Onan®

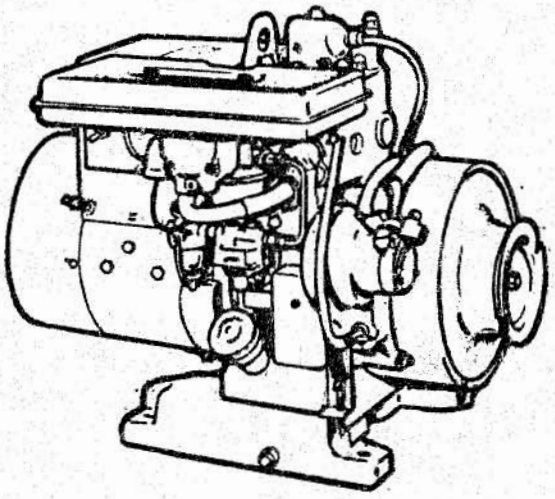
MAJOR SERVICE MANUAL

FOR

MAJ

SERIES

MARINE ELECTRIC GENERATING SETS



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WARNING

TO AVOID POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE, AN AUTHORIZED SERVICE REPRESENTATIVE MUST PERFORM ALL SERVICE.

GENERAL INFORMATION

SERVICE MANUAL

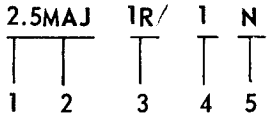
This Onan service manual contains information for proper servicing and overhauling MAJ electric generating sets. Onan recommends reading the entire manual to better understand the MAJ generating set before performing any work on the unit. The information will enable you to maintain and service the generating set, which will not only result in better generating set operation, but long unit life as well. Because correct diagnosis is an utmost part of repair, a troubleshooting chart is included.

Throughout the manual, engine end of the generating set is the front. Left and right are determined when facing the engine end (front).

When contacting the factory about the generating set, always supply the complete model number and serial number as shown on the nameplate (see "MODEL DESIGNATION" following).

MODEL DESIGNATION

The following typical model number is broken down into codes used by Onan Corporation.



1. Indicates kilowatt rating.
2. Factory code for general identification.
3. Specific Type:
   E - ELECTRIC. Electric starting at the plant only.
   R - REMOTE. Electric starting. Can be connected to optional accessory equipment for remote or automatic control of starting and stopping.
4. Factory code for optional equipment.
5. Specification (Spec.) letter (advances when factory makes production modifications).

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

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

SPECIFICATIONS

GENERAL	
Nominal dimensions of set (inches)	
Height	18 ″
Width	16 ″
Length	*
Weight	**
ENGINE DETAILS	
Number of cylinders	1
Displacement (cubic inch)	14.9
Cylinder bore	2-3/4 ″
Piston stroke	2-1/2 ″
Oil Capacity	3-1/2 Pints
RPM	
AC Set	3600
DC Set	1800 or 2400
Compression ratio	6.25:1
Battery Voltage	
1.5MAJ-224R/	24 Volt
1.5MAJ-232R/	32 Volt
Battery voltage (.6MAJ, 1.0MAJ, 2.5MAJ)	12 Volt
Battery size (1.0MAJ, 2.5MAJ)	
SAE Group 1H	Two in Series
Amp/Hr. SAE Rating - 20 Hr. (nominal)	105
Battery charge rate amperes	
2.5MAJ	1.5-2
.6MAJ, 1.0MAJ, 1.5MAJ	2-6
AIR REQUIREMENTS	
Ventilation required (cfm at 3600rpm)	
Generator	60
Combustion	16
Ventilation required (cfm at 2400rpm)	
Generator	40
Combustion	12
GENERATOR DETAILS	
Output rated at unity power factor load	1 Phase
AC voltage regulation in ± %	6
AC frequency regulation in %	5
Revolving armature generator	Yes
Revolving exciter	Yes

* - .6MAJ-1R/-19-5/8 ″, 1.0MAJ-1 & 3R/-22-7/16 ″, 1.5MAJ 224 & 232R/-22-13/16 ″ 2.5MAJ-1R/-23-7/8 ″, 2.5MAJ-3R/-24-1/2 ″

** - .6MAJ-1R/-150 lbs., 1.0MAJ 1 & 3R/-160 lbs., 1.5MAJ 224 & 232R/-180 lbs., 2.5MAJ-1R/-185 lbs., 2.5MAJ-3R/-190 lbs.

DIMENSIONS AND CLEARANCES

ALL CLEARANCES GIVEN AT ROOM TEMPERATURE 70° F.
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

	MINIMUM	MAXIMUM
Valve Tappet Clearance - Intake and Exhaust (Engine Cold)	0.010	0.012
Valve Stem in Guide - Intake	0.015	0.0025
Valve Stem in Guide - Exhaust	0.0025	0.0040
Valve Seat Interference Width	1/32	3/64
Valve Face Angle	44°	
Valve Seat Angle	45°	
Valve Interference Angle	1°	
Crankshaft End Play	0.008	0.012
Camshaft Bearings	0.0015	0.0030
Camshaft End Play	0.003	
Connecting Rod End Play	0.012	0.035
Timing Gear Backlash	0.002	0.003
Oil Pump Gear Backlash	0.002	0.005
Piston to Cylinder, Conformatic Type (Measured below oil controlling ring, 90° from pin) Clearance	.0040	.0060
Piston Pin in Piston at 70° F	Thumb Push Fit	
Piston Ring Cap in Cylinder	.006	.024
Crankshaft Main Bearing Journal - Standard Size	1.6857	1.6865
Crankshaft Rod Bearing Journal - Standard Size	1.3742	1.3750
Cylinder Bore - Standard Size	2.7520	2.7530

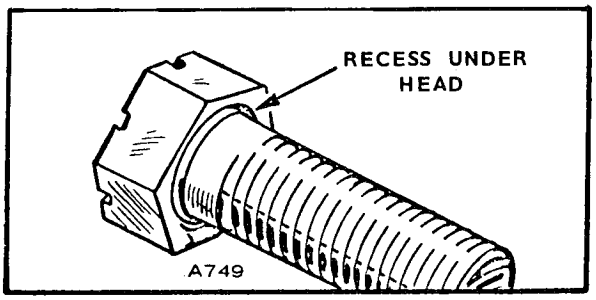
TUNE-UP SPECIFICATIONS

Spark Plug Gap		.025	
Ignition Breaker Point Gap at Full Separation		.022	
Flicker Point Gap		.020	
Magneto Pole Shoe Air Gap	.010		.015
Ignition Timing Advance			
2400 and/or 3600 rpm		25° BTC	
1800 rpm		19° BTC	

ASSEMBLY TORQUES AND SPECIAL TOOLS

Assembly torques assure proper tightness without danger of stripping threads. If a torque wrench is not available, estimate the degree of tightness. Use reasonable force and a wrench of normal length.

Special place bolts do not require lockwashers or gaskets. Never attempt to use a lockwasher with these bolts, it will defeat their purpose. Check all studs, nuts and screws often. Tighten as needed.



TORQUE SPECIFICATIONS LB.-FT.

	MIN.	MAX.
Connecting Rod Bolt	10	12
Flywheel Mounting Screw	35	40
Fuel Pump Mounting Screw	10	15
Oil Pump (For over 3000 RPM)	7	9
Gearcase Cover	15	20
Rear Bearing Plate - (Cast Iron)	20	25
Oil Base Mounting Screws	25	30
Cylinder Head Bolt	24	26
Spark Plug	25	30
Generator Through-Stud Nut	12	15
Valve Cover Nut	4	8
Carburetor Mounting Stud Nuts	8	12
Armature Through-Stud Nut	25	30

SPECIAL TOOLS AND EQUIPMENT

These tools are available from Onan to aid service and repair work.

Camshaft Bearing Driver	420-0066
Connecting Rod Aligning Set	420-0195
Main Bearing Driver	420-0127
Oil Seal Guide & Driver	420-0181
Piston Ring Spreader	420-0146
Ridge Reamer	420-0260
Replacement Blade for Reamer	420-0261
Ring Compressor	420-0214
Valve Grinding Tool	420-0120
Replacement Cup for Above	420-0121
Valve Lock Replacer	420-0105
Valve Seat Driver	420-0070
Valve Spring Compressor	420-0119

PERIODIC SERVICE GUIDE

SERVICE THESE ITEMS	AFTER EACH CYCLE OF INDICATED HOURS					
	8	50	100	200	500	1000
Inspect Set	x1					
Check Fuel Supply	x					
Check Oil Level	x					
Check Flame Arrestor		x				
Clean Governor Linkage		x				
Check Battery Electrolyte Level		x				
Change Crankcase Oil			x			
Clean Crankcase Breather			x			
Check Spark Plug			x			
Inspect Magneto Breaker Points				x		
Clean Commutator and Collector Rings				x		
Check Brushes				x2		
Check Valve Clearance					x	
Remove Carbon and Lead					x	
Clean Generator						x
Remove and Clean Oil Base						x
Grind Valves (If Required)						x
Clean Carburetor						x

x1 - With set running, visually and audibly check exhaust system for leaks.
x2 - Replace commutator brushes when worn to 5/8 inch.

GASOLINE ENGINE TROUBLESHOOTING GUIDE

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

COOLING SYSTEM

The MAJ uses a water cooled system. A water pump impeller circulates cooling water through the engine and discharges it into the exhaust line, several feet ahead of the muffler.

WATER PUMP (FIGURE 1)

Remove water pump cover and inspect neoprene impeller. If worn or damaged, install new impeller. Pump should discharge a nominal .56 gal./min. on 1800 rpm plants or .85 gal./min. on 3600 rpm plants when thermostat is open. Install pump cover air tight to prevent early pump impeller failure. Tighten screws 15 to 17 in-lb.

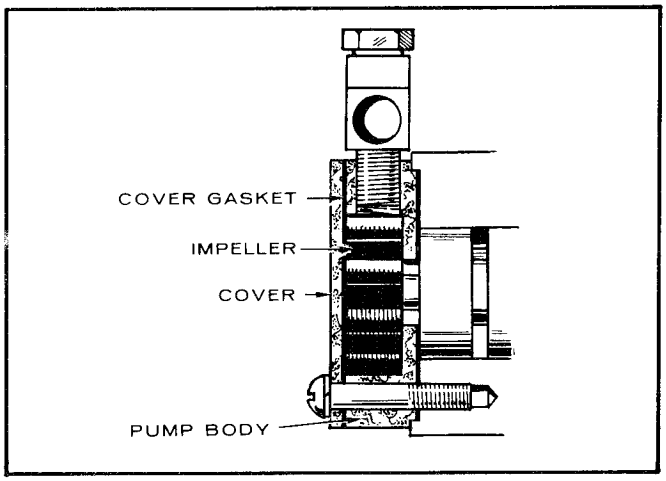


FIGURE 1. WATER PUMP IMPELLER

CAUTION *The neoprene impeller pump should never be run dry and should be primed in the sets initial state and at the beginning of each season (Figure 2).*

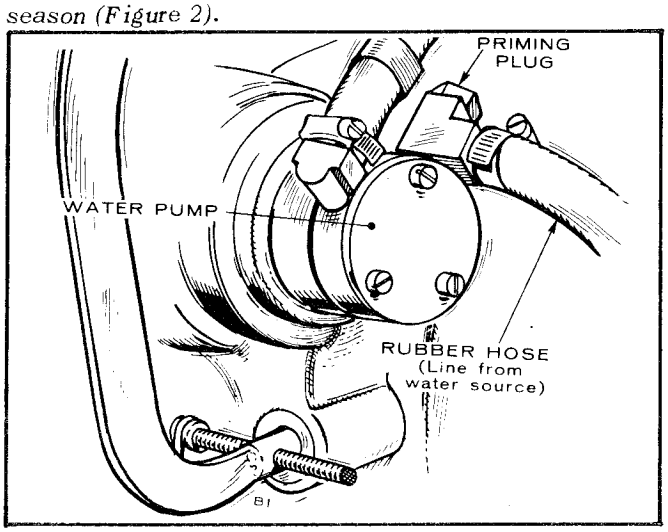


FIGURE 2. PRIMING WATER PUMP

When replacing water pump, always use Permatex or an approved sealant on all pipe fittings in supply line to water pump. To prove suction line is air tight, see that no bubbles appear in the discharged water. An air leak reduces lubrication and shortens pump impeller life.

Check the strainer in the water suction line for any obstructions which may reduce water flow.

HIGH WATER TEMPERATURE

The set utilizes a high water temperature cutout which shuts down the set if cooling water reaches a dangerously high temperature. Besides the impeller, one of the first things to check if this occurs is the thermostat. It is located on the engine cylinder head and maintains the cooling system temperature at 160° F.

TESTING THERMOSTAT (FIGURE 3)

If suspecting a faulty thermostat, test as follows:

1. Remove thermostat from cylinder head.
2. Heat a pan of water to approximately 150°F (using a thermometer immersed in the water to check temperature).
3. Suspend the thermostat in the hot water so that the sensitive portion does not touch any part of the pan.
4. Bring the water temperature up to a range of 155° to 165°F. Observe the thermostat; it should start to open within this range.
5. When thermostat is completely open, lift it out of the hot water and into the surrounding air . . . . the thermostat should close within a short time.
6. If the thermostat does not operate properly, replace with a new one.
7. Install new gasket when replacing thermostat.

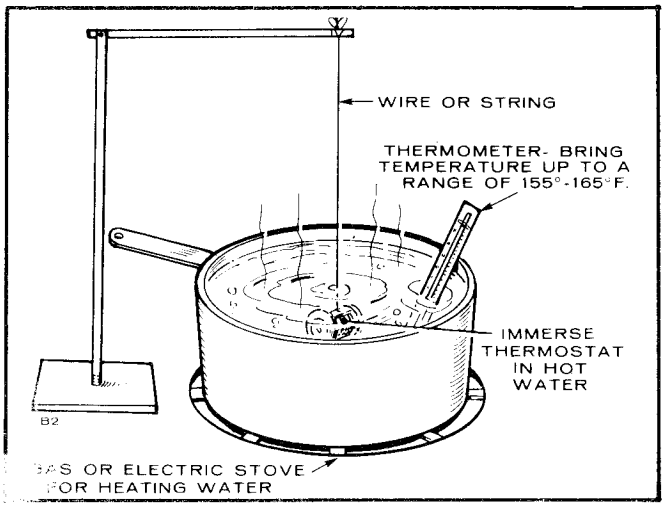


FIGURE 3. CHECKING THERMOSTAT

FUEL SYSTEM

CARBURETOR

A small piece of dirt lodged in the jet can cause hard starting and poor operation. Dirty gasoline can cause the jets to wear larger, resulting in excessive gasoline consumption. Before adjusting jet settings, mark the existing adjustment or count the number of turns the needle was backed out from its seat. Adjust carburetor only with flame arrestor resonator installed.

The carburetor is either a side (horizontal) draft type or a downdraft (vertical) type, and has two adjusting needles (Figure 4). The correct setting for the main jet needle gives the best stability at full rated load operation. The correct setting for the idle needle gives the best stability at no-load operation. Turning a needle inward gives a leaner fuel mixture for that jet.

IMPORTANT: *Full-load and no-load operating conditions are necessary when making carburetor adjustments.*

Observe the following:

AC Sets. To obtain a full rated load condition, connect an AC load equal to the nameplate rating.

To obtain a no-load condition; (1) disconnect all AC loads, (2) leave starting batteries connected, (3) adjust the governor properly.

DC Sets. To obtain a full rated load on battery charging (DC) sets, leave the batteries connected and increase the engine speed so the ammeter reading compares with that on the nameplate. This should be done only to a low charged battery. Avoid high charging currents to a fully charged battery.

To obtain a no-load condition, leave the batteries connected and decrease the engine speed so the ammeter reading is zero (or as low as possible), or use fully charged batteries.

