SURGE

PTO-POWERED ALTERNATORS

OPERATORS MANUAL

AND PARTS CATALOG

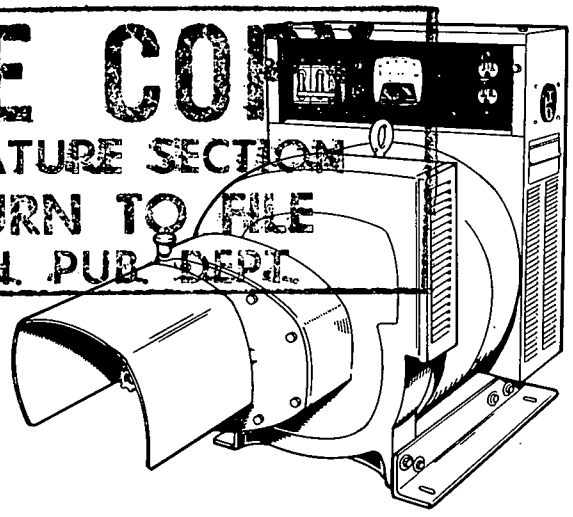
15 kW

MODEL NO. 20050

25 kW

MODEL NO. 20051

MODEL NO. 20052



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

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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 **This symbol is used 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 cautiously to avoid shocks.
- 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.
- Before lubricating alternator always:
  1. Disengage all power
  2. Shut off engine, and then
  3. Wait until rotor stops.

FIRE EXTINGUISHERS

- 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.

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.

If you must contact your dealer or the distributor regarding this equipment, be sure to supply the complete Model and Specification Number and the full Serial Number to identify your equipment.

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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 (16 kg). Six spline universal for 540 rpm PTO.

WARNING

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

SPECIFICATIONS

	15 kW Model 20050	25 kW Model 20051	25 kW Model 20052
Starting Watts	37,500	62,500	70,000
Running Watts	15,000	25,000	25,000
Volts	120/240	120/240	240*
Phase	1	1	3
Hertz	60	60	60
Current (Amperes)	62.5	104	75
Power Factor	1.0	1.0	0.8
Wire	3	3	4
Brushless	Yes	Yes	Yes
Alternator Speed (Nominal)	1800	1800	1800
Tractor Speed (Nominal)	540	540	540
Minimum Horsepower Required, Driving Source	30	45	45
Gear Box Oil Capacity, Pints	1.0 Pt. (0.47 litre)	1.0 Pt. (0.47 litre)	1.0 Pt. (0.47 litre)
Recommended Gear Lubricant	SAE 90 EP	SAE 90 EP	SAE 90 EP
Weight	355 lbs. (161 kg)	435 lbs. (197 kg)	435 lbs. (197 kg)

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

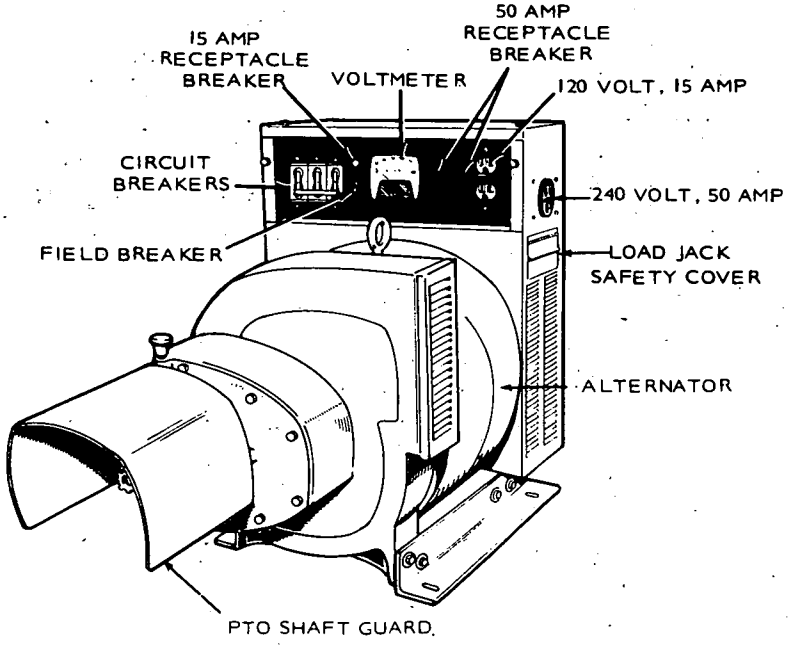


FIGURE 1. PTO-POWERED ALTERNATOR

DESCRIPTION

ALTERNATOR DESCRIPTION

The 15 kW and 25 kW alternators (Figure 1) are four-pole, revolving field, brushless exciter, 1800 rpm models of drip-proof construction. Alternator design includes both single and three-phase, 60 hertz type alternators. The alternator is fastened to the gear case by the rotor through-stud which passes through the rotor shaft, Figure 2.

A ball bearing at each end supports the rotor shaft. The end bell and stator housing are attached by four through-studs which pass through the stator assembly to the gear case alternator adapter. The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating rectifier assemblies mount on the alternator rotor shaft. The shaft is supported at both ends by lubricated 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 1.0-pint (.47 litre) of SAE 90 EP (extreme pressure) gear lubricant.

Control Box

All of the control components except the load connector are shown in Figure 1. The single or three phase load connector is mounted on the rear side of the control box. A load transfer switch is required to prevent the power line and the alternator from being connected simultaneously.

OPERATION

The basic operation of the alternator and voltage regulator involves the stator, voltage regulator, exciter field and armature, a full wave bridge rectifier, and the alternator rotor. Residual magnetism in the alternator rotor and a permanent magnet embedded in one exciter field pole begin the voltage build-up process as the alternator set starts running. Single-phase AC voltage, taken from one of the stator windings, is fed to the voltage regulator as a reference voltage for maintaining the alternator output voltage. The AC reference voltage is converted to DC by a silicon controlled rectifier bridge on the voltage regulator printed circuit board and fed into the exciter field windings. The exciter armature produces three-phase AC voltage that is converted to DC by the rotating rectifier assembly. The resultant DC voltage excites the alternator rotor winding to produce the stator output voltage for the AC load.

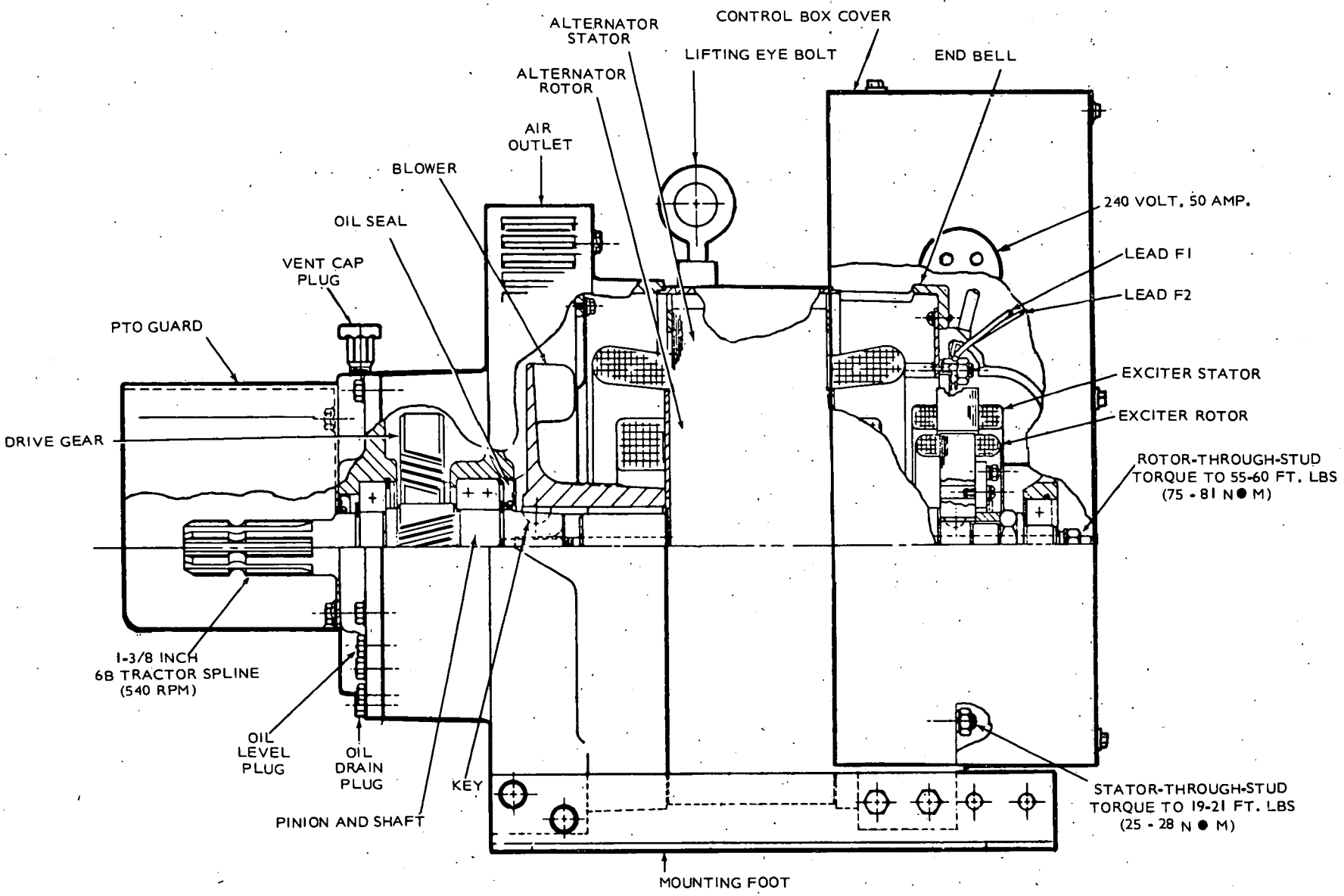


FIGURE 2. TRACTOR DRIVE ALTERNATOR

INSTALLATION

LOCATION

Figure 3 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 **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 take-off 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.

