Owner's Manual

Installation/Operator/Service/Parts

Cummins **Onan**

Performance you rely on.™

Welder
200 AMP.

CCK

English 5−2009 927−1031 (Issue 1)

200 AMP. WELDER
CCK
SERIES

TABLE OF CONTENTS

warranty

FORM NUMBER
927-1030

ISSUE DATE
3-76
(SPEC F-T)

Onan®

PRODUCT SUPPORT BULLETIN NO. 208
SERVICE/PARTS/PUBLICATIONS

DATE SEPT. 28, 1977

SUBJECT: "OSHA" GROUNDING REGULATIONS

REF. FILE# S-117 (SERVICE) (LEGAL) (PARTS)

MODEL(S) or SERIES:

EFFECTIVE: IMMEDIATELY

ALL "CCK" WELDERS, 6.0 "DJB" WELDERS AND CONSTANT POTENTIAL WELDERS

Beginning with serial number 770221449 (for "CCK") and D770230081 (For "DJB"); above production welders incorporate a new bonding lead to comply with current "OSHA" grounding regulations.

This bonding lead is a new lead connected from M2 to the frame of the generator.

Current replacement brush rigs will have this lead installed from the factory.

This bonding lead only is available from Onan under Part #336-0164.

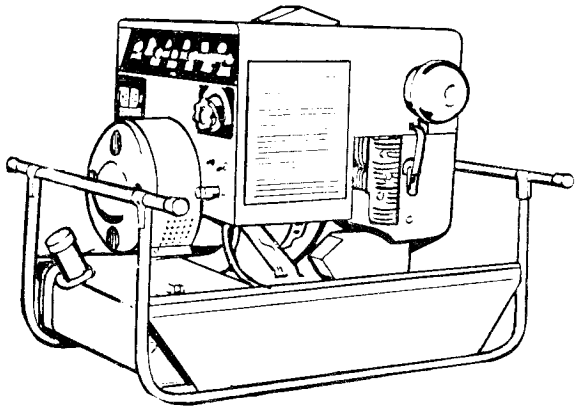
This bulletin is for informational purposes.

INTRODUCTION

FOREWORD

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 percent 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 percent 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.

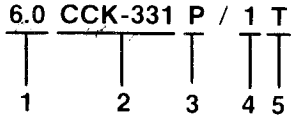


TYPICAL 200 AMPERE WELDER

MODEL IDENTIFICATION

Identify your model by referring to the complete Model and Specification number as shown on the unit nameplate.

How to interpret MODEL and SPEC NO.



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

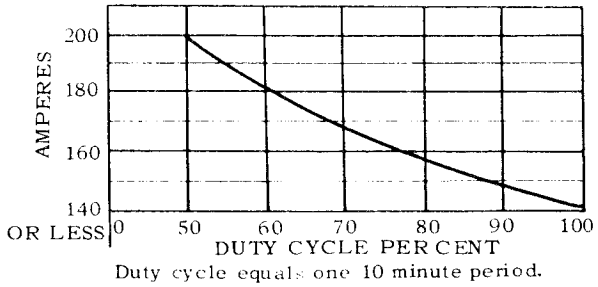
Where applicable, metric equivalents appear in parentheses following the U.S. customary units.

When interpreting the *Duty Cycle Chart*, note that at 200 amperes rated load, actual welding time must not exceed 50 percent 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.

WARNING **Onan uses this symbol throughout this manual to warn of possible serious personal injury.**

CAUTION **This symbol refers to possible equipment damage.**

DUTY CYCLE CHART



Duty cycle equals one 10 minute period.

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.

  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.**

  Do not use the welder without grounding it to earth as required by the National Electrical Code, Sections 250-26, 250-82, 250-83, and other referenced or applicable codes. Local codes take precedence over national codes. Consult your local building inspector.

  Use one continuous No. 8 copper grounding conductor. Attach one end of the conductor to the copper grounding terminal on the welder frame or case. Attach the other end to a metal (rod or pipe) grounding electrode with a continuous path to earth below the permanent moisture level.

  Uninsulated metal, underground, water piping systems or tanks generally provide a safe ground. Effectively grounded metal frame structures with concrete foundations below the permanent moisture level generally provide a safe ground, too.

  If a safe grounding electrode is not available to your installation, drive a 1/2 inch copper or iron rod (or a 3/4 inch iron pipe) into the earth to a depth of not less than 8 feet (2.4 m). The iron rod or pipe must be galvanized or otherwise metallic coated to prevent corrosion.

  WARNING **Do not ground a welder to pipelines carrying gases or flammable liquids because an electric arc in the line could create a fire or explosion hazard.**

  Always use three-prong plugs.

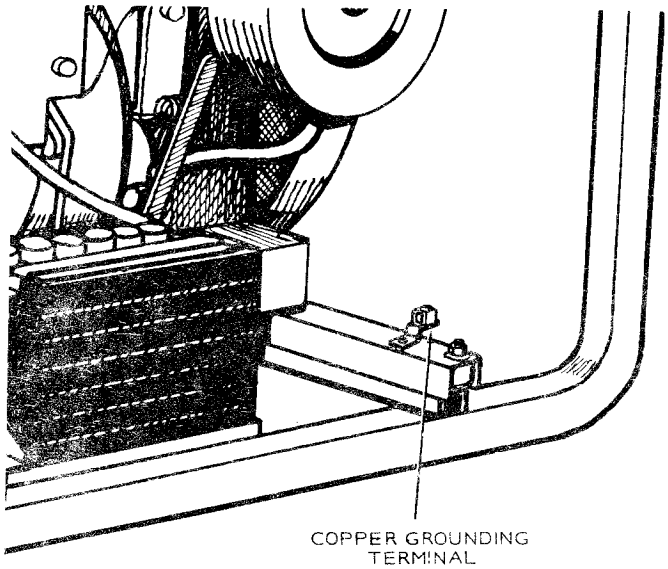


FIGURE 1. COPPER GROUNDING TERMINAL

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.**

WARNING **Never weld in or near explosive atmospheres because a welding arc can create a fire or explosion.**

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.**

- **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 asbestos 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.

- **Do Not Smoke While Servicing Batteries**

  Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

WARNING

MANUFACTURER RECOMMENDS THAT ALL SERVICE INCLUDING INSTALLATION OF REPLACEMENT PARTS BE DONE BY QUALIFIED ELECTRICAL AND/OR MECHANICAL SERVICEMEN. FROM THE STANDPOINT OF POSSIBLE INJURY AND/OR EQUIPMENT DAMAGE IT IS IMPERATIVE THAT THE SERVICEMAN IS QUALIFIED.

SPECIFICATIONS

Nominal Dimensions (inches)	
Height	26-1/2 (673 mm)
Width	29 (737 mm)
Length	36 (914 mm)
Number of Cylinders	2
Displacement (cubic inches)	50 (819.5 cm^3)
Cylinder Bore (inches)	3-1/4 (82.6 mm)
Piston Stroke (inches)	3 (76.2 mm)
Horsepower (at 1800 rpm)	10.2 (7.61 kW)
Compression Ratio	5.5:1
Oil Capacity	4 quarts (3.78 litre)
Fuel Capacity	7-1/3 gal. (27.8 litre)

DIMENSIONS AND CLEARANCES

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

	MINIMUM		MAXIMUM	
	Inches	(mm)	Inches	(mm)
Tappet to Cylinder Block	0.0015	(0.038)	0.003	(0.076)
Valve Stem in Guide—Intake	0.001	(0.025)	0.0025	(0.064)
Valve Stem in Guide—Exhaust	0.0025	(0.064)	0.004	(0.102)
Valve Tappet Clearance, Intake	0.006	(0.152)	0.008	(0.203)
Valve Tappet Clearance, Exhaust	0.015	(0.038)	0.017	(0.432)
Valve Seat Face Width	1/32	(0.794)	(3/64	(1.191)
Valve Face Angle	44°		44°	
Valve Seat Angle	45°		45°	
Valve Interference Angle	1°		1°	
Crankshaft Main Bearing Clearance				
Aluminum Alloy, Flanged—Prior to Spec H	0.0025	(0.064)	0.0038	(0.097)
Bronze-Faced, Begin Spec H	0.0025	(0.064)	0.0038	(0.097)
Crankshaft End Play	0.006	(0.152)	0.012	(0.305)
Camshaft Bearing	0.0015	(0.038)	0.003	(0.076)
Camshaft End Play	0.003	(0.076)		
Rod Bearing (Aluminum Rod)	0.002	(0.051)	0.0033	(0.084)
Rod Bearing (Forged Rod)	0.0005	(0.038)	0.0023	(0.058)
Connecting Rod End Play	0.002	(0.051)	0.016	(0.406)
Timing Gear Backlash	0.002	(0.051)	0.003	(0.076)
Oil Pump Gear Backlash	0.002	(0.051)	0.005	(0.127)
Piston to Cylinder (measured below oil control ring—90° from pin), Clearance	0.0015	(0.038)	0.0035	(0.089)
Piston Pin in Piston		Thumb Push Fit		
Piston Pin in Rod	0.0002	(0.051)	0.0007	(0.018)
Piston Ring Gap in Cylinder	0.010	(0.254)	0.023	(0.584)
Breaker Point Gap (Full Separation)	0.020	(0.508)	0.020	(0.508)
Spark Plug Gap—For Gaseous Fuel	0.018	(0.457)	0.018	(0.457)
Spark Plug Gap—For Gasoline Fuel	0.025	(0.635)	0.025	(0.635)
Crankshaft Main Bearing Journal—Standard Size	1.9992	(50.78)	2.000	(50.8)
Crankshaft Rod Bearing Journal—Standard Size	1.6252	(41.28)	1.6260	(41.30)
Cylinder Bore—Standard Size	3.249	(82.52)	3.250	(82.55)

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.	N•m
Cylinder Head Cap Screws	29-31	(39-42)
Rear Bearing Plate Nuts	20-25	(27-34)
Connecting Rod Screw—Aluminum Rod	24-26	(33-35)
Connecting Rod Bolt—Forged Steel Rod	27-29	(37-39)
Flywheel Cap Screw	35-40	(47-54)
Armature Through Stud and Nut	35-40	(47-54)
Other 5/16" (8 mm) Cylinder Block Studs and Nuts	10-12	(14-16)

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 and safety.

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

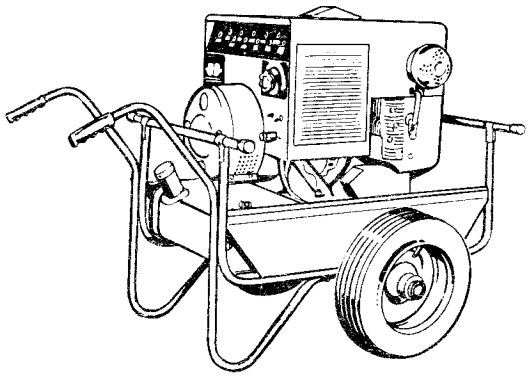


FIGURE 1. TWO WHEEL DOLLY

VENTILATION

Welders generate considerable heat during operation. If operating welder in any small enclosure, provide separate, unobstructed air inlet and outlet openings (minimum area of 3-1/2 square feet [3252 cm^2] 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! Leaky exhaust systems emit noxious carbon monoxide fumes which are a potential safety hazard in enclosed areas. May cause severe personal injury or death.**

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

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 degrees sideways, 30 degrees 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 degree elbow used for battery clearance. See Figure 2.

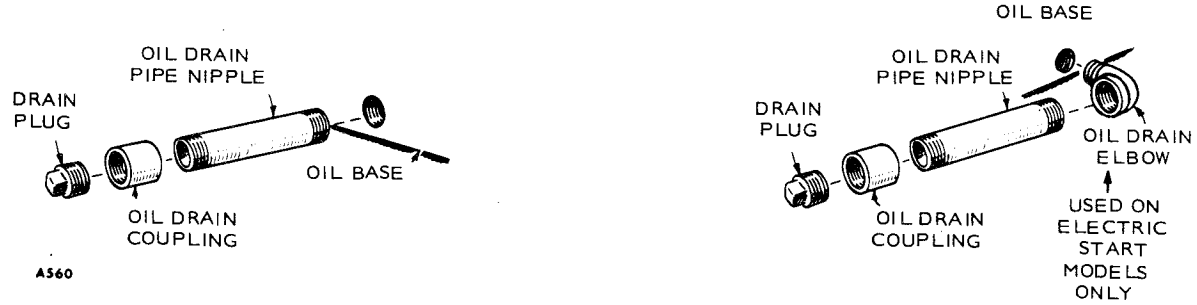


FIGURE 2. OIL DRAIN EXTENSION PIPES

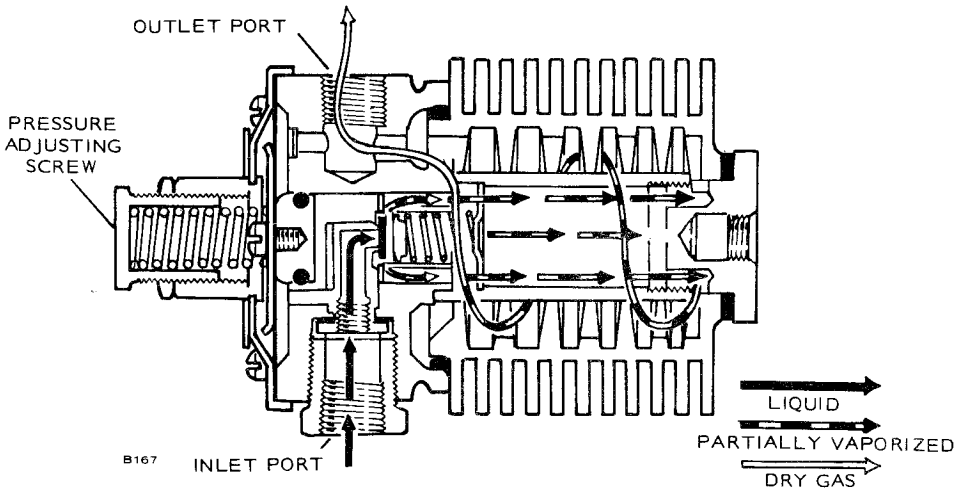


FIGURE 3. LPG VAPORIZATION PROCESS

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 (48 kPa). 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 (69 kPa). Bleed air from the fuel line by depressing the primer button. Major components of the LPG system are shown in Figure 4.

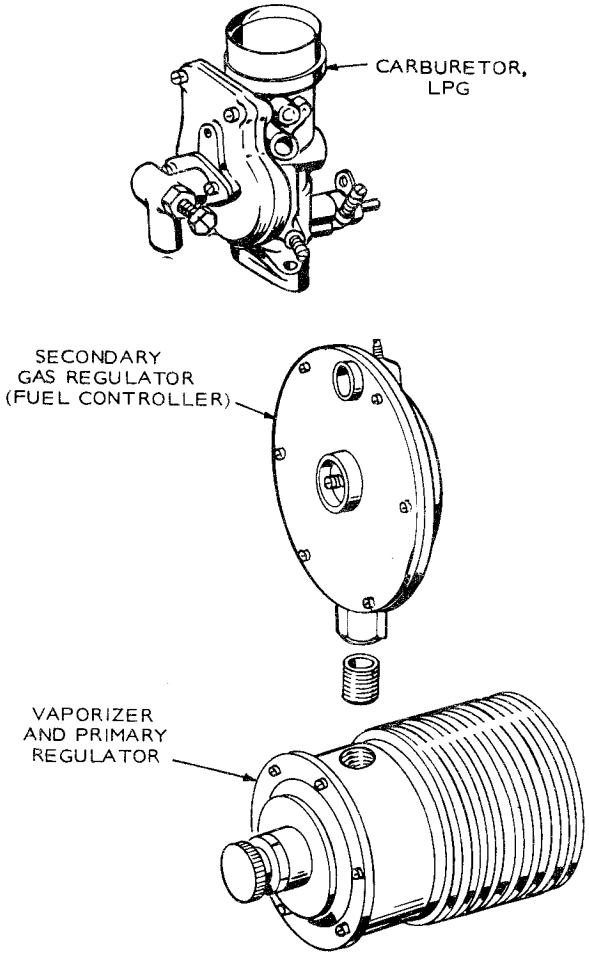


FIGURE 4. LPG FUEL SYSTEM COMPONENTS

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 solvent , dry thoroughly and reinstall. When the engine is first started, heavy exhaust smoke is normal and is caused by the inhibitor oil.

WARNING **Do not remove oil cap with engine running; oil will blow out causing possible injury.**

Crankcase Oil

Use detergent oil that meets API (American Petroleum Institute) service designations SE, SE/CC (former designation was MS or MS/DS). Refer to the *MAINTENANCE* section for the correct SAE grade oil.

CAUTION **Do not overfill crankcase. Do not mix brands nor grades of motor oil because they may not be compatible.**

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 nonleaded 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 nonleaded 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 **To prevent hazardous gasoline spillage, never fill the tank when the engine is running and leave some fuel expansion space. Observe safety precautions when handling gasoline to prevent an explosion.**

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.

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 about 6 inches (152 mm) 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.

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.

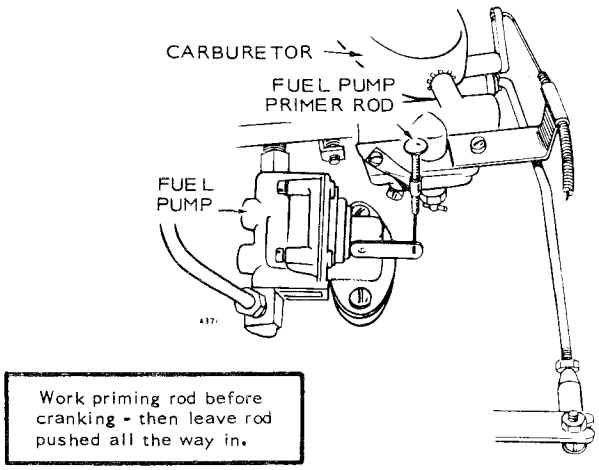


FIGURE 5. PRIMING FUEL PUMP

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. Move ignition switch located on control panel to ON position. (The battery must be connected.)
2. Adjust choke according to temperature conditions.
3. Push START switch firmly. If unit does not start within a few seconds, release START switch and wait a few seconds before re-attempting. If unit does not start after second attempt, open choke and repeat starting sequence.
4. After unit starts, adjust choke to best running position. Gradually push choke control in as 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 psi (138-242 kPa). Pressure is higher until the engine warms up.

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.

CAUTION **Before fifty operating hours, the cylinder head bolts must be re-torqued as described in the *ENGINE DISASSEMBLY* section, *Cylinder Heads*, to avoid blown gaskets.**

CONNECTIONS FOR WELDERS IN PARALLEL

Two welders can be connected in parallel whenever the current requirements are greater than those provided by one welder, Figure 6.

1. Start both engines before connecting the cables to parallel the welders.
   a. Adjust engines to same no-load speed. Use a tachometer or voltmeter for this adjustment.
      CAUTION **IF THE WELDERS ARE NOT ADJUSTED TO THE SAME SPEED, THE OUTPUT WILL NOT DOUBLE THE CURRENT JACK RATING.**
   b. After engines are operating at the same speed, connect the paralleling cables to the proper jacks.
2. Determine welding current requirements. Select IDENTICAL current jack receptacles on each welder which total the ampere requirement.

   EXAMPLE: If 300 amperes are required, select the

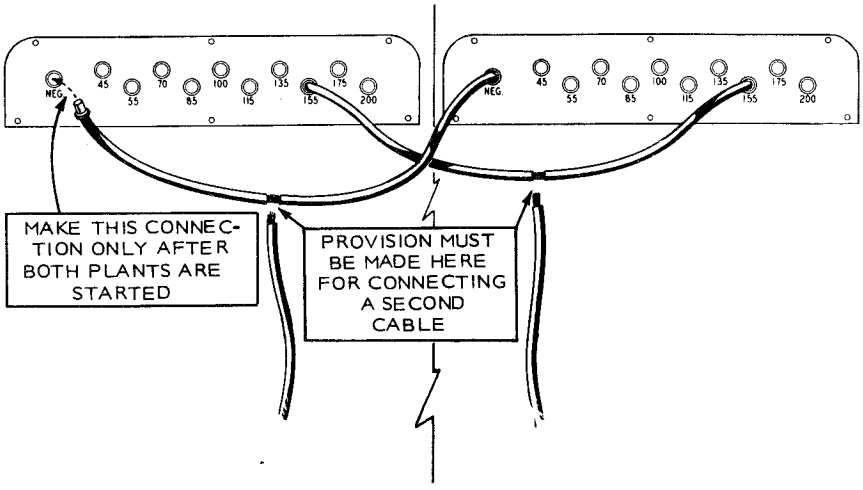


FIGURE 6. WIRING CONNECTIONS FOR WELDING IN PARALLEL

160 ampere receptacle on each welder. It may be necessary to select currents which total slightly higher than the welding requirements to obtain proper welding characteristics. This is due to voltage and current differences which occur when welders are connected in parallel and not running at the same speed.

Proper current can then be obtained using the fine current control adjustment, but adjust to approximately the same setting on both welders.

3. Large welding cables must be used because of the higher current. Consult your dealer, if in doubt, as to the welding cable size required.
   a. Connect a cable between the preselected IDENTICAL current jack receptacles of the welders. This cable (Figure 6) must have some means of attaching a second cable by splicing, clamping, etc., which will ensure a tight connection.
   b. Connect another cable (equal size and length) to the Negative jack receptacle of only one welder. DO NOT complete connection to NEG jack receptacle of second welder until both welders are running.

CAUTION **DO NOT ATTEMPT TO PARALLEL THE WELDER'S AC OUTPUT. SERIOUS CONTROL AND WELDER DAMAGE WILL RESULT.**

WELDING CURRENT ADJUSTMENT

Welders have an engine speed control lever and a fine current adjustment control, Figure 7.

When the engine speed control lever is in the WELD position (2500 rpm), 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 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.

   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 8), according to welding requirements. Some welding jobs may require frequent polarity changes to permit using various types of welding rods.

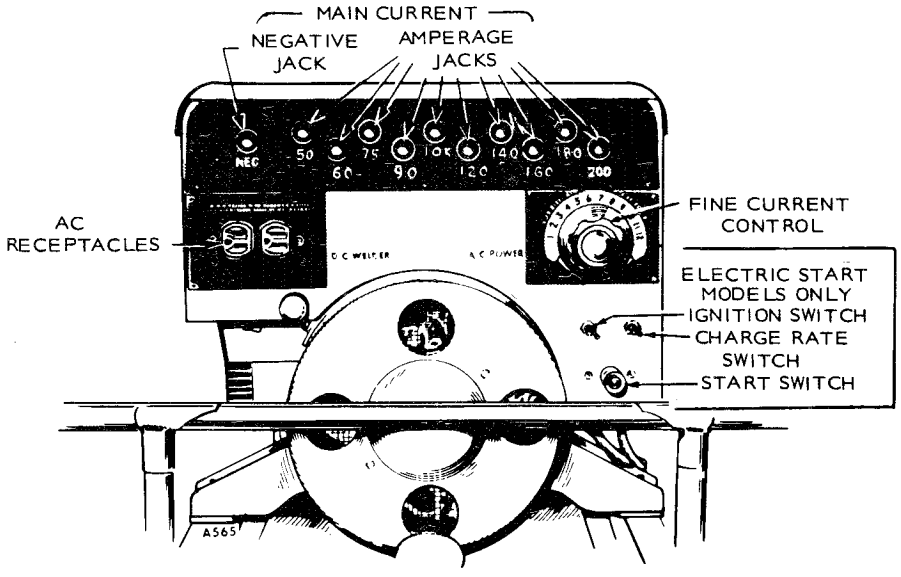


FIGURE 7. CONTROL PANEL SWITCHES AND ADJUSTMENTS

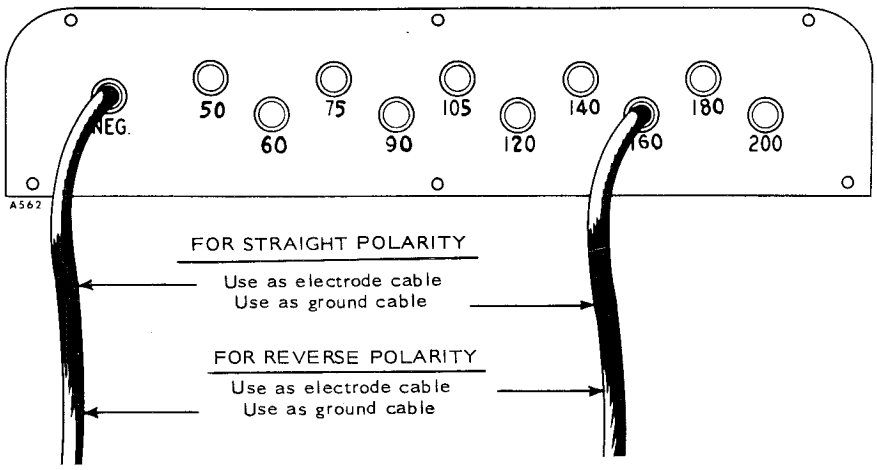


FIGURE 8. MAIN CURRENT JACK RECEPTACLES

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.

