INSTRUCTION MANUAL

INTRODUCTION

The information in this manual covers generator 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 installation and maintenance of the generator set.

The equipment described is the result of careful engineering design and manufacturing techniques. It has been carefully 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 generator should not be operated until the fault has been corrected.

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

Promptly fill in and return the guarantee card enclosed in the front of the manual. Winpower generators 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 of the generator is not exceeded. It should be remembered that the power line, for all practical purposes, is backed by an unlimited generator.

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. The engine, in most cases, will be an air-cooled, spark ignition, using gasoline, natural gas or liquid petroleum fuel. Discussion of the proper installation and maintenance for the various fuels will also be found in later pages of this booklet. In some cases, the engine may be water-cooled either spark ignition or diesel combustion system. As in the case of the generator, it is important that proper care and maintenance be given to the engine. The installation area should be kept clean and well ventilated. It is important that a standby generator set be operated at periodic intervals, preferably not to exceed seven to ten days. When the generator set is operated it 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.

GENERATOR

The generator is a revolving armature type, using a static system for excitation and control of the voltage regulation. Carefully read the paragraph which describes the static excitation. The generator armature is attached to the engine flywheel by a semi-flexible disc coupling and supported on the outboard end by a pre-lubricated ball bearing. The speed at which the armature turns determines the frequency of the current. A 60 cycle generator must be operated at approximately 1800 RPM and a 50 cycle generator at approximately 1500 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 by the generator. As in the case of the engine, it is important that the generator be kept in a clean condition and proper ventilation provided.

WHAT IS A STATIC EXCITED TYPE GENERATOR?

The word "static" means without motion; thus the term "static excited" means that the excitation current for the field is supplied without the use of outmoded rotating type of excitation. Commutators and commutator brushes with the inherent problems of sparking and maintenance are not used.

In the Winpower static excited alternator, the alternating current output of the generator is rectified by means of a full wave silicon diode bridge. Resulting direct current is used to supply the stationary field coils.

A circuit is included in the generator excitation system to maintain a relatively constant voltage as the generator load is varied. This circuit consists of a current transformer with the primary of the transformer in series with the load. The transformer secondary is connected to the rectifier bridge. By this means, as the load current is increased or decreased, the resulting change in energy in the transformer secondary results in a comparative change of energy through the generator field. The field strength, as a result, increases as the load increases and conversely decreases with a reduction in load. This offsets the reduction in output voltage which would occur without this provision. This circuit also provides for a means for "forcing the field" during sudden momentary overloads such as are encountered in the starting of motors. The momentary KVA of the generator can be increased far in excess of rating for the short time required to start the motor. Generator voltage is maintained and as a consequence motors do not stall.

CONTROLS

Manual start generator sets are started by means of a pull rope wrapped around a starting pulley on the engine flywheel, and are equipped with a stop switch, usually mounted on the engine. Electric start sets have a start-stop switch and the necessary magnetic starting contactors and equipment required for energizing the starting circuit. This equipment is contained in the control panel which also includes the generator excitation components, the battery charging circuit for maintaining state of battery charge and the load terminal strip. Cranking of the engine is accomplished by an automotive type starter, resulting in increased cranking torque and reliable starting.

Remote start generator sets, in addition to the equipment for the electric starting, include a terminal strip for connection of the remote controls. Cranking and battery charging components are identical with the exception that means is provided to actuate these controls from a remote location. The majority of remote start generator sets are controlled by an automatic load transfer switch. This switch senses the failure of normal power, starts the engine, and transfers the load to the generator when it has reached normal operating speed and voltage. As the normal power is restored, the load is again transferred to this source and the generator set shutdown. The function of automatic panels is explained in the manual included with that equipment.

INSTALLATION

There are several factors which must be considered for the proper installation of a generator set. These involve sufficient space for clearance between walls or other items which might interfere with accessability to the engine controls, generator controls, location of the exhaust system, load connections and battery placement. Each installation must be considered on its own merits -- these instructions are intended as a general guide. In no case should a generator set be installed so near to a wall that there is insufficient space for a walk way. Local regulations for building code, fire ordinance, etc. must also be taken into account.

