

PARTS LIST
(G-2536GP)
(Automotive Start Unit)

<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>QUANTITY</u>
0014-AGM-1050	Briggs & Stratton Engine	1
G-4918	Armature Assembly	1
G-4052-A	Brush Gear Assembly	1
I-336	Brush Spider	1
J-56	Bushing	4
G-47	Brushholder Assembly	4
Y-110	Brush	4
O-24	Brushholder Pin	4
B-436	Terminal Lug	4
G-292-A	Field Poles	4
H-469	Field Coils	4
A-606-A	Blower Fan	1
I-684-14T	Drive End Bell	1
I-706	Commutator End Bell	1
D-8	Bearing	1
I-781	Control Panel Support	1
G-4919	Control Panel Assembly	1
EE-120	Contactors	2
EE-133	Control Relay	1
AM-88	Ammeter	1
G-4923	Ammeter Shunt Assembly	1
EE-156	Toggle Switch	1
EE-654	Terminal Strip	1
EE-939	Pilot Light	1
EE-940	Pilot Light Bulb 12 Volt D.C.	1
EE-1334	Receptacle, Twistlock	1
EE-2136	Diode-Control Relay	1
EE-2137	Diode-Polarity Reversing	1
S-3289	Panel Cover	1
W-168	Boots, Rubber Load Terminal	2
B-684	Diode Mounting Strip	1
B-685	Terminal Bar	1
B-686	Terminal Bar	1
G-4920	Carrying Frame Assembly	1
W-167	Vibration Isolators	8
W-129	Grommet	1
G-4038	Commutator End Hood	1
G-4921-A	Load Cable Assembly	1
G-4922	Control Cable Assembly	1
G-4921-B	Load Cable Assembly	1
EE-1813	Thermal Relay	1
R-160	Resistor	1
R-161	Resistor	1

WIRING DIAGRAM Z-1544

C-5139

INTRODUCTION

Each Generator is carefully inspected at the Factory and run until the brushes are satisfactorily seated. Then it is checked for correct output under average operating conditions.

When unpacking the machine, be sure to inspect it carefully to see that no damage occurred in transit. If damage is noted, notify the transportation company immediately and have them write the nature of the damage on the freight bill, so that a claim can be filed if necessary.

If upon installation a new Generator does not work properly, check all of the electrical connections and the Generator speed before assuming that the Generator is not performing satisfactorily.

BATTERY

1 or 2, 12 Volt batteries rated at 72 ampere-hours or more is recommended for starting Remote Start or Electric Start Plants of over 1500 Watts capacity. Two 6-Volt car batteries connected in series can do the same job. This can be done by connecting the positive terminal of one battery to the negative terminal of the other. The remaining positive battery terminal is joined to the positive terminal on the side of the Generator panel and the remaining negative battery terminal to the negative terminal on the side of the Generator also. Speaking of the Generator as we have above, we are referring directly to the Generator panel. All connections must be clean and tight. Check the electrolyte (fluid) in the battery periodically to be sure it is above the plates. Never allow the battery to remain in a discharged condition.

STOPPING AND STARTING

Manual type units must be cranked by hand using a rope, recoil starter or crank. To stop the engine depress the stop button or toggle switch on the control box. Electric and Remote units can be started electrically by moving the switch to the start position and stopped by moving it to the stop position.

THERE IS NO OIL IN THE ENGINE WHEN THE UNIT IS SHIPPED. See the Engine Instruction Book regarding the amount and type of oil and fuel to be used.

Engines supplied as part of this generating plant are manufactured by highly reputable manufacturers who have established an excellent world-wide engine service organization.

See the Engine Instruction book for information pertaining to engine service in your area, for regular maintenance and for special overhaul information.

Each Generator plant is checked at the Factory at full rated capacity before it is released for shipment. For high altitude operation deduct 3% from the rating for each 1000 feet of altitude over 3000 feet above sea level.

GENERATOR MAINTENANCE

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Neglect of simple maintenance necessary to maintain peak performance of the Generator can cause failure at a time when the Plant is most urgently needed. Inspect the brushes every 30 hours of service. Always replace them when they have worn to a length of $5/8$ ". Never use any other than the same grade, size and make of brushes as supplied with the original generator. A spare set of brushes should be on hand at all times.

It is very important to keep the generator clean and free from accumulations of dirt and grease. It is not necessary to take the generator apart to clean it, as in most cases the dust can be readily blown out with an air hose. The slip rings and commutator can be wiped with a clean cloth.

Never use gasoline or any petroleum based product on the commutator or rings of the generator. The grooves between the commutator bars should be occasionally cleaned out and kept free from accumulations of carbon dust, or other foreign matter.