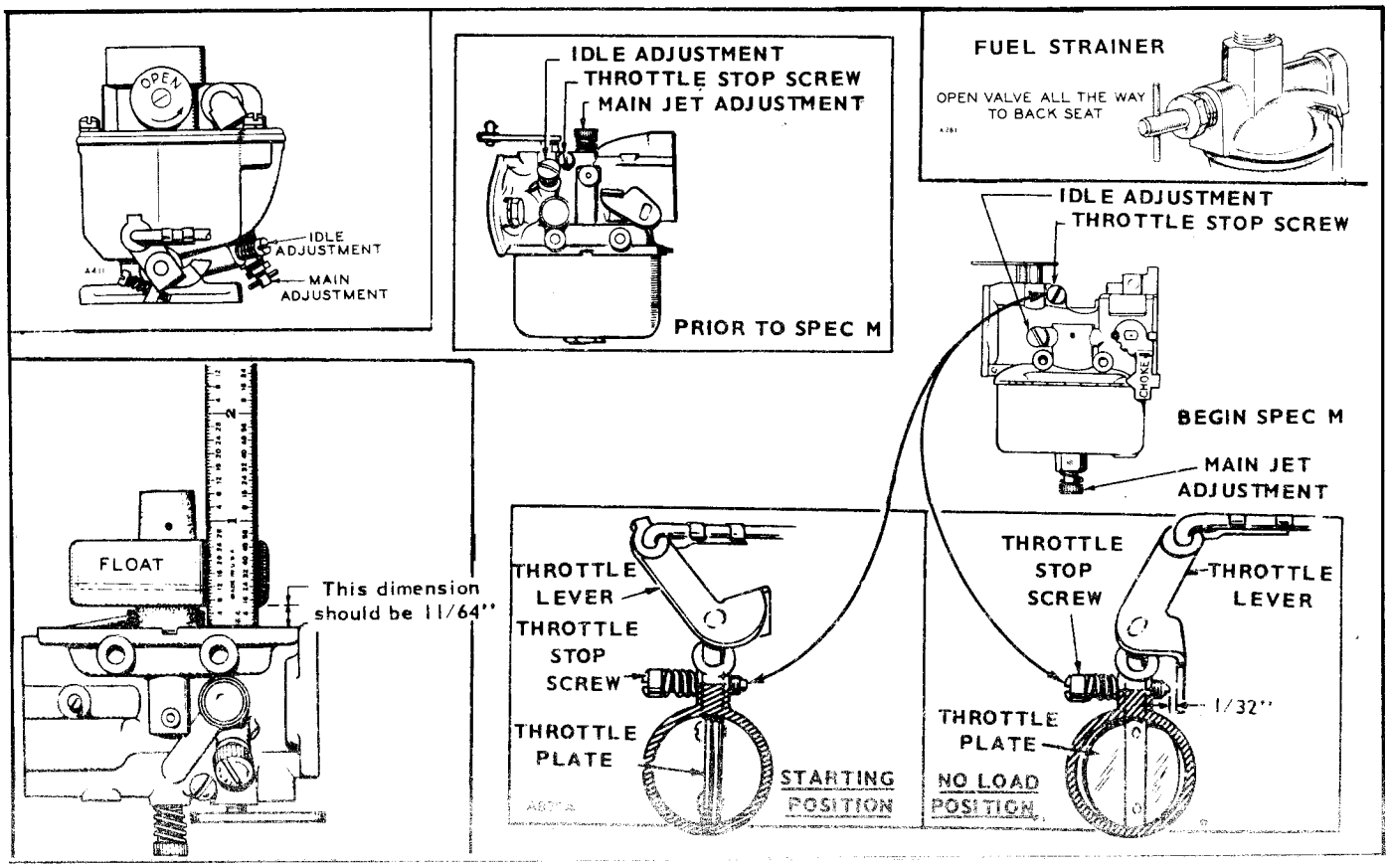


FIGURE 4. CARBURETOR ADJUSTMENTS

ADJUSTMENTS

To adjust the carburetor, turn the adjusting screws in gently (finger tight) to their seats. Do not force them in, as they may be damaged by seating too tightly. Back the main screw out about 2-1/2 (1-1/2 on downdraft carburetor) full turns. Back the idle screw out 3/4 (1-1/2 on downdraft carburetor) of a turn. Start the set and allow it to thoroughly warm up under a full-load condition.

Slowly turn the main adjusting screw inward (clockwise) for leaner mixture, until the set begins to lose speed, or the voltage drops. Turn the screw outward (counterclockwise) until the set carries the full-load. Check the operation at various loads. If there is a tendency to hunt (alternately increase and decrease speed) at any load, turn the adjusting screw out for a richer fuel mixture, until the hunting corrects itself, but do not turn the adjusting screw out more than 1/2 turn beyond the point where obtaining maximum generator output. For AC sets, adjust the idle screw with no AC electrical load connected. For battery charging sets, adjust the idle screw at the lowest possible charge rate. Slowly turn the idle adjusting screw inward (clockwise) until the set loses speed from lack of fuel. Then turn the screw slowly outward until the set runs smoothly.

Adjust the throttle idle stop screw to clear the throttle shaft stop by 1/32 inch when the set operates at desired speed and a no-load condition. This setting helps prevent hunting during changes in load.

ELECTRIC CHOKE

AC remote control sets are equipped with a thermal action electric choke. A thermostatic coil (bi-metal) engages the choke shaft and is factory set to give the correct choking action for average temperature conditions. When the set starts, the generator supplies current to a small heating element in the choke cover This heating element causes the thermal coil to wind tighter and turn the choke shaft, gradually opening the choke as the set warms up. When the set stops, the thermal coil cools off, causing the choke shaft to return to the correct position for the next start.

At a temperature of 70°F, the choke should be approximately 1/8 inch from the fully closed position. The thermal coil tends to coil tighter when heated.

Extreme temperatures may require a slight adjustment of the choke setting. To adjust the choke, loosen the two screws which retain the choke cover to the choke body. Adjust as illustrated in Figure 5.

If the choke does not operate properly, check to see that the heating element heats properly. There must be no binding of the choke shaft or thermal coil. Be sure to tighten the lockscrew after any adjustment.

A manual operating lever and weight, fastened on the opposite end of the choke shaft, may be used to operate the choke in the event the electric element burns out or the choke does not operate for any reason. Turn the lever to its horizontal position to open the choke. Choking position of the lever is vertical.

FLAME ARRESTER

Remove and clean in approved solvent as often as necessary. Dry and reinstall.

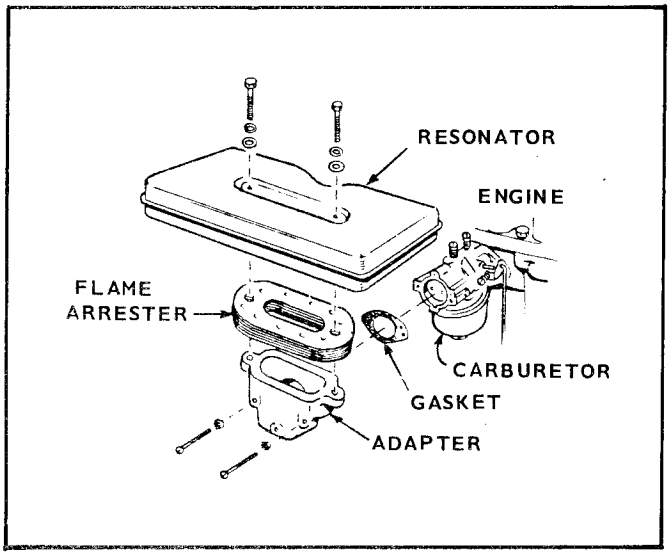


FIGURE 6. FLAME ARRESTOR

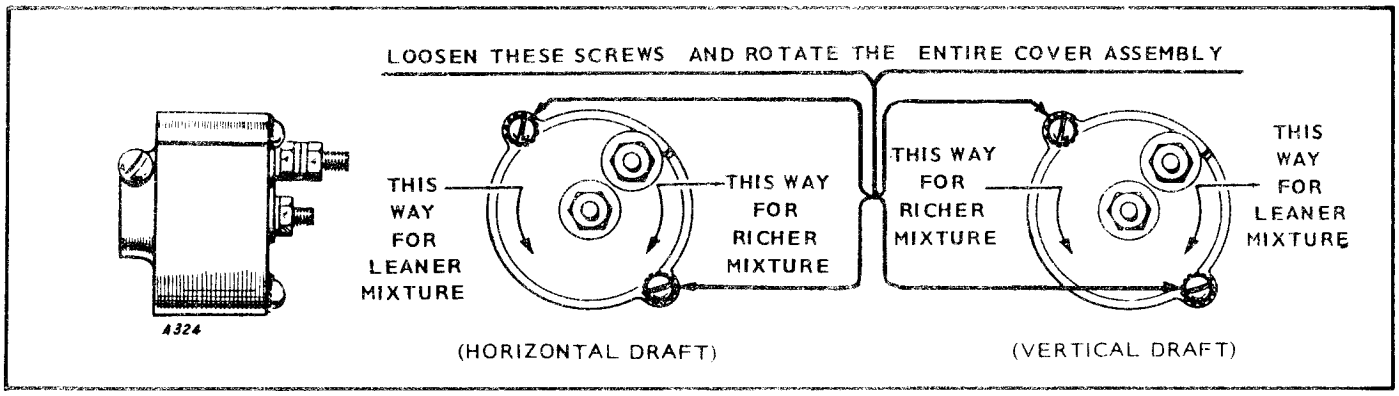


FIGURE 5. CHOKE ADJUSTMENTS

GOVERNOR SYSTEM

The governor controls the engine speed. On AC electric sets, engine speed determines generator output voltage and frequency. By increasing engine speed, generator voltage and frequency also increase and by decreasing speed, generator voltage and frequency decrease. Use an accurate voltmeter when adjusting the governor on AC sets. A small speed drop, not noticeable without instruments, will result in an objectionable voltage drop.

The governor arm fastens to a shaft which extends from the gear cover, and is connected by a ball joint and link to the carburetor throttle arm. If removing the carburetor or disassembling the governor, it may be necessary to readjust the governor.

A binding in the bearings of the shaft, which extends from the gear cover in the ball joint, or in the carburetor throttle assembly, causes slow governor action or poor regulation. Looseness or excessive wear in the governor mechanism causes erratic governor action or an alternate increase and decrease in speed (hunting). A lean carburetor adjustment may also cause hunting. Springs have a tendency to lose their calibrated tension after long usage. If all governor and carburetor adjustments are properly made, and the governor action is still erratic, replacing the spring with a new one and resetting the adjustments usually corrects the trouble.

When the set stops, tension of the governor spring should hold the carburetor throttle arm at the wide open position, pushed toward the generator end of the set. At wide open position, the lever on the throttle shaft should just touch the carburetor body or clear it by no more than 1/32 inch. Obtain this setting by increasing or decreasing the length of the connecting linkage as necessary, turning the ball joint on the threads of the link. Be sure to retighten the ball joint to the governor arm. This operation synchronizes governor action with carburetor throttle action.

Adjusting the Governor (AC Sets): Refer to Figure 7. Connect a voltmeter across the output of the generator. With no electrical load connected, start the set and adjust the speed adjusting nut to give a voltmeter

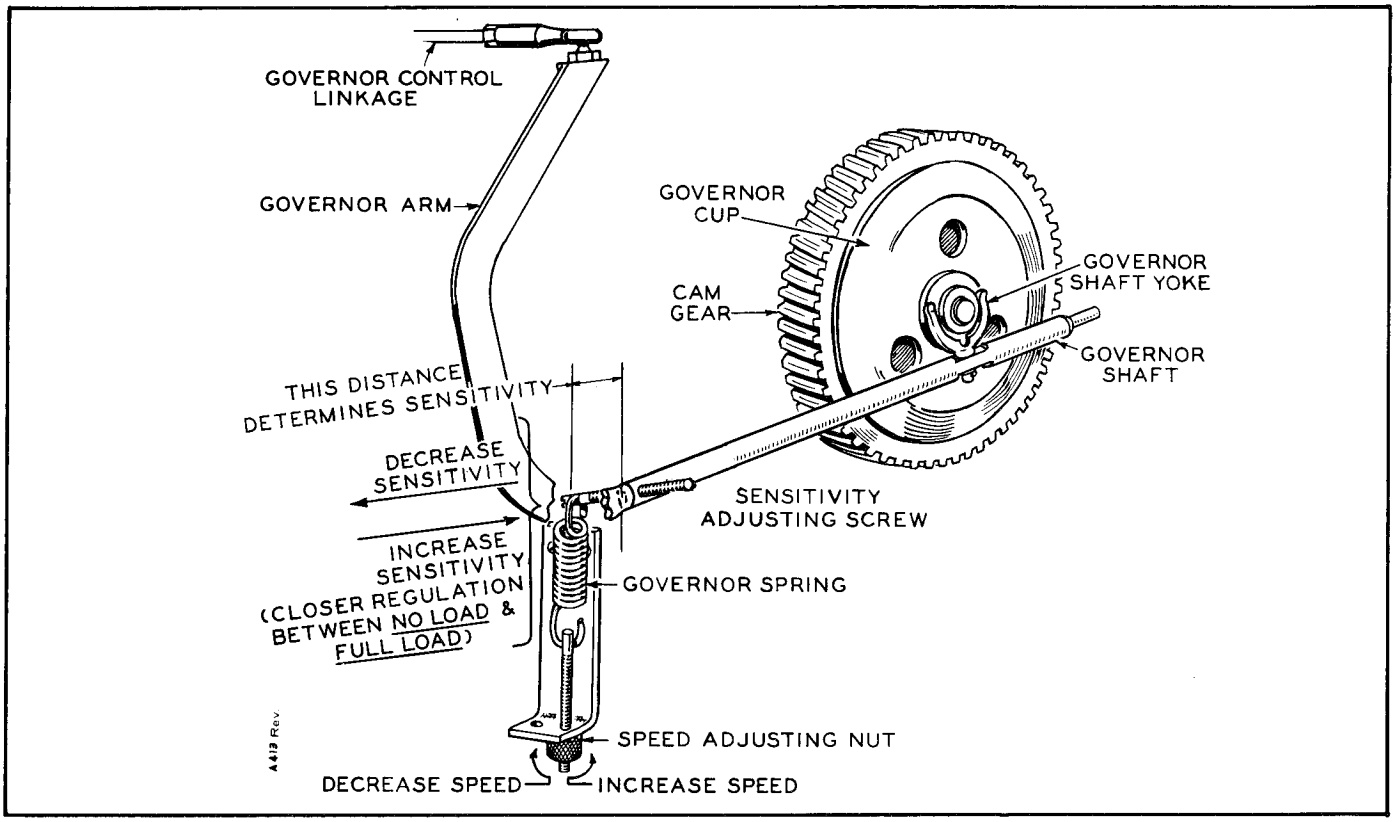


FIGURE 7. GOVERNOR ADJUSTMENTS

reading of approximately 126 volts maximum for a 120 volt set. Apply a full rated electrical load and again observe the voltage reading which should be approximately 108 volts or higher. For 240 volt plants, 252 volts at no-load is maximum and 216 full-load is minimum. The correct sensitivity adjustment gives the closest regulation without causing a hunting condition. If the voltage spread between no-load and full-load conditions is too great, move the end of the governor speed spring closer to the governor shaft. Test the governor action at various load conditions. If voltage regulation is good, but there is a tendency toward hunting at times, the sensitivity adjustment is too close or sharp. The sensitivity stud must then be turned slightly outward. Any change in the sensitivity adjustment requires a speed readjustment.

If using a tachometer for adjusting the governor, engine speed at full-load for a 60 cycle plant should be approximately 1800 rpm for a 4 pole generator, or 3600 rpm for a 2 pole generator, with a spread of not more than 100 rpm between no-load and full-load for an 1800 rpm unit (200 rpm for a 3600 rpm unit).

Adjusting the Governor (Battery Charging Sets): To adjust the governor on battery charging generators, turn the knurled speed adjusting nut (spring tension nut) to give the desired charge rate. The rate of charge is shown on the control box ammeter. The ability of the governor to keep the charge rate steady at the desired rate depends upon the distance between the center of the governor arm shaft and the governor arm end of the spring.

If the governor tends to "hunt" (alternately increase and decrease speed), turn the sensitivity adjusting stud outward to move the end of the spring slightly farther from the center of the governor shaft.

Any change in the sensitivity adjustment requires a compensating change in the speed (spring tension) adjustment. Increasing sensitivity results in a slight decrease in engine speed. The desired adjustment is a setting which gives the closest regulation without hunting. Maximum speed at full load operation of battery charging set is approximately 2400 rpm, as specified on the nameplate.

GOVERNOR LINKAGE

Lubricate the linkage at the carburetor and ball joint ends with powdered graphite (preferably), or a light, sewing machine oil. Do not lubricate plastic ball joints, they only require cleaning.

