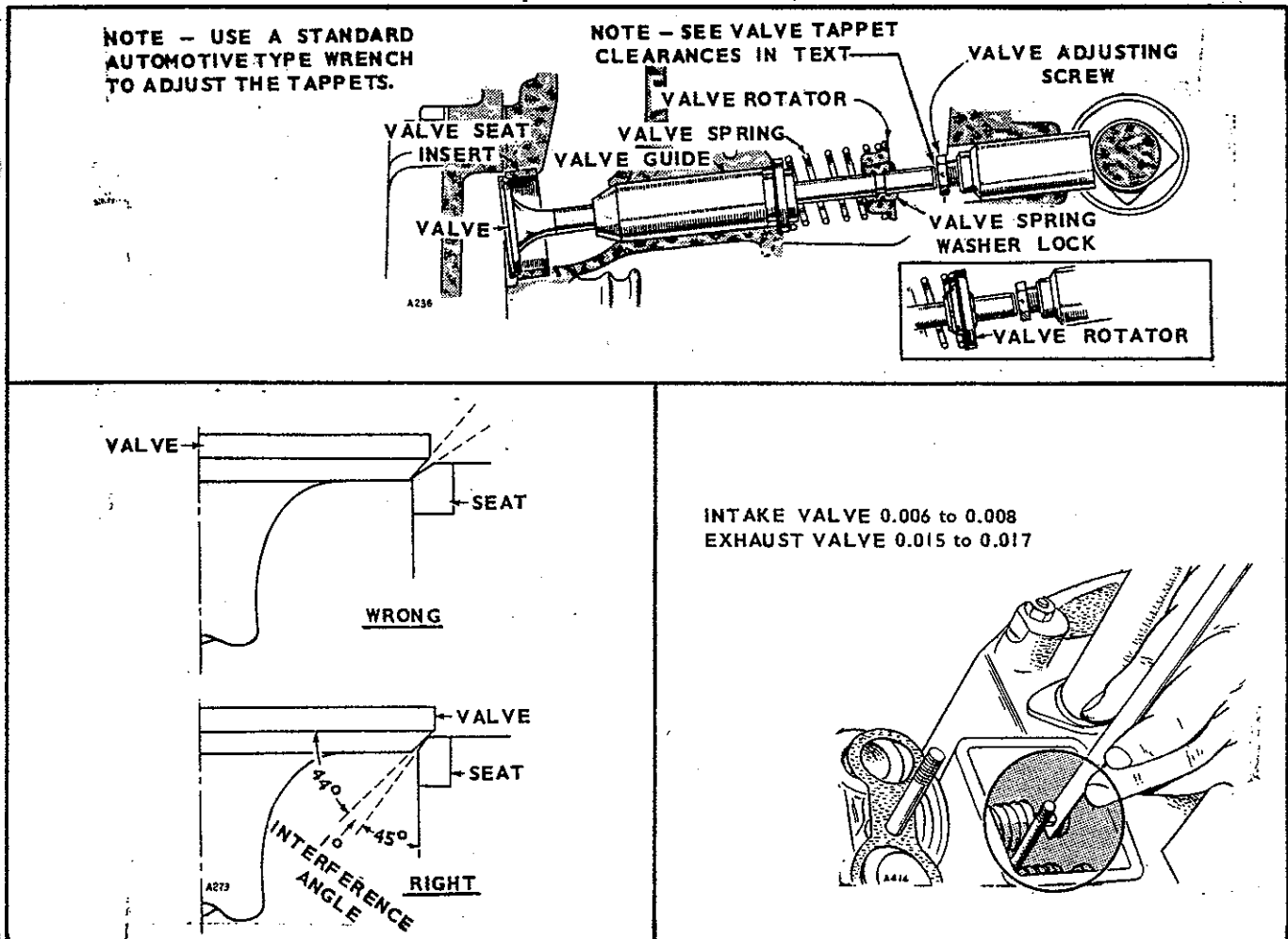


FIGURE 15. VALVE SYSTEM AND ADJUSTMENTS

Remove all grinding dust from engine parts and install each valve in its proper location. Check each 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 assemble all parts removed. Adjust the valve clearance.

The positive-type valve rotocaps serve to prolong valve life. When functioning properly, the valve is rotated a fraction of a turn each time it opens. When in the open position, the valve can be rotated freely but only in one direction. Install new rotocaps if rotocaps are faulty.

TAPPET ADJUSTMENT

The CCK series is equipped with adjustable tappets. To make a valve adjustment, remove the valve covers.

Slowly crank the engine by hand until the left-hand intake valve opens and closes when facing the flywheel. Continue about 1/4 turn until the mark on the flywheel and the TC mark on the gear cover are in line. This should place the left-hand piston at the top of its compression stroke, the position it must be in to get proper valve adjustment for the left-hand cylinder. Clearances are listed in the Table of Dimensions and Clearances. For each valve, the thinner gauge (minimum) should pass freely between the valve stem and valve tappet but the thicker gauge (maximum) should not. Refer to Figure 15.

To correct the valve clearance, turn the adjustable, self-locking screw as needed to obtain the right clearance.

To adjust the valves on the right hand cylinder, crank the engine one complete revolution and again line up the mark on the flywheel and the TC mark on the gear cover. Then follow the adjustment given for the valves of the left hand cylinder.

ENGINE DISASSEMBLY

If engine disassembly is necessary, observe the sequence as described in this section (i.e., flywheel, gear cover, etc. . .). To some extent, the sequence may be changed as required. (The engine assembly procedure is the reverse of disassembly.)

FLYWHEEL

To remove the flywheel, turn the mounting screw outward about two turns. Use a flywheel puller (Onan tool number 420A100) to simplify flywheel removal.

CAUTION

Do not drop the flywheel. A broken fin destroys the balance.

Always use a steel key for mounting the flywheel. A magneto flywheel that has lost its magnetism can be remagnetized with a flywheel magneto charger. Consult your dealer.

NOTE: After reassembling the flywheel to the engine, the spark should jump a 3/16-inch gap. Check the spark by holding the spark plug wire away from a clean metal part of the engine while cranking.

GEAR COVER

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

When installing the gear cover, the pin in the gear cover must engage 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; hold it in this position until the gear cover is installed flush against the crankcase. Do not damage the gear cover oil seal. Adjust the roll (stop) pin to protrude 3/4 inch from the cover's 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.

Replace any flyball that is grooved or has a flat spot. Replace the ball spacer if the arms are worn or otherwise damaged. The governor cup requires replacement if the race surface is grooved or rough. The governor cup must be a free spinning fit on the camshaft center pin, but without any excessive play.

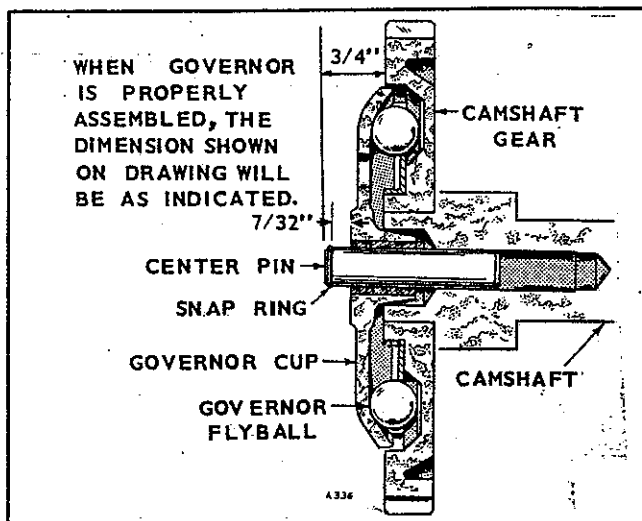


FIGURE 16. GOVERNOR CUP (CROSS SECTIONAL VIEW)

When installing the governor cup, tilt the engine so the timing gears are up. Put the flyballs in place (equally spaced), and install the cup and snap ring on the center pin.

The camshaft center pin protrudes 3/4 inch from the end of the camshaft, providing a 7/32-inch in-and-out travel distance for the governor cup (Figure 16). Hold the cup against the flyballs when measuring.

If the camshaft center pin extends less than 3/4 inch, the engine will race — especially at no load. Remove the center pin and press in a new pin or grind off the cup hub as required. (The camshaft center pin cannot be pulled outward or removed without damage.) If the center pin extends out too far, the cup cannot properly hold the flyballs.

TIMING GEARS

Always install a new crankshaft and a new camshaft when either needs replacing. To remove the crankshaft gear, first remove the snap ring and the retaining washer. Attach the gear puller ring (Onan tool number 420A248) to the crankshaft gear with two #10-32 screws. Tighten screws alternately until both are secure. Attach a gear puller to the puller ring and remove the gear. See Figure 18.

NOTE: The camshaft gear is pressed on and keyed to the camshaft. Therefore, the camshaft and gear must be removed as an assembly.

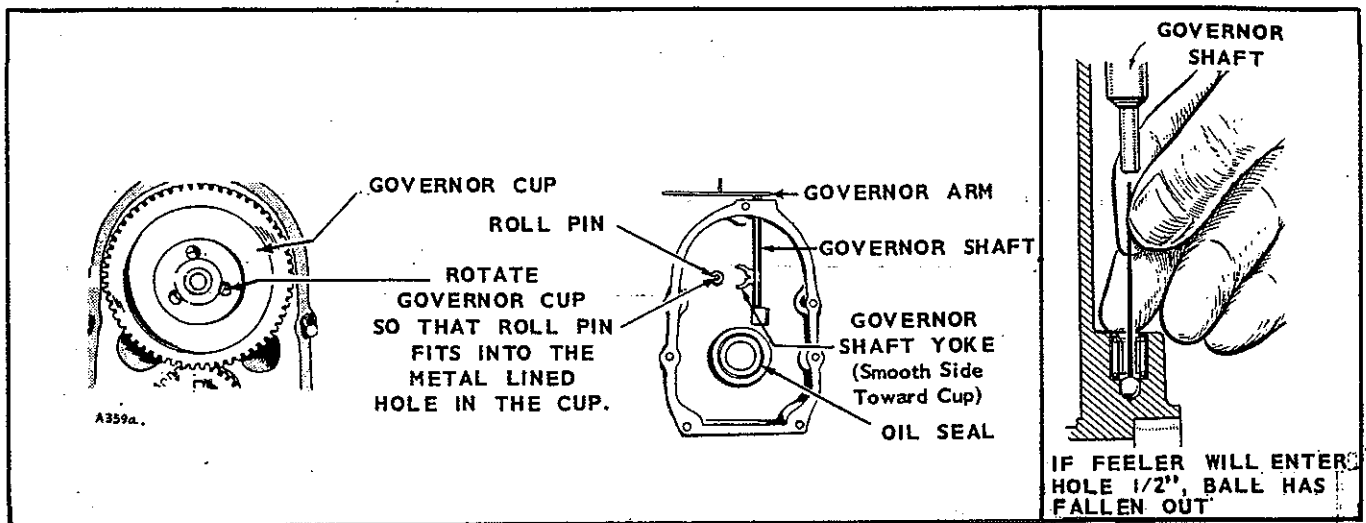


FIGURE 17. GEAR COVER ASSEMBLY

Before removing the camshaft and gear assembly, remove the following in the order given.

1. The crankshaft gear snap ring and retaining washer.
2. The cylinder head and valve assemblies.
3. The operating plunger for the breaker points.
4. The fuel pump and tappets.
5. The governor cup assembly.

Use a hollow tool or pipe that fits over the camshaft center pin and press the camshaft out of the center gear. (The governor ball spacer is riveted to the camshaft gear.)

CAUTION Do not press on the center pin or damage it in any way.

Be sure the mounting key is in place before pressing a gear onto the camshaft or crankshaft. Properly position the thrust washer on the camshaft. Align the keyway in the gear with the key on the shaft, pressing the gear into place.

NOTE: When replacing the camshaft gear on units having automatic spark advance mechanism, remove the spark advance mechanism and place blocks beside the pins to avoid damage when pressing on the camshaft gear. Install the governor cup assembly before reinstalling the camshaft and gear assembly in the engine.

Each timing gear is stamped with an "O" near the edge. Mesh the gear teeth so that these "O" marks coincide (as illustrated in Figure 18) when the gears are installed in the engine.

Be sure to reinstall the crankshaft retaining washer and snap ring.

PISTONS AND RINGS

Remove the piston and connecting rod assemblies from the top of the cylinder. Pistons are fitted with two compression rings, one oil control ring and one expander for the control ring.

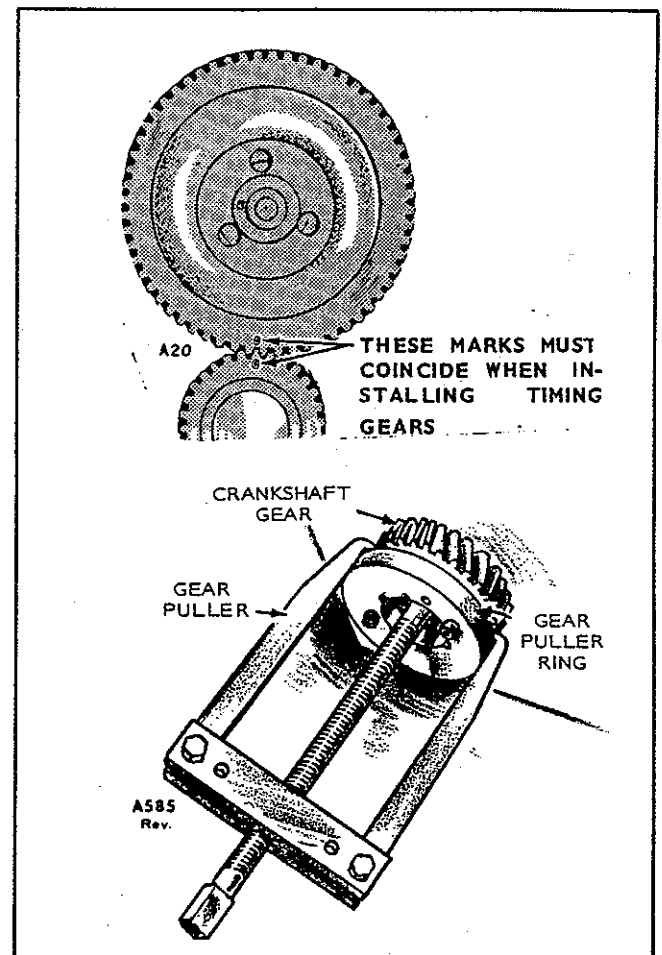


FIGURE 18. REMOVING CRANKSHAFT GEAR

Inspect each piston. Clean any carbon deposits from the piston ring grooves. The oil return slots in the lower groove must be open.

Install new pistons when they:

- are badly scored,
- are very loose in the cylinder,
- have badly worn ring grooves,
- are so loose in the piston pins that a 0.002-inch oversize pin does not correct it, or
- are in generally poor condition.

Handle pistons carefully to avoid nicking the walls. Any raised surface must be dressed down carefully.

Before installing new rings, check the ring gap by placing each ring squarely in its cylinder at a position corresponding to the bottom of its travel (Figure 19). The Table of Dimensions and Clearances lists the correct piston ring and cap. File slightly oversize rings as necessary to obtain the correct gap. Do not use rings that require too much filing. Standard size rings may be used on .005-inch oversize pistons. On .010, .020, and .030 and .040-inch oversize rings are to be used on the corresponding size piston.

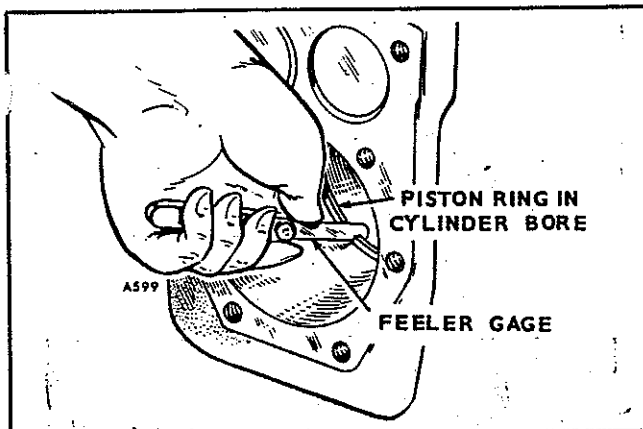


FIGURE 19. FITTING PISTON RINGS TO THE CYLINDER

The top of the tapered rings are usually identified in some manner. Install tapered rings with the top toward the piston head. Space each ring gap one-third of the way around the piston from the preceding one, with no gap directly inline with the piston pin. Fit the two upper grooves with compression rings. When a chrome-faced ring is used, insert it in the top groove. Onan selects the oil control ring that provides the best performance in regard to correct unit pressure characteristics. Always use genuine Onan parts for best results.

The piston is fitted with a full-floating piston pin. Two lock rings, one at each side, keep the pin in place. Be sure these lock rings are properly positioned in their groove before installing the piston and

connecting rod in the engine. Consult the Table of Dimensions and Clearances for the correct piston-to-cylinder clearance.

CONNECTING RODS

Service the connecting rods at the same time as the pistons or piston rings. Rods must be removed with the piston. There are two types of connecting rods: Prior to Spec H models, rods are aluminum alloy with bearings integral; beginning with Spec H, rods are forged steel with replaceable bushings and bearings. Rods are available in standard or .010, .020, or .030-inch undersize. Bearings are available in standard or .002, .010, .020, or .030-inch undersize.

Obtain proper rod clearance by replacing the pin bushing and the bearings. Rod bearings are precision size and require no reaming.

Properly align the connecting rod and piston assembly before assembling to the engine. Aligning should be done on an accurate aligning gauge by a competent operator. Misalignment causes rapid wear of the piston, pin, cylinder, and connecting rod.

Install connecting rods and caps with the raised lines (witness marks) aligned, and with the caps facing the oil base. The rod and cap numbered two fits on the crankshaft journal nearest the bearing plate. Coat the crankshaft journal bearing surfaces with oil before installing the rods. Crank the engine by hand to see that the rods are 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 the 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.

NOTE: Whenever making major repairs on the engine, always inspect the drilled passages of the crankshaft. Clean them to remove any foreign material and to assure proper lubrication of the connecting rods. Use gaskets as necessary behind the bearing plate to obtain proper crankshaft end play (Figure 20).

BEARINGS

Camshaft or crankshaft bearing removal requires complete engine disassembly. Use a press or suitable drive plug to remove the bearings. Support the casting

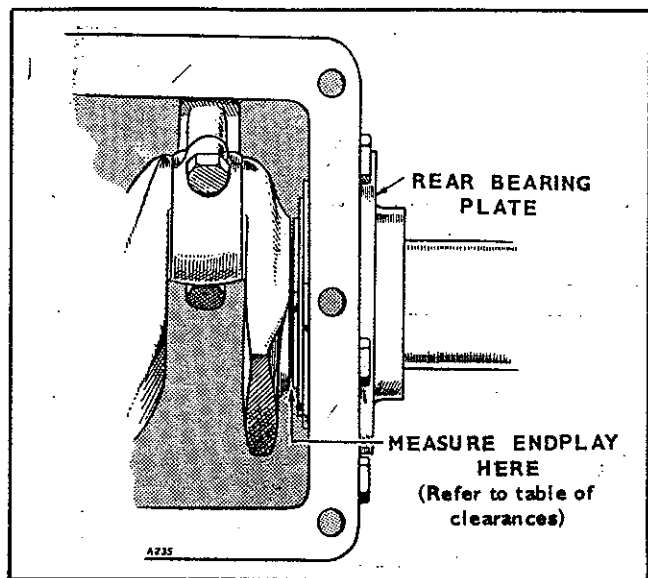


FIGURE 20. CRANKSHAFT ENDPLAY

to avoid distortion. 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.

Crankshaft main bearings are precision type that *do not* require line reaming or boring after installation. They are available in standard size, .002, .010, .020 or .030 inch 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.*

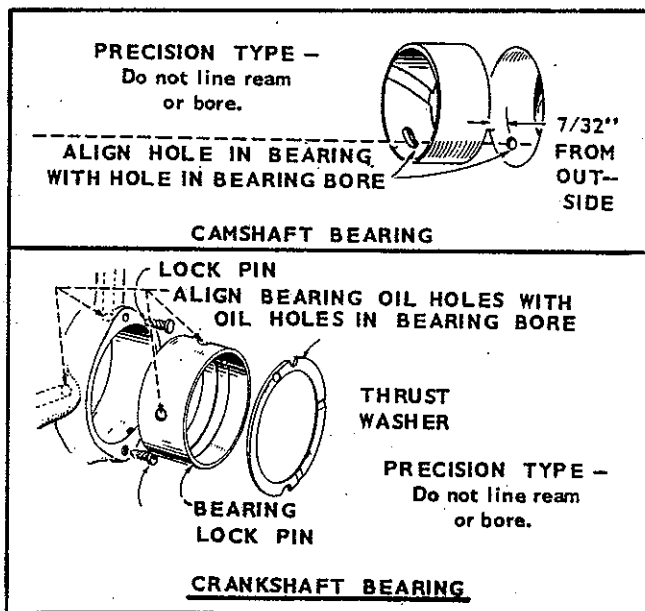


FIGURE 21. CAMSHAFT AND CRANKSHAFT BEARINGS

If practical, cool the precision bearing to shrink it. Crankshaft bearings must be installed from the inside of the cylinder block. Align the oil hole(s) in the bearing with the oil hole(s) in the bearing bore (Figure 21). The oil passage holes must be at least half open. The cold-oiled precision bearing should be pressed into position. If head of lock pin is damaged, use side cutters or Easy Out tool to remove and install new pin. Apply oil to thrust washer (one used with each bearing) 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 the washers two notches must fit over two lock pins to prevent riding on the crankshaft.

The precision camshaft bearings (Figure 21) do not require reaming or 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 the proper position and the narrow section facing out (except bores without oil holes, install with bearing groove at the top). Align the bearing with the bore. Press the front bearing in flush with the outside end of the bearing bore. Press the rear bearing in flush with the bottom of the counterbore that receives the expansion plug.

OIL SEALS

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

Before installing the seals, fill the space between the lips with a fibrous grease or stiff cup grease (Figure 22). This improves sealing.

