

Generating Quality



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Instruction Manual

DIESEL ELECTRIC PLANT AIR COOLED – 1800 R.P.M.

TDE 1401 L4-3



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INTRODUCTION

This manual covers the installation, operating and maintenance instructions for the Winpower line of air-cooled generator sets. Included as a part of this manual is a parts list and wiring diagram covering the particular model you have purchased. The engine manufacturer's manual is also furnished with the set and gives the necessary operating and maintenance information for the engine.

GENERAL

The engine generator sets covered by this manual are of the single bearing type. The rotating member of the generator is mounted on a tapered extension of the engine crankshaft except on those which have a flexible disc coupling connecting the rotating generator member and the engine shaft.

All sets have been thoroughly tested at the factory. The necessary engine speed adjustments have been made. The set has been tested with the grade of fuel specified by the manufacturer.

The set should be carefully inspected on delivery for evidence of possible shipping damage. If damage has occurred, a notation should be made on the freight bill, and you should file a claim if necessary. If the damage appears to be of a major nature, the set should not be operated until the fault has been corrected.

The model number and the serial number of the set must be given when contacting the dealer or the factory.

ELECTRICAL DESCRIPTION

There are basically two types of generators used in the Winpower line of air-cooled engine generator sets. They are revolving armature and revolving field.

The excitation system for the revolving armature type generators may be either static or commutator type. The excitation system for the revolving field type generator is static.

The static, or electronic excitation system, uses rectifiers to change part of the output of the AC generator to DC for excitation of the field. On most models using static excitation this system is extended still further by using current feedback thru rectifiers in order to obtain increasing field strength with load increase to give better voltage regulation.

The commutator type excitation system is used when it is desired to crank the engine thru the generator. There is a DC winding on the armature in addition to AC winding, thus giving a common magnetic circuit for both windings.

The generator is either 2 pole or 4 pole depending upon the speed it is driven at. It is 2 pole for 3600 RPM and 3000 RPM, and 4 pole for 1800 RPM and 1500 RPM.

The Total Power feature is used on some 120/240 volt portable single phase generators where 90% of the full KW rating of the set maybe taken from one of the 120 volt legs.

INSTALLATION

NOTE

If your set is a portable unit, these installation instructions do not apply except for load connections, grounding and wire size.

Check local and state regulations for installation of engine generator sets.

GENERAL

There are two prime requirements in the installation of an air-cooled engine generator set. They are:

1. Adequate cooling air for the engine.
2. Proper discharge of exhaust gas.

Other factors of importance are:

1. Location
2. Mounting
3. Fuel connection
4. Load connection

LOCATION

The plant should be located in an atmosphere that is free from excessive dust, wind blown particles, excessive high and/or low temperature, and corrosive fumes. Allowance must be made for a minimum of a two foot clearance around the plant for service accessibility.

MOUNTING

A permanently installed engine generator set should be mounted on a base, preferably concrete, with the mounting bolts being embedded in the concrete base. All 3600 RPM units are furnished with spring vibration isolators. They can be used for permanently mounting to a base as shown in Figure 1.

MOUNTING (Cont'd)

3.7 KW sets and higher at 1800 RPM are mounted on a rigid skid. For permanent installations it is advisable to bolt the skid to the floor, or base, with vibration dampening pads placed between the skid and floor.

COOLING AIR

It is imperative that the engine have an adequate supply of cooling air. If the unit is installed inside a building or enclosure, it means that there must be an adequate air inlet and an adequate air outlet. See Figure 3 for a typical layout.

The following is a suggested formula for use in determining the minimum size of the air inlet and air outlet:

$$\text{Size in sq. ft.} = 0.5 + (0.5 \times \text{KW})$$

$$\text{Size in sq. ft.} = 1.25 (0.5 + (0.5 \times \text{KW})) \text{ with louvers}$$

EXHAUST

When the unit is installed inside a building, means must be provided for exhausting the poisonous gases from the engine exhaust system. If a muffler is used, the preferable location is inside the building. If the exhaust pipe passes thru a wall with combustible material, it must be shielded by a metal thimble. See Figure 2. The end of the exhaust pipe should be located a distance away from the air inlet to the engine. Use a flexible tubing to connect the engine exhaust fitting to the rigid pipe or muffler.

