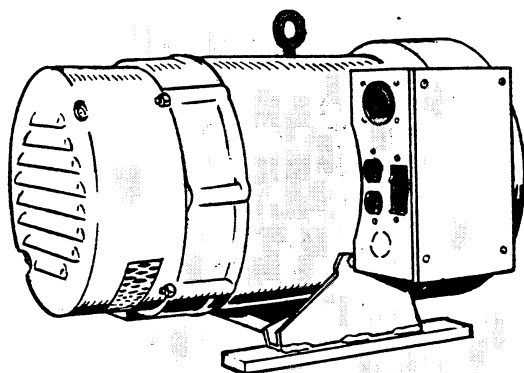


OPERATOR'S MANUAL AND PARTS CATALOG

FOR

UT SERIES

TRACTOR DRIVE ALTERNATOR



INTRODUCTION

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

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

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

FOR REPAIR SERVICE, CONTACT YOUR AUTHORIZED SERVICE REPRESENTATIVE.

WARNING

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

Important Safety Precautions

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

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

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC

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

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

EXHAUST GAS IS DEADLY

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

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

Make sure exhaust is properly ventilated.

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

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

BATTERY GAS IS EXPLOSIVE

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

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

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

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

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

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

If the cabinet must be opened for any reason:

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

MEDIUM VOLTAGE GENERATOR SETS (601V TO 15kV)

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

GENERAL SAFETY PRECAUTIONS

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

KEEP THIS DOCUMENT NEAR EQUIPMENT FOR EASY REFERENCE.

TRACTOR DRIVE ALTERNATOR

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SAFETY PRECAUTIONS

Investigation of thousands of accidents shows that careless use of machinery causes nearly 1/3 of all accidents. Study the following safety precautions carefully and insist that they be followed by those working with you and for you.

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.

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

Before lubricating alternator always:

1. Disengage all power
2. Shut off engine, and then
3. Wait until rotor stops

It is a good practice to have a fire extinguisher nearby. Be sure that the extinguisher is properly maintained and be familiar with it's proper use.

Be sure engine is in a well ventilated area.

Keep arms, legs, feet and other parts out from underneath alternator when it is being raised by eyebolt.

Make certain only a qualified electrician does the electrical installations.

When working around electrical equipment, move slowly.

Do not lunge after falling tools.

Stop all power, and ground all high voltage points before touching wires.

Make certain that power cannot be accidentally restored.

Do not work on underground electrical equipment.

Do not examine live equipment when mentally or physically fatigued.

Do not touch electrical equipment while standing on metal floors, damp concrete or other well grounded surfaces.

Do not handle 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.

Read the operator's manual.

GENERAL INFORMATION

INTRODUCTION

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

ALTERNATOR DESCRIPTION

The UT series is a revolving field, two bearing alternator. AC output voltage is generated in the stator and controlled by a static exciter attached to the end bell. The static exciter produces DC for field excitation and regulates the AC output.

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

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

Gear Box

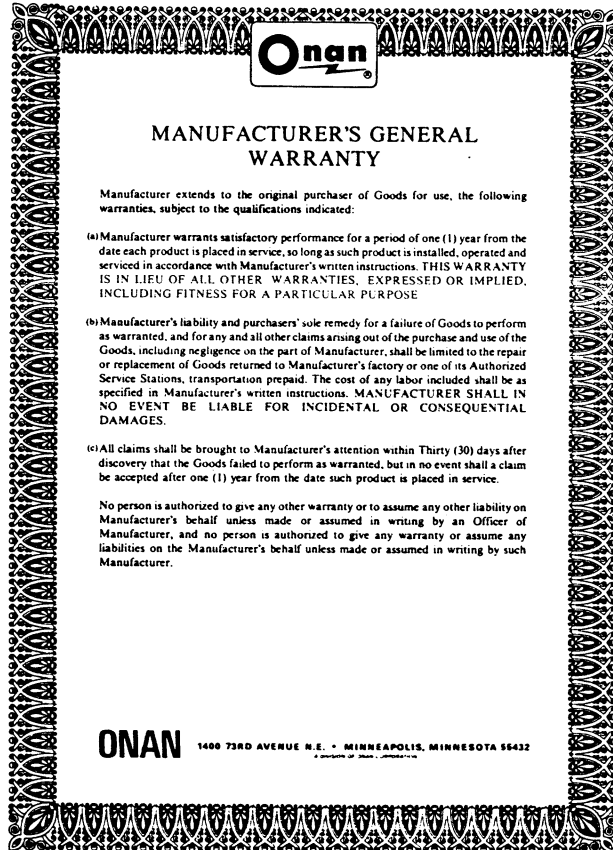
The gear box is secured to the alternator's rear end bell and has two gears. A pinion gear is pressed on and keyed to the alternator rotor shaft. It meshes with a larger spur gear which is pressed on and keyed to the gear reduction shaft. This shaft is supported by two roller bearings. The gear box capacity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

Control Box

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

Tumbling Rod (Optional)

A heavy duty, shielded tumbling rod is available. This 1-3/8 inch (35 mm) diameter rod has a double universal joint design and utilizes a six spline shaft fitting at both ends. Operating lengths are 36 inches (914 mm) to 52 inches (1320 mm).



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

CAUTION This symbol refers to possible equipment damage.

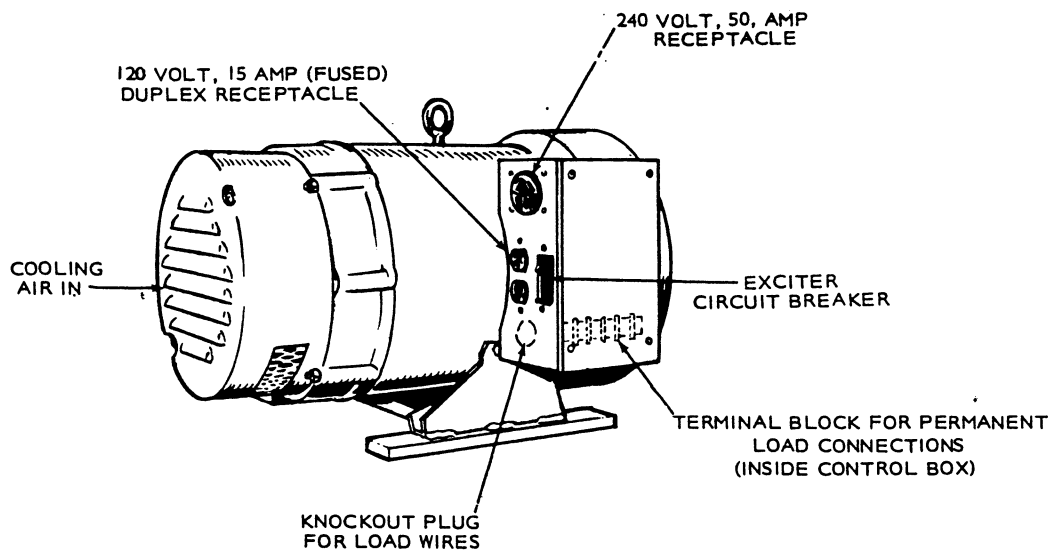
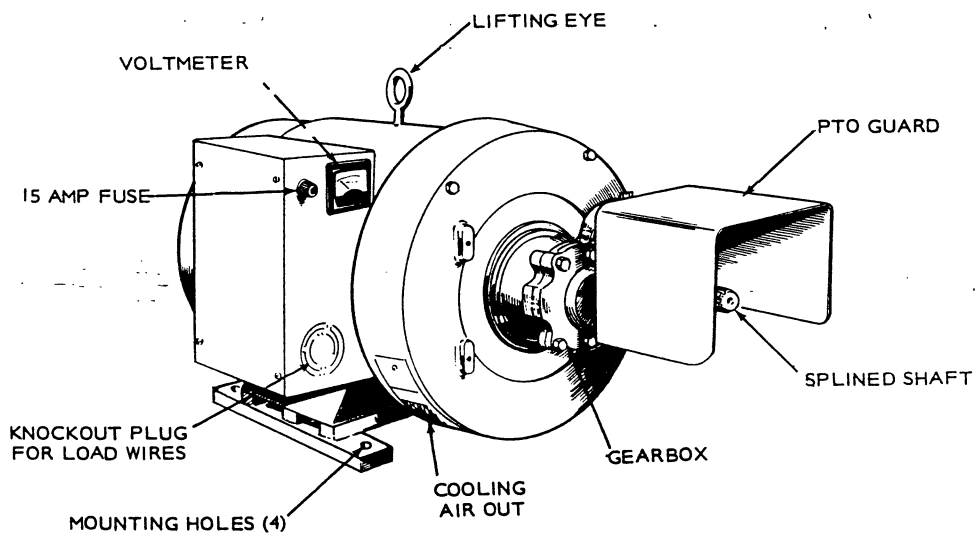