Examine the commutator and rings at regular intervals for any sign of wear on these parts. At the first sign of any wear, machine commutator and rings as the wear will increase rapidly after the commutator or ring has once become rough. Undue wear on the rings is usually caused by brushes that are sticking in the brush holders. Improper grade of carbon in the brushes or the use of motor type brushes may cause rapid deterioration of the rings. When smoothing down a commutator after machining use a fine grade of sandpaper. NEVER USE EMERY PAPER AS THIS HAS METALLIC PARTICLES WHICH WILL WORK INTO THE GENERATOR AND CAUSE SHORT CIRCUITING.

If trouble occurs and the operator is unable to determine the cause after a thorough study of this book, or if he is unable to determine what repair parts are required, needed information will be furnished upon request. When asking for information, be sure to state the Model and Serial Numbers of the unit. This information is absolutely necessary and may be obtained from the name plates. Give all other details available.

The process of building up voltage in all types of generators requires that there be a small amount of residual magnetism in the iron parts of the field exciter structure when the machine is standing still. This residual magnetism produces the initial voltages in the armature coils as soon as the armature is rotated, which are built up until the full magnetic field is developed, and the machine delivers full voltage. All generators leave the factory with sufficient residual magnetism to build up when started. However, through long period of storage, and sometimes due to rough handling in transit, an occasional generator will lose all or part of its residual magnetism, and so fail to build up voltage. The following procedures will usually correct the trouble:

1. Carefully check that all brushes are free in the brush holders, are seated on the commutator, and that no objectionable film has collected on the commutator. See that brush shunts are not binding on adjacent parts or shorted to ground.
2. With the generator running, apply light pressure to the top of one or two D. C. brushes with a wooden stick, to polish the commutator and break through commutator film. Often this will permit the generator to build up when the residual field is weak.

3. If the machine still refuses to build up, the residual magnetism can be restored by applying direct current to the fields. Lift all the brushes clear of the commutator. With the generator at standstill, connect the positive terminal of a 6-volt storage battery or "Hot Shot" dry battery to a positive brush holder. In generators where one brush holder is grounded this will be the grounded commutator brush. Touch the negative connection from the battery to the adjacent commutator brush holder. This will be a negative brush. Hold the connection a few seconds. Remove battery connections, lower brushes and start generator.
4. Should the generator build up with reversed polarity, that is, should the positive connection become negative, or in a A. C. machine still fail to produce current, this can be overcome by reversing the connections between the battery used to build up the residual magnetism and repeating the process described above.

In electrically cranked plants, where the generator serves as the starting motor, residual magnetism is automatically restored when the starting winding is energized.

DIRECT CURRENT GENERATORS

In a direct current generator the current always flows in the same direction. This is accomplished by means of the commutator and brushes which act to keep the current flowing in a constant direction. The commutator and brushes act as a group of double throw switches, reversing a coil's connection to the line just as it is starting to pass under a field pole of opposite polarity.

The commutator and brushes of a D. C. machine carry all the current generated within the machine. These are subject, therefore, to all overloads. If overload continues to exist, the generator may become damaged. The commutator becomes hot and then arcing develops, which, in turn, continues to ruin the commutator. Therefore, never subject a D.C. generator to overload as it shortens the life of the unit.

D. C. Generators are also divided into two types, namely, shunt and compound wound. The shunt wound type has only the shunt field coils. Therefore, the voltage of this type of machine will drop as load is increased. The shunt wound generator is used most often for battery charging plants. The compound wound machine, in addition to shunt field coils, also has the series field coils. These coils are in series with the load. As the load increases, so does the current through the series coils, automatically supplying excitation and either boosting the voltage slightly or maintaining it more or less constant.

GENERATOR TROUBLES - D. C.

The most common source of D. C. generator trouble is overloading. Overloading, in turn, causes commutator and brush troubles which can be very bothersome and costly. Overloading a machine beyond its rated capacity results in sparking or arcing brushes, accompanied possibly by heating and discoloration of the commutator due to the excessive current which they are carrying. This sparking is of such a nature as to damage both the brushes and commutator whose surface will be burned and discolored due to overheating, especially if the overload is allowed to continue. A healthy commutator will acquire a good polish and chocolate brown color. Black deposits on the commutator often indicate bad commutation.

Another source of commutator trouble is oil and grease. If oil or grease gets on the commutator, the mica insulation of the commutator will become oil soaked resulting eventually in ruined commutator. Ring fire is a visible symptom of this condition; therefore, never lubricate the commutator.