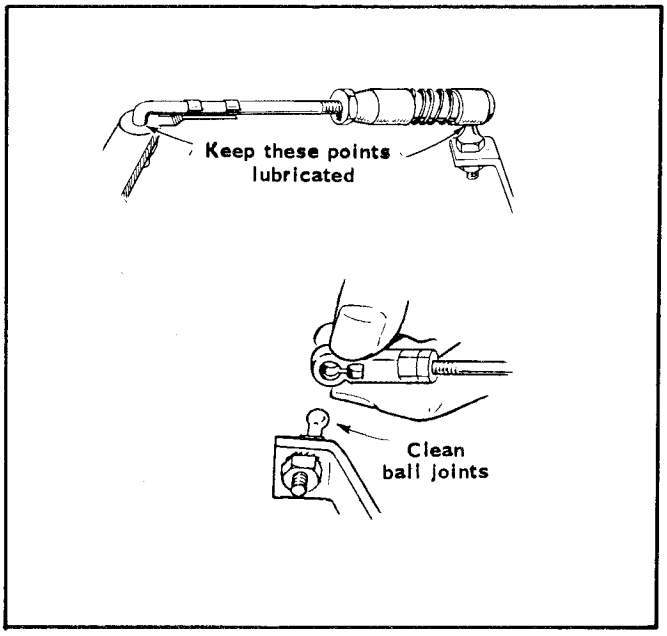


FIGURE 8. GOVERNOR LINKAGE

IGNITION AND STARTING SYSTEM

MAGNETO

The high tension magneto supplies ignition current to the spark plug. Proper ignition timing is accomplished by a breaker mechanism actuated by a cam on the crankshaft. To test the spark, disconnect the cable from the spark plug and support it so that the end of the wire is 3/16 inch from a clean metal part of the engine. Crank the engine with the hand rope, observing the spark, which should jump the 3/16 inch gap with ease. If there is no spark, or a spark that is weak or yellowish in color, make repairs as necessary.

Remove the flywheel guard and loosen the flywheel bolt a few turns. While pulling or prying outward on the flywheel, strike the flywheel bolt a sharp endwise blow to loosen the flywheel. Remove the flywheel bolt and carefully pull the flywheel off the crankshaft. Examine the magneto breaker contact points. Contact points which are not badly burned or pitted may sometimes be dressed smooth with a thin flexible abrasive stone or removed and dressed on any fine stone or hone. Replace badly burned or pitted points with new ones. Adjust the gap between points at full separation as given in the Tune-up Specifications.

A defective condenser must be replaced with a new one of proper capacity. A flywheel magnet which has lost its magnetism can be remagnetized. If the magneto backplate has been loosened or removed, see that the gap between the coil pole shoes and the flywheel is .010″ to .015″. Too wide an air gap will produce a weak spark.

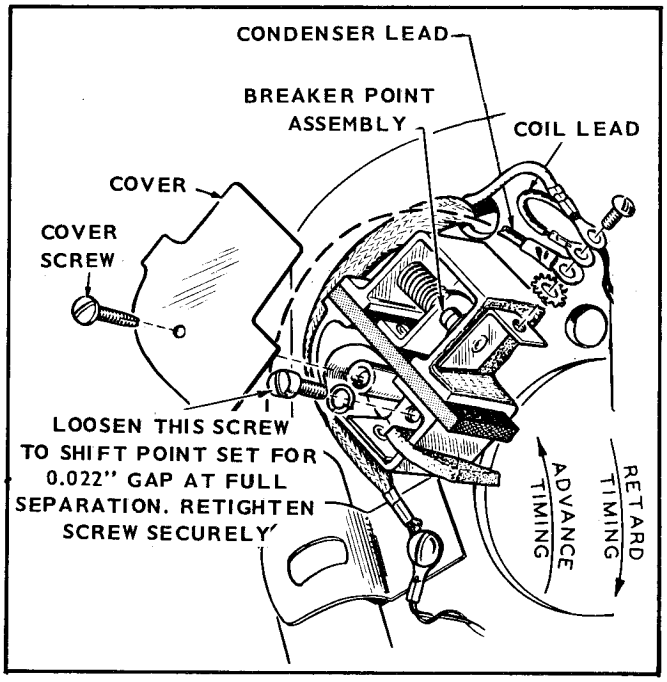


FIGURE 9. SETTING POINTS

TIMING THE IGNITION

Proper ignition timing is important for good engine operation. Refer to the Tune-up Specifications for the correct degree of spark advance before top center (TC) position of piston travel. If available, use a series test lamp for accuracy.

See that the point gap is properly adjusted (Figure 9). Install the flywheel loosely, with its key in place, and turn the flywheel with rotation direction to the position where the mark on the edge of the flywheel is in alignment with the proper degree on the gear cover. The points should just separate at this point. If they do not, remove the flywheel and loosen the magneto backplate mounting screws slightly.

If the points separate too soon, shift the entire backplate assembly clockwise. Tighten the backplate mounting screws and recheck the work for accuracy. When replacing the flywheel, always make sure the key is properly in place on the crankshaft.

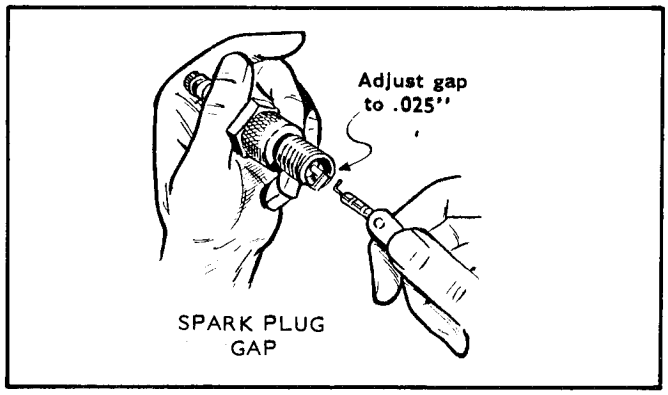


FIGURE 10. SPARK PLUG GAP

ANTI-FLICKER MECHANISM

The anti-flicker mechanism (Figure 11) is used on 1800 rpm AC set to compensate for the power surge during the power stroke of the engine. The breaker points, located on the left side of the crankcase just behind the gear cover, are connected to a generator field resistor. A condenser connected across the breaker points prevents sparking and burning of the contacts.

Burned or pitted contact points are usually an indication of a defective condenser. The breaker points gap at full separation should be 0.020″. If points and condenser are in good condition but light flicker is excessive, check for a defective resistor.

If an adjustable resistor is used, loosen the sliding clip on the resistor and while watching a small light connected with an average set load, slide the clip along the resistor to the point where the least flicker is noticeable. Tighten the clip at this position.

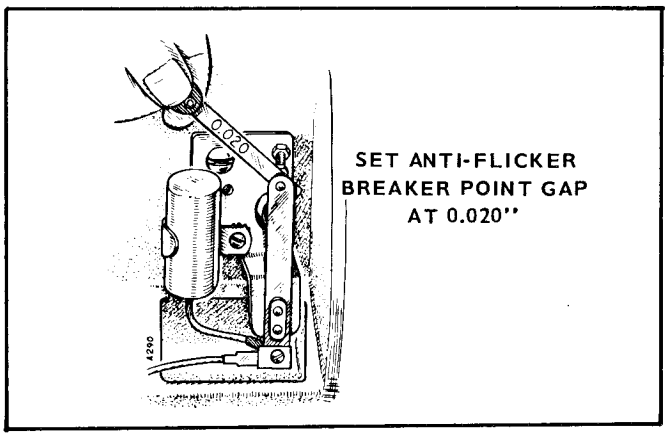


FIGURE 11. ANTI-FLICKER MECHANISM

OIL SYSTEM

PRESSURE LUBRICATION

Pressure lubrication does not apply to all models. Pressure lubricated plants have a gear type oil pump, oil intake cup and nonadjustable relief valve. If the oil pump fails, install a complete new pump. The relief valve can be removed for cleaning. The internal oil line, if accidentally damaged, is replaceable.

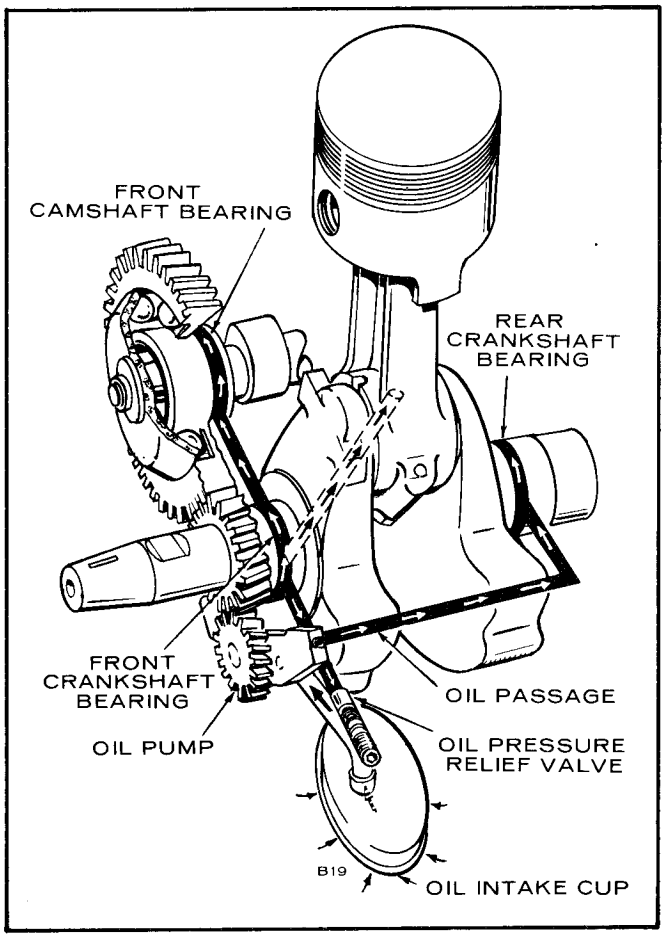


FIGURE 12. OIL SCHEMATIC

Crankcase Oil: Use a good quality heavy-duty detergent oil that meets the API (American Petroleum Institute) service designation SE. If SE oil is not available, (API), SD or SD/CC oil may be used. Oil should be labeled as having passed the MS Sequence Tests and the MIL-L-2104B Tests. Recommended SAE oil numbers for expected ambient temperatures are as follows:

30° F and Above	SAE 30
0° F to 30° F	SAE 10W-40, 5W-30
Below 0° F	SAE 5W

Do not mix brands nor grades. Refer to Periodic Service Guide for recommended oil changes. Oil drain plug is located on left front side of engine below oil fill tube.

When installing the oil pump, be sure the pump mounting gasket is in good condition. Install the intake pipe and cup tightly and at the correct angle to have the cup parallel to the oil base. BE SURE THE PUMP IS PRIMED WITH OIL.

VALVE COMPARTMENT OIL DRAIN

A drain hole from the valve compartment enters the crankcase. This hole must be unobstructed to provide for proper drainage of oil from the valve compartment.

CRANKCASE BREATHER VALVE (FIGURE 13)

Every 100 hours or sooner, remove breather tube and wash valve (5/16 inch ball) in a solvent. Check the breather tube for security and leaks.

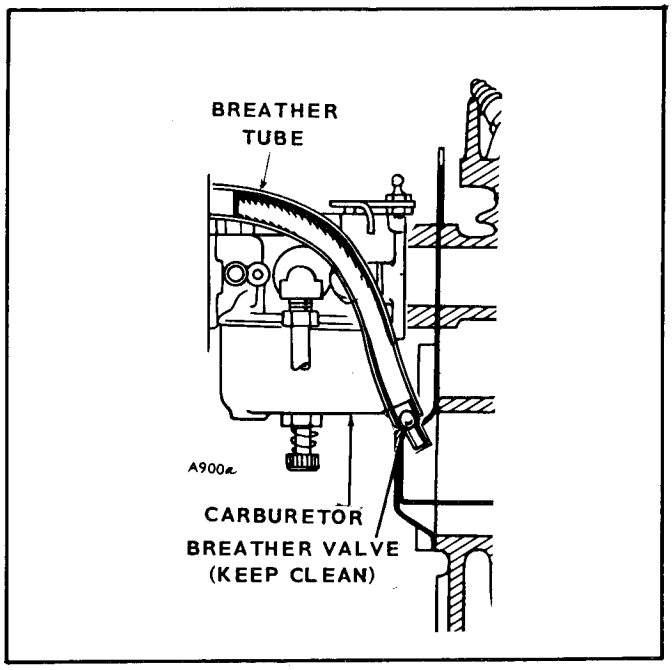
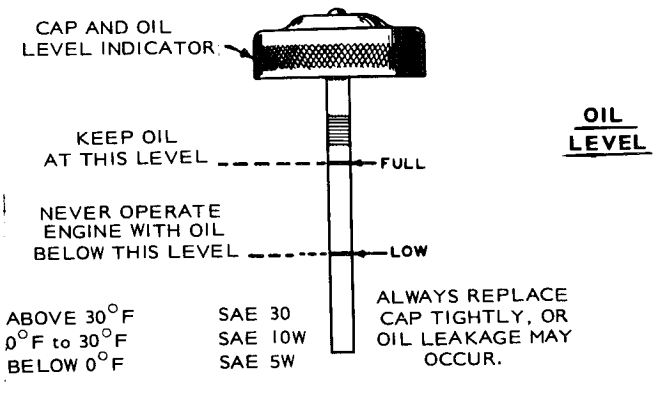


FIGURE 13. CRANKCASE BREATHER



ENGINE DISASSEMBLY

If engine disassembly is necessary, observe the following order (i.e. Flywheel, Gear Cover. . .). As disassembly progresses, the order may be changed somewhat as will be self-evident. The engine assembly procedure is the reverse of disassembly. Any special assembly instructions for a particular group are included in the applicable section. When reassembling, check each section for these special assembly instructions or procedures.

GEAR COVER

When removing the gear cover, it is not necessary to remove the magneto assembly from the cover. Just disconnect the spark plug lead at the spark plug and the stop wire. When installing the gear cover, make sure the pin in the gear cover engages in the metal lined hole of the governor cup (Figure 14). Turn the governor cup so that hole is in an upward position where it corresponds to the 12 o'clock position on the face of a clock. Turn the governor arm and shaft clockwise as far as possible and hold in this position until the gear cover is installed flush against the crankcase. Be careful not to damage the gear cover oil seal. Assemble carefully to engage the water pump gear with the cam gear.

GOVERNOR CUP

The governor cup may be removed from the cam gear and shaft after first removing the small lock ring from the camshaft center pin. Catch the governor flyballs as the cup assembly is removed. All models use 10 flyballs in the governor cup except 3600 rpm units which use only 5 flyballs.

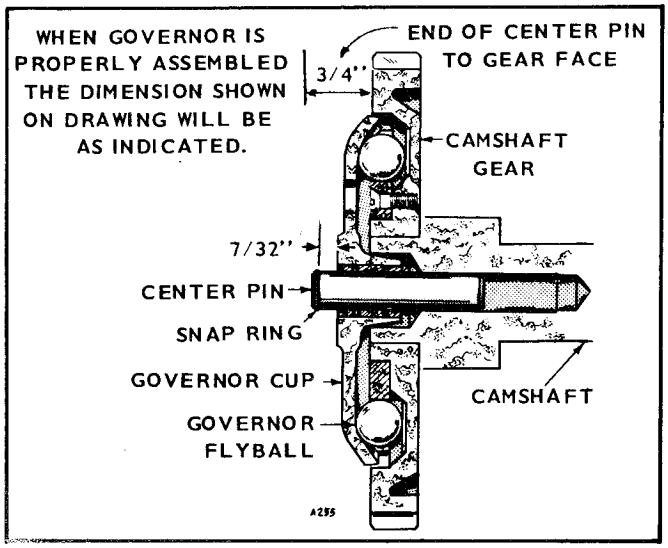


FIGURE 15. GOVERNOR CUP

If a new governor cup is being installed, the distance from the small lock ring on the center pin to the face of the governor cup must be exactly 7/32" (Figure 15) when the cup is pressed back against the flyballs as far as possible. If the distance is too small, carefully dress the face of the cup as required, being sure to remove any burr from the inside of the cup bore. If the distance is more than 7/32", carefully press the pin in the required amount. Do not damage the pin, as it is difficult to replace it in the field. Replacement of governor flyballs is easier if the set is tipped backward with the timing gears upward. Be sure that all flyballs are replaced and evenly spaced.