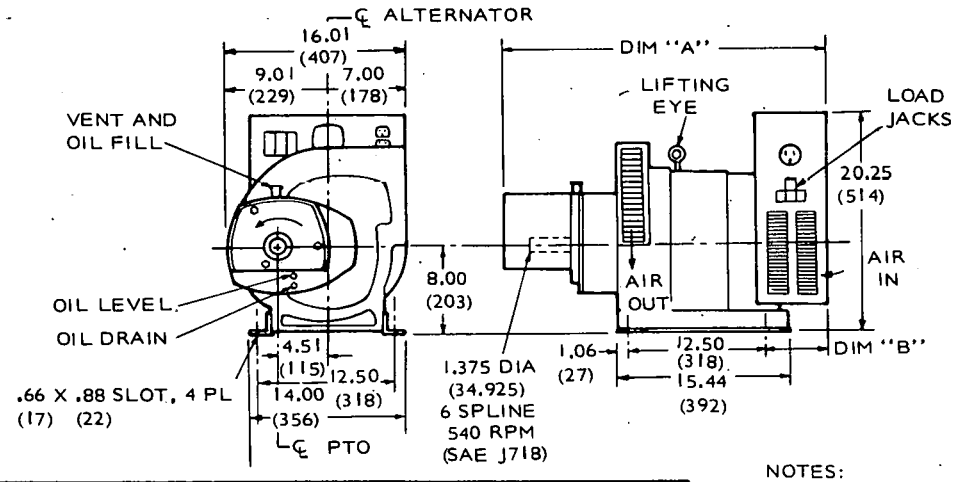
Wiring Convenience

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 4 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.

CAUTION **It requires about 45 horsepower at the power take-off to develop 25 kW. Therefore, 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.**



UNIT RATING	DIM "A"		DIM "B"		WEIGHT LBS	MASS kg
15.0KW-1Ø 1.0 PF	30.73	(780)	5.56	(141)	255	161.2
25.0KW-1Ø 1.0 PF	33.42	(849)	8.25	(210)	435	197.5
25.0KW-3Ø 0.8 PF	33.42	(849)	8.25	(210)	435	197.5

NOTES:

1. DIMENSIONS SHOWN IN ( ) ARE MILLIMETRES.
2. WEIGHT (MASS) INCLUDES GEN, CONTROL AND REGULATOR.

FIGURE 3. INSTALLATION OUTLINE

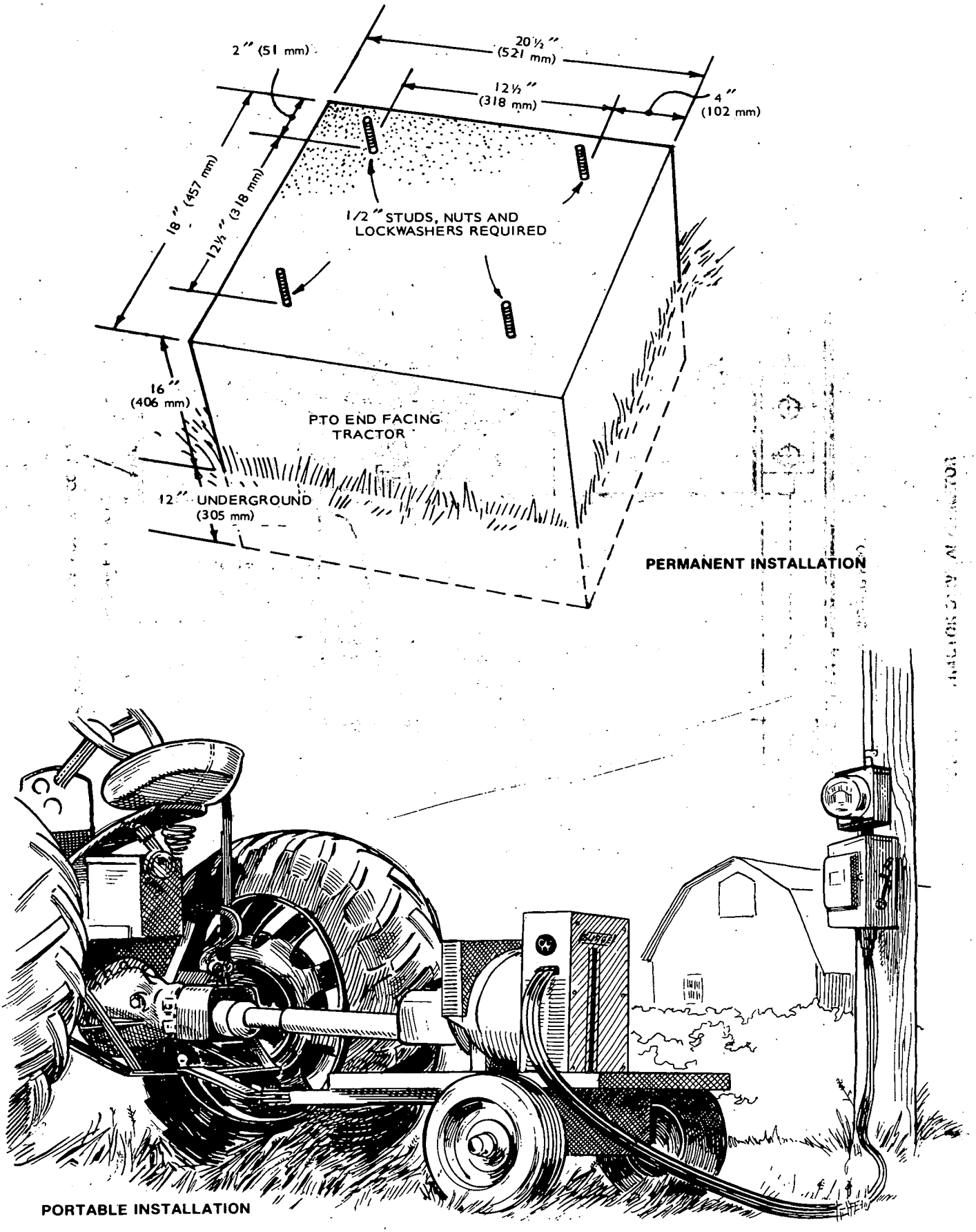


FIGURE 4. RECOMMENDED MOUNTINGS

PTO SHAFT INSTALLATION

Be sure that the tractor is properly aligned (parallel) with the alternator and that it will stay aligned during operation. See Figure 5.

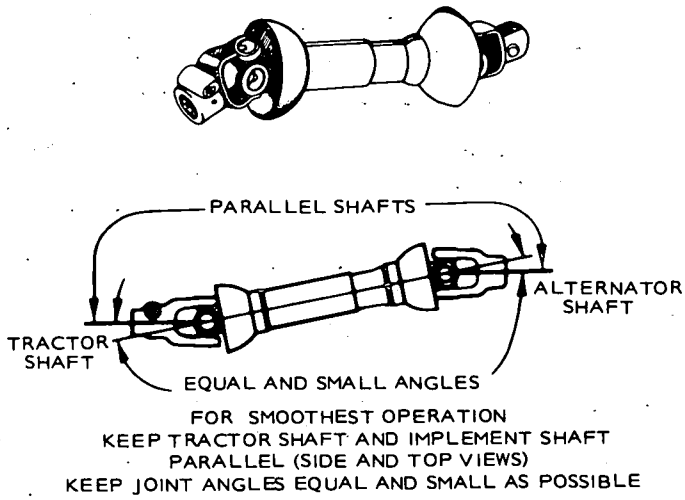


FIGURE 5. PTO SHAFT ALIGNMENT

CAUTION **The tractor PTO spline and the alternator input spline must be parallel for smoothest operation with minimum wear in the U-joints on the PTO shaft.**

WARNING **The protective guards on the rotating PTO shafts are for personnel safety. Exposed U-joints could wind up clothing that gets near it and cause serious personal injury. The guards may be removed for maintenance, but must always be in place for safe operation.**

The U-joints and the telescoping shafts require grease every 25 hours of operation.

WIRING CONNECTIONS

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

Recommendations:

- Use flexible conduit and stranded load wires near alternator to absorb vibration. Use sufficiently large insulated wire.
- Connect each load wire connector to the proper output lead on the control box.
- Insulate bare ends of ungrounded wires.
- Install a load transfer switch (or circuit breaker) between the alternator and load.
- If a test indicates reversed rotation of three-phase motors in the load circuit, reverse the load connections at any two alternator output leads (T1, T2, T3).

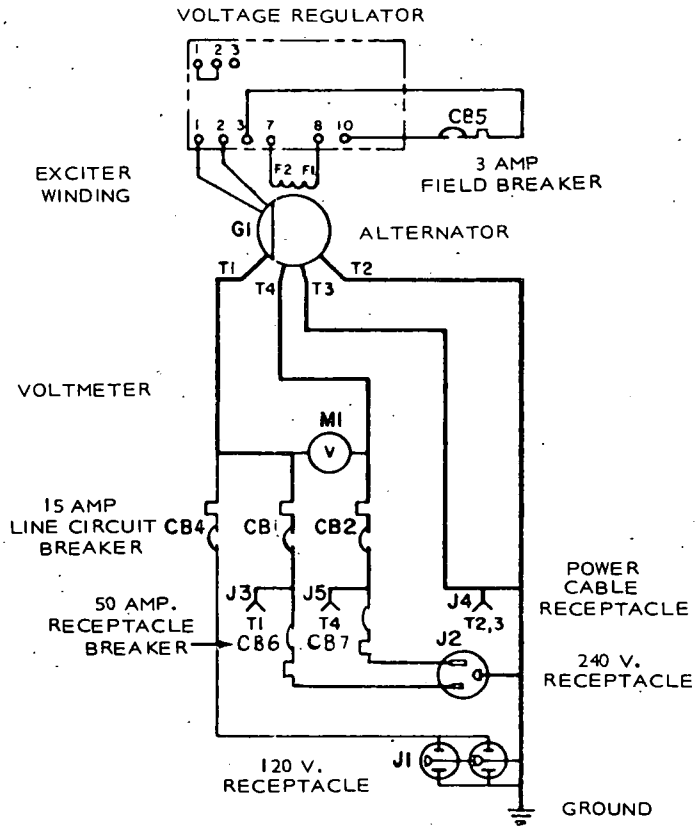


FIGURE 6. 120/240 VOLT, SINGLE PHASE CONNECTION

For portable use (alternator mounted on a trailer), connect load wires from output plug on 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, Figure 6.