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 1.5 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, move the ignition switch (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).

OPERATION AT HIGH TEMPERATURES

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

OPERATION AT LOW TEMPERATURES

1. Use correct SAE number oil for temperature conditions. Change oil only when engine is warm. If temperature drops unexpectedly and causes an emergency, move welder to a warm location or apply *flameless* heat externally until 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 ignition system clean, properly adjusted, and batteries well-charged.
4. Partially restrict cool air flow to 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 (775 m) above sea level, slightly closing the carburetor main adjustment maintains proper air-to-fuel ratio (refer to the *FUEL SYSTEM* section). Maximum power reduces about 4 percent for each 1000 feet (310 m) above sea level after the first 1000 feet. Thus, at an altitude of 5000 feet (1550 m), the welder delivers about 160 amperes with proper carburetor adjustment.

OUT-OF-SERVICE PROTECTION

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

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

RETURNING UNIT TO SERVICE

1. Remove cover and all protective wrapping. Remove plug from exhaust outlet.
2. Check tag on oil base and verify that oil viscosity is still correct for existing ambient temperature.
3. Clean and check battery. Measure specific gravity and charge battery until correct. If battery water level is low add water as necessary. Do NOT overcharge.
4. Connect batteries.
5. Start engine.

WARNING **Do not smoke while servicing batteries. Hydrogen/Oxygen gases emitted from batteries during charging are highly explosive.**

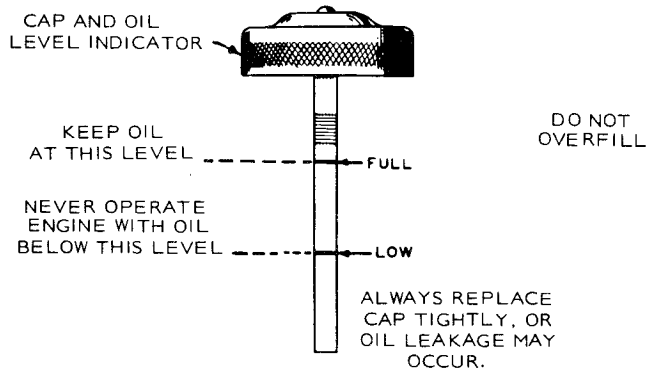
MAINTENANCE

CRANKCASE OIL

Oil capacity is 4 quarts (3.8 litre), U.S. measure. Fill to *full* mark on oil indicator. Use good quality detergent oil meeting API (American Petroleum Institute) service designations SE/CC. Use following SAE oil numbers for expected ambient temperatures.

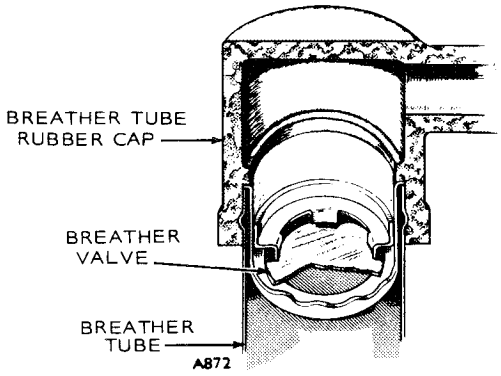
Above 32°F (0°C) ..... SAE 30
0°F to 32°F (-18 to 0°C) ..... SAE 10W
Below 0°F (-18°C) ..... SAE 5W
(SAE 5W-20 if 5W is not available)

Do not mix brands nor grades. Extremely dusty or low temperature conditions require oil change at 50 hours.

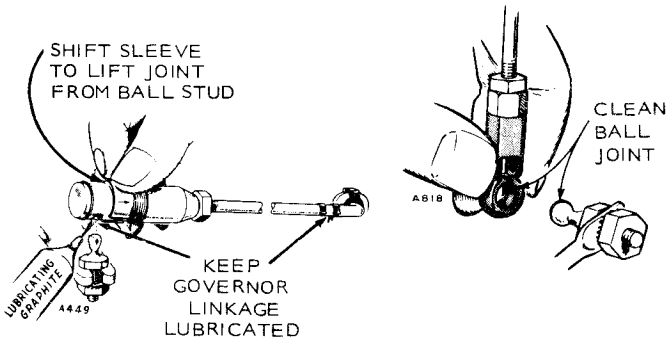


CRANKCASE BREATHER

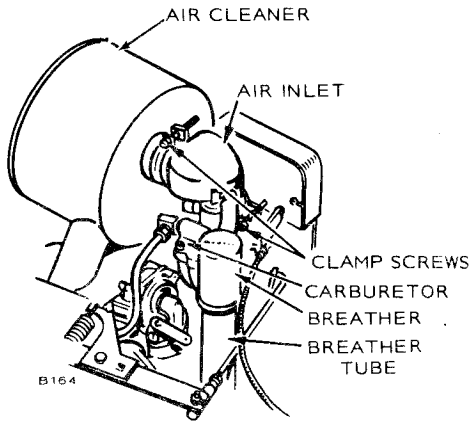
Lift off rubber breather cap. Carefully pry valve from cap. Otherwise, press hard with both of your thumbs on top of cap and fingers below to release valve from rubber cap. Wash this fabric flapper-type check valve in an approved solvent. Dry and install, positioning perforated disc toward engine.



CRANKCASE BREATHER



GOVERNOR LINKAGE



AIR CLEANER

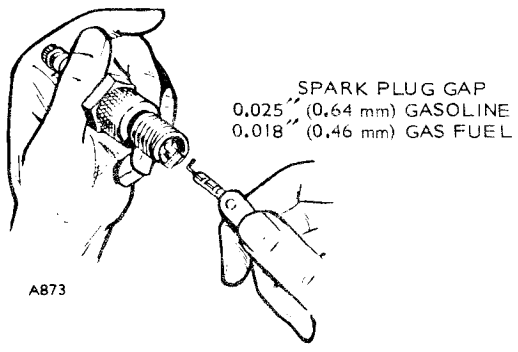


FIGURE 9. SERVICE PROCEDURES

MAINTENANCE SCHEDULE

Use this factory recommended maintenance schedule (based on favorable operating conditions) to serve as a guide to get long and efficient welder life. Neglecting routine maintenance (Figure 9) 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			
Inspect Exhaust System	x			
Clean Air Cleaner*		x1		
Clean Governor Linkage		x1		
Check Spark Plugs			x	
Change Crankcase Oil			x1	
Check Battery			x	
Clean Crankcase Breather				x
Clean Fuel System				x
Replace Oil Filter				x1

x1 - Perform more often in extremely dusty conditions.

* - 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.

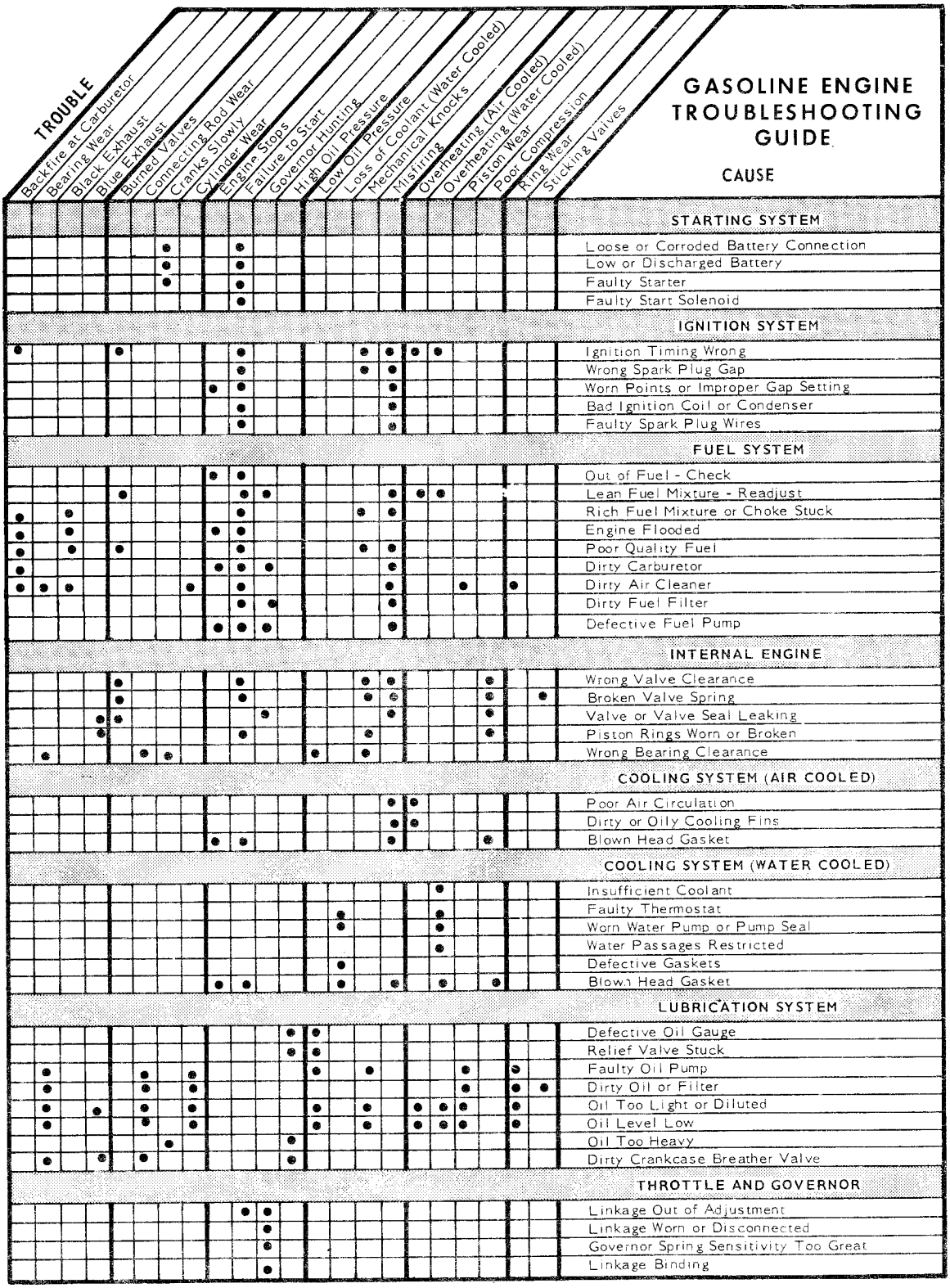
x2 - Replace brushes when worn to 5/8 inch (16 mm) or less.

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



FUEL SYSTEM

GASOLINE CARBURETOR

Carburetor maintenance includes regular cleaning. Some gasolines form gum deposits inside the carburetor which can be removed by soaking in alcohol or acetone. Use a fine, soft wire to clean the jets.

Float

See that the float is not damaged. If necessary, reset the float level by using a small screwdriver to bend the lip of the float. With the carburetor casting inverted and the float resting lightly against the needle in its seat, there should be a 5/16-inch (8 mm) clearance (1/4-inch [6.4 mm] with Styrofoam plastic float) between the bowl cover gasket and the free end of the float (side opposite the needle seat). See Figure 10.

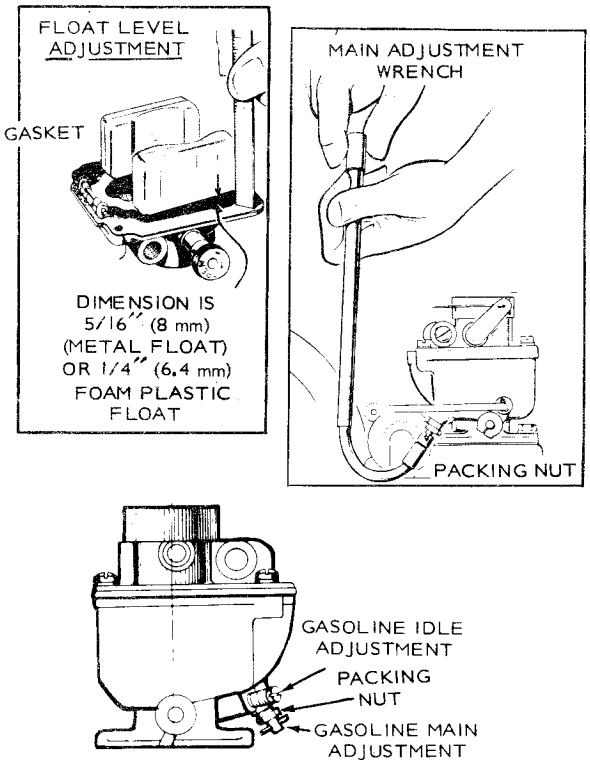


FIGURE 10. CARBURETOR ADJUSTMENTS

Adjustment Under Load

The carburetor has an adjustable idling jet. If the engine runs unevenly at half or full load due to faulty carburetion, the main adjusting needle (early models only) needs adjusting. Be sure the ignition system is working properly and that the governor is adjusted.

CAUTION **Loosen the packing nut before making main fuel adjustment and then tighten the nut to a snug fit after adjustment has been made. This procedure makes it easier to use the carburetor adjusting tool and prevents fuel leaks around the packing nut. Fuel leaks cause hard starting because the float level becomes lower than normal.**

1. Turn main adjusting needle (early models only) out about two full turns.
2. Slowly, turn needle in until engine begins to lose speed.
3. Very slowly, turn needle out until engine runs smoothly at full power and speed. A carburetor wrench (Onan tool number 420-0169) can be purchased from your dealer for easier adjustment of the carburetor main adjusting needle.

Adjustment Under "No Load"

When adjusting the idle jet needle, the engine should be running at normal operating temperature with no load connected.

1. Turn idle adjusting needle in until engine loses considerable speed.
2. Turn needle out until engine runs smoothly.

FUEL PUMP

The CCK series welder uses a diaphragm-type fuel pump. If fuel does not reach the carburetor, check the fuel pump before dismantling it.

1. Disconnect fuel line at carburetor.

WARNING **Use extreme care to direct fuel line flow into a suitable container. Make sure area is well ventilated to prevent accumulation of gasoline fumes. Make sure there is no possibility of accidental fire or explosion due to an open flame, pilot light, or an arc from the ignition wires.**

2. Crank engine slowly by hand, observing whether fuel comes from line at carburetor.

If the fuel tank is adequately filled and the line between the tank and the pump is open but the fuel pump fails, repair or replace it. Failure of the pump is usually due to a leaking diaphragm, a worn valve or valve gasket, a weak or broken spring, or wear in the drive linkage. Onan recommends the use of a complete repair kit if the operator chooses to repair the fuel pump rather than install a new one.

CAUTION **Gasoline-diluted oil may indicate a faulty fuel pump leaking fuel into crankcase.**

Always return the hand priming lever all the way inward so that the priming lever does not prevent normal pump operation.

VAPORIZER ADJUSTMENT

Adjust the vaporizor to a working pressure of 7 psi (48 kPa) whenever the pressure adjusting screw is moved or the unit is overhauled.

1. Place vaporizor in a vice or other suitable clamp. Attach an air hose from an air supply of about 75 psi (518 kPa) to the inlet, Figure 11.
2. Attach a 0 to 30 or 0 to 50 psi (0 to 207 or 0 to 345 kPa) pressure gauge to outlet.
3. Back off adjusting screw until only one or two threads are engaged. Apply air pressure to vaporizor unit.
4. Turn pressure adjusting screw in slowly until a reading of 7 psi (48 kPa) shows on gauge.

   To obtain an accurate gauge reading, it may be necessary to unscrew the gauge partially to bleed off some of the air. Then retighten the gauge and readjust for 7 psi. If the gauge indicator remains steady, the valve is not leaking. If the pressure reading increases slowly, it indicates a leaking valve. Check the components of the vaporizor for correct assembly procedures. Replace defective parts.

5. Tighten locknut on pressure adjusting screw. Turn off air pressure and remove gauge and air line.

THROTTLE STOP SCREW

Set the throttle stop screw, on the throttle shaft lever, to clear the manifold surface by 1/32 inch when the engine is operating at 1800 rpm with no electrical load connected (see Figure 12).

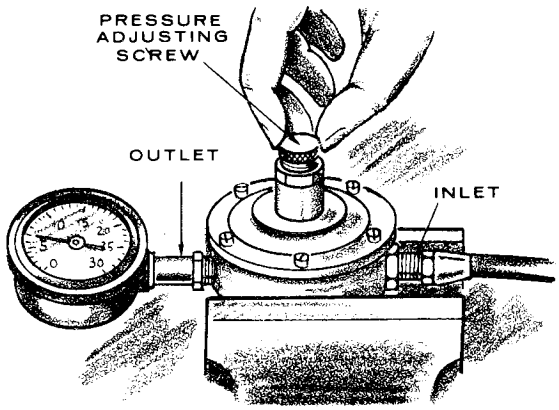


FIGURE 11. VAPORIZOR ADJUSTMENT

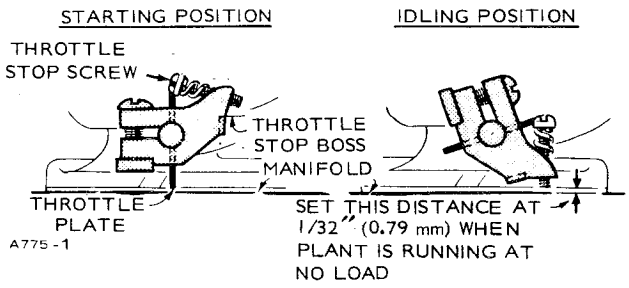


FIGURE 12. THROTTLE STOP SCREW ADJUSTMENTS

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 about 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 13.

1. Check length of linkage (A) that connects governor arm and carburetor throttle arm. This linkage synchronizes the governor arm travel with the carburetor throttle. If the original factory adjustment has been disturbed, adjust the length so that with the engine stopped and tension on the governor spring, the carburetor throttle lever stop is just touching the bottom surface of the carburetor body. Then, turn governor ball joint (B) about two more complete turns to shorten linkage (A). Now tighten locknut.
2. Set engine speed control lever (C) to POWER position, where lever boss (D) engages notch (E) in lever bracket (L).
3. Adjust spring tension to produce engine speed of about 1850 rpm (1550 rpm on 50 hertz models) at no-load. Spring tension is adjusted by loosening locknuts (F) and turning the inner nut on spring adjusting stud (M). This determines engine speed for AC operation.

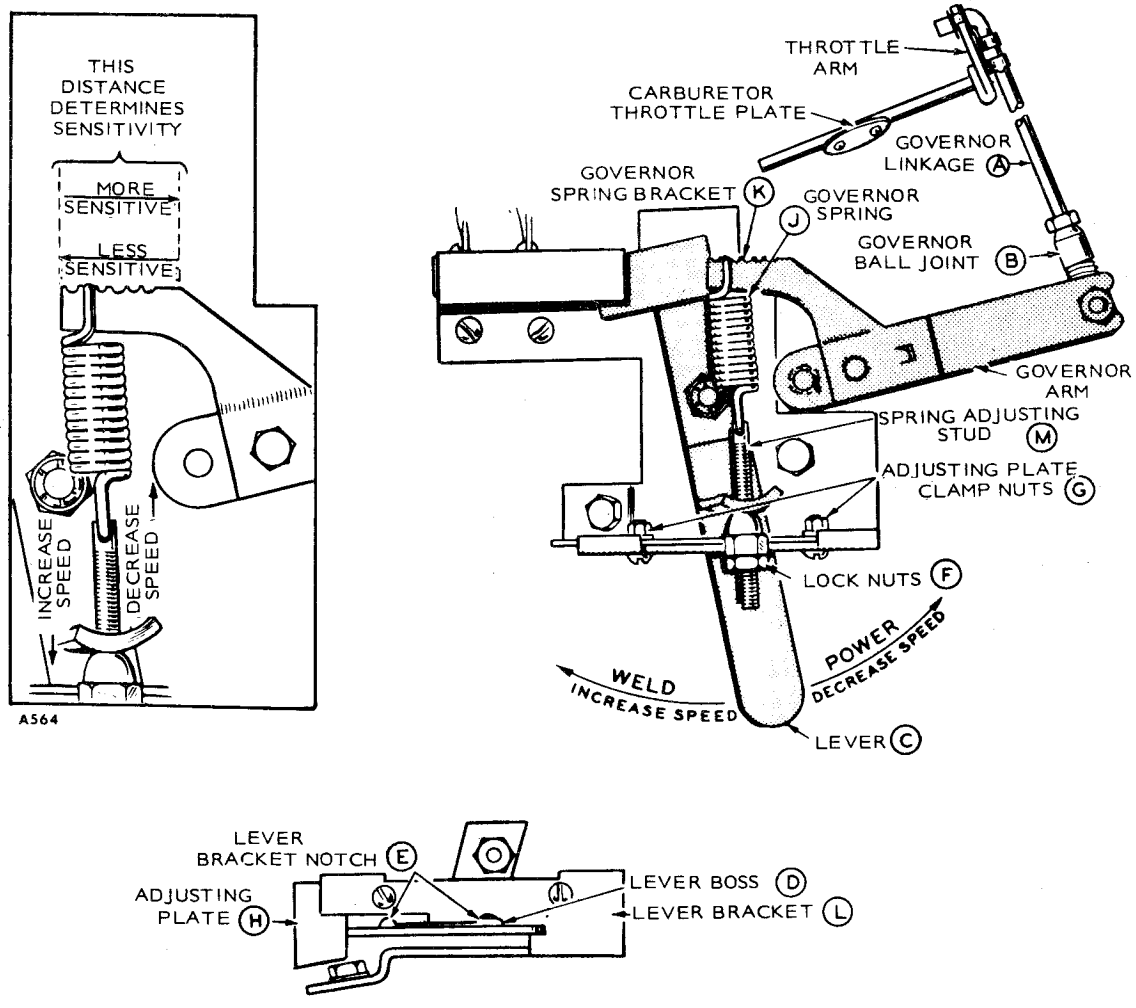


FIGURE 13. GOVERNOR AND GOVERNOR LINKAGE

4. Pull engine speed control lever to WELD position. The speed should be about 2700 rpm at no-load. If speed is not about 2700 rpm, loosen the two nuts (G) holding the adjusting plate (H), and slide the plate either in or out to gain the desired speed. Retighten nuts.
5. Check engine speed while welding at maximum current. Engine speed at full welding load should be about 200 rpm lower (about 2500 rpm) than no-load speed. If speed drop is excessive, move governor spring (J) in towards the governor arm one or more notches on spring bracket (K) until speed drop is about 200 rpm. 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 200 rpm, 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 (Figure 14) 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 degree 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.