CONNECTION - Fuel

All manual and electric starts have integral fuel tanks. Remote sets are equipped with fuel pumps. The fuel pump inlet is to be connected to the fuel supply by means of a flexible connection.

Underground fuel tanks are required in some localities. Local regulations should be checked and thoroughly complied with.

A day tank (sometimes called priming tank) is recommended for automatic, unattended starting installations.

The day tank is a small gravity feed tank and must have a return line to the main tank. A typical installation is shown in Figure 4.

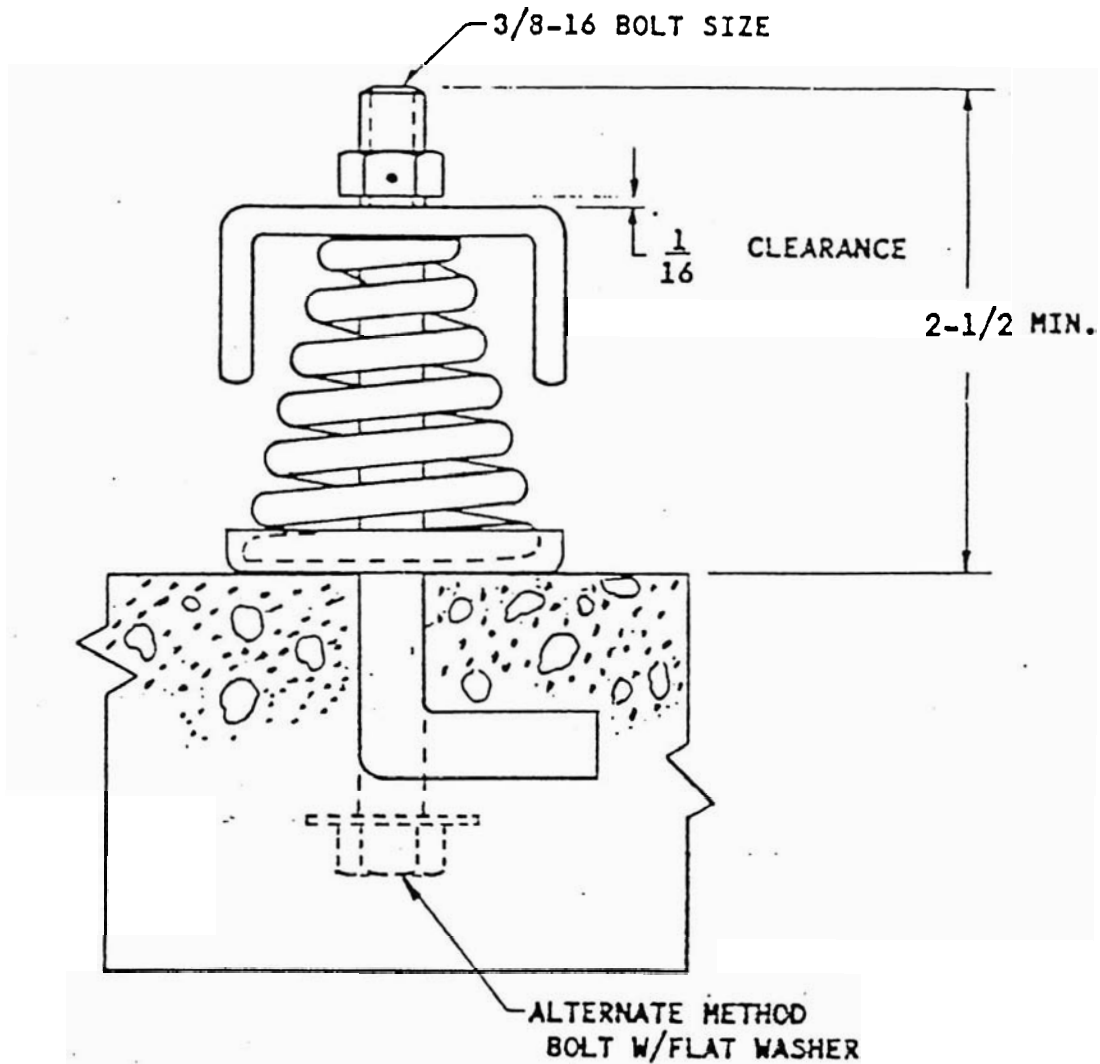
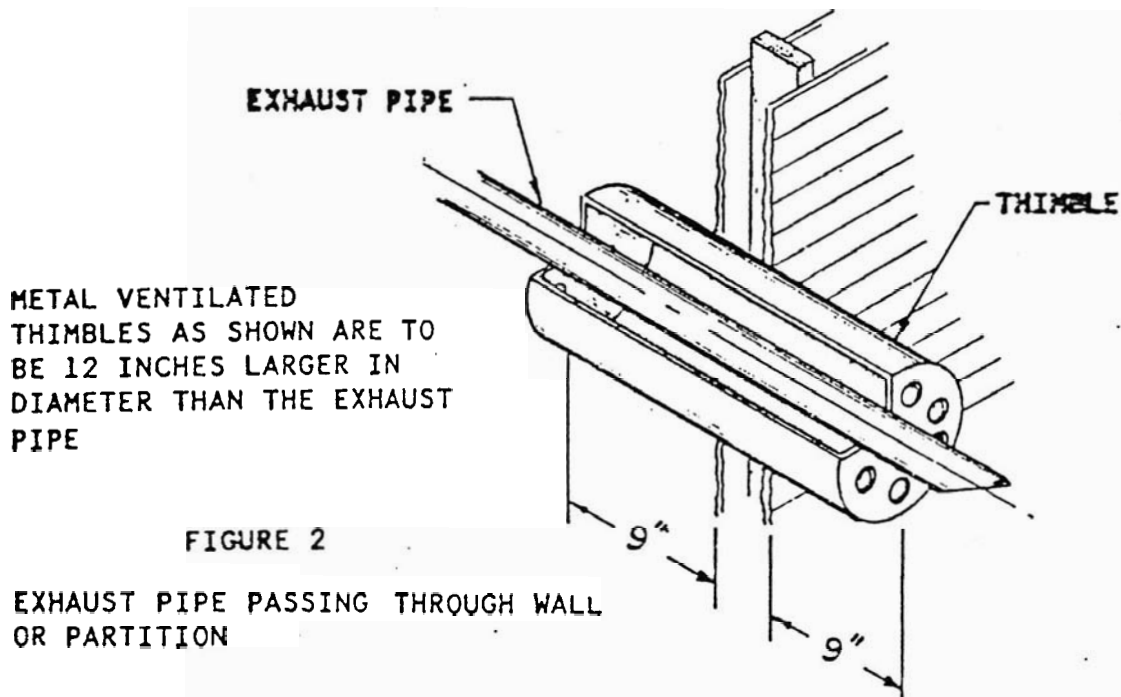


