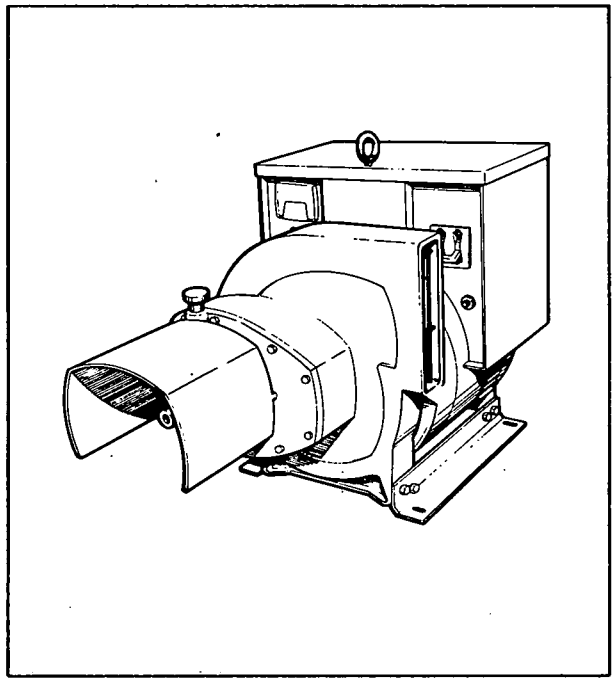


DE LAVAL STANDBY ALTERNATOR SERIES YD

Installation-Operation-Maintenance-Parts List

SNF-4877
929-0009

Printed in the U.S.A.

DE LAVAL™

JANUARY, 1979

Warranty

Sellers represent that De Laval's warranty is as follows:

This warranty is conditioned on the accuracy of the information furnished by the buyer, and installation (when applicable), operation, and performance of maintenance pursuant to equipment manufacturer's instructions.

De Laval warrants to the original user that equipment of its manufacture is free from defects in material and workmanship for a period of one year from the date of installation. Equipment parts or accessories manufactured by others carry the warranty and remedy provided by that manufacturer only.

The equipment will fulfill the mechanical function it is designed to perform, but due to the wide variation in farm animals, management practices on farms, and any other conditions beyond the equipment manufacturer's control, no specific level of performance is guaranteed.

Excluded from the foregoing warranty are damages caused by late delivery, ordinary wear and tear, erosion or corrosion, or by misuse, abuse, or improper handling or operation of the equipment by the purchaser or any third party.

Any warranty or claims which differ from the foregoing are unauthorized by De Laval, and become the warranty solely of the party making them.

De Laval will repair, replace (f.o.b. point of shipment) or at its option cause issuance of a credit for De Laval equipment and parts which are not as warranted above, provided the purchaser sends written notice to De Laval or the seller within 30 days of discovery by him setting forth the equipment or parts affected and the manner in which the warranty has not been fulfilled.

THIS IS THE SOLE REMEDY FOR BREACH OF THE FOREGOING WARRANTY, AND THE SELLER AND De LAVAL MAKE NO OTHER WARRANTY, EXPRESS OR IMPLIED, WHETHER OF MERCHANTABILITY OR OTHERWISE. NEITHER THE SELLER NOR De LAVAL IS RESPONSIBLE FOR ANY CONSEQUENTIAL DAMAGES OF ANY NATURE AND KIND INCLUDING BUT NOT LIMITED TO DELAYS IN DELIVERY, LOSS OF PRODUCT, PRODUCTION AND/OR PROFIT.

TABLE OF CONTENTS

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.

⚠ 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 wish to 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.

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 six spline universal joint with snap ring type shield and quick disconnect feature, fits a 1-3/8-inch (35 mm) tractor PTO drive. The power take-off shaft operating lengths are: minimum 45 inch (1143 mm), maximum 60 inch (1524 mm); weight 35 pounds.

The operating speed may vary from 540-600 rpm depending on the load. The nominal PTO speed is 540 rpm at full load.

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	25 kW	
	Model 3G	Model 3G	Model 5DG
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 75 amperes.

	20 kW Model 3G	30 kW Model 3G	30 kW Model 5DG
Starting Watts	52,000	80,000	95,000
Running Watts	20,000	30,000	30,000
Volts	120/240	120/240	120/240
Phase	1	1	3
Hertz	60	60	60
Current (Amperes)	83.3	125	90.3
Power Factor	1.0	1.0	0.8
Wire	4	4	4
Brushless	Yes	Yes	Yes
Alternator Speed (Nominal)	1800	1800	1800
Tractor Speed (Nominal)	540	540	540
Minimum Horsepower Required Driving Source	35	55	55
Gear Box Oil Capacity, Pints	1.0 Pt. (0.47 litre)	1.0 Pt. (0.47 litre)	1.0 Pt. (0.47 litre)
Gear Lubricant	SAE 90 EP	SAE 90 EP	SAE 90 EP
Weight	398 lbs. (181 kg)	483 lbs. (219 kg)	512 lbs. (232 kg)

DESCRIPTION

ALTERNATOR DESCRIPTION

The 15 thru 30 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 rotor is fastened to the gear case by the rotor through-stud which passes through the rotor shaft, Figure 2.

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, which includes voltmeter and a full output load plug.

Gear Box

The gear box and alternator adapter contain two helical gears supported by heavy duty ball bearings. The bearings and gears are lubricated by the gear box oil. The gear box requires 1.0-pint (.47 litre) of SAE 90 EP (extreme pressure) gear lubricant.

Control Box

The control box includes the voltage regulator, voltmeter, 15 amp duplex receptacle with circuit breaker, 50 amp welder receptacle with circuit breakers, a full output load connector with load circuit breakers, and a field circuit breaker. The load circuit breakers can be used as an on-off switch. Alternator power must feed into the farm electrical system through an approved double throw load transfer switch.

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 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 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.

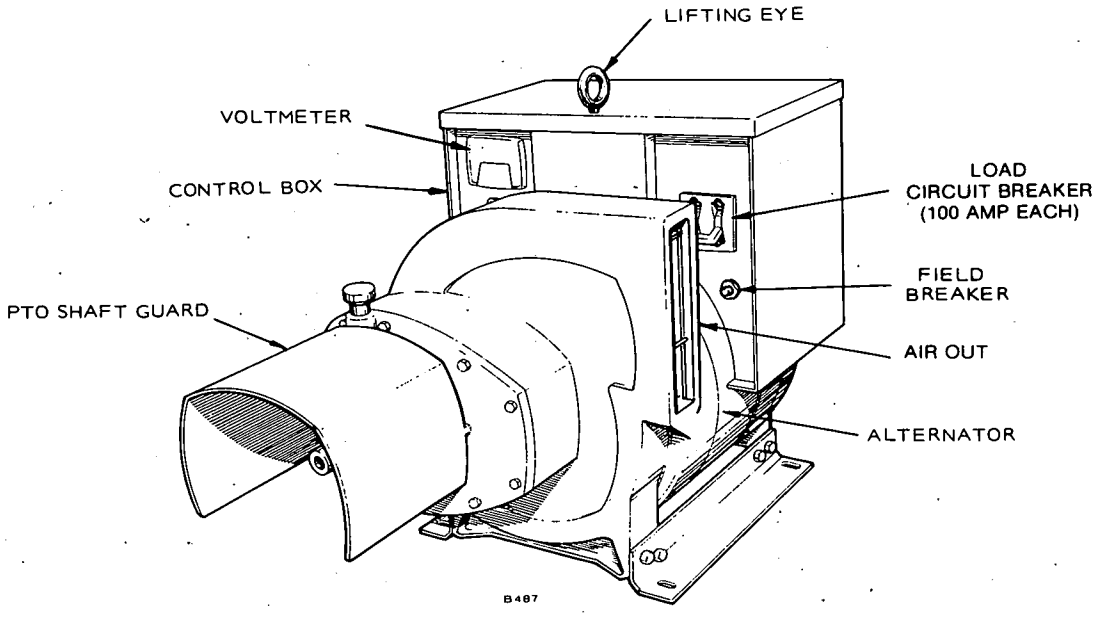


FIGURE 1. PTO-POWERED ALTERNATOR

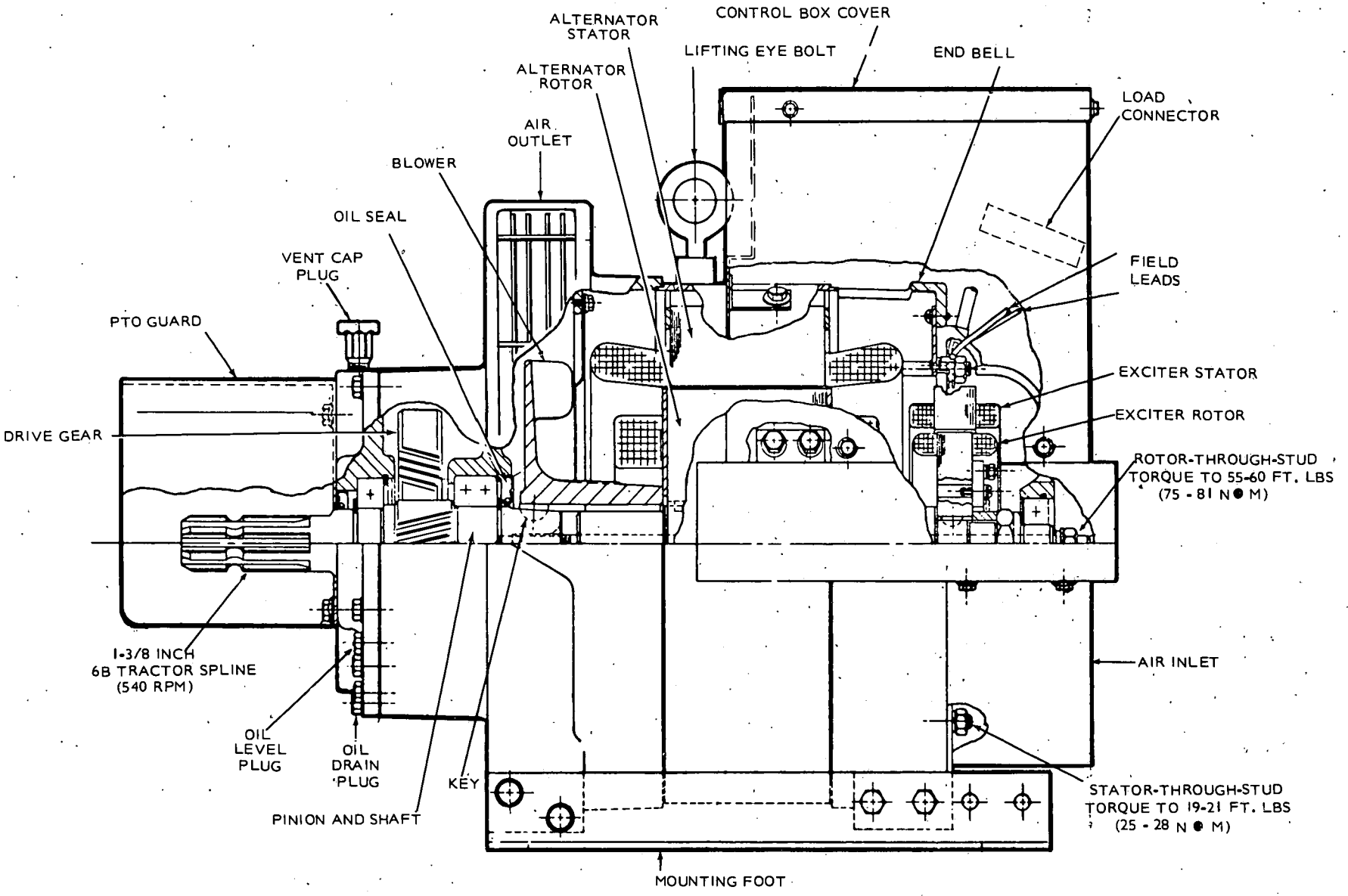


FIGURE 2. YD TRACTOR DRIVE ALTERNATOR

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 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.