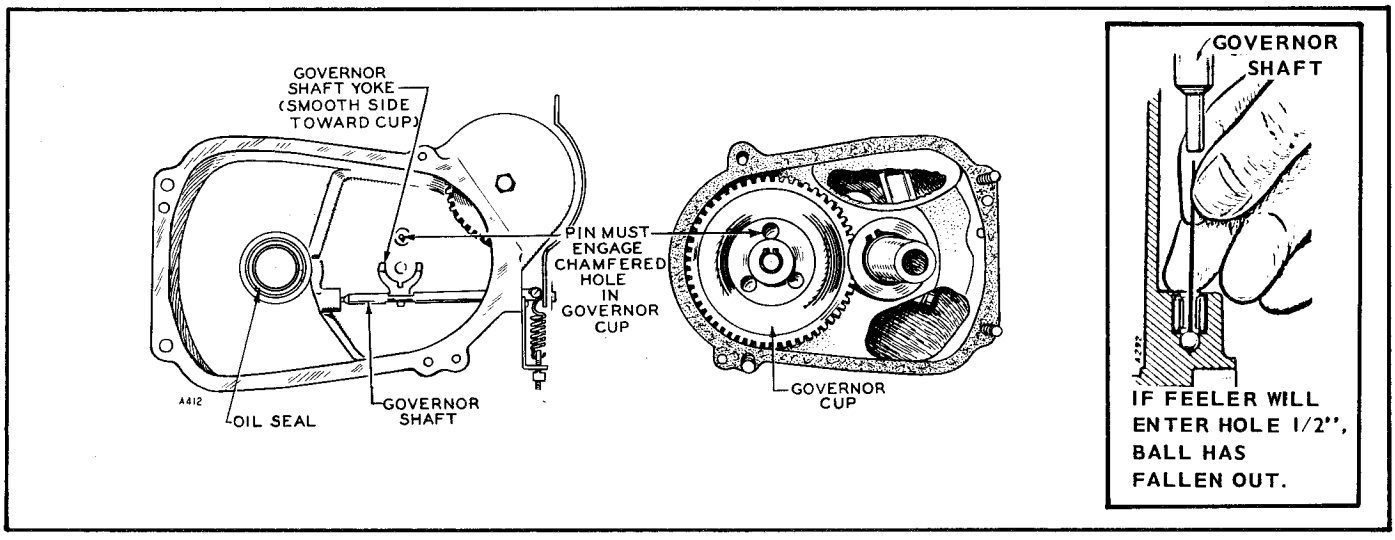


FIGURE 14. GEAR COVER

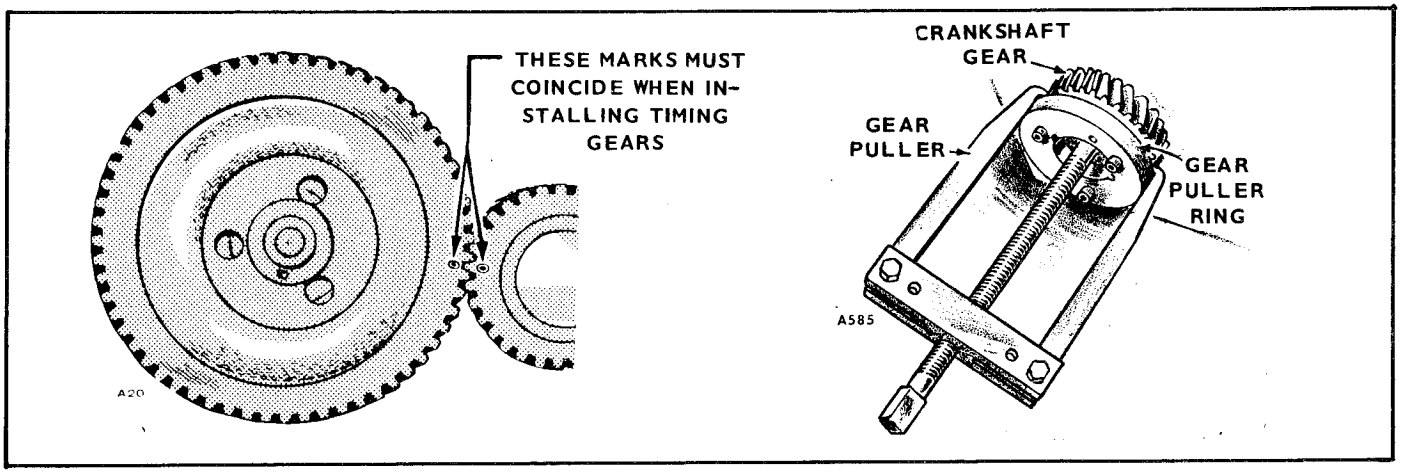


FIGURE 16. TIMING GEARS

TIMING GEARS

If replacement of either the crankshaft gear or the camshaft gear becomes necessary, install both gears new, never one only. Use a gear puller to remove the crankshaft gear (Figure 16).

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

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

Note that each timing gear is stamped with an "O" mark near the edge (Figure 16). The gear teeth must mesh so that these marks exactly coincide when the gears are installed in the engine. Be sure, when installing the camshaft gear and shaft assembly, that the thrust washer is properly in place behind the camshaft gear. Replace the retaining washer and lock ring to the crankshaft.

VALVE SERVICE

Properly seated valves are essential to good engine performance. The 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. Use a conventional valve spring lifter when removing the valve spring locks. Clean all carbon deposits from the cylinder head, piston top, valves, guides, etc. If a valve face is burned or warped, or the stem worn, install a new valve.

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

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

Valves should not be hand lapped, if at all avoidable, since the sharp contact may be destroyed. This is especially important where stellite faced valves and seats are used. Valve faces should be finished in a machine to 44°. Valve seats should be ground with a 45° stone, and the width of the seat band should be 1/32 to 3/64″ wide. Grind only enough to assure proper seating. Refer to Figure 17.

Remove all grinding dust from engine parts and place 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 turn against the seat.

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

The positive type exhaust valve rotocaps serve to prolong valve life, by rotating the valve a fraction of a turn each time it opens. While at open position the valve can be rotated freely but in only one direction. Try it. If rotocaps are faulty, install new rotocaps.

TAPPET ADJUSTMENT

Tappet clearance may be easily checked after first removing the valve compartment cover. Crank the

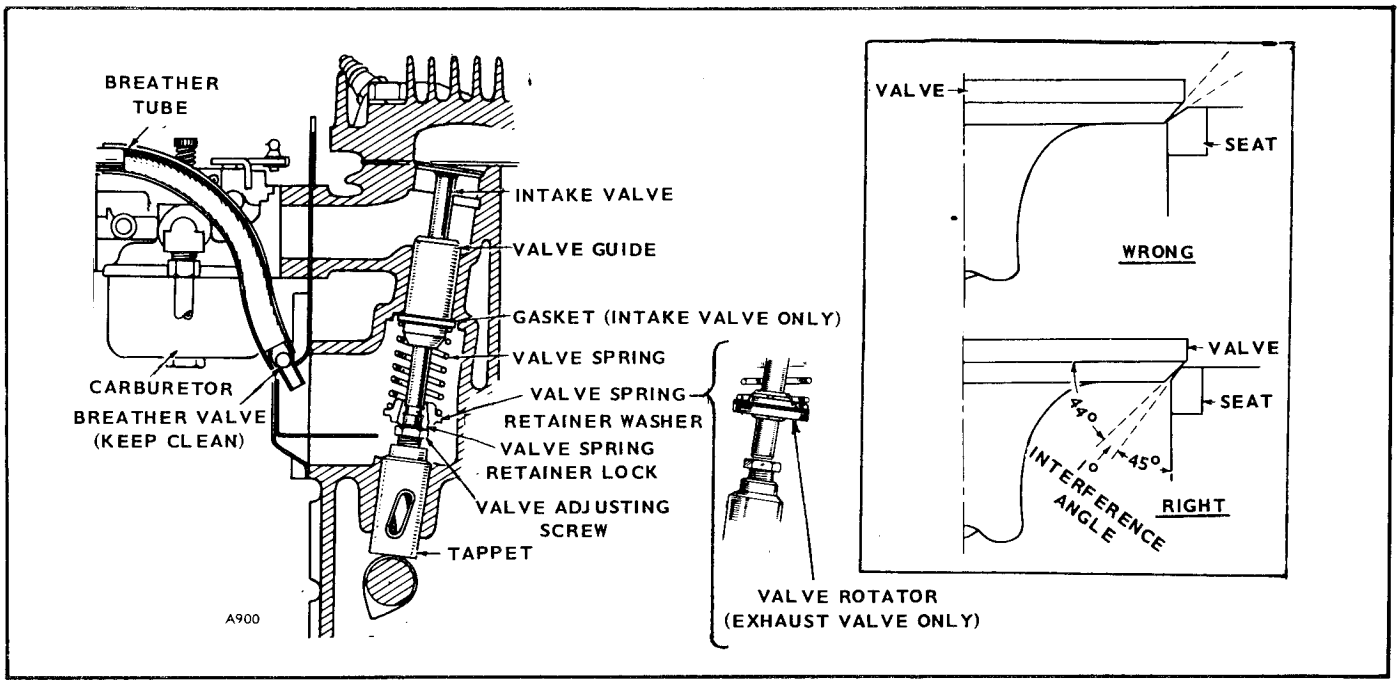


FIGURE 17. VALVE TRAIN

engine over by hand until the intake valve (the one nearest the carburetor) opens and closes. Continue turning the flywheel slowly until the mark on the flywheel is in alignment with the TC mark on the gear cover. The correct tappet clearance for both the intake and exhaust valves appears in the Dimensions and Clearances. Tappets are fitted with self locking adjusting screws. Use a 7/16″ wrench for the screw and a 9/16″ wrench for the tappet when making any adjustment.

PISTON AND RINGS

Remove the piston and connecting rod assembly through the top of the cylinder. The piston is fitted with two compression rings and one oil control ring. Remove carbon deposits from piston ring grooves. Check to be sure the oil return holes in the lower ring groove are open.

Before installing new rings on the piston, check the ring gap by placing each ring squarely in the cylinder at a position corresponding to the bottom of its travel (Figure 18). The gap between the ends of the ring are given in the Dimensions & Clearances. File rings which are slightly oversize as necessary to obtain the correct gap, but do not use rings which require too much filing. Standard size rings may be used on a .005″ oversize piston. Use .010″, .020″, .030″ and .040″ oversize rings on .010″, .020″, .030″ and .040″ oversize pistons, respectively. Rings of the tapered type are usually marked "TOP" on one side, or identified in some other manner, and the ring must be installed with this mark toward the closed end of the piston. Space each ring gap one third of the way around the piston from the preceding one, with no gap directly in line with the piston pin. Fit the bottom piston ring groove with an oil control ring and the two upper grooves fitted with compression rings.

The piston is fitted with a full floating piston pin. The pin is kept in place by two lock rings in the piston, one at each side. Be sure these lock rings are properly in place before installing the piston and connecting rod in the engine. Correct piston to cylinder clearance appears in the Dimensions & Clearances.

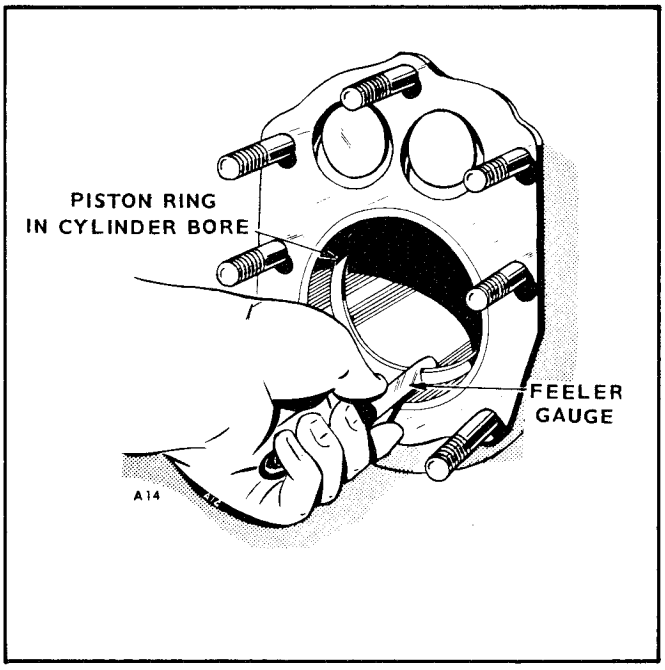


FIGURE 18. CHECKING RING GAP

CONNECTING ROD

Mark the connecting rod before removing it to assure proper reassembly. Note that the oil dipper is installed to splash oil towards the camshaft side of the engine (splash lubrication units only).

Connecting rods are available in standard size or .010″, .020″ and .030″ undersize.

The connecting rod bearing clearance to the crankshaft journal may be reduced as necessary by carefully dressing the cap on a sheet of abrasive cloth (#320 grit or finer) placed flat on a surface plate or piece of plate glass (Figure 19).

The connecting rod and piston assembly must be properly aligned before assembly to the engine. Aligning should be done on an accurate aligning gauge by a competent operator.

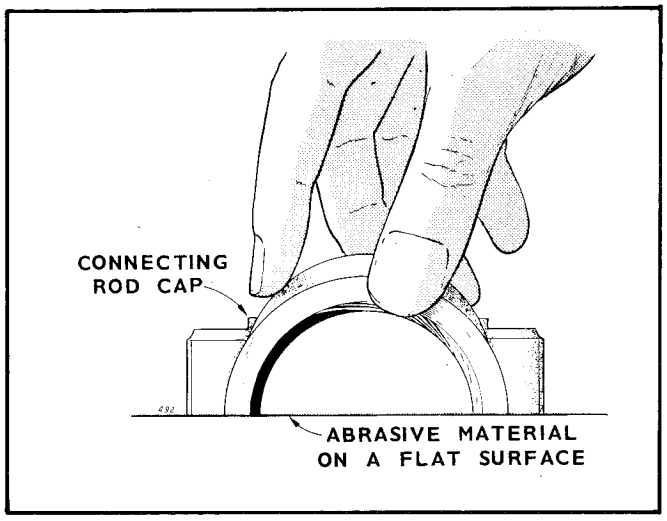


FIGURE 19. DRESSING ROD CAP

CAUTION *Misalignment may cause rapid wear of piston, pin, cylinder and connecting rod.*

Be sure the connecting rod oil dipper is properly installed, as it is vital to proper lubrication (splash lubrication units only).

MAIN BEARINGS

Crankshaft main bearings are precision type and are available in standard size, .002″, .010″, .020″ and .030″ undersize. Precision type bearings do not require line reaming.

Use a press or a suitable drive plug to remove bearings. Have the cylinder block supported to avoid distortion. Be careful not to damage the bearing bore, especially if using a punch tool.

Warm the bearing plate and cylinder block slightly with hot water or by placing in an oven heated to 200°F. Avoid overheating.

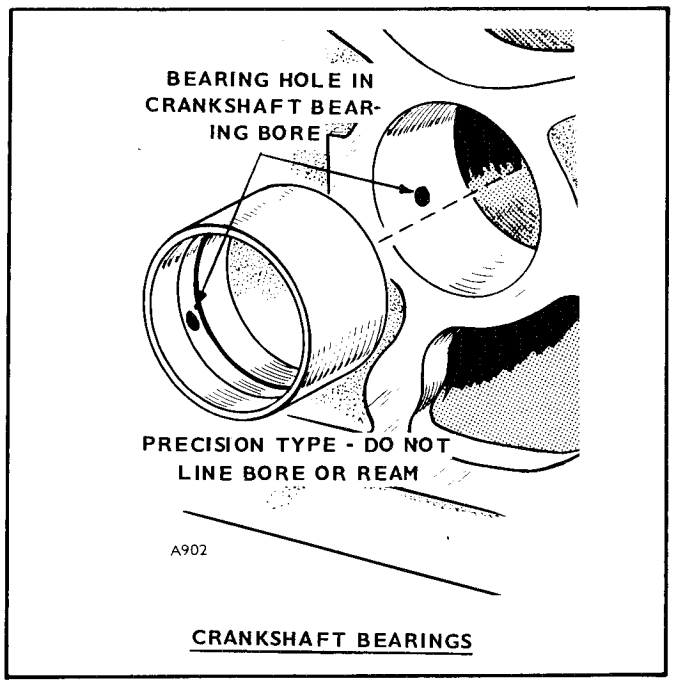


FIGURE 20. CRANKCASE BEARINGS

Align the oil hole in the bearing and the oil passage hole in the bearing bore (Figure 20). On splash lubricated units, the oil hole is upward. On pressure lubricated units, the oil hole is opposite from the camshaft. Install the cold precision bearing so that the inside end of the main bearing is 1/16″ to 3/32″ back from the inside end of the bore to allow clearance for the machined radius of the crankshaft.

Set crankshaft end play (Figure 21) according to the Dimensions & Clearances by using the correct thickness of gaskets between the rear bearing plate and the cylinder block. These gaskets must not block the oil passage on pressure lubricated units.

Before mounting generator to engine, tighten the rear bearing plate nuts. After securing generator to the engine, strike the flywheel screw sharply to readjust crankshaft forward end play.