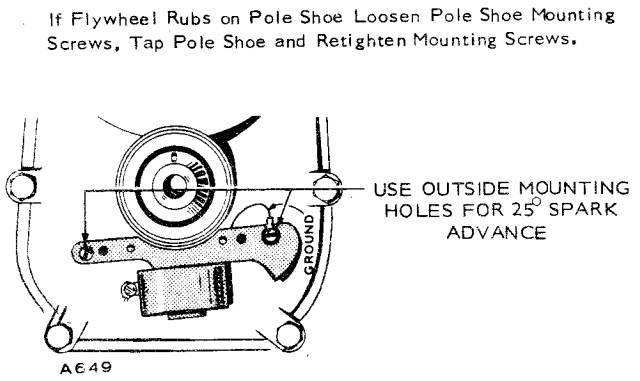


FIGURE 14. MAGNETO STATOR INSTALLATION

IGNITION COIL INSTALLATION (Prior to Spec H)

Coil connections differ between magneto ignition engines and battery ignition engines. Refer to Figure 15. 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 and for electric-start engines with 12-volt battery ignition.

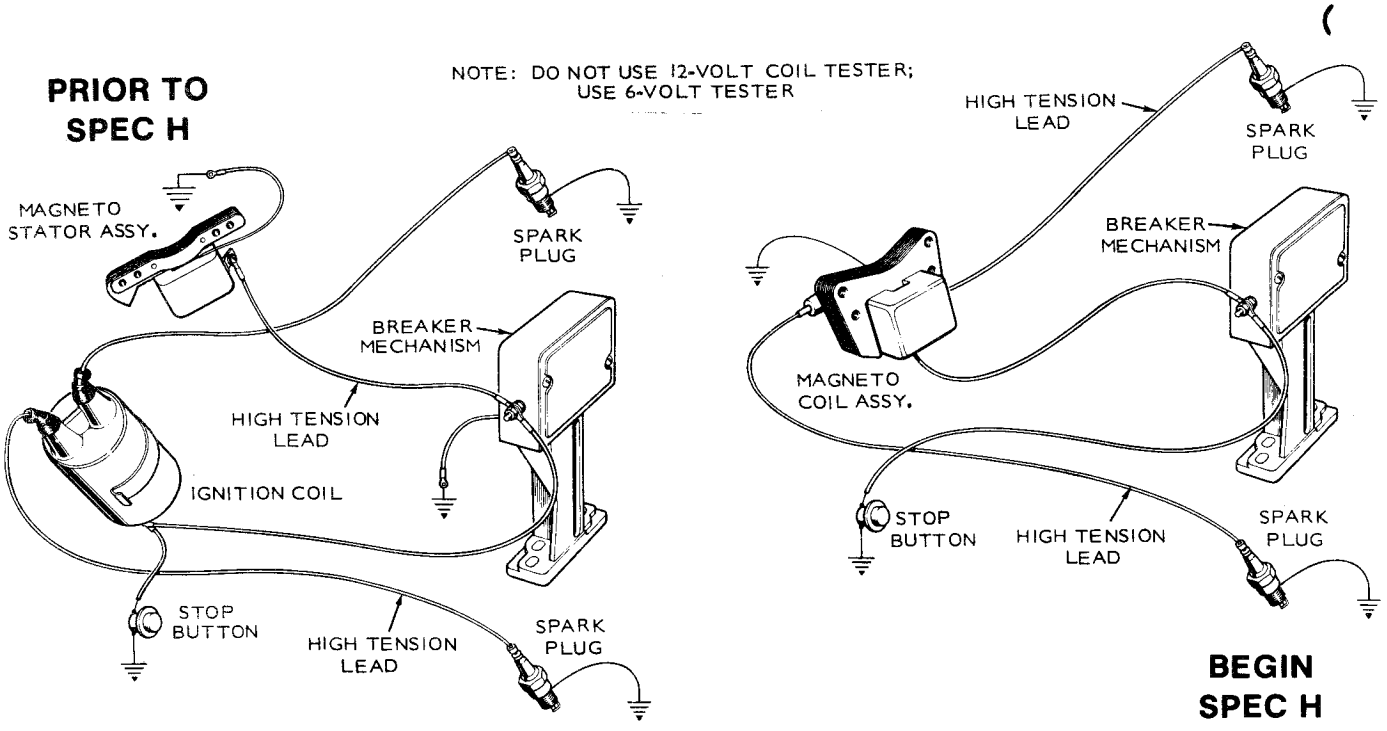


FIGURE 15. MAGNETO IGNITION

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

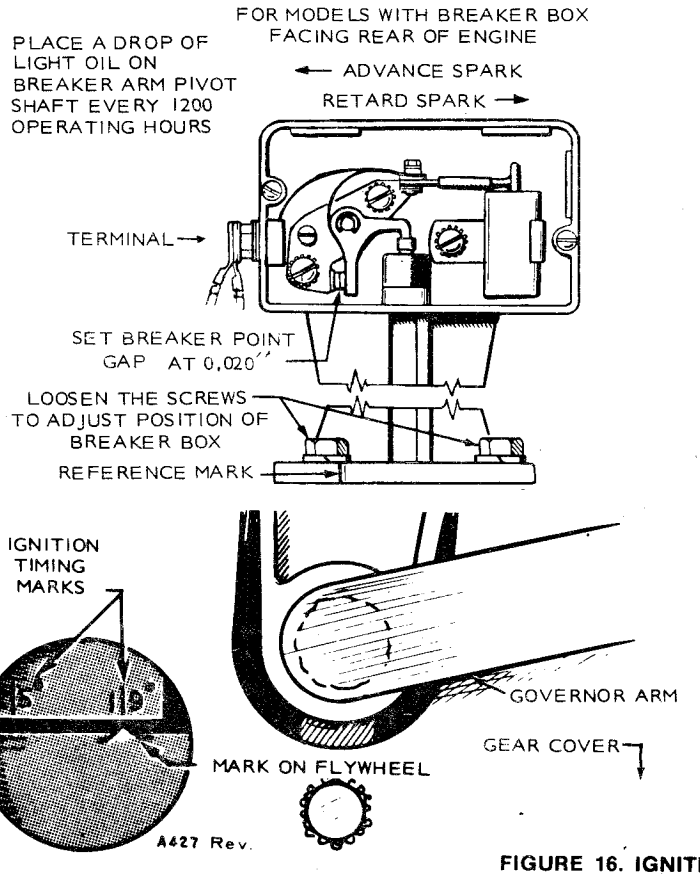
1. Remove cover from breaker box. If timing is off very far, attain an approximate setting by loosening the mounting screws and shifting the breaker box (and spacer if used) to align the witness marks on cylinder block and breaker box (or spacer).
2. Slowly crank engine by hand in direction of crankshaft rotation until witness mark on flywheel and TC mark on gear cover are exactly in line (Figure 16).
3. Adjust ignition breaker point gap to .020 inch (0.51 mm) at full separation.
4. Turn flywheel to left, against crankshaft rotation until timing mark is about two inches past 25 degree mark on gear cover.
5. Slowly turn flywheel to right and note whether ignition points just separate when TC mark on flywheel aligns with correct degree mark (19° or 25°) on 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 .
6. Tighten breaker box mounting screws securely after making an adjustment (Figure 16).

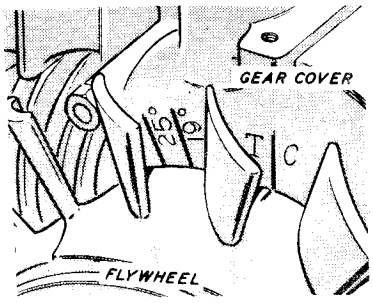
   To accurately check the time at which the spark occurs, an automotive-type timing light may be used when the engine is running.

   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.
7. Reinstall the breaker box cover.

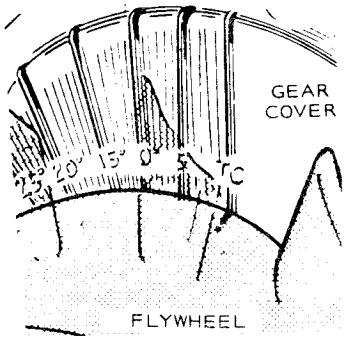
TIMING IGNITION (Begin Spec H, Prior to Spec L)

The correct timing (5 degrees stopped or idle speed—24 degrees 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.





PRIOR TO SPEC H



BEGIN SPEC H

FIGURE 16. IGNITION TIMING

Timing Marks on Flywheel

Align the correct timing mark on the flywheel with the TC mark on the gear cover.

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.

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 engine and run it at 1400 to 1600 rpm.
3. While watching timing marks with timing light, slow engine to below 800 rpm. The spark advance mechanism is operating properly if TC mark on flywheel disappears and then reappears when the engine is brought back to speed.
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.

CAUTION **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 degrees. The valve *seat* angle is 45 degrees. This 1-degree 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 17.

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 degrees. Valve seats should be ground with a 45-degree stone, and the width of the seat band should be 1/32-inch to 3/64-inch (0.79 to 1.19 mm) wide. Grind only enough to ensure proper seating.

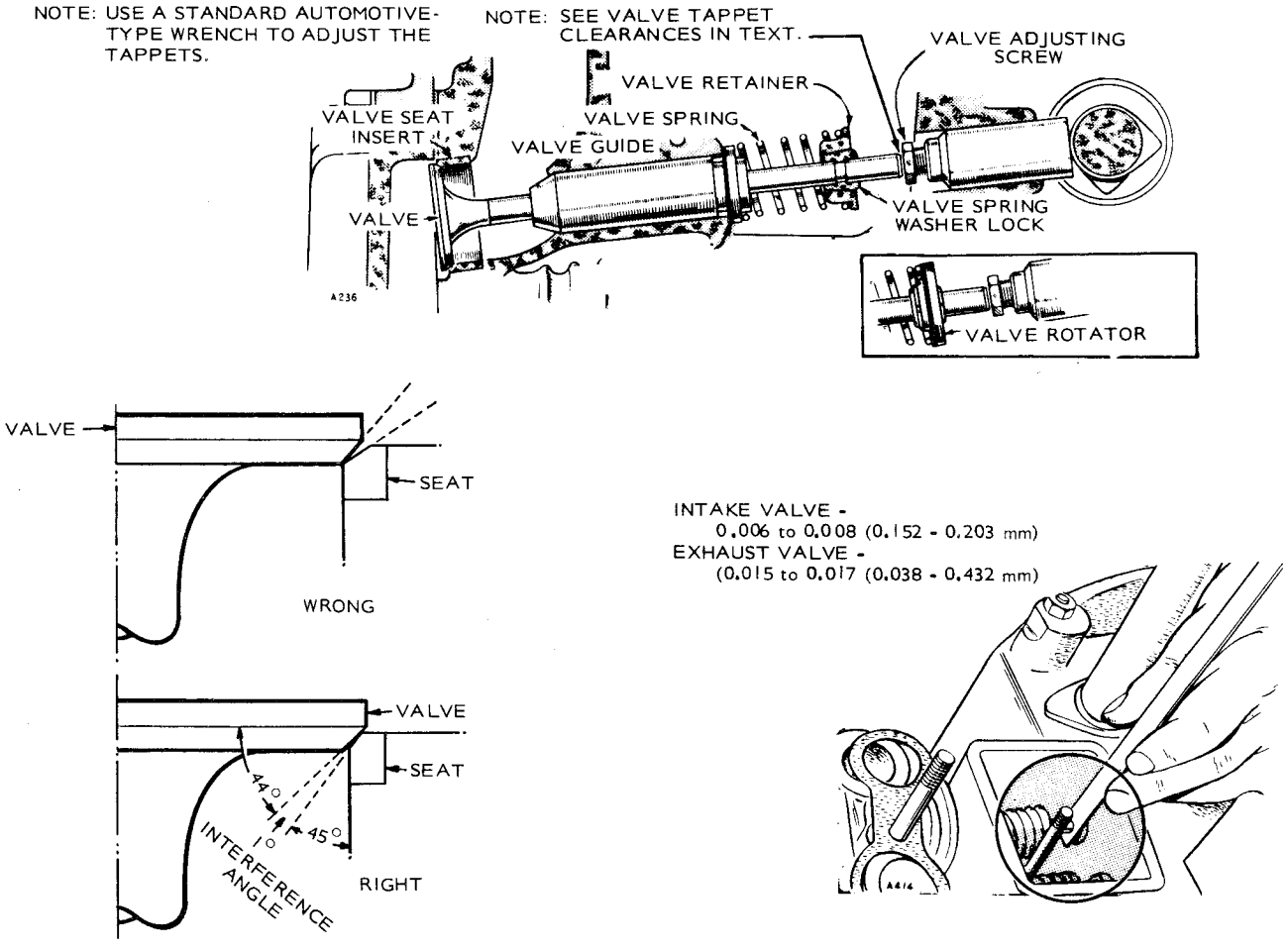


FIGURE 17. VALVE SYSTEM AND ADJUSTMENTS

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. 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:

1. Remove the valve covers.
2. Facing the flywheel, slowly crank engine by hand until left-hand intake valve opens and closes.
3. Continue about 1/4 turn until mark on flywheel and TC mark on 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 17.
4. To correct valve clearance, turn adjustable, self-locking screw as needed to obtain proper clearance.
5. To adjust valves on right hand cylinder, crank engine one complete revolution and again align mark on the flywheel and TC mark on gear cover. Then follow adjustment procedure given for valves of 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 420-0100) 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.

After reassembling the flywheel to the engine, the spark should jump a 3/16-inch (4.8 mm) 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 (Figure 18) 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 (19 mm) 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.

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 (19 mm) from the end of the camshaft, providing a 7/32-inch (5.6 mm) in-and-out travel distance for the governor cup (Figure 19). Hold the cup against the flyballs when measuring.

If the camshaft center pin extends less than 3/4 inch (19 mm), 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.

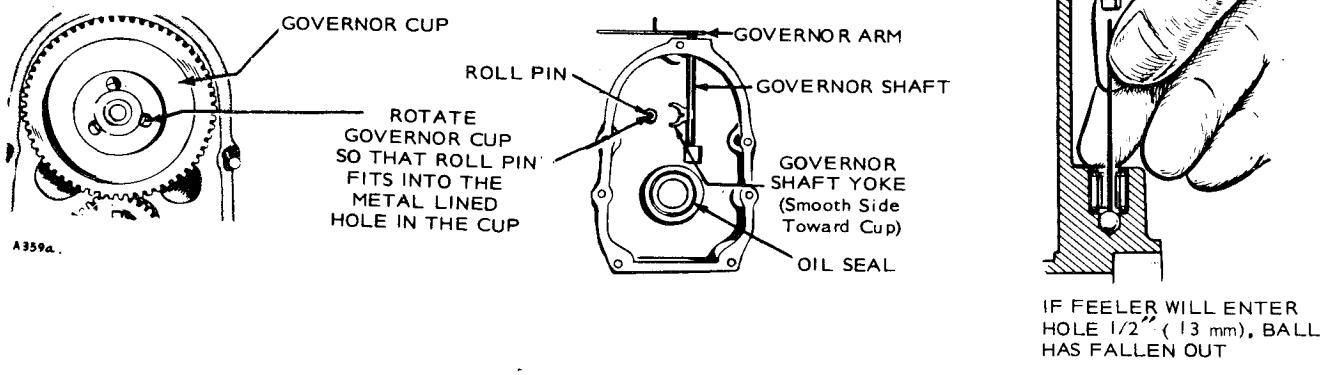


FIGURE 18. GEAR COVER ASSEMBLY

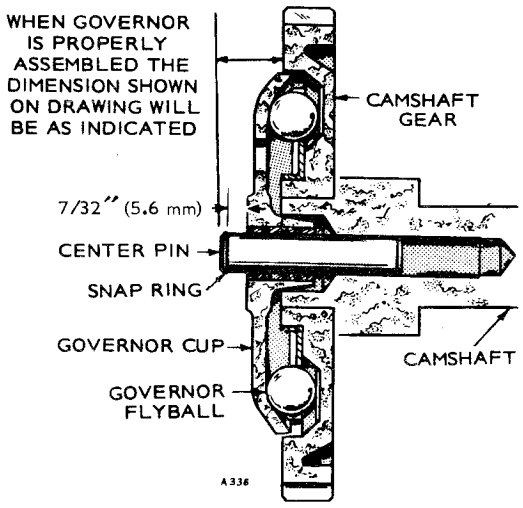
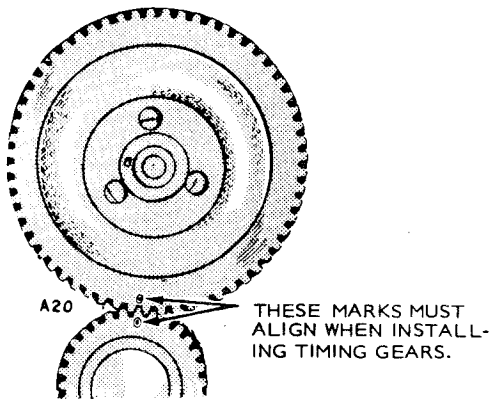


FIGURE 19. GOVERNOR CUP (CROSS SECTIONAL VIEW)



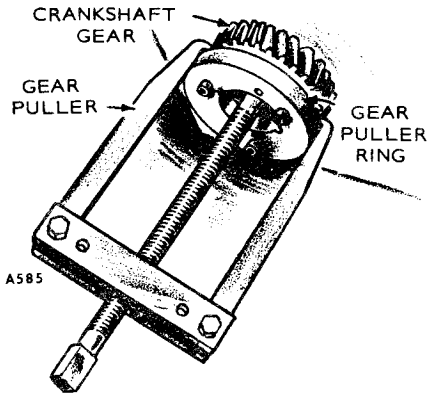


FIGURE 20. REMOVING CRANKSHAFT GEAR

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 420-0248) 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 20.

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

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

1. Crankshaft gear snap ring and retaining washer.
2. Cylinder head and valve assemblies.
3. Operating plunger for breaker points.
4. Fuel pump and tappets.
5. 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.

CAUTION **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 20) 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.

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 cylinder,
- have badly worn ring grooves,
- are so loose in piston pins that a 0.002-inch (0.05 mm) oversize pin does not correct it, or
- are in generally poor condition.

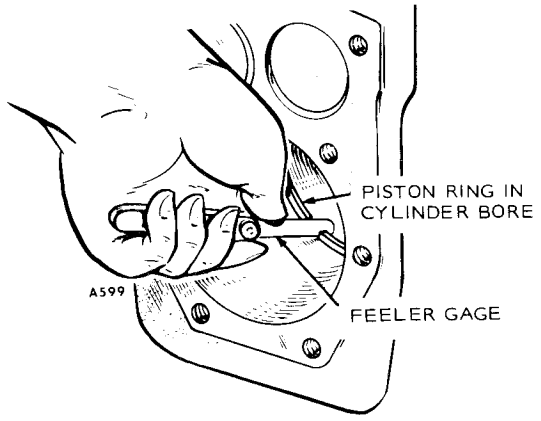


FIGURE 21. FITTING PISTON RINGS TO THE CYLINDER

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 21. The table of *DIMENSIONS AND CLEARANCES* lists the correct piston ring and gap. 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, .030 and .040-inch, oversize rings are to be used on the corresponding size piston.

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 (2) 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.

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 22.

BEARINGS

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

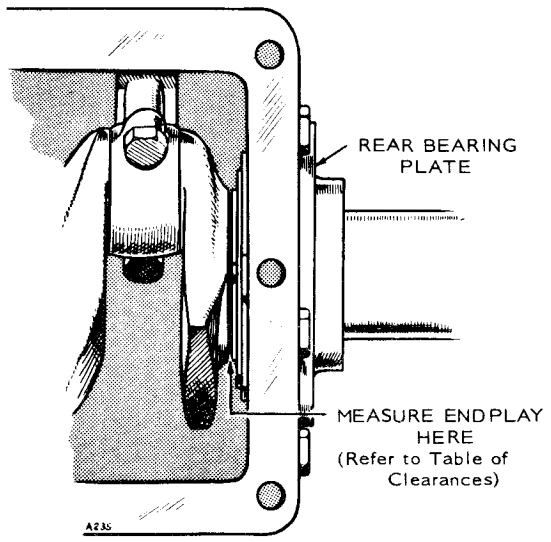


FIGURE 22. CRANKSHAFT ENDPLAY

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 (93° C).

CAUTION **If a torch is used, apply only a little heat or warping could occur.**

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 23. The oil passage holes must be at least half open.

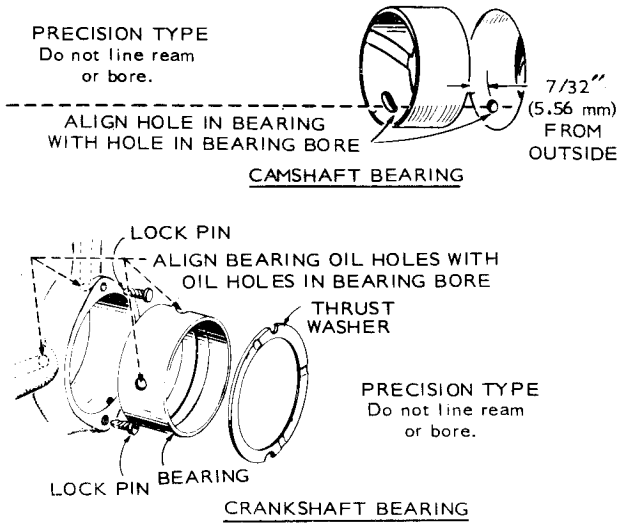


FIGURE 23. CAMSHAFT AND CRANKSHAFT BEARINGS

The cold precision bearing should be oiled and 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' two notches must fit over two lock pins to prevent riding on the crankshaft.

The precision camshaft bearings 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 counter-bore 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 24. 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 420-0181) 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 25. 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.