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

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.

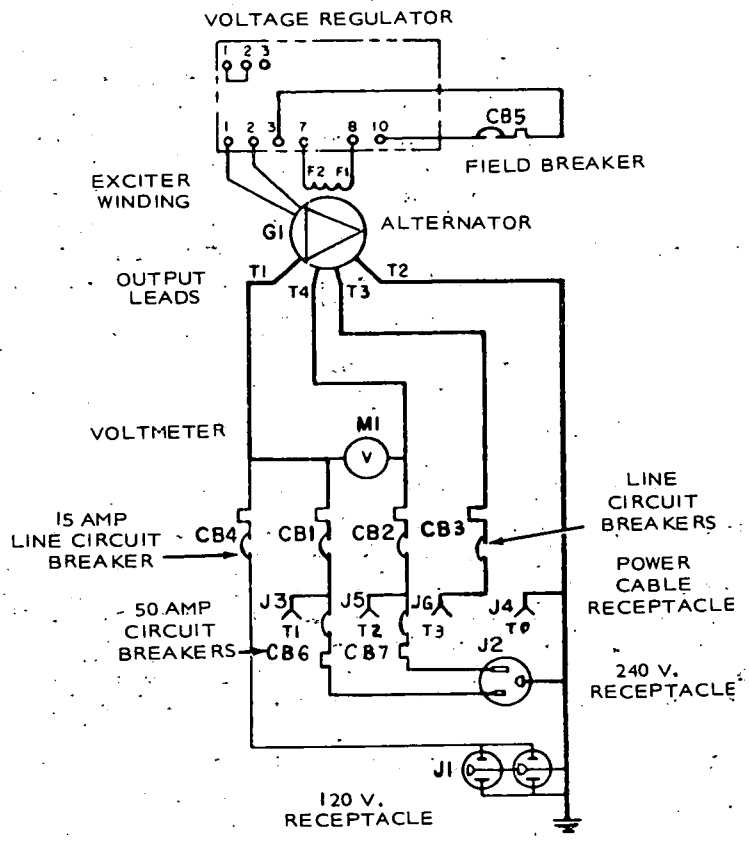


FIGURE 7. THREE PHASE 240 VOLT DELTA CONNECTIONS

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.**

INSTALLING THE LOAD TRANSFER SWITCH

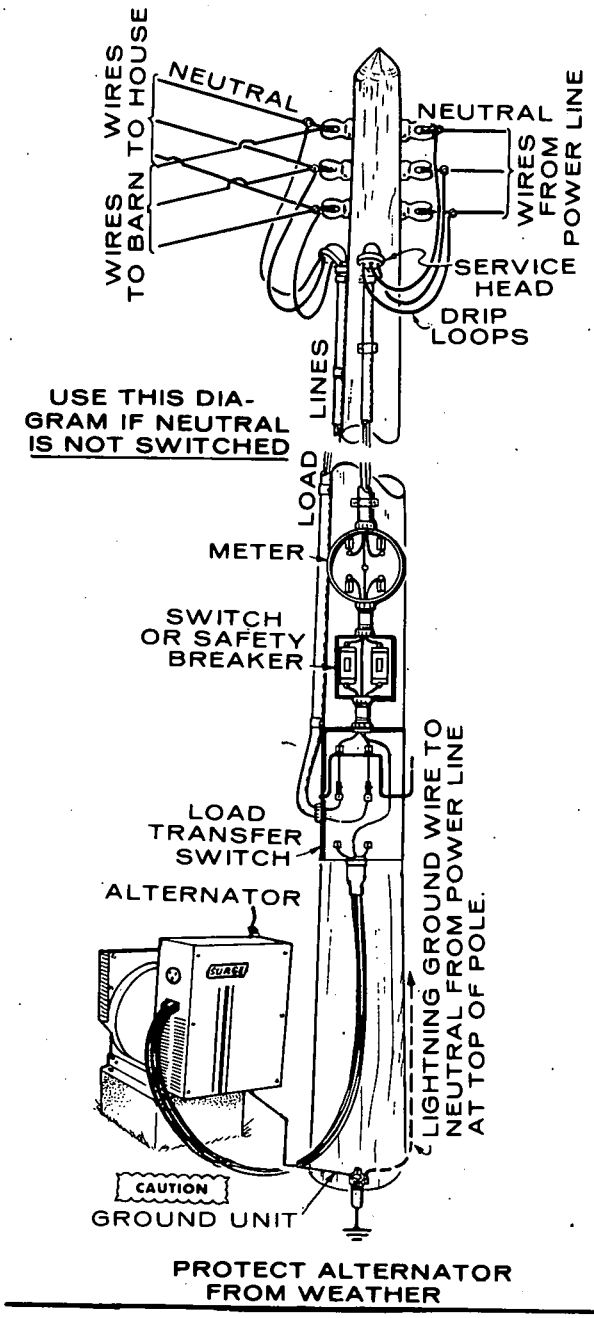
Before using the alternator for standby purposes, install a DOUBLE THROW LOAD TRANSFER SWITCH. The switch must have an ampere rating large enough to carry the total load when the main source of power is in use. Follow the local electrical code. The load transfer switch should always be installed close 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 opposite ends of the switch.

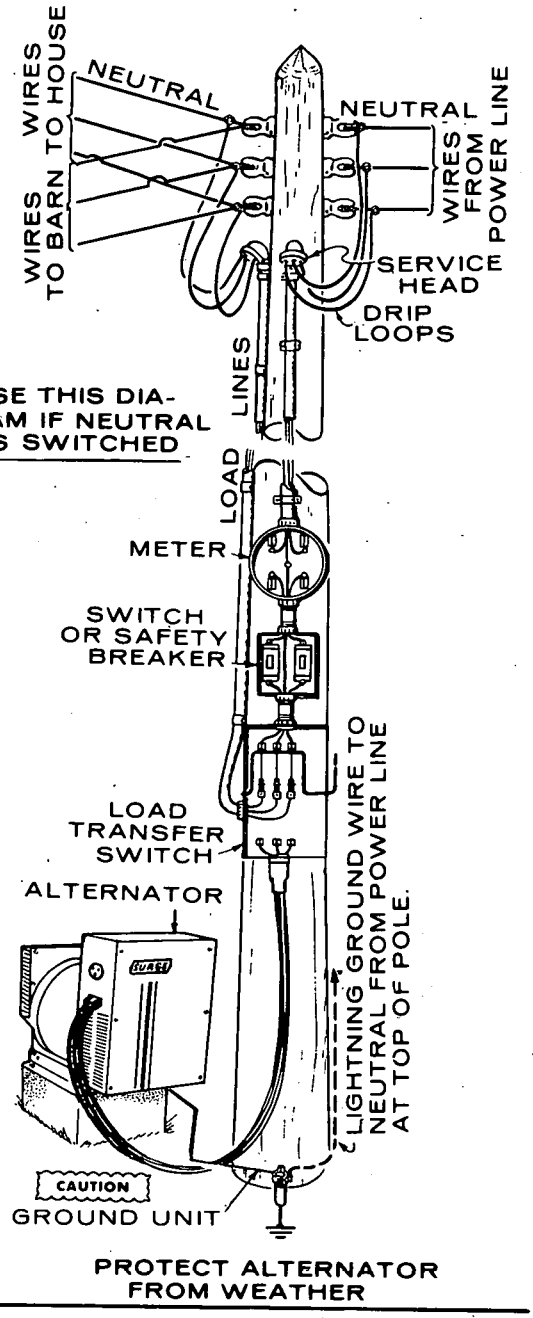
POWER RETURN SIGNAL

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 3-phase 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.