PROPER VENTILATION AND AMBIENT TEMPERATURE

Standby generator sets should not be located where ambient temperature will fall below 60°F in order to insure proper starting of the engine. Extremely high ambient temperatures should also be avoided as improper cooling of the engine will result. The maximum ambient temperature should not exceed 100°F. Adequate provision must be made for the inlet of fresh air and the exhaust of used air from the engine room. The combustion of the engine fuel produces carbon monoxide to some degree which can be very dangerous without proper ventilation. This is especially true when the fuel is gasoline. For small room installation it may be necessary to add a motor driven exhaust fan in order to assure the proper air flow. This motor driven fan can be connected to the generator set terminals so that it operates when the engine is running. These motor driven fans should be equipped with automatic louvers, which open during operation and close when the generator set is not running. This prevents the entrance of dust, rain, and cold air when the outside air temperature is low.

MOUNTING

The generator set is mounted on a rigid steel base to maintain the proper support and alignment of the components. The floor of the engine room should be level and substantial concrete of a minimum of 3" thickness. An additional block of concrete of a dimension of 2" on each side in excess of the dimensions of the generator set skid is recommended when possible. This will increase the ease of servicing and maintaining clean surroundings. Vibration isolating pads are also recommended.

EXHAUST PIPING

The weight of the exhaust pipe system must not be supported on the engine exhaust manifold. A short piece of flexible exhaust tube should be connected between the manifold and the rigid portion of the exhaust piping. The muffler should be installed as near as practical to the generator set. The complete exhaust system should be as short as possible. The pipe should be increased one size for each 10 ft. of length when an extended run is necessary. When elbows are required, they should be "long sweep" type or two 45^{o} elbows connected with a 4" pipe nipple. If possible, the exhaust line should slant slightly downward away from the engine or a condensation trap near the engine provided. This condensation trap can be constructed from a pipe tee with a short nipple and cap to trap the condensation and provide for drainage.

FUEL CONNECTIONS

The proper fuel line size and type is discussed in later paragraphs of this manual under the various fuel type headings. Fuel lines which might be damaged by impact, such as copper tubing, should be protected.

BATTERY

The majority of the batteries now used are the "dry charged" type. These batteries should be filled to the proper level from the electrolyte packages using care to avoid spilling. The electrolyte is an acid and any electrolyte accidentally spilled should be diluted and washed away using fresh water. Avoid contact with clothing and hands. Make sure that battery cable connections are tight. Do not attempt to force the cable on the battery post by hammer blows or damage to the battery can result. A screwdriver can be used to spread the battery cable connections slightly, if difficulty in seating on the battery post is experienced. A light coating of grease on the cable connection will prevent corrosion. Periodic inspection of the electrolyte level and state of charge will maintain the battery condition and assure proper starting. The rectifier charge circuit of the control panel can be connected to the load terminals of the automatic line transfer panel when this equipment is used. This will provide for continued battery charge regardless of the power connection. When this connection is made, the charge should be maintained at a low rate to prevent overcharging and evaporation of the electrolyte.

LOAD CONNECTIONS

It is important that all connections to the load meet local electrical requirements. In many cases inspection and approval is required for operation.

The generator control panel is equipped with a load terminal strip and in most cases a load circuit breaker for protection. The control panel is also equipped with a terminal strip for connection of remote starting equipment when required. The remote starting may be achieved by a station at some location remote from the generator set or by means of an automatic load transfer panel. The automatic transfer panel is used to sense the failure of normal power, start the

generator set and transfer the load to the generator. This equipment is used for installations where the interruption of the power cannot be tolerated and the fact of the power failure might not be known.

In some cases where the transfer of power is not of such a vital nature, a manual transfer switch is used. When the manual switch is used and the power fails, the first step is to disconnect the load from the power line by moving the switch to the neutral position. The generator set is started, using the starter switch on the control panel, and the load transferred to standby position after the generator set has reached rated speed and voltage. It is good procedure to allow the generator set to warm for a period of approximately five minutes before transferring the load if a power loss can be tolerated for that length of time. The operational sequence and function of the automatic transfer panels is explained in the manual included when that equipment is used.