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 (Onan tool number 420A181) 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.

OIL PUMP

Do not disassemble the oil pump if it has been working properly. Individual pump parts, with the exception of gaskets, are not available.

However, if the pump is not working properly, remove and inspect it. To remove the pump, detach the intake cup assembly (Figure 23). Prime the pump with oil before reinstalling it.

When fitting the pump onto the engine, use one of the thinner gaskets supplied in the repair kit. The pump must be free when tightened. If the pump is not free, use a thicker gasket.

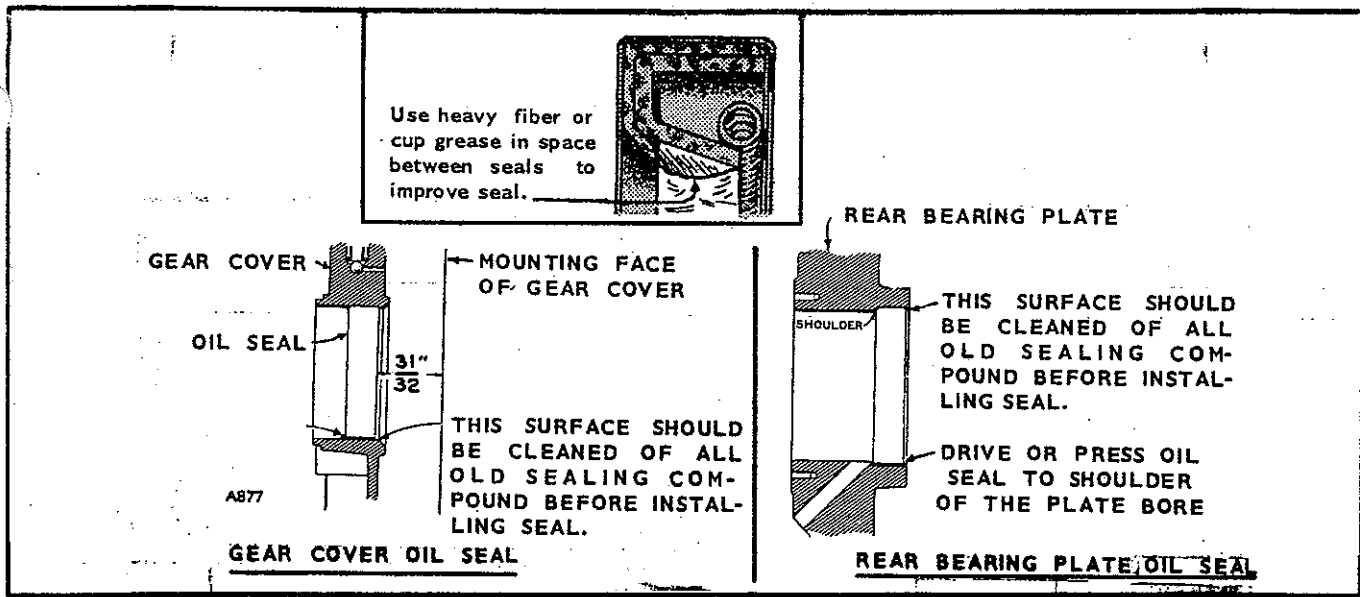


FIGURE 22. GEAR COVER AND REAR BEARING PLATE OIL SEALS

OIL PRESSURE RELIEF VALVE ADJUSTMENT

Engine oil pressure is easily adjusted by means of the slotted stud and locknut located near the breather tube. See Figure 24. When the engine is thoroughly warmed up, oil pressure readings should be between 20 and 35 pounds. To increase oil pressure, loosen the locknut and turn the stud inward. To decrease oil pressure, loosen the locknut and turn the stud outward. Be sure to tighten the locknut securely after making an adjustment. The spring and plunger can easily be removed and cleaned.

Low oil pressure may indicate:

- worn main or connecting rod bearings,
- improper clearance at the bearings,
- a weak or broken by-pass spring,
- an improperly adjusted by-pass, or
- a defective gauge.

Check the oil pressure gauge before making any other test.

CYLINDER

The cylinder wears very little in normal service. If, through improper lubrication or accident, the cylinder wall should become scored or badly worn, the cylinder may be rebored and honed to accommodate a new piston and rings of one of the available undersizes. If the cylinder is not being reconditioned, but new piston rings are being installed, remove any ridge that may have formed at the top of the piston ring travel in the cylinder bore. The engine may be fitted at the factory with a .005-inch oversize piston, and is so indicated by a letter E following the engine serial number stamped on the cylinder block and on the unit nameplate. The

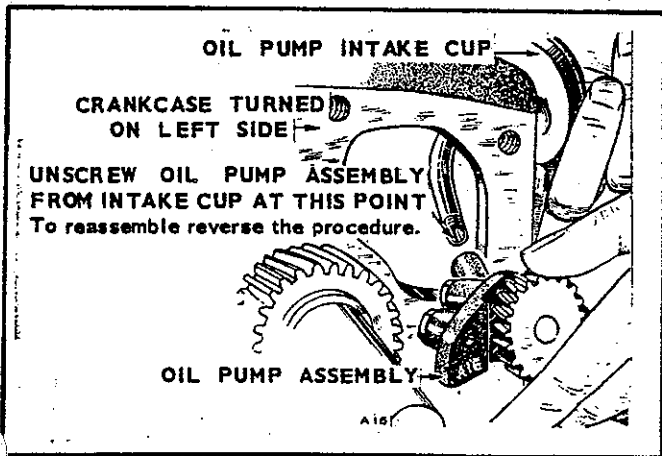


FIGURE 23. OIL PUMP ASSEMBLY

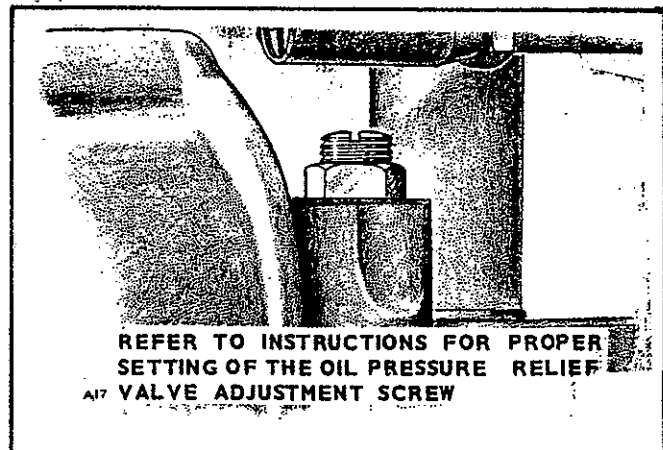


FIGURE 24. OIL PRESSURE RELIEF VALVE ADJUSTMENT

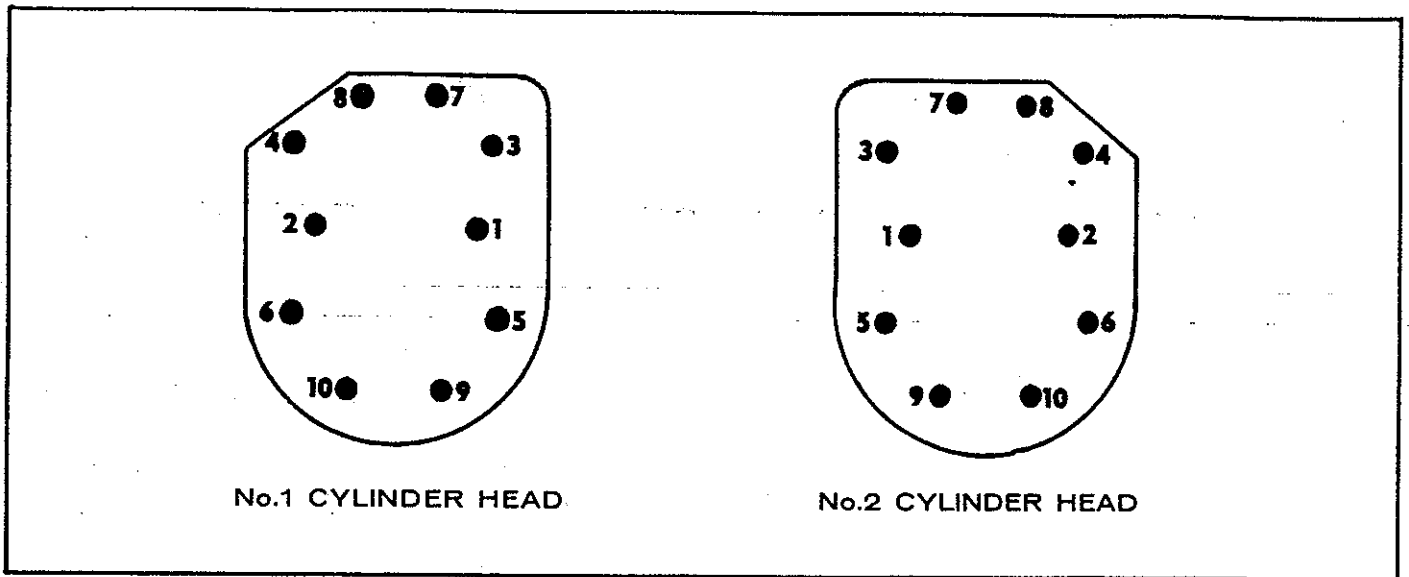


FIGURE 25. HEAD BOLT TIGHTENING ORDER

standard cylinder bore size is listed in the Table of Dimensions and Clearances.

CYLINDER HEADS

The cylinder head bolts should be tightened in the order designated in Figure 25, and to the torque specified at the time the engine is assembled or the cylinder

head replaced. This should be done when the engine is at room temperature. At some later time, after the engine has been operated (so that it has reached normal hot temperature and allowed to cool to room temperature), the cylinder head bolts should be retorqued to the original specified torque. (Refer to the Table of Assembly Torques.)

IMPORTANT: *This retightening should be done before the engine has been run a total of fifty operating hours.*

STARTING SYSTEM

SERVICING THE STARTER

Refer to Figure 26 showing the optional Readi-Pull manual starter disassembled.

WARNING The recoil spring may unwind and cause injury if allowed to fly wildly when starter is disassembled or assembled.

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

Remove the starter from its mounting ring by removing the four clamping screws.

To install a new rope, rotate the sheave (11) 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 rams in the rope sheave improves a sluggish 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 (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.

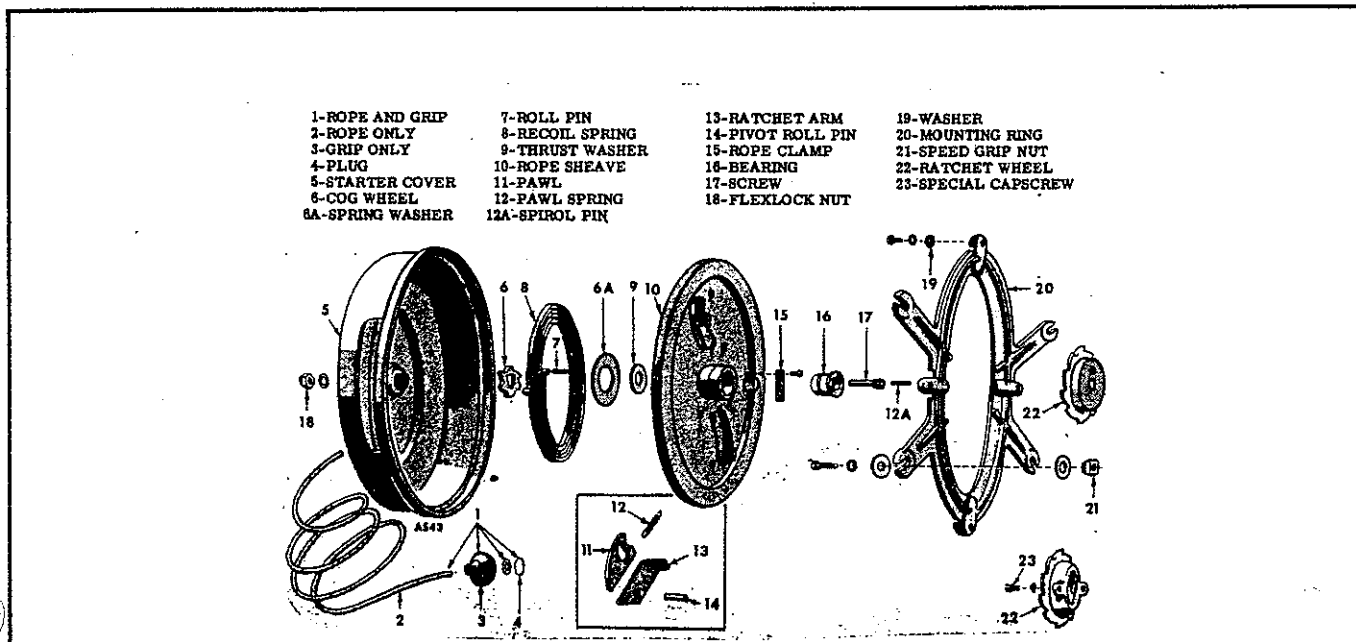


FIGURE 26. READI-PULL STARTER DISASSEMBLY

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

INSTALLING THE STARTER

Check the engine blower housing. If the mounting holes are worn, or if the blower housing is otherwise damaged, replace it with a new one. Refer to Figure 27.

1. Install the new ratchet wheel (1) against the rope sheave (11) using a lockwasher (10) and flywheel mounting screw (9). Discard the large flat washer from engines so equipped. Engage drive hole with flywheel boss.
2. Four special nuts 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. Install centering pin (12) in starter center screw (14) allowing 3/8 inch to protrude. For reinstallations, adjust pin depth.
4. Center the starter assembly over the ratchet wheel with the centering pin engaging the center hole of the flywheel mounting screw. While holding in position, mount the starter, using a hex head screw, lockwasher and two flat washers at each mounting arm as shown in Detail A. Tighten the mounting screws securely.
5. The direction of pull on the starter rope is adjustable to fit the requirements of the individual installation. See Detail B. To change the direction of pull, loosen the four clamp screws (8) 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 does not rub against the clamping screws.

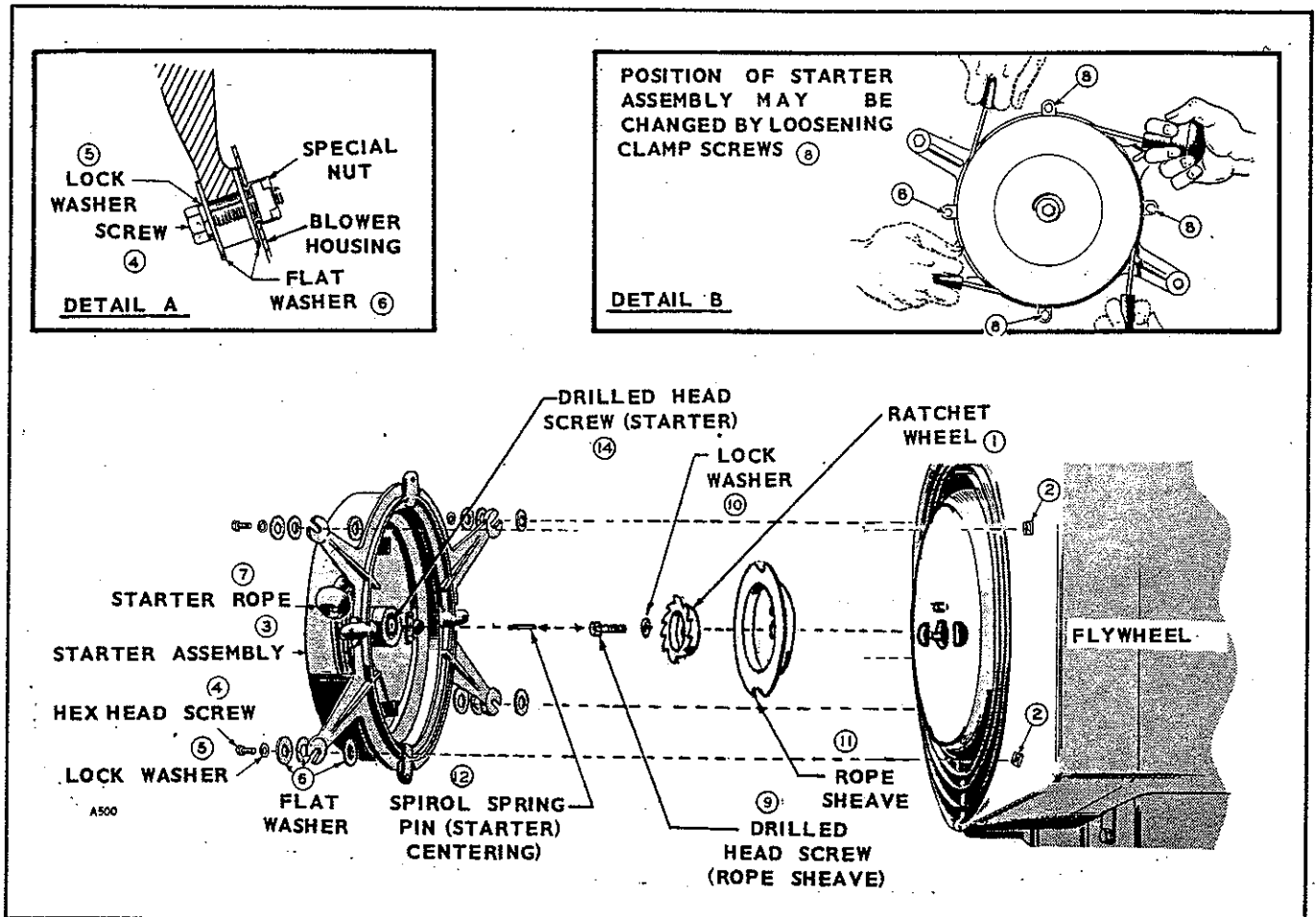


FIGURE 27. STARTER INSTALLATION

GENERATOR MAINTENANCE

Generators normally require little care other than a periodic check of the brushes, commutator and collector rings. If a major generator repair should become necessary, have the equipment checked and repaired by a competent electrician who is thoroughly familiar with electric generating equipment. Continuity tests can be performed without disassembling the generator.

GENERATOR DISASSEMBLY

1. The first step is to remove generator band and end bell cover. Remove all brush springs and lift the brushes from their holders.
2. Remove generator through-stud nuts. Hold both the endbell and frame assembly, since they are separate parts, and remove them as one assembly from the adapter. Screwdriver slots in the adapter provide for prying the frame loose. Be careful not to let the frame assembly rest or drag on the armature.
3. Remove baffle ring from adapter. Turn armature through stud nut out to the end of the through stud. While pulling the armature outward with one hand, strike a sharp endwise blow on the nut with a heavy soft faced hammer to loosen the armature. If the armature does not come loose, strike the arma-

ture with a sharp downward blow in the center of the lamination stack with a lead or plastic hammer. Rotate the armature and repeat. Be careful not to hit the collector rings, commutator, bearing or windings.

4. Upon disassembly, all parts should be wiped clean and visually inspected.

BRUSHES AND SPRINGS

Inspect brushes periodically. Replace brushes worn to 5/8 inch. Replace springs if damaged or if proper tension is questionable. Rapid brush wear may be caused from high mica between commutator bars, rough commutator or collector rings, or from a deviation from "neutral" position in the adjustment of the brush rig. NEVER bend the constant-pressure-type spring over the edge of its support.

BRUSH RIG POSITION

Check the reference mark on the edge of the brush rig and if necessary, align it with the boss in the end bell (Figure 29). If the brush rig is adjusted so that there is arcing of the brushes, brush wear will be rapid, voltage and current will not hold steady, and the generator may overheat.