Provide an outlet for tractor exhaust if operating inside a building. Exhaust fumes are deadly! See carbon monoxide warning at the end of this section.

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 feet 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
15.0YD-PTO (MISC) (1Ø1.0 PF)	28.94	(735)	3.75	(95)	355	161.2
20.0YD-PTO (MISC) (1Ø)	30.38	(772)	5.19	(132)	398	180.5
25.0YD-PTO (MISC) (1ØE.3Ø)	31.62	(844)	6.44	(164)	435	197.5
30.0YD-PTO (MISC) (1ØE.3Ø)	33.24	(844)	8.06	(205)	483	219.1

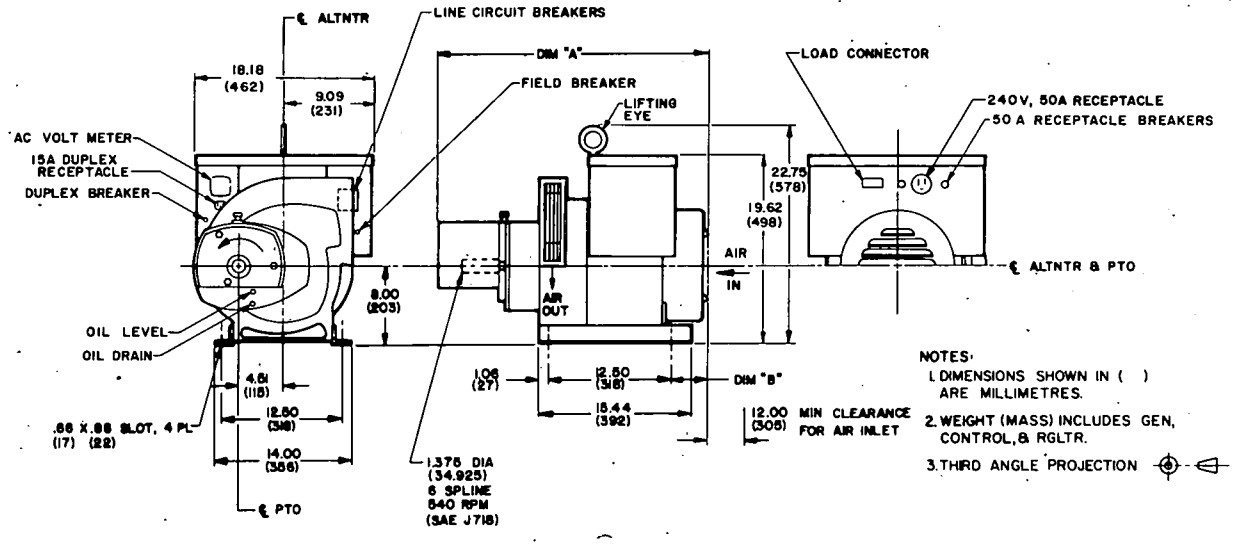
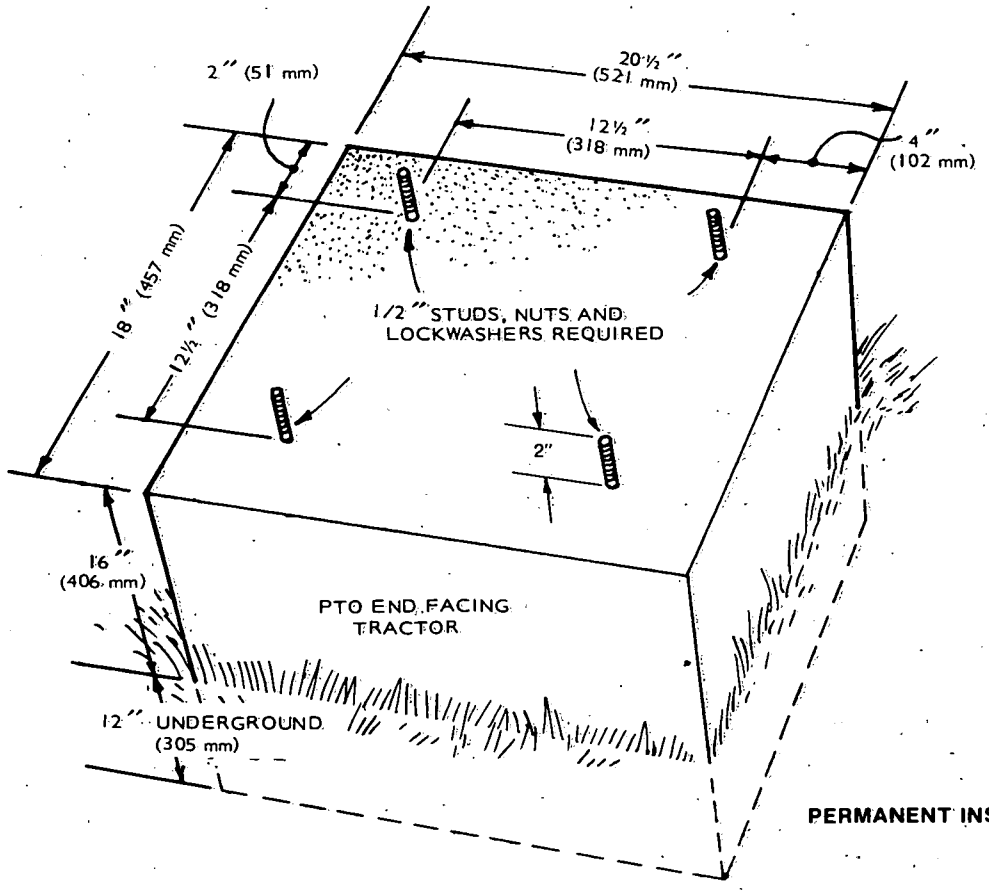
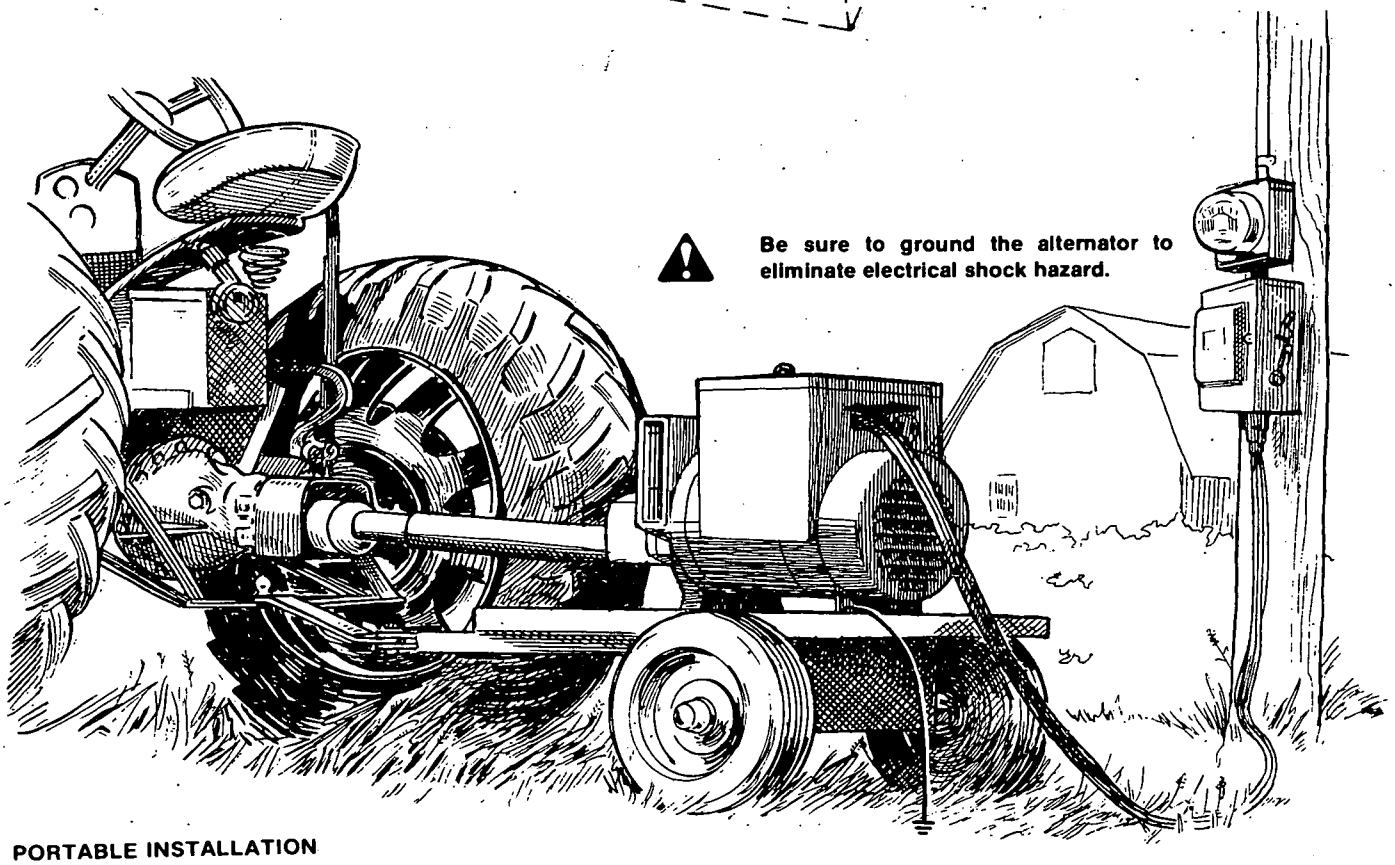


FIGURE 3. INSTALLATION OUTLINE



PERMANENT INSTALLATION



PORTABLE INSTALLATION

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.