FIGURE 1. 25.0 UT TRACTOR-DRIVEN ALTERNATOR

SPECIFICATIONS

	25.0 UT-3S/	25.0 UT-5DS/
Watts	25,000	25,000
Volts, AC	120/240	240*
Phase	1	3
Current Rating (Amperes)	104	60
Frequency	60 HZ	60 HZ
Wire	4	4
Alternator RPM.	1800	1800
Tractor PTO RPM	540	540
Gear Ratio, Alternator	3.32:1	3.32:1
Approximate Weight (LB)	460 (209 kg)	460 (209 kg)
Recommended Gear Box Lubricant	SAE 90	SAE 90

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

INSTALLATION

LOCATION

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

Ventilation

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

WARNING

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

Convenience to Driving Power

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

Dusty or Damp Conditions

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

Servicing Convenience

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

Wiring Convenience

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

MOUNTING THE ALTERNATOR

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

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

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

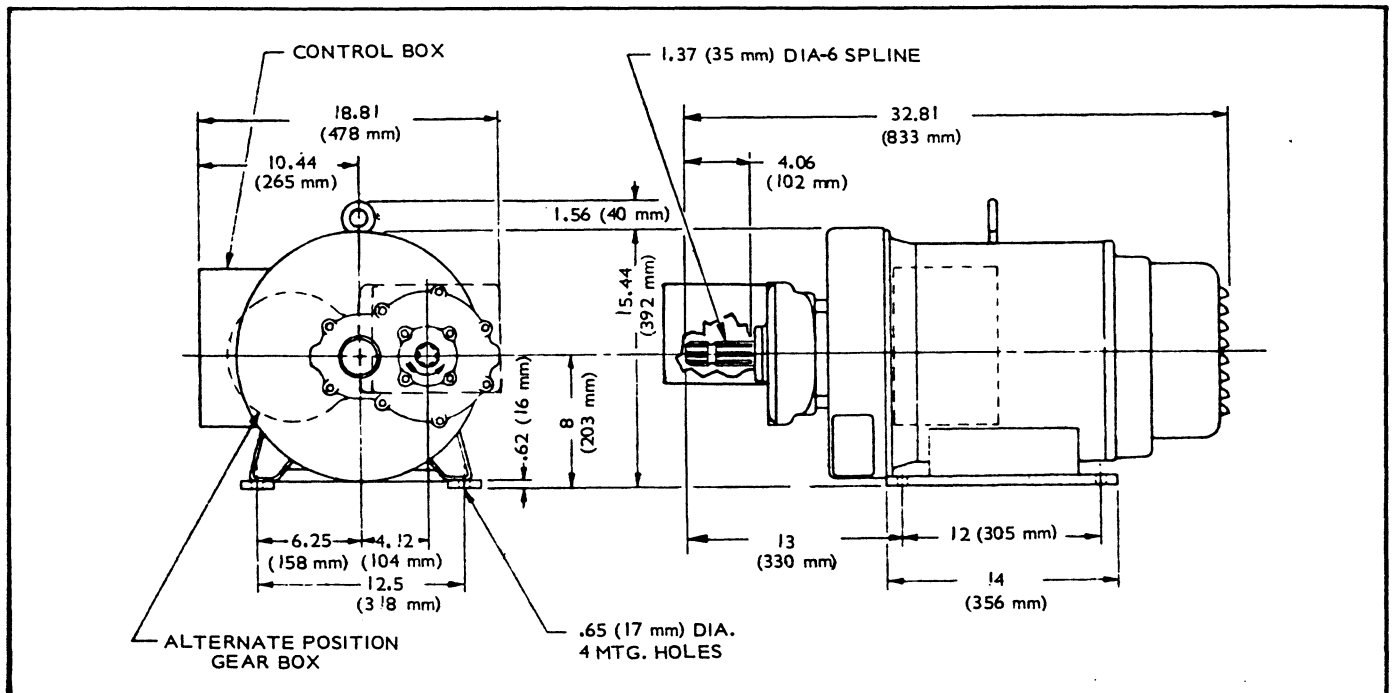


FIGURE 2. INSTALLATION OUTLINE

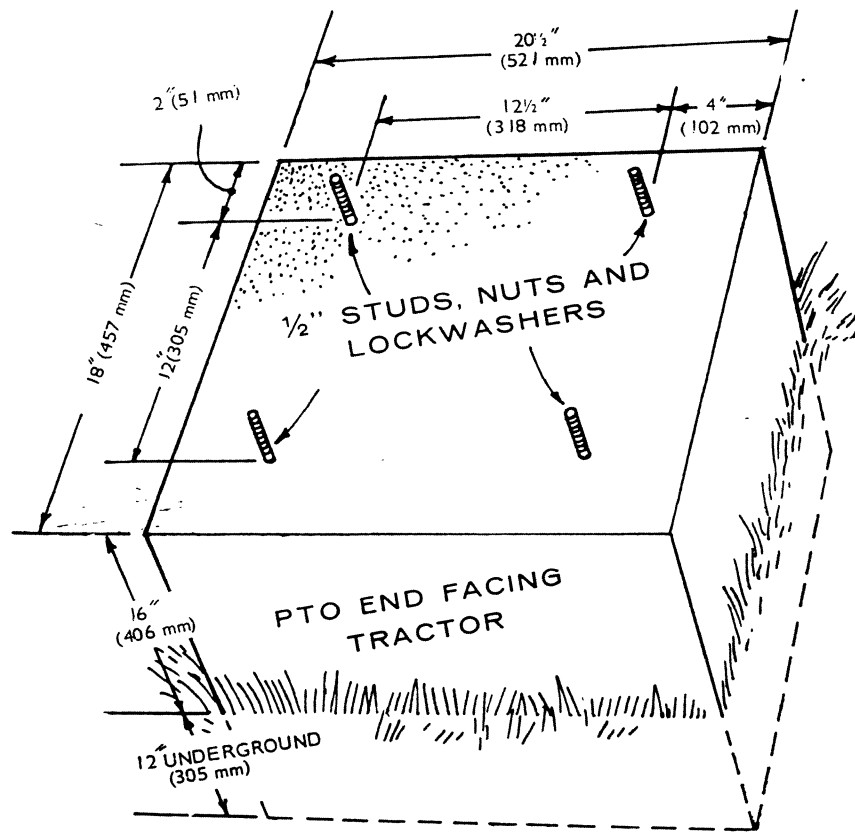


FIGURE 3. RECOMMENDED MOUNTING BASE

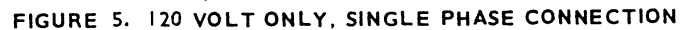
For wiring connections with alternator mounted on a permanent base, connect load wires from terminal box on alternator to load transfer switch. Use weather-protective fittings, couplings and wires throughout.

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.

The most popular single phase connection is the 120/240 combination. With this connection either 120 or 240 volts can be used alone or at the same time. Connections are shown in Figure 4. Be sure jumper strip is connected between T2 and T3 on terminal block.



Figure 5 shows connections for use of 120 volts only. Be sure jumpers are connected between T1 and T3, and T2 and T4.



Three phase alternators are connected as shown in Figure 6. The three load wires are connected to T1, T2 and T3. Single phase (240 volts) can be obtained between any two three-phase terminals. Single phase, (120 volts) can be obtained between T1 and T0 or T2 and T0. T0 is the grounded terminal for 120 volts.