Arcing brushes may also be caused by improper adjustment of the brush ring, thus placing all the brushes in wrong position with respect to the field poles. Brush rings are adjustable. It is, of course, first necessary to loosen the set screw. Then adjust the brush ring to a position where least sparking exists. In the case of some D.C. generators, individual adjustment of each brush may reduce arcing. Brushes should be equally spaced around the commutator. This spacing should not vary more than 1/32 inch.

Brush troubles which continually persist due to atmospheric conditions can usually be solved by some local electrical expert. However, should the services of such an expert not be available, it is possible that the dealer, through suggestions received from the factory, can correct the trouble.

Consistent overload, which overheats the insulation, exposure to oily or moist atmosphere, and a number of other causes will eventually ruin the insulation of the machine's windings. This will cause short circuits and grounds to appear. These conditions must be eliminated as faults of this type in an electrical machine are accumulative.

When the commutator of a generator shows bad condition from wear and improper operation, it should immediately be repaired. It never pays to wait, By having the commutator machined and brushes replaced at the first signs of improper condition, considerable service costs can be avoided.

Sanding the commutator with a fine grade of sandpaper (never use emery cloth) will often stop sparking and ring fire, if the damage is not already too great. Sometimes a dirty commutator is the primary source of sparking, and the removal of the blackening by sandpaper will cure the trouble. Therefore, inspect the generator about once or twice a week and considerable trouble and expense will be avoided.

An exceptional hot commutator will throw solder, and therefore connection between commutator bar and coil is broken. Should such a condition ever develop within the machine, it could be a direct result of overload. Therefore, never overload a D.C. generator. It may ruin the generator and also shorten the life of the engine.

GENERATOR SERVICE

The most common cause of a generator failing to produce current is an external short somewhere on the main line. If it is suspected that this is the cause of failure, the main line circuit should be disconnected by throwing the main line switch, and a test lamp placed across the output of the generator. If the plant fails to generate with the A.C. main line disconnected from the plant, then the trouble lies in the generator. With the trouble traced to the generator, the following tests will indicate whether or not the difficulty is due to a short or a grounded field or armature.

COMMUTATOR: Mica is used for insulation between the commutator bars. After the armature is machined, the mica is cut away from 1/32" below the surface of the bars. The surface of the bars will wear down to the level of the mica eventually. Mica is harder than copper and it forms ridges which cause the brushes to jump and make poor contact. High mica should be under-cut carefully, and the commutator turned and cleaned. Loose brush wires can cause failure of the generator to produce current. Brushes in which the leads have become loosened should be replaced.

TESTING D.C. WINDING OR ARMATURE FOR GROUNDS: First, disconnect battery and A.C. line wires from plant. RAISE ALL BRUSHES FROM COMMUTATOR AND COLLECTOR RINGS. Place one end of test lamp wire on commutator. Touch other end of test lamp wire on clean surface of armature shaft. If test lamp burns, the commutator or D.C. winding is grounded. NOTE: A shorted or grounded D.C. armature circuit will generally be indicated by overheating of the armature or burned windings. The plant will run, but no current will be generated.

SERVICE DIAGNOSIS

POOR COMMUTATION: Indication of poor commutation is excessive sparking and/or overheating of commutator, blackened or pitted commutator bars.

CAUSES OF POOR COMMUTATION:

1. The brushes not set correctly in respect to the field poles.
2. Brushes may not be fitted to the surface of the commutator.
3. Brushes binding in the holders.
4. Brushes may not be equally spaced around the commutator.
5. Brushes may have reached their limit of wear, with the result that there will be an insufficient amount of brush spring tension.
6. Some brushes may have excessive pressure, thereby taking more than their share of the current.
7. The carbon brushes, if replaced, may be of an unsuitable grade. Metal graphite brushes generally are not used on D. C. voltages higher than 30 to 40 volts. Great care must be taken to be sure that the proper grade is being used on the generator when replacements are made.
8. Some commutator bars may be loose or projecting above the other.
9. High mica, this prevents a proper contacting surface between the brush and the commutator.
10. A variation in the air gap of the machine or strength of the field poles. This will also cause severe sparking at the commutator.

