The information in this manual covers revolving field type alternator sets using static excitation. This type of excitation will be discussed in detail in later paragraphs of this manual. The information contained should be studied carefully and the instruction book kept at hand for ready reference. Read very carefully the paragraphs on proper use and maintenance of the alternator set.

The equipment described is the result of careful engineering design and manufacturing techniques. It has been thoroughly inspected and tested before shipment. Carefully inspect on delivery for evidence of shipping damage. If damage has occurred it should be noted on the freight bill in order that a claim can be filed to recover the cost of the damage. If the damage appears to be of a major nature, the alternator should not be operated until the fault has been corrected.

If you wish to contact your dealer or the factory, make sure you mention the model and serial number as listed on the nameplate on the side of the alternator.

Winpower alternators are designed to deliver voltage and current identical to that of a normal power line. Equipment that can be operated on normal power can also be operated by the generator set, provided the capacity is not exceeded. It should be remembered that the power line, for all practical purposes, is backed by an unlimited generator.

Promptly fill in and return the guarantee card enclosed in the front of the manual.

ENGINE

Information on the engine is to be found in the engine instruction manual attached. Engine problems and trouble shooting information will be found to be included in that part of the instructions. It is important that proper care and maintenance be given to the engine. It should be operated in a clean and well ventilated area.

When it is necessary to operate under dusty conditions the air cleaner should be serviced daily. Consult the engine instruction manual for the proper procedure. Follow instructions for frequency of oil change using recommended grade and type. Make sure cooling air passages are free from dirt and chaff.

Gasoline fueled engines should not be stored for long periods with gasoline in the fuel tank and carburetor. Gum deposits may form, blocking fuel lines and carburetor jets. Drain the fuel tank and allow the engine to run until it stops from lack of fuel. This is a good precaution when the length of storage isn't known.
An alternator set should be operated at periodic intervals, preferably not to exceed 30 days. Operation should be more frequent in salt air or corrosive atmosphere. This use should be for sufficient duration to assure that stabilized operating temperature has been reached before shutdown. An interval of too short duration will result in condensation, formation of sludge, carbon and poor ignition. Thirty minutes is recommended.

**ALTERNATOR**

The alternator is a revolving field type, using a static system for excitation and control of the voltage regulation. The section below describes the static excitation. The alternator rotor is attached directly to a tapered extension of the engine crankshaft and supported on the outboard end by a pre-lubricated ball bearing. The speed at which the rotor turns determines the frequency of the current. A 60 cycle, two pole alternator must be operated at approximately 3600 RPM and a 50 cycle alternator at approximately 3000 RPM. Engine speed is controlled by mechanical governor which maintains engine R.P.M. within 5% of the nominal rate. As frequency varies in direct relation to engine speed, there will be a variation in frequency of approximately 3 cycles from no load to rated load. This slight variation in frequency is of little consequence for normal equipment which will be powered. It is important that the alternator be kept in a clean condition and proper ventilation provided.

**WHAT IS STATIC EXCITATION?**

The word "static" means without motion; thus, the term "static excited" means that the control system which provides the current for the electro-magnetic field is provided without the use of an out-moded revolving DC armature. Commutators and commutator brushes with the inherent problem of sparking and maintenance are eliminated. The use of a mechanical voltage regulator with vibrating or multiple moving contacts is also eliminated.

Direct current is required for the electro-magnetic field. A single coil is wound in the alternator stator (the stationary winding) to provide the current for the base field. The coil is entirely separate from the main winding and is at right angles in mechanical position. The AC voltage generated in this coil is fed to a full wave silicon diode bridge to provide rectified direct current for the base field. As the field is the rotating component, the current connection is accomplished by the use of slip rings and brushes. The base field is connected to ring #1 (nearest to the bearing end) and ring #3. The base field is designed to provide magnetic lines of force required to generate rated voltage with no load on the alternator.