CAUTION



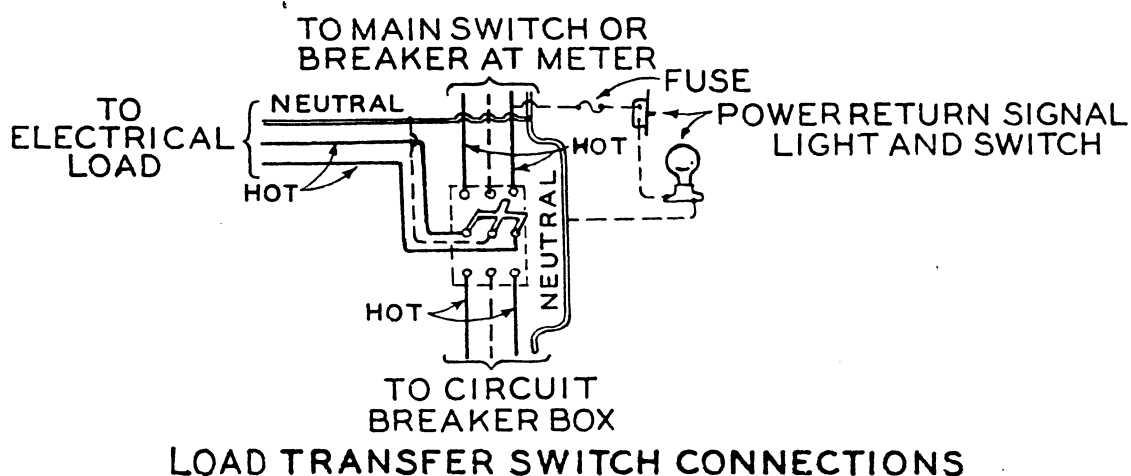
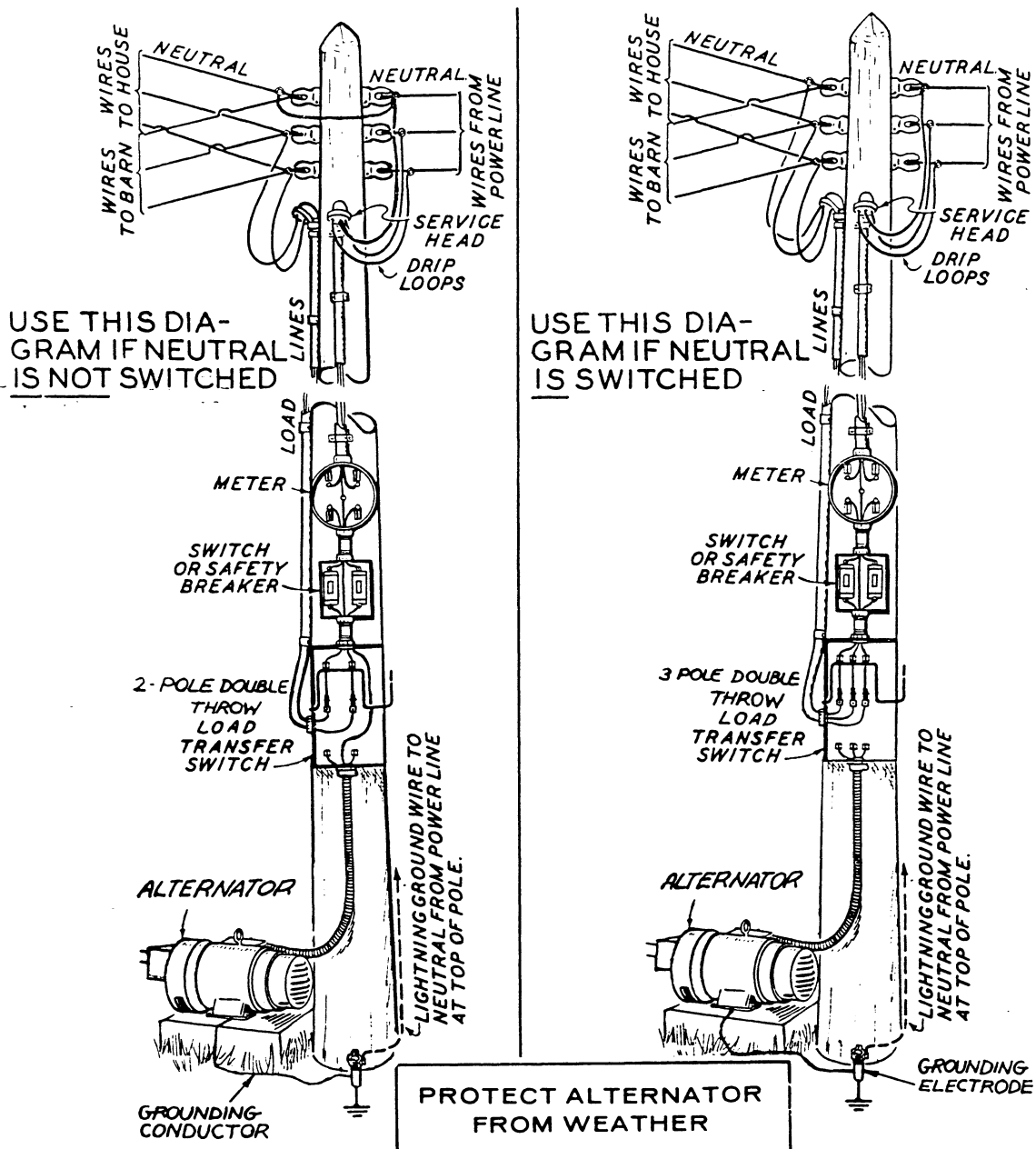


FIGURE 7. TYPICAL FARM STANDBY, SINGLE PHASE

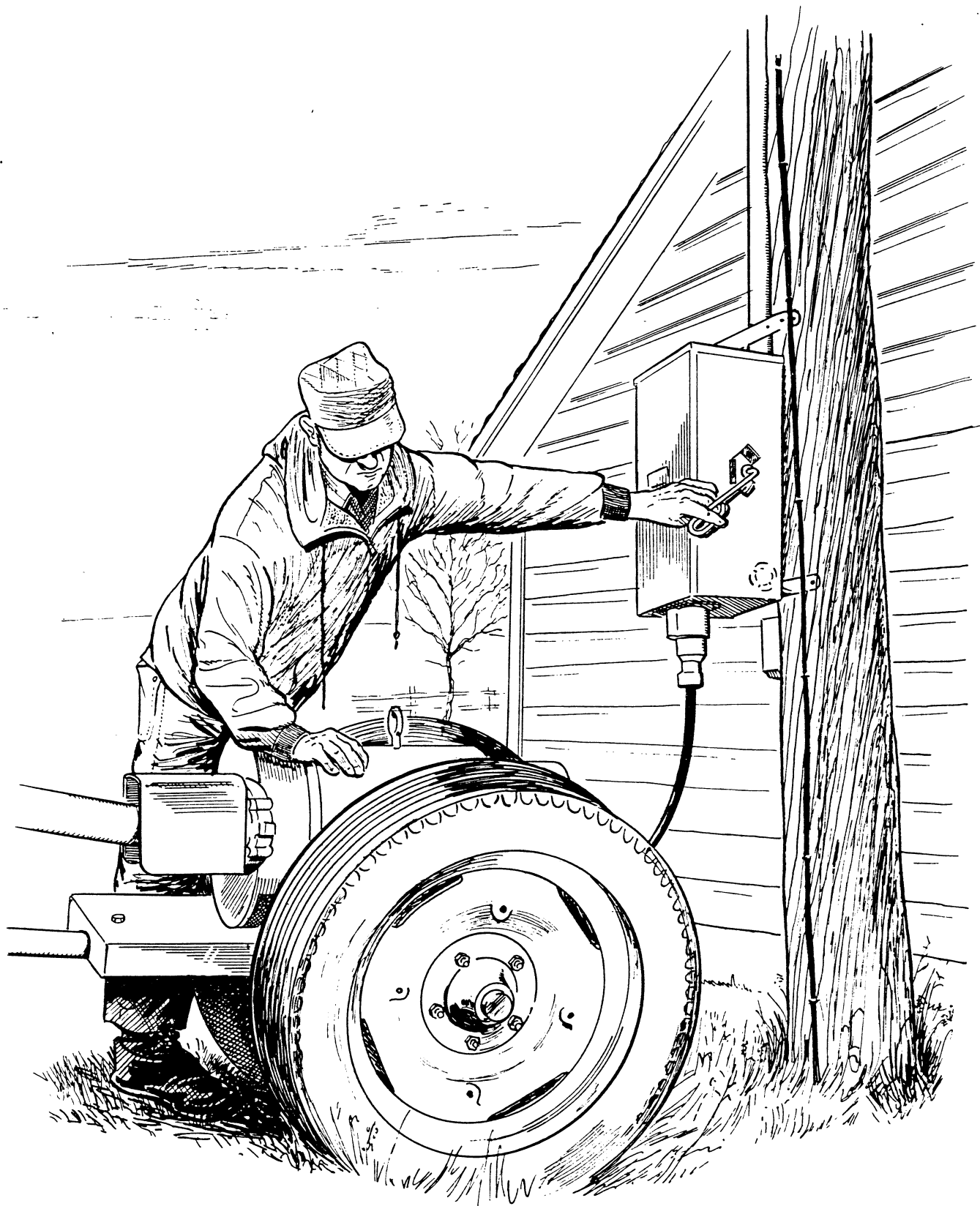


FIGURE 8. PORTABLE INSTALLATION

INSTALLING THE LOAD TRANSFER SWITCH

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

POWER RETURN SIGNAL (FIGURE 7)

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. Install an on-off switch and a fuse for the signal light. When a power failure occurs, snap the signal switch to the ON position before putting the alternator into operation. When the normal power returns, the signal operates and the alternator can then be disconnected.