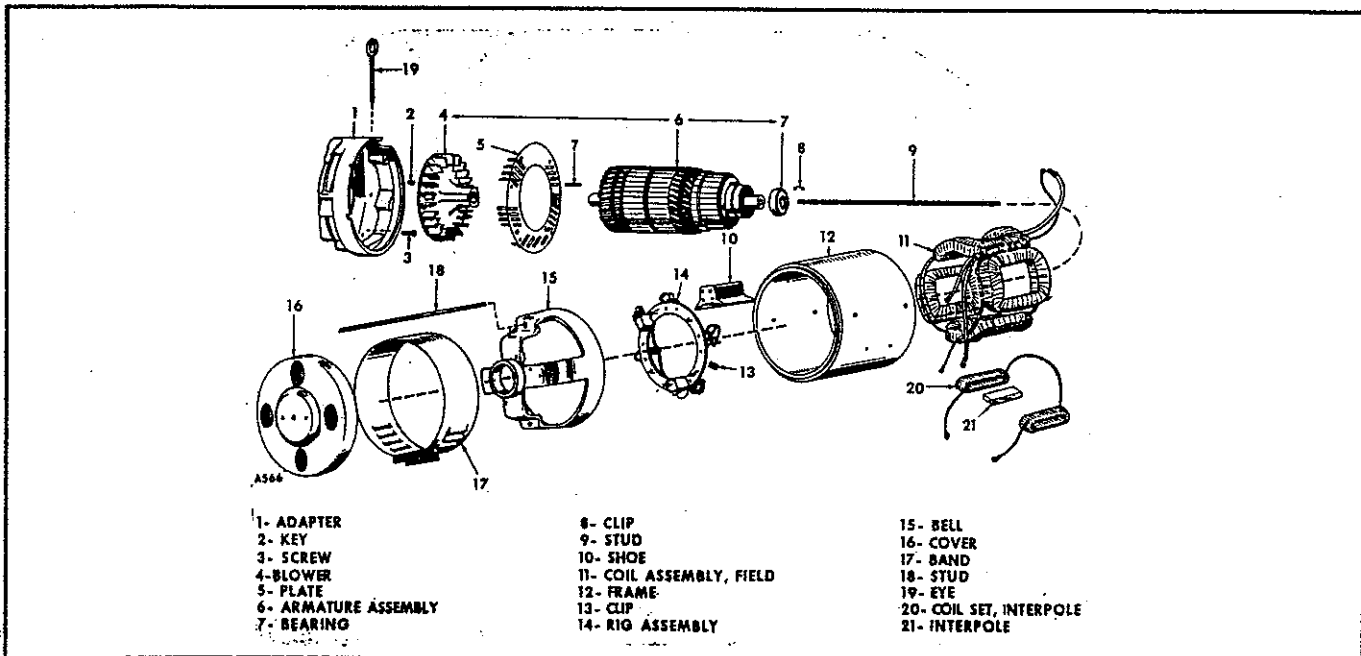


FIGURE 28. GENERATOR DISASSEMBLY

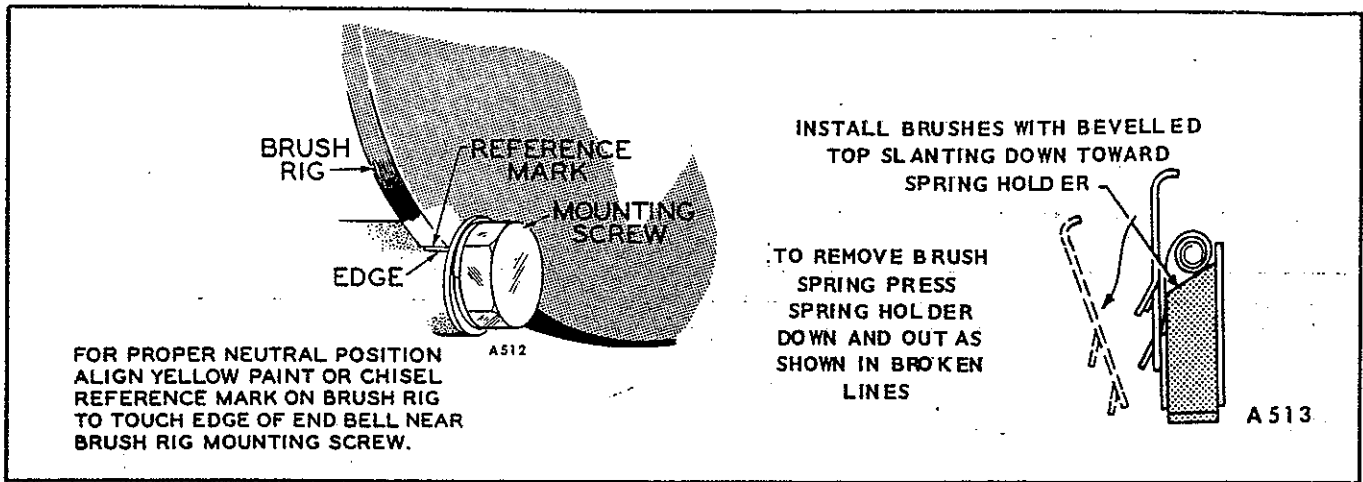


FIGURE 29. BRUSH RIG POSITIONING

Whenever a new brush rig or armature is installed, the brush rig must be adjusted to the point where the brushes do not arc, regardless of where the witness mark falls. This is commonly known as the "neutral" brush position.

COMMUTATOR

Commutator bars wear down with usage so that the mica between them must be undercut. This should be done as soon as the mica on any part of the commutator touches the brushes. Most service shops have equipment for undercutting mica. An emergency undercutting tool (Figure 30) can be made from a hack saw blade. Avoid injury to the surfaces of the copper bars. Leave no burrs along the edges of the bars. The mica must also be undercut whenever the commutator is refinished.

COLLECTOR RINGS

If collector rings become grooved or out of round, or the brush contact surface becomes pitted or rough so that good brush seating cannot be maintained, remove the armature and refinish the collector rings in a lathe. If the commutator appears to be rough or scored, refinish it at the same time. Remove or adequately shield the ball bearing during refinishing.

TESTING WINDINGS

A test lamp set and an armature growler are required for the various tests. Before making any tests, lift all brushes in their holders and disconnect the load circuit wires from the set. If the armature tests defective, replace the entire coil assembly unless the trouble is in one of the external leads. Then it can be repaired as required.

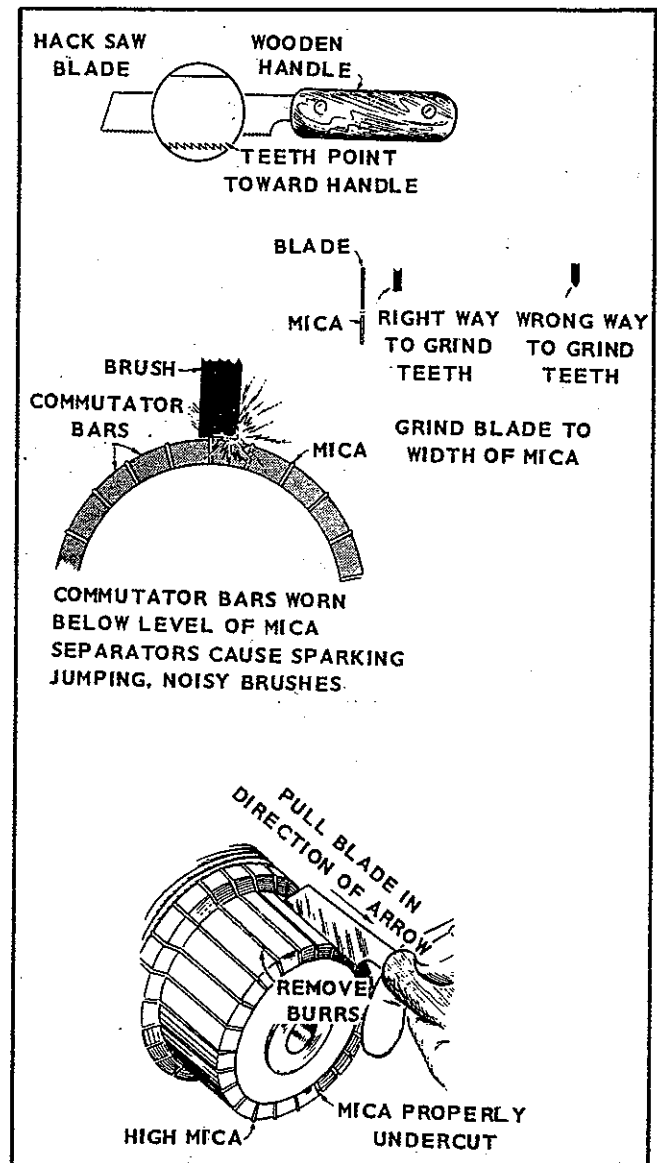


FIGURE 30. UNDERCUTTING COMMUTATOR MICA

ARMATURE GROUND TEST

To test the armature for a grounded condition, lift or remove the brushes so that none contact the commutator or collector rings. Use a continuity test lamp set. Place one test prod on the commutator, and the other test prod on a bare, clean part of the armature shaft (Figure 31). The test prods must make good electrical contact. The test lamp should not glow. If the test lamp does glow, the DC winding or the commutator is grounded. To test the AC winding, place one test prod on one of the collector rings and the other test prod on the armature shaft. If the test lamp glows, the AC winding or a collector ring is grounded. Replace a grounded armature with a new one.

ARMATURE OPEN CIRCUIT TEST

Armature AC windings may be tested for an open circuit without armature removal. Testing DC windings requires removal and the use of an armature growler.

To test the AC winding, be sure all brushes are lifted or removed. Use a test lamp set. Place one test prod on each of the collector rings. If the test lamp does not glow, the AC winding is open circuited.

To test the DC winding, place the armature in a growler. With the growler current on, pass a smooth steel strip across the commutator segments (Figure 31). Repeat all around the commutator. At some point around the commutator, a spark should occur as the strip contacts two adjacent segments. Rotate the armature slightly and repeat the test. Continue until a spark is obtained between all adjacent segments. If no spark is obtained at some point, and open circuit is indicated. Replace an open circuited armature with a new one.

NOTE: A short circuit in the winding might prevent sparking. This condition may be indicated by the short circuit test described in the next paragraph.

ARMATURE SHORT CIRCUIT TEST

To test for a short circuit, place the armature in a growler. With the growler current on, hold a steel strip about 1/2 inch above the armature laminations (Figure 31). Pass the strip back and forth over the laminations. Cover as much of the lamination area as possible. If the strip is magnetically attracted to the armature at any point, a short circuit is indicated. After testing in one position, rotate the armature slightly in the growler and repeat the test. Continue until a complete revolution of the armature in the growler has been made. Replace a short-circuited armature with a new one.

TESTING FIELD WINDINGS FOR GROUNDS

To test a coil assembly for a ground, disconnect its external leads and touch one test prod to the terminal of one of its leads and the other test prod to the generator frame. If the lamp lights, the coil assembly being

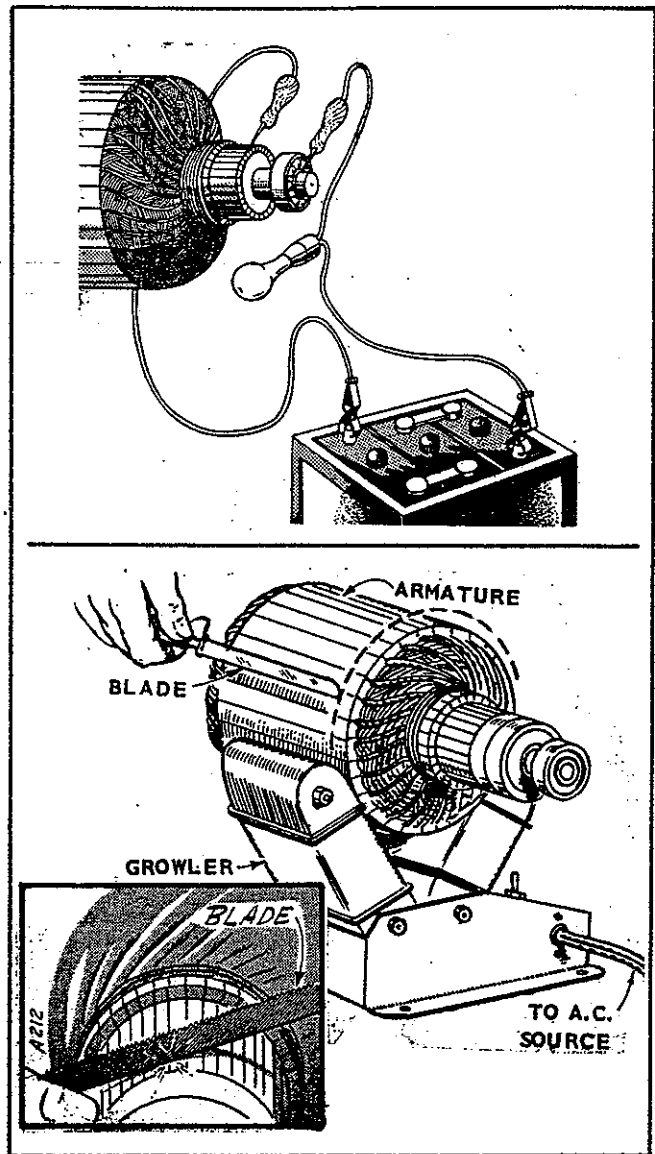


FIGURE 31. ARMATURE TESTING

tested is grounded. The ground may be in a coil, a coil connection, or a coil lead. Repair or replace as required.

TESTING FIELD WINDINGS FOR OPEN CIRCUIT

To test a coil assembly for an open circuit, disconnect its external leads and touch one test prod to the terminal of one coil winding lead and the other test prod to each of the other leads of that coil winding in turn. If the lamp does not light, the circuit being tested is open. If the fault lies in connection between coils or in a coil lead, the trouble can be repaired. If it is inside the coil, replace the entire coil assembly.

BALL BEARING

If armature ball bearing replacement becomes necessary, pull the bearing from the shaft with a suitable

bearing puller. Be careful not to damage the armature shaft because it must remain true to serve as a turning center when refinishing the commutator or collector rings. Drive the bearing on to the shoulder of the shaft. Use an Onan double-sealed, prelubricated ball bearing.

GENERATOR ASSEMBLY

1. Clean and inspect all mating surfaces. Surfaces should be free of nicks and dirt.
2. Coat mating area between the generator shaft and the engine crankshaft with a thin film of lubricating oil, Molycoat or equal.
3. Assemble the armature through stud to the engine crankshaft with required torque.
4. Check to see that the key is in the crankshaft.
5. Slide armature over the through stud and onto the crankshaft, being careful not to let the weight of the armature rest on the through stud.
6. Install baffle ring, when used.
7. Assemble generator through studs to the adapter with required torque.

CAUTION *DO NOT tighten the armature or rotor through stud before mounting the frame and bearing support. If this procedure is not followed, misalignment may occur, shortening the life of the rear main and outboard bearings. Also, cranking torque requirements could be doubled, resulting in damage to the commutator and DC brushes.*

8. Install the frame and bearing support. Tighten frame to required torque.
9. NOW torque down the armature through stud nut. The armature and frame are in alignment if the frame and bearing support are tightened before tightening the armature.
10. Tap the bearing support in the horizontal and vertical plane with a lead hammer to relieve stress on the components. Then, recheck the torque.
11. Reconnect the decompression solenoid and other leads to the engine.
12. Reinstall the battery cables.
13. Align the brush rig.

CONTROL

If any control equipment fails to function properly, replace the defective part with a new part rather than try to repair the old part. Check all electrical connections and contacts whenever servicing control equipment.

When disassembling controls, tag each lead that is to be removed, and mark the lead connection point on the tag to assure correct connections when assembling.

Always disconnect the battery (electric start units) whenever servicing controls to avoid accidentally starting the unit.

GENERATOR TROUBLESHOOTING

| POSSIBLE CAUSE | REMEDY |
|---|---|
| ENGINE CRANKS TOO SLOWLY | |
| Brushes worn excessively or making poor contact. | Replace brushes or clean commutator. |
| Short circuit in generator or load circuit. | Repair or replace parts necessary. Disconnect load. |
| EXCESSIVE ARCING OF BRUSHES | |
| Rough commutator or rings | Turn down. |
| Dirty commutator or rings. | Clean. |
| Brushes not seating properly. | Sand to a good seat or reduce load until worn in. |
| Open circuit in armature. | Install a new armature. |
| Brush rig out of position. | Line up properly. |
| GENERATOR OVERHEATING | |
| Operation of welder for long periods without welding. | Do not run engine for long periods of time unless welding, or using AC output. |
| Improper brush rig position. | See "Brushes" in "Generator" section. |
| UNSATISFACTORY WELDING AT HIGH AMPERAGE POSITION | |
| Engine lacks power. | See remedies under "Engine Misfires at Heavy Load". |
| Poor compression. | Tighten cylinder heads and spark plugs. If still not corrected, grind valves and replace piston rings if necessary. |
| Faulty carburetion. | Check fuel system. Clean, adjust or repair as needed. |
| Micro switch DC contacts stuck closed. | Replace micro switch. |
| Choke partially closed. | Choke plate must be wide open after warm up. |
| Carbon in cylinders or in carburetor venturi. | Remove carbon. |

Cont.

| POSSIBLE CAUSE | REMEDY |
|---|--|
| UNSATISFACTORY WELDING CONT. | |
| Restricted exhaust lines. | Clean or increase the size. |
| ENGINE RUNS BUT VOLTAGE DOES NOT BUILD UP | |
| Poor brush contact. | See that brushes seat well on commutator, collector rings, are free in holders and not worn shorter than 5/8" and have good spring tension. |
| Open circuit, short circuit, or ground in armature. | See "Generator Maintenance and Repair" section. |
| VOLTAGE UNSTEADY BUT ENGINE NOT MISFIRING | |
| Speed too low. | Adjust governor to correct speed. |
| Poor commutator or brush contact. | Refinish commutator or undercut mica if necessary. See that brushes seat well on commutator, are free in holders, are <i>not worn</i> shorter than 5/8", and have good spring tension. |
| Loose connections. | Tighten connections. |
| Improper brush rig position. | See "Generator Maintenance and Repair" section. |
| NO AC OUTPUT AVAILABLE | |
| Micro switch AC contacts stuck open. | Replace micro switch. |
| AC OUTPUT WHEN WELDING | |
| Micro switch AC contacts stuck closed. | Replace micro switch. |
| AC OUTPUT VOLTAGE LOW | |
| Micro switch DC contacts stuck open. | Replace micro switch. |
| NOISY BRUSHES | |
| High mica between bars of commutator. | Undercut mica. |

PARTS CATALOG

This catalog applies to the standard 200 Ampere Welders as listed below. Parts are arranged in groups of related items. 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 and SPEC NO. from the set nameplate, select the Parts Key No. (1, 2, etc. in the last column) that applies to your set 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 set sides are determined by FACING the engine end (front) of the set.

WELDER DATA TABLE

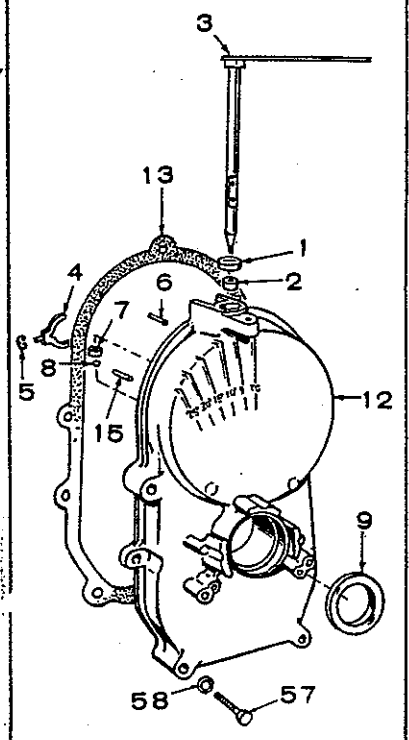
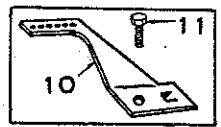
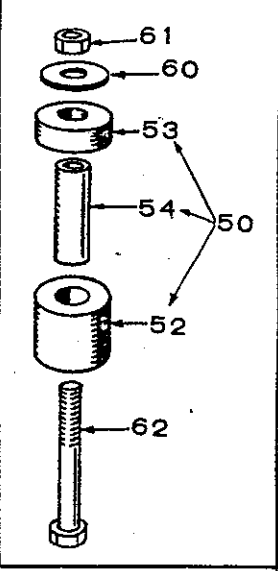
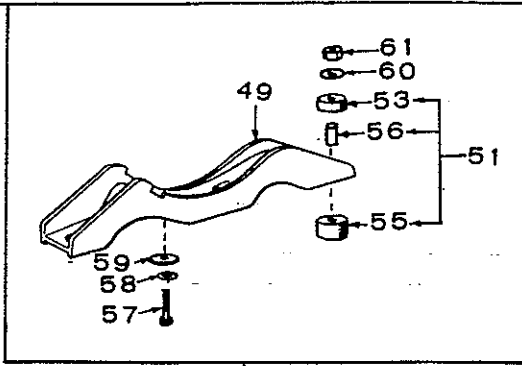
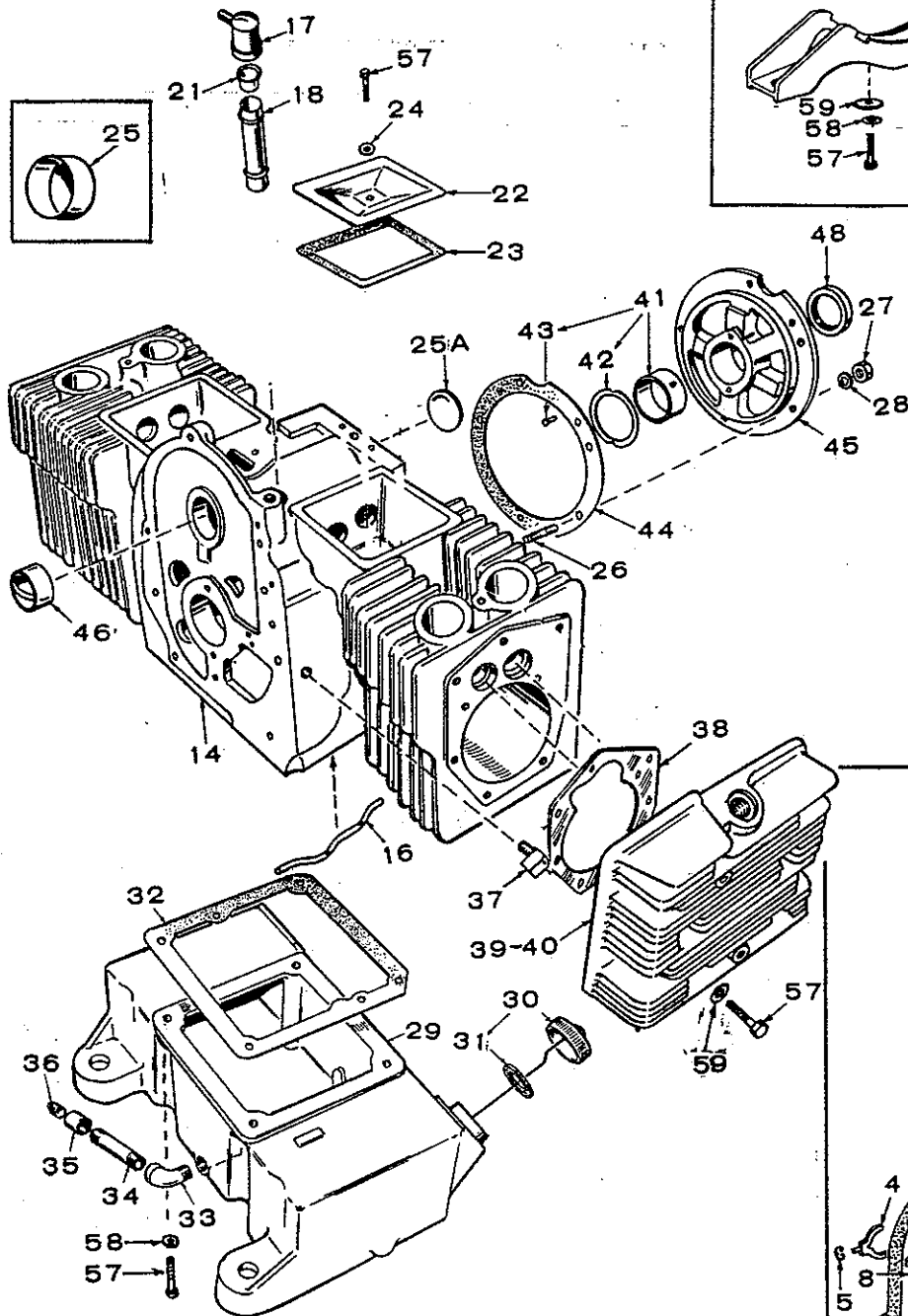
| ★ MODEL AND SPEC NO. | ELECTRICAL DATA | | | | | | TYPE | PARTS KEY NO. |
|-------------------------|----------------------------|-------|---------------|--|-------|-------|----------|------------------|
| | DC OUTPUT (For Welding) | | | AC OUTPUT, 1 Phase 2 Wire (Available continuously when not welding) | | | | |
| | Amps | Volts | Duty Cycle | Watts | Volts | Hertz | | |
| 6.0CCK-331P/1* | 200 | 30 | 50% | 3500 | 120 | 60 | Manual | 1 |
| 6.0CCK-332P/1* | 200 | 30 | 50% | 3500 | 240 | 60 | Manual | 1 |
| 6.0CCK-5331P/1* | 200 | 30 | 50% | 2500 | 120 | 50 | Manual | 1 |
| 6.0CCK-5332P/1* | 200 | 30 | 50% | 2500 | 240 | 50 | Manual | 1 |
| 6.0CCK-331E/1* | 200 | 30 | 50% | 3500 | 120 | 60 | Electric | 2 |
| 6.0CCK-332E/1* | 200 | 30 | 50% | 3500 | 240 | 60 | Electric | 2 |
| 6.0CCK-5331E/1* | 200 | 30 | 50% | 2500 | 120 | 50 | Electric | 2 |
| 6.0CCK-5332E/1* | 200 | 30 | 50% | 2500 | 240 | 50 | Electric | 2 |

* - The Specification Letter advances (A to B, B to C, etc.) with manufacturing changes.