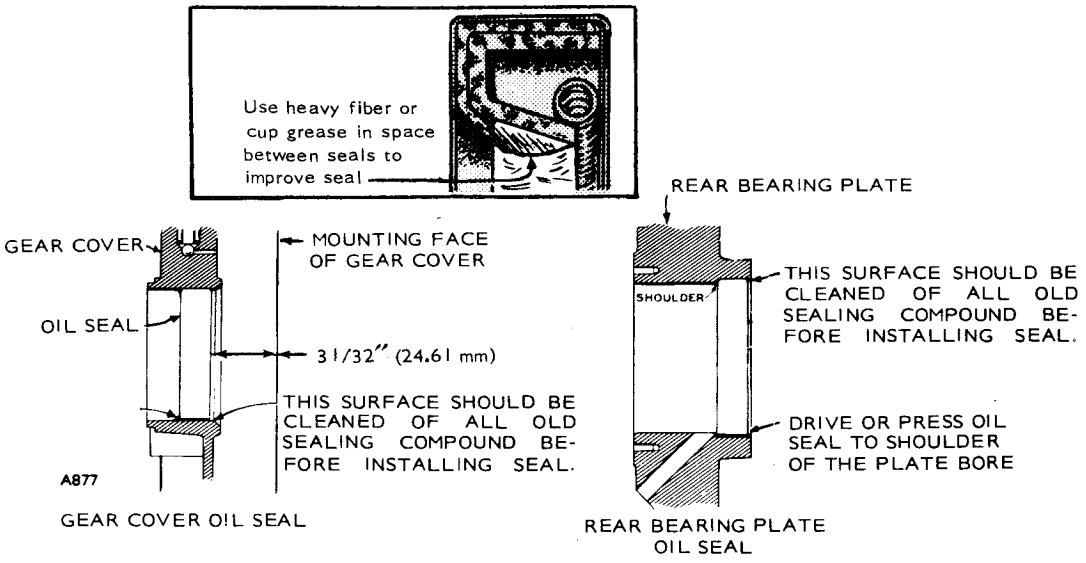


FIGURE 24. GEAR COVER AND REAR BEARING PLATE OIL SEALS

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 26. When the engine is thoroughly warmed up, oil pressure readings should be between 20 and 35 psi (138 - 241 kPa). 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 oversizes. 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 standard cylinder bore size is listed in the table of *DIMENSIONS AND CLEARANCES.*

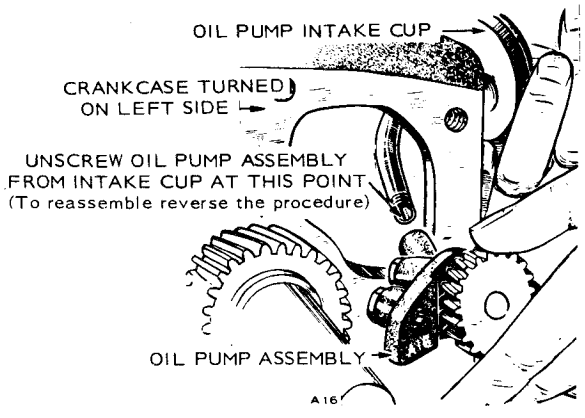


FIGURE 25. OIL PUMP ASSEMBLY

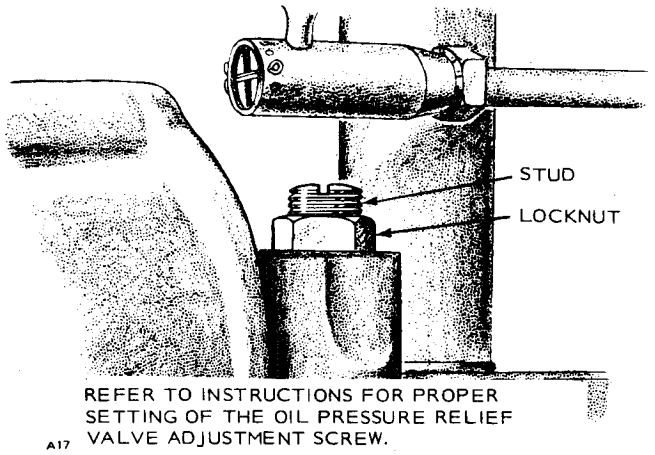


FIGURE 26. OIL PRESSURE RELIEF VALVE ADJUSTMENT

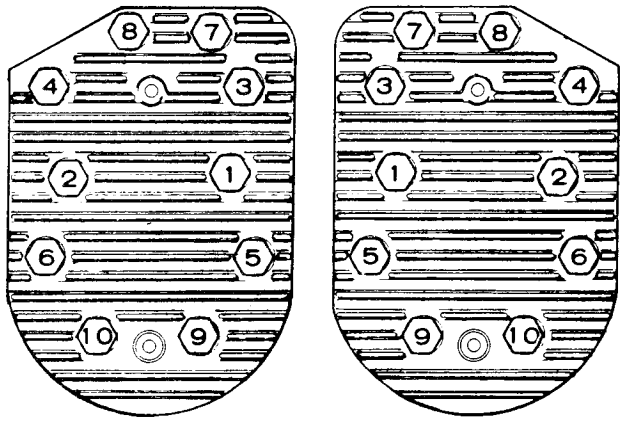


FIGURE 27. HEAD BOLT TIGHTENING ORDER

CYLINDER HEADS

The cylinder head bolts should be tightened in the order designated in Figure 27, 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*.

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 28 showing the optional Readi-Pull manual starter disassembled.

CAUTION **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).

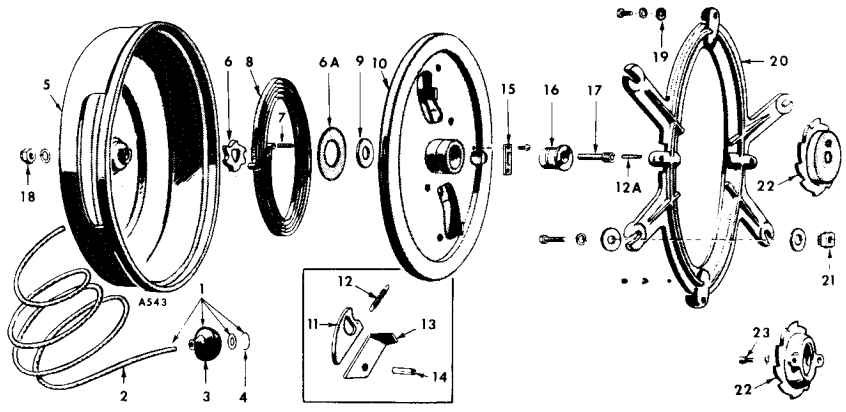
Remove the starter from its mounting ring by removing the four clamping screws.

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 outsize end loop of the recoil spring. Be sure the thrust washer (9) is in place. Then install the pull rope.

Spring breakage is much less common than spring fatigue due to long usage. In either case, the spring should be replaced. Cleaning and lubricating the pawls and ratchet arms in the rope sheave 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. The anti-back lash cogwheel (6) is an easy press fit on the starter cover.



1. ROPE AND GRIP
2. ROPE ONLY
3. GRIP ONLY
4. PLUG
5. STARTER COVER
6. COG WHEEL
6A. SPRING WASHER
7. ROLL PIN
8. RECOIL SPRING
9. THRUST WASHER
10. ROPE SHEAVE
11. PAWL
12. PAWL SPRING
12A. SPIRAL PIN
13. RATCHET ARM
14. PIVOT ROLL PIN
15. ROPE CLAMP
16. BEARING
17. SCREW
18. FLEXLOCK NUT
19. WASHER
20. MOUNTING RING
21. SPEED GRIP NUT
22. RATCHET WHEEL
23. SPECIAL CAPSCREW

FIGURE 28. READI-PULL STARTER DISASSEMBLY

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 29.

1. Install new ratchet wheel (1) against rope sheave (2) using a lockwasher (3) and flywheel mounting screw (4). Discard large flat washer from engines so equipped. Engage drive hole with flywheel boss.
2. Four special nuts are supplied for mounting starter to blower housing. If blower housing is not already fitted with similar nuts, remove blower housing and install nuts as shown in Detail A. Reinstall blower housing, tightening securely in place.
3. Install centering pin (5) in starter center screw (6) allowing 3/8 inch (9.5 mm) to protrude. For reinstallations, adjust pin depth.
4. Center starter assembly over ratchet wheel with centering pin engaging hole in flywheel mounting screw (4). While holding in position, mount starter assembly, using a hex head screw, lockwasher, and two flat washers at each mounting arm as shown in Detail A. Tighten mounting screws securely.
5. The direction of pull on starter rope is adjustable to fit requirements of the individual installation. See Detail B. To change direction of pull, loosen four clamp screws (7) and turn starter in its mounting ring to desired position. Tighten four clamp screws securely. Try starter several times, making sure that the pull rope does not rub against the clamping screws.

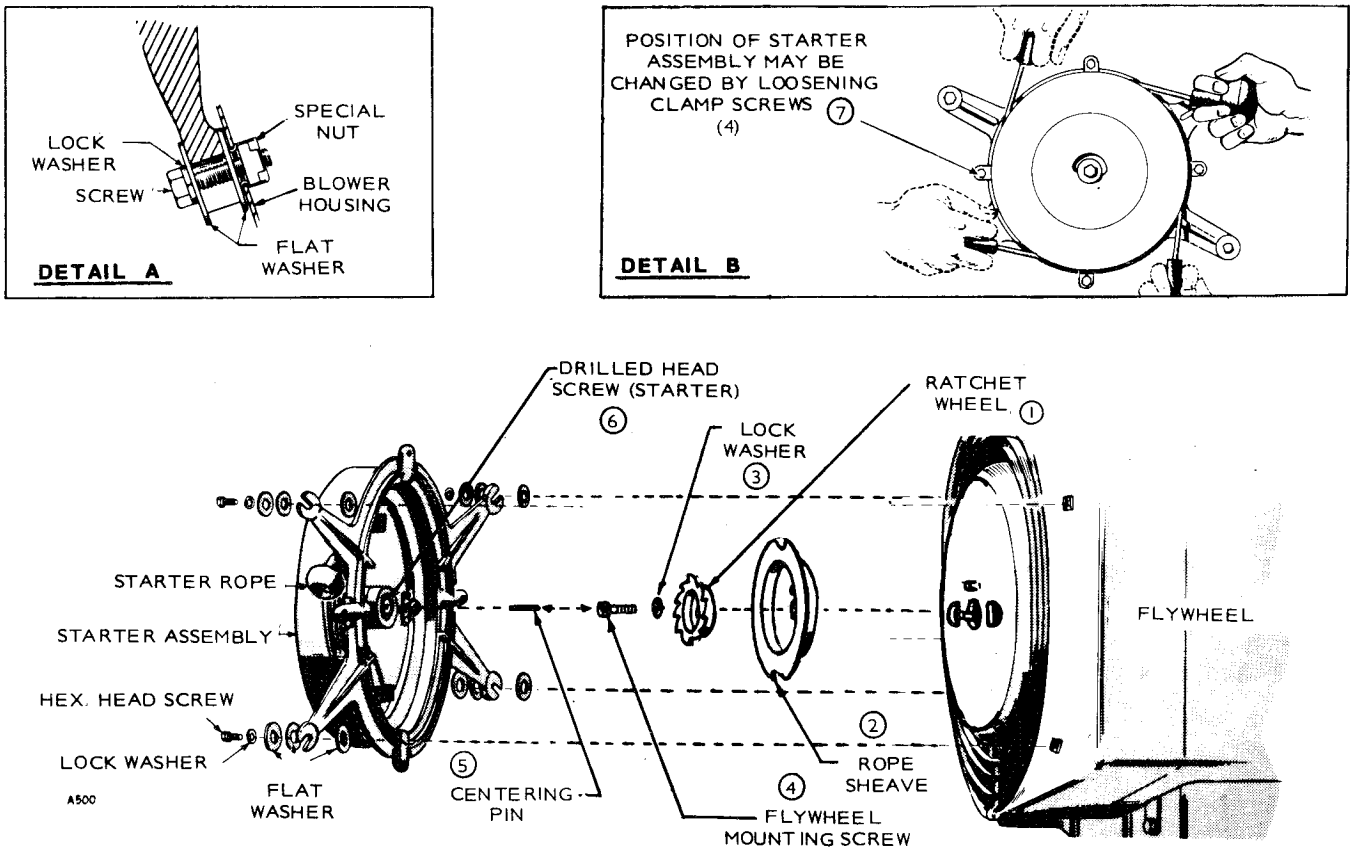


FIGURE 29. STARTER INSTALLATION

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, Figure 30. Remove all brush springs and lift the brushes from their holders.
2. Remove generator through-stud nuts. Hold both 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 end of 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 armature with a sharp downward blow in the center of the lamination stack with a lead or plastic hammer. Rotate armature and repeat. Be careful not to hit collector rings, commutator, bearing or windings.
4. Upon disassembly, all parts should be wiped clean and visually inspected.

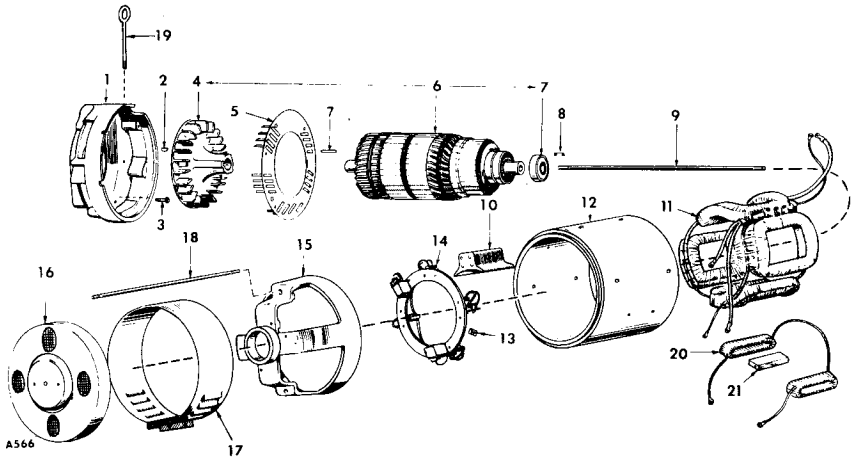
BRUSHES AND SPRINGS

Inspect brushes periodically. Replace brushes worn to 5/8 inch (16 mm). 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 31. 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.

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.



1. ADAPTER
2. KEY
3. SCREW
4. BLOWER
5. PLATE
6. ARMATURE ASSEMBLY
7. BEARING
8. CUP
9. STUD
10. SHOE
11. COIL ASSEMBLY, FIELD
12. FRAME
13. CUP
14. RIG ASSEMBLY
15. BELL
16. COVER
17. BAND
18. STUD
19. EYE
20. COIL SET, INTERPOLE
21. INTERPOLE

FIGURE 30. GENERATOR DISASSEMBLY

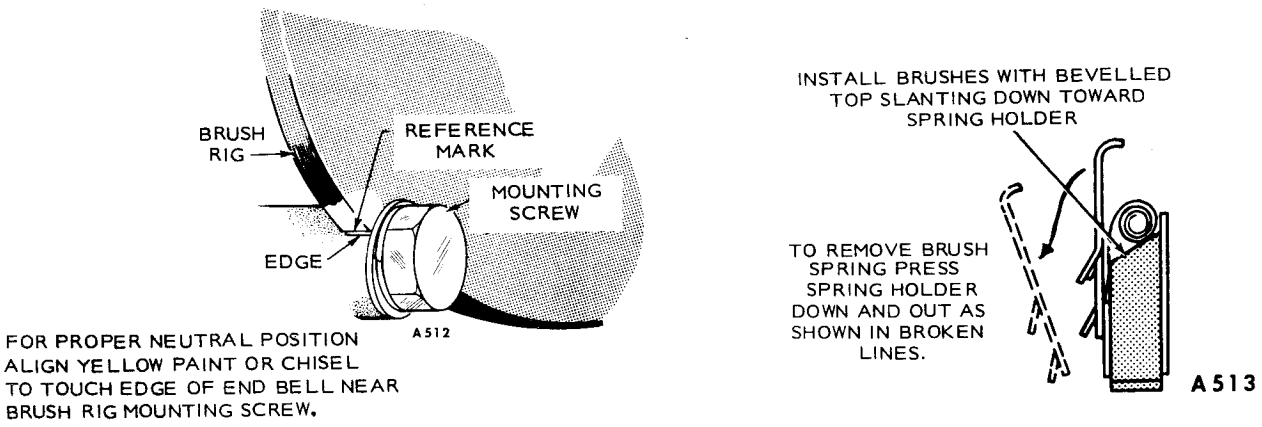


FIGURE 31. BRUSH RIG POSITIONING

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 32) 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.

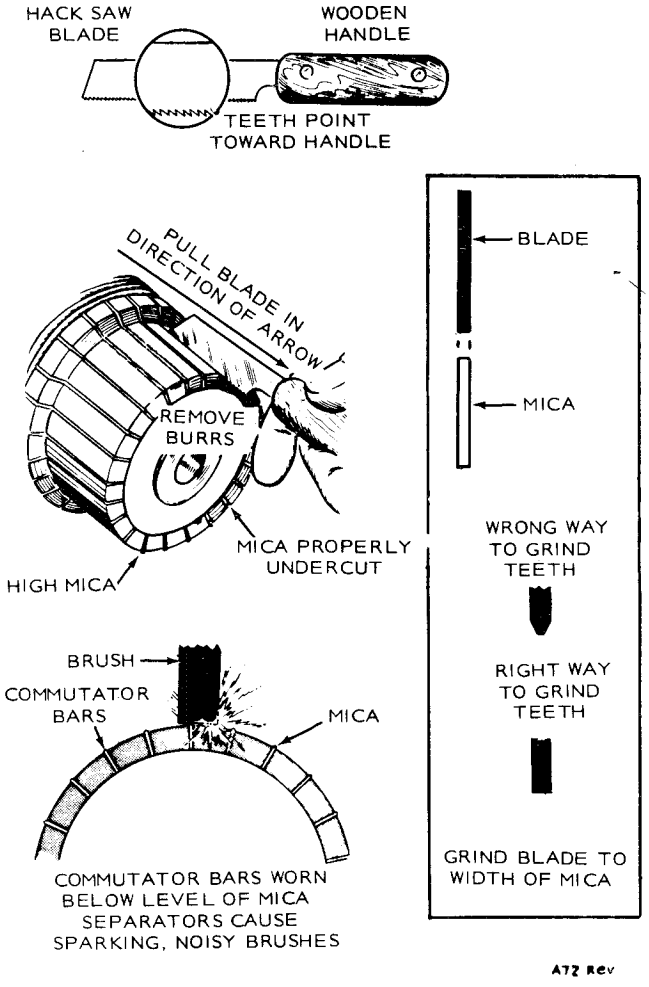


FIGURE 32. UNDERCUTTING COMMUTATOR MICA

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 33. 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 33). 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, an open circuit is indicated. Replace an open circuited armature with a new one.

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 (13 mm) above the armature laminations, Figure 33. 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.

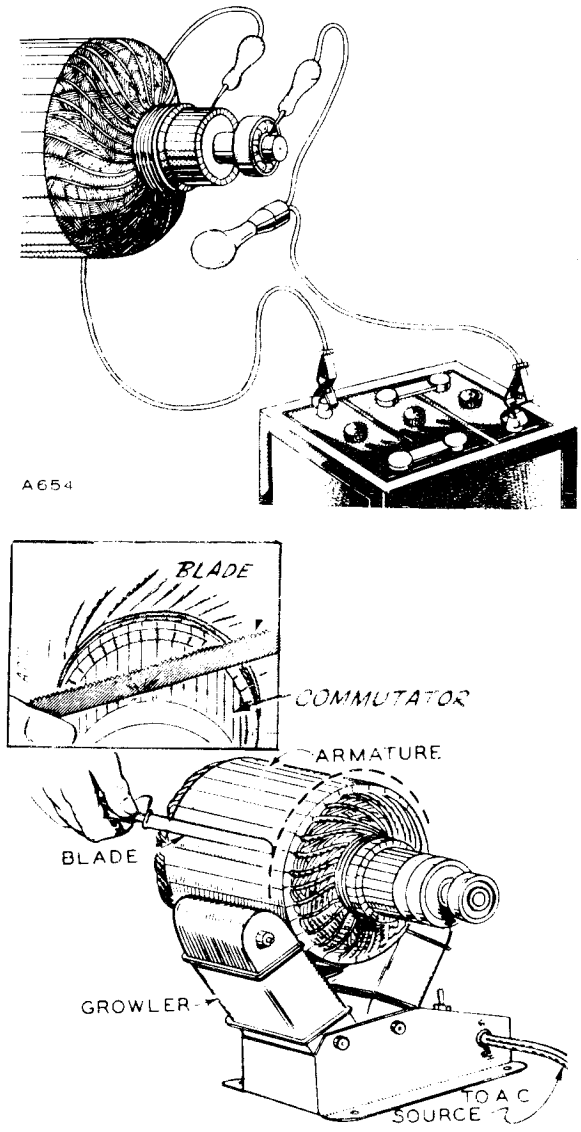


FIGURE 33. ARMATURE TESTING

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 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 generator shaft and engine crankshaft with a thin film of lubricating oil. Molykote or equal.
3. Assemble armature through stud to engine crankshaft with required torque.
4. Check to see that key is in crankshaft.
5. Slide armature over through stud and onto crankshaft, being careful not to let armature weight rest on through stud.
6. Install baffle ring, when used.
7. Assemble generator through studs to 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 frame and bearing support. Tighten frame to required torque.
9. NOW torque down 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 bearing support in horizontal and vertical plane with a lead hammer to relieve stress on components. Then, recheck torque.
11. Reconnect decompression solenoid and other leads to the engine.
12. Reinstall battery cables.
13. Align 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.

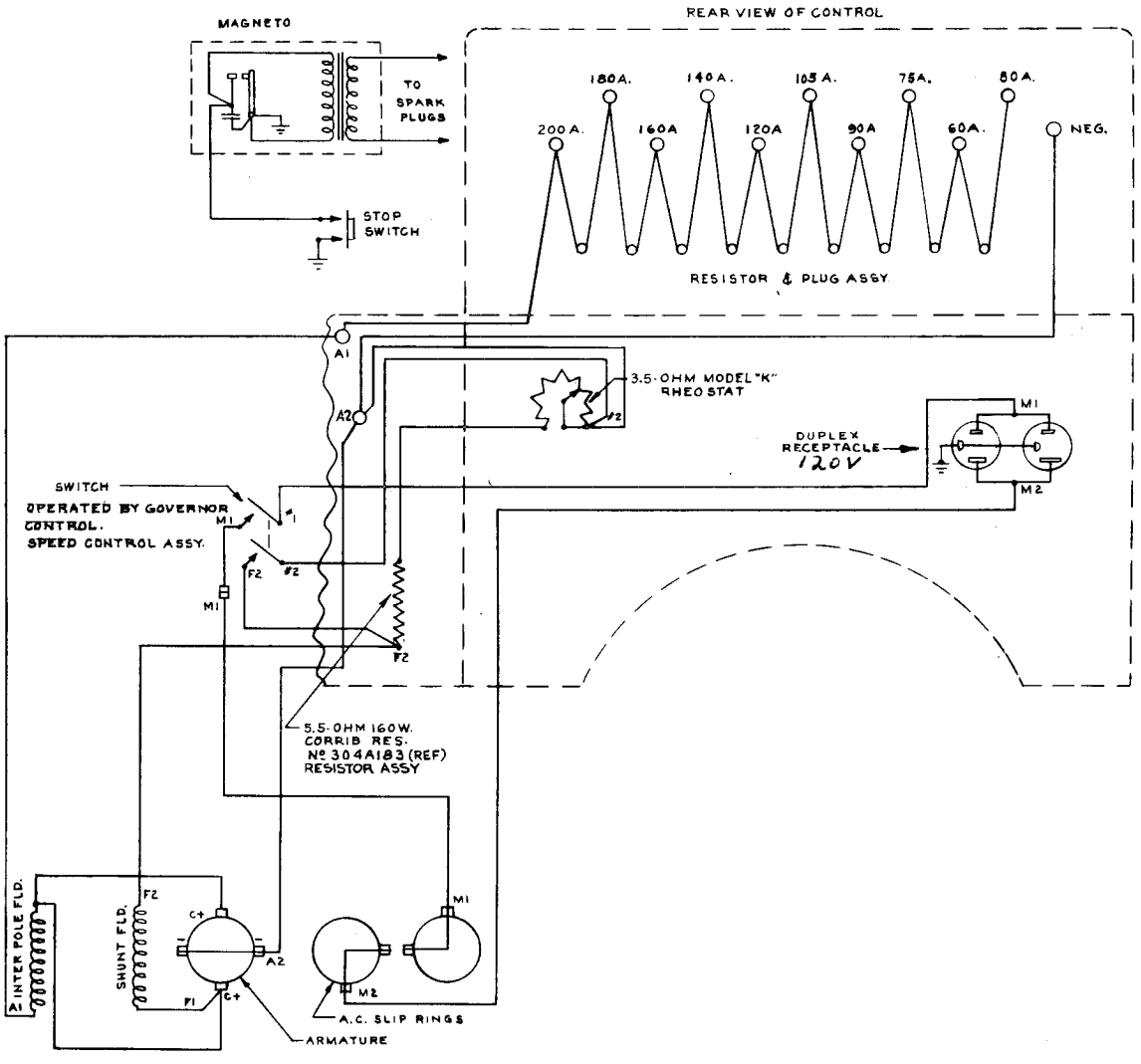
Always disconnect the battery (electric start units) whenever servicing controls to avoid accidentally starting the unit.

