

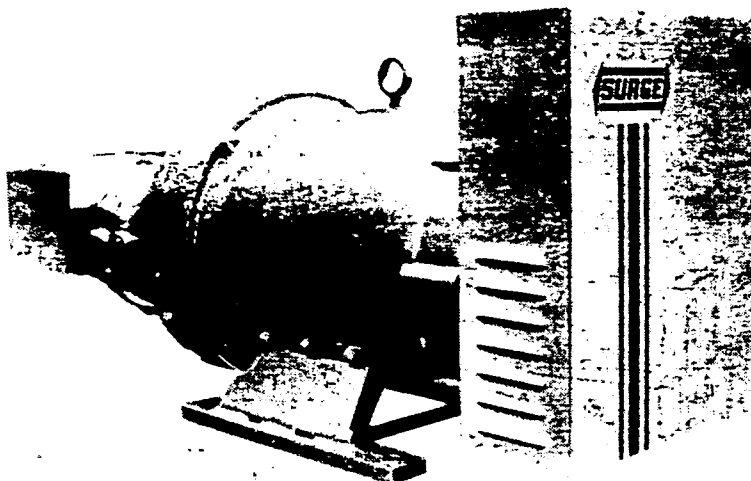
SURGE

PTO-POWERED ALTERNATORS

OPERATORS MANUAL
AND PARTS CATALOG

25 KW

- **MODEL NO. 20005**
- **MODEL NO. 20006**



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INTRODUCTION

THIS OPERATOR'S MANUAL CONTAINS INFORMATION PERTAINING TO THE OPERATION AND MAINTENANCE OF YOUR UNIT.

WE SUGGEST YOU KEEP THE MANUAL AND THE WIRING DIAGRAM WHICH ACCOMPANIES EVERY UNIT AND REFER TO IT WHEN MAKING EQUIPMENT ADJUSTMENTS OR ORDERING PARTS. ADDITIONAL COPIES ARE AVAILABLE FOR A NOMINAL CHARGE FROM YOUR DISTRIBUTOR.

WHEN ORDERING PARTS, REMEMBER TO INCLUDE THE MODEL, SPECIFICATION LETTER, AND SERIAL NUMBER LOCATED ON THE UNIT NAMEPLATE. THIS IS ESSENTIAL TO ENSURE THE CORRECT PART IS SHIPPED TO YOU.

FOR REPAIR SERVICE, CONTACT YOUR AUTHORIZED SERVICE REPRESENTATIVE.

WARNING

TO AVOID POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE, A QUALIFIED ELECTRICIAN OR AN AUTHORIZED SERVICE REPRESENTATIVE MUST PERFORM INSTALLATION AND ALL SERVICE.

Important Safety Precautions

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

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

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC

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

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

EXHAUST GAS IS DEADLY

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

- Warning: Engine exhaust is known to the State of California to cause cancer, birth defects and other reproductive harm.

Make sure exhaust is properly ventilated.

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

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

BATTERY GAS IS EXPLOSIVE

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

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

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

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

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

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

If the cabinet must be opened for any reason:

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

MEDIUM VOLTAGE GENERATOR SETS (601V TO 15kV)

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

GENERAL SAFETY PRECAUTIONS

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

KEEP THIS DOCUMENT NEAR EQUIPMENT FOR EASY REFERENCE.

GENERAL INFORMATION

INTRODUCTION

This instruction book contains information for the proper installation, operation and maintenance of your alternator. We suggest you keep this book handy so it can be referred to when necessary.

ALTERNATOR DESCRIPTION

These 25 kW models are revolving field, two bearing (UT Series) alternators. AC output voltage is generated in the stator and controlled by a static exciter attached to the end bell. The static exciter produces DC for field excitation and regulates the AC output.

The rotor consists of four inter-connected coils spaced symmetrically on a steel shaft. Slip rings on the shaft transmit excitation voltage to the field coils. The shaft is supported at both ends by prelubricated ball bearings. A centrifugal blower on the drive end of the alternator draws air through the alternator for cooling.

The complete alternator includes a built-in exciter and voltage regulator, mounting feet, lifting eye, mounted gear box and splined drive shaft and control box.

Gear Box

The gear box is secured to the alternator's rear end bell and has two gears. A pinion gear is pressed on and keyed to the alternator rotor shaft. It meshes with a larger spur gear which is pressed on and keyed to the gear reduction shaft. This shaft is supported by two roller bearings. The gear box capacity is 1/2 pint (.24 lit) of SAE 90 multi-purpose gear lubricant.

Control Box

The control box includes a voltmeter, a manual reset circuit breaker (alternator protection), one 120 volt, 15 amp duplex receptacle, one 50 amp, 240 volt range receptacle and main output terminal posts. The circuit breaker is in the exciter input circuit. It can be used as a line disconnect switch with a light load. However, a load transfer switch is required for disconnecting loads exceeding 5000 watts and is also recommended for lighter loads.

TABLE OF CONTENTS

General Information	1
Safety Precautions	2
Specifications	3
Installation	4
Operation	10
Service and Maintenance	12
Wiring Diagrams	18
Parts Catalog	21

OPTIONAL ACCESSORIES

Power Take-Off Shaft: Telescoping, shielded, heavy duty power take-off shafts (tumbling rods), recommended for use with PTO powered, gear drive alternators provide maximum safety for the operator. The splined universal joint with snap ring type shield and quick disconnect feature, fits a 1-3/8-inch (35 mm) tractor PTO drive. Telescoping power take-off shaft operating lengths are: minimum 45 inch (1143 mm), maximum 60 inch (1524 mm); weight 35 pounds. Six spline universal for 540 rpm PTO.

SAFETY PRECAUTIONS

The following symbols in this manual signal potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

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

CAUTION This symbol refers to possible equipment damage.

Study the following safety precautions carefully and insist that they be followed by those working with you and for you.

GUARD AGAINST ELECTRIC SHOCK

- Use extreme caution when working on electrical components. High voltage currents cause injury or death.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician.
- When working around electrical equipment, move slowly.
- Do not lunge after falling tools.
- Stop all power, and ground all high voltage points before touching wires.
- Make certain that power cannot be accidentally restored.
- Be sure power is off if you must work on underground electrical equipment.
- Do not examine live equipment when mentally or physically fatigued.
- Do not touch live electrical equipment while standing on metal floors, damp concrete or other well grounded surfaces.
- Do not handle live electrical equipment while wearing damp clothing (particularly wet shoes) or while skin surfaces are damp.
- Be extra cautious when working with alternator during a rain.

- Do not take unnecessary risks.
- Do not work alone.

EXHAUST GASES ARE TOXIC

- Provide an adequate exhaust system to properly expel discharged gases. Check exhaust system regularly for leaks.
- Be sure the unit is well ventilated.

PROTECT AGAINST MOVING PARTS

- Avoid moving parts of the unit. Loose jackets, shirts or sleeves should not be permitted because of the danger of becoming caught in moving parts.
- Clothing worn by the operator should be fairly tight and belted. Loose jackets, shirts, or sleeves should not be permitted because of the danger of getting into moving parts.
- Do not allow anyone to operate the alternator without proper instructions.
- Make sure all nuts and bolts are secure. Keep power shields and guards in position.
- If adjustments *must* be made while the unit is running, use extreme caution around moving parts, etc.
- Do not work on this equipment when mentally or physically fatigued.
- Before lubricating alternator always:
 1. Disengage all power
 2. Shut off engine, and then
 3. Wait until rotor stops.
- It is a good practice to have a fire extinguisher nearby. Be sure that the extinguisher is properly maintained and be familiar with its proper use.
- Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.

KEEP THE UNIT AND SURROUNDING AREA CLEAN

- Remove oil, grease, ice, snow or materials that create slippery conditions around unit.
- Remove oily rags and other materials that create potential fire hazards.

SPECIFICATIONS

	MODEL 20005	MODEL 20006
Watts	25,000	25,000
Volts	120/240	240*
Phase	1	3
Hertz	60	60
Current (Amperes)	104	60
Power Factor	1.0	1.0
Wire	4	4
Static Exciter	Yes	Yes
Alternator Speed (RPM)	1800	1800
Tractor Speed (RPM)	540	540
Minimum Horsepower Required, Driving Source	50	50
Gear Ratio	3.32:1	3.32:1
Gear Box Oil Capacity, Pints	1/2 (.24 lit)	1/2 (.24 lit)
Recommended Gear Lubricant	SAE 90	SAE 90
Weight	460 (209 kg)	460 (209 kg)

* Delta wound, one phase center tapped to deliver 120/240, single phase power in capacities to 20 kW (84 amperes).

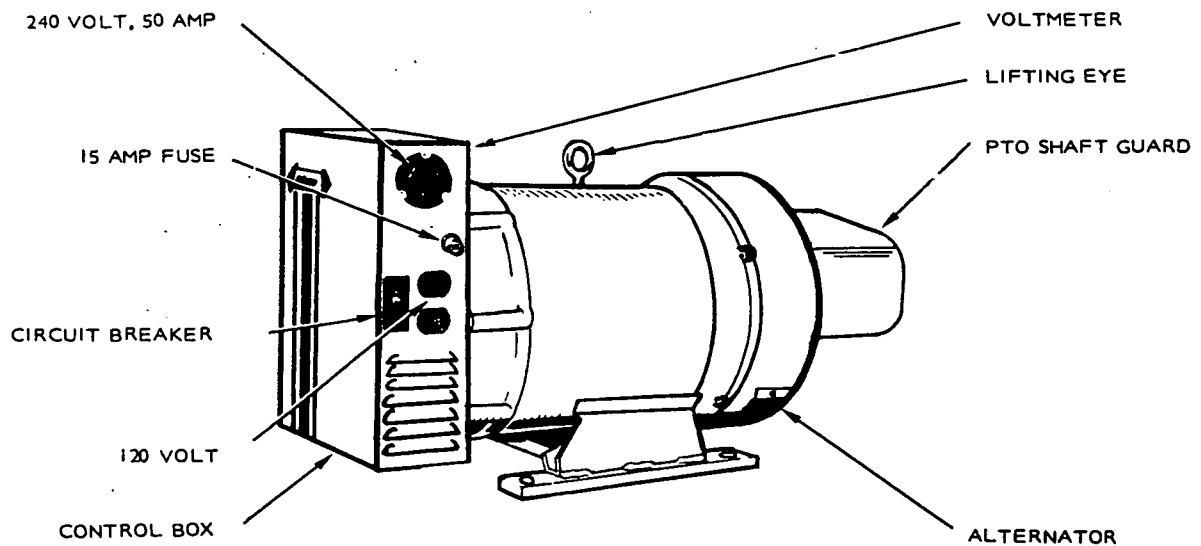


FIGURE 1. PTO-POWERED ALTERNATOR

INSTALLATION

LOCATION

Figure 2 shows alternator dimensions and bolt-hole centers for installation. Select a site for the alternator with the following points in mind.

Ventilation

The alternator creates considerable heat when operating under load conditions. It is important that this heat be removed by proper ventilation. If the alternator is installed inside a small room or compartment, provide a vent for exhausting the air heated by the alternator. Locate the heated air exhaust vent above the inlet vent. Heated air is discharged from the drive-shaft end of the alternator.

WARNING

WARNING Provide an outlet for tractor exhaust if operating inside a building. Exhaust fumes are deadly!

Convenience to Driving Power

Locate the alternator for easy connection to the tractor. Align the power takeoff to the alternator. Stay within the limits of the tumbling rod.

Dusty or Damp Conditions

Avoid dusty or damp conditions as much as possible. Alternator should be mounted under cover or inside a building to protect it against the weather.

Servicing Convenience

Allow at least 24 inches (610 mm) of space on all sides of the alternator.

Wiring Convenience

Do not locate the alternator in a location difficult to service or which would have poor ventilation, to save a few feet of wiring. Install the alternator as close to the load transfer switch as possible.

MOUNTING THE ALTERNATOR

Provide a substantial mounting base of concrete, wood or steel. Figure 3 shows dimensions of recommended mounting base. The surface of the base should be level so the alternator mounting brackets will not be sprung when tightened down.

The torque will flip the alternator over unless secured to a strong substructure. A narrow (30 inch, 762 mm) trailer is not suitable for operation. Forty inch hub-to-hub minimum measurement is required.

Be sure that the alternator is properly aligned with the driving mechanism and that it will stay in alignment.

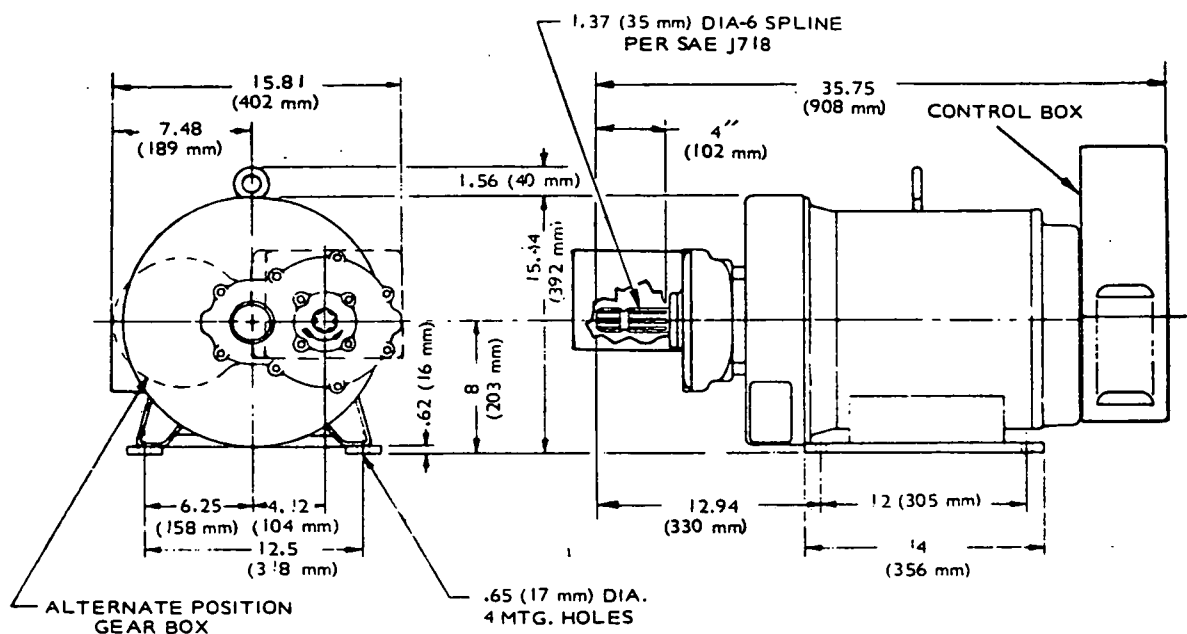


FIGURE 2. INSTALLATION OUTLINE

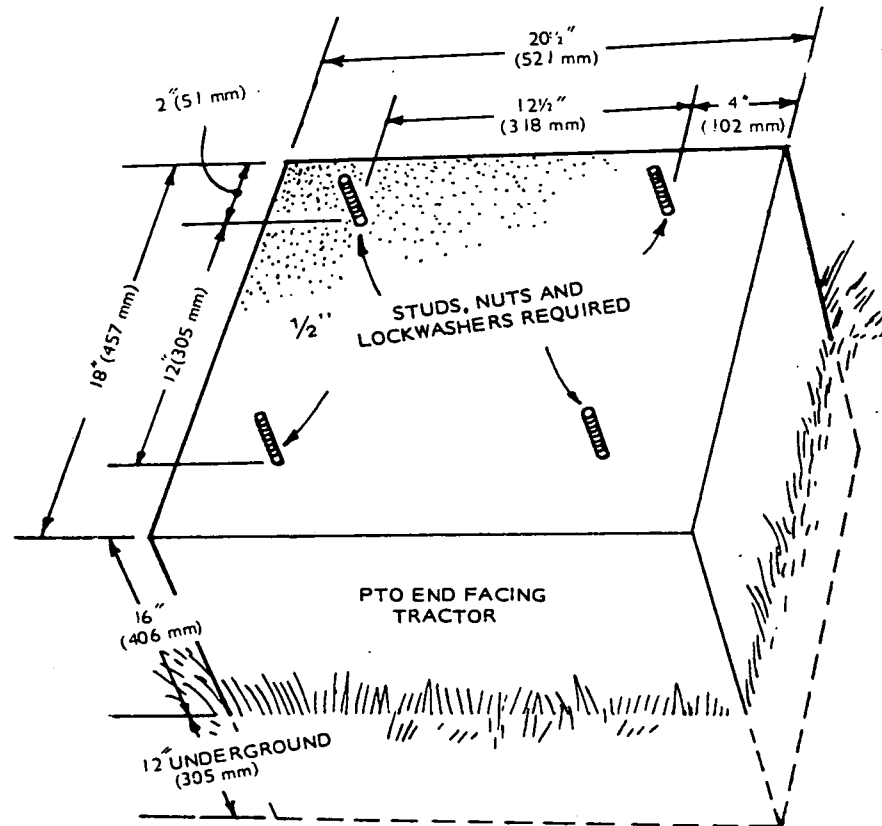


FIGURE 3. RECOMMENDED MOUNTING BASE

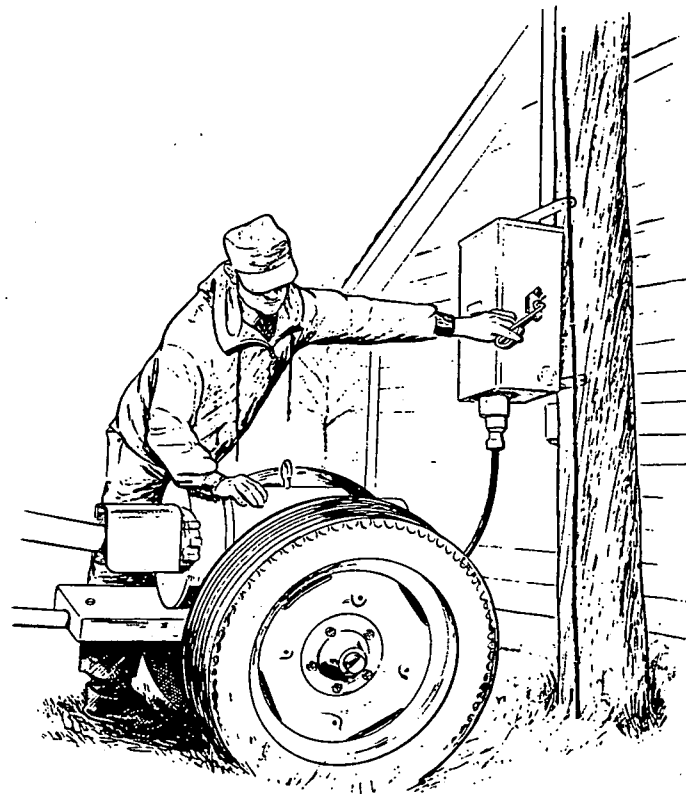


FIGURE 4. PORTABLE INSTALLATION

WIRING CONNECTIONS

For wiring connections with alternator mounted on a permanent base, connect load wires from terminal box on alternator to load transfer switch. Use weather-protective fittings, couplings and wires throughout.

For portable use (alternator mounted on a trailer), connect load wires from terminal block in alternator control box to an approved disconnect plug that can be connected to load transfer switch. Use a flexible power cord so cable can be easily wrapped up when not in use (Figure 4).

Receptacles on alternator control box allow connections when alternator has to be moved to the field or a remote location where no power is available.

SINGLE PHASE ALTERNATORS

The most popular single phase connection is the 120/240 combination. With this connection either 120 or 240 volts can be used alone or at the same time. Connections are shown in Figure 5. Be sure jumper strip is connected between T2 and T3 on terminal block.

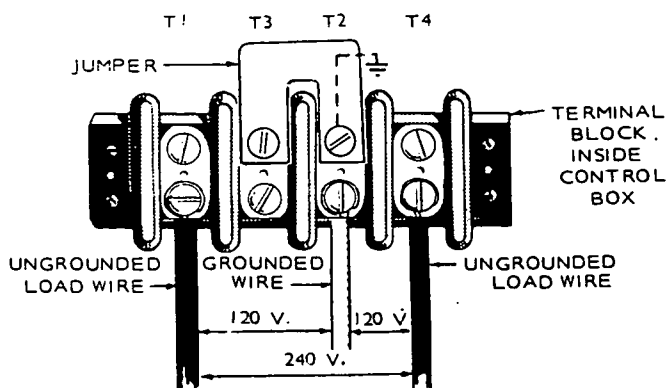


FIGURE 5. 120/240 VOLT, SINGLE PHASE CONNECTION

CAUTION

CAUTION Serious overloading can damage the alternator windings. When using two or more single phase circuits, don't overload any one circuit; divide the load equally between them.

Figure 6 shows connections for use of 120 volts only. Be sure jumpers are connected between T1 and T3, and T2 and T4.

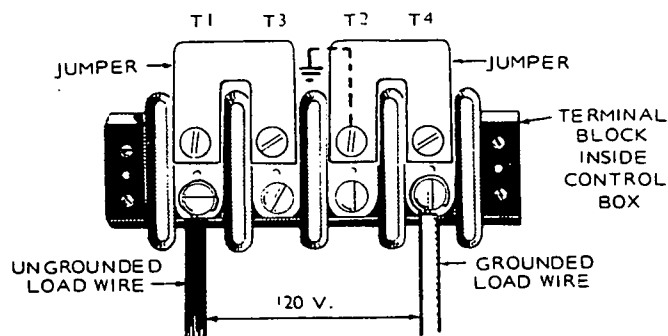


FIGURE 6. 120 VOLT ONLY, SINGLE PHASE CONNECTION

THREE PHASE ALTERNATORS

Three phase alternators are connected as shown in Figure 7. The three load wires are connected to T1, T2 and T3. Single phase (240 volts) can be obtained between any two three-phase terminals. Single phase (120 volts), can be obtained between T1 and T0 or T2 and T0. T0 is the grounded terminal for 120 volts.

CAUTION

CAUTION If no three phase output is used, usable single phase power is 2/3 of three phase kVA. Any overloading above 2/3 may damage the alternator windings.