FIGURE 1 MOUNTING OF SPRING TYPE VIBRATION ISOLATORS TO CONCRETE BASE



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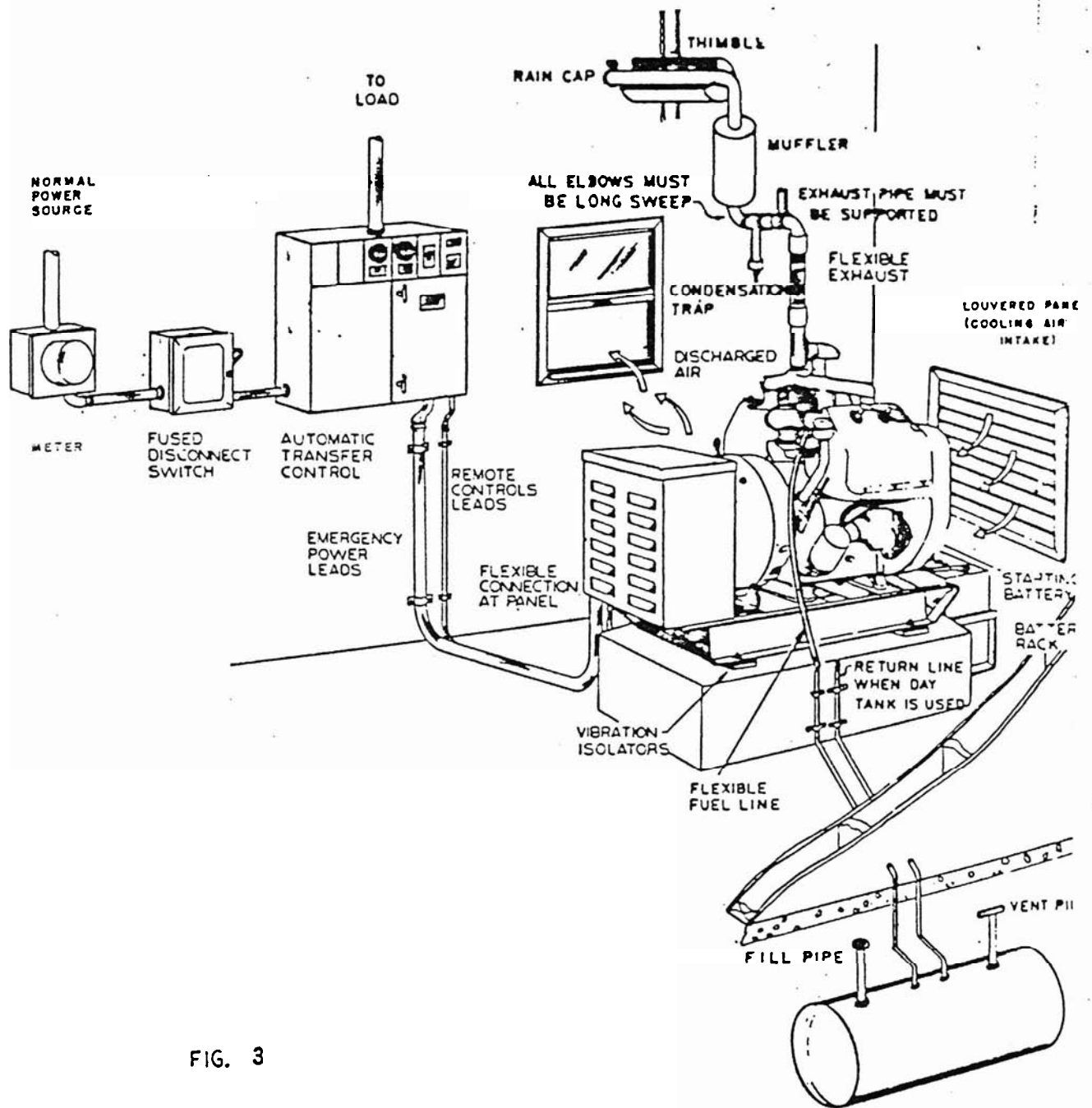