GENERATOR TROUBLESHOOTING

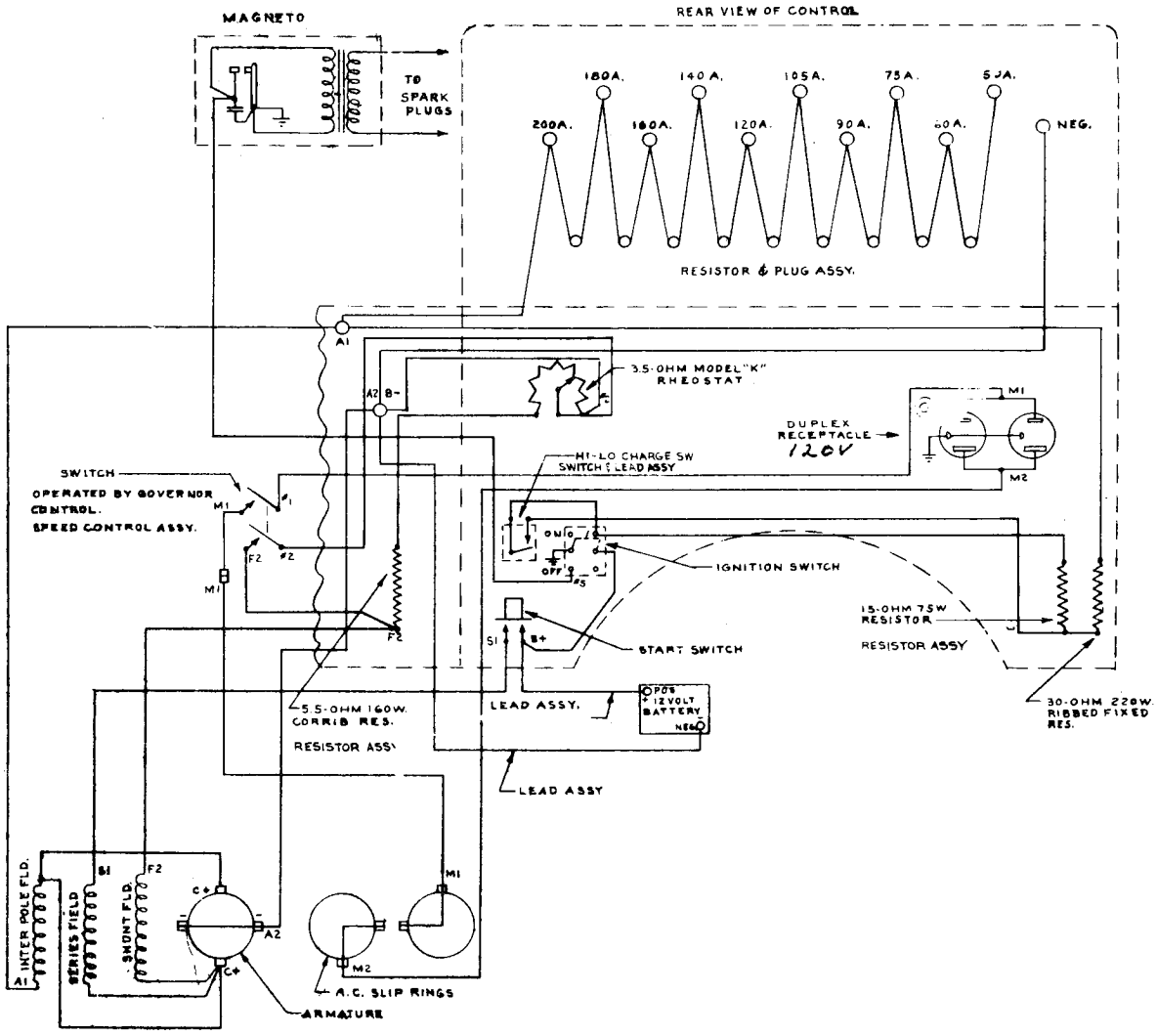
POSSIBLE CAUSE	REMEDY
ENGINE CRANKS TOO SLOWLY	
Brushes worn excessively or making poor contact.	Replace brushes or clean commutator.
Short circuit in generator or load circuit.	Repair or replace parts necessary. Disconnect load.
EXCESSIVE ARCING OF BRUSHES	
Rough commutator or rings.	Turn down.
Dirty 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 *Brush Rig Position* in *GENERATOR MAINTENANCE* section.
UNSATISFACTORY WELDING AT HIGH AMPERAGE POSITION	
Engine lacks power.	See *ENGINE TROUBLESHOOTING GUIDE.*
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.
Restricted exhaust lines.	Clean or increase the size.

POSSIBLE CAUSE	REMEDY
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 inch (16 mm) and have good spring tension.
Open circuit, short circuit, or ground in armature.	See *GENERATOR MAINTENANCE* 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 *not worn* shorter than 5/8 inch (16 mm), and have good spring tension.
Loose connections.	Tighten connections.
Improper brush rig position.	See *GENERATOR MAINTENANCE* 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.

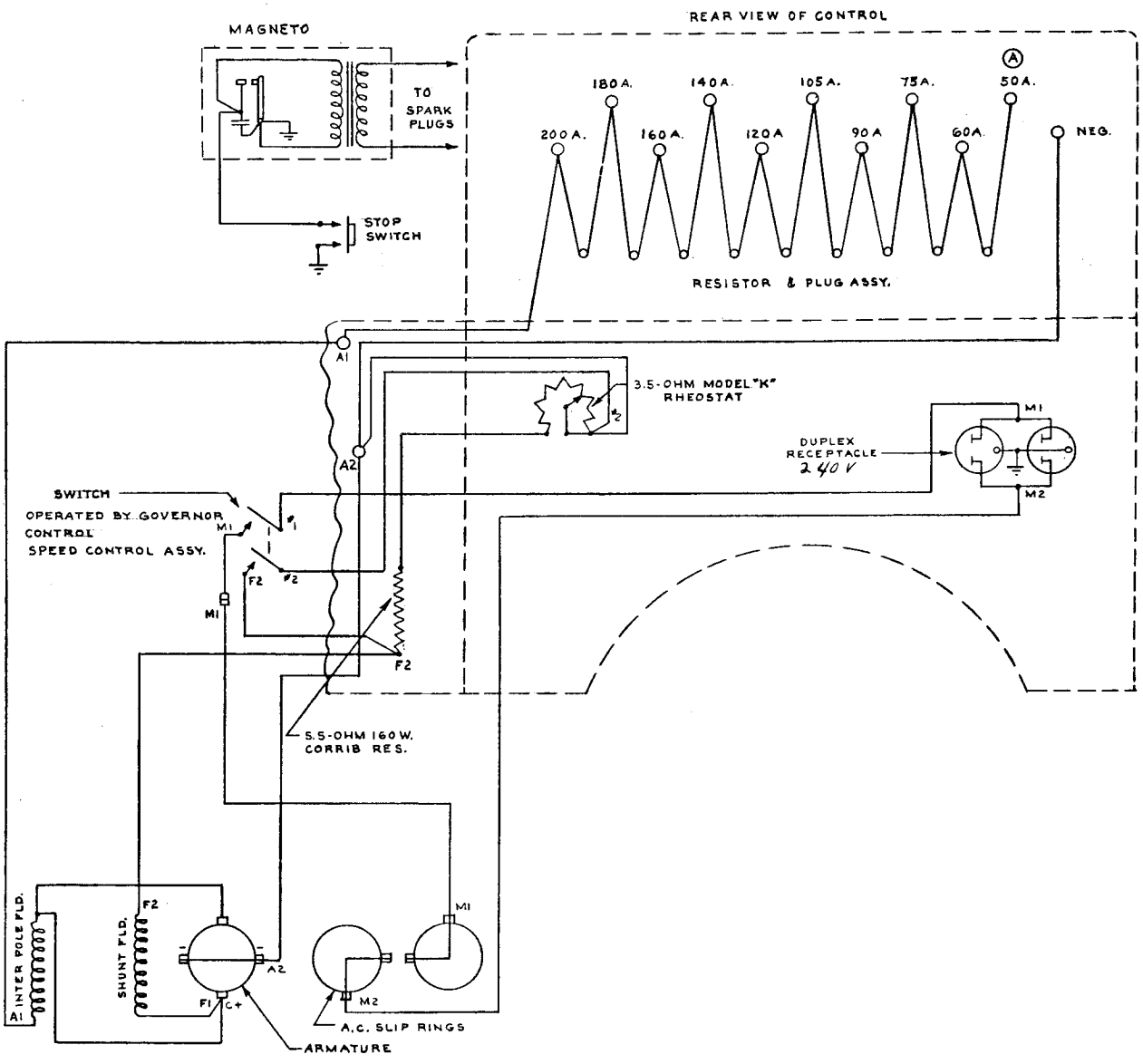
WIRING DIAGRAMS



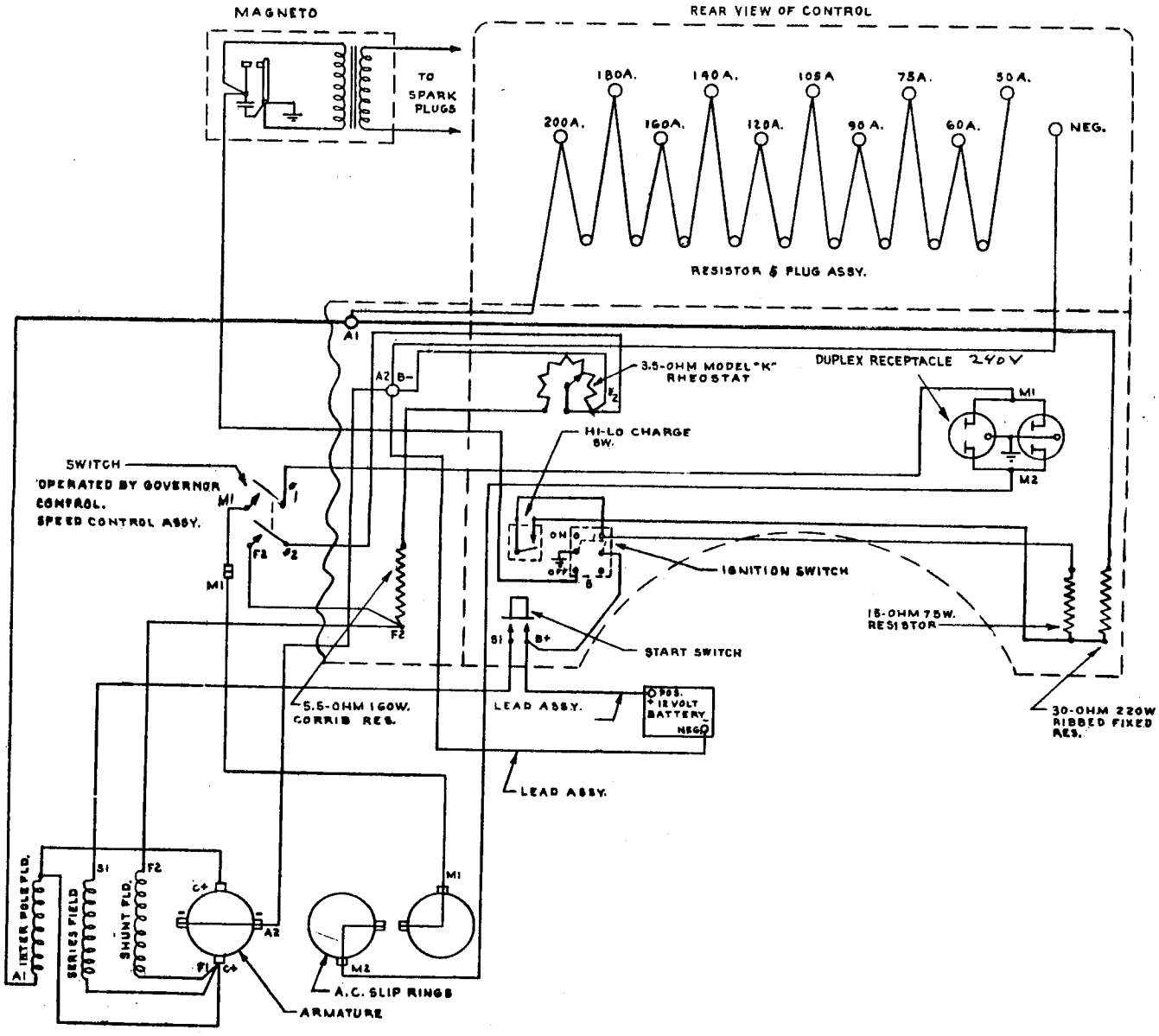
TYPICAL MANUAL START MODEL — 120 V
(602-0205)



TYPICAL ELECTRIC START MODEL — 120 V (606-0138)



TYPICAL MANUAL START MODEL — 240 V
(602-0204)



TYPICAL ELECTRIC START MODEL — 240 V
(606-0139)

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

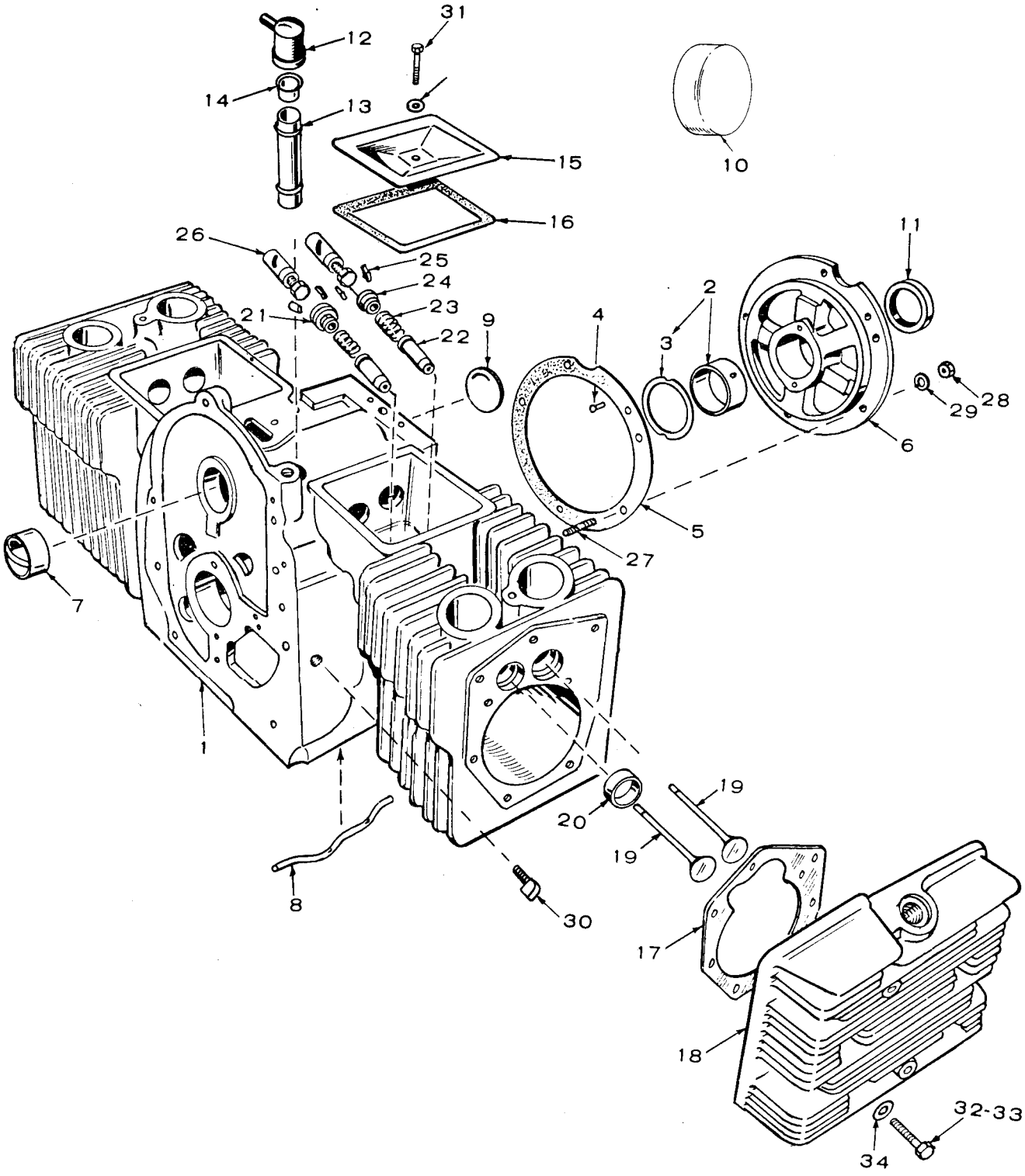
★ MODEL AND SPEC NO.	ELECTRICAL DATA						TYPE	PARTS KEY NO.
	DC OUTPUT (For Welding)			AC OUTPUT, 1 Phase 2 Wire (Available continuously when not welding)				
	Amps	Volts	Duty Cycle	Watts	Volts	Hertz		
6.0CCK-331P/1*	200	30	50%	3500	120	60	Manual	1
6.0CCK-332P/1*	200	30	50%	3500	240	60	Manual	1
6.0CCK-5331P/1*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

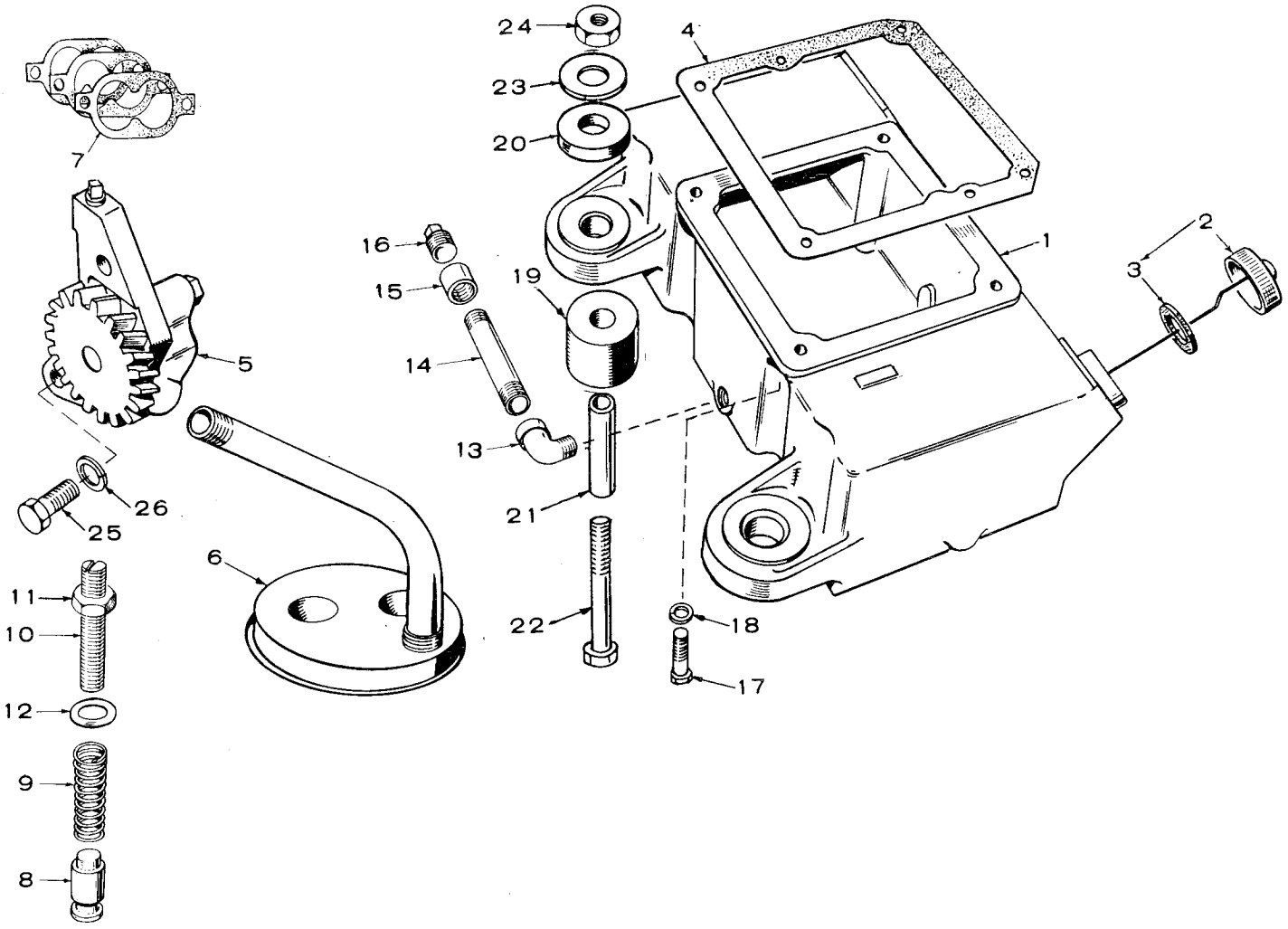


CYLINDER BLOCK GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	110-0915	1	Block Assembly, Cylinder (Includes Parts Marked *)
2	*BEARING KIT, CRANKSHAFT (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
3	104-0575	2	*Washer, Crankshaft Bearing Thrust
4	516-0072	4	*Pin, Thrust Washer Stop
5	101-0115	1	*Gasket Kit, Rear Bearing Plate
6	101-0316	1	*Plate, Rear Bearing (Less Bearing)
7	101-0367	2	*Bearing, Camshaft (Front & Rear)
8	120-0386	1	*Tube, Oil - Crankcase
9	517-0048	1	*Plug, Camshaft Expansion - Spec F and Begin Spec L
10	110-1283	1	*Cover, Timing Control (Spec H and L)
11	509-0041	1	Seal, Oil - Rear Bearing Plate
12	123-0293	1	Cup, Breather Tube
13	123-0129	1	Tube, Breather (Includes Steel Baffles)
14	123-0104	1	Valve, Breather Tube
15	110-0666	2	Cover, Valve Compartment
16	110-0667	2	Gasket, Valve Compartment Cover
17	110-0892	2	Gasket, Cylinder Head
18	HEAD, CYLINDER		
	110-0890	1	Right Hand (Spec F Only)
	110-0891	1	Left Hand (Spec F Only)
	110-0884	1	Right Hand (Begin Spec H) - Hi-Compression
	110-0883	1	Left Hand (Begin Spec H) - Hi-Compression
19	VALVE		
	110-0881	2	Intake
	110-0880	2	Exhaust
20	*INSERT, EXHAUST VALVE SEAT		
	110-0872	2	Standard
	110-872-02	2	.002" Oversize
	110-0872-05	2	.005" Oversize
	110-0872-10	2	.010" Oversize
	110-0872-25	2	.025" Oversize
21	110-0904	2	Rotorcap, Exhaust Valve
22	110-0902	4	Guide, Valve
23	110-0539	4	Spring, Valve
24	110-0893	2	Washer, Retainer - Intake
25	110-0639	8	Lock, Rotocap or Spring Retainer Washer
26	TAPPET, VALVE		
	115-0006	4	Standard
	115-0006-05	4	.005" Oversize
27	520-0114	5	Stud, Rear Bearing Plate Mounting (5/16 x 1-5/16")
28	110-0445	5	Nut, Hex - Rear Bearing Plate Mounting
29	850-0045	5	Washer, Lock - Spring - Rear BEaring Plate Mtg. (5/16")
30	520-0020	1	Elbow, Street - Oil Line to Block
31	800-0012	2	Screw, Cap - Hex Head - Valve Compartment Cover Mounting (1/4-20 x 2-1/4")
32	110-0879	8	Screw, Cap - Hex Head - Cylinder Head Mtg. (5/16-18 x 1-1/4")
33	114-0022	10	Screw, Cap - Hex Head - Cylinder Head Mtg. (5/16-18 x 1-3/4")
34	526-0122	18	Washer, Flat - Cylinder Head Mtg. (11/32 ID x 23/32 OD x .1345 THK)

* - Parts Included in Cylinder Block Assembly.