In order to maintain close voltage regulation as the load is varied, a control field is used. The control circuit consists of an additional full wave bridge, in series with one load line, and a control winding on the rotating field poles. The control field is connected to ring #1 and ring #2. When a load is connected to the alternator, this current is rectified and fed through the control field winding. By this means, the total strength of the field is varied in relation to the load. Voltage is maintained within 5% of the rated value.
The description of static excitation opened with the statement that 'static' is defined as without motion. In later paragraphs the revolving field has been discussed. To avoid confusion, a word of explanation is in order. There must be some relative motion between the coils which generate voltage and the magnetic field which causes the voltage to be produced. In a revolving field alternator, the winding that produces the voltage is stationary and the field poles revolve. The reverse is true in the case of a revolving armature alternator; the field is stationary and the voltage producing winding rotates.

**ALTERNATOR MODELS**

There are several variations of the basic design. The models having the suffix letter "A" (GR6036AP) are termed TOTAL POWER. Any combination of 125 volt and 250 volt loading, up to total capacity, can be used. Up to 90% of total rating can be used on one circuit at 125 volts. The 125 volt load need not be divided between two circuits.

Export models do not use the TOTAL POWER connection. These are identified by the suffix "X". The output voltage is also identified by a suffix letter. The letter "B" indicates 115 volts, "F" indicates 230 volts and "C" indicates 115/230 volts.

The last two numbers in the model number designate the rotational speed and frequency. (GR6036AP - 3600 RPM, 60 cycle; GR5030FP - 3000 RPM, 50 cycle.)

**ENGINE STARTING**

Consult the engine instruction manual for detailed starting procedure.

Manual start generator sets are cranked by either a rewind type cord or by a rope wrapped on the starting pulley.

Electric start sets use a combination starter and battery charging generator for cranking. An automatic voltage regulator controls battery charging. The manual choke is used for sets that are strictly electric start (Suffix letter "E").

The battery charge ammeter, stop switch, and start button are mounted on top of the engine. **Pull out the stop switch, close choke and depress start button.** Do not over choke. If flooding of the carburetor occurs, open choke fully and continue cranking.

Remote start sets (Suffix letter "R") use an automatic choke. The automatic choke is adjusted at the factory. It is activated when engine cranking is initiated and released when cranking stops. Do not alter the adjustment.

**ENGINE SHUTDOWN**

Generator sets using Briggs-Stratton engines (Model GR2036BP, GR1630FPX, etc.) are shutdown by means of a stop switch on the engine cylinder head which grounds the spark plug.

Manual and Electric start sets using the Wisconsin S-8D (GR4036AP, GR3330FPX, etc.) are shutdown using a ground switch on the breaker point box on the side of the engine. (Continued next page)
Manual and Electric start sets using the Wisconsin S-12D engine (GR6036AP, GR5030FPX, etc.) use a stop switch mounted on a protective governor shield on the side of the engine. The switch is depressed and held until the engine is at rest. The shield protects the engine from accidental overspeed by contacting the governor linkage in stopping the engine. Overspeed, accidental or intentional, will destroy the components of the diode bridge resulting in failure of the alternator.

Remote start sets (GR4036APR, GR3330FPRX, GR6036APR, GR5030FPRX, etc.) are shutdown by means of remote control.

**LOAD CONNECTION**

**TYPICAL PANEL - TOTAL POWER**

Load connection is provided by means of receptacles.

**Rated 250 Volt**

Single voltage models, 2000 watts and under, use grounding type convenience receptacles mounted in the bearing end bell.

Larger models use two or more receptacle types. Twistlock receptacles, in addition to the grounding convenience type, are provided. The twistlock type prevents accidental disconnection when using a power cable extension.

TOTAL POWER sets have an additional 3 wire "range" receptacle. Printing on the front identifies the 125 volt connection that can be used for 90% of total rating on one circuit.