FIG. 3
 typical installation

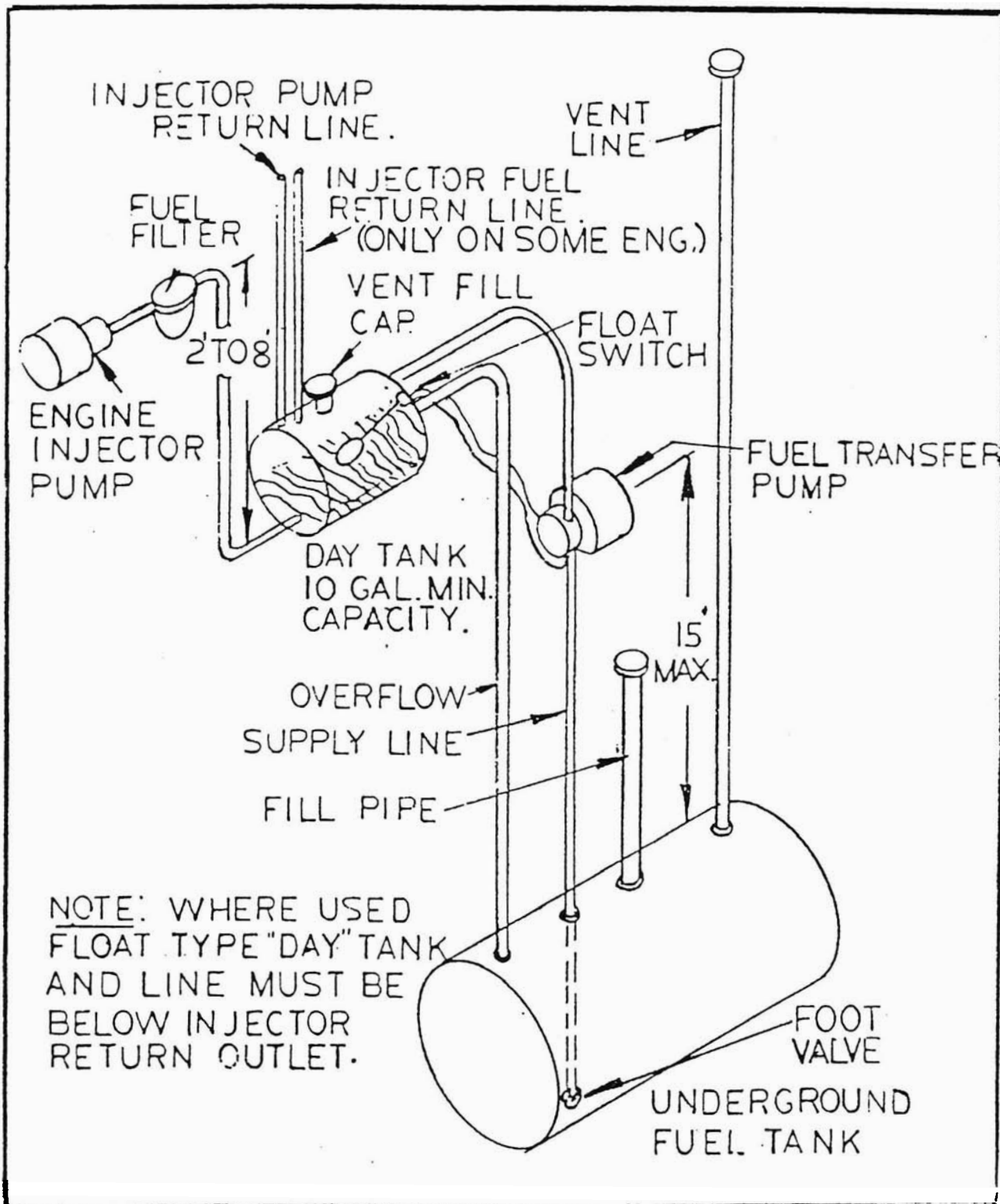


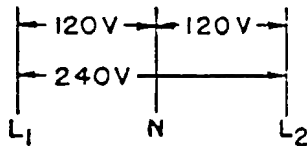
FIGURE 4 DIESEL FUEL SYSTEM



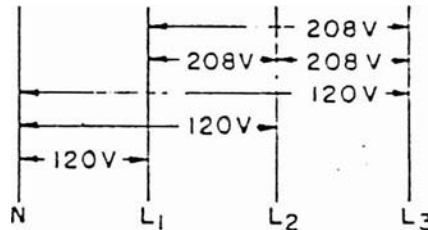
LOAD CONNECTIONS

The means for load connection varies depending on order requirements, capacity, and type of use. Receptacles are usually provided on models for portable use. Sets for permanent installations are normally provided with terminal strips for load connection. Permanent connections should be made by a qualified electrician with full knowledge of code requirements.

TYPICAL CONNECTIONS



120/240 V
Single Phase



120/208 V
Three Phase

N leads are grounded. Rotation on 3 phase motors must be checked for correct rotation after connecting. If rotation is wrong, reverse two of the input leads to the motor.

GROUNDING

The generator frame must be grounded to a grounding stake driven into moist earth or to a water pipe.