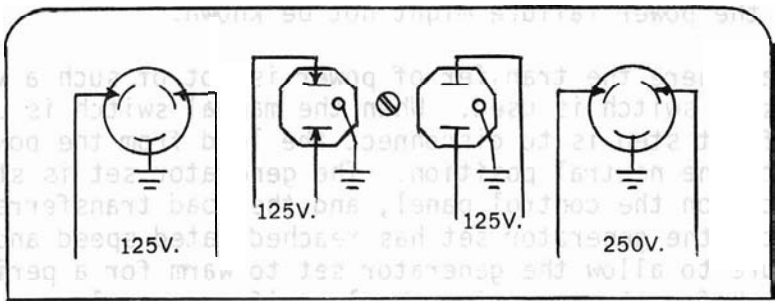
The smaller, portable contractor type generator sets are started manually by means of a pull rope. These portable sets are equipped with convenience outlets on the panel for connection of power tools etc. Two grounding type receptacles and one 3-wire twist lock receptacle are provided.

WIRING CIRCUITS

It is important that the wiring connections be made by someone qualified to do a proper job. The wiring used must conform to local electrical codes and be of ample size for the load. Using conductors that are too small will result in heating of the wiring and loss of voltage due to the drop in the line. Single phase generators may be either 2-wire 125 volt, 2-wire 250 volt, or 3-wire combination 125/250 volts. Generators termed "Total Power" can provide the entire generator capacity at 125 volts 2-wire, or 250 volts 2-wire. The Models GS6000C, GS10000C, GS15000C and GS20000C are 3-wire sets. This system provides two circuits at 125 volts and one circuit at 250 volts. (See illustration on next page.)

Three phase generators, Models GS6003D, GS10003D, GS15003D and GS20003D use "Wye" connected 4-wire systems. These generators provide for a three phase, 3-wire and ground system and also single phase at 2-wire, 216 volts and single phase, 2-wire at 125 volts. Three single phase circuits are available at either 216 volts or 125 volts providing no more than one third total generator capacity is used on any one circuit. Both three phase and single phase current can be obtained from the generator at the same time, but it is important that the current in any line does not exceed the rating of the generator. Subtract the amount of three phase current from the total capacity per line; the remainder is available for single phase loading. (See illustration on next page.)

"TOTAL POWER" LOAD OUTLETS

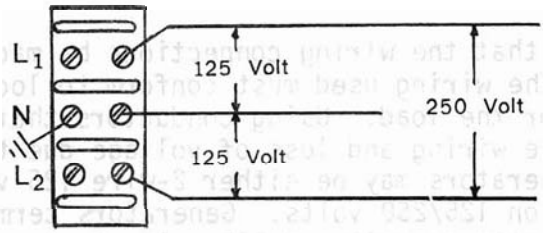


Twistlock receptacles are convenient for power cord with terminal box end (can't be accidently disconnected). Duplex outlet can be used for similtaneous adjacent power within generator capacity limits. Combination load at 125 volts and 250 volts is available. Example:

20 amps at 125 volts =	2500 watts
5 amps at 250 volts =	1250 watts
Total	3750 watts

SINGLE PHASE, 3 WIRE GENERATORS

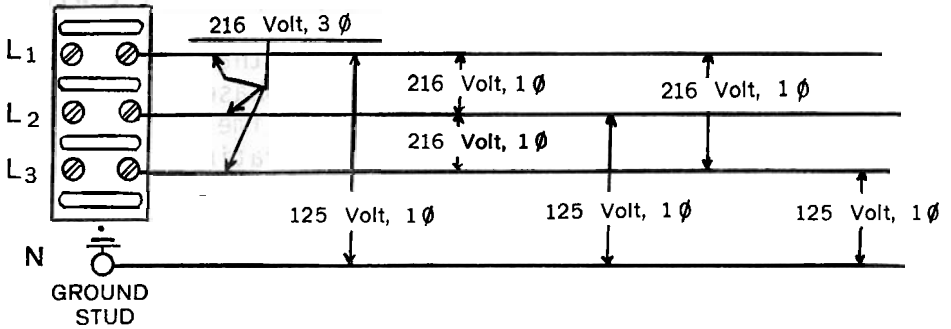
LOAD TERMINAL STRIP



Two circuits, of ½ generator capacity each, are available at 125 volts. Load can be combination of 250 volts and 125 volts. Care must be used not to overload either line. Subtract the 250 volt current from the nameplate amperes. The difference is available at 125 volts on each line. Excessive overload on any or all lines will trip the load breaker.