COMBINATION SINGLE AND THREE PHASE LOAD TRANSFER CONNECTIONS

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

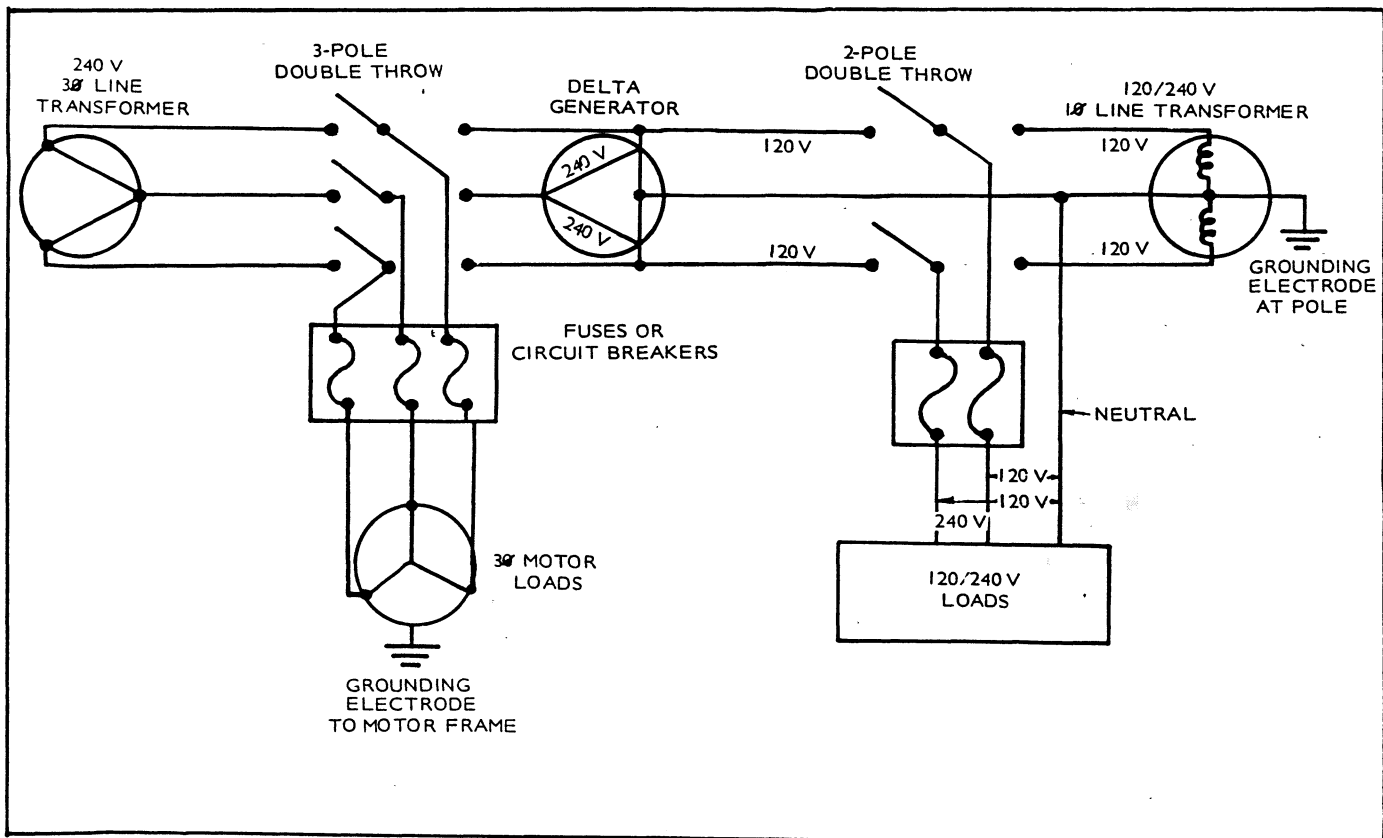


FIGURE 9. COMBINATION SINGLE AND THREE PHASE LOAD TRANSFER

OPERATION

STANDBY OPERATION

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

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

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

2. When the tractor is properly set up, aligned and anchored in place, switch the load transfer to disconnect the commercial power source. Move the switch to the alternator-connected position. Turn on the power return signal (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.

3. Make sure alternator line disconnect switch is in OFF position.
4. Start the alternator, and bring tractor speed up to 540 rpm.

IMPORTANT: A PTO speed of 540 rpm will run the alternator at the recommended speed of 1800 rpm. At this speed the voltmeter on the alternator control box must read approximately 250 volts (in the green range on voltmeter).

5. With alternator running, move the alternator line disconnect switch to the ON position.
6. Various electrical loads can now be connected.

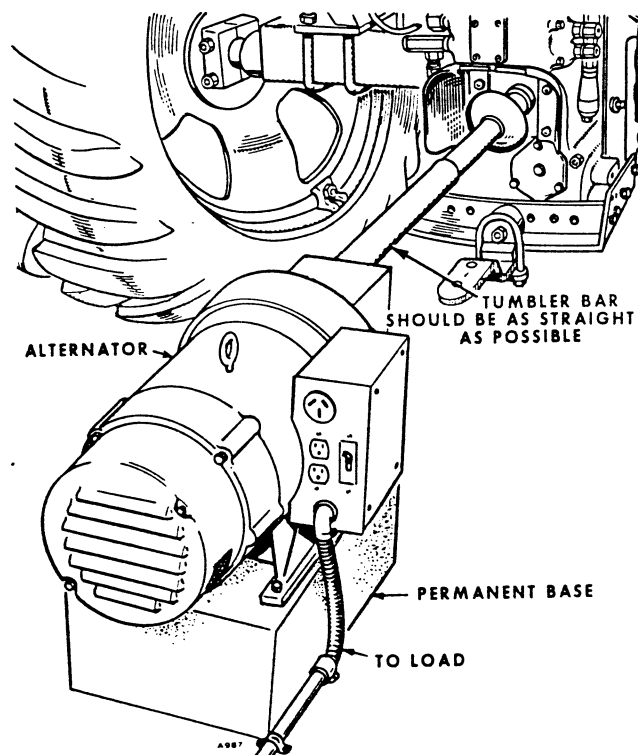


FIGURE 10. TRACTOR CONNECTION

RUNNING THE ALTERNATOR

When connecting motor loads, connect one at a time allowing each 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 when large changes in the electrical load are made to maintain the required 540 rpm.

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

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

CAUTION

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

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

LOAD REQUIREMENTS

Total the wattage requirements of all the equipment that could be operating simultaneously during a power outage. This can be done by taking the information either from the typical wattage requirement guide shown below, or by taking the information from the nameplate on the equipment itself.

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

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.

OUTPUT VOLTAGE

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

TYPICAL LOAD REQUIREMENTS

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

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

SERVICE AND MAINTENANCE

PERIODIC SERVICE AND INSPECTION

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

GEAR BOX LUBRICATION

Use only SAE 90 multi-purpose gear lubricant.

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

Maintain the proper oil level between changes.