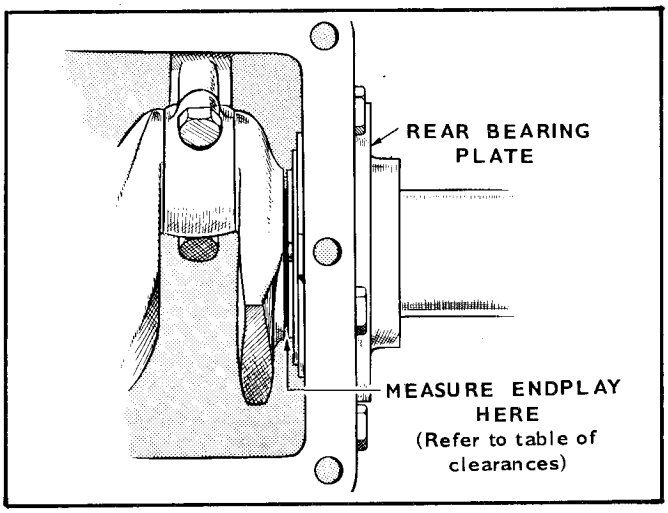


FIGURE 21. CRANKSHAFT END PLAY

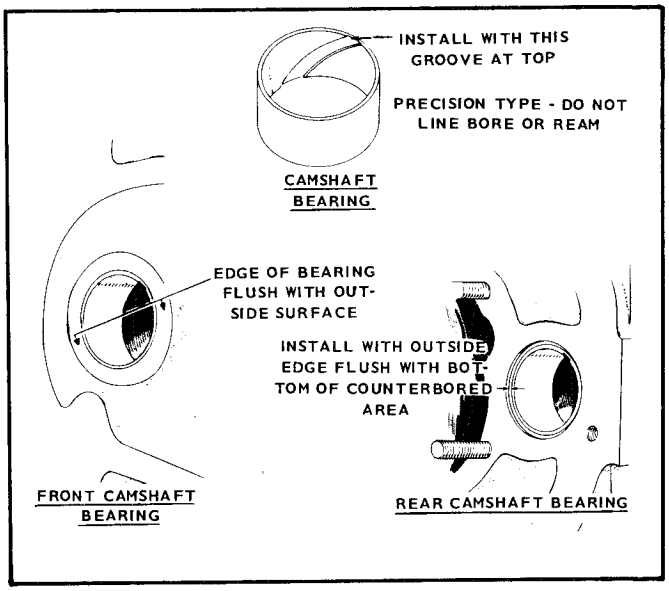


FIGURE 22. CAMSHAFT BEARINGS

CAMSHAFT BEARINGS

Camshaft bearings are precision type and do not require line reaming. Press the front camshaft bearing in flush with the outside surface of the cylinder block (Figure 22). Press the rear camshaft bearing in flush with the bottom of the counterbore which receives the expansion plug.

OIL SEALS

When replacing either crankshaft oil seal (Figure 23), be sure the open side faces toward the inside of the engine. Use care not to turn back the edge of the oil seal or damage it in any way. The rear bearing plate must be removed to replace the rear oil seal. Remove the gear cover to replace the front oil seal. Seal expanding and driving tools are available through your authorized Onan dealer.

CYLINDER

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

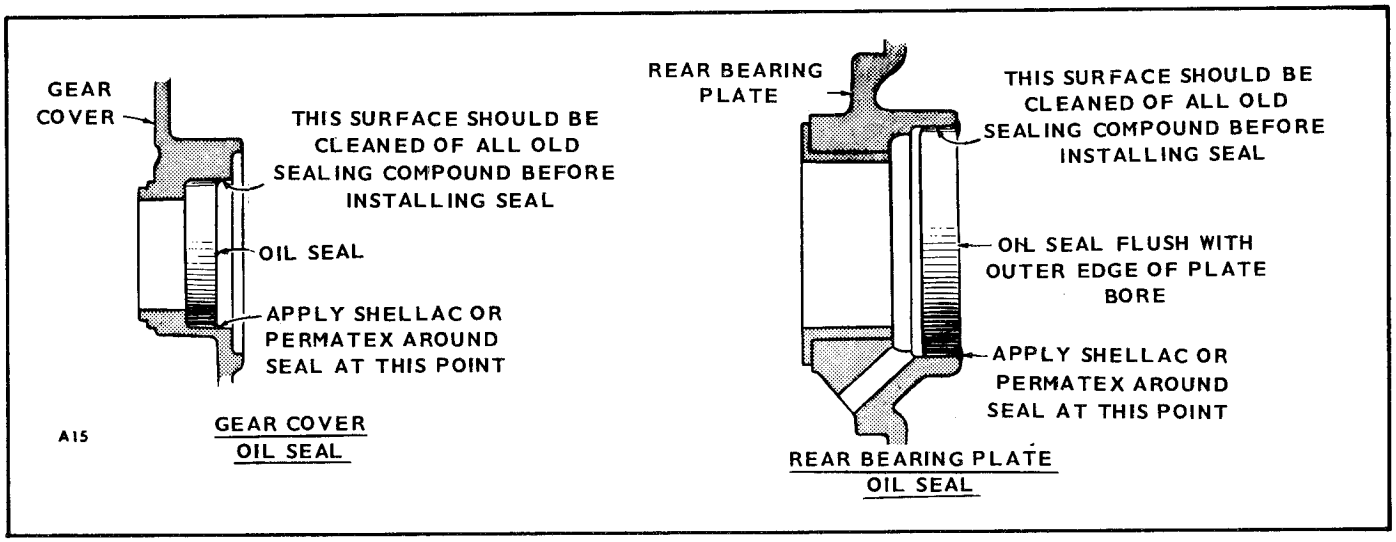


FIGURE 23. OIL SEALS

GENERATOR MAINTENANCE

There are two basic generator designs for the MAJ series. The 3600 rpm units have a 2 pole generator. All other sets have a 4 pole generator and differ according to model.

BRUSH REPLACEMENT

Install new commutator brushes and other rectangular brushes when the old ones are worn to 5/8″ or less in length. The cylindrical or nearly square (1/4″ x 3/8″) type collector ring brush with spring attached may be used until worn to 5/16″ in length. It is not necessary to remove the brush rig to install new brushes. Remove the end cover to expose the brush rig. Brushes and leads are then easily accessible. New brushes are shaped to fit and seldom need sanding to seat properly. Always use the correct brush as listed in the parts list, never substitute a brush which may appear to be the same, but may have different electrical characteristics. Be sure to tighten the brush lead terminal nuts. If some brush sparking occurs after replacing brushes, run the set at a light load until the brushes wear to a good seat.

BRUSH RIG POSITION

The position of the brush rig is important. The correct setting results in the least sparking at the commutator brushes at average load operation.

On standard models, the neutral brush rig position is determined and permanently fixed at the factory. It cannot shift from neutral position.

Special models may have a brush rig of the adjustable design, where the neutral position is identified by a "witness" mark at the point of mounting (Figure 24). As long as the original brush rig and armature are continued in service, these reference marks must be observed. If a new brush rig or armature is installed, the original alignment marks may have to be disregarded in order to find the proper neutral position.

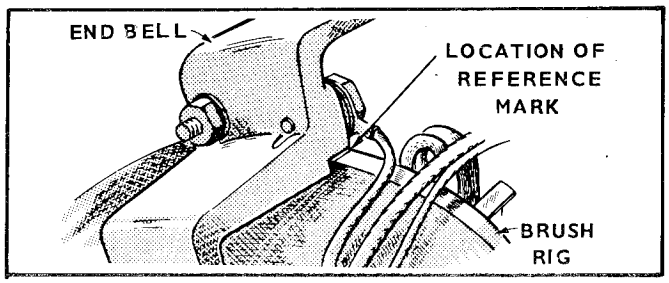


FIGURE 24. BRUSH RIG REFERENCE MARK

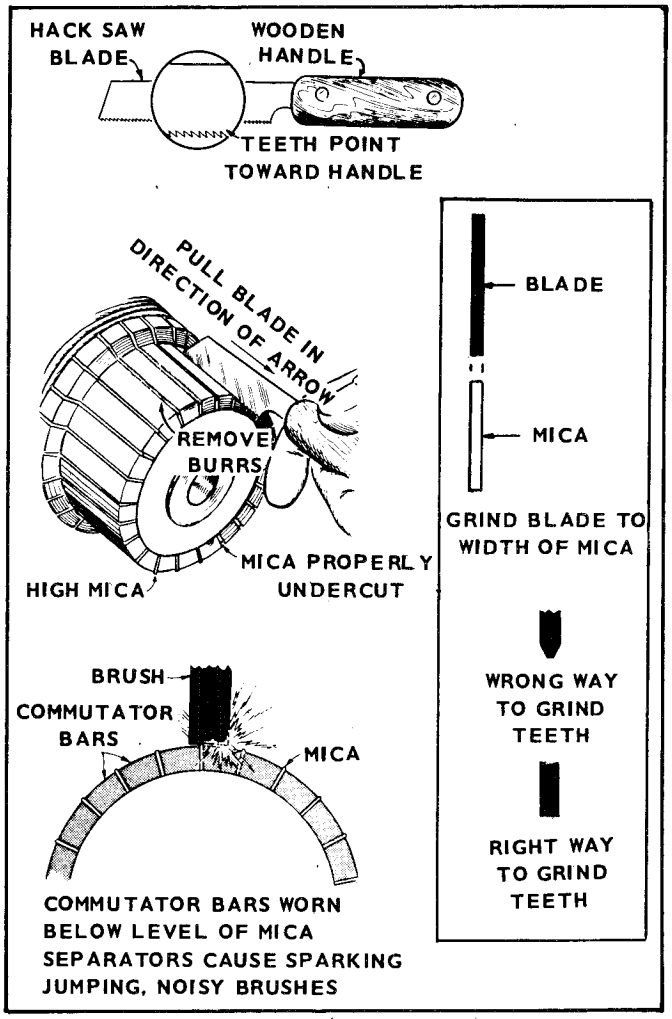


FIGURE 25. UNDERCUTTING MICA

COMMUTATOR AND COLLECTOR RINGS

Commutator and collector rings acquire a glossy brown finish in normal operation. Do not attempt to maintain a bright newly machined appearing surface. Ordinary cleaning with a dry, lint free cloth is usually sufficient.

Very find sandpaper (#00) may be used to remove slight roughness. Use only light pressure on the sandpaper, while the set is operating. Do not use emery or carborundum paper or cloth. Clean out all carbon dust from the generator.

After long service, the surface of the commutator may become worn down to the level of the mica insulation between the commutator bars. This condition would lead to noisy brush action, excessive brush sparking and wear and pitting of the commutator bars. Undercut

the mica between the bars to 1/32″ below the surface of the bars (Figure 25). If it is not convenient to take the armature to an electrical shop, the operation may be done with a tool fashioned from a hack saw blade. Grind the blade to a thickness equal to the mica between the bars. Do not scratch the surface of any bar. Use sandpaper to remove any burrs left along the edges of the bars. See that spaces between the bars are perfectly clean before assembling the generator.

If the commutator becomes damaged, or wears unevenly so that it is grooved or out of round, turn it smooth in a lathe. After turning, the mica must be undercut as described above.

GENERATOR DISASSEMBLY (FIGURE 26)

1. Remove the end cover.
2. Lift each brush high in its guide, so that the brush is held by spring pressure against its side. It is not necessary to remove the brush rig from its support.
3. Tag leads which are disconnected, to assure correct replacement. Mark the position of other parts by scratching them to aid correct replacement.
4. After removing the two frame stud nuts, the brush rig and frame may be removed as a unit, the armature bearing remaining on the armature.
5. To remove the armature, loosen the armature center nut just enough to avoid damaging the threads. While pulling outward on the armature, strike the nut a sharp endwise blow with a heavy soft faced hammer to loosen the armature. The armature has an internal taper which fits into the external taper of the engine crankshaft. When the armature is loose, remove the stud nut and slide the armature carefully off the through stud.

GENERATOR ASSEMBLY

Be sure the run-out at the commutator end is not more than .012″. Excessive run-out may be due to a nick or dirt on the taper of either the armature or crankshaft. Remove any foreign material, install the armature, then correct excessive run-out by striking the high side of the shaft near the ball bearing. Never strike the commutator.

To correct excessive run-out on armatures not having a ball bearing, strike against a board held flat to the high side of the lamination.

The frame will mount only in the correct side upward. If the brush rig has been removed, it must be installed in its original position. Avoid accidentally damaging brushes during assembly. Check for good brush contact and for good spring tension.

FIELD WINDINGS

Use a test lamp set for checking for a grounded or open circuit in the field coils. Disconnect (and tag) all field leads. Refer to the proper wiring diagram.

Test the field winding for an open circuit by placing one test prod on each of the two terminal ends of the winding. If the test lamp does not light, the field winding is open. If the open circuit can be located in one of the external leads, the break can be easily repaired. An internal break usually requires replacement of the coil set.

A grounded condition can be determined by placing one test prod on a terminal end of the winding and the other test prod on a bare metal part of the generator frame. If the test lamp lights, a ground is indicated. Find the point where the ground occurs and repair as necessary.

An internal short circuit is best located with a sensitive ohmmeter. By comparing the resistance of each individual coil winding, a short-circuited coil is indicated by a lower resistance reading. Replace the entire coil set assembly if a short-circuit is indicated.

GROUND TEST (FIGURE 27)

Use a series test lamp. To test the DC winding, place one test prod on the armature shaft and the other on a commutator bar. If the test lamp glows, a grounded circuit is indicated.

To test the AC winding, place one test prod on the armature shaft and the other prod to a slip ring. If the test lamp glows, a grounded winding or slip ring is indicated.

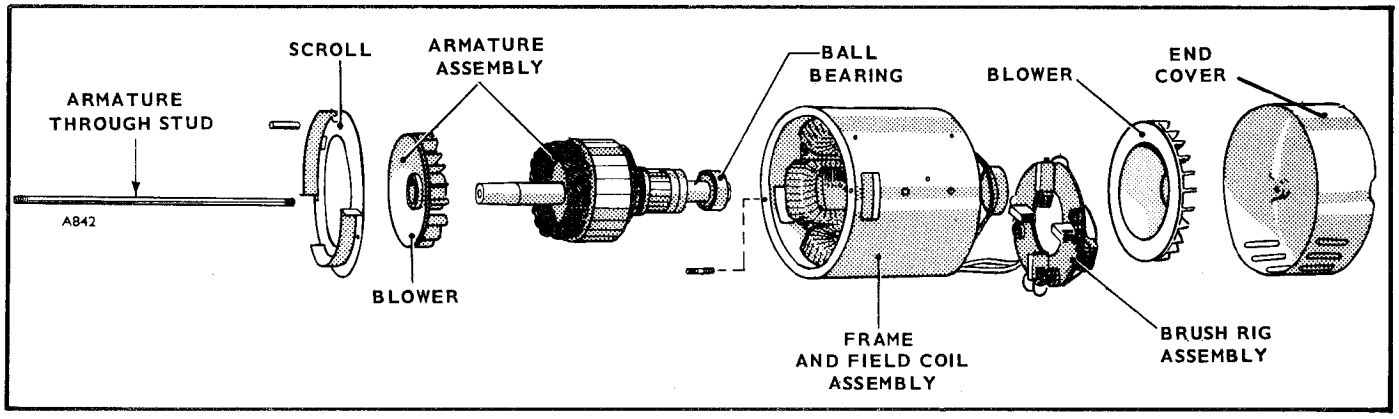


FIGURE 26. GENERATOR DISASSEMBLY

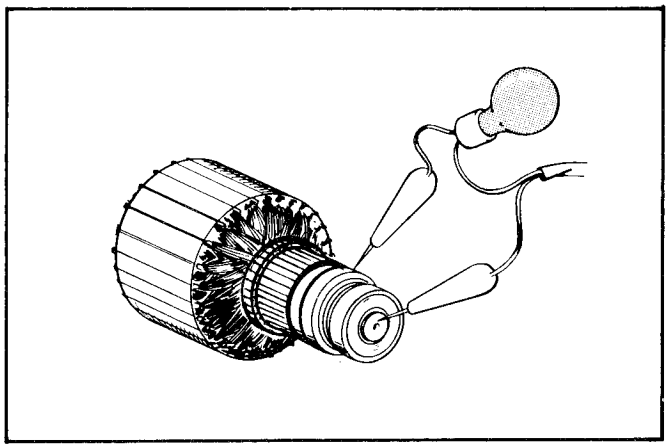


FIGURE 27. TESTING FOR GROUNDED ARMATURE

OPEN CIRCUIT, AC AND DC WINDING

To Test the AC Portion of the Generator: Use a series test lamp. Place one test prod on a slip ring and the other test prod to the other slip ring. The test lamp should light. If the generator has four slip rings, there are two separate AC windings. Test between the two rings nearest the ball bearing. In each case the test lamp should glow. Failure of the lamp to light indicates an open circuit. On the 120/240 volt reconnectible, the test is made between the two center rings. The test lamp should not glow. If the test lamp does glow, a short circuit between the separate windings is indicated. See Figure 28.