The convenience receptacles that are used for single voltage sets at 230 volts have a different configuration to prevent accidental connection of equipment designed for 125 volts. **See illustration.**
## SERVICE DIAGNOSIS

### LOW OUTPUT VOLTAGE

<table>
<thead>
<tr>
<th>POSSIBLE CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
</table>
| **Low Speed**  | 1. Check for overload on the engine.  
2. Defective governor. Check governor spring tension, tight or defective throttle levers and joints.  
3. Defective engine. (See engine check list.) |
| **High line loss. Indicated by lower voltage at load than at generator terminals** | Increase size of line wiring. Might also be the result of loose connections which will be indicated by excessive heating at the loose connections. |
| **Shorted or grounded field coil. In some cases one coil only, that is shorted or grounded, will reduce voltage to approximately one half of rating.** | See information for testing field circuits. |
| **Defective compound field circuit. Field connected to Rings #1 and #2** | See information for testing field circuits. |
| **Defective control field bridge.** | See information on testing bridge assemblies. |

### HIGH OUTPUT VOLTAGE

| **Excessive speed** | Check governor linkage, spring tension, etc. Governor linkage must be free from dirt & gum. |

### EXCESSIVE HEATING

| **Clogged ventilating inlet and/or outlet.** | Clean screens, make sure interior of generator is unobstructed. |
| **Rheated engine due to blocked ventilating passages.** | Clean intake and outlet air passages on air cooled engines. Check oil level, check coolant level, radiator core and fan belt tension on liquid cooled engines. |
| **High room temperature** | Improve engine room ventilation. |

### NO OUTPUT VOLTAGE

| **Poor Brush Contact: Brushes tight in holder** | Clean Brush Holder. Brush should move freely in holder. |
| **Weak Brush Spring Tension** | Brush spring tension should snap brush into contact with ring when lifted and released. |
| **Film on Collector Rings caused by corrosive or dirty atmosphere.** | Clean rings with fine sandpaper during rotation of armature. Caution: Tape sandpaper to stiff cardboard for safety. |
| **Defective Rectifier Bridge (See illustration for method of checking bridge)** | Replace defective bridge assembly. Find assembly number under DIODE ASSEMBLY in parts list. |
| **Open field circuit (see illustration for method for checking)** | Replace Rotor Assembly. |
| **Grounded or shorted field coil(s) (See illustration for method)** | Replace Rotor Assembly. |
| **Loss of residual magnetism. This is a condition brought about by some unusual condition. It will always occur after disassembly of the Generator.** | See note under field assembly for procedure to restore magnetism. |
| **Defective Stator:** Snorted winding. This can be identified by the use of a "growler" at a competent re-winding shop. Grounded winding. Check by test lamp from stator winding to frame. Open winding circuit. Check all circuits for continuity. IE: S2 to S1, S4 to L1. | Replace the Stator. See illustration for testing method. (Include generator model and serial number on the order.) |
BRUSH HOLDER ASSEMBLY

Models rated at 2000 watts and under use on bracket assembly as shown in solid lines (GR2036, GR1630, etc.). Models above that rating have two brushes on rings #1 and #2 (numbering from bearing end) and use the added bracket as shown by dotted lines.

Note: When replacing brushes, the most simple method is to disconnect the entire bracket assembly by removing the screw at each end. The bracket can then be tilted forward for easy access to the brush holder caps.

1. A-745 Brush holder bracket (right) 6. Y-114 Brush
2. A-746 Brush holder bracket (left) 7. S-6096 Clamp
3. B-701 Brush holder 8. #2005 Screws
5. B-701-B Clip 10. #2652 Screw - Self tapping
BRIDGE ASSEMBLIES

1. Base Field Rectifier Bridge Assembly
2. Negative Control Field Rectifier Bridge Assembly
3. Positive Control Field Rectifier Bridge Assembly

Note: The diodes in both sections of the control field bridge are pressed into the aluminum heat sink, on models rated at 2000 watts and under. Pressed in diodes require special tooling for replacement and cannot be changed in the field. Repairs are made by replacement of complete assemblies.