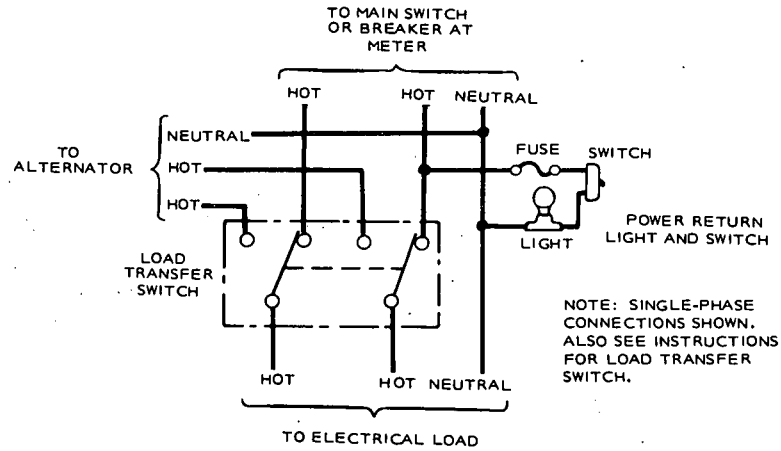
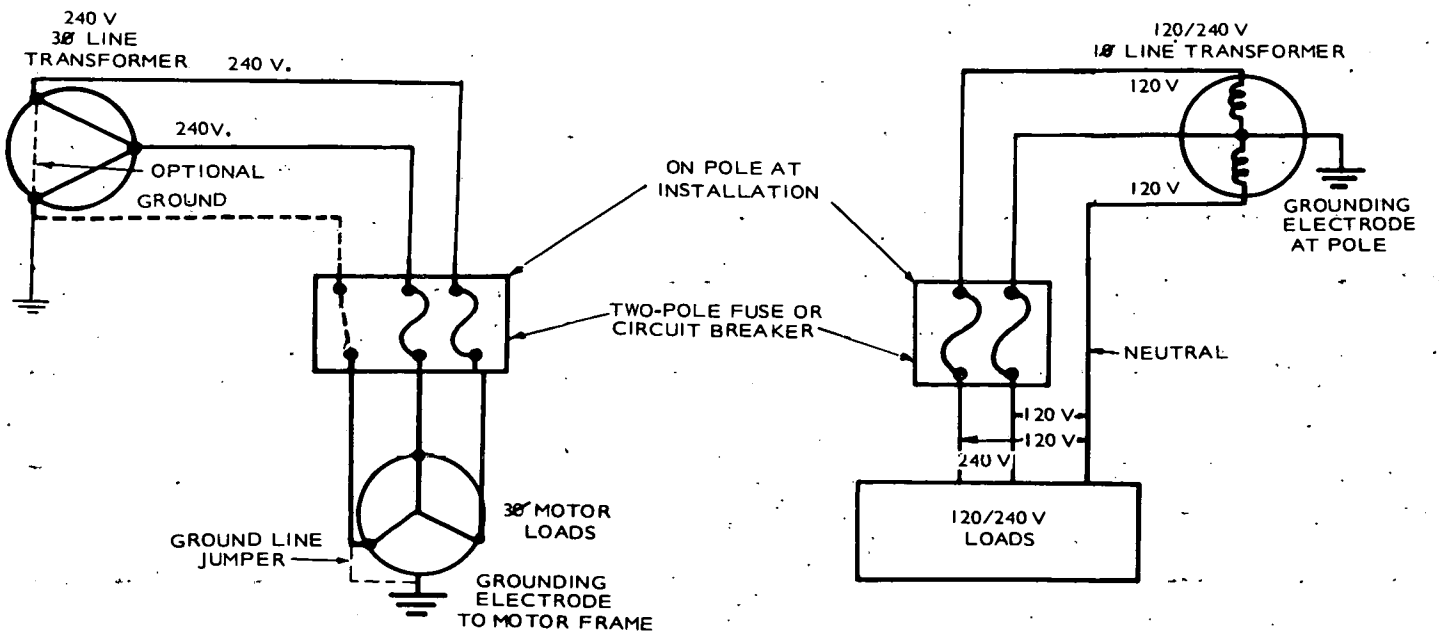
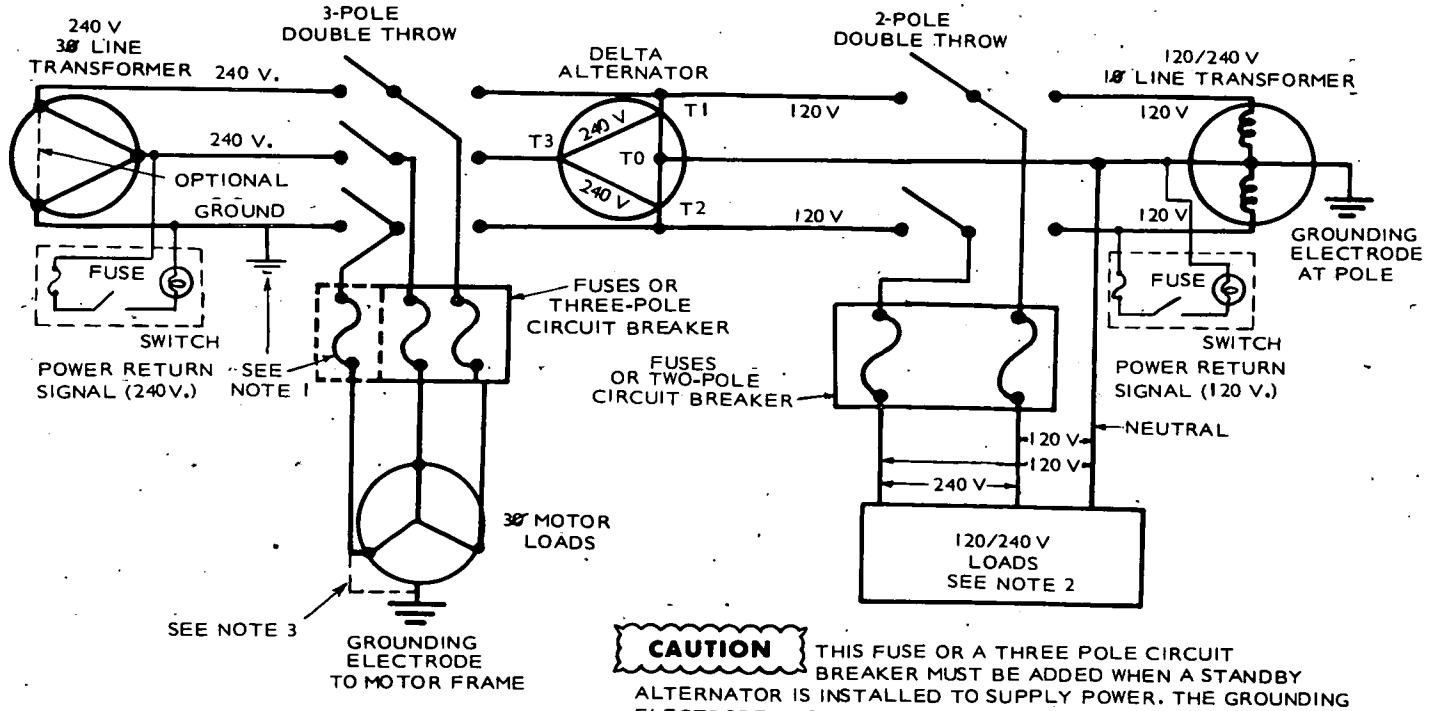


FIGURE 8. TYPICAL FARM STANDBY



TYPICAL CIRCUITS BEFORE INSTALLING ONAN PTO ALTERNATOR



CAUTION THIS FUSE OR A THREE POLE CIRCUIT BREAKER MUST BE ADDED WHEN A STANDBY ALTERNATOR IS INSTALLED TO SUPPLY POWER. THE GROUNDING ELECTRODE MUST THEN BE MOVED TO THE UTILITY SIDE OF THE FUSE OR CIRCUIT BREAKER.

NOTE 1

WARNING CHECK ALL LOADS FOR GROUNDS WITH AN OHMMETER BEFORE CONNECTING ALTERNATOR TO LOAD TO BE SURE THE MOTORS ARE ELECTRICALLY SAFE FROM SHOCKS DUE TO INSULATION FAILURES.

NOTE 2

WARNING REMOVE ALL GROUNDLINE JUMPERS, BUT GROUND THE FRAME OF ALL MOTORS TO EARTH TO BE SURE PERSONNEL ARE SAFE FROM ELECTRICAL SHOCKS DUE TO INSULATION FAILURES.

NOTE 3

TYPICAL CIRCUIT AFTER INSTALLING PTO ALTERNATOR

FIGURE 9. COMBINATION SINGLE AND THREE PHASE LOAD TRANSFER

INSTALLATION OF LOAD CABLE PLUG KITS

The YD PTO Alternators are factory equipped with either a single phase or a three phase output receptacle. The matching cable connectors supplied in Connector Housing Accessory Kit for single phase and three phase units require assembly to the customer's cable unless a complete cable is ordered with the alternator.

GENERAL

Field assembly of the cable connectors supplied in the above kits requires a heavy duty crimping tool or a high heat soldering iron. A torch is not recommended for soldering by inexperienced personnel for two reasons. First, the flame heat will burn the insulation from the cable; second, an excessive amount of solder may accumulate on the outside of the terminal preventing proper insertion of the terminal into the plug.

ASSEMBLY

1. Remove one inch of insulation from end of each cable for proper metal-to-metal contact with terminal end.
2. If a heavy duty crimping tool is available, insert wire end fully into terminal as shown in Figure 10 for No. 2 and No. 4 wire. Then crimp terminal onto wire to make a good electrical connection . Crimp each terminal and wire end in the same way.

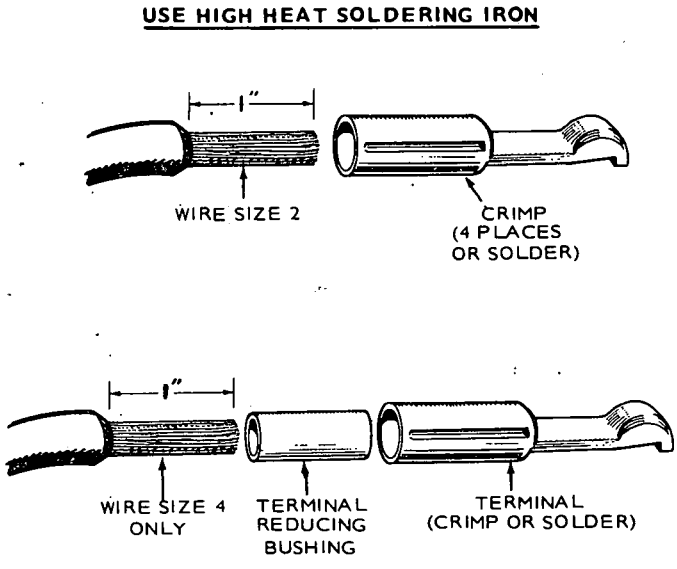


FIGURE 10. CABLE WIRE TO TERMINAL CONNECTIONS

WARNING **Use care with soldering iron and heated material to avoid being burned.**

3. If a high heat soldering iron is used, proceed as follows:
   a. Insert wire end fully into terminal as shown in Figure 10 for No. 2 and No. 4 wire. Use reducing sleeve with No. 4 wire. Hold wire and terminal horizontal while soldering, if possible.
   b. Apply heat from soldering iron at center of terminal sleeve until heat draws solder into terminal around wire.
   c. Add only enough solder to fill space in and around wire to make a good electrical connection.
   d. Using a clean rag, wipe excess solder accumulation, if any, from outside of terminal for a smooth finish. Otherwise the terminal may not fit into the connector housing. Solder each terminal and wire in the same way.
4. Assemble cable terminal ends into plug housing assembly as indicated in Figure 11. The terminal just snaps into the plug and is retained by a flat spring.