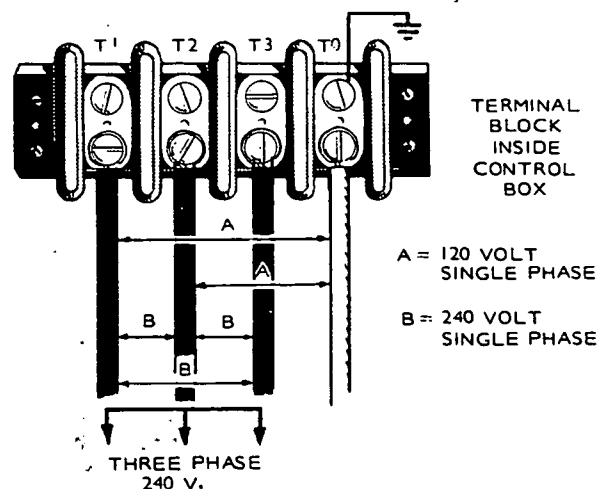
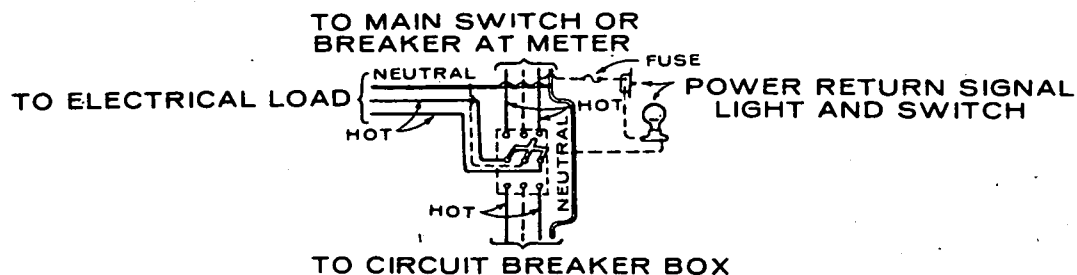
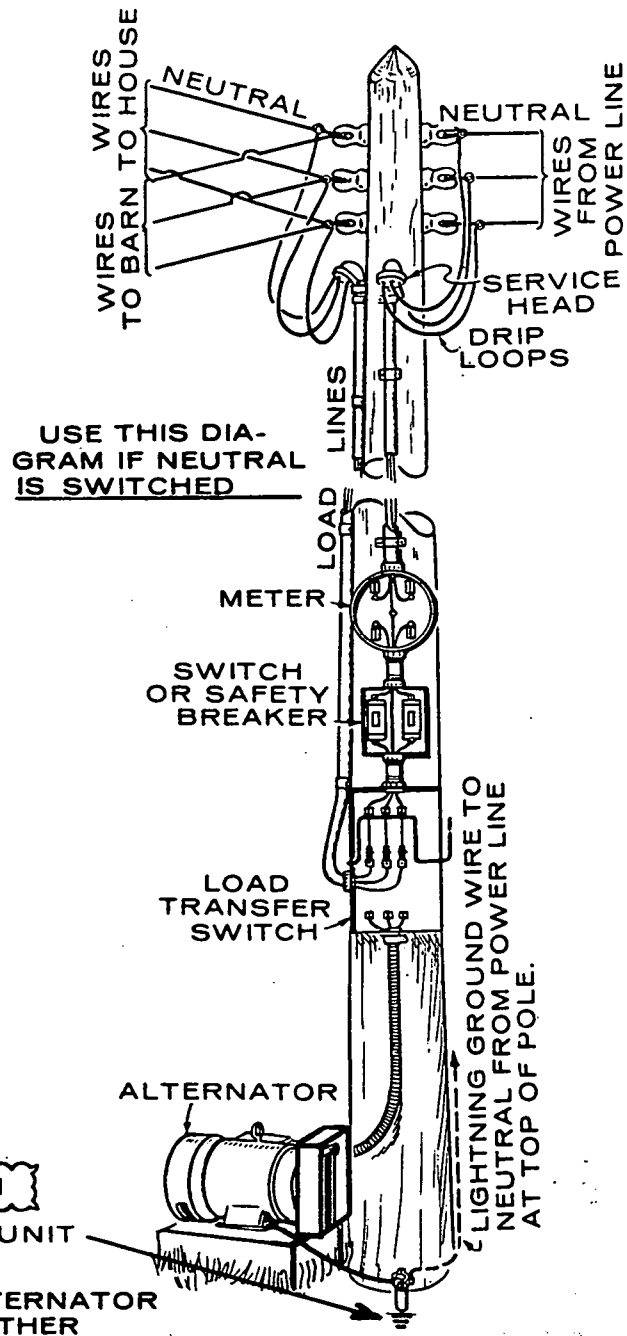
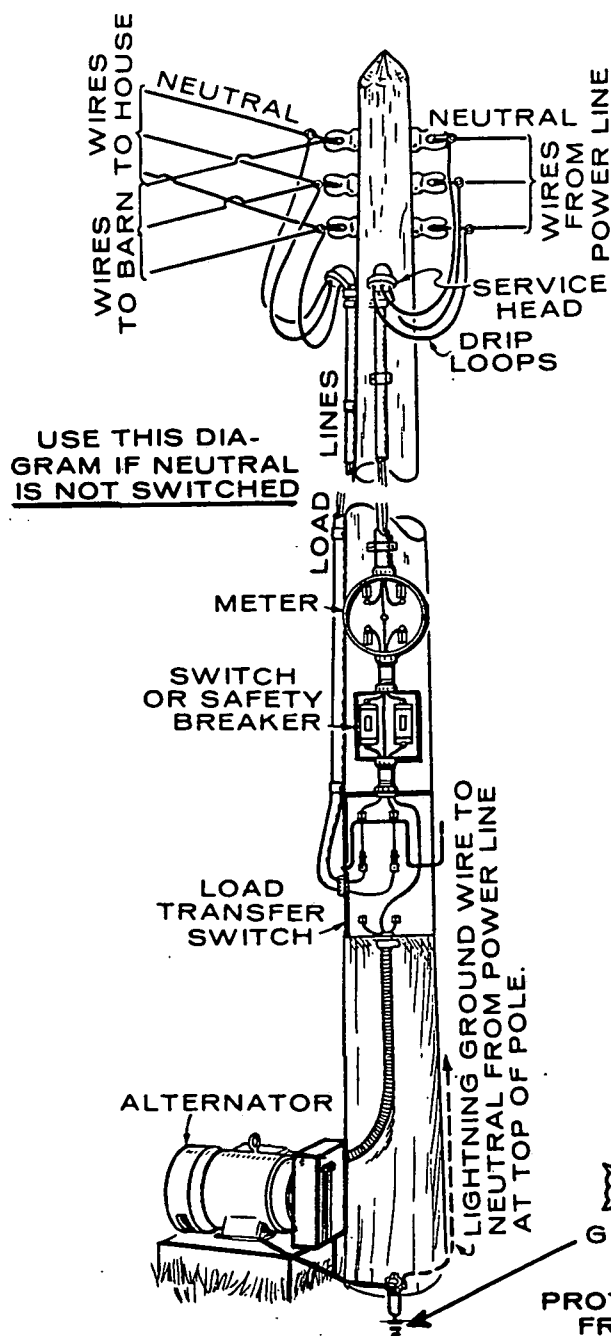
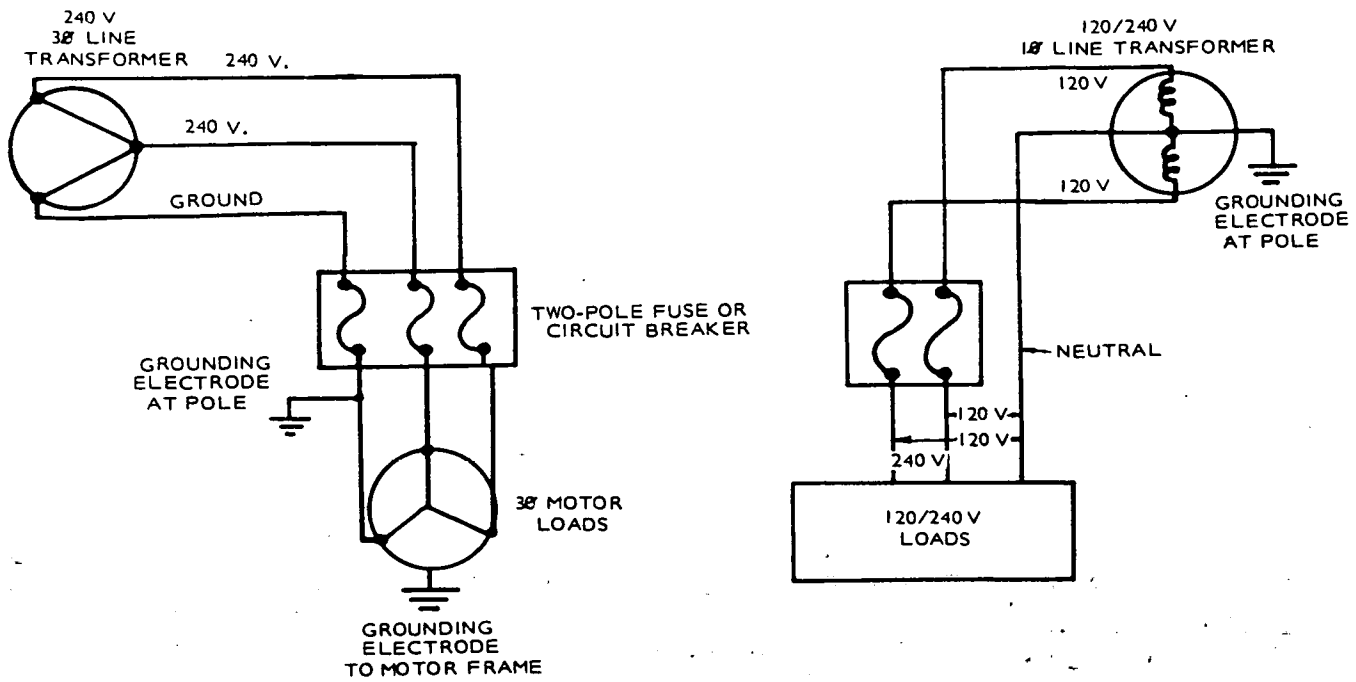


FIGURE 7. THREE PHASE CONNECTIONS

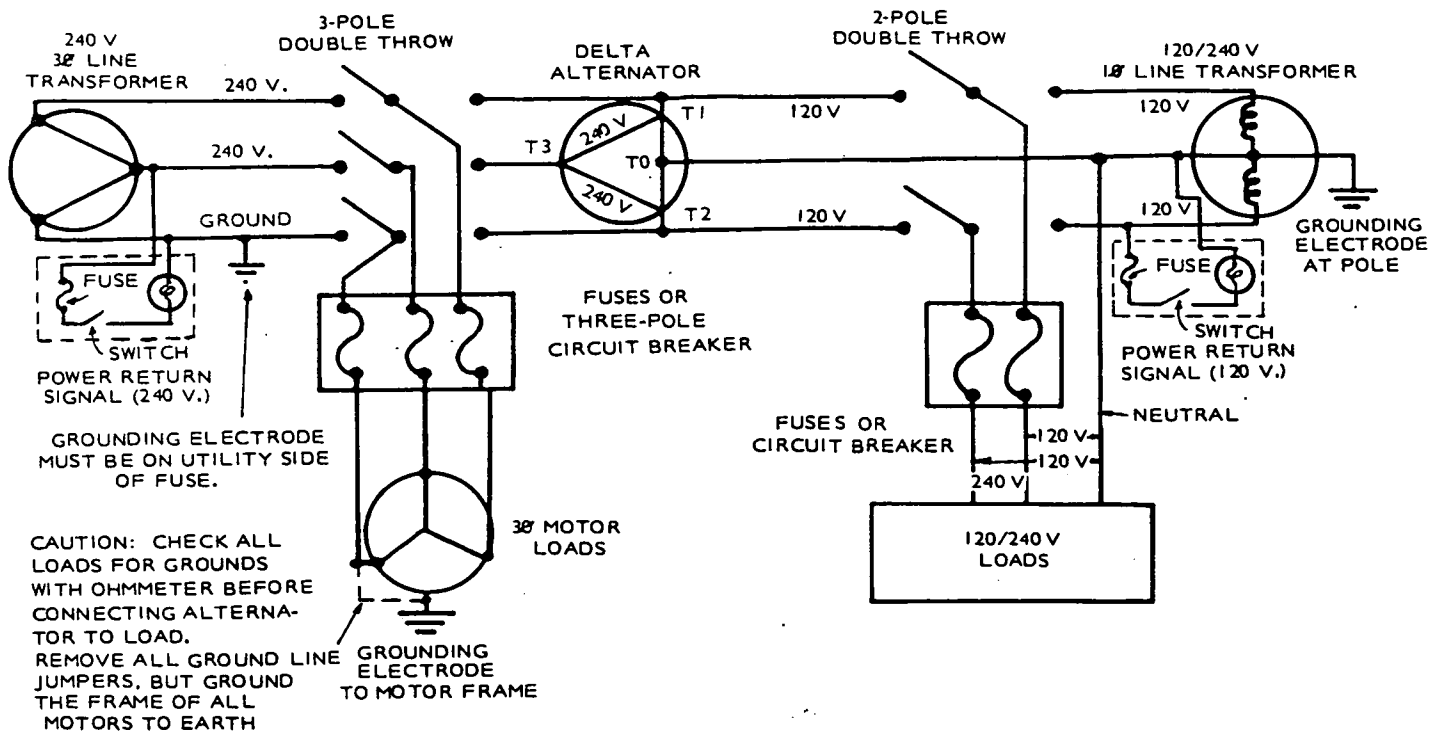


LOAD TRANSFER SWITCH CONNECTIONS

FIGURE 8. TYPICAL FARM STANDBY, SINGLE PHASE



TYPICAL CIRCUITS BEFORE INSTALLING
ONAN PTO ALTERNATOR



TYPICAL CIRCUIT AFTER INSTALLING
ONAN 3Ø PTO ALTERNATOR

FIGURE 9. COMBINATION SINGLE AND THREE PHASE LOAD TRANSFER

INSTALLING THE LOAD TRANSFER SWITCH

Before using the alternator for standby purposes, install a DOUBLE THROW LOAD TRANSFER SWITCH. The switch must have an ampere rating large enough to carry the total load when the main source of power is in use. Follow the local electrical code. The load transfer switch should always be installed close to the main line switch, and between the main line switch and the load. When properly installed, the load transfer switch in one position will connect the electrical load to the highline. When the load transfer switch is thrown to the other position, the load is first disconnected from the main source of power, and then connected to the tractor alternator. Using the load transfer switch makes it impossible to connect the alternator to the main source of power. The load lines must connect to the center terminals of the transfer switch. The alternator leads and the main power source leads must be connected at OP-ends of the switch.

POWER RETURN SIGNAL

When the generator is used for emergency applications, install a pilot light or alarm signal to

indicate when the power is restored and when the alternator can be disconnected. Connect a signal light across the regular power line, just ahead of the load transfer switch, Figure 8. Install an on-off switch and a fuse for the signal light. When a power failure occurs, snap the signal switch to the ON position before putting the alternator into operation. When the normal power returns, the signal operates and the alternator can then be disconnected.

COMBINATION SINGLE AND THREE PHASE LOAD TRANSFER CONNECTIONS

Two load transfer switches and additional wiring are required to connect one standby delta alternator in locations where separate 1-phase and 3-phase power lines normally supply the power. A 3-pole double throw switch alternately connects the 240 volt 3-phase line transformer power or the 240 volt 3-phase alternator motor loads. A 2-pole double throw switch alternately connects the 120/240 volt 1-phase line transformer power or the 1-phase alternator power to the 120 volt and 240 volt loads. The alternator and load transfer switches should be located close to the power line transformer which carries the heavier load. Separate power lines must be installed to carry power from the alternator to the lighter loads, Figure 9.

OPERATION

STANDBY OPERATION

When a power outage occurs, the alternator should be ready to run and to take over the electrical load, Figure 10.

1. Set up tractor and install PTO shaft. Depress spring loaded pin on PTO shaft at alternator end of drive shaft. Slide yoke onto alternator PTO shaft making sure spring loaded pin falls onto groove on alternator splined shaft.

WARNING

Be sure all power shields and guards are in place and secured before starting unit.

2. Position alternator circuit breaker to OFF.
3. If alternator is mounted on a trailer for portable use, connect power leads between receptacles or alternator and load, Figure 4.
4. Throw transfer switch to disconnect commercial power and connect load to alternator, Figures 8 and 9.
5. Turn power return signal ON, if one has been installed.

WARNING

To avoid injury to the operator, be sure tractor range shift lever is in the PARK position before dismounting tractor or operating alternator.

6. Start tractor, engage power take-off, and bring PTO shaft speed up to 542 rpm; alternator speed to 1800 rpm.
7. With alternator running, position alternator circuit breaker to ON position. At 1800 rpm the voltmeter on the alternator control box reads about 250 volts (in the green range on voltmeter).
8. Various electrical loads can now be connected.

When two or more single phase circuits are available, do not overload any one circuit—divide the load equally between them.

CAUTION

Serious overloading can damage the alternator windings!

APPLYING LOAD TO ALTERNATOR

When connecting motor loads, connect one motor at a time allowing each motor to reach running speed before connecting the next one. Motors require much more current for starting than for running at normal speed. If several motors are started at the same time, the total electrical load may overload the alternator, tripping the circuit breaker. Remove the load before throwing the circuit breaker back to the ON position.

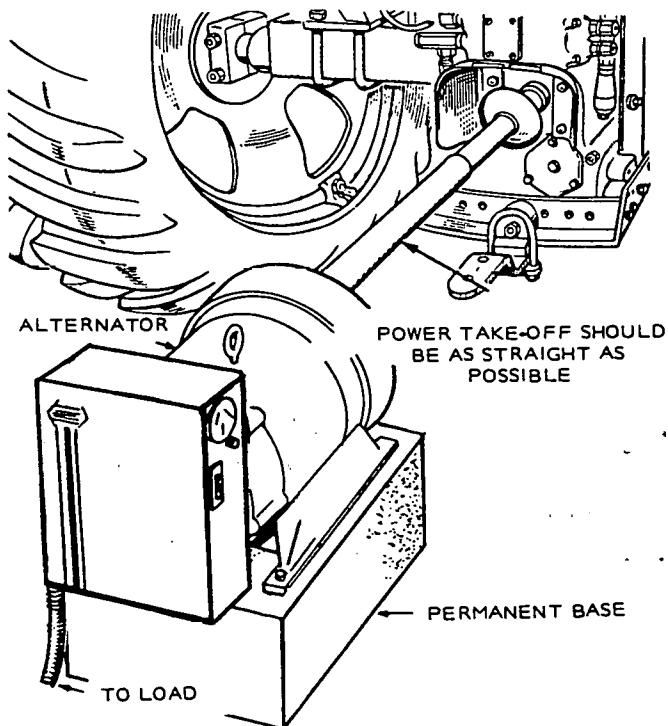


FIGURE 10. TRACTOR CONNECTION

In some cases it may be necessary to change the engine throttle setting to maintain 542 rpm when large changes in the electrical load are made.

Keep the alternator load within its nameplate rating. If the alternator is seriously overloaded, the circuit breaker will automatically trip, disconnecting the entire electrical load. Reduce the load before throwing the circuit breaker to the ON position.

If the tractor engine has very little reserve power, use care when operating alternator.

CAUTION

This alternator requires at least a 50 to 55 hp. (at the PTO) engine. If the tractor has little reserve power the governor cannot act quickly enough when the electrical load is removed. This will cause a surge of speed and high voltage which may damage any electrical equipment left connected.

When disconnecting large portions of the load, disconnect one piece of equipment at a time, or first disconnect that part of the load which will be left on. Then remove the rest of the load. Wait until voltage has stabilized, then reconnect the portion of the load which will be left on. The alternator voltage will remain stabilized and the tractor engine speed will not change or surge enough to cause any damage if this procedure is followed.

LOAD REQUIREMENTS

Add up all of the wattage requirements of all electrical equipment that could be operating simultaneously during a power outage. Take the information either from typical wattage requirements (Table 1) or from the nameplate on the equipment itself. Compare the total load requirements with the output rating of the alternator to determine how motor starting and total load will affect the alternator.

Check the motor nameplates for the horsepower rating of essential equipment: oil burner pump, furnace blower motor, circulating heater, electric milking machine, milk pump, barn cleaner, feed conveyor, silage unloader, chick brooder, sump pump, well pump, poultry house ventilating fan, freezer, refrigerator, washing machine, etc.

Start motors one at a time, beginning with the largest one. Then, after all motors are running, there will be extra power for other less critical equipment such as a television, air conditioner, etc.

OUTPUT VOLTAGE

Output voltage can be adjusted over a range of 5 percent by changing the location of the slide clip on the control resistor in the exciter. Be sure speed and frequency are correct before making an adjustment.

TABLE 1.
TYPICAL WATTAGE REQUIREMENTS

MOTORS* (CAPACITOR TYPE)	WATTS REQUIRED	
	START	RUN
1/2 horsepower	2800	550
3/4 horsepower	4300	775
1 horsepower	5500	1000
2 horsepower	7130	1960
3 horsepower	10350	2970
5 horsepower	16660	3500
7-1/2 horsepower	23000	5250

* Repulsion-induction motors require less starting wattage.
Split phase motors require slightly more starting wattage.

SERVICE AND MAINTENANCE

PERIODIC SERVICE AND INSPECTION

Follow a definite schedule of inspection and servicing. Make a good visual check before, while, and after alternator is operating; look for loose or broken leads and bad connections.

GEAR BOX LUBRICATION

Use only SAE 90 multi-purpose gear lubricant. Drain the gear box after the first 100 hours of operation and refill with fresh lubricant of the recommended grade. Repeat this procedure every six months thereafter, or every 100 hours. Maintain the proper oil level between changes.

CAUTION Overfilling will cause foaming, which can lead to an oil leak due to overheating.

Remove oil fill plug at top of the case and oil level plug from the face of the gear case, Figure 11. Fill case until oil just begins to flow from the oil level plug hole. Gear box holds 1/2 pint (0.24 lit) U.S. measure. Replace both plugs.