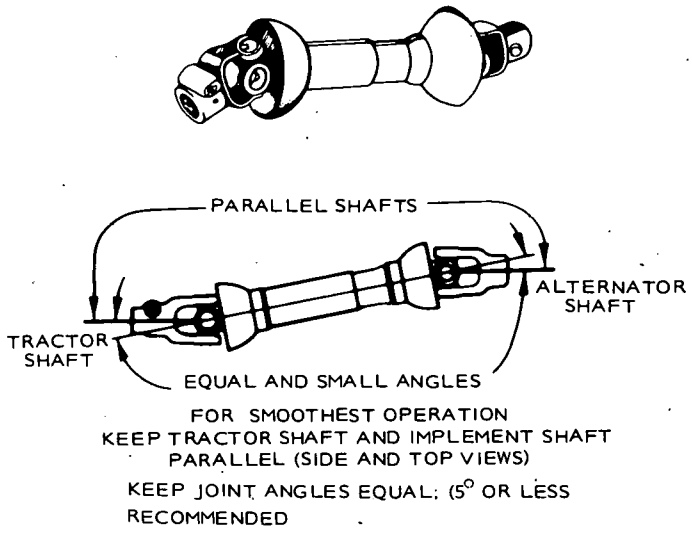


FIGURE 5. PTO SHAFT ALIGNMENT

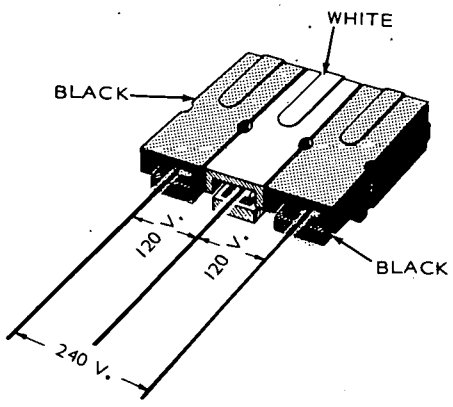


FIGURE 6. 120/240 VOLT, SINGLE PHASE CONNECTION

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.**

The protective guards on the PTO shaft are for personnel safety. They can be removed for maintenance, but should 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 plug position on the control box.
- Insulate bare ends of ungrounded wires.
- Install a load transfer switch 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 load leads (T1, T2, T3).

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

With this connection, either 120 volts or 240 volts can be used alone or at the same time. Figure 6 shows a 120/240 volt, single phase connector.

THREE PHASE ALTERNATORS

The 3-phase alternator will supply 240 volts, 3 phase and 120 and 240 volts single phase current, Figure 7. All black terminals are used for 240 volt, three phase. For 240 volt single phase, connections are made between any two (black) three phase terminals. Single phase, 120 volts connect between black and white terminals as shown.

Single phase connector, Figure 6, can be used in a three phase alternator.

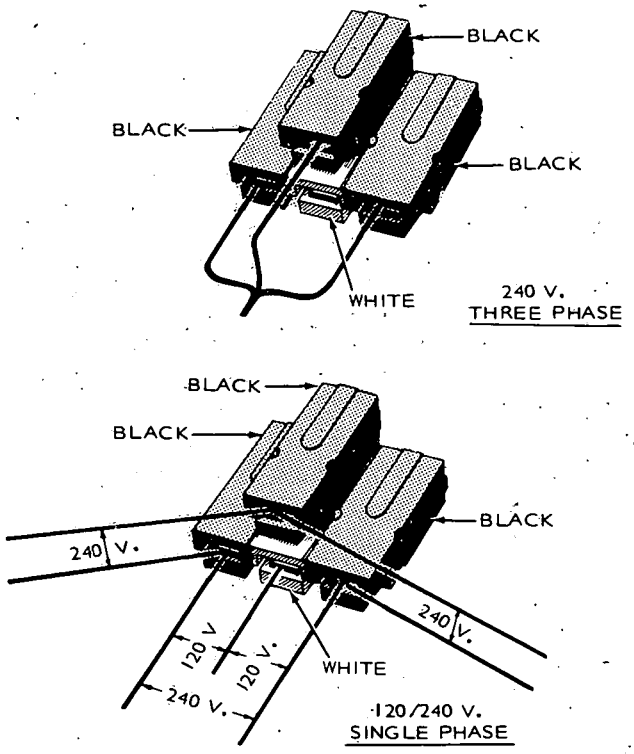


FIGURE 7. THREE PHASE 240 VOLT DELTA CONNECTIONS

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 alternator 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

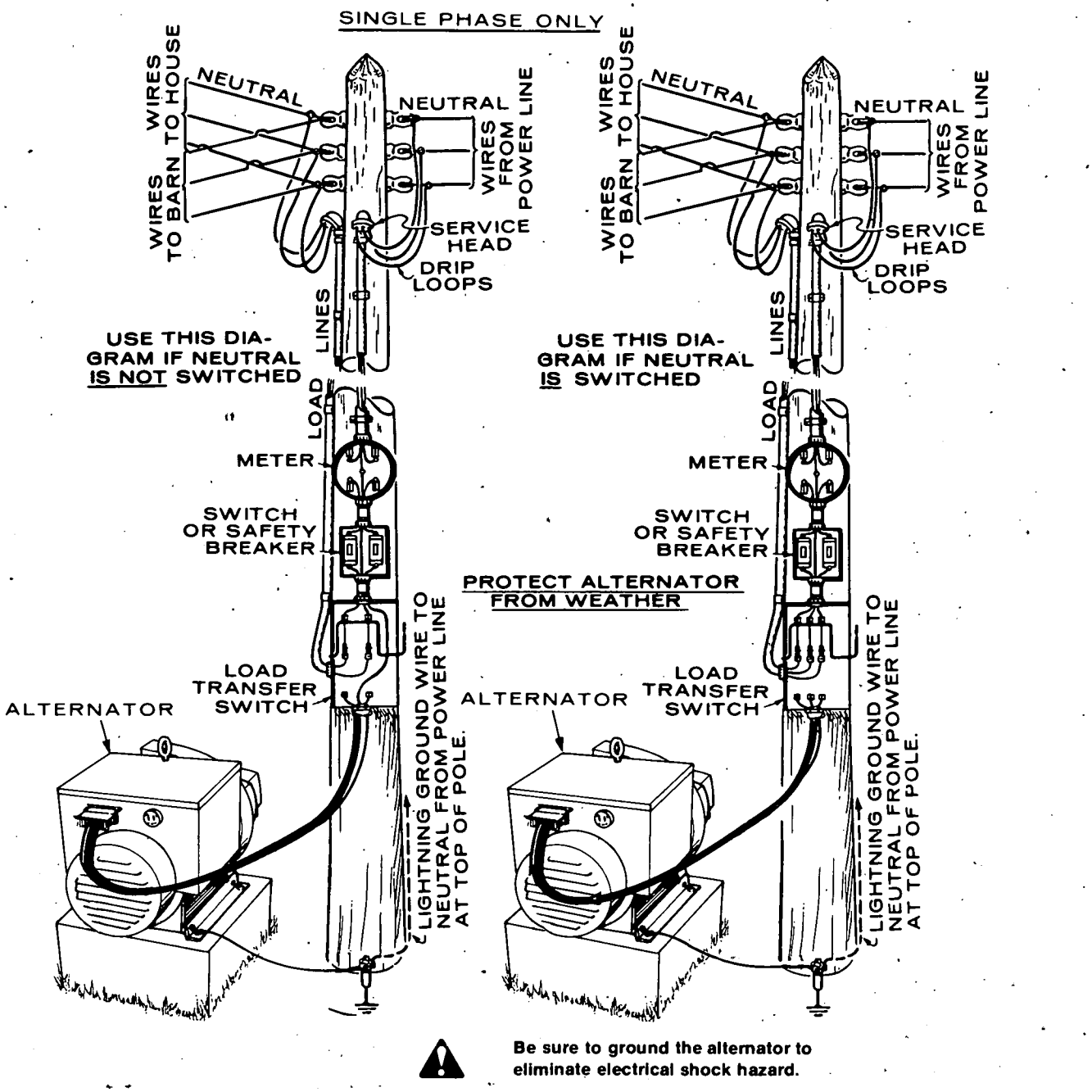
Two load transfer switches and additional wiring are required to connect one standby 3-phase alternator in locations where separate 1-phase and 3-phase power lines normally supply the power. A 3-pole, double throw switch alternately connects the 240 volt, 3-phase line transformer power or the 240 volt, 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.

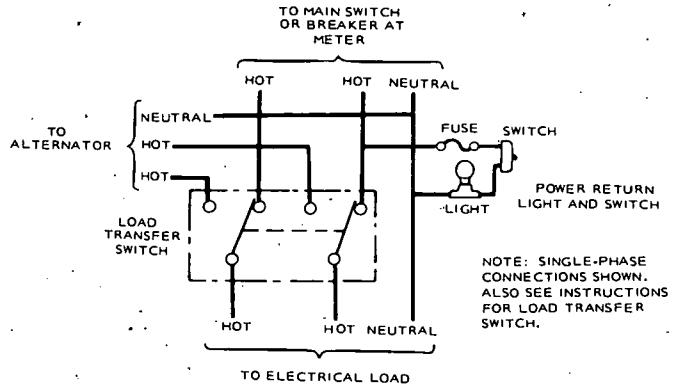
GROUNDING THE ALTERNATOR

CAUTION **Be sure to ground the alternator to eliminate electric shock hazard.**

Connect a #8 or larger wire between the alternator and:

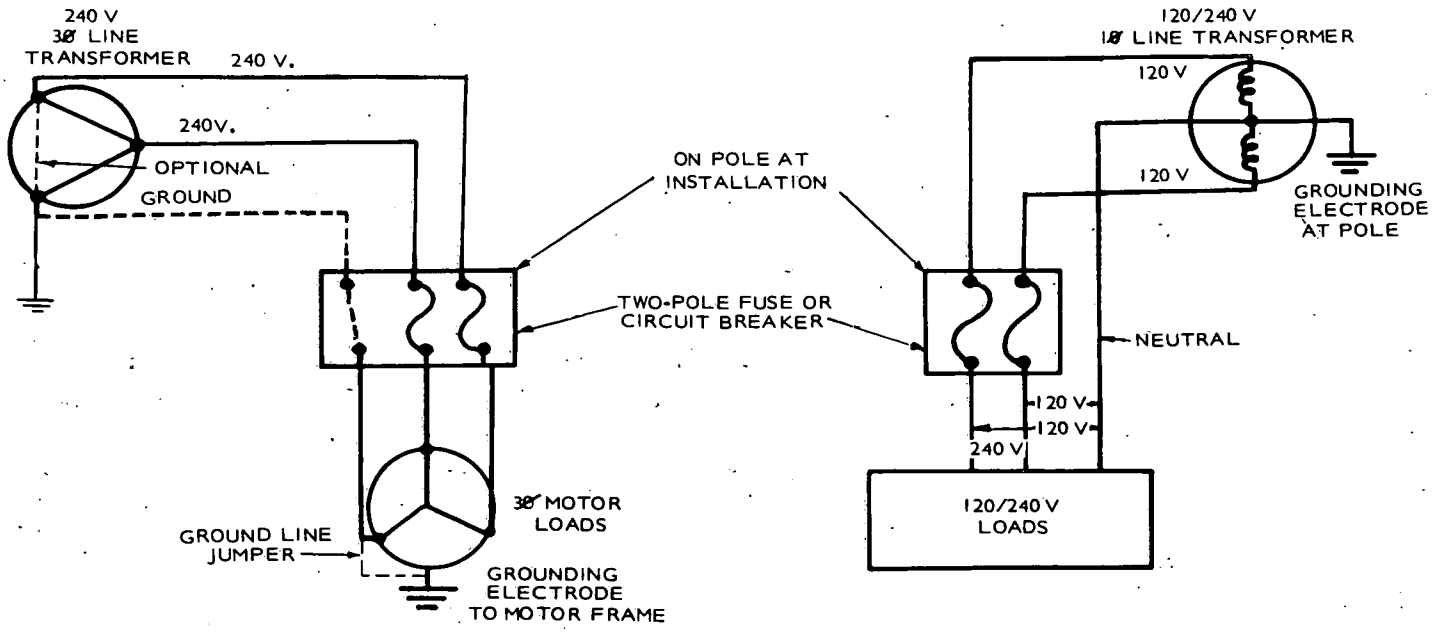
1. The lightning ground rod at the pole (grounds neutral from power line at top of pole) as shown in Figure 8.
2. A separate ground pipe or rod penetrating into moist earth as detailed by local codes.



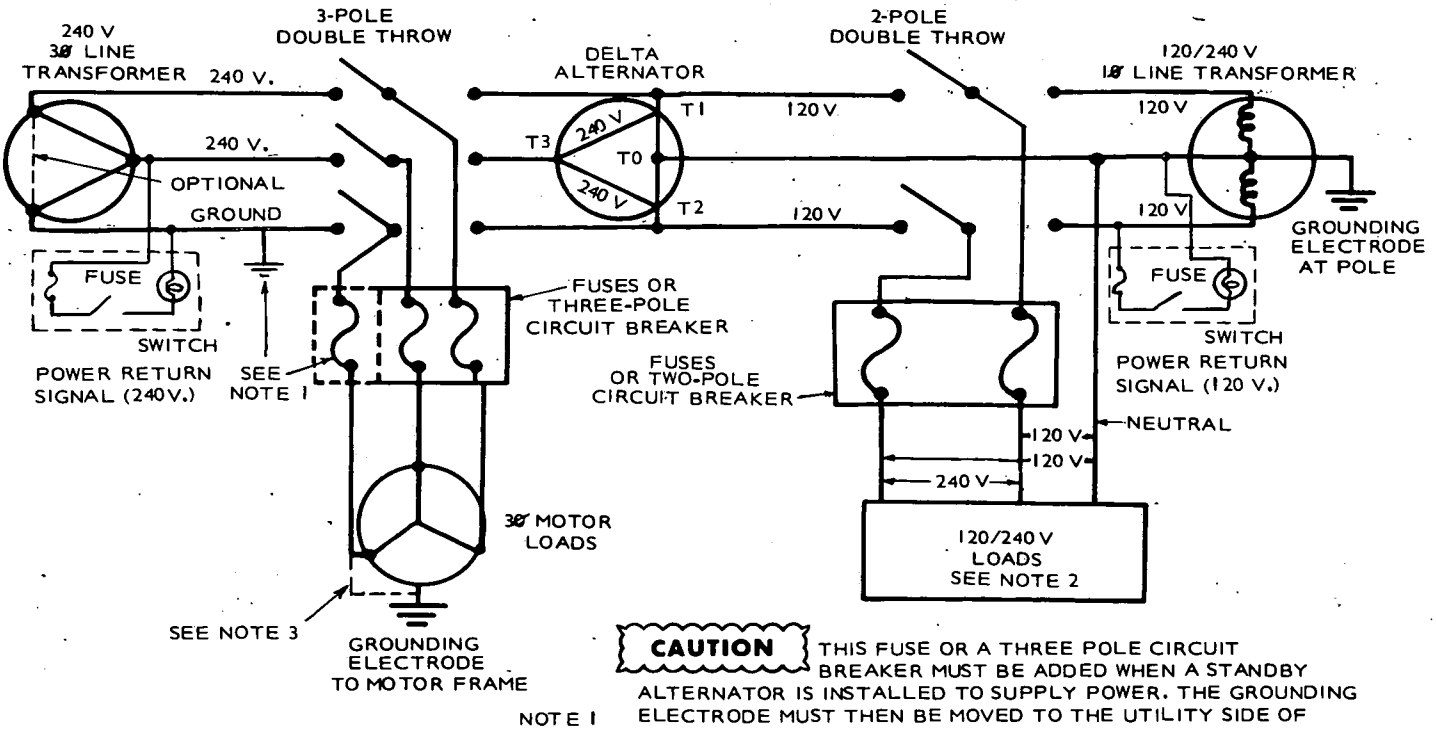


LOAD TRANSFER SWITCH CONNECTIONS

FIGURE 8. TYPICAL FARM STANDBY, SINGLE PHASE



TYPICAL CIRCUITS BEFORE INSTALLING 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

⚠ 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

⚠ 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 alternator single phase load cable connector will only accept the single phase cable assembly plug. The alternator three phase load cable connector will accept either the single or the three phase cable assembly plugs to provide either single or three phase power from a three phase alternator. 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.

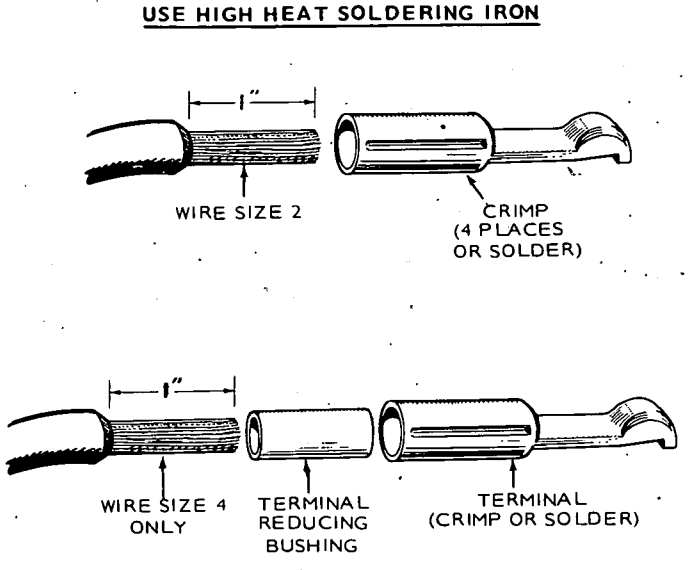


FIGURE 10. CABLE WIRE TO TERMINAL CONNECTIONS

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.
   e. 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.

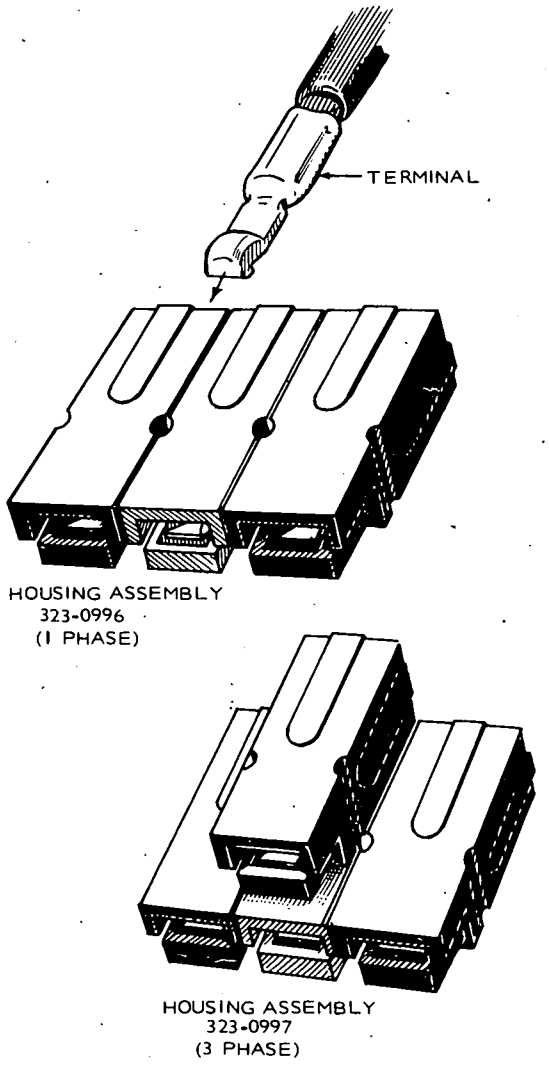


FIGURE 11. SINGLE AND THREE PHASE PLUGS

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.

For a safe and proper connection, 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.

4. 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.

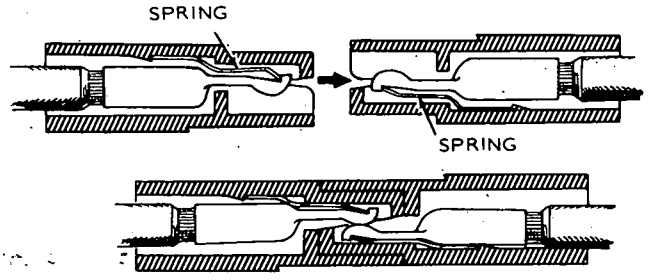


FIGURE 12. CONNECTOR HOUSING AND TERMINAL CONNECTION DETAILS

ENGINE EXHAUST GAS (CARBON MONOXIDE) IS DEADLY!