★ - New model designations shown, begin during 1969. Previous designations did not use a decimal in the KW rating. EXAMPLE: 6.0CCK was formerly 6CCK.

NOTE: Hertz is a unit of frequency equal to one cycle per second.

**CYLINDER BLOCK, OIL BASE
AND GEAR COVER GROUP**

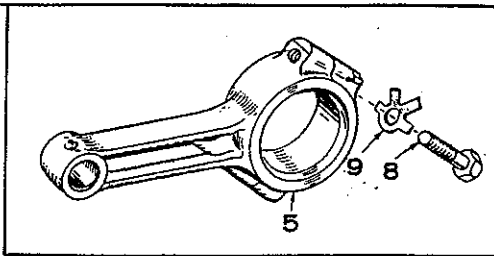
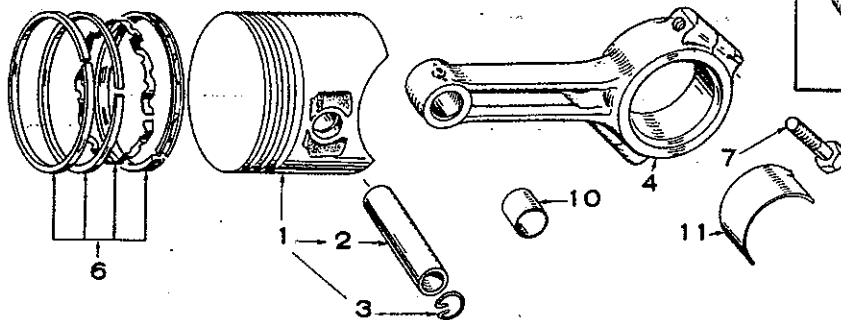


| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|-------------------------------------|-----------|--|
| 1 | 509-0008 | 1 | †Seal, Governor Shaft |
| 2 | 510-0013 | 1 | †Bearing, Governor Shaft, Upper |
| 3 | 150-0377 | 1 | †Shaft and Arm, Governor |
| 4 | 150-0620 | 1 | †Yoke, Governor Shaft |
| 5 | 518-0129 | 1 | †Ring, Yoke Retainer |
| 6 | 516-0130 | 1 | †Pin, Roll - Governor Cup Stop |
| 7 | 510-0008 | 1 | †Bearing, Governor Shaft, Lower |
| 8 | 510-0014 | 1 | †Ball, Bearing - Governor Shaft |
| 9 | 509-0040 | 1 | †Seal, Oil - Gear Cover |
| 10 | 150-1000 | 1 | †Extension, Governor Arm |
| 11 | 815-0181 | 1 | †Screw, Governor Arm Extension Mounting (10-32 x 1/2") |
| 12 | 103-0163 | 1 | Cover Assembly, Gear (Includes Parts Marked †) |
| 13 | 103-0011 | 1 | Gasket, Gear Cover |
| 14 | 110-0915 | 1 | Block Assembly, Cylinder (Includes Parts Marked *) |
| 15 | 516-0011 | 2 | *Pin, Gear Cover (5/16 x 1-1/8") |
| 16 | 120-0386 | 1 | *Tube, Oil - Crankcase |
| 17 | 123-0293 | 1 | Cap, Breather Tube |
| 18 | 123-0129 | 1 | Tube, Breather - (Includes Steel Baffle) |
| 21 | 123-0104 | 1 | Valve, Breather Tube |
| 22 | 110-0666 | 2 | Cover, Valve Compartment |
| 23 | 110-0667 | 2 | Gasket, Valve Compartment Cover |
| 24 | 526-0063 | 2 | Washer, Copper - Valve Compartment Cover |
| 25 | 110-1283 | 1 | *Cover, Timing Control - Spec H and J |
| 25A | 517-0048 | 1 | *Plug, Camshaft Expansion - Spec F and Begin Spec L |
| 26 | 520-0114 | 5 | *Stud, Rear Bearing Plate Mounting - 5/16 x 1-5/16" |
| 27 | 110-0445 | 5 | *Nut, Rear Bearing Plate |
| 28 | 850-0045 | 5 | *Washer, Lock (5/16) - Rear Bearing Plate |
| 29 | 102-0418 | 1 | Base, Oil |
| 30 | 123-0489 | 1 | Cap & Indicator, Oil Fill |
| 31 | 123-0191 | 1 | Gasket, Oil Fill Cap |
| 32 | 102-0158 | 1 | Gasket, Oil Base Mounting |
| 33 | ELBOW, OIL DRAIN (45°) - KEY 2 ONLY | | |
| | 505-0119 | 1 | Early Models (3/8) |
| | 505-0248 | 1 | Later Models (1/2) |
| 34 | NIPPLE, OIL DRAIN | | |
| | 505-0240 | 1 | Early Models (3/8 x 3-1/2") |
| | 505-0176 | 1 | Later Models (1/2 x 3-1/2") |
| 35 | COUPLING, OIL DRAIN | | |
| | 505-0028 | 1 | Early Models (3/8) |
| | 505-0014 | 1 | Later Models (1/2) |
| 36 | PLUG, OIL DRAIN | | |
| | 505-0110 | 1 | Early Models (3/8) |
| | 505-0056 | 1 | Later Models (1/2) |
| 37 | 502-0020 | 1 | Elbow, Street - Oil Line to Block |
| 38 | 110-0892 | 2 | Gasket, Cylinder Head |
| 39 | HEAD, CYLINDER - RIGHT HAND | | |
| | 110-0890 | 1 | Spec F Only |
| | 110-0884 | 1 | Begin Spec H - Hi-Compression |
| 40 | HEAD, CYLINDER - LEFT HAND | | |
| | 110-0891 | 1 | Spec F Only |
| | 110-0883 | 1 | Begin Spec H - Hi-Compression |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|---|-----------|---|
| 41 | *BEARING KIT, CRANKSHAFT - PRECISION (Includes Thrust Washer and Lock Pins) | | |
| | 101-0420 | 2 | Standard |
| | 101-0420-02 | 2 | .002" Undersize |
| | 101-0420-10 | 2 | .010" Undersize |
| | 101-0420-20 | 2 | .020" Undersize |
| | 101-0420-30 | 2 | .030" Undersize |
| 42 | 104-0575 | 2 | *Washer, Crankshaft Bearing Thrust - Included in Bearing Kit |
| 43 | 516-0072 | 4 | *Pin, Thrust Washer Stop |
| 44 | 101-0115 | 1 | *Gasket Kit, Rear Bearing Plate |
| 45 | 101-0316 | 1 | *Plate, Rear Bearing (Less Bearing) |
| 46 | 101-0367 | 2 | *Bearing, Camshaft Front and Rear |
| 48 | 509-0041 | 1 | Seal, Oil - Rear Bearing Plate |
| 49 | 232-1368 | 1 | Support, Generator |
| | CUSHION ASSEMBLY, SET MOUNTING | | |
| 50 | 402-0226 | 2 | Engine End |
| 51 | 402-0223 | 2 | Generator End |
| 52 | 402-0038 | 2 | Cushion, Mounting (Lower) Engine End |
| 53 | 402-0131 | 4 | Cushion, Mounting (Upper) Engine End (2), Generator End (2) |
| 54 | 402-0137 | 2 | Bushing, Spacer - Engine End |
| 55 | 402-0192 | 2 | Cushion, Mounting (Lower) Generator End |
| 56 | 402-0193 | 2 | Bushing (Sleeve), Mounting - Generator End |
| 57 | SCREW, CAP - HEX HEAD | | |
| | 800-0012 | 2 | Valve Compartment Cover Mounting |
| | 110-0879 | 8 | Cylinder Head Mounting 5/16-18 x 1-1/4" |
| | 114-0022 | 14 | (10) Cylinder Head Mounting, (4) Gear Cover Mounting (5/16-18 x 1-3/4") |
| | 800-0034 | 1 | Gear Cover Mounting (5/16-18 x 2-1/4") |
| | 102-0455 | 4 | Oil Base Mounting - (3/8-16 x 1-1/4") |
| | 800-0050 | 2 | Generator Support Mounting - (3/8-16 x 1") |
| 58 | WASHER, LOCK | | |
| | 850-0050 | 4 | Oil Base Mounting (3/8) |
| | 850-0045 | 5 | Gear Cover Mounting (5/16) |
| | 850-0050 | 2 | Generator Support Mounting (3/8) |
| 59 | WASHER, FLAT | | |
| | 526-0030 | 2 | Generator Support Mounting (5/16) |
| | 526-0122 | 18 | Cylinder Head Mounting |
| 60 | 526-0076 | 4 | Washer, Flat (11/32" I.D. x 1-1/2" O.D. x 1/16" thick) - Cushion Mounting |
| 61 | 870-0048 | 4 | Nut, Hex (5/16-18 Locking) - Cushion Mounting |
| 62 | 800-0037 | 2 | Screw (5/16-18 x 3") - Cushion Mounting - Engine End |

* - Parts included in Cylinder Block Assembly.

† - Parts included in Gear Cover Assembly.



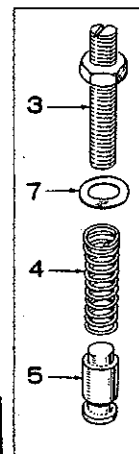
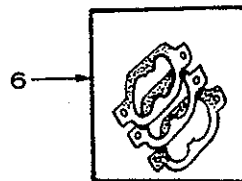
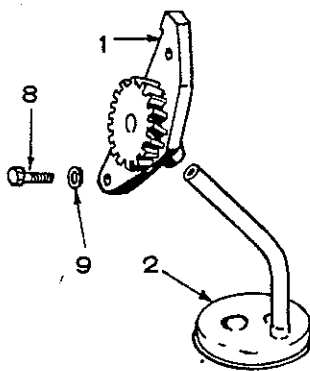
CONNECTING ROD AND PISTON GROUP

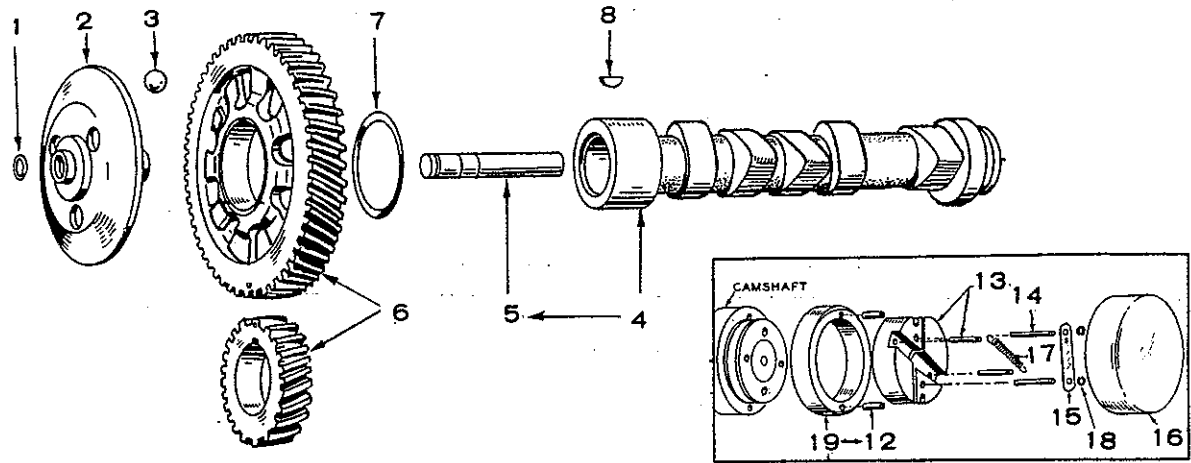
| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|---|-----------|--|
| 1 | PISTON AND PIN ASSEMBLY - INCLUDES RETAINER RINGS | | |
| | 112-0071 | 2 | Standard |
| | 112-0071-05 | 2 | .005" Oversize |
| | 112-0071-10 | 2 | .010" Oversize |
| | 112-0071-20 | 2 | .020" Oversize |
| | 112-0071-30 | 2 | .030" Oversize |
| | 112-0071-40 | 2 | .040" Oversize |
| 2 | PIN, PISTON | | |
| | 112-0069 | 2 | Standard |
| 3 | 112-0003 | 4 | Ring, Piston Pin Retaining |
| 4 | 114-0203 | 2 | Rod, Connecting (Forged) Includes Bushing & Place Bolts - Begin Spec H |
| 5 | ROD, CONNECTING (Aluminum) - SPEC F ONLY | | |
| | 114-0098 | 2 | Standard |
| | 114-0098-10 | 2 | .010" Undersize |
| | 114-0098-20 | 2 | .020" Undersize |
| | 114-0098-30 | 2 | .030" Undersize |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|---|-----------|---|
| 6 | RING SET, PISTON | | |
| | 113-0088 | 2 | Standard |
| | 113-0088-05 | 2 | .005" Oversize |
| | 113-0088-10 | 2 | .010" Oversize |
| | 113-0088-20 | 2 | .020" Oversize |
| | 113-0088-30 | 2 | .030" Oversize |
| | 113-0088-40 | 2 | .040" Oversize |
| 7 | 805-0010 | 4 | Bolt, Place - Connecting Rod Caps - Begin Spec H |
| 8 | 110-0284 | 4 | Screw, Connecting Rod Cap - Spec F Only |
| 9 | 114-0059 | 4 | Washer, Connecting Rod Cap - Spec F Only |
| 10 | 114-0036 | 2 | Bushing, Piston Pin - Connecting Rod - Begin Spec H |
| 11 | BEARING HALF, CONNECTING ROD - BEGIN SPEC H | | |
| | 114-0145 | 4 | Standard |
| | 114-0145-02 | 4 | .002" Undersize |
| | 114-0145-10 | 4 | .010" Undersize |
| | 114-0145-20 | 4 | .020" Undersize |
| | 114-0145-30 | 4 | .030" Undersize |

OIL PUMP GROUP

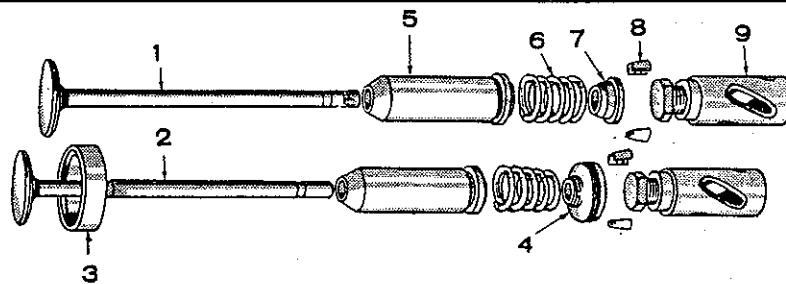
| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|--|
| 1 | 120-0491 | 1 | Pump, Oil - Complete (Int. parts not sold separately) |
| 2 | 120-0400 | 1 | Cup, Oil Pump Intake - Includes Cup, Pipe and Screen |
| 3 | 120-0187 | 1 | Stud Assembly, By-Pass Adjustment, Includes Stud and Nut |
| 4 | 120-0140 | 1 | Spring, By-Pass Valve |
| 5 | 120-0398 | 1 | Valve, By-Pass |
| 6 | 120-0161 | 1 | Gasket Kit, Oil Pump |
| 7 | 526-0066 | 1 | Washer, Copper - Oil Pressure Relief Valve Adjusting Screw |
| 8 | 800-0007 | 2 | Screw, Hex Cap - Oil Pump Mounting |
| 9 | 850-0040 | 2 | Lockwasher, Oil Pump Mounting |





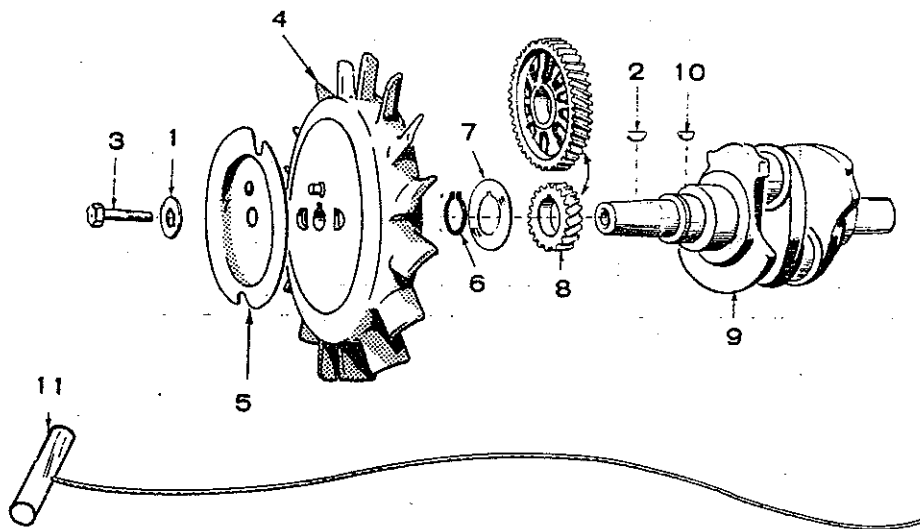
CAMSHAFT GROUP

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION | REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|--|----------|----------|-----------|--|
| 1 | 150-0078 | 1 | Ring, Camshaft Center Pin Snap | 13 | 160-0789 | 2 | Weight Assembly, Includes Pins - Timing Control - Spec H and J |
| 2 | 150-0612 | 1 | Cup, Governor | 14 | 516-0146 | 2 | Pin, Groove - 1" - Timing Control Cam - Spec H and J |
| 3 | 510-0015 | 10 | Ball, Fly - Governor | 15 | 160-0726 | 1 | Retainer, Timing Control - Spec H and J |
| 4 | CAMSHAFT | | | 16 | 110-1283 | 1 | Cover, Timing Control - Spec H and J |
| | 105-0140 | 1 | Spec F - Includes Center Pin | 17 | 160-0727 | 1 | Spring, Timing Control - Spec H and J |
| | 105-0234 | 1 | Spec H and J - Includes Center Pin and Spark Advance Mechanism Pins | 18 | 518-0185 | 2 | Lock, Timing Control - Spec H and J |
| | 105-0238 | 1 | Begin Spec L - Includes Center Pin | 19 | 160-0791 | 1 | Cam, Timing Control - Spec H and J |
| 5 | 150-0075 | 1 | Pin, Camshaft Center | | | | |
| 6 | 105-0353 | 1 | Gear Set, Timing - (Includes Crankshaft, Camshaft Gears, Flyball Spacer & Plate) | | | | |
| 7 | 105-0004 | 1 | Washer, Thrust, Cam Gear | | | | |
| 8 | 515-0001 | 1 | Key, Camshaft Gear Mounting | | | | |
| 12 | 516-0144 | 4 | Pin, Roll - 7/16" Timing Control - Spec H and J | | | | |



VALVE GROUP

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION | REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|---------------------------------------|-----------|---------------------------|----------|---------------|-----------|---|
| 1 | 110-0881 | 2 | Valve, Intake (Steel) | 5 | 110-0902 | 4 | Guide, Valve |
| 2 | 110-0880 | 2 | Valve, Exhaust (Stellite) | 6 | 110-0539 | 4 | Spring, Valve |
| 3 | INSERT, EXHAUST VALVE SEAT (STELLITE) | | | 7 | 110-0893 | 2 | Washer, Retainer - Intake |
| | 110-0872 | 2 | Standard | 8 | 110-0639 | 8 | Lock, Rotacap or Spring Retainer Washer |
| | 110-0872-02 | 2 | .002" Oversize | 9 | TAPPET, VALVE | | |
| | 110-0872-05 | 2 | .005" Oversize | | 115-0006 | 4 | Standard |
| | 110-0872-10 | 2 | .010" Oversize | | 115-0006-05 | 4 | .005" Oversize |
| | 110-0872-25 | 2 | .025" Oversize | | | | |
| 4 | 110-0904 | 2 | Rotacap, Exhaust Valve | | | | |