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

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

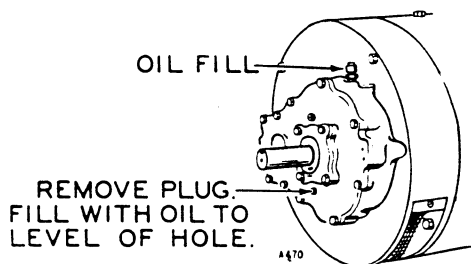


FIGURE 11. GEAR BOX LUBRICATION

TUMBLING RODS

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

SLIP RINGS

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

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

BEARINGS

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

BRUSHES

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

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

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

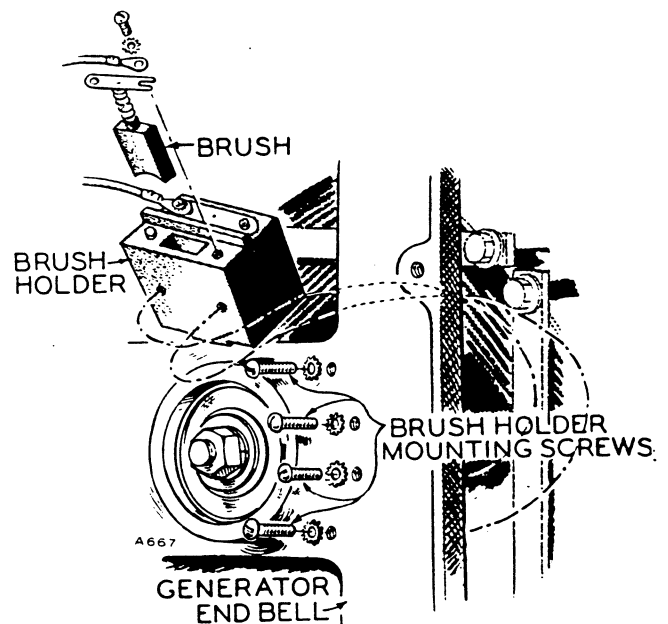


FIGURE 12. BRUSH REMOVAL

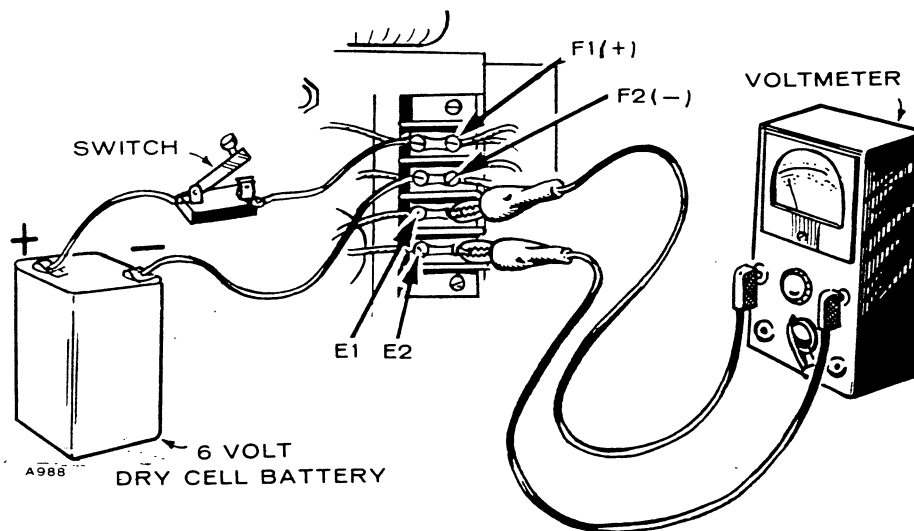


FIGURE 13. FLASHING THE FIELD

FLASHING THE FIELD

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

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

CHECKING STATIC EXCITER (SEE EXCITER TROUBLESHOOTING CHART)

Troubles are listed in advancing order, from no output voltage to rated but fluctuating output voltage. The relationship between trouble and cause is not always consistent from model to model, so the following information must be used as a guide, not an absolute rule. The column entitled "Step" indicates the step for testing a standard component. When the word "None" appears in that column, all the information needed to complete the check is given in the column headed "Corrective Action". Use a multi-meter to check continuity, voltage and resistance as indicated in the tests.

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

EXCITER TROUBLESHOOTING GUIDE

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

EXCITER TROUBLESHOOTING CHART (CONTINUED)

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

STEP 1 - CHECKING RECTIFIERS

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

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

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

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

CAUTION *Use an accurate ohmmeter when checking resistance values. Resistance readings between "G" and "G2" cannot be read with accuracy on the multimeter.*

- a. Set the resistance range selector on the meter to the resistance range.
- b. Isolate one gate winding by disconnecting either end of gate winding G1-G2 from its point of connection; for example, disconnect G1 at G2. Measure the resistance in the gate winding across G1-G2. Should be 0.66.
- c. Isolate one control winding by disconnecting either lead C1 or C2 from the terminal block. Measure the resistance in the control winding across D1-C2. Should be 5.5.
- d. Connect one meter lead to the disconnected gate winding lead and the other meter lead to the disconnected control winding lead and check for continuity.

Results:

1. REACTOR IS SERVICEABLE if resistance is within 20 percent either way of the value listed and there is no continuity between the control and gate windings.

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

STEP 3 - CHECKING CONTROL REACTOR

- a. Isolate the control reactor by disconnecting common lead "C" from its point of connection and carefully measure the resistance from this lead to the number lead on the control reactor. Should be 12.5.

Results:

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

STEP 4 - CHECKING RESISTORS

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

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

Results:

1. RESISTOR IS SERVICEABLE if the measured resistance falls within 20 percent of the value specified in the wiring diagram.
2. RESISTOR IS DEFECTIVE if there is indication of continuity through the resistor. If the measured resistance exceeds the percent limits either way, the stabilizing resistor can be adjusted to bring the resistance within the required limits.

ALTERNATOR TROUBLESHOOTING CHART

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

ALTERNATOR TESTING

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

1. Rotor Continuity – Remove the brushes so none touch the slip rings. Using an ohmmeter, test for grounding between each slip ring and the rotor shaft. Test for a short circuit in the rotor winding by measuring resistance in the winding (between both slip rings). It should measure between 2.0 and 2.5 ohms at 70° F (21° C). Replace the rotor if it is grounded, or has an open or short circuit.
2. Stator Continuity – Disconnect the alternator leads to the load in the control box. Use the wiring diagram to determine the output lead coding. Using an ohmmeter, check each winding of the stator for grounding to the laminations or frame. Note that some alternators have ground connections to the frame. Check the wiring diagrams. Using an accurate ohmmeter, test the resistance of each stator winding. Compare the resistances obtained. All windings of equal output voltage should indicate about the same resistance. An unusually low reading indicates a short, a high reading an open circuit.

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

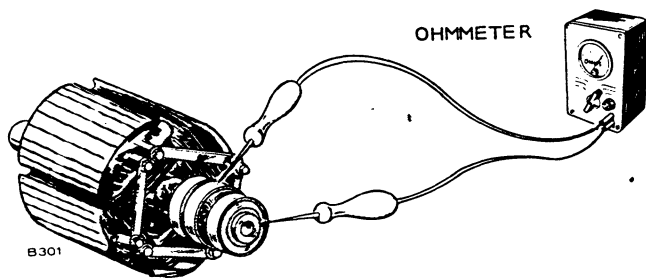


FIGURE 14. TESTING ALTERNATOR ROTOR WINDINGS

DISASSEMBLY

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

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

ALTERNATOR ASSEMBLY

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

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

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 Onan Parts and Service Center.

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

Always refer to the nameplate on your unit:

1. Always give the MODEL and SPEC NO. and SERIAL NO.

MODEL <input type="text"/>		
SERIAL <input type="text"/>		
ALWAYS MENTION MODEL & SERIAL No		
AC VOLTS <input type="text"/>	KVA <input type="text"/>	KW <input type="text"/>
AMPS <input type="text"/>	PF <input type="text"/>	H ₂ <input type="text"/>
PH <input type="text"/>	RPM <input type="text"/>	<input type="text"/>
EXCITER DC VOLTS <input type="text"/>	AMPS <input type="text"/>	
GENERATOR ONLY OF THIS GENERATING PLANT MANUFACTURED BY ONAN		
DIVISION OF ONAN CORPORATION MINNEAPOLIS MINNESOTA U S A		
99A413	FOR ELECTRICAL EQUIPMENT ONLY	

For handy reference, insert YOUR engine nameplate information in the spaces above.