THREE PHASE, 4 WIRE GENERATORS

LOAD TERMINAL STRIP



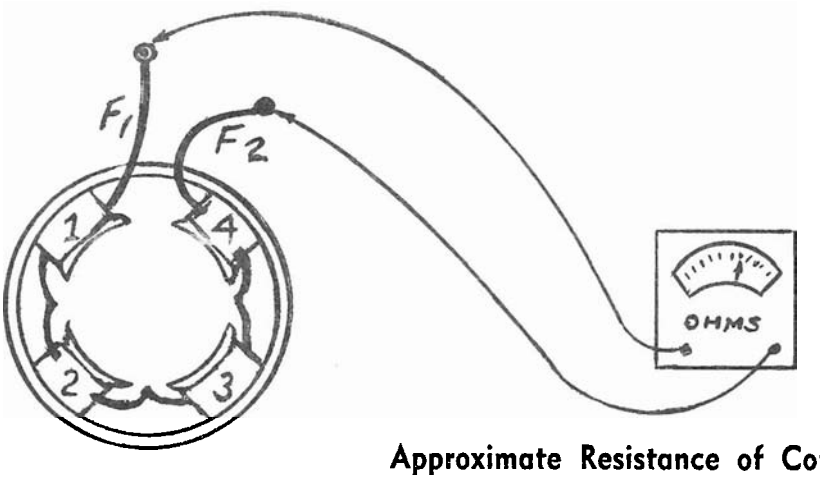
Three phase (3ϕ) generators can be used for 3ϕ load at 216 volts nominal and also single phase load at both 216 volts and 125 volts. The total current in any line should be the sum of both single and three phase as listed on the nameplate amps. per terminal. Single phase load should be distributed as evenly as possible to avoid overloading any one line.

Example: nameplate amps. per term. — 40

	L_1	L_2	L_3	N (Ground)
216 v, 3ϕ load	15	15	15	0
216 v, 1ϕ load	10	13	3	0
125 v, 1ϕ load	10	8	22	40
	35	36	40	40

This generator has more connected 216 volt load from L_1 to L_2. A larger part of the 125 volt load has been connected from L_3 to neutral.

FIELD ASSEMBLY



Typical Field Assembly shown for simplicity.

NOTE: When ordering replacement coils be sure to mention model and serial number.

Approximate Resistance of Complete Field Circuit at 20°C (70°F).

Basic Model	OHMS
GS6000, GS10000, GS15000	13 to 17
GS20000	25 to 31
18/30 PT (15PT 2 & 3)	13 to 17

TESTING A FIELD CIRCUIT

Disconnect field leads F_1 and F_2.

Measure resistance of entire field circuit as shown in the illustration. A resistance of less than the range shown on the table indicates a shorted coil. The defective coil can be identified by measuring the resistance of the individual coils. A coil with an appreciable lower resistance has shorted turns.

A reading of no deflection or very little deflection of the meter pointer indicates a defective coil or broken interconnection. Inspect all interconnecting wires for tight and un-corroded connection. Each coil should measure approximately $\frac{1}{4}$ of the total specified resistance. A very high resistance indicates broken internal wires.

A grounded field can be identified by connecting one ohmmeter lead to one field lead and touching the other to an un-painted spot on the field ring. Make sure that none of the coil leads are in contact with the ring. A grounded field can usually be corrected by repairing the insulation once the grounded point or points are located.

NOTE: Whenever the field coils have been removed and/or replaced, the field must be re-energized. For this purpose use a 120 to 25 volt step down transformer. The transformer should have a power cord to plug into a wall outlet on the 120 volt side and extension leads with insulated probes on the 25 volt side. With the generator set operating, plug the transformer primary into wall outlet. Touch the secondary leads to the AC connection studs on the rectifier bridge. (See bridge illustration.) Remove at once when voltage is indicated by a voltmeter connected to the load terminals. CAUTION: DO NOT USE AN AC TEST LAMP. A REVERSAL OF GROUND ON THE POWER LINE TO THE GENERATOR GROUND COULD BE DANGEROUS. THE TRANSFORMER ISOLATES THE GROUND.