Check for Defective Diode

1. Disconnect all external wiring from both AC and DC circuits. (Carefully mark the point of connection of each wire to assure proper re-connection).
2. A diode that is in good order will conduct current in one direction and block in the opposite. The conducting direction is marked on the case by an arrow (→) on the larger and by a color band on the smaller (□).
3. Use an ohmmeter (or a 1.5 volt flash light battery and bulb as illustrated) to check the current direction. Connect positive at the base of the arrow and negative at the end to which the arrow points. (See illustration) A diode that conducts in both directions or neither direction is defective.

Alternate means for testing a diode if an ohmmeter is not available.
FIELD ASSEMBLY

Resistance of Field Circuits at 25°C (77°F)

<table>
<thead>
<tr>
<th>Rating</th>
<th>Base Field (Ring #1 to 3)</th>
<th>Control Field (Ring #1 to 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 Watts &amp; under</td>
<td>32 to 42 ohms</td>
<td>Less than 1 ohm</td>
</tr>
<tr>
<td>3000 to 4000 Watts</td>
<td>43 to 53 ohms</td>
<td>Less than 1 ohm</td>
</tr>
<tr>
<td>Above 4000 Watts</td>
<td>47 to 57 ohms</td>
<td>Less than 1 ohm</td>
</tr>
</tbody>
</table>

Note: When ordering replacement field assemblies, be sure to include model and serial number from nameplate on generator frame.

TESTING A FIELD CIRCUIT

Make sure that all brushes are not in contact with the slip rings. If the alternator has not been disassembled, paper inserted between the brush and slip ring will serve as insulation. The complete brushholder bracket can be removed if this procedure is preferred, by removing the screws and nuts at each end of the bracket. The brush gear may use one bracket or two brackets, depending on the capacity of the alternator. When two are used, both must be insulated or disconnected.

To measure the resistance of the base field, touch the ohmmeter leads to ring #1 and #3 as shown in the illustration. Measure from rings #1 and #2 for the control field.

A resistance appreciably lower than shown on the table indicates shorted turns in one or both field coils. The resistance of less than one ohm on the control field is too low to measure accurately with the average ohmmeter. A complete circuit between rings should be indicated. A high resistance would indicate a broken connection.

A grounded field circuit can be identified by connecting the meter from the slip rings to the rotor shaft.

NOTE: Occasionally an alternator will lose residual magnetism. It is very unusual unless the alternator has been dis-assembled, in which case it will be necessary to "flash the field" on the first start.

(continued)
A step down transformer with a nominal 125 volt primary winding and from 15 to 30 volt secondary can be used for this purpose. The primary should have a cord with a plug for a wall receptacle. The secondary should have extension leads with insulated probes. With the alternator operating, plug into the wall outlet and insert the probes momentarily into the 125 volt convenience outlet. For equipment not furnished with the outlet, touch the probes to the connection of L1 and L2. A momentary contact is all that is required. The transformer assembly can be purchased from the factory at a nominal cost if not available locally.
Note: When ordering replacement stator assemblies be sure to include the model and serial number from the nameplate on the side of the generator.

The stator assembly has one single coil winding to provide voltage for the base field. This coil has brown lead extensions and is at 90° in mechanical position from the load winding.

Single voltage models have a two pole single winding for the load.

Dual voltage models have a double winding. Each winding develops voltage at the lower rating. For the higher voltage the connection results in a series connection of each winding. It is much the same as connecting two 6 volt batteries in series for 12 volts.

The 125 volt winding used for a single circuit, 90% capacity, on TOTAL POWER Models is wound with larger wire to provide for the increase in current.

A single voltage rating at the higher rating (220 to 250) merely omits the connection for the lower rating.

When a fault in the stator is suspected each individual winding should be checked. The resistance of the separate windings will be low, less than one ohm, but a complete circuit should be indicated. IE: #S1 to #S2, #S4 to #L1.

The various windings should also be checked for ground. For this purpose connect an ohmmeter from a bare spot on the frame to one lead of each coil. A meter deflection indicates a grounded winding.

When all stator leads are disconnected, there should be no circuit from one winding to any other. If a circuit is indicated the winding is shorted.

If any of the above conditions are indicated, the stator assembly must be replaced.