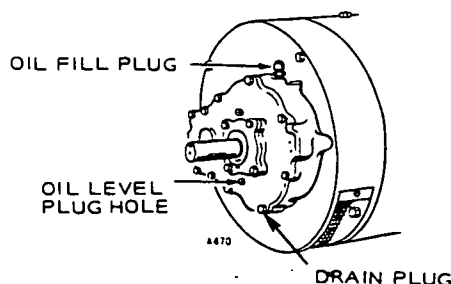


FIGURE 11. GEAR BOX LUBRICATION

TUMBLING ROD LUBRICATION

Grease the universal joints on the PTO shaft at least every 25 operating hours. Under adverse conditions, grease the joints as required, possibly every 4 to 8 hours. Never operate the alternator with the shield removed from the tumbling rod.

SLIP RINGS

Slip rings must be clean and free of scratches and burrs (do not remove the dark brown film). If necessary to use an abrasive on the slip rings, use No. 240 sandpaper, never emery cloth or other conducting abrasives.

If rings are grooved, out of round, pitted, or rough so brushes seat poorly, remove rotor and refinish rings in a lathe. Remove or shield the bearing during refinishing.

BEARINGS

The ball bearings are double sealed and lubricated for life. If the ball bearings become noisy, worn, or otherwise defective, replace them. Remove the old ball bearings with a gear puller and drive or press new ones into place.

BRUSHES

To examine the brushes, brush springs and slip rings remove the exciter cover from the alternator. Remove the screws from the right side of the exciter plate and swing the exciter assembly outward. To remove the brush holders, unscrew the four machine screws from the end bell, Figure 12. Do this every 500 hours.

Replace the brushes when they wear to about 5/16 inch (7.94 mm) in length. Order replacement brushes by part number, never by description; similar brushes may have different electrical characteristics.

WARNING Be careful when working on an alternator that is running. Electric shock hazard is present. Onan suggests that only a qualified mechanic or electrician perform these tests.

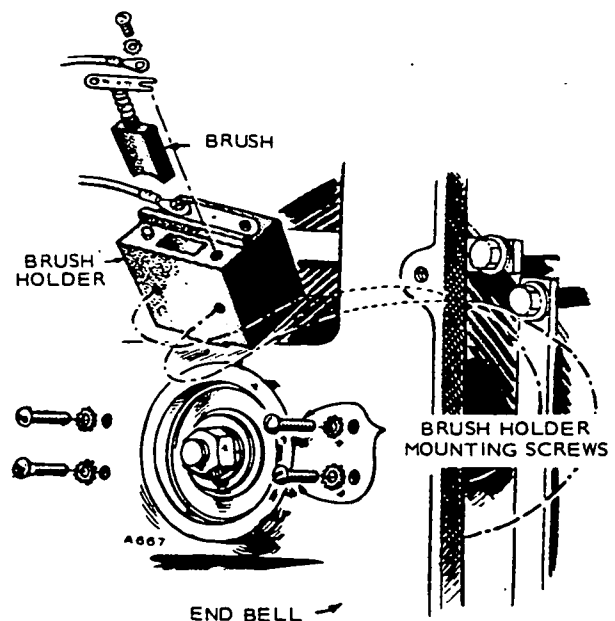


FIGURE 12. BRUSH REMOVAL

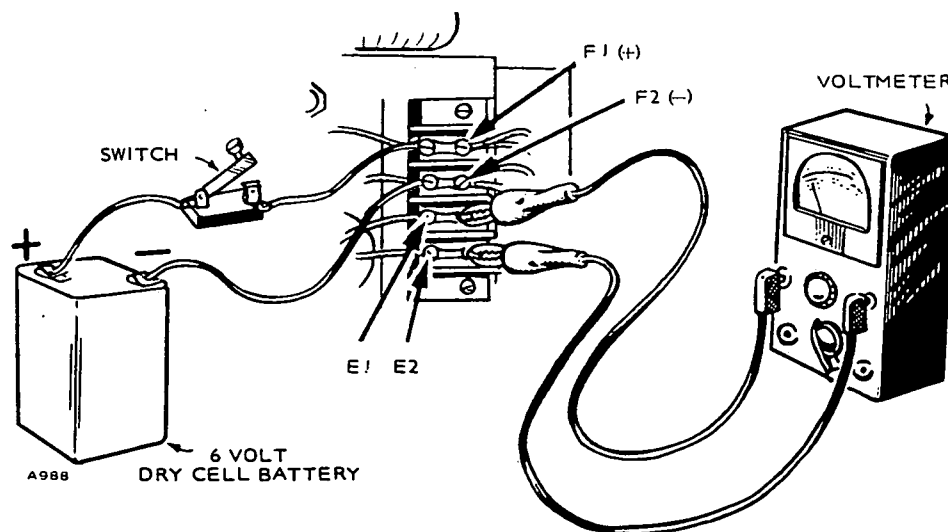


FIGURE 13. FLASHING THE FIELD

FLASHING THE FIELD

If there is no voltage buildup, remove the exciter cover, and with the alternator running, press the residual reset button. If there still is no voltage buildup, flash the alternator field. Proceed as follows:

1. Using a 6 volt dry cell battery, connect leads as shown in Figure 13 (positive to F1 and negative to F2).
2. Connect voltmeter leads to E1 and E2.
3. With the alternator running, close the switch momentarily to energize the buildup circuit. Watching the voltmeter:
 - a. If voltage now builds up normally, the trouble was due to a residual voltage loss in the field.
 - b. If voltmeter indicates low voltage, the exciter is at fault. Refer to *Exciter Troubleshooting*, Table 2.
 - c. If there is too much voltage, and the alternator is running at correct speed, the trouble is in the exciter.
 - d. If there is no voltage buildup, the alternator is probably at fault. Refer to *Alternator Troubleshooting*, Table 3.

STATIC EXCITER TESTING

Troubles are listed in advancing order, from no output voltage to rated but fluctuating output voltage. See Table 2. The relationship between trouble and cause is not always consistent from model to model, so the following information must be used as a guide, not an absolute rule. The "PROCEDURE" column in Table 2 indicates the procedure for checking a standard component. When the word "None" appears in that column, all the information needed to complete the check is given in the column headed "CORRECTIVE ACTION." Use a multimeter to check continuity, voltage and resistance as indicated in the tests.

Exciter checking procedures are:

1. checking rectifiers.
2. checking reactors A and B.
3. checking reactor control.
4. checking resistors.

It is imperative that the testing procedures are completely understood by the serviceman before attempting to perform corrective maintenance.

TABLE 2. EXCITER TROUBLESHOOTING

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	PROCEDURE
Alternator will not build up voltage.	Circuit breaker in "off" or "tripped" position.	Reset and close breaker.	None
	Open in circuit breaker.	Stop alternator and check breaker continuity.	None
	No AC power to Static Exciter.	Check AC voltage at E ₁ -E ₂ with the alternator operating. Voltage should be five percent of the rated voltage. If not, check continuity from E ₁ -E ₂ back to alternator.	None
	Partial loss of residual in rotor.	With alternator operating, jumper from E ₂ to heat sink of field rectifier Z until voltage begins to build-up. Then remove.	None
	Pair of field rectifiers open (either W & Z or X & Y).	Test rectifiers and replace if defective.	(1)
	Both field rectifiers X and Y shorted.	Test rectifiers and replace if defective.	(1)
Output voltage slow to build up. Circuit breaker opens in about five seconds.	Either field rectifier X or Y shorted.	Test rectifiers and replace if defective.	(1)
Output voltage slow to build up and five percent below rated voltage after build up. Voltage regulation poor.	Either field rectifier W or Z shorted.	Test rectifiers and replace if defective.	(1)
Output voltage slow to build up and higher than rated voltage after build up.	Open circuit in one or more control rectifier.	Test rectifiers and replace if defective. Check soldered connections to rectifiers.	(1)
Output voltage slow to build up and ten to twenty percent above rated voltage after build up.	Open in one field rectifier.	Test rectifiers and replace if defective.	(1)
	Open circuit in gate winding G ₁ -G ₂ of reactor A or B.	If field rectifiers Y and Z check okay, check continuities of gate windings G ₁ -G ₂ .	(2)
Output voltage builds up normally but less than rated voltage after build up.	Shorted winding in control reactor.	Test control reactor and replace if defective.	(3)
Output voltage builds up normally with slightly less than rated voltage at no load and low voltage at full load.	Compound winding S ₁ -S ₂ installed backward or has open circuit.	Check wiring diagram for polarity of compound windings through reactors A and B and test for continuity.	None
Output voltage builds up normally but 20 percent above rated voltage after build up. Voltage regulation poor.	Compound winding S ₁ -S ₂ installed backward through one reactor (A or B).	Check wiring diagram for polarity of compound winding through reactor A or B.	None
Output voltage builds up normally but is twenty five percent above rated voltage after build up.	Open circuit in control rectifier bridge.	Check continuity from the junction of control rectifiers Z and Y to the junction of control rectifiers X and W.	None
Output voltage builds up normally but 125 to 150 percent above rated voltage after build up.	Shorted turn in gate winding G ₁ -G ₂ of reactor A or B.	Test reactors A and B for shorted turns and replace if defective.	(2)

TABLE 2. EXCITER TROUBLESHOOTING (Continued)

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	PROCEDURE
Output voltage builds up normally but 150 to 200 percent above rated voltage after build up. No regulation possible.	Control winding C ₁ -C ₂ of reactor A or B polarized incorrectly.	Check circuit connections of both reactors A and B.	None
	Shorted turn in control winding C ₁ -C ₂ or reactor A or B.	Test reactors A and B for shorted turn and replace if defective.	(2)
	Open in control circuit.	Check continuity from E ₁ to E ₂ through control circuit.	None

PROCEDURE 1 — CHECKING RECTIFIERS

Disconnect one lead from, or remove, each rectifier for its individual test.

Observe carefully the mounting direction of any rectifier removed. It must be remounted in its original direction.

- Connect an ohmmeter across rectifier contacts and observe meter reading.
- Reverse connections and compare new reading with first reading.
- If one reading is considerably higher than other reading, rectifier can be considered satisfactory. However, if both readings are low, or if both are high which indicates an "OPEN" circuit, replace rectifier with a new identical part.

PROCEDURE 2 — CHECKING REACTORS A and B

Use an accurate ohmmeter when checking resistance values. Resistance readings between G₁ and G₂ cannot be read with accuracy on a multimeter.

- Set resistance range selector on ohmmeter to proper range.
- Isolate one gate winding by disconnecting either end of gate winding G₁-G₂ from its point of connection. Measure resistance in gate winding across G₁-G₂. Reading should be 0.66 ohms.
- Isolate one control winding by disconnecting either lead C₁ or C₂ from its point of connection. Measure resistance in control winding across C₁-C₂. Reading should be 5.5 ohms.
- Connect one meter lead to disconnected gate winding lead and other meter lead to disconnected control winding lead and check for continuity.

Results:

- REACTOR IS SERVICEABLE** if resistance is within 20 percent either way from value listed and

there is no continuity between control and gate windings.

- REACTOR IS DEFECTIVE** if there is an open circuit in either gate or control windings. Continuity between gate and control windings is also an indication of a defective reactor. In either case, reactor should be replaced.

PROCEDURE 3 — CHECKING CONTROL REACTOR

- Isolate control reactor by disconnecting common lead C from its point of connection.
- Carefully measure resistance from this lead to numbered lead on control reactor. Reading should be 12.5 ohms.

Results:

- CONTROL REACTOR IS SERVICEABLE** if resistance is within 10 percent of value specified.
- CONTROL REACTOR IS DEFECTIVE** if no continuity is indicated between common lead C and the numbered lead, indicating an open circuit.

PROCEDURE 4 — CHECKING RESISTORS

The resistors must be checked with a multimeter adjusted to appropriate range of resistances. See *Static Exciter Wiring Diagram* for correct values.

- Isolate resistor by disconnecting one end from its point of connection and carefully measure resistance.

Results:

- RESISTOR IS SERVICEABLE** if measured resistance falls within 20 percent of value specified on wiring diagram.
- RESISTOR IS DEFECTIVE** if there is no continuity through the resistor. If measured resistance exceeds the percent limits either way, the stabilizing resistor can be adjusted to bring resistance within required limits.

TABLE 3. ALTERNATOR TROUBLESHOOTING

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Alternator voltage will not build up.	Residual magnetism gone. Dead short in load. Exciter defective. Open circuit, ground or short in revolving field. Open circuit, ground or short in stator.	See paragraph on Flashing the Field. Inspect load and correct. See Exciter Troubleshooting Refer to Alternator Testing. Refer to Alternator Testing.
Current unsteady but engine speed not fluctuating.	Loose connection. Poor brush contact.	Clean and tighten connections. Reseat or replace brushes. Clean slip rings.
Frequency drops under heavy load.	Low engine power.	Use adequate source of engine power.
Voltage drops under heavy load, little frequency change.	Defective exciter.	See Exciter Troubleshooting
Alternator won't deliver rated current.	Unbalanced load on lines. Defective exciter. Defective field windings.	Adjust load. See Exciter Troubleshooting Test and replace if defective.
Alternator overheats.	Overloaded. Partial short in load. Poor ventilation.	Reduce load. Correct short. Increase ventilation.
Incorrect output voltage.	Voltage output control resistor adjusted incorrectly. Engine governor set wrong speed. Defective exciter	Adjust slide tap for proper output. Check engine speed, adjust governor. See Exciter Troubleshooting
Noise in alternator	Defective bearing. Collector rings out of round.	Replace. Turn down in lathe.

ALTERNATOR TESTING

Most alternator tests can be performed with an ohmmeter (Figure 14).

1. Rotor Continuity:

- Remove brushes so none touch slip rings.
- Using an ohmmeter, test for grounding between each slip ring and rotor shaft.
- Test for a short circuit in rotor winding by measuring resistance in winding (between both slip rings). Meter should read between 2.0 and 2.5 ohms at 70°F (21°C).
- Replace rotor if it is grounded, or has an open or short circuit.

2. Stator Continuity:

- Disconnect alternator leads to load in control box.
 - Use wiring diagram to determine output lead coding.
- Using an ohmmeter, check each winding of stator for grounding to laminations or frame.

Some alternators have ground connections to frame. Check wiring diagrams.

- Using an accurate ohmmeter, test resistance of each stator winding. Compare resistances obtained. All windings of equal output voltage should indicate about same resistance. An unusually low reading indicates a short, a high reading an open circuit.
- If any windings are shorted, open-circuited or grounded, replace the stator assembly.
- Before replacing stator assembly, check leads for broken wires or insulation. Replace any defective lead.
- If this doesn't correct the fault, replace the assembly. It isn't practical to attempt to rewind defective stator except at a competent rewinding shop.

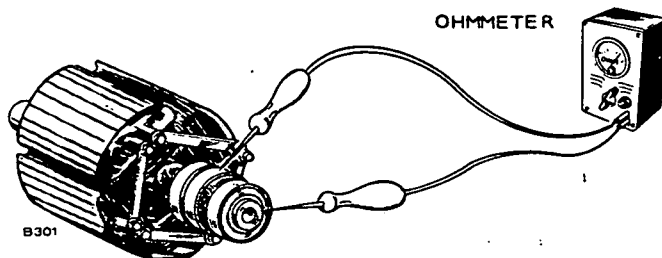


FIGURE 14. TESTING ALTERNATOR ROTOR WINDINGS

DISASSEMBLY

The rotor weighs over 100 pounds (45 kg), so use care when sliding it in the stator. Disassemble only as much as is required to repair the alternator. Almost all tests can be accomplished without disassembling the alternator. If tests indicate that the rotor or stator is defective, disassemble the alternator as follows:

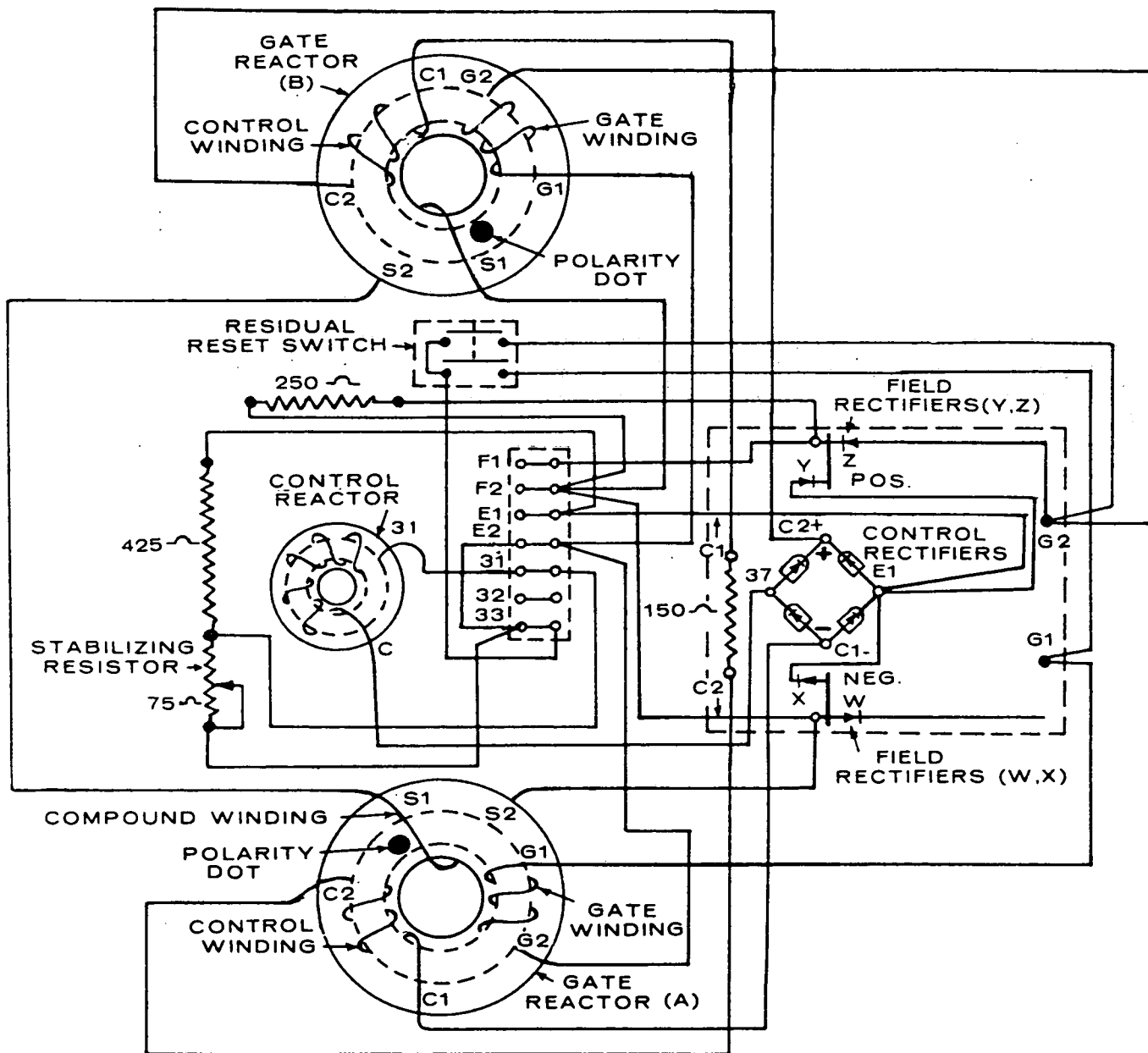
- Disconnect tumbling rod.
- Remove exciter cover and exciter screws. Swing out exciter. Remove brush holder screws (Figure 12), and lift brush holders so they are fully clear of slip rings.
- Remove rear end bell screws.
- Carefully slide gear box, rear end bell, and rotor out from stator. Support rotor when field coils are just about clear of stator.
- To remove gear box from rear end bell, first drain the oil. Remove gear box cover to gain access to gear box mounting screws.
- Remove six socket-head screws which secure gear box to alternator.
- To remove rear end bell from rotor, pull pinion gear with a gear puller.
- Remove oil seal and adapter assembly from rear end bell.
- Remove bearing retaining ring.
- Pull rear end bell from rotor.
- If necessary to pull bearings, first remove retaining ring, and then use a gear puller.

ALTERNATOR ASSEMBLY

Be sure all bearing surfaces and oil sealing surfaces are clean. Best balance is achieved by assembling the rotor, rear end bell and gear box before sliding the rotor back into the stator.

- With bearing retaining plate on rotor shaft, press bearing back into place. Install retaining ring.
- Position rear end bell on bearing.
- Secure oil seal and adapter in place.
- Press pinion gear onto rotor shaft so end of rotor shaft is flush with outside face of gear.
- With "O" mark in place on the oil seal and adapter assembly, install gear box. Secure with socket-head screw.
- Install gear box cover.
- Oil capacity of gear box is about 1/2 pint (.24 lit). Do not overfill. Remove vent plug on top of gear case and lower pipe plug on front of gear case. Pour oil in the upper hole; fill to level of lower hole.