FAILURE OF GENERATOR TO BUILD UP VOLTAGE:

1. The speed of the set may be below normal.
2. Field coils not connected in proper sequence. This could only occur if the wiring has been changed since leaving the factory.
3. A reversed shunt field. Switch wires leading to D. C. brush holders.
4. Brushes incorrectly spaced, and not located on a neutral position.
5. An external short circuit.
6. An open circuit in the shunt field.
7. Loss of residual magnetism. The process of building up voltage in all types of generators requires that there be a small amount of residual magnetism in the iron parts of the field exciter structure when the machine is standing still. This residual magnetism produces the initial voltages in the armature coils as soon as the armature is rotated, which are built up until the full magnetic field is developed, and the machine delivers full voltage. All generators leave the factory with sufficient residual magnetism to build up when started. However, through long periods of storage, and sometimes due to rough handling in transit, an occasional generator will lose all or part of its residual magnetism, and so fail to build up voltage. The following procedures will usually correct the trouble:
 - (a) Carefully check that all brushes are free in the brush holders, and are seated on the commutator, and that no objectionable film has collected on the commutator. See that brush shunts are not binding on adjacent parts or shorted to ground.
 - (b) With the generator running, apply light pressure to the top of one or two D. C. brushes with a wooden stick, to polish the commutator and break through commutator film. Often this will permit the generator to build up when the residual field is weak.
 - (c) If the machine still refuses to build up, the residual magnetism can be restored by applying direct current to the fields. Lift all the brushes clear of the commutator. With the generator at standstill, connect the positive terminal of a 6-volt storage battery or "Hot Shot" dry battery to a positive brush holder. In generators where one brush holder is grounded this will be the grounded commutator brush. Touch the negative connection from the battery to the adjacent commutator brush holder. This will be a negative brush. Hold the connection a few seconds. Remove battery connections, lower brushes and start generator.
 - (d) Should the generator build up with reversed polarity, that is, should the positive connection become negative, or in an A.C. machine still fail to produce current, this can be overcome by reversing the connections between the battery used to build up the residual magnetism and repeating the process described above.

In electrically cranked plants, where the generator serves as the starting motor, residual magnetism is automatically restored when the starting winding is energized.

NOISES IN THE BRUSHES: Noise in brushes is generally due to a rough or out-of-round commutator, caused by high and low bars. This difficulty may only be corrected by machining the commutator in a lathe.

COMMUTATOR: Mica is used for insulation between the commutator bars. After the armature is machined, the mica is cut away about 1/32" below the surface of the bars. The surface of the bars will wear down to the level of the mica eventually. The mica is harder than the copper, and it forms ridges which cause the brushes to jump and make poor contact. High mica should be under cut carefully, and the commutator re-machined and polished..

The commutator should maintain a polished surface. Blackening of all the bars indicates incorrect brush positions. Blackening of groups of bars at regular intervals indicates rough, eccentric commutator. A slight, even discoloration of the commutator is a normal condition.

A severely burned bar or number of bars, indicates an open circuit in the armature, which will also be noted by excessive flashing when the machine is operating with load. This type of difficulty can only be corrected by competent armature repair service man.

Ordinarily the commutator will require only an occasional wiping with a non-linting cloth, but if blackening appears and grows worse, the cause must be determined and corrected.

Use no lubricant on the commutator. The use of any lubricant will only cause sparking and increase the commutation difficulties.

BRUSHES: See that the brushes move freely in the holders and at the same time make firm even contact with the commutator. The brushes should all have the same spring tension to prevent one from carrying more than its share of the load. An extra set of brushes should always be kept on hand.

See that both the interior and the exterior of the machine are kept free from metal dust, dirt of any description, or water.

GENERATOR HEATING: May be due to one of the following causes:

1. Overload on the line.
2. Short circuit of a coil or number of coils in the winding.
3. Grounds in the armature winding or commutator.
4. Poor commutation.
5. Overheating of the entire unit, may be caused by:
 - (a) Unequal air gap.
 - (b) A shorted out or grounded field winding.
 - (c) A reversed field coil winding.

NOTE: Any of these troubles cause a large circulating current in the exciter armature windings of the commutator, the brushes and brush connections, which will cause artificial overloading of the armature. The air gap should not vary over a few percent either way from the average value. All field coils of the shunt type should have within 10% of the same resistance, a higher value than this indicates shorted turns in the winding.

FIELD COIL HEATING:

1. Too high an operating speed of the plant, with a resultant high output voltage.
2. A partial short circuit of one coil.

MAINTENANCE

All Generators are equipped with ball bearings. These bearings will last for many years. It is very important to keep the generator clean and free from accumulations of dirt and grease. It is not necessary to take the generator apart to clean it, as in most cases the dust accumulations can be readily blown out with an air hose and the rings and commutator be wiped with a clean cloth. The grooves between the commutator bars should be occasionally cleaned out and kept free from accumulations of carbon, dust or other foreign matter. This can best be done with a very thin hack saw blade ground to a hook shape or a large needle or hat pin.