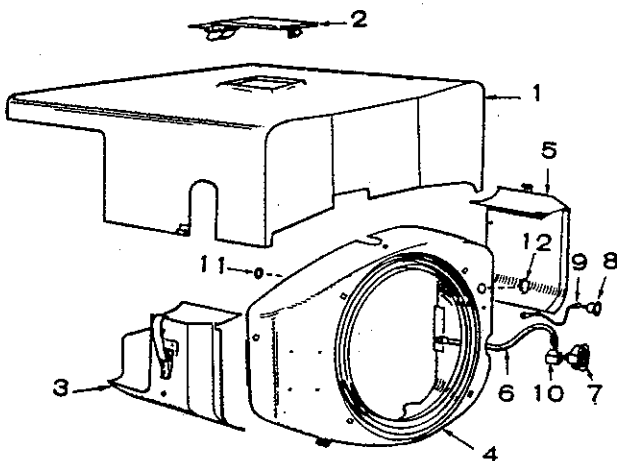


CRANKSHAFT AND FLYWHEEL GROUP

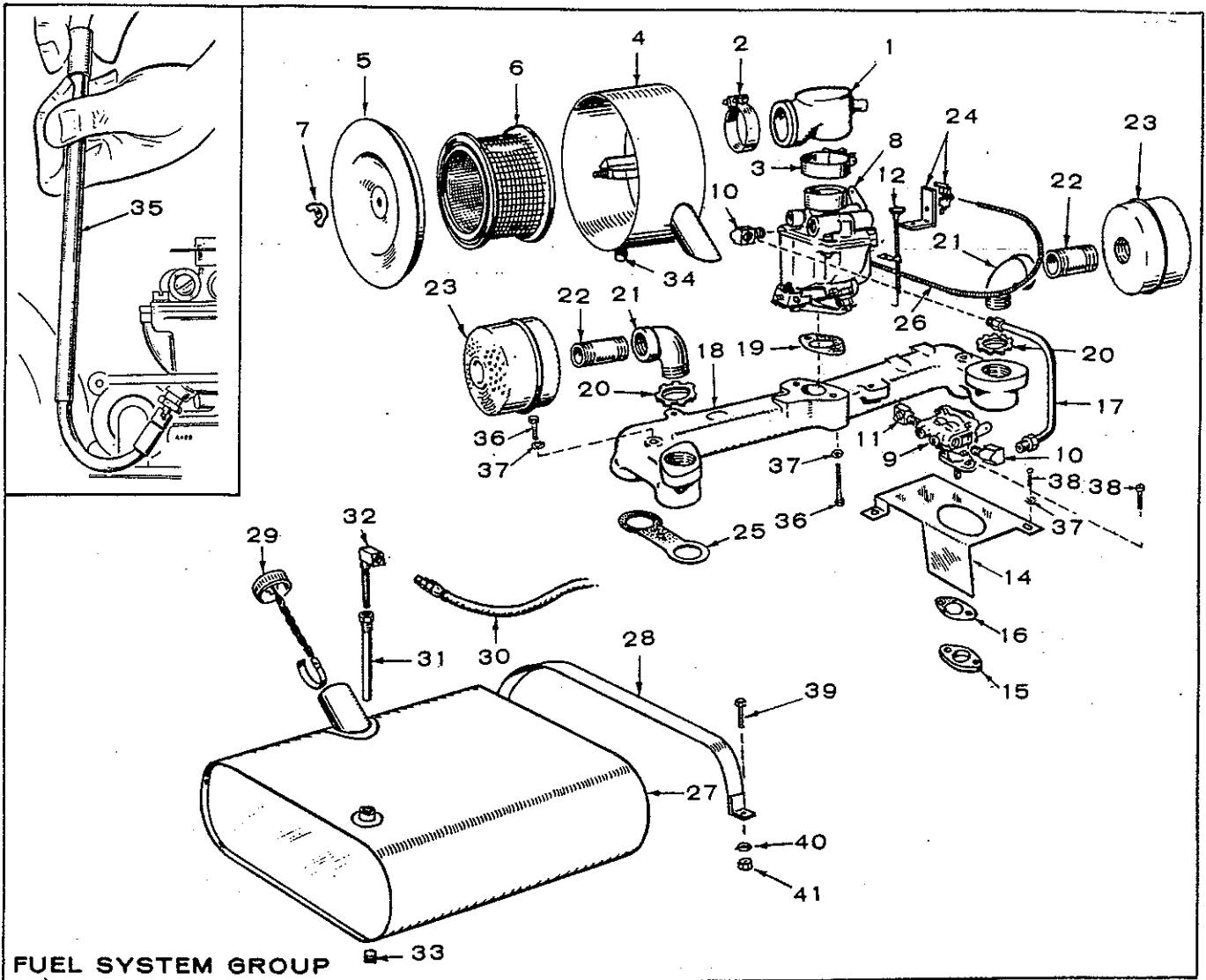
| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|--------------------------------------|-----------|------------------------------|
| 1 | 526-0017 | 1 | Washer, Flywheel Mounting |
| 2 | 515-0002 | 1 | Key, Flywheel Mounting |
| 3 | 104-0170 | 1 | Screw, Flywheel Mounting |
| 4 | FLYWHEEL, MAGNETO - LESS ROPE SHEAVE | | |
| | 160-0650 | 1 | Spec F Only |
| | 160-0761 | 1 | Spec H and J |
| | 160-0937 | 1 | Begin Spec L |
| 5 | 192-0308 | 1 | Sheave, Rope |
| 6 | 518-0014 | 1 | Lock, Crankshaft Gear Washer |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|--|
| 7 | 104-0043 | 1 | Washer, Crankshaft Gear Retainer |
| 8 | 105-0353 | 1 | Gear Set, Timing - Includes Crankshaft and Camshaft Gears (Also in Camshaft Group) |
| 9 | 104-0578 | 1 | Crankshaft |
| 10 | 515-0001 | 1 | Key, Crank |
| 11 | 192-0083 | 1 | Rope, Starting |

AIR HOUSING GROUP



| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|--|
| 1 | 405-1184 | 1 | Cover, Engine and Control |
| 2 | 405-1187 | 1 | Cover, Lifting Eye |
| 3 | 134-0980 | 1 | Housing, Cylinder Air - L.H. (#1 Cylinder) |
| 4 | 134-1579 | 1 | Housing, Blower |
| 5 | 134-0979 | 1 | Housing, Cylinder Air - R.H. (#2 Cylinder) |
| 6 | 501-0004 | 1 | Line, Oil Gauge (Flexible) |
| 7 | 193-0005 | 1 | Gauge, Oil Pressure |
| 8 | 313-0018 | 1 | Button, Stop - Key 1 |
| 9 | 336-0491 | 1 | Lead, Stop Button - Key 1 |
| 10 | 502-0005 | 1 | Elbow, Inverted Female - Oil Gauge |
| 11 | 508-0095 | 2 | Grommet (For 17/32" Hole) |
| 12 | 517-0021 | 1 | Button, Dot (For 7/8" Hole) |
| 13 | 193-0031 | 1 | Oil Gauge Mounting - 2" U Clamp |



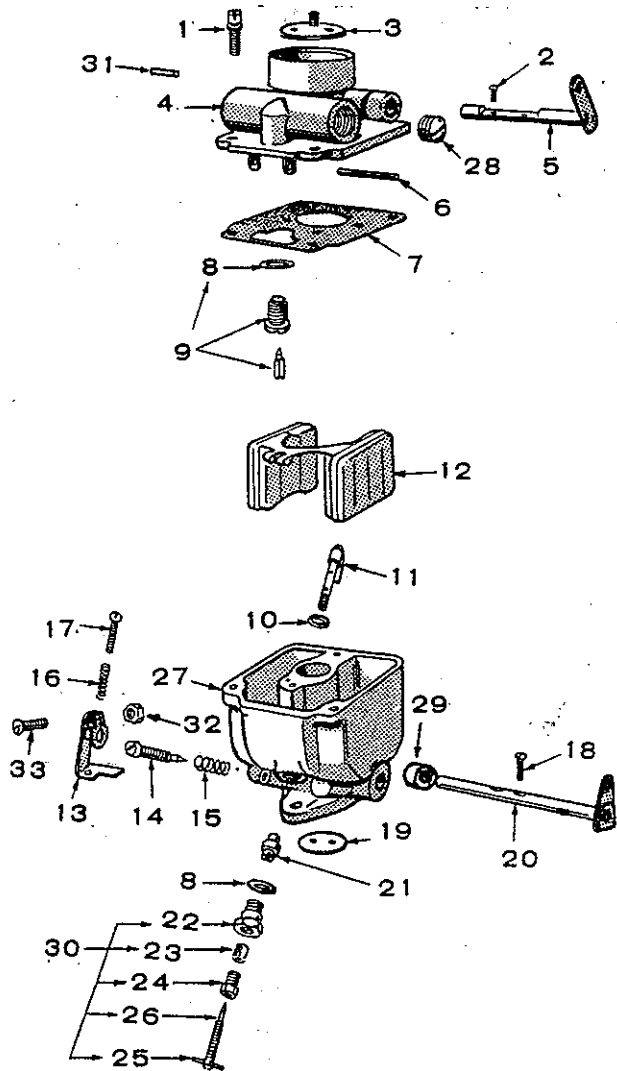
FUEL SYSTEM GROUP

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION | REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|-------------------------------|-----------|--|----------|---------------|-----------|---|
| 1 | 145-0094 | 1 | Inlet, Carburetor Air | 19 | 141-0078 | 1 | Gasket, Carburetor Mounting |
| 2 | 503-0280 | 1 | Clamp, Air Inlet to Air Cleaner | 20 | 331-0053 | 2 | Nut, Pipe - 1 - Exhaust Outlet |
| 3 | 503-0107 | 1 | Clamp, Air Inlet to Carburetor | 21 | 505-0003 | 2 | Elbow, Street (1") - Exhaust Outlet |
| 4 | 140-0537 | 1 | Housing, Air Cleaner | 22 | 505-0087 | 2 | Nipple, Pipe (1" x 3") - Exhaust Outlet |
| 5 | 140-0538 | 1 | Cover, Air Cleaner | 23 | 155-0484 | 2 | Muffler, Exhaust |
| 6 | 140-0495 | 1 | Cartridge, Air Cleaner | 24 | 153-0263 | 1 | Bracket and Clip, Manual Choke |
| 7 | 518-0056 | 1 | Screw, Wing - Air Cleaner Cover Mounting | 25 | 154-0013 | 2 | Gasket, Intake Manifold |
| 8 | CARBURETOR ASSEMBLY, GASOLINE | | | 26 | CHOKE, MANUAL | | |
| | 142-0386 | 1 | Spec F Only | | 153-0097 | 1 | Key 1 |
| | 142-0416 | 1 | Begin Spec H | | 153-0165 | 1 | Key 2 |
| 9 | 149-0693 | 1 | Pump Assembly, Fuel | 27 | 159-0690 | 1 | Tank, Fuel (7.35 Gal.) |
| 10 | 502-0002 | 2 | Elbow, Inverted Male - (1) Fuel Pump Outlet (1) Carburetor Inlet | 28 | 159-0692 | 2 | Strap, Fuel Tank Mounting |
| 11 | 502-0020 | 1 | Elbow, Street - Fuel Pump Inlet | 29 | 159-0020 | 1 | Cap, Fuel Tank |
| 12 | 149-0271 | 1 | Rod, Fuel Pump Primer - Key 1 | 30 | 501-0005 | 1 | Line, Flexible Fuel - Tank to Pump |
| 14 | 134-0981 | 1 | Baffle, Fuel Pump Air | 31 | 159-0695 | 1 | Tube, Pick-Up - Fuel Tank Outlet |
| 15 | 149-0045 | 1 | Spacer, Fuel Pump | 32 | 149-0773 | 1 | Elbow & Screen, Fuel Tank |
| 16 | 149-0003 | 2 | Gasket, Fuel Pump and Spacer Mounting | 33 | 505-0008 | 1 | Plug, Slotted Pipe - Fuel Tank Drain |
| 17 | 149-0775 | 1 | Line, Fuel Pump to Carburetor | 34 | 140-0554 | 1 | Spacer, Air Cleaner Mounting Screw |
| 18 | 154-0601 | 1 | Manifold, Intake | 35 | 420-0169 | 1 | Wrench, Carburetor Adjusting |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------------|-----------|---------------------------|
| 36 | SCREW, HEX CAP | | |
| | 800-0054 | 2 | Intake Manifold Mounting |
| | 800-0009 | 2 | Carburetor Mounting |
| 37 | WASHER, LOCK | | |
| | 850-0050 | 2 | Intake Manifold Mounting |
| | 850-0040 | 2 | Carburetor Mounting |
| | 850-0030 | 1 | Fuel Pump Baffle Mounting |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|---|
| 38 | SCREW | | |
| | 813-0100 | 1 | Fuel Pump Baffle Mounting |
| | 806-0009 | 2 | Fuel Pump Mounting |
| 39 | 800-0009 | 2 | Screw (1/4-20 x 1-1/2") - Tank Mounting |
| 40 | 850-0040 | 2 | Washer, Lock (1/4) |
| 41 | 860-0013 | 2 | Nut, Hex (1/4) |

CARBURETOR PARTS GROUP

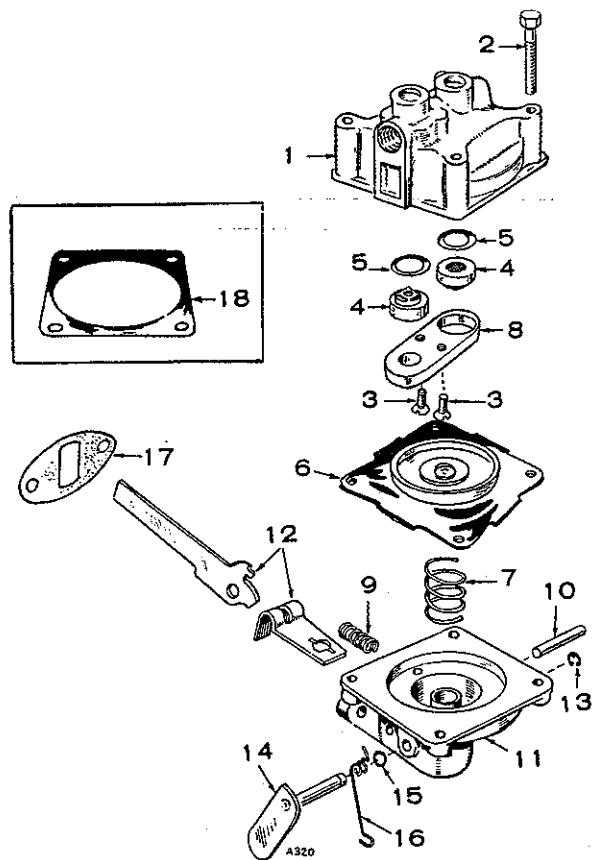


| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------------------------|-----------|--|
| 6 | 142-0039 | 1 | †*Shaft, Float |
| 7 | 142-0031 | 1 | +Gasket, Body to Bowl |
| 8 | 148-0017 | 2 | +Gasket (1) Float Valve Seat, (1) Main Adjusting Needle Retainer |
| 9 | VALVE SEAT ASSEMBLY, FLOAT | | |
| | 142-0356 | 1 | *Spec F Only |
| | 142-0049 | 1 | †Begin Spec H |
| 10 | 142-0032 | 1 | +Gasket, Nozzle |
| 11 | 142-0285 | 1 | Nozzle Assembly |
| 12 | 142-0361 | 1 | Float and Lever |
| 13 | 145-0008 | 1 | Lever, Idle Stop |
| 14 | 142-0040 | 1 | †*Needle, Idle Adjusting |
| 15 | 142-0282 | 1 | Spring, Idle Needle Adjusting |
| 16 | 142-0035 | 1 | Spring, Throttle Stop Adjusting Screw |
| 17 | 812-0063 | 1 | Screw, Throttle Stop Adjusting - #6-32 x 1/2" |
| 18 | 815-0072 | 2 | †*Screw, Throttle Fly - #4-40 x 1/4" |
| 19 | 142-0369 | 1 | Fly, Throttle |
| 20 | 142-0368 | 1 | †*Shaft Assembly, Throttle |
| 21 | NUT AND JET, NOZZLE | | |
| | 142-0370 | 1 | Spec F Only |
| | 142-0474 | 1 | †Begin Spec H |
| 22 | 142-0046 | 1 | Retainer, Main Adjusting Needle |
| 23 | 142-0206 | 1 | +Packing, Main Adjusting Needle |
| 24 | 142-0045 | 1 | Retainer, Main Adjusting Needle Packing |
| 25 | 516-0027 | 1 | Pin, Main Adjusting Needle |
| 26 | 142-0041 | 1 | †*Needle, Main Adjusting |
| 27 | | | Body Assembly (Not Sold Separately) |
| 28 | 505-0053 | 1 | Plug, Gas Inlet |
| 29 | 142-0343 | 2 | †Bushing, Throttle Shaft |
| 30 | 142-0042 | 1 | Needle Assembly - Includes Packing, Nut & Retainer |
| 31 | 142-0227 | 1 | Pin, Choke Stop |
| 32 | 870-0053 | 1 | Nut, Throttle Stop |
| 33 | 813-0102 | 1 | Screw, Throttle Stop Clamp - 10-32 x 5/8" |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|-------------------------------|-----------|------------------------------------|
| | CARBURETOR ASSEMBLY, GASOLINE | | |
| | 142-0386 | 1 | Spec F Only |
| | 142-0416 | 1 | Begin Spec H |
| 1 | SCREW, BOWL COVER | | |
| | 815-0103 | 1 | #10-24 x 1/2" |
| | 815-0109 | 2 | #10-24 x 5/8" |
| 2 | 815-0091 | 2 | †*Screw, Choke Fly - #4-40 x 3/16" |
| 3 | 142-0055 | 1 | Fly, Choke |
| 4 | 142-0205 | 1 | Sleeve, Choke (Cover) |
| 5 | SHAFT ASSEMBLY, CHOKE | | |
| | 142-0217 | 1 | Spec F Only (142-0386 Carburetor) |
| | 142-0420 | 1 | Begin Spec H (142-0416 Carburetor) |

| | | | |
|----|------------------------|---|--|
| 21 | 142-0370 | 1 | Spec F Only |
| 22 | 142-0474 | 1 | †Begin Spec H |
| 23 | 142-0046 | 1 | Retainer, Main Adjusting Needle |
| 24 | 142-0045 | 1 | Retainer, Main Adjusting Needle Packing |
| 25 | 516-0027 | 1 | Pin, Main Adjusting Needle |
| 26 | 142-0041 | 1 | †*Needle, Main Adjusting |
| 27 | | | Body Assembly (Not Sold Separately) |
| 28 | 505-0053 | 1 | Plug, Gas Inlet |
| 29 | 142-0343 | 2 | †Bushing, Throttle Shaft |
| 30 | 142-0042 | 1 | Needle Assembly - Includes Packing, Nut & Retainer |
| 31 | 142-0227 | 1 | Pin, Choke Stop |
| 32 | 870-0053 | 1 | Nut, Throttle Stop |
| 33 | 813-0102 | 1 | Screw, Throttle Stop Clamp - 10-32 x 5/8" |
| | 142-0033 | 1 | †*Gasket Kit, Carburetor (Includes Parts Marked +) |
| | REPAIR KIT, CARBURETOR | | |
| | 142-0387 | 1 | Spec F Only (Includes Parts Marked *) |
| | 142-0371 | 1 | Begin Spec H (Includes Parts Marked †) |

+ - Included in 142-0033 Gasket Kit.
 * - Included in 142-0387 Repair Kit.
 † - Included in 142-0371 Repair Kit.