CHECK FOR DEFECTIVE BRIDGE

1. Disconnect all external wiring from both the AC and DC circuits. (Carefully mark the point of connection of each wire to assure proper re-connection.)

2. Using an ohmmeter, place one lead on the aluminum plate and alternately touch the other lead to the AC connections. If a circuit is indicated by an appreciable deflection of the meter at one AC stud there should also be an identical deflection to the other. If there is very little deflection this also should be identical.

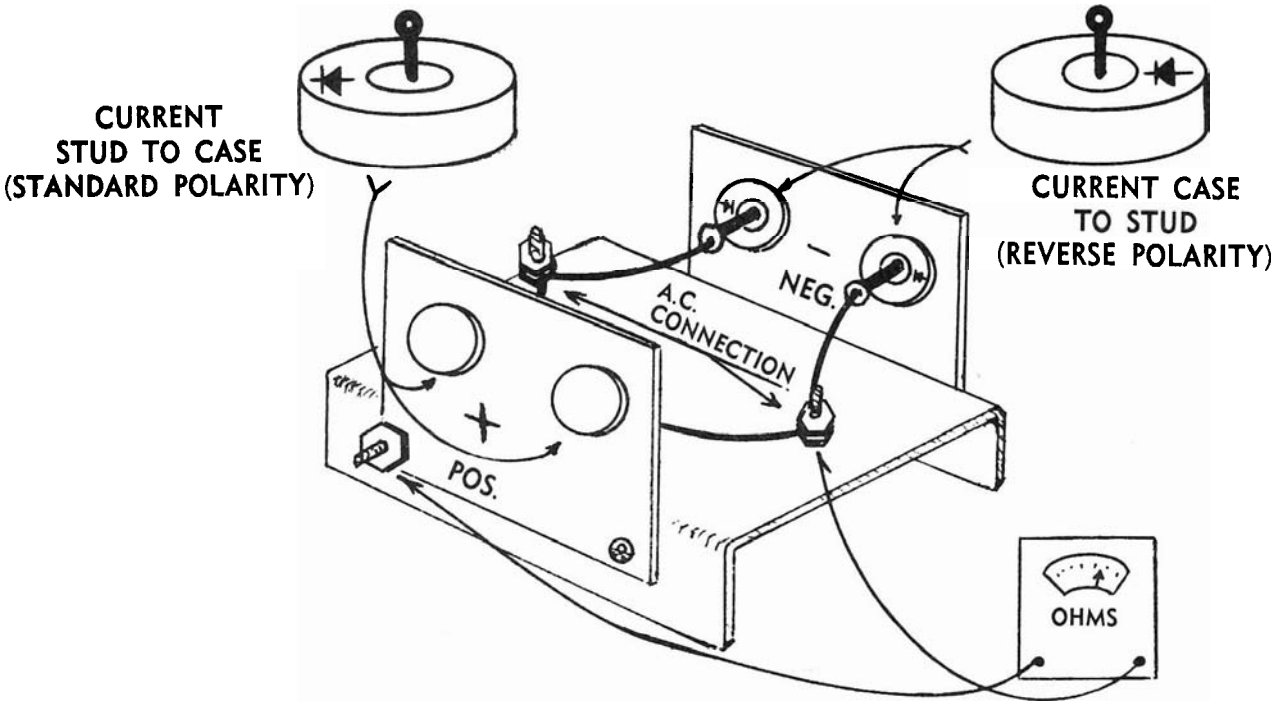
   The reading should be near infinity in the direction reverse to the arrow. In the conducting direction the reading should be in the range of 10 to 50 ohms. All diodes should read approximately the same resistance. In other words, if one diode reads 10 ohms while the others read 50 ohms, the low resistance diode is defective. Note: Do not attempt to replace defective diodes. Precision equipment is required to prevent damaging the diode during mounting. Order a complete assembly.

3. Next check the opposite side of the bridge. This will require a reversed connection of the ohmmeter. The connection that results in deflection on one side must result in very little deflection on the other.