Carbon monoxide is an odorless, colorless gas formed by incomplete combustion of hydrocarbon fuels. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal. Some of the symptoms or signs of carbon monoxide inhalation are:

- **Dizziness**
- **Intense Headache**
- **Weakness and Sleepiness**
- **Vomiting**
- **Muscular Twitching**
- **Throbbing in Temples**

If you experience any of the above symptoms, get out into fresh air immediately.

The best protection against carbon monoxide inhalation is a regular inspection of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.

OPERATION

CONNECTING TRACTOR TO ALTERNATOR

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.
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.

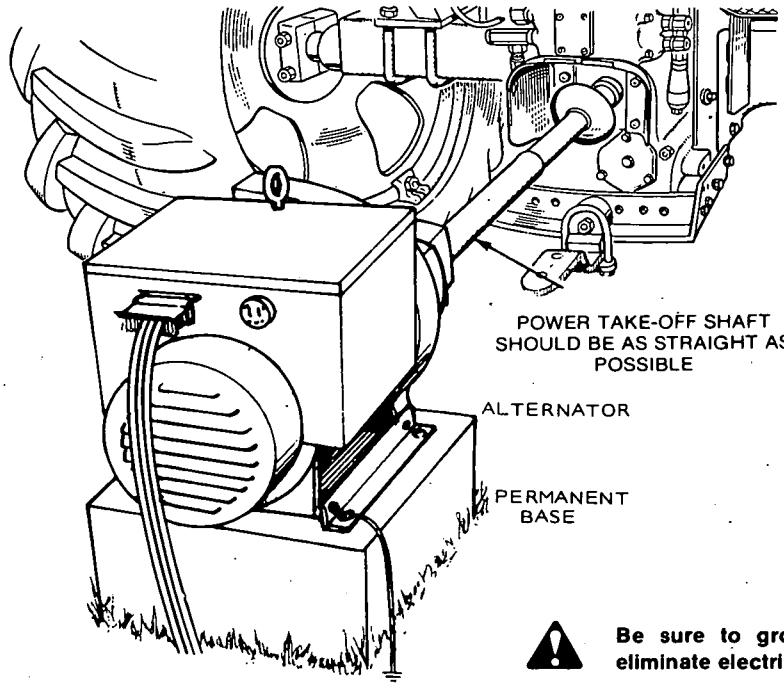
Be sure all power shields and guards are in place and secured before starting unit to prevent possible injuries to personnel.

STARTING ALTERNATOR AND CONNECTING LOAD

1. Start tractor, engage power take-off, and bring PTO shaft speed up to 540-600 rpm.
2. With alternator running, position alternator circuit breaker to ON position. At 600 rpm (PTO) the voltmeter on the alternator control box reads about 250 volts (in the green range on voltmeter).
3. Various electric loads can now be connected.

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

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



Be sure to ground the alternator to eliminate electrical shock hazard.

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.

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, it may be necessary to change the engine throttle if large changes occur in the electrical system.

CAUTION **Be sure the tractor has sufficient PTO horsepower. See *SPECIFICATIONS*. This alternator requires as a minimum the engine horsepower as given on page 4. If the tractor has little reserve power the governor may not act quickly enough when the electrical load is removed. This could 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

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)	800-1500
Range Oven	3000-4000
Food Freezer	300-800
Brooders	500-1000
Stock Tank Heater	300-1400

MOTORS*

Horsepower	Start	Run
1/2	2800	550
3/4	4300	775
1	5500	1000
2	7130	1960
3	10350	2970
5	16660	3500
7-1/2	23000	5250

* Capacitor type. Repulsion-induction motors require less starting wattage, split-phase motors require slightly more starting wattage.

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.

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

BEARINGS

The ball-bearings in the gear box are lubricated by the gear box lubricant (SAE 90 EP).

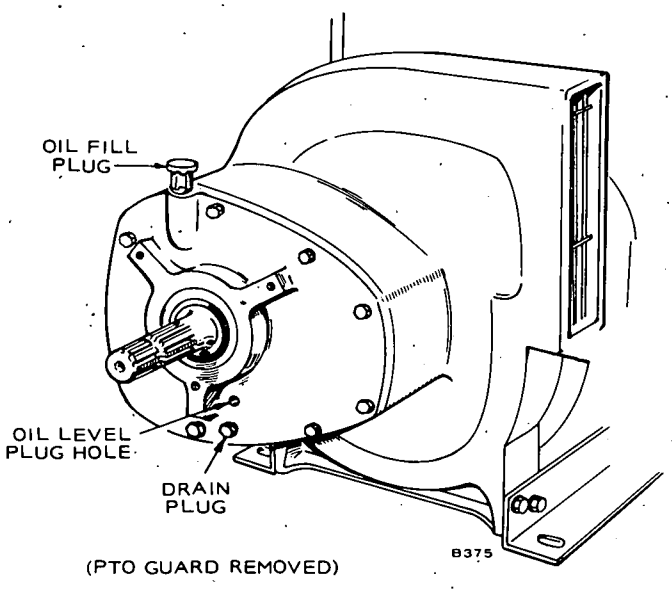


FIGURE 14. GEAR BOX LUBRICATION

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

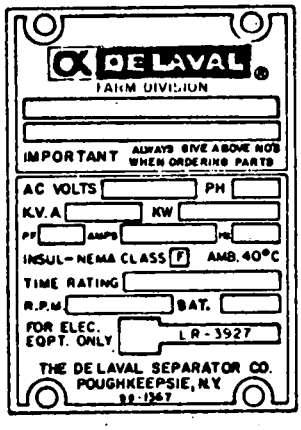
NATURE OF TROUBLE	POSSIBLE CAUSE	REMEDY
Alternator Overheats	1. Windings and parts covered with dirt and oil.	1. Disassemble alternator and clean.
	2. Air intake is restricted or incoming air too hot.	2. Clean alternator air intake and outlet areas.
	3. Overloaded.	3. Remove part of load.
Noisy Alternator	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 De Laval Dealer.
	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. Open circuit of field or stator winding.	4. Make proper connections.
	5. Short circuit of winding in the field or stator.	5. Call your De Laval Dealer.
Low Voltage Output of Alternator	1. External short circuit on line.	1. Test alternator with line wires disconnected.
	2. Incorrect PTO speed.	2. Readjust PTO speed to 540 to 600 rpm.

PARTS CATALOG

INSTRUCTIONS FOR ORDERING REPAIR PARTS

For parts or service, contact the dealer from whom you purchased this equipment or refer to your Nearest Authorized Parts & Service Center.

To avoid errors or delay in filling your parts order, please furnish all information requested.



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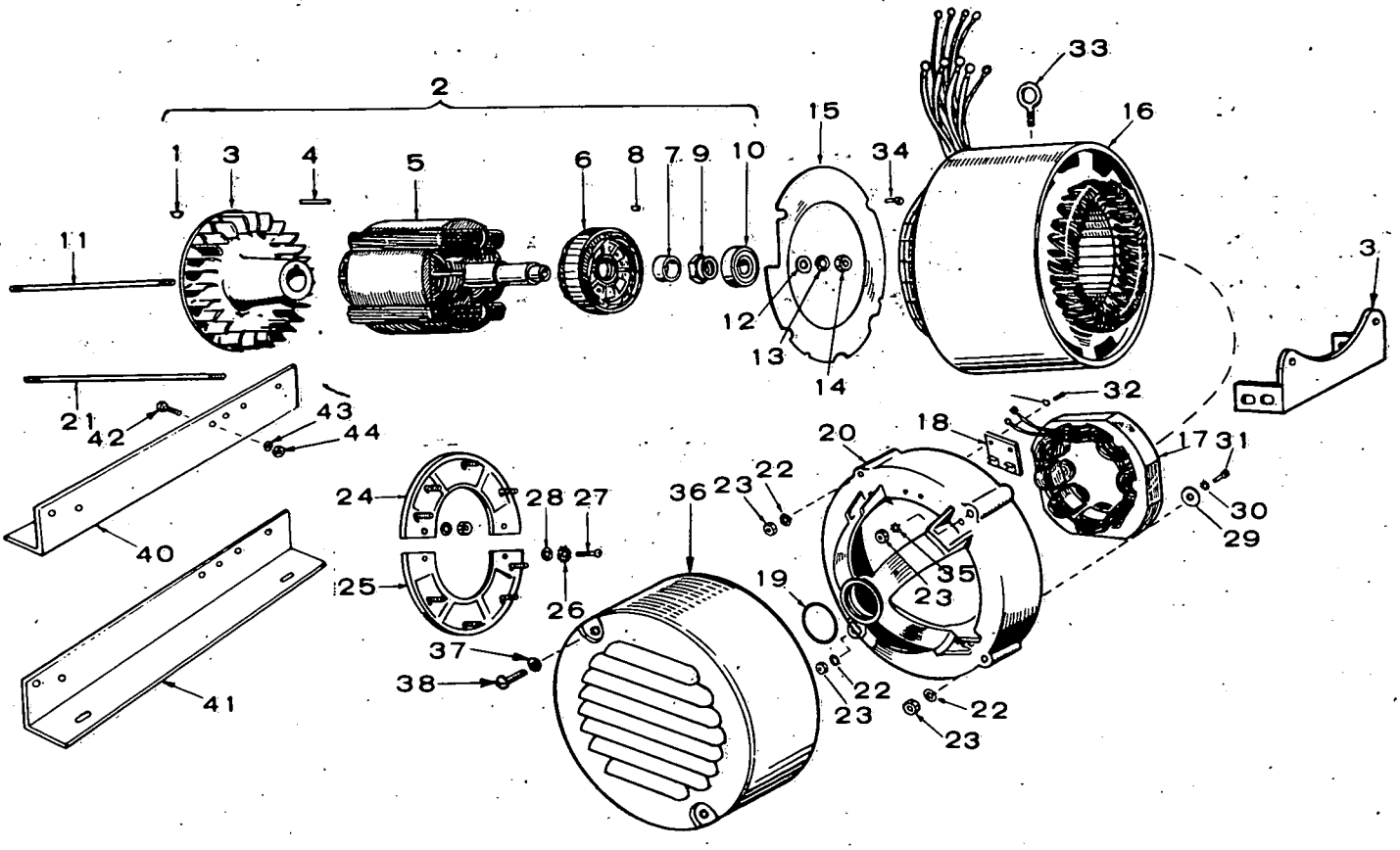
ALTERNATOR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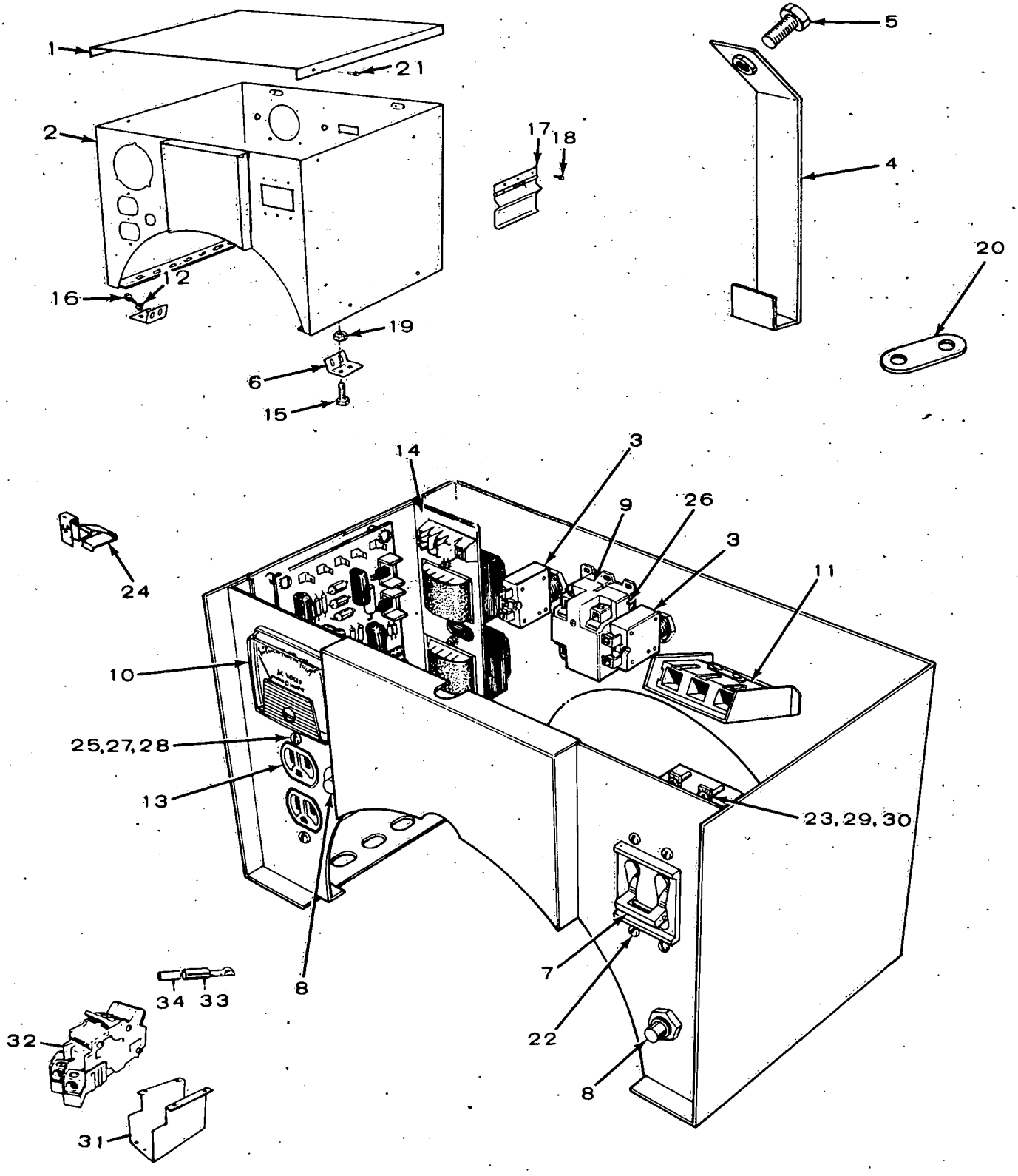
ALTERNATOR