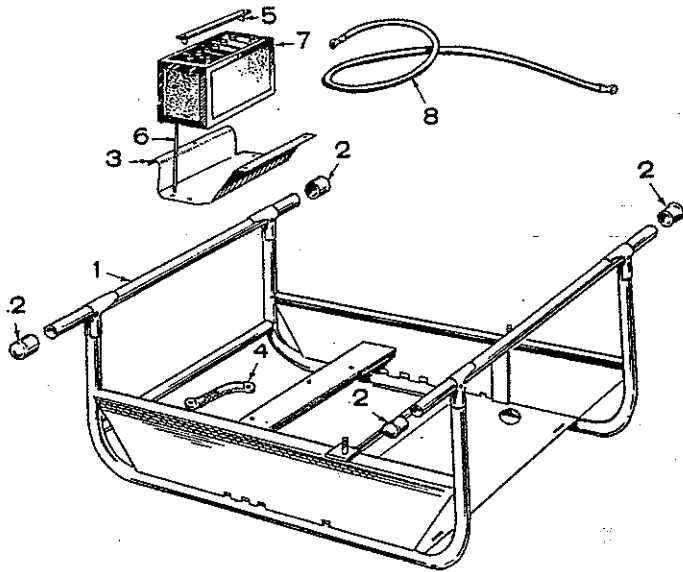


FUEL PUMP PARTS GROUP

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION | REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|---|----------|----------|-----------|--|
| | 149-0693 | 1 | Pump Assembly, Fuel | 11 | | 1 | Body, Lower (Not Sold Separately) |
| | 149-0526 | 1 | Repair Kit, Fuel Pump (Includes parts marked *) | 12 | 149-0710 | 1 | Arm and Link Set (Only as a set) |
| 1 | | 1 | Body, Upper (Not Sold Separately) | 13 | 518-0129 | 1 | Ring, "E" Retainer - Priming Lever |
| 2 | 815-0148 | 4 | Screw, Machine (8-32 x 7/8") | 14 | 149-0551 | 1 | Lever, Hand Primer |
| 3 | 815-0147 | 2 | Screw, Phillips Flat Head (6-32 x 5/8") | 15 | 509-0065 | 2 | Seal, "O" Ring |
| 4 | 149-0096 | 2 | *Valve and Cage | 16 | 149-0404 | 1 | Spring, Priming Lever |
| 5 | 149-0095 | 2 | *Gasket, Valve | 17 | 149-0003 | 2 | *Gasket, Fuel Pump and Spacer Mounting (Also in Fuel System Group) |
| 6 | 149-0582 | 1 | *Diaphragm Assembly | 18 | 149-0858 | 1 | *Gasket, Fuel Pump Diaphragm (Pull Rod Side) |
| 7 | 149-0672 | 1 | *Spring, Diaphragm | | | | |
| 8 | 149-0539 | 1 | Retainer, Valve Cage | | | | |
| 9 | 149-0675 | 1 | *Spring, Rocker Arm | | | | |
| 10 | 516-0113 | 1 | Pin, Rocker Arm | | | | |

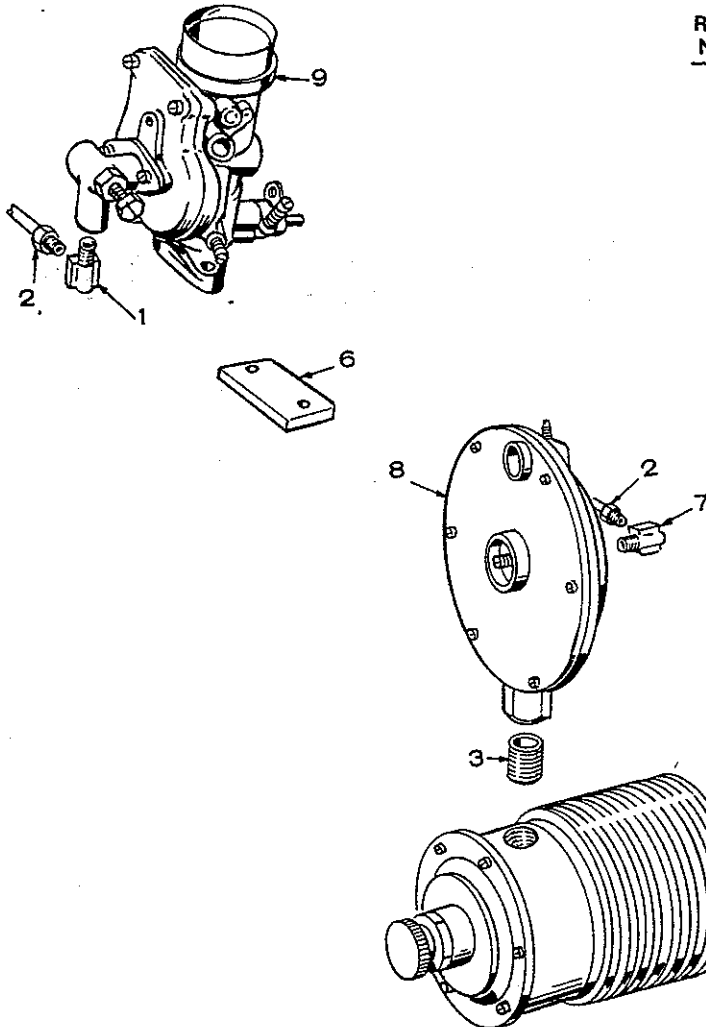
* - Contained in Repair Kit #149-0526.

CARRYING FRAME AND BATTERY GROUP

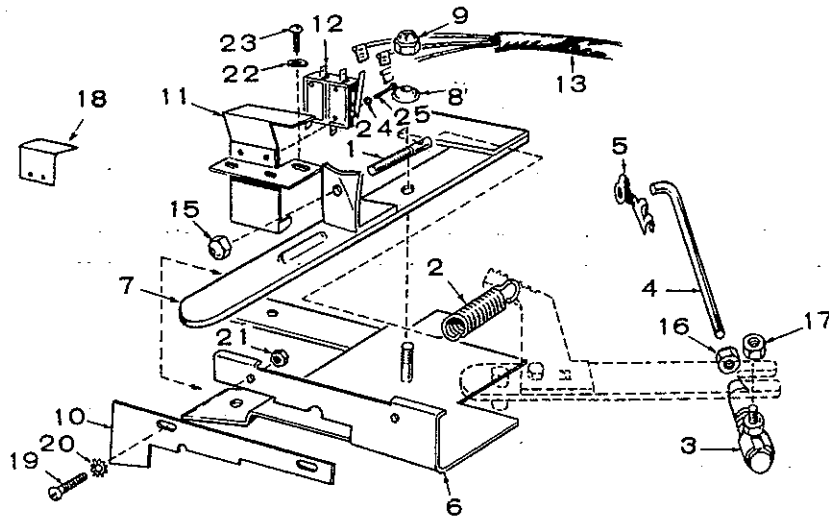


| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------------------------------|-----------|--|
| 1 | 403-0586 | 1 | Frame, Carrying |
| 2 | 403-0588 | 4 | Tips, Rubber - Carrying Frame |
| 3 | 416-0452 | 1 | Rack, Battery - Key 2 |
| 4 | 337-0050 | 1 | Strap, Ground - Carrying Frame to Blower Housing |
| 5 | 416-0453 | 1 | Strap, Battery Holddown - Key 2 |
| 6 | 416-0454 | 2 | Stud, Battery Holddown - Key 2 |
| 7 | 416-0616 | 1 | Battery, Starting - 12 Volt - (Optional Equipment) - Key 2 |
| 8 | LEAD, BATTERY TO CONTROL - KEY 2 | | |
| | 336-1248 | 1 | Positive Post to Start Switch (36") |
| | 336-1412 | 1 | Negative Post to Terminal Stud (36") |

OPTIONAL FUEL SYSTEM GROUP (Liquid Petroleum Gas Only)

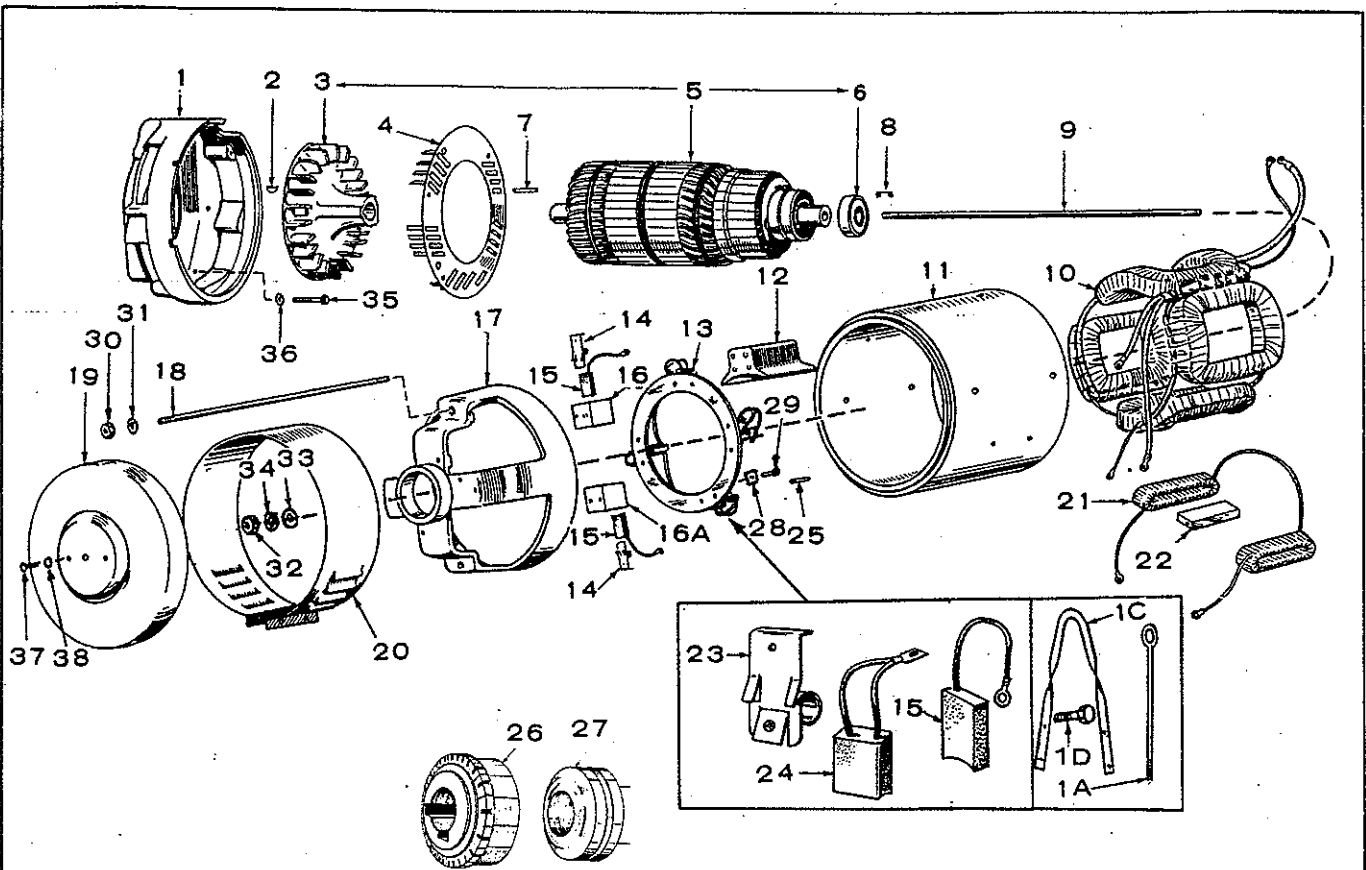


| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|---|
| 1 | 502-0039 | 1 | Elbow, Carburetor Inlet |
| 2 | 159-0745 | 1 | Line, Fuel - Vaporizer to Carburetor |
| 3 | 505-0099 | 1 | Nipple, Vaporizer to Regulator |
| 4 | 148-0418 | 1 | Vaporizer Assembly |
| 5 | 148-0423 | 1 | Bracket, Vaporizer Mounting |
| 6 | 149-0136 | 1 | Cover, Crankcase, Fuel Pump Hole |
| 7 | 502-0039 | 1 | Elbow, Regulator Outlet |
| 8 | 148-0465 | 1 | Regulator, LPG - Secondary |
| 9 | 141-0647 | 1 | Carburetor and Pressure Regulator Assembly - LPG |
| | 141-0653 | 1 | Repair Kit, Carburetor |
| | 141-0652 | 1 | Gasket Kit, Carburetor |
| | 141-0651 | 2 | Seal, Throttle Shaft (Component of Carburetor) |
| | 141-0650 | 2 | Retainer, Throttle Shaft Seal (Component of Carburetor) |



GOVERNOR AND THROTTLE GROUP

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION | REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------------------------------|-----------|---------------------------------------|----------|----------|-----------|---|
| 1 | 150-1009 | 1 | Stud, Governor Adjusting | 15 | 870-0053 | 1 | Nut, Governor Adjusting Stud |
| 2 | 150-0098 | 1 | Spring, Governor | 16 | 870-0053 | 1 | Nut, Hex - Governor Ball Joint to Link |
| 3 | 150-0639 | 1 | Joint, Governor Link Ball | 17 | 870-0131 | 1 | Nut, Keps - Governor Ball Joint to Governor Arm |
| 4 | 150-0629 | 1 | Link, Governor Arm to Carburetor | 18 | 152-0119 | 1 | Fiber Insulator - Micro Switch Terminal |
| 5 | 518-0006 | 1 | Clip, End - Link to Carburetor | 19 | 812-0077 | 2 | Screw, Round Head - (8-32 x 3/8") - Governor Plate Adjusting |
| 6 | BRACKET, VARIABLE SPEED GOVERNOR | | | 20 | 853-0005 | 2 | Washer, External Shake - (No. 8) Governor Plate Adjusting |
| | 152-0109 | 1 | Models with 60 Hertz AC Output | 21 | 860-0008 | 2 | Nut, Hex - (8-32) Governor Plate Adjusting |
| | 152-0130 | 1 | Models with 50 Hertz AC Output | 22 | 853-0008 | 2 | Washer, External Shake - Micro Switch Mounting Bracket |
| 7 | LEVER, SPEED ADJUSTING | | | 23 | 813-0098 | 2 | Screw, Round Head Steel Machine - Micro Switch Mounting Bracket |
| | 152-0111 | 1 | Models with 60 Hertz AC Output | 24 | 850-0020 | 2 | Washer, Lock - Micro Switch Mounting |
| | 152-0129 | 1 | Models with 50 Hertz AC Output | 25 | 812-0066 | 2 | Screw, Round Head - Micro Switch Mounting |
| 8 | 152-0041 | 2 | Washer, Tension - Speed Lever | | | | |
| 9 | 870-0065 | 1 | Nut, Huglock - Speed Lever - 1/4-20 | | | | |
| 10 | 152-0110 | 1 | Plate, Adjusting - Speed Lever Travel | | | | |
| 11 | 152-0112 | 1 | Bracket, Micro Switch Mounting | | | | |
| 12 | 308-0151 | 1 | Switch, Micro | | | | |
| 13 | 338-0228 | 1 | Harness, Wiring - Micro Switch | | | | |

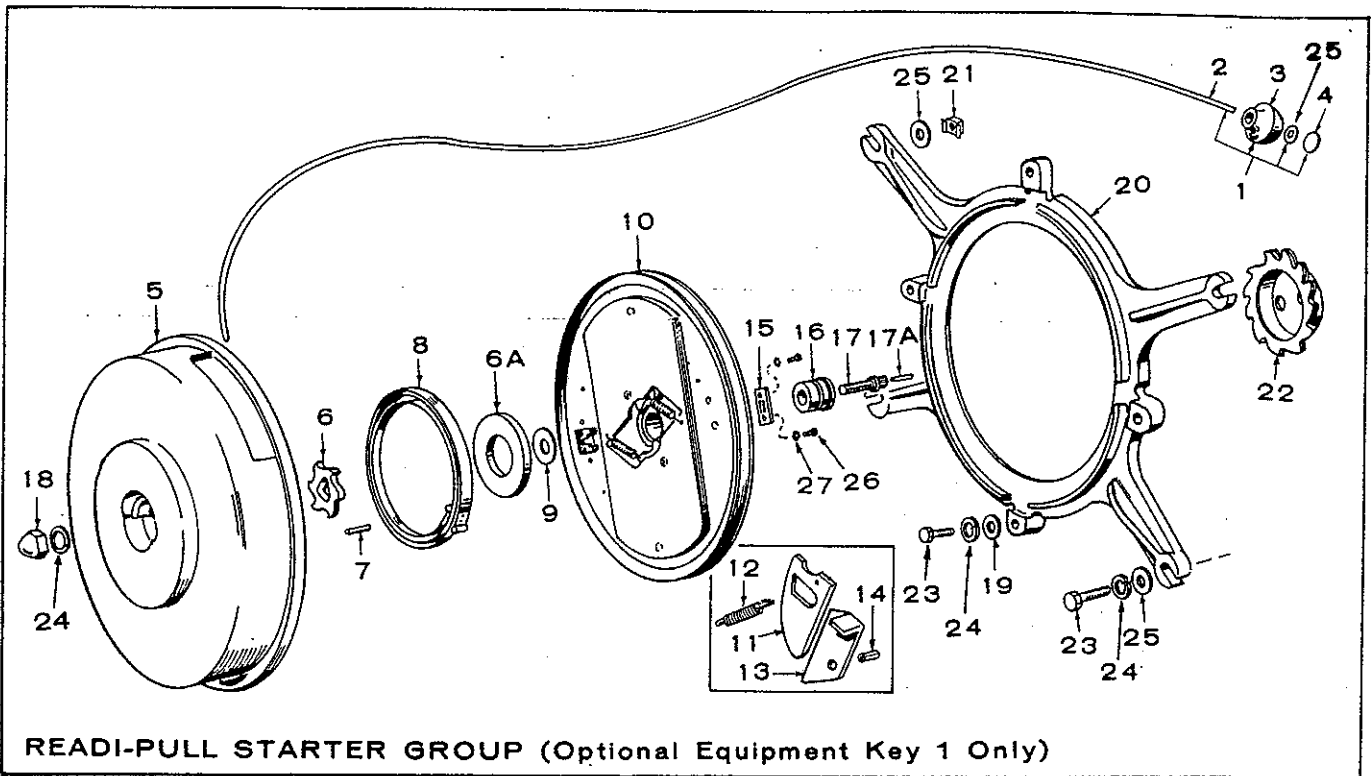


GENERATOR GROUP

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|------------------------------|-----------|--|
| 1 | ADAPTER, GENERATOR TO ENGINE | | |
| | 231-0124 | 1 | Spec F Only |
| | 231-0104 | 1 | Begin Spec H |
| 1A | 403-0580 | 1 | Eyebolt, Lifting - Spec F Only |
| 1C | 403-0642 | 1 | Yoke, Lifting - Begin Spec H |
| 1D | 800-0029 | 4 | Screw (5/16-18 x 1-1/8") - Lifting Yoke, Mounting - Begin Spec H |
| 2 | 515-0006 | 1 | Key, Blower to Crankshaft |
| 3 | 205-0053 | 1 | Blower, Generator |
| 4 | 232-1256 | 1 | Plate, Baffle |
| 5 | | 1 | Armature Assembly (Includes Blower and Bearing) |
| 6 | 510-0047 | 1 | Bearing, Armature (Double Sealed - Pre-Lubricated) |
| 7 | 515-0122 | 1 | Key, Drive - Blower to Armature |
| 8 | 232-0596 | 1 | Clip, Bearing Stop |
| 9 | 520-0534 | 1 | Stud, Armature Through |
| 10 | | 1 | Coil Assembly, Field (Set of 4 Coils, Connected) |
| 11 | 210-0260 | 1 | Frame, Generator (Machined) Less Coils & Poleshoes |
| 12 | 221-0118 | 4 | Shoe, Pole |
| 13 | RIG ASSEMBLY, BRUSH | | |
| | 212-0229 | 1 | Spec F Only, |
| | 212-0276 | 1 | Begin Spec H. |
| 14 | SPRING, AC BRUSH | | |
| | 212-1123 | 4 | Spec F Only |
| | 212-1105 | 4 | Begin Spec H. |
| | 214-0050 | 4 | Brush, AC |
| 15 | 212-1161 | 2 | Holder, AC Brush (Upper) - Spec F Only |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|-----------|-----------|--|
| 16A | 212-1160 | 2 | Holder, AC Brush (Lower) - Spec F Only |
| 17 | BELL, END | | |
| | 211-0111 | 1 | Spec F Only |
| | 211-0097 | 1 | Begin Spec H |
| 18 | 520-0161 | 2 | Stud, Generator Through |
| 19 | 211-0114 | 1 | Cover, End Bell |
| 20 | 234-0002 | 1 | Band, End Bell |
| 21 | 222-1458 | 1 | Coil Set, Interpole |
| 22 | 221-0116 | 2 | Interpole |
| 23 | 212-1106 | 4 | Spring, DC Brush |
| 24 | 214-0067 | 4 | Brush, DC |
| 25 | 516-0103 | 2 | Pin, Roll - Generator Frame |
| 26 | 203-0125 | 1 | Commutator |
| 27 | 204-0009 | 1 | Collector Ring |
| 28 | 212-1214 | 4 | Clamp, Brush Rig |
| 29 | 800-0003 | 4 | Screw (1/4-20 x 1/2") - Clamp Mounting |
| 30 | 862-0015 | 2 | Nut, Hex (5/16) |
| 31 | 850-0045 | 2 | Washer, Lock (5/16) |
| 32 | 862-0004 | 1 | Nut, Hex (7/16-14) - Armature Through Stud |
| 33 | 526-0032 | 1 | Washer, Flat (7/16) |
| 34 | 850-0055 | 1 | Washer, Lock (7/16) |
| 35 | 800-0050 | 4 | Screw (3/8-16 x 1") - Generator Adapter Mounting |
| 36 | 850-0050 | 4 | Washer, Lock (3/8) |
| 37 | 813-0098 | 2 | Screw (10-32 x 3/8") - Cover Mounting |
| 38 | 850-0030 | 2 | Washer, Lock (#10) |

* - Order by description, giving complete Model, Spec and Serial Number.