If the generator is a three phase (has four slip rings), the rings are connected together internally through the windings and the light should glow across any combination of slip rings. If the generator is a three phase, three wire model, only three slip rings are used.

To Test the DC Portion of the Generator: Place a test prod on a commutator segment and hold it on that one. Touch the other prod to successive bars around the commutator. If the light does not glow it indicates an open DC winding.

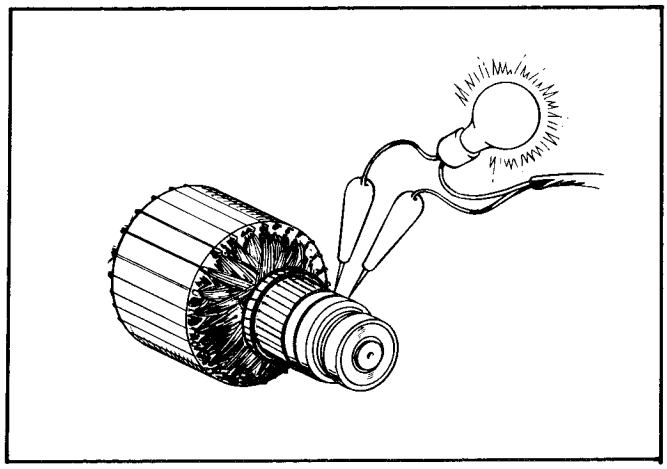


FIGURE 28. TESTING FOR OPEN ARMATURE

SHORT CIRCUIT

An armature growler will serve best for this test. With growler current on, pass a steel strip or hacksaw blade slowly over the laminations, parallel to slots. Hold the strip or blade against the laminations. A strong pull or vibration on a slot indicates a shorted winding.

After testing in one position, rotate the armature slightly in the growler and repeat the test. Continue until a complete revolution of the armature has been made (Figure 29).

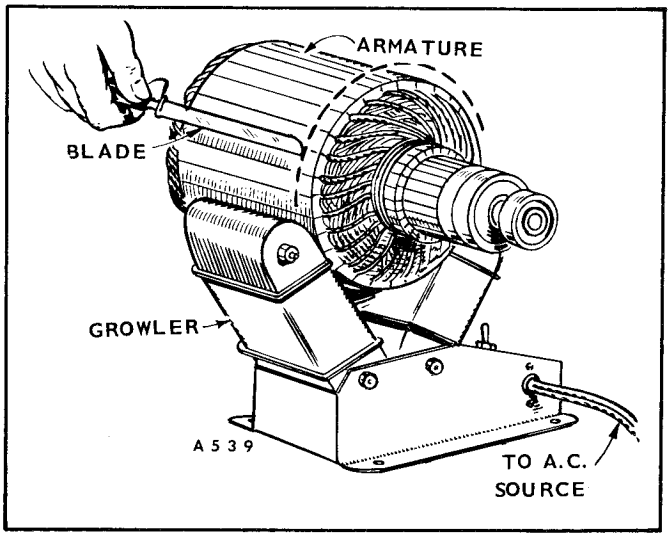


FIGURE 29. TESTING FOR SHORT CIRCUITS

CONTROLS

CONTROL SYSTEM

The control system regulates all functions of the marine generator and engine ignition, monitors temperature, oil and battery charging functions. A service man should understand the theory of operation thoroughly in order to properly adjust or troubleshoot the Control System. The operating cycle includes starting, start disconnect, running, stopping and emergency shutdown functions. The Onan components include the start stop switch, start solenoid, start disconnect relay and battery charging resistor. An optional electric choke, high water temperature cut off switch and low oil pressure cut off switch are available. A battery charge diode is located in the generator end bell housing. Older models have a charge ammeter and a reverse current relay instead of a battery charge diode in the control panel.

FUNCTIONS OF COMPONENTS

Start switch when pressed completes circuit from battery positive to start solenoid.

Start Solenoid: Supplies voltage to start engine cranking. Magneto supplies ignition to spark plug.

Stop Switch: When energized this electrically grounds the magneto through the start disconnect relay.

Start Disconnect Relay: Relay disconnects starting circuit when engine starts to run and generator builds up to about 1/2 its rated DC output voltage.

Battery Charge Diode: Prevents the battery from discharging through the generator when unit is shutdown. Replaces reverse current relay used in older models.

REVERSE CURRENT RELAY

1. Used to prevent engine from cranking through the charge circuit when set is stopped.
2. Disconnect battery from generator when set is stopped.
3. Allows battery charging current to flow only towards battery - and not reverse - flow back into generator.
4. Does no voltage regulation regardless of the condition of the battery.

BATTERY CHARGING RESISTOR

Fixed value resistor which determines the rate of charge depending on battery voltage from 2-7 amps.

Low Oil Pressure Switch (Engine)

Grounds magneto circuit when oil pressure drops below 9 lbs. Allows engine oil pressure buildup during cranking.

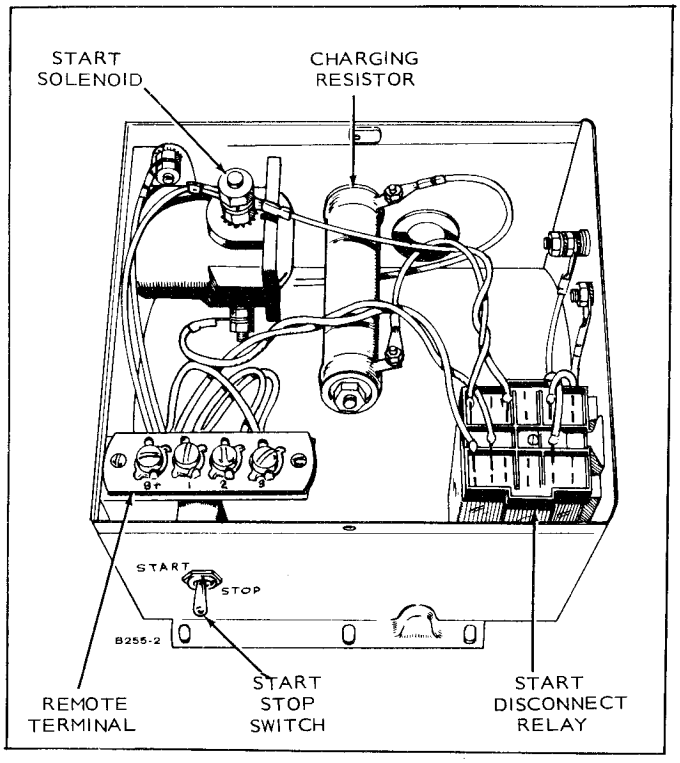


FIGURE 30. TYPICAL MAJ CONTROL PANEL BEGIN SPEC M

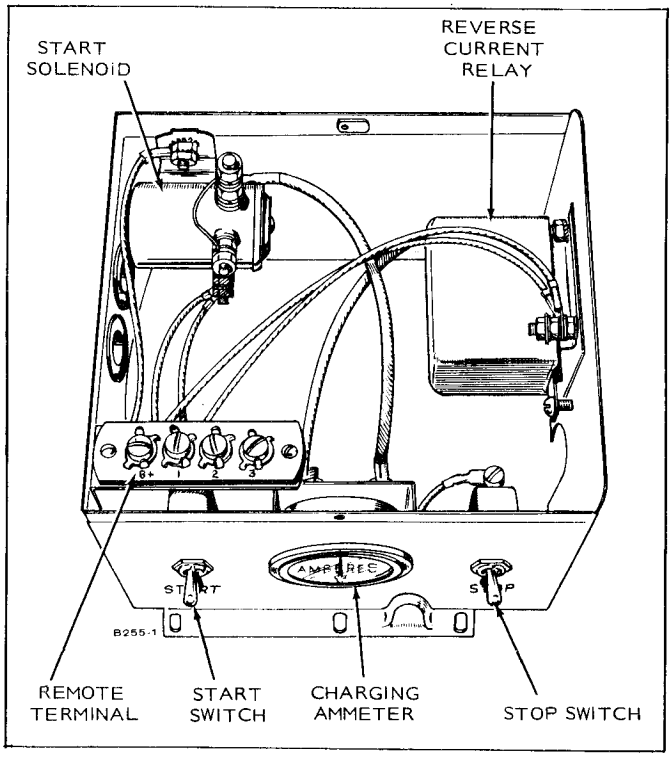


FIGURE 31. TYPICAL MAJ CONTROL PANEL PRIOR TO SPEC M

High Water Temperature Switch (Engine)
Grounds the magneto when cooling water temperature exceeds 235° F.

Low Oil Pressure Switch (Engine)
(Optional on 3600 rpm models equipped with oil pump).
Grounds magneto circuit when oil pressure drops below 9 lbs. Allows engine oil pressure buildup during cranking. Momentary contact switch opens LOPKO circuit during emergency hand cranking.

TERMINAL BLOCKS (STANDARD)

Remote - Gasoline

1. Marked B+ (battery), 1 (ground) 2 (stop) , 3 (start).
2. Connect #1 and 3 to start - #1 and 2 to stop. B+ for use with "HA" and "LT" controls.
3. Used on Class A units - except "J" series.

Easy Check - The unit can be checked for problems by grounding terminal 3 at the remote terminal block for checking starting, and grounding terminal 2 to check stopping.

SOLENOID CHECKOUT

1. Remove solenoid from circuit.
2. Apply 12 volts to the terminal marked "Battery".
3. Jumper a ground wire to the terminal marked "S" on start solenoid.
4. The solenoid should activate.
5. If the solenoid is good 12 volts can be read between S1 and ground.

RELAY CHECKOUT

1. Remove relay from circuit.
2. Place 12 volts on one side of the relay coil and ground the other side. If the relay activates it is operating.
3. Place a 12 volt source to one side of the contacts.
4. Place a voltmeter to the other side of the relay contact and to ground. If 12 volts is present when the relay is energized the relay is good.
5. If the relay has more than one set of contacts, each set must be checked in this fashion.

RESISTOR CHECKOUT

1. Remove battery B+ cable.
2. Disconnect one side of the resistor and using an ohmmeter measure across the resistor for an accurate reading.

SWITCH CHECK

1. Remove B+ cable.
2. Place ohmmeter leads across the switch.
3. Activate the switch. If a short is read on the meter the switch is good.

SUGGESTIONS

A. Servicemen should tag wires to assure proper reconnections.
B. Otherwise take photographs of more complex wiring before disconnecting wires.
C. Most reconnecting/rewiring is best accomplished by using the correct wiring diagram and following the connections shown on the diagram.

WARNING *Fire extinguishers should be conveniently located when electrical components are being cleaned and dried. Oil vapors and gases from solvents may be flammable or explosive when mixed with air. Be careful, the gases may be irritating to the eyes, throat or nose. Observe good safety practices at all times while cleaning, drying, and testing electric equipment.*

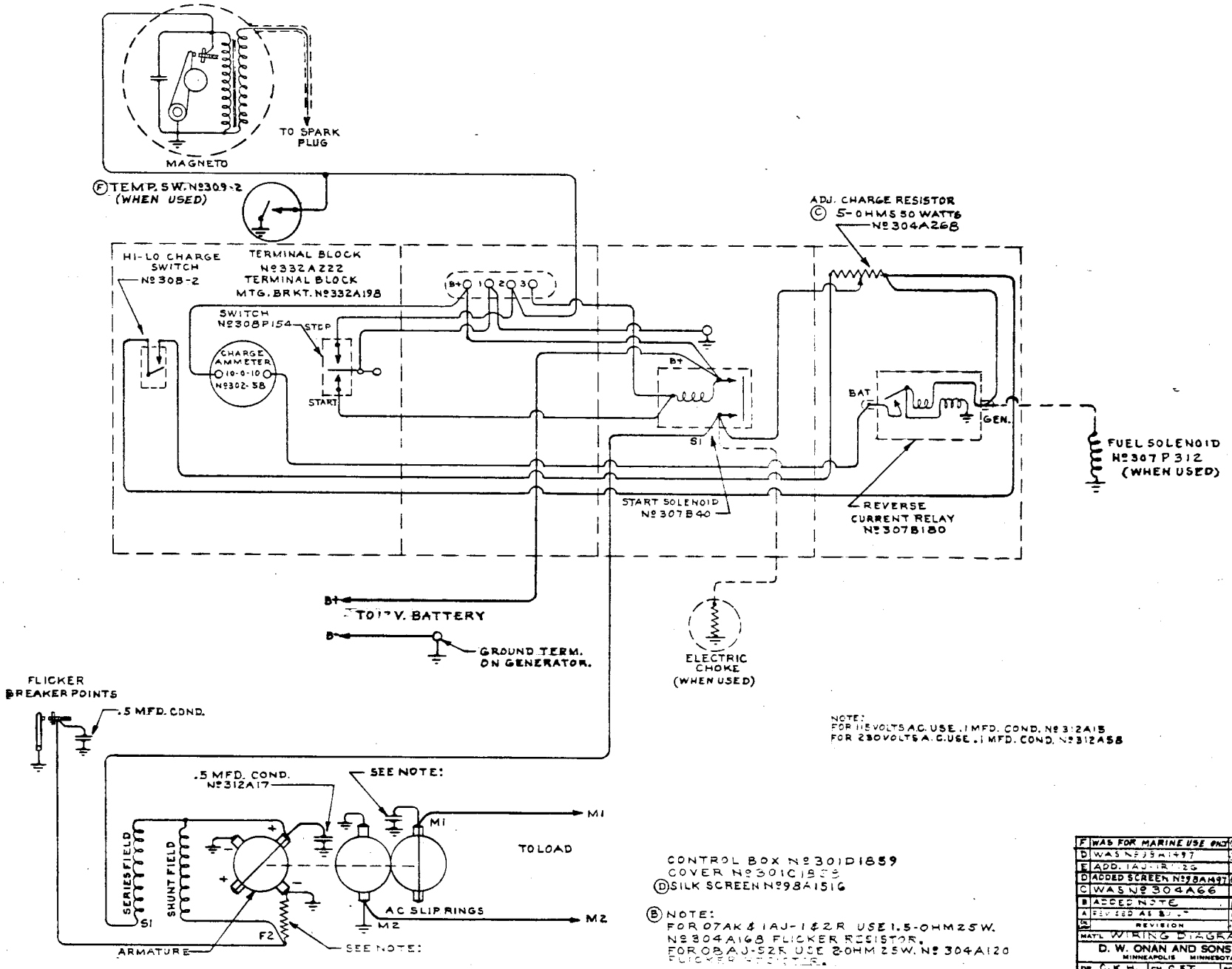
Always disconnect the battery from the set whenever servicing any controls or electrical equipment. Keep all connections clean and tight and inspect leads occasionally for worn insulation.