WIRING DIAGRAMS



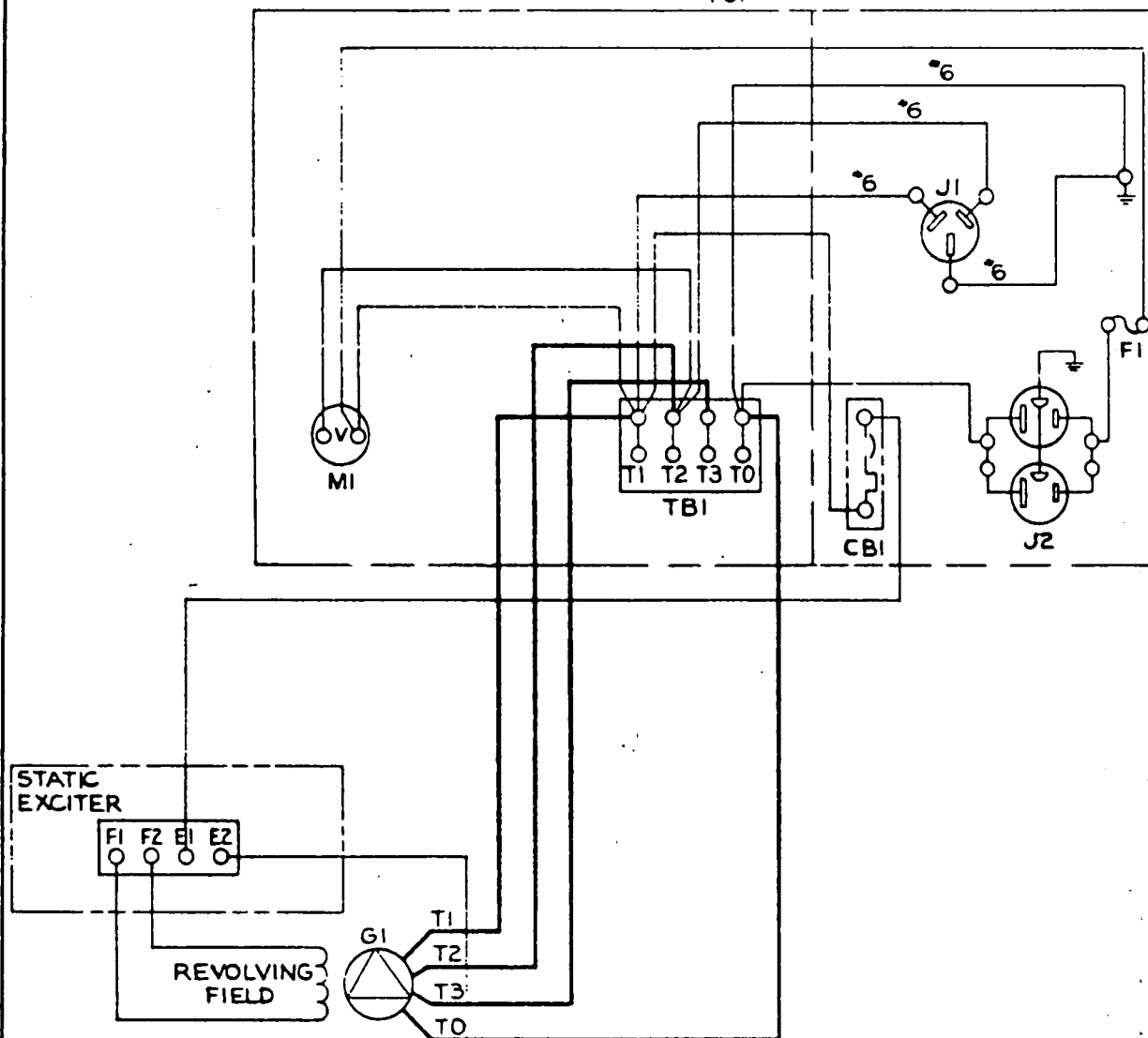
NOTE: WHEN GATE REACTORS ARE MOUNTED ON ALTERNATOR THE POLARITY DOTS WILL BE ON TOP OF EACH REACTOR.

STATIC EXCITER WIRING DIAGRAM



PARTS LIST

WIRING DIAGRAM – MODEL 2000S



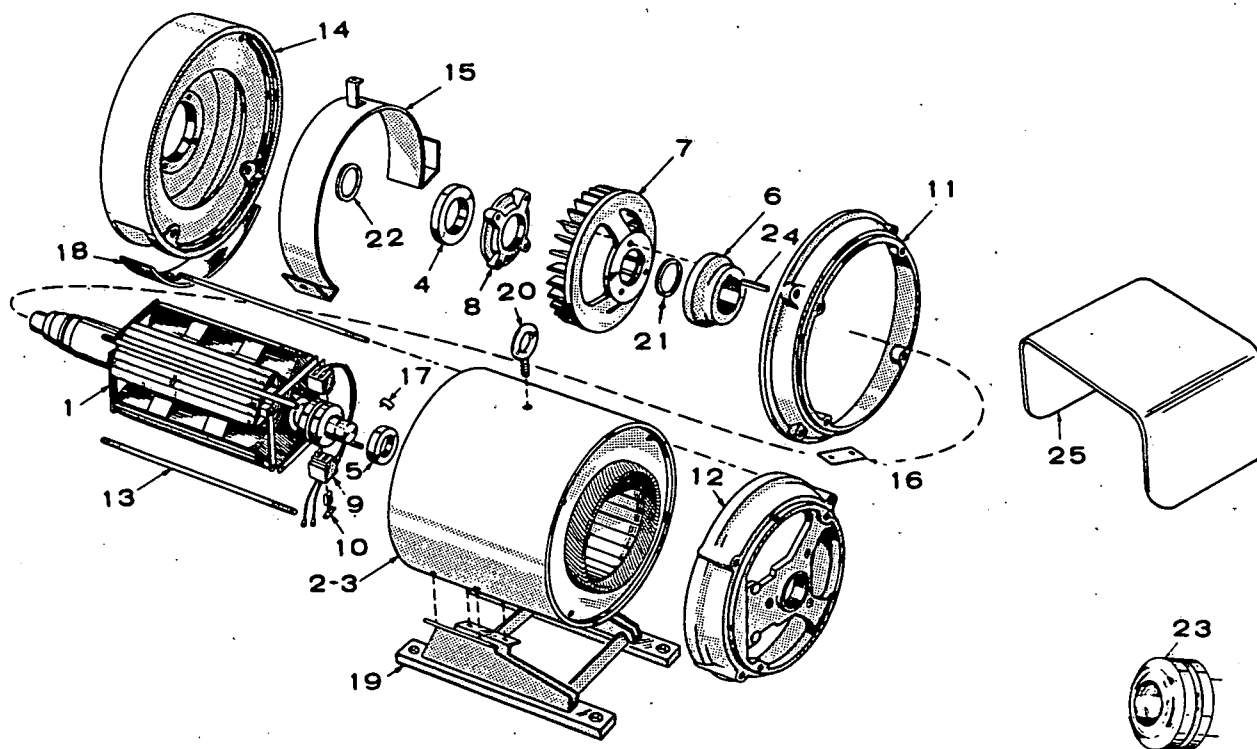
NOTES:

1. T_0 CENTER TAPPED
BETWEEN T_1 & T_2

[illegible]

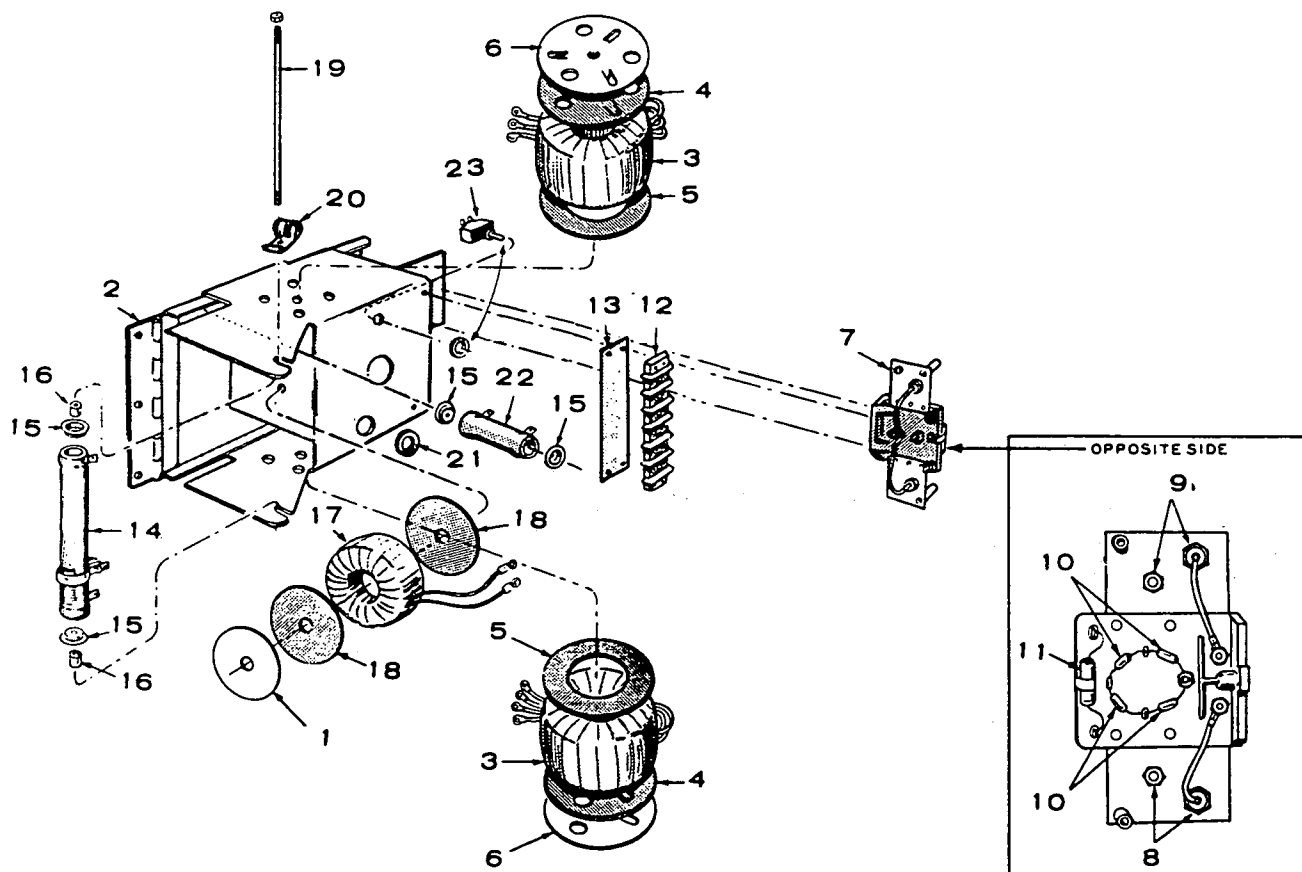
WIRING DIAGRAM – MODEL 20006

PARTS CATALOG



ALTERNATOR GROUP

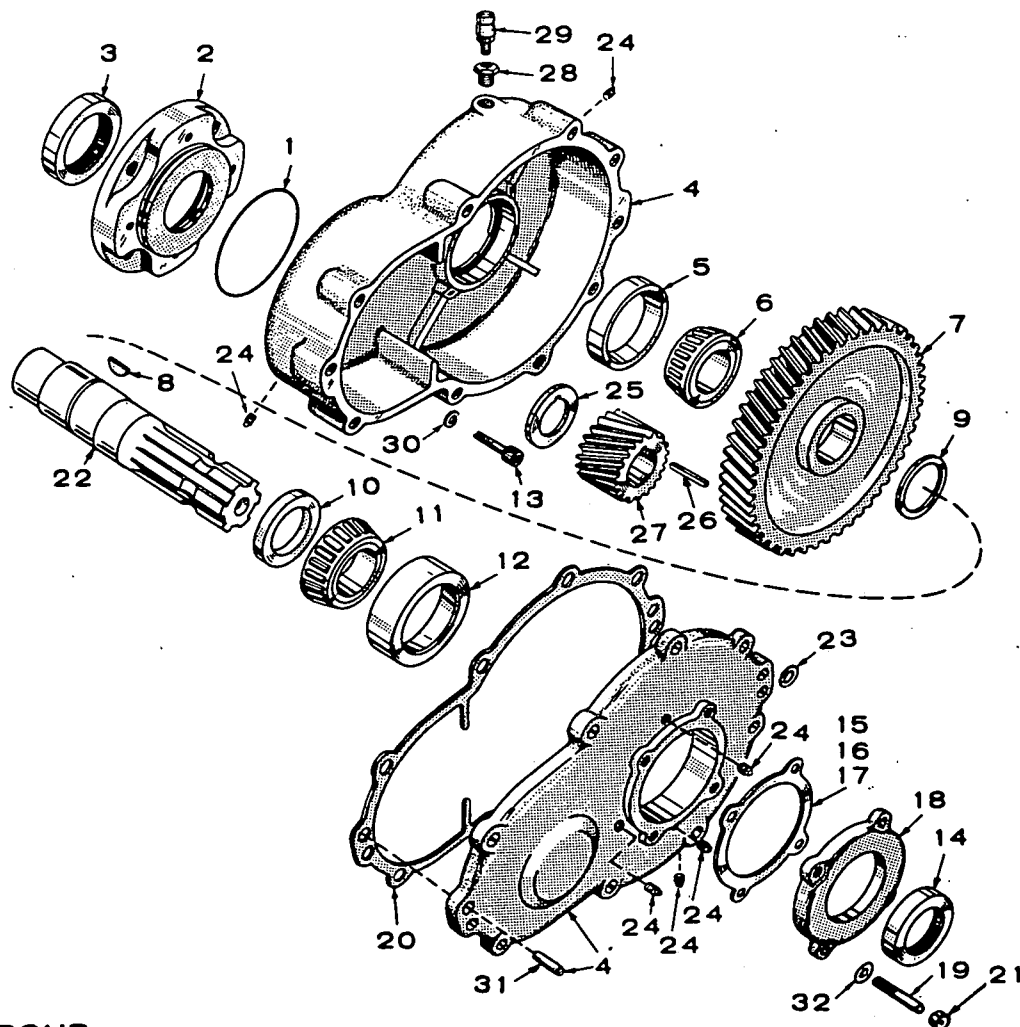
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	201-1153	1	Rotor Assembly, Wound
2	220-1771	1	Stator, Wound 120/240 Volt, 3 Phase
3	220-1769	1	Stator, Wound 120/240 Volt, 1 Phase
4	510-0063	1	Bearing, Drive End
5	510-0047	1	Bearing, Exciter End
6	232-1591	1	Hub, Generator Blower
7	205-0045	1	Blower
8	232-1341	1	Plate, Bearing Retaining
9	212-1064	2	Block, Brush
10	214-0059	4	Brush, Collector Ring
11	231-0158	1	Adapter
12	211-0146	1	Bell, End
13	520-0498	4	Stud, Thru-Stator
14	211-0125	1	Bell, End-Rear
15	232-1028	1	Scroll, Air
16	232-2286	1	Plate, Cover
17	232-0596	1	Clip, Bearing Stop
18	232-1077	1	Screen, End Bell
19	232-1605	1	Base Assembly, Mounting
20	403-0622	1	Eye, Lifting - 1/2
21	518-0083	1	Ring, Retaining - Hub
22	518-0122	1	Ring, Retaining - Bearing
23	204-0061	1	Ring, Collector
24	515-0007	1	Key, Blower Hub
25	190-0319	1	Guard, Power Take-off



STATIC EXCITER GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	209-0008	1	Exciter Complete (Less Cover)	10	305-0240	4	*Rectifier, Voltage Control
1	526-0173	1	Washer, Retainer, Voltage Control. Reactor	11	304-0512	1	*Resistor (150-Ohm, 5Watt)
2	234-0188	1	Panel Only, Exciter	12	332-0745	1	Block, Terminal
3	315-0102	2	Reactor, Gate	13	332-0746	1	Strip, Block Marker
4	232-1553	2	Gasket, Gate Reactor Mounting, Outer	14	304-0527	1	Resistor, Tapped, 500-Ohm (425 Fixed, 75 Adjustable)
5	232-1551	2	Gasket, Gate Reactor Mounting, Inner	15	304-0015	4	Washer, Resistor Centering
6	232-1552	2	Retainer, Gate Reactor	16	332-1474	2	Spacer, Resistor Mounting
7	305-0264	1	Rectifier Assembly, Resistor & (Includes Parts Marked *)	17	315-0100	1	Reactor, Voltage Control
8	305-0238	2	*Rectifier Only, Power Field, Negative	18	232-1548	2	Gasket, Voltage Control Reactor
9	305-0239	2	*Rectifier Only, Power Field, Positive	19	520-0641	1	Stud, Tapped Resistor Mounting
				20	332-0051	1	Clip, Tinnerman
				21	508-0008	1	Grommet, Rubber, For 7/8" Hole
				22	304-0510	1	Resistor, Fixed (250-Ohm, 25Watt)
				23	308-0175	1	Switch, Residual Reset

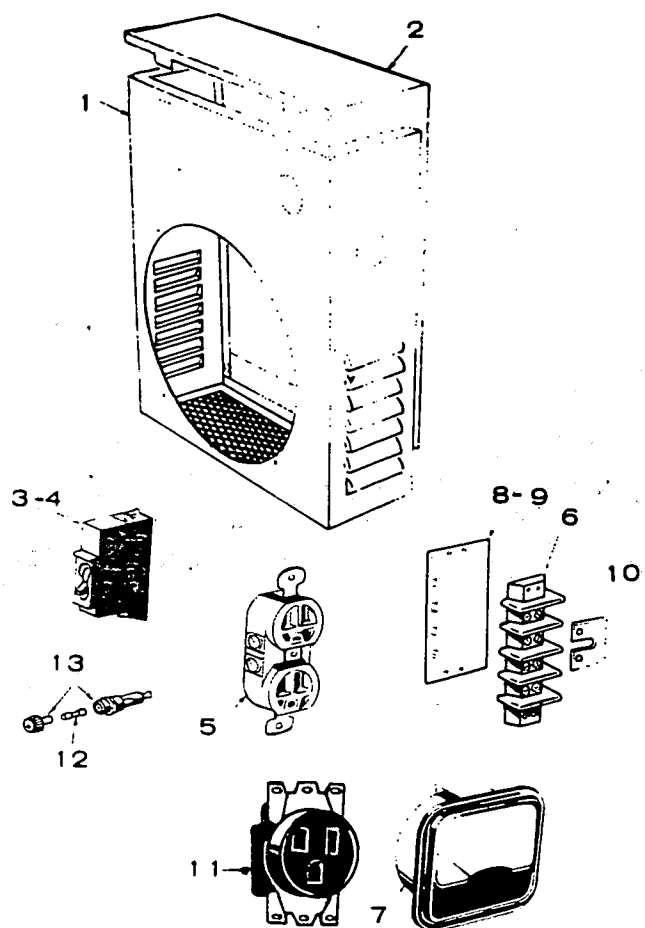
* - Included in 305-0264 Resistor and Rectifier Assembly.



GEAR BOX GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	190-0320	1	Gear Box Complete - Splined Shaft	13	802-0055	6	Screw, 5/16-18-x 1 Socket Head
1	509-0099	1	Seal, "O" Ring	14	509-0016	1	Seal, Oil-Drive Shaft
2	190-0246	1	Adapter and Oil Seal Assembly, Gear Box	15	190-0017	As Req.	Shim -.009" Thick
3	509-0041	1	Seal, Oil - Included in 190-0246 Adapter Assembly	16	190-0018	As Req.	Shim -.012" Thick
4	190-0250	1	Housing Assembly, Gear - Includes Cover & Dowel Pins	17	190-0019	As Req.	Shim -.016" Thick
5	510-0022	1	Cup, Roller Bearing - Inside Bearing	18	190-0016	1	Plate, Bearing Retaining
6	510-0021	1	Cone, Roller Bearing - Inside Bearing	19	520-0756	4	Stud, Bearing Plate
7	190-0224	1	Gear, Driven (3.32 to 1 Ratio)	20	190-0021	1	Gasket, Gear Cover
8	515-0159	1	Key, Woodruff - Driven Gear	21	862-0001	4	Nut, Hex (1/4-20)
9	518-0013	1	Ring, Retainer - Driven Gear	22	190-0292	1	Shaft, Input - Splined
10	190-0202	1	Spacer, Gear - Between Driven Gear and Bearing Cone	23	526-0065	8	Washer (Copper), Flat, 5/16"
11	510-0023	1	Cone, Roller Bearing - Outside Bearing	24	505-0054	6	Plug, 1/4 Pipe - Gear Cover
12	510-0024	1	Cup, Roller Bearing - Outside Bearing	25	190-0195	1	Washer, Pinion Gear
				26	515-0142	1	Key - Pinion Gear
				27	190-0225	1	Gear, Pinion (3.32 to 1 Ratio)
				28	505-0007	1	Bushing, 1/4 x 1/8 Reducer
				29	518-0172	1	Fitting, Vent
				30	526-0065	6	Washer (Copper), Flat, 5/16"
				31	516-0012	2	Pin, Dowel - Included in 190-0250 Housing Assembly
				32	526-0063	4	Washer (Copper), Flat, 1/4"

CONTROL GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-3437	1	Box, Control
2	301-3442	1	Cover, Control Box
3	320-0257	1	Bracket, Circuit 120/240 Volt, 3 Phase
4	320-0002	1	Breaker, Circuit 120/240 Volt, 1 Phase
5	323-0184	1	Receptacle, 120 Volt Duplex
6	332-0419	1	Block, Terminal
7	302-0665	1	Meter, Volt - 0-300
8	332-0492	1	Strip, Marker 120/240 Volt, 3 Phase
9	332-0744	1	Strip, Marker 120/240 Volt, 1 Phase
10	332-0440	2	Jumper, Terminal - 120/240 Volt, 1 Phase
11	323-0894	1	Receptacle, 50 Amp.
12	321-0138	1	Fuse, 15 Amp.
13	321-0104	1	Holder, Fuse

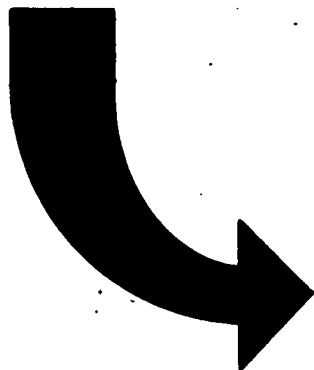
For PARTS, SERVICE & WARRANTY:

Always provide MODEL and SERIAL NO. found on Alternator nameplate when referring to any Surge Alternator. Contact the Authorized Surge Dealer from whom you purchased this equipment.

MODEL _____	
SERIAL _____	
ALWAYS MENTION MODEL & SERIAL NO.	
AC VOLTS _____	KVA _____ KW _____
AMPS _____	PF _____ CYCLES _____
PH _____	RPM _____
EXCITER DC VOLTS _____	AMPS _____
SURGE	
BABSON BROS. CO., OAK BROOK, ILL. 60521	
Babson Bros. Co. (Canada) Ltd., Port Credit, Ont.	
FILE NUMBER 3927	
99A1224 FOR ELECTRICAL EQUIPMENT ONLY	

IMPORTANT:

Please fill out this information and return card within 10 days in order to establish your warranty.