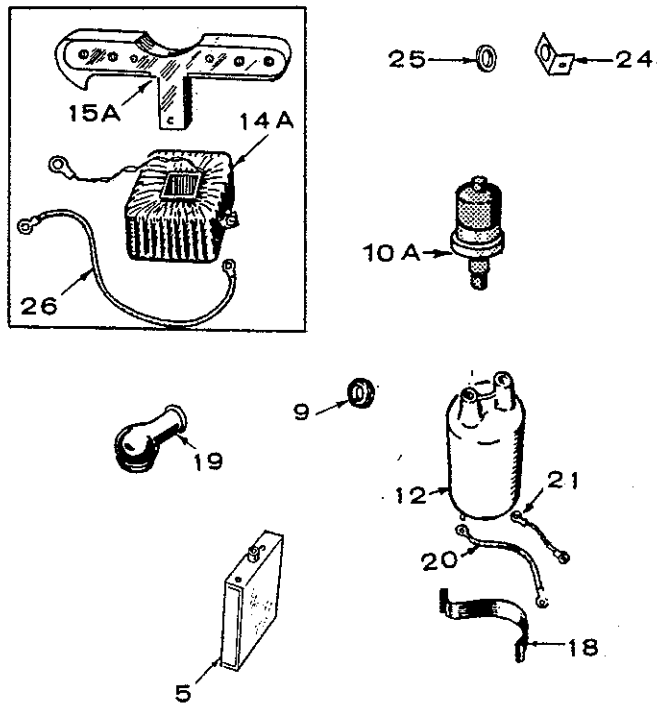
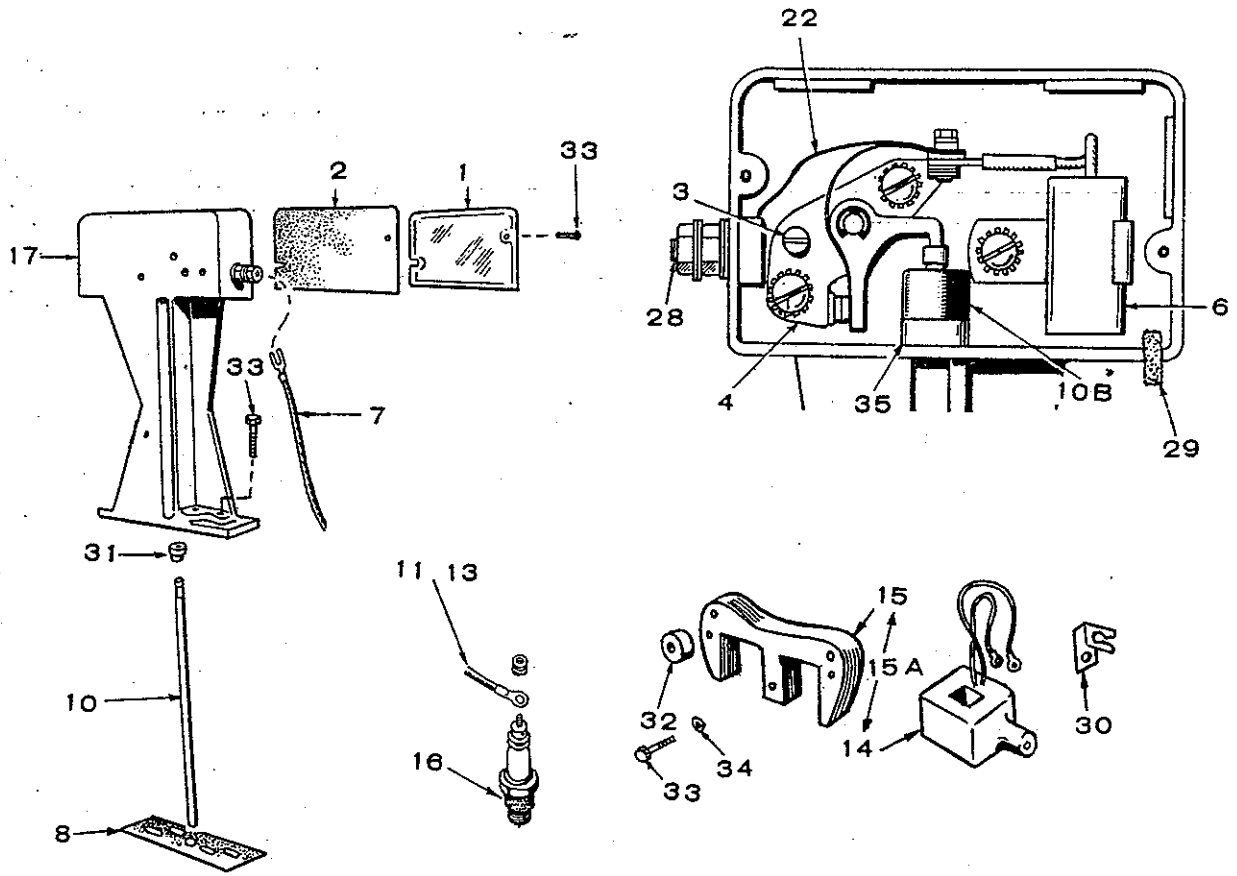


READI-PULL STARTER GROUP (Optional Equipment Key 1 Only)

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION | REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|---|----------|-----------------------------|-----------|--|
| | 192-0325 | 1 | Starter Kit, Complete (Includes Mounting Ring and Ratchet Wheel) | 18 | 870-0138 | 1 | Nut, Flexlock, Bushing to Cover Screw |
| 1 | 192-0045 | 1 | Rope and Grip Assembly | 19 | 526-0180 | 4 | Washer, Starter to Mounting Ring |
| 2 | 192-0043 | 1 | Rope (Less Grip) 83" Long | 20 | 192-0186 | 1 | Ring, Mounting - Starter to Blower Housing |
| 3 | 192-0044 | 1 | Grip, Starter Rope | 21 | 870-0110 | 4 | Nut, Speed Grip - Starter Ring to Blower Housing |
| 4 | 517-0025 | 1 | Plug, Starter Rope Grip | 22 | 192-0309 | 1 | Wheel, Ratchet |
| 5 | 192-0152 | 1 | Cover, Starter | 23 | SCREW, HEX HEAD 800-0007 | 4 | Starter Mounting |
| 6 | 192-0153 | 1 | Wheel, Cog, Anti-Backlash | 24 | 815-0137 | 4 | Starter to Mounting Ring |
| 6A | 526-0168 | 1 | Washer, Spring Retainer (Used on Later Model Starters) | 24 | WASHER, LOCK 850-0040 | 4 | Starter Mounting |
| 7 | 516-0138 | 1 | Pin, Roll (3/16 x 5/8) - Recoil Spring | 24 | 850-0040 | 4 | Starter to Mounting Ring |
| 8 | 192-0039 | 1 | Spring, Recoil | 24 | 850-0050 | 1 | Bushing to Cover |
| 9 | 526-0123 | 1 | Washer, Thrust - Sheave Bushing to Cover | 25 | WASHER, FLAT 526-0130 | 4 | Starter Mounting - 1/16" Thick |
| 10 | 192-0180 | 1 | Sheave Assembly, Rope (Includes Parts Marked *) | | 526-0158 | 4 | Starter Mounting - 1/8" Thick |
| 11 | 192-0172 | 2 | *Pawl | | 526-0169 | 1 | Starter Rope Grip |
| 12 | 192-0165 | 2 | *Spring, Pawl | 26 | 815-0137 | 2 | *Screw, Hex Cap - Rope Clamp Mounting |
| 13 | 192-0168 | 2 | *Arm, Ratchet | 27 | 526-0015 | 2 | *Washer, Flat - Rope Clamp Mounting |
| 14 | 516-0110 | 4 | *Pin, Roll (5/16 x 1/2") - (2) Ratchet Arm, (2) Pawl | | | | |
| 15 | 192-0167 | 1 | *Clamp, Rope | | | | |
| 16 | 192-0163 | 1 | Bearing (Bronze), Sheave Hub | | | | |
| 17 | 192-0323 | 1 | Cap Screw, Socket Head (3/8-16 x 1-1/2") Sheave Bushing to Cover | | | | |
| 17A | 516-0132 | 1 | Pin, Spiral (Brass - 1/8 x 5/8") - Starter Locating | | | | |

* - Included in #192-0180 Rope Sheave Assembly.

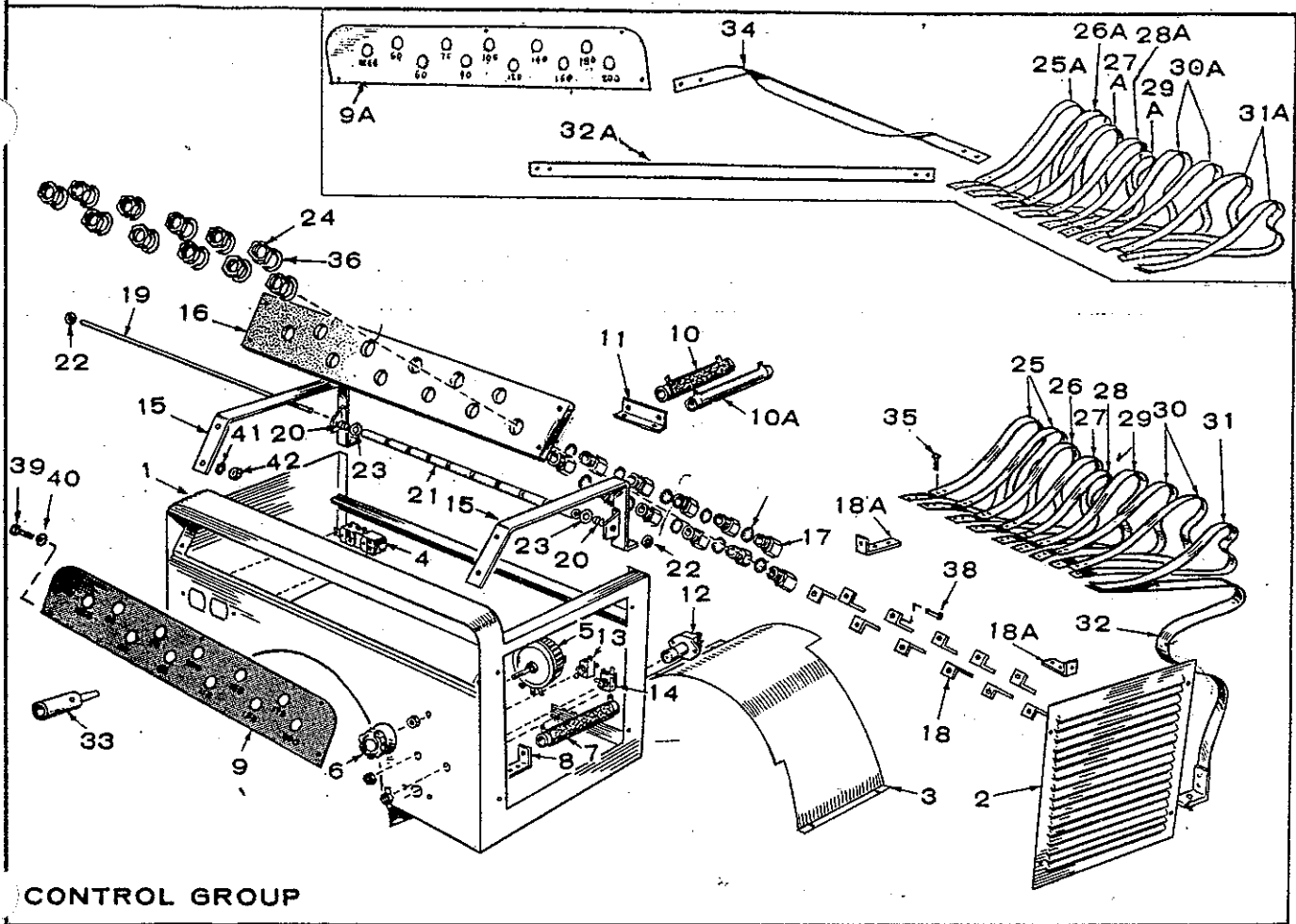
IGNITION GROUP



| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|--------------------------------|-----------|--|
| 1 | 160-0930 | 1 | *Cover, Breaker Box |
| 2 | 160-0150 | 1 | *Gasket, Breaker Box Cover |
| 3 | 160-0075 | 1 | *Cam, Point Gap Adjusting |
| 4 | 160-0002 | 1 | *Point Set, Ignition Breaker |
| 5 | 160-0633 | 1 | Spacer, Breaker Box Mounting - Spec F through H |
| 6 | 312-0069 | 1 | *Condenser, Breaker Box - 0.3 Mfd. |
| 7 | 336-1022 | 1 | Lead, Breaker Box to Ignition Switch |
| 8 | 160-0043 | 1 | Gasket, Breaker Box |
| 9 | 508-0005 | 2 | Grommet, Spark Plug Cables in Blower Housing - Spec F Only |
| 10 | 160-0723 | 1 | *Plunger Only, Breaker - Begin Spec J |
| 10A | 160-0776 | 1 | Plunger Assembly (Includes Plunger, Diaphragm, Guide) - Spec F through H |
| 10B | 160-1143 | 1 | *Diaphragm, Breaker Plunger |
| 11 | CABLE, SPARK PLUG - RIGHT HAND | | |
| | 167-1308 | 1 | 9" - Spec F Only |
| | 167-1404 | 1 | 19" - Begin Spec H |
| 12 | 160-0792 | 1 | Coil, Ignition - Spec F Only |
| 13 | CABLE, SPARK PLUG - LEFT HAND | | |
| | 167-1309 | 1 | 23" - Spec F Only |
| | 167-1403 | 1 | 16-3/4" - Begin Spec H |
| 14 | 160-0750 | 1 | Coil, Magneto Stator, Begin Spec H |
| 14A | 160-0282 | 1 | Coil, Magneto Stator - Spec F Only |
| 15 | 160-0749 | 1 | Pole Shoe, Magneto Stator - Begin Spec H |
| 15A | 160-0281 | 1 | Pole Shoe, Magneto Stator - Spec F Only |
| 15B | 160-0752 | 1 | Stator Assembly, Magneto (Includes Coil and Pole) |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|--|
| 16 | 167-0241 | 2 | Plug, Spark |
| 17 | 160-0963 | 1 | Box Assembly, Ignition Breaker - (Includes Parts Marked *) |
| 18 | 160-0488 | 1 | Clamp, Ignition Coil - Spec F Only |
| 19 | 160-0558 | 2 | Nipple, Ignition Coil (Rubber) - Spec F Only |
| 20 | 336-0530 | 1 | Lead, Ignition Coil to Ground (4") - Spec F Only |
| 21 | 336-0219 | 1 | Lead, Ignition Coil to Breaker Box (20") - Spec F Only |
| 22 | 160-0428 | 1 | *Strap, Point Set to Breaker Box Terminal Block |
| 24 | 332-0273 | 1 | Clip, Magneto Lead |
| 25 | 508-0002 | 1 | Grommet, Magneto Lead Clip |
| 26 | 336-1196 | 1 | Lead, Magneto Stator to Breaker Box (24") |
| 28 | 160-0349 | 1 | *Terminal Screw and Block Assembly |
| 29 | 160-0261 | 1 | *Wick, Oil Drain - Breaker Box |
| 30 | 167-0188 | 4 | Clip, Spark Plug Cable - Begin Spec H |
| 31 | 160-0929 | 1 | *Bushing, Breaker Box Plunger - Begin Spec J |
| 32 | 526-0015 | 4 | Washer, Pole Shoe Mounting (11/16" Thick) - Begin Spec H |
| 33 | SCREW | | |
| | 815-0357 | 2 | *Breaker Box Mounting |
| | 812-0077 | 2 | *Breaker Box Cover Mounting |
| | 815-0259 | 2 | Pole Shoe Mounting |
| 34 | 850-0040 | 2 | Washer, Lock |
| 35 | 160-0931 | 1 | *Guide, Plunger |

* - Included in Ignition Breaker Box Assembly.



CONTROL GROUP

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------------------------------|-----------|---|
| 1 | BOX, CONTROL | | |
| | 301-1803 | 1 | Key 1 |
| | 301-1779 | 1 | Key 2 |
| 2 | 301-1340 | 1 | Plate, Control Box Vent |
| 3 | 301-1339 | 1 | Plate, Control Box Reflector |
| 4 | RECEPTACLE, DUPLEX | | |
| | 323-0184 | 1 | Models with 120 Volt AC Output |
| | 323-0213 | 1 | Models with 240 Volt AC Output |
| 5 | 303-0112 | 1 | Rheostat <i>3.5R</i> |
| 6 | 304-0061 | 1 | Knob, Rheostat |
| 7 | 304-0183 | 1 | Resistor, Field (5.5-Ohm, 160 Watt) |
| 8 | 304-0117 | 1 | Bracket, Field Resistor Mounting |
| | PANEL, CONTROL BOX | | |
| 9 | 301-1785 | 1 | Spec F Only |
| 9A | 301-2298 | 1 | Begin Spec H |
| | RESISTOR, BATTERY CHARGE - KEY 2 | | |
| 10 | 304-0474 | 1 | 30-Ohm, 220 Watt (Ribbed) - 1-1/8" x 6" |
| 10A | 304-0472 | 1 | 15-Ohm, 75 Watt (13/16" x 6") |
| 11 | 304-0470 | 2 | Bracket, Battery Charge Resistor Mounting - Key 2 |
| 12 | 308-0028 | 1 | Switch, Start - Key 2 |
| 13 | 308-0068 | 1 | Switch, Ignition - Key 2 |
| 14 | 308-0002 | 1 | Switch, High-Low Charge Rate - Key 2 |

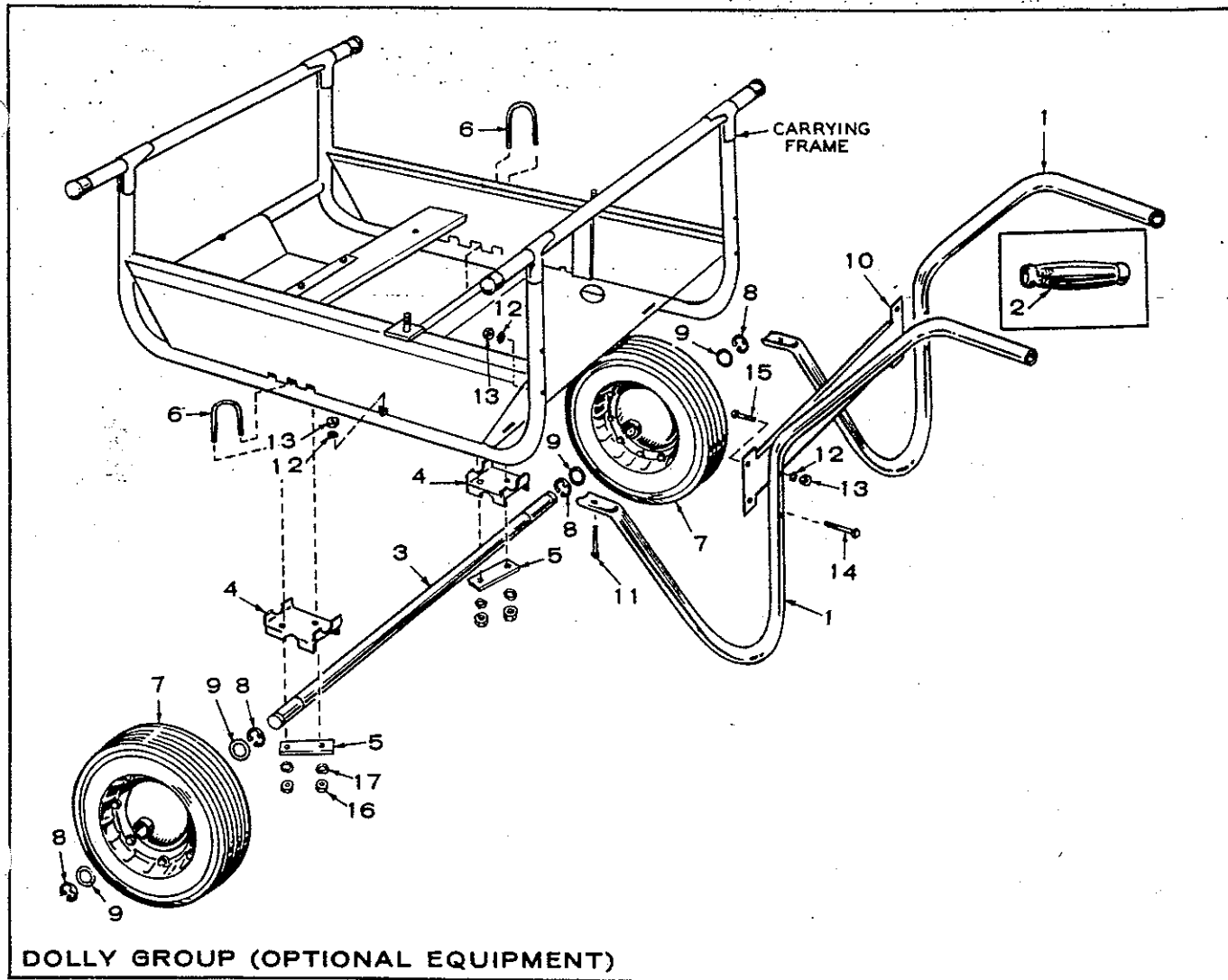
| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|-------------------------------------|-----------|--|
| | RESISTOR ELEMENTS AND JACK ASSEMBLY | | |
| | 304-0471 | 1 | Spec F Only (Includes Parts Marked *, plus hardware) |
| | 304-0558 | 1 | Begin Spec H (Includes Parts Marked †, plus hardware) |
| 15 | 301-1778 | 2 | †*Bracket, Resistor Elements Mounting |
| 16 | 301-1777 | 1 | †*Block, Terminal - Resistor Element Fastening |
| 17 | 316-0044 | 11 | †*Jack, Plug - Welder Cable Connecting |
| 18 | 308-0149 | 10 | †*Angle, Connector - Resistor Elements to Plug Jack - 1-23/32" Long |
| 18A | 308-0128 | 3 | †*Angle, Connector - Resistor Elements to Plug Jack - 3-1/8" Long (One only used Spec F) |
| 19 | 304-0469 | 1 | †*Rod, Insulator Tubes Mounting |
| 20 | 115-0056 | 1 | †*Spring, Insulator Tube |
| 21 | 304-0379 | 8 | †*Tube, Insulator |
| 22 | 870-0173 | 2 | †*Nut, Push - Insulator Rod Mounting |
| 23 | 526-0101 | 1 | †*Washer, Flat - Insulator Rod Mounting |
| 24 | 868-0011 | 11 | †*Nut, Hex Jam - Jack Mounting |
| | ELEMENT, RESISTOR | | |
| 25 | 304-0467 | 2 | *Spec F Only |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|-------------------|-----------|------------------|
| 25A | 304-0551 | 1 | †Begin Spec H |
| | ELEMENT, RESISTOR | | |
| 26 | 304-0466 | 1 | *Spec F Only |
| 26A | 304-0467 | 1 | †Begin Spec H |
| | ELEMENT, RESISTOR | | |
| 27 | 304-0462 | 1 | *Spec F Only |
| 27A | 304-0466 | 1 | †Begin Spec H |
| | ELEMENT, RESISTOR | | |
| 28 | 304-0463 | 1 | *Spec F Only |
| 28A | 304-0552 | 1 | †Begin Spec H |
| | ELEMENT, RESISTOR | | |
| 29 | 304-0465 | 1 | *Spec F Only |
| 29A | 304-0553 | 1 | †Begin Spec H |
| | ELEMENT, RESISTOR | | |
| 30 | 304-0468 | 2 | *Spec F Only |
| 30A | 304-0465 | 2 | †Begin Spec H |
| | ELEMENT, RESISTOR | | |
| 31 | 304-0464 | 1 | *Spec F Only |
| 31A | 304-0468 | 2 | †Begin Spec H |
| | ELEMENT, RESISTOR | | |
| 32 | 304-0383 | 1 | *Spec F Only |

| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|---|
| 32A | 304-0554 | 1 | †Begin Spec H |
| 33 | 316-0045 | 2 | Plug, Welding Cables |
| 34 | 304-0555 | 1 | †Element, Resistor - Begin Spec H |
| 35 | 815-0026 | 26 | Screw, Truss Head - 10-32 x 5/8" |
| 36 | 526-0120 | 11 | Washer, Jack Mounting |
| 37 | 854-0031 | 11 | Washer (Shakeproof) |
| 38 | 815-0223 | 11 | Screw (1/4-20 x 5/8") - Angle Connector to Jack |
| 39 | 800-0007 | 4 | Screw (1/4-20 x 1") - Panel Mounting |
| 40 | 526-0015 | 4 | Washer, Flat (1/4) |
| 41 | 850-0040 | 4 | Washer, Lock (1/4) |
| 42 | 860-0013 | 4 | Nut, Hex (1/4-20) |

* - These parts contained in 304-0471 Resistor Elements and Jack Assembly.