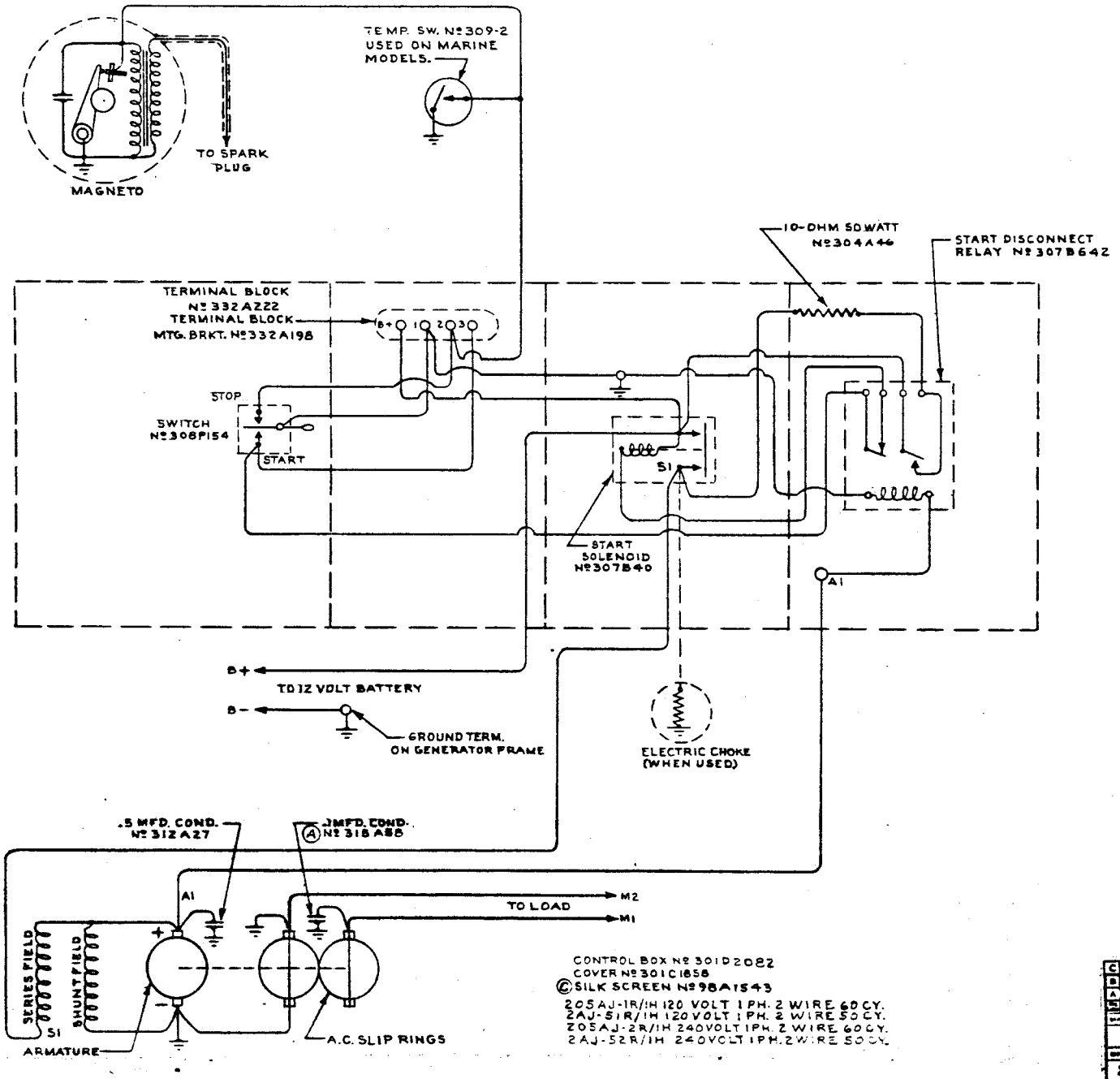
WIRING DIAGRAMS

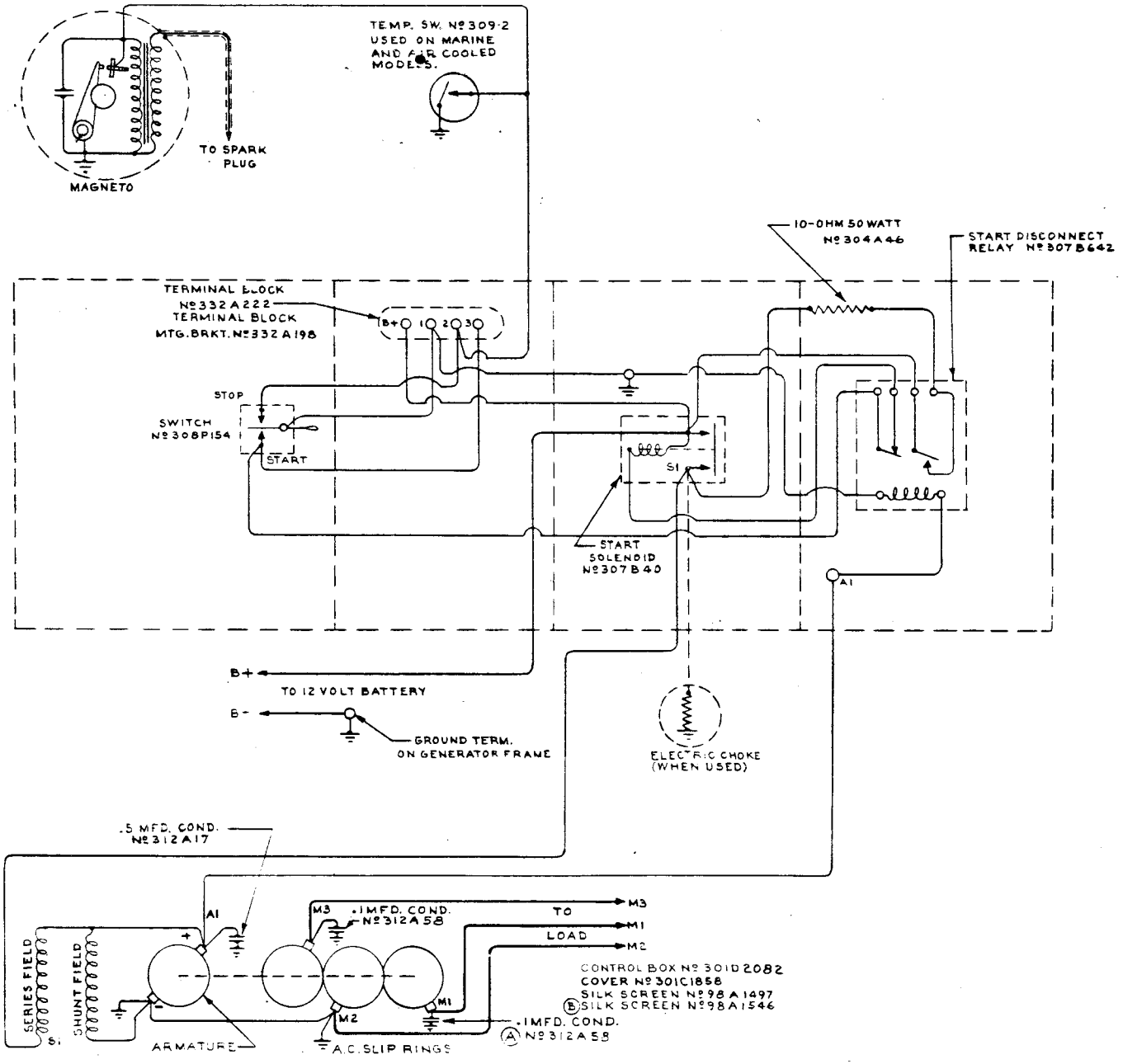
The wiring diagrams in this section are typical and apply only to standard electric set. Wiring diagrams for special models are available on request from the factory, send generator model, spec and serial numbers with the request.

Select the generator wiring diagram from table below according to the model, voltage, phase and number of output wires.

ELECTRICAL DETAILS				WIRING DIAGRAM PAGE NO.
BASIC MODEL	VOLTAGE	PHASE	WIRE	
1.0MAJ-1R	120	1	2	27
2.5MAJ-1R	120	1	2	28
2.5MAJ-3R	120/240	1	3	29
0.6MAJ-212R	12-15 DC		2	30
1.5MAJ-224R	24-30 DC		2	31
1.5MAJ-232R	32-40 DC		2	32
1.5MAJ-232E (Begin Spec N)	32 DC		2	33


MAGNETO
TO SPARK PLUG
Ⓕ TEMP. SW. Nº 309-2 (WHEN USED)
HI-LO CHARGE SWITCH Nº 308-2
TERMINAL BLOCK Nº 332A222
TERMINAL BLOCK MTG. BRKT. Nº 332A198
B+ 1 2 3
SWITCH Nº 308P154
STOP
START
CHARGE AMMETER 10-0-10 Nº 302-58
ADJ. CHARGE RESISTOR Ⓒ 5-OHMS 50 WATTS Nº 304A268
B+
S1
BAT
GEN.
FUEL SOLENOID Nº 307P312 (WHEN USED)
START SOLENOID Nº 307B40
REVERSE CURRENT RELAY Nº 307B180
B+ TO 12 V. BATTERY
B- GROUND TERM. ON GENERATOR.
ELECTRIC CHOKE (WHEN USED)
NOTE: FOR 115 VOLTS A.C. USE .1 MFD. COND. Nº 312A15 FOR 230 VOLTS A.C. USE .1 MFD. COND. Nº 312A58
FLICKER BREAKER POINTS
.5 MFD. COND.
.5 MFD. COND. Nº 312A17
SEE NOTE:
M1
TO LOAD
SERIES FIELD
SHUNT FIELD
S1
F2
AC SLIP RINGS
M2
ARMATURE
SEE NOTE:
CONTROL BOX Nº 301D1859
COVER Nº 301C1858
Ⓓ SILK SCREEN Nº 98A1516
Ⓑ NOTE: FOR 07AK & 1AJ-1&2R USE 1.5-OHM 25W. Nº 304A168 FLICKER RESISTOR. FOR 08AJ-52R USE 3-OHM 25W. Nº 304A120 FLICKER RESISTOR.
F WAS FOR MARINE USE ONLY GT 11-3-60
D WAS Nº 305M1497 GT 3-8-65
E ADD. 1AJ-1R 2G GT 4-3-63
D ADDED SCREEN Nº 98A1497 GT 8-1-68
C WAS Nº 304A66 GT 6-22-66
B ADDED NOTE GT 6-22-66
A REVISED AS BUILT GT 9-8-61
LTR REVISION INIT DATE
MATL WIRING DIAGRAM
D. W. ONAN AND SONS INC. MINNEAPOLIS MINNESOTA
DR. C.K.H. CH. G.F.T.
07AK-1&2R/1M 12DV. 1F2W 62...
DATE 4-11-60
DWG NO. 610C141


TEMP. SW. Nº309-2
USED ON MARINE
MODELS.
TO SPARK
PLUG
MAGNETO
10-OHM 50 WATT
Nº304446
START DISCONNECT
RELAY Nº307B642
TERMINAL BLOCK
Nº332A222
TERMINAL BLOCK
MTG. BRKT. Nº332A198
B+ 1 2 3
STOP
SWITCH
Nº308P154
START
S1
START
SOLENOID
Nº307B40
A1
B+
TO 12 VOLT BATTERY
B-
GROUND TERM.
ON GENERATOR FRAME
ELECTRIC CHOKE
(WHEN USED)
.5 MFD. COND.
Nº312A27
Ⓐ 1MFD. COND.
Nº318A88
A1
TO LOAD
M2
M1
SERIES FIELD
SHUNT FIELD
S1
ARMATURE
A.C. SLIP RINGS
CONTROL BOX Nº301D2082
COVER Nº301C1858
Ⓒ SILK SCREEN Nº98A1543
205AJ-1R/1H 120 VOLT 1 PH. 2 WIRE 60 CY.
2AJ-51R/1H 120 VOLT 1 PH. 2 WIRE 50 CY.
205AJ-2R/1H 240 VOLT 1 PH. 2 WIRE 60 CY.
2AJ-52R/1H 240 VOLT 1 PH. 2 WIRE 50 CY.
C WAS Nº98A1497
B ADD. 205AJ-2R/1H, 52R/1H
A WAS Nº312A3
REVISION
WIRING DIAGRAM
D. W. ONAN AND SONS INC.
MINNEAPOLIS MINNESOTA
DR. C.K.M. CH. G.F.T.
205AJ-1R SPEC 1H
DATE 12-7-61
DWG. NO. 610C199



C	ADD 205AJ-3RV/1228H	GT	11-15-65
B	ADD PART Nº 8	FJ	7-12-65
A	ADDED PART Nº 5	DH	1-9-62
NO.	REVISION	INIT.	DATE

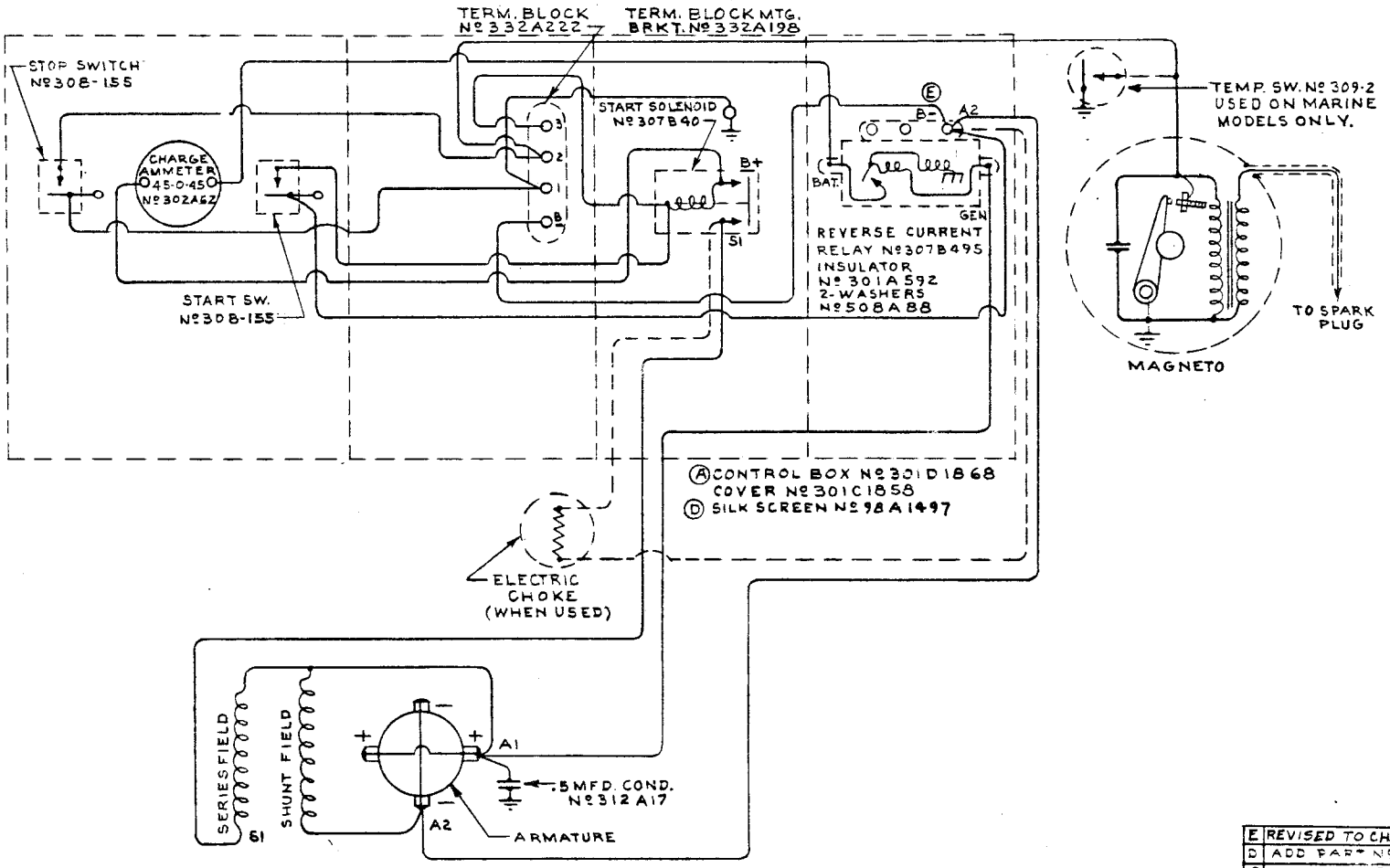
MATL WIRING DIAGRAM

D. W. ONAN AND SONS INC.
MINNEAPOLIS MINNESOTA

DR. C.K.H. CH. G.F.T. SC. ~

205AJ-3R SPEC. 1H
120-240V. 1PH. 3WIRE 60CY.