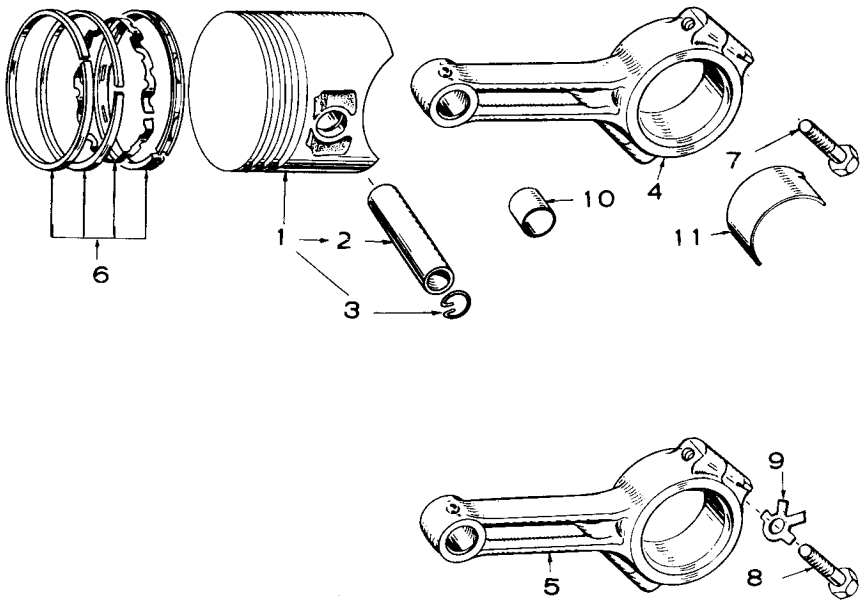
OIL BASE GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	102-0418	1	Base, Oil
2	123-0489	1	Cap and Indicator, Oil Fill
3	123-0191	1	Gasket, Oil Fill Cap
4	102-0158	1	Gasket, Oil Base Mounting
5	120-0491	1	Pump, Oil - Complete (Internal Parts not sold separately)
6	120-0400	1	Cup, Oil Pump Intake (Includes Cup, Screen & Pipe)
7	120-0161	1	Gasket Kit, Oil Pump
8	120-0398	1	Valve, By Pass
9	120-0140	1	Spring, By Pass Valve
10	120-0145	1	Stud, Oil By Pass Adjustment
11	868-0003	1	Nut, Oil By Pass Stud Adjustment
12	526-0066	1	Washer, Flat - Copper - Oil Pressure Relief Valve Adjusting Screw (25/64" ID x 9/16" OD x 1/16" THK)
13	ELBOW, OIL DRAIN (45") - Key 2 Only		
	505-0119	1	Early Models (3/8")
	505-0248	1	Later Models (1/2")
14	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")
15	COUPLING, OIL DRAIN		
	505-0028	1	Early Models (3/8")
	505-0014	1	Later Models (1/2")
16	PLUG, OIL DRAIN		
	505-0110	1	Early Models (3/8")
	505-0056	1	Later Models (1/2")
17	102-0445	4	Screw, Cap - Hex Head - Oil Base Mtg. (3/8-16 x 1-1/4")
18	850-0050	4	Washer, Lock - Spring - Oil Base Mtg. (3/8")
	402-0226	2	Cushion Assy., Engine End Mtg. (Includes Parts Marked *)
19	402-0038	2	*Cushion, Mtg.-Lower - Engine End
20	402-0131	2	*Cushion, Mtg.-Upper - End End
21	402-0137	2	*Bushing, Spacer - Engine End
22	800-0037	2	*Screw, Cushion Mtg. - Engine End (5/16-18 x 3")
23	526-0076	2	*Washer, Flat - Cushion Mtg. - Engine End (11/32" ID x 1-1/2" OD x 1/16" THK)
24	870-0048	2	*Nut, Hex - Cushion Mtg. - Engine End (5/16-18)
25	800-0007	2	Screw, Cap - Hex Head - Oil Pump Mtg. - (1/4-20 x 1")
26	850-0040	2	Washer, Lock - Spring - Oil Pump Mtg. (1/4")

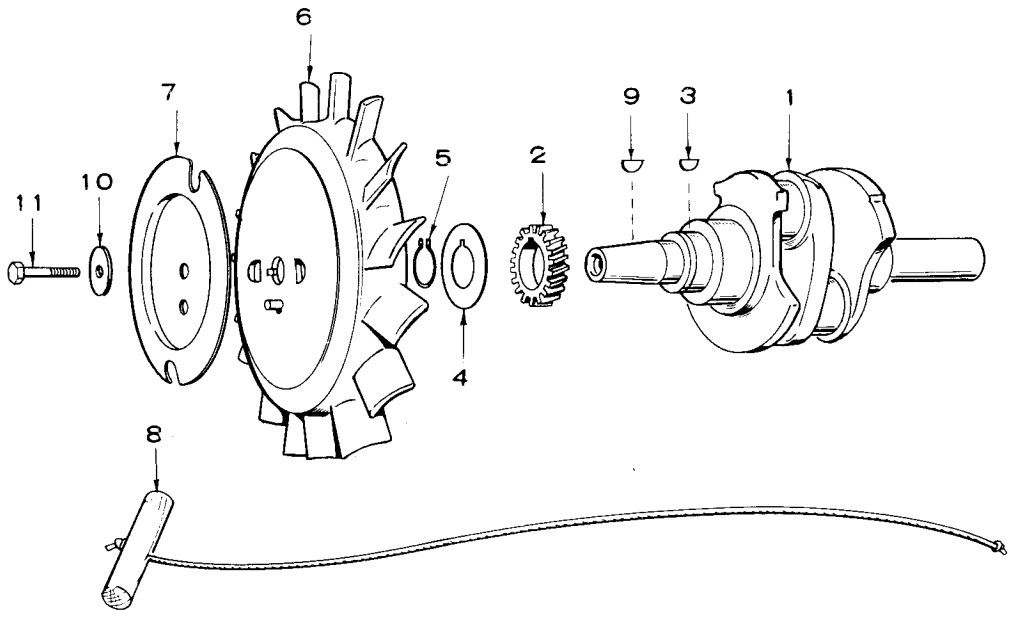
* - Parts Included in Mounting Cushion Assy. - Engine End.

PISTON AND CONNECTING ROD GROUP



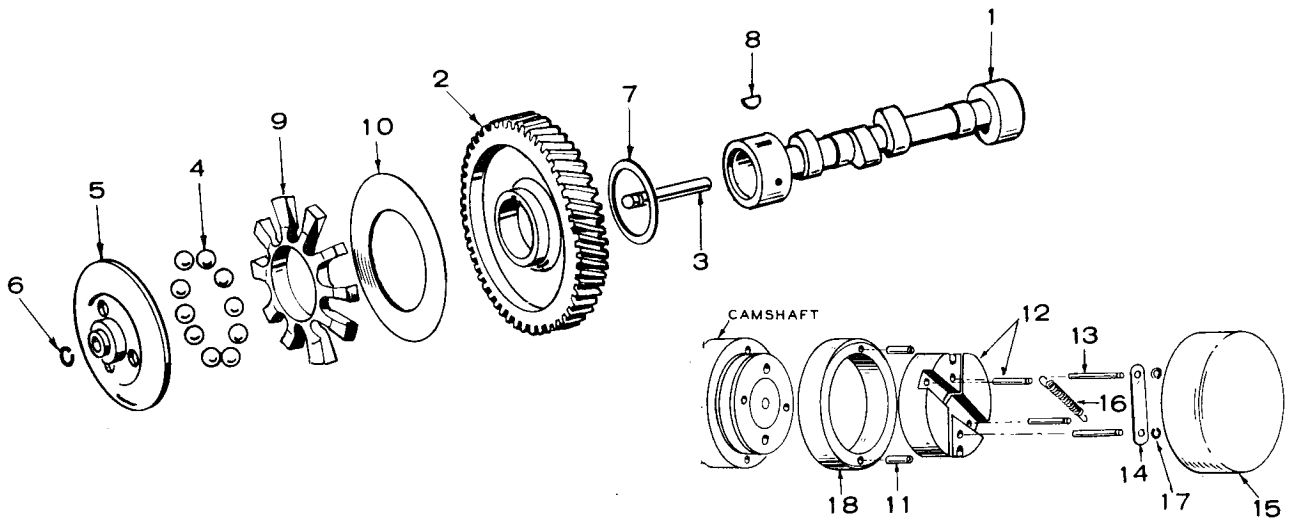
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	PISTON AND PIN ASSEMBLY - Includes Retainer Rings		
	112-0071	2	Standard
	112-0071-05	2	.005" Oversize
	112-0071-10	2	.010" Oversize
	112-0071-20	2	.020" Oversize
	112-0071-30	2	.030" Oversize
	112-0071-40	2	.040" Oversize
2	PIN, PISTON		
	112-0069	2	Standard
	112-0069-02	2	.002" Oversize
3	112-0003	4	Ring, Piston Pin Retaining
4	114-0203	2	Rod, Connecting - Includes Bushing and 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
6	RING SET, PISTON		
	113-0088	2	Standard
	113-0088-05	2	.005" Oversize
	113-0088-10	2	.010" Oversize
	113-0088-02	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 (5/16-24 x 1-1/4")
8	110-0284	4	Screw, Cap - Hex Head - Connecting Rod Cap - (Spec F Only)
9	114-0059	4	Washer, Connecting Rod Cap (Spec F Only)
10	114-0036	2	Bushing, Piston Pin - 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

CRANKSHAFT AND FLYWHEEL GROUP



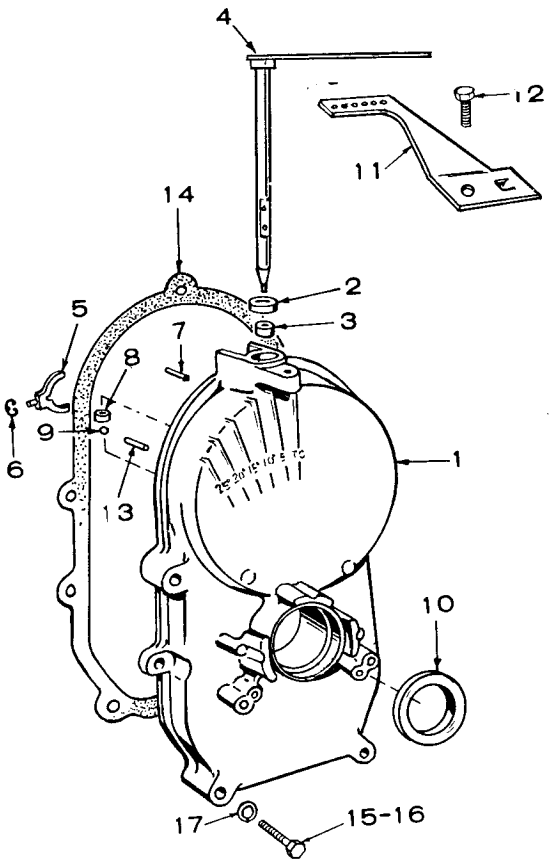
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	104-0578	1	Crankshaft
2	104-0032	1	Gear, Crankshaft
3	515-0001	1	Key, Crankshaft
4	104-0043	1	Washer, Crankshaft Gear Retainer
5	518-0014	1	Lock, Crankshaft Gear Washer
6	FLYWHEEL, MAGNETO - LESS ROPE SHEAVE		
	160-0650	1	Spec F Only
	160-0761	1	Spec H and J
	160-0937	1	Begin Spec L
7	192-0308	1	Sheave, Rope
8	192-0083	1	Rope, Starting
9	515-0002	1	Key, Flywheel Mounting
10	526-0017	1	Washer, Flat - Flywheel Mtg. (15/32" ID x 1-1/4" OD x 1/4" THK)
11	104-0170	1	Screw, Cap - Hex Head - Flywheel Mtg. (7/16-14 x 4-1/8")

CAMSHAFT GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	CAMSHAFT		
	105-0140	1	Spec F - Includes Center Pin
	105-0234	1	Spec H and J - Includes Center Pins and Spark Advance Mechanism Pins
	105-0238	1	Begin Spec L - Includes Center Pin
2	105-0332	1	Gear, Camshaft
3	150-0075	1	Pin, Camshaft Center
4	510-0015	10	Ball, Fly - Governor
5	150-0612	1	Cup, Governor
6	150-0078	1	Ring, Camshaft Center Pin Snap
7	105-0004	1	Washer, Thrust Camshaft Gear
8	515-0001	1	Key, Camshaft Gear Mounting
9	150-1257	1	Spacer, Governor Fly Ball
10	150-0077	1	Plate, Governor Fly Ball
11	516-0144	4	Pin, Roll - Timing Control Spec H and J - (7/16")
12	160-0789	2	Weight Assembly, Timing Control - Includes Pins (Spec H and J)
13	516-0146	2	Pin, Groove - Timing Control Cam - (Spec H and J)
14	160-0726	1	Retainer, Timing Control - (Spec H and J)
15	110-1283	1	Cover, Timing Control (Spec H & J)
16	160-0727	1	Spring, Timing Control (Spec H & J)
17	518-0185	2	Lock, Timing Control (Spec H & J)
18	160-0791	1	Cam, Timing Control (Spec H & J)

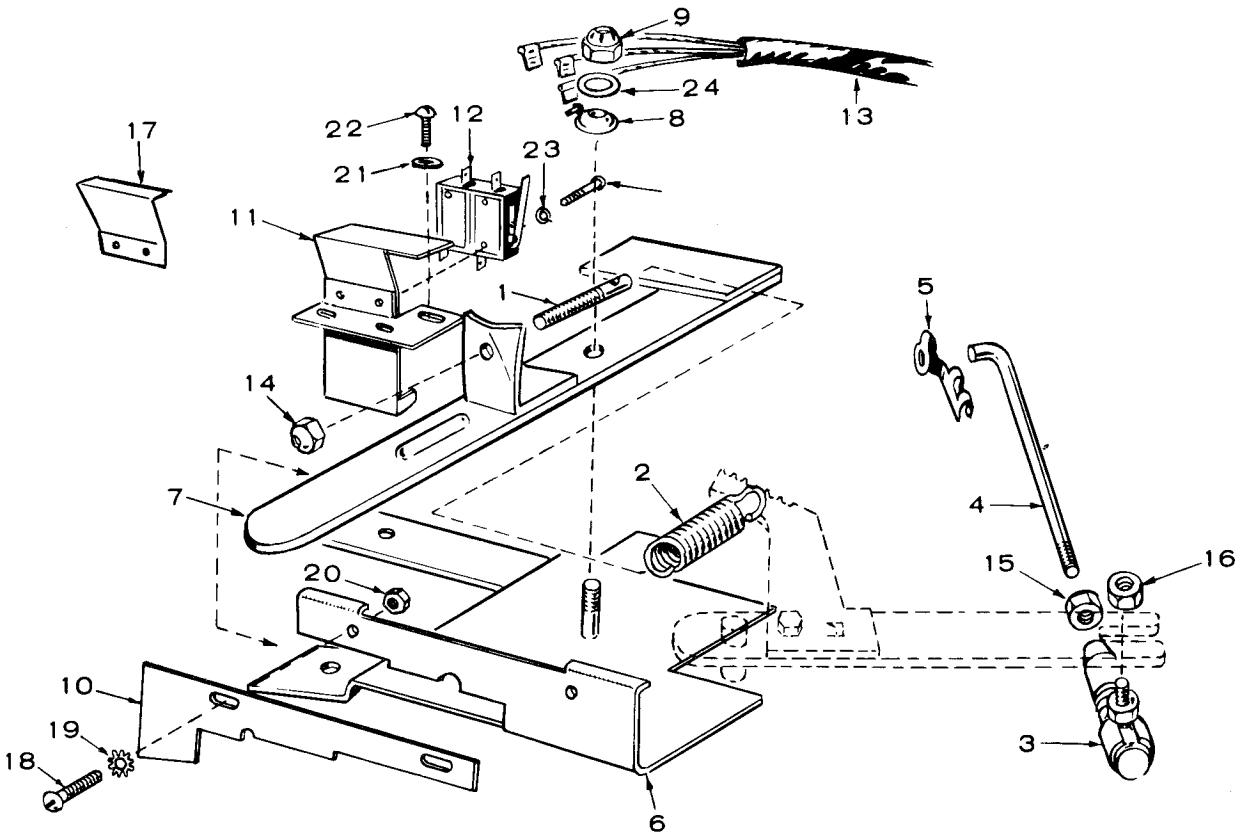
GEAR COVER GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	103-0163	1	Cover Assembly, Gear (Includes Parts Marked *)
2	509-0008	1	*Seal, Governor Shaft
3	510-0013	1	*Bearing, Governor Shaft - Upper
4	150-0377	1	*Shaft and Arm, Governor
5	150-0620	1	*Yoke, Governor Shaft
6	518-0129	1	*Ring, Yoke Retainer
7	516-0130	1	*Pin, Roll, Governor Cup Stop
8	510-0008	1	Bearing, Governor Shaft - Lower
9	510-0014	1	*Bearing, Ball - Governor Shaft
10	509-0040	1	*Seal, Oil - Gear Cover
11	150-1000	1	*Extension, Governor Arm
12	815-0181	1	*Screw, Governor Arm Extension - Mtg. (10-32 x 1/2")
13	516-0141	2	Pin, Gear Cover
14	103-0011	1	Gasket, Gear Cover
15	114-0022	4	Screw, Cap - Hex Head - Gear Cover Mounting (5/16-18 x 1-3/4")
16	800-0034	1	Screw, Cap - Hex Head - Gear Cover Mounting (5/16-18 x 2-1/4")
17	850-0045	5	Washer, Lock - Spring - Gear Cover Mtg. (5/16")

* - Parts Included in Gear Cover Assembly.

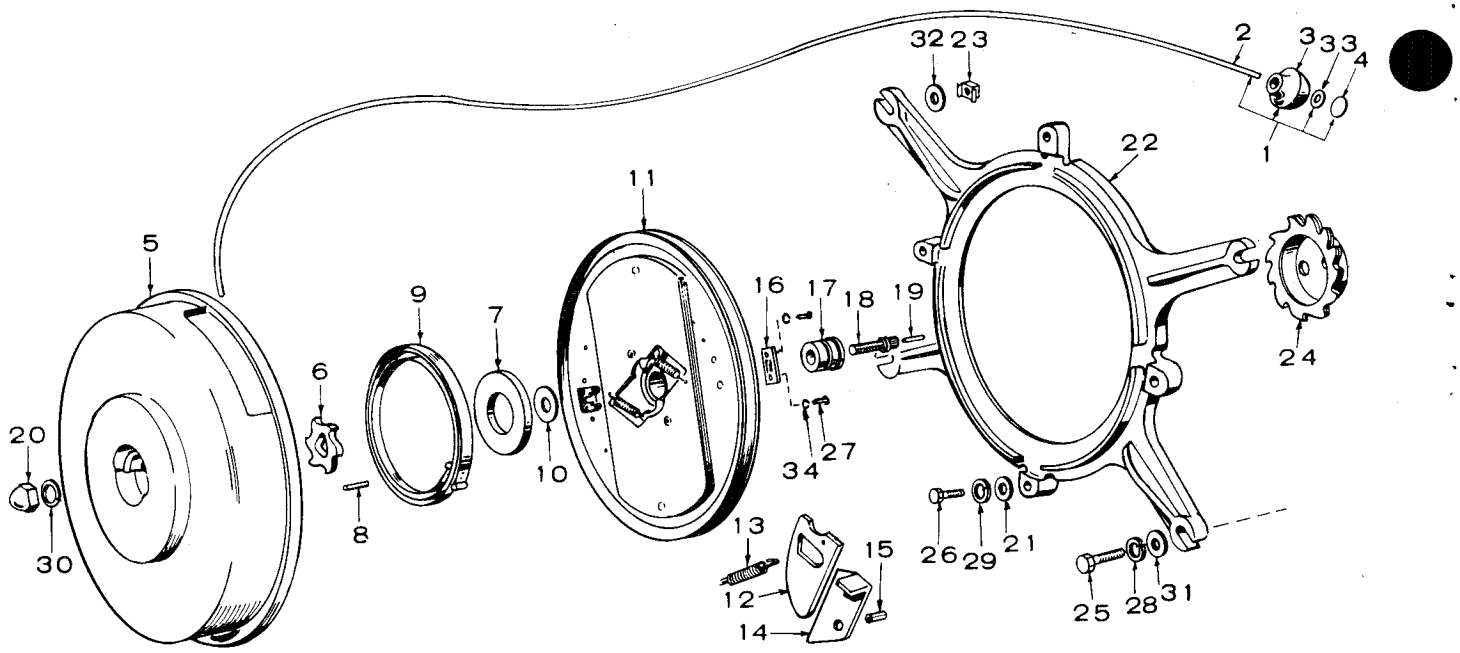
GOVERNOR GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	150-1009	1	Stud, Governor Adjusting
2	150-0098	1	Spring, Governor
3	150-0639	1	Joint, Governor Link Ball
4	150-0629	1	Link, Governor Arm to Carburetor
5	518-0006	1	Clip, End - Link to Carburetor
6	BRACKET, VARIABLE SPEED GOVERNOR		
	152-0109	1	Models with 60 Hertz AC Output
	152-0130	1	Models with 50 Hertz AC Output
7	LEVER, SPEED ADJUSTING		
	152-0111	1	Models with 60 Hertz AC Output
	152-0129	1	Models with 50 Hertz AC Output
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

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
13	338-0228	1	Harness, Wiring - Micro Switch
14	870-0053	1	Nut, Hex - Governor Adjusting Stud (10-32)
15	870-0053	1	Nut, Hex - Governor Ball Joint to Link (10-32)
16	870-0131	1	Nut, Hex - Governor Ball Joint to Governor Arm (10-32) - with External Lock Washer
17	152-0119	1	Insulator, Fiber - Micro Switch Terminal
18	812-0077	2	Screw, Machine - Round Head - Governor Plate Adjusting (8-32 x 3/8")
19	853-0005	2	Washer, Lock (External Shakeproof) - Governor Plate Adjusting (#8)
20	860-0008	2	Nut, Hex - Governor Plate Adjusting (8-32)
21	853-0008	2	Washer, Lock (External Shakeproof) Micro Switch Mtg. Bracket (#10)
22	813-0098	2	Screw, Machine - Round Head - Micro Switch Mtg. Bracket - (10-32 x 3/8")
23	850-0020	2	Washer, Lock - Spring - Micro Switch Mtg. (#6)
24	812-0066	2	Screw, Cap - Round Head - Micro Switch Mtg. (6-32 x 3/4")

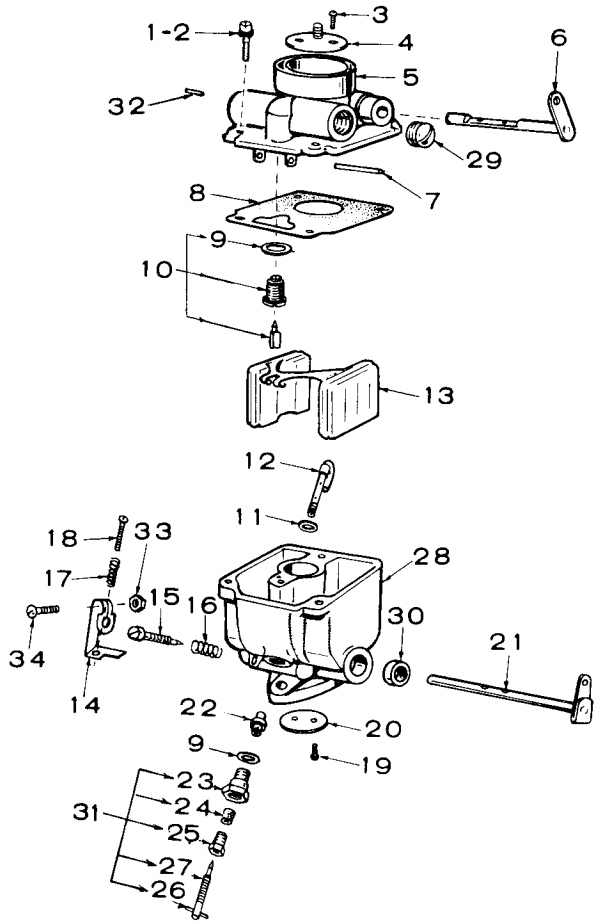
READI-PULL STARTER GROUP (Optional Equipment Key 1 Only)



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	192-0325	1	Starter Kit, Complete (Includes Mounting Ring and Ratchet Wheel)
1	192-0045	1	Rope and Grip Assembly
2	192-0043	1	Rope (Less Grip) 83" Long
3	192-0044	1	Grip, Starter Rope
4	517-0025	1	Plug, Starter Rope Grip
5	192-0152	1	Cover, Starter
6	192-0153	1	Wheel, Cog, Anti-Backlash
7	526-0168	1	Washer, Flat - Spring Retainer - (Used on Later Model Starters) (1-15/32" ID x 3" OD x .047 THK)
8	516-0138	1	Pin, Roll (3/16 x 5/8) - Recoil Spring
9	192-0039	1	Spring, Recoil
10	526-0123	1	Washer, Flat - Sheave Bushing to Cover (25/64" ID x 1-1/4" OD x .0598 THK)
11	192-0180	1	Sheave Assembly, Rope (Includes Parts Marked *)
12	192-0172	2	*Pawl
13	192-0165	2	*Spring, Pawl
14	192-0168	2	*Arm, Ratchet
15	516-0110	4	*Pin, Roll (5/16 x 1/2") - (2) Ratchet Arm, (2) Pawl
16	192-0167	1	*Clamp, Rope
17	192-0163	1	Bearing (Bronze), Sheave Hub
18	192-0323	1	Screw, Cap - Socket Head - Sheave Bushing to Cover (3/8-16 x 1-1/2")
19	516-0132	1	Pin, Spiral (Brass - 1/8 x 5/8") - Starter Locating
20	870-0138	1	Nut, Hex - Flexlock, Bushing to Cover Screw
21	526-0180	4	Washer, Flat - Starter to Mtg. Ring (17/64" ID x 7/8" OD x 1/8" THK)
22	192-0186	1	Ring, Mounting - Starter to Blower Housing
23	870-0110	4	Nut, Hex - Speed Grip - Starter Ring to Blower Housing (1/4-20)
24	192-0309	1	Wheel, Ratchet
25	800-0007	4	Screw, Cap - Hex Head - Starter Mtg. (1/4-20 x 1")
26	815-0137	4	Screw, Self Tapping - Hex Head - Starter to Mounting Ring (1/4-20 x 5/8")
27	815-0137	2	*Screw, Self Tapping - Hex Head - Rope Clamp Mtg. (1/4-20 x 5/8")
28	850-0040	4	Washer, Lock - Spring - Starter Mounting (1/4")
29	850-0040	4	Washer, Lock - Spring - Starter to Mounting Ring (1/4")
30	850-0050	1	Washer, Lock - Spring - Bushing to Cover (3/8")
31	526-0130	4	Washer, Flat - Starter Mounting (17/64" ID x 1" OD x 1/16" THK)
32	526-0158	4	Washer, Flat - Starter to Mtg. Ring (.261" ID x 1" OD x 1/8" THK)
33	526-0169	1	Washer, Flat - Starter Rope Grip (17/64" ID x 7/8" OD x 1/16" THK)
34	526-0015	2	*Washer, Flat - Rope Clamp Mtg. (9/32" ID x 9/16" OD x 1/16" THK)

* - Included in 192-0180 Rope Sheave Assembly.