BATTERY

If the set is a electric or remote start set, a 12 volt battery of at least 70 ampere hours, or 2 six volt batteries of at least 70 ampere hours each, should be used. Observe correct polarities in making the connections.

ELECTRIC AND REMOTE START

Electric and remote start sets have two different types of starting. They are:

1. A DC winding in the armature of the AC generator enables the generator to be used as an electric motor for the purpose of cranking the engine.
2. The engine is equipped with a starting motor. Electric start models can be started and stopped at the set. Remote start can be started and stopped at the set or at a remote location. There must be some indication of engine starting at the remote location so that the energization of the cranking circuit maybe manually terminated. Refer to the wiring diagram for the connection of the remote switch.

AUTOMATIC LINE TRANSFER CONTROL

A load transfer switch is required for standby or emergency plants. Most installations use an automatic line transfer switch rather than a manual.

The Winpower Automatic Line Transfer Control also incorporates protections against overcranking, cranking shut off on engine start, and a selector switch for selecting the following modes: automatic, test, hand and stop. Refer to the Automatic Line Transfer Control manual for information on it.

A customer buying an Automatic Line Transfer Switch from another source than Winpower, for use with a Winpower Air-Cooled Engine Generator, will require additional components for protection against overcranking and for deenergization of the starting circuit upon engine starting.

OPERATION

INITIAL START UP

The engine manual should be thoroughly read in regards to operation. The engine crankcase must be filled with an oil recommended by the engine manufacturer. The fuel should be as specified by the engine manufacturer. When filling the tank allow for fuel expansion.

MANUAL STARTING

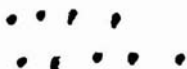
Consult engine manual

ELECTRIC START

Consult engine manual for decompression instructions. Push the start, or the start-stop switch, to its start position and release immediately upon engine starting.

REMOTE START

Remote start plants have a fuel pump and an electric shutdown device. Push the start-stop switch to the start position and release immediately upon engine starting.



MAINTENANCE

ENGINE

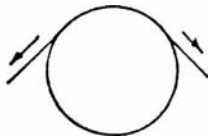
Refer to engine starting manual

GENERATOR

Check brush lengths after 500 hours of running, and every 100 hours thereafter. If brush length is less than 1/2", the brush should be replaced with a new one.

On units with a commutator, an even brown film on the commutator denotes a desirable condition and it should not be removed. If the commutator becomes rough and/or dirty it can be cleaned by sandpaper.

The unit should be started manually and the sandpaper applied as shown below:



If the commutator is excessively worn and rough, the set should be sent to a service shop to have the commutator turned and undercut.

The collector rings should be cleaned with sandpaper if dirty.

The generator bearing is a sealed bearing and requires no relubrication.

Dirt, and the moisture it will hold, are detrimental to generators. If dust and dirt accumulate, the generator should be cleaned periodically.

The level of the battery electrolyte should be checked weekly under constant use and monthly with intermittent use. Refill to proper level, if down, with distilled water. Never allow the battery to stand for a long period in a discharged condition.

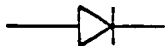
TROUBLE SHOOTING CHART

TROUBLE	CAUSE	REMEDY
No output voltage	<p>Loss of residual magnetism</p> <p>Defective diode in rectifier bridges (see instructions for testing rectifier bridges)</p> <p>Poor brush contact (brush can be stuck in holder, worn or spring can be weak)</p> <p>Open circuit (see instructions for testing of open circuits)</p> <p>Shorted armature coils in revolving armature unit or shorted coils in stator on revolving field units.</p> <p>Engine speed too low</p>	<p>See instruction for restoring residual magnetism</p> <p>Replace diode or rectifier assembly</p> <p>Free brush if stuck Replace with new brush if worn. Replace brush spring if weak.</p> <p>Complete circuit if in external wiring.</p> <p>Replace armature or stator.</p> <p>Adjust engine speed to correct value.</p>
Low output voltage at no load	<p>Low engine speed</p> <p>Shorted diode (see instructions for testing rectifier bridge)</p>	<p>Adjust engine speed to correct value</p> <p>Replace diode or rectifier assembly</p>
Voltage OK at no load but drops off rapidly on load application	<p>Shorted diode in series field bridge (see instructions for testing rectifier bridge)</p> <p>Engine speed drops off rapidly</p>	<p>Replace diode or rectifier assembly</p> <p>See engine manual</p>
High output voltage	<p>Excessive engine speed</p>	<p>Adjust engine speed to correct value</p>
Excessive generator heating	<p>Overload on generator</p> <p>Clogged ventilating inlets and/or outlets</p>	<p>Reduce load</p> <p>Clean inlets and outlets</p>
Arcing at brushes	<p>Rough or dirty commutator</p> <p>Brushes not seated properly</p> <p>Open circuit in armature</p>	<p>Sand commutator. Some cases may require turning in lathe</p> <p>See instructions for sanding brushes</p> <p>Replace armature</p>