DATE 12-7-6 DWG. NO. 610C200



E	REVISED TO CHASSIS GND	G.T.	3-7-67
D	ADD PART NO.	G.T.	3-8-65
C	ADDED 06AK-212E/1H	G.T.	5-25-62
B	ADDED 06MAJ-212E/1H	G.T.	5-1-62
A	WAS Nº 3[illegible]D1869	G.T.	4-25-60
No.	REVISION	INIT.	DATE

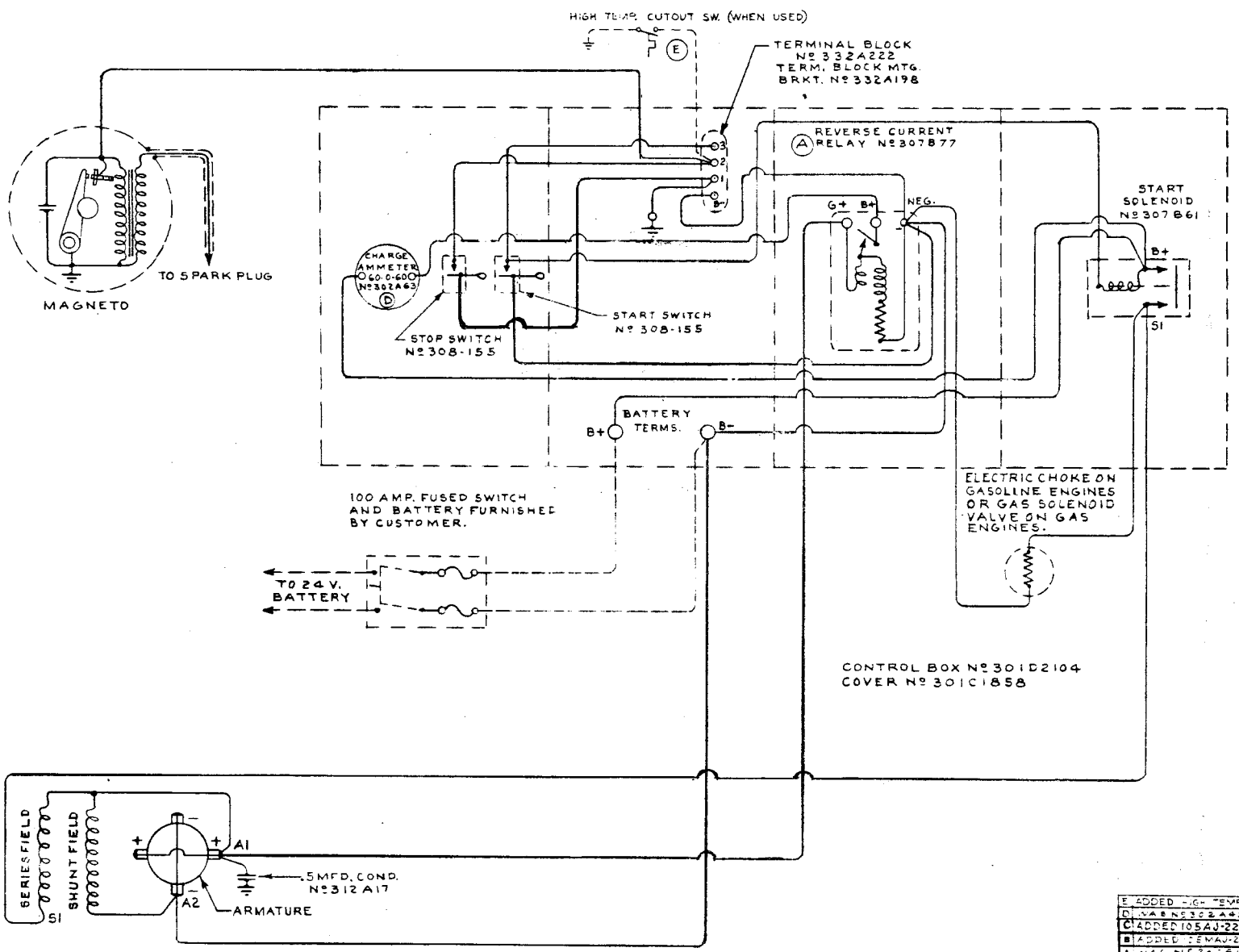
MAT'L WIRING DIAGRAM

D. W. ONAN AND SONS INC.
MINNEAPOLIS MINNESOTA

DR. C.K.H. CH. G.F.T. SC.

05AK-212-E SPEC 1H
12 VOLTS D.C.

DATE 4-20-60 DWG. NO. 610B144



E	ADDED HIGH TEMP SW		12-2-67
D	WAS Nº 302A457		11-1-62
C	ADDED 105AJ-224E/1SG		5-4-62
B	ADDED 105AJ-224R/1H		5-1-62
A	WAS Nº 302A457		3-22-62
No.	REVISION	INIT.	DATE

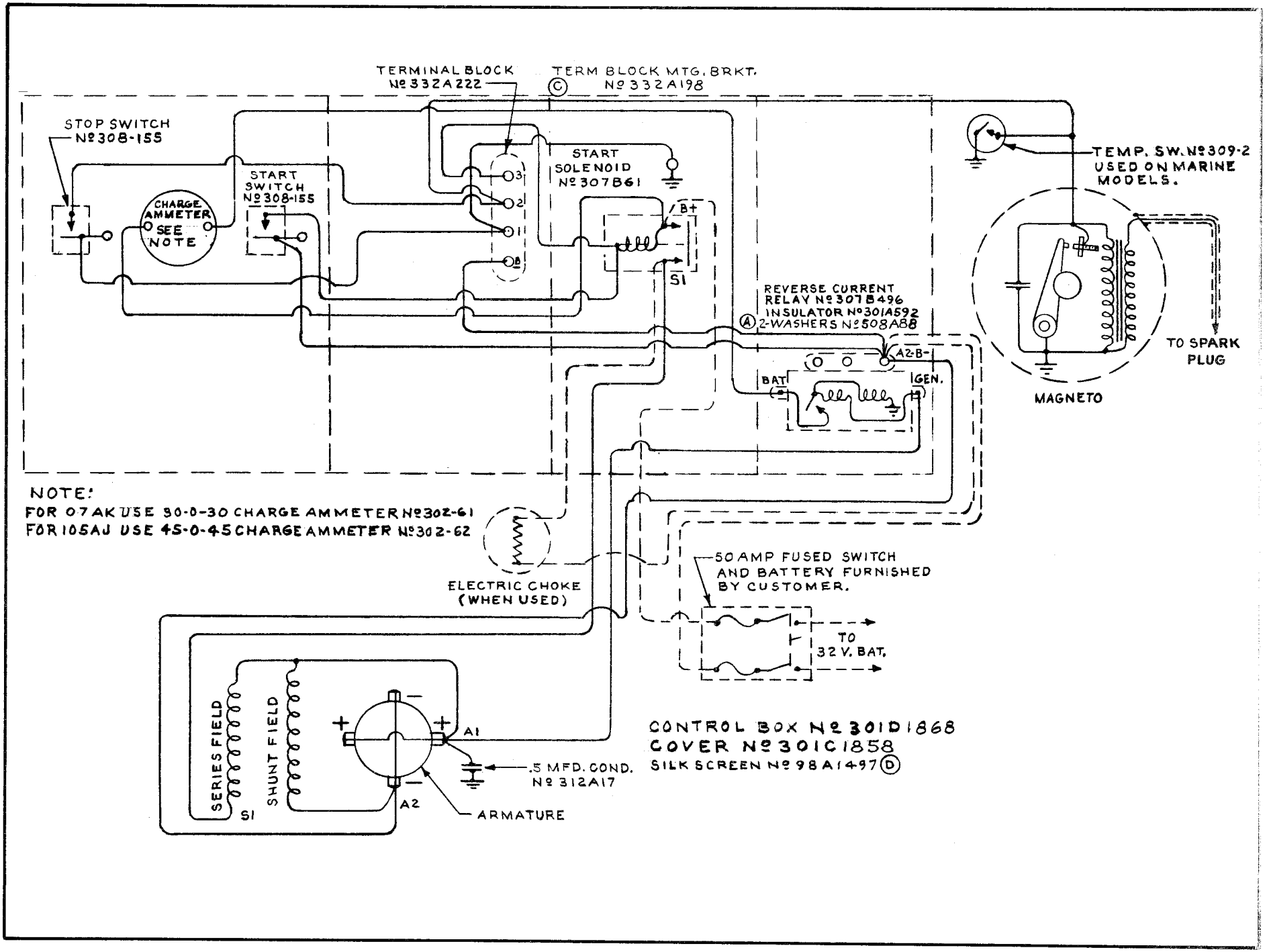
MATL WIRING DIAGRAM

D. W. ONAN AND SONS INC.
MINNEAPOLIS MINNESOTA

DR. C.K.H. CH. G.F.T. SC. ——

105AJ-224R SPEC 20436
24 VOLTS D.C.

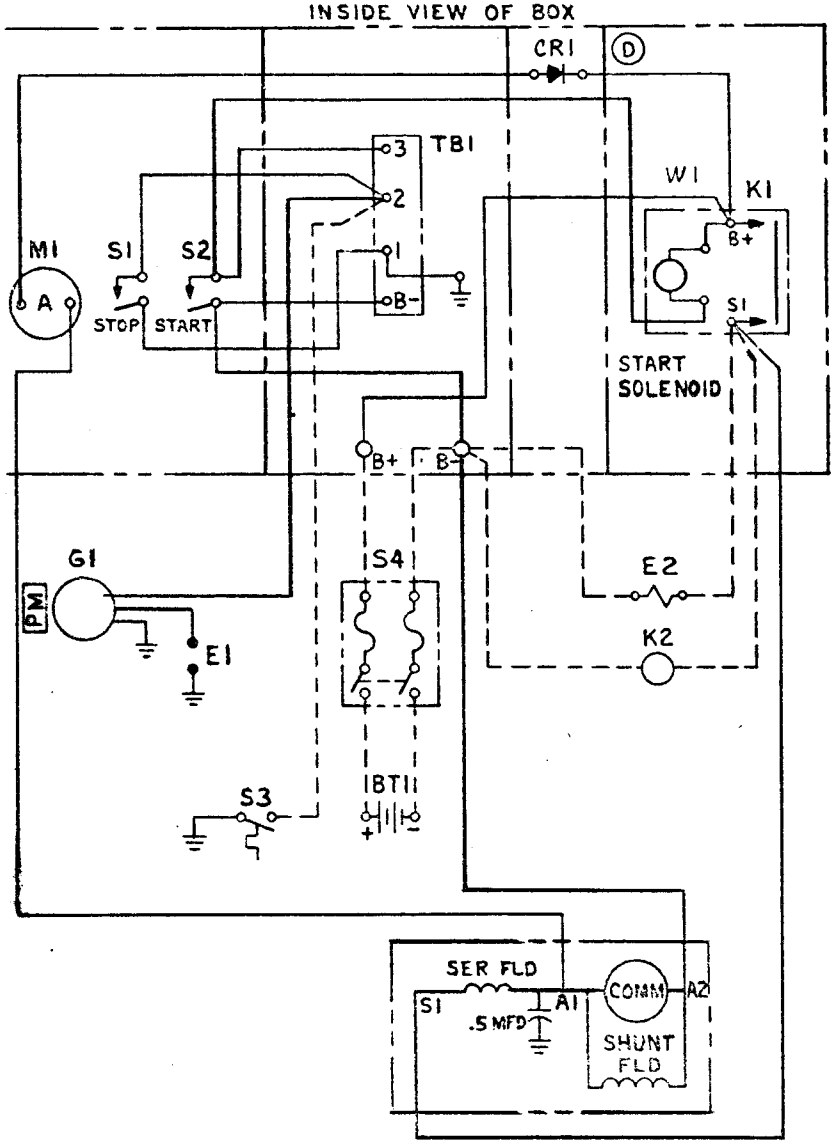
DATE 2-5-62 DWG NO. 610C204


TERMINAL BLOCK
№ 332A222
TERM BLOCK MTG. BRKT.
Ⓒ № 332A198
STOP SWITCH
№ 308-155
START
SWITCH
№ 308-155
CHARGE
AMMETER
SEE
NOTE
START
SOLENOID
№ 307B61
B+
S1
3
2
1
B
REVERSE CURRENT
RELAY № 307B496
INSULATOR № 301A592
Ⓐ 2-WASHERS № 508A88
A2-B-
BAT
GEN.
TEMP. SW. № 309-2
USED ON MARINE
MODELS.
TO SPARK
PLUG
MAGNETO
NOTE:
FOR 07AK USE 30-0-30 CHARGE AMMETER № 302-61
FOR 105AJ USE 45-0-45 CHARGE AMMETER № 302-62
ELECTRIC CHOKE
(WHEN USED)
50 AMP FUSED SWITCH
AND BATTERY FURNISHED
BY CUSTOMER.
TO
32 V. BAT.
SERIES FIELD
SHUNT FIELD
S1
A1
A2
.5 MFD. COND.
№ 312A17
ARMATURE
CONTROL BOX № 301D1868
COVER № 301C1858
SILK SCREEN № 98A1497 Ⓓ

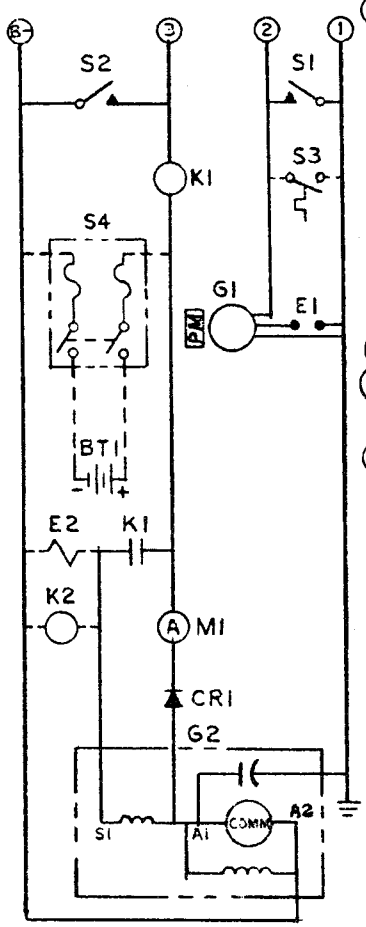
610-0336

WIRING DIAGRAM

INSIDE VIEW OF BOX



SCHEMATIC



PARTS LIST

	REF DES	DESCRIPTION
* C	BT1	BATTERY, 32V
	CR1	DIODE & HEAT SINK ASSY
		GROMMET
	E1	SPARK PLUG
**	E2	CHOKE-ELECTRIC
	G1	MAGNETO
	G2	GENERATOR
**	K2	SOLENOID-GAS
	K1	RELAY-START SOLENOID
	M1	AMMETER-CHARGE 45-0-45
	S1	SWITCH-STOP (REF.)
	S2	SWITCH-START (REF.)
**	S3	SWITCH-HIGH TEMP CUTOUT
*	S4	SWITCH-FUSE, 50 AMP
	TB1	BLOCK-TERMINAL (REF.)
		BRACKET-TERM BLOCK MTG (REF.)
F		SWITCH ASSY B
E		STUD (1¼ x 1¾-20NC)
		CONTROL BOX
		COVER-CONTROL BOX
G	W1	LEAD ASSY (B+ TO SOL.)

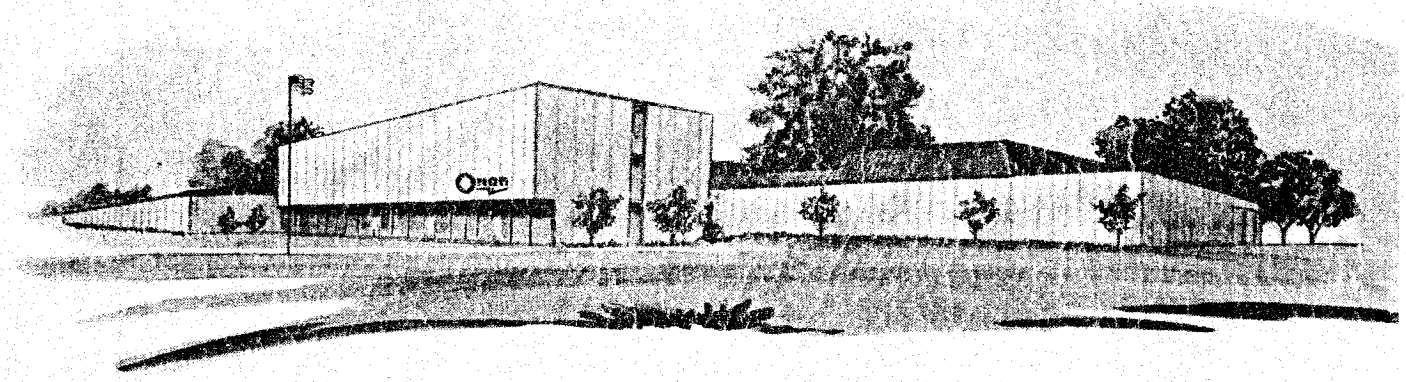
*FURNISHED BY CUSTOMER

**WHEN USED

LET	REVISION	CKD	DATE
G	336A0291 ADDED		7-23-74
F	308 B 0350 ADDED		9-25-7
E	ADDED 332A125		8-31-73
D	CHANGED CR1 TIE POINTS		12-21-71
C	CR1 WAS 358B42		11-12-71
R	WAS 24V REMOTE		9-24-71
A	WAS 1.5AJ-232E/1K & /1SK		6-17-71

Onan DIVISION OF STUDEBAKER CORPORATION Minneapolis, Minnesota

A	-01	MODEL NO. 1.5MAJ-232E/IN, 1.5AJ-232E/IL, 1.5AJ-232E/13L	DATE 5-18-71	BY CDR	CKD G.F.T.
B		32 V REMOTE	NAME CONTROL-GEN SET (WIRING DIAGRAM)		
			SEPIA FROM 610B333	DWG NO. 610-0336	B



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A DIVISION OF ONAN CORPORATION