RETURN TO:
BABSON BROS. CO.
2100 S. YORK ROAD
OAK BROOK, ILLINOIS 60521

CUT ALONG DOTTED LINE AND DETACH

WARRANTY VALIDATION CERTIFICATE for **SURGE** ALTERNATOR

Purchased from _____

Dealer _____

Address _____

_____ Date purchased _____

Model _____

Serial No. _____

Owner's Name _____

Address _____

Town _____

State/Province _____

Zip _____

***SURGE* ALTERNATOR WARRANTY**

BABSON BROS. CO. warrants to the original purchaser of this Alternator and such other purchasers as Babson Bros. Co. shall be notified of and agree in writing to extend this warranty to, that its manufacture is free from defects in material and factory workmanship — if properly installed, serviced and operated under normal conditions according to BABSON BROS. CO.'s instructions.

BABSON BROS. CO.'s obligation under this warranty is limited to correcting without charge for a period of one year any part or parts thereof which shall be returned to its factory or authorized service stations (transportation prepaid by customer) — and which upon examination shall disclose to BABSON BROS. CO.'s satisfaction to have been originally defective. Correction of such defects by repair to or supplying of replacements for defective parts shall constitute fulfillment of all obligations to person covered hereunder. Either on receipt of the returned part or upon receipt of an Authorized Service Report from an authorized dealer, BABSON BROS. CO. shall perform its obligation hereunder within fourteen (14) days or such other period of time as shall be reasonable under the circumstances. It is the responsibility of the person covered hereunder to take such steps as will result in BABSON BROS. CO. receiving the part or, in the alternative, a duly completed Authorized Service Report from an authorized dealer.

This warranty shall not apply to any Surge Alternator or parts thereof which must be replaced because of normal wear, which has been subjected to misuse, negligence or accident or which has been repaired or altered outside the factory or Service Center authorized by BABSON BROS. CO. Also excluded from this warranty is liability for loss, damage or expense directly or indirectly from the use of this Alternator or from any other cause, by BABSON BROS. CO.

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

THE SOLE AND EXCLUSIVE REMEDIES FOR ANY BREACH OF THIS WARRANTY BY BABSON BROS. CO. SHALL BE LIMITED TO THE REMEDIES AND GENERAL CONDITIONS PROVIDED IN THE ABOVE PARAGRAPHS AND SHALL IN NO EVENT INCLUDE ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

If desired, every authorized dealer of Babson Bros. Co. will negotiate and, upon agreement, execute a Surge Service Warranty Agreement, providing service during the term of this warranty.

BABSON BROS. CO., OAK BROOK, ILLINOIS
BABSON BROS. CO., (Canada) LTD. MISSISSAUGA, ONTARIO

CUT ALONG DOTTED LINE AND DETACH

**GUARANTEE
AND
WARRANTY
DEPARTMENT**

BABSON BROS. CO.
2100 S. YORK ROAD
OAK BROOK, ILLINOIS 60521

PLACE
STAMP
HERE

IMPORTANT:

Please fill out information on reverse side of this card and return within 10 days — in order to establish your warranty.

SURGE

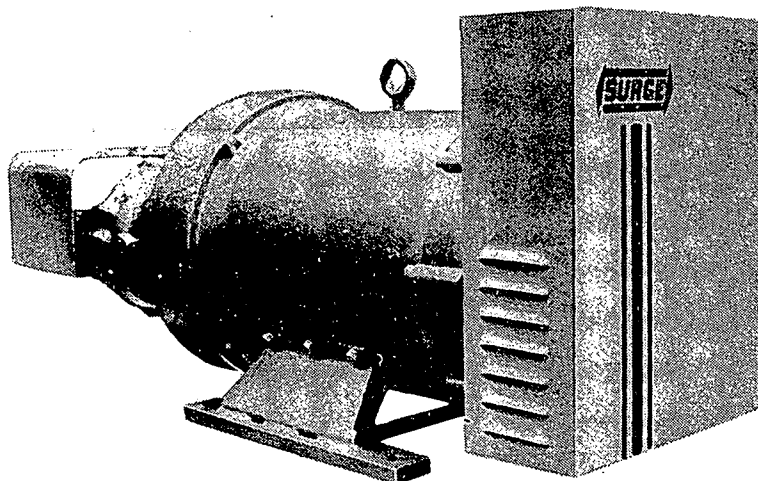
FILE
PTO-POWERED ALTERNATORS

OPERATORS MANUAL

AND PARTS CATALOG

25 KW

- **MODEL NO. 20005**
- **MODEL NO. 20006**



BABSON BROS. CO. 2100 S. YORK RD. OAK BROOK, ILLINOIS 60521

BABSON BROS. CO. (CANADA) LTD. PORT CREDIT, ONTARIO

TABLE OF CONTENTS

General Information	
Introduction	2
Description	2
Gear Box	2
Control Box	2
Optional Accessories	2
Specifications	3
Installation	
Location	4
Mounting the Alternator	4
Connecting the Alternator Wires	6
Balancing the Load	6
Installing the Load Transfer Switch	6
Power Return Signal	7
Operation	
Starting	8
Operating	8
Output Voltage	8
Service and Maintenance	
Periodic Service and Inspection	9
Gear Box Lubrication	9
Power Take-Off Shaft	9
Slip Rings	9
Bearings	9
Brushes	9
Flashing the Field	10
Checking Static Exciter	10
Exciter Troubleshooting Guide	11
Alternator Troubleshooting Guide	13
Alternator Testing	14
Alternator Disassembly	14
Alternator Assembly	14
Wiring Diagrams	
Static Exciter	15
Model 20005, Single Phase	16
Model 20006, Three Phase	17
Parts Catalog	18

GENERAL INFORMATION

INTRODUCTION

This manual contains information for the proper installation, operation and maintenance of your alternator. We suggest you keep this book handy so it can be referred to when necessary.

If you wish to contact your dealer regarding this equipment, be sure to supply the complete MODEL NUMBER and the full SERIAL NUMBER of your equipment. This information is necessary to identify your equipment among the many units manufactured.

WARNING

The use of this symbol throughout this manual warns of possible personal injury.

CAUTION

This symbol refers to possible unit damage.

DESCRIPTION

These 25 KW models are revolving field, two bearing alternators. AC output voltage is generated in the stator and controlled by a static exciter attached to the end bell. The static exciter produces DC for field excitation and regulates the AC output.

The rotor consists of four inter-connected coils spaced symmetrically on a steel shaft. Slip rings on the shaft transmit excitation voltage to the field coils. The shaft is supported at both ends by prelubricated ball bearings. A centrifugal blower on the drive end of the alternator draws air through the alternator for cooling.

The complete alternator includes a built-in exciter and voltage regulator, mounting feet, lifting eye, mounted gear box and stub drive shaft and control box.

GEAR BOX

The gear box is secured to the alternator's rear end bell and has two gears. A pinion gear is pressed on and keyed to the alternator rotor shaft. It meshes with a larger spur gear which is pressed on and keyed to the gear reduction shaft. This shaft is supported by two roller bearings. The gear box oil capacity is one half pint.

CONTROL BOX

The control box includes a voltmeter, a manual reset circuit breaker (alternator protection), one 120 volt, 15 amp duplex receptacle, one 50 amp, 240 volt range receptacle and main output terminal posts. The circuit breaker is in the exciter input circuit. It can be used as a line disconnect switch with a light load. However, a transfer switch is required for disconnecting loads exceeding 5000 watts and is also recommended for lighter loads.

WARNING

Do not attempt to belt drive this alternator. Bearings are not loaded for side pressure, therefore damage will result.

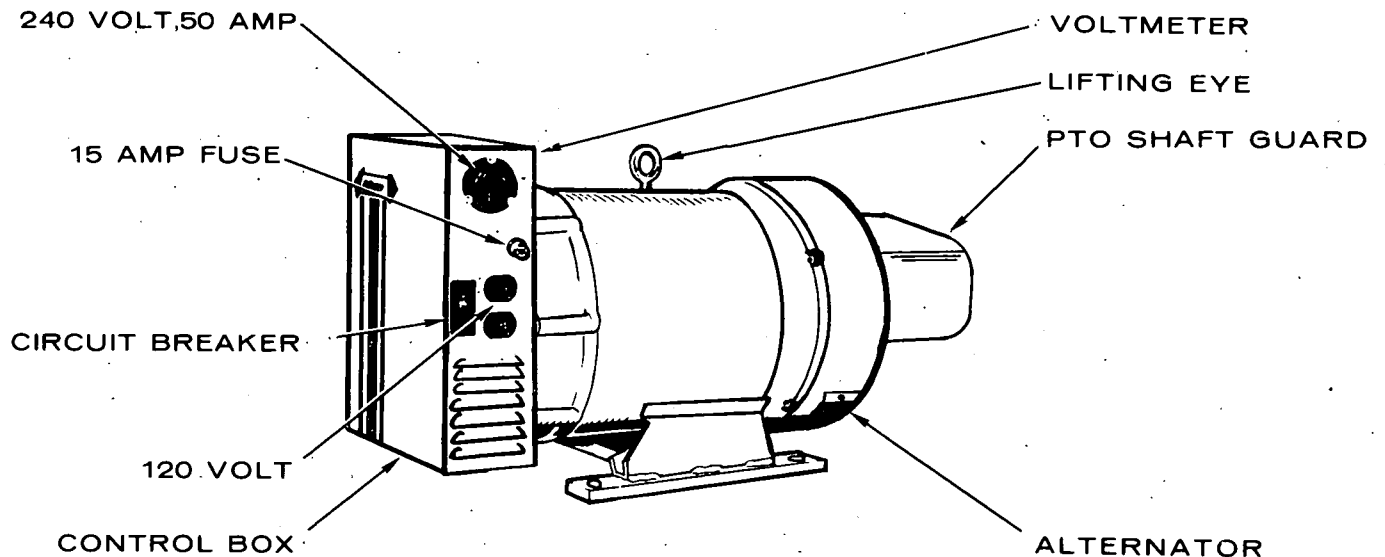
OPTIONAL ACCESSORIES

Power Take-Off Shaft: Telescoping, shielded, heavy duty power take-off shafts, recommended for use with PTO powered, gear drive alternators provide maximum safety for the operator. The splined universal joint with snap ring type shield and quick disconnect feature, fits a 1-3/8 inch tractor PTO drive. Telescoping power take-off shaft operating lengths are: minimum 45 inch, maximum 60 inch; weight 35 pounds. Six spline universal for 540 rpm PTO.

SPECIFICATIONS

	MODEL 20005	MODEL 20006
Watts	25,000	25,000
Volts	120/240	240 *
Phase	1	3
Hertz	60	60
Current (Amperes)	104	60
Power Factor	1.0	1.0
Wire	4	4
Static Exciter	Yes	Yes
Alternator Speed (RPM)	1800	1800
Tractor Speed (RPM)	540	540
Minimum Horsepower Required, Driving Source	50	50
Gear Ratio	3.32 : 1	3.32 : 1
Gear Box Oil Capacity, Pints	1/2	1/2
Recommended Gear Lubricant	SAE 90	SAE 90
Weight	460	460

* Delta wound, one phase center tapped to deliver 120/240, single phase power in capacities to 20 KW (84 amperes).



LOCATION

1. **Ventilation:** The alternator creates considerable heat when operating under load conditions. It is important that this heat be dissipated by proper ventilation. If the alternator is installed inside a small room or compartment, provide a vent for exhausting the air heated by the alternator. Locate the heated air exhaust vent above the inlet vent. Heated air is discharged from the drive-shaft end of the alternator.

2. **Convenience to Driving Power:** Locate the alternator for easy connection to the tractor. Align the power take-off to the alternator. Stay within the limits of the power take-off shaft.

4. Servicing Convenience: Allow at least 24 inches of space on all sides of the alternator.

5. **Wiring Convenience:** Do not locate the alternator in a location difficult to service or which would

MOUNTING THE ALTERNATOR

Technical drawing of a gear pump assembly, showing front and side views with dimensions and callouts.

Front View Dimensions:

- Overall width: $15\frac{13}{16}$
- Distance from centerline to mounting flange: $7\frac{7}{16}$
- Overall height: $18\frac{1}{4}$
- Distance from base to centerline: $15\frac{7}{16}$
- Distance from centerline to mounting flange (inner): $6\frac{1}{4}$
- Distance from centerline to mounting flange (outer): $4\frac{1}{8}$
- Overall distance from base to mounting flange: $12\frac{1}{2}$
- Distance from base to mounting flange (inner): $2\frac{5}{8}$
- Distance from base to mounting flange (outer): 8
- Distance from base to mounting flange (inner): $5\frac{1}{8}$

Side View Dimensions:

- Overall length: $35\frac{3}{4}$
- Distance from front flange to rear flange: $12\frac{5}{16}$
- Distance from front flange to rear flange (inner): 12
- Distance from front flange to rear flange (outer): 14

Callouts:

- $\frac{3}{8}$ DIA. 6 SPLINE PER SAE J718
- ALTERNATE POSITION GEAR BOX
- $\frac{21}{32}$ DIA. 4 MTG. HOLES

FIGURE 1. INSTALLATION OUTLINE

CAUTION

To develop 25 KW requires 50 to 55 horsepower at the power takeoff. The torque will flip the alternator over unless secured to a strong substructure. A narrow (30 inch) trailer is not

suitable for operation. Forty inch hub-to-hub minimum measurement is required.

Be sure that the alternator is properly aligned with the driving mechanism and that it will stay in alignment.

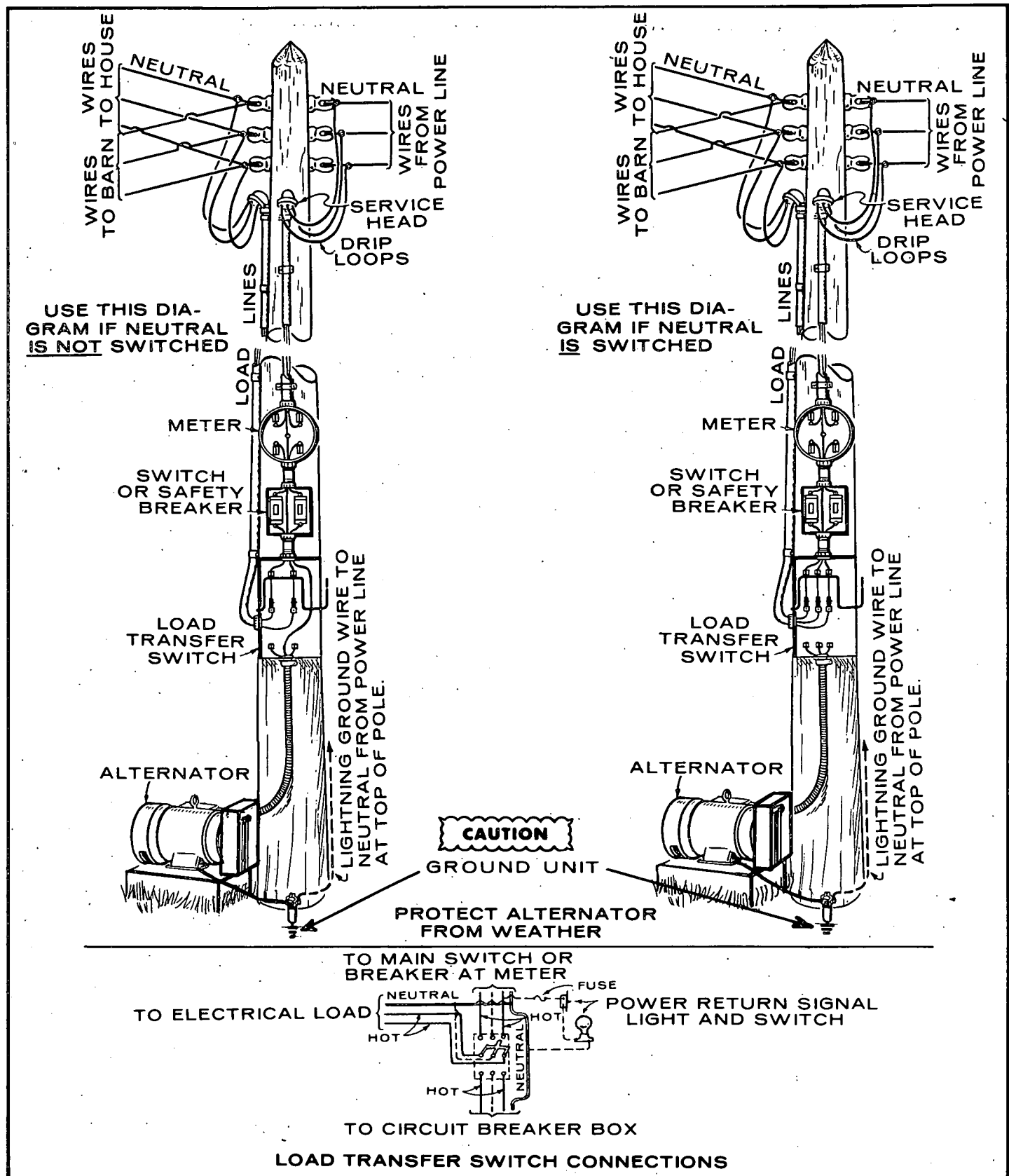


FIGURE 3. TYPICAL FARM STANDBY

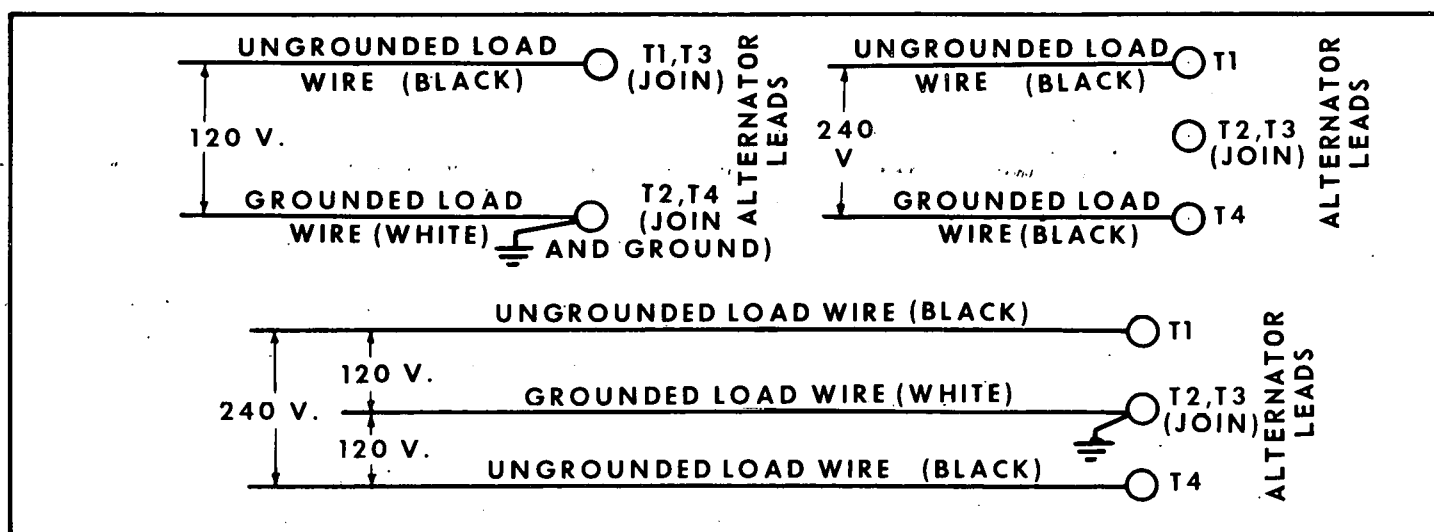


FIGURE 4. WIRING CONNECTIONS, SINGLE PHASE

CONNECTING THE ALTERNATOR WIRES (FIGURES 4 AND 5)

Connect the alternator leads inside the control box before putting the alternator into operation. See wiring diagram and also connection sketches. Connect the lower circuit breaker terminals to the load transfer switch with a flexible conduit, cable, or some other type of flexible lead wire.

NOTE: Any combination of 1 phase and 3 phase loading can be used at the same time as long as the current for any one lead does not exceed the nameplate rating of the alternator.

BALANCING THE LOAD

CAUTION

Serious overloading can damage the alternator windings!

When two or more single phase circuits are available, do not overload any one circuit — divide the load equally between them. To determine the amount of current available on each single phase circuit, subtract the higher voltage load or 3 phase load (whichever applies) from the rated output and divide the remainder

by the quantity of single phase circuits. **EXAMPLE:** On a 25,000 watt, 3 phase, 4 wire alternator, if 10,000 watts of 3 phase are used, a remainder of 15,000 watts are available to be equally divided among the three single phase circuits. Thus, only 5000 watts would be available on each of the three single phase circuits.

INSTALLING THE LOAD TRANSFER SWITCH

Before the alternator can be used for emergency purposes, a DOUBLE THROW LOAD TRANSFER SWITCH must be installed. The switch must have an ampere rating large enough to carry the total load when the main source of power is in use. Follow the local electrical code. The load transfer switch should always be installed close to the main line switch, and between the main line switch and the load. When properly installed, the load transfer switch in one position will connect the electrical load to the highline. When the load transfer switch is thrown to the other position, the load is first disconnected from the main source of power, and then connected to the standby alternator. Using the load transfer switch makes it impossible

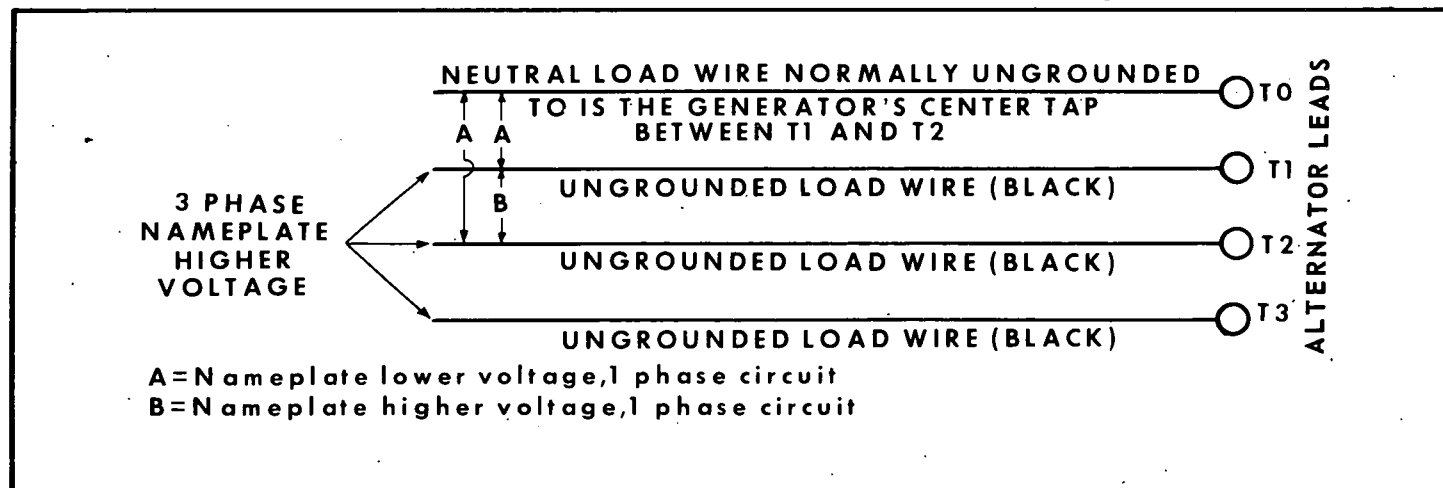


FIGURE 5. WIRING CONNECTIONS, THREE PHASE

to connect the alternator to the main source of power. The load lines must connect to the center terminals of the transfer switch. The alternator leads and the main power source leads must be connected at OPPOSITE ends of the switch. Refer to Figure 7.