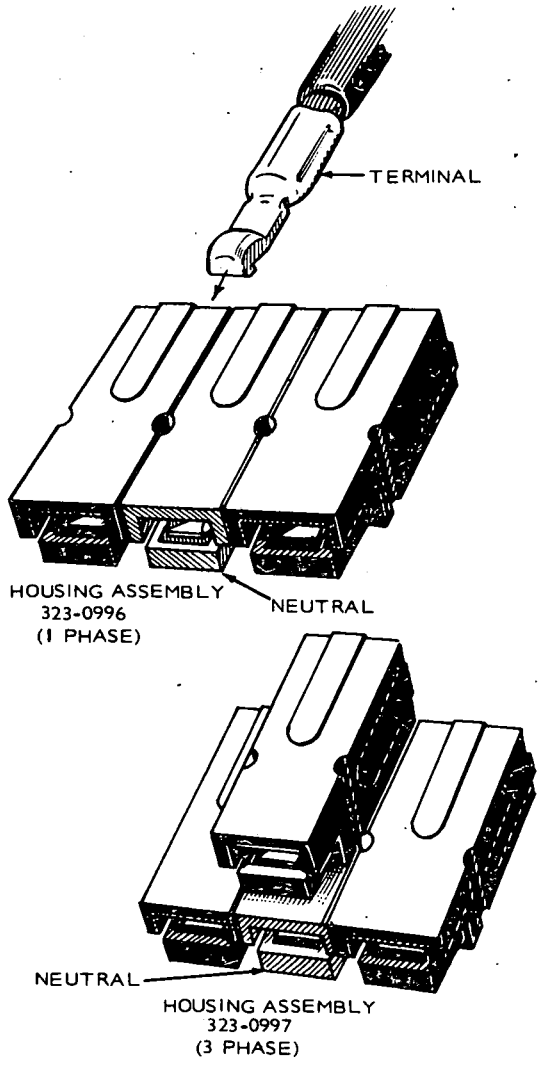


FIGURE 11. SINGLE AND THREE PHASE PLUGS

Each terminal can be removed from the plug by using a thin blade to release the terminal while a slight pull is made on the cable, Figure 12.

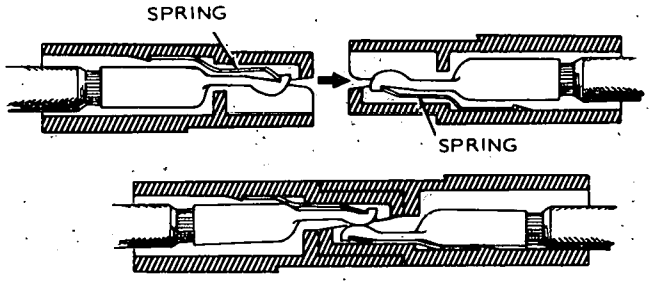


FIGURE 12. CONNECTOR HOUSING AND TERMINAL CONNECTION DETAILS

CAUTION Be sure the neutral cable connects to the white plug at the center of the housing for proper mating to the white receptacle on the PTO alternator. Any cross-connection between the neutral cable and one hot cable at the connector could cause equipment damage in the load circuits and trip the load circuit breakers on the control panel.

5. The cable and plug are now ready for mating with the receptacle on the alternator as soon as the other end of the cable is attached to the power pole transfer switch. See Figure 12.

WARNING The load cable receptacle on the PTO Alternator is equipped with a protective cover for safety. Keep this cover closed whenever the cable is not installed because the terminals in the receptacle are hot whenever the alternator is operating and the line circuit breaker is in the ON position.

OPERATION

STANDBY OPERATION

When a power outage occurs, the alternator should be ready to run and to take over the electrical load, Figure 13.

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 to prevent possible injuries to personnel.**

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.
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 **Overloading can damage the alternator windings!**

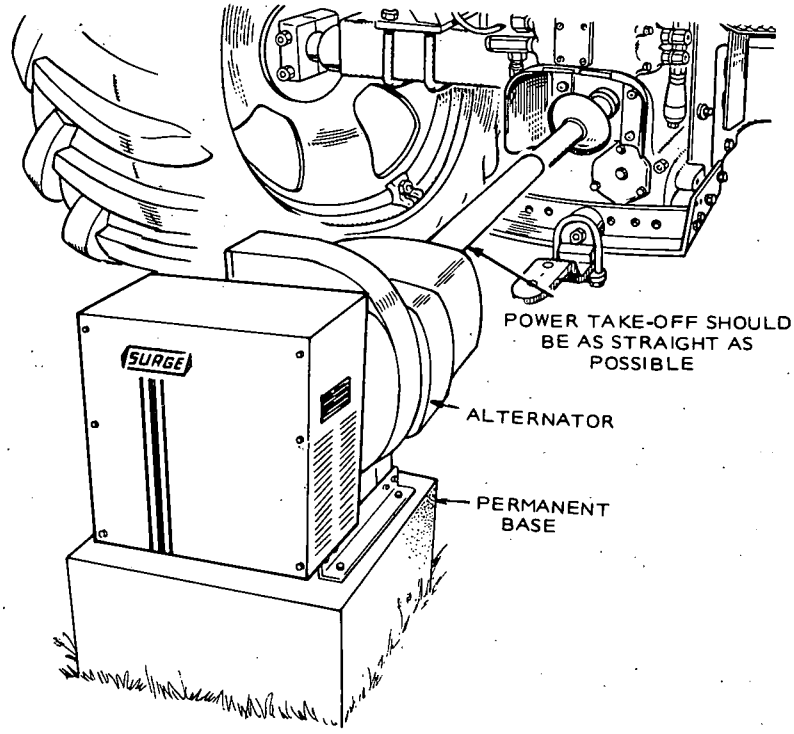


FIGURE 13. TRACTOR CONNECTION

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.

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 30 (15 kW) or 45 (25 kW) horsepower (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.

ALTERNATOR SPEED

Low input speed to the alternator causes low voltage and frequency. For example: if an 1800 rpm alternator is slowed to 1500 rpm, the frequency of the current produced will be 50 hertz instead of 60 hertz.

CAUTION **The low voltage and low frequency combination could result in burned output windings in any motor connected to the alternator such as refrigerators, silo unloader, feeder, etc. Undervoltage will not damage fans, blowers, or pump motors, but will cause a TV set picture to roll or have a smaller picture than normal.**

TABLE 1.
TYPICAL WATTAGE REQUIREMENTS

MOTORS* (Capacitor Type)	WATTS REQUIRED START	WATTS REQUIRED 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.

POWER REQUIREMENTS

Item	Approx. Wattage
Refrigerator	600-1000
Dishwasher	1000-1800
Water Heater	1500-5000
Space Heater	1000-1500
Television	200-600
Electric Drill	250-750
Water Pump	450-1000
Range Top (per element)	3000-4000
Food Freezer	300-800
Brooders	500-1000
Stock Tank Heater	300-1400

SERVICE AND MAINTENANCE

PERIODIC SERVICE AND INSPECTION

Follow a regular 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 EP 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 each year thereafter, or every 250 hours. Maintain the proper oil level between changes.

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

Remove oil fill plug at top of the case and oil level plug from the face of the gear case, Figure 14. Fill case until oil flows from the oil level plug hole. Gear box holds 1 pint (0.47 litre) U.S. measure. Replace both plugs.

PTO SHAFT LUBRICATION

Grease the universal joints and telescoping shafts on the PTO shaft at least every 25 operating hours. Under adverse conditions, grease the joints as required, possibly every 4 to 8 hours.

WARNING **For personnel safety, never operate the alternator with the protective guards removed from the PTO shaft.**

BEARINGS

The ball-type shaft bearing on the cover end and on the gear box end are lubricated by the gear box lubricant (SAE 90EP).

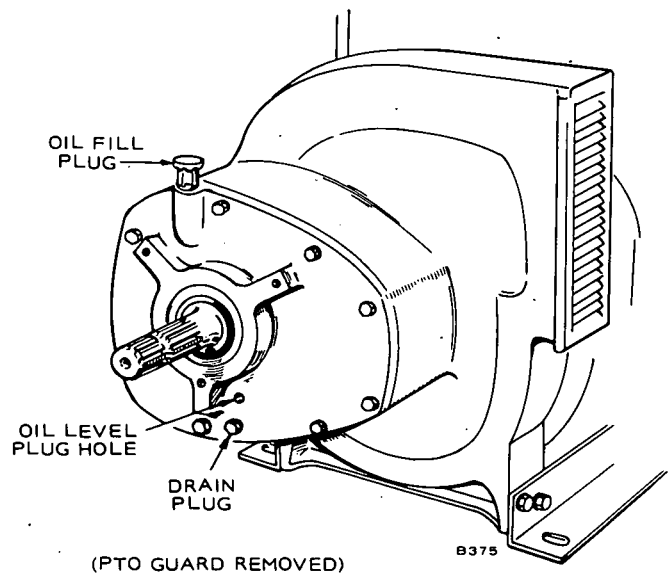


FIGURE 14. GEAR BOX LUBRICATION

TROUBLESHOOTING

A few simple checks and a proper troubleshooting procedure can locate the probable source of trouble and cut down troubleshooting time.