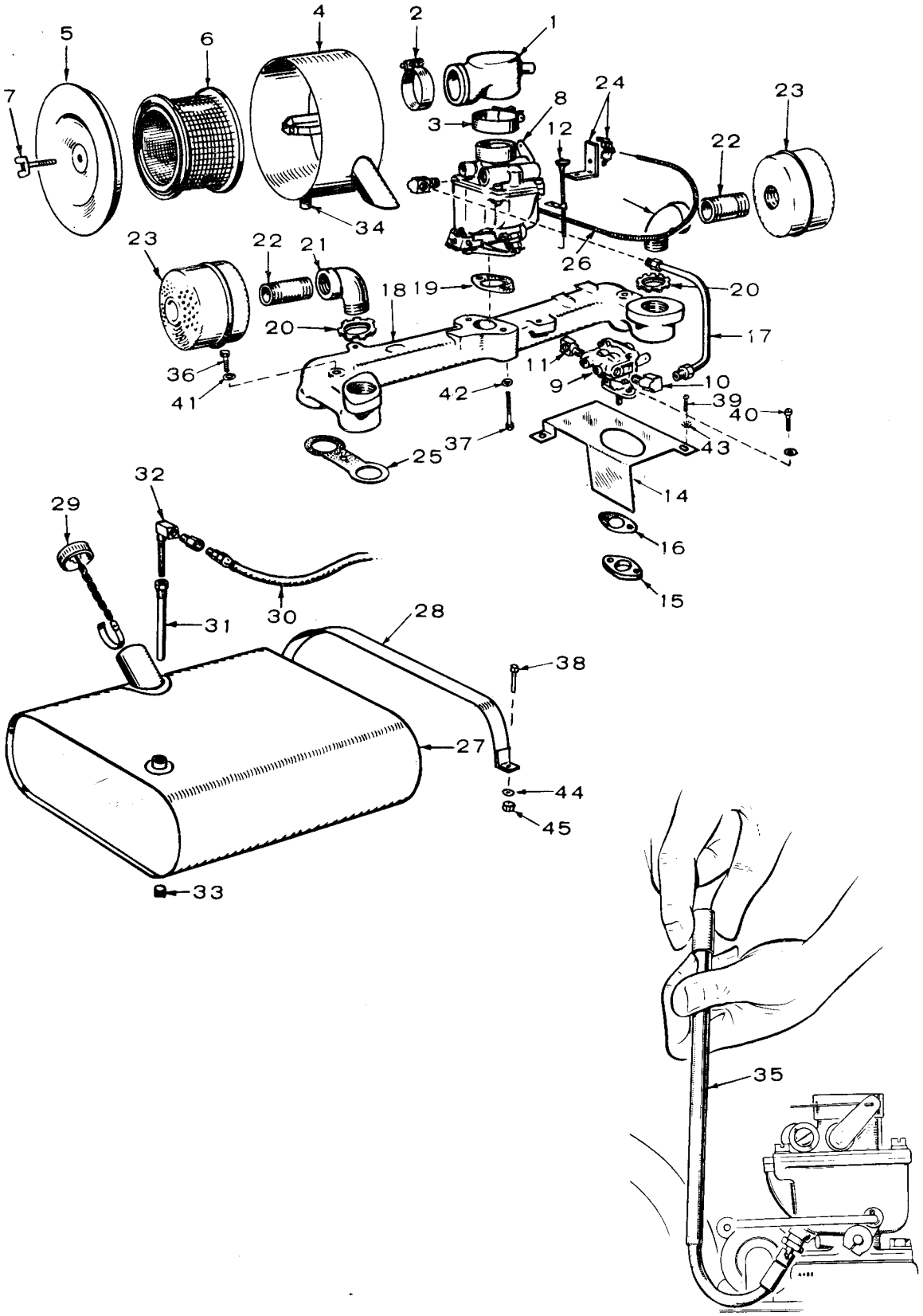
CARBURETOR PARTS GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	CARBURETOR ASSEMBLY, GASOLINE		
	142-0386	1	Spec F Only
	142-0416	1	Begin Spec H
1	815-0103	1	Screw, Cap - Fillister Head - Bowl Cover (10-24 x 1/2")
2	815-0109	2	Screw, Cap - Fillister Head - Bowl Cover (10-24 x 5/8")
3	815-0091	2	†*Screw, Cap - Fillister Head - (4-40 x 3/16")
4	142-0055	1	Fly, Choke
5	142-0205	1	Sleeve, Choke (Cover)
5	SHAFT ASSEMBLY, CHOKE		
6	142-0217	1	Spec F Only (142-0386 Carburetor)
	142-0420	1	Begin Spec H (142-0416 Carburetor)
7	142-0039	1	†*Shaft, Float
8	142-0031	1	+Gasket, Body to Bowl
9	148-0017	2	+Gasket (1) Float Valve Seat, (1) Main Adjusting Needle Retainer
10	VALVE SEAT ASSEMBLY, FLOAT		
	142-0356	1	*Spec F Only
	142-0049	1	†Begin Spec H
11	142-0032	1	+Gasket, Nozzle
12	142-0285	1	Nozzle Assembly
13	142-0361	1	Float and Lever
14	145-0008	1	Lever, Idle Stop
15	142-0040	1	†*Needle, Idle Adjusting
16	142-0282	1	Spring, Idle Needle Adjusting
17	142-0035	1	Spring, Throttle Stop Adjusting Screw
18	812-0063	1	Screw, Machine - Round Head - Throttle Stop Adjusting (6-32 x 1/2")
19	815-0072	2	†*Screw, Cap - Oval Head - Throttle Fly (4-40 x 1/4")
20	142-0369	1	Fly, Throttle
21	142-0368	1	†*Shaft Assembly, Throttle
22	NUT AND JET, NOZZLE		
	142-0370	1	Spec F Only
	142-0474	1	†Begin Spec H
23	142-0046	1	Retainer, Main Adjusting Needle
24	142-0206	1	+Packing, Main Adjusting Needle
25	142-0045	1	Retainer, Main Adjusting Needle Packing
26	516-0027	1	Pin, Main Adjusting Needle
27	142-0041	1	†*Needle, Main Adjusting
28			Body Assembly (Not Sold Separately)
29	505-0053	1	Plug, Gas Inlet
30	142-0343	2	†Bushing, Throttle Shaft
31	142-0042	1	Needle Assembly - Includes Packing, Nut & Retainer
32	142-0227	1	Pin, Choke Stop
33	870-0053	1	Nut, Hex - Throttle Stop (10-32)
34	813-0102	1	Screw, Machine - Round Head - 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.

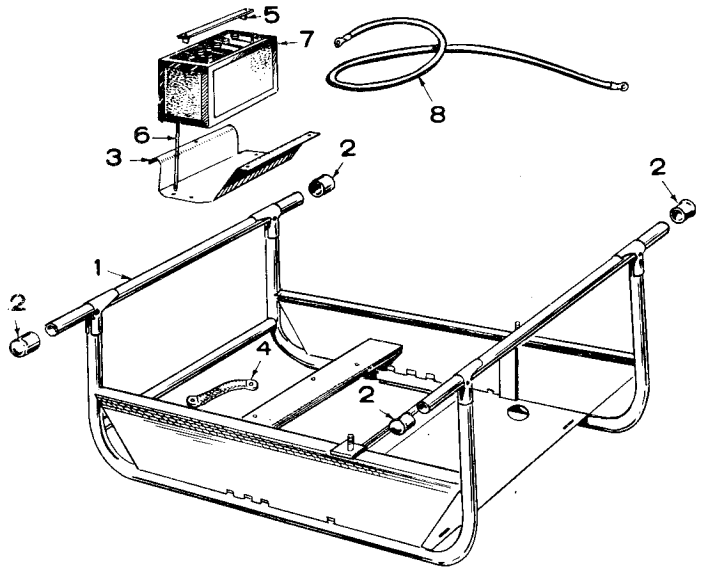
FUEL SYSTEM GROUP



FUEL SYSTEM GROUP

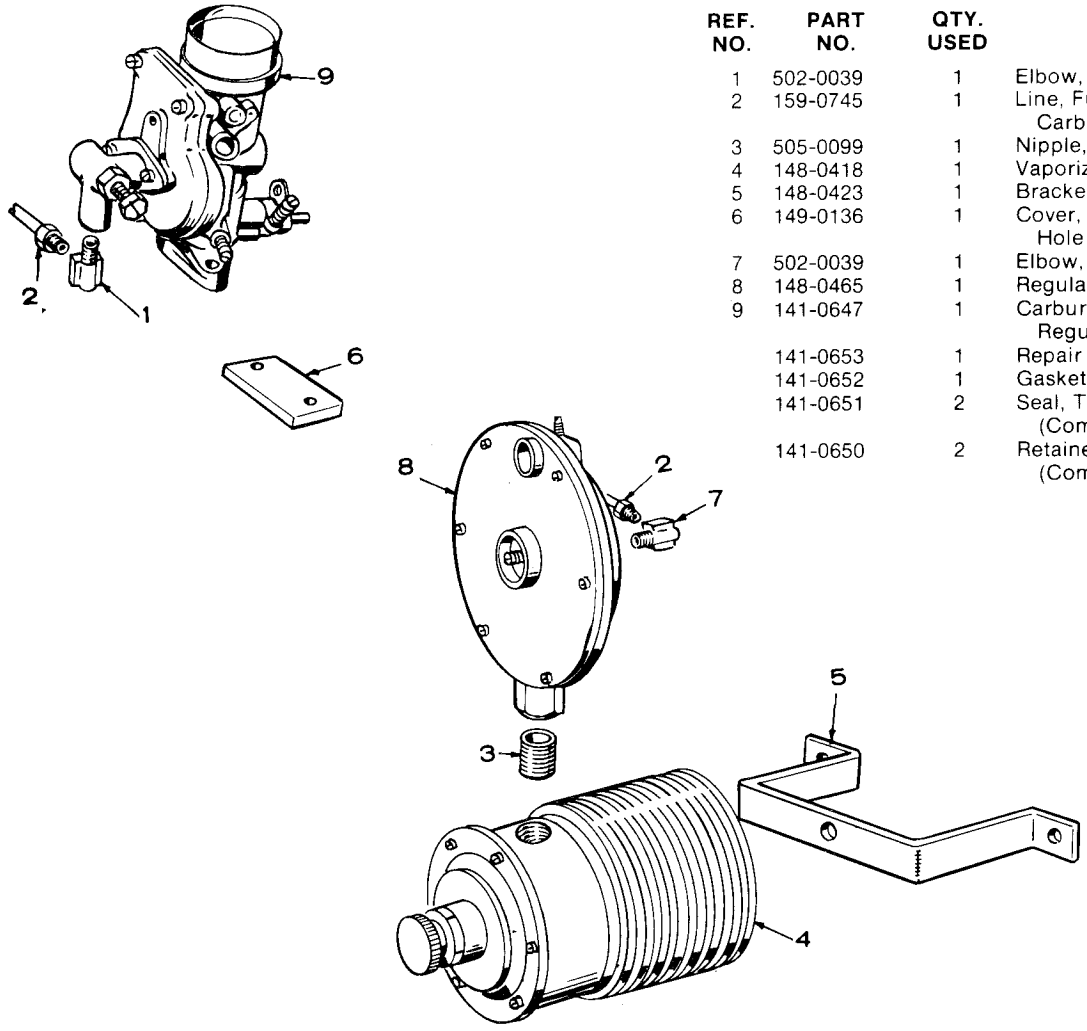
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	145-0094	1	Inlet, Carburetor Air
2	503-0280	1	Clamp, Air Inlet to Air Cleaner
3	503-0107	1	Clamp, Air Inlet to Carburetor
4	140-0537	1	Housing, Air Cleaner
5	140-0538	1	Cover, Air Cleaner
6	140-0495	1	Cartridge, Air Cleaner
7	518-0056	1	Screw, Wing - Air Cleaner Cover Mounting
8	CARBURETOR ASSEMBLY, GASOLINE		
	142-0386	1	Spec F Only
	142-0416	1	Begin Spec H
9	149-0693	1	Pump Assembly, Fuel
10	502-0002	2	Elbow, Inverted Male - (1) Fuel Pump Outlet (1) Carburetor Inlet
11	502-0020	1	Elbow, Street - Fuel Pump Inlet
12	149-0271	1	Rod, Fuel Pump Primer - Key 1
14	134-0981	1	Baffle, Fuel Pump Air
15	149-0045	1	Spacer, Fuel Pump
16	149-0003	2	Gasket, Fuel Pump and Spacer Mounting
17	149-0775	1	Line, Fuel Pump to Carburetor
18	154-0601	1	Manifold, Intake
19	141-0078	1	Gasket, Carburetor Mounting
20	331-0053	2	Nut, Pipe - 1 - Exhaust Outlet
21	505-0003	2	Elbow, Street (1") - Exhaust Outlet
22	505-0087	2	Nipple, Pipe (1" x 3") - Exhaust Outlet
23	155-0484	2	Muffler, Exhaust
24	153-0263	1	Bracket and Clip, Manual Choke
25	154-0013	2	Gasket, Intake Manifold
26	CHOKE, MANUAL		
	153-0097	1	Key 1
	153-0165	1	Key 2
27	159-0690	1	Tank, Fuel (7.35 Gal.)
28	159-0692	2	Strap, Fuel Tank Mounting
29	159-0020	1	Cap, Fuel Tank
30	501-0005	1	Line, Flexible Fuel - Tank to Pump
31	159-0695	1	Tube, Pick-Up - Fuel Tank Outlet
32	149-0773	1	Elbow & Screen, Fuel Tank
33	505-0008	1	Plug, Slotted Pipe - Fuel Tank Drain
34	140-0554	1	Spacer, Air Cleaner Mounting Screw
35	420-0169	1	Wrench, Carburetor Adjusting
36	800-0054	2	Screw, Cap - Hex Head - Intake Manifold Mtg.
37	800-0009	2	Screw, Cap - Hex Head - Carburetor Mounting (1/4-20 x 1-1/2")
38	800-0009	2	Screw, Cap - Hex Head - Tank Mtg. (1/4-20 x 1-1/2")
39	813-0100	1	Screw, Machine - Round Head Fuel Pump Baffle Mounting (10-32 x 1/2")
40	806-0009	2	Screw, Cap - Counterbore - Fuel Pump Mounting (1/4-20 x 1-1/10")
41	850-0050	2	Washer, Lock - Spring - Intake Manifold Mtg. (3/8")
42	850-0040	2	Washer, Lock - Spring - Carb. Mtg. (1/4")
43	850-0030	1	Washer, Lock - Spring - Fuel Pump Baffle Mtg. (#10)
44	850-0040	2	Washer, Lock - Spring Fuel Tank Mtg. (1/4")
45	860-0013	2	Nut, Hex - Fuel Tank Mounting (1/4-20)

CARRYING FRAME AND BATTERY GROUP



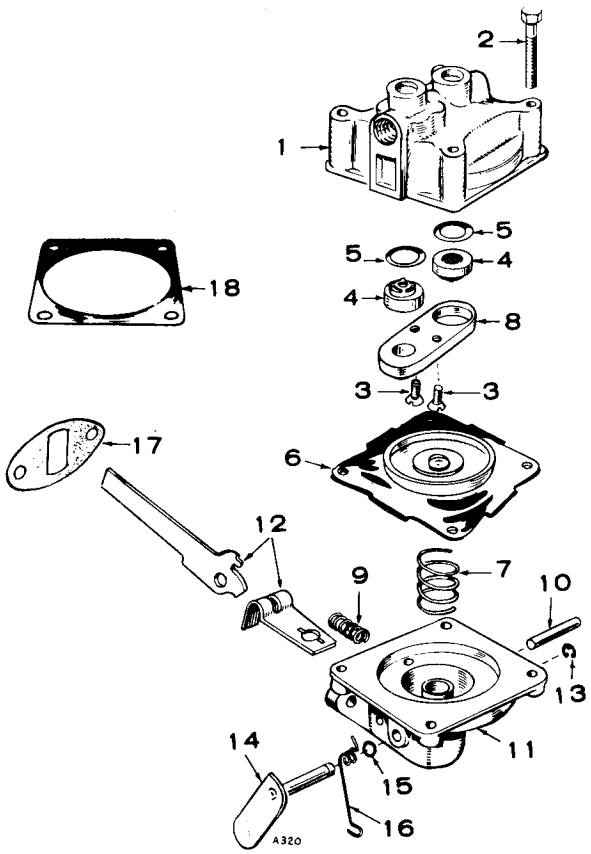
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	403-0586	1	Frame, Carrying
2	403-0588	4	Tips, Rubber - Carrying Frame
3	416-0452	1	Rack, Battery - Key 2
4	337-0050	1	Strap, Ground - Carrying Frame to Blower Housing
5	416-0453	1	Strap, Battery Holddown - Key 2
6	416-0454	2	Stud, Battery Holddown - Key 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")

FUEL SYSTEM GROUP (OPTIONAL)
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)

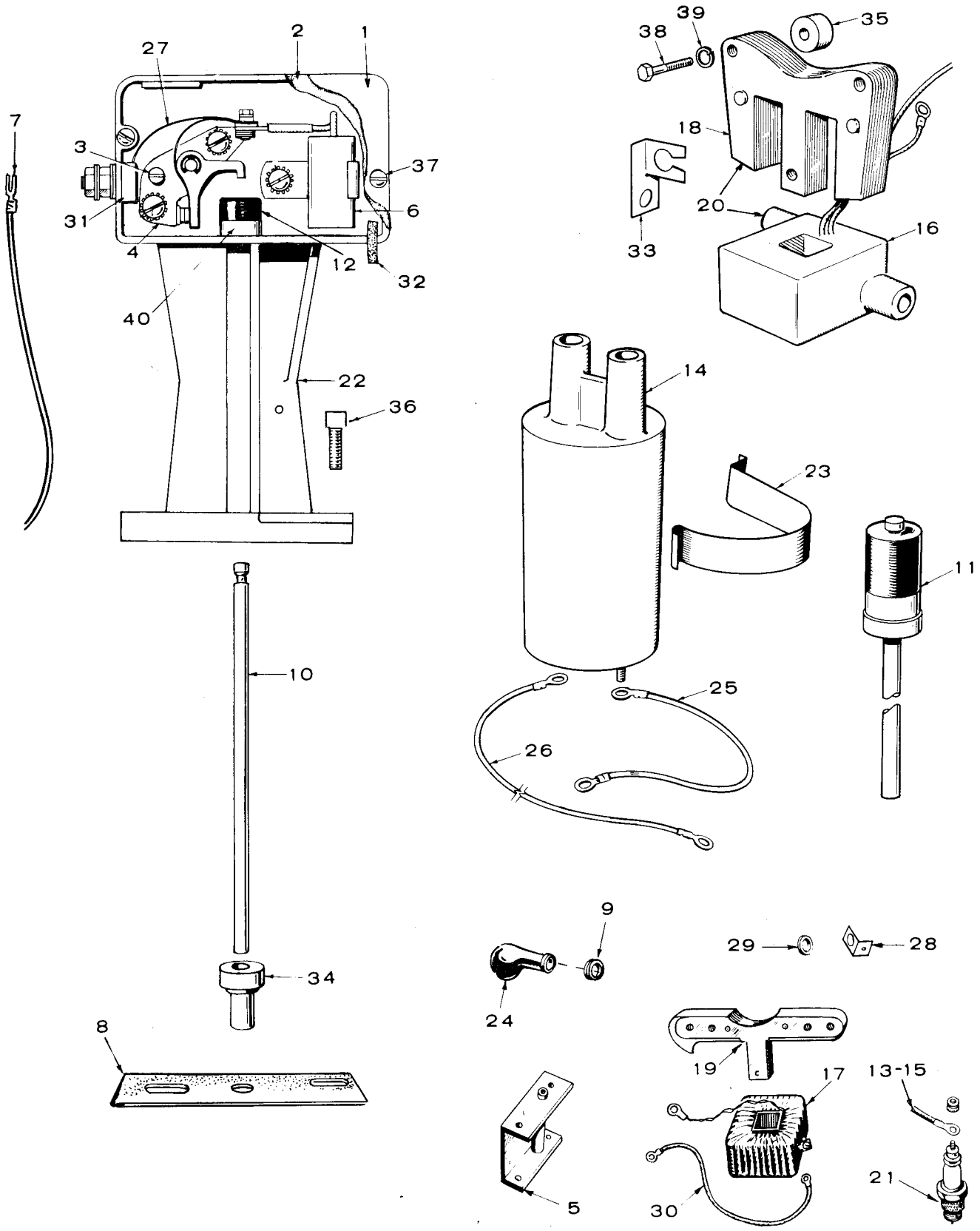
FUEL PUMP PARTS GROUP



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

* - Contained in Repair Kit #149-0526.