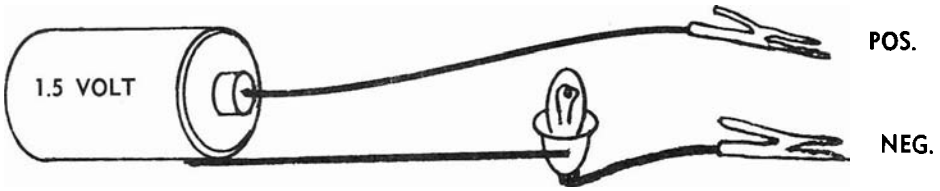
   If there is deflection in both directions to an AC stud, that diode is shorted and is defective.

   If there is little deflection in either direction, the diode is open and is defective. Order a new bridge assembly by the part number under DIODE ASSEMBLY on the parts list in this manual. Be sure to reference the generator set serial and model numbers on the order.

4. There is also a surge protecting "Thyrector" connected to the bridge. On some models this is connected from one D.C. terminal to the other. This one is made of six 1" square plates and is mounted on the side of the panel. It should conduct in one direction and block in the other. Some models use a thyrector across the AC terminals. This one has the appearance of a condenser with leads from each end. This type should not conduct in either direction.



RESISTANCE SHOULD BE 10 TO 50 OHMS IN THE CONDUCTING DIRECTION—NEAR INFINITY IN THE OPPOSITE.



1.0 AMP.

ALTERNATE MEANS FOR TESTING A DIODE IF AN OHMMETER IS NOT AVAILABLE. NOTE: TO CHECK CONDUCTING DIRECTION CONNECT POSITIVE AT BASE OF ARROW AND NEGATIVE AT POINT. EXAMPLE: STUD ON STANDARD; CASE ON REVERSE.

LOW OUTPUT VOLTAGE

POSSIBLE CAUSE	REMEDY
Low Speed	1. Check for overload on the engine or tractor. 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 (Models GS2500W, GS3800WT, 12/20). Field marked S_1 & S_2.	See information for testing field circuits.

HIGH OUTPUT VOLTAGE

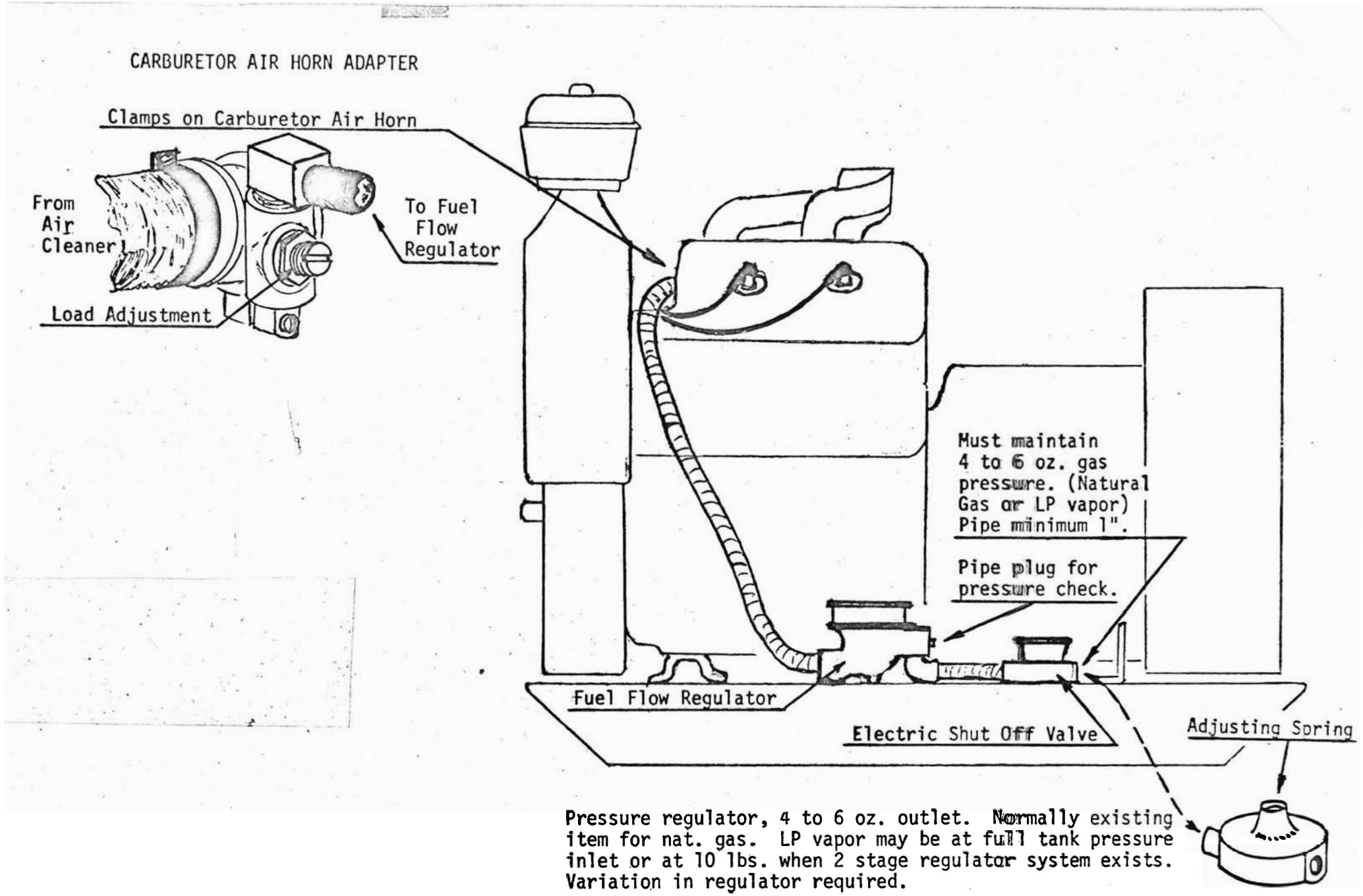
Excessive speed	Check governor linkage, spring tension, etc. Governor linkage must be free from dirt & gum.