2. Do not order by reference number or group number; always use part number and description.
3. Give the part number, description and quantity needed of each item. If an older part cannot be identified, return the part prepaid to your dealer or nearest AUTHORIZED SERVICE STATION. Print your name and address plainly on the package. Write a letter to the same address stating the reason for returning the part.
4. State definite shipping instructions. Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicates items are back ordered.

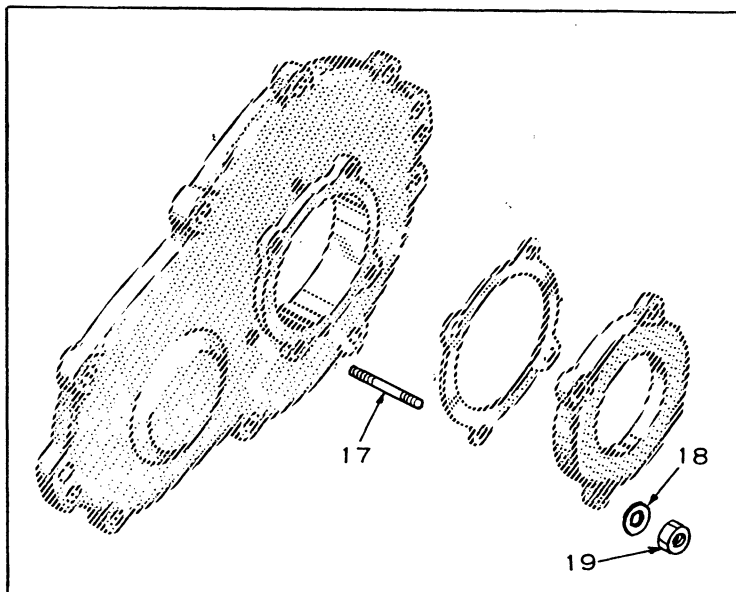
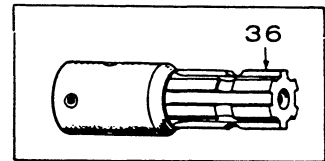
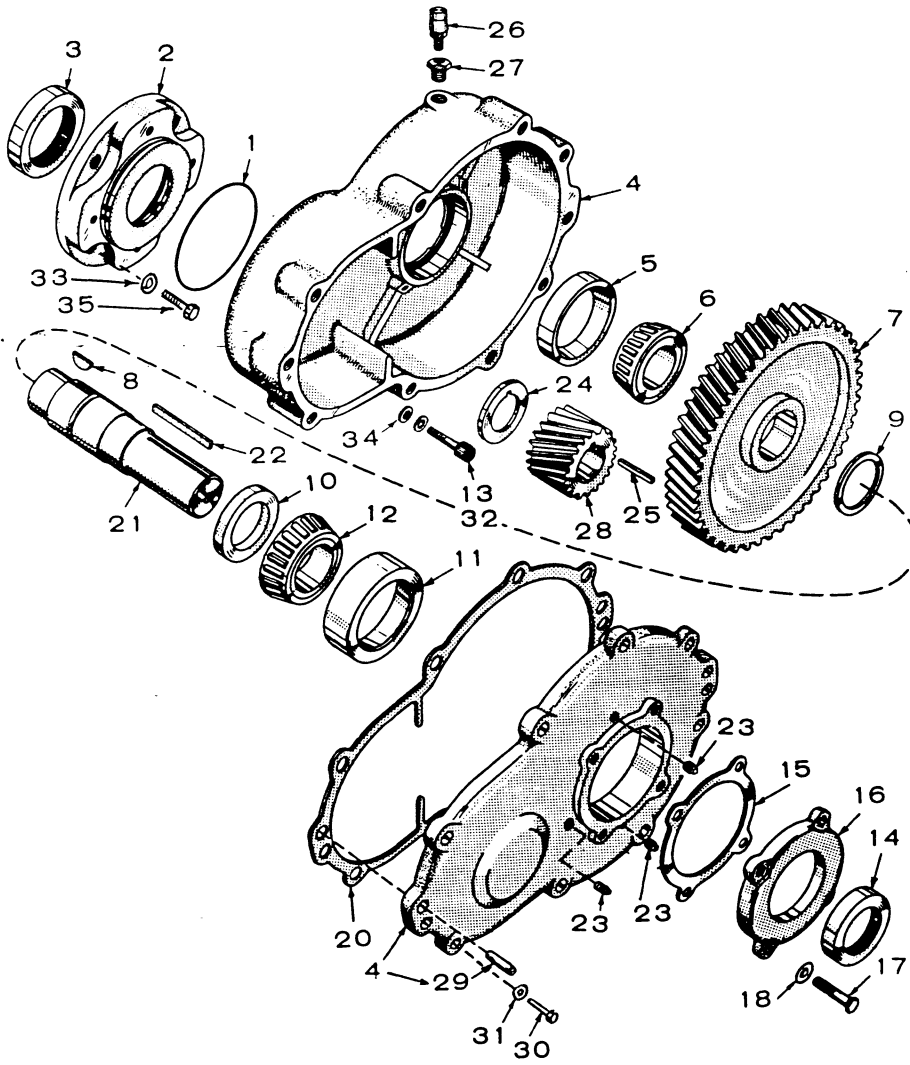
Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

For current parts prices, consult your Onan Dealer, Distributor or Parts and Service Center.

"En esta lista de partes los precios se omiten de proposito, ya que bastante confusion resulto de fluctuaciones de los precios, derechos aduanales, impuestos de venta, cambios extranjeros, etc."

Consiga los precios vigentes de su distribuidor de productos "ONAN".

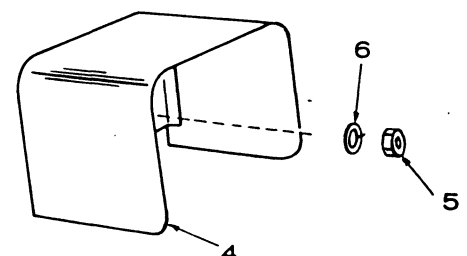
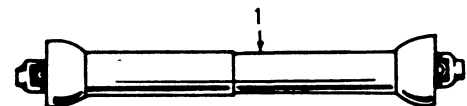
GEAR BOX GROUP



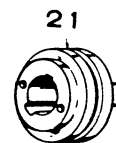
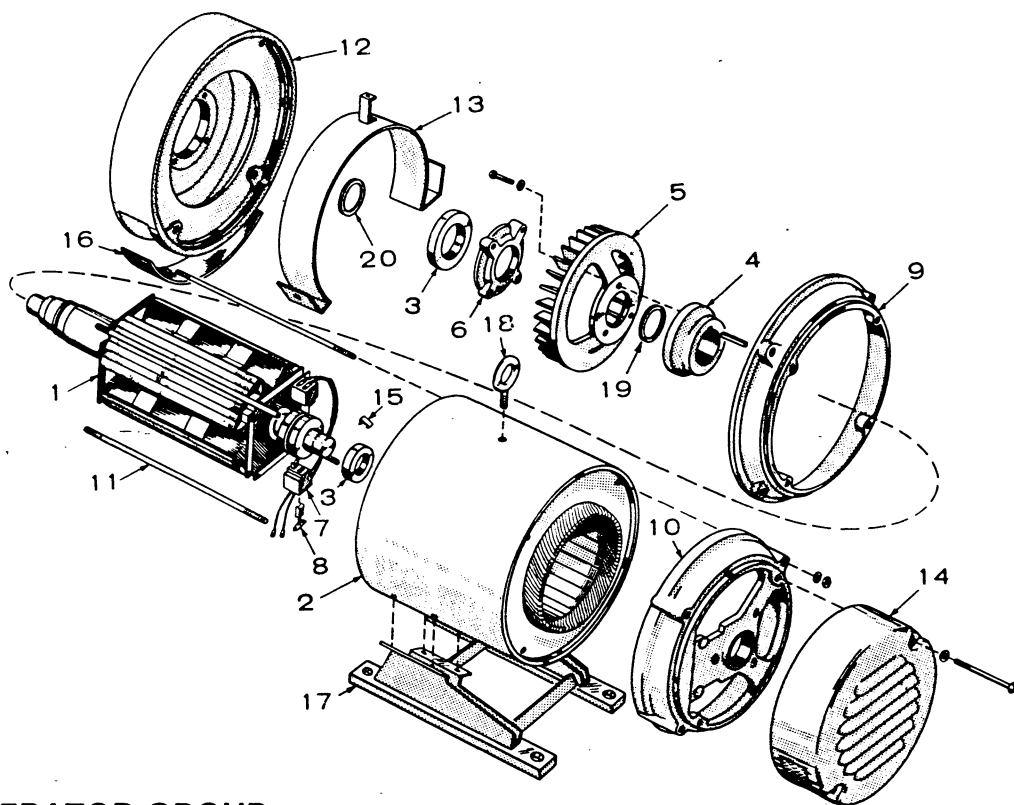
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	GEAR BOX ASSEMBLY, REDUCTION - COMPLETE		
	190-0245	1	Straight Shaft
	190-0293	1	Splined Shaft
	190-0320	1	Standard Beginning Spec B -
			Note: Some were used on earlier Models
1	509-0099	1	Seal, "O" Ring
2	190-0246	1	Adapter and Oil Seal Assembly, Gear Box
3	509-0001	1	Seal, Oil - Included in 190-0246 Adapter Assembly
4	190-0250	1	Housing Assembly, Gear - Includes Cover and Dowel Pins
5	510-0022	1	Cup, Roller Bearing - Inside Bearing
6	510-0021	1	Cone, Roller Bearing - Inside Bearing
7	190-0224	1	Gear, Driven (3/32 to 1 Ratio)
8	515-0159	1	Key, Woodruff - Driven Gear
9	518-0013	1	Ring, Retainer - Driven Gear
10	190-0202	1	Spacer, Gear - Between Driven Gear and Bearing Cone
11	510-0023	1	Cone, Roller Bearing - Outside Bearing
12	510-0024	1	Cup, Roller Bearing - Outside Bearing
13	802-0055	6	Screw, Socket Head (5/16-18 x 1" long) Gear Box to Rear End Bell
14	509-0016	1	Seal, Oil - Drive Shaft
15	SHIM, DRIVE SHAFT END PLAY		
	190-0017	As Req.	.009" Thick
	190-0018	As Req.	.012" Thick
	190-0019	As Req.	.016" Thick
16	190-0016	1	Plate, Bearing Retaining