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
	201-2159	1	20 kW Alternator
	201-2160	1	25 kW Alternator
	201-2446	1	30 kW Alternator
3	205-0105	1	*Fan, Generator
4	515-0103	1	*Key, Blower Fan
5	*ROTOR, WOUND		
	201-2052	1	15 kW Alternators
	201-2054	1	20 kW Alternators
	201-2055	1	25 kW Alternators
	201-2439	1	30 kW Alternators
6	*ROTOR ASSEMBLY, WOUND - EXCITER (Includes Parts Marked #)		
	201-2151	1	15, 20 and 25 kW Alternators
	201-2152	1	30 kW Alternators
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
	520-0791	1	20 kW Alternators
	520-0792	1	25 kW Alternators
	520-0858	1	30 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
	220-2740	1	20 kW Alternators
	220-2355	1	25 kW, Single Phase Alternators
	220-2595	1	30 kW Alternators - Single Phase
	220-2356	1	25 kW, Three Phase Alternators
	220-2602	1	30 kW Alternators - Three Phase
17	220-2009	1	Stator, Wound - Exciter
18	232-2418	1	Board, Connection
19	509-0094	1	Seal, "O" Ring - Bearing
20	211-0256	1	Bell, End
21	STUD, ALTERNATOR THROUGH		
	520-0797	2	15 kW Alternators (3/8 x 9-1/2")
	520-0860	2	15 kW Alternators (3/8 x 10-1/16")
	520-0799	4	20 kW Alternators (3/8 x 12-3/8")
	520-0801	4	30 kW Alternators (3/8 x 14")

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
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	403-1249	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	234-0557	1	Cover, End Bell
37	850-0040	2	Washer, Lock - Spring (1/4")
38	812-0165	2	Screw, Machine - Round Head (1/4-20 x 1/2")
39	232-2452	1	Bracket, Alternator Support
40	FOOT, MOUNTING - LEFT SIDE		
	232-2455	1	15 and 25 kW Alternators
	232-2656	1	20 kW Alternators
	232-2625	1	30 kW Alternators
41	FOOT, MOUNTING - RIGHT SIDE		
	232-2454	1	15 and 25 kW Alternators
	232-2655	1	20 kW Alternators
	232-2626	1	30 kW Alternators
42	800-0071	8	Screw, Cap - Hex Head (7/16-14 x 1")
43	850-0055	8	Washer, Lock - Spring (7/16)
44	862-0004	4	Nut, Hex (7/16-14)

* - Included in Complete Rotor Assembly.
\# - Included in Exciter Rotor Assembly.

CONTROL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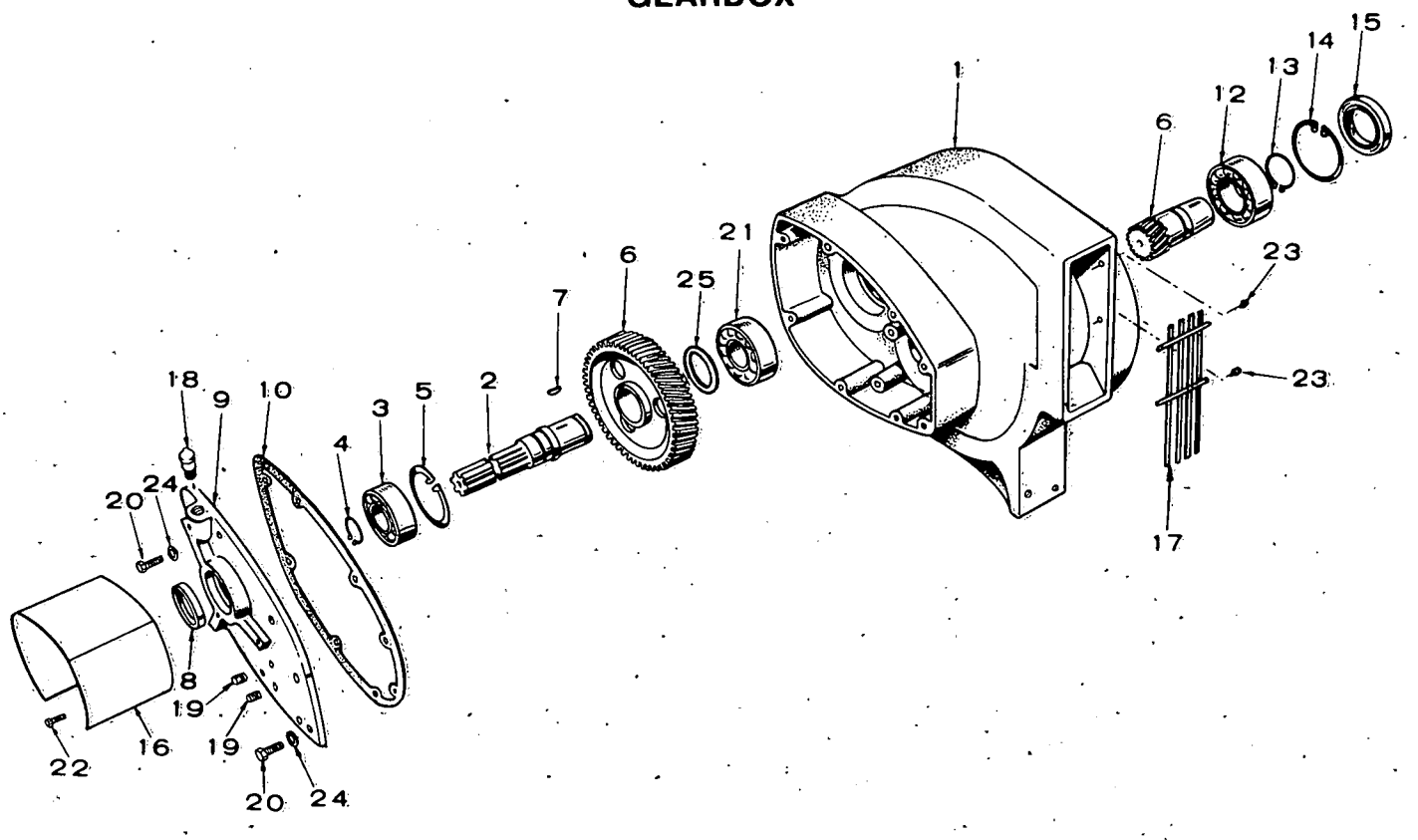
CONTROL