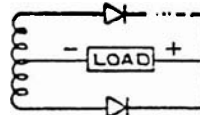
TESTING RECTIFIERS AND DIODES

DEFINITIONS

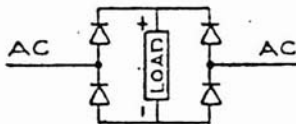
A diode is a single rectifying element represented graphically as shown below:



When a diode is used alone such as in half wave rectification it can also be called a rectifier. Two diodes are used in full wave rectification as shown:



Four diodes are used in a single phase rectifier bridge as shown:



TESTING

An ohmmeter is required for testing a diode or rectifier assembly. It is necessary to remove the leads going to the rectifier for testing it. A single diode will show a very high resistance in one direction and low resistance in the other direction.

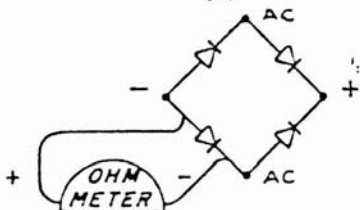


Low Reading

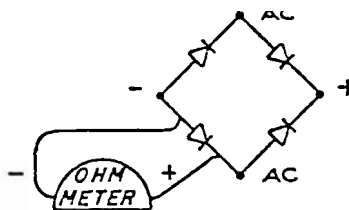


Very High Reading

A shorted diode will have a low reading in both directions. An open diode will have a high reading in both directions. Each diode in an assembly, can be tested as shown below:



Low Reading



Very High Reading

This reading has to be repeated on every diode. If the rectifier assembly is a molded assembly test + - - AC

AC - - -

between + and both of the AC terminals. The reading again should be low in one direction and very high in the other direction. The readings should be repeated between the negative terminal and the two AC terminals.

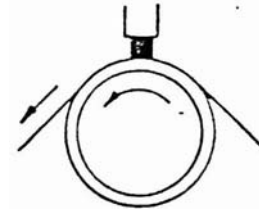
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SANDING BRUSHES

SANDING

It is important that the brushes make good contact with the collector rings and with the commutator if used. When installing a new set of brushes, they should be sanded in by using 00 sandpaper.



The sandpaper should be pulled in the direction of rotation. When pulled in the opposite direction to start a new stroke the brush should be raised. Continue the sanding until the brushes are fully seated. Do not use emery cloth.

TESTING FOR OPEN CIRCUITS

TESTING

The most likely place for an open circuit to occur is the shunt field circuit. The shunt field is connected to the rectifier output or to the brushes on a commutator type machine. One end of the shunt field should be disconnected. An ohmmeter reading should be taken between the disconnected end and the other end to determine continuity. If no reading is obtained there is an open circuit. Its exact location should then be determined and the open should be repaired.

The output leads should be checked for continuity. On three phase machines all three combinations should be checked for continuity that is L1 - L2, L1 - L3 and L2 - L3.

RESTORING RESIDUAL MAGNETISM

PROCEDURE

The restoring of residual magnetism should be done by someone who is familiar with electrical equipment. It can best be done by applying DC voltage (6-24 volts) across the terminals of the shunt field. Care must be taken that the polarity is correct. Incorrect polarity will destroy the diodes in the rectifier bridge if a limiting resistor is not used.