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
17	800-0532	4	Screw, Hex Head (1/4-20 x 1" long)
17	520-0756	4	Stud, 1/4-20 x 1-3/4")
18	526-0063	4	Washer, Flat - Copper
19	862-0001	4	Nut, Hex (1/4-20)
20	190-0021	1	Gasket, Gear Cover
21	SHAFT, GEAR REDUCTION		
	190-0192	1	Straight Shaft
	190-0292	1	Splined Shaft (Standard Spec B)
22	515-0103	1	Key, Gear Reduction - Shaft to Tumbling Rod for Straight Shaft (1/4 x 2")
23	505-0054	6	Plug, Pipe (1/4) - Gear Cover
24	190-0195	1	Washer, Pinion Gear
25	515-0142	1	Key, Pinion Gear
26	518-0172	1	Fitting, Vent
27	505-0007	1	Bushing, Reducer - Vent Fitting
28	190-0225	1	Pinion, Gear (3/32: 1 Ratio)
29	516-0112	2	Pin, Dowel
30	800-0028	4	Screw, Hex Head - Gear Cover (5/16-18 x 1" lg)
31	526-0026	8	Washer, Flat, Copper - Gear Cover
32	802-0055	4	Screw, Socket Head (5/16-18 x 1" long) - Gear Cover
33	850-0045	4	Washer, Lock - (5/16) Gear Case
34	526-0065	6	Washer, Flat - Copper
35	800-0032	4	Screw, Hex Head - (5/16-18 x 1-3/4" long) - Adapter Mounting
36	190-0295	1	Adapter, Straight Shaft - (Optional)

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	ROD, TUMBLING		
1	190-0248	1	Straight Shaft (with Keyway)
	190-0305	1	Splined Shaft (Both Ends)
2	516-0083	1	Pin, Roll - Locating
3	517-0045	2	Button, Dot
4	190-0319	1	Guard, Power Take-off
5	862-0001	4	Nut, Hex (1/4-20)
6	850-0040	4	Washer, Lock (1/4)



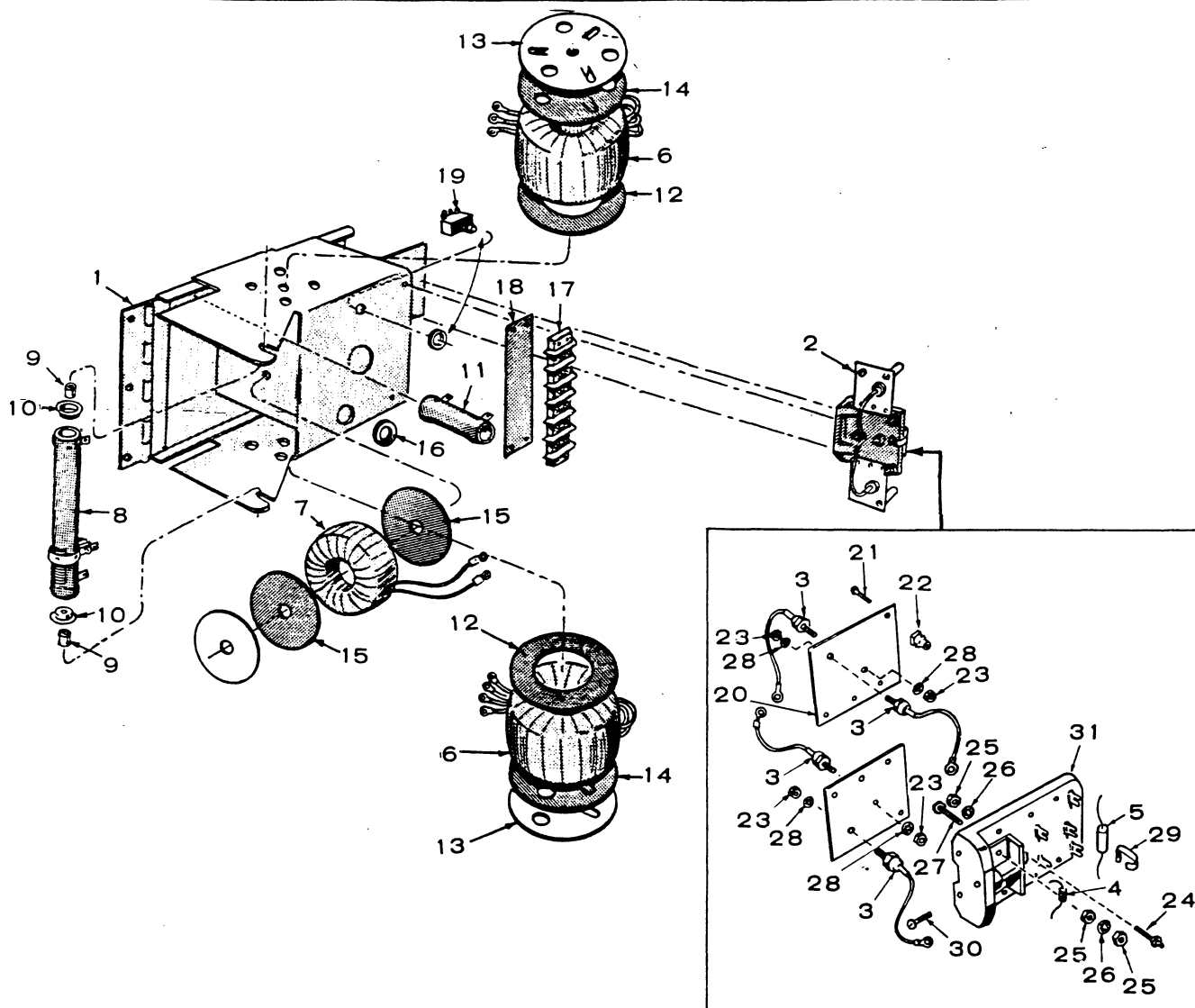
MISCELLANEOUS GROUP



GENERATOR GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	201-1153	1	Rotor Assembly, Wound
2	STATOR ASSEMBLY, WOUND		
	220-0659	1	Three Phase
	220-0661	1	Single Phase
3	BEARING, BALL - ROTOR		
	510-0063	1	Drive End
	510-0047	1	Exciter End
4	232-1591	1	Hub, Generator Blower
5	205-0045	1	Blower
6	232-1341	1	Plate, Bearing Retaining
7	212-1064	2	Block, Brush
8	214-0059	4	Brush, Slip Ring