POWER RETURN SIGNAL

When the alternator is used for emergency applications, a pilot light or alarm signal should be installed to indicate when the power is restored and the alternator can be disconnected. Connect a signal light across the regular power line, just ahead of the load transfer switch. Install an on-off switch and a fuse for the signal light. When a power failure occurs, snap the signal switch to the ON position before putting the alternator into operation. When the normal power returns, the signal will operate and the alternator can then be disconnected. Refer to Figure 7.

COMBINATION SINGLE AND THREE PHASE LOAD TRANSFER CONNECTIONS

Two load transfer switches and additional wiring are required to connect one standby delta alternator in locations where separate 1-phase and 3-phase power lines normally supply the power. A 3-pole double throw switch alternately connects the 240 volt 3-phase alternator motor loads. A 2-pole double throw switch alternately connects the 120/240 volt 1-phase line transformer power or the 1-phase alternator power to the 120 volt and 240 volt loads. The alternator and load transfer switches should be located close to the power line transformer which carries the heavier load. Separate power lines must be installed to carry power from the alternator to the higher loads. Refer to Figure 6.

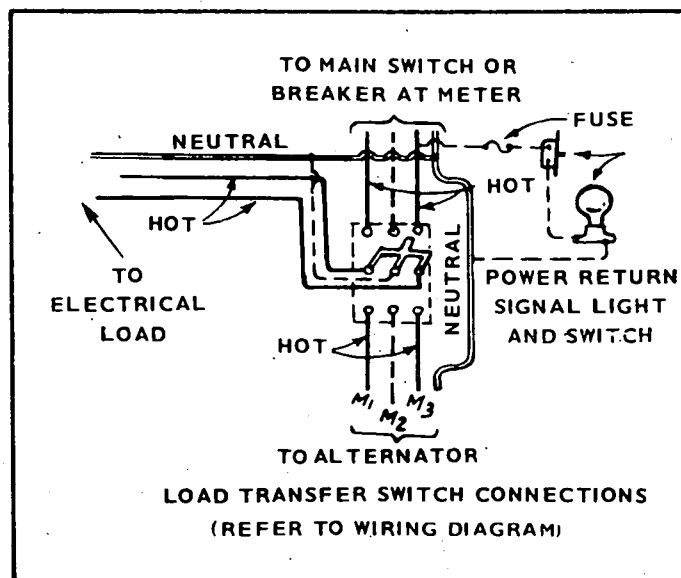


FIGURE 7. LOAD TRANSFER SWITCH

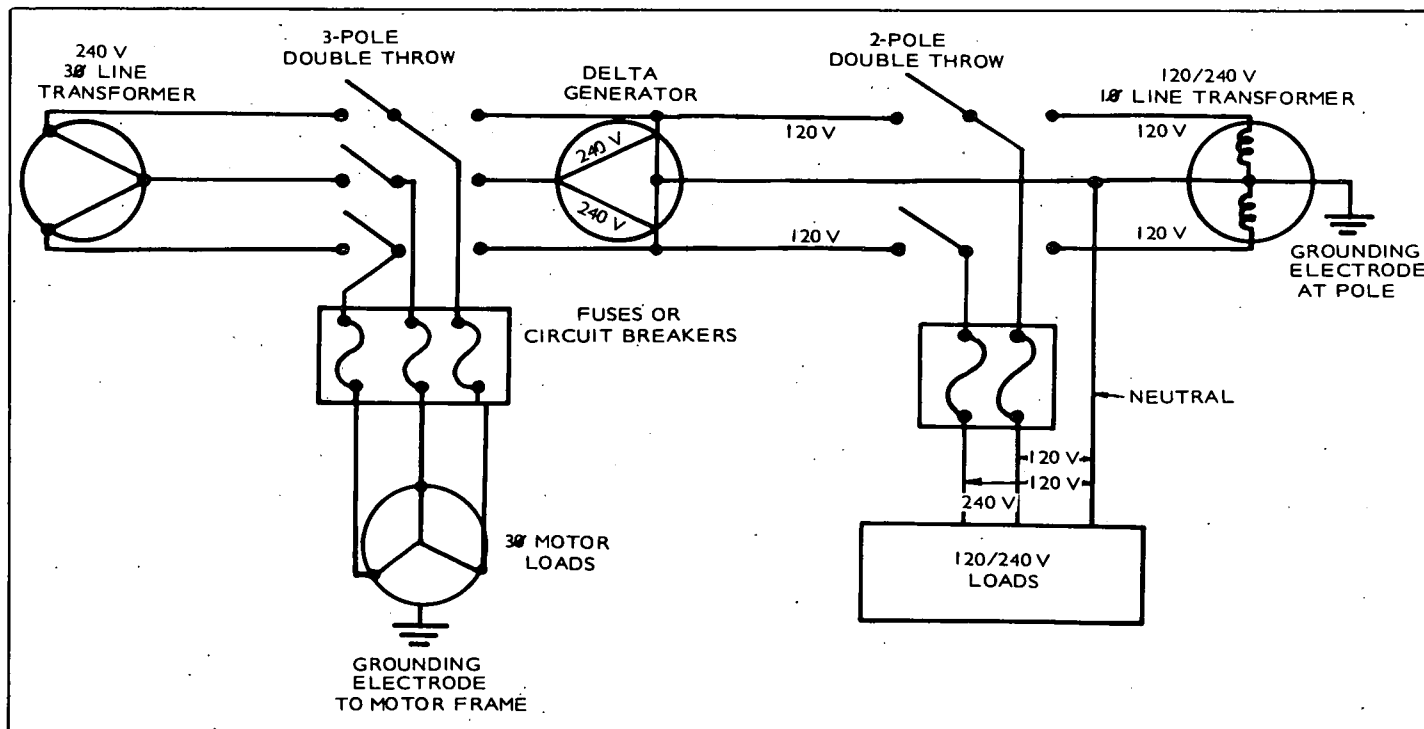


FIGURE 6. COMBINATION SINGLE AND THREE PHASE LOAD TRANSFER

OPERATION

STARTING

When a power failure occurs, the alternator should be ready to run and to take over the load. Set up the tractor and properly install the power take-off shaft. See Figure 8. Before engaging power take-off, proceed as follows in the order shown.

1. Alternator circuit breaker must be in the OFF position.
2. Connect power leads between the alternator and load transfer switch.
3. Throw transfer switch to connect load to alternator.
4. Turn power return signal ON if one has been installed.
5. Engage power take-off and bring PTO shaft speed to 542 rpm. The alternator speed at this time will be 1800 rpm (60 hertz). The voltmeter on the alternator control box will read approximately 250 volts.

OPERATING

With alternator running, throw the alternator line disconnect switch to the ON position. The various electrical loads can then be connected. When motor loads are connected, connect one at a time, allowing each to reach running speed before connecting the next one. Motors require four to five times more current for starting than for running at normal speed. If several motors are started at the same instant, the total electrical load may overload the alternator, causing the circuit breaker to operate.

If the alternator voltage is not at the proper value, it may be necessary to advance or retard the engine throttle control. In some cases, it may be necessary to change the engine throttle setting when large changes in the electrical load are made.

Keep the alternator load within its nameplate rating. If the alternator is seriously overloaded the circuit breaker will automatically trip, disconnecting the entire electrical load. Reduce the load before throwing the circuit breaker back to the ON position.

If the tractor engine has very little reserve power, use care when operating the alternator. For example, if a 50 or 55 horsepower (at the power take-off) engine is used to drive a 25,000 watt alternator, the engine throttle will be wide open at full alternator load. If most of the electrical load is suddenly removed, the governor cannot act quickly and smoothly enough to prevent a surge of speed and high voltage. Any electrical equipment left connected may be damaged by the resulting high voltage.

When disconnecting large portions of the load, disconnect one piece of equipment at a time, or first disconnect that part of the load which will be left on. Then remove the rest of the load. Wait until the alternator voltage has stabilized and then reconnect that part of the load which will be left on. The alternator voltage will remain relatively stable, and the tractor engine speed will not change or surge enough to cause any damage if this procedure is followed.

OUTPUT VOLTAGE

Output voltage can be adjusted over a range of 5% by changing the location of the slide clip on the control resistor in the exciter. Be sure speed and frequency are correct before making an adjustment.

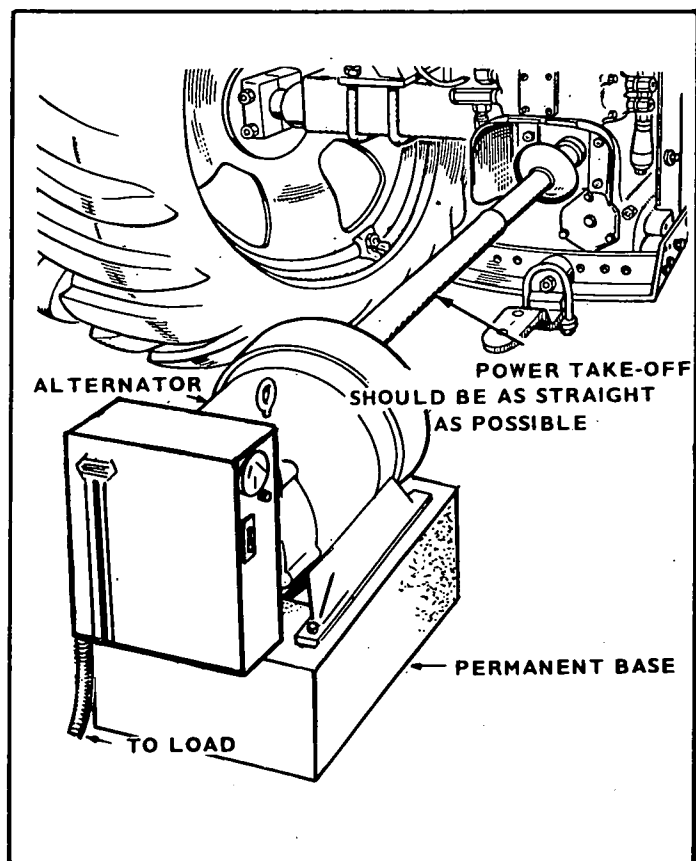


FIGURE 8. TRACTOR CONNECTION

SERVICE AND MAINTENANCE

PERIODIC SERVICE AND INSPECTION

Follow a definite schedule of inspection and servicing. Make a good visual check before, while, and after alternator is operating; look for loose or broken leads and bad connections.

GEAR BOX LUBRICATION

Use only SAE 90 multi-purpose gear lubricant.

Drain the gear box after the first 100 hours of operation and refill with fresh lubricant of the recommended grade. Repeat this procedure every six months thereafter, or every 100 hours.

Maintain the proper oil level between changes. Overfilling will cause foaming, which can lead to an oil leak due to overheating. Remove the filler plug on top of the case and the oil level plug from the face of the gear case. Fill the case until the oil just begins to flow from the oil level plug hole. Gear box holds 1/2 pint U.S. Measure. Replace both plugs. See Figure 9.

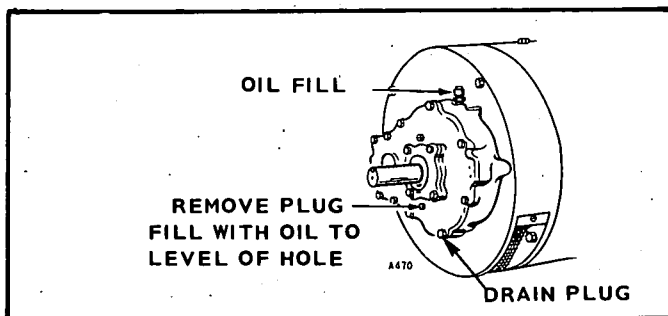


FIGURE 9. GEAR BOX LUBRICATION

POWER TAKE-OFF SHAFT

Grease the universal joints at least every 25 operating hours. Under adverse conditions, grease the joints as required, possibly every 4 to 8 hours. Never operate the alternator with the shield removed from the power take-off shaft.

SLIP RINGS

Slip rings must be clean and free of scratches and burrs (do not remove the dark brown film). If necessary to use an abrasive on the slip rings, use No. 00 sandpaper, never emery cloth or other conducting abrasives.

If rings are grooved, out of round, pitted, or rough so brushes seat poorly, remove rotor and refinish rings in a lathe. Remove or shield the bearing during refinishing.

BEARINGS

The ball bearings are double sealed and lubricated for life. If the ball bearings become noisy, worn, or otherwise defective, replace them. Remove the old ball bearings with a gear puller and drive or press new ones into place.

BRUSHES

To examine the brushes, brush springs and slip rings, remove the exciter cover from the alternator. Remove the screws from the right side of the exciter plate and swing the exciter assembly outward. To remove the brushholders, unscrew the four machine screws from the end bell, Figure 10. Do this every 500 hours.

Replace the brushes when they wear to about 5/16 inch in length. Order replacement brushes by part number, never by description; similar brushes may have different electrical characteristics.

WARNING

Be careful when working on an alternator that is running. Electric shock hazard is present. We suggest that only a qualified mechanic or electrician perform these tests.

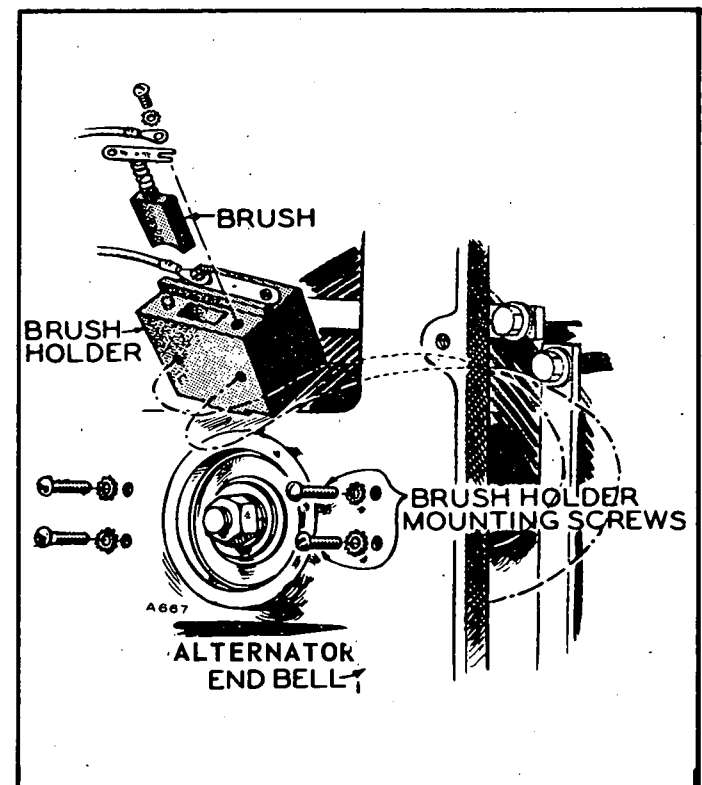


FIGURE 10. BRUSH REMOVAL

FLASHING THE FIELD

If there is no voltage buildup, remove the exciter cover, and with the alternator running, press the residual reset button. If there still is no voltage buildup, flash the alternator field. Proceed as follows:

1. Using a 6 volt dry cell battery, connect leads as shown in Figure 11 (positive to F1 and negative to F2).
2. Connect voltmeter leads to E1 and E2.
3. With the alternator running, close the switch momentarily to energize the buildup circuit. Watching the voltmeter:
 - A. If voltage now builds up normally, the trouble was due to a residual voltage loss in the field.
 - B. If voltmeter indicates low voltage, the exciter is at fault (refer to Exciter Troubleshooting Guide).
 - C. If there is too much voltage, and the alternator is running at correct speed, the trouble is in the exciter.
 - D. If there is no voltage buildup, the alternator is probably at fault (refer to Alternator Troubleshooting Guide).

CHECKING STATIC EXCITER (PAGE 11)

Troubles are listed in advancing order, from no output voltage to rated but fluctuating output voltage. The relationship between trouble and cause is not always consistent from model to model, so the following information must be used as a guide, not an absolute rule. The numbers that appear in the column headed "PROCEDURE" refer to the procedure number for testing particular components. The testing procedures are located at the end of the chart. When the word "NONE" appears in that column, all the information needed to complete the check is provided in the column headed "CORRECTIVE ACTION". Use a multimeter to check continuity, voltage and resistance as indicated in the tests.

NOTE: It is imperative that the testing procedures are completely understood by the serviceman before attempting to perform corrective maintenance.

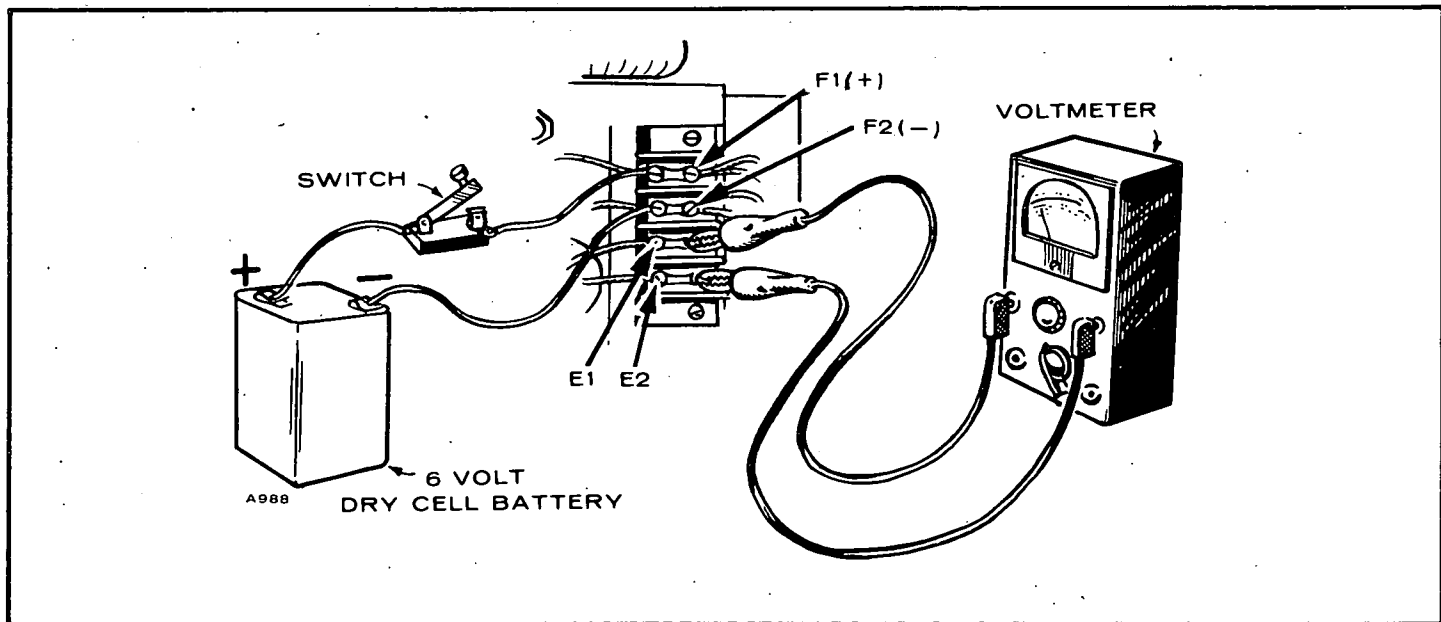


FIGURE 11. FLASHING THE FIELD

EXCITER TROUBLESHOOTING GUIDE

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	PROCEDURE
Alternator will not build up voltage.	Circuit breaker in "off" or "tripped" position.	Reset and close breaker.	None
	Open in circuit breaker.	Stop alternator and check breaker continuity.	None
	No AC power to Static Exciter.	Check AC voltage at E ₁ -E ₂ with the alternator operating. Voltage should be five percent of the rated voltage. If not, check continuity from E ₁ -E ₂ back to alternator.	None
	Partial loss of residual in rotor.	With alternator operating, jumper from E ₂ to heat sink of field rectifier Z until voltage begins to build-up. Then remove.	None
	Pair of field rectifiers open (either W & Z or X & Y).	Test rectifiers and replace if defective.	(1)
	Both field rectifiers X and Y shorted.	Test rectifiers and replace if defective.	(1)
Output voltage slow to build up. Circuit breaker opens in about five seconds.	Either field rectifier X or Y shorted.	Test rectifiers and replace if defective.	(1)
Output voltage slow to build up and five percent below rated voltage after build up. Voltage regulation poor.	Either field rectifier W or Z shorted.	Test rectifiers and replace if defective.	(1)
Output voltage slow to build up and higher than rated voltage after build up.	Open circuit in one or more control rectifier.	Test rectifiers and replace if defective. Check soldered connections to rectifiers.	(1)
Output voltage slow to build up and ten to twenty percent above rated voltage after build up.	Open in one field rectifier.	Test rectifiers and replace if defective.	(1)
	Open circuit in gate winding G ₁ -G ₂ of reactor A or B.	If field rectifiers Y and Z check okay, check continuities of gate windings G ₁ -G ₂ .	(2)
Output voltage builds up normally but less than rated voltage after build up.	Shorted winding in control reactor.	Test control reactor and replace if defective.	(3)
Output voltage builds up normally with slightly less than rated voltage at no load and low voltage at full load.	Compound winding S ₁ -S ₂ installed backward or has open circuit.	Check wiring diagram for polarity of compound windings through reactors A and B and test for continuity.	None
Output voltage builds up normally but 20 percent above rated voltage after build up. Voltage regulation poor.	Compound winding S ₁ -S ₂ installed backward through one reactor (A or B).	Check wiring diagram for polarity of compound winding through reactor A or B.	None
Output voltage builds up normally but is twenty five percent above rated voltage after build up.	Open circuit in control rectifier bridge.	Check continuity from the junction of control rectifiers Z and Y to the junction of control rectifiers X and W.	None
Output voltage builds up normally but 125 to 150 percent above rated voltage after build up.	Shorted turn in gate winding G ₁ -G ₂ of reactor A or B.	Test reactors A and B for shorted turns and replace if defective.	(2)

EXCITER TROUBLESHOOTING GUIDE (CONTINUED)

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION	PROCEDURE
Output voltage builds up normally but 150 to 200 percent above rated voltage after build up. No regulation possible.	Control winding C ₁ -C ₂ of reactor A or B polarized incorrectly.	Check circuit connections of both reactors A and B.	None
	Shorted turn in control winding C ₁ -C ₂ or reactor A or B.	Test reactors A and B for shorted turn and replace if defective.	(2)
	Open in control circuit.	Check continuity from E ₁ to E ₂ through control circuit.	None

PROCEDURE 1 - CHECKING RECTIFIERS

Disconnect one lead from, or remove, each rectifier for its individual test.