EXCESSIVE HEATING

Clogged ventilating inlet and/or outlet.	Clean screens, make sure interior of generator is unobstructed.
Overheated 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) Page	Replace defective bridge assembly. Find assembly number under DIODE ASSEMBLY in parts list.
Open field circuit (see illustration for method for checking)	Replace open coil(s) or repair if open connection is in the connecting leads.
Grounded or shorted field coil (s) (See illustration for method)	Replace grounded coil(s) and insulation or repair damage.
Loss of residual magnetism. This is a condition brought about by some unusual condition. It will always occur after disassembly of the field frame.	See note under field assembly for procedure to restore magnetism.
Defective Armature: Shorted winding. This can be identified by the use of a "growler" at a competent re-winding shop. Grounded armature winding check by test lamp or high potential tester from collector rings to shaft. Open armature circuit. Measure circuit between rings with an ohmmeter. Note: 4 ring single phase armatures will have a circuit between rings 1 & 2 and rings 3 & 4 (numbered from bearing end). There should be no circuit on any other combination. All others should have a circuit between any pair of rings.	Replace the armature. (Include generator model and serial number on the order.)



Pressure regulator, 4 to 6 oz. outlet. Normally existing item for nat. gas. LP vapor may be at full tank pressure inlet or at 10 lbs. when 2 stage regulator system exists. Variation in regulator required.

15 KW-WISCONSIN VG4D
NATURAL GAS OR VAPOR WITHDRAWAL LIQUEFIED PETROLEUM

INSTRUCTIONS

To Connect from natural gas to gasoline

It is assumed that natural gas is the preferred fuel which will be used except under emergency conditions.

The engine is set up for natural gas on shipment. The gasoline automatic choke rod has been disconnected from the choke butterfly which is blocked wide open. The choke electrical has also been disconnected. The natural gas fuel safety solenoid is connected to open electrically on starting. Fuel is piped to this valve at a pressure of 4 to 6 ounces.

Connect to gasoline as follows:

1. Disconnect solenoid ground wire and tape.
2. Remove blocking screw from choke butterfly and connect rod from choke solenoid.
3. Connect choke wire to "S" terminal of shift solenoid on top of starter motor.
4. Connect gasoline supply to engine fuel pump.

Reverse procedure to reconvert to natural gas.