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-4057	1	Cover, Control Box
2	BOX, CONTROL		
	301-4055	1	Single Phase Alternators
	301-4056	1	Three Phase Alternators
3	320-0548	2	Breaker, Circuit (50 Ampere)
4	301-4059	2	Bracket, Control Box Mounting (15 kW Alternators)
5	821-0010	2	Screw, Cap - Hex Head Locking (1/4-20 x 1/2")
6	301-4058	2	Bracket, Control Box Mounting
7	BREAKER, CIRCUIT		
	320-0366	2	65 Ampere (15 kW Single Phase Alternators)
	320-0251	2	100 Ampere (25 kW Single Phase Alternators)
	320-0641	3	75 Ampere (25 kW) Three Phase Alternator
8	BREAKER, CIRCUIT		
	320-0505	1	3 Ampere
	320-0540	1	15 Ampere
9	323-0894	1	Receptacle, Output
10	302-0551	1	Voltmeter (0-300 Volts)
11	HOUSING, CONNECTOR		
	323-0996	1	Single Phase (1 Ø)
	323-0997	1	Three Phase (3 Ø)
12	856-1008	4	Washer, Lock - EIT (5/16")
13	323-0383	1	Receptacle, Duplex
14	REGULATOR ASSEMBLY, VOLTAGE (See Separate Group for Components)		
	305-0534	1	15, 20 and 25k W Sets
	305-0579	1	30 kW Sets
15	821-0014	4	Screw, Cap - Hex Head Locking Flange (5/16-18 x 1/2")
16	815-0236	4	Screw, Cap - Hex Head - Locking Flange (5/16-18 x 5/8")
17	301-4233	1	Cover, Load Plug
18	821-0004	2	Screw (Whizlock), Hex - Cover Mounting (10-32 x 5/16" lg)
19	870-0257	4	Nut, Hex Locking (5/16-18)
20	301-4034	1	Retainer, Lead Connector
21	821-0005	4	Screw, Cap - Hex Head - Locking Flange (#10-32 x 1/2")
22	812-0059	4	Screw, Machine - Round Head (#6-32 x 1/4") **NOTE:** 6 used on Three Phase Alternators
23	871-0010	12	Nut, Brass (#10-32) **NOTE:** 18 used on Three Phase Alternators
24	518-0343	2	Clip, Regulator Assembly Mounting
25	812-0079	2	Screw, Machine - Round Head (#8-32 x 1/2")
26	812-0059	4	Screw, Machine - Round Head (#6-32 x 1/4")
27	853-0005	2	Washer, Lock - ET (#8)
28	860-0008	2	Nut, Hex (#8-32)
29	853-0008	4	Washer, Lock - ET (#10) **NOTE:** 6 used on Three Phase Alternators
30	811-0103	4	Screw, Machine - Round Head - Brass (#10-32 x 3/4") **NOTE:** 6 used on Three Phase Alternators
31	301-3985	1	Bracket, Circuit Breaker - 30 kW Single Phase Alternators
32	320-0580	1	Breaker, Circuit (125 Ampere) - 30 kW Single Phase Alternators
33	TERMINAL, CONNECTION		
	332-1880	6	Single Phase Alternators
	332-1880	8	Three Phase Alternators
34	REDUCER, TERMINAL		
	332-1881	6	Single Phase Alternators
	332-1881	8	Three Phase Alternators

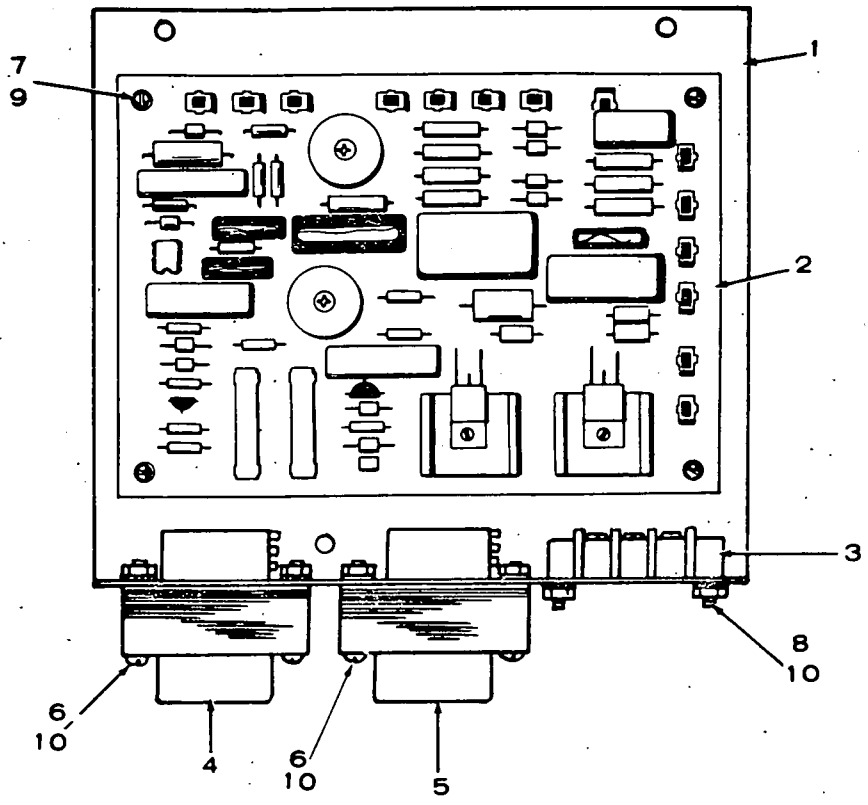
GEARBOX



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	231-0184	1	Adapter and Gear Drive Case
2	SHAFT, INPUT GEAR		
	190-0409	1	15 and 25 kW Sets
	190-0411	1	20 and 30 kW Sets
3	510-0114	1	Bearing, Ball - Input Shaft
4	518-0122	1	Ring, Retaining - External
5	518-0287	1	Ring, Retaining - Internal
6	190-0437	1	Gear Set
7	515-0141	1	Key, Drive Gear to Shaft
8	509-0138	1	Seal, Oil - Bearing Plate
9	PLATE, BEARING		
	190-0408	1	15 and 25 kW Sets
	190-0414	1	20 and 30 kW Sets
10	103-0451	1	Gasket, Bearing Plate
12	510-0126	1	Bearing, Ball - Output Shaft
13	518-0333	1	Ring, Retaining - External
14	518-0334	1	Ring, Retaining - Internal

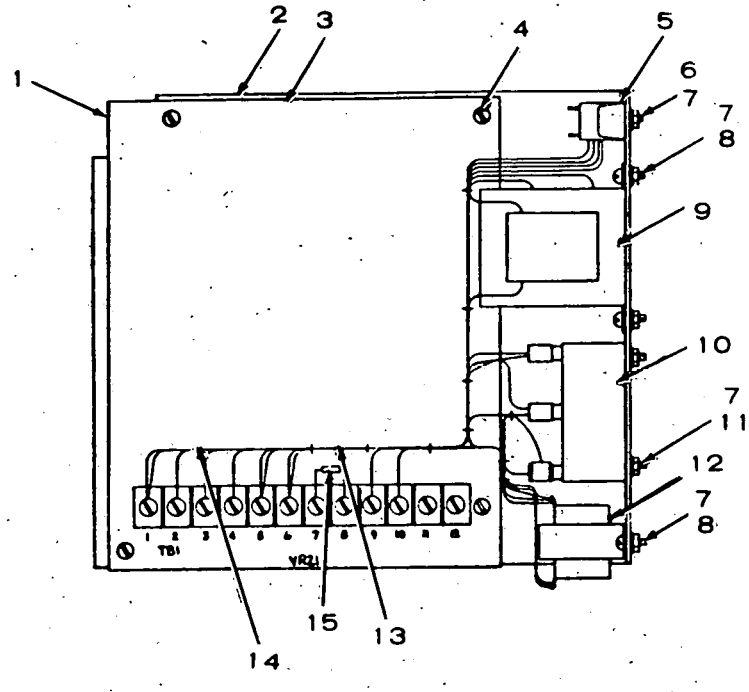
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
15	509-0139	1	Seal, Oil - Output Shaft
16	190-0384	1	Guard, Power Take-off
17	234-0581	1	Grille, Air Outlet
18	518-0275	1	Vent and Fill Plug
19	502-0028	2	Plug, Drain and Oil Level Brass
20	800-0029	8	Screw, Cap - Hex Head (5/16-18 x 1-1/8")
21	510-0117	1	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)

VOLTAGE REGULATOR — 15, 20 AND 25 kW ALTERNATORS



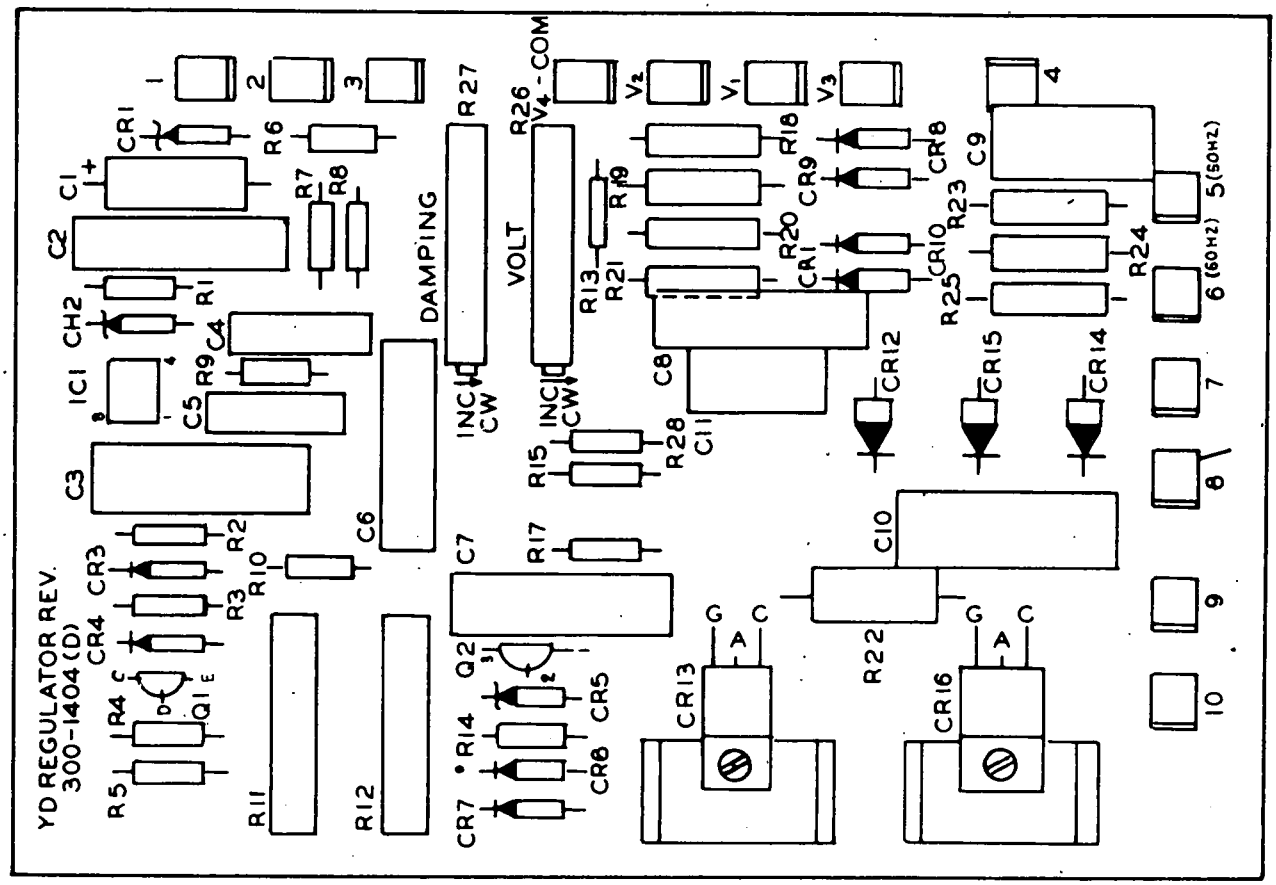
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	305-0534	1	Regulator Assembly, Voltage (Complete)
1	307-3719	1	Panel, Voltage Regulator Mounting
2	300-1404	1	Board Assembly, Printed Circuit (See Separate Group for Components)
3	332-1655	1	Strip, Terminal
4	315-0386	1	Transformer, Voltage
5	315-0391	1	Reactor
6	812-0068	4	Screw, Round Head Machine (#6-32 x 1")
7	812-0061	4	Screw, Round Head Machine (#6-32 x 3/8")
8	812-0063	2	Terminal Strip Mounting (#6-32 x 1/2")
9	853-0003	4	Washer, Lock - ET (#6)
10	870-0183	8	Nut, Hex - With ET (#6-32)