NOTE: *Observe carefully the mounting direction of any rectifier removed. It must be remounted in its original direction.*

- Connect an ohmmeter across the rectifier contacts and observe the meter reading.
- Reverse the connections and compare the new reading with the first reading.
- If one reading is considerably higher than the other reading, the rectifier can be considered satisfactory. However, if both readings are low, or if both are high which indicates an "OPEN" circuit, replace the rectifier with a new identical part.

PROCEDURE 2 - CHECKING REACTORS "A" and "B"

NOTE: *Use an accurate ohmmeter when checking resistance values. Resistance readings between "G1" and "G2" cannot be read with accuracy on a multimeter.*

- Set the resistance range selector on the ohmmeter to the proper range.
- Isolate one gate winding by disconnecting either end of gate winding G1-G2 from its point of connection. Measure the resistance in the gate winding across G1-G2. Reading should be 0.66 ohms.
- Isolate one control winding by disconnecting either lead C1 or C2 from its point of connection. Measure the resistance in the control winding across C1-C2. Reading should be 5.5 ohms.
- Connect one meter lead to the disconnected gate winding lead and the other meter lead to the disconnected control winding lead and check for continuity.

Results:

- REACTOR IS SERVICEABLE if resistance is

within 20 percent either way of the value listed and there is no continuity between the control and gate windings.

- REACTOR IS DEFECTIVE if there is an open circuit in either the gate or the control windings. Continuity between the gate and the control windings is also an indication of a defective reactor. In either case, the reactor should be replaced.

PROCEDURE 3 - CHECKING CONTROL REACTOR

- Isolate the control reactor by disconnecting common lead "C" from its point of connection and carefully measure the resistance from this lead to the numbered lead on the control reactor. Reading should be 12.5 ohms.

Results:

- CONTROL REACTOR IS SERVICEABLE if resistance is within 10 percent of the value specified.
- CONTROL REACTOR IS DEFECTIVE if no continuity is indicated between the common lead "C" and the numbered lead, indicating the presence of an open circuit.

PROCEDURE 4 - CHECKING RESISTORS

The resistors must be checked with a multimeter adjusted to appropriate range of resistances. See Static Exciter wiring diagram on page 15 for correct values.

- Isolate the resistor by disconnecting one end from its point of connection and carefully measure the resistance.

Results:

- RESISTOR IS SERVICEABLE if the measured resistance falls within 20 percent of the value specified in the wiring diagram.
- RESISTOR IS DEFECTIVE if there is no continuity through the resistor which indicates an open resistor. If the measured resistance exceeds the percent limits either way, the stabilizing resistor can be adjusted to bring the resistance within the required limits.

ALTERNATOR TROUBLESHOOTING GUIDE

NATURE OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Alternator voltage will not build up.	Residual magnetism gone. Dead short in load. Exciter defective. Open circuit, ground or short in revolving field. Open circuit, ground or short in stator.	See paragraph on Flashing the Field. Inspect load and correct. See Exciter Troubleshooting Guide. Refer to Alternator Testing. Refer to Alternator Testing.
Current unsteady but engine speed not fluctuating.	Loose connection. Poor brush contact.	Clean and tighten connections. Reseat or replace brushes. Clean slip rings.
Frequency drops under heavy load.	Low engine power.	Use adequate source of engine power.
Voltage drops under heavy load, little frequency change.	Defective exciter.	See Exciter Troubleshooting Guide.
Alternator won't deliver rated current.	Unbalanced load on lines. Defective exciter. Defective field windings.	Adjust load. See Exciter Troubleshooting Guide. Test and replace if defective.
Alternator overheats.	Overloaded. Partial short in load. Poor ventilation.	Reduce load. Correct short. Increase ventilation.
Incorrect output voltage.	Voltage output control resistor adjusted incorrectly. Engine governor set wrong speed. Defective exciter	Adjust slide tap for proper output. Check engine speed, adjust governor. See Exciter Troubleshooting Guide.
Noise in alternator	Defective bearing. Collector rings out of round.	Replace. Turn down in lathe.

ALTERNATOR TESTING

Most alternator tests can be performed with an ohmmeter. See Figure 12.

1. Rotor Continuity—Remove the brushes so none touch the slip rings. Using an ohmmeter, test for grounding between each slip ring and the rotor shaft. Test for a short circuit in the rotor winding by measuring resistance in the winding. It should measure between 2.0 and 2.5 ohms at 70°F. Replace the rotor if it is grounded, or has an open or short circuit.
2. Stator Continuity—Disconnect the alternator leads to the load in the control box. Use the wiring diagram to determine the output lead coding. Using an ohmmeter, check each winding of the stator for grounding to the laminations or frame. Using an accurate ohmmeter, test the resistance of each stator winding. Compare the resistances obtained. All windings of equal output voltage should indicate about the same resistance. An unusually low reading indicates a short, a high reading an open circuit. If the ohmmeter required for this test isn't available, check for open circuits with the test lamp.

If any windings are shorted, open-circuited or grounded, replace the stator assembly. Before replacing the assembly, check the leads for broken wires or insulation. Replace any defective lead. If this doesn't correct the fault, replace the assembly. It isn't practical to attempt to rewind a defective stator except at a competent rewinding shop.

ALTERNATOR DISASSEMBLY

The rotor weighs over 100 pounds, so use care when sliding it in the stator. Disassemble only as much as is required to repair the alternator. Almost all tests can be accomplished without disassembling the alternator. If tests indicate that the rotor or stator is defective, disassemble the alternator as follows:

1. Disconnect the power take-off shaft.
2. Remove the exciter cover and exciter screws.

Swing out exciter. Remove brushholder screws (Figure 9) and lift the brushholders so they are fully clear of the slip rings.

3. Remove the rear end bell screws.
4. Carefully slide the gear box, rear end bell and rotor out from the stator. Support the rotor when the field coils are just about clear of the stator.
5. To remove the gear box from the rear end bell, first drain the oil. Remove the gear box cover to gain access to the gear box mounting screws.
6. Remove the six socket-head screws which secure the gear box.
7. To remove the rear end bell from the rotor, pull the pinion gear with a gear puller.
8. Remove the oil seal and adapter assembly from the rear end bell.
9. Remove the bearing retaining ring.
10. Pull the rear end bell from the rotor.
11. If necessary to pull the bearings, first remove the retaining ring, and then use a gear puller.

ALTERNATOR ASSEMBLY

Be sure all bearing surfaces and oil sealing surfaces are clean. Best balance is achieved by assembling the rotor, rear end bell and gear box before sliding the rotor back into the stator.

1. With bearing retaining plate on the rotor shaft, press the bearing back into place. Install the retaining ring.
2. Position the rear end bell on the bearing.
3. Secure the oil seal and adapter in place.
4. Press the pinion gear onto the rotor shaft so the end of the rotor shaft is flush with the outside face of the gear.
5. With the "O" in place on the oil seal and adapter assembly, install the gear box. Secure with the socket-head screw.
6. Install the gear box cover.
7. Oil capacity of the gear box is about 1/2 pint. Do not overfill. Remove the filler plug on top of the gear case and the oil level plug on the front of the gear case. Fill the case until the oil just begins to flow from the oil level plug hole.

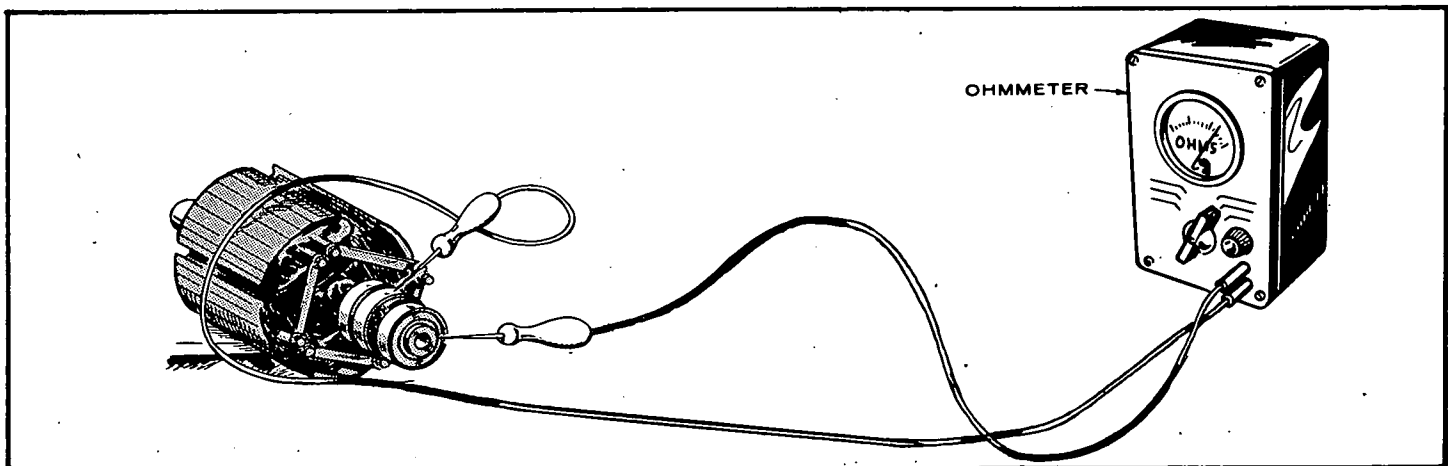
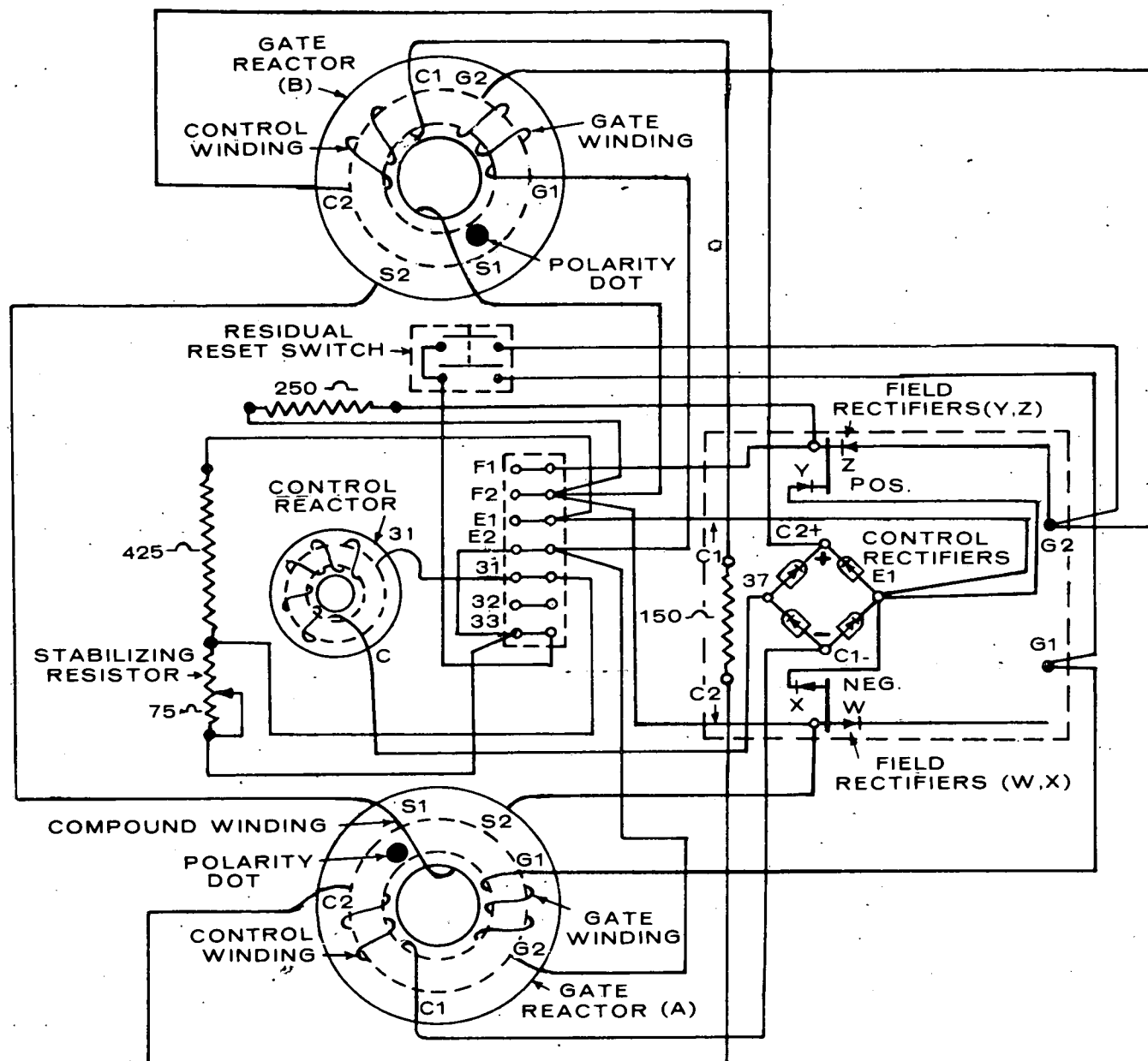
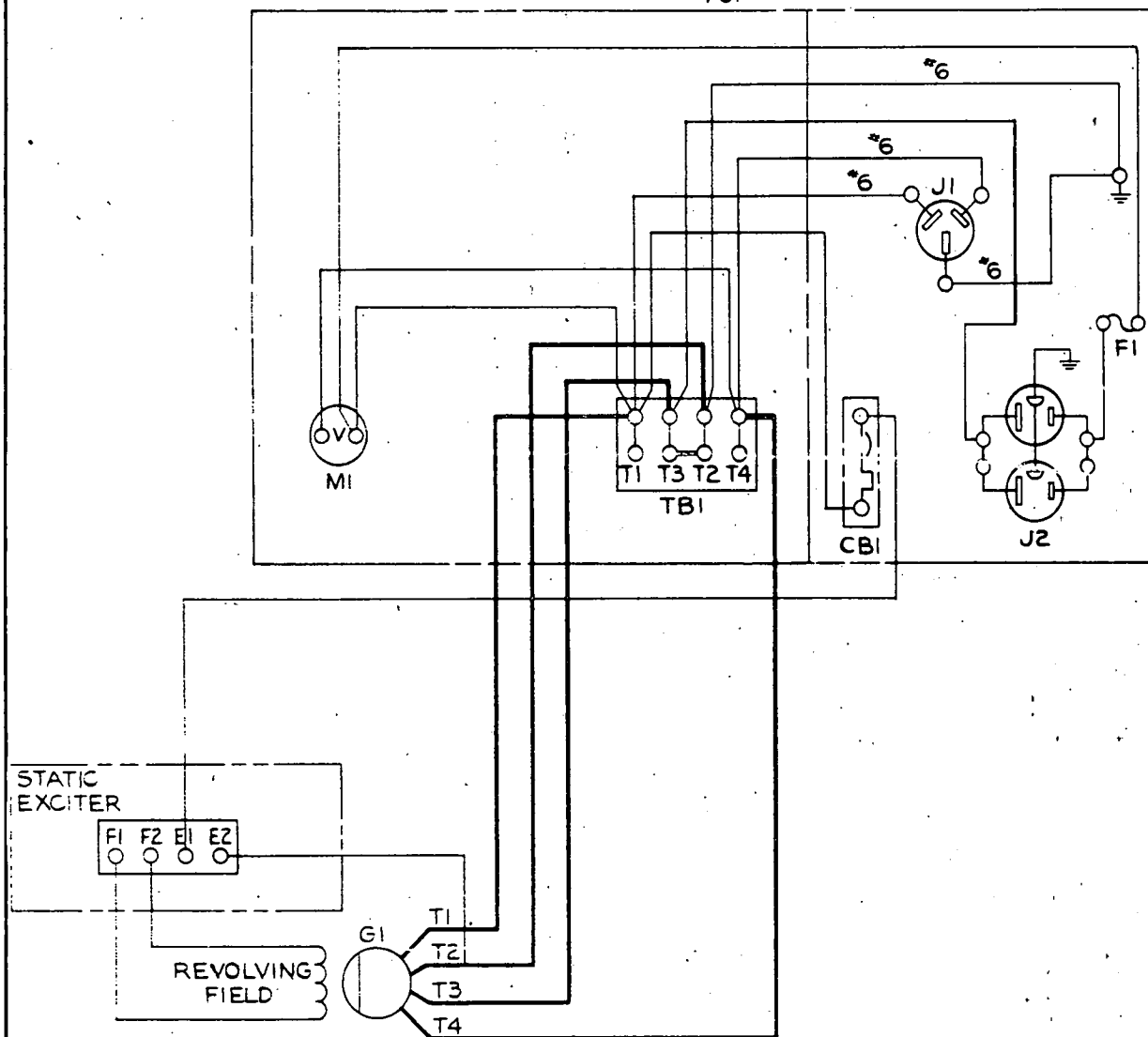


FIGURE 12. ARMATURE TESTING



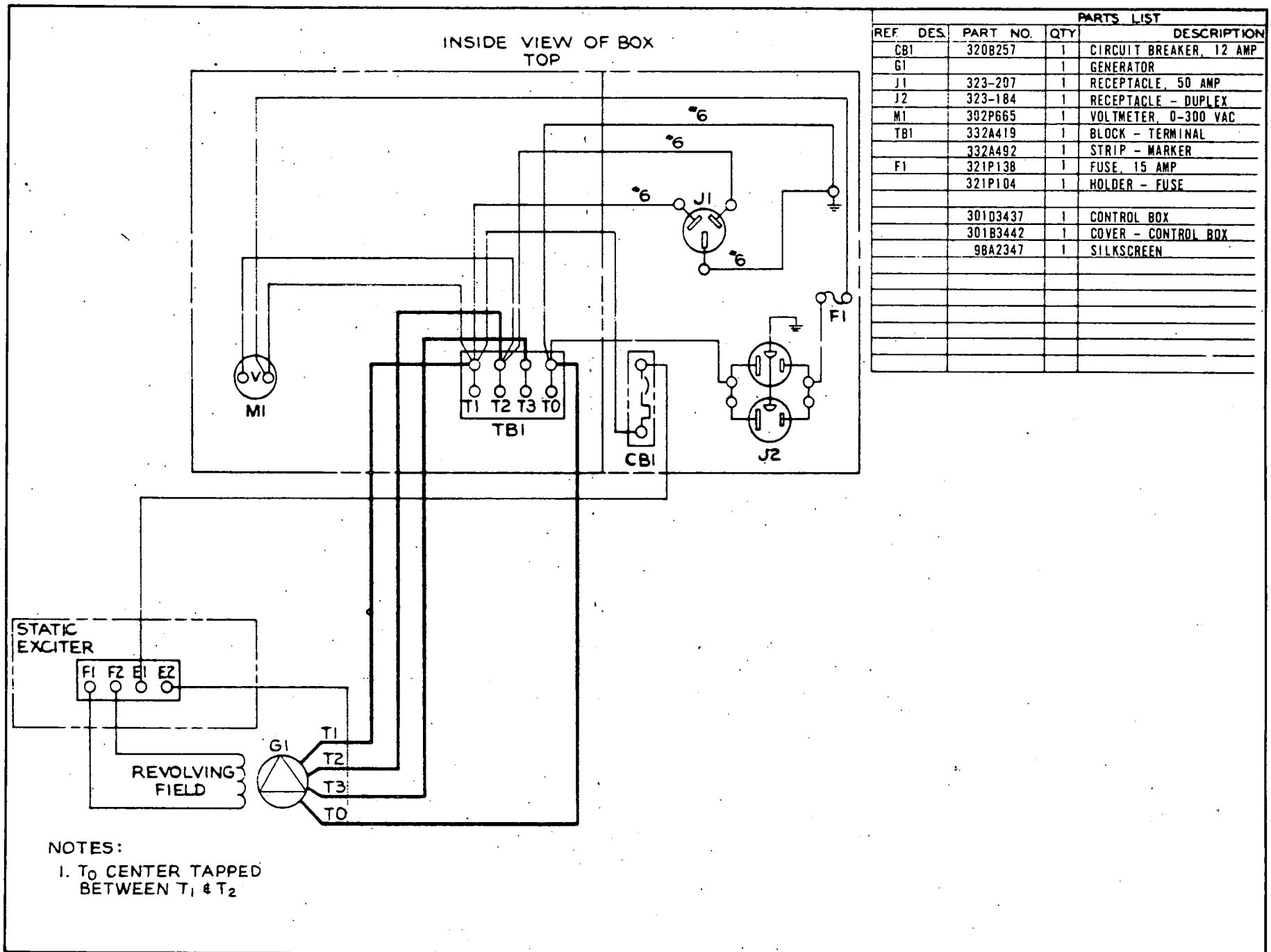
NOTE: WHEN GATE REACTORS ARE MOUNTED ON ALTERNATOR
THE POLARITY DOTS WILL BE ON TOP OF EACH REACTOR.