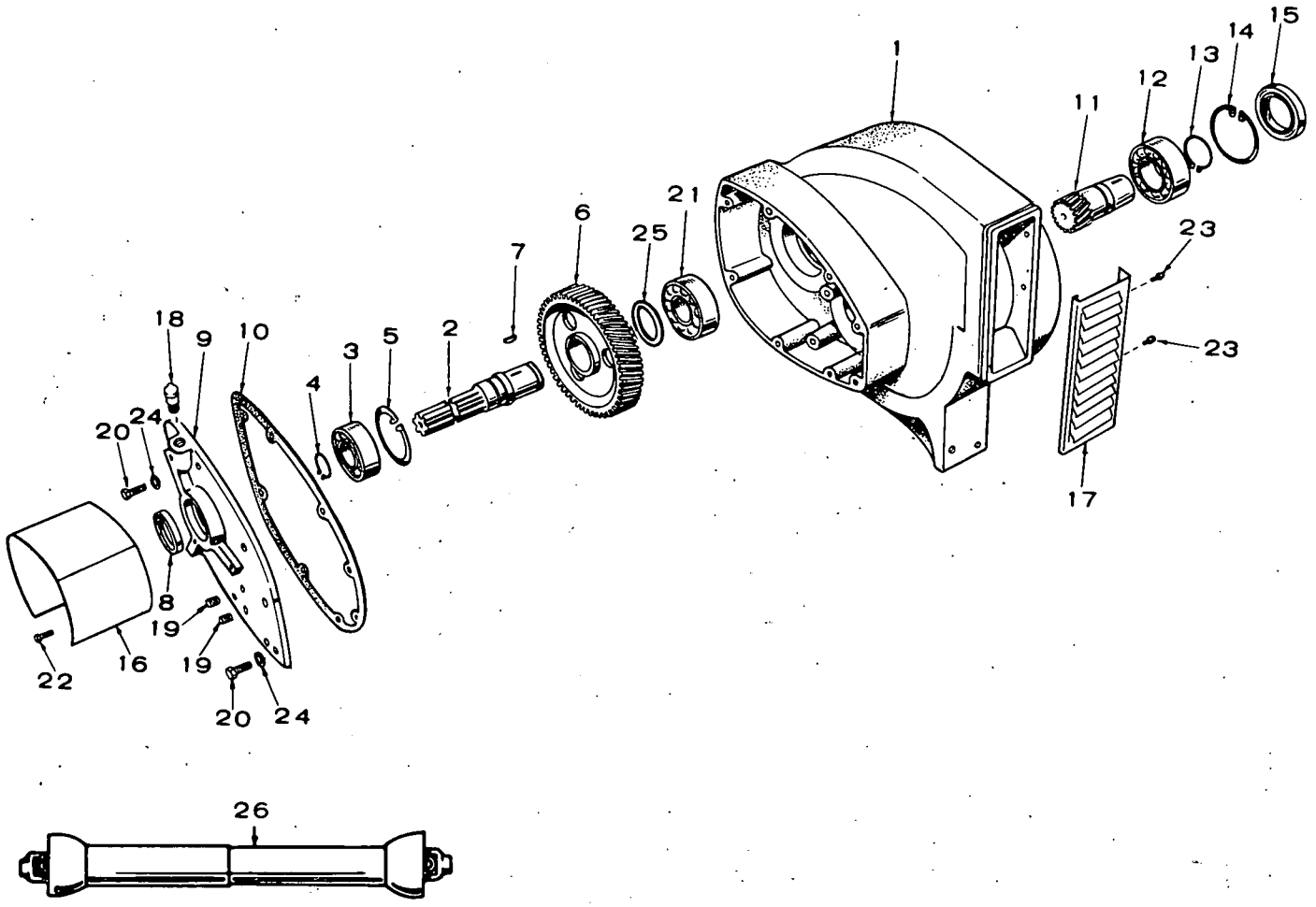
1. Check all modifications, repairs, and replacements performed since last satisfactory operation of set to be sure that connection of generator leads are correct. A loose wire connection, overlooked when installing a replacement part could cause problems. An incorrect connection, an opened circuit breaker, or a loose printed circuit board are all potential malfunction areas to be eliminated by a visual check.
2. Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.
3. Visually inspect components on voltage regulator. Look for dirt, dust, moisture and cracks in the printed solder conductors. Burned resistors, arcing tracks are all identifiable. Do not mark on printed circuit boards with a pencil. Graphite lines are conductive and can cause short circuits between components.

TROUBLESHOOTING

NATURE OF TROUBLE	POSSIBLE CAUSE	REMEDY
Alternator Overheats	1. Windings and parts covered with dirt and oil.	1. Disassemble alternator and clean.
	2. Air intake is restricted or incoming air too hot.	2. Clean alternator air intake and outlet areas.
	3. Overloaded.	3. Remove part of load.
Noisy Alternator	1. Alternator loose on base.	1. Tighten mounting bolts.
	2. Defective bearing.	2. Replace. Check alignment.
No Voltage Output	1. Voltage regulator trouble, or open, short or grounded circuit in alternator.	1. Call your Equipment Service Center.
	2. Alternator leads broken or loose.	2. Tighten connections and replace broken leads.
	3. Load circuit breaker in tripped position.	3. Remove part of load and reset circuit breaker.
	4. Incorrect PTO speed.	4. Adjust PTO speed to 540 rpm.
Low Voltage Output of Alternator	1. External short circuit on line.	1. Test alternator with line wires disconnected.
	2. Open circuit of shunt field winding.	2. Make proper connections.
	3. Short circuit of winding in the field or armature.	3. Call your Equipment Service Center.
	4. Incorrect PTO speed.	4. Readjust PTO speed to 540 rpm.

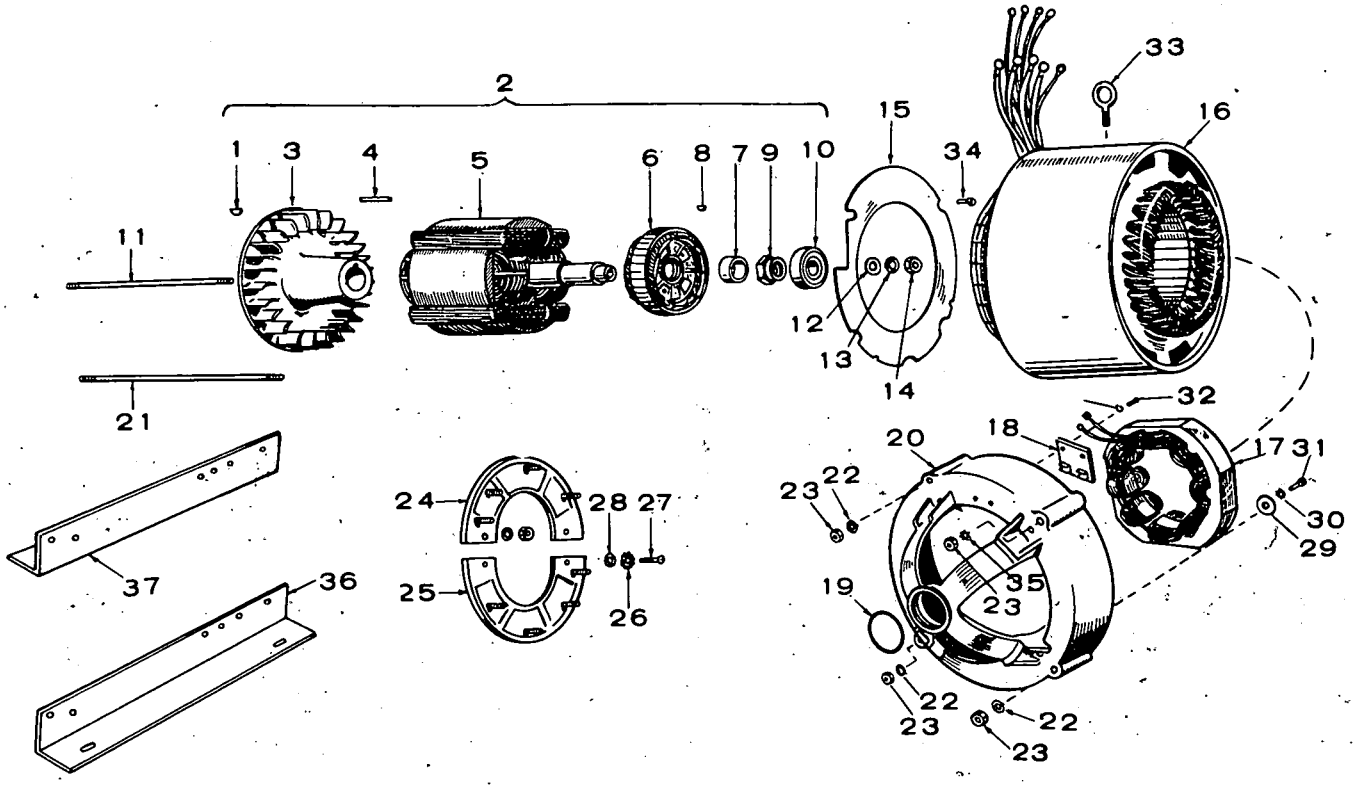
PARTS CATALOG

GEARBOX GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	231-0184	1	Adapter and Gear Drive Case
2	190-0409	1	Shaft, Input Gear
3	510-0114	1	Bearing, Ball - Input Shaft
4	518-0122	1	Ring, Retaining - External
5	518-0287	1	Ring, Retaining - Internal
6	190-0436	1	Gear, Drive
7	515-0141	1	Key, Drive Gear to Shaft
8	509-0138	1	Seal, Oil - Bearing Plate
9	190-0408	1	Plate, Bearing
10	103-0451	1	Gasket, Bearing Plate
11	190-0434	1	Shaft and Gear, Output (Generator Drive)
12	510-0113	1	Bearing, Ball - Output Shaft
13	518-0333	1	Ring, Retaining - External
14	518-0334	1	Ring, Retaining - Internal
15	509-0139	1	Seal, Oil - Output Shaft
16	190-0384	1	Guard, Power Take-off
17	234-0522	1	Grille, Air Outlet
18	518-0274	1	Vent and Fill Plug
19	502-0028	2	Plug, Drain and Oil Level - Brass
20	800-0029	8	Screw, Cap - Hex Head (5/16-18 x 1-1/8")
21	510-0117	1	Bearing, Ball - Input Shaft
22	821-0014	3	Screw, Cap - Hex Head Locking Flange (5/16-18 x 1/2")
23	821-0008	2	Screw, Cap - Hex Head Locking Flange (1/4-20 x 5/16")
24	850-0045	8	Washer, Lock - Spring (5/16")
25	526-0269	1	Washer, Flat (1.78 ID x 2.25 OD x .125 Thk)
26	ROD, TUMBLING - (Optional)		
	190-0305	1	15 kW Sets
	190-0446	1	25 kW Sets