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
9	231-0103	1	Adapter
10	211-0146	1	Bell, End
11	520-0640	4	Stud, Through - Stator
12	211-0125	1	Bell, End - Rear
13	232-1028	1	Scroll, Air
14	234-0185	1	Cover, End Bell
15	232-0596	1	Clip, Bearing
16	232-1077	1	Screen, End Bell
17	232-1605	1	Base Assembly, Mounting
18	403-0622	1	Eye, Lifting (1/2)
19	518-0083	1	Ring, Retaining - Hub
20	518-0122	1	Ring, Retaining - Bearing
21	204-0061	1	Ring, Collector

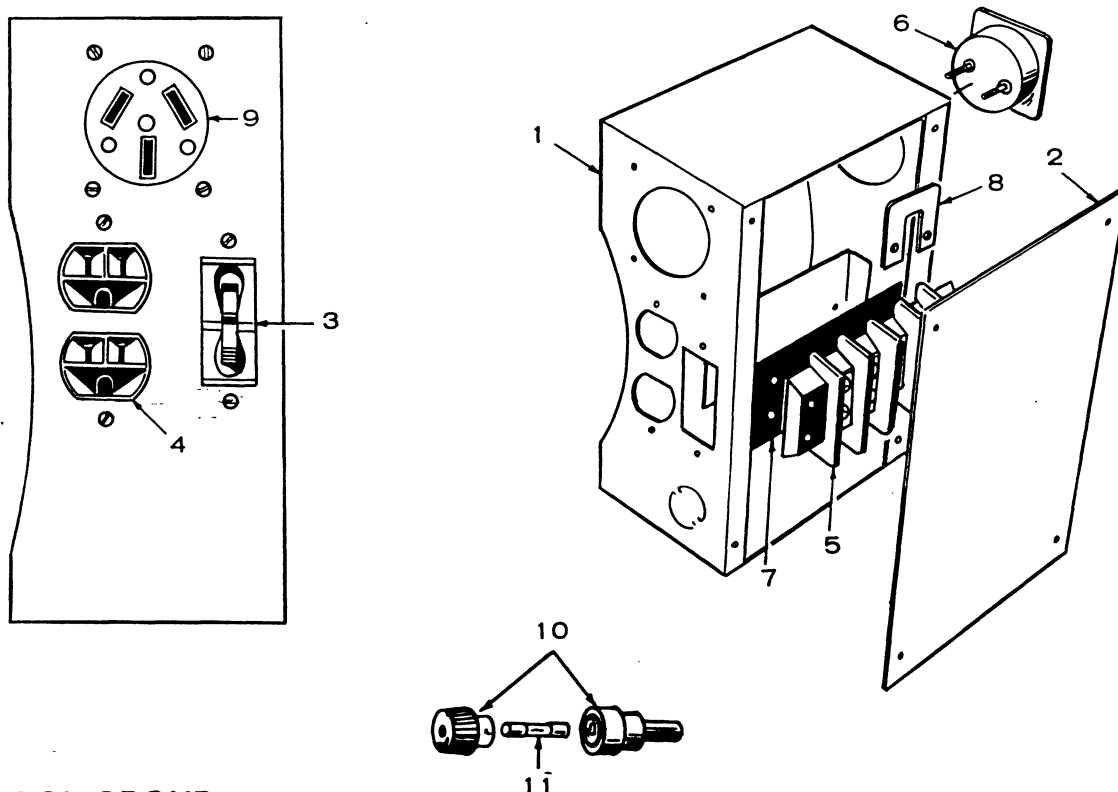


STATIC-EXCITER GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	234-0188	1	Panel and Bracket Assembly, Exciter
2	305-0264	1	Rectifier Assembly - Complete
3	RECTIFIER ONLY		
	305-0238	2	*Negative - Power Field - (Red Lead)
	305-0239	2	*Positive - Power Field - (Black Lead)
4	305-0240	4	*Rectifier - Voltage Control
5	304-0512	1	*Resistor, 5 Watt, 150-Ohm - Stabilizing
6	315-0102	2	Reactor, Gate
7	315-0100	1	Reactor, Voltage Control
8	304-0527	1	Resistor, Voltage Control
9	232-1474	1	Spacer, Resistor Mounting
10	304-0015	4	Washer, Resistor Mounting
11	304-0510	1	Resistor, 250-Ohm, 50 Watt Damping
12	232-1551	2	Gasket, Toroid Retainer
13	232-1552	2	Retainer, Reactor
14	232-1553	2	Gasket, Reactor Retainer
15	232-1548	2	Gasket, Coil Retainer

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
16	508-0008	1	Grommet, Rubber
17	332-0745	1	Block, Terminal
18	332-0746	1	Strip, Marker
19	308-0175	1	Switch, Residual Reset
20	305-0237	1	*Heat Sink, Rectifier
21	809-0045	2	*Screw, Roundhead Machine (10/32 x 5/8" long)
22	870-0196	2	*Fastener
23	871-0010	6	*Nut, Hex (Brass) 10-32
24	332-0698	1	*Stud, Terminal
25	871-0007	6	*Nut, Hex (Brass) 8-32
26	854-0007	3	*Washer, Internal Shakeproof (#8)
27	332-0697	2	*Stud, Terminal
28	854-0010	5	*Washer, Internal Shakeproof (#10)
29	304-0498	1	*Clip, Resistor
30	811-0098	1	*Screw, Round Head Machine (10-32 x 3/8")
31	332-0696	1	*Board, Terminal

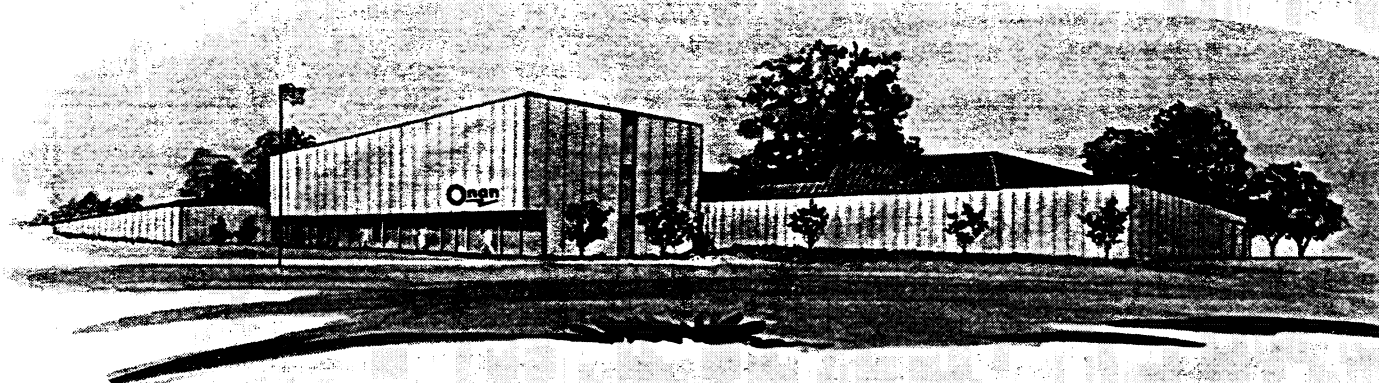
* - Parts Marked are Included in 305-0264 Rectifier Assembly.



CONTROL GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	BOX, CONTROL		
	301-2096	1	15.0UT5DN61
	301-2551	1	25.0UT
	301-2949	1	25.0UT
2	COVER, CONTROL BOX		
	301-0856	1	15.0UT5DN61
	301-2552	1	25.0UT
3	BREAKER, CIRCUIT		
	320-0161	1	7 Ampere
	320-0257	1	12 Ampere
	320-0002	1	15 Ampere
4	323-0184	1	Receptacle, 120 Volt Duplex - 15 Ampere

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
5	BLOCK, TERMINAL		
	332-0254	1	15.0UT5DN61
	332-0419	1	25.0UT
6	302-0665	1	Meter, Volt - 0-300 (AC)
7	STRIP, MARKER - (Terminal Block)		
	332-0603	1	Three Phase
	332-0492	1	Three Phase
	332-0744	1	Single Phase
8	332-0440	1	Jumper, Terminal
9	332-0894	1	Receptacle, 50 Ampere - 240 Volt
10	321-0104	1	Holder, Fuse
11	321-0138	1	Fuse - 15 Ampere



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