STATIC EXCITER WIRING DIAGRAM



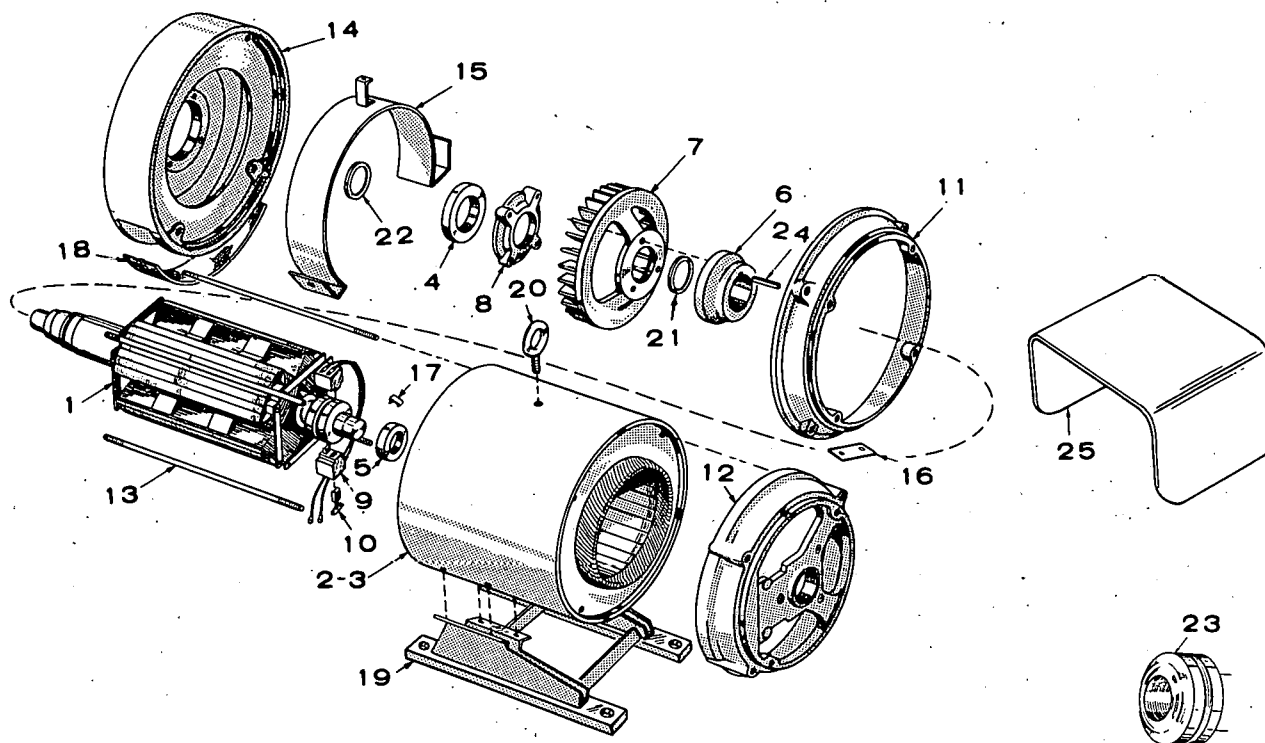
PARTS LIST			
REF.	DES.	PART NO.	QTY DESCRIPTION
	CBI	320B2	1 CIRCUIT BREAKER, 15 AMP
	G1		1 GENERATOR
	J1	323-297	1 RECEPTACLE, 50 AMP
	J2	323P184	1 RECEPTACLE - DUPLEX
	M1	302P665	1 VOLTMETER, 0-300 VAC
	TB1	332A419	1 BLOCK - TERMINAL
		332A744	1 STRIP - MARKER
		332A440	1 JUMPER
	F1	321P138	1 FUSE, 15 AMP
		321P104	1 HOLDER - FUSE
		301D3437	1 CONTROL BOX
		301D3442	1 COVER - CONTROL BOX
		98A2347	1 SILKSCREEN

WIRING DIAGRAM – MODEL 2000S



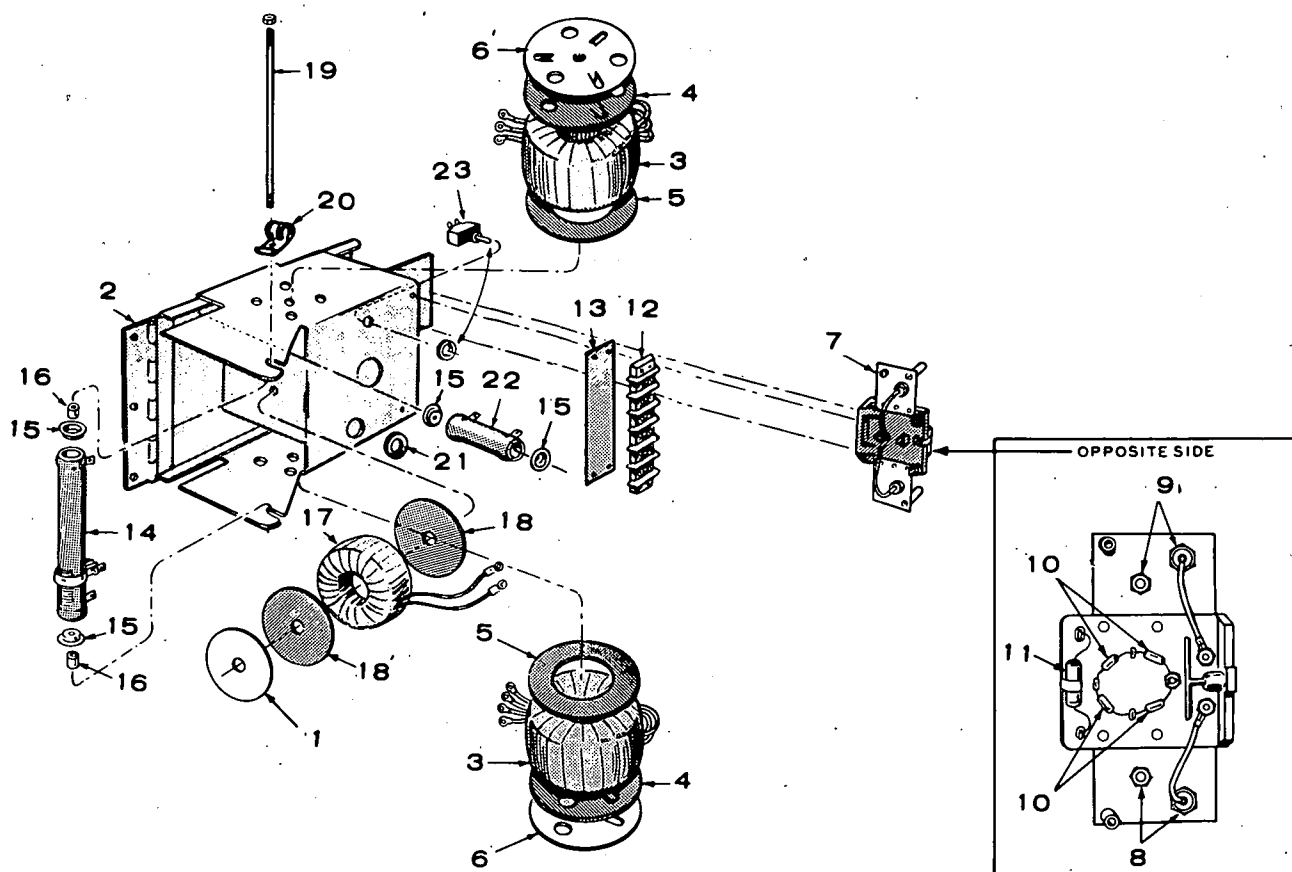
WIRING DIAGRAM — MODEL 20006

PARTS CATALOG



ALTERNATOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	201-1153	1	Rotor Assembly, Wound
2	220-1771	1	Stator, Wound 120/240 Volt, 3 Phase
3	220-1769	1	Stator, Wound 120/240 Volt, 1 Phase
4	510-0063	1	Bearing, Drive End
5	510-0047	1	Bearing, Exciter End
6	232-1591	1	Hub, Generator Blower
7	205-0045	1	Blower
8	232-1341	1	Plate, Bearing Retaining
9	212-1064	2	Block, Brush
10	214-0059	4	Brush, Collector Ring
11	231-0158	1	Adapter
12	211-0146	1	Bell, End
13	520-0498	4	Stud, Thru-Stator
14	211-0125	1	Bell, End-Rear
15	232-1028	1	Scroll, Air
16	232-2286	1	Plate, Cover
17	232-0596	1	Clip, Bearing Stop
18	232-1077	1	Screen, End Bell
19	232-1605	1	Base Assembly, Mounting
20	403-0622	1	Eye, Lifting - 1/2
21	518-0083	1	Ring, Retaining - Hub
22	518-0122	1	Ring, Retaining - Bearing
23	204-0061	1	Ring, Collector
24	515-0007	1	Key, Blower Hub
25	190-0319	1	Guard, Power Take-off

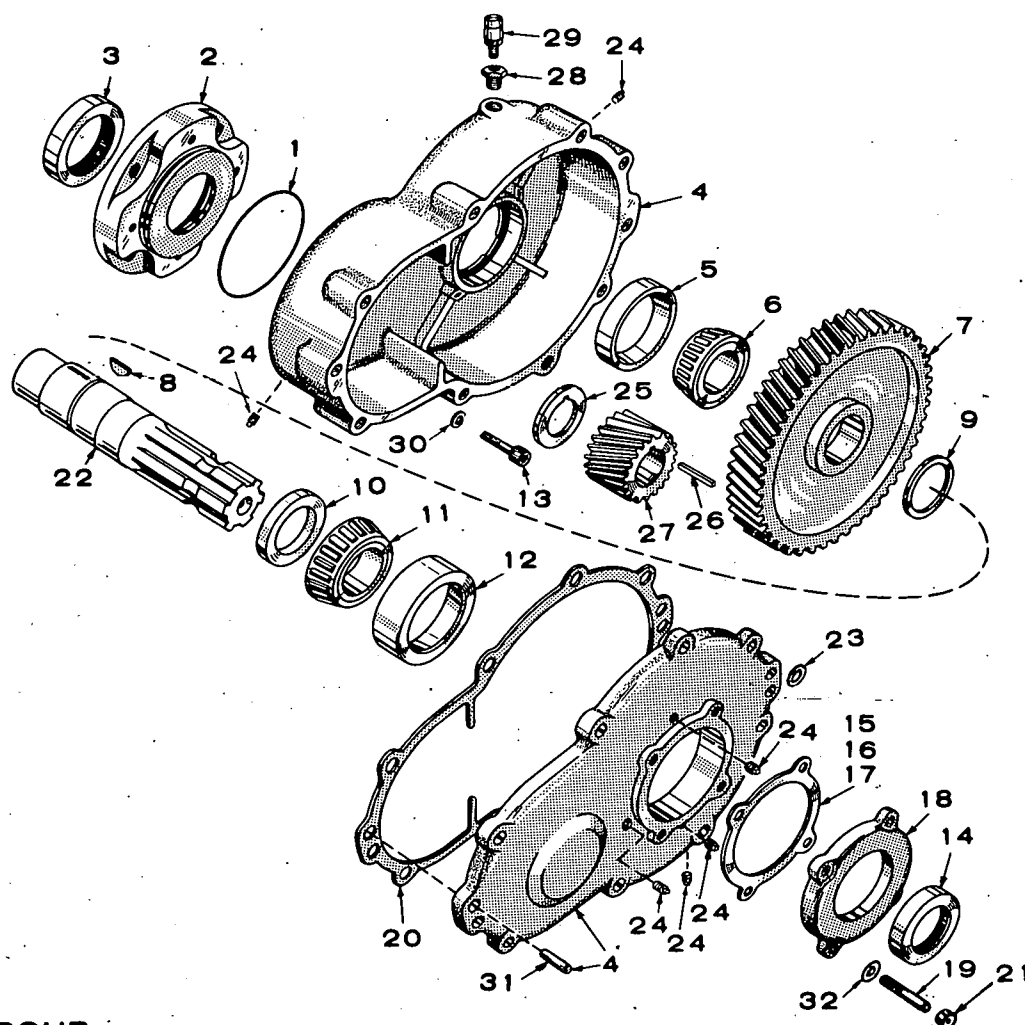


STATIC EXCITER GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	209-0008	1	Exciter Complete (Less Cover)
1	526-0173	1	Washer, Retainer, Voltage Control Reactor
2	234-0188	1	Panel Only, Exciter
3	315-0102	2	Reactor, Gate
4	232-1553	2	Gasket, Gate Reactor Mounting, Outer
5	232-1551	2	Gasket, Gate Reactor Mounting, Inner
6	232-1552	2	Retainer, Gate Reactor
7	305-0264	1	Rectifier Assembly, Resistor & (Includes Parts Marked *)
8	305-0238	2	*Rectifier Only, Power Field, Negative
9	305-0239	2	*Rectifier Only, Power Field, Positive

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
10	305-0240	4	*Rectifier, Voltage Control
11	304-0512	1	*Resistor (150-Ohm, 5 Watt)
12	332-0745	1	Block, Terminal
13	332-0746	1	Strip, Block Marker
14	304-0527	1	Resistor, Tapped, 500-Ohm (425 Fixed, 75 Adjustable)
15	304-0015	4	Washer, Resistor Centering
16	332-1474	2	Spacer, Resistor Mounting
17	315-0100	1	Reactor, Voltage Control
18	232-1548	2	Gasket, Voltage Control Reactor
19	520-0641	1	Stud, Tapped Resistor Mounting
20	332-0051	1	Clip, Tinnerman
21	508-0008	1	Grommet, Rubber, For 7/8" Hole
22	304-0510	1	Resistor, Fixed (250-Ohm, 25 Watt)
23	308-0175	1	Switch, Residual Reset

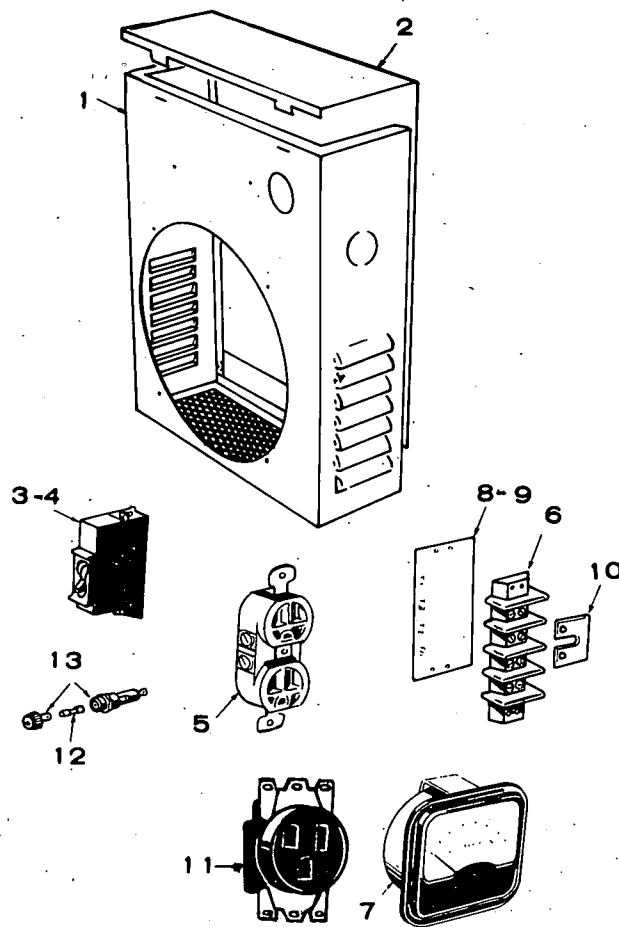
* - Included in 305-0264 Resistor and Rectifier Assembly.



GEAR BOX GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	190-0320	1	Gear Box Complete - Splined Shaft	13	802-0055	6	Screw, 5/16-18-x 1 Socket Head Gear Box to Rear End Bell
1	509-0099	1	Seal, "O" Ring	14	509-0016	1	Seal, Oil-Drive Shaft
2	190-0246	1	Adapter and Oil Seal Assembly, Gear Box	15	190-0017	As Req.	Shim - .009" Thick
3	509-0041	1	Seal, Oil - Included in 190-0246 Adapter Assembly	16	190-0018	As Req.	Shim - .012" Thick
4	190-0250	1	Housing Assembly, Gear - Includes Cover & Dowel Pins	17	190-0019	As Req.	Shim - .016" Thick
5	510-0022	1	Cup, Roller Bearing - Inside Bearing	18	190-0016	1	Plate, Bearing Retaining
6	510-0021	1	Cone, Roller Bearing - Inside Bearing	19	520-0756	4	Stud, Bearing Plate
7	190-0224	1	Gear, Driven (3.32 to 1 Ratio)	20	190-0021	1	Gasket, Gear Cover
8	515-0159	1	Key, Woodruff - Driven Gear	21	862-0001	4	Nut, Hex (1/4-20)
9	518-0013	1	Ring, Retainer - Driven Gear	22	190-0292	1	Shaft, Input - Splined
10	190-0202	1	Spacer, Gear - Between Driven Gear and Bearing Cone	23	526-0065	8	Washer (Copper), Flat, 5/16"
11	510-0023	1	Cone, Roller Bearing - Outside Bearing	24	505-0054	6	Plug, 1/4 Pipe - Gear Cover
12	510-0024	1	Cup, Roller Bearing - Outside Bearing	25	190-0195	1	Washer, Pinion Gear
				26	515-0142	1	Key - Pinion Gear
				27	190-0225	1	Gear, Pinion (3.32 to 1 Ratio)
				28	505-0007	1	Bushing, 1/4 x 1/8 Reducer
				29	518-0172	1	Fitting, Vent
				30	526-0065	6	Washer (Copper), Flat, 5/16"
				31	516-0012	2	Pin, Dowel - Included in 190-0250 Housing Assembly
				32	526-0063	4	Washer (Copper), Flat, 1/4"

CONTROL GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-3437	1	Box, Control
2	301-3442	1	Cover, Control Box
3	320-0257	1	Bracket, Circuit 120/240 Volt, 3 Phase
4	320-0002	1	Breaker, Circuit 120/240 Volt, 1 Phase
5	323-0184	1	Receptacle, 120 Volt Duplex
6	332-0419	1	Block, Terminal
7	302-0665	1	Meter, Volt - 0-300
8	332-0492	1	Strip, Marker 120/240 Volt, 3 Phase
9	332-0744	1	Strip, Marker 120/240 Volt, 1 Phase
10	332-0440	2	Jumper, Terminal - 120/240 Volt, 1 Phase
11	323-0894	1	Receptacle, 50 Amp.
12	321-0138	1	Fuse, 15 Amp.
13	321-0104	1	Holder, Fuse

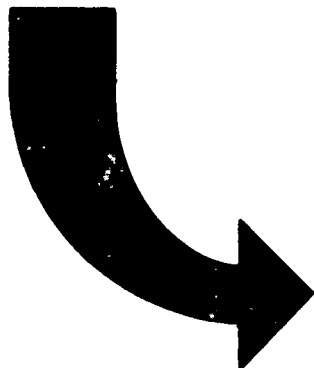
For PARTS, SERVICE & WARRANTY:

Always provide MODEL and SERIAL NO. found on Alternator nameplate when referring to any Surge Alternator. Contact the Authorized Surge Dealer from whom you purchased this equipment.

MODEL _____	
SERIAL _____	
ALWAYS MENTION MODEL & SERIAL NO.	
AC VOLTS _____	KVA _____ KW _____
AMPS _____	PF _____ CYCLES _____
PH _____	RPM _____
EXCITER DC VOLTS _____	AMPS _____
SURGE	
BABSON BROS. CO., OAK BROOK, ILL. 60521	
Babson Bros. Co. (Canada) Ltd., Port Credit, Ont.	
FILE NUMBER 3927	
99A1224 FOR ELECTRICAL EQUIPMENT ONLY	

IMPORTANT:

Please fill out this information and return card within 10 days in order to establish your warranty.



RETURN TO:
BABSON BROS. CO.
2100 S. YORK ROAD
OAK BROOK, ILLINOIS 60521

CUT ALONG DOTTED LINE AND DETACH

WARRANTY VALIDATION CERTIFICATE for SURGE ALTERNATOR	
Purchased from _____	
Dealer _____	
Address _____	
_____ Date purchased _____	
Model _____	Serial No. _____
Owner's Name _____	
Address _____	
Town _____	State/Province _____ Zip _____

***SURGE* ALTERNATOR WARRANTY**

BABSON BROS. CO. warrants to the original user of this Alternator, that its manufacture is free from defects in material and factory workmanship — if properly installed, serviced and operated under normal conditions according to BABSON BROS. CO.'s instructions.

BABSON BROS. CO.'s obligation under this warranty is limited to correcting without charge for a period of one year any part or parts thereof which shall be returned to its factory or authorized service stations (transportation prepaid by customer) — and which upon examination shall disclose to BABSON BROS. CO.'s satisfaction to have been originally defective. Correction of such defects by repair to or supplying of replacements for defective parts shall constitute fulfillment of all obligations to original user.

This warranty shall not apply to any Surge Alternator which must be replaced because of normal wear, which has been subjected to misuse, negligence or accident or which has been repaired or altered outside the factory or Service Center authorized by BABSON BROS. CO.

BABSON BROS. CO. shall not be liable for loss, damage or expense directly or indirectly from the use of this Alternator or from any other cause.

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

**BABSON BROS. CO., OAK BROOK, ILLINOIS
BABSON BROS. CO., (Canada) LTD., PORT CREDIT, ONTARIO**

CUT ALONG DOTTED LINE AND DETACH

PLACE
STAMP
HERE

**GUARANTEE
AND
WARRANTY
DEPARTMENT**

**BABSON BROS. CO.
2100 S. YORK ROAD
OAK BROOK, ILLINOIS 60521**

IMPORTANT:

Please fill out information on reverse side of this card and return within 10 days — in order to establish your warranty.