IGNITION GROUP

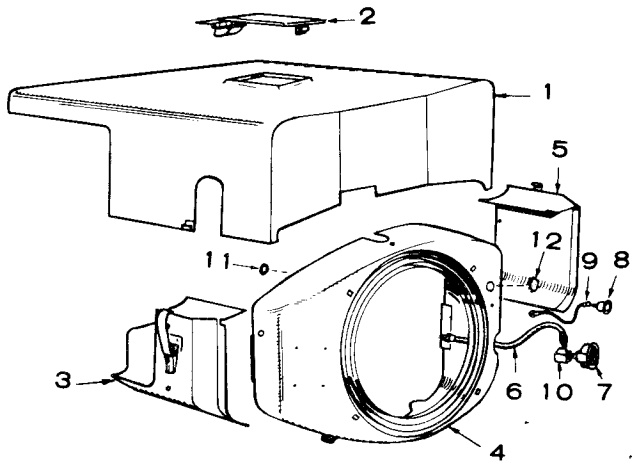


IGNITION GROUP

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 Mtg. - 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
11	160-0776	1	Plunger Assembly (Includes Plunger, Diaphragm, Guide) - Spec F through H
12	160-1143	1	*Diaphragm, Breaker Plunger
13	CABLE, SPARK PLUG - RIGHT HAND		
	167-1308	1	9" - Spec F Only
	167-1404	1	19" - Begin Spec H
14	160-0792	1	Coil, Ignition - Spec F Only
15	CABLE, SPARK PLUG - LEFT HAND		
	167-1309	1	23" - Spec F Only
	167-1403	1	16-3/4" - Begin Spec H
16	160-0750	1	Coil, Magneto Stator, Begin Spec H
17	160-0282	1	Coil, Magneto Stator - Spec F Only
18	160-0749	1	Pole Shoe, Magneto Stator - Begin Spec H
19	160-0281	1	Pole Shoe, Magneto Stator - Spec F Only
20	160-0752	1	Stator Assembly, Magneto (Includes Coil and Pole)
21	167-0241	2	Plug, Spark
22	160-0963	1	Box Assembly, Ignition Breaker - (Includes Parts Marked *)
23	160-0488	1	Clamp, Ignition Coil - Spec F Only
24	160-0558	2	Nipple, Ignition Coil (Rubber) - Spec F Only
25	336-0530	1	Lead, Ignition Coil to Ground (4") - Spec F Only
26	336-0219	1	Lead, Ignition Coil to Breaker Box (20") - Spec F Only
27	160-0428	1	*Strap, Point Set to Breaker Box Terminal Block
28	332-0273	1	Clip, Magneto Lead
29	508-0002	1	Grommet, Magneto Lead Clip
30	336-1196	1	Lead, Magneto Stator to Breaker Box (24")
31	160-0349	1	*Terminal Screw and Block Assembly
32	160-0261	1	*Wick, Oil Drain, Breaker Box
33	167-0188	4	Clip, Spark Plug Cable - Begin Spec H
34	160-0929	1	*Bushing, Breaker Box Plunger - Begin Spec J
35	526-0015	4	Washer, Flat - Pole Shoe Mtg. Begin Spec H (9/32" ID x 9/16" OD x 1/16" THK)
36	815-0357	2	*Screw, Machine - Round Head Phillips Self Tapping - Breaker Box Mounting (1/4-20 x 7/8")
37	812-0077	2	*Screw, Machine - Round Head - Breaker Box Cover Mtg. (8-32 x 3/8")
38	815-0259	2	Screw, Machine - Hex Head Thread Cutting - Pole Shoe Mtg. (1/4-20 x 1-1/4")
39	850-0040	2	Washer, Lock - Spring - Pole Shoe Mtg. (1/4")
40	160-0931	1	*Guide, Plunger

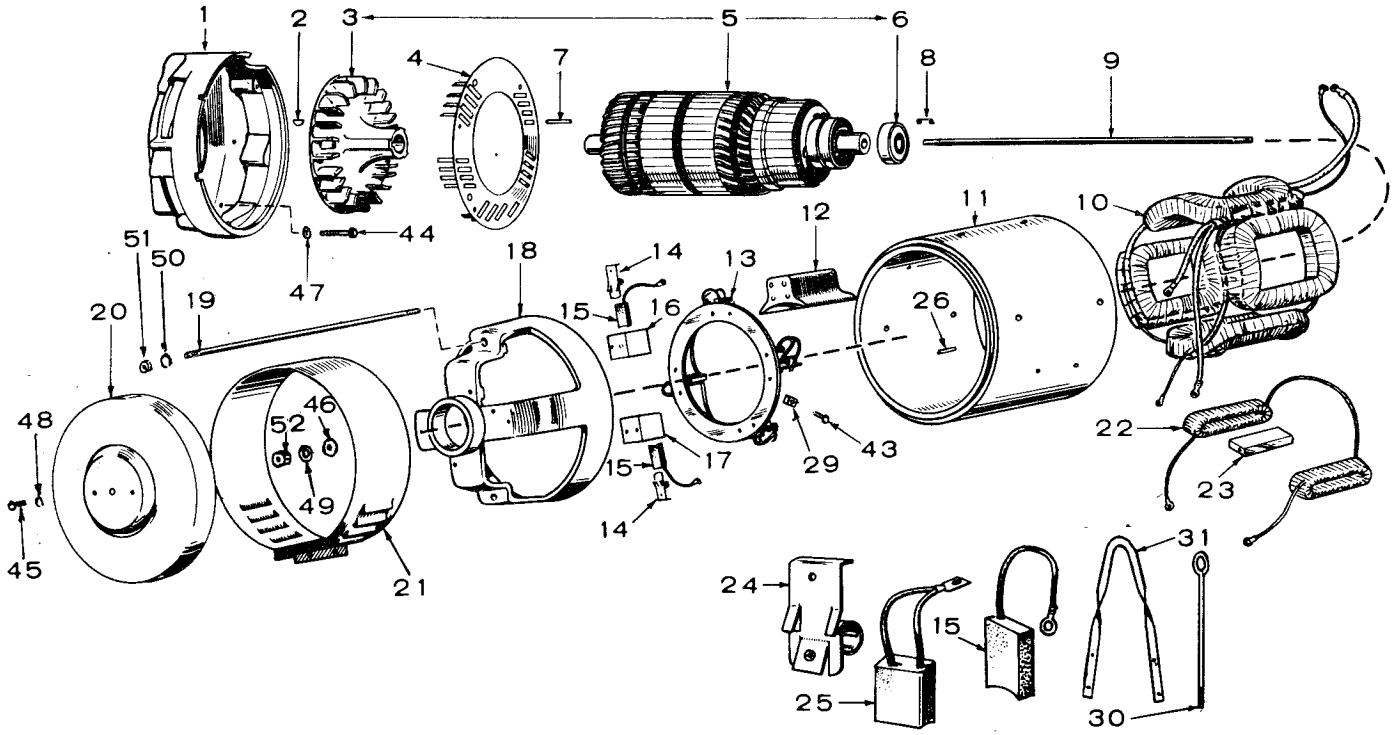
* - Included in Ignition Breaker Box Assembly.

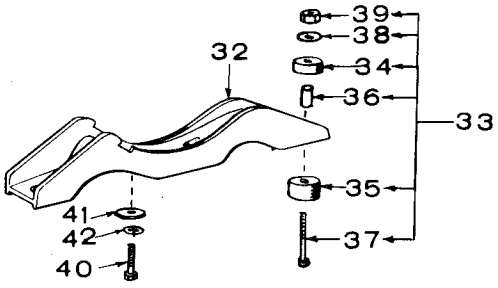
BLOWER HOUSING GROUP

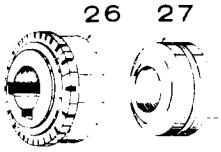


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	405-1184	1	Cover, Engine and Control
2	405-1187	1	Cover, Lifting Eye
3	134-0980	1	Housing, Cylinder Air - L.H. (#1 Cylinder)
4	134-1579	1	Housing, Blower
5	134-0979	1	Housing, Cylinder Air - R.H. (#2 Cylinder)
6	501-0004	1	Line, Oil Gauge (Flexible)
7	193-0005	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

GENERATOR GROUP







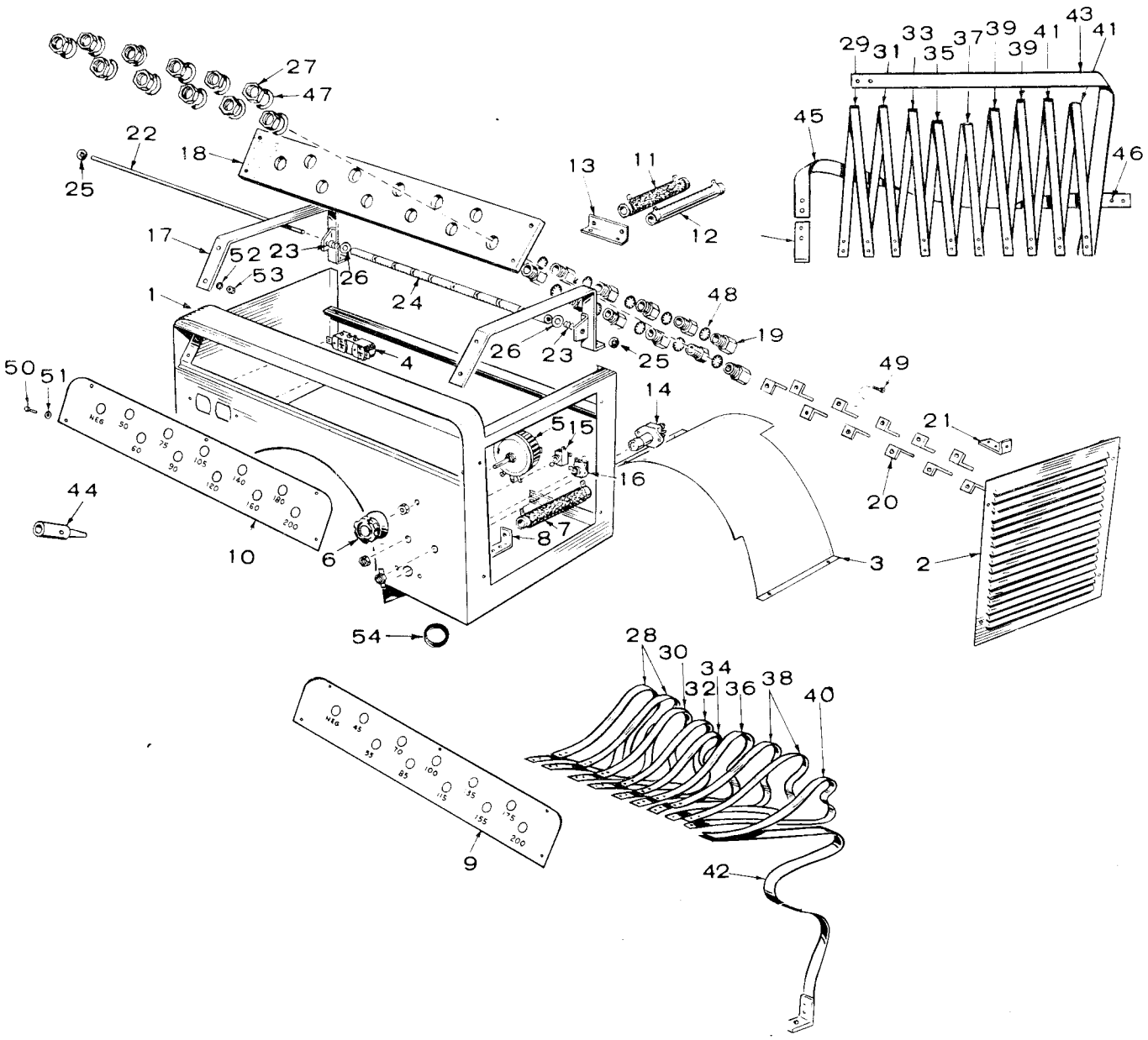
GENERATOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	ADAPTER, GENERATOR TO ENGINE		
	231-0124	1	Spec F
	231-0104	1	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 Assy. (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 - Less Coils & Poleshoes - (Machined)
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
15	214-0050	4	Brush, AC
16	212-1161	2	Holder, AC Brush - Spec F Only - (Upper)
17	212-1160	2	Holder, AC Brush - Spec F Only - (Lower)
18	BELL, END		
	211-0111	1	Spec F Only
	211-0097	1	Begin Spec H
19	520-0161	2	Stud, Generator Through
20	211-0114	1	Cover, End Bell
21	234-0002	1	Band, End Bell
22	222-1458	1	Coil Set, Interpole
23	221-0116	2	Interpole
24	212-1106	4	Spring, DC Brush
25	214-0067	4	Brush, DC
26	516-0103	2	Pin, Roll - Generator Frame
27	203-0125	1	Commutator
28	204-0009	1	Collector Ring
29	212-1214	4	Clamp, Brush Rig
30	403-0580	1	Eyebolt, Lifting - Spec F Only
31	403-0642	1	Yoke, Lifting - Begin Spec H
32	232-1368	1	Support, Generator
33	402-0223	2	Cushion Assy., Set Mtg. - Generator End (Includes Parts Marked *)
34	402-0131	2	*Cushion, Mounting - (Upper)
35	402-0192	2	*Cushion, Mounting - (Lower)
36	402-0193	2	*Bushing (Sleeve) Mounting
37	800-0037	2	*Screw, Cap - Hex Head - Cushion Mtg. (5/16-18 x 3")
38	526-0076	2	*Washer, Flat - Cushion Mounting (11/32" ID x 1-1/2" OD x 1/16" THK)
39	870-0048	2	*Nut, Hex - Cushion Mounting (5/16-18)
40	800-0058	2	Screw, Cap - Hex Head - Generator Support Mounting (3/8-16 x 1")
41	526-0030	2	Washer, Flat - Generator Support Mtg. (13/32" ID x 7/8" OD x 1/8" THK)
42	850-0050	2	Washer, Lock - Spring - Generator Support Mtg. (3/8")
43	800-0003	4	Screw, Cap - Hex Head - Clamp Mtg. (1/4-20 x 1/2")
44	800-0050	4	Screw, Cap - Hex Head - Generator Adapter Mounting (3/8-16 x 1")
45	813-0098	2	Screw, Machine - Round Head - End Bell Cover Mounting (10-32 x 3/8")
46	526-0032	1	Washer, Flat - Armature Through Stud (29/64" ID x 7/8" OD x 1/16" THK)
47	850-0050	4	Washer, Lock - Spring - Generator Adapter Mounting (3/8")
48	850-0030	2	Washer, Lock - Spring - End Bell Cover Mtg. (#10)
49	850-0055	1	Washer, Lock - Spring - Armature Through Stud (7/16")
50	850-0045	2	Washer, Lock - Spring - Generator Through Stud (5/16")
51	862-0015	2	Nut, Hex - Generator Through Stud (5/16-18)
52	862-0004	1	Nut, Hex - Armature Through Stud (7/16-14)

* - Parts Included in Cushion Assembly - Generator End.

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

CONTROL GROUP



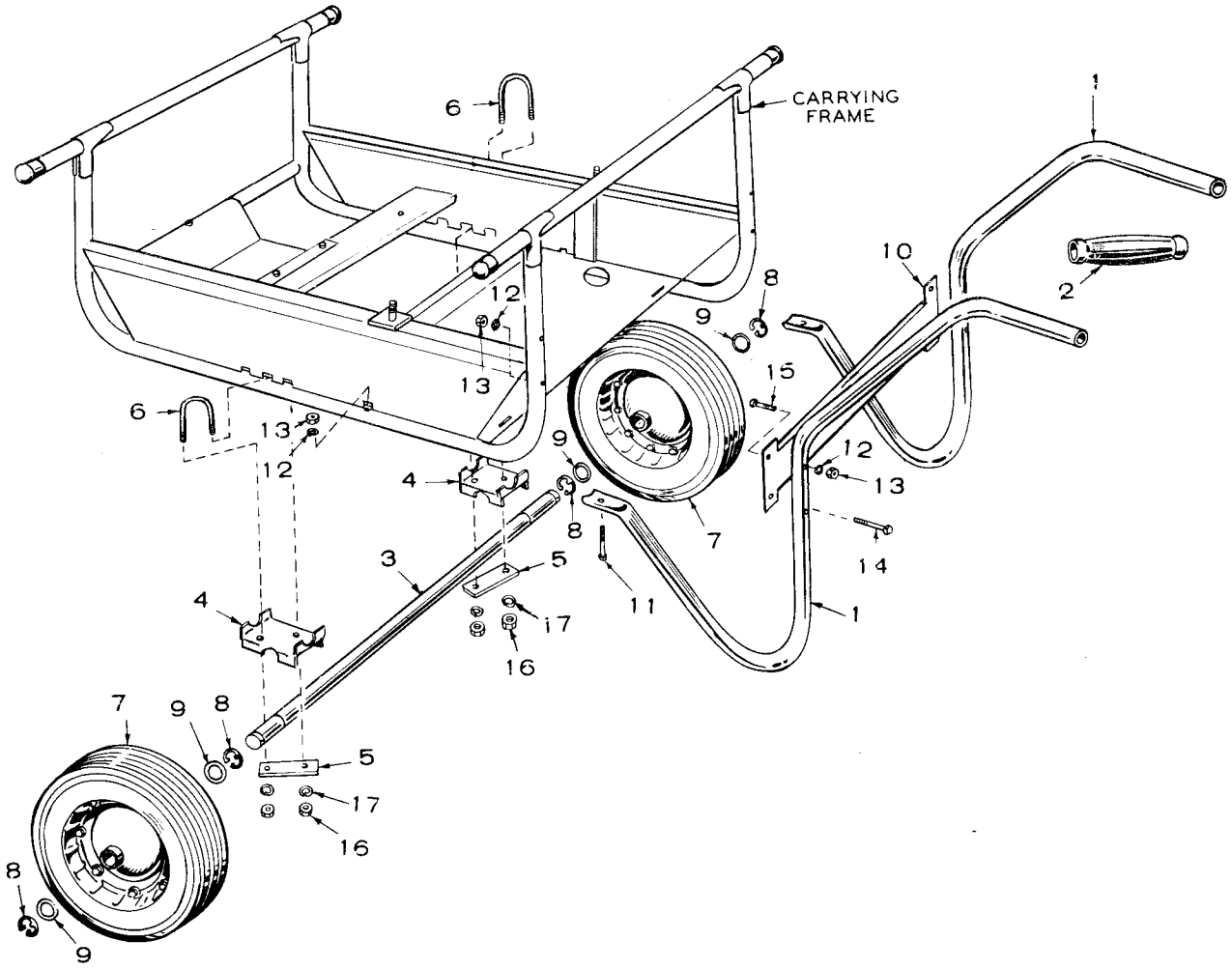
CONTROL GROUP

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
6	304-0061	1	Knob, Rheostat
7	304-0183	1	Resistor, Field (5.5-Ohm, 160 Watt)
8	304-0117	1	Bracket, Field Resistor Mtg.
	PANEL, CONTROL BOX		
9	301-1785	1	Spec F Only
10	301-2298	1	Begin Spec H
	RESISTOR, BATTERY CHARGE - KEY 2		
11	304-0474	1	30-Ohm, 220 Watt (Ribbed) - 1-1/8" x 6"
12	304-0472	1	15-Ohm, 75 Watt (13/16" x 6")
13	304-0470	2	Bracket, Battery Charge Resistor Mtg. - Key 2
14	308-0028	1	Switch, Start - Key 2
15	308-0068	1	Switch, Ignition - Key 2
16	308-0002	1	Switch, High-Low Charge
	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)
17	301-1778	2	†*Bracket, Resistor Elements Mtg.
18	301-1777	1	†*Block, Terminal - Resistor Element Fastening
19	316-0044	11	†*Jack, Plug - Welder Cable Connecting
20	308-0149	10	*†Angle, Connector - Resistor Elements to Plug Jack - 1-23/32" Long
21	308-0128	3	*†Angle, Connector - Resistor Elements to Plug Jack - 3-1/8" Long (One only used Spec F)
22	304-0469	1	*†Rod, Insulator Tubes Mtg.
23	115-0056	1	*†Spring, Insulator Tube
24	304-0379	8	*†Tube, Insulator
25	870-0173	2	*†Nut, Push - Insulator Rod Mtg. (3/8-24)
26	526-0101	1	*†Washer, Flat - Insulator Rod Mtg. (19/64" ID x 5/8" OD x 1/16" THK)
27	868-0011	11	†*Nut, Hex Jam - Jack Mtg. (3/4-16)
	ELEMENT, RESISTOR		
28	304-0467	2	*Spec F Only
29	304-0551	1	†Begin Spec H
	ELEMENT, RESISTOR		
30	304-0466	1	*Spec F Only
31	304-0467	1	†Begin Spec H
	ELEMENT, RESISTOR		
32	304-0462	1	*Spec F Only
33	304-0466	1	†Begin Spec H
	ELEMENT, RESISTOR		
34	304-0463	1	*Spec F Only
35	304-0552	1	†Begin Spec H
	ELEMENT, RESISTOR		
36	304-0553	1	†Begin Spec H
	ELEMENT, RESISTOR		
38	304-0468	2	*Spec F Only
39	304-0465	2	†Begin Spec H
	ELEMENT, RESISTOR		
40	304-0464	1	*Spec F Only
41	304-0468	2	†Begin Spec H
	ELEMENT, RESISTOR		
42	304-0383	1	*Spec F Only
43	304-0554	1	†Begin Spec H
44	316-0045	2	Plug, Welding Cables
45	304-0555	1	†Element, Resistor - Begin Spec H
46	815-0026	26	Screw, Cap - Truss Head - (10-32 x 5/8")
47	526-0120	11	Washer, Flat - Jack Mounting (25/32" ID x 1-1/4" OD x 1/16" THK)
48	854-0031	11	Washer, Lock - (Internal Shakeproof) - (3/4")
49	815-0223	11	Screw, Cap - Hex Head - Angle Connector to Jack (1/4-20 x 5/8")
50	800-0007	4	Screw, Cap - Hex Head Panel Mtg. (1/4-20 x 1")
51	526-0015	4	Washer, Flat (9/32" ID x 9/16" OD x 1/16" THK)
52	850-0040	4	Washer, Lock Spring (1/4")
53	860-0013	4	Nut, Hex (1/4-20)
54	508-0008	3	Grommet

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

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

DOLLY GROUP (Optional Equipment)



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
9	526-0081	4	Washer, Flat - Wheel Mtg. (1-1/64" ID x 1-5/8" OD x 1/8" THK)
10	410-0313	1	Brace, Handle
11	800-0031	2	Screw, Cap - Hex Head (5/16-18 x 1-1/2")
12	850-0045	6	Washer, Lock - Spring Handle Mtg. (5/16")
13	862-0015	6	Nut, Hex (5/16-18) - Handle Mounting
14	800-0035	2	Screw, Cap - Hex Head (5/16-18 x 2-1/2")
15	814-0182	2	Screw, Machine - Flathead (5/16-18 x 1-1/2")
16	862-0003	4	Nut, Hex (3/8-16)
17	850-0050	4	Washer, Lock Spring (3/8")

SERVICE KITS AND MISCELLANEOUS

NOTE: For other kits, refer to the group for the parts 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)

MANY OPTIONAL ITEMS ARE AVAILABLE TO MAKE THIS UNIT FIT YOUR REQUIREMENTS.

TWO-WHEEL DOLLY

12-VOLT, DRY CHARGED BATTERY AND ELECTROLYTE

CANVAS COVER

ACCESSORY KIT CONSISTING OF CABLES, ELECTRODE HOLDER, GROUND CLAMP, HELMET AND LENS

CONSULT YOUR DISTRIBUTOR

Cummins Power Generation
1400 73rd Ave. NE
Minneapolis, MN 55432
USA

Phone: 1-763-574-5000
Toll-free: 1-800-888-6626
Fax: 1-763-574-5298
Web: www.cumminsonan.com
Email: www.cumminsonan.com/contact

Cummins **Onan**
RV Generators