ALTERNATOR GROUP

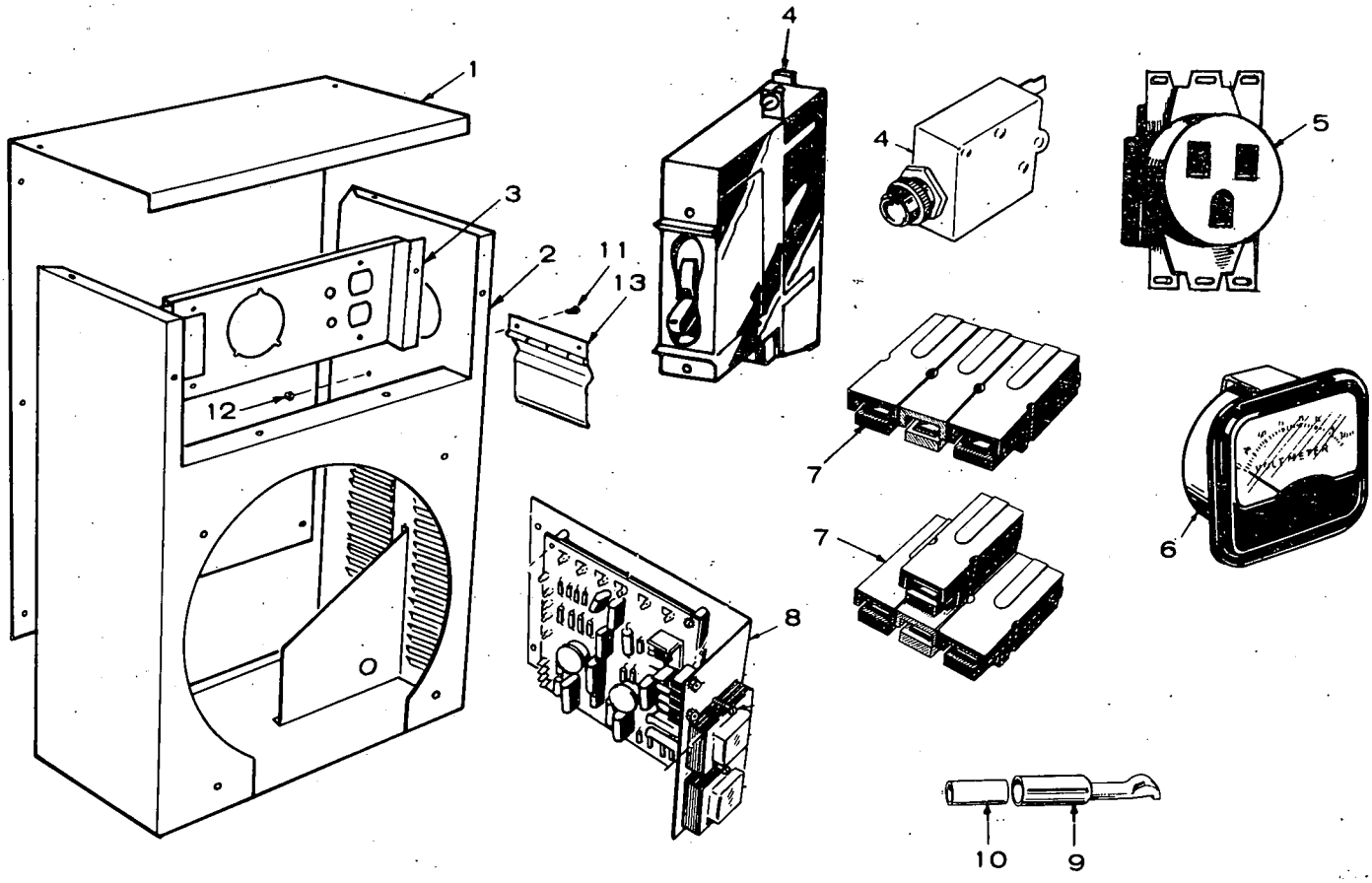


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	515-0124	1	Key, Alternator to Gear Box Output Shaft
2	ROTOR ASSEMBLY (Includes Parts Marked *)		
	201-2157	1	15 kW Alternator
	201-2160	1	25 kW Alternator
3	205-0105	1	*Fan, Generator
4	515-0103	1	*Key, Blower Fan
5	*ROTOR, WOUND		
	201-2052	1	15 kW Alternators
	201-2055	1	25 kW Alternators
6	201-2151	1	*Rotor Assembly, Wound - Exciter (Includes Parts Marked #)
7	232-2398	1	*Spacer, Bearing
8	515-0094	1	*Key, Exciter Rotor
9	870-0284	1	*Nut, Locking (Nylon Insert)
10	510-0112	1	*Bearing, Rotor
11	STUD, ROTOR THROUGH		
	520-0789	1	15 kW Alternators
	520-0792	1	25 kW Alternators
12	232-0200	1	Washer, Cone Shaped - Rotor Through Stud
13	850-0055	1	Washer, Lock - Spring (7/16")
14	870-0203	1	Nut, Hex (7/16-20)
15	234-0519	1	Baffle, Air
16	STATOR ASSEMBLY, WOUND		
	220-2354	1	15 kW Alternators
	220-2355	1	25 kW, Single Phase Alternators
	220-2356	1	25 kW, Three Phase Alternators
17	220-2009	1	Stator, Wound - Exciter
18	232-2418	1	Board, Connection

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
19	509-0094	1	Seal, "O" Ring - Bearing
20	211-0237	1	Bell, End
21	STUD, ALTERNATOR THROUGH		
	520-0797	4	15 kW Alternators
	520-0800	4	25 kW Alternators
22	850-0050	3	Washer, Lock - Spring (3/8")
23	862-0011	4	Nut, Hex (3/8-16)
24	358-0069	1	#Diode and Heat Sink Assembly - (Positive)
25	358-0070	1	#Diode and Heat Sink Assembly - (Negative)
26	853-0008	4	#Washer, Lock - ET (#10)
27	813-0100	4	#Screw, Machine - Round Head (#10-32 x 1/2")
28	526-0008	4	#Washer, Flat (13/64" ID x 7/16" OD x 1/32" THK)
29	526-0260	2	Washer, Flat (.28" ID x 1.25" OD x 10 Gauge)
30	853-0013	2	Washer, Lock - ET (1/4")
31	800-0004	2	Screw, Cap - Hex Head (1/4-20 x 5/8")
32	815-0194	2	Screw, Cap - Hex Head W/ET (#10-32 x 3/16")
33	403-0095	1	Bolt, Eye - Lifting
34	821-0008	4	Screw, Cap - Hex Head (1/4-20 x 5/16")
35	856-0010	2	Washer, Lock - EIT (3/8")
36	232-2454	1	Foot, Mounting - Alternator (Right Side)
37	232-2455	1	Foot, Mounting - Alternator (Left Side)

* - Included in complete Rotor Assembly.
\# - Included in 201-2151 Exciter Rotor Assembly.

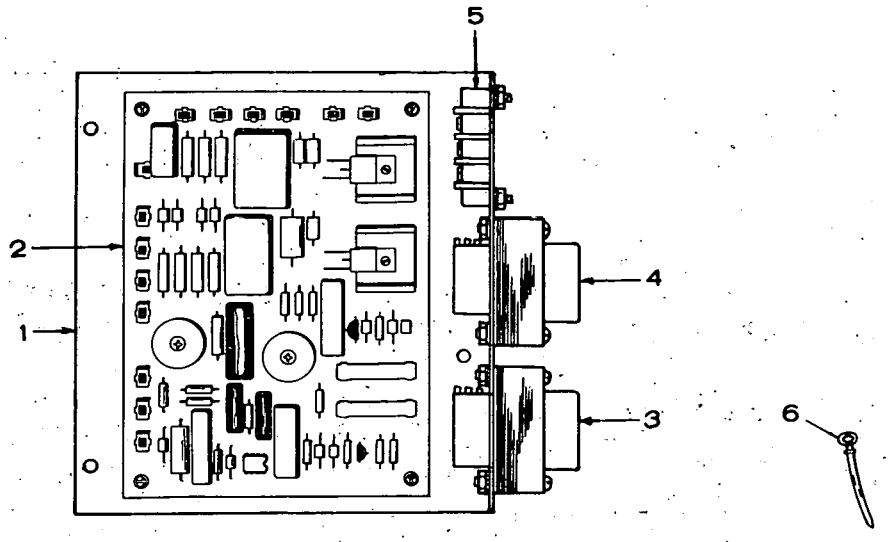
CONTROL GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-4004	1	Cover, Control Box
2	301-4002	1	Box, Control
3	PANEL, CONTROL BOX		
	301-4005	1	Single Phase Sets Non CSA
	301-4006	1	Three Phase Sets Non CSA
	301-4149	1	Single Phase Sets - CSA
	301-4150	1	Three Phase Sets - CSA
4	BREAKER, CIRCUIT		
	320-0366	2	65 Ampere (15 kW Sets)
	320-0251	2	100 Ampere (25 kW Single Phase Sets)
	320-0367	3	75 Ampere (25 kW Three Phase Sets
	320-0505	1	3 Ampere
	320-0540	1	15 Ampere
	320-0548	2	50 Ampere
5	RECEPTACLE		
	323-0184	1	Duplex
	323-0894	1	50 Ampere (Output)
6	302-0551	1	Voltmeter (0-300 Volts)