VOLTAGE REGULATOR — 30 kW ALTERNATORS



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	305-0579	1	Regulator Assembly, Voltage - 30 kW Alternators - Complete
2	301-4591	1	Panel, Voltage Regulator Mounting - 30 kW Alternators
3	332-1956	1	Board Assembly, Printed Circuit - 30 kW Alternators (See Separate Group for Components)
4	812-0059	4	Screw, Machine - RH (#6-32 x 1/4") - 30 kW Alternators
5	332-2097	1	Block, Terminal (12 Place) - 30 kW Alternators
6	812-0063	2	Screw, Machine - RH (#6-32 x 1/2") - 30 kW Alternators
7	870-0183	8	Nut, Hex W/ET (#6-32) - 30 kW Alternators
8	812-0061	4	Screw, Machine - RH (#6-32 x 5/8") - 30 kW Alternators
9	315-0431	1	Transformer, Voltage - 30 kW Alternators
10	305-0524	1	Bridge, SCR - 30 kW Alternators
11	812-0068	2	Screw, Machine - RH (#6-32 x 1") - 30 kW Alternators
12	315-0343	1	Reactor - 30 kW Alternators
13	338-1124	1	Harness, Wiring (Includes Resistor) - 30 kW Alternators
14	332-0942	1	Tie, Cable - 30 kW Alternators
15	350-1190	1	Resistor (1740-Ohm, 1/4 Watt) - Part of Wiring Harness - 30 kW Alternators

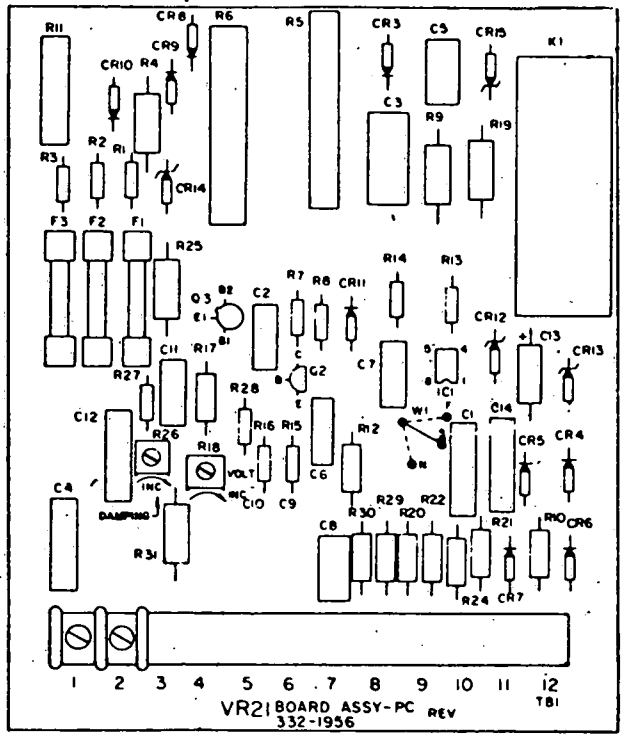
PRINTED CIRCUIT BOARD (300-1404)
15, 20 AND 25 kW ALTERNATORS



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 (1 Amp, 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
IC1	367-0005	1	Integrated Circuit
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)
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)

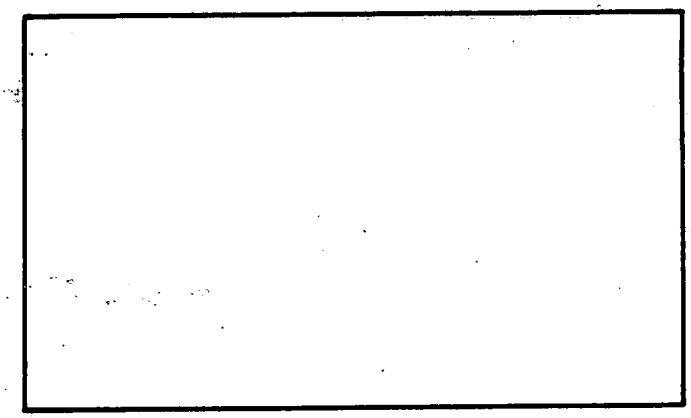
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
R11,12	353-0048	2	Resistor, Wire Wound (4,000-Ohm, 5 Watt)
R13	351-0293	1	Resistor, Film (11,000-Ohm, 1/4 Watt)
R14	350-0363	1	Resistor (100-Ohm, 1/2 Watt)
R15,17	350-0351	2	Resistor (33-Ohm, 1/2 Watt)
R18	351-0332	1	Resistor, Film (28,000-Ohm, 1/4 Watt)
R19	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 (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 (5,000-Ohm, 1 Watt)
R27	303-0207	1	Potentiometer (20,000-Ohm, 1 Watt)
R28	350-0355	1	Resistor (47-Ohm, 1/2 Watt)
	332-1511	13	Terminal, Lug
	363-0069	2	Heatsink, Diode
	812-0029	2	Screw, Round Head (4-40 x 3/8")
	526-0257	2	Washer, Flat (#4)
	860-0003	2	Nut, Hex (4-40)

PRINTED CIRCUIT BOARD ASSEMBLY (332-1956)
30 kW ALTERNATORS



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	332-1956	1	Board Assembly, Printed - Complete
C1,14	355-0042	2	Capacitor - 47 Mfd, 250 Volt
C2, C7	355-0043	2	Capacitor - 22 Mfd, 250 Volt
C3	355-0047	1	Capacitor - 47 Mfd, 400 Volt
C4, C12	355-0044	2	Capacitor - 47 Mfd, 250 Volt
C5, C8	355-0046	2	Capacitor - 1 Mfd, 100 Volt
C6	355-0056	1	Capacitor - .33 Mfd, 250 Volt
C11	355-0048	1	Capacitor - 1 Mfd, 400 Volt
C13	356-0039	1	Capacitor - Electrolytic 100 Mfd, 10 Volt
CR3 Thru 11	357-0014	9	Rectifier - Silicon
CR12	359-0036	1	Diode - Zener 5.6 Volt
CR13	359-0025	1	Diode - Zener 20 Volt
CR14	359-0026	1	Diode - Zener 18 Volt
F1, F2, F3	321-0204	3	Fuse 1/4 Amp
1C1	367-0005	1	Integrated Circuit
Q2	362-0017	1	Transistor - Silicon NPN
Q3	361-0004	1	Transistor - Unijunction
R1	350-0355	1	Resistor - 1/2 Watt, 47-Ohm
R2, R3	350-0351	2	Resistor - 1/2 Watt, 33-Ohm
R4	350-1075	1	Resistor - 2 Watt, 4.7 Meg-Ohm
R5	353-0040	1	Resistor - Fixed 10 Watt, 270-Ohm
R6	353-0039	1	Resistor - Fixed 15 Watt, 5,000-Ohm
R7	350-0398	1	Resistor - 1/2 Watt, 3,000-Ohm
R8, R16	350-0447	2	Resistor - 1/2 Watt, 330,000-Ohm
R10	351-0885	1	Resistor - 1/2 Watt, 51,100-Ohm
R11	352-0151	1	Resistor - Fixed 5 Watt, 15,000-Ohm
R12	351-0909	1	Resistor - 1/2 Watt, 90,900-Ohm
R13	350-0411	1	Resistor - 1/2 Watt, 10,000-Ohm
R14	350-0443	1	Resistor - 1/2 Watt, 220,000-Ohm
R15, R27	350-0435	2	Resistor - 1/2 Watt, 100,000-Ohm
R17	351-0521	1	Resistor, Metal Film - 1/4 Watt, 12,100-Ohm
R18	303-0210	1	Potentiometer - 5,000-Ohm, 1/2 Watt
R20, 22 29 & 30	351-0520	4	Resistor - 1/4 Watt, 28,000-Ohm
R21	351-0522	1	Resistor - Metal Film - 1/4 Watt, 5,110-Ohm
R24	351-0523	1	Resistor - Metal Film - 1/4 Watt, 8,870-Ohm
R25, R31	350-1011	2	Resistor - 2 Watt, 10,000-Ohm
R26	303-0211	1	Potentiometer - 1/2 Watt, 100,000-Ohm
R28	350-0568	1	Resistor - 1/2 Watt .47 Meg-Ohm
TB1	332-1252	1	Terminal Block
CR15	359-0015	1	Diode - Zener - 24 Volt
	321-0163	6	Clip - Fuse
K1	307-1063	1	Relay, Magnetic Reed
R9	350-1014	1	Resistor - 2 Watt, 13,000-Ohm
R19	350-1007	1	Resistor - 2 Watt, 6,800-Ohm

For parts and service, your De Laval Dealer is:



The De Laval Separator Company

DE LAVAL™

Farm Division, Poughkeepsie, New York