† - These parts contained in 304-0558 Resistor Elements and Jack Assembly.



| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|---|
| | 410-0287 | 1 | Dolly Assembly - Includes entire group plus hardware (Does NOT include Carrying Frame). |
| 1 | 410-0285 | 2 | Handle |
| 2 | 403-0205 | 2 | Grip, Handle |
| 3 | 410-0233 | 1 | Axle |
| 4 | 410-0283 | 2 | Support, Axle |
| 5 | 410-0284 | 2 | Plate, Axle Support |
| 6 | 410-0148 | 2 | Bolt, "U" - Axle Mounting |
| 7 | 410-0236 | 2 | Wheel & Tire Assembly - Includes Tube |
| 8 | 518-0130 | 4 | Ring, "E" Retainer - Dolly Wheel to Axle |

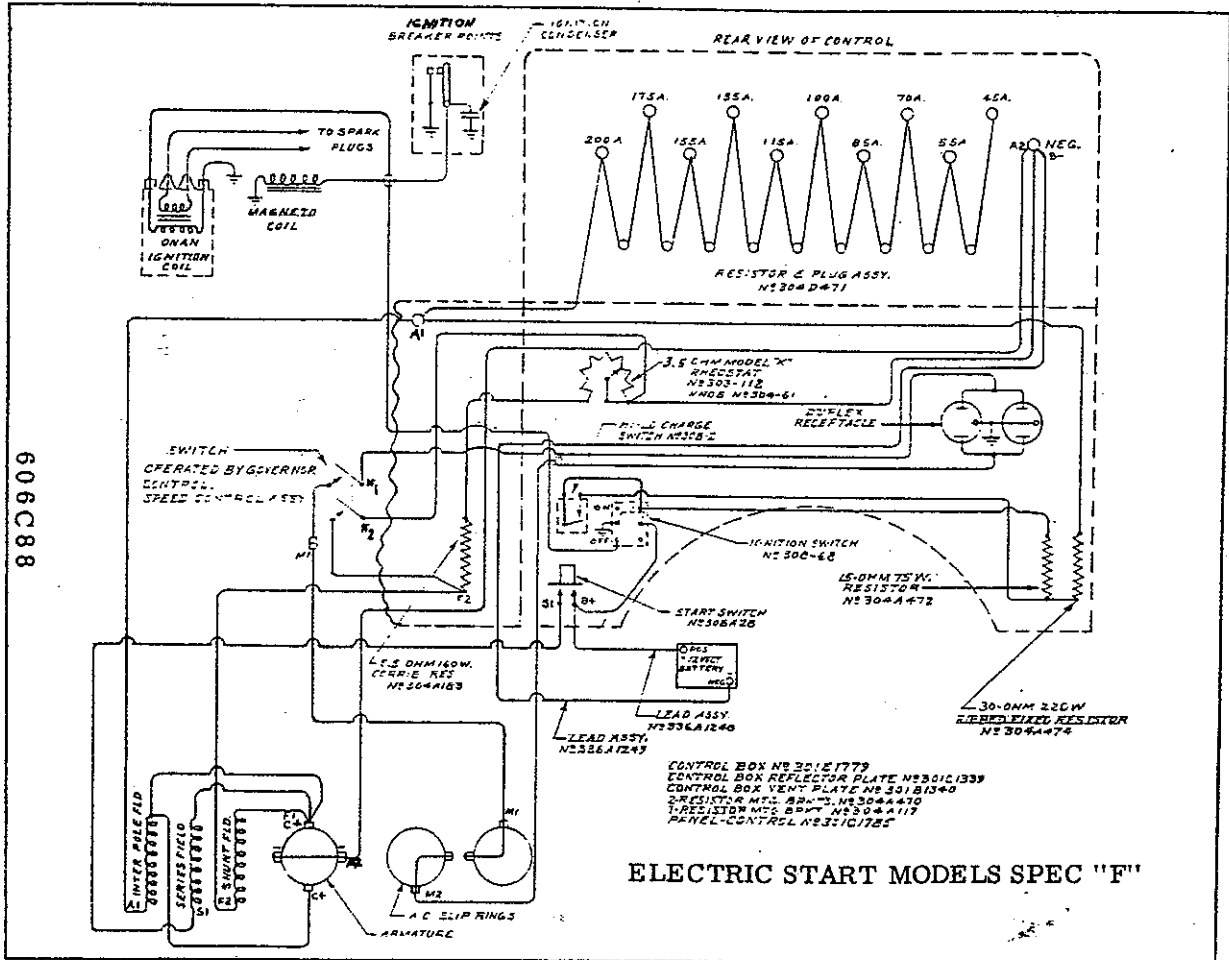
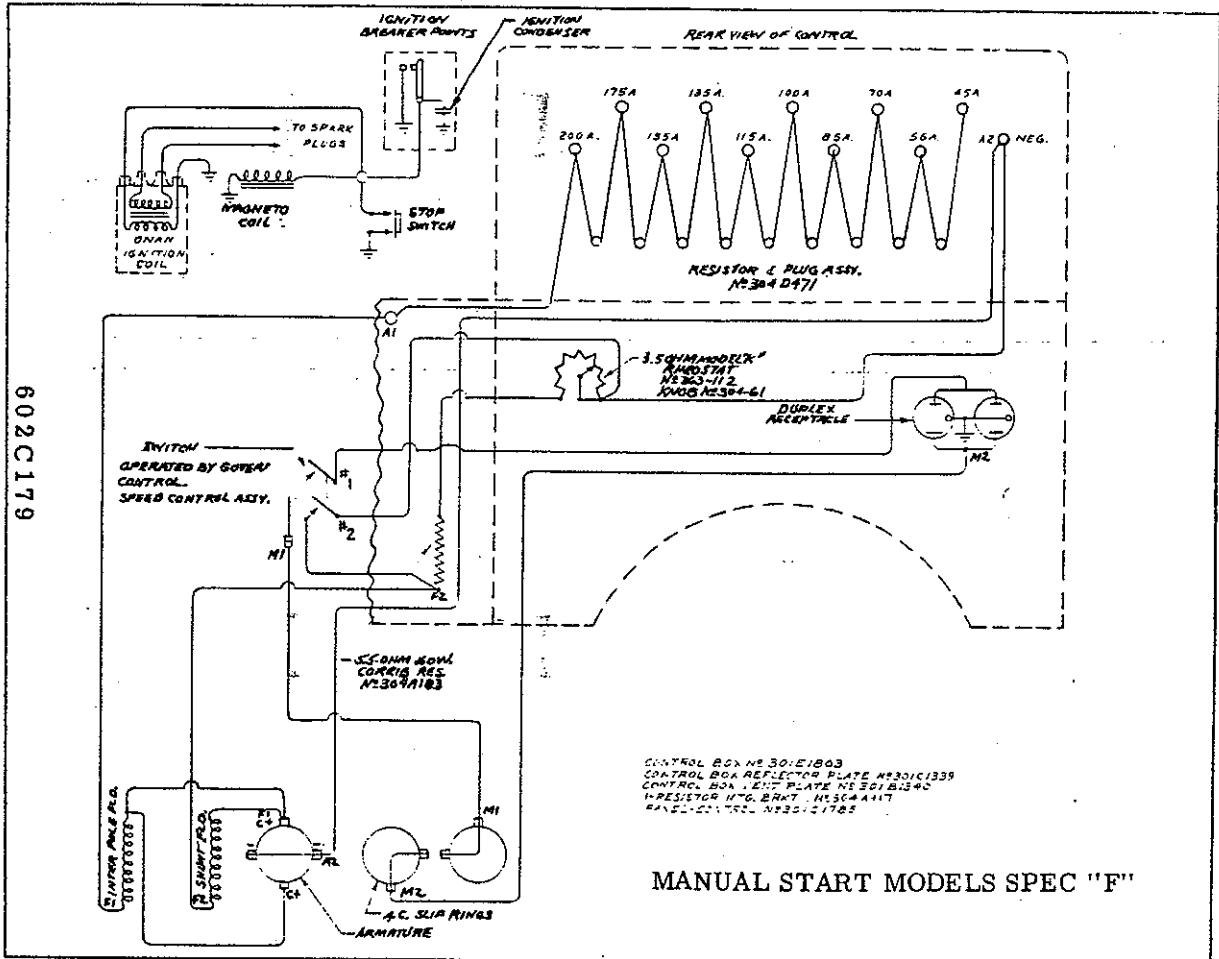
| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|---------------------------------------|
| 9 | 526-0081 | 4 | Washer, Flat - Wheel Mounting |
| 10 | 410-0313 | 1 | Brace, Handle |
| 11 | 800-0031 | 2 | Screw, Hex Head (5/16-18 x 1-1/2") |
| 12 | 850-0045 | 6 | Washer, Lock (5/16) - Handle Mounting |
| 13 | 862-0015 | 6 | Nut, Hex (5/16-18) - Handle Mounting |
| 14 | 800-0035 | 2 | Screw (5/16-18 x 2-1/2") |
| 15 | 814-0182 | 2 | Screw, Flat Head (5/16-18 x 1-1/2") |
| 16 | 862-0003 | 4 | Nut, Hex (3/8-16) |
| 17 | 850-0050 | 4 | Washer, Lock (3/8) |

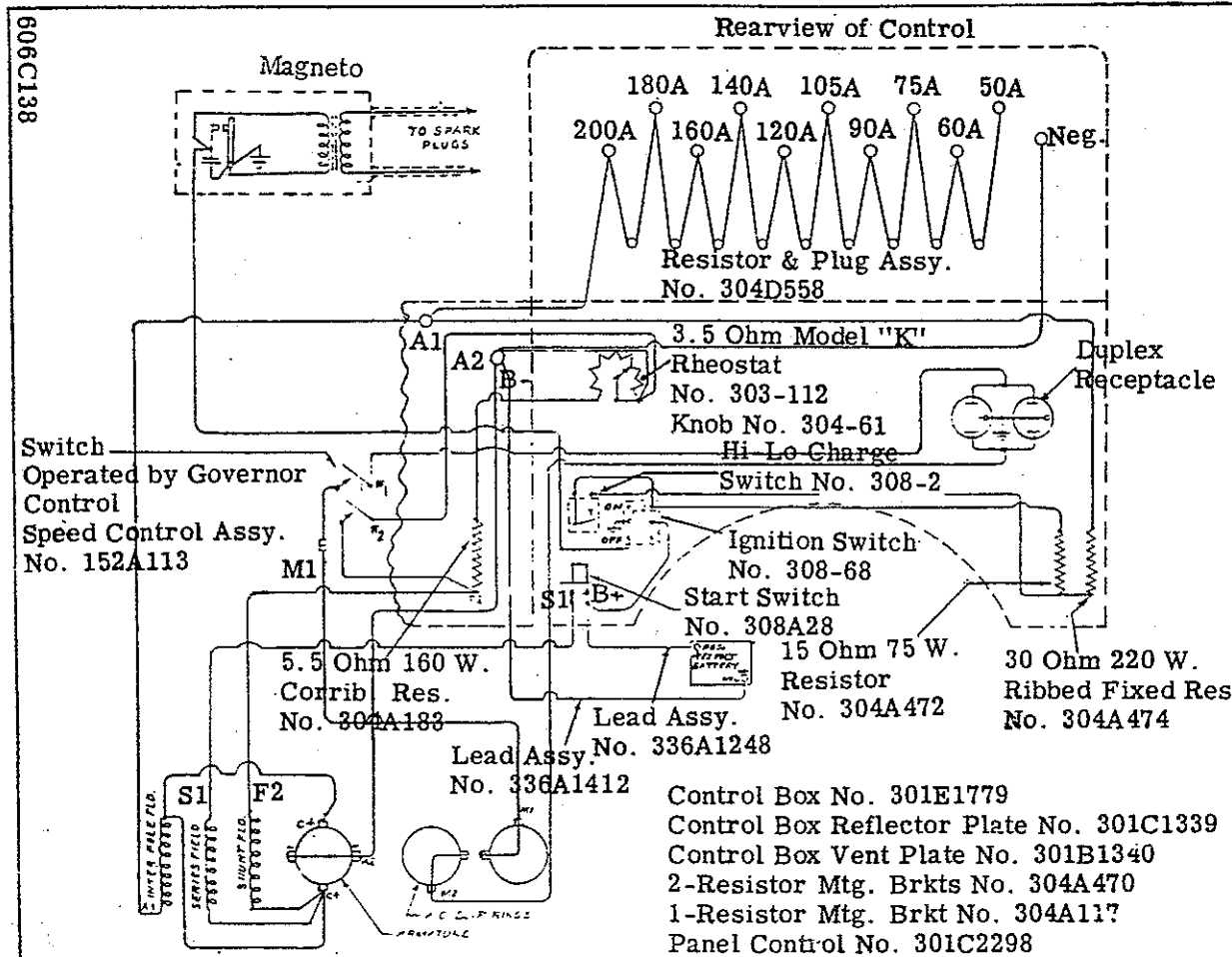
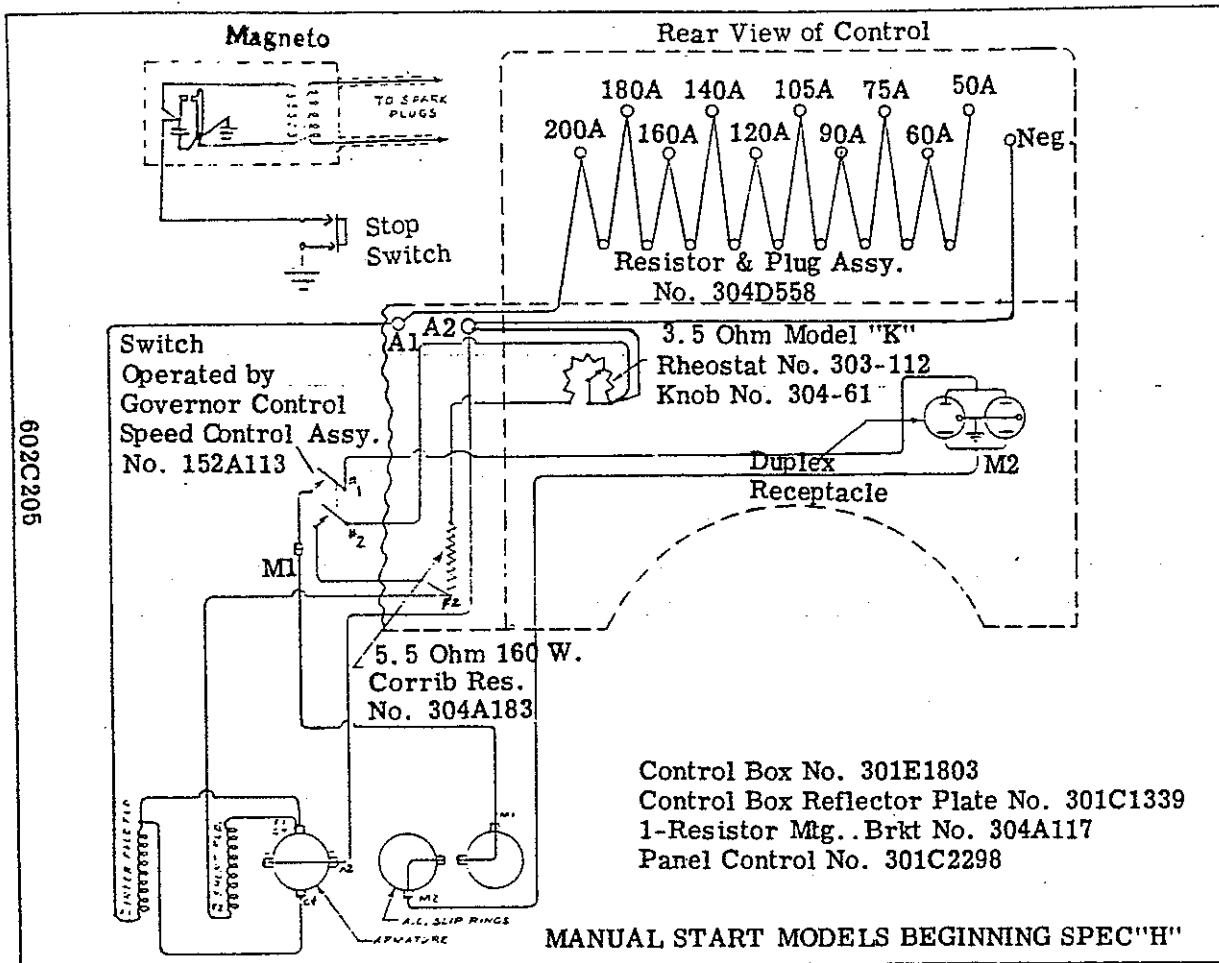
SERVICE KITS AND MISCELLANEOUS

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

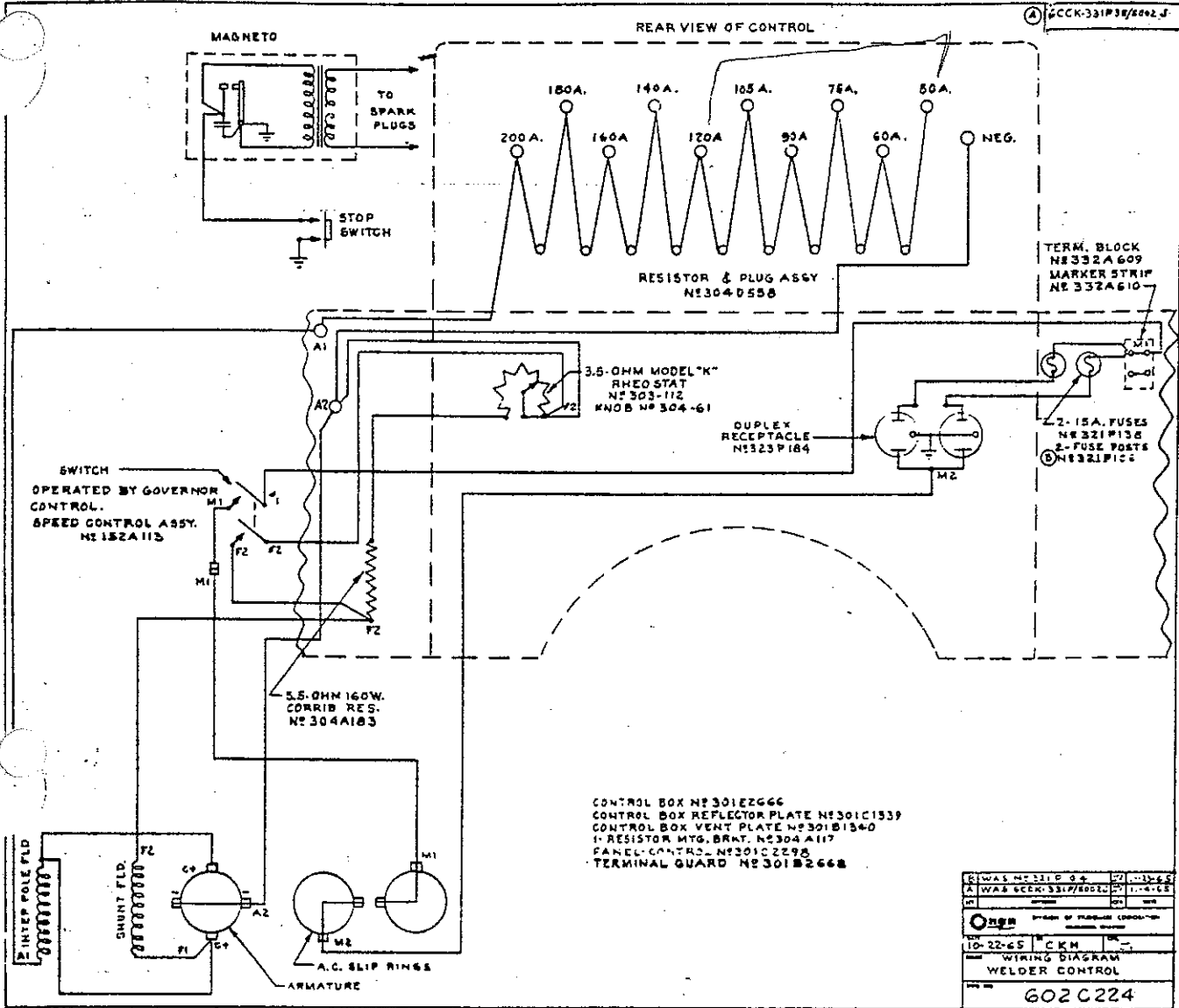
| REF. NO. | PART NO. | QTY. USED | PART DESCRIPTION |
|----------|----------|-----------|--|
| | 98-2028 | 1 | Decal Kit |
| | 168-0103 | 1 | Gasket Kit, Plant |
| | 160-0836 | 1 | Kit, Ignition Tune-up |
| | 168-0095 | 1 | Kit, Gasket - Carbon Removal (2 Manifold Gaskets Not Used) |
| | 522-0191 | 1 | Overhaul Kit |
| | 412-0028 | 1 | Cover, Canvas (Optional) |

WIRING DIAGRAMS





**SUPPLEMENTARY WIRING DIAGRAM FOR MANUAL START "CSA"
QUALIFIED UNIT, MODIFICATION 38**



| | | | |
|----------------------------------|---------|----------|--------|
| REVISED BY | DATE | BY | DATE |
| A. W. S. G. C. K. | 3/17/62 | C. K. M. | 1-4-68 |
| | | | |
| DIVISION OF FERRIS CORP. | | | |
| ID-22-65 | CKM | | |
| WIRING DIAGRAM WELDER CONTROL | | | |
| 602 C 224 | | | |