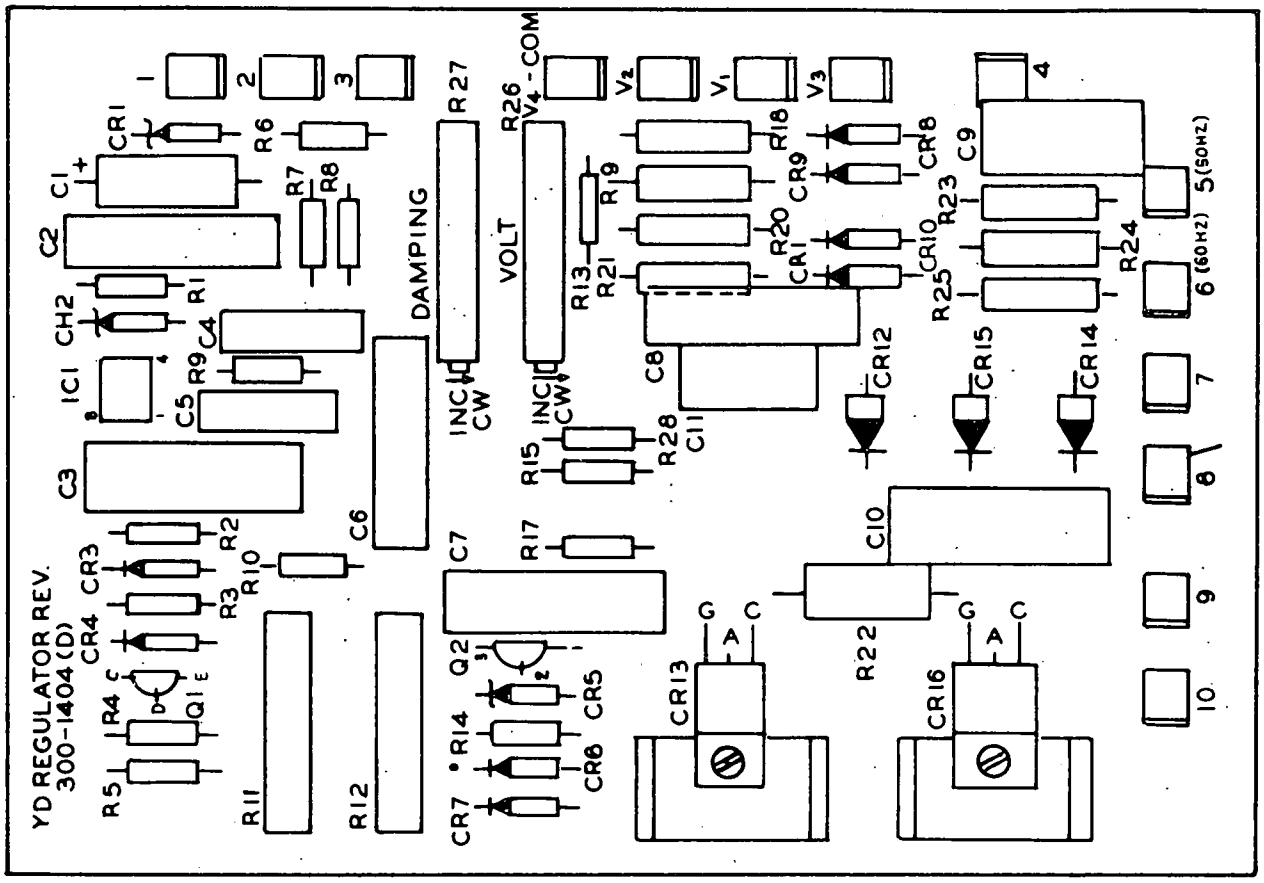
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
7	CONNECTOR, HOUSING		
	323-0996	1	Single Phase Sets
	323-0997	1	Three Phase Sets
8	305-0534	1	Regulator Assembly, Voltage (See Separate Group for Complete Breakdown of Components)
9	TERMINAL CONNECTOR		
	332-1880	6	Single Phase Sets
	332-1880	8	Three Phase Sets
10	BUSHING, REDUCER		
	332-1881	6	15 kW Single Phase Sets
	332-1882	6	25 kW Single Phase Sets
	332-1882	8	25 kW Three Phase Sets
11	821-0004	2	Screw, Cap - Hex Head Locking Load Plug Cover Mounting (10-32 x 5/16" lg)
12	870-0320	2	Nut, Hex Self Locking - Load Plug Cover Mounting (10-32)
13	301-4233	1	Cover, Load Plug

VOLTAGE REGULATOR GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	300-1404	1	Board Assembly, Regulator (See Separate Group for Complete Breakdown of Components)
2	301-3719	1	Panel, Voltage Regulator Mounting
3	315-0386	1	Transformer, Voltage
4	315-0391	1	Reactor, Commutator
5	332-1655	1	Strip, Terminal
6	332-0942	1	Tee, Cable

VOLTAGE REGULATOR BOARD GROUP

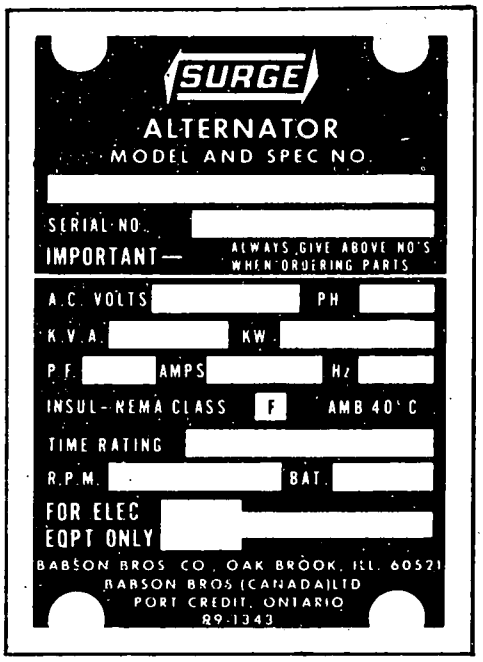


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1404	1	Board Assembly, Complete
C1	356-0039	1	Capacitor, Electrolytic (100 Mfd, 10 Volt)
C2,6	355-0006	2	Capacitor (.47 Mfd, 100 Volt)
C3,7	355-0005	2	Capacitor (.22 Mfd, 200 Volt)
C4,5,11	355-0015	3	Capacitor (.1 Mfd, 200 Volt)
C8	355-0016	1	Capacitor (1 Mfd, 100 Volt)
C9	355-0031	1	Capacitor (.39 Mfd, 100 Volt)
C10	355-0017	1	Capacitor (.47 Mfd, 400 Volt)
CR1	359-0036	1	Diode, Zener (5.6 Volt)
CR2	359-0025	1	Diode, Zener (20 Volt)
CR3,4,6,11	357-0004	8	Rectifier, Diode (400 Milliamp, 400 Volt)
CR5	359-0026	1	Diode, Zener (18 Volt)
CR12,14,15	357-0028	3	Rectifier, Diode
CR13,16	365-0002	2	Rectifier, Gate Control
E1-14	332-1511	14	Terminal, Lug
E15-16	363-0069	2	Heatsink, Diode
H1	812-0029	2	Screw, Round Head (4-40 x 3/8")
H2	526-0257	2	Washer, Flat (#4)
H3	860-0003	2	Nut, Hex (4-40)
IC1	367-0005	1	Integrated Circuit
MP1-2	517-0127	2	Cover, Potentiometer
Q1	362-0017	1	Transistor, NPN
Q2	361-0003	1	Transistor, Unijunction
R1	350-0423	1	Resistor (33,000-Ohm, 1/2 Watt)
R2	350-0443	1	Resistor (220,000-Ohm, 1/2 Watt)
R3	350-0447	1	Resistor (330,000-Ohm, 1/2 Watt)
R4	350-0398	1	Resistor (3,000-Ohm, 1/2 Watt)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R5	350-0466	1	Resistor (2 Megohm, 1/2 Watt)
R6	351-0202	1	Resistor, Film (1,240-Ohm, 1/4 Watt)
R7	350-0445	1	Resistor (270,000-Ohm, 1/2 Watt)
R8,10	350-0435	2	Resistor (100,000-Ohm, 1/4 Watt)
R9	350-0459	1	Resistor (1 Megohm, 1/2 Watt)
R11,12	353-0048	2	Resistor, Wire Wound (4,000-Ohm, 5 Watt)
R13	351-0293	1	Resistor, Film (11,000-Ohm, 1/4 Watt)
R14	350-0363	1	Resistor (100-Ohm, 1/2 Watt)
R15,17	350-0351	2	Resistor (33-Ohm, 1/2 Watt)
R18	351-0332	1	Resistor, Film (28,000-Ohm, 1/4 Watt)
R19	351-0240	1	Resistor, Film (3,090-Ohm, 1/4 Watt)
R20	351-0211	1	Resistor, Film (1,530-Ohm, 1/4 Watt)
R21	351-0234	1	Resistor, Film (2,670-Ohm, 1/4 Watt)
R22	350-0973	1	Resistor, Film (270-Ohm, 2 Watt)
R23	350-0512	1	Resistor (10-Ohm, 1/2 Watt)
R24	351-0353	1	Resistor, Film (46,400-Ohm, 1/4 Watt)
R25	351-0349	1	Resistor, Film (42,200-Ohm, 1/4 Watt)
R26	303-0208	1	Potentiometer (20,000-Ohm)
R27	303-0207	1	Potentiometer (5,000-Ohm)
R28	350-0355	1	Resistor (47-Ohm, 1/2 Watt)

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.



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

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.

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